

DIET AND ACTIVITIES OF PIED KINGFISHER (*CERYLE RUDIS*) IN LAKE HORA ARSEDI, DEBREZEIT

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ABSTRACT: The present study documents diet and activities of pied kingfisher (*Ceryle rudis*) in Lake Hora Arsed, Debrezeit. Data were collected from March to August in 2009 using focal and scan sampling methods. Repeated observations were administered to collect data on foraging behaviour of the pied kingfisher. Activity patterns including feeding, calling, perching, preening, flying, hovering, diving and scanning were followed. Fish constituted the diet of pied kingfishers for 92.2% and 90.2% (in percentage frequency) during the dry and wet seasons, respectively. There was significant difference ($F_{1, 49} = 3.86, P < 0.05$) in the type of food consumed during the wet season. The type of food consumed was also significantly different ($F_{1, 49} = 0.11, P < 0.05$) during the dry season. Pied kingfishers were observed spending most of their time on perching sites having height of 1-5 m during wet (73.3%) and dry (76.5%) seasons. Perching activity consisted of the largest proportion (35.3%) during the wet season, whereas, it was 21.27% during the dry season. Further ecological studies on pied kingfishers should be conducted to know more about the animal and facilitate conservation measures in the study area.

Key words/phrases: Activity pattern, Diet, Lake Hora Arsed, Pied kingfisher.

INTRODUCTION

Pied kingfisher (*Ceryle rudis*, Linnaeus, 1758) comprises the second largest of the African kingfishers, next to the giant kingfisher (*Ceryle maxima*). Pied kingfishers have an extensive range. They occur in pairs throughout sub-Saharan Africa and southern Asia, but can be moderately gregarious in parts of their range. They are closely associated with freshwaters including rivers, streams, lakes and reservoirs. They hover frequently and are less dependent on wetlands with overhanging tall trees. Pied kingfishers require suitable banks for the excavation of nest tunnels. They usually make their burrow in low or high bank of sand, loam, clay soil, lake shore or stream. They also burrow pits and ditches up to 1 km away from water sources (Fry *et al.*, 1993).

The distribution is similar to that of sympatric giant kingfishers. Pied and

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giant kingfishers frequently coexist without obvious interaction and the species usually use separate perches (Monadjem *et al.*, 1994). Pied kingfishers primarily feed on fish. Unlike other kingfishers, they swallow their prey during diving. This mode of ingestion makes it difficult to identify the species consumed (Johnston, 1989). Pied kingfishers may also feed on aquatic insects, crustaceans and more rarely on amphibians and mollusks. Adults can regurgitate three to four pellets of undigested bones per day. But chicks digest most of the bones and regurgitate only one pellet per day to absorb more calcium to support their bone growth (Cramp *et al.*, 1988). The main objective of the present study was to reveal the diet and activities of pied kingfishers in Lake Hora Arsedi, Debrezeit, Ethiopia.

THE STUDY AREA AND METHODS

The study area

Lake Hora-Arsedi is a crater lake formed by volcanic activity ~7000 years ago (Mohr, 1961). It is located in Debrezeit town about 47 km southeast of Addis Ababa at 1850 m altitude (Fig. 1). The lake has a surface area of 1.03 km², maximum depth 38 m and mean depth 17.5 m (Mohr, 1961). The average temperature of the surface water is about 22°C with a maximum of 24.5°C and minimum of 19.2°C, while the bottom temperature is almost constant (19.2°C-19.4°C) (Wood *et al.*, 1976). The lake has both indigenous and exotic flora, terrestrial and aquatic fauna including a variety of birds (Betre Alemu, 2000).

The region around the lake is characterized by moderate rainfall, varying around 850 mm per annum, high incidence of solar radiation and low relative humidity (Rippey and Wood, 1985). The region has two rainy seasons, the short rainy season from February to April and the long rainy season from June to September. The soil type is characterized as Andosol (Fisseha Itanna, 1992).

Methods

Data were collected from March to August in 2009. Observations were carried out for 720 hrs during the wet and dry seasons. Before the actual study, a pilot survey was conducted to gather information about the distribution, feeding behaviour and activities of pied kingfishers, and to select the sample areas. Information about the distribution of pied kingfishers in the study area was gathered from fishermen and individuals who spent most of their time around the study area. Sample areas were randomly selected.

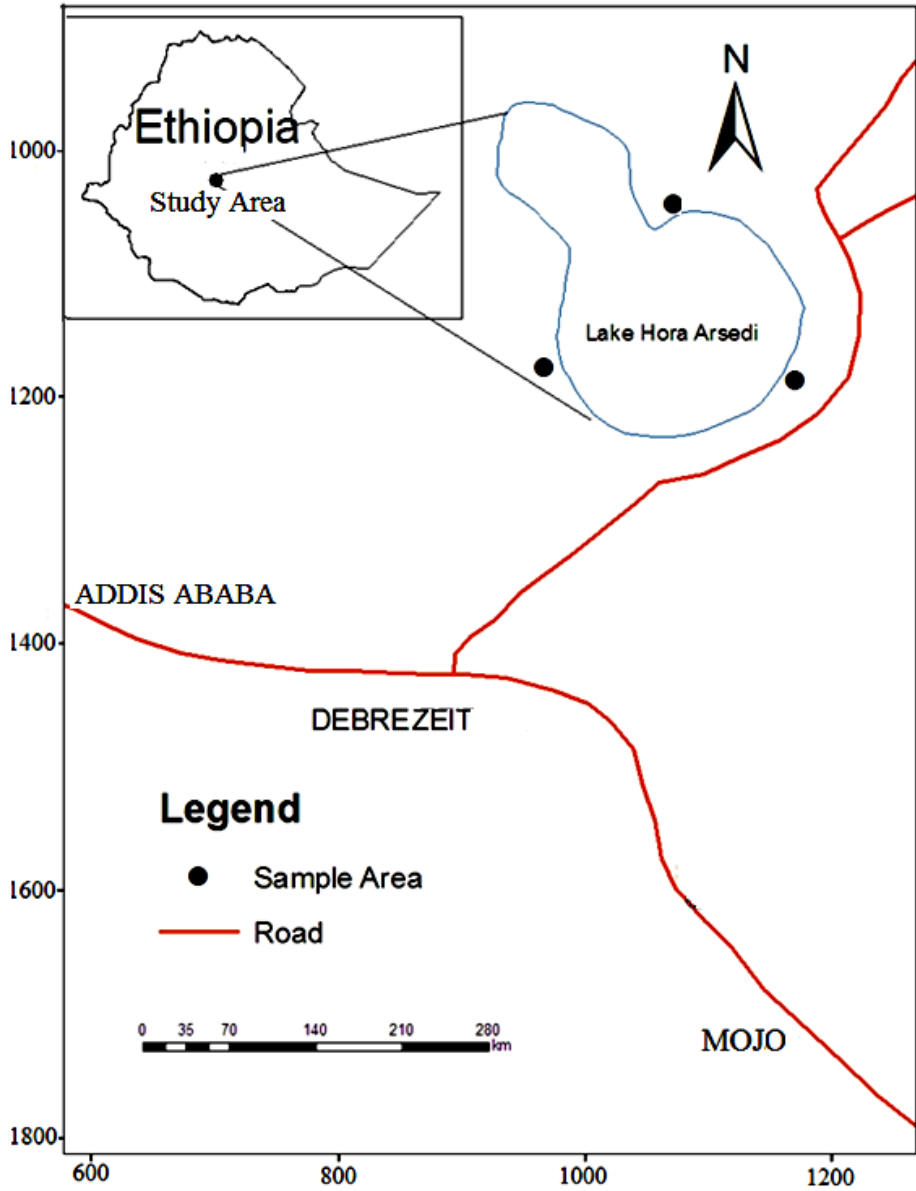


Fig. 1. Location map of the study area

To collect data on foraging behaviour, repeated observations were made (Hartley, 1953). Time spent on foraging was recorded using focal sampling method (Sutherland *et al.*, 2005), watching an individual for 10 minutes. Data on the type of food items consumed, time spent for foraging, activities during foraging (such as singing, perching, hovering and diving), time of the day and height of perching site were collected. The foraging behaviour of individual birds was followed for long period of time following Rodrigues *et al.* (1994). When a single individual or pair or flock was seen feeding, it was considered as one observation following Bhatt and Kumar (2001). The types of food items (in frequency) were recorded as fish, worm, insects and other invertebrates. Data were collected in the morning from 6:30 a.m. to 10:00 a.m. and in the afternoon from 2:00 p.m. to 6:00 p.m., when most of the avian species are active (Williams and Arlott, 1980).

Activities were recorded using scan sampling method throughout the study period (Altman, 1974). During the observation period, a group or an individual bird was followed at a distance of 5-10 m. Three minutes scan samples were taken at intervals of 15 minutes. The activities included feeding, calling, perching, preening, flying, hovering, diving and scanning. Time spent on each activity was also recorded. All data were analysed using SPSS software version 15 and Microsoft EXCEL.

RESULTS

The diet of pied kingfishers in percentage frequency consisted of fish (92.2%), insects (2.2%), worms (3.9%) and other invertebrates (1.7%) during the dry season. During the wet season, 90.2% of their diet consisted of fish, 2% insects, 3.9% worms and 3.9% other invertebrates. There was significant difference in the type of food consumed by pied kingfisher during the wet season ($F_{1,49} = 3.86$, $P < 0.05$) and during dry season ($F_{1,49} = 0.11$, $P < 0.05$). However, there was no significant difference observed in the type of food consumed during the wet and dry seasons ($F_{1,49} = 0.42$, $P > 0.05$) (Fig. 2).

Slight variation in height of perching sites was observed during both wet and dry seasons. However, it was not significant ($F_{1,49} = 1.31$, $P > 0.05$). Most of the time was spent on perching site ranging in height of 1 to 5 m during dry (73.3%) and wet (76.5%) seasons. On average, only 6% of pied kingfishers were observed perching on sites with height > 10 m (Table 1).

Pied kingfishers mostly swallow their diet quickly. 69.4% of them spent < 1 minute to swallow their diet during the dry season, whereas it was 72.5% of them during the wet season. In addition, 7.8% and 13.7% of the pied

kingfishers spent 6 to 10 minutes while perching at the shore of the lake so as to feed on their prey during the dry and wet seasons, respectively (Table 2).

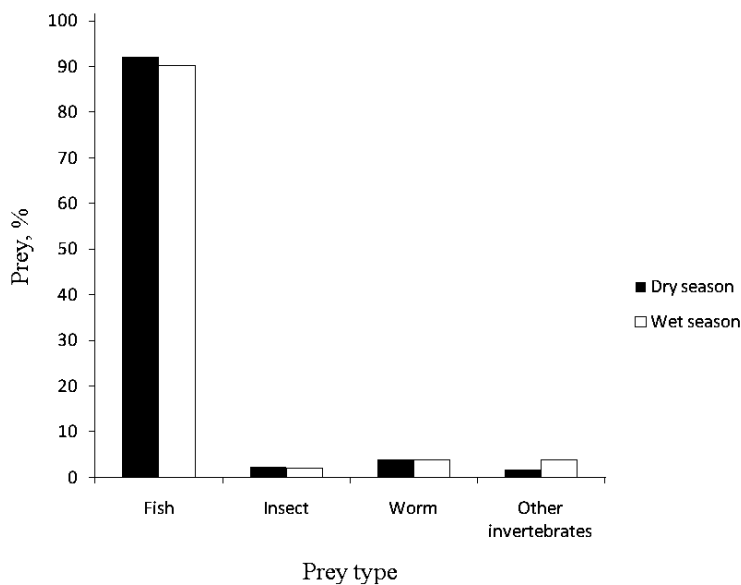


Fig. 2. Diet of pied kingfisher during the dry and wet seasons.

Table 1. Height of perching sites (m) for foraging during wet and dry seasons.

Height of perching sites	Dry season (%)	Wet season (%)
<1	7.8	3.9
1-5	73.3	76.5
5-10	12.8	13.7
>10	6.1	5.9
Total	100	100

Table 2. Time spent for foraging (in min) during wet and dry seasons.

Time spent foraging (min)	Dry season (%)	Wet season (%)
<1	69.4	72.5
1-5	22.8	13.8
6-10	7.8	13.7
Total	100	100

Based on this study, 32.8% of the pied kingfishers dived to capture their prey directly, whereas 7.8% of them hovered before capturing their prey during the wet season. On the other hand, during the dry season, 41.8% dived to capture the prey and 7.7% undertook singing after capturing their prey (Fig. 3).

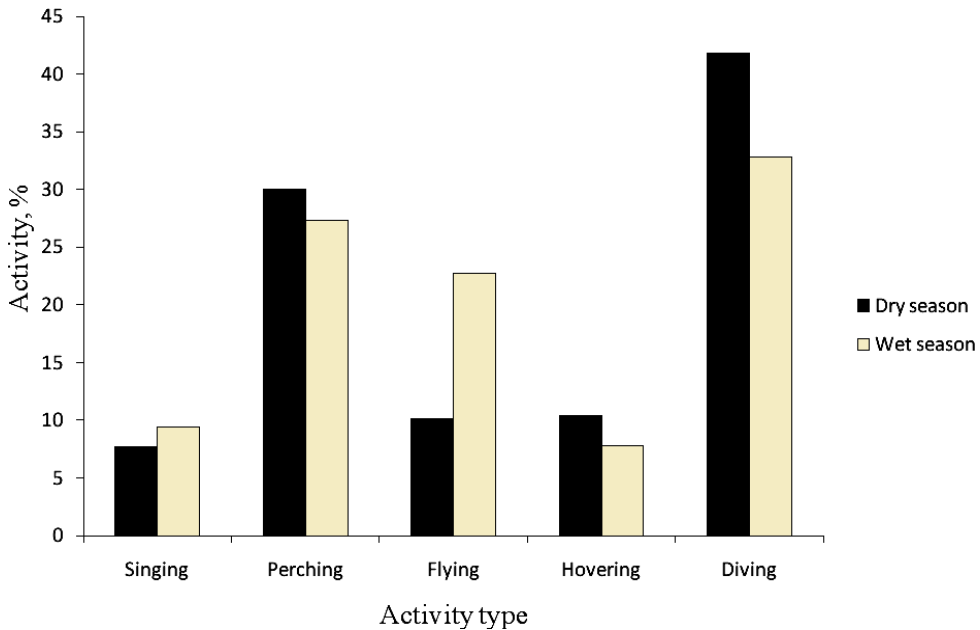


Fig. 3. Activities conducted by pied kingfisher in association with foraging during dry and wet seasons.

There was a significant difference ($F_{6, 338} = 3.66$, $P < 0.001$) among activities in a day during the wet season. Activities also differed significantly within a day during the dry season ($F_{1, 338} = 12.12$, $P < 0.001$). The major activities during the dry season were perching (21.27%), feeding (12.59%), calling (11.43%), flying (20.42%), hovering (5.93%), scanning (10.79%), diving (9.63%), preening (6.24%) and others (1.70%). This consisted of chasing each other and gazing in search of their prey during the dry season. During the wet season, largest proportion of the activity consisted of perching (35.4%), whereas the remaining activities were feeding (7.8%), calling (11.6%), flying (16.7%), hovering (3.3%), scanning (7.3%), diving (6%), preening (4.8%) and others (7.1%) (Fig. 4).

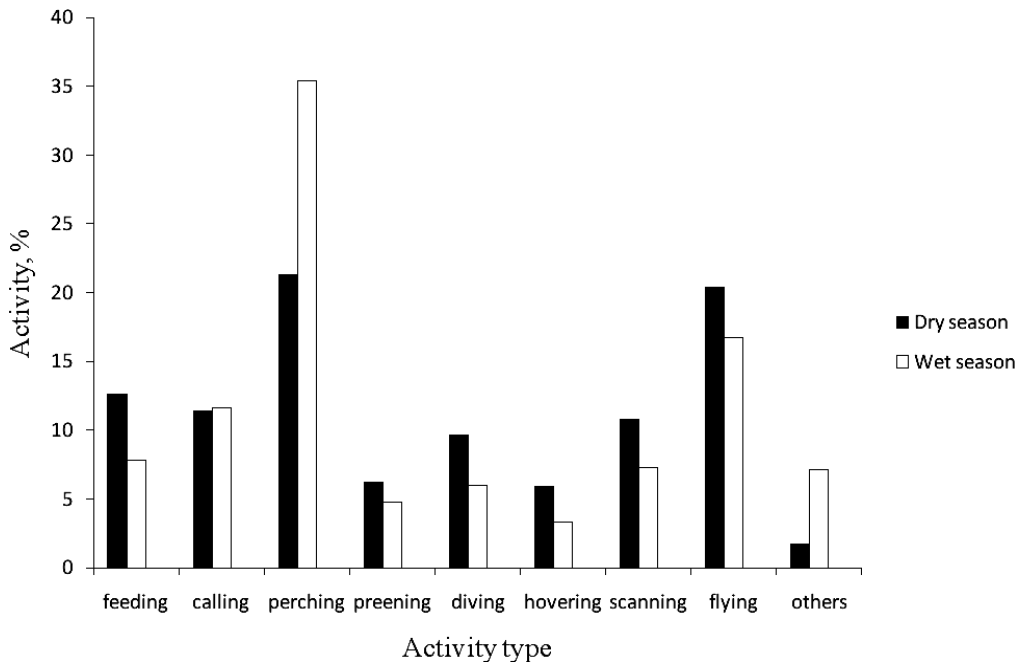


Fig. 4. Diurnal activity patterns of pied kingfishers during the dry and wet seasons.

DISCUSSION

Studies on diet and foraging behaviour can help to answer a wide range of questions (Newton and Green, 2005). Foraging behaviour can reflect variation in food availability relative to demands. Pied kingfishers frequently feed on fish, insects, worms and other invertebrates. Pied kingfishers were observed mostly on perching sites with a height of 1-5 m. This behaviour helps them to enhance prey collection efficiency, because they can follow their prey at short distance. Similarly, Monadjem *et al.* (1994) found pied kingfishers spending on perching sites having a length 2-4 m high in the Kruger National Park. Sometimes, it is difficult to identify the type of food item eaten by pied kingfishers because of their quick swallowing activity. A study conducted in Lake Malawi indicated that it was impossible to identify species of fish taken by the pied kingfisher without using regurgitated pellets (Johnston, 1989). Once they start feeding, they hover and dive continually. Pied kingfishers can hover approximately 5-10 m away from the water surface during foraging. According to Johnston (1989), pied kingfishers at Cape MacLear, Malawi, foraged using hover-

plunge (a method for foraging in pied kingfisher). This occurred when pied kingfisher left a perch adjacent to the shore line and then hovered at a height of about 10 m over the water.

During foraging, all dives may not be effective. To alleviate this problem, pied kingfishers dive repeatedly until they capture their prey or change sites. Similarly, Betts and Betts (1976) have stated that kingfishers hunt from perches and sometimes move to a new location, both after an attempt and when no attempt has been made. Pied kingfishers are effective in their feeding activity when they directly dive from their perching site rather than hovering then diving. Pied kingfishers change their site frequently throughout the day. This mainly depends on the amount of food availability. When there is enough food in the area, they spend more time in that area. Once they are satisfied, they prefer to perch for longer time. Pied kingfishers mostly spent their time at the shore of the lake but, avoided it when people swam, fished, worshiped and washed their clothes in the study area. Therefore, pied kingfishers were forced to leave such areas.

Daily activity patterns of birds are influenced by several factors including weather, season and habitat (Bull, 1997), even though, activity patterns are likely to differ among species (Blake, 1992). The most important diurnal activity of pied kingfisher was perching. The main reason why pied kingfishers spent more time in perching activity is to observe and search their diet. Pied kingfishers were observed spending less time for hovering. This is probably due to the less chance of capturing prey after hovering. Similarly, according to Bonnington *et al.* (2007), pied kingfishers showed hovering activity in few occasions in Kilombero River, Southern Tanzania. Pied kingfishers mostly spent their time perching on dead wood located at the shore in the study area for the purpose of taking rest and looking for their prey. However, people continually collected the dead wood from the study area. As a result, pied kingfishers were forced to change their site. Anthropogenic factors that affect the ecology of the pied kingfisher should be curtailed. The ecosystem in the study area is a site of tourist destination. It should be properly managed to conserve not only pied kingfishers but also other species.

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