

*Full Length Research Paper*

# Avian habitat use and activity budgets in a rare endangered tourist site: Case study of Lake Ol'Bolossat Basin, Kenya

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Lake Ol'Bolossat, Kenya is an attractive natural tourist site. The only lake in the Central Province is of great aesthetic value and particularly an important site for avian diversity. Being a wetland, it contains diverse biologically and economically important raw materials. The wetland is targeted for conversion to agricultural purposes and as a result is faced with degradation. The study established the habitat use and activity budget for red knobbed coots (*Fulicata cristata*), Egyptian geese (*Alopochen aegyptica*), Yellow-billed ducks (*Anas undulata*) and Glossy ibises (*Plegadis falcinellus*). Habitat use was established based on the number of birds of each species in each habitat type. For all the species, the marshland was occupied by significantly more birds than all other habitats, Red Knobbed coot ( $p = 0.07$ ), Egyptian geese ( $p = 0.061$ ) Yellow billed duck ( $p = 0.455$ ) and Glossy ibis ( $p = 0.752$ ). The marshland was the most preferred habitat type by all the birds. The activity budgets for the birds were obtained using the scan sampling method. Among all the birds, feeding was allocated significantly more time; Red Knobbed coot ( $p = 0.056$ ), Egyptian geese ( $p = 0.11$ ) Yellow billed duck ( $p = 0.09$ ) and Glossy ibis ( $p = 0.023$ ). The small birds spent more time feeding than bigger birds.

**Key words:** Wetlands, tourism, biodiversity, birds.

## INTRODUCTION

The population of Yellow-billed duck (*Anas undulata*), Egyptian geese (*Alopochen aegyptiaca*), Red knobbed coot (*Fulicata cristata*) and the Glossy ibis (*Plegadis falcinellus*) constitutes above half of all birds found in Lake Ol'Bolossat. Human activities in the Lake Ol'Bolossat have detrimental consequences and are bound to decrease the ecological integrity of the whole ecosystem, which is very important for the continued existence of these and other birds (Gichuki, 1995).

The deforestation of watershed area, domestic and agricultural pollution and high grazing pressure are causing additional habitat degradation and loss affecting the population of bird. However, data on habitat use and requirements of the birds in this ecosystem is lacking, and this is a critical time for the survival of such birds.

Many species of birds are threatened with extinction today because of the destruction of their habitats by the growing human interference. Among all threatened birds, 85% of them are affected by loss, degradation and fragmentation of their habitat (Bennun and Njoroge., 1999).

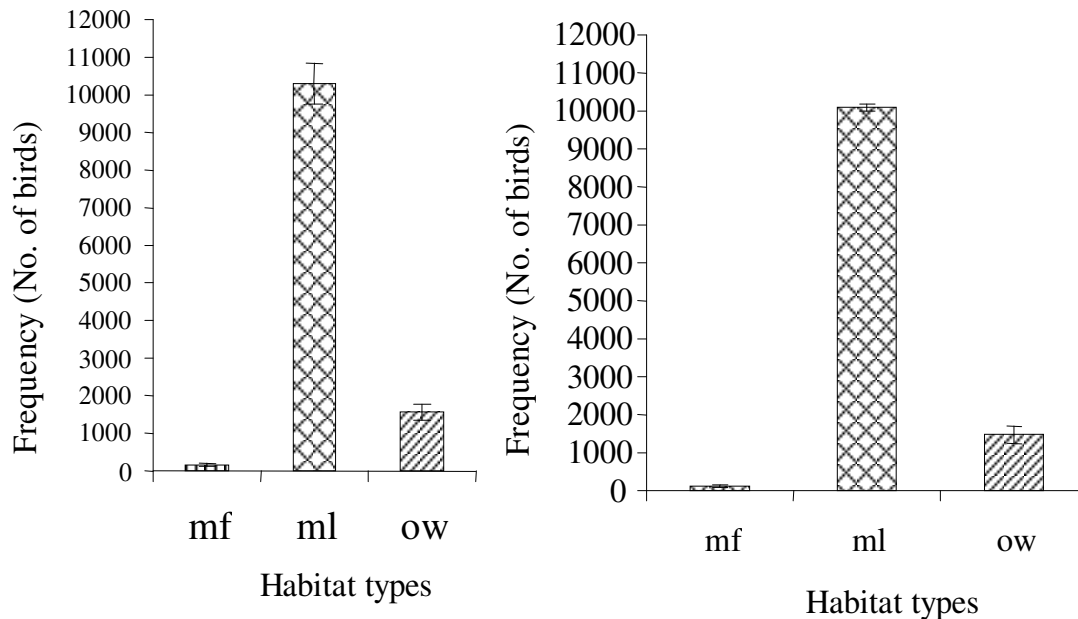
The objective of this study, therefore, was to determine the pattern of habitat utilization and the diurnal activity budgets for the Yellow-billed duck, Egyptian geese, Red knobbed coot and the Glossy ibis, which dominate numerically.

## STUDY AREA AND METHODS

The study area included the entire lake Ol'Bolossat and the marshland, which forms an extensive and important grazing area for livestock and the hippopotamus. The wetland is surrounded by small-scale intensive farming and horticultural farming, which depends on irrigation from streams feeding the lake or boreholes recharged by the wetland.

The habitat use for the four species of birds being studied was

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**Figure 1.** Diurnal mean frequencies of occurrence in various habitat types for Red knobbed coot in Lake Ol' Bolossat Basin.

was quantified by noting over time the number of birds in each habitat type (Krapu et al., 1984, Nesbit and William, 1990, Fasola and Biddau, 1997, Fraser et al., 1991, Susan et al., 1989). The observation took place in two, 1 × 1 km quadrat established in each habitat type. The observation, which started at 0700 h and stopped at 1800 h was carried out by the author using 7 × 35 mm binoculars. The data were collected in the morning and afternoon so that the diurnal effects on habitat use could be detected.

The number of birds in each habitat type was estimated and the habitat type with the highest number of the bird species being studied was considered to be the most preferred, whereas the habitat with the lowest number of birds was the least preferred.

Habitat types were classified as; marshland (Inaccessible area with short wetland vegetation), swampland (Inaccessible area with tall wetland vegetation), open –water (Non-vegetated area of water with or without submerged vegetation), mudflat (Inaccessible soft mud with or without vegetation), grassland (Accessible area with a mixture of aquatic and terrestrial grass species).

Instantaneous scan sampling (Altman, 1974) was used to collect activity budget data for the four species of birds being studied. A group of birds was observed and the activity taking place was instantly noted down every minute on the minute. This continued for 30 min after which the group was abandoned and another one chosen to ensure better representation of the population. The observation started at 0700 h and continued until 1800 h and everyday, the observer collected data on a different habitat type. During the study period, an attempt was made to obtain a 10 h activity data per day, per species twice a month and this was distributed evenly during the day. All the observations for each day were totaled up and an average taken for each fortnight.

The activities were categorized as; feeding (This includes the act of food intake and active search for food), loafing (includes resting with eyes closed or bill tucked under wing feathers, preening and bathing), movement (includes wading, walking and flying) and others (includes displaying, mating, agonistic and vocalizing). Time spent in each habitat for each species was analyzed using two way analysis of ANOVA (Zar, 1984).

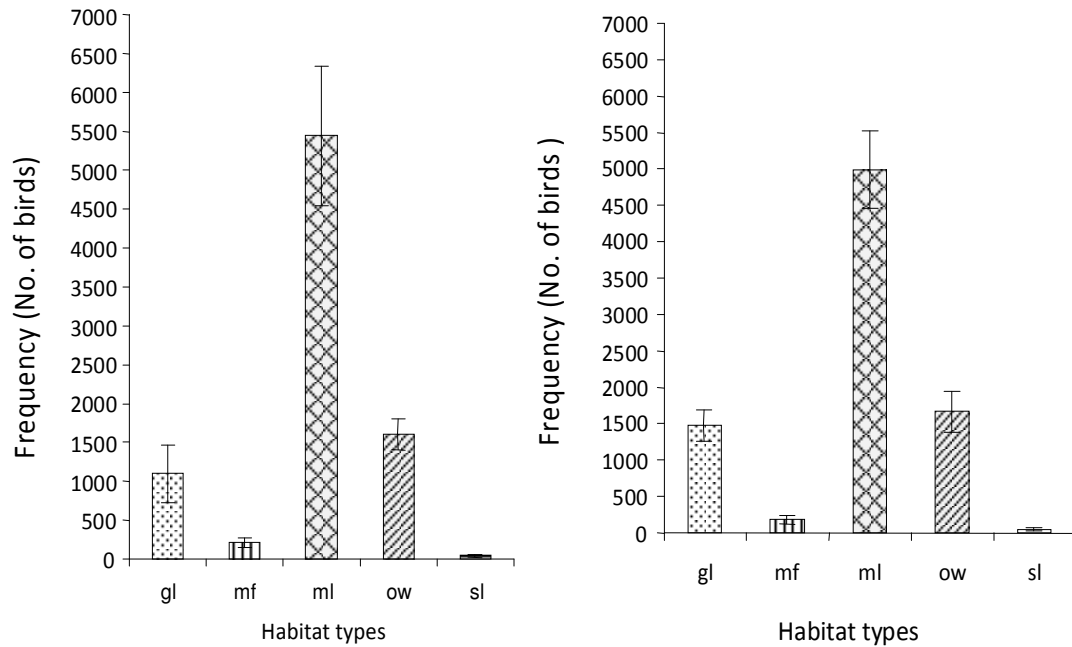
## RESULTS

### Habitat use

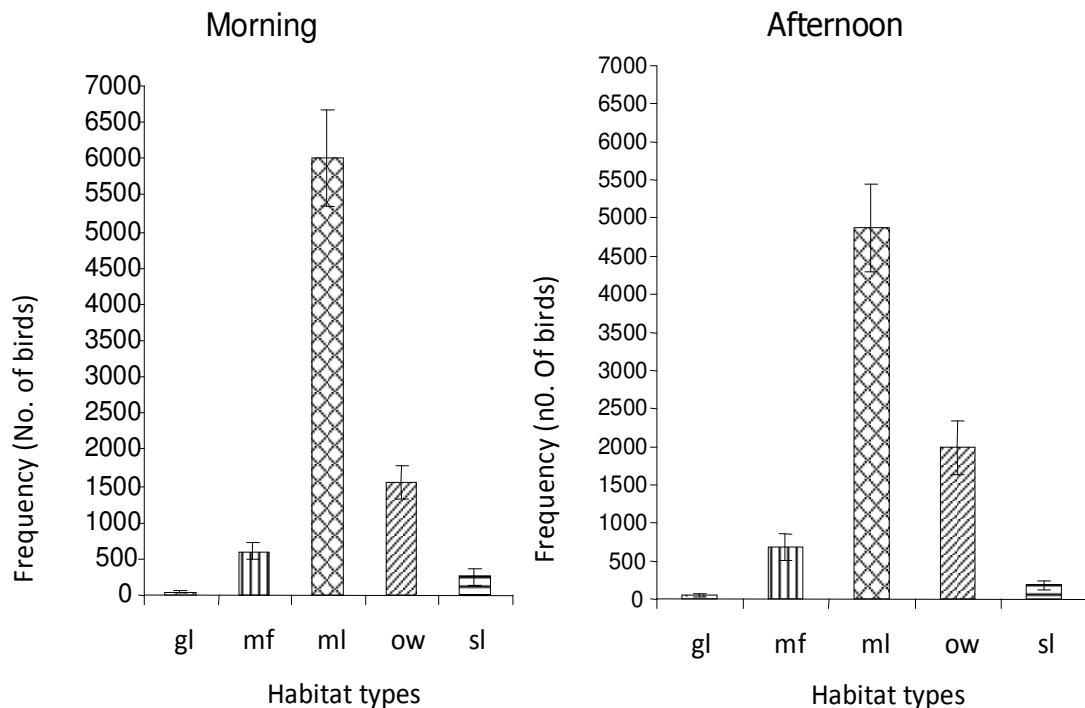
Diurnal mean frequencies of occurrences for the red knobbed coot in different habitat types were significantly different ( $p = 0.11841$ ;  $f = 2.501$ ;  $df = 1$ ). Significantly, more red knobbed coots occurred in the marshland than in any other habitat type during the study period ( $p = 0.07$ ). The red knobbed coots avoided the swampland and grassland but they utilized the open water and mudflats to a small extent (Figure 1).

The Egyptian geese showed a significant difference in their mean frequencies in each habitat ( $p = 0.06$ ;  $f = 260.7701$ ;  $df = 4$ ). The marshland recorded significantly higher mean frequencies than other habitat types. The mean frequencies in the mudflats and in the swampland were significantly different ( $p = 0.3456$ ). Most of these birds occurred in the marshland and relatively few were found in the grassland, open water and mudflats (Figure 2). They conspicuously avoided the swampland, foraging mainly in the marshland and roosting was in the grassland late in the evening. The Egyptian geese had the highest mean frequencies in the grassland compared to other birds.

The mean frequencies in the morning and in the afternoon for the Yellow-billed duck were significantly different ( $p = 0.4553$ ;  $f = 0.564$ ;  $df = 1$ ). The mean frequencies in each habitat types were not significantly different ( $p = 0.01$ ;  $f = 577.636$ ;  $df = 4$ ). The marshland mean frequencies were significantly higher than in all other habitat types (Figure 3). The mean frequencies for



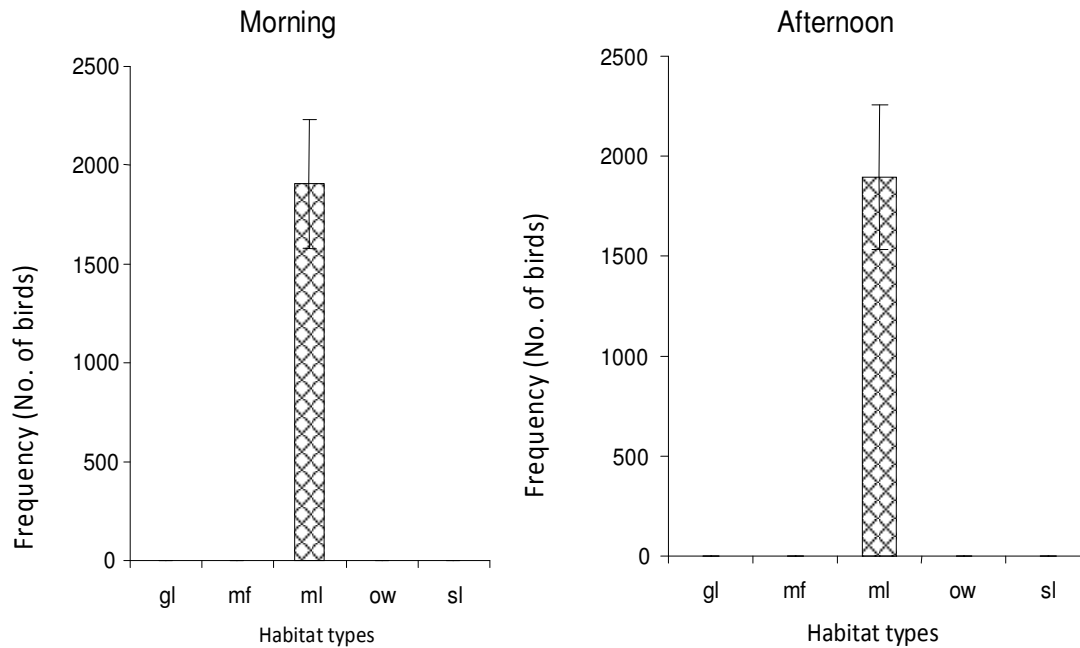
**Figure 2.** Diurnal mean frequencies of occurrence in various habitat types for Egyptian geese in Lake Ol' Bolossat Basin.



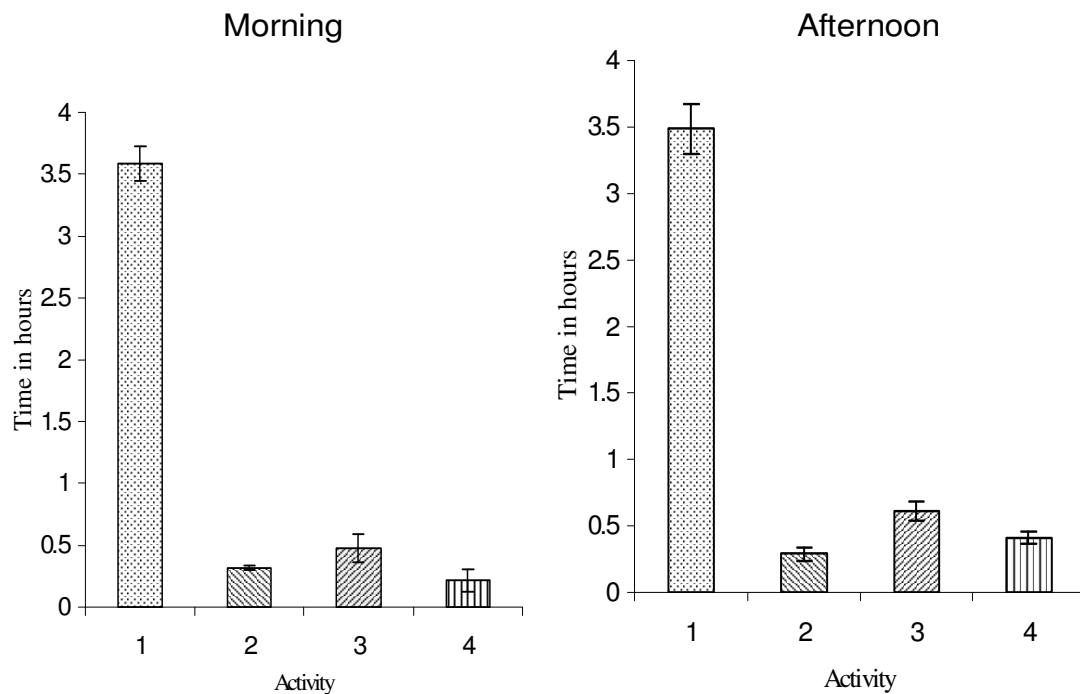
**Figure 3.** Diurnal mean frequencies of occurrence in various habitat types for Yellow-billed ducks in Lake Ol' Bolossat basin.

the Glossy ibises occurrence in the morning and in the afternoon were significantly different ( $p = 0.7521$ ;  $f = 0.101$ ;  $df = 1$ ). The mean frequencies in all the habitat types

were not significant ( $p = 0.010$ ;  $f = 455.733$ ;  $df = 4$ ). The Glossy ibis is predominantly a marshland bird, and it was not observed in any other habitat type (Figure 4). This bird



**Figure 4.** Diurnal mean frequencies of occurrence in various habitat types for the Glossy ibises in Lake Ol'Boლოსat basin. gl = Grassland, mf = Mudflats, ow = Open water, sl = Swampland.



**Figure 5.** Activity budget for the red knobbed coots in the morning and afternoon.

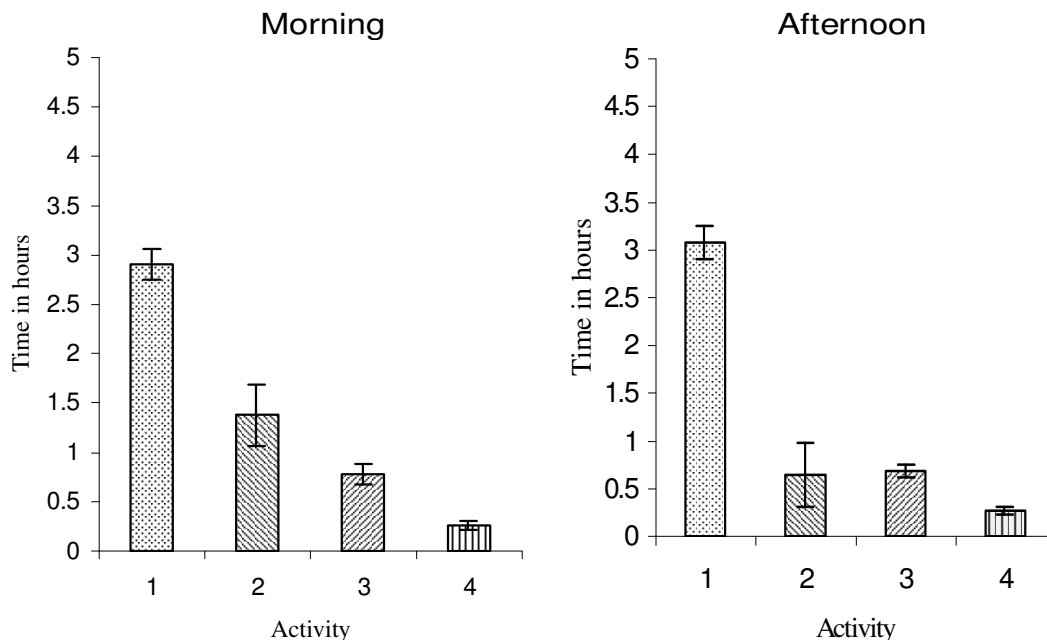
foraged actively throughout the day.

### Activity budgets

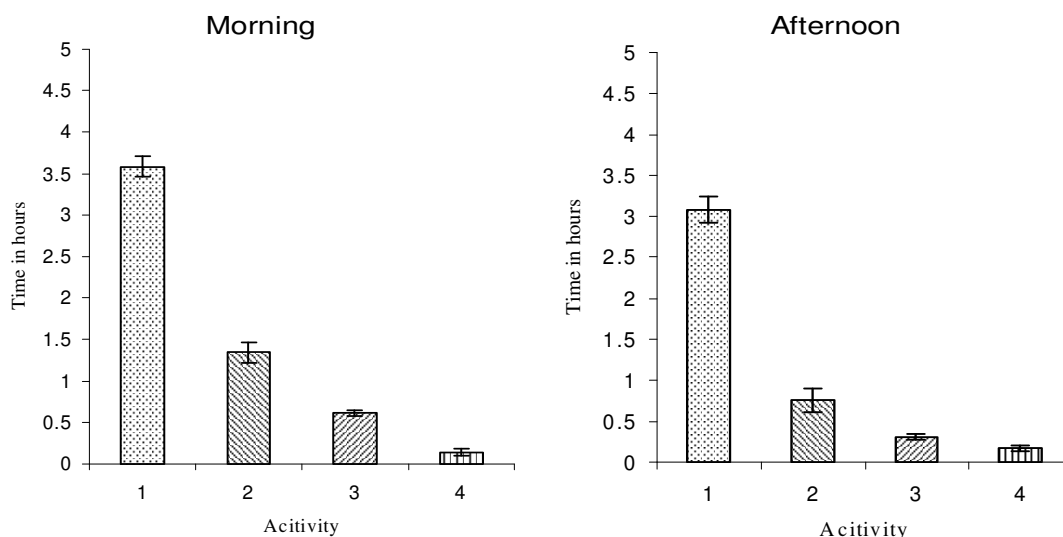
**Red knobbed coot:** Overall the Red-knobbed coot spent 75.1% of their total time feeding. Diurnally, the activity

budget was significant ( $p = 0.06$ ;  $f = 37.00$ ;  $df = 1$ ) (Figure 5). They spent significantly more time in feeding than in any other activity ( $p = 0.058$ ;  $df = 3$ ;  $f = 375.0$ ).

**Egyptian geese:** The Egyptian geese spent 59.9 % of the whole day feeding. Morning and afternoon time budgets was significantly different at ( $p = 0.08$ ;  $f = 9.52$ ;



**Figure 6.** Activity budget for the Egyptian geese in the morning and afternoon.



**Figure 7.** Activity budget for the Yellow-billed ducks in the morning and afternoon.

df = 1) (Figure 6). The mean time spent in feeding was significantly more than time spent in any other activity ( $p = 0.11$ ;  $f = 32.3$ ;  $df = 3$ ).

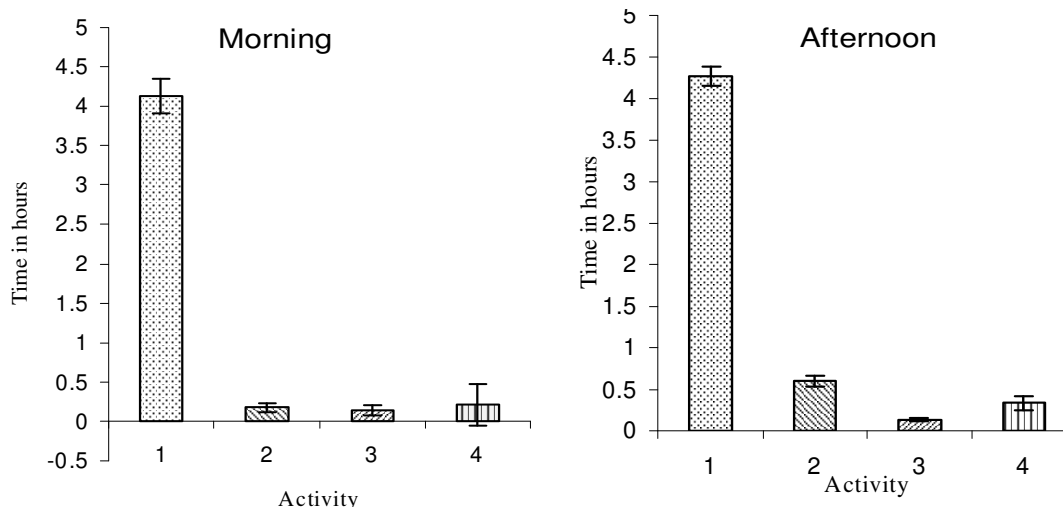
**Yellow-billed duck:** Overall the Yellow-billed duck spent 66.58 % of their total time feeding. The mean time spent in feeding was significantly more than any other activity ( $P = 0.19$ ;  $f = 29.2$ ;  $df = 3$ ) (Figure. 7). The morning and afternoon activity budgets were significantly different ( $p = 0.09$ ;  $f = 12.6$ ;  $df = 1$ ).

**Glossy ibis:** The Glossy ibis spent 83.8% of its total

time feeding. Among all the four species of birds this bird allocated most time to feeding. The time spent in feeding was significantly more than the time spent in other activities ( $p = 0.23$ ;  $f = 29.2$ ;  $df = 3$ ) (Figure 8). These birds' feed actively throughout the day spending very little time in the other activities.

## DISCUSSION

The last century has witnessed the loss and fragmentation of many wetland habitats for agriculture, human



**Figure 8.** Activity budget for the glossy ibises in the morning and afternoon.

**Table 1.** The mass of birds and % time spent in feeding.

Name of bird	Weight (g)	Time spent in feeding (%)
Glossy ibis	485 - 580	85.7
Red knobbed coot	722 - 840	76
Yellow billed duck	823 - 965	67.9
Egyptian geese	1872 - 2348	59.5

Source of weights data: Egyptian geese and Red knobbed coot, Gordon (1985); Glossy ibis, del Hoyo et al. (1992); Yellow billed duck, Dean and Skead (1979).

settlement and industrial development. This has resulted in the loss of many species of plants and animals while others have been driven to endangered levels and even to extinction (Dugan, 1993). Lake Ol'Bolossat is an important habitat for a diverse species of animals including a high diversity and abundance of waterfowl, which are a potential source of income for the local people through tourism.

The occurrence of animals, birds included, in different habitat areas is influenced predominantly by availability of food and security (Verner, 1965). One will therefore find that the habitat types which offer a lot of food and good security have most concentration of animals whereas habitats with little food and are insecure have low concentrations (Davies et al., 1989). The availability of food on the other hand is affected by environmental conditions and mans activities that lead to pollution and degradation of the habitats (Bishton, 1986).

In Lake Ol'Bolossat basin the results show that the marshland recorded the highest mean frequencies of bird occurrences among all other habitat types. The marshland is very extensive covering 80% of the whole of Lake Ol'Bolossat Basin (KWS, 2002). Marshland habitats are

very productive (Denny, 1985) with continuous supply of water throughout the year and primary production continues all year round. The marshland habitat in Lake Ol'Bolossat basin is not easily accessible thereby, reducing the chances of predators and hunters getting to birds. Another advantage the marshland might provide over the other habitat types is good plant cover, which offered shelter and nesting locations (Davis et al., 1989; Fasola and Biddau., 1997). The results indicate that the marshland was highly valued by the red knobbed coots, Yellow-billed ducks, Egyptian geese and the Glossy ibises.

In wetland ecosystems, for example Lake OL'Bolossat, birds are active throughout the day, with a slight reduction in late morning and early afternoon (Fasola et al., 1997). In Lake Ol'Bolossat, the frequencies in the morning and in afternoon did not vary significantly for all habitat types. This is an indication of very limited movement from one location to another.

The body size/mass of birds greatly influences the foraging strategies of birds. It has been established that smaller birds as compared to larger ones spend more time feeding (Gibb, 1954; Pearson, 1968; King, 1974; del Hoyo et al., 1992). This is because they have a high volume to surface area ratio, which makes them loose a lot of heat and hence body energy. Consequently, the energy demand per unit body mass for small birds is high whereas for larger birds it is low (Calder and King, 1974). Table 1 shows the body masses of the four bird species and time spent in feeding.

The glossy ibis has the smallest weight and spends most time feeding whereas the Egyptian goose that has the biggest weight spends little time feeding (Table 1). This study supports the prediction that smaller birds spend more time feeding than bigger birds. This compares well with other studies (Goudie et al., 1986; Gibb,

1954; Pearson, 1968 and; King, 1974).

Food quality and quantity also determine the foraging strategies for birds. The aquatic vegetation and algae have less nutrient concentration and lower caloric content than seed or animal matter (Paulus, 1982). Consumption of vegetable food would require that a bird spend more time foraging. The Glossy ibis feeds exclusively on animal matter (Gordon, 1985) that has high nutrient content but probably its small size requires it to allocate a big proportion of its time feeding.

The diet of the Red knobbed coot consists mainly of water plants and grasses and little insects and seeds (Gordon, 1985). It allocates most of its time to feeding so that it can acquire enough food for the body energy requirements. In the Red knobbed coot and Glossy ibis the quality of food eaten is inversely proportional to time allocated to feeding (Stott et al., 1973).

The Yellow-billed duck consumes predominantly vegetable matter (Gordon, 1985) and therefore spends more time feeding compared to other activities. The diet of the Egyptian goose is mainly leafy material, which has low nutrient and caloric content.

In Lake Ol'Bolessat, the marshland is a preferred foraging habitat for hippopotamus, livestock, and birds. The existence of these species of wildlife in same habitat is likely to create competition for the resources available in the marshland, which may influence the foraging strategy of birds. The lake and wetland have undergone critical changes in the environment, which also may influence the foraging strategy of birds (Gichuki, 1995). In times of change in the environment, bigger birds are able to adjust their time budgets easily as compared to smaller birds (Goudie et al., 1986). The concentration of a big number of livestock and hippopotamus has caused overgrazing which has affected the structure of the basin vegetation. This in turn has affected the number and distribution of the water birds (Gichuki, 1995). There is need to encourage controlled grazing, both wildlife and livestock, in order to experience great diversity of plants and animals.

It is apparent that the four species of birds allocated more than 50% of their total time to foraging. The foraging is restricted to the marshland meaning that a lot of attention should be given to conservation and maintenance of this habitat type. The other habitat types are important too but the management and planning of the marshland should be the primary goal for wildlife managers. The reversal of the present trend in habitat degradation in this study area (Gichuki, 1995) is necessary in order to maintain the population of birds at the present levels and to improve future populations. This will retain the attractiveness of the lake as an important tourist destination.

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