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WATER HOLE INFLUENCE ON DISTRIBUTION AND BEHAVIOUR OF LARKS IN KUWAIT FOR SPECIES COMPOSITION AND ABUNDANCE

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ABSTRACT

Water holes attract many avian species, particularly in semi-desert areas. We studied avifauna richness around a water hole in winter and summer. Desert resident species were not attracted to water holes in winter, when temperature is low. The water hole was almost found vacant in winter, even at midday. They spend most the day far away from water holes. As birds attracted to the water hole to drink and rest they may spend some times looking for food. During spring, we found herons chasing small passerines from tree to another to feed on them as a sign of food deficiency. Raptors (harriers, falcons, hawks, eagles) forage on prey in or around thewater hole, such as small fishes, passerines, rodents or lizards. During summer, local birds such as crested larks were attracted to the water hole, especially at midday. Crested larks gathered in flocks of 5-65 individuals seeking shade under implanted tall trees during midday 1-30m away from the water hole. As the temperature rises the individual numbers increase around the water hole and their distance from the water body is reduced. In June-August, they usually start shading around the water hole at 8am and continue until 3pm.

KEYWORDS: Crested Lark, Water Hole, Winter, Summer, Farness, Shade and Predation

INTRODUCTION

Avifaunal richness and abundance depends on habitat quality and resource availability (Schneider & Griesser 2009). In semi-arid lands, water holes are a limiting factor for many bird species, particularly during late summer and autumn (Gubanich & Panik 1987). In dry environments, animals often orient their activities around water holes, and adequate access to water holes is an essential habitat requirement for many bird species (Elder 1956, Freese 1978). Schneider and Griesser showed that there is a negative relationship between avian species richness and distance from a water body (Schneider & Griesser 2009). Since the 1940s, construction of a water hole has been used as a wildlife-habitat improvement technique in desert environments (O’Brien *et al.* 2006). This management option could partially mitigate the negative effect of climatic changes on fauna and flora diversity (Schneider & Griesser 2009). There are a number of examples of the successful impact that increased water access can have.For example, an increase in open water increased the numbers and species of birds in prairie glacial marshes in Hancock County, Iowa, USA (Weller & Fredrickson 1973). In Zambia, the creation of artificial water supplies after annual rainfall shortage has been shown to be a very important habitat management tool for lovebirds *Agapornisnigrigenis* (Warburton & Perrin 2005). Hence, small artificial water bodies can be stepping-stones that help bridge the gap between natural wetlands and water bodies (Schneider & Griesser 2009).

Permanent and temporary water bodies, in addition to providing drinking water, also facilitate inter and intra-species interactions. However, while the surrounding vegetation cover can protect drinking animals, it may also provide hiding places for predators (Schnell & McDade 1992). Hence, game or prey species become a target for predators as they approach the water surface (Schnell & McDade 1992). Consequently, animals alter their behaviour to avoid this hazard (Cade 1965), for example becoming more vigilant to reduce their chance of being preyed on (Schnell & McDade 1992). Under predation pressure, gambel's quails are forced to alter their diurnal activity schedule in the summertime at Deep Canyon site to avoid the two most likely avian predators: Cooper's hawk *Accipiter cooperii* and the prairie falcon *Falco mexicanus* (Goldstein 1984). In some cases, the presence of predators can deter animals from visiting the water body. For example, Beck *et al.* (1973) found gambel's quail *Lophortyxgambelii* did not visit water holes in the presence of raptors. Five species of columbiform were seen not drinking water directly as they arrive at a pool, waiting for a while in a relatively protected position as a precautionary response to falconiforms (Cade 1965). Drinking in groups can also provide protection due to increased vigilance. In doves for example, it has been shown that they drink in groups and their drinking bout length increases with group size, presumably as a consequence of the increased protection afforded by larger groups (Schnell & McDade 1992).

This work is to understand the key habitat features affecting aviafaunal richness, we investigated inter and intraspecific interactions amongst birds at drinking areas in the very arid environment of Kuwait. Hence, we recorded changes in the species composition and abundance of birds present throughout the day at a water hole in a Sabah Al-Ahmed Natural Reserve (SAANR),

METHODS

Study Areas and Species

This Study was carried out in Sabah Al-Ahmed Natural Reserve (SAANR), 60km away from Kuwait city in 2008-9. SAANR is a semi-arid protected area (330km^2) located north to Kuwait Bay. Talha water hole, 30m in diameter and 50cm depth, is the only permanent artificial water hole in SAANR. The water source is an underground, brackish well. Some local sea fishes have been brought to the Talha pool by the reserve management. The other two water sources in the area are very limited: a) a small concrete basin water hole, 1m radius and 20 cm depth, b) an irrigation pipeline from which water drips. Talha water hole is surrounded by dozens of planted trees *Aciacia sp*. and some *Ziziphus spp.* The tall and large trees provide extensive shade during the middle of the day, where birds can shade and rest near the water hole. Crested larks *Galeridacristata* and collared doves *Streptopeliadecaocto* are the most common sedentary species visiting the water hole. Hence, we examine the species richness, and intra and interspecies interactions. We also recorded the response of crested larks to other animal species approaching the water hole.

The water level of Talha water hole changed in 2009 after its deepening and the building of a sand bank barrier (about 80cm) around the water hole. This sand bank permitted an increase in the amount of water "overflowing" which provide the main area of salinity water.

Data Collected and Analysis

We chose seven spaced trees surrounding Talha water hole for this study (Figure 1 and 2). Distance from each tree to the water hole was measured. Ten visits in both winter (1st to 10th January 2009) and summer (21st to 30th June 2009) from 8am-4pm were carried out to identify bird species and their individual numbers resting under these trees. In 2008, most birds gathered on the islands in Talha water hole. But in 2009, the change of the water level in

Talha water hole contributed to reducing the number of birds within those islands and dispersed birds somewhere around the water hole.

Figure 1: An Aerial Image of Talha Water Hole, Google Earth 2008. The Water Hole itself is Indicated by the Red Circle; the Trees Used for this Study are Indicated by Arrows

Figure 2: A Landscape View of Talha Water Hole, Filled by Brackish Water as Seen from the Sub-Little Area Surrounded by Blocks (Gregory 2008)

This study aims to test the value a water hole can play in a desert environment by recoding: 1) the richness of avifaunaaround Talha water hole, 2) the effect of temperature on the distribution of birds around the water body and their distance from the water body seasonally and diurnally, and 3) the influence of the water hole on bird behaviour such as shading, drinking, roosting, foraging and predation.

Monitoring was done from a vehicle as hide, parked near the edge of the water body. Counts were made at hourly intervals of the number of birds of different species present. In total, we observed the birds for 160hr (20 days; 1-10 January and 1-10 June 2009). Lizards and mammals were also recorded. The use of the water hole was recorded in winter 5-10˚C and summer 40-53˚C. In addition to counts, we recorded the proportion of birds drinking and in the shade and incidences of predation or kleptoparasitism.

In addition, animal species that were encountered during other seasons (spring and fall) were also recorded in order to count the extent influence of water holeon attracting biodiversity.

RESULTS

The study shows that 96 animal species used the water hole; 91 bird species, 3 mammals and 2 lizards throughout 2009. Six of the bird species are resident (sedentary) species and 85 are migratory species. In summer, species diversity is low in comparison to other seasons, but the actual number of individual birds attracted to Talha hole is much larger than in other seasons (160 crested larks in summer compared with 6 crested larks in winter during midday time). The predominant bird species in summer were: crested larks 89.9%, laughing and collared doves 3.9%, house sparrows 4.2% and other species 2%. Desert resident species were not present at the water hole in winter when temperature is low. During winter, the resident species spend most the day far away from water holes. The peak number of avian species was in spring and fall, when birds visited Kuwait throughout their migration path. During midday summer, many birds roosted in the shade under trees located within the Talha water hole itself (Figure 3).

Figure 3: A Shaded Area inside Talha Water Hole. This Appeared to be the Best Roosting Area for Many Bird Species as Well as Crested Larks, Especially Crested Larks Gather in Midday Summer

This roosting area, which is surrounded by water, was clearly very attractive to most avifauna species, especially when ambient temperature rose. The beneficial value of this shaded area involves three factors: 1) wet substrate ground with a lower temperature than other dry shaded grounds where birds can sit to cool their bodies.; and 2) access to water to drink frequently as needed with minimum effort while they are shading from the sun (Figure 4) in comparison to other birds who fly to the water hole 3) some protection from predators.

Figure 4: A Wet Shaded Areas inside Talha Water Hole. Its Wet Substrate Ground Has a Lower Temperature than Dry Shaded Grounds around Talha Water Hole. Substrate-Wetness Leads to Evaporation and Evaporation Causes a Substrate to Cool Down (As for Human Skin with Sweat). The Birds Apparently Take Advantage of this

The crested lark is the most abundant species all the year. Crested larks gathered in flock sizes of 5-65, shading under tall trees during midday 1-60m away from the water hole (Figure 5), and also within the water hole (Figure 6). Crested lark numbers in shade around the water hole varied between 80-170 and 3-20 individuals in summer and winter, respectively. Figure 5 shows the changes in the numbers of crested larks present at different times of day in summer and winter. As temperature rises, numbers increase around the water hole and their distance from the water reduces (Figure 6).

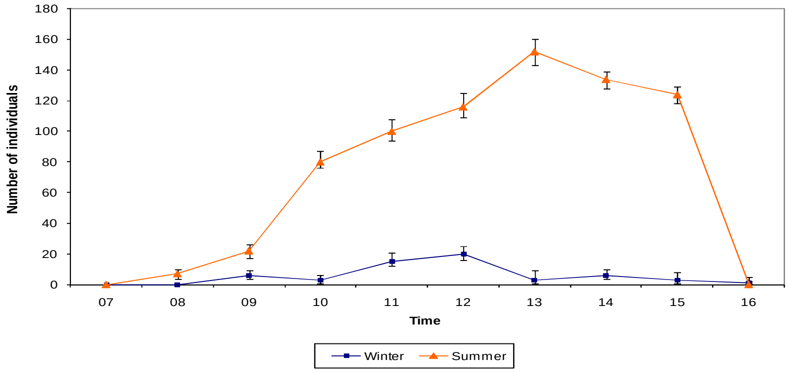

Figure 5: Talha Water Hole Diurnal Use by Crested Larks during Jan (Blue Line) and June 2009 (Red Line) Standard Error Bars Represent the Maximum and Minimum Bird Recorded during 10 Days. Number of Crested Lark Increased with Time and Reach its Maxima at after Midday from 13-15 in the Summer Season and around 11-12 in Winter

In June-August, they usually move to shaded areas around the water hole at 8am. During midday in summer, ambient temperature is about 70°C and 50°C in sun and shade respectively. Our results showed that crested lark group size was negatively correlated with distance from the water hole.

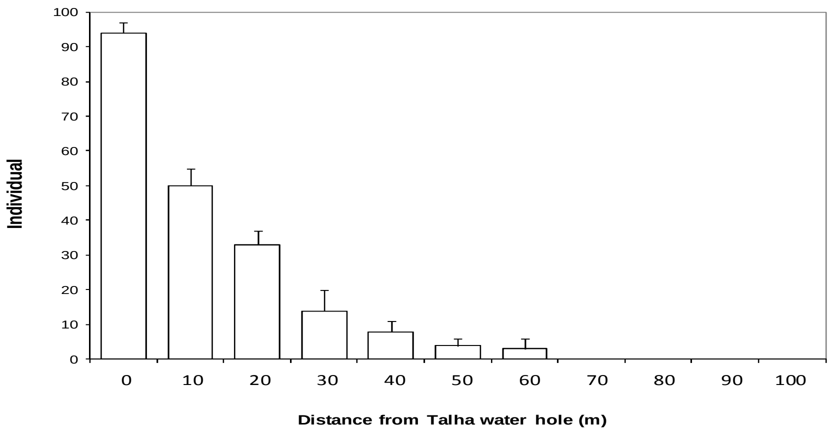

Figure 6: Distribution of Crested Larks around Talha Water Hole at Midday Summer during 21st to 30th June 2009. Standard Error Bars Represent the Maximum and Minimum Bird Recorded during 10 Days. Crested Larks Tend to be Close to the Water Hole in Midday in Summer Where their Group Size Decline as Distance from the Water Hole Increased

Water with plant cover is limited inside Talha water hole, only two places being shaded by *Acacia sp* trees (Figure 7). In the normal phase, a suitable amount of water is available which did not cover small islands within the waterhole, whereas in the overflow phase water covers most of these small islands. The deepening of Talha water hole decreased the available space area of these islands where crested larks roost mainly in midday of summer season. Shallow hole with normal fill is more preferable for crested larks by which they have shaded areas inside the water hole (small islands) to roost and easily get access to water.

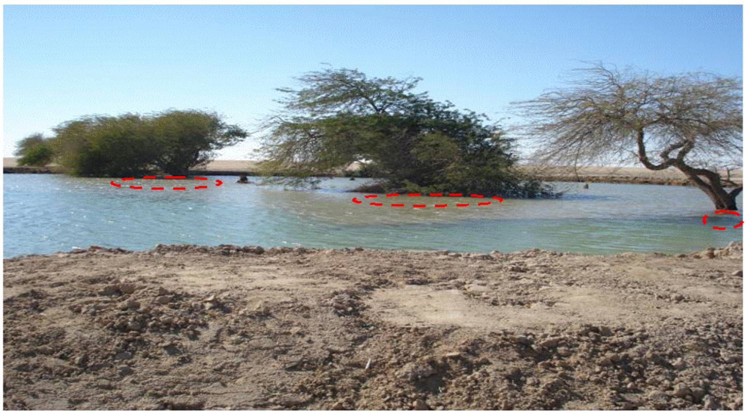

Figure 7: Talha Water Hole after Deepening its Basin during 2009. Red Circles Are the Roosting Areas Used by Crested Larks in Midday Summer Are Now under Water

Deepening the water basin several times during 2009 altered the form of the water body. One patch was covered by grass and the other patch was flooded 2/3 by water. Hence, many bird species were deprived of access to the water banks. Crested larks avoided one of these shaded areas within the water hole when dense grasses grew up, presumably to avoid possible hidden predators. Consequently, total number of crested lark flocks which was shading inside the water hole on the small islands during 2008 declined in 2009 (Figure 8). On the other hand, annual plant species increased and formed 3 small patches around the water hole after the flooding of the water basin. Thus, birds' drinking and shading places were shifted some distance. These changes in the structure of the water hole had an effect on the animals using it.

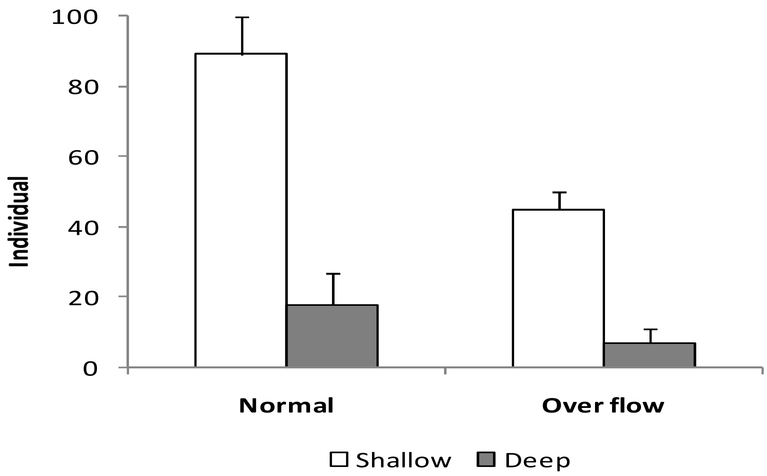

Figure 8: Comparison of Mean Abundance and Standard Error of Crested Larks within Talha Water Hole during Summer. Normal Phase with Suitable Amount of Water Which did not Cover Small Islands within the Water Hole (N=10) While over Flow Phase When Watercovers Mostly These Small Islands (N=10)

A small number of greater hoopoe larks, a solitary species, were also recorded around the water hole. Most observations of greater hoopoe larks were of one individual drinking water or shading alone or with two or three crested larks. Collared and laughing doves are sedentary species breeding in *Aciacia sp*. and *Ziziphusspp* trees surrounding Talha water hole. They were wary in approaching the water hole, drinking water for only a short time.

The water hole attracted a number of predatory species. Terrestrial predatory birds such as raptors appeared to stay at the water hole for only a short time to hunt. Aquatic predatory birds, on the other hand, appeared to stay for a longer time, up to several hours, to feed on fish. However, since individual birds were not marked it was not possible to quantify this. During spring, we found cattle egrets *Bubulcus ibis* chasing small passerines from one tree to another to feed on them, presumably reflecting a shortage of fish prey. They were observed to swallow several barn swallows *Hirundorustica* (Figure 9). A barn swallow was the most common prey item taken by predatory birds at the water hole. It was also seen being taken by squacco heron *Ardeolaralloides* and red-backed shrike*Laniuscollurio.* Ortolan bunting *Emberizahortulana* was also seen being eaten by cattle egrets and squacco herons. An immature crested lark was seen being eaten by a steppe buzzard *Buteobuteovulpinus*. Sparrow hawks were observed predating hoopoe *Upupaepops*, yellow wag-tailed *Motacillaflava,* house sparrow *Passer domesticus* and chasing crested larks. Other preys taken were wagtails, warblers and pipits. Thus quite a large number of predatory species are present at the water hole, and vigilance behaviour is very important.

Figure 9: Cattle Egrets Bubulcus Ibis Catching Barn Swallow Hirundorustica While the Later Feed on Insects Flying over Talha Water Hole

The desert monitor *Varanusgriseus* was the predator most frequently recorded. It presented a frequent predation risk to birds in the water hole area. It was very active at midday (particularly in summer), using shaded areas under vegetation cover to look for prey. The desert monitor swims in the water body to catch birds while they are drinking, or catches them when they are shading or even perching on low droopy tree stems. (It was also seen attacking the short-toed eagle and by several bite attempts tore the latter’s tail).

Mammal numbers were relatively low. A red fox *Vulpesvulpes* was seen drinking water at midday in summer. One dead red fox was also found near the water hole. Its scratched and bloody face implied an attack, probably by stray dogs. Small mammals recorded were long-eared hedgehogs *Hemiechinusauritus*and the Libyan jird *Merioneslibycus*. The former was seen frequently and dead bodies were found in different places away from the water hole. The later was seen predated by booted eagle *Hieraaetuspennatus.*

Neither black-crown sparrow lark nor bar-tail lark, which were seen in SAANR area, were seen at Talha water hole. Black-crown sparrow larks were seen near the coastal area of SAANR in winter and spring. Absence of the black-crown sparrow lark at the Talha water hole may be due to its low density in SAANR. On the other hand, bar-tailed lark were not seen around Talha water hole and not seen drinking water any where. Bar-tailed larks which inhabit ridges and remote habitats may drink from other water sources such as droplets from irrigation pipes.

DISCUSSIONS

The data collected demonstrate the importance of the water hole and its structure for the bird community. Water holes are essential for many desert species in arid lands. But there is also a balance to be struck in the provision of shade around the water hole and predation risk.Man-made waterholes should be introduced, but the design is very important. While deep water is suitable for some water birds such divers and large waders, it is unsuitable for many passerines such as lark species. Hence, the purpose of conservation and the species of interest should be considered (Rosenstock*et al.* 1999, Simpson *et al.*, 2011). Talha water hole became an essential spot for the attraction of most biodiversity in the SAANR, especially in summer. It is important to regulate human disturbance by controlling visitor numbers and minimizing works in the water hole base. Establishment of some other water holes ringed by trees will increase the total water surface area and biodiversity richness.

Crested larks are social throughout the year, but their group size varies with season, generally being higher in summer. Variation in group size depends on time, location and behaviour. During early morning and late afternoon, individuals are actively looking for food and are scattered on open ground substrates, forming small group size. In the middle of the day, especially in summer, hot weather forces birds to drink water and sit in the shade. Therefore, birds aggregate around water holes and under shading trees.

The approach of a sparrow hawk toward a flock of crested larks is more risky than that of a desert monitor *Varanusgriseus* approach. Hence, how much time a fast predator, e.g. sparrow hawk, needs to catch a prey is very short. Hart and Lendrem (1984) assumed 10 seconds for a moderate fast predator to make a final unconcealed approach and strike a prey. Avian predators often use random attacks while ground predators use prey behaviour to time an attack e.g. lions use check-wait and double-check wait tactics to launch attacks with first or second head down when an ostrich is foraging (Hart & Ledrem 1984). Furthermore, ambient temperature and time of day may influence prey response toward a detected predator; whereby a prey keeps looking and scrutinizing the detected predator for a period before responding (Elgar 1989). Global Raptor Information Network (2010) cited Geilikman (1959) states that sparrow hawks often catch prey passing nearby while sitting on a tree and also fly from tree to tree to flush passerine birds and then try to capture them in openings between trees. Thus, vegetation density is very important.

CONCLUSIONS

This study concludes that water hole is important for the bird community and the Water holes are essential for many desert species in arid lands. The design of the waterholes is very important. Talha water was essential to spot for the attraction of most biodiversity in the SAANR for summer. Increasing water holes will increase the total water surface area and biodiversity richness. Sparrow hawk toward a flock of crested larks is more risky than that of a desert monitor Varanusgriseus approach. Ambient temperature and day time may influence prey response toward a detected predator.

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