Pododces, 2008, 3(1/2): 39–44

Daily Arrival and Departure Patterns of Ruddy Shelduck *Tadorna ferruginea*, Northern Pintail *Anas acuta* and Mallard *Anas platyrhynchos* During Early Autumn at Kuyucuk Lake, Northeastern Turkey

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Received 10 May 2008; accepted 15 July 2008

Abstract: Between 25 and 28 September 2006 we observed daily local movements of non-breeding flocks of Ruddy Shelducks *Tadorna ferruginea*, Northern Pintails *Anas acuta* and Mallards *Anas platyrhynchos* staying at Kuyucuk Lake (northeastern Turkey). Mass departures of all three species from the lake started about 6:00 and most of the birds flew away within half an hour. Arrivals began only after 6:00 and lasted about twice as long as the departures. In the Ruddy Shelduck, there was a clear 135–180 minute gap between arrival and departure periods. In the Mallard and Northern Pintail, departures and arrivals overlapped to some extent. Afternoon flights were more extended in time and varied between days. Departures and arrivals were well separated only in the Ruddy Shelduck. Arrivals started *c.* 2 hours after departures both in the morning and in the evening. Observed rapid morning departures and two daily peaks of flight activity resemble patterns recorded elsewhere in these species and other ducks and geese during the non-breeding season.

Keywords: Ruddy Shelduck, Northern Pintail, Mallard, foraging, stopover, farmlands, flight movements, Kuyucuk Lake.

INTRODUCTION

Travel to foraging sites is an important part of a bird's time and energy budget. Dabbling ducks and geese often forage on cropland, and the distance between roosting and foraging sites may exceed 20 or even 40 km. Flocks usually leave a roost soon after dawn and return there near sunset (Newton *et al.* 1973; Davis *et al.* 1989; Frazer *et al*. 1990). Such a situation occurred at Kuyucuk Lake in the Kars region in northeastern Turkey (40°45'N, 43°27'E; Fig. 1). This small shallow lake is one of Turkey's Important Bird Areas (IBA) which in the non-breeding season holds thousands of waterfowl, including Ruddy Shelducks *Tadorna ferruginea* which breed in this region, and hundreds of Northern Pintails *Anas acuta* and Mallards *Anas platyrhynchos*(BirdLife International 2007). The maximum numbers of these species recorded during the study were 12,700, 580 and 1,990 Ruddy Shelducks, Northern Pintails and Mallards respectively. However, for these birds Kuyucuk Lake serves only as a roost during the night and a part of the day, and they forage on surrounding fields. In these three species we observed very regular patterns of foraging flights resembling those observed in other parts of the world (Lebret 1959; Newton *et al.* 1973; Davis *et al.* 1989; Frazer *et al.* 1990; Cox & Afton 1996; Shimada 2002).

This paper shows the flight activity pattern of three wildfowl species staying at Kuyucuk Lake during three consecutive days in autumn. Understanding the pattern and the place of foraging on fields in their energy budget may be helpful in introducing conservation measures at surrounding farmland, and to secure suitable conditions for both common wildfowl species and those with unfavourable conservation status using this IBA as a resting site.

STUDY AREAS

Kuyucuk Lake, with an area of 219 ha, is situated on the high Kars-Akyaka plateau, in the centre of an open, undulating landscape

(Fig. 1). The lake was designated as an IBA because of its importance for breeding waterbirds (BirdLife International 2007). Within the shallowest areas of the lake, the emergent vegetation is limited, but in more sheltered bays there are small stands of reed *Phragmites australis.* The altitude of Kuyucuk Lake (1630 m) is lower than that of similar neighbouring sites such as Çıldır Lake (1962 m), Aygır Lake (2200 m) and Ot Lake (2000 m), and this affects harvesting time in surrounding agricultural areas and also the period that farming leftovers remain in fields. Corn-growing and cattle-breeding are the main agricultural activities around Kuyucuk Lake and in adjacent areas. However, stubble fields around Kuyucuk Lake are grazed by cattle and sheep and in September there is very little grain available for foraging birds. In other neighbouring areas, located at higher altitudes near Çıldır and Aygır Lakes, harvest begins later and in September no cattle are grazed on stubble fields, so that birds can feed on leftover grain.

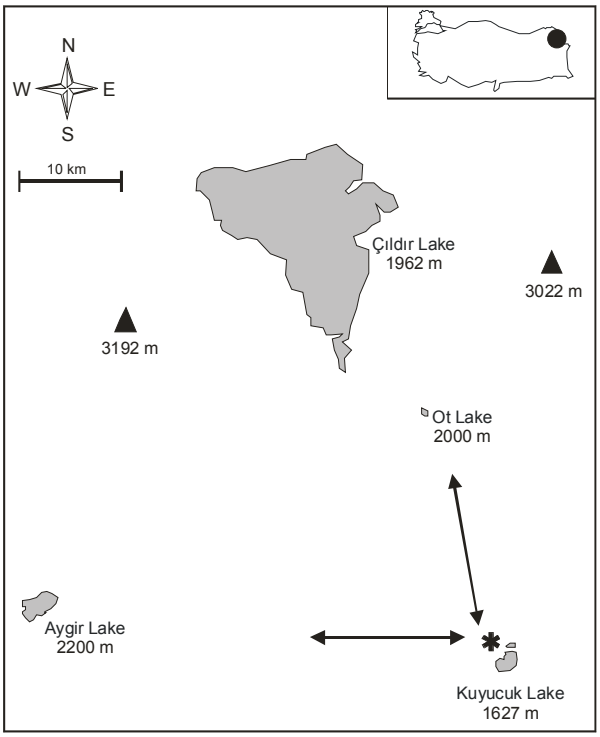

Figure 1. Location of the study area (black dot in inset) and surroundings of Kuyucuk Lake, and altitudes of highest mountain peaks and lakes (m a.s.l.). Asterisk - observation point; arrows – main directions of flights.

METHODS

In the period 25–28 September 2006, we counted birds departing from and arriving at Kuyucuk Lake continuously from dawn to dusk. The location of the observation point (Fig. 1) and coverage of the different sectors of the view by two or three observers counting birds at the same time allowed us to record accurately most of the waterfowl movements in all four cardinal directions, except for movements to and from the south, where visibility was reduced. However, during the counts, we did not note any departures or arrivals of birds in this sector. Similarly, there were no movements in the eastern sector of the lake shore. Thus, we assumed that our counts covered all departures and arrivals of Ruddy Shelducks, Northern Pintails and Mallards at Kuyucuk Lake during the study period. Birds of these three species were recorded from first light (05:30) to dusk (18:30), in 15 minutes intervals. The size and direction of departure or arrival were noted for each flock. However, during the peak period of arrivals and departures it was often impossible to count each flock separately, because small groups of birds frequently came together to form larger flocks while other flocks split apart. The weather conditions were similar on all days of the study, with occasional short showers in the afternoons. The winds were light and could have had only a limited influence on the movements observed, especially in the case of relatively heavy birds such as Ruddy Shelducks. The numbers of departing and arriving ducks recorded for each species varied slightly from day to day because the numbers of birds occurring at the lake also differed on consecutive days. Furthermore, we could not exclude the possibility that some of the flocks were overlooked during our observations. For this reason, the dynamics of departures and arrivals have been presented on a percentage scale, where 100% is the total number of birds of a given species departing or arriving during a day.

RESULTS

The majority of the flights were in a northerly or westerly direction in relation to the lake (Fig. 1). There were no movements in the sector to the south of the observation point. The only movements of birds on the eastern shore of Kuyucuk Lake were local movements between the lake and the shore, and no mass flights to or from the east were observed.

In the morning, the first departing birds (mainly Mallards) were noted about 05:40, but massive departures of all three species started in the second quarter of an hour after first light (05:45–6:00). The bulk of all three waterfowl species under study flew away within the first half an hour (Figs. 2–4). In the Mallard, arrivals started as early as 06:00, but in the two other species, not until 07:00–07:30. In all three species, arrivals lasted about twice as long as departures. In the Mallard and Northern Pintail, the time span between the peak of departures and peak of arrivals was about 105–135 minutes (Figs. 2–3). In the Ruddy Shelduck, departures and arrivals were more separated in time; there was no overlap between the arrival and departure periods, and the gap between peaks lasted from 135 to 180 minutes (Fig. 4). Except in a few cases, almost no flights were observed between 09:00 and 15:30, when birds began to depart again.

During the afternoon, flights to and from the feeding grounds occurred over a greater time period and their schedule varied more between days than in the mornings. Only in the Ruddy Shelduck was the timing of afternoon departures and arrivals well separated. After a period of departures lasting *c.* 2 hours, arrivals started rapidly about 17:30, and the peak numbers occurred about half an hour before darkness. However, the gap between departure and arrival peaks was shorter than in the morning and lasted for about 60–105 minutes, whereas in both the Mallard and Northern Pintail, the periods of departures and arrivals overlapped to a great extent.

The maximum number of Ruddy Shelducks departing in the morning in one 15-minute interval varied between 2516 and 9439 individuals (mean: 5415; *n*=4), while the maximum number of birds arriving in the evening ranged from 2863 to 8110 (mean: 5943; *n*=4). The daily maximum numbers of both *Anas* species during departure and arrival were much lower, and usually did not exceed 300 birds in 15 minutes except in two cases, when 558 Mallards and 690 Northern Pintails were noted arriving in one 15-minute period.

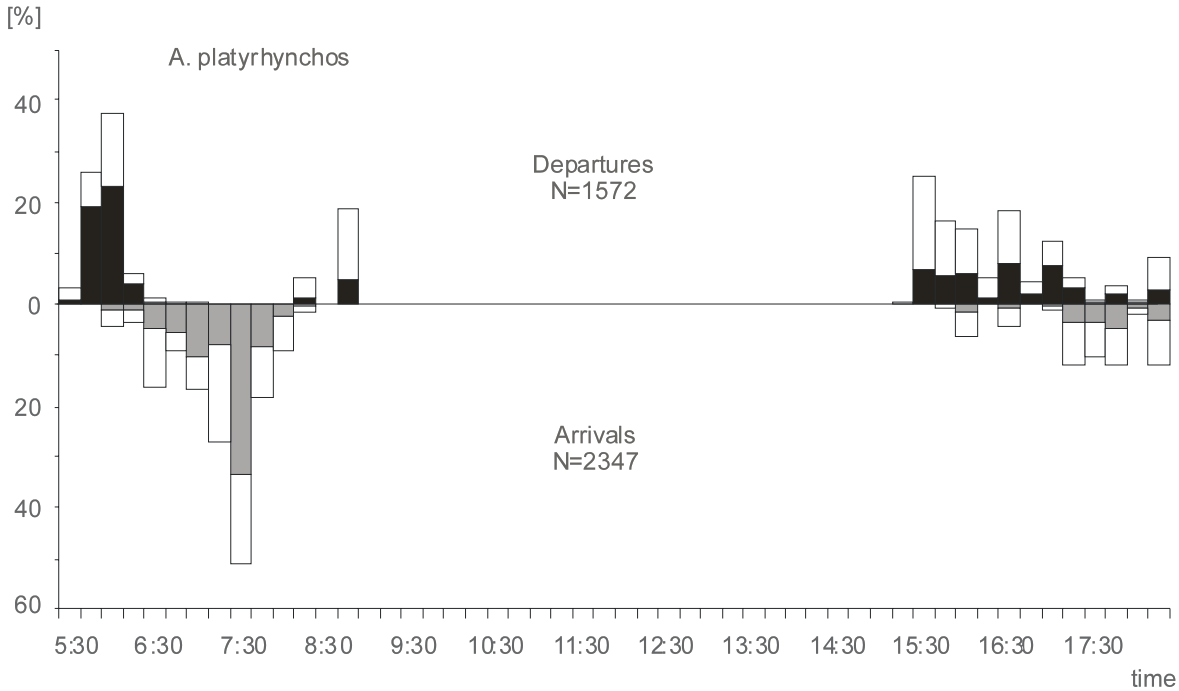

Figure 2. Timing of departures (above the axis) and arrivals (below the axis) of Mallard at Kuyucuk Lake. Black and grey bars – mean numbers in 15-minute intervals; white bars – maximum numbers in 15-minute intervals.

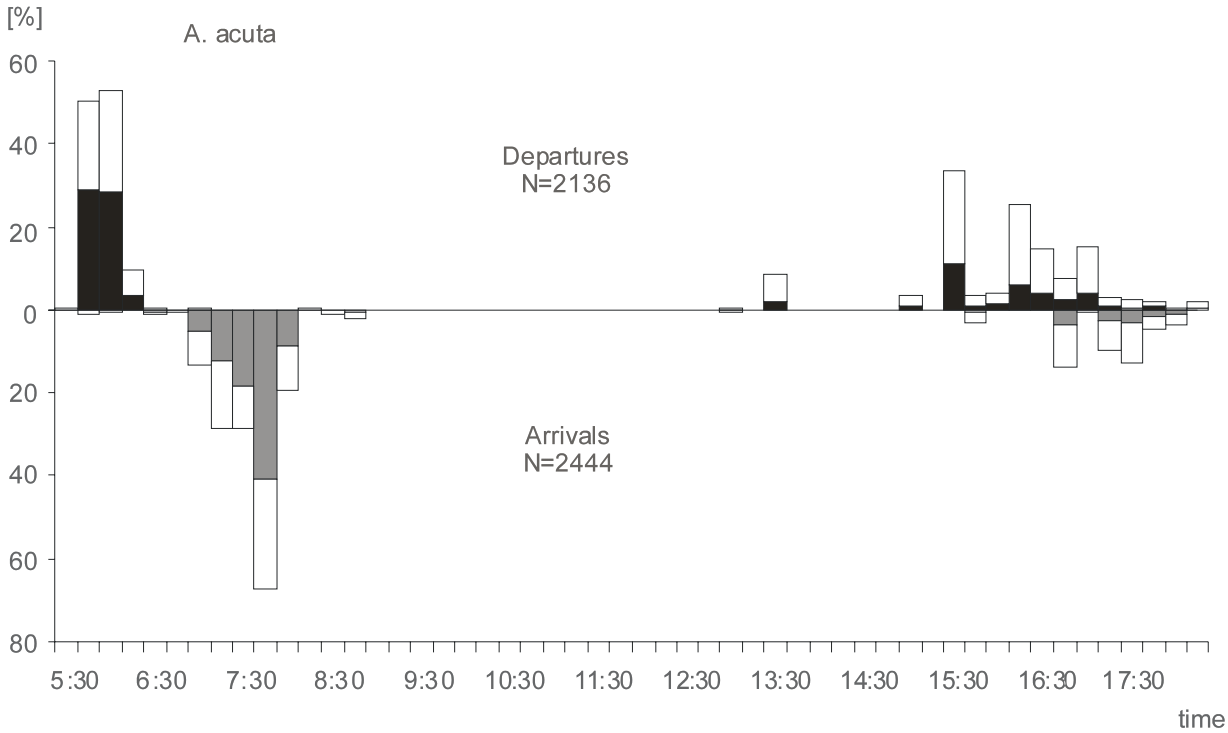

Figure 3. Timing of departures (above the axis) and arrivals (below the axis) of Northern Pintail at Kuyucuk Lake. Explanations as in Fig. 2.

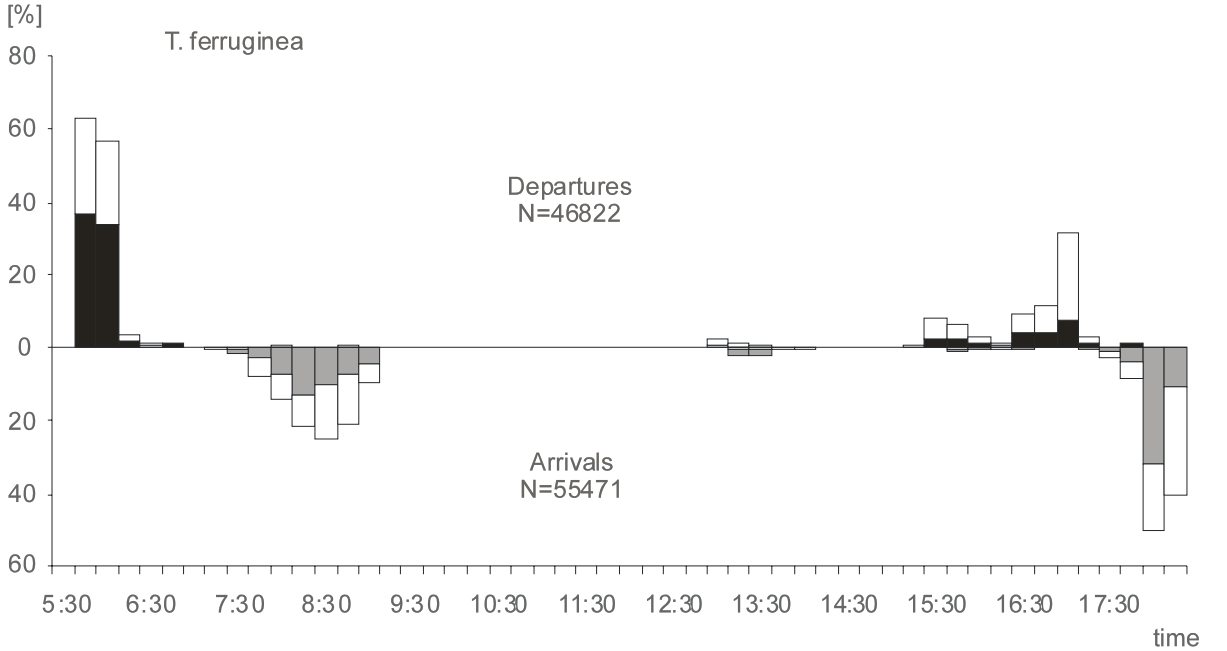

Figure 4. Timing of departures (above the axis) and arrivals (below the axis) of Ruddy Shelduck at Kuyucuk Lake. Explanations as in Fig. 2.

DISCUSSION

The northerly and westerly directions of flights from Kuyucuk Lake correspond with the location of farmland between this lake and Çıldır and Aygır Lakes. This suggests that these areas are foraging sites for waterfowl departing from Kuyucuk Lake. This is confirmed by information from local farmers about flocks of geese and ducks foraging on fields around Çıldır and Aygır Lakes. The reason why the birds use Kuyucuk Lake only as a roost and fly every day to forage in fields near the other lakes might be differences in the timing of the harvest and farming practices, and thus in food availability between these areas. However, in September 2007 flocks of feeding Ruddy Shelducks were observed regularly only a few kilometres from Kuyucuk Lake (A.Kośmicki pers. comm.), which was not the case in 2006. It is known that birds are able to adjust their behaviour to changes in food abundance and change foraging sites quickly (Stephens & Krebs 1986; Cox & Afton 1996).

The foraging flights of the three species under study were concentrated during the early mornings and late afternoons, with reduced activity during the middle of the day. The morning departures of all three species were very rapid, and almost all birds departed within a period of 30 minutes. Similarly rapid morning departures have been observed in the Canada Goose *Branta canadensis* (Raveling *et al.* 1972) and the Greater White-fronted Goose *Anser albifrons* (Ely 1992; Shimada 2002). The afternoon departure patterns of the Mallard, Northern Pintail and Ruddy Shelduck in Kuyucuk Lake were more variable and more protracted than in the morning, which is similar to results obtained for the Canada Goose in North America (Raveling *et al.* 1972).

Light and weather conditions may have a crucial influence on the timing of foraging flights in waterfowl (Hein & Haugen 1966; Raveling *et al.* 1972; Ely 1992). During the whole four-day period of our observations at Kuyucuk Lake, the weather was almost the same, and thus the pattern of foraging flights was similar on consecutive days.

A two-peak pattern of foraging flights has also been noted in the Canada Goose (Raveling *et al.* 1972) and Greater White-fronted Goose (Ely 1992), as well as in previous studies of the Northern Pintail and Mallard (Cramp & Simmons 1977). Thus, it seems that such behaviour is typical for Anatidae species that stopover in agricultural landscapes. However, in some circumstances geese rest during the day at the foraging site without returning to their night roost (Shimada 2002). In some areas, Mallard and other dabbling ducks may also depart after sunset for nocturnal foraging (Tamisier 1976; Cramp & Simmons 1977). Therefore, some birds, especially Mallards and Northern Pintails which can feed at night, might have returned to Kuyucuk Lake after dusk and could have been overlooked.

The quality of food is of great importance in the selection of feeding areas by avian herbivores (Owen 1971; Prop & Vulink 1992). When these birds are feeding on the green parts of plants, the foraging time is long because of the poor quality of this kind of food (Bruinzeel *et al.* 1997). The kernels of cereals and maize and fertilized leaves of grasses and cereals provide highly digestible food for waterfowl, thus the foraging time spent on such crops can be much shorter (Krapu & Reinecke 1992). It appears that for the birds observed at Kuyucuk Lake, the amount of time required to obtain sufficient food was about two hours of morning feeding and about one hour of evening feeding. However, the ducks probably did not spend the majority of their feeding period actually foraging. As in other species of ducks and geese, much time might be spent in alertness, loafing and aggression (Raveling *et al.* 1972, Ely 1992). Large concentrations of waterfowl comparable to those found at Kuyucuk Lake have not been recorded at other lakes in the area, and it seems that Kuyucuk Lake is their preferred roosting site. One of the reasons might be the rich underwater plant communities in the lake. Foraging on aquatic plants by waterfowl was confirmed by visual observations and by inspection of the droppings of Ruddy Shelducks collected from the lake shore. Wheat grains provide a high energy food source, but are deficient in several amino-acids that are required by waterfowl (Joyner *et al.* 1987). Thus, inclusion of aquatic plants in the diet provides important nutrients that do not occur in grain.

The Kuyucuk Lake is one of the most important sites for non-breeding Ruddy Shelducks within this species range, and during

the present study supported between 9,700 and 12,740 individuals. This is *c.* 6–7% of the global population estimated to be 173,000–223,000 individuals and 16% of Black and Caspian Sea population (Wetlands International 2006). If these numbers were supported regularly this Kuyucuk Lake would qualify as a Ramsar site. According to BirdLife International (2004) the Turkish population of Ruddy Shelduck is declining and at a European level (including Turkey) this species is classified as of unfavourable conservation status (SPEC3). Thus, any changes in agricultural land use in the surroundings of Kuyucuk Lake may have crucial influence on the future of this species, because expanding farmland and introduction of irrigation systems cause change in traditional farming practice and thus are current threats for this species.

Acknowledgements: We would like to acknowledge deeply Dr Cagan Hakki Sekercioglu of Stanford University, USA, and Dr Mehmet Ali Kirpik of Kafkas University in Kars, Turkey, for organising our visit in Turkey. The research was sponsored by the Christensen Fund (Palo Alto, 394 University Avenue, CA, USA). We are grateful to Prof. Murat Biricik, Dr Derek Scott, Dr Richard Hearn, Dr Taej Mundkur and Dr Boris Nikolov for useful comments on the earlier version of the manuscript.

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