

Diurnal patterns at an autumn migration ringing site near the Sudan Red Sea coast

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Summary

During August to October in 1982 and 1983 large numbers of migrating Palaearctic passerines were trapped and ringed after their early morning arrival in a small watered garden at Khor Arba'at near the Sudan Red Sea coast (Nikolaus 1983). Numbers within this small site varied throughout the day according to a regular pattern, and it was noted that different species peaked in the catch at different times of the morning. In 1984 the site was worked systematically with a constant number of mist-nets over the main migration period, from 17 August to 23 September. Times of capture were noted and the temporal capture profile, from dawn to midday, was determined for each species. Nocturnal migration was also investigated during September 1984 by observing birds crossing the face of the full or near full moon.

Site details and methods

Khor Arba'at (19°42'N, 37°16'E) lies at the foot of the Red Sea Hills, where it provided a water source and pump station for the town of Port Sudan on the coast about 25 km to the southeast. Here, an L-shaped watered garden of some 0.5 ha with date palms and lemon trees formed a small green oasis amid arid surroundings during August–September. The ground outside was completely bare, the small sparse acacia bushes leafless towards the end of the local hot dry season (see Fig. 1). Days and nights were fine throughout August–September 1984, with daily maximum temperatures of 40–44°C during early weeks, falling to 36°C later in September. Two sets of four 12 m x 2.5 m mist-nets were employed throughout, each set across an arm of the L, 96 m of net in all. These were opened each day from before dawn until 12:00 or 13:00, and usually closed during the afternoon. They were sometimes opened and checked throughout the night. Times of capture were routinely noted within half-hour periods. Sunrise was at 05:00–05:15, sunset at 18:00–18:15.



Figure 1. The Khor Arba'at water pump station in September 1984.

To compare the intensity of migration at different times of night, and to estimate direction of flight, birds crossing the disc of a full or near full moon were observed and counted during the four nights beginning 8–11 September. Numbers were recorded within 15-min periods of observation through 10x binoculars, continuously from 19:00 to 21:15, then over the first 15 min of each hour from 22:00 to 02:00. Mean counts per 15-min period were derived by pooling results from different nights. On the first two nights the moon was already up at sunset so that observation could begin from 18:15. On the last two nights the moon was high enough in the sky to allow counts nearer dawn, and these were made within 15-min periods from 03:00 to 04:45. Direction was deduced from points at which birds entered and left the moon's disc, taking account of its position in the night sky. Without knowledge of the birds' height and without correction for the moon's altitude no attempt could be made to assess migration density quantitatively, but moonwatching revealed a consistent nightly pattern of overhead migration traffic.

Daytime in the garden

Remarkable numbers of Palaearctic passerines entered the tiny garden at times. Thousands were present on some days with many hundreds caught and ringed. Although nets were occasionally opened and checked at night practically no birds were caught. But from first light at 04:45 birds descended rapidly into the garden each morning with a whistling wing sound, and this continued over a period of about 20 minutes. Many birds, mainly Thrush Nightingales *Luscinia luscinia*, were then caught in the nets before sunrise. Other species, notably Marsh Warbler *Acrocephalus palustris*, soon joined the catch, but others were scarce in the earliest net round and tended to appear mainly from 08:00 or later. These 'later' species were perhaps entering the garden throughout the morning unnoticed. Catching typically remained very brisk

for about five hours, but obvious activity decreased, most birds taking shelter within the date groves and other leafy cover and emerging only to drink from the various puddles and troughs provided. By 12:00–13:00, when the temperature often reached 43°C or higher and a northeasterly wind had got up, the garden would appear quiet, but inspection of the date groves often revealed the rustlings of hundreds of sheltering passerines, and the impression was that full numbers were then still present. Three hours later most of these birds had invariably left the garden, but attempts to observe their departure from its perimeter during the hot afternoon met with little success.

Moonwatching observations

Nocturnal activity as revealed by moonwatching occurred within two separated periods, as illustrated in Fig. 2. It peaked during the first hour after sunset, 18:30–19:30, when the mean hourly count of birds moving across the moon's disc exceeded 40. This initially included some very low flying birds that were assumed to be taking off from the garden. Movement then decreased steadily until finally ceasing around 21:00. It was renewed again after midnight and then continued until first light at 04:30. Peak activity in these early morning hours was recorded between 03:00 and 04:00, a time when many bird calls were heard, notably those of Ortolan Bunting *Emberiza hortulana*. A mean count then of about 20 birds per hour crossing the moon was lower, however, than that recorded after sunset. From their size and flight pattern during a typical one to two second transit of the moon's disc most birds were judged to be small passerines. They all appeared to be following a heading about south to south-southwest.

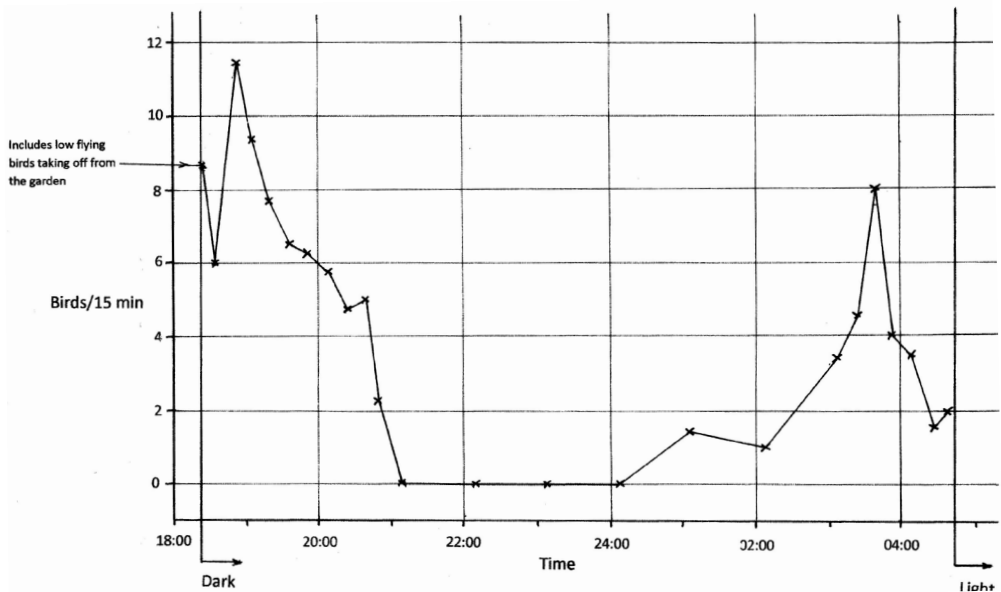


Figure 2. Mean count of birds crossing the moon during each 15-min period.

Hourly capture patterns of individual species

Capture patterns of the main species are shown in Fig. 3, which gives the percentage of the season's overall catch netted within each hourly period of the morning. Birds entered the nets from 05:00, just before sunrise, and continued to do so into the late morning. Activity typically tailed off about midday (12:00) and the nets were usually closed soon after. The first hour of netting was invariably dominated by Thrush Nightingale, and accounted for over 60% of this species' catch. The few Common Nightingales *Luscinia megarhynchos* were also mostly caught soon after dawn. Other early species were River Warbler *Locustella fluviatilis* (with 65% before 07:00) and Common Redstart *Phoenicurus phoenicurus* (60% before 06:00). Marsh Warbler, the principal species overall, made an early appearance, but the main catching period extended from 05:30 to 09:00. A similar temporal pattern was found for Reed Warbler *A. scirpaceus* and Great Reed Warbler *A. arundinaceus*, but Olivaceous Warbler *Iduna pallida* was caught mainly from 07:00 onwards. There were few *Sylvia* warblers during the early hours, but they became prominent throughout the garden from about 08:00 onwards. Almost half the Garden Warblers *S. borin* and Common Whitethroats *S. communis* were caught between 10:00 and midday, and a similar pattern was found with Blackcap *S. atricapilla*, Lesser Whitethroat *S. curruca* and Barred Warbler *S. nisoria*. Willow Warblers *Phylloscopus trochilus* and Spotted Flycatchers *Muscicapa striata* were scarce before 08:00, but commonly caught from 09:00 until after midday. Golden Oriole *Oriolus oriolus* was another species that appeared in late morning, as were Ortolan and Cretzchmar's Buntings *Emberiza caesia*, both caught mainly after 10:00. All three of the main shrike species, Red-backed *Lanius collurio*, Woodchat *L. senator* and Nubian *L. nubicus*, were very much in evidence from first light and then throughout the morning, undoubtedly following the concentration of small migrants. About half the catch of these shrikes was taken before 07:00. Lesser Grey Shrikes *L. minor*, on the other hand, seemed to arrive later, most being caught between 06:30 and 11:00.

Thus, as evidenced by trapping numbers, the invasion of this tiny 'oasis' at day-break by Thrush Nightingales was followed by the successive appearance of first Marsh Warblers, then Olivaceous Warblers, *Sylvia* species, and finally, in mid morning, Willow Warblers, Spotted Flycatchers, Golden Orioles and others.

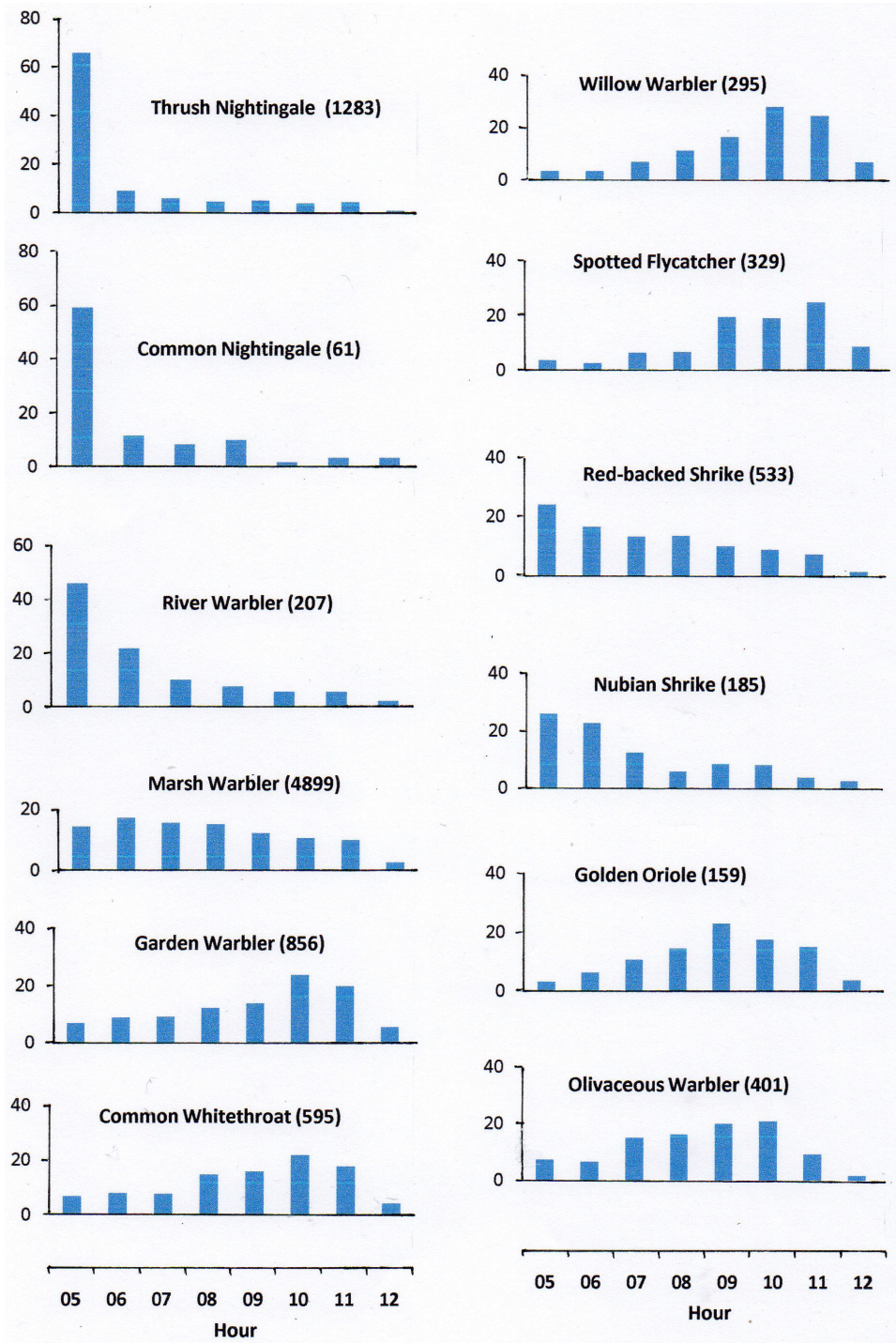


Figure 3. Percentage of the total season's catch of each species caught during hourly periods beginning at the morning times shown. The total catch for each species is given in parentheses.

Discussion

Migration at night

The passerine migrants arriving at Khor Arba'at each morning during August and September were mostly assumed to have crossed the Red Sea on a south to southwesterly heading, having set off the previous evening from northwest Saudi Arabia. The vegetated hills inland from the coast near Yanbu-al-Bahr may well have afforded a suitable transit and takeoff area. Such a flight would involve an oblique sea crossing of some 300–400 km followed before arrival at the ringing site by a shorter transit of the arid coastal Sudan plain, with its sparse littoral and semi-arid vegetation, as indicated in Fig. 4. The south to south southwest heading apparent in the birds observed crossing the moon would fit this picture.

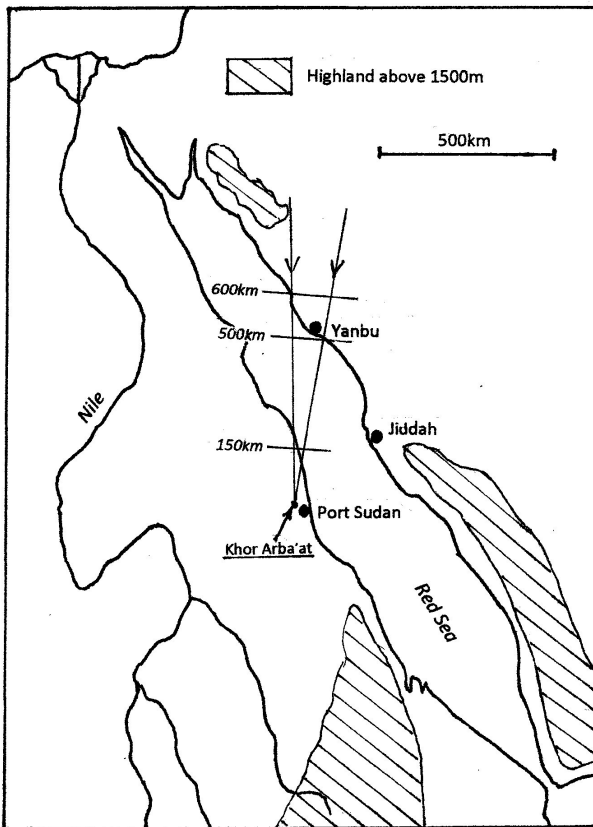


Figure 4. The Red Sea showing the location of Khor Arba'at, and suggesting the likely takeoff area and direction of migration of passerines arriving from Saudi Arabia. Distances from the site are indicated.

In a study of autumn migration across the deserts of northeast Egypt Biebach *et al.* (1991) assumed flight speeds for small passerines of between 15 and 21 m/s. This was based on radar measurements elsewhere, and included an 8 m/s component for the likely tailwind at an altitude of 1000 m. Winds over the northern Red Sea are also typically light to moderate from north to northwest (Edwards 1987), and would probably be stronger at 1000 m altitude. We could therefore assume a similar correction for wind speed as did Biebach *et al.* (1991) and also take likely ground speeds for birds flying from northwest Arabia to coastal Sudan as between about 15 and 20 m/s. Birds taking off in the evening from the Arabian coastal hinterland would then be expected to take some 9–12 h to reach Khor Arba'at about 500–600 km away, arriving shortly before or around dawn. If distance from takeoff or ground speed were outside these assumed ranges birds would arrive earlier before dawn or later into the morning.

Moonwatching at Khor Arba'at revealed two separate periods of nocturnal migration, one over the first three hours of darkness, the second over the last three to four hours of the night. Birds crossing the moon soon after dusk (a few quite close by) were assumed to be moving from the coastal plain shortly after takeoff from nearby sites. Again, assuming ground speeds in the range 15–20 m/s, the continuation of this movement up to 21:00 could account for birds heading from the plain from up to about 200 km to the north. But its cessation at this time indicated that further north–south nocturnal movement along the Sudan coast was minimal. The renewal of activity after midnight probably involved the arrival of the first of the birds to have taken off the previous evening from near the opposite Red Sea coast. Peak moon observations at 03:00–04:00 presumably reflected the main overhead passage of birds from Arabia heading into the Sudan Red Sea Hills and the Nile basin beyond.

Arrivals in the garden

The difference in arrival and capture times of different species in the Khor Arba'at garden was striking. Given their more crepuscular habits, the prominence of *Luscinia* species in the first round catches was to be expected. But the delay of two to three hours before the build up in numbers of some of the warbler species was surprising. One possibility is that species such as Thrush Nightingale and River Warbler were from less distant Arabian takeoff areas, or had faster flight speeds, than say Olivaceous Warbler and Willow Warbler, and so reached Khor Arba'at earlier. But this would imply that the later arrivals were continuing their migratory flight for several hot hours into the morning. It seems much more likely that all overflying migrants were looking for a landing area at first light, and the small green oasis of Khor Arba'at was especially attractive to birds requiring shade and cover such as *Luscinia*, *Acrocephalus* and *Locustella* species. Others might be able to tolerate landing in less verdant sites better, with Olivaceous Warblers, Willow Warblers and Spotted Flycatchers, for example, more able to feed in drier bush. Their influx into the garden may well have occurred unobtrusively, subsequent to an initial landing in the surrounding area.

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