

Chance and challenges in the protection of three avian specialists, Common Nightingale *Luscinia megarhynchos*, Clamorous Reed Warbler *Acrocephalus stentoreus* and Dead Sea Sparrow *Passer moabiticus*, in the Jordan valley, Hashemite Kingdom of Jordan

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Terrestrial biodiversity is increasingly threatened by a variety of human activities, including habitat conversion and degradation, habitat fragmentation, climate change, harvesting and pollution (Neubold *et al* 2015). The Jordan valley is ideal to investigate such impacts because of its limited resources, a rapidly growing population and regional political conflicts (*eg* Venot *et al* 2008, Hoff *et al* 2011). The Jordan valley consists of low-lying plains with a hot, arid climate. Located in the northern part of the Great rift valley, it includes the river Jordan which drains into the Dead sea at 410 m below sea level. The banks of this small river, adjacent floodplains and tributaries historically contained important wetlands and dry salt marshes for birds (Andrews 1995, RSCN 2000, Khoury & Korner 2018), amidst an arid, often barren landscape which has been partly converted to agricultural land and where natural water flow has dramatically diminished in recent decades due to high demands for water and building dams in the upper reaches of the tributaries (Venot *et al* 2008, Albert *et al* 2004, Waitzbauer & Petutsching 2004a). Overgrazing by livestock, wood cutting and invasion of the alien plant mesquite *Prosopis juliflora* which is facilitated by grazing livestock (Andrews 1995, Khoury & Korner 2018, Dufour-Dror & Schmida 2017) are causing additional pressures on ecosystem functions and bird habitats. The effects of the loss of a wetland habitat in an arid region on migrating and breeding bird species are already well demonstrated in another region in Jordan: the Azraq oasis marshland in the eastern desert of Jordan, which dried out during the 1980s due to over-pumping of ground water (Andrews 1991, Khoury 1996). On the eastern side of the Jordan valley, signs of population declines or local extinctions have been recently noted north of the Dead sea in at least three breeding passerine species (Common Nightingale *Luscinia megarhynchos*, Clamorous Reed Warbler *Acrocephalus stentoreus* and Dead Sea Sparrow *Passer moabiticus*), which appear to be specialists during the breeding season in natural or semi-natural, inundated habitats with dense vegetation (Khoury & Korner 2018). This paper lists breeding birds of some remnant wetlands in the Jordan valley, summarizes the current status of Common Nightingale, Clamorous Reed Warbler and Dead Sea Sparrow (three breeding species with very restricted distribution) and recommends conservation actions.

FIELD METHODS AND STUDY AREA

This report is based on field research conducted along tributaries (often in wadis *ie* valleys) of the river Jordan, in the central and southern parts of the Jordan valley. Field work consisted of walking 64 transects with a length of 200 m each along various sections of the wadis; each transect was walked twice during the breeding season (late March–early June) of 2016. The survey focused on downstream sections of three wadis or major wadi systems, in the flat part of the Jordan valley, *ie* Kafrein-Hisban-Gharba, Wadi Kharrar and

the Zarqa valley, in addition to other tributaries. Study sites were low-lying (below sea level) where mean annual precipitation is around 110 mm, and mean annual temperature 23°C. Most rain falls in winter when temperatures are mild, whereas the summer is very hot and dry (Waitzbauer & Petutsching 2004b). The lower parts of the Jordan's tributaries, often narrow and shallow wadis, are surrounded by arid landscape used as pasture, abandoned fields, or intensive, irrigated agriculture. Farmland dominates much of the landscape, and agricultural expansion has caused widespread destruction of natural bird habitats (Andrews 1995, Albert *et al* 2004). The open, irrigated fields contain mainly vegetables, sorghum and alfalfa, and there are a few sites with greenhouses, fish ponds, banana, date palm or citrus groves. Towns are located on the eastern edges of the study areas but there are bedouin camps and barns within the study areas where local overgrazing by livestock (goats, sheep and locally camels) and woodcutting are degrading much of the vegetation. Some wadis contain perennial streams, and the current sources of water are either springs located further upstream or drainage from farms and waste water facilities. The narrow streams are lined with reed and sedge, scattered shrubs and various shrubs and trees *eg* *Ziziphus* sp, *Balanites aegyptiaca*, *Tamarix* sp, and/or *Nerium oleander*. Highly



Plate 1. An example of a highly disturbed section in Wadi Gharba, bordered by a palm grove, Jordan. This habitat strip has experienced heavy grazing by camels, goats and sheep, and *Prosopis juliflora* invasion. © Fares Khoury



Plate 2. A highly disturbed section of Wadi Zarqa in the Jordan valley, Jordan, which has experienced intensive grazing by sheep, goats and camels. © Fares Khoury



Plate 3. A fairly undisturbed wetland strip along Wadi Zarqa (Damia, central Jordan valley, Jordan) 0.5 km before it flows into the river Jordan, with some occasional, marginal grazing by sheep and goats and surrounded by open fields and barren hills. The vegetation consists of *Tamarix* thickets mixed with reeds. Breeding birds include Turtle Dove, Common Nightingale, Reed and Clamorous Reed Warblers, Cetti's Warbler, Spanish and Dead Sea Sparrows. © Fares Khoury



Plate 4. Overview over a wide section of Wadi Gharba, Jordan, with moderate grazing intensity, forming a marsh with *Tamarix* thickets, c7 km north of the Dead sea and c3 km before it flows into the Jordan river. Breeding birds include Little Bittern, Blue-cheeked Bee-eater, Clamorous Reed Warbler, Cetti's Warbler, Spanish and Dead Sea Sparrows, and possibly Common Nightingale. © Fares Khoury

disturbed sections have either extremely impoverished vegetation and/or are dominated by alien *Prosopis juliflora* shrubs (Plates 1, 2). Fairly undisturbed sections often have heterogeneous vegetation, including sections with inundated *Tamarix* thickets mixed with reed, grasses, sedge, cattail, and in drier sections a variety of other shrubs (Plates 3, 4). The sections closest to the Jordan, which is also a political border, were less disturbed by grazing and woodcutting and relatively inaccessible. Riparian-like vegetation occurs where wadis meet the Jordan, with a mix of *Tamarix* sp, reeds, poplar *Populus euphratica* and willow *Salix* sp.

RESULTS AND DISCUSSION

Table 1 is a list of all avian species (including scientific names) recorded and assumed breeding along or adjacent to wadis with streams in lower parts of the Jordan valley. The most abundant and ubiquitous breeding species were Eastern Olivaceous Warbler, White-spectacled Bulbul and Graceful Prinia (in over 90% of sites), followed by Eurasian Collared Dove, Laughing Dove, Rufous Bush Robin and House Sparrow. These were also present in other habitats including the margins of farmlands, and can thus be considered generalist species. In comparison, breeding birds localized and associated with wetland habitats had intermediate or low frequencies of occurrence (Table 1). These specialists include Blue-cheeked Bee-eater, Pied Kingfisher, Common Nightingale, Clamorous Reed Warbler and Dead Sea Sparrow, some of which have experienced a recent reduction in breeding distribution in the Jordan valley (cf Khoury 2001, Khoury *et al* 2006). The latter three species were totally absent in sites degraded by overgrazing and/or dominated by the invasive *Prosopis juliflora*. They were found breeding locally in inundated *Tamarix* thickets which were usually mixed with reeds and low vegetation, with marginal or low grazing intensity. These three are discussed here.

Common Nightingale. Although at the southern limit of its breeding range, the Common Nightingale is not an uncommon summer visitor and breeding species along the river Jordan (Shirihai 1996). In Jordan, it is restricted to the banks of the Jordan and nearby sections of a few tributaries. During the breeding season of 2016, this was one of the most localized breeding species with 16 individuals, most of which were singing males, recorded in 6 transects in dense inundated habitats along the lower Wadi Zarqa (Damia, Plate 3), the adjacent banks of the river Jordan with one also recorded in Wadi Gharba. In Wadi al-Kharrar, which also includes the touristic 'baptism site', the Common Nightingale used to breed (Khoury 2001) but recent evidence is lacking. There is obvious habitat alteration and increase in disturbance due to decline of natural water resources and a recent increase in tourist numbers.

Clamorous Reed Warbler. This species apparently requires large patches of reed, preferably mixed with inundated *Tamarix* or other shrubs (Plates 3, 4). In 2016, 30 birds were counted in 11 transects, indicating its localized occurrence in less disturbed habitat. It breeds along the river Jordan and some tributaries. After disappearing from Azraq marshland, which dried out in the 1980s, it became restricted in Jordan to the Jordan valley area (Andrews 1995, Khoury *et al* 2006). It disappeared from Wadi al-Kharrar where it had previously bred (Khoury 2001) probably due to the drying out of the local spring and subsequent habitat change (Plate 5). It did not re-colonize this site by 2016 despite recent 'rehabilitation' attempts by pumping some water into the wadi.

Dead Sea Sparrow. A typical bird of the low-lying Jordan valley, inhabiting inundated *Tamarix* thickets where it breeds in loose colonies (Plates 3, 4, 6). In 2016, forty-seven birds and many active nests were counted in 16 transects. It used to occur in various sites around the Dead sea and along the Jordan and some tributaries (Andrews 1995, Khoury 2001, Khoury *et al* 2006). Except for the Fifa-Safi area (southernmost Dead sea) it appears

Table 1. Frequency of occurrence according to observations at 64 sites along small valleys in the lower Jordan valley. Wetland habitats: + = birds associated during the breeding season with natural and semi-natural wetland/marshy habitats in Jordan. (+) = birds regularly associated when breeding with man-made wetlands eg artificial ponds and canals. Geography: + = birds restricted within Jordan, when breeding, to the Jordan valley. In bold, wetland habitat specialists that breed in Jordan.

	frequency %	wetland habitats	geography
Sand Partridge <i>Ammoperdix heyi</i>	6		
Black Francolin <i>Francolinus francolinus</i>	8		+
Little Bittern <i>Ixobrychus minutus</i>	2	+	
Common Moorhen <i>Gallinula chloropus</i>	9	(+)	
Eurasian Stone-curlew <i>Burhinus oedicnemus</i>	2		
Spur-winged Lapwing <i>Vanellus spinosus</i>	22	(+)	
Feral Pigeon <i>Columba livia</i>	3		
Turtle Dove <i>Streptopelia turtur</i>	22		
Eurasian Collared Dove <i>S. decaocto</i>	69		
Laughing Dove <i>Spilopelia senegalensis</i>	61		
Namaqua Dove <i>Oena capensis</i>	22		
Little Owl <i>Athene noctua</i>	3		
White-throated Kingfisher <i>Halcyon smyrnensis</i>	50	(+)	
Pied Kingfisher <i>Ceryle rudis</i>	8	+	+
Green Bee-eater <i>Merops orientalis</i>	16		
Blue-cheeked Bee-eater <i>M. persicus</i>	39	+	+
European Bee-eater <i>M. apiaster</i>	8		
Eurasian Hoopoe <i>Upupa epops</i>	16		
Great Grey Shrike <i>Lanius excubitor</i>	14		
Desert Lark <i>Ammomanes deserti</i>	8		
Crested Lark <i>Galerida cristata</i>	44		
White-spectacled Bulbul <i>Pycnonotus xanthopygos</i>	94		
Rock Martin <i>Ptyonoprogne fuligula</i>	2		
Red-rumped Swallow <i>Cecropis daurica</i>	2		
Cetti's Warbler <i>Cettia cetti</i>	30	(+)	
Clamorous Reed Warbler <i>Acrocephalus stentoreus</i>	17	+	+
Eurasian Reed Warbler <i>A. scirpaceus</i>	22	(+)	
Eastern Olivaceous Warbler <i>Iduna pallida</i>	94		
Zitting Cisticola <i>Cisticola juncidis</i>	2		+
Graceful Prinia <i>Prinia gracilis</i>	91		
Arabian Babbler <i>Turdoides squamiceps</i>	3		
Sardinian Warbler <i>Sylvia melanocephala</i>	25		
Common Myna <i>Acridotheres tristis</i>	5		
Common Blackbird <i>Turdus merula</i>	25		
Rufous Bush Robin <i>Cercotrichas galactotes</i>	55		
Common Nightingale <i>Luscinia megarhynchos</i>	9	+	+
Blackstart <i>Cercomela melanura</i>	2		
Palestine Sunbird <i>Cinnyris osea</i>	30		
House Sparrow <i>Passer domesticus</i>	47		
Spanish Sparrow <i>P. hispaniolensis</i>	19		
Dead Sea Sparrow <i>P. moabiticus</i>	25	+	+
Indian Silverbill <i>Euodice malabarica</i>	14		
European Greenfinch <i>Chloris chloris</i>	9		
Desert Finch <i>Rhodospiza obsola</i>	3		



Plate 5. A section of Wadi al-Kharrar, Jordan, where surface water has mostly dried out in recent years. This site became overgrown with various shrubs due to exclusion of livestock. Breeding species include the ubiquitous Rufous Bush Robin, Olivaceous and Graceful Warblers, and White-spectacled Bulbul. Previously Blue-cheeked Bee-eater, Clamorous Reed Warbler and Dead Sea Sparrow also bred here. © Fares Khoury



Plate 6. Adult male Dead Sea Sparrow *Passer moabiticus* March 2018, Jordan valley, Jordan. © Fares Khoury

to be extinct at all other sites along the southeastern and northern shores. It persists as a breeding species along the Jordan and some of its tributaries, but usually is restricted to the last few kilometres before they flow into the Jordan. It has also disappeared during the previous decade from most of Wadi Kharrar due to the drying out of the stream. The disappearance of a colony at Sweimeh (Khoury *et al* 2006) is due to habitat destruction caused mainly by erosion of *Tamarix* habitats and use of the land for tourist projects.

CONCLUSIONS

There has been a recent decline of Common Nightingale, Clamorous Reed Warbler and Dead Sea Sparrow breeding populations in response to habitat degradation in the Jordan valley. This is not surprising, given that specialist species are more vulnerable to habitat fragmentation and degradation compared to generalists (Devictor *et al* 2008). Nevertheless, the persistence of specialists within some habitat strips indicates tolerance to current land use management in the surroundings. This is good reason to prioritize the protection of remnant patches of wetland habitat in the Jordan valley, and to further investigate habitat use by wetland specialist birds in the surrounding agricultural landscape (*eg* Bennet *et al* 2006). Additional surveys of rare and specialist species are still required in the Jordan valley, especially of little known and enigmatic birds like the Nubian Nightjar *Caprimulgus nubicus* that is a specialist in salt marsh conditions (Perlman & Weiss 2016, www.birds.org.il).

At the local scale, intensive grazing and the subsequent dominance of *Prosopis juliflora* are considered the biggest threats. The conservation of wetland habitat strips including *Tamarix* thickets should encompass the maintenance of sufficient water flow in the streams, which would require managing the adverse effects of agricultural development in the region. Additionally, rangeland management and controlling the spread of *Prosopis juliflora* would be critical for conserving bird diversity within the habitat patches or strips. As regards to the landscape level, as mentioned above, there is no doubt about the indirect, negative influences of agriculture on the wetland habitats along streams flowing into the Jordan river, such as decreasing water resources, increasing salinity, nutrients and other pollutants (Farber *et al* 2004, Salameh 2008). However, the surrounding landscape currently probably provides feeding habitat for kingfishers, bee-eaters and sparrows that breed along the wadis, indicating positive effects of some of its features on the breeding outcome of specialist species, *eg* fish and irrigation ponds, grassland-like fields and marginal vegetation patches. Moreover, Dead Sea Sparrows occasionally build their nests in cultivated trees or shrubs (*eg* olive, citrus fruits, persimmon) if these are close to or replacing part of their natural nesting habitats (FK, anon reviewer pers comm). The discovery of breeding Pallid Scops Owl *Otus brucei* in palm plantations of the Jordan valley is another example of a native bird using cultivated trees as nesting sites (Ben Dov & Kiat 2016). Certain agricultural practices can thus be tolerated or even be beneficial, and lead to local expansion of restricted species.

Conservation action is almost absent on the Jordanian side of the Jordan valley north of the Dead sea (Amr *et al* 2004) due to the challenges posed by a multitude of stakeholders and the lack of experience and will of authorities to carry out conservation in agricultural areas. Parts of the river Jordan with its flood plains and downstream wadi sections contain well preserved wetland fragments due to military restrictions (Khoury & Korner 2018). These inaccessible areas are considered among the last strongholds and refuges of some of the most restricted bird species in Jordan and a potential source for re-colonizing further suitable habitat strips or patches in the Jordan valley.

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