(TY22W) tracked westward over north Taiwan on 6–7 September 2002, attaining maximum winds speeds of 110 knots, leading to strong northerly winds in Batanes (Furze and Engel 2002). It is plausible that these weather conditions could have carried the bird to Batan Island.

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Frequency of avian road-kills in Kumbhalgarh Wildlife Sanctuary, Rajasthan, India

ANIL KUMAR CHHANGANI

Kumbhalgarh Wildlife Sanctuary (KWS) in Rajastan, India, as with most of the country's wildlife sanctuaries and national parks, is traversed by several public roads and railway tracks. Collision of birds and other animals with vehicles and trains are common. Although there are published studies of collision of birds with aircraft in India (Ali and Grubh 1984, Grubh 1988, Satheesan 1990, Satheesan *et al.* 1992) there is little information available on the bird taxa killed in road accidents, and the frequency of road-kills. Here I present such data from KWS.

METHODS

KWS (20°5′–23°3′N 73°15′–73°45′E) lies c.200 km south of Jodhpur in the west Aravalli hills of Rajasthan, India, at 270–1,150 m, and covers an area of 585 km^2. The climate is characterised by distinct winter, summer and monsoon seasons. Temperatures range from 2°C in December–January to 46°C during May–June; annual rainfall averages 725 mm. The sanctuary is primarily covered in dry deciduous forest dominated by 'gorya dhawa' *Anogeissus latifolia*, 'salar' *Boswellia serrata*, 'gol' *Lannea coromandelica*, 'kherni' *Wrightia tinctoria*, 'dhawa' *Anogeissus pendula*, 'kumbat' *Acacia senegal*, 'khair' *Acacia catechu*, 'ber' *Ziziphus mauritiana* and 'dhonk' *Butea monosperma*, with an undergrowth comprising 'jharber' *Ziziphus nummularia*, 'adusa' *Adhatoda zeylanica*, 'gangan' *Grewia tenex*, 'franger' *Grewia flavescens*, 'kanter' *Capparis sepiaria* and lantana *Lantana indica*.

Road-kill data were collected during a long-term study on the behaviour of hanuman langur *Semnopithecus entellus*. Two state highways (c.25 km long) and three ancillary roads (c.30 km long) pass through the sanctuary. Between December 1995 and August 1999, about five days per week were spent in the field driving along these roads checking for road-kills. Survey effort was constant throughout the year and between years. Occasionally road-kills were also reported by forest officials and drivers. These were verified and where confirmed were included in the totals.

RESULTS AND DISCUSSION

A total of 228 individuals of 32 species of birds were found dead on the roads in KWS (Table 1). The most frequently killed species included abundant species in the sanctuary such as Eurasian Collared Dove *Streptopelia decaocto* and Laughing Dove *S. senegalensis.* Road-kills of scavengers such as White-rumped Vulture *Gyps bengalensis*, Indian Vulture *G. indicus*, House Crow *Corvus splendens* and Large-billed Crow *C. macrorhyncus* were often found near mammal carcasses, where presumably they had been feeding. The two vulture species are listed as Critically Endangered (BirdLife International 2004), and the threat from road-kills must compound the poisoning by veterinary drugs that has largely caused the recent catastrophic declines in these species. Other species such as doves may have been attracted to roadsides to collect digestive grit. The maximum frequency of road-kills was in the monsoon months of August–September, with the lowest frequency during the summer months of May–July (Fig. 1). Although my data did not permit me to quantify the importance of collision with vehicles as a source of mortality in birds, it clearly is not insignificant. For threatened species, even the death of a few

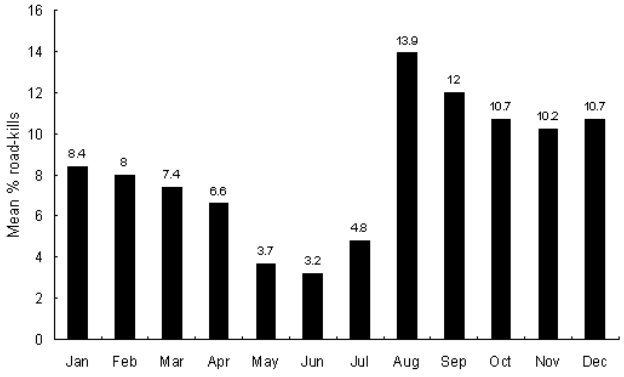

Figure 1. Monthly percentage of road-kills Kumbhalgarh Wildlife Sanctuary during 1995–1999 (n=228).

Table 1. Avian road-kills in Kumbhalgarh Wildlife Sanctuary during 1995–1999.

Species	Frequency	% of road-kills
Eurasian Collared Dove *Streptopelia decaocto*	21	9.2
Common Babbler *Turdoides caudatus*	18	7.8
House Sparrow *Passer domesticus*	17	7.4
Laughing Dove *Streptopelia senegalensis*	15	6.5
Grey Francolin *Francolinus pondicerianus*	13	5.7
House Crow *Corvus splendens*	13	5.7
Red Collared Dove *Streptopelia tranquebarica*	11	4.8
White-rumped Vulture *Gyps bengalensis*	11	4.8
Pied Bushchat *Saxicola caprata*	11	4.8
Asian Koel *Eudynamys scolopacea*	10	4.3
Common Quail *Coturnix coturnix*	9	3.9
Grey Junglefowl *Gallus sonneratii*	9	3.9
Jungle Babbler *Turdoides striatus*	9	3.9
Greater Coucal *Centropus sinensis*	9	3.9
Indian Peafowl *Pavo cristatus*	8	3.5
Rock Pigeon *Columba livia*	6	2.6
Indian Vulture *Gyps indicus*	6	2.1
Common Myna *Acridotheres tristis*	5	1.3
Rock Bush Quail *Perdicula argoondah*	3	1.3
Large-billed Crow *Corvus macrorhynchos*	3	1.3
Indian Robin *Saxicoloides fulicata*	3	1.3
Cattle Egret *Bubulcus ibis*	3	1.3
Black Drongo *Dicrurus macrocercus*	3	1.3
Rufous Treepie *Dendrocitta vagabunda*	3	1.3
Indian Nightjar *Caprimulgus asiaticus*	2	0.8
Common Moorhen *Gallinula chloropus*	2	0.8
Spotted Owlet *Athene brama*	2	0.8
Brahminy Starling *Sturnus pagodarum*	2	0.8
Rosy Starling *Sturnus roseus*	2	0.8
Sirkeer Malkoha *Phaenicophaeus leschenaultii*	1	0.4
White-bellied Drongo *Dicrurus caerulescens*	1	0.4

individuals might have an appreciable effect on small populations.

This study accords with that of Kumar *et al.* (2000) who reported road-kills in diurnal terrestrial birds and nocturnal birds in the Western Ghats, and other studies in Spain and Africa that highlight the significance of road-kills (Broekhuysen 1965, Lewis 1989, Drews 1991, 1995, Chhangani and Mohnot 1997).

Traffic along the roads in KWS was not quantified, but probably 500 vehicles use the roads daily, many to visit temples in Ranakpur. The potential for road-kills is therefore quite high, and this subject merits further study at KWS, and elsewhere.

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