mapping space missions by USA[23]. Differentiation of this lunar magma ocean, during its formative first billion years or so resulted mainly in its anorthositic crust, magnesium-rich highlands and small amounts of basalts. Judged by the age of the lunar highlands, the moon must have formed and differentiated ~ 50 m.y. after the start of the solar system and between 4.4 and 4.5 b.y. ago[7,16], soon after the earth's core formation, i.e. during the first 100 m.y. of earth's history. Presently, though the origin of the moon as arising from a giant impact or an impactor which had a metal segregational history similar to earth is widely accepted, this postulate remains still a hypothesis. Perhaps, future work will be able to assess better the influence of various forces in operation during and after the giant impact event, involving areas of high-pressure physics, shock-related changes (melting and vapourization) and a host of other inter-related forces and confirm the impact origin of the moon.

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## SCIENTIFIC CORRESPONDENCE

# Effect of helpers on breeding success of the common babbler (*Turdoides caudatus*)

The effect of helpers on the breeding success of the common babbler (*Turdoides caudatus*) inhabiting the arid zone of Rajasthan has been studied. The aim of the present study is to determine the contribution of helpers in the breeding success of the common babbler. The role of helpers in the breeding activities of the common babbler like feeding of the brooding female, nestling and fledgling, and defending the nests, improves the clutch size, hatching success and fledgling success. The significance of the role of helpers has been discussed.

An extensive literature exists about helping in birds, where some reproductively mature or immature members of the species temporarily or permanently forego their own reproduction and help other members of their species to reproduce[1–5]. Brown's book[6] is the most extensive review of helping in birds. The Florida scrub jay (*Aphelocoma caerulescense*), the acorn woodpecker (*Melanerpes formicivorus*), the pied kingfisher (*Ceryle rudis*), the splendid wren (*Malurus splendens*), the Galapagos mockingbird (*Nesomimus parvulus*), the green bee-eater (*Merops orientalis*) and the white-fronted bee-eater (*Merops bullockoides*) have been extensively studied for helping in birds[7–9].

Among babblers, the role of helpers has been studied in the jungle babbler (*Turdoides striatus*), the Arabian babbler (*T. squamiceps*), the grey-crowned babbler (*Pomatostomus temporalis*) and the white-headed babbler (*T. affinis*)[8–12]. Common babblers have been studied for their habits, habitat and reproduction[13,14]. Yet no effort has been made to study the effect of helpers on the breeding success of the common babbler. An attempt was therefore made to study the effect of helpers on the breeding success of the arid-zone common babbler (*T. caudatus*).

Nests of common babblers without helpers, with one helper and with two helpers were observed for one year (2000) during the breeding months (February to August) at one sampling site (10 $km^2$) in the Khasoli agricultural fields, Churu (29°N, 75°E; rainfall

325 mm; altitude 286 m asl). These nests were observed daily for 2 h (4.00 pm to 6.00 pm) from the period of nest site-selection till the chicks fledged. Birds approaching the nests were caught using mist nets and marked with a non-toxic dye (Fevicryl fabric paint) of different colours. The number of marked helpers per nest was noted. The helpers involved in feeding the brooding female, nestling and fledgling were noted. Those which were defending the nests were also counted. Observations were made from close vicinity of the nests of the common babblers to record the clutch size, hatching and fledgling success per nest. The average number of eggs laid, hatched and young fledged was calculated. The number of nests built by the common babbler without helpers, with one helper and with two helpers was 18, 14 and 4, respectively in 10 $km^2$ of the field. In fourteen nests, one helper each was found to engage itself in feeding the brooding female, nestling and fledgling, and defending the nests. They were not found to help in nesting and incubation. Similarly, two helpers each in four nests were found to carry out activities like feeding of the brooding female, nestling and fledgling, and defending the nests. They also did not participate in nesting and incubation.

The total number of eggs in all the eighteen nests of the common babbler without helpers was 56. It was 46 and 14 in fourteen nests with one helper and four nests with two helpers, respectively. The average clutch size, number of young hatched and young fledged were respectively $3.1 \pm 0.1$, $2.28 \pm 0.21$ and $1.72 \pm 0.11$ in the nests of the common babbler without helpers, while it was $3.32 \pm 0.2$, $2.71 \pm 0.19$ and $1.93 \pm 0.1$ in the nests with one helper. The average clutch size, number of young hatched and young fledged were comparatively higher, i.e. $3.5 \pm 0.14$, $3.0 \pm 0.1$ and $2.5 \pm 0.1$, respectively in the nests with two helpers. The differences are however not statistically significant ($P > 0.05$). It was also noticed that in the nests with helpers, the nestling grew rapidly and all the chicks fledged earlier, compared to nests without helpers. None of the nests helped were predated.

The number of nests without helpers is higher compared to nests with one or two helpers in the arid-zone common babbler. This may be due to the omnivorous habit of the bird[13]. Our findings of helpers in the common babbler are similar to those of the jungle babbler, the Arabian babbler, the grey-crowned babbler and the white-headed babbler, except that in the Arabian babbler the helpers also play the role of obstructors[8–12].


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ACKNOWLEDGEMENT. I am grateful to AZARI, Churu for providing facilities.

Received 27 April 2001; revised accepted 26 December 2001

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# Age of the fossiliferous Siwalik sediments exposed in the vicinity of Nurpur, District Kangra, Himachal Pradesh

The Siwalik Group, forming the southernmost foothills of the Himalaya, is represented by fluviatile sediments. This 7-km thick succession is divided into three subgroups: Lower, Middle and Upper. The Lower Siwalik Subgroup contains dominantly red mudstones that alternate with fine-to-medium, grey and compact sandstones. The presence of red mudstones exposed in the basal part of the Siwalik Group is generally taken as characteristic for the Lower Siwalik Subgroup. A thick succession of fossiliferous red mudstones is exposed in the vicinity of Nurpur (Kangra, Himachal Pradesh). The Siwalik Group here forms an anticline, the axis of which is faulted and passes near the Nurpur Fort[1,2]. The red-bed succession is exposed in the core and the base of the succession is not exposed. The exposed red-bed succession is about 1100 m thick. In general, the succession is dipping towards NE to ENE with dip amounts of 4–5° in the basal part and increasing to 65° upwards in the succession. In the uppermost part of the section, the beds are erected vertically or are even overturned. A fresh *in situ* collection has been made from these red beds, to interpret the age of these beds. For better resolution, faunas described by earlier workers are also undertaken.