

## Possible Cases of Infanticide by Immigrant Females in a Group-breeding Bird

PETER B. STACEY<sup>1,2</sup> AND THOMAS C. EDWARDS, JR.<sup>2,3</sup><sup>1</sup>Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809 USA, and<sup>2</sup>Department of Biology, University of New Mexico, Albuquerque, New Mexico 87131 USA

Infant-killing (infanticide) by conspecifics is a widespread phenomenon among animals and has been observed in many different situations (Hrdy 1979, Sherman 1981). Among birds, most reported cases involve either brood reduction (see O'Connor 1978) or, in group-breeding birds, attempts by one group member to decrease the reproductive success of other individuals in the group by destroying their eggs or nestlings (e.g. Vehrencamp 1977, Trail et al. 1981, Mumme et al. MS). One of the most controversial types of infanticide involves the killing of unrelated infants by recent immigrants into social groups. This behavior, observed in many primate species (Angst and Thommen 1977) and lions (Schaller 1972), is viewed either as an adaptive strategy that increases opportunities for the immigrant to breed within the group (e.g. Hrdy 1979) or as a pathological response to stress and over-crowding (e.g. Curtin and Dolhinow 1978). We present here observations suggesting that an analogous type of infanticide by immigrants also may occur in the cooperatively breeding Acorn Woodpecker (*Melanerpes formicivorus*).

Acorn Woodpeckers live in social groups that may contain up to 15 adults of both sexes (MacRoberts and MacRoberts 1976). There is usually only one nest at a time in each group, and reproductive opportunities within a group are therefore limited. Individuals that do not participate in mating at the one nest must wait for a new nest (if any) to be started to breed. Once eggs are laid, however, all group members typically help to incubate and feed the young. Various aspects of cooperative breeding in this species have been studied since 1975 at Water Canyon, in the Magdalena Mountains, New Mexico (Stacey 1979a, b).

Our first observations suggesting infanticide occurred during the 1981 field season in a group named Cattleguard. On 26 May the group contained a banded 4-yr-old male ("A"), an unbanded male ("B"), and an unbanded female ("R"). The group was feeding young in a nest cavity located in a dead tree limb approximately 12 m above the ground. On the basis of the adults' feeding behavior, the young were estimated to be 1-2 weeks old.

On 27 May, Male B was captured, banded, and released. Early on 28 May the resident Female R was caught, banded, and released at 0830. She was held for about 30 min, and during her absence an unbanded female of unknown origin entered the ter-

ritory. The intruding female ("I") was chased by all members of the group, especially Female R. Between 1005 and 1015, two intense "grapple" fights took place between the females, during which the birds made physical contact in the air and fell to the ground locked in each other's grip. At 1028, Female I cornered Female R on a low branch of a tree and pecked several times at her head, drawing small amounts of blood. To obtain a better view of the interaction one of us moved closer, unintentionally causing Female I to break off her attack. Female R did not again attempt to displace Female I. Both males continued to chase Female I throughout the morning, but during the afternoon the frequency of agonistic interactions decreased. By evening the female apparently had been accepted as a new member of the group.

Both males periodically fed the young during these interactions, and by afternoon they had resumed feeding rates typical of previous days. Female R also attempted to feed on several occasions but was driven off by the new female. By 29 May, Female R had left the territory and was not seen again until 2 months later when she joined a different group on an adjacent territory.

Female I frequently followed the males to the nest hole entrance while they fed the young, but she did not enter the nest cavity until 1443 on 28 May. After this time, she entered the hole on numerous occasions, remaining alone within the nest for periods of up to 95 s. She did not bring food to the young, and the males made no attempt to prevent her from entering the nest. That evening the dominant Male A roosted in the nest with the young.

Because the two males had continued to feed the young during their interactions with the female, we did not resume observations of the group until 1400 on 29 May. We found that although the males frequently went to the nest hole (at least once with food), they no longer entered or fed the young. Female I, however, continued to enter the nest, remaining alone inside for up to 158 s on five different occasions between 1400 and 1700. During this same period, both males and Female I began to enter a different nest hole 1 m above the old nest. That evening, Male A again carried food to the area of the nest but ate it himself after perching for several minutes. None of the adults spent the night in the nest.

The lack of feeding suggested that the young were no longer alive, and we planned to check the nest the next day (30 May). (This subsequently proved to be impossible due to the location of the cavity.) When we arrived, however, we observed Female I remov-

<sup>3</sup> Present address: School of Natural Resources and Conservation, 118 Newins-Ziegler Hall, University of Florida, Gainesville, Florida 32611 USA.

ing irregularly shaped, dark objects from the nest and eating them. From 0550 to 1051 and from 1440 to 1640, Female I visited the hole five times, entered or stuck her head in, and was observed to remove and consume 28 individual "items." Male A also fed from the nest, obtaining six items on two different occasions. The nature of the items could not be confirmed. Possibilities include: (1) maggots (unlikely as the young had been dead a maximum of 24 h), (2) other small insects (e.g. ants; again, unlikely due to the shape and/or size of the items consumed), (3) fecal sacs or other waste (e.g. egg shells), or (4) tissue of the dead nestlings.

After 30 May the birds did not return to the old nest. Female I subsequently laid eggs in the new hole, fledging one female young on 18 July. Based upon an incubation and nestling period of 38–40 days from the date of the first egg for this species in Water Canyon (unpubl. obs.), we estimate that Female I began to lay egg(s) 2–4 June, less than 1 week after she had immigrated into the group.

The sequence of events described above suggests that the immigrant female may have killed the young in order to raise her own brood. Because the nestlings were concealed in a cavity 12 m above the ground, however, it was impossible to observe her behavior directly when she entered the nest. There are several possible alternative explanations for the death of the young. For example, they may have died from disease or parasites on 29 May, they may have starved (although the males continued to bring food to the nest even after the young had died), or a predator may have killed the young (although one or more bodies were apparently left in the nest). Because it was impossible to reject unequivocally any of these alternatives, we decided to conduct an experiment during the summer of 1982 to determine whether or not a second case of possible infanticide would occur under similar circumstances.

In mid-May 1982, the Cattleguard group contained the same two males (A and B), Female I, and the yearling female ("Y") fledged in 1981. On 21 May, Female I disappeared. The group continued incubating eggs, which hatched between 30 May and 1 June. After Female I disappeared, several females attempted to join the group, but they were unsuccessful. We decided to capitalize on Female I's disappearance and removed Female Y on 7 June in order to create the opportunity for a new immigration event into a group with young. After her removal, there was a period of intense interaction as several new females attempted to join the group. By 1400 on 8 June, a banded female (Female R, originally displaced the previous year) had established herself as a new member.

The sequence of events that occurred after the immigration of Female R was similar to that observed the previous year and can be summarized as follows: (1) Shortly after joining the group Female R began to visit the nest hole without food and spend ex-

tended periods alone in the cavity. The males made no attempt to prevent her from entering the nest, and both continued to feed the young. (2) On 10 June the nest was checked and found to contain four live young. On 12 June the nest contained a single live young and one dead nestling. The males continued to feed the young from 10 to 12 June, but, in addition, the males and the female regularly removed items from the nest. Some of these were immediately eaten, while others were carried out of sight by the birds. Although we suspect they were consuming tissue of the dead nestling(s), we were again unable to confirm our suspicions directly. The dead young in the nest had a small (~2 mm) patch of dried blood anterior to its right eye, and numerous small skin punctures over its back and wings. The live nestling also had a small patch of dried blood posterior to its left eye. (3) The males continued to feed the remaining nestling from 12 to 16 June, when it too died. During this time, Female R regularly visited the nest and was observed to remove and consume items. On 17 June the nest contained a single Acorn Woodpecker egg, presumably laid by Female R, and the nestlings were gone. This nest was subsequently abandoned. (4) Female R then laid a four-egg clutch in a new hole. The eggs hatched on 3–4 July, indicating that the female began the new clutch on 19 or 20 June.

In both instances we were unable to determine whether or not the immigrating female actually killed the young. Because the young are concealed in cavities, it may be exceedingly difficult to observe an act of infanticide directly in this species. In the experimentally induced immigration, we decided against checking the nest every time the female entered it. We felt that checking the nest so frequently might create an abnormal situation and could possibly lead to the death of the young. In both cases, however, the nestlings of a previous female died under suggestive circumstances shortly after a new female immigrated into the group. The immigrants clearly benefited from their death, because they were then able to attempt to raise their own offspring. It is less clear why the males made no attempt to defend the young. Once the nestlings died, however, the males would have little to gain by not breeding with the new females. Although the evidence presented here is necessarily indirect, it does suggest that under certain conditions, infanticide by immigrants in order to increase reproductive opportunities may occur not only in primates but also in a cooperatively breeding bird.

Stephens (1982) recently presented indirect evidence of a possible case of infanticide during a mate takeover in the polyandrous Northern Jacana (*Jacana spinoza*); the potential existence of this phenomenon in other avian species should be considered.

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### A Hybrid Between the Orioles *Icterus chrysater* and *I. mesomelas*

STORRS L. OLSON

National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560 USA

The Yellow-backed Oriole (*Icterus chrysater*) and the Yellow-tailed Oriole (*Icterus mesomelas*) are broadly sympatric neotropical species of Icteridae that range jointly from southern Mexico through Colombia and parts of Venezuela. The range of *I. mesomelas* also extends south into Ecuador and Peru, whereas *I. chrysater* is strangely absent from Costa Rica. Both species are approximately the same size, and both are largely orange-yellow in color with the gular patch, lores, and most of the wings black. *Icterus mesomelas* differs from *I. chrysater* in that the mantle is black instead of yellow, the secondary coverts and three outer rectrices are entirely or partly yellow instead of black, and there is less black on the forehead than in *I. chrysater*.

In the collections of the National Museum of Natural History, Smithsonian Institution, is a specimen (USNM 403540) that is best interpreted as a hybrid between these two species. It was taken by M. A. Carriker, Jr., on 25 March 1948 at Hacienda Belén, 13 km (8 miles) west of Segovia, Dept. Antioquia, Colombia, at an elevation of 245 m (800 feet). It is labelled as a male, and, although there are no remarks on the condition of the gonads, it appears to be fully

adult, with the feathers of the gular patch entirely black.

The feathers of the mantle of the hybrid are yellow basally, tipped broadly with black in the area that is entirely black in all adult individuals of *I. mesomelas* examined (Fig. 1). Although the back is normally entirely yellow in *I. chrysater*, there was some trace of black in this region in 7 specimens (all males from Colombia) out of about 150 adults from Colombia and Panama. The traces ranged from a few feathers barely tipped with black to a faint scaly pattern in three individuals. In no instance was there any approach to the extreme condition shown by the hybrid.

In adults of *I. chrysater* the tail is entirely black. In the hybrid, however, the outermost rectrix on either side is narrowly edged with yellow and has a fairly wide stripe of yellow along the rachis that expands slightly distally and stops about 5 mm short of the tip of the feather (Fig. 1). The next rectrix inward has a faint yellow margin on the outer web. In *I. mesomelas* these feathers are yellow except at the bases, which are black. In *I. chrysater* the rectrices are typically black, although five specimens I examined had