

of the water and a drop in ambient temperature caused the nest temperature to drop to 35.8°C (Fig. 2, point G), at which time the bird apparently began to apply heat to the eggs, as the nest temperature increased to 37.7°C (Fig. 2, point H) and then dropped to 37.2°C, which corresponded to the temperature of the surrounding gravel. Drent (1973) reports that normal egg temperatures during incubation vary from about 33°C to 38°C for several bird species. Throughout their attentive periods, both birds kept the eggs shaded, usually lowering their wet belly feathers directly onto the eggs early in the attentive period, but often standing over the eggs with their matted feathers barely touching the eggs (Fig. 1). The adults stood over the eggs with feathers fluffed, mouth open, and gular area vibrating.

Belly-soaking has been recorded in seven families of Charadriiformes (Maclean 1975 and references therein). Within the family Charadriidae, belly-soaking has been reported in the genera *Charadrius* (*C. dubius*, *C. pecuarius*, *C. alexandrinus*, *C. melanops*, *C. marginatus*, and *C. vociferus*) and *Vanellus* (*V. albiceps*, *V. spinosus*, *V. indicus*, *V. malabaricus*, *V. senegallus*, and *V. leucurus*) (Maclean 1975 and references therein, Begg and Maclean 1976, Roberts 1977). The majority of records on belly-soaking have occurred in areas with hot climates. These include Nigeria (9°N), India (20°–26°N), and Zambia (15°–18°S) (Maclean 1975). An exception to this is an observation of belly-soaking in *C. dubius* near Plochingen, West Germany (49°N) (Gatter 1971). There, belly-soaking was observed when the ambient temperature was 29°C. In North America belly-soaking has been reported for the Least Tern (*Sterna albifrons*) (Tompkins 1942) and for Killdeer (Boyd 1972, Kull 1977). Belly-soaking has not been reported in several studies conducted in the more northern portions of the Killdeer's range (e.g. Bunni 1959, Lenington and Mace 1972, Mace 1971).

Belly-soaking appears to be an important thermoregulatory mechanism in Killdeers nesting in Mississippi. It apparently becomes more common late in the season with higher temperatures and in pairs selecting nesting substrates that readily conduct heat.

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Helpers at the Nest in Passerines from Buenos Aires Province, Argentina

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Breeding systems that involve the presence of additional helping individuals are now considered to be relatively widespread among birds of tropical regions and southern continents. Cooperative breeding is

probably not uncommon among subtropical and temperate South American birds. In this paper I report the occurrence of helpers at nests for five species of passerines that breed in a study area near Lobos, Buenos Aires Province, Argentina (35°15'S, 59°13'W, see Fraga 1978 for a general description). There I have accumulated nesting records from 24 species of passerines that breed in woodland areas. A sixth species in the sample, the Baywinged Cowbird (*Molothrus badius*), is a regular cooperative breeder (Fraga 1972, Orians et al. 1977). I include here, however, bird species in which the habit is not regular or in which helpers were recorded only during nest building. Such species may be particularly interesting for testing current ideas on the evolution of this breeding system.

Family Furnariidae

Rufous Hornero (*Furnarius rufus*).—I have twice observed banded juveniles helping their parents to build nests. Although juveniles remain in the parental territories for periods of up to 9 months, the habit is uncommon, apparently because adults do not tolerate juveniles around their nests.

Leñatero or Firewood-gatherer (*Anumbius anumbi*).—In a study of this species involving the nesting activities of 12 pairs (1970), 9 pairs (1971), and 7 pairs (1972), 8 banded juveniles were recorded helping their parents (3 pairs) in nest building. Two additional cases involving unbanded juveniles also were observed. Considering the lower nesting success of the species, the habit seems to be more common than among Rufous Horneros, although all the banded juveniles were expelled from the parental nest sites less than 1 month after fledging.

Some juveniles started carrying twigs at the age of 40 days. In another case, in 1973 three unbanded birds were regularly seen between 5 and 17 October around a nest that contained eggs; unfortunately, the nest was destroyed by predators and the birds disappeared.

As these are the only furnariids for which I have nesting records, the occurrence of (at least) nest-building helpers in the family is likely to be common; Skutch (1969) also recorded nest-building helpers in Rufous-fronted Thornbirds (*Phacellodomus rufifrons*). Judging from published accounts, regular cooperative breeding occurs in the Crestudo (*Coryphistera alaudina*). This furnariid lives in small groups of 6–10 birds even during the breeding season, and apparently more than one female may lay in a single nest (Masramón 1971).

Family Hirundinidae

Brown-chested Martin (*Phaeoprogne tapera*).—On 4 March 1972, 2 fledglings were regularly attended by 4–5 adults, which sometimes brought food to the juveniles almost simultaneously. Up to three adults also perched in the same branch near the fledglings, but sometimes they chased each other. All of these birds were unbanded. No other similar case was observed, although only eight other groups of fledglings were observed for a reasonable amount of time. At least during the early stages of the nesting cycle, all the Brown-chested Martins that I observed were seen in pairs. The species breeds in my study area only in nests of Rufous Horneros.

Helpers have been recorded in several species of swallows (Skutch 1960: 285, Myers and Waller 1977), and the available evidence suggests that the helpers are siblings from previous broods. The late date of my record agrees with this explanation.

Family Mimidae

Chalk-browed Mockingbird (*Mimus saturninus*).—I have studied this mockingbird (chiefly as a host of Shiny Cowbirds, *Molothrus bonariensis*) since 1972. Most of the 11–12 pairs that inhabit my study area have occupied extensive home ranges and have usually nested hundreds of meters apart; there was nothing unusual in the breeding behavior of these pairs. In an area of 2.35 ha of optimal nesting habitat, 2–3 pairs have bred closer to each other (inter-nest distances of 25–80 m) with a certain amount of cooperation in nest defense. Not infrequently when visiting nests there I saw 3–5 scolding mockingbirds perched in the same shrub. Family groups in this area sometimes included juveniles reared by other pairs, although I have no evidence of communal feeding. Twice during this study (December 1974–January 1975 and September–October 1978) single helpers were detected at two nests in this area. In the first instance the helper was a banded yearling; it was flushed from the nest shrub on eight occasions during the nestling period, and on 2–3 January 1975 it fed one of the fledglings. This helper was apparently the offspring of another pair in this area, in whose nest it was banded. In the next breeding season and up to August 1978 it was one of the breeding mockingbirds of this area; as it incubated by night it was probably a female.

The second case involved an unbanded helper of unknown age and parentage; the nest was observed from a nearby building and three mockingbirds brought food to the nestlings.

Group territories and cooperative breeding occur in Galápagos Mockingbirds (*Nesomimus*, Hatch 1966), and helpers may possibly occur in Long-tailed Mockingbirds (*Mimus longicaudatus*, Marchant 1960). In Tropical Mockingbirds (*M. gilvus*) in Venezuela, Skutch (1968) found that fledglings remained with their parents during later broods. In Chalk-browed Mockingbirds, young of the last broods usually remain associated with their parents for the entire nonbreeding season (February–August). The described case that involved a banded helper suggests that breeding Chalk-browed Mockingbirds may at times have close relatives among their neighbors. The case may also be suggestive of reciprocal altruism (Trivers 1971), as this individual finally obtained good nesting sites in which it reared several broods. As I have studied 59 nests of mockingbirds, it is obvious, however, that helpers seldom occur in this species.

Family Sylviidae

Masked Gnatcatcher (*Poliophtila dumicola*).—Although I have studied 26 nests of this gnatcatcher, only one case of cooperative breeding was found. In October 1974, in a small isolated woodland, a male was associated with two females. This case involved bigamous mating and communal nesting. The two females and the male built a nest in which a double clutch of six eggs was laid. Only four nestlings survived, so the bigamous bond was disadvantageous for at least one of the females, although both brought food at roughly equal rates. Masked Gnatcatchers are usually monogamous, and the pair bond may persist for more than one breeding season. Juveniles of last broods remain with their parents for up to 6–7 months, and within the family groups dominant individuals (chiefly the breeding males) are preened by subordinate ones. Allopreening was not observed between the male-sharing females, but this would not exclude the possibility that they were sisters.

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Cleaning/Feeding Symbiosis Between Grackles (*Quiscalus*: Icteridae) and Map Turtles (*Graptemys*: Emydidae)

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Cleaning symbiosis has been reviewed recently by MacFarland and Reeder (1974, *Z. Tierpsychol.* 34: 464–483). They cited symbioses involving fish, terrestrial mammals and oxpeckers, crocodiles and sand-

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