1977). Thus, as far as known, none of these three species allopreens interspecifically, only Red-winged Blackbirds allopreen intraspecifically and only Brewer's Blackbirds and Brown-headed Cowbirds solicit allopreening. It is curious that female Red-winged Blackbirds respond appropriately to the display although they (apparently) do not allopreen each other in nature. It is also curious that female Brewer's Blackbirds *solicit* allopreening but do not (apparently) allopreen. This suggests that these species have the motor patterns associated with the display and the response.

Most studies of free-living icterids have been made during the breeding season. We hope that our observations will alert others to watch for allopreening solicitation and allopreening in icterids in the non-breeding season as well. The behavior is subtle and may be easily overlooked.

The discovery that solicitation of intraspecific allopreening is not restricted to cowbirds weakens Selander and La Rue's (1961) and Selander's (1964) hypothesis that the function of this behavior is to appease potential hosts. Selander and La Rue (1961) and Harrison (1965) suggested that the invitation display is conciliatory, while Rothstein (1971, 1977) suggested that at least in captive Brown-headed Cowbirds the head-down display is aggressive in nature. Rothstein supported his hypothesis with the observation that female and male Brown-headed Cowbirds in captivity displayed mainly to other females. Although our observations agree with his (female Brewer's Blackbirds displayed only to female Red-winged Blackbirds) we find it difficult to see why only female Brewer's Blackbirds would be aggressive towards female Red-winged Blackbirds, while at the same time male Brewer's Blackbirds did not show similar aggressive tendencies towards male Red-winged Blackbirds. The same difficulty arises when we accept the interpretation that the display is conciliatory.

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OBSERVATIONS AT A TWENTY-EGG KILLDEER NEST

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Plovers of the genus *Charadrius* typically lay clutches of two to four eggs (MacLean 1972). Supernumerary clutches have been reported for the: Snowy Plover (*C. alexandrinus*) and Chestnut-banded Sand Plover (*C. pallidus*), four eggs (Blaker 1966); Semipalmated Plover (*C. semipalmatus*), five eggs (Havens 1970); and Piping Plover (*C. melodus*), eight eggs (Hussell and Woodford 1965). We report here a 20-egg nest of the Killdeer (*C. vociferus*), whose normal clutch size is four.

The nest was discovered on 24 April 1978 on a lawn in Brooklyn Park, Minnesota. At the time of discovery the nest contained four eggs. After 6 May, when nine eggs were found, the nest was inspected once or twice daily. Discovery dates of the other 11 eggs are listed in Table 1. Between 11 May and 5 June the nest was watched for a total of 46 h using an automobile as a blind. On 12 May both attending birds were marked by means of a sponge impregnated with India ink and affixed to the nest cup. The nest was apparently abandoned on 16 June and observations were discontinued. We sought to ascertain whether: (1) two or more females were laying in the same nest; (2) the pair consisted of females; or (3) a single female was associated with the nest.

From the laying of the 13th egg to the laying of the

TABLE 1. Discovery dates (in 1979) of eggs in 20-egg Killdeer clutch.

No. eggs in nest	Date	Days since last egg discovered
4	24 April	—
9	6 May	—
10	7 May	1
11	8 May	1
12	10 May	2
13	13 May	3
14	15 May	2
15	17 May	2
16	19 May	2
17	22 May	3
18	24 May	2
19	26 May	2
20	29 May	3

FIGURE 1. Killdeer nest at 16-egg stage. Arrows show wreath-like spotting pattern on four of the eggs. Some eggs are dark owing to the ink-impregnated sponge that was placed in the nest to mark the adults.

20th we saw only two marked birds associated with the nest. Eleven copulations were observed near the nest, all between the marked birds. One bird (hereafter called the male) invariably assumed the male role in copulation (see Phillips 1972). These copulations appeared qualitatively similar in all respects to over 150 Killdeer copulations previously observed by the senior author. The presumed male also gave distraction displays and incubated more often than the presumed female, whereas, the female fed and preened more frequently. These observations agree with role specialization of the sexes in this species (Mundahl 1977).

The bird that assumed the female role in copulation was seen to lay the 13th and 16th eggs. Her behavior on the evening of 28 May suggested that she might be ready to lay again. That evening 19 eggs were present in the nest, and at 06:30 the next day another egg was present.

To further evaluate the possibility that both members of the pair might be female, we collected four eggs and tested them for fertility, two each on 26 and 31 May. These eggs were opened and inspected for embryonation. Three of the four eggs were embryonated and judged to be fertile by C. M. Czarnecki; the fourth was either infertile or in a very early stage of development. The above observations cast doubt on the multiple-female hypotheses (listed as 1 and 3 above).

The single female hypothesis is further supported by the following data: Between 12 May and 29 May, eight eggs were laid (thus 2.1 days/egg). During this period we were relatively certain that only the marked female was laying. Between 24 April and 12 May, eight eggs were laid (2.3 days/egg), indicating a similar timing. Killdeers normally complete clutches in three to four days (about 0.8 days/egg; Bunni 1959).

It is possible to determine the parentage of a clutch by the pigmentation pattern (Blow et al. 1950, Cherms 1961, Jones et al. 1964, Nethersole-Thompson 1973, and Hildén 1975). Distinctive pigmentation patterns in spotted eggs are due to the distribution of pigment glands in the female's uterus and slight differences in the spotting patterns of eggs produced by one female are due to slight differences in the size of the eggs and their orientation and motion while in the uterus (Welty 1975). Most eggs in the 20-egg clutch had a distinctive pigmentation feature, and on this basis they were divided into two groups: 16 eggs with a wreath-like spotting pattern at the large end (Fig. 1); and four that apparently lacked the wreath.

Egg dimensions have been used to identify the parentage of a number of bird species including five species of waders (Väisänen et al. 1972). Using egg volume and shape, and egg length and breadth measurements, Väisänen et al. (1972) determined that approximately 60% of the variance in egg dimensions was due to differences among females. We compared the length and breadth of eggs from 11 Killdeer clutches (from the collections of the Bell Museum, University of Minnesota, and the National Museum of Natural History, Washington, DC) using a multivariate analysis of variance. The difference among clutches (approximate $F_{20,62} = 5.72$, for Hotelling's T^2 test; Morrison 1967) was highly significant ($P < 0.001$).

In a similar way, we compared the length and breadth measurements of the 13 eggs (from the 20-egg clutch) against three that did not exhibit this characteristic (four eggs used to check fertility were not analyzed). There was no significant difference between the two subgroups. Furthermore, eggs from this clutch had an unusually large breadth ($\bar{x} = 29.9$ mm). The average breadths of the 11 museum clutches varied from 25.4 mm to 27.5 mm.

Our conclusions based on the data presented were: only one female was associated with the last eight eggs in the nest; the same female probably laid the first 12 eggs; probably only one male was involved; and the eggs were not laid in distinct separate clutches, but at relatively uniform intervals.

Killdeers are known to renest up to three times if previous nests are unsuccessful (B. J. Shardien, pers. comm.), a potential maximum production of 16 eggs per breeding season. If one female produced this 20-egg clutch, it would correspond to 315% of the average female Killdeer's body weight (calculated from values in Graul 1974). Emlen and Oring (1979) reported an instance of annual egg production of 20 eggs, or over 400% of the adult female's body weight for a female Spotted Sandpiper (*Actitis macularia*). Hildén (1975) mentioned several instances of female Temminck's Stints (*Calidris temminckii*) producing a total of 12 eggs in as little as 16 days; this represented approximately 260% of an adult female's body weight. Apparently there are no severe physiological limits on clutch size in these species or in the Killdeer.

This pair of birds was able to cover only about six eggs during incubation and probably even fewer eggs could be shielded from the intense sunshine during

the midday hours. Widely fluctuating egg temperatures, which undoubtedly resulted from inadequate coverage of the clutch, were probably the reason why none of the eggs hatched.

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FIRST RECORDS OF BLACK-LEGGED SERIEMA (*CHUNGA BURMEISTERI*) IN BOLIVIA

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The Black-legged Seriema (*Chunga burmeisteri*) is a monotypic cariamid previously recorded only from southwestern Paraguay (Chaco) and from northern Argentina as far south as Chaco, Santiago del Estero and San Luis (Meyer de Schauensee, The species of birds of South America and their distribution, Livingston Publ. Co., Narbeth, PA, 1966; Meyer de Schauensee, A guide to the birds of South America, Livingston Publ. Co., Wynnewood, PA, 1970; Short, A zoogeographical analysis of the South American Chaco avifauna, Bull. Am. Mus. Nat. Hist. 154: Art. 3, 1975; Blake, Manual of Neotropical birds, Vol. 1, Univ. Chicago Press, Chicago, 1977). This note presents data taken from a specimen of *C. burmeisteri* that we collected in Bolivia and lists our sight records of this species in that country.

On 12 May 1979, Dpto. Chuquisaca, ca. 27.3 km (by road) SW Carandayti (20°46′S, 63°10′W), at 610 m Schmitt collected a Black-legged Seriema (Delaware Museum of Natural History No. 66951; left testis 4 × 5 mm, right testis 4 × 4 mm, cream colored; no fat; wt. 1,224.4 g; bill, tarsi and feet—black; iris—carmine; and total length—768 mm).

We also saw this species as follows: Dpto. Santa Cruz, 10 km (by road) E Gutierrez, Laguna Caucaya (19°26′S, 63°27′W), two on 1 January 1979; Gutierrez (19°25′S, 63°34′W), one on 26 April 1979; Dpto. Chuquisaca, ca. 28 km (by road) N Camatindi (21°46′S, 63°21′W), one on 11 May 1979; ca. 18 km (by road) SW Carandayti (20°45′S, 63°09′W), one on 12 May 1979; ca. 27 km (by road) SW Carandayti (20°46′S, 63°10′W), two on 12 May 1979; ca. 34 km (by road) SW Carandayti (20°48′S, 63°12′W), five on 12 May 1979; Dpto. Tarija, YPFB refinery near Villa Montes (20°16′S, 63°32′W), one on 27 April 1979; 8 km S, 10 km E Villa Montes (21°20′S, 63°29′W), one on 27 April 1979 (at this same locality, we heard this species daily 27 April–10 May 1979); 2 km S, 10 km E Tiguipa, Laguna Palmar (21°01′S, 63°19′W), three on 19 May 1979 (at this locality we heard vocalizations of this seriema daily between 13–24 May 1979).

These records extend the known range of this species about 350 km N into southern Bolivia (Santa Cruz, Chuquisaca, Tarija) to the foothills of the eastern Cordillera and in the western Chaco.

We saw seriemas mostly within or adjacent to areas of forest (tree heights up to 18 m) characterized by a moderate to dense understory of smaller trees, shrubs, forbs, and ground bromeliads. Observations made near Laguna Caucaya, Gutierrez and Camatindi were in