

SHORT COMMUNICATION

# Cases of induced alloparental care in Seba's short-tailed fruit bat

## Casos de cuidado aloparental induzido em morcego-de-cauda-curta

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### Abstract

Alloparental care has been reported in over 120 mammalian species. Here, we describe the first observed cases of induced alloparental care in Seba's short-tailed fruit bat (*Carollia perspicillata*) at Macaregua cave (Santander, Colombia). As a part of a reproductive study, specimens of *C. perspicillata* were sampled between June and August 2015. During two separate occasions, we observed the willingness of lactating females to accept and carry abandoned pups, after we put a female and a non-parental pup together. Additional data is needed to confirm adoption capacity of Seba's short-tailed fruit bat. This is the first observation of potentially cooperative behavior in this species.

**Keywords:** alloparenting, Chiroptera, cooperative behavior, Colombia, lactating females.

### Resumo

O cuidado aloparental tem sido relatado em mais de 120 espécies de mamíferos. Aqui, descrevemos os primeiros casos observados de cuidado aloparental induzido no morcego-de-cauda-curta (*Carollia perspicillata*) na caverna Macaregua (Santander, Colômbia). Como parte de um estudo reprodutivo, indivíduos de *C. perspicillata* foram amostrados entre junho e agosto de 2015. Durante duas ocasiões distintas, observamos a disposição das fêmeas lactantes em aceitar e transportar filhotes abandonados após colocarmos uma fêmea e um filhote não parental juntos. Informações adicionais são necessárias para confirmar a capacidade de adoção do morcego-de-cauda-curta. Este é o primeiro registro de comportamento potencialmente cooperativo nessa espécie.

**Palavras-chave:** cuidado aloparental, comportamento cooperativo, Chiroptera, Colômbia, fêmeas lactantes.

Alloparental care or alloparenting is defined as the care provided by an individual to a non-descendent young (Wilson, 1975). Although it seems maladaptive due to the high cost to the benefactor, alloparenting has been reported in over 120 mammal species (Riedman, 1982). For bats, alloparental care includes behaviors such as allonursing (Wilkinson, 1992; Fanis and Jones, 1996) and adoption (LeBlanc, 2001). Herein, we report two cases of potential alloparenting behavior in Seba's short-tailed fruit bat (*Carollia perspicillata* LINNAEUS 1758).

Macaregua cave is located in the municipality of Curití, department of Santander, in Colombia (06°39'36.2" N, 073°06'32.3" W). The matrix around the cave is composed of tropical dry forest and agricultural fields of tobacco, maize, beans and coffee. Thus far, the cave harbors the highest bat richness in Colom-

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bia, with 10 bat species (Pérez-Torres *et al.*, 2015). *Carollia perspicillata* is the most abundant species in this cave and maintains a permanent colony there (Pérez-Torres *et al.*, 2015). As a part of a reproductive study at Macaregua cave, individuals of *C. perspicillata* were sampled following the guidelines of the American Society of Mammalogists (Sikes *et al.*, 2016) between June and August 2015 (Bohlender *et al.*, 2018).

On 18 July 2015, an adult female *C. perspicillata* was captured carrying one pup (Figure 1). The female was entering the cave and was captured in a mist net open between 3h a.m. – 6h a.m. After capture, the female was deposited into a cloth bag and the pup in another cloth bag inside the same bag as the mother. We held both mother and pup for two hours to obtain fecal samples and milk from the mother, in order to parse out dietary variation during reproduction of *C. perspicillata* (Bohlender *et al.*, 2018). However, the female died because of a dog attack to the cloth bag. The interruption or premature ending of maternal care can lead to the death of the pup (West and Redshaw, 1987), since wings of pups are not fully developed and they are unable to fly on their own until they reach 90 percent of adult wing dimensions and 70 percent of adult body mass (Barclay, 1994). For pups caught in this study (Figure 1), average forearm length was 28.53 mm (SD: 4.79; SE: 0.73), which is less than the 67% of their mothers ( $\bar{X}$ : 43.12 mm; SD: 2.48; SE: 0.33). Pups are vulnerable (LeBlanc, 2001); hence, the mother assistance is imperative for their survival during this early developmental stage (Kunz and Hood, 2000).

Accordingly, we placed the pup with another lactating female (not carrying a pup nor pregnant) into the same cloth bag. We monitored the lactating female and the pup, and, within three minutes, the pup latched onto the belly of the female with its feet and latched onto the nipple with its mouth. Then, the female flew into the cave, carrying the pup with her.

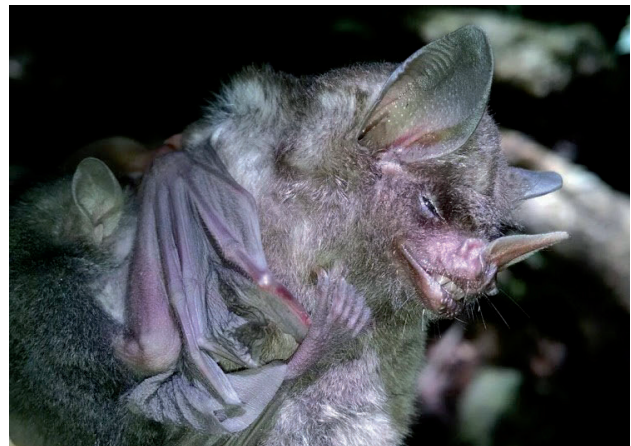
On 18 August 2015, one month after the first record, we captured a female carrying a pup of her own with mist nets open in the same cave entrance. We collected fecal samples from the mother and while we were manipulating both individuals to take morphometric measurements (length of forearm, tibia, and total body), the female escaped and flew away alone. As we did before, we put the pup together with a lactating female that had no pup and was not pregnant. The result was the same: the female also accepted it and she took the pup into the cave. Although these observations were made under manipulated conditions, the cases demonstrate the willingness of lactating females of *C. perspicillata* to accept and carry orphans.

Two explanations have been rendered for alloparental care: (1) confusion of a mother's young with others (mistaken identity) or (2) benefits associated with care for the young of others (cooperative behavior) (Roulin, 2002;

Riedman, 1982). According to Clutton-Brock and Godfray (1991), parents should avoid investment in non-descendent young due to the high cost of parental care. Indeed, experiments with Seba's short-tailed fruit bat have demonstrated that mothers are able to discriminate between their own pups and alien pups using individual vocal signatures (Knörnschild *et al.*, 2013). Hence, these cases of alloparenting may not be explained by the mistaken identity hypothesis.

Alternatively, cooperative behavior seems to be a better explanation to the fact that lactating females accepted and carried abandoned pups. As Riedman (1982) has pointed out, in the vast majority of social mammals, parental care frequently falls upon lactating females, hence it is normal that most cases of alloparental care involve females rather than male assistants. One of the benefits obtained from alloparenting is the increase of maternal experience, which is valuable to improve mothering abilities in females (Roulin, 2002; Riedman, 1982). To the best of our knowledge, alloparenting in *C. perspicillata* has not been documented previously. Besides communal roosting (Fleming, 1988), this is the only report of potentially cooperative behavior for this species.

We are not sure about the frequency of this behavior in the wild given the manipulated conditions in which these cases occurred, but we highlight that both cases occurred during the breeding season (June to August) with lactating females. Probably the hormonal status of the lactating females might have influenced their willingness to accept any infant that came into contact, given the short time at which the female accepted the pup. In other mammals such as primates and rodents, higher levels of prolactin and oxytocin play a key role in alloparental behavior (Bales *et al.*, 2007; Mota and Sousa, 2000). Hormonal studies are still poorly investigated in bats and may provide a better explanation regarding this behavior.



**Figure 1.** Female of *Carollia perspicillata* carrying her pup photographed in Santander, Colombia.

Finally, we do not know the ultimate fate of either female or pup. It would be important to determine if a real capacity for adoption have been existed. Adoption had been suggested for *C. perspicillata* (Porter, 1979), but it requires long-term field data to monitor the relationship between female and pup. A permanent provision of food and protection for the orphan by the female is necessary to determine adoption (Boesh *et al.*, 2010). Therefore, adoption may be rare in bats due to high energetic cost (LeBlanc, 2001). Additional data is needed to confirm adoption capacity of Seba's short-tailed fruit bat.

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