Adoption of a Lesser Short-nosed Fruit Bat (*Cynopterus brachyotis*) in Captivity

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Bats have a distinctive biological strategy for mammals of their size (Racey and Entwistle, 2000). They typically have only a single large young, although a few *microchiroptera* commonly have twins (Racey, 1982; Tuttle and Stevenson, 1982). Bats are also characterized by having a long gestation period for small mammals, a long period of lactation and post-natal care, and a long lifespan with some species living for over 30 years (Racey, 1973; Hayssen, 1993; Racey and Entwistle, 2000; Kunz and Pierson, 1994). This biological strategy starts with a special bond between pup and dam since the rearing of young is carried out exclusively by females (Altringham, 1996). Maternal investment is the hinge-pin of this strategy that starts with a functionally altricial offspring that has a limited ability to regulate its body temperature and is unable to do little more than to hang on to its dam and suckle.

Short-nosed fruit bat *(Cvnopterus brachyotis)* **with pup.** *Photo by John Seyjagat*

This biological strategy is energetically expensive, since a mother must provide her pup with a warm thermal environment, security, transportation, nutrition in the form of milk, and she must be able to communicate to her pup as an individual (Kunz and Hood, 2000). This investment is also prolonged for several months until the pup reaches 90% of the adult wing dimensions and is able to fly. In many cases, the darn continues her investment by allowing her pup to shadow her during foraging flights in which echolocation and hunting skills may be refined (Dwyer, 1970; Bradbury and Emmons, 1974; O'Shea and Vaughan, 1977; Altringham, 1996; Kunz and Hood, 2000). If maternal care is interrupted or ends prematurely this can lead to certain death for the pup (West and Redshaw, 1987).

The focus of this article is the maternal life of a female lesser short-nosed fruit bat *(Cynoplerus brachyotis)* (#929604) named "Patricia". Short-nosed fruit bats are small *megachiroptera* (Wt. = 30-48 grams [1.06-1.69 oz,]; Forearm length = 58 - 68mm [2.28-2.68 in.]) with a distribution from Sri Lanka through southern Asia to Indonesia and the Philippines (Lekagul and McNeely, 1988;Nowak, 1994; Flannery, 1995). They feed primarily on fruit, nectar and pollen in agricultural and disturbed habitats (Mickleburgh et. al. 1992; Flannery, 1995). Short-nosed fruit bats are unique in the family *Ptempodidue* in that they modify plant leaves into "tents" to form suitable roost sites (Kunz et. al. 1994). Recent reports suggest that males construct tents as a defendable

resource that is used by their harem for rearing young. Small groups of 6 - 12 may roost together. In addition to "tents," short-nosed fruit bats will also roost in modified fruit clusters of the kitul palm, under the caves of houses, and the twilight zone of caves (Lekagul and McNeely, 1988; Nowak, 1994). They breed throughout the year and females may become pregnant at six to eight months of age. Gestation is approximately 120 days with a lactation period of 6 - 8 weeks. The greatest documented longevity in the wild is 4.5 years (Heideman and Heaney, 1989; Mickleburgh et. al. 1992).

"Patricia" was born in 1995 to a wild-caught female. She gave birth to her first successful pup when she was 16 months old. West and Redshaw (1987) have suggested that inexperienced bat mothers may lose their first few pups, but these events are important in the learning process of successful care-giving. In 1997, "Patricia" was observed nursing a hand-reared pup at the end of her lactation period while her male pup was in the weaning process. A second altruistic act was recorded in 2000, when after loosing her premature pup she adopted her grandson on the sudden death of her daughter. Both the premature pup and the grandson were born one day apart, and both females were observed roosting together.

Short-nosed fruit bat *(Cynopterus brachyotis)* **under palm frond.**
Photo by Dana LeBlanc

Communal or non-offspring nursing and adoption are noteworthy in Chiroptera because of the high level of energetic costs. Communal nursing has been observed in the wild with common pipistrelles (Pipistrellus pipistrellus), common long-fingered bats (Miniopteris schreibersi), Mexican free-tailed bats (Tadarida brasiliensis), and evening bats (Nycticeius humeralis) (Kunz and Hood, 2000; Richarz and Limbrunner, 1993; McCraken, 1984; Wilkinson, 1992).

Communal nursing may be more common in captive situations due to a greater opportunity for reciprocation, a lower nutritional cost, and a higher degree of genetic relatedness in captive colonies (Kunz and Hood, 2000). The following species have been observed to nurse non-related offspring in captivity: California leaf-nosed bats (Macrotus californicus), common pipistrelles (Pipistrellus pipistrellus), Mexican free-tailed bats (Tadarida brasiliensis), common vampire bats (Desmodus rotundus), straw-colored fruit bats (Eidolon helvum) and Egyptian fruit bats (Rousettus aegyptiacus) (Donna Bear-Hull, personal comment; Lewis, 2001; John Seyjagat, personal comment; Gould, 1977; Schmidt, 1978; Mills, 1980; Bales et. al. 1988; Lollar, 2001).

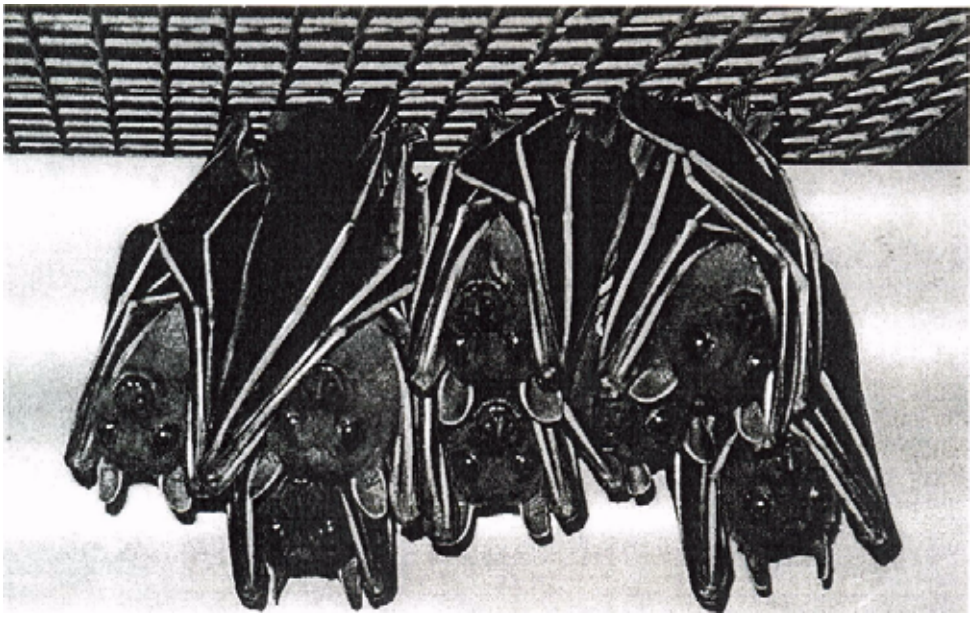
Observations of adoption in wild colonies are difficult, since 'adoptive' nursing may increase with human disturbance (Fogden, 1971). In captivity, observations on adoption have been made with common vampire bats (Claudia Coen, personal comment; Richarz and Limbrunner, 1993).

Since the altruistic acts of communal nursing and adoption does occur in Chiroptera, how can these altruistic acts be explained on an evolutionary scale? Altruism is defined as an act, or some other property, of one organism that increases the chances of survival of another organism while decreasing its own (Dawkins, 1976).

The theory of natural selection favors adaptations that cause their bearers to bear more offspring, and it should favor individual selfishness (Ridiey and Dawkins, 1981). One theory that might account for adoption and communal nursing is km selection (Hamilton, 1964). Bertram (1976) showed that kin selection in lions could be responsible for communal nursing of cubs since young females remain in the pride and have a high degree of genetic relatedness. Kin selection could explain why a grandmother would care for her maternal grandson since they share 1/4 of their genes.

Another theory is reciprocal altruism. In this theory, altruism is favored provided that it is repaid (Trivers, 1971). Food sharing behavior with non-kin in common vampire bats in small, stable social groups is an excellent example of this behavior (Kunz and Hood, 2000). Adoption with common vampire bats may also be able to be explained by this theory.

Communal nursing may also be attributed to parental mistakes and milk stealing by young (McCrakcn and Gustin, 1991). Dawkins (1976) stated that mistakes such as adoption of orphaned offspring by a non-kin female occasionally happen in nature in species that live in herds or colonies. This behavior is regarded as a misfiring of the selfish gene principal since the female is wasting time and energy that could be invested in passing her own genes to the next generation.



Short-nosed fruit bat (Cynopterus brachyotis) ***colony.*** Photo by Dana LeBlanc '·vs

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