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ONTOGENY AND MATERNAL CARE

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Although many aspects of phyllostomatid biology have received increasing attention in recent years, there is still a dearth of information on the growth and behavioral ontogeny of this diverse family of bats. This is in contrast with studies of the Vespertilionidae, where both field and laboratory investigations of development have been common, although by no means numerous (Jones, 1967; Pearson *et al.*, 1952; Kleiman, 1969; Orr, 1970; Gould, 1971). The lack of interest in chiropteran ontogeny is discouraging because the special adaptations for flight, including echolocation, and diverse feeding strategies should provide fertile ground for developmental studies, as Gould (1970) has pointed out.

In this chapter we will attempt to review some aspects of ontogeny in the phyllostomatid bats, concentrating on growth and development in *Carollia perspicillata*, which we have studied in captivity. Field and laboratory observations of other species will be included where they are available. The vampire bat, *Desmodus rotundus*, is the only other phyllostomatid for which detailed information is available (Schmidt and Manske, 1973).

The colony of *Carollia perspicillata* was originally captured in Trinidad in April 1972 and maintained at Johns Hopkins University for six months by E. Gould. During this period, several births occurred. Sixteen *Carollia* were brought to the National Zoological Park, Washington, D.C., in October 1972. At this time, one female had a small infant; a second female gave birth three days after the arrival of the colony. Both young were reared. Table 1 presents the history of the colony between January 1973 and January 1974. Three *Glossophaga soricina* (two males, one female) were acquired with the *Carollia*, of which one adult male died and one male was born. Nine *Anoura geoffroyi* (four males, five females) also were received, but all but a pair died within the first three days. No breeding of *Anoura* occurred.

The colony was housed in a climate-controlled room measuring approximately 3 by 3 by 2.5 meters. Temperatures averaged 29°C (range 27 to 31°C); relative humidity, 70 per cent (range 50 to 80 per cent). A light cycle of 12 hours of light to 12 hours of dark was used. Two wire mesh cages with wooden frames and burlap covers were provided for roosts in an elevated position. Several branches were placed between the roosts and from the roosts to the floor.

Bats were fed a peach-nectar mixture developed by Rasweiler and De Bonilla (1972) for nectarivorous phyllostomatids, although there is evidence that *Carollia* also feeds on insects (Pine, 1972; Ayala and D'Alessandro, 1973). Water was available *ad libitum*, as were ripe, peeled bananas that were suspended from branches. Dishes with the nectar diet were placed in brackets

TABLE 1.—*History of* Carollia perspicillata *colony from January 1973 to January 1974.*

	Males	Females	Total
Number of original adults	6	11	17
Number of births	17	13	30
Number of deaths:			
Adults	0	1*	1
Juveniles	1	5*	6

*One mother and young died accidentally.

attached to the outside of the roosts so that bats could feed while in flight or while hanging on the roost.

Bats were caught with butterfly nets; adults initially were examined bimonthly beginning in January 1973, but weekly examinations were instituted in April 1973. Young were weighed and measured every two to four days. Individuals were identified by a number punch marked on the wing membrane (Bonaccorso and Smythe, 1972; Kleiman and Davis, 1974). Behavioral observations and retrieval tests were conducted at irregular intervals.

REPRODUCTIVE CYCLE

After the two births in October 1972, there were three birth peaks in *Carollia*: February 1973, June and July 1973, and November and December 1973 (Table 2). Known interbirth intervals ranged from 115 to 173 days. During the first peak of parturition, females were highly synchronized—nine of 11 females gave birth within a 17-day period. The births were more scattered

TABLE 2.—*Dates of birth and interbirth intervals for 12* Carollia perspicillata *females, between January 1973 and January 1974.*

No. of females	Birth no. 1	Birth no. 2	Birth no. 3	Interbirth interval (days)
4	12 Feb. 73	1 July 73	25 Oct. 73	138, 116
6	26 Jan. 73	29 May 73	18 Nov. 73	123, 173
7	28 Feb. 73*	23 June 73	6 Dec. 73*	115, 165
10	20 Feb. 73*	21 June 73*		121
11	14 Feb. 73*			
16	5 Mar. 73	21 July 73*	10 Dec. 73	138, 142
17	16 Feb. 73*	3 Aug. 73*		168
19	12 Feb. 73	24 June 73	8 Nov. 73*	132, 137
20	18 Feb. 73*	1 July 73	15 Nov. 73*	133, 137
25	22 Feb. 73*	12 July 73*	7 Dec. 73*	140, 148
26	22 Feb. 73*	20 June 73*	10 Dec. 73	118, 173
35	14 Jan. 74*			

*Indicates accurate birth date. Other dates are estimated and parturition might have occurred a maximum of three days earlier.

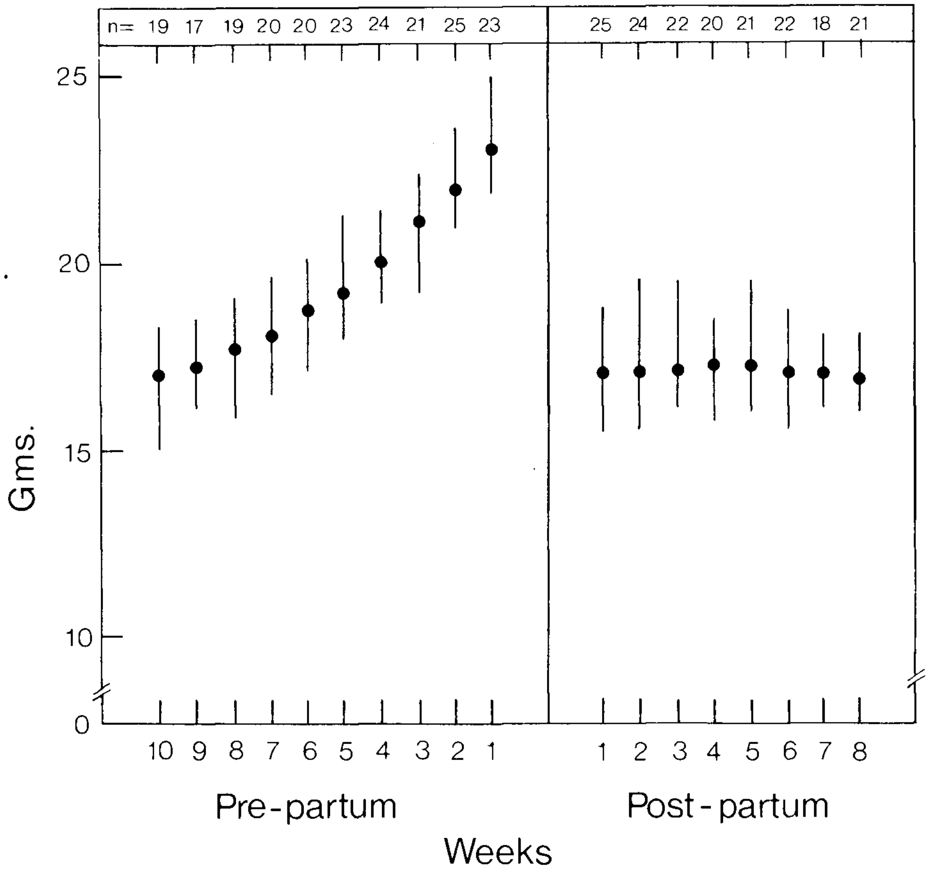

FIG. 1.—Average weights and ranges of weights in pre and postpartum *Carollia perspicillata*, based on 25 births of 11 females.

during the succeeding two parturition periods. The shortest interbirth intervals ranged from 115 to 123 days ($N = 5$). Rasweiler and De Bonilla (1972) found an implanting blastocyst in a female killed 21 days postpartum, suggesting that estrus may occur shortly after parturition. If an immediate postpartum heat occasionally occurs, the gestation period for *Carollia perspicillata* may be approximately 115 to 120 days. The single *Glossophaga soricina* female gave birth in March 1973 and did not become pregnant again for a full year.

A total of 30 *Carollia* young were born (see Table 1), of which 24 survived through weaning. No females aborted nor were any infants rejected after birth. The majority of juvenile deaths occurred at weaning, and at least four of these might have resulted from feeding on spoiled food or a disfunction in the humidity control, which caused a rapid drop in humidity in the flight room. Adult losses were limited to a single female and her young, which died accidentally.

Females gained approximately one-third of their initial weight during pregnancy (see Fig. 1). Average weight during the last week of pregnancy was 22.9 grams as compared with 17.3 grams during the first week postpartum. During the final weeks of pregnancy, females were reluctant to fly and maneuvered less efficiently when they flew. Fetuses were palpable from about five to six weeks before birth, and were in a transverse position.

The nipples of pregnant females were not obvious prior to birth, but within two days of parturition the surrounding fur had been shed and the mammary region had become pink in color. Thick milk could be expressed from the nipples up until approximately 33 days postpartum (range 21 to 49 days). Thereafter, the milk began to thin, but fluid could be expressed until approximately 56 days after birth (range 42 to 72 days). The area around the nipples began to assume a darker pigmentation and the fur began to reappear from 48 days postpartum (range 37 to 66 days); however, the mammary region did not assume prepartum condition until 72 days postpartum (range 64 to 87 days). From these observations, it would appear that heavy lactation continues for slightly over one month after birth, but females continue to produce milk until approximately 1.5 to 2 months postpartum.

Data available for length of lactation in other phyllostomatids indicate a lactation period of one to two months (Jenness and Studier, 1976). In the vampire bat, *Desmodus*, nursing may continue for nine months although weaning is initiated at three (Schmidt and Manske, 1973). In *Macrotus* and *Leptonycteris*, lactation continues for one month and four to eight weeks, respectively (see Jenness and Studier, 1976). A single *Glossophaga soricina* female in our colony continued lactating for approximately two months.

Maternal Care

No births were observed in *Carollia* although females were seen eating placentas and licking newborn young. The umbilical cord was rarely severed at the base, but usually dried up and fell off within a day following birth.

Parturition has been described for *Stenoderma rufum* (Tamsitt and Valdivieso, 1966*b*), *Artibeus lituratus, Glossophaga soricina, Vampyrops helleri* (Tamsitt and Valdivieso, 1965), and *Choeronycteris mexicana* (Barbour and Davis, 1969). In all species, parturition occurred in the normal head-down position; this seems to be typical of phyllostomatids but rare in vespertilionids (Wimsatt, 1960), except for *Nyctalus noctula* (Kleiman, 1969).

In the species observed by Tamsitt and Valdivieso (1965, 1966*b*), a head presentation was found. Placentophagia has not been reported for the above-mentioned species, nor for *Desmodus* (Schmidt and Manske, 1973).

During the first few days, young *Carollia* were carried parallel to the mother's body and held under the wing. Thereafter, the typical carrying position, both at rest and in flight, was cross-wise on the mother's ventral surface, just posterior to the throat. *Carollia* infants (up to 14 days) were rarely observed hanging alone. Young attached themselves primarily with the mouth and hind feet;

the wings were tightly closed and partially covered the infant's body. Claws on the thumbs were not used for clinging because the distal portion of the forearm was pressed tightly against and covered the infant's head and ears. Young removed from the mother's nipple occasionally remained in this carrying posture for several seconds, even when placed on their back. The cross-wise carrying posture was also seen in our individual of *Glossophaga soricina*, *Desmodus* (see fig. 2 *in* Schmidt and Manske, 1973), and might be present in *Choeronycteris* (see fig. 8 *in* Barbour and Davis, 1969). It appears to be an adaptation for carrying young while the female is flying. For the first 10 days, captive young of *Artibeus* were reported (Novick, 1960) to hang head down under the mother's wing with the hindfeet around the mother's thigh.

Carollia mothers preferred to hang freely from a horizontal ceiling when carrying attached young. Thus, it was impossible for infants to be attached simultaneously to the nipple and support themselves by the hind feet until they were about half the size of the mother. Young were capable of hanging from the ceiling by the age of 18 days, but still remained attached to a nipple. Similar observations were made of a young *Glossophaga*. In *Desmodus*, young do not support themselves until at least two weeks of age (Schmidt and Manske, 1973).

From our observations, it appeared that resting *Carollia* females supported the bulk of their infant's weight for at least 14 days. An added advantage to the cross-wise carrying position assumed by the young, other than providing balance, was that they did not need to readjust their position when a female flew. Young were last observed attached to the mother approximately 23.5 days postpartum (range 19 to 31; $N = 15$), when they were approximately 57 per cent of the mother's weight.

Because we were unable to observe the bats without disturbing them, especially at night, we do not know whether females foraging in the wild carry their young or, if they do, for how long. One 11-day-old young was seen hanging alone next to its mother approximately 45 minutes after the lights went out, but the infant attached to the nipple and moved back into a cross-wise carrying position immediately after we entered the room. The mother flew as soon as the young attached. This suggests that mothers may detach from the young at night, but we had no evidence that young were ever left in a crèche. Mothers with attached young were more reluctant to fly when disturbed than were unencumbered bats but did so, nevertheless, and seemed able to maneuver efficiently.

Observations of development in a single young *Glossophaga soricina* were similar to those for *Carollia*. The young was last seen attached to the mother when it was 20 days old.

Both from our *Carollia* observations and some field reports, it appears as though some species of phyllostomatid bats commonly carry their young and, unlike vespertilionids (see Fenton, 1969; Davis, 1970), do not leave them in crèches.

Felten (*in* Pine, 1972) apparently netted a *Carollia perspicillata* with a half grown young, and Tamsitt and Valdivieso (1963*a*) caught lactating *Artibeus lituratus* and *Glossophaga sorcina* carrying young in the vicinity of fruit trees where presumably they were foraging. One *A. lituratus* female carried a young 53.8 per cent of her weight (Tamsitt and Valdivieso, 1965). Mumford and Zimmerman (1964) reported netting lactating *Choeronycteris mexicana* with attached young at a distance of approximately 200 yards from the main daytime roost. Bradshaw (1961) captured a female *Macrotus californicus* in a roost carrying a young weighing 57 per cent of her weight; Cockrum (in Davis, 1970) observed female *Leptonycteris sanborni* moving young within a cave as well as carrying advanced young to a previously abandoned roost. Schmidt and Manske (1973) indicated that *Desmodus* females can carry young up to eight weeks old. A. M. Greenhall (personal communication) has observed *Desmodus* females with attached young of unknown age feeding on cattle; however, these bats were similar in size to young that he had observed crawling around in roosts without the mothers. These young were not newborn and might have been approaching weaning age.

Observations discussed above suggest that phyllostomatids may carry attached young of an advanced age. Whether females forage with the young or simply move them from roost to roost remains to be determined. Certainly, except for *Macrotus waterhousii* (Goodwin, 1970), *Leptonycteris sanborni* (Hoffmeister, 1959), and *Phyllostomus hastatus* (J. Bradbury, personal communication), one does not find reports of crèches of infants in phyllostomatids, although lactating females may roost colonially and segregate themselves from males. Bradbury (personal communication) suggested that female *Carollia*, for example, may move their babies from the day roost to a night roost prior to foraging, which may partly account for the well-developed tendency to carry young in captivity.

Retrieval of young *Carollia* was observed under several experimental conditions. Mothers and young were released into a small holding cage after being weighed and measured; typically, they reestablished contact within 30 minutes to an hour (that is, before being released into the flight room). On several occasions, young were deliberately separated and hung on the outside of the roost, after which time the other bats were released into the flight room. Several different bats would fly past hanging infants, pausing briefly to hover, as though to inspect the young. Usually, a juvenile was inspected several times (both by its mother and other bats) before the mother would alight above her offspring and crawl down to it.

Juveniles that were too young to fly were never observed attempting to regain contact with their mother by climbing higher on the roost. Normally, they hung motionless until the mother made tactile contact with them. Audible vocalizations (ultrasonic calls were given by the mother and young, Gould, 1975) were not heard nor did the infant reveal much sign of disturbance. Licking of the young by the mother usually accompanied retrieval, especially before the mother flew again. The latency to retrieve was highly variable in the females, ranging from two to 30 minutes. The age of the young did not seem to affect this latency because infants between one and three days old were retrieved within two to 22 minutes.

Mothers clearly recognized their own offspring; we never caught a female with an alien young attached to her. Moreover, mothers and young retained an association (roosted near each other) long after weaning. One *Carollia* mother and daughter were regularly caught together until the daughter was five months old, about a week prior to the next birth.

Development of Young

Carollia are born in an advanced state, with the eyes open (Fig. 2). Neonates are fully furred on the dorsum, and the more sparsely furred venter and muzzle become covered within two to three days after birth. The dark brown juvenile pelage is complete by day 7 to 10.

Of the neonatal phyllostomatids observed, *Macrotus, Leptonycteris* (Gould, 1975), *Carollia, Glossophaga* (this study and Klíma and Gaisler, 1968), *Choeronycteris* (Mumford and Zimmerman, 1964), and *Artibeus* (Tamsitt and Valdivieso, 1966*a*) are born well furred. *Desmodus* (Schmidt and Manske, 1973; Gould, 1975), *Phyllostomus discolor* (Klíma and Gaisler, 1968), and *P. hastatus* (Gould, 1975) are sparsely furred at birth.

Eyes are open at birth in *Carollia* (this study), *Artibeus* (Tamsitt and Valdivieso, 1966*a*), *Desmodus* (Schmidt and Manske, 1973; Gould, 1975), *Macrotus* (Gould, 1975), and *Phyllostomus hastatus* (Gould, 1975). Only *Leptonycteris* and *Phyllostomus discolor* have been reported (Tamsitt and Valdivieso, 1963*a*) to have the eyes closed at birth.

Carollia neonates were active from birth and when handled would squirm, try to crawl away, and often vocalize. This contrasted with their behavior in the flight room during retrieval tests when they hung motionless on the bat roost. The increased activity might have been caused by the temperature of the room in which weights and measurements were taken, which was cooler than was the flight room. Gould (1975) stated that the young of *Desmodus, Phyllostomus hastatus,* and *Leptonycteris sanborni* are active during reunions with the mother, whereas those of *Macrotus californicus* are passive.

C. perspicillata young are born with a complete set of 22 deciduous teeth, with the formula di 2-2/2-2, dc 1-1/1-1, dpm 3-3/2-2 = 22. A comparison of preserved skulls from the U.S. National Museum with living neonates suggests that only 16 of the 22 deciduous teeth are functional. The four lower incisors, barely penetrating the gingivum, disappear several days after birth, and the first upper deciduous premolars are not even visible in live specimens. Lower deciduous premolars are simple, highly reduced spicules, undifferentiated in width from root to crown. The second and third upper premolars, although more prominent than the lower ones, are tiny pegs that taper to a fine point at the crown. The second milk

FIG. 2.—Neonate of *Carollia perspicillata* on the day of birth. Note that the eyes are open, and the animal's dorsum is fully furred. The venter typically has only sparse fur.

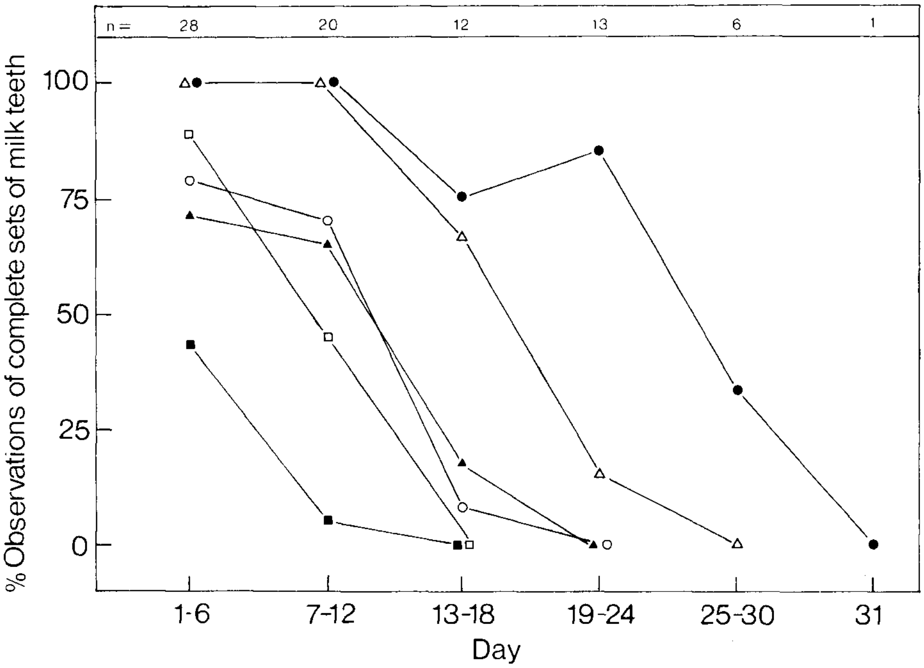

FIG. 3.—The loss of deciduous teeth in juvenile *Carollia perspicillata*. Observations within a given time period may include the same individual. (Symbols are closed circles, upper outer incisors; open circles, upper inner incisors; closed triangles, lower canines; open triangles, upper canines; closed squares, lower premolars; and open squares, upper premolars).

premolar is weakly recurved. Lower canines are slender, mildly recurved spicules that gradually taper to a point. The upper canines and upper outer incisors are the largest, most strongly recurved stylettes; also, they are retained longest. Upper inner incisors are bifid at the distal extremity.

The comparative rate of loss of deciduous teeth is represented in Fig. 3. Lower deciduous premolars are lost during the first two weeks postpartum. Lower canines, upper premolars, and upper inner incisors are shed next. The upper canines and upper outer incisors are retained until one month postpartum, the last milk tooth being lost at 34 days postpartum. The permanent dentition of the upper jaw emerged first. By day 22 postpartum, one-third of the permanent teeth had emerged; by day 26, two-thirds; and by day 31, all were present.

Deciduous upper and lower canines and upper outer incisors are the teeth primarily used to attach to a nipple. Two observed perforations in a female's nipple were a clear result of the upper canines, the distances between the perforations and the canines both measuring 2.6 millimeters. *Carollia* resembles *Tonatia*, *Mimon*, *Chrotopterus*, *Choeronycteris*, and *Phyllostomus* in that the upper outer incisors are more prominent than the upper inner ones.

In *Macrotus, Glossophaga,* and *Leptonycteris,* both outer and upper inner incisors are functional (Phillips, 1971).

In general, the deciduous dentition of most phyllostomatids is reduced and less complex than that of vespertilionids (Phillips, 1971; Miller, 1907). This seems to correlate with the tendency to carry attached young rather than deposit them in crèches, thus suggesting that increased complexity in the deciduous dentition of vespertilionids may function to grasp the returning mother (or any female in species that nurse promiscuously) rather than to maintain a hold on the nipple when already attached.

The development of flight in *C. perspicillata* was investigated by periodically dropping infants and juveniles. Prior to day 14, all young drop straight to the ground, with the wings extended. As infants approached 14 days of age, they occasionally flapped their wings once or twice as they fell. Between days 14 and 16, young bats began flapping the wings when dropped, but could not maintain altitude or turn. They also were unable to land and often collided with obstacles or eventually dropped to the floor. By day 18, they could maintain (and gain) altitude, take off from a roosting position, turn, and avoid obstacles. However, their landing ability was poor, and they often landed with the wings extended. Between days 20 and 23, the ability to land upside-down with the wings folded perfected, and, after day 24, flight development essentially was complete. Juveniles, however, could be distinguished from adults by their flight patterns for several weeks more because they flew more slowly and erratically. Juveniles were first captured independent of the mother on an average of 27.6 days (range 23 to 31, $N=16$) after birth.

There is little information available on flight development in other young phyllostomatids. In *Desmodus,* young achieve flight capability at eight to ten weeks of age (Schmidt and Manske, 1973); Novick (1960) reported that a young *Artibeus* began to fly at approximately 28 days of age. A single juvenile *Glossophaga soricina* was first found separate from its mother and flying at age 25 to 28 days.

Neonates of *Carollia perspicillata* average 5.0 grams at birth (range 4.1 to 5.9; $N=13$), which is 28.4 per cent of the postpartum weight of females. Initial growth in weight is rapid (Fig. 4), but juveniles do not achieve adult weight until 10 to 13 weeks of age. Forearm length at birth is 24.4 millimeters (range 22.4 to 27.5 mm; $N=10$), and forearm growth essentially is complete at six weeks (Fig. 4). At approximately 24 days of age, when the young first begin to fly, forearm length is 93.4 per cent and weight 63.0 per cent of that for adults ($N=10$).

Neonatal and postpartum weights and measurements are not available for most phyllostomatid bats. Table 3 presents some accurate and estimated neonatal to mother weight and measurement ratios for both phyllostomatid and vespertilionid bats, based on known and derived data. Weights and measurements were taken from full-term fetuses and nonlactating females. Young-to-mother weight ratios are poor for comparative purposes because weights tend to fluctuate seasonally, captive and field weights frequently

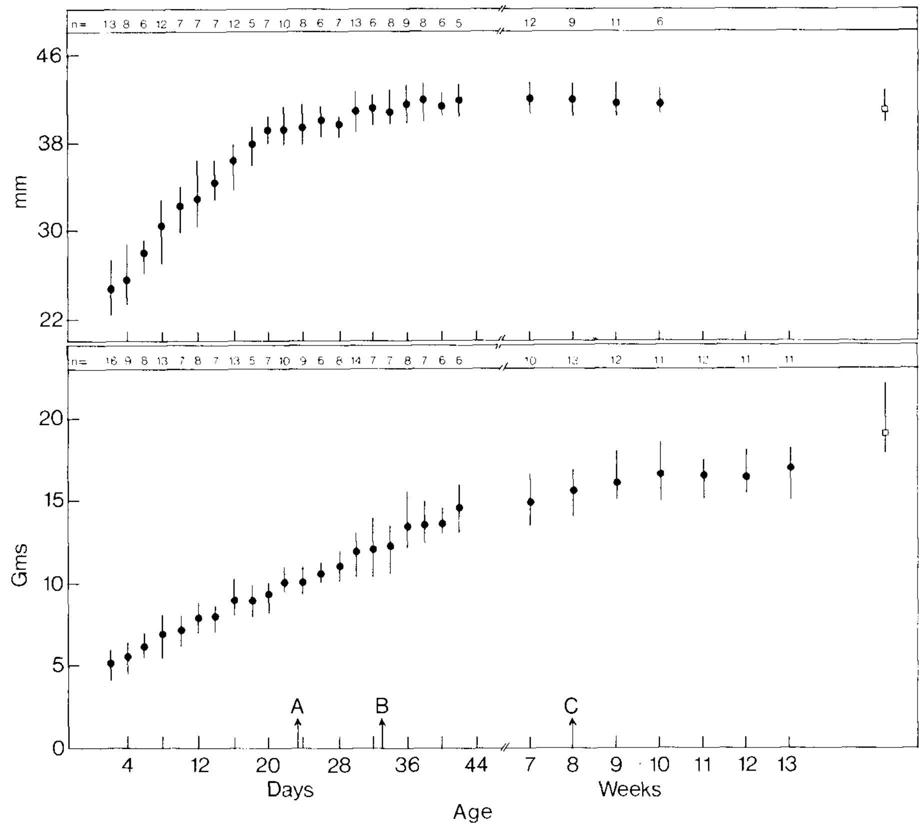

FIG. 4.—Increase in average weight (bottom) and forearm length (top) for *Carollia perspicillata*: A, average day when young were last observed attached to the mother; B, average day when the mother's milk began to thin; C, average day when milk no longer could be expressed from the mother's nipples. These averages are based on measurements from 17 individuals (8 females, 9 males) of known age. The open squares indicate the mean weight and forearm length (and range) for 12 adult males for comparison.

differ, and species may have one to three young per litter. However, most phyllostomatids exhibit ratios greater than 0.25 (for single births). Orr (1970) noted that the ratio in vespertilionids depends on species size, larger species tending to have a smaller ratio. Neonatal-to-mother forearm ratios are a better comparative measure. Table 3 indicates that phyllostomatid bats may be born in a more advanced stage than vespertilionids because seven of eight species of phyllostomatids have a ratio usually exceeding 0.41 whereas this ratio is exceeded in only three of 13 vespertilionids.

DISCUSSION AND CONCLUSIONS

The paucity of information on phyllostomatid development not withstanding, available data suggest that ontogeny and maternal care in phyllostomatids differs in several characteristics from those in vespertilionids.

TABLE 3.—*Average neonate to adult weight and forearm length ratios in selected phyllostomatid and vespertilionid bats. Weights are given in grams, lengths in millimeters, and sample size appears in parentheses.*

Species	Weight			Length of forearm			References
	Neonate	Adult	Percentage of adult size	Neonate	Adult	Percentage of adult size	
				PHYLLOSTOMATIDAE			
Macrotus waterhousii				26		51	Gould, 1975
Phyllostomus discolor	7.6(1)	31.6-36.9(4L)	20.6-24.1	26.2(1)	59.2-63.2 (2M; 2NP)	41.4-44.3	Tamsitt and Valdivieso, 1963*a*; Goodwin and Greenhall, 1961
Phyllostomus hastatus				37		46	Gould, 1975
Leptonycteris sanborni				16		47	Gould, 1975
Anoura geoffroyi	5.1(4)	11.3-16.2(20NP)	31.5-45.1				Goodwin and Greenhall, 1961
Choeronycteris mexicana	4.4(2FF)	16.2(2B)	26.5				Mumford and Zimmerman, 1964
Carollia perspicillata	5.0(13)	17.6(7PP)	28.4	24.4(10)	42.3(10)	57.7	Kleiman and Davis, this study
Artibeus lituratus	7.8-15.5	56.1(6NP)	13.9-27.6	38.7(1)		55.2	Tamsitt and Valdivieso, 1965
	10.7(1)	56.4(1B)	19.0		69.9(4M;10NP)		Tamsitt and Valdivieso, 1966*a*
	8.9(1)	26.1(1B)	34.1				Tamsitt and Valdivieso, 1963*b* (*in* Orr, 1970)
Stenoderma rufum	7.0(1)	19.0(1B)	36.8	29.4(1)	49.6(1)	59.3	Tamsitt and Valdivieso, 1966*b*
Desmodus rotundus	7.0(FF)		21.9				Crespo *et al.*, 1970
				25		43	Gould, 1975
	5.5(3)	24.4-40.4(30L)	13.6-22.5	22.3(3)	56.7-59.6(16)	37.4-39.3	Burns, 1970; Goodwin and Greenhall, 1961

TABLE 3.—*Continued.*

				VESPERTILIONIDAE			
Myotis lucifugus	1.5-1.9	6-7.5	20-31.7				Barbour and Davis, 1969; Orr, 1970
	2.3(1)			16-17		42	Gould, 1971, 1975
			28.3	15.7 (18)	39.5(100)	39.7	O'Farrell and Studier, 1973
Myotis thysanodes			27	16.3(2)	43.8(100)	37.2	O'Farrell and Studier, 1973
Myotis velifer	3.0		25.8	16.0	43.6-48.6	32.9-36.7	Kunz, 1973
Pipistrellus subflavus	1.89*	5.86(5L)	32.2				Lane, 1946
Pipistrellus pipistrellus	1.4(9)	5.9(2PP)	23.7	11.4(7)	32.0(38NP)	35.6	Kleiman, 1969
Eptesicus fuscus	4	16.0(1L)	50.0**	18.0	42-51	35.2-42.8	Davis *et al.*, 1968; Barbour and Davis, 1969
	3.1-3.6			17.0(3)	44-48	35.4-38.6	Gould, 1971
				18		39	Gould, 1975
Eptesicus serotinus	5.8(4)	28.3(3PP)	20.5	22.4(4)	51.9(8)	43.9	Kleiman, 1969
Nyctalus noctula	5.7(10)	28.9(9PP)	19.7	20.7(9)	51.9(17)	39.9	Kleiman, 1969
Lasiurus cinereus				18.6(2)	46-58	32.1-40.4	Bogan, 1972; Barbour and Davis, 1969
Lasiurus intermedius	ca. 3			ca. 16	45-56	28.6-35.6	Jennings, 1958
Nycticeius humeralis	2.0(11)	8(L)	50**	14(11)	32-36	38.9-43.8	Jones, 1967
Plecotus townsendii	2.4(10)	8.5-11.3(32NP)	21.2-28.2	16.6(10)	42-44	37.7-39.5	Pearson *et al.*, 1952; Orr, 1970.
Antrozous pallidus	3.1(2)	25.2(16M)	24.6**	17.5(2)	57.9(13)	31.0	Orr, 1954, 1970
	3.0(9M); 3.2(11F)	22.2(39NP)	27.0; 28.8**	17.4(20)	53.9(103)	32.3	Davis, 1969
Tylonycteris pachypus	1.4*	L	36	8(1)	26-28	28.6-30.8	Medway, 1972
Tylonycteris robustula	2.5*	L	39				Medway, 1972

*Combined weights of twins; **percentage doubled since twin litters common; NP, nonpregnant females; L, lactating females; M, males; B, weight of pregnant female minus neonate weight; PP, postpartum females; FF, full-term fetuses; F, female.

1. Phyllostomatids generally are born in a more precocial condition, (furred, eyes open, mobile, and size large relative to that of the mother) than vespertilionids. As Gould (1975) pointed out, there is no clear dividing line between altriciality and precociality, but within the two families, the degree of overlap in such characteristics as mobility, eye opening, and pelage development is small.

2. In phyllostomatids, deciduous teeth are reduced in size, relatively simple in form, and functional teeth are fewer in number. The deciduous dentition might be related to permanent dentition and different feeding strategies, but it might also correlate with maternal care patterns, as discussed in point 3 below.

3. Phyllostomatid young usually are not deposited in large crèches by foraging mothers. Instead, they remain attached to the mother in the roost during the day and might be carried during foraging. Bradbury (personal communication) suggested that young might be carried to a nocturnal roost before the female begins to forage. The cross-wise position assumed by attached young could be an adaptation of phyllostomatids to frequent carrying by the mother.

The occurrence of these three characteristics in many species of phyllostomatid bats is intriguing, especially when considering how such adaptations evolved. Carrying young during foraging or transferring young to individual nocturnal roosts before foraging could serve as an antipredator strategy for bats living under conditions where other bats have evolved as predators. However, transferral to a nocturnal roost might be an adaptation that could evolve only under stable tropical conditions where temperature fluctuations are not great. By contrast, crèches of vespertilionids might function, in part, to retain heat in the altricial young. Clearly, behavioral studies in the field are needed to determine how ontogency and maternal care in the Phyllostomatidae relate to feeding strategies, social organization, roosting behavior, and possible antipredator mechanisms.

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