MAMMALIAN SPECIES No. 112, pp. 1-5, 3 figs.

Callicebus moloch.

By Clyde Jones and Sydney Anderson

Published 29 December 1978 by the American Society of Mammalogists

Callicebus Thomas, 1903

Titi Monkeys

Callitrix Hoffmannsegg, 1807:85. Type species *Callitrix torquata* Hoffmannsegg, by monotypy. Preoccupied by *Callitrix* Latreille, 1803 (= *Cebus)*.

Saguinus Lesson, 1827:56. Type species *S. personatus* É. Geoffroy Saint-Hilaire, by selection of revisor (Hershkovitz, 1963:5). Preoccupied by *Saguinus* Hoffmannsegg, 1807, a genus of marmosets.

Callicebus Thomas, 1903:457. Type species *Callithrix personatus* É. Geoffroy Saint-Hilaire, in Humboldt (1812:357), by original designation.

CONTEXT AND CONTENT. Order Primates, Suborder Anthropoidea, Superfamily Ceboidea, Family Cebidae. In addition to *Callicebus,* this family includes the extant genera *Aotus, Cacajao, Chiropotes, Pithecia, Alouatta, Cebus, Saimiri, Ateles, Brachyteles,* and *Lagothrix.* The genus *Callicebus* includes the species *C. personatus, C. torquatus,* and *C. moloch* as treated below. The following key was modified from Hershkovitz (1963) and others:

1 Distal portions of limbs (at least forefeet and hind feet) black and in sharp contrast to the gray or rufous of wrists and other proximal parts ---------- *C. personatus*

Distal portions of limbs (at least hind feet) gray, buff, reddish, brown, or if black or blackish, not in sharp contrast with proximal parts ---------------------------- 2

2(1) Color of body reddish to black, venter either not or slightly defined from dorsum; hind feet and tail to tip black; forearms black above and below; upper surface of forefeet either whitish or blackish like the wrists -- *C. torquatus*

Color of body gray, reddish, or brown; venter either like dorsum or sharply defined reddish orange or buff; hind feet black, brown, red, or gray; tail gray or blackish with the tip grayish; forearms gray, red, brown, or blackish above; forefeet gray or black above, not in contrast with the color of the wrists ------ *C. moloch*

Callicebus moloch (Hoffmannsegg, 1807)

Dusky Titi

Cebus moloch Hoffmannsegg, 1807:97. Type locality right bank of the lower Rio Tapajóz, district of Santarém, Pará, Brazil, by revisor's redesignation (Hershkovitz, 1963:27).

Callithrix cinerascens Spix, 1823:20. Type locality "dans les forêts de la rivière Putomaio ou Iça aux frontières du Pèrou," Tabatinga, Amazonas, Brazil.

Callithrix cuprea Spix, 1823:23. Type locality "in sylvis Solimöens, imperio Peruviano confinibus," Rio Solimôes, Amazonas, Brazil (restricted to Tabatinga by Hershkovitz, 1963:36).

Callithrix donacophilus D'Orbigny, 1836:pl. 5. Type locality Moxos, Beni, Bolivia. Lectotype from Santa Cruz de la Sierra, Santa Cruz, Bolivia (Rode, 1938).

Callithrix brunea Wagner, 1842:357. Type locality not given by author. Cachoeira da Bananeira, Rio Mamoré, upper Rio Madeira, Beni, Bolivia, by revisor's designation (Hershkovitz, 1963:32).

Callithrix caligata Wagner, 1842:357. Type locality "Borba et Rio Solimoëns" (restriction to Borba implied by Thomas, 1908:90).

Callithrix discolor I. Geoffroy St.-Hilaire and Deville, 1848:498. Type locality "Du Pérou," Sarayacu, [Río Ucayali, Loreto, Perú] by author's later restriction (I. Geoffroy St.-Hilaire, 1851:41).

Callithrix castaneoventris Gray, 1866:57. Type locality Brazil.

Callithrix ornata Gray, 1866:57. Type locality "New Granada" (restricted to the Villavicencio region, upper Río Meta, Meta, Colombia, by Hershkovitz, 1963:44).

Callicebus pallescens Thomas, 1907:161. Type locality "Chaco of Paraguay; type from 30 miles N. of Concepcion."

Callicebus subrufus Elliot, 1907:192. Type locality "Pachitea, Ucayali River, Peru. Altitude 400 to 500 feet."

Callicebus usto-fuscus Elliot, 1907:191. Type locality not precisely known, only "Brazil."

Callicebus egeria Thomas, 1908:35. Type locality "Teffé, Middle Amazons," Rio Solimões.

Callicebus hoffmannsi Thomas, 1908:89. Type locality "Urucurituba, Santarém," Rio Tapajóz, Pará, Brazil.

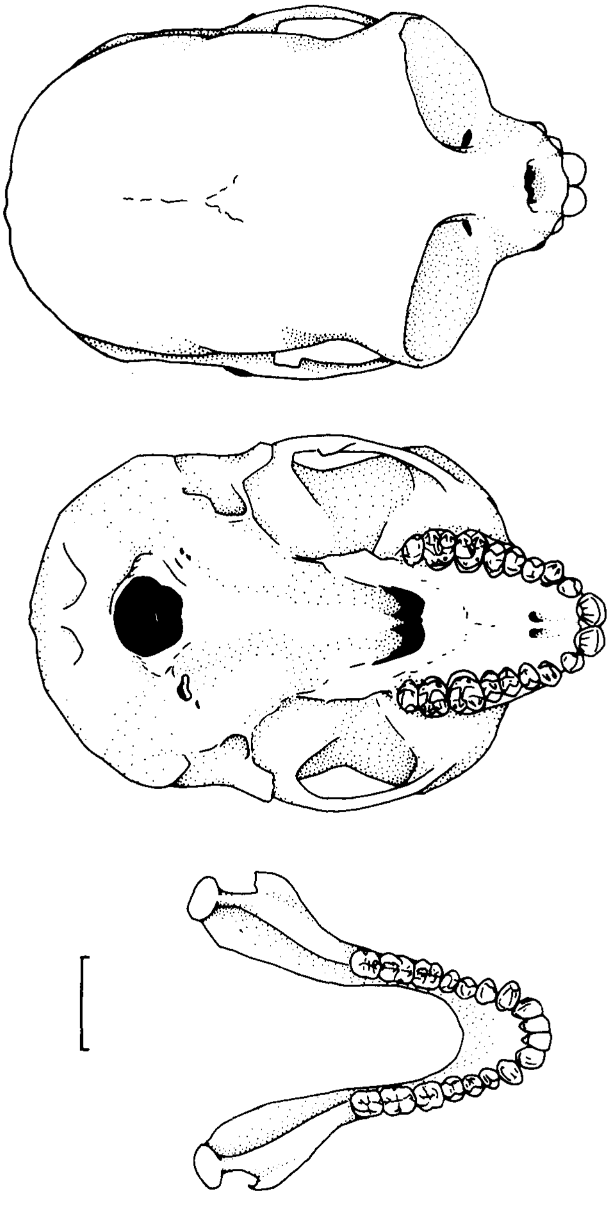

FIGURE 1. Dorsal and ventral views of skull and dorsal view of lower jaw of *Callicebus moloch* (USNM 461701). Drawings by Wilma Martin. Scale represents 10 mm.

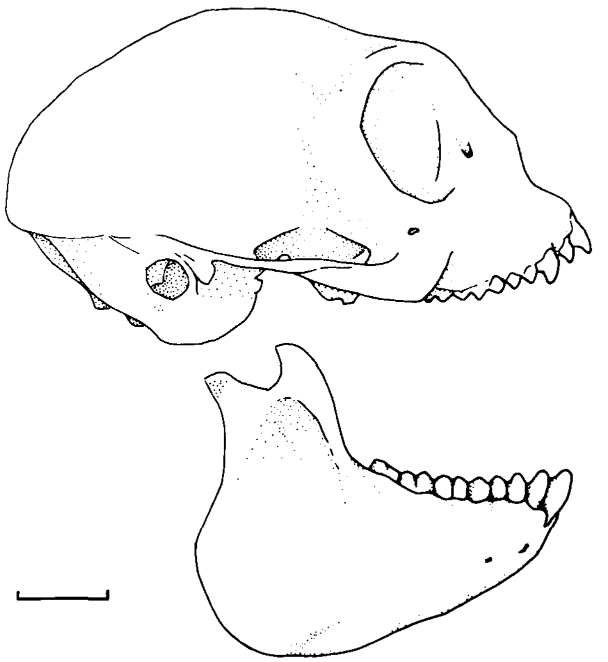

FIGURE 2. Lateral views of skull and jaw of *Callicebus moloch* (USNM 461701). Drawings by Wilma Martin. Scale represents 10 mm.

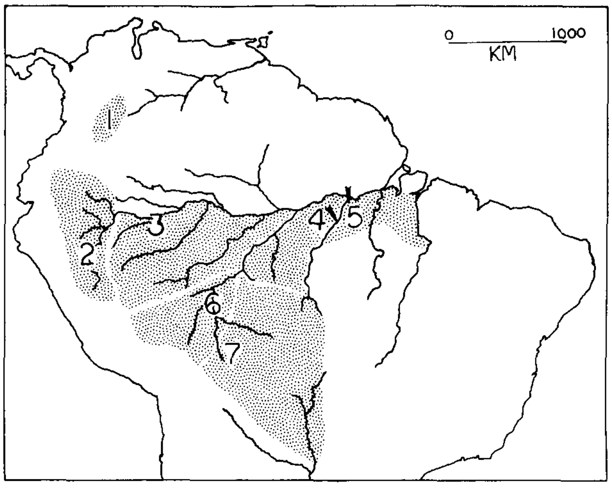

FIGURE 3. Distribution of *Callicebus moloch* in northern South America. Subspecies are 1, *C. m. ornatus;* 2, *C. m. discolor;* 3, *C. m. cupreus;* 4, *C. m. hoffmannsi;* 5, *C. m. moloch;* 6, *C. m. brunneus;* 7, *C. m. donacophilus.* Numerals show type localities. Redrawn from Hershkovitz (1963).

Callicebus remulus Thomas, 1908:88. Type locality "Santarém, Lower Amazon," Rio Tapajóz, Pará, Brazil.

Callicebus paenulatus Elliot, 1909:244. Type locality "Andoas, on the Pastasa River, Ecuador."

Callicebus emiliae Thomas, 1911:606. Type locality "Lower Amazons," Pará, Brazil.

Callicebus toppini Thomas, 1914:480. Type locality "Rio Tahuamanu, N.E. Peru, near Bolivian Boundary. About 12°20'S, 68°45'W," in Madre de Dios.

Callicebus geoffroyi Miranda Ribeiro, 1914:19. Type locality "Urupá," upper Rio Jiparaná, Brazil.

Callicebus oenanthe Thomas, 1924:286. Type locality "Moyobamba, N. Peru. Alt. 2700'," in Amazonas.

Callicebus rutteri Thomas, 1923:692. "Rio Pachitea, Upper Ucayali, Peru. Type from Puerto Leguía, 1500'."

Callicebus ollallae Lönnberg, 1939:16. Type locality "Bolivia, Rio Beni, La Laguna, una legua de [5 km from] Santa Rosa."

Callicebus baptista Lönnberg, 1939:7. Type locality "Lago do Baptista, E. of Rio Tapajoz . . . Estado do Amazonas," Brazil (restricted by inference by Hershkovitz, 1963:29).

Callicebus modestus Lönnberg, 1939:17. Type locality "Bolivia, Rio Beni, El Consuelo."

CONTEXT AND CONTENT. Context as given in the generic summary above. The seven recognized subspecies are:

C. m. moloch (Hoffmannsegg, 1807:97), see above (*remulus* Thomas and *emiliae* Thomas are synonyms).

C. m. cupreus (Spix, 1823:23), see above (*cinerascens* Spix, *caligata* Wagner, *ustofuscus* Elliot, and *egeria* Thomas are synonyms).

C. m. donacophilus (d'Orbigny, 1836:pl. 5), see above (*pallescens* Thomas and *geoffroyi* Miranda Ribeiro are synonyms).

C. m. brunneus (Wagner, 1842:357), see above (*ollallae* Lönnberg, *castaneoventris* Gray, *toppini* Thomas, *modestus* Lönnberg, and *acreanus* Vieira are synonyms).

C. m. discolor (I. Geoffroy St.-Hilaire, 1848:498), see above (*paenulatus* Elliot, *subrufus* Elliot, *rutteri* Elliot, *oenanthe* Thomas, *napoleon* Lönnberg, and *leucometopa* Cabrera are synonyms).

C. m. ornatus (Gray, 1866:57), see above.

C. m. hoffmannsi Thomas, 1908:89, see above (*baptista* Lönnberg a synonym).

DIAGNOSIS. Some distinctive features of the species are indicated in the key above. *Callicebus moloch* differs from *C. torquatus* also as follows: malar foramen usually less than 1.5 mm in diameter and rarely more than 2.0 (rather than 1.5 or more and rarely less than 0.75); maxilla providing 10 to 50% but usually 20 to 40% of descending process of zygoma (rather than 40 to 60%); auditory bullae usually closely approximated (rather than widely separated), and other characters (Hershkovitz, 1963:16).

GENERAL CHARACTERS. Manus and pes are similar, their first digits are not opposable. Feet are prehensile. The pollex is larger than the hallux. There are six palmar pads. Digits have nails. Digital formula (longer to shorter toes) is 3-4-2-5-1. Limb proportions are as follows: brachial index (radius length × 100/humerus length), 88 (83 to 92); crural index (tibia length × 100/femur length), 99 (97 to 100); intermembral index (humerus + radius length × 100/femur + tibia length), 73 (72 to 73); hand length index (total length of hand × 100/humerus + radius + hand length), 28 (28 to 29).

The dental formula is i 2/2, c 1/1, p 3/3, m 3/3, total 36. The upper incisors are elongate and the incisiform canines barely extend beyond the other teeth. Upper premolars are sometimes tricuspid, lower premolars are relatively simple. Upper and lower molars are quadricuspid. The root formula is premolar (p) 2, 1/1; p3, 1-2/1; molar (m) 1, 3/1-2; m2, 2-3/2; m3, 1-2/1-2.

Ears are relatively large, but usually somewhat obscured by the fur on the sides of the head. The nose has a wide internarial septum and the nares open laterally.

In adults, the pelage of the back is gray, reddish, or brown. The underparts are similar to the back, with occasional lateral areas of orange, red, or buff. There is usually a gray or black band on the forehead. The feet are gray, red, dark brown, or black. The tail is either like the back in color, or is dark gray, frequently with a whitish tip. Young and adults have the same colors.

Ranges of measurements in millimeters are: head and body, 287 to 390; tail, 331 to 480; hind foot, 85 to 100; ear, 26 to 32; greatest length of skull, 58.5 to 68.2; condylobasal length, 47.5 to 55.9; zygomatic breadth, 35.9 to 42.8; breadth of braincase, 31.0 to 36.4; upper incisor to M3, 20.3 to 23.7; width of palate between first molars, 8.5 to 10.8. Range of weight is 510 to 730 g. Cranial capacity ranges from 15 to 21 cc. The skull is illustrated in Figures 1 and 2.

Black and white photographs of this species are found in Hershkovitz (1963), Hill (1960), Napier and Napier (1967), Mason (1968), and Walker *et al.* (1975). Several color plates of *Callicebus* are found in Cruz Lima (1945).

DISTRIBUTION. The dusky titi occurs north of the Río Amazonas in the Upper Río Orinoco basin of eastern Colombia from the Río Guayabero to the upper Río Meta along the base of the Macarena Mountains west to the base of the Andes in Ecuador and Perú. The range south of the Río Amazonas is from the Río Huallaga in Perú and the Río Tocantins, Pará, Brazil, to the upper Río Madeira in Bolivia and extending into the Mato Grosso, Brazil, and the Upper Río Paraguay basin in Bolivia and Paraguay. *C. moloch* is absent in the Amazonian region of Colombia, where *C. torquatus* occurs. This hiatus in distribution of *C. moloch* has been reviewed by Hershkovitz (1963, 1968) and by W. G. Kinzey and A. H. Gentry (personal communication). Geographic distribution of *C. moloch* is depicted in Figure 3.

FOSSIL RECORD. There are no known fossils of *C. moloch*, but late Pleistocene remains of *C. personatus* have been reported. The known Pleistocene cebids are similar to the living ones. For a review and discussion of the fossil record and relationships of *Callicebus* with other members of the family, see Simpson (1945). A relatively close relationship of *Callicebus* and *Xenothrix* (Jamaican subfossil) was suggested by Rosenberger (1977).

FORM. The ear has a helical margin that ascends upward and backward, the anterior superior margin is rolled; the posterior margin is thin. Tragus and antitragus are small, lobate, and equal in size.

The manus has distinct, raised pads. The interdigital pads are separated from each other and the palm by deep flexure lines. The palm consists of two elongated central pads, a prominent hypothenar pad and a thenar pad. The pes has torulae less prominent than those of the manus.

The skull is orthognathus, orbits are unfenestrated, bullae are inflated ventrally, a large frontal sinus is above the nasals. Foramen magnum is directed posteriorly, atlas has shallow anterior articular facets for the condyles. Anterior margin of the lachrymal fossa is formed at least in part by the maxilla. Maxilla is high and compressed laterally. The descending process of the zygoma is well developed. The mandibular angle is expanded, especially behind the plane of the condyle. Hyoid bone is expanded and highly convex ventrally.

The upper dental arcade is highly arched partly because I2 is implanted posterior to the level of I1, and because the canines are so small. The I1 is larger than I2, and has an oblong crown and convex biting edge; I2 has a conical crown. The lower incisors are about equal in size, their tall crowns are convex on the labial surface and slightly concave on the lingual side. The canines have conical crowns and no diastema on either side. The upper premolars are usually bicuspid; the posterior teeth are slightly larger than the anterior teeth. The lower premolars are subequal, and the anteriormost is slightly caniniform. The first two molars are nearly equal in size and have quadrate crowns. The M3 is smaller than the other molars and has an oval crown. Canine teeth are not different in size in the two sexes (Kinzey, 1972). For photographs of the teeth of *C. moloch*, see the work by Hershkovitz (1963).

Vertebral formula is C 7, T 13, L 6, S 2, Cd 21 to 23. There are occasionally as few as 11 thoracic vertebrae (Hill, 1960). The thorax is narrower transversely than dorsoventrally. The clavicle is stout and has a cylindrical medial part and a dorsoventrally flattened lateral part. The pelvis is narrow and elongated; the sacrum is broad anteriorly and narrow posteriorly.

The intestinal tract is longer than the length of head and body. Measurements of four males and five females reveal the following relationships: relative length of small intestine (length of small intestine/length of head and body) 1.15 (0.99 to 1.36); relative length of large intestine (length of large intestine/length of head and body) 0.50 (0.37 to 0.72); relative length of caecum (length of caecum/length of head and body) 0.07 (0.06 to 0.08). No sexual dimorphism is apparent with regard to length of the intestinal tract. For some similar data on closely related forms, see the works by Fooden (1964) and Jones (1972).

A sublingual organ (sublingua or frenal lamella) occurs in *C. moloch* (Hofer, 1969). The organ contains excretory ducts of salivary glands that open at the lateral edges and at the tip. The body of the sublingua lacks musculature and is dependent on movements of the tongue.

Glandular tissues were found in front of the sternum in nine *C. moloch* examined by Epple and Lorenz (1967). Two of these specimens also had glandular tissue on the throat.

ONTOGENY AND REPRODUCTION. In wild *C. moloch*, births occur in December to April (Mason, 1966). Captive animals produced young on 27 December, 20 January, 12 March, and 10 May; abortions occurred on 14 January, 12 February, and 17 April.

The gestation period is not known. A captive female at the Delta Regional Primate Research Center (DRPRC) aborted a small fetus on 14 January 1969 and another on 17 April 1969.

The following information on growth was obtained mostly from weekly measurements (linear data in millimeters) and observations of two female *C. moloch* born on 20 January and 12 March 1969 at the DRPRC. For additional information on this colony of *Callicebus*, see the report by Lorenz and Mason (1971).

An aborted fetus found on 12 February was measured as follows: total length, 208; length of tail, 89; length of hind foot, 33; length of ear, 15; weight 62.1 g. Sparse white hairs about 4 mm long covered the dorsal surfaces of the head, body, and legs. The ventral surfaces were bare. The tail was haired. The skin of the body appeared dark, but the skin of the tail was white. A white spot on the top of the head measured 5 by 3 mm, and the location seemingly coincided with the unossified area of the cranium. The umbilicus was 79 mm in length. The primary placenta was 41 mm in diameter; the secondary placenta was 32 mm in diameter. The eyelids were not sealed and the pinnae were not folded. Four lower incisors were in place.

An animal on day one was measured as follows: total length, 233; length of tail, 108; length of hind foot, 37; length of ear, 14; weight 74.4 g. The white spot on the head was about 18 mm in diameter. A white stripe extended from the base of the tail up the back for 35 mm. A glandular area on the throat and chest was conspicuous and measured 2 mm by 15 mm. The dorsal surfaces of the body, legs, and the entire tail were covered with short brown underfur and conspicuous white guard hairs. The ventral surfaces of the body and legs were relatively bare. Four lower incisors were emerged.

For the animals studied, total length, length of tail, length of hind foot, and length of ear increased in linear fashion for the first ten months of age, when these young animals attained sizes and limb proportions comparable to adults. Weights of young animals increased steadily from birth to month 8.5; at this time weight gains became irregular until weights similar to adults were reached at about month 10.

White spots on the head and white markings on the back anterior to the base of the tail prevailed until complete adult pelage was developed about month 12.

The glandular areas on the throat and chest were noted to increase only slightly in size with age, but these regions became rather obscure as pelage developed.

The full complement of dentition was not present in captive animals until at least month 15. For details of dental succession in *C. moloch*, see the materials presented and summarized by Hershkovitz (1963).

ECOLOGY. *Callicebus moloch* inhabits low and dense tropical forests especially near river banks and frequently occurs in low canopy, thickets, and other understory vegetation (Napier and Napier, 1967; Moynihan, 1976:75).

Callicebus moloch is highly arboreal. However, some observers imply that animals occasionally move on the ground (Mason, 1966, 1968).

The diet is mostly frugivorous (more than 75% of feeding time, Kinzey, 1977). The two most frequently eaten fruits in Manu National Park in Perú are *Ficus* sp. and *Brocimum rubescens*, both rather soft fruits. Fruits, twigs, buds, leaves, insects, eggs, and small birds were given as dietary components by Napier and Napier (1967) and Walker *et al.* (1975). Kinzey has categorized *Callicebus moloch* as a frugivore-folivore. For some information on foods eaten by captive animals, see the report by Lorenz and Mason (1971). Some comments about the stomach contents of an escaped animal were provided by Jones *et al.* (1970).

Home ranges of *C. moloch* are small in comparison to those of other primates. Of several groups studied intensively by Mason (1966, 1968), animals moved within home ranges that varied from 3201 to 5093 m^2. Movements of animals within their home range depended on established patterns of travel and the availability of food (Mason, 1968). The average "day range" was 568 m. Jolly (1972) postulated that *Callicebus* could occur in densities ranging from 201 to 500 animals per km^2.

Estimates by Janson (1975) and Freese (1975) range from 2.1 to 24/km^2. Titis are strongly territorial, each group defending its area with vocal activity at the boundaries.

This species is capable of existing in small patches of gallery forest (Mason, 1966; Hershkovitz, 1963). However, competition by man for favorable habitats and expanding deforestation probably pose the greatest threats to the welfare of the species.

No information is available with regard to parasites and diseases of wild *C. moloch*. A brief review of parasites and diseases found in captive animals was presented by Lorenz and Mason (1971). Seibold (1969) reported an unusually high susceptibility of captive *Callicebus* to ketosis.

Callicebus moloch has not been exhibited commonly in zoos (Crandall, 1964), probably due mostly to problems with procurement and maintenance of captive animals. For additional discussions of difficulties encountered in attempting to maintain this species in captivity, see the report by Lorenz and Mason (1971), who also gave mortality rates for these animals brought into captive conditions.

A longevity record for *C. moloch* of four years and two months was reported by Napier and Napier (1967). A captive born animal survived for about seven years in the colony housed at the DRPRC (Lorenz and Mason, 1971). Two animals from this colony have been residing in private homes for at least eight years.

BEHAVIOR. Groups vary in size from two to four animals each and consist of an adult male and female and their offspring of several seasons. At two or three years of age young leave the group. Mean group size ranges from 3.1 to 3.4 animals (Mason, 1966). Interactions with other primates seem limited (Kinzey *et al.*, 1977; Moynihan, 1976).

Callicebus is strongly diurnal in habit. Activities begin at early dawn with some moving about in the lodge tree, urination, and defecation, followed by a period of vocalizations. From a few minutes to half an hour after the first vocalizations, the animals usually leave the lodge tree and begin feeding. The diurnal pattern of activity and feeding begins with intense feeding in the early morning, includes a major resting period in mid-day and considerable feeding after hour 1500 (Kinzey, personal communication). They select a lodge tree, often the same tree, before dark, and usually sleep in a tangle of vines on small-diameter branches.

In adult *C. moloch*, the repertoire of acoustic signals is quite complex. Robinson (1977) presented spectrograms of 16 discrete vocalizations. A few nonvocal sounds (sneezes, gnashings of teeth) are made, and many diverse vocal patterns occur. Among the latter, Moynihan (1966) included high-pitched squeaks, whistles, trills, and screams, medium-pitched chuck notes and chirrups, and low-pitched moans, resonating notes, grunts, and pumping notes. For additional discussions of the vocalizations of *Callicebus*, as well as comparisons with other species, see the works by Moynihan (1966, 1970). Sound spectrograms of individual vocal patterns of *C. moloch* were depicted by Moynihan (1966). Functional aspects of many parts of the acoustic repertoire are not understood. The vocalizations of the species are more frequent, diverse, and complex than those of most other primates inhabiting similar environments and with similar social organizations.

Chest rubbing is exhibited by *C. moloch*. This is done by grasping a branch and dragging the chest slowly forward along the surface. Sometimes animals pause after stroking and sniff or mouth the areas just rubbed. Animals occasionally use their feet to rub the chest in slow downward strokes (Mason, 1966). A discussion of chest rubbing in connection with visual signals is presented by Moynihan (1966).

Grooming occurs frequently throughout the day, especially during rest periods. Grooming is performed by adults and juveniles of both sexes. Moynihan (1966) suggested that grooming facilitates habituation to the near presence and physical contact with companions. There is little evidence of important dominant and subordinate roles with regard to grooming in *C. moloch*.

Adults and juveniles of both sexes intertwine the tails frequently whenever two or more animals of the same social group sit side by side. Tail twining occurs when the animals are either asleep or awake. The tails may be looped loosely around one another with only one turn, or may be wound together tightly with several turns. For detailed descriptions and discussions of the social functions of this habit, refer to Moynihan (1966) and Mason (1966).

Bonding within male-female pairs is especially strong and enduring in *C. moloch*. Once established, partners remain close to each other, and usually intertwine the tails whenever possible. Members of a pair follow each other and remain within a few meters of each other during feeding, traveling, and resting. For additional discussions of the pair bond, comparisons with other species, and specific social activities associated with pair relationships, see the papers by Mason (1966, 1974) and Moynihan (1966).

A wide array of postures and movements are used as visual signals by *C. moloch* (Moynihan, 1966). Swaying of the entire body, turning the head sideways, and lowering the head to face downward are probably related to disturbance and escape tendencies. Scratching and self-grooming are performed frequently, perhaps as exhibitions of displacement activities. Displacement scratching is frequently oriented to the chest region (see the comments on chest rubbing). Arching of the body is associated with hostility, and usually occurs just prior to either attack or escape. Pilo-erection and tail lashing usually accompany the arch posture. Facial expressions exhibited by the species include partial and complete closing of the eyes, protrusion of the lips, and baring of the teeth frequently accompanied by smacking of lips. These facial patterns seemingly are responses to disturbances. Complex combinations of vocalizations are associated with postures and movements of the head and body. For detailed discussions of the relationships between visual and acoustic patterns, as well as comparisons with other species, see the works by Moynihan (1966, 1970).

The infant is usually carried by the adult male of a pair group. The following comments are based on studies of wild animals by Mason (1966), as well as observations of captive titis at the DRPRC. The adult male apparently carries the infant except when it is either being licked or nursed by the female. Sometimes the transfer from one adult to the other is accomplished by the infant, especially when the adults are close together. Frequently, the infant is transferred by one of the adults, especially prior to and after nursing and licking of the infant's genital region by the female. Mason (1966) suggested that infants in groups of three or four *Callicebus* may be carried periodically by immature animals. There is a close association between the male and the juvenile after the infant becomes self-locomoting (Robinson, 1977).

GENETICS. The diploid number of chromosomes is 46. There are 20 submetacentric autosomes and 24 acrocentric autosomes. The X chromosome is submetacentric. The Y chromosome is submetacentric also, but this is a minute element (Egozcue *et al.*, 1969). The diploid number of *C. moloch* is comparable to that of marmosets and tamarins (Hsu and Benirschke, 1968), but the morphology of chromosomes is similar to that of *Alouatta caraya* and *Cebus albifrons* (Egozcue *et al.*, 1969). It is of interest that the diploid number of chromosomes for the closely related *C. torquatus* is 20, the lowest for any primate.

REMARKS. Not all of the original publications cited in the synonymies above were seen by us. Some of the information on nomenclature was verified after being obtained from citations in Elliot (1913), Cruz Lima (1945), and Hershkovitz (1963). We are grateful to Marie Lawrence and Nancy Olds for bibliographical assistance, and to Warren Kinzey and Alfred Rosenberger for helpful comments and new information.

The species name *moloch* refers to a fire god of the ancient Phoenicians and biblical Hebrews (Hershkovitz, 1963). The vernacular name titi is a Guarani Indian and Spanish word used commonly to refer to small monkeys.

LITERATURE CITED

Cabrera, A. 1900. Estudios sobre una colleción de monos americanos. Anal. Soc. Española Hist. Nat., ser. 2, 9(29):65–93, plus plate.

Crandall, L. 1964. The management of wild mammals in captivity. Univ. Chicago Press, xv + 769 pp.

Cruz Lima, E. 1945. Mammals of Amazonia. Contribution from the Meseu Paraense Emilio Goeldi de Historia Natural e Etnografia, Belem do Para, Rio de Janeiro, Brazil. Vol. I. 274 pp. + XLII plates.

d'Orbigny, A. 1836. Voyage á l'Amérique méridionale. Mammiféres, Atlas, pl. 5. (Date is as later indicated by d'Orbigny, see Ann. Mag. Nat. Hist. ser. 7, 7:389).

Egozcue, J., E. Perkins, F. Hagemenas, and D. Ford. 1969. The chromosomes of some Platyrrhini (*Callicebus*, *Ateles*, and *Saimiri*). Folia Primatol. 11:17–27.

Elliot, D. G. 1907. Descriptions of apparently new species and subspecies of mammals belonging to the families Lemuridae, Cebidae, Callitrichidae, and Cercopithecidae .... Ann. Mag. Nat. Hist., ser. 7, 20:185–196.

— 1909. Descriptions of apparently new species and subspecies of monkeys of the genus Callicebus, ... Ann. Mag. Nat. Hist., ser. 8, 4:243–274.

— 1913. A review of the primates. Amer. Mus. Nat. Hist. Monogr., 1:cxxvi + 317 + xxxviii.

Epple, G., and R. Lorenz. 1967. Vorkommen, morphologie und funktion der sternaldruse bei den Platyrrhini. Folia Primatol. 7:98–126.

Fooden, J. 1964. Stomach contents and gastro-intestinal proportions in wild-shot Guianan monkeys. Amer. Jour. Phys. Anthropol. 22:227–231.

Freese, C. 1975. Final report: A census of non-human primates in Peru. PAHO project AMR-0719. Pan American Health Organization, Washington, D.C.

Geoffroy Saint-Hilaire, É. 1812. Tableau des quadrumanes ou des animaux composant le premier ordre de la classe des mammiféres. Ann. Mus. Hist. Nat., Paris, 19:85–122.

Geoffroy Saint-Hilaire, I. 1851. Catalogue méthodique de la collection des mammiféres, ... Catalogue des Primates. Mus. Nat. Hist. Natl., Paris, vii + 96 pp.

Geoffroy Saint-Hilaire, I., and E. Deville. 1848. Note sur huit espéces nouvelles de Singes américains, faisant partie des collections de MM. Castelnau et Émile Deville. Compt. Rend. Acad. Sci., Paris, 27:497–499.

Gray, J. E. 1866. Notice of some new species of *Callithrix* in the collection of the British Museum. Ann. Mag. Nat. Hist., ser. 3, 17:57–58.

Hershkovitz, P. 1963. A systematic and zoogeographic account of the monkeys of the genus *Callicebus* (Cebidae) of the Amazonas and Orinoco river basins. Mammalia 27:1–79.

— 1968. The recent mammals of the neotropical region: a zoogeographic and ecological review. Pp. 311–431, *in* Evolution, mammals, and southern continents (A. Keast, F. Erk, and B. Glass, eds.), State Univ. New York Press, Albany, 543 pp.

Hill, W. 1960. Primates. Vol. IV Cebidae, Part A. Edinburgh Univ. Press, Edinburgh, xxii + 523 pp.

Hofer, H. 1969. On the organon sublinguale in *Callicebus* (Primates, Platyrrhini). Folia Primatol. 11:268–288.

Hoffmannsegg, G. von. 1807. Beschreibung vier affenartiger Thiere aus Brasilien. Mus. Gesellsch. Naturf. Fr. Berlin, Jahrg. 1:83–104.

Hsu, T., and K. Benirschke. 1968. An atlas of mammalian chromosomes. Springer-Verlag, New York, vol. II, folio 98.

Humboldt, Alexandre de, and A. Bonpland. 1811–1812. Recueil d'observations de zoologie et d'anatomie comparée, faites dans l'océan atlantique, dans l'intérieur du nouveau continent et dans la mer de Sud pendant les années 1799, 1800, 1801, 1802 et 1803:1. Paris, vii + 368 pp.

Janson, C. H. 1975. Ecology and population densities of primates in a Peruvian rainforest. Unpublished B.A. thesis, Dept. Biology, Princeton Univ., Princeton, New Jersey.

Jolly, A. 1972. The evolution of primate behavior. Macmillan Co., New York, xiii + 397 pp.

Jones, C. 1972. Natural diets of wild primates. Pp. 58–77, *in* Pathology of simian primates (R. N. T-W-Fiennes, ed.), S. Karger, Basel, Part I, 929 pp.

Jones, C., T. W. Martin, and W. A. Mason. 1970. Survival of an escaped *Callicebus moloch* in southern Louisiana. Lab. Primate Newsletter 9:6–7.

Kinzey, W. G. 1972. Canine teeth of the monkey *Callicebus moloch:* lack of sexual dimorphism. Primates 13:365–369.

— 1977. Dietary correlates of molar morphology in *Callicebus* and *Aotus*. Amer. Jour. Phys. Anthropol. 47:142.

Kinzey, W. G., A. L. Rosenberger, P. S. Heisler, D. Prowse, and J. Trilling. 1977. A preliminary field investigation of the yellow handed titi monkey, *Callicebus torquatus torquatus*, in northern Peru. Primates 18:159-181.

Lesson, R. P. 1827. Manuel de mammalogie, Paris, xv + 442 pp.

Lönnberg, E. 1939. Notes on some members of the genus Callicebus. Ark. f. Zool. 31A(13):1–18, plus plate.

Lorenz, R., and W. Mason. 1971. Establishment of a colony of Titi monkeys, *Callicebus moloch*. Internat. Zoo Yearbook 11:168–175.

Mason, W. 1966. Social organization of the South American monkey, *Callicebus moloch:* A preliminary report. Tulane Studies Zool. 13:23–28.

— 1968. Use of space by *Callicebus* groups. Pp. 200–216, *in* Primates: studies in adaptation and variability (P. Jay, ed.), Holt, Rinehart and Winston, New York, xii + 529 pp.

— 1974. Comparative studies of social behavior in *Callicebus* and *Saimiri:* Behavior of male-female pairs. Folia Primatol. 22:1–8.

Miranda Ribeiro, A. de. 1914. Annexo No. 5, Historia Natural, Zoologia, Mammiferos. Commissão de Linhas Telegraphicas Estrategicas de Matto-Grosso ao Amazonas. Rio de Janeiro, 49 + 3 pp. + 25 plates.

Moynihan, M. 1966. Communication in the Titi monkey, *Callicebus*. Jour. Zool. 150:77–127.

— 1970. Some behavior patterns of platyrrhine monkeys. II. *Saguinus geoffroyi* and some other tamarins. Smithsonian Contrib. Zool. 28:iv + 1-77.

— 1976. The New World primates: adaptive radiation and the evolution of social behavior, languages, and intelligence. Princeton Univ. Press, x + 262 pp.

Napier, J., and P. Napier. 1967. A handbook of living primates. Academic Press, New York, xiv + 456 pp.

Robinson, J. G. 1977. Vocal regulation of spacing in the titi monkey *Callicebus moloch*. Ph.D. dissertation, Univ. North Carolina.

Rode, P. 1938. Catalogue des types de mammiféres du Muséum National d'Histoire Naturelle, I. Ordre des Primates. Bull. Mus. Nat. Hist. Paris, 10:202–251.

Rosenberger, A. L. 1977. Xenothrix and ceboid phylogeny. Jour. Human Evol. 6:461–481.

Seibold, H. 1969. Ketosis in subhuman primates. Lab. Animal Care 19:826-830.

Simpson, G. 1945. The principles of classification and a classification of mammals. Bull. Amer. Mus. Nat. Hist. 85:xvi + 1–350.

Spix, J. de von. 1823. Simiarum et vespertilionarum brasiliensium species novae, ou histoire naturelle des espéces nouvelles de singes et de chauves-souris observées et recueillies pendant le voyage dans l'interieur de Brésil. Monaco, viii + 72 pp. + 38 plates.

Thomas, O. 1903. Notes on South-American monkeys, bats, carnivores and rodents, with descriptions of new species. Ann. Mag. Nat. Hist., ser. 7, 12:455–464.

— 1907. On neotropical mammals of the genera *Callicebus*, ... Ann. Mag. Nat. Hist., ser. 7, 20:161–168.

— 1908. Four new Amazonian monkeys. Ann. Mag. Nat. Hist., ser. 8, 2:88–91.

— 1911. Three new mammals from the lower Amazons. Ann. Mag. Nat. Hist., ser. 8, 7:606–608.

— 1914. New *Callicebus* and *Eumops* from S. America. Ann. Mag. Nat. Hist., ser. 8, 18:480–481.

— 1923. Three new mammals from Peru. Ann. Mag. Nat. Hist., ser. 9, 7:692–694.

— 1924. New *Callicebus*, *Conepatus*, and *Oecomys* from Peru. Ann. Mag. Nat. Hist., ser. 9, 14:286–288.

Wagner, J. 1842. Diagnosen neuer Arten Brasilischer Säugthiere. Wiegmann's Archiv f. Naturgesch., Jahrg. 8, 1:356–362.

Walker, E., *et al.* 1975. Mammals of the world. Johns Hopkins Press, Baltimore, 1:xlviii + 1–644. Third edition, revised by J. Paradiso.

Principal editor for this account was J. KNOX JONES, JR.

C. JONES, AND S. ANDERSON, NATIONAL FISH AND WILDLIFE LABORATORY, FISH AND WILDLIFE SERVICE, NATIONAL MUSEUM OF NATURAL HISTORY, WASHINGTON, DC, 20560, AND AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK, NEW YORK 10024.