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Population dynamics of the Common opossum, *Didelphis marsupialis* (Mammalia, Marsupialia), in southern Brazil

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Nowadays, the majority of the American marsupial species is found distributed in the Neotropical Region and included in three families (Kirsch 1977). The common opossum, *Didelphis marsupialis* Linnaeus, 1758, one of these marsupials, shows a clear neotropical distribution occurring from Mexico to northern Argentina (Hershkovitz 1969). Despite its abundancy in urban environments (Husson 1978), the main studies concerning the population dynamics of the common opossum in Brazil were carried out by Davis (1945), Cerqueira et al. (1993), and Cherem et al. (1996). Thus, as there is little demographic data available to understand the general ecology of this opossum, this study aims to verify its sexual rate, age structure, population density, recruitment, and mortality.

This study was carried out in an area of Curitiba City, State of Paraná, southern Brazil (25°25′ S and 49°18′ W), at 940 m above sea level. The area has five hectares covered with mixed ombrophyllous forest, and it has many roads, houses, and buildings in the vicinity. The mean annual temperature is 16.5 °C (Maack 1981). It is possible to define two distinct seasons in Curitiba City, the dry season (April to August) and the wet season (September to March), in accordance with climatic data obtained at the Meterorological Station of the Universidade Federal do Paraná, 8 km distant from the study area.

Opossums were captured in 30 live traps (40×20×20 cm) that were uniformly placed in the study area between February 1995 and January 1996. These live traps were baited during the afternoon and observed for opossum captures the following morning once per week. The bait was ripe banana with peanut butter and codfish liver oil. After capture, animals were sexed, aged (Tyndale-Biscoe and Mackenzie 1976), marked by combinations of holes in each ear and released. Sexes of pouch young were determined taking care not to detach them from teats. A binomial distribution test (Zar 1984) was utilized to verify if there was a significant difference between expected (1:1) and observed sexual rates. For a better understanding of the age structure, the opossum permanence in the area was verified taking into account the time between the first and the latter capture day of each individual. The immigration rate was obtained by taking the proportion of the number of new individuals captured during each period of two months divided per the total of individuals in the area during the last two months. Inversely, the emmigration rate was obtained by taking the individuals that were not recaptured during each period of two months. The density and migration rates were based on the minimum number known to be alive in the study area. The mortality was verified through direct observation in the study area and its surroundings during the field phases.

After 12 months of studies, 1761 baited traps resulted in 192 opossum captures. The estimated population size was 18 opossums, with 11 females and seven males (1.6 females: 1.0 male). Utilizing the binomial distribution test (ZAR 1984), the sexual rate observed for adults and subadults did not differ significantly from the expected rate ($P > 0.12$). The same occurred for pouch young ($P > 0.10$) with 25 females and 21 males (1.2 females: 1.0 male).

Juveniles and subadults (all less than one year old) were captured during the end of the wet season and the beginning of the dry season, respectively. Some of them (three females) remained in the area until the adult stage (seven to 12 months). Two older adult females were recaptured for a time longer than eight months. Adult males (about one year old) and females with pouch young were captured mainly during the wet season (September to January and August to January, respectively). Males remained in the area for three months at maximum.

The mean population density was 1.4 opossums/ha (range: 0.8 to 2.2 individuals/ha). The immigration rate showed a positive correlation with the density ($r = 0.91$, $P < 0.05$). The emmigration rate did not contribute to density fluctuations ($r = 0.00$, $P < 0.05$). Based on births, the density was high during August and November (8.2 and 6.8 pouch young/ha, respectively), and was zero from February to July.

There were two common opossum deaths in the area. One death was as a result of human contact. On the other hand, several *D. albiventris* Lund, 1841 were found dead on roads near the study area.

Sexual rates observed here corroborate some other studies on *Didelphis* (STOUT and SONENSHINE 1974; ATRAMENTOWICZ 1986; CHEREM et al. 1996). However, there was an untested trend for a greater number of female opossums in the population (see HOLMES and SANDERSON 1965; ATRAMENTOWICZ 1986). The higher rate of females in the study area is most probably related to this trend. Studies of DAVIS (1945), ATRAMENTOWICZ (1986), SUNQUIST et al. (1987) and O'CONNELL (1989) also revealed greater female permanence in other regions. The absence of males in the study area during the dry season is probably related to non-oestrous females that possibly avoided them during this time (see MOTTA et al. 1983). The study of RYSER (1992) on *Didelphis virginiana* Kerr, 1792 gives some evidence to support this, with females showing stable home ranges and males increasing theirs during the breeding season while seeking for mates.

The presence of pouch young was only observed during a certain period of the year. This is in agreement with studies of FLEMING (1973), TYNDALE-BISCOE and MACKENZIE (1976), CERQUEIRA et al. (1993), and CHEREM et al. (1996) concerning the same species. Juveniles were also seasonally captured, which is in agreement with the study of FLEMING (1972) in Panamá. The common opossum probably showed this population pattern in response to advantages that their young gain if they are weaned during a season with widely available resources (see FLEMING 1973; JULIAN-LAFERRIERE and ATRAMENTOWICZ 1990). Some cited evidences of seasonality in the population succession were already reported by O'CONNELL (1989) and CERQUEIRA et al. (1993) from other sites in South America.

Our observations in southern Brazil were in accordance with other authors that reported a rapid turnover, every two or three years, for the common opossum in northern South America (ATRAMENTOWICZ 1986; SUNQUIST et al. 1987; SUNQUIST and EISENBERG 1993). Hence, we noticed that the great majority of captured opossums originated from the preceeding breeding season as reported by O'CONNELL (1989) from Venezuela.

Except for the study of AUGUST (1984) in the llanos of Venezuela, other estimated densities for the common opossum (FLEMING 1972; CHARLES-DOMINIQUE et al. 1981; ATRAMENTOWICZ 1986; SUNQUIST et al. 1987; O'CONNELL 1989; CERQUEIRA et al. 1993) were similar to the density verified here.

Considering the greater difference between the high densities of pouch young and the

low abundance of independent opossums in our field area, it is probable that relatively few individuals survive until maturity, which is in agreement with data of ATRAMENTOWICZ (1986).

The main factor of opossum mortality in the study area was human action. Based on our data, the common opossum must be less often run over by cars than the white-eared opossum in Curitiba City. GARDNER (1983) reported that the common opossum is often run over by cars in Costa Rica. On the other hand, ATRAMENTOWICZ (1986) and SUNQUIST and EISENBERG (1993) reported that the main mortality causes in natural environments outside urban areas are wild predators.

Therefore, the common opossum showed a population dynamic subject to seasonal variations, exhibiting a population density strongly related to births and immigrations. Evidences of sexual demographic differences were observed, with females tending to remain in forested sites, when the species occurs in urban environment. This trend may reflect an attempt to better guarantee reproductive success in these sites.

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