

# Investigations on the ethological adaptations of the raccoon (*Procyon lotor* L., 1758) in the urban habitat using the example of the city of Kassel, North Hessen (Germany), and the resulting conclusions for conflict management.

Dipl.-Biol. F.-U. Michler, Dr. U. Hohmann

## Introduction

Due to its high ecological plasticity, its ability to climb and its tactile skills, the raccoon has had particular success in claiming human settlement areas for itself. This is notably applicable in Central Europe for the north Hessian city Kassel, in which raccoon densities of ca. 100 animals per 100 ha were established in places (Gunesch 2003). A marked increase in conflicts with the population of Kassel led to a research project in 2001/02 on the urbanization of the raccoon being conducted (Michler 2004).



Fig. 1: Our today's affluent society produces a huge food abundance in the urban habitat which is a great supply of energy for the raccoons and so this is the reason for the partly high density of raccoons. Picture: I. Bartsussek

## Methods and Materials

All in all 106 different raccoons over an area of 300 ha were caught in the city area of Kassel. From these animals 17 adult raccoons (9 females, 8 males) were immobilized with the aid of a ketamine-xylazine anaesthetic agent and fitted with a 90 g VHF radio collars (corresponding to ca. 1.5 % of average body weight). The telemetric data collection took place between July 2001 and March 2002 over an area of ca. 2200 ha both in the western parts of Kassel city and the bordering Habichtswald. After the data evaluation of 2785 localisations (1674 night and 1111 day localisations), statements could be made concerning the home range, the day resting site and the social system under the particular circumstances of an urban habitat (Michler 2003).



Fig. 2: Wooden trap (75x30x35 cm) for capturing raccoons. Picture: F. Michler



Fig. 3: The mechanism to close the trap is in a separate food box and makes it possible to capture only raccoons (mis-capturing rate = 1.6 %). Picture: F. Michler



Fig. 4: Anesthetized female raccoon 2008 with a 90g VHF radio collar. Kassel July 2001. Picture: F. Michler

## Results

### 1. Home Range Sizes

The raccoons roamed a remarkably small home range with an average of 129 ha (standard error; short: SE ± 43), whereby the females' home range was significantly (Mann-Whitney U-Test: P = 0,021) smaller with an average 36 ha (SE ± 5; Min = 25 ha, Max = 61 ha) than the males' home range average of 210 ha (SE ± 70; Min = 20 ha, Max = 613 ha). Almost all the raccoons demonstrated clear seasonal changes in the size of the home range which became smaller from summer to winter (Michler et al. 2004).

Compared with the home ranges in natural woodland habitats (Hohmann et al. 2000) the measured action ranges in Kassel are on average ten times smaller and indicate consequently a nearly optimal presence of resources (food, sleeping and nesting sites; *Resource Dispersion Hypothesis*).

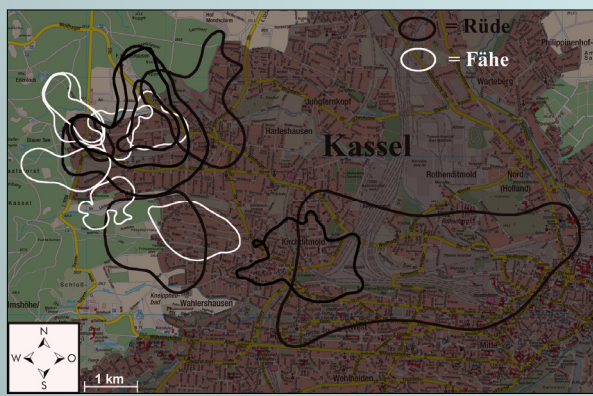


Fig. 5: Location of all home ranges of the examined radio collared raccoons, Kassel July 2001 – March 2002. The calculation was done with the 95% Fixed-Kernel-estimation (optimal smoothing factor by sixth square root of SD).

### 2. Den Sites

In investigations of the day resting sites, 200 different resting sites could be determined in over 30 categories. The raccoons selected the following sites accordingly: buildings 43 % (n = 476); trees 39 % (n = 429) and dens above and below the ground 17 % (n = 198). Under the category of buildings garages, houses, factory halls, garden houses and cowsheds were summarized. In 54 % (n = 258) of the cases the buildings were uninhabited (garages, factory halls, empty houses etc.) and in 46 % (n = 218) they were found in houses which were inhabited all the year round (Fig. 7). And here lofts with 121 localisations served as the most frequent den site. Also the chimney (94 localisations) was used especially in winter.

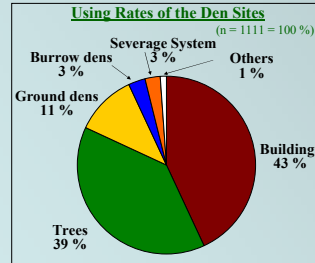


Fig. 6: Distribution of the den site uses on six categories of 17 radio collared raccoons in Kassel, July 2001 – March 2002, (n = number of use).



Fig. 7: Typical building den site in Kassel. The left chimney served a female raccoon as den site throughout the winter. Picture: F. Michler



Fig. 8: The best way to climb the building is the pipe of the rain channel. Picture: I. Bartsussek



Fig. 9: The most frequent places for the radio collared raccoons were the lofts in inhabited houses which provide best conditions especially in winter. Picture: I. Bartsussek

### Summary:

Beside the use of considerably small action ranges and an intensive use of human structures as sleeping and nesting sites the most important ethological adaptations of the raccoons in Kassel could be seen in a clearly reduced fear of humans, the aggregation of many animals over a small area (high population density) with corresponding increased intraspecific tolerance (complex social system) and the exploitation of new food sources (artificial food; Michler 2003).

## Conclusions for Conflict Management

The high population densities of the urban raccoons are often the reason for a visible conflict with the resident population which considers the raccoons to be a nuisance.

Thereby the potential for conflict is multi-faceted: denuded cherry trees, ripped open binbags and devastated garden ponds are considered mere trifles. More problematic is the entering of buildings where the attics or chimneys are then used as sleeping or nesting sites. As a result of the high population density and the corresponding increased contact between human ↔ raccoon there is also a serious epidemiological problem through the increased risk of infections for humans through the transfer of diseases and parasites.

Demands to eliminate the raccoons from the settled areas and keep them away permanently are not possible partly due to the favourable conditions presented by urban habitats and partly due to today's laws. Therefore, the primary aim must be to enable a cohabitation between humans and raccoons with minimal conflict. Multiple solutions are necessary for this in the light of the mentioned problems (1. damage caused in the garden, 2. entering of buildings and 3. fear of zoonoses). The first option has to be habitat management, i.e. the resources supply for the raccoons must be made lastingly difficult (food supply, sleeping and nesting sites).

One possibility to reduce the population density of the urban raccoons could be a reduction of anthropogenic food supply. But, because in any case an important number of raccoons can exist in the town, useful measures should be taken to protect the inhabited houses from the raccoons (Fig. 11).

In the sensitive area of zoonoses it has been shown that with clear and objective information on the dangers and risks (particularly on *Baylisascaris procyonis*) the existing problems and fears can be effectively removed.



Fig. 10: Often people consider the raccoon in the urban habitat to be a nuisance. Picture: I. Bartsussek

Through education and directed measures it is also possible with relatively few resources to minimise the existing conflict potential. The most important criteria for this are intensive public relations work and information strategies.



Fig. 11: Effective method to prevent the raccoon from getting into the inhabited house. Picture: F. Michler

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