

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.

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One cause of the general urbanisation of wild animals has in the first instance to do with the large excess of food which our affluent society today produces and makes available to wild animals (Prange et al. 2003).

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).

To this end 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 immobilised 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).

The raccoons roamed a remarkably small home range with an average of 129 ha ($S_{\bar{x}} \pm 43$), whereby the females' home range was significantly (Mann-Whitney U-Test: $P = 0,021$) smaller with an average 36 ha ($S_{\bar{x}} \pm 5$; Min = 25 ha, Max = 61 ha) than the males' home range average of 210 ha ($S_{\bar{x}} \pm 70$; Min = 20 ha, Max = 613 ha). Almost all the raccoons demonstrated clear seasonal changes in the size of the home range (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.

On the other hand the raccoons in Kassel reached a population density that was around ten times higher than in the woodland (Hohmann 1998). From 182 raccoon trappings using a catch-recatch rate a population density of 95 animals per 100 ha (Petersen-/Lincoln Index) was determined (Gunesch 2003). However, this density value cannot be extrapolated to the entire city area of Kassel as there is a clear density gradient from the city outskirts into the city centre – i.e. the population density constantly decreases with increasing proximity to the city centre. An important cause is probably the increase in sealed surfaces as well as the decrease in green areas.

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 %; trees 39 %; and dens above and below the ground 17 %. The raccoons used 52 % of all resting sites only once. However, a relatively small number of sites (14 %) were chosen more than ten times (max. 94 times; Michler et al. 2004).

In summary it can be said that the most important ethological adaptations of the raccoons in Kassel could primarily be seen in the use of considerably small action ranges, in a clearly

reduced fear of humans, an intensive use of human structures as sleeping and nesting sites, the congregation (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 (anthropogenic food supply; Michler 2003).

All these factors together often cause in city habitats a visible conflict with the resident population which considers the raccoons to be a nuisance (Hadidian et al. 1991). 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. The resulting damage (especially from nesting sites) can quickly reach the equivalent cost of a new small car. As a result of the high population density and the corresponding increased contact between human \leftrightarrow raccoon and pet \leftrightarrow raccoon there is also a serious epidemiological problem through the increased risk of infections for humans and pets through the transfer of diseases and parasites (Jacobson et al. 1982). In contrast to its American cousins the raccoons in Central Europe have only a limited spectrum of parasites and hardly play a role as carriers of diseases (e.g. rabies) (Gey 1998). A few parasites can be considered as parasitic zoonoses, however, in Germany only one nematode (*Baylisascaris procyonis*) is a potentially dangerous zoonosis pathogen. This is particularly pertinent for Kassel with the determined roundworm infections in North Hessen of over 70% (Gey 1998).

Despite the conflict potential mentioned opinions on the raccoons within the city area are very varied. The stances range from effusive affection for the animals linked with intensive feeding up to total rejection. 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).

The entering of raccoons into buildings is felt to be the biggest problem. In order to avoid damage mere treating of the symptoms is as a rule highly ineffective (removal of individual animals) due to the habit of nesting sites as well as there being a high population density. Prophylactic measures which make a building „raccoon-proof“ are on the other hand relatively simple and extremely effective. In order to keep the food supply at a minimum rubbish, compost, food leftovers and fruit trees (metal guards) should be made inaccessible. In the sensitive area of zoonoses it has been shown that with clear and objective information on the dangers and risks (particularly on the raccoon roundworm) the existing problems and fears can be effectively removed.

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.

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