

Investigations on nutrition ecology of the North American raccoon in the Müritz National Park (Mecklenburg-Western Pomerania, Germany) with particular focus on species conservation and endoparasite infestation

The North American raccoon *Procyon lotor* (Linné, 1758) is an introduced carnivore species in Germany. Against the background of a vast increase of raccoon numbers in Germany over the last years, a controversial discussion has developed regarding the influence of the new inhabitant on indigenous resp. protected species and the potential transmission of diseases and parasites. Based on the hypothesis that raccoons may affect local stock of ecological relevant species through predation raccoon faecal samples were collected in a close to nature beech forest in the Müritz National Park (Mecklenburg-Western Pomerania, Germany) and analysed with regard to nutrition ecology and endoparasite infestation. The study area represents a characteristic inland drainage area of North-Eastern German lowlands, which provides a very suitable habitat for raccoons with regards to essential resources. Simultaneously, examinations were carried out in raccoons from a control area in the Nature Park Feldberger Seenlandschaft (Mecklenburg-Western Pomerania), focusing on the question as to whether raccoons might have higher ecological impact in an anthropogenically modified habitat due to poorer food resources.

This thesis is part of a long-term and integrated research project (Projekt Waschbär), which was conducted between 2006 and 2011 in the subterritory Serrahn of the Müritz National Park. The study consists of the following subjects:

Establishing specific conversion factors

In order to quantitatively assess raccoon feeding habits, it is essential to apply conversion factors to interpret the ratio between consumed and excreted biomass. For this purpose, feeding trials were conducted with ten individuals from the Zoological Garden of Neustrelitz (Mecklenburg-Western Pomerania) and from a private enclosure in Lindow (Brandenburg). Raccoon-specific digestion coefficients were thus established for 17 feeding categories, which were adapted to the local food sources of the National Park. This yielded conversion factors with values between 8.6 (beetles) and 89.0 (avian eggs). The methods and validity of the applied coefficients were scrutinized in the discussion of the present work.

Faecal analysis with regard to endoparasitic infestation

The raccoon roundworm *Baylisascaris procyonis* is currently the only relevant parasitic zoonosis for raccoons in Europe, with prevalences of partly more than 70% in Central Germany. No prevalence has been detected so far in the northeastern parts of distribution (Brandenburg, Mecklenburg-Western Pomerania). By means of coproscopic analyzes of 400 raccoon scats from both the study and the control area the question was considered as to whether the raccoon specific roundworm has meanwhile pressed forward to the North-East German range. The investigation revealed no infestation with this zoonotically relevant nematode. Other microfaunistic structures, primarily sporozoa (*Monocystis*) and non-parasitic soil nematodes were found in 298 samples. The potential establishment of *Baylisascaris procyonis* in the study area could be estimated based on feeding behaviour, population structure, the expected expansion of raccoons, and the epidemiology of the roundworm.

Faecal analysis concerning qualitative und quantitative composition of nourishment categories

For the purpose of feeding analysis, 113 different raccoon latrines were sampled over an area of 1,821 ha, resulting in 982 fecal samples. These were assessed using frequency of occurrence (FO) and the con-

sumed biomass (BM) concerning three general food categories (invertebrates, vertebrates and plants) and 13 food categories. The nourishment of the raccoons in the National Park consisted mainly of invertebrates (FO=96.0%; BM=51.9%), followed by plants (FO=68.7%; BM=31.8%) and vertebrates (FO=53.2%; BM=16.3%). A significant phenological variance was observed. Within the single food categories, the outstanding importance of invertebrates in the raccoon diet was observed, especially for earthworms (FO=46.8%; BM=23.2%) and aquatic molluscs (FO=59.9%; BM=20.5%). Fruits (FO=38.0%; BM=16.3%) and forest tree fruits (FO=28.8%; BM=12.1%) were predominant as well, followed by insects (FO=87.9%; BM=7.5%), fish (FO=15.4%; BM=5.9%), amphibians (FO=32.1%; BM=5.7%), mammals (FO=7.4%; BM=1.7%), birds (including eggs, FO=13.4%; BM=2.9%) and corn (FO=11.5%; BM=2.4%). Each of the remaining categories (reptiles, crayfish and hazelnuts) represented less than 1% of the consumed biomass. In total, 128 different items were identified in faeces of raccoons from the National Park.

In order to directly compare the food spectrum at a natural habitat and at an anthropogenically influenced habitat, 298 further raccoon faecal samples from the nearby control area were evaluated. Plant categories were predominant (FO=96.0%; BM=51.4%), followed by invertebrates (FO=96.9%; BM=43.0%) and vertebrates (FO=32.0%; BM=5.6%). 70 different species were detected in the samples from the control area, which were mostly also found in the National Park. The amount of anthropogenic food sources such as fruit and corn was higher, as expected.

Ecological impact

The relationship between feeding categories and the available resources of the study area allows a deeper understanding of predation and the ecological impact of raccoons. Intense monitoring in the National Park and detailed knowledge about the population structure (population density, age patterns, natality and so on) allowed the calculation of the number of predated individuals. This is, to the best of our knowledge, the first approach to estimate raccoon predation rates in order to assess its local impact on prey species. Taking into account the respective amount of biomass of the prey species, the annual number of consumed individuals was estimated for an area of 100 ha. The annual predation rates were, for instance in the case of birds, between 0.004 (corvids) and 5.93 (great tit) individuals/100 ha, corresponding to a size range of between 0.8% (starling) and 6.2% (great resp. medium spotted woodpecker) of the respective juvenile bird population.

The hypothesis that raccoons strongly affect the local stock of ecologically relevant species through predation could not be confirmed with the results from the Müritzer National Park presented in this work. The calculations revealed relatively low predation rates on vertebrates with the most affected species showing relatively high densities in the study area. Most species currently classified as vulnerable did not occur in the scat samples. Due to the documented population structure (population close to the carrying capacity) and the lack of food specialization, a threat to native species seems unlikely even in the future. The food analyses indicate a highly opportunistic use of the available food resources. Furthermore, the hypothesis of a higher impact of raccoons in an anthropogenically modified habitat due to poorer food resources could not be corroborated. The food availability in the anthropogenic landscape of North-Eastern German lowlands doesn't seem to be a limiting factor for raccoons.