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From litter tree to dispersal – Insights into the social development of raccoon (*Procyon lotor* L.) families obtained by VHF telemetry in northeastern Germany

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Extended Abstract

Until nowadays only few insights into the social development of raccoons (*Procyon lotor* Linné, 1758) exist (SCHNEIDER *et al.* 1971, FRITZELL 1977, FRITZELL 1978) and the opportunistic carnivore was classified as solitary (SANDERSON 1987, KAUFMANN 1982), but recent studies discovered social tolerance as well as a complex fission-fusion-system (HOHMANN 1998, PRANGE *et al.* 2004; PRANGE *et al.*, submitted). Nevertheless the development of this social system within raccoon families remains unclear and our goal has been to identify sociospatial behavior of adult female raccoons and their young. This study represents a subproject of a three year ranging wildlife study (www.projekt-waschbaer.de) in the German national park Müritz where extensive basic data concerning the population ecology of raccoons has been collected (among others: KÖHNEMANN & MICHLER 2008, WIBBELT *et al.* 2008, MUSCHIK *et al.* 2009, MICHLER in prep.).

To determine sociospatial behavior we monitored radiocollared adult female raccoons (n = 7) and their cubs (n = 13, 8 ♀, 5 ♂) in a bog and swamp area of the German lowlands during one year (April 2007 to April 2008). Additionally we radiotracked 6 adult females without litter for comparisons. During a pilot study in the year 2006 special, expanding radiocollars (Andreas Wagener Telemetrieanlagen GmbH, Cologne/Germany) were tested on 4 juvenile raccoons for the first time. In the year 2007 (this study) 13 juvenile raccoons were fitted with these collars at the age of 12 weeks after having a minimum weight of 2.000 g. Within the seven family units the number of radio-collared cubs per mother reached from 1 to 4. Since the appending mother was tracked before, the cubs could be observed at the litter trees and on camera traps (MICHLER & KÖHNEMANN 2008) prior to their collaring. Thus a perennial observation of juvenile raccoons from litter tree to dispersal was possible. Beside home range analysis (out of 6602 localisations, fixed kernel, h = 1.0) and evaluation of denning behavior we applied a special index on social bonds (Jacobs-Index J_x , details in JACOBS 1974 and KENWARD *et al.* 1993) with the RANGES7 program, that reveals attraction ($J_x = 1.0$), neutral behavior ($J_x = 0$) or avoidance ($J_x = -1.0$) between two individuals.

Within the family units (7 adult females, 13 juveniles) we estimated an extensive overlap of home-ranges year-round (av. = 74.5%, SD = 24.9%, min. = 23.0%, max. = 93.1%) as well as communal denning and shared traveling during night. Litter trees were left after an average of 59 days (min. = 46, max. = 66), but accordingly some monitored family units (n = 3) occupied a successional litter tree for up to 15 days. A daily change of den sites could not be documented before 11 weeks after parturition. Except for numerous maternal excursions cubs accompanied their mother within short distances (< 100 m) until their 20th week. After that the intrafamilial distances increased by degrees and communal denning decreased until most of the juvenile raccoons moved independently within their 7th month, except for two female cubs in a family with very strong social bonds. Home range comparison of females leading young with adult non-leading females revealed no significant

influence of cub-rearing on maternal spatial behavior during this study (Mann-Whitney-U-Test: $p = 0.890$, $n = 13$).

The familial bonds maintained until the next mating season with a clear break-up in February (mating season), but the development of dynamic interactions (Jacobs-Index) within the monitored raccoon families brought out individual differences. Two families showed very strong social bonds lasting until the end of January ($J_x = 1.0$ to 0.65), while another family showed light attraction ($J_x = 0.41$ to -0.06) during autumn and winter. Neutral behavior towards their young could be documented for two mothers ($J_x = 0.10$ to -0.08). Avoidance within the family units could not be documented. The latest dissolution of a mother and her juvenile male occurred as the adult female frequented her litter tree at the beginning of April. Additionally the social bonds between one sibling pair last until the end of March.

After one year 6 out of 13 juvenile raccoons, all females, remained in their natal area. Three cubs died (2 females, 1 male) and 4 males dispersed. Dispersal occurred during April and May 2008 except for one juvenile male that left his maternal area in October 2007. He established his new home range 2.5 kilometers away and is still under telemetric control (June 2009).

Examining the differences between adult and juveniles yielded that the development of young raccoons is not completed after their first year of life. The remaining subadult raccoons knew fewer den sites, used smaller home-ranges than the related adult females and they mainly occupied areas within their maternal home range. Our data suggest a long period of development for juvenile raccoons, which could be confirmed by late dispersal and independency as well as long-lasting familial bonds. Through this study, using intensive VHF telemetry for juvenile raccoons from the place of birth to establishment of their own home ranges or dispersal, deep insights into sociospatial behavior of raccoon families were obtained and give new aspects to the complex social system of this generalistic carnivore.

Type of presentation: Oral presentation.

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