(Invasive) alien vertebrates

Immunocontraceptive vaccines as fertility-control measure in the invasive raccoon

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DOI: 10.20315/evmc.2025.153

In the 1930s, the first raccoons (*Procyon lotor*) were released into the wild in Central Europe. After several decades, raccoons have spread throughout Europe and are identified as an invasive alien species, which forms a threat to, amongst others, the European pond sliders and many bird species. Furthermore, the raccoon spreads the raccoon roundworm, a zoonosis, and causes property damages. In Germany alone, the number of raccoons has been estimated to exceed 2 million. Attempts to manage or eradicate raccoons have mainly focused on hunting and trapping. However, due to the extreme adaptive capacity of the species and relatively high reproductive rate, the population is still growing. Hence, the development of new management tools is of crucial importance. In several species, immunocontraceptives have proven to be a valuable fertility-control tool. A number of contraceptives are available, however, their efficacy, side effects, and the effect on the population dynamic have not been tested in raccoons. Two contraceptives are especially of interest: the porcine zona pellucida (pZP) vaccine and the gonadotrophin releasing hormone (GnRH) vaccine. In a positive scenario, a single vaccination could lead to lifetime infertility. The vaccine targets females, but the territorial behaviour of males remains present, therefore an influx of new raccoons in the area is prevented. In addition, the peak in the energetic demand during the gestation and lactation will not take place, therefore decreasing the negative effect of raccoons on local fauna.

In our study, two vaccines will be first tested in a captive environment, where the efficacy and side effects will be tested on 10 raccoons. The efficacy will be determined using blood samples to detect the development of antibodies over a period of 3 to 4 years. During the same period, mate attempts will be conducted by introducing potent males. Consecutive ultrasound examinations will be performed to test for pregnancy. Side effects will be tested in the first phase of the trial. At its end, raccoons will be castrated surgically to examine the reproductive tract. This will help to identify any long-term side effects of the vaccination. Given the average life expectancy of 3.1 years of raccoons in the wild, a study over 3 to 4 years will enable us to identify whether any of the methods can provide life-time infertility with minimum negative effects on health and welfare. In order to test the effect of immunocontraception in a wild population, smart traps will be developed. These traps will identify raccoons and their sex, and will have an arm that can apply the vaccination without human interference, thereby making the fertility-control cost-effective, whilst remaining species-specific. Furthermore, a population estimate will be conducted pre- and post-vaccination, to determine the effect of the fertility control method on the population dynamic. This overarching approach encompassing the effect of immunocontraceptives on the individual and population level could form an important fertility-control tool to manage the invasive raccoon. Additionally, it might serve as a model for similar approaches for other invasive species.