

Adaptation of European ground squirrel (*Spermophilus citellus*) following conservation translocations in Bulgaria

PhD Thesis

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The present work clearly outlines the mechanism of adaptation of the European ground squirrel (*Spermophilus citellus*) after conservation translocations. It summarises the methodologies used in 8 such actions implemented in Bulgaria during the last decade and analyses the factors impacting their success. Five of the completed six translocations were successful. In most of the actions (6) a soft release approach was used. In 6 cases, the animals settled 100 to 720 metres away from the release site, implying management and protection of suitable habitat beyond the translocation area. In 7 of the translocations, the altitude between the donor colony and the release site varied from 470 to 1320 m which could have a hindering effect on the adaptation of animals due to the specific conditions in the mountains. The main reasons for failure are probably poorly selected and maintained habitats and bad climatic conditions (rainy and cool weather) during the translocation action. In two of the mountainous reintroduced ground squirrel colonies (NP “Bulgarka” and “Vrachanski Balkan”) the vast majority of the burrows are located in the base of anthills, mainly of yellow meadow ant (*Lasius flavus*). The benefits for the ground squirrel, including reduced energy demand for digging, as well as additional surveillance and hiding places available, could greatly enhance the post-reintroduction adaptation process.

An in-depth multidisciplinary study accompanying real conservation action (population reinforcement of a colony near the village of Momina tsarkva) was conducted. It provided pioneering data on spatial behaviour, stress levels and dynamics of helminth parasites infection during the first months after the individuals were moved to the new environment. A particular value of the study is the possibility for comparison between the resident and the translocated individuals that significantly contributes to the understanding of the adaptation process. The analysis of the faecal cortisol metabolites concentrations (FCM) showed that the stress in the translocated individuals decreased after the release and that the time span after the translocation

event was the key variable explaining that decrease. Surprisingly, the FCM levels were higher in the resident ground squirrels than in the translocated individuals throughout the active season and in the following spring. We found no effect of FCM concentrations on dispersal distances or body mass gain in translocated individuals. The study of the spatial behaviour showed that the translocated individuals had much larger territories in comparison with the residents. They settled close to the release site (108 m) but were able to traverse considerable distances (712 m). The males and the adults were significantly more mobile than the females and the juveniles. The survival of the translocated individuals at the end of the first active season after the translocation was 79%. The main reason for death was predation. The parasitological survey showed that the diversity of helminth parasites and their prevalence were higher in the donor colony compared to the levels in the recipient colony before the translocation. In the donor colony were found four type of egg, identified as belonging to *Moniliformis moniliformis* (Acanthocephala), *Streptopharagus kutassi*, *Trichostrongylus cf. colubriiformis* and Capillariidae gen. sp. (all three Nematoda), and the overall positive samples for helminths was 54% (n = 24). In the samples taken from the colony of Momina tsarkva before the reinforcement only *Moniliformis moniliformis* was found with a prevalence of 8% (n = 13). Both translocated and resident individuals had higher prevalence of parasites later in the season (August and September), likely a result of the seasonal dynamics of the parasites life cycle and the host activity. During the next two years reinforced colony developed same helminth species as those in donor colony showing that they were probably co-translocated. The growing number of ground squirrels in the reinforced colony suggests that the developed parasite loads (49%), similar to those of the donor colony, did not affect negatively the host population and the overall success of the conservation action.