Alexandre Roulin – abstract

Navigation ecology in the barn owl

A central question in evolutionary biology is how phenotypic diversity evolved and is maintained. It is key to identify the factors that trigger the evolution of genetic variation in a population. To address this issue, color polymorphic organisms are well suited because the expression of color morphs is under the control of polymorphic genes implying a strong connection between genotype and phenotype. However, it has proven hard to identify the ecological factors that drive the evolution and maintenance of color polymorphism. I will study an organism that proved particularly useful to understand the adaptive value of color morphs, the barn owl (Tyto alba) and in particular the importance of the moonlight, whose evolutionary role for coloration was only recently considered.

The Moon cycle exposes nocturnal animals to marked variation in light conditions. Surprisingly, it remains obscure how moonlight influences the foraging behavior of nocturnal animals displaying different coat colors as sunlight does in diurnal species. We recently found that red barn owls hunt less successfully and provide less food to their broods during moonlit nights. Contrarily, the hunting and parenting performance of white barn owls are unaffected by moonlight, even though white owls should be more visible to their prey. The white plumage of barn owls reflect moonlight to exploit light aversion in prey which in reaction freeze for longer times facilitating their capture by owls. We predict that moonlight influences foraging strategies, such as hunting techniques and habitat selection, which should affect owl fitness. My research group will study three aspects of the role of the lunar illumination on predator-prey relationships.

1. Impact of variation in moonlight on the fitness of differently colored barn owls. This includes an analysis of reproductive parameters, parental investment, adult survival and mating pattern with respect to color.
2. Foraging strategies of differently colored barn owls in relation to the lunar illumination. We will track barn owls with GPS tags, combined with accelerometer, light and pressure sensors. In addition, we will install camera traps close to the nest entrance to determine prey species, size and sex as well as where and how prey items were captured and under which light and weather conditions based on the tracking devices attached to the owls. This will be combined with experiments where brood food need is manipulated, and also where the plumage light reflectance is modified experimentally by applying preen oil on the feathers.
3. Evolution of white plumage under the moonlight. We will investigate the mechanism of white color production in barn owls and other nocturnal birds to test if they present features making them reflect more light. We will also investigate in detail how white barn owls exploits light aversion in different prey as well as the potential fitness costs that may derive from a white, conspicuous coloration.

Our study has the potential to pinpoint the role of a very original factor (moonlight) in the evolution and maintenance of intraspecific phenotypic diversity. Our results will shed new light on the long-suspected influence of the Moon on the evolution of coloration in nocturnal life, evidencing the importance of coloration also in the nocturnal realm.