

Encadrement :

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Titre du stage :

Selection Under Variable Environments

Mots clés :

Selection, Evolution, Life history traits, spatio-temporal variation, fitness.

Résumé :

Evolution results from consistent longer term selection patterns, yet we are increasingly faced with the empirical observation that environments and their selective consequences are highly variable. Variability in environments – both ecological and social – should favor plastic life history strategies and could provide resolutions to a number of long standing paradoxes in evolutionary biology. For example, we find extensive genetic variation in traits under selection even though consistent selection should erode this variation. Likewise, numerous studies document short term selection but no evolutionary response to selection which might be expected if selection is in fact variable. Furthermore, environmental variability should favor plastic life history strategies which in turn will affect the impact of selection and evolutionary dynamics. Clearly then, understanding the role that environmental variability plays in selection and the evolution of traits is a question of fundamental importance to understanding evolutionary dynamics. As anthropogenic impacts alter the landscape, understanding both the process of adaptation to new conditions and the effects of increased environmental stochasticity has become increasingly essential to predicting how species will cope with a changing planet. Yet the degree of variability in selection regimes across space, seasons, and time and the effects of such variability on selection have received very little research focus in natural systems.

How much does selection on social and life history traits differ across seasons and across environments? Do different environmental factors – social or ecological – show a different degree of variation and impose more or less variable selection? Does plasticity in social strategies attenuate the effects of selection on traits? What is the net effect of variability in selection throughout the lifetime of individuals on longer term evolutionary patterns? This project will aim to document and understand the effects of environmental variability on natural and sexual selection in birds in natural populations. The project will focus on social and reproductive traits since these traits are most likely to be affected by variability in the environment. Social interactions and the signal traits used to mediate these interactions are particularly sensitive to a changing ecological and social environment since the benefits of a particular strategy results from the actions of others. Secondly, life history strategies are often very directly tied to fitness (both survival and reproductive success) and are also directly dependent on both the social and ecological environment. Many life history decisions may be plastic and the degree of plasticity in these traits may determine how much environmental variability will actually impose different selection regimes.

This project will take advantage of a sharp altitudinal gradient (>1000m) over a very small spatial scale (<7km) that has important impacts on environmental conditions and should therefore effect both social strategies and the resources needed for survival and reproduction. While this sharp gradient should affect selection pressures and favor local adaptation, the close spatial proximity of these populations should allow admixture of gene pools and thus potentially favor plasticity in social and life history strategies. The project will focus on Great and Blue tits (*Parus major* and *Cyanistes caeruleus*). Nest box populations were established at the first site in the fall of 2010 and more than 75 adults of each species were captured and individually color marked during the spring 2011 breeding season. In 2012 the remaining 3 sites were active and we now have data on nesting success and a large portion (>70%) of the resident populations banded at these locations. This initial information has already revealed striking differences in selection both across years and across sites. Surveys of uniquely marked individuals will provide information on the variability in selection pressures across space (4 sites), time (2-3 years; 2010-2013), and seasons (winter and spring in 2011,

2012). Surveys will quantify social and spatial structure, parental investment, social behavior, reproductive success, and environmental conditions. The end result will be a first step in understanding variation in selection regimes due to environmental and social structure variation across space and time.

Deux références bibliographiques:

Chaine A.S. and Lyon B.E. (2008) Adaptive plasticity in female mate choice dampens sexual selection in male ornaments in the lark bunting. *Science* 319: 459-462

Lyon B.E., Chaine A.S., Winkler D.W. (2008) A matter of timing. *Science* 321: 1051-1052.

Techniques mises en œuvre:

Concretely, this project will entail capturing and color ringing birds and gathering primary data on social behavior, life history traits, and nesting success. Work will be collaborative – with the PIs, a technician, and other master's students (one from UPS Toulouse working on genetics of migration, one from Exeter, UK working on parental investment). The student (Alice Thiney) will also be responsible for managing this dataset and will analyze this data for her project under my guidance.

Compétences particulières exigées:

Some experience in handling and banding birds. Field identification of parid species and experience reading color rings.

Ability to manage and manipulate large databases.

Good physical condition (nest monitoring requires hiking day after day up steep slopes).

A retourner à : François-Xavier Dechaume-Moncharmont (fx.dechaume@u-bourgogne.fr) et à Loïc Bollache (bollache@u-bourgogne.fr) avant le 10 juin.