

Genetic connectivity of hare (European and mountain hares) and rock ptarmigan populations in the French Alps

Context:

The mountain hare (*Lepus timidus*) and the rock ptarmigan (*Lagopus muta*) are two species that are restricted to alpine environments in France. Confined to high altitudes, they are biogeographically isolated and their distribution areas are confronted with habitat fragmentation due to the combined pressures of warmer temperatures and human activities.

In addition, the mountain hare is facing increasing competition from the European hare (*Lepus europeus*), a species whose distribution is increasing in altitude in response to global warming. The interaction between these two species of hares is an important parameter to integrate in order to understand the functioning and distribution of their populations.

One of the conditions for maintaining populations of the mountain hare and the rock ptarmigan (with limited dispersal capacity) at the Alpine scale is the ability of individuals to move and maintain flows between different populations in different mountain ranges. Ecological connectivity between favorable habitats is therefore crucial for the survival of these species. Within the framework of several research programs and action plans for the preservation and management of these species, non-invasive sampling of feces and feathers have been carried out in the French Alps. These samples were genotyped with microsatellite markers for the three species (i.e. *Lagopus muta helvetica*, *Lepus timidus* and *Lepus europeus*) in order to (i) characterize their genetic structure and diversity; (ii) infer landscape elements that may affect their dispersal and associated gene flow; (iii) characterize their genetic connectivity. While for the two hare species the analyses have been carried out either entirely (genetic structuring and diversity) or partially (landscape and genetic connectivity studies), the analyses on rock ptarmigan remain to be developed.

Duties:

The selected candidate will be responsible for:

- Analyzing the genetic diversity and structuring of Rock Ptarmigan;
- For the three species, analyzing landscape resistance to gene flow using a genetic optimization approach implemented in the ResistanceGA method (Peterman et al. 2018);
- Drawing conclusions on landscape elements affecting gene flow, and making recommendations in terms of preserving/improving landscape connectivity for the studied arctic-alpine species;
- Writing scientific papers reporting the results of these analyses and presenting them at scientific conference(s).

He/she may have opportunities to participate in occasional field work (a few days per year) on these 3 species.

Required skills:

- Candidates must have a PhD in Ecology - Evolution;
- Knowledge and experience in landscape genetics, spatial ecology including landscape ecology;
- Knowledge of GIS and R tools;
- Good knowledge of scientific English.

Work team:

The recruited person will work in close collaboration with the steering committee of this project, composed of:

- Aurélie Coulon, associate professor at the MNHN, affiliated with the CESCO (Centre d'Ecologie et des Sciences de la Conservation) and the CEFE (Centre d'Ecologie Fonctionnelle et Evolutive); her research work focuses on the effects of the environment on animal movements, through telemetry, landscape genetics and spatially explicit individual-centered modeling approaches;

- Jérôme Letty, research fellow (OFB); his research work concerns the management, behavioral ecology and population dynamics of lagomorphs, in relation to the effects of global changes and human activities.
- Charlotte Perrot, research fellow (OFB); her research work concerns conservation biology, ecology, spatial behavior and population dynamics of galliformes, in relation with the effects of global changes and human activities.
- Nicolas Bech (University of Poitiers), lecturer (UMR CNRS 7267; EBI Laboratory); his research work attempts to evaluate the impact of global changes on the spatial distribution and genetic variability of populations;
- Jérôme Mansons (Mercantour National Park, leader of the POIA project on arctic-alpine species).

Host labs:

The person will be affiliated with the CESCO and located at the CEFE, in Montpellier, France, within the MAD (Movement and Abundance of Populations) team.

Contract:

18-month MNHN fixed-term contract, paid between 1800 and 2800 euros net per month, depending on the candidate's experience and the pay scales of the Muséum national d'Histoire naturelle.

How to apply:

Candidates must send a cover letter and a CV mentioning at least one reference to Aurélie Coulon (aurelie.coulon[at]mnhn.fr), before 14/12/2022. The auditions will take place during the week of January 2, 2023.

A few publications of the steering committee :

- Bech N.**, Boissier J., Drovetski S. & Novoa C. (2009) Population genetic structure of rock ptarmigan in the 'Sky Island' of French Pyrenees: implications for conservation. *Animal Conservation*, 12:138-146.
- Bech N.**, Quemere E., Barbu C., Novoa C. & Boissier J. (2013) Pyrenean Ptarmigan Decline under Climatic and Human influences through the Holocene. *Heredity*, 111: 402-409. doi.org/10.1038/hdy.2013.62 IF=3.8
- Beugin M.-P., **Letty J.**, Kaerle C., Guitton J.-S., Muselet L., Queney G. & Pontier D. (2017) A single multiplex of twelve microsatellite markers for the simultaneous study of the brown hare (*Lepus europaeus*) and the mountain hare (*Lepus timidus*). *Ecology and Evolution* 7:3931-3939.
- Coulon A.**, Fitzpatrick J.W., Bowman R. & Lovette I.J. (2012) Mind the gap: genetic distance increases with habitat gap size in Florida Scrub Jays. *Biology Letters* 8, 582-585.
- Darinot F., Le Petitcorps Q., Arnal V., **Coulon A.†** & Montgelard C. † (2021) Effects of landscape features and flooding on the genetic structure of a small wetland rodent, the harvest mouse (*Micromys minutus*). *Landscape Ecology* 36: 1755–1771.
- Flavenot T., Fellous S., Abdelkrim J., Baguette M. & **Coulon A.** (2015) Impact of quarrying on genetic diversity: an approach across landscapes and over time. *Conservation Genetics* 16, 181-194.
- Letty J.** & Bouche M. (2021) *Lepus timidus* Linnaeus, 1758, Lièvre variable. Pages 194-199 in A. Savouré-Soubelet, C. Arthur, S. Aulagnier, G. Body, C. Callou, P. Haffner, S. Marchandea, F. Moutou, C. Saint-Andrieux, and (coord.), editors. Atlas des mammifères sauvages de France. Volume 2 : Ongulés et Lagomorphes. Muséum national d'Histoire naturelle, Paris.
- Muffat-Joly B., Bel A., Novoa C., Marin-Cudraz T., Fournet Q., Desmet J.-F., **Mansons J.**, **Perrot C.**, Montadert M. & Sèbe F. (2020) Lagopède alpin : mobilité des mâles chanteurs durant les comptages printaniers en fonction de leur statut reproducteur. Exemple du suivi sur le domaine skiable de Flaine (Haute-Savoie). *Faune Sauvage* 325:20-21.
- Novoa C., **Bech N.**, Bro E., Resseguier J., Martinez-Vidal R., Garcia Ferré D., Sola de la Torre J. & Boissier J. (2014) A translocation experiment for improving the genetic diversity of an isolated population of Pyrenean rock ptarmigan (*Lagopus muta pyrenaica*). *Grouse news*, 47 : 11-18.

References:

Peterman, W.E. (2018) « ResistanceGA: An R package for the optimization of resistance surfaces using genetic algorithms ». *Methods in Ecology and Evolution* 9 (6): 1638-47.