Bonelli's Eagle: A thirty-year study of European populations

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A new scientific research analyses key vital rates in Western Europe Bonelli's Eagle populations between 1980 and 2009. It alerts that North Spain populations are the ones at greatest risk. The research, published on the journal *Ecological Monographs*, a publication of the Ecological Society of America, is headed by experts Joan Real and Antonio Hernández Matías, from the Conservation Biology Group of the Department of Animal Biology and the Biodiversity Research Institute (IRBio) of the University of Barcelona.

The study, based on Bonelli's Eagle populations long-term monitoring in the Iberian Peninsula and France, enabled to know demographic relationships among populations and to understand population dynamics in Western Europe, the area where species are more endangered. Experts from the National Center for Scientific Research (CNRS, France) and research centres from Spain, Portugal and South Africa collaborated too.

Bonelli's Eagle (Aquila fasciata) is one of the most typical —and most endangered too— raptors of the Mediterranean area. Since 1980, the Conservation Biology Group of the UB is a leading centre in the research on this species ecology and in providing solutions to improve its conservation.

Bonelli's Eagle: Northern and southern edges

Joan Real, professor from the Department of Animal Biology and head

of the Conservation Biology Group, explains that "Bonelli's Eagle does not have a large distribution in Europe. Northwest edge is located at southern France and the most Southern populations are in Portugal and Andalusia". "We have been performing —adds the researcher— an annual analysis of Bonelli's Eagle populations in Catalonia for thirty years. This work, together with other analysis carried out by European research groups, has covered for the first time the whole eagle population. It has enabled to study them in a homogeneous way and to develop solid analysis of their demographic evolution, which are really useful for conservation".

The research reveals that eagle populations are not isolated in the Iberian Peninsula. The researcher Antoni Hernández Matías states: "Our complex model confirms the presence of large-scale spatially structured population with source–sink dynamics in the Peninsula". In other words, populations located at hundreds of kilometres may be essential to local population survival. "This fact is not always taken into account; if it is not considered, unsuitable conservation actions must be taken which might affect species viability in a future", remarks the expert.

Why are Iberian Peninsula populations so different?

This is the first study that provides a detailed analysis of differences between vital rates in eagle populations in Europe. These differences are due to human activity and environmental, geographical and climatic conditions. Most populations in Northern Iberia, where rural areas are under populated and tree-covered, are at high risk (high adult mortality rate, decreased fertility, etc.). However, in Southern Iberia populations, who live in warmer areas where traditional activity continues, demographic parameters are better.

"The species coexist well with traditional agriculture and farming managed in a sustainable way —affirms Joan Real—, as they facilitate

prey presence". If these activities do not longer continue, habitats change and preys disappear, so eagles find difficulties to survive. However, the researcher stresses that "excessive human activity (intensive agriculture, urbanization) can also affect negatively eagle survival as they are usually electrocuted, the areas to capture preys disappear and breeding areas are disturbed".

Models to improve future predictions

Regarding methodology, the study provides novelties in the application of the population viability analysis (PVA), a basic tool of current conservation practice. The research proves the relevance of considering uncertainty in model structure and vital rates in order to provide more reliable estimates. "Results prove —continues Hernández Matías— the importance of taking into account population spatial structure, subpopulation heterogeneity, dispersion processes and main uncertainty sources". "In the future —highlights the researcher—, it will be extremely important to include the effect of ecological factors (habitat fragmentation, new risks, etc.) in order to improve predictions in situations associated to global change". The research also proves that adult survival is the chief vital rate regulating Bonelli's Eagle populations.

Catalonia and France are pioneer in promoting large-scale and long-term monitoring studies of Bonelli's Eagle populations. The Mediterranean coast is a highly humanized area so species are at high mortality risk due mainly to electrocution and direct persecution. Adult mortality in Catalonia is 17%, whereas in Andalusia the rate is 5%. Therefore, Catalan populations are critically endangered and their survival probably depends on their arrival of individuals from other regions. The research published on Ecological Monographs was supported by Miquel Torres Foundation, Vilafranca del Penedès (Barcelona) and Barcelona Provincial Council. It has been possible thanks to a long and intense

collaboration among researchers, managers and nature benefactors which enabled to carry out a long-term monitoring, a basic tool to design biodiversity conservation policies from a broad, effective and contemporary perspective.

More information: Hernandez-Matias, A. et al. 2013. From local monitoring to a broad-scale viability assessment: a case study for the Bonelli's Eagle in western Europe, *Ecological Monographs* 83:239–261. dx.doi.org/10.1890/12-1248.1

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