

# Bonelli's Eagle diet reconstruction by means of isotope analysis to improve population conservation

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The Bonelli's Eagle is one of the most representative —and threatened— raptor species of the Mediterranean region Credit: Conservation Biology Group, UB

Carbon, nitrogen and sulphur stable isotopes analysis is an effective technique to reconstruct nestling Bonelli's Eagle diet, according to a paper published in the journal *The Ibis*, one of the most prestigious publications in the field of ornithology. The article is signed by experts Jaime Resano Mayor, Antoni Hernández Matías, Joan Real and Francesc Parés, from the Conservation Biology Group, affiliated with the Department of Animal Biology of the University of Barcelona (UB) and the Biodiversity Research Institute of UB (IRBio). Richard Inger and

Stuart Bearhop, researchers from the University of Exeter (United Kingdom), also participated in the study.

Diet analyses are central to the study of avian trophic ecology and can be an important conservation tool. Despite the high number of studies on Bonelli's Eagle (*Aquila fasciata*) diet developed in Western Europe, [eagle](#)'s relationship between prey consumption and vital parameters remains unknown.

## **A new methodology to study Bonelli's Eagle diet**

Joan Real, head of the Conservation Biology Group of UB—a research group that has carried out studies on European Bonelli's Eagle populations for more than thirty years—, explains that "most Bonelli's Eagle diet studies are based on the analysis of pellets, undigested food that some raptor species regurgitate". Besides this conventional technique, the stable isotope analysis (SIA) has been successfully used in recent years to study animals' diet, even if its applicability to raptor species diet studies remains unknown. Therefore, carbon, nitrogen and sulphur—common elements in the biosphere— act as biogeochemical markers in animal tissues which can indicate diet composition

In order to reconstruct eagles' diet by analysing the isotopic composition of their feathers, first authors had to characterise the isotopic composition of Bonelli's Eagle main preys in Catalonia. Jaime Resano-Mayor, first author of the paper, affirms: "we carried out a methodological study to compare diet estimations by applying pellet and stable isotope analysis. The study showed that the isotopic analysis of feathers allows inferring individual species' diet during the breeding period, something that is not possible by using pellet. We recommend applying conventional pellet analysis in those studies that aim at identifying prey species".

At the population level, the study proves that diet estimations made by applying AIE and pellet are quite similar. At the territory level, both methodologies showed similar results when classifying main prey consumption from high to low values. However, similarity varied among preys, in rabbits, pigeons and gulls it was moderate; in squirrels and passerines it was lower and in partridges it was low. Authors highlight that carbon and nitrogen analysis are essential in all cases, but sulphur is particularly useful to estimate the consumption of Yellow-legged Gulls (*Larus michahellis*).

## **Study of Bonelli's Eagle feeding strategies in Western Europe**

The analysis of isotopic composition is also an indicator that enables to infer diet composition and diversity (trophic niche) of Bonelli's Eagle during breeding at a population level, according to another publication by the former UB research group, which was published in the journal PLOS ONE and is also signed by Marcos Moleón (University Miguel Hernández). The study assesses the trophic niche width of Bonelli's Eagle populations in Catalonia, Andalusia and France, by means of the [stable isotope analysis](#); in addition, it analyses whether or not trophic niche width influences productivity (number of chicks per pair) at population and territory levels.

"The trophic niche of Bonelli's Eagle populations in Andalusia is narrower than in French and Catalan populations —explains Jaime Resano Mayor— as high consumption of rabbits and partridges in Andalusia reduces trophic diversity". Differences in prey consumption among territories could primarily be a consequence of variation in prey availability among territories, which is low in northern regions. Among other conclusions, the study detects a negative correlation between annual productivity and trophic niche width at a population level. At a

territory level, productivity increases in those pairs with low trophic diversity (due to the high consumption of rabbit and partridge) and in those that show medium values of trophic diversity (moderate consumption of rabbit, partridge and pigeons). On the contrary, pairs with high trophic diversity show less productivity. Authors point out that these results suggest that individual diet variation within populations is likely to have important ecological and evolutionary implications.

## **To know diet in order to improve the conservation of a threatened species**

To know diet effects on vital parameters in threatened species, like the Bonelli's Eagle, is crucial to plan and apply conservation measures. The research developed by the Conservation Biology Group of UB suggests that in those territories where the most negative vital rates (productivity, survival, etc.) are detected for eagles, conservation actions must be addressed towards the improvement of trophic resources (rabbits, partridges, pigeons, etc.) in order to improve these indicators. Moreover, [diet](#) composition studies not only can provide information about eagles' trophic resources abundance and availability but it also provides new interesting data to studies centred on changes in the habitats and ecosystems where the Bonelli's Eagle, one of the most representative—and threatened— raptor species of the Mediterranean region, lives.

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