Isotopes: Unconventional Tools in Illuminating Patterns of Animal Movement

Emily Ong
Department of Biology
Lake Forest College
Lake Forest, Illinois 60045

All aspects of an animal's life can be deduced from where it moves: its eating habits, mating behavior, and social interaction all involve movement. Therefore, patterns of animal movement are key in understanding and, furthermore, in conserving animals. Using biogeochemical markers to study animal movement has become a popular method due to recent advancements, as Rubenstein and Hobsen discuss in their article. Biogeochemical markers come in two forms: trace elements, elements in animal tissues that are in very low amounts and isotopes, variations of elements that differ in weight. These provide information about animal movement indirectly because they are incorporated into animal tissue through diet and certain food is only found in certain places. They also vary depending on environmental conditions, which provide even more information about animal movement.

Other methods of studying animal movement include extrinsic markers, which can be physical tags or radio transmitters put on animals and biological markers, which are genetic, behavioral, and morphological differences between animals that provide information about where animals move. Biogeochemical markers may prove to be superior to these other methods because they don't require capture of many animals and the differences in biogeochemical markers among animals is well established.
Within biogeochemical markers, isotopes are the most abundant and therefore the most widely studied. Patterns in how the levels of certain isotopes rise and fall in animal tissues are beginning to become clear to those in the field. For example, researchers have discovered that many carbon isotopes vary with altitude and latitude among terrestrial animals and that nitrogen isotopes are more enriched in animals in northern oceans compared to southern oceans. Patterns of isotope fluctuations have also been noted in plants. Levels of carbon isotopes have been found to vary during photosynthesis, for example.

These patterns have already provided invaluable information about particular threatened species. The study of isotopes of hydrogen revealed the location of a breeding population of one threatened species of bird, Catharus bicknelli. For another threatened species of warblers, Dendroica caerulescens, carbon and hydrogen isotopes pointed to deforestation as a contributor to concerning population declines. Analysis of isotopes within animals, therefore, provides us with information that is biologically significant to the survival and conservation of these species and so many more like these, which have dangerously low numbers.

Although exciting findings like those mentioned have already been made, like any studies in science, there are always some questions that still need to be answered. One area in which further research is needed is in the area of tissues that turnover elements and isotopes very quickly. For example the liver typically cycles elements and isotopes in and out every couple hours. These patterns of turnover need to be elucidated in order to see the entire picture painted by the elements and isotopes. In addition, more research has to be done on individual differences in tissue isotope ratios between species in one area. While we would think species living in the same area would have similar isotope ratios, this may not be the case. Furthermore, as the study of isotopes advances and new techniques become developed, they may be combined with the other methods to allow us to gain an even better understanding of patterns of animal movement. Although scientists may be doing the bulk of this work, it ultimately works towards animal conservation, which everyone can understand and which everyone is affected by.

References

Rubenstein, D. R., & Hobson, K. A. (2004). From birds to butterflies: animal movement patterns and stable isotopes. Trends In Ecology & Evolution, 19(5), 256.