BIRD BANDING AND CLIMATE CHANGE: CAN WE MAKE A DIFFERENCE?

So how does your banding effort fit into the new paradigm of climate science? A little background: many bird populations underwent mass declines during the 19th century from a variety of causes including hunting and habitat change. Current human-induced climate change represents a new and fast-acting pressure that is inherently more difficult to curtail and may drive vulnerable bird populations to the brink of extinction. New problems often require creative tools and today's scientists rely on a diverse array of methodologies to determine changes in bird populations including citizen science (e.g., eBird, breeding bird surveys and Christmas bird counts) and long-term banding stations.

Most studies reliant on banding to examine the impact of climate on birds use long-term datasets to measure changes in the timing of migration; e.g., 43 years of data from Col de Bretolet on the Swiss-French border high in the Alps (Jenni and Kéry 2003). A different approach is to compare survival and condition indices to long-term weather conditions. Climate change has been predicted to alter regularly occurring climatic phenomenon, such as the North Atlantic Oscillation (NAO) and El Niño Southern Oscillation (ENSO) (Karl and Trenberth 2003), affecting all aspects of bird ecology.

Associating survival and condition indices derived from banding data with NAO and ENSO has provided unparalleled insights into how birds respond to climatic perturbations (e.g., Marra et al. 2005, Wolfe and Ralph 2009) and may shed light on how future changes in climate will affect global bird populations.

What are the other low-hanging, relatively untapped, fruits of bird metrics? We suggest the influence of climatic change and perturbations on avian phenology, such as the timing of molt and breeding state (cloacal protuberance and brood patch), represent largely unexplored avenues of research. These data are recorded regularly at constant-effort stations and readily available for analyses. Even a single banding station may have adequate data for one or two species that are susceptible to climatic fluctuations associated with ENSO or NAO.

Let us say intrepid bird banders are interested in using their banding data to explore relationships between the aforementioned life-cycle metrics and climate. Two immediate problems face our heroic protagonists: (1) acquiring the right climatic dataset and (2) analyzing the data in a robust statistical framework. Most climatic datasets used by scientists are freely available online. El Niño studies most commonly use SOI (Southern Oscillation Index–observed sea level pressure differences between Tahiti and Darwin, Australia), and others have suggested ESPI (the El Niño precipitation index) as a more biologically meaningful alternative. Both data sets are available freely through NOAA and NASA, respectively. NOAA also archives NAO data and climate trend data (temperature, rainfall, etc.) for your area. Very little is known about how bird responses to climate change vary across the breeding range of most migrants, because most studies have occurred as part of migration monitoring studies and at just one or a few sites (Knudsen et al. 2007). Data from more single banding stations will be critical in filling in the continent-sized gaps in our knowledge.

The second challenge is the degree of computer skill and adequate software necessary to deal with the data. Understanding basic statistical philosophies and basic multivariate skills are necessary to evaluate long-term banding datasets relative to climatic change. Collaboration makes the scientific world go-round. Do not hesitate to contact statisticians and other biologists to see if they would be interested in partnering to evaluate your unique dataset.

Even those banders who may not have all of the technological or statistical advantages can think about how their data might be useful to investigate changes in phenology. Since most single banding stations lack adequate sample sizes in all but the most common species, consider associating with a larger network to really contribute to a greater cause. You can join networks of stations, either under the auspices of a long-term bird observatory, other banding projects (such as the Institute for Bird Populations projects of MAPS or MoSI), or data repositories such as LaMNA (Landbird Monitoring Network of the Americas). All these ensure that your data can be archived and used at larger scales, both over time and space, to evaluate the influence of climate change on birds.

Banders can also consider intensive comparative metrics from your local station. For instance, you can measure plant phenology, recording when local plants bud, flower, and fruit. Many birds eat fruit. Discovering the changes in when and where birds' resources are available relative to climate is insightful.

We can make a difference!

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LITERATURE CITED

Jenni, L. and M. Kéry. 2003. Timing of autumn bird migration under climate change: advances in long–distance migrants, delays in short–distance migrants. Proceedings of the Royal Society of London. Series B: *Biological Sciences* 270:1467-1471.

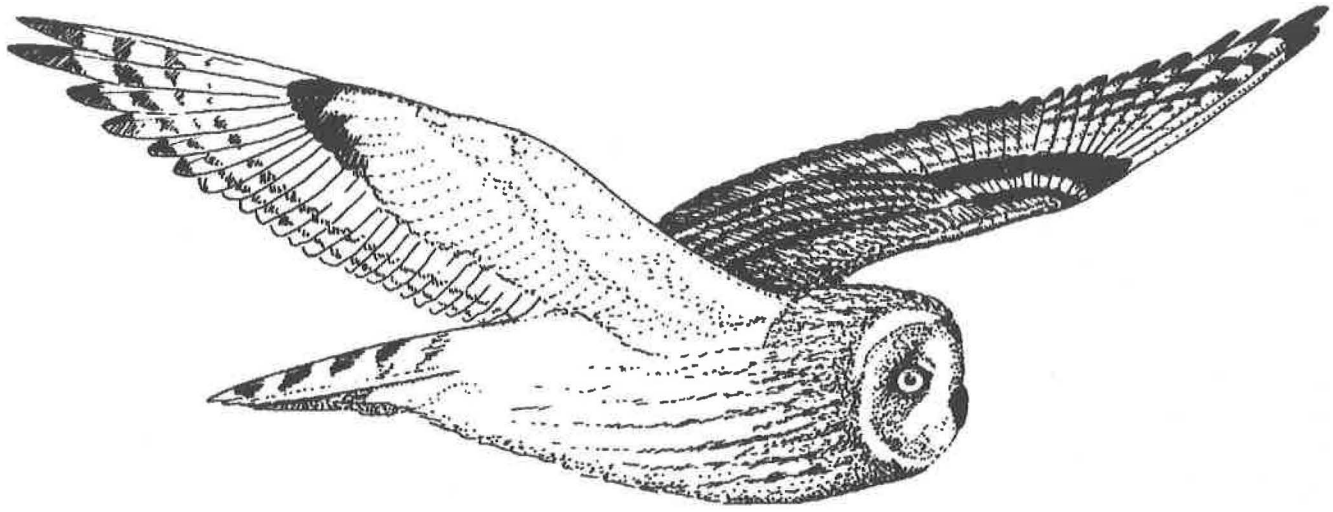
Karl, T. R. and K. E. Trenberth. 2003. Modern global climate change. *Science* 302:1719-1723.

Knudsen E., A. Linden, T. Ergon, J. Niclas, J.O. Vik, J. Knape, J.E. Roer and N.Stenseth. 2007. Characterizing bird migration phenology using data from standardized monitoring at bird observatories. *Climate Research* 35:59-77.

Marra, P.P., C.M. Francis, R.S. Mulvihill and F.R. Moore. 2005. The influence of climate on the timing and rate of spring bird migration. *Oecologia* 142:307-315.

Wolfe, J.D.and C.J. Ralph. 2009. Correlations between El Niño-Southern Oscillation and changes in Nearctic-Neotropic migrant condition in Central America. *Auk* 126:809-814.

p.s. We thank Wade Leitner, Linda Long, Carol Ralph, Renee Cormier, and Walter Sakai for very helpful thoughts and comments on this article.



Short-eared Owl by George West