

Voucher specimens and quality control in avian molecular studies

Arctander and Fjeldså (1994) correctly point out that present avian tissue collection holdings are inadequate for the rate at which molecular studies can be conducted. Hopefully, more ornithologists will be encouraged to collect samples for these important collections. However, we wish to emphasize the importance of preserving voucher specimens for these samples as well.

The study skin is the basis for identification in birds—not tissue specimens. When tissues are collected, good scientific procedure requires that a voucher specimen (i.e. a specimen that enables the identification of accompanying material) be preserved and deposited in a research collection. Voucher specimens serve as quality control for phylogenetic and population genetic analyses based on tissues.

Neglecting to properly voucher nontraditional material is a result of several naive assumptions: that errors in identification do not occur; that avian species limits are known and fully documented; that hybridization, clines and ranges are stable, well-documented phenomena and that ornithological nomenclature is accurate and stable. Anyone familiar with avian systematics will understand the futility in any of these assumptions.

Mistakes in identification are not infrequent, even when vouchers are preserved. When only tissues are preserved, there is a very low possibility of later rectifying these errors. Collecting only tissue samples without proper supportive voucher material lessens the value of tissue collections because they are likely to include identification errors that can never be resolved. Without voucher material, how can one go back to decipher or interpret unusual findings?

Voucher specimens may be less vital to population genetics studies of birds that are unlikely to be misidentified in the field (e.g. Great Tit *Parus major*), but the value of such studies is greatly enhanced by parallel morphological analyses of vouchers. Blood sampling alone is preferred in rare species, where the collection of a few individuals may endanger populations, or when long-term behavioural studies are involved. Nevertheless, these are exceptional cases, and, even

here, salvage efforts can assure that some voucher material is acquired and preserved, because all individuals eventually die.

Arctander and Fjeldsá (1994) contrast the inadequacies of tissue collections with "the vast numbers of voucher specimens that have been accumulated over more than 100 years in the major zoological museums." However, skeletal and spirit specimen holdings are notoriously small (Jenkinson & Wood 1985), and skin holdings are rarely adequate for thorough studies of such things as geographic variation, individual variation (e.g. age, sex) and migration (Zusi 1982, Phillips 1986, 1991). Further collection of traditional material will enable the verification of species limits, will change our perception of species limits, will easily advance our perceptions of intraspecific variation and will enable other important contributions. Traditional specimens have a well-documented useful life of centuries, and this includes the DNA they contain (Houde & Braun 1988, but see also Graves & Braun 1992). The need for general collecting noted by Arctander and Fjeldsá (1994) for tissues is true of all avian specimens. Unless a species is critically endangered, there is little or no excuse for neglecting to preserve proper voucher material (see Parkes 1963, Banks 1979, Remsen 1995).

The 2 + g frozen samples of several tissues that usually accompany traditional specimens collected today are superior in many ways to a few drops of blood or a small muscle biopsy. First, they are less likely to be exhausted with repeated sampling. Second, a full range of allozyme loci can be studied. (While allozyme data are currently more familiar and less glamorous than DNA data, allozyme data sets are cheaper to generate and can be of equal or greater value than DNA data from the same organisms.) Third, there is a lower chance of amplifications of mitochondrial DNA (which exists at low concentrations in blood) becoming conflated with nuclear copies of mtDNA genes.

We strongly recommend that authors, editors and reviewers recognize that neglecting to support research results with voucher specimens is a serious problem in ornithology. Authors of proposals and manuscripts should be held accountable in the review process for demonstrating that appropriate vouchers are preserved and deposited in recognized systematics collections. Curators of tissue collections should also encourage proper voucher support. Putting a name on a tissue sample without a voucher specimen is not a scientifically sound policy and may make the tissue specimen useless. Why include something of uncertain or questionable quality in a study?

Good specimen-based science demands the preservation of proper voucher material. We encourage field ornithologists to practice their science in a responsible manner and, where possible, deposit a specimen legacy. The top ornithologists of yesteryear continue to make important contributions to today's science through the specimen legacy they left to future researchers. This specimen base is incomplete, however, and awaits the contributions of today's ornithologists. Scientists practicing the policies outlined here can be assured that their efforts will have far greater value and impact than if only blood or biopsied tissue samples are preserved.

REFERENCES

- Arctander, P. & Fjeldsá, J. 1994. Avian tissue collections for DNA analysis. *Ibis* 136: 359–360.
- Banks, R.C. 1979. Human Related Mortality of Birds in the United States. Special Scientific Report, Wildlife No. 215. Washington, D.C. U.S. Fish & Wildlife Service.
- Graves, G.R. & Braun, M.J. 1992. Museums: Storehouses of DNA? *Science* 255: 1335.
- Houde, P. & Braun, M.J. 1988. Museum collections as a source of DNA for studies of avian phylogeny. *Auk* 105: 773–776.
- Jenkinson, M.A. & Wood, D.S. 1985. Avian anatomical specimens: A geographic analysis of needs. *Auk* 102: 587–599.
- Parkes, K.C. 1963. The contribution of museum collections to knowledge of the living bird. *Living Bird* 2: 121–130.
- Phillips, A.R. 1986. *The Known Birds of North and Middle America, Part I*. Denver, Colo.: Allan R. Phillips.
- Phillips, A.R. 1991. *The Known Birds of North and Middle America, Part II*. Denver, Colo.: Allan R. Phillips.
- Remsen, J.V., Jr. 1995. The importance of continued collecting of bird specimens to ornithology and bird conservation. *Bird Conserv. Int.* 5: 177–212.
- Zusi, R.L. 1982. Intraspecific geographic variation and the subspecies concept. *Auk* 99: 606–608.

Submitted 28 March 1995; accepted 1 June 1995