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Analysis of standard DNA procedures on feathers of late 19th to late 20th century Osprey (Pandion haliaetus)

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Species with well-documented demographic histories and well-known perturbations to gene flow provide good models for understanding how historic events impact contemporary population genetic structure. Osprey (*Pandion haliaetus*), a marine bird-of-prey, experienced steep declines after widespread organochloride pesticide (e.g. DDT) use in the mid-20th century, however, population genetic consequences remain unknown. Use of historic specimens can aid population genetic studies, however, these samples can degrade over time impacting quantity and quality of extracted DNA. We compared the concentrations of extracted DNA of Osprey feathers from museum and research collections to those of contemporary samples collected according to standard field collection protocols.

**Methods**

82 Osprey feather samples from collection gathered for previous study: • Date from late 19th to late 20th century • 41 from Smithsonian National Museum of Natural History (A3-A72) • 41 from VCU research collection (1999: A73-A118) Standard genetics procedures: • QIAEN DNAeasy extraction kit • Agarose gel electrophoresis, GeneRuler Ladder (100bp) • Microsatellite primers (PHAL 12: forward primer: QIAGEN DNeasy extraction kit • QIAGEN DNeasy extraction kit

**Objectives**

The objective of this study was to determine if feather samples from museum and research collections can be used for population genetic analysis of pre- and post-DDT effects in Osprey. A secondary objective is to promote the further development and use of museum and research collection samples in research; this avenue offers a noninvasive technique for studies of species of conservation concern through easily accessible materials.

**Introduction**

84 successful amplifications out of 82 samples: 8 of NMNH samples, 39 of VCU collection

**Results**

- Mean (+SE) extracted DNA (ng/μL) of various tissue types: Museum feathers, VCU research collection feathers (1999), Plucked feathers, Naturally shed feathers, Blood (FTA), Blood (FTA) with heparin, and Blood in Ethanol (EIOH)

**Conclusion**

The results show that historic feather samples can yield amplifiable DNA for population genetic studies. Historic feather samples collected from living organisms resulted in higher concentrations of genomic DNA than museum study skins. Storage conditions and degradation of specimens may affect the ability to extract amplifiable DNA. However, there is no significant difference in concentration of DNA obtained from historic feather specimens and shed feathers or some types of blood samples collected from live individuals which are commonly used in population genetic studies. The highest concentration of DNA was obtained from blood and feather samples recently collected from live birds. However ability to collect blood samples or plucked feathers from wild individuals across a large area, especially for protected species sensitive to disturbance, can be limiting. Including specimens from natural history museums and research collections can combat these limitations and may allow comparison of historic and contemporary population genetic structure over broader temporal and spatial scales. In addition, maintaining research collections and utilizing museum specimens can help build relationships between museum researchers, academics, and outside scientists.

**Future Direction**

Standard extraction techniques were used in this study with some modifications developed specifically for feathers. Optimizing these procedures and adding additional steps in the extraction and PCR processes may yield better results for future studies as well an increase in sampling size with a stringent focus on specimen condition. The next step is determining the quality of the extracted DNA by genotyping multiple microsatellites of different sizes and sequencing a portion of the mitochondrial DNA. If the DNA is of sufficient quality, the samples will go on to be included in a current population genetic study of Osprey for pre- and post-DDT effects.

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