Use of serum biochemistry to evaluate health and capture-related stress in molting greater white-fronted geese in Interior and Northern coastal Alaska

Biological Objectives
Examine serum biochemistries (blood parameters) as a means of assessing 1) differences in health and nutritional status and 2) the effects of capture-related stress; as these factors may relate to differential survival between interior (boreal) and northern (tundra) populations of molting greater white-fronted geese in Alaska.

Background
Estimates of adult survival for the mid-continent population of greater white-fronted geese (Anser albifrons) have persistently differed among geese in boreal versus tundra habitats. Differences in health has been suggested as one competing hypotheses explaining the differential mortality. One measure of relative avian health is levels of various blood biochemistries. Concentrations of some blood analytes, such as glucose, have been used to provide insight into nutritional health and stress levels. For example, high glucose levels have been correlated with better body condition, indicating greater 'quick energy' available, while reduced glucose levels may provide an indication of nutritional stress. Based on data collected in 2008, we found that glucose levels and handling time during banding operations were negatively related in interior Alaska, but not in northern Alaska, suggesting differences in condition of birds between sites. Further, our 2008 results indicated that other biochemistry analytes (e.g., creatine kinase (CK), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and lactate dehydrogenase (LDH)) all increased with handling time, consistent with capture myopathy effects documented in the literature.

Planning/Project Design
Analysis of archived blood samples collected in interior and northern Alaska in 2009 and 2010 provided an opportunity to better understand differences between boreal and tundra molting geese and to improve our understanding of the relationship between handling time and serum biochemistry indicators of capture related stress.

Implementation
Through funding provided by the USFWS Avian Health and Disease Program, 356 samples collected between 2009 and 2010 were analyzed for comparison with earlier data (2008). The results revealed that concentrations of biochemistry analytes differed between ages, locations, genders, and years, with effects at locations varying annually. Differences between sexes and ages were consistent across years. Birds in northern Alaska (coastal tundra habitat) were higher in alkaline phosphatase (ALP), glucose, triglycerides (TRIG), and body mass, and lower in β-hydroxybuturate (BHBA), globulin (GLOB), total protein (TP), and uric acid (UA), suggesting these birds may have been in better nutritional condition and experienced less hyperthermic stress than birds in interior Alaska (boreal habitat). At both locations, AST, BHBA, CK, LDH, non-esterified fatty acids (NEFA), and UA significantly increased with handling time, while albumin (ALB), serum glucose, whole blood glucose, and TP significantly decreased; suggesting birds from both populations experienced some level of capture-related stress.

Management
Our results suggest that comparative measurements of blood biochemistry parameters in greater white-fronted geese do provide a means of evaluating health differences between populations. Overall, the northern population maintained higher levels of circulating GLU, TRIG, and ALP (possibly indications of better nutrition), and lower levels of GLOB and UA (possibly indicating

increased hydration). The combination of these biochemical results suggests overall health of the birds may be better in the northern population. We hypothesize that the differences may reflect effects of local habitat conditions, particularly ambient temperatures and available food resources, during the molt. Although the northern population appeared to be in better overall health, both populations experienced similar negative effects related to capture, as indexed by increased CK, AST, LDH, BHBA, and NEFA and decreased concentrations of GLU and ALB with handling time. We suggest that reduction of overall handling time, preferably by limiting the extent of drives, captivity, and human-handling, will help in minimizing capture-related effects. We also advocate future research examining variation in survival relative to environmental and habitat conditions on molting grounds and more detailed studies of body condition.

Accomplishments

Our analysis demonstrates how non-destructive sampling can be used to provide insight into avian health and factors related to differential survival between avian populations.

1. Molting greater white-fronted geese being herded for capture

2. An individual greater white-fronted goose after banding and blood collection, just prior to release.

3. Another greater white-fronted goose after banding and blood collection, just prior to release.

4. Jugular vein blood