



SCOPE OF WORK

Project Title: Concentration and Effects of Selenium in American Avocet and Black-necked Stilt eggs at Great Salt Lake, Utah

This work will be completed as a contract to Weber State University. The Principal Investigator (PI) is John F. Cavitt, Ph.D., Professor of Zoology, Weber State University.

Project Objectives

1. Collect American Avocet (*Recurvirostra americana*, AMAV) and Black-necked Stilt (*Himantopus mexicanus*, BNST) eggs from at least two study sites (e.g. Ogden Bay, Saltair) at Great Lake (GSL), Utah.
2. Collect water, sediment and invertebrate food items from each site.
3. Examine AMAV and BNST eggs for malpositions and malformations.
4. Determine selenium levels in collected samples.
5. Examine diets of migratory waterfowl utilizing the Willard Spur shallow and deep water habitats.
6. Compare diets of migratory waterfowl from Willard Spur to the impounded wetlands at Farmington Bay Waterfowl Management Area (FBWMA), Bear River Migratory Bird Refuge (BRMBR), and Public Shooting Grounds (PSGR) as well as published studies.

General Assumptions

1. All work completed as part of this scope of work will follow UDWQ's Quality Assurance Plan protocol. Samples will be shipped to LET Inc., for analysis of selenium. Cost of laboratory analysis is included in this scope of work.
2. The Avian Ecology Lab (AEL) will obtain permission and coordinate access to all study sites.
3. All work completed as part of this scope will follow the AEL Standard Operating Procedures (SOP) for tasks associated with this project.
4. All necessary clearances/permits to complete the work specified herein will be acquired prior to and maintained for the length of the work.
5. Study sites will be utilized depending on access and avian utilization.
6. All waterfowl collected will be in accordance with state and federal waterfowl hunting regulations and bag limits. Collections will be made by individuals possessing a valid Utah hunting license, a Utah Harvest Information Program number and Federal Duck Stamp.
7. All samples and specimens collected for this project will be stored at the AEL.
8. AEL and Weber State University health and safety protocols will be followed.

Task 1 – Identify Study Sites

Prior to egg collections, study sites will be surveyed for aggregations of nesting shorebirds. Shorebirds do not always choose the same nesting area year to year, so birds must be located prior to egg collection. Field technicians on foot will locate nesting birds. GPS coordinates of observed nesting areas will be recorded to facilitate subsequent collection. Three areas will be examined at Great Salt Lake, Utah for possible egg collections:

- **Ogden Bay**- a 20,000-acre wetland Waterfowl Management Area located west of West Haven, Utah. The largest such management unit under division of Wildlife Resources Stewardship, it is critically important to breeding shorebirds.
- **Bridger Bay**- located on the north end of Antelope Island.
- **Saltair** – Is located north of I-80 near the Kennecott Copper Tailings area, approximately 10km west of the Salt Lake international AirPort.

Schedule:

Searches for nesting shorebirds will begin in early May each year. Study sites will be identified by mid-June.

Task 2 – Collect Eggs from Nesting AMAV and BNST

After study sites have been identified, up to 15 AMAV and 15 BNST eggs will be collected, 5 eggs from each species per site. A single egg will be collected from each of 15 nests for both species. Established protocols for collecting eggs for contaminant analysis will be followed. After clutch completion, eggs will be chosen for late-stage development, as determined by egg flotation. Eggs will be marked with a unique identification number, placed in an egg carton, and refrigerated. Samples will be collected according to methodologies outlined in Cavitt 2007.

Schedule: Eggs will be collected by the end of the shorebird breeding-season (early July).

Task 3 – Collect water, sediment and invertebrate samples.

Up to 5 samples of water, sediment and invertebrates will be collected from each study site (total samples up to 15). Samples will be collected from observed shorebird foraging areas. Foraging areas will be delineated from the point AMAV and BNST are detected foraging. A transect will be established within that area and sediment (including surficial sediment) and water samples collected and depths recorded at five random points along its length. Sediment will be composited into a single sample for each feeding transect. Invertebrates will be collected from the mudflat, benthos, and water column within each foraging area. Invertebrate food items (brine fly adults and/or larvae or pupae and brine shrimp), will be collected opportunistically in the general area of each foraging area. If available, three samples of each species and life stage (i.e., larvae, pupae or adult of brine flies) will be collected at each area, with sufficient biomass for analysis (target 5 grams) and additional biomass when that is feasible. However, the numbers and types of invertebrate samples will be based on what is available to foraging shorebirds. Samples will be collected according to methodologies outlined in Cavitt 2007.

Schedule: Samples will be collected by the end of the shorebird breeding-season (early July), prepared and delivered immediately to LET Inc. for analysis.

Task 4 - Examine Eggs for Malpositions and Malformations.

All eggs collected will be examined for malpositions and malformations. Egg breakout analyses will be performed at The Avian Ecology Laboratory, Weber State University. Dissection will occur within 7 days of collection. Each embryo will be checked for stage of development, and developmental abnormalities, including the embryo's position in the egg. Observations of embryo development and position will be recorded according to standard procedures. All embryos will be photographed and these images will be provided in the final report. Egg contents (including the embryos) will then be placed in a chemically cleaned container, and preserved frozen, for chemical analysis.

Schedule: Eggs will be examined within a week of field collection.

Task 5 – Deliver Samples to Laboratory for Chemical Analysis

Up to 15 whole eggs, or egg contents, of each species will be delivered to the UDWQ designated laboratories contracted to analyze for total selenium content. In addition, up to 15 water samples, 15 sediment samples and 15 invertebrate samples will also be collected and delivered to designated laboratories for total selenium content.

Schedule: Delivery of eggs to LET Inc. laboratories will occur immediately following dissection. Delivery of additional samples will occur immediately following collection.

Task 6 – Locate and Collect Waterfowl

Common species such as, Mallard (*Anas platyrhynchos*), Northern Pintail (*Anas acuta*), Gadwall (*Anas strepera*), Northern Shoveler (*Anas chrypeata*), Green-winged Teal (*Anas crecca*), Redhead (*Aythya americana*), Ruddy Duck (*Oxyura jamaicensis*), and American Coot (*Fulica americana*) will be collected during migration starting in October 2011. Individuals will be collected from selected Willard Spur sites (shallow water and deep water sites). In accordance with the state bag limits, collections shall not exceed 2 hen Mallards, 2 Northern Pintails, 2 Redheads, 25 American Coots, and 7 specimens of each of the remaining species per day of the collection process. The attached budget is based on a maximum collection of 40 individuals on two different collection trips. Attempts will be made to collect similar species as those collected from reference sites.

Schedule:

Collection will occur in October 2011.

Task 7 – Observe Foraging Behavior, Collect Sweep Samples of Available Food Items, and Collect Diet Samples

Foraging observations will be made during a 5-minute sampling period prior to collecting adults. Observations of each individual will be made with 8x42 binoculars. Because these collections are occurring during the regular waterfowl hunting season, birds may be moving more frequently from site to site within Willard Spur due to this disturbance.

Following collection birds will be dissected in the field. The mouth and pharynx will be rinsed with 80% ethanol and the wash collected into plastic containers. In addition, the esophagus, proventriculus and ventriculus will be removed and preserved with 80% ethanol. Food items will be sorted and identified to family and order (Merritt and Cummins 1984, Voshell 2002, Cronk and Fennessy 2001, Cooper, 1989) in the

AEL. Dietary items will be identified and volumes and dry mass determined for each taxa. Data from samples will be summarized as aggregate % and aggregate volume and mass.

After each waterfowl collection, invertebrates and other food items will be collected from the water column and benthos at the point birds were observed foraging. Samples will be collected using a D-frame net. The net will be lowered so that the frame is flat on the bottom and then quickly moved forward for a distance of 1 m and then back again. The contents of the sample will be placed in a collecting container and returned to the laboratory. Samples will be sorted and characterized to determine the relative proportion of food items within waterfowl foraging sites.

Schedule:

Data collection for this task will take place from October 2011 to January 2012.

DELIVERABLES

- Technical report detailing the locations of all samples collected, egg collection data sheets, breakout analyses, photographs and results of laboratory chemical analyses
- Data for this project will be provided as Excel spreadsheets.
- Final written report on waterfowl diets to be submitted by April 30, 2012. This report will provide a complete analysis of all data collection and will address all project objectives and tasks.

LITERATURE CITED

- Cavitt, J.F. 2007. Concentration and effects of selenium on breeding shorebirds at Great Salt Lake. In: *Development of a Selenium Standard for the Open Waters of the Great Salt Lake*, 30pp. State of Utah Department of Environmental Quality, Division of Water Quality, Salt Lake City, UT.
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