

## **Project 1B Concentration and Effects of Selenium in California Gulls**

SUBCONTRACT WITH: Utah State University

PRINCIPAL INVESTIGATOR: Dr. Michael Conover

CONTRACT VALUE: \$67,500

SCHEDULE: April 1, 2006 through November 1, 2006 (elapsed time: 8 months)

### **Project Objective**

The project objectives generally are to:

1. Determine ambient selenium concentrations in water, sediment, brine shrimp, brine flies, and identified food items in nesting California gull foraging areas, bird eggs, bird blood, and livers.
2. Determine stomach contents of nesting birds.
3. Determine if selenium concentrations affect reproductive success of California gulls at the Great Salt Lake.

Please see Data Quality Objectives for Project 1B for further detail.

### **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 the laboratory selected by UDWQ following required protocol. Cost of laboratory analysis is not included in this scope of work.
2. All necessary clearances/permits to complete the work specified herein will be acquired prior to and maintained for the length of the work. All access will be properly coordinated and permission obtained.
3. Safety is of the essence. Health & safety protocol will be identified prior to beginning field work and followed.

### **Scope of Work**

#### **Task 1. Preparation of Workplan, Budget Estimates, and Data Quality Objectives**

Prior to executing Project 1B, a workplan and the associated components (i.e., budget, required SOPs/protocols, etc.) as well as Data Quality Objectives will be prepared and then

reviewed by the Great Salt Lake (GSL) Science Panel, Utah Division of Environmental Quality, technical advisors, and GSL Steering Committee. This task also includes participation in study team meetings, conference calls, and other tasks on an as-needed basis.

### Deliverables

1. Draft and Final Data Quality Objectives for Project 1B (completed by 5/15/2006).
2. Workplan including scope of work, projects costs, project schedule, health & safety plan, protocols for (1) collecting water/sediment samples, (2) collecting, handling, and shipping samples (completed by 5/15/2006).

## Task 2 – Survey GSL for California Gulls Nesting Areas

Four nesting colonies of gulls have been identified at GSL (see Figure 1). These areas will be surveyed for nesting aggregations and include: Hat Island colony, GSL Mineral colony, Egg Island colony, and White Rock Island colony. The Egg Island and White Rock colonies are so close together that the foraging areas for gulls in these two colonies probably overlap. Hence, it is assumed that they will be considered as a single colony but will collect eggs from both of them.

### Deliverable

- Technical memorandum with simple maps indicating coordinates and description of nesting locations.

### Schedule

This task will be completed by July 1, 2006.

## Task 3 – Locate Foraging Areas of Nesting Gulls

Once we identify the specific sites where we will collect eggs, we need to determine where the birds are foraging. We will locate foraging areas of gulls using both visual observations and aerial strip census photography. We have experience with both methods and have used them in the past to assess avian densities and use patterns on the GSL

### Deliverable

- Technical memorandum with simple maps describing nesting and foraging locations and their relation to the colonies described in Task 2
  - Summary of behavioral observations of foraging sites and their relation to the nesting aggregations described in Task 2 above.
  - Table indicating range of nest initiation dates for each study location

### Schedule

This task will be completed by July 1, 2006.

## Task 4 – Collect Adult Gulls

Once we locate the foraging grounds for the birds, we will collect 12 adult gulls from each of the three nesting areas by shooting them while they are foraging or netting them at their nests. We will determine the birds' diet by analyzing stomach contents. Incubating gulls often regurgitate food when disturbed. We will collect regurgitated food for additional samples to assess diet.

### Deliverable

- Technical memorandum providing the location, number, and species of gulls collected and initial determination of their diets.

### Schedule

This task will be completed by July 1, 2006.

## Task 5 – Collect Food Samples and Water from the Areas Where Gulls are Foraging

Once we know what the gulls are eating and where, we can begin to sample their food items and collect water samples from their foraging areas. Foraging areas will be delineated based on where the birds are foraging, and random points will be selected from within the foraging area to collect invertebrates, water and sediment. If available, five 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 the birds are eating. We have observed gulls foraging in the deeper water around all of their nesting colonies: they feed by swimming around and plucking items from the top 10 centimeters of the water column. They also forage by wading in the shallow water and walking along the shoreline. Here, they forage on items blown along the shore and capture brine flies from the air. The birds near Antelope Island can easily forage in Farmington Bay, Ogden Bay, and on the mainland.

Protocol for collecting water, sediment, and food samples will be coordinated with other researchers.

### Deliverable

- Technical memorandum detailing the location and number of samples (including foraging microhabitat), water depth at foraging sites if less than 2 m, identification of invertebrates collected, and water sampled.

### Schedule

This task will be completed by July 1, 2006.

## Task 6 – Collect Random Eggs from Nesting Gulls

We will collect a single gull egg per nest during the incubation period. All eggs will be collected from 3-egg clutches. We will collect 24 gull eggs per colony during 2006. A preformatted field data sheet will be filled out that will include a unique nest/egg

identification code, location, date, number of eggs in the clutch, and initial estimation of incubation stage. Each egg will be marked with a unique identification code, location, date, and the number of eggs in the clutch. The location coordinates of each nest from which an egg is collected will be taken using a hand-held global positioning system (GPS) unit. Eggs will be stored in a refrigerator until they can be broken out. Eggs must be broken out within one week of collection. Each embryo will be checked for stage of embryonic development (embryo age), developmental abnormalities including a determination of the embryo's position in the egg (i.e., malposition). The entire egg contents (including the embryos) will then be placed in a marked chemically-cleaned container and preserved frozen for later analysis. Up to 10 eggs from each colony will be analyzed for total selenium and variability of selenium concentrations and the remainder will be stored for possible later analysis.

**Redhead, Canada goose, and other species egg collection:** Up to 10 eggs from each of the areas described above will be opportunistically collected from redhead, Canada goose, or other nests found during other activities in 2006. When nests are found, a single egg will be collected, the location information taken using a hand-held GPS unit, and the egg will be marked as described above.

#### Deliverable

- Technical memorandum providing the locations, numbers, and species of bird eggs collected and field data sheets

#### Schedule

This task will be completed by July 1, 2006.

### Task 7 – Revisit Gull Nests when the Chicks Begin to Hatch to Check for Deformed Chicks and Collect Salvage Eggs

Immediately after the chicks hatch, we will revisit the gull colonies to check newly hatched chicks for deformities. Any deformed chicks will be collected, placed in a clean container marked with a unique identification code, location, and date. A preformatted field data sheet will be filled out for each deformed chick that will include a unique nest/egg/chick identification code, location, date, number of eggs/chicks in the nest, and initial estimation of chick condition (e.g., normal or abnormal appearance and type of abnormality). The location coordinates of each deformed chick will be taken using a hand-held GPS unit and the chick will be preserved (frozen). Forty eight salvage eggs will also be collected from the Hat Island and GSL Mineral colonies (24 from each colony). Salvage eggs will be checked to determine fertility and the presence of dead embryos. Dead embryos will be checked for the stage of embryonic development, embryo malposition, stage of development, deformities and eggshell thickness. All embryos (including all contents of those eggs) will be placed in chemically-cleaned containers and preserved frozen for later analysis.

#### Deliverable

- Technical memorandum providing the locations, numbers, and location of any deformed chicks and salvage eggs that were collected.

## Schedule

This task will be completed by October 1, 2006.

## Task 8 – Determine Selenium Concentrations in Samples

Samples (blood and liver) from up to 10 collected adult gulls from each location (total of 30), up to 10 deformed chicks from each location, up to 24 randomly collected eggs from each location, and up to 24 salvage eggs from each area will be analyzed for selenium and possibly heavy metal concentrations. Additional samples will be stored frozen for possible later analysis. Samples will be shipped to the UDWQ's selected laboratory following required protocol. Heavy metal concentrations will also be determined in all food samples (e.g., brine flies and brine shrimp), sediment and water samples collected from the foraging areas.

A draft and final report will be prepared to document activities, methods, assumptions, data, recommendations, and conclusions completed as part of this task to address the project's objective.

## Deliverables

- Laboratory chain-of-custodies (COCs) and list of stored samples
- 2006 Interim Final Report

## Schedule

The laboratory COCs and list of stored samples will be completed by October 1, 2006. The 2006 Interim Final Report will be completed by November 1, 2006.

*Task 9 - Overwintering Birds (not included in this scope of work, to be defined at a later time)*

## Schedule of Tasks

### Time Frame for 2006

The 2006 chronological order of field work with California Gulls is as follows:

1. Determine presence and/or count birds in water around each gull colony. April 2006.
2. Collect 10 adult gulls from areas near each colony before the egg-laying period. April and May 2006. Prepare and ship liver and blood samples for selenium analyses. May and June 2006.
3. Examine gull crops for forage items. April and May 2006. Quantitative analyses of crop contents will be completed by July 1, 2006.
4. Collect five samples of brine shrimp and a water and composite sediment sample from each of the areas where gulls from the three colonies are foraging. Prepare and ship samples for selenium analyses. April – June 2006.

5. Collect one egg from each of 24 nests in each colony during late incubation. Prepare and ship samples for selenium analyses. May and June 2006.
6. Examine eggs for fertility and embryos for teratogenesis from 48 salvage eggs. Only salvage eggs with abnormal embryos will be analyzed for selenium. Prepare all samples for shipping to lab. May and June 2006.
7. Make repeated visits to gull colonies to check just-hatched chicks for deformities and collect salvage eggs from nests where other chicks have hatched. May and June 2006.

As part of Task 8, the team will determine selenium concentrations in samples. All samples will be submitted to the lab by July 1, 2006. The priority for selenium sampling will be first to submit 10 eggs per area, then 20 eggs per area, then blood and liver samples if funding allows. Samples not analyzed immediately for selenium will be saved for possible analysis later.

The 2006 Interim Final Report will be completed by November 1, 2006.

FIGURE 1  
Locations of California Gull Colonies to be Sampled on the South Arm of Great Salt Lake

