GSL Science Panel Coordination

ATTENDEES:

Theresa Presser
Don Hayes
Bill Wuerthele
Brad Marden
Bill Adams
Bill Moellmer
Theron Miller
Harry Ohlendorf
Jeff DenBleyker
Mike Conover
Wayne Wurtsbaugh
Dave Naftz
Bill Johnson

FROM: Jeff DenBleyker

DATE: March 21-22, 2007

The following summary is based on the author's notes and recollections of the discussion, and may include details that have not yet been verified. This summary is subject to review and comment by the attendees listed above. Summary will be discussed and approved at the April 27, 2007 Science Panel conference call. Please do not distribute to a wider audience until the summary is approved by the Science Panel.

Wednesday, March 21, 2007

Objective: Update on projects and resolution of project issues

Discussion of Project 1A – Shorebirds Report

John Cavitt was unable to attend. Anne Fairbrother had previously provided her written comments on report. Jeff DenBleyker requested comments from the remaining panel members. Theresa requested that John include details of sample dates and weights for the invertebrates that were collected and documented in Appendix 3 (p. 28) of his report. Joe mentioned on Friday (3/23) that he has substantive comments he will provide. Jeff indicated John would like to finalize his report as soon as possible.

Action Items

Panel members to provide report review comments to CH2M HILL and John Cavitt

Discussion of Project 1B1 – California Gulls and Project 1B2 – Overwintering Birds

Mike Conover handed out a new "final" version of the report. The following were general discussion items:

1. Theresa asked that Mike include figures/graphs that illustrate the data presented and discussed (e.g., liver vs blood Se concentrations, bar charts of data with standard error, etc.). Harry Ohlendorf or Gary Santolo will discuss with Mike to finalize.
2. Report indicates that t-test says there is no difference for Se among gull colonies.
3. Report should clearly indicate that it is not possible to correlate sampled eggs to blood/liver samples.

4. Diet samples that were analyzed were collected from the environment rather than directly from birds. Timing of diet samples may be more important than the location where diet samples were collected. Data table should include when samples were collected.

5. Appendix 2 in the report needs to be re-done. Gary Santolo prepared these statistics from very early data. Statistics were not updated with final dataset. Need to make sure it is consistent with other tables.

6. Add abstract/executive summary to front end of report.

7. Add more details about how blood samples were collected to the methods section of the report.

8. Bruce Wadell commented on how the mass of the diet samples taken from the gulls seemed small. Mike confirmed data and that sampled gulls were healthy, and that the sample volumes were small because they were taken from the esophagus (gulls do not have a crop, and samples did not include material from the gizzard). Mike commented that gulls are opportunistic, feed at different times and quantities, and these birds were feeding predominantly on shrimp because they are available close to their nests.

Mike provided an update on the overwintering bird study. He collected the required number of grebes plus some extra grebes at both locations and at both sampling periods. He noted that the grebes' mass appeared to double during their stay on the Great Salt Lake (GSL). Mike was able to collect his quota of male goldeneyes during the early collection period but had been unable to collect any this spring. The Panel agreed that Mike should collect female goldeneyes if that is all he could get. He should end his efforts within the next 2 weeks. Mike would like to finalize his report as soon as possible. Mike mentioned that he had collected male goldeneyes the previous year for the Div of Wildlife Resources and had blood/liver samples available. He agreed to summarize what he had so that the Panel could decide if they could be used for this project.

There was brief discussion on reporting blood concentration as dry weight vs wet weight. Harry summarized the discussion in the Avian Blood memorandum. Blood is typically reported in dry-weight terms. Theresa mentioned that marine birds will sometimes have high Se concentrations in blood. Perhaps due to salinity?

Action Items

1. Mike to finish collecting goldeneyes within 2 weeks
2. Mike to summarize collection and storage of male goldeneye samples he collected as part of separate project
3. Panel to provide all comments on his report to CH2M HILL and Mike within 2 weeks

Bird Blood Discussion

Jeff summarized the discussion and recommendations from the final Avian Blood Sample Analysis memorandum dated March 15, 2007. See slides. General discussion items:

1. Is arsenic (As) a potential issue as well as mercury (Hg)? Bill Johnson reported observing up to 200 ppb of As in the GSL. Is there a mechanism for As and Se to interact and limit exposure to Se in eggs? The Panel agreed we should be able to move forward with the current analytical/sampling strategy but perhaps complete further studies of the issue in parallel with future monitoring as part of implementation of a standard.

2. Theresa asked if low moisture in blood is a representation of stress in the birds. Mike Conover indicated that the birds appeared to be in very good condition. They typically will wait as long as possible before they go to get fresh water. The moisture level in the blood could just be a function of how long it had been since that particular bird had gone to drink fresh water.

3. Bill Moellmer asked about the driver for the concern over blood Se concentrations. The Panel agreed that there are substantial laboratory data available describing the relationship of blood/diet/egg Se concentrations. These Se concentrations in the blood do not reflect typical patterns in laboratory data resulting in the need to verify the values and better understand the issue.

4. The Panel generally agreed that if blood concentrations from the labs return with:

    a. Low Se values, the 2006 nesting bird blood data would likely need to be thrown out and the Panel will need to rely on lab studies focusing only on diet and eggs.
    b. Verification of high Se values, the datasets will need to include a caveat describing the apparent anomaly and require future study.
    c. Verification of high Se values and high Hg values, we will have some idea as to why we have high Se values but will need further study.
    d. Verification of high Se values and low Hg values, we will need to reconsider high Se values and may require further study.

5. The Panel asked CH2M HILL to create summary tables of liver, blood and egg Se concentrations for marine-type birds (from habitats with salinity at least equal to seawater) from the literature to compare against what has been observed at the Great Salt Lake.

6. The Panel agreed with the inter-laboratory comparison recommended in the March 15, 2007 memorandum. Results to be discussed with the Panel prior to LET proceeding with further blood analyses.

7. The Panel agreed that further sampling of gulls and shorebirds should be completed during the 2007 nesting season. The objective of this work is to 1) verify the Se concentrations observed in the 2006 nesting season and 2) understand why elevated Se concentrations were observed. The objective is not to repeat the sampling program completed in 2006. The following sampling plan was agreed to:

    a. Mike Conover will collect 10 California gulls per colony from Hat Island, Great Salt Lake Minerals and one colony near the Great Salt Lake that utilizes a fresh water diet source (e.g., Farmington Bay, Bear River National Wildlife Refuge). Blood, liver, and diet from 30 birds will be collected and analyzed.
    b. John Cavitt will collect 10 female shorebirds from the 2006 Ogden Bay sampling site by trapping them on their nest during the egg-laying period (i.e., when their clutch has less than 4 eggs); it is expected that those birds would have an egg in their oviduct. This will allow the Panel to look at a direct diet to blood to egg linkage. Blood will be collected from the birds' jugular vein. Livers, diet and the egg from the oviduct will also be collected and analyzed. However, it may not be possible to collect diet samples for analysis directly from the nesting birds. This summary includes update from discussion on Thursday, March 22.

c. Both PIs will also opportunistically collect brine flies (adults/larvae) at their sampling locations (3 composites by life stage at each location) with one PI to collect brine flies at the 2006 Saltair shorebird sampling site.

8. Science Panel agreed that Mike and John could finalize their reports once Panel comments were received and incorporated and a caveat was included to describe uncertainty surrounding blood Se concentrations. The data could then be made public and PIs can publish.

Action Items

1. CH2M HILL to create requested data tables from the literature describing marine bird Se concentrations.
2. CH2M HILL to provide LET and USGS with notice to proceed on inter-lab comparison.
3. CH2M HILL to draft a paragraph describing uncertainty of blood Se concentrations for inclusion in final reports. Panel to review and finalize.
4. Mike Conover and John Cavitt to prepare workplans to complete requested sampling.

Discussion of Project 2B – Synoptic Survey

Brad Marden presented results and observations to date. See slides. General discussion items:

1. Brad was unable to start sampling in 2006 until June due to funding constraints. He was able to extend his sampling season into January 2007.

2. Brad collected 3 cyst samples and 3 seston samples in March 2007. The seston samples were sent to Jason Unrine for speciation in support of Martin Grosell's work.

3. Brad noted that it was not uncommon for norther shovelers and goldeneyes to largely feed on cysts during the winter (pers. comm. Josh Vest/UDWR). This is why he collected the cyst samples in March 2007.

4. Brad's brine shrimp Se concentrations were different than those of other PIs and unrelated sampling completed in previous years. If values are reported as dry weight, then values are lower and if values are reported as wet weight, then values are much higher. CH2M HILL to verify. Bill Adams noted that prior to this meeting his thought was that brine shrimp sampling/analysis provided consistent results. Given this apparent disparity, it is worth looking at sampling and analytical methods to see what caused the difference.

5. Brad's water samples had low recoveries on MS/MSDs. CH2M HILL to discuss with Frontier to identify reason and develop plan to address. Brad has extra water samples that could be analyzed.

6. Brad proposed to conduct additional sampling during April – July 2007 to complete one year of data, collect the first brine shrimp cycle of the year, collect data during the critical nesting season, and overlap slightly with the 2006 sampling months to verify results. Panel recommended that his proposal be completed as stated.

7. Bill Adams and Brad will coordinate to compare Bill's brine shrimp sampling method to Brad's method and sample shrimp with both methods at same location/day to verify results.

Action Items

1. Brad to submit draft report for 2006 and workplan for spring 2007 sampling program.
2. CH2M HILL to verify brine shrimp and water sample data with laboratories and discuss further with Brad.
3. Bill Adams and Brad Marden to compare sampling methods of brine shrimp.

Discussion of Project 5 – Brine Shrimp Kinetics Study

Jeff DenBleyker provided an update on progress. See slides. Bill Adams noted that Marjorie Brooks had gone down to the University of Miami to assist Martin Grosell with culturing.

Discussion of Project 2A – Benthic Zone

Wayne Wurtsbaugh provided a summary of his draft report. See slides. General discussion items:

1. The Panel suggested that Wayne add the range of values to his graphs in the report.
2. A spatial/temporal comparison is important to flesh out transfer factors - particularly for data differences between Bill Adams and Brad Marden. This will be done as part of data integration.
3. Wayne's sediment Se concentrations were higher than Bill Johnson's samples. Is this is a difference between oxic and anoxic sediments (shallow vs deep)?
4. Wayne asked an important question: "Are flies more important in the bird diet than brine shrimp?" We have only limited data on brine flies. Goldeneyes seem to feed predominantly on fly larvae or pupae. Discussion reflected increased interest of the Panel in Se data for brine flies.

Action Items

1. CH2M HILL to finish review of Wayne's final report next week.
2. Wayne to finalize draft for Panel review.

Discussion of Project 3, Selenium Loads

Dave Naftz provided a summary of data and observations to date. General discussion items:

1. It was suggested that Goggin Drain should be shown next to Lee Creek and the KUCC discharge on pie charts so that it is easier to discern their influence on south part of Gilbert Bay.
2. Lee Creek has an elevated Se load that is difficult to understand. KUCC has some groundwater wells that could be looked at but it wasn't thought that groundwater would cause the higher flows/loads.
3. Bill Moellmer asked if Dave could take his load estimates and extrapolate based upon known hydrology. The concensus was that this could be done but that it would be based upon a significant number of assumptions and estimates and would therefore not be reliable for decision making.
4. The Panel agreed that a long-term monitoring tool is needed to ascertain the influence of hydrology on loads. The group discussed Dave's illustration of the importance of loading on lake Se concentrations assuming conservative assimilation. Bill Adams presented a few slides to compare conservative vs 90% loss of Se on lake concentrations.

This supported the need for long term monitoring and good characterization of Se loss mechanisms (fate) of waterborne Se.

Action Items

1. Dave to finalize draft report for Panel review.

Discussion of Project 4, Selenium Flux

Bill Johnson provided a summary of his draft report, which he has provided to CH2M HILL and received comments back. See slides. General discussion items:

1. The flux of Se from the GSL is significantly higher than expected. Bill will apply volatilization estimates to actual wind measurements on the lake to estimate the flux to atmosphere. Additional study will measure actual volatilization to compare with and confirm theory behind estimates. Bill will provide initial measurements in May and final report in November.

2. Bill noted that only one sediment core (out of 3) had a good net sedimentation rate. The Panel discussed whether there might be other information available such as from USGS, universities, or mineral industry. Dave Naftz will check into possible cores from USGS Geologic Division. Dave will also check into the availability of the USGS' coring crew and how many cores could be completed for a reasonable cost (~$30,000). Dave and Bill will estimate what a reasonable sample size would be (20-30 or just a few) and location of coring sites to provide a good assessment of sedimentation patterns and rates in the GSL. Bill Adams noted that understanding the sedimentation flux is essential to determining a water quality standard.

Action Items

1. Dave Naftz to verify possibility of using other USGS sediment cores from the GSL.
2. Dave Naftz to determine availability, cost and schedule to obtain additional sediment cores. Bill and Dave will present a proposal with number of recommended corings and location for Panel approval.
3. Bill to finalize draft report for Panel review. Will need to identify which sections are final and which have incomplete datasets still being evaluated.

General Discussion

Theresa Presser requested that the project database on DWQ's website be made easier to use. Joe Skorupa and others agreed. The question was asked as to why MS Access was being used rather than MS Excel. CH2M HILL had previously provided custom Excel spreadsheets on request because Access is used for validation. That was helpful but current Access database is unwieldy. Other specific requests were:

1. Include a separate data spreadsheet for each project, with tabs for field data and another for all data (including QA/QC samples;
2. Include a map with each spreadsheet identifying where each location is;
3. Make lat/long coordinates consistent among projects;
4. Include a key with each spreadsheet/database that defines every abbreviation/symbol; and
5. Include a separate MS Access database that covers all projects and includes a cover similar to what we have now but allow user to select data by project, QC, etc.

Joe Skorupa asked that PIs submit examples of their nest cards for review.

Action Items

1. CH2M HILL will provide separate spreadsheets with database dictionary and an Access database for entire program that includes a "front page" to allow user to select data by project, matrix, QC, etc. Data for each project will be populated and standardized in conjunction with PIs.
2. CH2M HILL to obtain examples of nest cards and forward to Panel.

Thursday, March 22, 2007

Objectives: Further develop plan for integrating/evaluating datasets to determine standard

Discussion of Deep Brine Samples

Jeff summarized the discussion and recommendations from the memorandum, titled *Evaluation of Sample Preparation and Spiking for the Great Salt Lake Selenium Sample, 2007* and dated March 21, 2007. See slides. General discussion items:

1. Panel asked that a conference call be facilitated among chemists involved in round robin (i.e., Frontier, Brooks Rand, et al.), Bill Johnson, and Dan Moore to discuss poor recoveries.
2. Samples should be analyzed by Frontier the same day they are prepared.
3. Frontier should complete the recommended analysis without oven prep and spiked with selenite, selenate and selenomethionine.
4. Bill Johnson and Dave Naftz should collect the additional samples as suggested in memo. Dave reported that these samples had already been collected, although Bill said it was found not to be feasible to open the cartridge filter for analysis of particulates collected.
5. Bill Johnson will use his ICP data for mass balance but will continue to send samples to Frontier. Bill agreed to send a spreadsheet with his analytical data for comparison. Bill will run splits of recent deep brine samples and send samples to Frontier for comparison.
6. We will need to decide how to split new deep brine samples for analysis by Frontier, UofU and USGS. These samples should wait until Frontier completes its evaluation and spiking with different forms of Se and with/without oven prep.
7. Current data will be presented for now with a note indicating low recoveries.

Action Items

1. CH2M HILL to communicate discussion to Frontier. Frontier to complete evaluation of prep method and spiking method.
2. CH2M HILL to facilitate a conference call with pertinent chemists to discuss results.
3. Bill Johnson to forward analytical data for comparison with Frontier's data.
4. New deep brine samples to be split and analyzed.

Discussion of Threshold Values Memorandum

Harry Ohlendorf summarized the results of the memorandum and led discussion of new ranges derived from new hockey stick statistical analysis provided by Bill Adams. This analysis was

completed using available duckling mortality data (as opposed to egg hatchability data from the same studies that Harry had used in his analyses presented in the tech memo).

Joe Skorupa stated that the hockey stick method was developed to find the cut point on the hockey stick. It was designed to be completed using actual data instead of adjusted values as apparently were used in Bill Adams' analysis. Joe said it is not appropriate to use the hockey stick method using adjusted values. Anne Fairbrother noted that the purpose of completing the analysis with the adjusted values was to try to hone in on the cut point by adjusting the data to remove "noise". Bill A. and Joe agreed to discuss the appropriate use of hockey stick analysis using adjusted values and perhaps to even re-analyze the complete data set with the method.

The degree of protectiveness that should be used was discussed next. Clean Water Act requires a process where the State adopts a water quality standard, in this case based on a recommendation from the Science Panel, and the EPA reviews and approves the standard if it is protective of uses.

There is no national guidance on what is protective of wildlife. The EPA has typically only developed criteria protective of aquatic resources. The 1985 guidelines for development of ambient water quality criteria and the wildlife criteria established through the 1993 Great Lakes Initiative identified standards that were protective of 95% of species, not specific to individuals, individual species or populations. The EPA has precedence for establishing criteria that do allow some effect (i.e., No Observed Effect Concentration as opposed to a true No Effect Concentration). The ammonia standard used an EC20 but this level of protection was likely driven more by data limitations rather than by policy. The draft Se criterion was thought to use an EC20, although Joe pointed out that it was developed from data that represent EC40 values. Bill Wurthele's recommendation to his supervisors will be that EPA not allow a standard that is higher (less protective) than EC10 for the prey base with bird egg hatchability as the critical end point. This value will then be translated to a water column value that can be used for permitting. The EPA is not looking to protect individual organisms or individual species populations. The State is free to select a standard with a higher level of protectiveness based upon its own risk management decision. The State will need to evaluate the level of precaution due to the need to address the level of uncertainty in the determination of a water quality standard. Bill will also recommend that the State use compliance monitoring to address some of the uncertainty and variability of the system and include periodic review and mechanism for adjustment. The State could also use a lower value to address uncertainty.

The EPA will not support the use of hormesis in setting a standard. Joe said that there is only one data set from Heinz that can be used to study the hormesis effect of Se in birds.

The Endangered Species Act requires, under Section 7, for the EPA to consult with the USFWS to obtain concurrence that the standard will not jeapordize the continued existence of listed species. The state is not involved in this process. Section 9 of the ESA requires terms and conditions if individuals are affected. The State will need to incorporate the uniqueness of the GSL in making its decision.

Bill Wurthele said he felt that a water quality standard was appropriate even with uncertainty in data. A new numeric standard will be better than no standard as we have now. The State can also include compliance monitoring as part of the standard.

Action Items

1. Bill Adams and Joe Skorupa to discuss hockey stick approach further. Bill may run analysis again with complete data set.

2. State of Utah to consider degree of protectiveness to be used.

Discussion of Data Integration Process

Jeff presented a hypothetical schedule to complete the project by September 2007. General discussion items:

1. There was general agreement that there are four parallel tracks in completing the remaining work: 1) integration and evaluation of 2006 sampling program, 2) completion of 2007 sampling program, 3) completion of Brine Shrimp Kinetics study, and 4) preparation of a summary report. Track 1 and 2 will converge in August 2007. Track 4 will be ongoing. Track 3 will converge with the others in October 2007.
2. It was agreed that a recommendation by September 2007 was too aggressive of a schedule. It was agreed that the Panel would make its recommendations in November 2007. The following meetings were scheduled:
    a. Conference calls: April 27, May 22, June 19
    b. Meetings in Salt Lake City: August 21 and 22, November 28 and 29

Harry presented summary of the data integration process. See slides. General discussion items:

1. Geometric mean should be used on the first pass of data evaluation, look at the distribution of data and complete sensitivity analysis to see what drives the system. Look at how much it can vary.
2. Look at probability bounds to bracket the range of transfer factors, high to low, low to high, and central tendency. There was discussion of whether this was the best method or if a Monte Carlo simulation should be completed to look at probability based on variability.
3. We should use a deterministic approach first to understand the data and then use Monte Carlo simulations or other analyses.
4. Joe Skorupa described "algebraic trick" to estimate how the BAF decreases with higher concentrations. He will provide reference to group. Joe also described his recent visit to the Hailstone NWR in Montana. The reservoir their has extremely high TDS, Se concentrations, and brine shrimp. The Panel agreed that this data would be useful in evaluating the GSL.
5. Martin Grosell's work will help determine relationship between water and brine shrimp.
6. CH2M HILL will prepare a memorandum to document and track variables/compartments/flux components in the conceptual model and the assumptions to be made in handling them.
7. Work from what we know reliably to what we don't know reliably. Fill in as needed to fit what we know.
8. Bill Adams is publishing paper on how to calculate variability in transfer factors.
9. Panel requested one spreadsheet for conceptual model with a "dashboard" up front that will allow user to toggle between alternative inputs. Model should allow the user to evaluate sensitivity of varying loads/concentrations and varying degrees of protectiveness.

10. Panel recommended the following projects to the steering committee with first cut cost estimates (costs to be confirmed with PIs and CH2M HILL):

    a. Spring Synoptic Survey (Brad Marden): $45,000. Purpose is to sample shrimp/seston/water and capture first growth cycle of shrimp.
    b. Gull survey: $35,000. Purpose is to verify nesting bird blood concentrations in 2 colonies on GSL and compare to "fresh water" reference colony.
    c. Shorebird survey: $30,000. Purpose is to trap 10 nesting female shorebirds, collect blood, liver, egg and verify blood concentrations, provide direct connection between blood and egg.
    d. Additional sediment cores: $30,000. Purpose is to determine sedimentation patterns and rates to better estimate sediment flux.
    e. CH2M HILL oversight/modeling: $??. Manage/review 2007 sampling program, additional requested analysis, extended schedule.
    f. Additional lab analysis: $40,000.

Action Items

1. Joe Skorupa to provide reference for algebraic estimation for BAF variability and data from the Hailstone NWR.
2. CH2M HILL to draft memorandum summarizing system variables/methods for discussion with PIs and submittal to Panel.
3. CH2M HILL to begin integration of complete datasets.
4. PIs to submit proposals for identified projects.

Friday, March 23, 2007

Joint Science Panel & Steering Committee Meeting

Meeting Summary to be developed by DWQ