

Utah Lake Water Quality
Study
Science Panel Meeting
July 11, 2019
Salt Lake City, UT

Data Gaps and Strategic Research Planning

Utah Lake Nutrient Criteria
Development Technical
Support



Objective

- There is no rush....but it doesn't hurt to start planning the next, great research need
- And these needs stem from data gaps related to charge to the Science Panel

Mapping Needs to Actions: Charge Questions

1. What was the historical condition of Utah Lake?

1.1. What does the diatom community and macrophyte community in the paleo record tell us about the historical trophic state and nutrient regime of the lake?

- Can diatom (benthic and planktonic) and/or macrophyte extent or presence be detected in sediment cores? And if so, what are they?
- What were the environmental requirements for diatoms and extant macrophyte species?
- How have environmental conditions changed over time?

1.2. What were the historic phosphorus, nitrogen, and silicon concentrations as depicted by sediment cores?

1.3. What information do paleo records (eDNA/scales) provide on the population trajectory/growth of carp over time? What information do the paleo records provide on the historical relationship between carp and the trophic state and nutrient regime of the lake?

1.4. What do pollen, resting spores, photopigments, DNA, midge head capsules, mollusks, and exuviae from zooplankton in the paleo record tell us about the historical water quality, trophic state, and nutrient regime of the lake?

Paleo RFP

Data Analysis (Plan)

Paleo RFP

Paleo RFP

Mapping Needs to Actions: Charge Questions

1. What is the current condition of Utah Lake?

2.1. What are the impacts of carp on the biology/ecology and nutrient cycling of the lake and how are those impacts changing with ongoing carp removal efforts?

- What contribution do carp make to the total nutrient budget of the lake via excretion rates and **bioturbation**? How much nutrient cycling can be attributed to carp?
- What is the effect of carp removal efforts on **macrophytes, nutrients, secchi depth, turbidity, and primary productivity**?
- How much non-algal turbidity and nutrient cycling is **due to wind action** versus carp foraging? **How much does sediment resuspension contribute to light limitation, and does wind resuspension contribute substantially in the absence of carp?**

Data Analysis

Gaeta Lab?

Data Analysis

Mapping Needs to Actions: Charge Questions

○ 2. What is the current condition of Utah Lake?

- 2.2. What are the environmental requirements for submerged macrophytes currently present at Utah Lake?

Data Analysis (Plan)

- What is the role of lake elevation and drawdown in macrophyte recovery? Are certain species more resilient to drawdowns and nutrient related impacts? Can some species establish/adapt more quickly?

- What is the relationship between carp, wind, and macrophytes on non-algal turbidity and nutrient cycling in the lake? What impact could macrophyte reestablishment have?

Data Analysis

Mapping Needs to Actions: Charge Questions

○ 2. What is the current condition of Utah Lake?

○ 2.3. What are the linkages between changes in nutrient regime and HABs?

- Where do HABs most frequently start/occur? Are there hotspots and do they tend to occur near major nutrient sources?
- Which nutrients are actually controlling primary production and HABs and when?
- If there are linkages between changes in nutrient regime and HABs, what role if any does lake elevation changes play?
- How do other factors affect HAB formation in Utah Lake (e.g., climate change; temperature; lake stratification; changes in zooplankton and benthic grazers and transparency)?
- What is the role of calcite “scavenging” in the phosphorus cycle?
- What is the relationship between light extinction and other factors (e.g., algae, TSS, turbidity)?

Data Analysis

Bioassay RFP

Data Analysis

Data Analysis

Sediment RFP

Data Analysis

Mapping Needs to Actions: Charge Questions

- **2. What is the current condition of Utah Lake?**
- 2.4. How do sediments affect nutrient cycling in Utah Lake?
 - What are current sediment equilibrium P concentrations (EPC) throughout the lake? What effect will reducing inputs have on water column concentrations? If so, what is the expected lag time for lake recovery after nutrient inputs have been reduced?
 - What is the sediment oxygen demand of, and nutrient releases from, sediments in Utah Lake under current conditions?
 - Does lake stratification [weather patterns] play a role in anoxia and phosphorus release into the water column? Can this be tied to HAB formation?

Sediment RFP

Sediment RFP

Mapping Needs to Actions: Charge Questions

- **2. What is the current condition of Utah Lake?**
- 2.5. For warm water aquatic life, waterfowl, shorebirds, and water-oriented wildlife:
 - Where and when in Utah Lake are early life stages of fish present?
 - Which species are most sensitive and need protection from nutrient-related impacts?

Mapping Needs to Actions: Charge Questions

- **3. What additional information is needed to define nutrient criteria that support existing beneficial uses?**
 - 3.1. For warm water aquatic life, waterfowl, shorebirds, and water-oriented wildlife
 - 3.2. For primary contact recreation
 - 3.3. For agricultural uses including irrigation of crops and stock watering

Mapping Needs to Actions: Charge Questions

- **Additional High-level Questions**

- **4. Is there an improved stable state that can be reached under the constraints of current water and fishery management?**

- **What would be the current nutrient regime of Utah Lake assuming no nutrient inputs from human sources? This question may require the identification of primary sources of nutrients.**
- **Assuming continued carp removal and current water management, would nutrient reductions support a shift to a macrophyte-dominated state within reasonable planning horizons (i.e., 30- 50 years)?**
- **If the lake stays in a phytoplankton-dominated state, to what extent can the magnitude, frequency, and extent of harmful and nuisance algal blooms be reduced through nutrient reductions?**

Model/Nutrient Budgets

Model/Nutrient Budgets

Mapping Needs to Actions: Models

Phosphorus model

