Utah Lake Authority FY 2023 Annual Monitoring Report

October 2023

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Eric Ellis, Executive Director
Addy Valdez, Conservation Biologist
Sam Braegger, Programs Manager
Jenna Ahern, Outreach Coordinator

WHO WE ARE

The Utah Lake Authority (ULA) works with government entities, property owners, stakeholders, and private parties to encourage recreation, facilitate improvements, and implement management strategies at Utah Lake. We do everything we can to make the lake a fun, safe, accessible place for everyone.

The Utah Lake Authority was founded to replace the Utah Lake Commission in 2022. We strive to promote multiple public uses of the lake and facilitate orderly planning and development in and around the lake.

We're lake lovers! Whether we grew up here or not, all of us have grown to love and appreciate the beauty and recreation Utah Lake has to offer. Our team sees the potential in the lake and want to do our part to improve any areas of concern and make sure that the lake is healthy and full of life.

We strive to:

Lead a cooperative effort to identify, fund and implement projects and programs to:

- Enhance the lake's ecosystems
- Recreational opportunities
- Thriving communities
- Encourage and promote multiple uses of the lake

Foster communication and coordination between ULA members and the public

- Promote resource utilization and protection
- Maintain and develop recreation access
- Monitor and promote responsible economic development

As we address these issues, we hope to protect, preserve, and enhance the lake for present and future generations to enjoy.

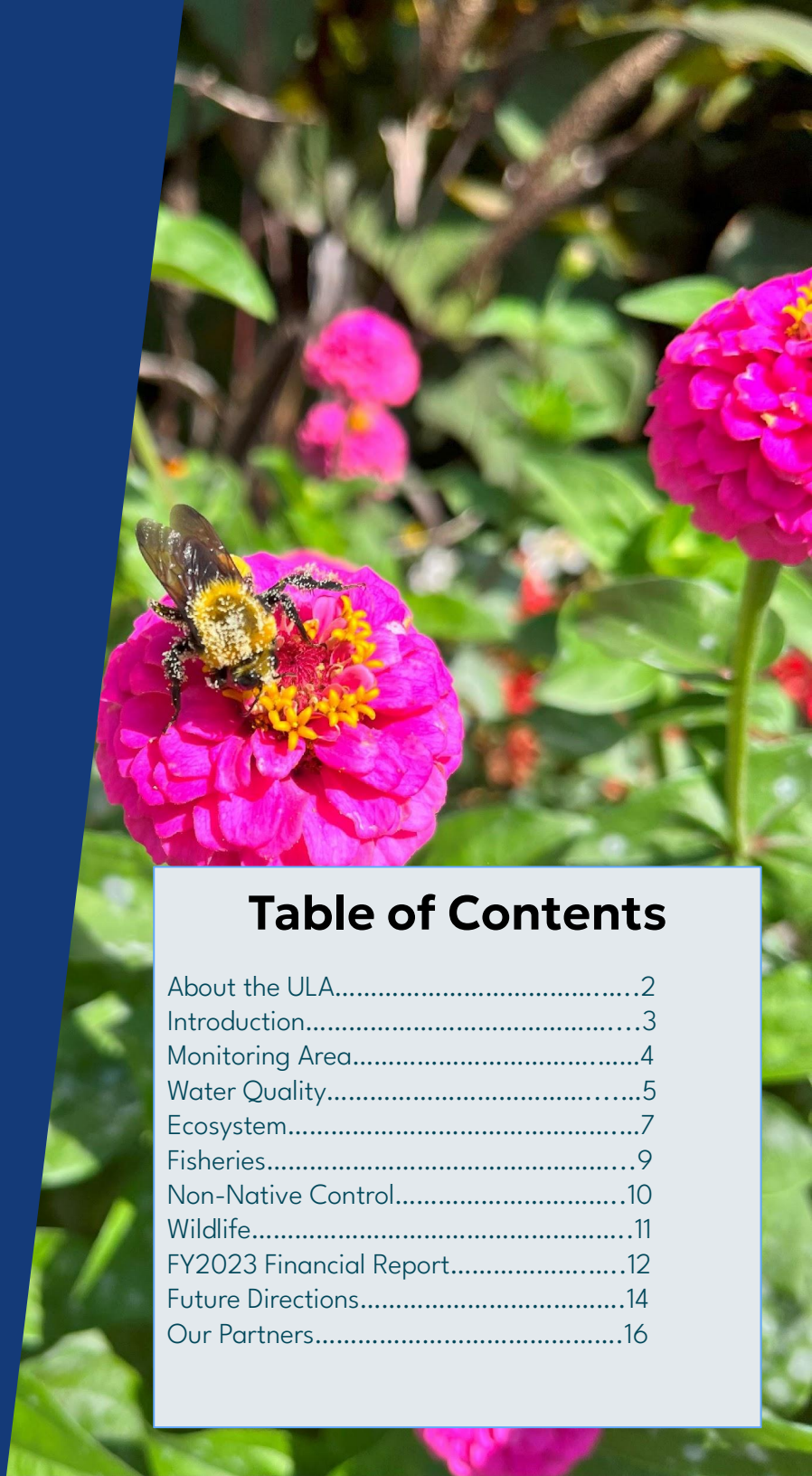
INTRODUCTION [12]

Utah Lake (Map 1), ranks as the third largest naturally occurring lake west of the Mississippi River. It encompasses an extensive surface area of approximately 148 square miles. Characterized by its shallowness, Utah Lake has an average depth of 9 feet. After millions of years, the lakebed has accrued sediment layers spanning thousands of feet, which significantly contribute to its shallow characteristics and the naturally turbid appearance it presents. The lake's water volume is profoundly influenced by the annual snowfall in Utah's mountainous regions, which accounts for nearly 98% of its inflow. During each summer season, the lake experiences a notable reduction in its volume, losing roughly one third to one half of its water content primarily due to evaporation, resulting in a decrease of three to four feet between June and September. Additionally, the lake's water level is subject to fluctuations based on the withdrawal of water from the lake itself and its tributaries for municipal and irrigation purposes.

Notably, this lake is enveloped by an urban corridor, and the population in its vicinity has experienced exponential growth over recent decades. Consequently, the influence of human activities on the lake's ecosystem has imposed strain on native fish populations, water quality, and shoreline vegetation.

For instance, the water quality of Utah Lake presents certain challenges; it falls under the category of impairment due to elevated levels of total dissolved solids and phosphorus, rendering it less than ideal for sustaining aquatic life. The lake's ecosystem, which once accommodated numerous fish species, now finds itself dominated by carp, and its capacity to offer suitable habitat for its sole remaining native fish species — the June sucker and the Utah sucker — has dwindled considerably. Nevertheless, recent endeavors aimed at the removal of non-native carp are progressively contributing to a positive transformation in this regard.

All data presented in this report is sourced from the 2022 calendar year



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Utah Lake in Proximity to Utah County and State Lines

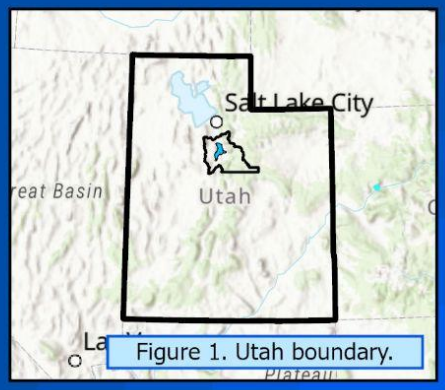


Figure 1. Utah boundary.

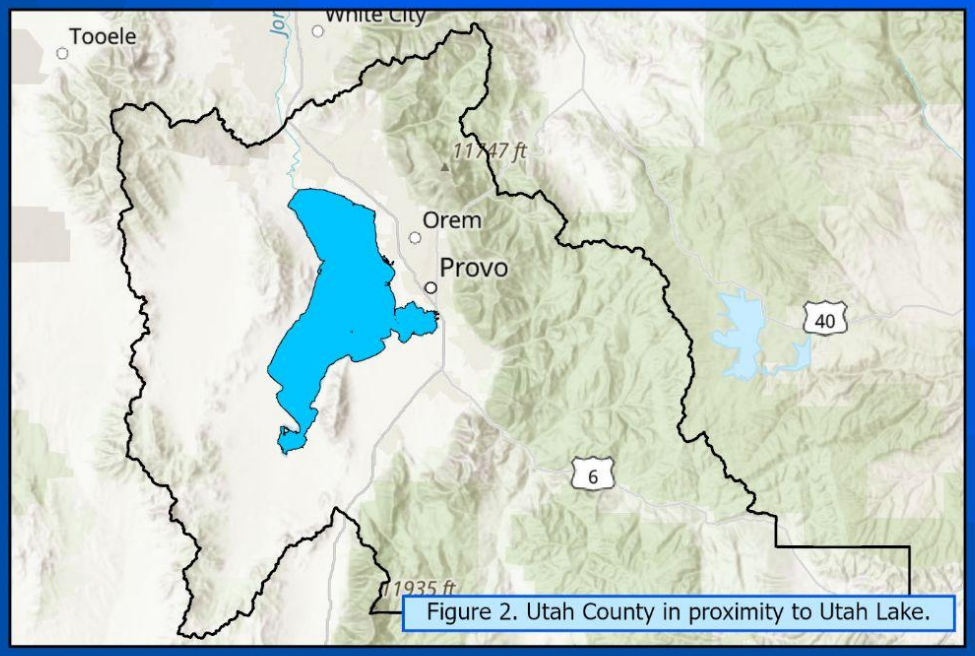


Figure 2. Utah County in proximity to Utah Lake.

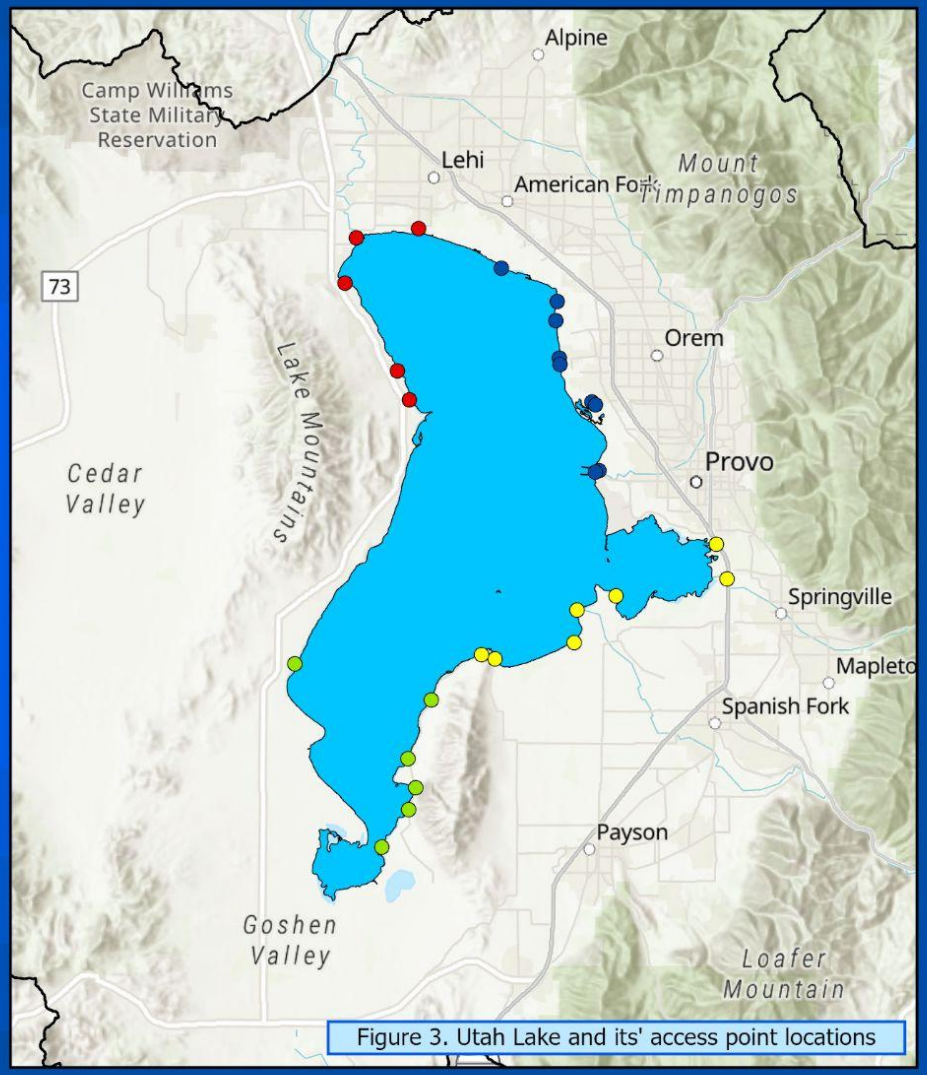


Figure 3. Utah Lake and its' access point locations

Map 1. Utah County and Utah Lake in proximity to each other with access point locations marked in four quadrants (northwest, northeast, southeast, southwest).

Water Quality Monitoring

USU and DWQ Monitoring[5]

- Data collection involved the use of a YSI Professional Plus multiparameter meter. Parameters such as conductivity, total dissolved solids (TDS), salinity, and pH values were collected just below the water surface. Additionally, dissolved oxygen and temperature profiles were recorded at various depths, starting from the water surface and measured in 0.5-meter increments down to the lake bottom (Image 1).
- Throughout the duration of the USU monitoring, the **concentrations of total phosphorus in the lake have not shown a decrease** and have remained at high levels, with a mean concentration of 0.17 mg/L in the year 2022 (Figure 4).
- There have been **no observed improvements in water clarity**, as indicated by the consistently low secchi depth (with a mean of 0.25 meters in 2022). Additionally, turbidity measurements have remained high, with a mean of 218 NTU in 2022, further indicating poor water clarity (Figure 4).
- **Desired Range**: UDWQ, ULA, and the Utah Lake Stakeholder community are developing water quality nutrient goals for the lake to protect and enhance recreation experiences, fish and aquatic life, and water used for agricultural production. These goals are being developed through a "multiple lines of evidence" approach. **A draft of water quality goals should be complete in 2024 and a water quality improvement strategy early 2025**. A parallel effort to develop a water quality improvement strategy to achieve water quality goals is also underway.

Harmful Algal Blooms[10]

- Due to ongoing drought conditions and another mild winter, the water level in Utah Lake remained low during the summer of 2022, creating favorable conditions for the development of Harmful Algal Blooms (HABs)(Figure 5).
- The Division of Water Quality (DWQ) conducted monitoring to assess the response of treatment efforts for HABs at Utah Lake State Park Marina.
- Two types of algaecide were used: Phycomycin, a peroxide-based treatment; and SeClear, a copper-based treatment (Image 2).
- **Nearly all of the treatments aimed at addressing Harmful Algal Blooms (HABs) were successful in reducing the levels of toxigenic cyanobacteria (Image 3). However, 34% of the cases, treatments did not succeed in bringing HAB cell densities below the health advisory threshold of 100,000 cells/mL.**
- The most effective approach to mitigate the harmful impacts on recreational uses in the lake is to reduce nitrogen and phosphorus inputs. However, it is possible that these efforts could be complemented or enhanced by implementing HAB treatment methods.

Image 1. Water sampling equipment used in ecosystem monitoring.

Image 2. Harmful algal bloom treatments at Lindon Marina.

Image 3. Example of visual difference between before and after algal treatment.

Water Quality Monitoring Graphs

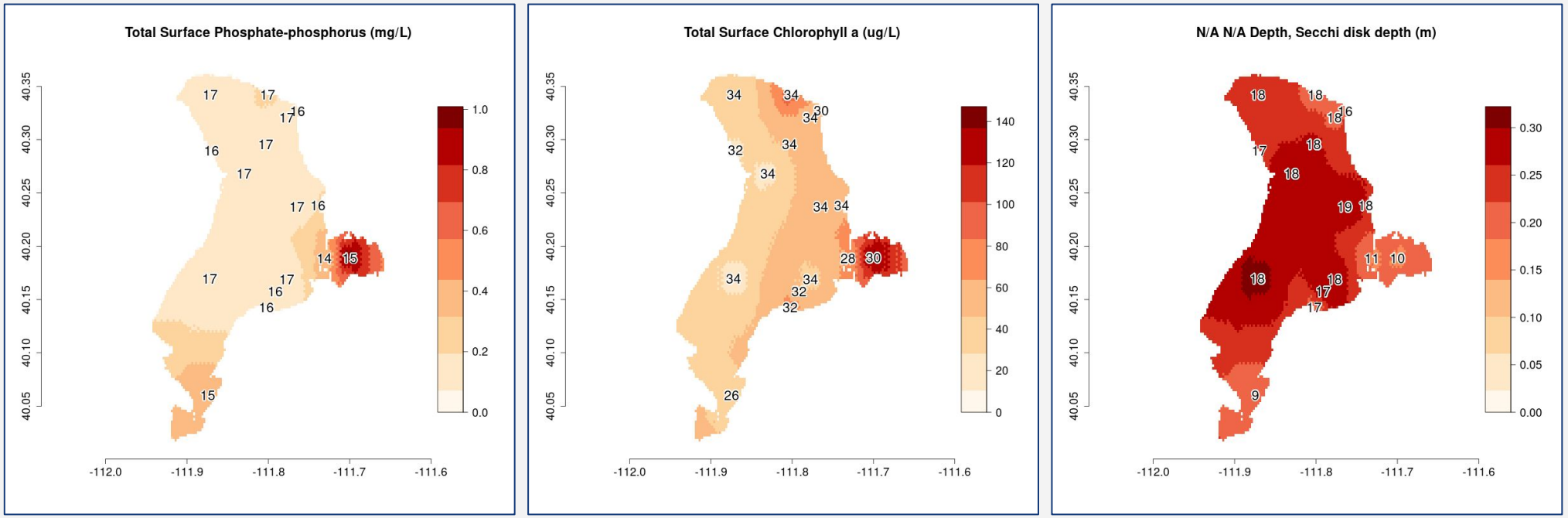


Figure 4. Interpolated graphs depicting total surface phosphorus concentration, total chlorophyll a concentration, and secchi disk depths on Utah Lake in calendar year 2022. Public data obtained from Utah Lake Data Explorer (2023).

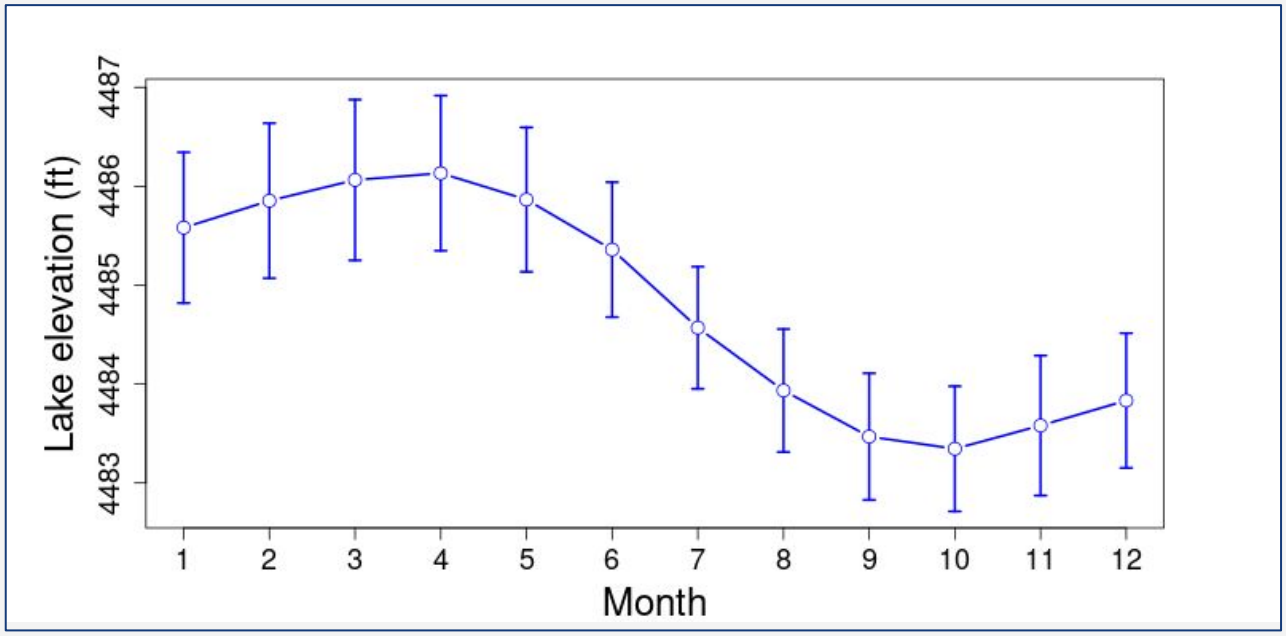


Figure 5. Utah Lake elevation changes throughout the 2022 calendar year. Public data obtained from Utah Lake Data Explorer (2023).

Ecosystem Monitoring

Macroinvertebrates[5]

- **Changes in the biomass of macroinvertebrates in Utah Lake were strongly linked to the biomass of carp populations and the lake's water level.** Macroinvertebrate biomass was notably higher in areas with aquatic plants (macrophytes) compared to areas with bare sediment. This could be attributed in part to the availability of habitat provided by macrophytes.
- Data also suggested that when lake levels decreased, certain mobile species like the predatory Corixidae had to adapt by using open water habitats more often.
- A decrease in carp biomass was associated with an increase in Chironomid biomass. Chironomids were the primary prey (food source) for carp in the lake, as well as for other fish species.
- While there was a rise in macroinvertebrate biomass in 2016 due to an increase in macrophyte species diversity, subsequent years have seen a plateau in biomass levels. This stagnation can be attributed to the absence of sustained growth in macrophyte diversity throughout the entire lake.

Macrophytes[5]

- Four sampling locations — Provo River Delta Restoration Project, Powell Slough, Skipper Bay, and Provo Bay — were established for monitoring potential change in the near-shore macrophyte community.
- At the landscape level, imagery results showed no significant changes in emergent and submerged vegetation due to Phragmites and carp removal, with lake level being a more significant driver of vegetation changes. However, changes in carp biomass and Phragmites can influence the macrophyte community at the site level.
- **While there has been an increase in species richness, there hasn't been a substantial increase in macrophyte coverage as a result of carp removal efforts.**
- Since 2017, both the diversity of macrophyte species and the density of submerged macrophytes have declined as carp biomass has rebounded.

Image 4. Jar containing a macroinvertebrate sweep sample.

Image 5. Macroinvertebrate sampling equipment.

Image 6. A bulrush species observed during macrophyte sampling.

Ecosystem Monitoring

Zooplankton[5]

- Carp population biomass had a slightly stronger impact on the total biomass of zooplankton compared to lake level, but lake level had a more pronounced effect on the biomass of specific zooplankton species than carp biomass did.
- There was an observed shift in the composition of the zooplankton community, favoring larger-bodied species over smaller ones, coinciding with a decrease in carp population biomass.
- Overall, the results suggest that carp removal has altered the dynamics of both primary producers, with increased Chlorophyta densities and primary consumers, with a shift toward dominance by larger-bodied zooplankton species in Utah Lake.
- **Continued efforts to control carp populations could positively reshape the entire food web and move the ecosystem closer to a more desirable state, particularly in support of June sucker conservation (Figure 6).**

Fish Populations[5]

- While initially hypothesized that reducing carp biomass would lead to an increase in sport fish biomass, results did not align with this expectation. Instead, it was found that the biomass of most sport fish species increased with low lake levels. *This discrepancy might be due to high water conditions affecting sampling efficiency.
- **During periods of low carp biomass, June sucker exhibit a significant improvement in their body condition, likely because they face less competition for their preferred prey resources.**
- Among the various fish species studied, white bass is the only one that shows a substantial increase in catch rates when carp biomass is reduced.
- There has been no observed increase in young-of-year June sucker, even though catch rates and the spawning abundance of adult June sucker have risen in recent years.

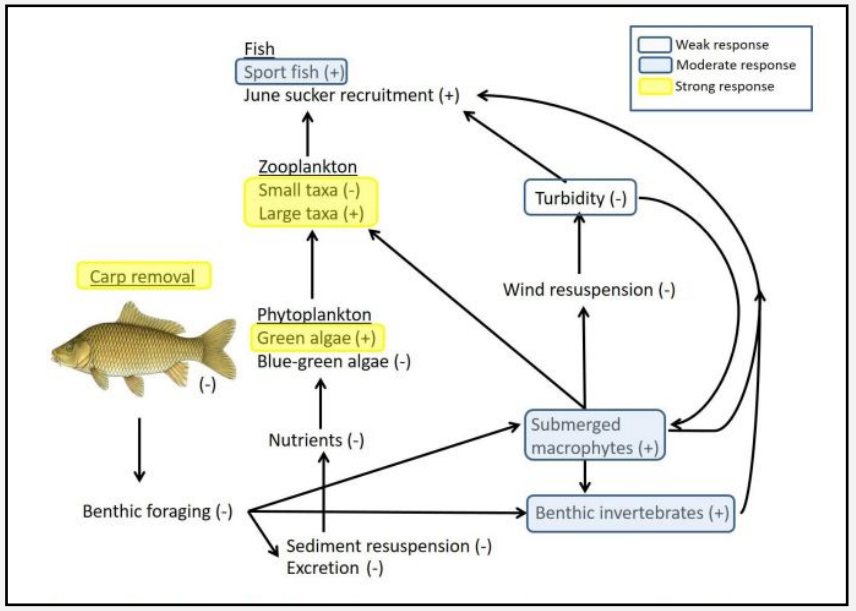


Figure 6. Conceptual flow diagram of Utah Lake that depicts predicted ecosystem responses of carp removal. (+) = predicted increase, (-) = predicted decrease. Figure obtained from Landom (2023).

Images 7 & 8. Zooplankton collection methods and sample.

Image 9. USU sampling boat (Greta) with fishing seine attached.

Fisheries

June Sucker Recovery[7]

- **The count of 5,199 suckers observed in the Provo River in 2022 marks a continuation of the upward trend in detections**, following 4,228 in 2021 and 2,471 in 2020. In total, there has been a substantial 110% increase in individual detections since 2020. In contrast, between 2016 and 2020, the numbers remained steady, ranging from approximately 2,000 to 2,500.
- Recent increases in detections may be attributed in part to alterations in the stocking program. Commencing in 2017, the Fish and Environmental Services (FES) initiated stocking fish at a larger size of 300mm, deviating from the previous target of 200mm. Another possible explanation for the surge in Provo River detections in recent years could be linked to a concurrent decline in the utilization of other tributaries.
- **In 2022, the collection of larvae was notably limited,** likely due to a diminished spawning run, with only a few dozen detections recorded.
- Despite the earlier presence of larvae, **no juvenile June suckers were captured in 2022**. This absence of juveniles appears to be a consequence of a reduced number of spawners.

Pike Removal[6]

- In 2022, the primary focus of pike monitoring activities revolved around three main objectives: providing support to Marsh and Associates in their telemetry research and related initiatives, executing strategies to remove juvenile and adult pike from concentration zones, and implanting sonic tags as part of the telemetry study.
- **A total of 52 northern pike were caught during the year.** Among these, eight were identified as juveniles, exhibiting sizes within the range of 225–255mm. Two out of the 52 pike that were collected had tags implanted.
- The number of adult pike collected has continued to rise over the past few years to an alarming level. Control efforts will need to be intensified to reflect the risk they represent to the June Sucker and other fish species.

Image 10. Adult June sucker caught during spring trammel netting.

Image 11. Seining of Hobble Creek for larval June suckers in the fall.

Image 12. Larval June sucker in aerated tank,

Image 13. Adult northern pike implanted with radio-telemetry tag.

Non-Native Removals

Carp Management [13]

- Field surveys in 2022 showed higher carp catch rates compared to 2019 and 2020, however, **biomass removed in years 2020 - 2022 remained substantially lower than previous years of removal** (Figure 7).
- Carp body condition improved in 2022, surpassing levels observed in 2012–2014 but remaining below the peak condition observed in 2016.
- **Carp biomass was at its lowest in 2017, estimated at around 30% of the 2009 biomass. However, USU modeling suggests that by 2022, carp biomass increased to approximately 60% of the 2009 level.**
- USU population models also indicate that high water years result in greater per capita carp recruitment compared to low water years, leading to the production of increasing carp recruitment classes in both 2019 and 2020
- Efforts are underway to explore alternative carp control methods, including different harvesting techniques, targeted baits, genetic technology, and lake-level management.

Phragmites Treatment & Monitoring

- **An evaluation of the entire shoreline revealed that 3,828.48 acres required and received herbicide treatment to control Phragmites regrowth**.[3]
- Marsh Masters utilized roller choppers and mowers to complete the smashing and mowing treatment on 1,241.33 acres of the shoreline (Image 13). A total of 64.5 acres of invasive trees and tamarisk were successfully removed in 2022. [3]
- **In areas where the regrowth of Phragmites was limited, seeding was applied to 136.18 acres. [3]**
- UDAF has established 23 line transects: 14 treatment transects, 6 references, and 3 control monitoring points to get a better idea of the restorative change over time on Utah Lake. [1]
    - Project goals have been met as >20% non-noxious plant cover and <20% Phragmites cover of transects have been attained (Figure 8).[1]

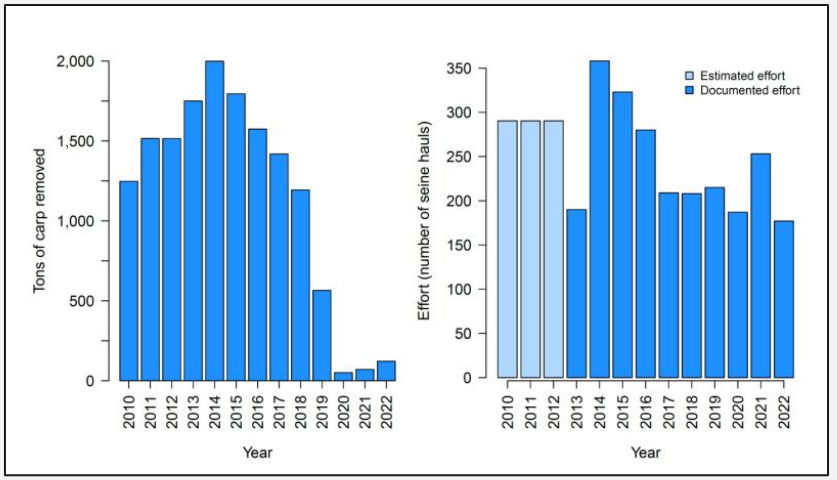


Figure 7. Biomass of removed carp (left) and commercial removal effort (right). Data was used in creating Utah Lake carp population model. Figure obtained from Walsworth (2023).

Image 13. Marsh Master being driven in wetland zone.

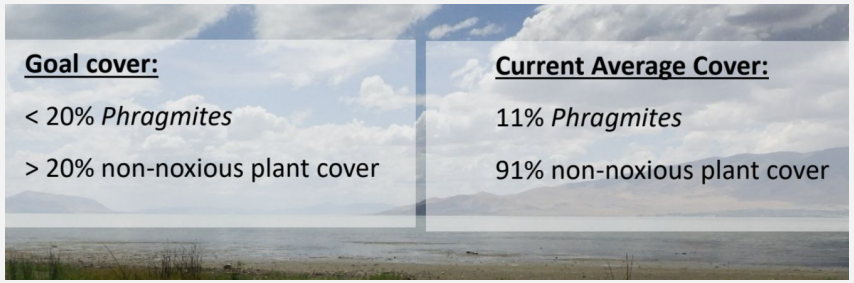


Figure 8. UDAF project vegetation cover goals compared to current average cover of transects. Obtained from Duncan UDAF report.

Wildlife Management & Monitoring

Mosquito Abatement [8]

- Utah County Mosquito Abatement (UCMA) applies integrated mosquito management (IMM) in order to reduce the quantity of mosquitoes while still maintaining environmental quality. IMM is a monitoring-based control and prevention strategy that stays up to date with modern treatment technologies.
- UCMA conducts surveillance by gathering population metrics, locations, and species.
- **Among the 15 carbon dioxide traps that were monitored weekly from June to September, over 17,129 mosquitos were captured total.**
- Over 46% of species caught were *Ochlerotatus dorsalis;* 26% were *Culex pipiens*; and 19% were *Culex tarsalis*.

Image 15. Carbon dioxide emitting mosquito trap.

Bird Monitoring [2]

- A total of twenty-two distinct monitoring locations are visited on a thrice-weekly basis in the Provo River Delta Restoration Project.
- Skilled observers are tasked with identifying species, pinpointing their positions, noting their elevations, assessing their habitat preferences, tracking their flight directions, and capturing other relevant metrics.
- **In year six 134 distincts species were identified in the delta with a total of ~295,000 observations. Passerines were the largest guild of bird species observed with 44 species.**

Image 16. Ruby-crowned kinglet caught with a mist net.

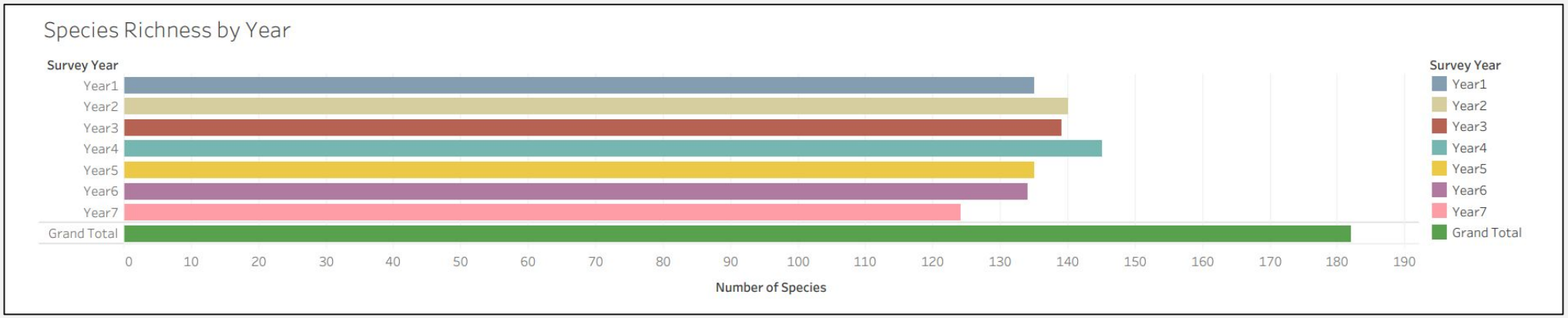


Figure 9. Changes in bird species richness across monitoring years in the PRDRP. Data publicly obtained from PRDRP Bird Monitoring Dashboard.

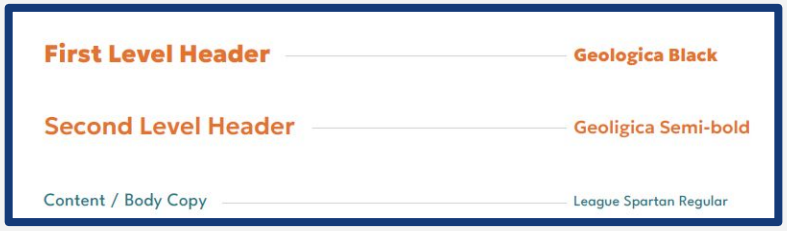
Budget & Projects

FY2024 Budget Update

Ongoing ULA appropriation: $1.5M

Consulting Services

- Management plan creation (final plan to be adopted at the December 7, 2023, Governing Board Meeting
- ULA branding package: completed and adopted



4th Grade Field Trips (Spring & Fall)

- ~1,300 students combined

Utah Lake Festival 2023 and Sailboat Regatta

- Back for the first time since 2019!

Shoreline Restoration

- $140k ULA investment, leveraged with partners for a ~$500k shoreline restoration project (DNR Watershed, UDAF, Utah County, FFSL)
- Treatment of over 3,800 acres
- Achievement of targets around the lake monitoring sites: less than 20% Phragmites cover and greater than 20% non-noxious plant cover
- Order of 9,800 wetland plugs and more than 400 native trees for a major planting effort this coming spring
- $40k order of native and desirable seed mix for suitable areas of the Utah Lake shoreline

Budget & Projects

FY2024 Budget Update

Ongoing ULA appropriation: $1.5M

Other Events

- Lake-wide Scavenger Hunt (hundreds of participants from around the county)
- Full-day Utah Lake Symposium at UVU Clark Building

ULA Small Grant Program

- $60k to incentivize lake recreation programs
- Planned for a December release

Algae Treatments

- Two marinas were treated this year with great success. This is a $313k contract that extends to spring of 2024.

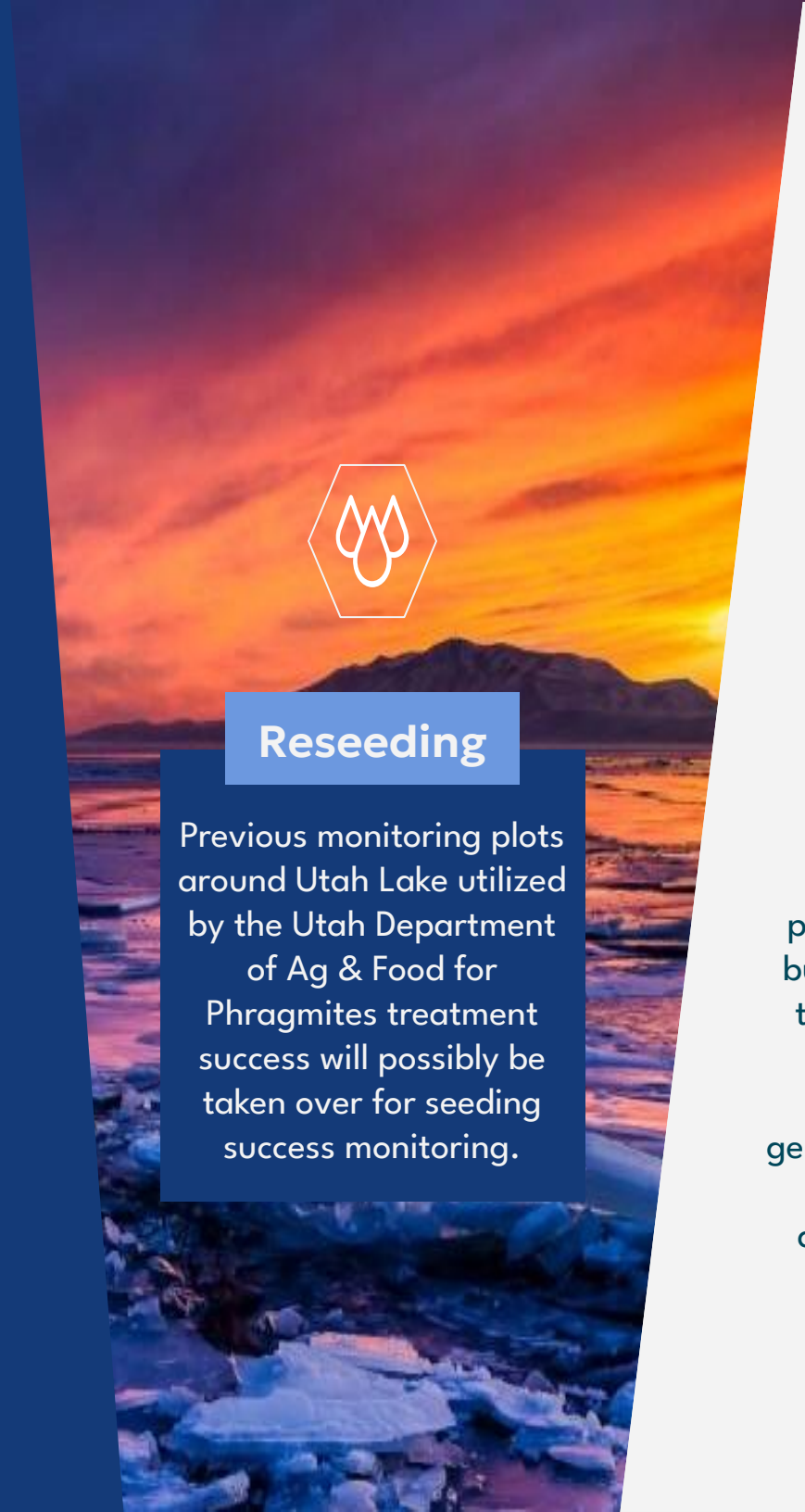
Access Enhancements

- ULA budgeted $750k for access enhancements. Working with partners and land managers, four sites were selected for access enhancements. The RFP is prepared and awaiting responses for winter/spring construction

Future Projects of Utah Lake Authority

Revegetation

Utah Lake's shoreline is ready for revegetation in select areas. A few strategies for restoration will be utilized: locally sourced seed will be grown out as education outreach, native seed will be spread via marsh masters, and native plugs will be outsourced from nurseries to plant in large community events.



Reseeding

Previous monitoring plots around Utah Lake utilized by the Utah Department of Ag & Food for Phragmites treatment success will possibly be taken over for seeding success monitoring.

Re-evaluation

Strategic partners are collaborating to create a comprehensive carp removal plan. Previous efforts are being built upon in order to determine the best approach for effective carp elimination. Ideas being explored include biocontrol, genetic manipulation, innovative mechanical removal methods, and netted bait traps to create an integrated lake level pest management program.

Citations

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Utah Lake Partners

U.S. Bureau of Reclamation, Provo Area Office
U.S. Department of Agriculture
U.S. Department of the Interior
U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Geological Survey
Utah Department of Transportation
Utah Department of Natural Resources
Utah Division of Wildlife Resources
Utah Division of Parks and Recreation
Utah Division of Forestry, Fire and State Lands
Utah Division of Water Rights
Utah Geological Survey
Utah Division of Water Quality
Utah Governor's Office of Management and Budget
Utah Natural Heritage Program
Central Utah Water Conservancy District
Salt Lake County
Utah County
Provo City
Provo River Delta Restoration Project
Salt Lake City
Springville City
Jordan River Commission
National Audubon Society
The Nature Conservancy in Utah
Trust for Public Lands
Utah Open Lands
Brigham Young University
University of Utah
Utah State University