



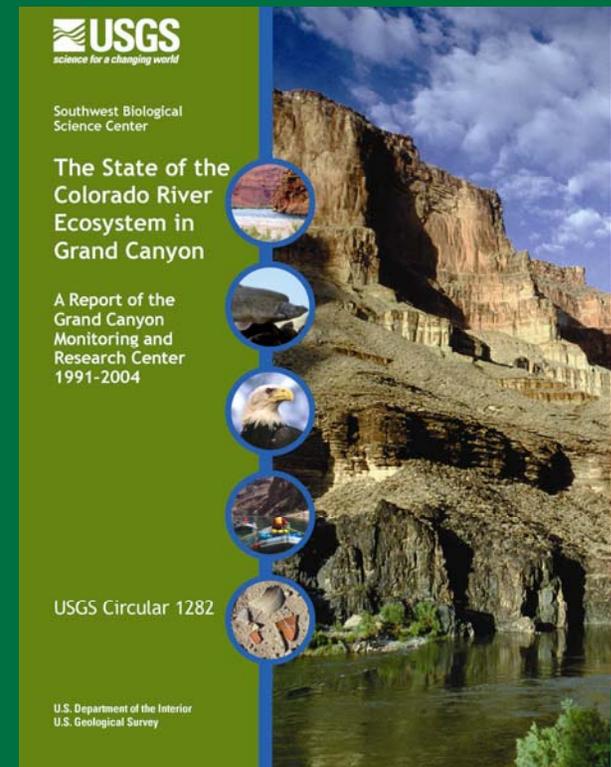
# Water Quality in Lake Powell and the Colorado River

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Colorado River Ecosystem  
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U.S. Department of the Interior  
U.S. Geological Survey



<http://www.gcmrc.gov/products/score/2005/score.htm>

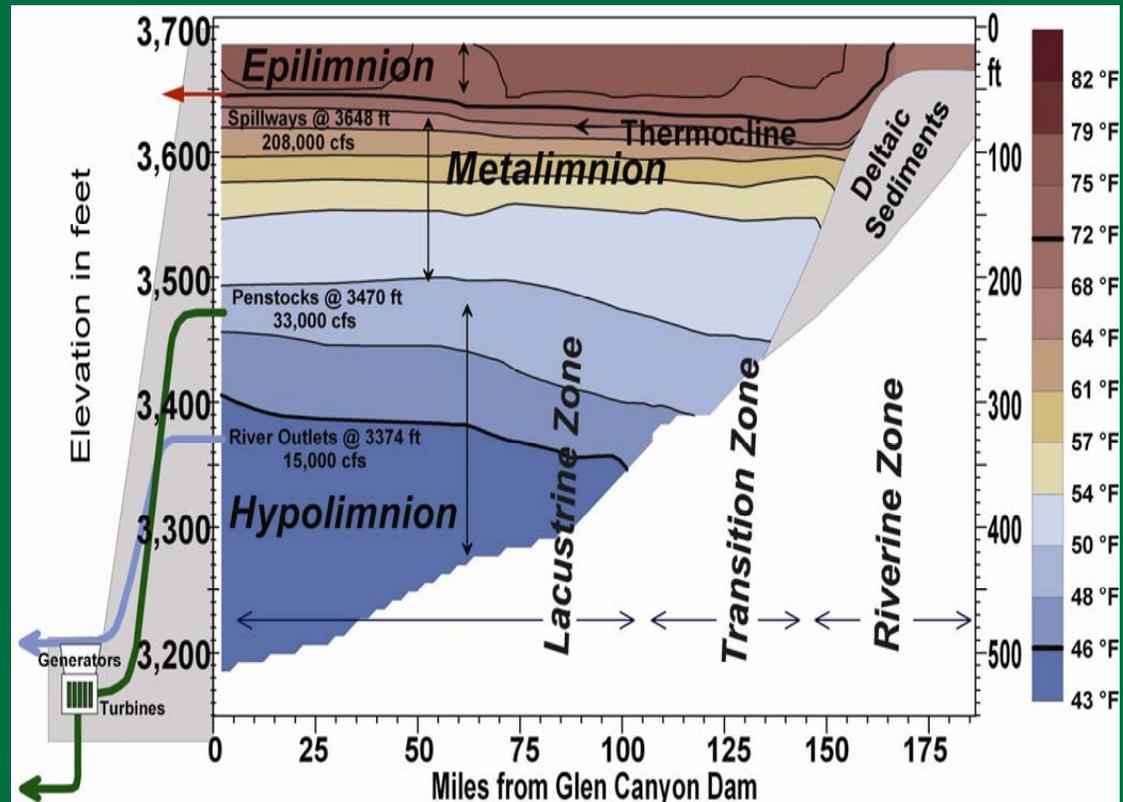
# Outline of Presentation

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- Background Information
- GCMRC Water Quality Monitoring Program
- Lake Powell History
- Release Temperatures and Warming Patterns
- Nutrient and Plankton Concentrations

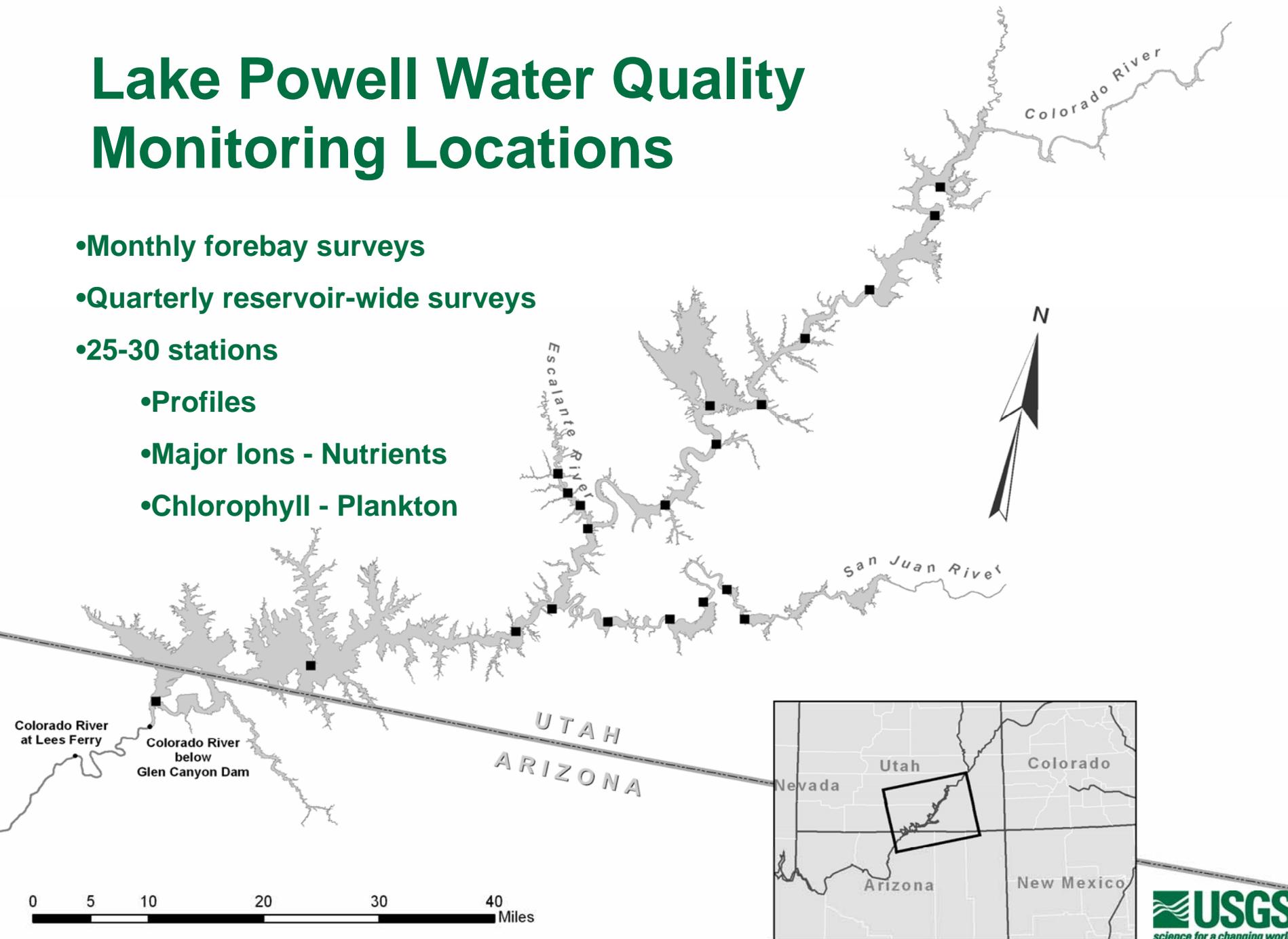
# Lake Powell and Glen Canyon Dam

- 3 Discharge structures
- Reservoir stratified by density
- Longitudinal zonation



# Lake Powell Water Quality Monitoring Locations

- Monthly forebay surveys
- Quarterly reservoir-wide surveys
- 25-30 stations
  - Profiles
  - Major Ions - Nutrients
  - Chlorophyll - Plankton



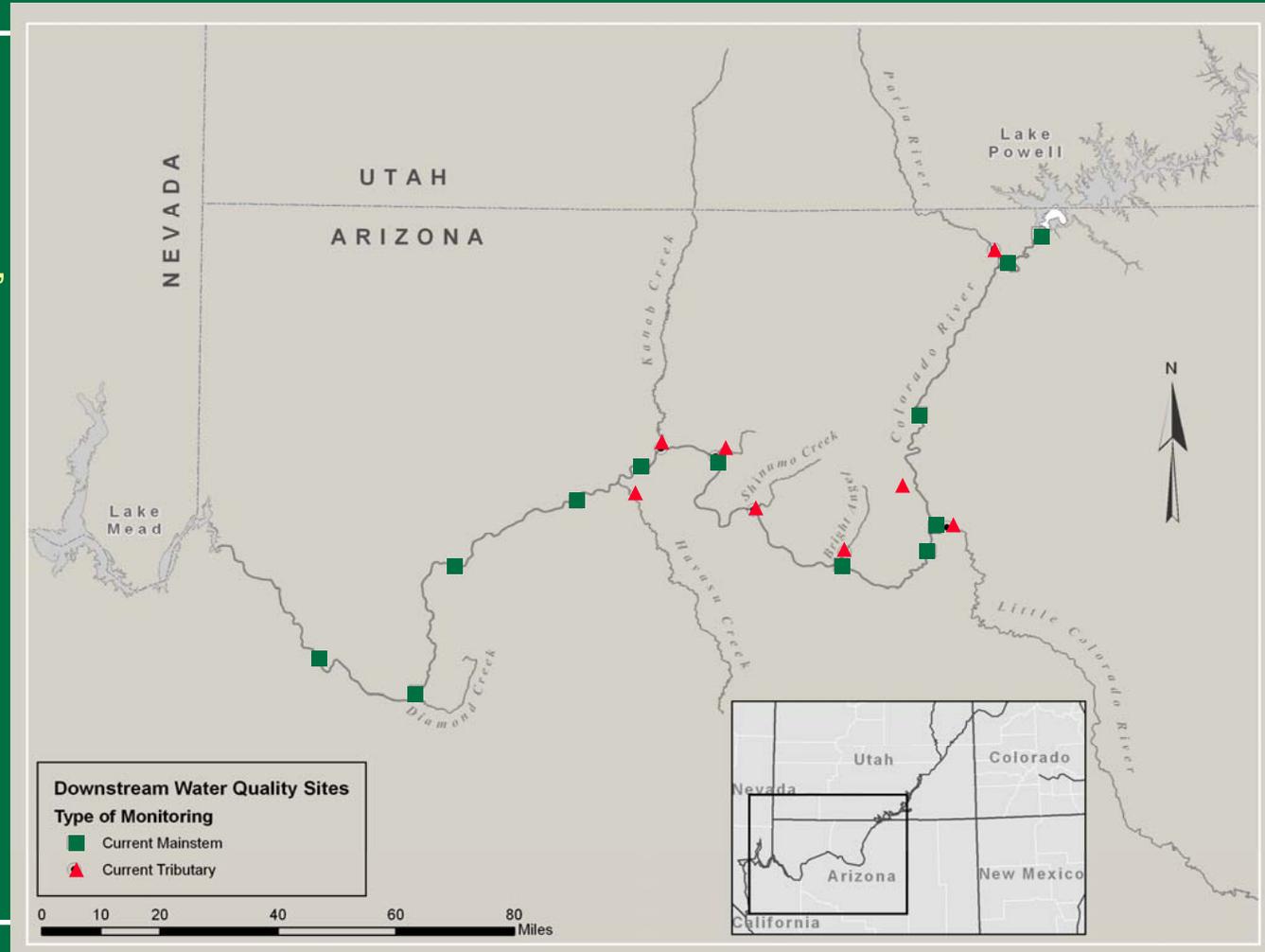
# Grand Canyon Water Quality Monitoring

## •Tailwater

- Continuous monitoring since 1990 (T, Sp. Cond, DO, pH)
- Monthly chemical and biological sampling

## •Grand Canyon

- Mostly thermal
- 10 mainstem
- 8 tributary
- Since 1992-1994



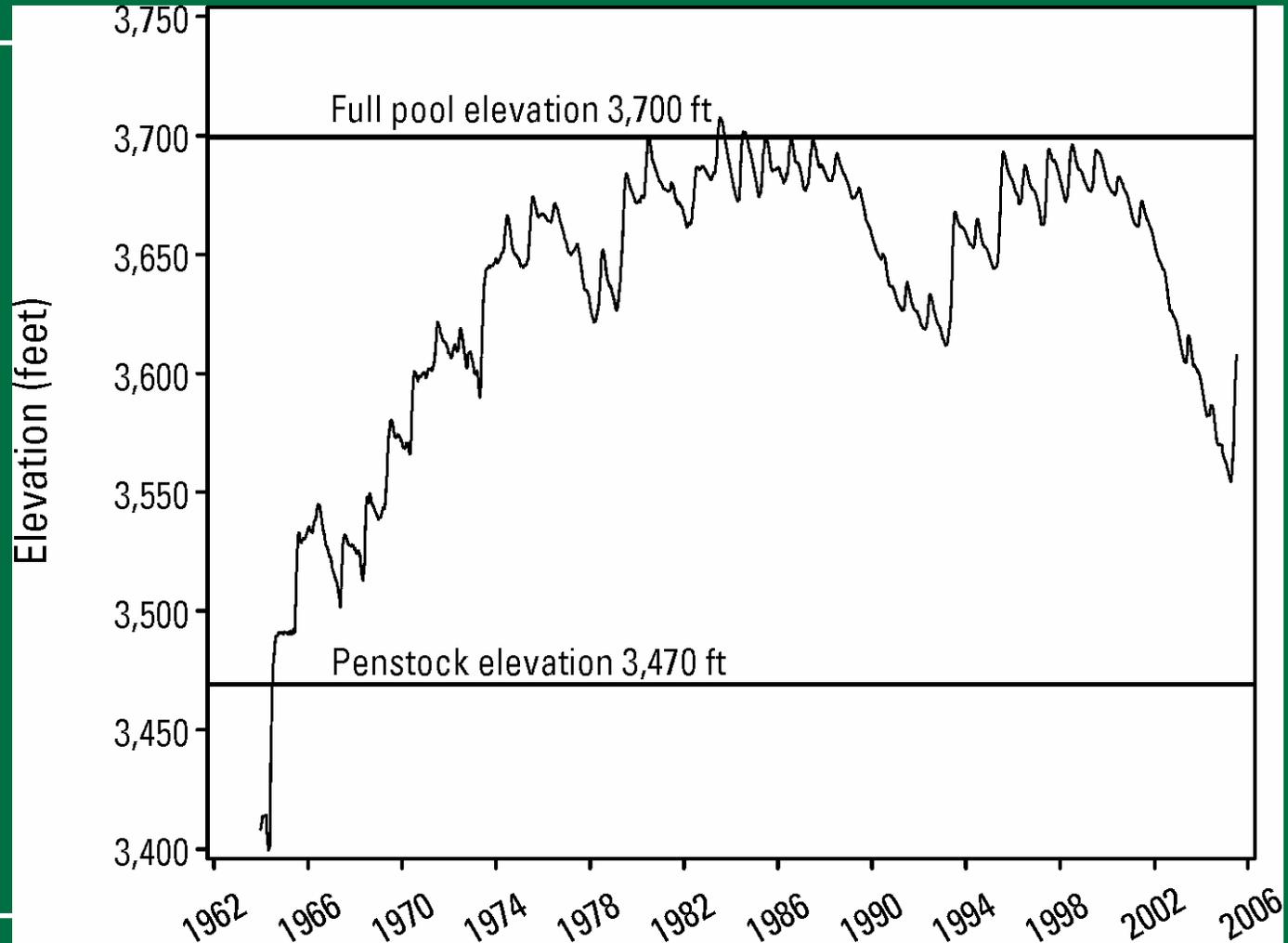
# Water Quality Monitoring Parameters

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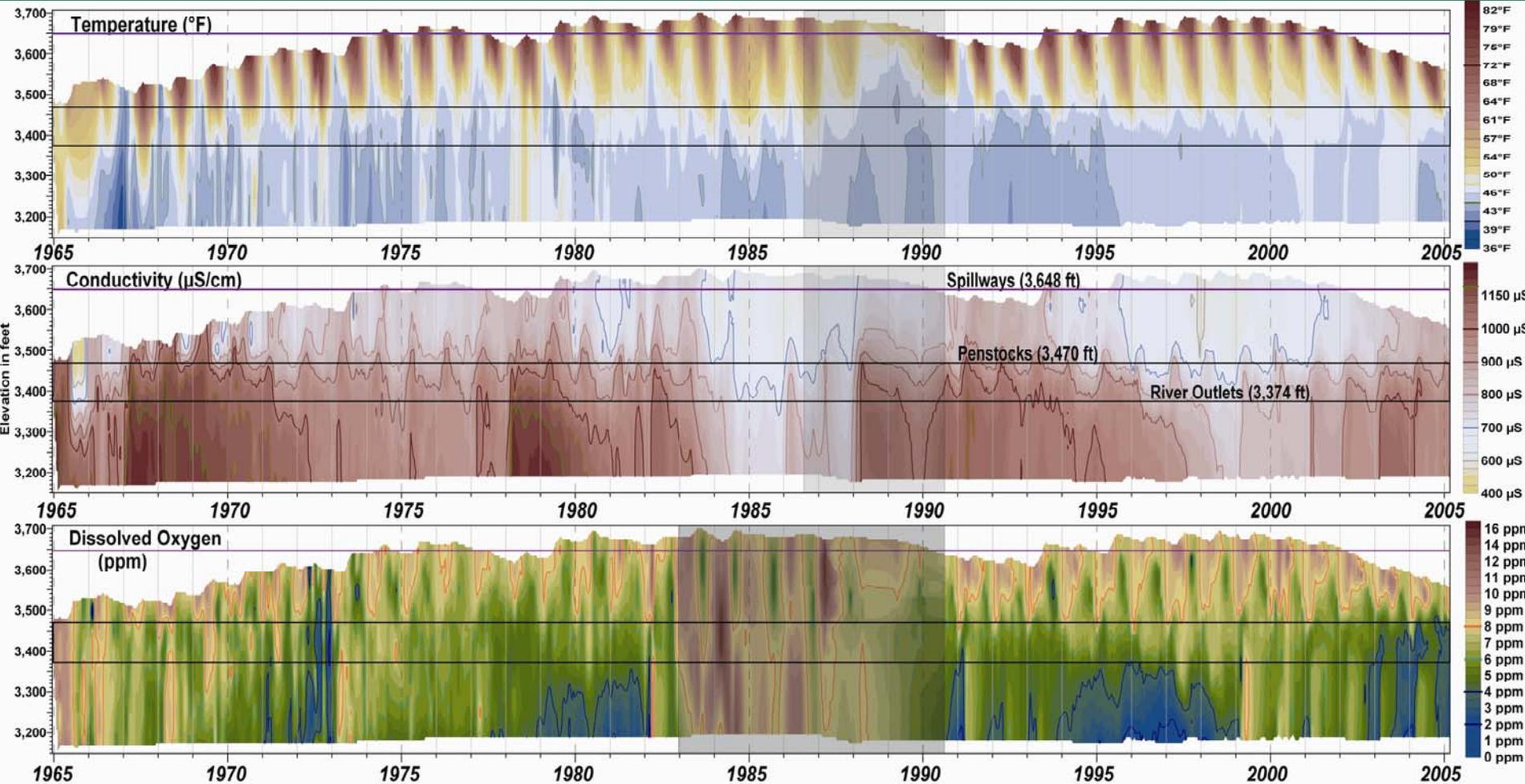
- **Temperature**
  - Affects density and fate of currents through reservoir
  - Affects aquatic life in downstream environment
  - Effects to HBC primary reason for selective withdrawal structure
- **Dissolved oxygen**
  - Supports aquatic life in downstream ecosystem
  - Affected by organic material and respiration
  - Affected by primary productivity
- **Nutrients**
  - Affect primary productivity (photosynthesis) in reservoir and downstream ecosystem
- **Major Ions**
  - Affects density and fate of currents through reservoir
- **Biology – Chlorophyll, plankton**
  - Reflective of primary production in reservoir
  - Available for export to aquatic food base

# Lake Powell Surface Elevation

- Glen Canyon Dam completed in 1963
- Full pool in 1980
- Droughts in late 1970s, early 1990s, and 2000-2004

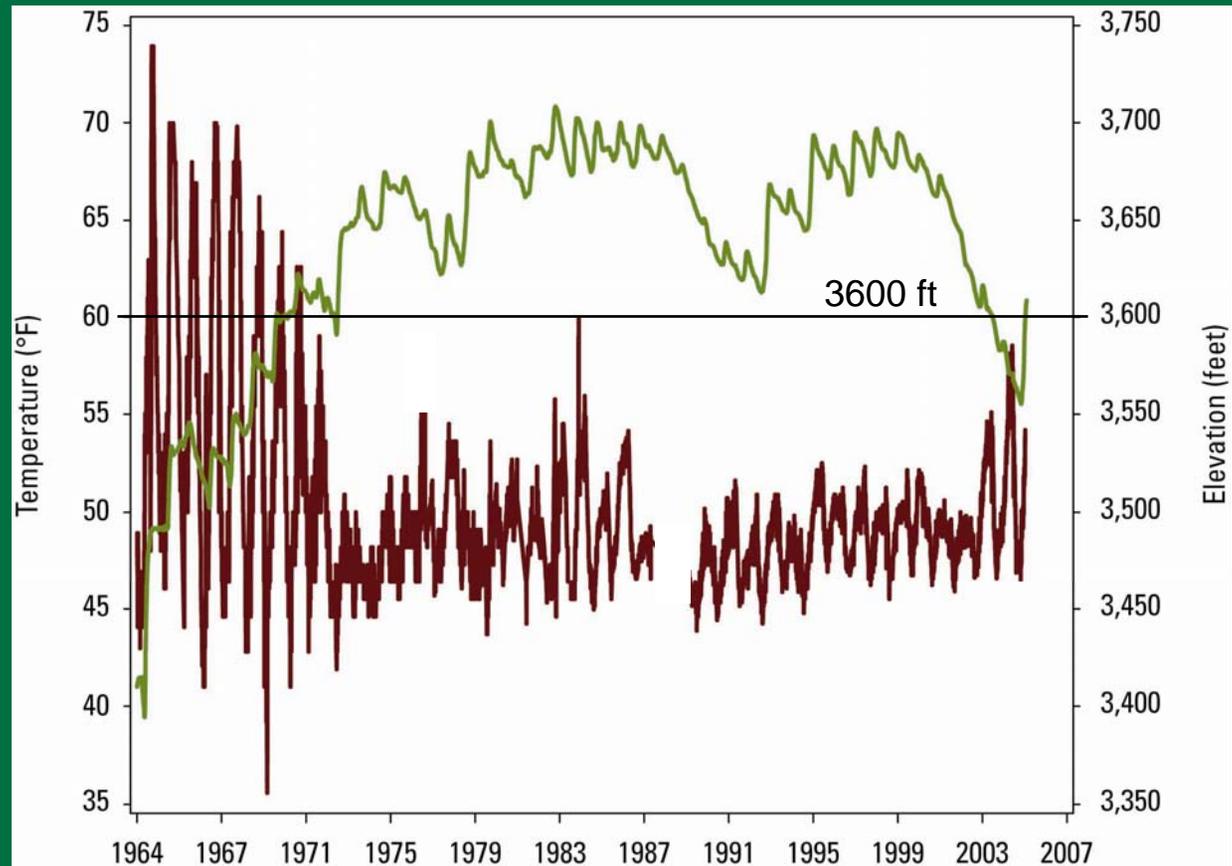


# Lake Powell Water Quality History



# Glen Canyon Dam Release Temperature

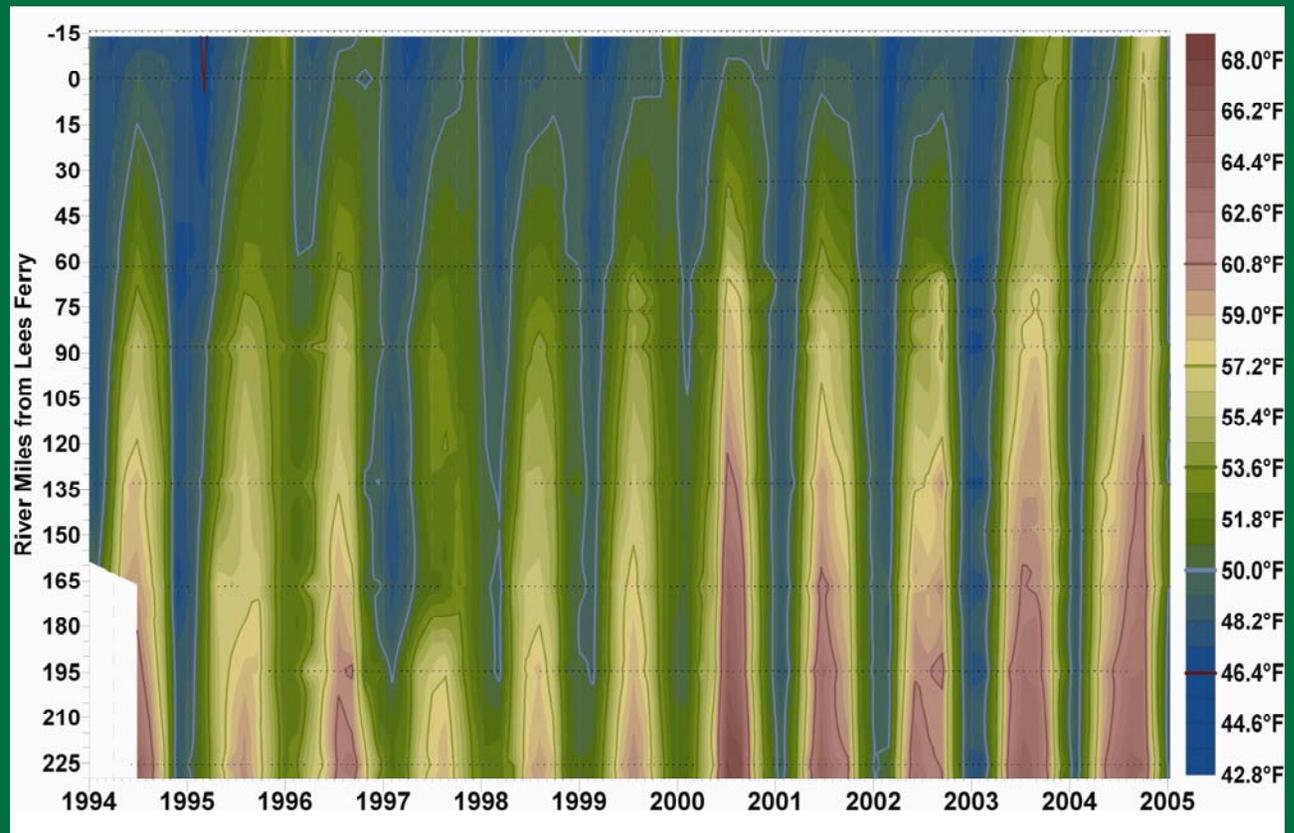
- Temperature fluctuations confined at higher reservoir levels
- Warmest temperature in winter from reservoir mixing
- Recent release temperatures highest since 1971
- Current 2005 temperature 60 °F



# Grand Canyon Temperature

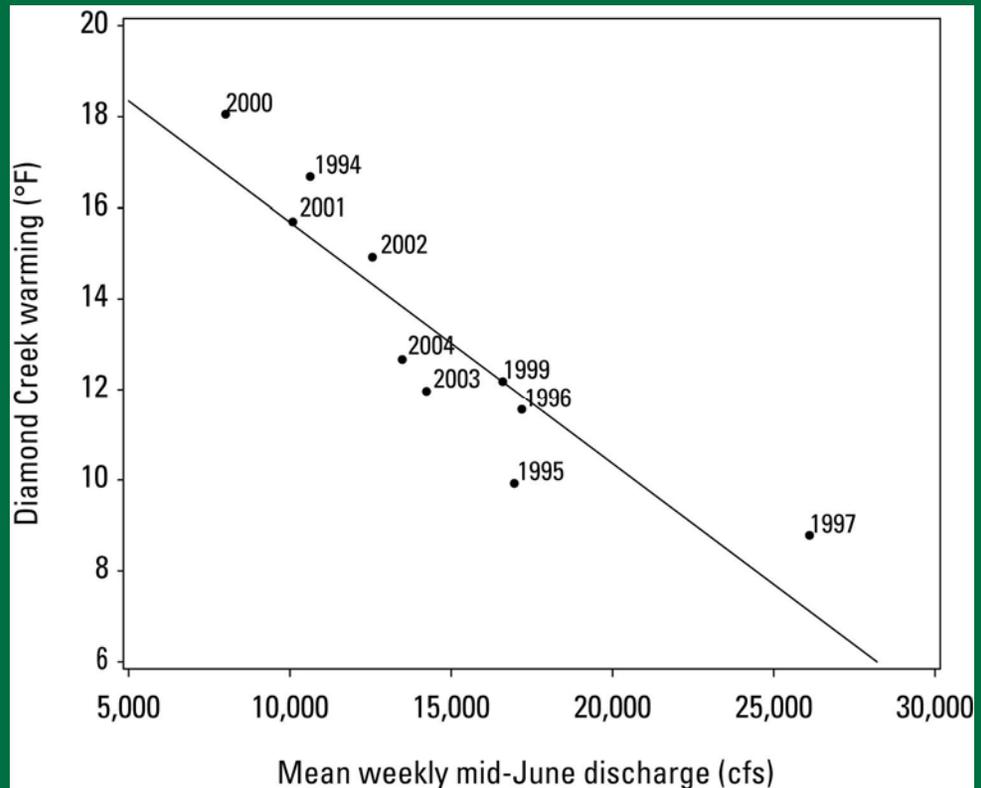
Affected by:

- Time of year
- Glen Canyon Dam Release Temperature
- Discharge



# Grand Canyon Warming

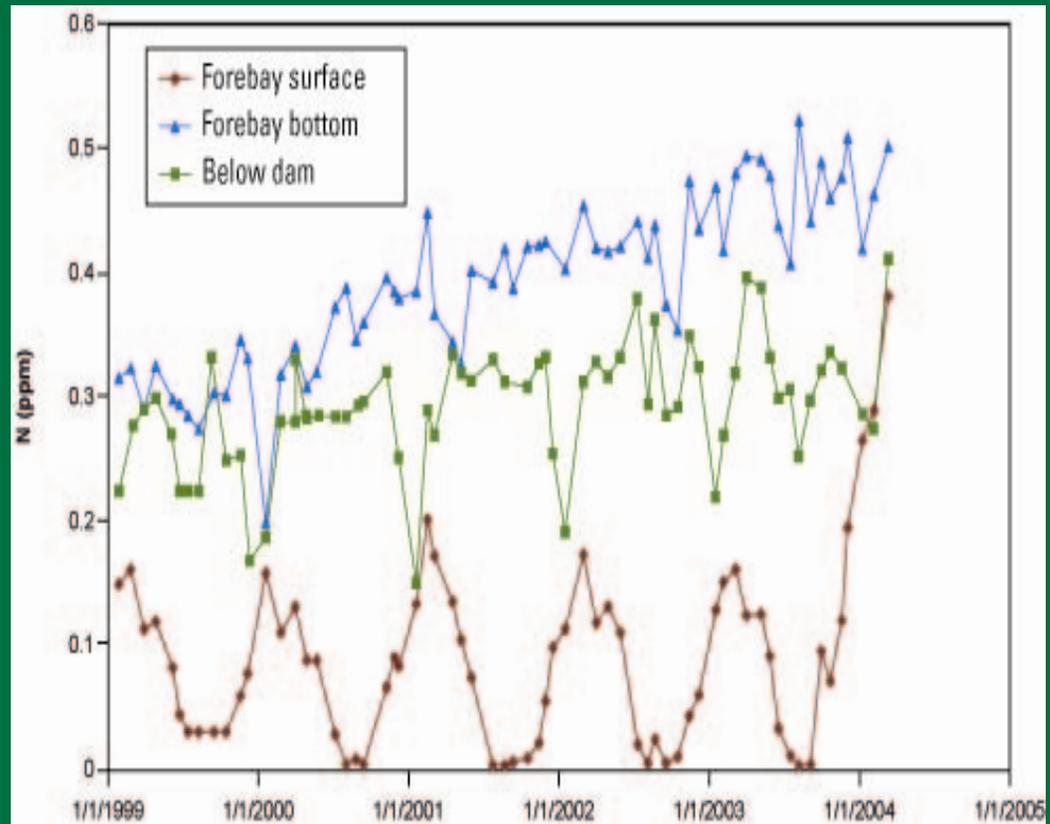
Relationship  
between  
downstream  
warming at  
Diamond  
Creek and  
discharge  
levels



# Nutrient Concentrations

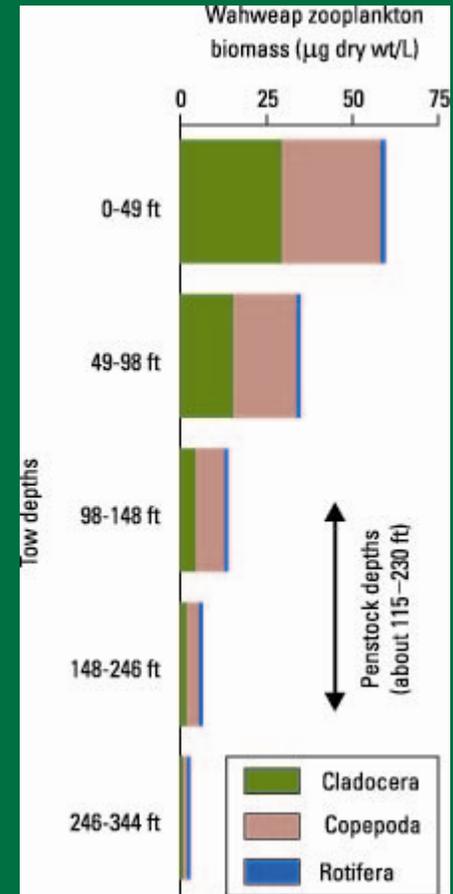
## Nitrate + Nitrite Nitrogen

- Surface concentrations consumed by primary productivity
- Releases higher, similar to surface concentrations in winter
- Implications for selective withdrawal

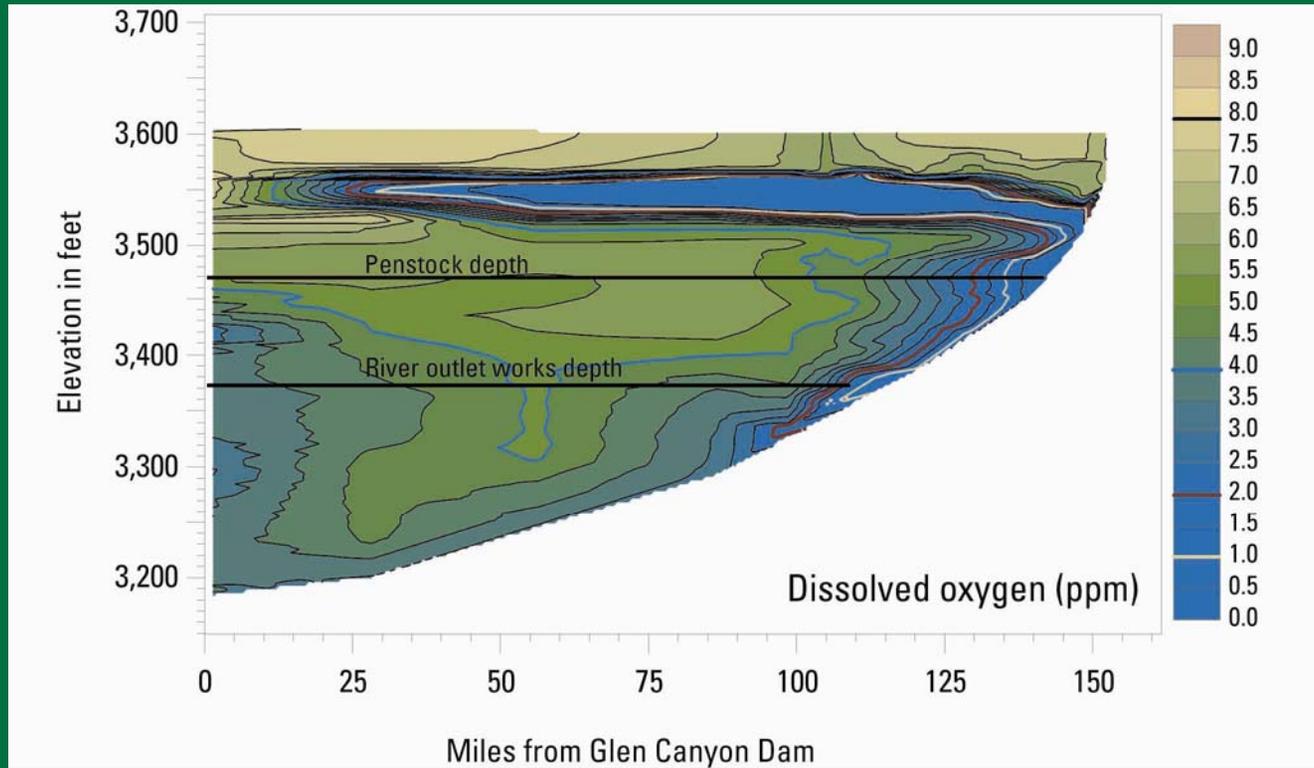


# Zooplankton in Lake Powell Forebay

- Much more biomass for export near surface
- Available for export by selective withdrawal



# Effects of Reservoir Drawdown



Lake Powell Dissolved Oxygen – September 2003

# Conclusions

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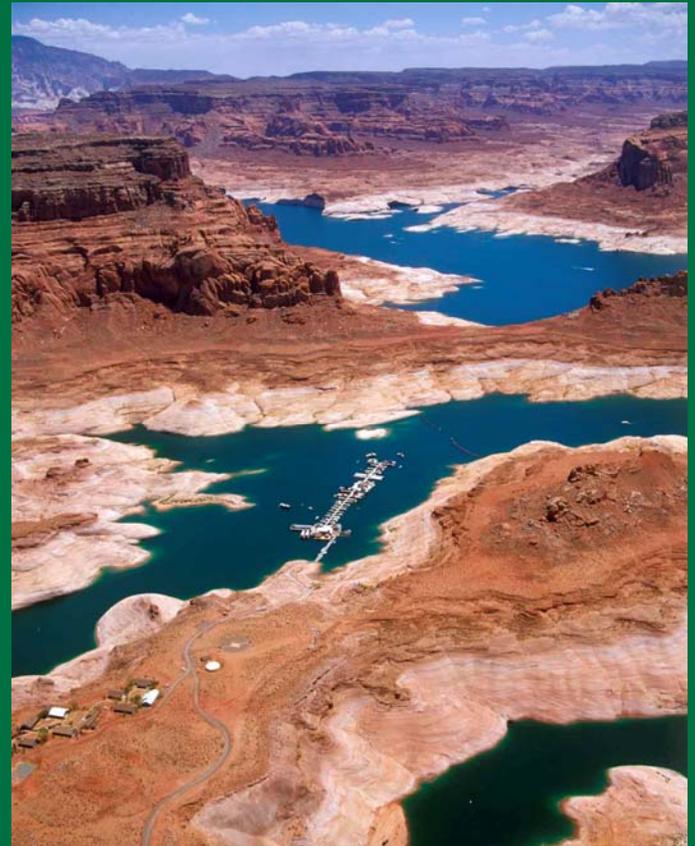
Water quality affected by:

- Glen Canyon Dam and climate and meteorology
- Glen Canyon Dam operations
  - Alternative release structures
  - Release volumes

Implications for selective withdrawal

Future model-based approach

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# Acknowledgements

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  - **Jerry Miller, Robert Radtke, Amy Cutler**
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  - **Mark Anderson, Jesse Granet**
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  - **Susan Hueftle, Steve Gloss, Nick Voichick**