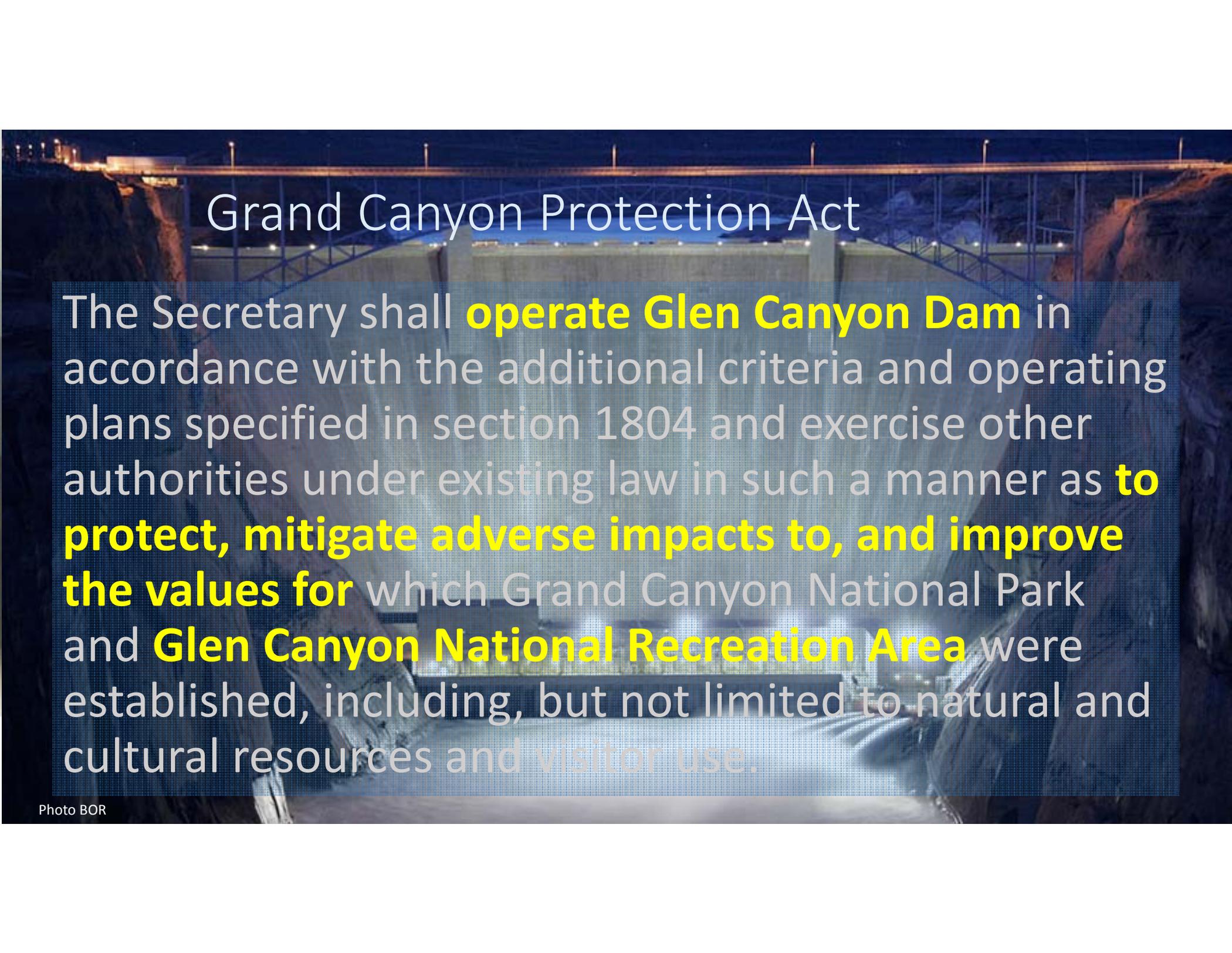


Linkages between Lake Powell Reservoir and the Colorado River Below Glen Canyon Dam



Mark Anderson and Ken Hyde
Glen Canyon National Recreation Area
Division of Science and Resource Management



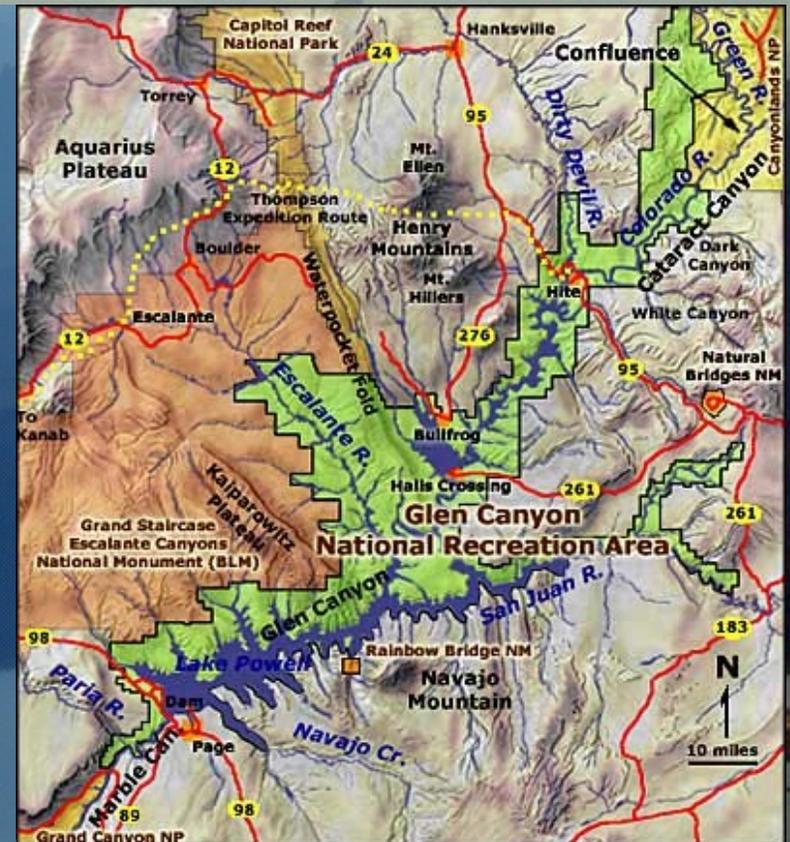
Grand Canyon Protection Act

The Secretary shall **operate Glen Canyon Dam** in accordance with the additional criteria and operating plans specified in section 1804 and exercise other authorities under existing law in such a manner as **to protect, mitigate adverse impacts to, and improve the values for** which Grand Canyon National Park and **Glen Canyon National Recreation Area** were established, including, but not limited to natural and cultural resources and visitor use.

Glen Canyon National Recreation Area (GLCA)

- GLCA is larger than Grand Canyon NP
(Grand Canyon = 1.22 million acres / Glen Canyon = 1.25 million acres)
- GLCA extends north as far as Canyonlands NP
- Longest average stay of any NPS unit (4.5 days)
- “Recreation Areas” follow the same management as any NPS unit
- Lake Powell = 90% of visitors, 13% of GLCA

Management Policies 2006



What is the **largest** man-made reservoir in the United States?



Measure	Mead	Powell
Surface Area (acres when full)	158,000	163,000
Main Stem Length (miles)	110	186
Shoreline Length (miles)	550	2000

Limnological Monitoring

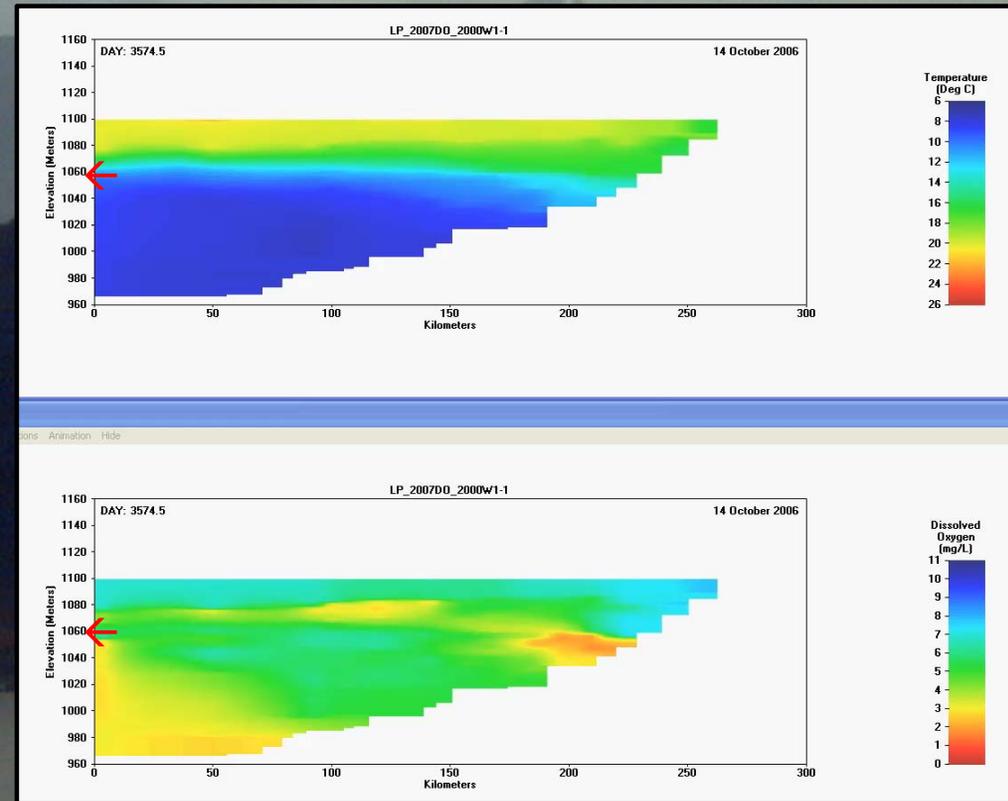


	Phase 1 1964-1971	Phase 2 1972-1981	Phase 3 1982-1990	Phase 4 1990-Present
Frequency: forebay reservoir	monthly quarterly	monthly monthly	variable variable	monthly quarterly
Number of stations	7	7-8	8-10	23-30
Physicochemical parameters	Temperature DO (Winkler)	Temperature DO (electro.)	Multi-parameter profiling (T, SC, DO, pH, ORP)	Multi-parameter profiling (T, SC, DO, pH, ORP, turb.)
Chemical Sampling	Major Ions	Major Ions	Major Ions	Major Ions Nutrients
Sampling interval	50 ft	50 ft	50 ft	Variable
Inflow monitoring	None	None	Colorado River	Colorado River San Juan River Escalante River
Tailwater monitoring	None	None	Below Dam T, SC (<1985)	Below Dam Lees Ferry T, SC, DO, pH

Limnological Monitoring

04 Oct – 21 Nov 2005

14 Oct – 22 Apr 2007



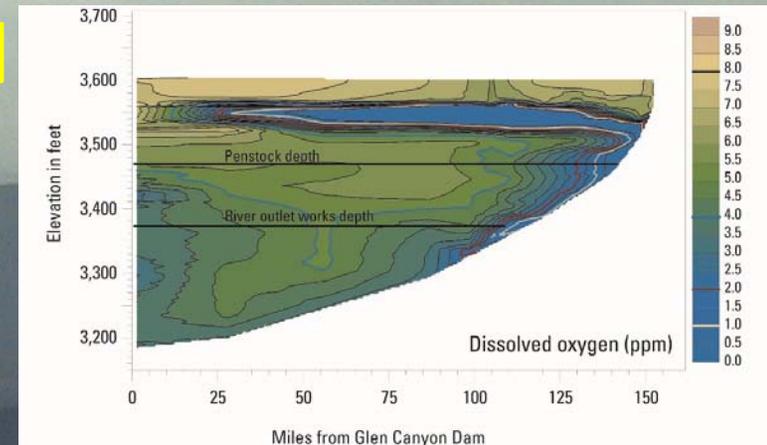
Limnological Monitoring

- Uncertain Future
 - Contract End ---- BOR → GCMRC
 - Uniflight Sank
 - Bill Vernieu Retired
- Currently Patched
 - NPS staff and Vessel 321
 - GCMRC doing monthly forebay monitoring
 - BOR doing quarterly lake-wide monitoring
- UT USGS contract?
- AMWG Needs?

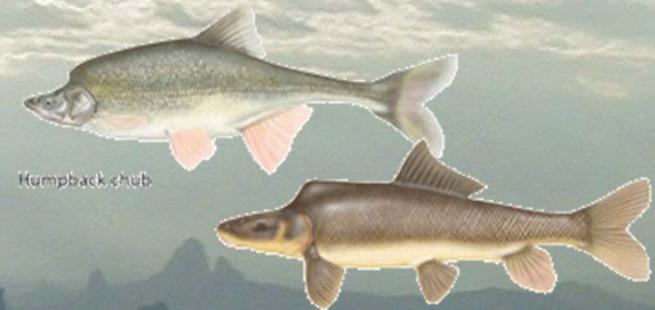
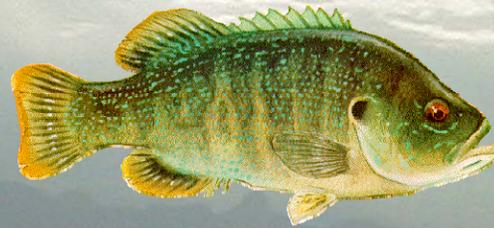


Linkages – DISSOLVED OXYGEN

- Drawing from mid-column, GCD can pass water from which oxygen has been depleted
- Low oxygen levels can kill aquatic organisms, especially trout
- Low oxygen that can pass through the dam is created at the inflow
 - Organic matter resuspended from the bottom and coming in with the river can use up the oxygen
 - Low oxygen water cannot get oxygen if travelling deep
 - These flows can be detected months before they reach the dam
- Steps can be taken to mitigate the effects on the river
 - Aeration (in forebay or at turbines), Cavitation, other?



Linkages - FISH

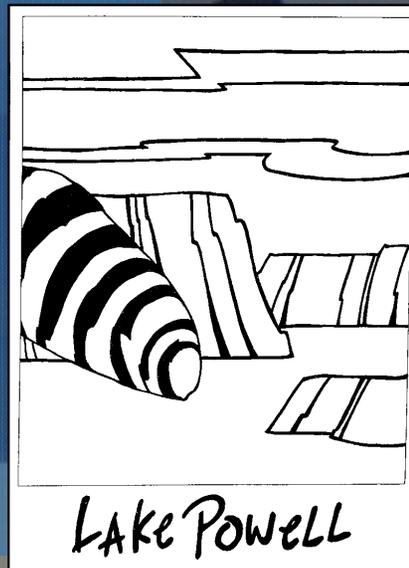


- Dams are imperfect barriers to downstream fish movement
- Many species that could be problematic exist above the dam
 - Green Sunfish – Lake Powell likely source for slough population
 - Smallmouth Bass – potentially more detrimental than Green Sunfish
 - Walleye and Northern Pike are currently concerns above the lake
- Fish populations of Lake Powell are fairly well understood (UDWR), but the specific information needed to address issues in the river is not included
 - What fish use the dam area?
 - What fish survival occurs through the dam?
 - How do HFE's effect fish passage through the dam?
 - What is the fate of surviving fish?



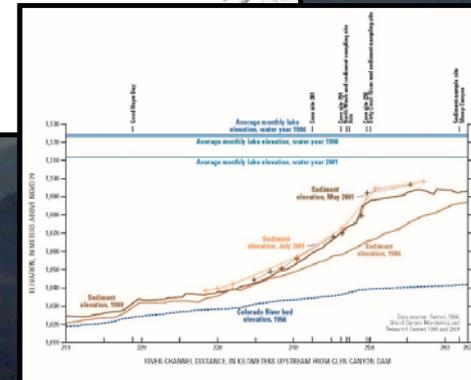
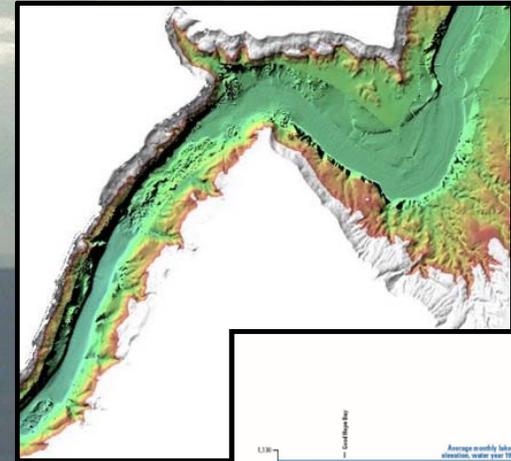
Quagga Mussel Effects Monitoring

- Water Clarity
- Phytoplankton/Zooplankton
- Fishery
- Waterfowl
- Aquatic Vegetation
- Harmful Algal Blooms
- Dissolved Oxygen
- *Dreissena polymorpha*



Linkages – SEDIMENT

- Big issue that will only get bigger
 - Hite
 - San Juan Marina
 - Waterfalls
- Generally trapped by the lake, mostly near inflows
 - Deep Sediment Deltas – Colorado >180ft, SJ >120ft, Esc >80ft
 - Long distance transport in density currents
 - 10cm/year sedimentation at dam
- Contaminants - Locked up or released based on flows
- Oxygen demand
- Turbidity (WW creek)

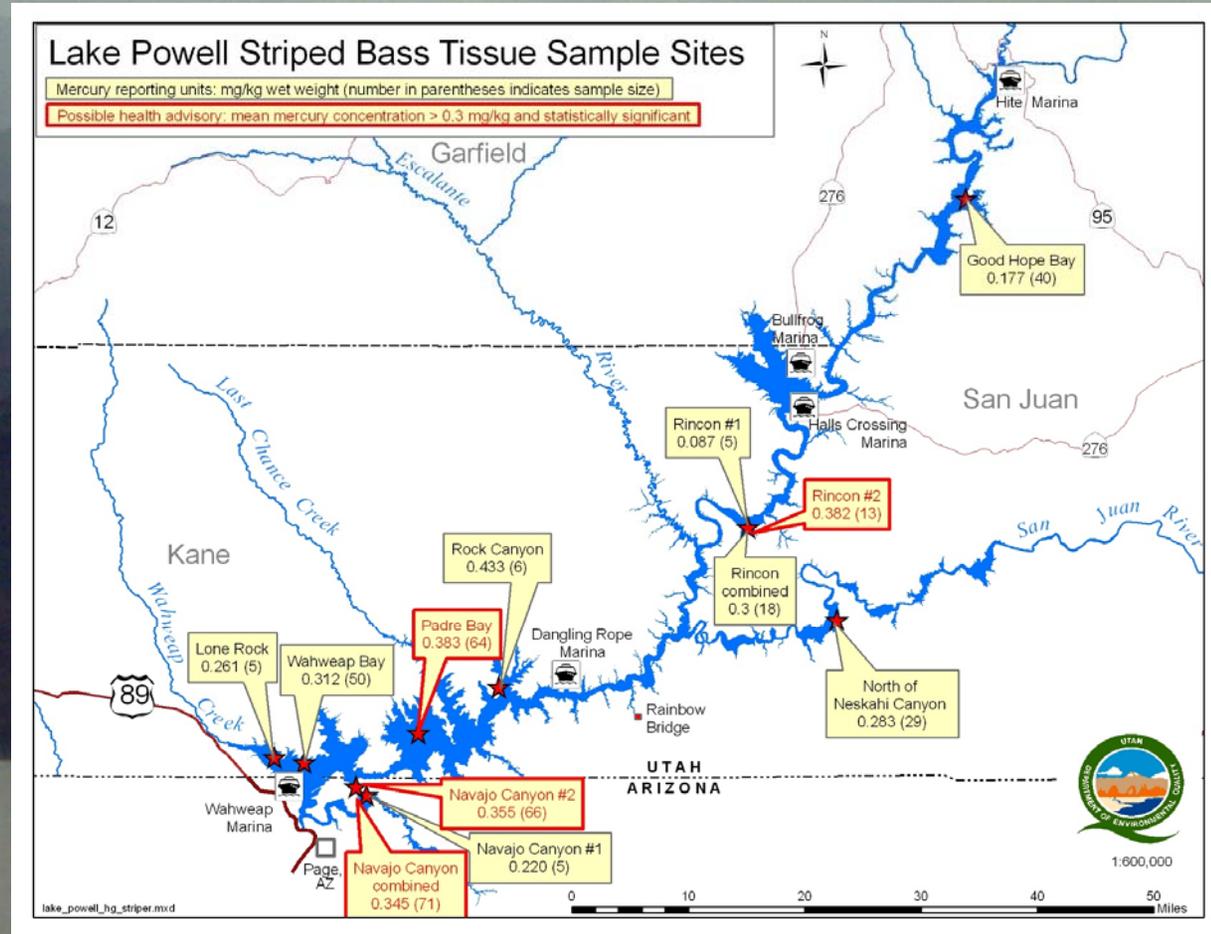




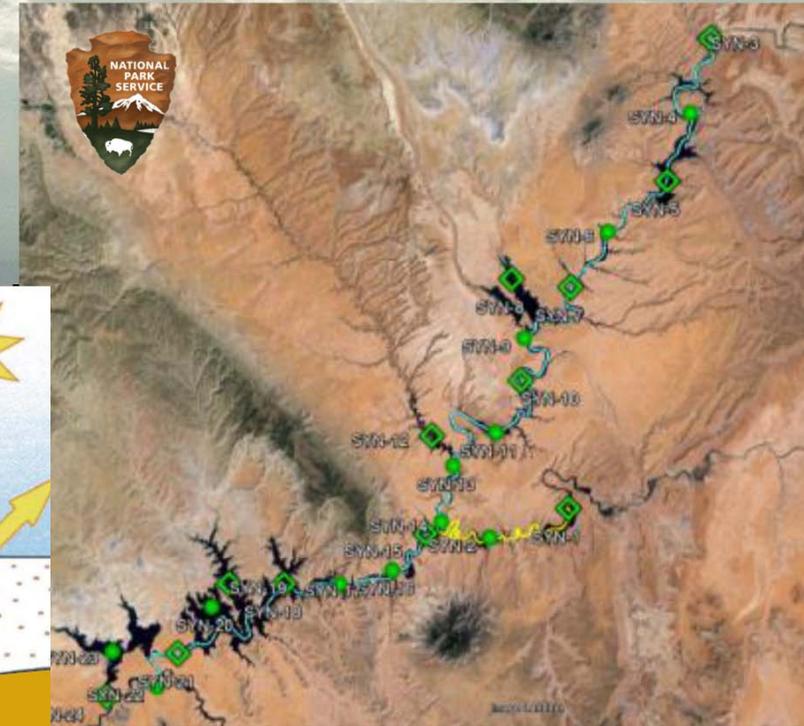
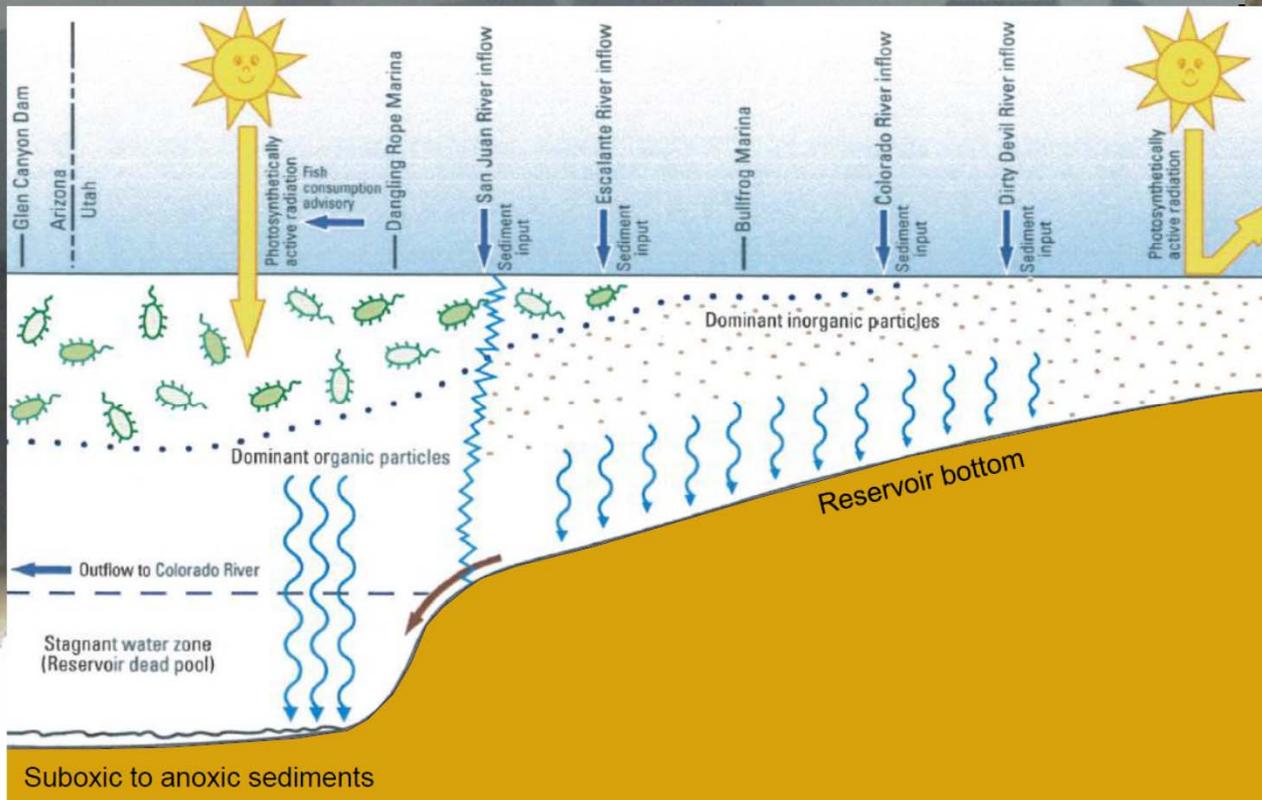
Linkages – MERCURY

Lake Powell Striped Bass Consumption Advisory (UT and AZ) (from Dangling Rope Marina south to the dam)

- Children should limit their consumption of Striped Bass to one 4-ounce meal per month.
- Women of childbearing age should limit their consumption of Striped Bass to two 8-ounce meals per month.
- Adult women past childbearing age and men older than 16 should limit their consumption of Striped Bass to eight, 8-ounce meals per month.



Linkages – MERCURY



Other Existing or Potential Issues

- Plankton
 - Energy & Food Web changes
 - AIS (quagga & other AIS effects)
- Nutrients
- Dissolved Organic Carbon
- WEEDS – Exposed Shoreline
- Archaeology
- Water Levels
 - HFE = 4ft to 6ft drop in lake level
 - Lake fish habitat
 - Upper basin native fish
 - Waterfall barriers
 - Inflow condition
 - Habitat
 - Contaminants



Future

- The phrase “Colorado River Ecosystem” would appropriately address the river from mountains to the ocean, but usually we don’t even mean the full area addressed by the GCPA
- GCPA Parks are GLCA and GRCA – no hierarchy is established in law
- GLCA issues are more esoteric, especially when making a distinction between dam existence and dam operation
- Perspective can be everything – Understanding of the river will be poor without looking at the source; holistically considering the lake and the river may provide management opportunities beyond the current approach

Thank you!

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Glen Canyon National Recreation Area

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