



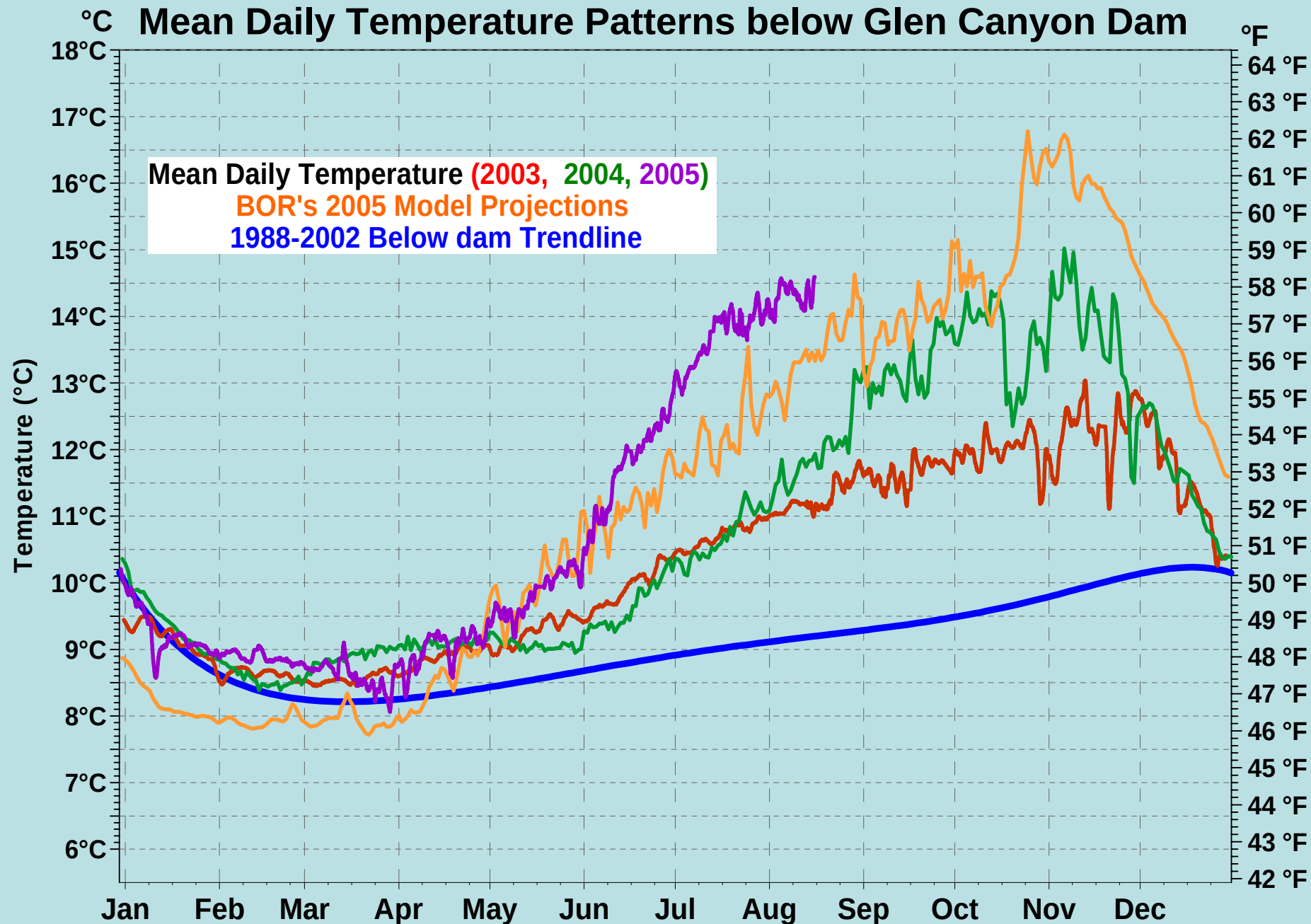
Status of Temperatures and Dissolved Oxygen Levels Released from Glen Canyon Dam

Opportunities and strategies associated with warm water releases

Southwest Biological Science Center
Grand Canyon Monitoring and Research Center

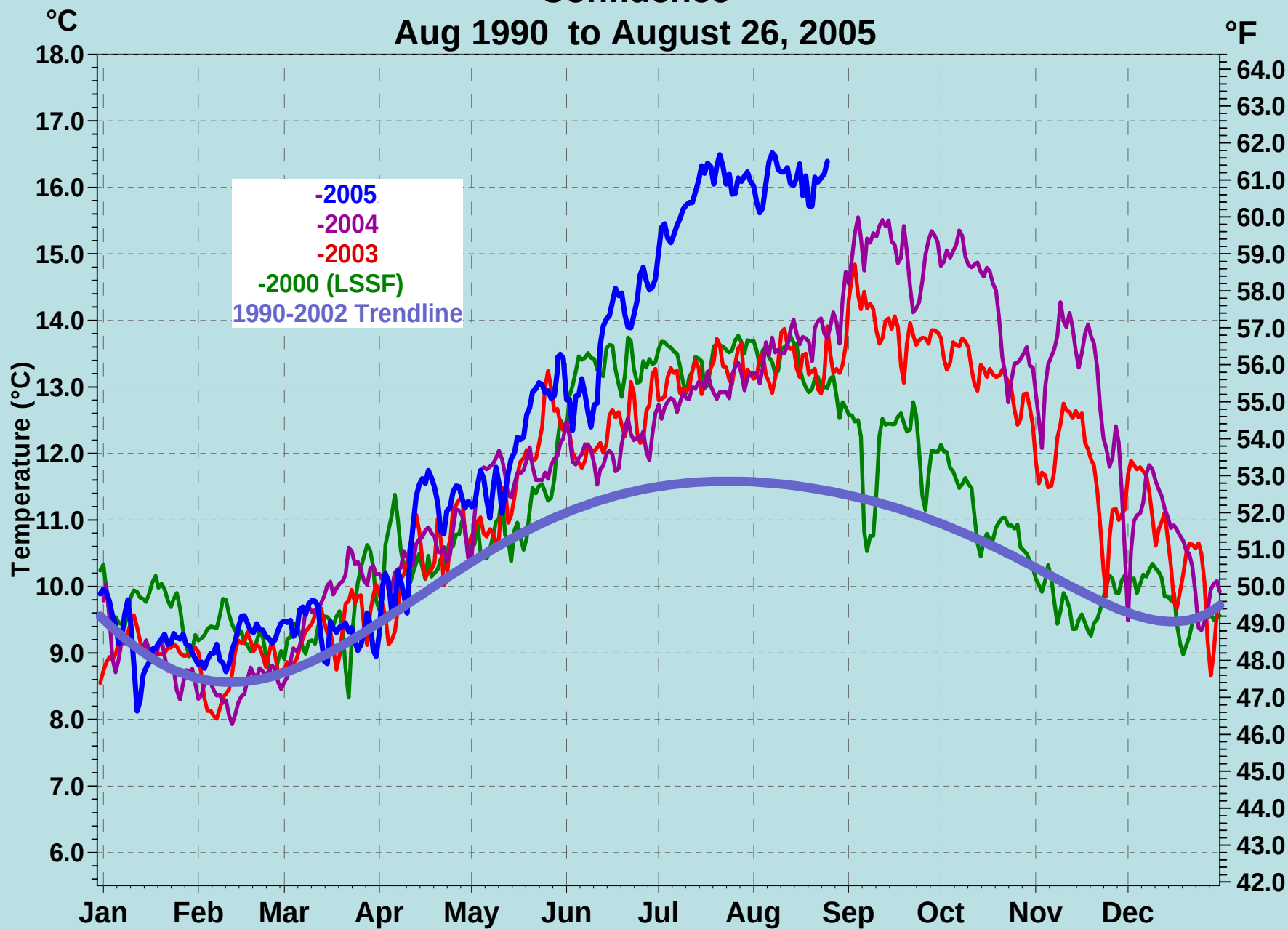
B. Ralston, L. Coggins, S. Hueftle, W. Vernieu

Mean Daily Temperature Patterns below Glen Canyon Dam



Mean Daily Temperatures in the Colorado River @ 60 mile above the LCR Confluence

Aug 1990 to August 26, 2005



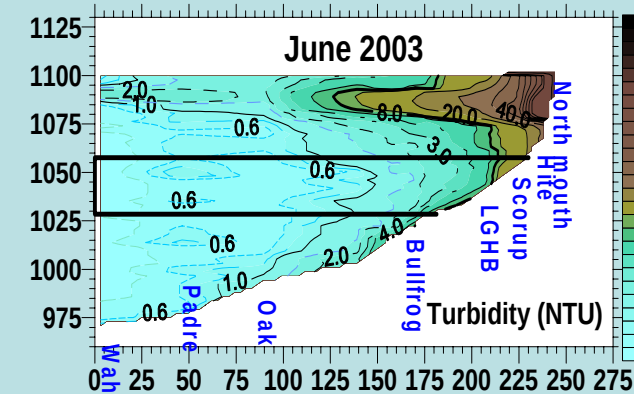
Inflow, Temperature and Dissolved Oxygen Forebay Measurements 1998-2005

Water Year	Apr-Jul Regulated Inflow (MAF)	Apr-Jul Unreg Inflow (MAF)	% of average	Minimum elevation (ft)	Maximum mean daily temperature (°C)	Minimum median daily D.O. (mg/L)
1998	7.761	8.625	112%	3672.75	11.01	6.37
1999	6.555	7.621	99%	3677.09	11.47	5.76
2000	4.100	4.352	56%	3669.91	10.63	5.21
2001	3.711	4.301	56%	3656.16	10.19	6.63
2002	1.439	1.115	14%	3620.04	10.10	5.76
2003	3.522	3.907	51%	3597.22	12.93	4.62
2004	2.884	3.638	46%	3564.39	15.02	4.92
2005	7.491	8.813	111%	3555.02	(14.69)	(5.00)
2006	6.556*	7.400*	93%*	3595.28*		

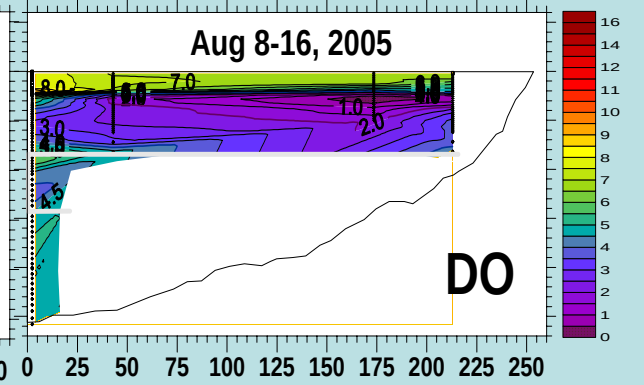
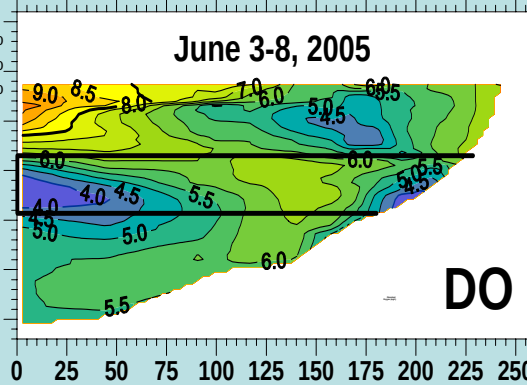
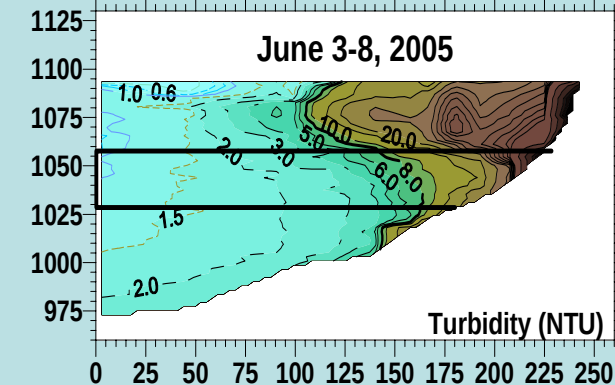
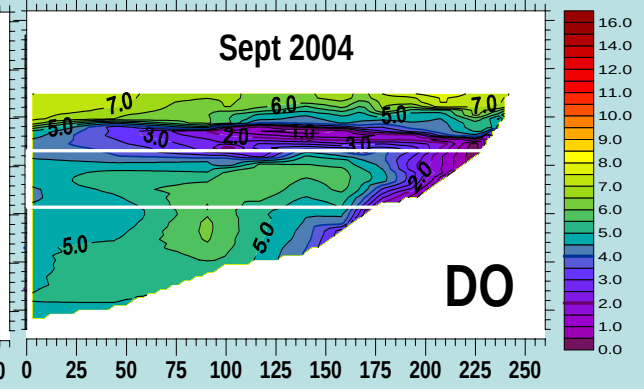
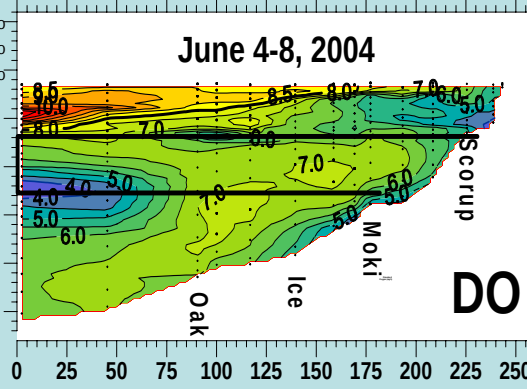
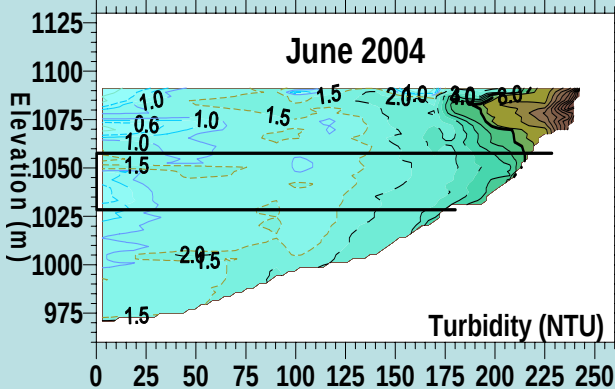
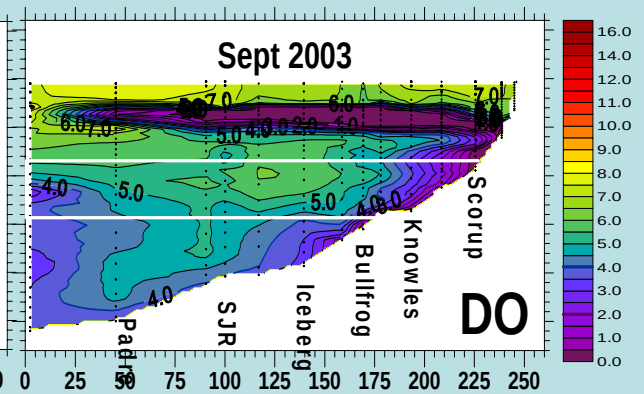
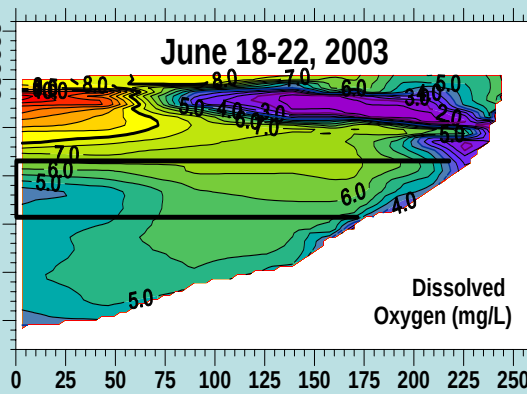
* projected values from BoR 24 months study; (2005 values as of August 18 2005)

Inflow Volume, Turbidity and DO in Lake Powell, 2003-2005

Turbidity (NTU)

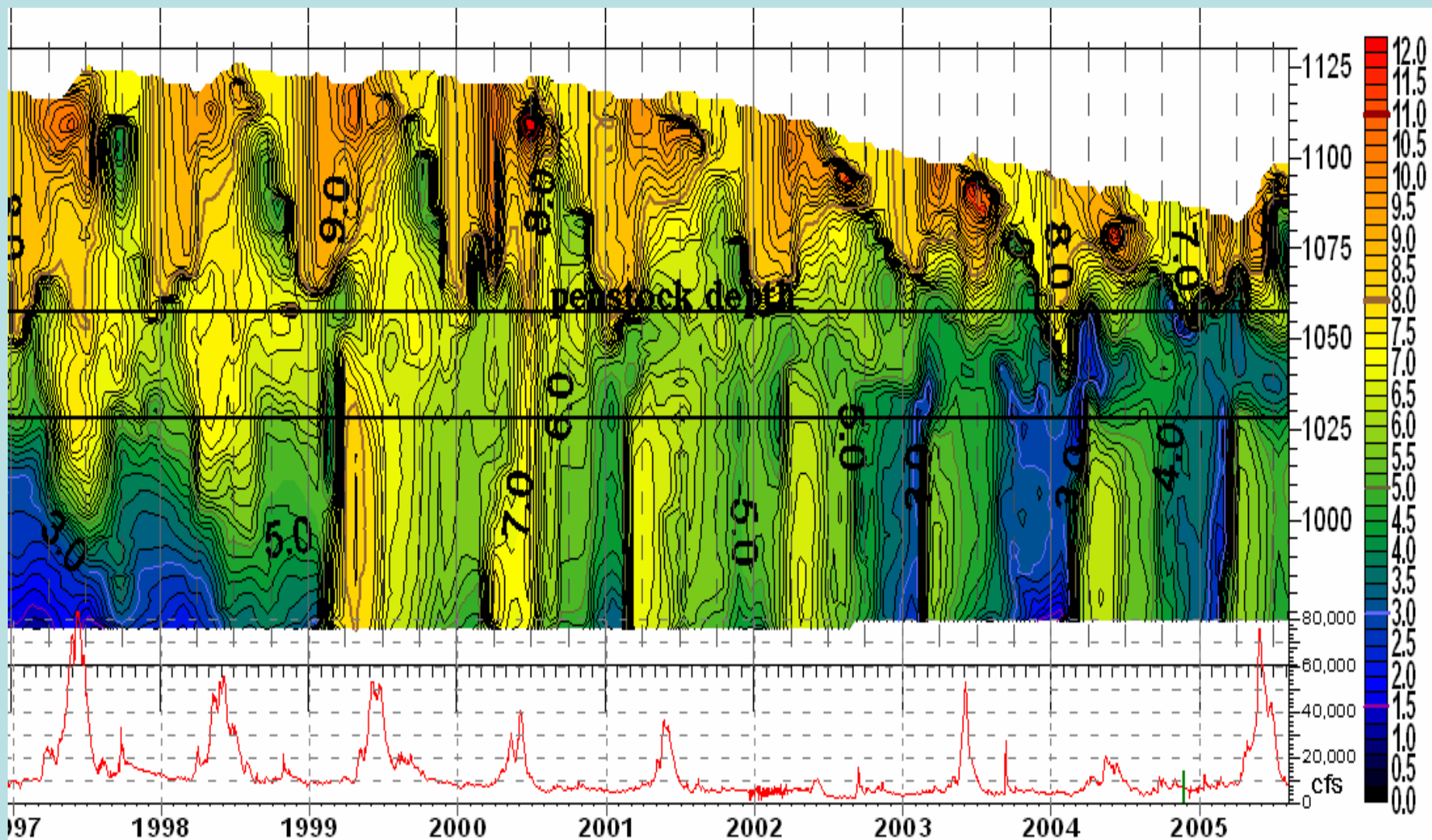


Dissolved Oxygen (mg/L)

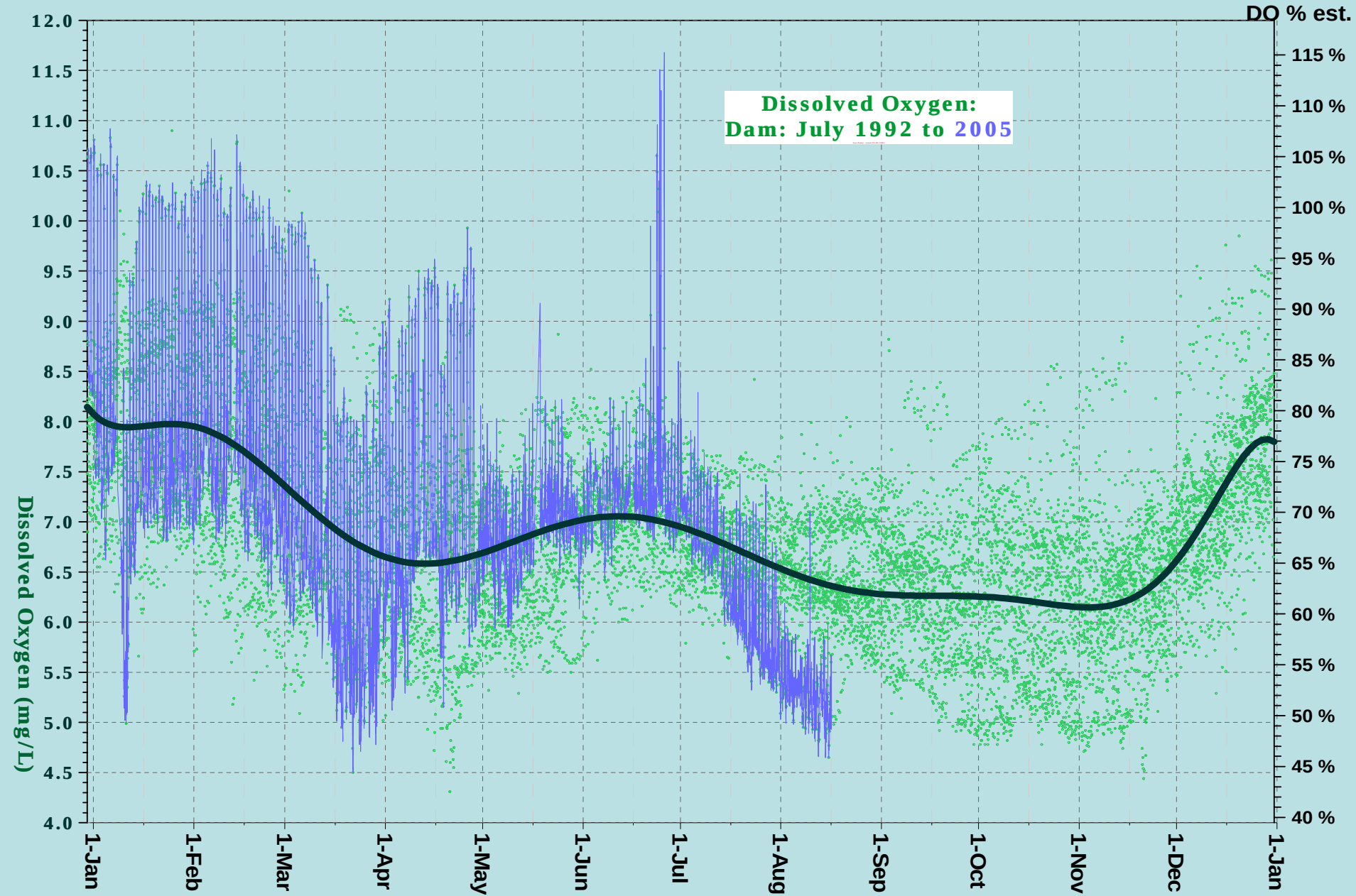


Kilometers from GC Dam

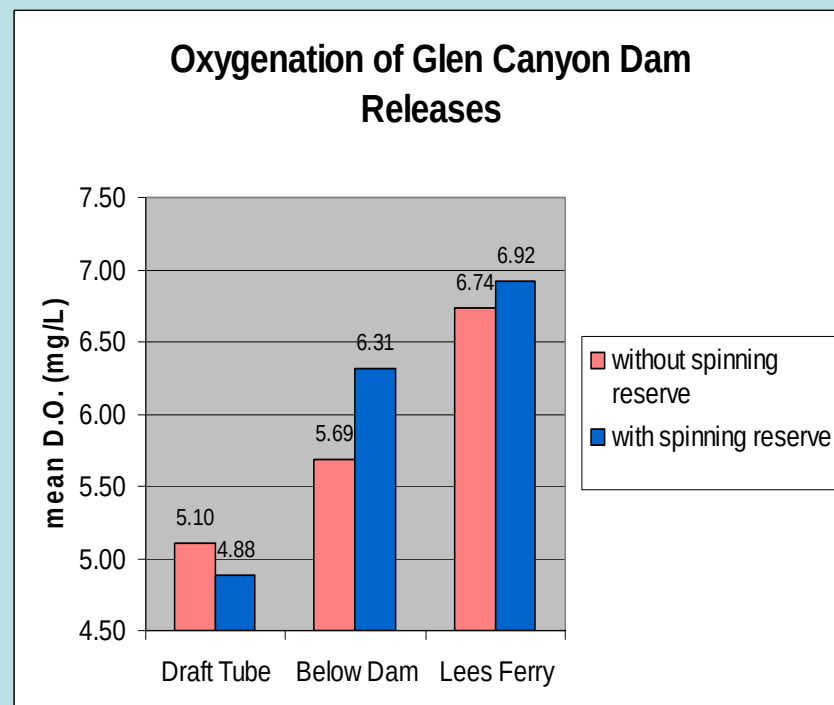
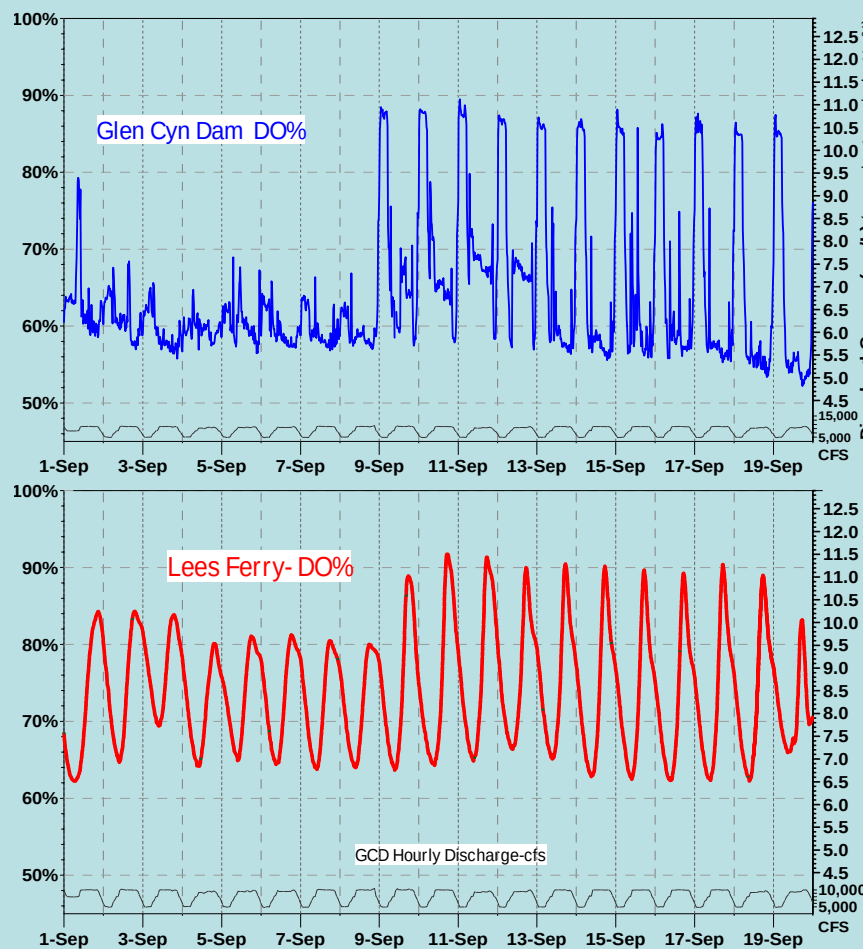
Dissolved oxygen (mg/L) patterns at Glen Canyon Dam forebay-Wahweap 1997- August 10, 2005



Annual Dissolved Oxygen Patterns below Glen Canyon Dam July 1992 to August, 2005



Oxygenation possibilities: spinning reserve vs. by-pass



What is spinning reserve?

- Spinning reserve
 - Pressurizing turbine with air to displace water (that results in aeration of discharge)
 - current is reversed to run the turbine as a motor rather than a generator
 - Usually happens between 11 pm and 5-7 am
 - Not as effective as Jet tube release but not as costly
 - Could increase DO concentrations in tailrace by at least 1 mg/l – (depending on number of turbines, duration and river volume)

Summary

- Maximum probable release temperature 16-18 °C
- Minimum probable release DO concentration 2-3 mg/l (difficult to project)
- Telemetry for Temperature and Dissolved Oxygen on-line by mid-September.
- Decision point for implementing spinning reserve needs agreement/coordination.

Mainstem Warming and Ability to Detect Trends among Mainstem Fishes

Can we detect an effect of mainstem temperatures on natives and exotic fish?

- Exotics (green sunfish, striped bass, smallmouth bass) reported in July 2005 around LCR from mechanical removal trip but none found in August
- Does the occasional capture of a striped bass in a trammel net mean that there is a high abundance of STB or did we just get lucky with inefficient gear?
- What does it mean when we set a trammel net in Middle Granite Gorge and fail to catch a humpback chub? No HBC present? Highly inefficient gear?
- For long-lived and non-native trend detection, **monitoring is the primary method of measure.**

Fish Monitoring in the Mainstem

- **Problems with monitoring**

- Ability to detect, as well as quantify fish numbers
- We are much less certain of sampling efficiency of our present gear types for:
 - Adult centrarchids (bass) and adult ictalurids (catfish)
 - Adult humpback chub and adult bluehead sucker

Strategic View

- Problems of monitoring for exotics and natives fish in the mainstem are one in the same.
- Need robust sampling that provides abundance and distribution information for both native and exotic warm water
- This need is basic for mainstem monitoring associated with Management Objectives and for subsequent removal efforts, should they be necessary.

Need

– Primary Need:

- Basic research related to capture efficiency of present sampling gear of native fishes in the mainstem.

AND

- Basic research related to how to capture warm-water non-native fishes. Evaluation of efficiencies of present and alternate capture gear.

– Follow-up need:

- a science based recommendation on best methodologies and strategies on how to develop a warm-water removal program within the context of long-term experimentation.

Potential Methodologies

- Alternate Detection Methods and Utility
 - Hydro-acoustics (sonar, fish finders)
 - Didson Camera
 - Modified Electrofishing Configurations
 - Angling (long-line or trot-line)
 - Pheromone Traps??

Goal, Schedule and Process

Three-year Goal: To evaluate gear efficiencies and test alternative capture methods to improve mainstem monitoring for detection and quantification of native and non-native warm water species, and to provide recommendations on mainstem approaches that are effective relative to warm-water predator control.

Process & Schedule:

- Host workshop in December 2005
 - Product would be a study plan for implementation
- Present results to AMWG in ~February 2006 and recommendations for implementation and funding levels in FY06 using experimental flow funds.

Grand Canyon Colorado River Temperatures (°C)

August 1988 to July 2005

