Temperature Control Device Workshop

January 22-24, 2001
Saguaro Lake Ranch
Mesa, Arizona

Summary of Results

Organizations Represented

- GCMRC
- Fish and Wildlife Svc
- Bureau of Reclamation
- EPA
- National Park Service
- USGS
- AGFD
- Utah DNR
- Arizona State Univ.
- Utah State Univ.
- Colorado State Univ.
- Northern Arizona Univ.
- Argonne National Lab.
- SWCA
- Ecometrics
- Reservoir Environ. Mgmt.
- Stevens Consulting

Requested Information

- Summary of variables being measured,
- Frequency and intensity of measurements,
- Methods of analysis,
- Ability to detect change in those variables,
- Recommendations for changes or additions to assess effects of a TCD.

Presentations

- GCDAMP Background: Dennis Kubly and Barry Gold (AMP and TCD), Barb Ralston (AMP Science Program)
- Modeling: Josh Korman (Conceptual Model), Amy Cutler (CEQUAL-W2), Dave Harpman (Flow Routing)
- Empirical: Susan Hueftle (Lake Powell-Colorado River Water Quality), Joe Shannon (Algae-Invertebrates), Wayne Gustaveson (Lake Powell Fisheries), Bill Persons (Lees Ferry Trout), Rich Valdez (Mainstream Native-Nonnative Fish), Lew Coggins (Little Colorado River Native-Nonnative Fish), Larry Stevens (Riparian)

Types of Monitoring

- Core monitoring to measure status and trends of high priority resources; highly standardized, few changes once established
- Effects monitoring to measure conditions before and after management actions are taken; more flexible, event driven, set up to accommodate particular actions

Monitoring and Management Actions

- Water temperature is modified as a consequence of modifying hydrology: consider them together in planning
- Researchers need more lead time for design and implementation; water managers need to work more closely with researchers

Hydrology-Temperature Factorial

Hydrology	Temperature
Experimental Flow 1	Temp Increment 1
Experimental Flow 2	Temp Increment 2
Experimental Flow 3	Temp Increment 3

Controlling Factors and Categories for Glen Canyon Dam Release Years

ANNUAL INFLOW

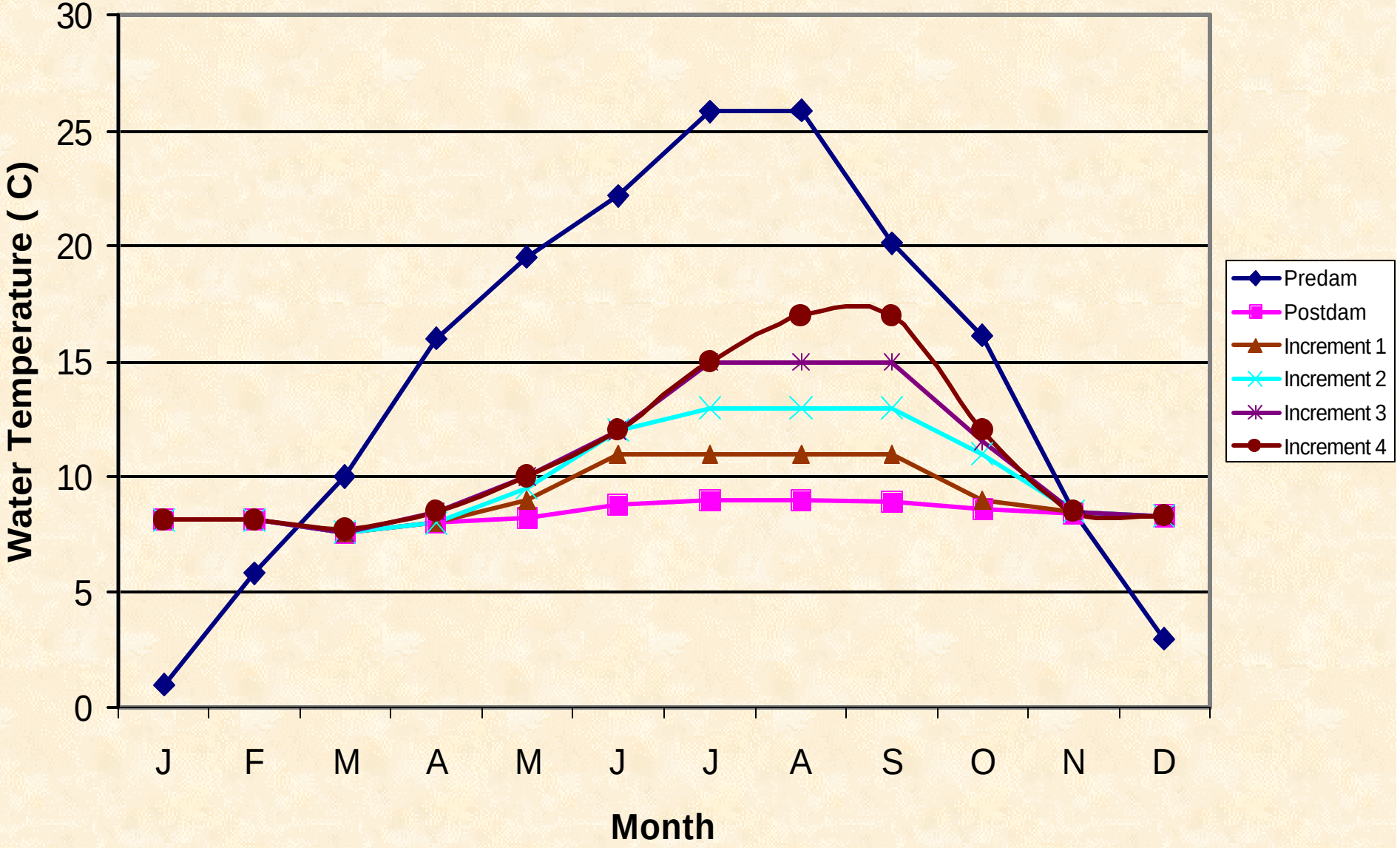
RESERVOIR LEVEL		**Low**	**Medium**	**High**
	Low	**Low/Low**	**Low/Medium**	**Low/High**
	Medium	**Medium/Low**	**Medium/Medium**	**Medium/High**
	High	**High/Low**	**High/Medium**	**High/High**

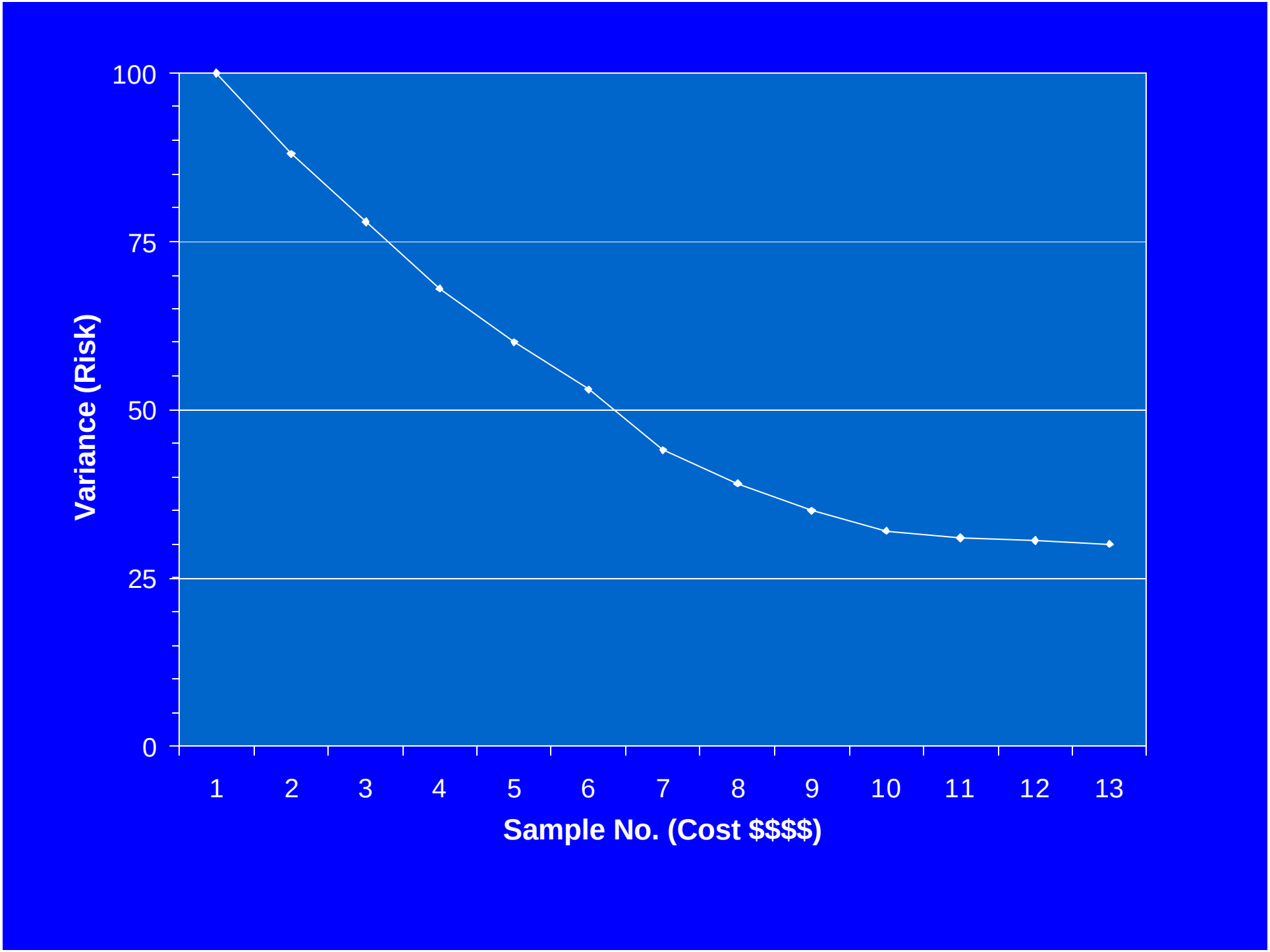
Flow Parameters under Record of Decision for Operation of Glen Canyon Dam

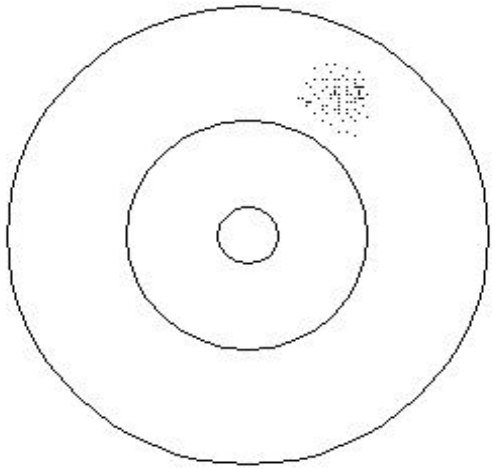
Monthly release volume (ac-ft)	Mean flow (cfs)	Minimum flow (cfs)	Maximum flow (cfs)	Allowable daily fluctuation (cfs)
<600,000	<10,000	5,000/8,000	25,000	5,000
600,000-800,000	10,100-13,400	5,000/8,000	25,000	6,000
>800,000	>13,400	5,000-8,000	25,000	8,000

Maximum releases identified here can be exceeded during beach habitat-building flows and habitat maintenance flows

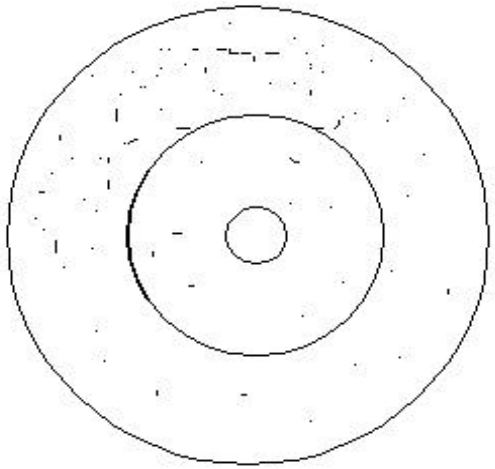
Predam-Postdam and Potential TCD Release Water Temperatures



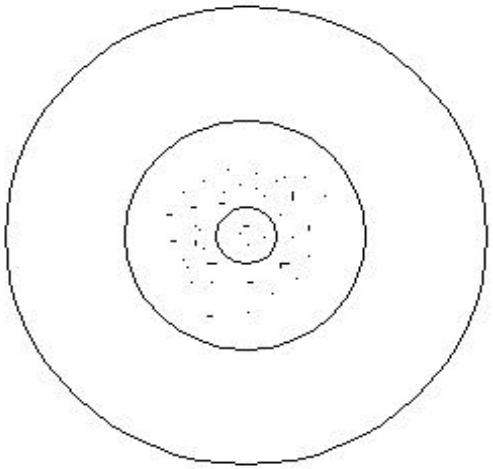

100
75
50
25
0
Variance (Risk)
1
2
3
4
5
6
7
8
9
10
11
12
13
Sample No. (Cost $$$$)



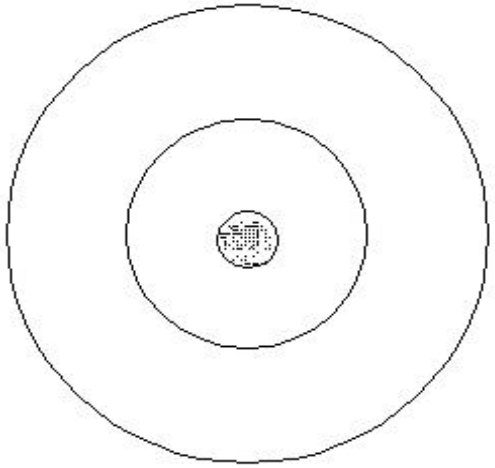
H, L



L, L



L, H



H, H

Precision and Accuracy

Temporal Indicators of Change

	Early (~Yr 1)	Mid (~Yr 2-5)	Late (~Yr 6-20)
Physico-chemical	Water temp System metabolism Allochthonous input (reservoir) C:N SI Ratios		
Lower Trophic	PB & MIB Biomass New colonists	PB Community Composition	MIB Community Composition
Fish	Catch rates, Range, Reprod success, Growth, SBE numbers, New colonists	Sustained range expansion, Growth, Disease/ parasites, Pop estimates	Recruitment, 2nd population, Down- and delisting of T&E

Core Monitoring Physicochemical

	Uplink Continuous	Continuous	Monthly
Forebay	Water Temperature	Conductivity, DO, pH, chlorophyll	Nutrients (P, N, TOC), hydroacoustic survey
Dam	Water Temperature, Discharge	Conductivity, DO, pH, chlorophyll	Nutrients (P, N, TOC), plankton, eggs
Downstream (3 stations)	Water Temperature, Flow	Conductivity, DO, pH, chlorophyll	Nutrients (P, N, TOC)

Core Monitoring Lower Trophic

- Present sampling design is biased
- Change to randomized approach and clearly define the universe you are sampling; EPA ORD-EMAP approach, GIS-based
- Two index periods—spring and fall
- Three major habitats—cobble bars, backwaters, and tributaries
- 30-50 samples in each stratum
- Integrate physical habitat, water quality, lower trophic, and fish sampling

Core Reservoir Fish Monitoring

- Shad population measurement indicative of all elements of Lake Powell fishery
- Sample with midwater trawls and tow nets
- Some hydroacoustic work done; may be useful tool in forebay for measuring potential for entrainment with TCD

Core Fish Monitoring - LCR

Trips	Purpose
May (1-2 weeks)	Suite of demographic parameters • > 100 mm TL pit tag • intensive mark-recapture • hoop net, trammel catch rates • stock synthesis models • native fish emphasis
June (2-3 weeks)	
Oct (1-2 weeks)	
Nov (2-3 weeks)	

Core Fish Monitoring - Mainstem

Trips	Purpose
March-April	Mark-recapture HBC, FM, BH aggregations in tributaries Spike flow camps Kanab, Havasu
Early April	Systemwide survey LF-DC
May	Systemwide survey LF-DC
Mid-May	Lees Ferry, native fish on spawning bars, trammel nets
June-July	Mark-recapture LCR area (HBC, FM, BH),
Sep	Nonnative electrofishing, predator collections

Riparian Monitoring

- Water Quality & Hydrogeology—Flows, GIS network, local velocities, system-wide air temp and relative humidity (10 Tw sites)
- Establish meterological instrument stations to measure and model nearshore climate
- After third year of TCD measure dendrochronology of *Tamarix* and *Salix exigua*
- Secondary productivity of important insects
- Diet analysis of herps as surrogate for riparian birds

Recreation Monitoring

- Questionnaire to river runners 2 yrs before TCD and during operation re: occurrence of bacterial infections, sickness, injuries during swimming
- Involve Center for Disease Control in monitoring for *Shigella* and other pathogens?

Lee's Ferry Trout Fishery Frequency of Sampling

- Electroshocking:
  - 1984-1990 — Inconsistent
  - 1991-1996 — 15 sites 3x / year — 2000 sec/site
  - 1997-2000 — 9 sites 3x / year — 2000 sec/site
  - 2001 - ? — 9 + 27 sites 4x / year — 500 sec/site
- Creel:
  - 1965-1970 — Inconsistent
  - 1977-2000 — Monthly estimates (12d/month)
  - 2001 - ?
- Snorkel:
  - 1998-2000 — Exploratory
  - 2001 - ? — 36 sites 4x / year to evaluate, calibrate

Status and Trend Variables
Lee's Ferry Fishery

- Electrofishing:
  - Date, time, RM station, effort (seconds)
  - Species, length, weight, PIT tag info (growth, movement), sex, maturity
  - Wild/hatchery origin (coded wire tags)
- Creel:
  - Angler catch/hour
  - Angler use (angler hours/month)
  - Satisfaction
- Snorkel Surveys:
  - Fish density/calibration efforts