Low Steady Summer Flows (LSSF)

Project Results and Status Update

Adaptive Management Work Group Meeting

Phoenix,AZ

January 29, 2003

USGS
science for a changing world

LSSF Science Plan Background

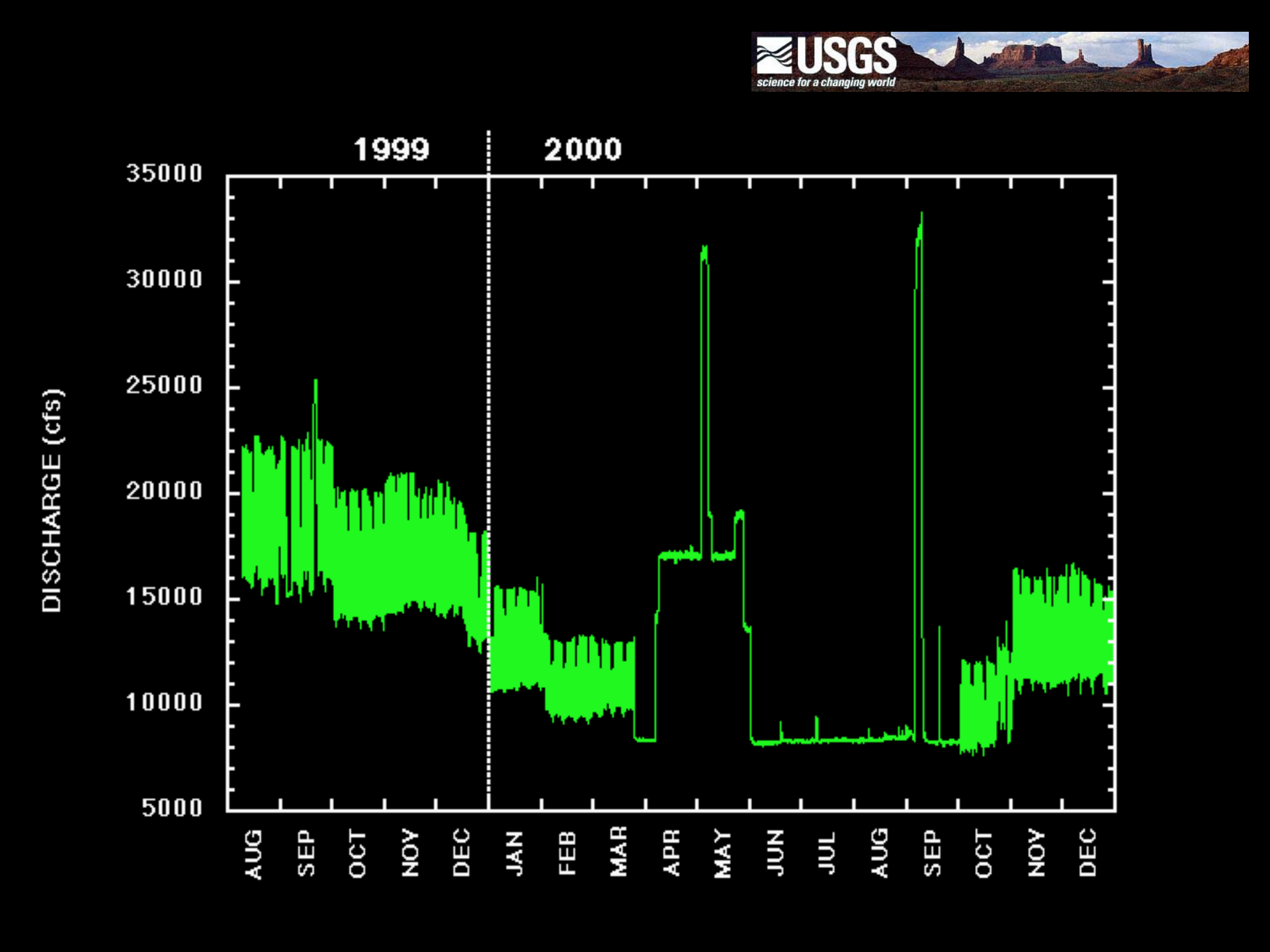
- Final Plan April 25, 2000
- Projects Implemented May-October 2000
- LSSF Budget $3.5 Million
- Preliminary Results Presented at 2001 GCMRC Science Symposium

18 Projects in LSSF Science Plan

- 9 Final Reports Have Been Submitted to GCMRC
- 9 Final Reports Still Pending-to be completed by 2003 GCMRC Science Symposium

Individual Project Status and Key Findings

Physical Resources
Biological Resources
Lake Powell Studies
Economic & Recreational Studies


USGS
science for a changing world
1999
2000
DISCHARGE (cfs)
35000
30000
25000
20000
15000
10000
5000
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Basis for Hydrograph

- Treatment Design - Valdez et al. (2000) "A Program of Experimental Flows for Endangered and Native Fishes of the Colorado River in Grand Canyon" Proposed to mimic elements of "natural" hydrograph
- Elevated Spring Flows - to Backwater LCR Confluence as Precursor to Spawning
- Spring Spike Flow - to Condition Physical Habitats in Main Channel (Backwaters)
- Low Summer Steady Flows - to Improve Rearing conditions for YOY Natives
- Fall Spike Flow - to disadvantage Non-Native Fishes in Main Channel Following Steady Summer Flows

Fate of Tributary Sand Inputs

- Eos Article- "Recent Sediment Studies Refute Glen Canyon Dam Hypothesis"- Rubin, et al.
- Take Home Points
  - Tributary sand inputs are conserved in the main channel at flows of 8,000 cfs and below (net increase in Marble Canyon)
  - Releases of 31,500 cfs quickly export new sand (net loss in Marble Canyon)

Reach-Integrated Responses of Fine Sediment Under LSSF

- Draft Report anticipated February '03
  - "Synthesized Report on the LSSF Integrated Reach Response of Fine Sediment Resources Between Lees Ferry and Phantom Ranch" Schmidt et al.
- Take Home Points
  - Sand-bar Resources Between Lees Ferry & Phantom Ranch Have Decreased by 25% Since 1984

Backwater Habitats

- "Spatial and Temporal Trends in the Area and Number of Backwaters Between 1935 and 2000, Marble and Grand Canyons, Arizona" Goeking, et al. Draft Report in review, final report to GCMRC expected in winter 2003

- Take-Home Points – Between 1935 and 2000, backwater habitat areas between Lees Ferry and Phantom Ranch were greater in 1984, than any period of the record before or since.

- Flooding above 31,500 cfs is necessary to maintain backwater habitats

Effects of LSSF on Drift and Benthic Biomass in Lees Ferry

- Draft Report received‘02, Final Report due Feb ‘03 based on revision following peer review- Rogers, et al.

- Take Home Points
  - No significant changes in biomass or composition attributable to LSSF, possible shift in peak from fall to mid-summer
  - Drift reduced after spike flow and remained low during LSSF

Effect of LSSF on Drift, Benthic Mass, and Composition at Lees Ferry and Downstream

- Draft Report Submitted 2001, Final Report submitted Sept. 2003-Shannon et al.
- Take Home Points
  - Increases in Cladophora and NZMS (and decomposing invertebrates) Were Significant from Lees Ferry Downstream to National Canyon (RM 160)
  - No Increase in Invertebrates in Lower Grand Canyon Due to Increased Temperature

Algal Colonization and Recolonization Response Rates During LSSF

- Final Report received June 2001-Yard, et al.

- Take Home Points
  - Algae recover rapidly after mechanical damage
  - Newly submerged substrates however demonstrated a slow colonization response
  - colonization response may have been different w/o NZMS grazing pressure
  - Stable flows may result in substantial amounts of production

Effect of Discharge on Shoreline, Channel, and Tributary Velocities

- Draft Manuscript Submitted to GCMRC 2002-Final Report due March 2003, Protiva, et al.

- Take Home Points
  - Low velocity, warm water habitats at the mouth of the LCR are maximized between 8-12,000 cfs (Channel Morphology Important)
  - Flows above 17,000 cfs eliminate suitable HBC habitat in the main channel CR at the confluence of the LCR

Effects of Steady v Fluctuating Flows on Creation of 'vegetated shoreline'

- Final Report/Thesis submitted to GCMRC. Manuscript being revised for journal submission-Porter et al.
- Take Home Points
  - Tamarisk Seedlings Quickly Established During Steady Flows (600/m2), Native plants (horsetail) slower to respond and negative response to initial drop in water table
  - By August 2001 Horsetails (300/m2) replaced Tamarisk (60 m2)

Modeling Effects of Discharge on Habitat Quality and Dispersal of Juvenile Humpback Chub (*Gila cypha*) in the Colorado River, Grand Canyon

- Draft Report (manuscript)Submitted 2001, Final Report Sept. 2002- Korman et al.

- Take Home Points
  - Suitable shoreline habitat typically declined with increasing discharges above 226-425 cubic meters per second, the response varied among modeled reaches dependent on local morphology.
  - In general, changes in discharge caused by impoundment tended to decrease the availability of suitable shoreline habitat from September to February, but increased habitat availability in the spring (May-June)

Effect of Steady Flows on Relative Abundance and Distribution of Fish Including Young-Of-Year Humpback Chub Along Shoreline

- Draft Report received June 2001, Final Report received Dec 2002. Trammel & Valdez
- Take Home Points
  - Catch of bluehead sucker and flannelmouth sucker in backwaters significantly higher than 1991-97
  - No increase in upstream distribution of warm-water fish from downstream
  - No observable increase in growth of YOY native fish (including HBC)
  - Catch rates of HBC overall too low to draw any conclusions

Effect of LSSF on Rainbow Trout in the Lees Ferry Tailwater

- Draft Report 2001, Final Report Due February 2003, Speas, et al.
- Take Home Points
  - No apparent difference in CPUE or survival for RBT due to LSSF
  - Possible increase in growth and shift in fish condition to peak in summer rather than fall

Effect of Discharge and Flows on Temperatures in Aquatic Habitats

- Draft Report submitted in 2000, Final Report anticipated Feb. 2003. Vernieu
- Take Home Points
  - Maximum warming occurs during the month of June and varies with discharge level. The Colorado River at Diamond Creek experienced 10°C warming above tailwater temperatures at discharge levels of 8000 cfs in June 2000 compared to less than 5°C warming during high steady discharge of 26,000 cfs in June 1997.
  - Significant warming of near-shore environments occurred during the LSSF in shallow water with little or no velocity. Warming dependent on amount of direct solar ensolation and the degree of isolation from the main channel.

Effect of LSSF on Stratification, Composition, and Hydrodynamics of Lake Powell and Downstream Water Quality

- Final Report Anticipated-March, 2003
  - Poster Presentation at 2002 North American Lake Management Society Meeting-Hueftle
- Take Home Points
  - No Discernible Affects on Lake Powell
  - Conductivity is a Useful Tracer for Glen Canyon Dam Hydrograph Downstream

Impacts of Low Flow Rates on Recreational Rafting Traffic

- Final Report Received May 2001, Roberts

- Take Home Points
  - Based on trip reports, trips spend 50% less time off the river during low flow regimes of 8,000 cfs because boats travel slower at low flows
  - On-river travel time affected layover time and selection of attraction sites and campsites

Economic Impacts of LSSF on Recreation

- Final Report Received March 2002, Kim & Hjerpe

- Take Home Points
  - Rafting concessionaires incurred additional expenses due to low flows
  - Angling concessionaires lost revenue during ‘spike flows’
  - Private boaters and anglers not significantly affected

Whitewater boating safety studies below Lees Ferry

- Results being compiled and draft Report anticipated by the end of 2003-Jalbert

- Hypothesis tested:
  - Whitewater safety will not significantly differ from safety during normal daily flows

Economic Impacts to power customers

- Draft Report Submitted 2002. Results being finalized; final report anticipated February 2003, Palmer

- Hypothesis tested:
  - Economic impacts to power customers will not differ significantly from economic impacts under normal daily operations

Changes in Campable Beach Areas

- Project incorporated into larger beach synthesis project. Draft report received. Final report anticipated March ‘03-Kaplinski.

- Hypothesis tested:
  - Campable beach areas will not differ significantly from campable beach areas under normal daily operations