# Science Plan for Fall Steady Flows

## USGS/SBSC/Grand Canyon Monitoring and Research Center

U.S. Department of the Interior
U.S. Geological Survey

# Background

- **February 2008**
  - **Environmental Assessment: Steady flows 2008-12**
  - **Biological Opinion: Study near shore ecology & steady flows**
- **May 2008**
  - **AMWG: GCMRC prepare science plan; incl. flow levels to support study**
- **Science Plan comments from**
  - **Scientific Advisors review, July 2009**
  - **TWG review, August 2009**
  - **AMWG August 2009**
  - **TWG September 2009**
- **Revision delivered to TWG March 3, 2010**

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# Examples of comments incorporated

- **Better integration & Pursue modeling**
  - Added ecosystem modeling to study plan (R12.P1.10)
  - Added conceptual diagram showing integration
- **How will plan answer SSQs?**
  - Linked projects with SSQs
- **Include results of LSSF and 2005 Steady Flows**
  - Added
- **Using same flow level across years is flawed**
  - Changed recommendation to “lowest flows” (to maximize backwater habitat [Grams and others 2010])
    - 2008-2010 FSF discharges: 12 kcfs, 10 kcfs, 8 kcfs.

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Grams, P.E., Schmidt, J.C., and Andersen, M.E., 2010, 2008 high-flow experiment at Glen Canyon Dam; morphologic response of eddy-deposited sandbars and associated aquatic backwater habitats along the Colorado River in Grand Canyon National Park: U.S. Geological Survey Open-File Report 2010-1032, 73 p.

# Examples of comments not incorporated

- **Add in testable hypotheses**
  - **Not fruitful with current design**
- **Explore other months/time of year to test transition flows**
  - **FSF experiment not the place for this; could be another study**
- **Need to address stranding**
  - **Existing data suggests stranding given the current discharge levels is unlikely during transition (Maddux and others, 1987)**

Maddux, H.R., D.M. Kubly, J.C. deVos Jr., W.R. Persons, R. Staedicke, R.L. Wright. 1987. Effects of Varied Flow Regimes on Aquatic Resources of Glen and Grand Canyon. Arizona Game and Fish Department Report Prepared for Bureau of Reclamation (Contract # 4-AG-40-01810).

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# GCMRC Approach: 6 Projects

- Near-shore ecology
  - Bio 2.R15, Funded in 2010-2011
- Stock assessment of Grand Canyon native fish
  - Bio 2.R7, Funded in 2010-2011
- Aquatic foodbase monitoring
  - Bio 1.R1 & R4, Funded in 2010-2011
- Rainbow trout monitoring
  - Bio 4.M1, Funded in 2010-2011
- Supplemental water temperature data collection
  - New project [thermisters funded, thermal imagery not funded]
- Ecosystem Modeling
  - Plan 12 P1.10, Funded in 2010-2011

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# Present

- Comments made document much better and more comprehensive
- Revised document ready for approval

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# Next Steps

- TWG discussion/approval
- TWG recommendation to AMWG for approval

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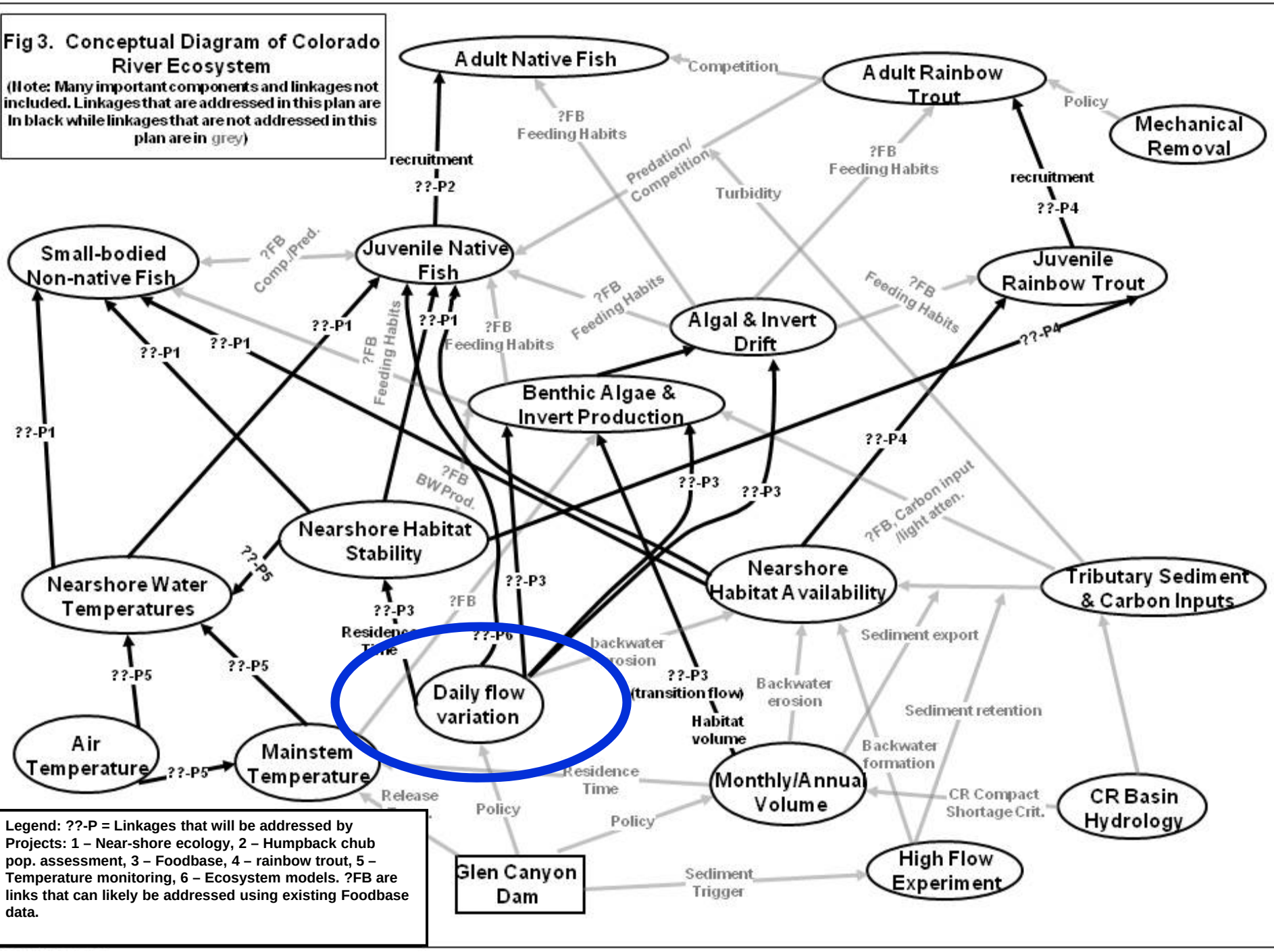
Fig 3. Conceptual Diagram of Colorado River Ecosystem
(Note: Many important components and linkages not included. Linkages that are addressed in this plan are In black while linkages that are not addressed in this plan are in grey)
Adult Native Fish
Competition
Adult Rainbow Trout
Policy
Mechanical Removal
?FB Feeding Habits
recruitment
??-P2
Predation/ Competition
Turbidity
?FB Feeding Habits
recruitment
??-P4
Small-bodied Non-native Fish
?FB Comp./Pred.
Juvenile Native Fish
Juvenile Rainbow Trout
??-P1
?FB Feeding Habits
Algal & Invert Drift
?FB Feeding Habits
??-P4
Benthic Algae & Invert Production
??-P3
?FB BW Prod.
?FB, Carbon input /light atten.
Nearshore Habitat Stability
??-P5
Nearshore Habitat Availability
Tributary Sediment & Carbon Inputs
Nearshore Water Temperatures
??-P6
backwater erosion
Sediment export
Daily flow variation
??-P3 (transition flow)
Habitat volume
Backwater erosion
Sediment retention
Air Temperature
Mainstem Temperature
Backwater formation
Residence Time
Monthly/Annual Volume
CR Compact Shortage Crit.
CR Basin Hydrology
Release
Policy
Policy
Glen Canyon Dam
Sediment Trigger
High Flow Experiment
Legend: ??-P = Linkages that will be addressed by Projects: 1 – Near-shore ecology, 2 – Humpback chub pop. assessment, 3 – Foodbase, 4 – rainbow trout, 5 – Temperature monitoring, 6 – Ecosystem models. ?FB are links that can likely be addressed using existing Foodbase data.