

# Final Draft GCMRC Work Plan and Budget FY15/16/17

Grand Canyon Monitoring and Research Center  
Southwest Biological Science Center  
August 2014

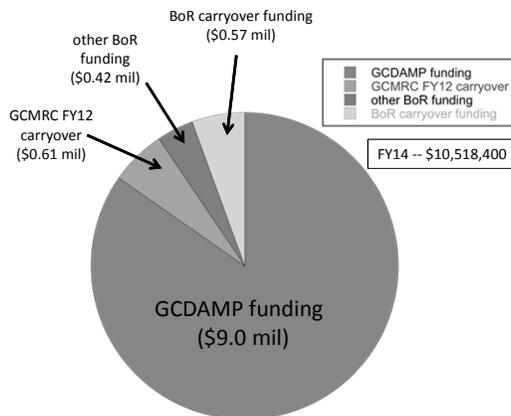


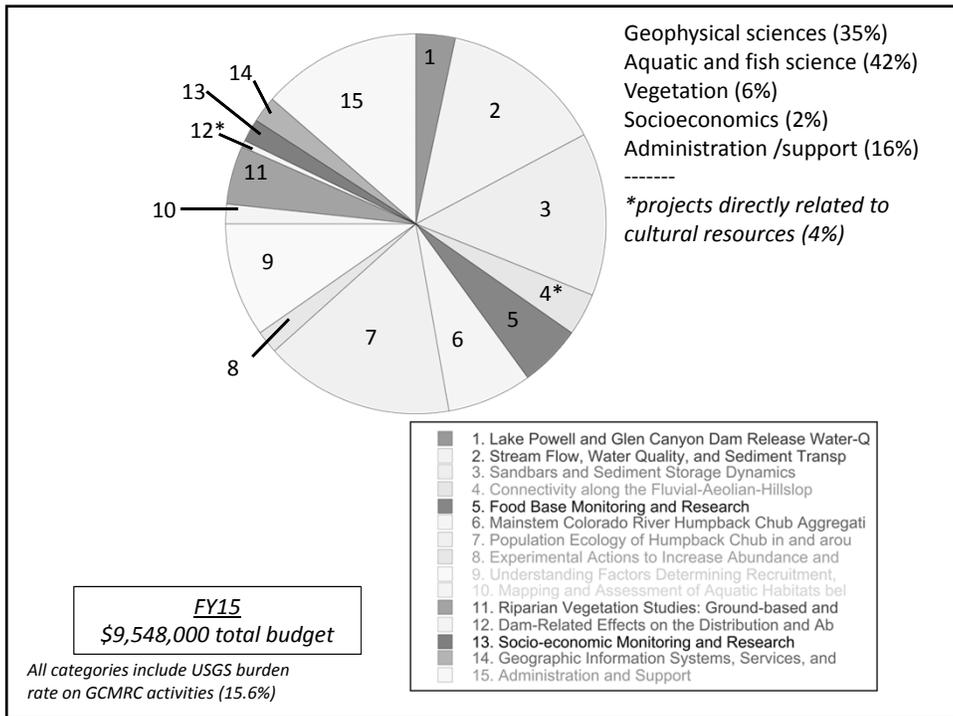
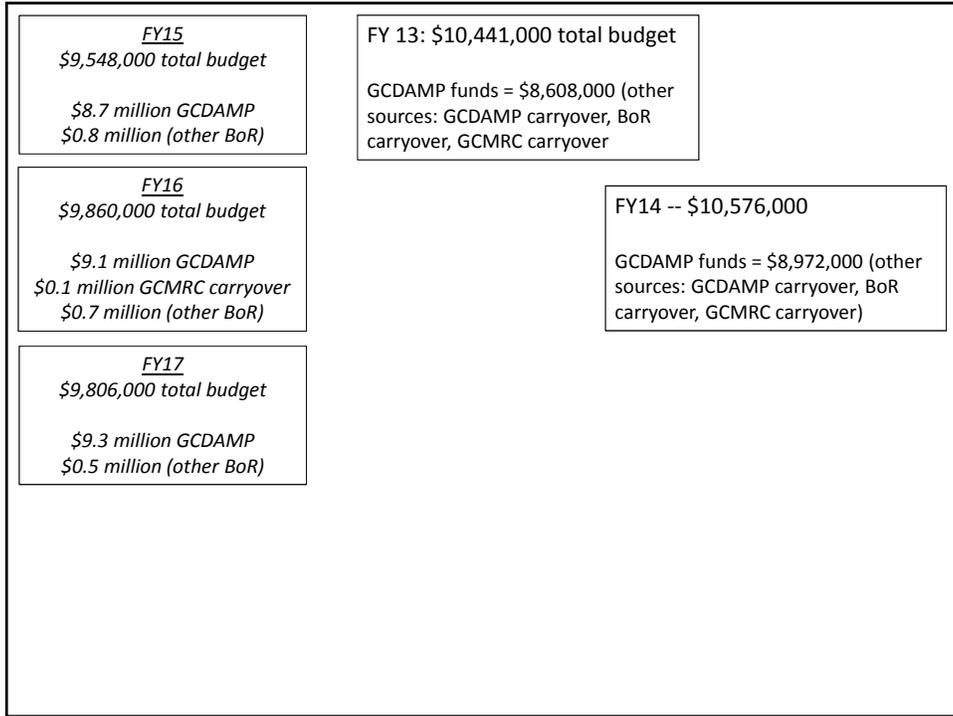
FY 13: \$10,441,000 total budget

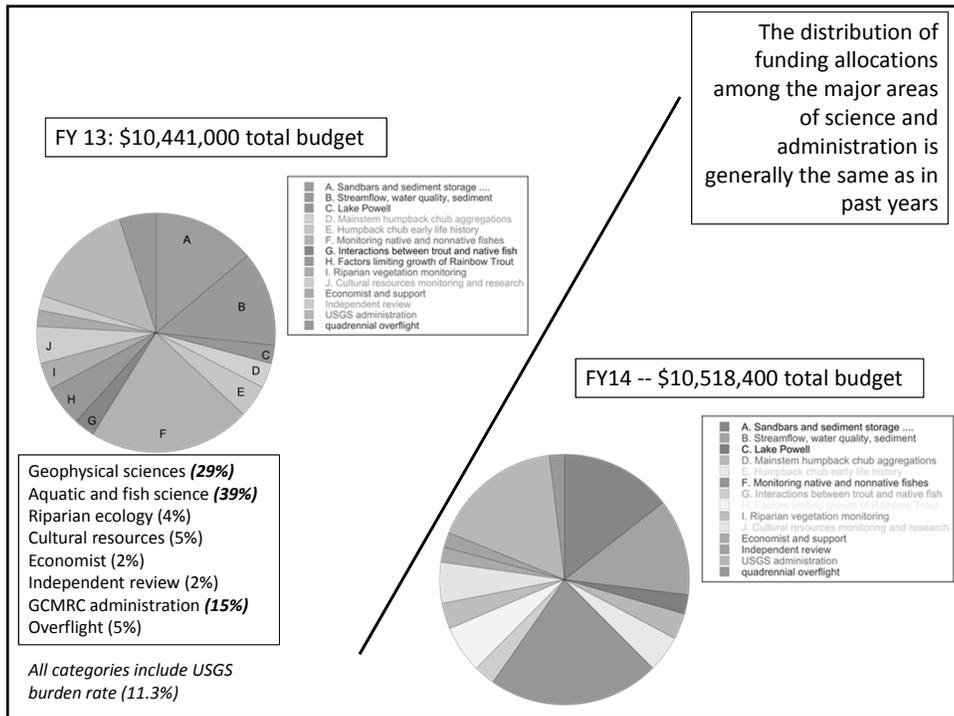
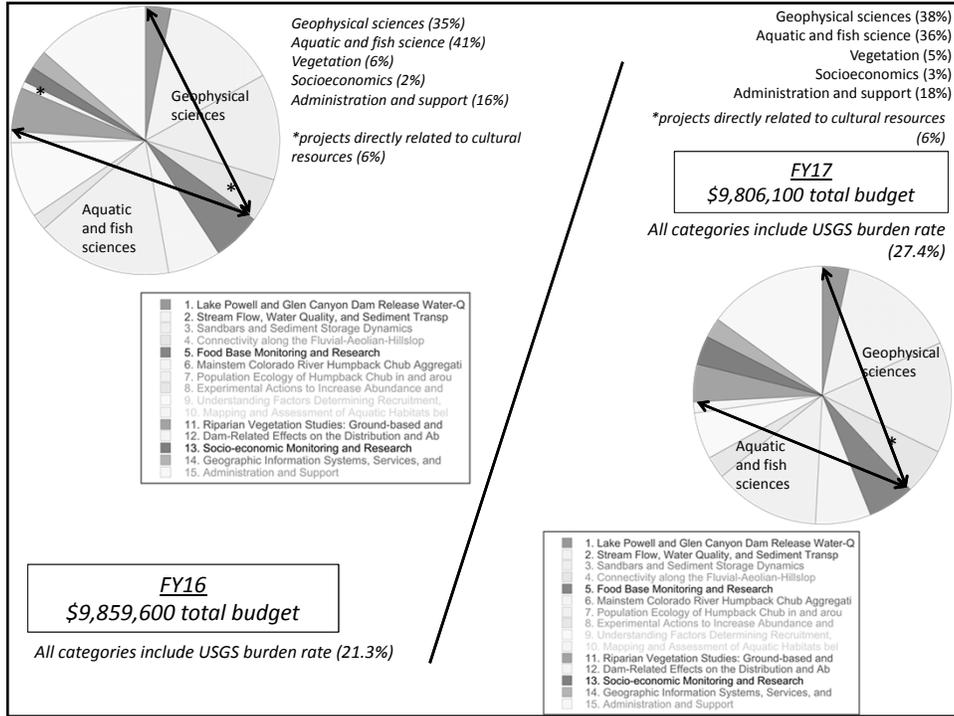
GCDAMP funds = \$8,608,000 (other sources: GCDAMP carryover, BoR carryover, GCMRC carryover)

FY14 -- \$10,576,000

GCDAMP funds = \$8,972,000 (other sources: GCDAMP carryover, BoR carryover, GCMRC carryover)







Annual Reporting meeting and knowledge assessment (January 28)  
Technical Work Group meeting (January 29-30)  
TWG Budget Ad Hoc Group webinar (February 13)  
Adaptive Management Work Group meeting (February 19-20)

Initial identification of potential projects (Mar)

Technical Work Group meeting (April 8-9)  
TWG Budget Ad Hoc Group webinar (April 21)  
GCMRC/tribes meeting (April 22)

Important meetings that affected development of FY15/16/17 TWP

TWP Prospectus (May 9)

Budget Ad Hoc Group webinar (May 20)  
GCMRC/tribes meeting (May 22)  
Adaptive Management Work Group webinar (May 27)

First draft TWP (June 6)

Stakeholder and Science Advisors review (June)  
Technical Work Group meetings (June 24-25, July 15)

Final draft TWP (August 1)

The Big Questions in Applied River Science ...

What is the largest amount of fine sediment that can occur along the banks of the Colorado River, especially as eddy sandbars?

What flow regime, in relation to the natural supply of fine sediment from tributaries, results in the most widespread distribution of fine sediment along the channel banks and in eddies?

Do larger amounts of fine sediment along the channel banks and in eddies significantly change the amount and distribution of fine sediment that occurs above the active channel and that occurs at or near archaeological sites?

What management strategies should be employed to maintain a high quality rainbow trout fishery in Glen Canyon while protecting, and potentially recovering, the endangered humpback chub fish community in Marble and Grand Canyons?



Questions, Expectations, Concerns

**Assistant Secretary's Guidance concerning research and monitoring priorities** in GCMRC science planning (March 2011 and May 2014 memos)

**2011 Desired Future Conditions Ad Hoc Group**

*(April 30, 2012: Sol directed AMWG "to utilize these DFCs to inform and guide the AMWG's future considerations")*

**Secretarial Directive** concerning Environmental Assessments and related Science Plans for (1) High-flow Experimental Releases, and (2) Non-native Fish Control (May 23, 2012: *"I direct ... USGS ... to undertake coordinated implementation of the actions and commitments described and analyzed in the Environmental Assessments ..."*)

**GCDAMP Documents and Guidance:**

- Core Monitoring Plan** (February 2011, draft)
- Strategic Science Plan** (April 2009)
- Monitoring and Research Plan** (April 2009)
- Priority Questions (5) and Program Goals (12)** (August 2004)

**Recent Guidance from Secretary's Designee Regarding Triennial Budget Process and Science Planning Priorities**

- "science relevant to compliance with Endangered Species Act, particularly relative to native fish and humpback chub"
  - "science informing ... compliance with the Grand Canyon Protection Act, especially the sediment resource"
  - "science on non-native fish control and the recreational trout fishery"
- science priorities originally described in March 2011 for which "the need for this science continues"*

• "the evolving issue related to cultural/archaeological resources as linked to modern river processes"; "understanding ... how cultural and archaeological sites are linked to modern river processes"

• "the role of Traditional Ecological Knowledge in contributing to scientific understanding and river operations"

• "other investigations for which there is "widespread support and further the purposes of the Adaptive Management Program"

• "continue ... long-term monitoring of core ecosystem components"

"within the relevant budget constraints"

"river corridor landscape ... matches natural conditions ..."

"... maximum opportunity to experience the wilderness character of the canyon ..."

"maintain significance and integrity of [prehistoric archaeological and historic sites] ... through preservation in place ..."

"Maintain culturally appropriate resource conditions ..."

"native riparian systems ..."

"High elevation open riparian sediment deposits ..."

"Water quality ..."

"native fish species and their habitats ..."

"adequate, diverse, productive aquatic foodbase ..."

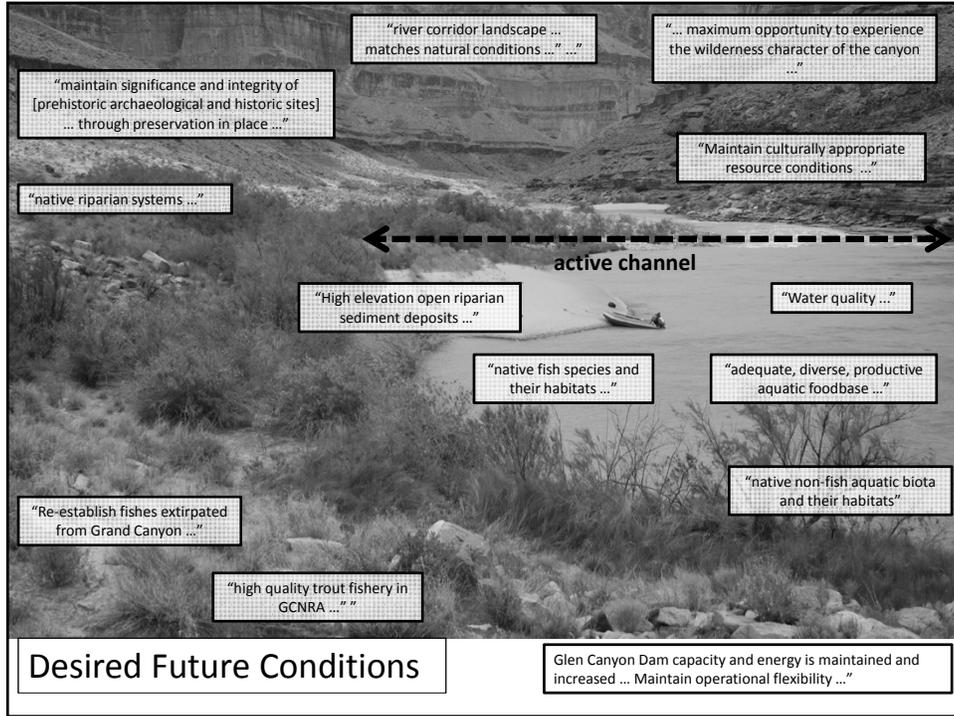
"Re-establish fishes extirpated from Grand Canyon ..."

"native non-fish aquatic biota and their habitats"

"high quality trout fishery in GCNRA ..."

**Desired Future Conditions**

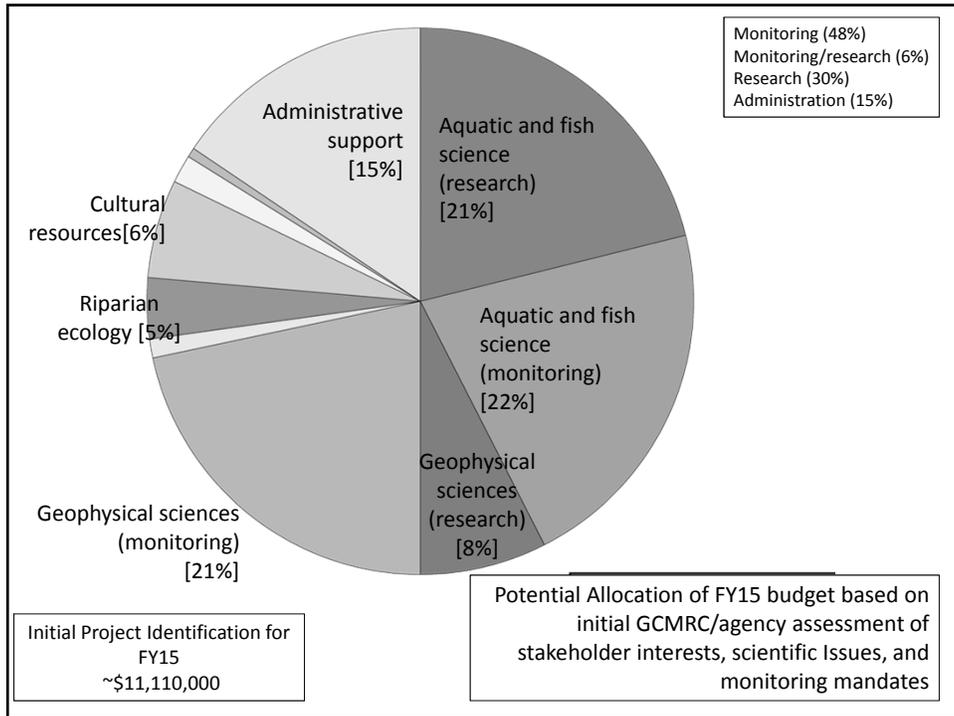
Glen Canyon Dam capacity and energy is maintained and increased ... Maintain operational flexibility ..."



## Principles in Budget Development

- Each project **comprehensively focuses** on a particular resource and/or specific questions; each project focuses on key monitoring activities and resolving key management uncertainties.
- To the degree possible, **projects should** reference each other and **be linked** with each other.
- Research projects should consider **cost effective strategies to resolve knowledge uncertainties**. Field-scale experiments should be avoided unless based on previous laboratory experiments, literature reviews, innovative data analysis, and/or comparative studies of other rivers
- **Collaborate** with land, species, and water management agencies. Pursue cost effective monitoring strategies.
- Report the **full cost** of each project (i.e., incorporate logistics and remote sensing/GIS costs in the associated science activity)





### Guidelines for Prioritization of Projects

1. *Monitoring projects* that implement the HFE Protocol and NNFC EAs
1. *Monitoring projects* that evaluate the effectiveness of the HFE Protocol and NNFC EAs
1. Other core *monitoring activities*
1. Creating *independent science review panels* on critical issues
1. Advancing the *integration of tribal concerns* into monitoring and research
1. *Research* that advances monitoring techniques and analytical methods
1. *Research* that advances predictive modeling capabilities
1. *Research* to resolve critical scientific uncertainties.



**USGS**  
science for a changing world

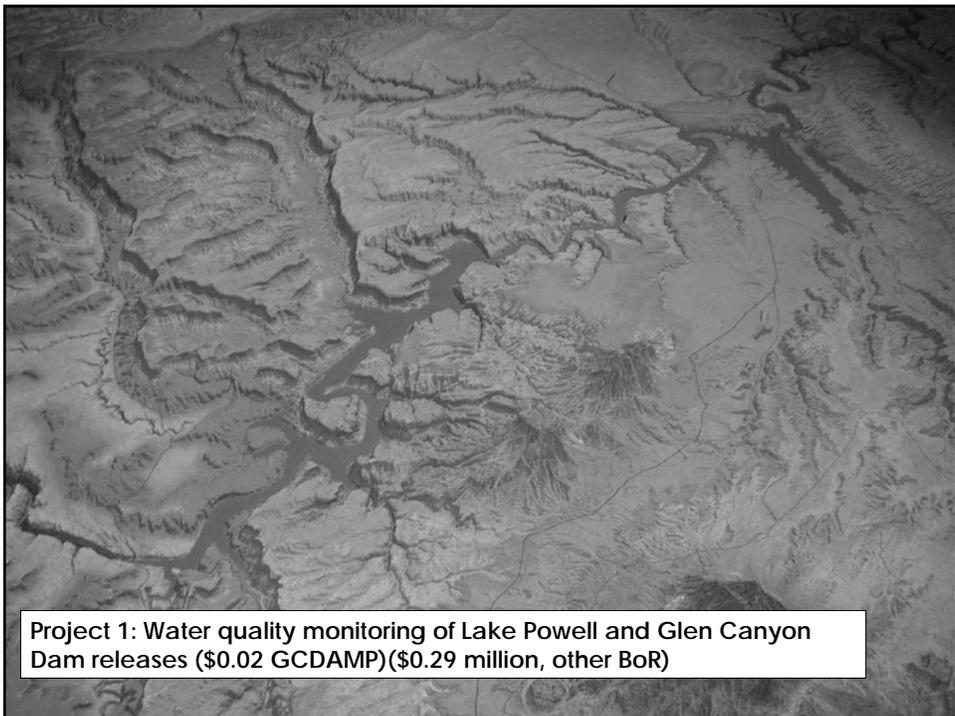
Desired Future Conditions

"high elevation open riparian sediment deposits ... in sufficient volume, area, and distribution ..."

"Physical characteristics, including climate, site-specific geomorphology, dam-related discharge and flow, and tributary flows, generally predominate ..."

"Water quality with regards to dissolved oxygen, nutrient concentrations and cycling, turbidity, temperature, etc. is sufficient to support natural ecosystem

"... maintain significance and integrity [of] prehistoric archaeological sites and historic sites]"



**Project 1: Water quality monitoring of Lake Powell and Glen Canyon Dam releases (\$0.02 GCDAMP)(\$0.29 million, other BoR)**



FY15 proposed work

**Project 2: Stream flow, water quality, and sediment transport ... (\$1.34 million, GCDAMP)**



**Project 3: Sandbars and sediment storage dynamics ... (\$1.32 million, GCDAMP)**

- 3.1.1 Monitoring sandbars using topographic surveys and remote cameras (\$370,000)
- 3.1.2 Monitoring sand bars and shorelines...by remote sensing (\$120,000)
- 3.1.3 Surveying with a camera: rapid topographic surveys... (\$42,000)
- 3.1.4 Analysis of historical images at selected monitoring sites (\$89,000)
- 3.2 Sediment storage monitoring (\$460,000)
- 3.3 Characterizing, and predictive modeling, of sand bar response... (\$100,000)
- 3.4 Connecting bed material transport, bed morphodynamics... (\$36,000)
- 3.5 Control network and survey support (\$110,000)

FY15 proposed work

**Project 4: ...Quantifying the relative importance of river-related factors that influence upland geomorphology and archaeological site stability (\$0.34 million, GCDAMP)**

- 4.1 Quantifying connectivity along the fluvial-aeolian-hillslope continuum at landscape scales (\$140,000 AMP; \$75,000 BoR)
- 4.2 Monitoring of cultural sites in Grand and Glen Canyons (\$48,000 AMP; \$75,000 BoR)(\$174,000 of FY14 carryover allocated to purchase Terrestrial Laser Scanner)





Desired Future Conditions

Native Species -- "Native fish species and their habitats ... sustainably maintained ..."

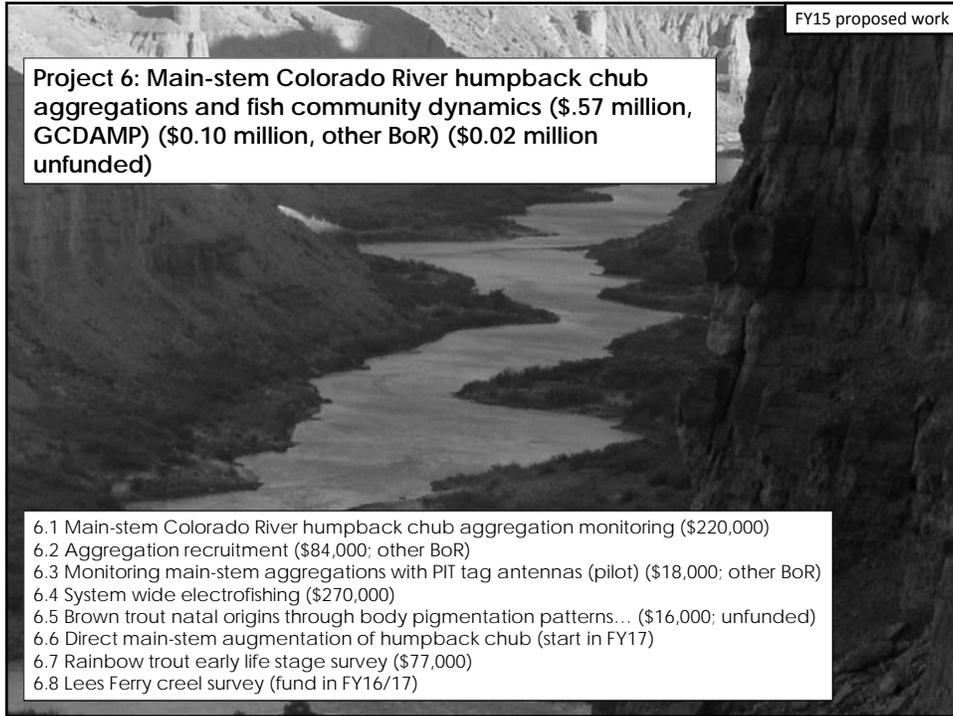
"A high quality trout fishery in GCNRA ... that does not adversely affect the native aquatic community in GCNP"

FY15 proposed work

**Project 5: Food base monitoring and research (\$0.52 million, GCDAMP; \$0.04 million unfunded; \$0.18 million request to WAPA for work beyond CRE)**

- 5.1 Are aquatic insect diversity and production recruitment limited?
  - 5.1.1 Insect emergence in Grand Canyon via citizen science (\$120,000)
  - 5.1.2 Effects of hydropeaking on oviposition and egg mortality (\$97,000)
  - 5.1.3 Synthesis of stressors and controls on EPT distributions (\$30,000)
  - 5.1.4 Synthesis of the aquatic foodbase in western US tailwaters (\$30,000)
  - 5.1.5 Natural history of oviposition for species in Grand Canyon (\$26,000)
  - 5.1.6 Laboratory studies on insect oviposition and egg mortality (\$37,000; unfunded)
  - 5.1.7 *Comparative emergence studies in Upper Basin (\$59,000; WAPA)*
  - 5.1.8 *Natural history of oviposition for EPT in the Upper Basin (\$25,000; WAPA)*
- 5.2 Patterns and controls of aquatic invertebrate drift in Colorado River tailwaters
  - 5.2.1 Characterize and monitor drift, emergence in Glen Canyon (\$52,000)
  - 5.2.2 Drift monitoring in Glen, Marble, and Grand Canyons (\$87,000)
  - 5.2.3 Link drift to channel bed shear stress (\$21,000)
  - 5.2.4 Link drift patterns to substrate in Glen, Marble, Grand Canyons (\$21,000)
  - 5.2.5 *Comparative drift in Upper and Lower Basin tailwaters (\$94,000 ;WAPA)*
- 5.3 Primary Production Monitoring in Glen Marble and Grand Canyons
  - 5.3.1 Synthesis and publication of Glen Canyon algae production (\$26,000)
  - 5.3.2 Monitoring dissolved O<sub>2</sub> in Glen, Marble, and Grand Canyons (\$15,000)
  - 5.3.3 *Developing automated tools for estimating algae production (outside funding)*

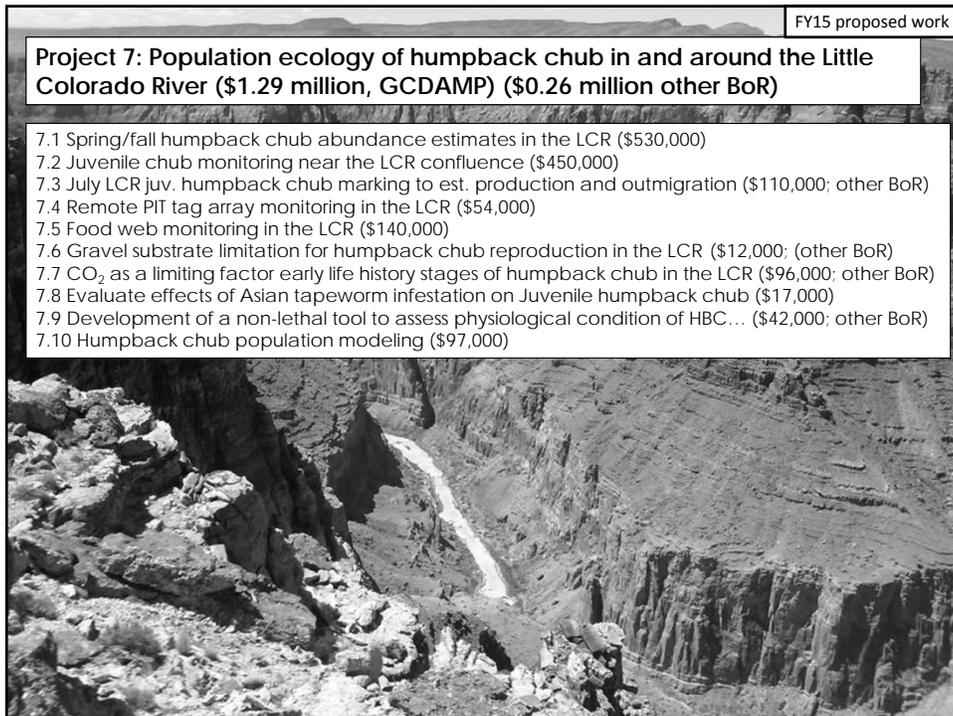
WAPA: submitted to Western Area Power Administration for funding consideration



FY15 proposed work

**Project 6: Main-stem Colorado River humpback chub aggregations and fish community dynamics (\$0.57 million, GCDAMP) (\$0.10 million, other BoR) (\$0.02 million unfunded)**

- 6.1 Main-stem Colorado River humpback chub aggregation monitoring (\$220,000)
- 6.2 Aggregation recruitment (\$84,000; other BoR)
- 6.3 Monitoring main-stem aggregations with PIT tag antennas (pilot) (\$18,000; other BoR)
- 6.4 System wide electrofishing (\$270,000)
- 6.5 Brown trout natal origins through body pigmentation patterns... (\$16,000; unfunded)
- 6.6 Direct main-stem augmentation of humpback chub (start in FY17)
- 6.7 Rainbow trout early life stage survey (\$77,000)
- 6.8 Lees Ferry creel survey (fund in FY16/17)



FY15 proposed work

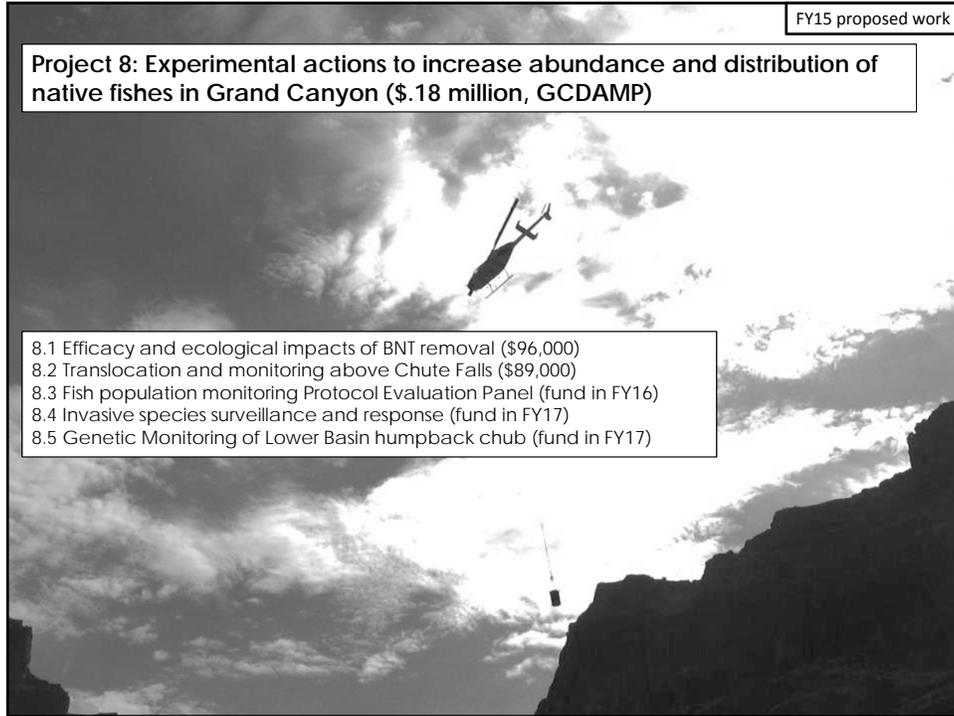
**Project 7: Population ecology of humpback chub in and around the Little Colorado River (\$1.29 million, GCDAMP) (\$0.26 million other BoR)**

- 7.1 Spring/fall humpback chub abundance estimates in the LCR (\$530,000)
- 7.2 Juvenile chub monitoring near the LCR confluence (\$450,000)
- 7.3 July LCR juv. humpback chub marking to est. production and outmigration (\$110,000; other BoR)
- 7.4 Remote PIT tag array monitoring in the LCR (\$54,000)
- 7.5 Food web monitoring in the LCR (\$140,000)
- 7.6 Gravel substrate limitation for humpback chub reproduction in the LCR (\$12,000; other BoR)
- 7.7 CO<sub>2</sub> as a limiting factor early life history stages of humpback chub in the LCR (\$96,000; other BoR)
- 7.8 Evaluate effects of Asian tapeworm infestation on Juvenile humpback chub (\$17,000)
- 7.9 Development of a non-lethal tool to assess physiological condition of HBC... (\$42,000; other BoR)
- 7.10 Humpback chub population modeling (\$97,000)

FY15 proposed work

**Project 8: Experimental actions to increase abundance and distribution of native fishes in Grand Canyon (\$.18 million, GCDAMP)**

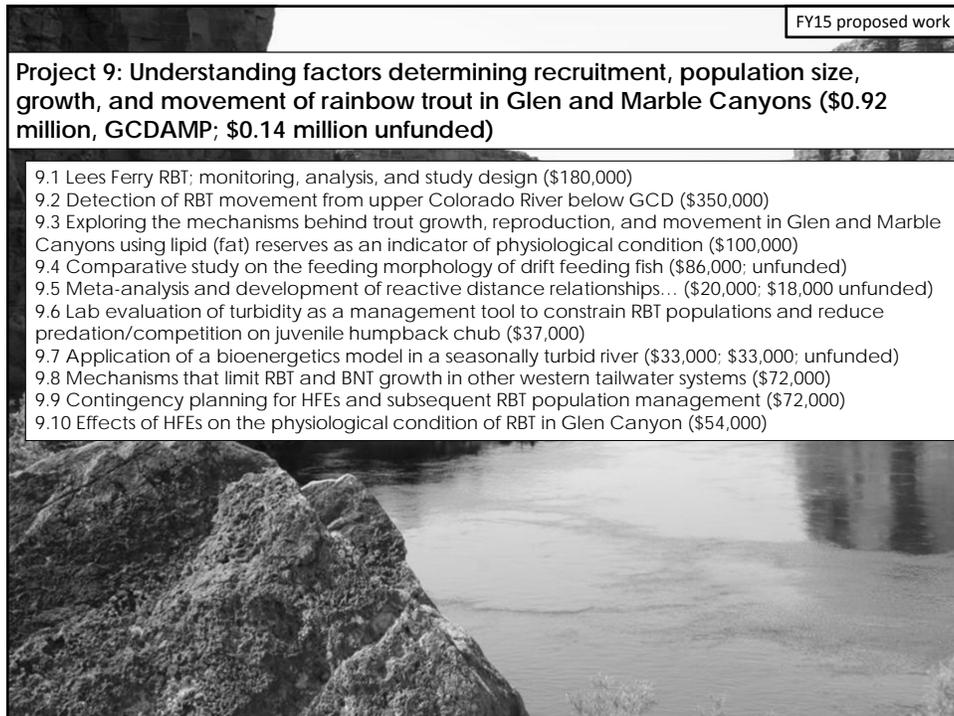
8.1 Efficacy and ecological impacts of BNT removal (\$96,000)  
 8.2 Translocation and monitoring above Chute Falls (\$89,000)  
 8.3 Fish population monitoring Protocol Evaluation Panel (fund in FY16)  
 8.4 Invasive species surveillance and response (fund in FY17)  
 8.5 Genetic Monitoring of Lower Basin humpback chub (fund in FY17)



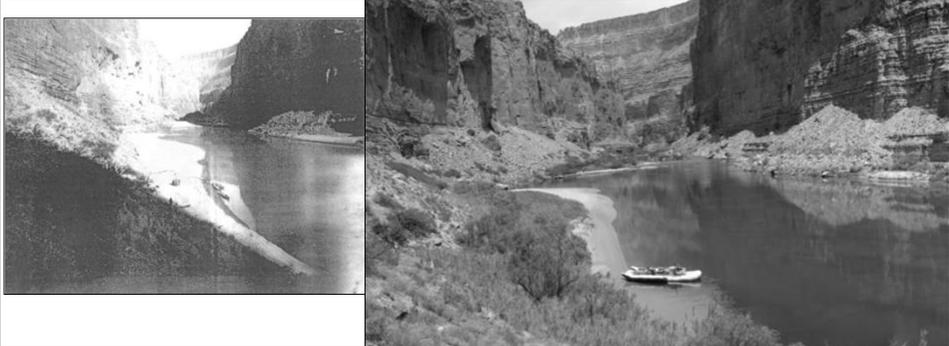
FY15 proposed work

**Project 9: Understanding factors determining recruitment, population size, growth, and movement of rainbow trout in Glen and Marble Canyons (\$0.92 million, GCDAMP; \$0.14 million unfunded)**

9.1 Lees Ferry RBT; monitoring, analysis, and study design (\$180,000)  
 9.2 Detection of RBT movement from upper Colorado River below GCD (\$350,000)  
 9.3 Exploring the mechanisms behind trout growth, reproduction, and movement in Glen and Marble Canyons using lipid (fat) reserves as an indicator of physiological condition (\$100,000)  
 9.4 Comparative study on the feeding morphology of drift feeding fish (\$86,000; unfunded)  
 9.5 Meta-analysis and development of reactive distance relationships... (\$20,000; \$18,000 unfunded)  
 9.6 Lab evaluation of turbidity as a management tool to constrain RBT populations and reduce predation/competition on juvenile humpback chub (\$37,000)  
 9.7 Application of a bioenergetics model in a seasonally turbid river (\$33,000; \$33,000; unfunded)  
 9.8 Mechanisms that limit RBT and BNT growth in other western tailwater systems (\$72,000)  
 9.9 Contingency planning for HFEs and subsequent RBT population management (\$72,000)  
 9.10 Effects of HFEs on the physiological condition of RBT in Glen Canyon (\$54,000)



FY15 proposed work
<b>Project 10: Where does the Glen Canyon Dam rainbow trout tailwater fishery end? – Integrating fish and channel mapping data below Glen Canyon Dam (\$0.15 million, GCDAMP)</b>


FY15 proposed work
<b>Project 11: Riparian vegetation studies: ground-based and landscape-scale riparian vegetation monitoring and plant response-guild research associated with sandbar evolution and wildlife habitat analysis (FY15: \$0.49 million, GCDAMP)</b>
11.1 Ground-based vegetation monitoring (\$180,000) 11.2 Periodic landscape scale vegetation mapping and analysis using remotely sensed data (\$150,000) 11.3 Influence of sediment and vegetation feedbacks on the evolution of sandbars in Grand Canyon(\$100,000) 11.4 Linking dam operations to changes in terrestrial fauna (\$24,000) 11.5 Science review panel of successes and challenges in non-native vegetation control in the Colorado River and Rio Grande watersheds (\$33,000;)


FY15 proposed work

**Project 12: Dam-related effects on the distribution and abundance of selected culturally-important plants in the Colorado River ecosystem (\$0.05 million, GCDAMP)**

- 12.1 Tribal workshop and analysis of cultural landscape change (\$52,000)
- 12.2 Tribal evaluations of cultural landscape changes (begins in FY16)



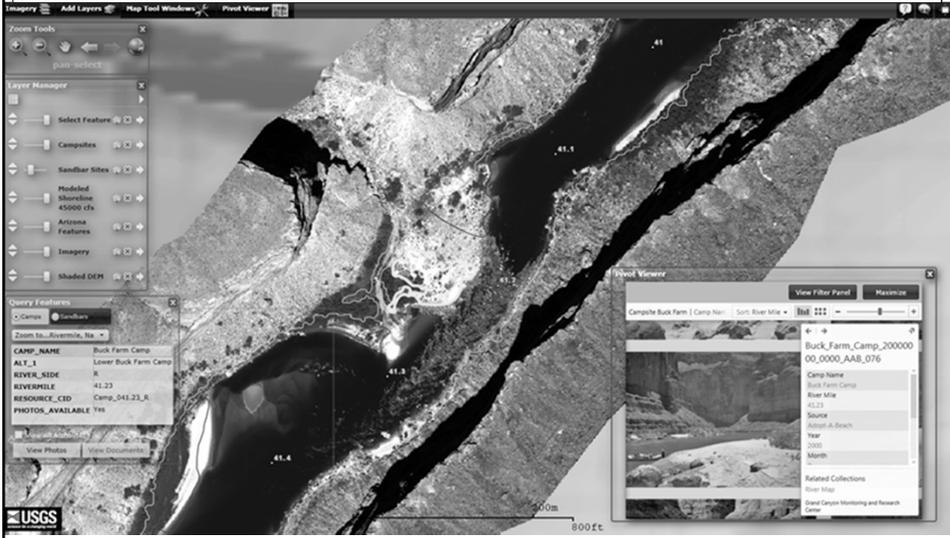
FY15 proposed work

**Project 13: Socio-economic monitoring and research (\$0.18 million, GCDAMP)**

- 13.1 Economic values of recreational resources along the Colorado River – Grand Canyon whitewater floater and Lees Ferry angler values (\$70,000)
- 13.2 Tribal values and perspectives of resources downstream of Glen Canyon Dam (begin in FY17)
- 13.3 Applied decision methods for the Glen Canyon Adaptive Management Plan (\$110,000)



**Project 14: Geographic information systems, services, and support (FY15: \$0.23 million, GCDAMP)**



**Project 15: Administration and Support (FY15: \$1.30 million, GCDAMP)**

**FY 16 and FY 17**

Anticipated GCDAMP funding:  
FY16 -- \$9.0 million  
FY 17 -- \$9.3 million

USGS/SBSC/GCMRC indirect cost rates:  
FY16 – 21.3%  
FY17 – 27.4%

**FY 16 and FY 17**

**Anticipated GCDAMP funding:**  
 FY16 -- \$9.0 million  
 FY 17 -- \$9.3 million

**USGS/SBSC/GCMRC indirect cost rates:**  
 FY16 – 21.3%  
 FY17 – 27.4%

Prioritize monitoring and research activities  
 Shift research projects from 3 years to 2 years  
 Delay start times of some projects  
 Remove some projects from GCDAMP funding

**Reduce GCDAMP funding and implement cost saving mandate:**  
 FY16 – GCDAMP funding at 93% of identified costs  
 FY17 – GCDAMP funding at 95% of identified costs



**Project 2: Stream flow, water quality, and sediment transport ...**  
**(FY15: \$1.34 million) (FY16: \$1.35 million) (FY17: \$1.46 million)**

**Project 3: Sandbars and sediment storage dynamics ...**  
**(\$1.33 million) (FY16: \$1.27 million) (FY17: \$1.37 million)**

3.1.1 (FY15: \$370,000) **(FY16: \$350,000)** (FY17: \$370,000)

3.1.2 (FY15: \$120,000) **(FY16: \$130,000)** (FY17: \$140,000)

3.1.3 (FY15: \$42,000) **(FY16: \$73,000)** (FY17: \$77,000)

3.1.4 (FY15: \$89,000) **(FY16: \$45,000)** \$45,000 (FY17: 45,000; \$45,000)

3.2 (FY15: \$460,000) **(FY16: \$520,000)** (FY17: \$550,000)

3.3 (FY15: \$100,000) **(FY16: \$110,000)** (FY17: \$120,000)

3.4 (FY15: \$36,000) **(FY16: \$18,000)** \$18,000 (FY17: \$18,000; \$18,000)

3.5 (FY15: \$110,000) **(FY16: \$120,000)** (FY17: \$120,000)

Individual project elements -- bold indicates proposed for funding; normal text indicates unfunded in indicated year; total of all project elements is equal to original cost estimate. Sum of all elements will be reduced in FY16 and FY17 by 7% and 5%, respectively.

**Project 4: ...Quantifying the relative importance of river-related factors that influence upland geomorphology and archaeological site stability (FY15: \$0.34 million) (FY16: \$0.57 million) (FY17: \$0.59 million)**

4.1 (FY15: \$140,000; \$75,000 BoR) (FY16: *\$140,000*; \$75,000 BoR) (FY17: *\$160,000*; \$93,000 BoR)  
 4.2 (FY15: \$48,000 AMP; \$75,000 BoR) (FY16: *\$270,000*; \$75,000 BoR) (FY17: *\$250,000*; \$93,000 BoR)

Wind-blown (aeolian) sand

River-deposited (fluvial) sandbar

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**Project 5: Food base monitoring and research (FY15: \$0.52 million; FY16: \$0.55 million; FY17: \$0.57 million)**

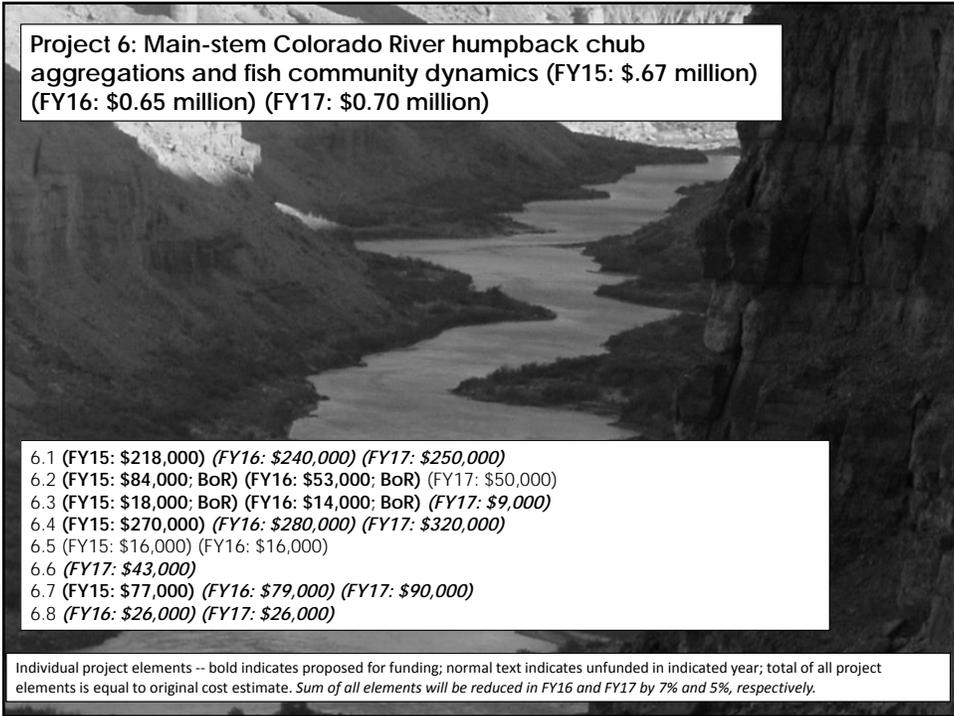
5.1 Are aquatic insect diversity and production recruitment limited?  
 5.1.1 (FY15: **\$120,000**) (FY16: *\$120,000*) (FY17: *\$140,000*)  
 5.1.2 (FY15: **\$97,000**) (FY16: *\$110,000*) (FY17: *\$120,000*)  
 5.1.3 (FY15: **\$30,000**) (FY16: *\$30,000*) (FY17: \$38,000)  
 5.1.4 (FY15: **\$30,000**) (FY16: *\$32,000*) (FY17: \$38,000)  
 5.1.5 (FY15: **\$26,000**) (FY16: *\$28,000*) (FY17: \$31,000)  
 5.1.6 (FY15: \$37,000) (FY16: \$40,000) (FY17: \$47,000)  
 5.1.7 (FY15: *\$59,000*) (FY16: *\$64,000*) (FY17: *\$75,000*) (WAPA)  
 5.1.8 (FY15: *\$25,000*) (FY16: *\$27,000*) (FY17: *\$31,000*) (WAPA)

5.2 Patterns and controls of aquatic invertebrate drift in Colorado River tailwaters  
 5.2.1 (FY15: **\$52,000**) (FY16: *\$67,000*) (FY17: *\$88,000*)  
 5.2.2 (FY15: **\$87,000**) (FY16: *\$116,000*) (FY17: *\$157,000*)  
 5.2.3 (FY15: **\$21,000**) (FY16: *\$25,000*) (FY17: \$30,000)  
 5.2.4 (FY15: **\$21,000**) (FY16: *\$25,000*) (FY17: **\$30,000**)  
 5.2.5 (FY15: *\$94,000*) (FY16: *\$168,000*) (FY17: *\$203,000*) (WAPA)

5.3 Primary Production Monitoring in Glen Marble and Grand Canyons  
 5.3.1 (FY15: **\$26,000**) (FY16: *\$27,000*) (FY17: \$14,000)  
 5.3.2 (FY15: **\$15,000**) (FY16: *\$17,000*) (FY17: *\$18,000*)  
 5.3.3 (FY15-FY17: *outside funding*)

Individual project elements -- bold indicates proposed for funding; normal text indicates unfunded in indicated year; total of all project elements is equal to original cost estimate. Sum of all elements will be reduced in FY16 and FY17 by 7% and 5%, respectively.

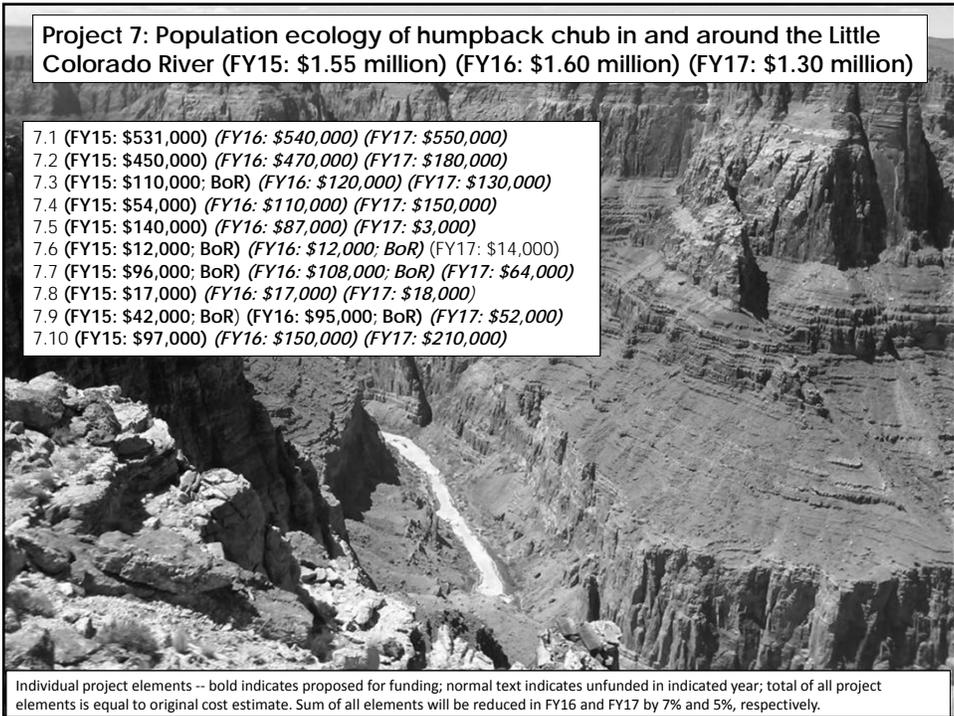
WAPA submitted to Western Area Power Administration for funding consideration.



**Project 6: Main-stem Colorado River humpback chub aggregations and fish community dynamics (FY15: \$.67 million) (FY16: \$0.65 million) (FY17: \$0.70 million)**

6.1 (FY15: \$218,000) (FY16: \$240,000) (FY17: \$250,000)  
 6.2 (FY15: \$84,000; BoR) (FY16: \$53,000; BoR) (FY17: \$50,000)  
 6.3 (FY15: \$18,000; BoR) (FY16: \$14,000; BoR) (FY17: \$9,000)  
 6.4 (FY15: \$270,000) (FY16: \$280,000) (FY17: \$320,000)  
 6.5 (FY15: \$16,000) (FY16: \$16,000)  
 6.6 (FY17: \$43,000)  
 6.7 (FY15: \$77,000) (FY16: \$79,000) (FY17: \$90,000)  
 6.8 (FY16: \$26,000) (FY17: \$26,000)

Individual project elements -- bold indicates proposed for funding; normal text indicates unfunded in indicated year; total of all project elements is equal to original cost estimate. Sum of all elements will be reduced in FY16 and FY17 by 7% and 5%, respectively.



**Project 7: Population ecology of humpback chub in and around the Little Colorado River (FY15: \$1.55 million) (FY16: \$1.60 million) (FY17: \$1.30 million)**

7.1 (FY15: \$531,000) (FY16: \$540,000) (FY17: \$550,000)  
 7.2 (FY15: \$450,000) (FY16: \$470,000) (FY17: \$180,000)  
 7.3 (FY15: \$110,000; BoR) (FY16: \$120,000) (FY17: \$130,000)  
 7.4 (FY15: \$54,000) (FY16: \$110,000) (FY17: \$150,000)  
 7.5 (FY15: \$140,000) (FY16: \$87,000) (FY17: \$3,000)  
 7.6 (FY15: \$12,000; BoR) (FY16: \$12,000; BoR) (FY17: \$14,000)  
 7.7 (FY15: \$96,000; BoR) (FY16: \$108,000; BoR) (FY17: \$64,000)  
 7.8 (FY15: \$17,000) (FY16: \$17,000) (FY17: \$18,000)  
 7.9 (FY15: \$42,000; BoR) (FY16: \$95,000; BoR) (FY17: \$52,000)  
 7.10 (FY15: \$97,000) (FY16: \$150,000) (FY17: \$210,000)

Individual project elements -- bold indicates proposed for funding; normal text indicates unfunded in indicated year; total of all project elements is equal to original cost estimate. Sum of all elements will be reduced in FY16 and FY17 by 7% and 5%, respectively.

**Project 8: Experimental actions to increase abundance and distribution of native fishes in Grand Canyon (FY15: \$0.19 million) (FY16: \$0.21 million) (FY17: \$0.28 million)**

- 8.1 (FY15: \$96,000) (FY16: \$118,000) (FY17: \$120,000)
- 8.2 (FY15: \$89,000) (FY16: \$88,000) (FY17: \$88,000)
- 8.3 (FY16: \$21,000)
- 8.4 (FY17: \$52,000)
- 8.5 (FY17: \$33,000)

Individual project elements -- bold indicates proposed for funding; normal text indicates unfunded in indicated year; total of all project elements is equal to original cost estimate. Sum of all elements will be reduced in FY16 and FY17 by 7% and 5%, respectively.

**Project 9: Understanding factors determining recruitment, population size, growth, and movement of rainbow trout in Glen and Marble Canyons (FY15: \$1.01 million) (FY16: \$1.02 million) (FY17: \$0.74 million)**

- 9.1 (FY15: \$180,000) (FY16: \$210,000) (FY17: \$77,000)
- 9.2 (FY15: \$350,000) (FY16: \$440,000) (FY17: \$370,000)
- 9.3 (FY15: \$100,000)
- 9.4 (FY15: \$86,000) (FY16: \$103,000) (FY17: \$92,000)
- 9.5 (FY15: \$20,000; \$18,000) (FY16: \$20,000; \$18,000) (FY17: \$18,000; \$17,000)
- 9.6 (FY15: \$37,000) (FY16: \$29,000) (FY17: \$30,000)
- 9.7 (FY15: \$33,000; \$33,000) (FY16: \$35,000; 35,000) (FY17: \$33,000; 33,000)
- 9.8 (FY15: \$72,000) (FY16: \$81,000)
- 9.9 (FY15: \$72,000) (FY16: \$62,000) (FY17: \$99,000)
- 9.10 (FY15: \$54,000) (FY16: \$70,000) (FY17: \$5,000)

Individual project elements -- bold indicates proposed for funding; normal text indicates unfunded in indicated year; total of all project elements is equal to original cost estimate. Sum of all elements will be reduced in FY16 and FY17 by 7% and 5%, respectively.

**Project 10: Where does the Glen Canyon Dam rainbow trout tailwater fishery end? – integrating fish and channel mapping data below Glen Canyon Dam (FY15: \$0.15 million) (FY16: \$0.15 million) (FY17: \$0.13 million)**



**Project 11: Riparian vegetation studies: ground-based and landscape-scale riparian vegetation monitoring and plant response-guild research associated with sandbar evolution and wildlife habitat analysis (FY15: \$0.49 million) (FY16: \$0.51 million) (FY17: \$0.48 million)**

- 11.1 (FY15: \$180,000) (FY16: \$190,000) (FY17: \$210,000)
- 11.2 (FY15: \$150,000) (FY16: \$130,000) (FY17: \$130,000)
- 11.3 (FY15: \$100,000) (FY16: \$98,000) (FY17: \$50,000)
- 11.4 (FY15: \$24,000) (FY16: \$136,000) (FY17: \$110,000)
- 11.5 (FY15: \$33,000)



Individual project elements -- bold indicates proposed for funding; normal text indicates unfunded in indicated year; total of all project elements is equal to original cost estimate. Sum of all elements will be reduced in FY16 and FY17 by 7% and 5%, respectively.

**Project 12: Dam-related effects on the distribution and abundance of selected culturally-important plants in the Colorado River ecosystem (FY15: \$0.05 million) (FY16: \$0.08 million)**

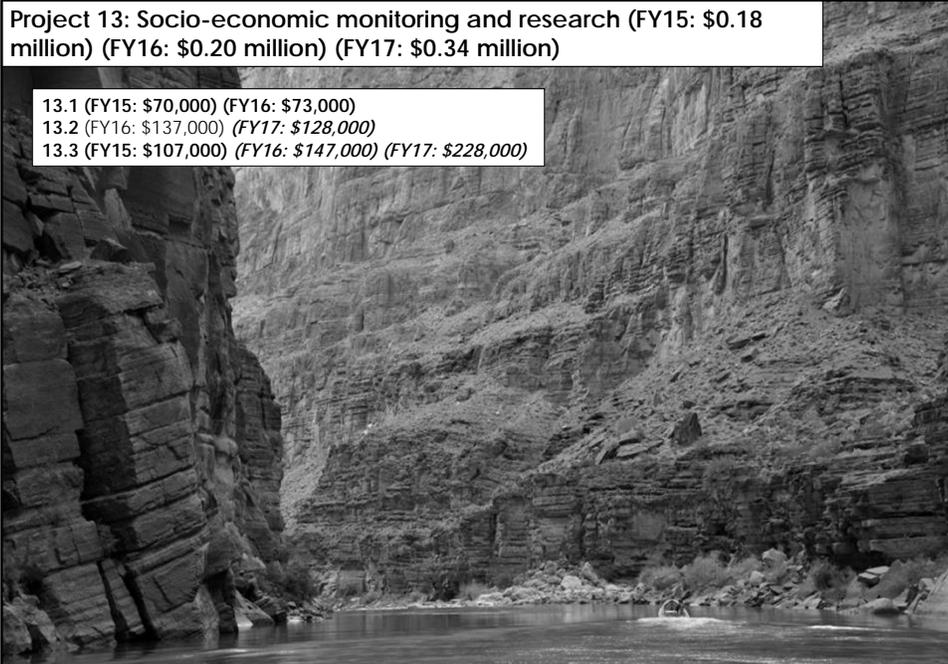
- 12.1 Tribal workshop and analysis of cultural landscape change (FY15: \$52,000) (FY16: \$80,000)
- 12.2 Tribal evaluations of cultural landscape changes (FY16: \$31,000)



Individual project elements -- bold indicates proposed for funding; normal text indicates unfunded in indicated year; total of all project elements is equal to original cost estimate. Sum of all elements will be reduced in FY16 and FY17 by 7% and 5%, respectively.

**Project 13: Socio-economic monitoring and research (FY15: \$0.18 million) (FY16: \$0.20 million) (FY17: \$0.34 million)**

- 13.1 (FY15: \$70,000) (FY16: \$73,000)
- 13.2 (FY16: \$137,000) (FY17: \$128,000)
- 13.3 (FY15: \$107,000) (FY16: \$147,000) (FY17: \$228,000)

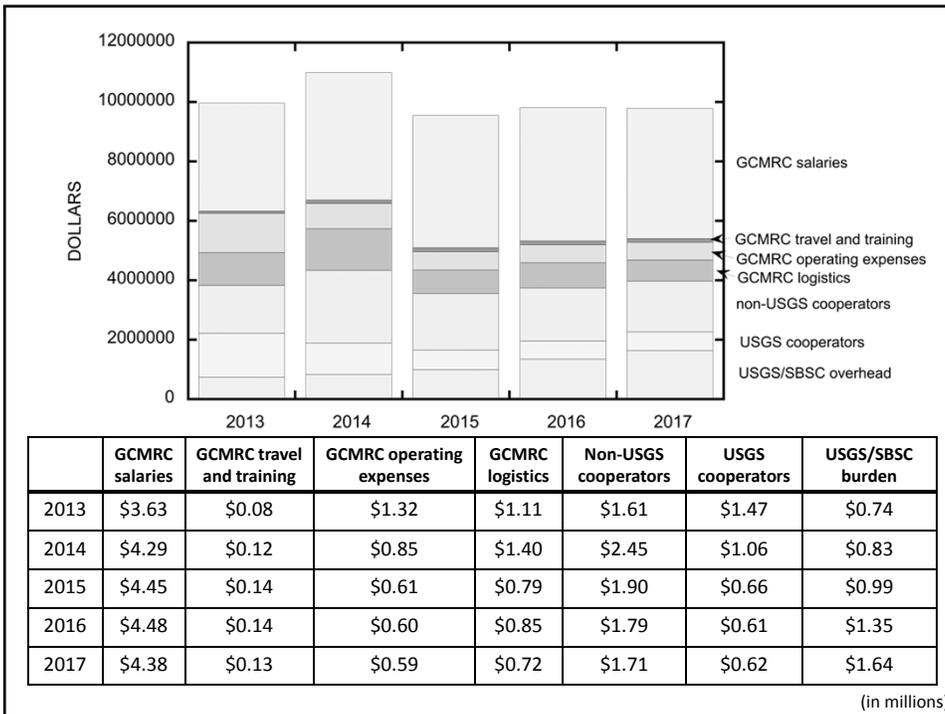


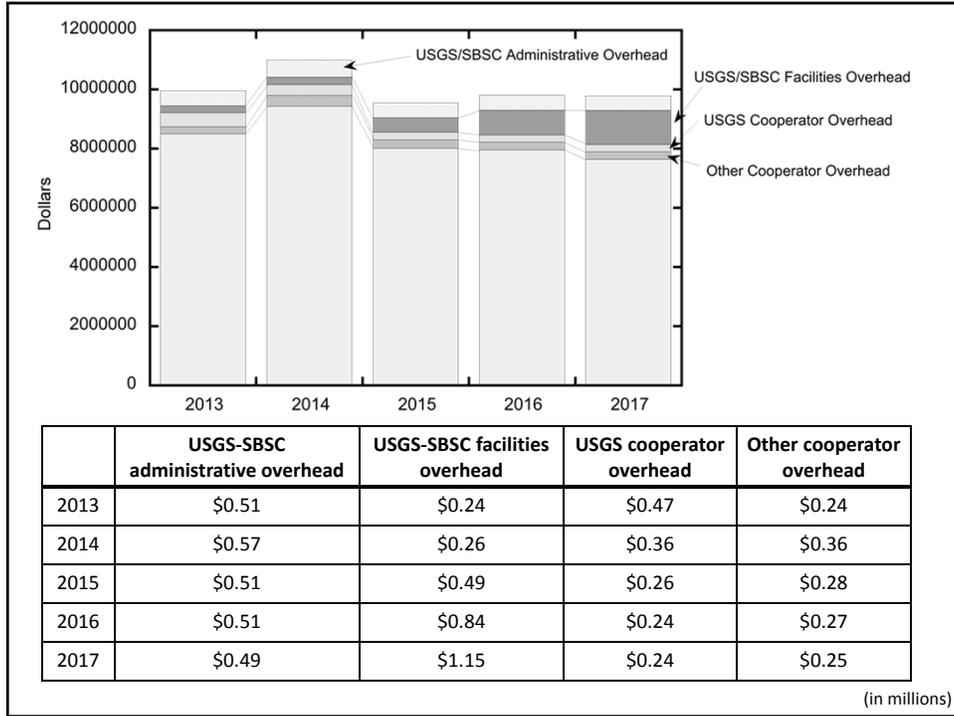
Individual project elements -- bold indicates proposed for funding; normal text indicates unfunded in indicated year; total of all project elements is equal to original cost estimate. Sum of all elements will be reduced in FY16 and FY17 by 7% and 5%, respectively.

**Project 14: Geographic information systems, services, and support (FY15: \$0.22 million) (FY16: \$0.22 million) (FY17: \$0.24 million)**



**Project 15: Administration and Support (FY15: \$1.30 million) (FY16: \$1.33 million) (FY17: \$1.48 million)**





### Impact of increasing Indirect Costs on Program

**FY15**  
 total GCMRC program costs -- \$9.55 million  
 GCDAMP support -- \$8.7 million  
 other BoR support – \$0.8 million

unfunded projects -- \$0.19 million

USGS/SBSC burden ~\$1.0 million  
 total indirect costs ~\$1.5 million  
 SBSC proportion of total indirect costs ~65%  
 total indirect costs as proportion of total program costs ~16%

**Total program costs – total indirect costs = ~\$8.0 million**

