

**Glen Canyon Dam Adaptive Management Work Group Meeting
February 24-25, 2016**

Summary of Actions Taken

The AMWG reached consensus on the following actions during this meeting:

- AMWG approves the minutes of August 26-27, 2015, meeting.
- The AMWG accepts the December 9, 2015, Grand Canyon Monitoring and Research Center (GCMRC) Technical Memo (Memo) of the Lees Ferry Trout Fishery Management Recommendations (Recommendations) subject to the following:
 1. Any actions resulting from the Recommendations must be fully consistent with the “Law of the River” and Department of the Interior (DOI) policy considerations.
 2. Recommendations that fall under the purview of water and natural resource management agencies such as Bureau of Reclamation, National Park Service, United States Fish and Wildlife Service, Arizona Game and Fish Department, and AMWG Tribes will require additional evaluation among these management agencies within the AMP for further consideration.
 3. Recommendations that address dam operations are expected to be considered and evaluated in light of the ongoing Long-Term Experimental and Management Plan (LTEMP) Environmental Impact Statement (EIS).

In addition, the AMWG directs the TWG to consider the Recommendations with the caveats above and the Memo as work plans and budgets are developed or reviewed.

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**February 24, 2016**

**Start Time:** 9:30 a.m.

**Conducting:** Jennifer Gimbel, Principal Deputy Assistant Secretary for Water and Science

**Facilitator:** Mary Orton, The Mary Orton Company, LLC

**Committee Members/Alternates:**

Jan Balsom, National Park Service (GRCA)  
Charley Bullets, So. Paiute Consortium  
Tom Buschatzke, State of Arizona  
Chris Cantrell, Arizona Game and Fish Department  
Deborah Dixon, State of New Mexico  
Jayne Harkins, State of Nevada  
Dawn Hubbs, Hualapai Tribe  
Leslie James, CREDA  
Sam Jansen, Grand Canyon River Guides  
Lynn Jeka, Western Area Power Administration  
John Jordan, Int'l Federation of Fly Fishers & TU  
Leigh Kuwanwisiwma, Hopi Tribe

Chip Lewis, Bureau of Indian Affairs  
Ora Marek-Martinez, Navajo Nation  
John McClow, State of Colorado  
Eric Millis, State of Utah  
David Nimkin, National Parks Conservation Assoc.  
Don Ostler, State of Wyoming  
Daniel Picard, U.S. Bureau of Reclamation  
Ted Rampton, UAMPS  
Steve Spangle, U.S. Fish and Wildlife Service  
Larry Stevens, Grand Canyon Wildlands Council  
Tanya Trujillo, State of California  
Ora Marek-Martinez, Navajo Nation

**Committee Members Absent:**

Eric Bobelu, Pueblo of Zuni  
James deVos, Arizona Game and Fish Department

Steve Wolff, State of Wyoming  
VACANT, San Juan Southern Paiute Tribe

**USGS/Grand Canyon Monitoring and Research Center**

Helen Fairley, Program Manager  
Kyrie Fry, Communications & Outreach Coordinator

Paul Grams, Program Manager  
Scott VanderKooi, Chief, GCMRC

**Interested Persons, TWG Members, and Alternates:**

Adam Arellano, WAPA  
Melinda Arviso-Ciocco, Navajo Nation  
Tara Ashby, U.S. Bureau of Reclamation

Mary Barger, Interested public  
Rob Billerbeck, National Park Service  
David Braun, Sound Science LLC

Kathleen Callister, U.S. Bureau of Reclamation  
Shane Capron, WAPA/TWG Vice Chair  
Bill Chada, U.S. Bureau of Reclamation  
Kerry Christensen, Hualapai Tribe  
Marianne Crawford, U.S. Bureau of Reclamation  
Kevin Dahl, National Parks Conservation Assoc.  
Kurt Dongoske, Pueblo of Zuni  
Marlon Duke, U.S. Bureau of Reclamation  
Ed Gerak, CREDA  
Katrina Grantz, U.S. Bureau of Reclamation  
Jessica Gwinn, U.S. Fish & Wildlife Service  
John Hamill, Int'l Federation of Fly Fishers & TU  
Paul Harms, State of New Mexico (phone)  
Beverley Heffernan, U.S. Bureau of Reclamation  
Vineetha Kartha, State of Arizona & TWG Chair  
Ted Kowalski, State of Colorado  
Kirk LaGory, Argonne National Laboratory  
Doug Milligan, Salt River Project (phone)  
Joe Miller, Trout Unlimited National Leadership Council  
Jill Nagode, U.S. Bureau of Reclamation  
Jessica Neuwerth, State of California

Jenika Raub, Salt River Project (phone)  
Jennifer Rebenack, National Park Service  
Brent Rhees, U.S. Bureau of Reclamation  
Sarah Rinkevich, DOI Federal Tribal Liaison  
Kendra Russell, U.S. Bureau of Reclamation  
Brian Sadler, Western Area Power Administration  
Seth Shanahan, Southern Nevada Water Authority  
Billy Shott, National Park Service (GLCA)  
Angela Slaughter, Colorado River Commission  
Rodney Smith, DOI/Solicitor's Office  
Stacey Smith, U.S. Bureau of Reclamation  
Rosemary Sucec, NPS (GLCA)  
Justin Tade, DOI/Solicitor's Office  
Shana Tighi, U.S. Bureau of Reclamation  
Lee Traynham, U.S. Bureau of Reclamation  
Jason Tucker, U.S. Bureau of Reclamation  
Dave Uberuaga, National Park Service (GRCA)  
Rich Valdez, SWCA  
Chris Watt, U.S. Bureau of Reclamation  
Michael Yeatts, Hopi Tribe

**Recorder:** Linda Whetton, Reclamation

**Welcome and Administrative.** Ms. Gimbel, Secretary's Designee, welcomed the members and general public.

- Introductions were made and a quorum was determined to be present.
- Approval of August 26-27, 2015, Meeting Minutes. Motion proposed by Mr. Nimkin, seconded by Ms. Trujillo. Pending an edit from Ms. Kartha (via e-mail), the minutes were approved by consensus.
- Action Item Tracking Report (**Attachment 1**) – The Havasupai Tribe is not interested in becoming an AMWG stakeholder but will continue to receive program correspondence.
- Progress on Nominations and Reappointments (**Attachment 2**) and other changes:
  - Ms. Gimbel welcomed the newly-appointed AMWG members: Eric Bobelu (absent, Pueblo of Zuni), Deborah Dixon (State of New Mexico), Dawn Hubbs (Hualapai Tribe), and Ora Marek-Martinez (Navajo Nation).
  - Ms. Gimbel welcomed the newly-appointed AMWG alternates: Melinda Arviso-Ciocco and Timothy Begay, Navajo Nation; Jan Balsom, National Park Service; Carleton Bowekaty, Pueblo of Zuni— member of the Tribal Council; Kathleen Callister, Bureau of Reclamation, who will also replace Beverley Heffernan on April 1 as the new Manager of the Environmental Resources Division in Salt Lake City; Ben Reeder, Grand Canyon River Guides; and Warren Turret, State of Nevada.
  - Jayne Harkins has been reappointed the AMWG member from Nevada.
  - Ms. Katrina Grantz replaced Glen Knowles as Chief of the Adaptive Management Group and will assume Reclamation's co-lead role on the LTEMP EIS effective April 1, 2016.
- Long-Term Experimental Management Plan EIS Update – Ms. Gimbel complimented Ms. Heffernan and Mr. Billerbeck on their Herculean efforts spearheading the LTEMP EIS effort, and thanked everyone involved in addressing the many issues. The Obama administration and DOI Secretary Jewell want this document completed this year. Because of the thousands of comments they anticipate they will receive, it will take considerable time and resources to respond, finalize the EIS, and prepare a Record of Decision. While she is sympathetic to requests for an extension to the comment period, the LTEMP co-leads issued a memo on February 16, 2016 (**Attachment 3**), stating the original schedule would be followed, in part because the 90-day comment period is already twice as long as the standard regulatory timeframe. She advised attendees to work as diligently as possible to review and provide comments on the Draft EIS, and then contact DOI if they absolutely cannot work within the schedule. Congress approved an additional \$2 million in Reclamation's budget that will go toward completion of the EIS. A public meeting will be held tomorrow at 6 p.m. in this conference room and a public meeting webinar on March 1. Comments should be submitted through the Argonne website (<http://ltempeis.anl.gov/>).

**Hopi Tribe's Monitoring Program (Attachment 4)** – Mr. Leigh Kuwanwisiwma, Hopi Tribe. The Hopi Tribe, comprised of about 14,000 Hopis, has been at their location and directly connected to the Grand Canyon for thousands of years. Hopis consider the Grand Canyon to be a sacred and revered place and their final destination. He provided background information on their ceremonies, traditions, and migrations and noted there are currently 34 clans at Hopi. The Hopi Tribe has such reverence for the Canyon that they do not allow alcohol on their river trips. Hopi resources in the Grand Canyon include: (1) Cultural – traditional cultural properties, archaeological sites, human remains, petroglyphs, and pictographs; (2) Biological – plants, birds, mammals, insects, reptiles, fish, springs, and side streams; and (3) Physical – minerals, sand, beaches, water, and springs.

Mr. Yeatts said the Hopi monitoring program officially began in 2008 although surveys have been done annually since 2003. Those completed since 2006 are used in current analyses. There have been 262 surveys completed, representing 148 individual Hopis. Over all the surveys and across all resource categories, the surveys indicate a positive assessment of resource health for 68% of the resources. There is a strong desire by the Hopi Tribe to remain involved in the management of the Grand Canyon. Additional input on terrestrial resources is needed, as the AMP has not consistently collected information on the status of a number of resource categories that are culturally important to the Hopi Tribe. This includes archaeological sites, vegetation, avifauna, reptiles, insects, and mammals.

**Technical Work Group Report (Attachment 5a)** – Ms. Vineetha Kartha, TWG Chair.

- The GCMRC Annual Reporting meeting was held on January 26-27, 2016 followed by a TWG meeting on January 28. The TWG will use new information on HBC, native fishes, and sediment in development of the FY 2017 budget and work plan.
- At the AMWG August 2015 meeting, the AMWG asked GCMRC to provide a technical review of the Lees Ferry Trout Fishery Management Recommendations report (Recommendations), and the TWG to evaluate that technical review. At the October TWG meeting, it was noted that some of the recommendations addressed dam operations; TWG members pointed out that those were being addressed in the LTEMP EIS. Other recommendations addressed policy issues and management considerations that were outside the purview of GCMRC and perhaps even the AMWG and TWG. Based on the discussions, the TWG created the Trout Ad Hoc Group (TAHG) to evaluate the GCMRC review. GCMRC submitted a revised review of the Recommendations on Dec. 9, 2015. The TAHG evaluated that review and while they found it to be comprehensive, they felt additional research or clarifications could be helpful on some of the recommendations. The TWG should identify any outstanding research questions as future work plans are deliberated. Based on the TWG's acceptance of GCMRC's report, the following motion was proposed (amended from the motion that was sent in advance to the AMWG):

**Motion** by John Jordan, seconded by Deborah Dixon:

The AMWG accepts the December 9, 2015, Grand Canyon Monitoring and Research Center (GCMRC) Technical Memo (Memo) of the Lees Ferry Trout Fishery Management Recommendations (Recommendations) subject to the following:

1. Any actions resulting from the Recommendations must be fully consistent with the "Law of the River" and Department of the Interior (DOI) policy considerations.
2. Recommendations that fall under the purview of water and natural resource management agencies such as Bureau of Reclamation, National Park Service, United States Fish and Wildlife Service, Arizona Game and Fish Department, and AMWG Tribes will require additional evaluation with these management agencies for further consideration.
3. Recommendations that address dam operations are expected to be considered and evaluated in light of the ongoing Long-Term Experimental and Management Plan (LTEMP) Environmental Impact Statement (EIS).

The AMWG directs the TWG to consider the Lees Ferry Trout Management Recommendations and the GCMRC Technical Memo when it reviews the GCDAMP Triennial Work Plan and Budget for FY 2017

and makes a recommendation to AMWG in June, and to report the results of that review with any recommended changes to the FY 2017 budget and work plan at the August 2016 AMWG meeting.

Discussion included the following points:

- *It seems the motion is asking for the TWG to consider the motion that was already considered in the memo. Is it appropriate to have the memo and not revisit all the recommendations?*
- *What goes forward are the technical recommendations from GCMRC. The intent is to have broad-based discussions, including development of the budgets and work plans.*
- *Non-federal entities would not be included in these discussions and they should be.*
- *Is this needed? The TWG already considers input from all stakeholders.*
- *We failed to comprehensively look at the metrics for the fishery. What does this quality fishery look like? The guides have put together a well-rounded set of recommendations and sets a baseline for what that fishery should look like. There were a few that fell outside purview of GCMRC.*
- *There is value going forward into the TWG process. It does not bind or obligate but provides an open arena for one stakeholder's concerns.*
- *Paragraph #2 follows the recommendations, so how can we have TWG consider what is outside their own purview while GCMRC is calling for items that are in purview of this program?*
- *"Consider" does not seem prescriptive but only a suggestion. The debate is whether we are instructing or prescribing something.*
- *Concerned about the time it takes GCMRC to do things and then asking them to do more on the fly.*

After further discussion, the following amended motion was considered and **approved by consensus**:

**Motion: The AMWG accepts the December 9, 2015, Grand Canyon Monitoring and Research Center (GCMRC) Technical Memo (Memo) of the Lees Ferry Trout Fishery Management Recommendations (Recommendations) subject to the following:**

1. **Any actions resulting from the Recommendations must be fully consistent with the "Law of the River" and Department of the Interior (DOI) policy considerations.**
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3. **Recommendations that address dam operations are expected to be considered and evaluated in light of the ongoing Long-Term Experimental and Management Plan (LTEMP) Environmental Impact Statement (EIS).**

**In addition, the AMWG directs the TWG to consider the Recommendations with the caveats above and the Memo as work plans and budgets are developed or reviewed.**

**Motion was proposed by John Jordan, seconded by Deborah Dixon.**

Spring HFE Discussion. Ms. Kartha said that in response to a request from a stakeholder who was concerned that the sediment accounting system in the HFE Protocol (HFEP) would ever allow a spring HFE, the TWG discussed the sediment accounting period and the process for planning a Spring HFE. Because the LTEMP ROD will replace the HFEP, some members of the TWG felt these concerns should be addressed in the LTEMP EIS process. She also invited the concerned stakeholders to make a presentation at this AMWG meeting.

Dr. Larry Stevens distributed copies of the paper, "The Adequacy of the High Flow Experiment Protocol for Testing Springtime HFEs Under the LTEMP" (**Attachment 5b**), which provided ten reasons why spring HFEs would be beneficial. The language in the HFEP limits the potential for testing HFEs during the March-April springtime period. HFE benefits to conservation of sediment mass balance, nearshore native fish habitats, the aquatic food base, and recreational sandbar camping areas are largely lost within six months of an HFE. Springtime HFEs happen when high flows naturally occurred and may provide substantially improved resource benefits during the springtime and summer months than do autumn

(November) high flows, in keeping with the intent of the GCPA. As such, the request to the Secretary and the LTEMP co-lead agencies is to modify the HFEP in the LTEMP to allow for testing of springtime HFEs by: (1) including consideration of unused sediment supplies following autumn HFEs, or (2) when an autumn HFE is not conducted and sufficient sand exists on the channel bed. Under such sediment conditions, the HFEP language should be modified to relax accounting period constraints and permit springtime HFEs. They further recommended that springtime HFE testing and evaluation be conducted during any year when sediment conditions are favorable, because such conditions are rare.

Discussion included the following points:

- The LTEMP analysis has shown that the HFEP protocol would allow for Spring HFEs every three to four years.
- GCMRC has a solid monitoring program and would be able to monitor after a Spring HFE.
- Until there have been three spring HFEs, it would be hard to determine the trout response.
- If a trout response (increased numbers of trout) were seen, and the other triggers met, the current EA would require non-native fish control. The action would be trout removal downstream in the Lower Colorado River. In the Draft LTEMP EIS, there is the option for trout management flows in response to the trout population for mitigative measures.
- This is the only program in the basin that does not emphasize spring high flows. The idea of the natural flow regime is to try to mimic natural conditions.

**2016 Annual Reporting Meeting Update (Attachment 6a, PowerPoint presentation)** – Mr. Paul Grams, GCMRC. The Annual Reporting meeting was held January 26-27, 2016, with presentations by GCMRC staff, cooperators and collaborators, staff of sister federal agencies, and tribal representatives. Updates to the following projects were provided:

- **Project 2: Streamflow, Water Quality, and Sediment Transport.** The sediment budget is affected by disruption of sand supply and change in flow regime. In Marble Canyon between the Paria River confluence and the Little Colorado River, there is about 6% of the pre-dam sand supply to the river channel; and below the Little Colorado River, there is about 16% with inputs from the LCR and additional small tributaries.
  - Lower Marble Canyon 1-1-2011 through 1-6-2016
    - Zero Bias Value: 190,000 metric tons
    - Upper Uncertainty Bound: 770,000 metric tons
    - Lower Uncertainty Bound: -390,000 metric tons
  - Results:
    - Sand evacuation occurs during periods of sustained high releases (equalization flows) and sand accumulation occurs during periods of sustained low/normal releases.
    - Sand resources (amount) appear to be sustainable over the long-reach scale except in higher release years.
  - Sand Budgets: 2011 – Present
    - Upper Marble Canyon – Accumulation before and export during each HFE. This is consistent with objective to “use” Paria sand without causing depletion from bed.
    - Lower Marble Canyon – There is accumulation during each HFE.
  - Results:
    - Systemic response of reach-scale sand budgets during HFEs appears to be emerging under the HFE Protocol.
    - Differences from that observed during the 2004 and 2008 HFEs is likely because of differing longitudinal distribution of the antecedent sand supply (large supply all in upper Marble Canyon under HFE protocol, either smaller supply or further downstream in previous high flows).
- **Project 3: Bedload Sand Transport.** The purpose of this research is to develop a more robust estimate of bedload sand transport and thereby reduce uncertainty in estimates of total sand transport.
  - Sand moves both on the bed and in suspension in the water.
  - The relative proportions moving by each process depends on grain size and flow strength.
  - Measurements made in 1998 indicated that only about 5% of the total sand load moved as “bedload.” Measurements were made over small areas of the bed at a limited number of sites and one flow rate.
- Preliminary conclusions:
  - New estimate of bedload consistent with earlier estimates
  - But shows variation with discharge
- Future work: Additional measurements at higher and lower discharges and need for measurements at additional sites.

- **Project 3: Sandbars and In-channel Sand Storage Monitoring.** This project measures the erosion of sandbars between HFEs and changes in high-elevation campsites.
  - HFEs in 2012, 2013, and 2014 built sandbars
    - Bars eroded between HFEs.
    - Greater erosion in years of higher release volumes.
    - Bars are larger now than at start of HFE protocol and periods with no HFEs, but there is no evidence for “progressive” increases in sandbar size.
  - High-elevation Campsite area (above 25,000 cfs stage)
    - No net change in non-critical reaches.
    - Increase from 2012 to 2014 in critical reaches.
  - The first three years of the HFE protocol were a period of low annual release volumes and good tributary sand supply.
    - Bar deposition occurred without depleting sand from storage.
    - Sand accumulated in Marble Canyon, replenishing sand evacuated during the 2011 equalization.
  - Sandbars: 2008 – present
    - 50 individual sandbars with data 2008-present
      - 25 in Marble Canyon, 7 in Grand Canyon (RM 60-87) and 18 in Grand Canyon (below RM 87)
    - With 2008 as reference (8-month post-HFE):
      - Increase in Marble Canyon and Grand Canyon (below RM 87).
      - No change in Grand Canyon (RM 60-87).
- **Projects 3 and 11: Linkages between controlled floods, eddy sandbar dynamics, and riparian vegetation.** This project attempts to explain the spatial variability in eddy sandbar response to floods. Spatial variability in eddy sandbar response to floods had been a challenge for monitoring, and it was difficult to characterize “average” response. Although the variability has long been recognized, it has not been fully explained. Because the extent of riparian vegetation has varied in time and varies among sites, they are investigating the linkage between vegetation and changes in sandbar morphology.
  - Sites with less vegetation showed: (1) Changes in sediment storage occur in eddy, (2) More HFE deposition on sandbar, and (3) Greater surface flow velocities.
  - Sites with more vegetation showed: (2) Changes in sediment storage occur in the channel, (2) Less HFE deposition on sandbars, and (3) Lower surface flow velocities.
  - Long-term increase in vegetation in zones inundated by charges less than 45,000 cfs showed: (1) Elevated baseflows that increase water table, and (2) Reduced frequency and magnitude of flood flows.
  - No change or decrease in vegetation in zones inundated by discharges 45,000 cfs indicated (1) Decoupled from river hydrology, and (2) Changes associated with regional precipitation.
- **Projects 3 and 11: Riparian Vegetation Monitoring with Remote Sensing.** This incorporates the 2013 overflight images to analyze long-term riparian vegetation changes 1964 to 2013. It also used remote sensing to analyze tamarisk beetle impacts to tamarisk.

Percentage of green tamarisk in 2009 was defoliated in 2013:

| Reach                           | % Tamarisk Vegetation | Total Area (m <sup>2</sup> ) |
|---------------------------------|-----------------------|------------------------------|
| Glen Canyon (GCD to Lees Ferry) | Green<br>Defoliated   | 200,055<br>9,535             |
| Kanab (RM 134.6 to 155.7)       | Green<br>Defoliated   | 40,470<br>10,948             |
| National (RM 158.6-180.5)       | Green<br>Defoliated   | 217,275<br>28,927            |

Mr. VanderKooi, GCMRC, provided the following updates (**Attachment 6b**):

- **Riparian Vegetation Monitoring & Workshop.** The workshop was held in June 2015 and colleagues from the Rio Grande and Upper and Lower Colorado River were invited to participate with the goal of having a broader look at riparian vegetation. They looked at the successes and challenges in nonnative vegetation control and to seek recommendations for scientifically based vegetation control programs. Restoration can be viewed on a different scales - global scales, reach in river, down to river scales and then to whole watershed scales. The participants

also shared success stories and what kinds of approaches could be utilized moving into the future. Resilience was a big concern not only in terms of demands on rivers and waterways but also in the context of climate change and the fundamental processes that are driving changes in riparian vegetation. If there is low genetic variability, there will be low resilience in the system. If you have a resilient system and you're taking a passive approach, it doesn't cost that much and you just let things happen. But the more hands-on you have to be, the higher the costs. Sharing information the key to making sure that everyone is learning from one another, staying current on best practices and moving forward with the various restoration plans. A USGS Open File Report is currently being reviewed and will include extended abstracts of most of the presentations.

- Project 12. This pilot project attempts to integrate traditional ecological knowledge (TEK) and western science through evaluating and documenting changes in 16 culturally-valued riparian plant species—as reflected in matched pairs of past and current photographs. A meeting was held with the tribal members yesterday and they want to make sure there is open communication and collaboration on how the work will factor into the 2017 workplan.
  - o So far, 128 of 456 existing Stanton images have been examined (28%) from base of Glen Canyon Dam to the Little Colorado River (LCR) confluence – covering approximately 32% of river corridor
  - o Total of 256 matched pairs analyzed (1889/1890 with early 1990s and early 1990s with 2010/2011)
- Aquatic Insects. The LCR is home to most Humpback Chub (HBC) in Grand Canyon and HBC like to eat bugs. The question is whether there are more bugs, which results in more chub or fatter chub. Insect sampling has been conducted by setting sticky traps that collect the terrestrial form or the aerial forms of these aquatic insects and using them as a surrogate of in-water densities. These traps are deployed at every kilometer from the confluence all the way up to Blue Spring, five times a year. Our results show that spring is a really good time for fish to be in the LCR since there are a lot of bugs available to be eaten. The months of April and May are best with lots of bugs present, but not so many in the other months. There is also some geographic variation in bug densities. Sticky trap catches were highest near Blue Spring, declined as one goes downstream with lowest catches between river kilometers (rkms) 10-14, and increased again between rkms 5-10. These results may help explain the high growth rates and high survival rates observed in HBC translocated above Chute Falls by the USFWS. The foundation of the foodweb in the LCR is algae and plants. It turns out light conditions in the LCR vary widely. In the Upper river (where the fat chub are) the water is crystal clear, but little light gets to the water because it's so shaded. In the Lower river there is plenty of light at the water surface, but little of it gets to the river bed because of the turbidity.. The reach of the river around rkm 10 is a really bad spot for bugs because it's shady and the water is turbid. Conditions improve downstream because there is more direct sun. It's also more turbidity so you have better conditions, but not as good as upstream reaches. This work is helping us better understand what's driving the aquatic foodbase and may help explain what we're seeing with fish in terms of the distribution and timing of HBC in the LCR.
- Humpback Chub and Rainbow Trout Updates. Annual estimates of spring abundance HBC in the Little Colorado River for fish >150 mm and >200 mm declined noticeably in 2015. It is possible that these lower estimates were due to an actual decline in adult HBC population abundances, but several lines of evidence indicate reductions were due to skipped spawning. Data from passive integrated transponder (PIT) tag antennae arrays show that far fewer adult HBC entered the LCR than in recent years. We also found that the body condition of adult HBC declined beginning in September 2014 suggesting these fish had less energy to devote to reproduction. Adult HBC population abundance estimates for 2015 were similar to those observed in recent years. Juvenile HBC survival estimates in the mainstem Colorado River near the Little Colorado River confluence for the interval from July 2014 to July 2015 were similar to those observed for the July 2013 to July 2014 interval. The trend in declining abundance of rainbow trout between Glen Canyon Dam and Lees Ferry stabilized in 2015 to levels of approximately 200,000 fish. Unlike in recent years (2012-2014), the relative condition of rainbow trout has increased. In contrast to observations made last year, abundance estimates for rainbow trout near the Little Colorado River confluence have decreased below trigger levels identified in the 2011 Biological Opinion for Nonnative Fish Control. No action is warranted at this time since other triggering criteria have not been met.

- Creel and Economic Value of Angling. The objective of the project is to estimate the seasonal variation in economic value of angling at Lees Ferry and identify angler preferences that influence their experience. Results point to fewer annual trips for guided anglers and walk-in anglers above the Paria River. It is this variation in annual trips and distance traveled that allowed them to construct a demand curve in the travel cost model to estimate the economic value of angling at Lees Ferry. Preliminary estimates of angler economic value by season indicate on average angler willingness to pay in excess of trip costs is \$148 per trip in the summer compared to \$341 in the winter. The individual economic values per trip can be used with total angler visitation by season to inform management decisions.
- Green Sunfish in Glen Canyon. In July 2015, biologists with the Arizona Game and Fish Department discovered a reproducing population of invasive Green Sunfish in a slough located three miles downstream of Glen Canyon Dam. Green Sunfish are prolific (one female can produce from 2,000 to 10,000 eggs) and also voracious predators of native fish and their eggs. A rapid response action was necessary to eradicate the population before it spread downstream into critical habitat for the endangered humpback chub. After carefully analyzing alternative methods for control, agencies authorized a short-term targeted treatment with the plant-based piscicide rotenone. A treatment was conducted by AZGFD, NPS, and USGS in early November 2015. A second treatment was deemed unnecessary after subsequent surveys detected no Green Sunfish. This was a very collaborative process between many agencies and tribes and they were successful in getting rid of the Green Sunfish. Ms. Sucec said the success of this project was a result of shared vision, hard work, and cooperation from BOR, USFWS, WAPA, NPS, USGS, AZGFD, and the tribes. It was such a success that it's now a national model for rapid response to aquatic invasives. The tribes advised to not lose the momentum and start dealing with future invasive species.

Q&A:

*Q: As we've talked about the nexus of trout and HBC and the translocation of HBC to Havasu and that population becomes larger, is that part of the consideration of how you're going to be exploring the recovery or sustainability of HBC?*

*A: Yes. That's been a very involved process and I was fortunate to be invited to participate. It's been very interesting and interacting with colleagues from the upper basin and learning a lot more about these other populations. We need to understand the whole Grand Canyon in context. For native fish in the west it's kind of a shining star particularly given that in Western Canyon the vast majority of fish community there is made up of natives. We are concerned about the nexus and what's coming up from Lake Powell. Both upstream and downstream reservoirs have non-natives, and we don't want them in Grand Canyon. A review of the fisheries program will be done this year and one item for discussion is the appropriate level of monitoring needed.*

*Q: Are you assuming a spawn was missed because of that low condition which is the result of foodbase decline in that section of the river?*

*A: Yes, we think the lower condition observed in adult HBC has been the result of a decline in the aquatic foodbase in the mainstem. This same decline in the aquatic foodbase was also responsible in part for the decline in trout observed in Glen and Marble Canyons. For trout it was a combination of fewer groceries as well as an over-abundance of trout.*

*Q: I don't see a lot of relationship between the numbers of HBC and the numbers of trout down at the LCR. Is that your observation as well?*

*A: When you have really high numbers of trout down there, you affect juvenile HBC survival rates. Some of the modeling that went into the LTEMP showed that. We had very high numbers down there but we also had a lot of juvenile chub in the system. That may have been masking that effect. It's not a one-to-one thing. It's also tied to temperature, warmer water results in faster growth which helps juvenile HBC move more quickly through size classes where they are more vulnerable to predation by trout.*

*Q: Can you characterize how those trout removal triggers will change as proposed in the LTEMP?*

*A: The idea with the revision of the triggers is to not completely remove mechanical removal from the toolbox but leave as a mechanism of last resort and have a two-tier approach. The first tier saw declines in the HBC population and we would do things to benefit HBC, more translocations or other efforts, so we're benefitting the chub directly rather than indirectly. But then if things get worse, you would move to a second tier which would include tools like mechanical removal.*

*Q: Have you factored in seasonal flooding that created a loss of HBC as the waters from the LCR come in? Has there been any evidence of HBC being washed out of the LCR and being seen downstream?*

*A: Charles Yackulic will be leading an ongoing effort this summer to mark small HBC to determine if these fish get moved to the mainstem when monsoon season kicks in and the Little Colorado River starts flooding. Randy Van Haverbeke (USFWS) has suggested that the lack of floods may affect spawning. In years when no spring flood has occurred, when there isn't much snowpack for example, there have been fewer juveniles and less spawning. It could be the lack of floods is a negative effect because all the minerals coming out of the springs coat the rocks and covers up the spawning substrates.*

**Humpback Chub Recovery Team Update (Attachment 7)** – Dr. Rich Valdez, SWCA, with Tom Czapl and Tom Chart, Fish and Wildlife Service via telephone. In an effort to identify activities necessary for species conservation, a new Humpback Chub Recovery Team was appointed by U.S. Fish and Wildlife Service last November. The Team consists of a Team Leader (Rich Valdez), Agency Lead (Tom Czapl), a Science Subgroup, an Implementation Subgroup, and a Writing Subgroup, for a total of 22 Team members. The Team includes stakeholder representatives on the Implementation Subgroup as an addition to previous traditional Recovery Teams. The Team is expected to meet five times and the meetings will be open to the public. A comprehensive recovery plan is expected to be delivered to the Regional Director for signature by July 2017. The Recovery Team has responsibility for producing three reports: (1) a Species Status Assessment, (2) a Recovery Plan, and (3) an Implementation Plan. Dr. Valdez said it was not the intent of the Recovery Team to make prescriptive recommendations; it is the intent of the Team to acknowledge the biological reality of the species and put forward management actions that will reduce and minimize the threat to the species and will establish demographic and recovery criteria. From that information, the Service would like to keep the flexibility within the programs themselves, allowing them to go forward and manage those issues as they deem most appropriate.

**Basin Hydrology, Operations, and 2017 Hydrograph (Attachment 8)** – Ms. Lee Traynham, Bureau of Reclamation. The Upper Basin is currently showing average snowpack for this time of year. Based on SNOTEL (Snow Telemetry) sites above Lake Powell, as of February 22, 2016, the basin snowpack was 101% of the 30-year median index, with 72% of total average accumulation on the ground. The hydrology could still shift towards either wetter than average or drier than average conditions. Lake Powell is 46% full with the other basin reservoirs at expected levels for this time of year. The April-July forecast is for Lake Powell at 94% of average at 6.70 maf, very close to what was observed in 2014 and 2015 and a little less than the 30-year average of 7.16 maf. The forecast center has a minimum probable forecast of 4.10 maf and maximum probable at 9.90 maf. There is a 10% chance that the observed seasonal inflow to Lake Powell could be above or below that range. The forecasted water year inflow volume for Lake Powell is 9.92 maf, 92% of average.

**Operations.** In 2016, Lake Powell is being operated in the upper elevation balancing tier, as determined by the 24-month study completed in August 2015. Under these conditions, the initial water year release volume from Lake Powell is 8.23 maf, with the potential for an April 2016 adjustment to either balancing or equalization releases. Given the current forecasted inflows and modeling, all three inflow scenarios (minimum, maximum, and most probable) project an April 2016 shift to balancing and a resulting release from Lake Powell of 9.0 maf. However, if the hydrology becomes significantly drier than anticipated, the April 2016 adjustment would not occur and Lake Powell would release 8.23 maf. If the hydrology becomes significantly wetter than anticipated, there would be an April 2016 adjustment to equalization and Lake Powell would release around 12.0 maf. The end of calendar year 2016 projection for Lake Mead is 1,077.5 (38% full).

**GCD Maintenance Schedule.** For 2016, five to seven units are expected to be available at any time and Reclamation anticipates having enough capacity to meet the scheduled releases for 2016. In 2017, there are expected to be seven units available for the majority of the year. Under the HFE Protocol, there is a

potential for a spring HFE if there is adequate sediment input. As of today, there is not enough sediment to trigger a spring HFE in water year 2016.

Hydrograph Development for 2017. The goals are to target lower releases in August and September with sediment coming into the system, to move releases to other equal volume months for hydropower (December and January), and to avoid shifting “extra” water to June (which cools temperatures at the mouth of the LCR). The projected release scenarios for 2017 are:

| Powell Inflow Scenario | WY 2017 Release Projection                                                                    |
|------------------------|-----------------------------------------------------------------------------------------------|
| Probable Minimum       | Upper Elevation Balancing Tier with no Projected April Shift<br>8.23 maf release              |
| Most Probable          | Upper Elevation Balancing Tier with Projected April Shift to Balancing<br>9.0 maf release     |
| Probable Maximum       | Upper Elevation Balancing Tier with Projected April Shift to Equalization<br>11.9 maf release |

Current projections for 2017 would put Lake Powell in the upper elevation balancing tier. However, the determination of the tier will not occur until August 2016, and there is still a wide range of potential releases.

**Adaptive Management Program Assessment (Attachment 9)** – Ms. Mary Orton, The Mary Orton Company. Ms. Orton said that the task order under her contract with Reclamation directed her to interview AMWG members and others, and prepare the Assessment Report that had been sent (in draft and then final) to interviewees and others. She explained that it is quite normal for a facilitator to do such an assessment to see how the group is operating together, particularly if there are new people to the group. She said the purpose of the report is to allow AMWG stakeholders to better understand each other and each other’s concerns and interests, which can help the group with their collaboration; and to invite concerns about structure and process so they can be addressed.

After the draft report was sent out for comments, she received observations from several people that the report seemed negative for a group that works so well together. She said she was surprised at this characterization, because she also felt the group has been working together well, and so she emphasized this in the final version. In fact, Ms. Orton noted in the report that stakeholders from five of the six stakeholder groups, without being prompted, said that the group worked together very well, and much better than before.

She explained that if at least one member of at least four of the six stakeholder groups mentioned an issue or concern, she considered that a significant issue and developed a recommendation about that issue or concern. She reported her recommendations for GCDAMP participants for the issues that rose to that level were:

- In order to improve mutual understanding, a recommendation that the AMWG discuss several issues that were raised, including:
  1. Dissatisfaction with how adaptive management is administered in the program, and how slowly changes are instituted.
  2. Lack of discussion of important issues, lack of input into recommendations, and the feeling that recommendations to the Secretary by the AMWG had already been decided by the time the AMWG acted
  3. Concerns that all interests are not being heard or do not have equal influence at the table.
  4. Improvements needed on the subject of tribal relationships and participation.

5. Certain disagreements about facts.
- In order to respond to numerous concerns about updating the GCDAMP long-term planning documents, a recommendation that the Secretary's Designee give the AMWG guidance regarding whether the AMWG should respond to the Secretary's goals, objectives, and priorities; or develop its own.
- Because there was widespread belief that the LTEMP ROD would significantly change the GCDAMP, schedule time for the GCDAMP participants to discuss the future of the program after the LTEMP ROD is signed.
- Because of apparent confusion, clarify policies of "DOI Speaking With One Voice" and "Non-Voting Status of DOI Agencies."

She encouraged the group to discuss these issues during the time set aside for discussion of this agenda item including:

- What were the important issues that should be discussed by the AMWG?
- For persons who felt their voices were not being heard adequately, what might be done to help that situation?
- What would enable the tribal representatives to fully participate or feel more fully a part of the program?

Ms. Gimbel said the report highlighted many AMWG strengths and just the fact that the report was written spoke highly of the group. She felt it was time to have this kind of assessment and noted that the decision to do the assessment came from Interior. She said a few people had contacted her and were concerned about what was said in the report, and she reminded them that Mary was reporting what she was told, except when she made it clear that she was offering her opinion. She said she thought the Report brought out many important recommendations for the group to consider. Ms. Gimbel reviewed the following from the report:

- Recommendation for an orientation for new members: Ms. Gimbel said the report pointed out where there were some misperceptions about the program, and an orientation would be a good idea. As a start, she has asked Jill Nagode, Reclamation's Federal Advisory Committee Act (FACA) Officer, to provide a "mini FACA 101" course during the May 25 webinar. Also, during the same webinar, Solicitor Rod Smith will make a presentation on the laws, documents, etc., that guide the AMWG.
- AMWG Retreat: There will be a new Administration in January 2017, and Ms. Gimbel said she would recommend that the new leadership consider a retreat next year.
- DOI Non-Voting status: The recommendation to have the DOI representatives be non-voting was a recommendation from the Charter AHG from two years ago. DOI is committed to being involved in AMWG discussions and she believed that DOI member involvement has not changed, even though she was one of the people at the time who was concerned about a diminishment of DOI engagement. She said she had assured the DOI representatives that she wants their candid opinions.
- DOI Speaking with One Voice: Ms. Gimbel said that the fear is that DOI speaking with one voice means DOI has already decided the policy issues in advance of meetings, but that's not the case. Pre-meetings are held to help with understanding the concerns and interests of each agency.
- AMWG's Role after LTEMP: She said that the AMWG will have the same role, i.e., making recommendations on yearly operations, science plans, monitoring plans, etc.

Comments from AMWG members and others included the following:

- *We need to capture action items from the report, synthesize areas that seem most pertinent, and work toward making progress on changes.*
- *Great job on the report. I recommend you shorten it and share it with the peer-reviewed scientific community. It is a very thorough look at how the sociology of our family works. We have had external reviews of the program, and this is a fabulous example of adaptive management. What is the most important next step?*
  - *Mary responded that in her view, discussion among the AMWG of the five issues (listed above) were the most important.*
- *Good report. Things have changed for the better in my brief tenure. There may still be some fear about litigation and people may be reluctant to share important concerns because of that fear. It would be helpful to understand more about the key interests and values of the stakeholders. It seems there are elements in our discussion that are scripted; we want to learn about your individual points of view. For example, I would love to know more about the states' "delicate balance" referenced in the Report. Going on the river trip this summer with the tribal leadership and representatives was a great way to interact with one another. We have made improvements and we can do better.*

- *It is a delicate balance between what goes on in the Upper Basin and Lower Basin and it is not always easy to discuss in a large forum like this. We need time to delve into the large issues. Don Ostler's presentation tomorrow will help explain this.*
- *I am not sure how you tease out some of the responses about what is not occurring around this table. I am here autonomously, while others have specific directions from their employer or organization. I am not sure how we get past that point, whether we are locked in based on comfort or position of stakeholder group.*
- *The previous speaker made a good point. Some of you are specialists. I am in charge of 17 million acres and this is one of many projects for me. I have to carry questions and concerns back to the tribe so our leaders can make decisions. It is not a matter of not being engaged; it is because we have to reserve decision-making for those who have that responsibility. It creates this environment in the tribal perspectives and that is something you all need to take into consideration. I am not a fish biologist; I am an archaeologist. Tribal members are concerned about how things are being disseminated throughout the administration. Some say, "Go to the website to learn more;" however, there are still tribal members who do not have electricity and so cannot go on the Internet. I am a little offended by the view that tribes are not engaged, but it does not mean I do not have an opinion. Federal agencies take that for granted. When you look at the regulations, we have to consult. I am one person of this larger body. We all have our checks and balances. I am not the enemy. I am not against science and I felt that opinion yesterday. We all need to be able to speak with one another and not make assumptions.*
- *I am an accountant by education. I have learned a lot in the three years I have been on the AMWG. I did not know what redds or juveniles were. If Scott could give a fish biology 101 and explain some of the terminology, it would better inform our discussions. It is amazing what we do not know about biology or science 101.*
  - *Scott VanderKooi (GCMRC): GCMRC's role is to provide science to this organization and a key part of that is science education. I completely understand that we have a diverse group here. We are often rushed at these meetings, and I invite you to please reach out to GCMRC and ask questions. The Wiki website ([gcdamp.org](http://gcdamp.org)) also has a wealth of information on what is occurring in the program.*
- *I am really taking to heart what the previous tribal speaker said. Some of the most important things I have learned came from spending time with Arden Kucate and being invited to visit Zuni. From the standpoint that I am not a biologist or accountant, the Report has offered us the ability to talk. After I read the initial draft, I had concerns about the written word; it was fortuitous timing when I saw David Nimkin at an event and we chatted about it. It has served its purpose to encourage us to talk and learn about each other. It is very hard when you have people who are being asked about a program when you have such a variety and diversity of why we are even here, your tenure in the program, and where do you come from as a person. We all are here for a reason. We all represent different interests. You cannot divorce what you are as a person.*
- *This is a good discussion and many of these things can be implemented. Improved cultural sensitivity and an orientation need to happen. It is difficult coming into the program and learning all the terminology. It is important to establish some type of orientation because we are a very diverse group. We have to wear multiple hats and articulate the knowledge of our worldviews and what is most sacred and precious to us as a people. This could be the start of an orientation. One of the first teachings I received is that I am a tribal member first and then come my other roles in the professional world. I cannot only wear the professional hat and then wear the tribal hat later. It would be good to have that dialogue.*
- *I know how to work within the confines of the tribes. I would suggest more presentations like what Hopi did today. It might also be nice to have the tribal representatives present about how they have to report back for decisions. There are many levels within some tribes. For example, Hopi villages have greater sway than the government. It might help this body to not only improve their cultural understanding, and also have the tribes help us figure out how to get things done.*
- *It would be helpful to hear about the DOI discussions during their pre-meetings and their critical decisions.*
  - *Ms. Gimbel replied that the history of the "one voice" policy started when Secretary Salazar was executive director of the Colorado Department of Natural Resources and had two water agencies sniping at each other in public. He said that would not happen any more. It is not that we make decisions behind closed doors; it is more that we are communicating with each other in advance. DOI agencies have different missions, and Secretary Salazar said we were to work as a team. She said she has seen improvements in that teamwork.*
- *The pre-AMWG meeting gives us an opportunity to walk through the agenda and discuss potential issues. Making plans for a retreat in the next Administration seems right to me.*
- *I have been involved with this program since the beginning and helped write the plan for the GCDAMP for the first EIS. At the time, the intent was to put together this diverse group of stakeholders that come together with a shared vision that moves us into the future. I see in the room a half dozen folks who were involved in those early discussions; they know that we struggled to make sure that everyone still has that shared vision. Of course we need an orientation. Maybe we also need a "buddy" system for new members. Jason's attempt at*

*the Wiki page was to try to memorialize these things for new members. There is strength in what this group brings together, and I also think that it is important that sometimes we sit next to someone we do not know. It is important to remember where we have been and where we are going as well.*

- *As a stakeholder, I support the DOI agencies not voting. In my view, they participate very well in our discussions. I feel my job is to push back carefully, and the federal agency representatives' job is to explain.*
- *One aspect of this committee that is not fully appreciated is its influence on recovery planning, including stakeholder involvement and drafting the recovery planning documents.*

Jill Nagode, Reclamation's FACA Officer, said she was impressed with how the AMWG was run. She joked that she wanted a chub as a pet. She said she was impressed that members wanted to be part of the assessment. She said the AMWG is the gold standard for Federal Advisory Committees (FACs) within Reclamation and DOI, and maybe even GSA. For years, AMWG was the largest and the most expensive of FACs, and even though with every election, Congress closely examines costs and committees, AMWG has never been targeted. She said AMWG's work was praised in reports every year. The stability of this committee has stood on its own. The AMWG website is an example for others: while the Committee Management Secretary acknowledges the AMWG is a large committee, she often directs other FAC staff to the AMP website to see what work is being done, how the meeting minutes are written, and how the meetings are being facilitated. She said the assessment proves that the members want to do better and are not afraid to address problems. She noted that there are 113 FACs in DOI and to be named one of the best is an achievement.

**Farewell to Beverley Heffernan.** Ms. Gimbel congratulated Bev Heffernan on being such an exemplary public servant and for what she has given to the United States, Reclamation, and the AMWG. She praised Bev for her sense of humor and always telling people what she thinks. She has been a great resource.

- Mr. Rhees recalled that Bev once told him "that if you want something really, really bad, that's how you're going to get it." He worked with her for many years in the Provo Office and appreciated her hard work and being instrumental in helping Reclamation do a lot of good. Reclamation will host a retirement party for Bev in Salt Lake City.
- Mr. Billerbeck said he met Beverley five years ago and did not realize how many hobbies she had. She was even starting a new one this week: horseback archery. She has regaled him with stories of flying small aircraft, possessing a fine cellar of wine, meeting astronauts and actors, volunteering with the Sundance Film festival, and riding the Pony Express every year. He thanked her for providing the needed experience and being such an asset for the past five years on the LTEMP EIS team.
- Ms. Balsom seconded everything Rob said and presented Bev with two gift books to grace her ranch in Hurricane.

Ms. Heffernan thanked everyone for their kind thoughts and said she has really enjoyed her federal career. While she has not gotten rich being a bureaucrat, she has been able to accomplish some good things.

Ms. Gimbel invited AMWG members to participate in a group photo, and everyone to meet on the patio for a reception to celebrate Ms. Heffernan and wish her well.

**Adjourned:** 4:37 p.m.

## Glen Canyon Dam Adaptive Management Work Group Meeting

**February 25, 2016**

**Time:** 8:31 a.m.

**Conducting:** Jennifer Gimbel, Principal Deputy Assistant Secretary for Water and Science

**Facilitator:** Mary Orton, The Mary Orton Company, LLC

### Committee Members/Alternates:

Jan Balsom, National Park Service (GRCA)  
Charley Bullets, So. Paiute Consortium  
Tom Buschatzke, State of Arizona  
Chris Cantrell, Arizona Game and Fish Department  
Deborah Dixon, State of New Mexico  
Jayne Harkins, State of Nevada  
Dawn Hubbs, Hualapai Tribe  
Leslie James, CREDA  
Sam Jansen, Grand Canyon River Guides  
Lynn Jeka, Western Area Power Administration  
John Jordan, Int'l Fed. of Fly Fishers/Trout Unlimited  
Chip Lewis, Bureau of Indian Affairs

Ora Marek-Martinez, Navajo Nation  
John McClow, State of Colorado  
Eric Millis, State of Utah  
David Nimkin, National Parks Conservation Assoc.  
Don Ostler, State of Wyoming  
Daniel Picard, U.S. Bureau of Reclamation  
Ted Rampton, UAMPS  
Steve Spangle, U.S. Fish and Wildlife Service  
Larry Stevens, Grand Canyon Wildlands Council  
Tanya Trujillo, State of California  
Mike Yeatts, The Hopi Tribe  
Ora Marek-Martinez, Navajo Nation

### Committee Members Absent:

Eric Bobelu, Pueblo of Zuni  
James deVos, Arizona Game & Fish Department  
Leigh Kuwanwisiwma, Hopi Tribe

Steve Wolff, State of Wyoming  
VACANT, San Juan Southern Paiute Tribe

### USGS/Grand Canyon Monitoring and Research Center

Helen Fairley, Program Manager  
Kyrie Fry, Communications & Outreach Coordinator

Paul Grams, Program Manager  
Scott VanderKooi, Chief, GCMRC

### Interested Persons, TWG Members, and Alternates:

Adam Arellano, Western Area Power Administration  
Melinda Arviso-Ciocco, Navajo Nation  
Mary Barger, Interested public  
Rob Billerbeck, National Park Service  
David Braun, Sound Science LLC  
Kathleen Callister, U.S. Bureau of Reclamation  
Shane Capron, WAPA/TWG Vice Chair  
Bill Chada, U.S. Bureau of Reclamation  
Kerry Christensen, Hualapai Tribe  
Marianne Crawford, U.S. Bureau of Reclamation  
Kevin Dahl, National Parks Conservation Assoc.  
Kurt Dongoske, Pueblo of Zuni  
Marlon Duke, U.S. Bureau of Reclamation  
Ed Gerak, CREDA  
Katrina Grantz, U.S. Bureau of Reclamation  
Jessica Gwinn, U.S. Fish and Wildlife Service  
John Hamill, Int'l Federation of Fly Fishers/TU  
Paul Harms, State of New Mexico (phone)  
Beverley Heffernan, U.S. Bureau of Reclamation

Vineetha Kartha, State of Arizona  
Ted Kowalski, State of Colorado  
Mark McKinstry, U.S. Bureau of Reclamation  
Jill Nagode, U.S. Bureau of Reclamation  
Jessica Neuwerth, State of California  
Brent Rhees, U.S. Bureau of Reclamation  
Sarah Rinkevich, DOI Joint Tribal Liaison  
Kendra Russell, U.S. Bureau of Reclamation  
Brian Sadler, Western Area Power Administration  
Seth Shanahan, So. Nevada Water Authority  
Rod Smith, DOI Solicitor's Office  
Stacey Smith, U.S. Bureau of Reclamation  
Rosemary Sucec, National Park Service (GLCA)  
Shana Tighi, U.S. Bureau of Reclamation  
Lee Traynham, U.S. Bureau of Reclamation  
Jason Tucker, U.S. Bureau of Reclamation  
Dave Uberuaga, National Park Service (GRCA)  
Rich Valdez, SWCA  
Chris Watt, U.S. Bureau of Reclamation

**Recorder:** Linda Whetton, Reclamation

**Welcome and Administrative.** Ms. Gimbel welcomed the members and public. She offered the following comments:

- Today's start time was incorrect on the website. She apologized for any inconvenience that was caused by starting at 8:30 today. Future second day AMWG meetings held in Phoenix will begin at 8:30 as feasible.

- She thanked Ms. Callister for arranging a very nice reception for Beverley last night. Anyone who would like to contribute should talk with Ms. Callister.
- With a new administration coming in January 2017, she suggested the AMWG revisit the AMWG Operating Procedures and decide whether non-voting members should be able to make and second motions.

### **Stakeholders' Perspective: The Upper Basin States (Colorado, New Mexico, Wyoming, and Utah)**

**(Attachment 10)** – Mr. Don Ostler, Upper Colorado River Commission. The Upper Colorado River Commission is an interstate water administrative agency that was created in 1948. It involves the states of Colorado, Utah, New Mexico, and Wyoming, whose governors appoint their Commission members. The President appoints a Federal chair that is also a voting member of the Commission. Its responsibilities include conducting studies, making findings of water deliveries to the Lower Basin, determining water uses in the Upper Basin and each state, making findings of extraordinary drought and implications on the operation of the river and with Mexico, addressing salinity issues, and making determinations of shortage and the actions that need to be taken under the Colorado River Compact when those occur. The states are unique stakeholders in that the Colorado River is apportioned to the states to manage and are granted water rights for use under the 1922 Colorado River Compact. The states have to balance many different issues as they deal with water management. The Law of the River encompasses many laws, compacts, and treaties that govern all aspects of administering the water, including international relations, water quality, and environmental issues.

The Colorado River is over-allocated, based on the original allocation in 1922. Demands for water from the river have at times exceeded the supply in some areas. Balances must be made to address Upper Basin new development, climate change, sharing shortages with Mexico, ensuring compact compliance, sustaining Lake Mead uses, and endangered species and other environmental concerns. The Colorado Basin has also experienced a drought for the last 15 years (2000-2014). The basin states and Reclamation are focusing drought contingency planning on: (1) reducing or eliminating the probability of Lake Powell reaching minimum power pool elevation, (2) ensuring the continued operation of the 2007 Interim Guidelines through 2026, (3) respecting the framework for administering the use of Colorado River water in both the Upper Colorado River Basin and each Upper Basin state, and (4) combining with expected actions in Lower Basin to increase the synergistic benefits for the Basin as a whole.

The Upper Basin states' representatives joined Mr. Ostler for the discussion period that followed.

*Q: What are the sources of salinity that need to be controlled?*

*A: Mr. Ostler: Primarily water that has percolated through saline soils and agricultural uses. There have been efforts to reduce the percolation of the water through those salty soils, such as Manco soils in Utah and on the Gunnison. There have also been agricultural improvement projects to reduce the amount of return water that carry soil and salt into the Colorado River. In the Gunnison Basin, they also utilize land use control to avoid development in the Manco shell areas. These are expensive projects.*

*Q: The Upper Basin is currently using 4.5 maf out of 7.5 maf, and as you noted the water in the Colorado is over-allocated. How do you entertain proposals for additional development of water? It must be very complicated.*

*A: John McClow: There is some tension between the Upper and Lower basins on the issue of consumption, and the contention is internal as well. The State of Colorado demographer estimates that our population will double by 2050 to 10 million people which would leave us with a supply gap of around 600 kaf per year if we do not improve our efficiency. Colorado is trying to develop additional storage to capture water in wet years, and also improve efficiency while trying to not reduce agricultural activities.*

*Eric Millis: The same things are being faced in Utah. We have a 3 million population right now that is expected to be 6 million by 2060. We have some unused allocation in the river. Modeling by Reclamation shows developing up to our allocation should be feasible, and we are expecting to do that. We are also pursuing a pipeline project to transport water from Lake Powell to southwest Utah.*

*Deborah Dixon: New Mexico is fully using our allocation; however, much is used for agriculture. A large proportion of New Mexico surface water is in the northwest area in the San Juan Basin, and is being used for irrigation and other municipal uses. While our growth has slowed, we are predicted to grow significantly over the next 30 years.*

*Don Ostler: The Colorado River Compact says that the Upper and Lower basins must satisfy their uses or their needs from the water apportioned to that basin. The Lower Basin is using up to the full compact amount. The Upper Basin has not reached theirs. There is a risk of shortage and so it is a process that each state must go through to assess the risk of additional development as opposed to the frequency of shortages that may occur. It is a risk management decision that has to be made on a case-by-case basis. Additional development increases the risk of shortages. Depending on a particular state's ability or willingness to manage through shortage, that state might be willing to accept a higher risk or, alternatively, a lower risk. Just because the whole system is over-allocated, there is still allocation for the Upper Basin. Some risk of shortage might be deemed to be acceptable; how high a risk of shortage is acceptable is a judgment that has to be made by each state, based on its ability to respond to risk.*

*Q: Do the basin states recognize the forces that are contributing to climate change and address them as part of water and drought management? For example, many scientists recognize that fossil fuel burning contributes to climate change. Is there some consideration that the basin states individually or collectively would recognize and represent as part of the solution?*

*A: Mr. McClow: In Colorado, yes, we take that into account. Our water plan released in November addresses the future in scenario planning and an adaptive management approach. At one end of the scenario is the extreme and the other end is less extreme, but they are all there and climate change is identified as an issue. We understand it and we are doing what we can to eliminate the causes that we understand contribute to it.*

*Mr. Millis: In Utah, we are working with our state climatologists on what climate change might mean to our proposed projects. Utah is not pushing on the causes and the things that the state can individually do to help reduce those effects. We have an inversion problem in the winter which results in bad air quality, and measures to reduce that could potentially become measures to help with climate change. Climate change is something we are considering seriously and determining its impacts.*

*Ms. Dixon: In New Mexico, since 1992, we have been planning for the possibility of impacts of climate change. We have regional water plans for 16 regions in the state and that comprise a state water plan. The first was in 2003 and because of the drought, we are updating it now. The gap in water supply was based on a consideration of predicted climate change impacts over the 50-year period. New Mexico is also looking at the coal-fired Four Corners Power Plant and how the carbon footprint there could be reduced (though the state does not control the plant).*

*Q: You described that the river water was divided, with 7.5 maf to each of the Upper and Lower basins. What was not clear to me was the source of the other maf and what happens to them.*

*A: Mr. Ostler: We believe that the rationale in the compact was that Lower Basin tributaries provide additional water, and so the Lower Basin is allocated an additional 1 maf of water from tributaries that are below the Upper Basin. That allows for increased use in the Lower Basin to reflect those tributaries.*

*Q: How are tribes involved in some of these management decisions, discussions, and committees where decisions are made? The tribes often have some of the earliest water rights.*

*Ms. Dixon: New Mexico has been quite involved in Indian water rights settlements in the last decade. Navajo Gallup is one of the projects that resulted from the Navajo Indian Water Rights settlements. That is a strong influence in how our water is being managed and how decisions are made.*

*Mr. Millis: In Utah, most of the Indian water rights settlements are addressed by the state engineer's office in the Division of Water Rights, separate from my agency. We have two major settlements upcoming. We have had several that we have settled over the years with the Navajo Nation and also with the Ute Tribe. Those have the potential to take about half of the water that Utah believes it still has left in allocation. There is a lot of interaction with tribes.*

*Mr. McClow: In Colorado, we have reached a water rights settlement with the Southern Ute and the Ute Mountain Ute. The Animas La Plata Project, a 125,000 acre-foot reservoir, provides the resources to deliver the water that was agreed to with the Utes.*

*Ms. Gimbel: Part of Mike's question is how are tribes involved in water management. From the federal perspective, when we did the Colorado River Basin Study, the tribes were involved in our subgroups (along with the basin states and DOI). The tribes have also been involved in our implementation planning subcommittees.*

*Q: You mentioned weather modification such as cloud seeding, and how that might produce 1 maf. Where does that water come from? Will somebody else be sad to not have that rain?*

*Mr. Ostler: Cloud seeding has been a controversial measure. We recently demonstrated in the laboratory that it does actually increase the amount of precipitation. Our weather consultants have told us to expect a 5-15% increase. Wyoming recently completed a 13-year study that confirmed that 5-15% increase. The information we*

*have is that the atmospheric reservoir of water is so large that cloud seeding has a negligible effect on that reservoir. They believe that if there is any impact at all 90 miles downstream, it is probably is increasing precipitation, so it does not appear this is an issue to be concerned about.*

*Q: More than 90% of precipitation that comes into the basin evaporates. Are the states addressing or planning to address evaporation control measures?*

*Mr. Ostler: No.*

*Q: I know there is a lot of planning in the Upper Basin on drought contingency and other water issues. The Upper Colorado River Commission integrates the planning, and the states are continuing to develop their water based on their individual risk assessments. Do the states have, or plan to have, an integrated planning approach rather than four individual approaches? Is there a way that you all might say, "No, we only have this much water and we collectively have to not get below that critical level;" or is it individually based within the system? Also, is there a Lower Colorado River Commission?*

*Mr. McClow: It is a collective effort. The Upper Basin states are working together as a group because we know that the allocation in the compact is to the Upper Basin states, not to any one state individually. The Lower Basin states are similarly working on a contingency plan. It is different there because they do not have a commission, the Secretary of the Interior is the rivermaster of the Lower Basin, and all the water from Lake Mead comes under contract from the Bureau of Reclamation. We do not have that simplicity. We have a complex system of water law and water rights. Each state is a little different but they are all similar. We are working as a unit. We know that we have to work collaboratively with our sister states in the Lower Basin because otherwise it just will not work.*

*Mr. Millis: We are also working closely with Reclamation on modeling and the uses, depletions, and supplies available so that we can better understand the system as we work collaboratively.*

*Q: I recently saw that famous slide that Reclamation created of the Basin Study that shows the demand and supply curves are not going in positive directions. The presenter indicated a point at which water demand seems to be decreasing, which is very hopeful. Is there collaboration or coordination among the states to improve water conservation efforts that would reduce some of the challenges or risks that we are facing?*

*A: We are working together on the system conservation pilot program. Our state has a goal for municipal and industrial (M&I) water conservation, particularly for the use of water for outdoor landscaping. Conservation is very much a part of our plan to meet our future water needs. Our future water needs are going to principally additional M&I uses. We do not expect agricultural water needs to grow significantly, and there will be some conversion of agriculture water to M&I uses. It is a reasonable and balanced plan.*

*Mr. McClow: In addition, the Upper Basin states are collaborating on measuring the consumptive use within the states, such as establishing weather stations and other devices to produce accurate numbers on consumption, as well as targets for reducing consumption if necessary.*

*Q: It does not make sense to me that each state would not have as a primary legal directive or guidance to have sustainable water supplies. How close is each of the states to having that as a mandate? Rather than dealing with risk, which is a probability of failure, why not have a mandate guaranteeing the sustainability of water as a priority?*

*Mr. Millis: We actually do have an in-state water law provision that we must not mine groundwater. We will not use more than what naturally recharges, which is difficult. Good water management means we need not exceed the available supply. We have imported water from one area of the state into another and will continue to do such things. Some ask, "Why not just live with the water supply you have, and not import water?" We feel that if we do not need water in one place and need it in another, we can look at moving that water.*

*Mr. McClow: Colorado's legal mandate is exactly the opposite: it is based on risk. Water development based on risk is enshrined in our Constitution. "The right to divert water from the unappropriated waters of the state shall not be denied." Therefore, we work under the prior appropriation system. You can develop as much as you want to, in priority order, but at the risk of a senior water right that could curtail your use if the supply is inadequate. Our entire water law system, both for groundwater and surface water, is mandated to be a risk management operation. Could we change that? Not in my lifetime, I am sure.*

*Ms. Dixon: New Mexico is similar to Colorado, with some nuances that are slightly different. We do not have a state law that you cannot mine groundwater. Sustainability is a goal, but it is not a mandate.*

*Mr. Ostler: Some states can tolerate having a shortage once every 10 years that impacts agriculture, and the remaining 9 years having no shortage. For them, this is viewed as an acceptable risk, and maybe even higher risks are viewed as acceptable. To develop based upon zero risk is not very practical if, even with a shortage, the cities have water and there are no undue consequences. The decision-making and result are different for each state. In Nevada, they have no agriculture and so any shortage means municipal shortage. In other states with*

*agriculture, which can tolerate an agricultural shortage and insure that municipalities are supplied, perhaps that is viewed as a more tolerable risk. It is not the same strategy for every state. Risk needs to be determined in each location.*

*Q: A question came up yesterday about the states preferring experiments to management actions, because they did not want to upset the "delicate balance" among and between states. Please talk about that delicate balance and how that fits in with experiments vs. management actions.*

*Mr. Ostler: With regard to HFE experiments in which water bypasses power generation, the statutes and compacts contain provisions that govern when you can "spill" without generating electrical power. It allows only a limited a number of circumstances, according to our interpretation of the law. We do not see these high flows allowed except as an experiment. If high flows became a management action, we believe we would need to change those legal provisions so that they allowed bypassing the power plant for those general situations.*

**Tribal Liaison Report (Attachment 11)** – Dr. Sarah Rinkevich, Interior. Dr. Rinkevich provided the following updates:

- Theresa Pasqual from the Acoma Pueblo will become the second joint tribal liaison. Theresa is working on a bachelor's degree in Anthropology from the University of New Mexico with a minor in Southwestern Archaeology and Museum Studies.
- John Jordan and John Hamill made a presentation at the last tribal coordination meeting (October 2015) on the Lees Ferry Recreation Trout Fishery Management Recommendations.
- The tribes met recently to discuss the LTEMP EIS comments as requested by the Hualapai Tribal vice-president. Presentations were made by Reclamation and NPS to the individual tribes. The tribes are still reviewing the document and offered the following concerns:
  - Hualapai Tribe's concerns that HFEs are damaging the docks around Diamond Creek.
  - Trout removal remains an issue because of the desecration of life and uncertainty whether the effort is helping humpback chub.
  - The tribes were involved in writing the first EIS (1990s), and are now in a position of only giving comments.
- The Programmatic Agreement is in revision with concerns over the area of potential effect.
- The tribal representatives and Dr. David Braun feel this would be a good time for a review of the AMP cultural program because the last Cultural PEP was done in 2000.
- The tribes would like to work with GCMRC on the next budget cycle.
- Dr. Rinkevich would like to invite the Southwest Tribal Fisheries Commission to the next TWG meeting. This is a non-profit organization established to help Southwest tribes create and expand their fisheries program. Their mission is to advance tribal self-determination and tribal stewardship of fisheries resources through professional development to support tribal resource management programs. She would also like to invite the Navajo Nation's Wildlife Department to make a presentation on their program.
- Dr. Rinkevich is interested in tribal youth programs and suggested the possibility of starting an AMP tribal internship program.

**Science Advisors' Executive Coordinator FY2016 Work Plan Update (Attachment 12)** – Dr. David Braun, Sound Science LLC. The genesis of the Science Advisors (SA) program is within the Independent Review Panels (IRPs) that were created by the 1995 Glen Canyon Dam Final Environmental Impact Statement. The IRPs were responsible for periodically reviewing resource monitoring and research programs and for making recommendations to the AMWG and GCMRC regarding monitoring, priorities, integration, and management. The SA Program was established to fulfill certain IRP responsibilities with an Executive Secretary (later renamed "Executive Coordinator") assigned to lead the program. From 1998 to 2001, GCMRC assumed responsibility for many of the SAs' activities, including the proposal review process and scientific reports generated by Science Advisors. From 2002 to 2014, numerous reviews were completed, the SAs collaborated with GCMRC on the 2005 Knowledge Assessment Workshop, and the first review of the Triennial Work Plan for FY 2015-17 was completed.

In 2016, special circumstances were identified:

- No annual work plan had been developed or approved since FY2014.

- AMWG and TWG members were uncertain about SA roles.
- Program practices had evolved from 2002-14 but there was no program archive.
- The LTEMP EIS created an opportunity to review and rethink GCDAMP needs for SAs.

Also in 2014-15, as part of the restarting of the SA program, it was decided that

- Administration would be transferred to Reclamation and all services would require task orders.
- SAs were no longer to be continuously on-call but separate panels would be formed for each review or service.

The SA FY2016 Work Plan was developed in consultation with Reclamation, GCMRC, TWG leadership, and the Secretary's Designee with three objectives identified: (1) Review and update the SA Charter and protocols for the SA Program and Executive Coordinator (EC), (2) Develop and confirm the FY2017 work plan, and (3) Assist GCMRC in design and implementation of the Fisheries Protocol Evaluation Panel (PEP). The EC would also establish and maintain a program archive. Dr. Braun identified key steps to developing the FY2017 work plan and SA involvement in the Fisheries PEP.

In answer to questions, Dr. Braun said that:

- *As members of AMWG and TWG, the tribes work with both the GCMRC and the SA program to identify topics concerning cultural resource management potentially suitable for SA program review. Continued dialogue with the AMWG/TWG membership, including tribes, and GCMRC will inform the SA functions and assignments.*
- *The EC reports administratively directly to Reclamation but on all substantive matters it reports to the AMWG, and protocols for interaction with stakeholders will be established.*

Other comments included:

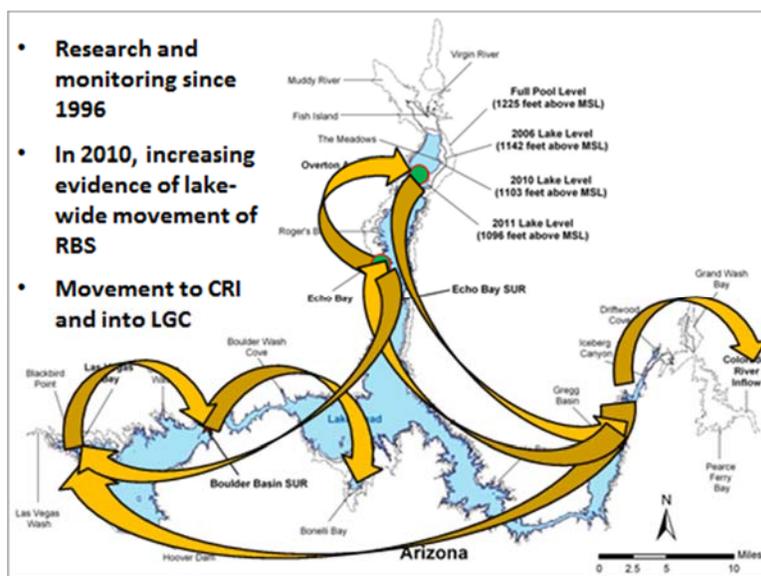
- *GCMRC internal review and oversight is needed on what other programs/literature will be built into research.*
- *SA assistance is needed in writing the AMP administrative history.*
- *The National Research Council provided one review to the AMP, published in 1999, and had previously also reviewed work along the Colorado River in 1991. The 1995 FEIS anticipated that the AMP might request the Council to perform additional reviews.*

**Razorback Sucker Research Update (Attachment 13)** – Dr. Mark McKinstry, Bureau of Reclamation. The Razorback Sucker was listed as an endangered species in 1991, critical habitat designed in 1994, a recovery plan developed in 1998, and recovery goals established in 2002. Recovery goals require two populations in Upper Basin (Green River and Upper Colorado River or San Juan River), and two populations in the Lower Basin (location not specified). Dr. McKinstry provided RBS records from Grand Canyon and an overview of RBS in Lake Mead. A science panel was created in 2010 for the purpose of obtaining advice, primarily focused on the stocking element of the conservation measures. The panel provided the following recommendations for future work in Lower Grand Canyon:

- Continue work on RBS at Colorado River Inflow (CRI) and Lake Mead.
- Do not force augmentation for political reasons.
- Use translocated wild fish (wild larvae from lake population) if augmentation is needed.
- Integrate all information on fish and foodbase in Lower Grand Canyon (LGC) and CRI.
- Expand fish surveys in LGC, especially for RBS including a larval fish study.
- Potentially sonic-tag large adult RBS and release in Lower Grand Canyon, to be able to identify habitat use, movements, and other fish.

In 2012-13, RBS records from the CRI indicate 13 untagged (wild) RBS adults were captured, 13 recaptured, and 12 larvae were captured. Also, two fish had moved upstream to Quartermaster or beyond, three moved upstream past Pearce Ferry, and one male, ripe wild fish was captured at Spencer Creek. Results obtained in 2015 revealed that fish were spawned in each year going back to 1999 that have not recruited into the population.

Objectives going forward: (1) continue monitoring the CRI, using the same methods since 2010, (2) determine RBS presence and habitat use in LGC, and (3) explore linkages between Lake Mead and LGC. The following graphic illustrates movements of RBS from around the Lake to various locations:



Larval RBS are being captured all the way to Lava Falls. They captured 476 larvae in 2014 and 81 in 2015. The Grand Canyon is unlike any other place in the basin in that it is dominated by native fish, and even the non-native fish are driven by a few small locations. Inflow habitats appear to be important for native fishes.

Q: *Why are we seeing that shift from non-native to native fish?*

A: *GRCA is a harsh place, and the temperatures are cold. There is a hypothesis that it may have started because the water warmed a few years ago.*

Q: *It appears from your sources slide that the fish from the Lower Basin are heading upstream, so somehow they are imprinted on a habitat condition and moving around.*

A: *If you go to Lake Powell, you see an even bigger story. There are fish that have been released in Green River and the Colorado River by Grand Junction that are coming down through Lake Powell, taking a turn, and going up the San Juan, banging their heads against the waterfall in the San Juan. There have also been fish that have managed to get past the waterfall and go all the way to Farmington. That is a movement of about 500 miles. Those are stocked fish that may not have been imprinted on anything.*

Q: *What predator eats the RBS and are there predators where they are moving?*

A: *In a natural environment, they are probably eaten by pikeminnow, which are no longer in this system. In the lake, striped bass eat them. The fascinating thing about RBS is that they are somehow able to avoid that predation in the lake, and Lake Mead has some big stripers. The hypothesis is that they use areas that have high turbidity for cover. So instead of staying under a tree or a rock, they are in turbid water. Most of the predators like stripers or walleye are sight feeders.*

*Mr. VanderKooi added that the vast majority of fish biomass in WGC is flannelmouth sucker, which are much more likely to be eaten than the RBS.*

Q: *Please mention the release of fish at Diamond Creek.*

A: *We release sonic-tagged "Judas fish" that take us to the aggregations of spawning fish. We have used that technique in the lake, and we did the same thing after 2014 with nine male fish that we released at Lava Falls. We have never had wild fish there, but some of those fish have now traveled downstream, back out into the lake, and then came back up toward Lava Falls again. Today they are releasing 10 more of these radio-tagged fish at Diamond Creek to augment the effort to figure out the location of the other wild fish. We want to identify two things: (1) the zero point in time, and (2) zero point in place. We think we have the zero point in time as far as spawning goes, but now we want to find out where they are spawning.*

Q: *What is the estimate that those larval fish you are finding would reach maturity?*

*A: They produce hundreds of thousands of eggs, but only one or two of those may eventually lead to an adult fish. The probability of a larval fish reaching maturity is very small and it is even smaller in an area with many predators.*

*Q: The AZGFD will soon hire a biologist to focus on big river fishes. We want to support this type of project with that position. Are there potentials for other additional big river fish species since we have seen some successes with RBS?*

*A: I will not answer the second question, though I have my own personal opinion. I want to say thanks to AZGFD because they contributed some of the data. You guys actually shocked up a spawning adult RBS in LGC in 2012 so we have proven that there were wild fish up there.*

*Ms. Balsom: We have looked at restoring native populations in the canyon and I think we're all talking about pikeminnow, an extirpated species that was part of the system. Our fish plan discusses feasibility assessments and we need to consider that.*

*Dr. McKinstry: There is a lot of food there for pikeminnow. I do not know if it is suitable or not. The system is currently lacking a large predator. Some people would say it would be great to do it because you have two ESA species already there.*

*C: To put a perspective on RBS, keep in mind it is a unique genus; that is, the first scientific name *Xyrauchen* is unique to this species. While there is no other species that shares that genus, it is related to what are known as the lake suckers, which are different from a flannelmouth or bluehead sucker. They have a different structure that enables them to be in reservoirs and lakes. That is what is so exciting about this work. If you look at the impounded Colorado River, and look at Lake Mead, Mojave, and some of these other reservoirs, of all the native fish that are in the system, the RBS is the only one that has persisted in these reservoirs over time. That is because of that evolutionary adaptation of that fish, which is linked to that of other lake suckers. This fish will use a reservoir in combination with an inflowing river, and this is a beautiful example of that very situation taking place. I think it is unlikely that other native Colorado fishes can do the same thing. We see some remnants of bonytail in Mojave and some remnants of Colorado River pikeminnow in Lake Powell, and certainly HBC would not reside in a reservoir. I think what Mark has discovered is an understanding of how this is linked to a lake sucker lineage that enables this particular species, RBS, to persist in Lake Mead.*

**Public Comment:** None

**Wrap-Up and Adjourn:** Ms. Jennifer Gimbel thanked everyone for their attentiveness and participation.

**Adjourned:** 11:50 a.m.

**Upcoming Meetings:**

- May 25, 2016 – AMWG Webinar
- Aug 24-25, 2016 – AMWG meeting in Flagstaff, Arizona

Respectfully submitted,

Linda Whetton  
Bureau of Reclamation  
Upper Colorado Region

## Key to Glen Canyon Dam Adaptive Management Program Acronyms

|                                                   |                                                                        |
|---------------------------------------------------|------------------------------------------------------------------------|
| ADWR – Arizona Dept. of Water Resources           | HMF – Habitat Maintenance Flow                                         |
| AF – Acre Feet                                    | HPP – Historic Preservation Plan                                       |
| AGFD – Arizona Game and Fish Department           | IG – Interim Guidelines                                                |
| AIF – Agenda Information Form                     | INs – Information Needs                                                |
| AMP – Adaptive Management Program                 | KA – Knowledge Assessment (workshop)                                   |
| AMWG – Adaptive Management Work Group             | KAS – Kanab Ambersnail (endangered native snail)                       |
| AOP – Annual Operating Plan                       | LCR – Little Colorado River                                            |
| ASMR – Age-Structure Mark Recapture               | LCRMCP – Lower Colorado River Multi-Species<br>Conservation<br>Program |
| BA – Biological Assessment                        | LTEMP – Long-Term Experimental and Management Plan                     |
| BAHG – Budget Ad Hoc Group                        | LTEP – Long Term Experimental Plan                                     |
| BCOM – Biological Conservation Measure            | MAF – Million Acre Feet                                                |
| BE – Biological Evaluation                        | MA – Management Action                                                 |
| BHBF – Beach/Habitat-Building Flow                | MATA – Multi-Attribute Trade-Off Analysis                              |
| BHMF – Beach/Habitat Maintenance Flow             | MLFF – Modified Low Fluctuating Flow                                   |
| BIA – Bureau of Indian Affairs                    | MO – Management Objective                                              |
| BO – Biological Opinion                           | MRP – Monitoring and Research Plan                                     |
| BOR – Bureau of Reclamation                       | NAU – Northern Arizona University (Flagstaff, AZ)                      |
| BWP – Budget and Work Plan                        | NEPA – National Environmental Policy Act                               |
| CAHG – Charter Ad Hoc Group                       | NHPA – National Historic Preservation Act                              |
| CAP – Central Arizona Project                     | NNFC – Non-native Fish Control                                         |
| GCT – Grand Canyon Trust                          | NOI – Notice of Intent                                                 |
| CESU – Cooperative Ecosystems Studies Unit        | NPCA – National Parks Conservation Association                         |
| cfs – cubic feet per second                       | NPS – National Park Service                                            |
| CFMP – Comprehensive Fisheries Management Plan    | NRC – National Research Council                                        |
| CMINS – Core Monitoring Information Needs         | O&M – Operations & Maintenance (Reclamation Funding)                   |
| CMP – Core Monitoring Plan                        | PA – Programmatic Agreement                                            |
| CPI – Consumer Price Index                        | PBR – Paria to Badger Creek Reach                                      |
| CRBC – Colorado River Board of California         | PEP – Protocol Evaluation Panel                                        |
| CRAHG – Cultural Resources Ad Hoc Group           | POAHG – Public Outreach Ad Hoc Group                                   |
| CRCN – Colorado River Commission of Nevada        | Powerplant Capacity = 31,000 cfs                                       |
| CRE – Colorado River Ecosystem                    | R&D – Research and Development                                         |
| CREDA – Colorado River Energy Distributors Assn.  | RBT – Rainbow Trout                                                    |
| CRSP – Colorado River Storage Project             | RFP – Request for Proposal                                             |
| CWCB – Colorado Water Conservation Board          | RINs – Research Information Needs                                      |
| DAHG – Desired Future Conditions Ad Hoc Group     | ROD Flows – Record of Decision Flows                                   |
| DASA – Data Acquisition, Storage, and Analysis    | RPA – Reasonable and Prudent Alternative                               |
| DBMS – Data Base Management System                | SA – Science Advisors                                                  |
| DOE – Department of Energy                        | Secretary – Secretary of the Interior                                  |
| DOI – Department of the Interior                  | SCORE – State of the Colorado River Ecosystem                          |
| DOIFF – Department of the Interior Federal Family | SHPO – State Historic Preservation Office                              |
| EA – Environmental Assessment                     | SOW – Statement of Work                                                |
| EIS – Environmental Impact Statement              | SPAHG – Strategic Plan Ad Hoc Group                                    |
| ESA – Endangered Species Act                      | SPG – Science Planning Group                                           |
| FACA – Federal Advisory Committee Act             | SSQs – Strategic Science Questions                                     |
| FEIS – Final Environmental Impact Statement       | SWCA – Steven W. Carothers Associates                                  |
| FRN – Federal Register Notice                     | TCD – Temperature Control Device                                       |
| FWS – United States Fish & Wildlife Service       | TCP – Traditional Cultural Property                                    |
| FY – Fiscal Year (October 1 – September 30)       | TEK – Traditional Ecological Knowledge                                 |
| GCD – Glen Canyon Dam                             | TES – Threatened and Endangered Species                                |
| GCES – Glen Canyon Environmental Studies          | TMC – Taxa of Management Concern                                       |
| GCT – Grand Canyon Trust                          | TMF – Trout Management Flows                                           |
| GCMRC – Grand Canyon Monitoring & Research Center | TWG – Technical Work Group                                             |
| GCNP – Grand Canyon National Park                 | UCRC – Upper Colorado River Commission                                 |
| GCNRA – Glen Canyon Nat'l Recreation Area         | UDWR – Utah Division of Water Resources                                |
| GCPA – Grand Canyon Protection Act                | USBR – United States Bureau of Reclamation                             |
| GLCA – Glen Canyon Nat'l Recreation Area          | USFWS – United States Fish & Wildlife Service                          |
| GRCA – Grand Canyon National Park                 | USGS – United States Geological Survey                                 |
| GCRG – Grand Canyon River Guides                  | WAPA – Western Area Power Administration                               |
| GCWC – Grand Canyon Wildlands Council             | WY – Water Year                                                        |
| HBC – Humpback Chub (endangered native fish)      |                                                                        |
| HFE – High Flow Experiment                        |                                                                        |