

**Glen Canyon Dam Adaptive Management Program  
Technical Work Group Meeting  
Nov 7- 8, 2023**

Day 1: Tuesday, Nov 7, 2023

**Start Time: 10:02 AM MT**

**Conducting:** Seth Shanahan, Southern Nevada Water Authority (SNWA) and TWG Chair

**Designated Federal Official:** Daniel Picard, Bureau of Reclamation

**Meeting Recorder:** Beccie Mendenhall, SeaJay Environmental LLC

### **Welcome and Administrative**

- **Introductions and Determination of Quorum (16 members):** A Quorum was reached.
- **Adoption of Prior Meeting Minutes:** Meeting minutes adopted with no revisions.
- **Next Meeting Date(s):** January 23-25, 2024, proposal is for in person, in Phoenix.
- **Ad Hoc Group Membership and Updates:** Reminder for TWG members to review and update ad hoc group memberships on the website. Erik Skeie (CWCB) Budget Ad Hoc Group Triennial work plan process is starting, First BAHG call proposed for Dec 6th. Planning 4 more BAHG calls in Jan-Feb.
- **Seth Shanahan (SNWA) Socio Economic Ad Hoc Group (SEAHG) is already on the agenda, will skip updates here.**
- **SCAHG:** The Steering Committee group meets before and after each TWG with a primary goal to make the program work better. All members are welcome to join. Also, anyone who feels there is a gap in communication or program activities please bring it to this group.
- **Review Action Items, Motions, and Votes Form:** A quick review of the list shows all but one action item was either completed or are on the agenda for this meeting. A request was made to include the link for action items to make it easier for review prior to the meeting.
- **Update on Monitoring and Research Trips to Occur from Today Until Next Meeting:**  
**Andrew Schultz (GCMRC)** Two TRGD trips planned Nov 8 - 13 and Jan 24 – 30.

### **Glen Canyon Dam Adaptive Management Program Budget Priorities**

**Bill Stewart (BOR)** There are many projects on both the Reclamation and GCMRC sides of this work. It is important to understand how these projects tie into compliance for the program. The workplan was created based on a few key things:

- LTEMP EIS and Record of Decision from 2016
- 2007 Biological Opinion for the Interim Guidelines
- 2016 Biological Opinion for LTEMP
- Section 106 of the National Historic Preservation Act

One of the action items in AMWG is prioritization of projects. This is important due to the uncertainties of funding, which has switched back and forth between Power and Appropriations. It can be a lengthy process with partial funding scenarios. The Grand Canyon Protection Act is the umbrella agreement for GCDAMP activities pursuant to NEPA, LTEMP ROD, LTEMP Biological Opinion, Endangered Species Act. There is funding required to be compliant with each of these as well as the administrative costs to run the programs.

The Risk Assessment Matrix was developed as a tool to prioritize these projects. Each project is evaluated and assigned a score for impact and a score for likelihood. Scores are numbered from 1 to 5 with one being the lowest and five being the highest score (most impact or most likely).

## Q&A and discussion

**Shana Rapoport (CRBC)** In the risk matrix, how do the two columns impact and likelihood interact?

**Bill Stewart (BOR)** It is a sum of the two individual scores, so 2 to 10 is the scale with ten being the highest priority.

**Craig Ellsworth (WAPA)** What kind of feedback do you want from the program? Are we to use this in the BAHG process? **Bill Stewart (BOR)** My intent is twofold. First making sure folks understand factors related to compliance. And then offering up a framework that may be helpful to compare the many projects and how they tie to mitigation. Also looking for information that will be helpful to the BAHG process.

**Seth Shanahan (SNWA)** I may have missed something, you have this risk assessment and you have already applied it to the existing workplan elements? **Bill Stewart (BOR)** It was applied but not completed and it was over a 2 years ago, so it is outdated. **Seth Shanahan (SNWA)** Is the idea that what comes to the TWG BAHG will have this Risk assessment framework applied to it after it is received? **Bill Stewart (BOR)** That is one potential path, you could use this to draw the line for projects to be funded, like a threshold score. **Seth Shanahan (SNWA)** Do you see this framework helpful to make sure we meet the minimum deliverables on a multi part initiative (like Humpback Chub)? **Bill Stewart (BOR)** Yes, it could be used to help evaluate tradeoffs or what might be lost with partial funding scenarios. **Seth Shanahan (SNWA)** I feel like it would be beneficial if people developing the projects have access to the risk assessment framework. I am specifically thinking of this for Andrew and GCMRC staff. **Bill Stewart (BOR)** Also drawing connections from the project to the environmental commitment it mitigates is helpful in building the case to support a specific project.

## Socioeconomic Ad Hoc Group Charge

**Seth Shanahan (SNWA, TWG Chair)** The Socioeconomic Ad Hoc Group (SEAHG) has had many purposes over the years. One point for SEAHG is to provide feedback to TWG about budget priorities. For the budget workplan in this last year, however, there were several budget items that could have been discussed but perhaps were missed. Project N is one example. We learned a lot in the budget cycle, and we got to a good place with the recommended budget, but there were additional side bar conversations that not everyone was included in. The first purpose of this item on the agenda is to bring forth some of the conversations that came out in the budget process last year that have not yet been shared. The second purpose is to task the SEAHG with continuing to share the conversation. Colleagues at WAPA, CREDA and GCMRC were involved in a side bar conversation earlier this year. I will look to volunteers from that group to share comments.

**Leslie James (CREDA)** The SEAHG kicked off in 2011-2012 focused on developing information needs for Recreational, Hydropower, and Tribal groups. The reason in part for this group was that those 3 areas had less science support and thus needed additional stakeholder involvement to develop information needs. **Lucas Bair (GCMRC)** I joined in 2014 and got involved working on the information needs of the three resource areas as identified by Leslie. Funding for these resource areas waxed and waned across the three over time. Refocusing in this BAHG process on those three resource elements individually might be a good approach. **Craig Ellsworth (WAPA)** One of the problems we struggle with is how to mesh the communications from different entities in the group. What we are looking for is a way to open an increased level of communications. Get input from others on things we could use some help with. **Leslie James (CREDA)** We had a good discussion at GCMRC the day before June TWG. How can we best work towards the objectives for hydropower while ensuring it fits within all the other objectives of LTEMP. If we can increase communication between resource experts it should help.

**Seth Shanahan (SNWA)** It sounds like there is support for having a group come together for these conversations. There is a proposed charge to SEAHG in the meeting agenda. Do people think this is a good place to start?

### **Proposed Charge for SEAHG**

*“The Socioeconomic Ad Hoc Group is charged with working with the Grand Canyon Monitoring and Research Center to recommend a Project N work plan project that, if implemented, might help achieve the LTEMP hydropower and energy resource goal to “maintain or increase Glen Canyon Dam (GCD) electric energy generation, load following capability, and ramp rate capability, and minimize emissions and costs to the greatest extent practicable, consistent with improvement and long-term sustainability of downstream resources.”*

### **Discussion Followed**

### **Hydrology, Glen Canyon Dam Operations, and Water Quality Conditions in Lake Powell and Below Glen Canyon Dam**

**Alex Pivarnik (BOR)** Precipitation for the fall months was dry, which leaves the full year at or a little above average. Lake Powell is still the lowest at only 37% fill. Upper Colorado is at median for the year but note that there is still a lot of uncertainty between now and end of the 2024 water year. The April forecast was quite a bit higher than where we ended up. The drying trend started in June and has continued through the fall. No changes in Reservoir Operations, no balancing operations required. The Drought Response Operations Agreement (DROA) shows completed volumes by year. We should be able to zero out all drought volumes by the end of this year. In September the Glen Canyon Dam release patterns were reduced due to drought in the upper and lower water basins and an increase in water inputs in the lower Colorado. Glen Canyon Dam release patterns returned to normal levels in October.

**Robert Radtke (BOR)** The water temperatures in Lake Powell are well stratified across the depth. Oxygen saturation levels are good everywhere except at the Penstock layer. Temperature analysis in the forebay shows higher temps going down into the Penstock layer. Some of the sediment measurements were higher than expected. There was hypoxic discharge noted in the data. The model provides temperature projections for specific points in the Grand Canyon. The model projections seem to be low, however, probably need to add 2.5 degrees to get more realistic projections in the canyon.

### **Q&A and discussion**

**Bill Persons (FFI/TU)** The model for temperature and oxygen does not seem to be working well. Does it consider Lake Powell elevation? **Robert Radtke (BOR)** Yes, that data does feed into the model. There were some adjustments to the model a few years ago to reduce crashes caused by the Powell elevation drop. And currently it appears to be impacted by the large spring Inflows. **Seth Shanahan (SNWA)** It seems there is continuing work on the model, can you give us an update on who is doing what? **Robert Radtke (BOR)** Bryce is working on the model. He fixed the crashes related to elevation drop and is analyzing the large inflow impact. **Bryce Mihalevich (USGS)** There has been a change in the total volume of this system. We have been updating the bathymetry with some resurveying. There is a 7% decrease in the volume since the reservoir was built. That has a big impact on the model. Lower elevations in the reservoir cause higher variability in temperature, so the model does not work as well.

**Ben Reeder (GCRG)** There was no communication to the River Guides when the water rate was lowered in September, nor again when it was returned to higher levels in October. It wreaked havoc on the water and there were some serious injuries. We can't operate boats safely below 6000 CFS. **Seth Shanahan**

(SNWA) Alex, can you react to that comment from Ben? And then the Park Service to comment on the information that was shared? **Alex Pivarnik (BOR)** We appreciate the feedback from outfitters. Having that 6000 CFS number is good to know. It was very hard to balance things in September, getting hit from both sides. **Emily Omana Smith (NPS-GRCA)** I don't have specifics but agree communications need improvement, guides need to know the details before launching. **Bud Fazio (NPS)** NPS did receive notice from Reclamation, but with a very short timeframe. One improvement would be to discuss this much earlier so there is more time to inform stakeholders. Also, the low flows occurred at a different time of day than everyone expected, which required a dynamic change in navigation on the river.

**Craig Ellsworth (WAPA)** Is this temperature model what they will be using in the LTEMP SEIS? And if so, will it be adjusted before it is used to make decisions? **Robert Radtke (BOR)** There was no problem with the model in the original LTEMP. Hopefully any issues will be remedied prior to decisions for the new LTEMP. **Bridget Deemer (GCMRC)** Bryce has a new version of the model that has not been given to BOR yet. There is also a temperature model from Charles that was used in the LTEMP SEIS. **Craig Ellsworth (WAPA)** Do these models work better? **Bryce Mihalevich (USGS)** They are not ready, we have not modeled all the data points yet.

### **Discussion Followed**

Kelly Burke - curious about the implications of this type of river flows for the overlap with what is our imposed calendar year, the water year. It puts an end to the motor season. Suggested we build in flexibility to allow for a bump in flows if it is needed. Allow some flexibility to make recreation safe. Suggestion by **Seth Shanahan (SNWA)** – This concept could be added to the post 2026 SEIS.

Suggested action item - instead of showing the Dibble model from Jan forward, can you update the model based on observed temperature projections?

### **Resource Impacts from the Spring High-Flow Experiment**

**Paul Grams (GCMRC) Sediment Impacts** First a reminder, the HFE was a release of 40,000 cfs for 79 hours at bypass. We ended up with 45,000 cfs measured downstream at Diamond Creek. The April 2023 HFE was designed to address high sediment accumulated from Jul – Oct 2022 in Marble Canyon. The summer reservoir balance May to Aug 2023 moved more sediment than the HFE export in April. The same pattern was seen back in 2011 when there was a summer balancing activity. In summary, the summer balancing undoes some of the sand deposits intended by the Spring HFE. We still ended up with a net positive, but benefits are offset by erosion due to balancing activity.

### **Joel Sankey (GCMRC) Field Report on wind transport for archaeological sites**

The premise is that by removing riparian vegetation barriers you increase windblown dune creation which promotes preservation of the sites. This experiment was started in 2019 but 2023 was the first year we had an HFE to work with. In 2023 a repeat vegetation management trip by NPS was conducted in Sept 2023. It is worth noting that this experiment is under scrutiny around the world as something new for vegetation management. There are six different sites managed by this program and each site responds uniquely. Based on photographic evidence of the sites, results are positive.

### **Josh Korman (Ecometric Research, GCMRC Cooperator) Effect on Rainbow and Brown Trout**

2017 LTEMP imposed a temporary ban on Spring HFE due to the abundance of Rainbow Trout (non-native fish) measured following 2011 equalization flows. This year's HFE was an opportunity to validate two core premises of the original LTEMP. Measurements show no increase in Rainbows or Brown trout following the HFE in 2023. We can conclude that it is possible to have an HFE event without increasing

these populations. Why there was no increase is more difficult to pin down. The later timing of this HFE may have been a factor. The ecosystem is also very different today than it was in 2008. We will continue to analyze the data and report further results in January.

**Ben Reeder (GCRG)** Paul Grams nailed what I wanted to say about the sediment. The guides felt like it was a huge success. The HFE filled in all the gully's, allowed return of camps that had been eliminated. Marble Canyon did extremely well, even after the summer high flow activity. Camps that had been gone for decades were back. The western end of the Grand Canyon also did very well after the HFE, although most of that gain was lost after the summer flows. There were less ants in camp, so it was a good cleanse for the canyon and beaches. Also improved the safety of camps with less gullies to fall into at night.

**Nick Williams (BOR)** After the Spring HFE we found signs of cavitation in the outlet works at the low reservoir water elevations. Research also found a paper from 1965 reporting the same results at low water elevation. Cavitation is when the static pressure drops below the water vapor pressure, which is the pressure at which water transitions from water to gas. It manifests as tiny implosions, which can then eat away at the metal. The solution to this is slowing the water down, not sure yet how slow, need more modeling to determine that. There is also a project Alex is working on for coating the metal. Should have results to report on that sometime in the Spring.

**Ryan Mann (AZGFD)** Our fish program manager in Flagstaff did not report any negatives in fishing. Lower populations perhaps but larger, healthier adults are still being caught so anglers are not complaining. There is acknowledgement of the long-term benefits to recreational resources. I do want to reiterate allowing adequate time for communication to recreational users when there are changes.

**Emily Omana Smith (NPS-GRCA)** Grand Canyon supports the HFE activity. We have received a lot of positive comments from commercial and private sectors. We look forward to opportunities for more.

**Bud Fazio (NPS-GLCA)** Glen Canyon also supports the HFE, we understand their importance and are pleased to see all the results presented today. They do suffer some erosion when these HFE happen but will tolerate that for the benefit down river.

### **Q&A and Discussion**

**Craig Ellsworth (WAPA)** Vegetation removal project goal is to increase sand transport via wind, which promotes dune creation. Would there be a possibility of adding some desirable vegetation back to these sites like a cottonwood or Gooddings willow that would continue to allow dune creation but also provide recreational or wildlife habitat? **Joel Sankey (GCMRC)** There is a second goal to the vegetation removal, which is to increase camp size. For that reason, you might not want to add back vegetation. But we are looking at partial removal, a more middle line approach. **Paul Grams (GCMRC)** We are doing some of these hybrid restoration ideas working with NPS.

### **LTEMP Supplemental Environmental Impact Statement**

**Bill Stewart (BOR)** The purpose of the LTEMP SEIS is to address Small Mouth Bass invasion with flow alternatives from 2024 to 2027 and adjustments to the HFE protocol for duration of the LTEMP SEIS that runs through 2036. In the last few years, the water temperatures at Lees Ferry have been in range for Small Mouth Bass. We have been in prevention mode since the reservoir filled but are at a critical point now. The draft EA was published in February and had 7000 comments. Specific to the LTEMP SEIS, there are 4 flow options using the bypass as outlined in the EA plus one non-bypass alternative. A change in the sediment account period, as approved at the August AMWG, is also included. We wrapped up scoping on Friday Oct 23<sup>rd</sup>. There were two public webinars on Oct 18<sup>th</sup> and 20<sup>th</sup>, those recordings are available online. The 30-day window for public comment closed Nov 3<sup>rd</sup> with about 40 comments

returned. We are preparing the draft SEIS for year end with a target to have the final Record Of Decision by May or June 2024.

**Kurt Dongoske (Pueblo of Zuni)** I want to underscore again the letter sent to Reclamation requesting they come to the Zuni for recommendations. The experts on this are the Zuni tribe.

### Discussion Followed

#### Invasive Fish Surveillance in Lake Powell

**Barrett Friesen (Utah State University)** This presentation is focused on water temp, Oxygen Saturation and fish populations in the forebay (dam side) from 2022 through 2023. I have found temperature to be the foremost driver of the non-native fish distribution at Powell. The water temperature is homogenous in the winter, then stratifies in the summer with warmer temperatures at the top. When there is warmer water, more fish are caught in the gill nets. Looking at the capture of SMB, these were only present in the forebay when the water temperature is stratified (higher temperature at the top). The reason we did not see cooler temps today in the river is because the penstock layer moved lower 20 meters in 2022 and 35 meters in 2023 due to lower elevation of water in the reservoir. Fish distribution modeling aligned well with the actual measurements. Last year he did not measure small fish near the dam. He measured it now and confirmed there are many, including SMB. They might even be hiding in the dam structure itself. The young fish may use the penstock gate structures as cover or as a nursery. Conclusion: Higher water elevation means lower fish density and lower entrainment.

Only 4 native fish caught in the forebay out of 3000 total caught to date. This included one stocked Razorback Sucker that had traveled 500 km downstream from the Gunnison River.

**Mike Horn (BOR)** There are more fish associated with the canyon walls and the face of the dam, not the open water. Fish tend to remain above the thermocline in well oxygenated water near the top in the summer. They will only go down to the lower levels when the water temperature and oxygen are homogeneous. Conclusion: Risk of entrainment is low in the summer because fish will stay above the thermocline.

### Q&A and discussion

**Emily Omana Smith (NPS-GRCA)** Barret, can you speak about entrainment survival? **Barrett Friesen (Utah State University)** The gas bladder will rupture at 6.7x the ratio between acclimation pressure and tail water pressure.

### Discussion Followed

#### Invasive Fish Surveillance in Glen and Grand Canyons

**Jeff Arnold (NPS)** This report covers surveillance and monitoring in Glen Canyon reach this summer. The temperature is still 17 degrees coming out of the dam. Farther down the river temperatures were well above the levels required for SMB. We wanted to electrofish twice a month, but only got out about once per month. We wanted to set fike nets every other week but ended up at about half of that. There were challenges this year getting drivers for the boats and the high flow event prevented nets. The SMB and Green Sunfish frequency was highest closest to the dam. Also caught a lot of SMB in the lower slough using nets. Six hundred thirty-one (631) Smallmouth Bass and more than 2,000 Green Sunfish were captured in the lower slough. Not all reaches were samples equally. We are ramping up operations for this project due to funding secured from the Disaster Supplemental Funds - \$5M over the next 5 years. Reference the slides for details on fish capture rates for the year.

**Emily Omana Smith (NPS-GRCA)** I will provide an update on fish surveillance in Grand Canyon plus captures in 2023 from all cooperators. Grand Canyon surveillance was focused on the first 8 miles of the Grand Canyon with a few additional trips farther downstream. Three emergency trips were launched in Sept and Oct due to the first reported SMB capture in the Grand Canyon. A total of 13 SMB was captured from these emergency trips. Action is planned at Lava Chuar Slough (mile 66.1) to eradicate large numbers of Green SF and Flathead Minnows prior to reconnecting the slough to the river. The Lava Chuar slough has been cutoff since the flows decreased below 20k cfs. Reference the slides for details on the trips, methods and captures to date.

#### **Discussion Followed**

**Bill Persons (FFI/TU)** asked about the status of the Humpback Chub (HBC). **David Ward (USFWS)** there are more HBC than I have ever seen. Estimating that electrofishing catches only 10% of the population, not only are there more HBC, but there may be as many as 42K adult SMB in the canyon. **Ryan Mann (AZGFD)** – there is a shift toward more native species. We have been seeing this since 2015. There are a ton of native fish. They are doing great. Some of this success is attributed to the warmer water temperatures. That also increases the risk of the nonnative warm water species. The system is ripe for change.

**Craig Ellsworth (WAPA)** asked about the temperature data from the slough. **David Ward (USFWS)** – no, we were not able to recover the loggers. They disappeared in mid-July.

**Craig Ellsworth (WAPA)** – what can we do to help collect that data in the slough? We are at the cusp of making important decisions. That is the only place we've recorded bass spawning below the dam. How can we get that info for the slough?

**David Ward (USFWS)** – getting the loggers out there and collecting the data is a matter of the number of people. It is just me and the tech. My goal is to get more loggers and more people out there. I did have a logger at the dam slough. I haven't collected downloaded the data yet. When I collected the data, the logger was on dry land. It was in the water during the high-water event.

**Craig Ellsworth (WAPA)** – has anyone looked into seeing if bass are spawning anywhere else? **David Ward (USFWS)**-we planned on doing some snorkeling and we have an underwater ROV, I am pretty sure they spawned right below the dam. I went up to the area below the dam with Dave Rogowski. Seeing SMB below the dam leads me to believe they spawned up close to the dam. Some of the bass caught in Grand Canyon and Glen canyon were in 40 mm range. The ones we caught were 50 mm. This makes me think these 50 mm SMB spawned somewhere other than in the slough. Those fish have been saved; we'll do the genetics to see if they are related to the slough SMB.

**Seth Shanahan (SNWA)**– we'll revisit all of this in January. We'll organize the January meeting to look at this.

**Public Comment: None**

**Meeting adjourned at 5:04 PM PDT**

Day 2: Wednesday, Nov 8, 2023

**Start Time: 9:01 AM MT**

**Conducting:** Seth Shanahan, Southern Nevada Water Authority (SNWA) and TWG Chair

**Designated Federal Official:** Daniel Picard, Bureau of Reclamation

**Meeting Recorder:** Beccie Mendenhall, SeaJay Environmental LLC

### Welcome and Administrative

Seth Shanahan, TWG Chair

- **Introductions and Determination of Quorum (16 members):** A quorum was reached.
- **Unresolved Issues from Yesterday's Meeting:** No unresolved issues.
- **Special Update from US Fish and Wildlife Service:**  
**David Ward (USFWS) Little Colorado Humpback Chub** Most of the water of the Little Colorado River comes out of Blue Springs. There is high CO2 in this area, so we did not think a lot of fish were up there. But approximately 8 miles upstream of the springs we found nine (9) adult Humpback Chub and seven (7) young of year. We don't know if they were always there or if they traveled up there in the spring runoff. This almost doubles the miles of Humpback Chub river habitat in the Little Colorado River.

### Update on Status of Draft Performance Metrics for the Long-Term Experimental and Management Plan

**Helen Fairley (GCMRC)** Why is this Metric project important? The LTEMP 20-year plan defines 11 goals. Section 6.1 of the LTEMP ROD requires metrics to be developed for monitoring goals and objectives defined in appendix C. But there are challenges in turning the original ideas into actual measured outcomes. Metrics and monitoring are different:

Metrics – quantitative measure to assess performance, progress, success reaching a goal.

Monitoring – effectiveness (progress), surveillance (early warning), validation (confirm/refine models)  
This project is about defining metrics to measure achievement of goals in the original LTEMP. These metrics will not tell us “Why” we achieved something. Therefore, this project will not cover all the metrics or measures we want for the program. Reference slides for details on the LTEMP metrics.

There are two areas of metrics that are still under discussion and need to be resolved. First, sediment metrics need to be focused on the areas above high-water levels. Second, the single goal statement in LTEMP for Tribal Values is too generic for the diversity and complexity of tribes that exist. The tribes themselves have pushed back on that. My thought is to break this into 4 areas:

- Respect - a value shared by all tribes.
- Responsibility (Stewardship)
- Relationships – kinship with all forms of life.
- Reciprocity – ability to give back when something is taken.

I am open to assistance and suggestions on refining these two areas that need resolution. The target is to present final metrics proposal at the January TWG and February AMWG with a published report ready by March 2024.

### Discussion Followed

**Craig Ellsworth (WAPA)** noted that the hydropower metrics edits that WAPA submitted were not included in the latest draft. WAPA is suggesting the LTEMP program use the metrics that WAPA provided because they are informative to WAPA, whereas the metrics that are currently chosen are not. Helen Fairley (GCMRC) suggested dissecting the hydropower metrics in the same way that natural flow process metric is being dissected. **Larry Stevens (GCWC)** noted that the Wildlife Council is interested in flow variability, managing for variability in the ecosystem.



### **Tracking Natal Origins of Brown Trout in Grand Canyon Using Otolith Microchemistry**

**Michael Akland (SUNY College of Environmental Science and Forestry)** Source suppression efforts to prevent spawning of Brown Trout began at Bright Angel Creek in 2012 and continue to this day. Despite those efforts, Brown Trout moved upstream into Glen Canyon starting in 2013 with populations increasing from 2014 to 2017, then stabilizing. The goal of this research is to address the original hypotheses and possibly confirm why the suppression efforts failed. The origin of fish is determined based on the chemical makeup of their inner ear core (Otolith). You can then identify the migration activity of that individual based on where the adult fish was captured in the river.

Conclusions: Mainstem invasion of Brown Trout is not new, there are probably many sources, not just Bright Angel Creek. There is no evidence today of fish moving upstream from the tributaries to Glen Canyon, they move downstream. Inhibiting access to spawning at Bright Angel Creek likely contributed to fish straying into the mainstream and did not accomplish the goal of preventing Brown Trout in the canyon. The initial population increase of Brown Trout measured in 2014 – 2017 was likely due to exceeding the Ailee threshold.

#### **Discussion Followed**

### **Brown Trout Incentivized Harvest Program Status Update**

**Jeff Arnold (NPS)** The Incentivized Harvest Program for Brown Trout was started in November 2020 as a response to the sharp increase in population since 2014. The original program goal was 2500 fish per year. Not much progress was made at \$25 per fish. The price was increased to \$33 per fish with added education outreach to anglers. That got them to a higher steady state of harvest but still below target. In 2022 an incentive of \$300 per pit tag was added. This produced a big spike in catch from December 2022 through March 2023. For example, one angler earned \$30,000 in the month of February 2023. The \$300 PIT tag bonus has now been removed and catch is back down to normal levels. A total of 5410 Brown Trout have been captured since the program began. There is a proposal to continue this program for 2 years if funding is available. If no funding, we will spend remaining money on the tribal youth fishing program.

#### **Discussion Followed**

### **Informational Updates**

- **Southwestern Native Aquatic Resources and Recovery Center (SNARRC) follow up:** **Kerri Pedersen (BOR)** There is a project at SNARRC looking at potential hybridization in Razorback Suckers. **Martina Dawley (Hualapai Tribe)** made a request at the January TWG for more info on this study. There was a call on March 8th with Martina sharing information. A site visit was offered at that time but has not yet been scheduled.
- **2007 Interim Guidelines Supplemental Environmental Impact Statement update:** **Bill Stewart (BOR)** A draft of the Interim SEIS guidelines was released to the public on October 27<sup>th</sup>, 2023. Virtual webinars are scheduled for November 9<sup>th</sup> and 17<sup>th</sup>, more information can be found on the website. The comment period closes December 11<sup>th</sup>. The scoping summary report for 2023 through 2026 was published last month. Over 24,000 comments have been received to date, web tool for comments available until December timeframe.
- **A Review of the Implementation Process that Was Used for a Potential Fall High-Flow Experiment and Possible Experimental and Management Actions in the Next 12 Months:** **Jeremy Hammen (BOR)** Fall 2023 HFE kicked off in early September. Modeling was revisited weekly to determine if the mass balance load exceeded threshold to initiate action. Mid-October load was negative 530,000 metric tons with very low probability of rain on the river that might increase sand load. Hence the no trigger met for Fall 2023 HFE. Potential flows for FY 2024: Two Spring HFE plus potential added flows for Trout and SMB to be considered.

- **Air injection test opportunities to address low dissolved oxygen at Glen Canyon Dam:**  
**Clarence Fullard (BOR)** We were able to implement this experiment in September due to conditions that aligned this year – low flow and low starting DO in the canyon. The process involves injecting air into the draft tubes as water passes through the dam. This method has been successful in other dams with a reported 2-point increase in DO downstream. Our experiment measured DO in the draft tubes, directly below the dam and then 8 miles downstream. Results: Minor increase in DO directly below the dam but measured nothing 8 miles downstream. One note, if we continue this experiment, we need to improve equipment and understand DO dynamics downstream.

#### **Discussion Followed**

#### **Fish Propagation Program for the Upper Colorado River Endangered Fish Recovery Program**

**Julie Stahl (USFWS)** This program is a partnership of 10 different organizations. The goal is recovery and ultimately to delist the 4 endangered fish species in this basin. The work requires adaptive recovery efforts, ESA compliance, no impacts to water production and no litigation. There are 5 hatcheries in the system that deliver young fish for stocking. There are unintended volunteer offspring produced in the hatchery area, 5,000 to 50,000 per year depending on the species. The current plan is 100% removal of these hybrids until there is a better understanding of their impact. The Bonytail program is not having much success despite stocking 40,000 per year. These fish seem to be dying young, within weeks or months of release. There is also concern that Bonytail from the Upper Colorado River basin will make it through Glen Canyon dam and hybridize with the Glen and Grand Canyon Bonytail.

#### **Discussion Followed**

#### **Rapid Response Actions to Address Invasive Fish in the -12 Mile Slough**

**Jeff Arnold (NPS)** Slough Chemical Treatment was done Aug 26 through 28. According to the literature, chemical treatment can remove from 20% to 60% of total fish population. Prior to the chemical treatment electrofishing was done to save Rainbow Trout and Flannelmouth Suckers, although the rainbow trout did not do well in this process. Reference slides for counts of fish removed.

#### **Discussion Followed**

#### **Other Actions to Prevent Invasive Fish Establishment – Slough Modification Discussion, Thermal Curtain Discussion, and Bypass Tube Generation Discussion**

**Bud Fazio (NPS-GLCA)** I have some slides regarding slough modification discussion. We are considering the conceptual proposal from Reclamation to modify the -12-mile slough within Glen Canyon National Recreation Area. To date, we have not yet made a decision to modify, pro or con, and have not yet found a path forward. First, we need to have a better understanding of the Reclamation conceptual proposal verbally discussed in the June 2023 TWG meeting and distributed in writing just prior to the August 2023 AMWG meeting. We will connect with Reclamation in November, December and January to discuss in much greater detail the costs and logistics involved, including more details in design, equipment, compliance paths and potential fund sources. We also are thinking heavily about related potential impacts to public use of the slough regarding its various values that include amphibians, wetland habitat which includes riparian, waterfowl resting and feeding, angling, hunting, kayaking or other small vessels, native plants of value to tribes, and dynamics of a "spring" or similar water source which fills the upper slough independent from Colorado River flows and from lower slough water levels. Native vegetation restoration and long-term maintenance requirements need to be discussed. So, NPS is concerned about making changes to the mostly natural feature we call the -12-mile slough due to many

interrelated uses and complex ecology of this system. Since the proposed modification represents habitat conversion and changes in public use, NPS hopes any potential slough modification would be part of a greater package of actions meant to discourage establishment of invasive fish. Among these are addressing water temperature in parallel, since the success of slough modification depends in part on maintaining cooler water below the 16 C invasive fish breeding threshold.

## **Discussion Followed**

### **Tribal Monitoring Program and Other Activities**

#### **Brent Powers (Navajo Nation TWG Alternate and Zoologist for the Navajo Heritage Project)**

This presentation starts with a diagram showing the 4 layers of the Navajo world and how those interact with each other. I thought it might help to understand the tribal world view. Cultural resources are often attributed only to physical artifacts. It is important to understand that wildlife is also a cultural resource. Birds hold a special place for the Navajo – providing feathers for ceremonies and costumes as well as a source for medicine. Current research on the Colorado River excludes these birds because they live above the high-water zone. By limiting our research to the high-water line, we are missing a large part of the ecosystem which has seen a dramatic decline in population over the years. Reference the slides for stories on some of the special birds and statistics on the loss in bird populations.

**Daniel Bullets (Southern Paiute Consortium)** I want to open with a Paiute circle dance song for the Grand Canyon which the tribe used to perform before they returned to the canyon each fall season.

“I’m going where the rocks are warm”

The Paiute tribe inhabited the northern side of the Colorado river from Moab south to California. When caring for this resource, we need to make sure the goal is stewardship, not making money. This group has the support of the Paiute people. I believe we are all doing our best, trying to do the right thing. By presenting and sharing tribal songs at this meeting I am making a connection with all of us. I will close with another tribal song: “the rock with the fire in it”

## **Discussion Followed**

### **Discussion of Emerging Issues, Updates on Items of Interest That Are in Consideration for Implementation Before Next TWG Meeting, and Request for Agenda Items for Next Meeting**

**Seth Shanahan (SNWA)** The next meeting is January 23-25, 2024. We may want to have some small group breakouts and additional topics beyond the annual reports.

**Deb Williams (USFWS)** Can we have a Report out from Bud on the Slough?

**Bill Stewart (BOR)** Can we get more of what we heard from Daniel and Brent at every meeting?

**Shana Rapoport (CRBC)** Can we get the metrics report for review in advance of the January meeting?

**Erik Stanfield (Navajo Nation)** We have talked about having some of these meetings on tribal lands.

Hopefully we can do that in 2024 and have a meeting that is more oriented to tribal presentations.

**Tara Ashby (BOR)** Dates for next year’s meetings are April 10-11, May 15, Jun 12-13, Aug 21-22, Oct 9-10. Note that we are hoping to host the August AMWG meeting at the Grand Canyon.

**Public Comment: None Noted**

**Meeting adjourned at 4:45 PM PDT**

Participants

## **TWG Members, Alternates, and Leadership**

Ben Reeder (GCRG)  
Betsy Morgan (State of Utah)  
Bill Persons (FFI/TU)  
Brent Powers (Navajo Nation)  
Brian Hines (BOR)  
Bud Fazio (NPS-GLCA)  
Carrie Cannon (Hualapai Tribe)  
Christina Noftsker (State of New Mexico)  
Cliff Barrett (UMPA)  
Colleen Cunningham (NMISC)  
Craig Ellsworth (WAPA)  
Dan Leavitt (USFWS)  
Daniel Bulletts (Southern Paiute Consortium)  
David Rogowski (AZGFD)  
Emily Higuera Young (ADWR)  
Emily Omana Smith (NPS-GRCA)  
Erik Skeie (CWCB)

Erik Stanfield (Navajo Nation)  
Hannah Chambless (NPS-GRCA)  
Jakob Maase (Hopi Tribe)  
Jeremy Hammen (BOR)  
Kelly Burke (GCWC)  
Kurt Dongoske (Pueblo of Zuni)  
Larry Stevens (GCWC)  
Leslie James (CREDA)  
Mel Fegler (State of Wyoming)  
Michelle Garrison (CWCB)  
Rob Billerbeck (NPS-GLCA)  
Rudy Keedah (BIA)  
Ryan Mann (AZGFD)  
Scott McGettigan (State of Utah)  
Seth Shanahan (SNWA)  
Shana Rapoport (CRBC)  
Shane Capron (WAPA)  
Ted Rampton (CREDA)

## **Other GCDAMP Members and Interested Persons**

Alicyn Gitlin (Sierra Club)  
Amee Andreason (BOR)  
Andrew Schultz (GCMRC)  
Anya Metcalf (GCMRC)  
Barrett Friesen (Utah State University)  
Beccie Mendenhall (SeaJay Environmental)  
Becki Bryant (BOR)  
Bill Stewart (BOR)  
Brandon Loomis (Arizona Republic)  
Bridget Deemer (GCMRC)  
Bryce Mihalevich (GCMRC)  
Charles Yackulic (GCMRC)  
Christina Kalavritinos (DOI)  
Clarence Fullard (BOR)  
Craig McGinnis  
Daniel Picard (BOR)  
Dave Speas (BOR)  
Dave Worthington, Grand Canyon  
David Braun (Sound Science)  
David Scott  
David Topping (GCMRC)  
David Ward (USFWS)  
Deb Williams (USFWS)  
Derek Fryer (WAPA)

Drew Eppheimer (GCMRC)  
Emily Palmquist (GCMRC)  
Emily Zmak (CWCB)  
Erica Byerley (GCMRC)  
Gerard Salter (GCMRC)  
Helen Fairley (GCMRC)  
Jenny Erickson (UC Public Affairs)  
Jess Newton (USFWS)  
Jessie Olson  
Jim Strogon (FFI/TU)  
Joel Sankey (GCMRC)  
John Gatto (BOR)  
Joseph Thomas (GCMRC)  
Josh Korman (Ecometric Research)  
Julie Carter (AZGFD)  
Julie Stahl (USFWS)  
Kate Behn (GCMRC)  
Katharine Dahm (DOI)  
Katherine Tucker (BOR)  
Kathy Callister (BOR)  
Keith Kohl (GCMRC)  
Kevin Bulletts (Southern Paiute Consortium)  
Kevin Garluck (UMPA)  
Laura Tennant (NPS)  
Lauren Tango (GCMRC)  
Lindsay Hansen (GCMRC)  
Lucas Bair (GCMRC)

Lynn Hamilton (GCRG)	Robert Radtke (BOR)
Mark Anderson (GCMRC)	Robert Tusso (GCMRC)
Mark Getscher (ADWR)	Ronda Newton (NPS-GRCA SRM)
Matt Kaplinski (GCMRC)	Ryan Randol (BOR)
Matt O'Neill (BOR)	Scott VanderKooi (GCMRC)
Matt Rice (American Rivers)	Shannon Sartain (GCMRC)
Melissa Trammell (NPS)	Sheri Farag (Salt River Project)
Melynda Roberts (BOR)	Tara Ashby (BOR)
Michael Akland, SUNY College of Environmental Science and Forestry	Tara Preston (NPS)
Michael Pillow (USFWS)	Taylor McKinnon (Center for Biological Diversity)
Mike Horn (BOR)	Teo Melis (GCMRC)
Nick Williams (BOR)	Thomas Gushue (GCMRC)
Paul Grams (GCMRC)	Thomas Gushue Alex Pivarnik (GCMRC)
Peggy Roefer (CRCN)	Warren Turkett (CRCN)
Phaedra Budy (Utah State University)	
Pilar Wolters-Rinker (USFWS)	

## Acronyms

°C – Degrees Celsius

AMWG – Adaptive Management Work Group

ADWR – Arizona Department of Water Resources

AHAHG – Administrative History Ad Hoc Group

AZGFD – Arizona Game and Fish Department

BAHG – Budget Ad Hoc Group

BOR – Bureau of Reclamation

CFS – Cubic Feet per Second

CRBC – Colorado River Board of California

CRCNV – Colorado River Commission of Nevada

CREDA – Colorado River Energy Distributors Association

CRSP – Colorado River Storage Project

CWCB – Colorado Water Conservation Board

D.O. – dissolved oxygen

DOI – Department of the Interior

DROA – Drought Response Operations Agreement

DWR – Department of Water Resources

EA – Environmental Assessment

EIS – Environmental Impact Statement

FLAHG – Flow Ad Hoc Group

FFI – Fly Fishers International

FY – Fiscal Year

GCDAMP – Glen Canyon Dam Adaptive Management Program

GCMRC – Grand Canyon Monitoring & Research Center

GCPA – Grand Canyon Protection Act

GCRG – Grand Canyon River Guides

GCWC—Grand Canyon Wildlands Council

HFE – High Flow Experiment

LTEMP – Long-Term Experimental and Management Plan

MOA – Memorandum of Understanding

mm – Millimeter

NEPA – National Environmental Policy Act

NMISC – New Mexico Interstate Stream Commission

NPS – National Park Service

NPS-GLCA – Glen Canyon National Recreation Area

NPS-GRCA – Grand Canyon National Park

PDT – Pacific Daylight Time

P&I Team – Planning and Implementation Team

Reclamation – Bureau of Reclamation

ROD - Record of Decision

SEAHG – Socioeconomic Ad Hoc Group

SEIS – Supplemental Environmental Impact Statement

SMB – Smallmouth Bass

SNWA – Southern Nevada Water Authority

SNARRC – Southwestern Native Aquatic Resources and Recovery Center

TRGD – Trout Recruitment and Growth Dynamics

TU – Trout Unlimited

TWG – GCDAMP Technical Work Group

UCRC – Upper Colorado River Commission

UMPA – Utah Municipal Power Agency

USFWS – United States Fish & Wildlife

USGS – United States Geological Survey

USU – Utah State University

YoY – Young-of-Year

WAPA – Western Area Power Administration