**Call 3: Foodbase, Rainbow Trout Fishery, Other Native Fish Species (other than HBC), and Nonnative Invasive Species**

Attendees: Craig Ellsworth, Lee Traynham, Jan Balsom, Ken Hyde, Mellissa Trammel, Craig McGinnis, Vineetha Kartha, Cliff Barrett, Kelly B., Steve Wolff, Jakob Maase, Eric, Paul Harms, Kara Larsen, Ben Reeder, Shane Capron, John Jordan, Dave Rogowski, Seth Shanahan, Emily OS., Kim Dibble, Scott VanderKooi, David Ward, Ted Kennedy, Jeff Muehlbauer, Larry Stevens,

BAHG Members MIA: Richard Begay, Charley Bulletts, Winkie Crook, Kurt Dongoske, Michelle Garrison, Brian Healy, Leslie James, Jessica Neuwerth, Theresa Pasqual, Jim Strogen, Clayton Palmer, Bill Davis, Kirk Young, Ryan Mann, Peggy Roefer, Peter Bungart, Rob Billerbeck, Bill Persons,

* **Aquatic Food Base**
  + Lead researcher: Ted Kennedy
  + Resource goal
    - A healthy food base is an indicator of *Natural Processes* and aligns with the LTEMP goal which states: "Restore, to the extent practicable, ecological patterns and processes within their range of natural variability, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems."
  + 2019 DOI guidance
    - "Future research should be tied directly to LTEMP resource goals and objectives."
    - "Explore the feasibility of conducting a spring HFE, along with modeling for improvements and efficiencies that benefit natural, cultural, recreational, and hydropower resources."
  + BO Conservation Measures: none
  + LTEMP experiment
    - Bugflows 2018, 2019, ¿2020?
    - Spring HFEs
  + Status and Trends:
    - 2017: Significant concern and declining with high confidence
  + Knowledge Assessment recommendations:
  + Data being collected
    - Project F.1. Influence of dam operations on the food base
      * Light traps, sticky traps, and drift
    - Project F.2. Aquatic food base status at humpback chub monitoring locations
      * Light traps, sticky traps, and drift
    - Project F.3. Terrestrial-aquatic linkages
      * Quantify bat and bird activity throughout Grand Canyon
    - Project F.4. Glen Canyon aquatic food base monitoring and research
      * Light traps, sticky traps, and drift
    - Project F.5. Are undesirable shifts in the Glen Canyon prey base facilitating expansion of brown trout?
      * Compare and contrast prey utilization and selection by rainbow trout and brown trout
      * Use this information on trout foraging ecology to model
    - Measurements of primary production
  + Metrics used
    - Drift biomass (production)
    - Number of insect caught per light/sticky trap (production)
    - Aquatic insect diversity (diversity; EPT)
    - Bat and bird activity
  + How is this being used to adaptively manage the CRE?
    - Evaluate food web response to Bugflows, HFEs, and other LTEMP flow experiments
  + Stakeholder discussion
    - Foodbase Questions:
    - What is condition of food base for fishes?
    - Are Bug Flows “successful”? In what way?
    - How else can we improve food base?
* Include additional anoxic substrates research with tie to aquatic veg monitoring,
* Brown trout spawning substrates and fall HFEs (and other flows)
  + - Are there flows that are improving (spawning) conditions for brown trout?
    - Sampling: will continue with citizen scientist monitoring but not the intensive weekday/weekend samples tied to bugflows.
    - Will cut back on fall drift, will continue spring drift grand canyon sampling.

* **Rainbow and brown trout**
  + Lead researchers: Mike Yard, Dave Rogowski
  + Resource goal:
    - Achieve a healthy high-quality recreational rainbow trout fishery in GCNRA and reduce or eliminate downstream trout migration consistent with NPS fish management and ESA compliance.
* 2019 DOI guidance:
  + Future research should be tied directly to LTEMP resource goals and objectives
  + Explore the feasibility of conducting a spring HFE, along with modeling for improvements and efficiencies that benefit natural, cultural, recreational, and hydropower resources
* BO Conservation Measures:
  + Investigate the possibility of renovating Bright Angel and Shinumo Creeks with a chemical piscicide or other tools
  + Remove brown trout and other nonnative species
  + Experimental use of TMFs to inhibit brown trout spawning and recruitment in Glen Canyon
* LTEMP experiment:
  + Trout Management Flows (TMFs)
  + Spring and fall HFEs
    - Do fall HFEs affect population dynamics of brown trout in Glen Canyon?
  + Mechanical removal of nonnative species
    - Trout control in Bright Angel Creek
    - Green sunfish control in the -12 mile slough
    - Brown trout control in Glen Canyon
  + Status and Trends:
    - 2017: Moderate concern and unchanged with medium confidence
  + Knowledge Assessment recommendations:
* Data being collected:
  + Project Element H.1. Experimental flow assessment of trout recruitment
    - Experimental TMF model
    - Mark-Recapture electrofishing: TRGD/TELS
  + Project Element H.2. Rainbow and brown trout recruitment and outmigration model
    - Mark-Recapture electrofishing: TRGD
    - Also incorporates foodbase, nutrients, and humpback chub monitoring
  + Project Element H.3. Using early life history and physiological growth data from otoliths to inform management of rainbow trout and brown trout populations in Glen Canyon
    - Rainbow trout and brown trout otolith work
  + Project Element H.4. Rainbow trout monitoring in Glen Canyon (AZDGF)
    - CPUE electrofishing
    - Glen Canyon CREEL (AZDGF)
  + NPS: Brown trout control in Bright Angel Creek
    - Electrofishing removals and weir operation
* Metrics used:
  + Trout abundance, survival, movement, reproduction, and growth (Mark-Recapture via TRGD/TELS)
  + CPUE (AZDGF electrofishing)
  + Angler effort, catch, and harvest (CREEL)
* How is this being used to adaptively manage the CRE?
* Stakeholder discussion
  + Trout impacts in tributaries: at Nankoweep and bald eagles. Any monitoring?
  + Is there anything that could be scaled back in rainbow trout research so more of a focus could be applied to brown trout? Much of the monitoring done on rainbow trout in the Lees Ferry reach would be the same monitoring that would be done for brown trout.
  + There are BiOp conservation measures for brown trout here under this heading.
  + Where will the additional brown trout work fit in the workplan? In this trout project, not in the Nonnative Fish section, that will focus more on warmwater nonnative fish. BTELs, population monitoring (TRGD), assessing incentivized harvest,
  + Other research: pheromone attractants, low probability of success but could be most effective,
  + AZDFG: CREEL, witch hunt electrofishing, citizen science angling,
  + Focus more research on brown trout spawning and YOY life history and what sort of conditions are creating good recruitment events in Lees Ferry (pulsed recruitment events).
  + Are we prepared to evaluate a spring HFE? Yes: TRGD for trout, lighttrapping for foodbase,
  + Is work being done now able to address the risk associated bt at Lees Ferry with hbc at the LCR? NO established a strong link between LF and the LCR. JCM assesses number of trout and impacts to hbc. Also have a risk assessment of rbt and hbc relative to population dynamics and when to take management actions. Still don’t know a lot about bt movement (because they are so rare) but could do a similar risk assessment on bt. Do have information on rbt/bt piscivory (bt are 20x more piscivorous than rbt). If LF bt population continues to increase, at some point downstream migration will become an issue for hbc. Also have size dependent predation relationship for bt. Much of what we think we know about bt has come from rbt work. Easier to work on a more common species and then infer impacts to a more rare species even if the inferences aren’t perfect they will probably be close enough.
  + BT incentivized harvest to be tested as a research action, not a management action. Will need to be able to assess if it works: TRGD, abundance estimates: take vs population size, must be able identify fish with and without PIT tags (being able to tag and release in TRGD monitoring and in the CREEL). Map where bt are caught. No change in fishing regs.

* **Other native fish species 2:18**
  + Lead researchers: David Ward, Dave Rogowski
  + Resource goal:
    - Maintain self-sustaining native fish species populations and their habitats in their natural ranges on the Colorado River and its tributaries.
* 2019 DOI guidance:
  + Future research should be tied directly to LTEMP resource goals and objectives
* LTEMP experiment: none
* BO Conservation Measures:
  + Larval and small-bodied fish monitoring (razorback sucker)
  + Status and Trends:
    - 2017: Good condition and increasing with medium confidence
  + Knowledge Assessment recommendations:
* Data being collected:
  + Project Element I.1. System-wide native fish and invasive aquatic species monitoring
    - Electrofishing
    - Hoop netting - hbc
  + NPS/BioWest: Larval and small-bodied fish monitoring (razorback sucker)
* Metrics used:
  + CPUE
* How is this being used to adaptively manage the CRE?
* Stakeholder discussion

* **Invasive fish species**
  + Lead researchers: David Ward, Dave Rogowski
  + Resource goal:
    - Minimize or reduce the presence and expansion of aquatic nonnative invasive species.
  + 2019 DOI guidance:

Future research should be tied directly to LTEMP resource goals and objectives

Activities associated with the Endangered Species Act

Evaluate the threat posed by invasive non-native species

* BO Conservation Measures:
  + Explore the efficacy of a temperature control device to limit nonnative fish establishment
  + Prevent the passage of deleterious invasive nonnative fish through Glen Canyon Dam
  + Alter the backwater slough at River Mile (RM) 12
  + Rapid response control plan for newly establishing or existing deleterious invasive nonnative species
  + Disease and parasite monitoring
* LTEMP experiment:
  + Mechanical removal of nonnative species
    - Green sunfish control in the -12 mile slough
  + Status and Trends:
    - 2017: Good condition and unchanging with medium confidence
  + Knowledge Assessment recommendations:
* Data being collected:
  + Project Element I.1. System-wide native fish and invasive aquatic species monitoring
    - Electrofishing
    - Hoop netting
    - Angling (channel catfish)
    - Asian fish tapeworm monitoring
  + Project Element I.2. Improve early detection of warm-water invasive fish
    - Electrofishing 12 sites in Glen Canyon (including -12 mile slough)
    - eDNA
  + Project Element I.3. Assess the risks warm-water nonnative fish pose to native fish
    - Laboratory experiments
    - Modeling with field data
  + BOR C.8: Evaluation of means to prevent fish passage through GCD
* Metrics used:
  + CPUE
    - Lees Ferry reach, Bright Angel Creek, elsewhere in the mainstem in Grand Canyon
  + Presence/absence
    - Specifically green sunfish in -12 mile slough
* How is this being used to adaptively manage the CRE?
* Stakeholder discussion
  + What about other nonnative parasites, monitor every 5-10 years
  + Crayfish: baited hoopnets, mainstem, caught a few in WGC, swamp crayfish P.clarkii, new invasive and could have an enormous impact, need to include in reporting
  + NZMS in elves chasm
  + Can eDNA detect population size? Mostly used for detecting presence/absence but will develop standard curves that may be helpful in coming up with relative abundance. Working with Forest Service National Genomic Center.
  + Fall seining trip important tool in picking up early life stages of warm water invasives
  + At what intervals do with do reviews of what nonnatives are present in the system and what nonnatives should be the focus of effort? Example: shift from rainbow trout to brown trout.
  + BiOp: Who is working on looking at renovating BAC/SHI with a chemical piscicide? NPS is working on that. BAC above Split Rock Falls.
  + Invasive species coming down the LCR. Ex: pools between Grand Falls and Blue Spring. Who is working on this? “Mitigation of dam ops in the ecosystem.” Is this “in” the program? Maybe more flexibility on research: what is going on? Who is responsible for management of that area? Lots of fish get produced there and get flushed into the LCR every monsoon season. Navajo Nation land.