2020 GCDAMP Annual Reporting Meeting Overview – Part 2 (cont.)

Adaptive Management Work Group Meeting
Feb 12-13, 2020

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

- Part 1
  - Humpback Chub
  - Native and Nonnative Fishes
  - Bug Flows

- Part 2
  - Nutrients and Temperature as Ecosystem Drivers and Lake Powell
  - Riparian Vegetation
  - Warm-Water Invasive Fishes
  - Trout

- Part 3
  - Sediment
  - Archaeological Site Monitoring
  - Socioeconomics and Hydropower
Project I. Effects of Warm-Water Invasive Species on Native Colorado River Fishes

Channel Catfish
- Nocturnal
- Effective predator in turbid water
- Large gape
- Abundant in Little Colorado River

Green Sunfish
- Aggressive predator
- Group hunting behavior
- Highly fecund
- Prone to rapid colonization
- Can be spread with HFE’s
Channel Catfish caught in the Little Colorado River by Angling – 2019

Mostly large adults caught. Widely distributed, but use same habitats as humpback chub so high potential for negative impact. Very vulnerable to angling.

4 Trips May – June (109 hours of angler effort)
Mean total length = 408 mm (Range = 261-630 mm)
Only two recaptures

N=82
Laboratory predation trials with Green Sunfish

Green sunfish are very aggressive and will eat any fish they can fit in their mouth. Steep predation curve indicates quick transition for humpback chub from completely vulnerable to completely invulnerable.
Rainbow Trout and Brown Trout
Project H
Rainbow trout catch rates in Glen Canyon are cyclical and exceed levels in AG&F management plan for Lees Ferry.

(Preliminary Data from Rogowski et al. AGFD. 2020. Do Not Cite.)
Rainbow trout catch rates in Glen Canyon are cyclical and driven by abundance of young fish.

(Preliminary Data from Rogowski et al. AGFD. 2020. Do Not Cite.)
Angler Catch Rate

Goal: Angler catch rate $\geq 1$ Rainbow per hour

Angler catch rates increasing in the walk-in fishery and unchanged in the upriver boat fishery and. Boat fishery just below goal in AG&F management plan for Lees Ferry.

(Preliminary Data from Rogowski et al. AGFD. 2020. Do Not Cite.)
Glen Canyon Study Area

Trout Recruitment, Growth, and Population Dynamics
Sampling Design

- Years 2017 – Present
- 4 Full trips per year
- Trips: Jan, Apr, Sep, & Oct
- Sample 3 Subreaches
  - 6 Nights / trip of sampling
  - Subreach - 3 km
- 1 Single mid-summer trip
  - 1C Subreach
  - 2 passes (2 nights)
  - 3 km

(Feb 12, 2020)
Rainbow Trout Abundance And Condition

1C - Subreach

2012-13

2014

2015-16

2017

2018-19

Preliminary data, do not cite
Conceptual model

(Feb 12, 2020)
Rainbow Trout Recruitment Models

Model using soluble reactive phosphorus (SRP) and existing rainbow trout population size as covariates outperforms flow model used in LTEMP EIS.

Out of sample R2: 0.85
Out of sample R2: -0.33

Phosphorus model (2 covariates)
Flow model (4 covariates)

Preliminary data, do not cite

(Feb 12, 2020)
Brown trout catch rates increased again in 2019. Still comprise a small (but growing) proportion of fish in Glen Canyon.

(Preliminary Data from Rogowski et al. AGFD. 2020. Do Not Cite.)
Autumn Brown Trout total length

Higher catch rates in 2019 driven by increase in numbers of young of year and sub adult (200-250 mm) fish. Indicates successful reproduction and recruitment to larger size classes.

(Preliminary Data from Rogowski et al. AGFD. 2020. Do Not Cite.)
Science needs to improve predictions to be useful. Process understanding (arrows) and state-dependent decisions (boxes) should be the primary motivation of applied science.

Predicting how a state will change through time (horizontal arrows) without management intervention, and how interventions do or do not change this trajectory should be the primary motivation of applied science. Improved precision about actual states only matters when optimal management depends on the state.
"An approximate answer to the right question is worth a great deal more than a precise answer to the wrong question." - Tukey
Abundance estimates for larger size classes of brown trout are more similar now between models with different assumptions (red and blue represent different assumptions on survival).

Preliminary data, do not cite
There is no doubt population growth will continue if things don’t change.

Lambda is the finite rate of population change. Values > 1, as shown here for two models for brown trout in Glen Canyon, indicate a population is increasing.

Preliminary data, do not cite.
Rainbow Trout And Brown Trout Condition Factor

Condition factor consistently higher for brown trout than same size rainbow trout (300 mm). Suggests differences in ability to find food and/or feeding success.

Preliminary data, do not cite
Rainbow Trout Abundance Downstream of the Little Colorado River Confluence

- 5 reaches sampled quarterly, 2012-2016 (Natal Origins)
- Glen Canyon (reach I) and LCR inflow reach (IVb), 2017-2019 (TRGD, JCM)
- No sampling in Marble Canyon (II-IVa) after 2016 except for one night in reach II on July and September trips
- Mark-recapture used to estimate:
  - abundance
  - survival rate
  - recruitment (births and immigration)
  - growth rate
  - movement
- Drift measured in each reach on each trip, 2012-2016

(Feb 12, 2020)
Trend in Rainbow Trout Abundance Downstream of the Little Colorado River (IVb, inflow reach)

Phase 1: expansion from immigration
Phase 2: collapse due to poor condition
Phase 3: low abundance due to limited recruitment
Phase 4: moderate abundance from local reproduction & immigration

Preliminary data, do not cite
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