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Glen Canyon Dam/Smallmouth Bass Environmental Assessment Update

January 26, 2023

Intro to GCD/SMB EA

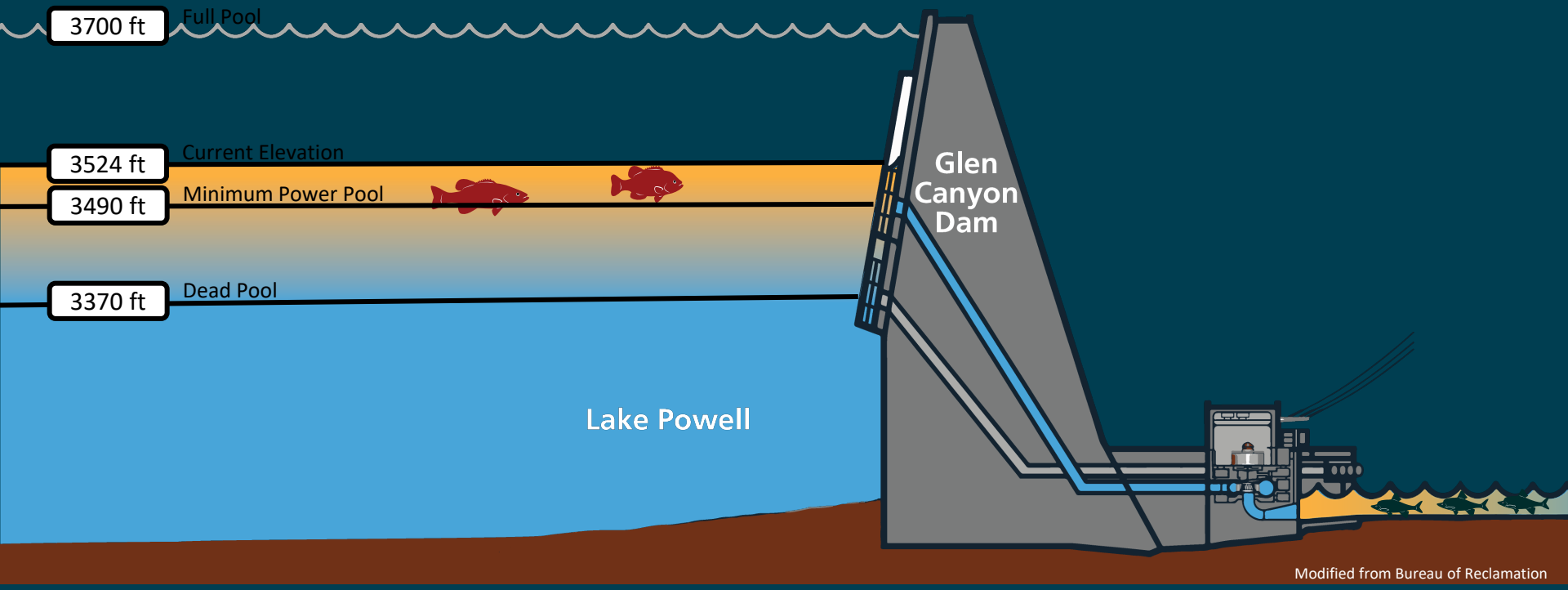
Purpose:

The Bureau of Reclamation has determined that an Environmental Assessment is necessary to pursue implementation of flow options to respond to smallmouth bass detections in the Colorado River below Glen Canyon Dam.

Intro to GCD/SMB EA

Need:

To respond to the threat of smallmouth bass establishment, this EA identifies various GCD flow options designed to disrupt and help prevent SMB from spawning in the Colorado River between Glen Canyon Dam and the confluence with the Little Colorado River. A mix of water releases from both the GCD penstocks and bypass tubes would be needed to cool the river below 16 degrees C from GCD to the LCR confluence, which is the temperature at which smallmouth bass initiate spawning behaviors.

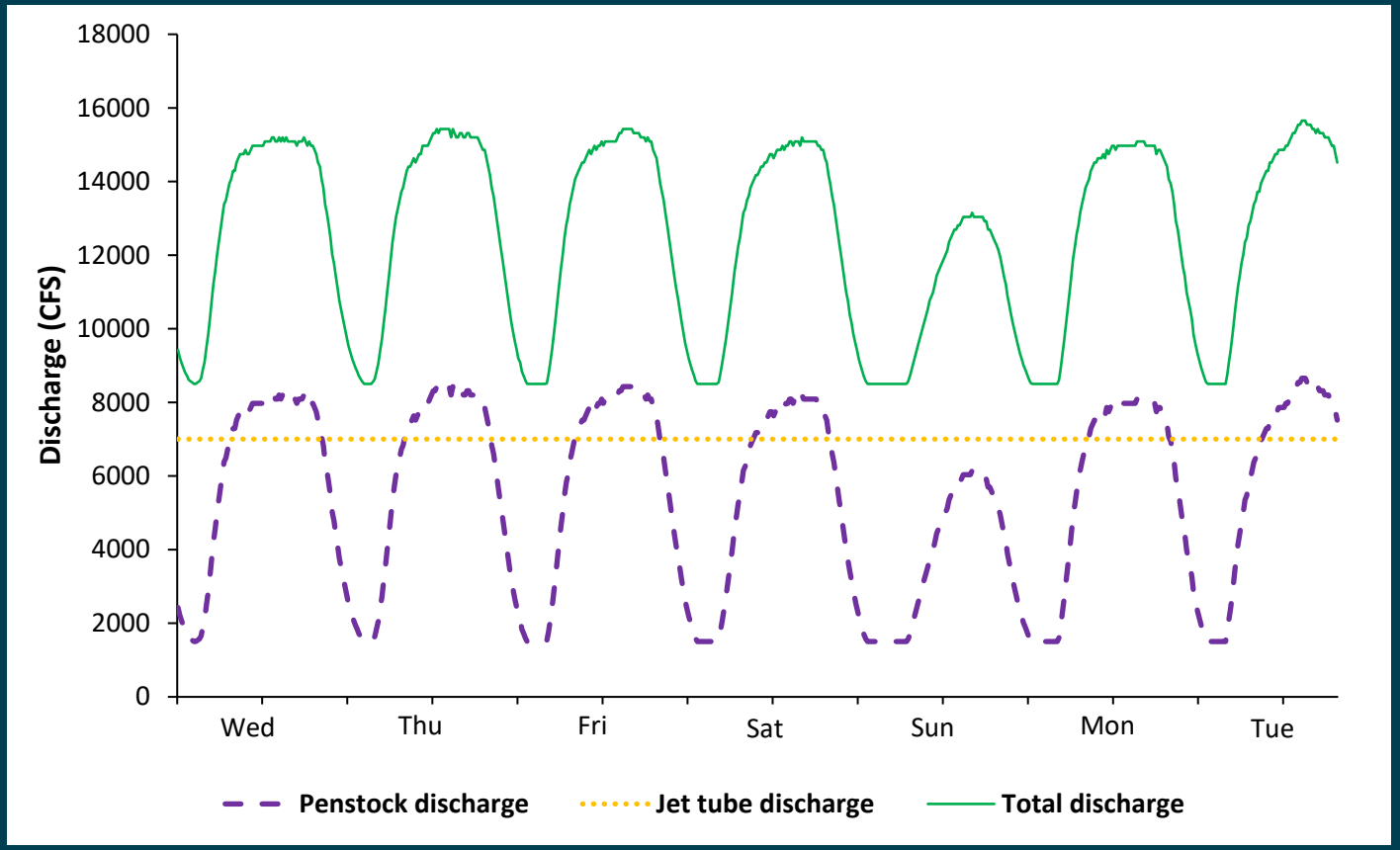

3700 ft
Full Pool
3524 ft
Current Elevation
3490 ft
Minimum Power Pool
3370 ft
Dead Pool
Lake Powell
Glen Canyon Dam
Modified from Bureau of Reclamation

Alternatives

- No Action
- Proposed Action with Flow Options
  - Option A: Cool Mix
  - Option B: Cool Mix with Flow Spikes
  - Option C: Cold Shock
  - Option D: Cold Shock with Flow Spikes

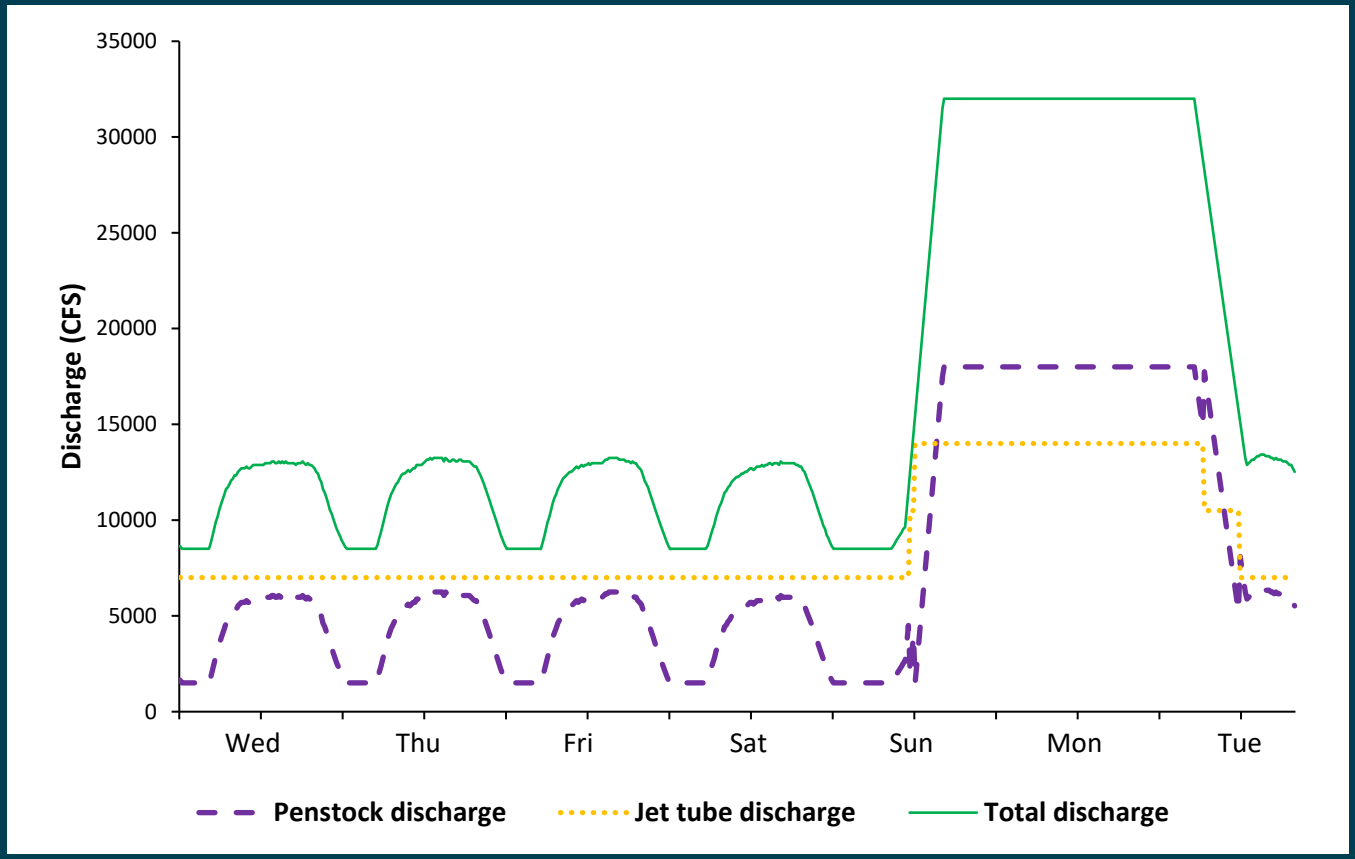
Flow Option A: Cool Mix

- Water is released from both penstocks and bypass tubes to maintain a daily average water temperature below 16°C from below the dam to the Little Colorado River (LCR).
- This would be initiated whenever temp at LCR is 16°C.



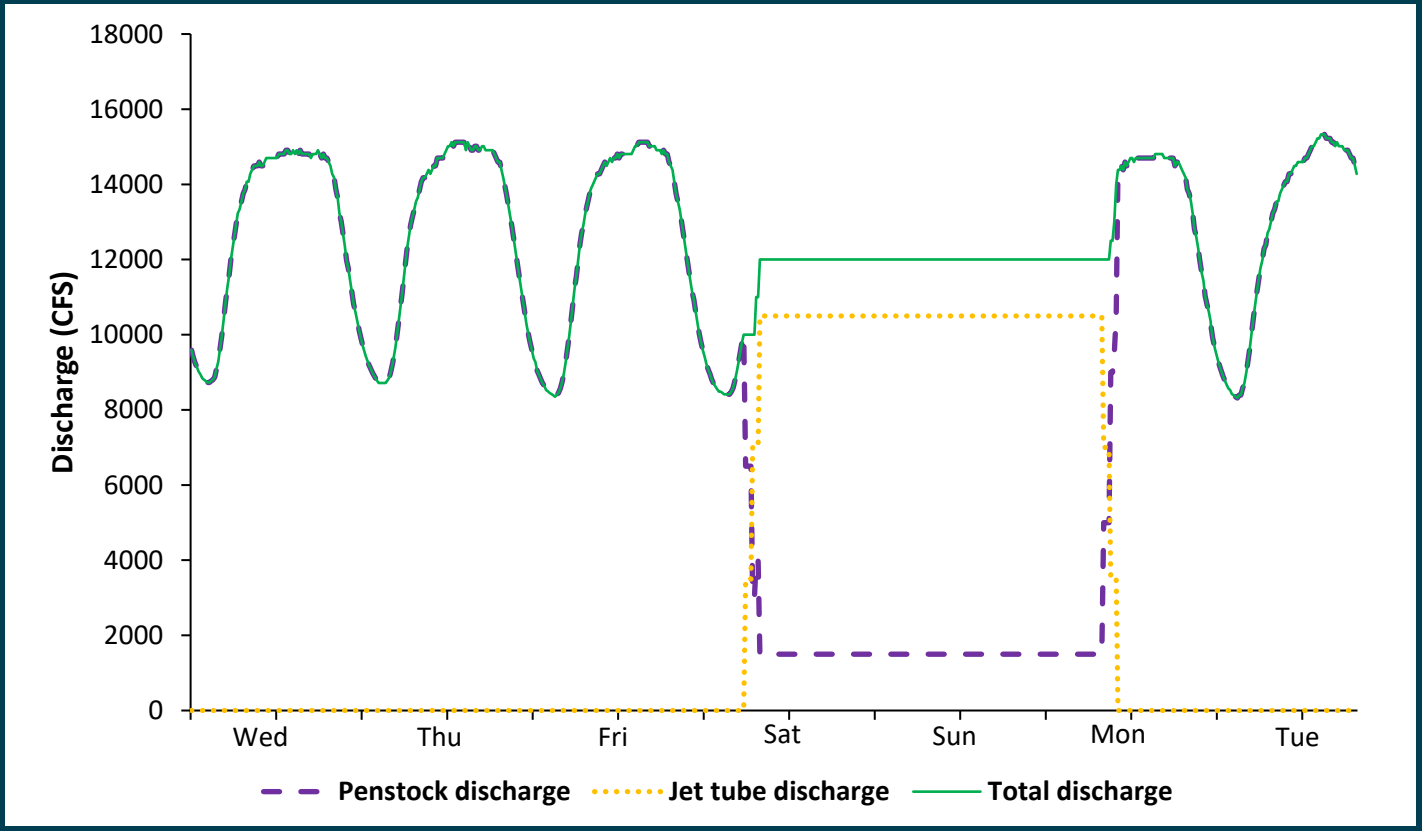
Flow Option B: Cool Mix with Flow Spikes

- Water is released from both penstocks and bypass tubes to maintain a daily average water temperature below 16°C from below the dam to the Little Colorado River (LCR). In addition, up to three 36-hour flow spikes would be added between late-May and mid-July if sufficient water was available.
- This would be initiated whenever temp at LCR is 16°C.



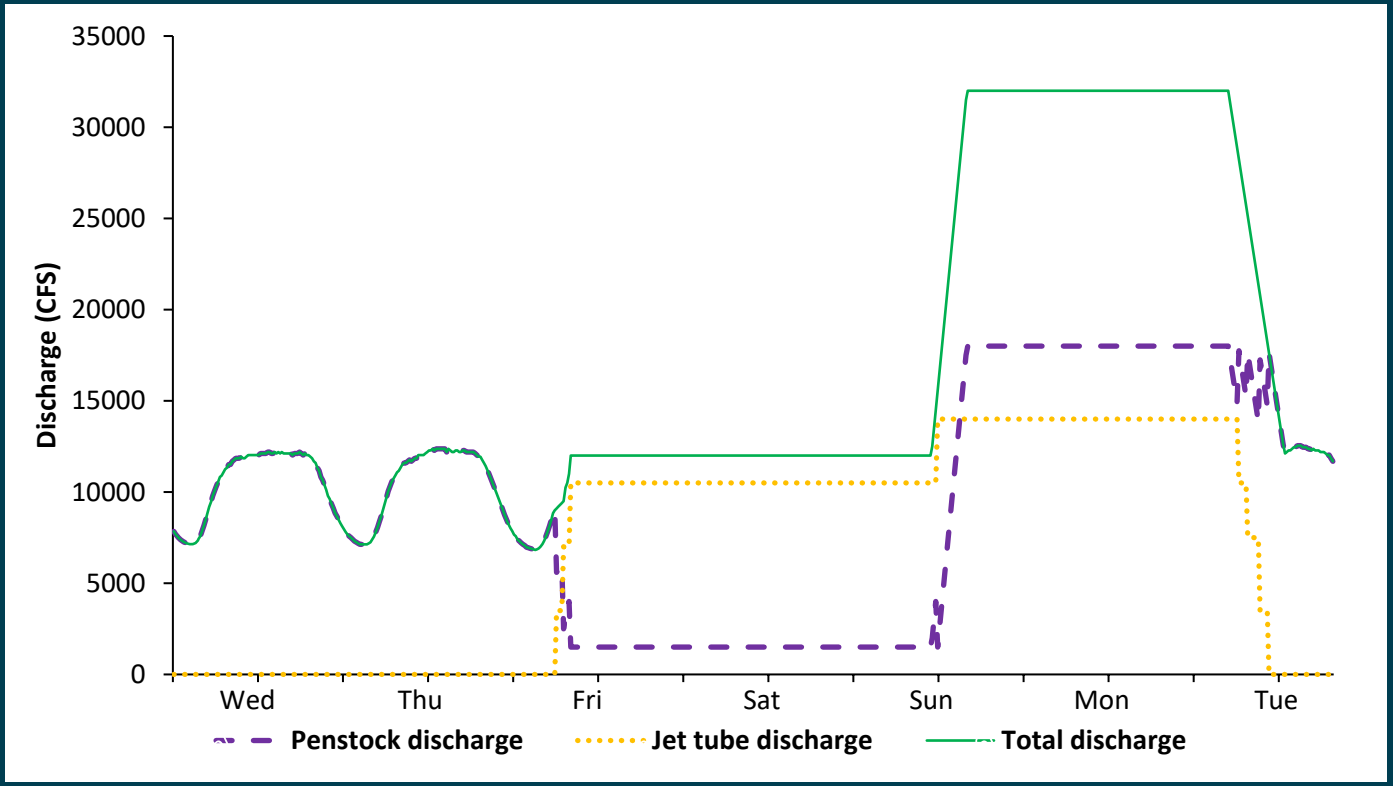
Flow Option C: Cold Shock

- Once a week for at least 48 hours, switch to the minimum amount of water released through the bypass tubes required to create a cold shock all the way down to the Little Colorado River (LCR).
- Minimum of 12 weeks starting when daily water temperatures near the LCR approach 16°C



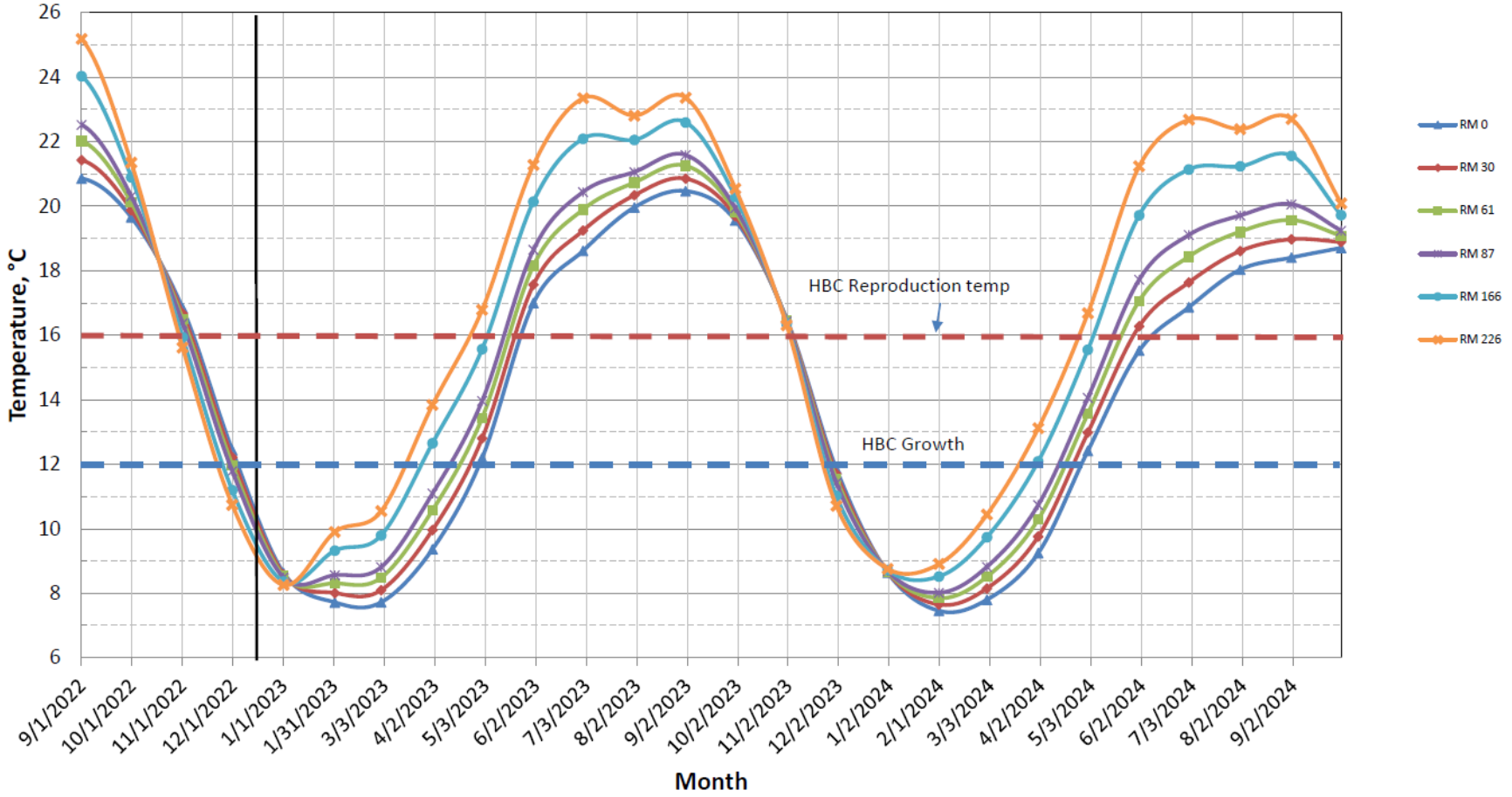
Flow Option D: Cold Shock with Flow Spike

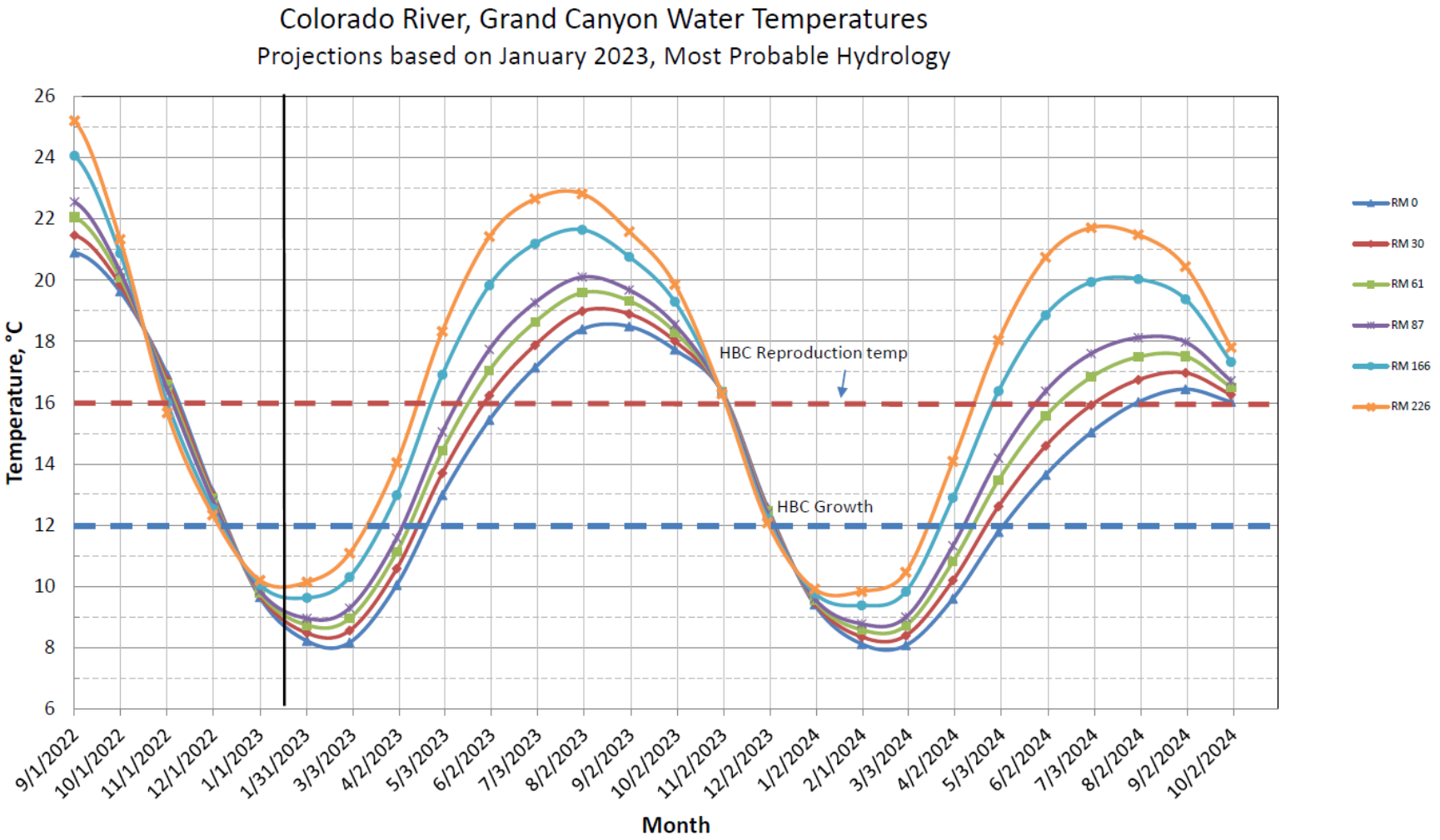
- Once a week for at least 48 hours, switch to the minimum amount of water released through the bypass tubes to create a cold shock from the dam down to the Little Colorado River (LCR). In addition, up to three 36-hour flow spikes would be added between late-May and mid-July if sufficient water was available.
- Minimum of 12 weeks starting when daily water temperatures near the LCR approach 16°C



Colorado River, Grand Canyon Water Temperatures

Projections based on December 2022, Most Probable Hydrology





GCD/SMB EA Process

- Timeline/Key Dates:
  - Dec 1 – Information session
  - Dec 15 - Stakeholder Written Input due (Comments from 11 stakeholders)
  - Early Feb- Draft EA for public review (14 day review)
  - Early-Mid April - Post Final EA

Questions?

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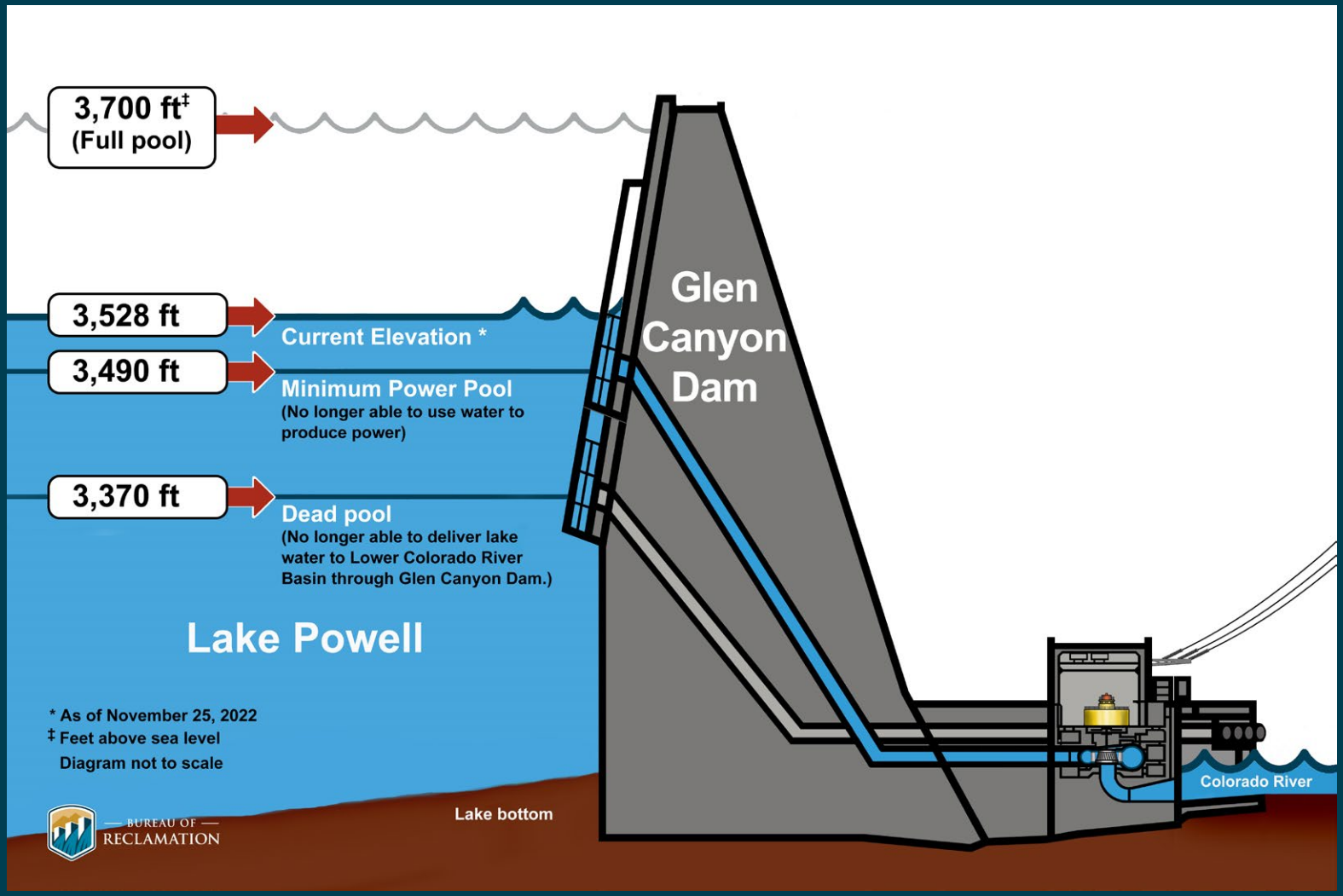
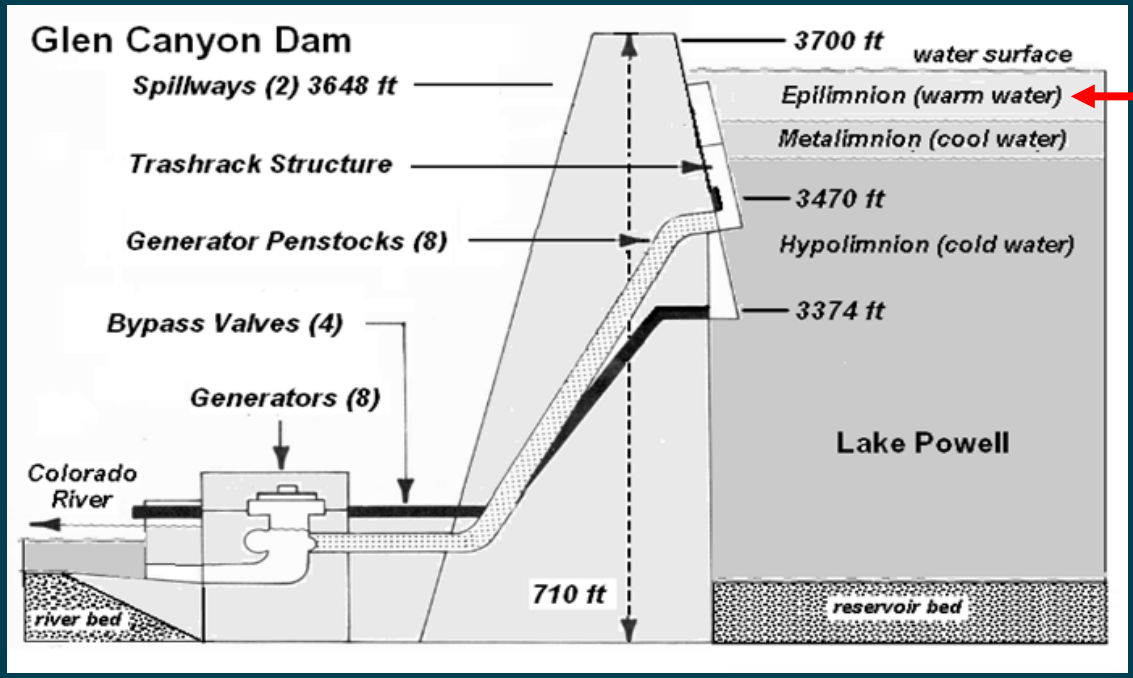
Glen Canyon Dam Key Elevations



Problem

- Sustained drought conditions
- Low lake elevations
- Increased risk of entrainment
- Warmer release temperatures
- Suitable for reproduction/growth of smallmouth bass

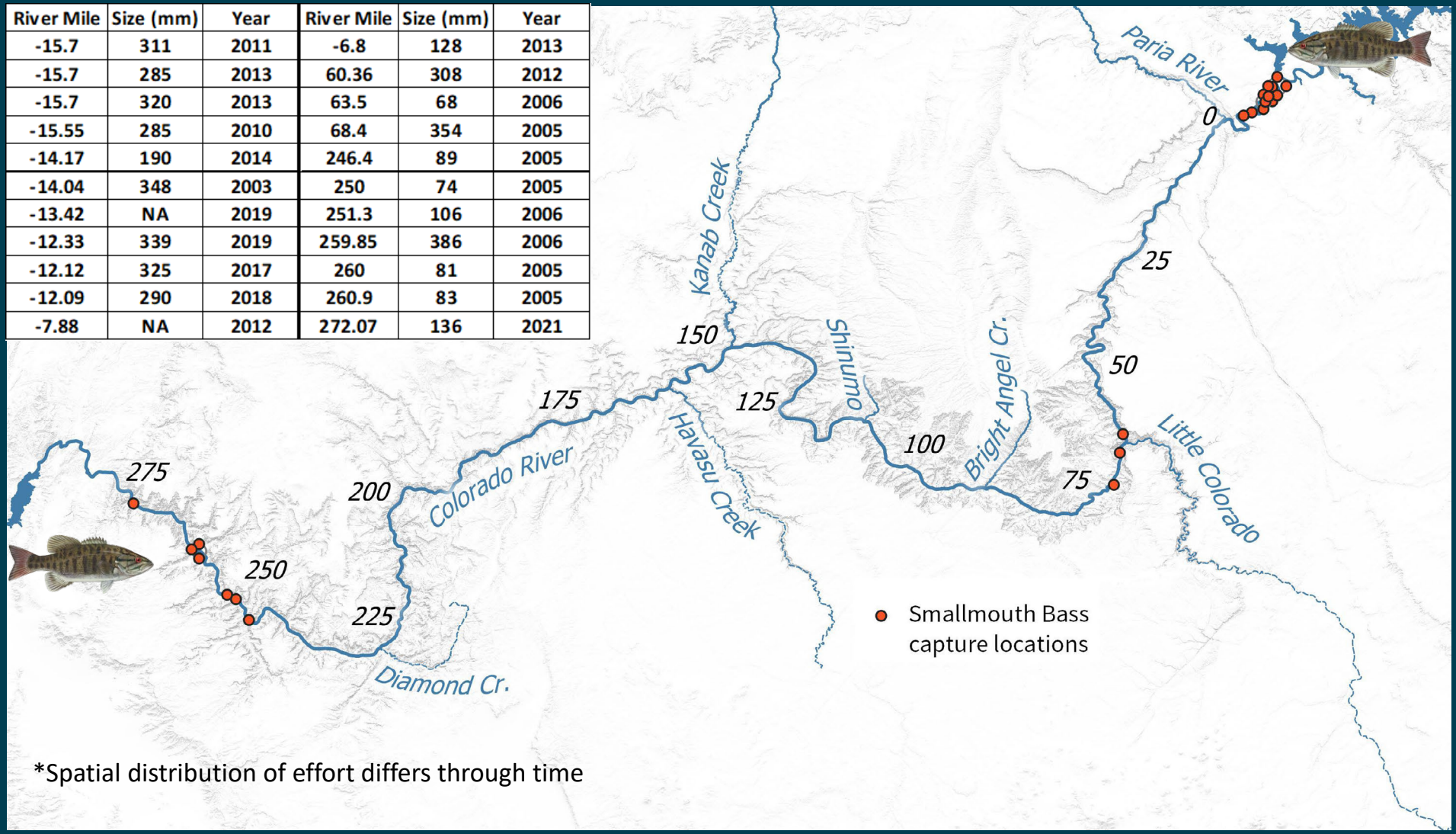


Why worry about smallmouth bass?

- Smallmouth bass have caused a decline in native fishes throughout the west
  - Upper Basin
- Highly piscivorous - highest predatory threat in the upper basin
- Highly fecund
  - Females have lots of eggs
  - Males guard nests which results in higher survival rates of young
- Considered a high-risk species

Smallmouth bass capture locations in the Grand Canyon prior to 2022

River Mile	Size (mm)	Year	River Mile	Size (mm)	Year
-15.7	311	2011	-6.8	128	2013
-15.7	285	2013	60.36	308	2012
-15.7	320	2013	63.5	68	2006
-15.55	285	2010	68.4	354	2005
-14.17	190	2014	246.4	89	2005
-14.04	348	2003	250	74	2005
-13.42	NA	2019	251.3	106	2006
-12.33	339	2019	259.85	386	2006
-12.12	325	2017	260	81	2005
-12.09	290	2018	260.9	83	2005
-7.88	NA	2012	272.07	136	2021



*Spatial distribution of effort differs through time

Besides enough spawners, what other conditions are required for SMB to establish?

- Sufficient food
- Infrequent high turbidity
- Low velocity gravel/cobble habitat
- Suitable water temperature (primary driver)

Temperature Related to Smallmouth Bass

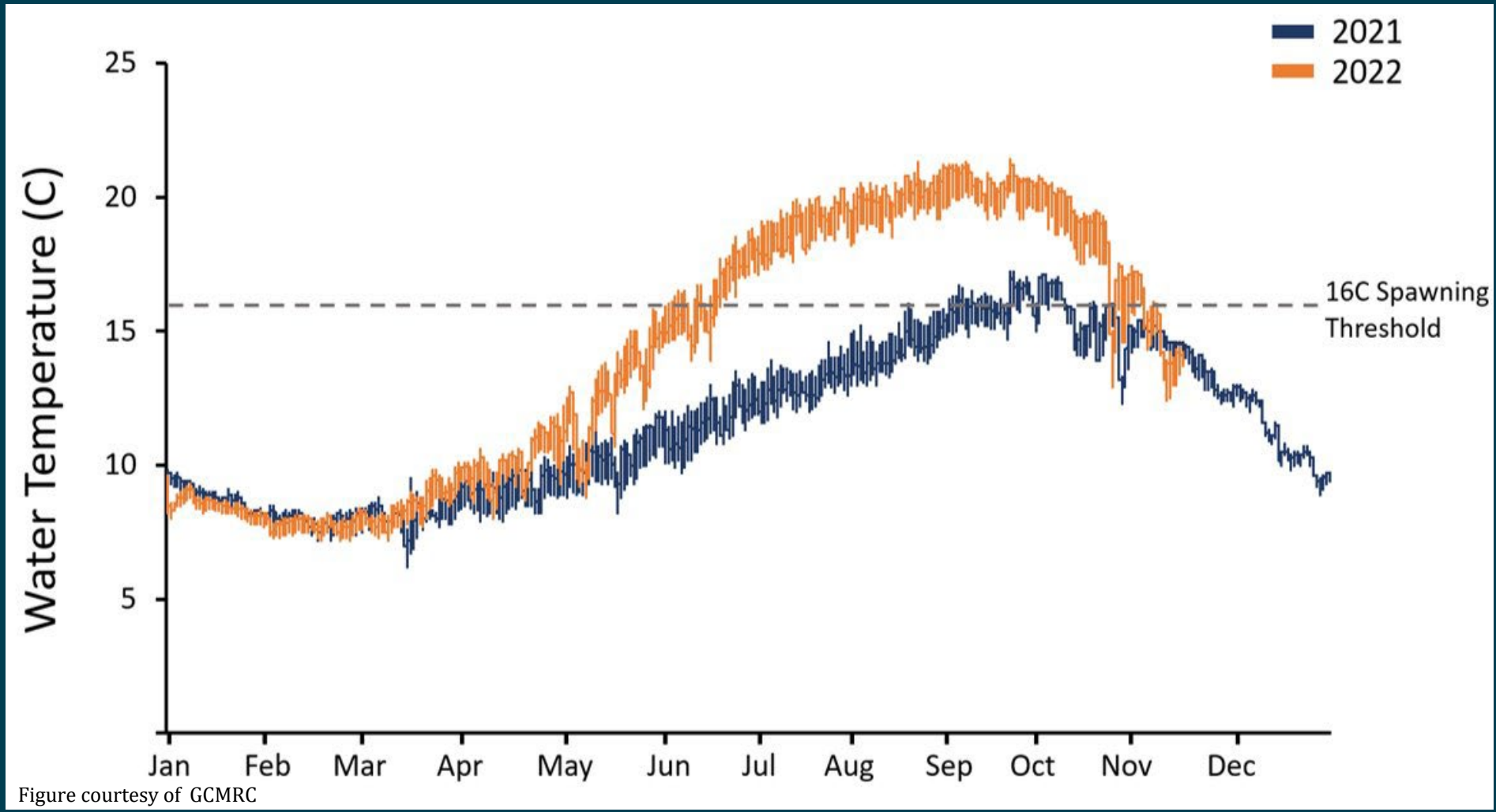


Figure courtesy of GCMRC

Timeline of Smallmouth Bass in Glen Canyon Reach

- Smallmouth bass detected in -12 mile slough on June 30th
- Chemical treatment in slough in September 2022
- Smallmouth bass detected throughout Lees Ferry reach over course of September/October 2022
  - Primarily juveniles detected
  - Indicates not established
- Removal efforts following science plan initiated in October 2022
  - Serve to buy some time

May AMWG - Directive from Secretary's Designee

Develop 2-4 operational alternatives that could help prevent cool- and warmwater invasive fish establishment, while minimizing potential adverse effects to other resources. Operational alternatives that are not within the scope of the LTEMP ROD may be proposed, but would require additional NEPA, ESA, and NHPA compliance.

Directive from August AMWG Meeting

NEPA Compliance for Operational Flexibilities to Address Nonnative Fish – The second of the non-native fish actions is to task Reclamation with developing a project management plan that includes a budget and schedule for initiating a NEPA process associated with operational alternatives /actions to disadvantage SMB and other non-native fish, which may require further refinement from GCMRC. We ask that the schedule be aimed at completing a NEPA decision document in time for possible implementation in the late spring/early summer of 2023. I encourage Reclamation to analyze the degree to which such compliance can be tiered off the LTEMP FEIS and ROD. It will be important to maintain a focused scope for this effort and to avoid inclusion of ancillary actions and issues to ensure the process can meet a possible spring/summer 2023 implementation. This NEPA analysis must not become a vehicle for addressing the range of concerns about the LTEMP FEIS and ROD but should rather give us possible tools that we can implement in a timely manner to address the non-native fish challenges we are currently facing. I propose that the project management plan, be shared with the GCDAMP partners by October 14, 2022.

Process for Developing Flow Options

- SMB task force – started meeting in January/February 2022
  - Provided preliminary data to start process presented during April TWG
- SMB Ad Hoc Group formed after May AMWG
  - Tasked with developing strategic plan
  - Provided input during development of flow options
- GCMRC conducted the modeling and developed flow options
  - Initial conversations for flow options during SMB task force
  - Refined during SMB Ad Hoc group process

Considerations for Developing Flow Options

- Maintenance schedule
- Hydrology
- Bypass tube coating
- Regulatory – maintain 1,500 cfs
- Conduct flows within normal operations (up-ramp, down-ramp, etc)

Operational/Regulatory Constraint Considerations in Model

- 1,500 cfs minimum discharge always released through penstocks
- 25,000 cfs maximum discharge released through penstocks
- 15,000 cfs maximum discharge released through bypass tubes
- Bypass tubes can be operated at ½ tube increments
  - (*i.e.*, 1,750 CFS, assuming 3,500 CFS per outlet tube) to minimize the bypass required to reach a particular target temperature

- Follow normal operations as described in LTEMP:
  - Maximum up-ramp rates of 4,000 cfs
  - Maximum down-ramp rates of 2,500 cfs
  - Minimum total discharge of 8,000 cfs during the day (7am-7pm)
  - Minimum total discharge of 5,000 cfs during the night (7pm- 7am)

General Modeling Assumptions

- Target fish is smallmouth bass
- Downriver warming estimated with Dibble et al. (2021) model
- ≥16°C is required for SMB to initiate spawning
- Cold shocks may disrupt SMB spawning behavior
  - <13°C most likely to be effective
- Flow spikes can disrupt spawning in margin habitats

Hydrograph Assumptions

- All options can be implemented at 740 kaf (forecast for June 2023)
- Water temperatures through penstocks is 18°C
- Water temperature through bypass tubes is 11°C

*All hydrographs are samples only and need to be updated based on the conditions at the time the flow is implemented

Flow Options

- Option A: Cool Mix
- Option B: Cool Mix with Flow Spikes
- Option C: Cold Shock
- Option D: Cold Shock with Flow Spikes

Temperature & Velocity

- Combination of cold water and flow spikes are most likely to be successful at preventing establishment
- Temperature is the primary driver of spawning
- Changes in velocity with flow (>0.3 m/s) can cause nest abandonment but not prevent it completely
- SMB can spawn multiple times in a season

Potential Success of Flow Options

- Option A: Cold Mix – high certainty of prevention under most conditions except the potential for spawning in warmer margin habitats
- Option B: Cold Mix with Spike Flow - high certainty of prevention under most conditions
- Option C: Cold Shock – less certainty than options A or B but good chance of prevention under most conditions
- Option D: Cold Shock with Spike Flow – less certainty than option A or B but higher than option C because it will also disrupt margin habitats.

*Success of any of these options depends on available hydrology

https://www.usbr.gov/uc/progact/amp/amwg/2022-08-18-amwg-meeting/20220818-Yackulic_Op_Alts_AMWG_508.pdf

Stakeholder Written Input

- Email your written input to Sarah Bucklin sbucklin@usbr.gov

by December 15th

Questions?

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