LTEMP Science Plan

Adaptive Management Workgroup Meeting

August 24-25, 2016

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Grand Canyon Monitoring and Research Center

Southwest Biological Science Center

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

LTEMP EIS:

Final EIS in September

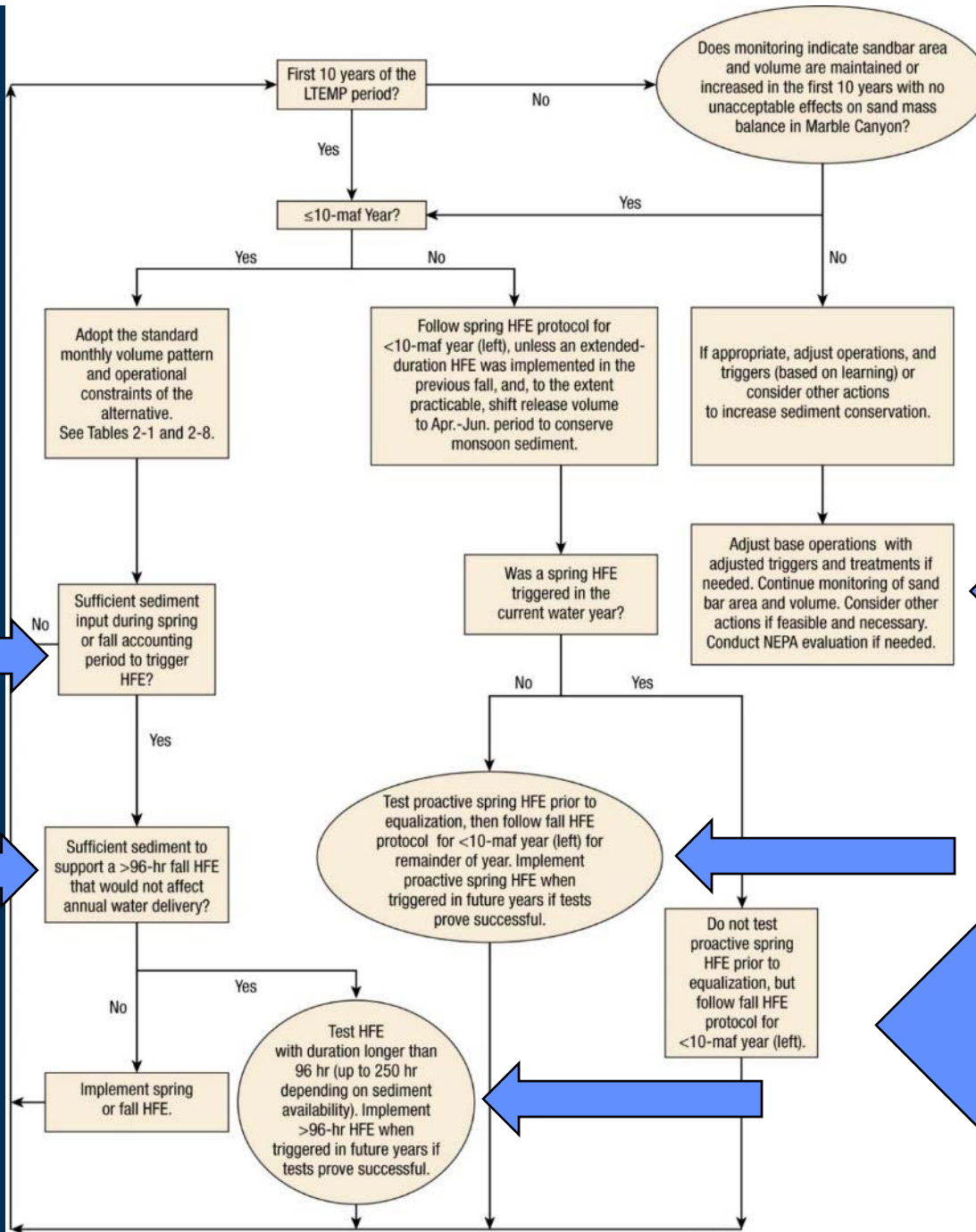**ROD in November**

Implemented over the next 20 years

Preferred Alternative: Sediment-Related Adjustments to Base Operations

- **Fall and spring HFEs (up to 96 hours)**
- **Proactive spring HFEs (initially 24 hours)**
- **Extended-duration HFEs (up to 250 hours)**
- **Trout management flows**

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First 10 years of the LTEMP period?

Does monitoring indicate sandbar area and volume are maintained or increased in the first 10 years with no unacceptable effects on sand mass balance in Marble Canyon?

No → ; Yes ↓

≤10-maf Year?

Yes (from monitoring) → ≤10-maf Year?

Yes ↓ / No ↓ / No ↓

Adopt the standard monthly volume pattern and operational constraints of the alternative. See Tables 2-1 and 2-8.

Follow spring HFE protocol for <10-maf year (left), unless an extended-duration HFE was implemented in the previous fall, and, to the extent practicable, shift release volume to Apr.-Jun. period to conserve monsoon sediment.

If appropriate, adjust operations, and triggers (based on learning) or consider other actions to increase sediment conservation.

Sufficient sediment input during spring or fall accounting period to trigger HFE? No → ; Yes ↓

Was a spring HFE triggered in the current water year?

Adjust base operations with adjusted triggers and treatments if needed. Continue monitoring of sand bar area and volume. Consider other actions if feasible and necessary. Conduct NEPA evaluation if needed.

No ↓ / Yes ↓

Sufficient sediment to support a >96-hr fall HFE that would not affect annual water delivery? No ↓ / Yes →

Test proactive spring HFE prior to equalization, then follow fall HFE protocol for <10-maf year (left) for remainder of year. Implement proactive spring HFE when triggered in future years if tests prove successful.

Do not test proactive spring HFE prior to equalization, but follow fall HFE protocol for <10-maf year (left).

Implement spring or fall HFE.

Test HFE with duration longer than 96 hr (up to 250 hr depending on sediment availability). Implement >96-hr HFE when triggered in future years if tests prove successful.

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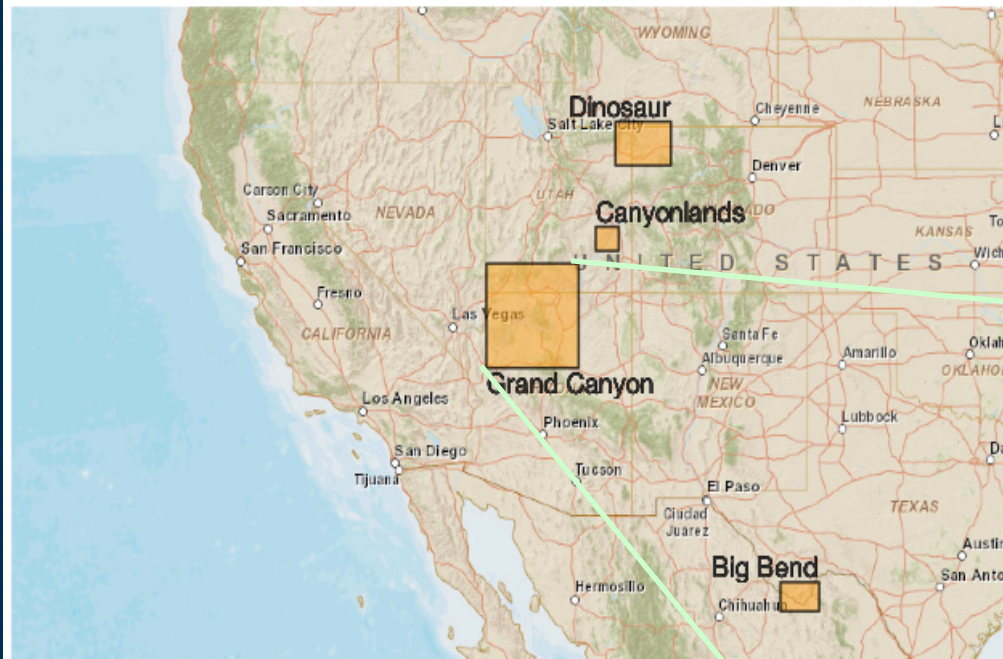HFE = High-Flow Experiment
NEPA = National Environmental Policy Act

Arrows show where scientific information needed

USGS

Streamflow, Sediment Transport, and Sand Budgets in the Colorado River

Provides technical data to managers and stakeholders in near real time to facilitate river management decisions
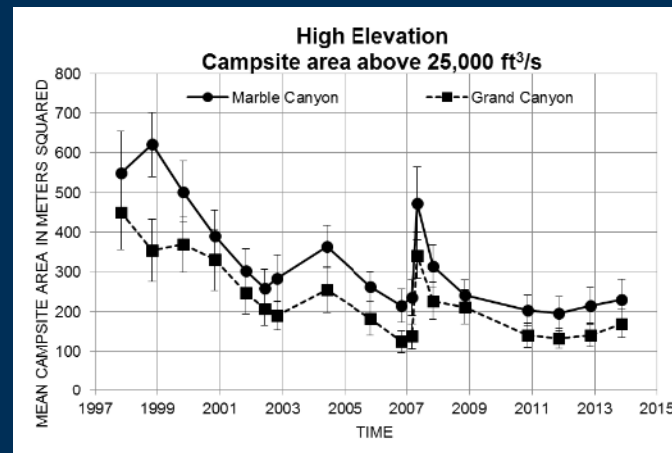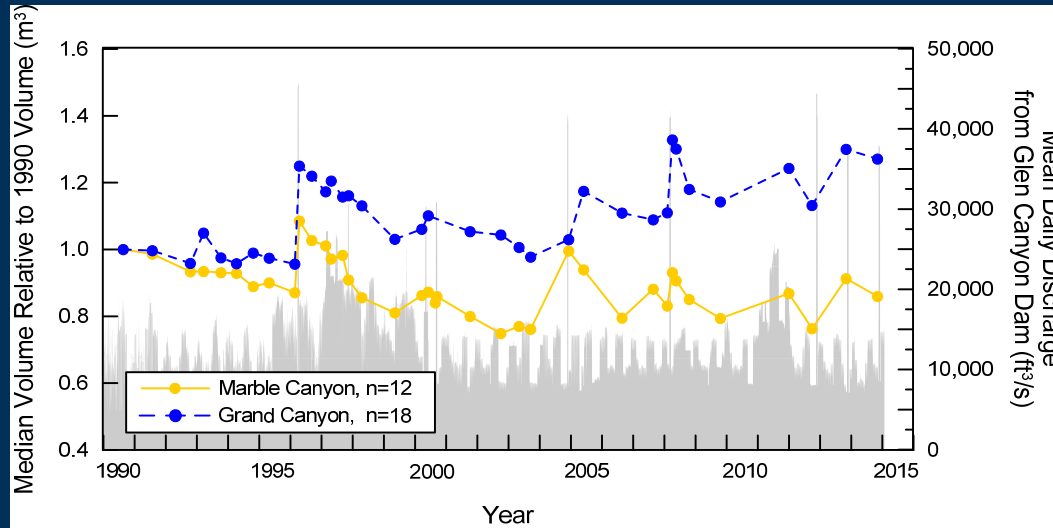
- Suspended- and bed-sediment data
- Sediment loads (silt and clay loads and sand loads)
- User-interactive sand budgets in 6 reaches from Lees Ferry to Lake Mead
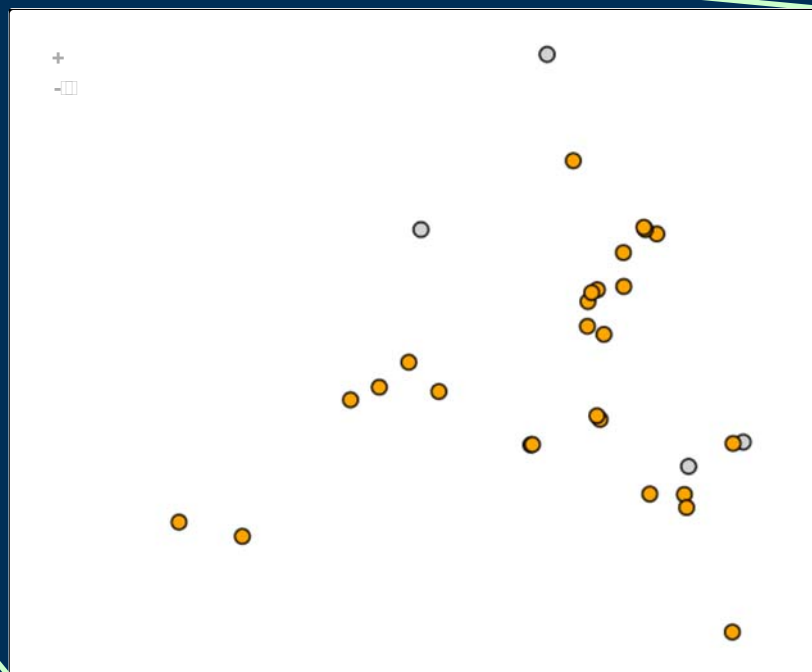
www.gcmrc.gov

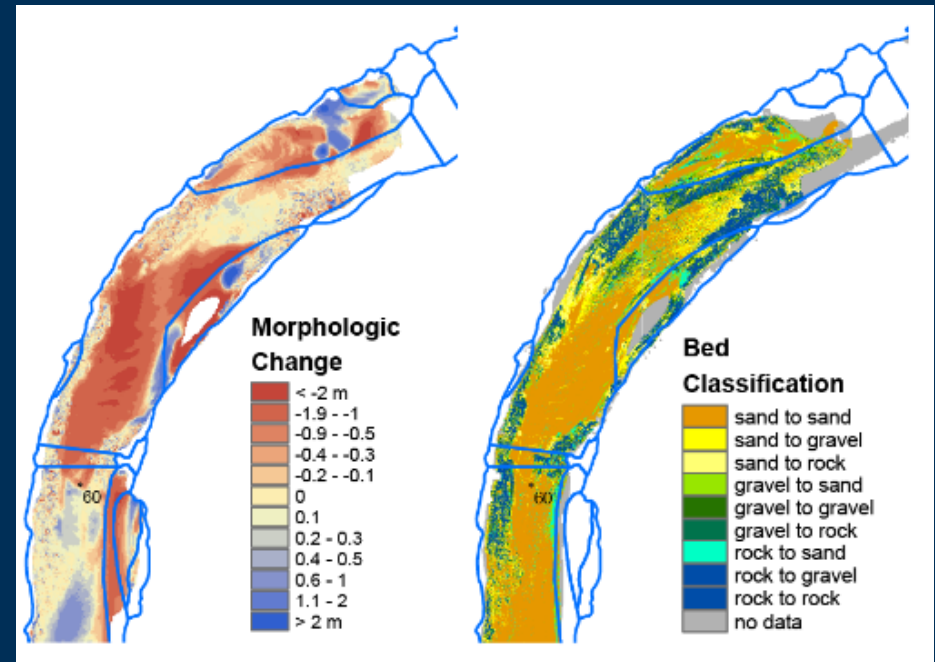http://www.gcmrc.gov/discharge_qw_sediment/

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Annual Sandbar and Campsite Monitoring

Data at www.gcmrc.gov/sandbar/

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Remote sensing

- Aerial, lidar, and satellite imagery and data.
- Data are used for:
  - Maps to support field data collection and river navigation
  - Analysis and change detection of sandbars, riparian vegetation, backwater and near-shore habitats, and other ecosystem-wide mapping

Little Colorado River Confluence

Glen Canyon Slough

Upper Chevron Camp

National Canyon 2009
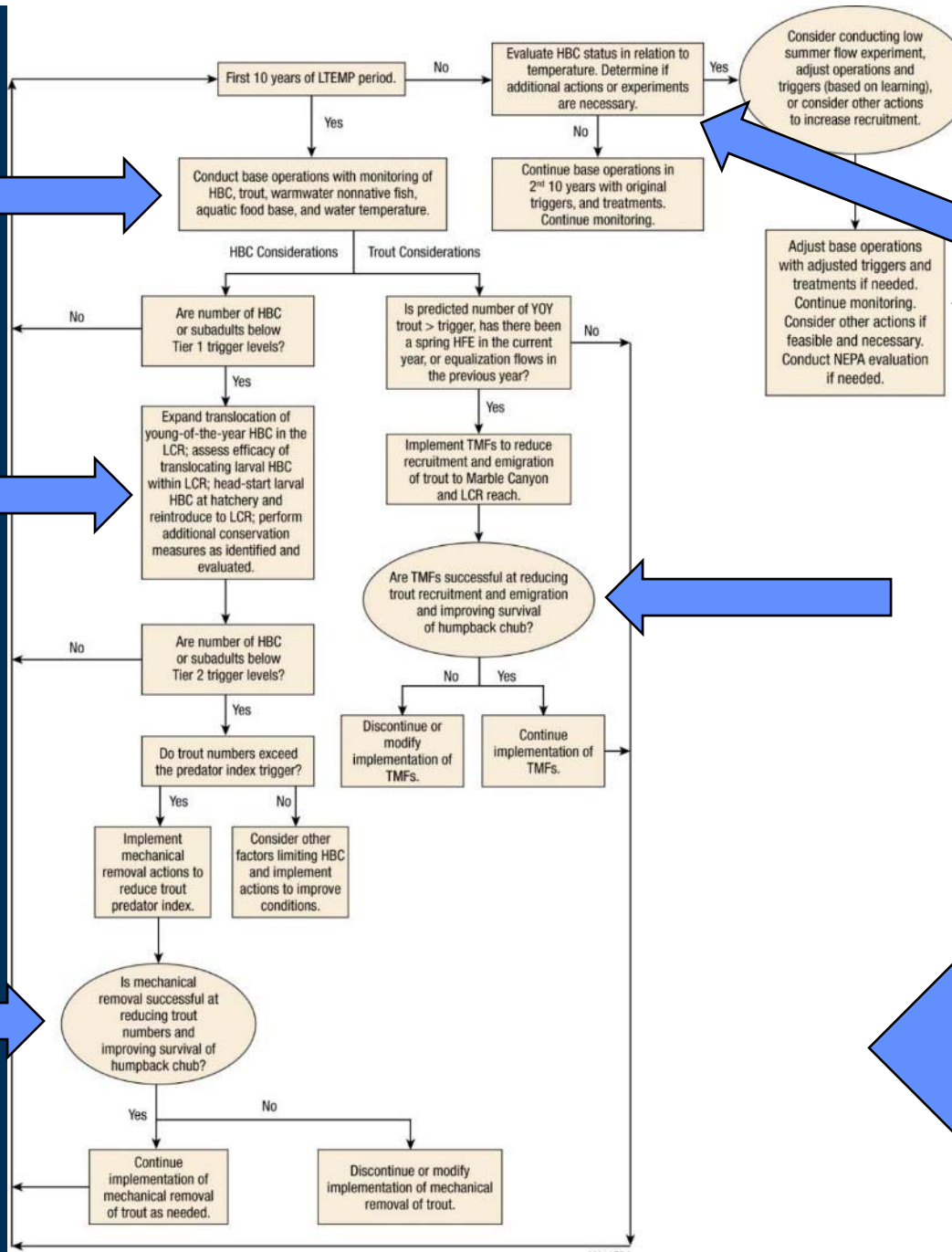
National Canyon 2013

Kanab Creek 2009

Kanab Creek 2013

Extended Duration HFE Monitoring

- **Temporal and longitudinal changes in suspended sediment concentration during floods**

- **Lateral changes in concentration in eddy deposition zones**

- **Temporal and longitudinal comparisons of sandbar topography during floods to determine changes in deposition rates of fine sediment in eddies**

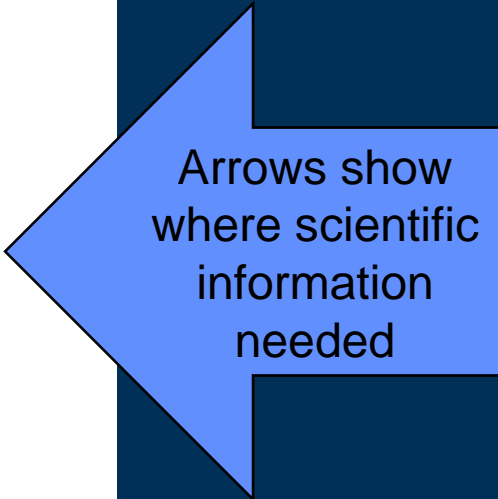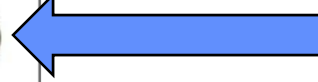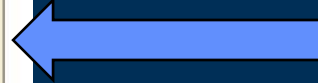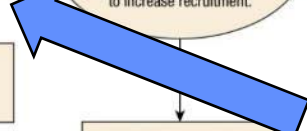- **Suggest establishing contingency fund to support more extensive evaluation**
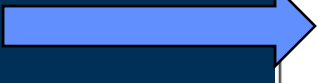
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Preferred Alternative: Aquatic Resource-Related Adjustments to Operations and Non-Flow Actions

- **Trout control actions**
  - **Trout management flows (TMF)**
  - **Mechanical removal from the LCR reach**
- **Macroinvertebrate production flows**
- **Low summer flows**
- **Non-flow vegetation treatments**

First 10 years of LTEMP period. — No → Evaluate HBC status in relation to temperature. Determine if additional actions or experiments are necessary. — Yes → Consider conducting low summer flow experiment, adjust operations and triggers (based on learning), or consider other actions to increase recruitment.

Yes ↓

Conduct base operations with monitoring of HBC, trout, warmwater nonnative fish, aquatic food base, and water temperature.

No ↓ Continue base operations in 2nd 10 years with original triggers, and treatments. Continue monitoring.

Adjust base operations with adjusted triggers and treatments if needed. Continue monitoring. Consider other actions if feasible and necessary. Conduct NEPA evaluation if needed.

HBC Considerations | Trout Considerations

Are number of HBC or subadults below Tier 1 trigger levels? — No

Is predicted number of YOY trout > trigger, has there been a spring HFE in the current year, or equalization flows in the previous year? — No

Yes ↓

Expand translocation of young-of-the-year HBC in the LCR; assess efficacy of translocating larval HBC within LCR; head-start larval HBC at hatchery and reintroduce to LCR; perform additional conservation measures as identified and evaluated.

Yes ↓ Implement TMFs to reduce recruitment and emigration of trout to Marble Canyon and LCR reach.

Are TMFs successful at reducing trout recruitment and emigration and improving survival of humpback chub?

Are number of HBC or subadults below Tier 2 trigger levels? — No

Yes ↓

Do trout numbers exceed the predator index trigger?

No ← Discontinue or modify implementation of TMFs. | Continue implementation of TMFs. → Yes

Yes ↓ Implement mechanical removal actions to reduce trout predator index.

No ↓ Consider other factors limiting HBC and implement actions to improve conditions.

Is mechanical removal successful at reducing trout numbers and improving survival of humpback chub?

Yes | No

Continue implementation of mechanical removal of trout as needed. | Discontinue or modify implementation of mechanical removal of trout.
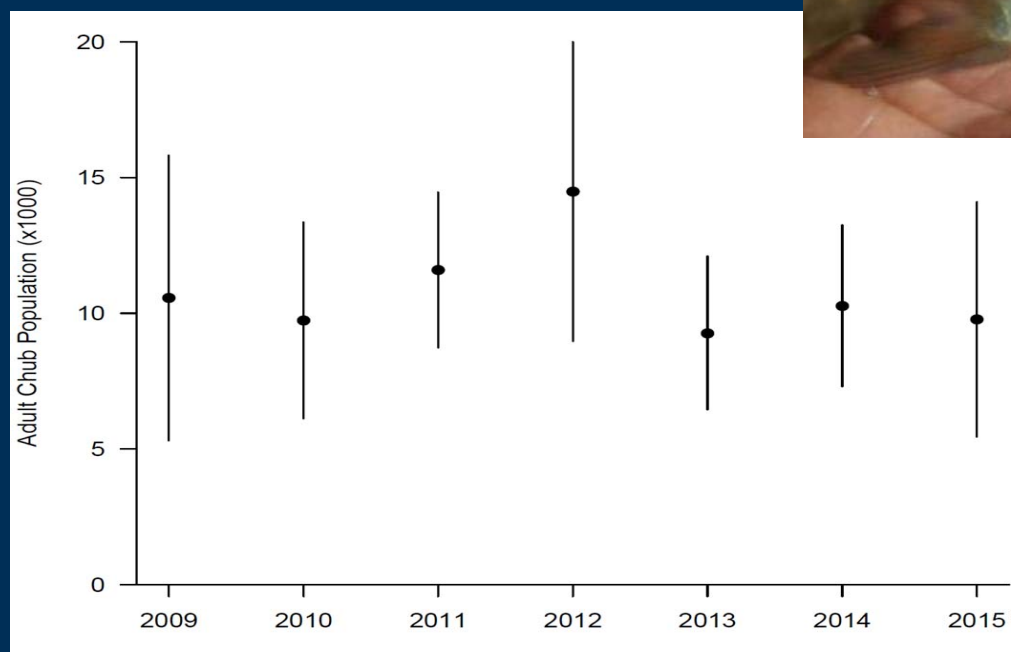
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HBC = Humpback Chub
HFE = High-Flow Experiment
LCR = Little Colorado River

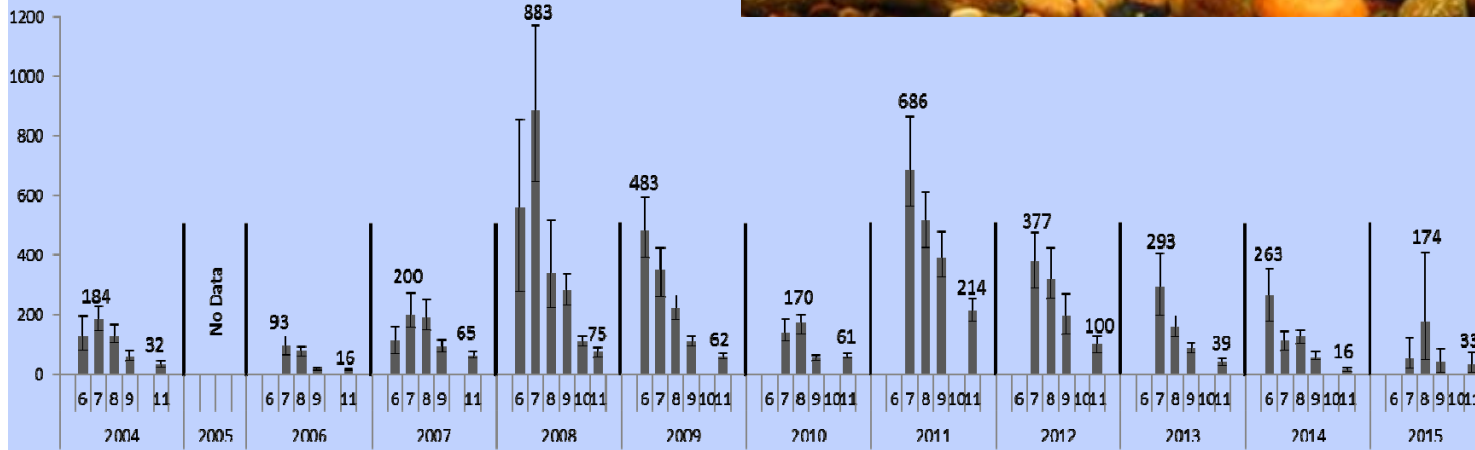NEPA = National Environmental Policy Act
TMF = Trout Management Flow

Arrows show where scientific information needed

USGS

Humpback Chub Monitoring

Rainbow Trout Monitoring
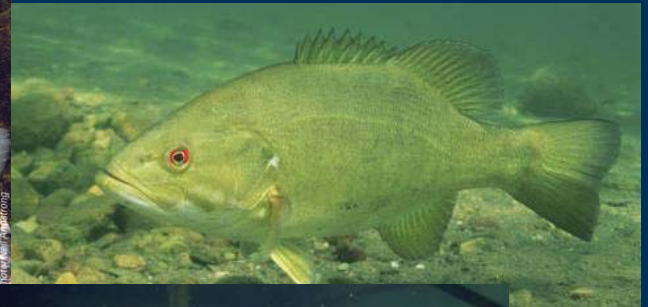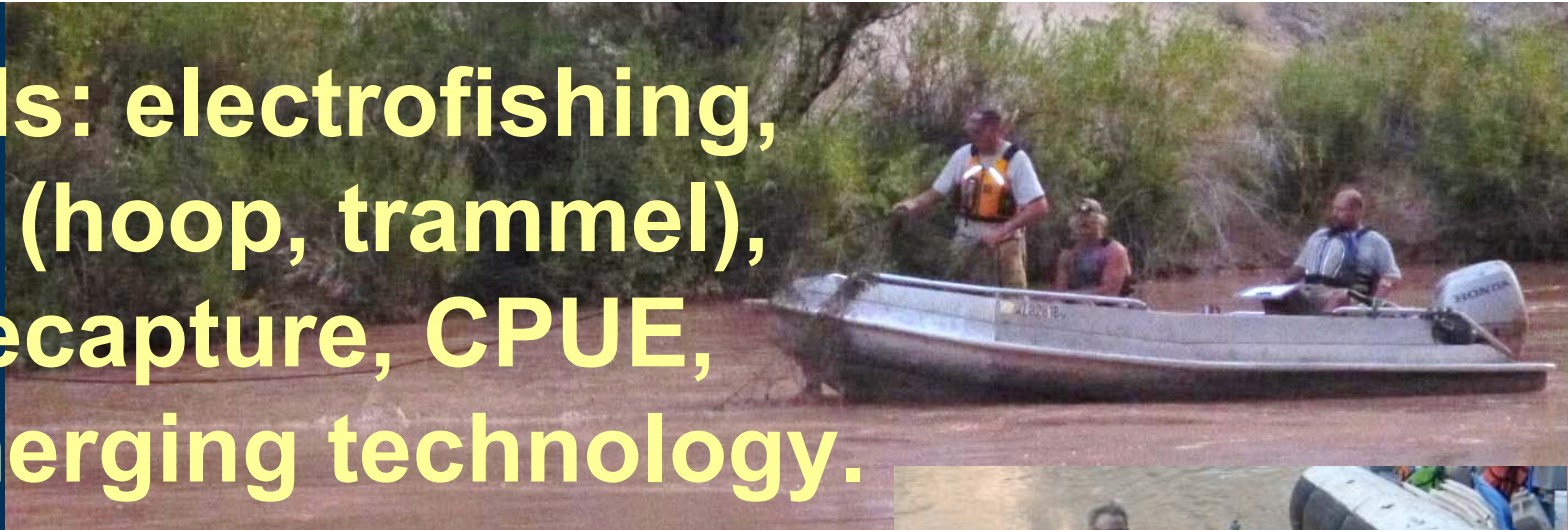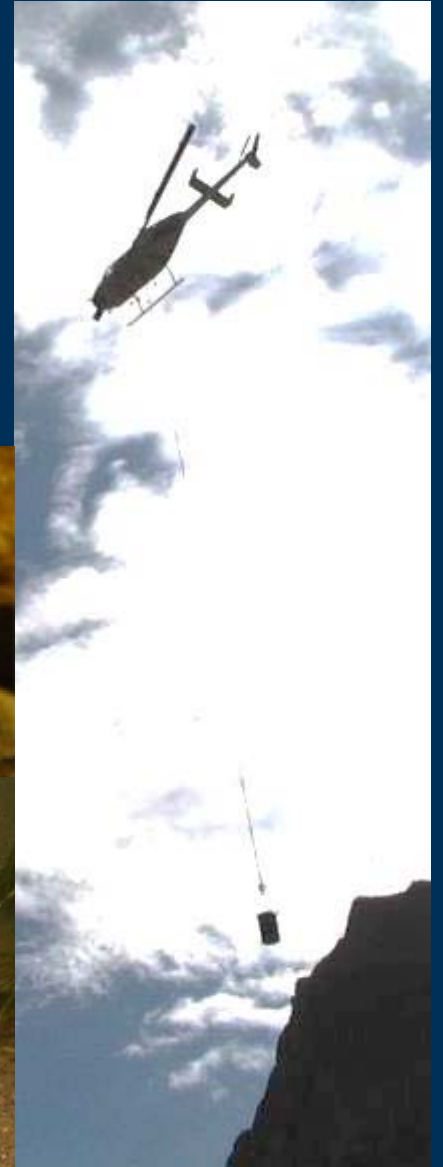

Dustin Patar

Nonnative/Invasive Fish Monitoring

Methods: electrofishing, netting (hoop, trammel), mark-recapture, CPUE, and emerging technology.
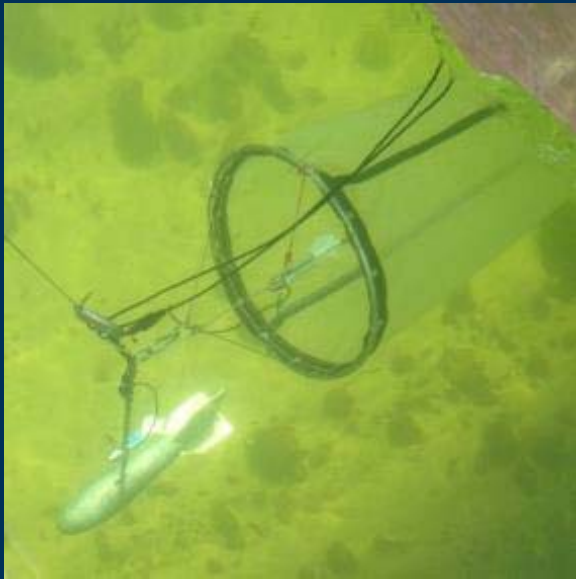
Fisheries Program Protocol Evaluation Panel

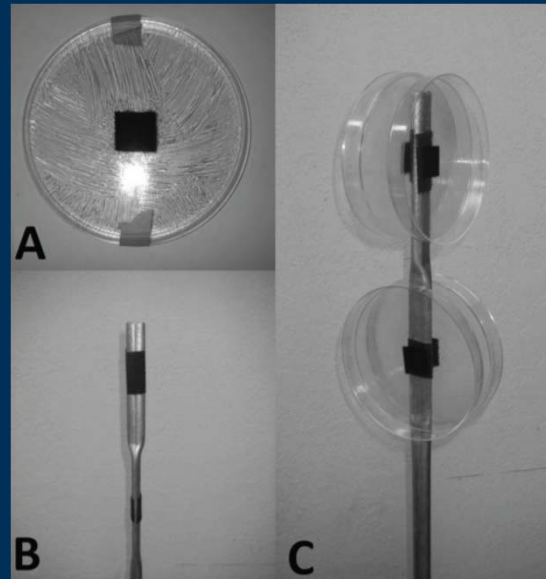# Monitoring the prey base

Invertebrate Drift

Plankton nets

Optimized for large rivers

Proportional to benthic density

Direct measure of prey
availability for drift feeding fishes

Insect emergence

Sticky traps

Light traps

Developed new methods that are quick
and easy to deploy

Proportional to benthic density

Understudied life stage

Has shed light on why so few insects

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Studying insect egg laying

Artificial substrates

Natural substrates

Multiple approaches will be used to determine how "bug flows" affects the environment for insect egg laying and rearing

USGS

Preferred Alternative: Other Resources

- **Vegetation**
  - **nonnative plant removal**
  - **revegetation with native species**
  - **mitigation at specific and appropriate cultural sites**
- **Cultural Resources**
  - **Preservation of historic properties through a program of research, monitoring, and mitigation**
    - **archeological and ethnographic sites**
    - *National Register* **historic properties**

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Riparian vegetation

- Future issues
  - Vegetation removal/restoration per LTEMP
  - Tamarisk and tamarisk beetles
  - Continued vegetation expansion onto sandbars
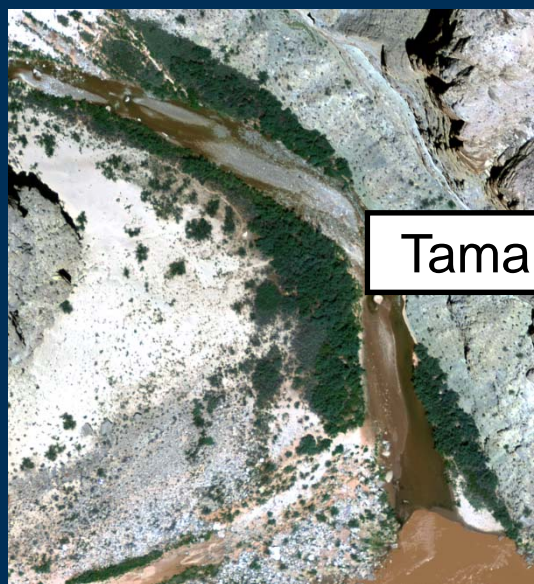
Tamarisk Beetle

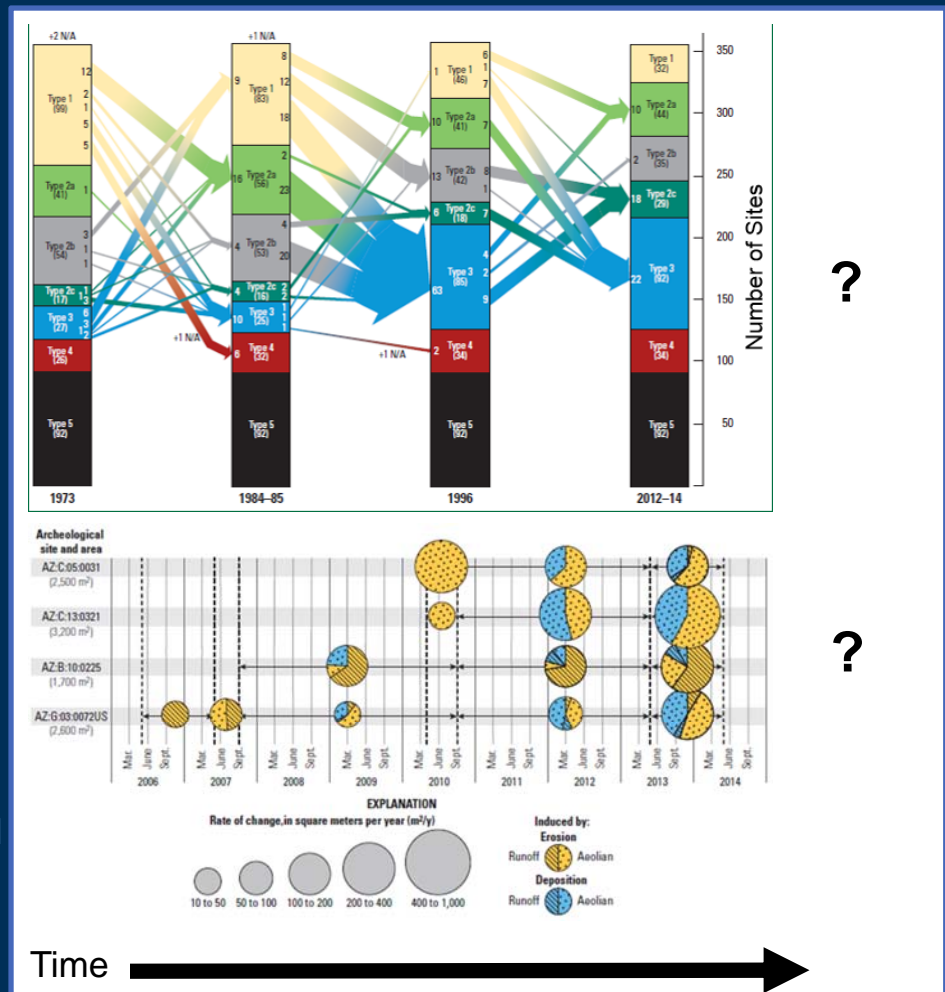**Kanab Creek 2009**   **2013**

Dam Operations, Geomorphic Processes & the Future of Archaeological Sites

Questions?