Non-native Fish Control in Tributaries: Grand Canyon National Park

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Cooperators

• Funded by Reclamation and NPS

• Volunteers (several thousand hours)
Trout Control Projects

Shinumo Creek – Rainbow Trout

Bright Angel Creek – Rainbow and Brown Trout
Project Background

- NPS Management Policies: Exotic Species Management

Shinumo Creek
- Shinumo Creeks: Rainbow trout introduced 1920’s and 1930’s (US Forest Service and NPS)
Shinumo Creek - Background

- Non-native fish control:
  - "Essential precursor to humpback chub translocation..." (USFWS 2008)
  - Goal: improve survival of humpback chub

- Uncertainties:
  - Electro-fishing impact upon native fish/humpback chub?
  - Effectiveness?
Shinumo - Methods

Electro-fishing:
- Pre-translocation
  - May, June 2009
  - 2.8 km+ (translocation reach)
- Post-translocation
  - 2009 angling/netting only
  - 2010-2012:
    - Translocation reach angling/netting
    - Upstream: electro-fishing

Joe Tomelleri Illustrations
Shinumo – Trout Control Methods

2009 Electro-fishing
- Single-pass - no abundance estimation

2010 – 2012 Electro-fishing
- 3-pass depletion-abundance estimation

Angling/Netting
- No abundance estimation

Beneficial Use:
- To the extent practical
- Consumed the majority of trout removed
Shinumo - Evaluation

- **Abundance/survival:**
  - Humpback chub and Bluehead sucker
  - Mark-recapture (netting)
  - Tagged Blueheads captured during electro-fishing

- **Density (Electro-fishing):**
  - Number of fish per 500 meters
  - Bluehead sucker, speckled dace, rainbow trout

- Trend analysis
Shinumo Creek – Trout Removed

<table>
<thead>
<tr>
<th>Reach/Trip</th>
<th>Translocation Reach</th>
<th>Upstream</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Angling/ Netting</td>
<td>Electro-fishing</td>
</tr>
<tr>
<td>May/June 2009 (pre-trans.)</td>
<td>292</td>
<td>694</td>
</tr>
<tr>
<td>2009 (post-trans.)</td>
<td>45</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>391</td>
<td>0</td>
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<tr>
<td>2011</td>
<td>260</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>302</td>
<td>0</td>
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<tr>
<td>TOTAL:</td>
<td>1,290</td>
<td>694</td>
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</table>
Shinumo Creek - Results

- 86-94% of RBT removed (2010-2012 – electro-fishing)
- Trout capture efficiency related to fish size (range 0.38 to 0.88)
- Annual HBC/BHS survival
  - “Apparent Survival”
    - Emigration + mortality
    - (Stayed + survived)
Humpback Chub Survival and Trout Density

Limited control
Humpback Chub Survival and Trout Density

Limited control
Rainbow Trout Size Structure

- Spurgeon et al. *in review*: RBT > 200 mm more likely to be piscivorous
Bluehead Sucker Survival and Trout Density

No Data *
Bluehead Sucker Abundance

- **Electro-fishing:**
  - Stable trend in upstream areas (electro-fishing)

- **Mark-recapture:**
  - *Few recaptures Sept. 2010 (No estimate)*
  - Decline observed
Bluehead Sucker Abundance

- **Electro-fishing:**
  - Stable trend in upstream areas (electro-fishing)

- **Mark-recapture:**
  - *Few recaptures Sept. 2010 (No estimate)*
  - Decline observed

- **Fire/ash deposition?**
  - July 2010
  - Low recruitment
  - HBC lower body condition (Spurgeon 2012)
Speckled Dace Abundance

- Stable trend/slight increase
- M/R Annual estimate only: 2012 and beyond (June)
- SPD Mark-recapture: = labor intensive
Summary – Shinumo Creek

- Efficiently remove RBT using electro-fishing
- Expect compensatory response - future control needed
- Trout abundance - appears to be related to juvenile humpback chub apparent survival

Questions:
- Higher HBC apparent survival related to low emigration?
- Actual RBT abundance in translocation reach?

Control methods don’t appear to be impacting natives
- Humpback chub predation upon natives? (see Spurgeon et al. in review/poster session)
- Disturbance (fire/flood) = confounding factor?
Summary – Shinumo Creek

- Next steps:
  - Incorporate antenna data into survival models (“true survival”)
  - BHS recruitment/size structure

- Reports/Publications:
Bright Angel Creek – Background

- Bright Angel Creek:
  - Major source of Brown Trout to Grand Canyon
  - Brown trout may be greater threat others
Bright Angel Creek Trout Reduction Project

- **Purposes:**
  1. Benefit endangered humpback chub/other native fishes in the Colorado River.
  2. Restore and enhance, to the extent feasible, native fishes that once flourished in Bright Angel Creek.

- **Actions:** Remove Brown and Rainbow Trout
  1. Install and operate a weir (fish trap)
  2. Electro-fishing for monitoring and removal
Background

- Potential Humpback chub translocation site (BioOPs)
- >120 Days over 16 degrees C

![Bright Angel Creek Temperature vs. HBC Thermal Needs](chart.png)
Project Background
Bright Angel Creek

- 2003 – Feasibility Study
- 2006 – EA Completed
- 2006-2007:
  - Weir Installed
  - Fall and Spring electro-fishing
  - Only Brown Trout Removed
- No funding
- 2010-2013 – Continued Implementation
Methods – Electro-fishing

- **Field Methods (2010-2013):**
  - Backpack electro-fishing
  - Multiple-pass depletion with block nets
  - Count/measure all fish (release native fish alive)
  - Mark bluehead suckers (PIT tag, >150 mm)

- **Analysis/Evaluation:**
  - Calculate abundance using depletion methods (all fish)
    - Trend Analysis
  - Bluehead sucker survival/recruitment: Mark-recapture
  - Size structure (all fish)
Methods – Electro-fishing Effort

- Stream Length
  - 2006
  - Oct., 2010
  - Jan., 2011
  - Oct., 2011
  - Jan., 2012
  - Fall/winter 2012-13 (In Progress)

- Through 1/8/2013
- Bright Angel Creek = 21km/13 miles
Results – Electro-fishing

- October 2010 – January 2012 (preliminary)
  - Proportion removed (3-passes): 70 – 91%
  - Lower than Shinumo Creek (more complex habitat)
Results – Electro-fishing

- Bluehead sucker survival: Preliminary/In progress
  - Number of BHS captured/tagged:
    - October 2010: 4
    - January 2011: 46
    - October 2011: 77
    - January 2012: 63
  - BHS 2011 Survival:
    - Bright Angel ~ 11%
    - Shinumo: 45-47%
Results – Electro-fishing

- 2012-13: Species composition (In progress: 1/8/13)
- Counts from data sheets (data entry incomplete)
Weir Design – 2006 - 2012
Weir Design – 2013
Weir Results –

- 2012-13 Installed early October – operate through early/mid-March
  - Expanded slightly to more fully encompass spawning periods

- Weir Captures:
  - 2010-11: 105 Brown trout, 107 Rainbow trout
  - 2011-12: 32 Brown trout, 55 Rainbow Trout
  - 2012-13: 145 Brown trout, 21 Rainbow trout (through December, in progress)
Questions?

Phantom Ranch Boat Beach, circa 1911
Brown Trout 2010

Brown Trout Length Frequency

No. Fish

0 2 4 6 8 10

Total Length (mm)

N = 104
Average size = 382

Joe Tomelleri Fish Art
Rainbow Trout 2010

Rainbow Trout Length Frequency

N = 90
Average size = 362

Joe Tomelleri Fish Art

Total Length (mm)

No. Fish

200 240 280 320 360 400 440 480 520 560 600 640
Results – Weir Captures (BNT)

BAC Brown Trout Capture 10/27-1/10

- BNT n=104
- H2O temp C
Results – Weir Captures (RBT)

BAC Rainbow Trout Capture 10/27-1/7

No. Fish vs Date

Morning Water Temperature (C)
# Trout Re-captures

<table>
<thead>
<tr>
<th>Species</th>
<th>Length (mm)</th>
<th>Tag Number</th>
<th>Date Tagged</th>
<th>Days at Large</th>
<th>Location Tagged (RM)</th>
<th>Initial Length</th>
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<tr>
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<td>390</td>
<td>3D9.1C2D17D301</td>
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<td>Rainbow Trout*</td>
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<td>USGS12706</td>
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</table>
Rainbow Trout Size Structure

- Spurgeon et al. in review): RBT > 200 mm piscivorous (or aggressive)

- Or histograms (use

![Graph showing Rainbow Trout size structure from 2010 to 2012](image-url)