National Park Service
U.S. Department of the Interior

Grand Canyon National Park

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

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Joe Tomelleri Illustrations

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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

- Trout Control: conservation Measures for Humpback Chub (USFWS 2008, 2011)

- NPS Management Policies: Exotic Species Management

<u>Shinumo Creek</u>

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

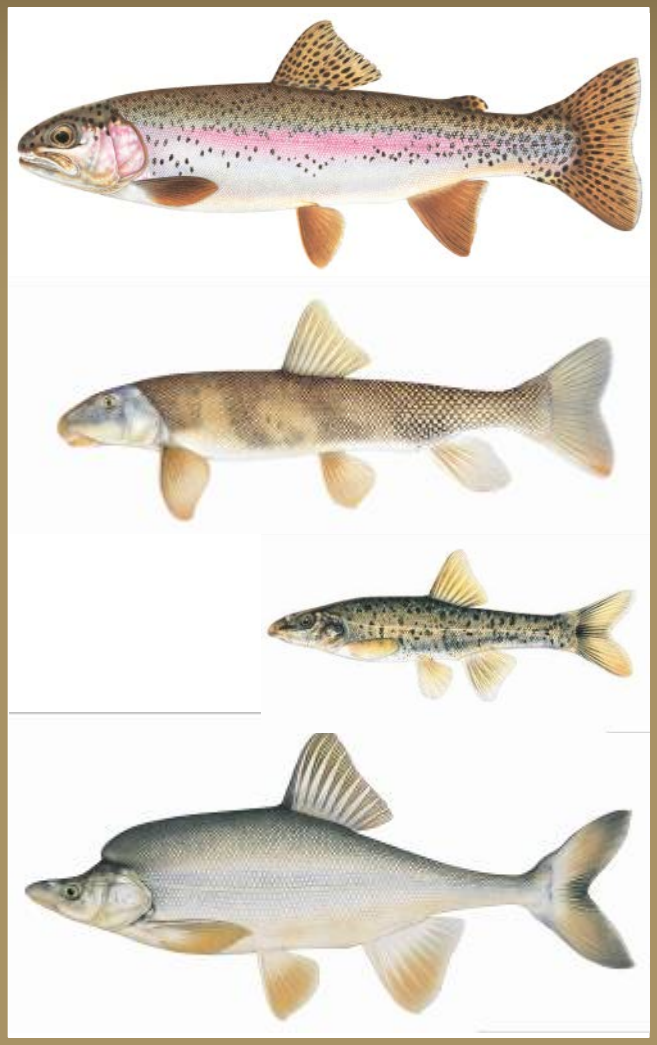
Shinumo Creek - Background

- 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

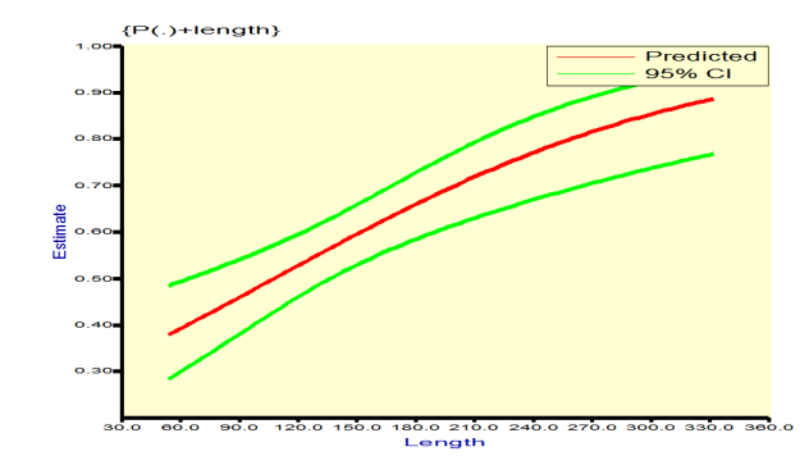
- Abundance/survival:
  - Humpback chub and Bluehead sucker
  - Mark-recapture (netting)
  - Tagged Blueheads captured during electro-fishing
- Density (Electro-fishing):
  - Number of fish per 500 meters
  - Bluehead sucker, speckled dace, rainbow trout
- Trend analysis

Shinumo Creek – Trout Removed

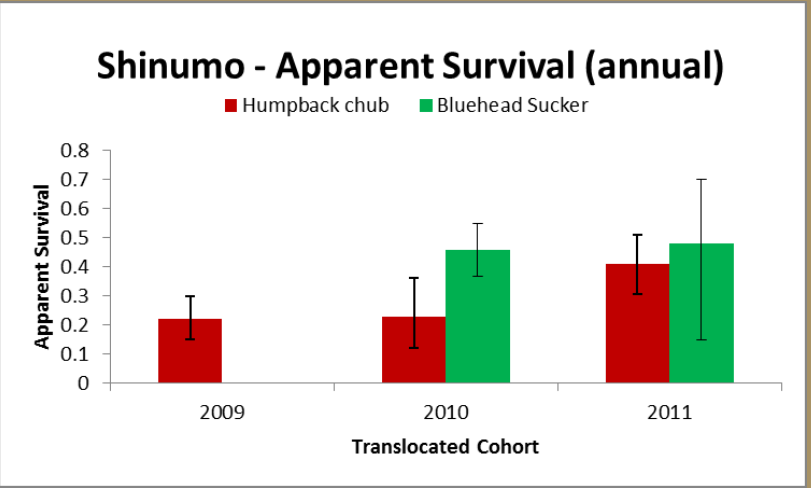
Reach/Trip	Translocation Reach		Upstream
	Angling/ Netting	Electro-fishing	Electro-fishing
May/June 2009 (pre-trans.)	292	694	0
2009 (post-trans.)	45	0	0
2010	391	0	538
2011	260	0	498
2012	302	0	916
TOTAL:	**1,290**	**694**	**1,952**

Shinumo Creek - Results

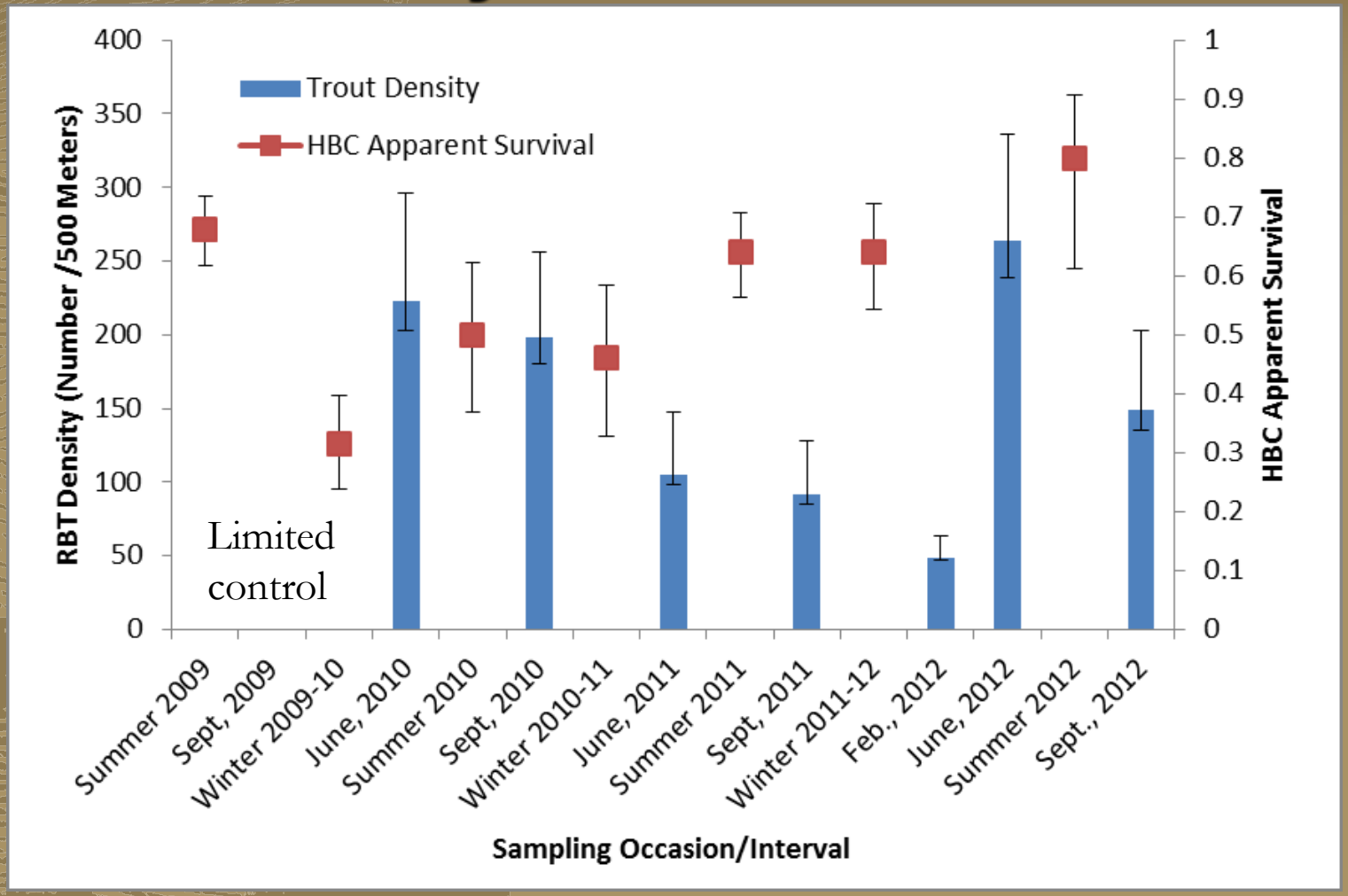
- 86-94% of RBT removed (2010-2012 – electro-fishing)
- Trout capture efficiency related to fish size (range 0.38 to 0.88)



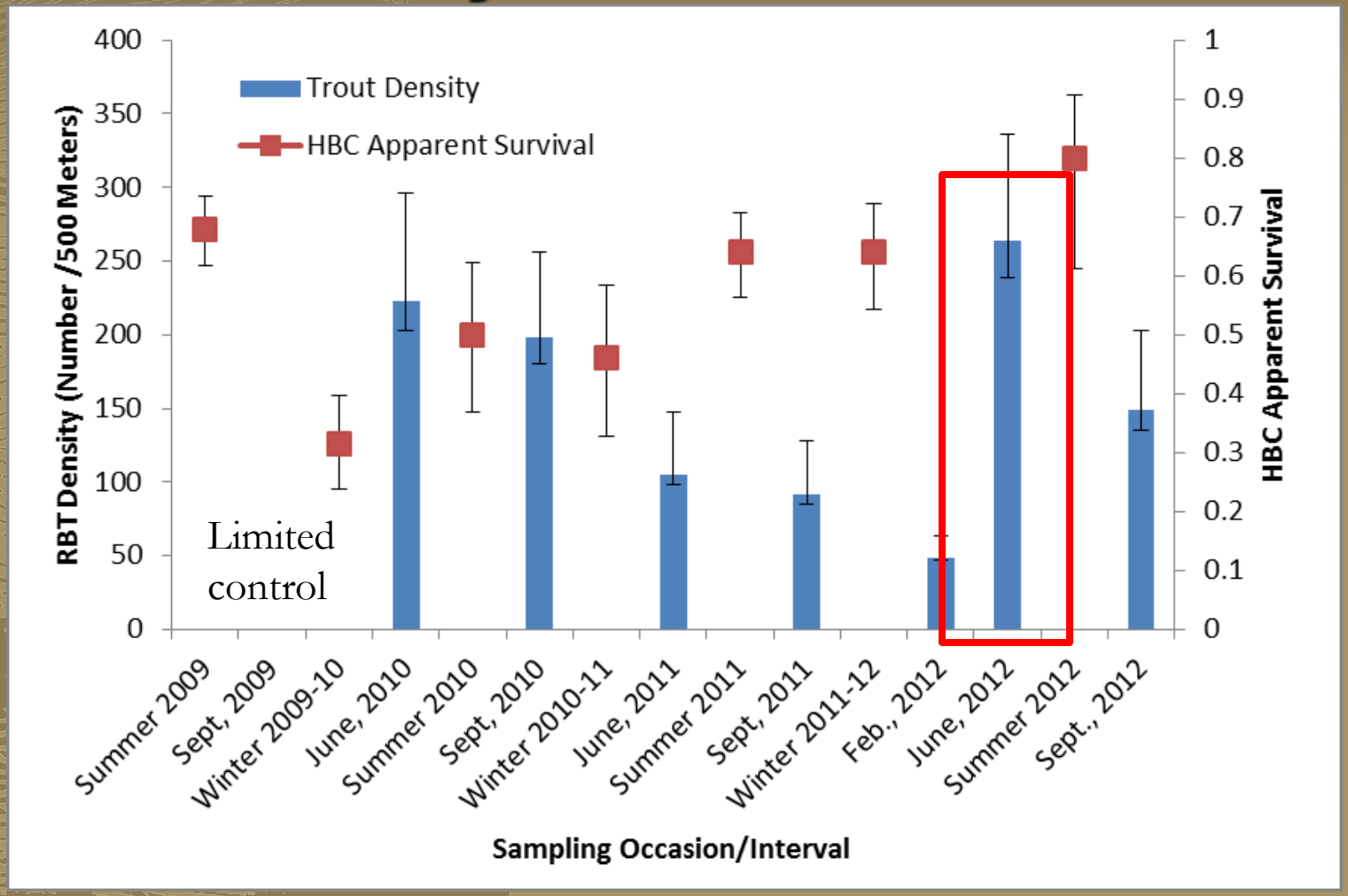
- Annual HBC/BHS survival
  - "Apparent Survival"
    - Emigration + mortality
    - (Stayed + survived)



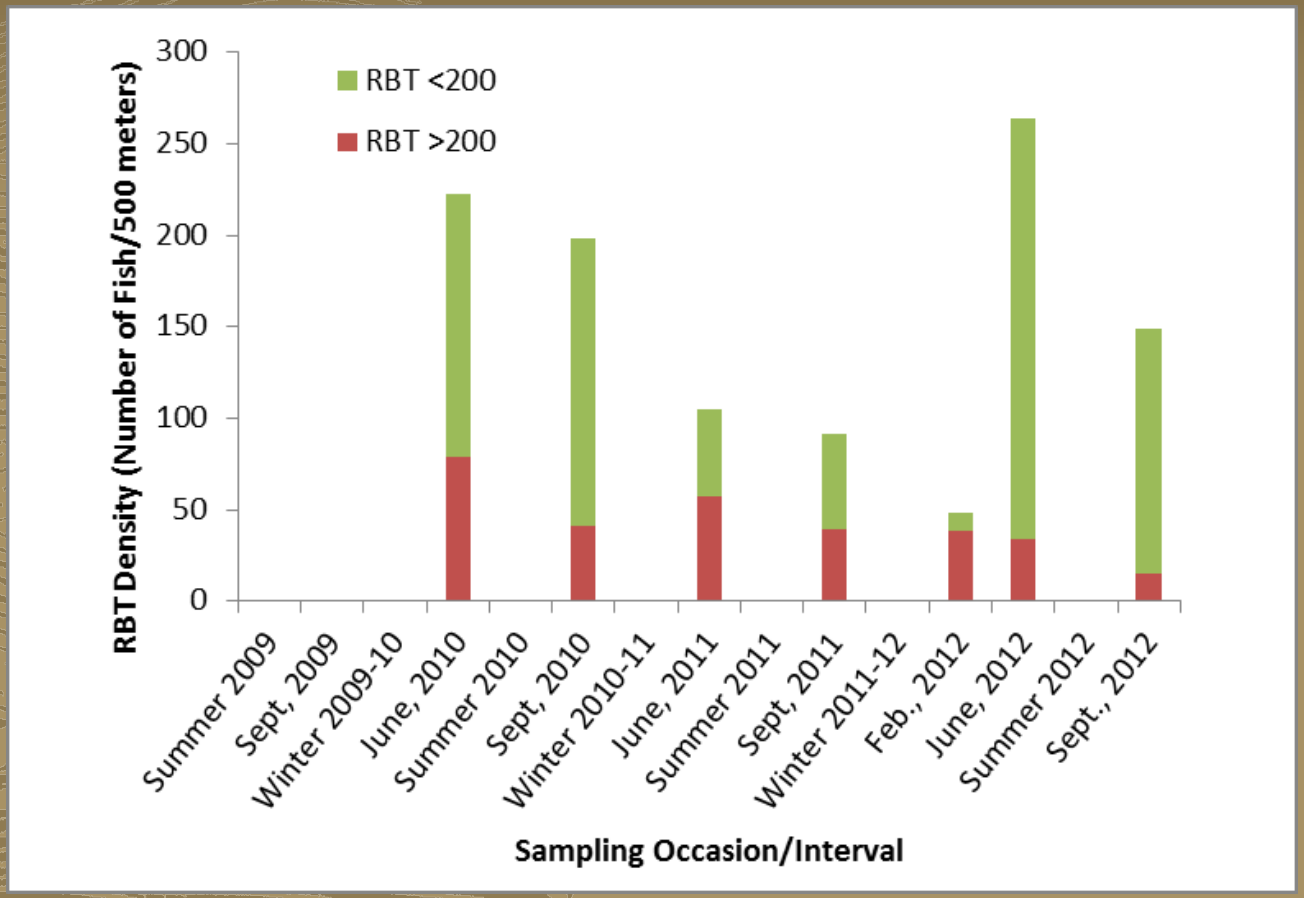
Humpback Chub Survival and Trout Density



Humpback Chub Survival and Trout Density

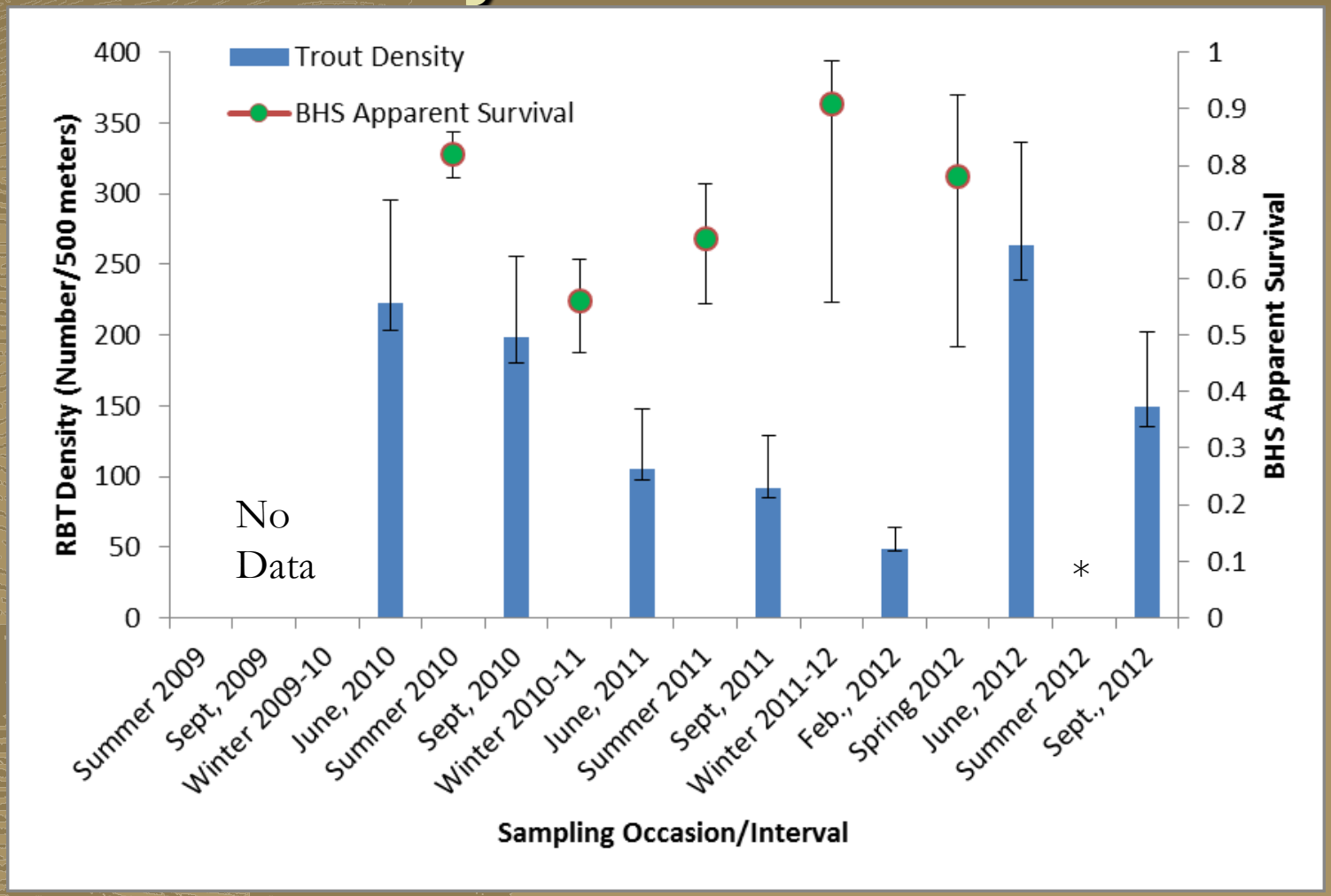


Rainbow Trout Size Structure



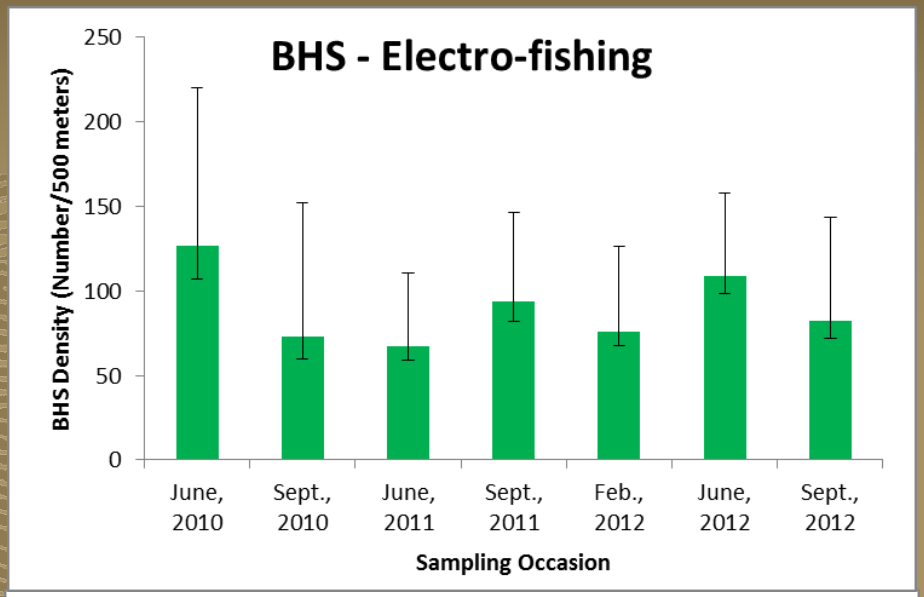
- Spurgeon et al. *in review*: RBT > 200 mm more likely to be piscivorous

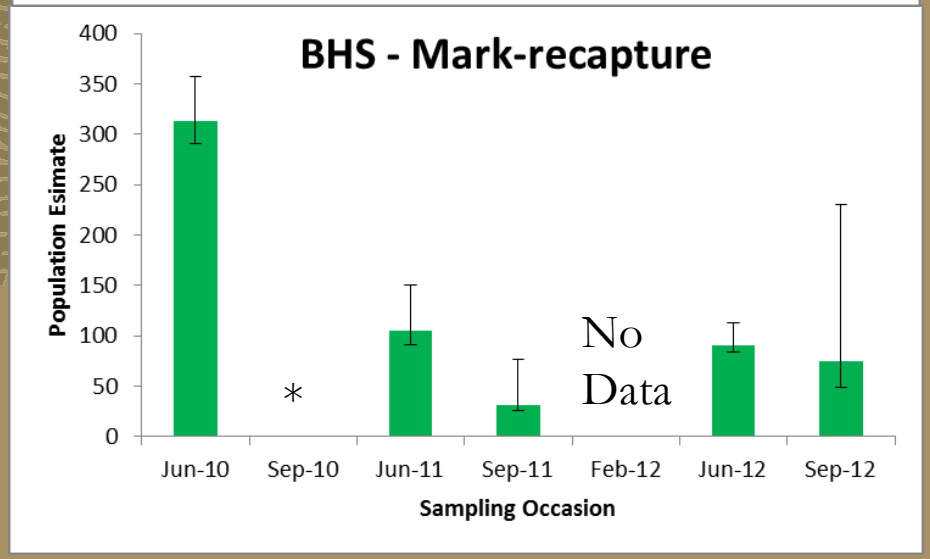
Bluehead Sucker Survival and Trout Density



Bluehead Sucker Abundance

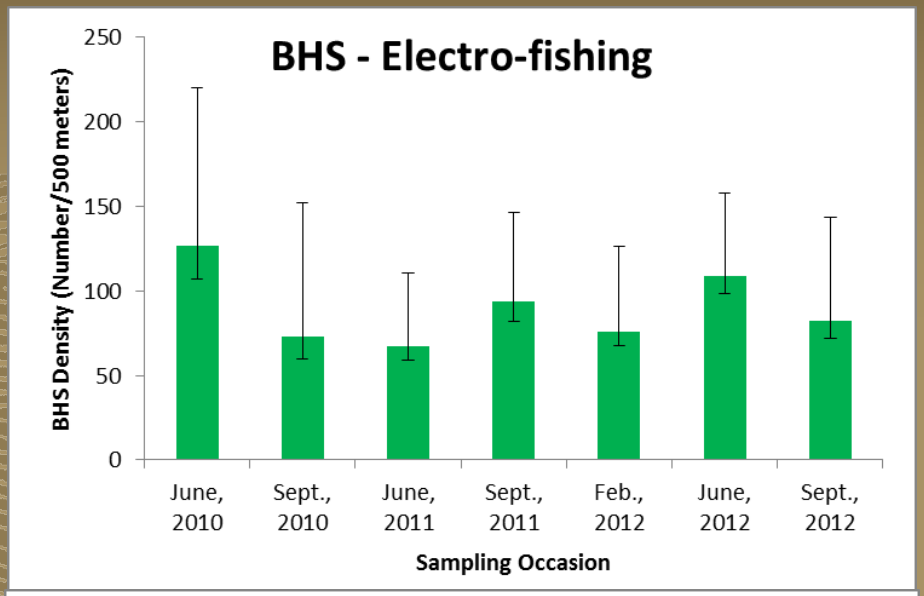
- Electro-fishing:
  - Stable trend in upstream areas (electro-fishing)
- Mark-recapture:
  - *Few recaptures Sept. 2010 (No estimate)
  - Decline observed

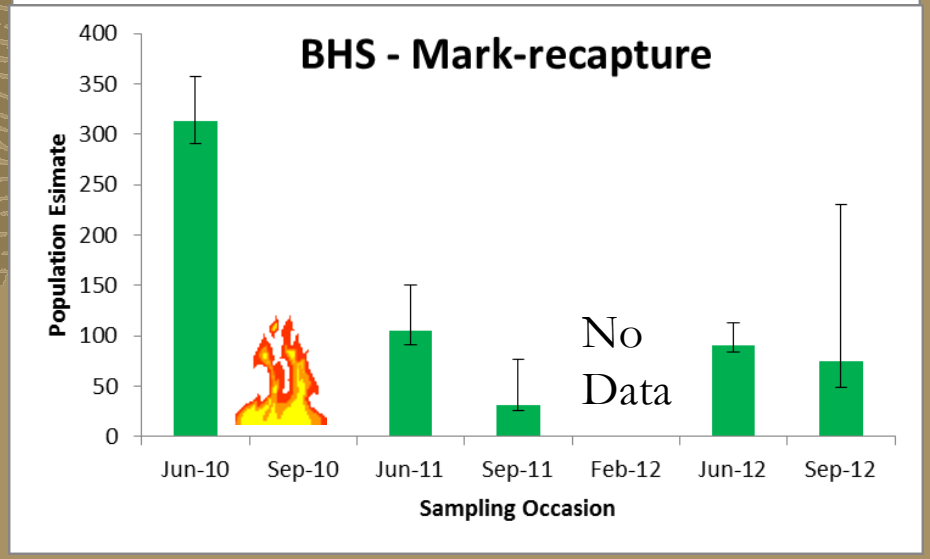




Bluehead Sucker Abundance

- 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)

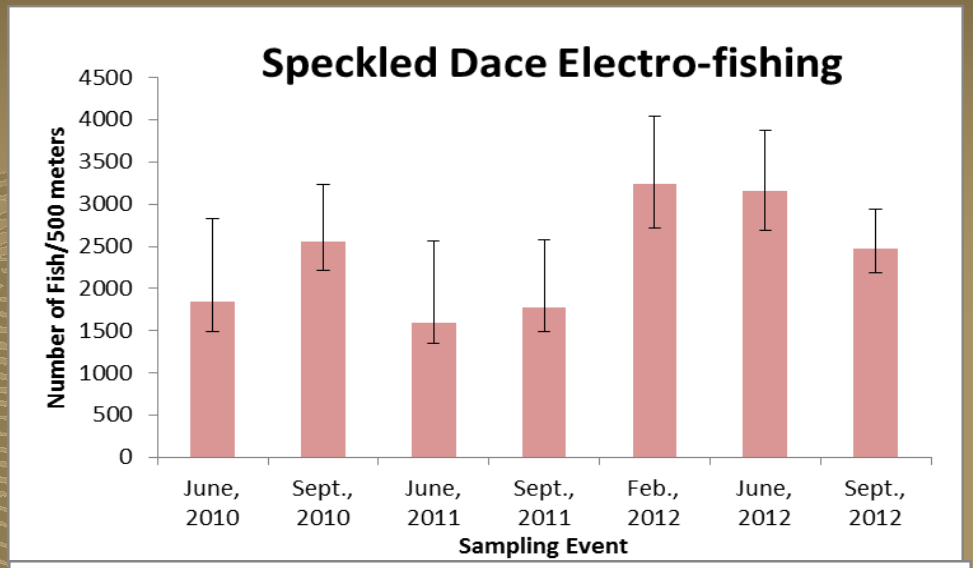


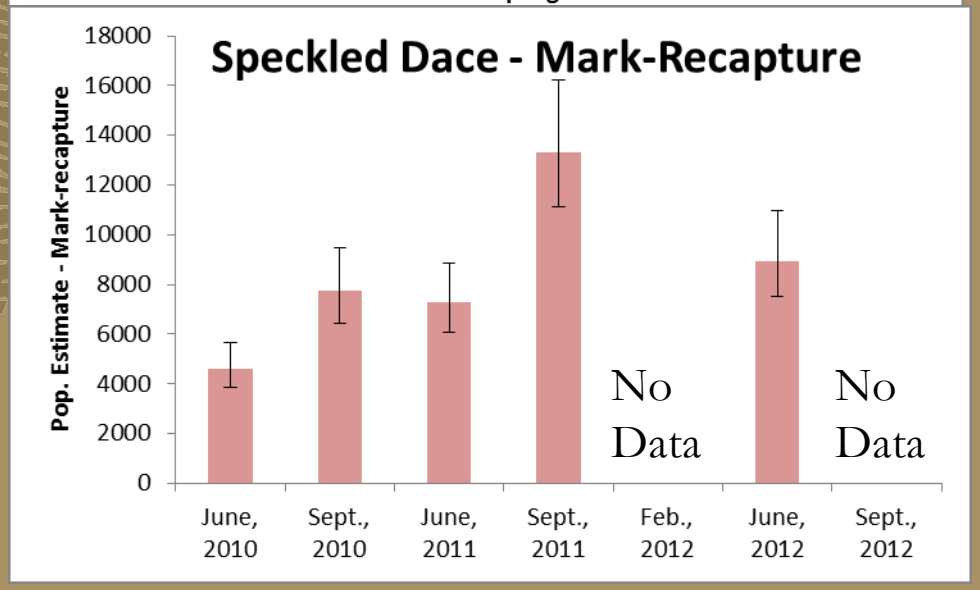


Speckled Dace Abundance

- 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
  - <u>Questions:</u>
    - 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?

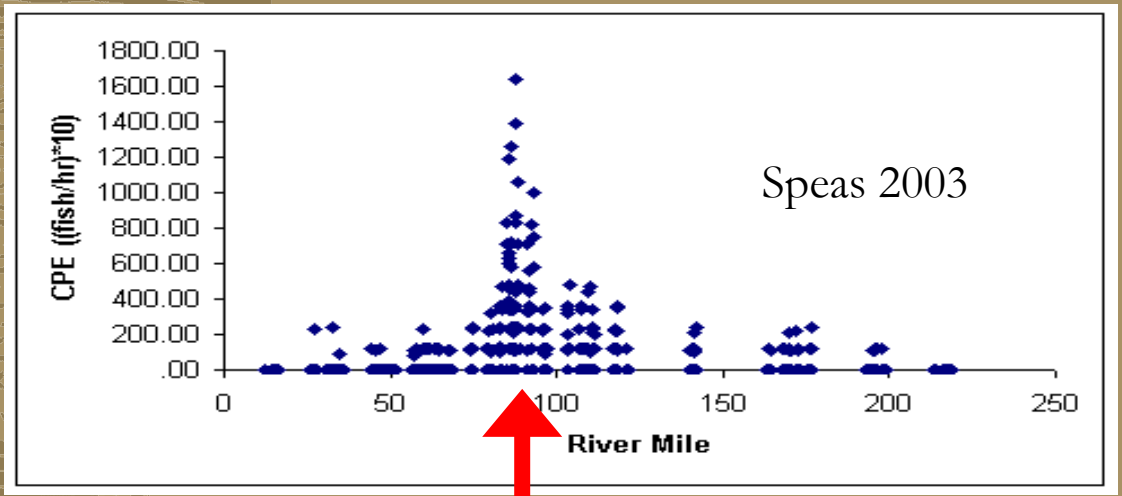
Summary – Shinumo Creek

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

- Reports/Publications:
  - In preparation. Annual Report, NPS Publication Series.

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 Inflow

Bright Angel Creek Trout Reduction Project

- Purposes:

1. Benefit endangered humpback chub/other native fishes in the Colorado River.

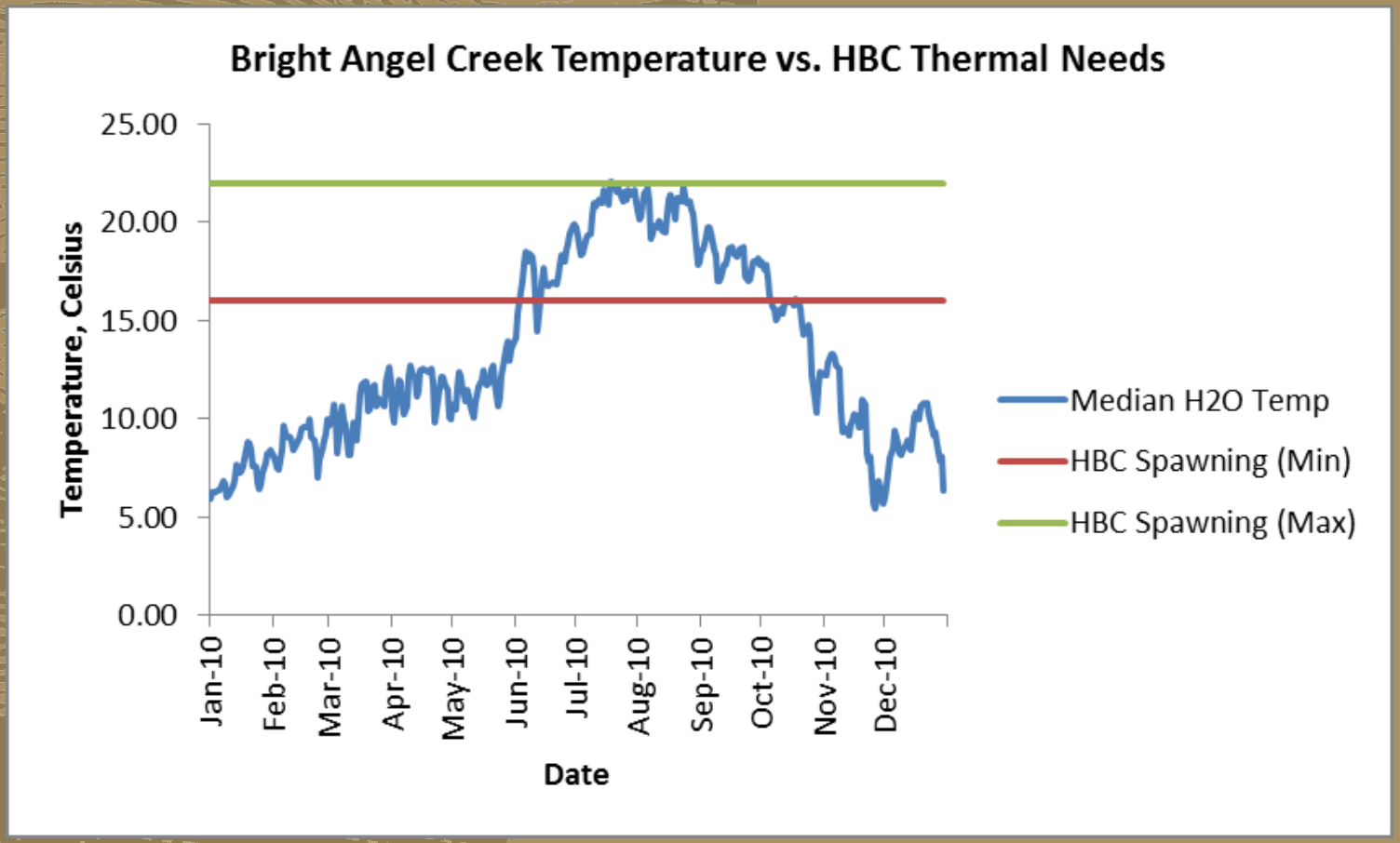
2. Restore and enhance, to the extent feasible, native fishes that once flourished in Bright Angel Creek.

- Actions: Remove Brown and Rainbow Trout

1. Install and operate a weir (fish trap)
2. Electro-fishing for monitoring and removal

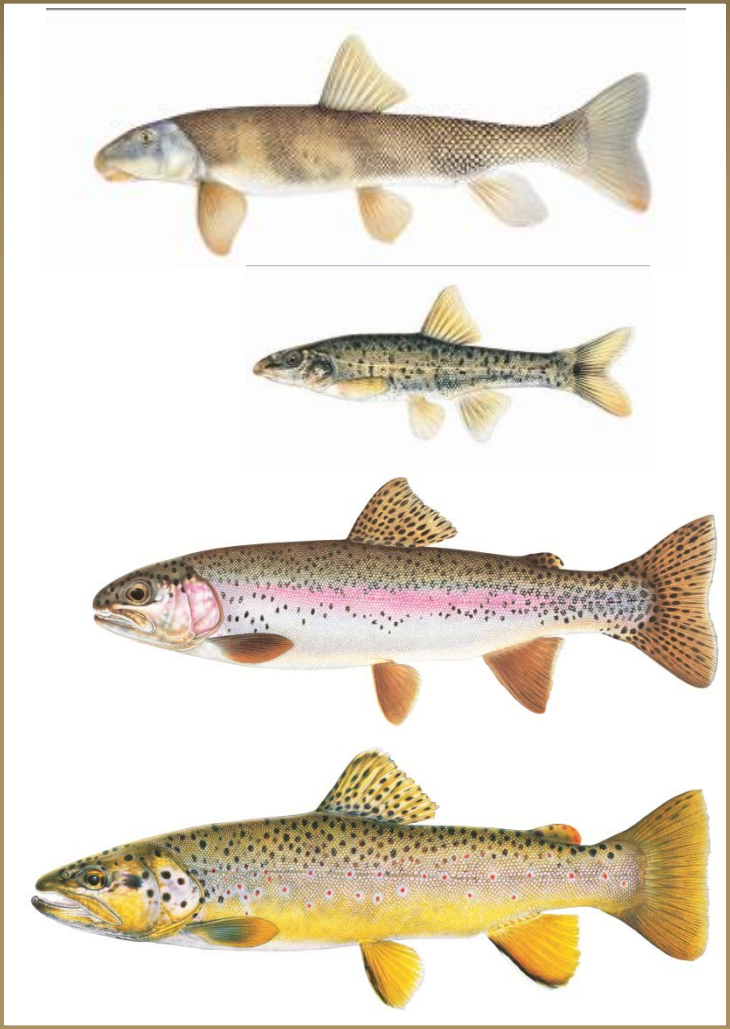
Background

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



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

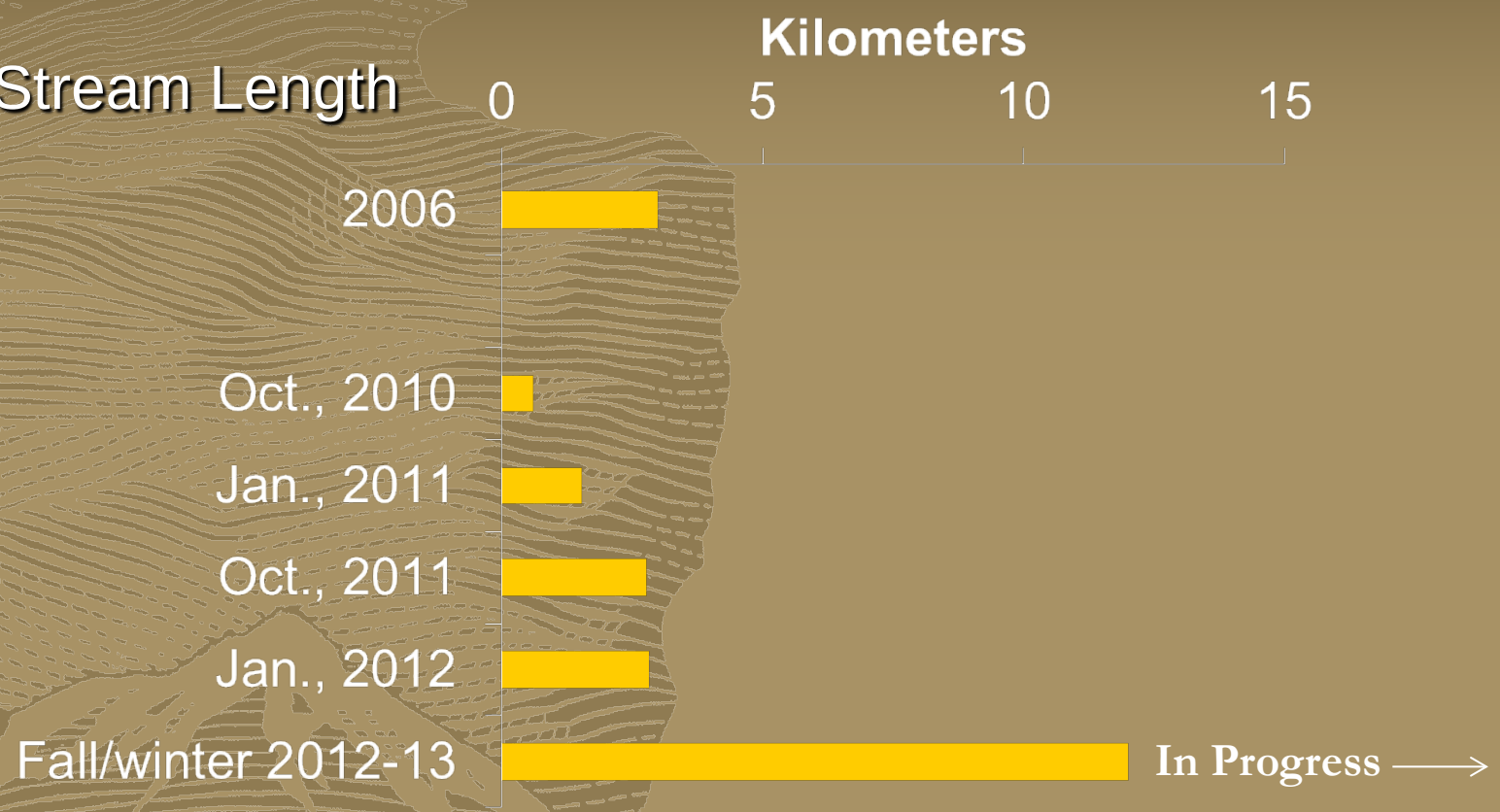


Methods – Electro-fishing

- 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

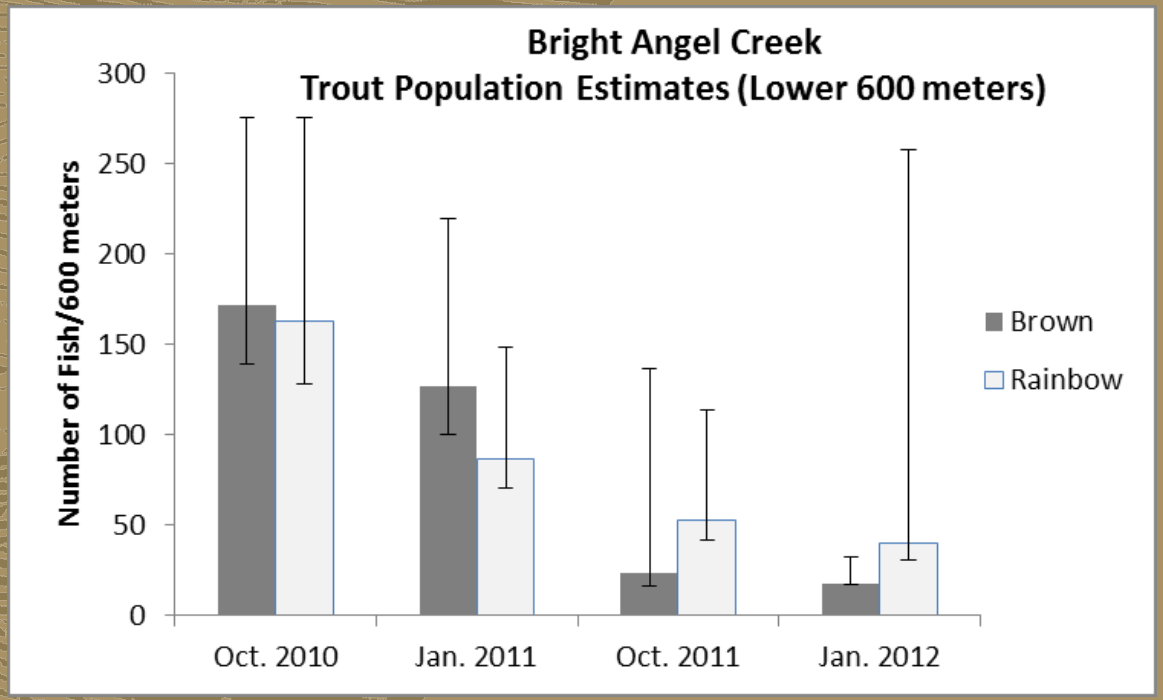
- Stream Length



- 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)

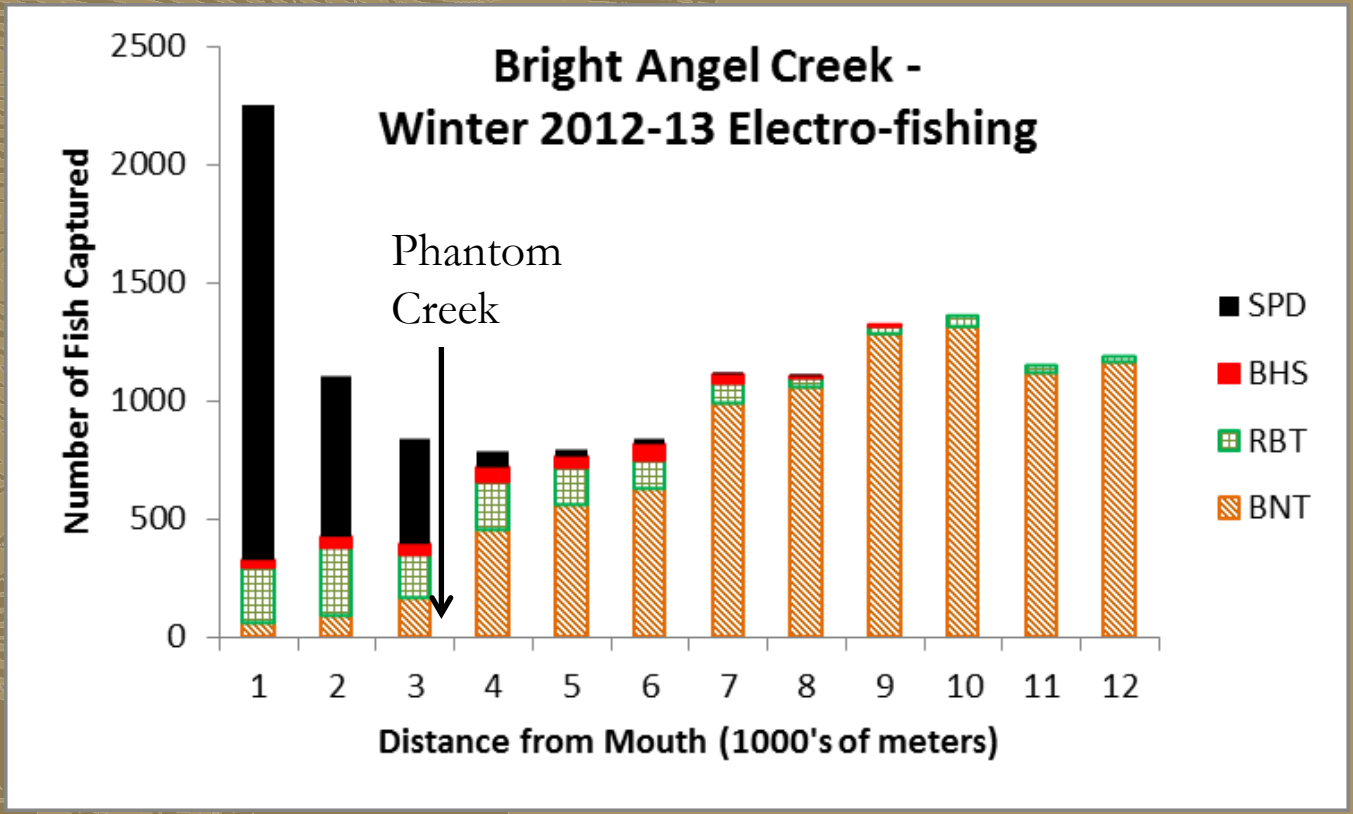


Results – Electro-fishing

- 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

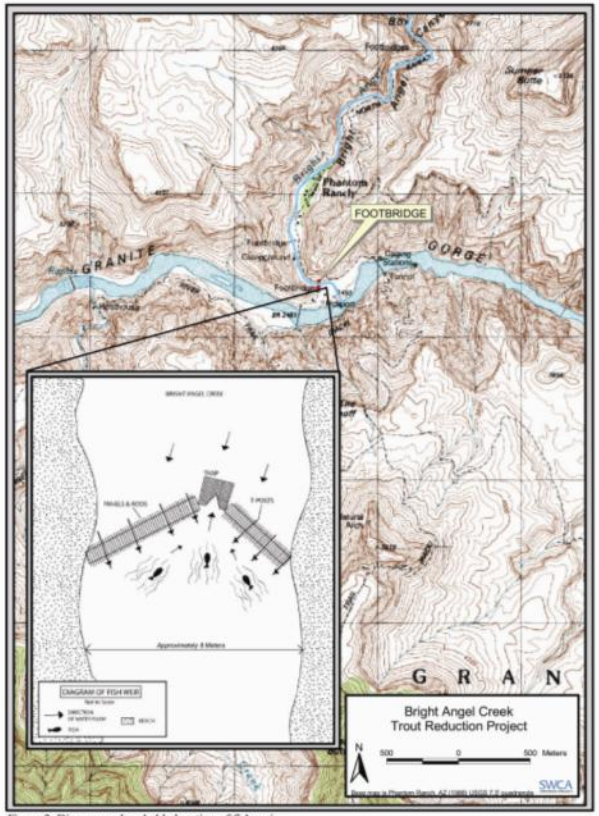


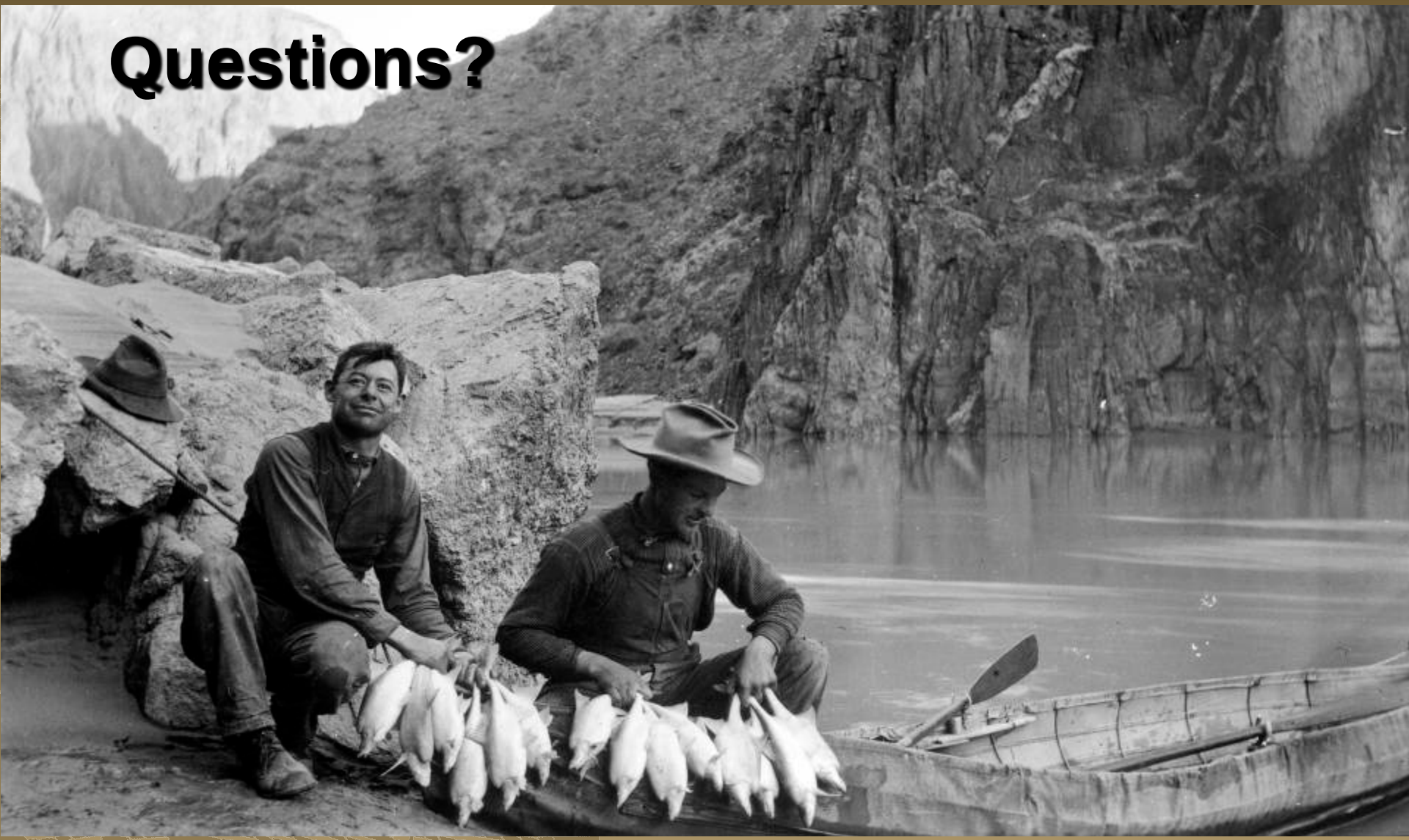
Figure 2. Diagram and probable location of fish weir.

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

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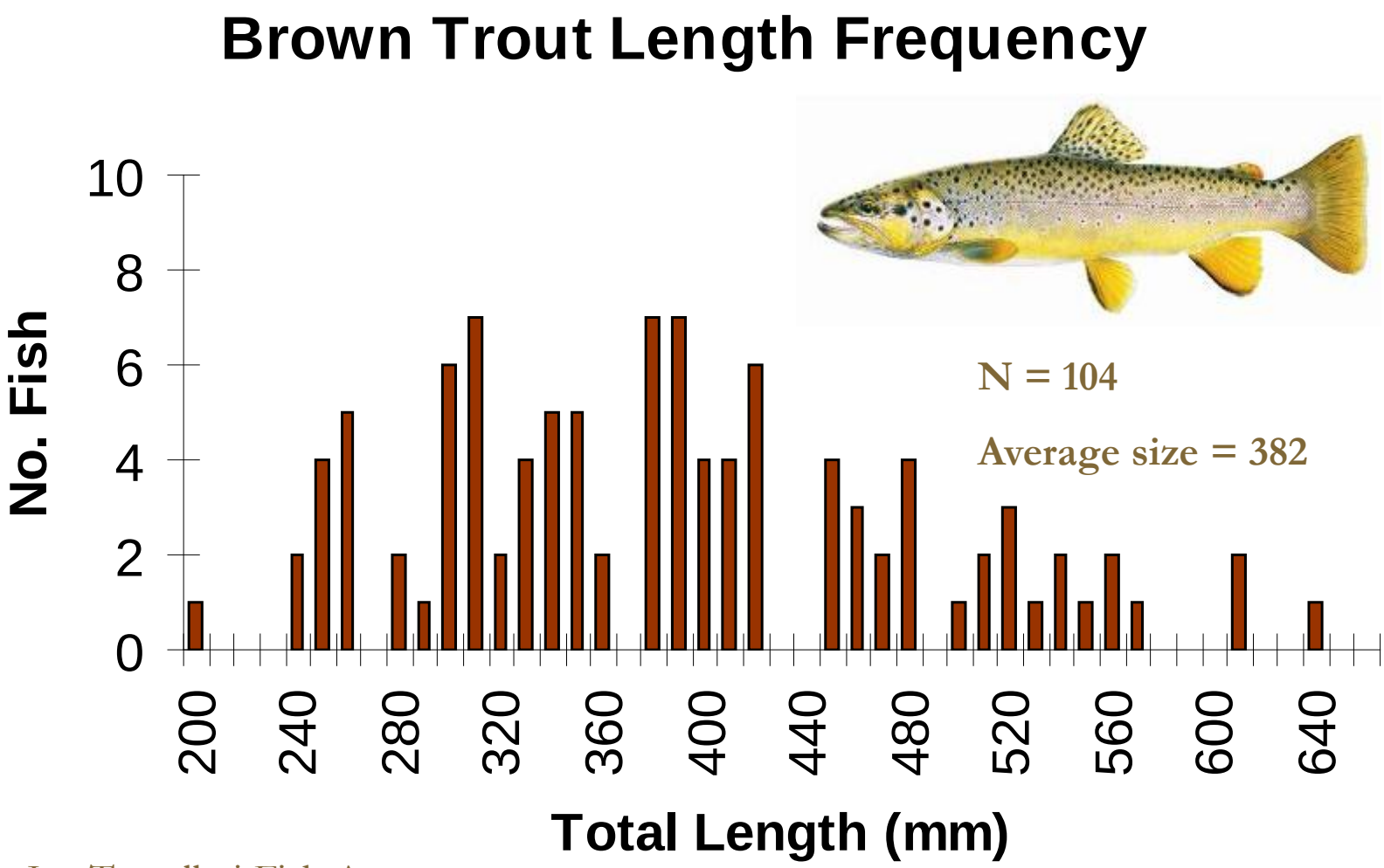
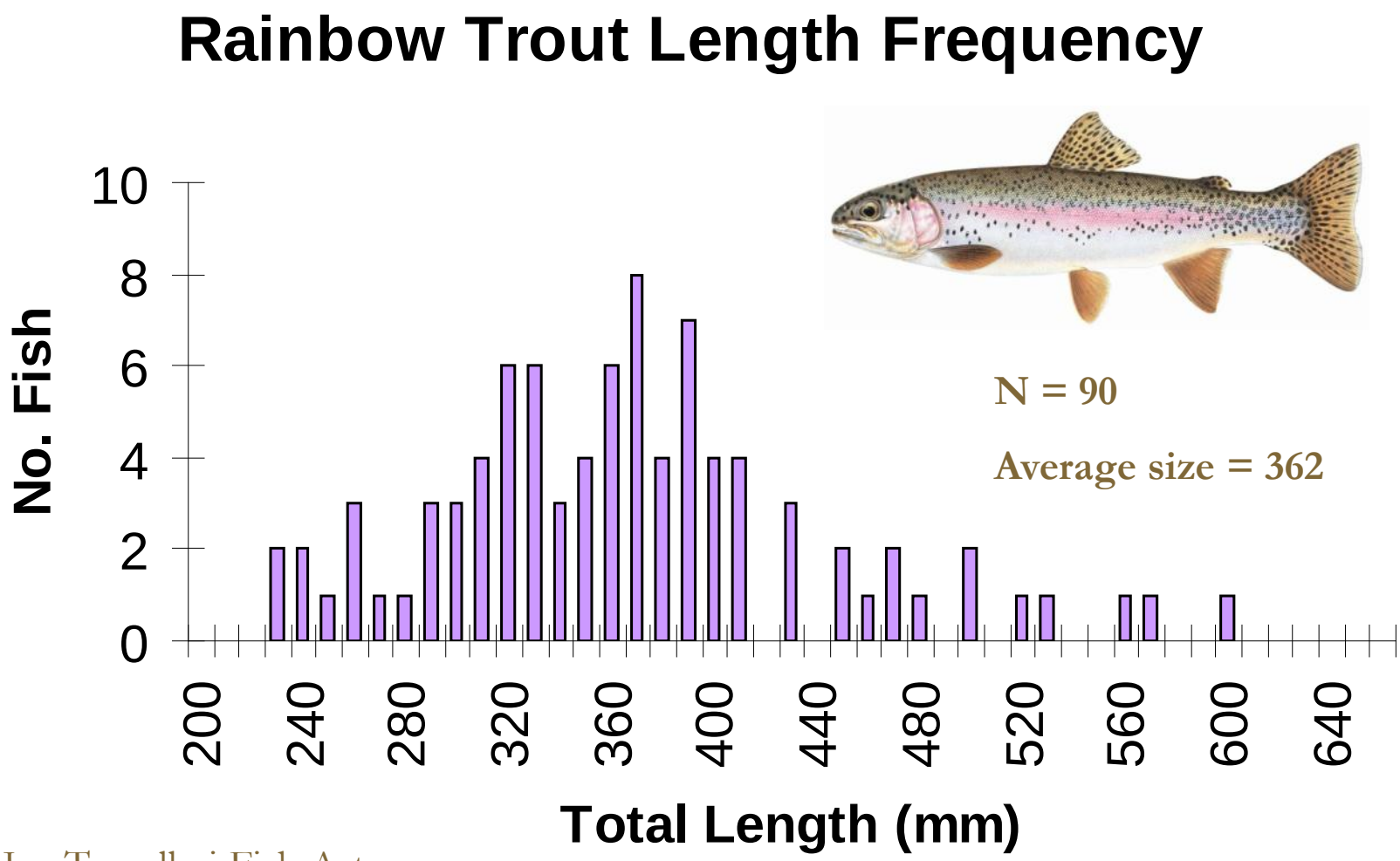
Brown Trout 2010



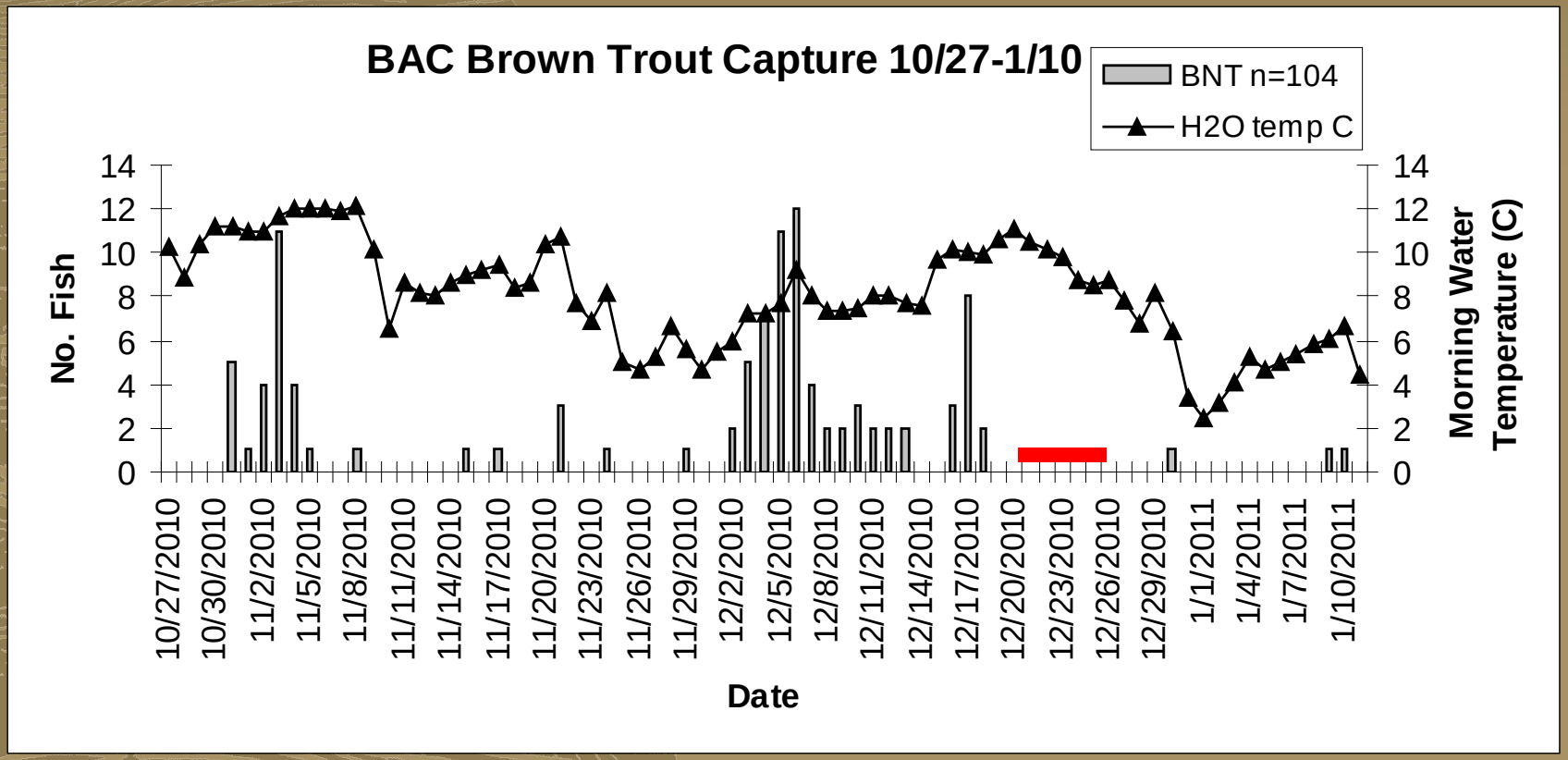
Joe Tomelleri Fish Art

Rainbow Trout 2010

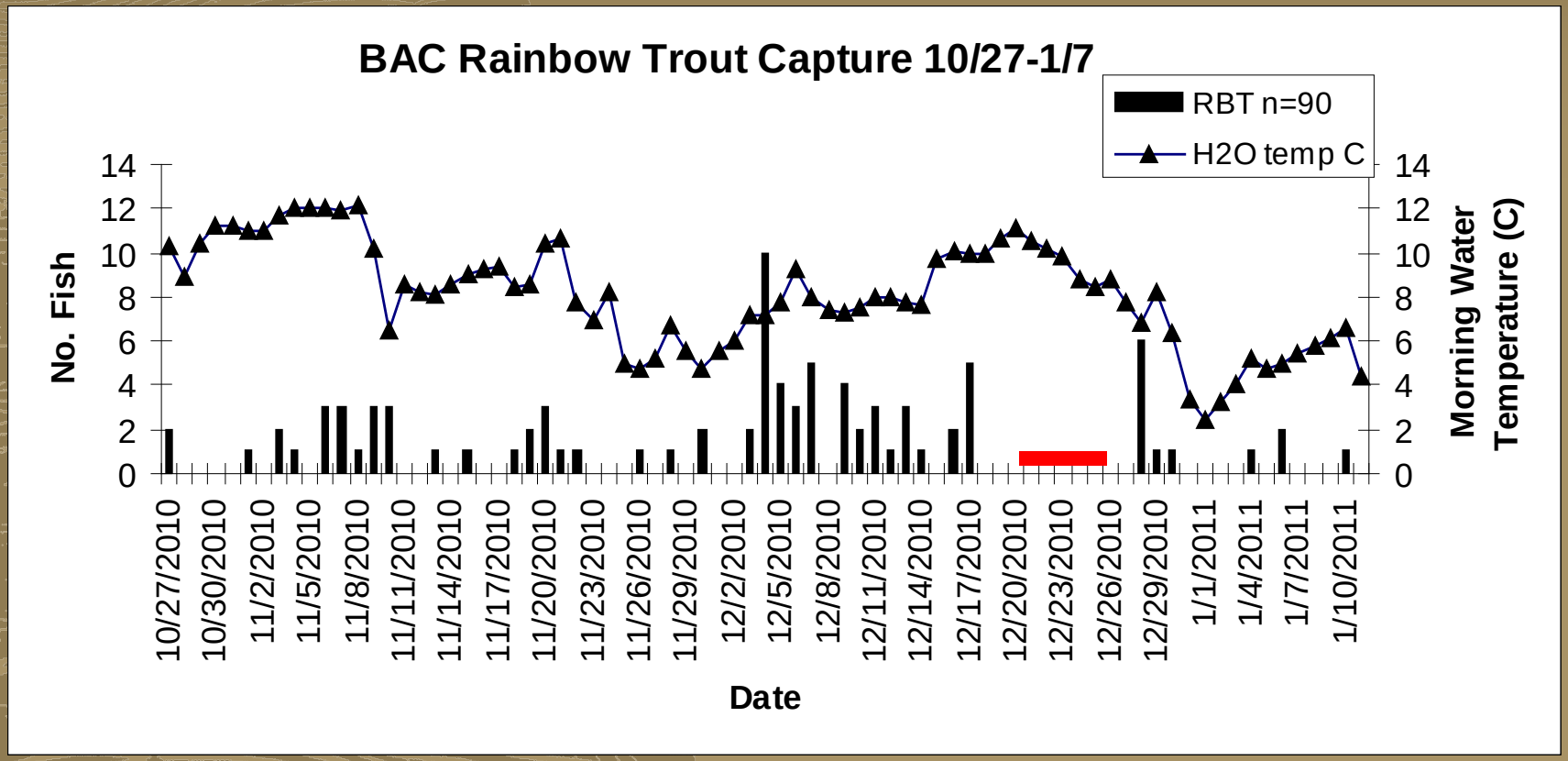


Joe Tomelleri Fish Art

Results – Weir Captures (BNT)



Results – Weir Captures (RBT)

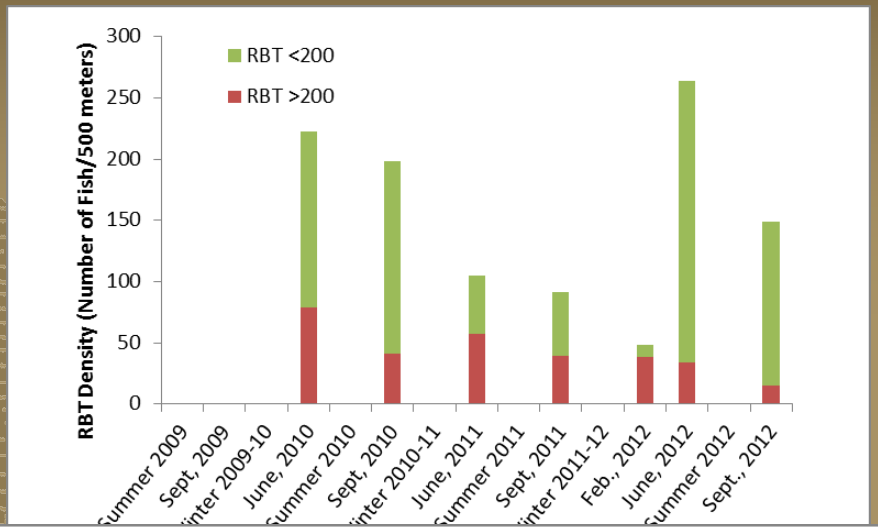
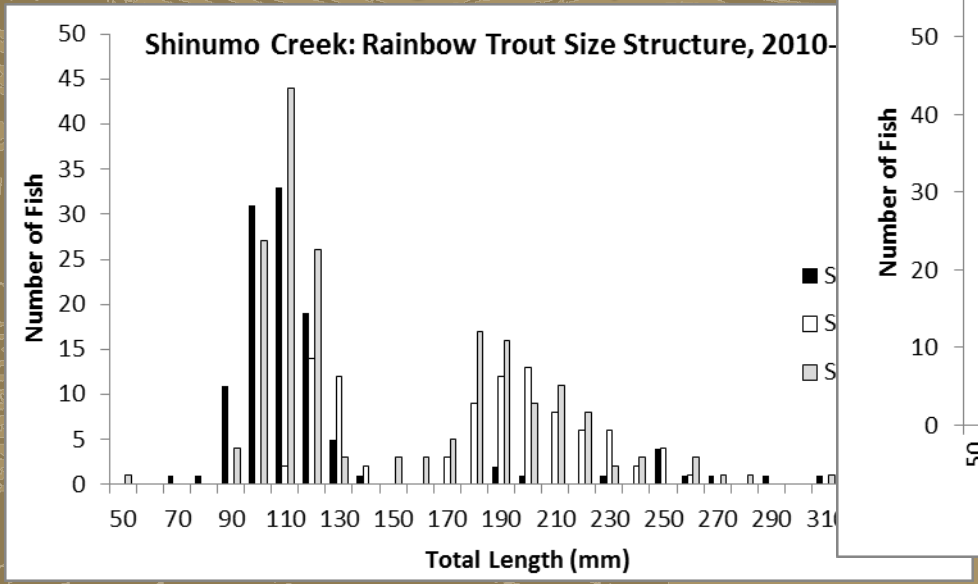
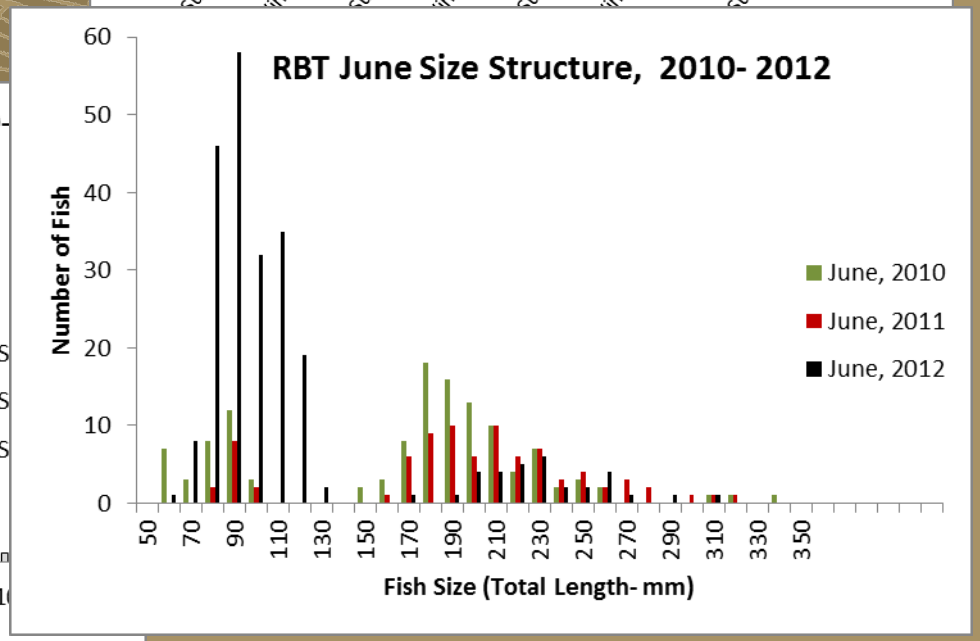


Trout Re-captures

Species	Length (mm)	Tag Number	Date Tagged	Days at Large	Location Tagged (RM)	Initial Length
Brown Trout	390	3D9.1C2D17D301	4/1/2009	582	86.4	367
Brown Trout	330	3D9.1C2D2132F3	4/2/2009	582	88.5	263
Rainbow Trout*		USGS20916	?	?	?	?
Rainbow Trout	**450**	**USGS13283**	**3/30/2009**	**590**	**60.2**	**402**
Rainbow Trout	479	USGS20911	?	?	?	?
Brown Trout	551	3D9.1BF1CD4EDE	5/21/2005	2018	87.4	230
Tag found in 332mm BNT digestive tract		3D9.1C2D8F0483	?	?	?	?
Brown Trout	297	3D9.1BF255F9ED	9/20/2007	1178	82.5	229
Brown Trout	296	3D9.1BF1D12101	?	?	?	?
Brown Trout	480	3D9.1C2D3D9D7D	?	?	?	?
Rainbow Trout	295	USGS12706	?	?	?	?

Rainbow Trout Size Structure

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



- Or histograms (use