Non-Native Mechanical Removal Operations in the Colorado River: *Update and a Proposed Modification*

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Presentation Outline

- Background
- Field Operations
- Preliminary Results
- Proposed Modification and Justification

Objectives – What do we want to Accomplish?

- Effect of Adult RBT and BNT in the LCR Inflow Reach on the Population Dynamics of the LCR HBC Population.
  - Will humpback chub recruitment increase as a result of non-native removal?
- Efficacy of Mechanical Removal of Adult RBT and BNT from the LCR Inflow Reach.
  - To what extent can we remove non-native fishes from a ~10 mile stretch of the Colorado River?
- Rainbow and Brown Trout Diet Analysis and Predation.
  - What are non-native fish eating? How many natives?

16 Year Experimental Plan

Year	Mechanical Removal	Fluctuating Flows	Temperature Control Device
1	XXX	XXX	
2	XXX	XXX	
3	XXX		
4	XXX		
5		XXX	
6		XXX	
7			
8			
9	XXX	XXX	XXX???
10	XXX	XXX	XXX???
11	XXX		XXX???
12	XXX		XXX???
13		XXX	XXX???
14		XXX	XXX???
15			XXX???
16			XXX???

Mechanical Removal Trips

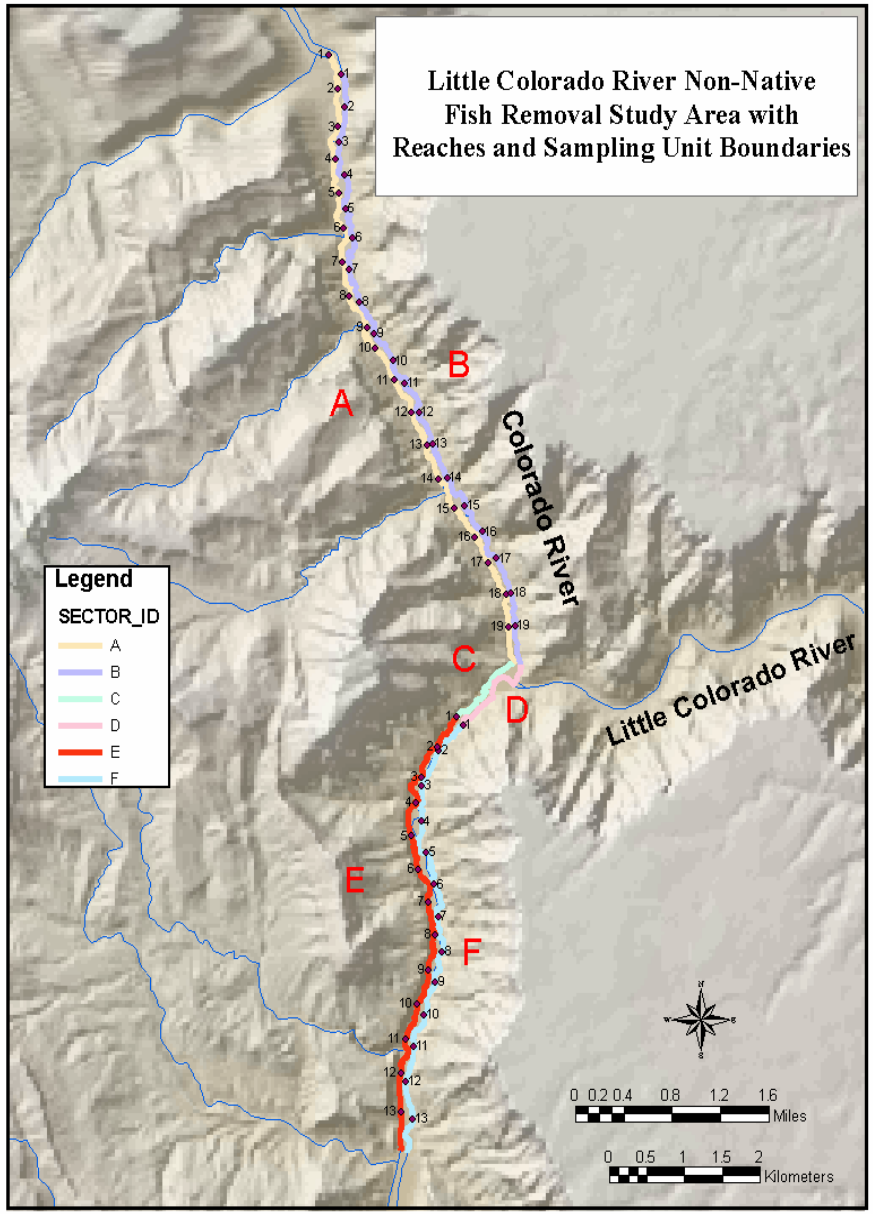
- 6 trips per year (Jan, Feb, Mar, Jul, Aug, Sep) for 4 years.
- This design will allow:
  - Estimation of initial trip abundance for the entire LCR Inflow Reach and cumulative reduction of non-native fish overtime.
  - Estimation of immigration rate into the removal reach between trips.

Control Reach Field Operations –Day 1&2

- Control Reach (RM 44-52)
  - Purpose is to evaluate changes in trout abundance and size distribution that are a result of factors other than mechanical removal (e.g. fluctuating flows)
  - Each trip, 24 500m sampling units are randomly selected and electrofished to estimate catch-rate.
  - All RBT and BNT >= 200mm are fitted with a flow tag to assess movement and estimate abundance.

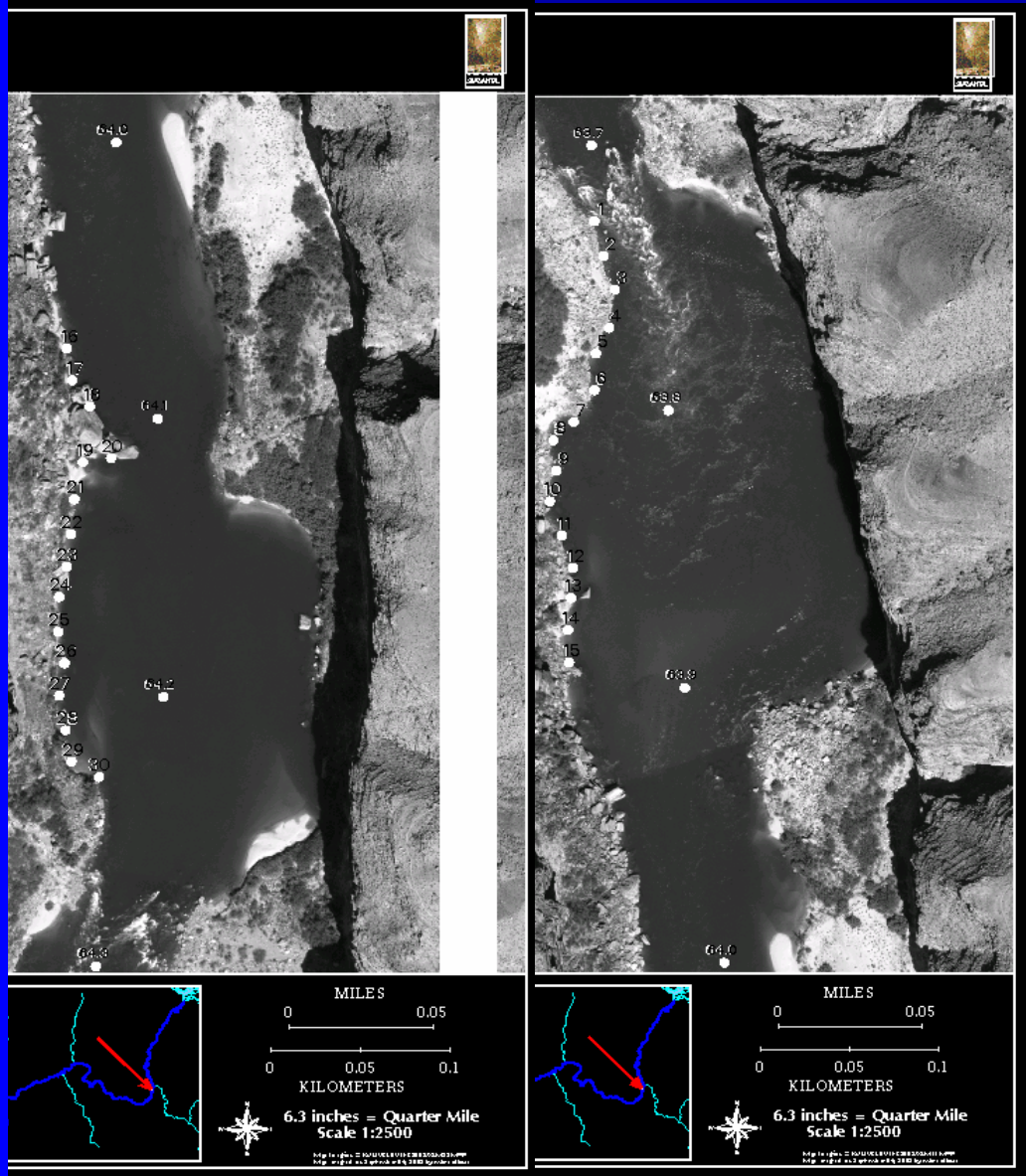
Mechanical Removal Field Operations – Day 3-13

- Camp within the removal reach for 11 days
- 5 pass depletion between RM 56.2 – 65.7
- Each depletion pass takes 2 days
  - Day 1: Kwagunt to above 60 mile rapid and below LCR confluence to below Salt Mine
  - Day 2: Above 60 mile to Science Beach and below Salt Mine to Lava Chuar



Field Operations - Hoopnetting

- Hoopnetting provides relative abundance estimates for juvenile HBC and other natives.
- Sampling conducted at 30 sites ~ 2 miles downstream from the LCR Confluence.



Field Operations - Diet Analysis

- All non-native fishes captured in the removal reach have there stomach removed and preserved for later analysis.
- Two types of diet analysis will be performed:
  - Presence/absence of fish remains in stomachs.
  - Detailed analysis of diet of a sub-sample of rainbow trout and brown trout.
- Analyses for winter trips will be completed by mid-summer.

Field Operations - Fish Disposal

- Fish Disposal and Use
  - Carcasses are disposed of by grinding them into a paste and placing them in 15 gal plastic barrels.

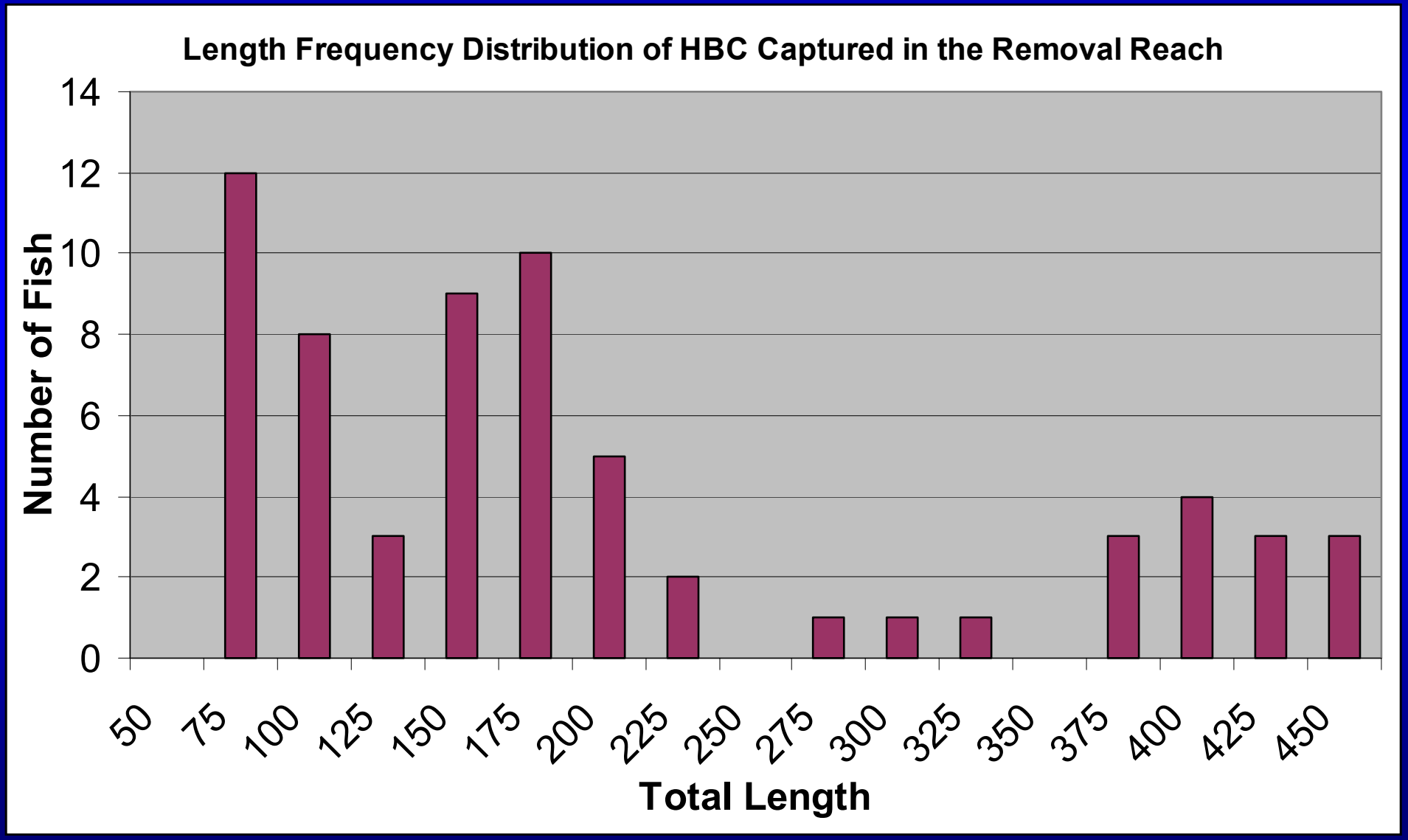
Field Operations - Fish Disposal

- Fish Disposal and Use
  - At the takeout, the barrels are delivered to a representative of the Hualapai Nation for use as fertilizer.

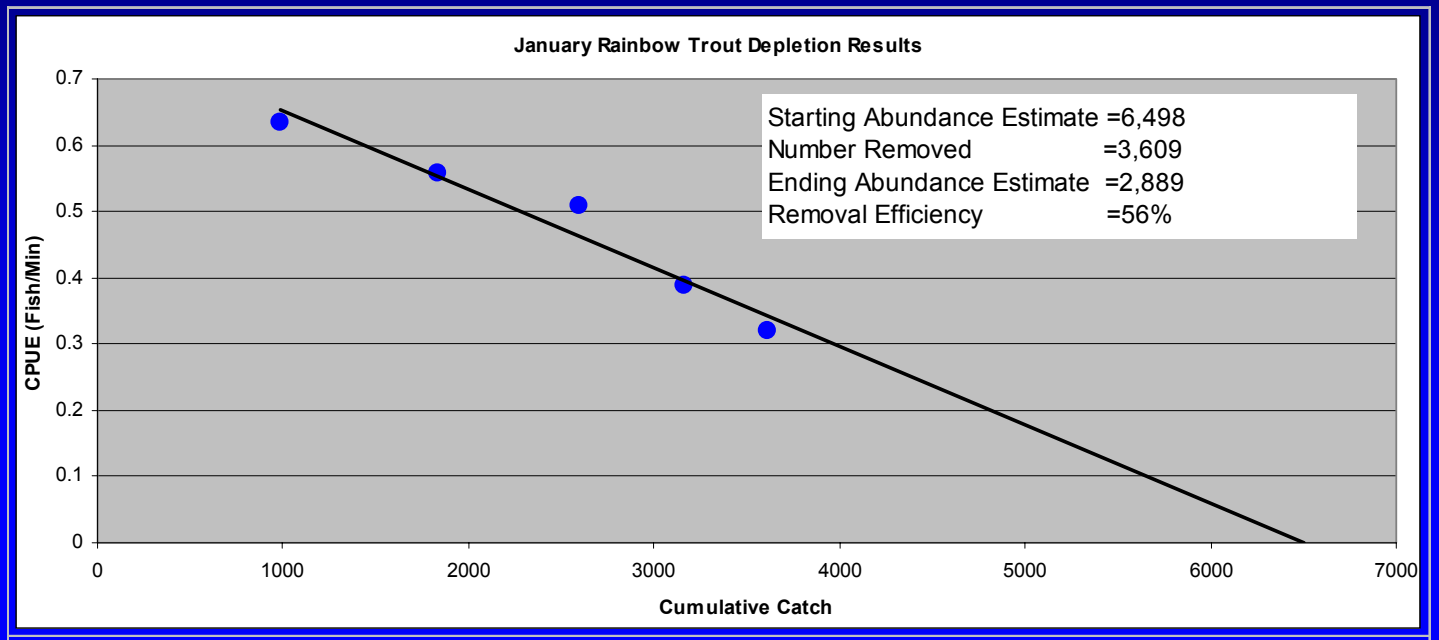
Preliminary Results – Removal Reach Catch

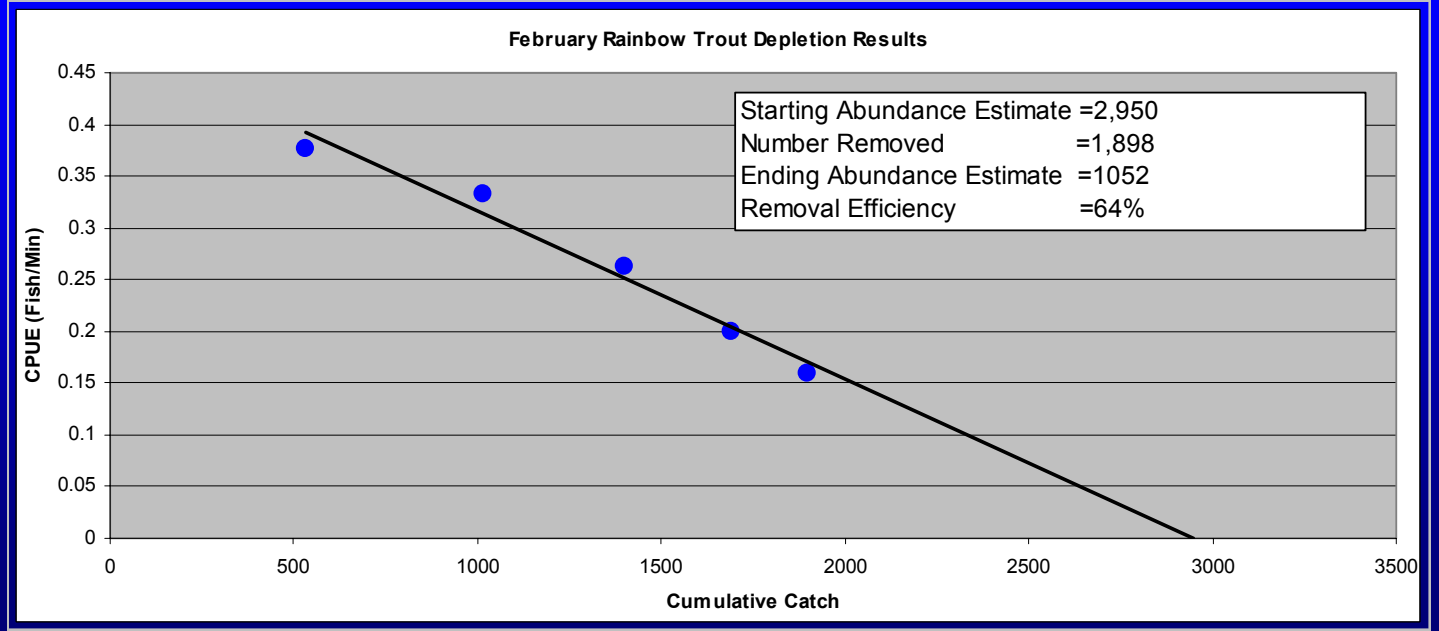
	SPECIES										
Trip	Bluehead Sucker	Brown Trout	Channel Catfish	Common Carp	Fathead Minnow	Flannelmouth Sucker	Humpback Chub	Rainbow Trout	Speckled Dace	Other	Grand Total
January	8	86		80	17	185	26	3609	7	3	4021
February	18	24		33	21	156	26	1898	2	1	2179
March	11	20	1	22	8	89	13	1196	8	5	1373
Total	37	130	1	135	46	430	65	6703	17	9	7573

Preliminary Results – Removal Reach HBC Length Frequency



Preliminary Results – Removal Reach RBT Abundance Estimates





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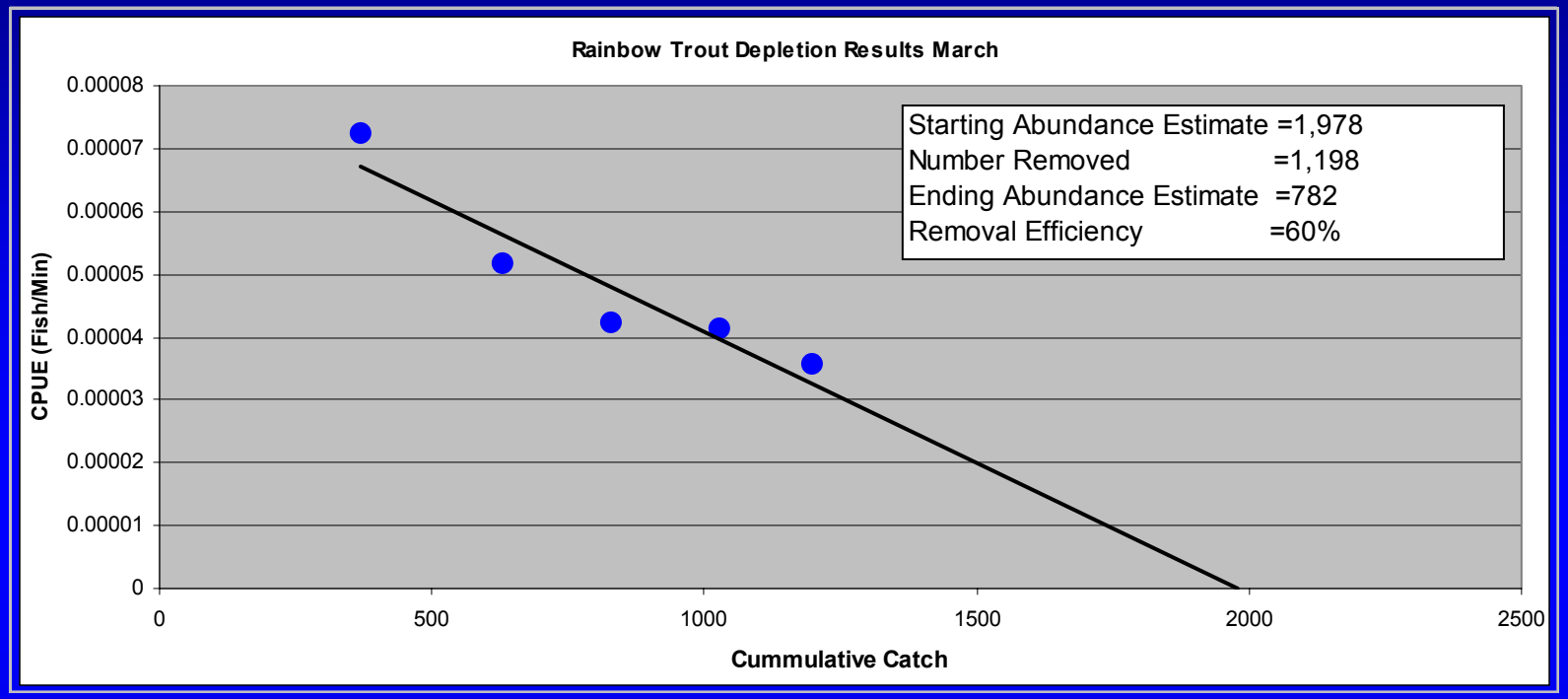
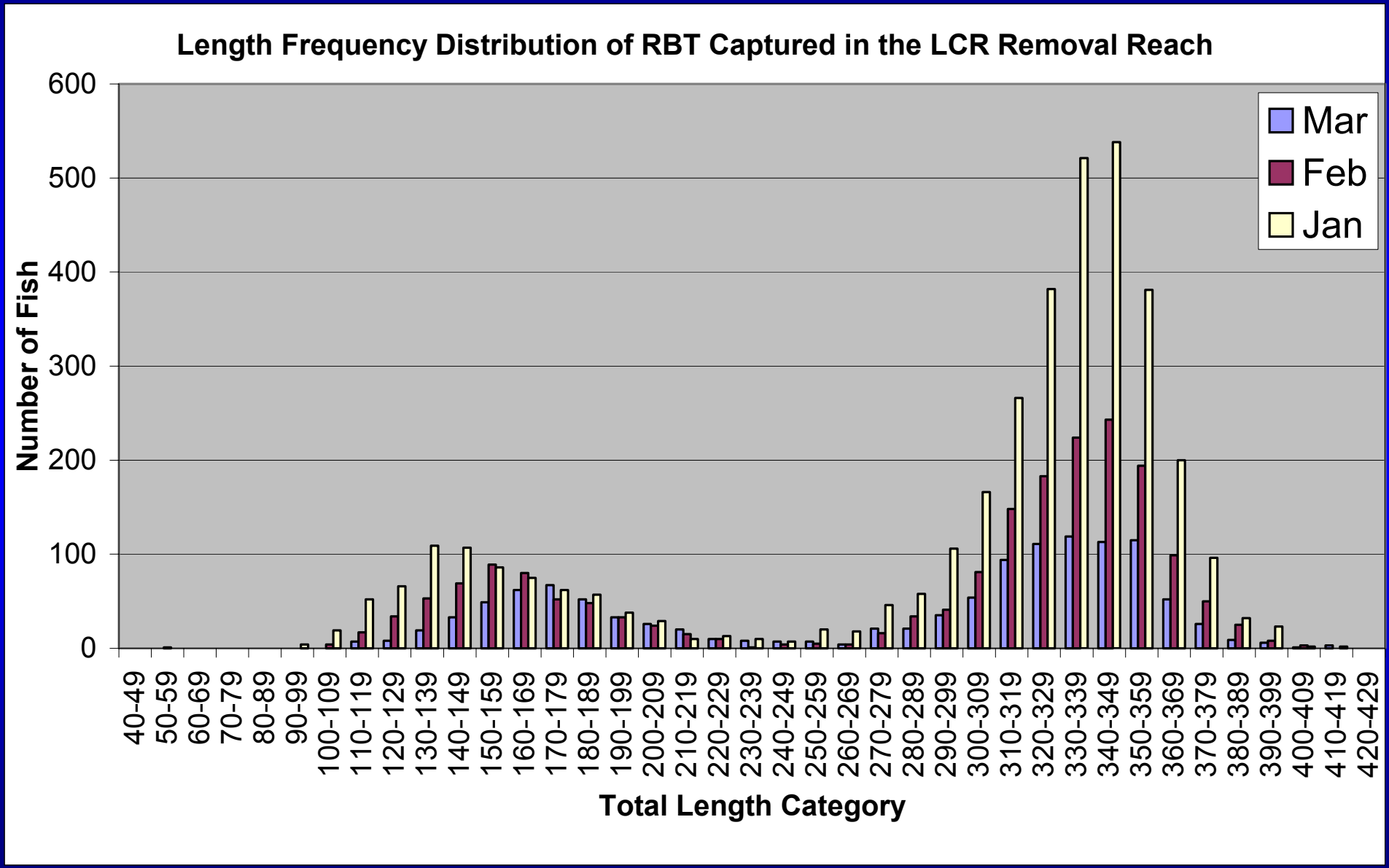


Ending abundance estimate in March is 12% of starting abundance estimate in January.

Preliminary Results – Removal Reach RBT Length Frequency



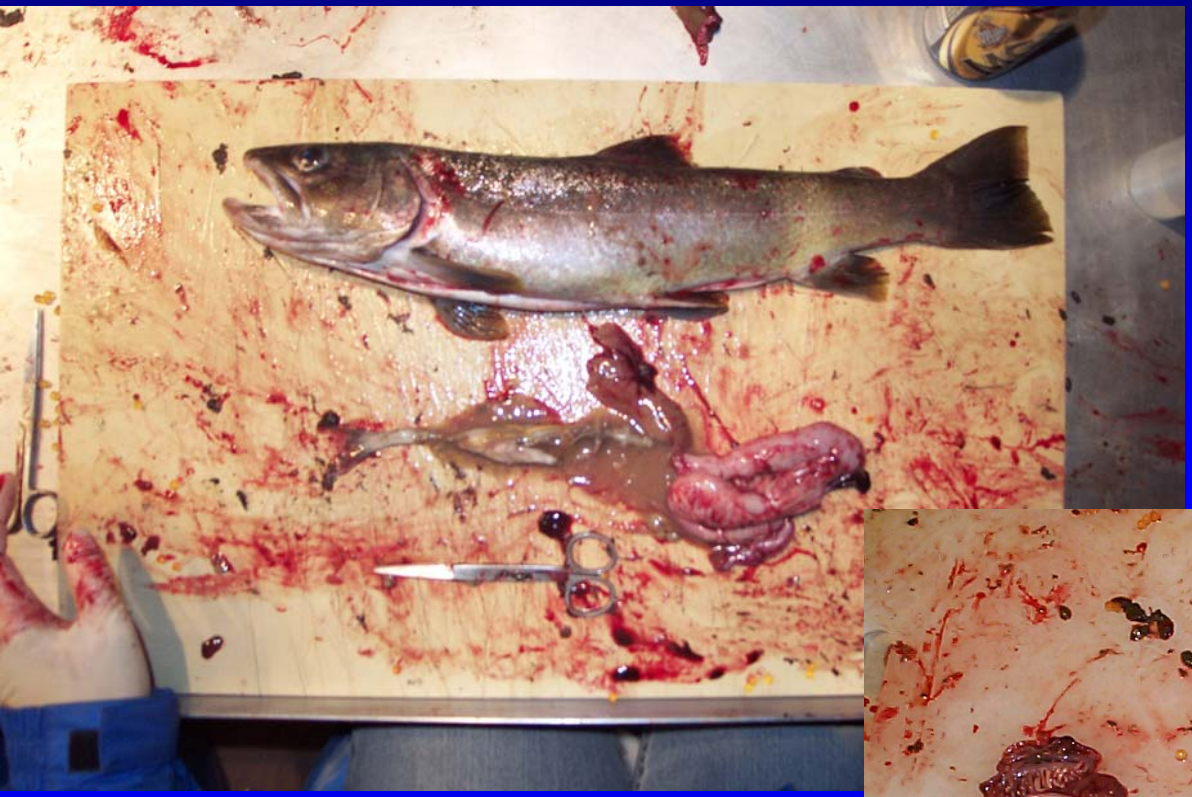
Preliminary Results – Movement of Floy Tagged Rainbow Trout

N=1,323

Tag Location	Recap Location	Tag Date	Recap Date	Distance Moved	Elapsed Time
46 mile	61.5 mile	1/15/2003	1/25/2003	15.5 miles	10 days
50 mile	57.5 mile	2/13/2003	2/16/2003	7.5 miles	3 days
48.5 mile	65.7 mile	2/13/2003	2/23/2003	17.2 miles	10 days
49 mile	56.2 mile	2/13/2003	2/16/2003	7.2 miles	3 days
50 mile	56.2 mile	2/13/2003	3/5/2003	6.2 miles	20 days
46.5 mile	58.5 mile	1/16/2003	3/12/2003	12 miles	55 days
51.1 mile	59.5 mile	3/10/2003	3/18/2003	8.4 miles	8 days
41 mile	59.5 mile	3/10/2003	3/18/2003	18.5 miles	8 days

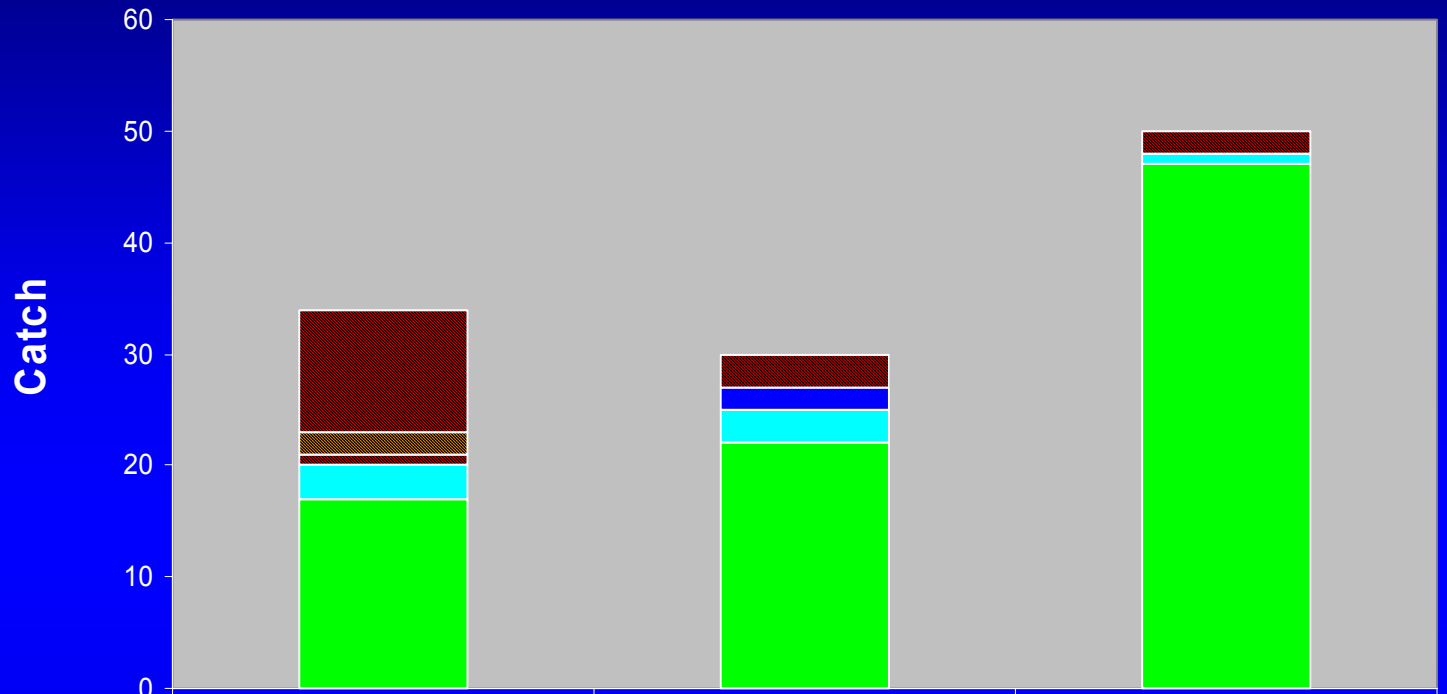
First fish was a rainbow trout 15 inches long and had a 3.5 inch long flannelmouth sucker lodged in it's mouth.

Preliminary Results – Predation



Preliminary Results – Predation

Preliminary Results – Hoopnet Catch Below The LCR



	Jan	Feb	Mar
Rainbow Trout	11	3	2
Brown Trout	2	0	0
Fathead Minnow	1	0	0
Bluehead Sucker	0	2	0
Flannelmouth Sucker	3	3	1
Humpback Chub	17	22	47

Preliminary Results – Summary

- Non-native removal efforts appear to be much more effective than anticipated (88% reduction after 3 trips).
  - Previous abundance estimates of RBT in the LCR inflow area seem to have over-estimated abundance by an order of magnitude (ADFG 2001).
  - Immigration rates to the removal reach appear to be quite small based on between trip comparisons and AGFD spring monitoring (pending results of July Trip).
- Diet analyses still ongoing but results thus far indicate low rate of piscivory by RBT and high rate of piscivory by BNT.
- Hoopnet catches of HBC may indicate a habitat/survival response by HBC following non-native removal.
- Suggest defining a target treatment level of 10% initial abundance to serve as trigger to postpone robust mechanical removal operations until next evaluation trip (i.e. January or July).

Presentation Outline

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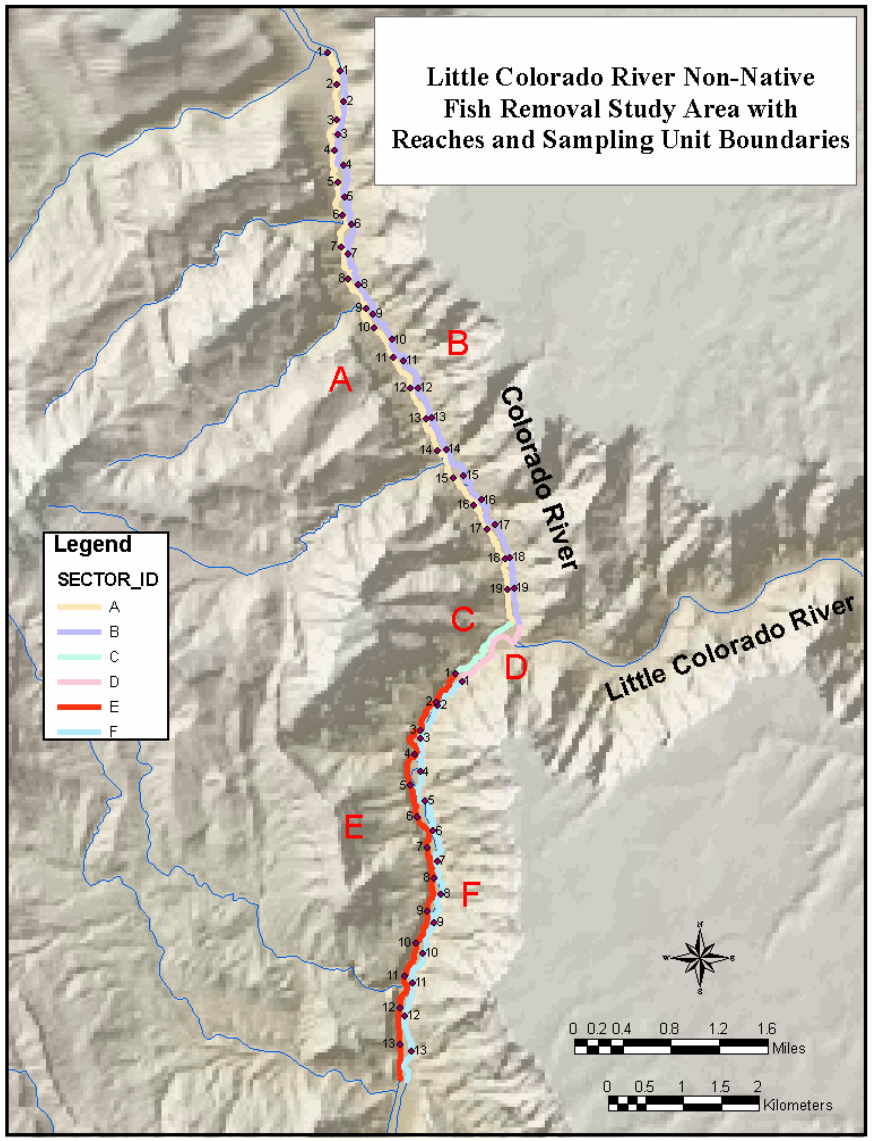
Proposed Modification

- Prompted by the greater than expected efficacy of non-native removal, we suggest expanding the geographic scope of removal area downstream an additional 7 miles.
  - Allow for a greater treatment magnitude.
  - Potentially result in greater ability to detect change in HBC population dynamics as a result of non-native removal.
  - Additional HBC monitoring opportunities.

Proposed Modification

Original



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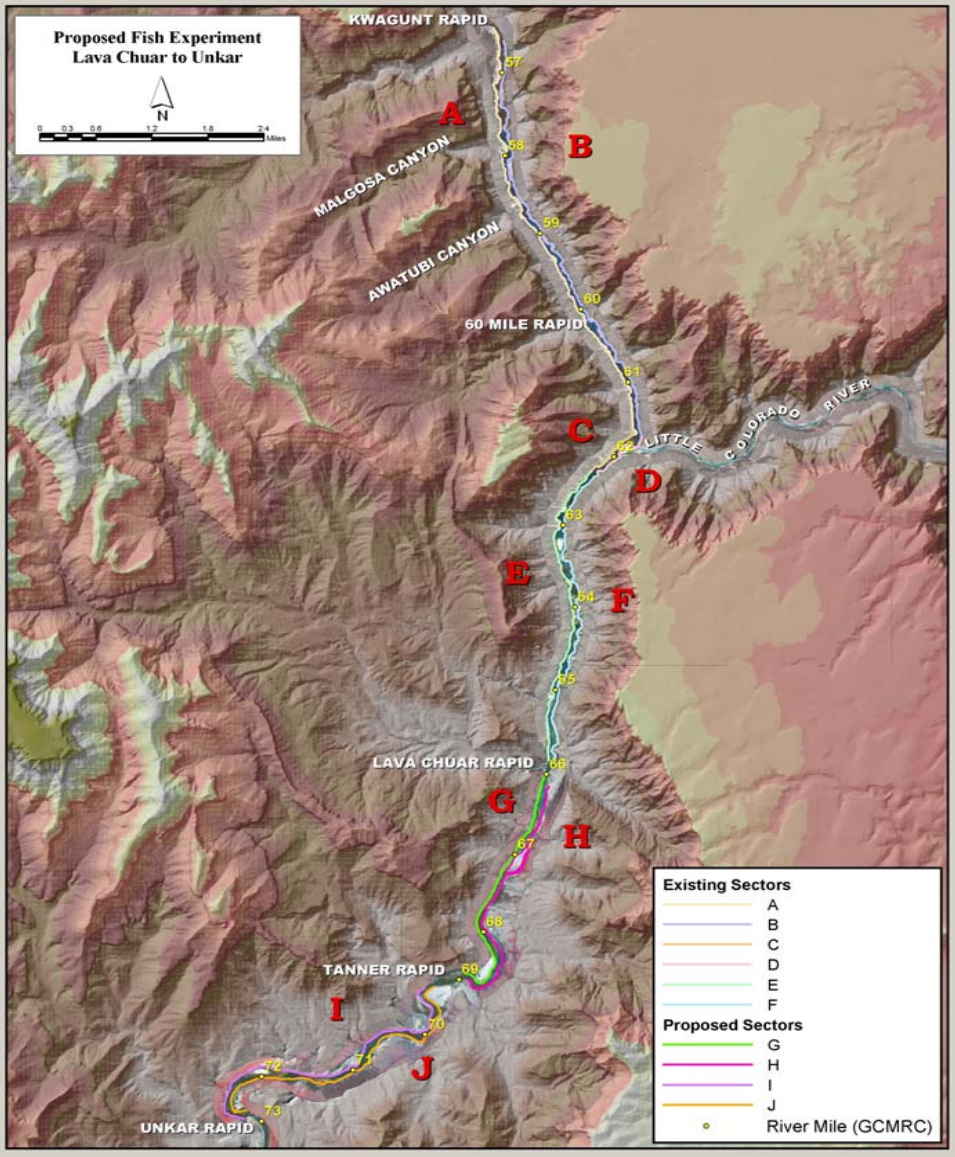

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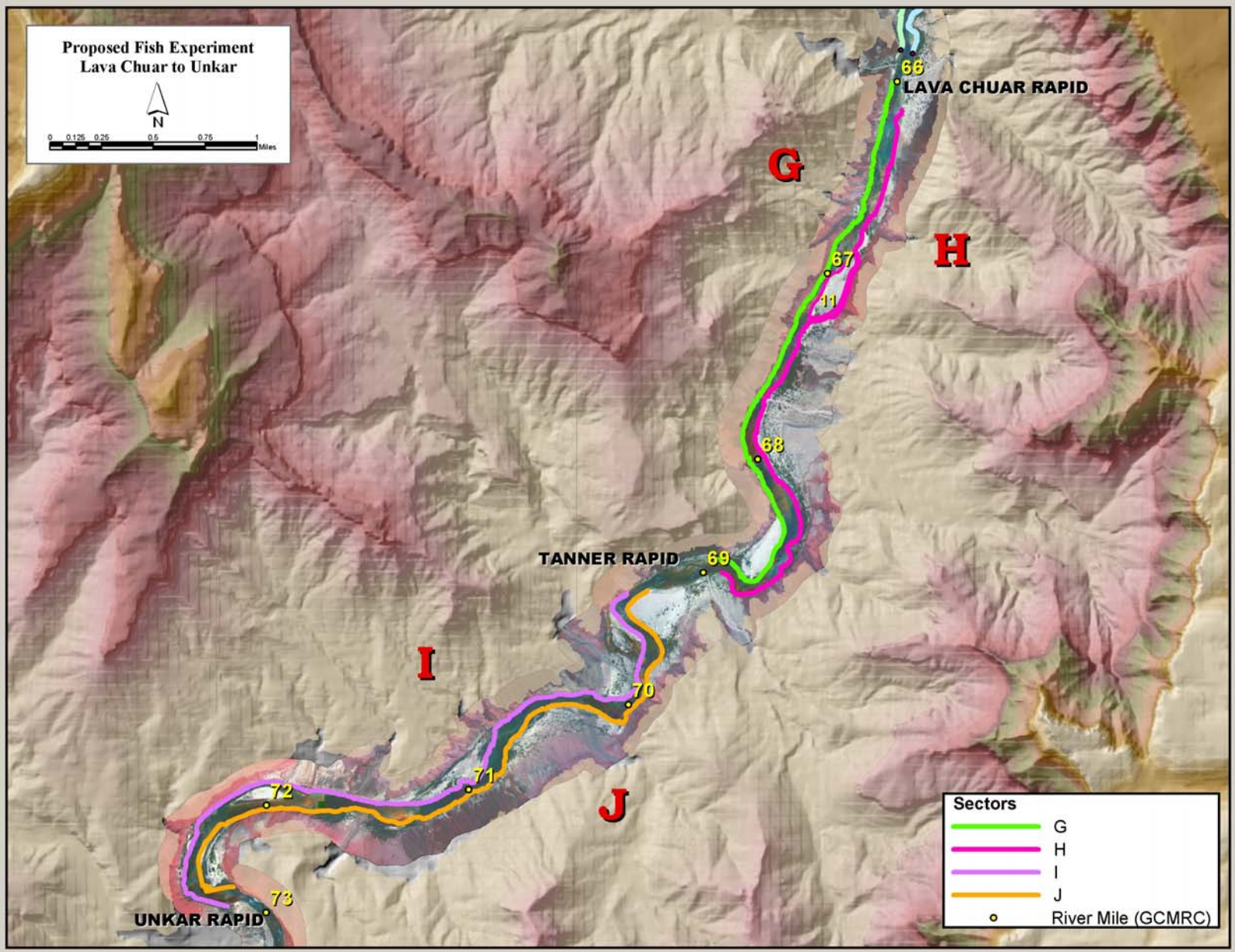
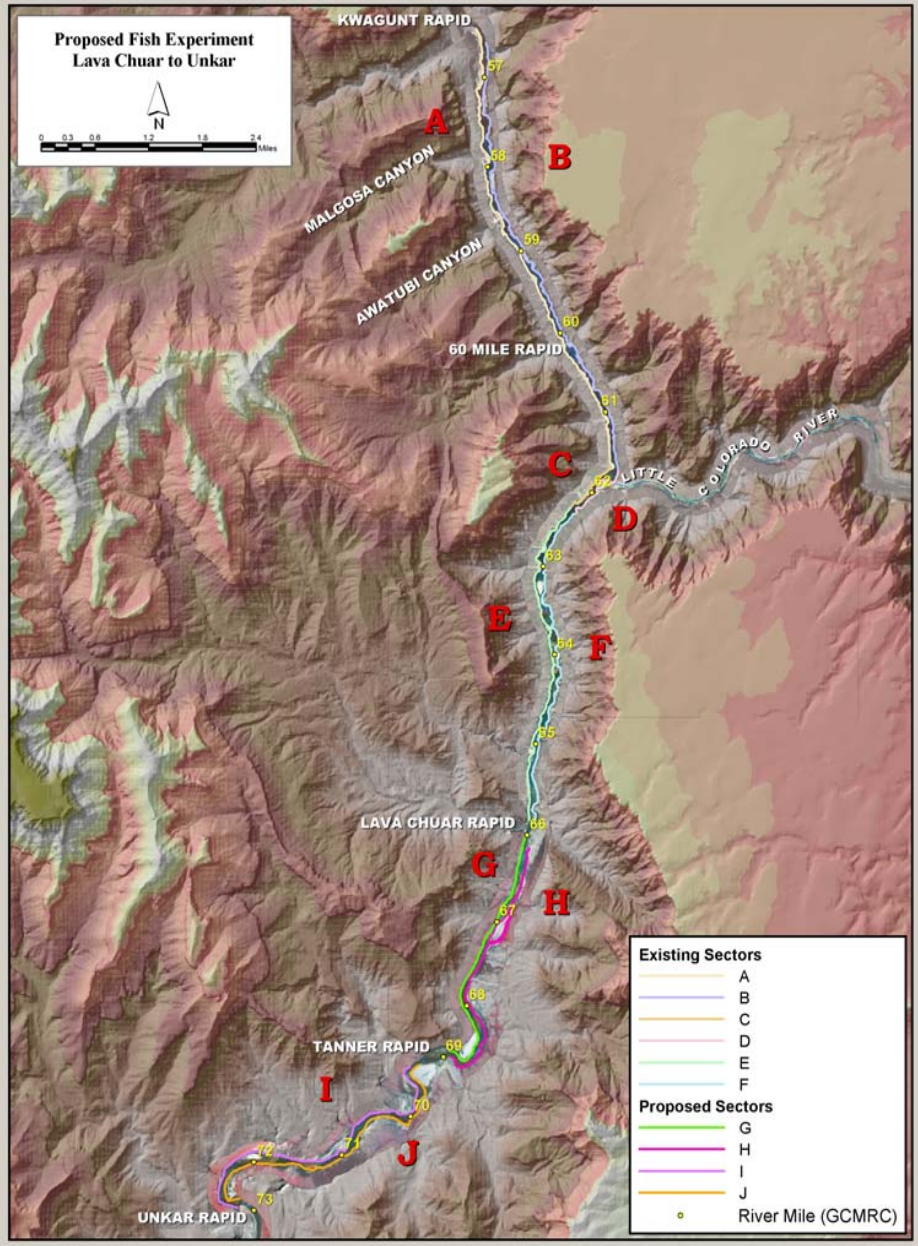


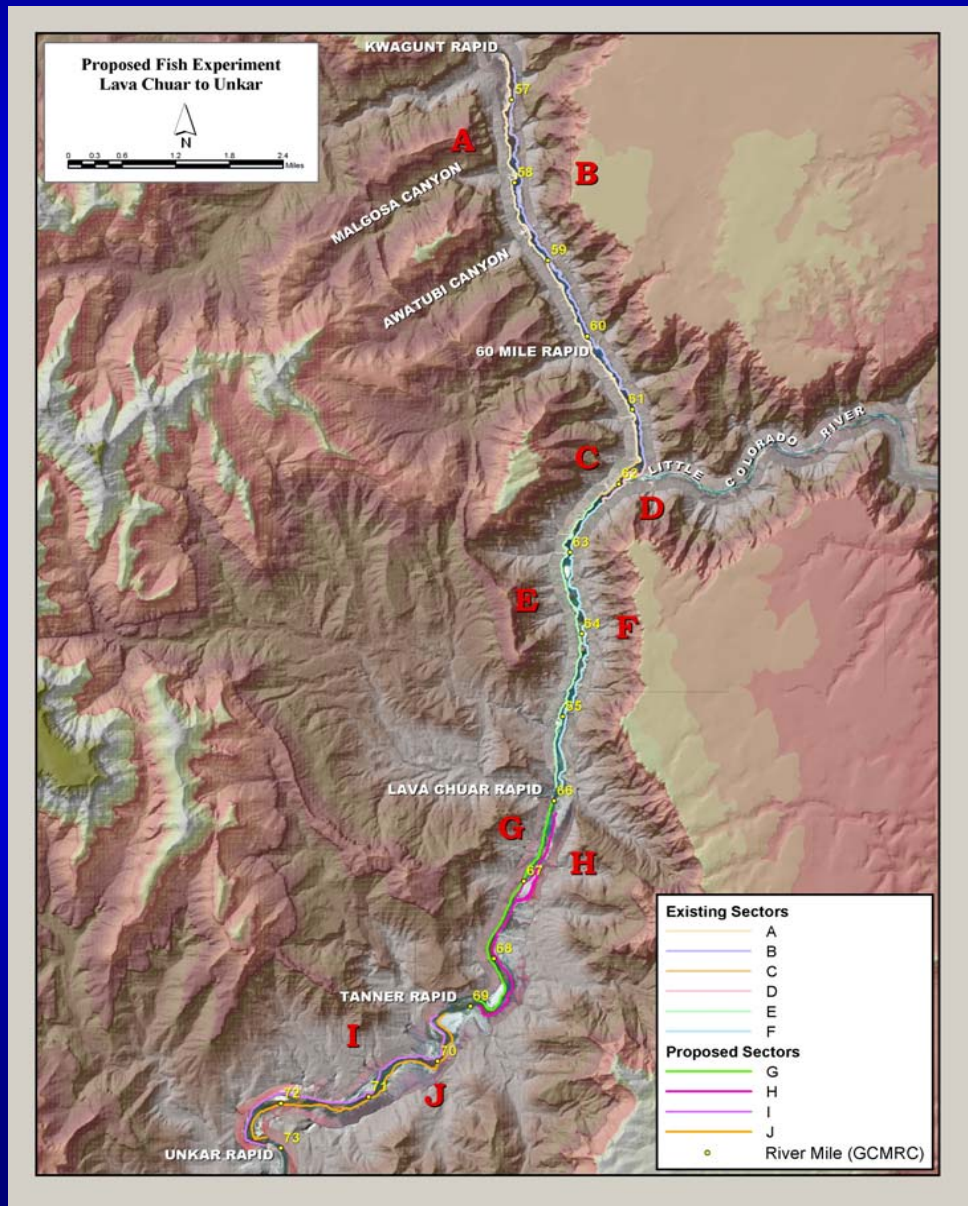
Proposed Modification – Why??

- The motivation to modify the study is to increase the magnitude of the treatment in order to have the best chance of obtaining an unambiguous experimental result.
- Why will this help?
  - Will affect a larger portion of the area where HBC and non-natives are believed to interact (Greater treatment magnitude, increased survival of juveniles).
  - Will potentially provide a greater likelihood that the HBC stock assessment program will detect a change.
  - Will allow a more robust (time and area) sampling program of relative abundance (hoopnetting).



We will affect a larger portion of the area where HBC and non-natives are believed to interact (increased survival of juveniles).

- Current paradigm of LCR HBC juvenile recruitment is:
  - Larval HBC emerge in the late Spring-early Summer.
  - Some proportion of the juveniles rear in the LCR, the rest move to the mainstem Colorado (YOY during monsoon, 1+ juveniles during spring runoff).
  - Most if not all of the juvenile HBC transported to the mainstem do not survive. Majority of recruitment coming from LCR rearing.



Will affect a larger portion of the area where HBC and non-natives are believed to interact (increased survival of juveniles).

- Key supporting observations
  - Juvenile HBC abundance declines with distance from the LCR Confluence and time since last LCR flood (Valdez and Ryel 1995).

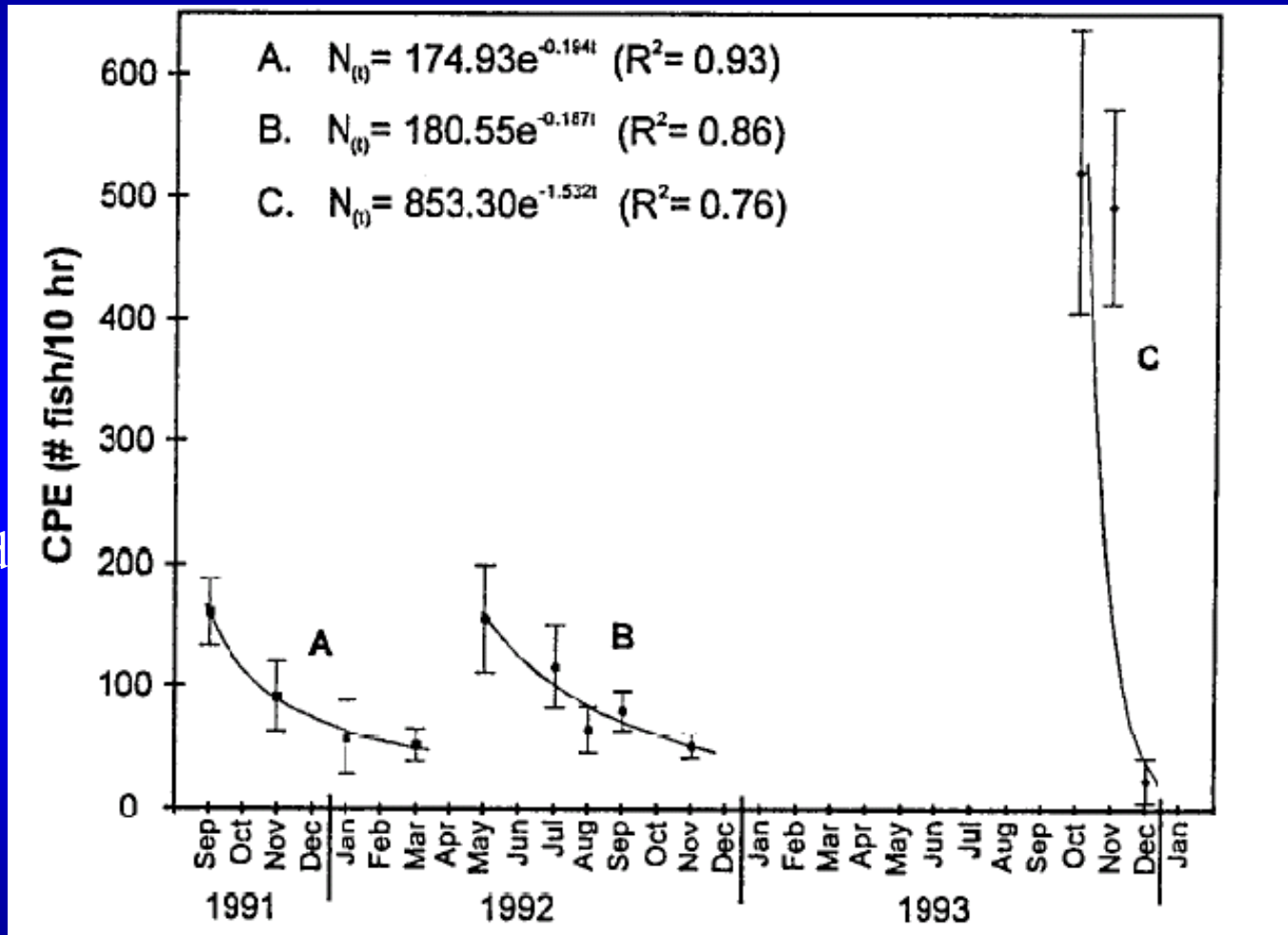
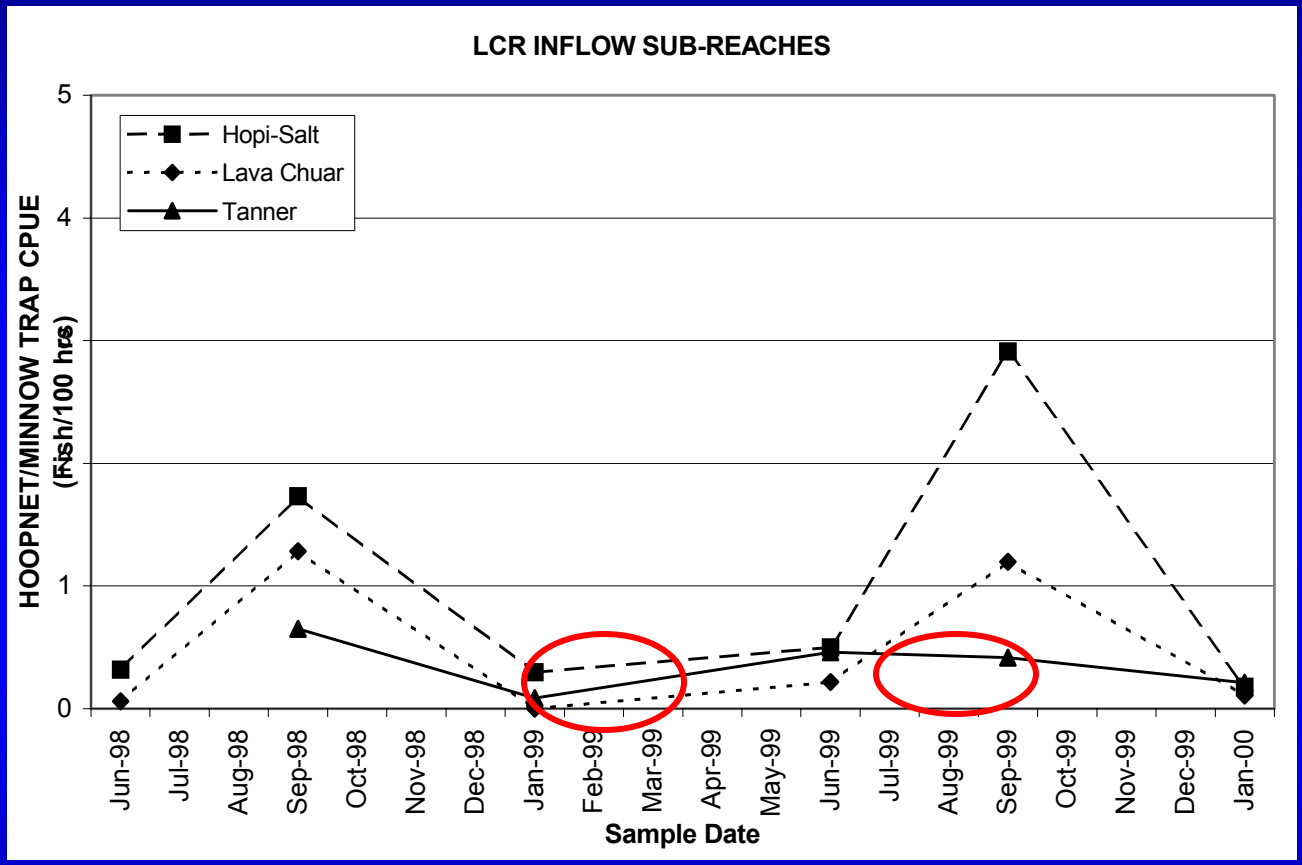


Fig. 6-12. Exponential decreases in densities of subadult humpback chub in the mainstem Colorado River from the LCR (RM 61.3) to Lava Canyon (RM 65.4) for September 1991 through March 1992 (A), May through November 1992 (B), and September through November 1993 (C).

Will affect a larger portion of the area where HBC and non-natives are believed to interact (increased survival of juveniles).

- Key supporting observations
  - USFWS hoopnetting efforts regularly detected juvenile HBC near Tanner Rapid, but in lower abundance than closer to the LCR confluence (Gorman et al 2000).



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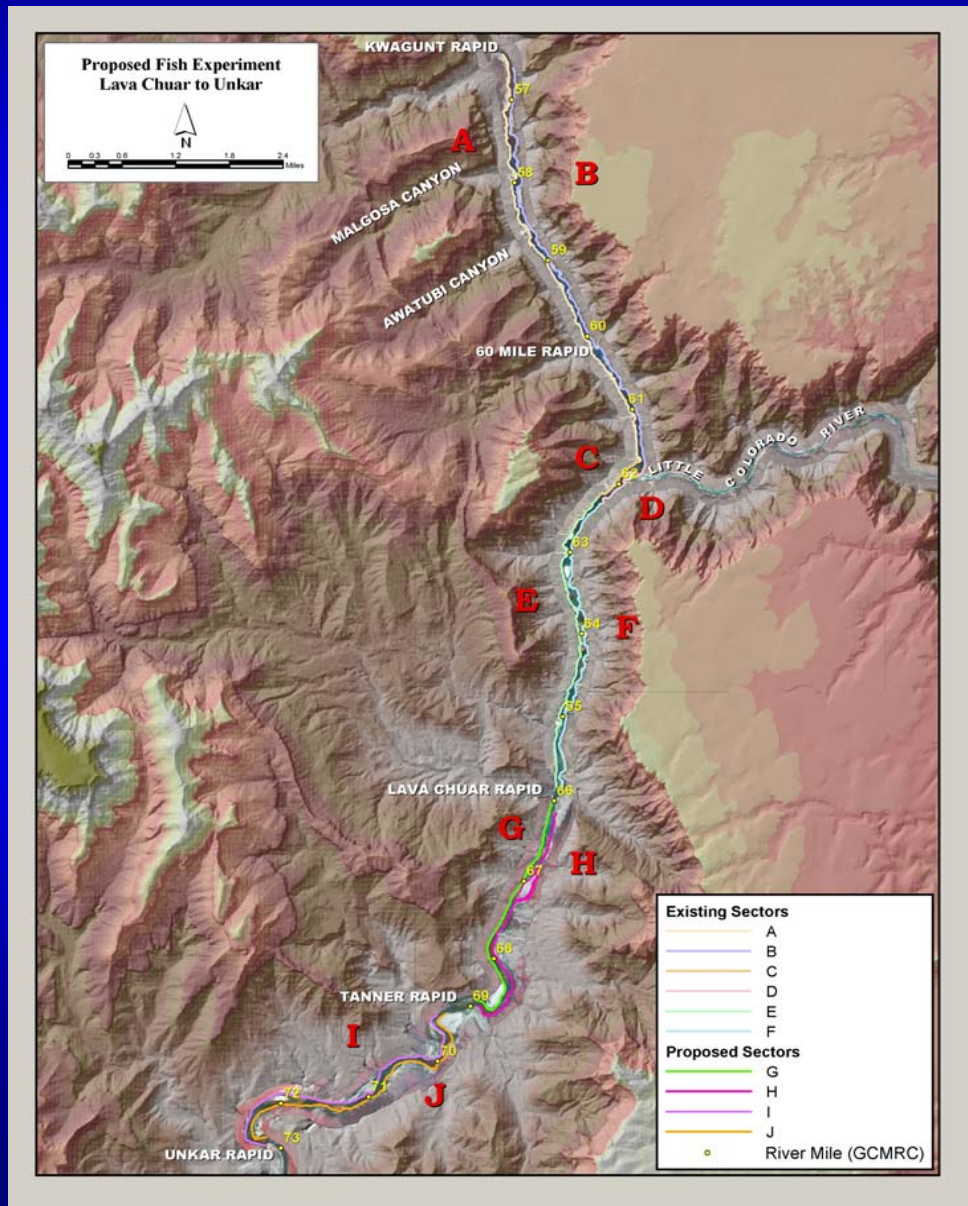
- Why are there fewer HBC juveniles below Lava Chuar?
  - Above Palisades Fault, slower, bigger eddy complexes, talus.
  - Below the Palisades Fault, river is shallower, faster, cobbles.
  - Below Palisades Fault, non-native abundance increases.
  - Are juvenile HBC less abundant below Palisades Fault because of habitat or cumulative predation response?



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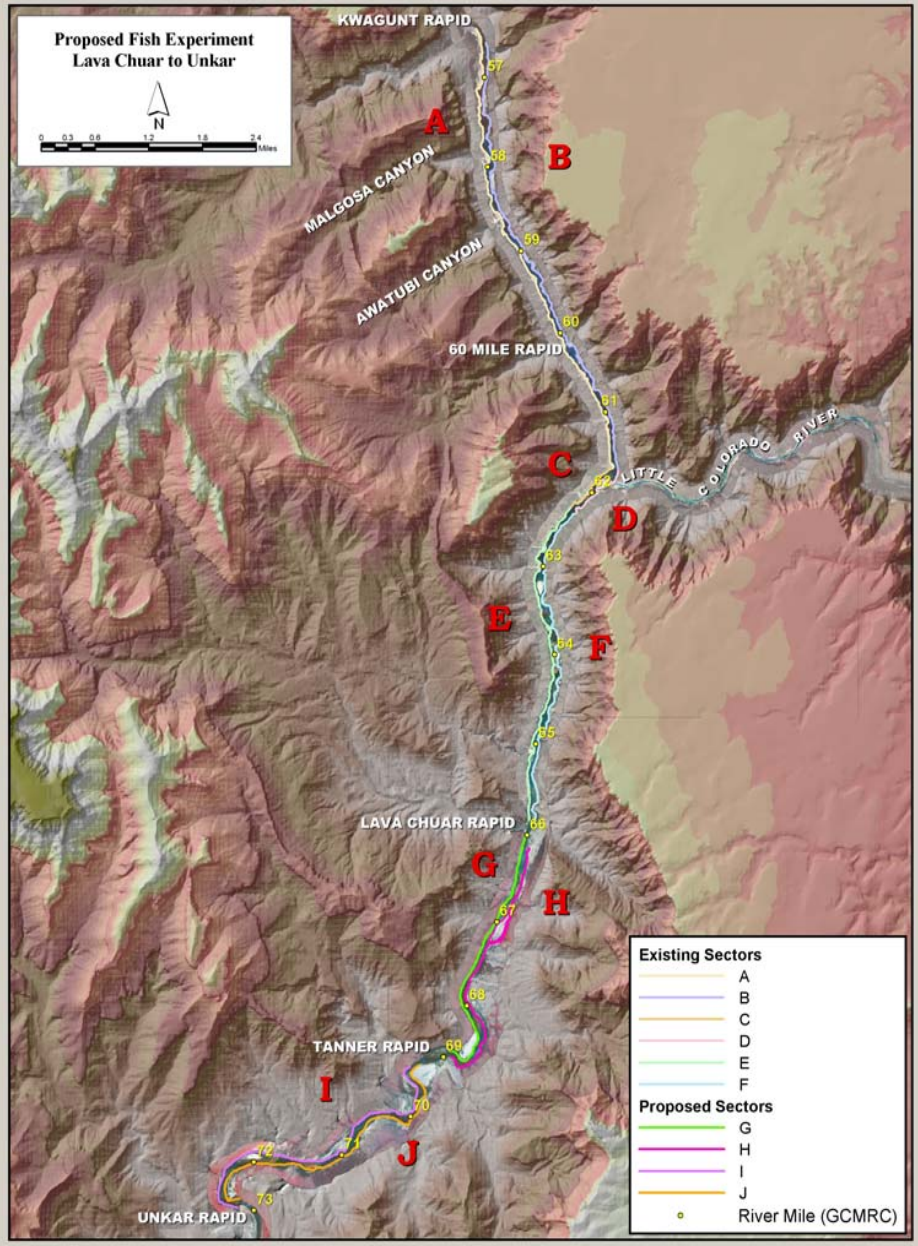
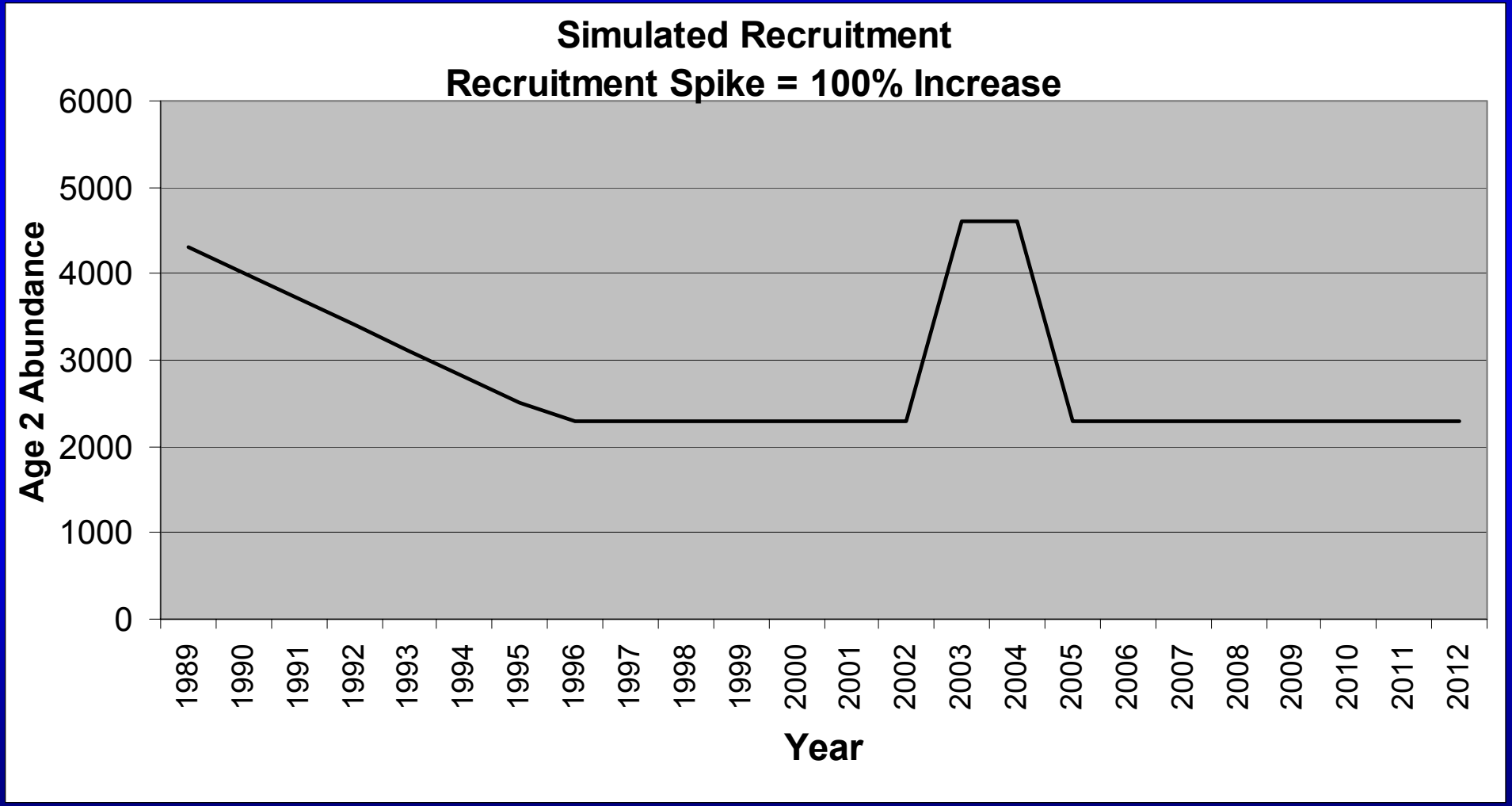


Will potentially allow HBC stock assessment programs a bigger signal to detect.



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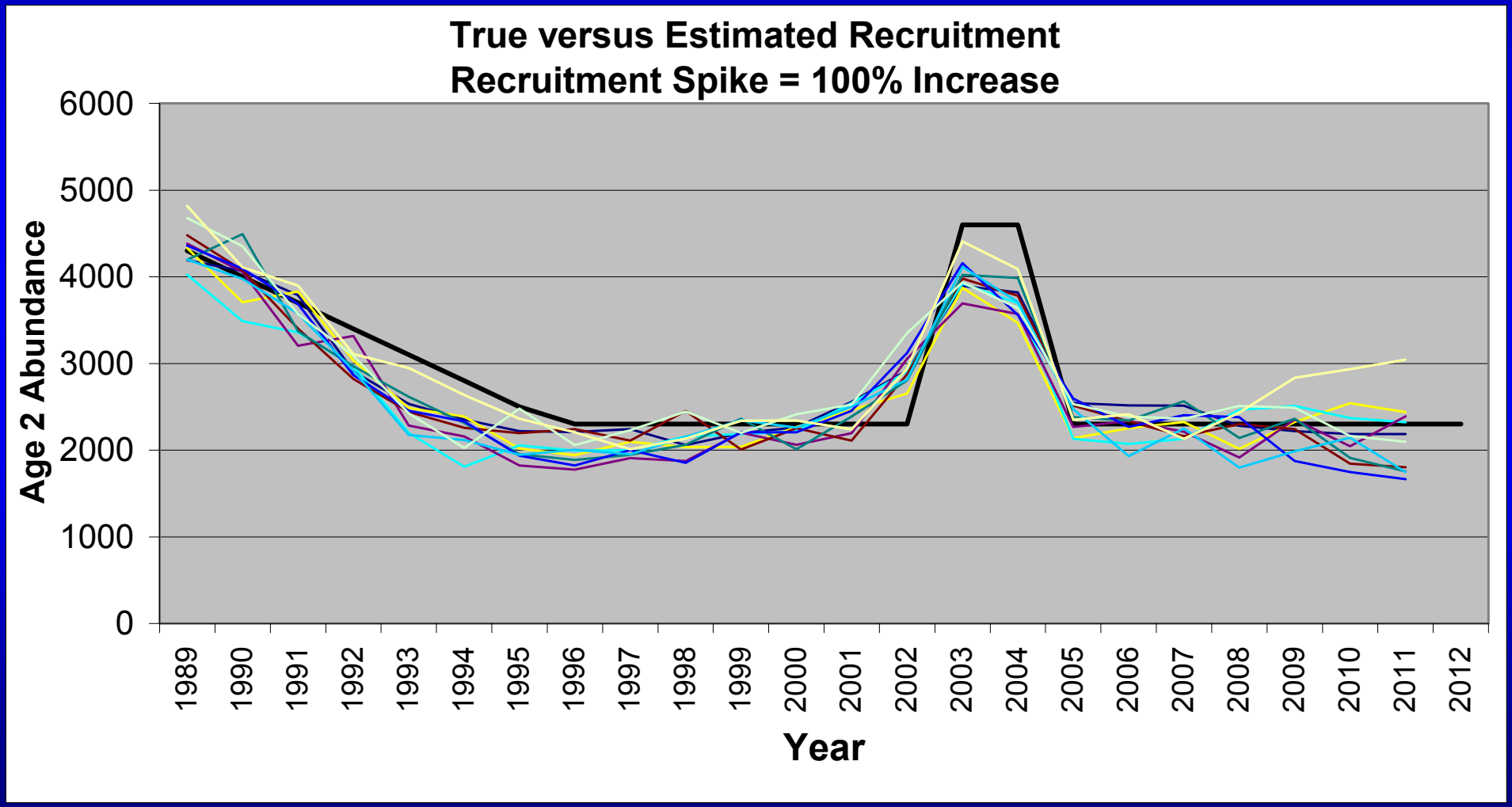

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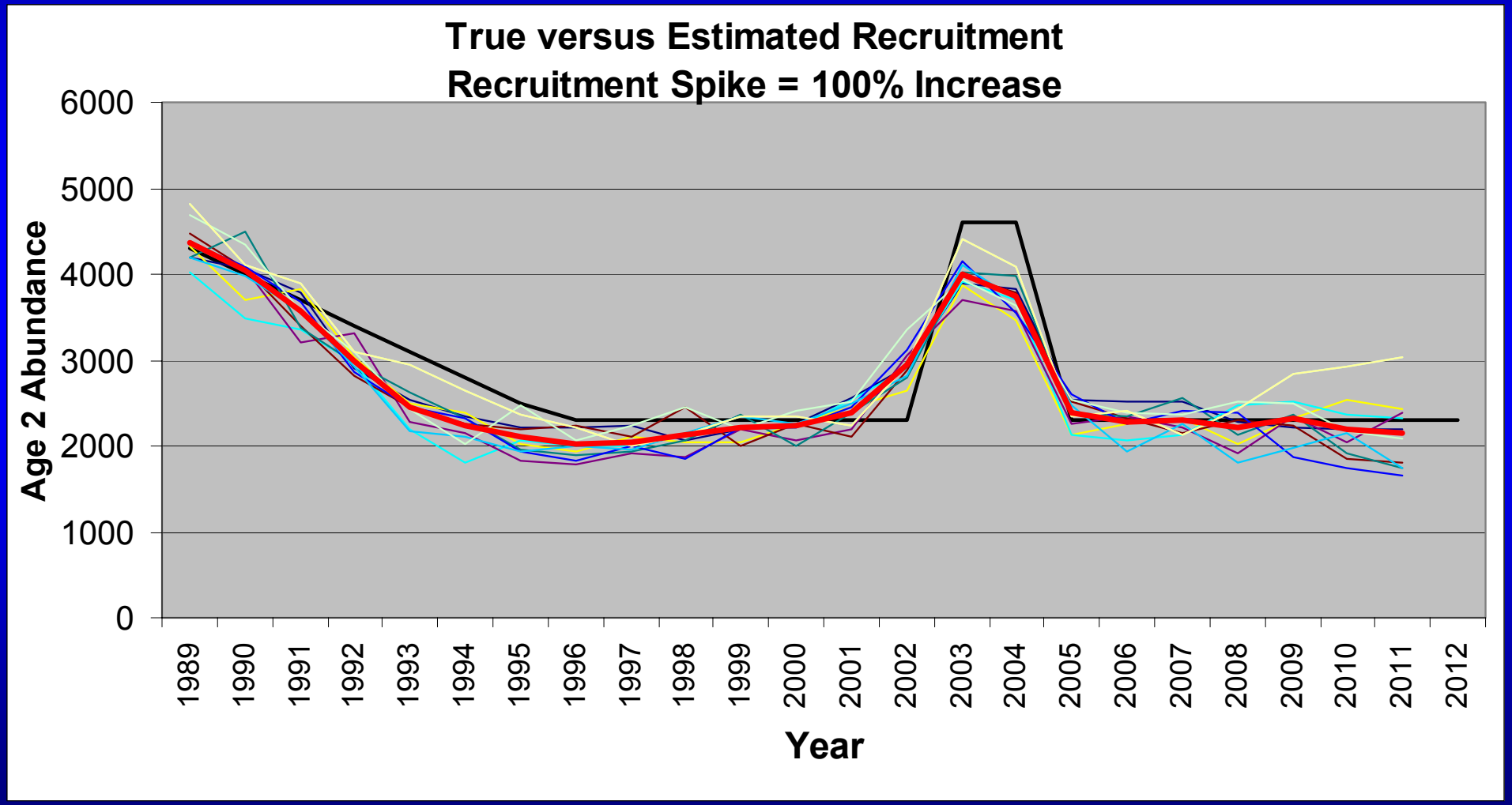

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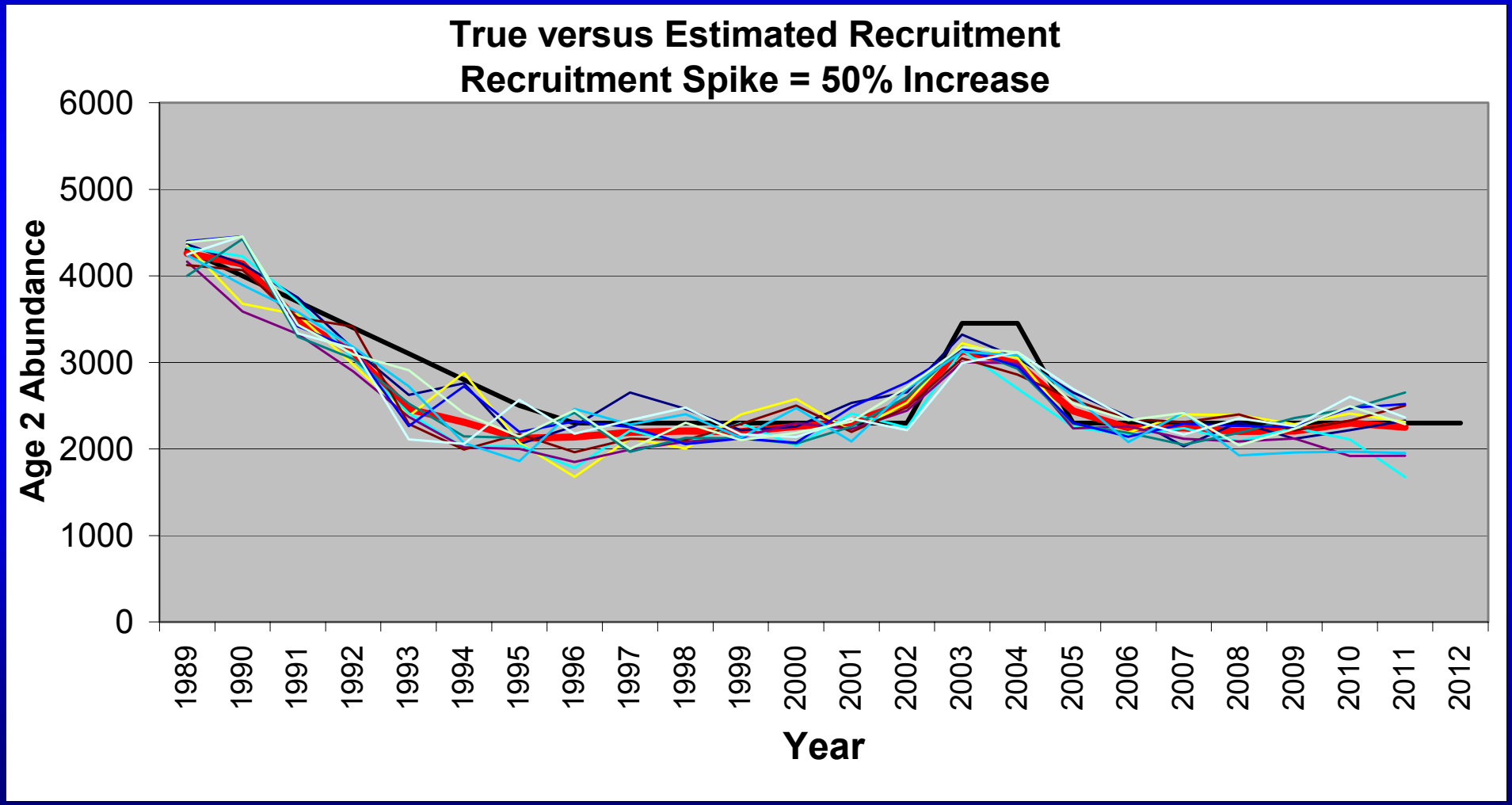

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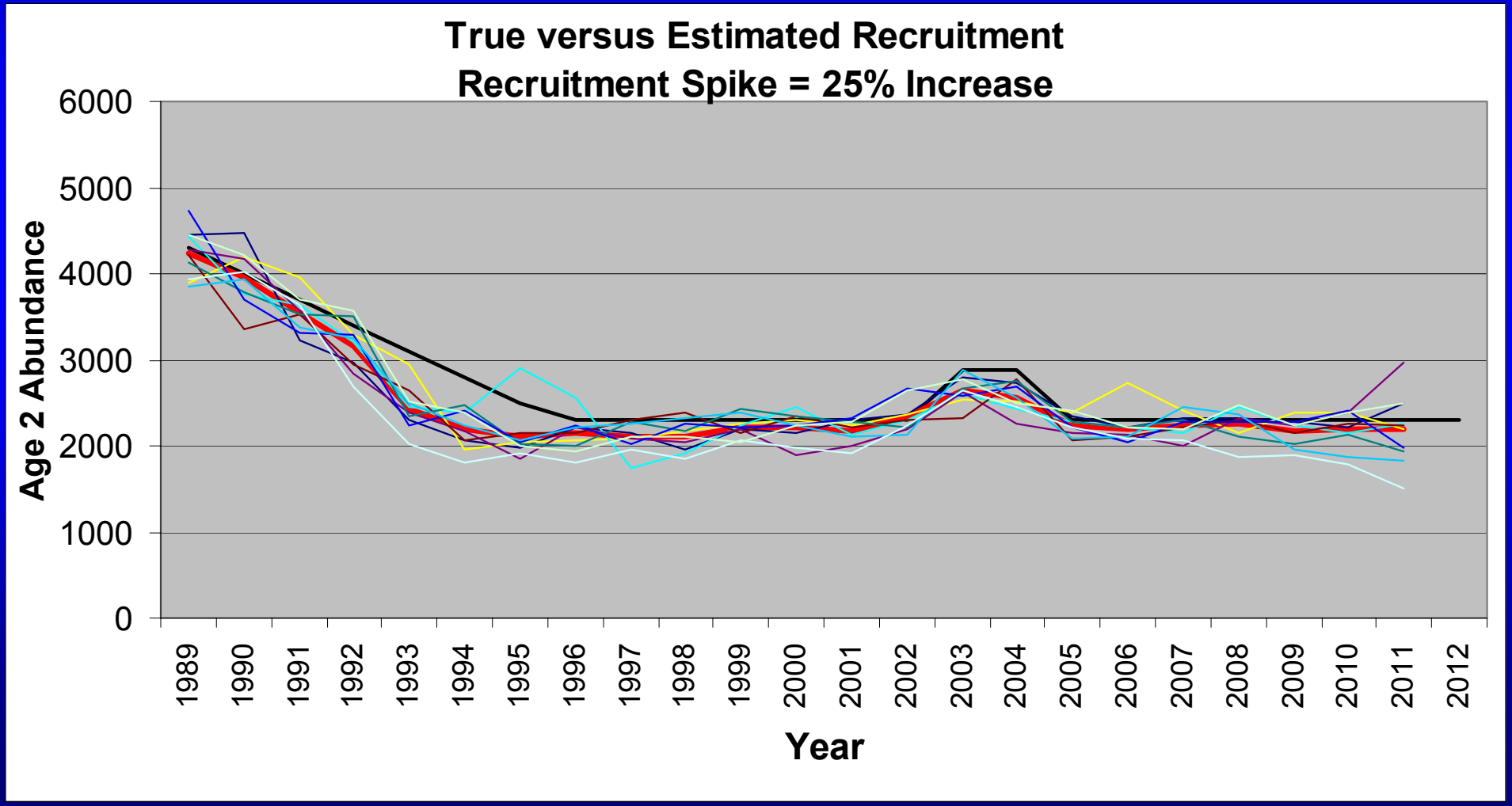

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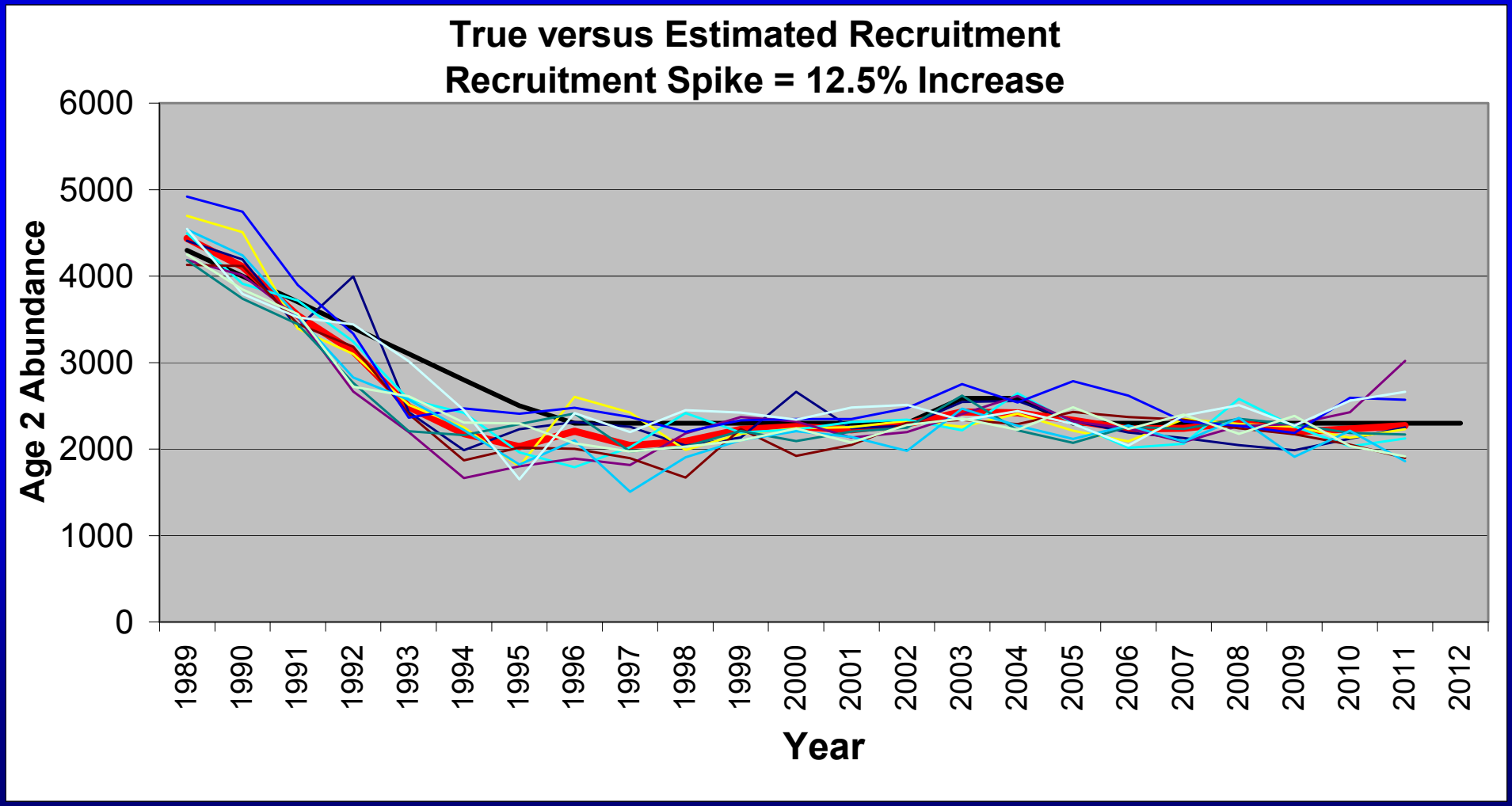
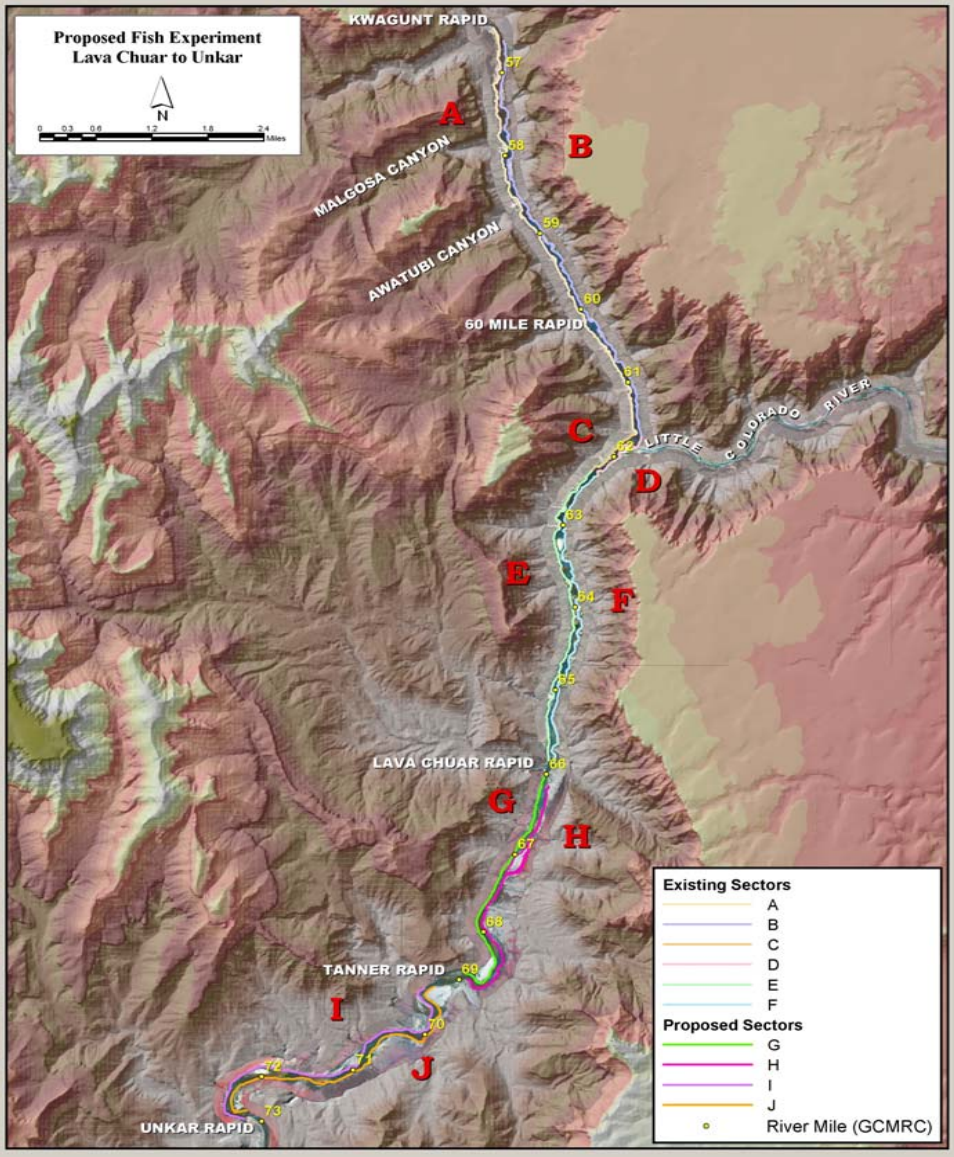


Proposed Modification

Will provide about the same geographic extent of predator free habitat in the mainstem as is available in the LCR.

If need ½ as much recruitment out of the mainstem as the LCR, need to make abundant rearing habitat in the mainstem.



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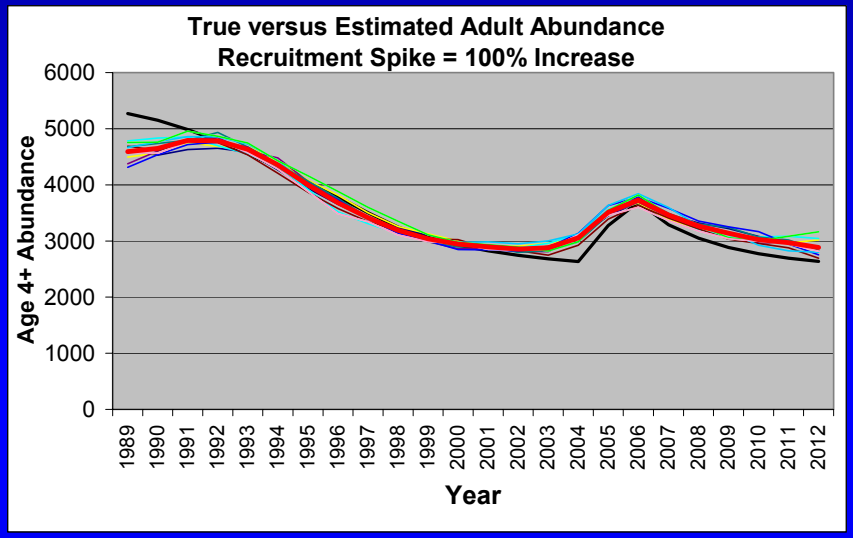

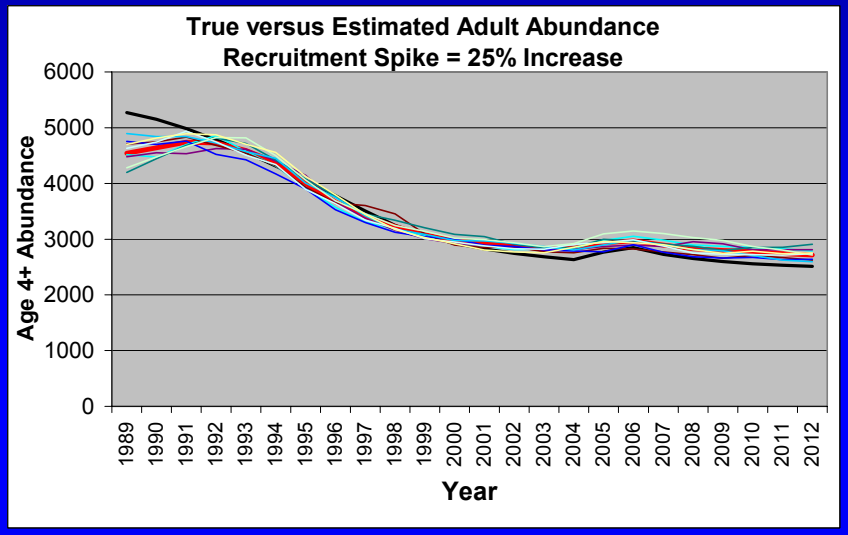

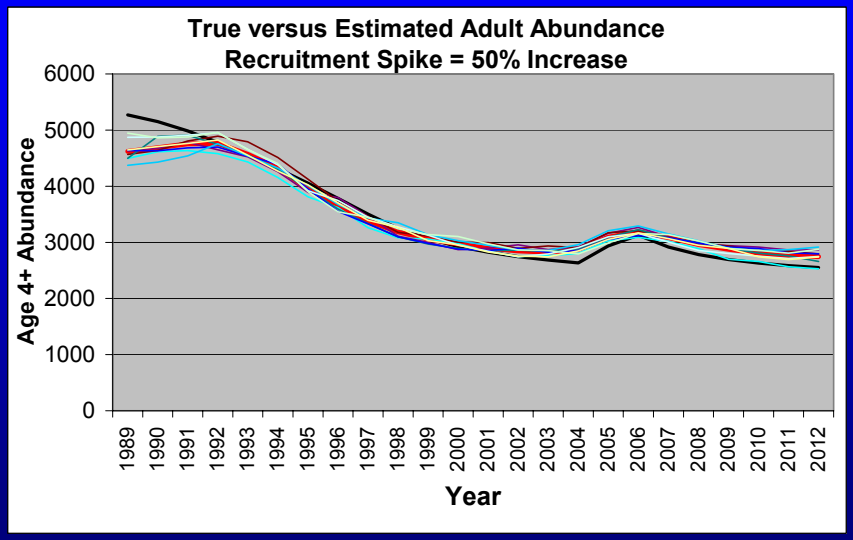

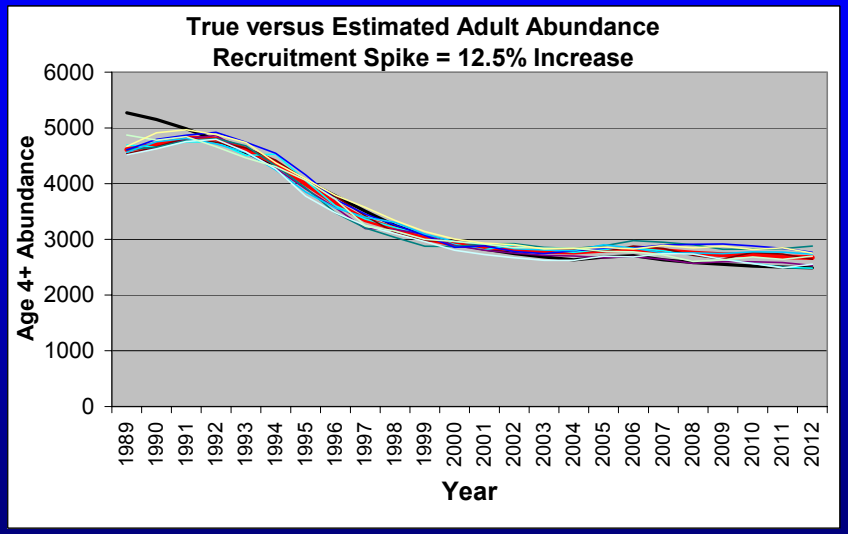

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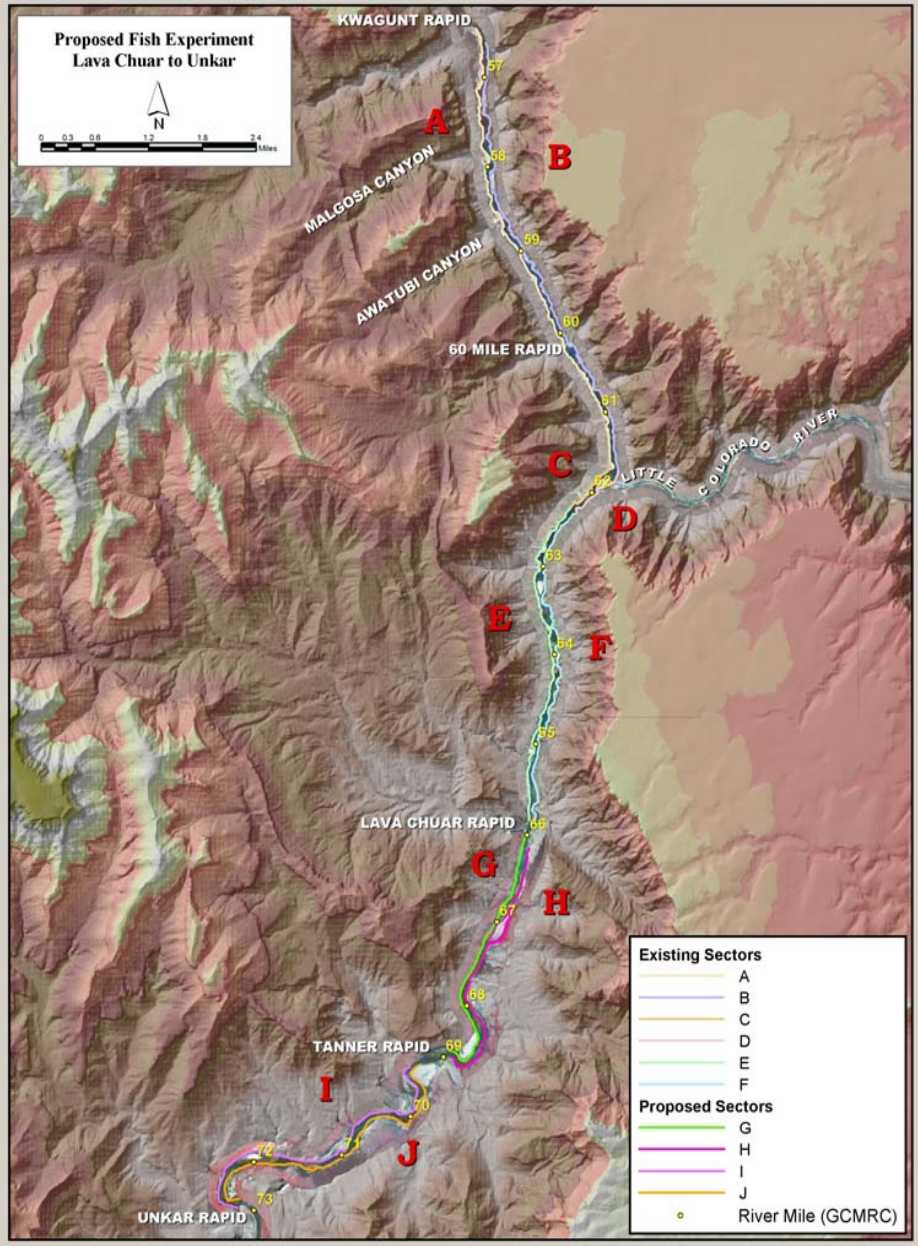


Will allow a more robust (time and area) sampling program of relative abundance (hoopnetting).

- Additional hoopnetting sites will be established within the proposed removal reach (Lava Chuar to Tanner, Tanner to Unkar).

- Hoopnetting to infer relative abundance will be conducted during each non-native removal trip within each reach.

- This will provide information about survival and growth of HBC juveniles within the downstream sections of removal reach.

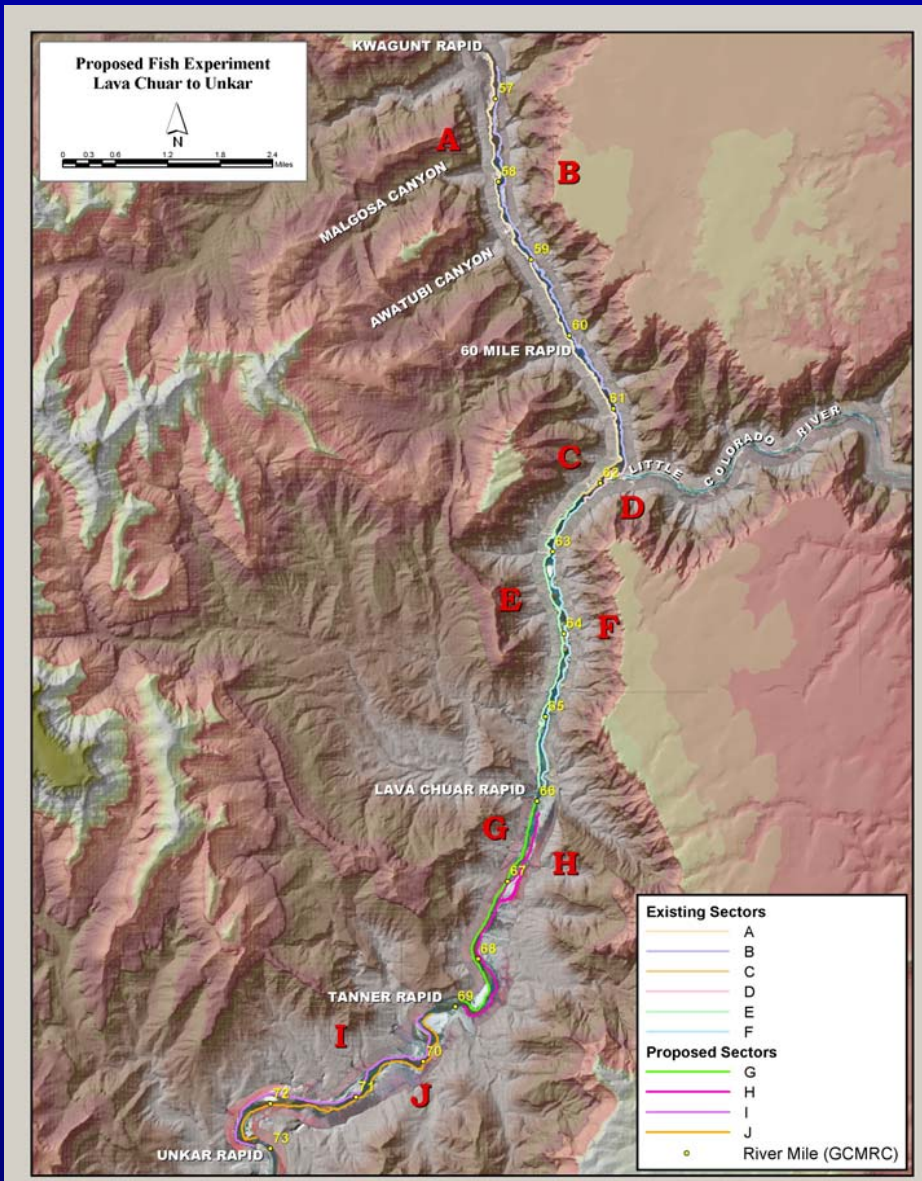
- Provide additional information to infer the outcome of the experiment without putting additional trips on the water.

- Alternately, if we scale back on trips, we will not be able to provide information on these local trends.

When Would The Proposed Removal Begin?

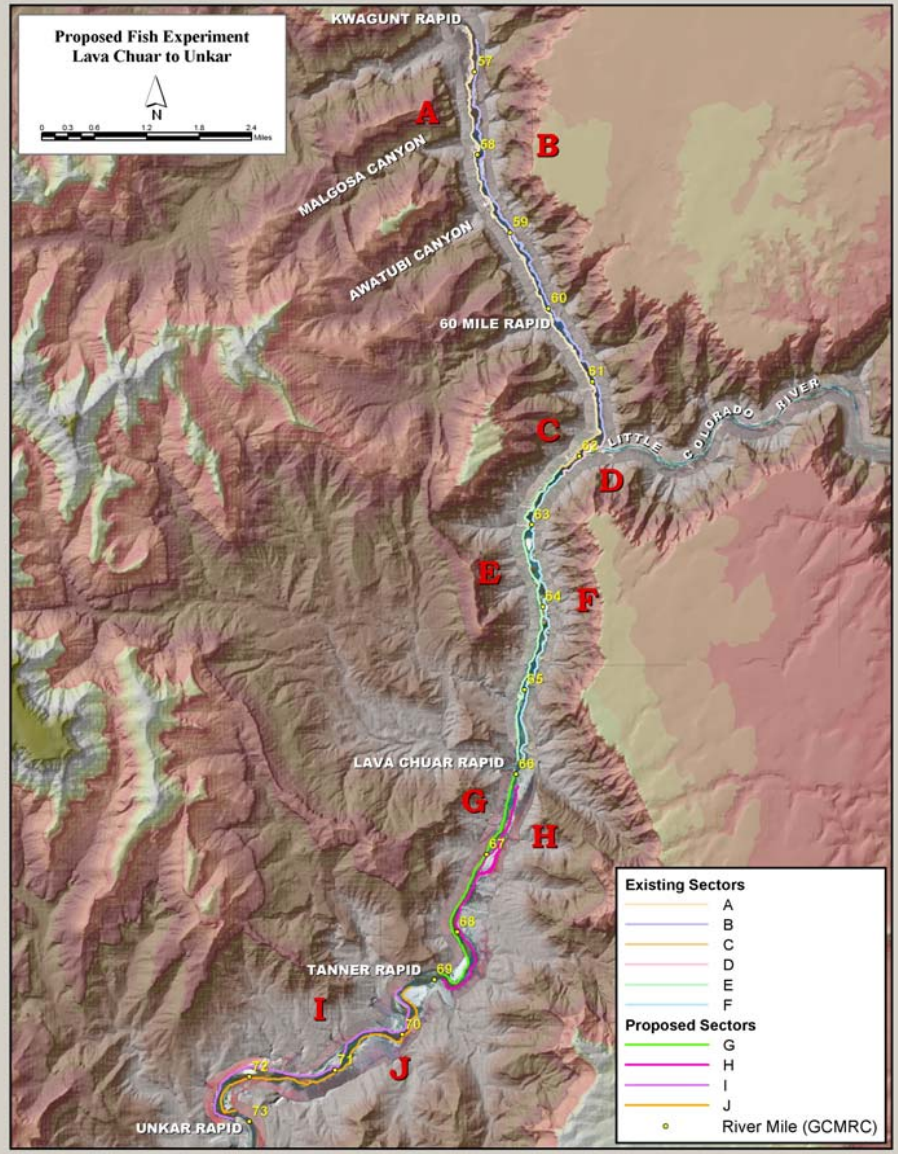
- Removal within the proposed reach would begin only if July efforts suggested that we had reached the target treatment level within the current removal section

- Assuming July confirms that the target level is met:
  - Removal within the proposed reach would proceed during August and September.
  - If all goes well, following September we will have achieved the target in all sections.



What would be the activities in 2004? 2005-06??

- January 2004 would be a reconnaissance trip to conduct a depletion within the entire reach.
- Pending those results, we would decide where further winter trips should concentrate.
- July 2004 would inform the decision for further summer trips.

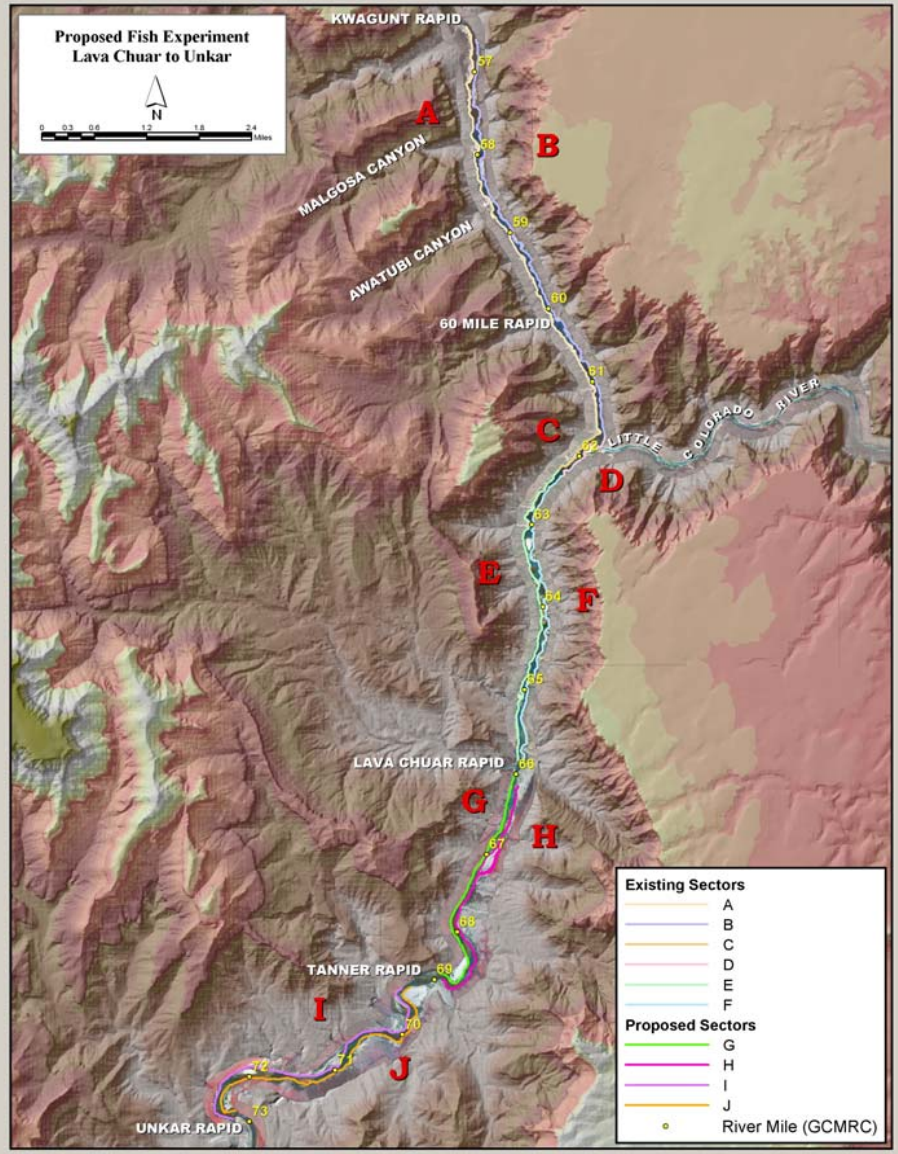


Indirect Benefits

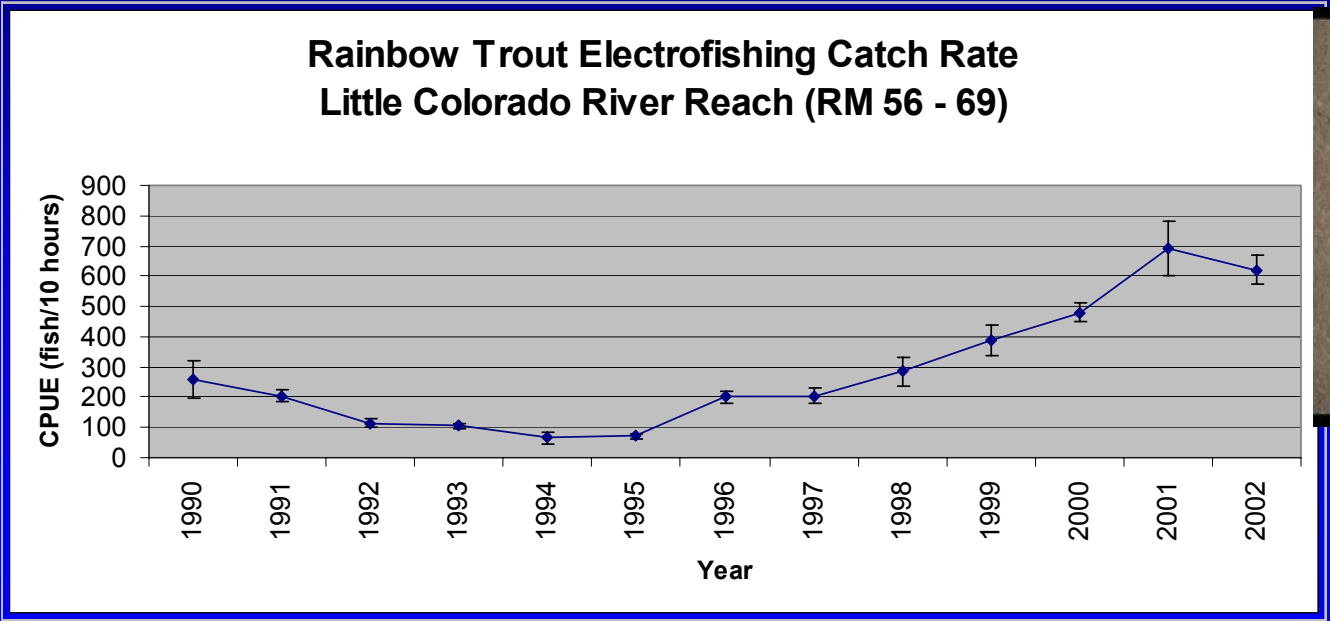
- By catch of HBC in proposed depletion area should be much less than in original depletion area.

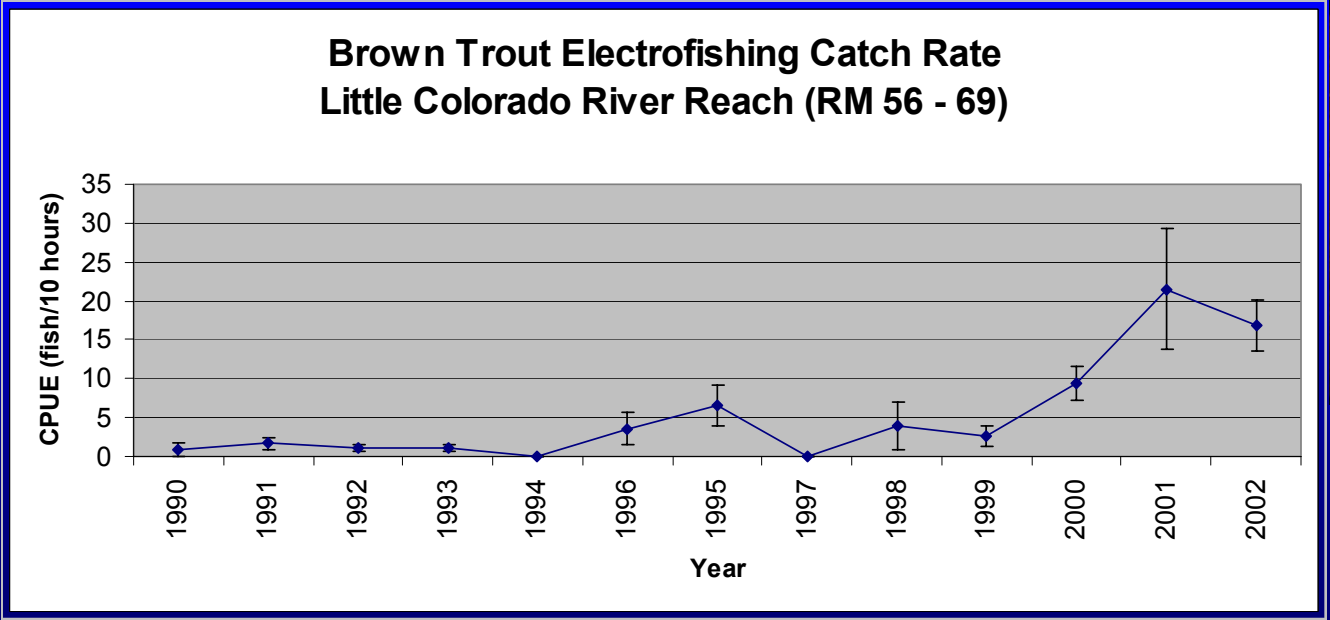
- Lower visitation in proposed removal reach than in original removal reach leading to fewer interactions with park visitors.

- Less effort in area deemed sacred to many Native Americans.



Recent Trends in Salmonid Abundance





USGS