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Native and Nonnative Fishes in Glen, Marble, and Grand Canyons

HFE Workshop, February 2015

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Implementation of High Flow Experimental Protocol

Responses of Native and Nonnative Fishes to Fall High Flow Experiments (HFEs)

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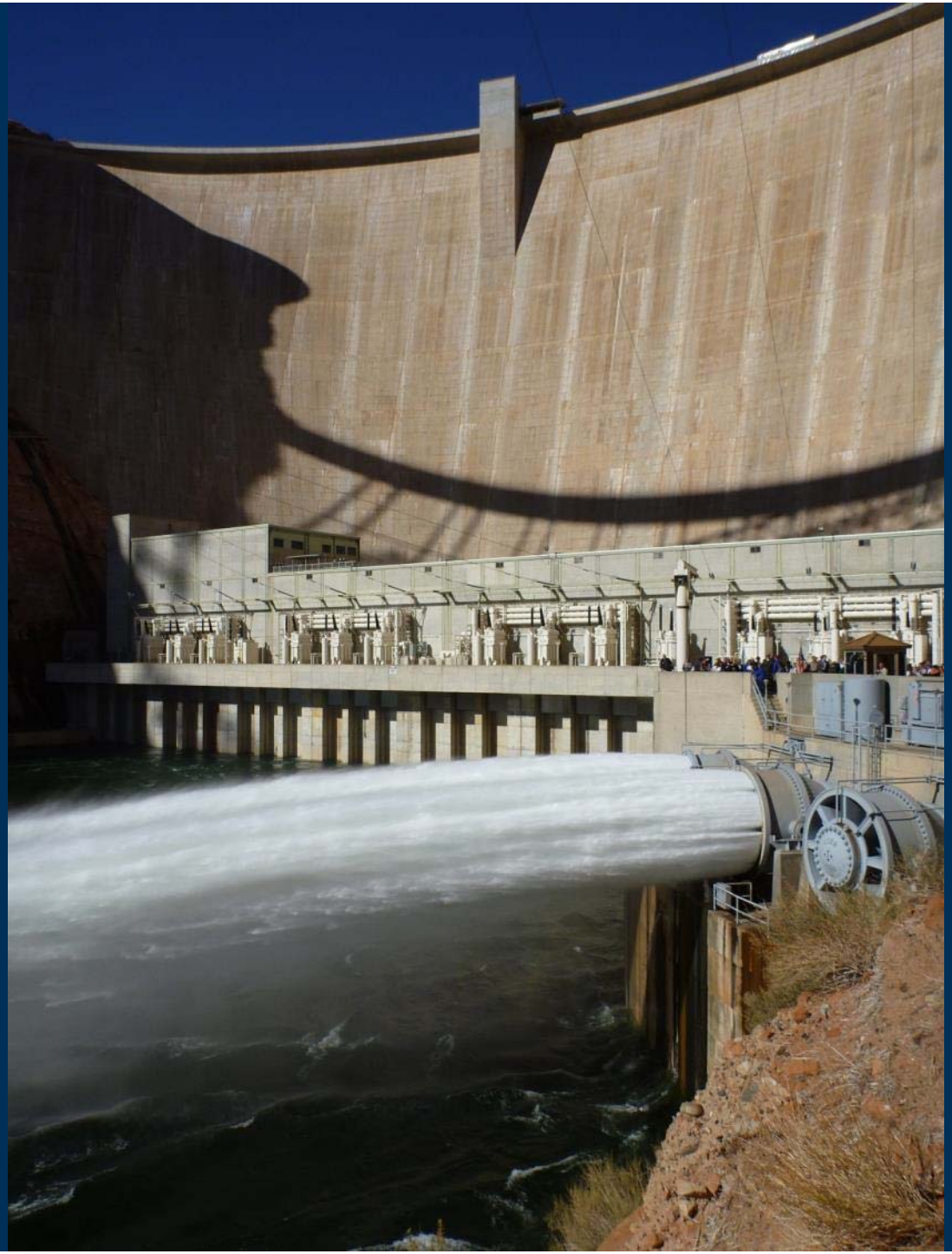

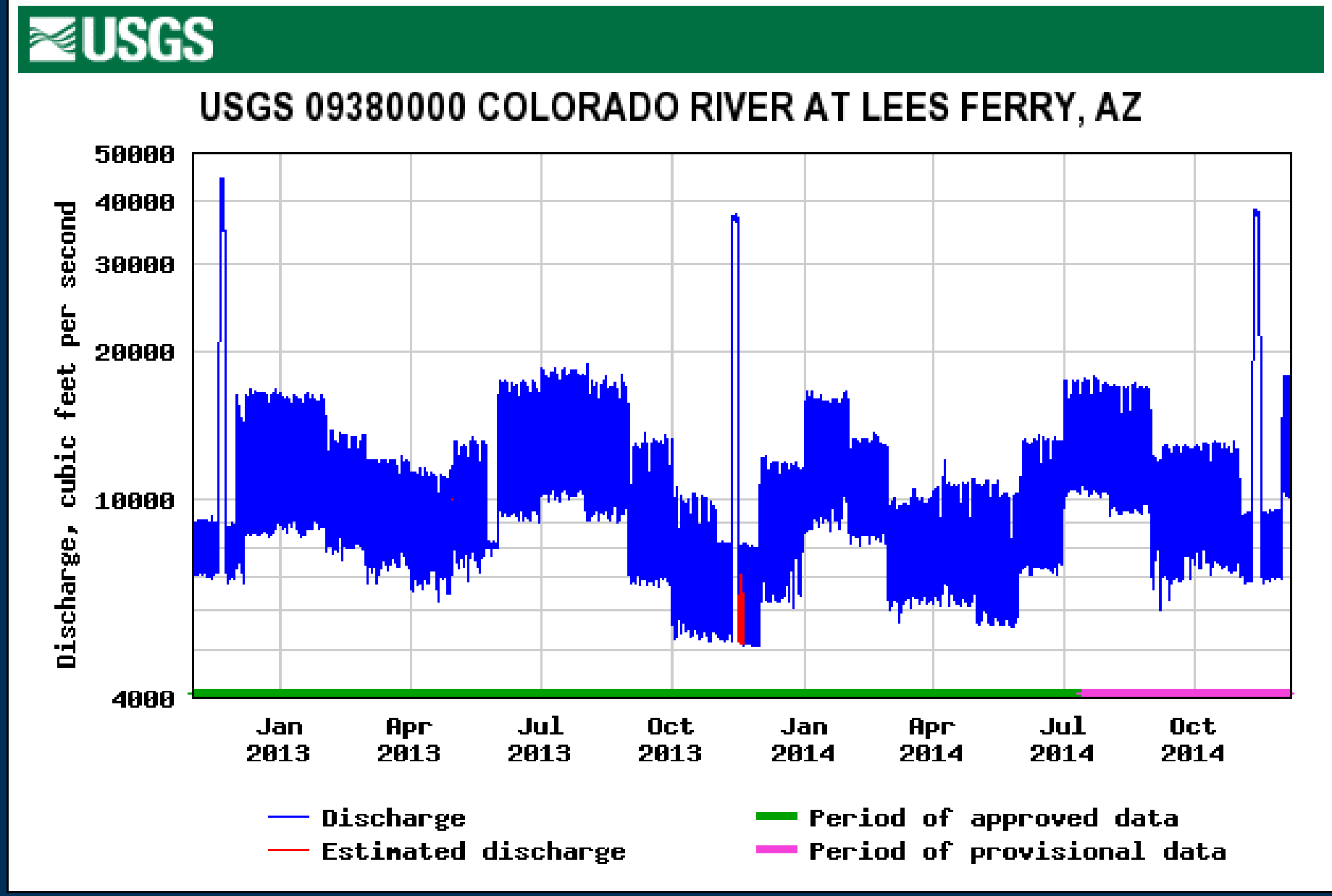

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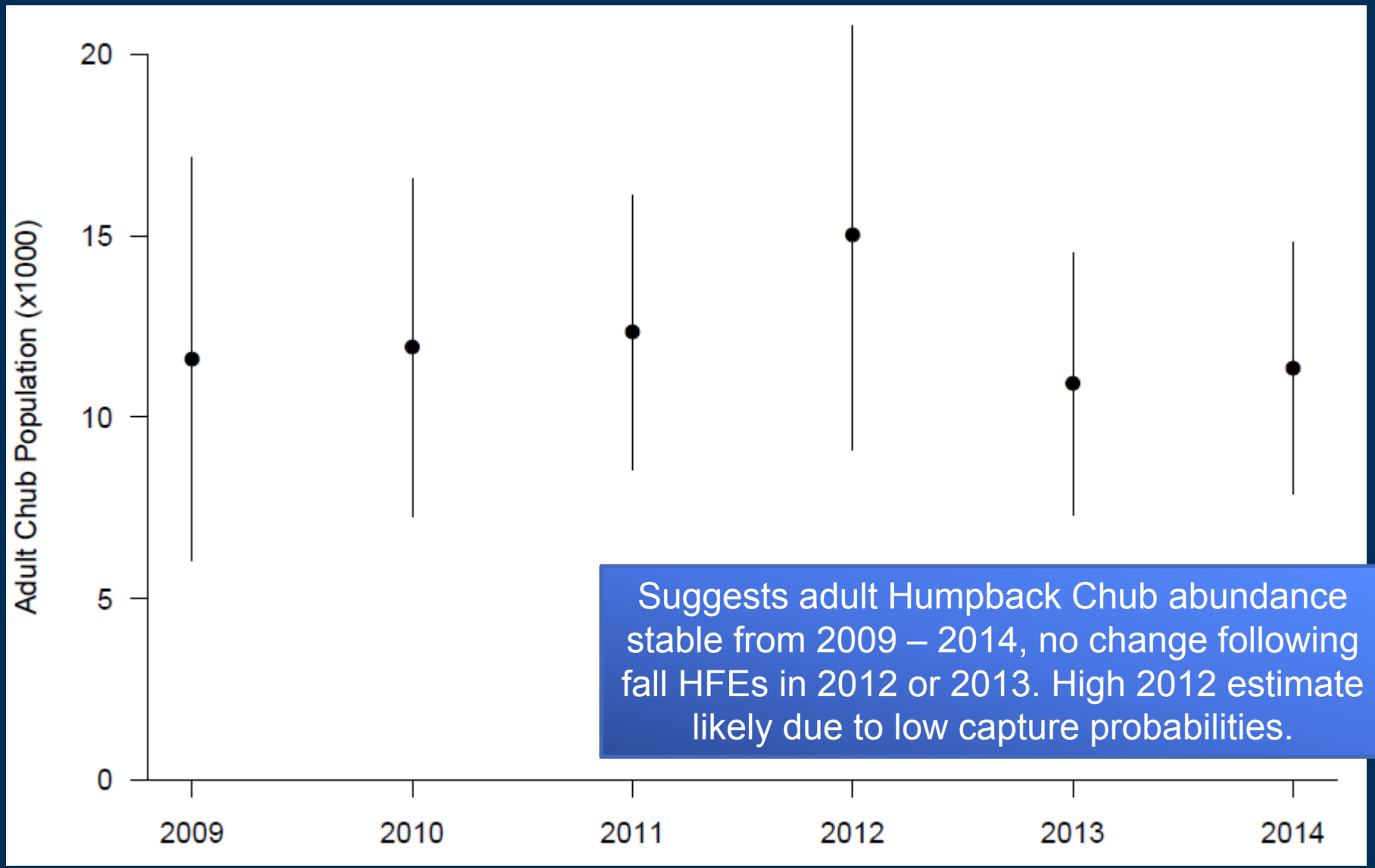
In the last two years (plus a month)…

Glen Canyon/
Lees Ferry

Marble
Canyon

Little Colorado River
and Confluence

Adult Humpback Chub Abundance Estimates: Multistate Population Model



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(Preliminary Data from Yackulic 2014. Do Not Cite.)

Annual spring abundances of humpback chub ≥ 150 mm and ≥ 200 mm in lower 13.6 km of LCR

Recent spring estimates indicate Humpback Chub abundance stable in the LCR, no change post fall HFEs

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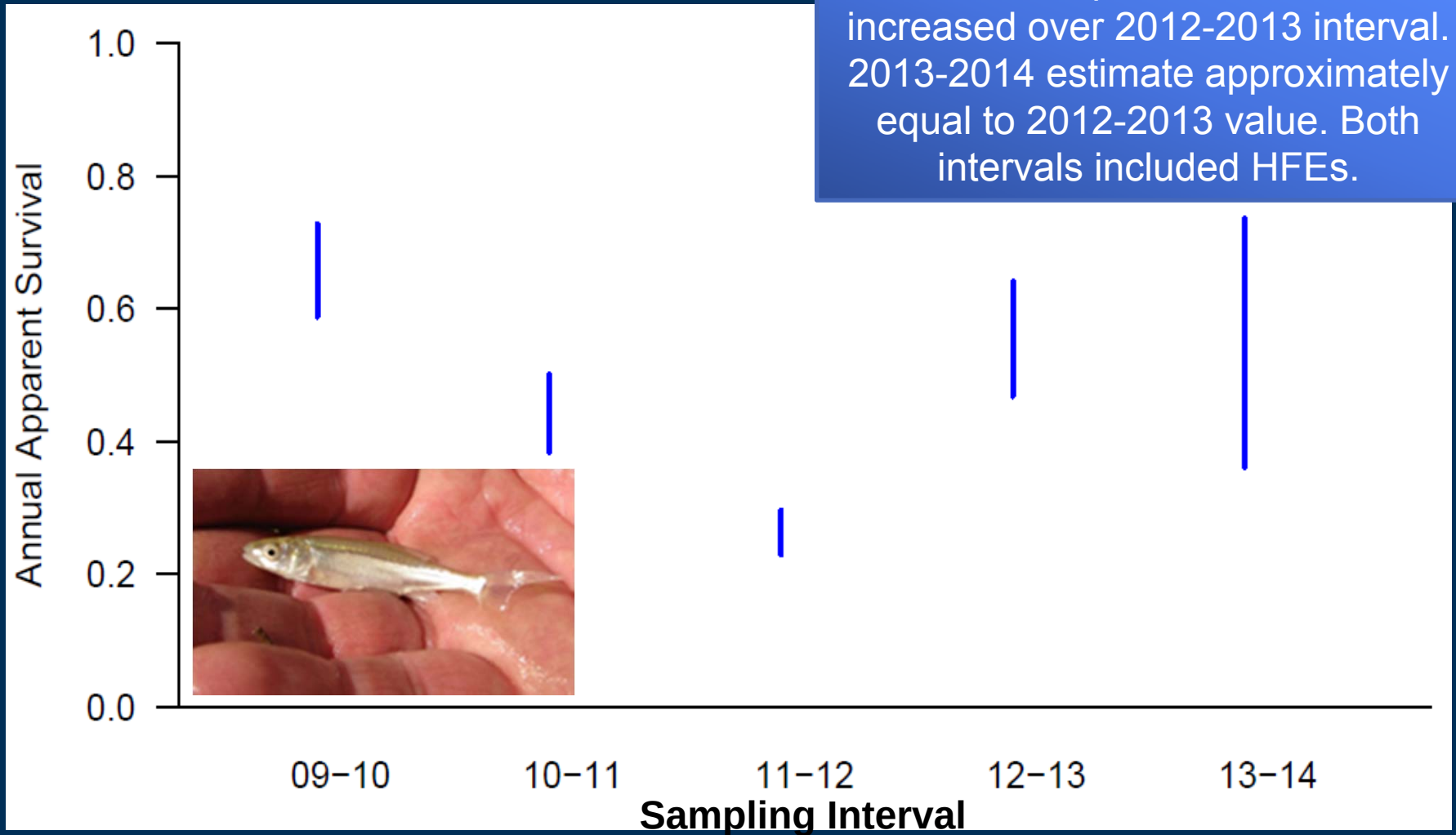
(Preliminary Data from VanHaverbeke et al. 2014. Do Not Cite.)

Annual Survival of Humpback Chub (40-99 mm) in the Colorado River Study Site

Juvenile humpback chub survival increased over 2012-2013 interval. 2013-2014 estimate approximately equal to 2012-2013 value. Both intervals included HFEs.



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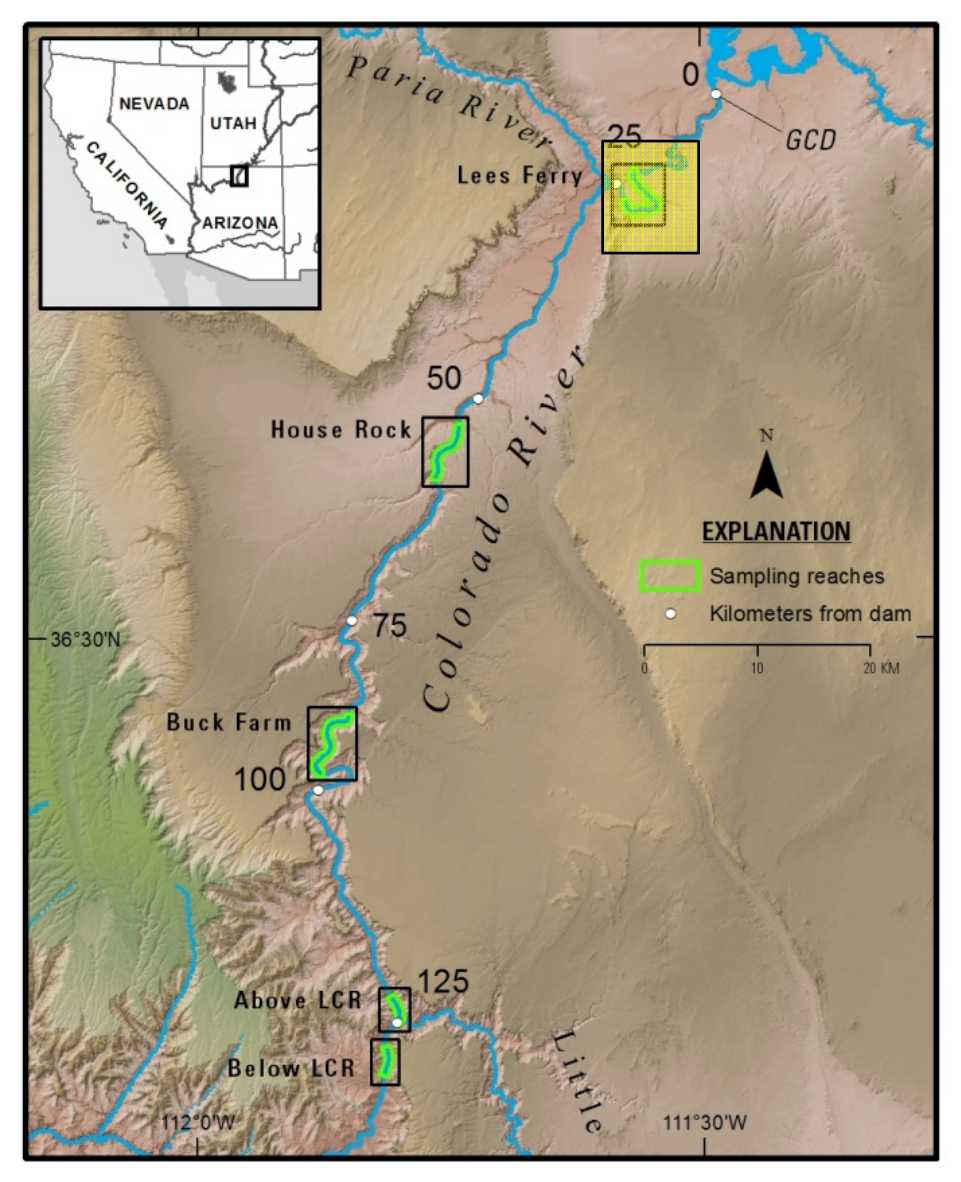
(Preliminary Data from Yackulic 2014. Do Not Cite.)

Rainbow Trout Natal Origins Study Sampling Design



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- **Annual age-0 marking trips from dam to Lees Ferry**
  - Length >75 mm
  - ~ 10,000 marked/yr
  - Nov. 2011, Oct & Dec 2012, 2013, and 2014
- **Quarterly trips for marking and tag recovery by reach**
  - Jan, Apr, Jul, and Sept
  - LEES FERRY (I, -5.5 to -2.1 RM)
  - HOUSE ROCK (II, 17.2-20.6 RM)
  - BUCK FARM (III, 38.2 to 41.6 RM)
  - ABOVE LCR (IVa, 60.2 to 61.2 RM)
  - BELOW LCR (IVb, 63.4 to 64.9 RM)

Rainbow Trout Within-Reach Movement

I – Glen Canyon/Lees Ferry

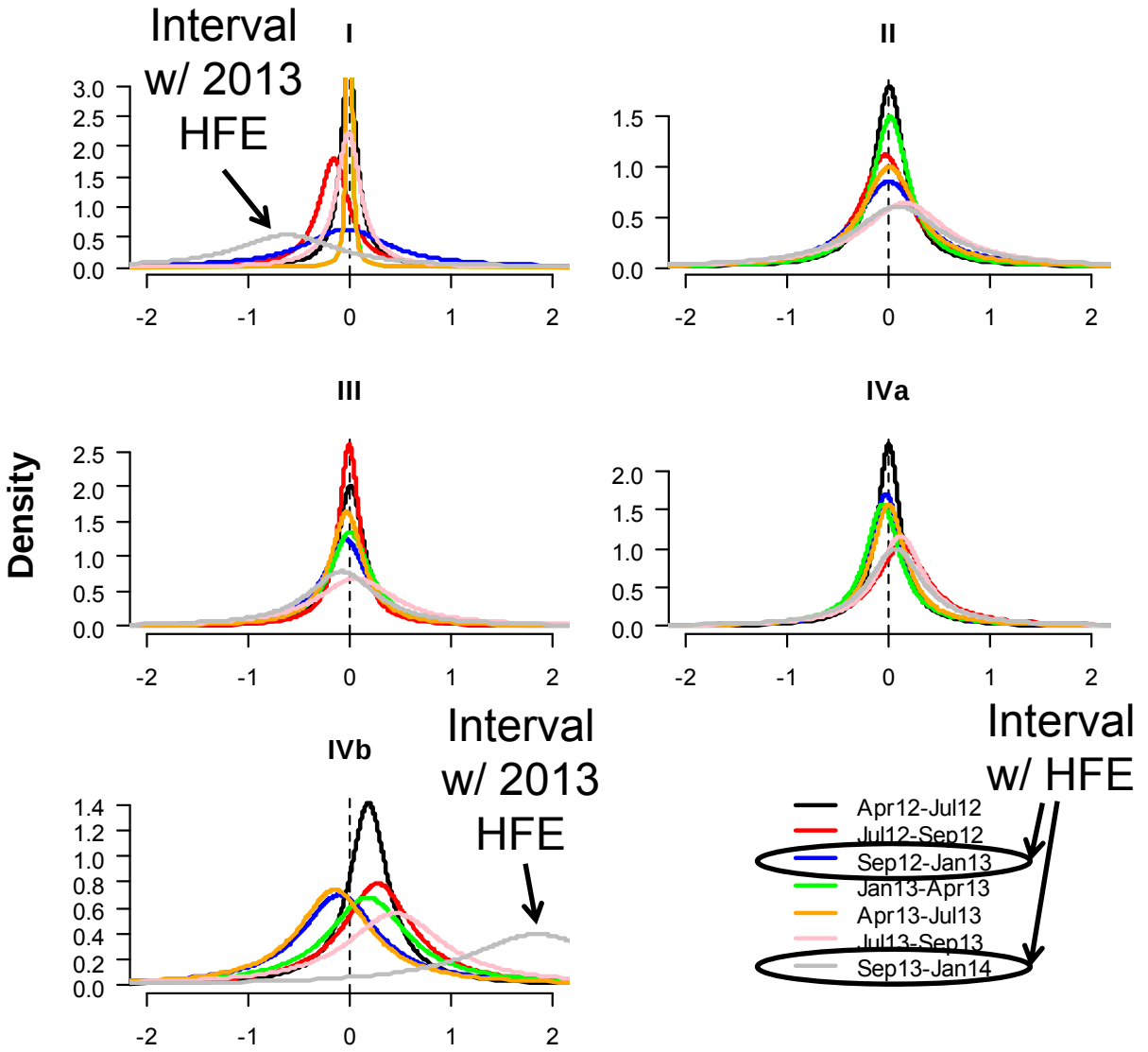
II – House Rock

III – Buck Farm

IVa – Upstream of LCR

IVb – Downstream of LCR

Most rainbow trout move little between marking and recapture even over intervals that include HFEs



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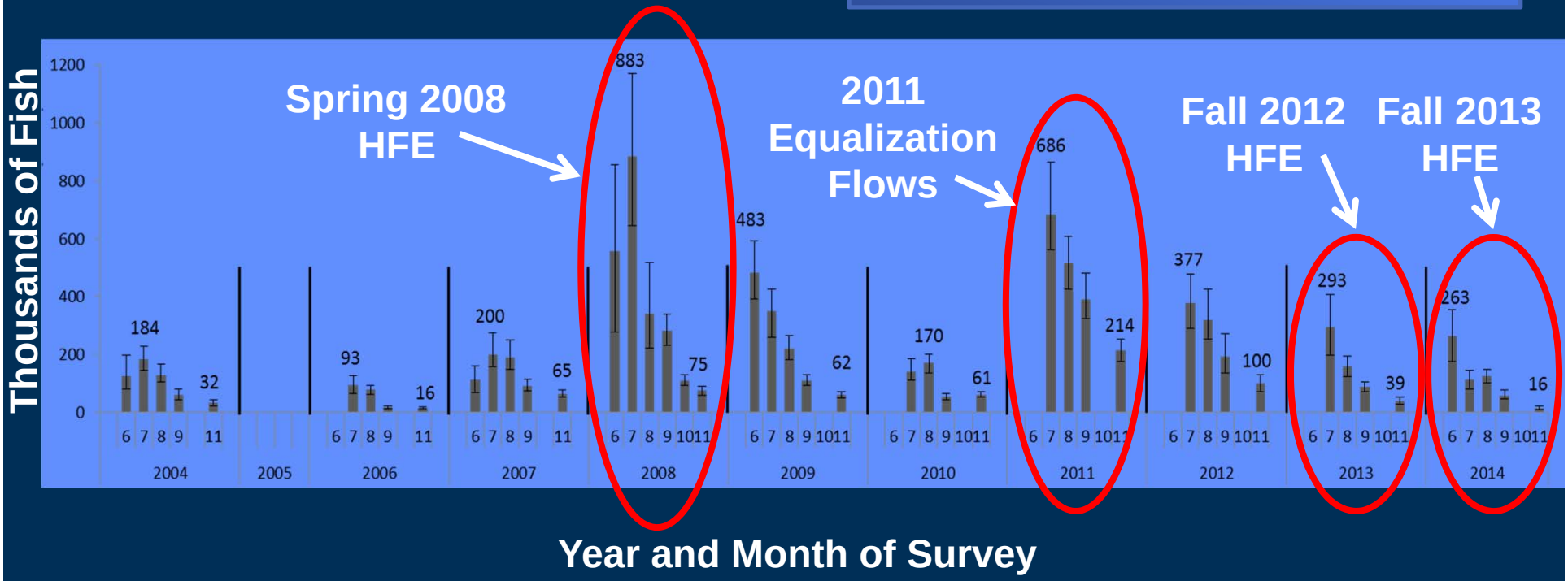
(Preliminary Data from Korman and Yard 2014. Do Not Cite.)

Rainbow Trout Early Life Stage Studies: Age-0 Population Estimates

2013 and 2014 age-0 Rainbow Trout abundance (post 2012 and 2013 fall HFEs) much lower than 2008 (post spring HFE) or 2011 (equalization)



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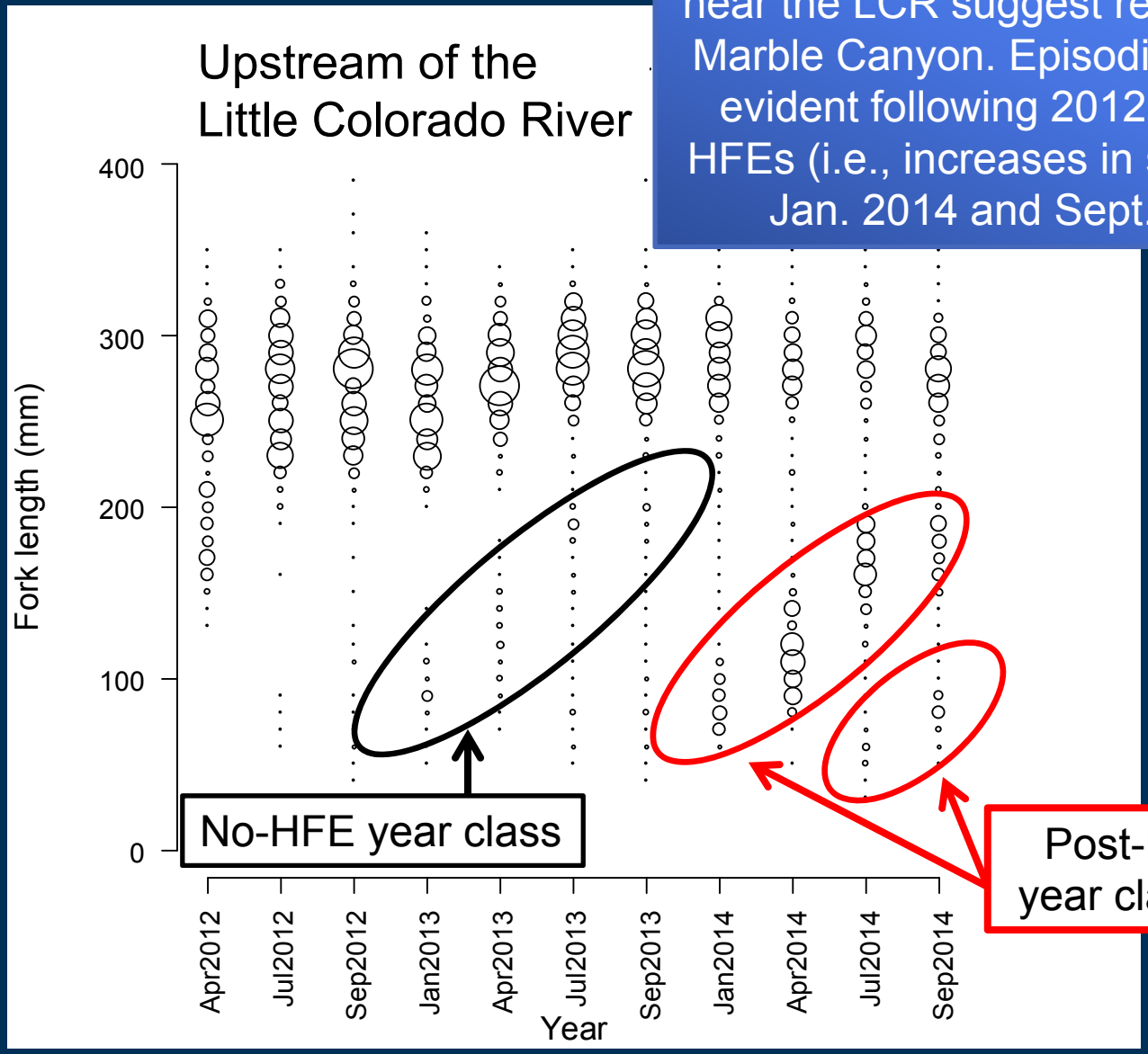
(Preliminary Data from Avery, Foster, and Korman 2014. Do Not Cite.)

Local Rainbow Trout Recruitment in Marble Canyon

Appearance of young Rainbow Trout near the LCR suggest recruitment in Marble Canyon. Episodic, but more evident following 2012 and 2013 HFEs (i.e., increases in small fish in Jan. 2014 and Sept. 2014).



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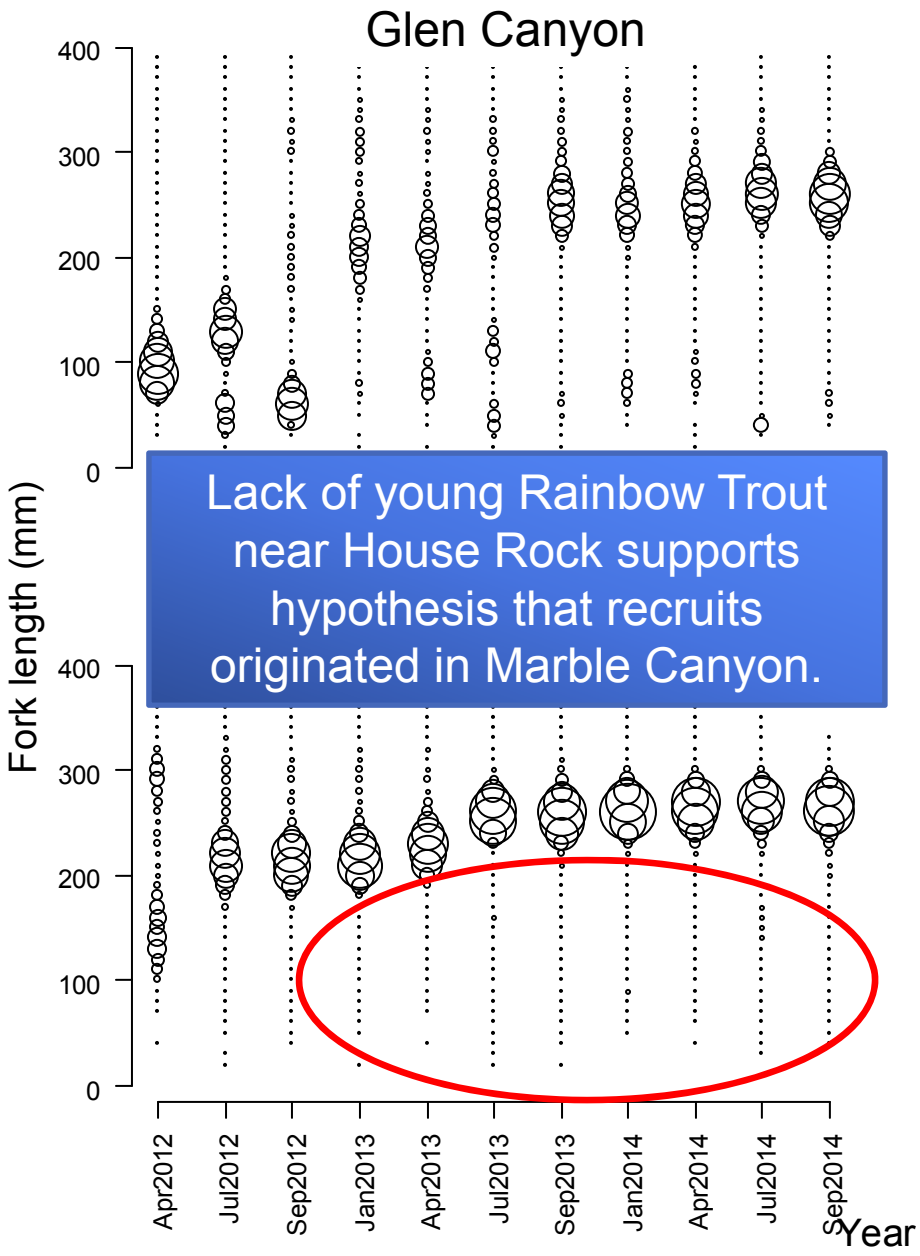
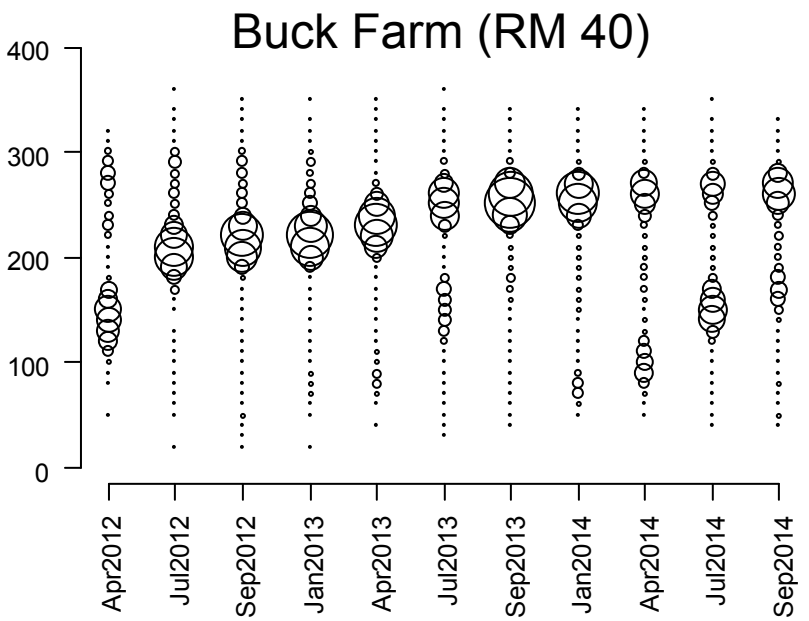
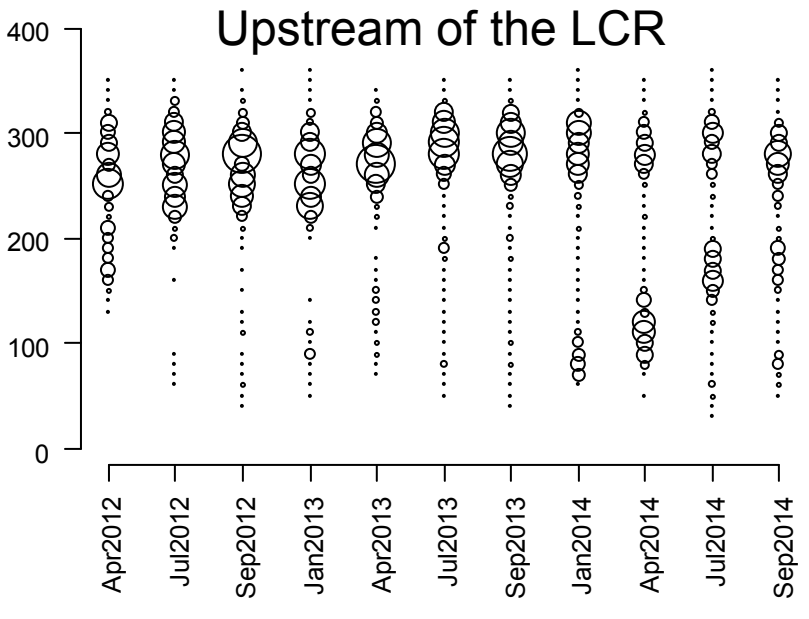
(Preliminary Data from Korman and Yard 2014. Do Not Cite.)



Lack of young Rainbow Trout near House Rock supports hypothesis that recruits originated in Marble Canyon.





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(Preliminary Data from Korman and Yard 2014. Do Not Cite.)

Estimated Percentage Movement of Rainbow Trout from Glen and Marble Canyon Reaches to Upstream (IVa) and Downstream (IVb) of the Little Colorado River Confluence

%		Destination Reach	
		IVa	**IVb**
Source Reach	**I**	0.01	0.02
	II	0.14	0.05
	III	0.20	0.18

Although most Rainbow Trout move little between marking and recapture, fish are moving downstream at low rates

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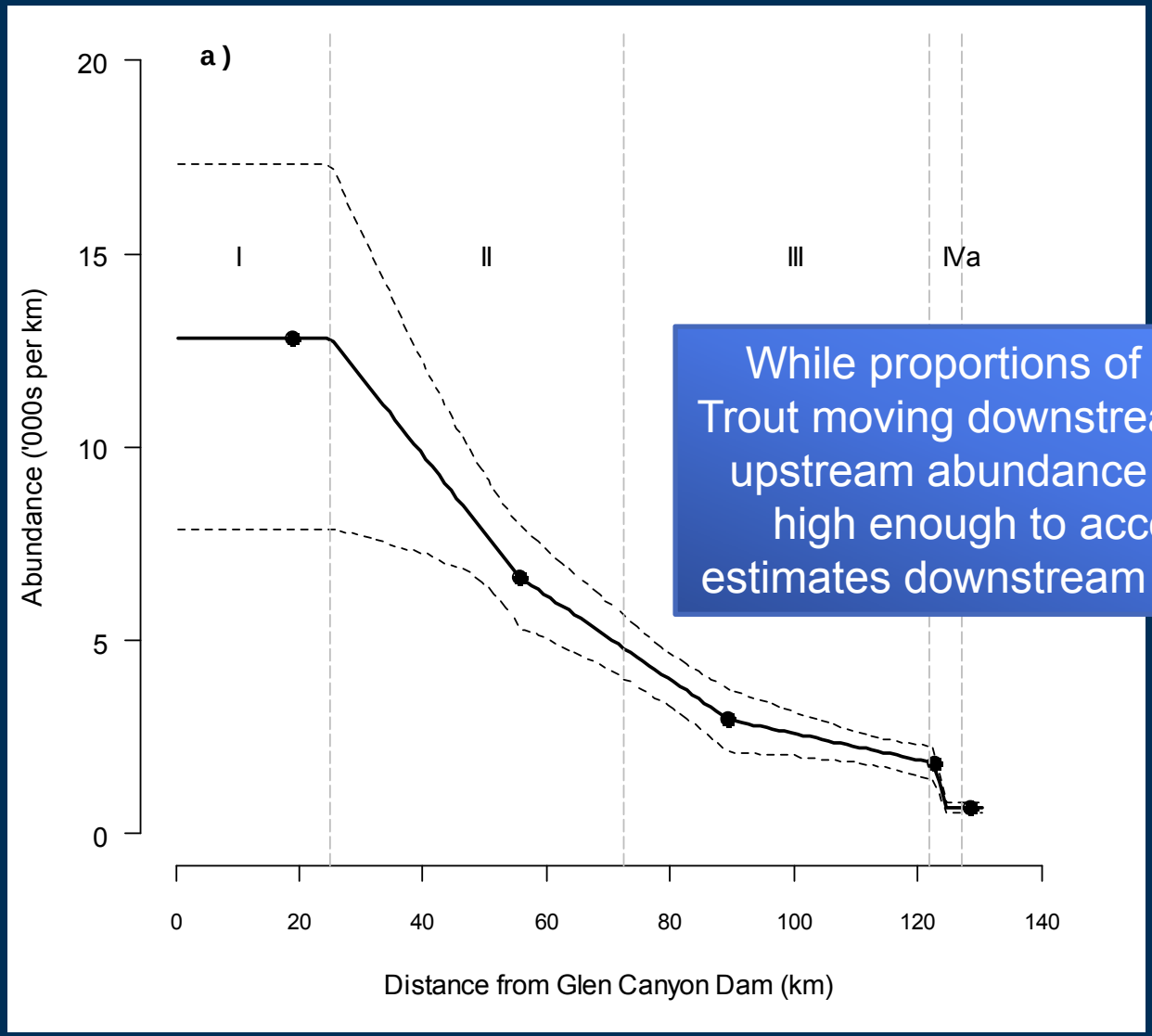
(Preliminary Data from Korman and Yard 2014. Do Not Cite.)

Rainbow Trout Abundance Estimates (fish/km) by Sampling Reach (Interpolated from GCD-IVb)



While proportions of Rainbow Trout moving downstream are low, upstream abundance has been high enough to account for estimates downstream of the LCR

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(Preliminary Data from Korman and Yard 2014. Do Not Cite.)

Rainbow Trout Movement Among Reaches

No movement

Downstream movement

		Recapture Reach					Outside of Release Reach	
		GC	II	III	IVa	IVb	# of Recaps	% of Recaps
Release Reach	GC	2228	8	1	0	2	11	0.5%
	II	13	1999	12	8	6	39	1.9%
	III	1	8	2087	10	7	26	1.2%
	IVa	0	0	2	1153	67	69	5.6%
	IVb	1	0	1	11	541	13	2.3%

Upstream movement

Rainbow Trout movement may be episodic. High proportion observed in September 2014 potentially related to recent decline in fish condition

Recaptures from Sep 2014 Trip

		Recapture Reach					# of Recaps Outside of Release Reach	% of Recaps in Sep2014 to Total
		GC	II	III	IVa	IVb		
Release Reach	GC	214	2	1	0	1	4	36.4%
	II	5	590	8	4	4	21	53.8%
	III	0	3	365	4	3	10	38.5%
	IVa	0	0	0	201	15	15	21.7%
	IVb	0	0	0	4	71	4	30.8%

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(Preliminary Data from Korman and Yard 2014. Do Not Cite.)

Preliminary Findings:

- **Humpback Chub**
  - **Adult abundance appears to be stable, similar in HFE and non-HFE years**
  - **Annual survival rates of juveniles downstream of the LCR confluence relatively high in years that include HFEs**

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Preliminary Findings:

- Rainbow Trout
  - Little movement over sampling intervals with and without HFEs
  - No increase in age-0 abundance following 2012 or 2013 HFEs
  - Some evidence of recruitment in Marble Canyon. Appears to be episodic and more evident after 2012 and 2013 HFEs, but abundance downstream of LCR can be explained by observed low movement rates given upstream abundance
  - Recent evidence that downstream movement may be episodic. 22-54 % of between-reach recaptures observed in September 2014, potentially related to recent decline in fish condition

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