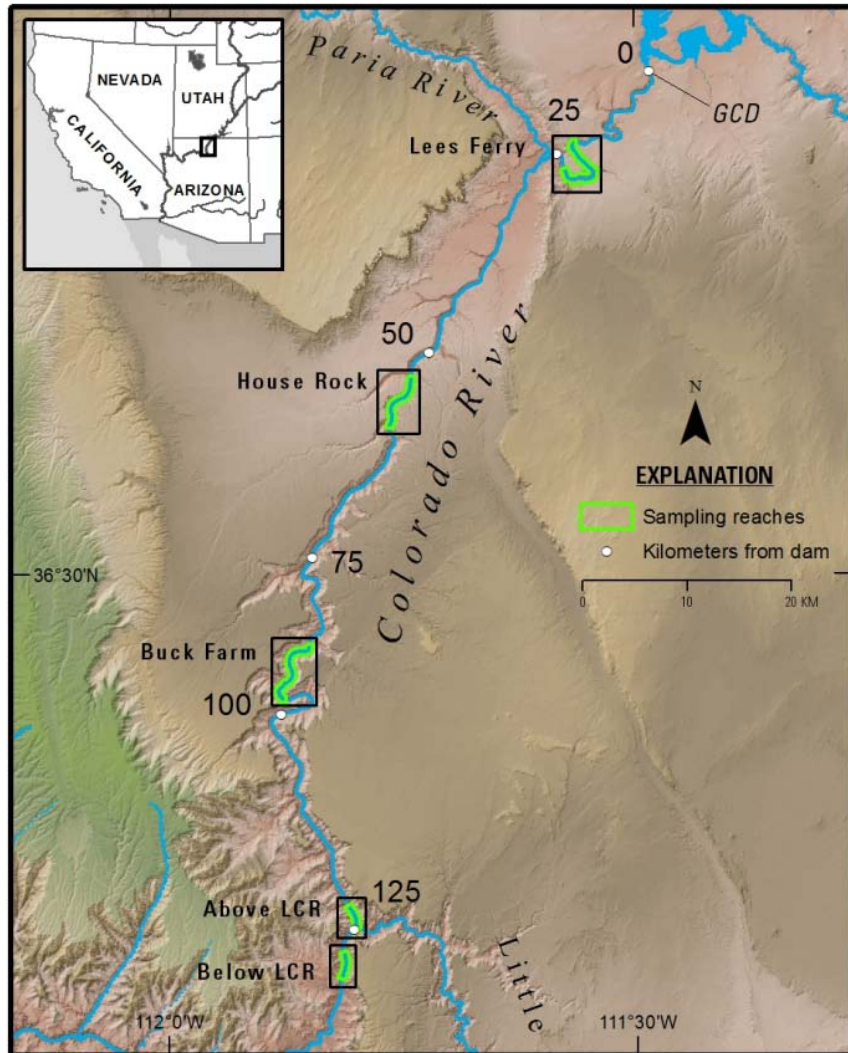




Natal Origins: Glen Canyon and Marble Canyon

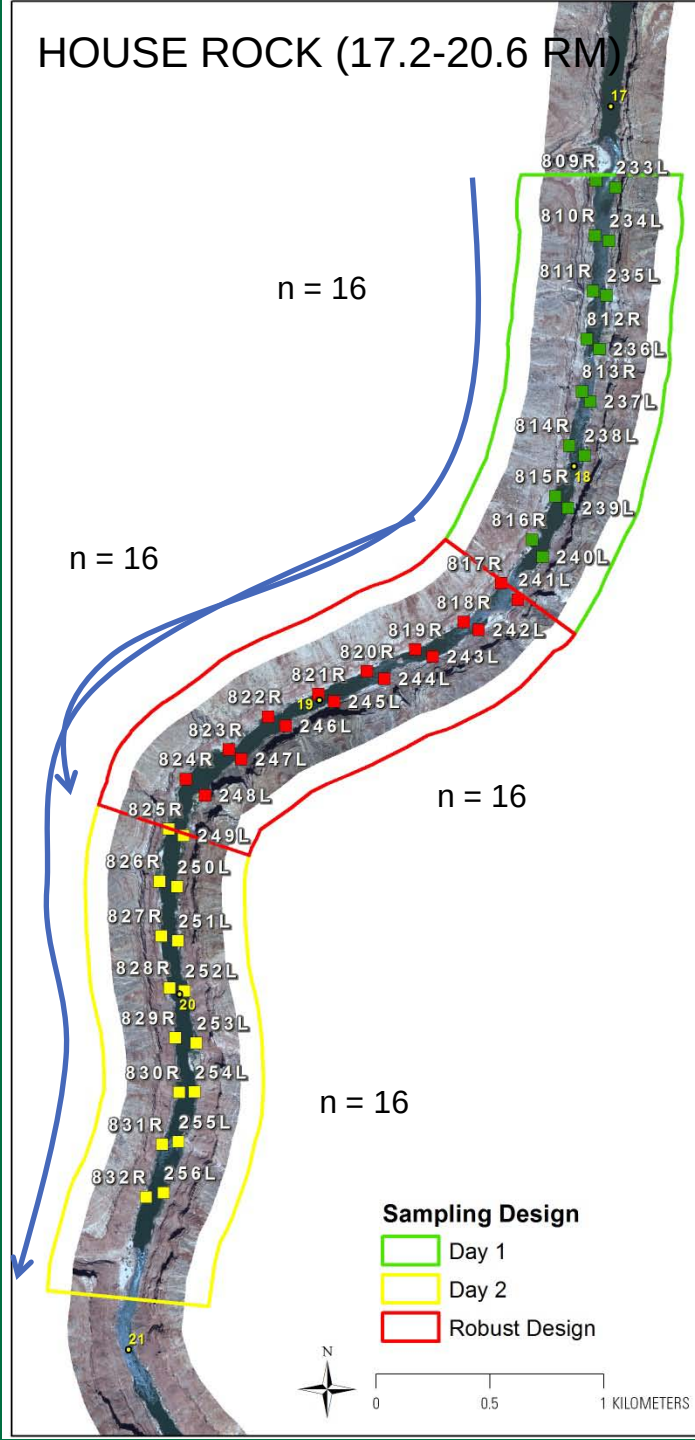
Josh Korman, Ecometrics, Inc. Vancouver, B.C.
Michael D. Yard, GCMRC, Flagstaff, AZ.

Sampling Design



- Spatially referenced sampling
 - Site length (250 m)
 - Total of 1,160 sites
 - Estimate movement probabilities
- Annual fall marking trips (Oct-Dec)
 - Age-0 (FL >75 mm)
 - ~ 10,000 marked animals
 - Glen Canyon Dam to Lees Ferry
- Quarterly trips for tag recovery and mark-recapture
 - Jan, Apr, Jul, and Sep
- 5 Study Reaches
 - LEES FERRY (-5.5 to -2.1 RM)
 - HOUSE ROCK (17.2-20.6 RM)
 - BUCK FARM (38.2 to 41.6 RM)
 - ABOVE LCR (60.2 to 61.2 RM)
 - BELOW LCR (63.4 to 64.4 RM)

HOUSE ROCK (17.2-20.6 RM)



Sampling Design

➤ Mark-Recapture

- o Robust Design
- o 2 – Electrofishing boats (Osprey)
- o Conduct 2-pass mark recapture

➤ 48 sampling sites / sampling reach

- o Sample 32 sites / night
- o Exception Reaches 4A & 4B (LCR)

➤ Rapid Computer Data-entry Program

CATCH TABLE

Common Name	Natal Origin						Juvenile Chub Monitoring					
	2011			2012			2011			2012		
	Nov	Apr	Jul	Sep	Oct	Dec	Nov	Apr	Jul	Sep	Oct	Dec
Yellow Bullhead			3				-	3	2	1	-	-
Bluehead Sucker		11	23	13			-	42	120	95	-	-
Brown Trout	29	12	14	10	11	18	-	2	2	3	-	-
Channel Catfish						1	-	2	1	1	-	-
Common Carp		2	5	3	2	8	-	5	9	3	-	-
Fathead Minnow		41	8	36			-	509	303	627	-	-
Flannemouth Sucker		83	190	115		4	-	58	81	89	-	-
Green Sunfish			1		1	1						
Humpback Chub		88	60	114			-	1,267	875	3,600	-	-
Killifish				1			-	9	62	29	-	-
Rainbow Trout	16,559	11,889	11,642	17,884	22,950	12,733	-	118	215	272	-	-
Red Shiner		2	1	5			-	39	24	65	-	-
Smallmouth Bass				1		1						
Speckled Dace		10	2	2			-	85	16	42	-	-
Unknown				2			-	-	2	-	-	-
Total Catch	16,588	12,138	11,949	18,186	22,964	12,766	-	2,139	1,712	4,827	-	-

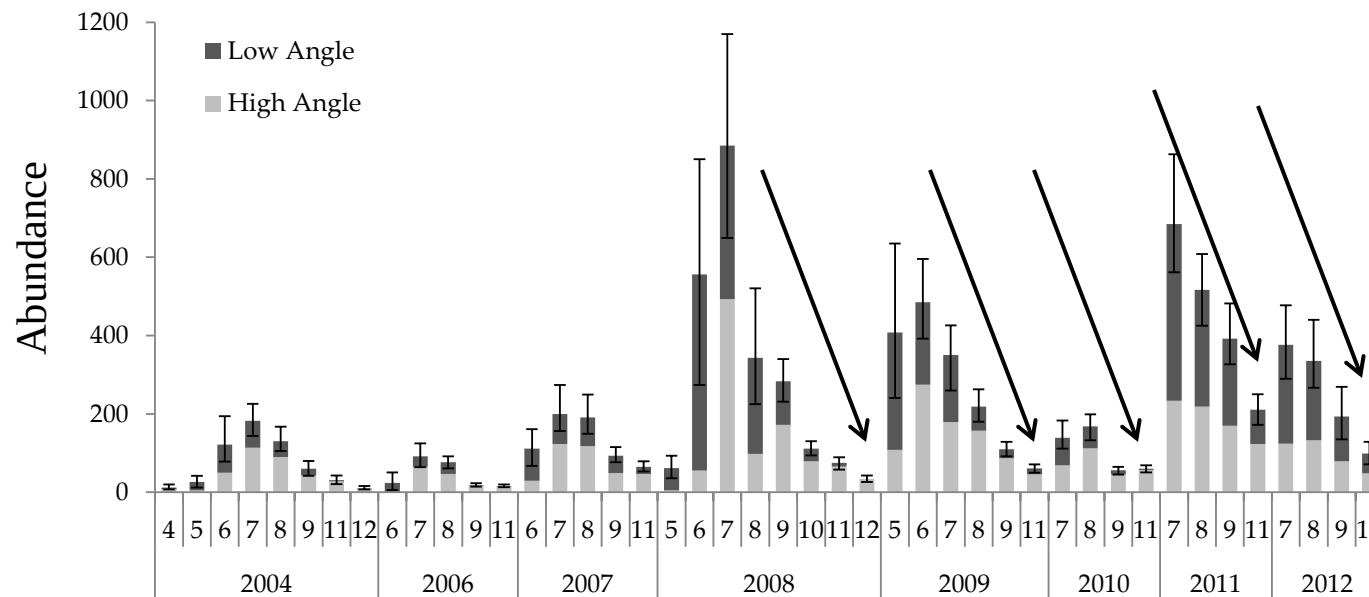


PIT-tag Releases and Recaptures

Nov., 2011	(12,320	80-150 mm age-0 LF only)
Apr., 2012	(2,164	>=80 mm, all reaches)
Jul., 2012	(2,947	>=80 mm, all reaches)
Sep., 2012	(2,789	>=80 mm, all reaches)
Oct. & Dec. 2012	(9,432	75-150 mm age-0 LF only)

- 1,173 across-trip recaptures based on 26,863 releases between Nov. 2011 and Dec. 2012.

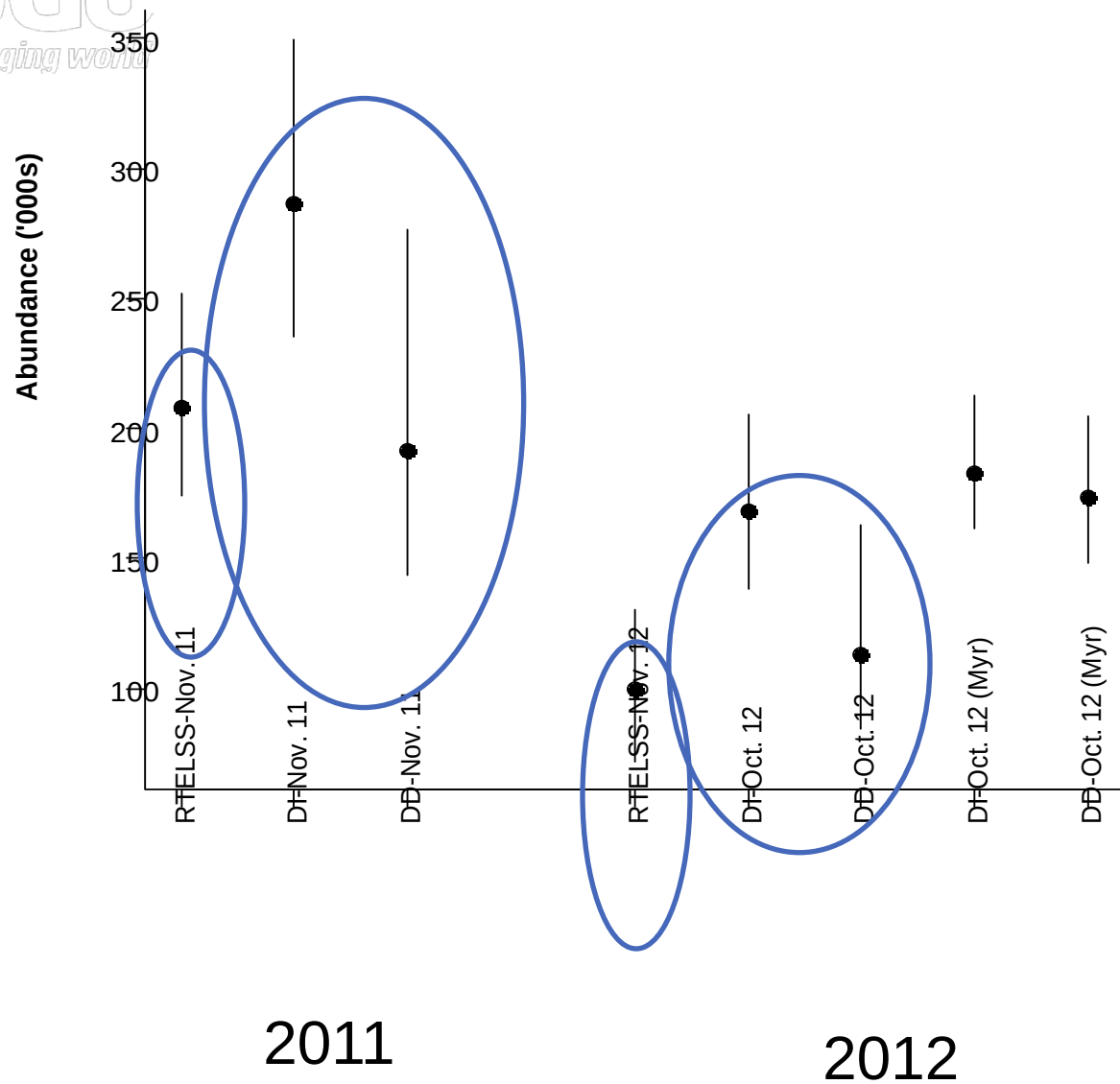
Rainbow Trout Early Larval Life-history Study (RTELSS)



	Low		High		Total	
	July	Nov.	July	Nov.	July	Nov.
2008	392	9	493	66	883	75
2009	171	15	179	46	350	62
2010	70	3	69	57	140	61
2011	451	88	234	123	686	214
2012	252	51	124	48	377	100

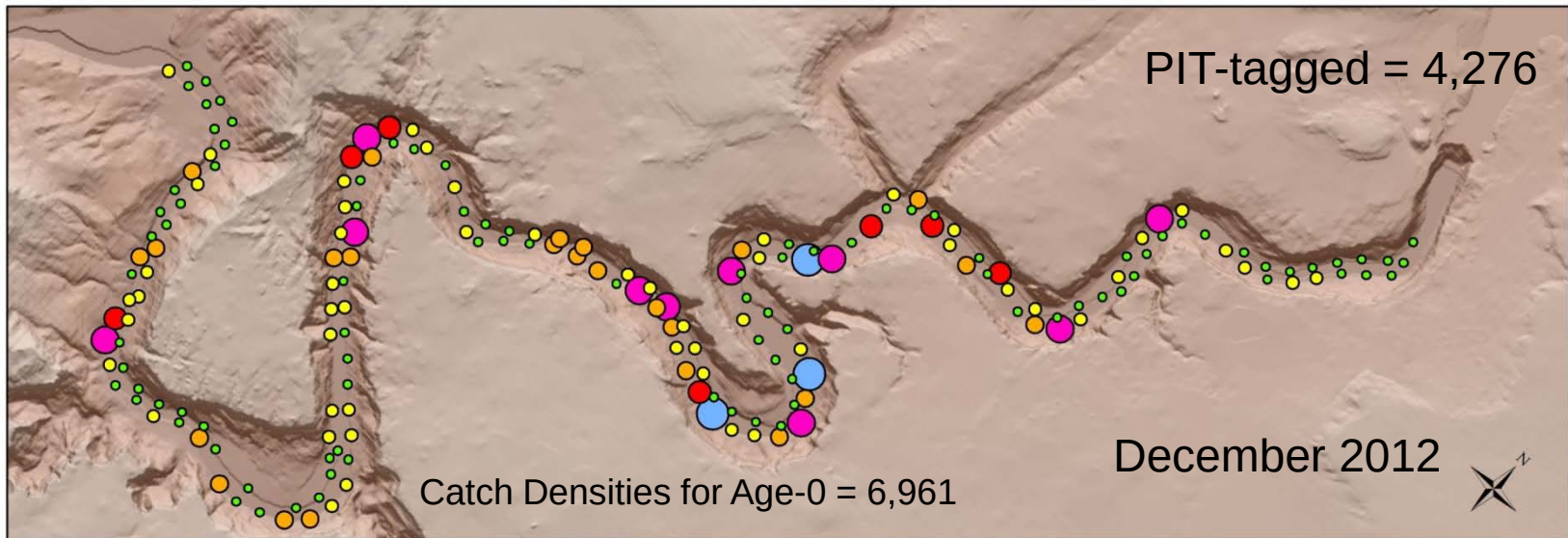
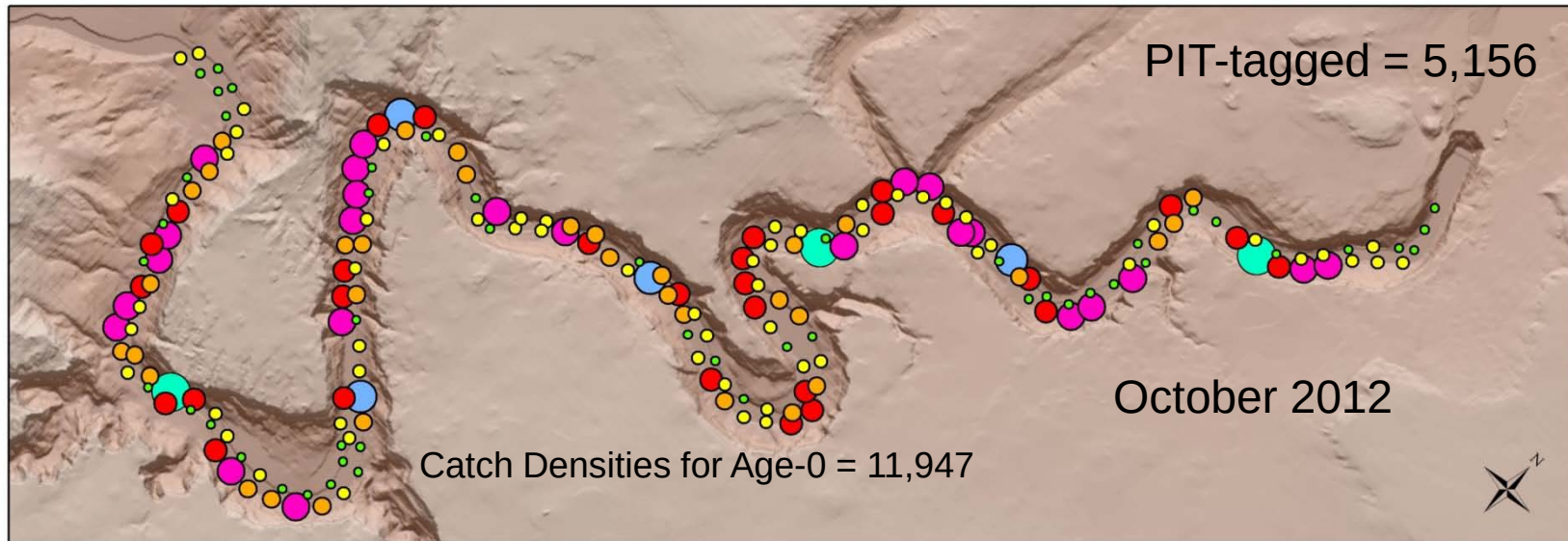
Age-0 Abundance ('000's)

Rainbow Trout Age-0 Estimates

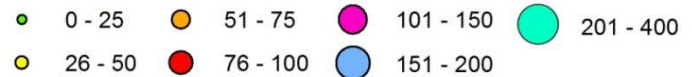


Glen Canyon Dam to Lees Ferry

(Rainbow Trout Electrofishing Catch Densities)

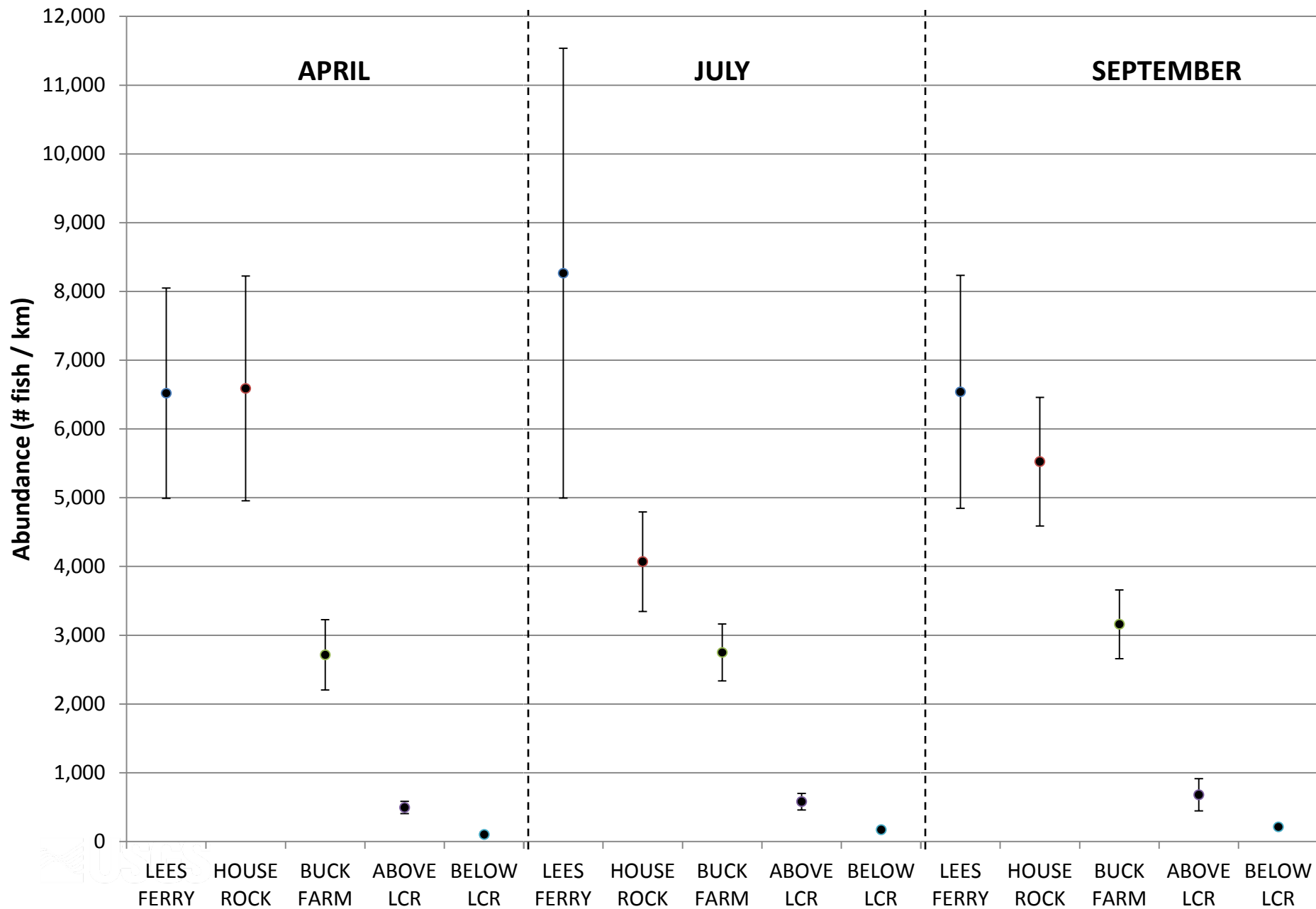


RBT (<150 mm FL)/250 m

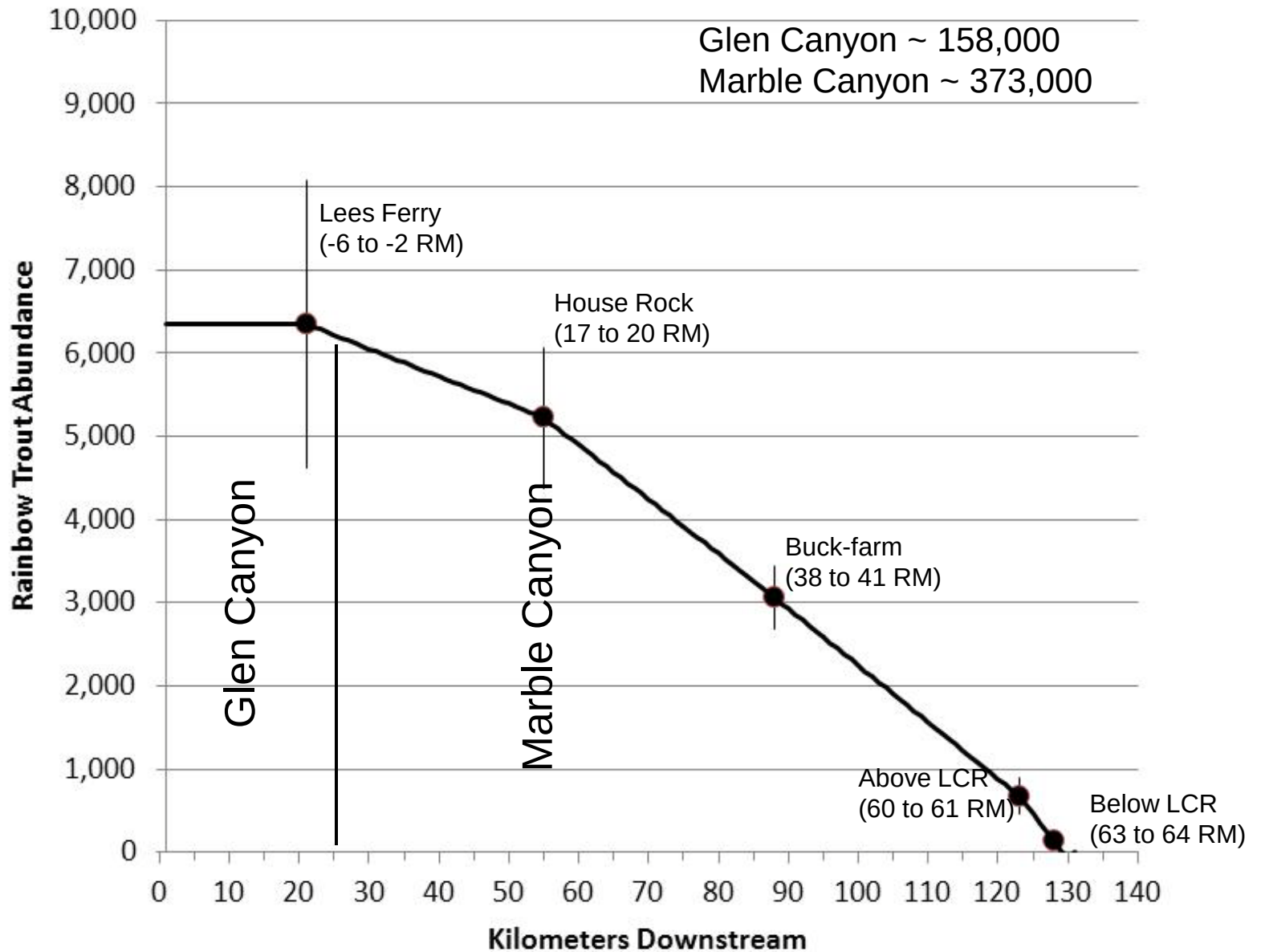


0 1 2 3 4 Kilometers

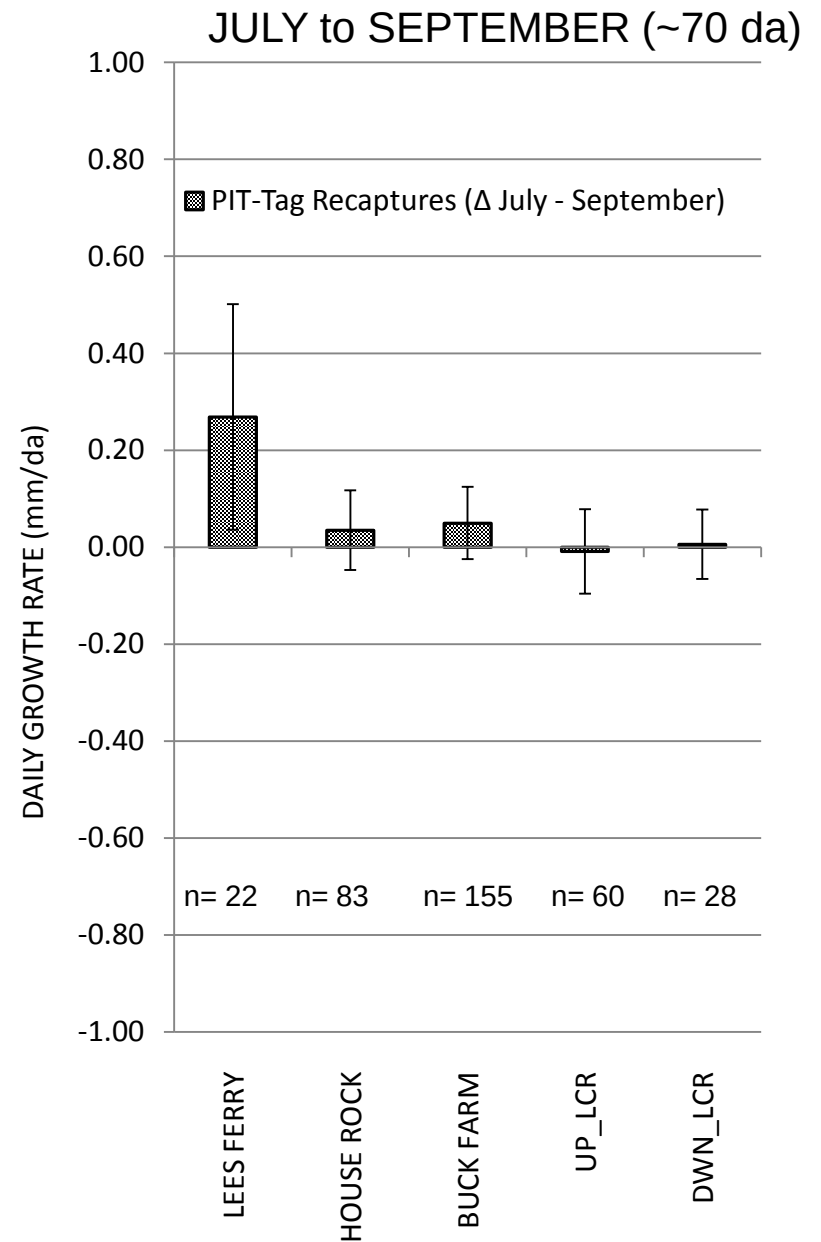
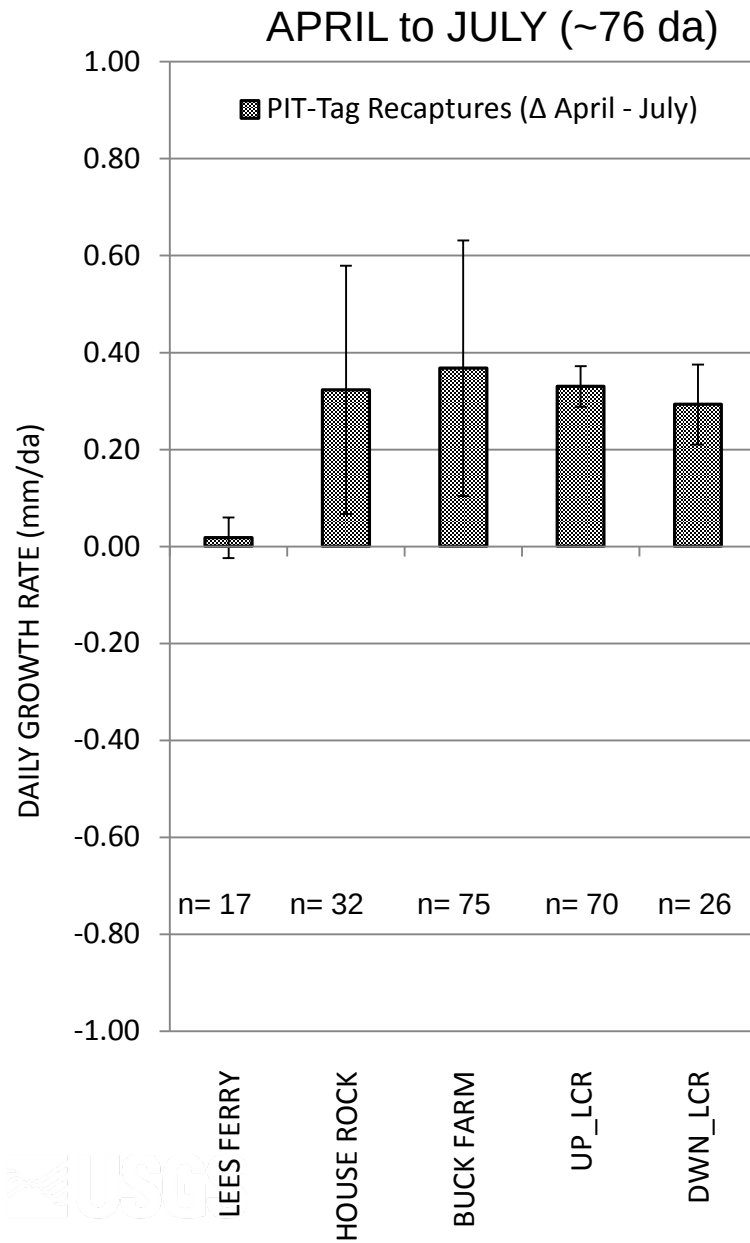
Rainbow Trout Abundance - 2012



September - 2012

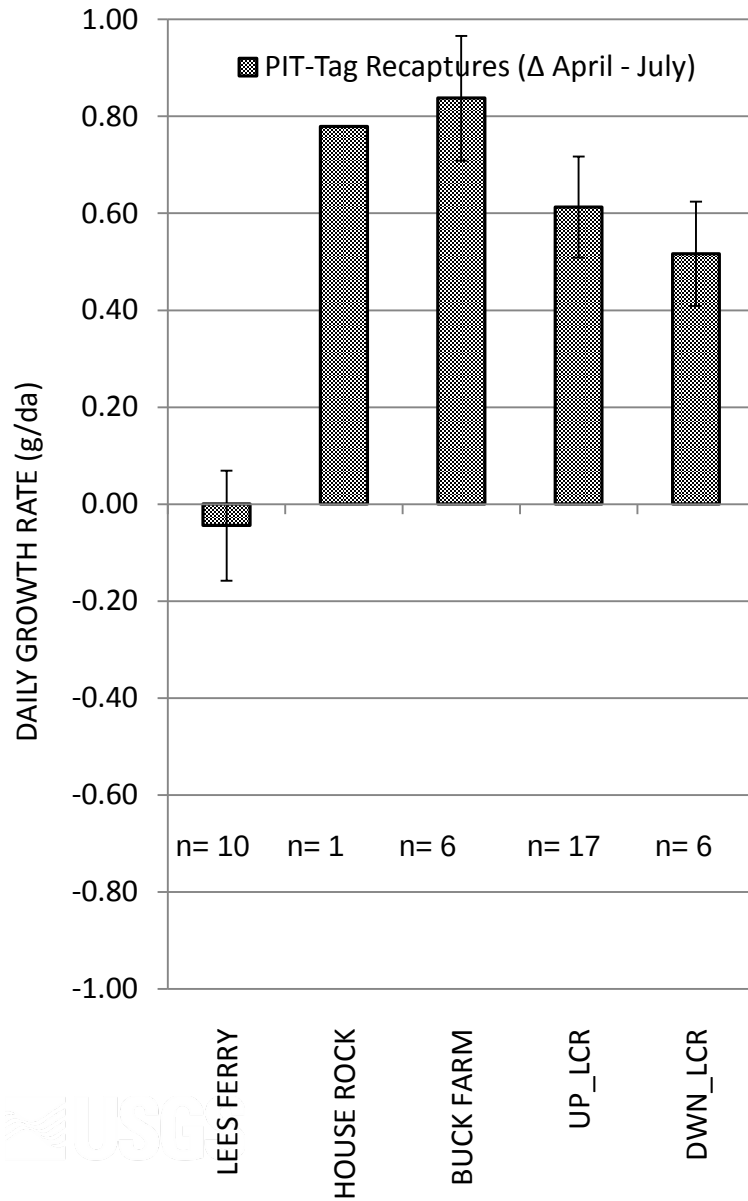


Rainbow Trout (≥ 150 mm FL)

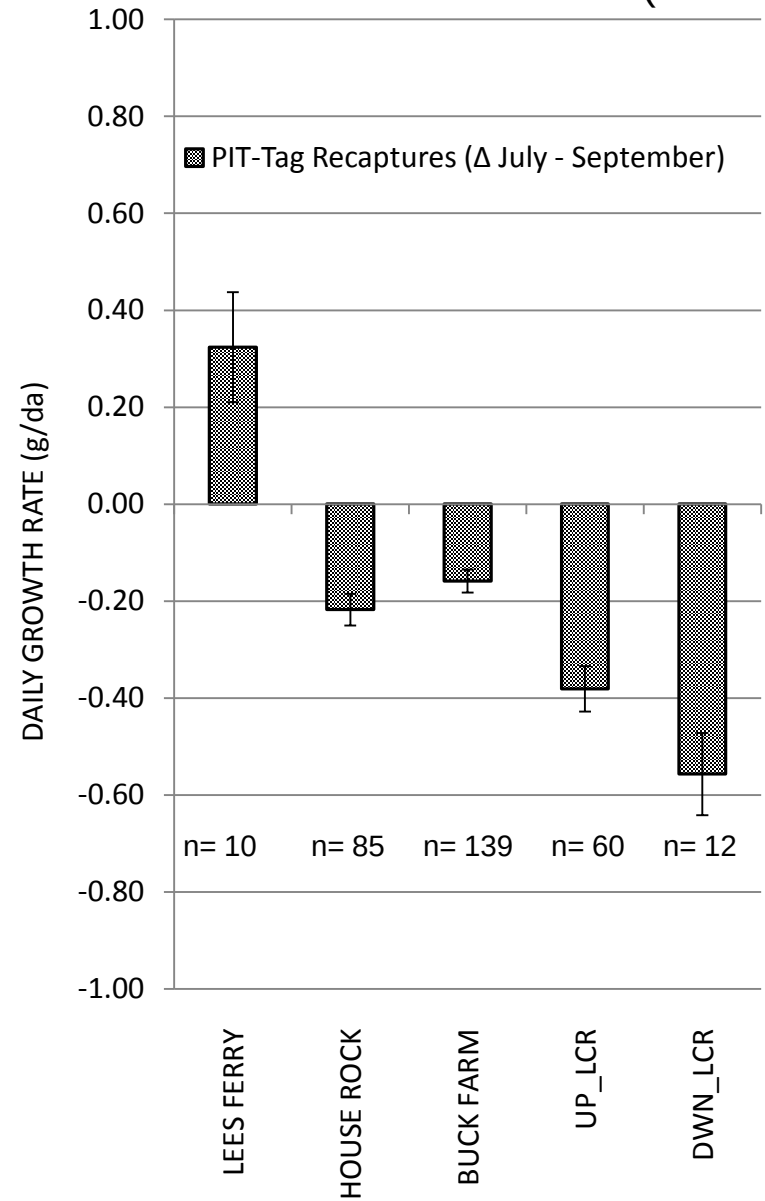


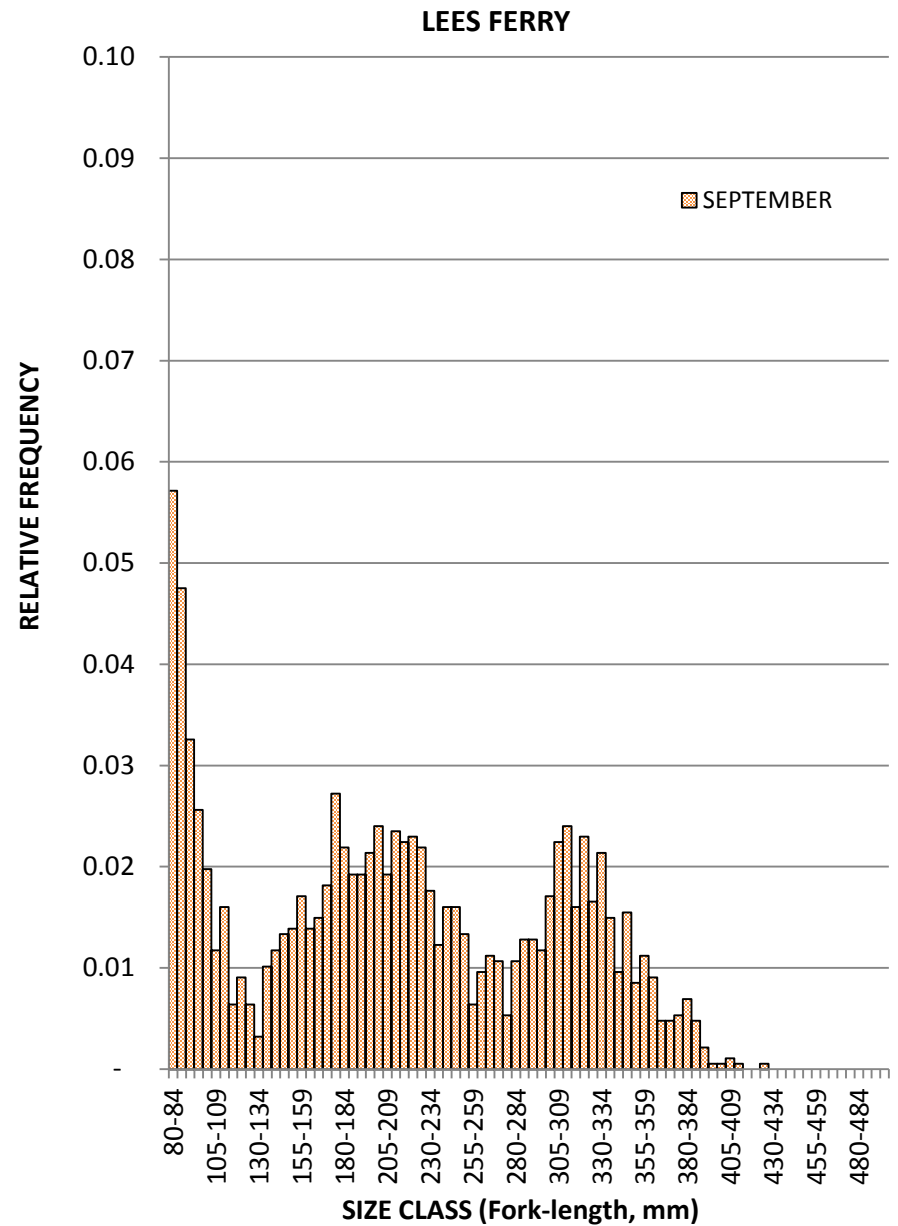
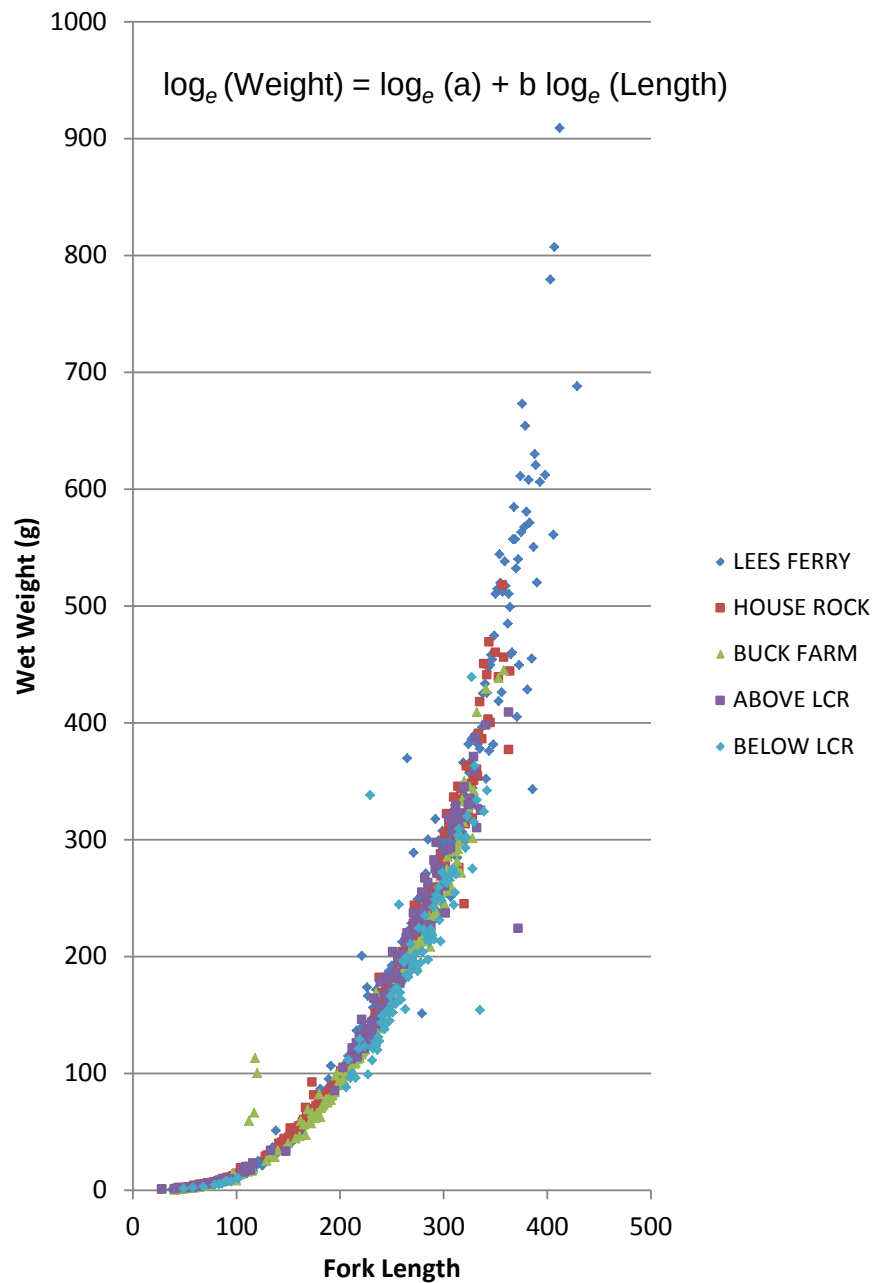
Rainbow Trout (≥ 150 mm FL)

APRIL to JULY (~76 da)

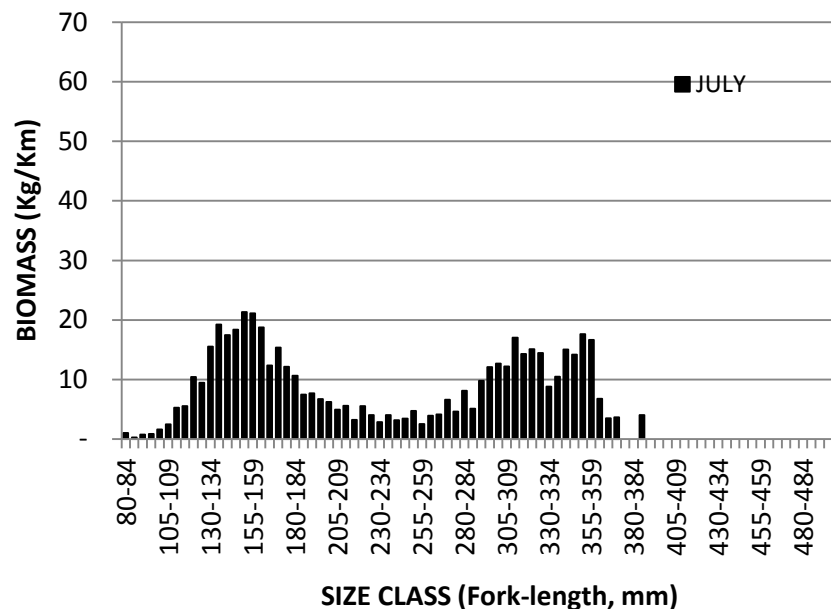


JULY to SEPTEMBER (~70 da)

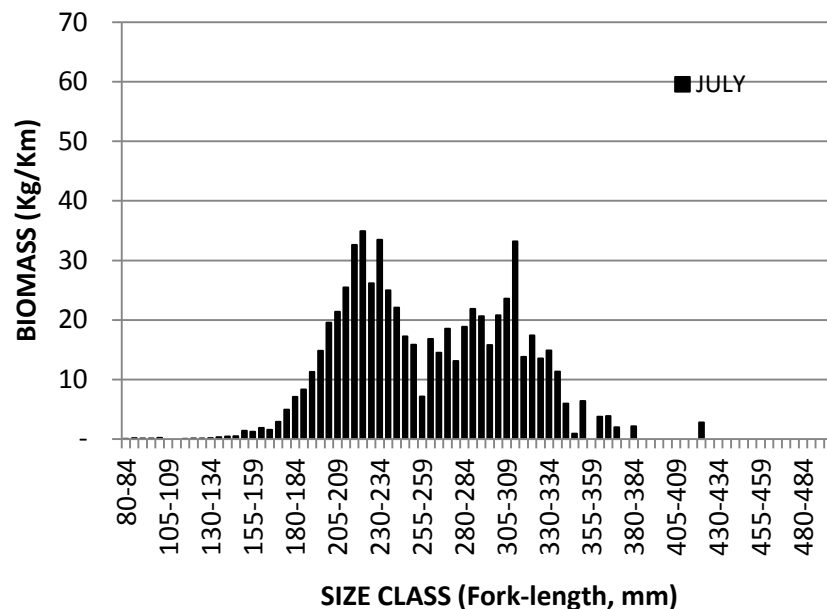




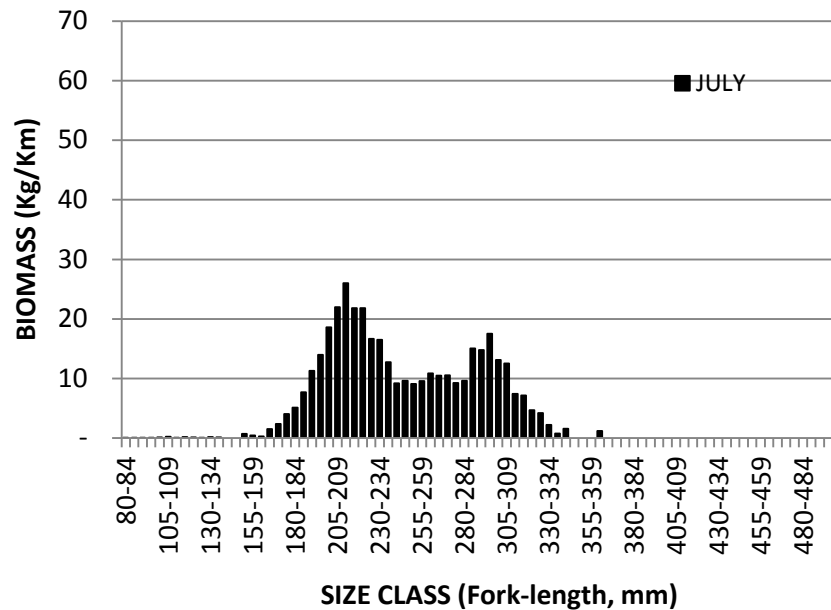
LEES FERRY



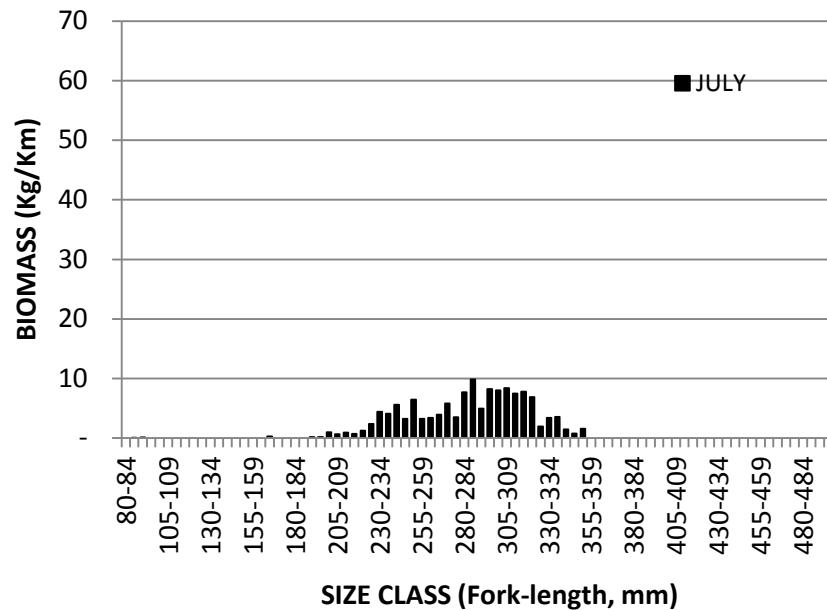
HOUSE ROCK

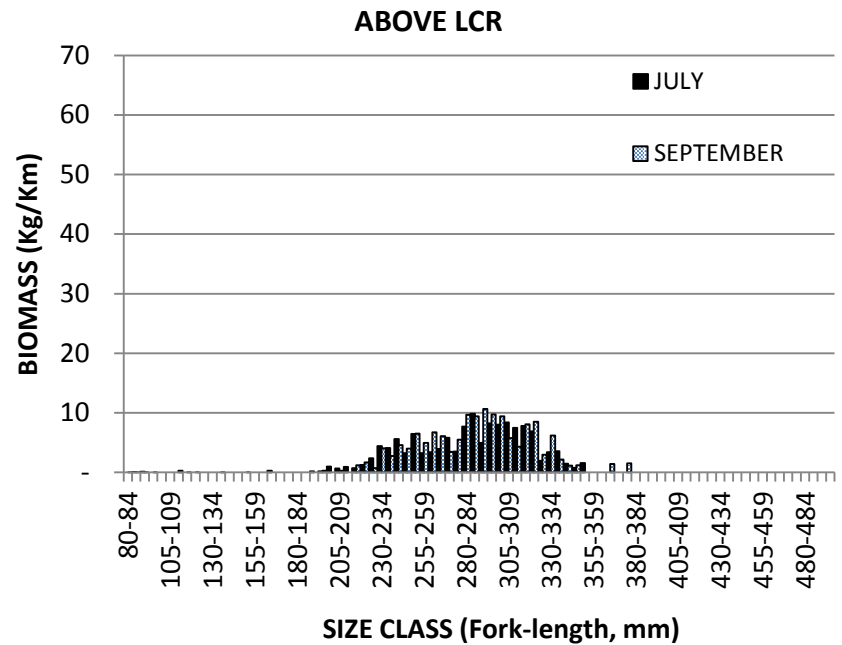
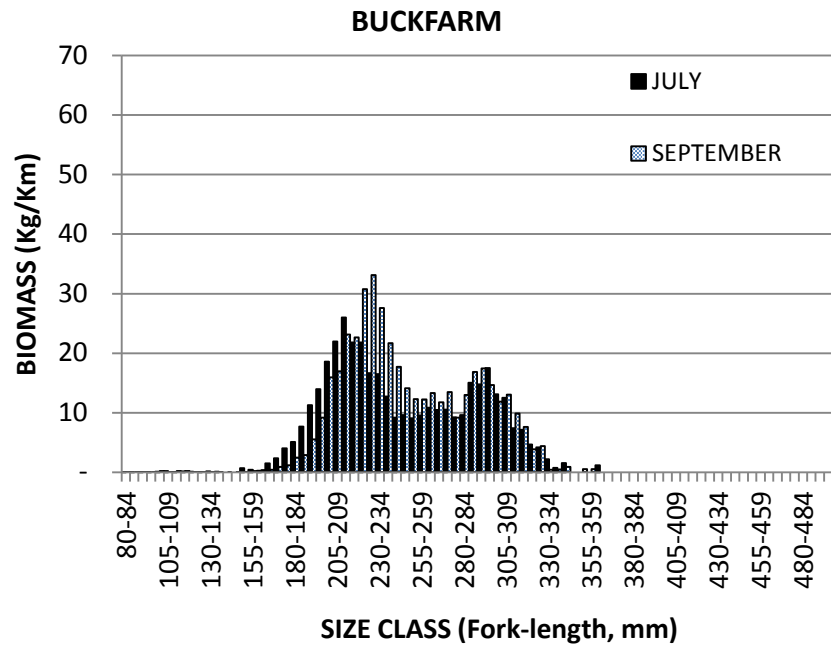
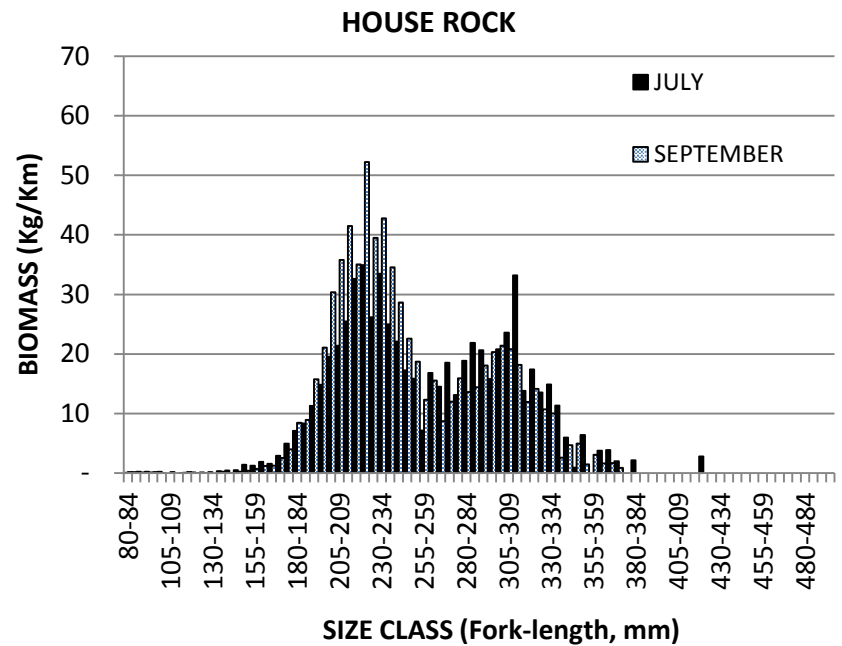
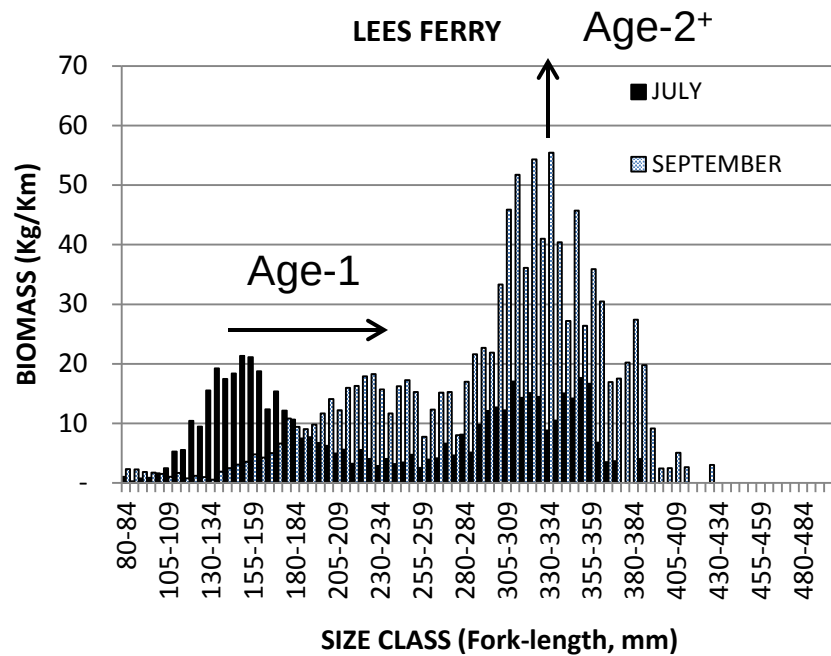


BUCKFARM

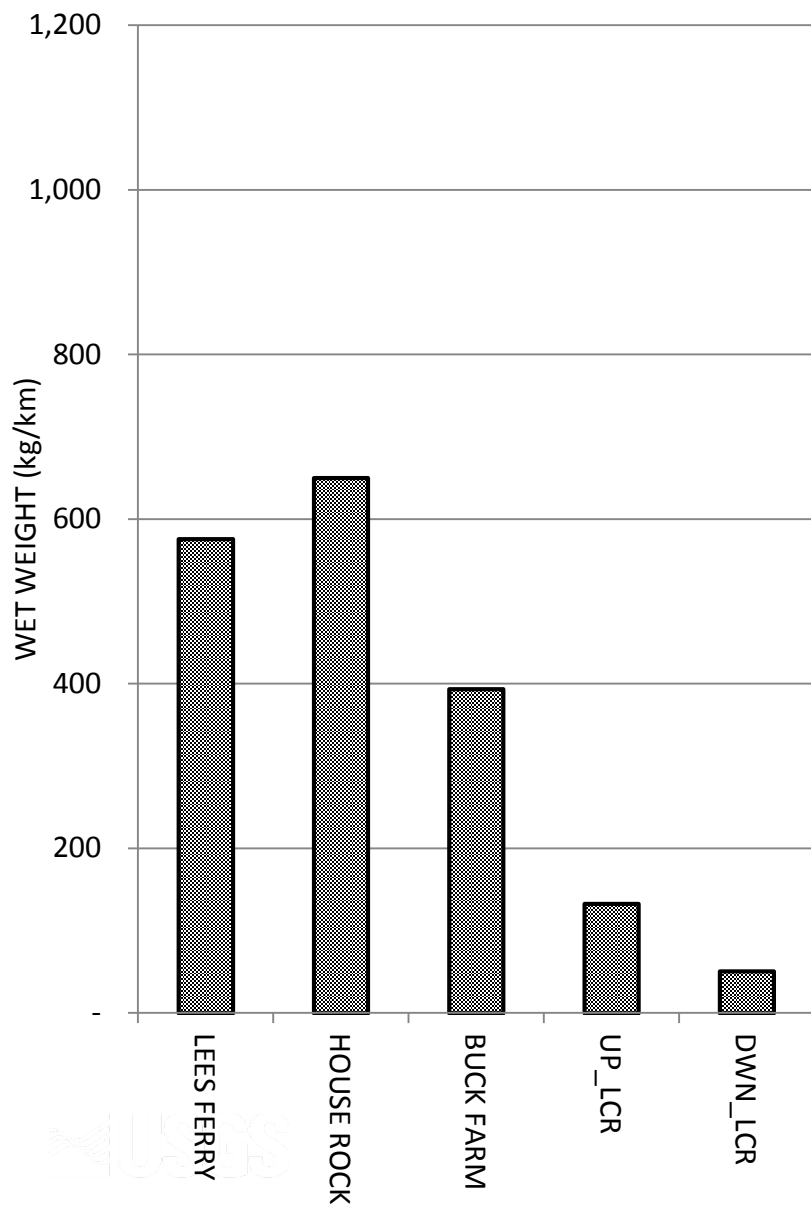


ABOVE LCR

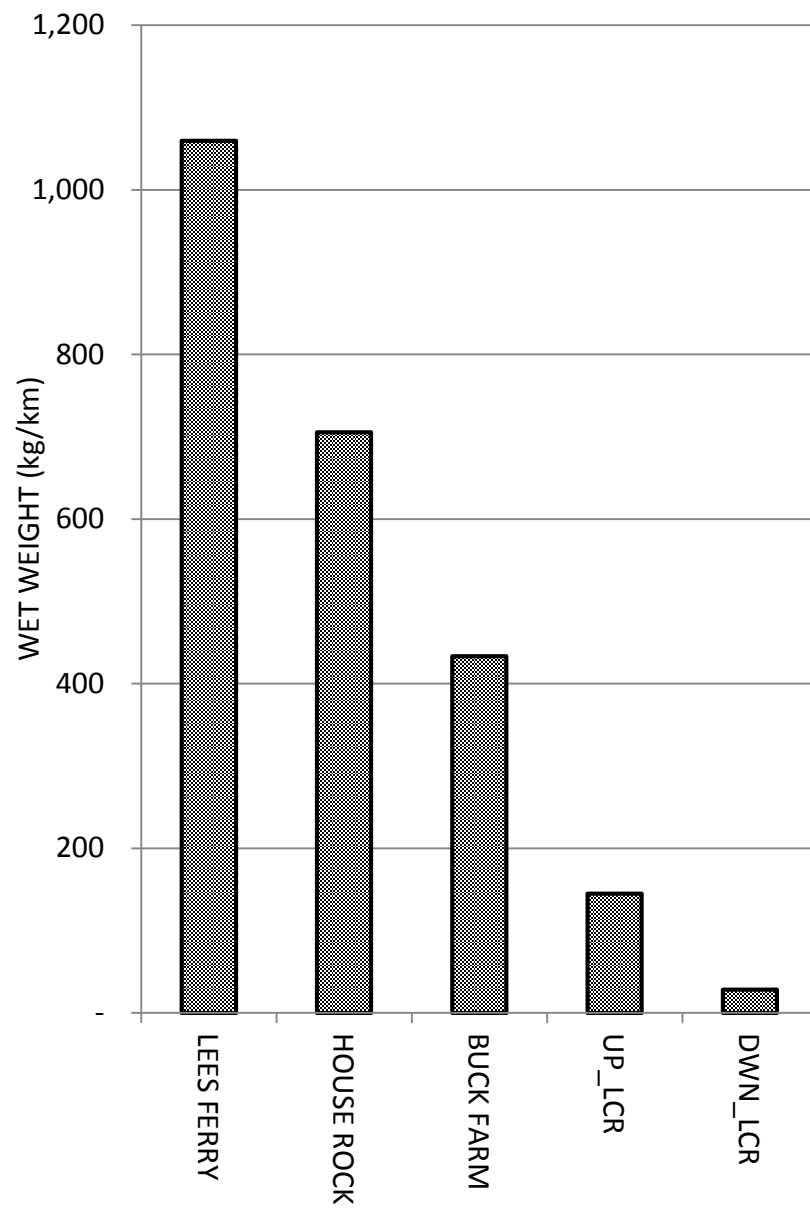




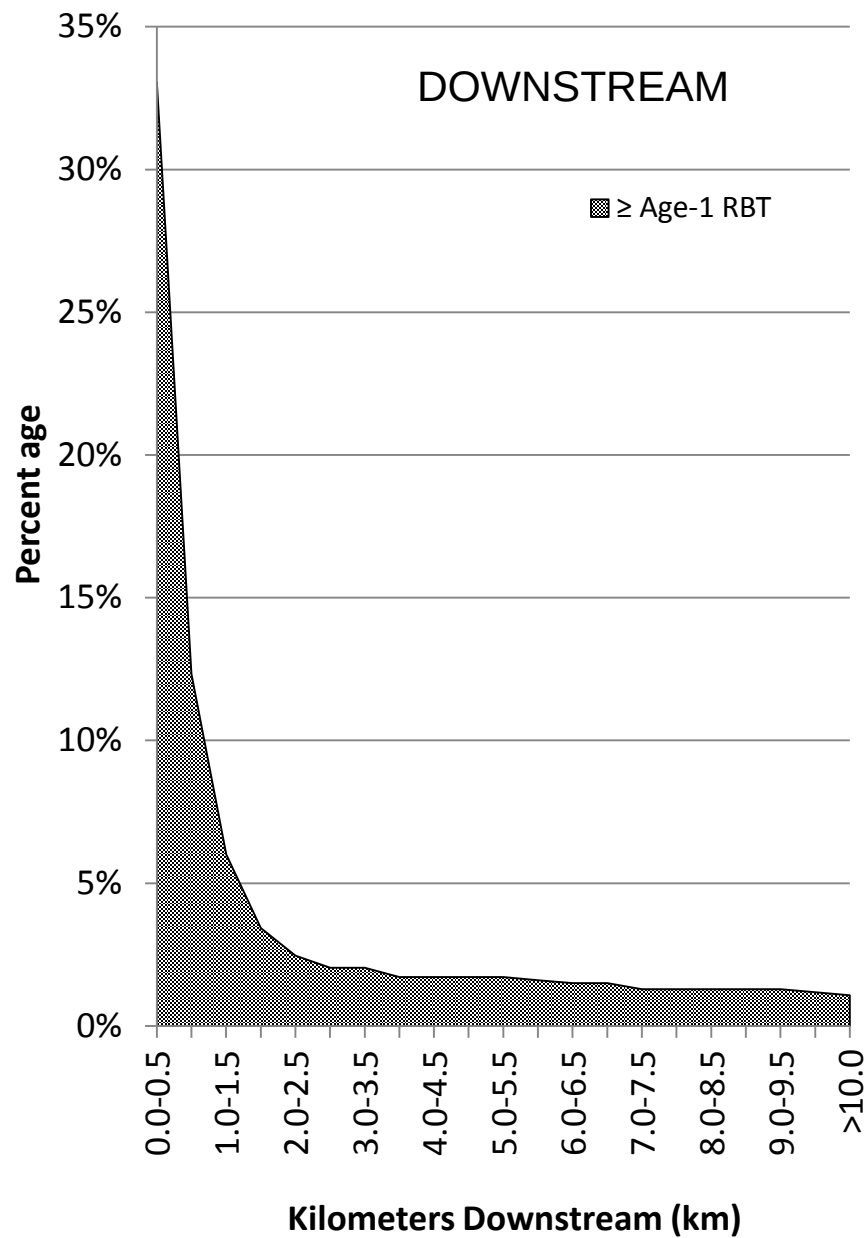
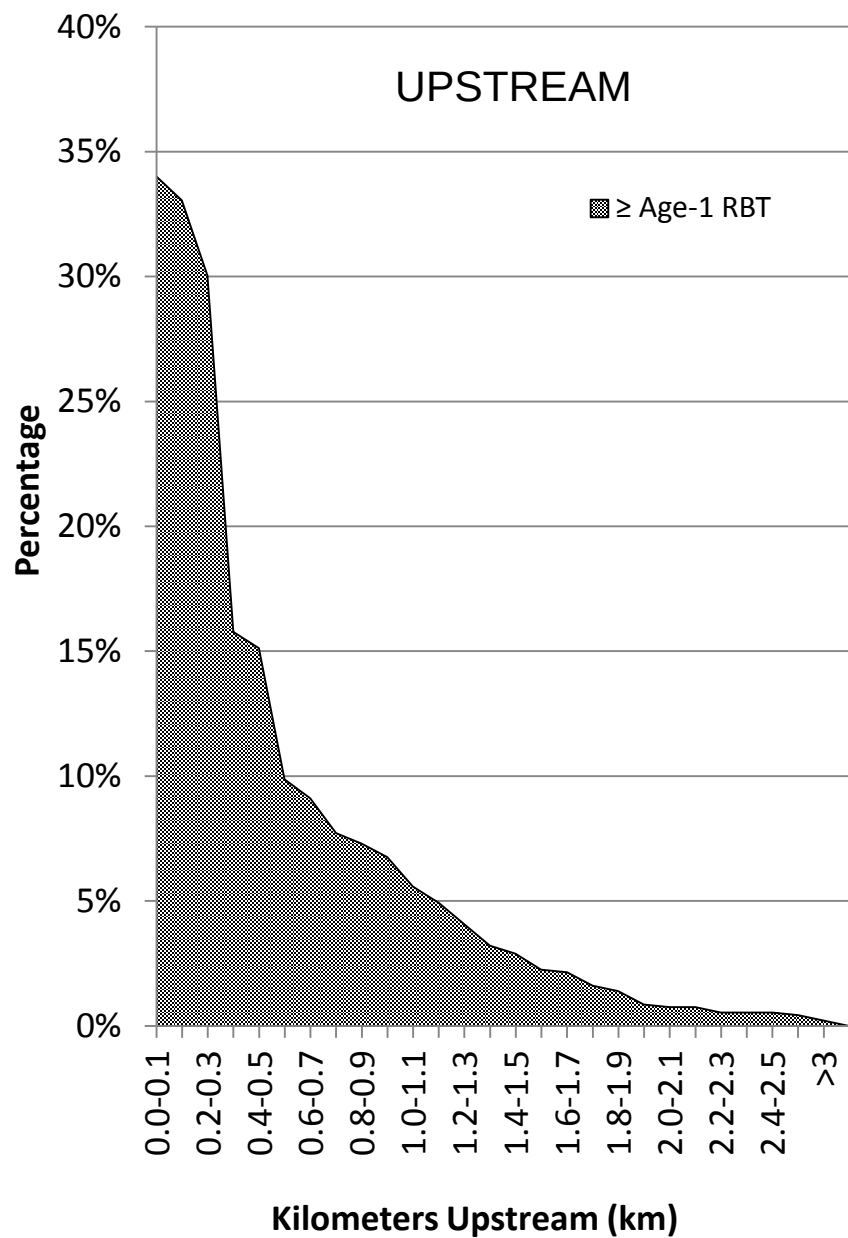
JULY 2012



SEPTEMBER 2012



2012 PIT-Tag Recaptures

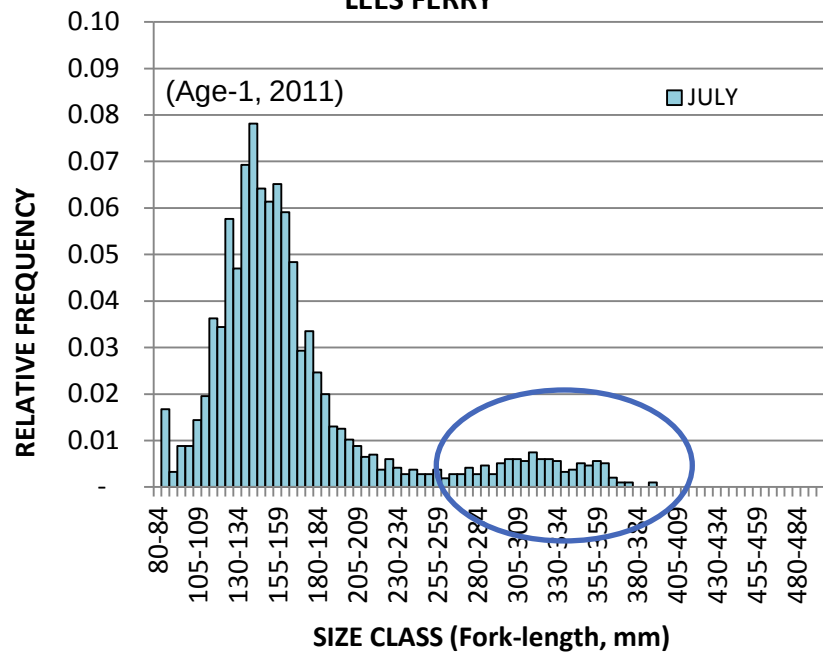


Long-Range Movement to Date

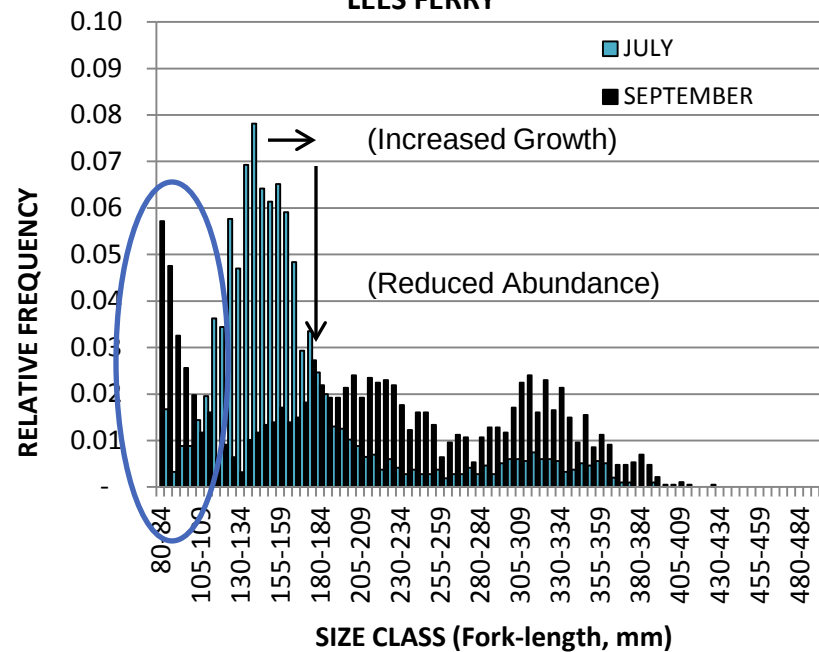
PIT ID	Trip		Location (mi)		Fork Length (mm)		Growth (mm)	Net Movement	
	Release	Recapture	Release	Recapture	Release	Recapture		Miles	Kilometers
384.1B796B6F61	Nov. 11	Apr. 12	-4.9	18.7	90	125	35	23.6	38.0
384.1B796BB627	Nov. 11	Apr. 12	-11.6	19.1	93	107	14	30.7	49.4
384.1B796CA340	Apr. 12	Jul. 12	-6.2	17.4	299	312	13	23.6	38.0
384.1B796BA11E ¹	Apr. 12	Jul. 12	60.3	64.1	305	316	11	3.8	6.1
384.1B796C994B	Apr. 12	Sep. 12	-12.44	19.14	-	-	-	31.6	50.8
384.1B796CA80E ¹	Apr. 12	Sep. 12	60.47	64.45	205	243	38	4.0	6.4
384.1B796FAB90	Apr. 12	Sep. 12	19.28	61.01	294	297	3	41.7	67.1
384.1B796A4A35 ¹	Apr. 12	Sep. 12	60.2	64.56	254	268	14	4.4	7.0
384.1B796C9E18	Nov. 11	Jul. 12	-13.27	-0.84	91	113	22	12.43	7.0
384.1B796FA285	Nov. 11	Apr. 12	-3.2	-14.89	93	103	22	-11.69	7.0

¹ Trout movement into study reach located below the LCR confluence

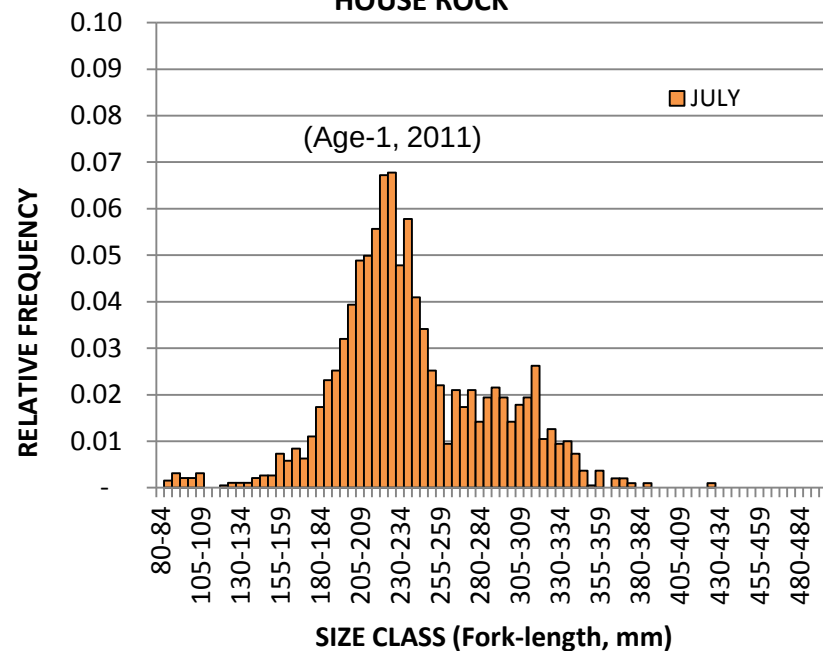
LEES FERRY



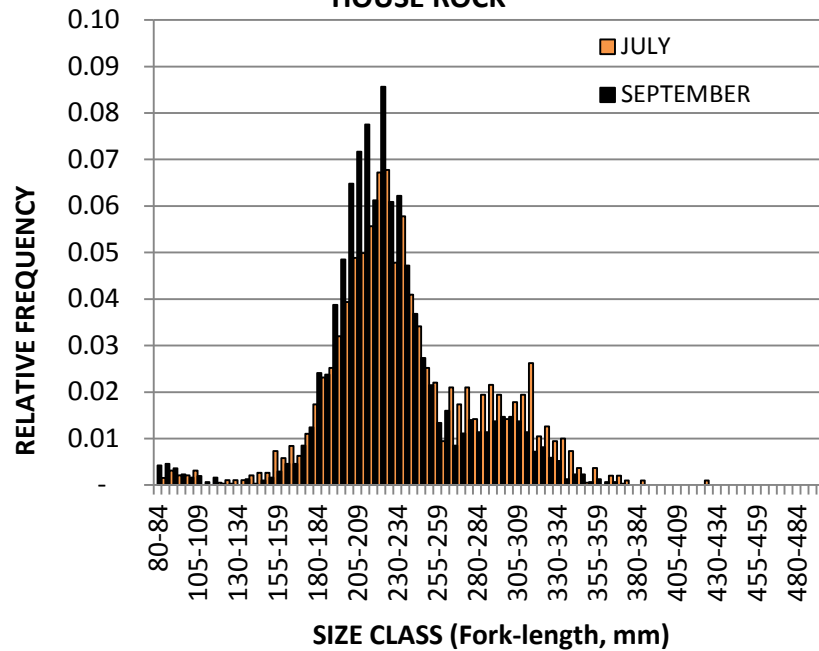
LEES FERRY



HOUSE ROCK



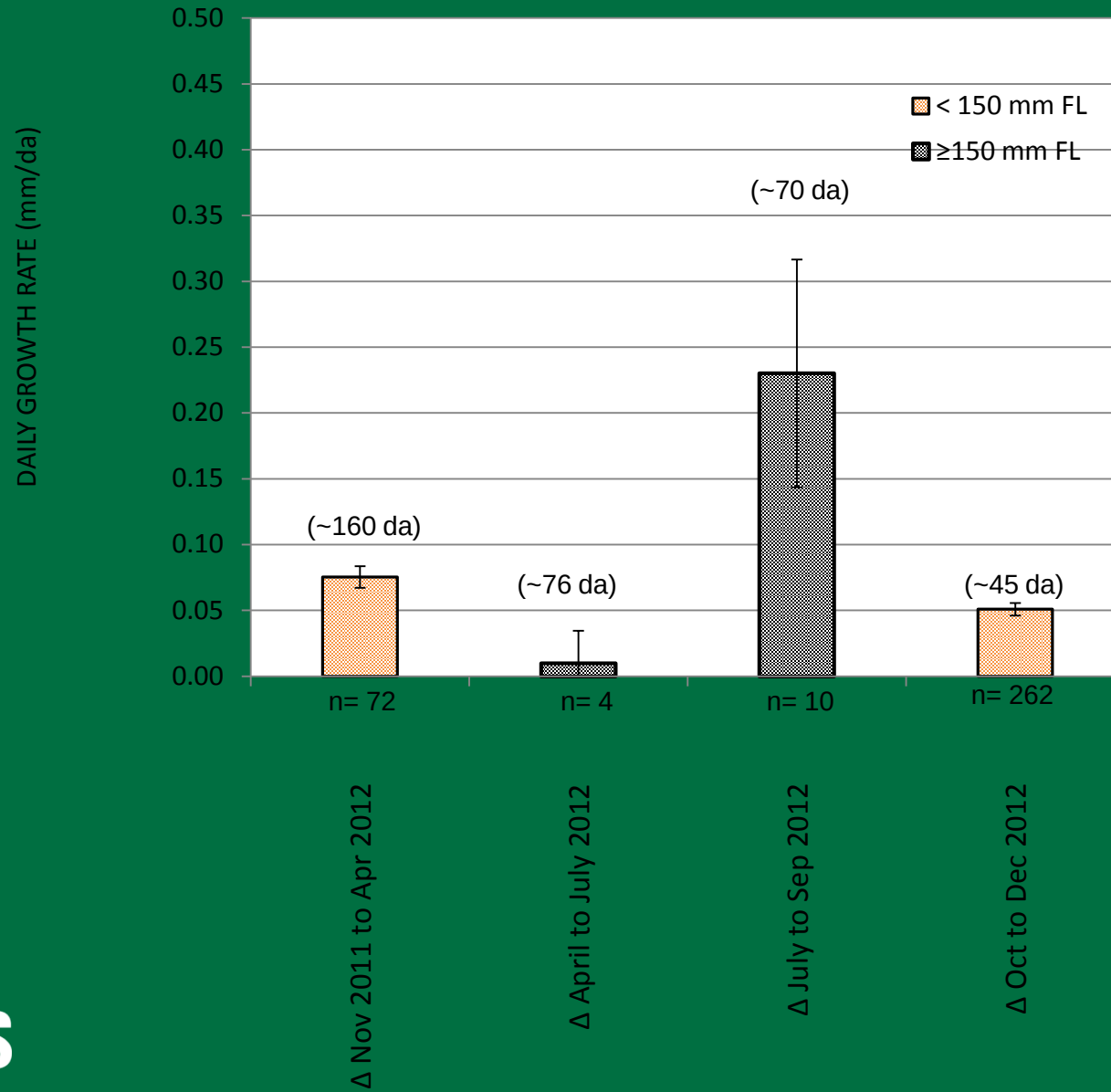
HOUSE ROCK



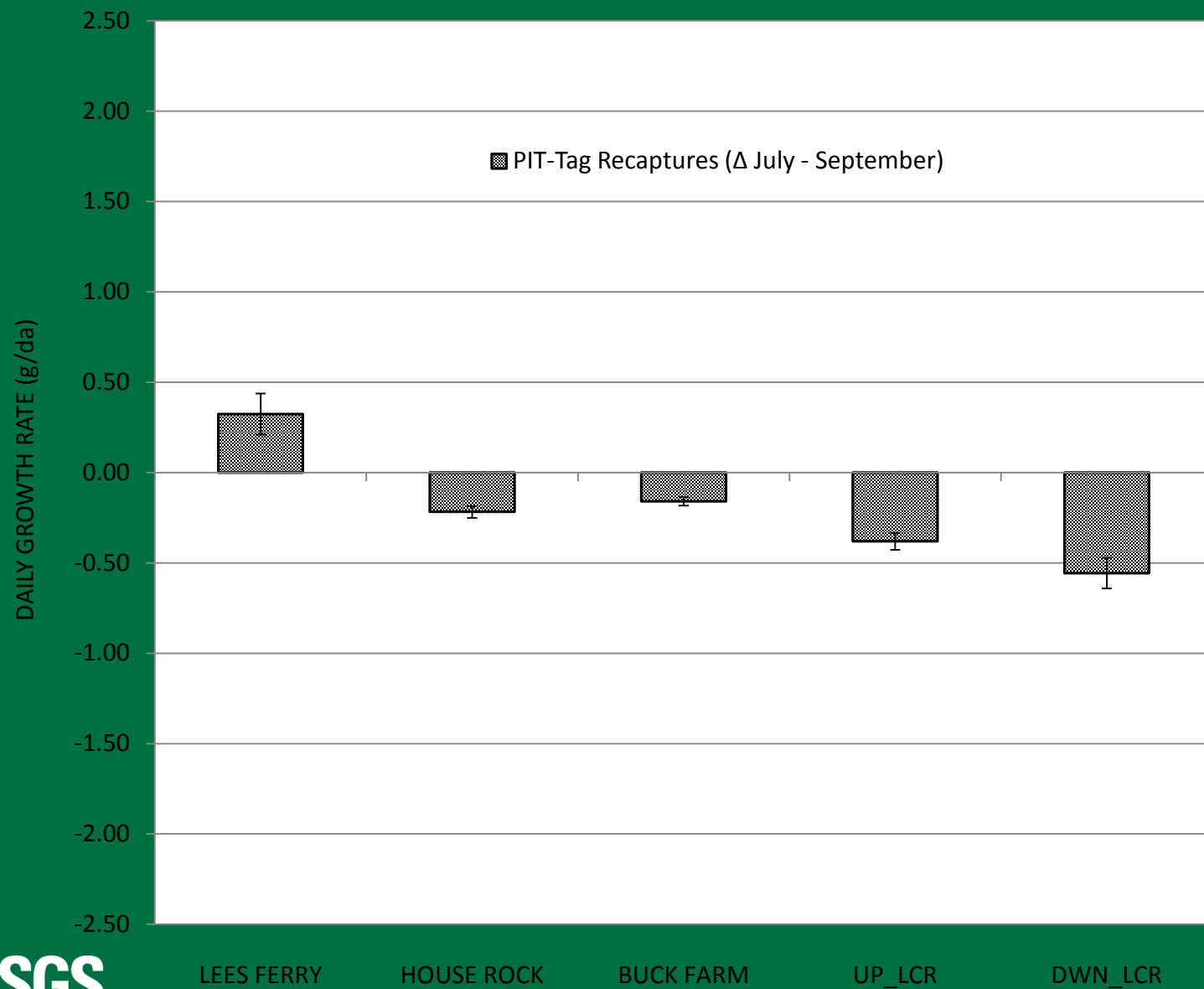
CONCLUSION

- Uncertain whether or not the Fall-2012 HFE had any direct effect on the apparent survival or abundance levels of Age-0 RBT in Glen Canyon.
 - Abundance estimates for December (Post-HFE) are to be performed and reported on in the next couple of months (Feb.-Mar.)
 - Owing to differences in capture probabilities across trips, differences in observed catch densities will not always correspond to changes in actual abundance.
- To date, no significant large scale change in trout abundances (2-pass method) has occurred in any of the downstream reaches.
 - 70% of all rainbow are currently found downstream in Marble Canyon.
 - Trout abundance is unevenly distributed from Glen Canyon to Little Colorado River.
 - Upstream removal activities (PBR) are not likely to be very effective at reducing trout densities at the LCR confluence area.
- Growth was geographically and seasonally variable in the Colorado River.
 - Factors like density dependence (Lees Ferry) and turbidity (Marble Canyon) are likely influencing rainbow trout growth.
 - Daily growth rate measured as weight rather than length appears to be a more sensitive metric for evaluating growth.
- Minimal downstream movement of rainbow trout was observed in 2012.
 - Only 33% of all recaptured fish show any downstream movement
 - Most large scale movement (> 10 km) occurs in a downward direction.

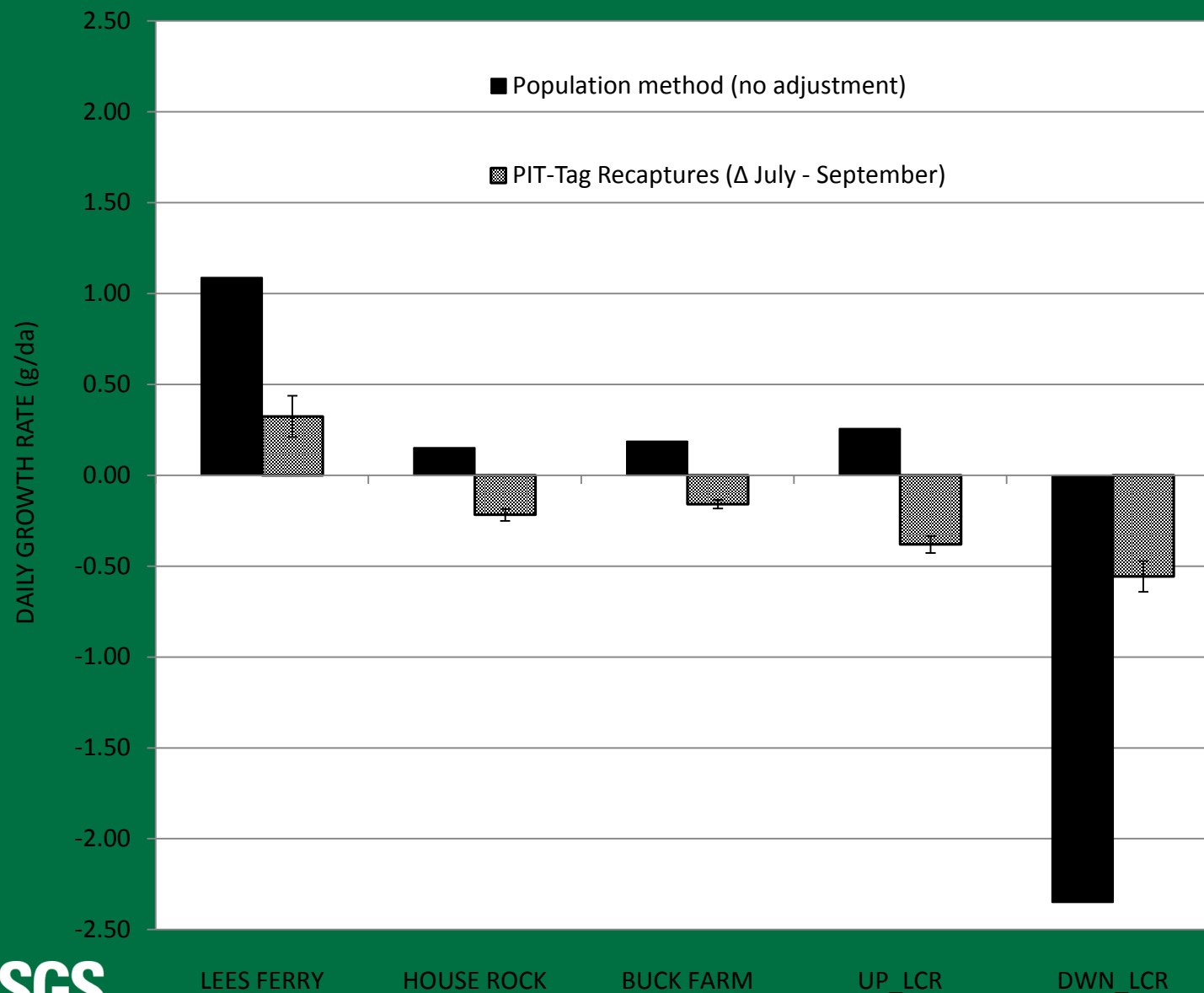
LEES FERRY



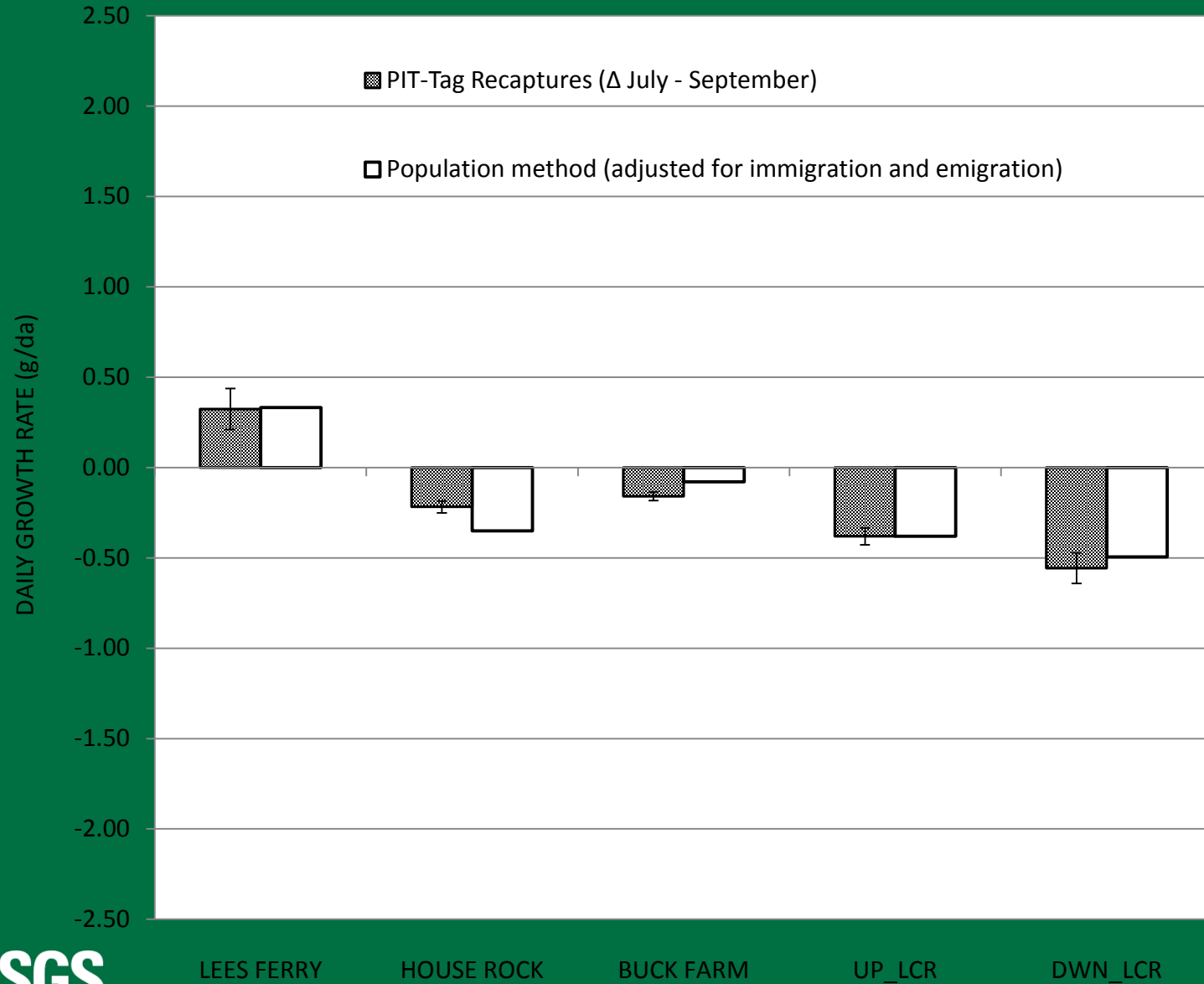
Rainbow Trout



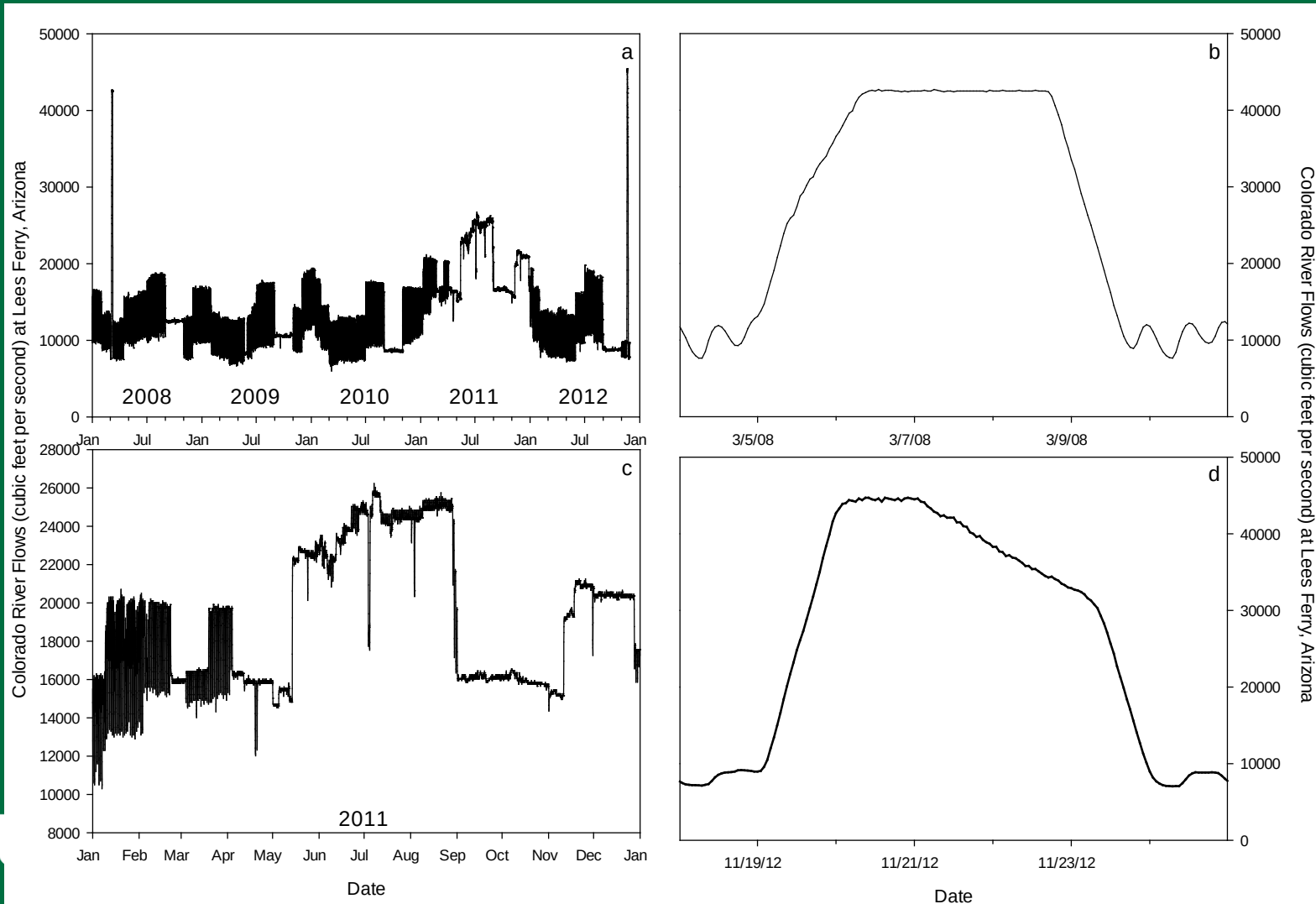
Rainbow Trout



Rainbow Trout

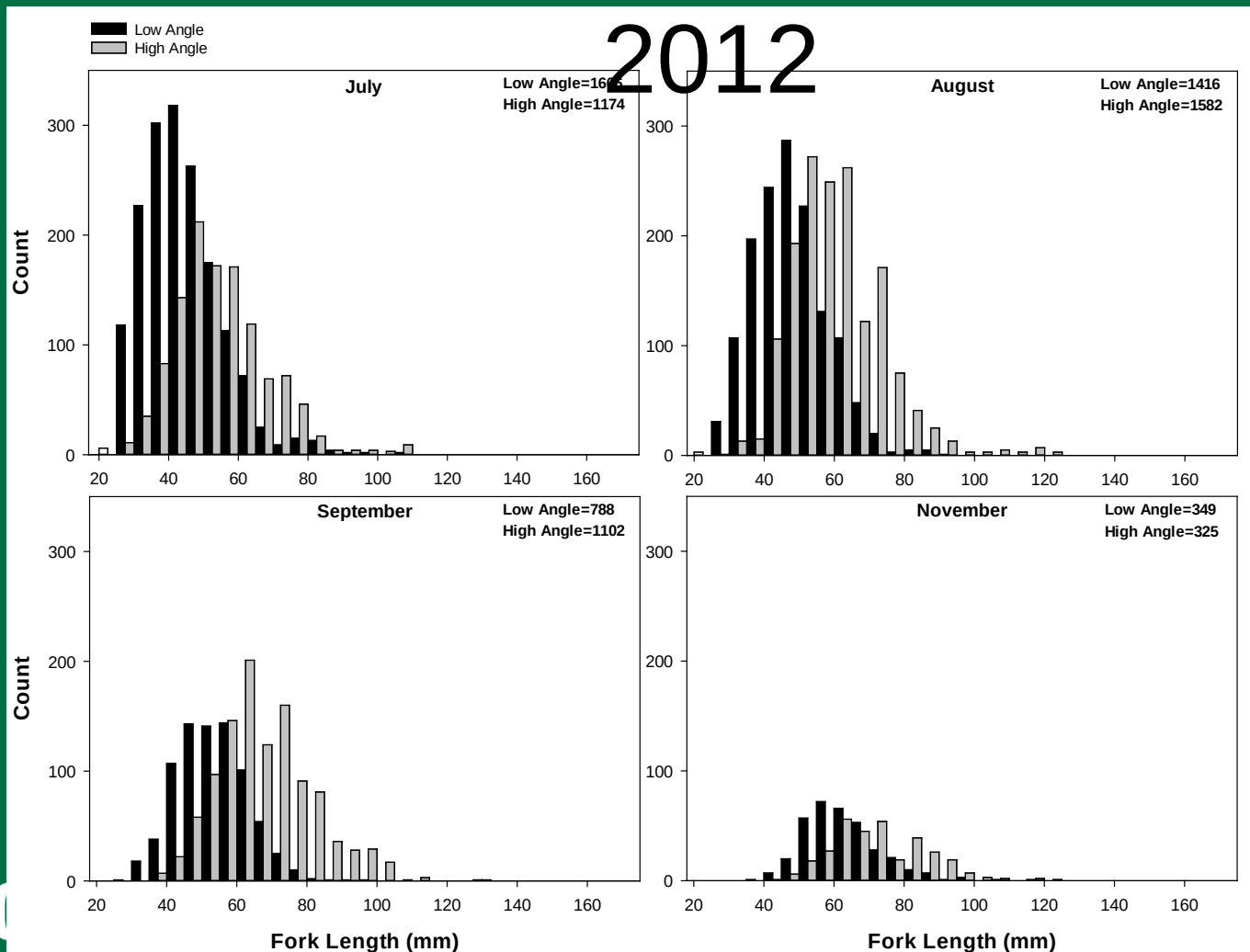


Atypical Flow Events



Results

Larval/Juvenile Monitoring



Results Spawning

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Total Surveys	Redds Count	Estimated # of Redds
2003			1	1	1	1	1	1		6	2661	2310
2004	1	1	1	2	2	1	2		1	11	3596	2310
2006		1	1	2	2	2	2	1		11	165	90
2007		1	1	1	1	1	1	1		7	1186	1215
2008		1	2	2	2	1	1	1		10	2741	1875
2009	1	1	1	2	2	2	2			11	3107	1697
2010			1	1	1	1	1			5	895	900
2011		1	2	1	2	2	1			9	4433	3062
2012		1	1	2	2	1	1			8	2286	1852
											Mean	1701.2
											SE	291.6