



CHELAN COUNTY

Rocky Reach Reservoir White Sturgeon Monitoring and Evaluation Program

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BLUE LEAF
ENVIRONMENTAL



Wells Dam

Rocky Reach Reservoir

- 67 km long from RKM 762 to 829
- Mean discharge 1,700 m³/s (60kcfs) to 5,100 m³/s (180 kcfs)



Rocky Reach Dam

Rocky Reach Relicensing

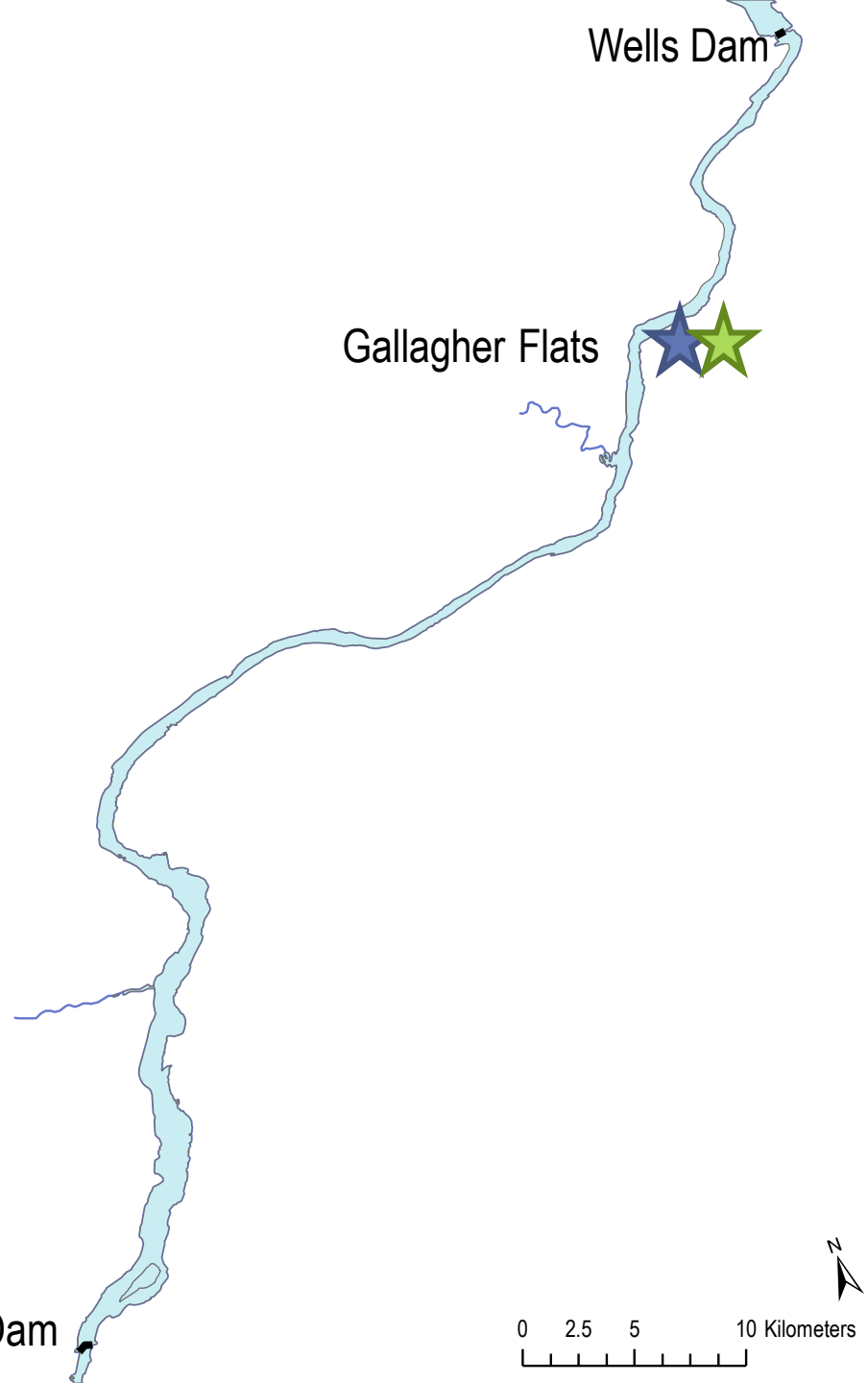
- Mark rapture population estimates in 2001 and 2002. (R. L. & L., Golder)
- Remnant reservoir population estimated to be between 50-115 individuals (Golder 2003)
- No observed recruitment since the late 1990's.
- Very limited sporadic recruitment before then.

White Sturgeon Management Plan

- Need for supplementation identified and management plan adopted with overall goal of
 - ***“promoting white sturgeon population growth in the Rocky Reach Reservoir to a level that is commensurate with available habitat”***
- Supplementation program began in 2010 with first broodstock collection
- Monitoring and Evaluation program began in 2012

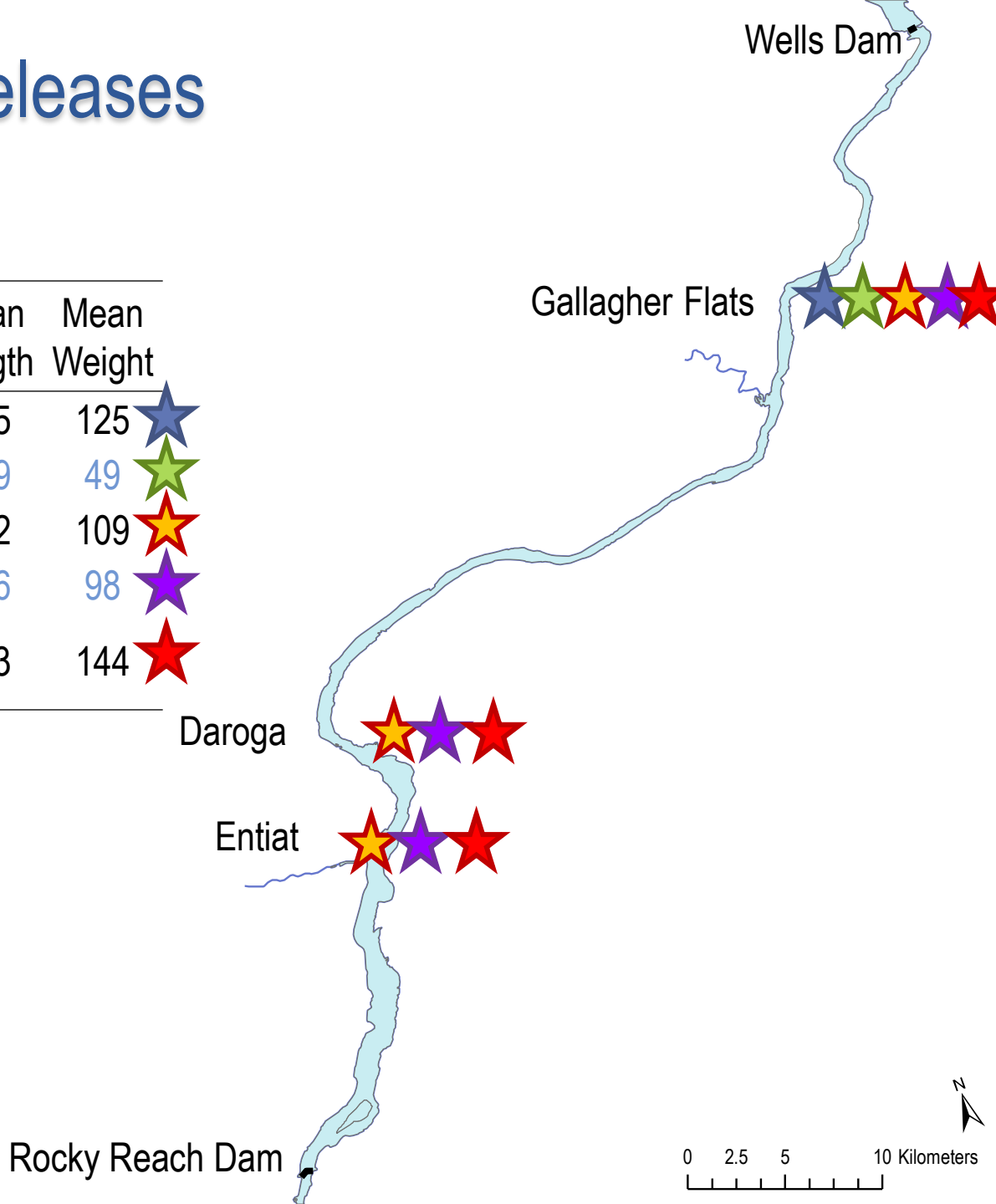
Supplementation Releases

Year	Released	Release Date	Mean Length	Mean Weight	
2011	6,376	April 20-21	245	125	★
2012	137	May 16	189	49	★



Supplementation Releases

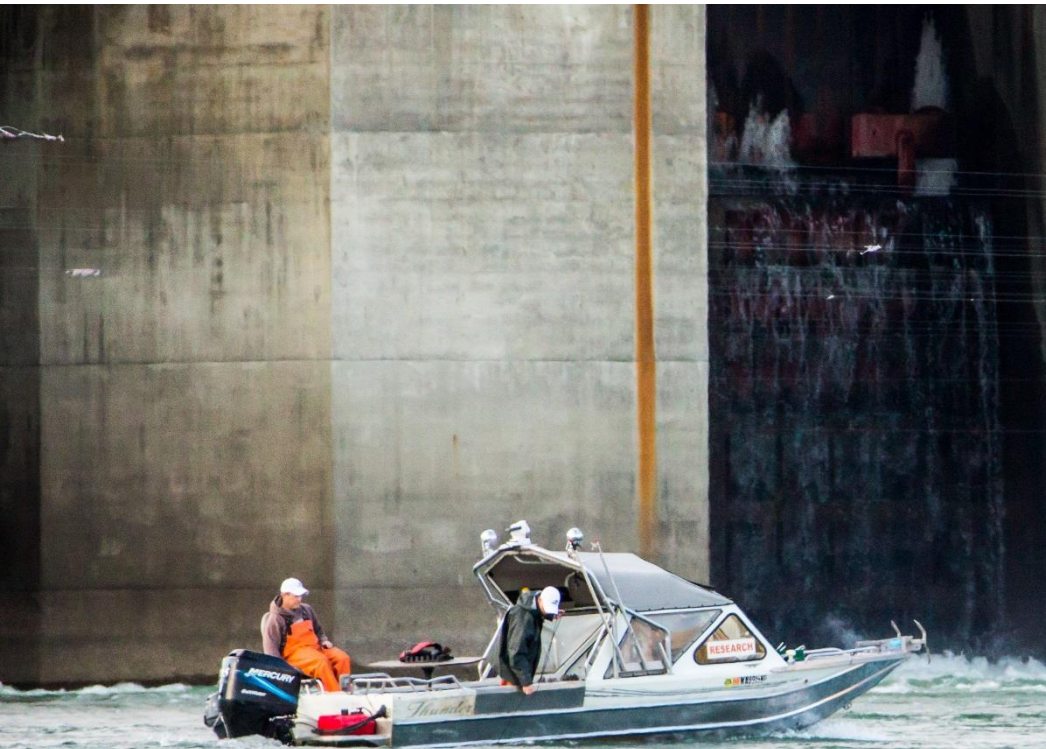
Year	Released	Release Date	Mean Length	Mean Weight	
2011	6,376	April 20-21	245	125	★
2012	137	May 16	189	49	★
2013	7,975	May 20-23	252	109	★
2014	4,962	May 8,14-15	246	98	★
2015	6,492	April 27,29,30 and May 8	263	144	★
Total	25,807				



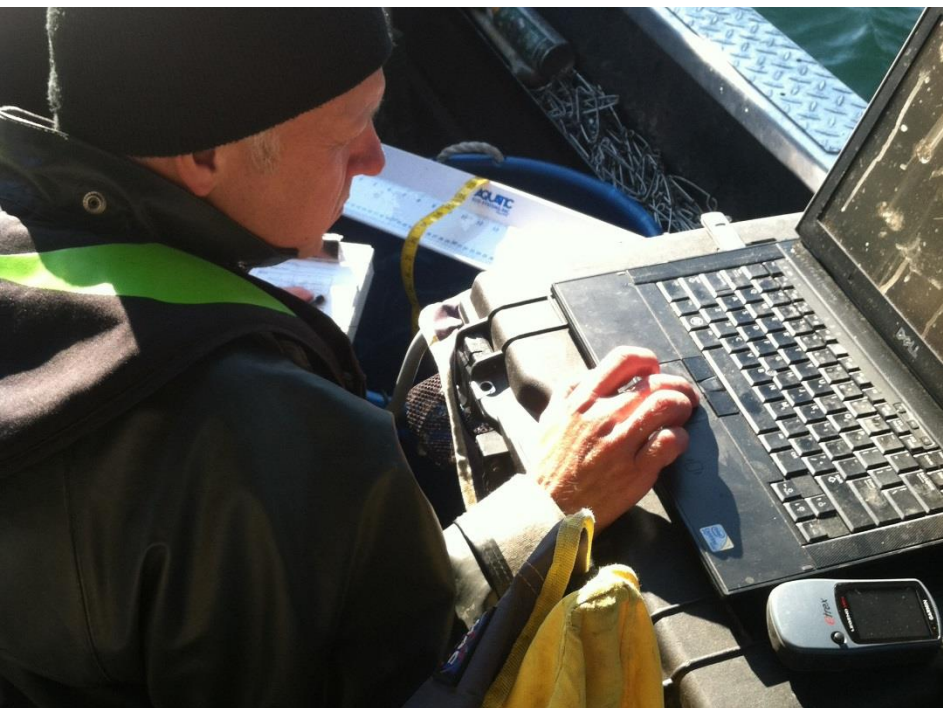
Monitoring and Evaluation Program

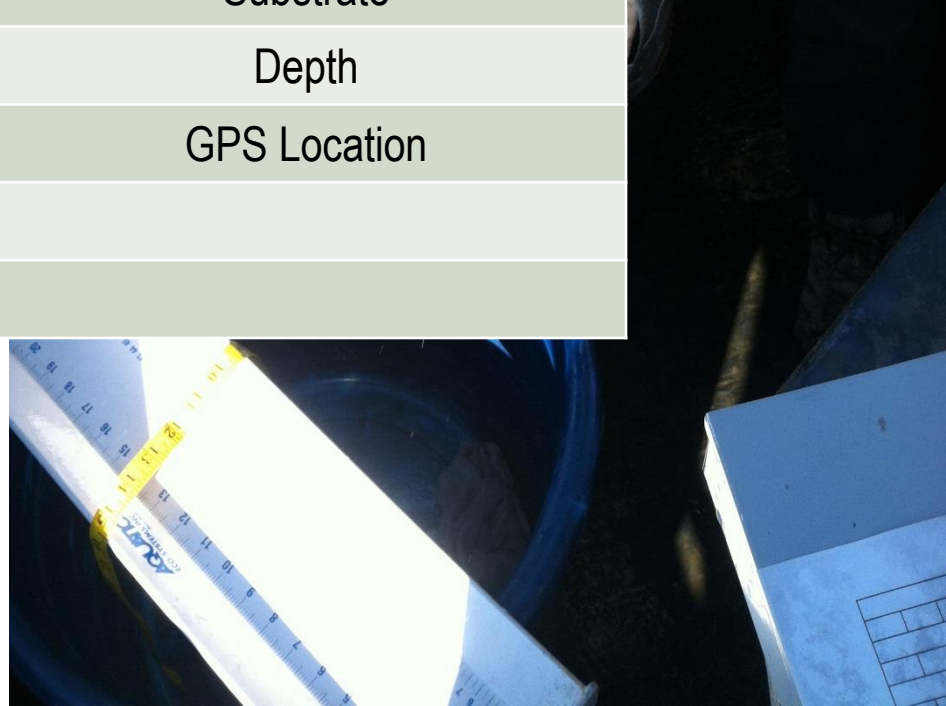
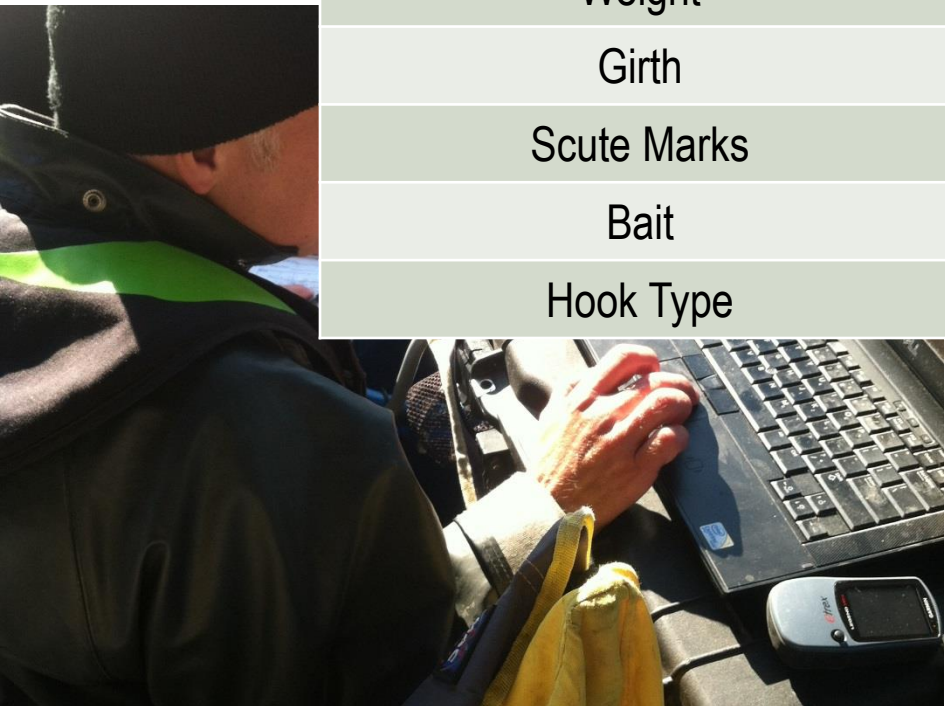
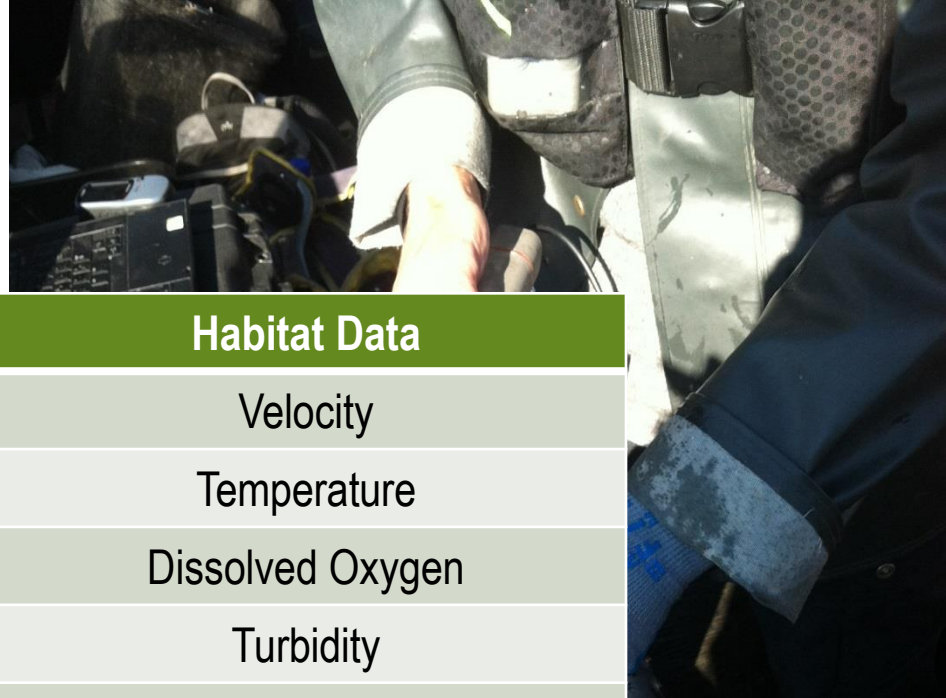
- Ongoing mark and recapture indexing study to look at survival, growth, and habitat use (2013 - 2015)
- Ongoing acoustic telemetry study to inform indexing effort, determine emigration rates from the reservoir, and investigate behavior and habitat use (2012 – 2015)

Mark Recapture Setline Fishing



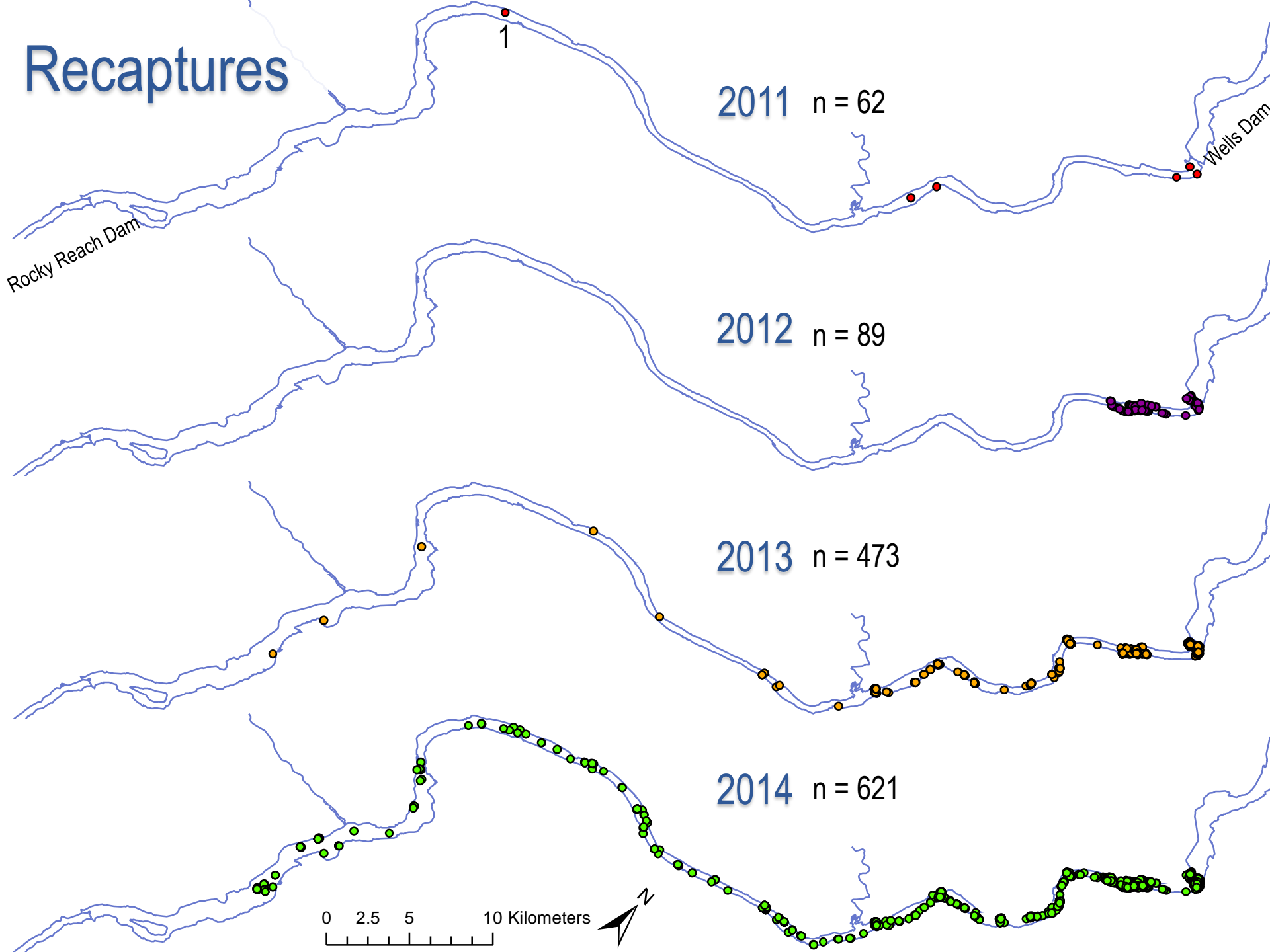
- 250 ft. lines with 80 hooks
- Circle and treble hooks
- Pickled squid, crickets and earth worms





Recapture Data	Habitat Data
PIT Tag ID	Velocity
Depth	Temperature
GPS Location	Dissolved Oxygen
Length	Turbidity
Weight	Substrate
Girth	Depth
Scute Marks	GPS Location
Bait	
Hook Type	

Recaptures



1

2011 n = 62

2012 n = 89

2013 n = 473

2014 n = 621

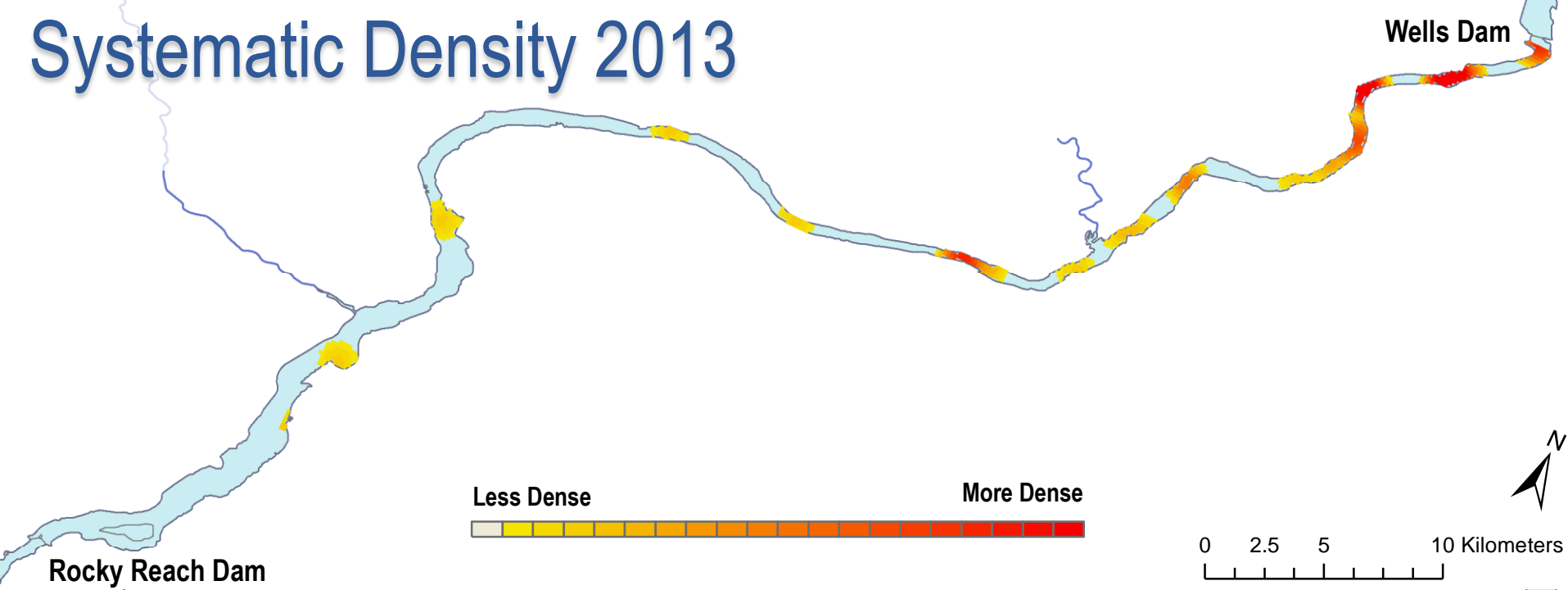
Rocky Reach Dam

Wells Dam

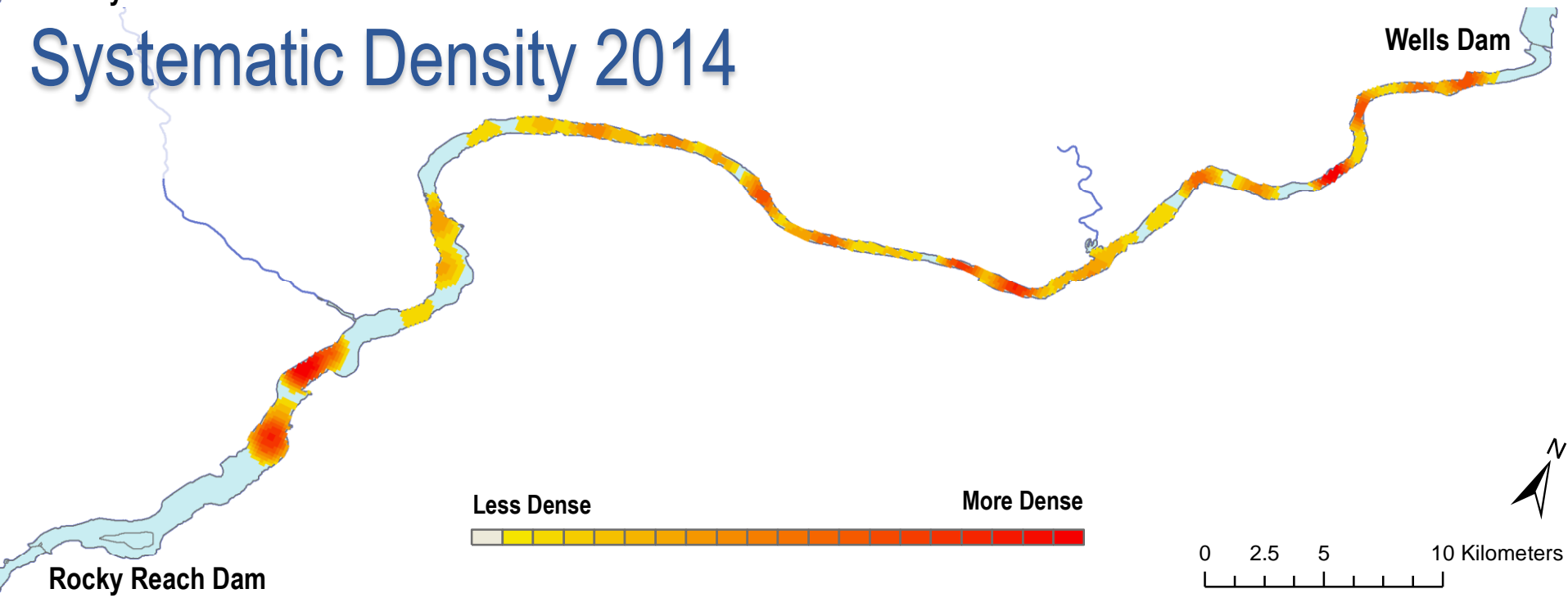
0 2.5 5 10 Kilometers



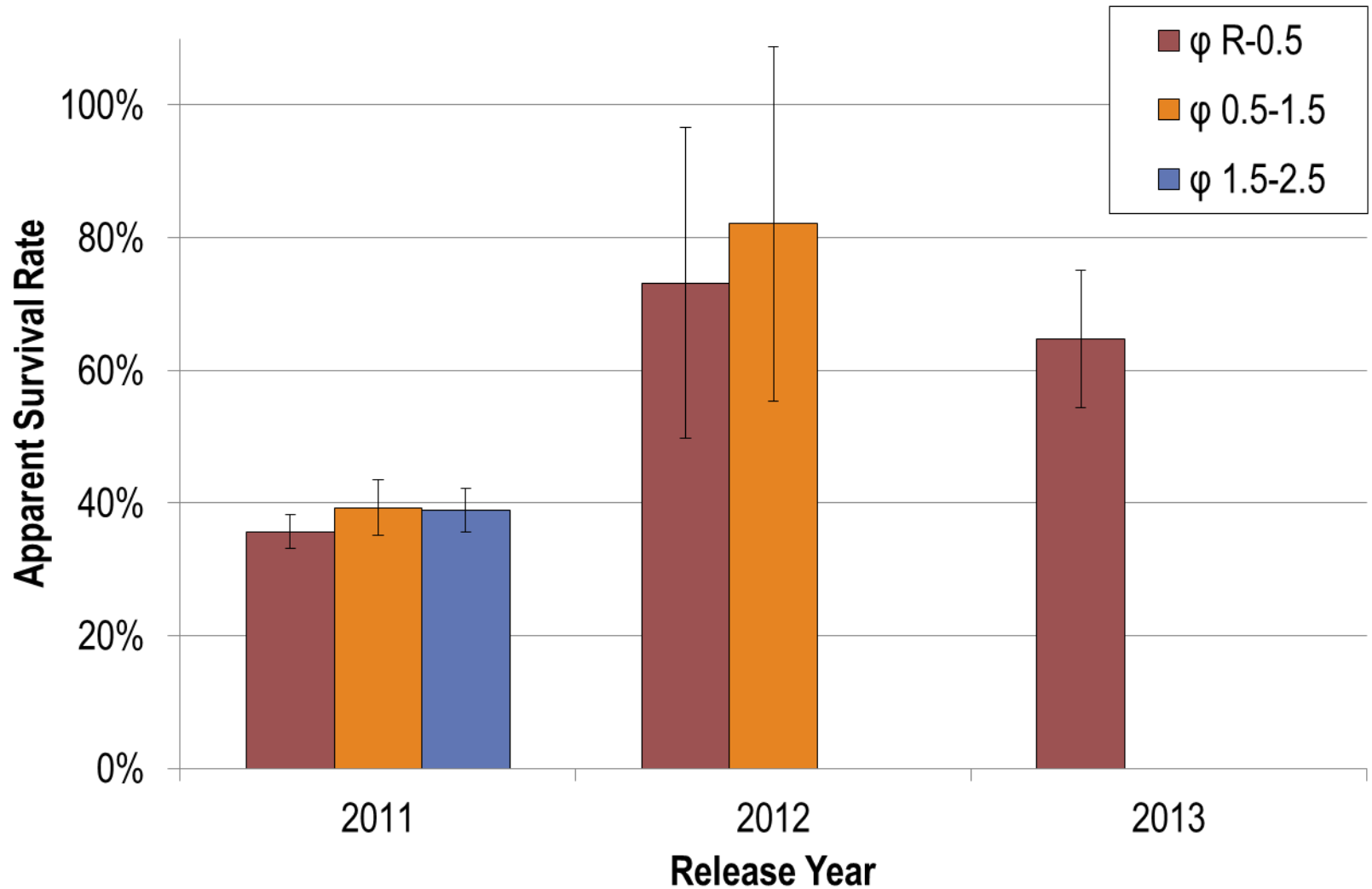
Systematic Density 2013



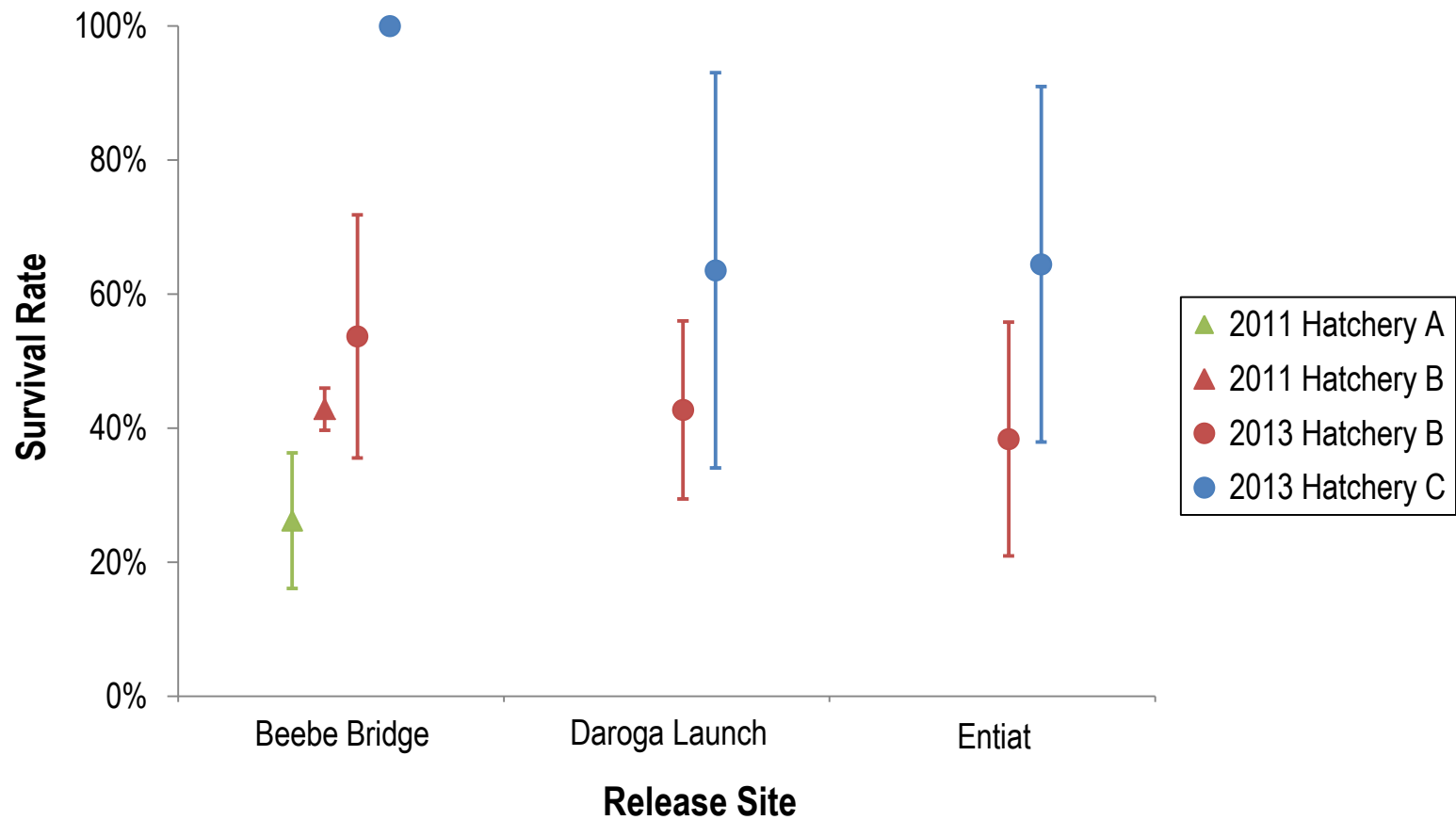
Systematic Density 2014



Apparent Survival Probabilities



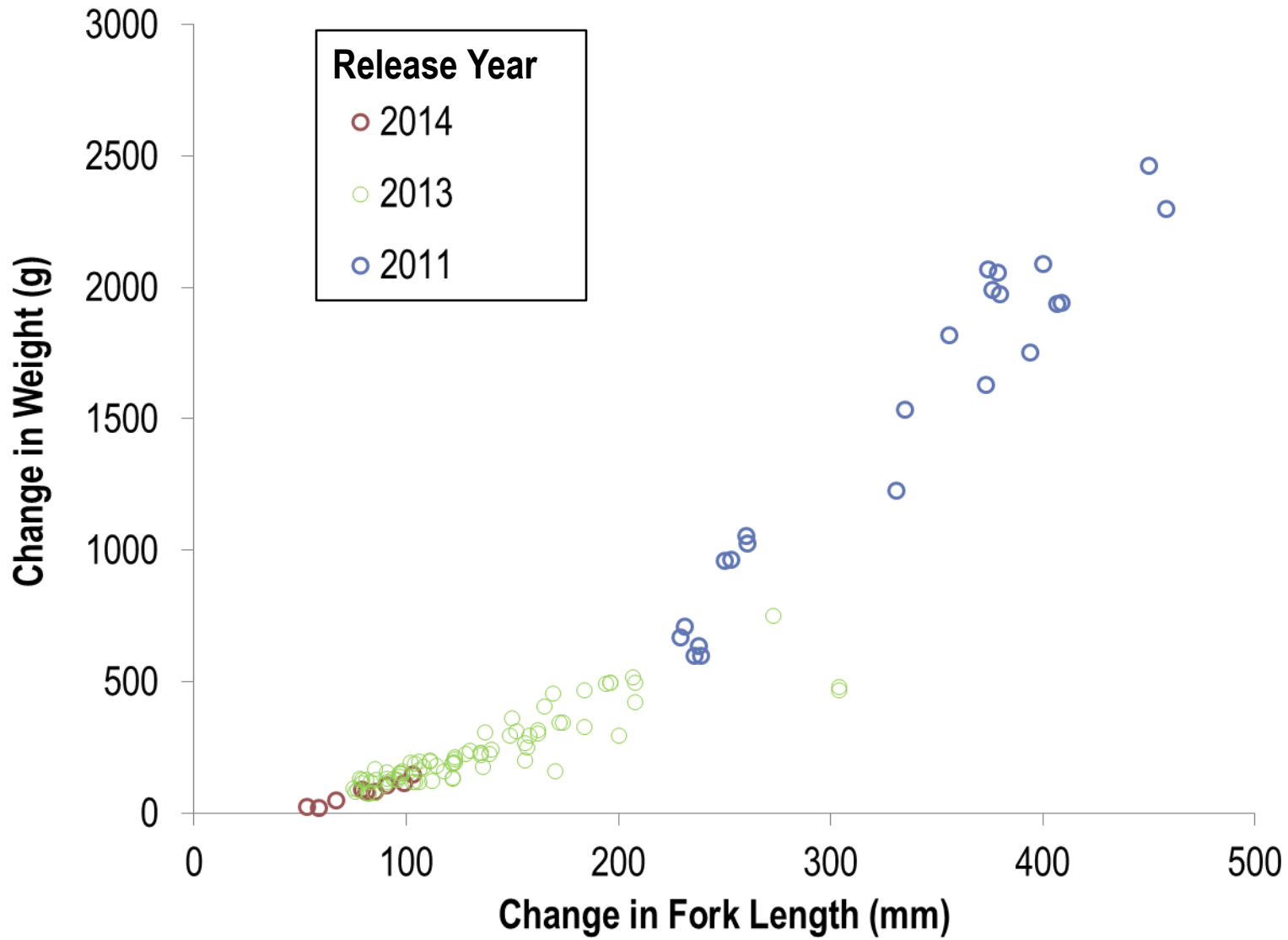
Survival Release to 0.5 years



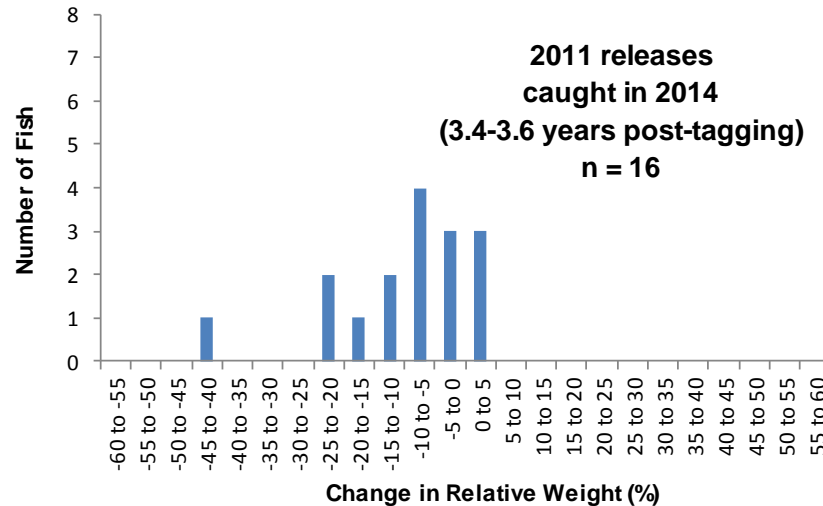
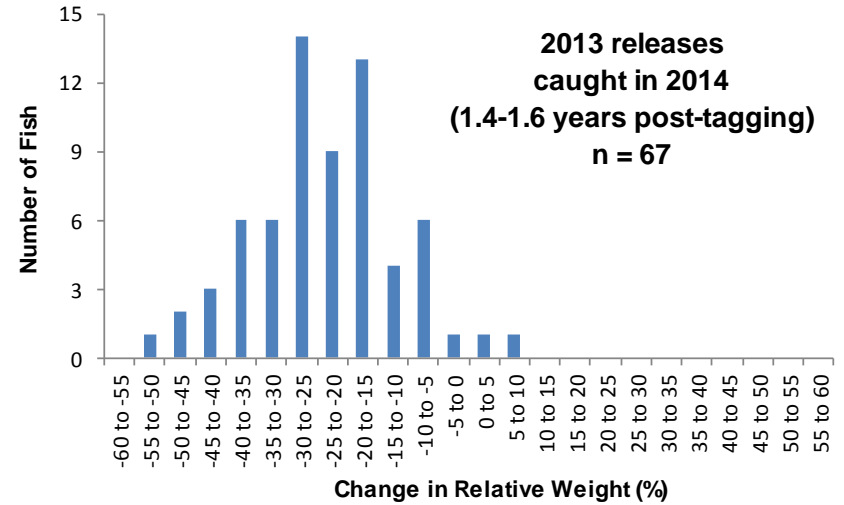
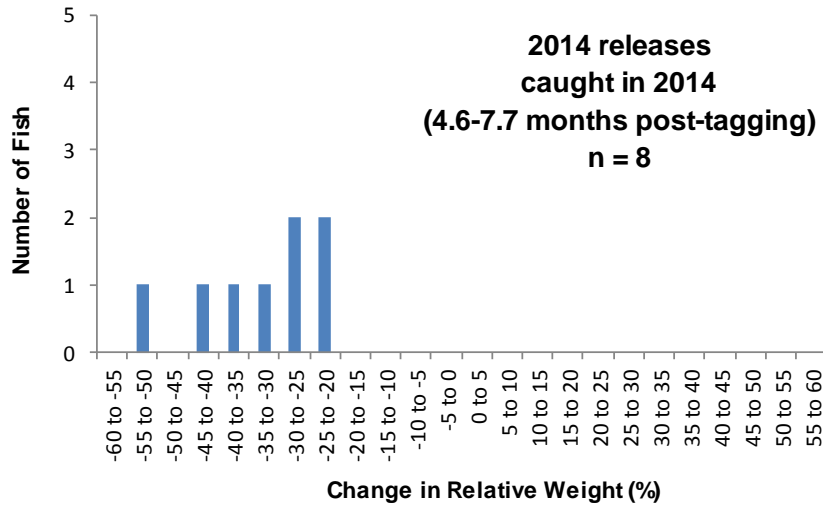
Survival 0.5 to 1.5 years



Growth



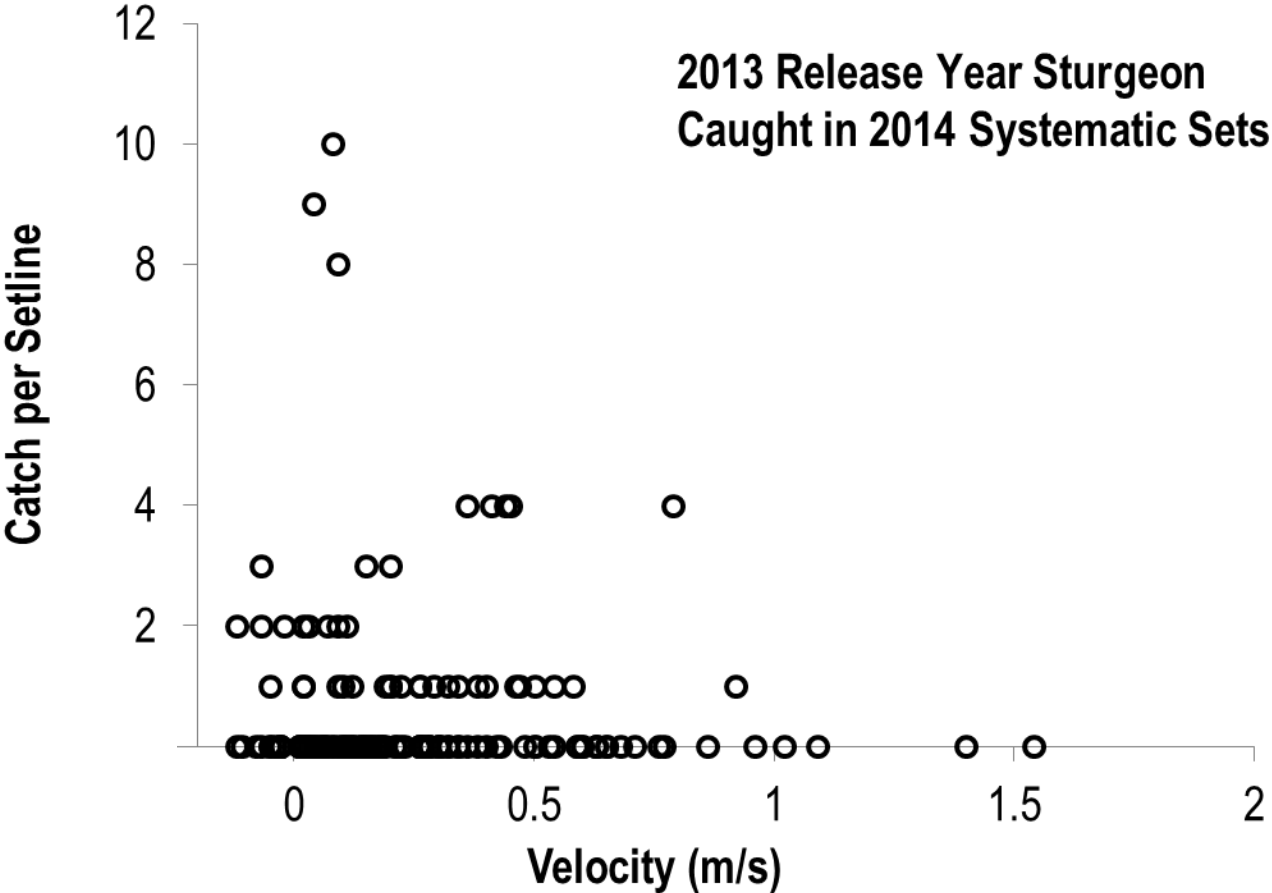
Relative Weight



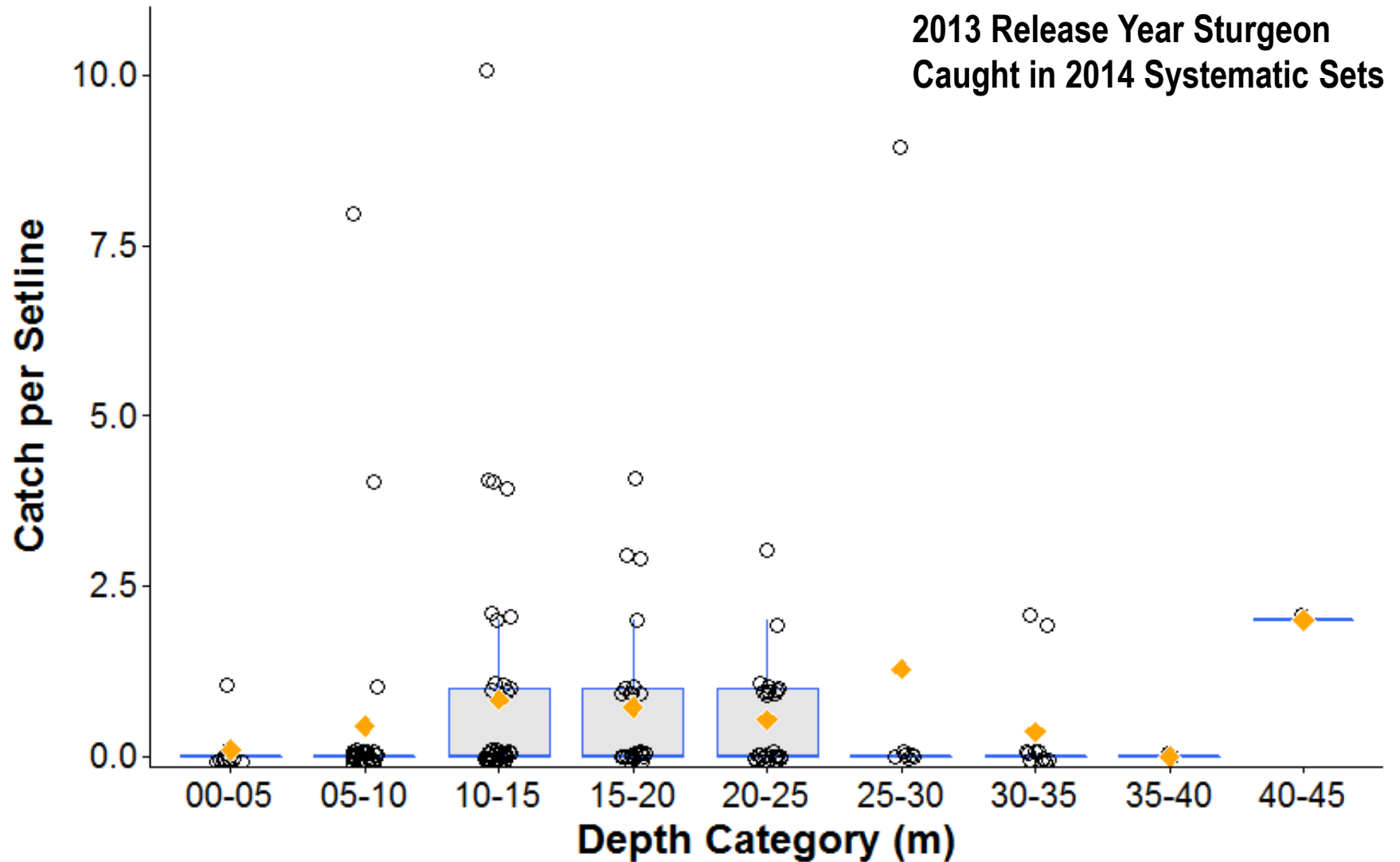
Habitat Associations

Model Parameters

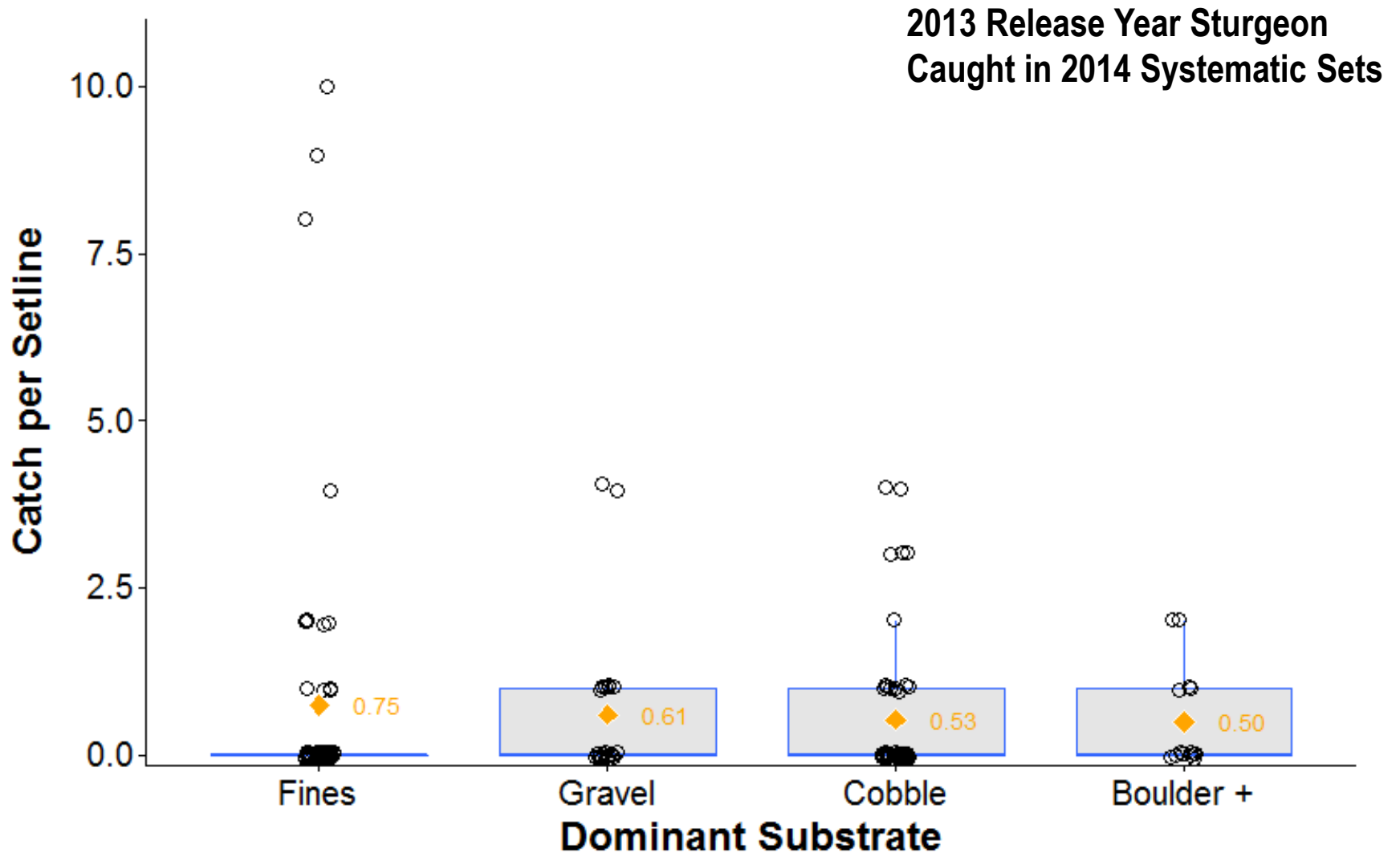
- *Water Velocity*
- *Dominant Substrate*
- *Dissolved Oxygen*
- *Temperature*
- *Depth*
- *Fishing Session*
- *Reservoir Zone*
- *Hook Hours*



Habitat Associations



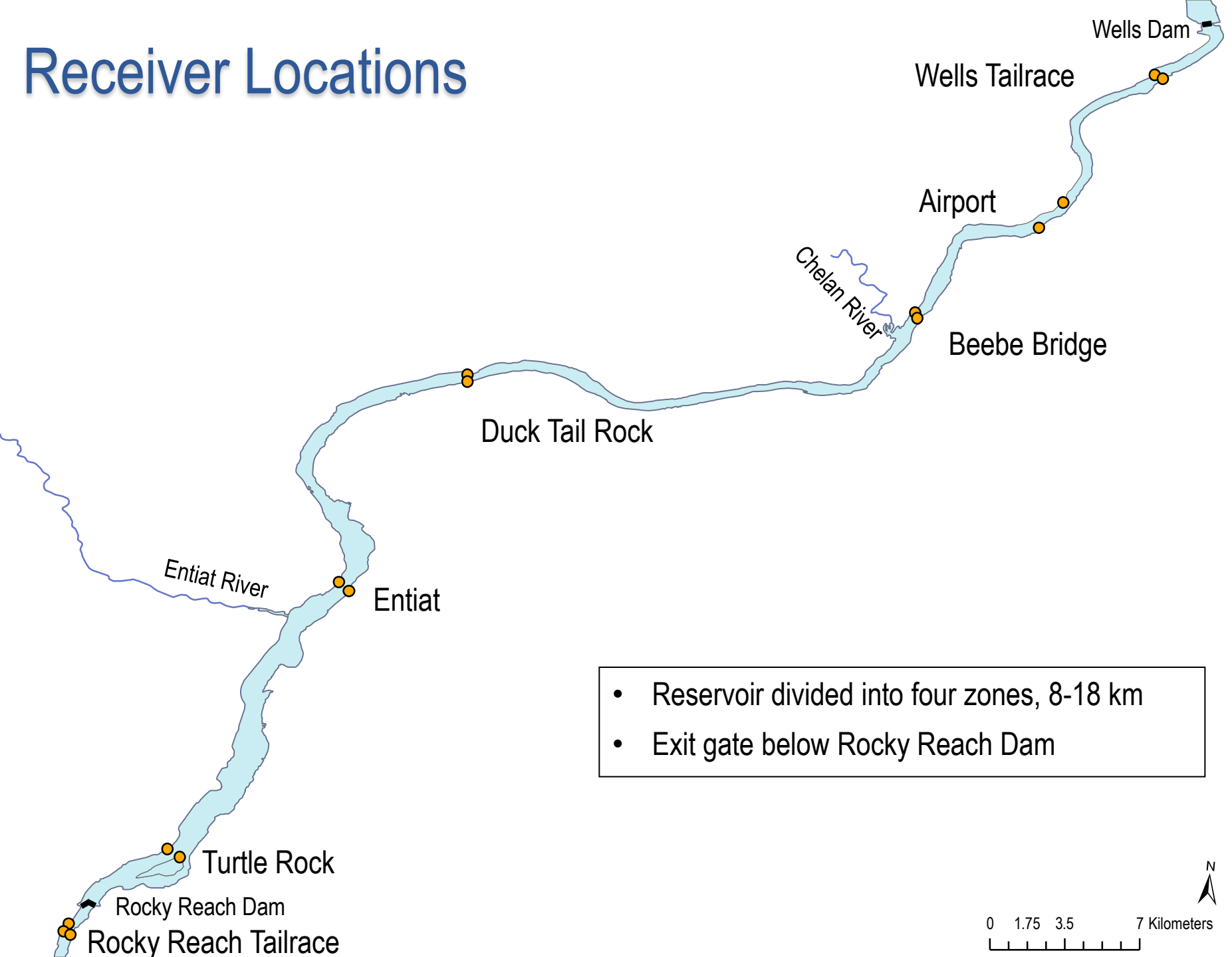
Habitat Associations



Acoustic Monitoring



Receiver Locations



Vemco Acoustic Tags

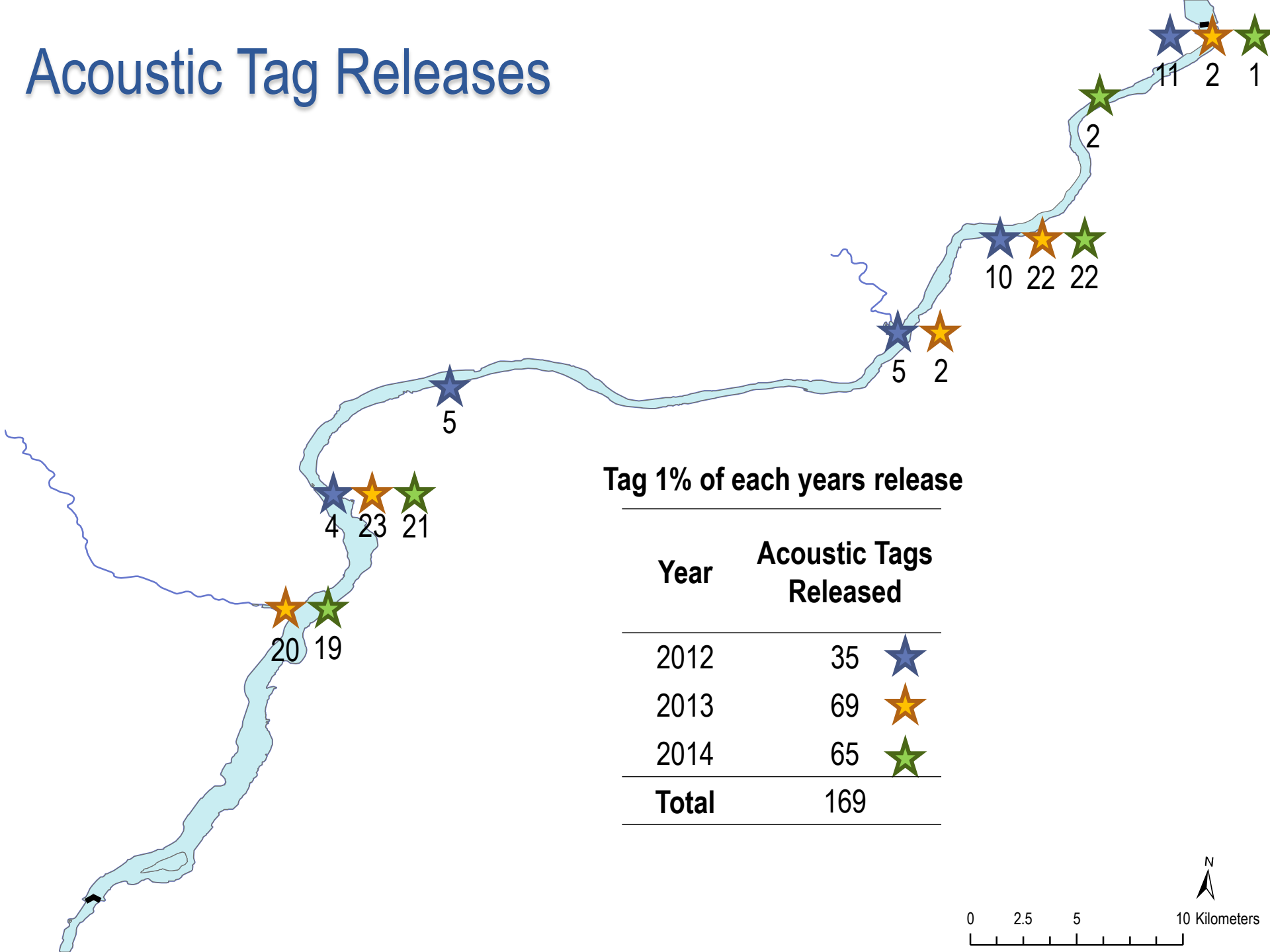


Tag Model	Number Released	Weight in Air (g)	Estimated Tag Life (d)
V7	30	1.6	185
V9	120	4.7	838
V9-P	15	6.4	581
V13	4	11	1462




- Tag 1% of each years release

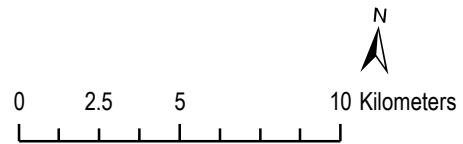
Year	Acoustic Tags Released
2012	35
2013	69
2014	65
Total	169

Acoustic Tag Releases



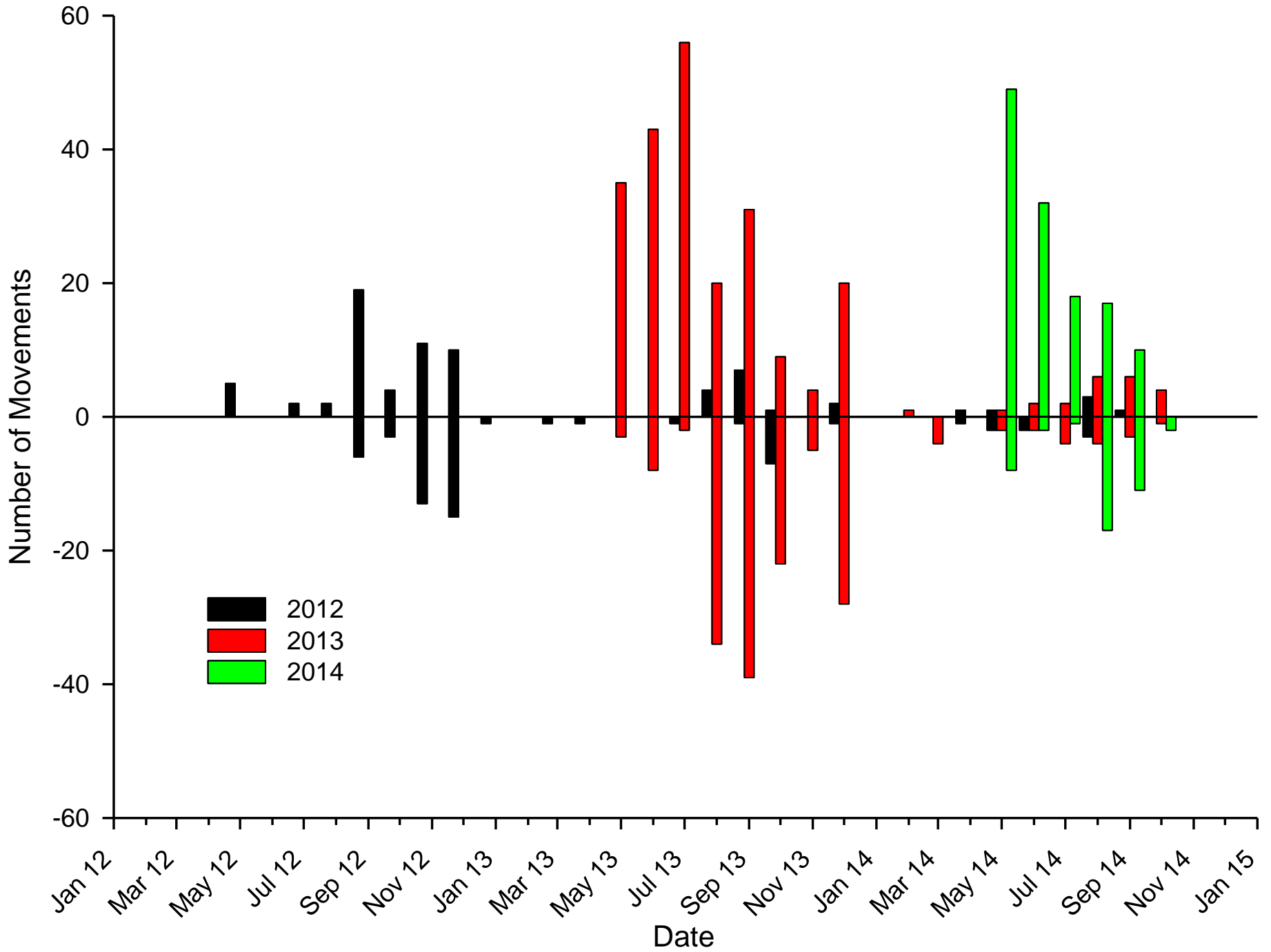
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2012	35 
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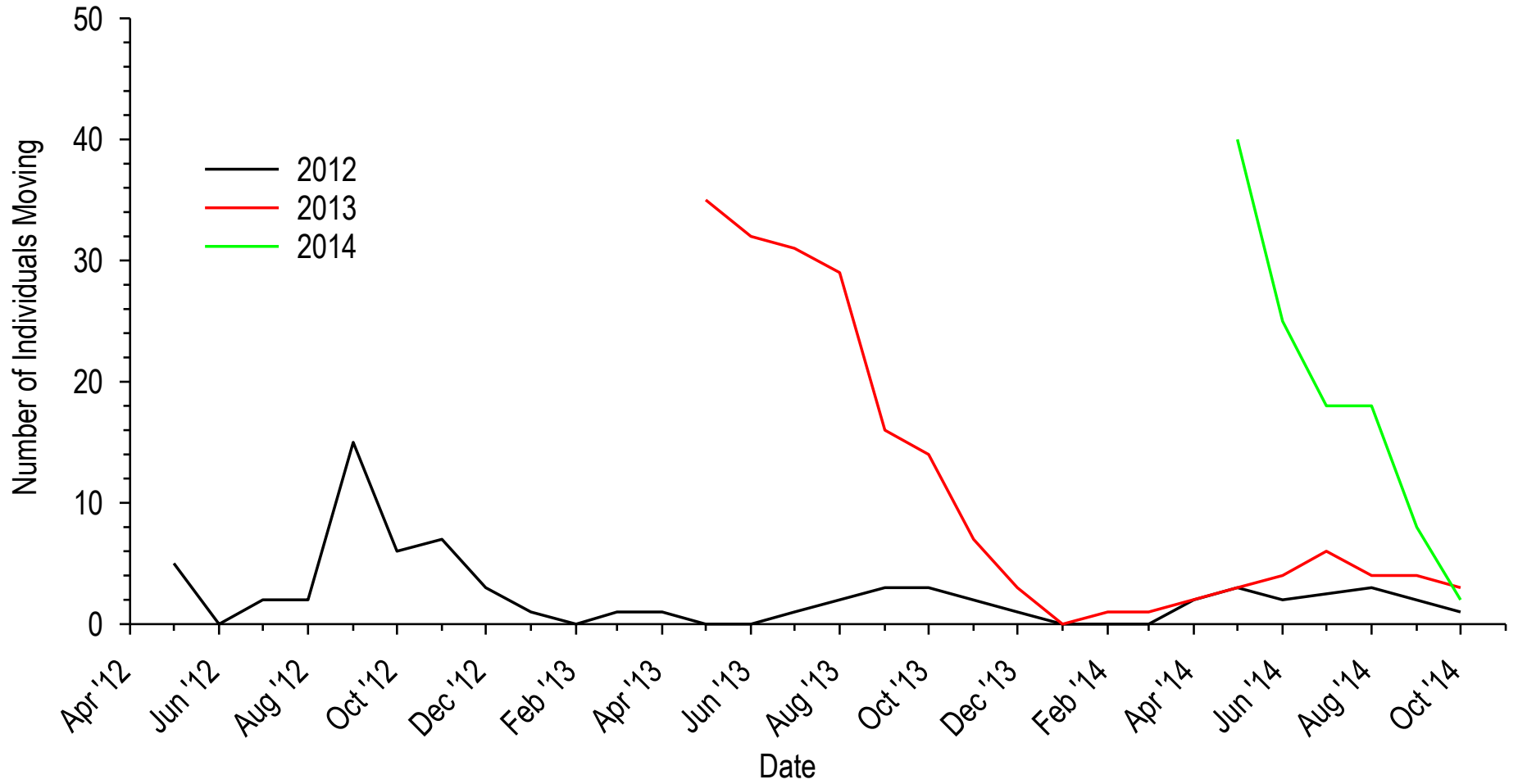


Acoustic Detections

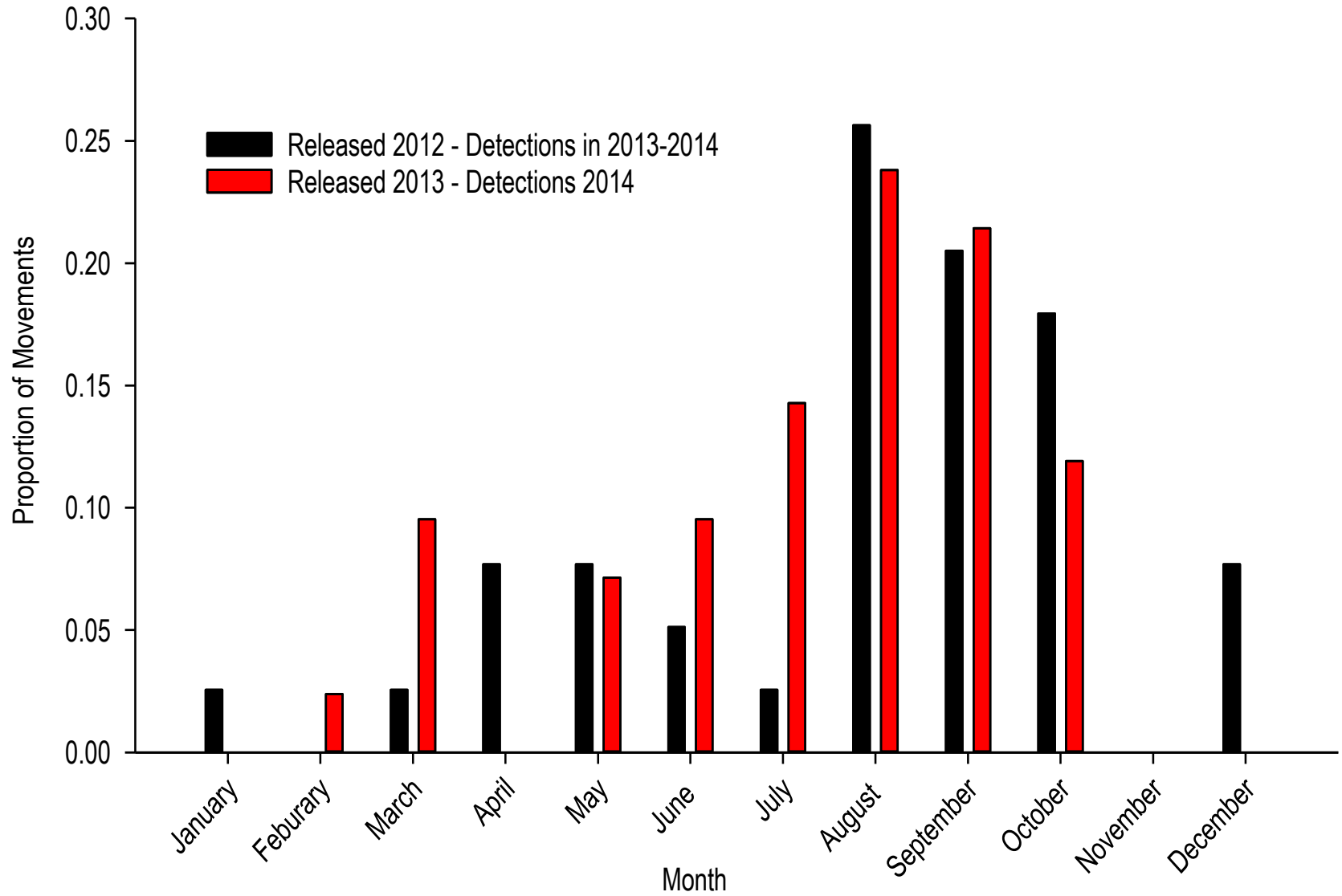
- 1,189,468 detections, 83% in top 18 km of the reservoir
- Largest number of individuals detected in upper reservoir
- Longest residence times near receivers in the upper reservoir
- Predominantly upstream movements with 63% released below Beebe bridge moving into upper 18 km of reservoir



Number of Sturgeon Moving Over Time

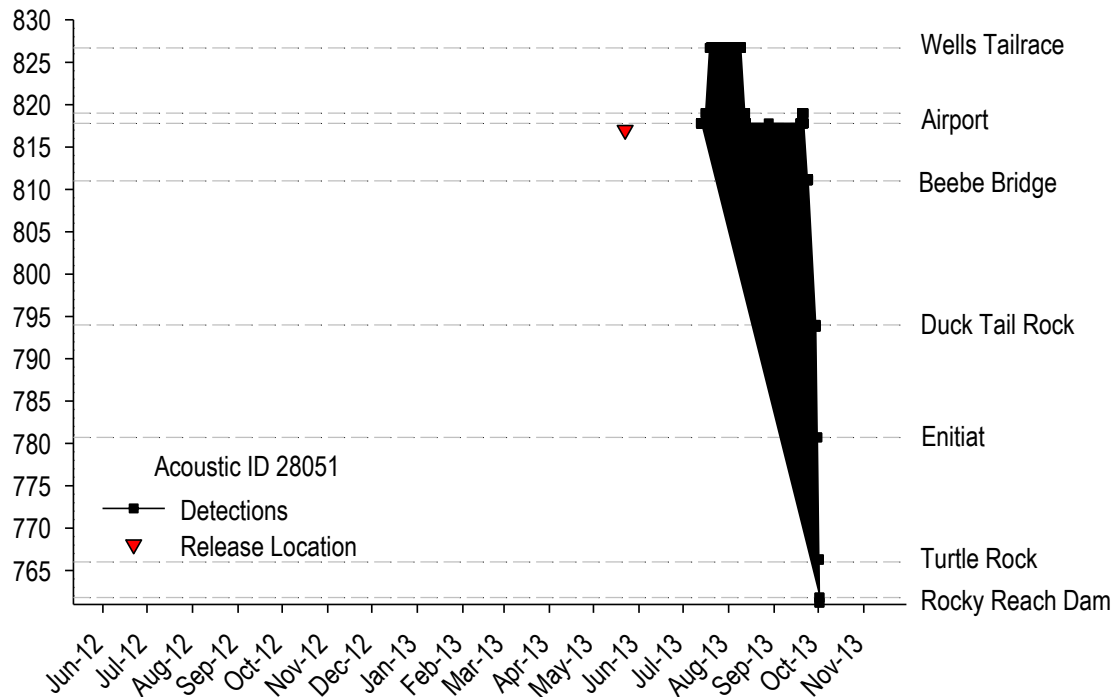


Seasonal Movements



Emigration

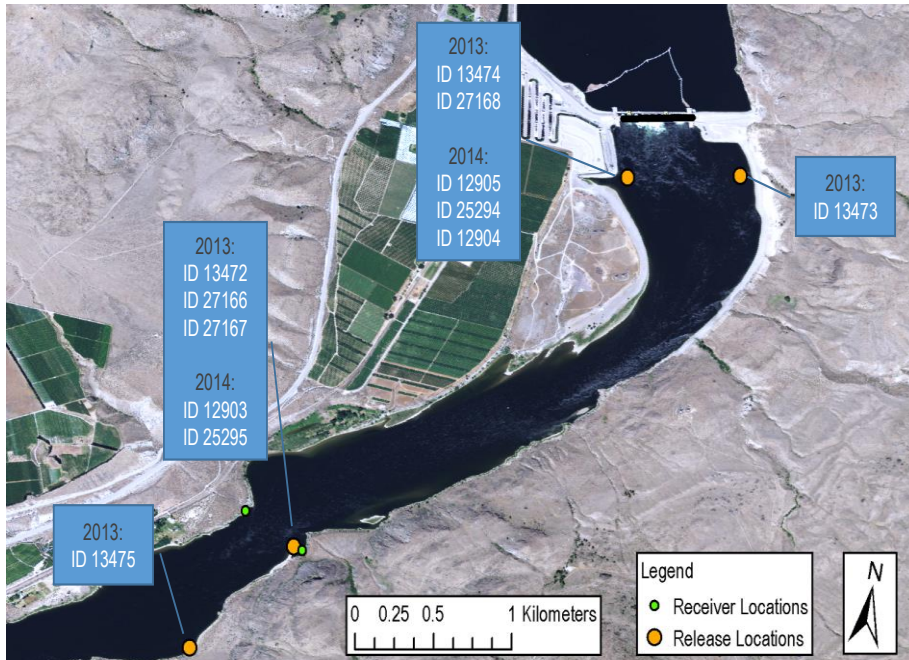
Year	Tags Detected Below Rocky Reach Dam	Acoustic Tags Released	Percent Emigration
2012	2	35	5.7%
2013	4	69	5.8%
2014	2	65	3.1%
Total	8	169	4.7%



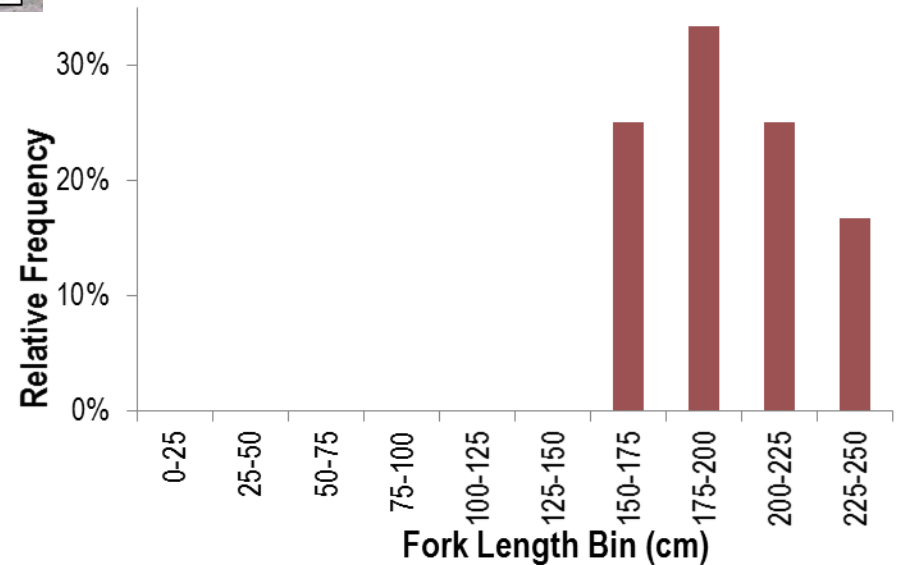
Juvenile Monitoring Conclusions

- 'Typical' survival pattern not observed
- Fish released in 2013 surviving better than 2011 fish
- Steady growth observed post-release
- Habitat model: highest catch where low velocity, over fines, between 10-30 m or below 40 m.
- High use of upper reservoir and predominant movement upstream with settling over time
- Relatively low emigration from reservoir of acoustically tagged individuals to date

Adult Tagging

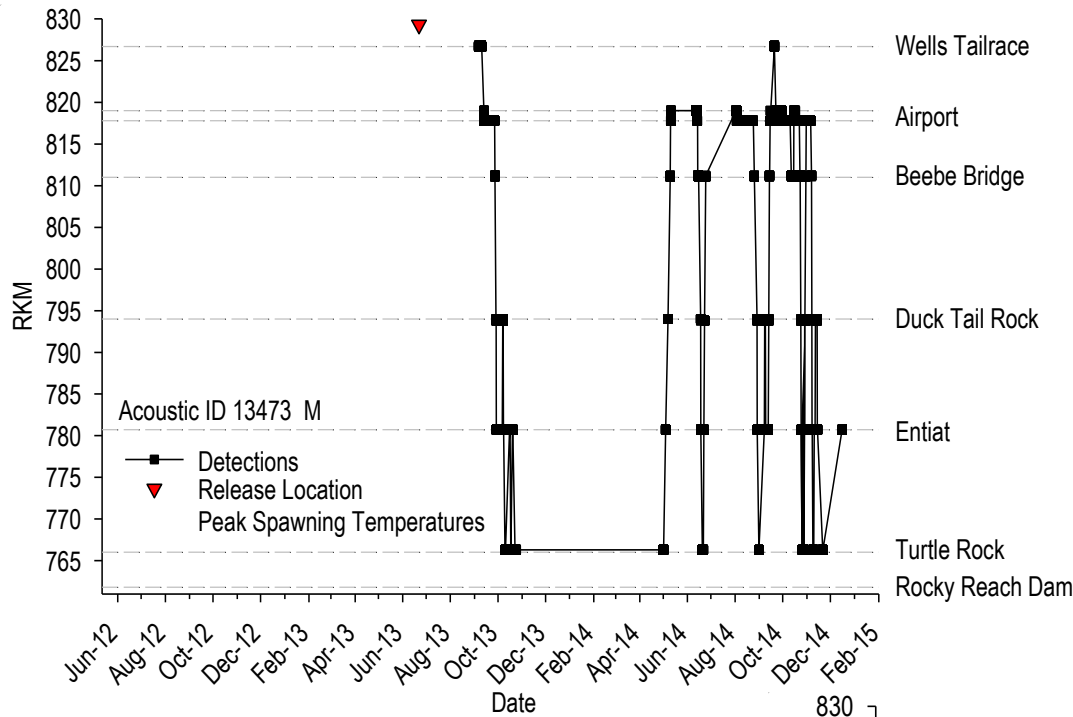


- 4 days of fishing each year, 6 in late June 2 in Early August
- Captured and tagged 7 Adults in 2013 and 5 in 2014

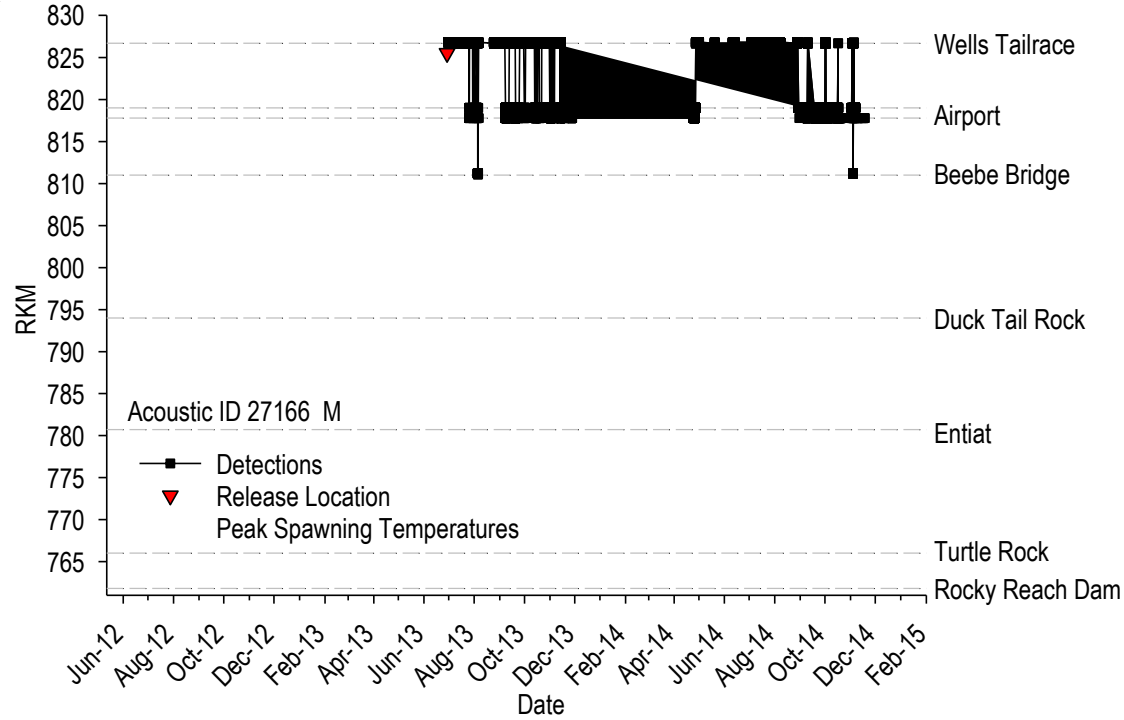


Adult Movements

- 7 of 12 (88%) overwintered near Entiat and made multiple reservoir transects



- 5 of 12 overwintered in upper reservoir and made fewer movements

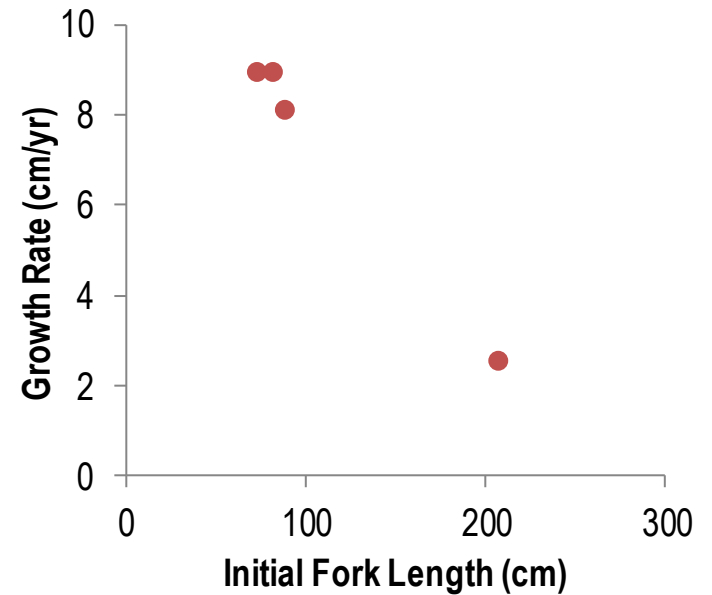
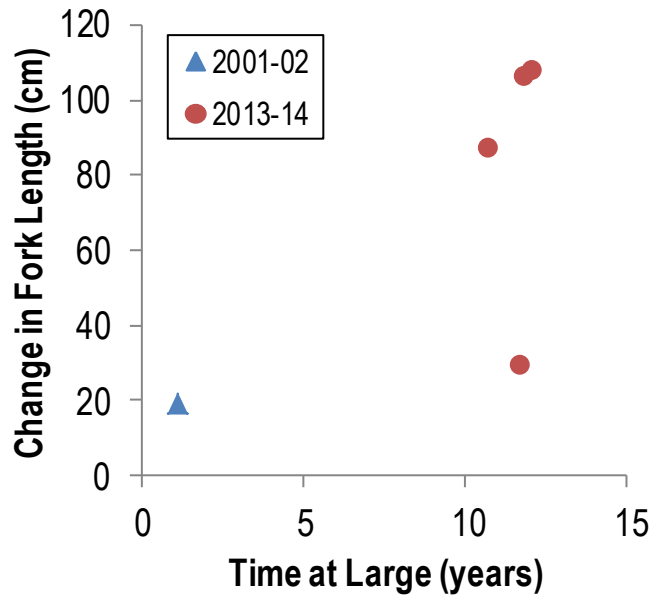
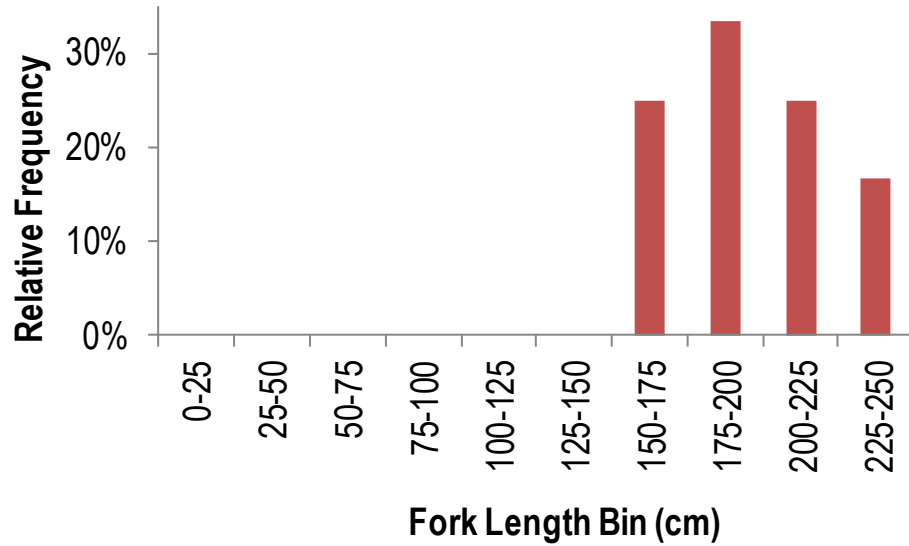


Adult Population

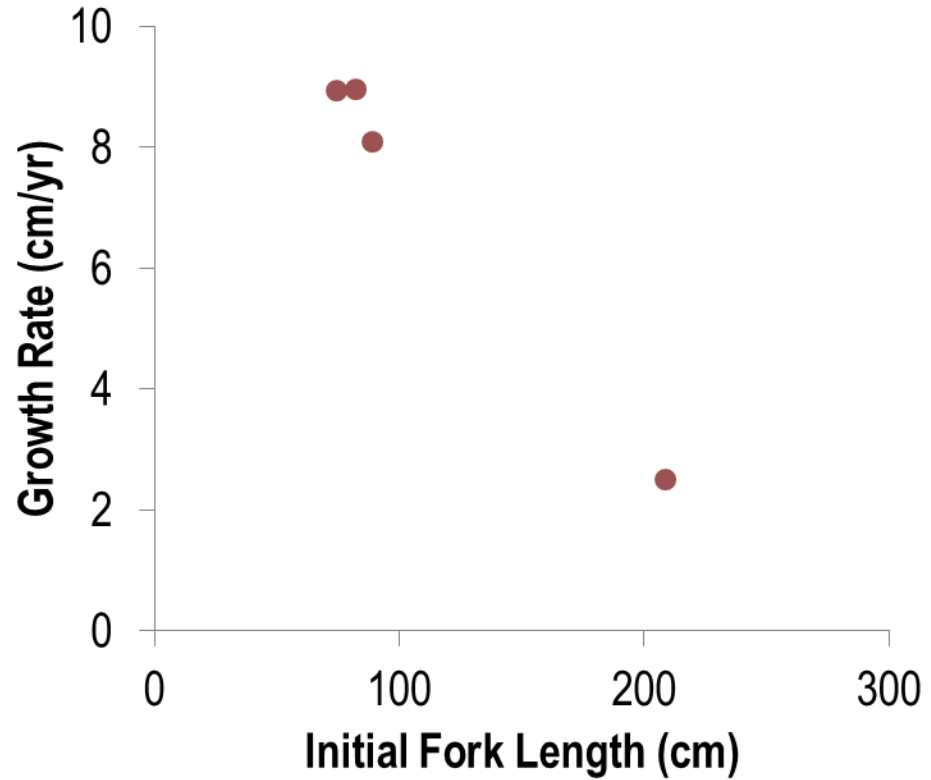
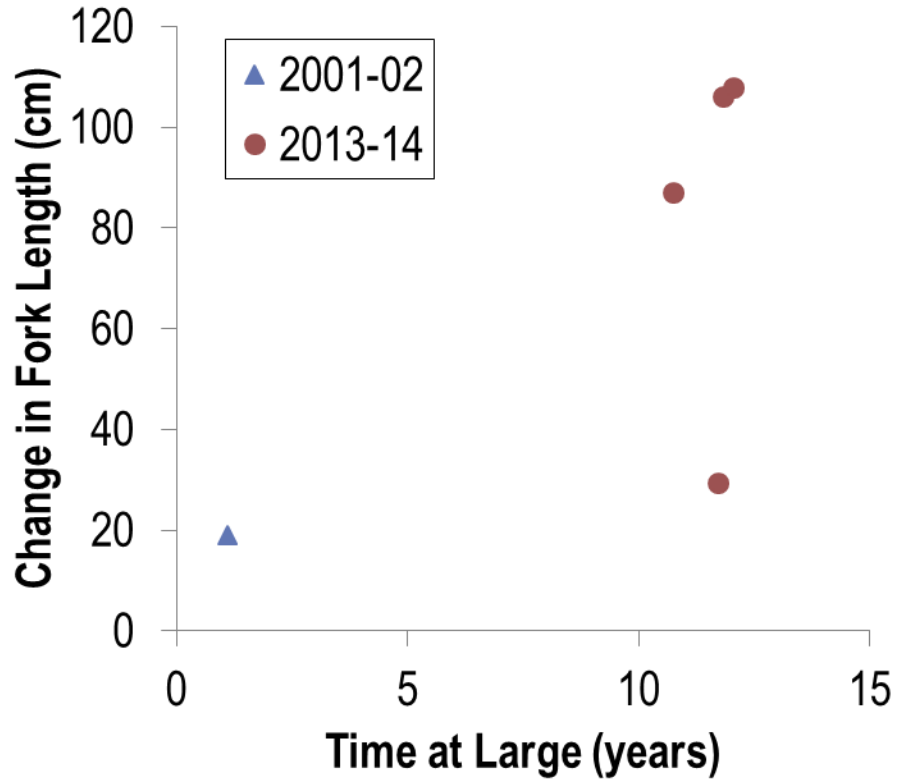
- Population appears stable but little evidence of recruitment in past ~19 years.
- Abundance estimated at 38-151 individuals
- Adults move substantial distances in some cases making multiple transects of the reservoir
- Two subpopulations: Entiat overwintering (large movements) and upper reservoir overwintering (small movements)



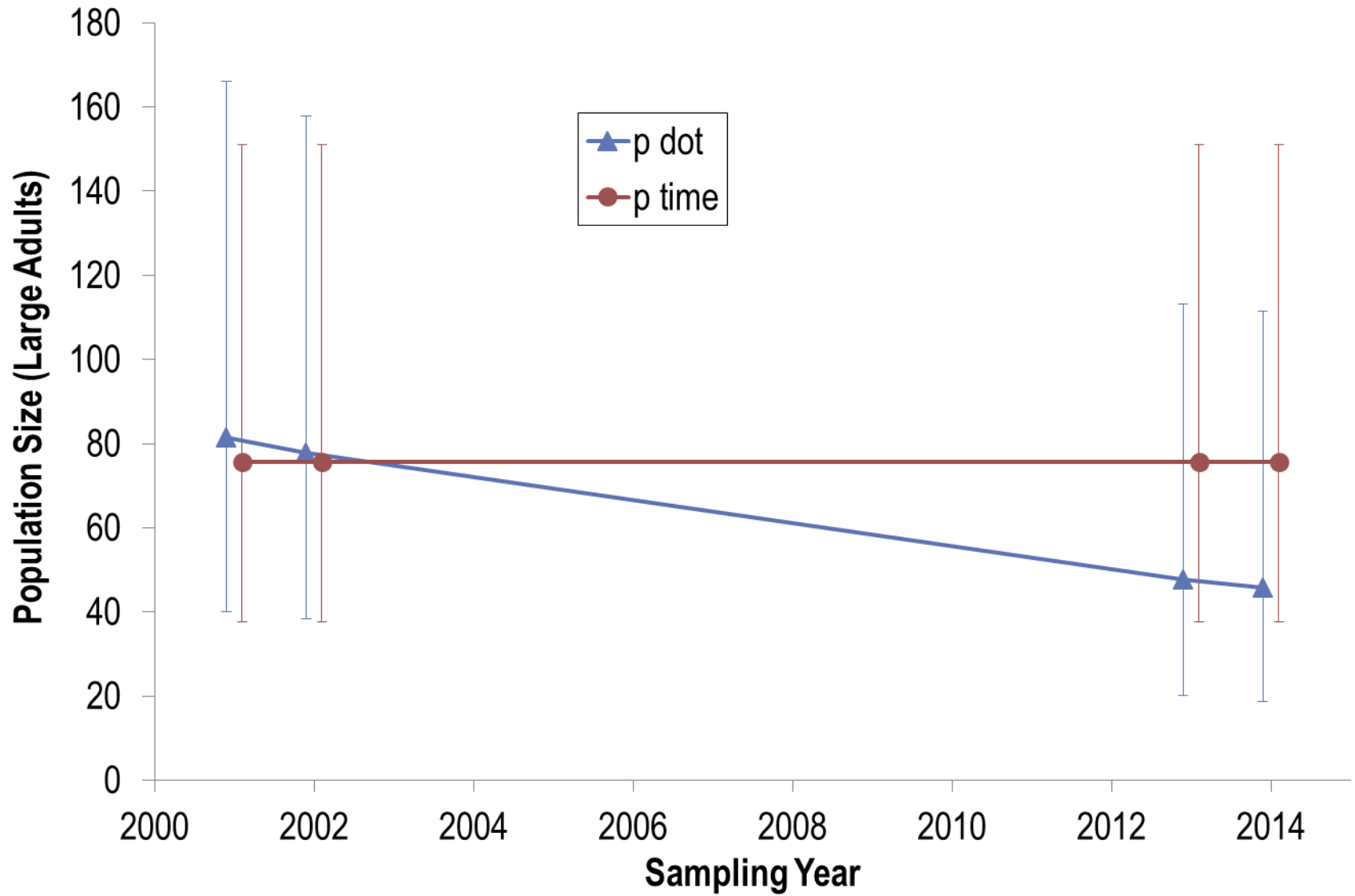
Length Frequency



Growth



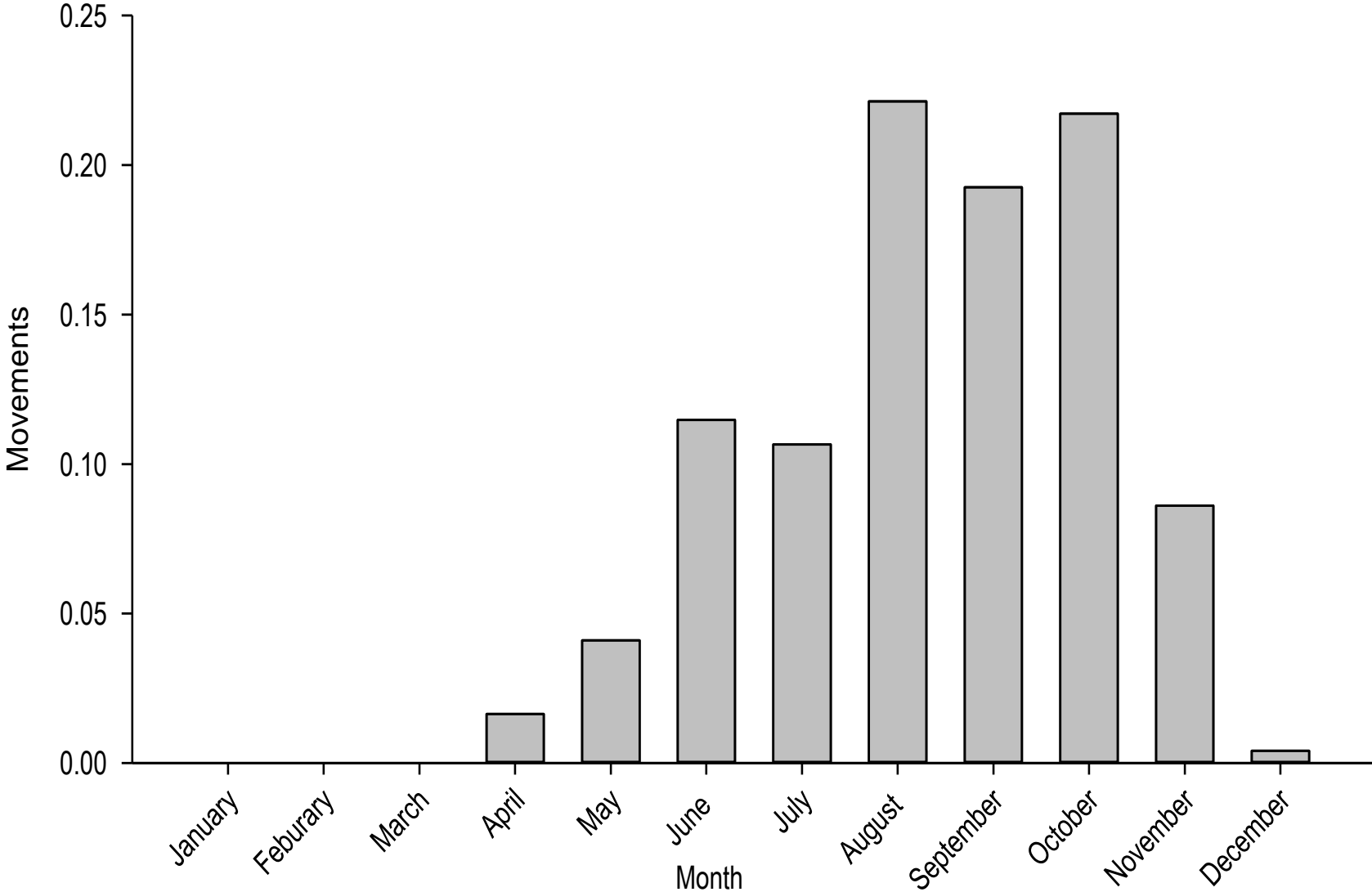
Abundance

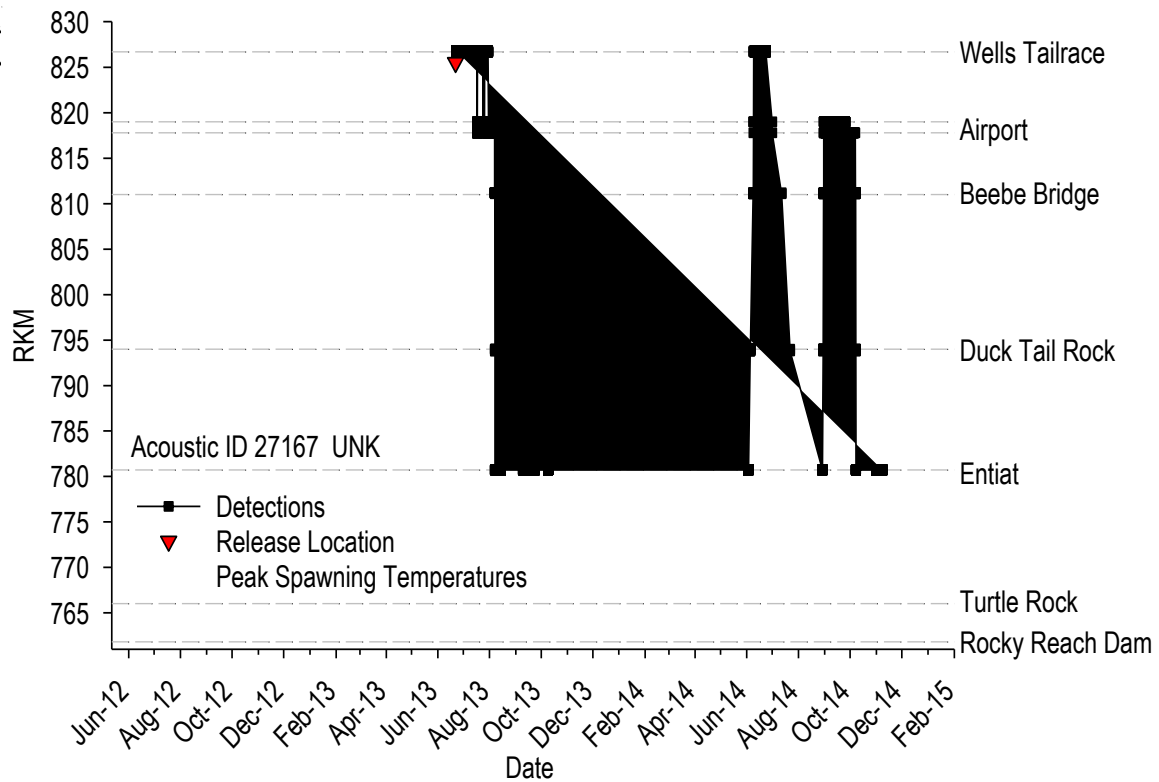
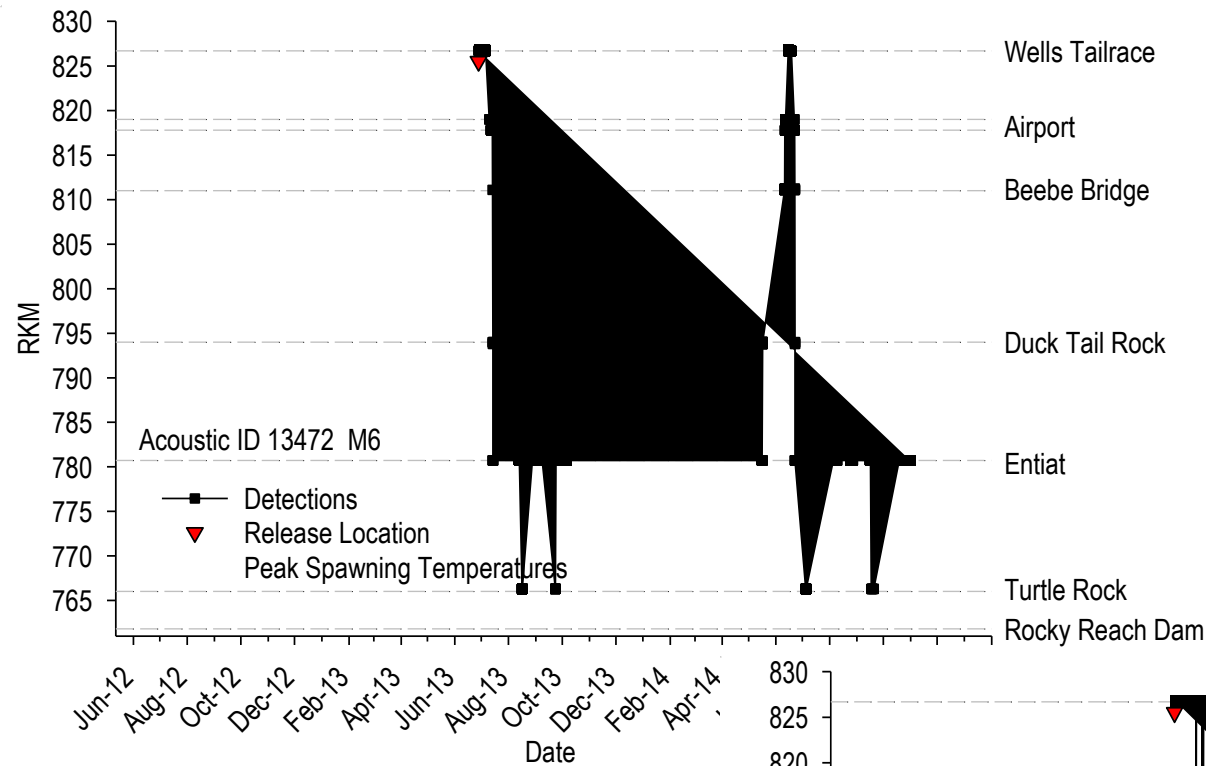


Movements Between Detection Arrays

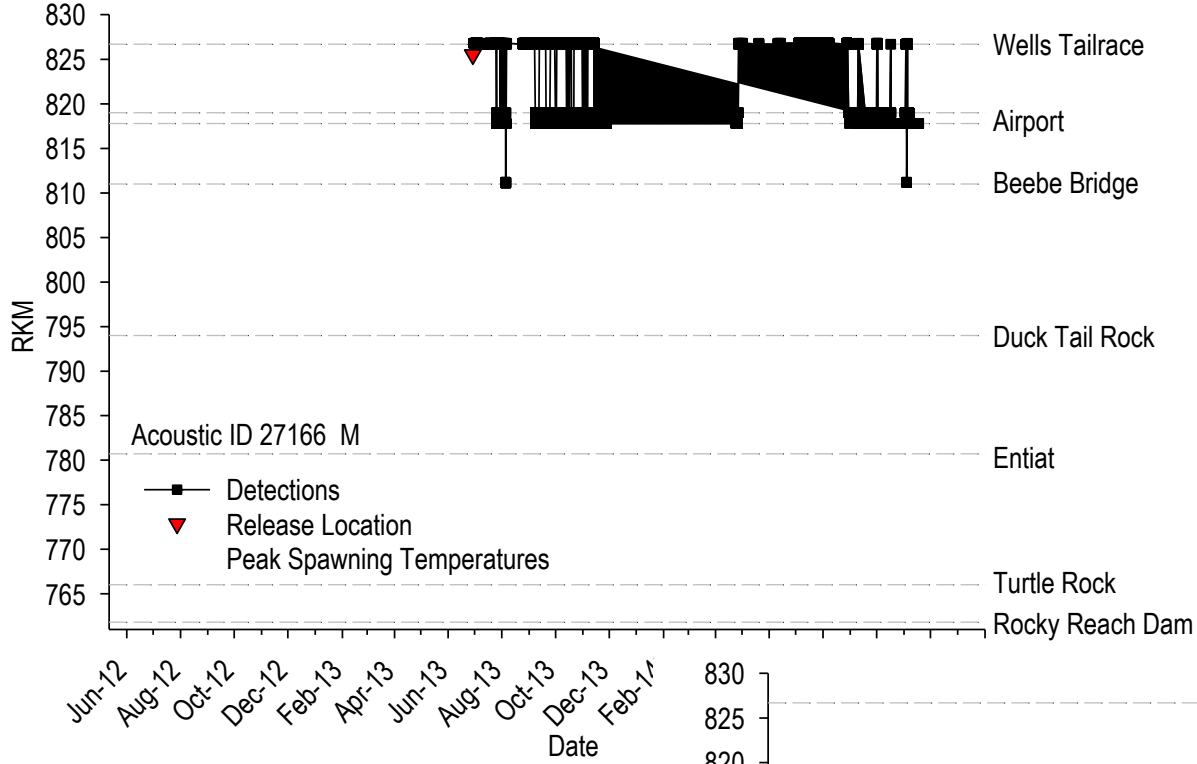
- Mean of 9 upstream and 12 downstream
- Mean km of movement 228.2 (range =10.6 - 688.1km)
- Longest residence times in upper reservoir

Seasonal Movements



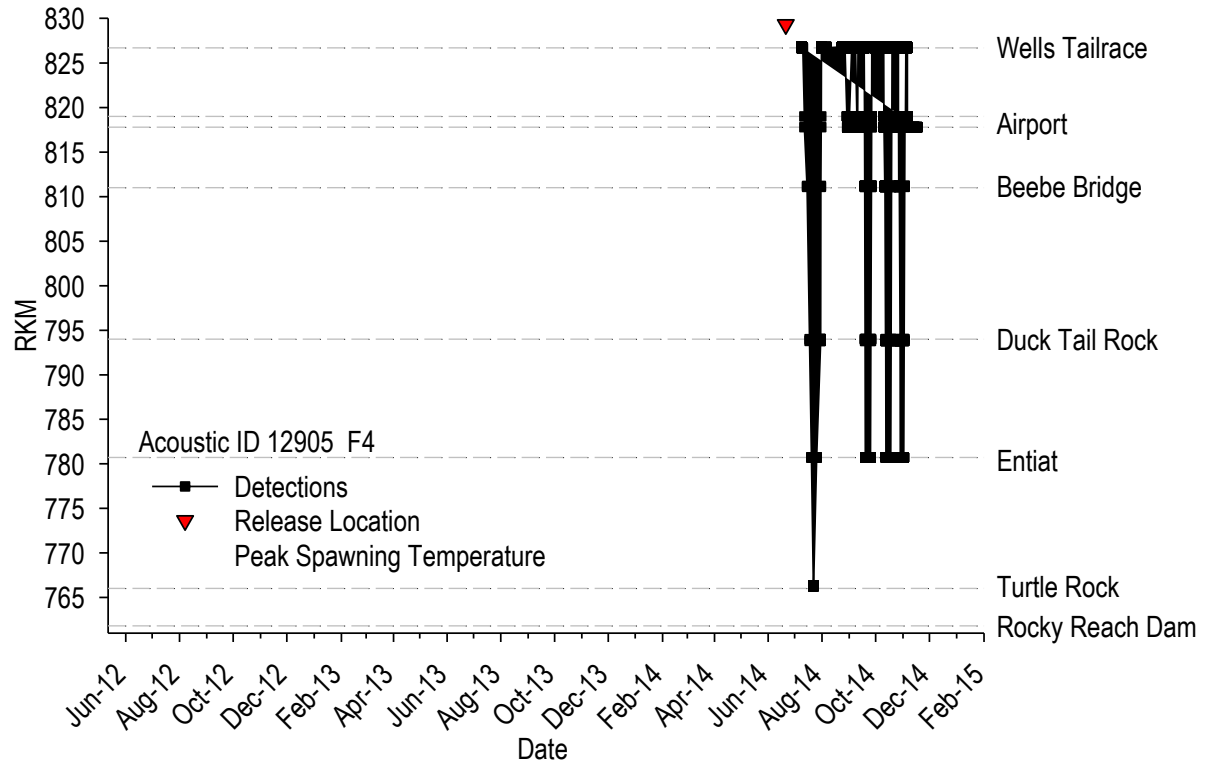


- 3 males returned to upper reservoir during peak temperatures



- 5 of 12 overwintered in upper reservoir

- Only one of these five moved out of the upper reservoir

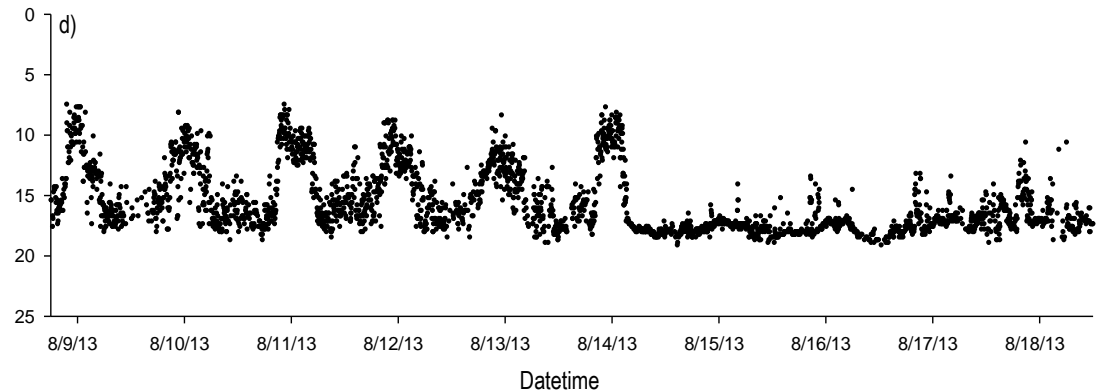
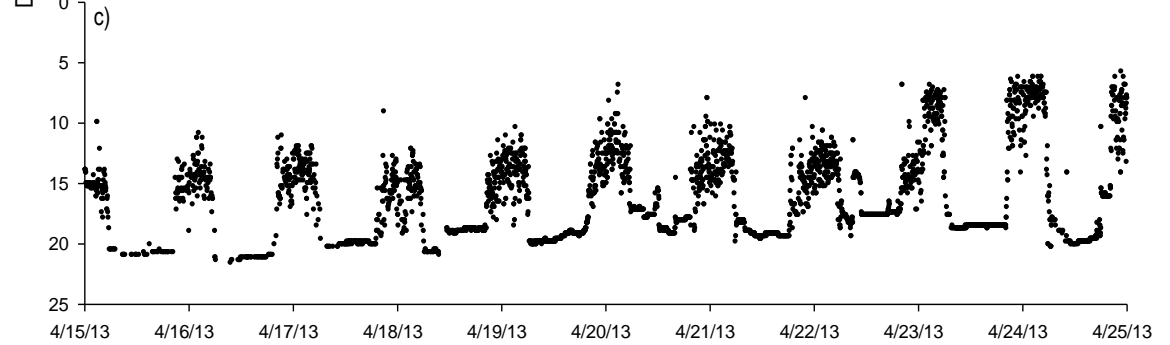
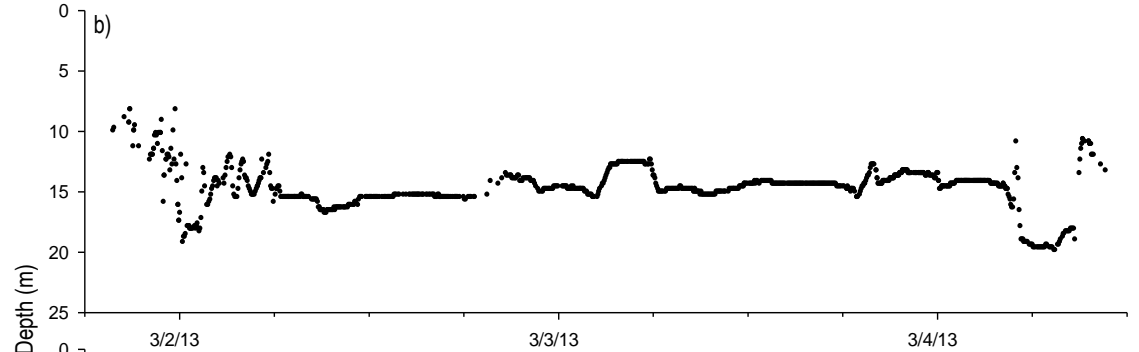
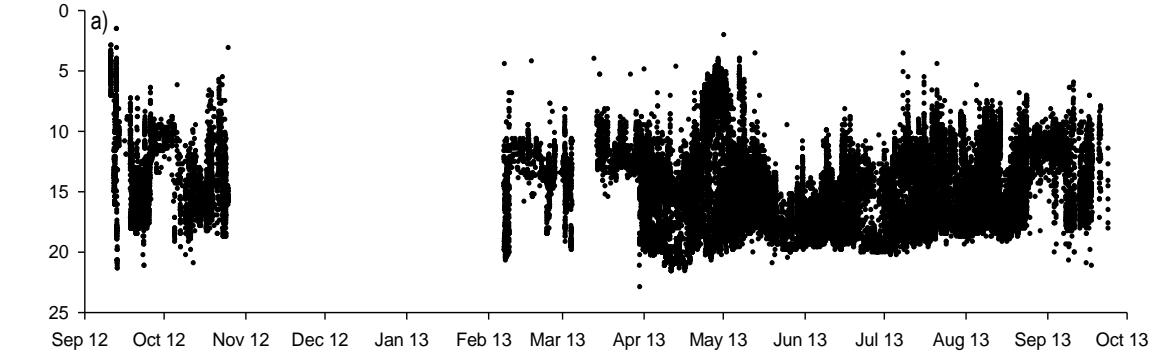


Adult Conclusions

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- Adults move substantial distances in some cases making multiple transects of the reservoir
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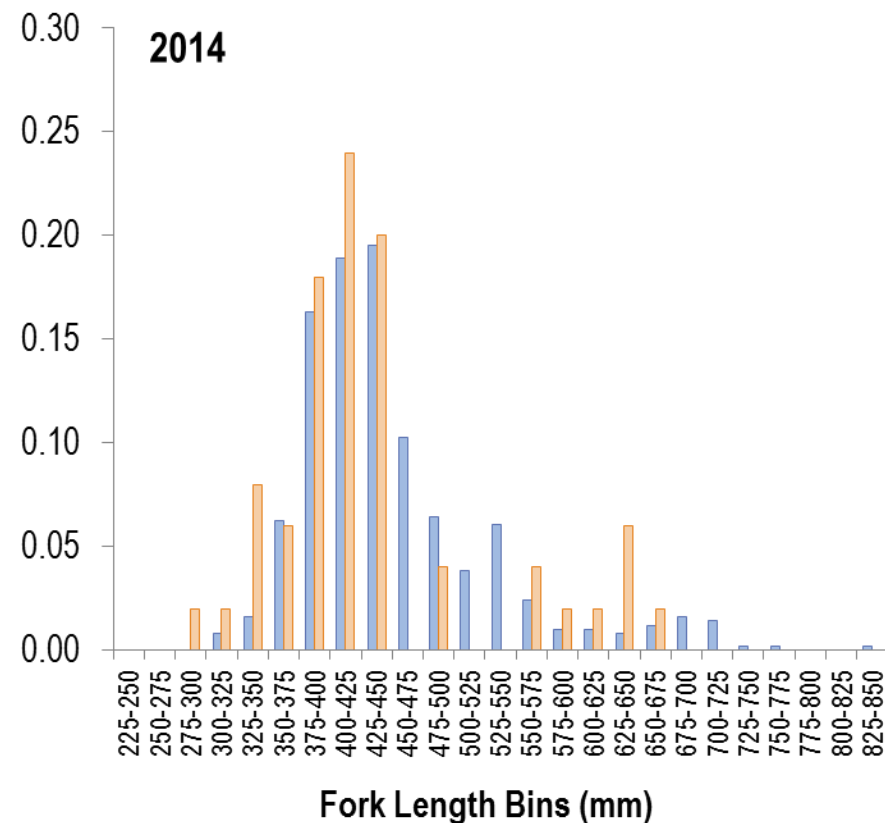
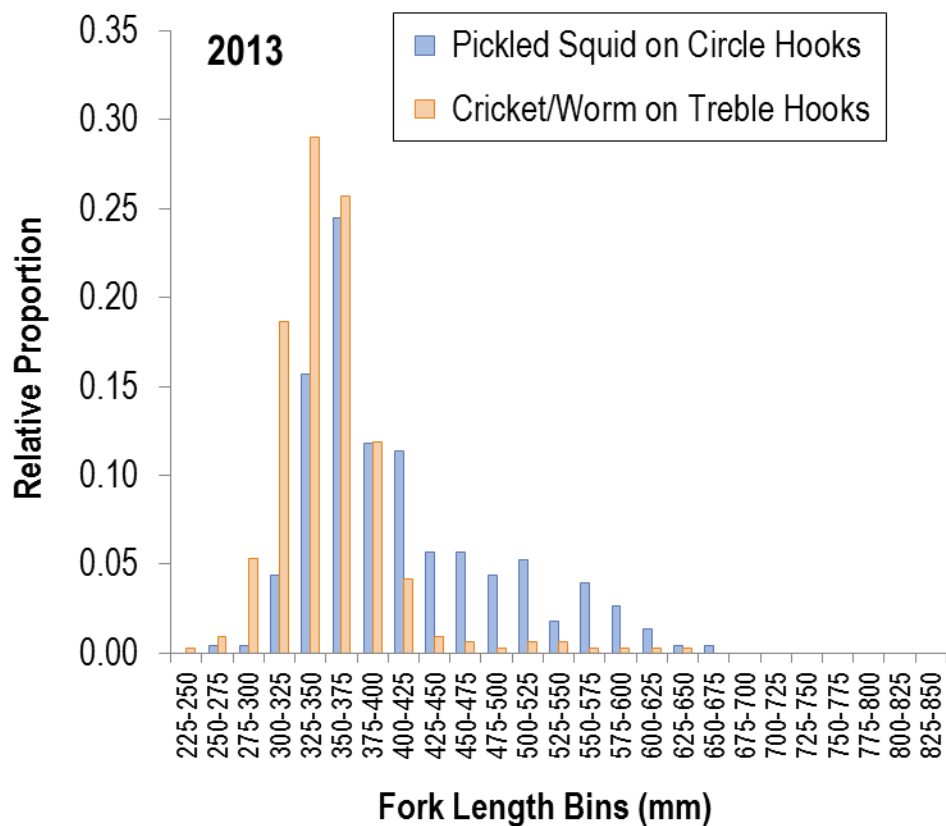
Depth Data

- Mean = 17.8 m
- Individual means ranged from 9.1 m to 29.5 m

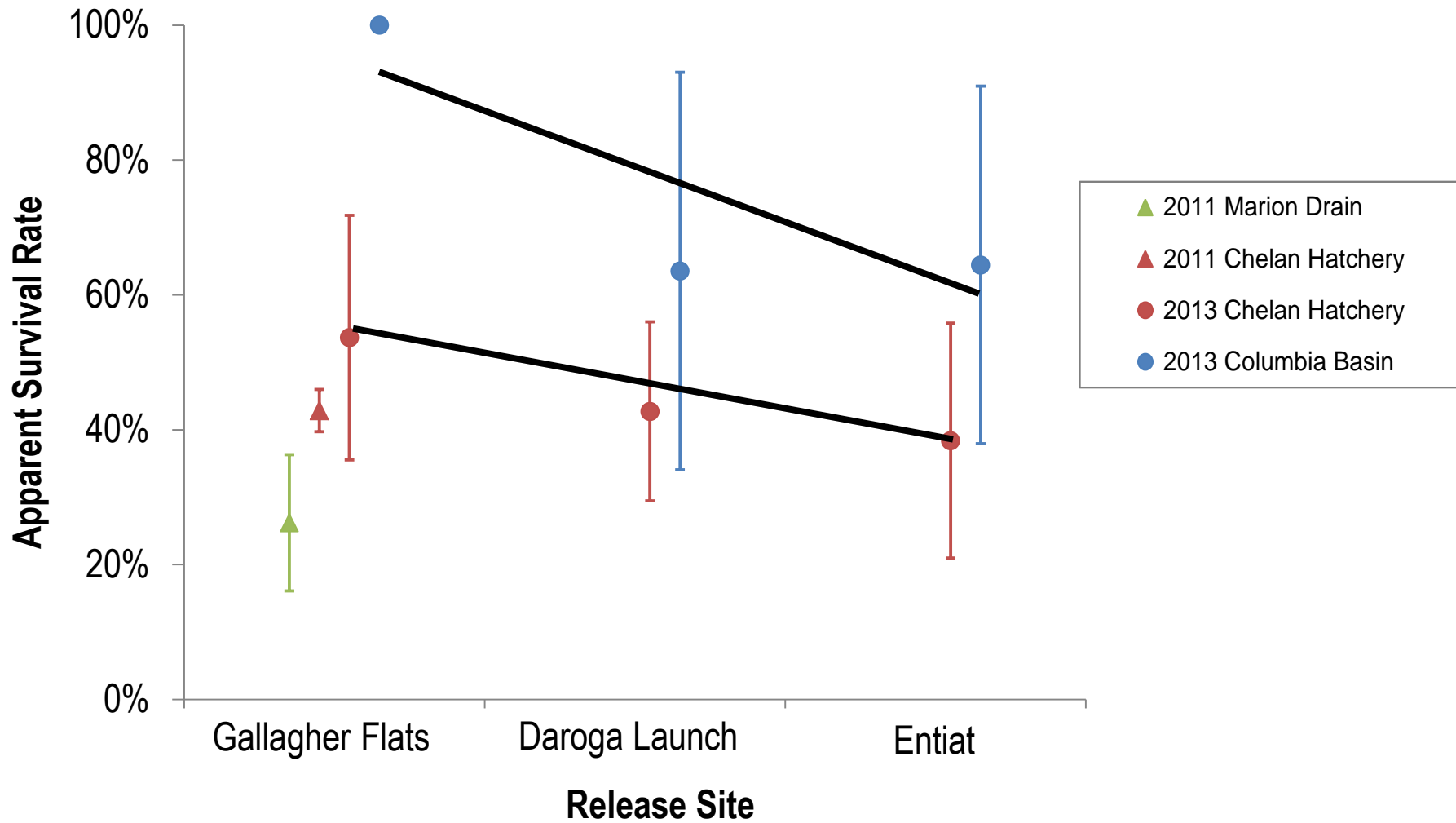


CPUE and Size-frequency Distribution

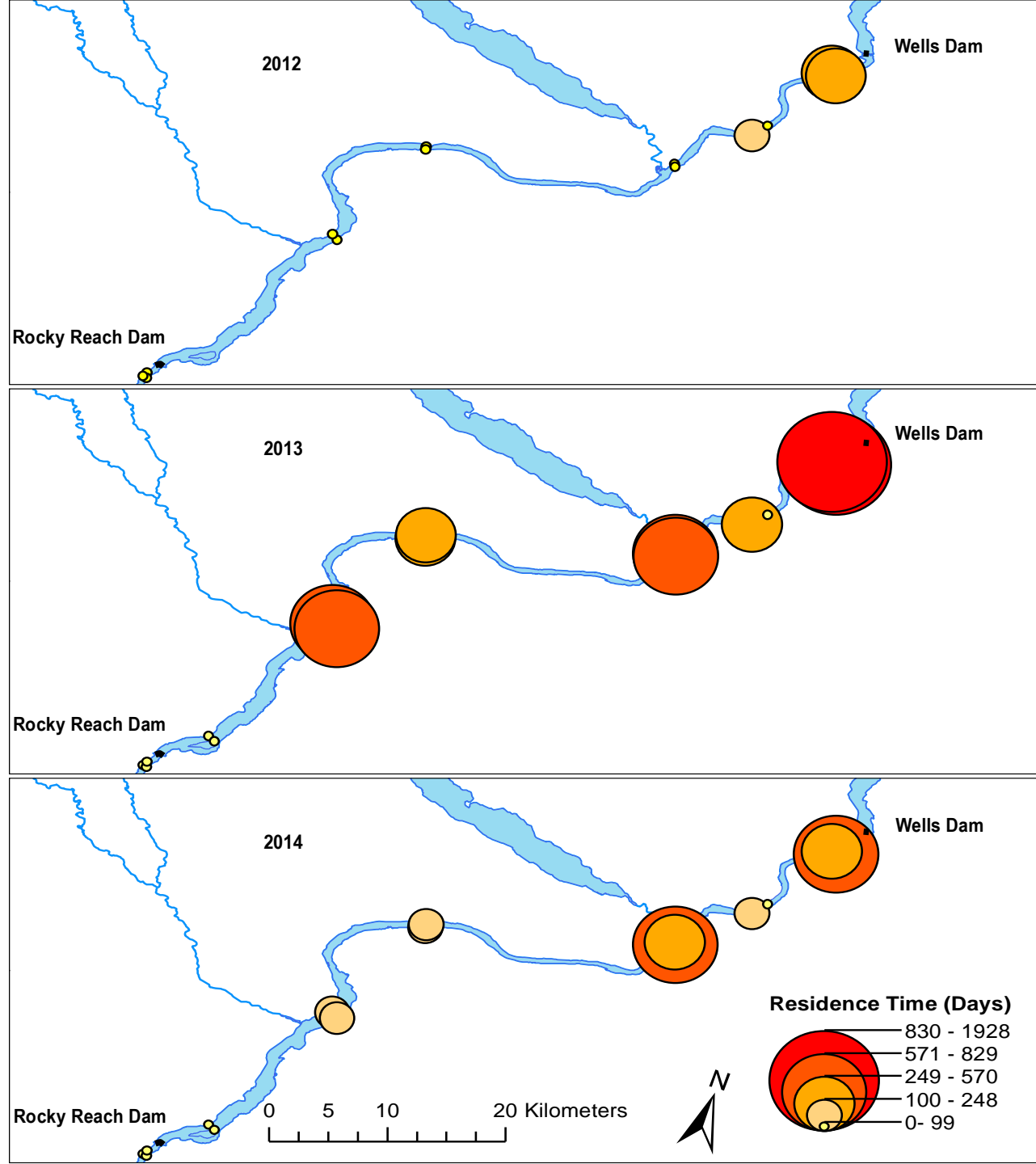
	Catch per 1000 Hook Hours		Proportion of Hook Hours	
	2013	2014	2013	2014
Treble	0.60	0.21	0.86	0.39
Circle	2.50	2.09	0.14	0.61



Survival Release to 0.5 years



Residence Time of Acoustically Tagged Sturgeon



Movements

Direction	Movements	Mean Movements	Total km	Mean km
Upstream	439	2.6	3804	22.9
Downstream	260	1.6	2357	14.2
Total	699	4.2	6161	37.1
