

Population dynamics of razorback sucker in two lower Colorado River reservoirs



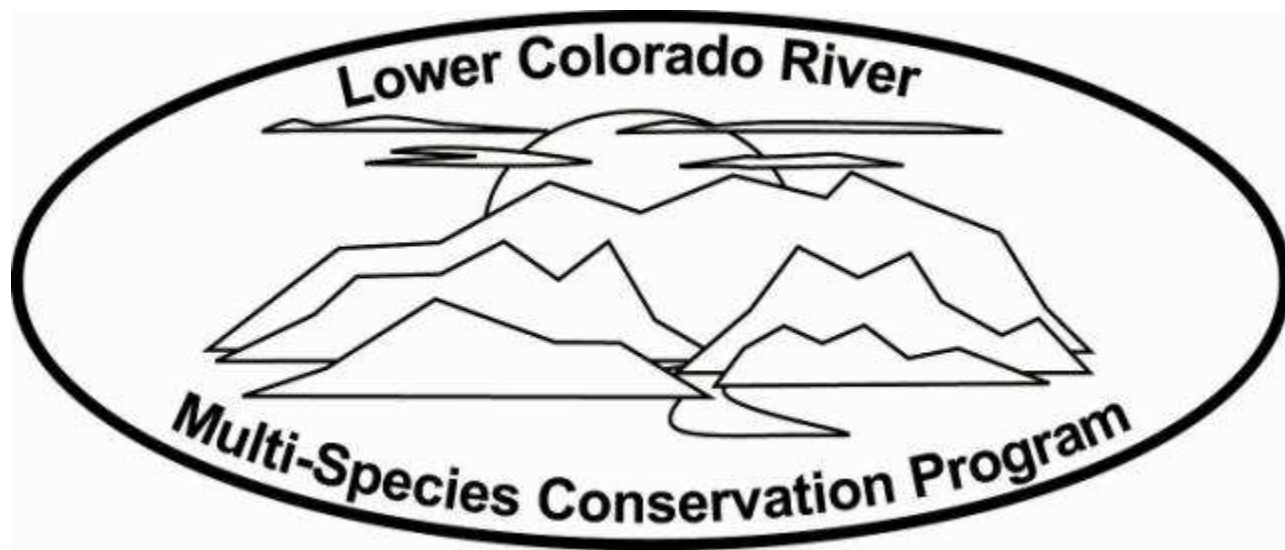
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MARSH & ASSOCIATES, LLC



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Laughlin, NV

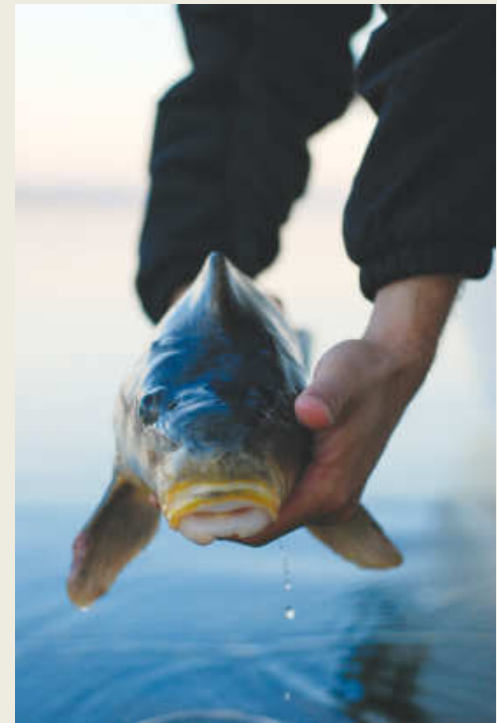
Funding for this project has been provided by the Lower Colorado River Multi-Species Conservation Program.



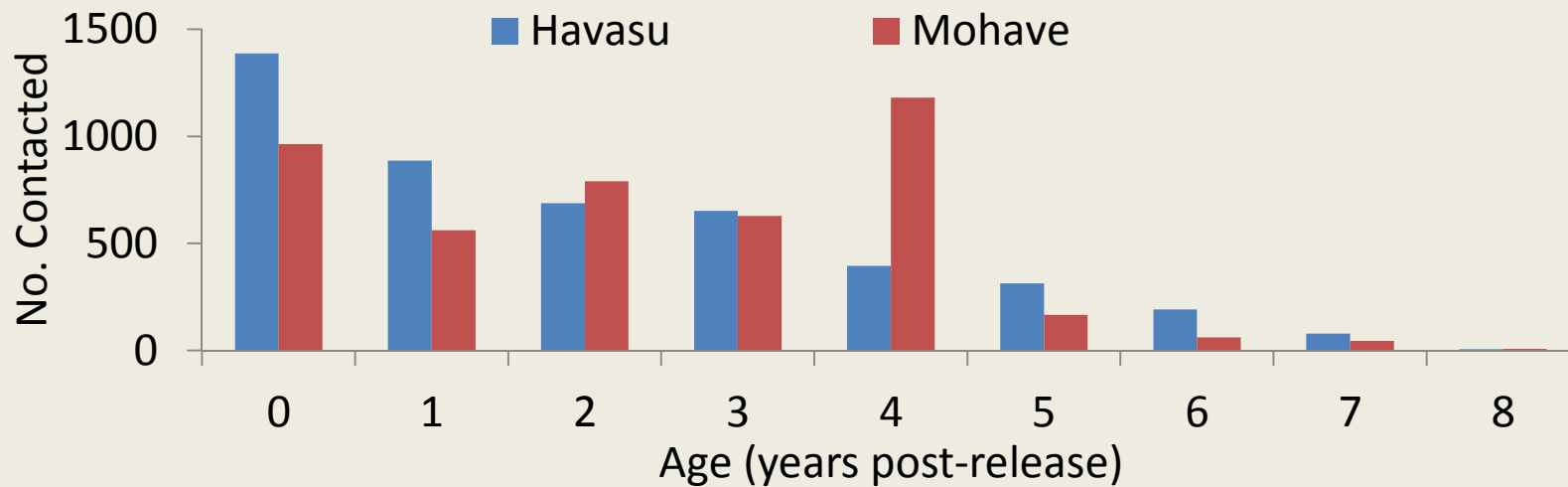
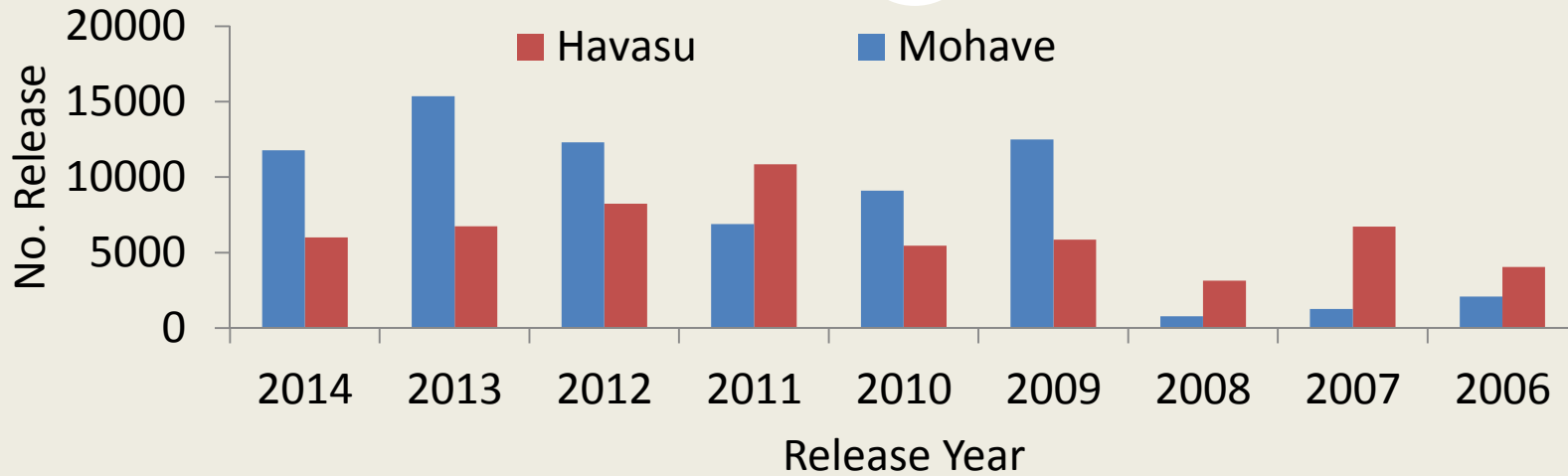
Razorback Sucker 134 kHz PIT Tagged Stockings



- 134 kHz tagged at release in database
 - Lake Havasu – 57,037
 - ✦ October 24, 2006 to February 27, 2014
 - Lake Mohave – 72,071
 - ✦ May 3, 2006 to January 27, 2014
- 134 kHz tagged at release contacts
 - Lake Havasu – 4,600 (8.1% of releases)
 - Lake Mohave – 4,405 (6.1% of releases)



Release Totals for PIT Tagged Razorback Sucker



Lake Mohave PIT Scanning



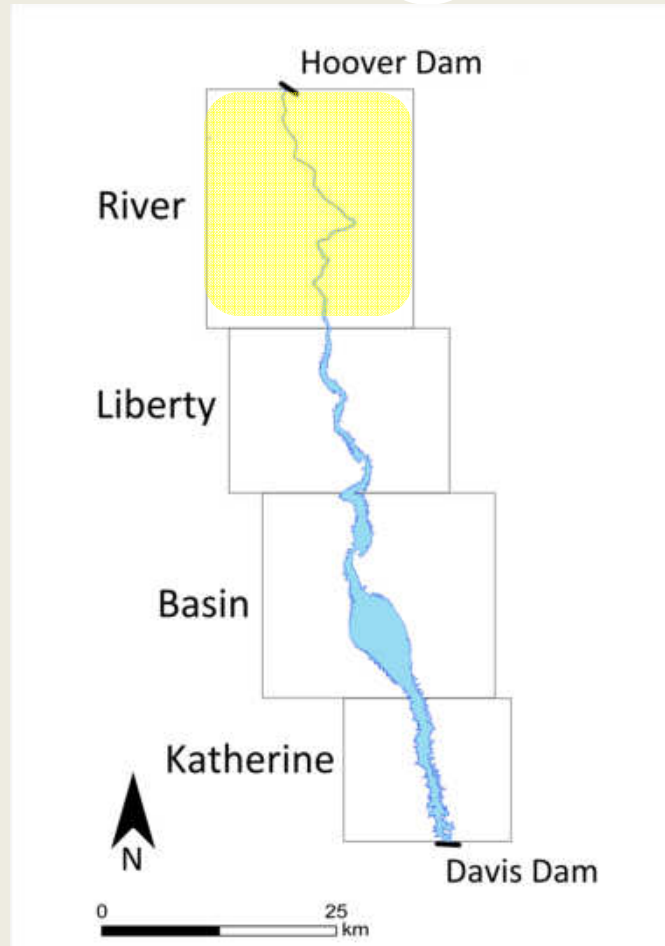
Release Year	Scan Year				
	2010	2011	2012	2013	2014
2006	8	5	36	29	33
2007	28	17	60	62	56
2008	28	32	72	73	63
2009	227	609	1035	1020	871
2010	16	253	610	628	538
2011	-	0	719	584	513
2012	-	-	22	171	199
2013	-	-	-	5	121
2014	-	-	-	-	10
	307	916	2554	2572	2404

28,000 released

27,000 released



Lake Mohave Zones



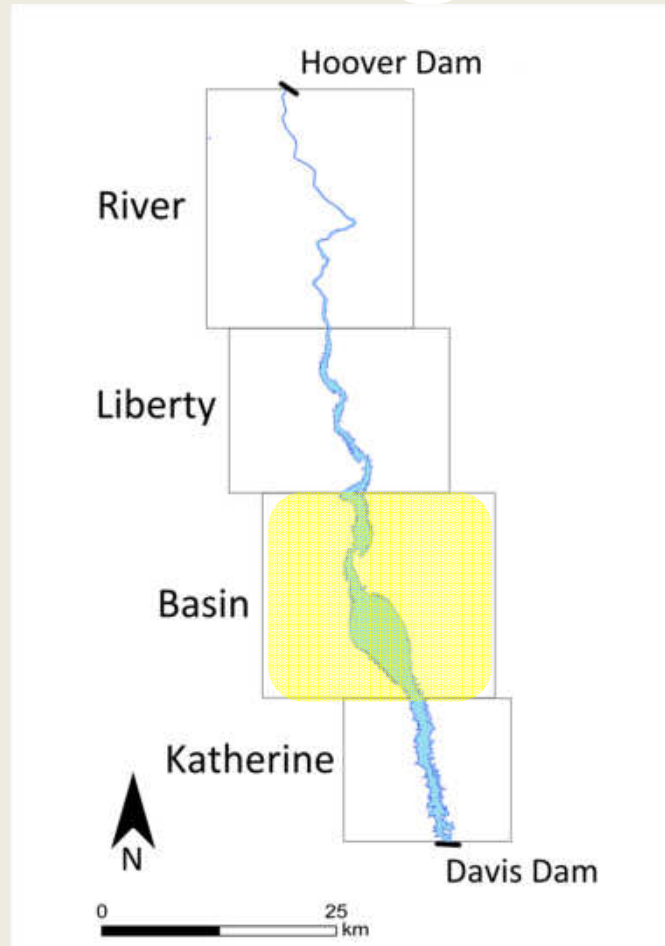
Lake Mohave PIT Scanning - River



Year	Released		Contacted		
	Released	Mean TL (mm)	Contacted	Mean TL (mm)	Proportion Contacted
2007	66	445	2	442	0.030
2008	95	478	29	497	0.305
2009	6290	402	971	437	0.154
2010	5576	370	552	444	0.099
2011	2470	396	666	431	0.270
2012	3926	352	42	446	0.011
2013	4523	330	3	384	0.001
2014	2976	332	0		0.000



Lake Mohave Zones



Lake Mohave PIT Scanning - Basin



Year	Released		Contacted		
	Released	Mean TL (mm)	Contacted	Mean TL (mm)	Proportion Contacted
2006	1050	386	43	456	0.041
2007	612	443	74	475	0.121
2008	443	449	48	492	0.108
2009	2682	381	370	470	0.138
2010	3262	366	293	459	0.090
2011	2399	361	198	448	0.083
2012	2564	384	214	448	0.083
2013	3804	351	63	458	0.017
2014	4219	344	10	459	0.002

- 51 of 63 fish contacted from 2013 release were from 278 fish released out of backwaters
- 58 additional fish were contacted from 2013 stocking released in Katherine or Liberty zones



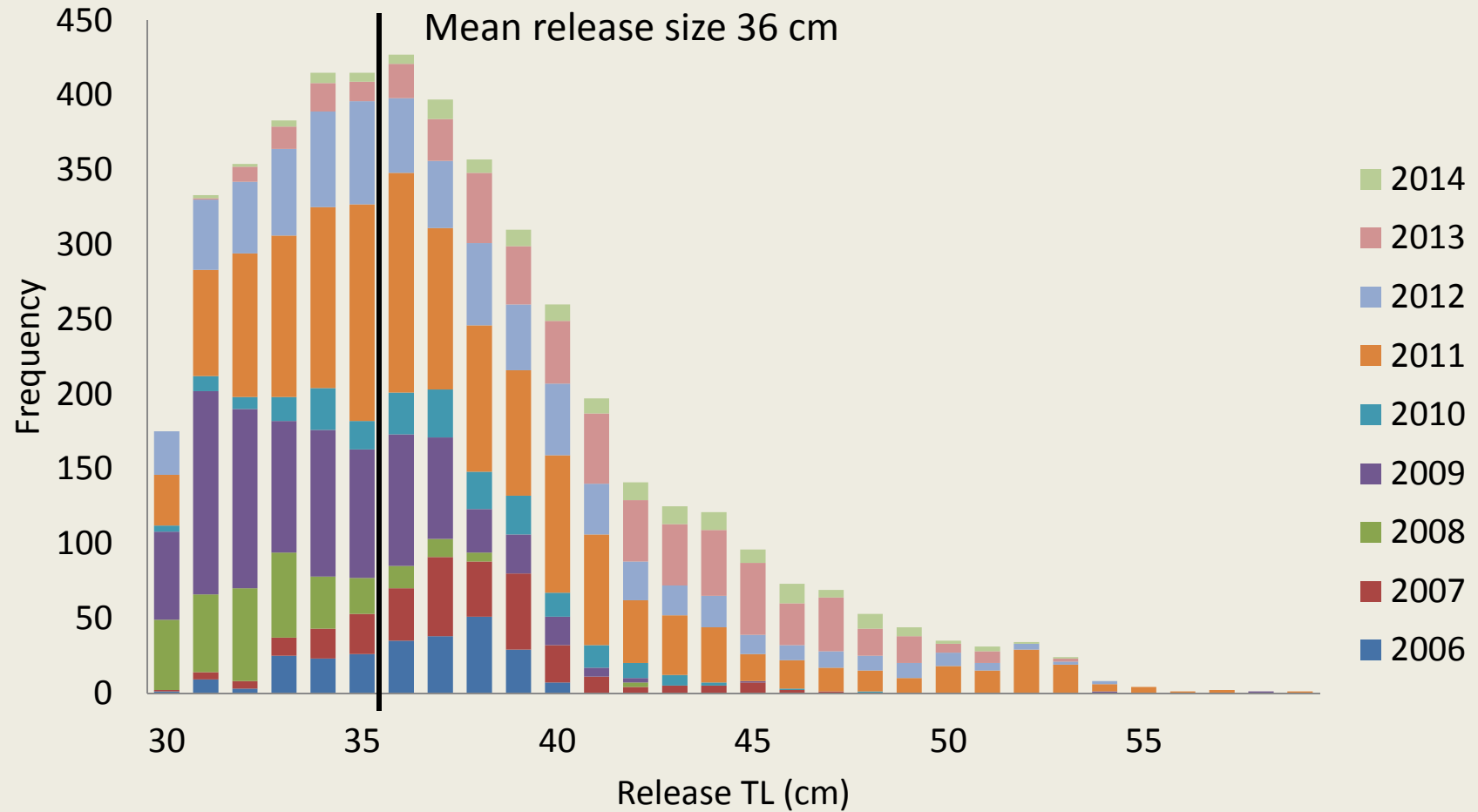
Lake Havasu PIT Scanning



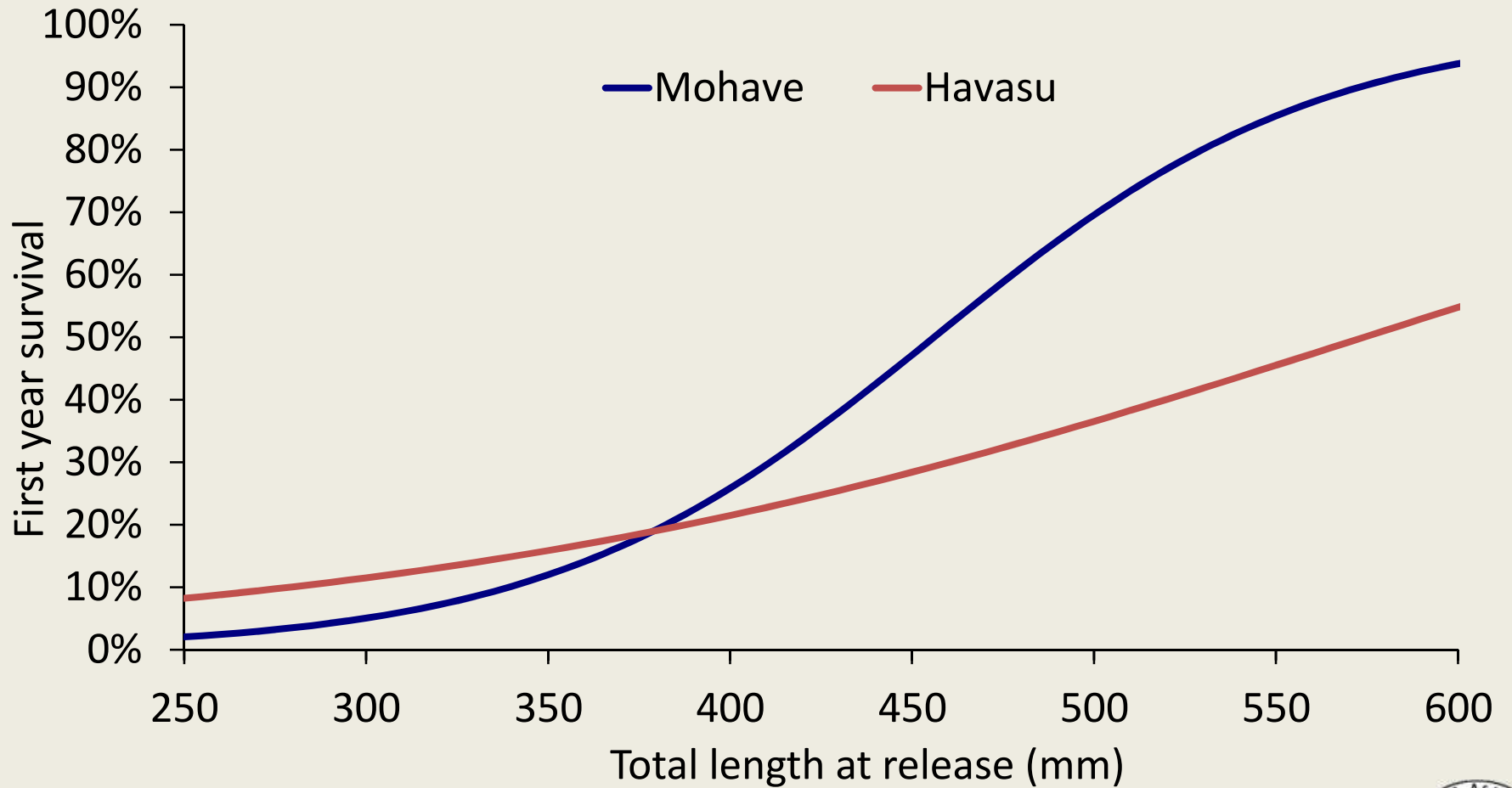
Year	Released		Contacted		
	Released	Mean TL (mm)	Contacted	Mean TL (mm)	Proportion Contacted
2006	4046	345	173	365	0.040
2007	6718	354	205	379	0.030
2008	3138	326	222	328	0.070
2009	5858	332	564	342	0.100
2010	5465	361	173	372	0.030
2011	10840	362	1083	381	0.100
2012	8220	359	601	378	0.070
2013	6243	396	538	418	0.090
2014	5645	398	177	419	0.030



PIT Scanned Release Size Distribution Lake Havasu



MARK Post-Release Survival Estimates



Stocking Population Dynamics

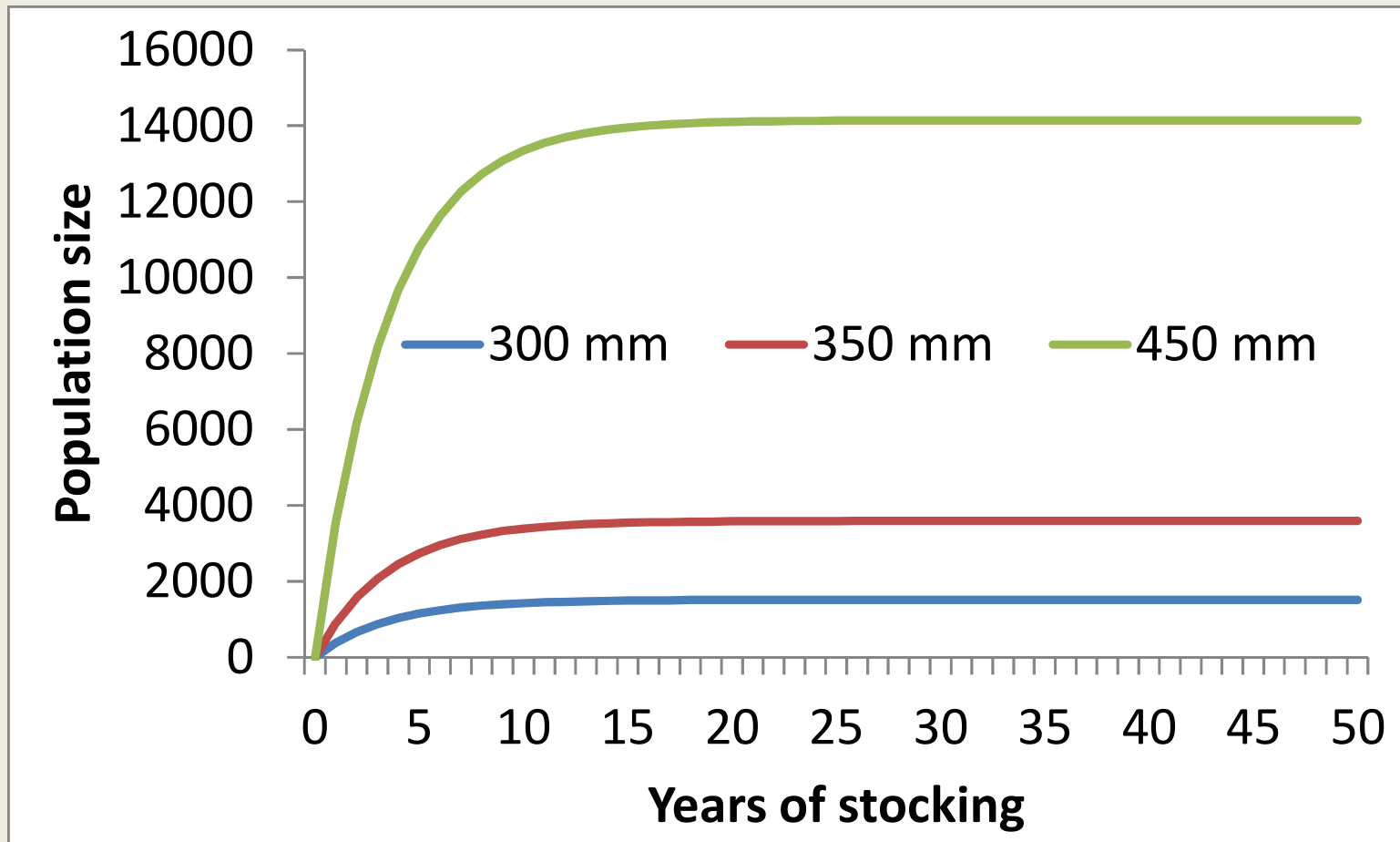


How does this difference impact population dynamics?

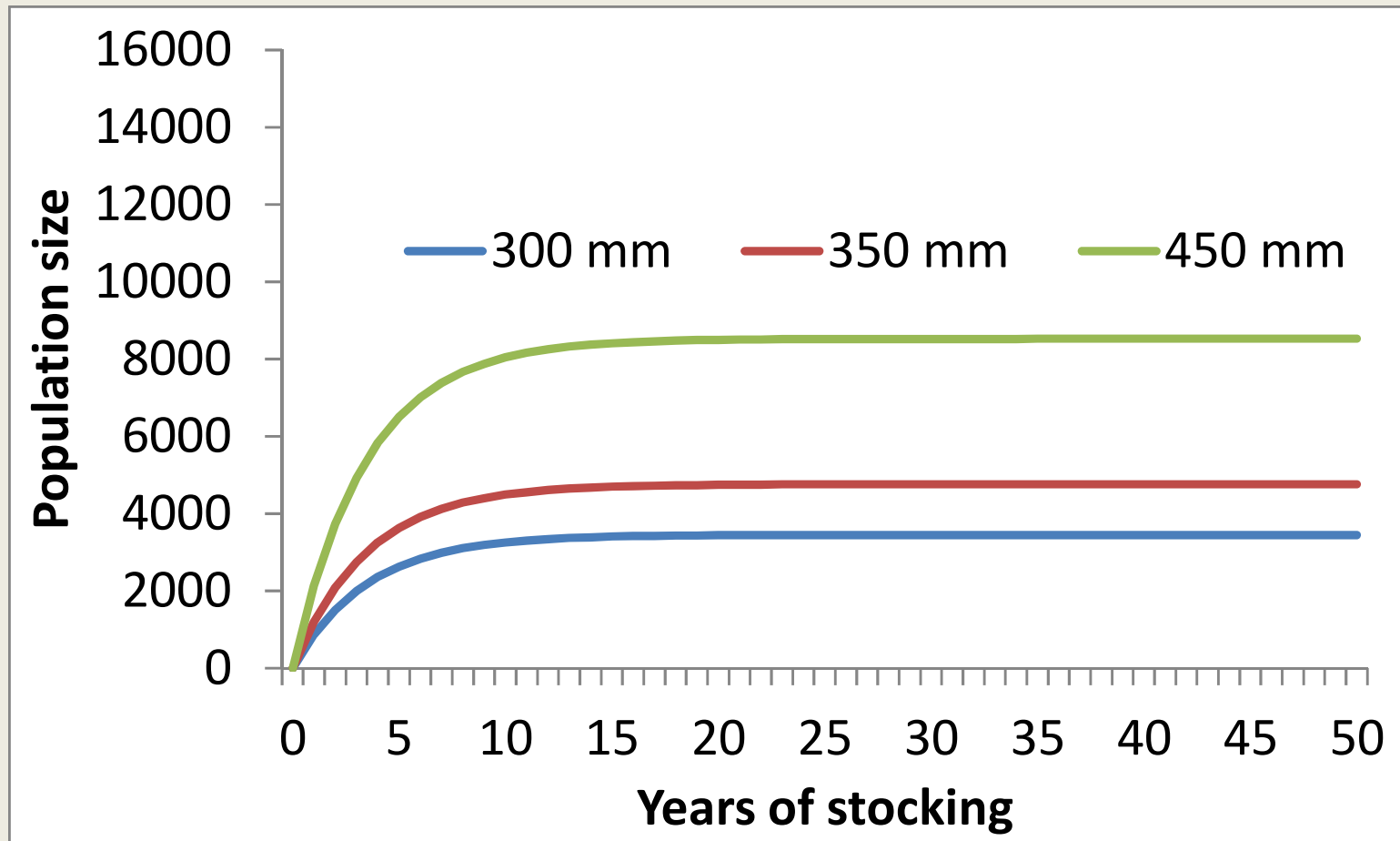
- Simple population model
 - Stock 10,000 fish a year at three sizes
 - ✦ 300 mm
 - ✦ 350 mm
 - ✦ 450 mm
 - First year survival based on MARK survival estimates for each size class in each reservoir
 - Second year and older fish survive at 75% annually



Stocking Choices - Mohave



Stocking Choices - Havasu



Havasu Still an Unknown

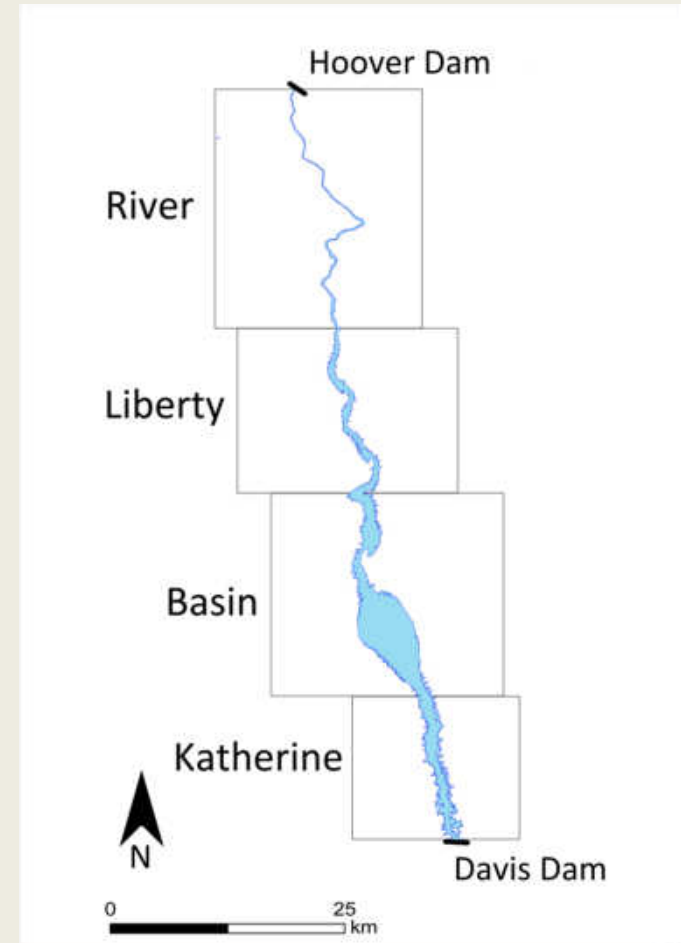


- Wary of results due to differences in contact rates
 - PIT scanning contacting a quarter to a third of population
 - ✦ In 2012, a total of 971 were scanned out of an estimated 4524
 - ✦ In 2013, a total of 1649 out of an estimated 4196
- Few fish larger than 450 mm have been released
- Nonrandom assortment?

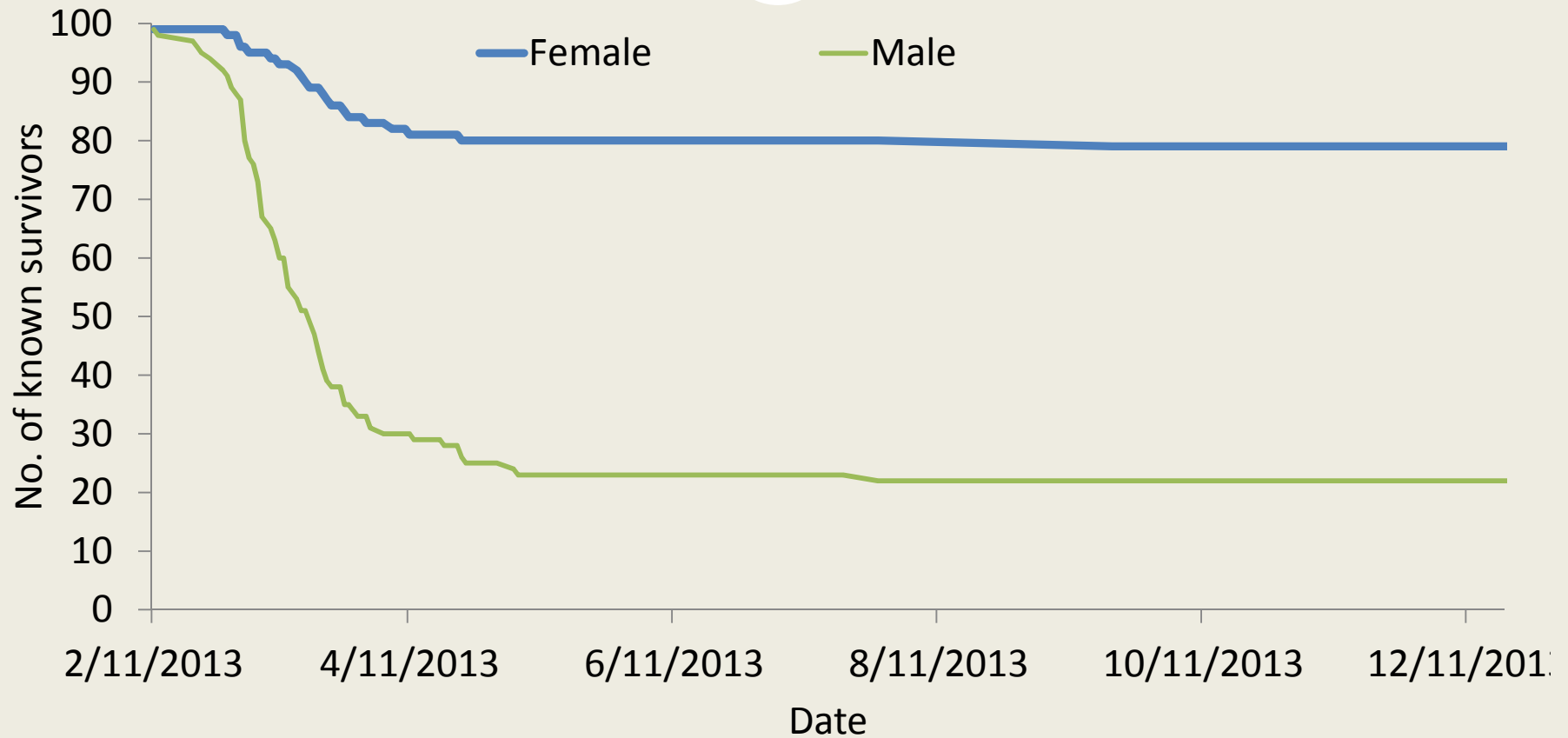


Lake Mohave Adult Survival

Zone	Period	Estimate (95% Confidence Interval)
River	Jan 2012 to Feb 2012	92.8% (82.1% - 97.3%)
	Feb 2012 to Mar 2012	99.3% (98.7% - 100%)
	Mar 2012 to Apr 2012	99.3% (98.7% - 100%)
	Apr 2012 to Jan 2013	99.3% (98.7% - 100%)
	Jan 2013 to Feb 2013	85.5% (76.2% - 91.5%)
	Feb 2013 to Mar 2013	98.9% (96.5% - 99.7%)
	Mar 2013 to Apr 2013	98.9% (96.5% - 99.7%)
	Apr 2013 to Jan 2014	98.9% (96.5% - 99.7%)
	Jan 2014 to Feb 2014	98.8% (1.1% - 100%)
	Feb 2014 to Mar 2014	72.2% (0% - 100%)
Basin	Jan 2012 to Feb 2012	81.7% (63.2% - 92.1%)
	Feb 2012 to Mar 2012	99.3% (98.2% - 100.4%)
	Mar 2012 to Apr 2012	99.3% (98.3% - 100.3%)
	Apr 2012 to Jan 2013	99.3% (98.3% - 100.3%)
	Jan 2013 to Feb 2013	76.2% (62.4% - 86.1%)
	Feb 2013 to Mar 2013	99.9% (99.4% - 100.5%)
	Mar 2013 to Apr 2013	99.9% (99.4% - 100.5%)
	Apr 2013 to Jan 2014	99.9% (99.4% - 100.5%)
	Jan 2014 to Feb 2014	74.1% (37.7% - 93.1%)
	Feb 2014 to Mar 2014	26.9% (0% - 100%)



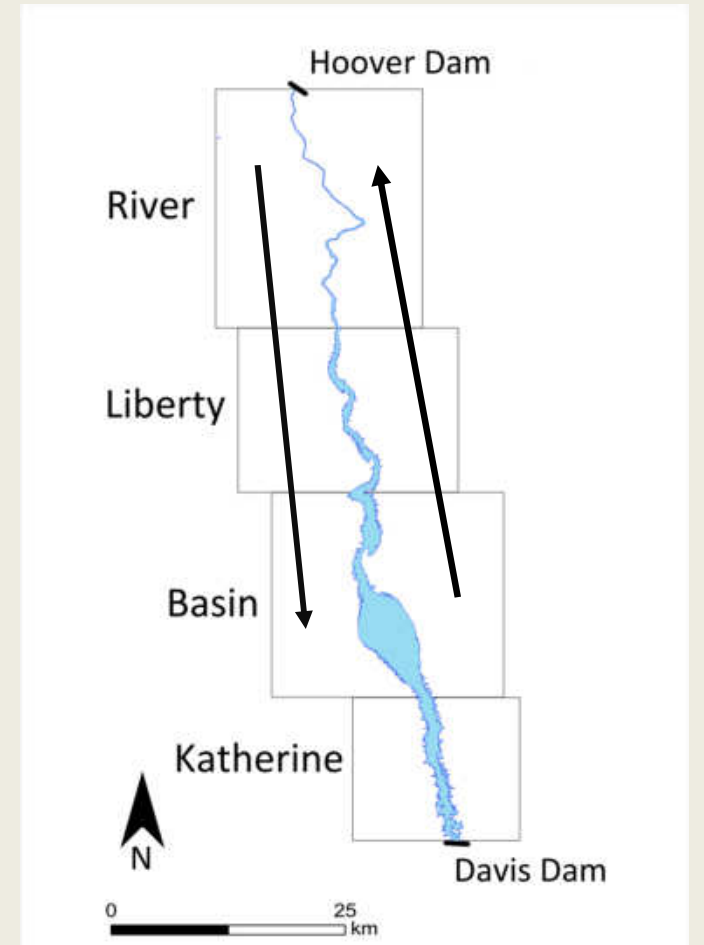
Yuma Cove PIT Scanning 2013



Lake Mohave Adult Transition



- Post release
 - 6.0% released in river transition to basin
 - 6.6% released in basin transition to river
- Adult monthly transition
 - 0.6% transition from river to basin
 - 2.3% transition from basin to river



Thanks to our partners for their support

- USBR



- USFWS



- NPS



- NDOW



- Cross Country Consulting, LLC

