

*Release Strategies to Improve Post-Release
Performance of Hatchery Summer Steelhead in
Northeast Oregon.*

By

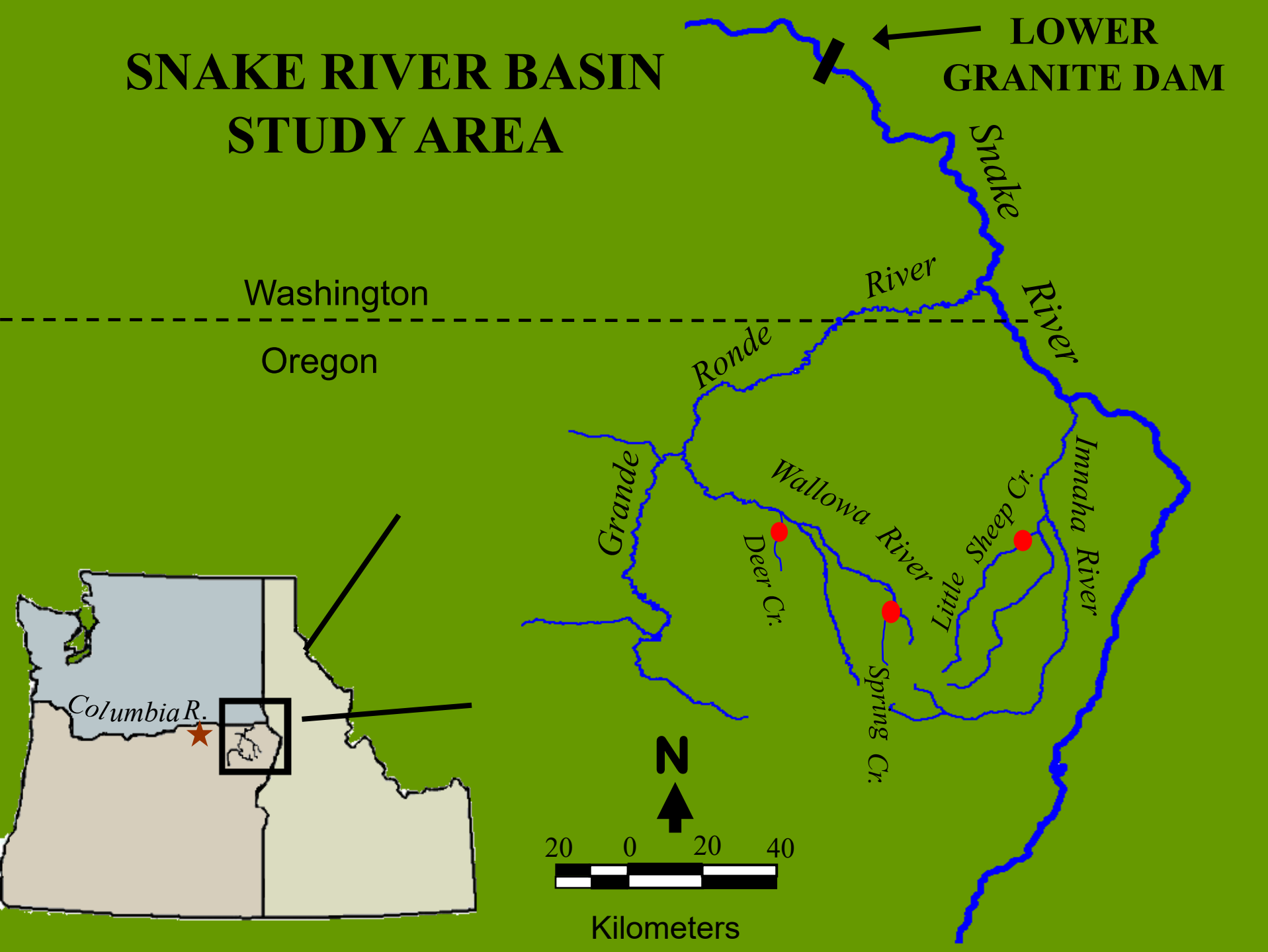
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Carmichael*



STUDY DESIGN

1. *Acclimation vs. Direct-Release*: One group released after a 16-57 day acclimation, the other group direct-released on same day.
 - 14 paired groups.
 - Spring Creek, (1987-1990)
 - Deer Creek, (1991-1996)
 - Little Sheep Creek, (1993-1996)
2. *Volitional vs. Forced Release following Acclimation*: Both groups acclimated for at least 27 days, 1 group provided a 14-21 day volitional release the other group forced from acclimation pond.
 - 6 paired groups.
 - Spring Creek, (1996-1999)
 - Deer Creek, (1998-1996)

Snake River Basin STUDY AREA



COMMON METHODS

1. Rearing in hatchery raceways to yearling stage, water temperature range = 10 -14 °C. Fish trucked 3.5 to 4.5 h to acclimation sites.
2. Release groups of 25,000 to 50,000. Fish were freeze-branded or PIT-tagged to measure outmigration travel time and survival to dam. All fish received coded-wire-tags; tag recoveries used to estimate smolt-to-adult survival and straying.
3. Acclimation ponds are rectangular and concrete, supplied with stream water.

Response Metrics

1. Outmigration Travel Time
2. Outmigration Survival
3. Smolt-to-Adult-Survival
4. Stray Rate Index

PIT Tagging and Coded-Wire-Tagging at Irrigon Hatchery



Big Canyon Acclimation Pond



Adult Returns to Wallowa Hatchery

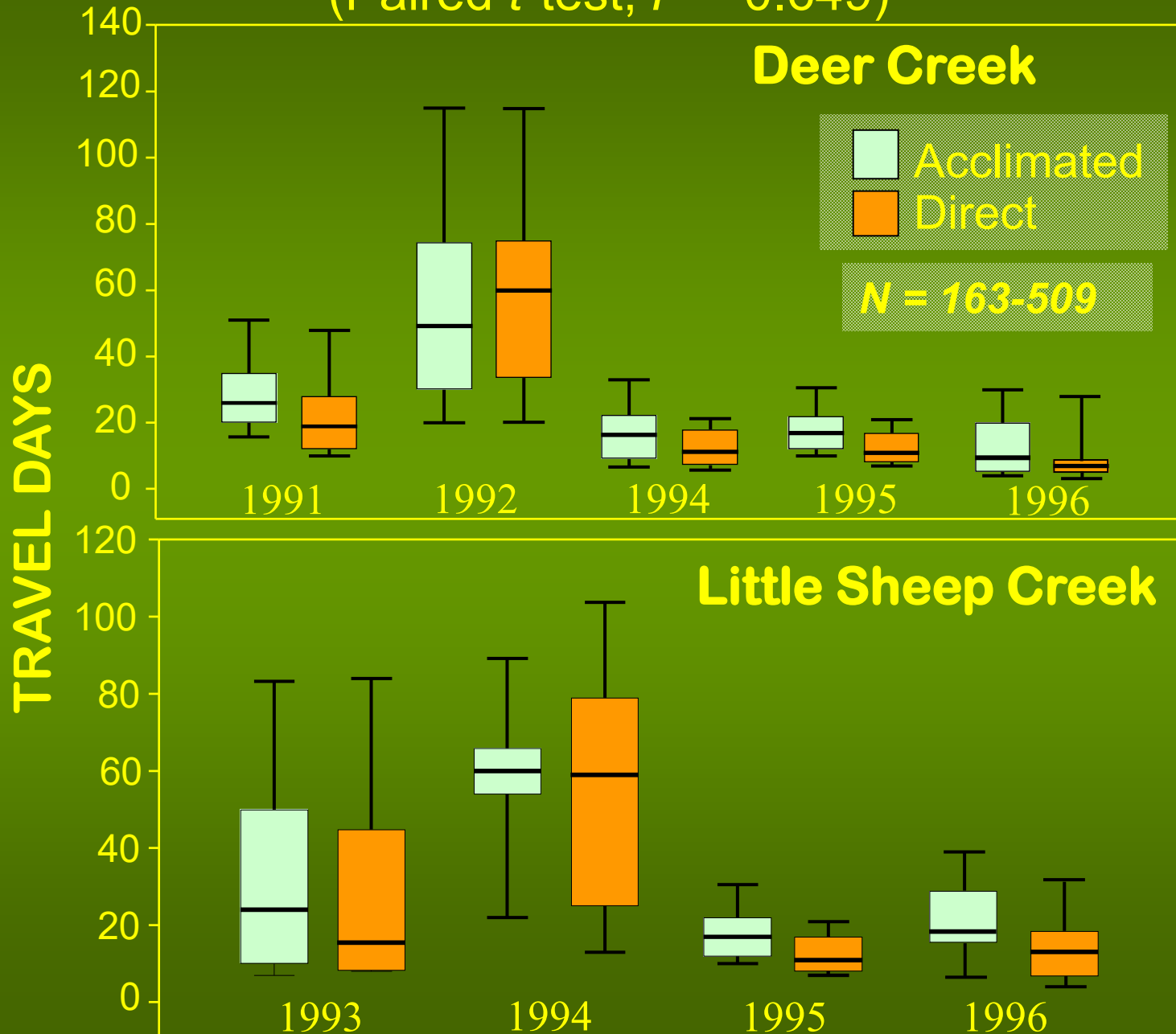


ACCLIMATION VERSUS DIRECT-RELEASE RESULTS

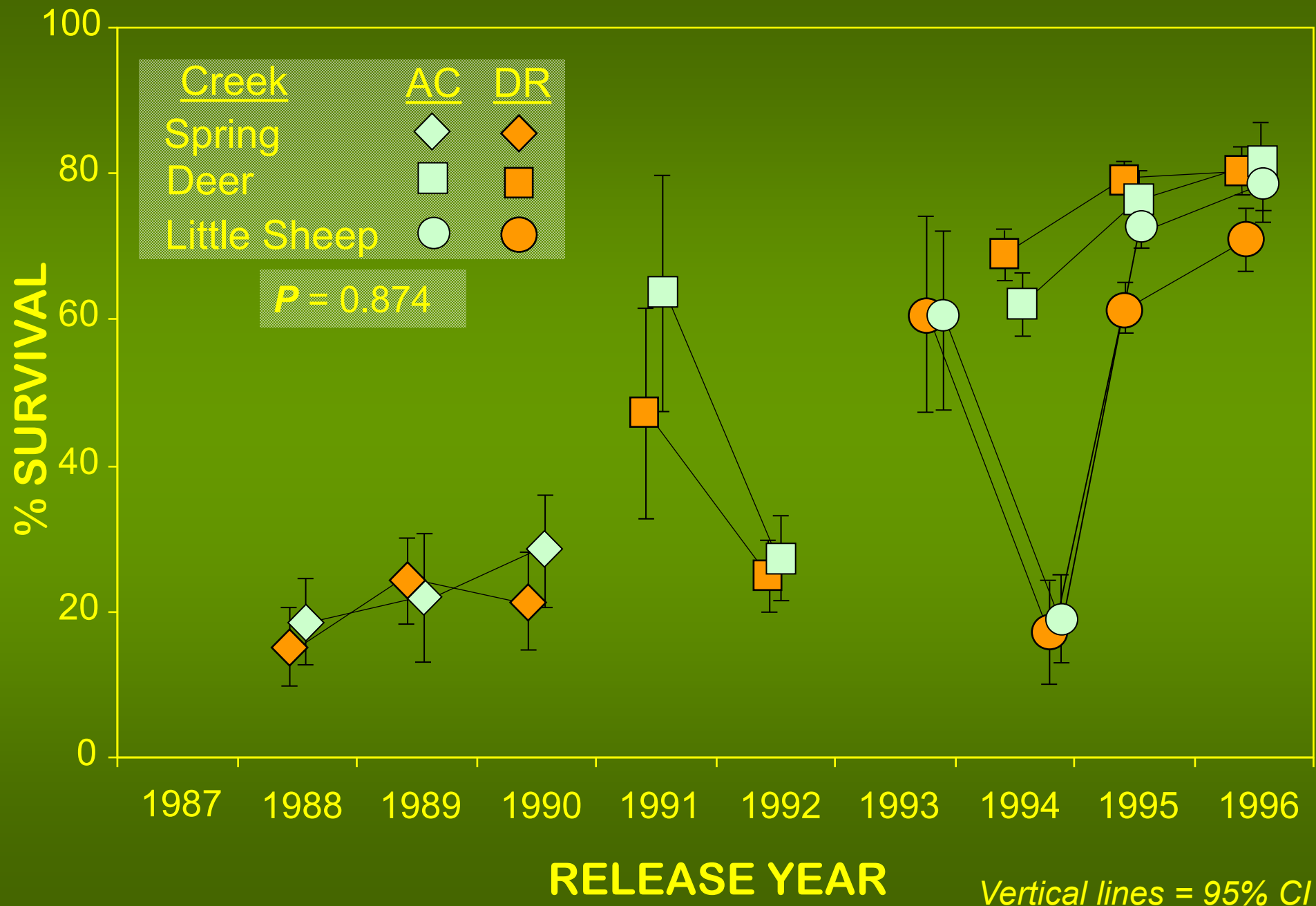


SIMILAR TRAVEL TIME TO LOWER GRANITE DAM

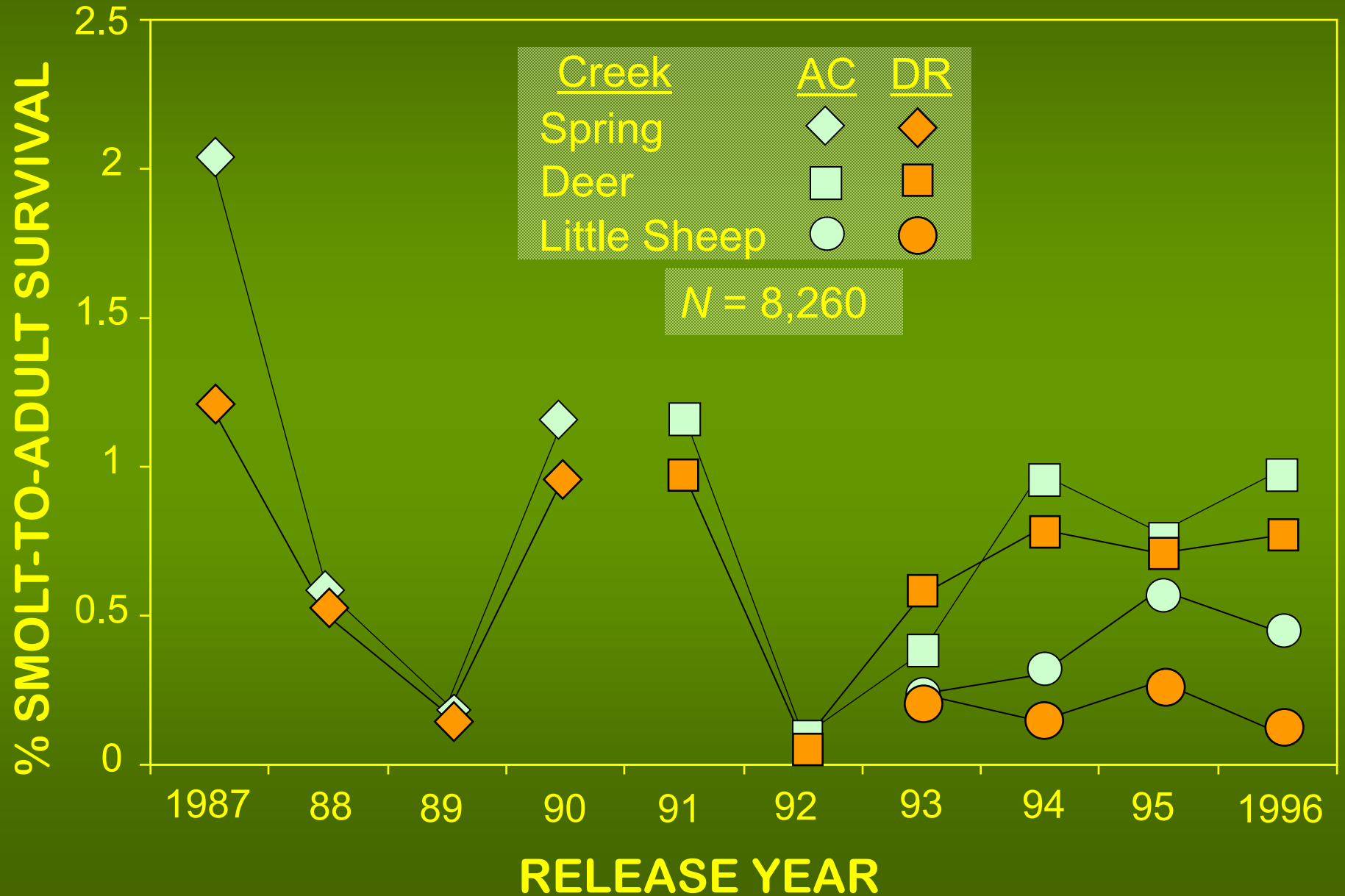
(Paired *t*-test, $P = 0.649$)



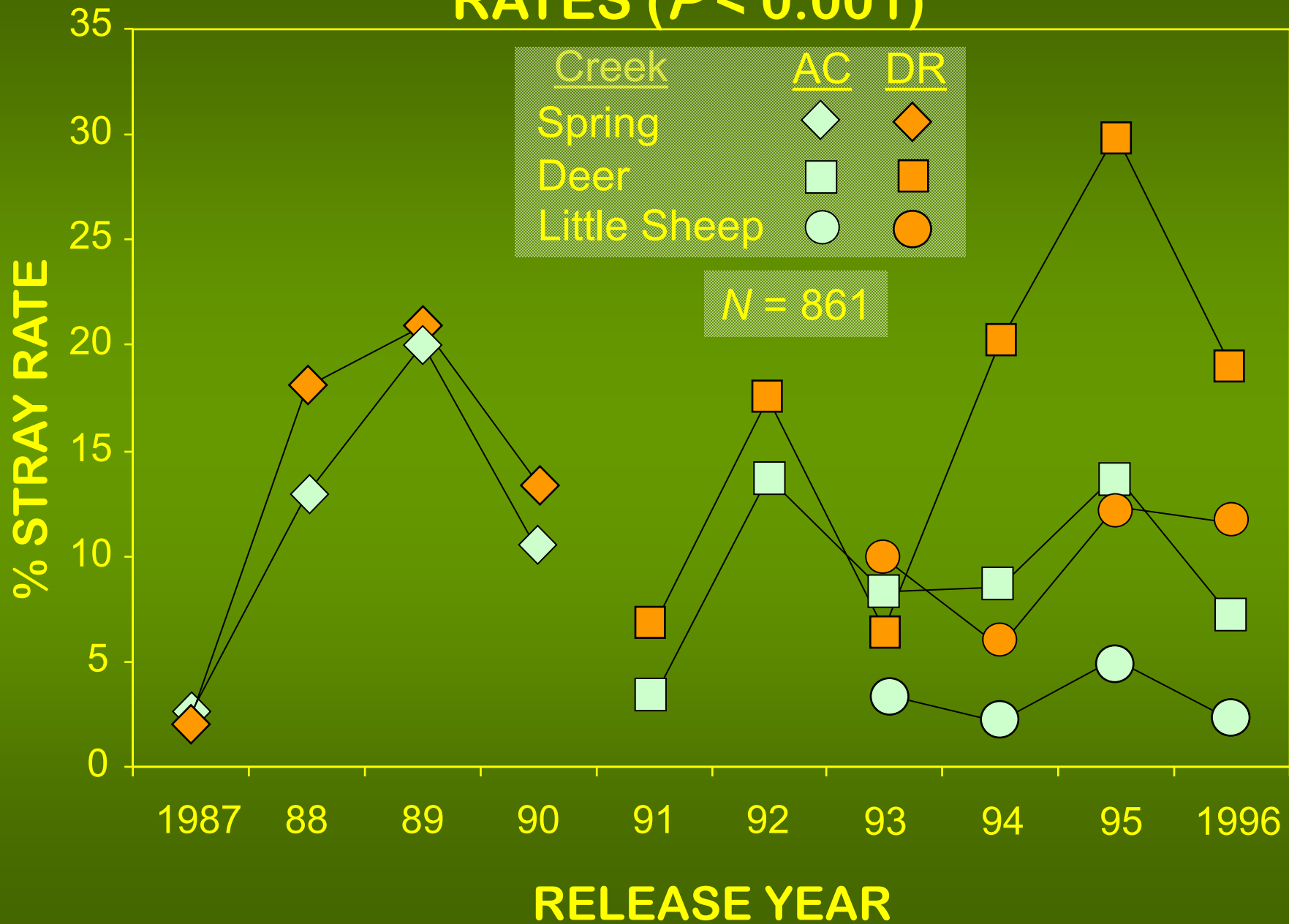
SIMILAR OUTMIGRATION SURVIVAL TO DAM



ACCLIMATED GROUPS HAD HIGHER SURVIVAL TO ADULTHOOD ($P = 0.013$)



ACCLIMATED GROUPS HAD LOWER STRAY RATES ($P < 0.001$)



Deschutes River Basin

56% of recoveries after 1 February were Direct-Release

Warm Springs National Fish Hatchery (RK 154)

Mouth (RK 0)

54% Direct-Release

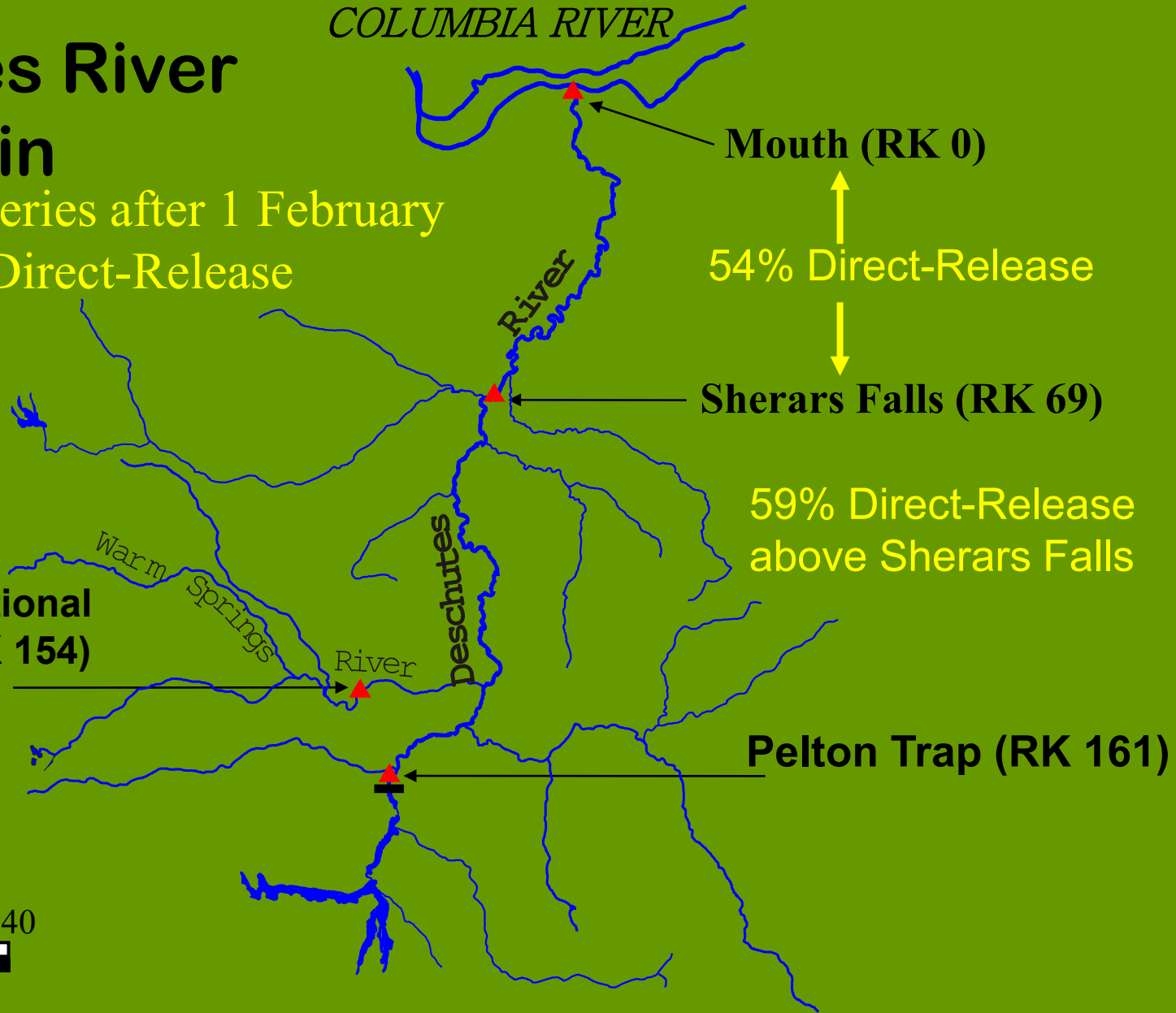
Sherars Falls (RK 69)

59% Direct-Release above Sherars Falls

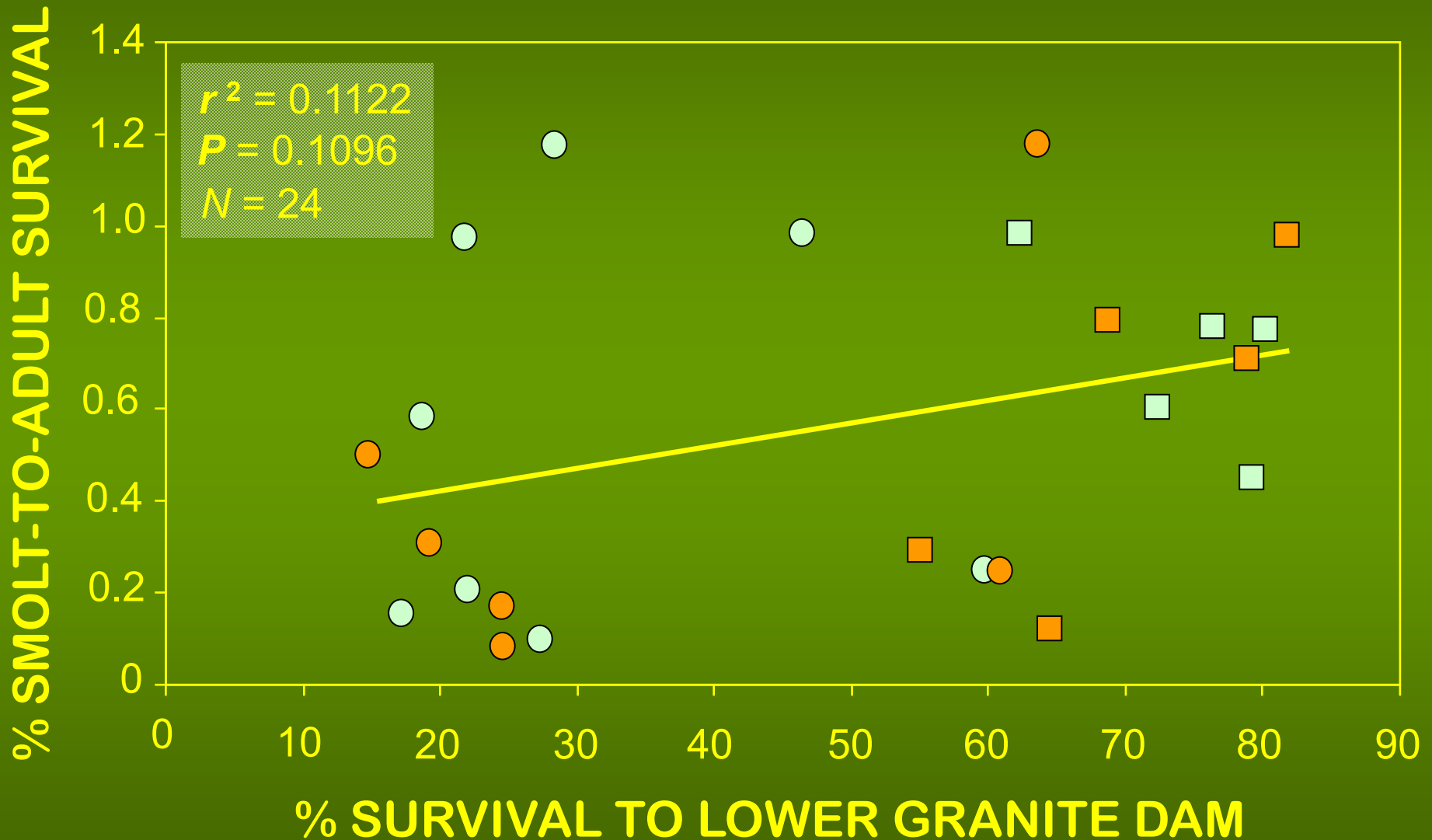
Pelton Trap (RK 161)



Kilometers



DOES OUTMIGRATION SURVIVAL MATTER?

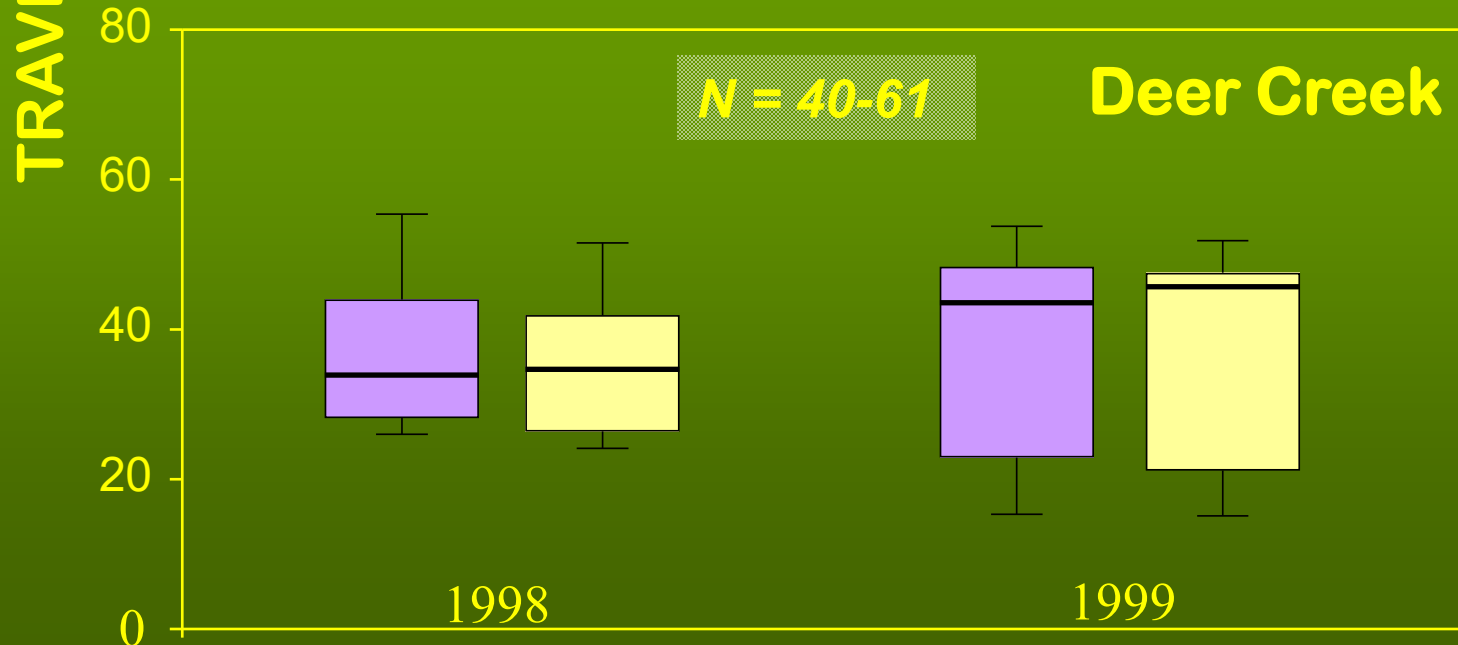
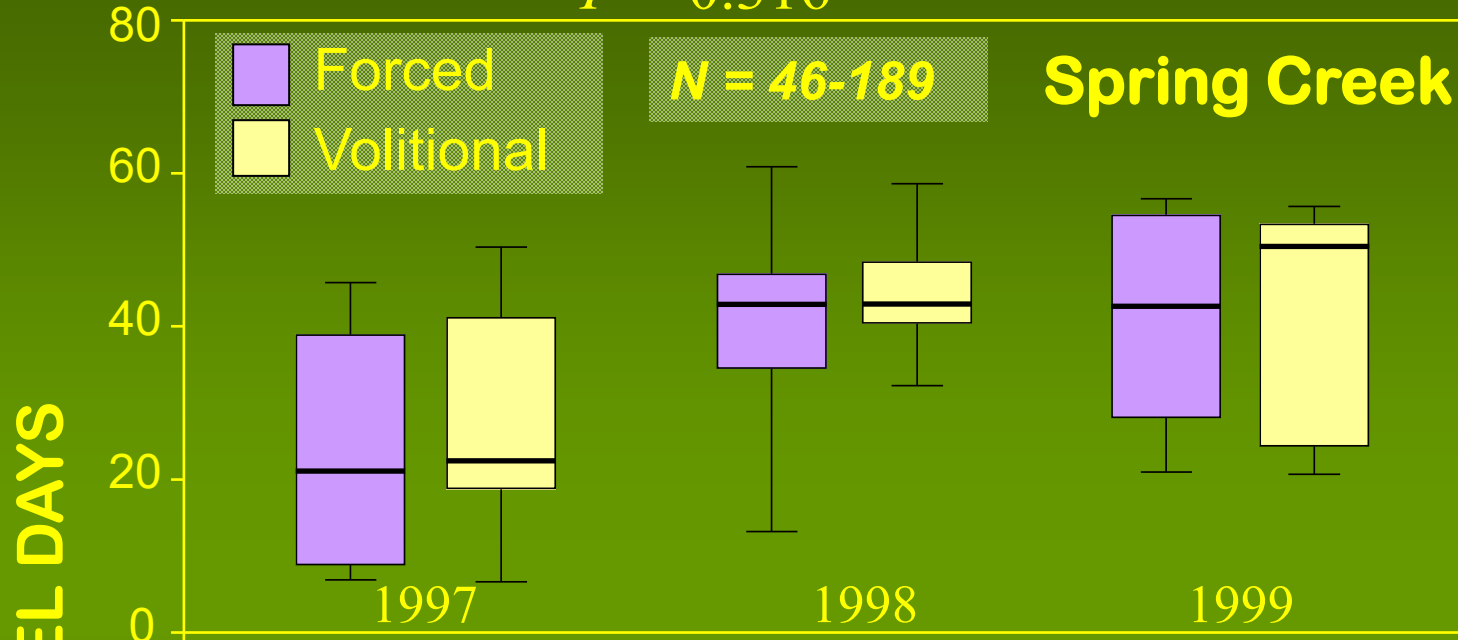


**VOLITIONAL RELEASE
FORCED VERSUS**

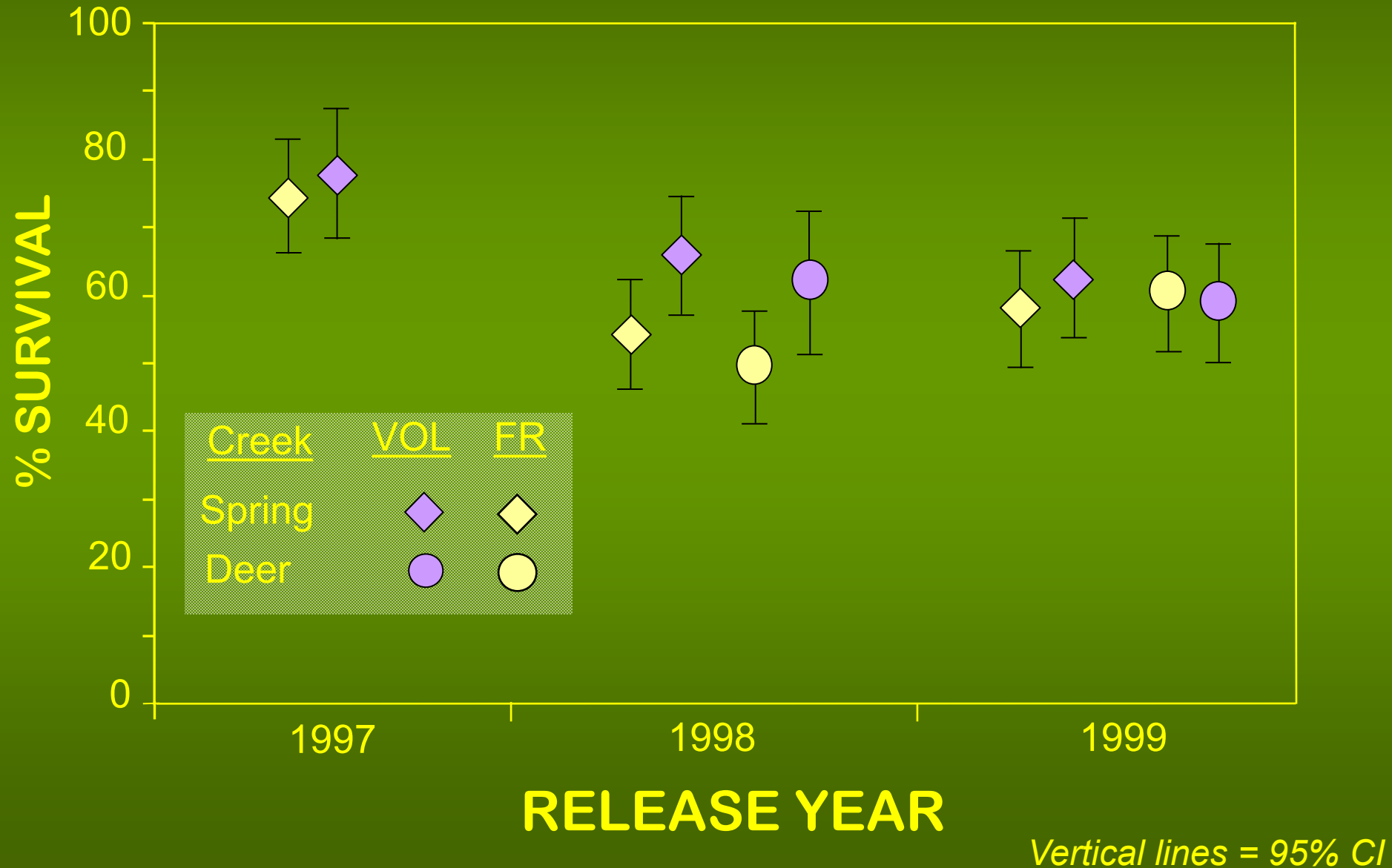


SIMILAR TRAVEL TIME TO LOWER GRANITE DAM

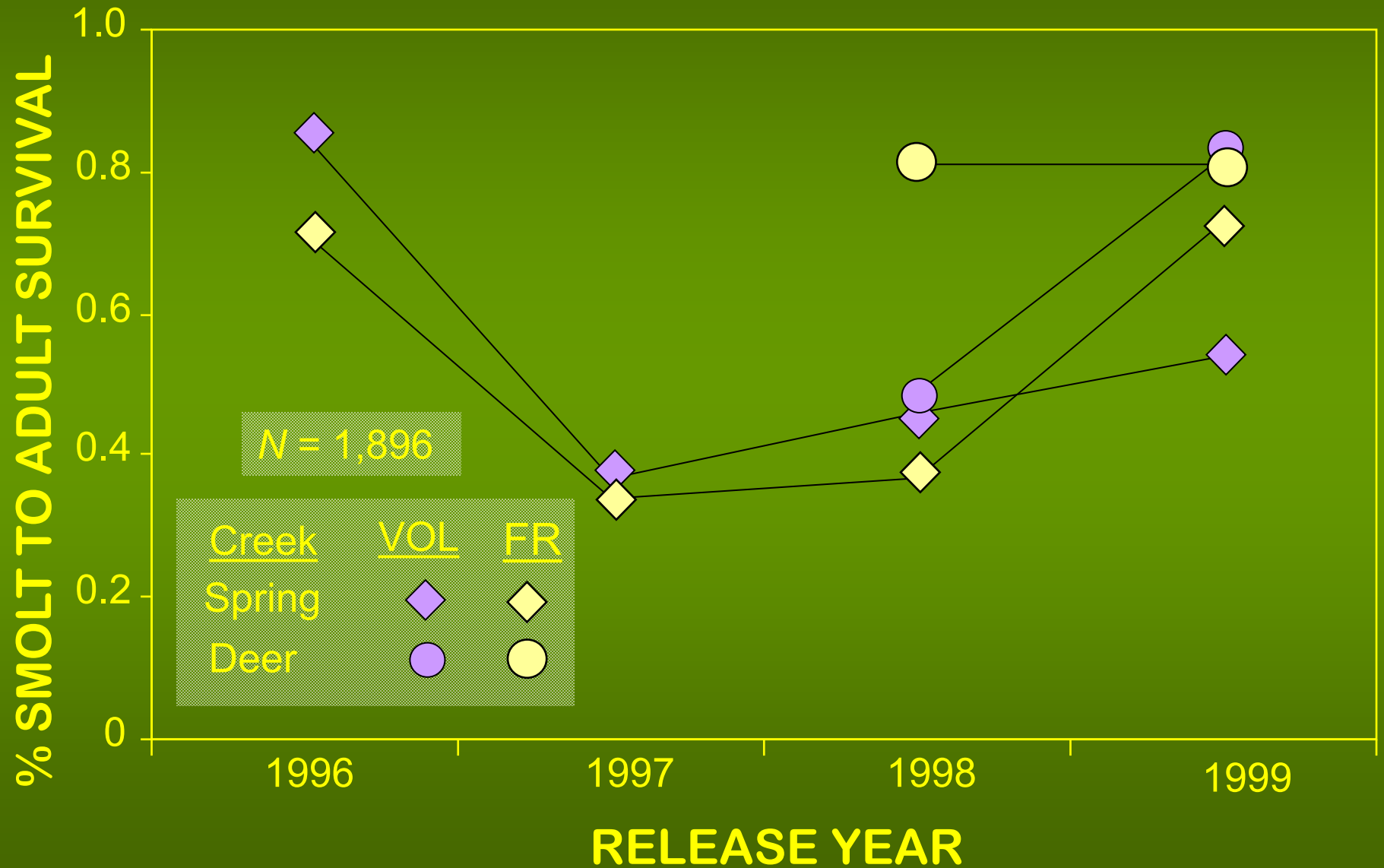
$P = 0.316$



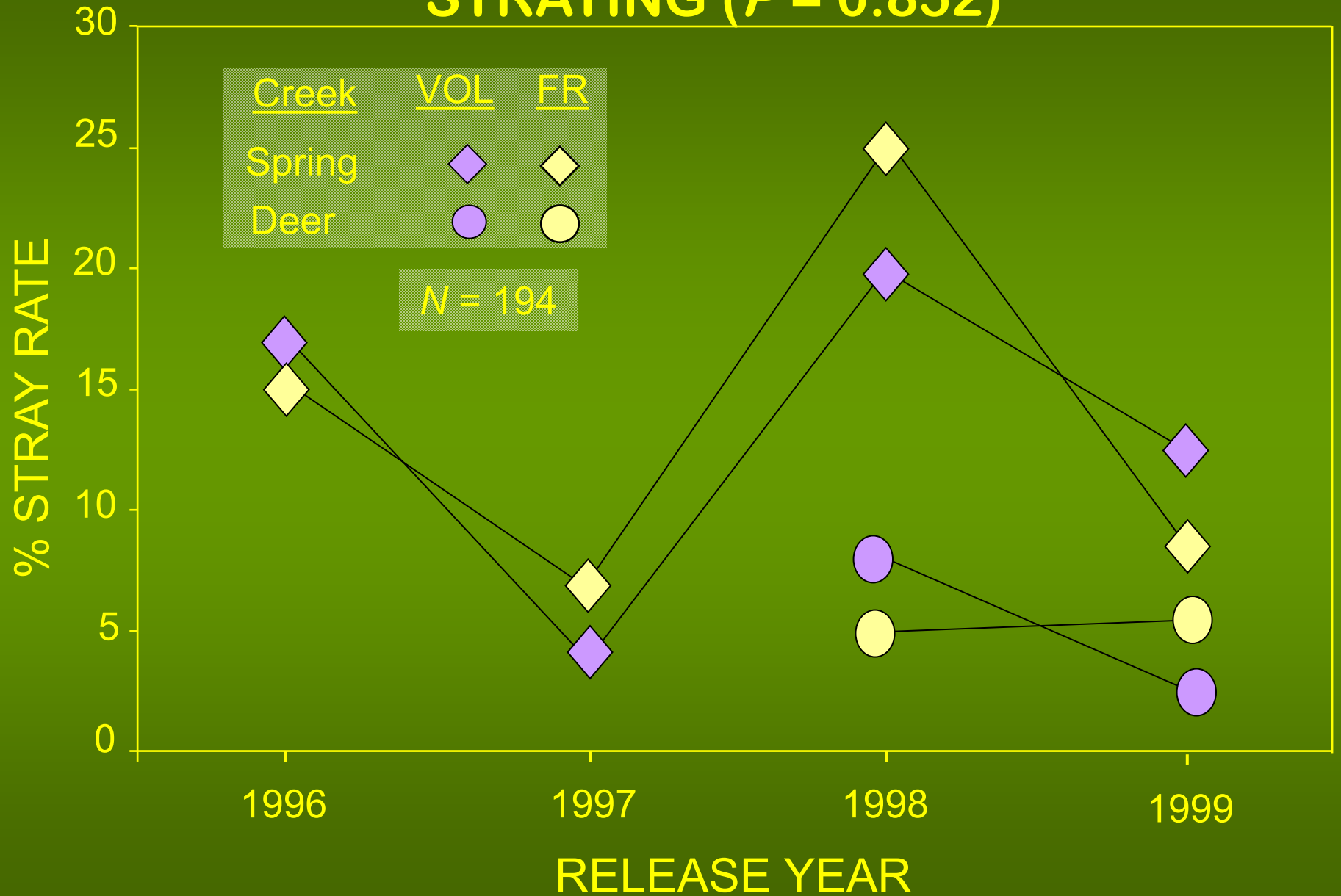
OUTMIGRATION SURVIVAL WAS SIGNIFICANTLY HIGHER FOR VOLITIONAL RELEASE ($P = 0.035$)



SURVIVAL TO ADULTHOOD WAS NOT DIFFERENT ($P = 0.658$)



VOLITIONAL RELEASE DID NOT REDUCE STRAYING ($P = 0.852$)



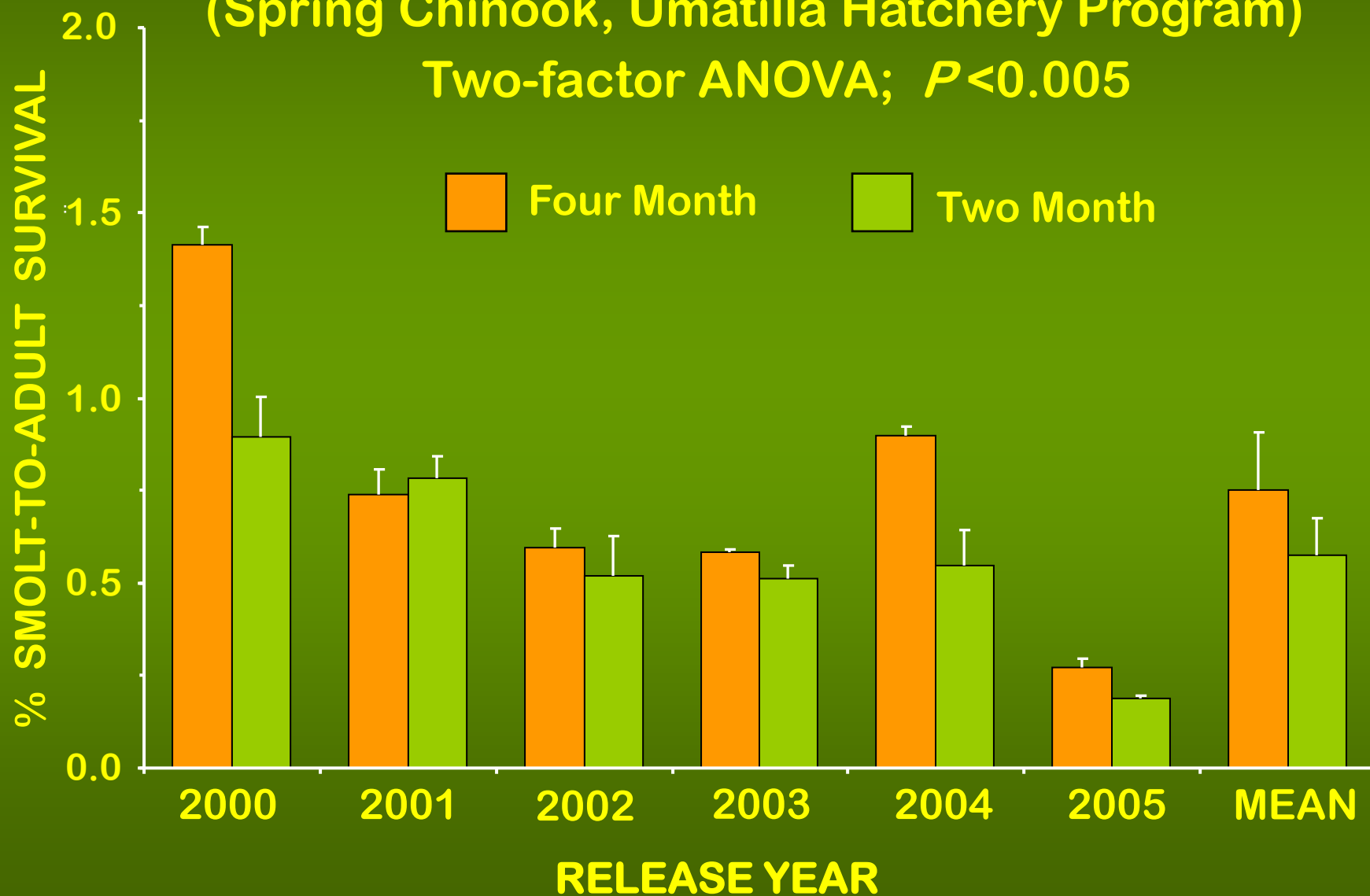
Use of Volitional Release to Remove Residuals

Big Canyon Facility				Little Sheep Facility		
Release Year	% Male	Number removed	Stream Density (no./100 m ²)	% Male	Number removed	Stream Density (No./100 m ²)
2003	76	2,014	7.0			
2004	65	0	9.2			
2005	--	--	5.6	92	8,470	13.8
2006	72	4,968	6.8	73	9,187	14.7
2007	67	0	21.3	81	9,701	10.6
2008	73	2,361	6.0	59	0	14.3
2009	84	2,457	5.6	78	4,733	8.2
2010	68	0	10.9	65	0	27.7
2011	70	0	3.5	65	0	16.8

Survival to Adulthood, Four Month vs. Two Month Acclimation

(Spring Chinook, Umatilla Hatchery Program)

Two-factor ANOVA; $P < 0.005$



CONCLUSIONS

- 1. Acclimation increased survival to adulthood and decreased straying.**
 - **Acclimation appears to ameliorate affects of stress.**
 - **Survival results not consistent with other steelhead acclimation studies.**
 - **Management action: all releases are now acclimated.**
- 2. Volitional release did not increase survival to adulthood or decrease straying.**
 - **Survival results consistent with similar studies.**
 - **Management action: retain some volitional releases to remove residuals.**
- 3. Juvenile outmigration survival did not correlate well with survival to adulthood.**
 - **Judge the success of release groups based on adult returns.**

Adjust Acclimation Protocols to the Hatchery Program

1. Acclimation locations, length, timing, feeding protocols, etc., can affect success of release groups. Hatchery specific investigations are needed.
 - Unpublished data from the Wallowa program suggests that straying is 30-40% higher for fish acclimated at Wallowa Hatchery than those at Big Canyon.
2. For supplementation programs, small temporary acclimation ponds spread throughout the watershed may promote a better distribution of returning adult spawners.
3. Acclimation is an ideal time to develop behavioral traits (i.e. prey or predator recognition training) that may improve survival.
4. Volitional release used as a tool to remove residuals; however, difficult to judge the success of that strategy.

For More Information

- Clarke, L.R., M.W. Flesher, T.A. Whitesel, G.R. Vonderohe, and R.W. Carmichael. 2010. Post-release performance of acclimated and direct-released hatchery summer steelhead into Oregon tributaries of the Snake River. *North American Journal of Fisheries Management* 30:1098-1109.
- Clarke, L.R., M.W. Flesher, S.M. Warren, and R.W. Carmichael. 2011. Survival and straying of hatchery steelhead following forced or volitional release. *North American Journal of Fisheries Management* 31:116-123.
- Clarke, L.R., W.A. Cameron, and R.W. Carmichael. 2012 Performance of spring Chinook salmon reared in acclimation ponds for two and four months before release. *North American Journal of Aquaculture* 74: 65-72



NOW, WHAT
DID HE
SAY?