

Population Structuring Among Steelhead of the Alsea Basin

A large steelhead trout is captured mid-jump, leaping out of the water with its mouth wide open. The fish has a silvery body with dark vertical stripes. The water is a vibrant blue, and a small splash is visible behind the fish's head. In the background, a small boat is visible on the water's surface.

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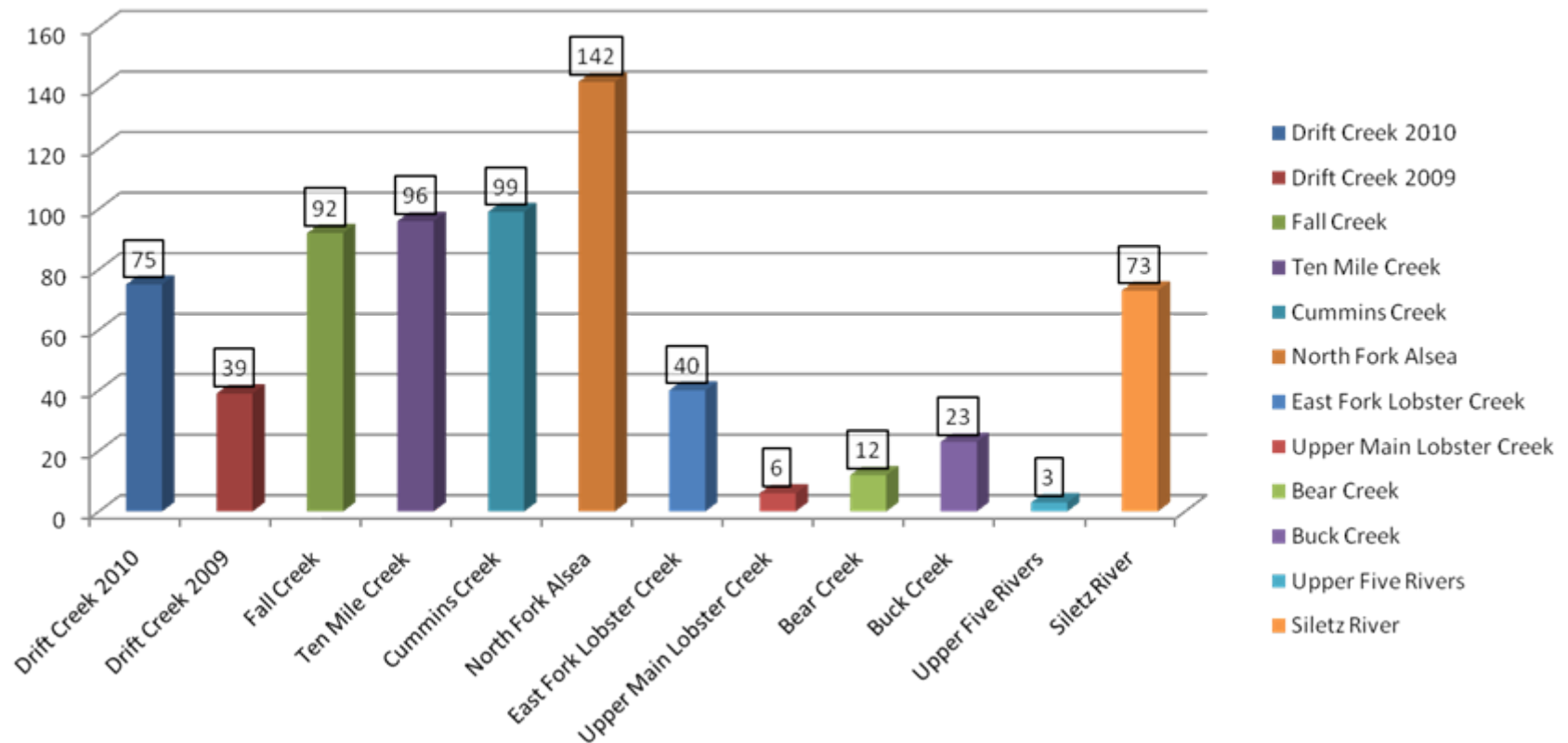
Populations

- 12 populations, 715 individuals.
- Alsea locations: Drift Creek, North Fork Alsea, and Five Rivers, Lobster Creek, Fall Creek.
- Out of basin locations: Siletz River, Ten Mile Creek, Cummins Creek.

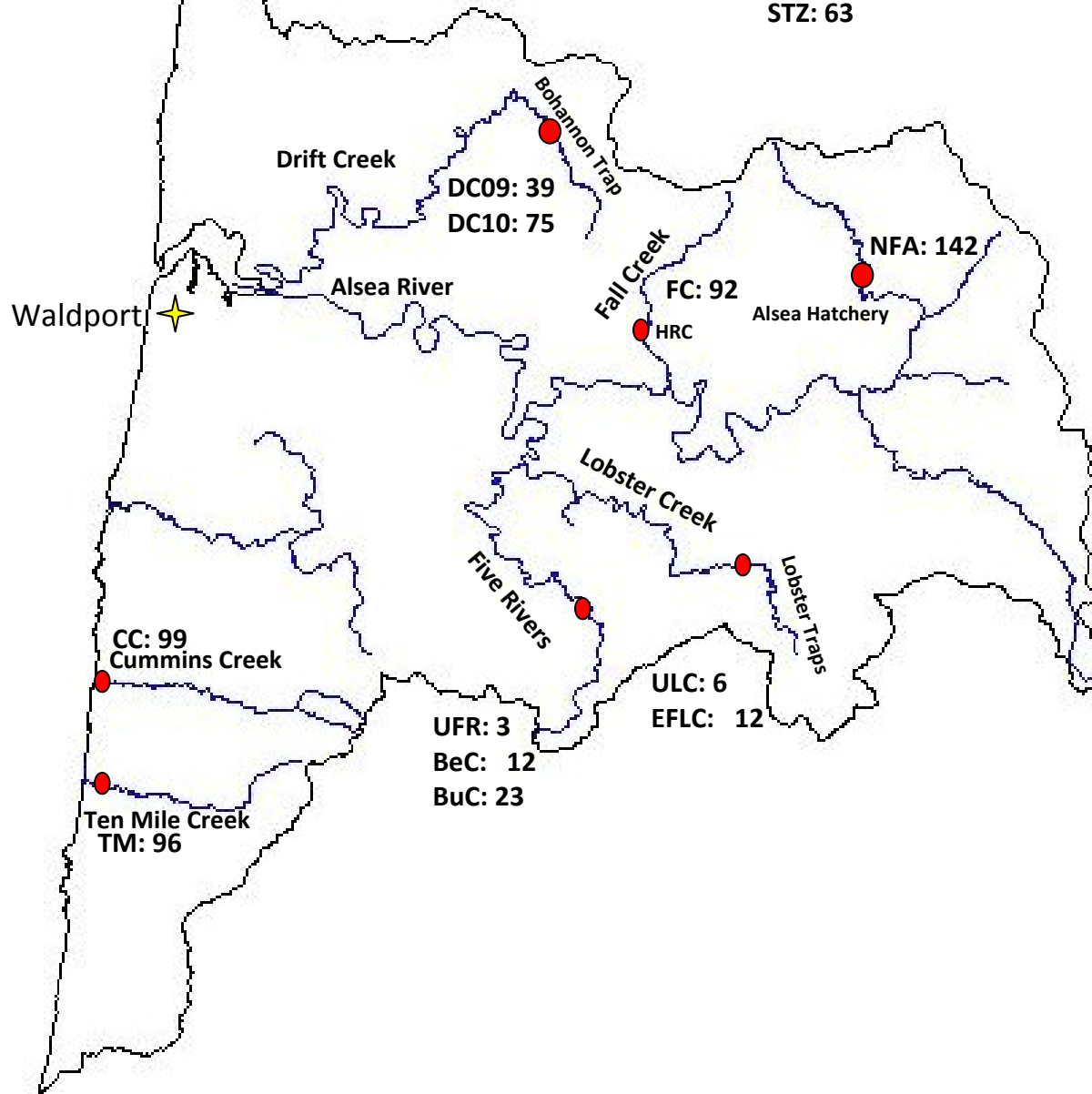


Populations

Locations vs. Samples



North to Siletz
STZ: 63



Key:

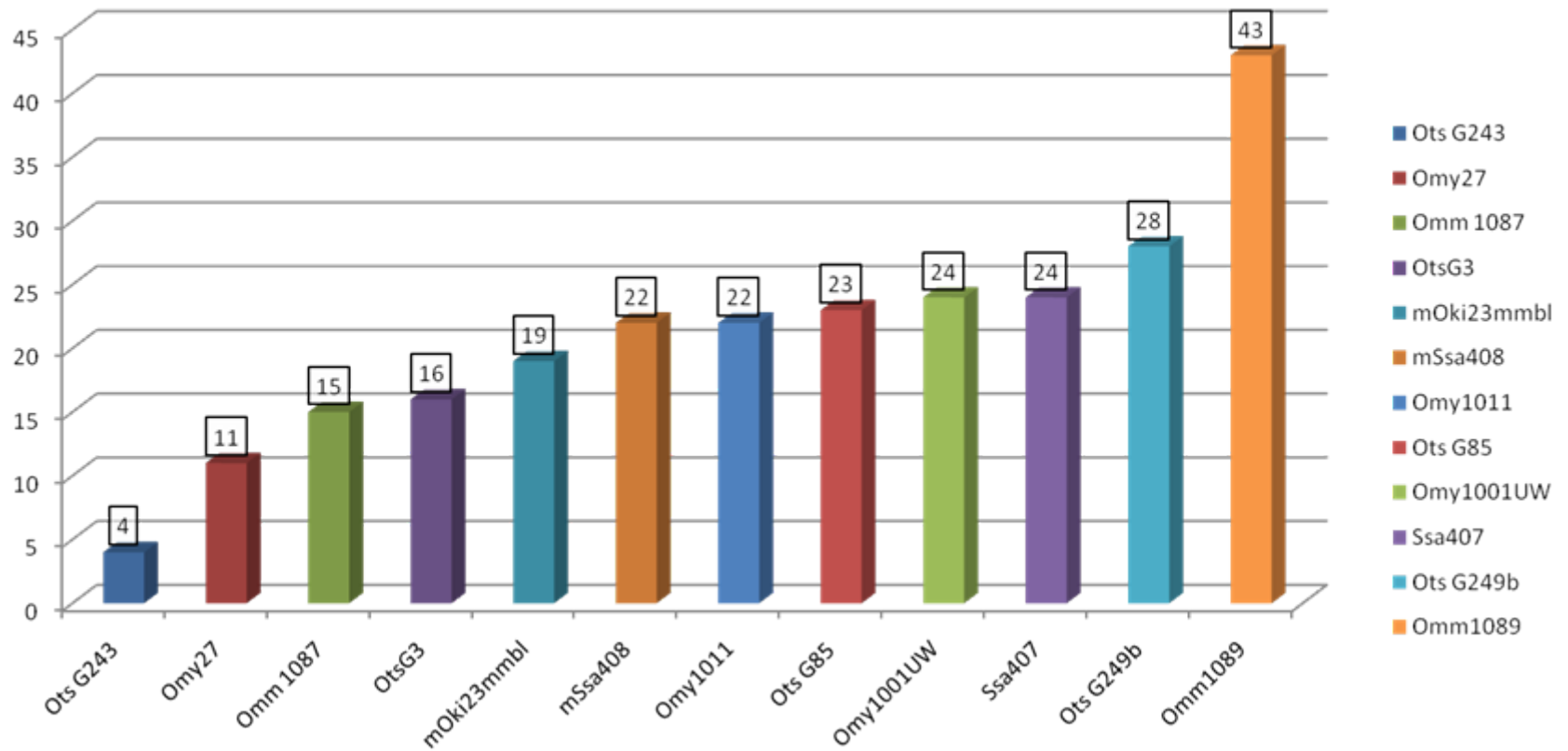
- NFA:** North Fork Alsea
- FC:** Fall Creek
- DC09:** Drift Creek 2009
- DC10:** Drift Creek 2010
- ULC:** Upper Main Lobster Creek:
- EFLC:** East Fork Lobster Creek
- UFR:** Upper Five Rivers
- BeC:** Bear Creek
- BuC:** Buck Creek
- CC:** Cummins Creek
- TM:** Ten Mile Creek
- STZ:** Siletz River

Loci

- 12 microsatellite loci
- Samples with 7 or more failed amplifications were removed (15 samples).
- Loci had between 4 (Ots G243) and 42 (Omm 1089) possible alleles.

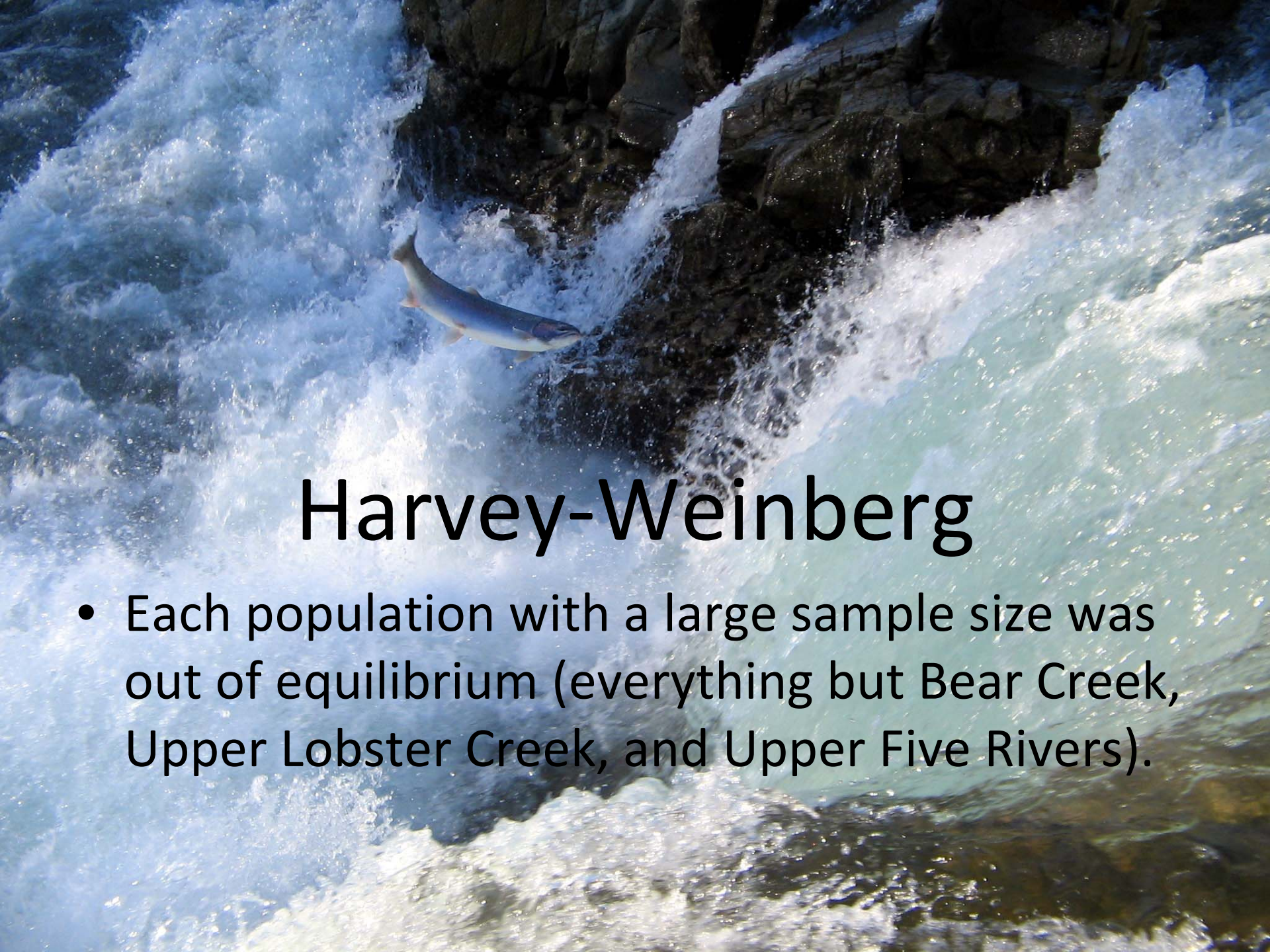
Loci

Loci vs. Alleles



Note:

- Two individuals were removed before further analysis, one from Ten Mile Creek, one from Cummins Creek. Both were strong outliers with bad amplification.
- The Ten Mile individual was unscored on 3 loci, homozygous for several others with poor amplification.
- The Cummins Creek individual was unscored on 6 loci, with poor amplification on the others.
- Only changes “All site” results.

A photograph of a salmon in mid-jump over a rocky waterfall. The water is turbulent and white with foam, and the rocks are dark and jagged. The salmon is positioned in the center-left of the frame, with its body arched and its tail just leaving the water.

Harvey-Weinberg

- Each population with a large sample size was out of equilibrium (everything but Bear Creek, Upper Lobster Creek, and Upper Five Rivers).

Linkage Disequilibrium

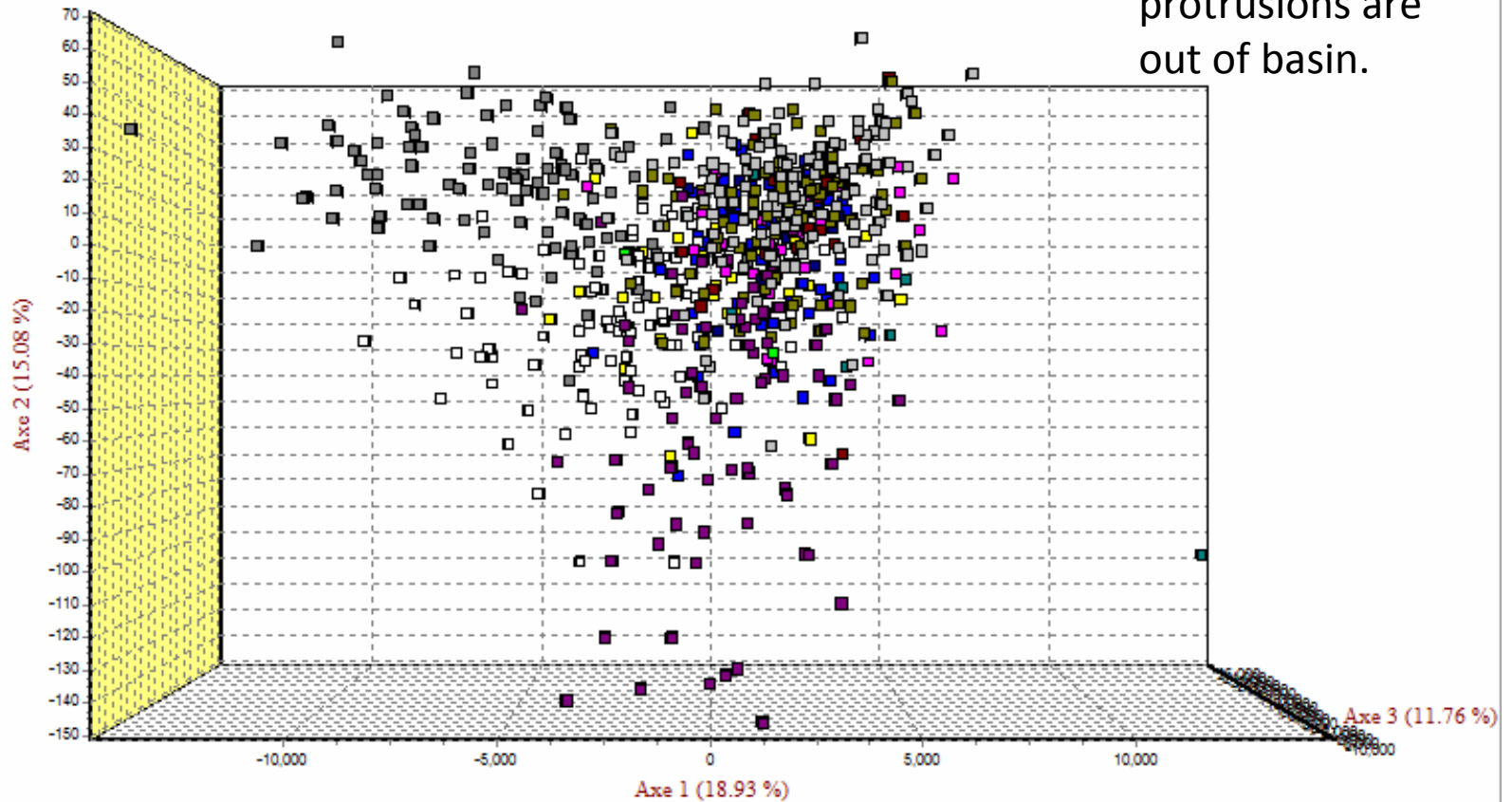
- Populations displaying significant LD (greater 20% of crosses from 100 permutations significant, GENETIX):
 - Cummins Ck (99): 56%
 - N. Fork Alsea (142): 50%
 - Bear Creek(12): 30%
 - E. Fork Lobster Ck (40): 24%
 - Drift Ck 10 (75): 23%



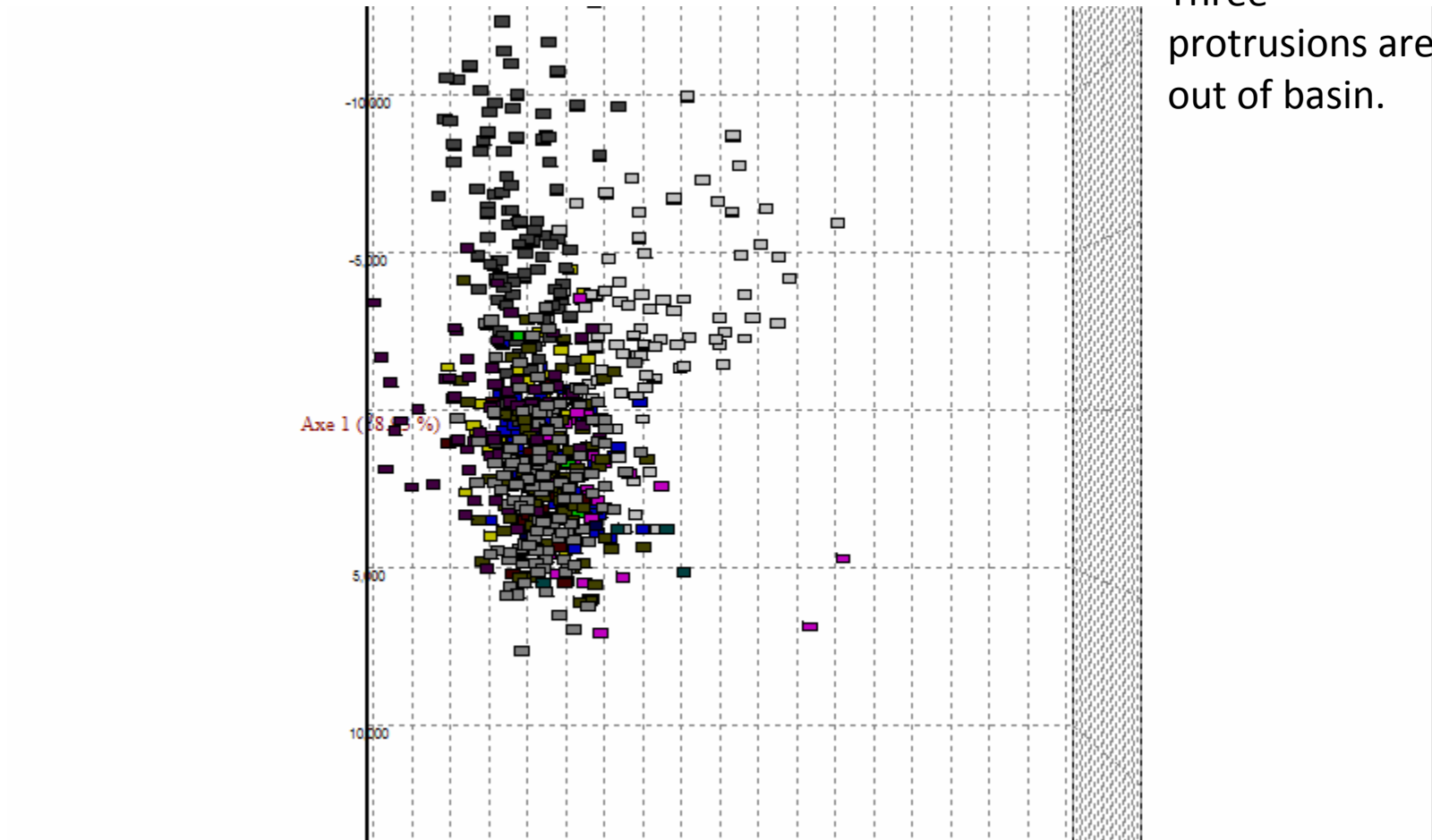
All site graphics

SHgenetixfull.gtx

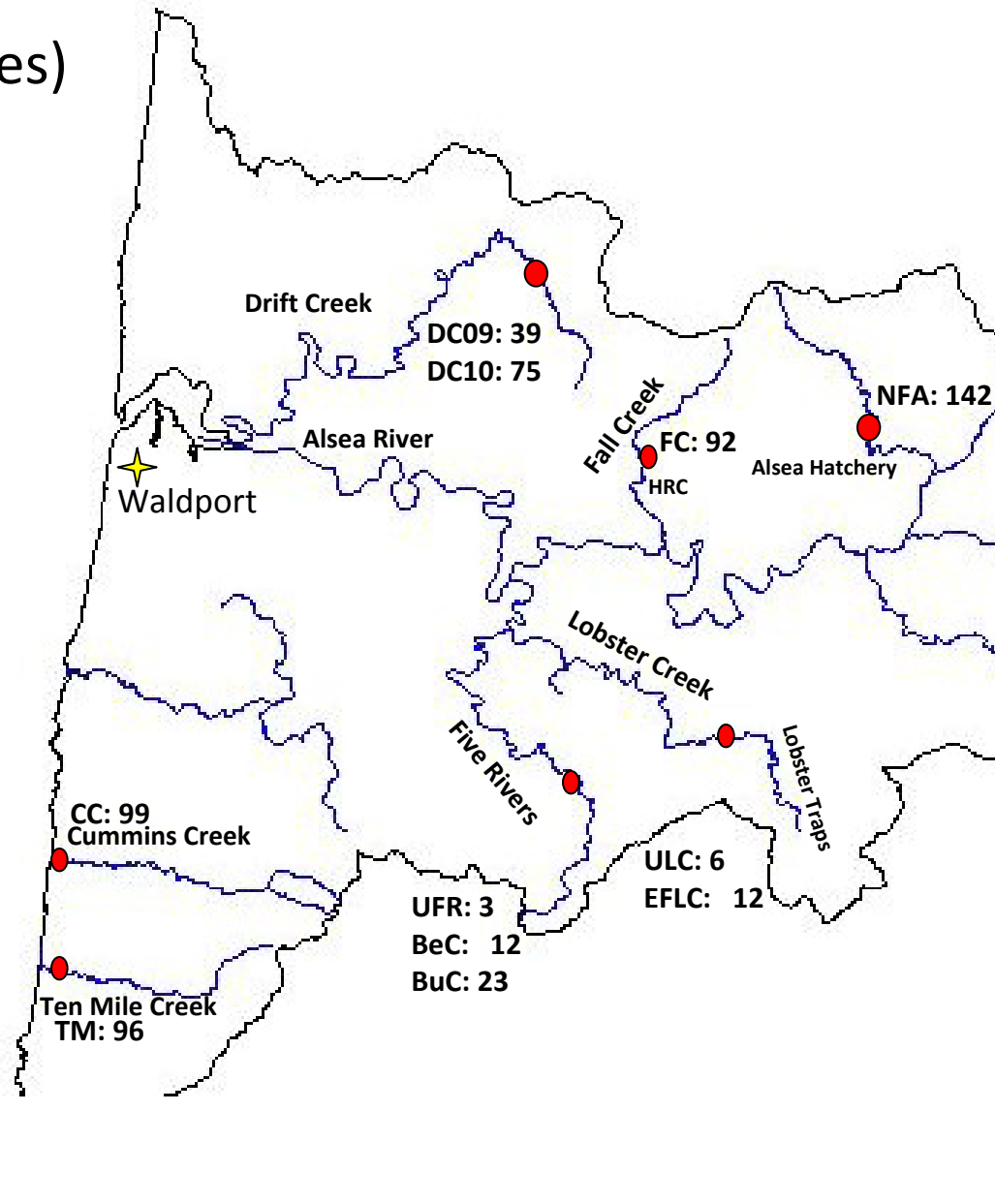
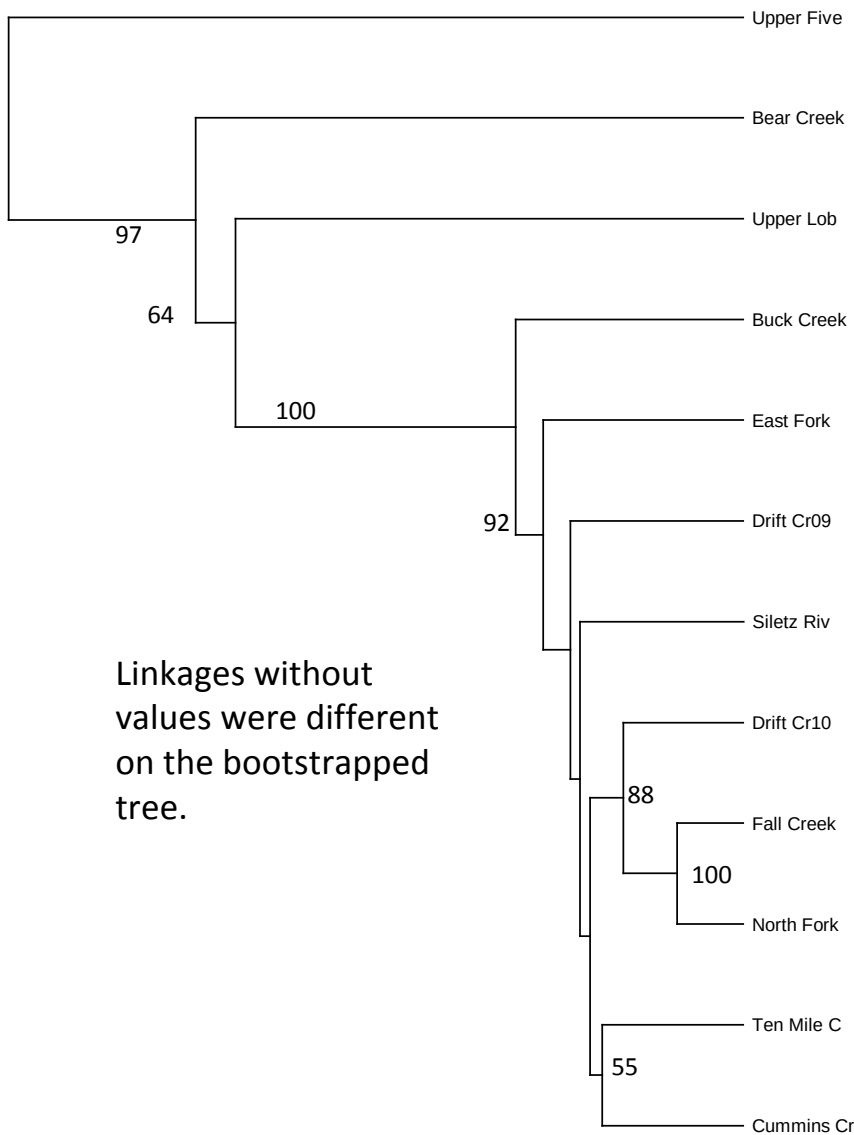
Three
protrusions are
out of basin.



All site graphics



All site tree (bootstrapped values)

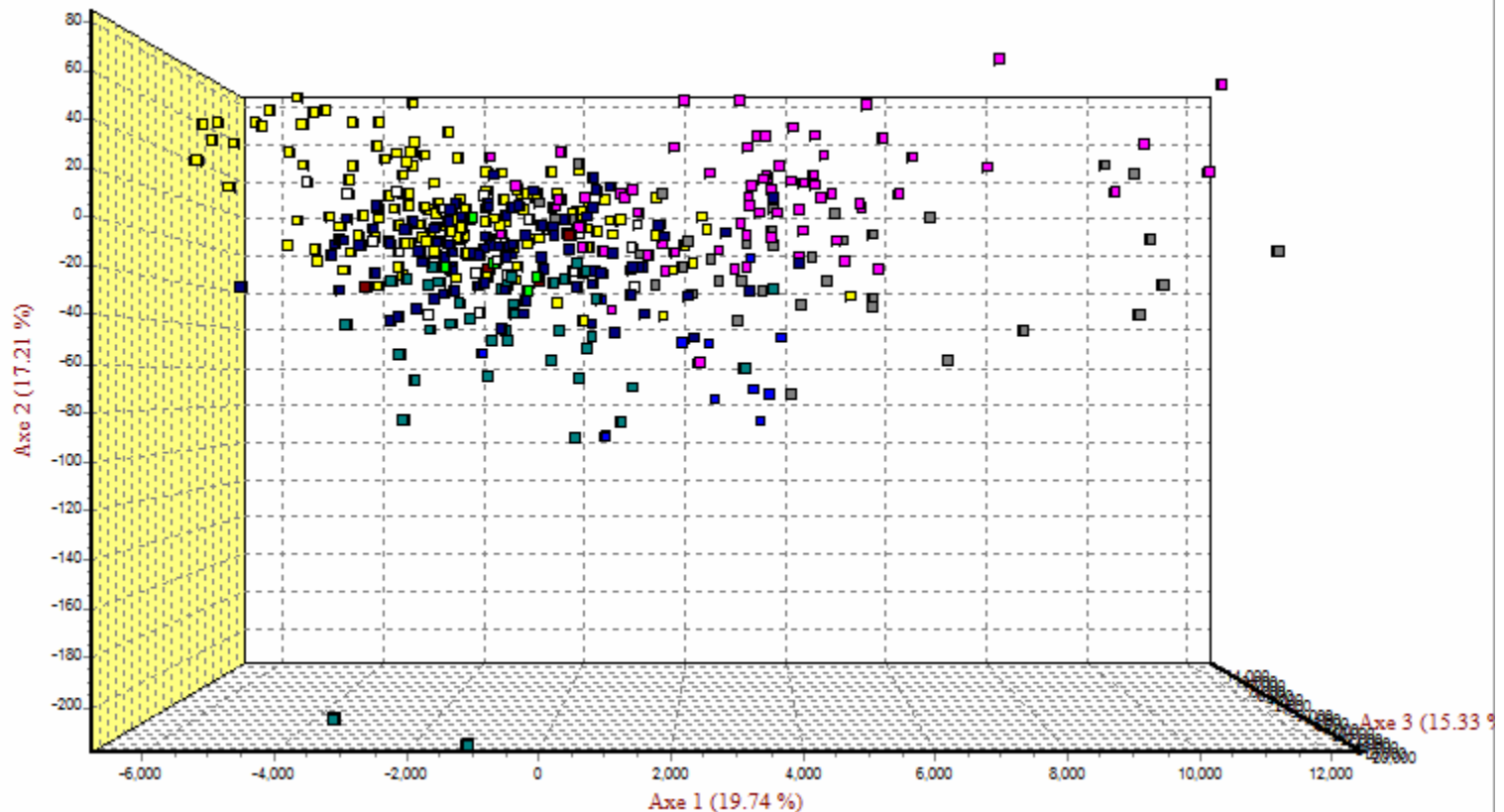


Basin only graphics

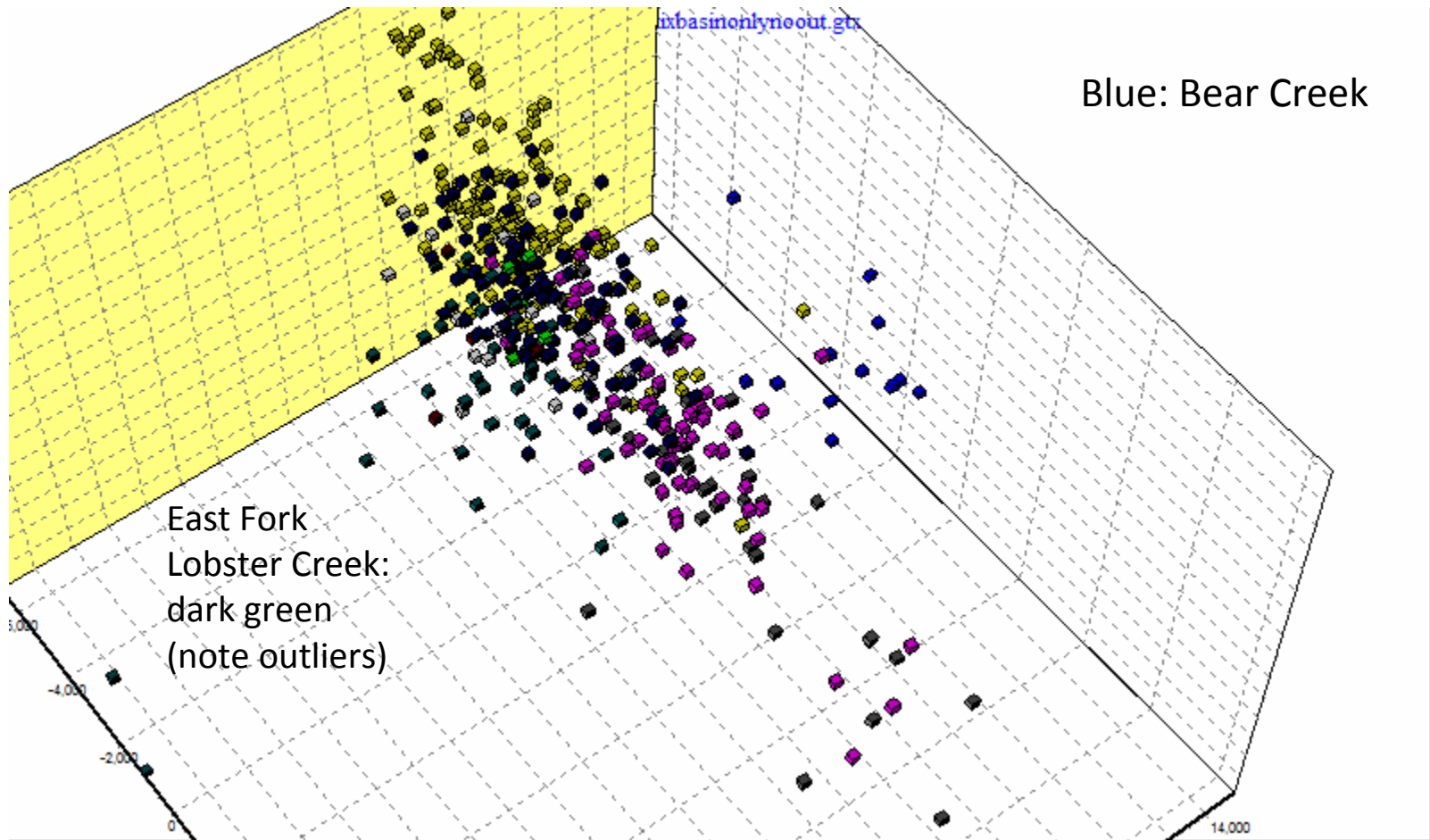
Note the North Fork Alsea
(Hatchery) samples, in
yellow.

[SHgenetixbasinonlynoout.gtx](#)

Pink and gray: Drift
Creek 09 and 10

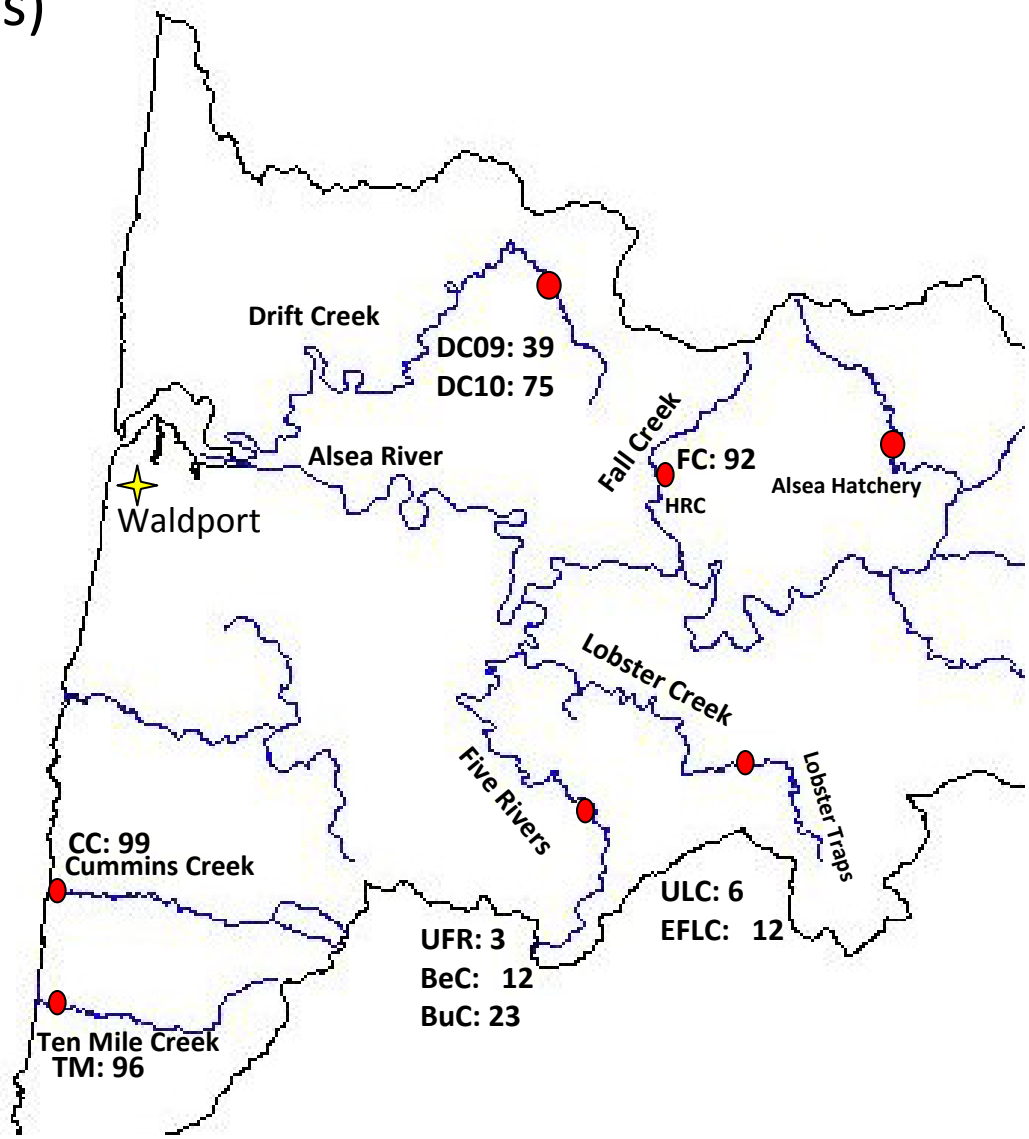
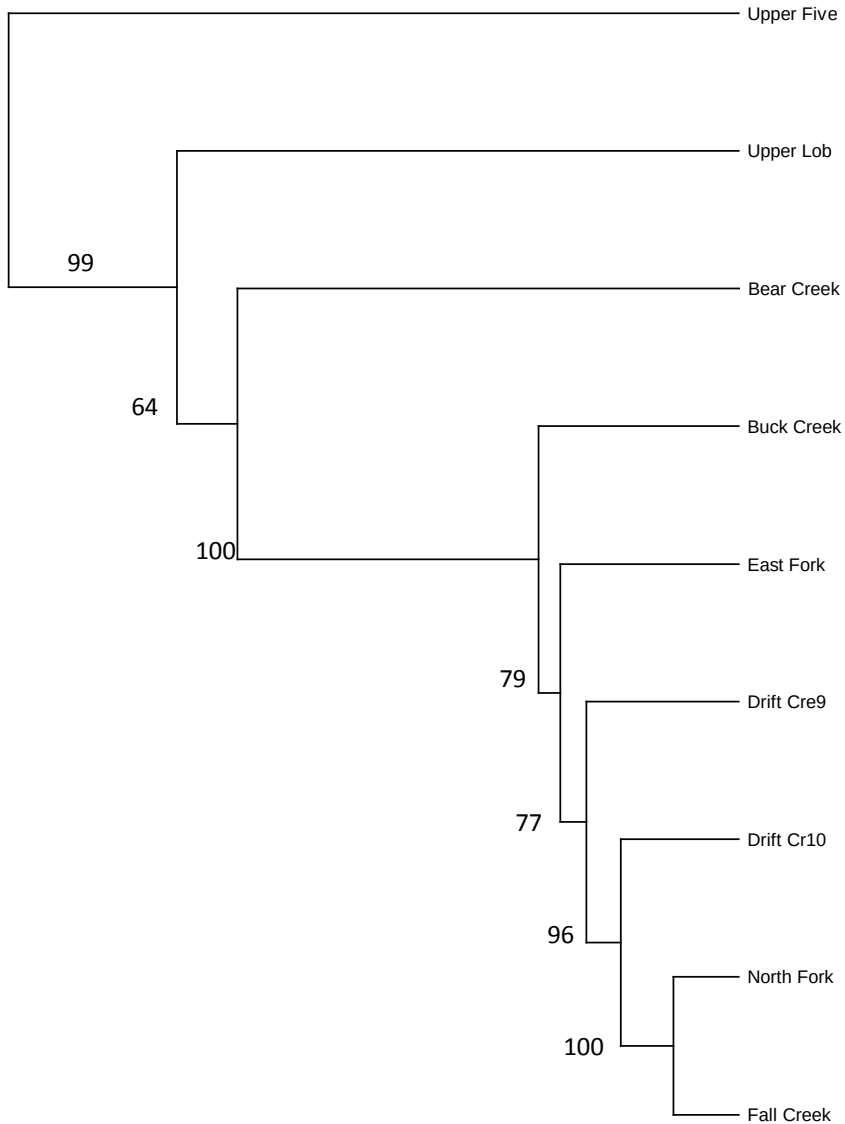


Basin only graphics



More EFLC, Five Rivers samples?

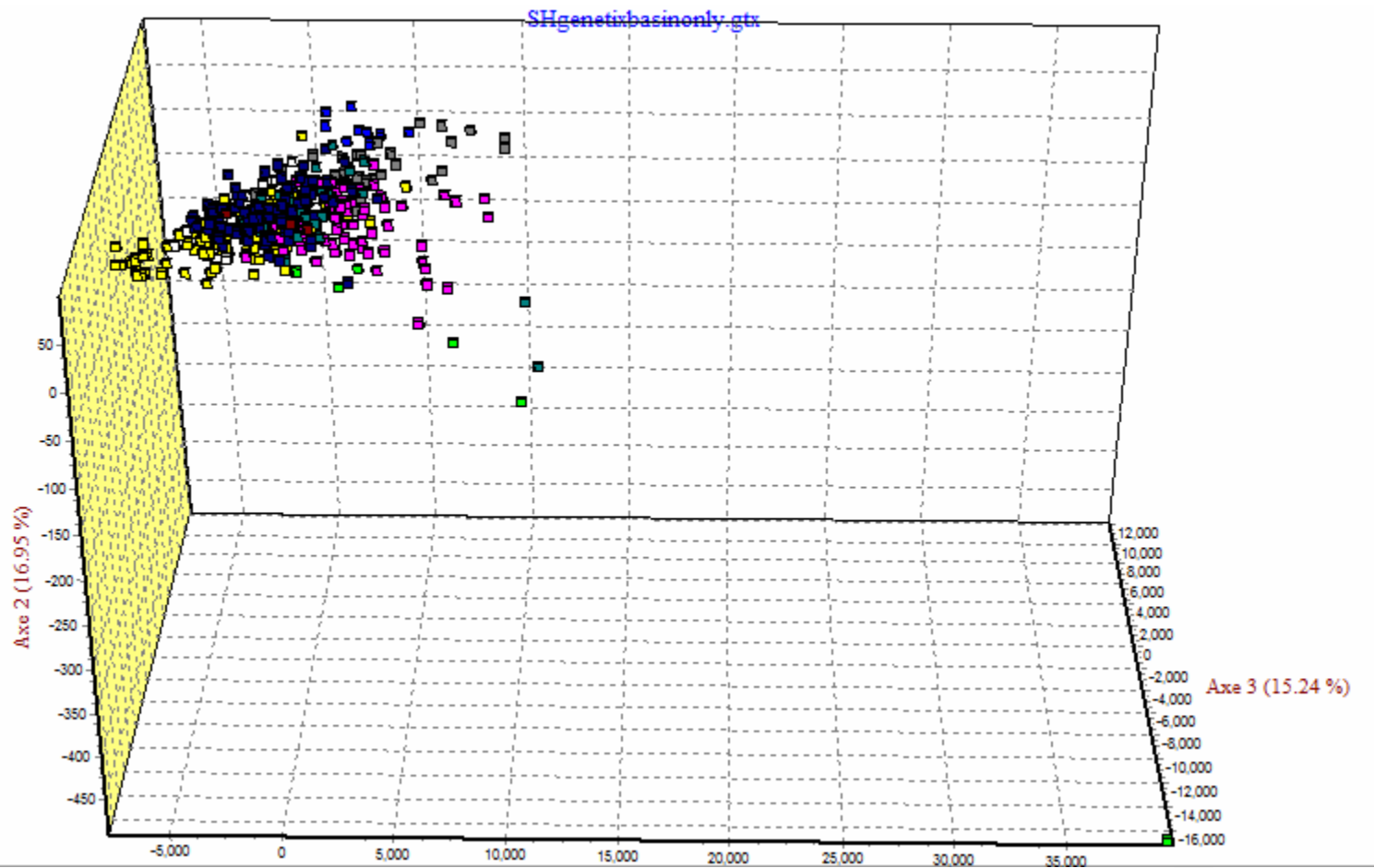
Basin only tree (Bootstrap values)



Basin Outlier

- One sample from Upper Lobster Creek was a strong, in-basin outlier, and was removed in the above basin only graphs (though not for the F-stats).
- Scored on all loci well.
- Two private alleles.
- Homozygous for a rare allele.

Basin Outlier



Basin Outlier

- A tree was formed including this outlier: nothing changed except for a few of the bootstrap values (not by much).
- Possibly a stray?



F-Stats

Pairwise F-stats (GENEPOP)

Estimates for all loci (diploid):

pop	NFA	BeC	BuC	CC	DC09	DC10	ELC	FC	TM	UFR	ULC
BeC	0.0522										
BuC	0.0038	0.0611									
CC	0.0179	0.0583	0.0184								
DC09	0.0121	0.0485	0.0085	0.0152							
DC10	0.0072	0.0480	0.0079	0.0155	0.0065						
ELC	0.0115	0.0535	0.0074	0.0203	0.0127	0.0101					
FC	0.0029	0.0437	0.0030	0.0149	0.0078	0.0056	0.0046				
TM	0.0116	0.0502	0.0111	0.0104	0.0131	0.0083	0.0105	0.0080			
UFR	0.0150	0.1210	0.0048	0.0231	0.0173	0.0106	0.0062	0.0032	0.0055		
ULC	-0.0042	0.0565	-0.0089	0.0085	0.0049	-0.0032	-0.0059	-0.0049	-0.0065	0.0029	
Szt	0.0165	0.0697	0.0130	0.0194	0.0128	0.0143	0.0183	0.0165	0.0102	0.0043	-0.0015

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Population Differentiation

- Evidence of genetic structure.
- Population Differentiation(genotypic, GENEPOP):
 - North Fork Alsea (hatchery)—Drift Creek 2010
 - χ^2 value “infinity,” p-value = “highly significant.”
 - Bear Creek – East Fork Lobster Creek
 - χ^2 value “infinity,” p-value = “highly significant.”
 - Ten Mile Creek – Fall Creek
 - χ^2 value “infinity,” p-value = “highly significant.”
- All comparisons with large sample sizes are significant.