

Determining if genetic markers associated with life history development of rainbow trout are shared across freshwater drainages



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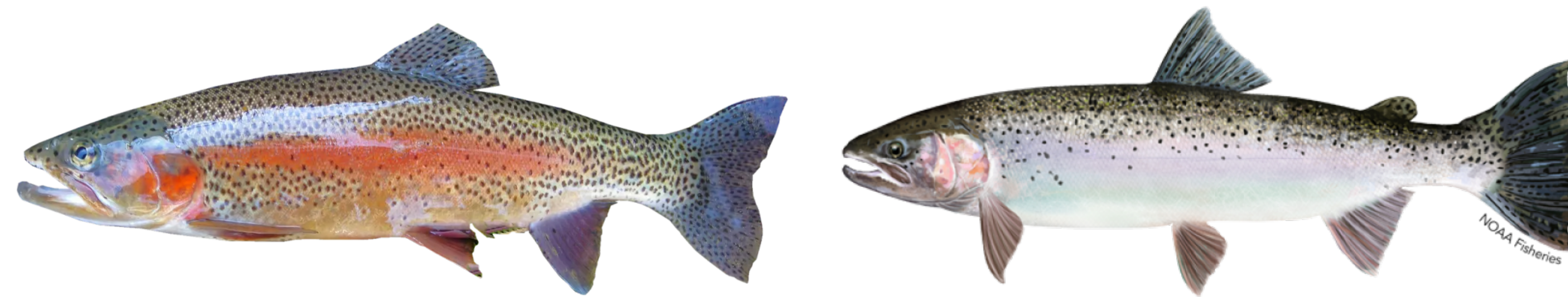
Introduction

Migration is a seasonal movement of organisms for an advantage in resources or reproduction.

- Migration is caused by unknown environmental and genetic factors
- Anadromous fish, fish who migrate to the ocean, risk increased predation for a greater amount of nutrients

Rainbow trout (*Oncorhynchus mykiss*) exhibit partial migration.

- Migrants change morphology into Steelhead trout



Rainbow morphology

Steelhead morphology

Migratory rainbow trout in the Sashin water system in Alaska have genetic markers indicating if an individual spawns from a lake or river resident (Barfuss 2021).

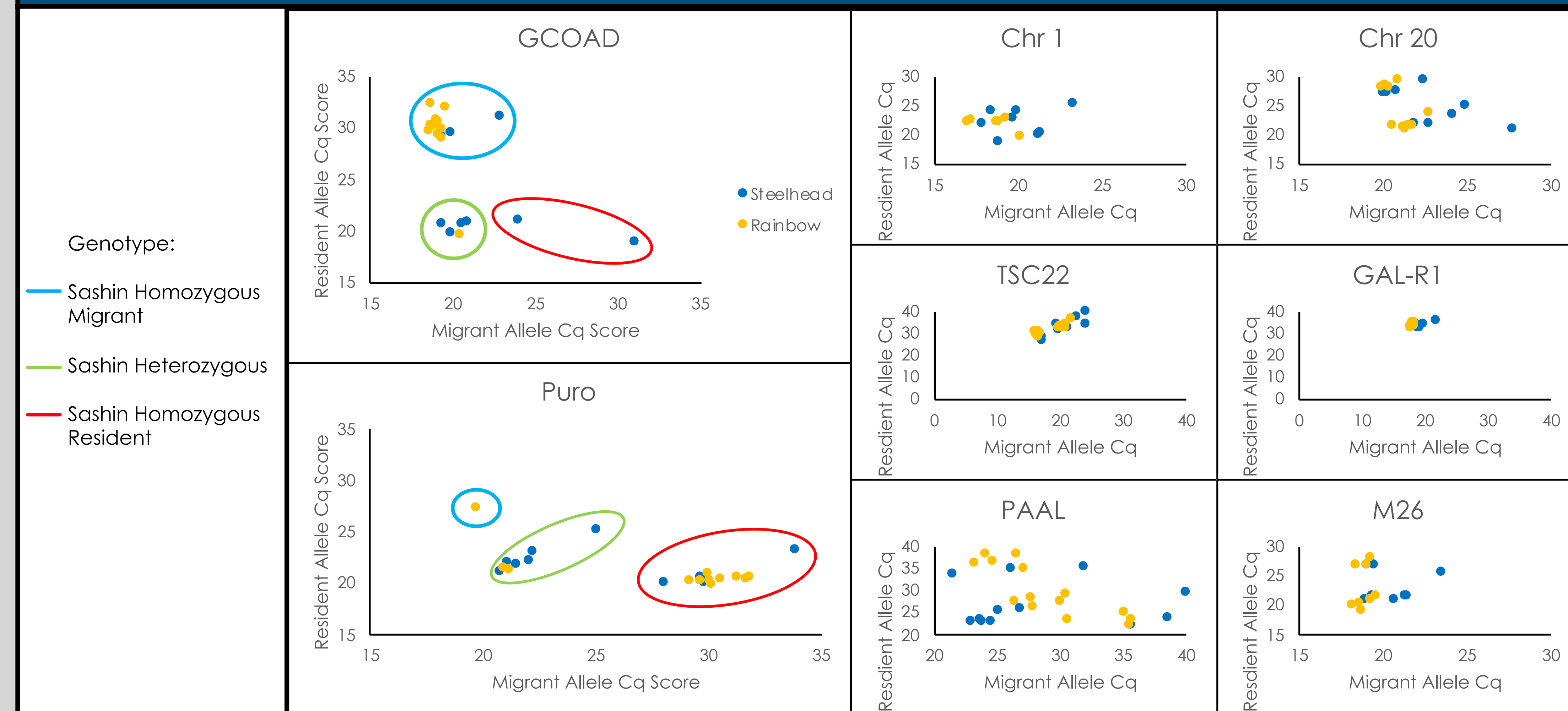
Objective: Determine if the same genetic markers can be used in the separate water system Little Sheep Creek, Oregon

Methods

- 1) Extract DNA of 26 steelhead of known origin from Little Sheep Creek
- 2) Obtain the two forward and one reverse primers for 8 loci from Barfuss 2021. The migrant forward primer binds better to the established migrant SNP. The resident primer binds better to established resident SNP.
- 3) Conduct DMAS-qPCR and determine fish genotype
- 4) Determine correlation across water systems.



Results



Locus	Steelhead Phenotype			Rainbow Phenotype		
	Resident Homozygous	Heterozygous	Migrant Homozygous	Resident Homozygous	Heterozygous	Migrant Homozygous
Chr 1	12.50	25.0	62.50	0.00	16.7	83.33
Chr 20	16.67	41.7	41.67	14.29	42.9	42.86
TSC-22	0.00	0.0	100.00	0.00	0.0	100.00
PAAL	25.00	50.0	25.00	28.57	35.7	35.71
GAL-R1	0	0.0	100.00	0	0.0	100.00
GCOAD	22.22	44.4	33.33	0.00	9.1	90.91
Puro	50.00	50.0	0.00	75.00	16.7	8.33
M26	0.00	75.0	25.00	0.00	55.6	44.44
AVG %	28.30	35.8	35.94	27.23	22.07	50.70

Conclusion

The SNPs at loci GCOAD and Puro can be used to determine life history in the separate water system Little Sheep Creek. Notably, the rainbow trout show a decrease in heterozygosity with an increase in the Sashin migrant alleles at these loci. The steelhead trout maintain this heterozygosity. Therefore, there is evidence of assortative mating and selective pressures occurring between the migratory and resident populations.

Future Studies

Determine the phenotypic functions of the GCOAD and Puro loci for this population.

Replicate study in another water system to see if these loci segregate universally.

Investigate possibility of selection against residents with migrant ancestry

References

- 1) Barfuss, E. J. (2021). The development and use of genetic markers for determining the population of origin of migratory steelhead (*O. mykiss*) in satin creek, Alaska, USA
- 2) Rainbow Trout | Meiggs Points Nature Center [Digital image]. (n.d.) <https://www.meigspointnaturecenter.org/today-is-rainbow-trout-day/>
- 3) Sachdeva (2022). There and back again: Using whole genome sequencing to identify the genes associated with migration patterns in rainbow trout. Undergraduate Honors Thesis.
- 4) Steelhead Trout | NOAA Fisheries [Digital image]. (n.d.) <https://www.fisheries.noaa.gov/species/steelhead-trout>

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