

Mount Rainier White River Ponds Cutthroat Trout Genetic Analysis
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Background

The National Park Service seeks to draft a removal program focused on non-native brook trout from the White River, a glacial-fed tributary to the Puyallup River originating on Mt. Rainier, while limiting impact on native species. A key component of this plan is to identify native and non-native fish. Cutthroat trout (*Onchorhynchus clarki*) inhabit the White River and its tributaries and it is unclear whether they are native Coastal Cutthroat (*O. clarki clarki*) or descendants of Westslope Cutthroat trout (*O. clarki lewisi*) stocked historically in the region. To identify the unknown Cutthroat trout, ten fish (WDFW code 16QE) were collected from ponds and seasonal tributaries draining into the White River, on September 14, 2016 and August 8, 2017. Starting with this collection, the primary objective is to identify the genetic ancestry of Cutthroat Trout observed in alpine lakes and tributaries of the upper White River.

Methods:

The WDFW genetics lab genotyped Mt Rainier Cutthroat trout samples at seven microsatellite loci (Ogo3, Omm1138, One108, Ots103, Omy77, Ots1, and Ots3M), the microsatellite component of the locus suite for genotyping Coastal Cutthroat trout. These loci distinguish Coastal Cutthroat trout from Westslope Cutthroat trout and from the hatchery strain of Coastal Cutthroat trout planted in Washington, and from Rainbow trout, both hatchery and wild. The loci also distinguish some local populations of native Coastal Cutthroat trout.

The microsatellite genotypes for the Mt. Rainier Cutthroat trout were compared to microsatellite genotypes for Coastal and Westslope Cutthroat trout collections in the WDFW baseline (Table 1) in a factorial correspondence analysis (Belkhir et al. 2001).

Results and discussion:

One allele (*Ogo3**197) was unique to the Mt. Rainier Cutthroat trout (Appendix 1). Two samples (Appendix I) failed to produce genotypes and were eliminated from analyses. The remaining samples showed no similarity to Rainbow trout or to Westslope Cutthroat trout (WCT) and were similar to other Coastal Cutthroat trout (CCT): in a FCA plot including hatchery WCT that had been planted in the region (Figure 1), the Cutthroat trout from Mt. Rainier plotted with the cluster of CCT. Because including the WCT compressed the CCT onto the right side of axis 1, obscuring relationships among CCT, we conducted a second FCA excluding the WCT (Figure 2). In the second FCA, the Mt. Rainier Cutthroat trout and hatchery CCT (broodstock origin Lake Whatcom in North Puget Sound) are more visible. The Mt. Rainier Cutthroat trout plot distantly from hatchery CCT and close to native CCT from Central Puget Sound (Cedar and Snoqualmie

rivers). The pattern to the genetic variation suggests that Mt Rainier Cutthroat trout are native CCT rather than descendants of hatchery CCT or hatchery WCT.

Acknowledgements:

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Reference:

Belkhir, K, P Borsa, L Chikhi, N Raufaste, F Bonhomme. 2001. GENETIX 4.05, logiciel sous Windows TM pour la genetique des populations. Montpellier (France): Laboratoire Genome, Populations, Interactions, CNRS UMR 5000, Universite de Montpellier II.

Table 1. List of collections used in the study to compare to the unknown Cutthroat trout from Mt. Rainier. Coastal Cutthroat trout are abbreviated “CCT” and Westslope Cutthroat trout are abbreviated “WCT”. The collections listed below Mt Rainier constitute the WDFW Cutthroat trout genetic baseline. Cascade appeared to be a naturalized hatchery population.

status	collection	code
Unknown	Mt. Rainier	16QE
WCT_hatchery	TwinLakesWCT	99GB
CCT_hatchery	14TokulH	14MK
CCT_hatchery	01TokulH	01NZ
CCT_native	Cedar	05BB
CCT_native	Snoqualmie	09IJ
CCT_hatchery	Cascade	14QW
CCT_native	Doe	14QX
CCT_native	Garrison	14QZ
CCT_native	Goodman	00CU
CCT_native	GraysH	11OI
CCT_native	Nooksack	95VF
CCT_native	Kennedy	14JG
CCT_native	McLane	14JG
CCT_native	Skookum	14JG

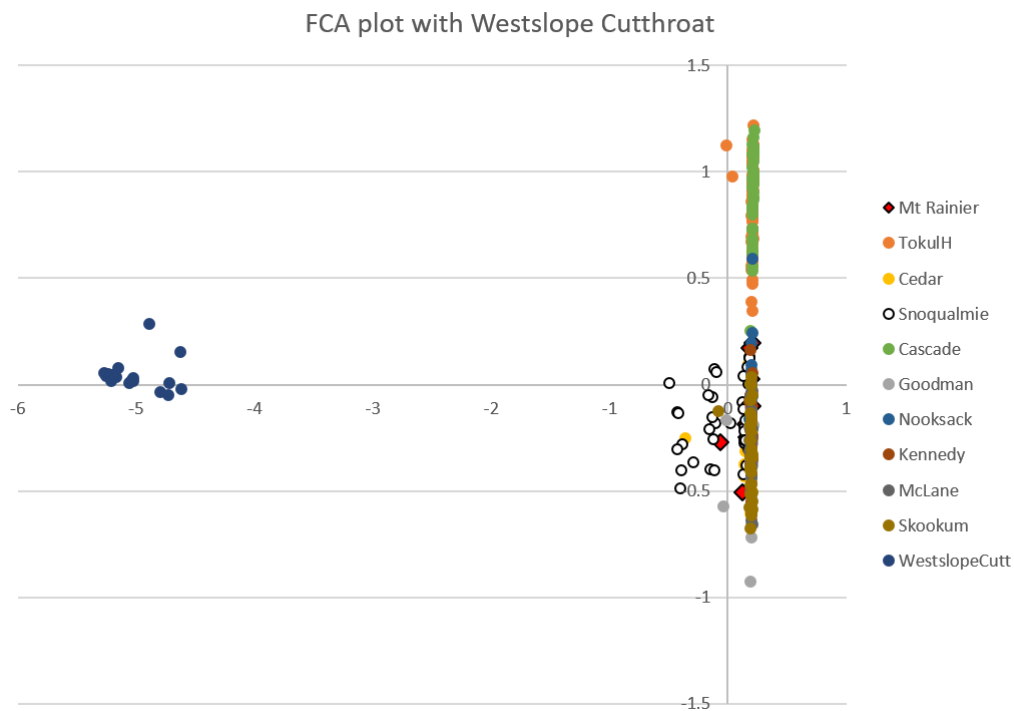


Figure 1. A factorial correspondence analysis plot of Coastal and Westslope Cutthroat trout collections and the unknown trout from Mt Rainier.

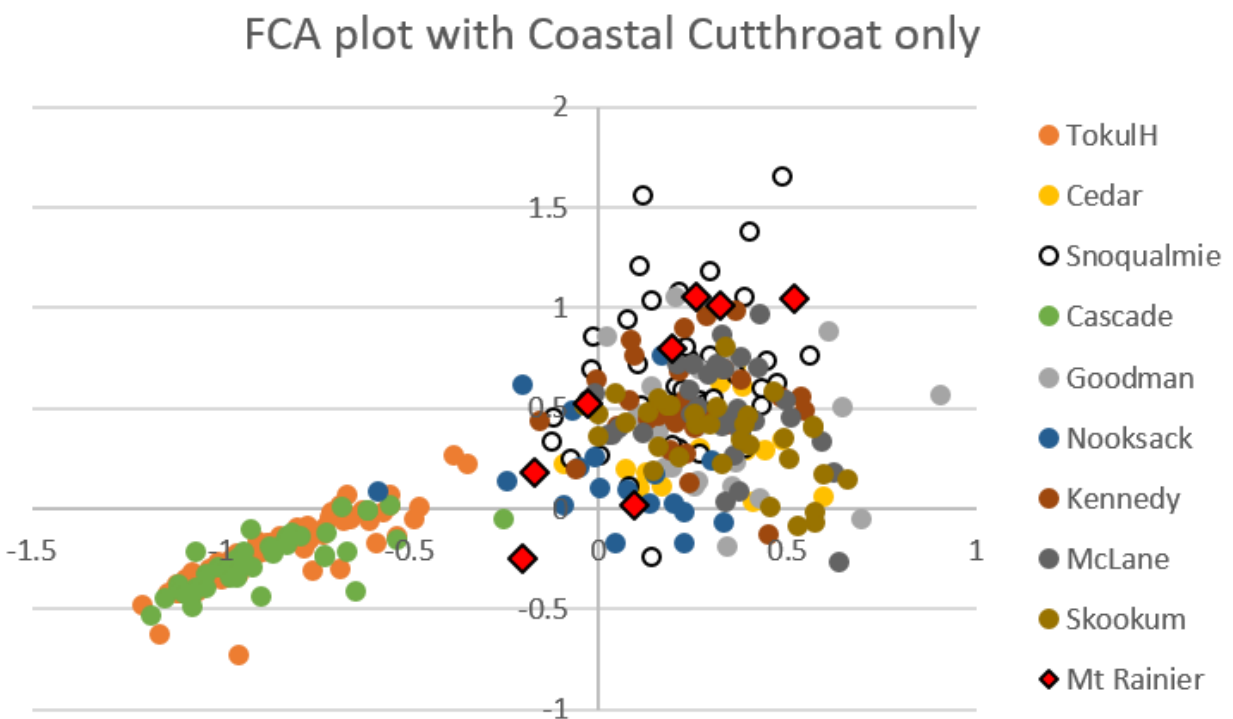


Figure 2. A factorial correspondence analysis plot of only Coastal Cutthroat trout collections and the unknown trout from Mt. Rainier.

Appendix I. List of unknown Cutthroat trout collected in the White River on Mt. Rainier, their genotypes at seven microsatellite loci, and the sample data that accompanied the tissue samples. Question marks indicate loci that had no data.

	Ogo-3	Omm-1138	Omy-77	One-108	Ots-1	Ots-103	Ots-3M								Site code	Species	Sample ID	Fork Length	Date
16QE0001	189	189	?	?	135	133	166	158	289	289	70	66	160	134	LW18	ONCL	716-046	210	9/14/2016
16QE0002	189	189	161	161	133	115	166	166	295	280	66	66	158	134	LW18	ONCL	716-071	180	9/14/2016
16QE0003	197	189	?	?	?	?	208	158	?	?	66	66	?	?	LW17	ONCL	716-069	180	9/14/2016
16QE0004	189	189	165	161	133	131	208	166	282	280	66	66	166	162	LW17	ONCL	716-035	160	9/14/2016
16QE0005	197	189	165	161	133	131	166	166	289	287	66	66	?	?	LW17	ONCL	716-056	190	9/14/2016
16QE0006	?	?	?	?	?	?	?	?	?	?	?	?	?	?	LW16	ONCL	716-022	190	9/14/2016
16QE0007	189	189	165	165	135	115	166	166	289	236	66	66	176	158	LW16	ONCL	716-032	185	9/14/2016
16QE0008	?	?	?	?	?	?	?	?	?	?	?	?	?	?	LW16	ONCL	714-072	210	9/14/2016
16QE0009	189	189	165	165	115	115	?	?	282	282	?	?	176	158	LW16	ONCL	716-073	155	9/14/2016
16QE0010	189	189	165	165	115	115	166	166	285	282	66	66	176	134	outlet	ONCL	713-022	113	8/8/2017