

Microsatellite Analysis of Yakima Basin Bull Trout



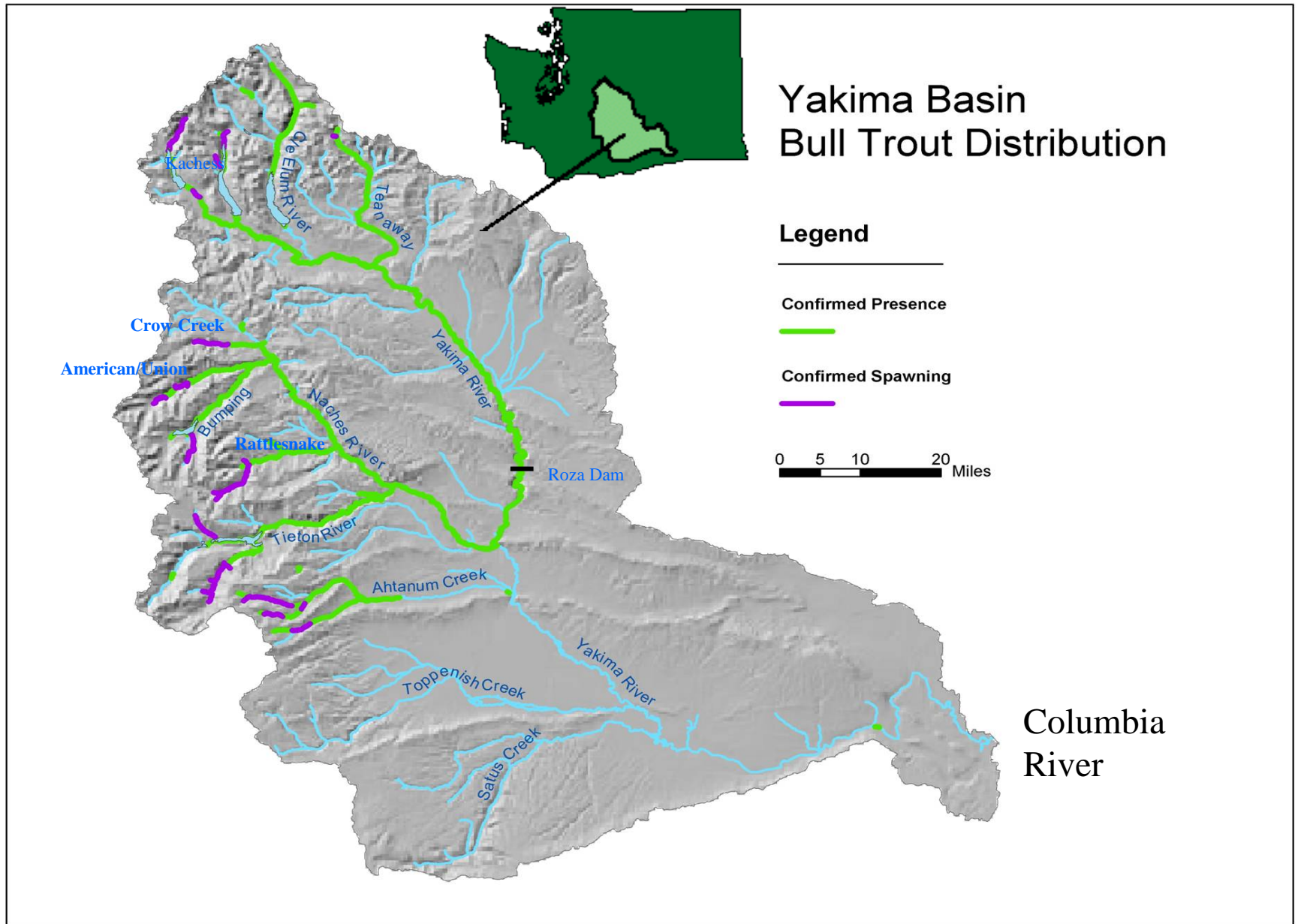
WDFW Molecular Genetics Lab

Denise Hawkins and Jennifer Von Bargaen

Objectives

- Develop a standardized microsatellite DNA baseline for Yakima Basin bull trout
- Examine genetic population structure using the standardized microsatellite loci
- Determine population of origin for unknown fish from WDFW radio telemetry study

Study Site

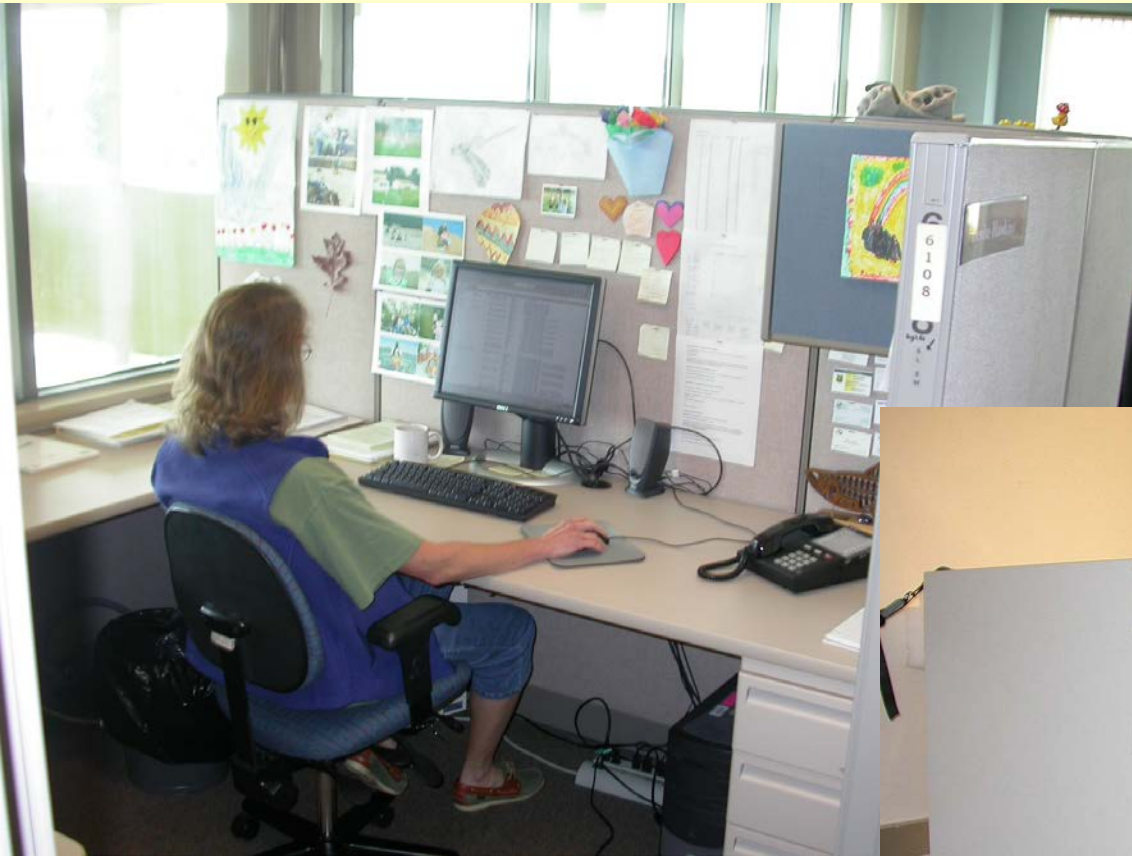


Samples

WDFW Collection Code	Stock ¹	Population ¹	Collection Location	Life History Type ¹	Age Class	Sample Type	Sample Size
01QI	American-Naches	Union Creek	Union Creek	fluvial	juvenile	extracted DNA	11
02OJ	American-Naches	Union Creek	Union Creek	fluvial	juvenile	fin	2
03GG	American-Naches	Union Creek	Union Creek	fluvial	adult	fin	8
01QH	American-Naches	American River	American River	fluvial	juvenile	extracted DNA	30
03GG	American-Naches	?	American River	fluvial	adult	fin	5
01QJ	American-Naches	Rattlesnake Creek	Rattlesnake Creek	fluvial	juvenile	extracted DNA	27
03GG	American-Naches	Rattlesnake Creek	Rattlesnake Creek	fluvial	adult	fin	17
01QK	American-Naches	Crow Creek	Crow Creek	fluvial	juvenile	extracted DNA	31
03GG	American-Naches	Crow Creek	Crow Creek	fluvial	juvenile	fin	1
03GG	American-Naches	?	Naches River	fluvial	adult	fin	22
03GG	Rimrock Lake	?	Tieton Pool	adfluvial	adult	fin	5
03GG	Rimrock Lake	?	NF Tieton/Clear Lake	adfluvial	adult	fin	7
03GG	Bumping Lake	?	Bumping River	adfluvial	adult	fin	4
03GG	Ahtanum	MF Ahtanum	MF Ahtanum	fluvial/resident	adult	fin	13
03GG	Ahtanum	NF Ahtanum	NF Ahtanum	fluvial/resident	adult	fin	5
03GG	Kachess Lake	?	Kachess River Dam Pool	adfluvial	adult	fin	1
03GG	?	?	Yakima River Roza Dam	?	adult	fin	1

1. ? indicates unknown stock, population membership, life history type.

“Real” Study Site



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Microsatellites

- Tandem repeats of short sequences of DNA
- Non-coding, selectively neutral
- Different levels of variation at loci useful for various study types
- Standardization allows multi-lab and multi-year data collection

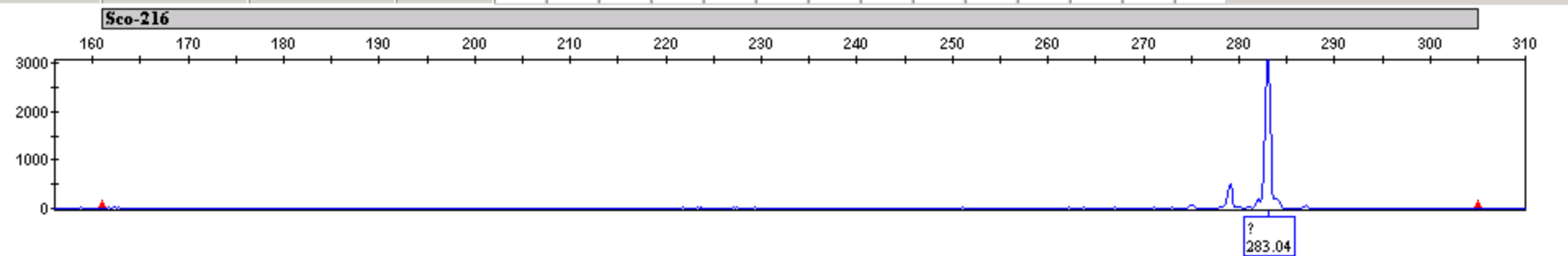
Microsatellite Loci

Core Loci – bold

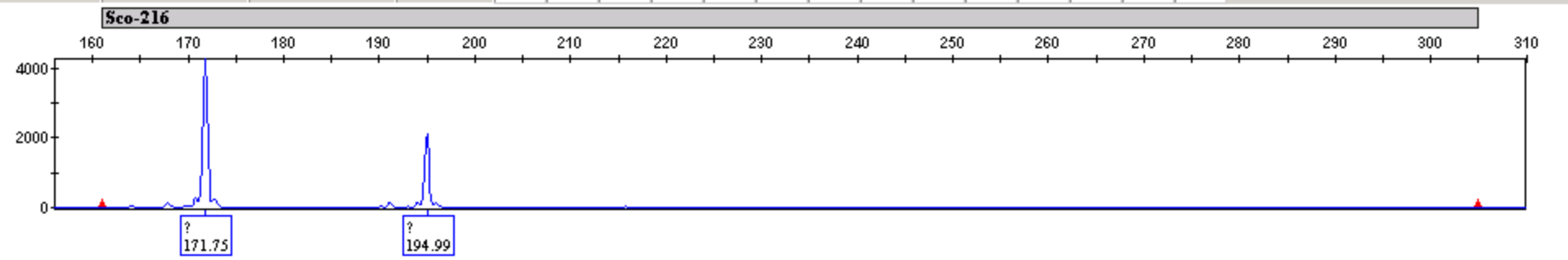
* - bull/brook
diagnostic locus

Multiplex	Locus	# of Alleles	H _o	H _e
	Sco-212	12	0.6264	0.8266
Sco A	Sco-107*	11	0.7386	0.8005
	Sco-109*	16	0.6023	0.8608
Sco B	Sco-106	16	0.8427	0.8704
	Sfo-18*	1	NA	NA
	Smm-22	18	0.7714	0.8660
Sco C	Sco-102	5	0.5568	0.5932
	Omm-1130	16	0.7232	0.7840
Sco E	Omm-1128*	10	0.7049	0.7820
	Sco-105	10	0.5027	0.5723
Sco I	Sco-200	8	0.7056	0.7268
	Sco-202	4	0.6919	0.7120
	Sco-218	14	0.7962	0.8933
	Sco-220	18	0.8090	0.8893
Sco J	Sco-215*	1	NA	NA
	Sco-216*	9	0.7166	0.8358

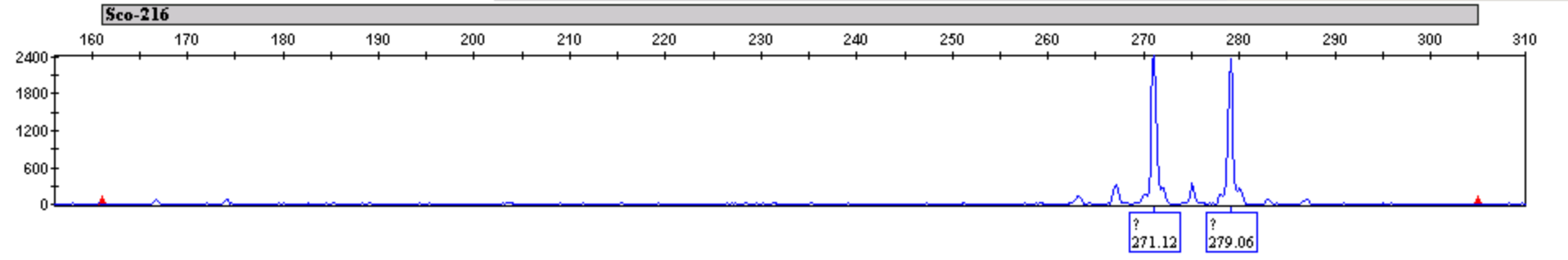
File	Sample Name	Panel	Marker	OS	SHP	OBA	SPA	SP	BIN	PHR	LPH	SPU	AN	BD	CC	OVL	GQ
03GG0040_Scc	03GG0040	Sco-J	Sco-216	■	■	■	▲	■	▲	NA	■	■	■	■	NA	NA	0.06



03GG0041_Scc	03GG0041	Sco-J	Sco-216	■	■	■	▲	■	▲	▲	■	■	■	■	NA	NA	0.03
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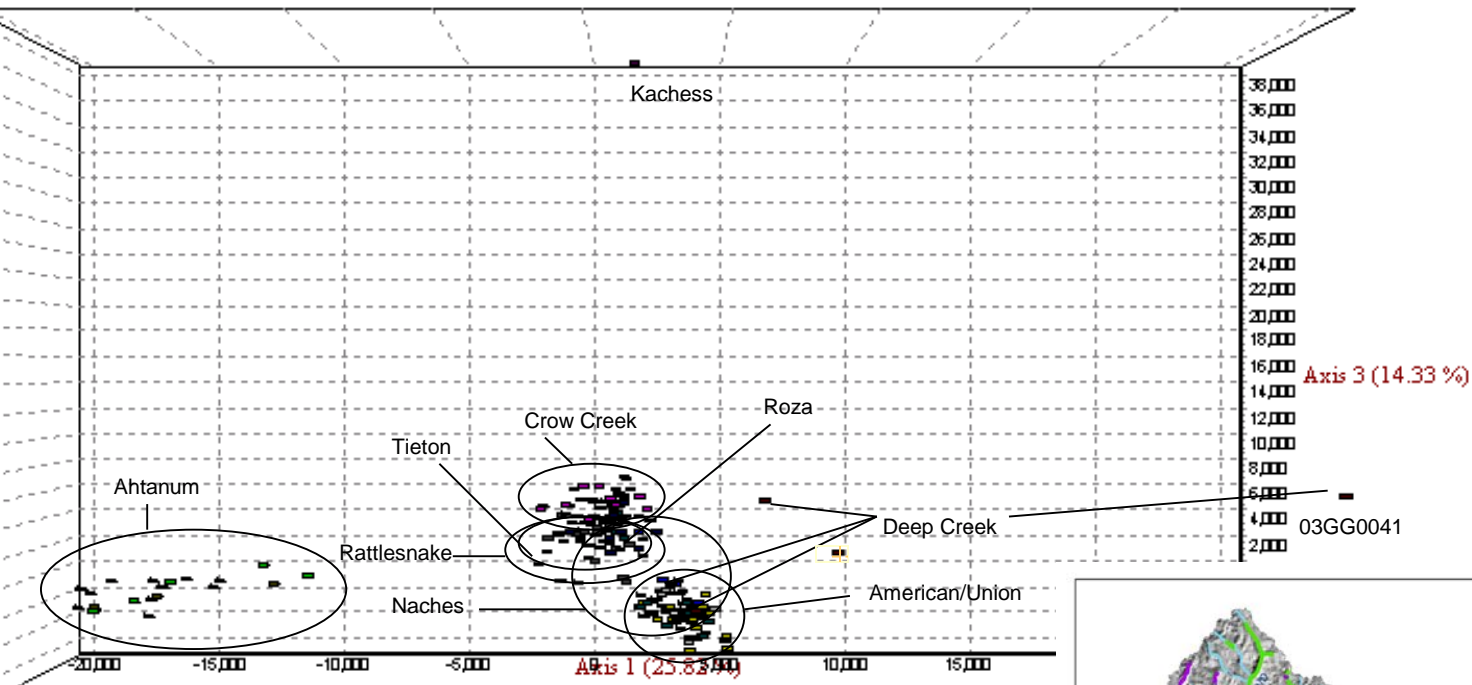
03GG0042_Scc	03GG0042	Sco-J	Sco-216	■	■	■	▲	■	▲	■	■	■	■	■	NA	NA	0.03
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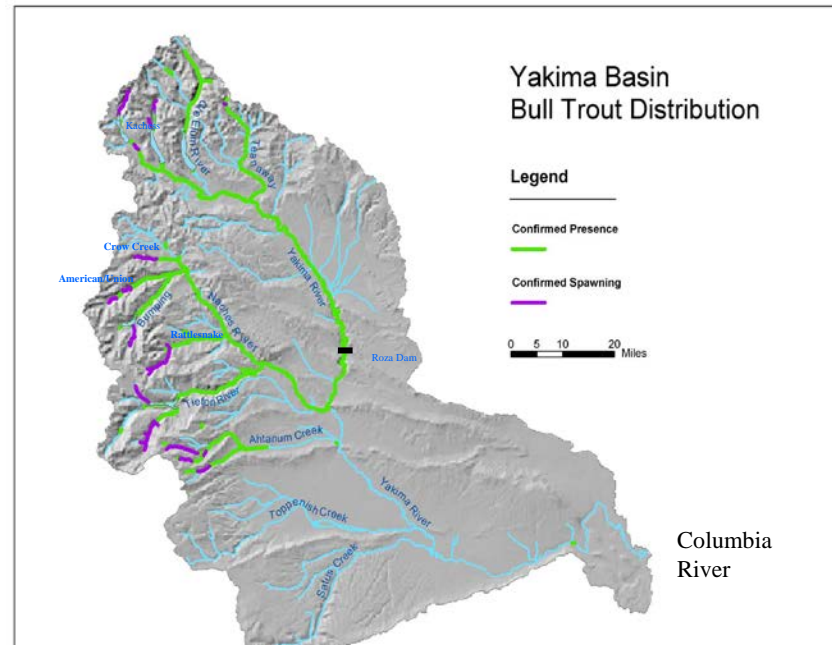
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Scatter Plot of Collections



Genetix 4.03





Bull Trout



Brook/Bull Trout Hybrid

03GG0041



Brook Trout

Study Site

Yakima Basin Bull Trout Distribution

Legend

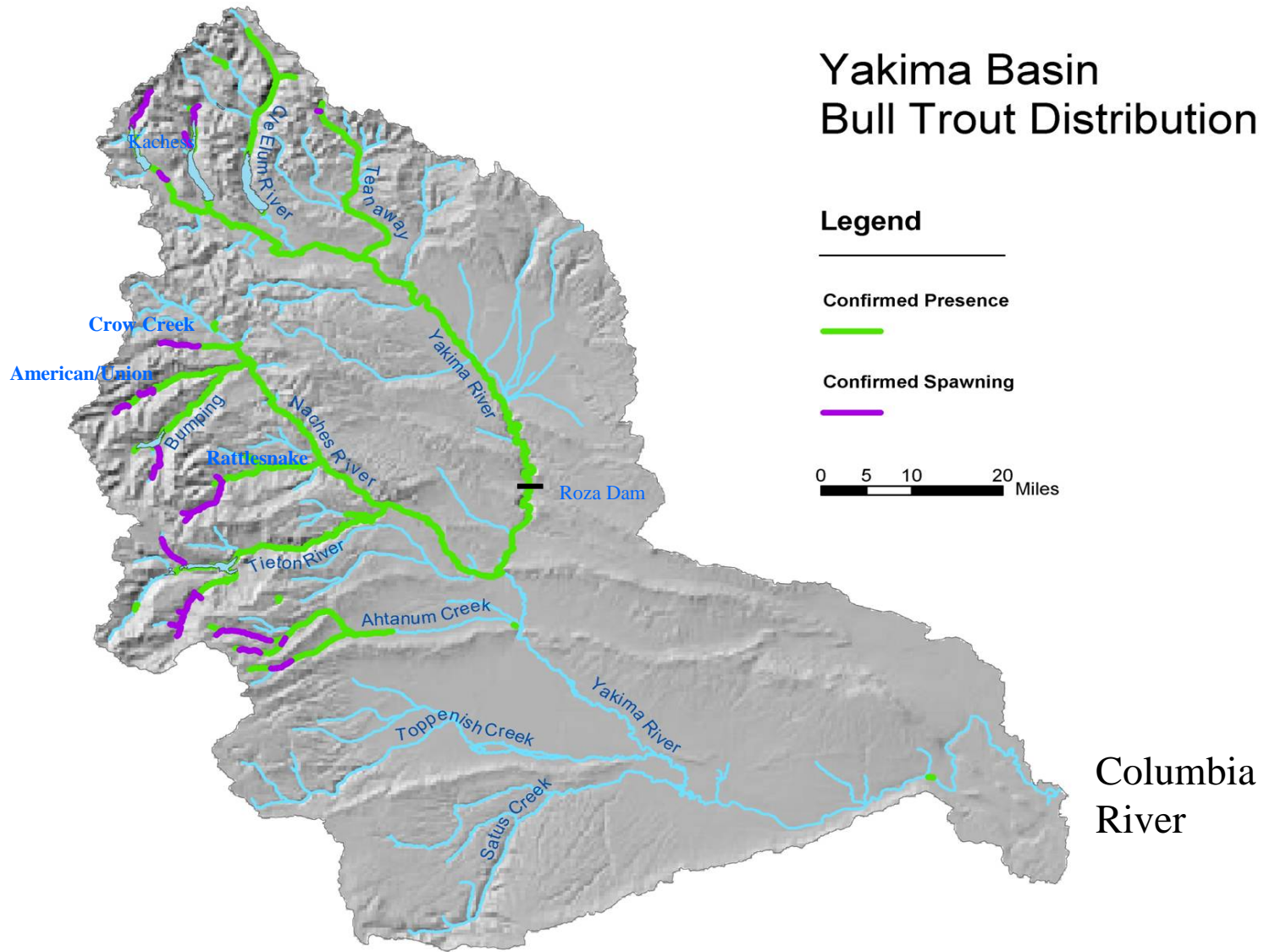
Confirmed Presence



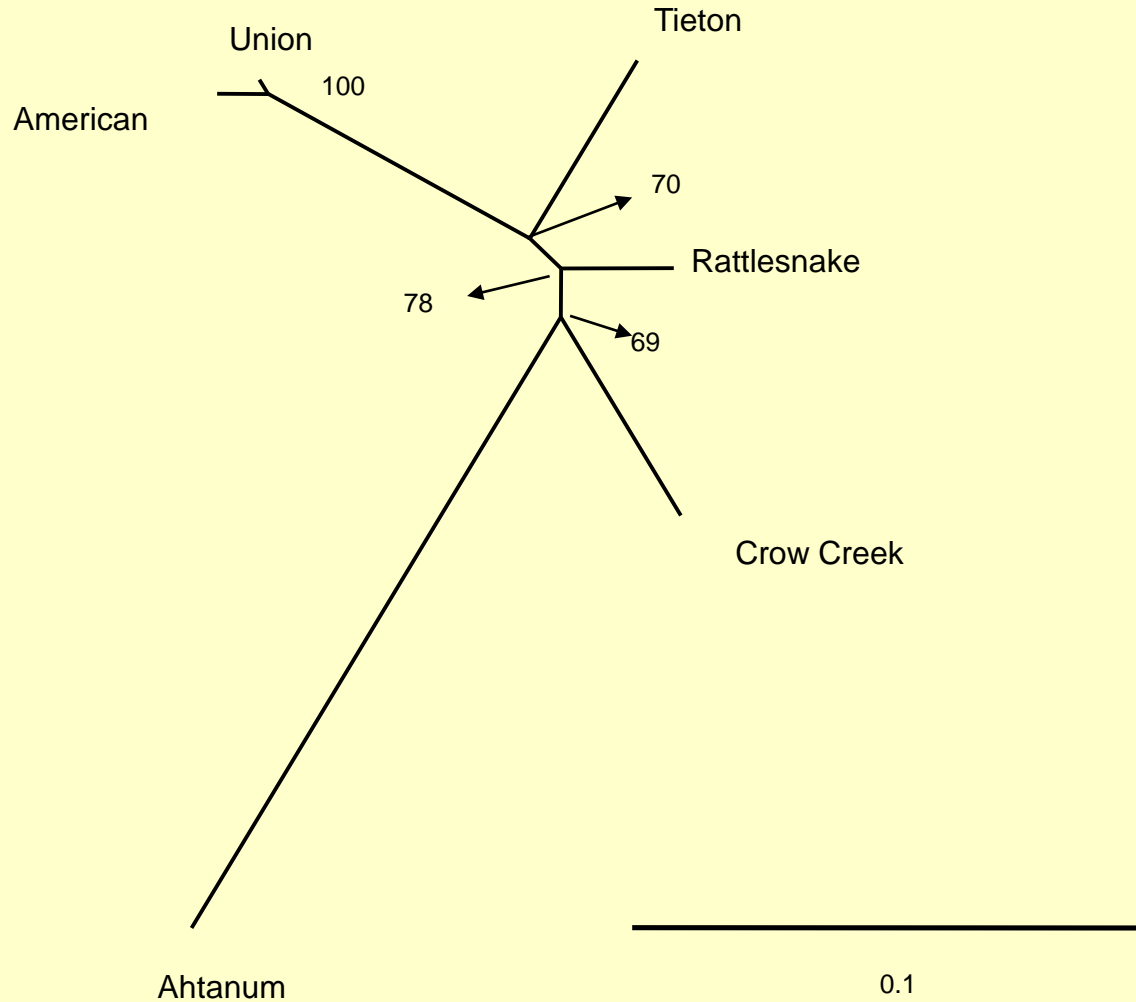
Confirmed Spawning



0 5 10 20 Miles



Cavalli-Sforza and Edwards Neighbor-joining Tree



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Assignment Results

Reference Populations

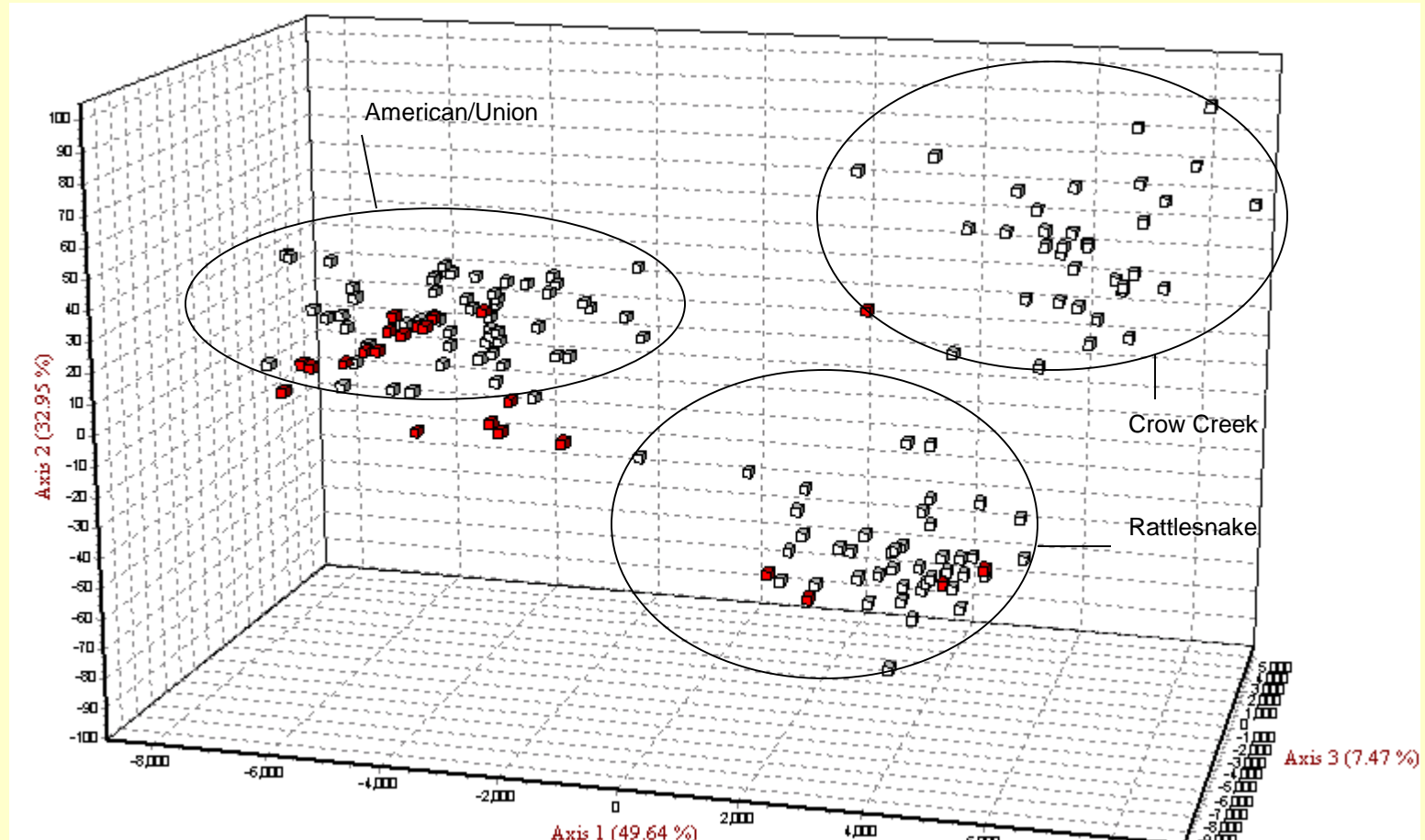
- American/Union
- Crow Creek
- Rattlesnake
- Tieton
- Ahtanum

Sample Name	Collection Location	Assignment 1	Rank Score
03GG0037	American/Boulder Cave	AmerUnion	100
03GG0038	American/Jefferson Hole	Rattlesnake	100
03GG0058	American/Union Hole	AmerUnion	100
03GG0059	American/Union Hole	AmerUnion	100
03GG0036	American/Wapataux	AmerUnion	100
03GG0018	Crow Creek juvenile	CrowCreek	100
03GG0030	Naches/Blue Nile	Rattlesnake	100
03GG0084	Naches/FS Road	CrowCreek	100
03GG0024	Naches/Jefferson Hole	AmerUnion	100
03GG0067	Naches/Jefferson Hole	AmerUnion	100
03GG0068	Naches/Jefferson Hole	AmerUnion	99.998
03GG0077	Naches/Jefferson Hole	AmerUnion	99.933
03GG0025	Naches/Pine Cliffs Hole	AmerUnion	100
03GG0073	Naches/Pine Cliffs Hole	AmerUnion	100
03GG0074	Naches/Pine Cliffs Hole	AmerUnion	100
03GG0066	Naches/Pine Cliffs Hole	Rattlesnake	100
03GG0083	Naches/Sawmill Flats	AmerUnion	99.997
03GG0027	Naches/Wapataux	AmerUnion	100
03GG0031	Naches/Wapataux	AmerUnion	100
03GG0032	Naches/Wapataux	AmerUnion	100
03GG0069	Naches/Wapataux	AmerUnion	100
03GG0070	Naches/Wapataux	AmerUnion	100
03GG0079	Naches/Wapataux	AmerUnion	100
03GG0080	Naches/Wapataux	AmerUnion	100
03GG0081	Naches/Wapataux	AmerUnion	100
03GG0033	Naches/Wapataux	Rattlesnake	100
03GG0082	Naches/Wapataux	Rattlesnake	100
03GG0078	Naches/Work Center Hole	AmerUnion	100
03GG0046	Roza Dam/Yakima River	Tieton	99.692

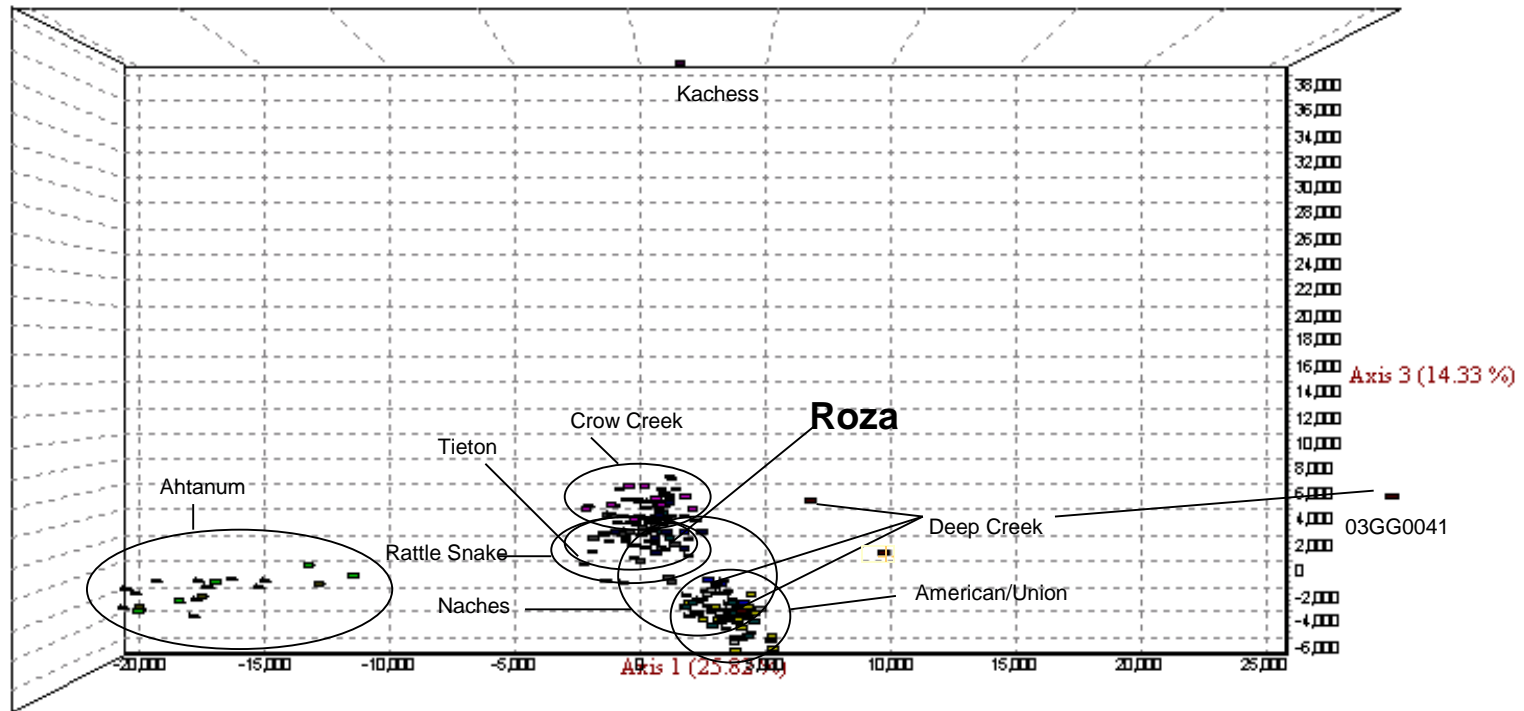
Population Assignment

Legend

- Fish collected from the mainstem Naches



Scatter Plot of Collections



Yakima Basin Bull Trout Distribution

Legend

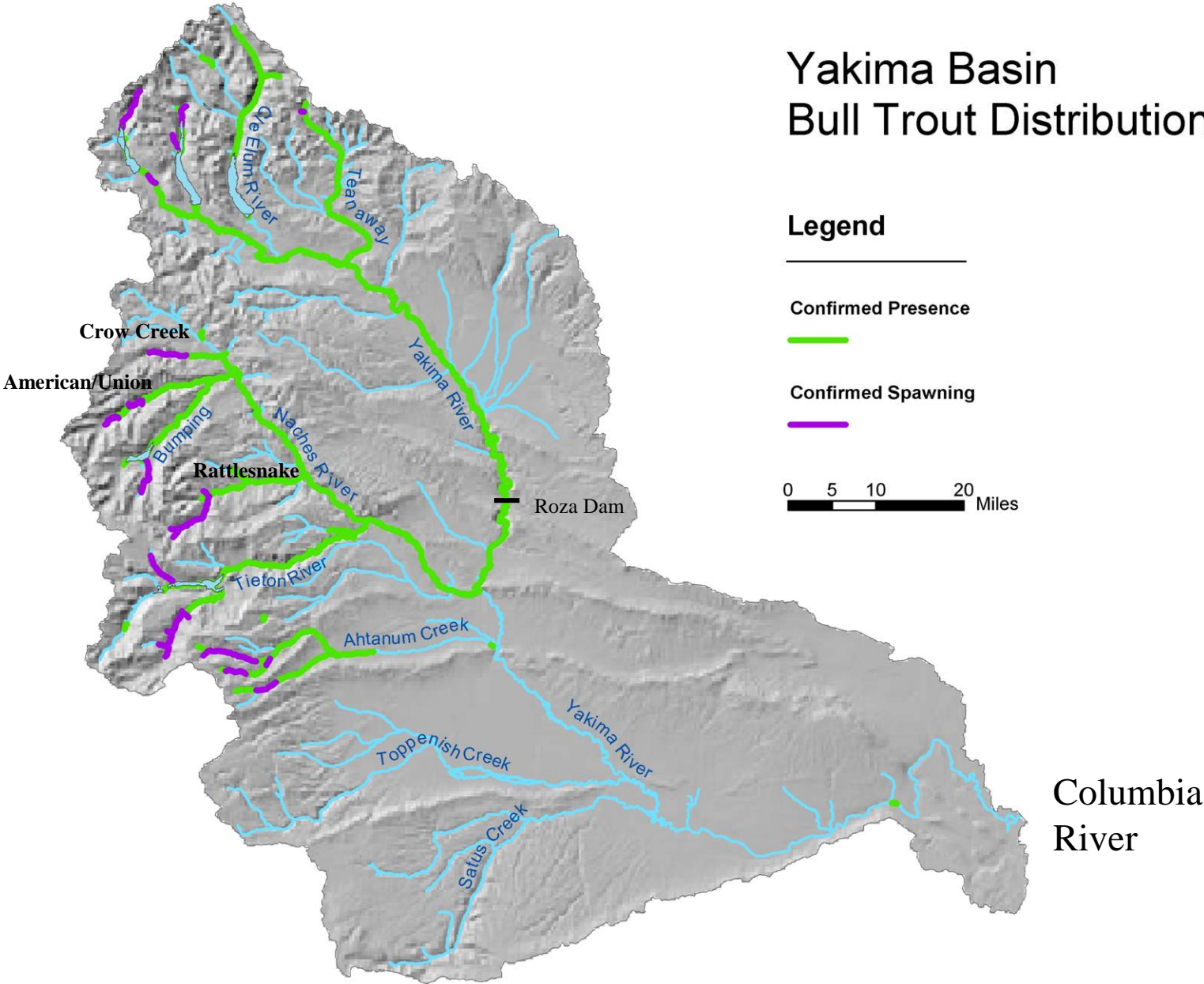
Confirmed Presence



Confirmed Spawning

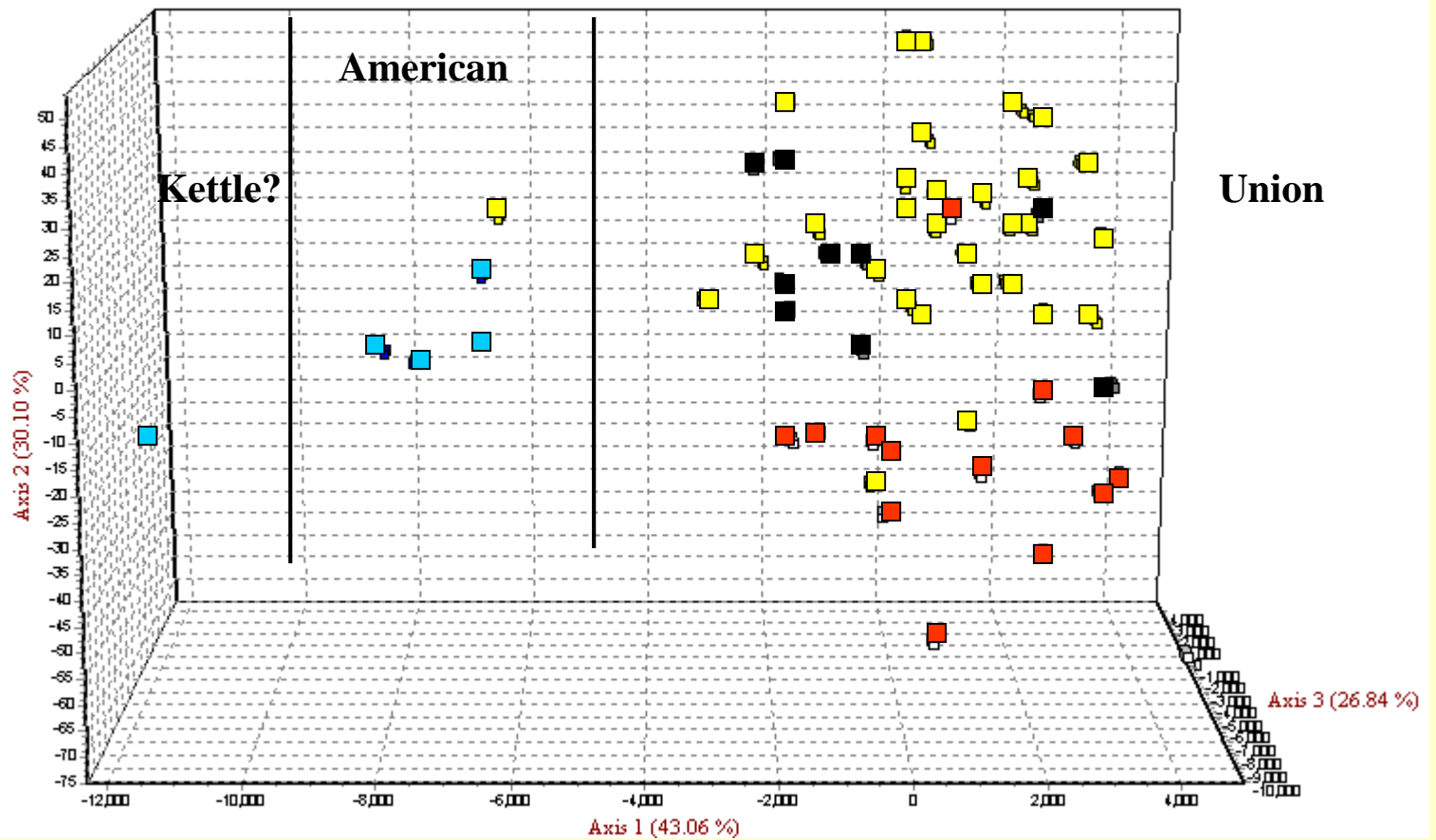


0 5 10 20 Miles



Legend

- American Juvenile
- American Adult
- Union Juvenile
- Union Adult



Results and Conclusions

- Yakima Basin bull trout microsatellite baseline started (190 fish, 16 loci)
- Genetic differences indicated among collections support telemetry data
- Population assignment for 22 fish collected in the mainstem Naches
- Potential for genetically differentiating American/Union/Kettle populations

Unanswered Questions

- American/Union/Kettle: can we genetically distinguish among them?
- Ahtanum: North, Middle and South Forks genetically different?
- Tieton: Indian Creek, South Fork, North Fork above and below Clear Lake, Tieton Pool – where do they go?, are they all genetically different?

Available Samples

Stock	collection location	life history	Telemetry Fish WDFW	USFS Reiss	Other WDFW Samples	Bureau of Reclamation Samples
American-Naches	American River	fluvial	5	30		
	Union Crk	fluvial	8	11	2	
	Rattlesnake Crk	fluvial	17	27/6		
	Crow Crk	fluvial	1	31		
	Naches River	fluvial	22			
Rimrock Lake	SF Tieton	adfluvial		30	93	
	Indian Crk	adfluvial		30	138	
	Tieton Pool	adfluvial	5			
	NF Tieton/Clear Lake	adfluvial	7			
Bumping Lake	Deep Crk	adfluvial	8	30	92	
	Bumping River	adfluvial	4/1			
Ahtanum	SF Ahtanum	resident		6		
	MF Ahtanum	resident	13	16	23	
	NF Ahtanum	resident	5	8	1	
Kachess Lake	Kachess River Dam Pool	adfluvial	1		2	1
	Box Canyon Crk	adfluvial		31	9	
	Mineral Crk	adfluvial		30	51	
?	Yakima River Roza Dam	adfluvial	1			1
NF Teanaway	NF Teanaway	resident		10		
Keechelus Lake	Gold Crk/Cold Creek	adfluvial		21	61	2
Tieton Pool Salvage			46		22	
WDFW Secondary			7			
BOR nets			8			
Total			89/70	99/218	2/492	4

Bold blue samples already analyzed

THANKS!

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Kachess Lake

worldisround.com