

## Determination of the Origin of Bull Trout below Cabinet Gorge Dam

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ABSTRACT --Migratory bull trout (*Salvelinus confluentus*) that spawned in the Clark Fork River drainage historically inhabited Lake Pend Oreille as subadult and adult fish. If this premise is correct, the construction of Cabinet Gorge Dam disrupted the connectivity of the Pend Oreille / Clark Fork metapopulation. We used eight microsatellite loci to compare bull trout collected at the base of Cabinet Gorge Dam to fish sampled both above and below the dam. These data were analyzed using Cavalli-Sforza and Edwards' (CSE) chord distance and Paetkau's individual assignment test. The CSE UPGMA and Paetkau's individual assignment test suggest that Cabinet Gorge bull trout are genetically more similar to tributaries sampled from above the dam. This relationship suggests that the risks associated with passing a limited number of radio tagged adults are minimal compared to the potential genetic and demographic benefits to populations located above the dam.

- Bull trout, *Salvelinus confluentus*, are currently listed as threatened under the United States Endangered Species Act.
- Many factors have contributed to declining bull trout numbers. One major factor is habitat fragmentation resulting from hydroelectric dams.
- Historically there were no barriers to bull trout migration between spawning tributaries in the lower Clark Fork River and Lake Pend Oreille where subadults rear.
- Cabinet Gorge Dam was constructed in 1952 with no facilities for fish passage. However, it may be possible for fish to pass downstream over the dam. Those individuals would be unable to return upstream to spawn.
- The Objective of our study was to determine the genetic relationship among adult bull trout returning to the base of Cabinet Gorge Dam, populations in tributaries to the lower Clark Fork River, and populations in tributaries to Lake Pend Oreille. We compare our results to patterns expected for each of our hypotheses as predicted by principles of population genetics. Based on these results [see table on next page], we estimate the probably origins of the Cabinet Gorge Dam samples. We then weigh the genetic risks associated with fish passage at dams along the lower Clark Fork River versus risks associated with maintaining the existing migration barriers in the system.

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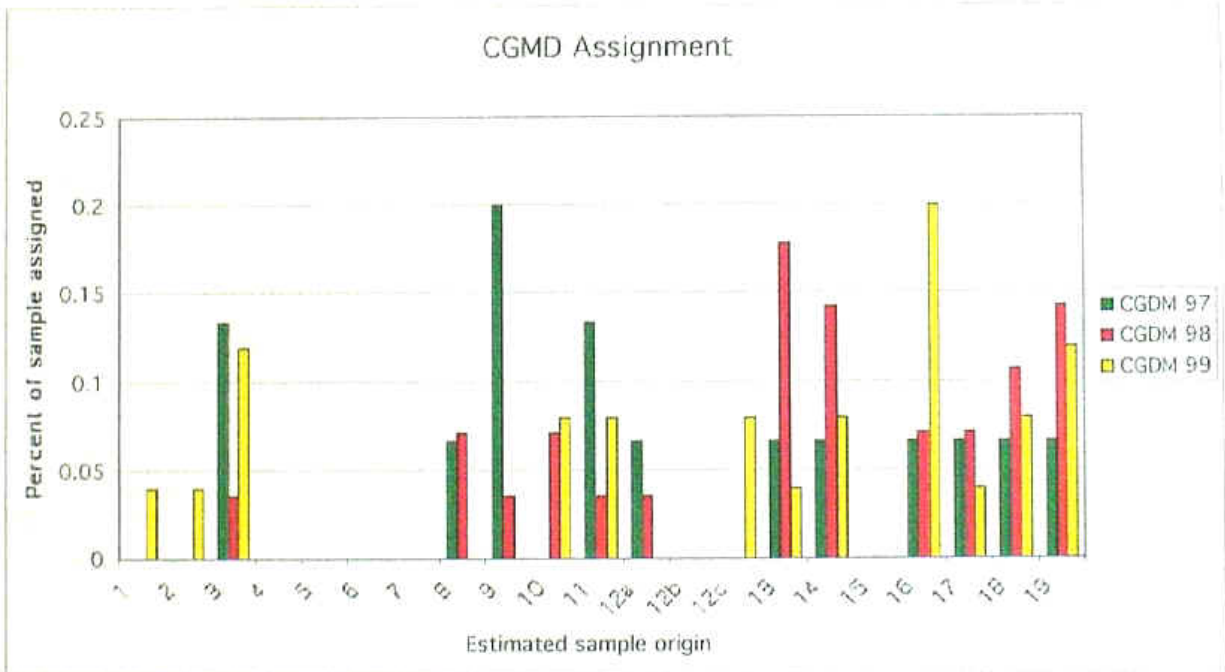
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Population Name	Population Number	He	Number of Alleles
GROS	1	0.335	19
TRSL	2	0.340	23
GRNT	3	0.355	20
GOLD	4	0.288	21
MORR	5	0.364	16
SAVG	6	0.386	19
EFLT	7	0.297	23
PRCP	8	0.285	20
RATL	9	0.342	20
LTNG	10	0.386	20
TWIN	11	0.472	19
CG97	12a	0.431	22
CG98	12b	0.388	23
CG99	12c	0.397	21
EFBR	13	0.383	24
ROCK	14	0.316	23
SWMP	15	0.399	19
GRAV	16	0.413	18
PROS	17	0.269	20
THOM	18	0.366	18
WFTC	19	0.362	23

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- A UPGMA dendrogram suggests that there is substantial differentiation between samples collected in tributaries to Lake Pend Oreille and those collected in lower Clark Fork River tributaries (Fst=0.137)



- Samples collected independently from the same spawning aggregate should cluster together on allele frequency-based dendrograms. Cabinet Gorge Dam 1997, 1998, and 1999 samples do not cluster together on a dendrogram and are dispersed with the lower Clark Fork River samples.
- The data are more consistent with the results expected from a sample representing multiple populations. This suggests the bull trout sampled from the base of Cabinet Gorge Dam are more genetically similar to samples collected from tributaries located above the dam.
- Most individuals are assigned back to the site from which they were captures. The Cabinet Gorge Dam samples were preferentially assigned to samples from tributary above the dam rather than back to their initial sampling location.
- These data support the hypothesis that Cabinet Gorge Dam adults are a mixture of migratory individuals from tributaries to the Clark Fork River that pass downstream to rear in Lake Pend Oreille.