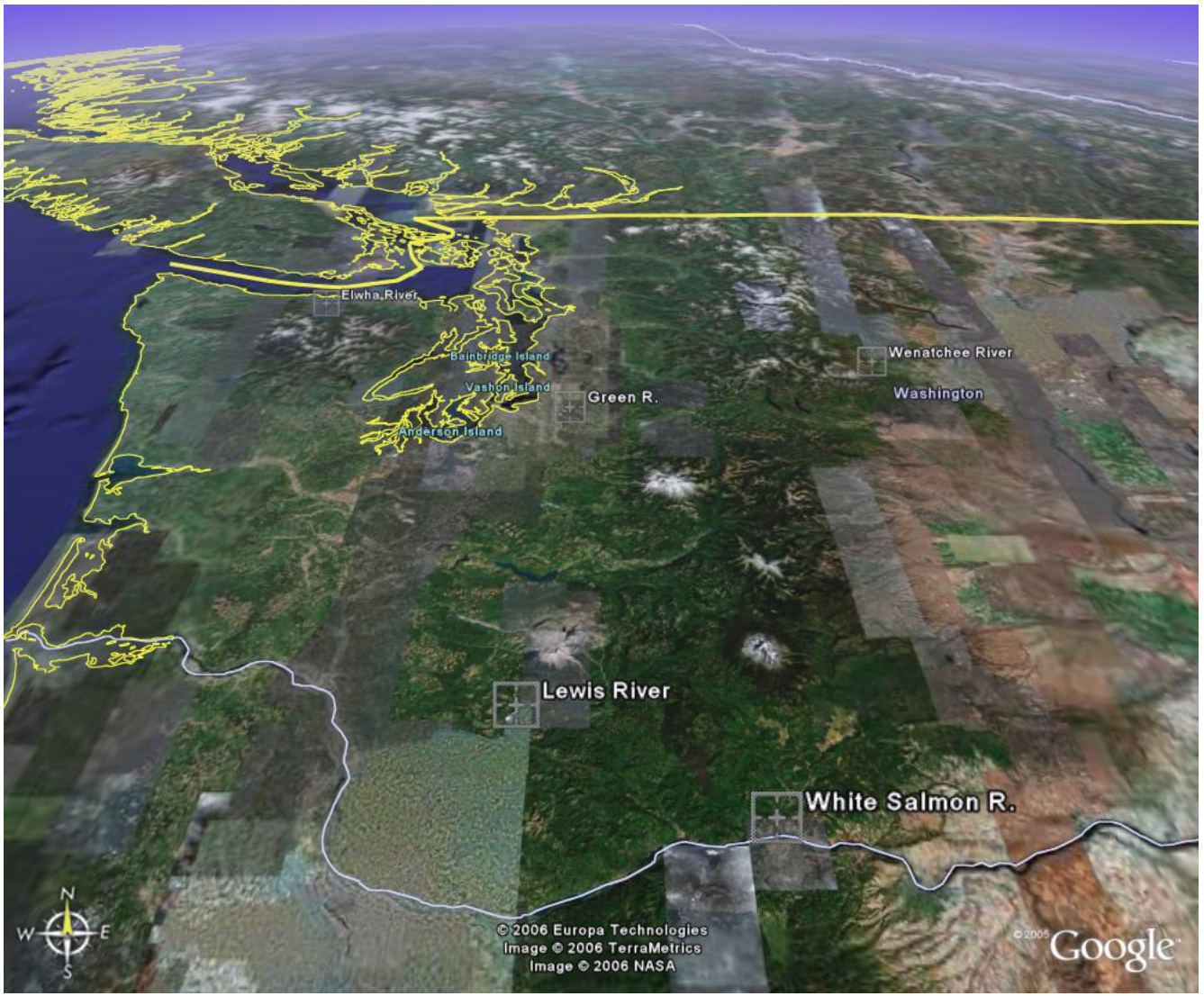
Recolonization of *O. mykiss* above Dams



The presence of resident rainbow trout *Onchorynchus mykiss* above these dams potentially complicates the reintroduction of steelhead *O. mykiss*.

To what extend will the two gene pools interact and will rainbow trout contribute to recolonization of steelhead?

We are using genetic and phenetic data to describe gene pool differentiation and to prepare to monitor recolonization at these sites in the Pacific Northwest.

3 Data Sets are being used to characterize *mykiss* gene pools

Morphological characters (body shape and parr mark characteristics*)* may be indicative of local adaptation.

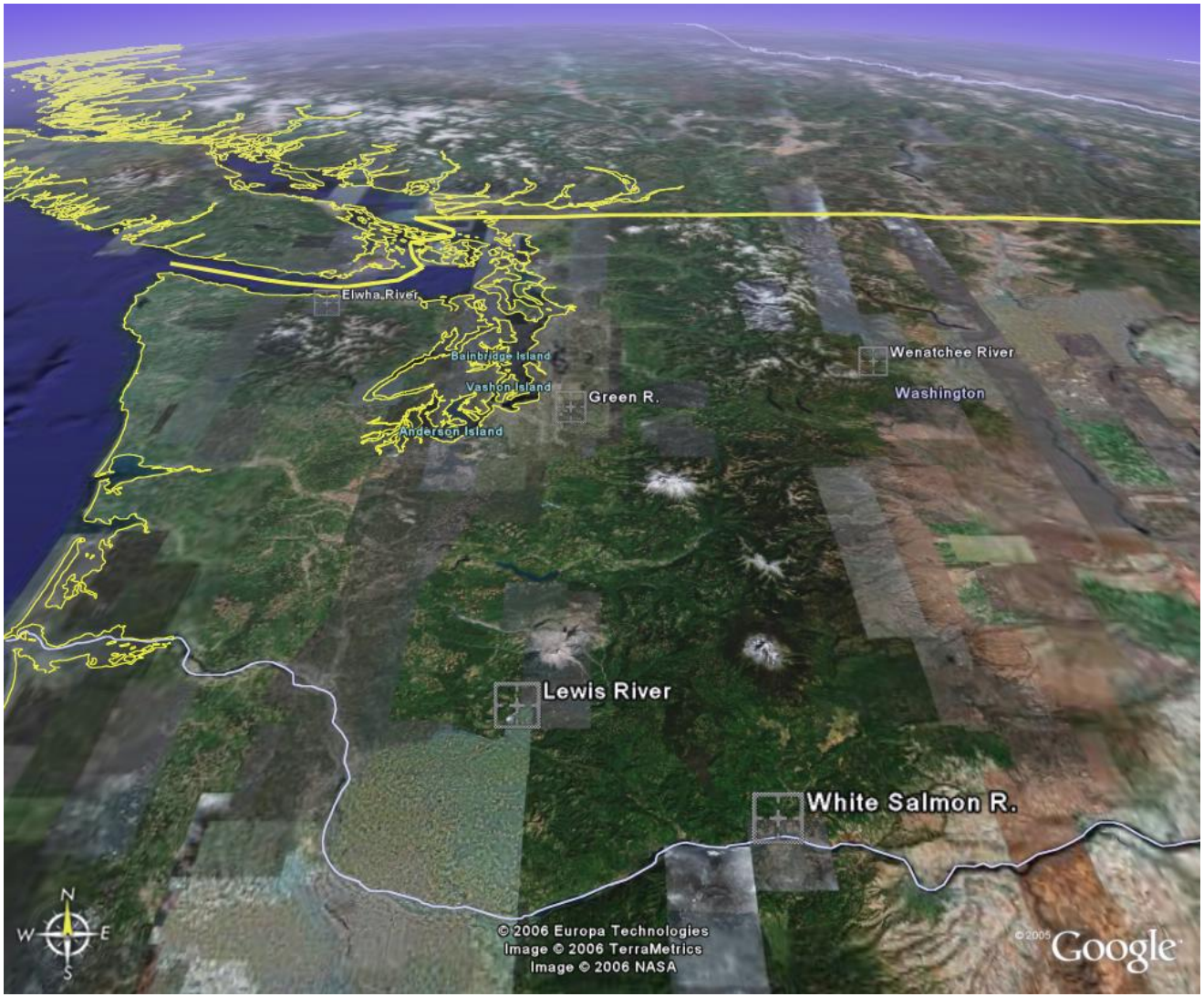
Microsatellite loci (mSATs, n = 15) are used to determine pedigree relationships among and degree of stock purity within relevant gene pools. These markers are evolutionarily neutral and estimate historic and present-day levels of gene flow.

Major histocompatibility loci (MHC) are presumably under natural selection for disease related characteristics**.**

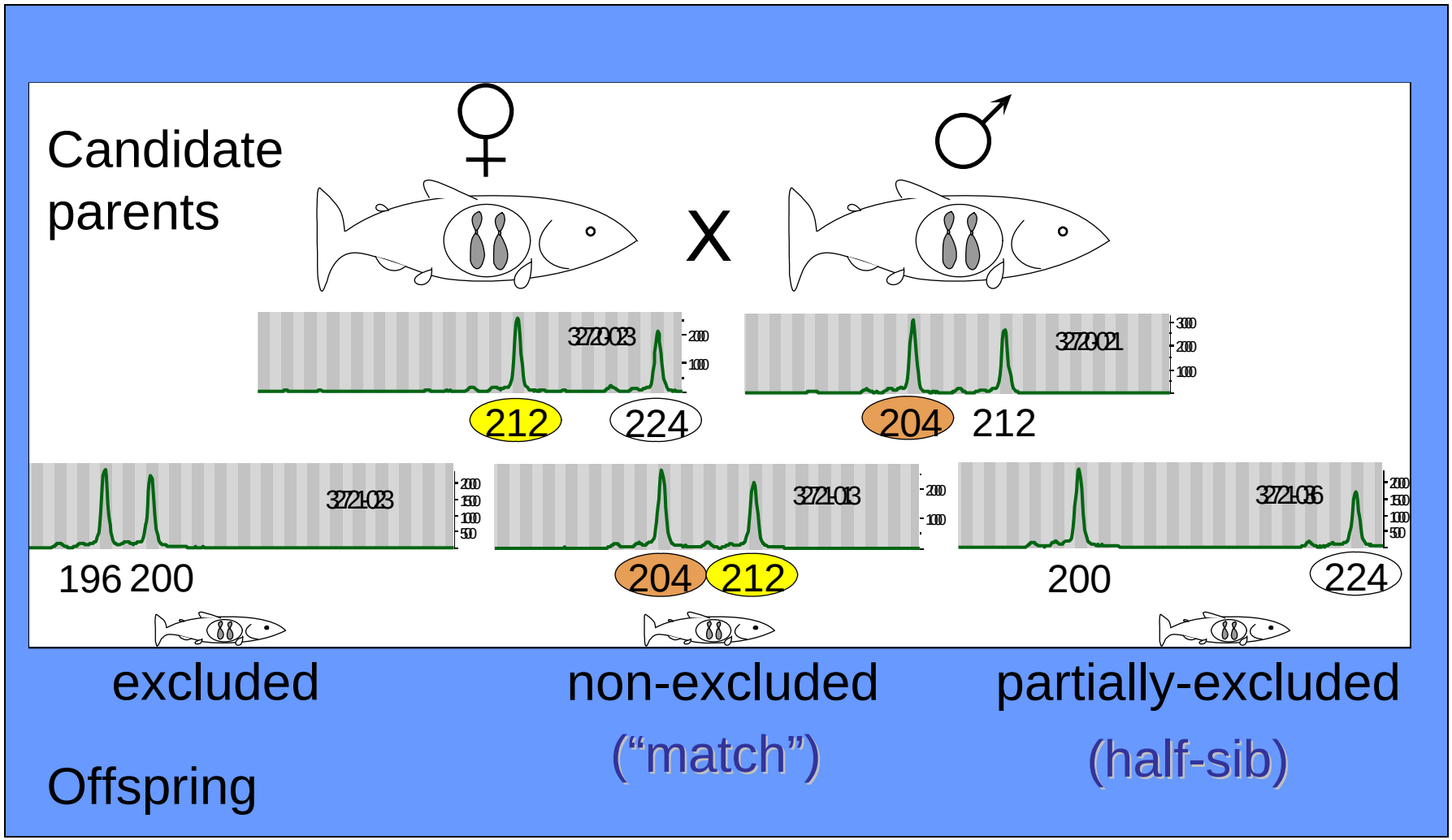
Who will be the recolonizers? –who will smolt and who will recruit?

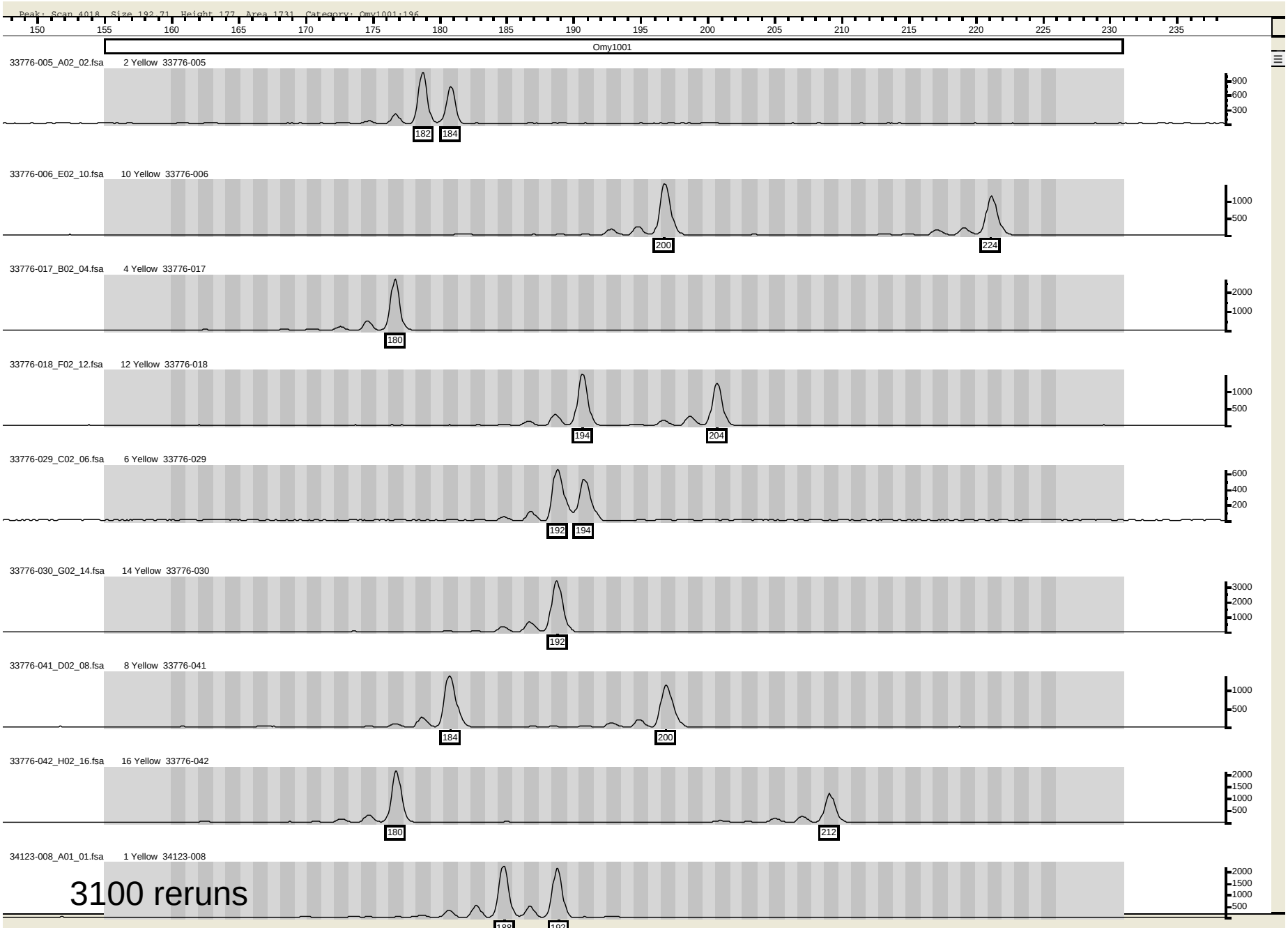
And what will be the genetic and phenetic characters of each.

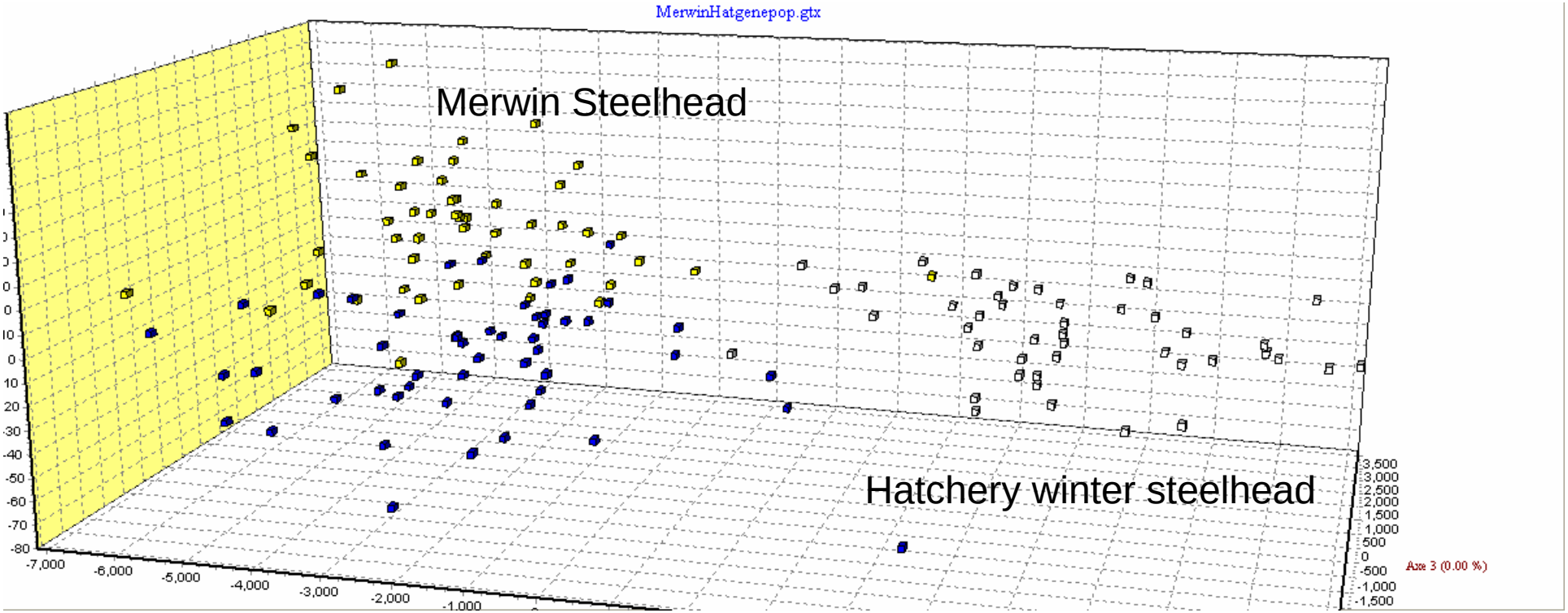
--over 5 dam sites--


Elwha River
Bainbridge Island
Vashon Island
Anderson Island
Green R.
Wenatchee River
Washington
Lewis River
White Salmon R.
N
W
E
S
© 2006 Europa Technologies
Image © 2006 TerraMetrics
Image © 2006 NASA
©2006 Google

Mendelian inheritance

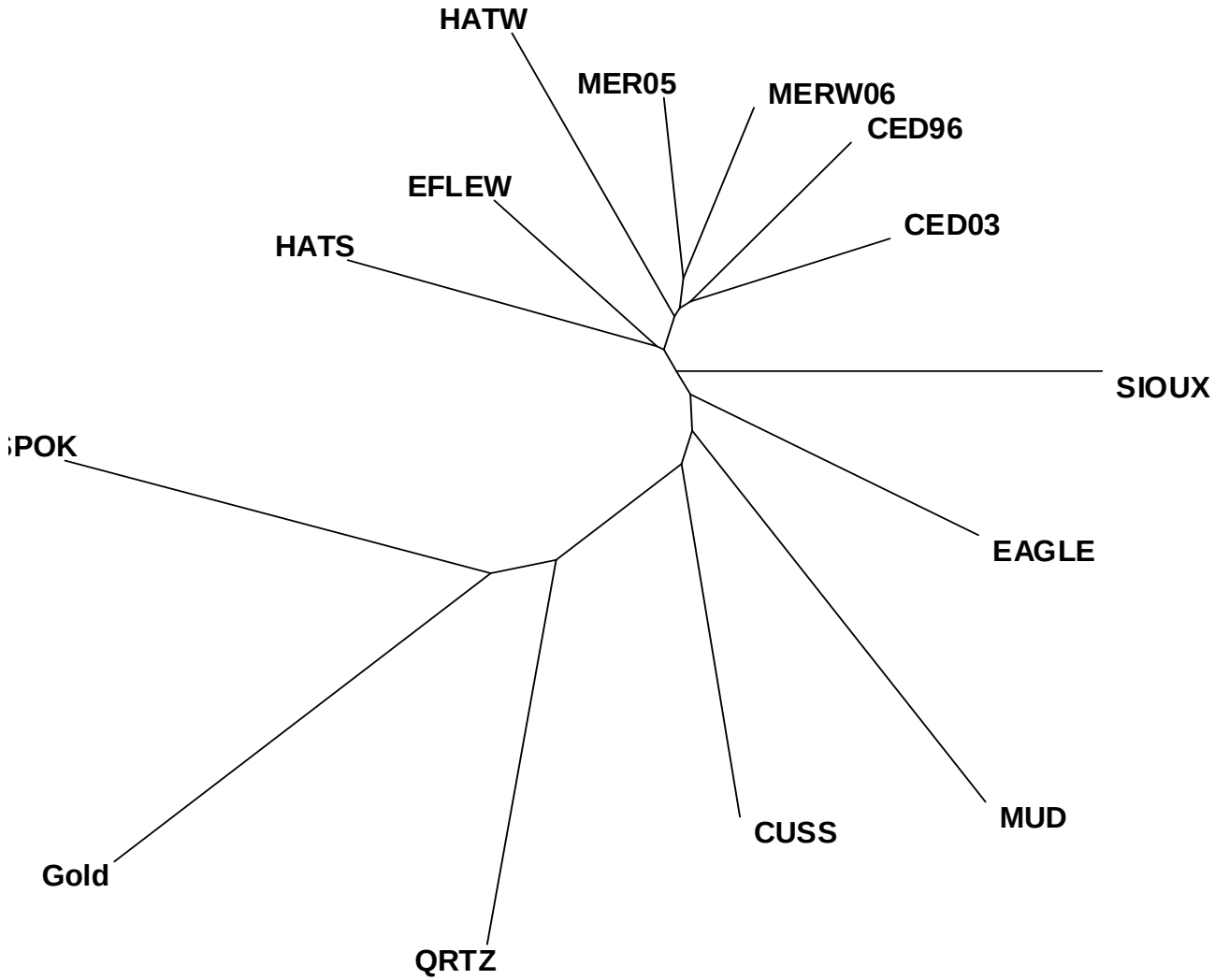



Peak: Scan 4018, Size 192.71, Height 177, Area 1731, Category: Omy1001:196
150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235
Omy1001
33776-005_A02_02.fsa 2 Yellow 33776-005
900 600 300
182 184
33776-006_E02_10.fsa 10 Yellow 33776-006
1000 500
200 224
33776-017_B02_04.fsa 4 Yellow 33776-017
2000 1000
180
33776-018_F02_12.fsa 12 Yellow 33776-018
1000 500
194 204
33776-029_C02_06.fsa 6 Yellow 33776-029
600 400 200
192 194
33776-030_G02_14.fsa 14 Yellow 33776-030
3000 2000 1000
192
33776-041_D02_08.fsa 8 Yellow 33776-041
1000 500
184 200
33776-042_H02_16.fsa 16 Yellow 33776-042
2000 1500 1000 500
180 212
34123-008_A01_01.fsa 1 Yellow 34123-008
2000 1500 1000 500
3100 reruns

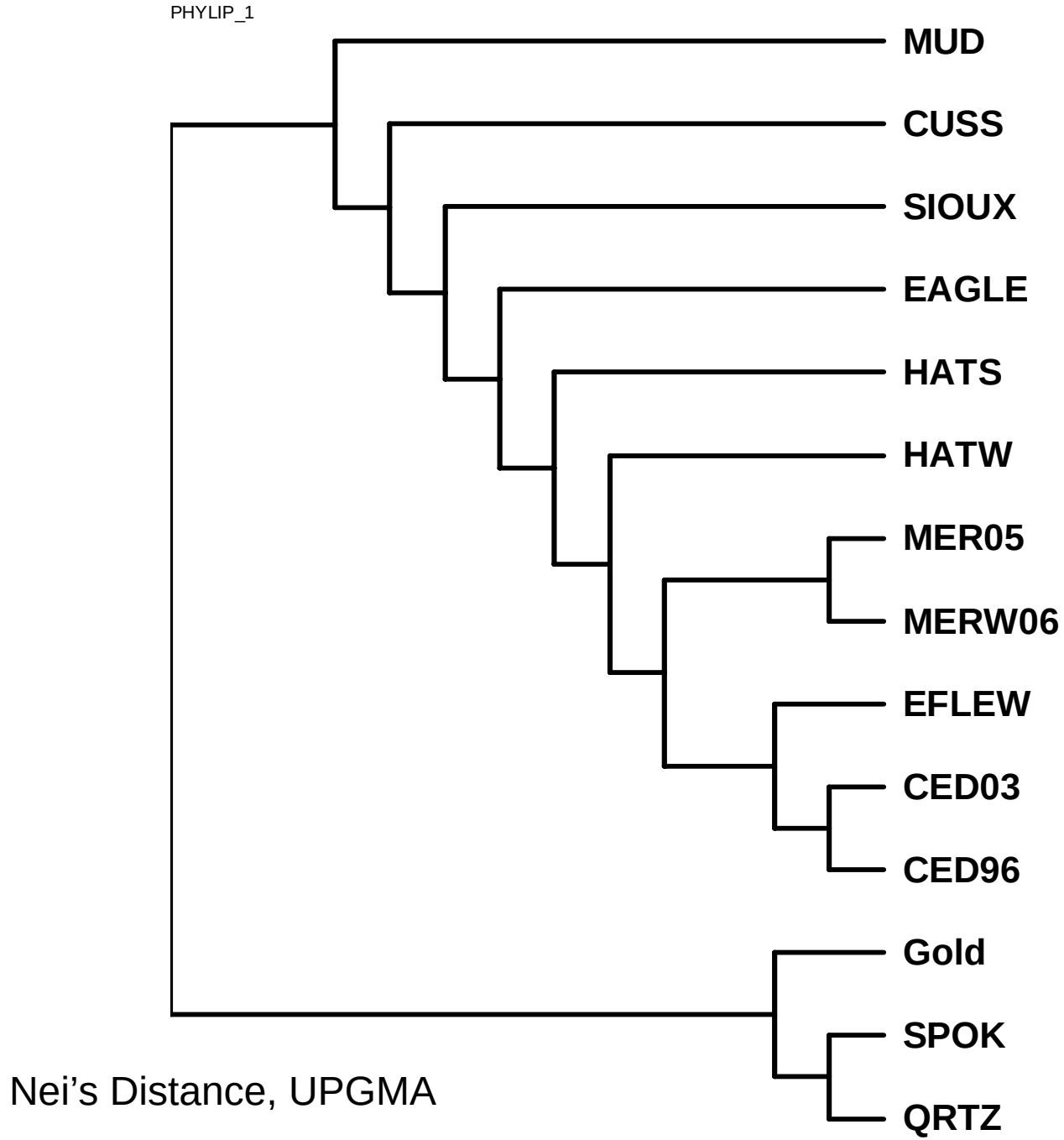


For Merwin vs. Hatchery, the summary chi square over 15 loci is highly significant

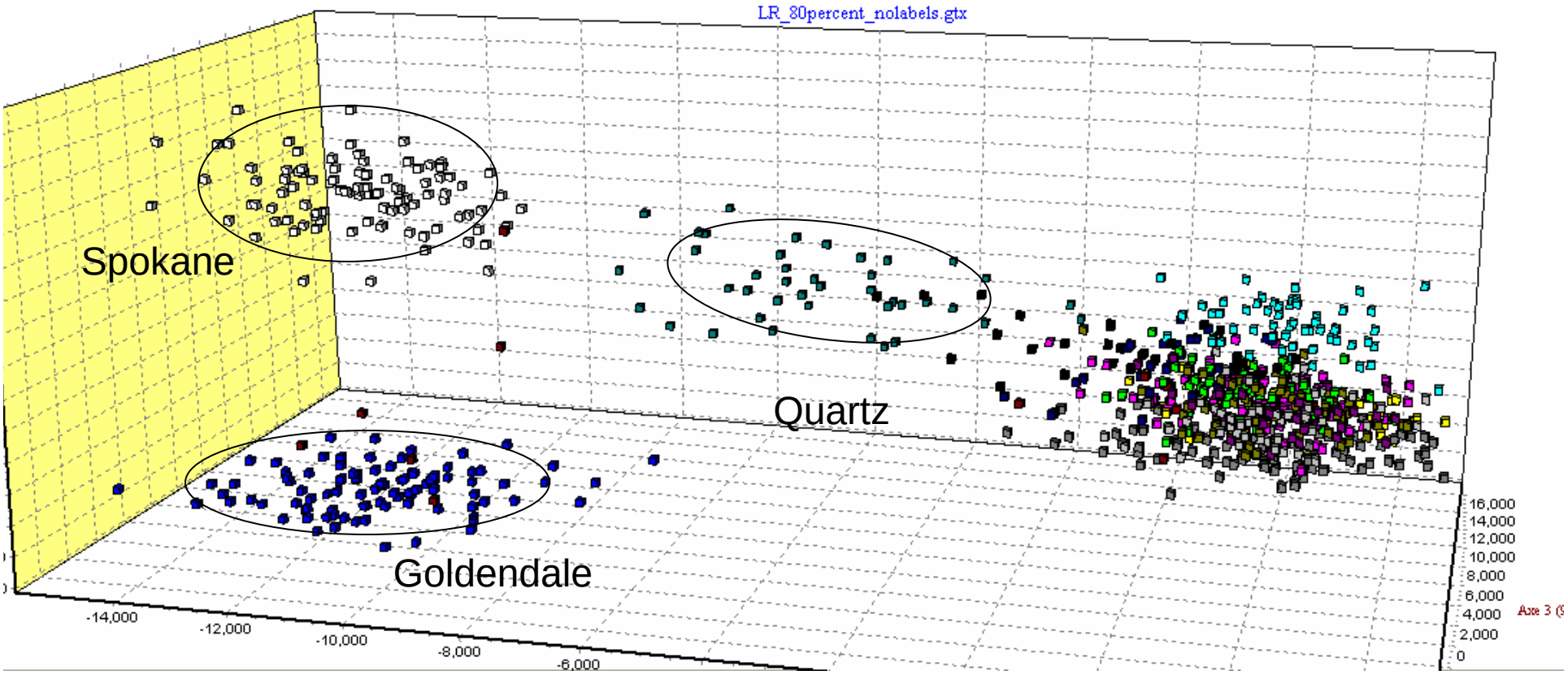
Above	Quartz
	Cussed Hollow
	Muddy
	Eagle Cliff Trap
	Range Cr/Swift Res.
	Siouxon
Below	Merwin Dam 05 & 06
	Hatchery winters
	Hatchery summers
	Cedar 96 & 03
	EF Lewis
	Goldendale & Spokane



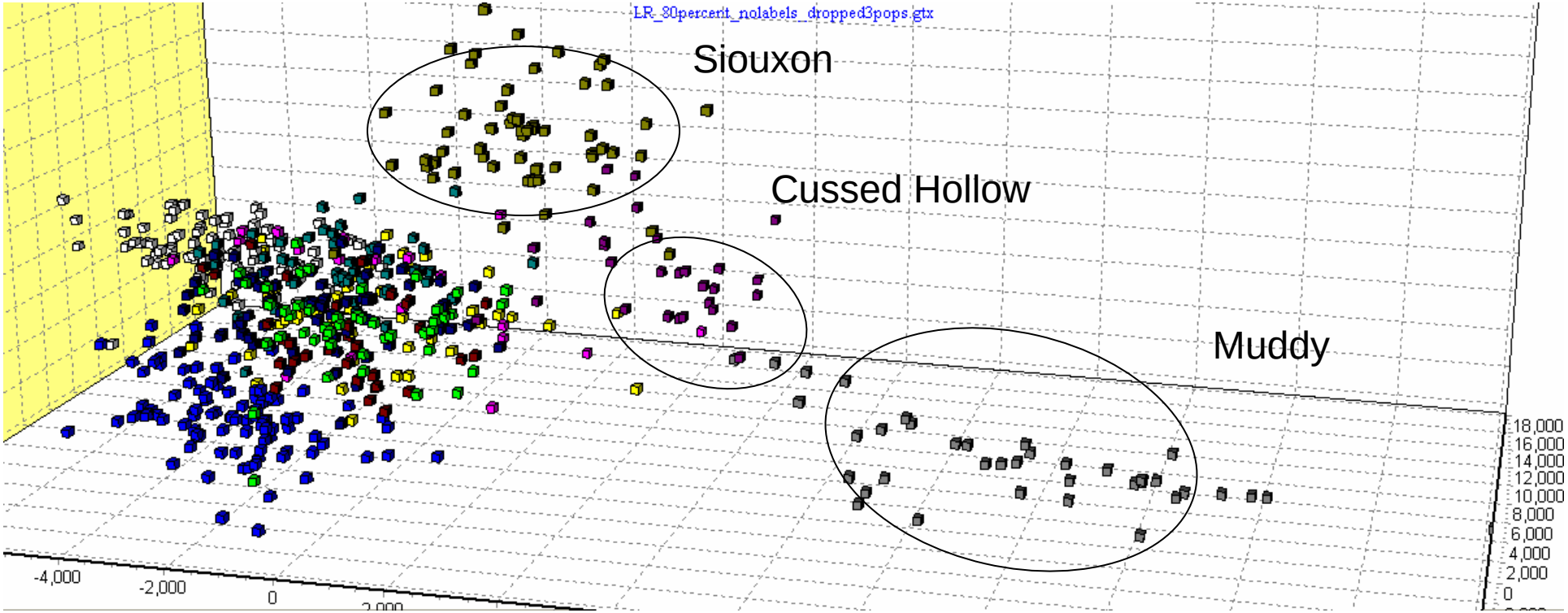
Cavalli 1000 NJ



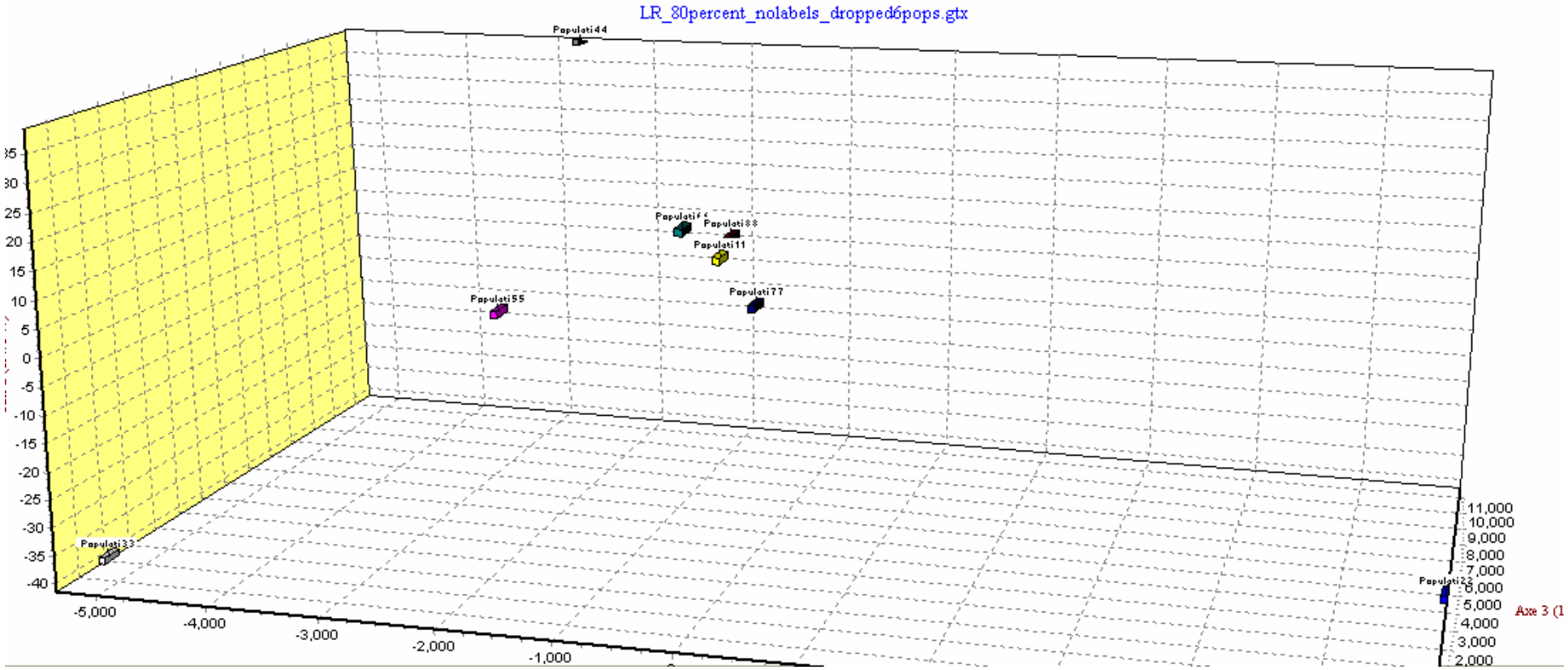
Nei's Distance, UPGMA


LR_80percent_nolabels.gtx
Spokane
Quartz
Goldendale
-14,000
-12,000
-10,000
-8,000
-6,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0

All samples



After dropping Quartz, Goldendale, and Spokane collections.


LR_80percent_nolabels_dropped6pops.gtx
Populati44
Populati88
Populati11
Populati77
Populati55
Populati33
Populati22
Axe 3 (1
-5,000
-4,000
-3,000
-2,000
-1,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
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20
15
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5
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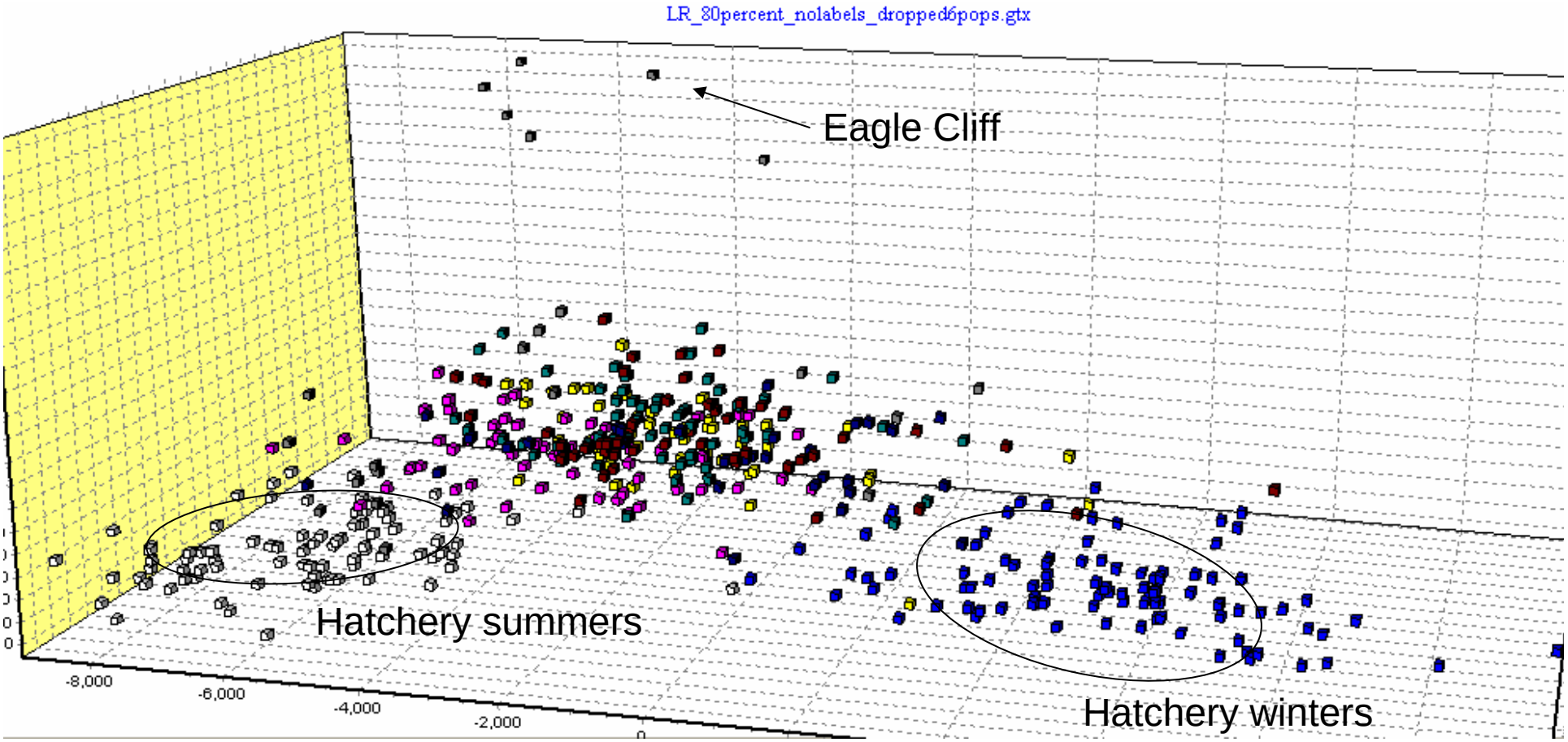
-5
-10
-15
-20
-25
-30
-35
-40


LR_80percent_nolabels_droppedбpops.gtx
Eagle Cliff
Hatchery summers
Hatchery winters
-8,000
-6,000
-4,000
-2,000
0

Why do MHC?

Microsatellites - Neutral variation

- Evolutionary histories and demographic parameters of population structure
  - number of populations
  - levels of differentiation, gene flow
  - founder effects/bottlenecks
  - effective population sizes

MHC - Adaptative variation

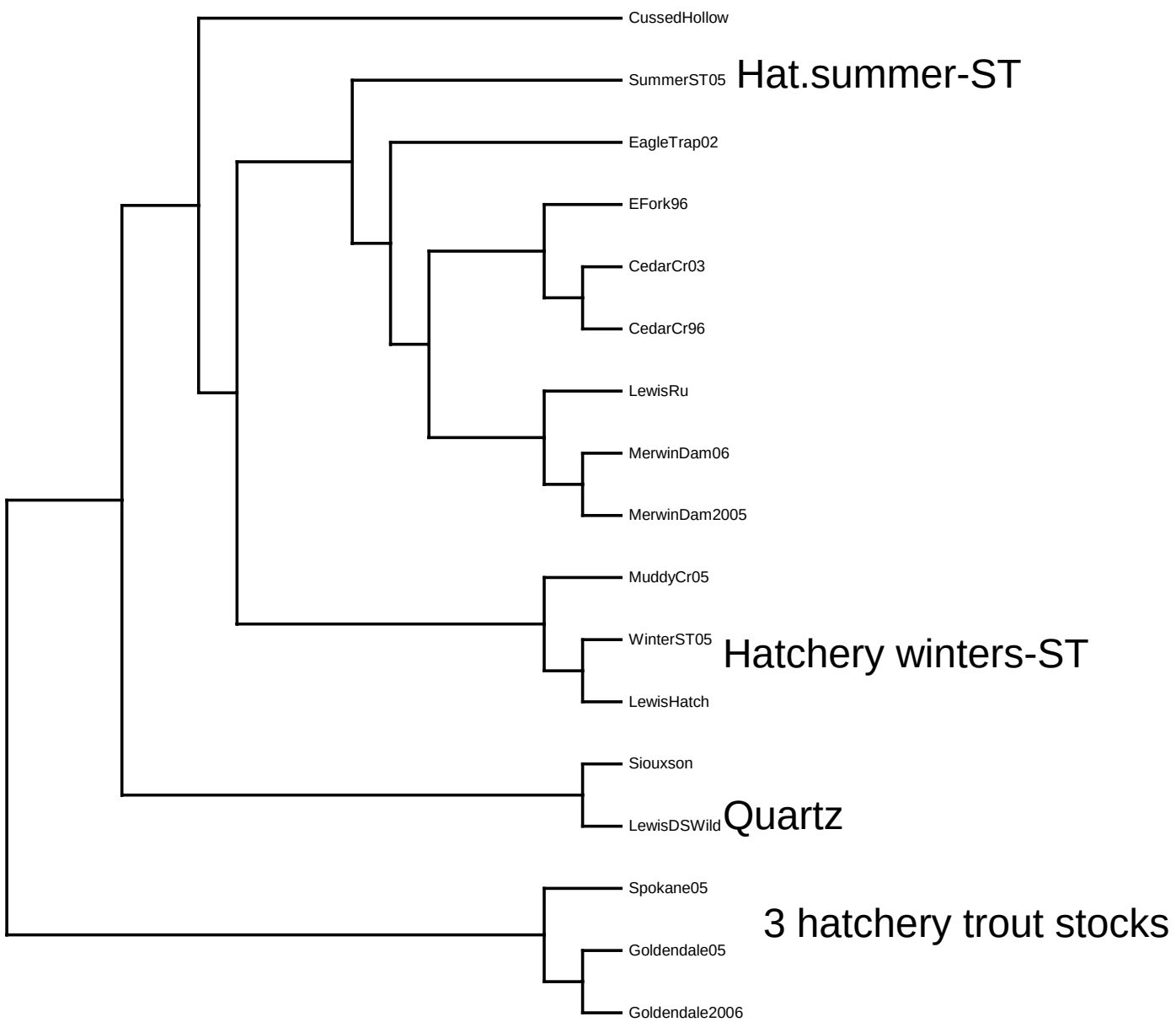
- effects of selection on genetic variation of populations
  - fitness of individuals
  - evolutionary potential of populations

MHC - most significant adaptive loci in vertebrate organisms

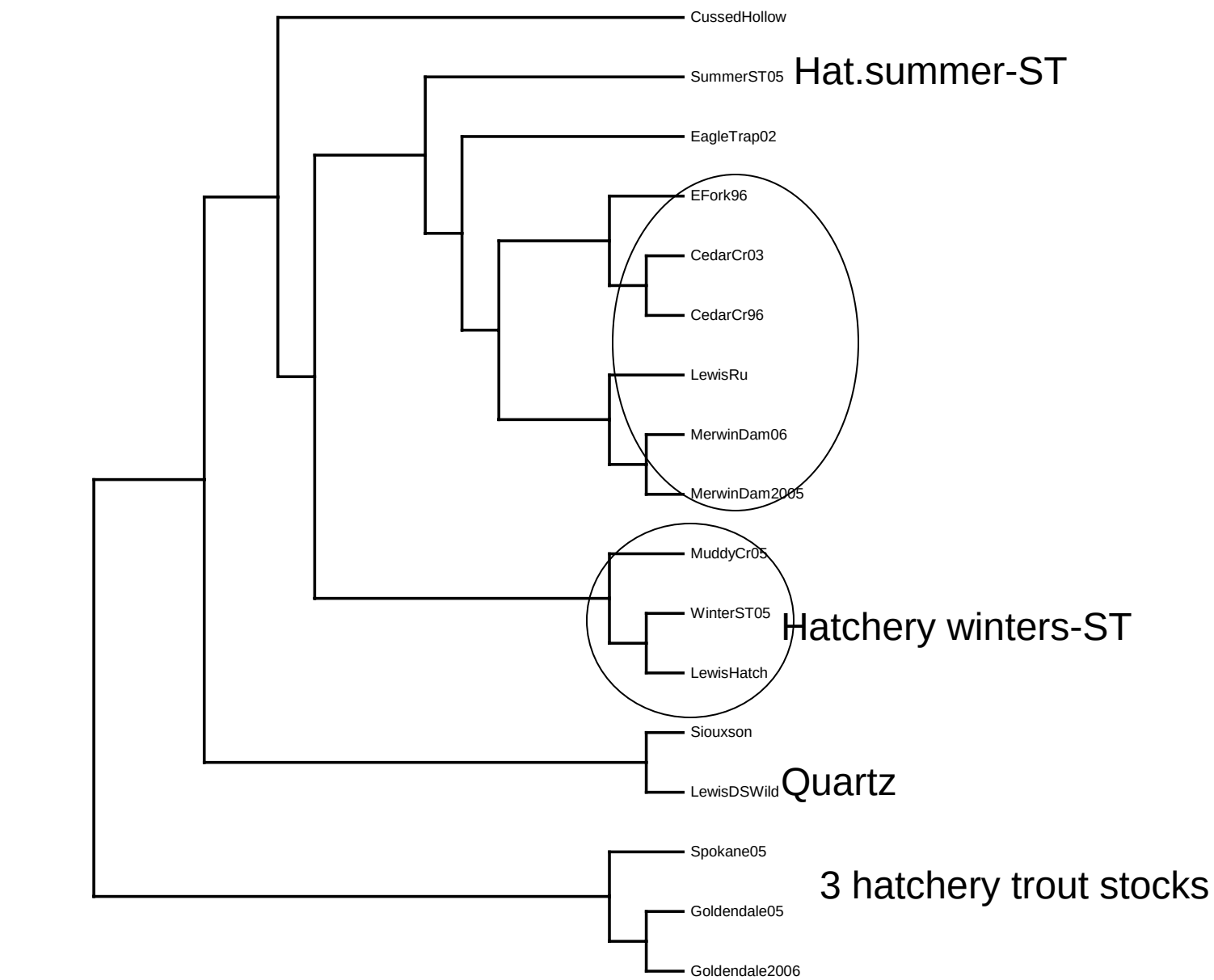
MHC Genes

Adaptive Immunity-
recognition and binding of foreign pathogens

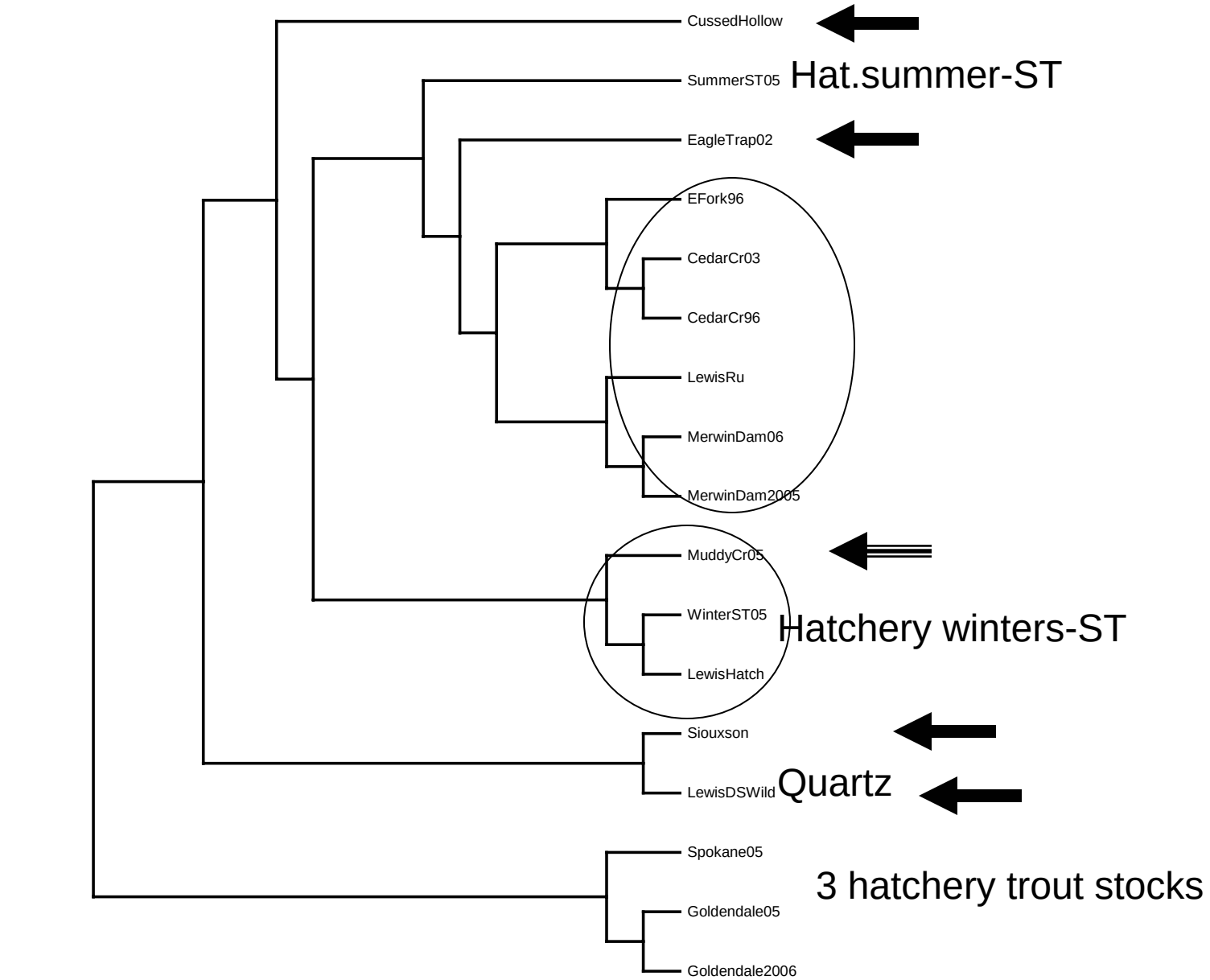
Pathogen-Driven Selection-
alleles differ in their ability to recognize specific antigens


CussedHollow
SummerST05
Hat.summer-ST
EagleTrap02
EFork96
CedarCr03
CedarCr96
LewisRu
MerwinDam06
MerwinDam2005
MuddyCr05
WinterST05
Hatchery winters-ST
LewisHatch
Siouxson
LewisDSWild
Quartz
Spokane05
3 hatchery trout stocks
Goldendale05
Goldendale2006

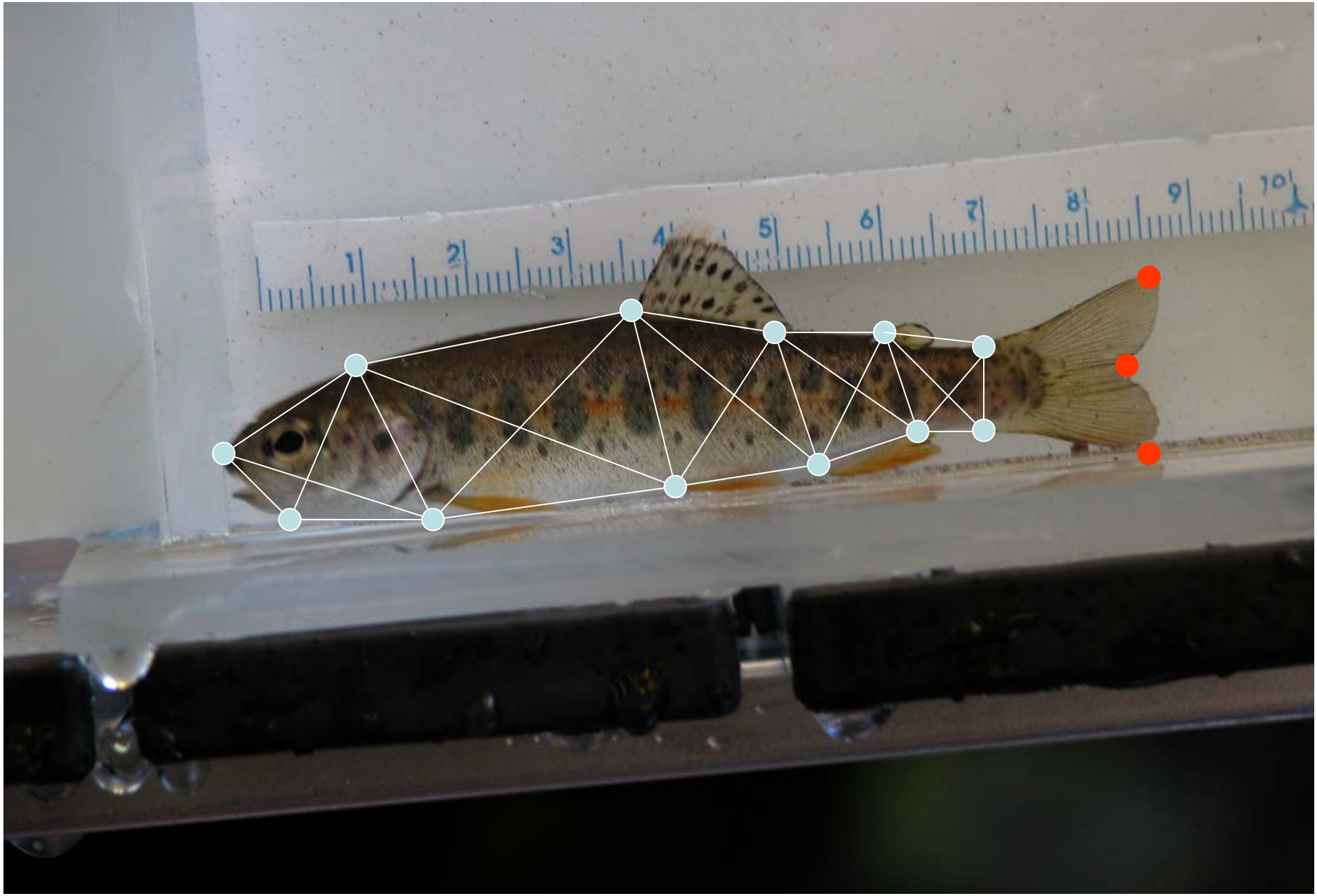
MHC, 1 locus


CussedHollow
SummerST05
Hat.summer-ST
EagleTrap02
EFork96
CedarCr03
CedarCr96
LewisRu
MerwinDam06
MerwinDam2005
MuddyCr05
WinterST05
Hatchery winters-ST
LewisHatch
Siouxson
LewisDSWild
Quartz
Spokane05
3 hatchery trout stocks
Goldendale05
Goldendale2006

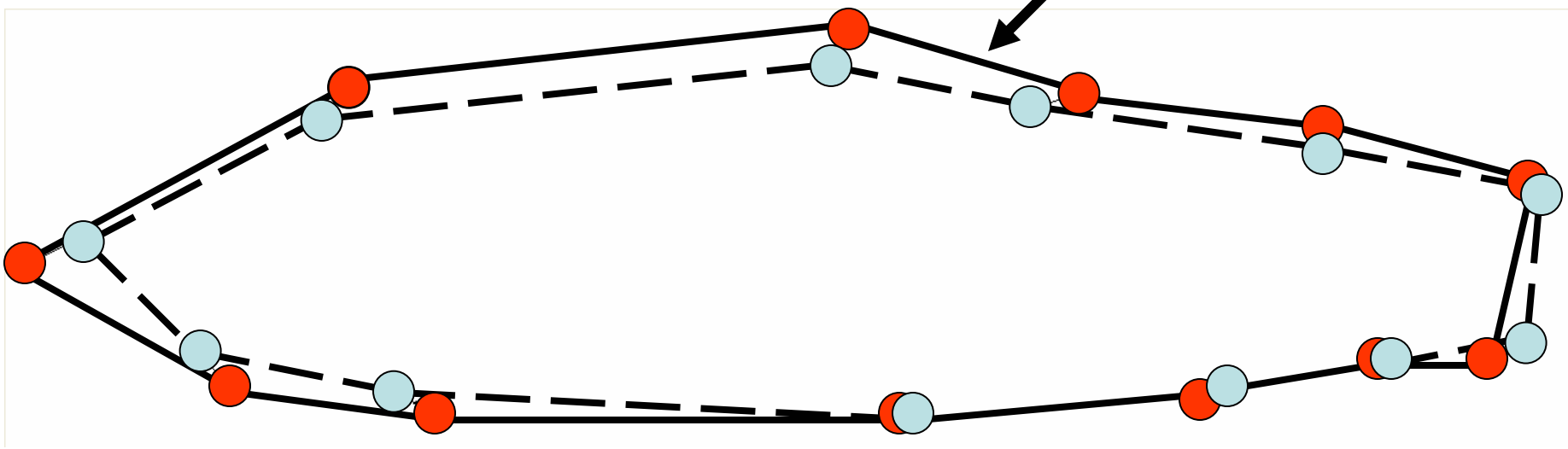
MHC, 1 locus


CussedHollow
SummerST05
EagleTrap02
EFork96
CedarCr03
CedarCr96
LewisRu
MerwinDam06
MerwinDam2005
MuddyCr05
WinterST05
LewisHatch
Siouxson
LewisDSWild
Spokane05
Goldendale05
Goldendale2006
Hat.summer-ST
Hatchery winters-ST
Quartz
3 hatchery trout stocks

MHC, 1 locus



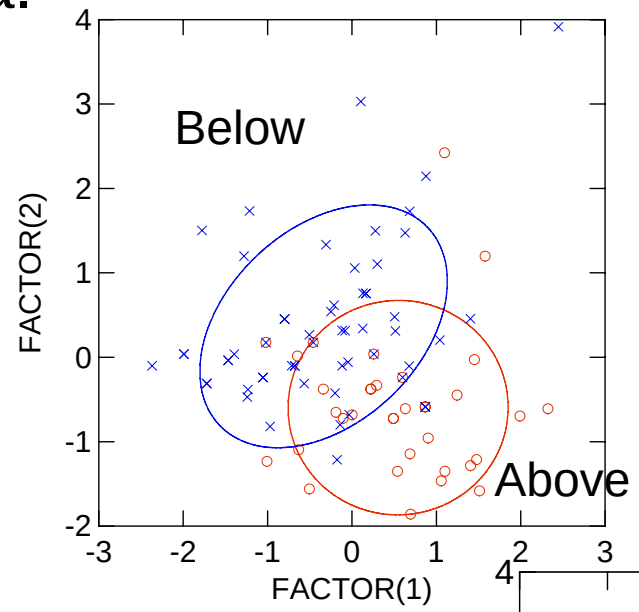
Shape differences: resident vs. consensus



Neg RW1; elongate nose, deeper head; deeper trunk; v. shortened CP

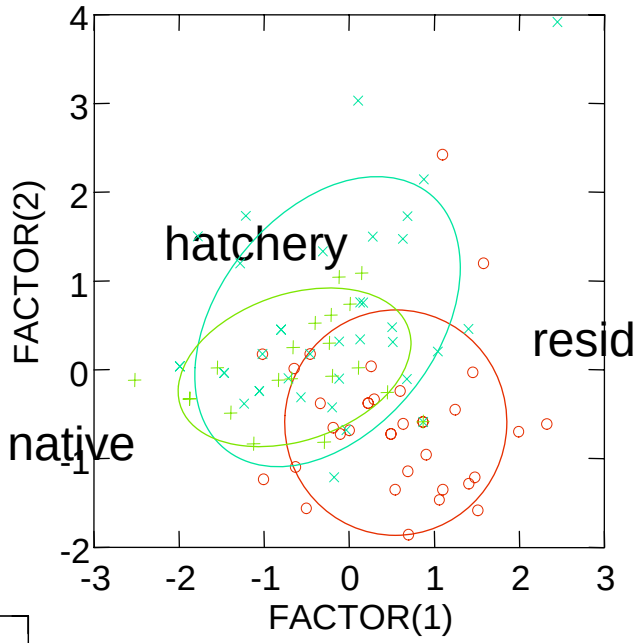
Parr analysis of 5 collections using 11 parr variables

a.



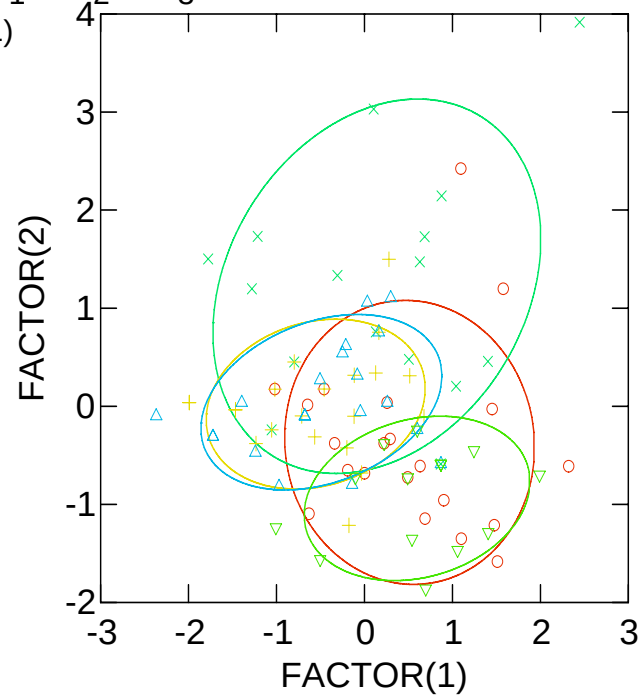
b.

D parr



Total LL parr

Total parr

c.

3 may03 4 hatch04 691
10 hatch05
11 wild05,33825
12 maywood 06