Yakima River Steelhead: A Preview of Updated Genetic Structure and Escapement Comparison Between Independent Methods

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Photo: Zack Mays

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Yakima River Summer Run Steelhead

Populations

upper Yakima R.
Gmean: 151

Naches R.
Gmean: 840

Toppenish Cr.
Gmean: 599

Satus Cr.
Gmean: 660

Yakima River steelhead status

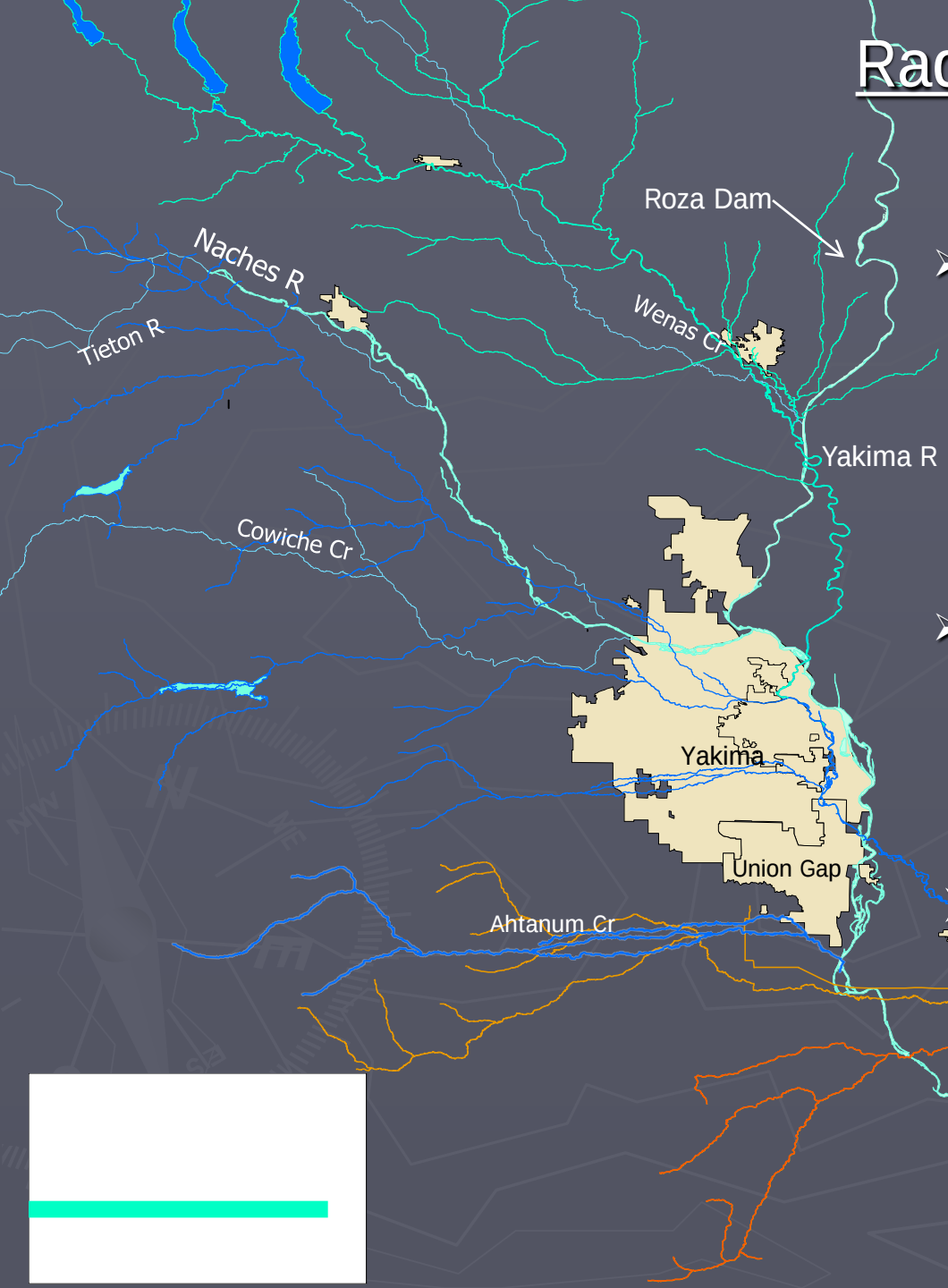
- 1999 Mid Columbia DPS listed as threatened

Yakima River adult steelhead counts

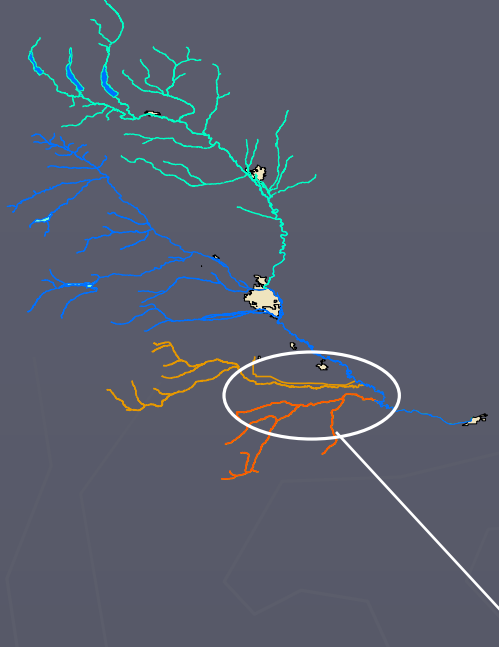
Enumeration 2002-2013
- Avg 3,951 (1,537-6796)

Prosser

Radio Telemetry Objectives (2012 – 2014)

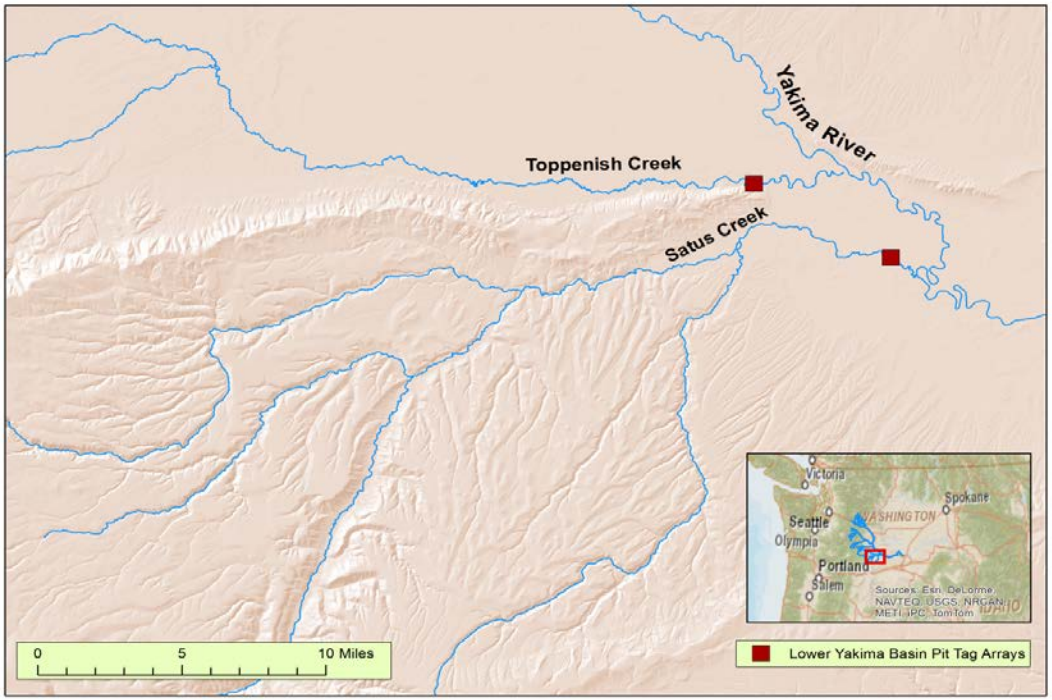


- Generate adult abundance estimates
  - Estimate population specific adult abundance
  - Test & validate long term methods
    - GSI
    - Remote instream PIT-arrays
- Refine upper Yakima & Naches spawning distributions
  - Clarify extent, distribution, and contribution of mainstem spawners
- Collect life history/demographic data



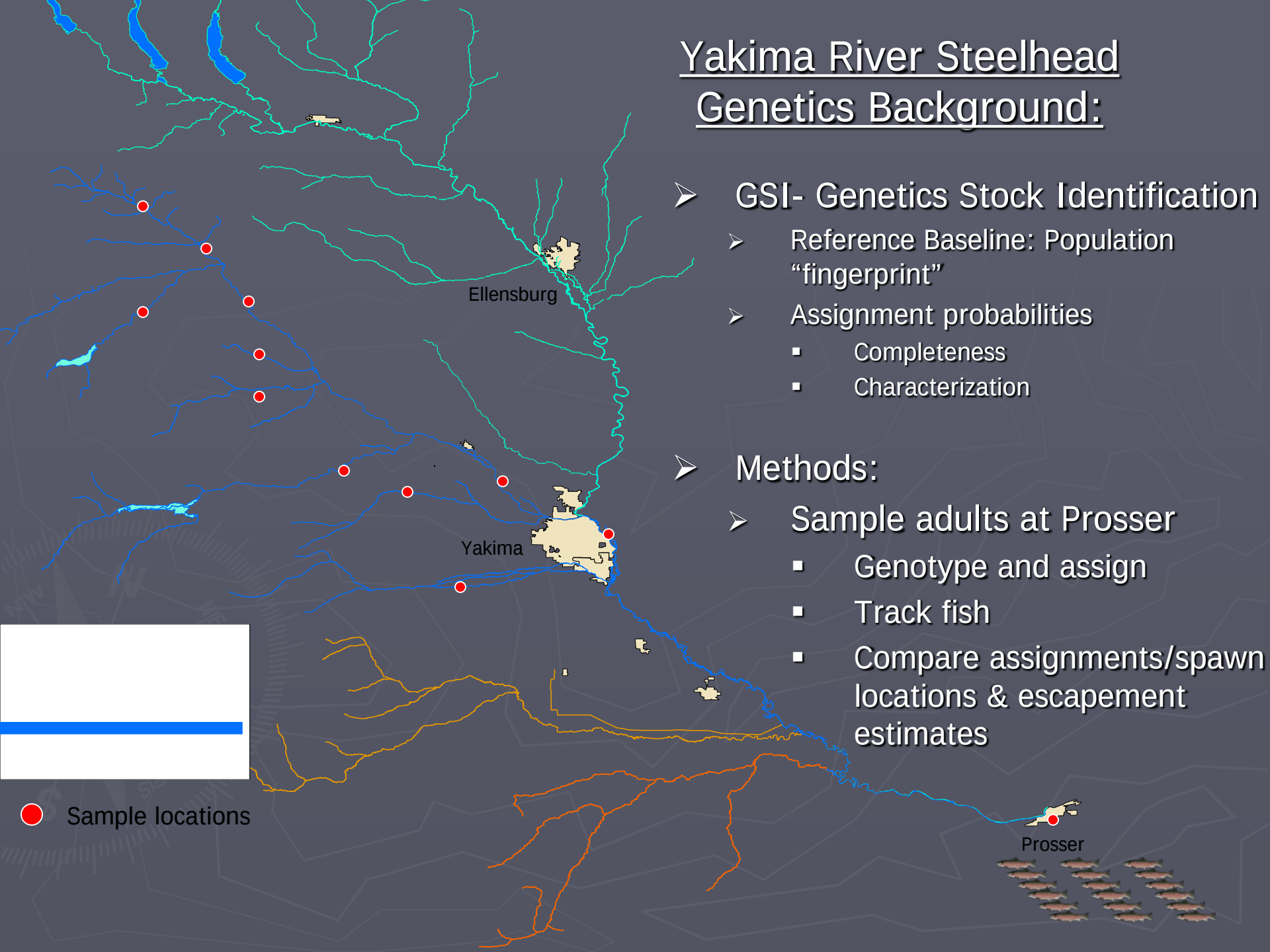
Remote Instream PIT-tag Detection Arrays:

- Satus & Toppenish Cr
  - Installed prior to Telemetry Study
    - 2 channel spanning antenna arrays
  - Use Telemetry to estimate Detection efficiencies
    - Fixed telemetry monitoring equipment at site
    - Steelhead outfitted Rtags, Ptags
  - Presence/absence of simultaneous detections
  - Generate escapement estimates
    - Compare to telemetry



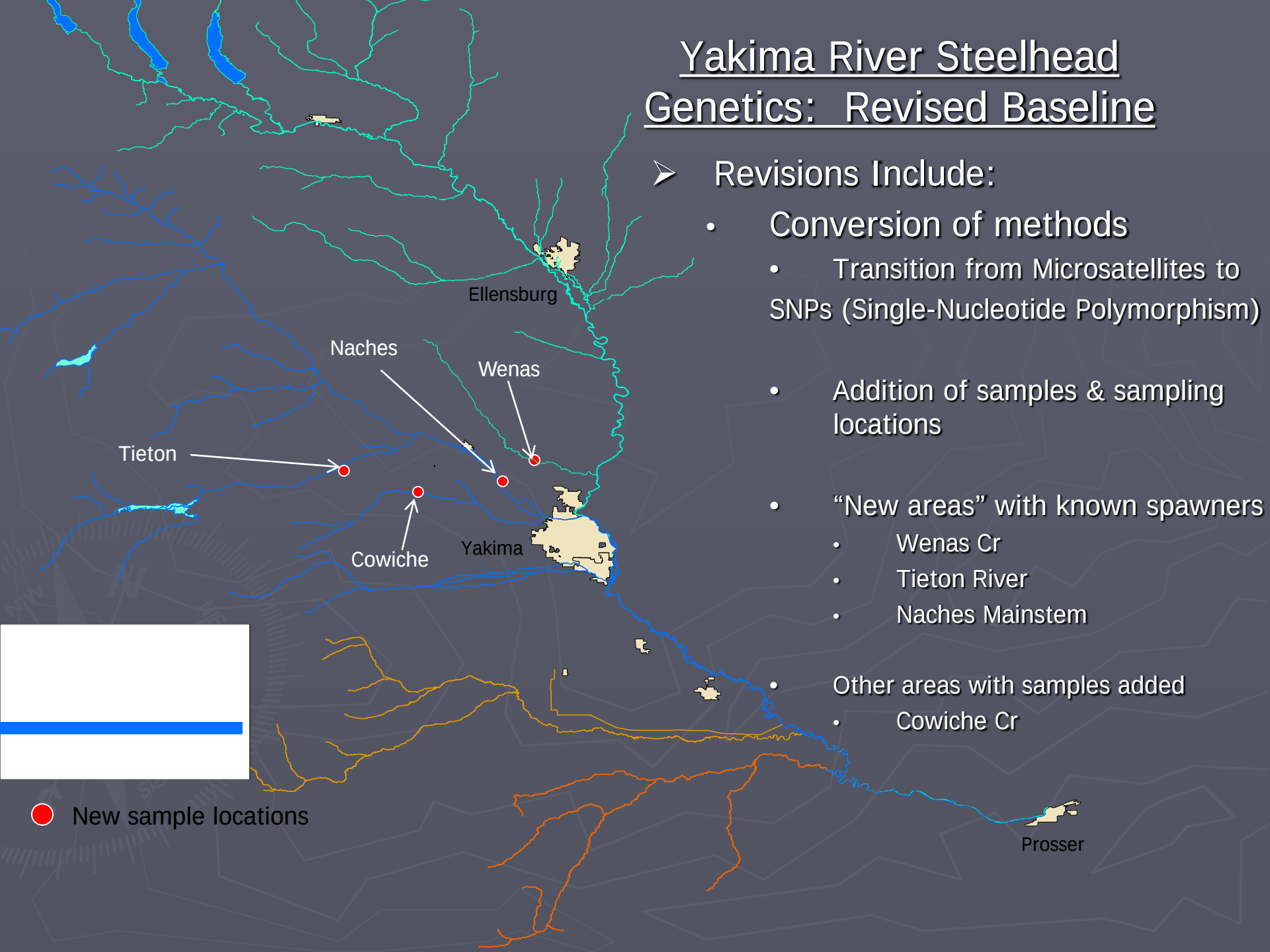
Yakima River Steelhead Genetics Background:

- GSI- Genetics Stock Identification
  - Reference Baseline: Population "fingerprint"
  - Assignment probabilities
    - Completeness
    - Characterization
- Methods:
  - Sample adults at Prosser
    - Genotype and assign
    - Track fish
    - Compare assignments/spawn locations & escapement estimates



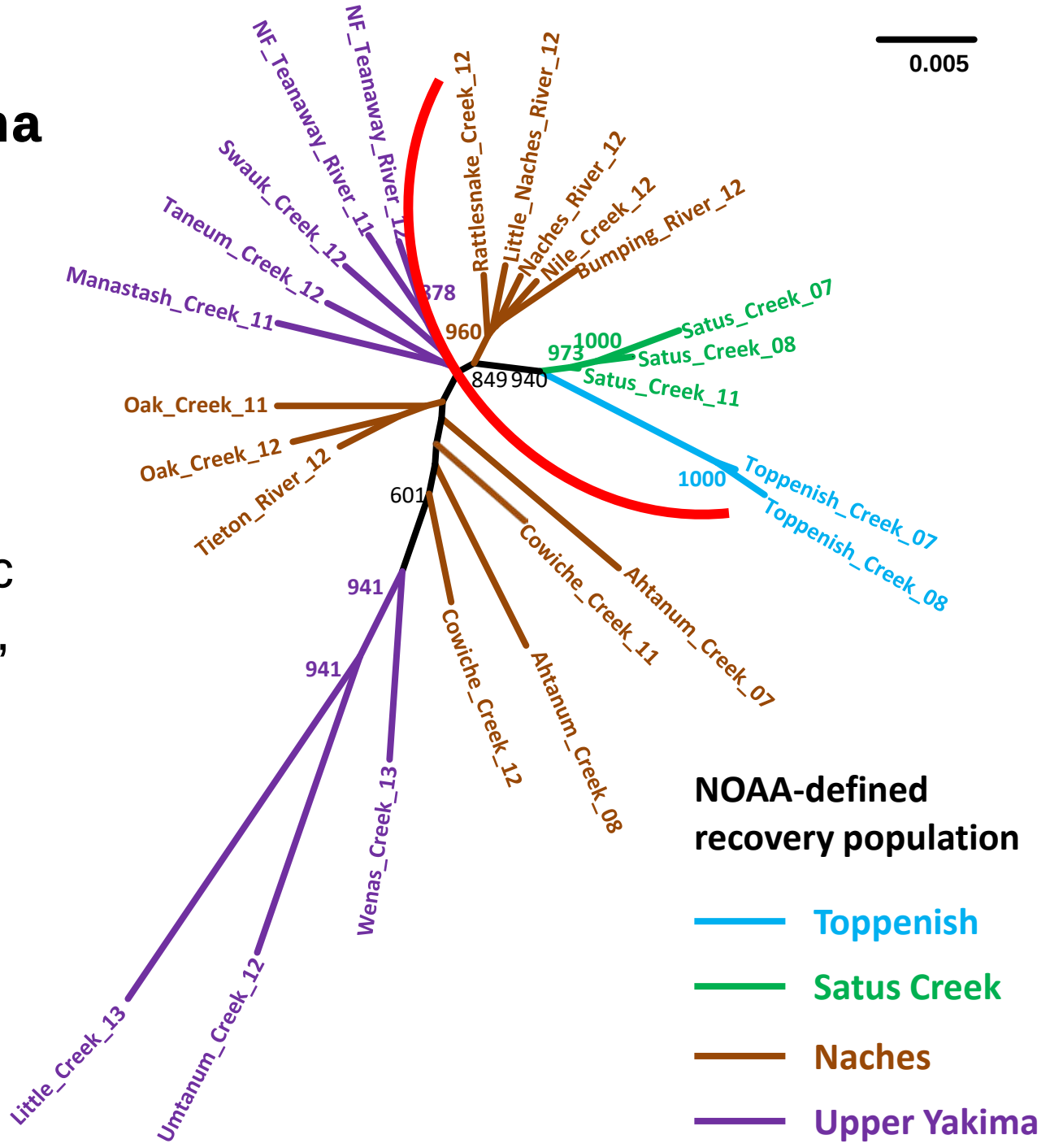
Yakima River Steelhead Genetics: Revised Baseline

- Revisions Include:
  - Conversion of methods
    - Transition from Microsatellites to SNPs (Single-Nucleotide Polymorphism)
  - Addition of samples & sampling locations
  - "New areas" with known spawners
    - Wenas Cr
    - Tieton River
    - Naches Mainstem
  - Other areas with samples added
    - Cowiche Cr



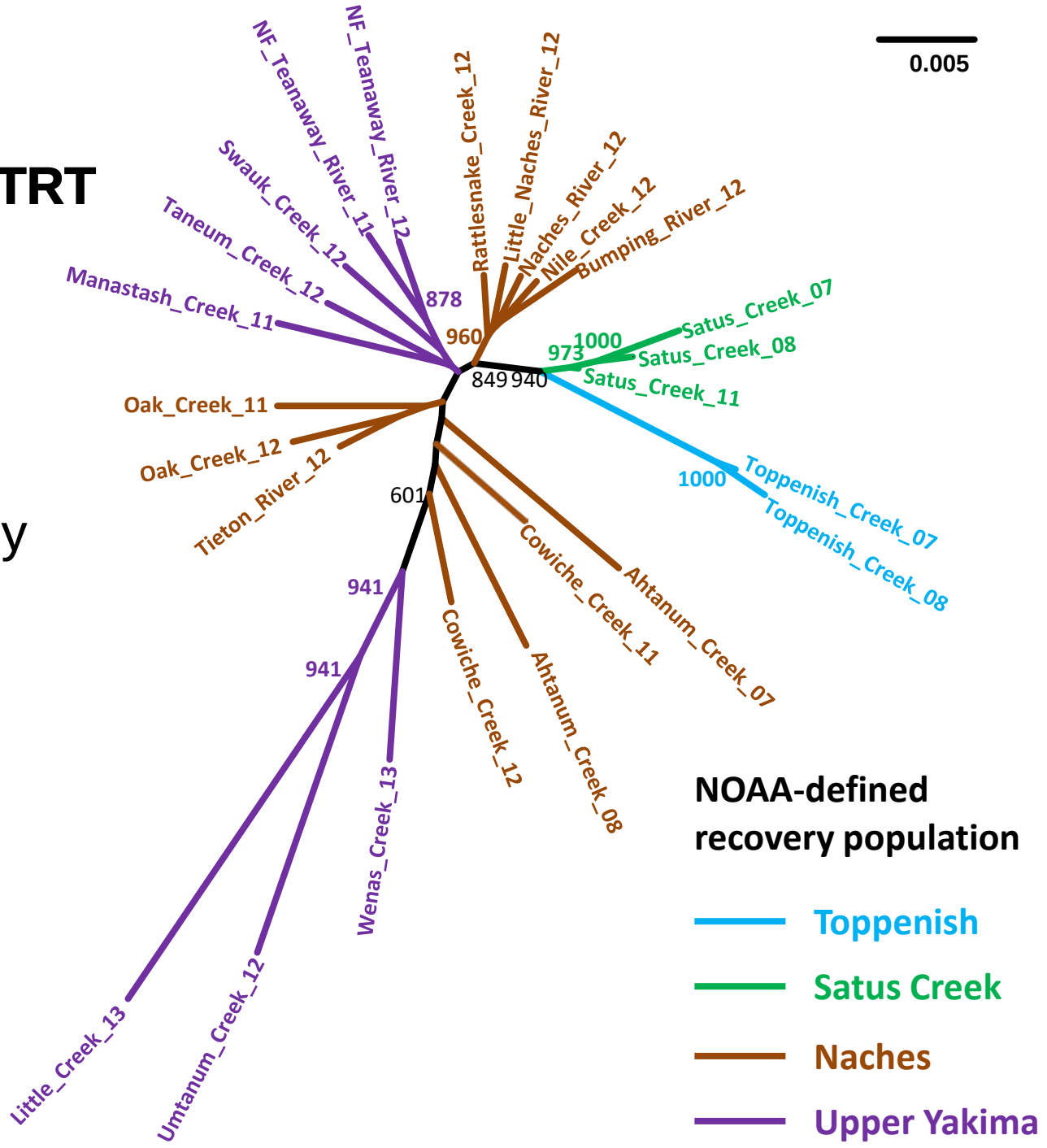
Observed genetic structure of Yakima MPG Steelhead

The data strongly support the genetic structure of **Satus**, **Toppenish**, and upper **Naches** collections



Observed genetic structure partially aligns with NOAA TRT defined recovery populations

The data do not strongly support any structure among most of the **Upper Yakima** and lower **Naches** collections



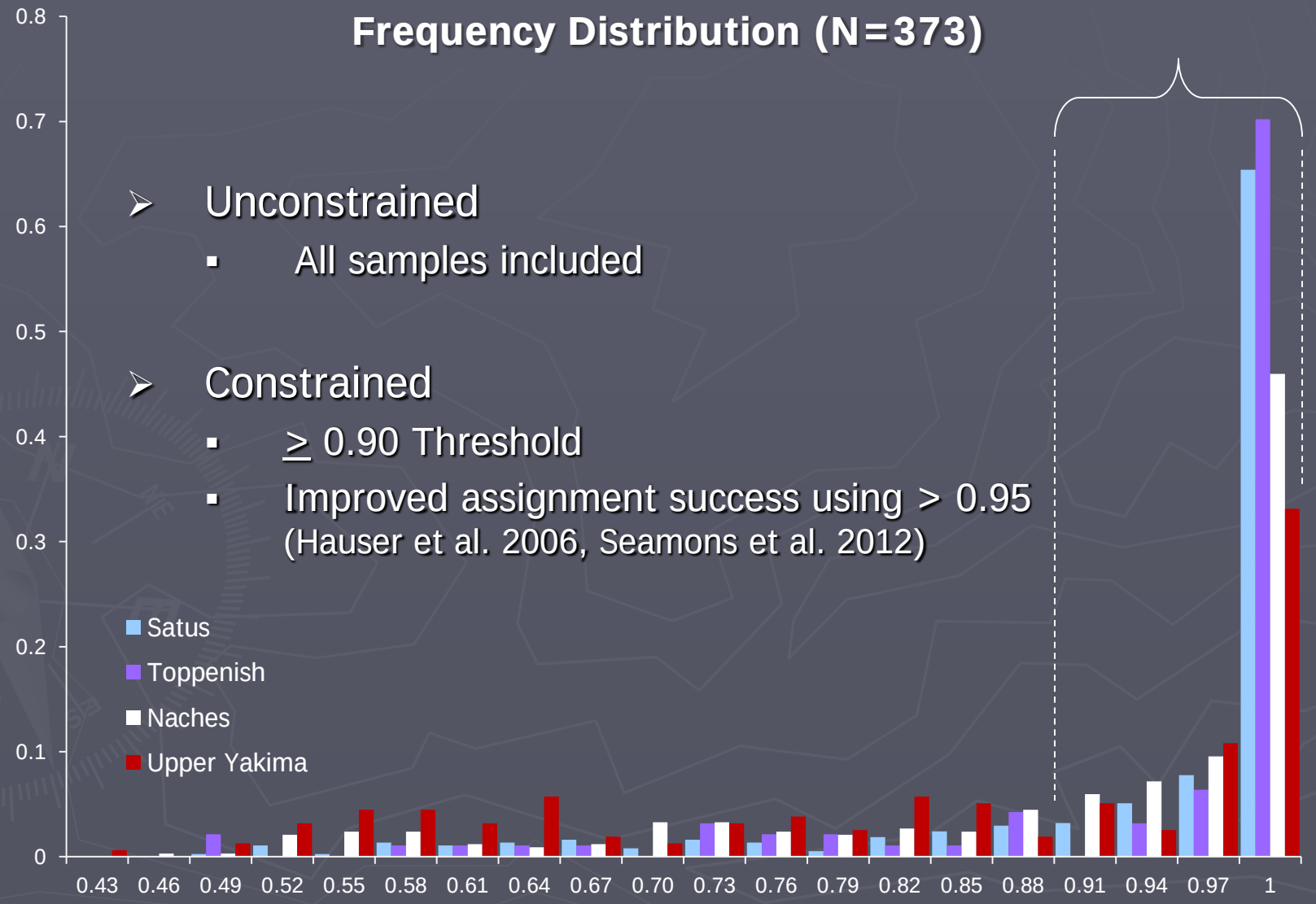
Low power for assigning upper Yakima migrants (preliminary)

Upper Yakima incorrect assignments mostly to Naches reporting group, except for NF Teanaway.

NF Teanaway evenly split between incorrect assignments to Satus and Naches

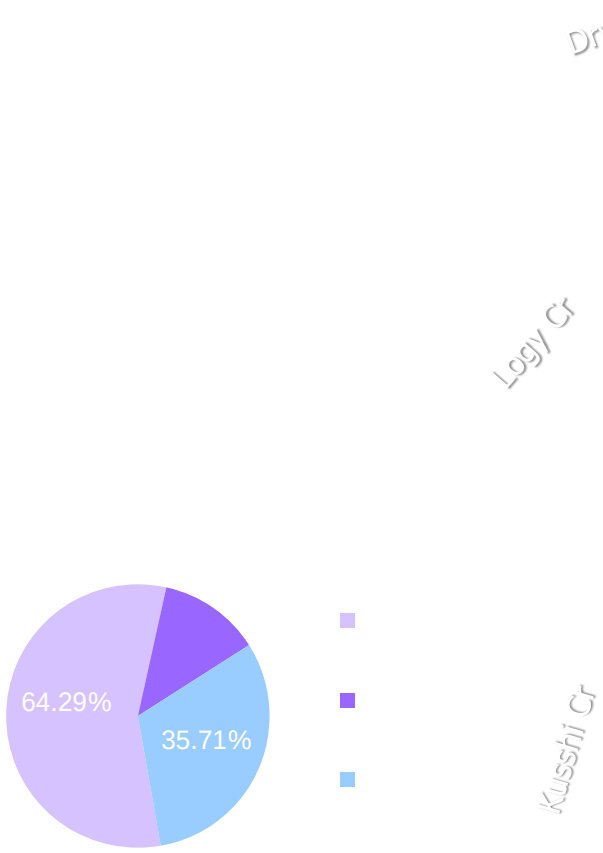
	Assignment rate (%) to:	
Collection	Population	Reporting group
Satus_Creek_07	99.6	99.6
Satus_Creek_08	99.8	99.8
Satus_Creek_11	99.0	99.0
Toppenish_Creek_07	99.7	99.7
Toppenish_Creek_08	99.9	99.9
Ahtanum_Creek_07	5.2	85.7
Ahtanum_Creek_08	51.4	96.7
Cowiche_Creek_11	79.2	96.7
Cowiche_Creek_12	81.1	95.7
Tieton_River_12	81.4	98.1
Oak_Creek_11	74.6	97.7
Oak_Creek_12	36.2	98.4
Naches_River_12	39.2	98.1
Little_Naches_River_12	68.4	98.1
Rattlesnake_Creek_12	70.8	98.5
Nile_Creek_12	74.7	98.8
Bumping_River_13	80.2	98.5
Wenas_Creek_13	96.1	96.8
lower_Umtanum_Creek_12	62.7	79.9
Manastash_Creek_11	72.2	83.6
Taneum_Creek_12	58.0	76.2
Swauk_Creek_12	69.5	88.0
NF_Teanaway_River_11	84.4	89.2
NF_Teanaway_River_12	78.9	84.7
Little_Creek_13	94.2	96.5

Genetics Methods Background:



- Unconstrained
  - All samples included
- Constrained
  - ≥ 0.90 Threshold
  - Improved assignment success using > 0.95 (Hauser et al. 2006, Seamons et al. 2012)

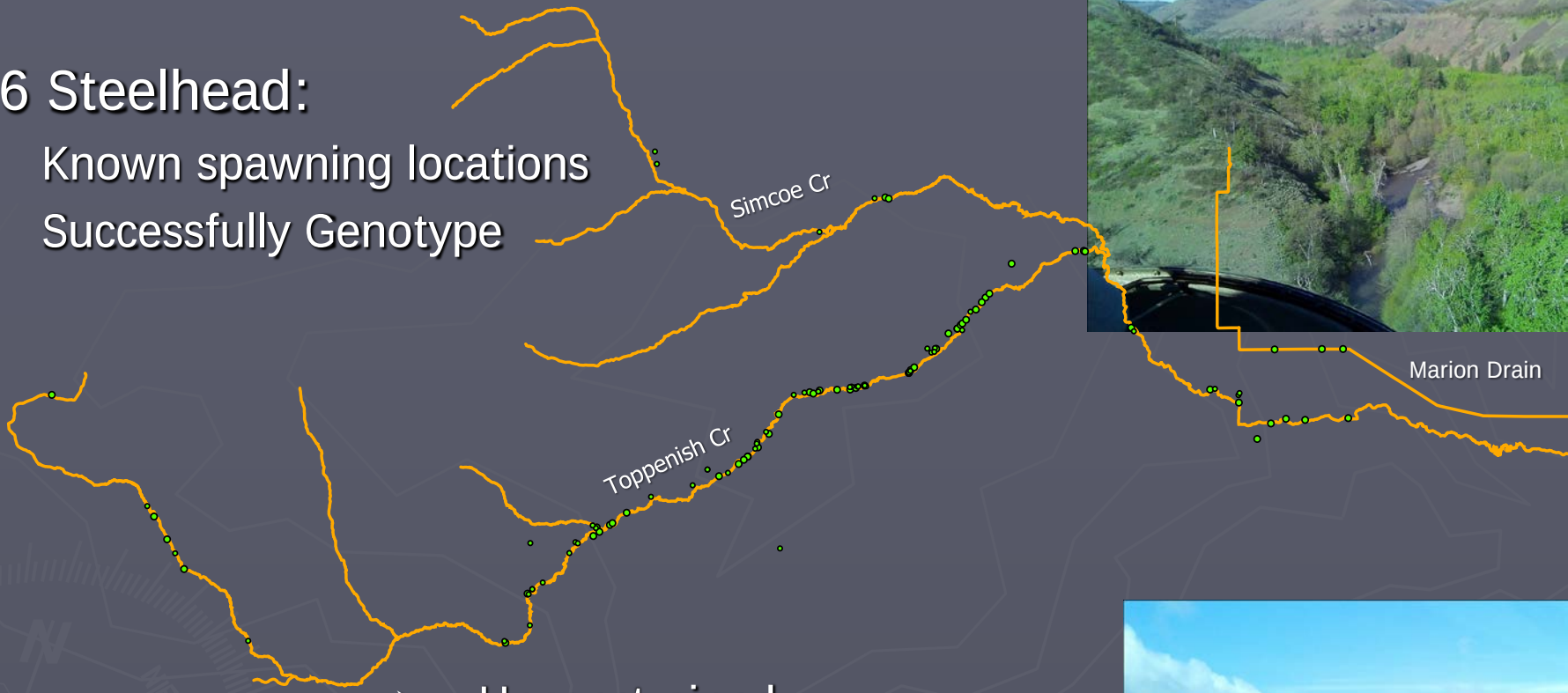
Satus Cr Population



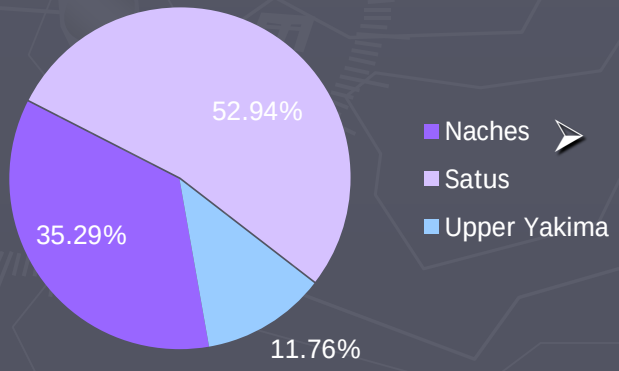
- 153 Steelhead:
  - Known spawning locations
  - Successfully Genotype
- Unconstrained
  - 139 (90.9%) correctly assigned
- Constrained (>.90 Threshold)
  - 27 samples dropped
  - 125 (99.2%) correctly assigned

Toppenish Cr (w/Marion Drain)

- 56 Steelhead:
  - Known spawning locations
  - Successfully Genotype



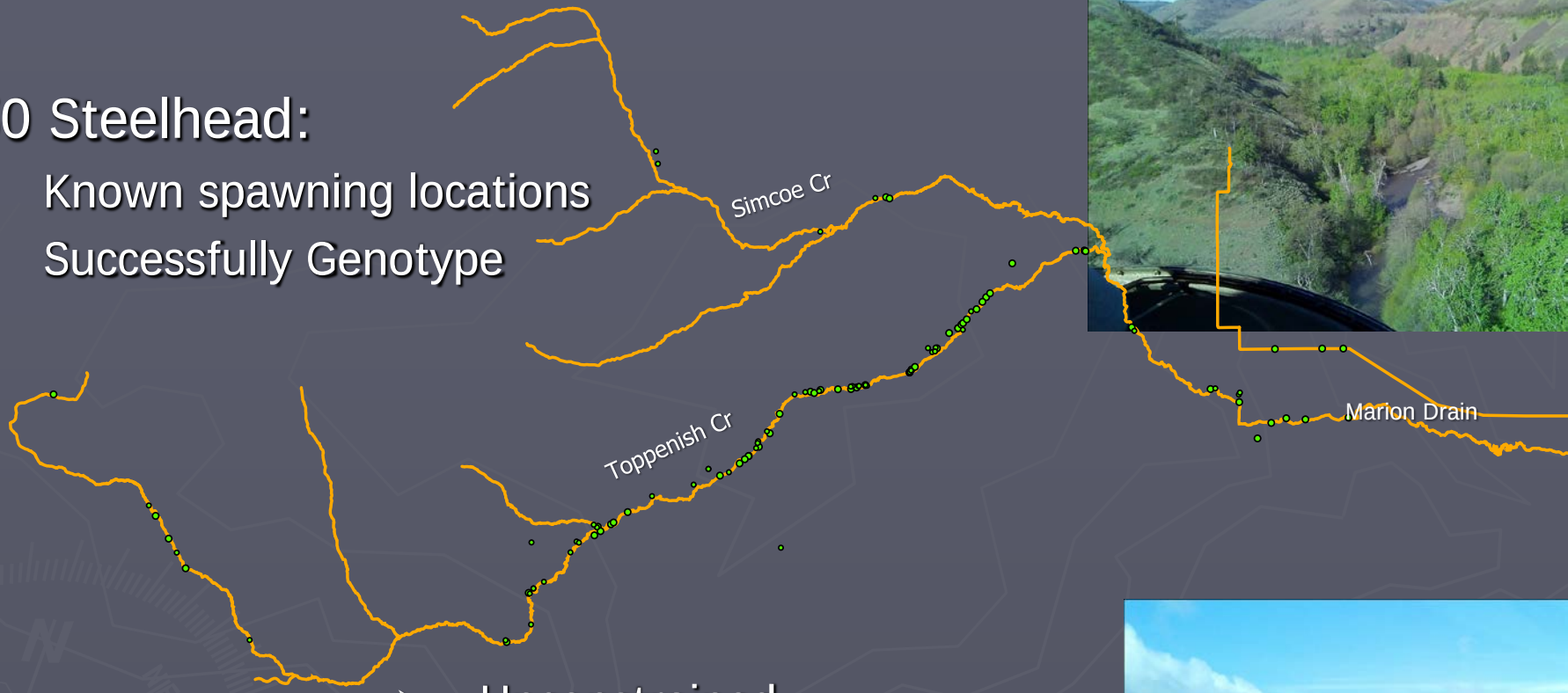
Misassignments (n=17)



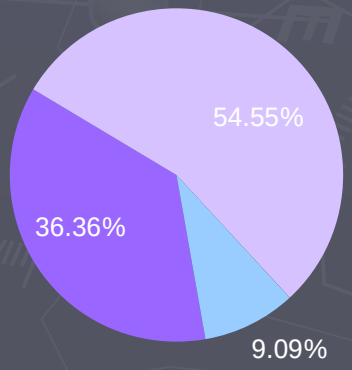
- Unconstrained
  - 39 (69.6%) correctly assigned
- Constrained (>.90 Threshold)
  - 11 samples dropped
  - 32 (71.1%) correctly assigned

Toppenish Cr (wo/Marion Drain)

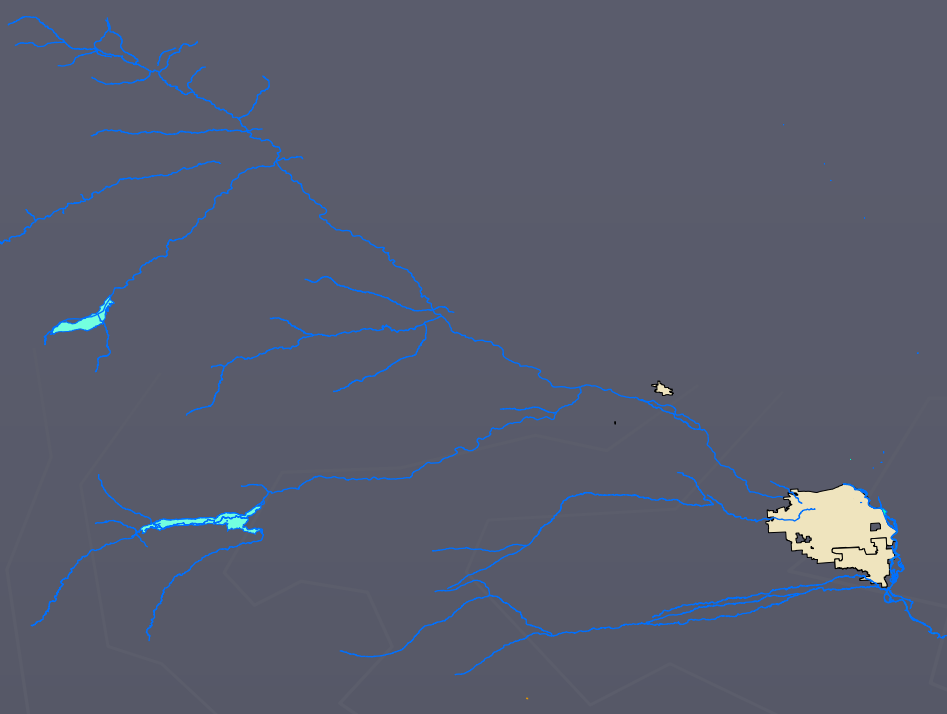
- 50 Steelhead:
  - Known spawning locations
  - Successfully Genotype



Misassignments (n=11)



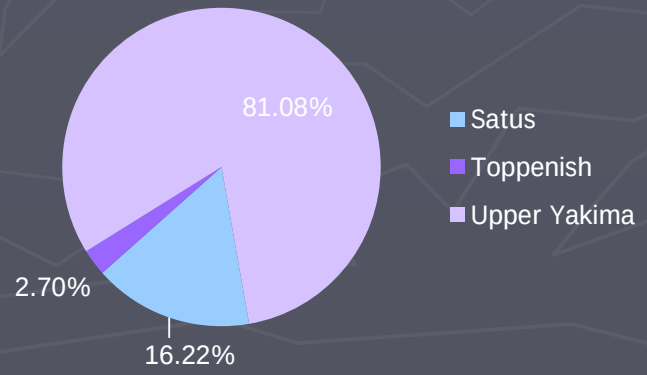
- Unconstrained
  - 39 (78.0%) correctly assigned
- Constrained (>.90 Threshold)
  - 11 samples dropped
  - 32 (82.1%) correctly assigned



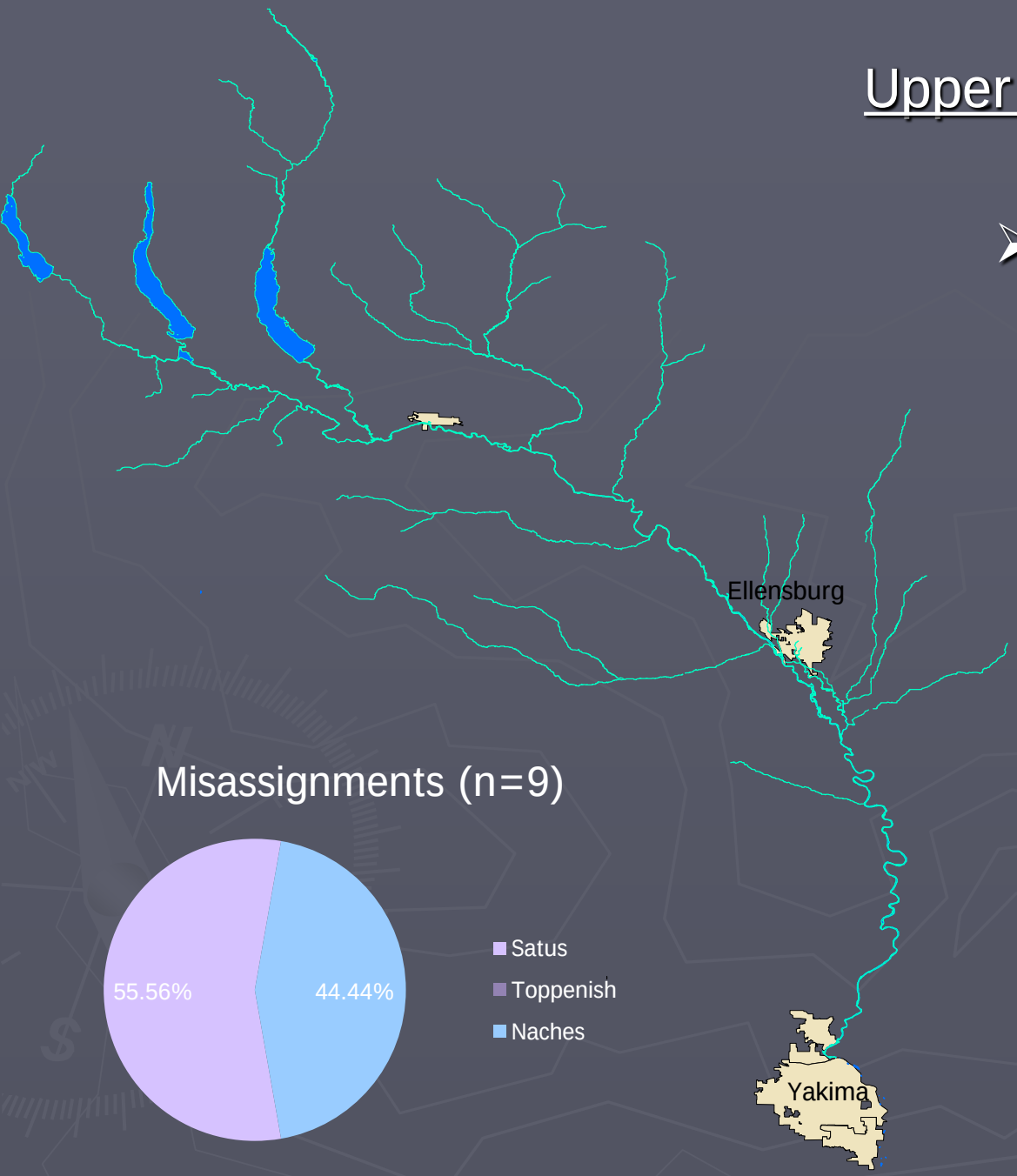
Naches Population:

- 139 Steelhead:
  - Known spawning locations
  - Successfully Genotype
  - Unconstrained
    - 102 (73.4%) correctly assigned
  - Constrained (>.90 Threshold)
    - 54 samples dropped
    - 74 (87.1%) correctly assigned

Misassignments (n=37)



Upper Yakima Population:

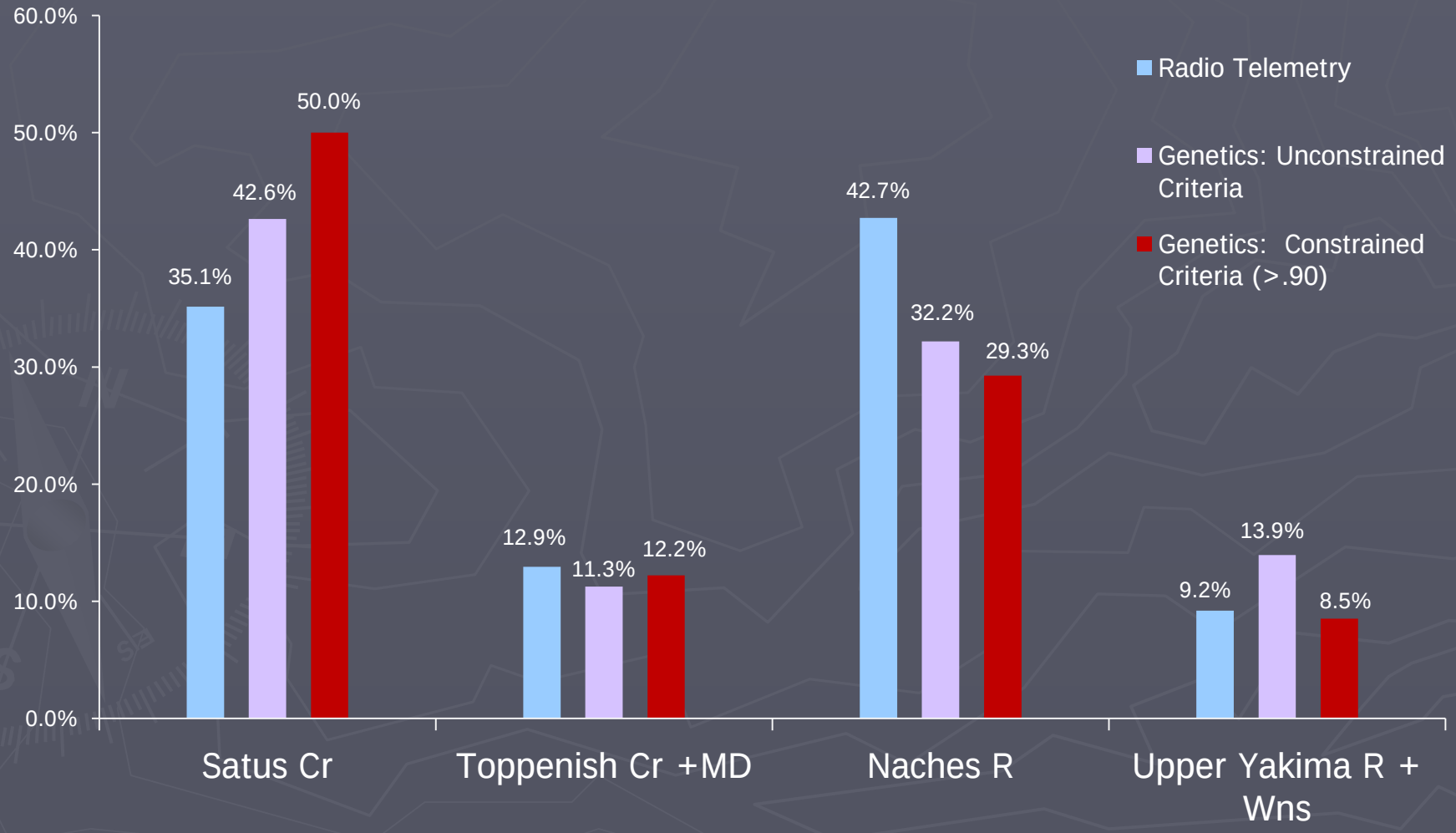


- 25 Steelhead:
  - Known spawning locations
  - Successfully Genotype
  - Unconstrained
    - 16 (64.0%) correctly assigned
  - Constrained (>.90 Threshold)
    - 11 samples dropped
    - 12 (85.7%) correctly assigned

Misassignments (n=9)

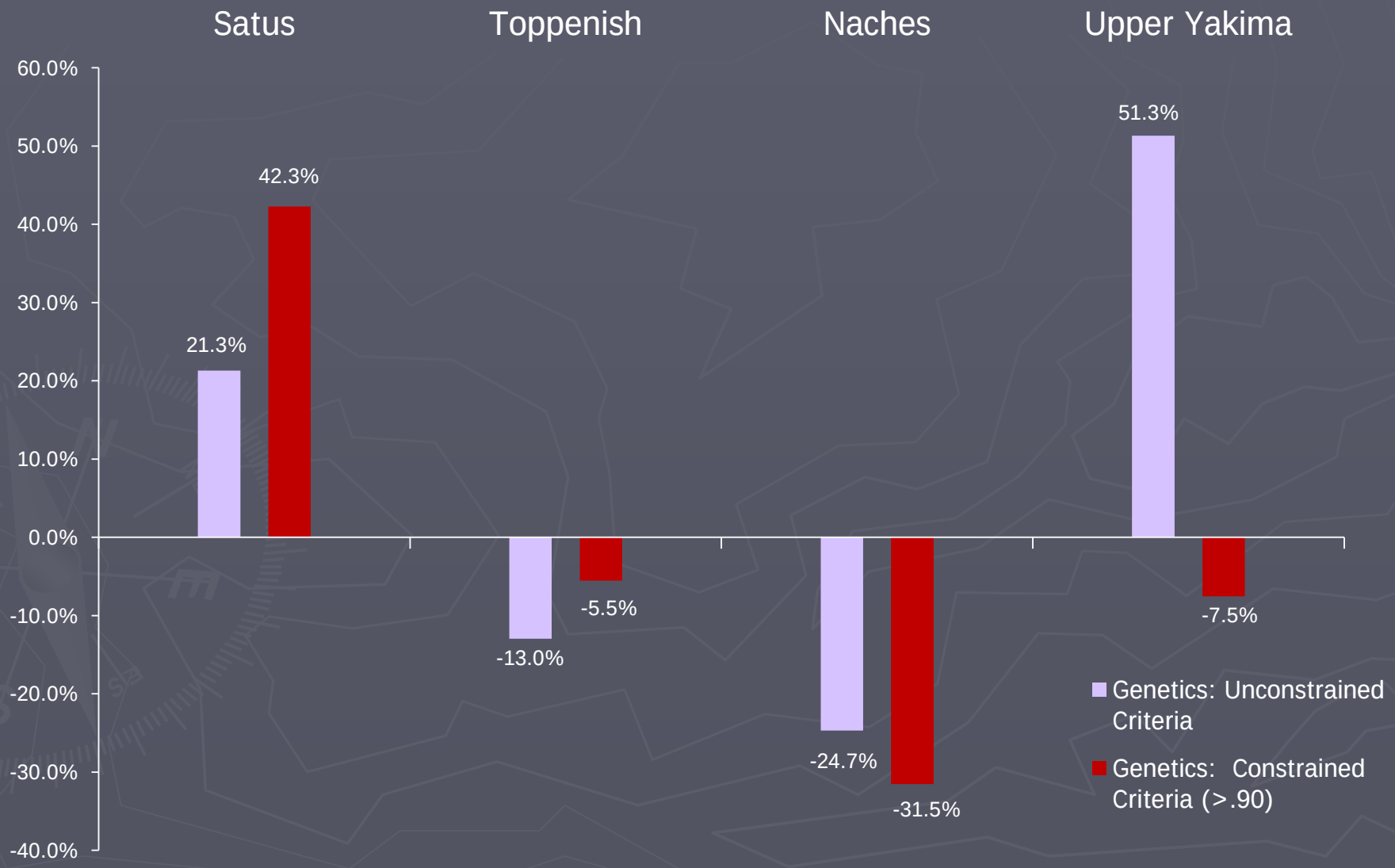
Adult Escapement Methods Comparison

-Graph expressed as % of Yakima MPG spawner escapement
-Genetics: Individual Based Summation (N=373)

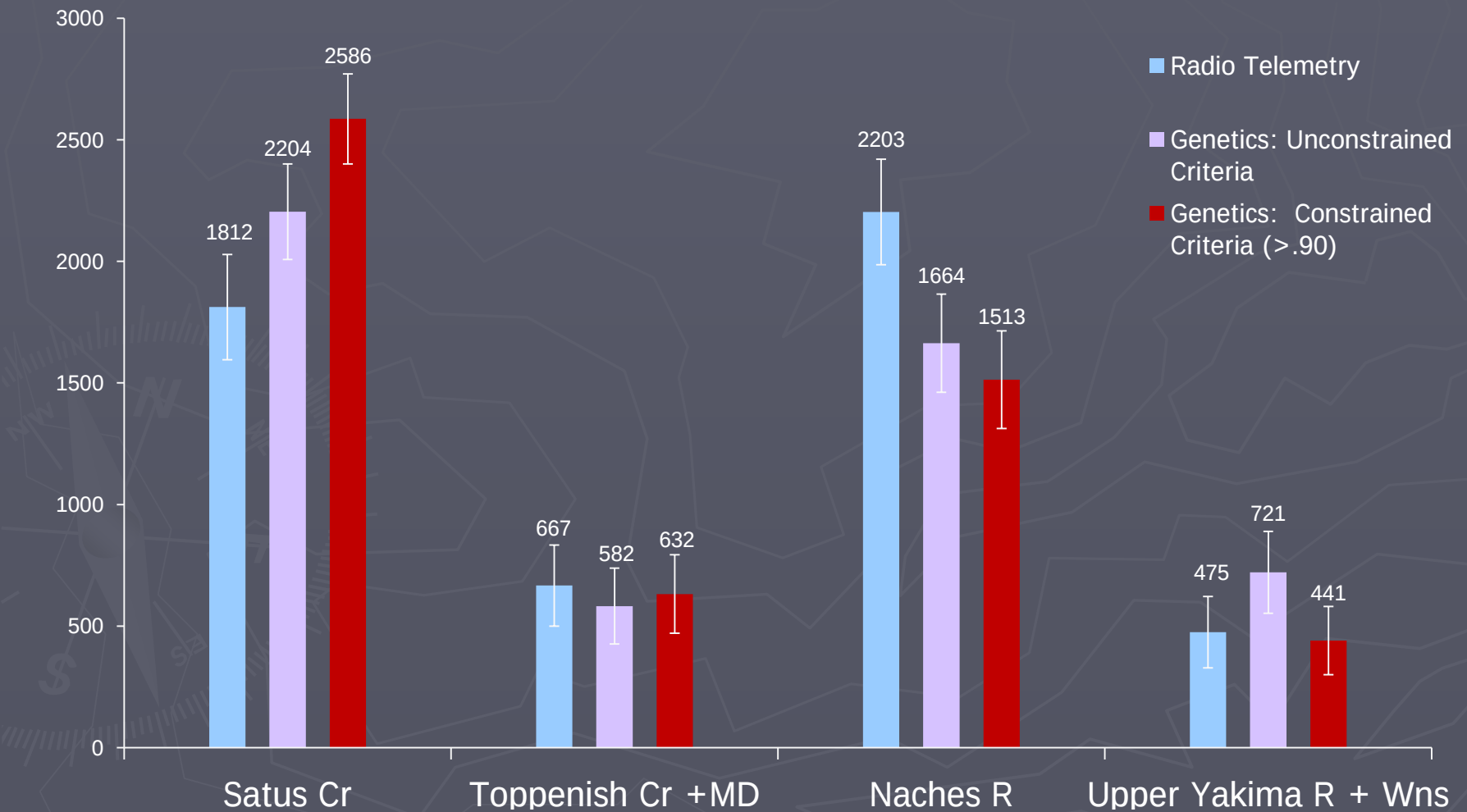


Adult Escapement Methods Comparison

-Graph expressed as % relative to Radio Telemetry estimates



Adult Escapement Methods Comparison



Adult Escapement Methods Comparison

Instream PIT-tag Array Detection Efficiencies		
	Satus Cr Instream PIT-Array	Toppenish Cr Instream PIT-Array
PIT-Array detection efficiency	96.9%	100.0%

Comparison between Radio Tag and PIT-tag based escapement estimates

Metric				
Method	Population	Abundance	CI (α = .05)	
Total number of radio+PIT tagged fish (N=484)				
Radio tag (N=484)	Satus Cr	1859	+/-	216
PIT-tag (N=698)	Satus Cr	1906	+/-	212
Radio tag (N=484)	Toppenish Cr*	620	+/-	160
PIT-tag (N=698)	Toppenish Cr	626	+/-	140

Radio tag (N=484) over PIT-tag (N=698)

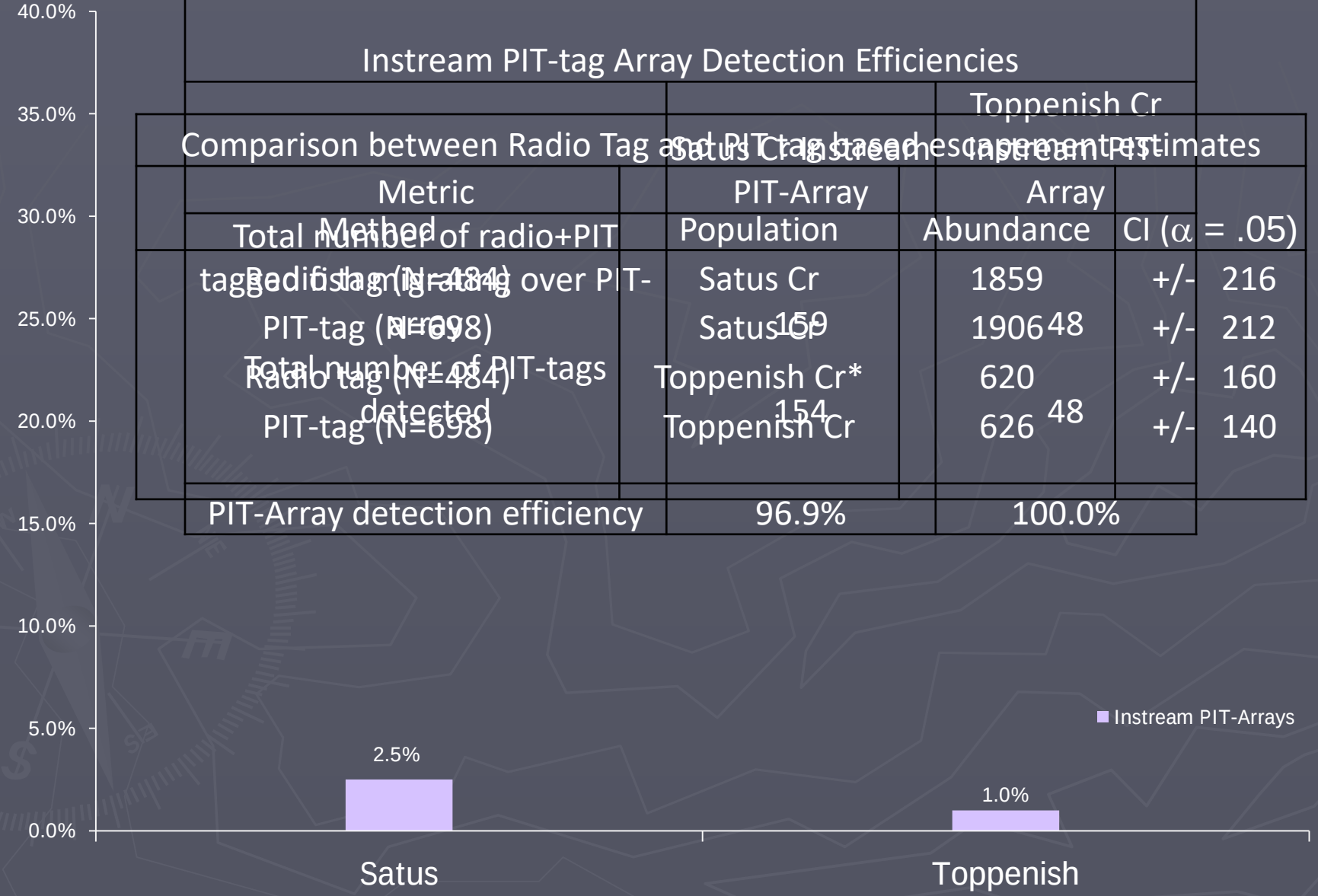
Total number of PIT-tags detected

159

154

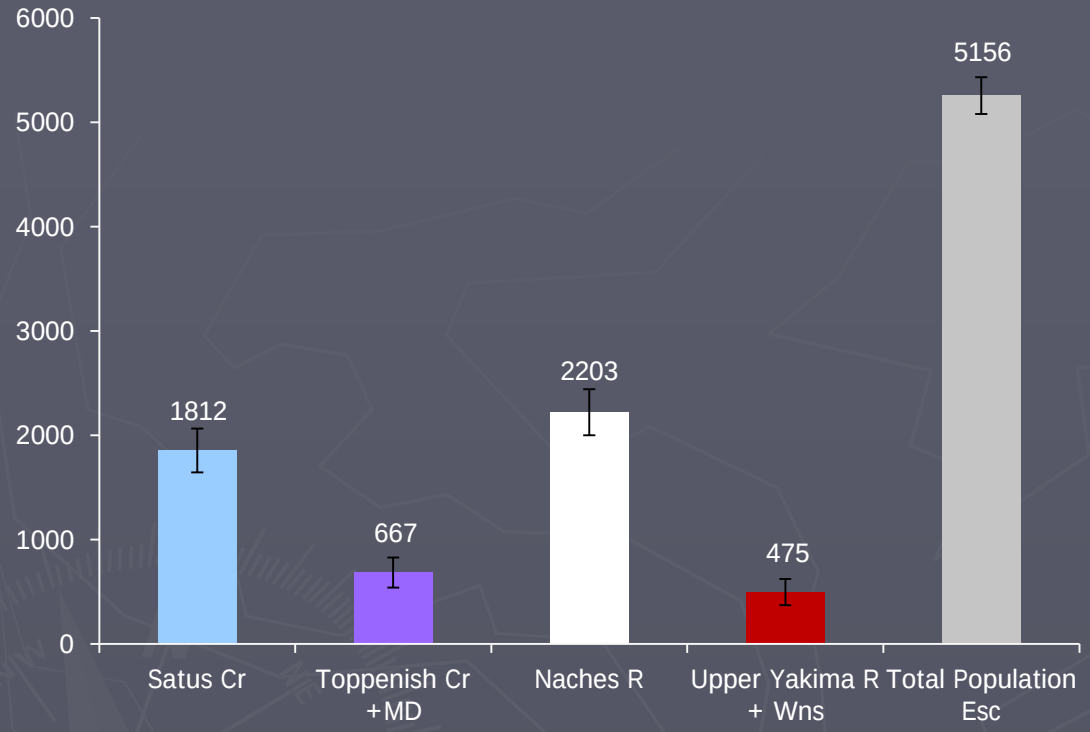
48

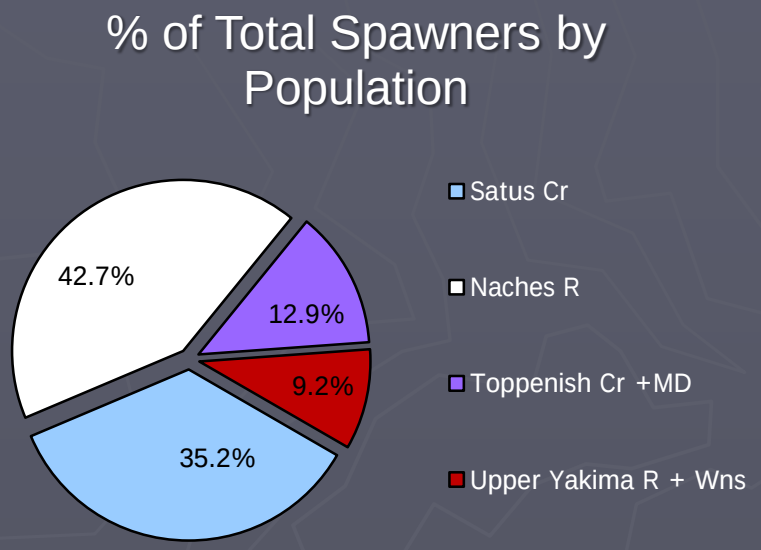
48



That’s all Folks!

Population Estimates: Expanded w/ TR +TM





Population	Abundance	CI (α = .05)
Satus Cr	1812	+/- 216
Toppenish Cr +MD	667	+/- 167
Naches R	2203	+/- 217
Upper Yakima R + Wns	475	+/- 147
Total Population Esc	5156	+/- 86

Partitioning of Run-Timing & Sampling at Prosser Dam

-Improved Method for Population Expansion Estimates

-Differential run-timing between populations
-Under/Over sampling effort for stratified periods