Genetic Variation in *Baetis tricaudatus* in the Russian River Watershed

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Baetis

- Ephemeroptera-Baetidae
  - "small-minnow mayflies"
- Large and widespread genera
- Many taxonomic "problems"
  - Much revisionary work, more needed

PROC. ENTOMOL. SOC. WASH.
110(3), 2008, pp. 577–591

EVALUATION OF MAYFLY SPECIES ORIGINALLY DESCRIBED AS *BAETIS* LEACH (EPHEMEROPTERA: BAETIDAE) FROM CALIFORNIA

W. P. McCafferty, M. D. Meyer, R. P. Randolph, and J. M. Webb

The family Baetidae (Insecta: Ephemeroptera): synthesis and future challenges

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The systematics of the Baetidae has been the subject of much attention during the last three decades, with descriptions of new species and genera as well as several generic revisions. The family now encompasses about 100 genera and 900 species which constitute one-quarter of the world's mayfly diversity. It is thus an opportune time to evaluate the pertinence of these works. The diversity of the Baetidae of the different realms is discussed with emphasis on the rate of endemism and biogeographic affinities. We have also tried to identify the

Baetis tricaudatus

- Key role in ecosystems
  - Grazers
  - Prey for fish and birds/bats
- Common in bioassesment/biomonitoring programs
- Widely distributed across N. America
- Cannot be identified to species as larvae, except late instars (maybe)

Baetis tricaudatus: a species Complex?

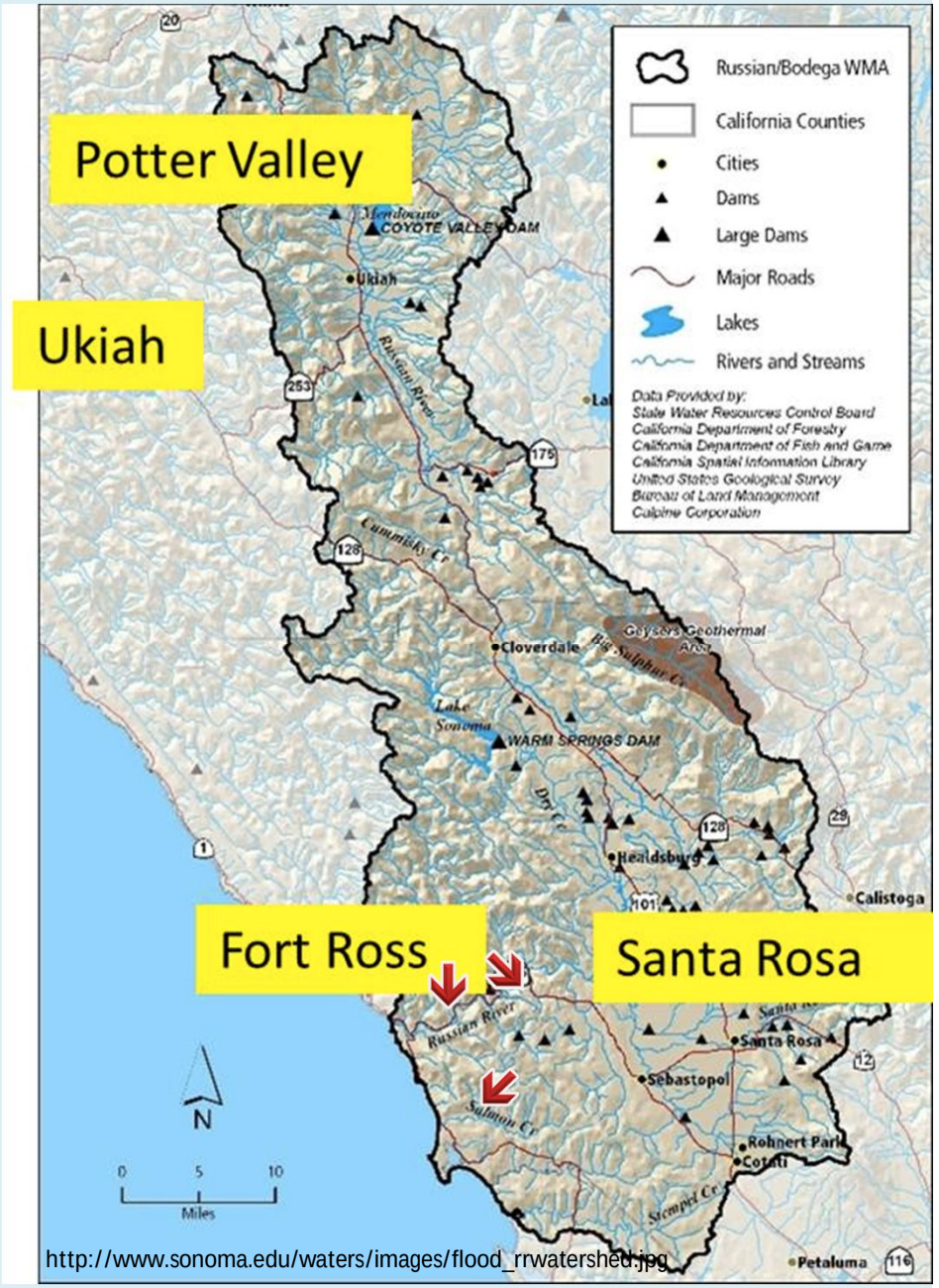
-Diverse morphologically and genetically
-Unpublished work by Jeffrey Webb found 5 haplogroups within COI

Webb et al, 2012, Webb pers. comm.

Study Questions

- What is the genetic diversity of the COI gene segment for *Baetis tricaudatus* within the Russian River watershed?
- What is the genetic divergence between *Baetis tricaudatus* and closely related species?
- How is diversity arranged temporally? And to a smaller degree, how is it arranged spatially?
- Is there evidence to support cryptic diversity within sampled *Baetis tricaudatus* populations?

Study Location



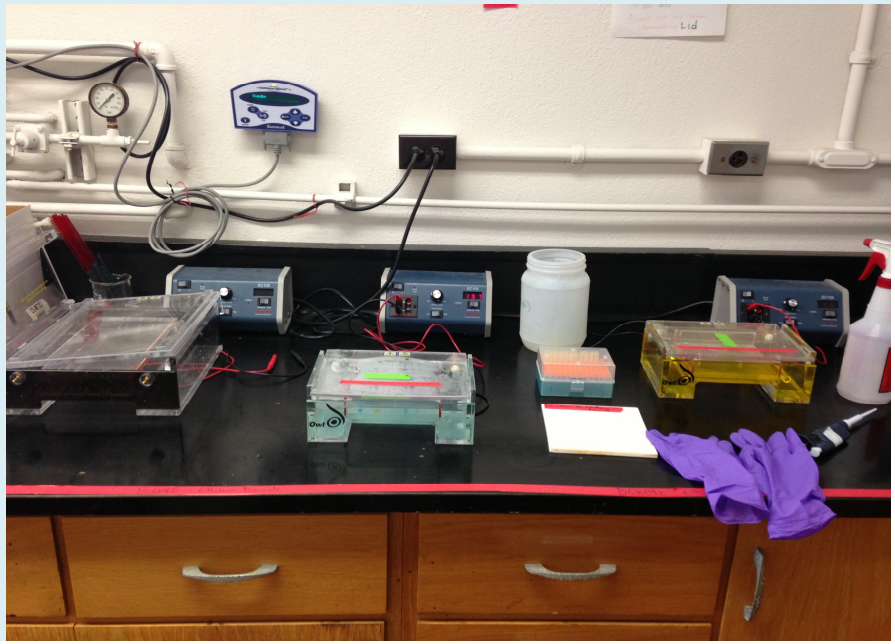
http://www.sonoma.edu/waters/images/flood_rrwatershed.jpg

First step-collect!

-Many sites around Northern California
-3 sites in the Russian River watershed monthly since 9/2012 (38 collection events)
-2 more extensive collection events- 11/2014 & 5/2015 at Russian River at Sunset site

Molecular Work

- Store specimens in 95% EtOH
- Morphologically identify
- Universal COI primers (LCO & HCO)
- DNA extraction, PCR, ExoSap, sequencing
- 469 sequences across 37 months
- Analyze in Geneious
- BLAST
- Genetic analyses
  - Arlequin
  - Popart



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For morphologically AND genetically identified *Baetis tricaudatus*- 2.3%

- What is the genetic divergence between *Baetis tricaudatus* and closely related species?

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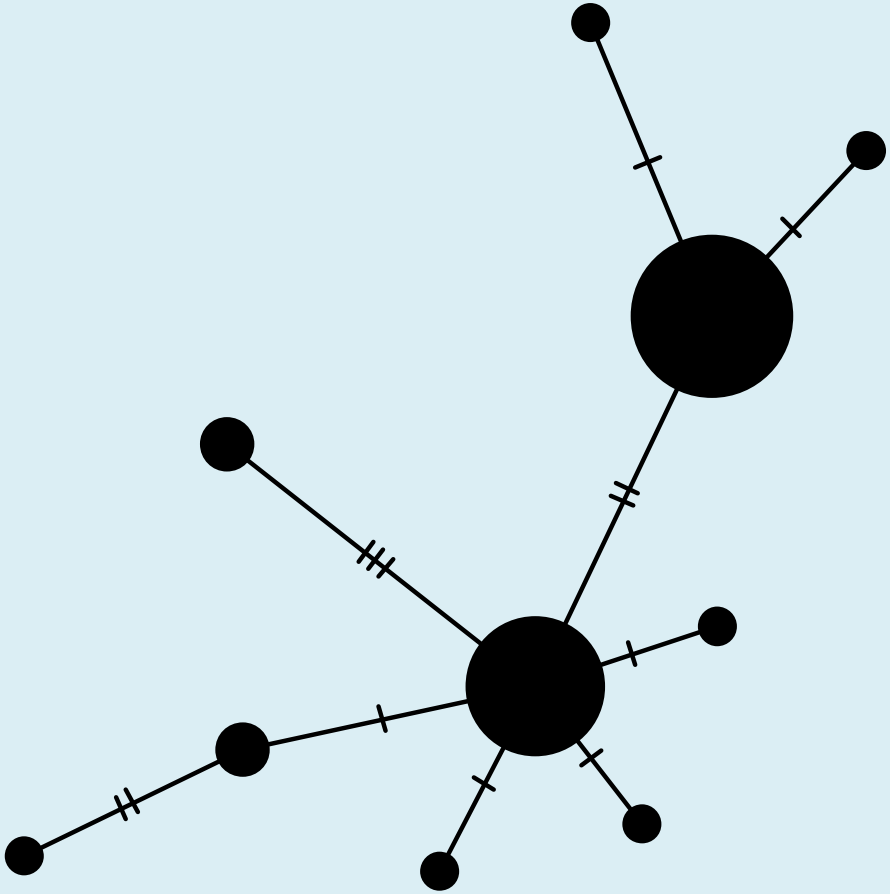
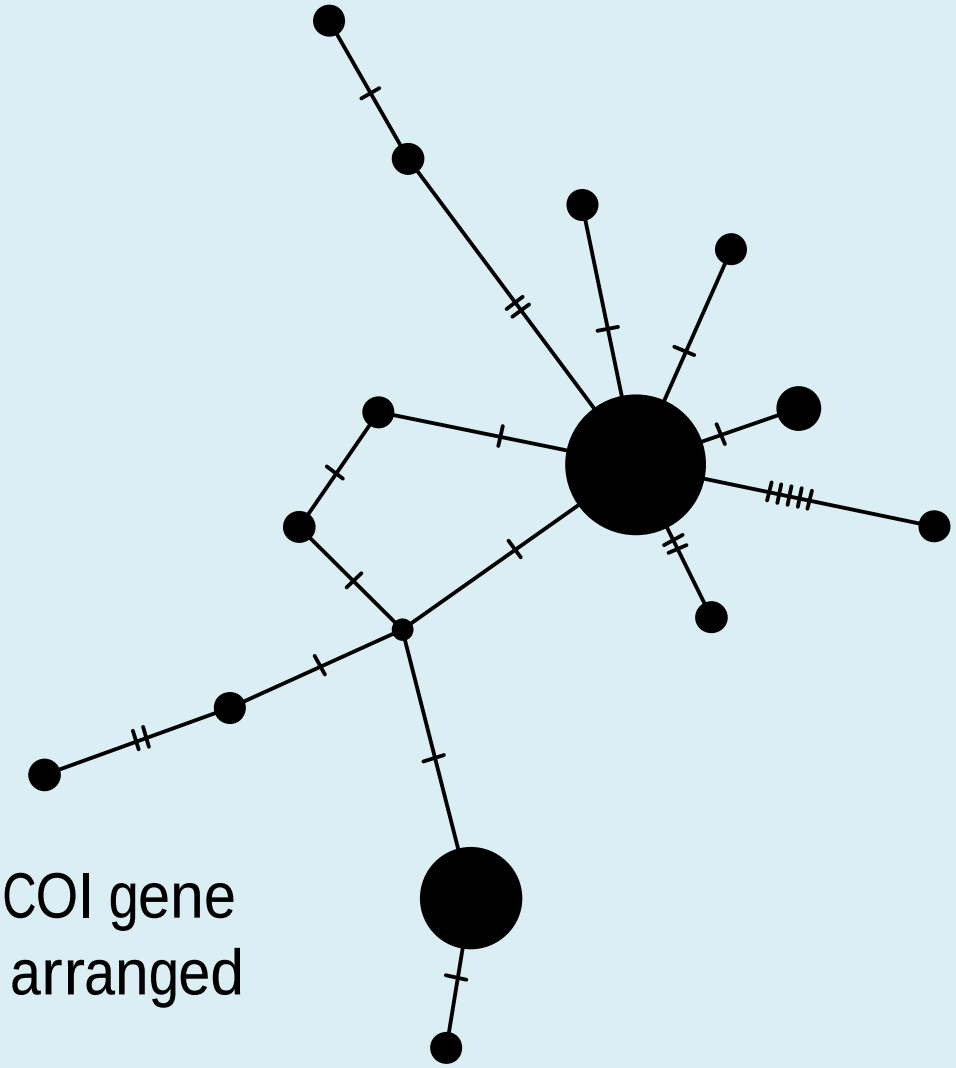
  - Species
    - *B. tricaudatus* to *B. adonis* ~10%
    - *B. tricaudatus* to *B. intercalaris* ~22%
  - Genera
    - *B. tricaudatus* to *Diphetor hageni* ~20%
    - *B. tricaudatus* to Fallceon sp~21%

← Spring 2015





Fall 2014 →

How is genetic diversity of the COI gene segment for *Baetis tricaudatus* arranged temporally?

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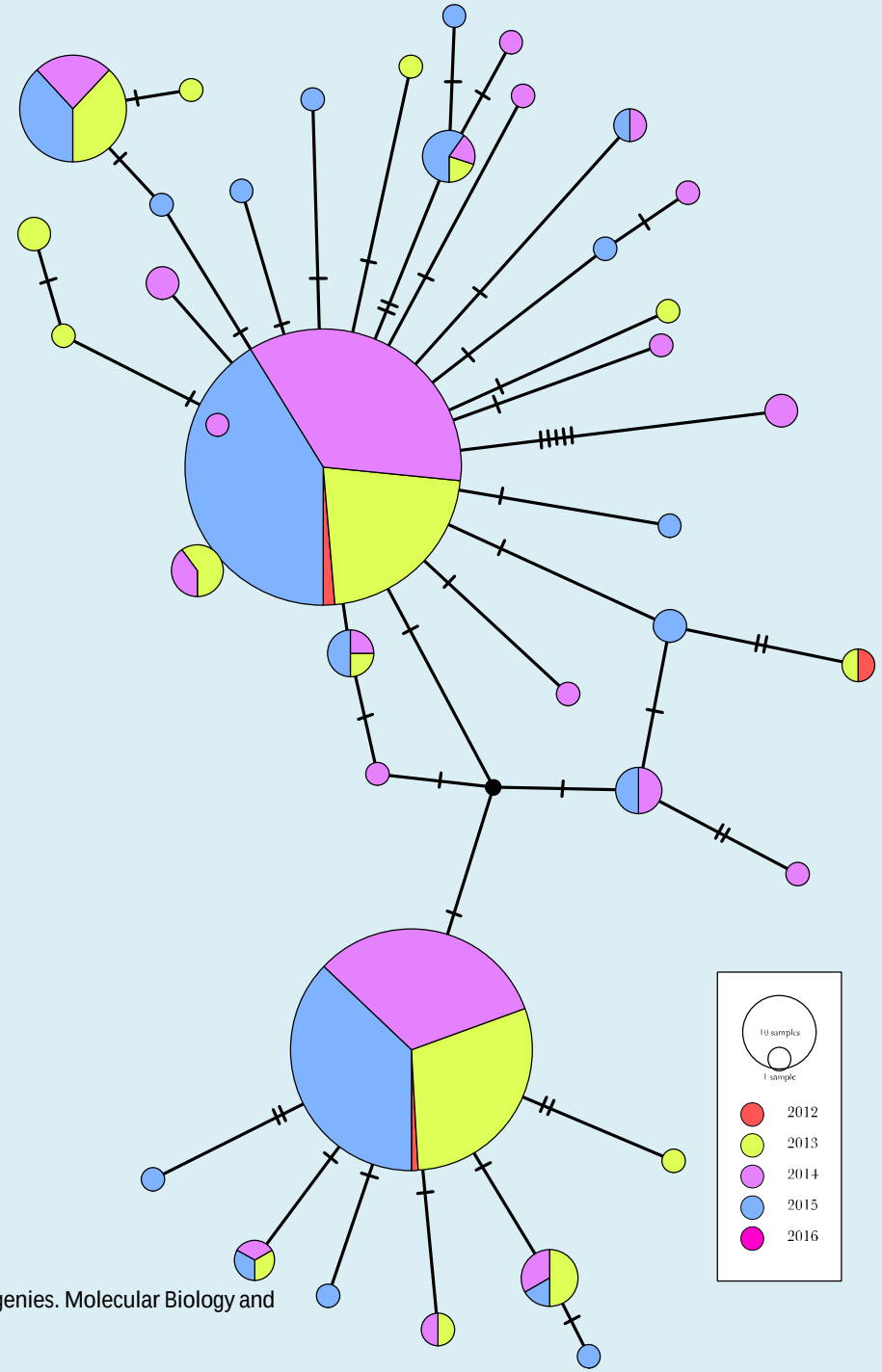
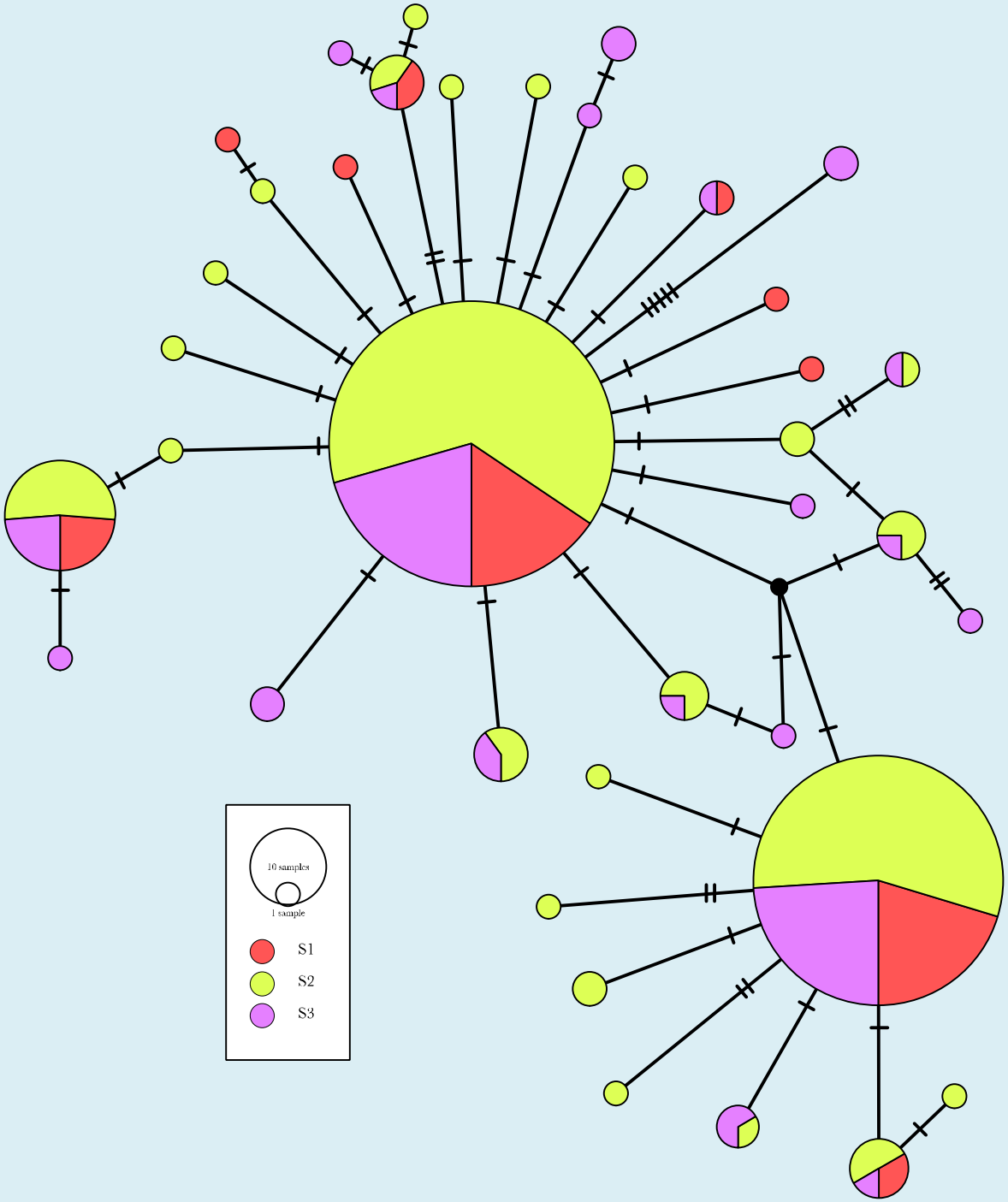
Haplotype network by year…



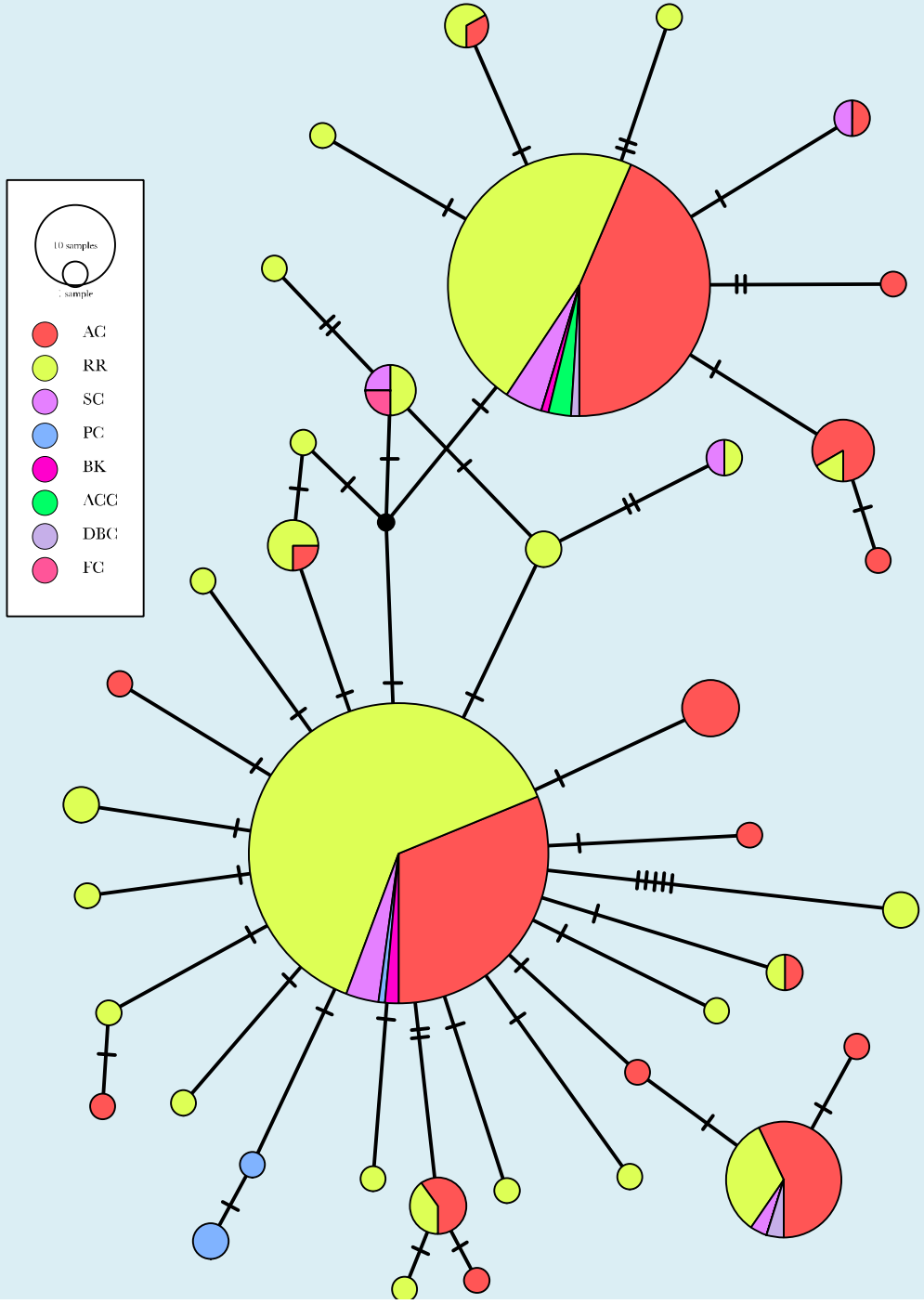
Bandelt, H., Forster, P., & Röhl, A. (1999). Median-joining networks for inferring intraspecific phylogenies. Molecular Biology and Evolution, 16(1), 37–48.
http://popart.otago.ac.nz

How is diversity arranged seasonally?

By season… Same haplotypes present in roughly the same proportions

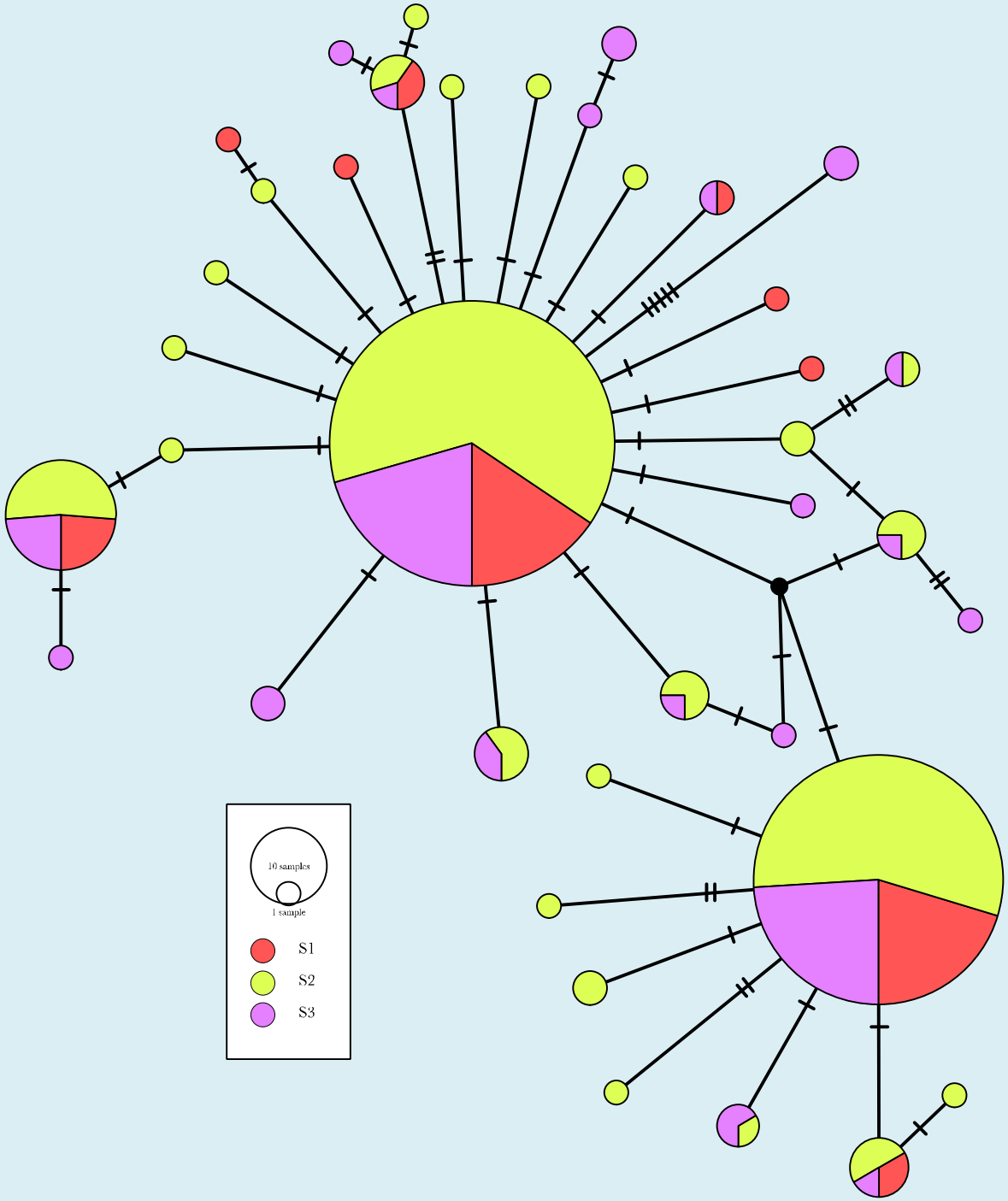


How is diversity arranged spatially in Northern California?



Is there evidence to support cryptic diversity within sampled *Baetis tricaudatus* populations?

No



Next steps

- Spatial patterns?
  - Northern vs. Southern California?
  - West vs. East coasts?
- Tie to habitat availability and quality
  - flow
  - Temperature
- Distributions?
- BLAST issues
- Proportions of species through time
  - Make number of specimens collected quantitative

Thank you!

- Patrick O'Grady
- Vincent Resh
- Michael Peterson
- Jim Stauffer

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