DNA-based stock-of-origin assignment of Chinook salmon smolts outmigrating past Chandler trap for years 2004-2008:

Computational error, methodological concerns, and outmigration trends

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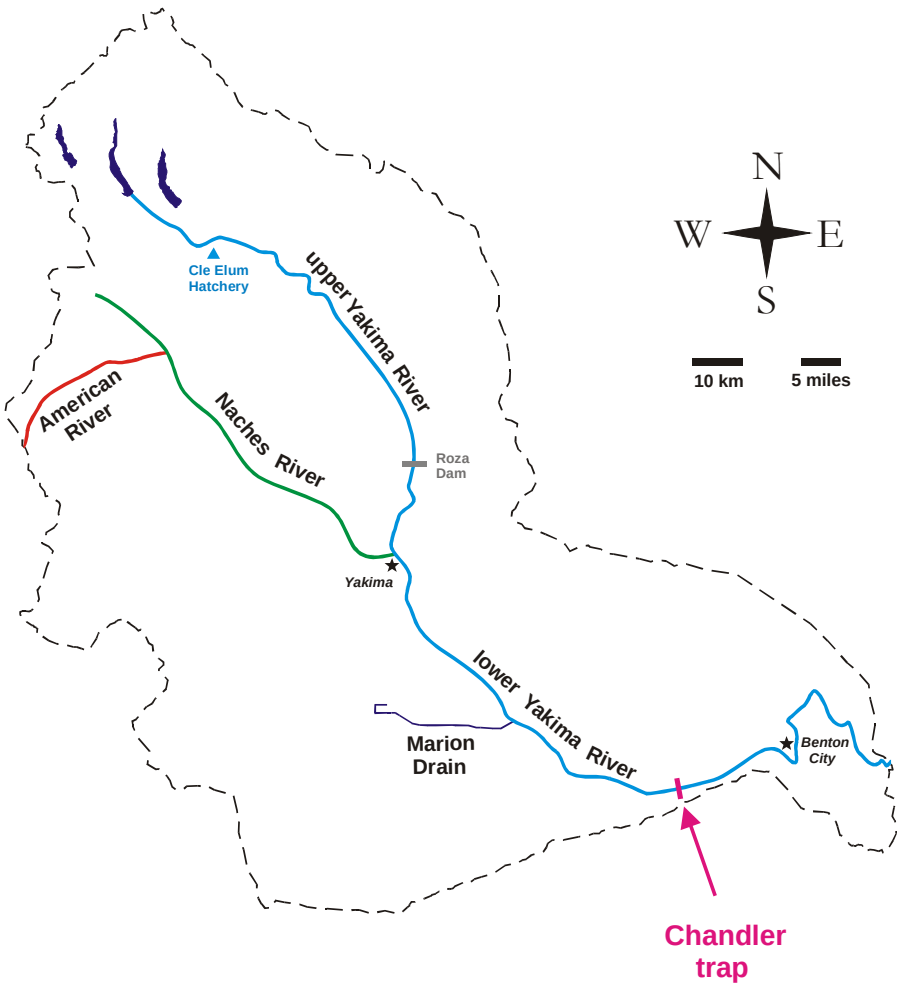
Project Summary

- Five populations (baseline)
  - Upper Yakima River – Spring
  - Naches River – Spring
  - American River – Spring
  - Lower Yakima river – Fall
  - Marion Drain – Fall
- DNA samples from outmigrating smolts collected at Chandler Trap
- Data from eight brood years (2000-2008)
- Standardized (GAPS) markers and proportional sampling since 2004 (5 years)



Previous Reports & Talks

- Separately for each year and season (Jan-Feb, Mar, Apr, May, Jun-Jul) assign smolts to populations
  - 20 independent assignments (5 years x 5 seasons)
  - Conditional likelihood / partial Bayesian Procedure (e.g., GMA, ONCOR)
- "Power" analysis of baseline
  - e.g., Jackknife assignments

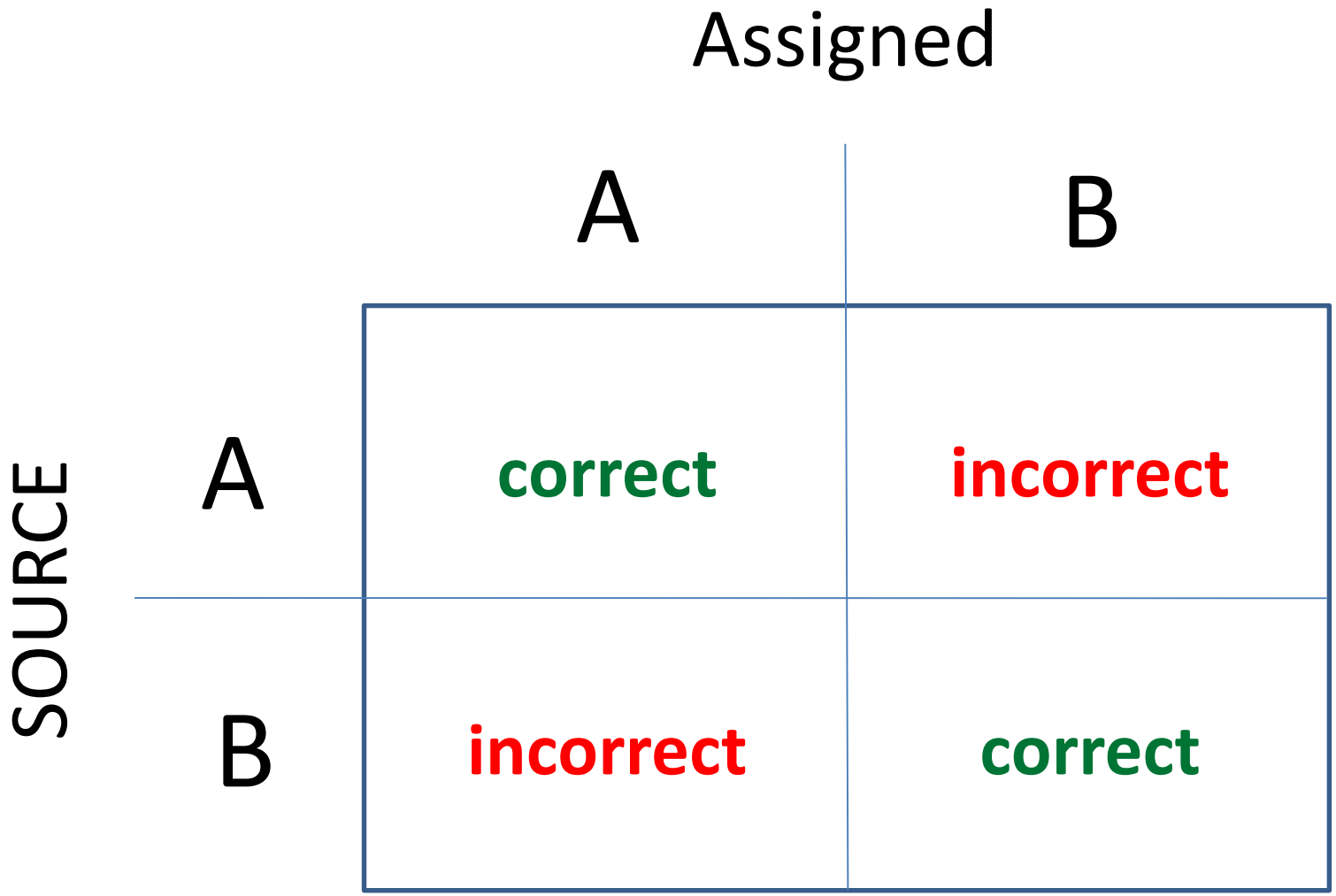
New Stuff – presented here

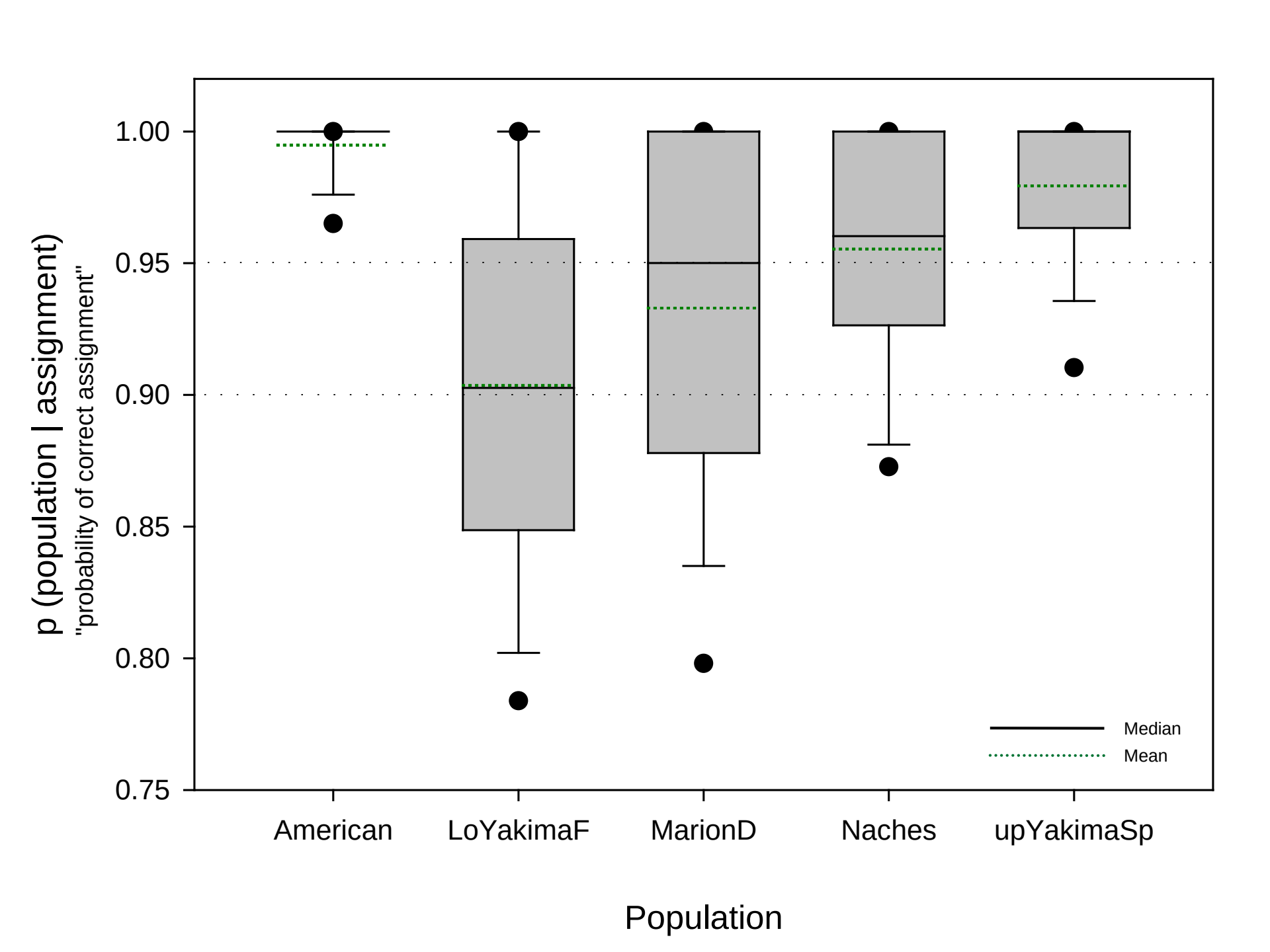
- Power analysis of baseline
  - Model-based
  - Calculates probability of correct assignment
- Population assignment of smolts
  - Hierarchical conditional-likelihood
    - Considers all samples from all years and seasons simultaneously
    - Bi-weekly population assignment
  - Outmigration trends

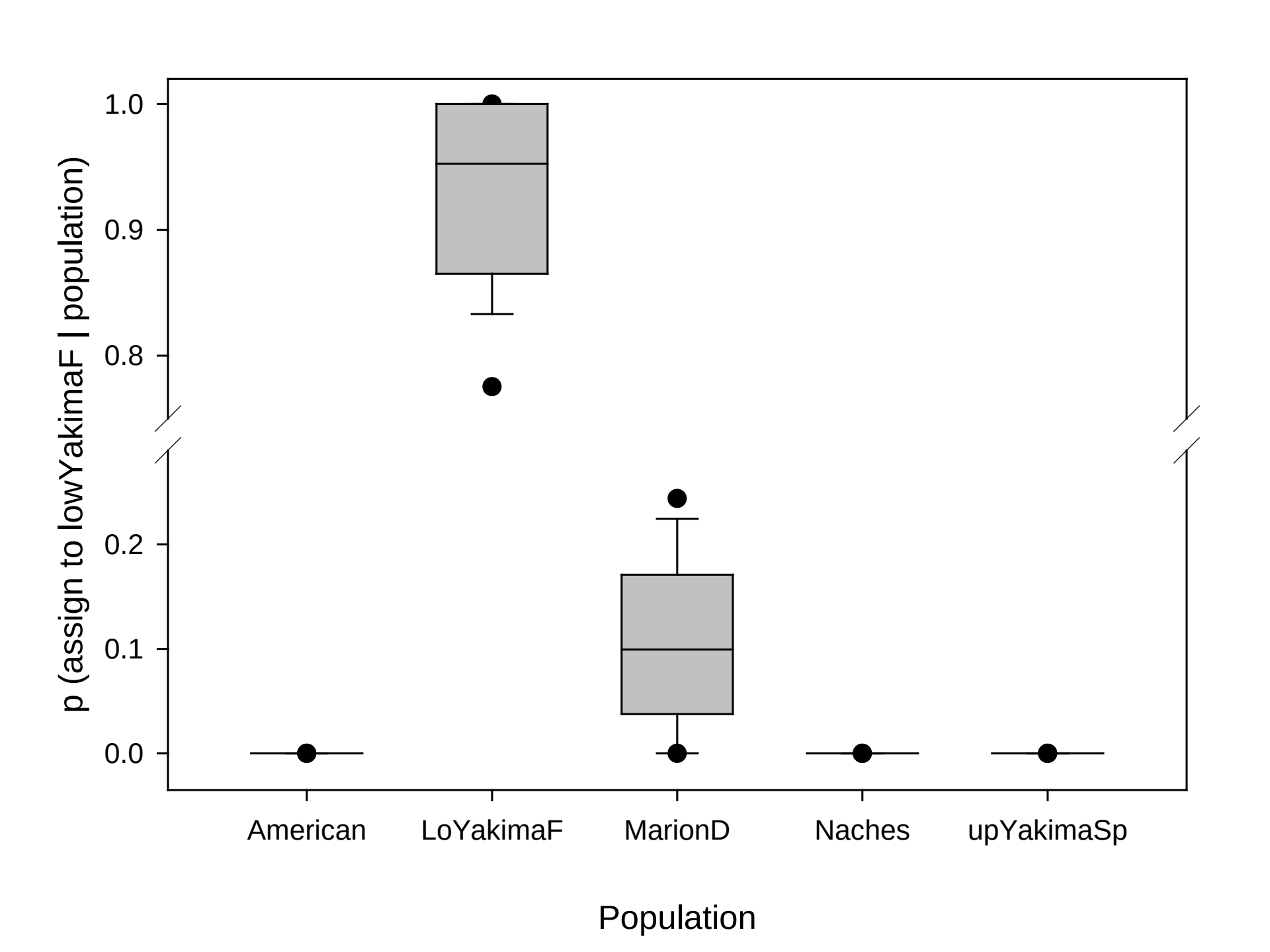
All models and analyses written in R or Matlab by Warheit

Power Analysis

- How good is the baseline for assigning smolts to populations?
- Many methods
  - Jackknife ("leave-one-out")
  - 100% simulations
  - Cross-validation method (Anderson et al., 2008)
  - Prob (assignment | population)
- Model used here:
  - Building on Anderson et al.
  - Prob (population | assignment)
  - Probability of the correct assignment


Assigned
A
B
SOURCE
A
B
correct
incorrect
incorrect
correct


p (population | assignment)
"probability of correct assignment"
1.00
0.95
0.90
0.85
0.80
0.75
American
LoYakimaF
MarionD
Naches
upYakimaSp
Population
Median
Mean

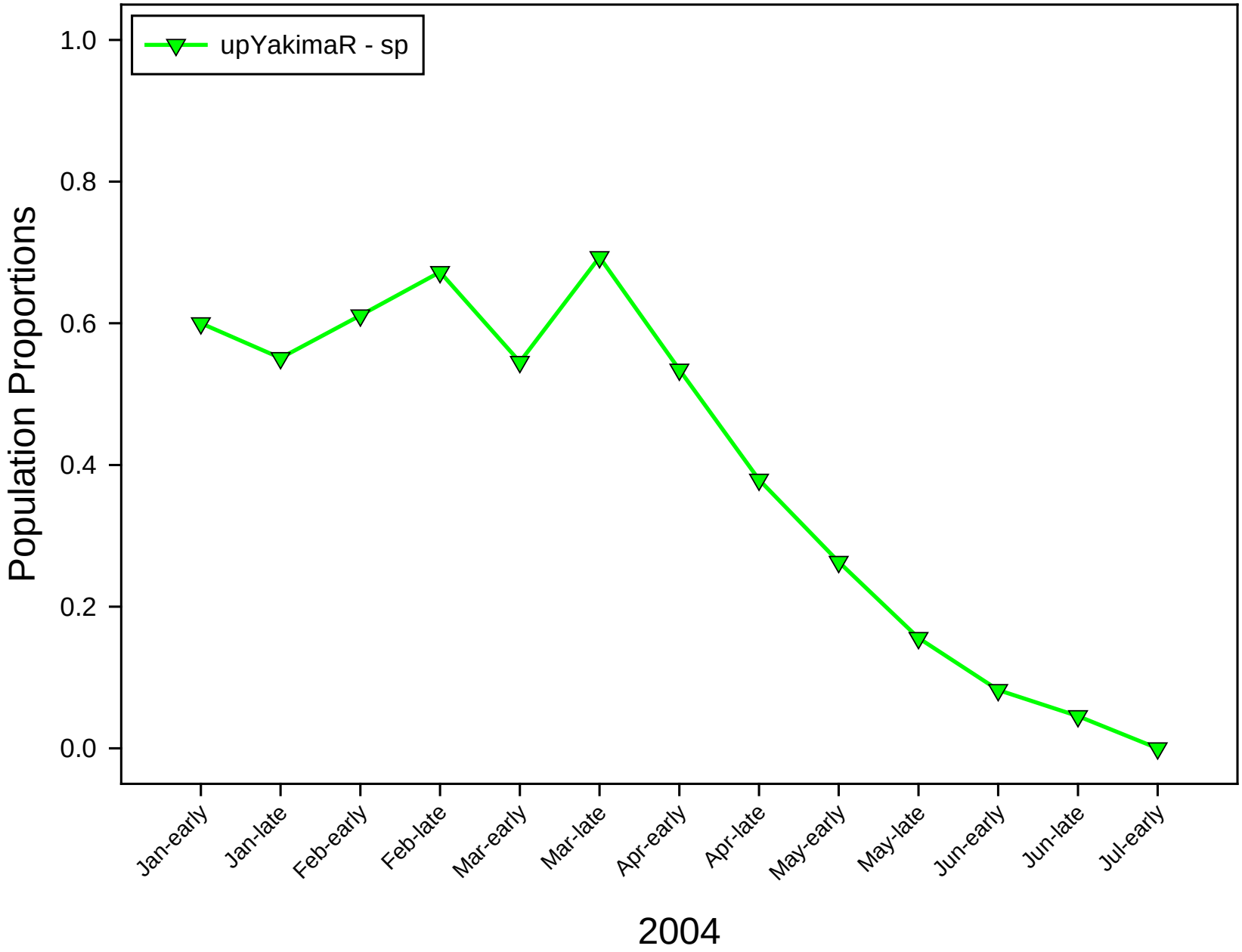

p (assign to lowYakimaF | population)
1.0
0.9
0.8
0.2
0.1
0.0
American
LoYakimaF
MarionD
Naches
upYakimaSp
Population

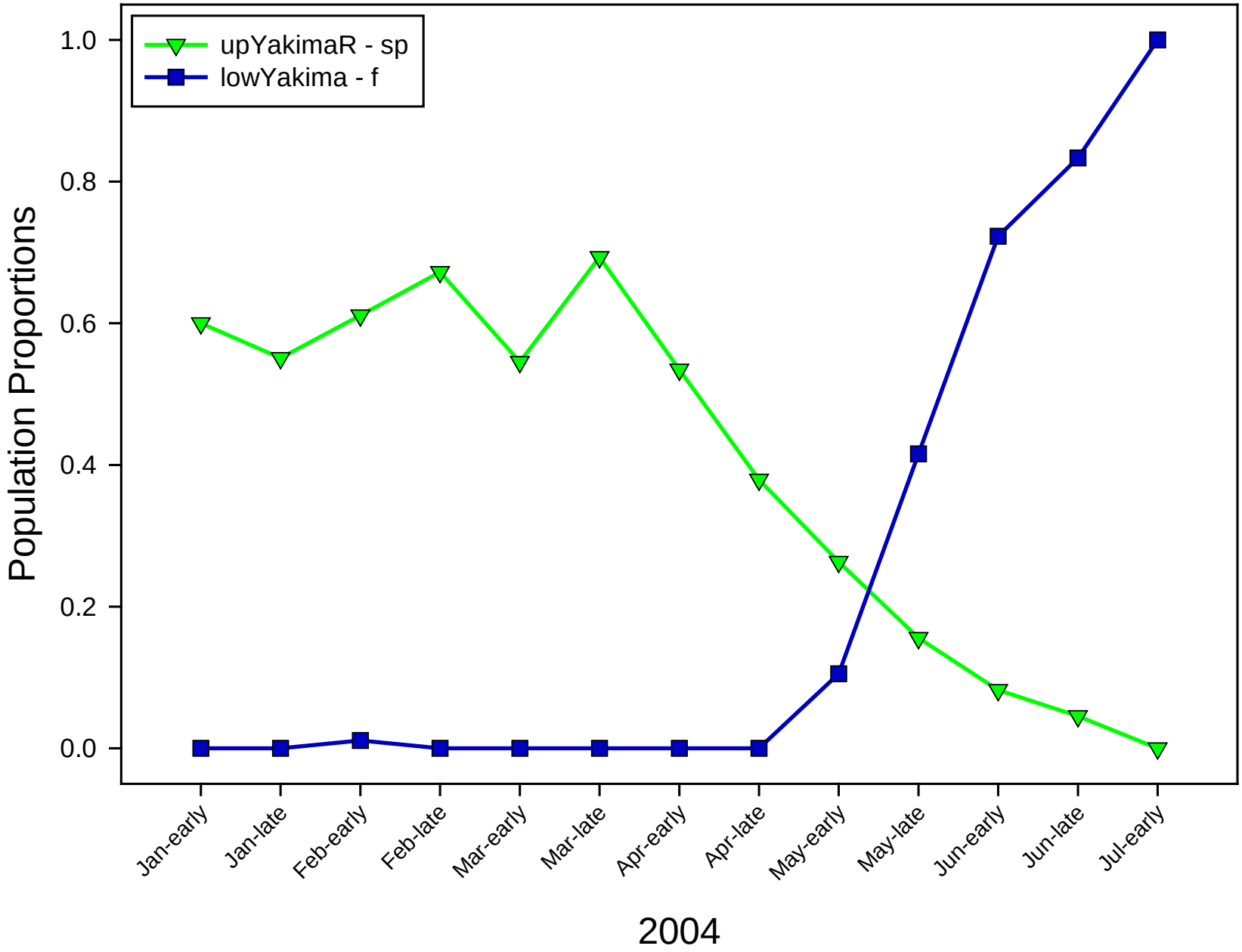
Population Assignment

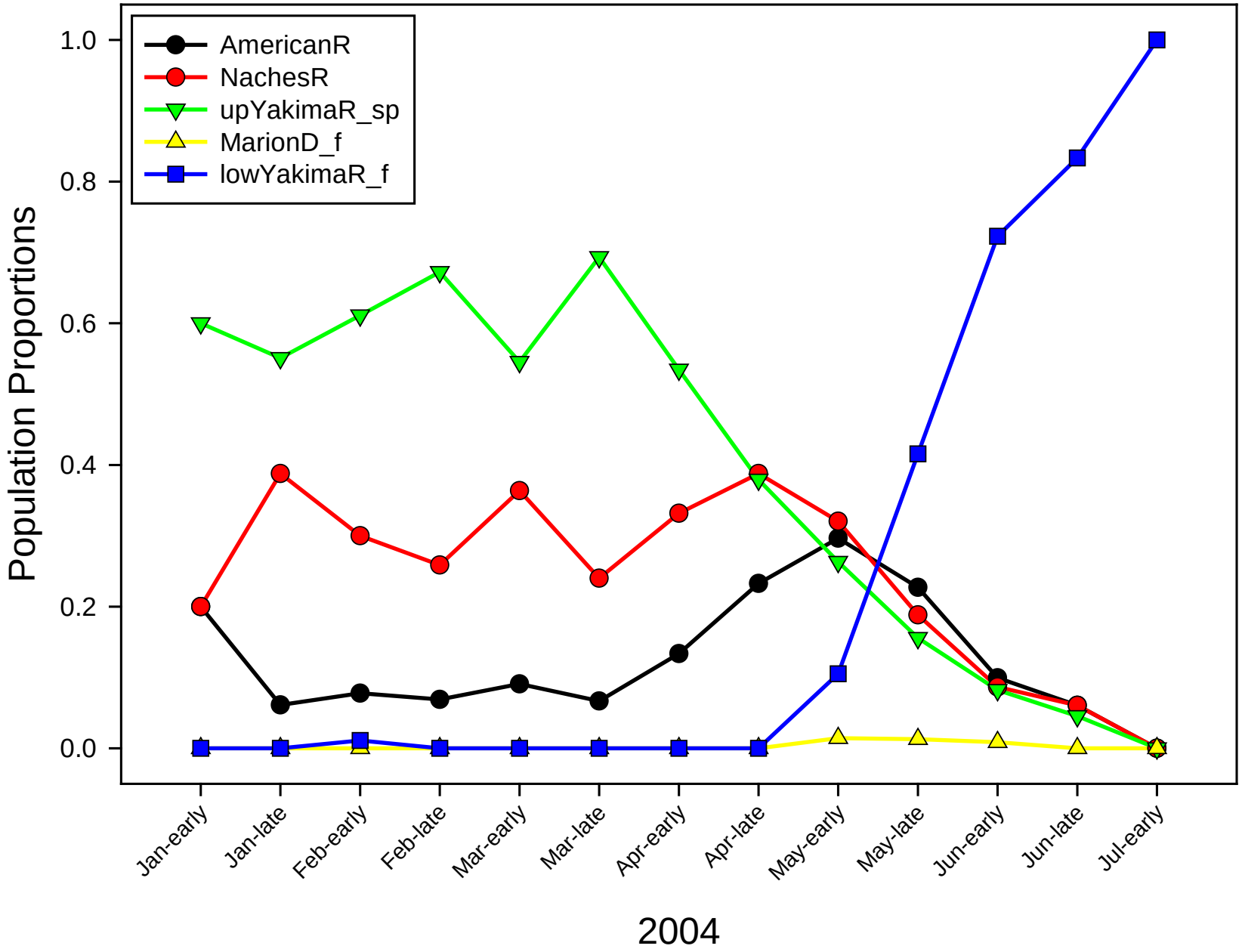
- No details of methods
  - Hierarchical approach
  - Informed priors at each level in the hierarchy
  - Sufficient power to assign bi-weekly, rather than monthly
- Population trends of outmigrating smolts
  - Within a year
  - Differences among years
- For each population:
  - Year-to-year variability of migration timing
  - Within a year compare timing among populations

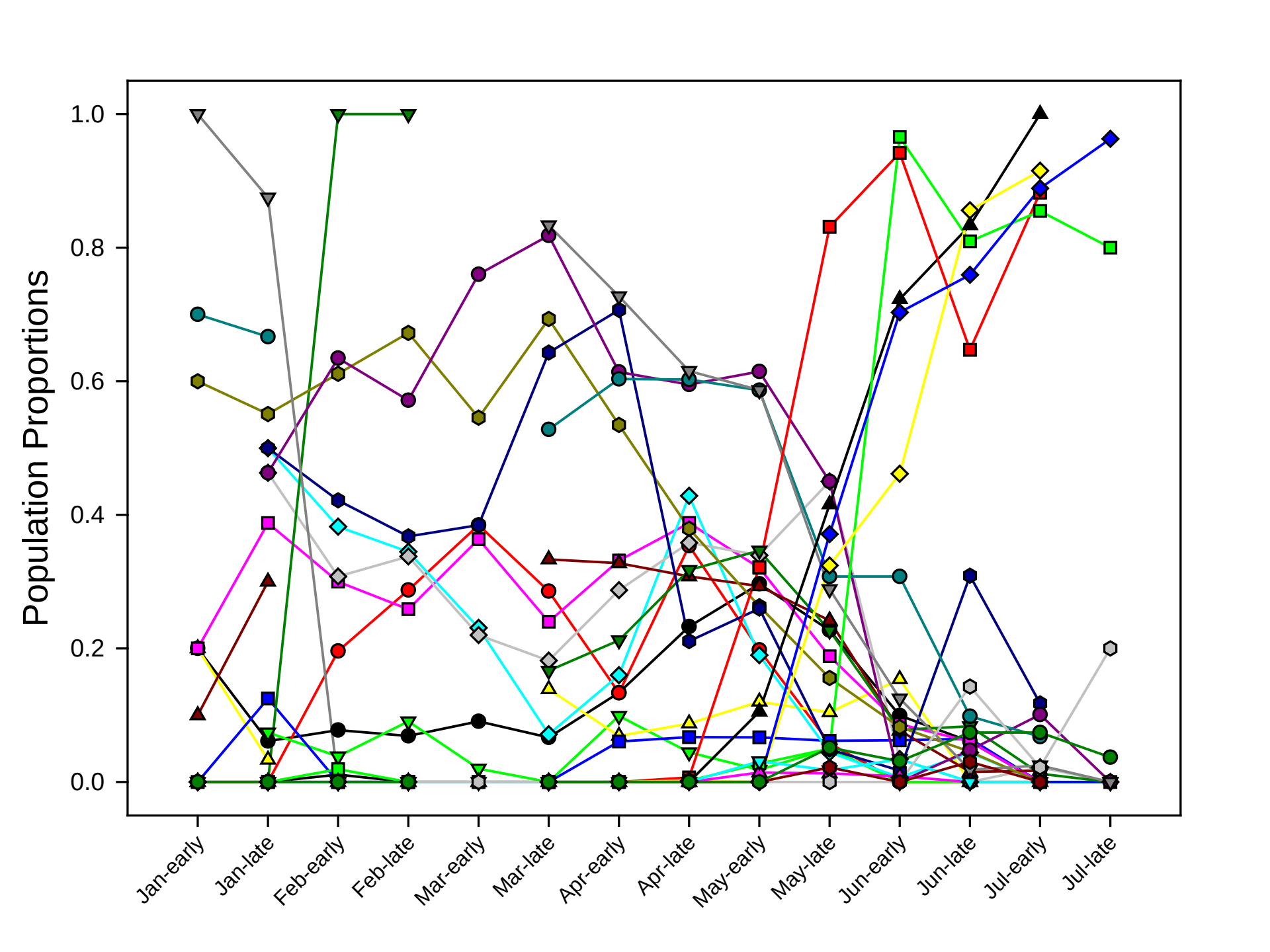
POPULATION TRENDS

- 5 populations
- 5 years (2004-2008)
- 14 time periods (early and late, Jan – July)
- **25 trends with 14 data points for each trend**


upYakimaR - sp
Population Proportions
1.0
0.8
0.6
0.4
0.2
0.0
Jan-early
Jan-late
Feb-early
Feb-late
Mar-early
Mar-late
Apr-early
Apr-late
May-early
May-late
Jun-early
Jun-late
Jul-early
2004

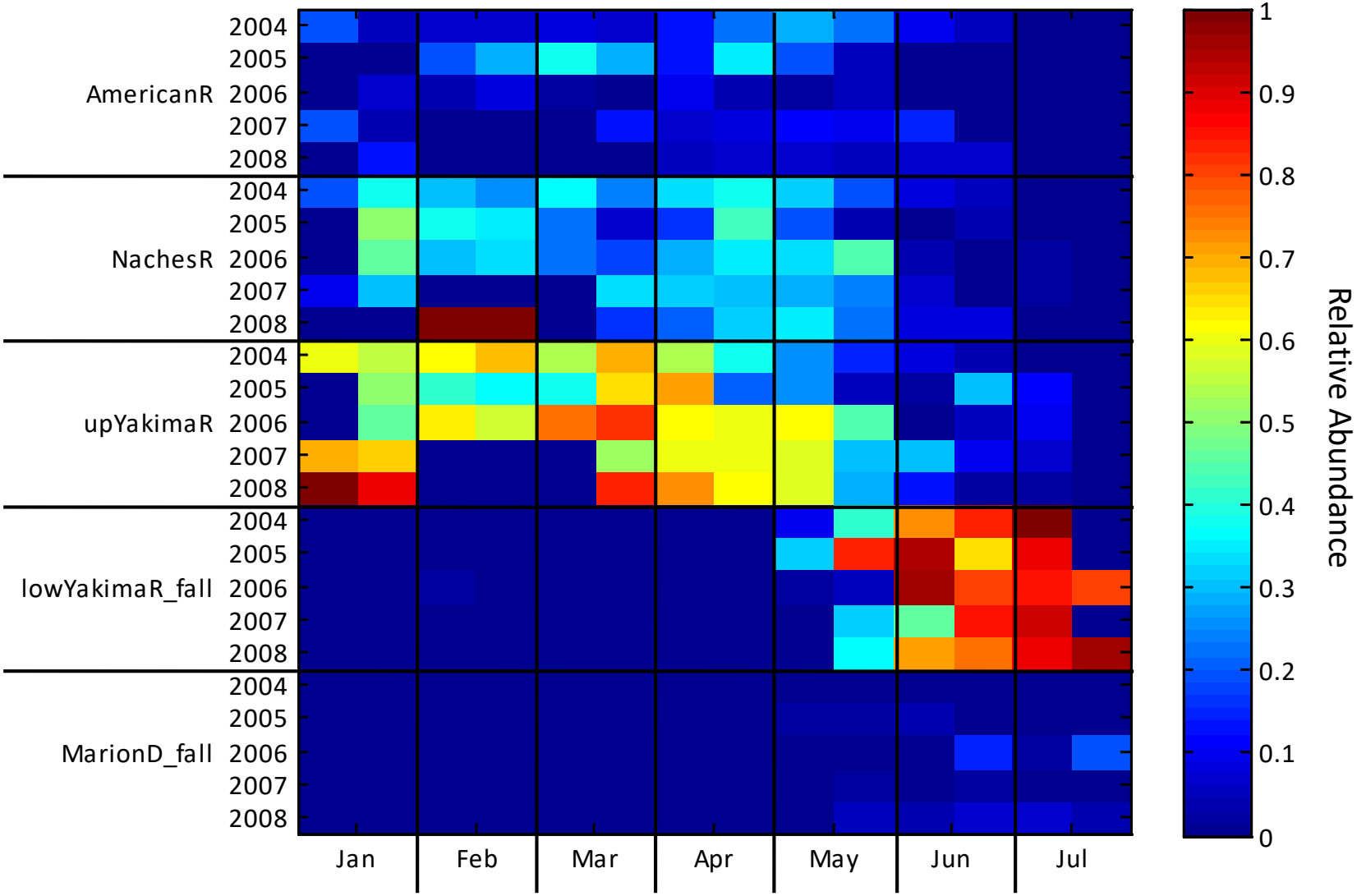

upYakimaR - sp
lowYakima - f
Population Proportions
1.0
0.8
0.6
0.4
0.2
0.0
Jan-early
Jan-late
Feb-early
Feb-late
Mar-early
Mar-late
Apr-early
Apr-late
May-early
May-late
Jun-early
Jun-late
Jul-early
2004


AmericanR
NachesR
upYakimaR_sp
MarionD_f
lowYakimaR_f
Population Proportions
1.0
0.8
0.6
0.4
0.2
0.0
Jan-early
Jan-late
Feb-early
Feb-late
Mar-early
Mar-late
Apr-early
Apr-late
May-early
May-late
Jun-early
Jun-late
Jul-early
2004


Population Proportions
1.0
0.8
0.6
0.4
0.2
0.0
Jan-early
Jan-late
Feb-early
Feb-late
Mar-early
Mar-late
Apr-early
Apr-late
May-early
May-late
Jun-early
Jun-late
Jul-early
Jul-late

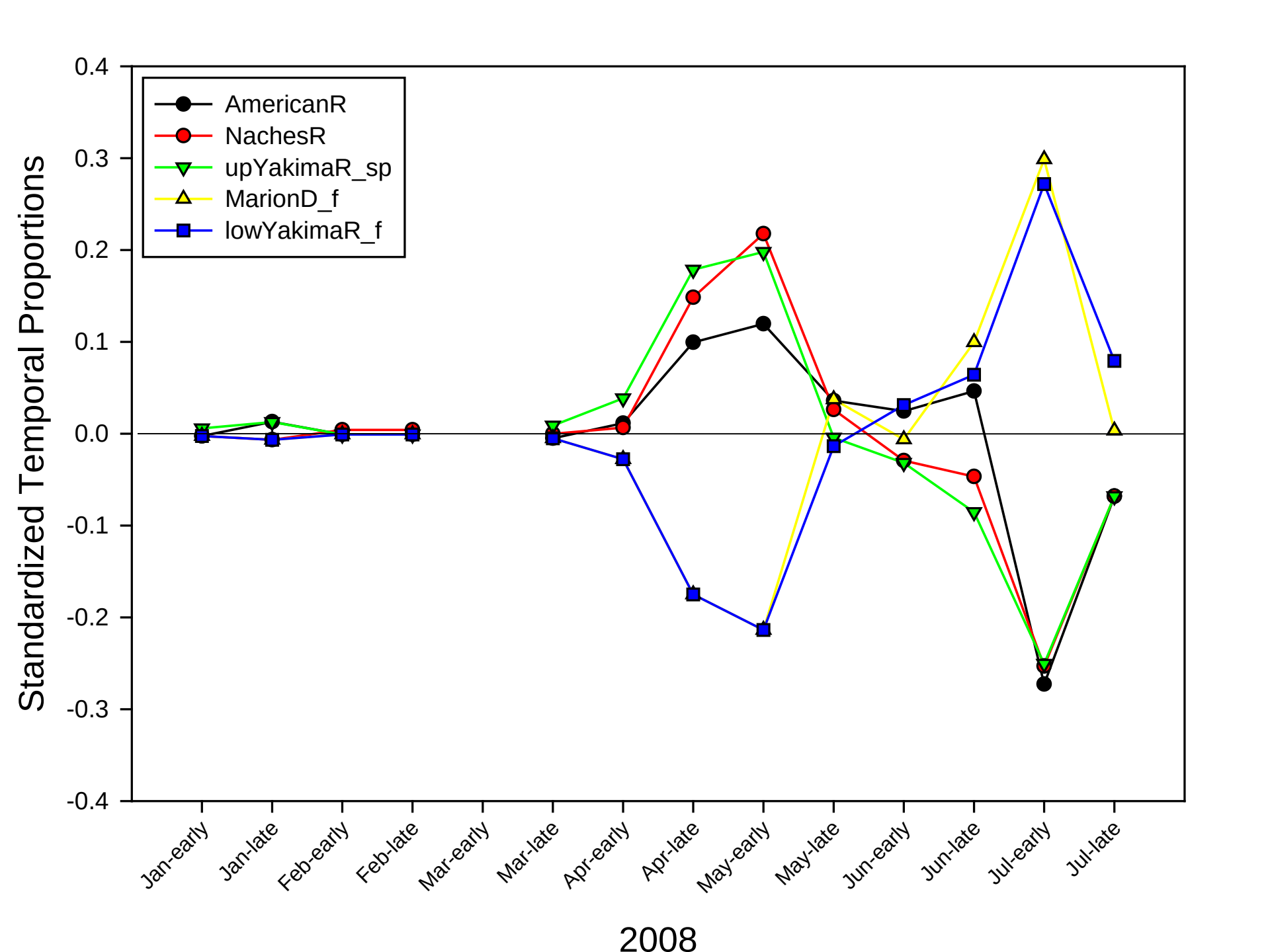
Population Proportions of Smolts at Chandler

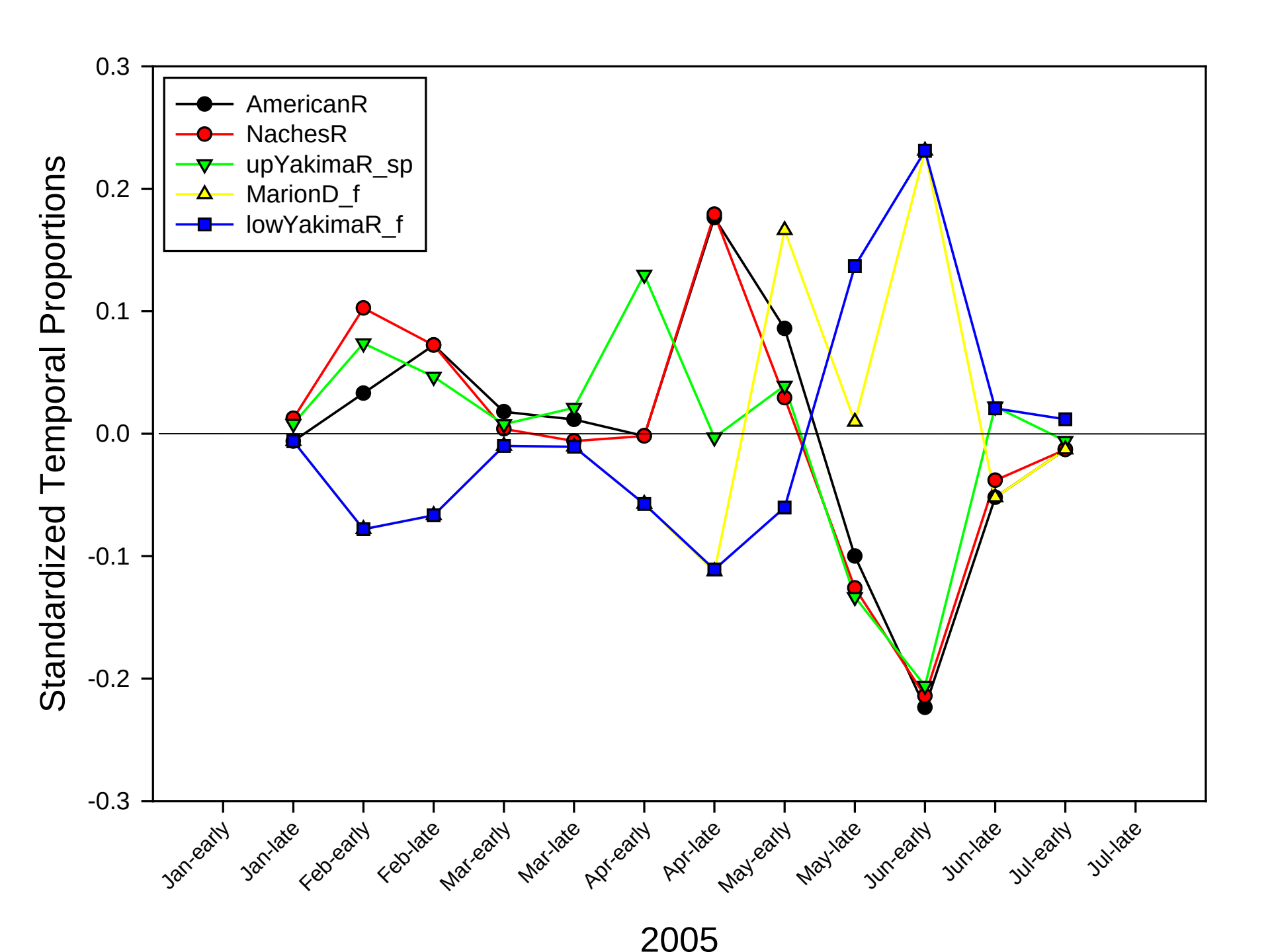
By Year and Bi-week

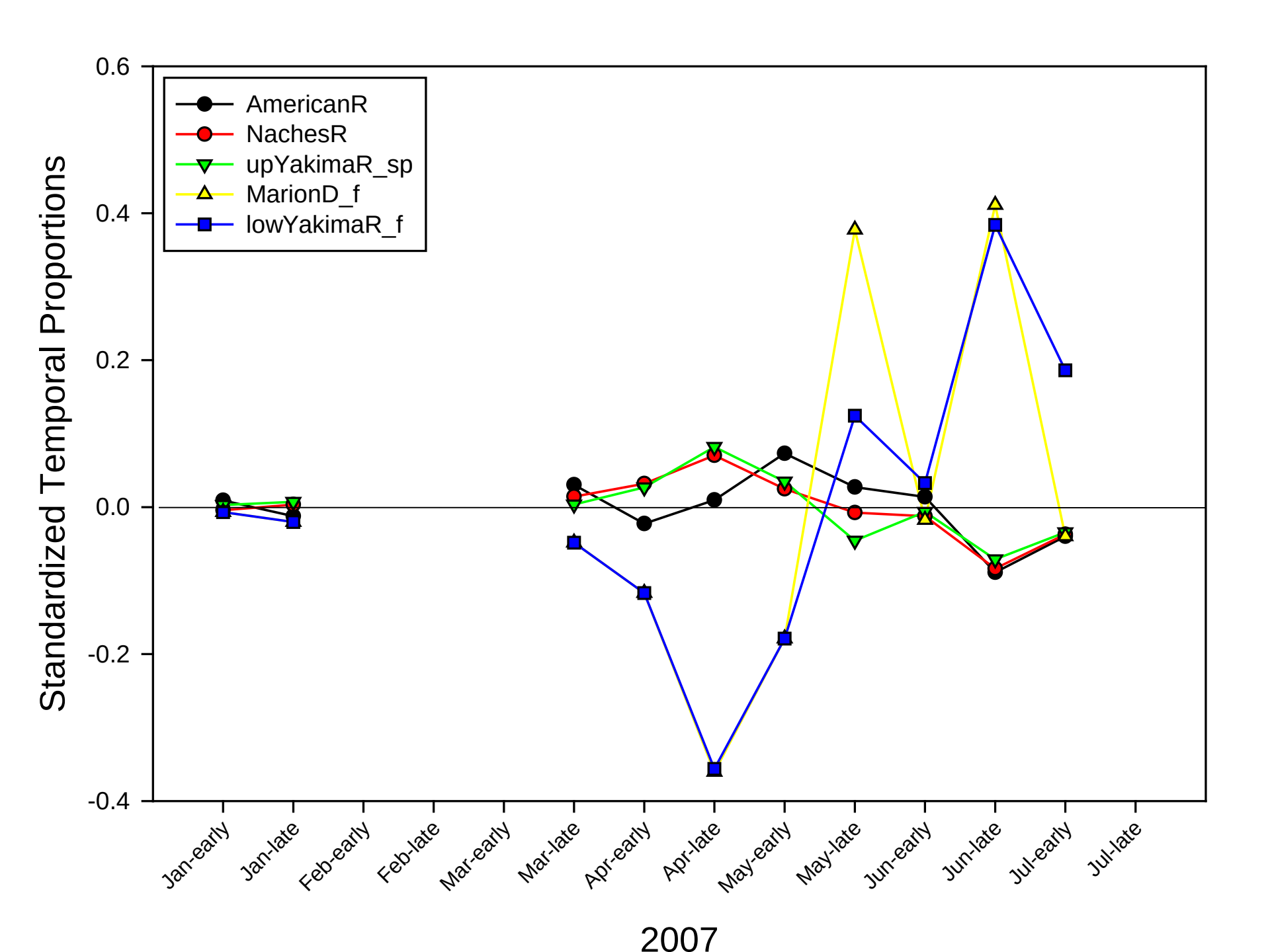


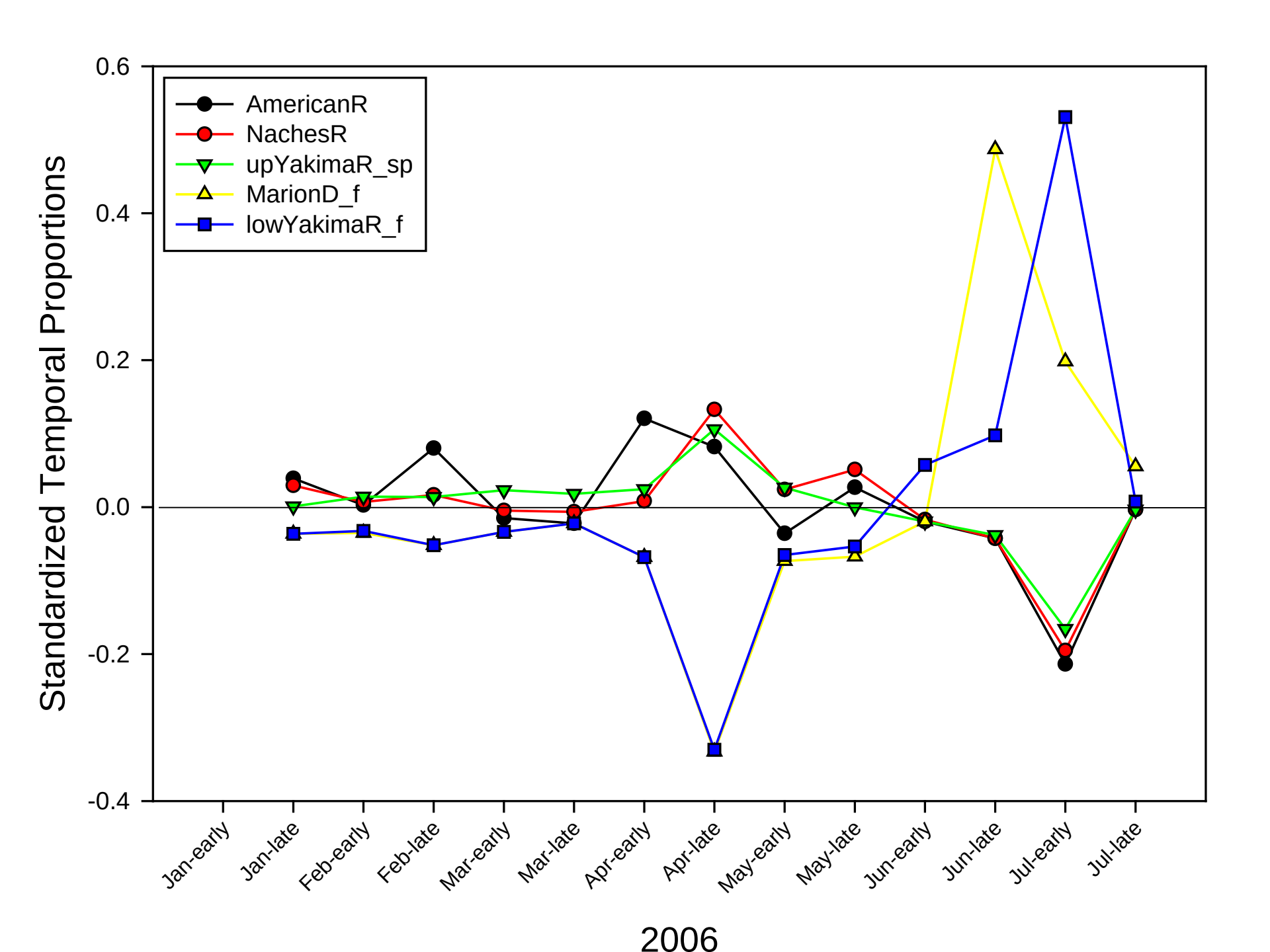
TIMING OF OUTMIGRATION

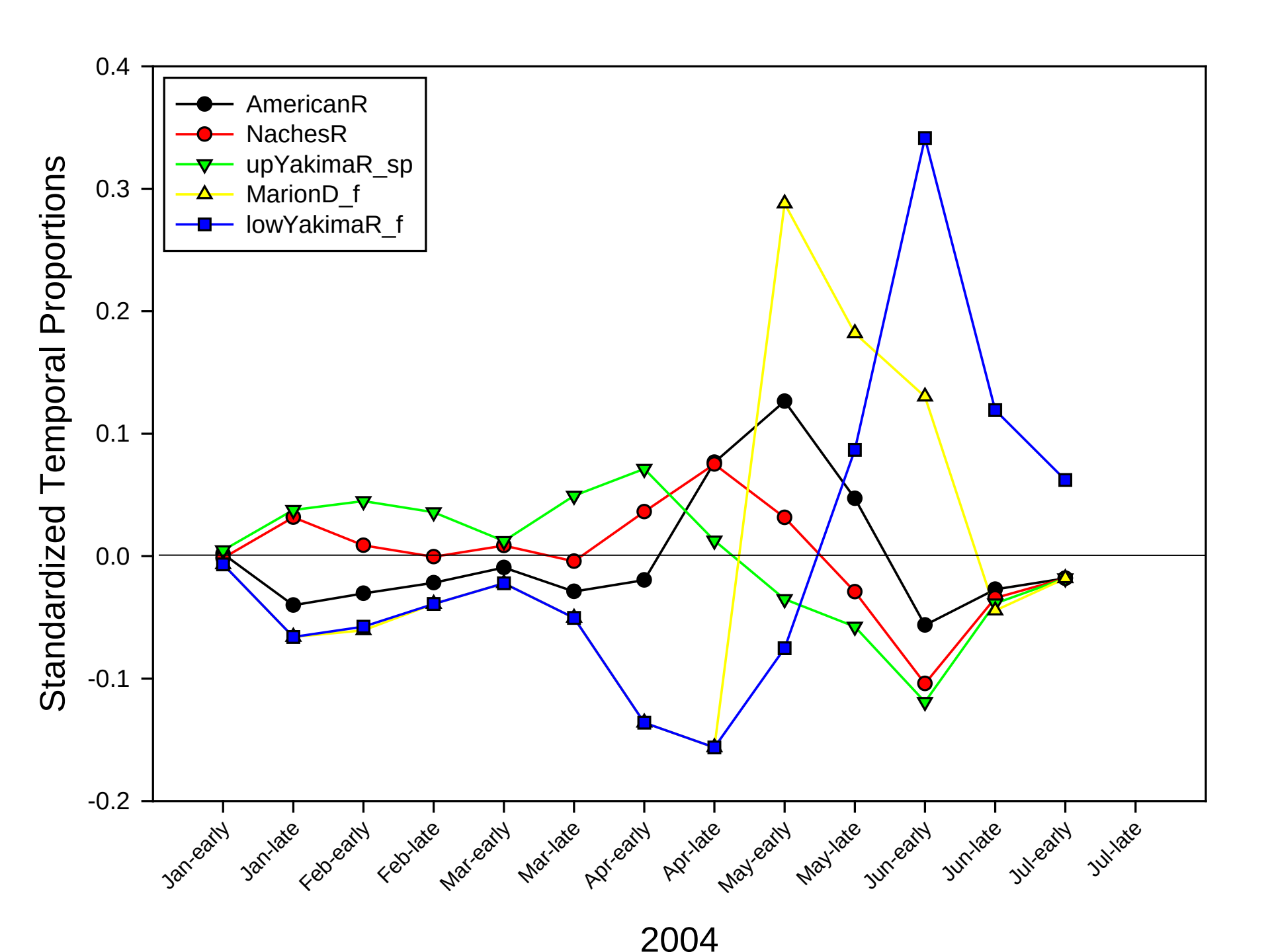
- New method – no details
- Independent trends for each stock
- Sampling effects are removed
- Trends expressed as deviations from total outmigration of all pops


AmericanR
NachesR
upYakimaR_sp
MarionD_f
lowYakimaR_f
Standardized Temporal Proportions
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
Jan-early
Jan-late
Feb-early
Feb-late
Mar-early
Mar-late
Apr-early
Apr-late
May-early
May-late
Jun-early
Jun-late
Jul-early
Jul-late
2008


AmericanR
NachesR
upYakimaR_sp
MarionD_f
lowYakimaR_f
Standardized Temporal Proportions
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
Jan-early
Jan-late
Feb-early
Feb-late
Mar-early
Mar-late
Apr-early
Apr-late
May-early
May-late
Jun-early
Jun-late
Jul-early
Jul-late
2005


AmericanR
NachesR
upYakimaR_sp
MarionD_f
lowYakimaR_f
Standardized Temporal Proportions
0.6
0.4
0.2
0.0
-0.2
-0.4
Jan-early
Jan-late
Feb-early
Feb-late
Mar-early
Mar-late
Apr-early
Apr-late
May-early
May-late
Jun-early
Jun-late
Jul-early
Jul-late
2007


AmericanR
NachesR
upYakimaR_sp
MarionD_f
lowYakimaR_f
Standardized Temporal Proportions
0.6
0.4
0.2
0.0
-0.2
-0.4
Jan-early
Jan-late
Feb-early
Feb-late
Mar-early
Mar-late
Apr-early
Apr-late
May-early
May-late
Jun-early
Jun-late
Jul-early
Jul-late
2006


AmericanR
NachesR
upYakimaR_sp
MarionD_f
lowYakimaR_f
Standardized Temporal Proportions
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
Jan-early
Jan-late
Feb-early
Feb-late
Mar-early
Mar-late
Apr-early
Apr-late
May-early
May-late
Jun-early
Jun-late
Jul-early
Jul-late
2004

Conclusions

- Baseline sufficient power to assign smolts to populations
- Spring stocks dominate outmigration January – late May or early June
- Lower Yakima fall dominant population June and July
- Among spring pops: upYakima > Naches > American

Conclusions

- Timing of outmigration variable among years, but some patterns:
  - Outmigration not necessarily synchronous
  - upYakima earlier than Naches and American
  - Some years with two “waves” of spring outmigration: late Jan-early Feb and then late April/early May
  - March either no sampling or few fish

Acknowledgements

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