

Estimating the Effective Population Size of Delta Smelt Using RAD-seq Data

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Outline

- Background on effective population (N_e) size
- Long-term and contemporary N_e
- Methods
- Results
- Future

What is effective population size?

- The size of an ideal population which **genetic drift** occurs at the same rate as that in an actual population.

What is drift?

- Random variation in the relative frequency of alleles in a population

Why estimate the effective population size?

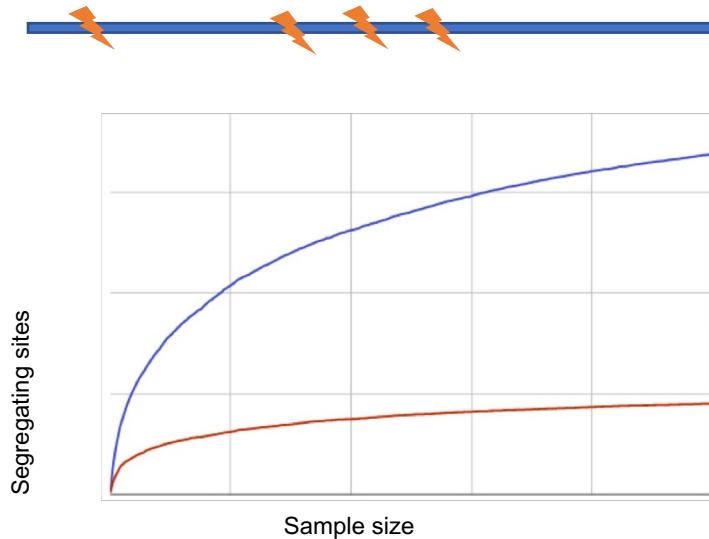
- Can be used to monitor the genetic diversity of wild population of Delta Smelt

Long-term N_e

$$\theta = 4N_e\mu$$

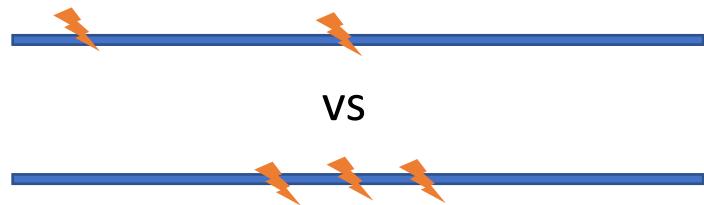
Watterson's Theta

Number of segregating sites



Theta Pi

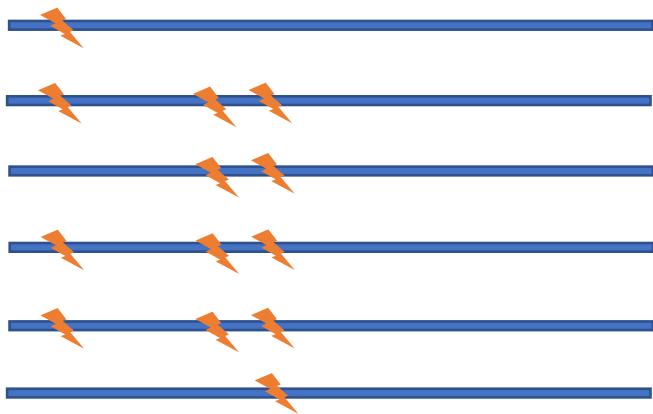
Pairwise nucleotide diversity



Contemporary N_e

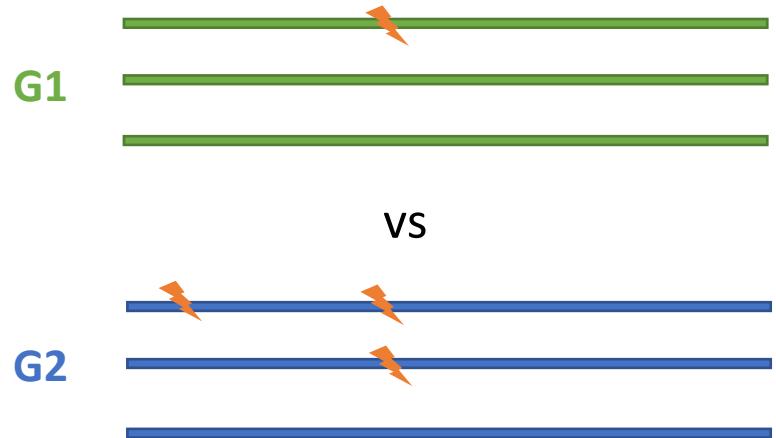
Linkage Disequilibrium

- Sample at one timepoint

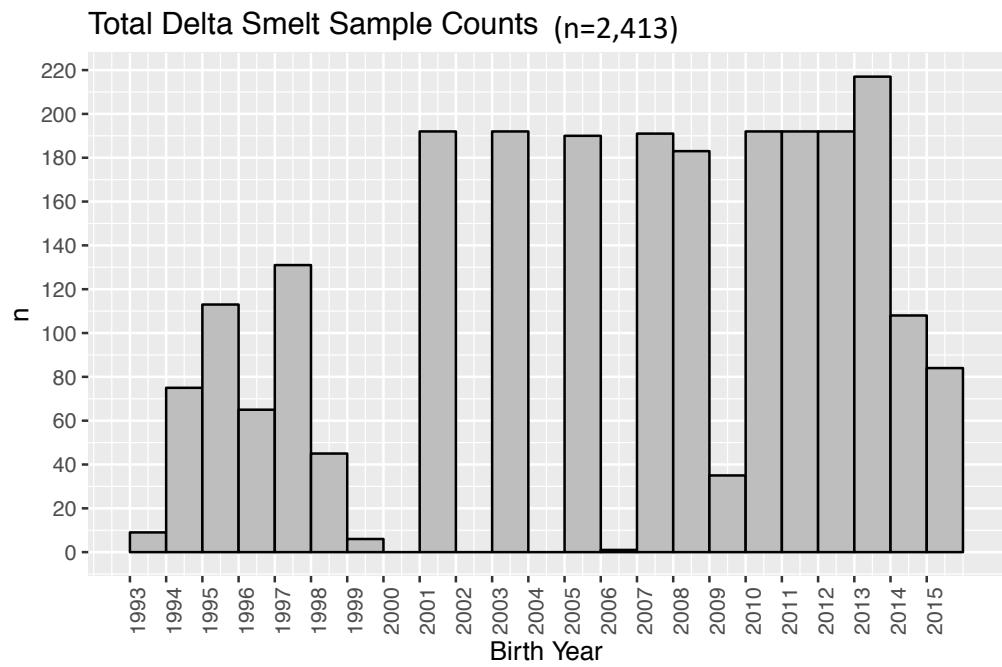


Temporal

- Sample at two timepoints

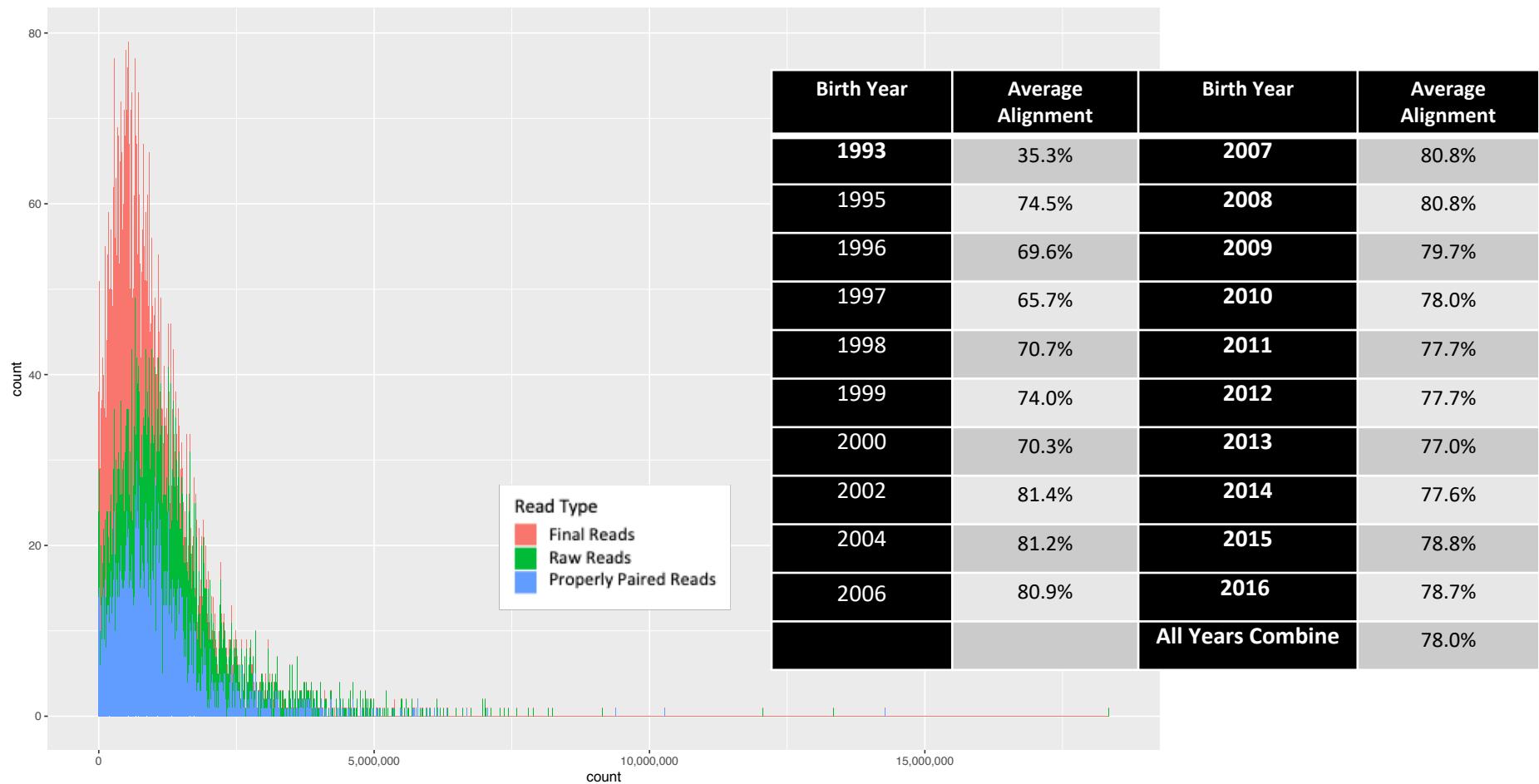


Sampling



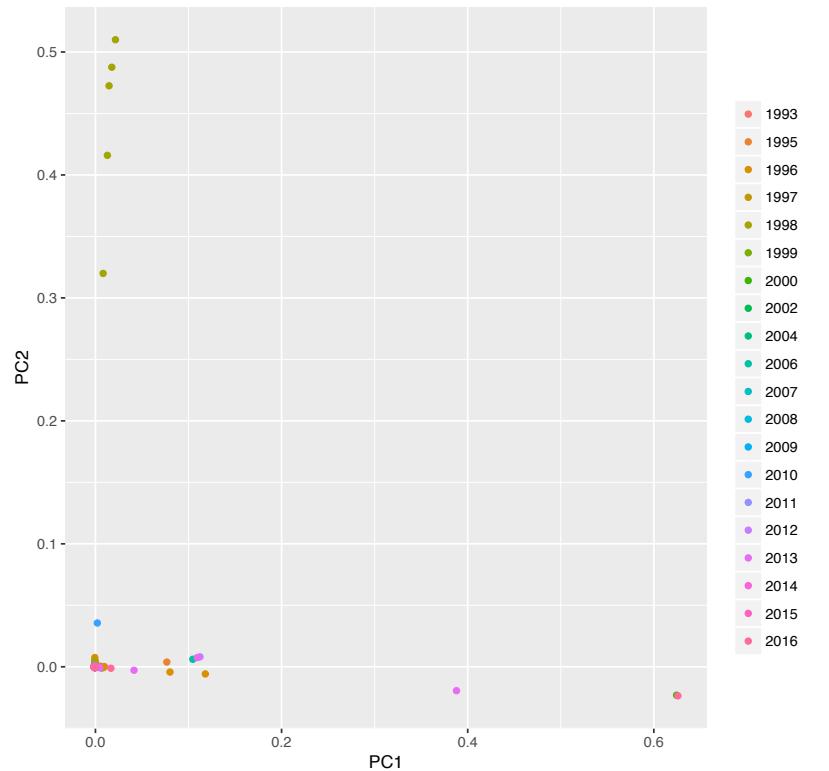
Birth Year	Samples	Pass Filt	Birth Year	Samples	Pass Filt
1993	9	9	2005	0	0
1994	0	0	2006	190	189
1995	75	70	2007	1	1
1996	113	109	2008	191	191
1997	65	65	2009	183	183
1998	131	125	2010	35	32
1999	45	45	2011	192	192
2000	6	4	2012	192	191
2001	0	0	2013	192	189
2002	192	192	2014	217	217
2003	0	0	2015	108	108
2004	192	192	2016	84	82

De novo Assembly & Alignment

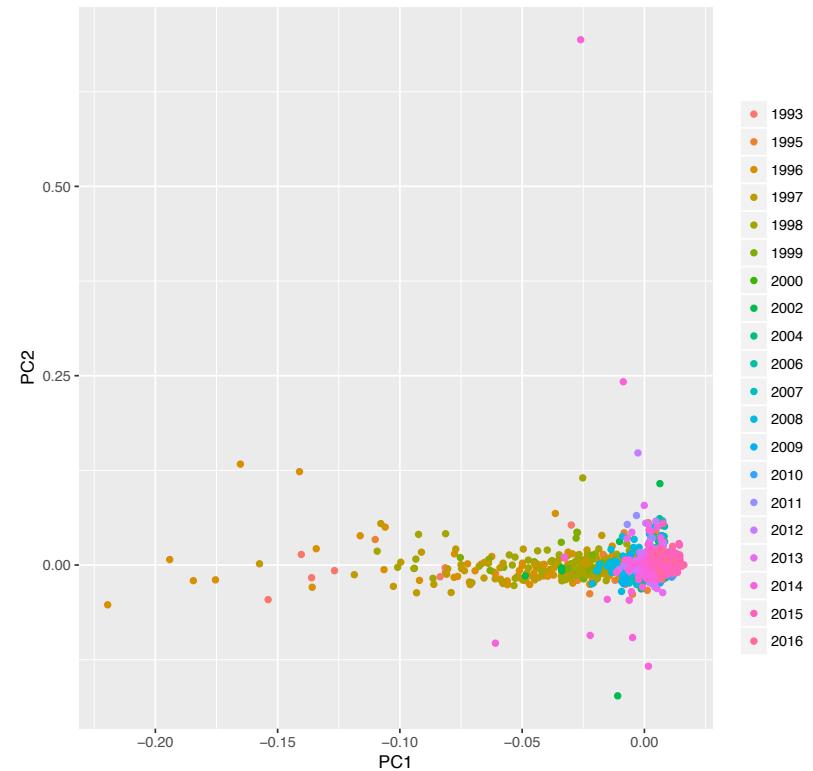


PCA Filtration

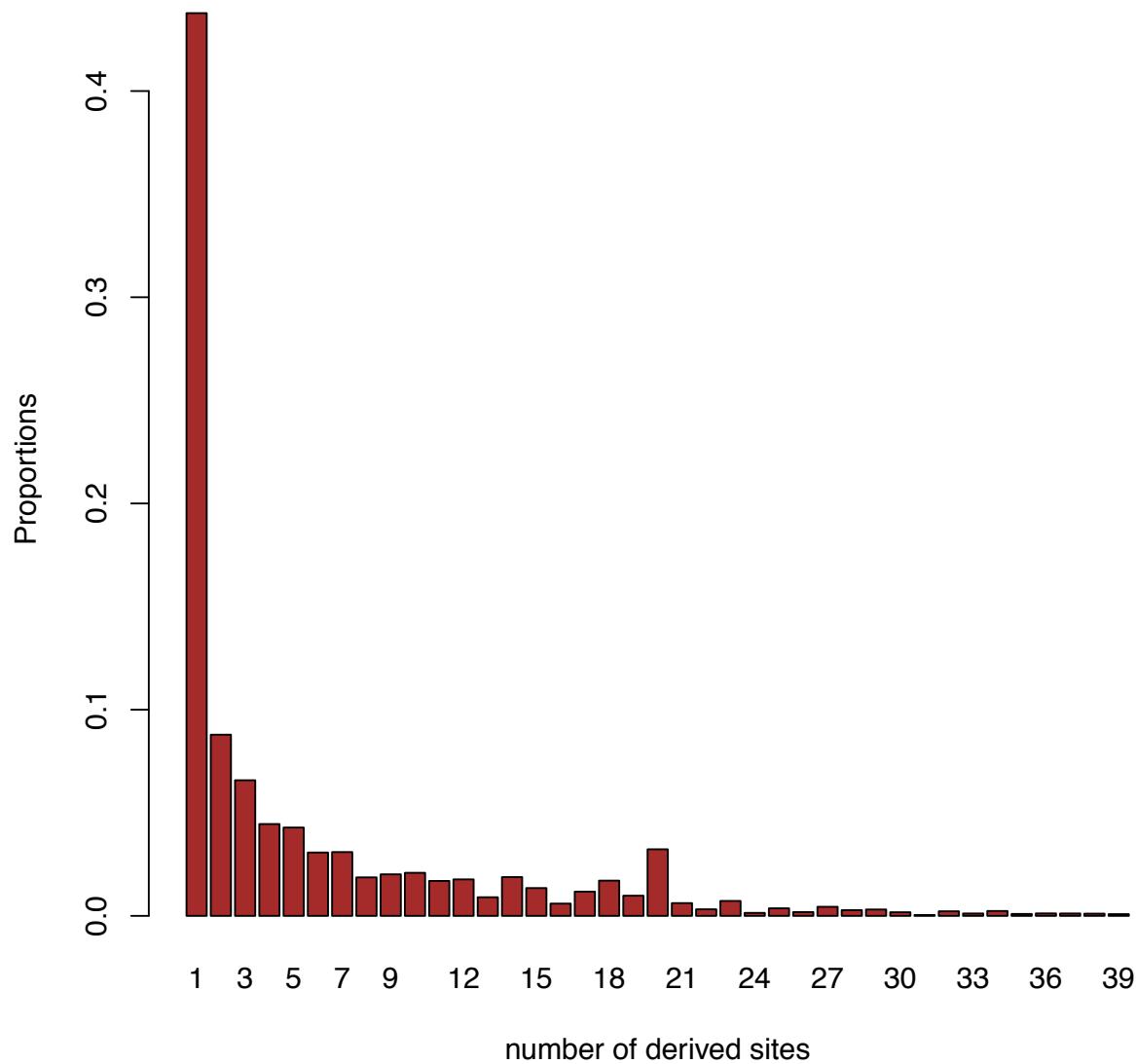
A. PC1 (23.5%) / PC2 (13.2%)



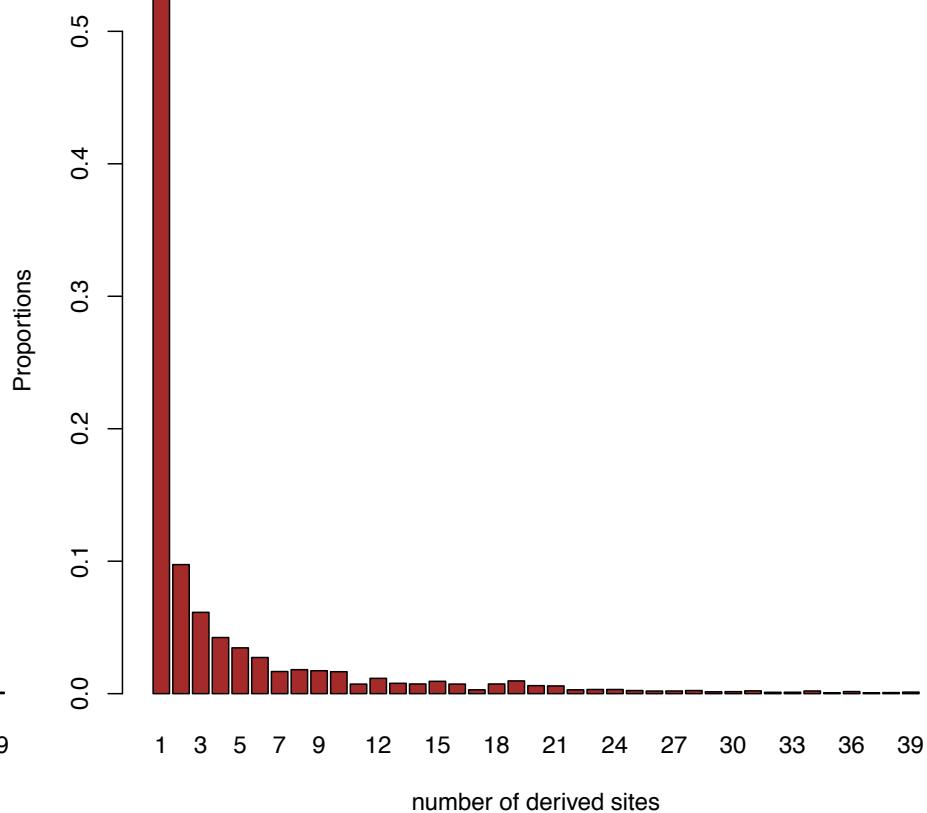
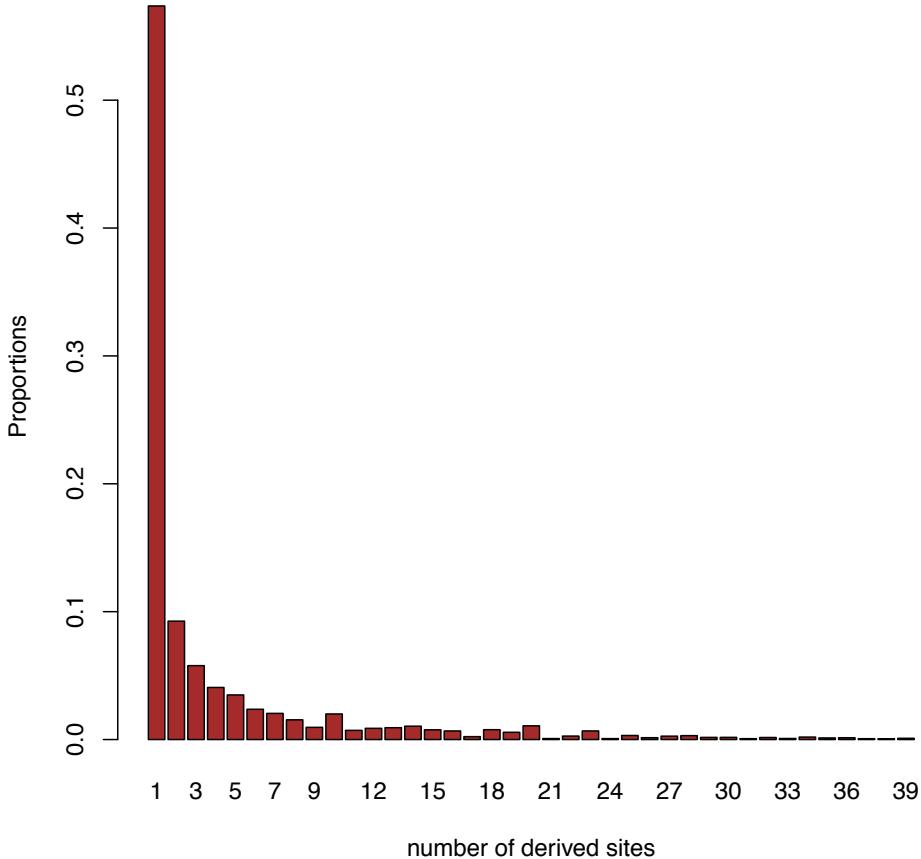
B. PC1 (0.234%) / PC2 (0.107%)



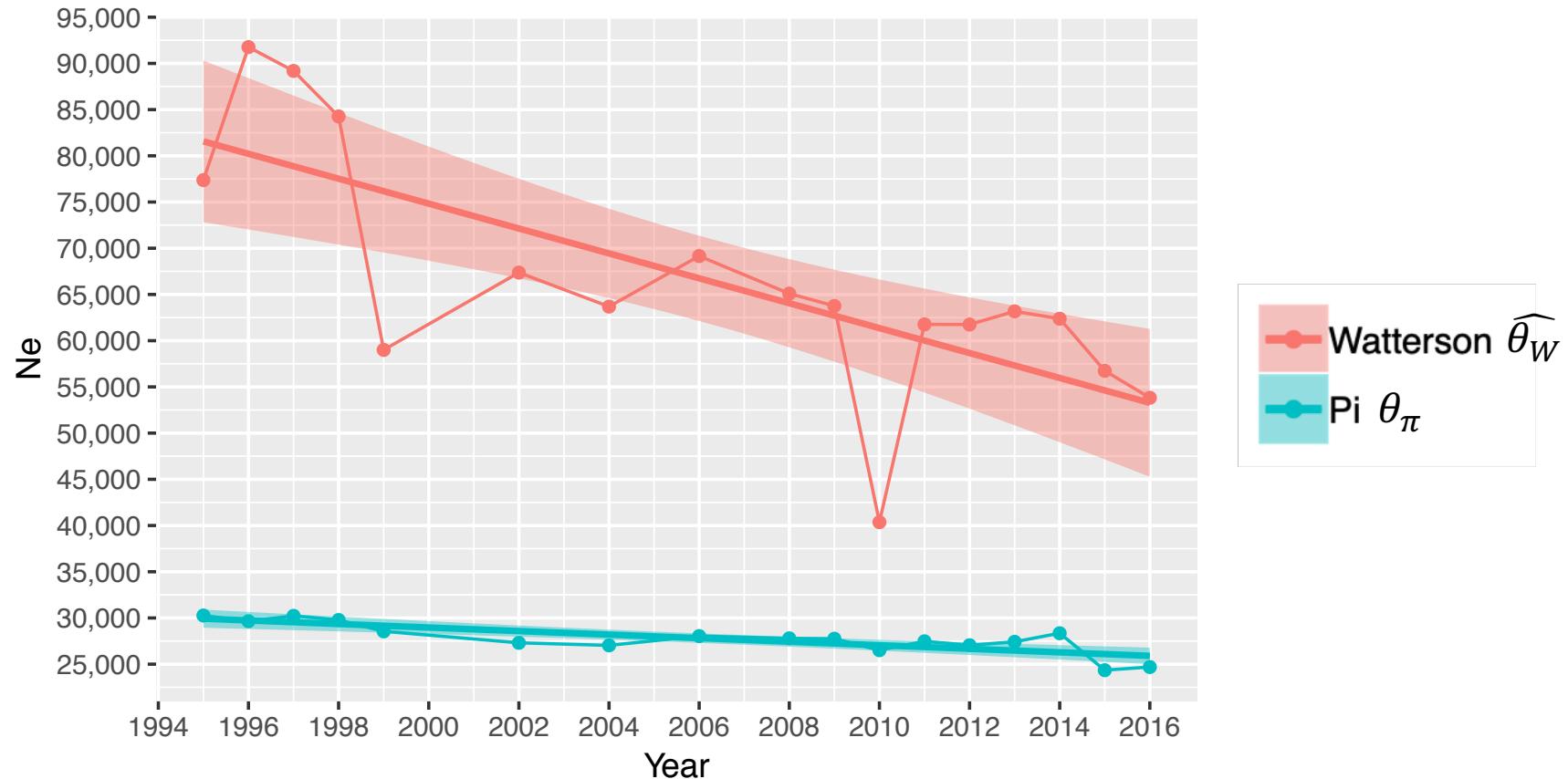
Identification of Paralogs



After Paralog Filtration



Long-Term N_e

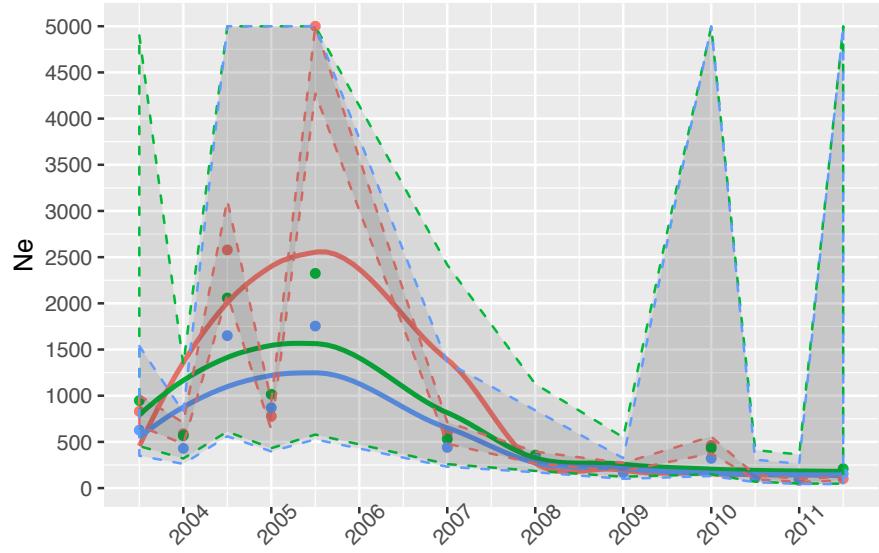


Contemporary N_e

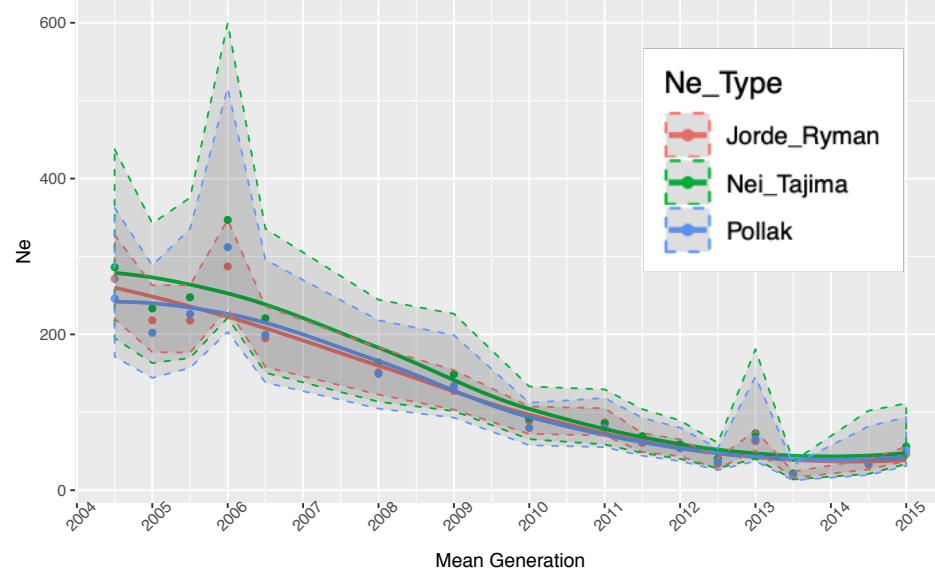


Contemporary N_e

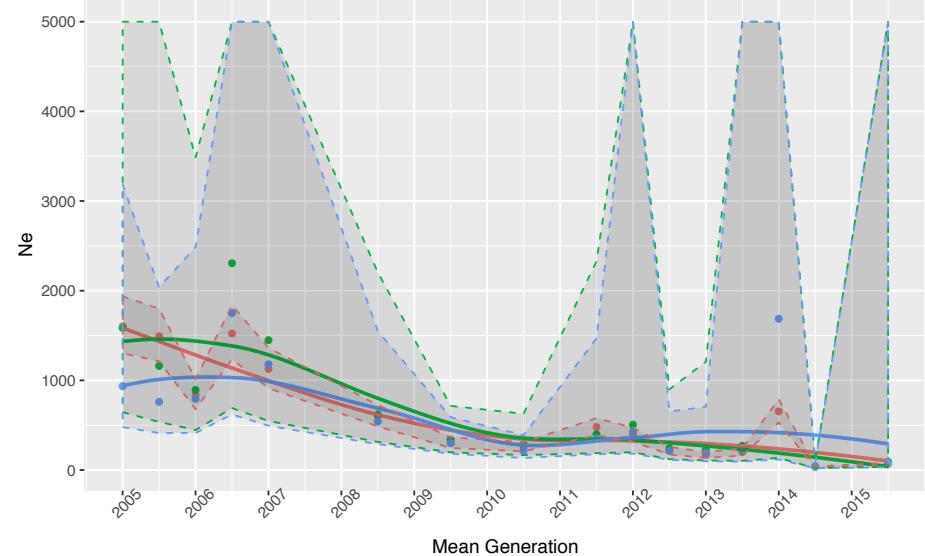
Temporal N_e 2012



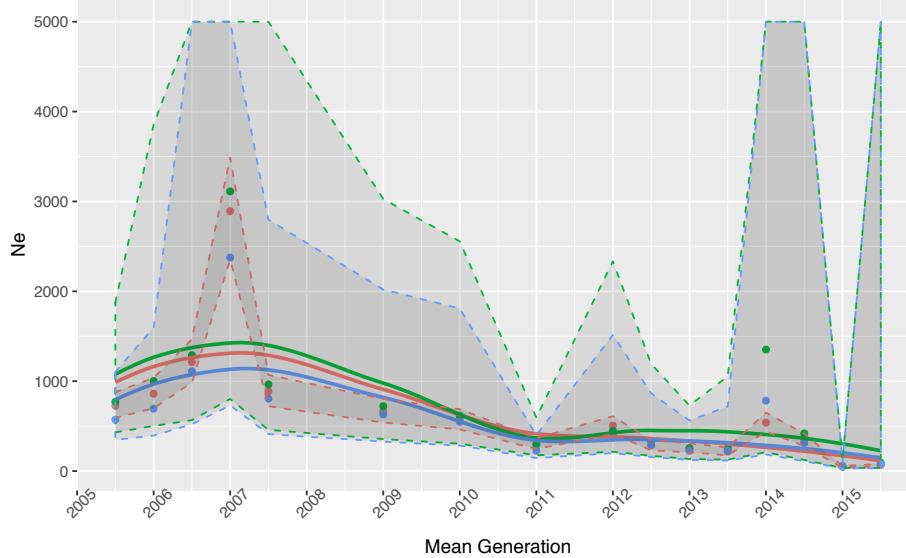
Temporal N_e 2014



Temporal N_e 2015



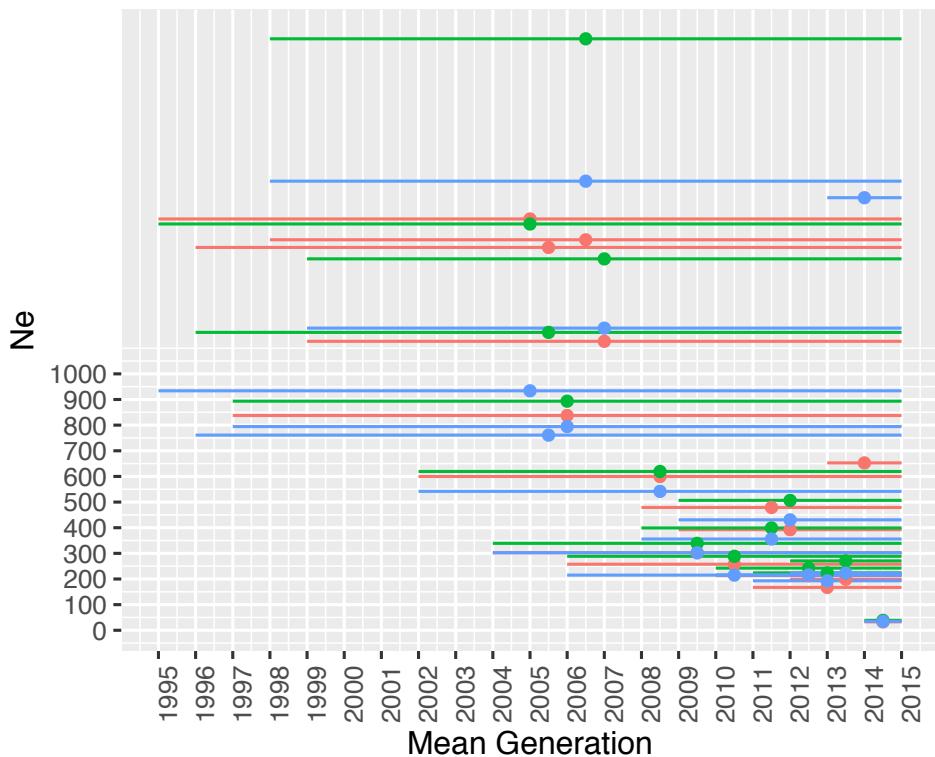
Temporal N_e 2016



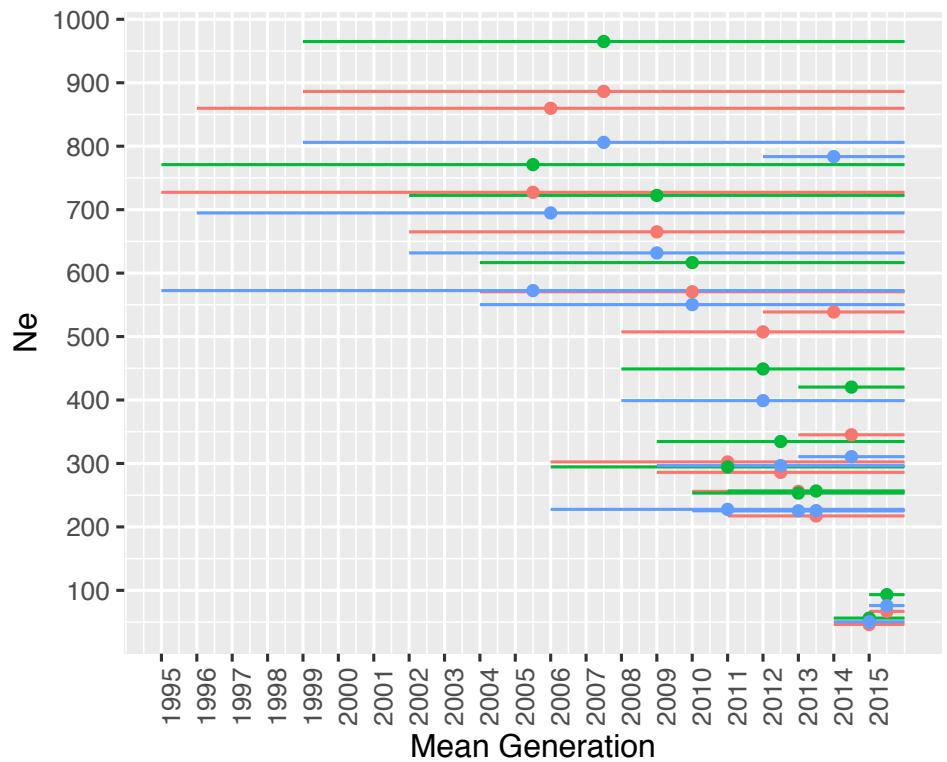
Ne_Type
Jorde_Ryman
Nei_Tajima
Pollak

Contemporary N_e is declining

Temporal N_e (Generation 0 = 2015)



Temporal N_e (Generation 0 = 2016)

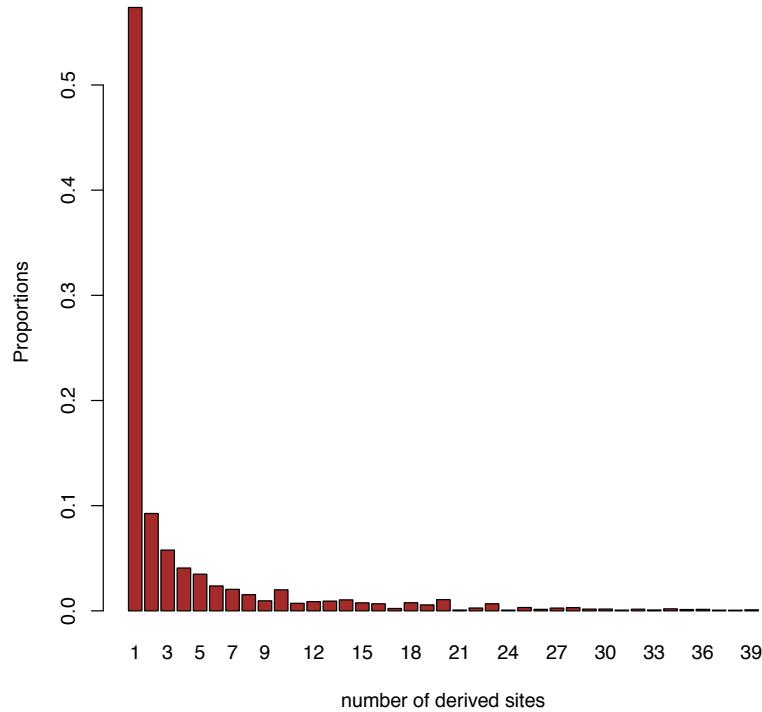


Ne Type

- Jorde_Ryman
- Nei_Tajima
- Pollak

Too many singletons?

objects/DS_history/data/paralog_id/results_SFS_unfold_noParalogs/DS_histot



The future

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Thank you!

Mandi Finger
Alisha Goodbla
Alyssa Benjamin
Ismail Saglam

Mike Miller
Andrea Schreier
Melinda Baerwald
Ted Sommers

Dept. Water Res.
Genomic Variation Lab

Miller Lab



Year	CI Low	LD Ne	CI High
2016	71.5	112.5	240.9
2015	60.9	85.9	139.1
2014	34.2	52.8	101
2013	41.9	111.8	Infinite
2012	48.9	62.1	83.5
2011	Infinite	-135.3	Infinite
2010	Infinite	-156.3	Infinite
2009	2103.2	-257.8	Infinite
2008	57.8	149.6	Infinite
2006	49.8	379.3	Infinite
2004	55.5	94.2	254.8
2002	332.9	-234.7	Infinite
1999	674.6	-198.5	Infinite
1998	165.4	551,714.8	Infinite
1997	165.1	1,149.6	Infinite
1996	Infinite	-100.8	Infinite
1995	283	-286.7	Infinite

Table 5. Linkage disequilibrium analysis of contemporary effective population size. Ne estimates for each year are given in bold with the corresponding low and high jackknife confidence interval .