# *Genetic testing informs breeding methods for Olympia oyster restoration*

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# Restoration Strategies

1. Restrict harvest, shoreline development
2. Enhance settlement structure to increase natural recruitment
3. Collect oysters at healthy site, transfer to restoration site
4. Grow seed in hatchery, outplant

# Puget Sound has the only Olympia oyster <u>restoration</u> hatchery



WASHINGTON DEPARTMENT OF FISH & WILDLIFE'S
HISTORIC LOCATIONS OF LARGE OLYMPIA OYSTER
BEDS

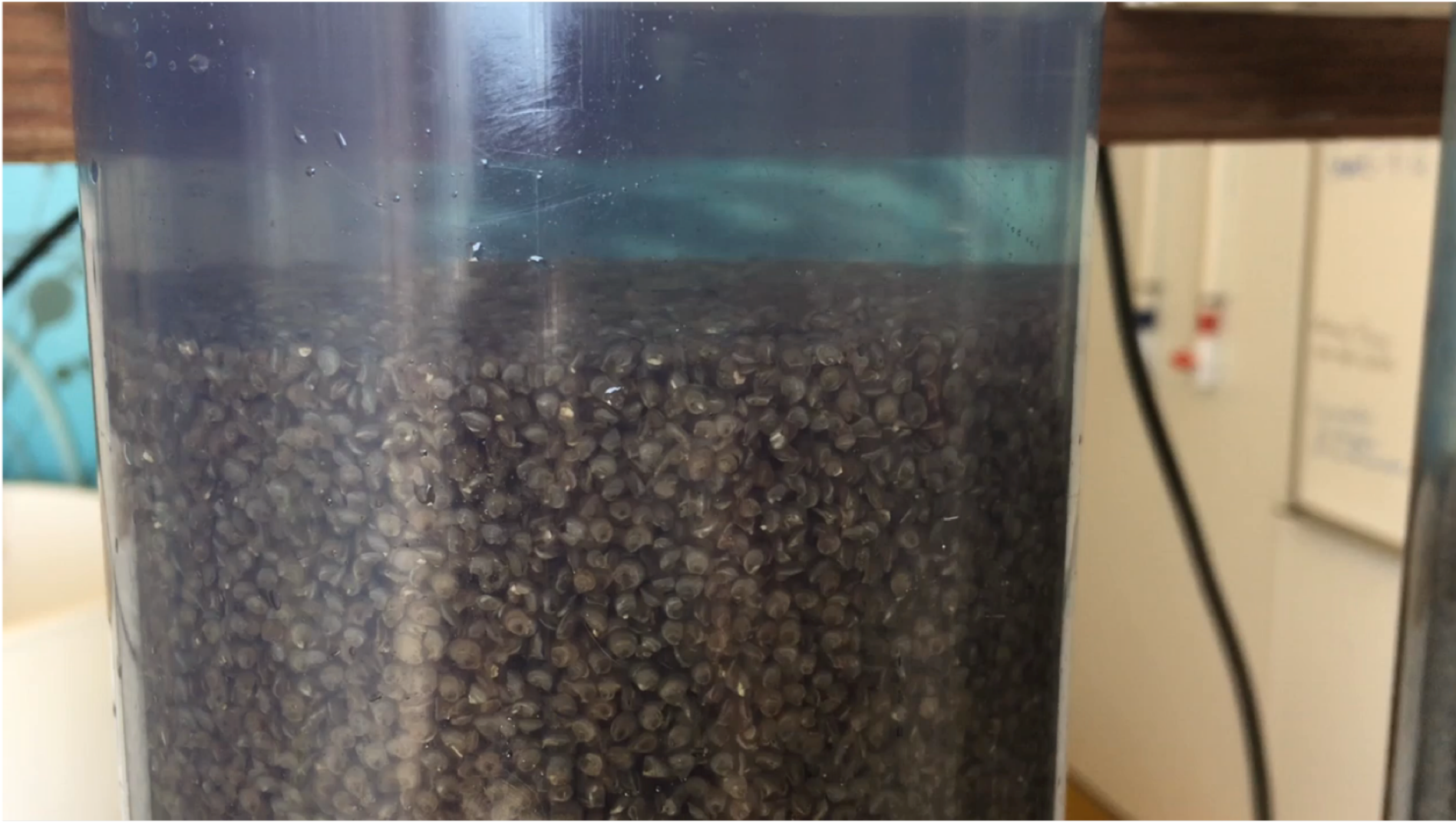*Peabody & Davis, Puget Sound Restoration Fund, 2015*
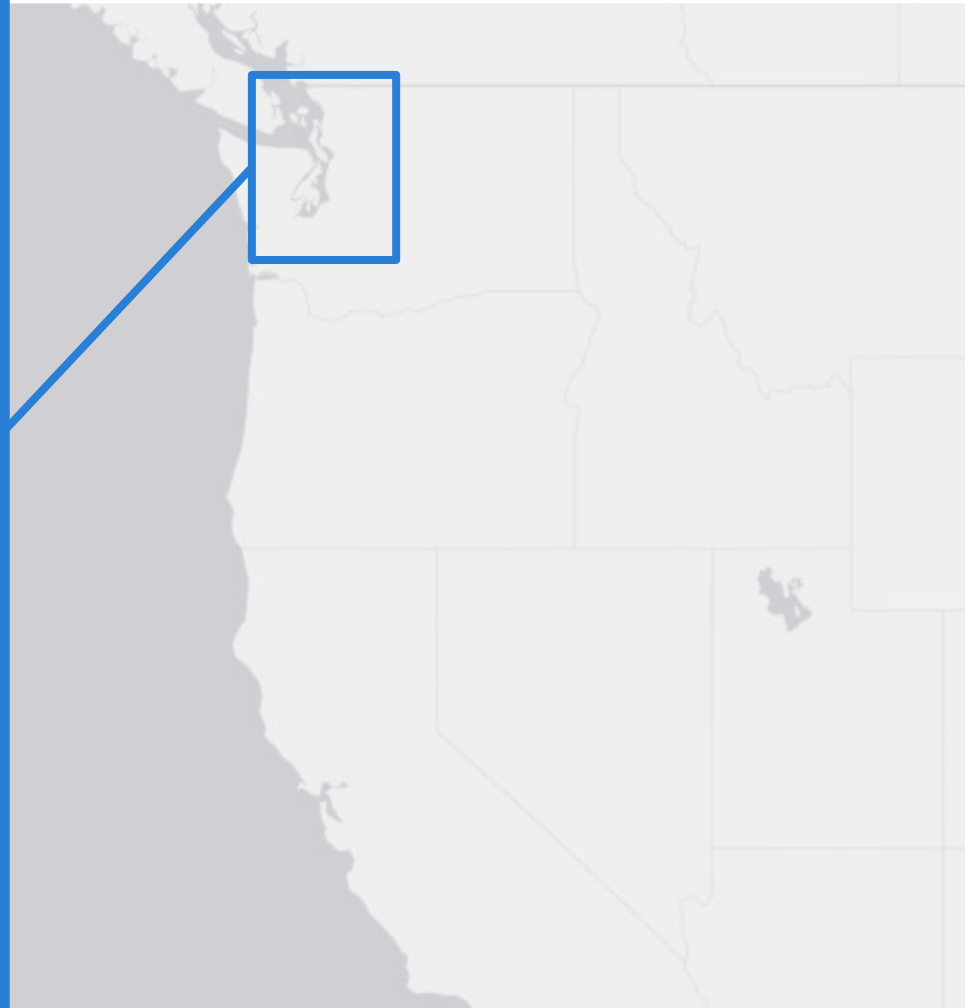
# Hatchery production by Puget Sound Restoration Fund, NOAA

**Genetic concerns** in restoration breeding

1. **Lack of diversity**: producing only a few families

2. **Mixing** genetically **distinct sub-populations** that are locally adapted

3. **Hatchery selection**: traits beneficial in hatchery system amplified, but detrimental in natural system

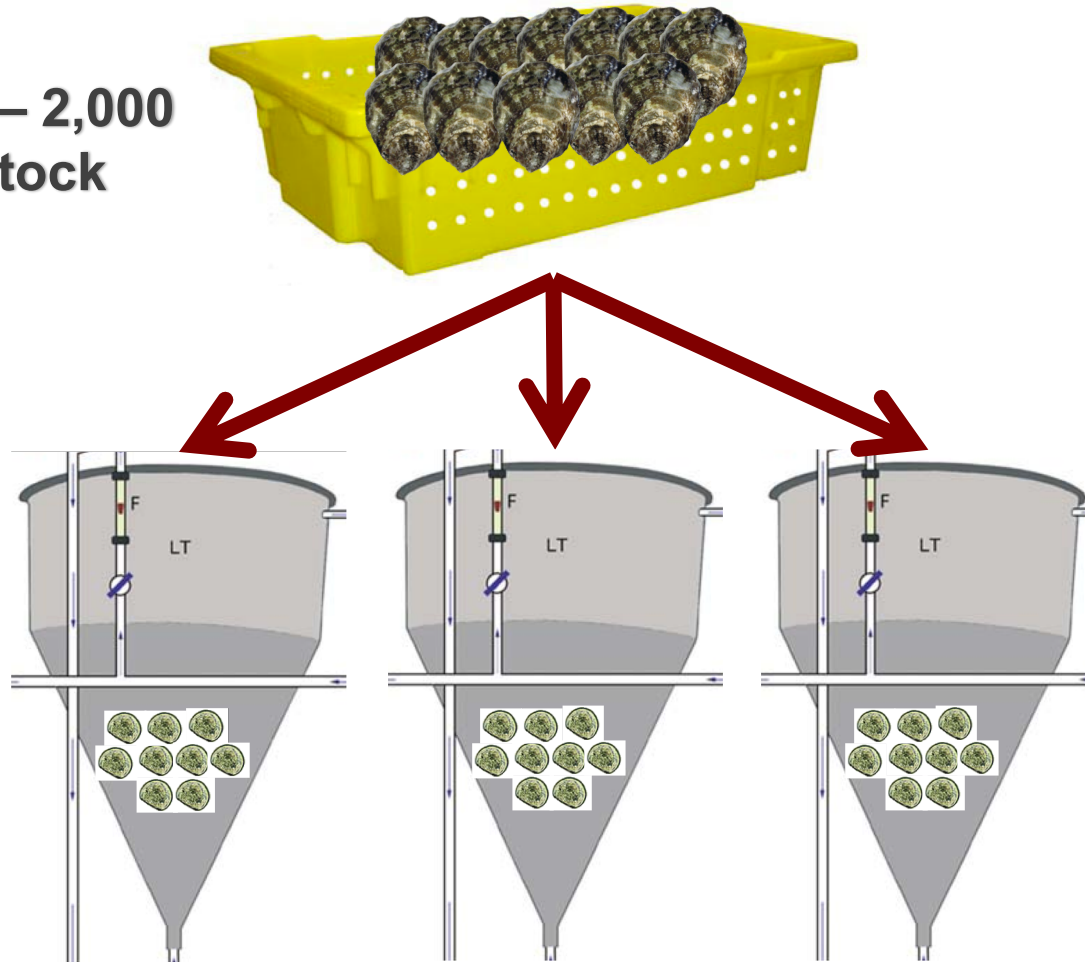*How to produce oysters that are genetically indiscriminate from wild?*

# Question

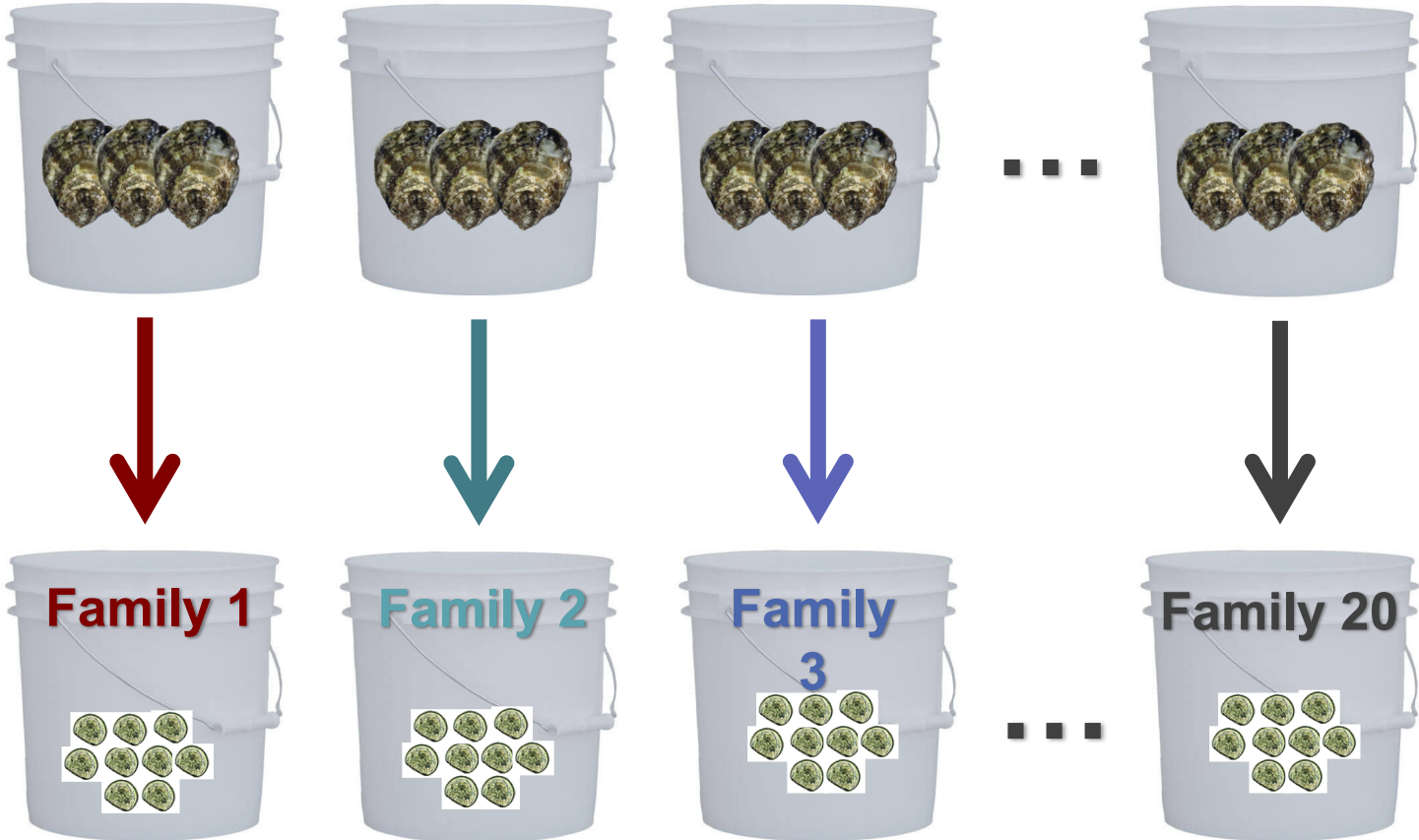Which breeding method results in the **highest genetic diversity**?

# Breeding method A

**N=~1,500 – 2,000 broodstock**

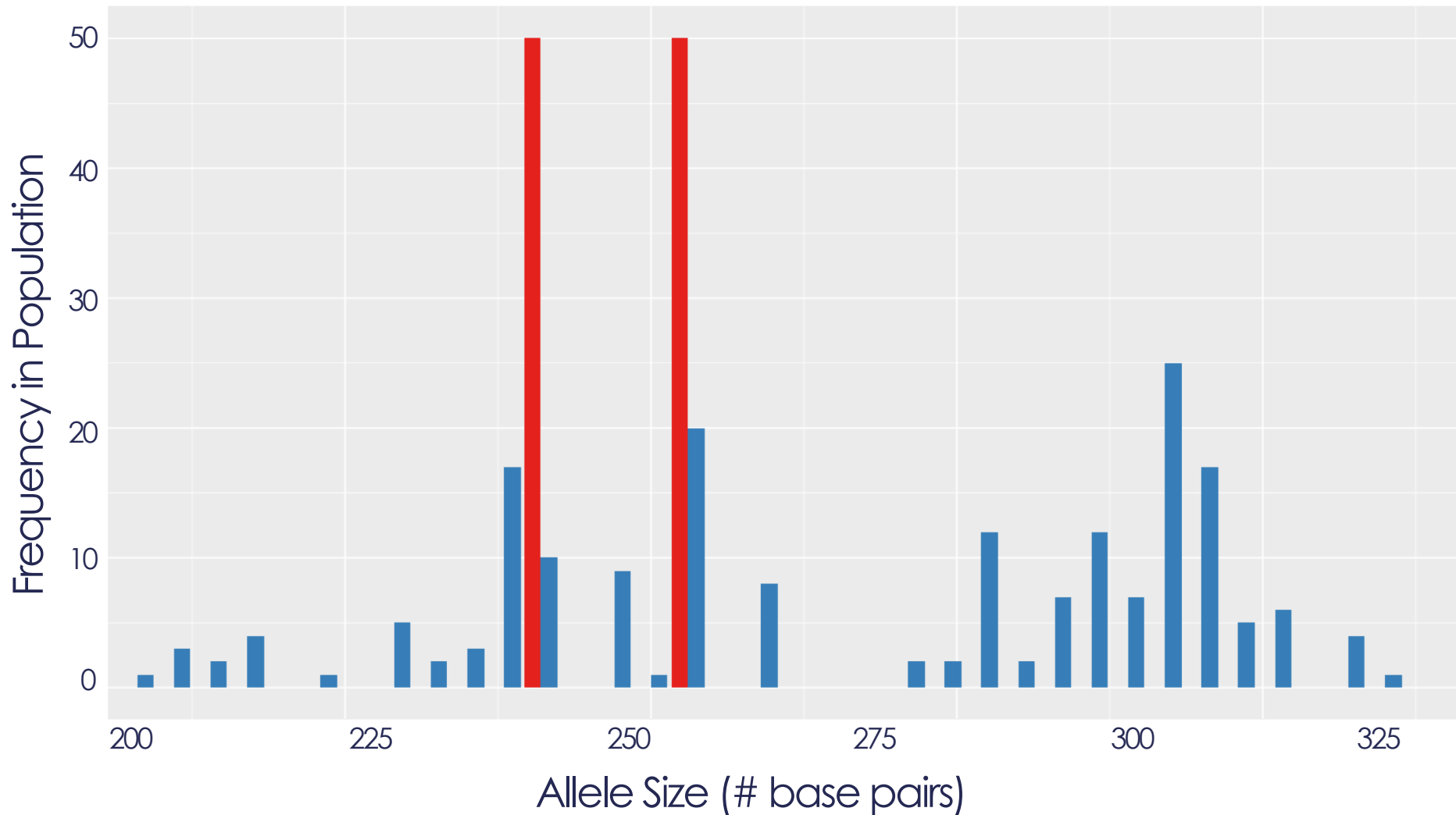Mass volitional spawn, no larvae separated

# Breeding method B

n=~25 brood-stock per family

Family 1    Family 2    Family 3    Family 20

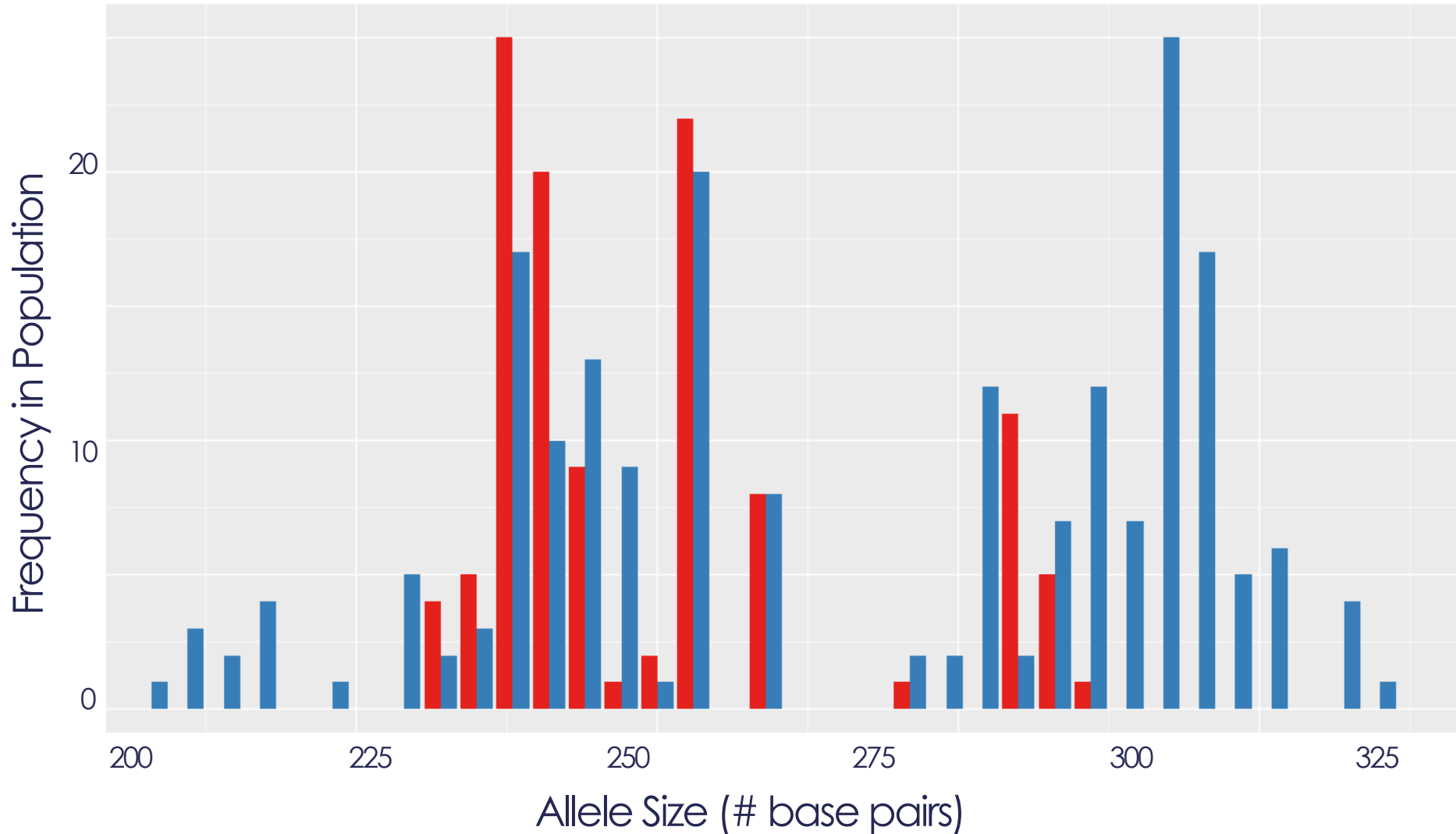Separated broodstock & larvae, "Bucket" method
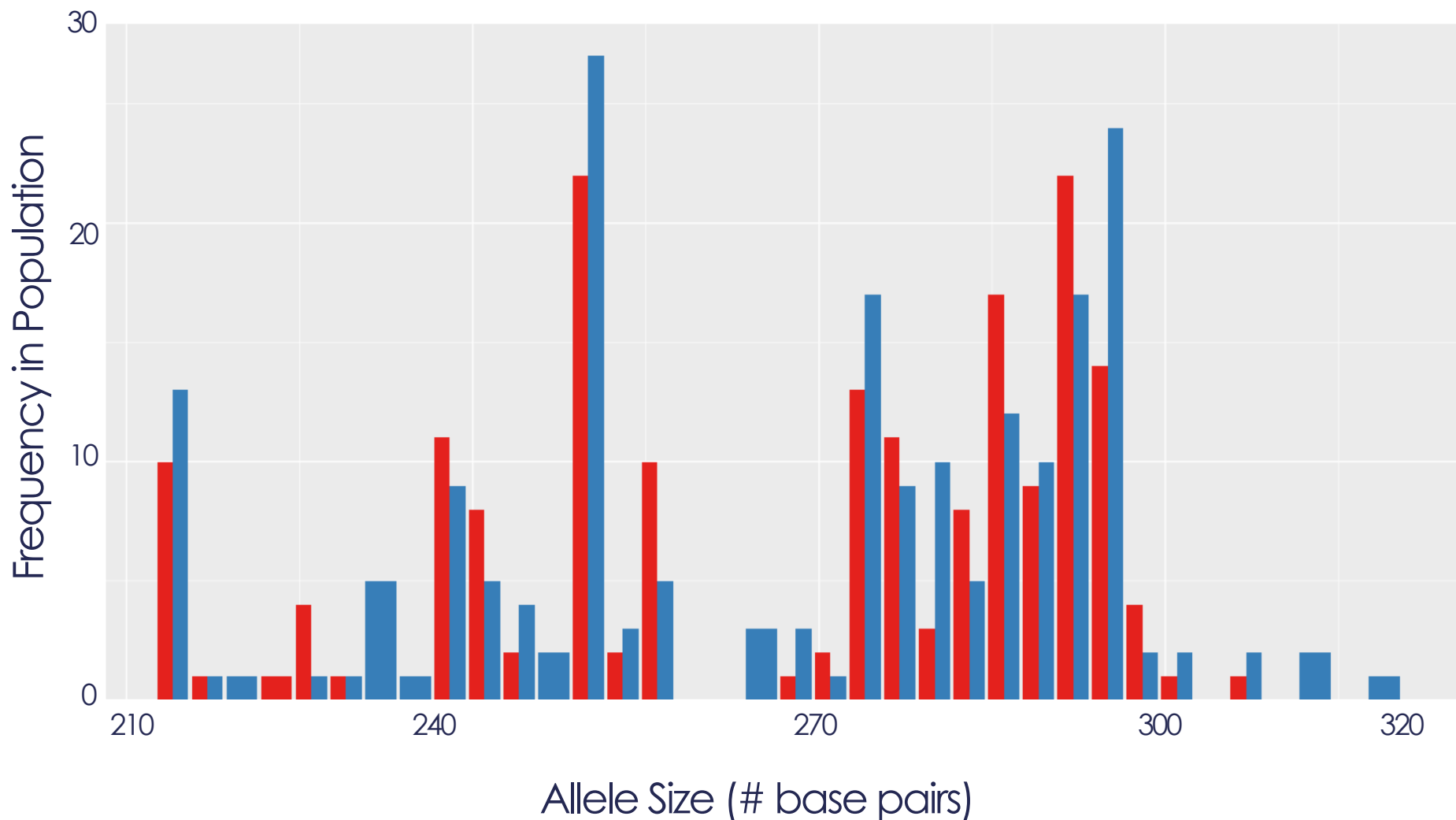
Hypothetical *Wild* vs. **Hatchery (F1)** all siblings

Hypothetical **Wild** vs. **Hatchery**
*less diversity compared to wild*

2014 "Bucket" *Wild* vs. *Hatchery (F1)*

# *Microsatellites informed breeding methods*



**Family 1**

**2014 Seed vs. Wild**
P-value across all loci
(Fisher's method)
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| Locus | P-Value |
| ------------ | -------- |
| Olur10 | 0.23431 |
| Olur11 | 0.08533 |
| Olur12 | 0.3782 |
| Olur13 | 0.00006* |
| Olur15 | 0.00009* |
| Olur17 | 0.78623 |
| Olur18 | 0.00423* |

All: Chi2= 39.524 (df= 14)
**P-value= 0.000000158**

**2011 Seed vs. Wild**
P-value across all loci
(Fisher's method)
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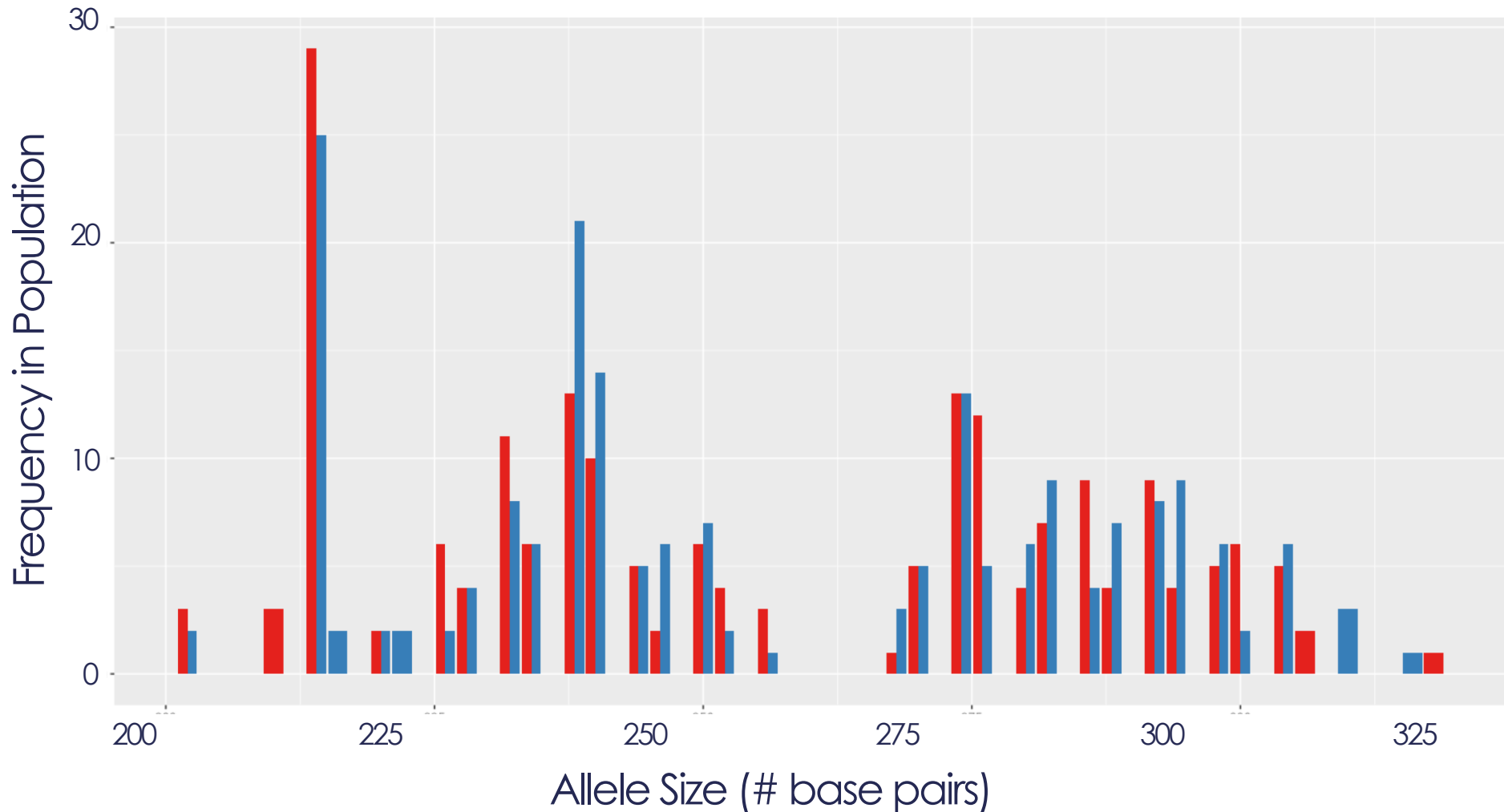| Locus | P-Value |
| ------------ | -------- |
| Olur10 | 0.00663 |
| Olur11 | 0.22946 |
| Olur12 | 0.01095 |
| Olur13 | 0.01624 |
| Olur15 | 0.00054 |
| Olur17 | 0.00011 |
| Olur18 | 0.09468 |

All: Chi2= 68.2382 (df= 14)
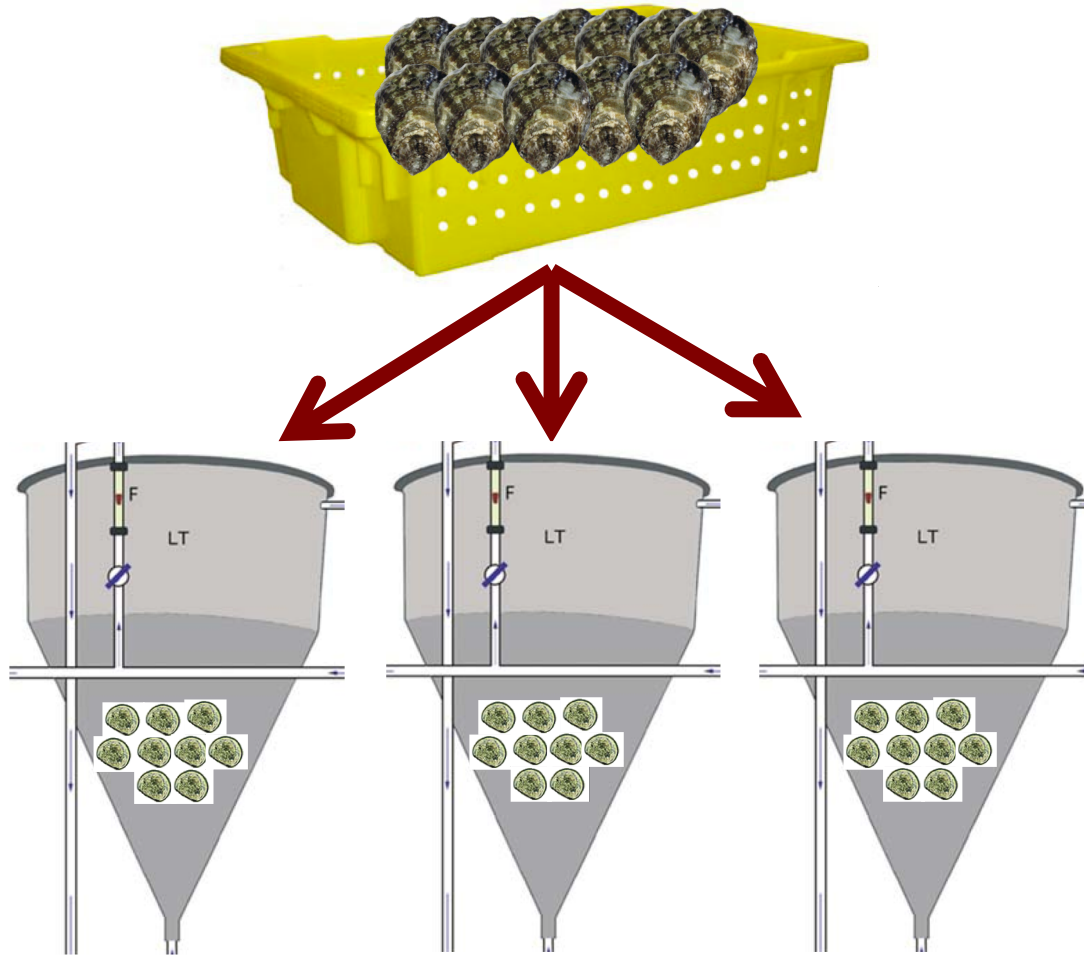**P-value= 4.01679e-09**

# 2010-2014          Separated broodstock & larvae

2016 "Mass Volitional" **Wild** vs. **Hatchery (F1)**

# Microsatellites informed breeding methods



**2016 Seed vs. Wild**
P-value across all loci
(Fisher's method)

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| Locus | P-Value |
| ------------ | -------- |
| Olur10 | 0.32784 |
| Olur11 | 0.54191 |
| Olur12 | 0.67662 |
| Olur13 | 0.08560 |
| Olur15 | 0.06505 |
| Olur19 | 0.01146 |

All: Chi2= 18.39076 (df= 12)
**P-value= 0.104331**

2014-today

Mass spawn, collected for 4+ weeks,
separated larvae based on capacity

## Lessons

- 2016 Oly cohort genetically indiscriminate from wild (*p=0.104*)
- Genetic testing informed breeding methods
- Better method: Mass volitional spawn
- Added benefit: less labor, resources

## Caveats

- No guarantee from year to year
- Not directly assessing hatchery selection
- More robust testing soon! (SNP testing)

## Thank you

- NSA
- Puget Sound Restoration Fund: Betsy, Ryan, Stuart, many others …
- NOAA: Crystal, Rick, Andy
- Roberts Lab @ UW: Brent, Steven
- NSF GRFP