Salmon stock structure – update: Pink salmon in Prince William Sound

Alaska Department of Fish & Game
Gene Conservation Lab

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Study Design: Odd year

	Contemporary 2013	Historical
Natural Pink Salmon	√	
Hatchery Pink Salmon	√	√

Population Structure Analyses

- **Homogeneity tests**
- **Principle Component Analyses (PCA)**
- **Multidimensional Scaling (MDS)**
- **Fixation indices (F_{ST})**

Study Design

	Contemporary	Historical
Natural Pink Salmon	√	
Hatchery Pink Salmon	√	√

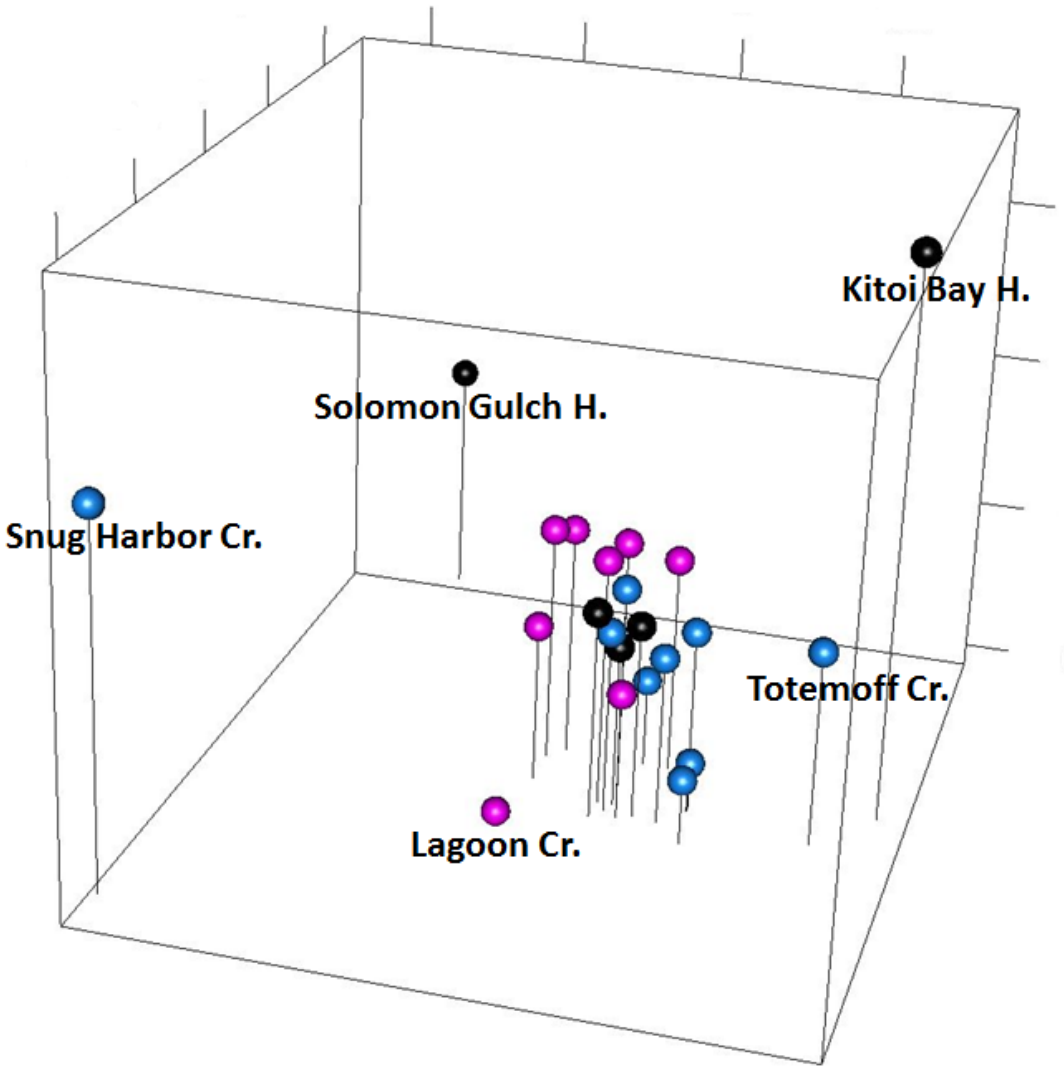
Homogeneity tests

H_0: Each collection in Prince William Sound was drawn from a single homogeneous source.

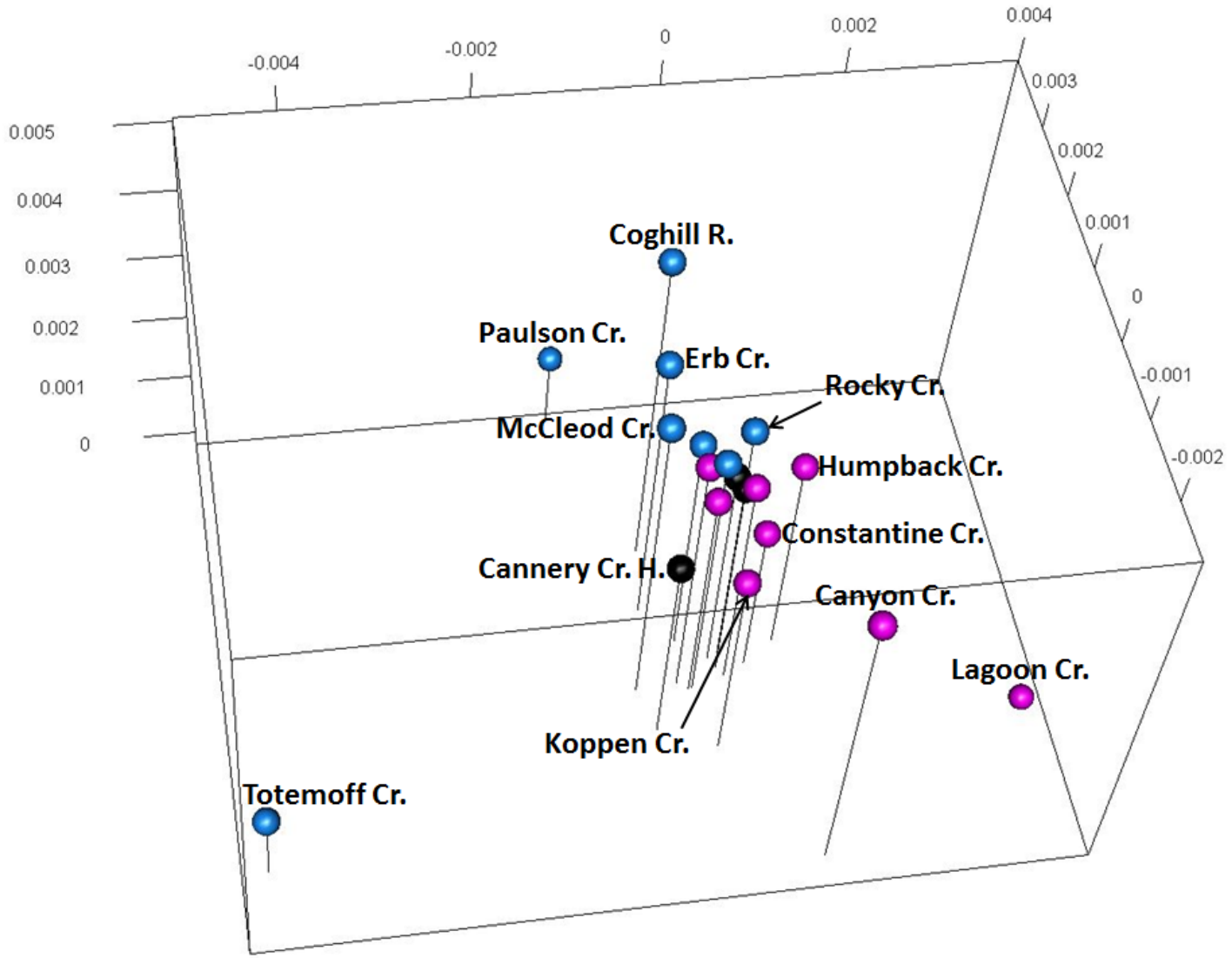
$$p = 3.05 \times 10^{-70} \quad (\alpha = 0.05)$$

Conclusion: Not all collections from the same population.

Multidimensional Scaling (MDS)



Multidimensional Scaling (MDS)



Study Design

	Contemporary	Historical
Natural Pink Salmon	√	
Hatchery Pink Salmon	√	√

Comparison between contemporary and historical hatchery collections

Hatchery	Year	P-value (α=0.05)	Conclusion
AFK	2013 vs. 1991	0.077	Can not reject H_0.
CANN	2013 vs. 1991	0.278	Can not reject H_0.
VFDA	2013 vs. 1991	0.308	Can not reject H_0.
KRAA	2013 vs. 2009	0.109	Can not reject H_0.

Fixation index (F_{ST})

- **The proportion of total variation that can be accounted for by differences among populations**

- **$0 \leq F_{ST} \leq 1$**

Study	Marker	Geography	Pops/Sites	Spatial scale (km)	F_{ST}
Cheng et al.	Microsatellite	PWS, AK	22	~10-200	0.002 (odd year)

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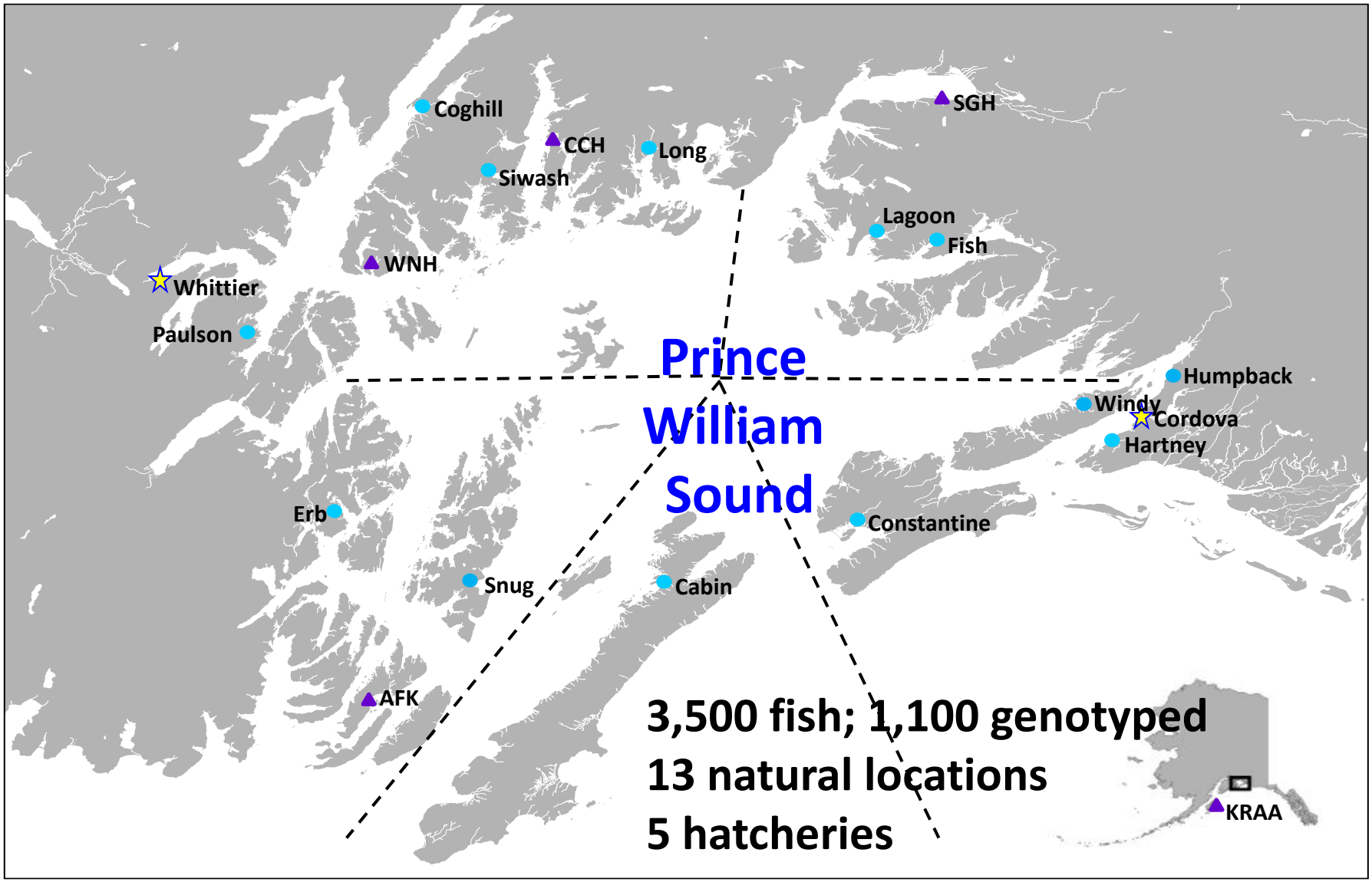
Seeb et al. (1999)	Allozyme	PWS,AK	22	~10-200	G_{st}=0.007 (even year)
Hawkins et al. (2002)	Allozyme	Asia	25	~10-3700	0.006 (odd year)
Olsen, et al. (1998)	Microsatellite	AK,BC, and WA	12	~50-4700	$\widehat{\theta}$=0.022 (odd year)
Beacham *et al.* (2012)	Microsatellite	BC and WA	146 (odd year) 116 (even year)	~1,400	0.005 (odd year) 0.002 (even year)

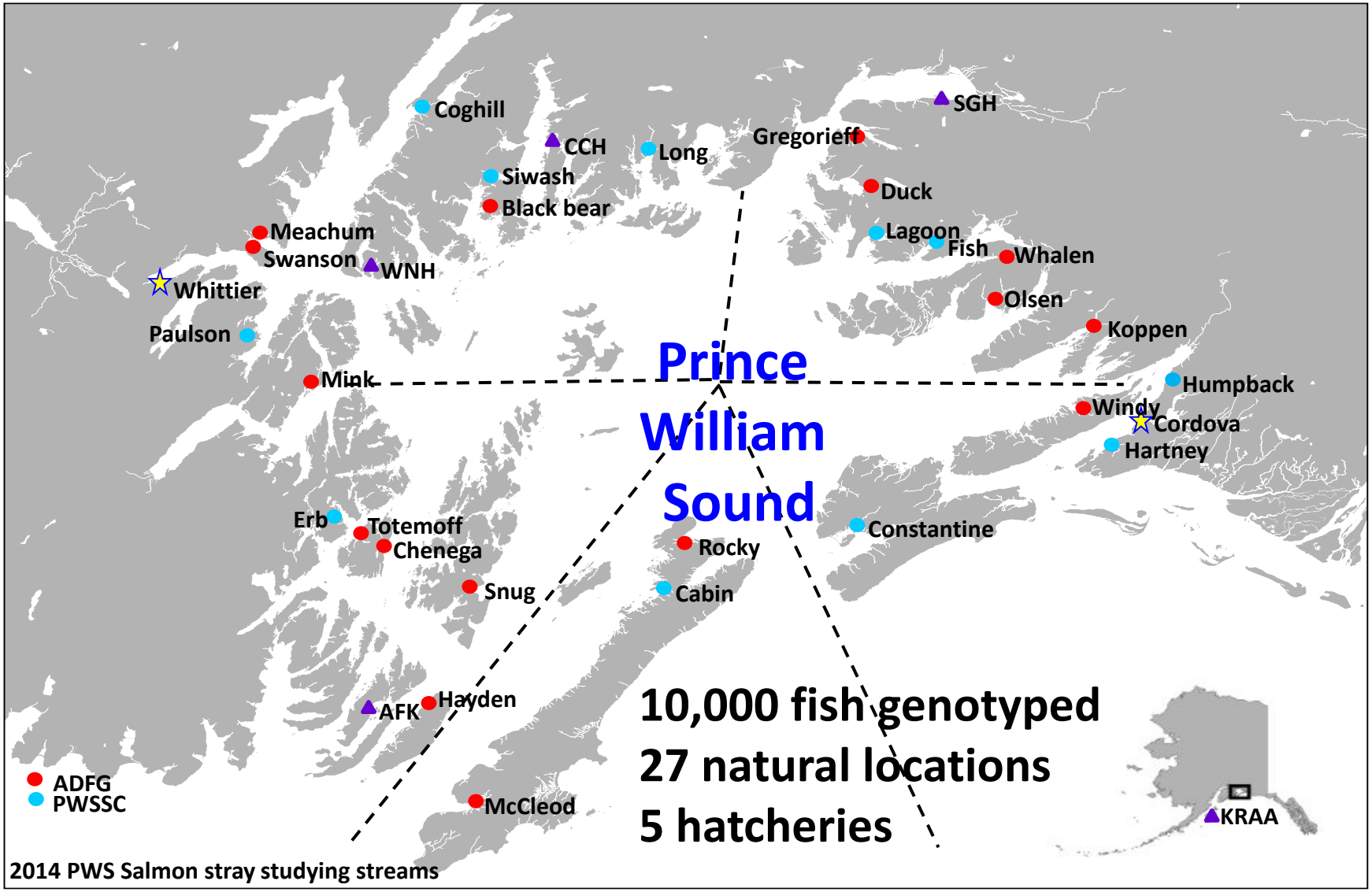
Summary

- Kodiak vs. Prince William Sound (PWS)
  - Significantly different
- Population Structure in PWS
  - Significantly
- VFDA Hatchery
  - Divergent
- Early run vs. late run
  - Maybe different
- Hatchery stocks temporal stability
  - Stable over time

2015 collections



Even Year collections (2014 + Historical data)



Future Study

- **Odd-year analysis**
- **Fish with different run timing**
- **Contemporary vs. historical in natural populations**

Acknowledgements

- Hatcheries
  - PWSAC, VFDA, KRAA
- Prince William Sound Science Center
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  - Pacific Biological Station
- Alaska Department of Fish and Game
- Alaska Hatchery Research Program Science Panel
- University of Alaska Fairbanks – Juneau Center