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Population genetics of native shellfish aquaculture species and potential genetic risks of cultivation

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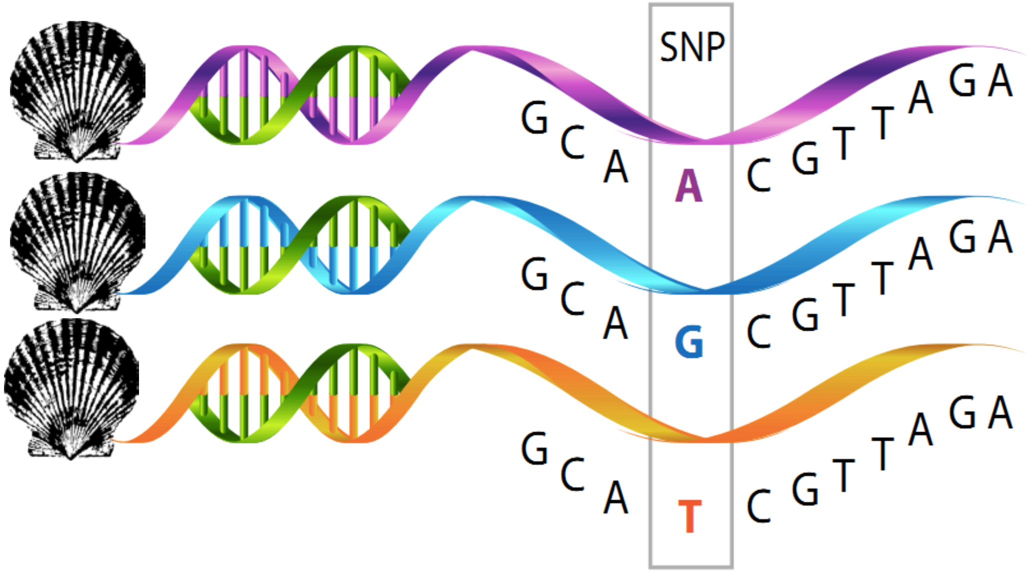

Natalie Lowell, Lorenz Hauser, & Brent Vadopalas (UW)

& Joth Davis (Baywater Inc), Brady Blake (WDFW), Andy Suhrbier (PSI), Bobbi Hudson (PSI), Robert Sizemore (WDFW), Benoit Eudeline (Taylor Shellfish), & Eric Ward (NOAA Fisheries)

April 5, 2018 | Salish Sea Ecosystem Conference

Native shellfish aquaculture

- Shellfish aquaculture supports many livelihoods
  - Geoduck (native sp) particularly valuable
- Expanding native species
- May pose genetic risks to wild populations if farmed and wild animals interbreed
  - True for farms, stocking beaches, or restoring w/ seed

Genetic risks of native shellfish aquaculture

- Native shellfish farming poses genetic risks to wild populations:
    1. Loss of genetic diversity within populations
    2. Loss of genetic diversity between populations
    3. Reduced fitness due to domestication selection

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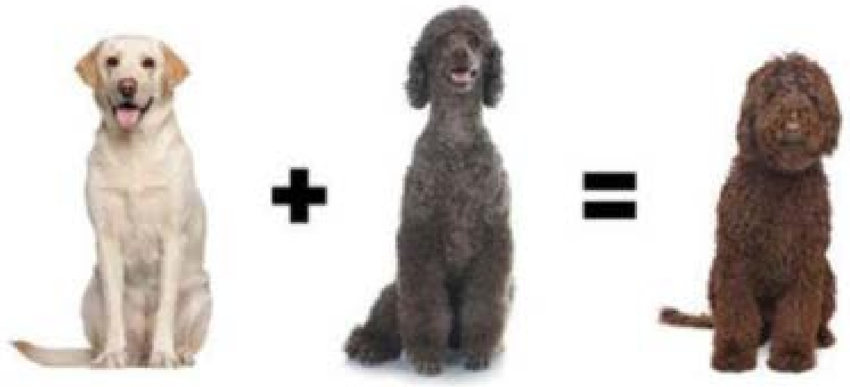

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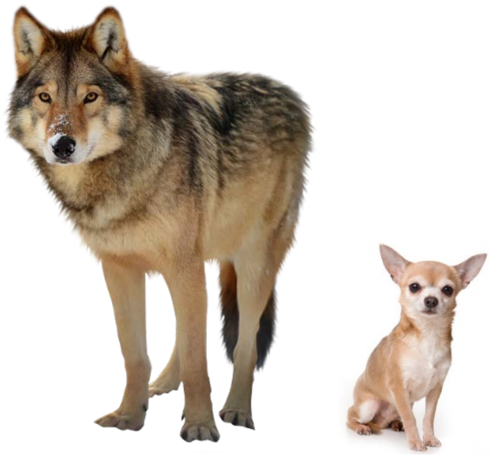

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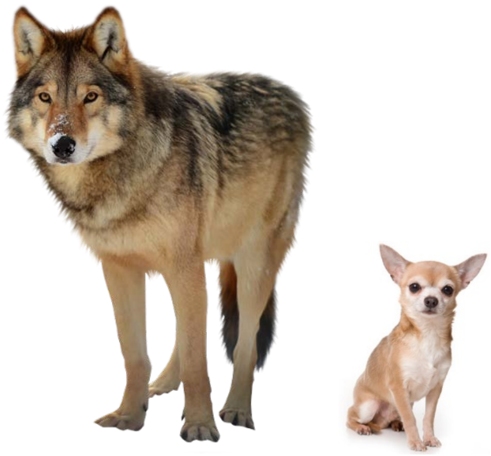
     - Intentional & unintentional
     - Relaxation of natural selection



Genetic risks of native shellfish aquaculture

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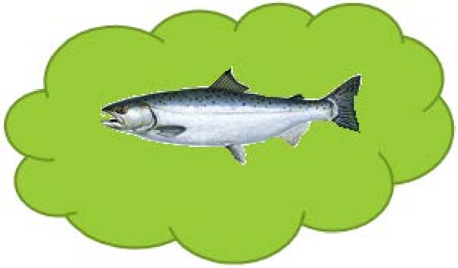
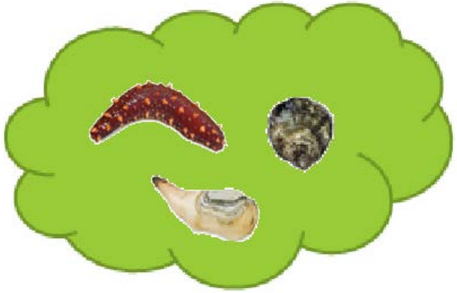
    1. Loss of genetic diversity within populations
    2. Loss of genetic diversity between populations
    3. Reduced fitness due to domestication selection
        - Intentional & unintentional
        - Relaxation of natural selection
- Genetic risks may increase **population extinction risk**

Our knowledge of these risks is salmon-centric

	Pacific salmon	(Most) Shellfish
Relative fecundity	Low	High
Reproductive strategy	Semelparity	Iteroparity
Harvest time	Before reproduction	After reproduction

Dissertation Overview

1. Population genetics
   a) Purple-hinged rock scallops
   b) California sea cucumbers
2. Genetic risk assessment
   a) Construction of genetic model
   b) Management strategy evaluation
   c) Case study analysis

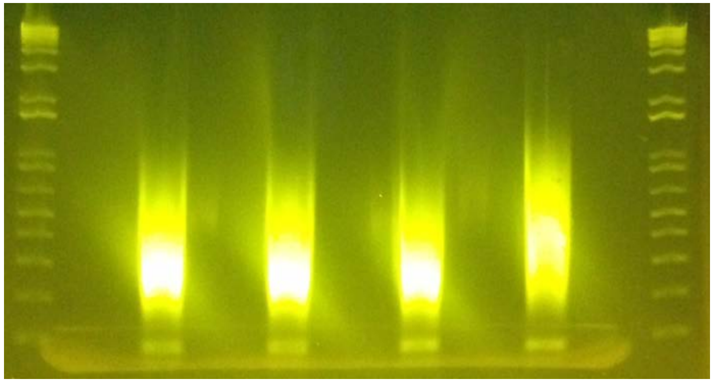
Population genetics

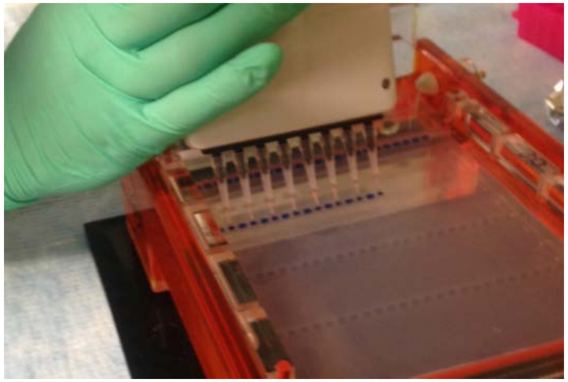
Population genetics: methods

1. **Process tissue samples with single digest RADseq**

2. Discover SNPs by assembling sequences into loci with ipyrad

3. Genotype individuals in different populations & compare





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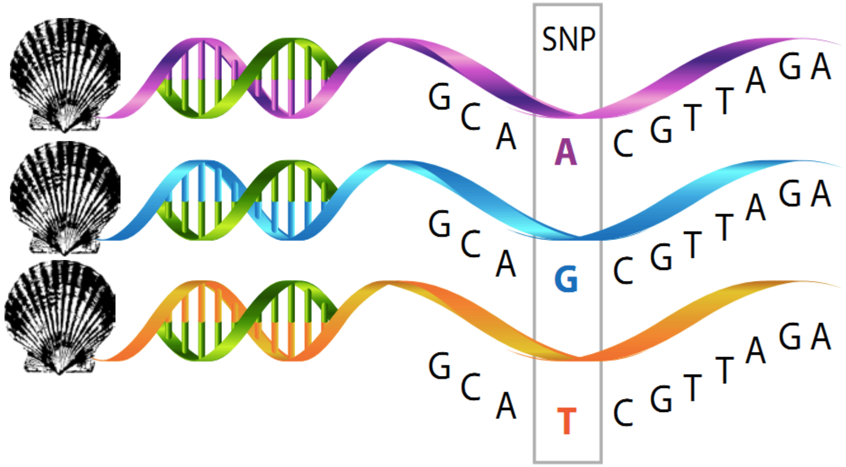


Population genetics: methods

1. Process tissue samples with single digest RADseq

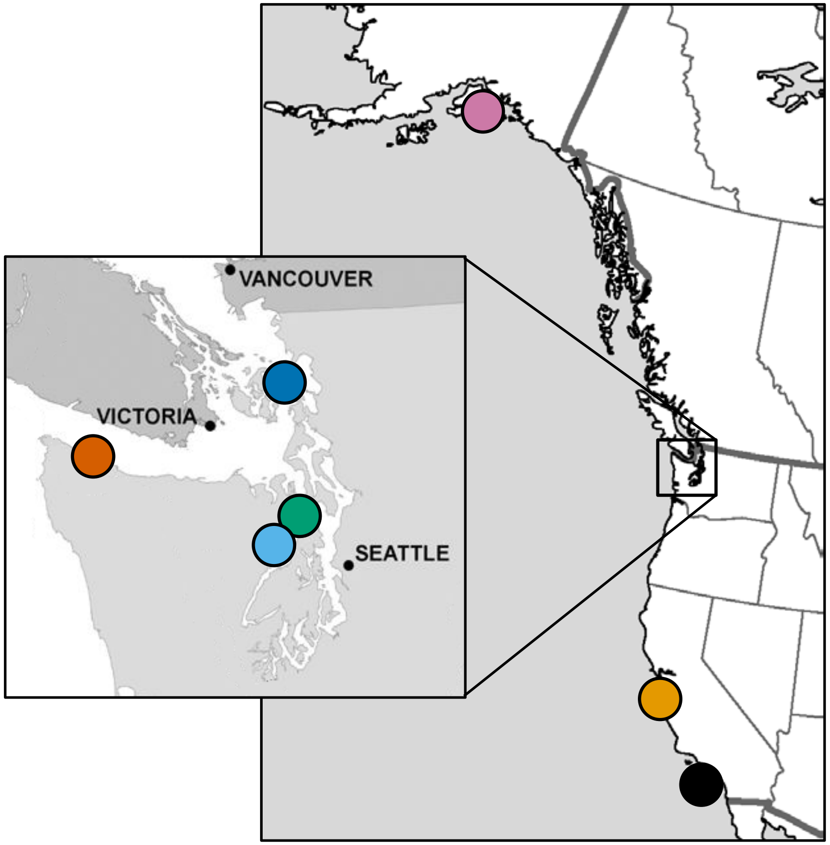
2. Discover SNPs by assembling sequences into loci with ipyrad

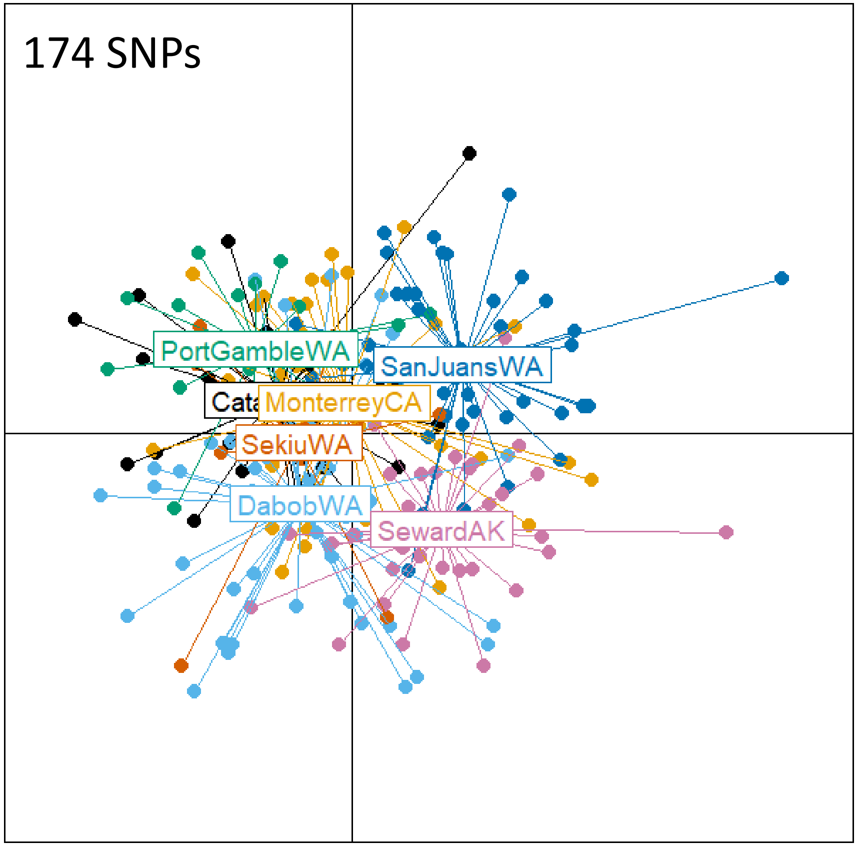
3. Genotype individuals in different populations & compare

			
SNP 1	A	A	T
SNP 2	C	C	C
SNP 3	G	G	C

Population genetics: preliminary results

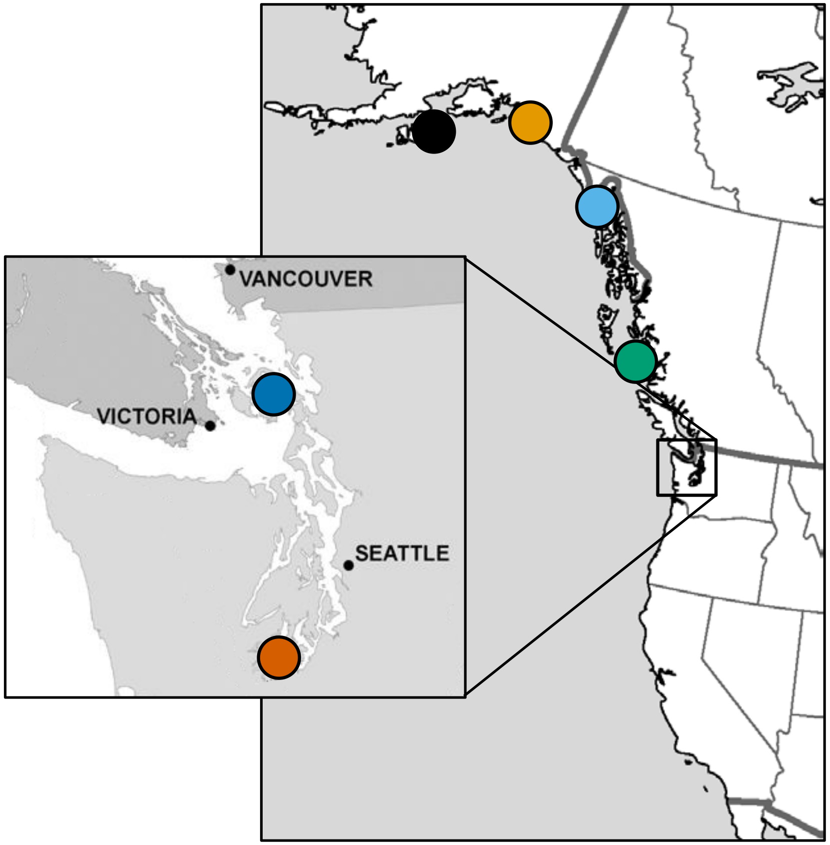
Rock scallops

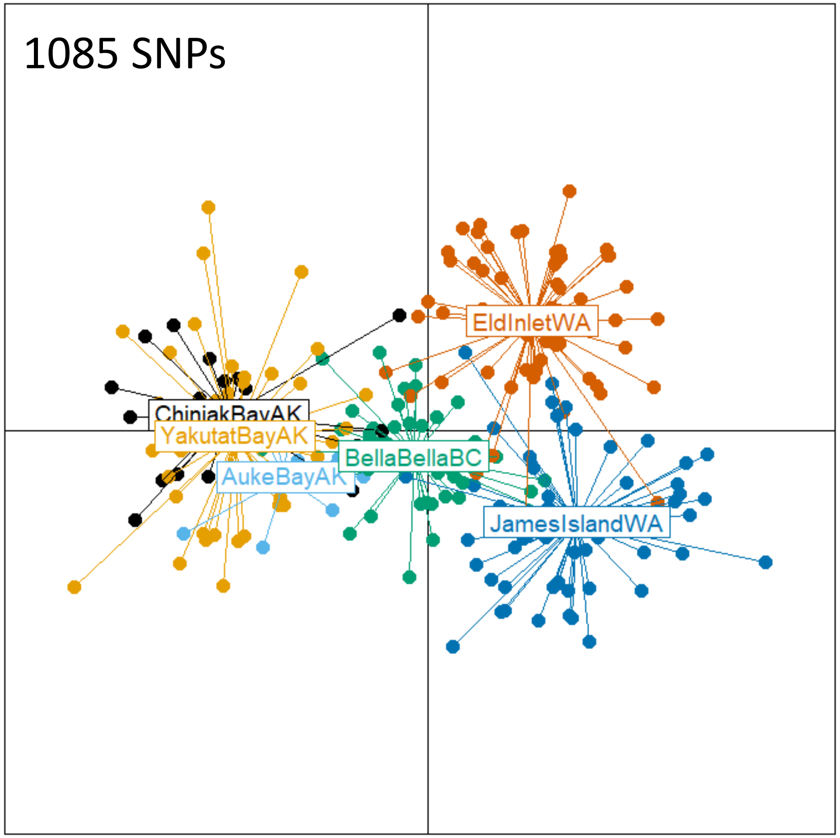




Population genetics: preliminary results

California sea cucumbers



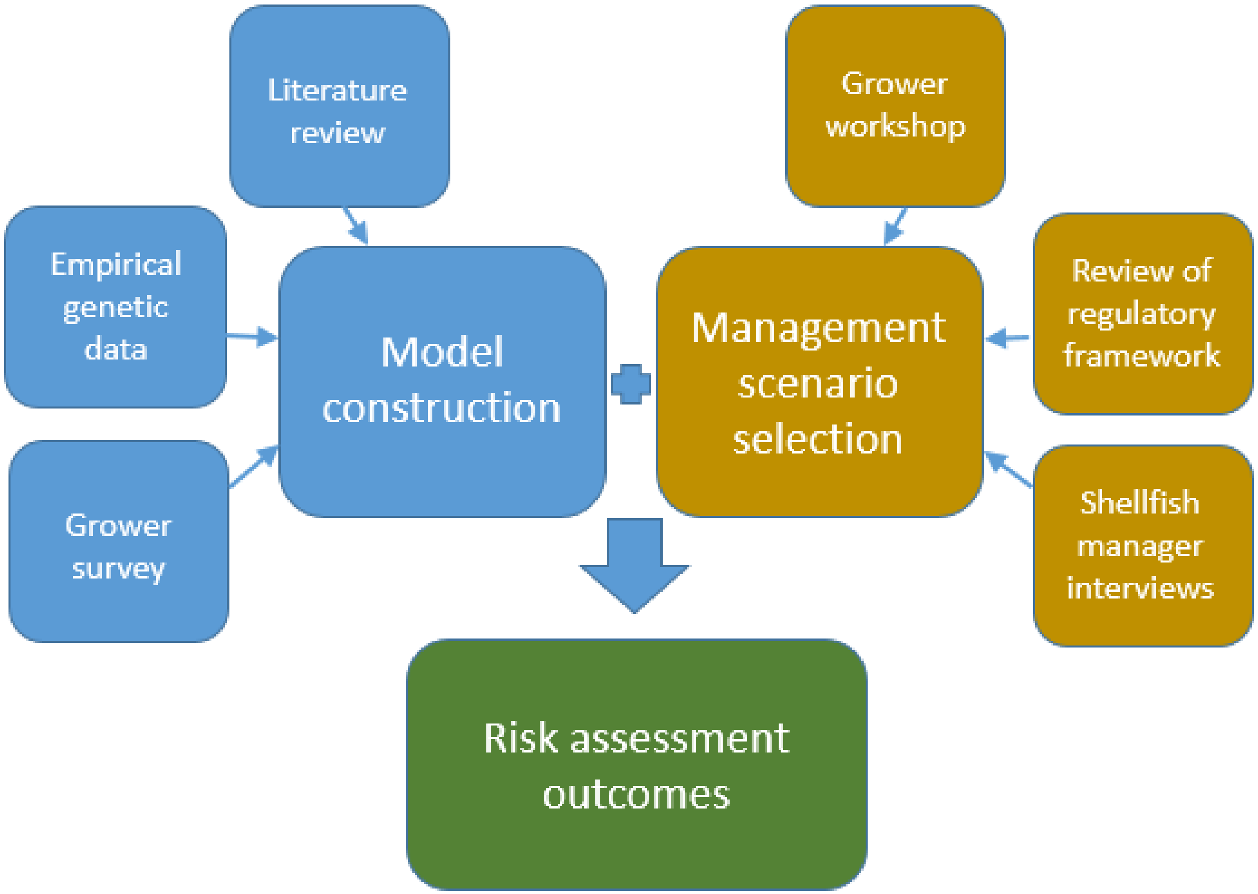


Population genetics: next steps

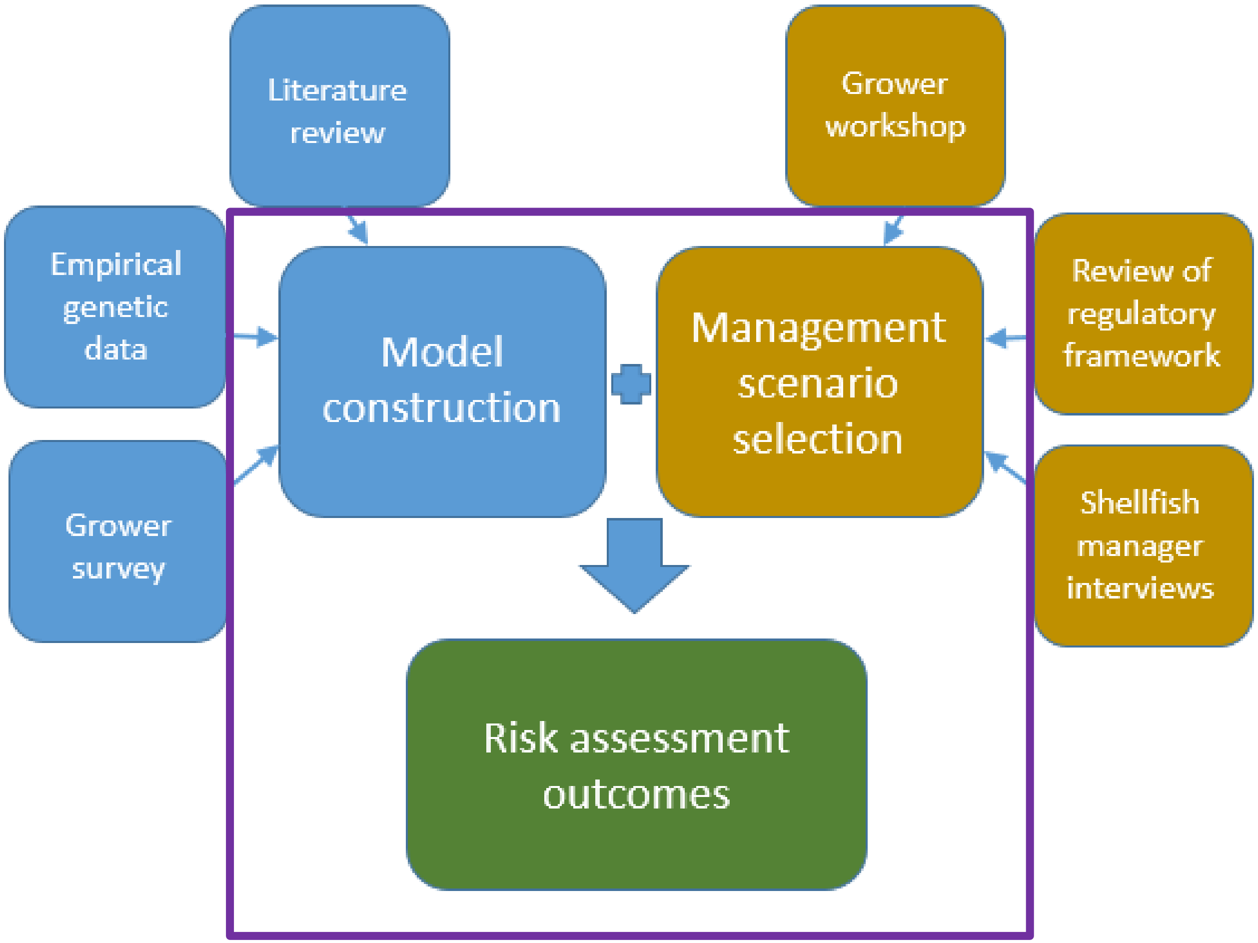
- Finalize analysis
  - Verify bioinformatics methods
  - Test for significant patterns

Genetic risk assessment

Genetic risk assessment: methods

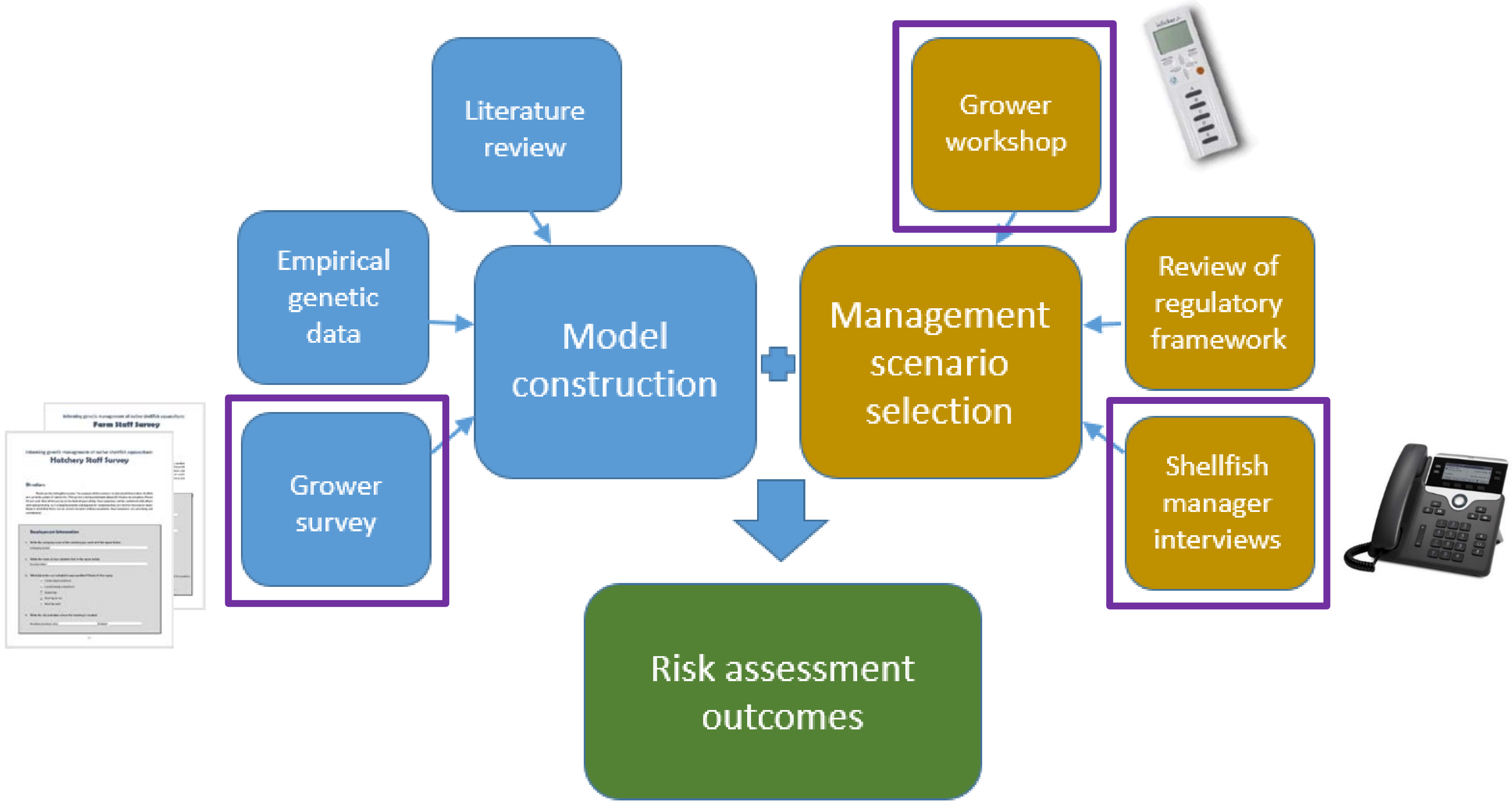


Genetic risk assessment: methods



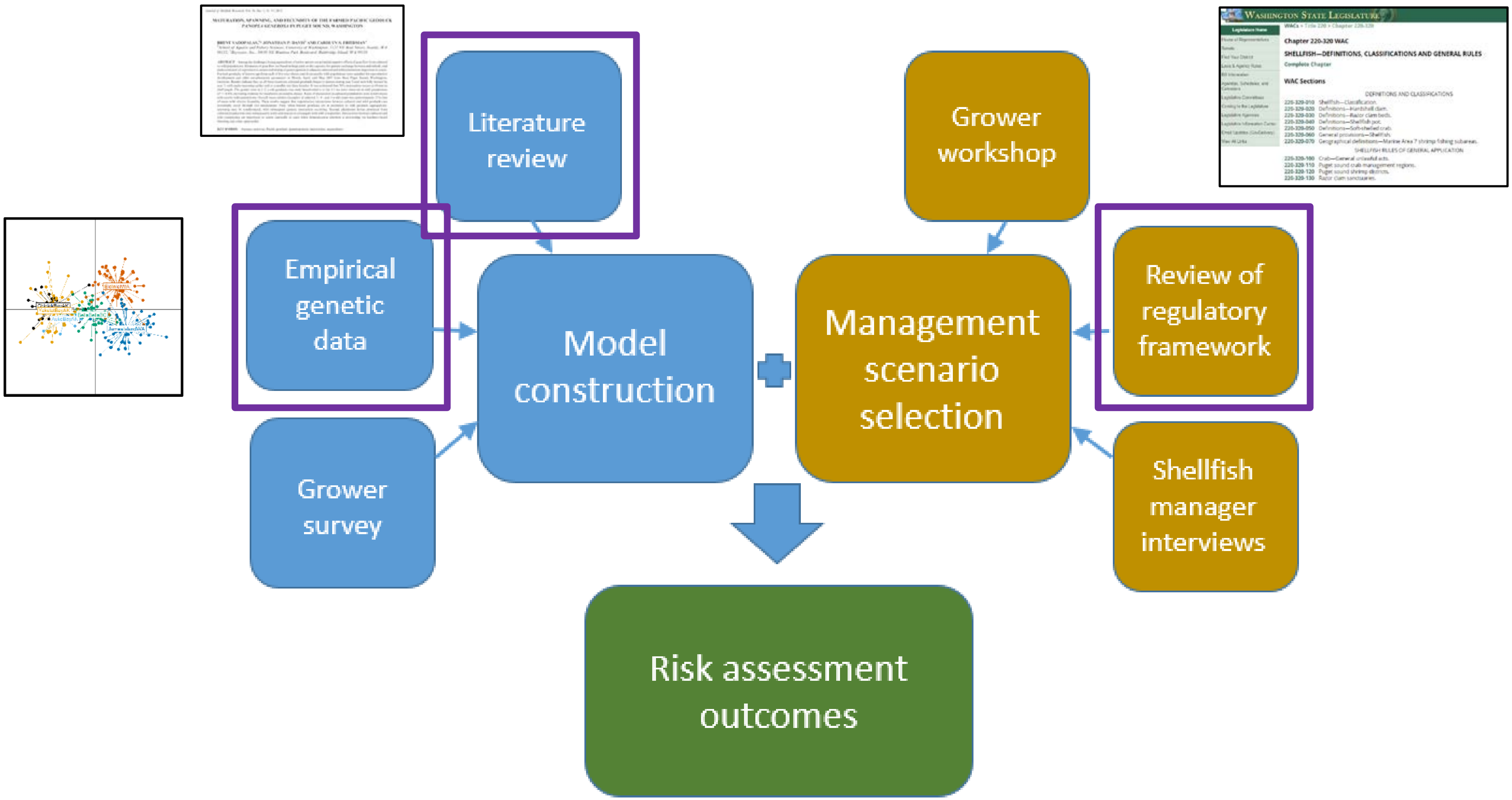
Genetic risk assessment: methods

Stakeholder input gathering



Genetic risk assessment: methods

Review of the literature

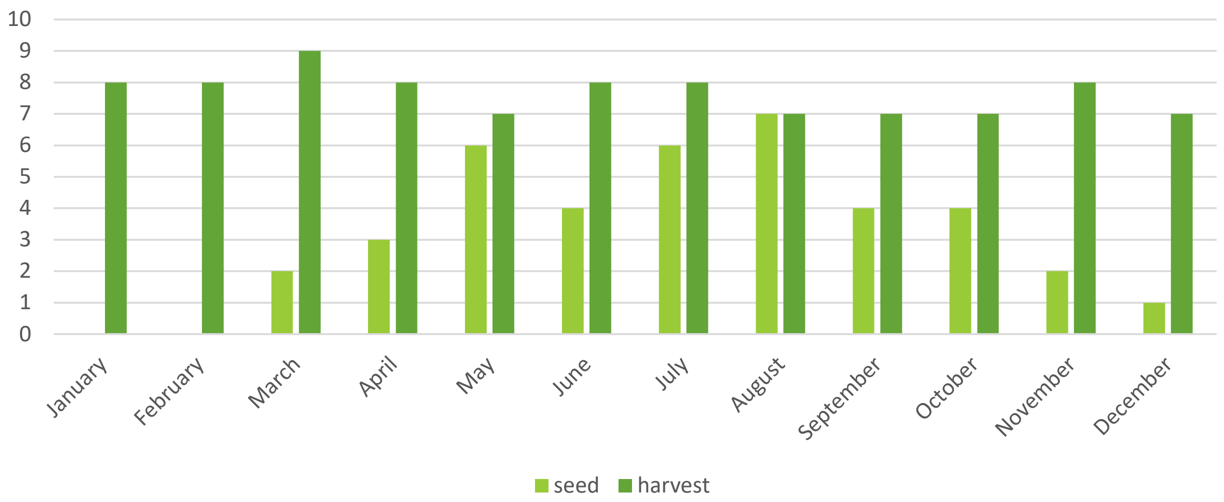


Genetic risk assessment: preliminary results

Stakeholder input gathering

Grower survey

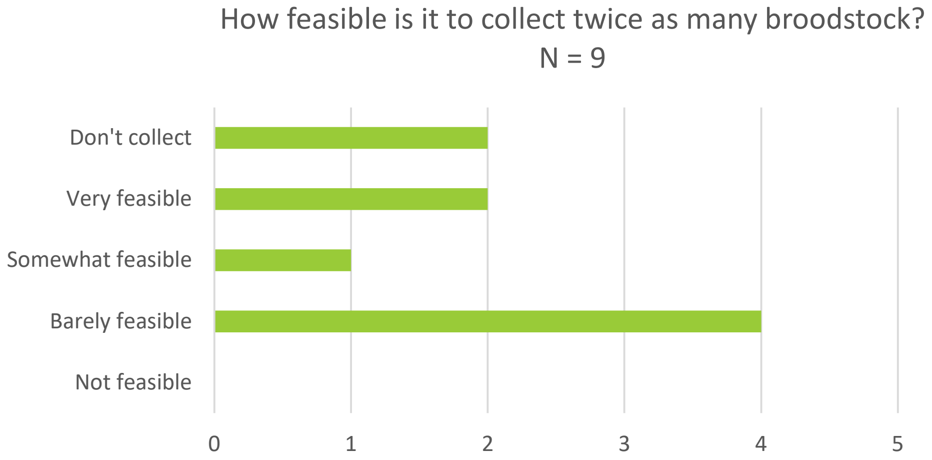
Number of growers reporting seeding and harvesting by month
N = 10

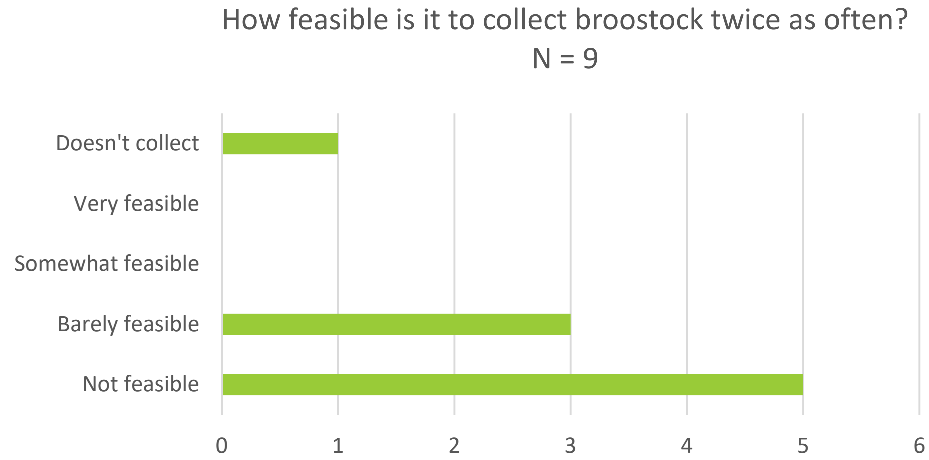


Genetic risk assessment: preliminary results

Stakeholder input gathering

Grower workshop

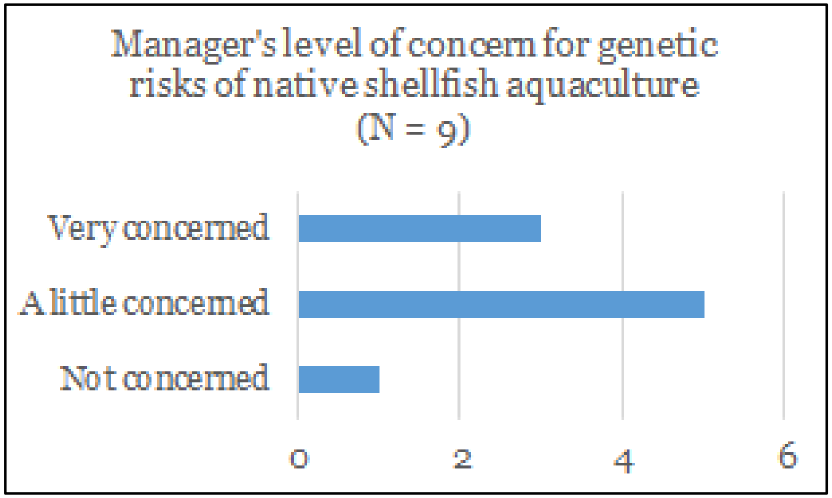


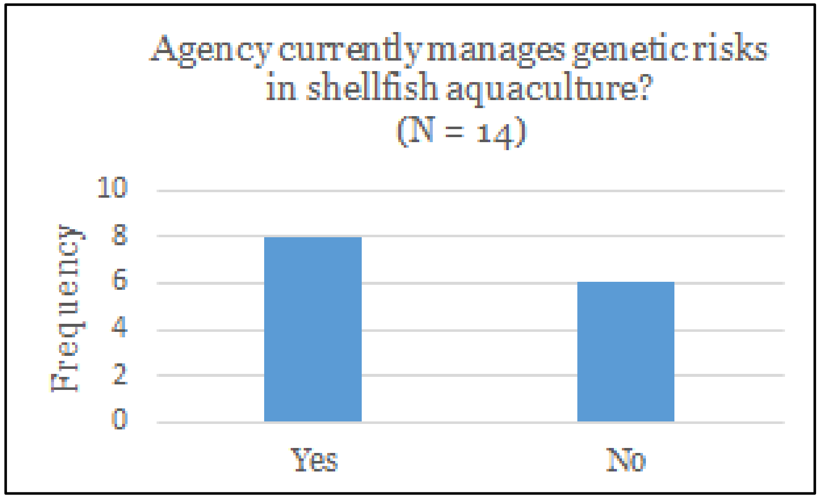


Genetic risk assessment: preliminary results

Stakeholder input gathering

Manager interviews





Genetic risk assessment: next steps

- Finish analyzing stakeholder input data
- Build genetic model
- Select management scenarios for evaluation
- Run model through scenarios for case study species

Thank you!

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