



Western Washington University
Western CEDAR

Salish Sea Ecosystem Conference

2018 Salish Sea Ecosystem Conference
(Seattle, Wash.)

Apr 5th, 11:00 AM - 11:15 AM

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

Natalie Lowell

Univ. of Washington, United States, nclowell@uw.edu

Lorenz Hauser

Univ. of Washington, United States, lhauser@uw.edu

Brent Vadopalas

Univ. of Washington, United States, brentv@uw.edu

Follow this and additional works at: <https://cedar.wwu.edu/ssec>

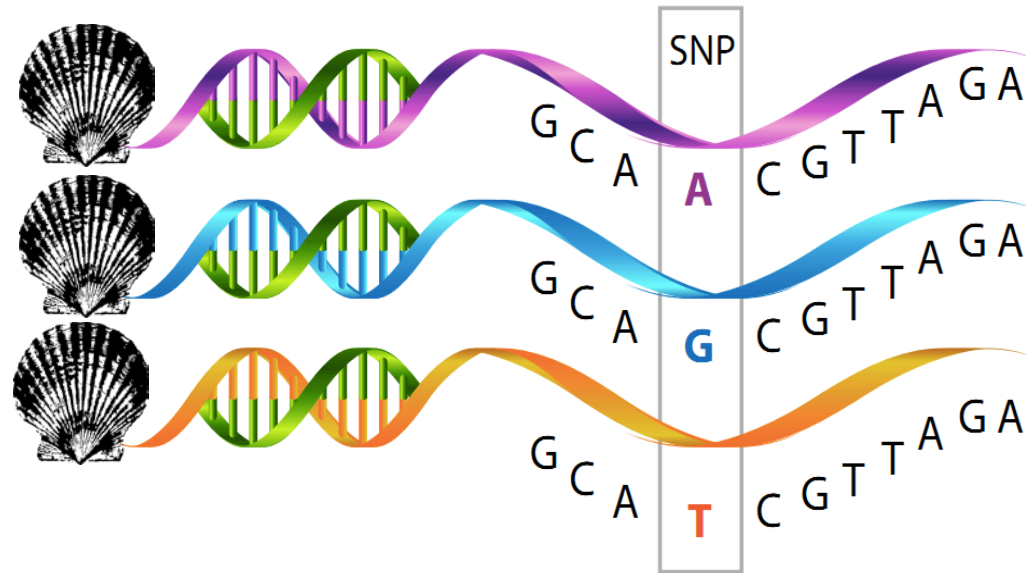


Part of the [Fresh Water Studies Commons](#), [Marine Biology Commons](#), [Natural Resources and Conservation Commons](#), and the [Terrestrial and Aquatic Ecology Commons](#)

Lowell, Natalie; Hauser, Lorenz; and Vadopalas, Brent, "Population genetics of native shellfish aquaculture species and potential genetic risks of cultivation" (2018). *Salish Sea Ecosystem Conference*. 165.
<https://cedar.wwu.edu/ssec/2018ssec/allsessions/165>

This Event is brought to you for free and open access by the Conferences and Events at Western CEDAR. It has been accepted for inclusion in Salish Sea Ecosystem Conference by an authorized administrator of Western CEDAR. For more information, please contact westerncedar@wwu.edu.

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



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)

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

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

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

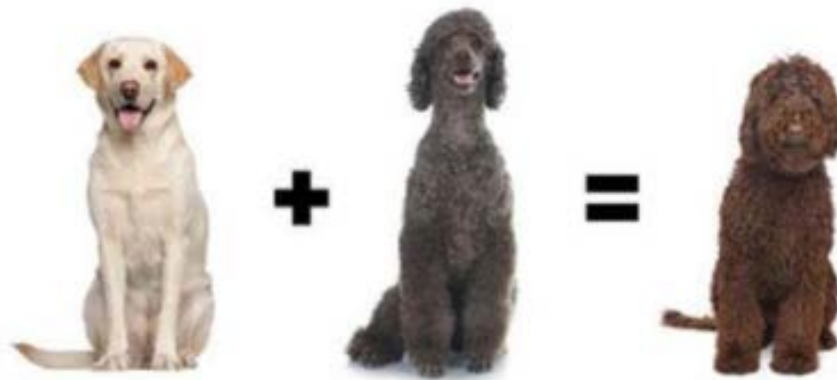


Genetic risks of native shellfish aquaculture

- 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

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

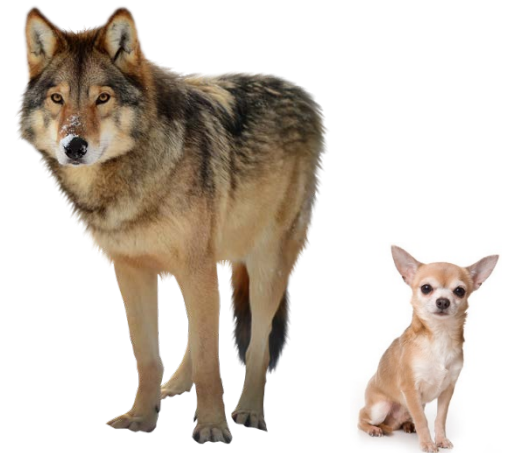


Genetic risks of native shellfish aquaculture

- 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**

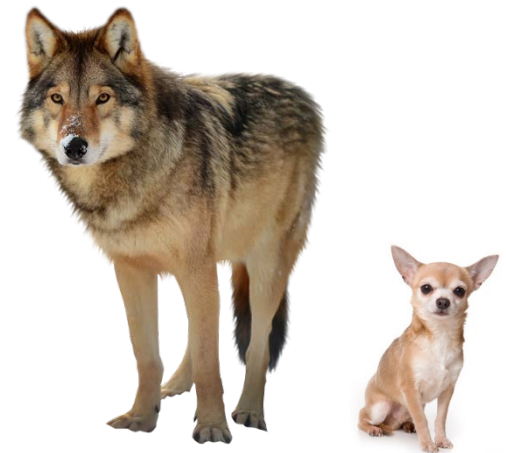
Genetic risks of native shellfish aquaculture

- 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**



Genetic risks of native shellfish aquaculture

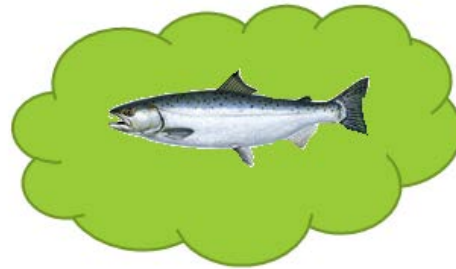
- Native shellfish farming poses genetic risks to wild populations:
 1. Loss of genetic diversity within populations
 2. Loss of genetic diversity between populations
 - 3. Reduced fitness due to domestication selection**
 - Intentional & unintentional
 - Relaxation of natural selection



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
 - 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



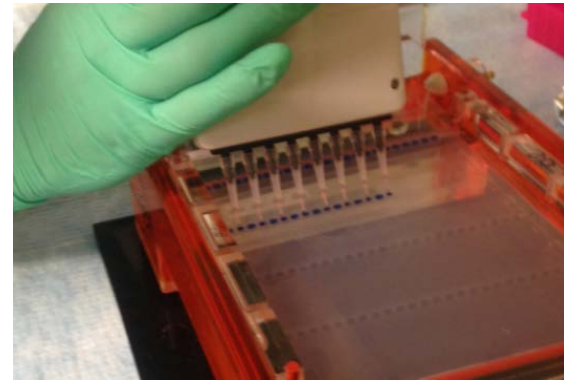
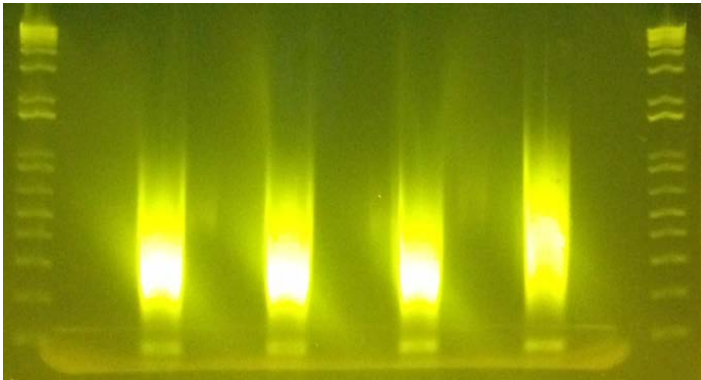
NOAA FISHERIES



Population genetics

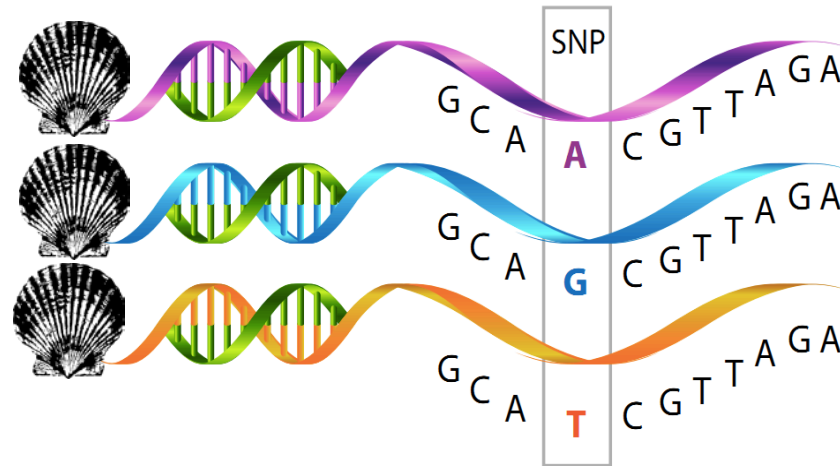
Population genetics: methods

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




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



Population genetics: methods

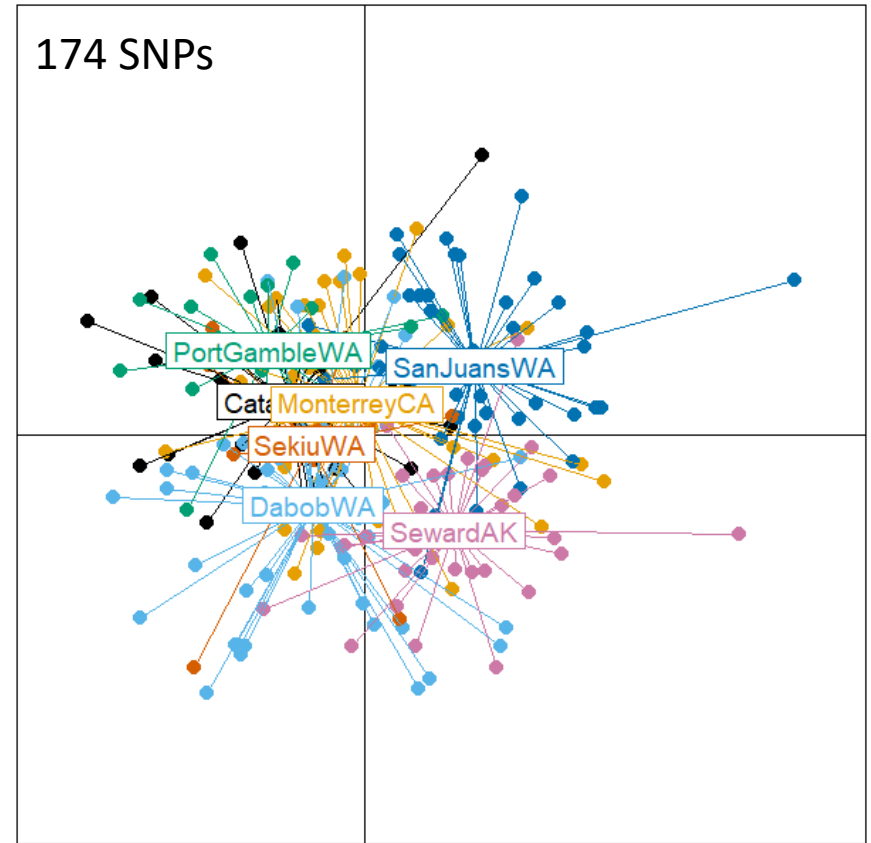
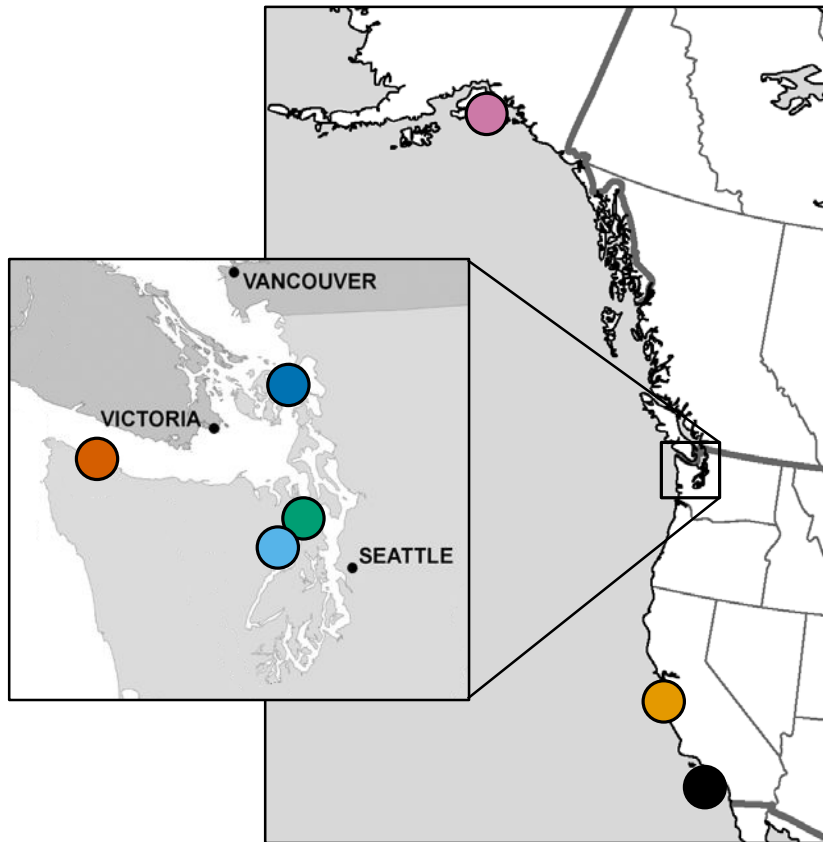
1. Process tissue samples with single digest RADseq
2. Discover SNPs by assembling sequences into loci with ipyrad
- 3. Genotype individuals in different populations & compare**

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



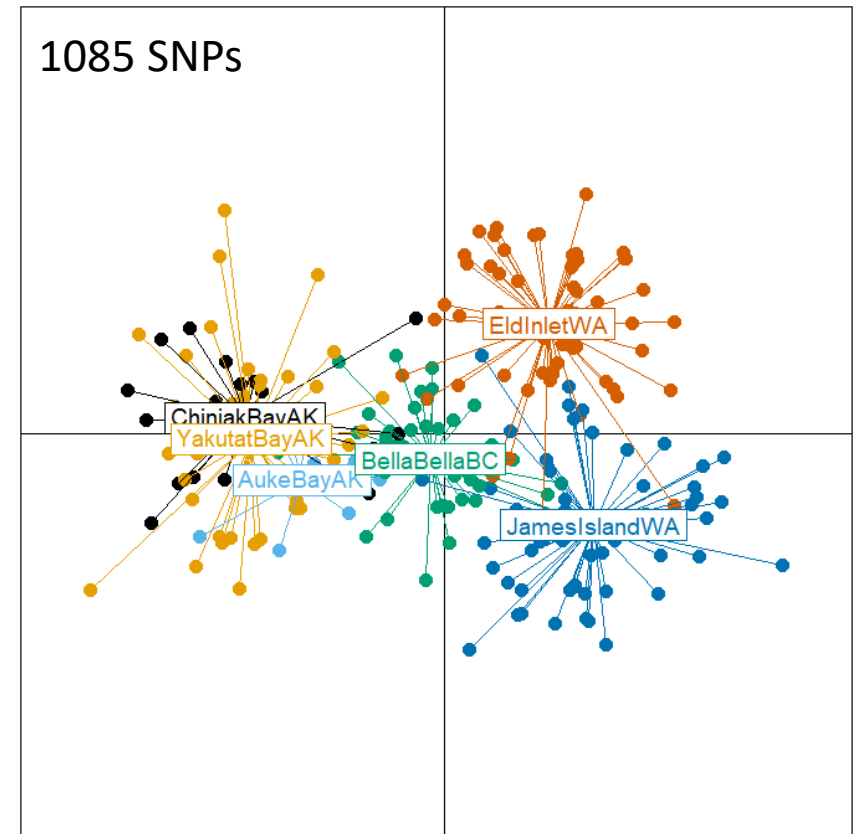
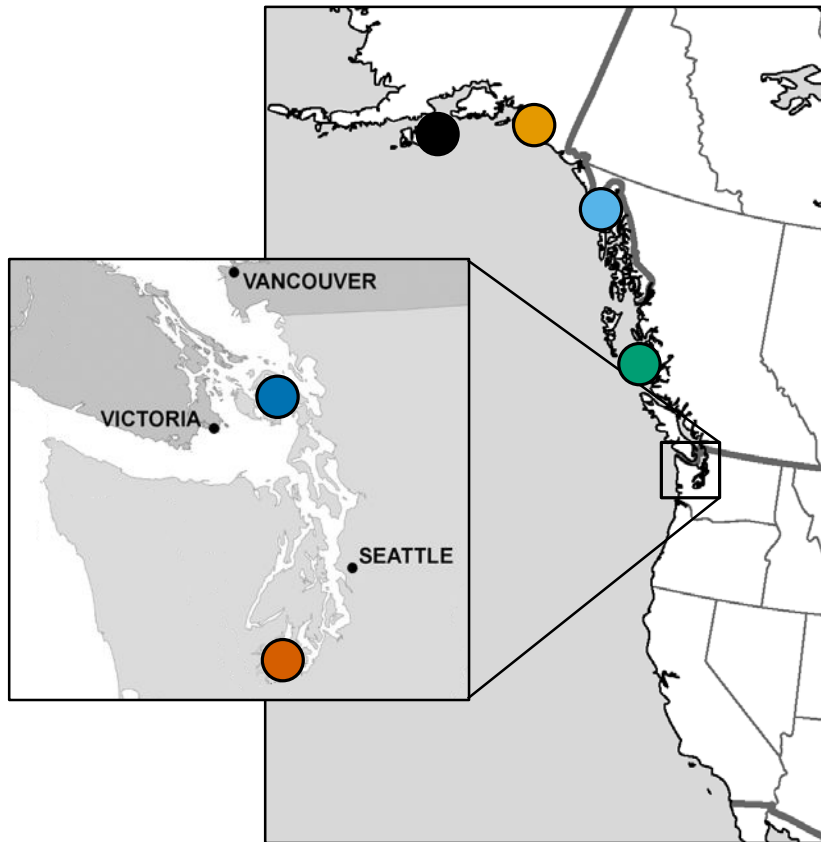
Population genetics: preliminary results

Rock scallops



Population genetics: preliminary results

California sea cucumbers

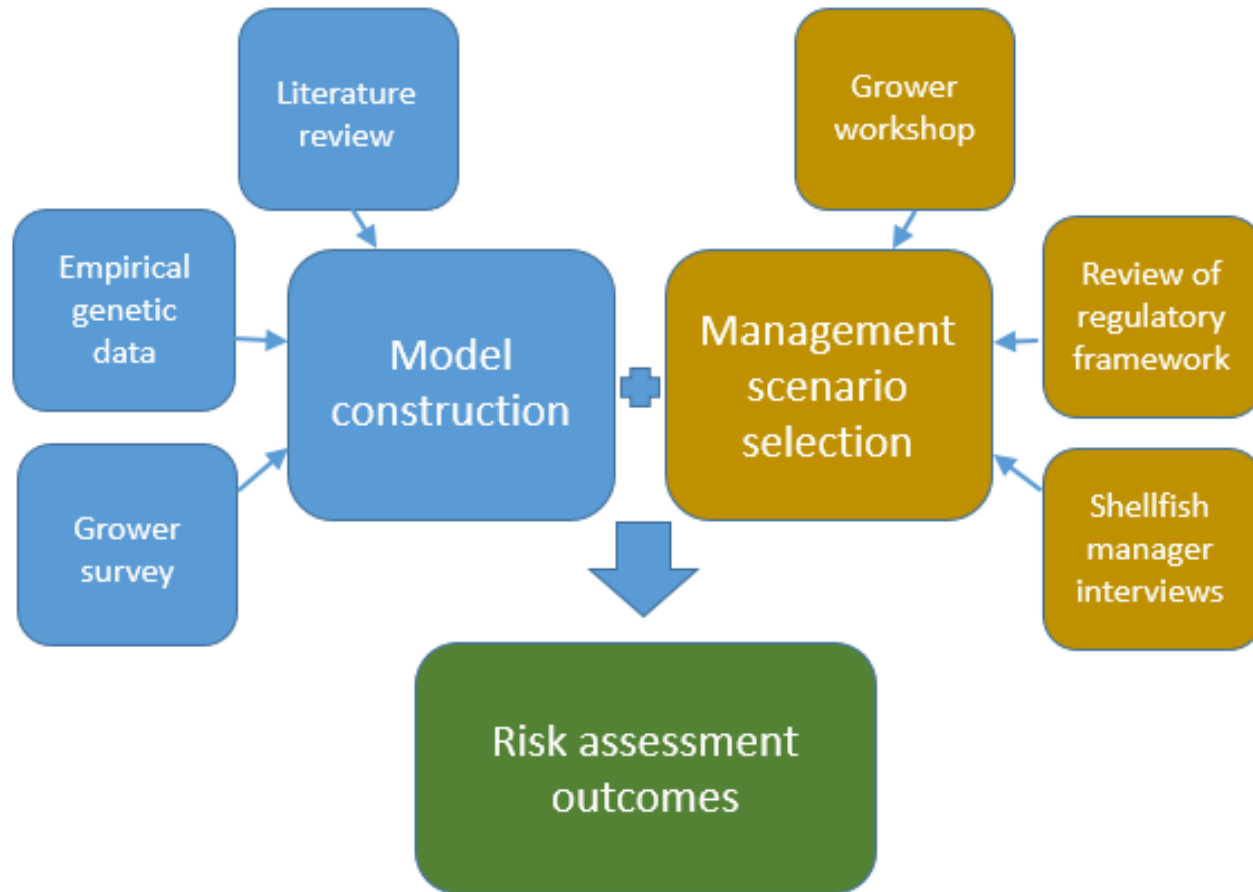


Population genetics: next steps

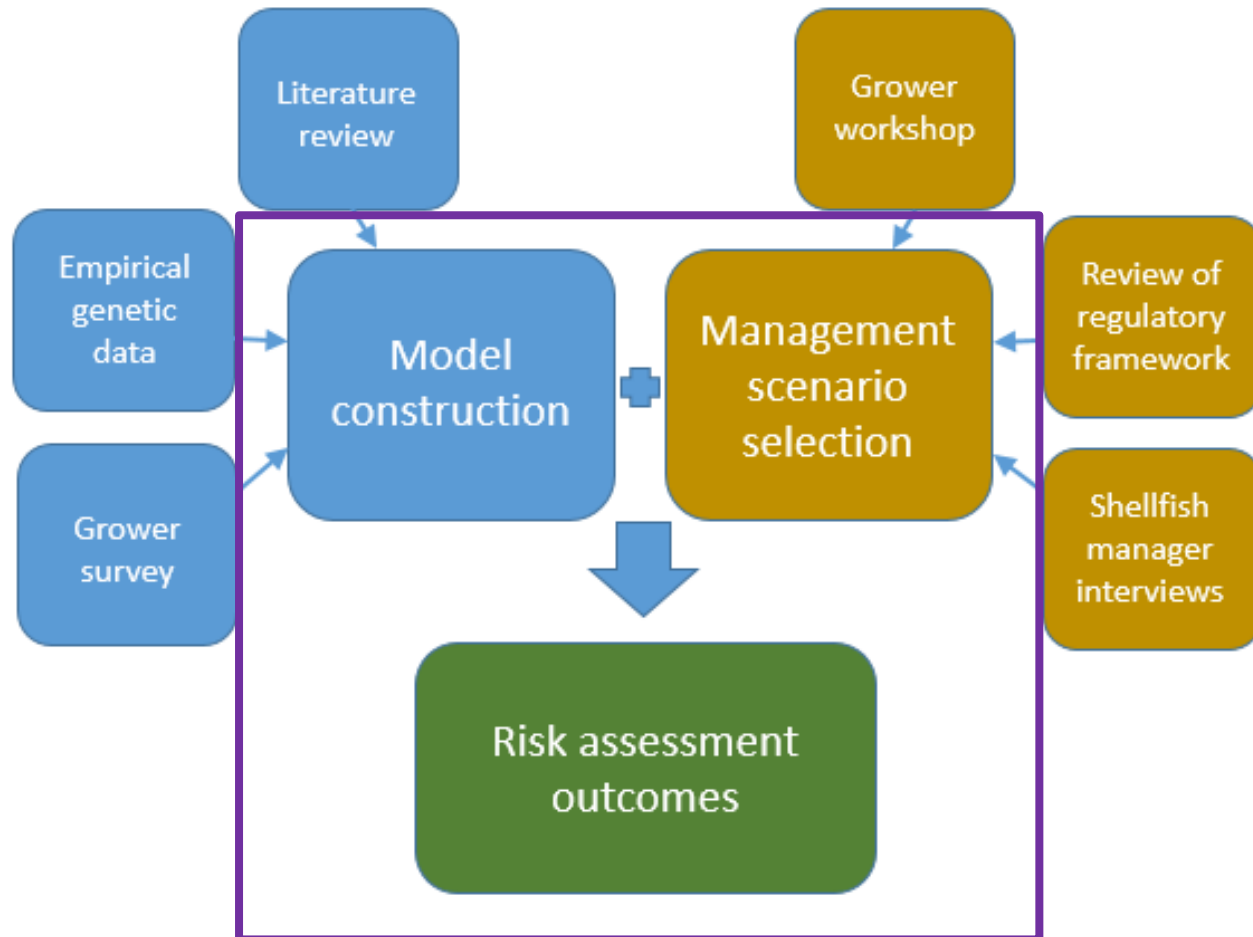
- Finalize analysis
 - Verify bioinformatics methods
 - Test for significant patterns

Genetic risk assessment

Genetic risk assessment: methods

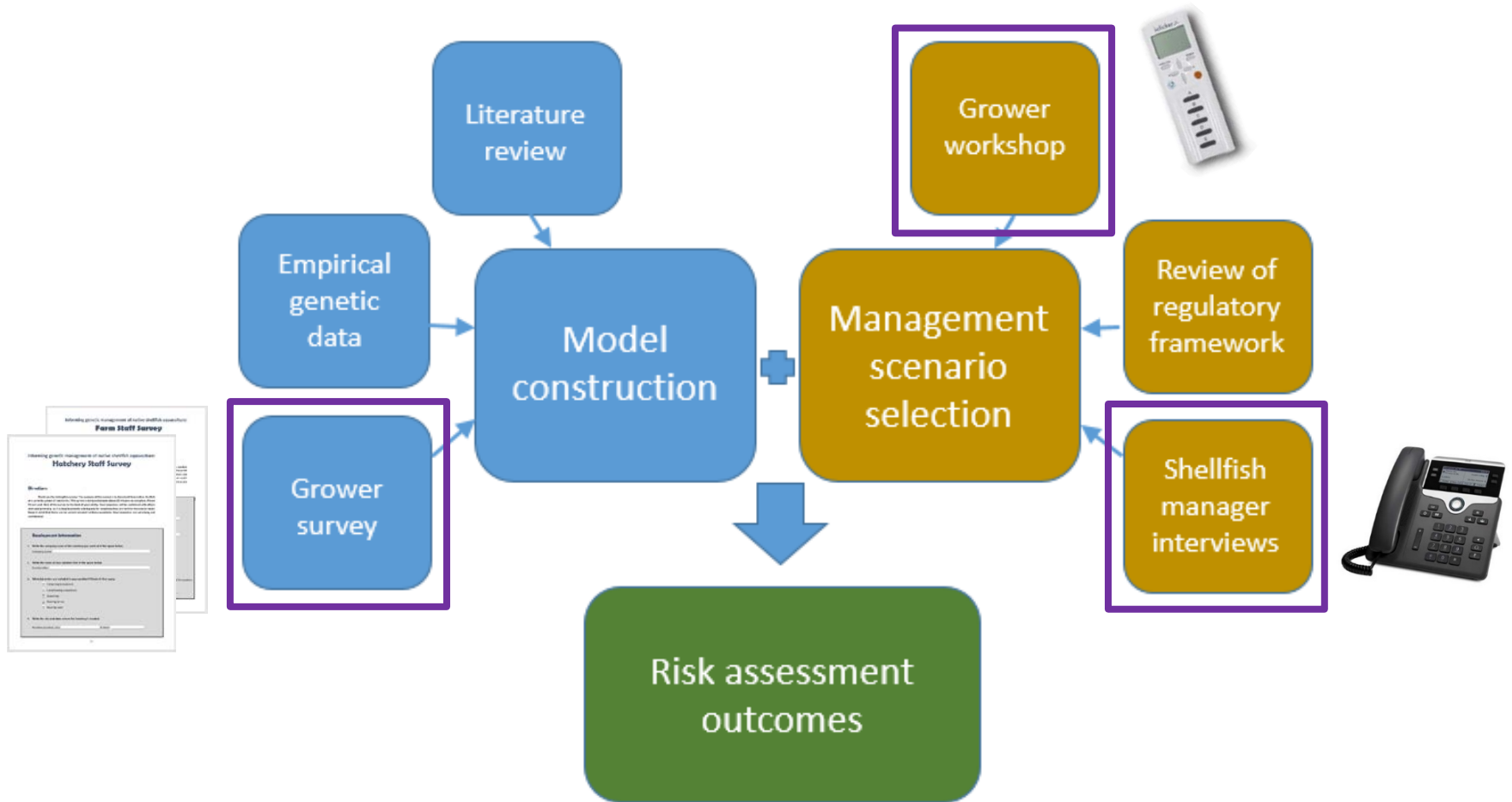


Genetic risk assessment: methods



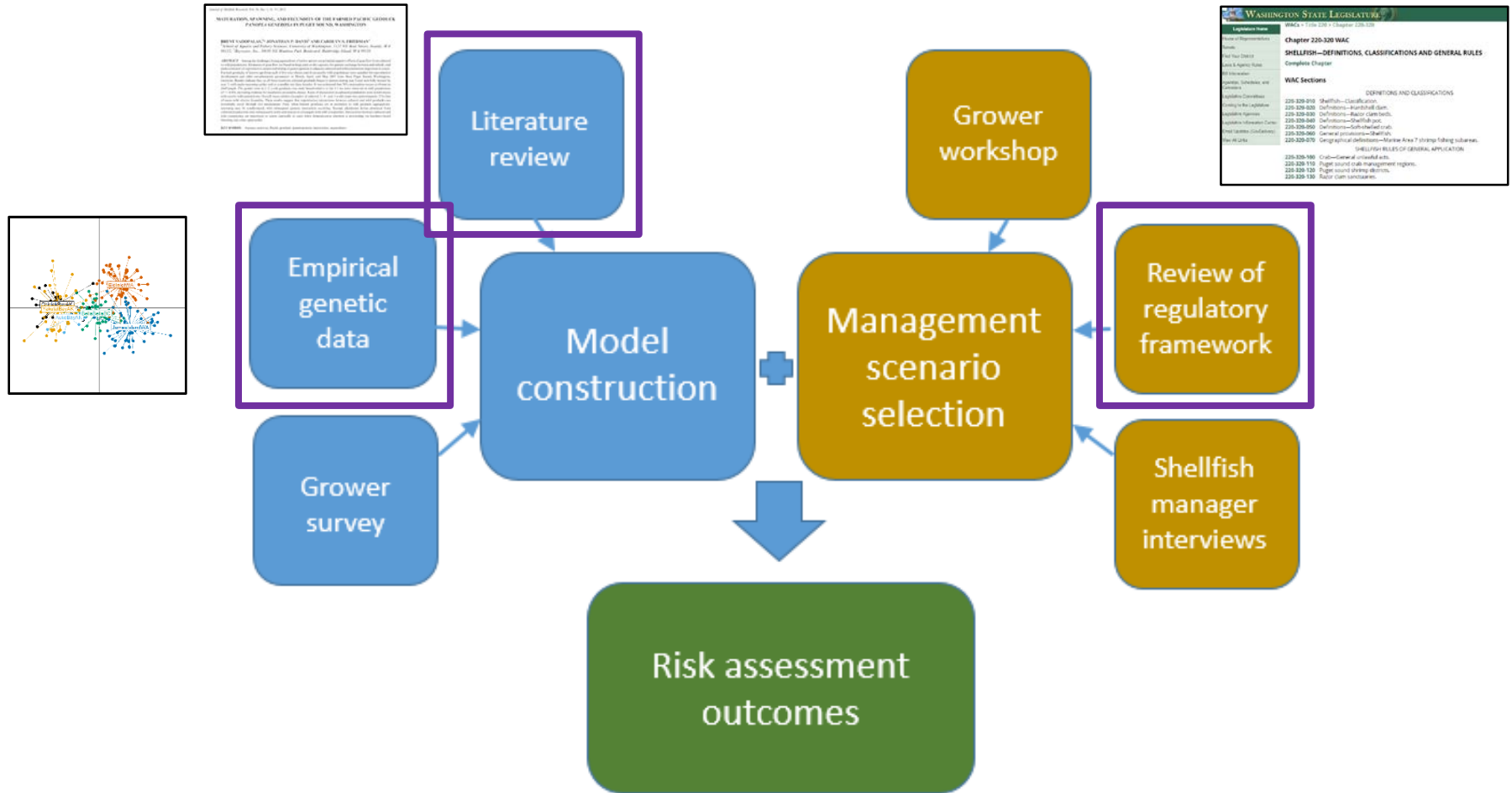
Genetic risk assessment: methods

Stakeholder input gathering



Genetic risk assessment: methods

Review of the literature



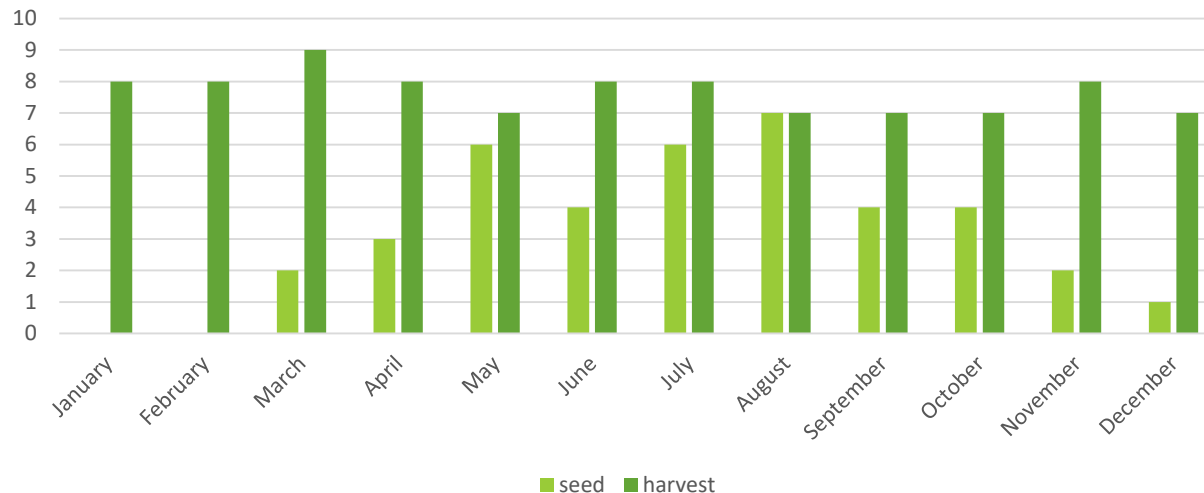
Genetic risk assessment: preliminary results

Stakeholder input gathering

Grower survey



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



Genetic risk assessment: preliminary results

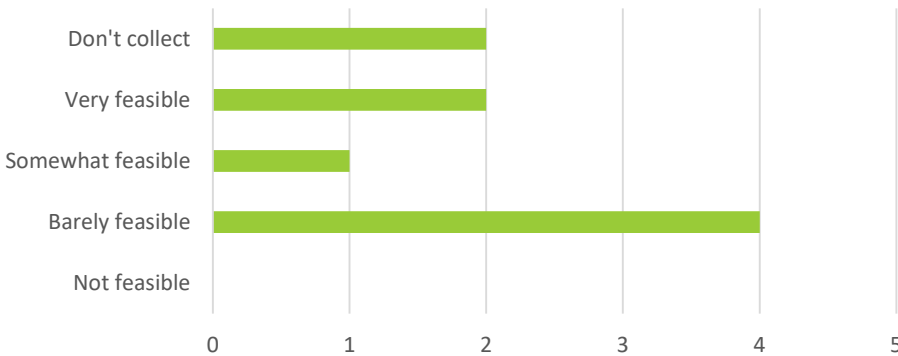
Stakeholder input gathering

Grower workshop



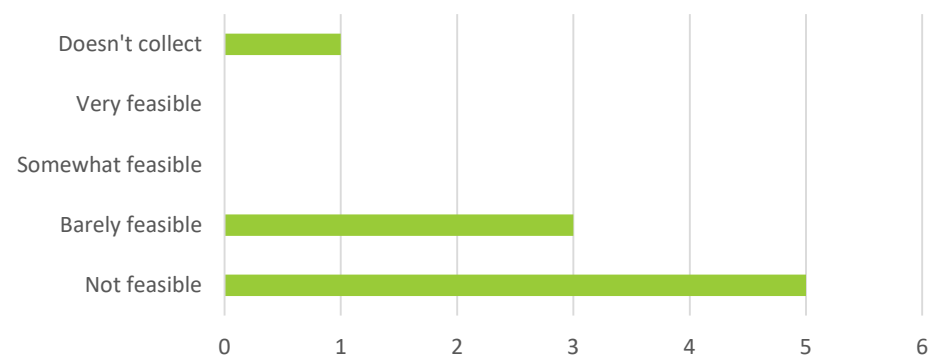
How feasible is it to collect twice as many broodstock?

N = 9



How feasible is it to collect broodstock twice as often?

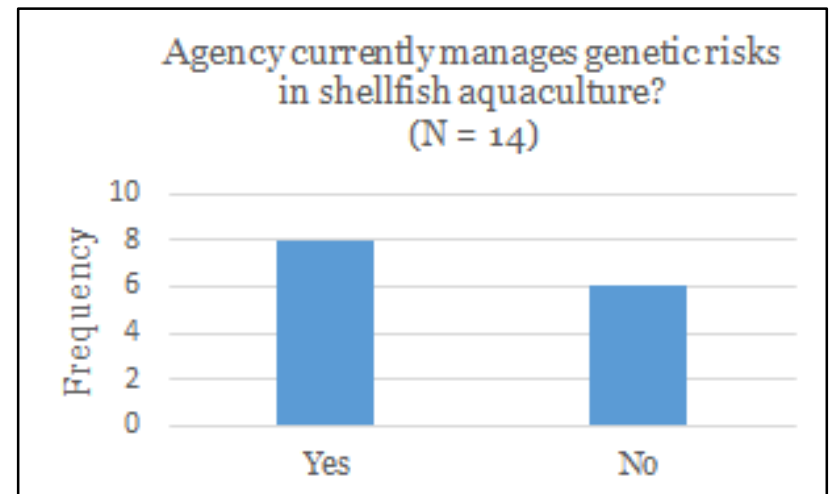
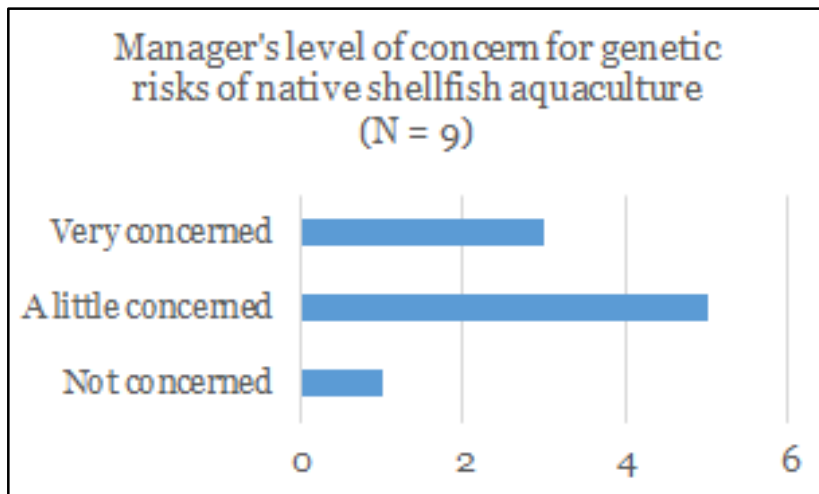
N = 9



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!

Acknowledgements:

- Isadora Jimenez
- Mary Fisher
- Molly Jackson
- Charlie Waters
- Eleni Petrou
- Dan Drinan
- Kerry Naish
- Maya Garber-Yonts
- Sam May
- Chris Eardley
- Hank Carson
- Brian Allen
- Josh Bouma
- Gordon King
- Joth Davis
- Kelly Toy
- Ralph Riccio
- Christopher Burns
- Hans Daubenberger
- Luke Kelly
- Viviane Barry

