Epigenetic Phenomena Connecting Climate Change and Coastal Marine Species

Steven Roberts - University of Washington

ROBERTSLAB.INFO

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Course Objectives

- Objective 1: Understanding the Interplay between Climate Change, Epigenetics, and Marine Invertebrate Physiology
- Objective 2: Gaining Proficiency in Functional Genomics
- Objective 3: Developing Skills for Analyzing and Evaluating Scientific Research

Personal Experience

Background

- Undergrad - Fish Reproductive Physiology
- PhD - Salmonid and Perch Growth Physiology
- USDA Post-Doc - Scallop Development
- MBL - Shellfish Functional Genomics

Current Regional Aquaculture Research

- Applying cutting-edge technology for reproductive control in emerging bivalve species

  Summary | GitHub Repository **Support::Pacific States Marine Fishery Commision**

- Field-based Education and Research at Regional Aquaculture Sites (FERRAS)

  Summary **Support::UW SAFS**

- Improved climate resilience in oysters through optimization of hatchery-based environmental conditioning practices

  Summary | GitHub Repository **Support::USDA**

- Vernon: Development of innovative approaches to support sustainable aquaculture and understand the effects of ocean acidification on marine species

  Summary **Support::NOAA**

- Readying sustainable aquaculture for a changing ocean: uncovering the mechanisms associated with intergenerational carryover effects to enhance bivalve resilience to acidification

  Summary | GitHub Repository **Support::Washington Sea Grant**

- A collaborative partnership to address mass mortalities in oyster aquaculture through improved field monitoring, husbandry practices, and workforce development

  Summary **Support::Washington Sea Grant**

- Development of environmental conditioning practices to decrease impacts of climate change on shellfish aquaculture

  Summary **Support::FFAR**

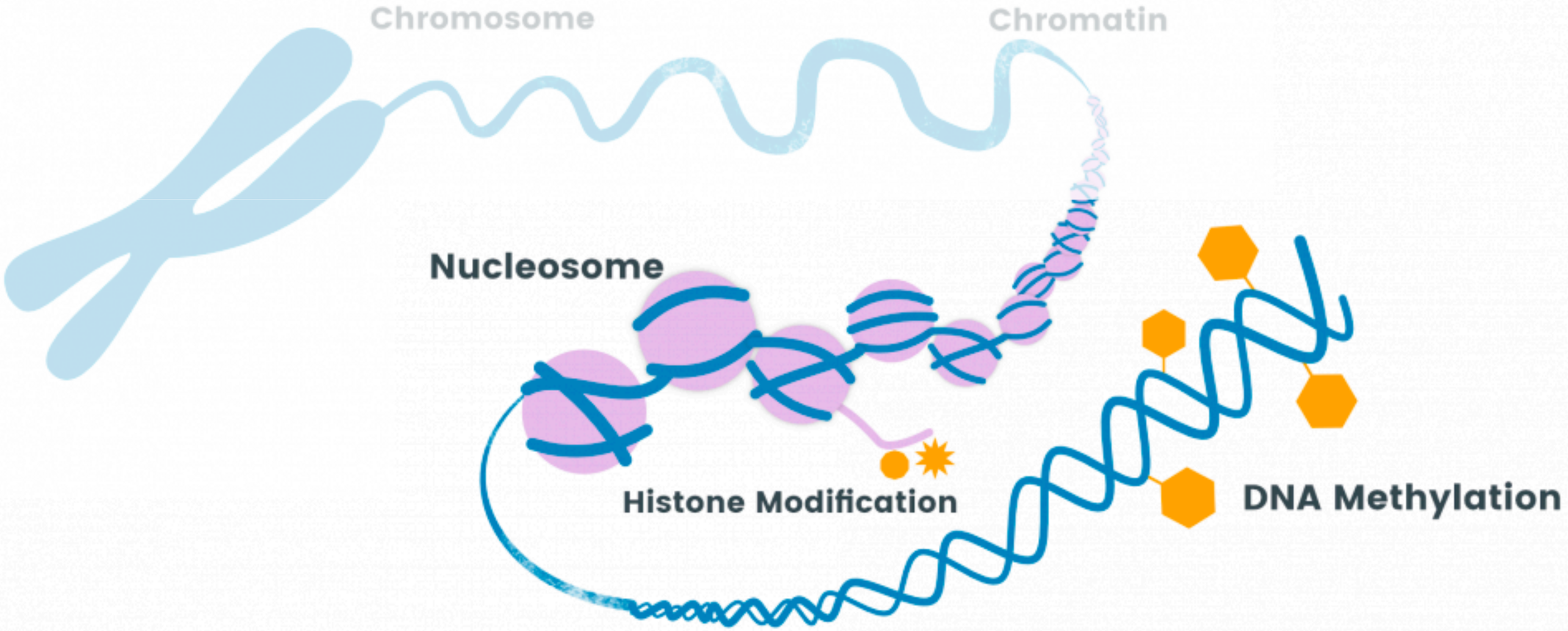
Shellfish resilience in changing conditions, larval mortality, summer mortality, triploid field performance

*a subset of regional issues - what drives my program

Research Vignettes

Environmental memory
Genomic applications

ALTERS THE PHENOTYPE (WITHOUT CHANGING DNA CODE); HERITABLE



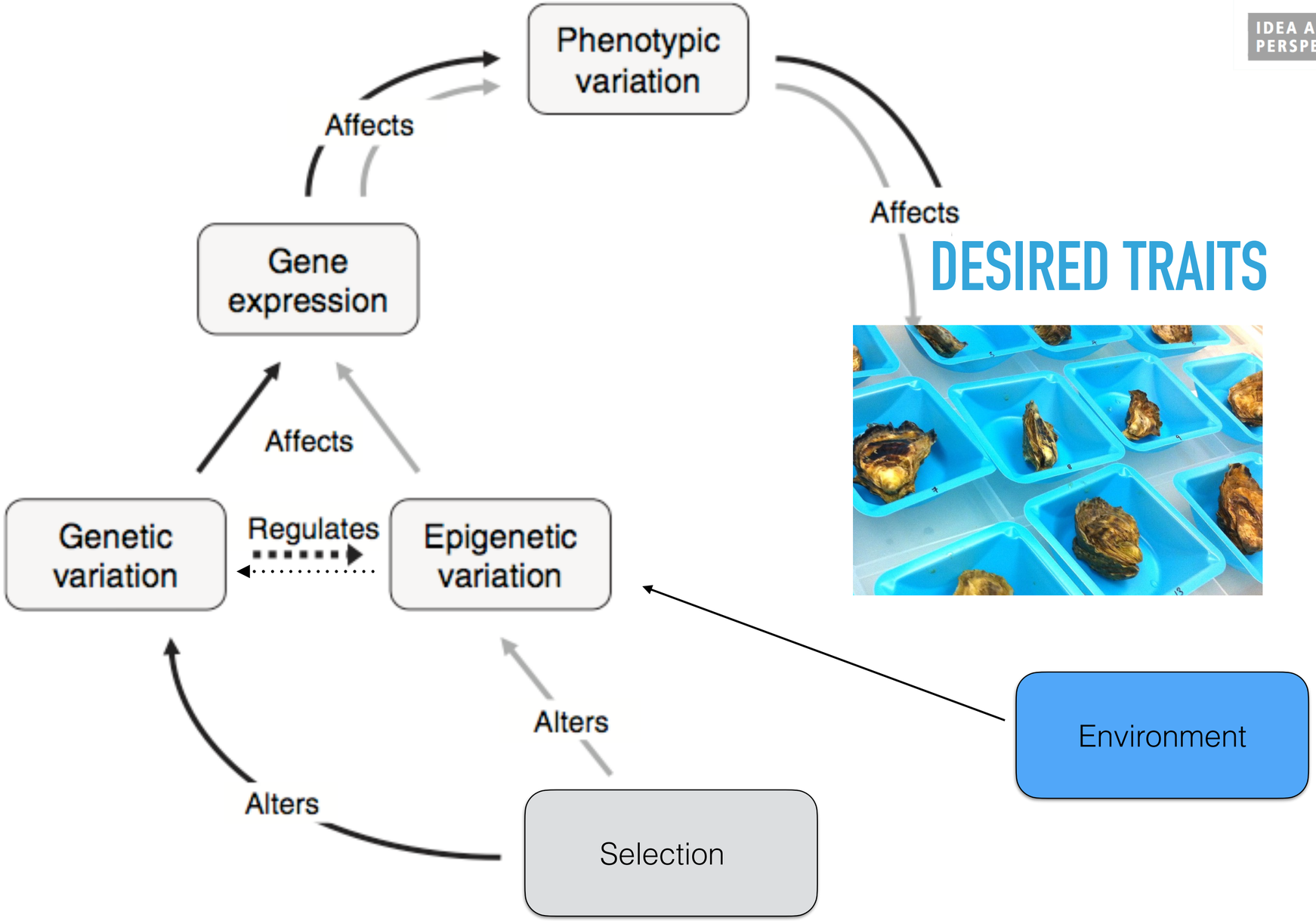
CAN BE INDUCED WITH ENVIRONMENTAL MANIPULATION

ECOLOGICAL EPIGENETICS

Ecology Letters, (2008) **11**: 106–115 doi: 10.1111/j.1461-0248.2007.01130.x

IDEA AND PERSPECTIVE

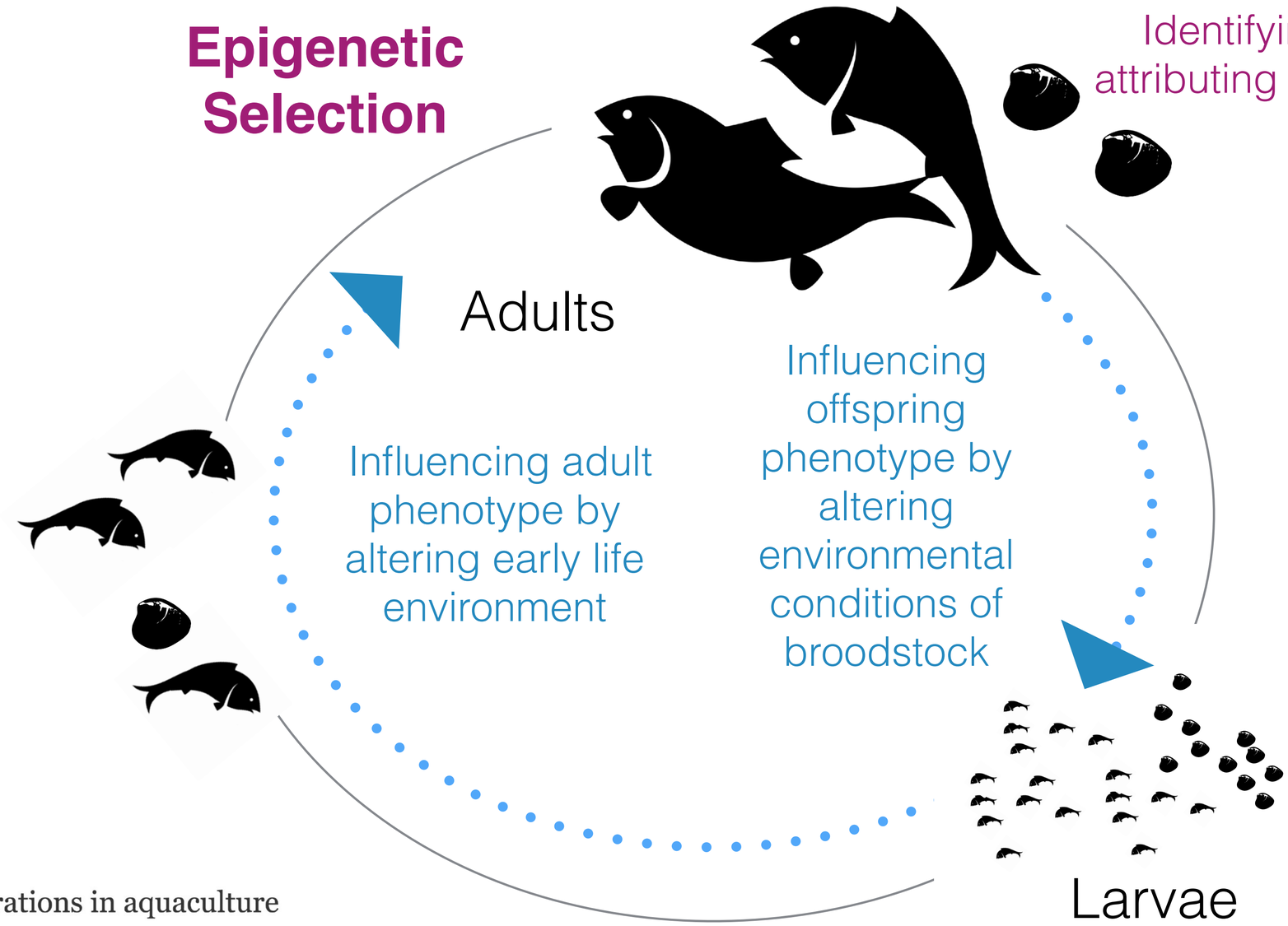
Epigenetics for ecologists



DESIRED TRAITS

Epigenetic Selection

Identifying individuals by attributing trait to epigenotype



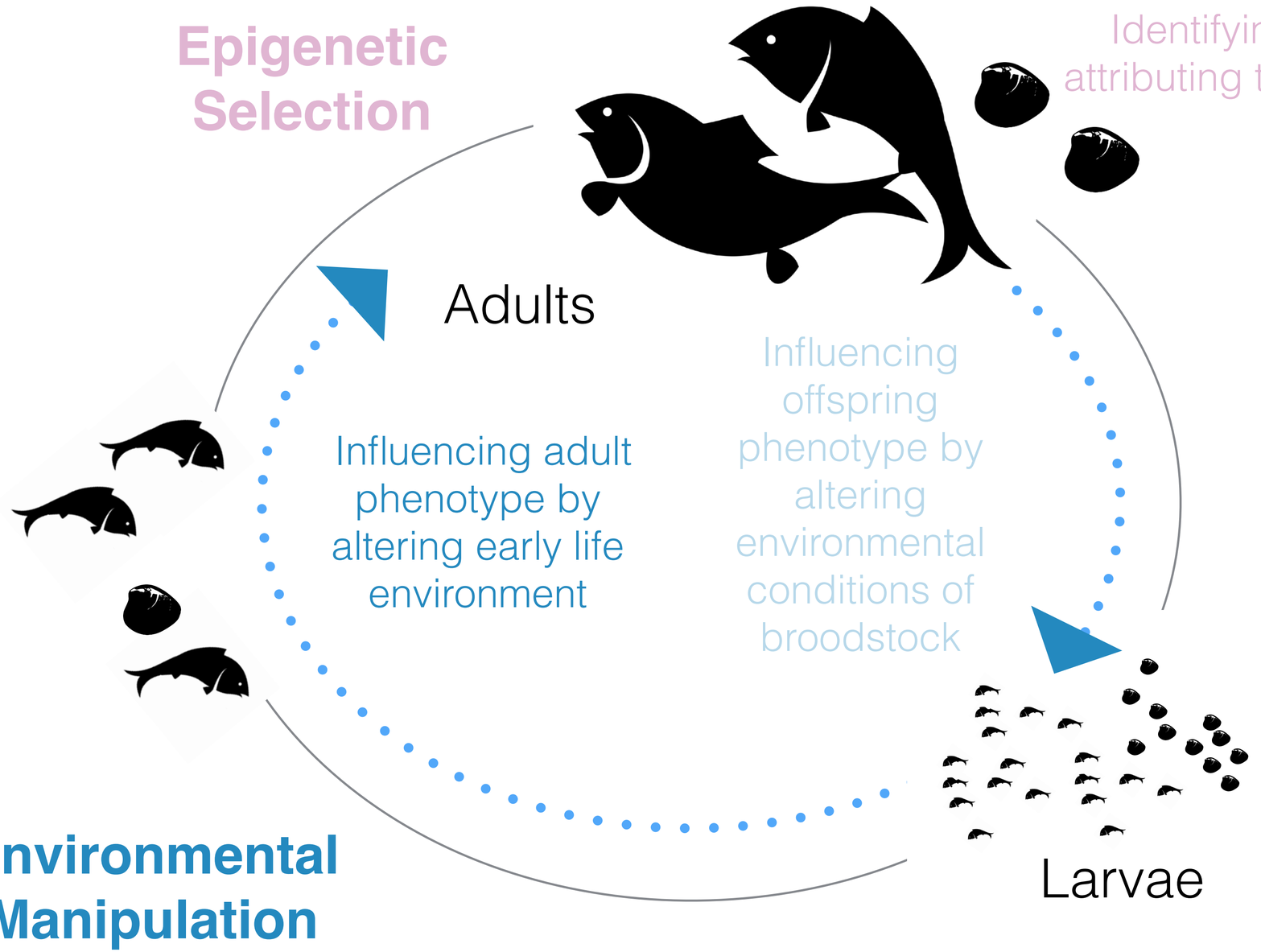
Environmental Manipulation

PEER-REVIEWED Aquatic Biology section ›

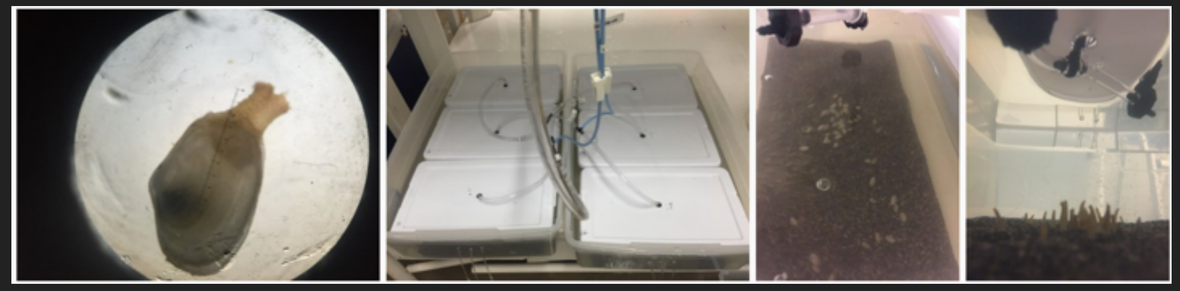
Epigenetic considerations in aquaculture

Literature review | Aquaculture, Fisheries and Fish Science | Molecular Biology

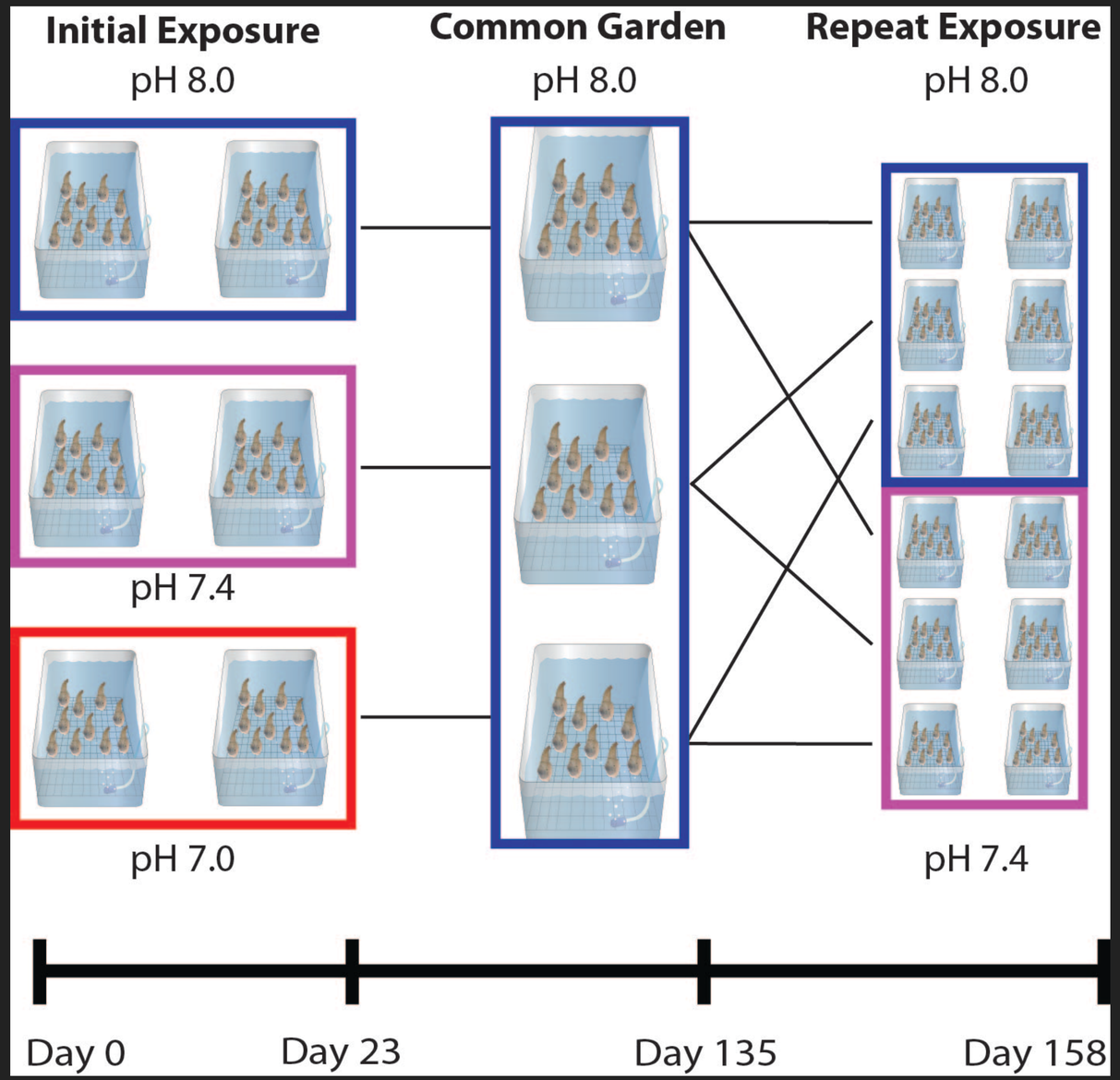
Mackenzie R. Gavery, Steven B. Roberts


Epigenetic Selection
Identifying individuals by attributing trait to epigenotype
Adults
Influencing offspring phenotype by altering environmental conditions of broodstock
Influencing adult phenotype by altering early life environment
Larvae
Environmental Manipulation

GEODUCKS AND OA

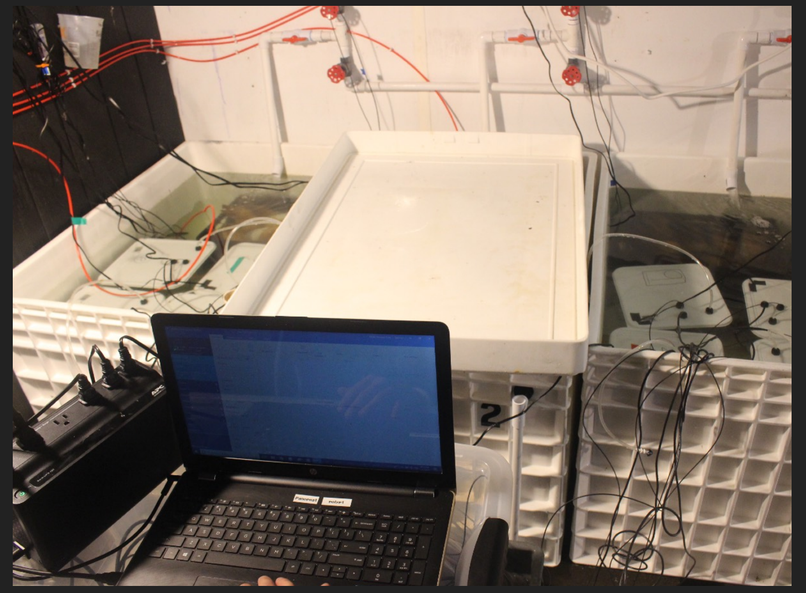


- Does conditioning to low pH confer tolerance within a generation?



HOLLIE PUTNAM, SAM GURR, BRENT VADOPALAS, SHELLY TRIGG, JAMESTOWN S'KLALLAM TRIBE

GEODUCKS AND OA



GEODUCKS AND OA

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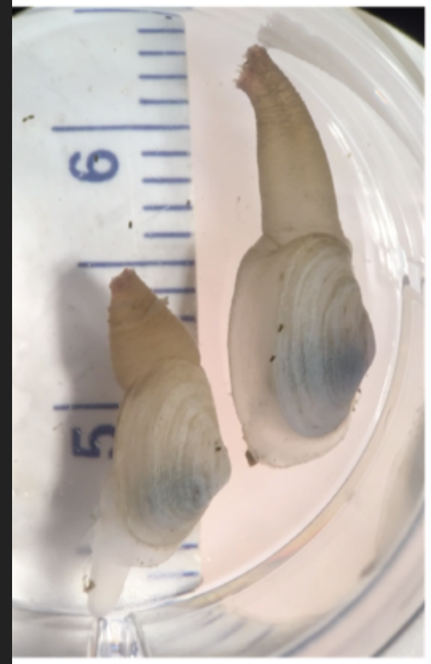

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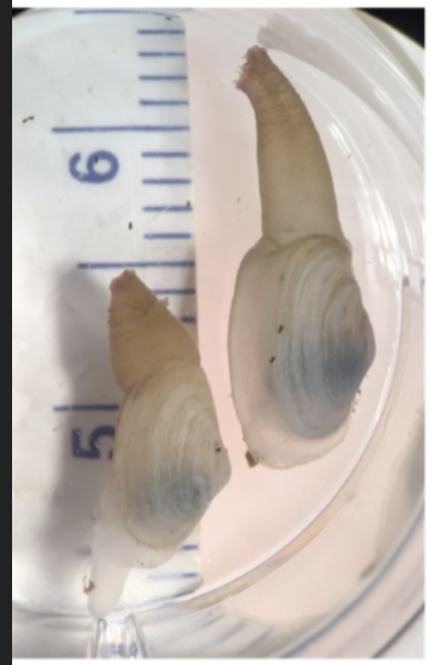
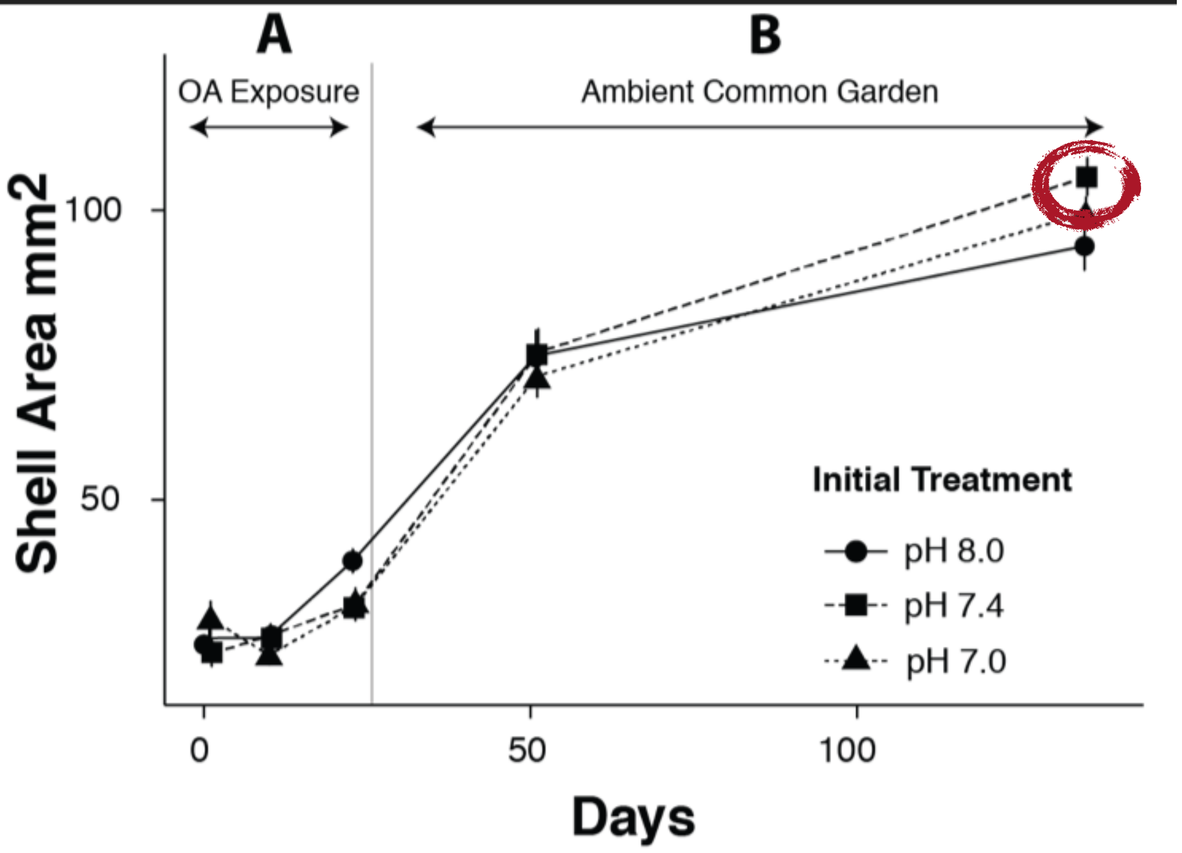
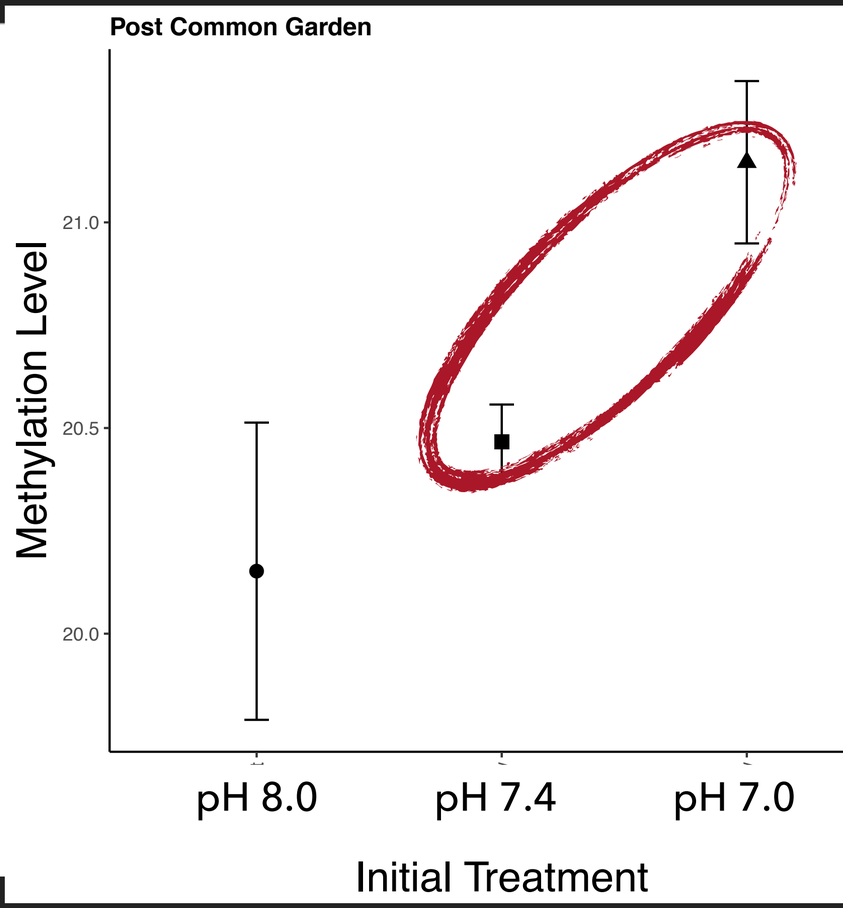
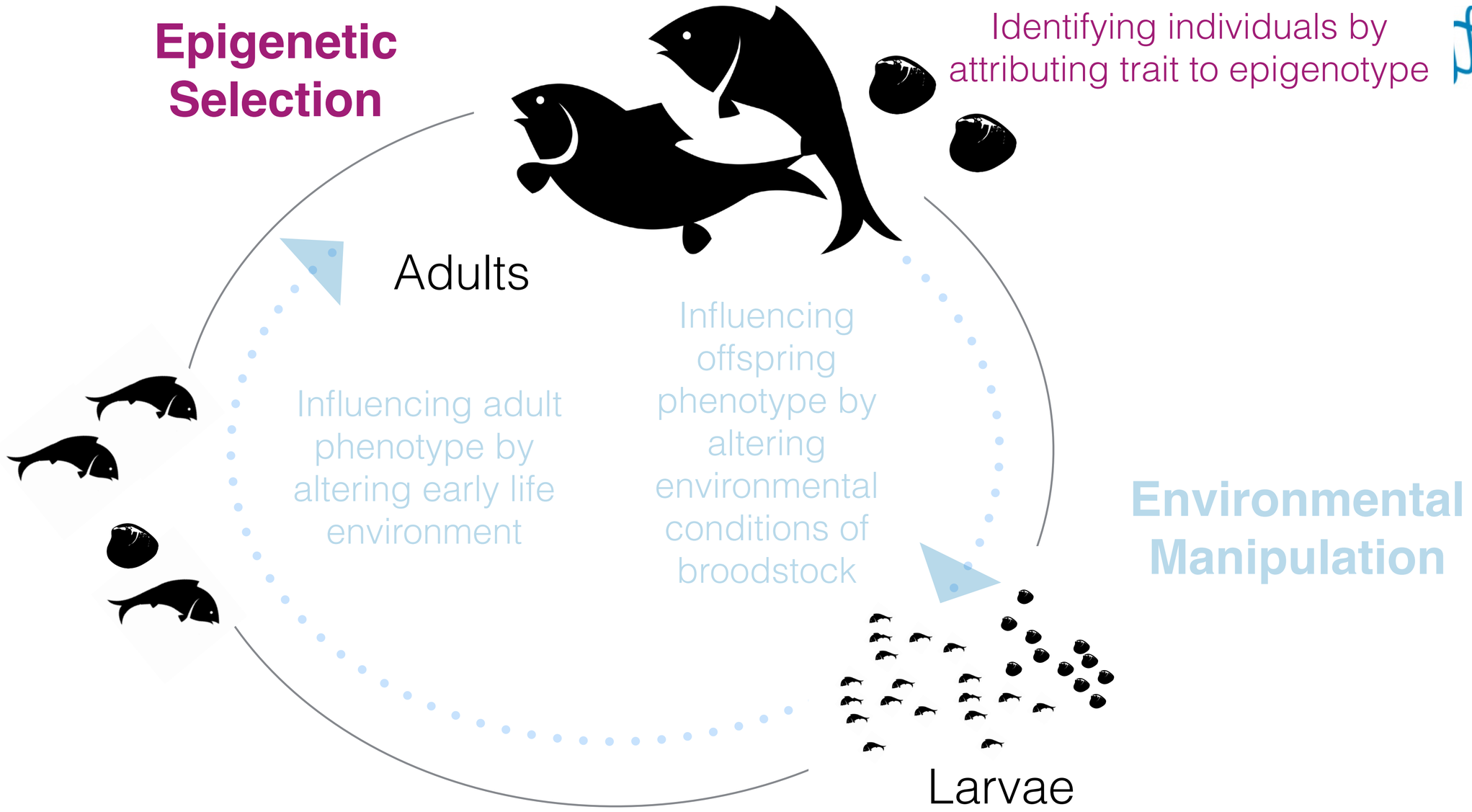




DNA METHYLATION

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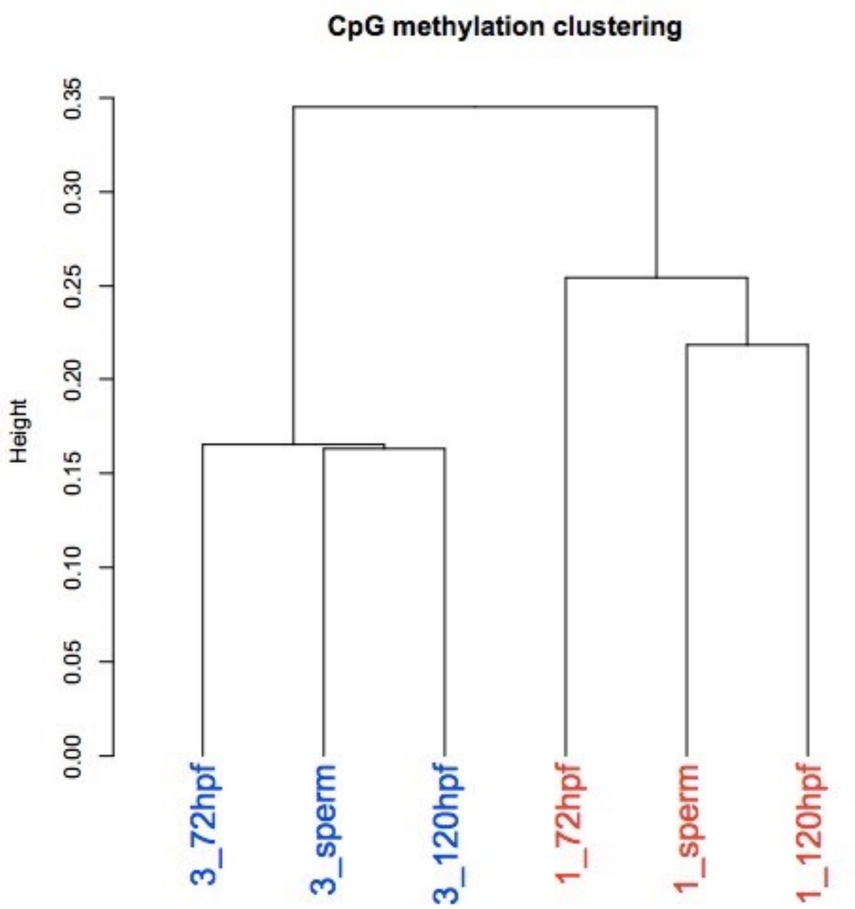
SELECTION POTENTIAL



New Results

Indication of family-specific DNA methylation patterns in developing oysters

Claire E. Olson , Steven B. Roberts
doi: http://dx.doi.org/10.1101/012831

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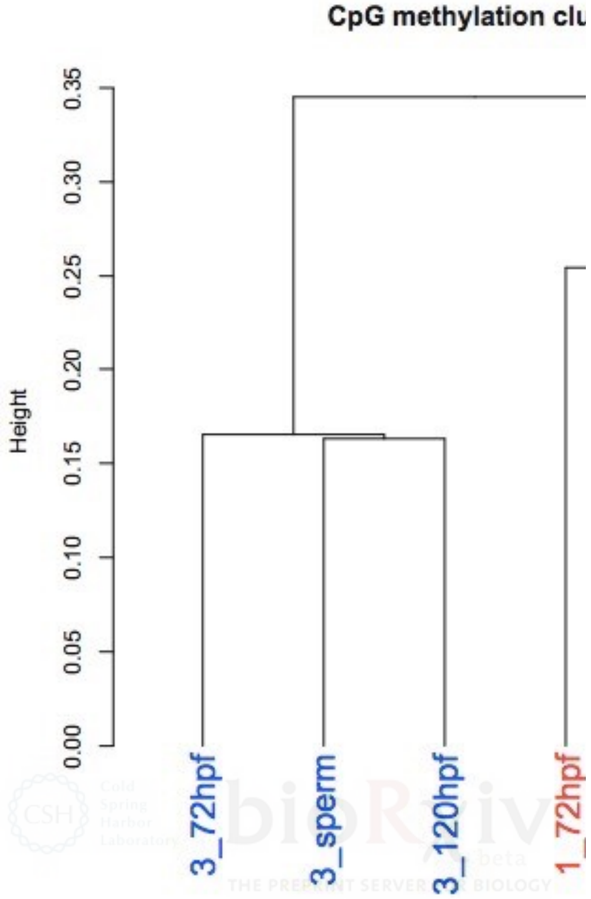

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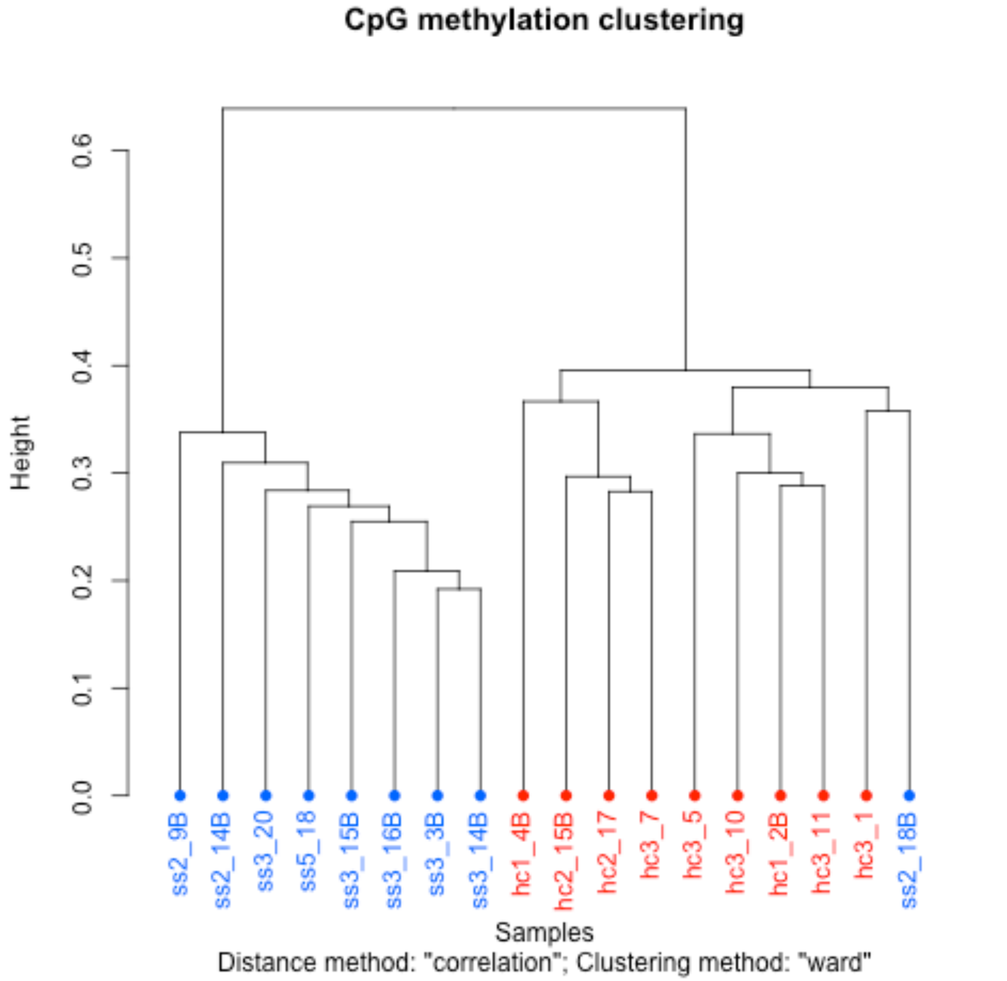
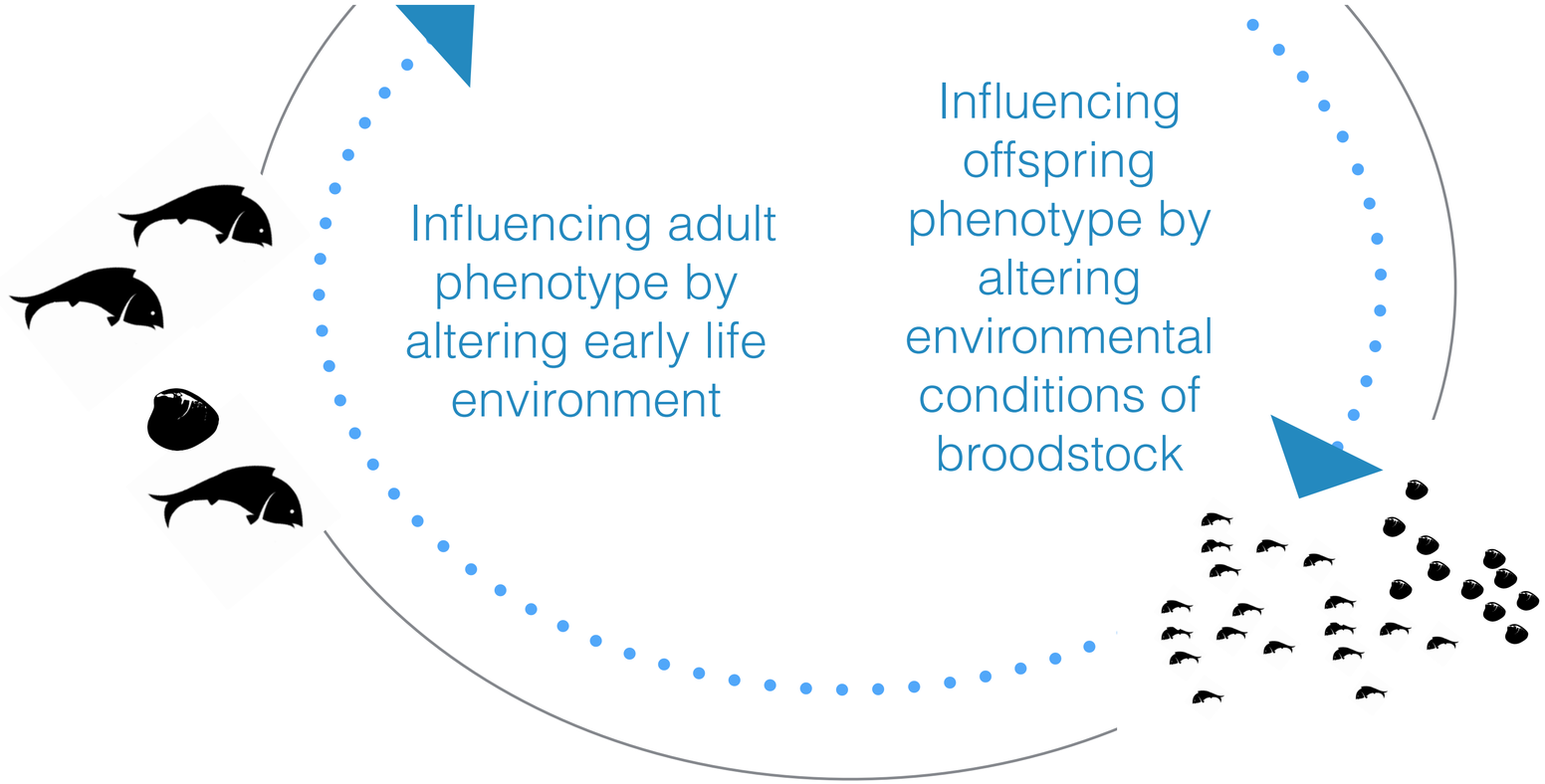


Epigenetics is an attractive lens through which to consider manipulation of traits through environmental memory or selection.



General Challenges

Regulatory Hurdles

Environmental Impact

Market and Economics

Resource Scarcity

General Challenges

Regulatory Hurdles

Regulatory costs on Pacific coast shellfish farms

Jonathan van Senten[a], Carole R. Engle[b], Bobbi Hudson[c], and Fred S. Conte[d]

[a]Virginia Polytechnic Institute and State University, Hampton, Virginia, USA; [b]Engle-Stone Aquatic$ LLC, Strasburg, Virginia, USA; [c]Pacific Shellfish Institute, Olympia, Washington, USA; [d]University of California Davis, Davis, California, USA

ABSTRACT

Concern within the U.S. aquaculture industry and a developing research literature on aquaculture regulations have prompted attempts to quantify on-farm regulatory compliance costs. A survey was conducted of the Pacific coast shellfish industry (Washington, Oregon, and California) to assess the on-farm economic effects of regulations. The response rate for this study was 27%, but captured 74% of the value of Pacific coast shellfish production. The total annual regulatory burden for the Pacific coast, excluding non-cash opportunity costs, was estimated at $15.6 million (increased farm costs due to

KEYWORDS

Clams; oysters; regulation; shellfish; United States

Necessary

"Convoluted and Redundant"

APPLIED STUDIES | Open Access

Regulatory costs on U.S. salmonid farms

Carole R. Engle, Jonathan van Senten, Gary Fornshell

First published: 18 March 2019 | https://doi.org/10.1111/jwas.12604 | Citations: 10

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Abstract

The economic effects of the implementation of regulations on aquaculture farms in the United States, while of concern, are not well understood. A national survey was conducted of salmonid (trout and salmon) farms in 17 states of the United States to

markets with annual sales values of $66,274/farm; annual lost production of $49,064/farm; and an annual value of thwarted expansion attempts estimated at $375,459/farm. Smaller-scale farms were affected to a disproportionately greater negative extent than larger-scale farms. Per-farm regulatory costs were, on average, greater for foodfish producers than for producers selling to recreational markets, but per-kg regulatory costs were greater for those selling to recreational compared to foodfish markets. Regulatory costs constituted 12% of total production and marketing costs on U.S. salmonid farms. The greatest regulatory costs were found to be effluent discharge regulations. The majority of regulatory costs were fixed costs, but regulatory barriers to expansion precluded compensatory adjustments to the business in spite of growing demand for salmonid products. Results of this study show that the on-farm regulatory cost burden is substantial and has negatively affected the U.S. salmonid

General Challenges

Environmental Impact

Discharge
Climate Change

General Challenges

Market and Economics

Global Trade
Workforce
Consumer Preferences

General Challenges

Water
Land
Energy
Feed

Resource Scarcity

General Challenges

Regulatory Hurdles

Environmental Impact

Market and Economics

Resource Scarcity