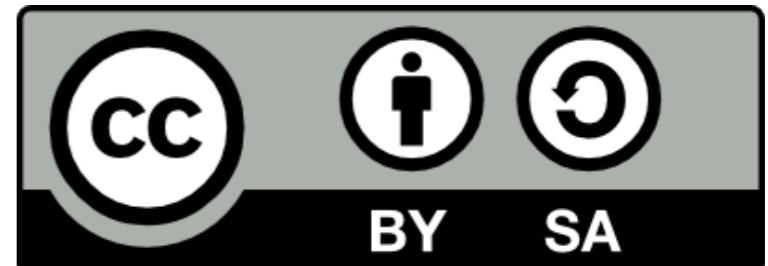


Genomic approaches to assessing ecosystem health

Steven Roberts
School of Aquatic and Fishery Sciences
University of Washington

Open Science

- You are free to Share!
- Our lab practices open notebook science



IP[y]: IPython
Interactive Computing



- Slides and more available

robertslab.info

sr320@uw.edu

@sr320

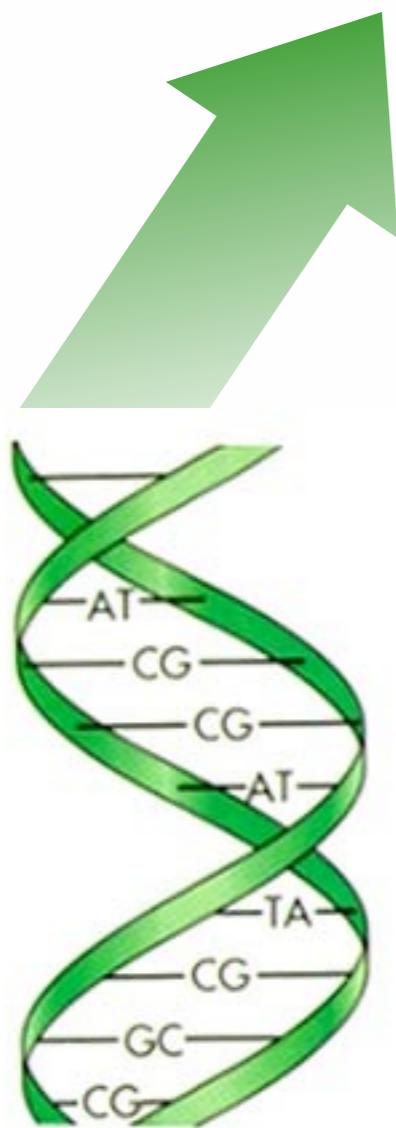
#sse14







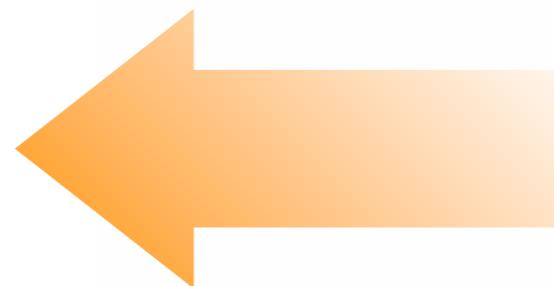
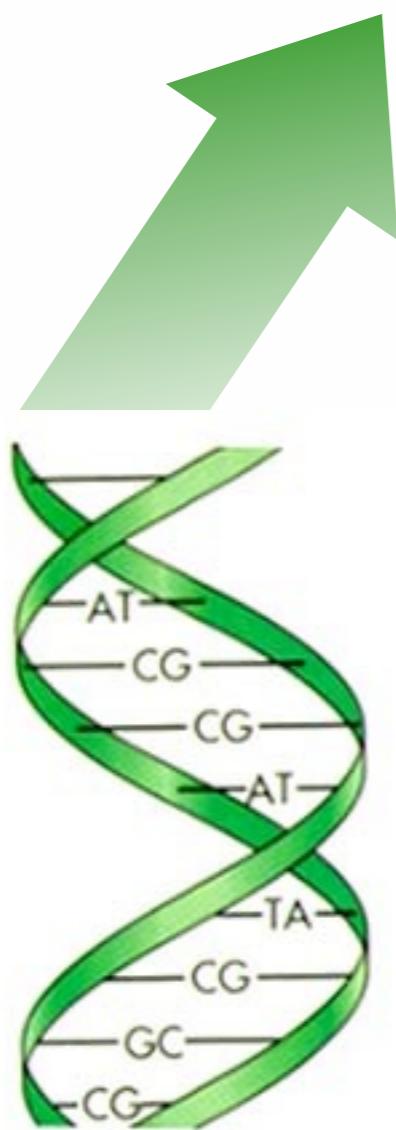
Physiology



Very easy to get billions of A,C,T, and Gs



Physiology



Biological Indicators of Ecosystem Health

DNA Variation

Gene Expression

Proteins

Epigenetic Alterations - DNA Methylation

Biological Indicators of Ecosystem Health

DNA Variation

Gene Expression

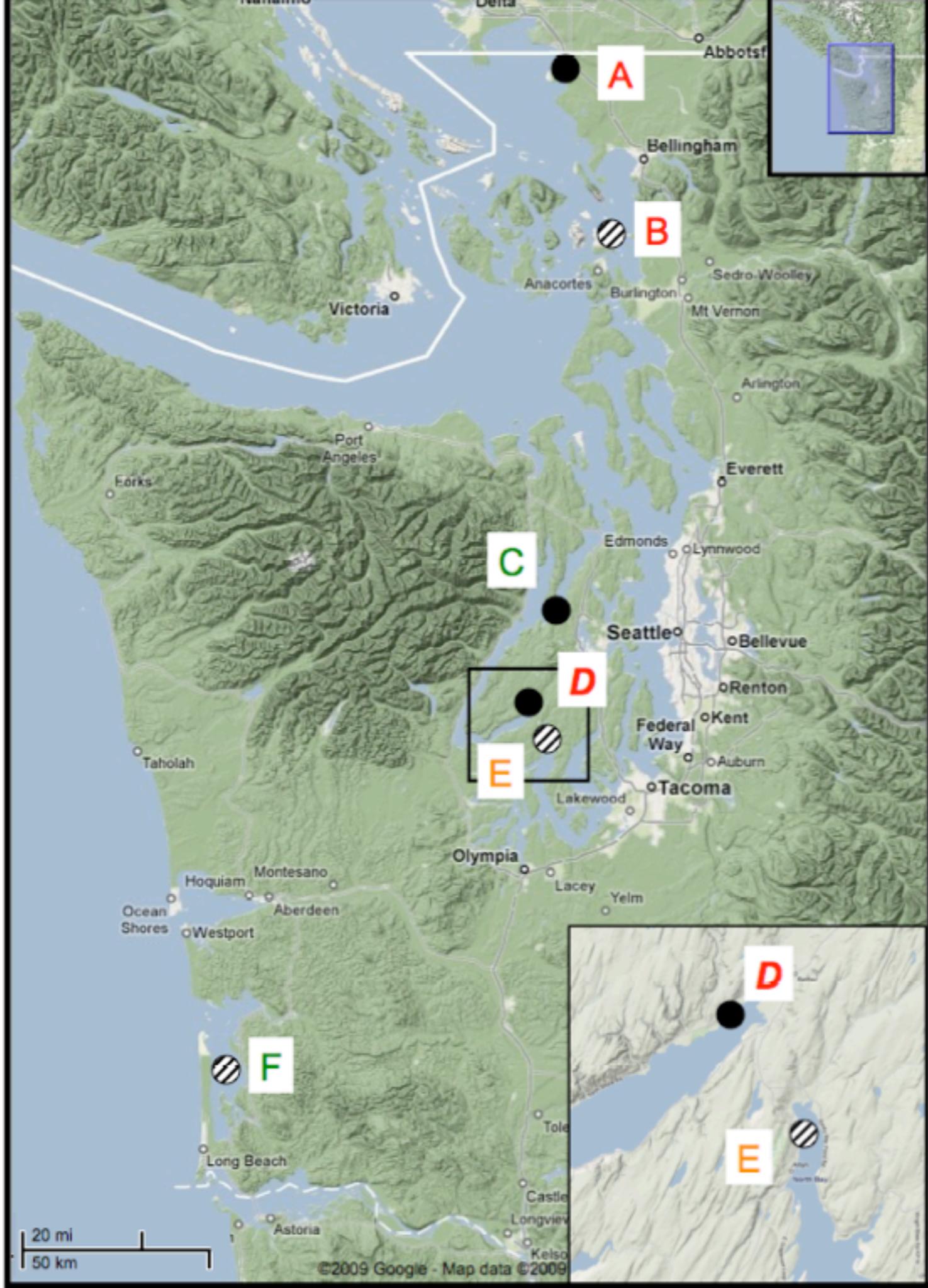
Proteins

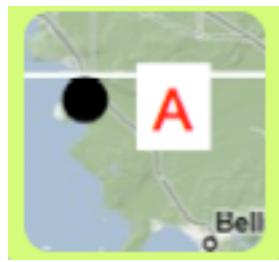
Epigenetic Alterations - DNA Methylation



Gene Expression

**Physiological
Response of
Oysters in
Puget
Sound**

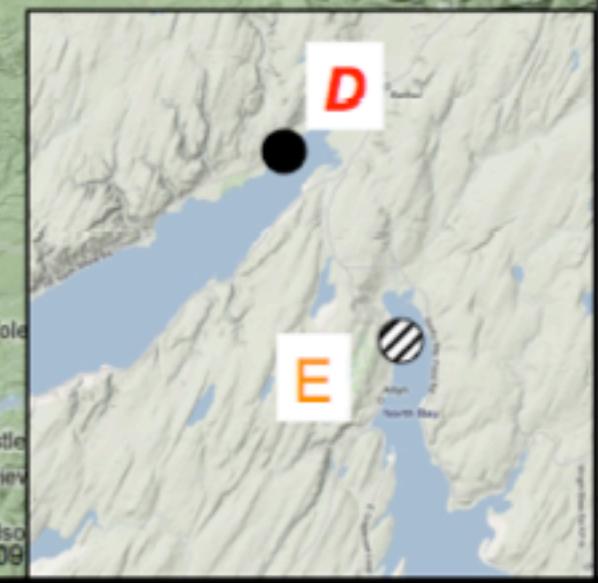
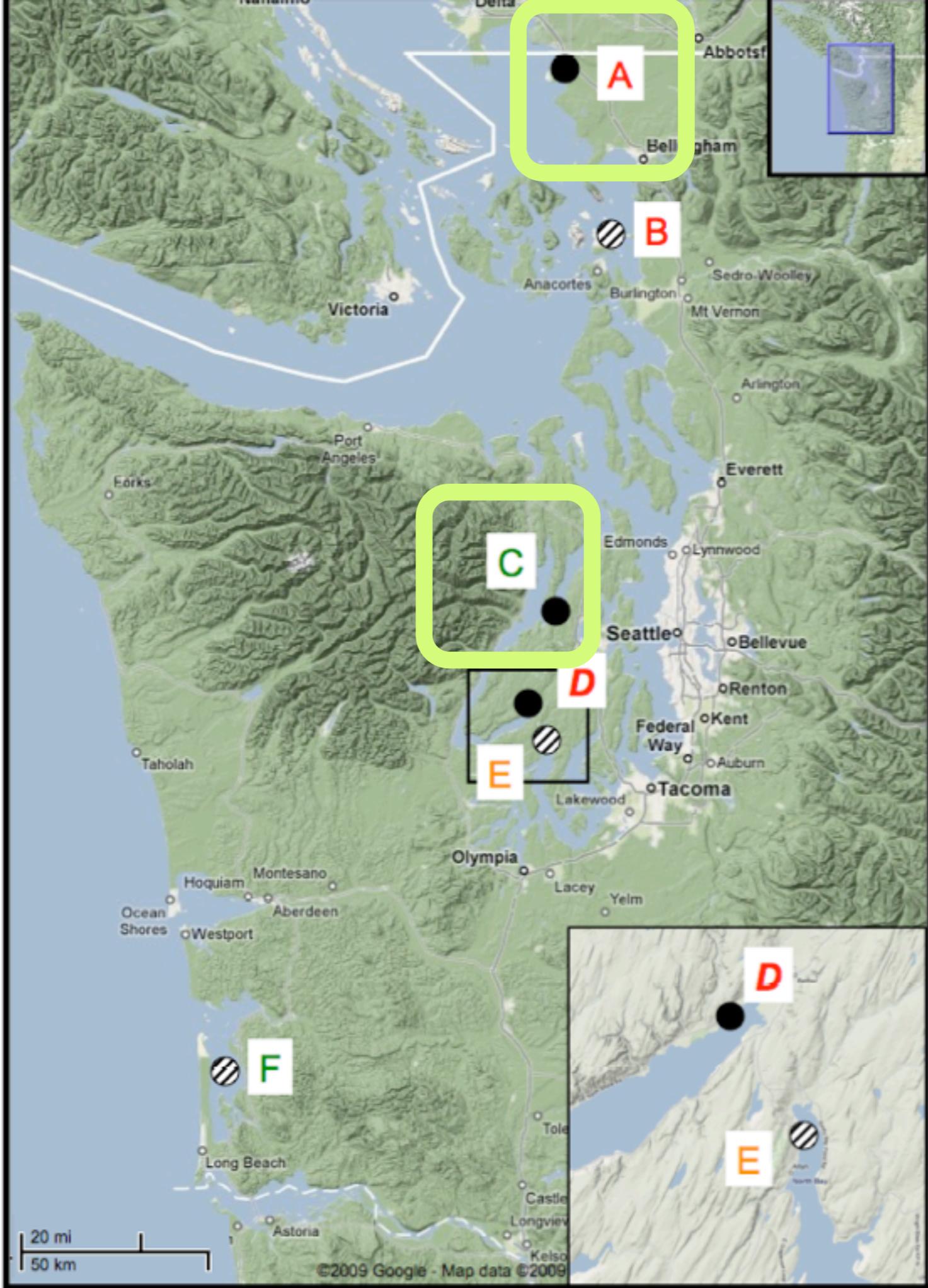


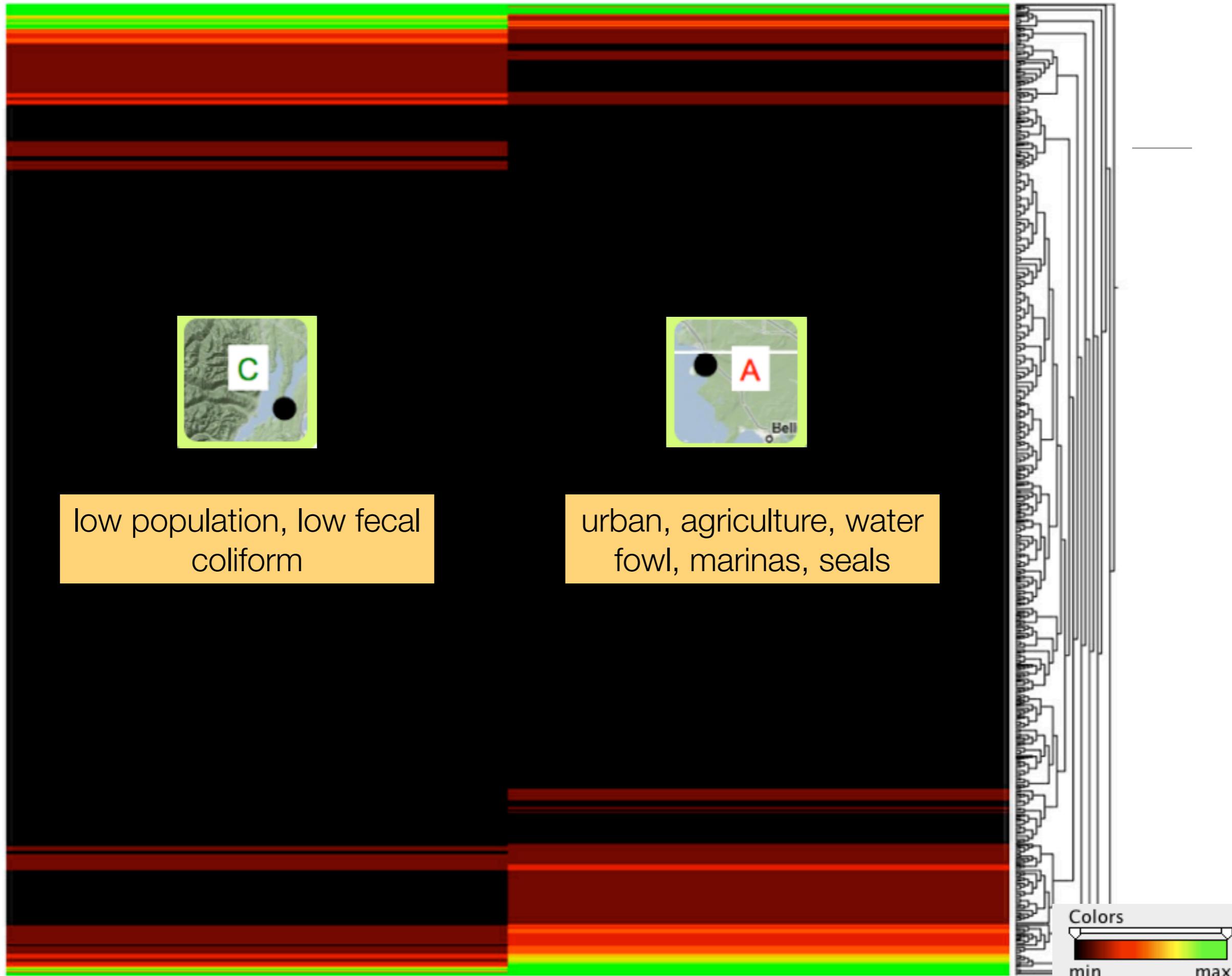


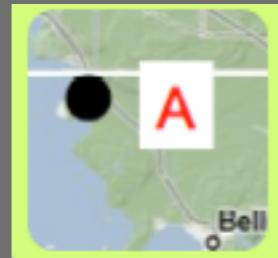
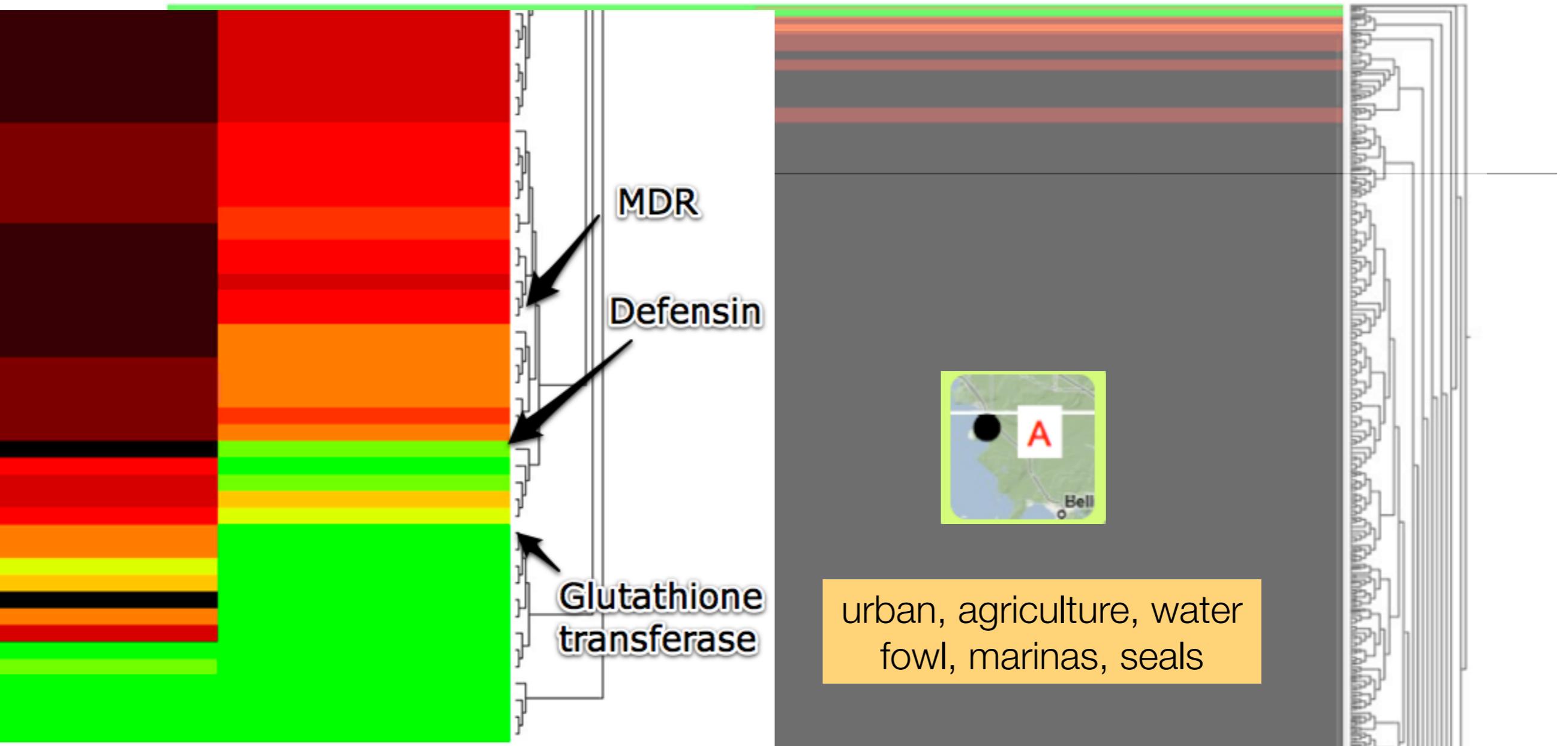
A urban, agriculture, water fowl, marinas, seals



C low population, low fecal coliform





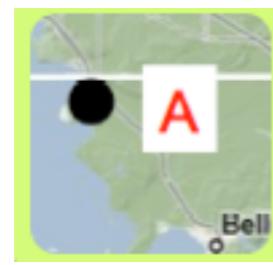
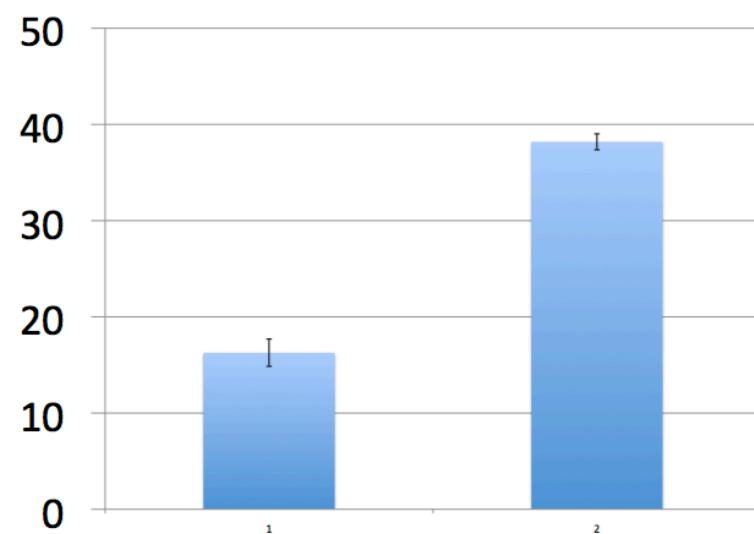


urban, agriculture, water
fowl, marinas, seals

with replication / validation -> signature

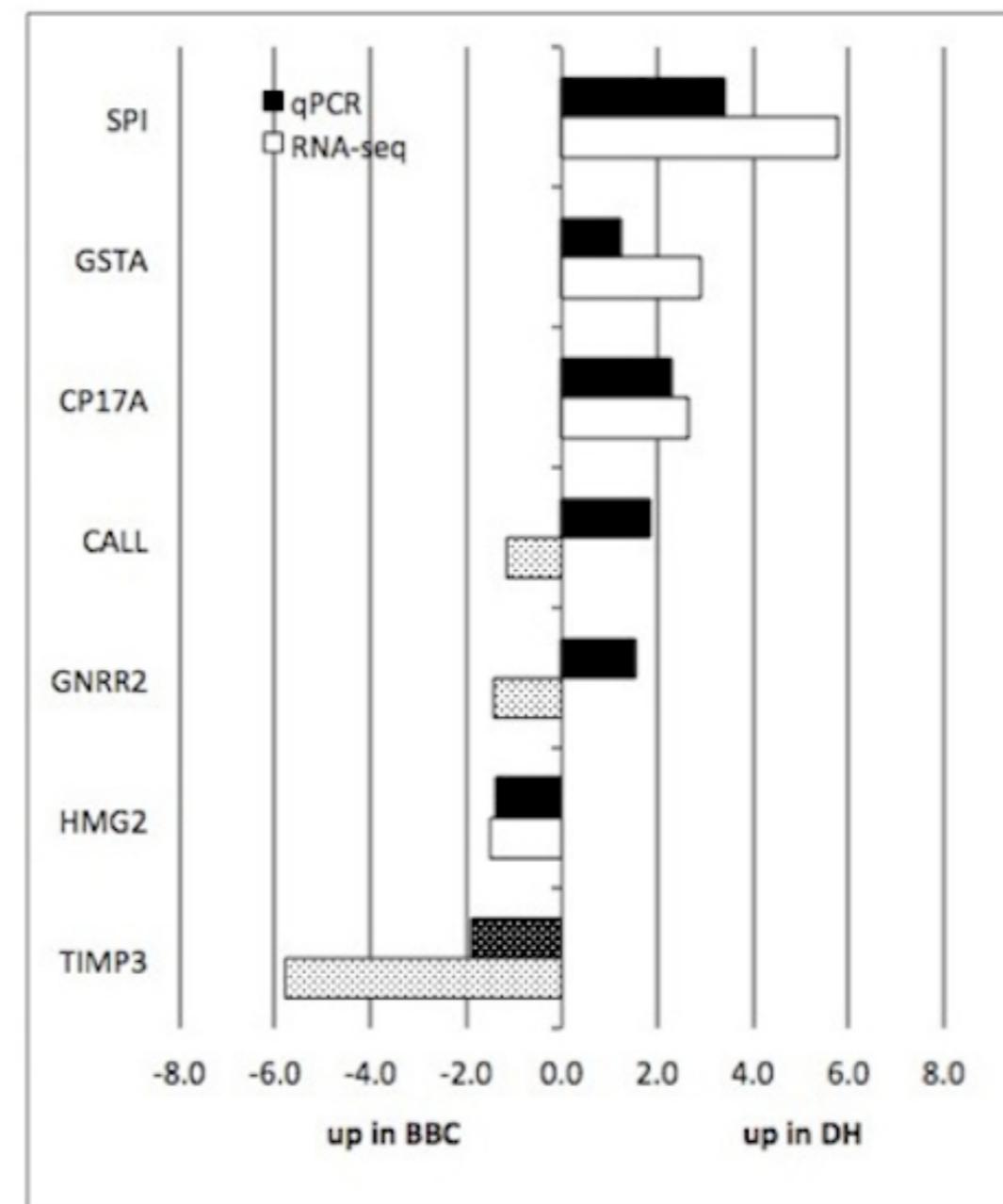
qPCR

metalloproteinase inhibitor 3

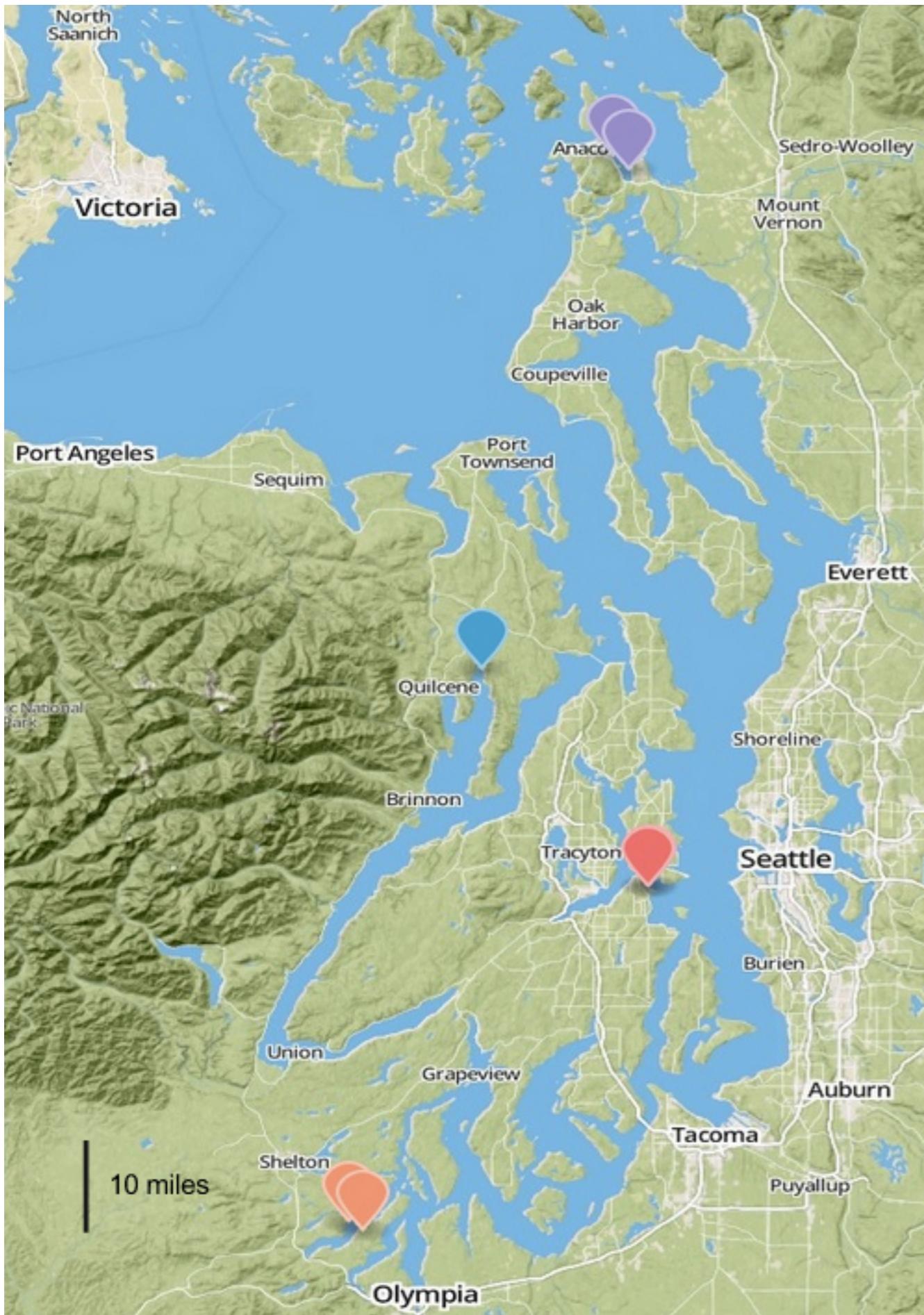


low population,
low fecal coliform

urban, agriculture,
water fowl,
marinas, seals



Gavery, Mackenzie; Roberts, Steven; White, Samuel (2013):
qPCR corroboration of an RNA-Seq experiment. figshare.
<http://dx.doi.org/10.6084/m9.figshare.683879>

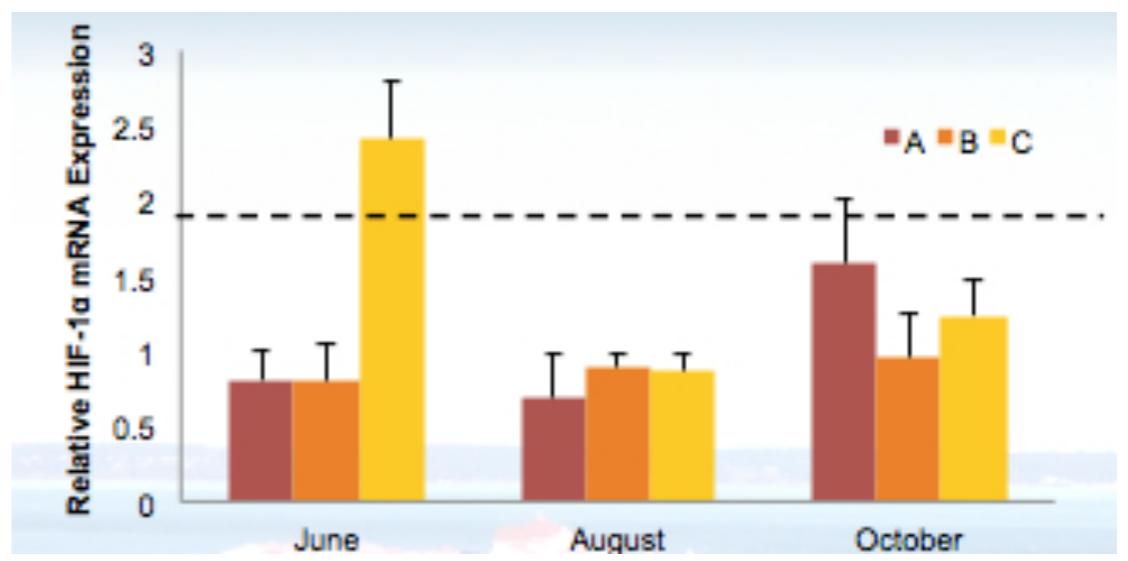
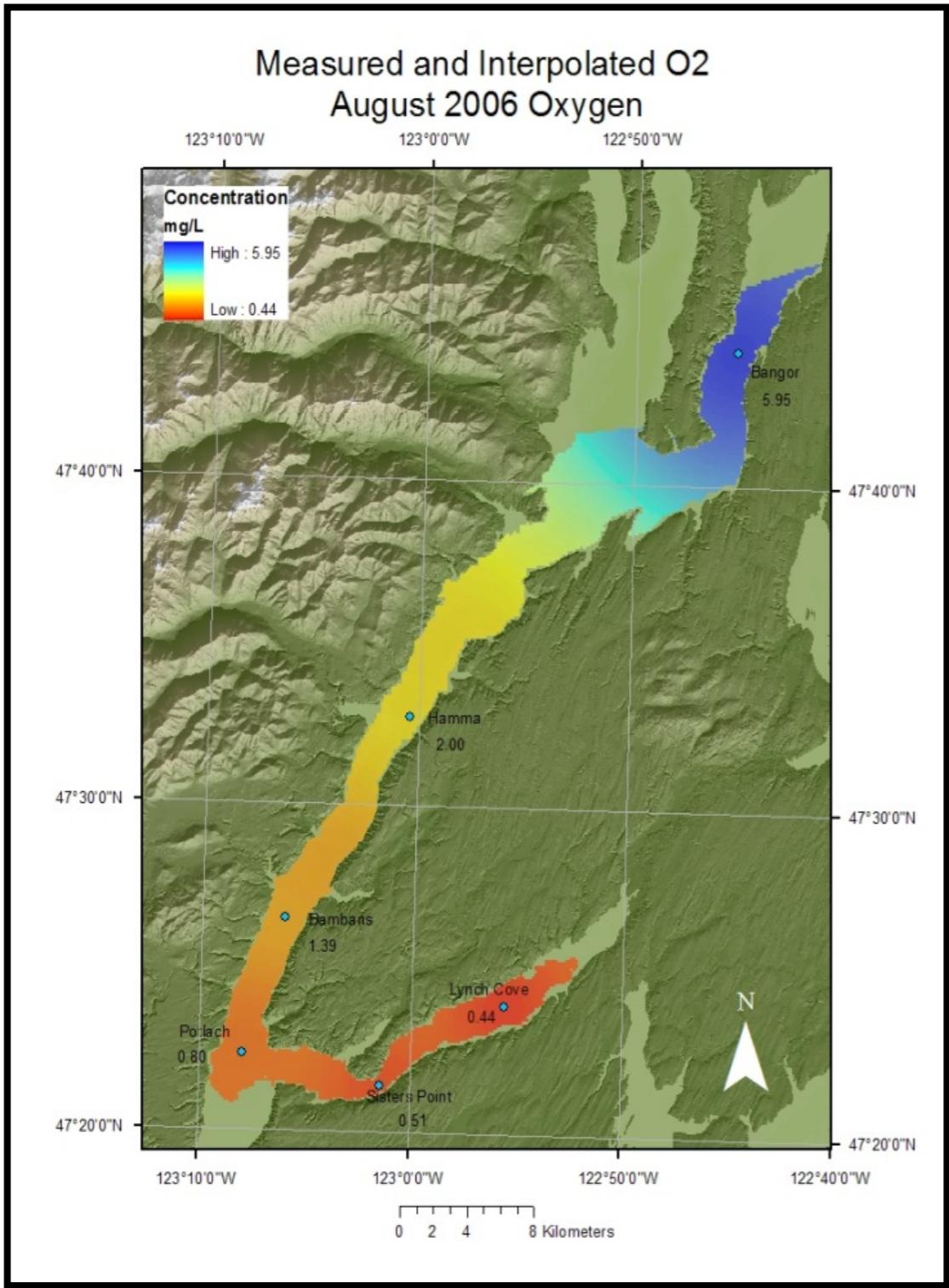


Olympia oyster



PROPS v2

Application of qPCR



Very easy to get billions of A,C,T, and Gs

Very easy to get thousands of genes online

Biological Indicators of Ecosystem Health

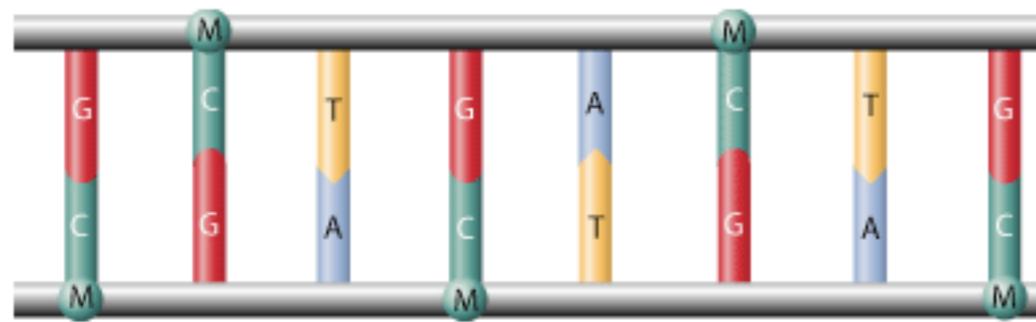
DNA Variation

Gene Expression

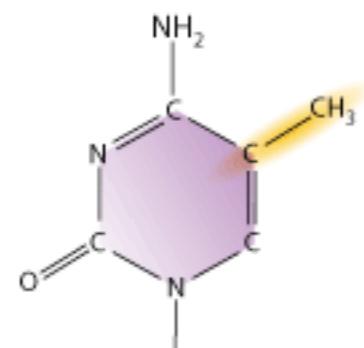
Proteins

Epigenetic Alterations - DNA Methylation

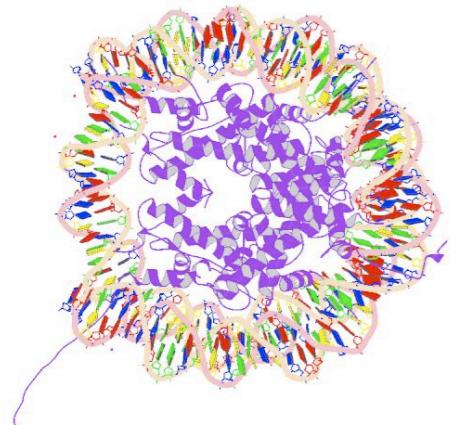
Epigenetic Alterations - DNA Methylation



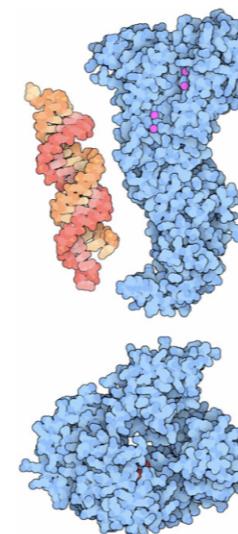
DNA Methylation



DNA methylation is the addition
of a methyl group (M) to the
DNA base cytosine (C).



Histone
Modification



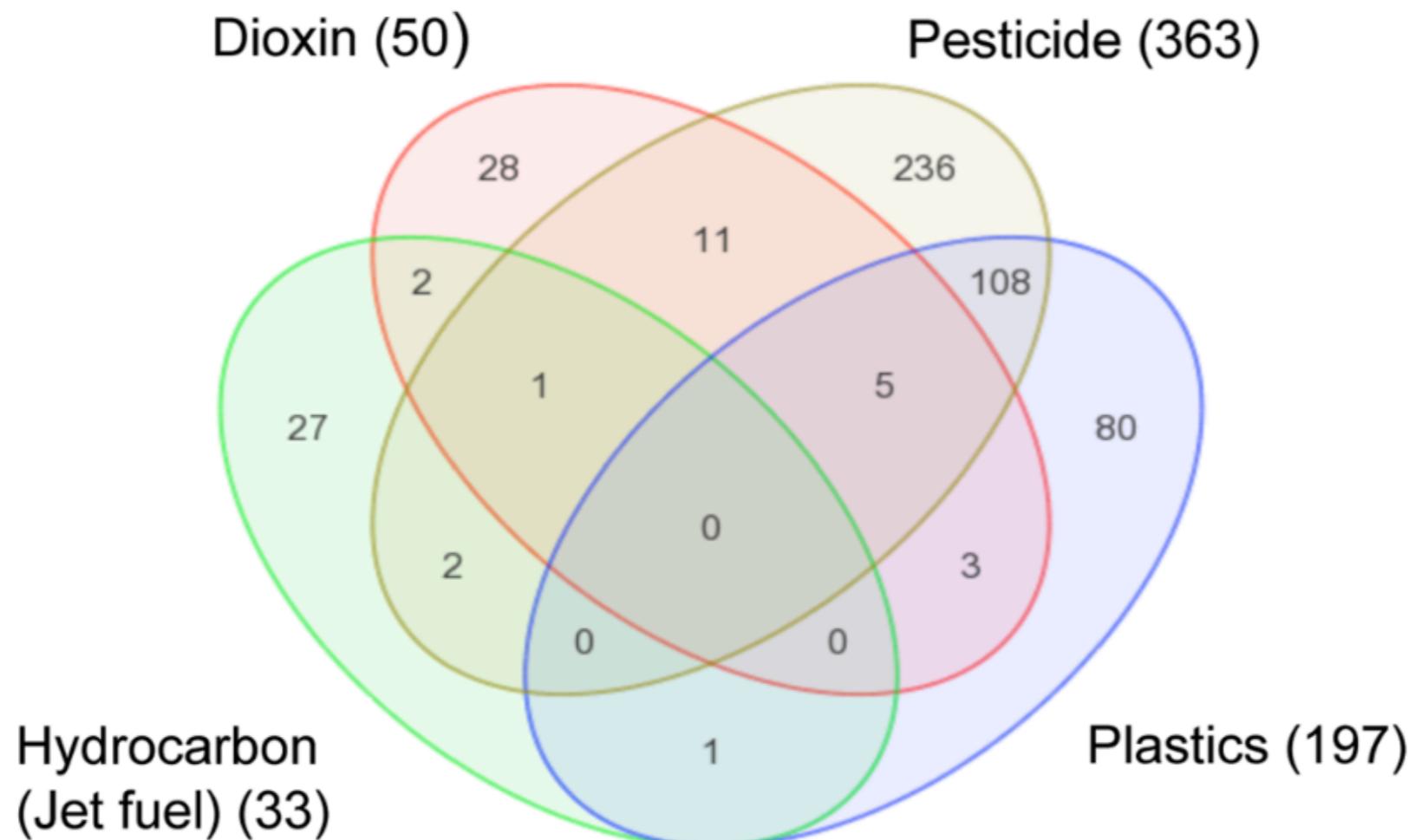
Small Interfering
RNA

Epigenetics

- controls normal developmental processes
- implicated in human diseases including cancer
- possible means for adaptation of changing environmental condition
 - heritable for several generations

Contaminants and DNA Methylation

Transgenerational differential DNA methylation regions (DMR) associated with exposures

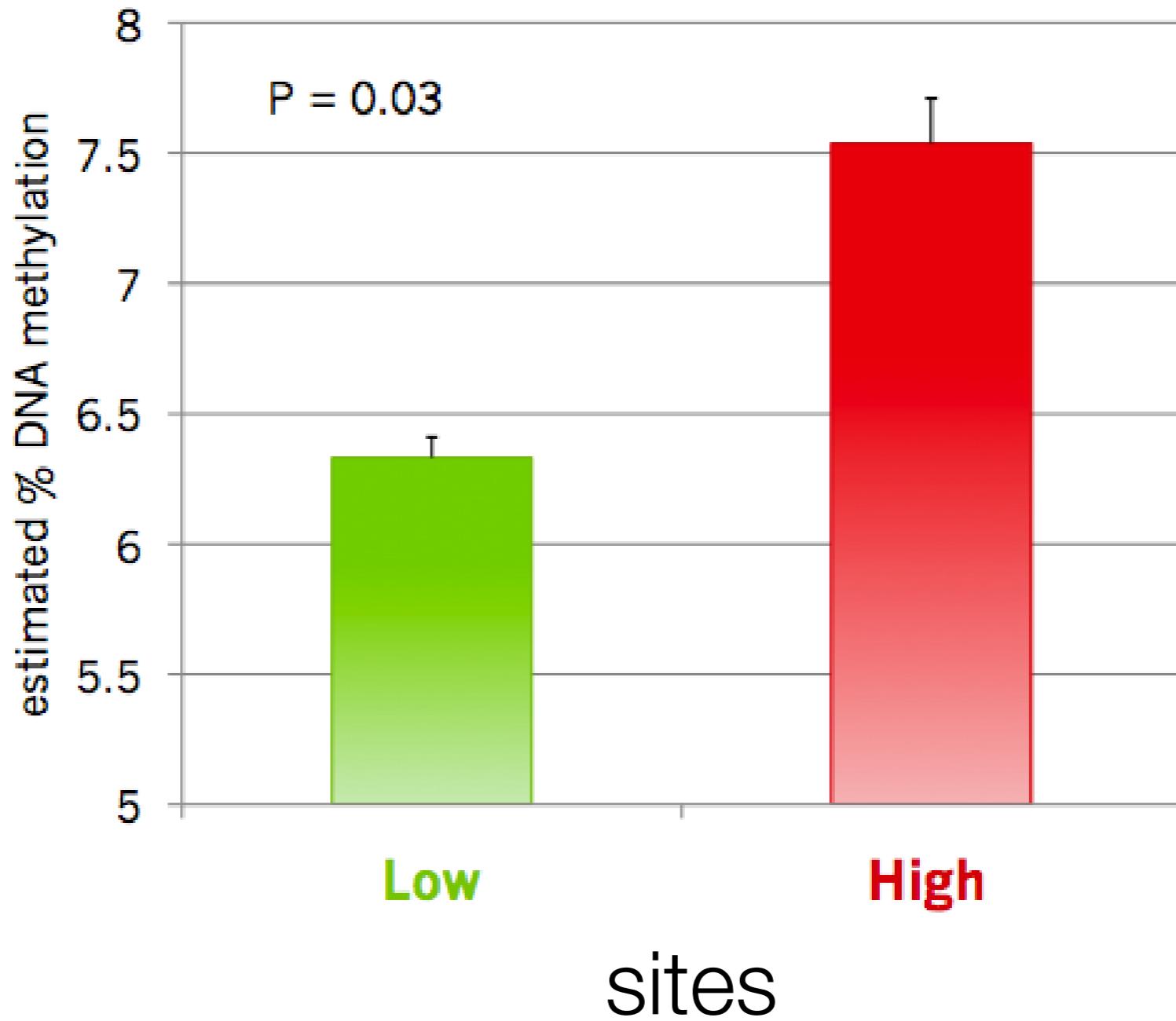
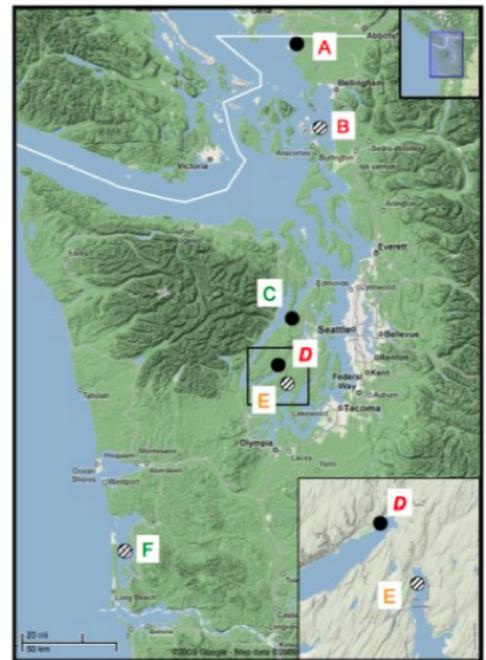


Transgenerational Actions of Environmental Compounds
on Reproductive Disease and Identification of Epigenetic
Biomarkers of Ancestral Exposures

Mohan Manikkam^a, Carlos Guerrero-Bosagna^a, Rebecca Tracey, Md. M. Haque, Michael K. Skinner*

Center for Reproductive Biology, School of Biological Sciences, Washington State University, Pullman, Washington, United States of America

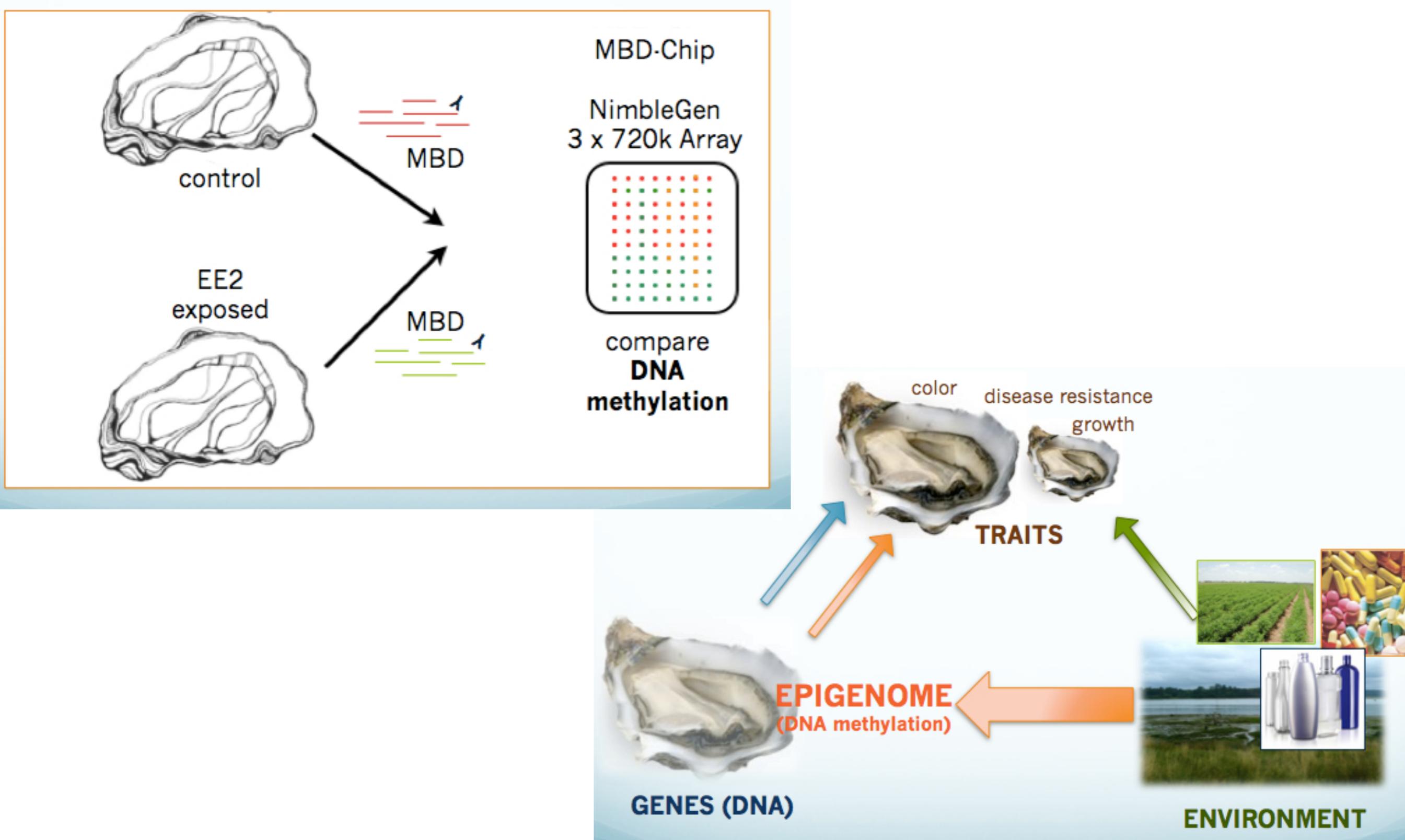
DNA methylation and oysters



Gavry, unpublished

DMRs

Gavery - Friday 9:00 - #383



Summary

- Sequencing technology allows for easy integration of genomic approaches into environmental studies.
- Practical implementation would involve using targeted assays*.
- Significant lack of knowledge concerning toxins and epigenetics in marine invertebrates. This could have significant ecosystem impacts.

Acknowledgements

Mackenzie Gavery
Claire Olson

DNA methylation



EPA
STAR



Sam White
Brent Vadopalas
Jake Heare



Aquaculture Program

robertslab.info

sr320@uw.edu

@sr320
oystergen.es