

US EPA ARCHIVE DOCUMENT



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Living with Stress: Genetic Adaptation or Environmental Acclimation?

Question

Species that inhabit stressful environments are successful due to evolutionary adaptation or environmental acclimation?

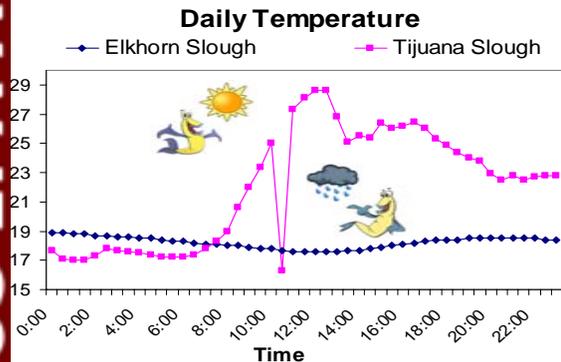


Life History Characteristics

Tolerant to daily fluctuations in temperature, salinity and oxygen¹.

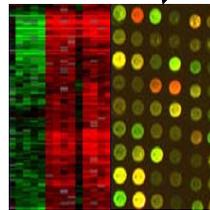
Limited gene flow between northern and southern populations.

Reside in tidal flats, bays and coastal sloughs from Tomales Bay, CA to Bahia Magdalena, Sea of Cortez



Scientific Approach

I will measure the strength of selection in genes that are environmentally regulated versus genes that are not.



Some genes turn on or off during physiological stress

Some genes are unregulated

How does selection operate on differentially regulated genes?

Microarray of 6000 genes, data courtesy of A. Gracey, B. Buckley and G. Somero

Why is this study important?

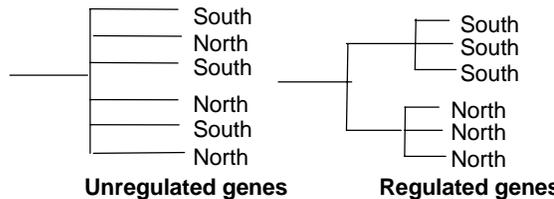
A clear depiction of a species' genetic response to natural selection along an environmental gradient will help us understand how individual resilience and local adaptation contributes to long term ecosystem stability.

Materials & Methods

I will test for disruptive selection on these genes using the following molecular methods: (1) D_n/D_s ratios, (2) McDonald-Kreitmann tests, (3) Codon Bias, (4) Phylogenetic Analysis of Maximum Likelihood and (5) Linkage disequilibria (cline theory)

These analyses will provide a means of detecting a geographic component of gene expression patterns.

Predictions



Under coalescence theory, we expect nuclear loci to evolve three times slower than mtDNA loci.

Neutral evolving genes will show no phylogeographic structure.

If the patterns at both mtDNA loci and nuclear loci are congruent and demonstrate geographic structure, we can conclude that these genes are under selection.



Photo by: Yang, T.

Species: *Gillichthys mirabilis* (Cooper 1846)
Common name: Long-jawed mudsucker