Mitochondrial DNA Population Genetics of *Entosphenus tridentatus: Recent Research and Considerations for Translocation Practices*

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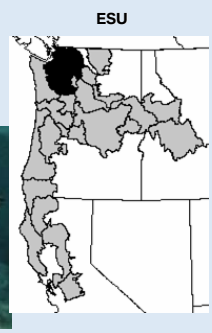
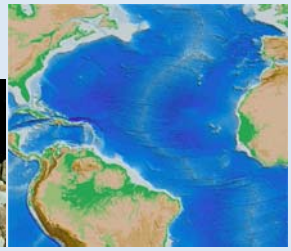
Diadromous Population Structure

- *Oncorhynchus tshawytscha*
  - Anadromous lifecycle
  - Natal stream fidelity
  - Well defined population structure
  - Genetic differences between runs

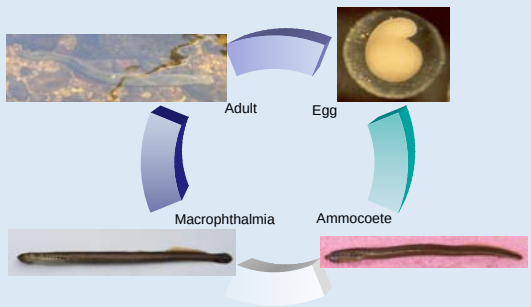


Diadromous Population Structures (2)

- *Anguilla rostrata*
- Catadromous
- Little population structure



Complex Lifecycle

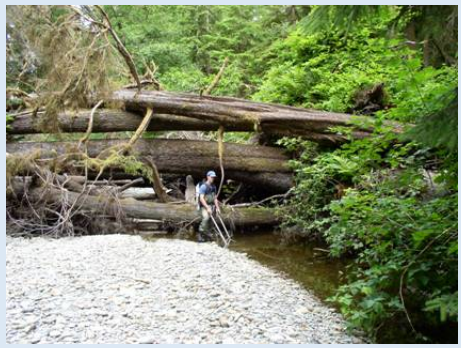


Study Objectives

- Develop genetic markers to evaluate population structure in Pacific lampreys.
- Determine if Pacific lampreys exhibit among population differentiation in mtDNA.

Collecting

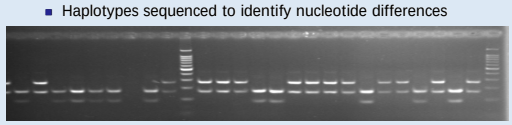
Olympic Peninsula, WA



Arroyo Seco (Salinas), CA

Methods

- Lamprey Identification
  - Genetics & morphology (Goodman et al. in press)
- Population structure (Docker et al. 2006)
  - Foundation of sequence based analysis of mtDNA
    - 2690 bp
    - ND1;ND2;ND4:ND5 genes
    - 3 tRNA genes
    - Small non-coding regions
  - 5 PCR-RFLP assays analyze variation at 19 positions
  - Haplotypes sequenced to identify nucleotide differences

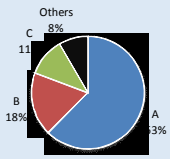


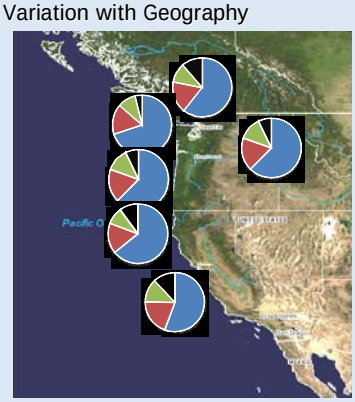
Results

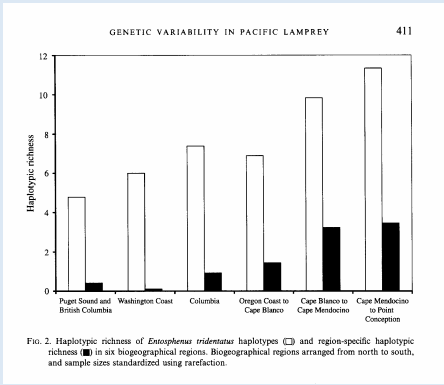
- 1239 individuals analyzed
- 30 haplotypes
- 3 common haplotypes spanning all collections.
  - 92% of total sample
- 14 rare haplotypes
  - 7%
- 13 private haplotypes
  - 1%

Genetic Variation with Geography

Total Sample



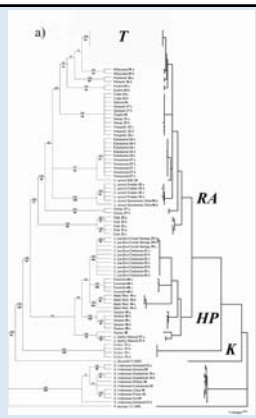




Genetic differentiation among haplotypes

- mtDNA complete cyt-b sequence
- Max sequence divergence
  - 0.4% E. tridentatus
  - 8.0% L. richardsoni
- Parsimony tree
  - 50% majority rule

D.A. Boguski, M.S. Thesis, Univ. Manitoba. 2009



Discussion

- Little evidence for geographic population structure
  - (>2600 km)
- Gene flow sufficient to homogenize mtDNA differences
  - Mechanism.....
- Higher diversity in southern regions
- Low level of divergence among haplotypes

Population Structure of Anadromous Lampreys

- *Petromyzon marinus*
  - Little evidence for geographical population structure
    - North America (Bryan et al. 2005)
    - North America vs. Spanish populations (Rodriguez-Munoz et al. 2004)
  - Mechanism
    - Larval pheromones (Bjerselius et al. 2000)
- *Lethenteron camtschaticum* (Docker 2006)
- *Geotria australis* (Johnston et al. 1987)

More Work is Needed

- Multiple independent data sets
  - DNA data: mtDNA & nuclear
  - Behavioral data: migratory behavior, etc.
- Marker resolution
  - Example: Gila topminnow (*Poeciliopsis occidentalis occidentalis* ; Parker et al. 1999)
  - No structure identified in mtDNA and allozymes
  - Structure resolved using microsatellites

Genetic Considerations for Translocation

- Founder effects & population bottlenecks
  - Genetic variation
  - Artificial selection
- Locally adapted gene complexes
  - May affect: behavior, morphology & life history
  - Localized adaptation may not be observed in neutral markers (Allendorf 1983)

Historical Climate Conditions

- Cordilleran Ice Sheet
  - Maximum extent approx 15,000 ybp
- Post Glacial Colonization
- Genetic signature
  - Lower diversity in glaciated areas

McPhail and Lindsey 1986