

Population structure, local adaptation, and genetic basis of fitness traits in Pacific salmonids

Problem Statement

Understanding how patterns of genetic diversity influence population and species viability is essential for developing recovery plans and evaluating the impacts of management actions and environmental change.

Critical Factors

- The homing behavior of Pacific salmonids has led to considerable genetic diversity among populations.
 - Genetic diversity is believed to be important for population and species viability, but this relationship is not well quantified.
 - Understanding the relationship between genetic diversity and species viability is important for setting recovery goals and evaluating impacts on protected species. Critical questions include:
 - How small can a population be before the consequences of inbreeding significantly reduce viability?
 - How genetically different can two populations be before interbreeding between them leads to significant reduction in fitness?
 - If a local population goes extinct, how readily can another population adapt to take its place?
 - What are 'natural' levels of straying among populations, and what are the consequences of increasing straying rates due to releases of hatchery fish?
 - What is the genetic basis of important traits such as growth or age at maturity? Does this basis vary among species or populations?
 - Can we identify specific genes where variation is particularly important for population fitness?
 - Can salmon populations adapt rapidly enough to long-term environmental changes produced by global warming or other anthropogenic factors?



Status of Research

Northwest Fisheries Science Center (NWFSC) scientists are conducting research to better understand and quantify the importance of genetic diversity within and among salmon populations. These projects include:

- Measuring the effects of inbreeding in Puget Sound chinook salmon.
- Creating genome maps of chinook and coho salmon and identifying chromosomal regions associated with traits important to adaptation and fitness in these species.
- Characterizing the effects of interbreeding among Alaskan coho salmon populations to measure the strength of local adaptations.
- Conducting research to determine the usefulness of molecular tools in measuring natural selection and local adaptation.

Future considerations

Understanding how local adaptation shapes genetic diversity contributes significantly to correctly managing Pacific salmon stocks, as well as to broader problems in population genetics. NWFSC experiments designed to provide insights into the patterns and processes of salmon adaptation to the local environment and quantify the importance of local adaptation to species survival will address these important questions.

Population structure, local adaptation, and genetic basis of fitness traits in Pacific salmonids (continued)

Key Players

Conservation Biology (CB) Division, NWFSC

Bonneville Power Administration

Long Live the Kings

Oregon Department of Fish and Wildlife

Suquamish Tribal Fisheries Department

University of Washington

University of Alaska

U.S. Geological Survey

U.S. Fish and Wildlife Service

Washington Department of Fish and Wildlife

Aquaseed, Inc.

Contact: Dr. Peter Kareiva, Director, CB Division (206/860-3403)

