

## Estuarine and ocean ecology

### Problem statement

There is little information available about the crucial period during which juvenile salmon make their transition from salt to fresh water in estuarine and nearshore environments.

### Critical factors

- Over the past two decades, ocean conditions influenced by the California Current have altered the biogeography of species (e.g., warm-water predators, such as Pacific mackerel, have shifted northward), increased salinity in estuaries, and decreased biological productivity.
- The critical transition from salt to fresh water is one of the least understood life-history stages of Pacific salmon.
- The abundance of predators and the availability of forage fish to serve as prey for larger fish, birds, and marine mammals help determine juvenile salmon survival.
- Resource managers must understand the ecological linkages in estuarine and nearshore environments and their influence on survival rates in order to discriminate between natural population variations and the effects of human activities.

### Status of research

Northwest Fisheries Science Center (NWFSC) scientists are sampling juvenile Pacific salmon in, and adjacent to, the Columbia River plume to determine their health and growth rates. The scientists are also sampling to determine the physical characteristics of the marine waters, the abundance and diversity of prey and predator resources, and the biodiversity of the biological communities in the nearshore ocean environment.

NWFSC scientists are part of a team that is preparing to sample the waters around Oregon's Cape Blanco in June and August. At this location, the California Current moves offshore, forcing the development of different oceanographic environments north and south of the cape. The scientific team will assess the physical and biological conditions of the marine environments, and the impact of the current's shift on the distribution, growth, and survival of juvenile salmon.

### Future considerations

NWFSC scientists will test hypotheses to gain a better understanding of the interactions among biotic factors (e.g., prey availability, predation, disease, growth rates) and abiotic factors (e.g., river plumes, upwelling) that affect juvenile salmon survival in estuaries and after their entry into the ocean.

A physical/biological model of the California Current that captures the dynamics of regional circulation patterns and biological production must be developed.

Synthetic research on regional oceanography and the estuarine and nearshore ecology of juvenile salmon must also be expanded. This will make fishery forecast models more accurate and improve the ability to manage harvests.



Northern anchovy sampling off the Washington coast

### Key Players

Fish Ecology (FE) Division, NWFSC  
Pacific Fishery Management Council  
U.S. Army Corps of Engineers  
Bonneville Power Administration  
Northwest Power Planning Council  
National Biological Service, U.S. Geological Survey

U.S. Fish & Wildlife Service  
Columbia River Inter-Tribal Fish Commission  
University of Washington  
Oregon State University  
Oregon Graduate Institute

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