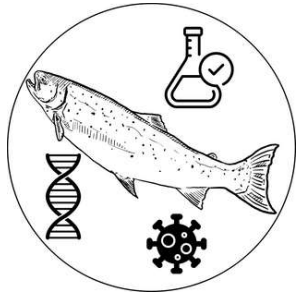
Innovative Ecosystem Based Approaches to identify cumulative stressors: Salmon Fit-Chips and eDNA



Conservation and Stewardship

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Disease

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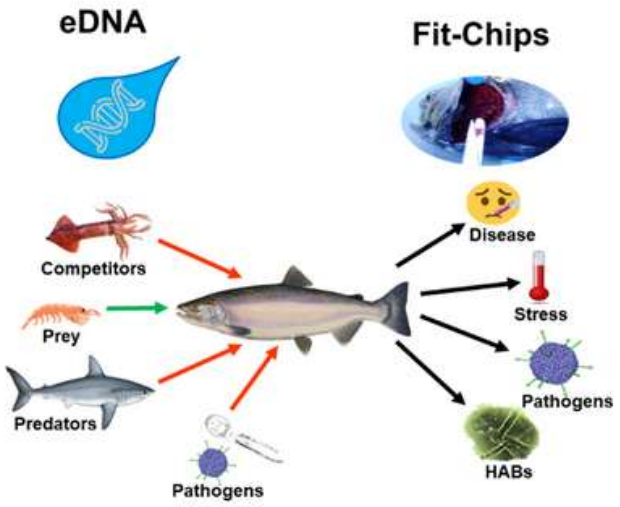
Back to Top



While oceanographic monitoring can measure temperature, oxygen, and salinity, it does not tell us whether fish are actually experiencing stress or avoiding areas where stressors occur. Salmon Fit-Chips contain curated biomarker panels that can specifically recognize independent stressors, condition, and disease, based on gene expression profiling of non-lethal gill samples.

Thousands of hatchery and wild Chinook were sampled over their first year at sea by DFO and First Nations as part of the West Coast Vancouver Island (WCVI) "Follow the Fish" (FtF) consortium. Fit-Chip analyses revealed Chinook are experiencing high levels of hypoxia throughout WCVI sounds in the fall, consistent with low surface O_2 conditions in the most inland reaches of the inlets. Epizootic patterns of *Tenacibaculum maritimum* infection occur during peak summer temperatures in Barkley Sound, and continued hotspots of infection are observed in more northern sounds in fall.

Take-aways

- Salmon experience a variety of physiological stressors and pathogens over migration which can be monitored non-lethally using Fit-Chip technology.
- Chinook salmon will expose themselves to potentially impactful stressors to avail feeding opportunities, enhancing vulnerability to cumulative stressors.
- eDNA data resolves habitat usage for Chinook salmon and demonstrating they associate with high biomass areas (prey availability), including aquaculture facilities, and avoid harmful algae.
- Models addressing the cumulative and synergistic interplay between factors will inform which levers under human control will result in strongest outcomes for salmon.

Synchronous to the FtF, e(nvironmental) DNA was sampled to monitor ecosystems, following smolts from estuaries to the outer reefs across all sounds from Barkley to Quatsino. Researchers use eDNA as a "universal net" to describe salmon ecosystems from viruses to whales and compare these insights with the individual based Fit-Chip data. This allows inferences on ecosystem factors to be drawn that promote salmon health (e.g. presence of prey species) as well as the factors that negatively impact salmon (predators, competitors, pathogens, HABs). Most salmon species are attracted to aquaculture sites, which are hotspots for several pathogens, and that salmon avoid areas of HABs.

Timeline

- May 2023-Mar 2025: Generate eDNA and Fit-Chip datasets from WCVI FtF
- Jan–Mar 2025: Identify salmon habitats and temporal periods requiring additional sampling
- Apr–Mar 2026: Complete sampling and spatial/temporal and cumulative factor modeling

DFO Science Division

Aquatic Diagnostics, Genomics and Technology

DFO Science Section

Molecular Genetics

Project Leads

Kristi Miller-Saunders

Christoph Deeg

Locations

West Coast Vancouver Island

Collaborations

Full list at Follow the Fish

Species

Chinook

Follow the Fish

Project ID

2447