Prevalence of Paralytic Shellfish Toxins in the Marine Food Web of Southcentral & Southwest Alaska

NPRB #1801: Project Update

**Project Summary**

Saxitoxins (STXs) produced by the dinoflagellate *Alexandrium catenella* are potent neurotoxins that accumulate in shellfish during blooms each spring and summer. Recent data have also shown STXs may be transferred through the marine food web, reaching seabirds, marine mammals and other high level consumers. Because these compounds are likely transferred through middle trophic level organisms such as zooplankton, forage fish and benthic invertebrates, there is concern that STXs may also accumulate in salmon and other commercially important predatory fish species, although the trophic transfer pathways for PSP toxins in Alaska are unclear.

This 3-year project investigates the occurrence of PSP toxins in plankton, shellfish, forage fish, predatory fish and other marine biota via focused sampling efforts in Prince William Sound (PWS), lower Cook Inlet (LCI), and sites across the Kodiak & Aleutian Islands.

**Objectives**

1. Develop STX screening and analysis capacity based on a new ELISA test protocol and follow-up analysis with HPLC.
2. Characterize the seasonal occurrence of *Alexandrium* blooms within in the phytoplankton community.
3. Assess trophic transfer of STXs to the zooplankton community, shellfish and forage fish during blooms.
4. Quantify STX levels in organs and flesh of commercially important predatory fish species.
5. Assess potential risks to high level marine consumers, human health, and the Alaskan seafood industry.

**Study Sites**

- **Prince William Sound**
- **Lower Cook Inlet**
- **Kodiak Islands**

**Sample Collection**

- **Sampling fish organs**
- **Stomach contents**
- **Forage fish collection**
- **Zooplankton collection**
- **Plankton sample processing**
- **Shellfish collection**

**Project Team**

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- Julie Matweyou - University of Alaska Fairbanks, Alaska Sea Grant

**Partners**

- Sun'aq Tribe of Kodiak
- SeaTox Research, Inc.
- Alaska DEC Environmental Health Laboratory
- Ocean Tester, LLC
- Alaska DEC Div. Environmental Health, State Veterinarian Office
- Alaska Dept. Fish & Game Div. of Sport Fisheries

**Alexandrium Blooms & Toxicity**

- 2018-2019 Shellfish toxicity (mussels, butter clams, littlenecks) & *Alexandrium* cell abundance via qPCR at Sites in Prince William Sound (PWS), Lower Cook Inlet (LCI) and Kodiak. Red lines: Upper panel, FDA advisory level (80 µg STX 100 g⁻¹); Lower Panel, threshold for PSP risk.

**Results so far…**

- *Alexandrium* cells are present at all study sites in Feb-Dec, & generally bloom during Apr-Oct.
- During blooms, PSP toxins are readily transferred to zooplankton, invertebrates, forage & predatory fish.
- Toxins are widespread and variable through the food web, but are highest where intense *Alexandrium* blooms occur.
- Saxitoxins are present in all salmon species, with the highest levels in digestive and excretory organs, and very low in muscle and roe.
- ELISA screening (with HPLC backup) is a reliable, cost effective approach for large sample sizes.

**Implications**

- Low risks to the finfishing industry & human health.
- Higher risks to marine mammals, seabirds, & other marine consumers.