Prevalence of Paralytic Shellfish Toxins in the Marine Food Webs of Coastal Alaska

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Paralytic Shellfish Poisoning (PSP) in Alaska

Alexandrium catenella

PSP Toxins (PSTs)

Saxitoxins (STXs)
Mussels, clams, oysters, crabs

Symptoms

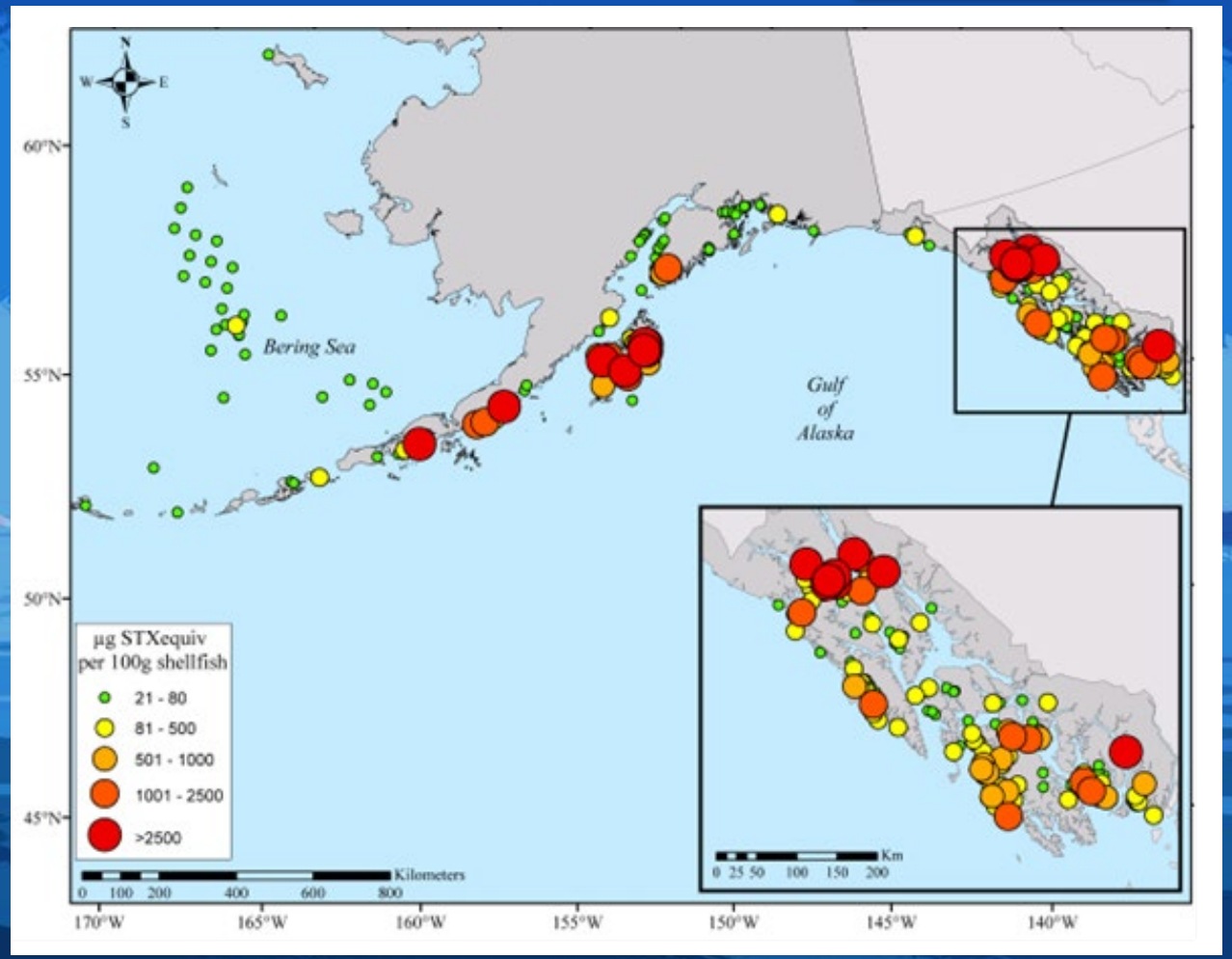
Nausea, vomiting, diarrhea
Headaches, dizziness, numbness
Paralysis, death

FDA Advisory Limit

80 µg STX 100 g^{-1}

Effects

Human illness
Shellfishing closures
Barrier to shellfish farming
Seafood marketing impacts
Effect on marine biota



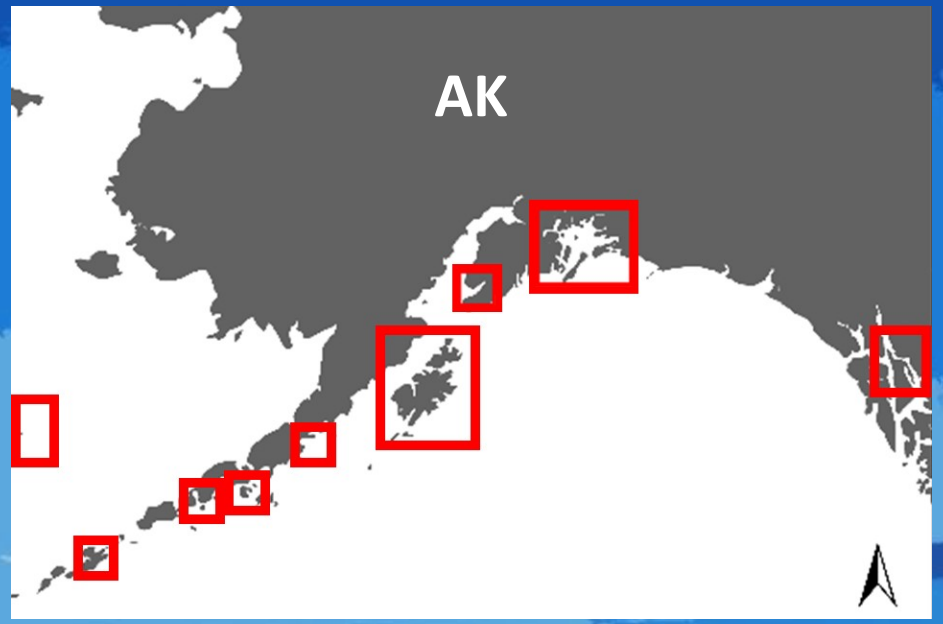
Ralonde, Trainer, Litaker, et al.

Algal toxins were detected in 13 species marine mammals from Southeast Alaska to the Arctic Ocean during 2004 to 2013

NPRB 1801 & Knik Tribe of Alaska

Objectives

- Develop STX screening and analysis capacity
- Characterize *Alexandrium* blooms & phytoplankton
- Zooplankton
- Forage fish
- Commercially important predatory fish
  - Organs & Muscle
- Invertebrates
  - Subsistence species
- Assess potential risks to:
  - Higher level consumers
  - Human health
  - Seafood industry



Collection & Analysis

Collection

Plankton	Surface samples, Net tows
Forage fishes	Beach seine, cast net, trawls, stomachs
Predatory Fishes	Sport catch, set net, fish processers
Other Invertebrates	Intertidal collection

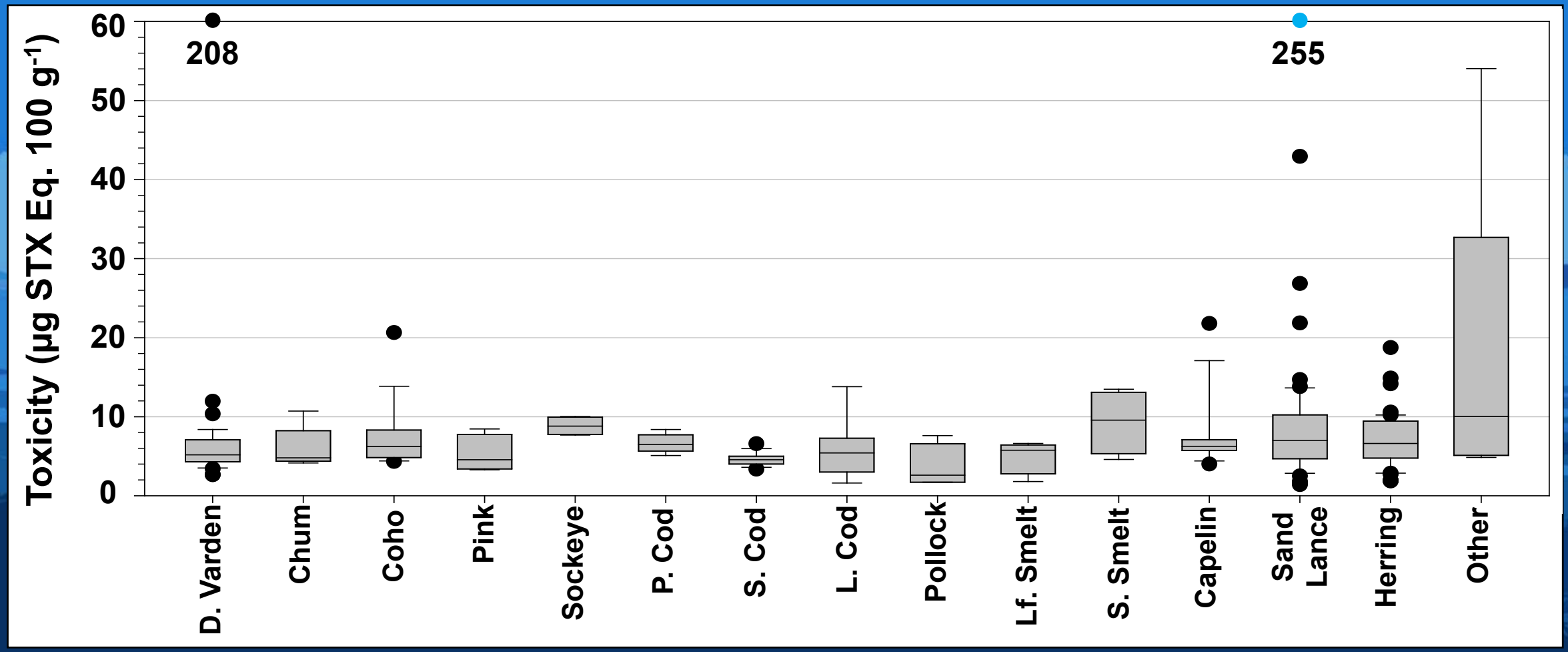
Analysis

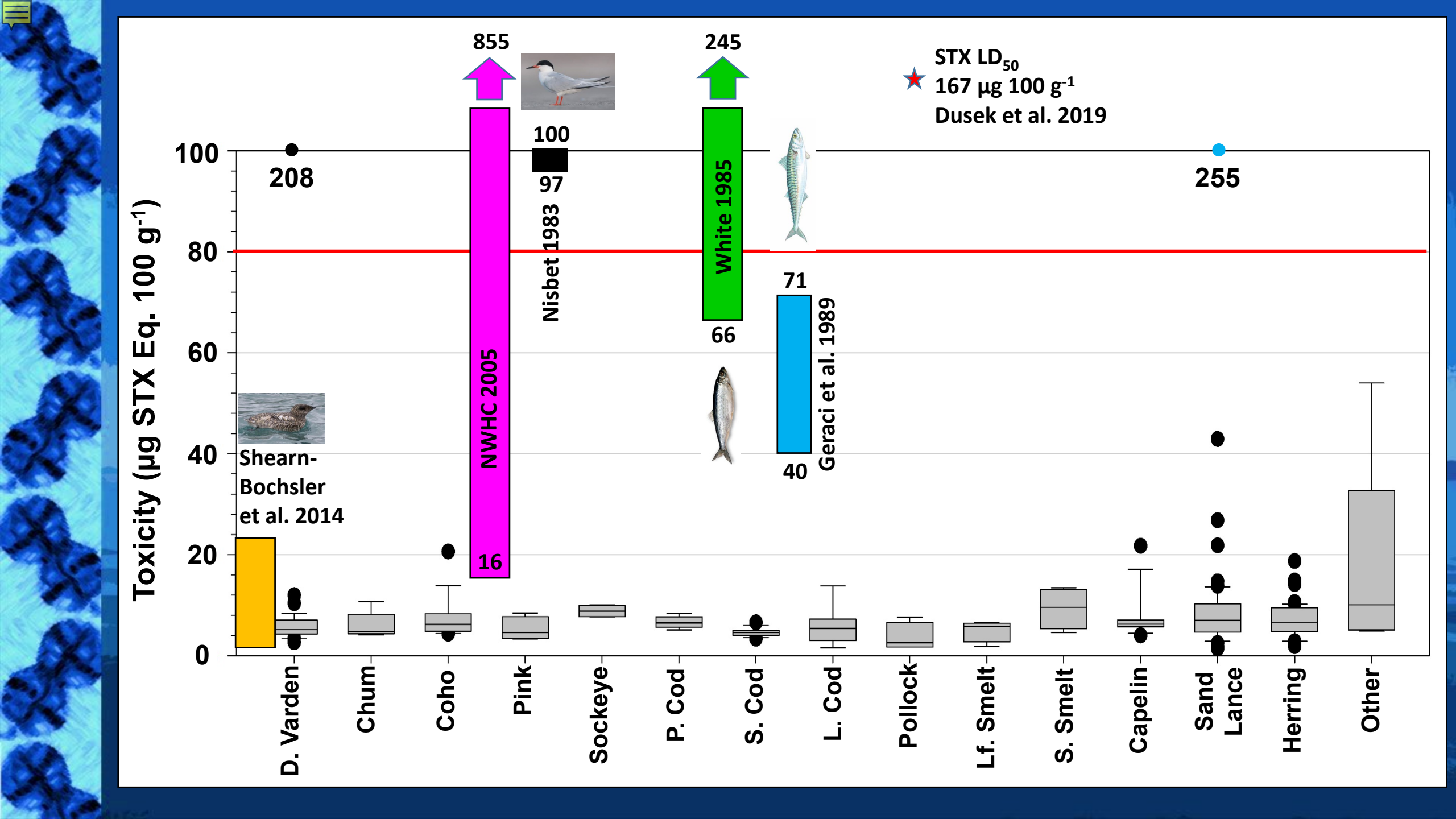
ELISA Screening	Threshold of 10 µg STX Eq. 100 g^{-1}
HPLC Follow-up	≥10 µg STX Eq. 100 g^{-1}

Forage Fish

249 Analyzed

<10 µg STX Eq. 100 g^{-1}	84.3%
10-20	12.9%
>20	2.8%



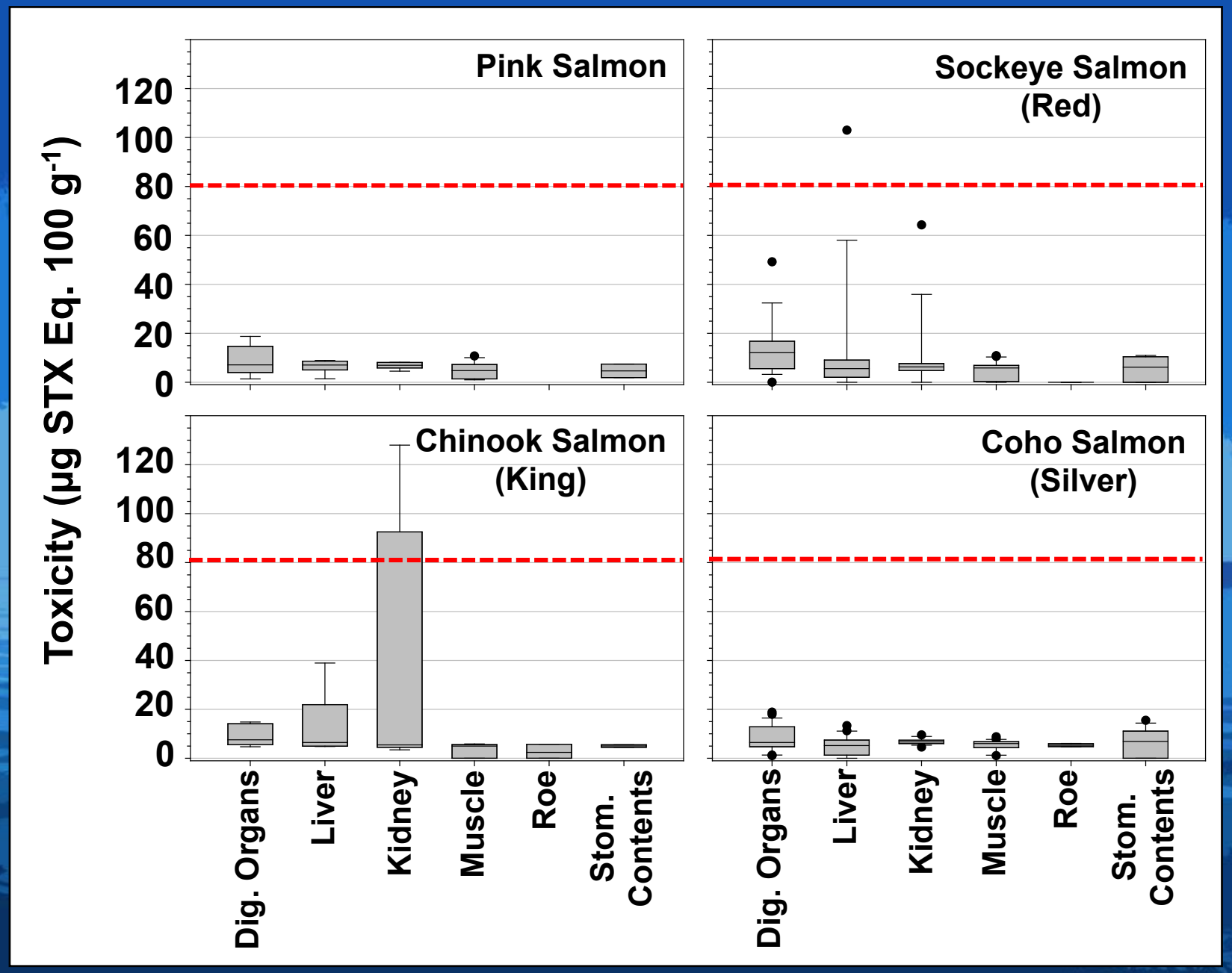

855
245
STX LD50
167 µg 100 g-1
Dusek et al. 2019
100
208
97
Nisbet 1983
255
White 1985
71
66
NWHC 2005
Geraci et al. 1989
40
16
Shearn-
Bochsler
et al. 2014
Toxicity (µg STX Eq. 100 g-1)
100
80
60
40
20
0
D. Varden
Chum
Coho
Pink
Sockeye
P. Cod
S. Cod
L. Cod
Pollock
Lf. Smelt
S. Smelt
Capelin
Sand
Lance
Herring
Other

Predatory Fish

Alaskan Salmon

73 Analyzed

- Digestive Organs
- Liver
- Kidney
- Muscle
- Roe
- Stomach contents



Summary

Overall

Toxins in plankton, juvenile and forage fishes, predatory fish
Highly variable in time & space
Widespread low level toxicity in fish
Commensurate with *Alexandrium* bloom intensity

Salmon

PSTs in digestive tract, excretory organs
Very low in muscle meat & gonads
- Very low human health risk
- Little economic threat to seafood industry
- Higher risks to predators

More Questions

During intense *Alexandrium* blooms?
What's worse? Higher toxin levels vs. Higher incidence
Upper limit to body burden?
Effect on fish?

Thank You

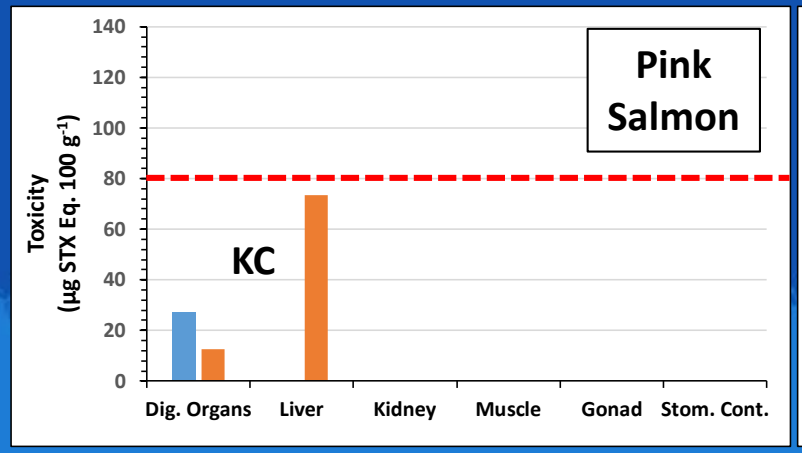
2019 data

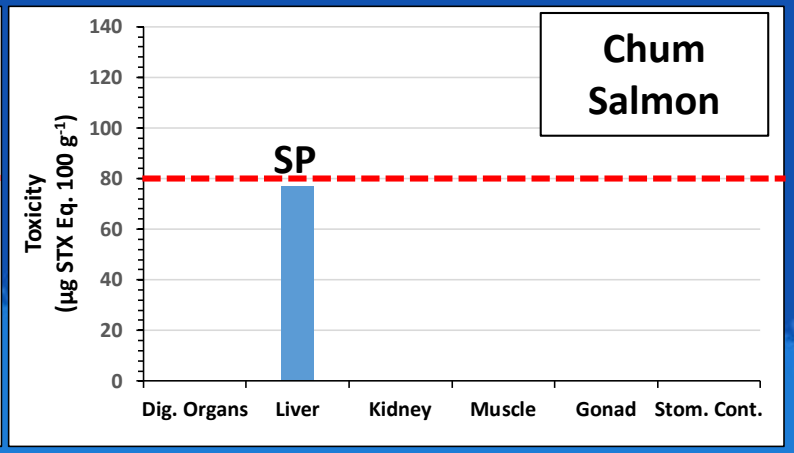
KC = King Cove

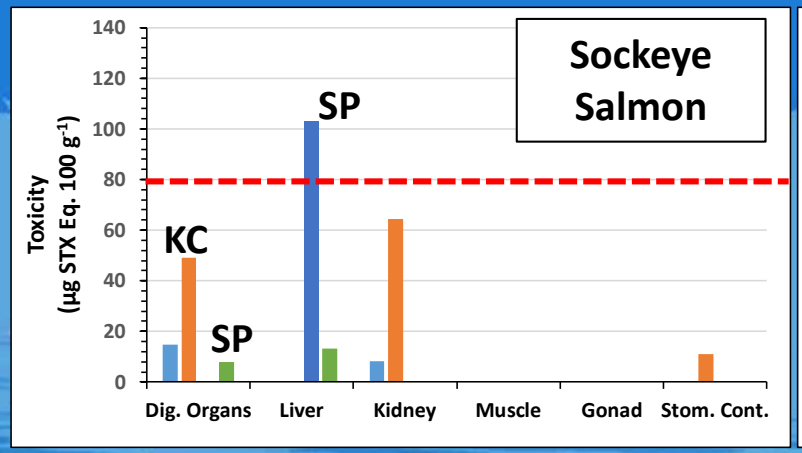
SP = Sand Point

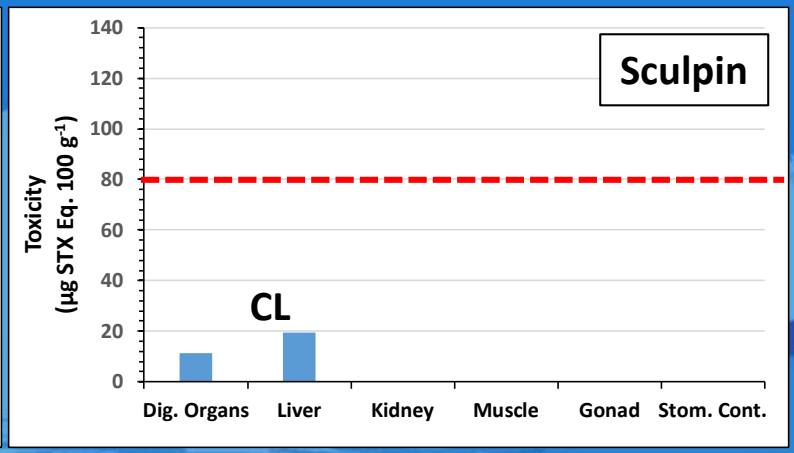
CL = Chignik Lagoon

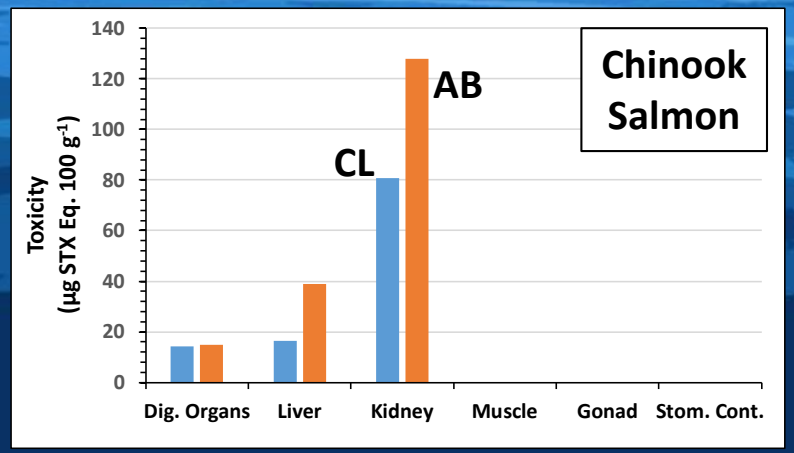
AB = Auke Bay











PSTs in Marine Food Webs

Phytoplankton grazers
- Small and large copepods
- Ciliates, rotifers, heterotrophic dinoflagellates
- Fish and invertebrate larvae

Trophic transfer of PSTs
- Crabs & sea stars
- Predacious zooplankton
- Zooplanktivorous fish
- Shrimp & other invertebrates
- Seabirds
- Marine mammals