



IDENTIFYING PRIORITY TOXIC HOTSPOTS: A TALE OF TIRES, SALMON AND ECOSYSTEM RECOVERY

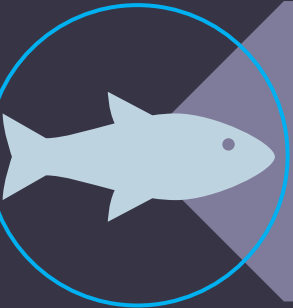
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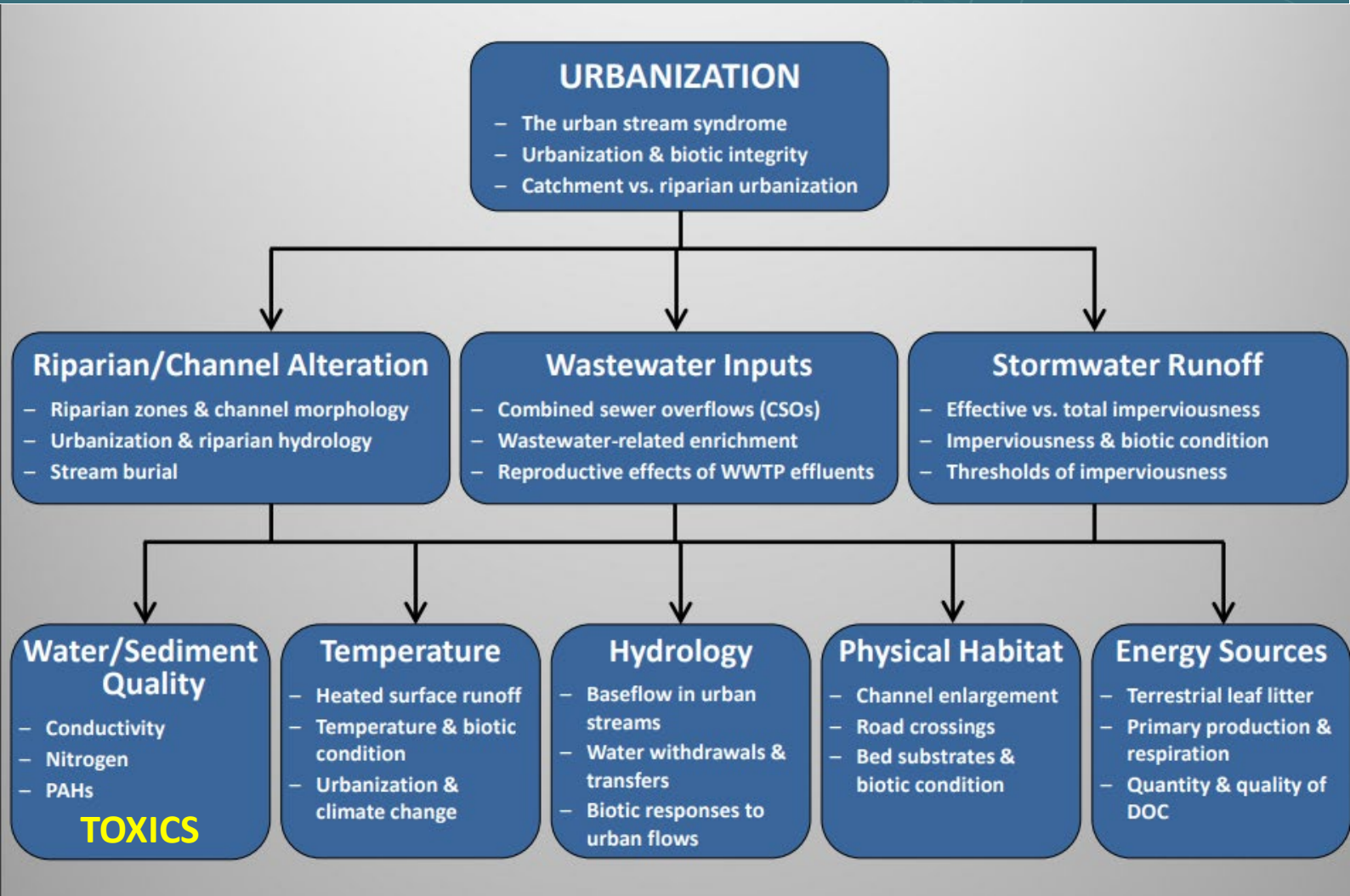


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CHAPTER 1: INTRODUCTION

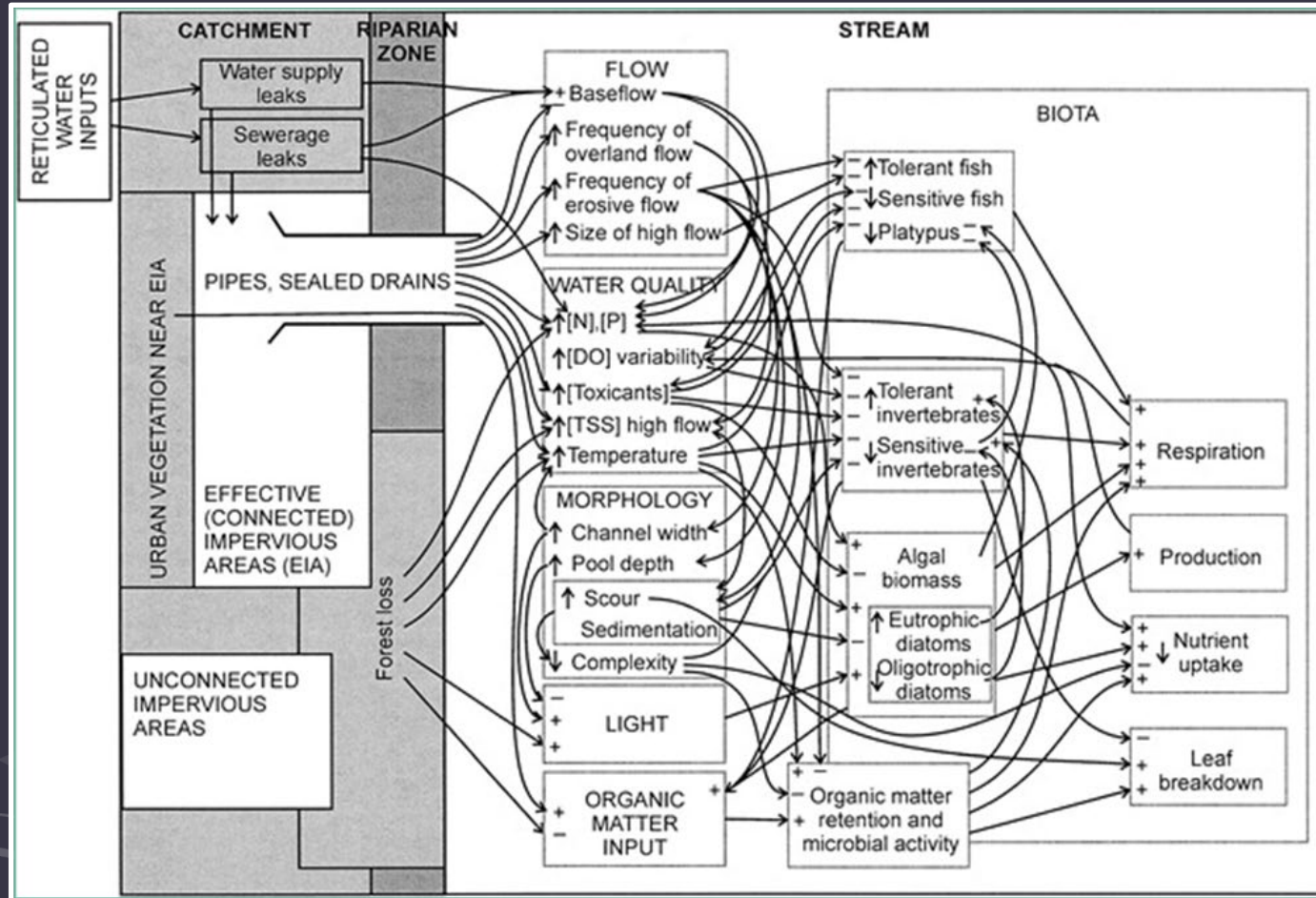


EPA 2017

Sobocinski et al. 2022
Image: Emily M. Eng, WWU.

CHAPTER 1: INTRODUCTION

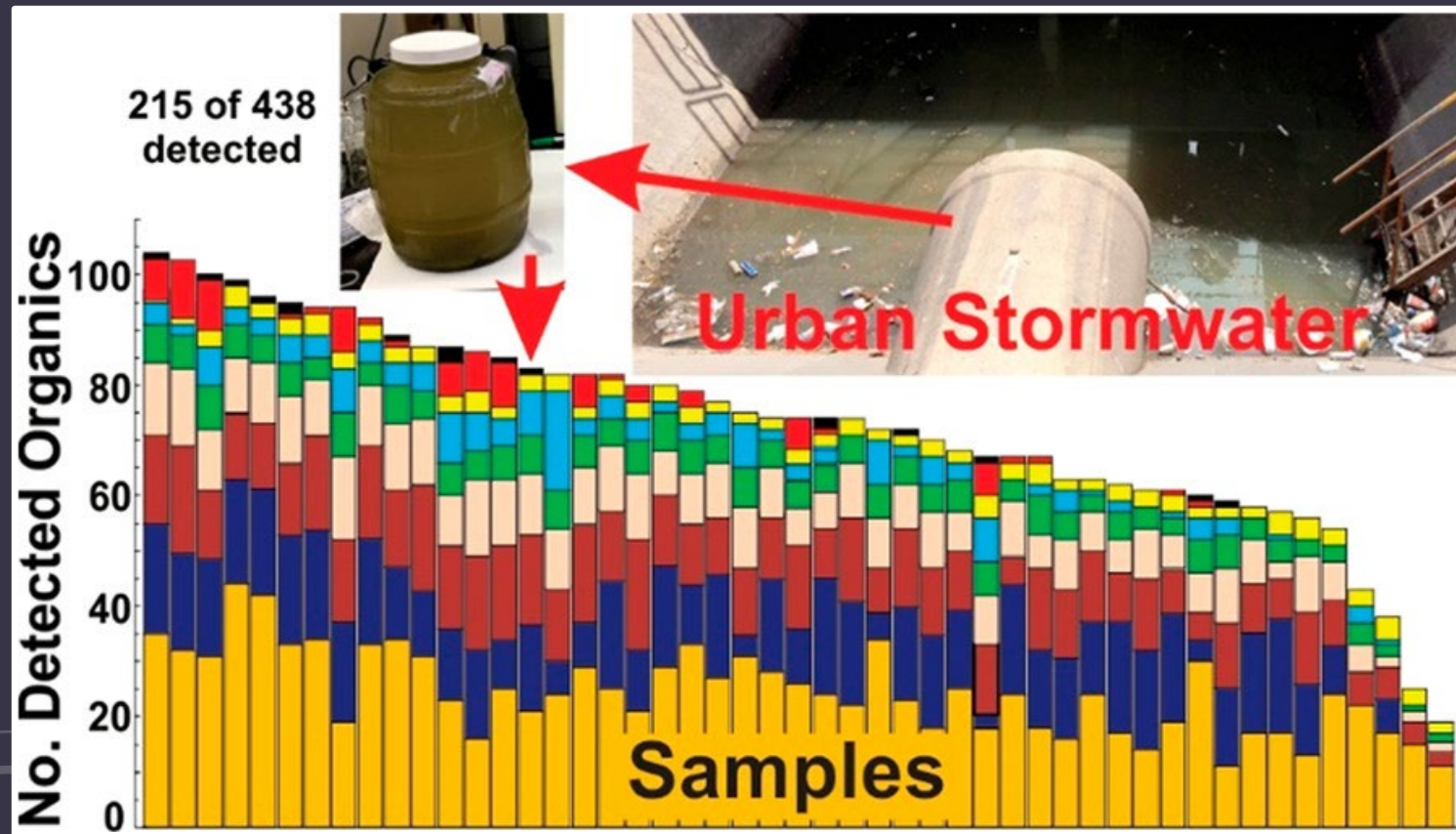
Cumulative impacts in watersheds = Urban stream syndrome



Multiple
Ecosystem stressors

CHAPTER 1: INTRODUCTION

Hundreds of contaminants of concern are released to aquatic ecosystems via urban runoff (James et al. 2023).



Multiple
contaminants

CHAPTER 1: INTRODUCTION



Impervious surfaces = deposition and accumulation of toxics



Urban runoff = transport of toxics to natural waterbodies



Reliance on motor vehicles = release of toxics



Consumer products = the source of toxics

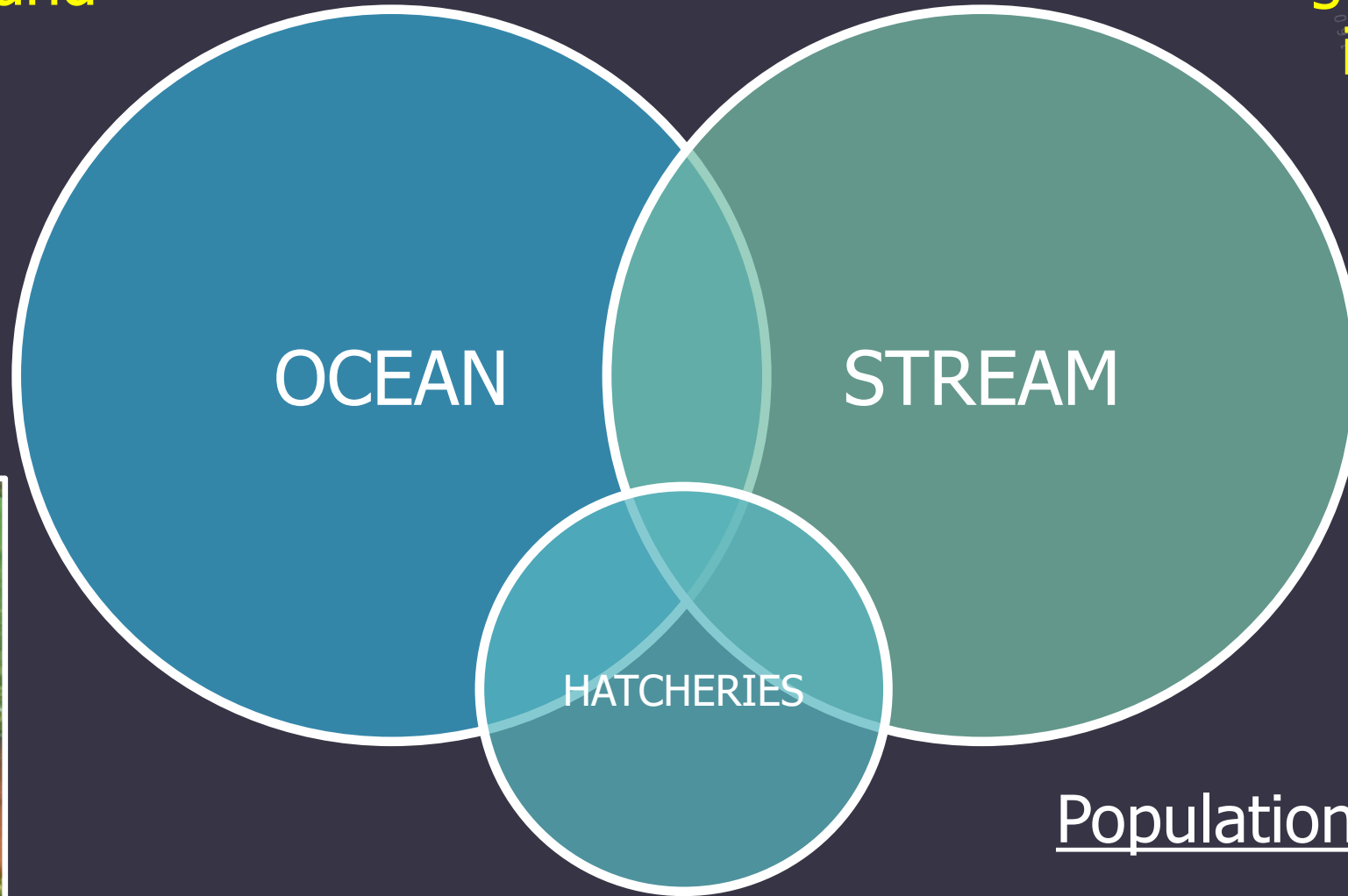
Multiple
management &
policies

We know on a sub-watershed scale where % impervious area is greatest, but higher resolution prioritizations would help

CHAPTER 1: INTRODUCTION

Refuge from land impacts

Refuge from ocean impacts



Coho salmon trend modeling shows greater correlations with precipitation
Sobocinski et al. 2021

Population Reservoirs



CHAPTER 2: SALMON & TIRES

Coho Salmon Pre-spawn Mortality* Syndrome



Photo: Clear Creek coho
(courtesy of Wild Fish Conservancy, 2021)

- 1980 — Re-occurring pre-spawn mortality
- 1990 — Correlated with urban runoff
- 2000 — Pre-spawn mortality surveys begin
- 2011 — PSM correlated with roads and tires
- 2016 — Biofiltration prevents mortality
- 2020 — Discovery of 6PPD-quinone

*Now referred to as **Urban Runoff Mortality Syndrome (URMS)**

CHAPTER 2: SALMON & TIRES

6PPD and 6PPD-quinone

- **6PPD** is a chemical in tires that prevents the rubber from cracking
- **6PPD** transforms into **6PPD-quinone (6PPDQ)** when exposed to ozone
- Both are emitted from tires and in tire wear particles that are deposited and transported to land and water.
- **6PPDQ** is acutely toxic to coho salmon

With 6PPD



Without 6PPD

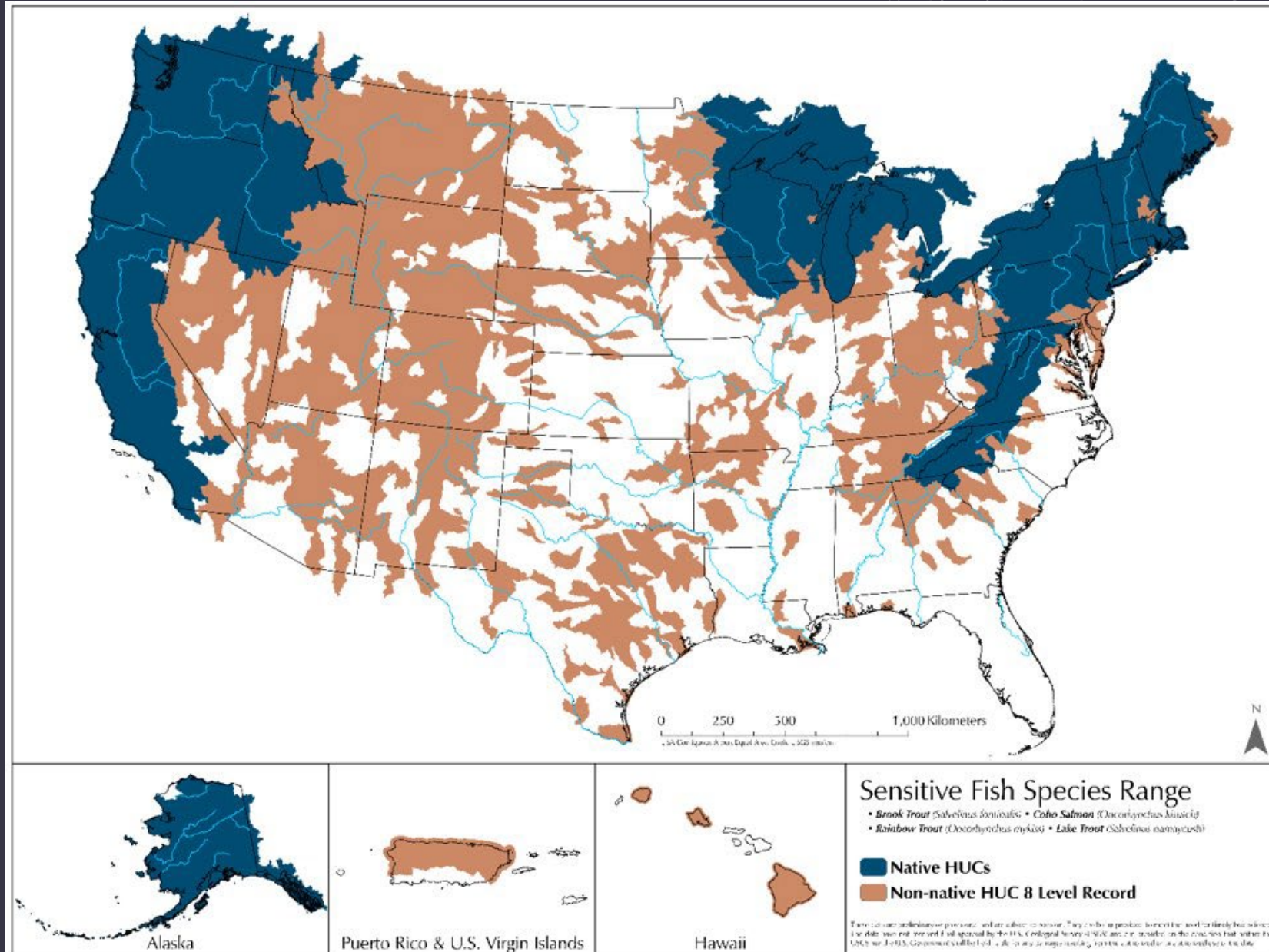


Photo: U.S. Tires Manufacturer's Association

CHAPTER 2: SALMON & TRES

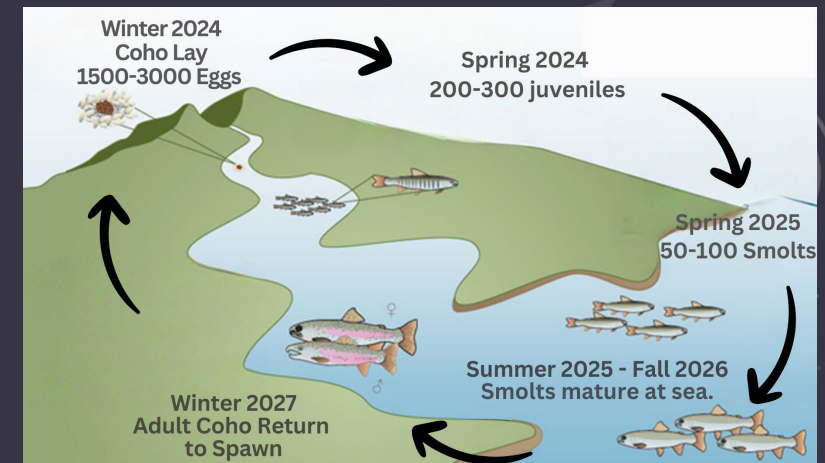
6PPDQ is toxic
to other fish:

Brook trout
Lake trout
Rainbow trout
Steelhead
Coastal cutthroat trout



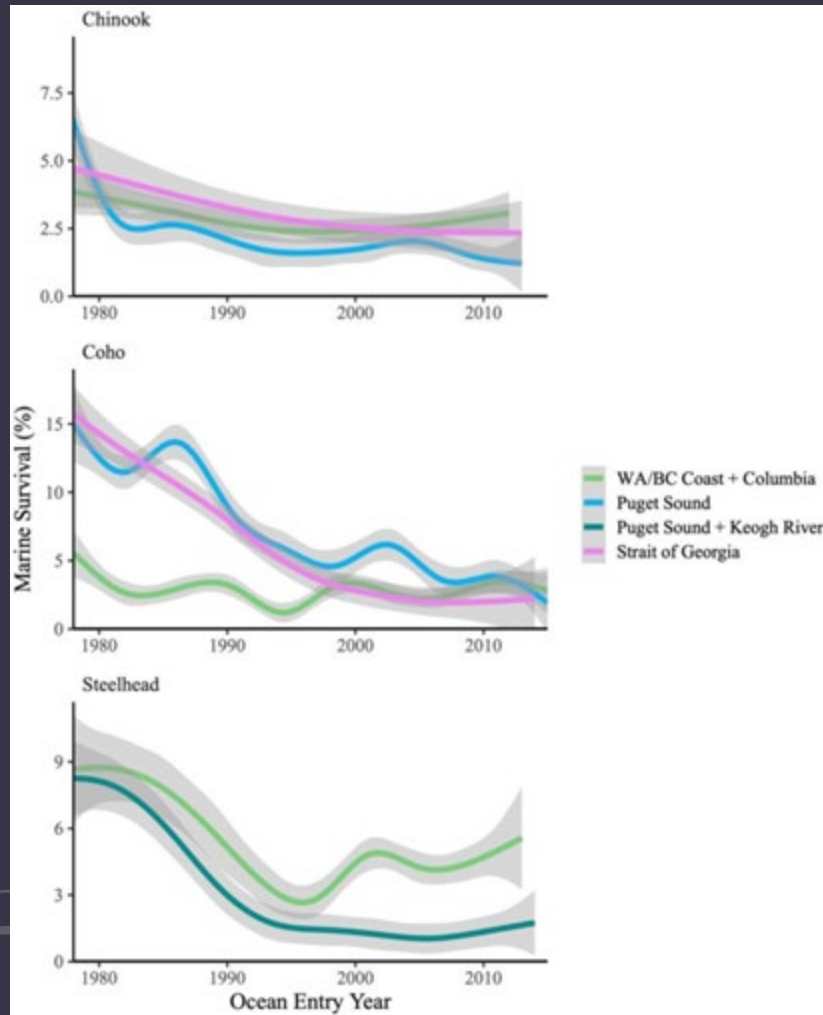
CHAPTER 2: SALMON AND TIRES

- When and where are coho salmon exposed to 6PPD?

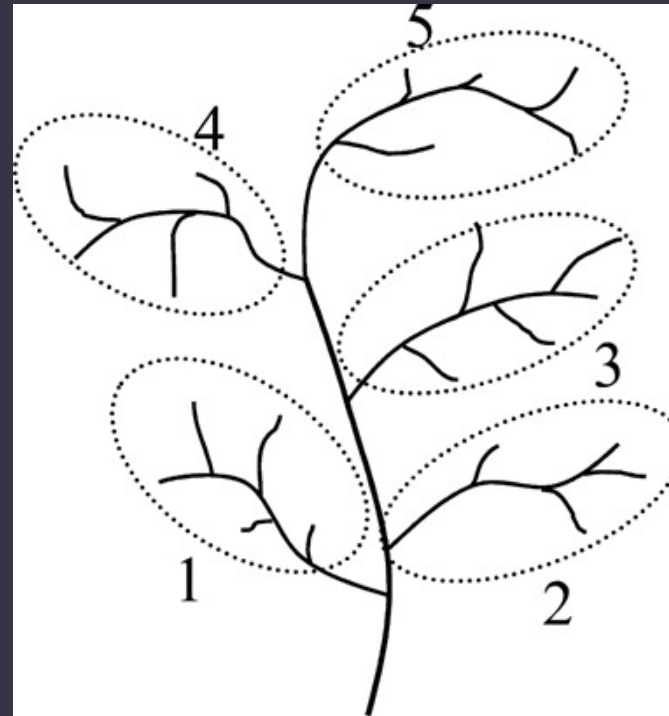


CHAPTER 2: SALMON & TIRES

Declining Salmon Stocks

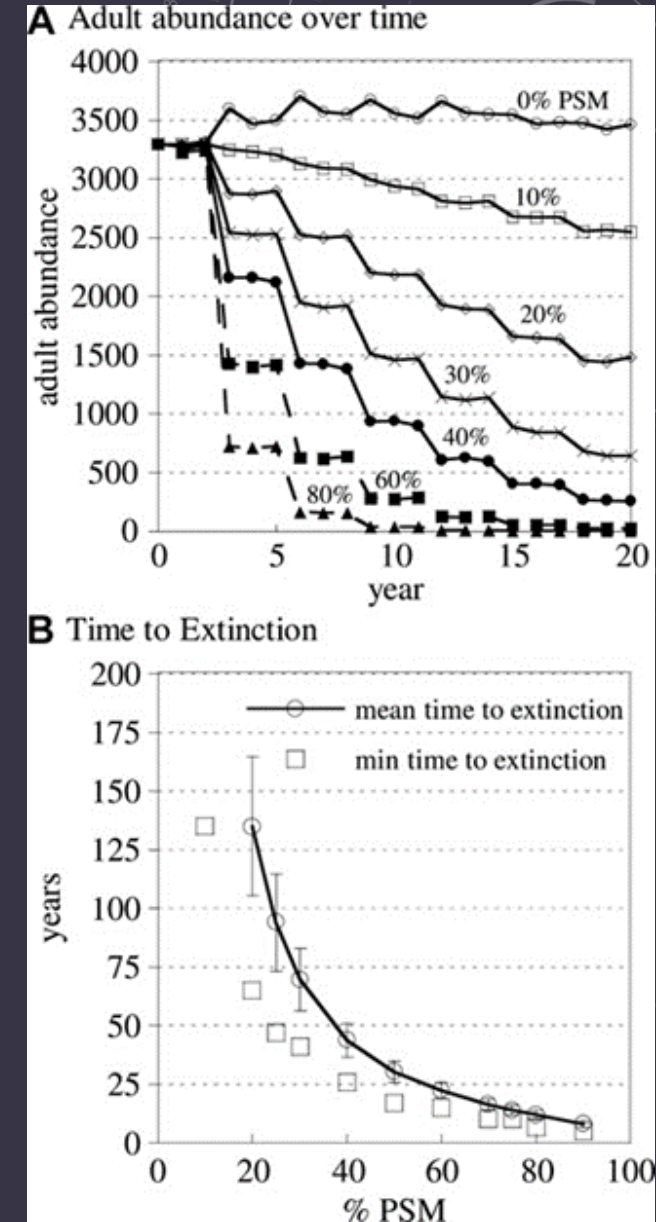


Pearsall et al. 2021; Sobocinski et al. 2022



Wild coho extinction estimates using metapopulation modeling approach

Spromberg & Scholz 2011

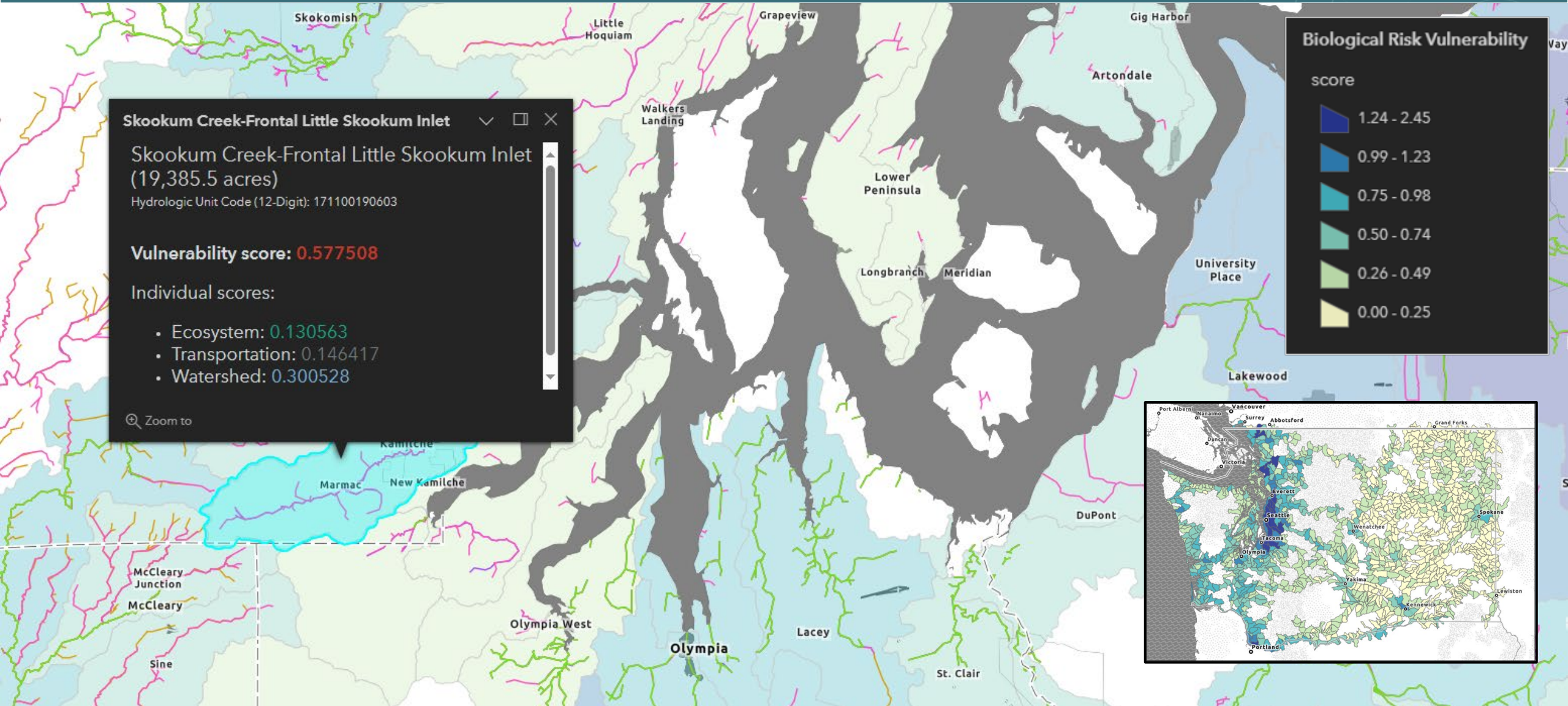


CHAPTER 2: SALMON AND TIRES

- 6PPDQ may help us identify high priority areas for water quality improvement projects.
- Both physical AND chemical habitat conditions need to be restored, while avoiding **ecological traps**.



CHAPTER 3: ASSESSMENT STRATEGIES



CHAPTER 3: ASSESSMENT STRATEGIES

- Passive sampling is a great tool for initial screening assessments and source identification



Iris Kemp, King County

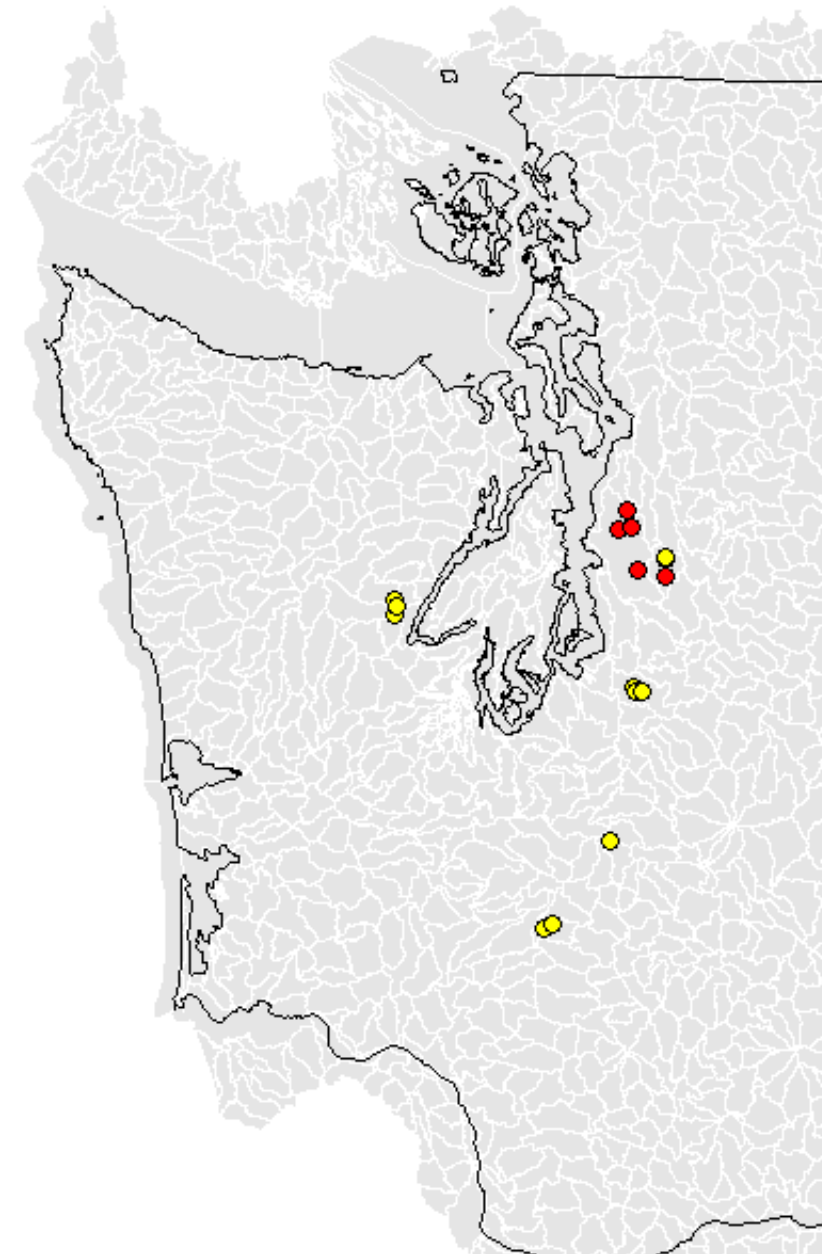
CHAPTER 3: ASSESSMENT STRATEGIES

PASSIVE SAMPLING RESULTS

- 6PPDQ was only detected in the high urban, high traffic lakes



- Detect
- Non-detect



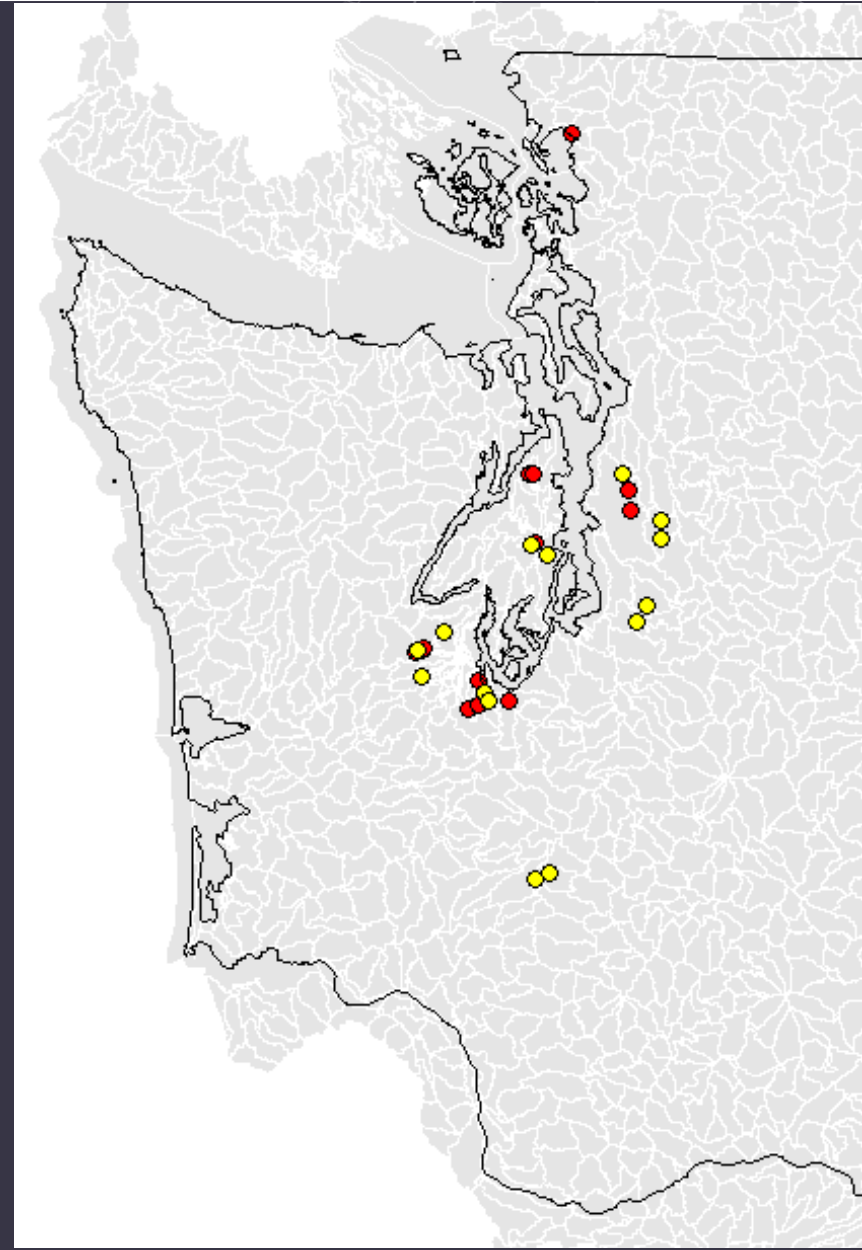
CHAPTER 3: ASSESSMENT STRATEGIES

AUTOSAMPLING AND GRAB RESULTS

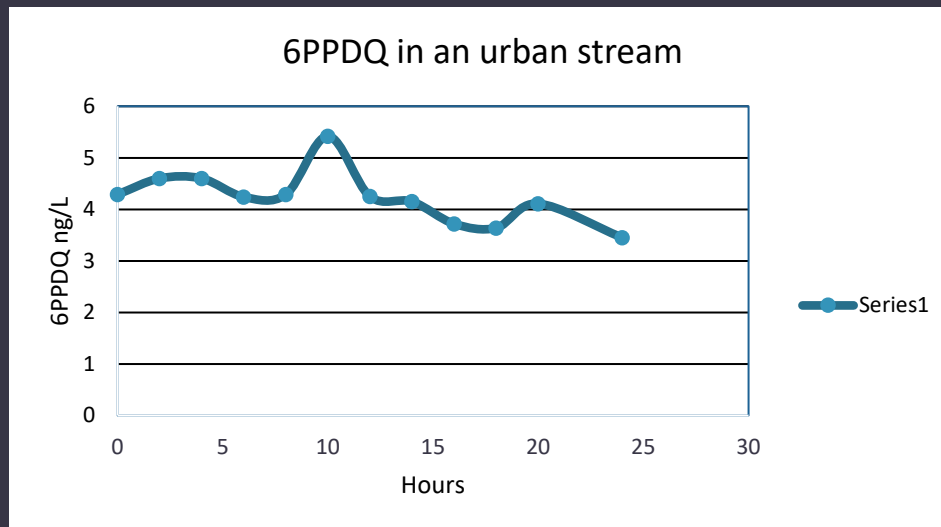
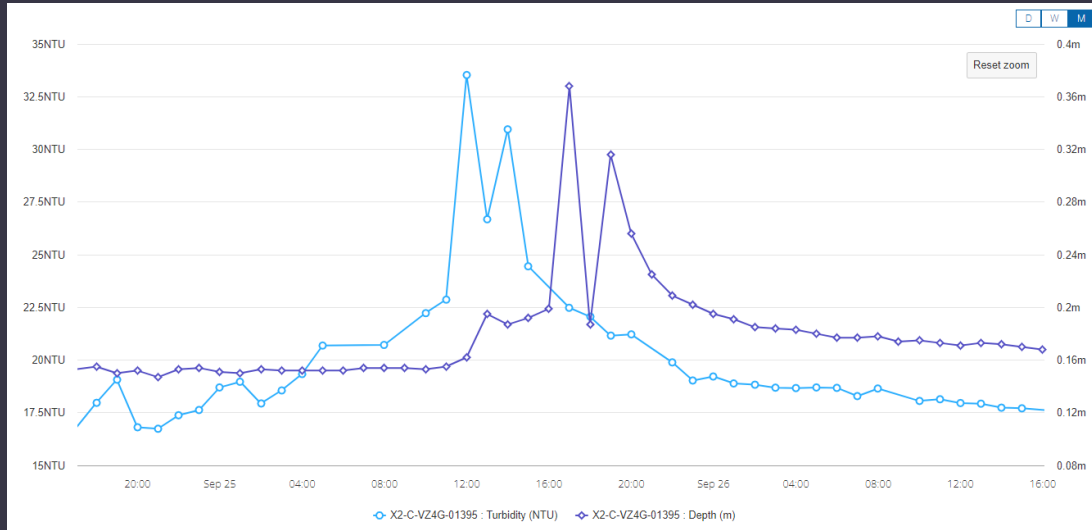


● Detect

● Non-detect



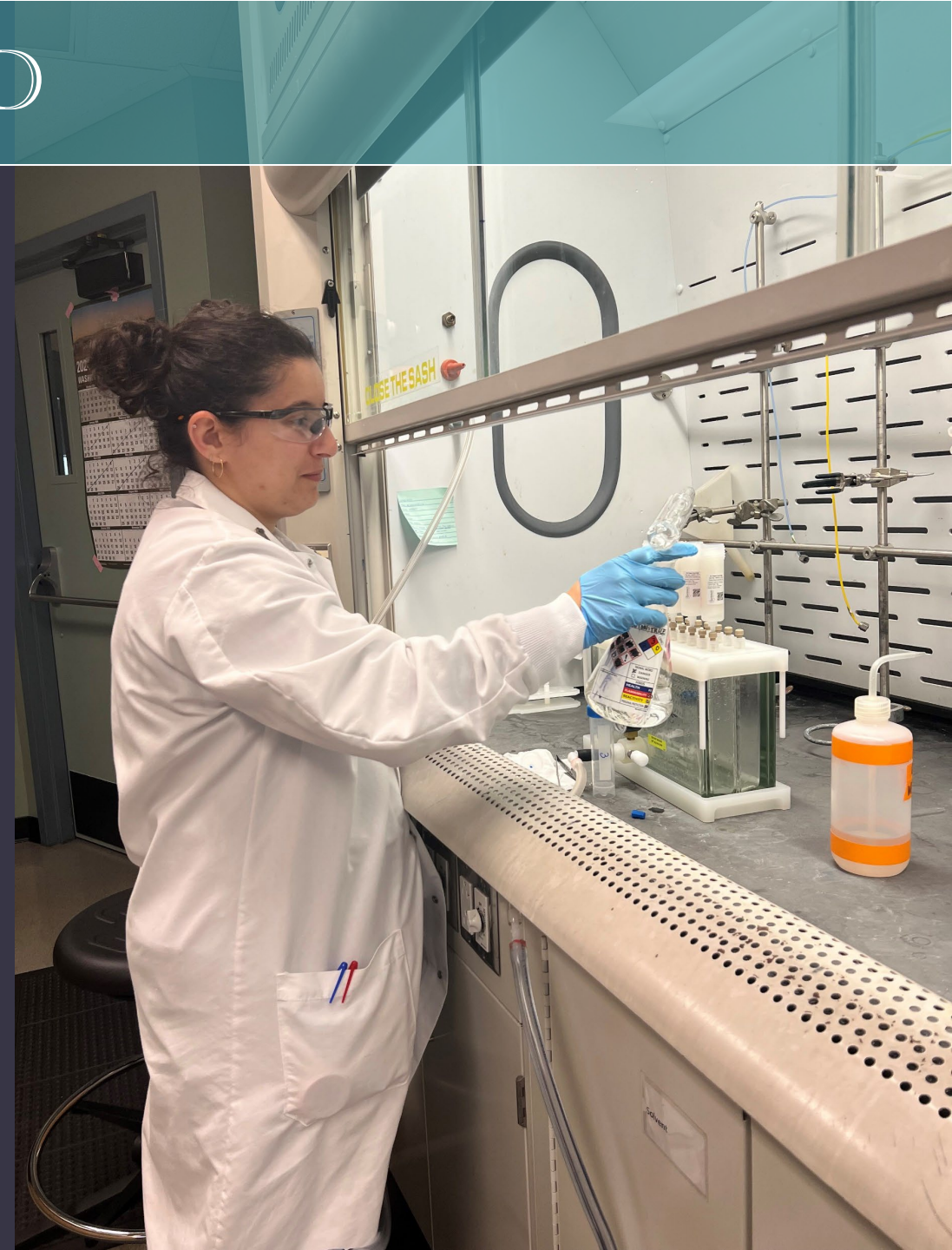
CHAPTER 3: ASSESSMENT STRATEGIES



THE END

WE HAVE MORE TO LEARN

- Assess hazards of other PPD chemicals
- Results of a tire recycling study
- Toxicity research on tire anti-ozonants
- Effectiveness of stormwater management
- Aquatic ecosystems impacts
- Fate and transport field and lab studies
- Human exposure and health impacts



QUESTIONS



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