



WASHINGTON STATE UNIVERSITY
EXTENSION

CANARY IN THE CREEKBED: WHAT COHO SALMON ARE TELLING US ABOUT THE URBAN STREAM CRISIS

Presented by Nathan Ivy
MARCH 26, 2025





ABOUT ME



- **WSU Graduate Student**
- **Passion for Salmonids**
- **Protecting Future Generations**
- **Purpose-Driven Science**
- **Collaborative Action**



RESEARCH PARTNERS & SUPPORTERS



WASHINGTON STATE
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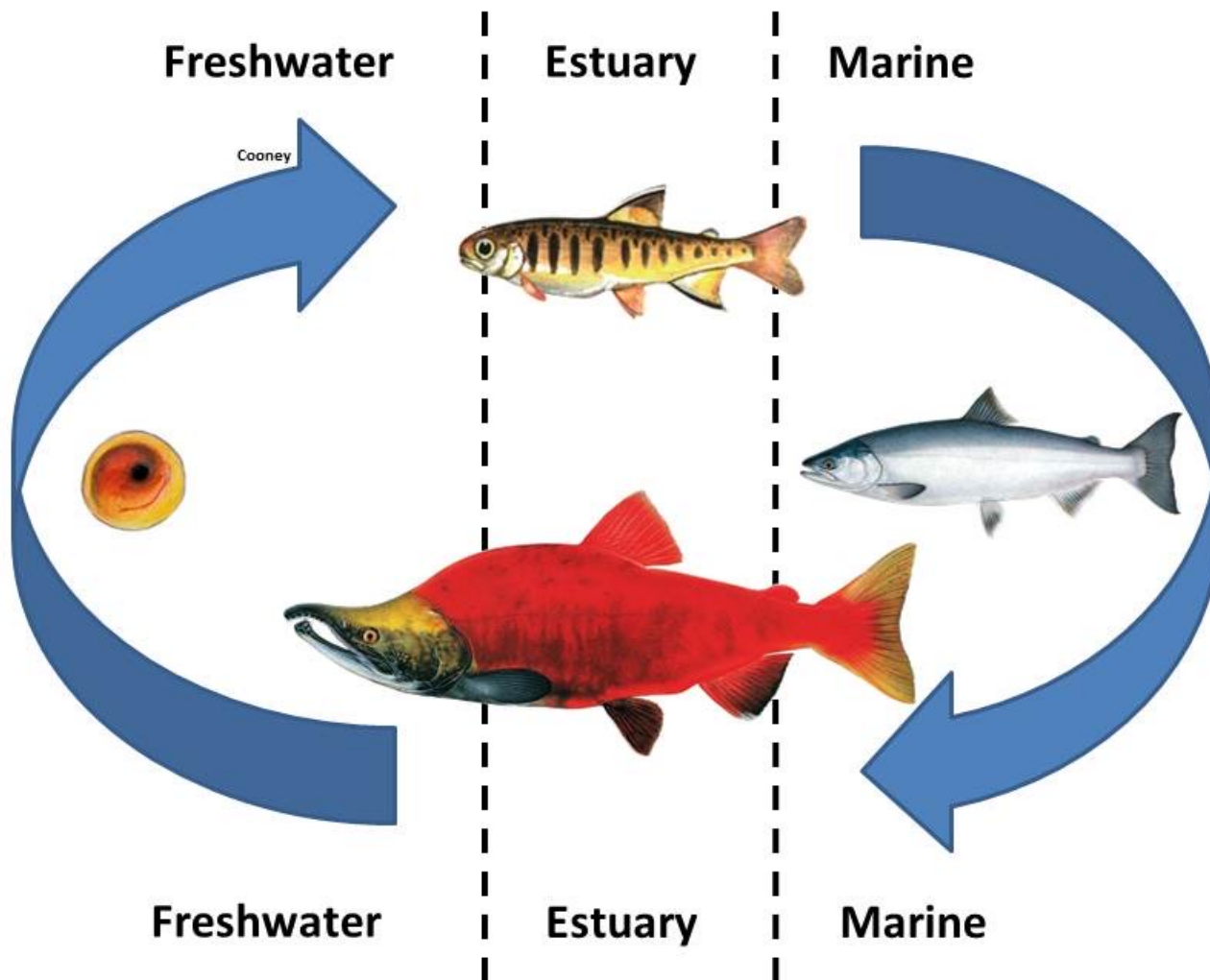


STORMWATER





Anadromous Life Cycle





SALMONIDS: KEYSTONE SPECIES OF THE SALISH SEA

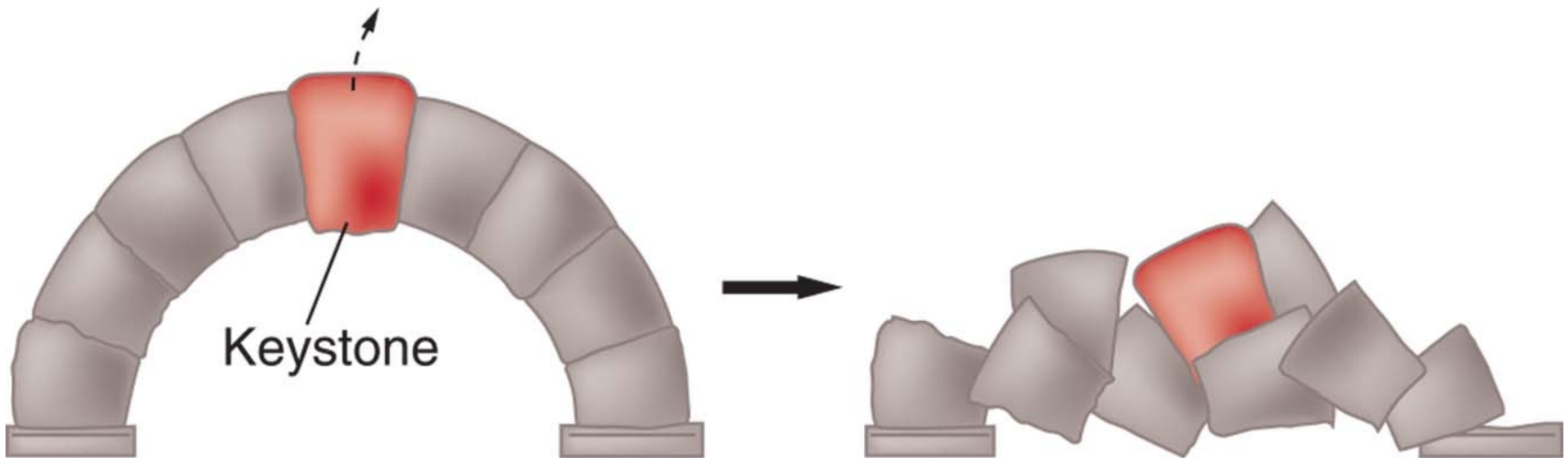


Figure 20.9

Friedland, *Environmental Science for AP*®, 2e, © 2015 W.H. Freeman and Company

- Keystone species stabilize ecosystems by supporting nutrient cycles and food webs.
- Salmonids connect marine, freshwater, and terrestrial systems through nutrient transfer.
- Declines in salmonid populations signal broader ecological instability.



SENTINELS: CANARY IN THE COAL MINE



©2010 Luke Massman-Johnson



COHO SALMON: CANARY IN THE CREEK BED

- Wide Distribution
- Lowland Habitat
- >1 Year in Freshwater
- Food Web Dependent
- Water Sensitivity
- ESA-Listed





Urb Runoff Mortality Syndrome (URMS)





Urb Runoff Mortality Syndrome (URMS)





PRESPAWN MORTALITY OF COHO SALMON



Widespread
&
Recurrent



High rates of
pre-spawn
mortality in
urban creeks
(60-90%)

Scholz et al. 2011. PLoS ONE



THE CULPRIT: TIRE WEAR PARTICLES & 6PPDQ

- Particles come off every time we brake, accelerate, or corner.
- 6PPD-quinone: a tire-derived chemical.
- Lethal to coho salmon at trace amounts

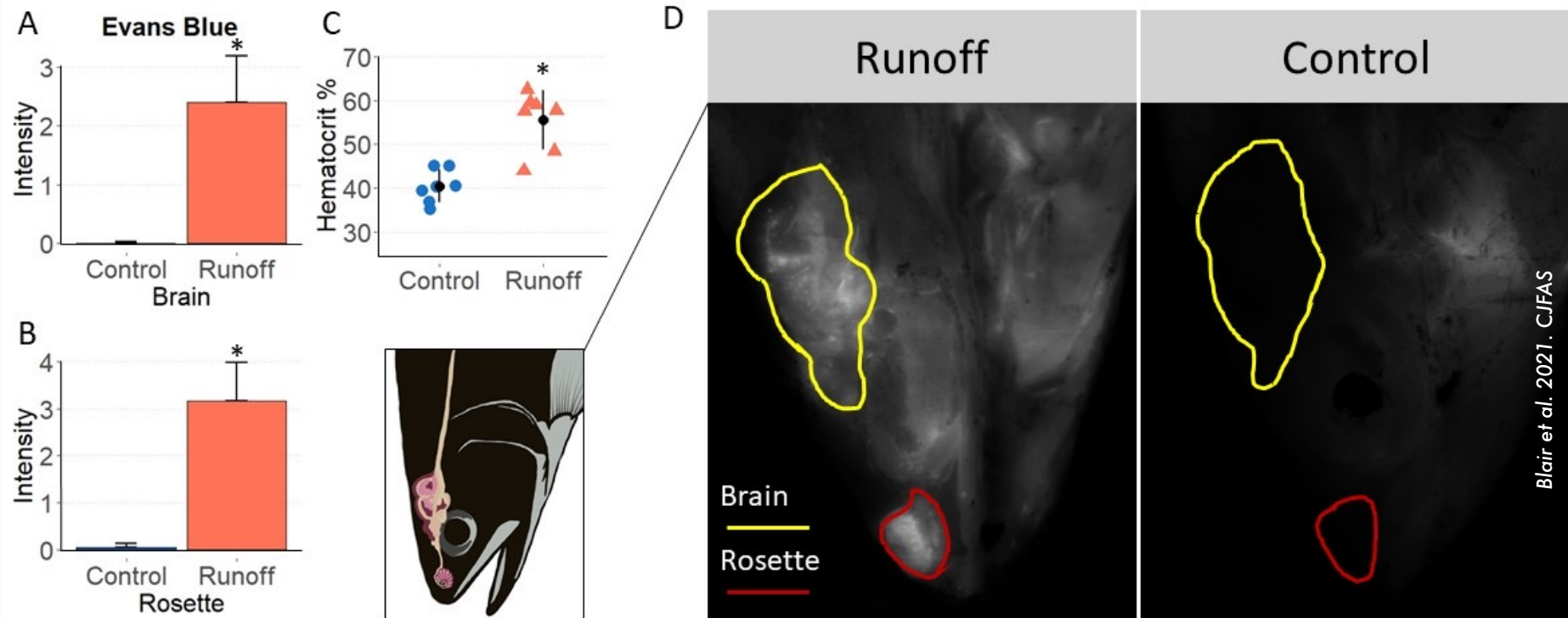




URBAN RUNOFF AND THE BLOOD BRAIN BARRIER



Negonne Blair
Ph.D. student





ADULTS IN FRESHWATER

2 WEEKS – 2 MONTHS

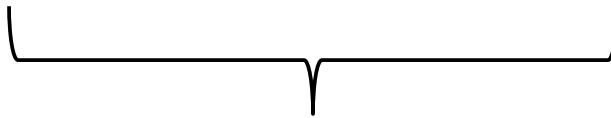


61-76 cm
(24-30 inches)



JUVENILES IN FRESHWATER

UP TO 18 MONTHS



6 - 8cm
(2-3 inches)



JUVENILE STUDY MILLER CREEK

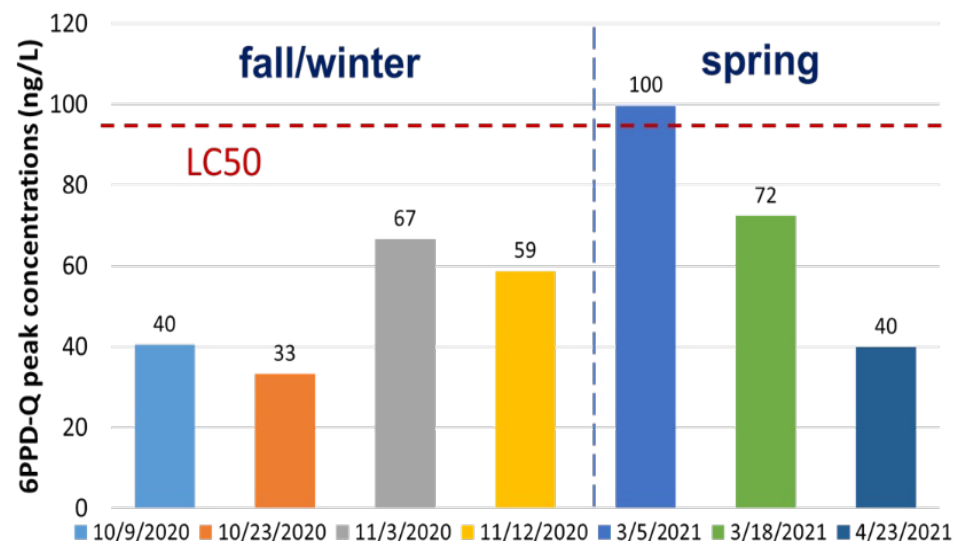
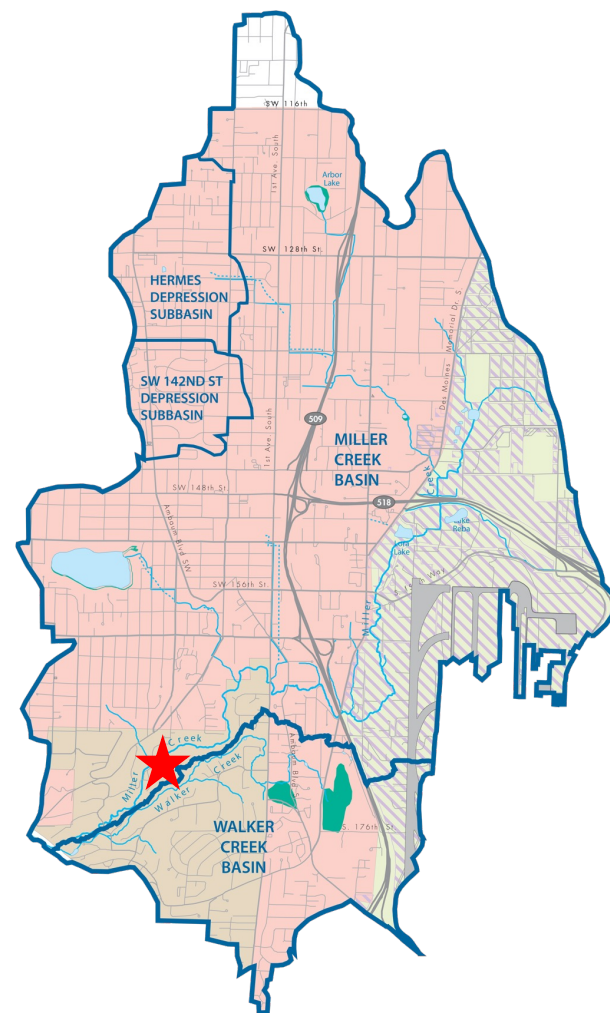


Figure 1: Observed concentrations of 6PPD-quinone in Miller creek during fall and spring storms over the 2020-2021. We note although that traffic was lighter during this period due to covid, higher concentrations are expected for “typical” traffic and even with covid impact, concentrations exceeded LC_{50} values during spring storms. (Kolodziej unpublished data)

A bar chart showing 6PPD-Q peak concentrations (ng/L) for various dates. The y-axis ranges from 0 to 120 ng/L. A dashed red line indicates the LC50 at approximately 95 ng/L. The chart is divided into two seasons: fall/winter (left) and spring (right) by a vertical dashed blue line. The data points are as follows:

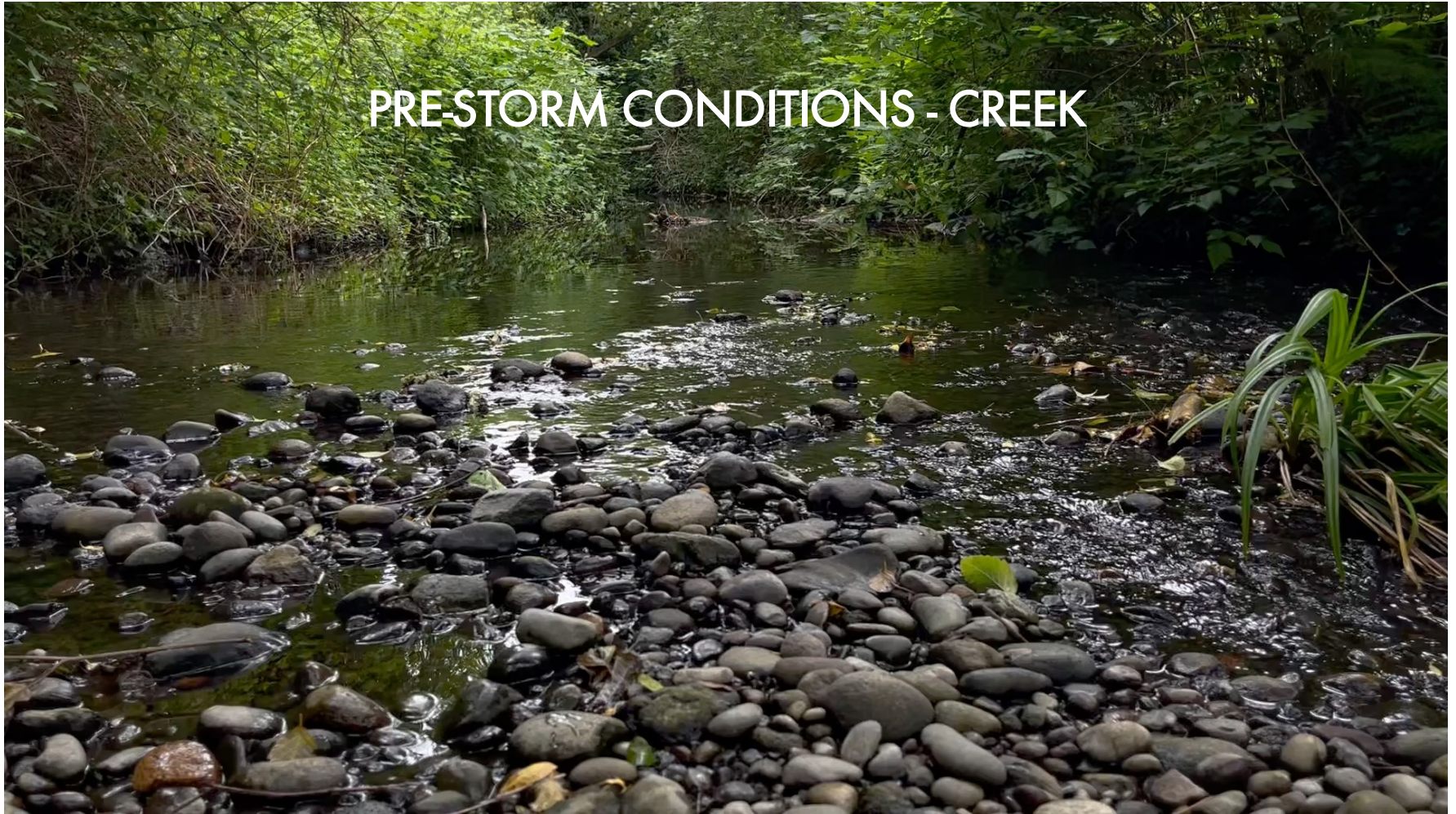
Date	Season	6PPD-Q peak concentration (ng/L)
10/9/2020	Fall/Winter	40
10/23/2020	Fall/Winter	33
11/3/2020	Fall/Winter	67
11/12/2020	Fall/Winter	59
3/5/2021	Spring	100
3/18/2021	Spring	72
4/23/2021	Spring	40

Figure 1: Observed concentrations of 6PPD-quinone in Miller creek during fall and spring storms over the 2020-2021. We note although that traffic was lighter during this period due to covid, higher concentrations are expected for “typical” traffic and even with covid impact, concentrations exceeded LC₅₀ values during spring storms. (Kolodziej unpublished data)





PRE-STORM CONDITIONS - CREEK





PRE-STORM CONDITIONS - LAB

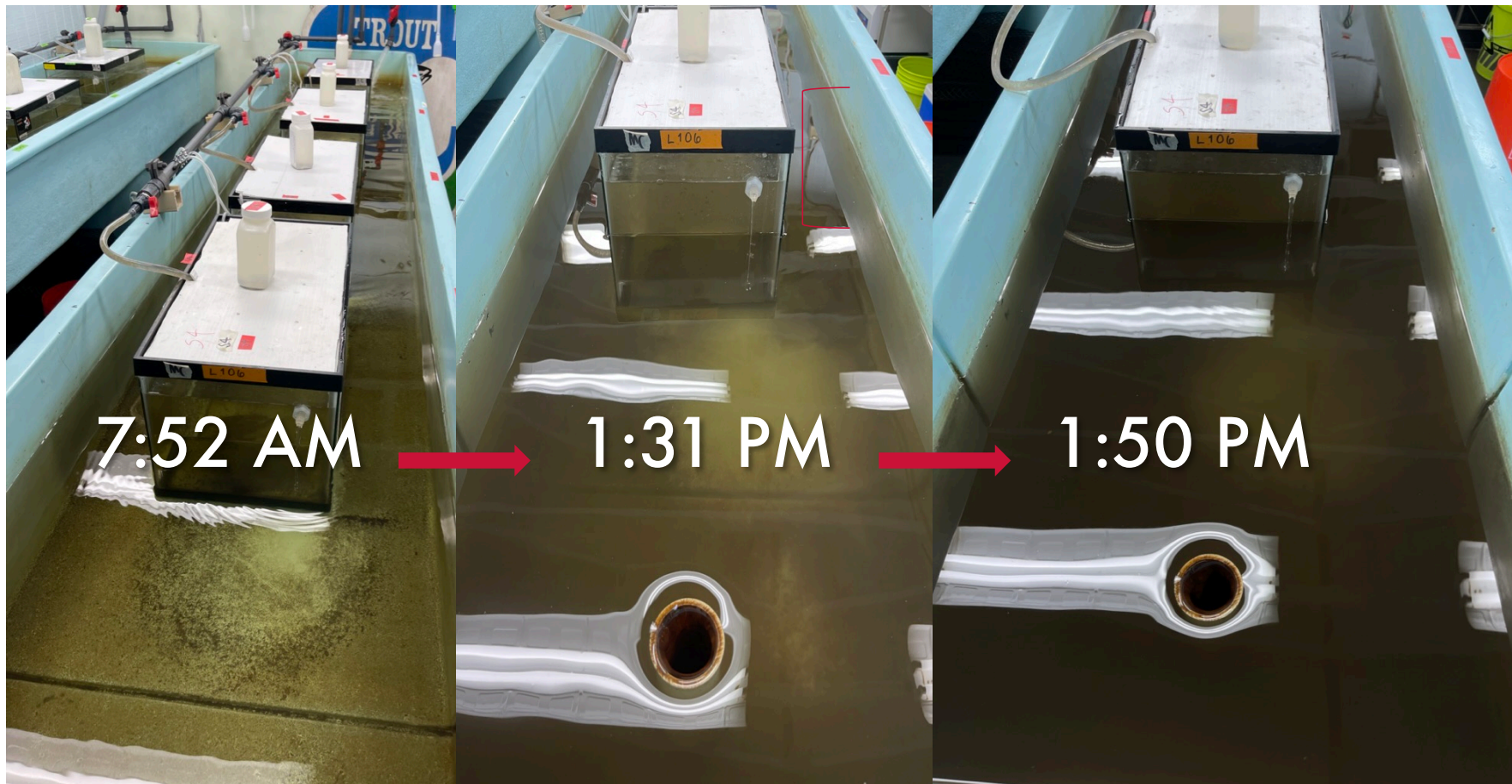




INTERMEDIATE STORM CONDITIONS









URBAN RUNOFF MORTALITY SYNDROME (URMS)

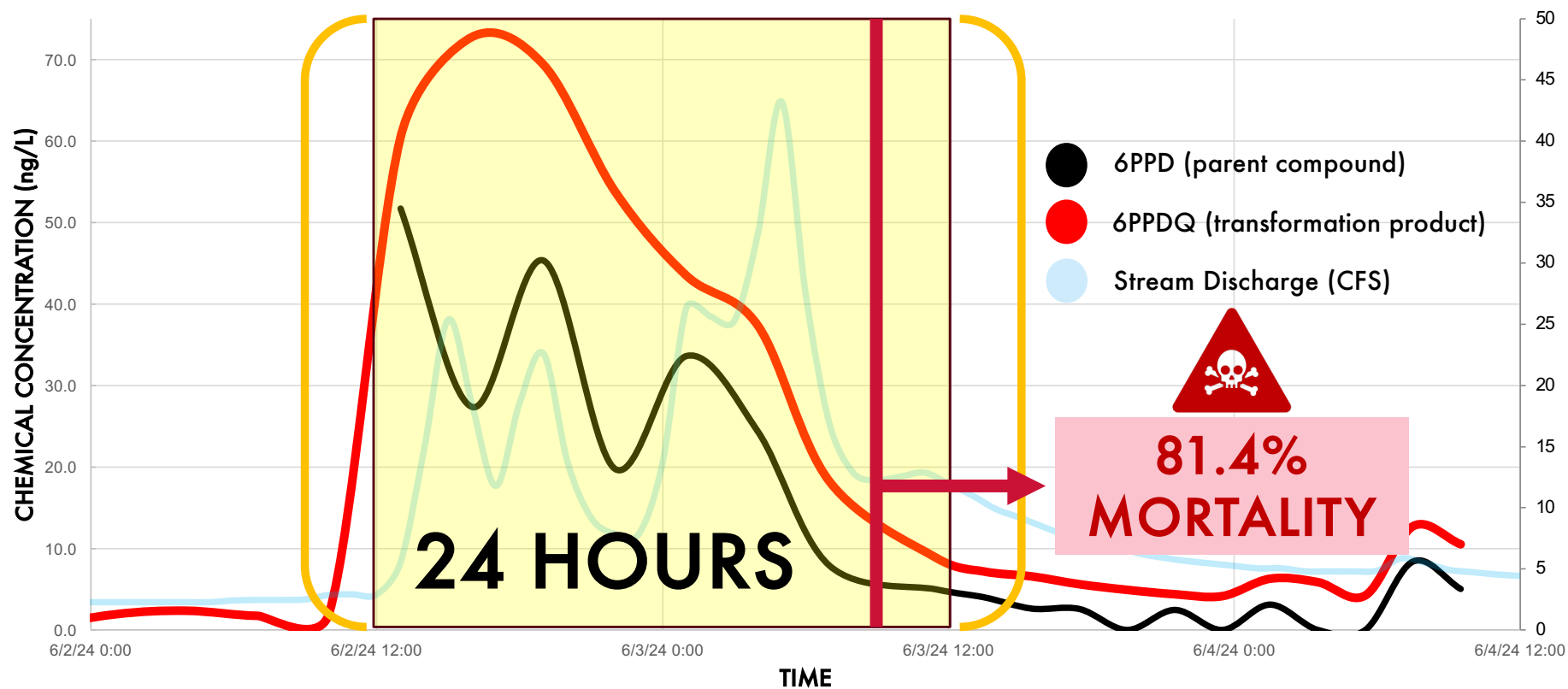
SYMPTOMS:

- SPIRALING
- GAPING
- ERRATIC SWIMMING
- LOSS OF EQUILIBRIUM

STORM 1 DATA:		STORM 2 DATA:		STORM 3 DATA:		ALL STORM DATA:	
Stream Mortality	79.2%	Stream Mortality	79.8%	Stream Mortality	81.4%	Averaged Mortality Across All Storms	80.1%



6PPD & 6PPDQ STORM 3





ADULT & JUVENILE MORTALITY WHEN EXPOSED TO STORMWATER



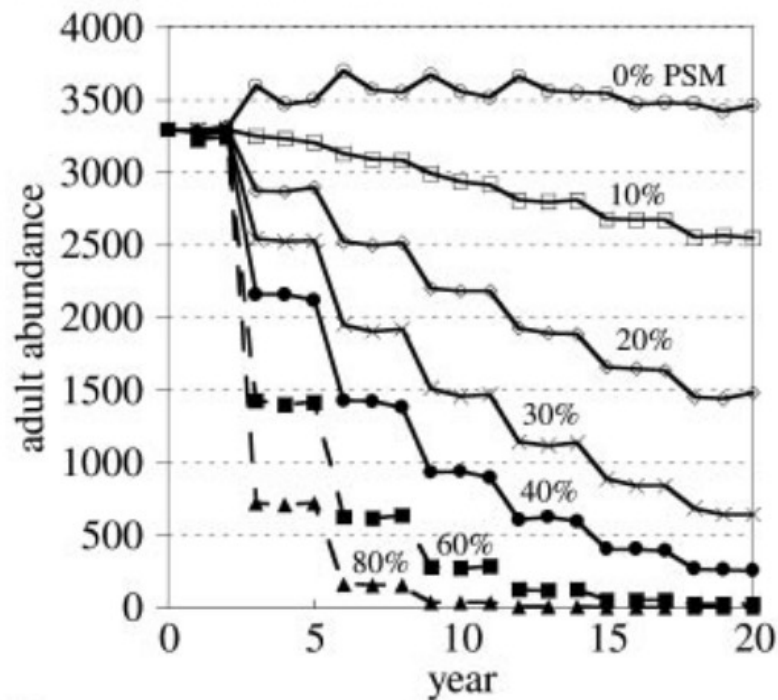
NEAR TOTAL MORTALITY



80% MORTALITY



STATUS QUO: EXTIRPATION OF COHO?



(Spromberg & Scholz, 2011)

- PSM Weakens Populations
- Juvenile Mortality Adds Pressure
- Urbanization Intensifies Risks
- The Result?



URBANIZATION'S ROLE IN RISING POLLUTION & ECOLOGICAL IMPACTS



- **Toxic Runoff:** 6PPDQ, metals, & microplastics flood streams.
- **Fragmented Habitats:** Roads & development block salmon movement
- **Runoff Loops:** Repeated exposure worsens URMS & ecosystem stress.



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ONGOING RESEARCH



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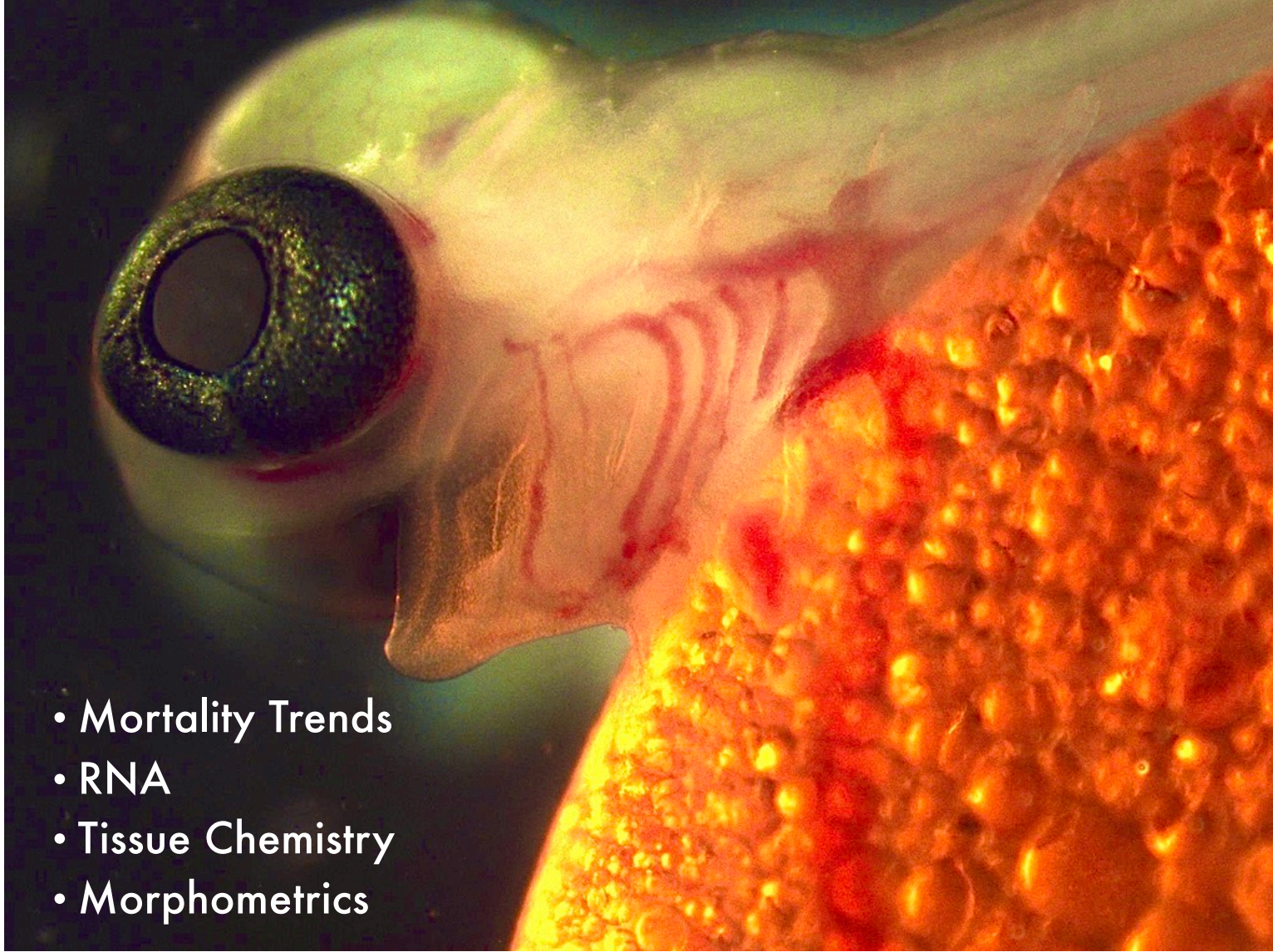
EMBRYOS & ALEVIN





EMBRYOS & ALEVIN

- Mortality Trends
- RNA
- Tissue Chemistry
- Morphometrics





URMS in Alevin

- 18% mortality during first post-hatch storm
- URMS behavior confirmed at alevin stage
- Lower mortality in later storms → possible adaptation?



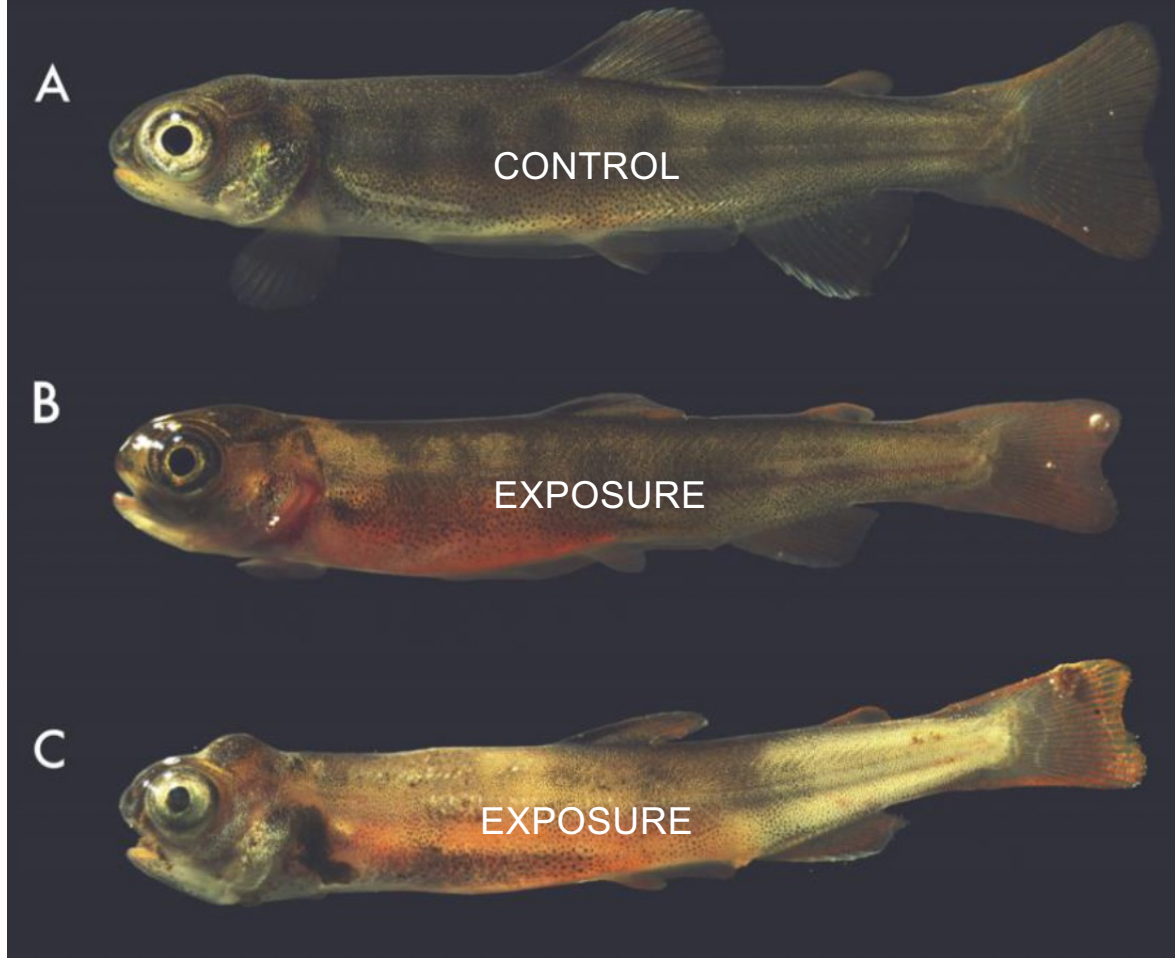
URMS in Fry

Fry: Post Yolk Stage First Storm Mortality = 5.7%





FRY





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