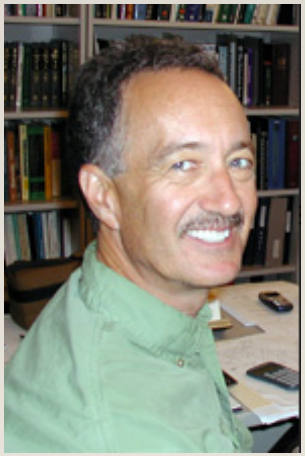
University of Washington
Superfund Research Program

Effects-Related Biomarkers of Environmental Neurotoxic Exposures

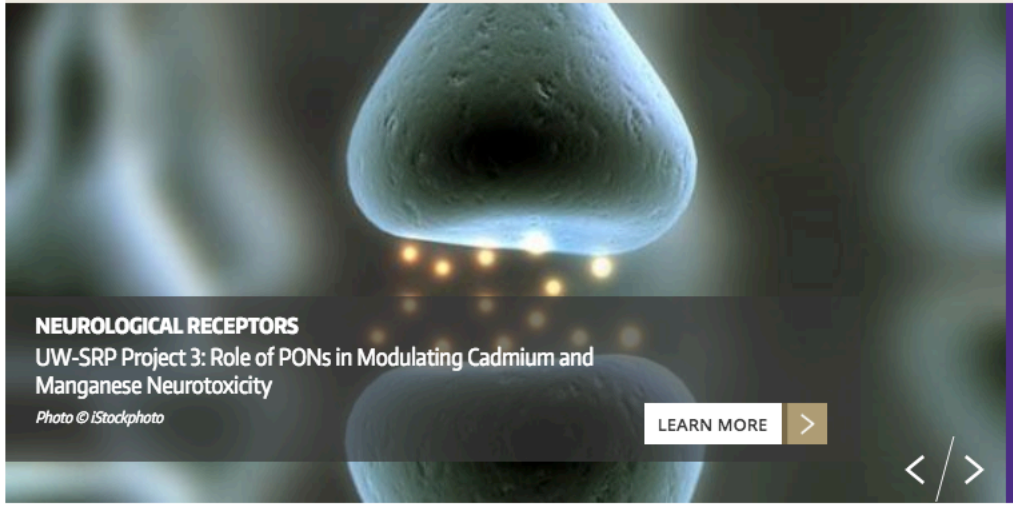


PI, Evan P. Gallagher

Co-PI, *Zhengui* Xia

Department of Environmental and Occupational Health Sciences
School of Public Health

SUPERFUND RESEARCH PROGRAM



NEUROLOGICAL RECEPTORS

UW-SRP Project 3: Role of PONs in Modulating Cadmium and Manganese Neurotoxicity

Photo © iStockphoto

LEARN MORE

Investigating the neurotoxic effects of metals commonly found at Superfund hazardous waste sites on human and ecological health.

OVERVIEW

The University of Washington Superfund Research Program is an interdisciplinary program that conducts and communicates research on the impacts of metal neurotoxicity on human and ecological health. Our research focuses upon metals that commonly occur at Superfund hazardous waste sites for which there are important data gaps impeding the full understanding of their neurotoxic effects on human and ecological health. The physiological processes we study include adverse effects on cognition, olfaction and neurobehavioral processes, and are associated with the risk of developing Alzheimer's and non-Alzheimer's related dementia, Parkinson's disease, and other neurodevelopmental diseases.

> READ MORE

LATEST NEWS

Gallagher Lab discusses loss of olfaction in fish on King 5 News
August 16, 2018

UW SRP hosts BRANCH and SURE-EH students for campus visit
July 20, 2018

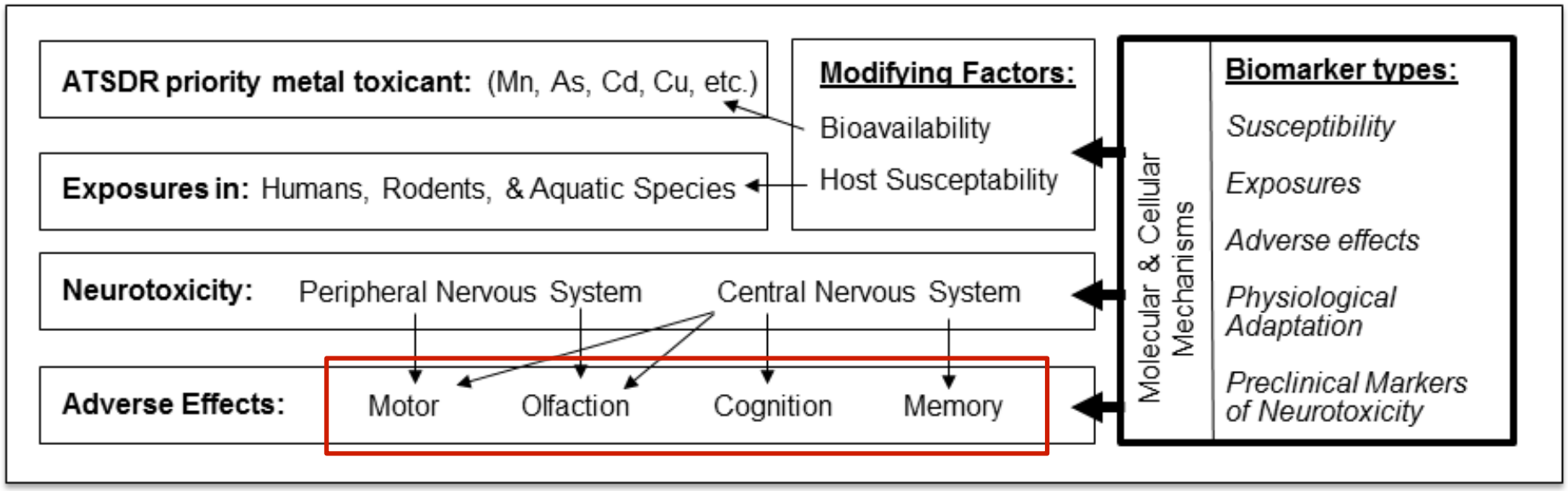
Dr. Xia presents to leading Alzheimer's researchers on the role of gene-environment interations on cognitive impairment in mice
June 6, 2018

Cadmium found to impair cognition and olfaction in mice
May 23, 2018

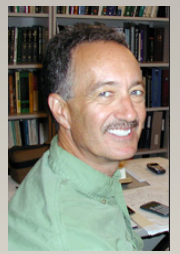
UW SPR hosts the 14th Summit of the Northwest Toxic Communities Coalition
May 8, 2018

> ALL NEWS

Conceptual model : UW Superfund research program



Our Research Projects



Mechanisms and Biomarkers of
Metal Olfactory Injury in Salmon

PI, Evan Gallagher, PhD. (collaborators, Zia, Storm)

Cellular and Molecular Mechanisms of
Cadmium Neurotoxicity

PI, Zhengui Xia, PhD. (collaborators Gallagher, Storm)

Role of Paraoxonases in Modulating
Cadmium and Manganese Neurotoxicity

PI, Clement Furlong, PhD. Co-PI-Lucio Costa

Arsenic in Shallow, Un-stratified and Seasonally Stratified Urban Lakes: Mobility, Bioaccumulation and Ecological Toxicity *PI, Rebecca Neumann, PhD.*
(collaborators Gawel, Olden, Horner-Devine, Gallagher)

UW SRP Support Cores

Functional Genomics

and Bioinformatics Core

Director, Theo Bammler, Ph.D.

Research Translation and

Community Engagement Cores

Director, Tom Burbacher

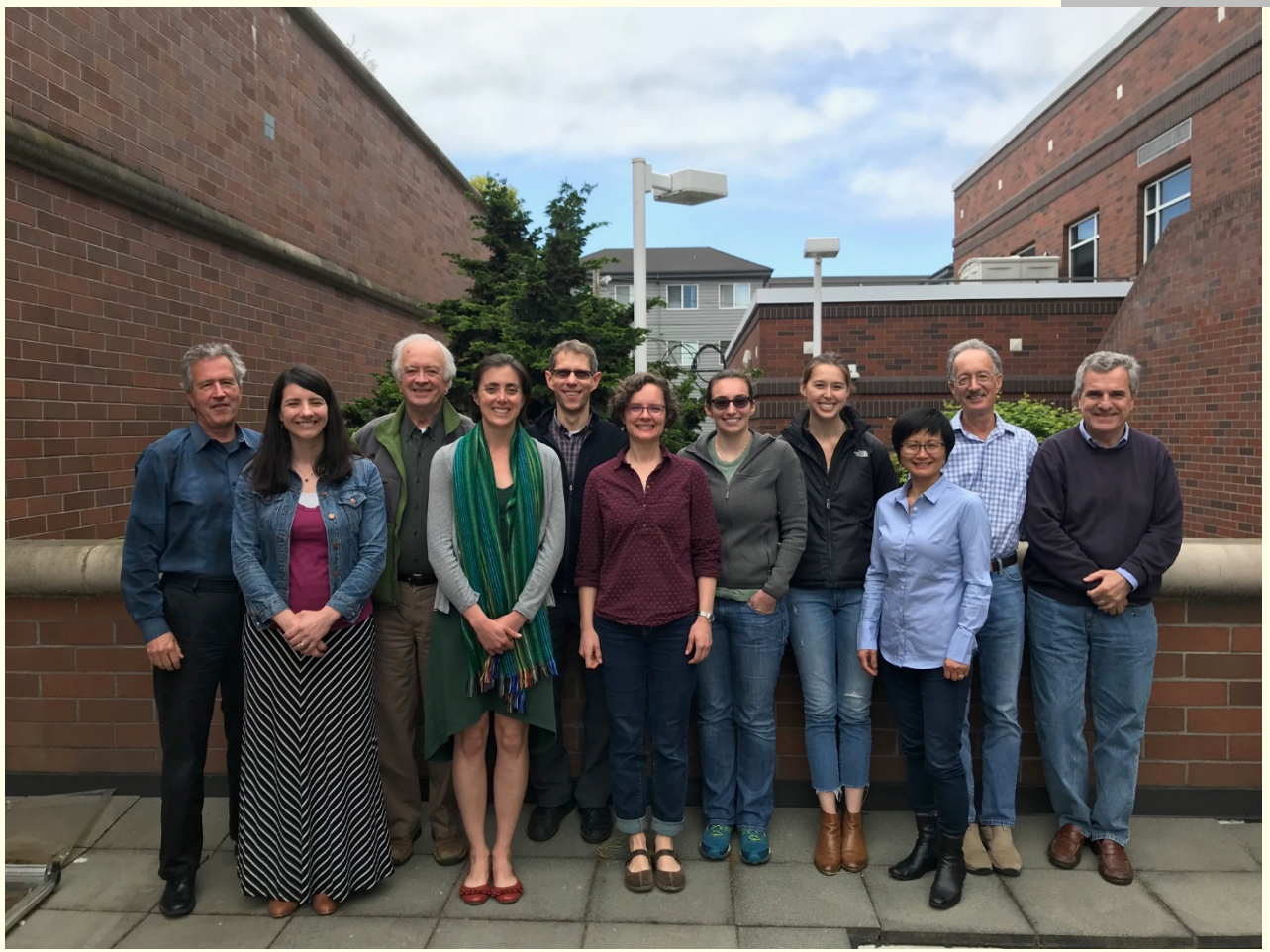
(L. Hayward, Ph.D., Communications manager)

Administrative and Training Cores

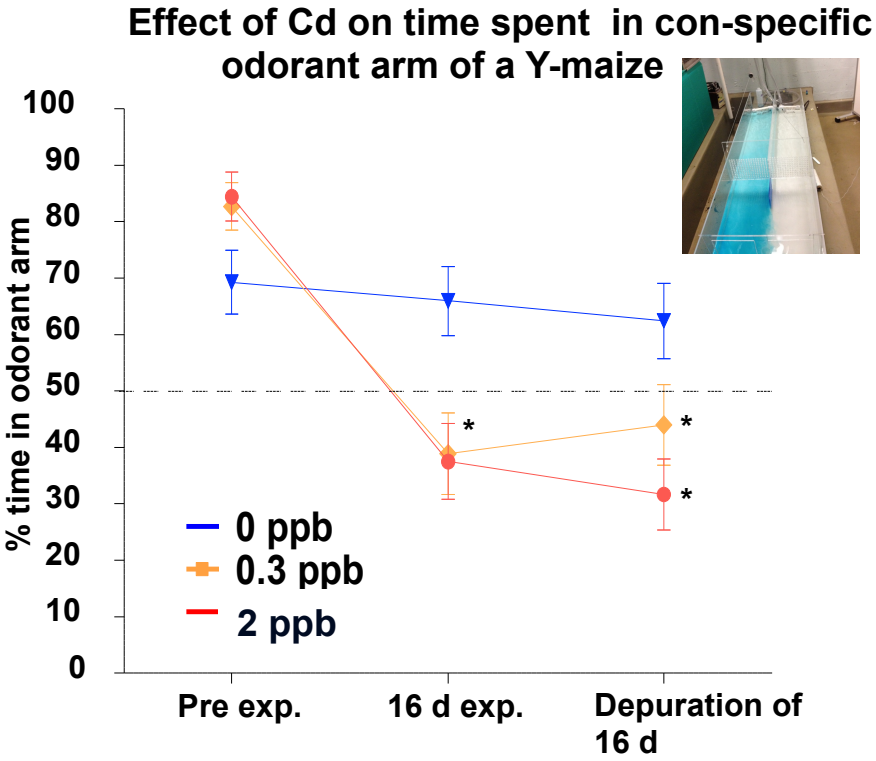
Director, Evan Gallagher, Ph.D.

(Guzy, Program Manager)

UW SRP investigators



Project 1-Mechanisms of olfactory injury: Effect of environmental levels of Cd on salmon neurobehavior



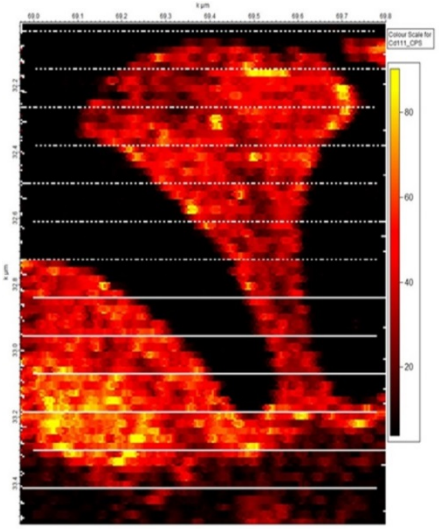
Toxicological Sciences 2016

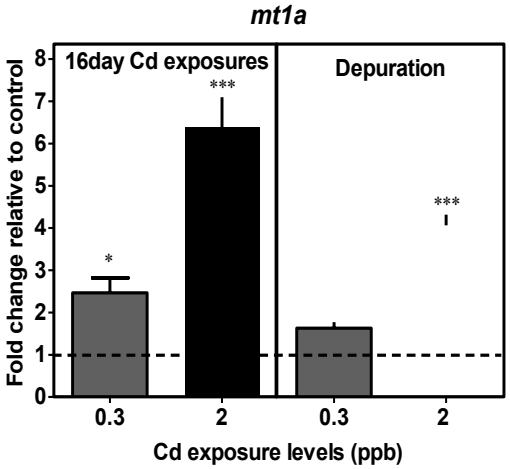
LA-ICP-MS shows that Cd rapidly accumulates and persists in the salmon olfactory epithelium

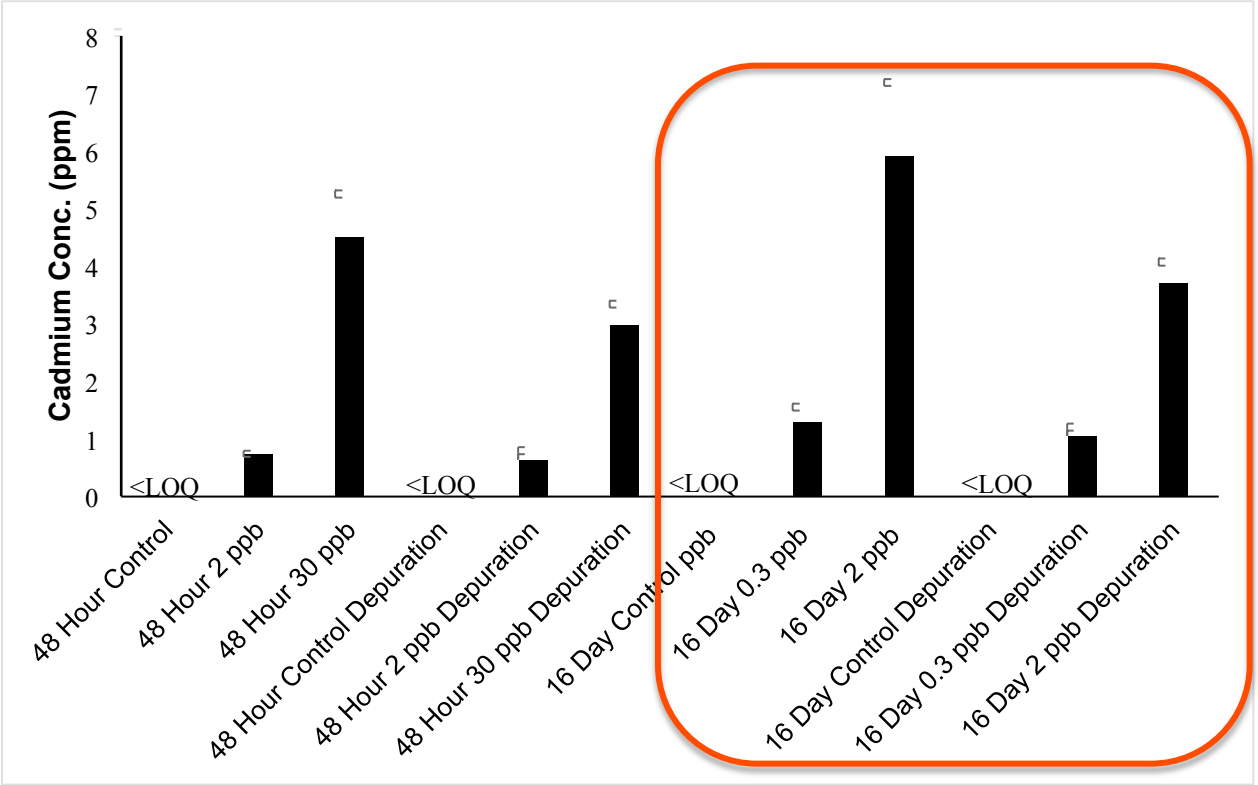
Cadmium Exposure Differentially Alters Odorant-Driven Behaviors and Expression of Olfactory Receptors in Juvenile Coho Salmon (*Oncorhynchus kisutch*)

Chase R. Williams, James W. MacDonald, Theo K. Bammler, Michael H. Paulsen, Christopher D. Simpson, and Evan P. Gallagher[1]

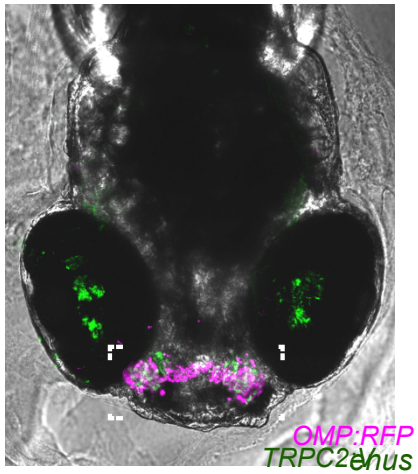
Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, Washington 98105

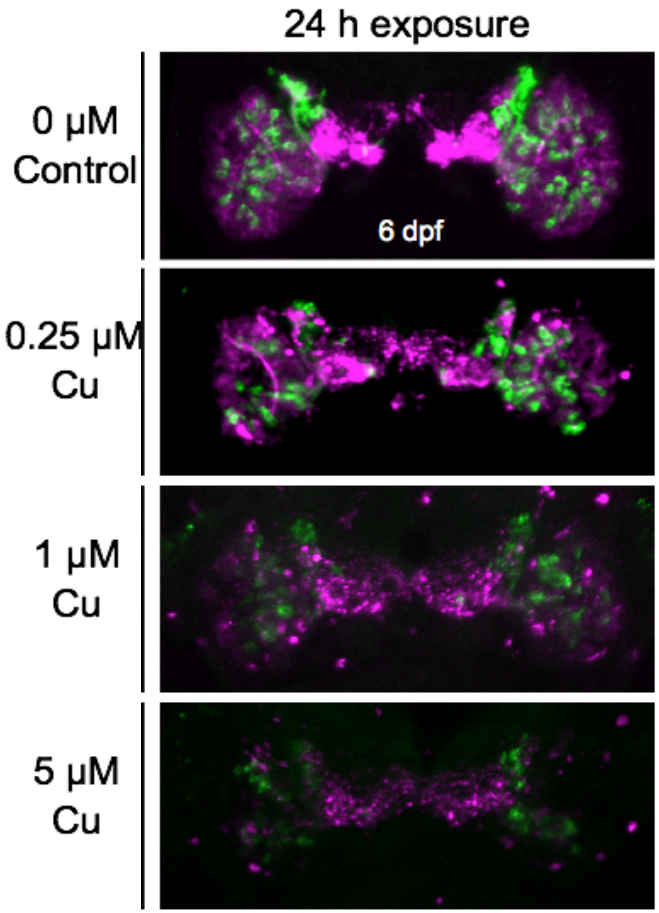


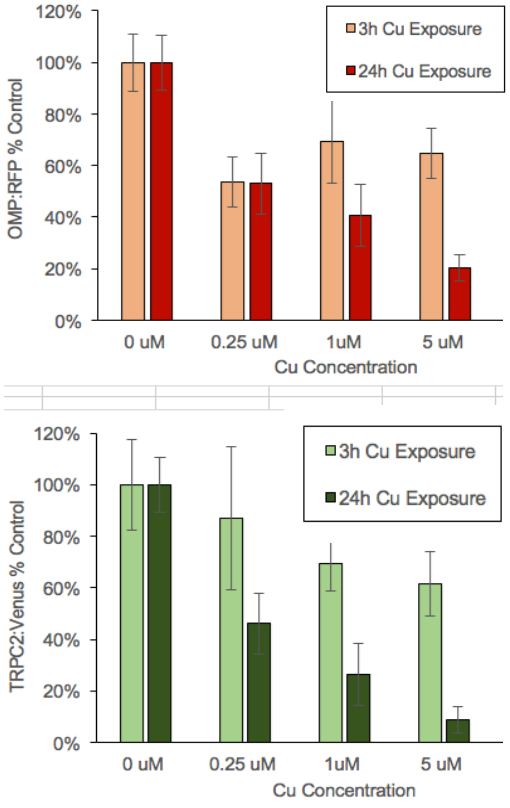




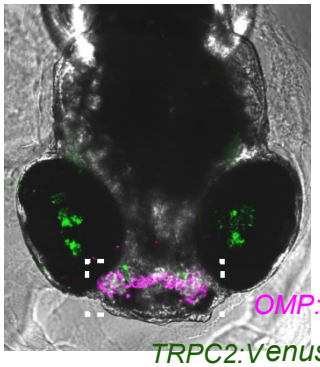
Project 1. Copper injury to zebrafish OSNs is dose-dependent and targets both ciliated and microvillous OSNs





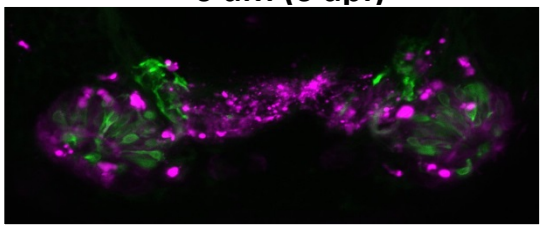


Eva Ma

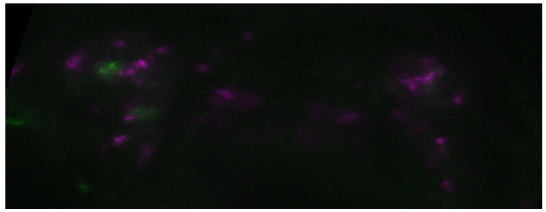


Project 1. Using zebrafish transgenics we see that olfactory cell proliferation increases after injury from Copper and leads to recovery of olfaction

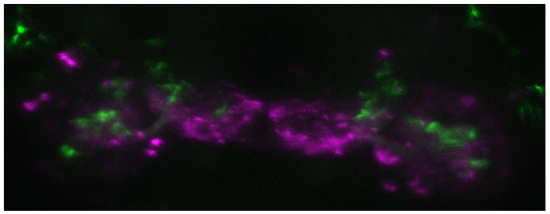
0 uM (6 dpf)

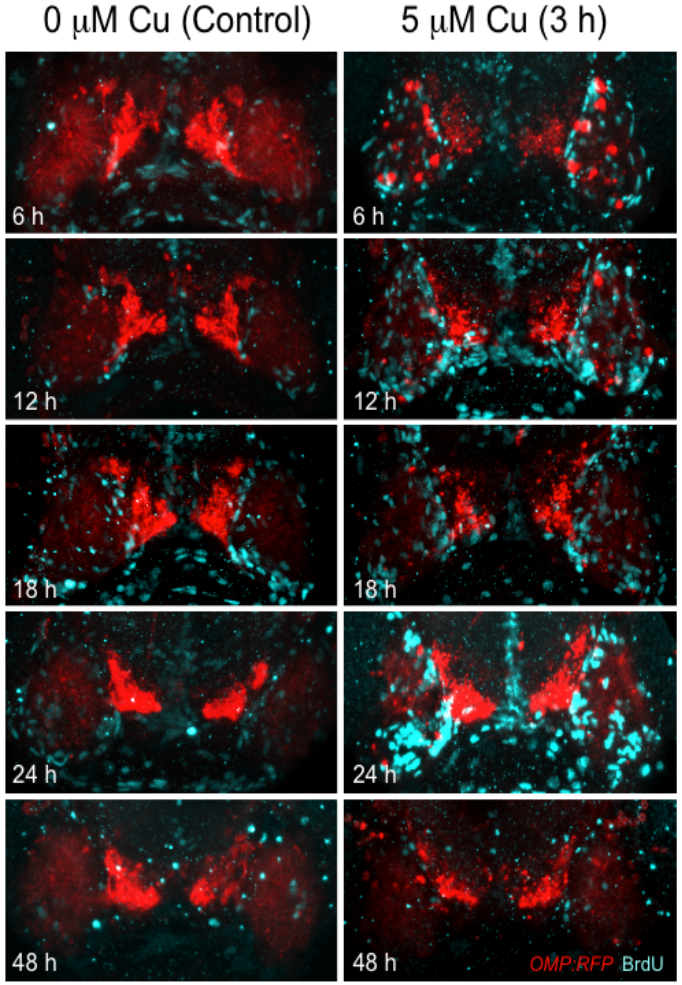


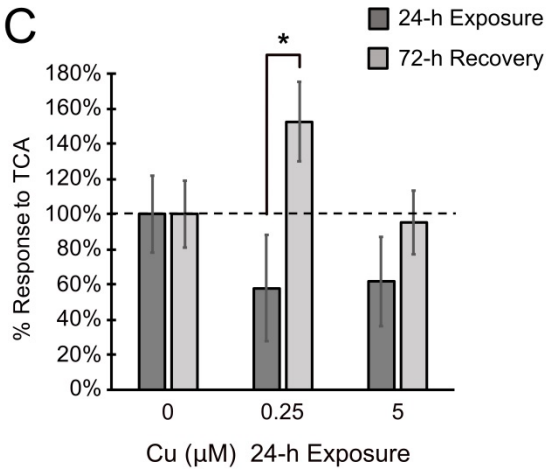
10 uM Cu 24 h (6 dpf)



10 uM Cu for 24 h and 24 hr recovery (7 dpf)



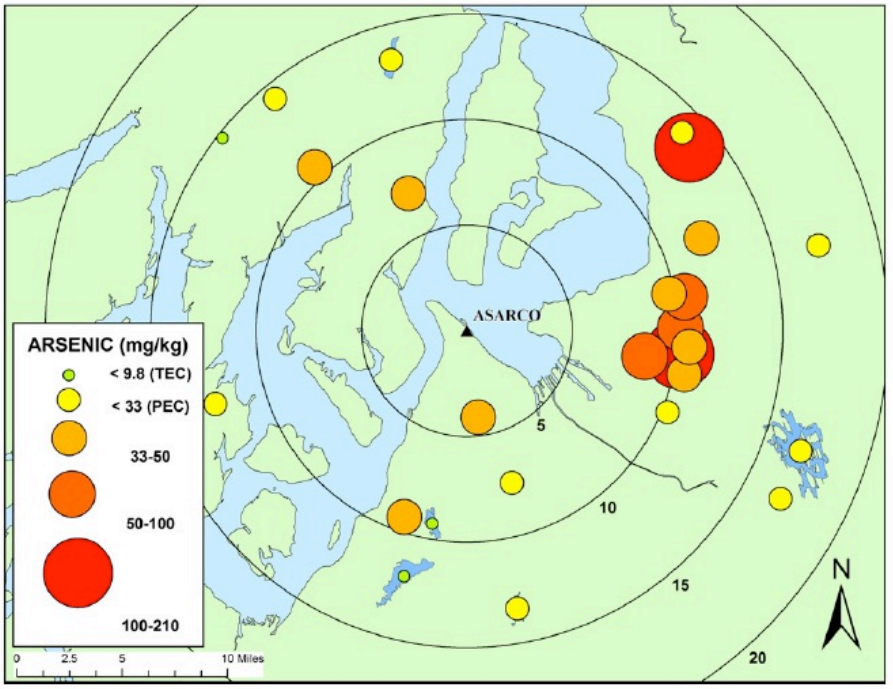




BrdU labeling in OMP-RFP transgenics

Dr. Eva Ma

ASARCO smelter, Ruston, WA
1890–1986



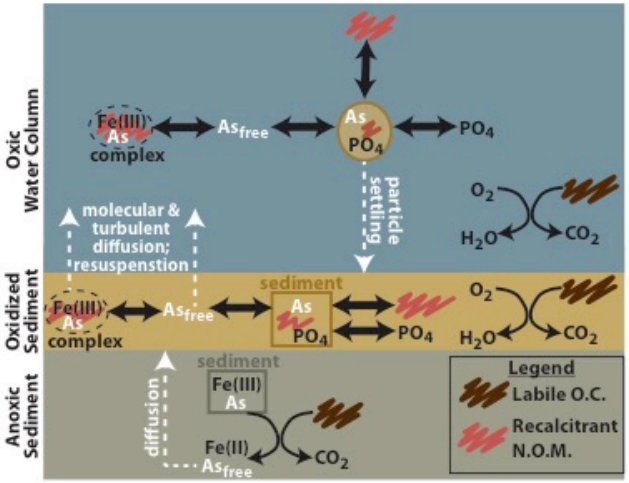
Gawel et al., 2014

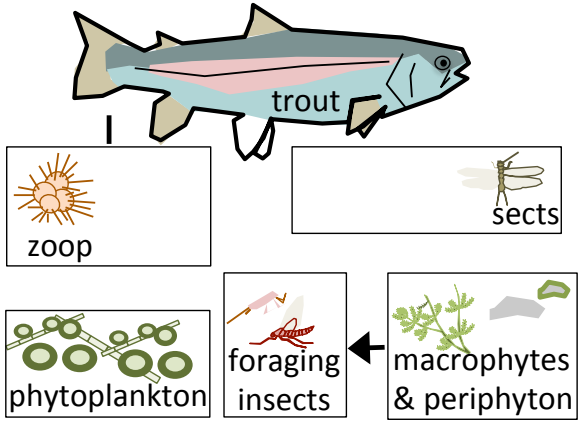
-

Study lake	surface sediment (mg As/kg)	max depth (m)	seasonal stratification
Angle Lake	208	5.8	yes
Lake Killarney	206	4.5	weak/no
North Lake	85	9.0	yes
Steel Lake	48	7.6	weak/no

Specific Aims for Project 4

1. Identify physical and biogeochemical lake attributes that promote arsenic mobilization from sediments and maintain elevated aqueous concentrations of arsenic in unstratified oxic lakes
2. Determine the physical and biogeochemical factors that control arsenic bioaccumulation through aquatic food webs in both seasonally stratified and unstratified lakes.
3. Assess ecological toxicity of arsenic at different trophic levels within both seasonally stratified and unstratified lakes using established and novel molecular biomarkers that indicate arsenic stress and injury.





Research Translation Core

Lisa Hayward (Manager)

SRP RTC and NIEHS Center (EDGE)
CEC

Ph.D. in Environmental Endocrinology

Post-Doctoral work in Conservation Biology

Science and Technology Policy Fellowship with AAAS

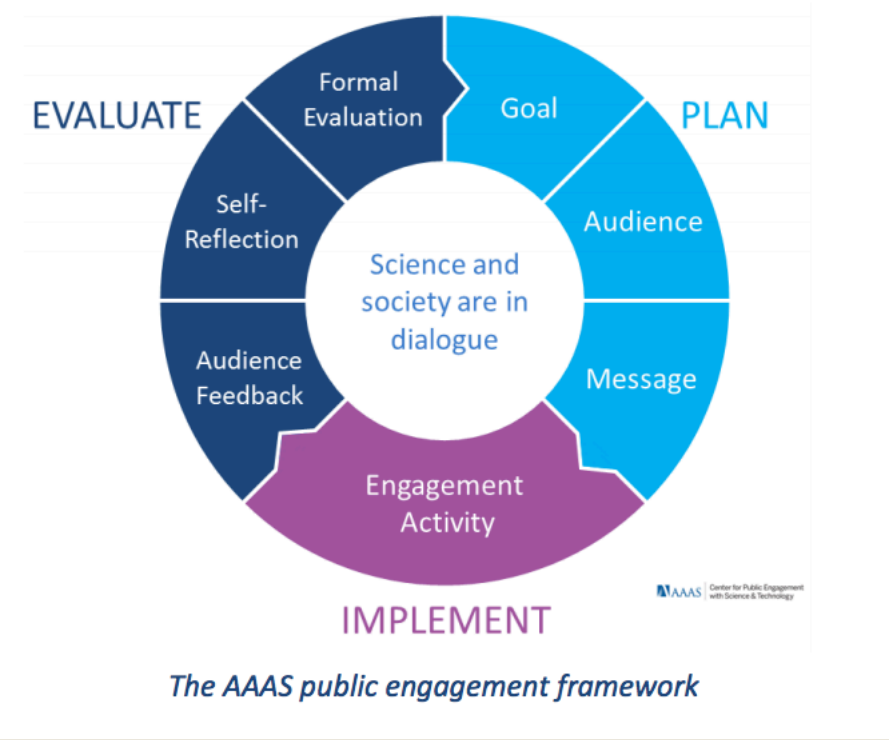
Managed Communications for the Department of Interior's Northwest Climate Science Center

CREATING INDIVIDUALIZED RESEARCH TRANSLATION PLANS FOR EACH PROJECT

AAAS Public Engagement Plan Template

Goals, near-term, mid-term, long-term

- **Information sheets for Policy Makers**
- **Continuing Education Classes for Medical Practitioners**
- **Engagement with Local Regulatory Agencies and Lake Association Members**
- **Presentations for Groups such as National Parkinson's Foundation and Partner's in Parkinson's**



The AAAS public engagement framework

http://theconnector.missouri.edu/wp-content/uploads/2018/04/TEMPLATE-PE-Plan-Template.pdf

Research Translation Core (RTC)

RTC Material


UNIVERSITY of WASHINGTON
Superfund Research Program

Welcome to the University of Washington's Superfund Research Program (UW SRP) September 2017 e*Bulletin!

We offer a few snapshots highlighting some of our program's recent work, as well as providing links to interesting upcoming talks and events. Our Principal Investigator, Dr. Evan Gallagher, and Research Translation and Community Engagement Core Director, Dr. Tom Burbacher, invite you to please read and enjoy the stories that catch your eye.

E-Bulletin

Tweets


UW SRP Retweeted

UW Public Health @uwsph

.@UWDEOHS's Lucio Costa receives @NIEHS grant to study the links between traffic-related #airpollution and #autism ow.ly/5sfP30fZTkI

Oct 23, 2017


To the Point

UW-SRP* Research Snapshots

Dr. Evan Gallagher

A fish lives each day by successfully avoiding its predators and by finding food. What can fish, like the Pacific salmon, tell us about the challenges of survival these days? Research scientist, **Evan Gallagher**, looks at olfaction (sense of smell) in fish to answer that question. It is here, with signals from the nervous system, that a fish detects predators and returns to native streams for reproduction. Certain metals and chemicals in our waterways can have harmful impacts on fish olfaction, affecting essential survival skills. Exposure to metals such as copper and cadmium have an adverse effect on survival behaviors such as schooling and the recognition and avoidance of predators.

Dr. Gallagher's research focuses on trace metals found in fish. The decline in salmon populations in the Western United States has been linked to the deterioration of coastal habitat and the contamination of surface water. Greater understanding of these exposures may be integral to fish survival, ecosystem sustainability and to human health through fish consumption.

What are neurotoxicants?
Neurotoxicants include heavy metals, metalloids and chemical compounds that can cause damage to the central nervous system in humans and other animals. Dr. Gallagher's research focuses on copper and cadmium (heavy metals) that enter the aquatic environment.

How do neurotoxicants enter the environment?
Most often these contaminants are products of manufacturing and industrial waste, they can also be found in brake pads or as a component of vehicle exhaust, entering regional waterways as roadway runoff. Tobacco smoke also contains cadmium. Exposure to cadmium and copper may happen by contact with contaminated soil, contact with contaminated water and by inhaling contaminated air particles.

What does this research have to do with Superfund site hazardous chemicals?
Dr. Gallagher's research will include sampling in the Lower Duwamish Waterway Superfund site in Seattle, Washington. The Superfund is a federal program that was established to clean up the nation's priority hazardous wastesites. A list of the most harmful chemicals has been established by the Agency for Toxic Substances and Disease Registry (ATSDR). The Gallagher laboratory studies exposure to copper and cadmium, both identified on the ATSDR list.

What is already being done to protect the environment?
In 2010, Washington State passed a law reducing the use of toxic material in automotive brake pads and shoes. In 2015, use of several heavy metals and asbestos was restricted, along with the phasing out of the use of copper. Dr. Gallagher's research helped inform these state and federal regulatory policies. To learn more about the laws that protect our health see the Toxic Substance Control Act link below.

Linked resources for further information:
University of Washington Superfund Research Program: http://depts.washington.edu/sfund/
NIEHS Superfund Research Program: http://www.niehs.nih.gov/research/supported/srp/index.cfm
ATSDR ToxFAQs™: http://www.atsdr.cdc.gov/substances/toxchemicallisting.asp?sysid=39
EPA Superfund sites information: http://www.epa.gov/superfund/sites
EPA summary of the Toxic Substances Control Act: http://www.epa.gov/lawsregs/laws/tsca.html

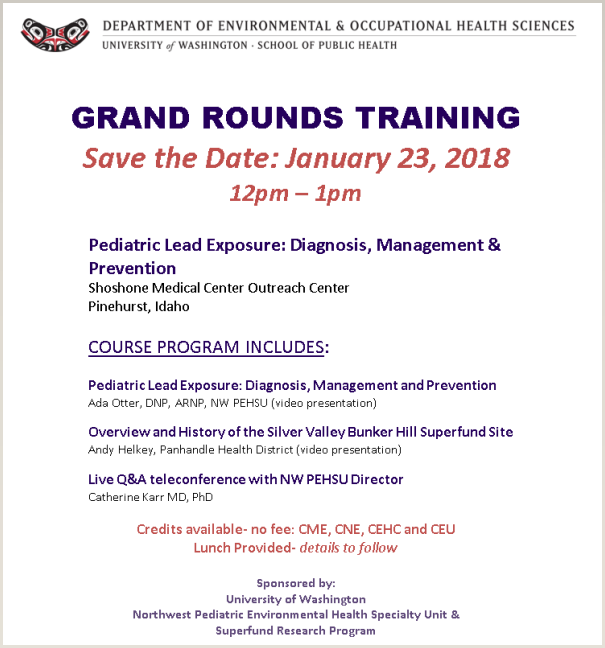
*University of Washington Superfund Research Program

To-the-Point Fact Sheets

Research Translation Core (RTC)

RTC Engagement

Pub Talk



DEPARTMENT OF ENVIRONMENTAL & OCCUPATIONAL HEALTH SCIENCES
UNIVERSITY of WASHINGTON · SCHOOL OF PUBLIC HEALTH

GRAND ROUNDS TRAINING

Save the Date: January 23, 2018

12pm – 1pm

Pediatric Lead Exposure: Diagnosis, Management & Prevention
Shoshone Medical Center Outreach Center
Pinehurst, Idaho

COURSE PROGRAM INCLUDES:

Pediatric Lead Exposure: Diagnosis, Management and Prevention
Ada Otter, DNP, ARNP, NW PEHSU (video presentation)

Overview and History of the Silver Valley Bunker Hill Superfund Site
Andy Helkey, Panhandle Health District (video presentation)

Live Q&A teleconference with NW PEHSU Director
Catherine Karr MD, PhD

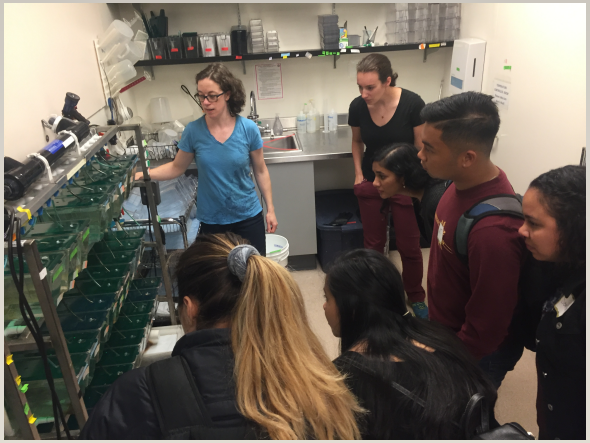
Credits available- no fee: CME, CNE, CEHC and CEU
Lunch Provided- *details to follow*

Sponsored by:
University of Washington
Northwest Pediatric Environmental Health Specialty Unit &
Superfund Research Program

Continuing Education

Lower Duwamish Boat Tours

Educating Next Generation of Community Leaders



CAMPUS VISIT FOR BRIDGE (CDC) and SURE-EH (NSF) STUDENTS

Duwamish Valley Youth Corps

- Conduct tours of SRP labs with investigators and trainees
- Meet with Office Minority Affairs –Education Ambassadors

Career Day

Community Engagement Core (CEC)

Goal

The primary goal of the CEC is to work with community stakeholders and federal, state and local agencies to develop intervention strategies to reduce community exposures to hazardous substances in order to improve public health

Specific Aim 1

Work with community organizations and federal, state and local agencies to develop intervention strategies to reduce exposure to fish contaminants at the Lower Duwamish Waterway (LDW) Superfund Site in Western Washington.

Katie Frevert, CEC Manager at Duwamish River Festival

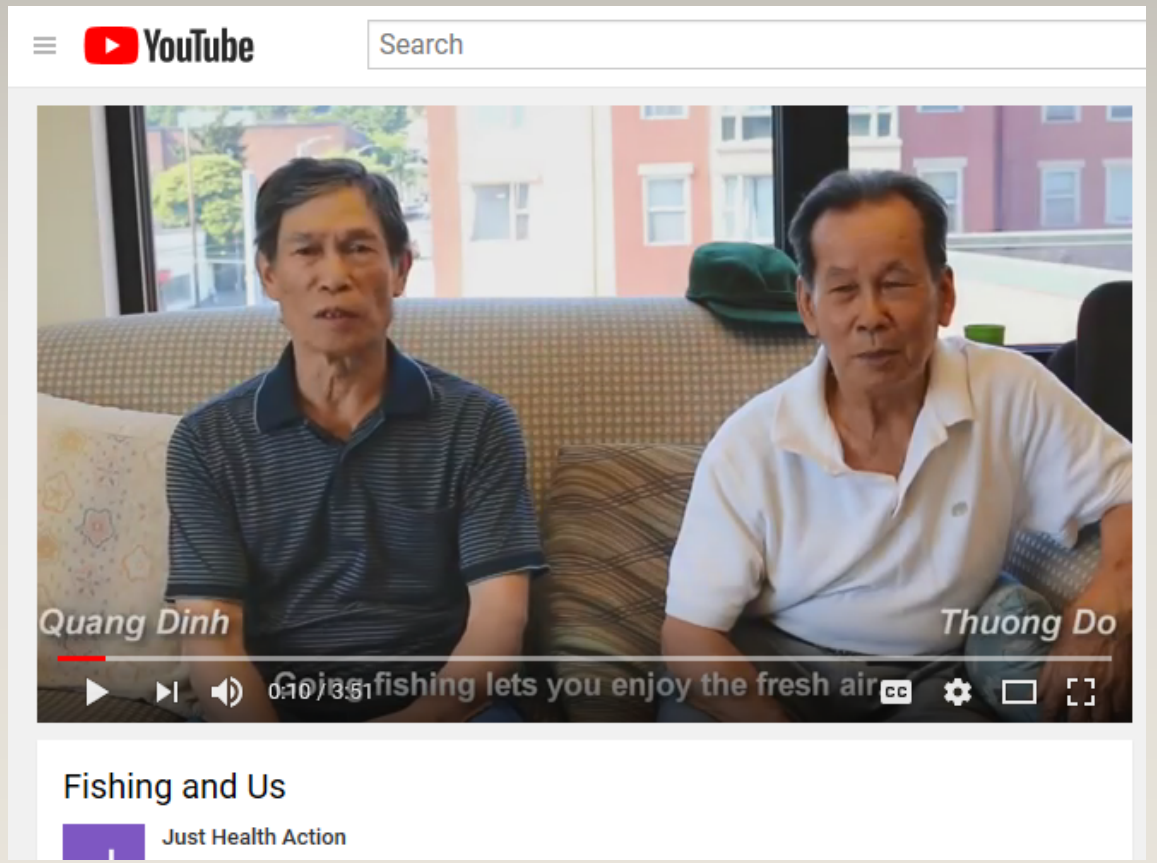
Institutional Controls Fish Advisories

Community Health Advocates meeting with Fish & Wildlife staff

Community Advocates for Safe Fishing

Collaborating with nonprofit organization Just Health Action led by Linn Gould, MPH

FishNet webinar, Using a Community-Based Process to Promote Healthy Fish Consumption within the Lower Duwamish Waterway Superfund Site.

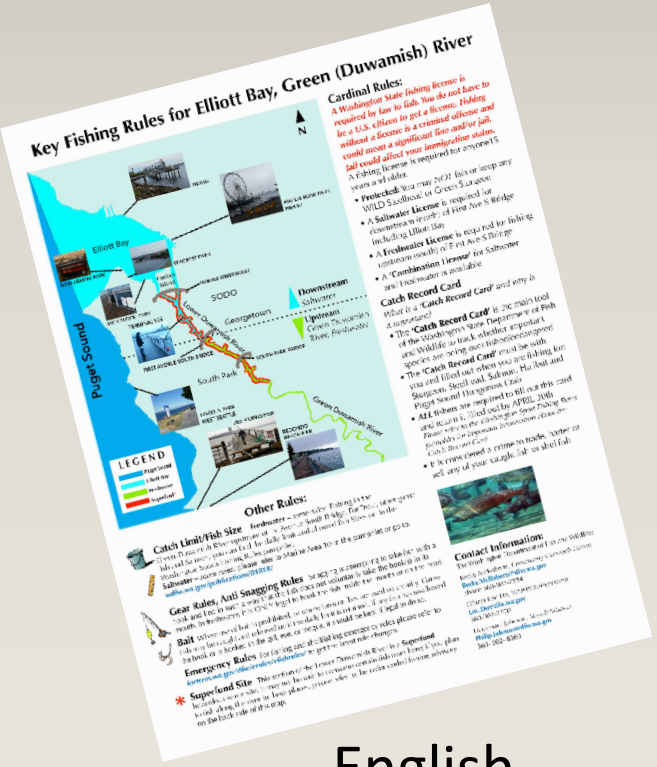


Vietnamese fishers in Seattle share a story about the importance of fishing as a cultural practice, as well as information to the community around the contamination and clean up of the Lower Duwamish River.

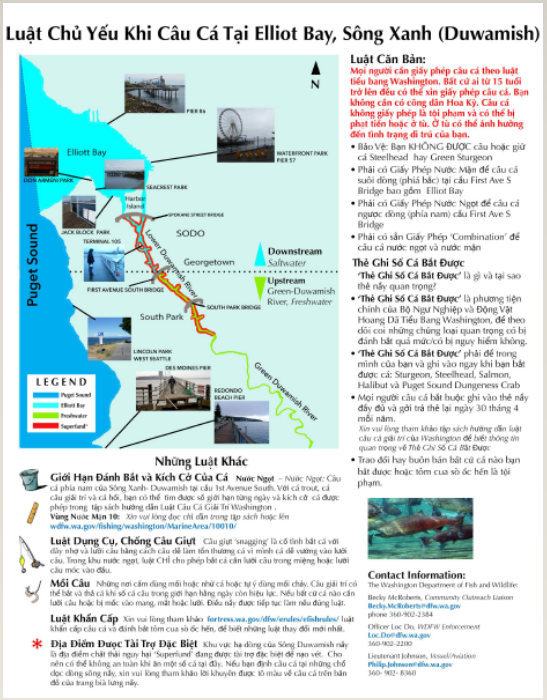
https://www.youtube.com/watch?v=NDmkoBJpKYU

Simplifying Fishing Rules and Regulations

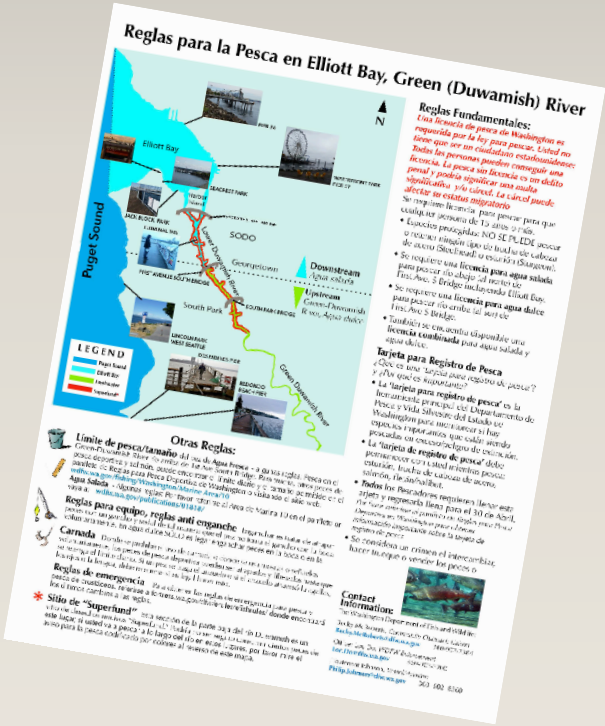
Working with Washington State Department of Fish and Wildlife



English



Vietnamese



Spanish

Maps with fishing locations and regulations

Simplifying Fishing Rules and Regulations

Short Educational Videos on Fishing Rules & Health

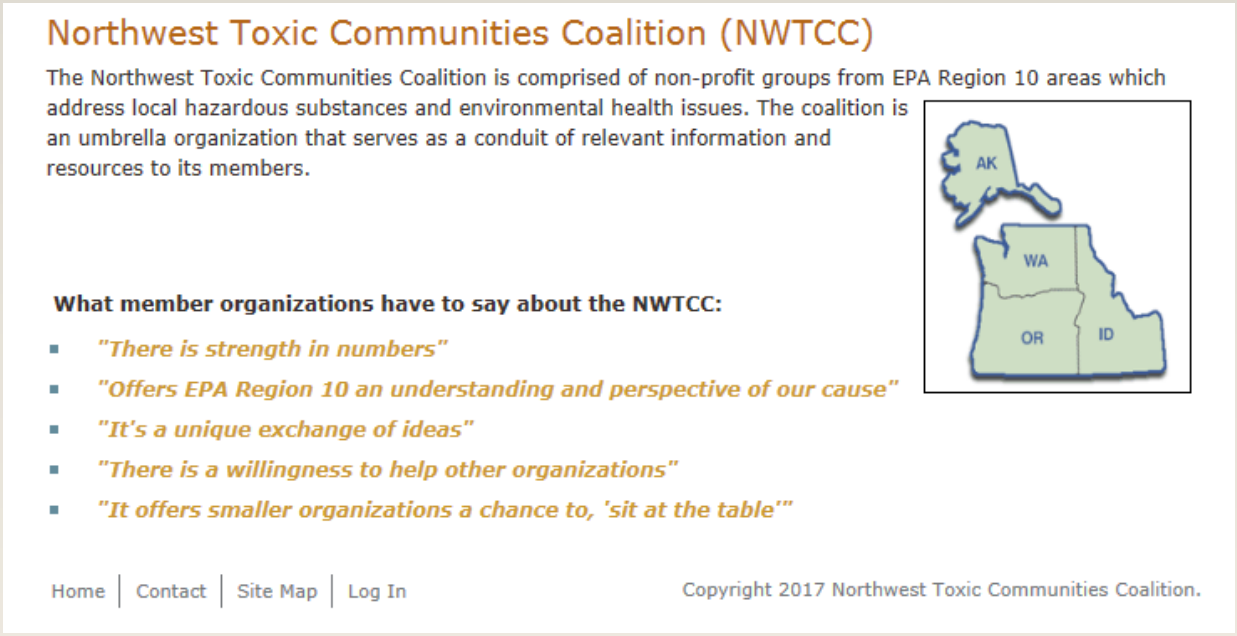
The themes for these Educational Videos include:

1. Opportunities Available to Fishers in the Duwamish
2. What Do I Need to Know Before Going Out? (Rules/ Regs/Safety/Fish Types)
3. How to Buy a Fishing License
4. What Fishing Gear Do I Need?
5. How to Land a Fish & Clean it Properly
6. Cooking Fish and Health Tips

Community Engagement Core (CEC)

Specific Aim 2

Build upon our previous collaborations with the Northwest Toxic Communities Coalition (NWTCC) to address hazardous waste site issues common across neighborhoods and reduce exposures to contaminants in these waste site communities.



NORTHWEST TOXIC COMMUNITIES COALITION

SUMMIT 2018

SILVER VALLEY COMMUNITY RESOURCE CENTER

DIANA ROHLMAN, PhD

Oregon State University, College of Public Health & Human Sciences: New studies on PAH effects, community-engaged health literacy

DAVID CARPENTER, PhD

University at Albany, State University of NY, Director of U Albany's Institute for Health & the Environment: New studies on PCB effects

TOM FOX, MS

Environmental engineer and former Water Resource Manager for Seattle Public Utilities: Water use & reclaimed water

TODD WILDERMUTH, PhD

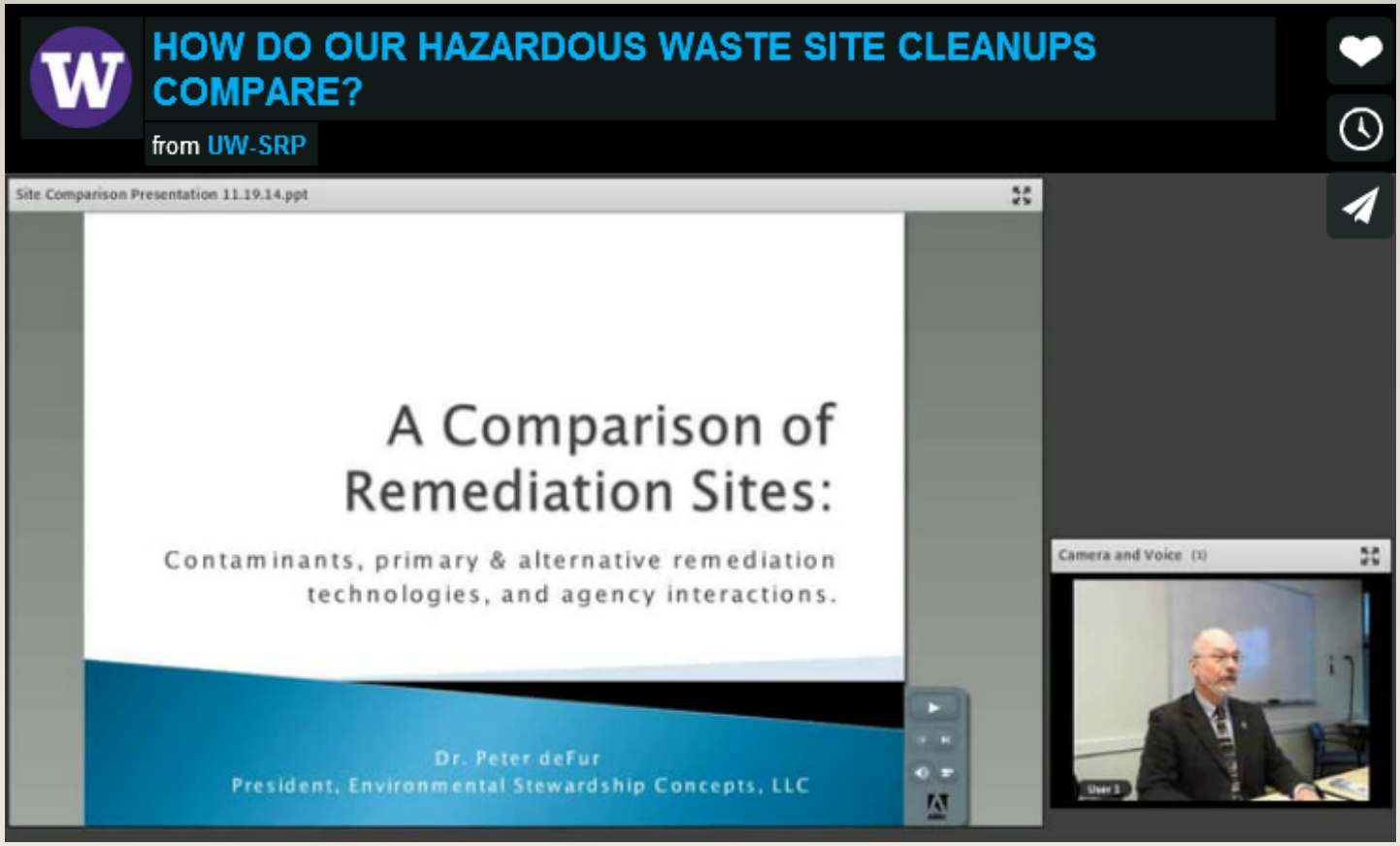
Director Environmental Law Program Policy Director / Regulatory Environmental Law and Policy Clinic University of Washington School of Law: Open topics

PATTY MARTIN

NWTCC board member, environmental activist and former mayor of Quincy, Washington. As mayor she challenged corporations that dumped toxic waste in fertilizers used in area farms: Community-based strategies.

NWTCC Collaborations

Quarterly Webinars



Needs Assessment Outcomes

- Grant Writing Assistance
- Environmental Sampling