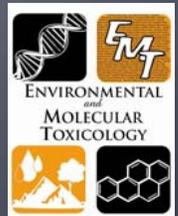


Continuous Monitoring for Pesticides in a Pacific Northwest Freshwater Off-Channel Habitat

Phil Janney, Jeffrey Jenkins and Kim Anderson
Department of Environmental and Molecular Toxicology
Oregon State University



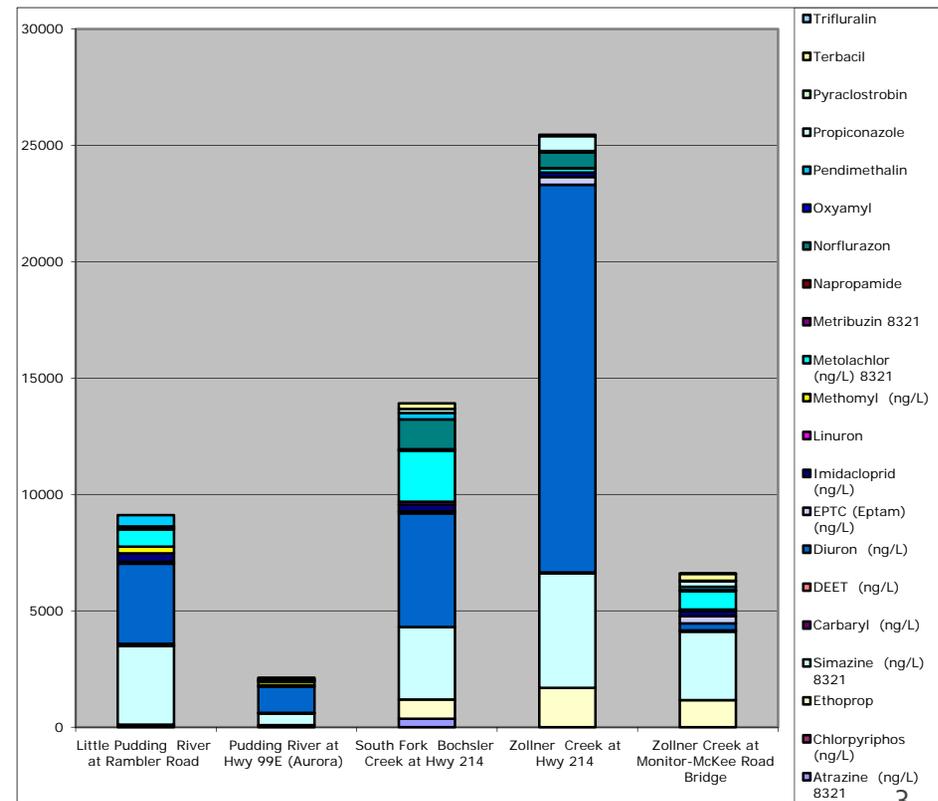
Introduction

- NMFS Biological Opinions
 - Concern regarding exposure in off-channel and shallow habitats utilized by juvenile salmonids
 - Data limited so exposure estimated for direct overspray and drift (AgDrift)
- Passive sampling devices deployed to evaluate continuous exposure in off-channel and shallow salmonid habitats.

Pesticide Monitoring in Pudding River Basin

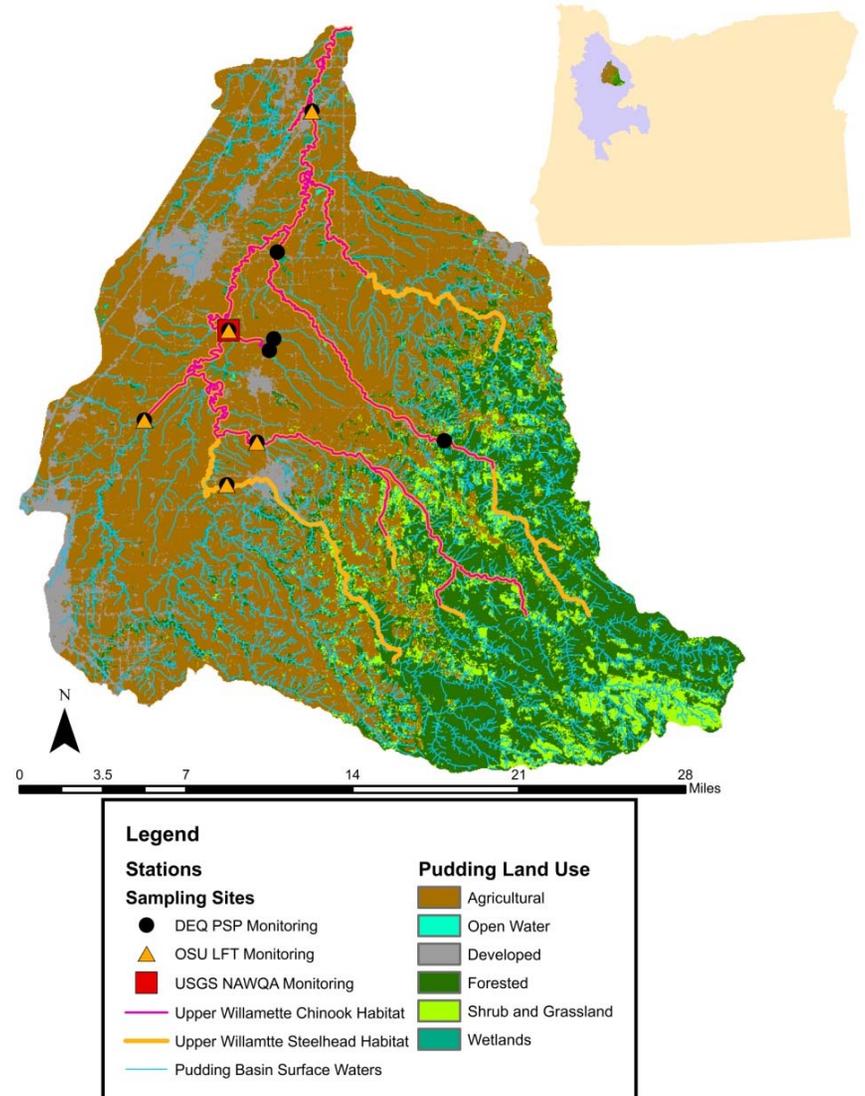
- USGS National Water Quality Assessment
 - Long term agricultural site
 - Pesticides sampled from 1993-2008
 - High frequency of detections and levels

- Oregon DEQ
 - Total Maximum Daily Load
 - Approved by EPA 2008
 - Zollner TMDLs for dieldrin and chlordane
 - Pesticide Stewardship Partnership
 - Pesticides sampled from 2005-present



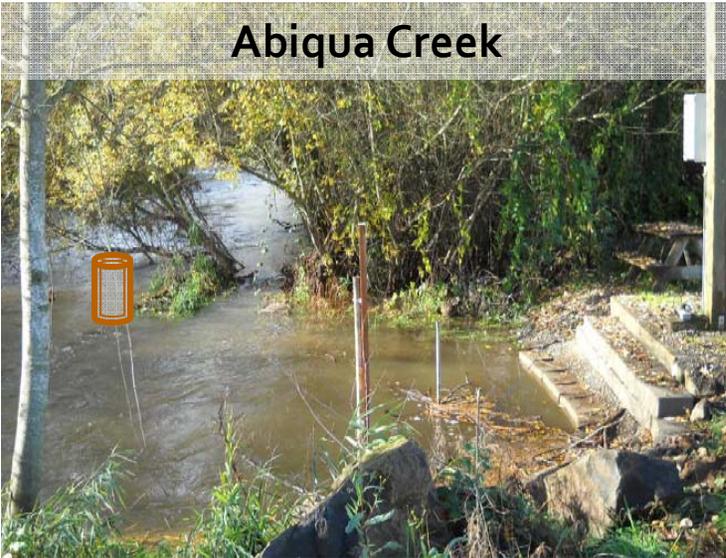
Sampling

- Pudding River basin
 - 2456 ha (54% agricultural, 8% developed, 38% forested)
 - Upper Willamette Chinook and Steelhead habitat
- Sampled June 2010 to October 2011
 - 5 sample locations
 - 4 accessible to salmonid species
 - Sampled 3-4 week intervals



Sample Sites

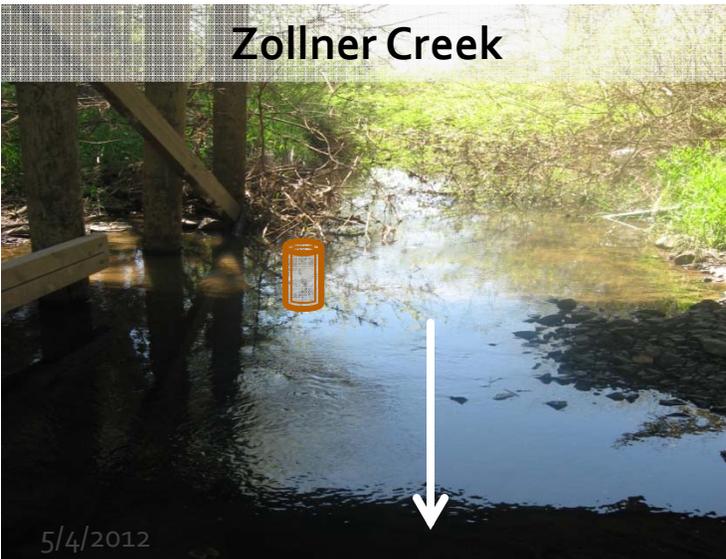
Abiqua Creek



Silver Creek



Zollner Creek



Pudding River



Lipid Free Tubing (LFT) Passive Sampling Devices

- Low density polyethylene
- Samples the freely dissolved fraction of contaminant
- 2 compartment model based on Fick's Law
- Provides integrated time weighted average



Lipid Free Tubing (LFT) Passive Sampling Devices

ADVANTAGES

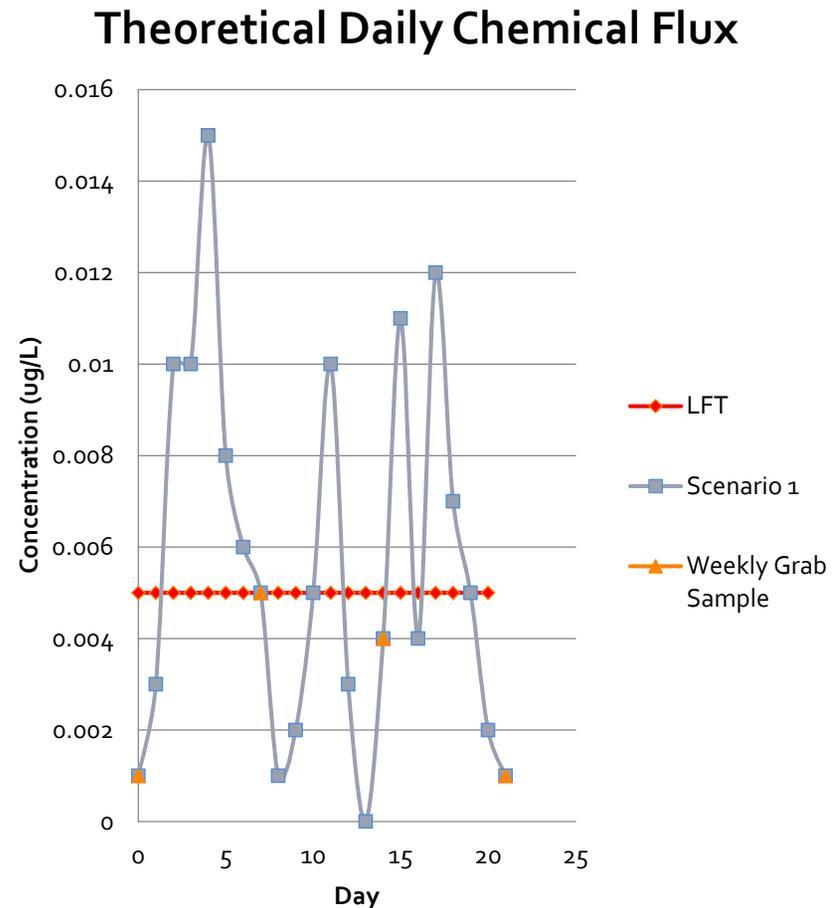
- Continuous sampling
 - Capture episodic events
 - Reduce sampling numbers/frequency
- Lower detection limits
- Mimic passive biological uptake

LIMITATIONS

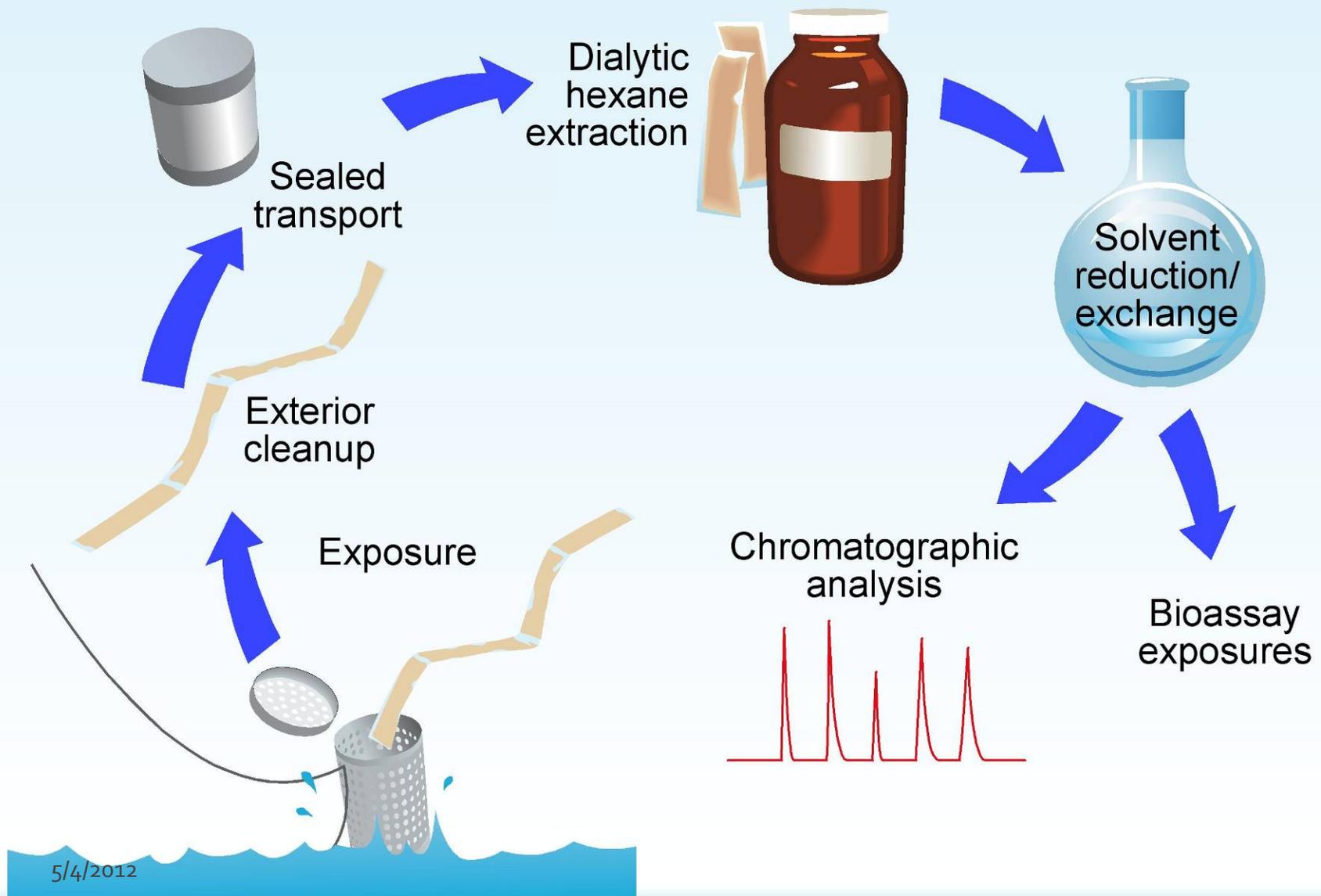
- Integrated time weighted average concentration
- Specific chemical sampling range
 - Sampler material determines chemicals sequestered

Example Daily Chemical Flux

- Daily chemical flux variable in low order streams and shallow environments
- LFT provide time-weighted average concentration
 - Can normalize daily fluctuations
- Toxicity data generally 48-96 hour exposures
 - Still uncertainty about level of exposure



LFT Processing



Pesticide Quantification

- LFT Analysis
 - GC/ECD (Quantification) – based on EPA Method 8081
 - Agilent 6890N with DB-17ms and DB-XXLB columns
 - 40 pesticides: 31 OCs, 3 OPs, 3 pyrethroids, 4 various
 - GC/MS (Confirmation)
 - RTL DRS deconvolution software

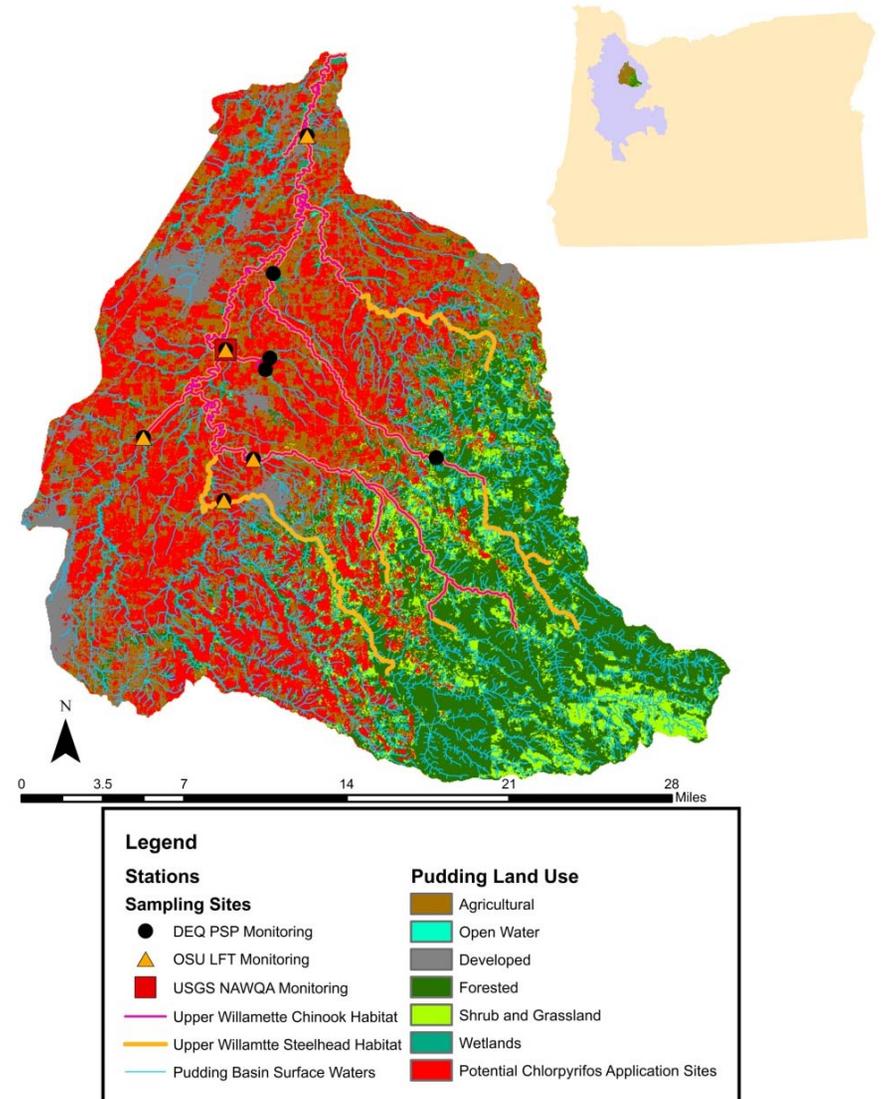


- Water Concentration Calculation
 - Performance reference compounds
 - In-situ uptake rate calibration

$$C_w = \frac{N}{V_s K_{sw} \left(1 - \exp\left(\frac{-R_{st} t}{V_s K_{sw}}\right)\right)}$$

Potential Chlorpyrifos Applications

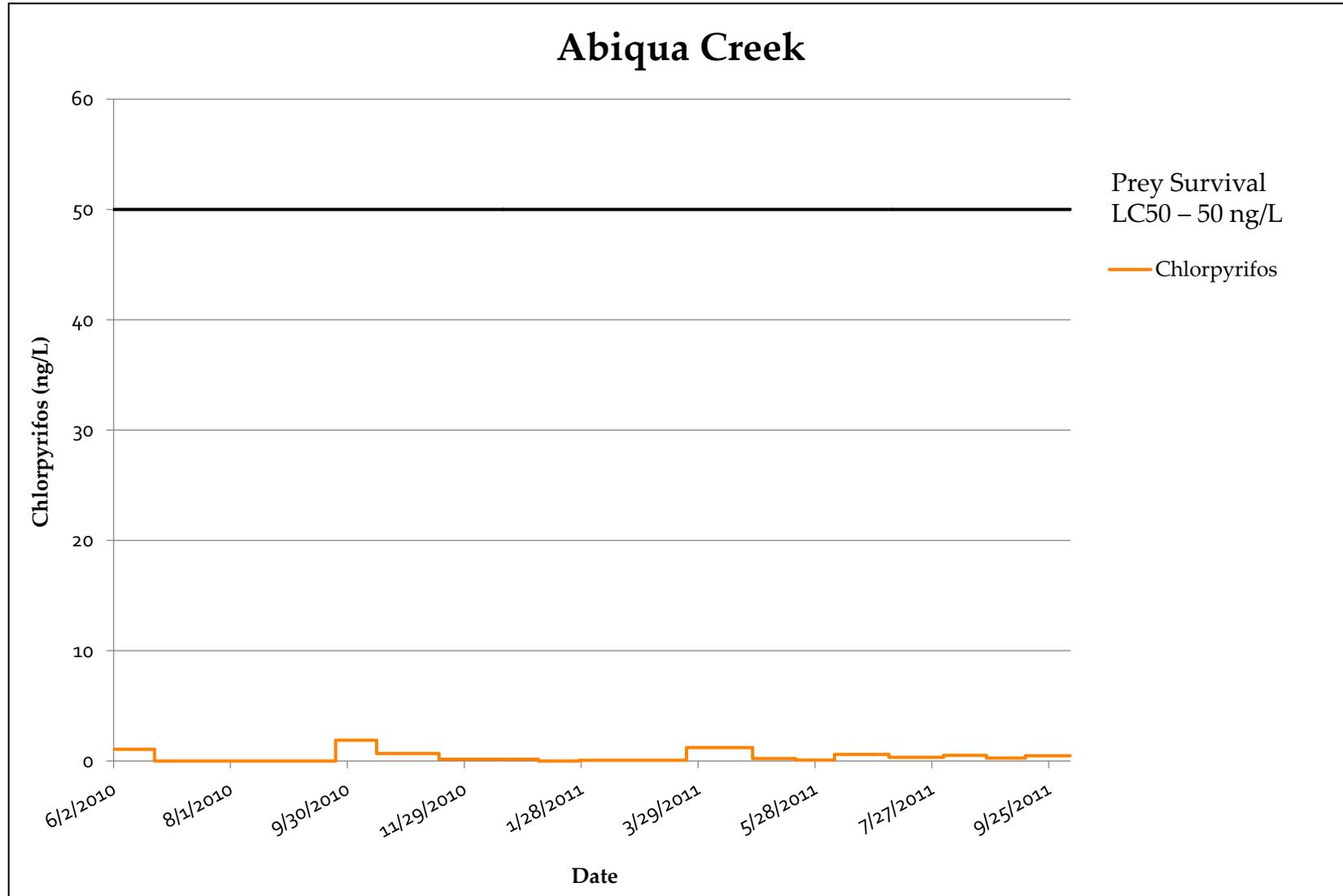
- Potential chlorpyrifos use
 - 65 land uses from NASS Cropland Data Layer
 - 25 land uses in basin in IPM handbook
 - 30% of watershed area potential (55% agricultural area) chlorpyrifos application area



Chlorpyrifos Aquatic Life Levels of Concern

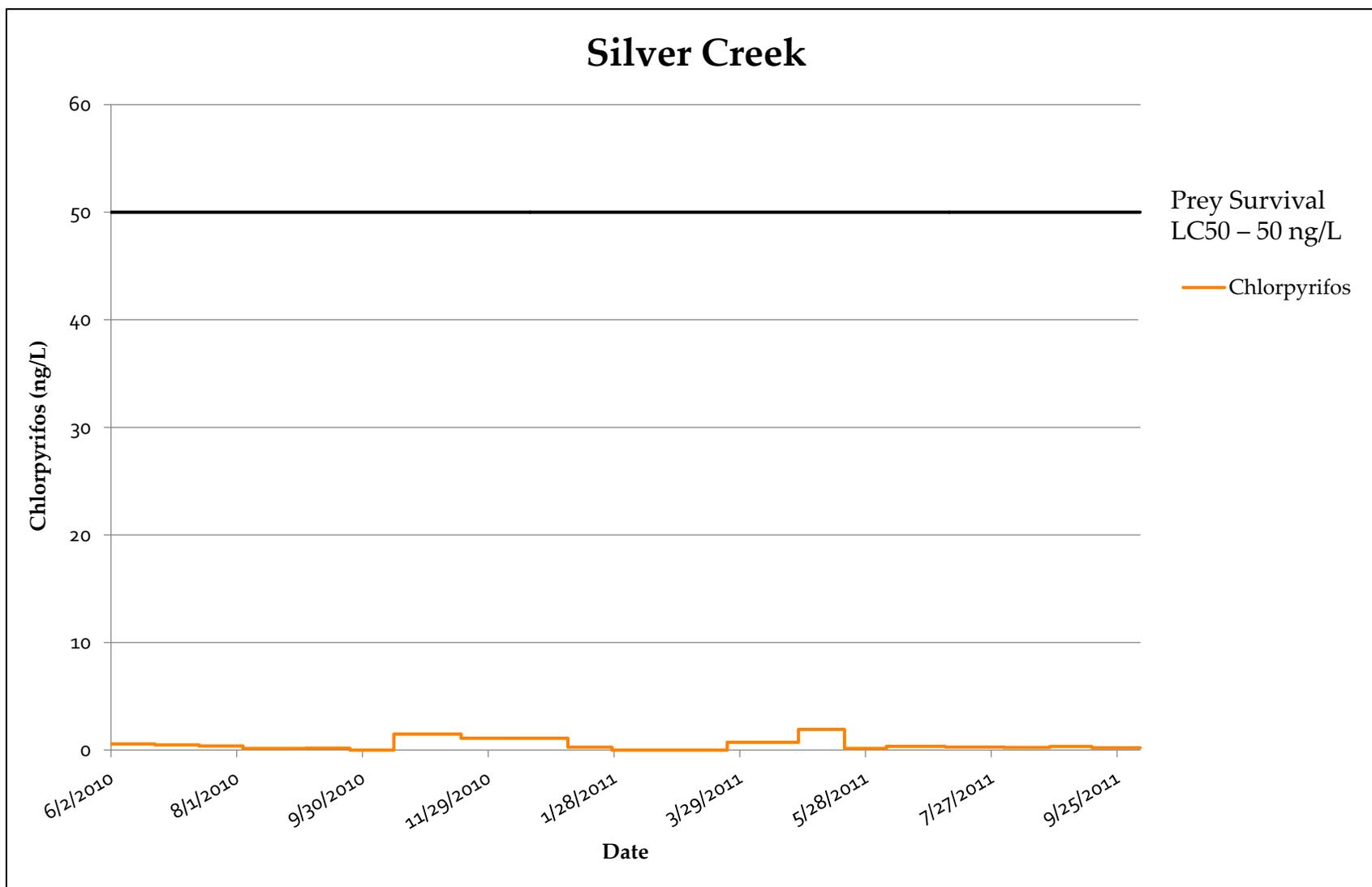
- CWA aquatic life criteria
 - Acute - 0.083 $\mu\text{g/L}$
 - Chronic – 0.041 $\mu\text{g/L}$
- NMFS ESA-listed salmonid BiOps
 - Prey survival – 0.05-600 $\mu\text{g/L}$
 - Fish survival – 0.8-2200 $\mu\text{g/L}$
 - Fish growth – 0.12-4.8 $\mu\text{g/L}$
 - Fish reproduction – 1.09-1.21 $\mu\text{g/L}$
 - Fish olfactory behaviors – 0.625-2.5 $\mu\text{g/L}$

Monitoring Results – Abiqua Creek



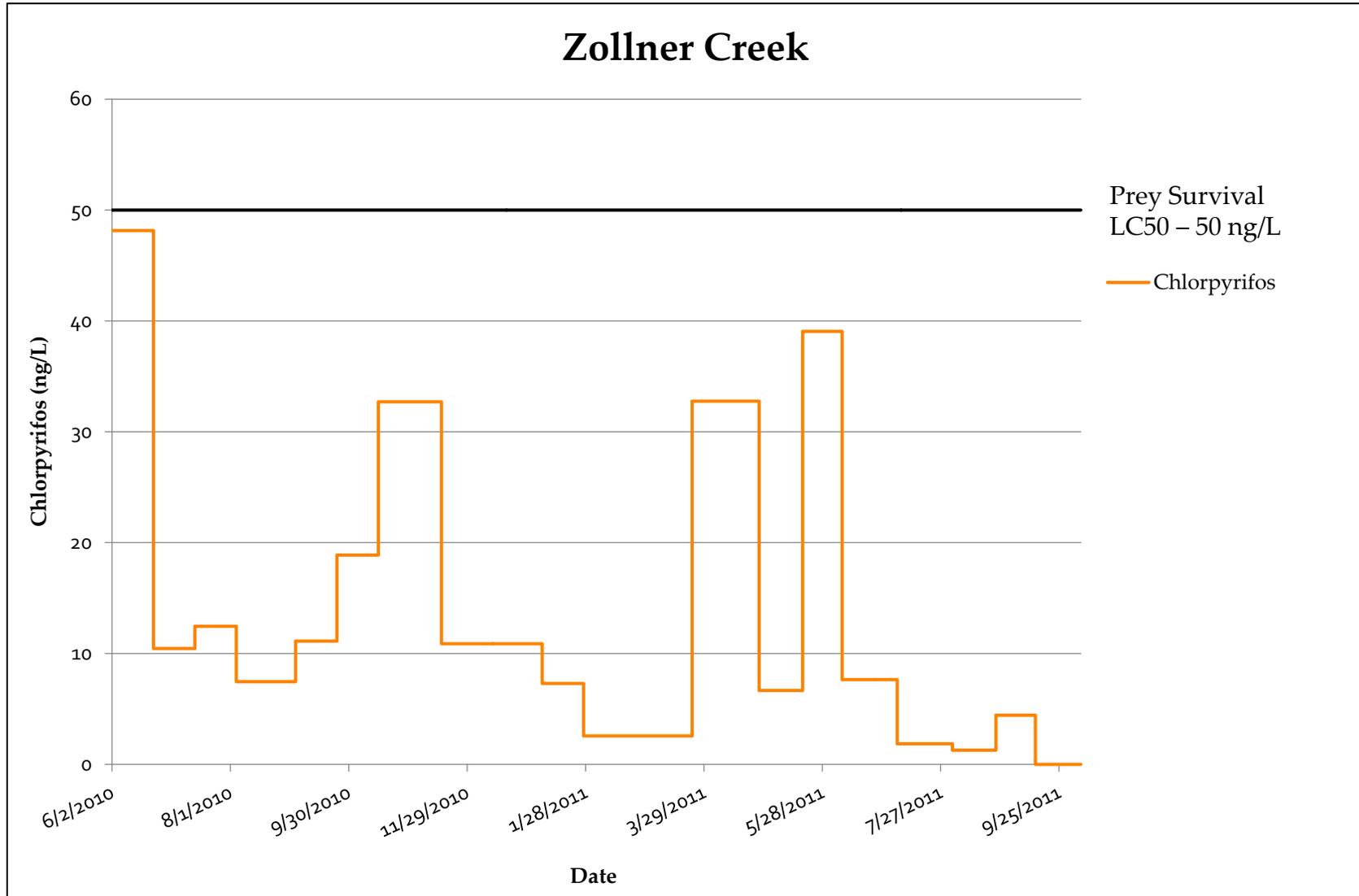
5/4/2012

Monitoring Results – Silver Creek



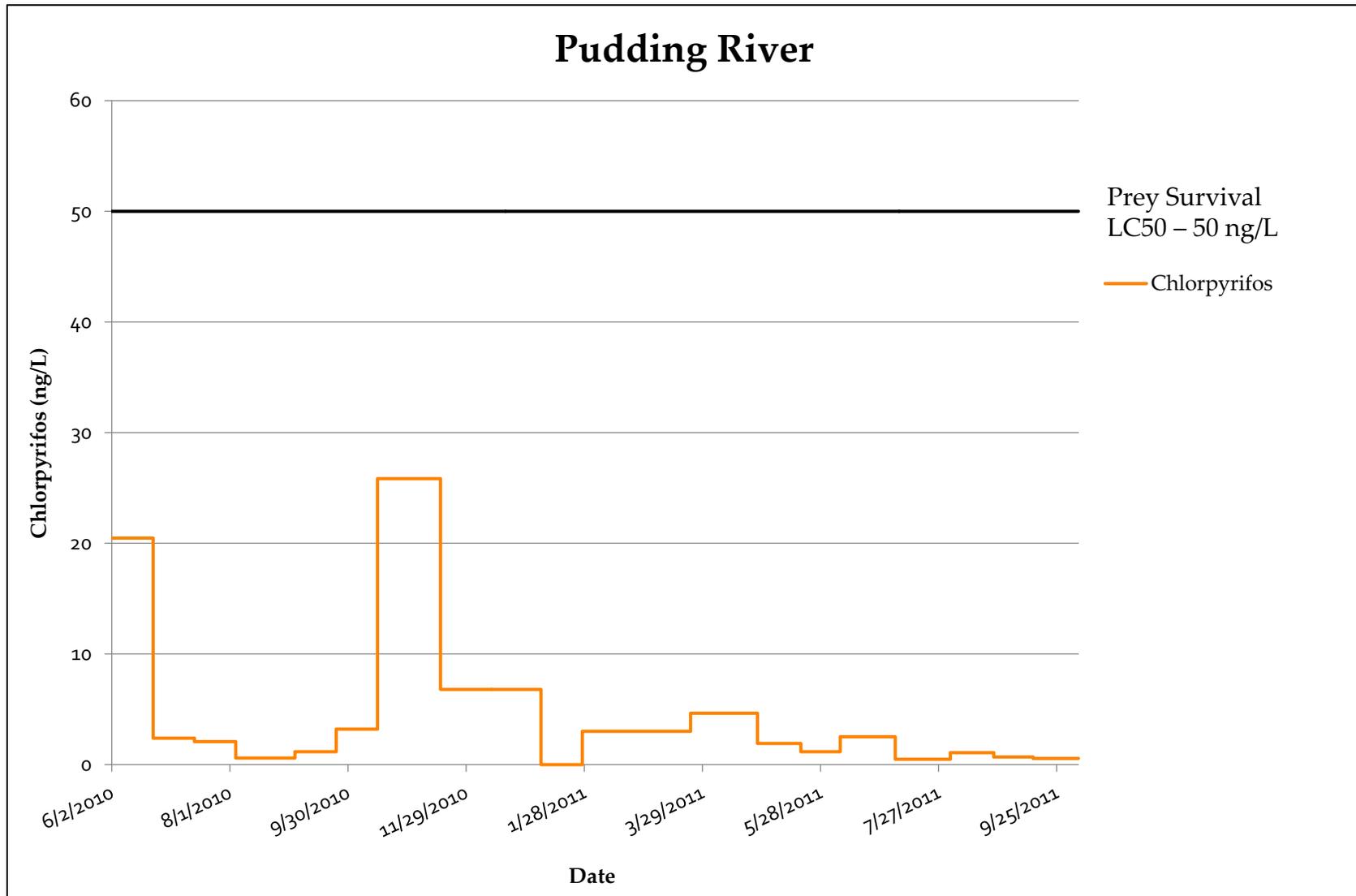
5/4/2012

Monitoring Results – Zollner Creek



5/4/2012

Monitoring Results – Pudding River



5/4/2012

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- Food Safety and Environmental Stewardship Lab, Oregon State University
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- Questions?

