Aquatic Risk Assessment

Organophosphate insecticide mixtures in Washington surface waters

Chlorpyrifos, diazinon, & malathion:
2018 – 2020 preliminary analysis

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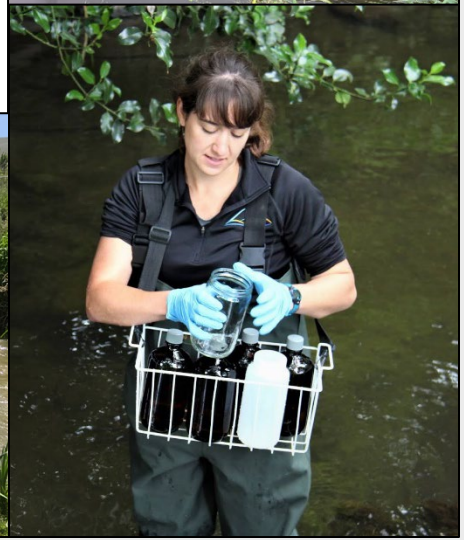
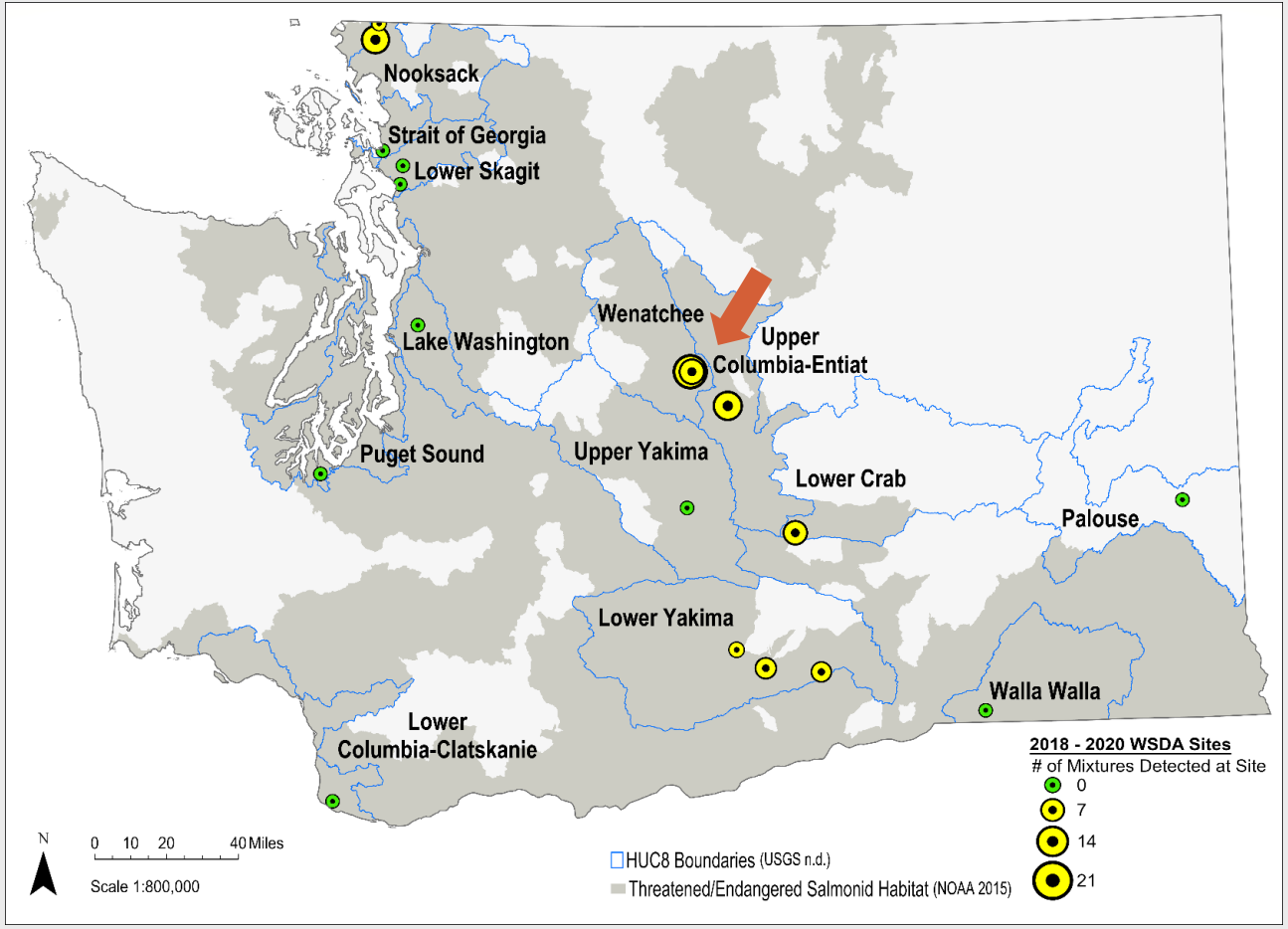
WSDA Surface Water Monitoring Program

- Natural Resources Assessment Section established in 2003
- Sample agricultural and urban streams Mar – Nov
  - All streams currently or historically provided habitat for ESA listed salmonids

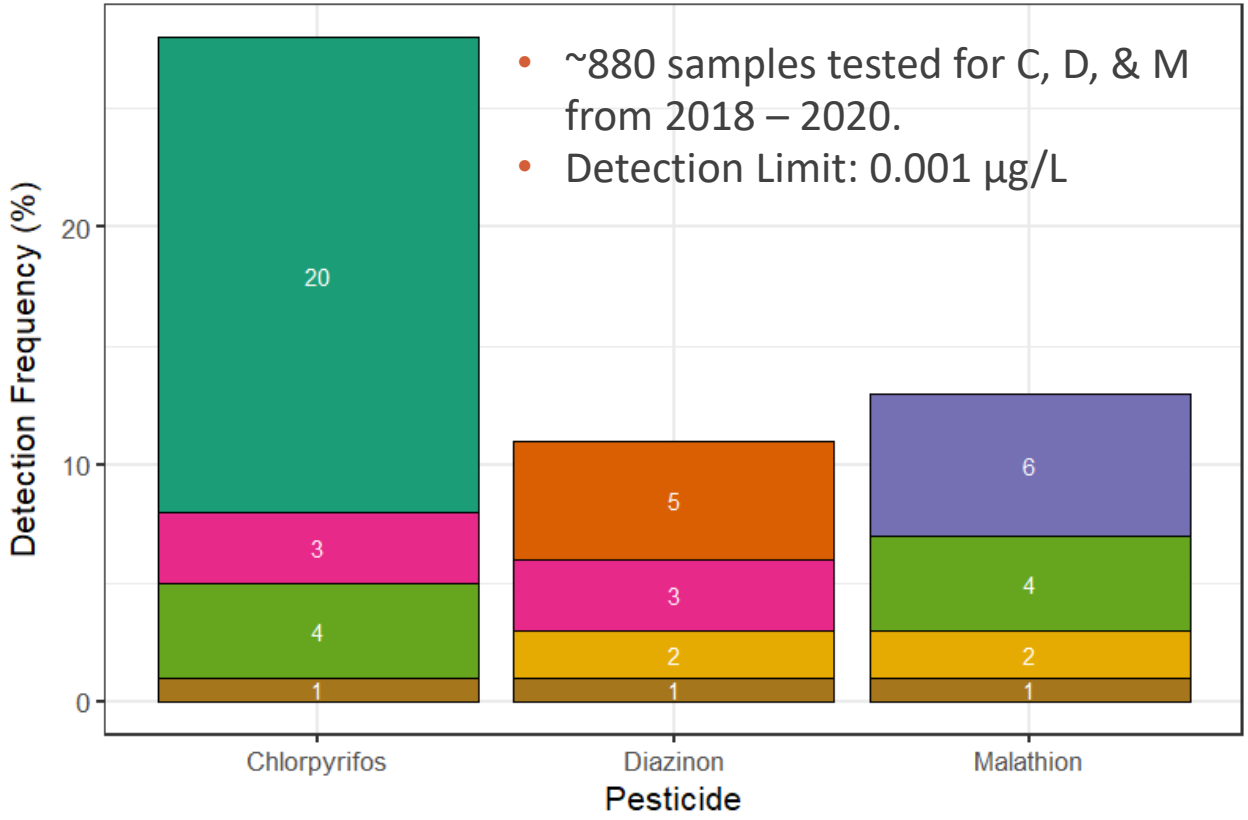


Monitoring Sites



	ESA Status
Chinook	Endangered
Chum	Protected
Coho	Protected
Sockeye	Endangered
Steelhead Trout	Threatened

Detection Frequencies



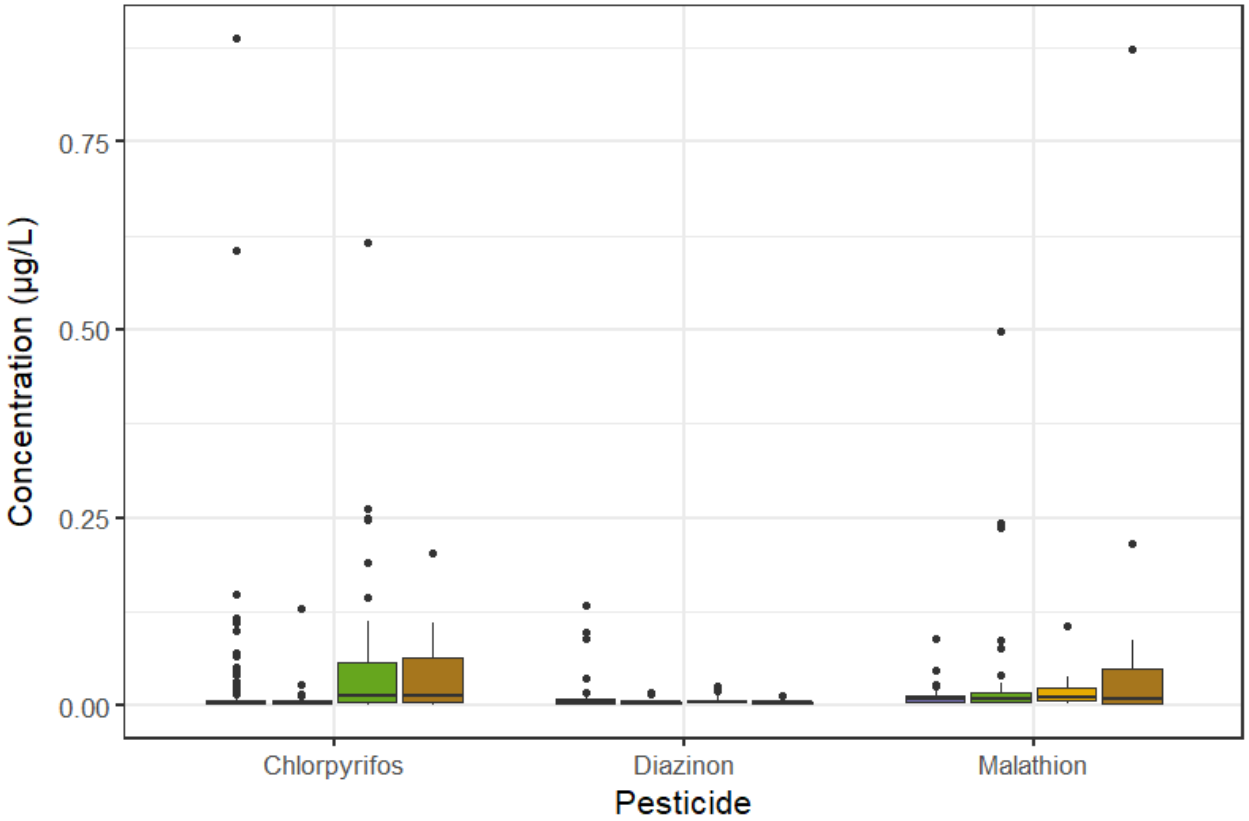
- ~880 samples tested for C, D, & M from 2018 – 2020.
- Detection Limit: 0.001 µg/L

Mixture (# of Detections)

C	(172)
D	(47)
M	(55)
CD	(28)
CM	(39)
DM	(15)
CDM	(12)

- Detections are not double counted across mixtures.

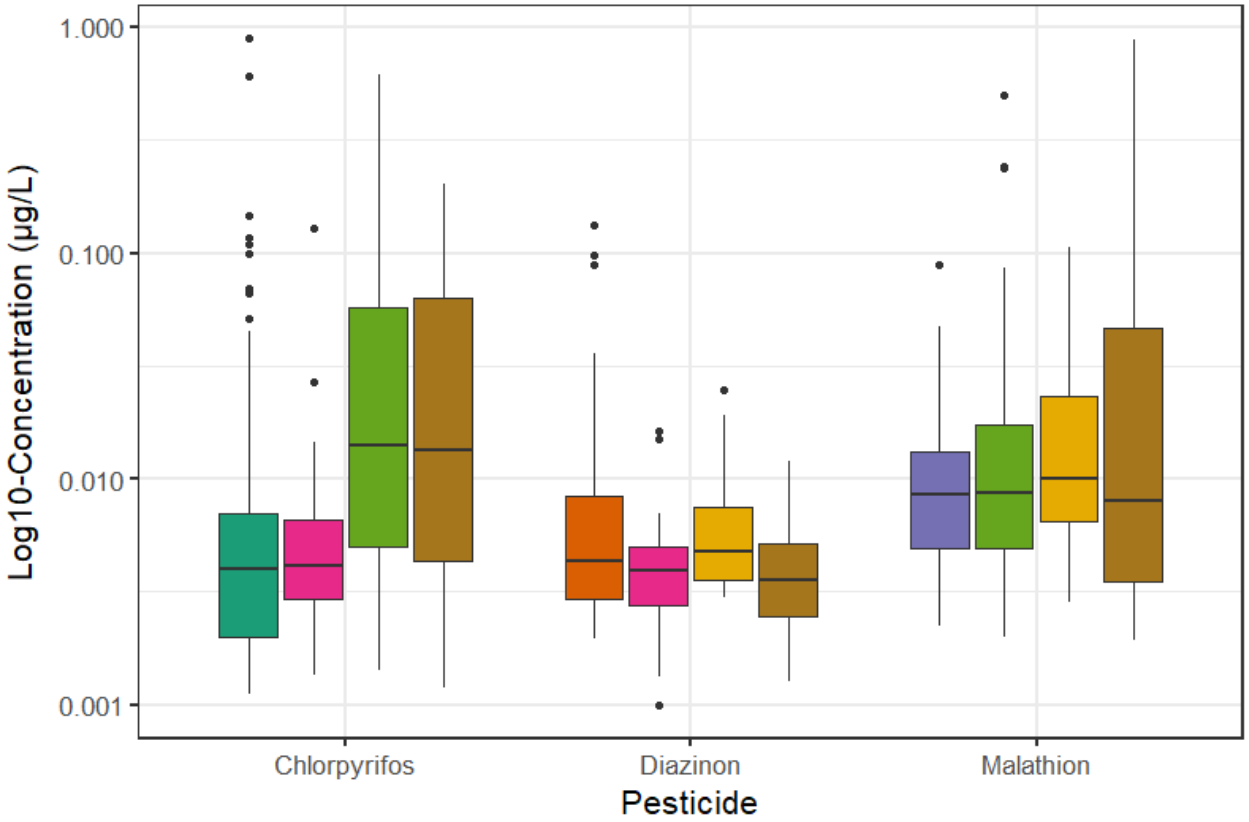
Measured Concentrations



- Concentrations generally higher and more variable in mixtures with C & M

Mixture
- C
- D
- M
- CD
- CM
- DM
- CDM

Measured Concentrations



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Benchmark Quotient (BQ)

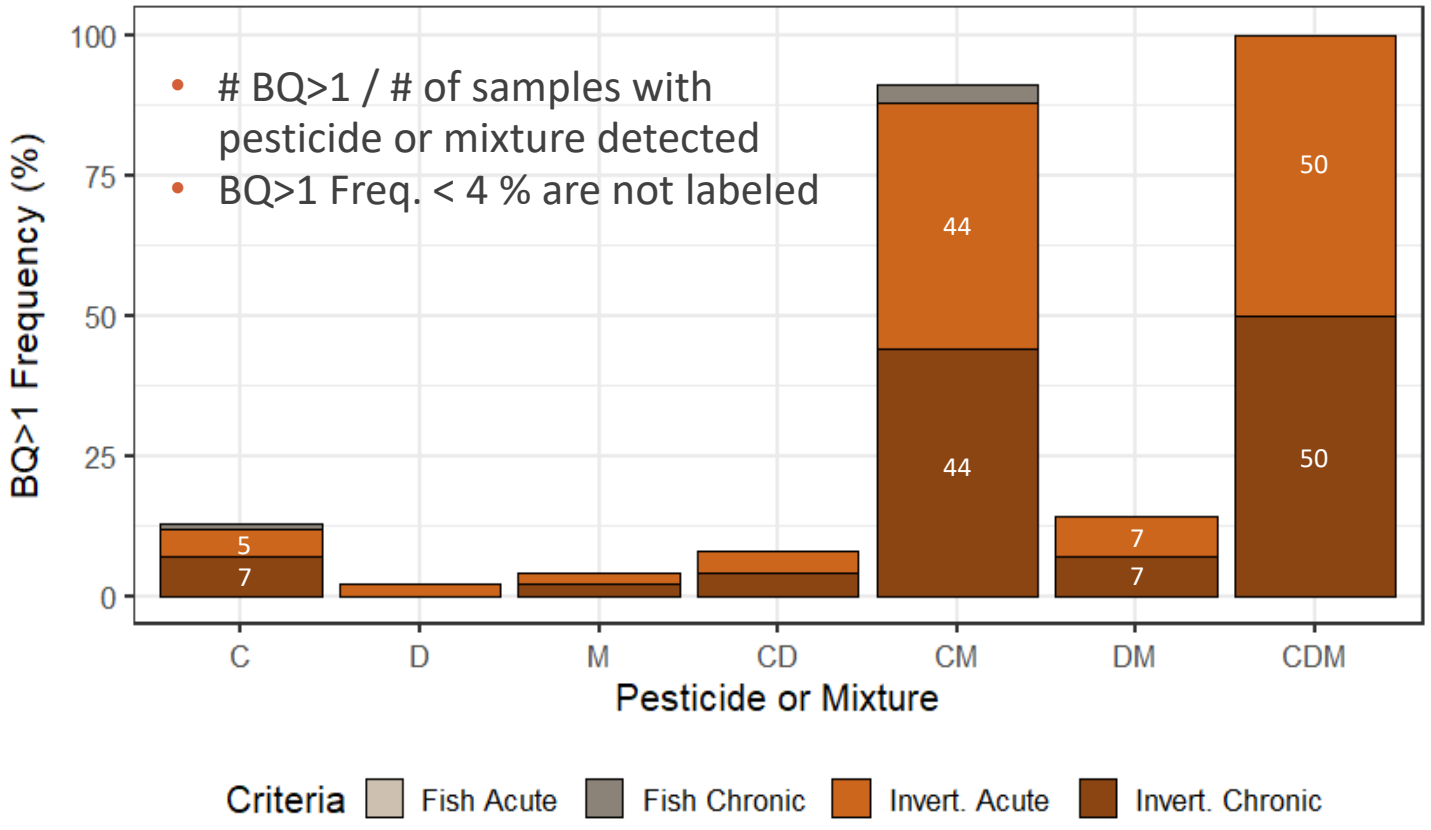
	Invertebrate		Fish	
	Acute (µg/L)	Chronic (µg/L)	Acute (µg/L)	Chronic (µg/L)
Chlorpyrifos	0.05	0.04	0.9	0.57
Diazinon	0.105	0.17	45	0.55
Malathion	0.049	0.06	2.05	8.6

Aquatic Life Benchmarks (EPA 2021)

$$Individual\ BQ = \frac{\text{Measured Concentration}}{\text{Benchmark}}$$

$$Mixture\ BQ = \sum_{i=1}^{n} \frac{\text{Measured Concentration}_i}{\text{Benchmark}_i}$$

BQ>1 Frequencies



Conclusions

- C & M most frequently detected AND most frequently BQ>1
  - Likely primary contributors to overall toxicity of each mixture

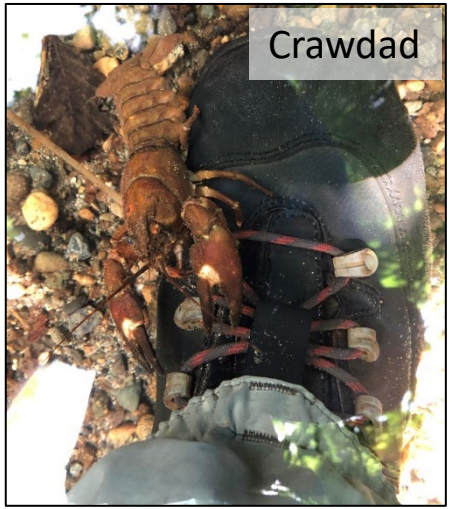
- Mixtures after C tolerance revocation?

Conservatism and Uncertainty

- EPA ALBs apply safety factor (LOC) of 0.5 or 1 to lowest toxicity value (EC_{50}, LC_{50}, or NOAEC)

- BQ analysis did not consider:
  - Water quality parameters
  - Pesticide properties
  - Spatial or temporal patterns

- Only assessed OP mixtures
  - In 2018, up to 44 different analytes were detected in a single sample



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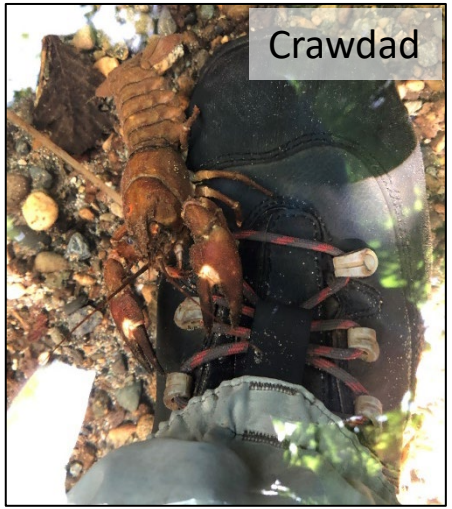

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Future Work

- Refine RA based on more specific scenarios

- Only assessed OP mixtures
  - In 2018, up to 44 different analytes were detected in a single sample

- Assess more pesticide groups with same mode of action

Acknowledgements

- WSDA NRAS
- Dr. Robert Peterson, Montana State University
- Dept. of Ecology Manchester Environmental Lab

Thank you!

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agr.wa.gov/AgScience

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