# Aquatic Risk Assessment

## Organophosphate insecticide mixtures in Washington surface waters

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

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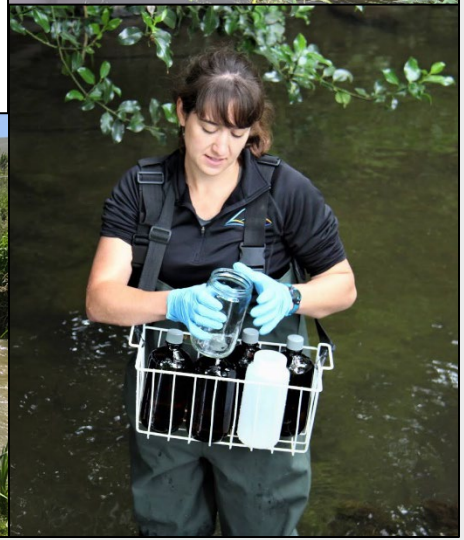
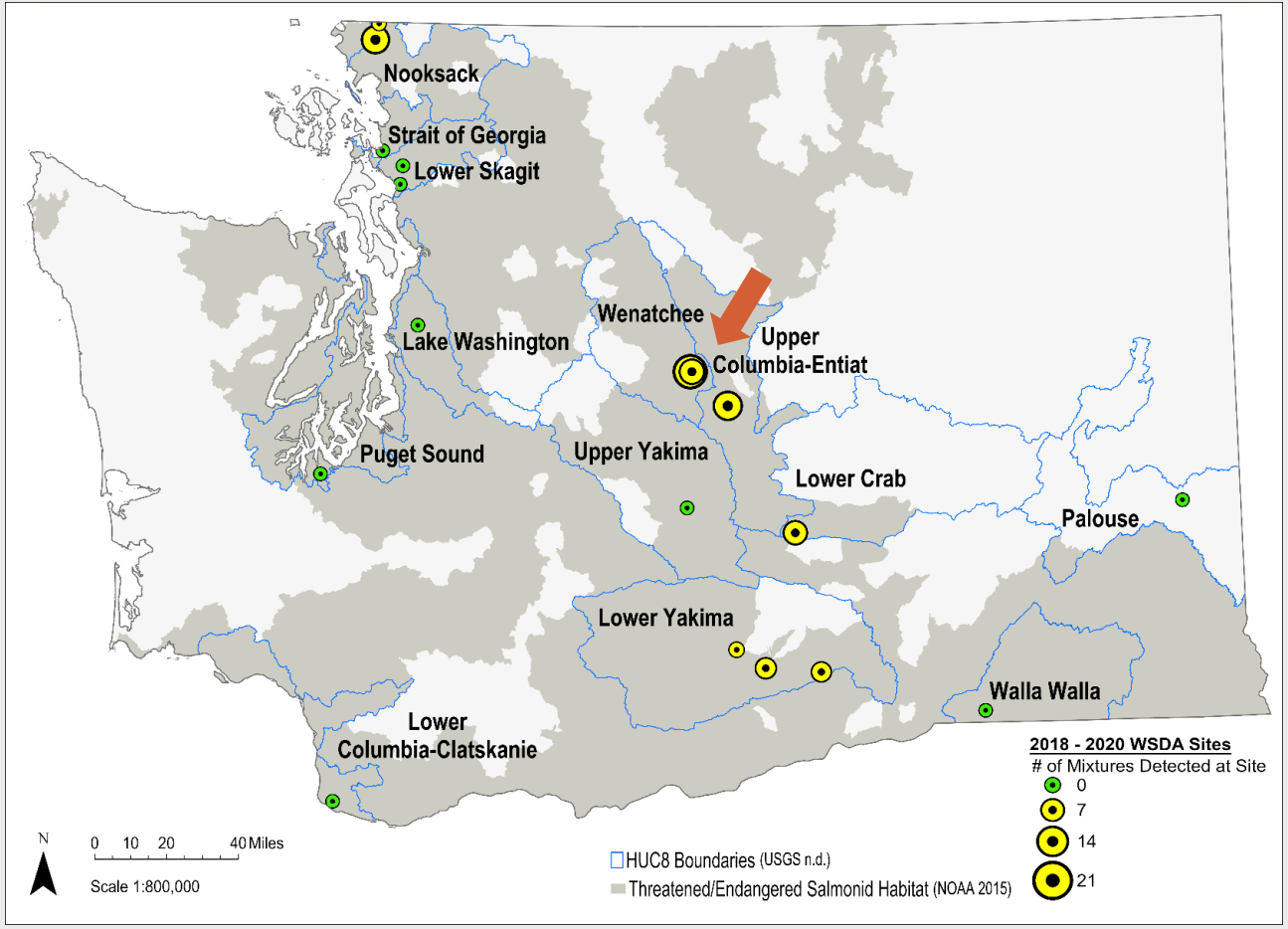
# WSDA Surface Water Monitoring Program

- 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

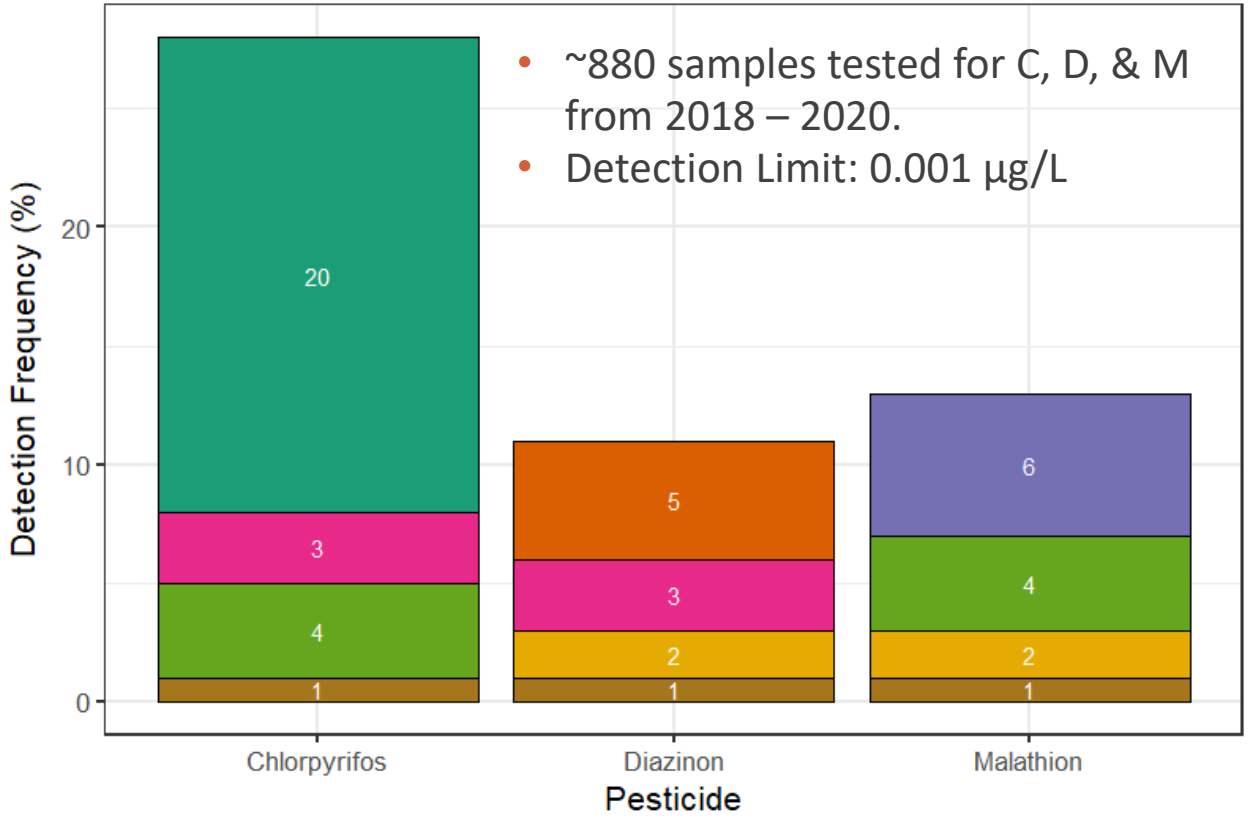


# Monitoring Sites




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

# Detection Frequencies



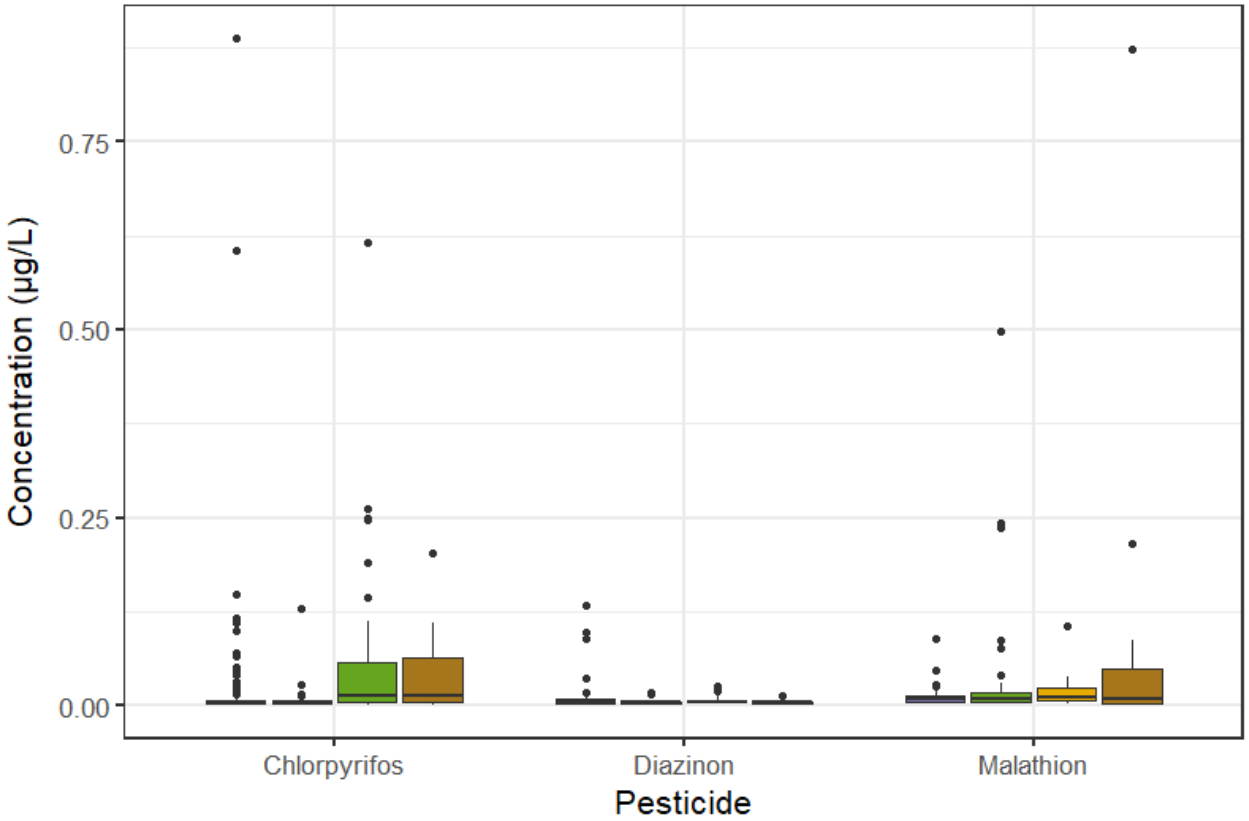

- ~880 samples tested for C, D, & M from 2018 – 2020.
- Detection Limit: 0.001 µg/L

Mixture (# of Detections)

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

- Detections are not double counted across mixtures.

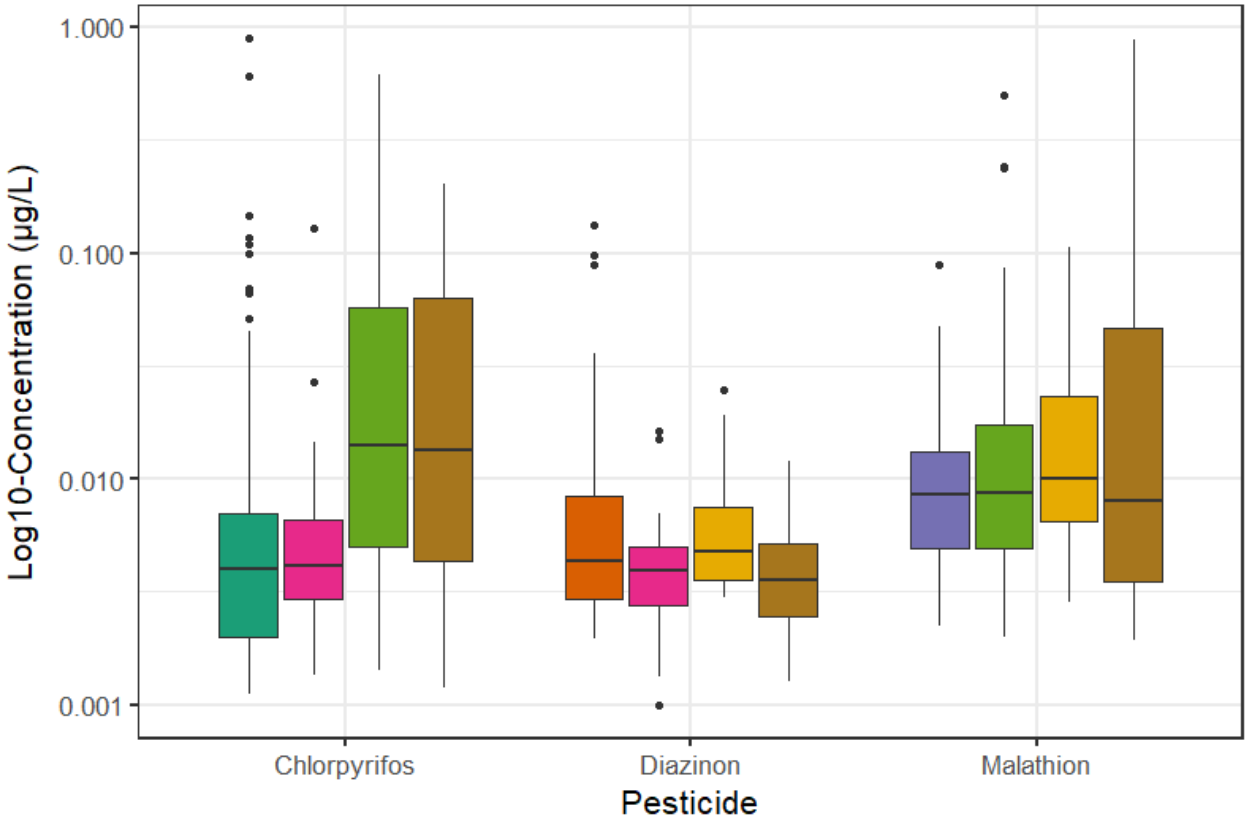
# Measured Concentrations




- 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)

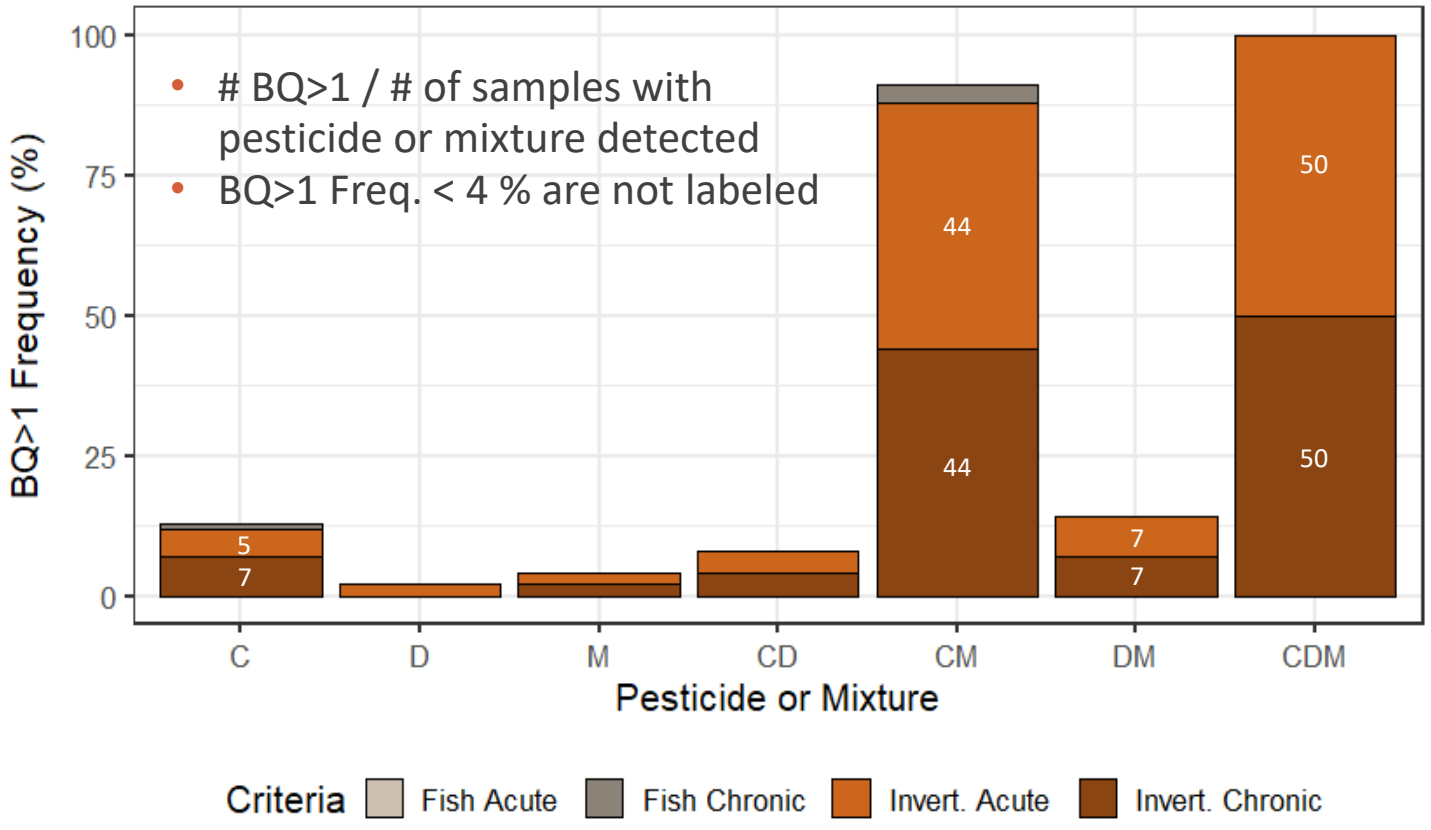
| | Invertebrate | | Fish | |
|---|---|---|---|---|
| | Acute (µg/L) | Chronic (µg/L) | Acute (µg/L) | Chronic (µg/L) |
| Chlorpyrifos | 0.05 | 0.04 | 0.9 | 0.57 |
| Diazinon | 0.105 | 0.17 | 45 | 0.55 |
| Malathion | 0.049 | 0.06 | 2.05 | 8.6 |

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



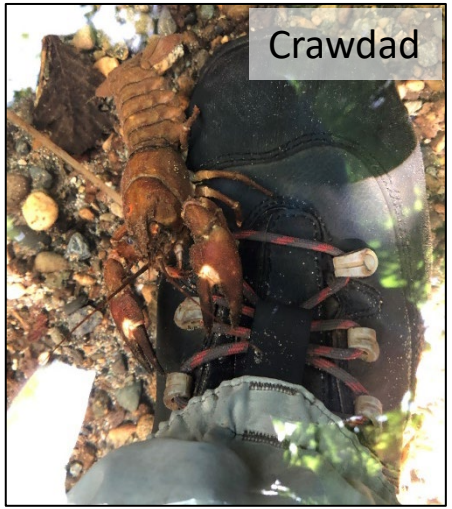
- Mixtures after C tolerance revocation?

# 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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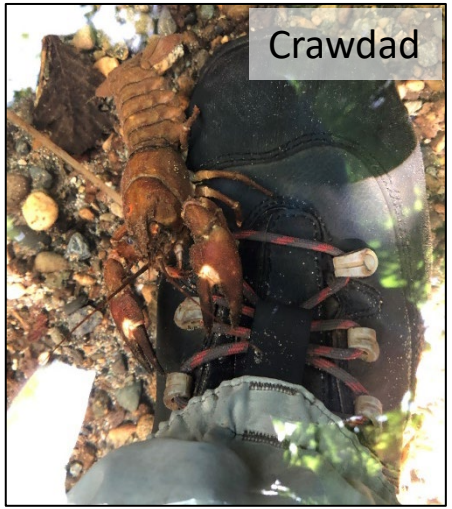


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## Future Work

- 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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