An Assessment of Pesticides, Trace Elements, and Their Potential to Affect Salmonids in the Hood River Basin, Oregon, 1999-2009

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In cooperation with the Confederated Tribes of Warm Springs

U.S. Department of the Interior
U.S. Geological Survey
Effects of pesticides on salmon

- Mortality
- Sub-lethal effects:
  - Physiological
    - Growth, reproduction, olfaction
  - Behavioral
    - Swimming, feeding, predator avoidance, homing
- Effects can be compounded when present together
- Reduced prey availability
Pesticide Stewardship Partnerships

GOAL
Reduced instream pesticide presence

- Stakeholder collaboration
- Education & outreach
- Implement BMPs
- Monitoring

Reduced instream pesticide presence
Summary of sampling locations/schedule: pesticides

- 16 sites
- 953 grab samples
- 78% collected March-June
- 10 OP insecticides, 4 OP degradation products, 2 herbicides (1999-2008)
- 100 pesticides (2009-present)
Objectives

- Summarize pesticide & trace element data collected by ODEQ 1999-2009 in Hood basin
- Use the data to assess potential effects of those contaminants on the health of salmonids that spawn and rear in the basin
- Identify gaps in the dataset
Analysis approach

- Summarize detection concentration & frequency

- Comparators:
  - Water-quality standards
  - Lethal concentrations
  - Concentrations causing sub-lethal effects to salmonids and their macroinvertebrate prey

- Analyze trends
Select findings

- **Herbicides (54% of detections, n=236):**
  - 6 active ingredients detected
  - less-than-harmful concentrations

- **Insecticides (43%, n=188):**
  - 11 detected
  - concentrations exceeded water-quality criteria & effects thresholds

- **Fungicides (3%, n=13), 2009 only:**
  - 2 detected
  - less-than-harmful concentrations
## Findings: Comparisons to thresholds

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Exceeded WQ standards</th>
<th>Exceeded sublethal endpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azinphos-methyl</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>✓</td>
<td>Swimming, Feeding, AChE inhibition, Effects to prey, Growth*, Reproduction*</td>
</tr>
<tr>
<td>Diazinon</td>
<td>✓</td>
<td>Olfaction, Effects to prey</td>
</tr>
<tr>
<td>Malathion</td>
<td>✓</td>
<td>Effects to prey</td>
</tr>
<tr>
<td>Endrin</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Phosmet</td>
<td>-</td>
<td>Effects to prey</td>
</tr>
</tbody>
</table>
Findings: Comparisons to thresholds

**Exceeded WQ standards**

<table>
<thead>
<tr>
<th>Year</th>
<th>AZM (μg/L)</th>
<th>Chlorpyrifos (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
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<tr>
<td>2009</td>
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</tbody>
</table>

**Exceeded sublethal endpoints**

- **AChE inhibition**
- **Prey effects**
- **Swim/feeding**

**Graphs**

1. **AZM > 0.036 μg/L**
2. **Chlorpyrifos > 0.04 μg/L**
Findings: *Comparisons to thresholds*

**Exceeded WQ standards**
- **Diazinon > 0.105 ug/L**
- **Malathion > 0.000026 ug/L**

**Exceeded sublethal endpoints**
- **Prey effects**
- **Olfaction**

**Phosmet**

*Graphs show data from 1999 to 2009 for Diazinon and Malathion.*
Findings: Trends

[Graph showing trends in concentrations of chlorpyrifos in Neal Creek over the years 1999 to 2009. The graph indicates detection values, non-detections, and censored detections.]
Gaps in the dataset

- **Sediment-bound** pesticides may be underrepresented
- Presence of pesticides *used, but not analyzed*
  - Pyrethroids, neonicotinoids
- **Seasonal** presence of pesticides
- **Exposure duration** for aquatic biota
- Effects of pesticide **mixtures** at environmentally realistic concentrations
Sampling since 2009:

- ODEQ/PSP:
  - Continued sampling (grab and passive)
  - Agriculture and forestry
  - Ongoing education and outreach

- USGS passive sampling in basin helps fill data gaps identified in this analysis
  - Results will help guide new monitoring plan
  - May expand to other contaminants of concern
Summary

- PSPs: a unique collaboration
- Some issues addressed
- Ongoing work is addressing data gaps

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Pesticide stewardship

Responsible use of pesticides can help protect bees from pesticide poisoning, protect natural resources such as fish and other aquatic organisms, and avoid resistance development. Information on each of these topics is included below.

**Bees**—Some pesticides used in orchards are highly toxic to bees. To avoid damage to bees, follow label instructions for protecting bees. For detailed information on pesticide toxicity to bees and practices for preventing bee poisoning, see How to Reduce Bee Poisoning from Pesticides (PWM 591): http://extension.oregonstate.edu/catalog/pdf/pmw/pmw591.pdf.

**Buffers**—Many pesticide labels now have specific buffer requirements for use near surface water. To avoid damage to fish and other aquatic organisms, follow label instructions for buffers and drift reduction. Additional information is included below, see “Suggested best management practices for orchard spraying.” Additionally, in the Pacific Northwest, mandatory buffers are required for certain pesticide active ingredients when used near certain fish-bearing streams. For specific requirements, see: http://gov.oregon.gov/00A/PEST/furkims.shtml

**Surface water**—Some pesticides are toxic to fish or other aquatic organisms important for healthy stream ecosystems. To avoid damage to fish and other aquatic organisms, follow label instructions for avoiding surface water contamination. Additional information is included below, see “Suggested best management practices for orchard spraying.”

**Suggested best management practices for orchard spraying**

The OSU Extension Service is working with the Hood River Grower Shipper Association, local packing houses, and chemical suppliers to help protect our water resources while ensuring the continued availability of chemical crop protection tools. The following practices should help minimize the possibility of pesticides and herbicides entering our waterways. You should review your operations and consider adjusting your practices as necessary to follow these recommendations:

- Apply spray tank mix water back into the orchard, do not drain it in one spot.
- Clean up spills immediately. Have spill-absorbent material (cat litter, sand, etc.) available when mixing and loading.

Maintenance and calibration

Maintain your sprayer and equipment in good working order. Regular maintenance will help ensure the best performance of your equipment.
More information


- ODEQ Pesticide Stewardship Partnerships: www.deq.state.or.us/wq/pubs/factsheets/community/pesticide.pdf
Findings:

- **spatial**
  - Detections at 13 sites
  - No detections (3 sites)
  - Exceeded WQ standards (9 sites)
Findings: Mixtures

- 12% of samples with 2+ pesticides detected
  - OPs:
    - Azinphos-methyl (43% of mixture samples)
    - Chlorpyrifos (20%)
  - Herbicides:
    - Simazine (79%)
    - Diuron (31%)
    - Hexazinone (13%)