



Pesticide Concentrations in Ontario's Urban Streams
One Year after the Cosmetic Pesticides Ban

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Background: *Cosmetic Pesticides Ban Act*

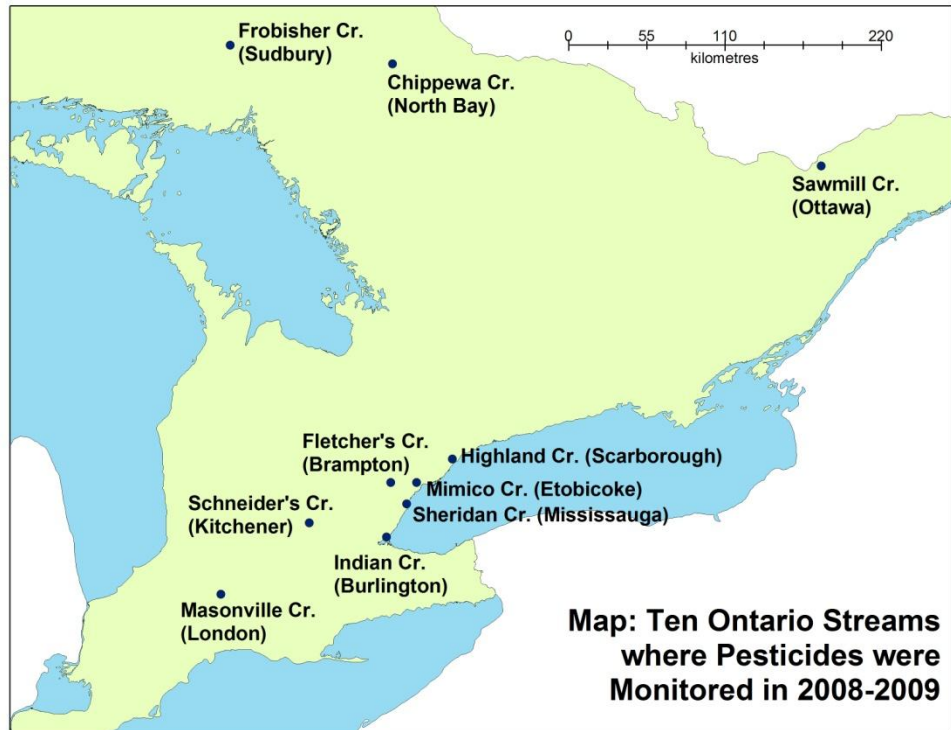
- Ontario's *Cosmetic Pesticides Ban Act*, 2008, amends the *Pesticides Act* to ban the use and sale of pesticides for cosmetic purposes.
- The province-wide ban took effect on April 22, 2009.
- More than 180 pesticide products are banned for sale and the cosmetic uses of over 90 pesticides ingredients have been prohibited.
- Exceptions to the ban are allowed for some industries such as agriculture, forestry and golf courses.
- Consumers are still able to purchase certain pesticide products for health and safety reasons, such as controlling stinging insects and plants poisonous to the touch.

2008-2009 Urban Stream Water Pesticides Study

- In 2008 and 2009, the Ontario Ministry of the Environment, along with five Conservation Authorities, monitored pesticide concentrations in urban streams.
- The study was built upon the ministry's existing stream monitoring activities and partnerships under the Provincial Water Quality Monitoring Network.
- The objectives of the study were to:
 - determine which pesticides were detectable in urban stream water at low levels of analytical detection;
 - quantify the range in concentration of detected pesticides relative to water quality guidelines for the protection of aquatic life; and,
 - determine whether concentrations changed significantly in response to the cosmetic pesticides ban.

Stream Sampling Locations

- Ten streams draining urban watersheds were selected to isolate the cosmetic uses of pesticides from other uses (e.g. agriculture, golf courses).
- Selected watersheds met the following criteria:
 - high proportion of urban/residential land cover;
 - no point sources (e.g. sewage treatment plants);
 - limited agriculture; and,
 - no golf courses (with a few exceptions).



Sample Collection and Laboratory Analysis

- 88 and 80 stream water samples were collected in the summers of 2008 and 2009, respectively, representing the periods before and after the implementation of the Cosmetic Pesticides Ban in April 2009.
- Samples were analyzed for as many as 87 pesticides and 18 degradates.
 - Acid extractable herbicides were measured in all samples.
 - Additional pesticides and degradates were measured in samples from three streams (Sawmill, Highland and Schneider's Creeks).
- Laboratory methods were capable of detecting most analytes at the sub-nanogram per litre level.



Results: Pesticide Detection

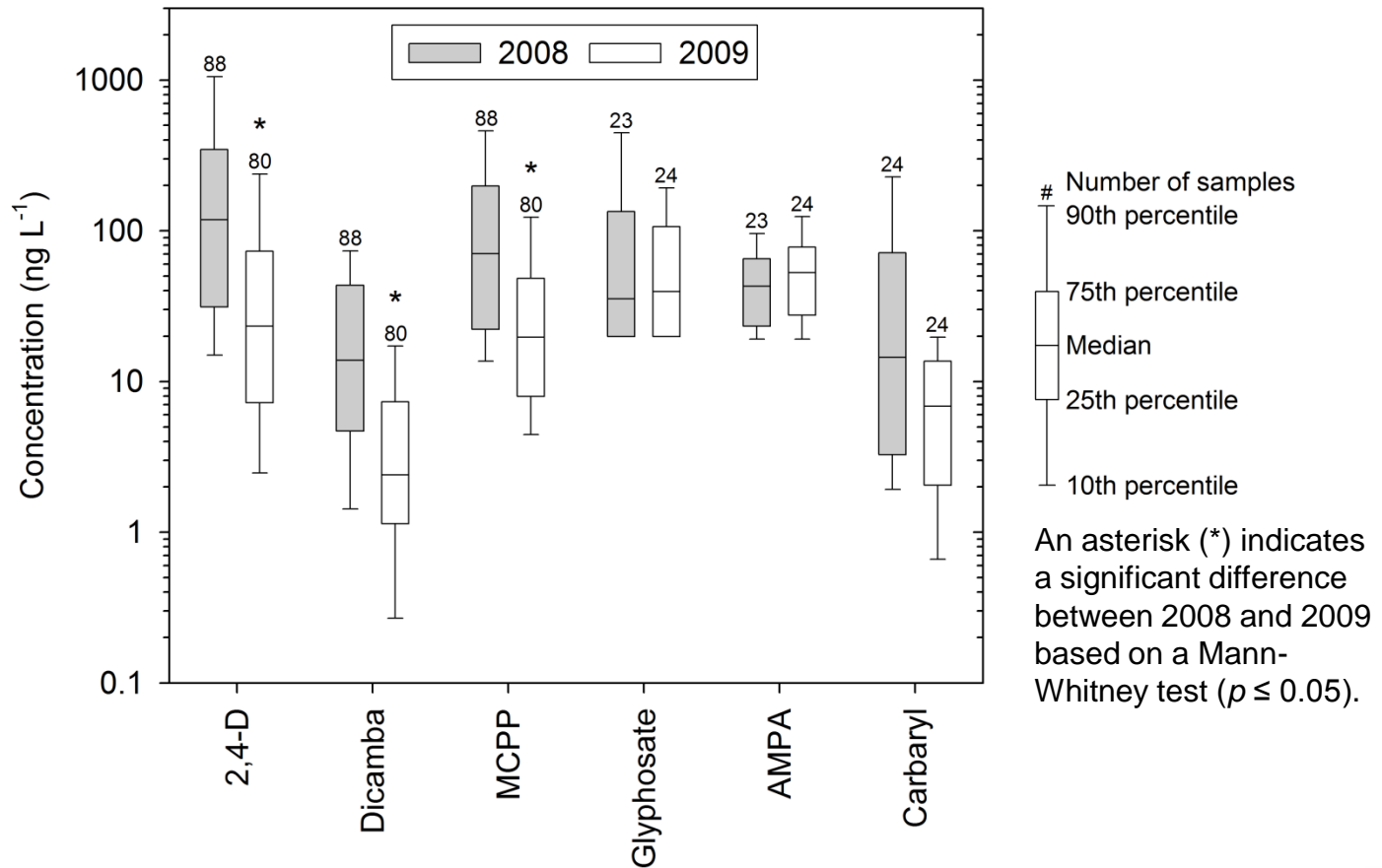
- Combinations of two or more pesticides were observed in all samples.
- A total of 33 pesticides and 3 degradates were detected at least once at a concentration > 1 ng/L.
 - Of these, four pesticides (2,4-D, dicamba, diazinon and MCPP) and one degradate (desethylatrazine) were detected in all of the samples.
- Almost 90% of pesticide measurements were < 10 ng/L.
- Two pesticides (2,4-D and MCPP) were detected at a concentration $> 1,000$ ng/L.
- Selected pesticides accounted for the bulk of the total pesticides concentration in most samples.
- The mean number of pesticides detected per sample in 2009 was marginally less than that observed prior to the ban.

Most Frequently Detected Pesticide Mixtures Before (2008) and After (2009) the Cosmetic Pesticides Ban

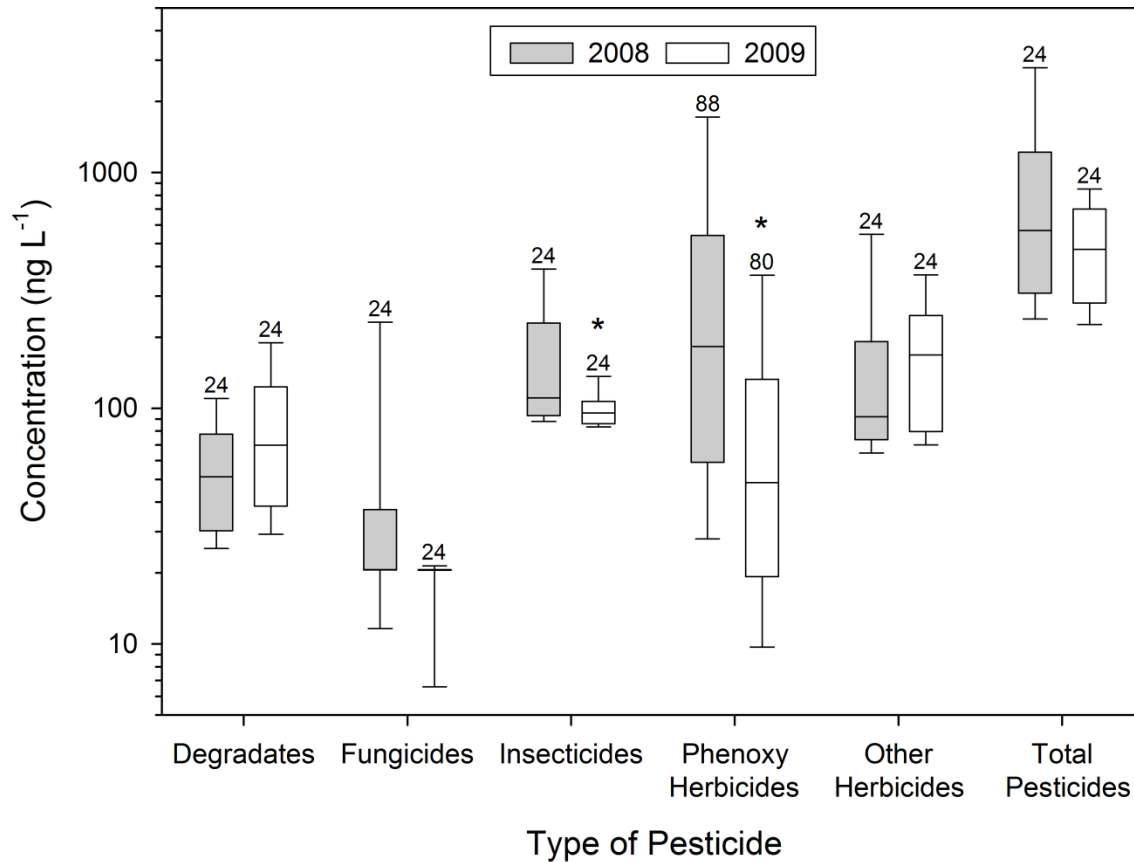
2008 (n = 24)		2009 (n = 24)	
Pesticides in mixture	Percentage of samples with mixture	Pesticides in mixture	Percentage of samples with mixture
2,4-D; MCP	50	2,4-D; MCP	29
2,4-D; glyphosate; MCP	42	2,4-D; glyphosate; MCP	25
2,4-D; carbaryl	29	2,4-D; AMPA	29
2,4-D; carbaryl; glyphosate; MCP	25	2,4-D; glyphosate	29
2,4-D; AMPA; MCP	21	AMPA; glyphosate	29
2,4-D; dicamba; glyphosate, MCP	21	glyphosate; MCP	25

Mixtures include pesticides detected at > 50 ng/L (a level above the laboratory detection limit for all of the 105 analytes).

Concentrations of Selected Pesticides Before (2008) and After (2009) the Cosmetic Pesticides Ban



Concentrations by Pesticide Type Before (2008) and After (2009) the Cosmetic Pesticides Ban



Results: Changes in Pesticide Concentrations

- Concentrations of 2,4-D, dicamba and MCPP in urban stream water were significantly lower after the ban.
- Median concentrations decreased by 81% (2,4-D), 83% (dicamba) and 71% (MCPP).
- Nearly half of the pesticide products banned under the Cosmetic Pesticides Ban contain one or more of 2,4-D, dicamba and MCPP.
- These three herbicides have relatively high solubility and low persistence in surface waters. Concentrations in stream water vary with changes in runoff and application rates.
- Runoff data are of limited availability for the study streams. Rainfall data were used as a surrogate for runoff.

Rainfall Summary (2008 and 2009)

Stream (Creek)	Weather Station	total June-October rainfall (mm)		
		2008	2009	1971-2000
Chippewa	North Bay	591	498	501
Fletcher's, Highland, Mimico, Sheridan	Toronto	519	410	369
Frobisher	Sudbury	447	479	423
Indian	Hamilton	523	543	405
Masonville	Dorchester	450	483	479
Sawmill	Ottawa	405	572	423
Schneider's	Waterloo	520	411	410
	<i>Mean (all stations)</i>	<i>494</i>	<i>485</i>	<i>430</i>

Rainfall data are from Canada's National Climate Archive (www.climate.weatheroffice.gc.ca).

Results: Changes in Pesticide Concentrations (cont'd)

- Concentrations of glyphosate and its degradate AMPA did not change significantly in urban stream water following the ban.
- Cosmetic uses of glyphosate are prohibited under the ban; however, certain uses of glyphosate for health and safety purposes are permitted (e.g. control of poisonous plants) and pesticide products containing glyphosate are still commercially available.
- The ongoing availability and use of glyphosate was likely the reason that concentrations did not change.
- Decreases in carbaryl concentrations in urban stream water following the ban approached statistical significance ($p = 0.053$).
- Over 20 pesticides products containing carbaryl were banned under the Cosmetic Pesticides Ban.

Results: Water Quality Guidelines

- Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life exist for over half of the pesticides detected in the study.
- Pesticides concentrations rarely exceeded these guidelines.
- There were seven measurements exceeding a guideline in 2008 (before the ban) compared to only one in 2009 (after the ban).

Pesticide	CWQG (ng L ⁻¹)	Number of Samples Exceeding the CWQG	
		2008	2009
Carbaryl	200	12.5% (3/24)	0% (0/24)
Permethrin	4	4.2% (1/24)	4.2% (1/24)
Total Phenoxy Herbicides	4,000	3.4% (3/88)	0% (0/80)

Summary of Study Results

1. Mixtures of pesticides were measured in Ontario's urban streams at low levels of analytical detection; however, a few selected pesticides generally comprised the bulk of the total pesticides concentration.
2. Pesticide concentrations rarely exceeded water quality guidelines for the protection of aquatic life.
3. Significant changes in concentrations of selected pesticides were measured after the implementation of Ontario's Cosmetic Pesticides Ban.

Next Steps

- The 2008-2009 study results have been summarized in a report that is posted on the Ontario Ministry of the Environment website:
<http://www.ene.gov.on.ca/en/publications/water/index.php#8b>
- Samples were collected in 2010 at the same sites as in 2008 and 2009. Laboratory analysis of these samples has recently been completed. Statistical analysis of the data is underway.

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