

Changes in Acid Herbicide Concentrations in Urban Streams after a Cosmetic Pesticides Ban

Table S1. Inter-laboratory comparison of acid herbicide concentrations for split samples collected from Indian Creek in 2012, where AXYS = AXYS Analytical Services and NLET = National Laboratory for Environmental Testing.

Pesticide	N	AXYS		NLET		Paired Student's <i>t</i> -test		Wilcoxon signed-rank test	
		Median (ng L ⁻¹)	Mean (ng L ⁻¹)	Median (ng L ⁻¹)	Mean (ng L ⁻¹)	<i>t</i>	<i>p</i> (two tailed)	<i>W</i>	<i>p</i> (two tailed)
2,4-D	8	289	318	298	316	0.21	0.84	8	0.64
Dicamba	8	22	23	21	24	0.78	0.46	14	0.39
Mecoprop	8	84	84	90	86	0.34	0.74	8	0.64

Figure S1. Inter-laboratory comparison of acid herbicide concentrations for split samples collected from Indian Creek in 2012, where AXYS = AXYS Analytical Services and NLET = National Laboratory for Environmental Testing. The solid line represents the one-to-one line. Results of statistical tests for differences are shown in Table S1.

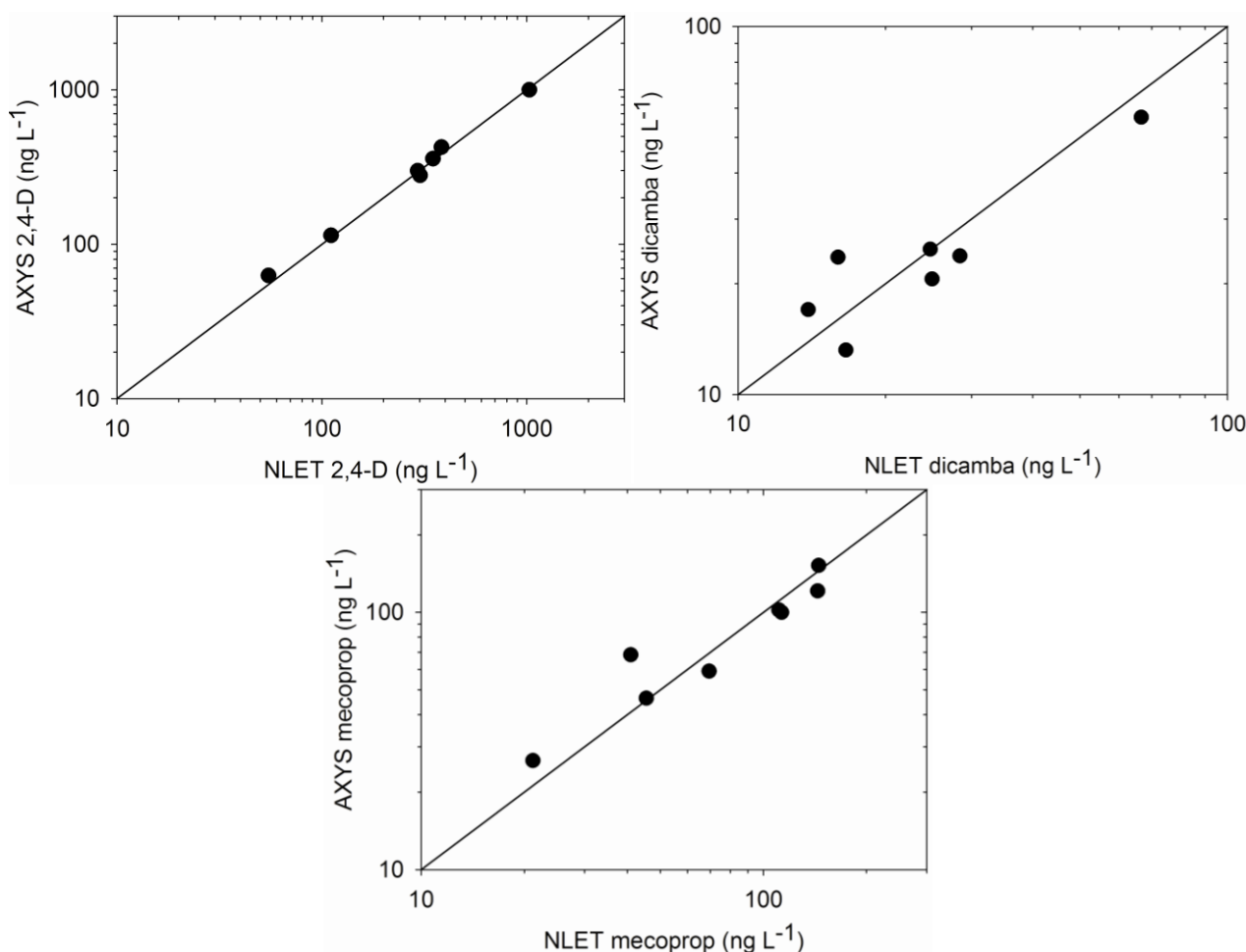


Figure S2. Pre- (2007–2008) and post-ban (2009–2012) herbicide concentrations vs. stream flow for Highland and Mimico Creeks. Statistically significant associations were observed between post-ban concentrations of 2,4-D and mecoprop and stream flow in Highland Creek.

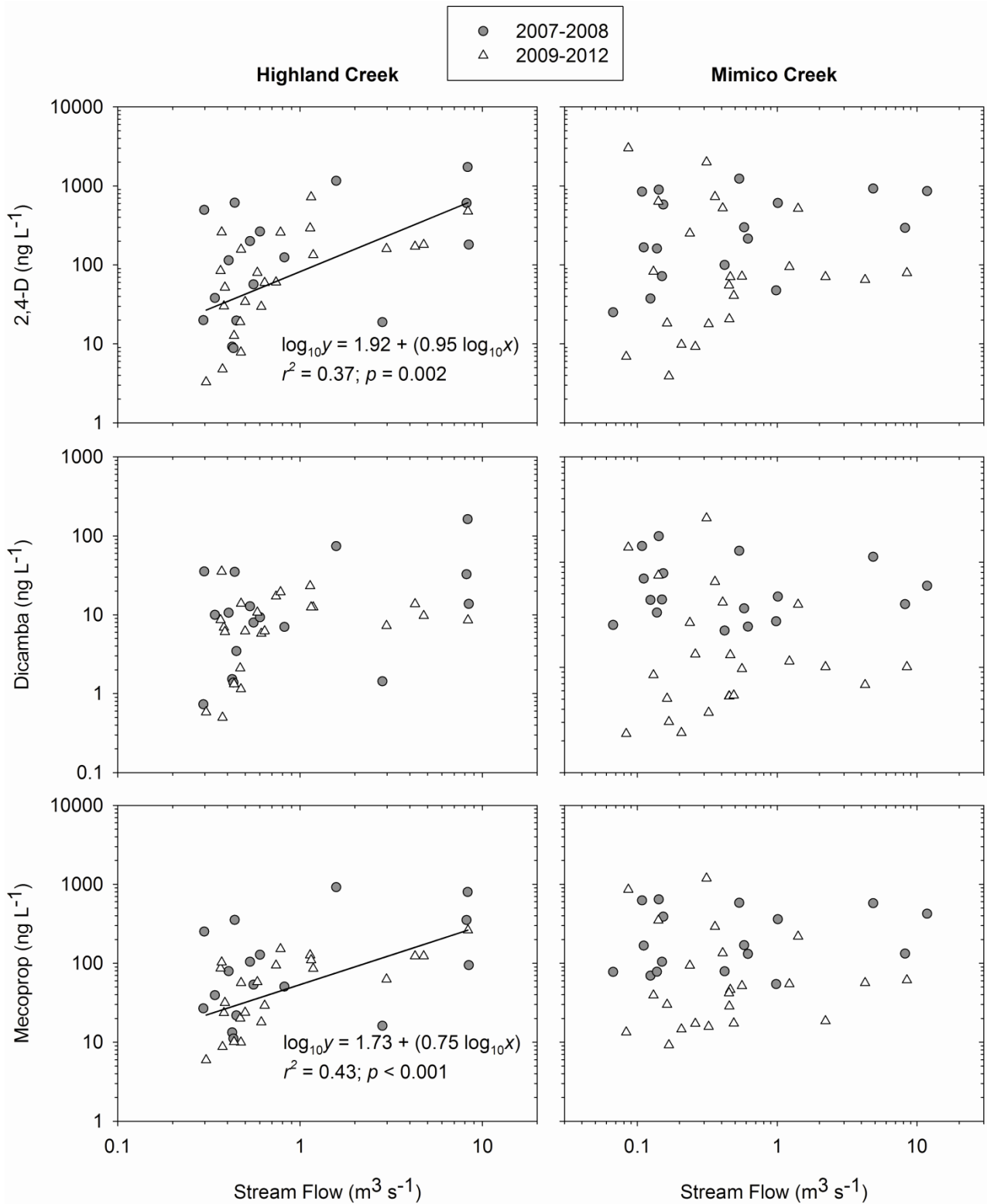


Table S2. Differences in 2,4-D concentrations by stream for the pre-ban (2003–2008) and post-ban (2009–2012) periods.

Stream	N _{pre-ban}	N _{post-ban}	Median _{pre-ban} (ng L ⁻¹)	Median _{post-ban} (ng L ⁻¹)	Mann-Whitney Test		Hodges-Lehmann Estimator	
					U	p (two tailed)	(ng L ⁻¹)	(%)
Chippewa	7	16	19.5	2.8	10	0.002	-15.0	-76.8
Fletcher's	9	16	585	178	47	0.165	-300	-51.4
Frobisher	8	16	75.1	2.1	26	0.022	-12.2	-16.3
Highland	17	23	124	79.8	161	0.345	-26.7	-21.5
Indian	54	45	357	30.9	379	<0.001	-268	-73.0
Masonville	10	16	458	33.3	21	0.002	-398	-87.0
Mimico	17	23	294	70.7	115	0.029	-140	-47.7
Sawmill	26	24	85.6	14.2	92	<0.001	-69.4	-81.0
Schneider's	9	24	481	64.2	56	0.036	-417	-86.7
Sheridan	9	16	102	23.9	33	0.029	-46.9	-45.9

Table S3. Differences in dicamba concentrations by stream for the pre-ban (2003–2008) and post-ban (2009–2012) periods.

Stream	N _{pre-ban}	N _{post-ban}	Median _{pre-ban} (ng L ⁻¹)	Median _{post-ban} (ng L ⁻¹)	Mann-Whitney Test		Hodges-Lehmann Estimator	
					U	p (two tailed)	(ng L ⁻¹)	(%)
Chippewa	7	16	2.0	0.5	14	0.006	-1.3	-63.9
Fletcher's	9	16	61.5	12.4	16	0.002	-40.6	-66.0
Frobisher	8	16	4.4	0.1	17	0.004	-3.6	-82.6
Highland	17	23	10.0	8.6	164	0.389	-1.4	-14.2
Indian	54	45	50.0	4.2	324	<0.001	-36.8	-73.6
Masonville	10	16	44.0	1.5	15	<0.001	-40.1	-91.3
Mimico	17	23	44.1	10.1	71	<0.001	-31.4	-71.1
Sawmill	26	24	8.3	1.2	77	<0.001	-6.3	-75.5
Schneider's	9	24	27.0	4.0	27	0.001	-22.9	-85.1
Sheridan	9	16	12.3	4.6	37	0.047	-6.5	-53.2

Table S4. Differences in mecoprop concentrations by stream for the pre-ban (2003–2008) and post-ban (2009–2012) periods.

Stream	N _{pre-ban}	N _{post-ban}	Median _{pre-ban} (ng L ⁻¹)	Median _{post-ban} (ng L ⁻¹)	Mann-Whitney Test		Hodges-Lehmann Estimator	
					U	p (two tailed)	(ng L ⁻¹)	(%)
Chippewa	7	16	18.6	4.4	4	<0.001	-11.3	-60.7
Fletcher's	9	16	274	101	41	0.084	-156	-56.9
Frobisher	8	16	43.4	6.5	16	0.004	-16.9	-40.0
Highland	17	23	79.2	57.9	154	0.262	-18.7	-23.6
Indian	47	45	196	34.7	264	<0.001	-154	-78.7
Masonville	10	16	236	13.4	17	<0.001	-196	-83.0
Mimico	17	23	167	46.3	80	0.002	-90.1	-53.6
Sawmill	26	24	48.2	10.2	53	<0.001	-39.0	-80.9
Schneider's	9	24	333	36.1	40	0.006	-278	-83.1
Sheridan	9	16	39.9	17.9	45	0.134	-13.8	-34.7

Table S5. Spearman rank order correlations between pre-ban (2003–2008) herbicide concentrations and watershed attributes for the study streams.

	2,4-D	Dicamba	Mecoprop	Area	Urban	Agriculture	Golf	Population Density	Road Density	Stream Density
2,4-D	1.00									
Dicamba	0.88	1.00								
Mecoprop	0.95	0.77	1.00							
Area	0.05	0.08	0.04	1.00						
Urban	0.26	0.32	0.15	0.24	1.00					
Agriculture	0.74	0.67	0.72	0.14	−0.02	1.00				
Golf	−0.10	0.23	−0.10	0.37	0.10	0.08	1.00			
Population Density	0.66	0.41	0.58	0.20	0.36	0.32	−0.60	1.00		
Road Density	0.08	0.02	0.03	0.01	0.82	−0.11	−0.26	0.46	1.00	
Stream Density	0.46	0.52	0.49	−0.08	−0.26	0.46	0.36	−0.01	−0.37	1.00

Absolute values of Spearman correlations > 0.63 are significant at $\alpha = 0.05$ and shown in bold. The Bonferroni correction for evaluating 45 correlations simultaneously increases the critical value for the correlation to 0.87.

Table S6. Spearman rank order correlations between post-ban (2009–2012) herbicide concentrations and watershed attributes for the study streams.

	2,4-D	Dicamba	Mecoprop	Area	Urban	Agriculture	Golf	Population Density	Road Density	Stream Density
2,4-D	1.00									
Dicamba	0.88	1.00								
Mecoprop	0.95	0.77	1.00							
Area	0.05	0.08	0.04	1.00						
Urban	0.26	0.32	0.15	0.24	1.00					
Agriculture	0.74	0.67	0.72	0.14	−0.02	1.00				
Golf	−0.10	0.23	−0.10	0.37	0.10	0.08	1.00			
Population Density	0.41	0.59	0.59	0.20	0.36	0.32	−0.60	1.00		
Road Density	0.02	0.03	0.03	0.01	0.82	−0.11	−0.26	0.46	1.00	
Stream Density	0.52	0.49	0.49	−0.08	−0.26	0.46	0.36	−0.01	−0.37	1.00

Absolute values of Spearman correlations > 0.63 are significant at $\alpha = 0.05$ and shown in bold. The Bonferroni correction for evaluating 45 correlations simultaneously increases the critical value for the correlation to 0.87.

Figure S3. Relative proportions of 2,4-D, dicamba and mecoprop in stream water samples from the study sites (a) before and (b) after the cosmetic pesticides ban.

