Interactions with freshwater biofilms cause rapid removal of common herbicides through degradation – evidence from microcosm studies

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Supplementary information

Table S1 Known metabolites of bentazone, metribuzin and metazachlor. Data from EPA and PPDB.

Parent compound	*Metabolites*	*Properties*			
		log Kow	*Kfoc*	*BCF*	*Vapour pressure (mPa)*
Bentazone	2-amino-N-isopropylbenzamide	1.5			
	N-methyl bentazone	1.34	257.5		
	8-hydroxy-bentazone	1.55		10.6	
	6-hydroxy bentazone				
	3-isopropyl-4,5-dioxo-1,3,4,5,6,7-hexahydrocyclopenta[c][1,2,6]thiadiazine-6-carboxylic acid 2,2-dioxide				
	[2-(isopropylcarbamoyl)phenyl]sulfamic acid, salts (Ref: M351H024)				
Metribuzin	diketo-metribuzin (Ref: BCS-AG59919)	0.9			0.000081
	desaminodiketo-metribuzin	1.49			0.051
	desamino-metribuzin (Ref: BCS-AA91084)		43.7		0.0065
	4-amino-6-(1,1-dimethylethyl)-1,2,4-triazine-5(4H)-one				
	6-tert-butyl-4,5-dihydro-1,2,4-triazin-5-one-3-mercapturic acid				
	6-(1-hidroxy-1-methyl-ethyl)-3-methylsulfanyl-4H-[1,2,4]-triazine-5-one				
	4-methyl-6-(1,1-dimethylethyl)-1,2,4-triazine-3,5(2H,4H)-dione				
Metazachlor	metazachlor oxalic acid (Ref: BH479-4)	3.01	24.6	3.24	
	metazachlor sulfonic acid (Ref: BH479-8)		0.5		
	C16H19N3SO4; Metazochlor M09; 479M09				
	C15H18N3SO2; Metazochlor M11; 479M011				
	C14H13N3O5; Metazochlor M12; 479M012				

Table S2 Biofilm sorption of herbicides as % of initially added amount (mean ± 1 SD, n=4).

Herbicide	Exposure level	day 1	day 8	day 16
Bentazone	high	0.02% ± 0.005%	0.03% ± 0.002%	0.01% ± 0.002%
	low	0.02% ± 0.011%	0.02% ± 0.004%	0.01% ± 0.002%
Metazachlor	high	0.03% ± 0.001%	0.09% ± 0.018%	0.05% ± 0.005%
	low	0.05% ± 0.007%	0.11% ± 0.017%	0.06% ± 0.008%
Metribuzin	high	0.07% ± 0.009%	0.06% ± 0.004%	0.02% ± 0.002%
	low	0.51% ± 0.096%	0.23% ± 0.052%	0.06% ± 0.022%

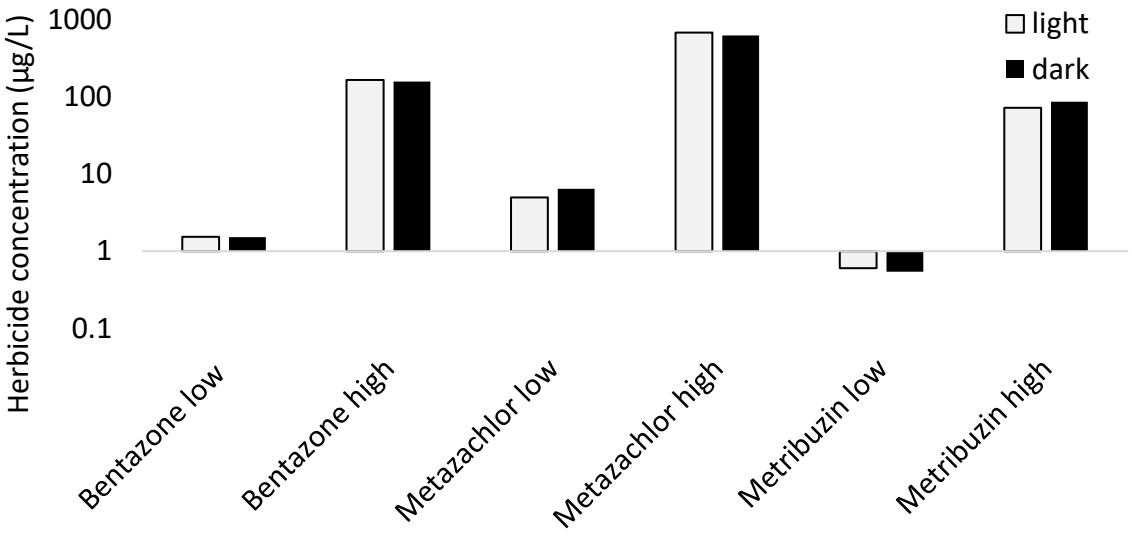

Figure S1 Herbicide water concentrations (log scale) after 16 days in light and dark treatments without biofilms.

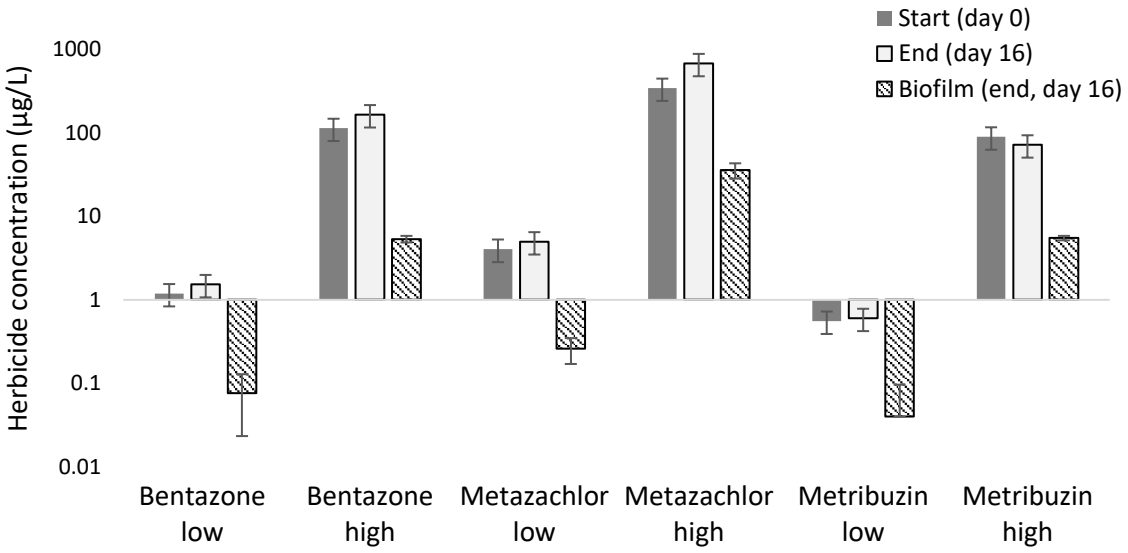

Figure S2 Herbicide water concentrations in treatments with and without biofilms (patterned and plain bars, respectively). Error bars represent measurement uncertainty for replicates without biofilm and standard deviation among replicates with biofilm. The concentrations in treatments with biofilm are calculated from DPM, disintegrations per minute (see text for details).