California Department of Pesticide Regulation
Environmental Monitoring Branch

DEPARTMENT OF PESTICIDE REGULATION (DPR)   Date: April 21, 2022

SURFACE WATER AMBIENT MONITORING REPORT

1. Study highlights

- DPR Study Number   310
- SURF ([Surface Water Database](#)) Study Number   658
- Study Title   **Surface Water Monitoring for Pesticides in Agricultural Areas of Northern California, 2020**
- Project Lead   Mason Zoerner
- Email   Mason.Zoerner@cdpr.ca.gov
- Protocol Source (*protocol available online for five years, thereafter, request a copy from the SWPP list of archived files*) [Environmental Monitoring Protocol Page](#)

- Study Area

    County: Butte, Colusa, Merced, Stanislaus, Sutter, Yolo

    Waterbody/Watershed: Lower Logan Creek, Willow Creek, Clarks Ditch-Colusa Basin Drain, Lower Cottonwood Creek, South Slough-Deadman Creek, Town of Hilmar-San Joaquin River, Ingram Creek

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- Land use type   ☒ Ag   ☐ Urban   ☐ Forested   ☐ Mixed   ☐ Other

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- Water body type

    ☒ Creek   ☐ River   ☐ Pond   ☐ Lake

    ☒ Drainage Ditch   ☐ Storm drain outfall   ☐ Other   Enter other type

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- Objectives

1) Determine the presence and concentrations of selected pesticides in surface waters and sediments collected from selected sites; 2) Assess potential impacts to aquatic organisms by comparing measured pesticide concentrations to USEPA aquatic life benchmarks; 3) Determine the toxicity of collected water samples using toxicity tests conducted on representative test organisms.

- Sampling period   May 2020 to December 2020

- Major findings

    INSECTICIDES IN WATER: Overall, the most frequently detected insecticidal active ingredients (AIs) were as follows: methoxyfenozide (92%), bifenthrin (24%), chlorantraniliprole (17%), and imidacloprid (14%). AIs with detection frequencies (DFs) between 3% and 8% include dimethoate, clothianidin, permethrin, and malathion. Other monitored insecticides were not detected in any samples collected

during 2020. Four insecticides exceeded their lowest USEPA (United States Environmental Protection Agency) aquatic life benchmarks (BMs), including bifenthrin, imidacloprid, and permethrin. Their BM exceedance frequencies were 9%, 5%, and 1%, respectively.

HERBICIDES AND FUNGICIDES IN WATER: Listed by greatest DF (%), herbicides that were detected, included thiobencarb (60%), propanil (33%), oxyfluorfen (25%), diuron (25%), S-metolachlor (22%), hexazinone (18%), isoxaben (18%), pendimethalin (13%), and oryzalin (3%). The aquatic BM exceedance frequencies were 13% for oxyfluorfen and 6% for thiobencarb. Fungicides detected in 2020 included azoxystrobin, propiconazole, and pyraclostrobin, with detection frequencies of 75%, 18%, and 9%, respectively. There were no fungicide concentrations that exceeded aquatic life BMs. Other monitored herbicides and fungicides were not detected in any sample collected in 2020.

PYRETHROIDS IN SEDIMENT: Three sediment samples were collected in October 2020 from the Sacramento and San Joaquin Valleys. Samples were screened for bifenthrin, cyfluthrin, cypermethrin, esfenvalerate/fenvalerate, lambda cyhalothrin, and permethrin. However, no pyrethroids were detected in any of the 2020 sediment samples.

TOXICITY: Twelve samples, collected in June and September, were used for toxicity testing. The 96-hour toxicity tests were conducted on an acute exposure basis, measuring survival of test organisms, *Hyalella azteca* and *Chrionomus dilutus*. Significant levels of toxicity to either test organism were not observed as a result of these tests.

- Recommendations for pesticides that need a CDFA analytical method (from SWMP):

  Paraquat dichloride, glufosinate ammonium

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2. Pesticide detection frequency

Data available in [SURF](#) upon yearly update. Contact Project Lead for data not yet uploaded. In SURF, use "SURF Study Number" (Section 1) for obtaining the data.

Table 1. Pesticides detection in water

Pesticide	Sample Number	Detection Number[1]	Detection frequency (%)[1]	Minimum Reporting Limit (µg/L)	Lowest USEPA benchmark (BM) (µg/L)[2]	BM Type[3]	Number of BM exceed-ances	BM exceedance frequency (%)
Abamectin	36	0	0	0.02	0.17	IA	0	0
Acetamiprid	36	0	0	0.02	2.1	IC	0	0
Atrazine	36	0	0	0.02	1	NVA	0	0
Azoxystrobin	36	27	75	0.02	44	IC	0	0
Benfluralin	16	0	0	0.05	1.9	FC	0	0
Bensulide	11	0	0	0.02	11	IC	0	0
Bifenthrin	37	9	24	0.001	0.00005	IC	9	24
Boscalid	8	0	0	0.02	116	FC	0	0
Bromacil	11	0	0	0.02	6.8	NVA	0	0
Carbaryl	36	0	0	0.02	0.5	IC	0	0
Chlorantraniliprole	36	6	17	0.02	3.02	IC	0	0

Pesticide	Sample Number	Detection Number[1]	Detection frequency (%)[1]	Minimum Reporting Limit (µg/L)	Lowest USEPA benchmark (BM) (µg/L)[2]	BM Type[3]	Number of BM exceed-ances	BM exceedance frequency (%)
Chlorfenapyr	3	0	0	0.1	2.915	IA	0	0
Chlorpyrifos	36	0	0	0.02	0.04	IC	0	0
Clothianidin[3]	36	3	8	-	0.05	IC	-	-
Cyfluthrin	37	0	0	0.002	0.00012	IC	0	0
Cypermethrin	37	0	0	0.005	0.00005	IC	0	0
Cyprodinil	11	0	0	0.02	8.2	IC	0	0
Desulfinyl Fipronil	11	0	0	0.01	0.53	FC	0	0
Desulfinyl Fipronil Amide	11	0	0	0.01		(no BM)	0	0
Diazinon	36	0	0	0.02	0.105	IA	0	0
Diflubenzuron	36	0	0	0.02	0.00025	IC	0	0
Dimethoate	36	3	8	0.02	0.5	IC	0	0
Diuron	36	9	25	0.02	0.13	VA	1	3
Esfenvalerate/ Fenvalerate	37	0	0	0.005	0.0000309	IC	0	0
Ethalfluralin	16	0	0	0.05	0.4	FC	0	0
Ethoprop	11	0	0	0.02	0.8	IC	0	0
Etofenprox	11	0	0	0.02	0.17	IC	0	0
Fenamidone	8	0	0	0.02	4.7	FC	0	0
Fenhexamid	8	0	0	0.02	101	FC	0	0
Fipronil	11	0	0	0.01	0.011	IC	0	0
Fipronil Amide	11	0	0	0.01		(no BM)	0	0
Fipronil Sulfide	11	0	0	0.01		(no BM)	0	0
Fipronil Sulfone	11	0	0	0.01	0.22	IC	0	0
Fludioxonil	8	0	0	0.02	14	IC	0	0
Hexazinone	11	2	18	0.02	7	NVA	0	0
Imidacloprid	36	5	14	0.01	0.01	IC	5	14
Indoxacarb	11	0	0	0.02	75	IC	0	0
Isoxaben	11	2	18	0.02	10	VA	0	0
Kresoxim-methyl	11	0	0	0.02	30.3	NVA	0	0
Lambda Cyhalothrin	37	0	0	0.002	0.00004	IA	0	0
Malathion	36	1	3	0.02	0.049	IA	0	0
Mefenoxam	8	0	0	0.02	1200	IC	0	0
Methidathion	11	0	0	0.02	0.66	IC	0	0
Methomyl	11	0	0	0.02	0.6	IC	0	0
Methoxyfenozide	36	33	92	0.02	3.1	IC	0	0
Metribuzin	11	0	0	0.02	8.1	NVA	0	0
Norflurazon	11	0	0	0.02	9.7	NVA	0	0
Oryzalin	36	1	3	0.02	13	VA	0	0
Oxadiazon	11	0	0	0.02	0.88	FC	0	0

Pesticide	Sample Number	Detection Number[1]	Detection frequency (%)[1]	Minimum Reporting Limit (µg/L)	Lowest USEPA benchmark (BM) (µg/L)[2]	BM Type[3]	Number of BM exceed-ances	BM exceedance frequency (%)
Oxyfluorfen	16	4	25	0.05	0.29	NVA	2	13
Pendimethalin	16	2	13	0.05	5.2	NVA	0	0
Permethrin Total	29	1	3	0.001	0.0033	IA	1	3
Prodiamine	16	0	0	0.05	1.5	IC	0	0
Prometon	11	0	0	0.02	98	NVA	0	0
Prometryn	11	0	0	0.02	1.04	NVA	0	0
Propanil	36	12	33	0.02	9.1	FC	0	0
Propargite	36	0	0	0.02	7	IA	0	0
Propiconazole	11	2	18	0.02	15	FC	0	0
Pyraclostrobin	11	1	9	0.02	1.5	NVA	0	0
Pyriproxyfen	36	0	0	0.015	0.015	IC	0	0
Quinoxyfen	11	0	0	0.02	13	FC	0	0
Simazine	36	0	0	0.02	6	NVA	0	0
S-Metolachlor	36	8	22	0.02	8	NVA	0	0
Tebuconazole	8	0	0	0.02	11	FC	0	0
Tebufenozide	11	0	0	0.02	29	IC	0	0
Tebuthiuron	8	0	0	0.02	50	NVA	0	0
Thiabendazole	8	0	0	0.02	42	IC	0	0
Thiacloprid	8	0	0	0.02	0.97	IC	0	0
Thiamethoxam	36	0	0	0.02	0.74	IC	0	0
Thiobencarb	35	21	60	0.02	1	IC	2	6
Trifloxystrobin	36	0	0	0.02	2.76	IC	0	0
Trifluralin	16	0	0	0.05	1.9	FC	0	0

[1] Clothianidin detections are qualitative only

[2] Benchmarks are used as a screening tool for risk analysis

[3] FA, fish acute; FC, fish chronic; IA, invertebrate acute; IC, invertebrate chronic; NVA, non-vascular acute; VA, vascular acute

Table 2. Pesticide detection in sediment

Pesticide	Sample Number	Detection Number	Detection frequency (%)	LC_{50} (µg/kg OC)*	Detection Frequency > LC_{50} (%)
Bifenthrin	3	0	0	0.52	NA
Cyfluthrin	3	0	0	1.08	NA
Cypermethrin	3	0	0	0.38	NA
Esfenvalerate/Fenvalerate	3	0	0	1.54	NA
Lambda Cyhalothrin	3	0	0	0.45	NA
Permethrin	3	0	0	10.83	NA

*LC50 is derived from published values (from Amweg et al. 2005, Toxicol. Chem. 24:966-972; Amweg and D.P. Weston 2007, Environ. Toxicol. Chem. 26:2389-2396; Maund et al. 2002, Environ. Toxicol. Chem., 21:9-15)

3. Tracking Exceedances of Aquatic Benchmarks or Sediment LC$_{50}$ values

For further data analysis: pesticides that have $\geq$ 10% aquatic benchmark exceedance rate or exceed their OC normalized sediment LC$_{50}$ for three consecutive years are recommended for further detailed data analysis if no analysis has been complete in the past five years (Ambient Urban Monitoring Methodology SOP METH014).

Table 3. Pesticides with three consecutive years of either 1) $\geq$ 10% of their detections exceeding their lowest USEPA aquatic life water benchmark or 2) percentage of sediment detections exceeding their sediment LC$_{50}$ (normalized to OC).

Pesticide	Matrix	Current year (2020)	2019	2018	Last written evaluation (reference)	Further data analysis (Y/N)
Bifenthrin	Water	24	23	8	Budd et al. (2020)	N
Imidacloprid	Water	14	9	4	Deng et al. 2019	Y
Oxyfluorfen	Water	13	7	0	Ensminger et al. (2013)	Y

4. Quality Control

Table 4. Laboratory Quality Control (QC) summary

QC Type	Sample Matrix	Total Number	Number of QC Out of Control
Blind Spike	Water	91	0
Lab Blank	Water	139	38
Matrix Spike	Water	9	0
Surrogate Spike	Water	78	0
Lab Blank	Sediment	8	0
Matrix Spike	Sediment	8	0

All lab blanks, blind spikes, and surrogate spikes were within the QC limits. Matrix spikes of 38 pesticides in the LC screen were out of the QC control range. The lab estimated this is 20-25% higher than usual due to a prolonged storage period in the refrigerator. Analytical results for 8 samples associated with the matrix spikes were included in this report without any changes, and flagged in the monitoring result datasheet, which is available upon request.

5. Data: water quality, aquatic toxicity, and analytical chemistry results

Water quality data, aquatic toxicity data, and monitoring results are available upon request. Please contact the Project Lead or SURF database administrator for the data.