

In 2017, the Idaho State Department of Agriculture (ISDA) conducted a pesticide residue-monitoring program at four locations in the Rock Creek watershed near Twin Falls, Idaho (Figure 1). Four locations were monitored on an everyother-week basis on the mainstem Rock Creek. The upstream location was on US Forest Service managed land off of Rock Creek Road at site RFS. The agricultural dominated lands were roughly bisected with monitoring near E3275N at site RTF. The RHY location was at the CSI hatchery, approximately at the southern end (upstream) location of much of the Twin Falls urban area. Whereas the RCC location was above the confluence of the Snake River, but within the Snake River Canyon. Monitoring was initiated on May 16, 2017, and samples were collected at all sites through October 18, 2017. The samples were delivered to and analyzed by the Idaho Food Quality Assurance Laboratory (IFQAL), located in Twin Falls, Idaho.



This monitoring project was designed to determine if there were significant pesticide sources to the mainstem of the Rock Creek. Locations were selected to identify potential input source areas by comparing upstream-downstream differences. One of the objectives was whether there were identifiable urban pesticide sources between the RHY and RCC locations.

The Rock Creek headwaters are within the US Forest Service managed lands south of Twin Falls, ID, within the Sawtooth National Forest. It was presumed that application and use of pesticides within this portion of the watershed would be minimal, and therefore the RFS location would be acceptable as a reference location to determine the potential source sub-watersheds by identifying where there were increases to the pesticide concentrations within the creek.

Drain waters and seeps were identified between the RHY and RCC locations, therefore the goal to identify urban inputs was not sufficiently effective to separate out urban from rural inputs. However, the collected data does indicate that additional monitoring of inputs and tributaries to Rock Creek is required to meet this goal and that ground water seeps into the canyon may also have pesticide contributions that may not be readily identified through surface water monitoring.

Of the nine (9) pesticide compounds identified, no pesticide was measured at concerning levels (Table 1 and Figure 2). The pesticide with the greatest number of detections was the herbicide 2,4-D. Over half of the 2017 detections (10 of 19) were 2,4-D. The RFS site, located on US Forest Service managed lands, had one low-level detection of the herbicide 2,4-D. The 2,4-D herbicide is one of the most commonly detected pesticides in Idaho's surface waters. The effects of long-term low-level concentrations of 2,4-D on aquatic life are unknown.

Table 1. Overall Detections.

Location	Herbicide	Fungicide	Insecticide	Total
RFS	1	0	0	1
RTF	4	0	0	4
RHY	4	0	1	5
RCC	7	2	0	9
Total	16	2	1	19

There were three additional pesticide detections that were not herbicides. Two fungicides and one insecticide were detected. Oxamyl was the only insecticide detected during the study, it was detected at the RHY site. Overall, eleven (11) of the detections occurred on two monitoring dates, however, there was a lack of consistency between upstream and downstream locations, indicating inputs and/or a change in the chemistry.

Assessment of potential impacts to the aquatic life and habitat was beyond the scope of this study. Based on the extended duration of greater than average discharges in Rock Creek in the spring of 2017, there may have been dilutional flows that led to pesticides not being identified in the creek that might have been at levels above detection in other years. However, there are sufficient data to identify sub-watersheds to direct future monitoring.

Additional monitoring locations at tributaries/canals between RHY and RCC will better identify urban versus rural pesticide sources zones.

Pesticides of Concern

ISDA defines a pesticide of concern (POC) as any pesticide that is detected at a concentration that is greater than or equal to fifty percent (\geq 50%) of an established US EPA Aquatic Life Benchmark. Table 2 lists the pesticides detected in 2017, the number of detections, the maximum detection concentration, the maximum detected concentration, and whether those pesticides have historically been considered a POC in the surface waters of Idaho. None of the pesticides detected in 2017 were at POC levels in Rock Creek. The benchmarks are developed for acute and chronic effects on fish, aquatic invertebrates, and acute effects on vascular and nonvascular plants. Acute toxicity of a pesticide refers to the effects from a single dose or repeated exposure over a short period of time (i.e. a few hours or a day). Chronic toxicity is the ability of a substance to cause adverse health effects resulting from long-term or repeated low levels of exposure.



Figure 2. Pesticide detections and type.

 Table 2. Rock Creek Detections-ISDA historically

 identified Pesticides of Concern or Pesticides of Interest.

Conclusions

Maximum Number of Detection Historic ISDA Detections POC/POI $(\mu g/L)$ Pesticide Type POI 2, 4-D 10 Herbicide 1.100 0.037 POI ATRAZINE 1 Herbicide 1 BROMACIL Herbicide 0.150 POI CHLOROTHALONIL 1 Fungicide 0.076 POI DIURON 1 Herbicide 0.370 POI EPTC 0.068 POI 2 Herbicide METRIBUZIN 1 Herbicide 0.055 POI OXAMYL 1 Insecticide 0.320 POC PROPICONAZOLE 1 Fungicide 0.041 POI

There greatest detection in the Rock Creek was for 2,4-D at the RTF location. This detection was at 1.1 μ g/L (approximately 1.1 parts per billion), but the 299.2 μ g/L reference point is for aquatic vascular plants, being that 2,4-D is an herbicide and most detrimental to vascular plants when detected in surface waters. Additionally, 2,4-D has a Drinking Water Standard (also known as a Maximum Contaminant Level [MCL]) set at 70 μ g/L. None of the 2,4-D detections are considered a POC level detection, however, 2,4-D is considered a Pesticide of Interest (POI) as it is commonly detected in Idaho's surface waters. Ten of the 19 detections of pesticides in Rock Creek in 2017 were 2,4-D. It was also detected at every monitoring location ISDA tested at in Rock Creek (Table 2).

There was one detection of Chlorothalonil, a fungicide, which has potential impacts on aquatic invertebrates. The detection was at 13% of the Chronic Aquatic Invertebrate benchmark. Diuron, an herbicide was measured at 15% of the non-vascular plant acute benchmark. While these maximum detections do not exceed a benchmark or other reference point, the concentrations are noted for follow-up monitoring and outreach. While all of the detections were at levels well below any aquatic life benchmarks, these detections indicate that there is opportunity to improve the retention of these pesticides in the locations they were intended. These herbicides are regularly detected in Idaho's surface waters and are pesticides of interest.

There is concern that these low level concentrations may lead to additional impairments to the Rock Creek habitat and beneficial uses. However, assessment of impacts to the aquatic life and habitat was beyond the scope of this study. Transport of pesticides from their applied location not only decreases their effectiveness where applied, but also represents an economic loss.

Recommendations

The following items are several precautions that can be taken when applying pesticides:

- Read and follow label directions Always follow label directions for water quality protection.
- Conduct maintenance and calibration of application equipment, match application rates to pest problem.
- Implementation of management strategies Field scouting, evaluation of pest control needs selection of proper pesticide, irrigation management, etc.
- Implement BMPs, including conservation buffers, vegetative filter strips, sediment basins, and pump back systems.
- Avoid runoff due to weather events, excessive irrigation and check the forecast prior to pesticide applications.
- Avoid overspray and drift, do not mix and load near water.

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