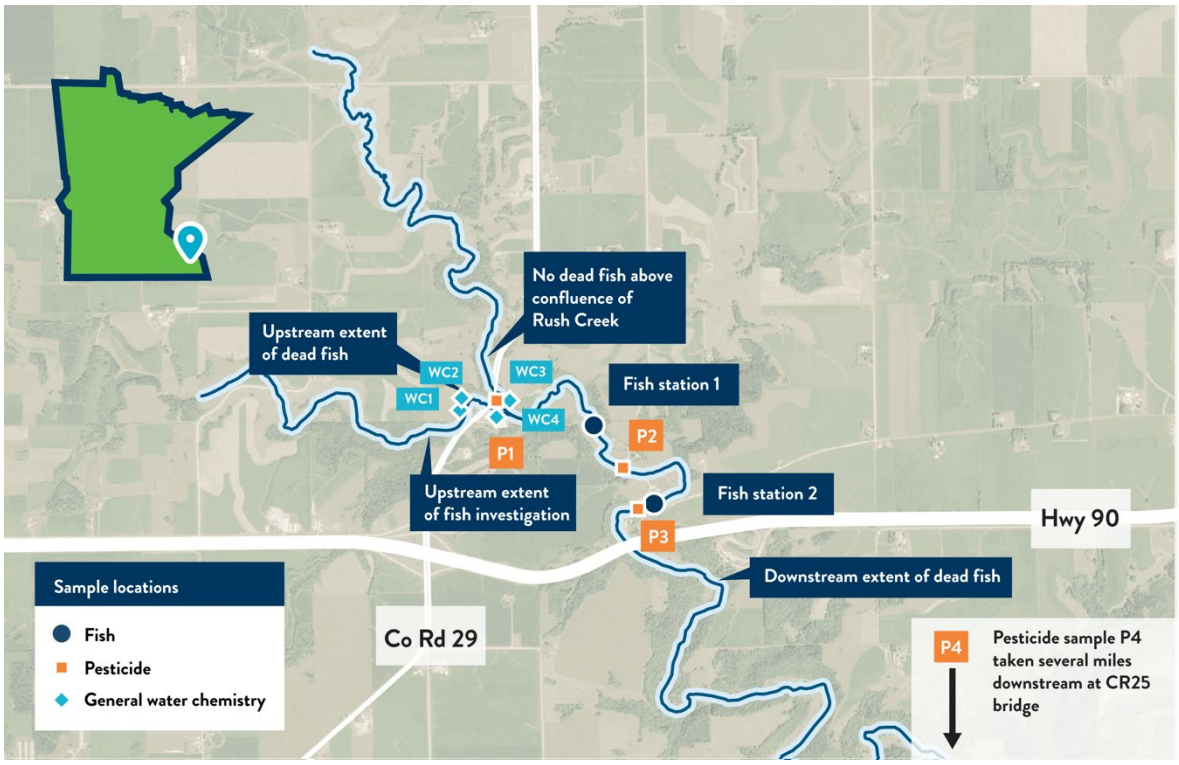
Rush Creek fish kill response — Winona County

Summary

Rush Creek is a cold-water trout stream that begins just south of the city of Lewiston in Winona County. It flows in a southerly direction into Fillmore County and eventually joins the Root River at the city of Rushford. Rush Creek is highly valued by trout anglers.



Rush Creek investigation map

On the evening of July 25, 2022, the Minnesota Duty Officer (MDO) received a report of several dead fish in Rush Creek. Local staff from the Minnesota Department of Natural Resources (MDNR) and Minnesota Pollution Control Agency (MPCA) began coordinating a response immediately. The field response began the following morning, July 26, and included staff from Winona County, the Minnesota Department of Agriculture (MDA), MDNR, and MPCA.

Fisheries staff from the MDNR estimated that more than 2,500 fish were killed, including at least 1,900 brown trout. The remaining species included white sucker and mottled sculpin. The responding agencies concluded that the fish kill likely happened after a significant runoff-producing local rainfall event on July 23, 2022 (1.5 inches to 2 inches that fell in a short period of time). Several factors may have contributed to the fish kill including warm temperatures, recent upstream applications of manure and pesticides, and low-flow conditions in the creek prior to the rainfall, resulting in limited dilution of the contaminated runoff.

Two branches of Rush Creek converge in the area of the fish kill; one from the north in the direction of Lewiston, the other from the west. Because no dead fish were observed in the branch from the north, it was concluded that the contaminated runoff came from the 10 square-mile area that drains to the western branch. This eliminated from consideration a wastewater discharge from the City of Lewiston.

First report, response, extent, and size of fish kill

Following the report to the Minnesota Duty Officer, local staff from DNR and MPCA began coordinating a response on the evening of July 25, 2022.

On July 26, MDNR Fisheries staff, MPCA feedlot staff and water monitoring staff, MDA pesticide monitoring staff, and Winona County feedlot staff were all on site. MDNR Fisheries staff walked the stream to determine the geographic extent of the fish kill and to document the type, size, and number of fish lost. MPCA and Winona County feedlot staff evaluated livestock facilities and a manure application field in the vicinity of the fish kill and began a broader survey of livestock facilities in the larger upstream drainage area. MPCA and MDA monitoring staff made visual observations, took field measurements, and collected water chemistry samples as well as macroinvertebrates at multiple locations on Rush Creek.

White sucker fish found in Rush Creek

MDNR Fisheries staff determined that the fish kill occurred over two miles of Rush Creek from just upstream of Winona County Road 29 to downstream of Interstate Highway 90. Their survey of 1,050 feet of Rush Creek collected 162 brown trout, 27 white sucker, and 23 mottled sculpin. The estimated total number of fish killed were 2,523 including 1,921 brown trout, 325 white sucker, and 277 mottled sculpin. *For information about fish by location, type, size, and quantity, see Tables 1-3 in the Appendices.*

On the morning of July 27, DNR Fisheries staff noticed after a second, smaller rainfall event, that the western branch of Rush Creek was cloudy and discolored as compared to the branch from the north. Fisheries staff collected water samples for analysis by MPCA and MDA.

In subsequent days, additional investigatory visits were made to the area, including a visit on August 4 that included a stream ecologist from Winona State University accompanying MDNR Fisheries staff surveying aquatic macroinvertebrates in Rush Creek.

Water sample results

MPCA and MDA staff coordinated water quality sampling on July 26 at multiple locations on Rush Creek. The samples were analyzed for 182 different pesticide analytes (including fungicides and insecticides) and 13 different general water chemistry analytes (*see Table 4 in Appendices*) typically measured during fish kills. None of the analytes were detected at elevated levels.

Additional samples were also taken on July 27, after a small rain event. This rain event produced observed runoff and stream response, so a sample was collected to gain information about potential sources that may have still been present in the watershed. Elevated levels of E. coli bacteria (an indicator of manure or sewage) and phosphorus were present in this sample, but the remaining general water quality parameters were not found at elevated levels. Compared to the July 26 sample, some

additional pesticides were detected, but not at elevated levels. The results showed organic pollution, which is common for a runoff event in this region. *See Table 5 for pesticide sample results.*

Organic pollution results from the decomposition of living organisms and their by-products. This includes decaying plant material, manure and human sewage, livestock feed, and waste products from the food processing industry. Organic pollution can be directly or indirectly toxic to fish and other aquatic life.

Typically, water quality impacts from fish kill events are difficult to capture unless samples are collected within a short period of time (i.e., ideally within 24 hours). Streams will often fall back to "normal" water chemistry levels very quickly after storms due to constant inflows of new groundwater. By the time water samples were taken on Rush Creek (two to three days after the storm event), the contamination that killed the fish had already moved downstream and/or was significantly diluted, making it difficult to detect in water quality samples.

Aquatic macroinvertebrate sample results

There were two primary purposes for the macroinvertebrate sampling conducted by a stream ecologist from Winona State University and MDNR Fisheries staff. The first purpose was to help understand whether there would be broader or lingering ecological impacts to Rush Creek beyond the fish that died at the end of July. Macroinvertebrates play a key role in a stream's food chain. In simple terms, they eat algae and other organic matter and become food for fish. While fish are highly mobile and can recolonize rapidly, it would take some time for macroinvertebrates to return to an area where they were severely impacted. The second purpose for the sampling was to provide clues to possible causes of the fish kill, as fish and macroinvertebrates have different susceptibilities to pollutants.

The intent of the macroinvertebrate sampling was to assess conditions at multiple locations in the fish kill zone, and to compare these results with a sample from the non-impacted north branch of Rush Creek. There was also a limited opportunity to compare with previous macroinvertebrate sampling on Rush Creek.

The macroinvertebrate sampling results indicate that whatever killed the fish in Rush Creek did not harm the macroinvertebrate community in an appreciable way. A comparison of the macroinvertebrate data collected on Rush Creek above and below the confluence with the South Tributary stream did not show any differences that suggest an impact to the macroinvertebrate community. Similarly, a comparison between the data collected in the South Tributary, to the data collected on the upstream and downstream reaches did not show any discernable differences. There were subtle differences in the data, but not more than would be expected to occur naturally.

Combined with the pesticide water sample results, the lack of impact to the macroinvertebrate community may suggest pesticides were less of a factor in the fish kill as compared to organic pollution.

Feedlot and pesticide use survey results

MPCA and Winona County staff conducted multiple feedlot inspections and in-field land application inspections in the area of the fish kill on July 26, July 27, and Dec 12, as well as a stockpile investigation on Aug 11. These inspections included feedlot facility inspections, review of land-application of manure records, and in-field land-application inspections. Winona County feedlot staff requested land application of manure records from all facilities located within the 10 square-mile watershed in the western branch of Rush Creek. Of the 100 landowners contacted regarding manure application and manure stockpiling activities, Winona County received more than 60 responses. Winona County determined that those who did not respond were not feedlot owners, were small feedlot owners who were not required to maintain land-application records or were small land/feedlot owners whose land

did not directly impact the stream (meaning the land was in the watershed, but any run-off from the land would flow overland across others property prior to making it into a Rush Creek).

The inspections and records review showed that two facilities within the watershed had inadequate or incomplete records, as well as setback violations from sinkholes and special protection areas. This resulted in notices of violation issued to these two facilities. However, during the course of the in-field land-application inspections, no evidence of direct discharge to Rush Creek was found. The MDA surveyed property owners in the vicinity of Rush Creek to identify potential pesticide applications in the area. During the MDA's investigation, they identified cropland that had received pesticide applications around the time of the rain event on July 23. After reviewing application records and applicator interviews, the MDA found no label violations associated with these applications.

Fish kill cause: Burst of rain; contaminated runoff; low creek flows

Responding state agencies concluded that contaminated runoff following a significant rainfall event on July 23 likely caused the fish kill. As discussed previously, several factors may have contributed to the fish kill including warm temperatures, recent upstream applications of manure and pesticides, and low-flow conditions in the creek prior to the rainfall, resulting in limited dilution of the contaminated runoff. It is difficult to determine how a mix of contaminants might interact to harm fish. Warm summer temperatures and lower flows may also elevate stream temperatures; this in turn may stress cold-water fish species and make them more susceptible to mortality, although there is no direct evidence that this was the case here.

Infectious disease may also be an important factor associated with fish kills in Minnesota, and opportunistic bacterial pathogens are implicated in multiple freshwater fish mortality events each year. However, infections disease was ruled out as a major contributing factor to the Rush Creek mortality event since standard pathological inspection (including parasite screening, viral and bacterial culture) did not uncover any infectious agents.

Fish community recovery

As we have observed in recent fish kills, fish will continue to return to the section of stream where the kill occurred, but it will take years to replace the larger fish that previously resided in this section of stream. Rush Creek is known for having abundant brown trout, is larger than most area streams, and is over 22 miles long. These are all factors that increase resiliency, but brown trout are a sensitive fish species. A fish kill of this magnitude will certainly disrupt the size structure, species diversity, and numbers of catchable size trout. If pollution events continue, there could be detrimental effects to the entire stream long-term.

Also, despite the apparent resiliency observed in Minnesota driftless-region trout streams so far, large scale mortality events are evidence of severe stressors that are concerning, including the possibility of increased frequency of extreme weather events. Minnesota waters are expected to continue their warming trends and be impacted by increased frequency of severe precipitation events. Thus, it is imperative to identify and work to mitigate stressors associated with large scale mortality events in these vulnerable fisheries.

Next steps

This is the fourth significant trout stream fish kill in this part of southeastern Minnesota since 2015. The other fish kills occurred on the South Fork of the Whitewater River, Garvin Brook, and Trout Valley Creek. Certain common conditions and risk factors have emerged. These include low stream flow, warm air temperature, elevated water temperatures, thunderstorms, and the presence of certain types of pollutants that are susceptible to runoff.

Unauthorized releases and permit violations that lead to fish kills are preventable and unacceptable. To mitigate the fish kill risk, the MPCA, MDNR, and MDA are working to summarize and proactively communicate these risk factors as part of an interagency effort. An emphasis of this communication effort will be on the use of weather and runoff forecasting tools to help plan the timing of manure and pesticide applications. Additional strategies include inspections of livestock facilities, including land application of manure records and field reviews, in areas where fish kills have occurred, and the precise identification of high-risk runoff pathways on agricultural fields in a part of Minnesota characterized by steep slopes and karst topography.

For more information

It is critical for anyone that observes a fish kill to report it immediately to increase the chances of identifying the cause or source for a fish kill. If you see something, contact the MDO at 800-422-0798. If there is an immediate threat to life or property, call 911 first.

There is more information on fish kills in Minnesota on the MPCA website. You can also learn more on the DNR website.

Appendices — Rush Creek fish kill

Table 1. Universal Transverse Mercator (UTMs) of stations on Rush Creek, July 26, 2022. Station 1 and 2 were counting dead fish and fish kill extent is the entire reach dead fish were observed (12,437 ft).

Station	Station length (feet)	Downstream UTMs (easting, northing)	Upstream UTMs (easting, northing)
Fish station 1	536	591071, 4865976	591017, 4866125
Fish station 2	514	591528, 4865304	591670, 4865369
Fish kill extent	12,437	592004, 4864755	590280, 4866074

Table 2. Species and length of dead fish collected in Station 1 and 2 (1,050 ft) on July 26, 2022.

Species	Length category	Number
Brown trout	3-5 inches	33
Brown trout	6-10 inches	112
Brown trout	11-15 inches	15
Brown trout	16-20 inches	2
White sucker	ALL	27
Mottled sculpin	ALL	23
	TOTAL	**212**

Table 3. Estimated numbers of dead fish in Rush Creek (12,437 ft).

Species	Estimated number	% of total
Brown trout	1,921	76%
White sucker	325	13%
Mottled sculpin	277	11%
TOTAL	**2,523**	

Table 4. General Water Chemistry Sample Results

	Water Sample Station			
	WC1	WC2	WC3	WC4
Date	7/26	7/26	7/26	7/27
	all values in mg/l			
Ammonia-N	0.10	<	<	0.06
Unionized ammonia	0.011*	na	na	na
Chloride	25.3	25.7	34.9	23.4
NO2/NO3	<	12.0	8.7	7.9
TSS	490	5.2	10	28
TSVS	100	<	3.2	9.0
TP	2.06	0.068	0.102	0.491
Ortho-P	1.42	0.059	0.089	0.301
TKN	9.07	<	<	1.04
CBOD (5-day)	25.7	0.78	0.99	na
Comments	Standing water near stream; 1L given to MDH for pesticides; some analyses not available	South (west) trib.	North trib.	South (west) trib.; repeat sample by DNR next day after 0.5 inches rain; preserved late.; E. coli out of hold - 24000 MPN/100ml

< = below reporting limit, non-detect

All field parameters (temperature, pH, dissolved oxygen, conductivity) taken were normal on 7/26

*Chronic WQ standard for unionized ammonia for cold-water streams (0.016 mg/L; 16 ug/L)

Table 5. Rush Creek Fish Kill Pesticide Samples

Analyte	P1 - CR 29 South Tributary		P2 - CR 5 North	P3 - CR 5 South	P4 - CR 25	Lowest available aquatic life fish benchmark or MN state standard
All results and reference values are in ng/L						
2022 Dates sampled	**7/26**	**7/27**	**7/26**	**7/26**	**7/26**	
2,4-D	< 8.3	9.15	22.6	16	18.4	79,200
Acetochlor ESA	31.8	162	98.3	96.6	99.5	> 90,000,000
Acetochlor OXA	< 33.3	296	98.6	96.6	< 33.3	No benchmark available
Alachlor ESA	< 41.6	< 41.6	178	165	595	> 52,000,000
Atrazine	32.2	60.7	33.9	< 30	46.4	3,400†
Azoxystrobin	< 10	36.7	< 10	< 10	< 10	147,000
Deethylcyanazine Acid	< 25	< 25	< 25	< 25	28.8	No benchmark available
Desethylatrazine	92.9	72.4	97.1	98.9	84.6	1,000,000*
Didealkylatrazine	155	151	206	199	151	> 50,000,000
Hydroxyatrazine	13.7	58.8	29.1	28.1	18.6	> 1,500,000
Metolachlor ESA	455	258	546	504	425	24,000,000
Metolachlor OXA	< 10	36.1	28.4	26.6	16.1	> 46,550,000
Propiconazole	< 10	25.6	< 10	< 10	< 10	15,000
Pydiflumetofen	< 10	49.0	< 10	< 10	< 10	42,000‡

† Class 1B, 2A and 2Bd waters; protected for cold water aquatic life and drinking water

* No fish benchmark available; used the non-vascular plant benchmark value for reference

‡ No fish benchmark available; MDA calculated an insect-based value based on toxicity data from the EPA Environmental Fate and Effects Division (EFED)