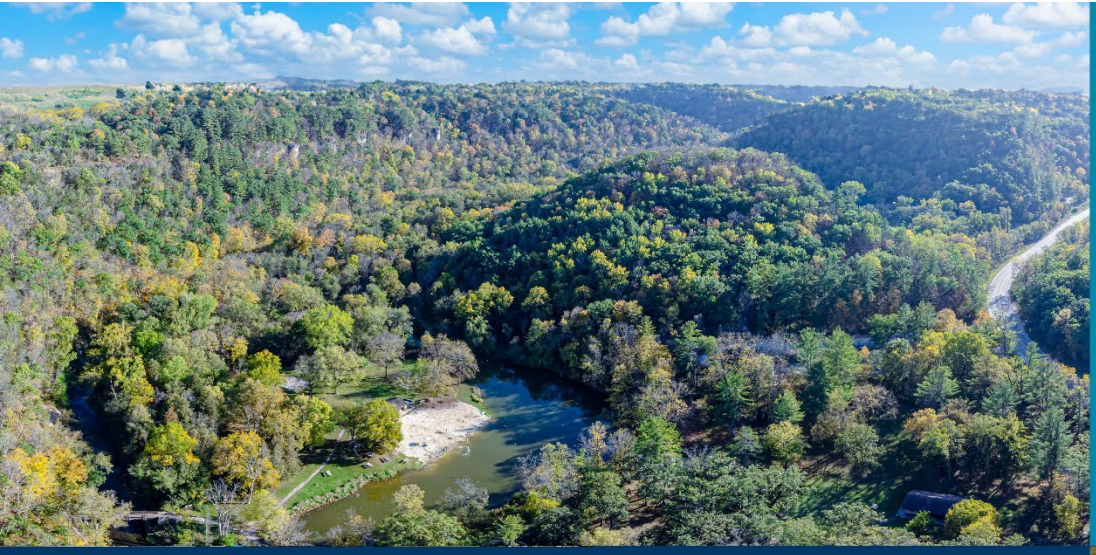

REPORT TO THE LEGISLATURE
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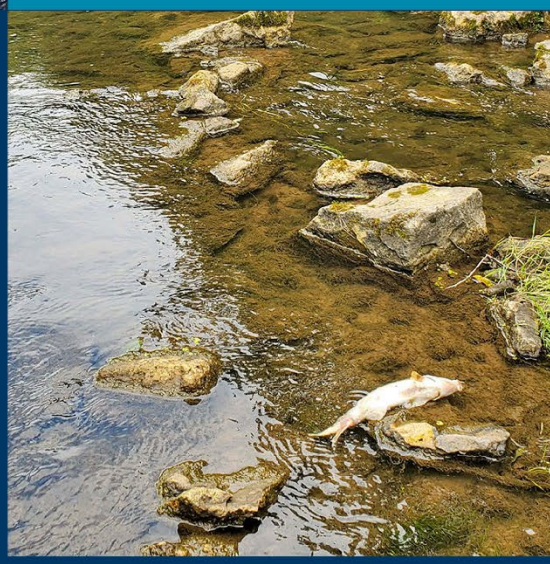

Preventing fish kills in Minnesota's driftless region

Recommended strategies

MINNESOTA POLLUTION CONTROL AGENCY

MINNESOTA DEPARTMENT OF AGRICULTURE

MINNESOTA DEPARTMENT OF HEALTH

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

Legislative charge

STATUTORY AND RULE REVISIONS TO PREVENT FISH KILLS IN DRIFTLESS AREA.
By January 15, 2024, the commissioners of agriculture, health, and natural resources and the commissioner of the Pollution Control Agency must make recommendations to the Legislature for statutes and rules that should be amended to prevent fish kills within the boundaries of the Department of Natural Resources Paleozoic Plateau ecological section.

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Introduction

This legislative report seeks to satisfy the requirement of this statute, which passed in the 2023 legislative session:

> **STATUTORY AND RULE REVISIONS TO PREVENT FISH KILLS IN DRIFTLESS AREA**
>
> By January 15, 2024, the commissioners of agriculture, health, and natural resources and the commissioner of the Pollution Control Agency must make recommendations to the Legislature for statutes and rules that should be amended to prevent fish kills within the boundaries of the Department of Natural Resources Paleozoic Plateau ecological section.

Fish die-offs and fish kills – an important distinction

Hundreds of fish die-offs or fish kills occur in Minnesota every year, mostly in lakes and ponds. Distinguishing between the two is important for focusing attention and resources on preventing fish kills, whereas fish die offs are typically more natural events and less preventable. Fish kills are the focus of the prevention recommendations offered in this report.

Die-off vs. kills: What's the difference?

Disease

Low oxygen levels

Water levels, temperature

Spills

Wastewater/stormwater discharges

Runoff: manure/pesticides/ fertilizer

Fish die-offs

Most lake/pond fish die-offs are from causes such as disease or low oxygen levels. These natural causes, however, may be exacerbated by chronic environmental conditions such as excess nutrients in lakes and extreme weather. The retreat of lake and stream ice can sometimes leave behind dead fish, which is an example of fish die-off. Lower autumn water levels can increase the probability and severity of fish die-offs in winter. Early ice-on and late ice-out dates also increase the winterkill potential. Wetlands and shallow, soft-bottom lakes are more winterkill-prone than deeper, hard-bottomed lakes. Fish die-offs are uncommon in southeast Minnesota due to the lack of lakes and wetlands.

In spring and summer, groupings of dead fish are usually the result of common, opportunistic infections or low oxygen. These infections tend to affect fish as water temperatures warm and fish experience stress from the energy they spent on spawning. Such infections can kill sunfish, crappies and bullheads, and occasionally largemouth bass and northern pike.

Fish kills

Fish kills are caused by the release of pollutants and are different than fish die-offs. Fish kills are infrequent as compared to fish die-offs, and they are acute events. According to state agency information, there have been four fish kills on trout streams in southeast Minnesota since 2015 where the cause could be determined, and a few where the cause could not be determined. In trout streams, fish kills may be related to the discharge or runoff of pollutants from the landscape through incidents like toxic spills, runoff of manure, pesticides, fertilizers, high-temperature stormwater, or wastewater discharges.

The definitive cause of fish kills is often difficult to determine, due to factors like the passage of time between when a fish kill happens and when it is discovered and reported, and lack of evidence. Key investigative elements such as water levels, water temperature, water quality, and amount or type of runoff can quickly change and move downstream and become diluted, leaving little evidence.

Weather and climate impacts

Minnesota's weather is changing: it is getting warmer and wetter overall and we are seeing more extreme weather events such as drought and intense precipitation events. Increased water temperatures stress cold water fish species, and this stress magnifies when combined with other factors. Strong storms following long dry periods can increase the risk for fish kills in streams. Low flow in streams due to hot, dry periods are more dramatically impacted by polluted runoff since there isn't enough water to dilute pollution entering the waterway during a runoff event. This extreme and unpredictable weather makes land management more difficult for farmers and landowners. While slow, soaking rains typically allow nutrients and chemicals to be absorbed by fields and yards, intense storms can "sweep fields clean" of anything that has been recently applied, washing it all downstream. Weather transitions from extreme wet to dry are also happening more quickly and more frequently, making the timing of any applications of agricultural fertilizers and chemicals that much more critical.

Response and investigation

State and county specialists in water quality, watershed management, feedlots, fisheries, human exposure pathways, and agriculture all work together to explore possible causes of fish die-offs and fish kills. The Minnesota Department of Natural Resources (DNR) takes the lead for investigating possible fish die-offs. When water professionals believe a discharge/release may have caused a fish kill, the Minnesota Department of Agriculture (MDA) takes the lead for suspected pesticide or fertilizer incidents and the Minnesota Pollution Control Agency (MPCA) investigates cases for suspected hazardous materials, oil, wastewater/stormwater, or manure releases. The Minnesota Department of Health (MDH) has more recently joined fish kill response teams by assessing health risks from a fish kill. When these professionals believe fish died from natural causes or changes to overall ambient water conditions rather than the discharge of a pollutant, then the event is deemed a fish die-off, and investigation and follow-up action is limited. The state's watershed approach to protecting and improving lakes and streams provides the framework for addressing overall, long-term water quality conditions. Investigations of fish kills are robust, often time-consuming, and involve a great deal of coordination among state and local professionals.

Some fish kills have obvious causes, such as a spill or identifiable discharge to a surface water. One example is when a tanker truck tips over in a ditch, spilling a product toxic to fish that flows to a stream. Other fish kills have less discernible causes that are often driven by rain events somewhere in a watershed. An example would be an intense rain event that creates runoff to streams from many agricultural fields and city streets in a large upstream watershed. Finding a clear explanation for a fish kill depends largely on the lag time between the kill and its reporting, as well as the complexity and scope of the potential cause(s). Even when lag time is short, finding the definitive cause of a fish kill can still be difficult or inconclusive.

Drinking water

Contaminated runoff doesn't just impact fish. It may impact drinking water in private and community wells. Some geographic land features can quickly deliver pollutants to groundwater through sinkholes and fractured bedrock. In southeast Minnesota, for example, the cracks and gaps between rocks in the earth's surface called karst make groundwater more susceptible to pollution. The MDH provides well testing information to well owners and regulates public water systems.

Prevention recommendations, technical support, and response actions

Prevention of environmental contamination and fish kills is paramount for state agencies. During fall 2022, state agencies worked together to develop a communications campaign to help prevent fish kills by reducing contaminated runoff, including a toolkit of communications resources for anyone to use—from specialists in water quality and management to farmers and individual residents. The 2023 Legislature asked state agencies to develop proposals for changes to statutes and rules that could help prevent fish kills from occurring in the karst region in the southeastern corner of Minnesota. After listening to perspectives and ideas from citizens and organizations such as environmental groups, agricultural groups, county feedlot officers, and local health professionals, we realized that many of the most impactful activities to prevent fish kills fall under existing authorities and do not require changes in statute or rule. As the intent is to ensure more proactive risk management beyond current efforts, the agencies worked together to develop the recommendations below, both regulatory and non-regulatory.

Minnesota Pollution Control Agency

The MPCA works to protect the health and well-being of Minnesotans and their communities. We are committed to continuing work to address the large-scale problem of nitrate in our waters by working with other government entities, community partners, landowners, and residents to develop long-term solutions that protect drinking water, address nitrate contamination, and support responsible farming practices. In the context of this report, we have focused on fish kills whose cause was directly connected to permittees we regulate, and we have developed a series of recommendations that will prevent the types of releases that have occurred in previous fish kills.

Provide support to expand liquid manure storage capacity.

Provide grant funding and technical assistance to farmers in southeastern Minnesota to expand liquid manure storage. Adequate manure storage capacity allows farming operations improved opportunities to manage manure. Applying manure at the right time, which includes under the right field conditions and weather conditions, can reduce the chance of an off-site discharge. Limited manure storage capacity is a topic that has come up in discussions with farmers and environmental advocacy groups on numerous occasions. There are ~2,660 registered feedlots in southeastern Minnesota. Almost 80% are smaller than 300 animal units, and don't require permits to operate. Another 18% are between 300 and 999 animal units, and don't require permits from the MPCA. The remainder are more than 1,000 animal units in size, and these permitted operations are currently required to ensure about nine months of liquid manure storage. Some grant and loan programs exist that can provide funding for increasing manure storage, but a grant program dedicated to landowners in southeastern Minnesota would reduce competition when applying for these funds and expand available funding for farmers in this region.

Potential results/benefits: For farms with little to no storage ability, this proposal provides the ability to store manure and only apply when manure could be incorporated or when soil and weather conditions are more favorable. If appropriated to the MPCA, we would seek to utilize existing programs in other state departments to administer these grants.

Potential issues: Liquid storage in southeastern Minnesota is inherently risky and costly due to geology. There may be limited engineering capacity in the private sector to design new liquid manure storage areas.

Costs to implement (financial, technology, staff, resources, etc.): Significant cost share dollars would be needed to subsidize projects. Concrete or composite liners, which would be required for many sites in this area, are expensive. A rough approximation of total cost is $50 million for the southeast Minnesota counties.

Provide cover crop cost-share funding to southeastern Minnesota farms.

Provide grant funding to farmers in southeastern Minnesota to plant cover crops if applying manure in September. Funding would support both seed and equipment purchase. Cover crops are a key strategy described in the state Nutrient Reduction Strategy. They hold manure and soil in place and help prevent nitrate leaching from soils. There are other grant and loan programs in other state departments that can provide funding for cover crops and equipment purchase, but a grant program dedicated to landowners in southeastern Minnesota will reduce the competition when applying for these funds and expand available funding for this important need. If appropriated to the MPCA, we would seek to utilize existing programs in other state departments to administer these grants.

Potential results/benefits: Reduces chance of runoff to surface water and leaching of nutrients to groundwater. Reduces soil erosion.

Potential issues: Possible lack of availability of cover crop seed. Establishing a cover crop is weather dependent, though this is less of an issue in southeastern Minnesota than in more northern parts of the state.

Costs to implement (financial, technology, staff, resources, etc.): Cost associated with planting cover crops: seed, equipment. Estimate ~ $30-$40/acre. Financial assistance/incentives for planting a cover crop would accelerate adoption of this critical best management practice.

Restrict application of manure in a floodplain, unless incorporated.

The current feedlot rules include a requirement to incorporate manure within 300 feet of surface waters. This would expand this requirement to the entire floodplain and serve to provide more protection during peak flooding periods, when the ground is frozen, snow covered or actively thawing, or if precipitation is forecast.

Potential results/benefits: Rain or flood waters would not carry manure to a stream.

Potential issues: Some farmers may not have adequate ground available out of the floodplain and restricting application in a floodplain will decrease land available for manure application. May require additional storage if more time is required for proper conditions to land apply manure.

Costs to implement (financial, technology, staff, resources, etc.): Would increase complexity of manure application rules and time required by producers to identify floodplains. Possible additional hauling costs and time for some farms. Cost of revising manure management plans to identify and address floodplains, and potential costs for increasing storage capacity. Funding for installation of additional storage and manure management plan modifications would help implementation. This proposal would require a rule or statutory change.

Evaluate current manure management setback requirements from surface waters.

The current feedlot rules include a requirement to incorporate manure within 300 feet of surface waters. This proposal seeks to re-evaluate existing research on manure management practices adjacent to waters. Included in the review should be soil and water runoff research to evaluate whether current

requirements are adequate. Results of the research could then be incorporated into state rules as appropriate.

Potential results/benefits: The feedlot rules are over 20 years old. Increased size of feedlots has led to more manure being concentrated in smaller areas during this time period. Additional research could provide demonstrated results for practices not currently required. Research can help determine the predominant field conditions that influence off-field discharges.

Potential issues: Research takes time to complete, but it ensures potential rule changes are based on science.

Costs to implement (financial, technology, staff, resources, etc.): Funding would be needed to contract with qualified researchers. Costs are unknown until research is better scoped.

Evaluate methods to reduce manure runoff from hay fields with summer manure applications.

Application of manure on cut hay has led to manure runoff in the past. Research liquid vs solid manure broadcast application compared with no manure applied on cut hay. Evaluate different liquid manure application techniques (broadcast, dribble bar/banding, injected, none applied) on cut hay fields. Use rainfall simulations to evaluate nutrient runoff. Incorporate research findings into technical assistance, and into feedlot rules, if warranted.

Potential results/benefits: Would enable the development and targeting of technical assistance and cost share to improve manure management practices on hay land and improve water quality.

Potential issues: Research takes time to complete, but it ensures potential rule changes are based on science.

Costs to implement (financial, technology, staff, resources, etc.): Funding would be needed to contract with qualified researchers. Costs are unknown until research is better scoped.

Hire dedicated feedlot staff for southeastern Minnesota.

This proposal centers on dedicated staff to serve southeastern Minnesota and to focus on education, providing technical assistance, connecting landowners to grant opportunities, individualizing manure management plans to minimize fish kill risks, discussing how to remove barriers to accelerating adoption of best management practices, and composting manure.

Potential results/benefits: Can develop/target technical assistance and cost share to improve manure management practices and improve water quality. Could specialize in manure management plan reviews and education to improve water quality and reduce nitrate contamination.

Potential issues: Increased costs for additional staff.

Costs to implement (financial, technology, staff, resources, etc.): Increased support would require additional staffing and funding.

Minnesota Department of Natural Resources

Technical support – natural resources

The DNR currently provides technical assistance regarding hydrology, geology, water flow, water monitoring data, and other site-specific natural resource considerations related to fish kills. In very limited instances we have assisted MPCA in adding fish restitution values to permits.

Potential results/benefits: Collecting restitution values contained in permits would be efficient, so adding them into additional permits may be beneficial.

Potential issues: Data and information may not always be specific to the location and in the timing needed to provide definitive conclusions.

Costs to implement (financial, technology, staff, resources, etc.): Continuing support at the current levels would not add costs. Increased support would require additional FTE and funding.

Technical support – fish assessment

The DNR currently provides technical assistance regarding determination of cause of death (if able to be determined), fish count, fish identification, and restitution value calculations.

Potential results/benefits: Determination of cause of death may help in identifying whether it was natural or caused by a pollutant. Identifying violations and/or responsible parties may help agencies pursue enforcement and identify prevention methods. Identifying fish and restitution values may help in assessing penalties to compensate the state for the loss, levy penalties against a responsible party, as well as provide a deterrent for future responsible parties.

Potential issues: DNR staff cannot always safely or immediately deploy to a site in time to determine the cause of death.

Costs to implement (financial, technology, staff, resources, etc.): Continuing support at the current levels would not add costs. Increased support would require additional FTE and funding.

Response actions

The DNR currently receives notification of fish deaths from the Minnesota Duty Officer, visits the fish death site if conservation officers are in the area of concern and available to respond, use criminal citations, permit conditions, and/or natural resource damage assessment (NRDA) authority to collect restitution, when prudent and feasible, and consult with other agencies on appropriate enforcement response.

Potential results/benefits: Potential identification of cause of fish death and/or responsible party. Potential enforcement and/or collection of restitution costs to hold the responsible party accountable. Potential information will be collected that may be used to prevent future fish kills.

Potential issues: DNR is limited to collecting established restitution values. The NRDA process is time-consuming and expensive and requires involvement from the Attorney General's Office. For some responsible parties, penalties will be impactful and provide some deterrent value, but not for others.

Costs to implement (financial, technology, staff, resources, etc.): Continuing support at the current levels would not add costs. Increased support would require additional FTE and funding.

Minnesota Department of Agriculture

Require training for commercial animal waste technician applicators that includes Runoff Risk Advisory Forecast tool and fish kill content (could be regionally-specific).

Potential results/benefits: This would increase fish kill awareness and tools available to applicators to help reduce the likelihood of runoff from the application site.

Potential issues: No forecast is 100% accurate and may not eliminate runoff.

Costs to implement (financial, technology, staff, resources, etc.): This would not cost a great deal to implement. The MDA has been doing some of this already.

Require training of the Runoff Risk Advisory Forecast tool and fish kill information in all applicator training (could be regionally-specific).

This could include all commercial, aerial, and private applicator training workshops. Currently Minnesota Statutes 18B.305 and 18B.36 outline the requirements for training for commercial and private applicators respectively.

Potential results/benefits: This would increase fish kill awareness and tools available to applicators to help reduce the likelihood of runoff from the application site.

Potential issues: No forecast is 100% accurate and may not eliminate runoff.

Costs to implement (financial, technology, staff, resources, etc.): This would not cost a great deal to implement. The MDA has been doing some of this already.

Develop targeted best management practices (BMPs).

Possible BMPs are:

1. Targeted fungicides/insecticides BMP distribution in the Paleozoic Plateau Region. Several of the recent fish kills have occurred during the fungicide and insecticide application periods (July).
2. Develop fungicide/insecticide BMPs specifically for aerial applicators to prevent drift.

   Specific buffer/setbacks BMPs recommended for the Paleozoic Plateau area.

   Will not prevent runoff incidences.

3. Develop surface applied fertilizer BMPs specific to the Paleozoic Plateau region.

Potential results/benefits: This would increase the knowledge of best practices recommended to reduce runoff from the various applications.

Potential issues: Because it is not known if pesticides have caused or contributed to a fish kill, the recommended practices may not reduce the occurrence of fish kills but they are good, preventative measures.

Costs to implement (financial, technology, staff, resources, etc.): The development of BMPs is a very extensive process and would include many hours of staff time and involvement from outside interested parties and researchers.

Develop a monitoring network.

Develop and implement prospective (early warning) fish kill monitoring network for the Paleozoic Plateau region.

Potential results/benefits: This monitoring could assist the state agencies in determining the cause of a fish kill. Once the actual cause is determined, it would be easier to focus efforts on specific practices needed to prevent such an incident.

Potential issues: It is possible that even a dedicated monitoring network may not clearly identify the source of a fish kill. Determining where to place monitoring equipment would be challenging as a fish kill can occur anywhere. Monitoring would only help in those locations where monitoring equipment is placed. A consistent sampling protocol, and lab analysis of samples would be needed to assure high-quality data.

Costs to implement (financial, technology, staff, resources, etc.) This would be a very costly effort that would require staffing, equipment and lab analysis funding and this funding would require an ongoing commitment from the Legislature. Assistance from volunteers to maintain such a network would help reduce costs, but state staffing would still be needed to oversee volunteers, ensure adherence to standard sampling protocols, analyze data, submit data to databases, and maintain monitoring equipment. Utilizing volunteers may have liability considerations.

Increase penalties.

Double the amount for pesticide misuse violations occurring in the Paleozoic Plateau ecological section that result in impacts to fish or other aquatic life. Currently MS 18D.40 allows for enhanced penalties for damage to property that is part of the state recreation system. This statute could be amended to include violations that cause a fish kill.

Potential results/benefits: Possible deterrent from increased awareness of fish kill risk to land operators. Would likely get media attention and distribution. Would likely have wide support from organizations who invest in protecting and enhancing these high value resources.

Potential issues: The enhanced penalties may not be known to land operators and may not serve as a deterrent. This may not have any impact if responsible party cannot be identified.

Costs to implement (financial, technology, staff, resources, etc.): This recommendation would have minimal cost to implement.

Minnesota Department of Health

Protecting the health of all Minnesotans is central to the mission of the MDH. In the context of the environment, this translates into identifying hazards and threats to human health from air, water, soil, food, and the built environment. Prevention strategies and interventions are developed based on a scientific analysis of the exposure pathway. The exposure pathway tracks the hazard from source which is then transported through environmental media to a place where people encounter the hazard. The health outcome(s) often depend on whether the hazard enters the body through ingestion, inhalation, or skin contact. The final point in the pathway is to identify the potentially exposed population. The duration of the exposure and the toxicity of the hazard are also considered. Public health actions and advice are based on this analysis.

Response actions: Analyze for potential impacts to human health.

Assess potential for microbial pathogens, pollutants, and/or environmental conditions to affect drinking water quality in public and/or private wells that are hydrologically connected to the affected surface water body. In a similar approach, assess potential for impacts to human health through fish consumption or swimming. Potential response actions include:

- Conduct a limited human health risk assessment with relevant risk management strategies.
- Provide technical support for analyzing surface water and groundwater interactions; data on public and private wells; well construction, geology, and aquifers; and drinking water and fish consumption guidance values.
- Develop science-based risk communication and coordination with local public health.

Potential results/benefits: As this is an emerging area of science, it may be possible to eliminate concerns about some exposures and human health impacts. On the other hand, a better understanding of the exposure potential, especially through public and private drinking water would allow MDH to provide guidance to public water systems, private well owners and users, and local public health.

Potential issues: This is an emerging area of science and the potential to affect human health is not well understood. Due to the sporadic and ephemeral nature of fish kills/die-offs, staffing this initiative will be challenging.

Costs to implement (financial, technology, staff, resources, etc.): There would be significant staff and laboratory costs to stand up this process.