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# The 2025 major fish kill on the Munster Blackwater, Ireland. Organisational responses and key recommendations

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## Abstract

In August 2025 a major fish kill event occurred on the Munster Blackwater, Ireland. It is estimated that up to 42,000 fish were killed. This was the largest recorded fish kill in Ireland and it caused widespread upset in the community and across the country. The initial response by state agencies was rapid with investigations occurring within hours of notification. However, the suspected cause and source of the pollution remains undetermined. The inter-agency report considered that the pollutant could have entered the river on the 5th or 6th of August and subsequently dissipated before notification of fish deaths on the 11th.

This report reviewed the response of state agencies and the inter-agency report produced. Key recommendations are aimed at preventing, detecting and improving the coordinated response to future fish kills. It is recommended to place continuous monitoring on major Irish rivers, develop, agree and test a multi-agency protocol for major fish kills to include comprehensive sampling of the river as well as discharging facilities in the catchment. A communication strategy should focus on immediately passing on knowledge, specifying any uncertainties, investigative steps being taken, and give immediate advice for the public. Research should determine high risk areas for fish kills for preventative action and to determine the economic cost of the fish kill. An intensification of ongoing restoration efforts is now needed in the catchment to achieve the environmental objectives under the Water Framework Directive.

## Acknowledgements

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## Executive summary

In August 2025 a major fish kill event occurred on the Munster Blackwater in county Cork, Ireland. It is estimated that up to 42,000 fish were killed. This represents the largest recorded fish kill in Ireland and it caused widespread upset in the community and across the country. The suspected cause and source of the pollution remains undetermined. Upon notification of the disaster the initial response of the principal agencies responsible – IFI (Inland Fisheries Ireland) CCC (Cork County Council) and the EPA (Environmental Protection Agency) was rapid with site investigations occurring within hours. Subsequent investigations, extended for weeks, included habitat inspections of the main channel and tributaries (IFI), macroinvertebrate and water samples of the river (EPA, CCC) and inspections of licenced industries (EPA) as well as smaller businesses and farms (CCC).

While a fungal agent was initially suspected by the IFI, fish pathology results carried out later by the Marine Institute shifted focus from pathogenic agents to a water-borne irritant. Following this, Minister Timmy Dooley (Department of Agriculture, Food and the Marine & Department of Climate, Energy and the Environment) established an inter-agency group led by the IFI to expand the investigation. A detailed fish-tissue residue analysis of 900 chemicals did not reveal a causal agent. While investigations are ongoing, the final report, produced quickly in little over six weeks, could not conclude on the agent of harm or its source. The inter-agency report considered that the pollutant could have entered the river on the 5$^{th}$ or 6$^{th}$ of August and subsequently dissipated before notification of fish deaths on the 11$^{th}$.

Overall, the agencies responded rapidly to the major fish kill and the logic of the investigation was correct with four initial lines of enquiry that found no evidence for pollution: habitat investigations, macroinvertebrate samples, ambient chemical samples and immediate inspections of licenced facilities. It was postulated that the pollution event could have occurred up to a week before notification of the fish kill and this is likely to have been the principal barrier to a successful investigation. However, it is also clear that the interagency response to major fish kills could be improved.

This report has reviewed the organisational response and inter-agency report and recommends:

**To improve detection:**

- Major rivers (>100 km length) should have basic continuous monitoring with current and historical results available online. This should be provided together with ‘travel time’ catchment maps for different flow scenarios.
- Chemical samples should be taken immediately when a fish kill is identified. This should be followed by frequent catchment-wide ambient water samples for complete background and pollutant specific chemistry for major fish kills. Local authorities should follow clear protocols to achieve this.
- Given that the pollutant or its source has not been identified, vigilance should be maintained. Monitoring should be intensified in the river and its tributaries by IFI and CCC.
- The public were first to raise the alarm. It is recommended to increase citizen scientist initiatives in the catchment led by LAWPRO and IFI.

**To improve the coordinated response:**

- Designate one agency to be responsible for leading and directing the response.
- Major fish kills need to be recognised as such and treated with a higher level of priority. IFI should lead work to develop procedures to quickly classify and quantify fish kill extent.
- IFI should lead work to develop and agree a clear multi-agency operating procedure to deal with major fish kills. This should guide all agencies to urgently explore all possible avenues until a cause is clearly determined. As part of this, the EPA and IFI should review investigative monitoring protocols for local authorities.
- All agencies should establish clear reaction time goals for i) cross-agency information sharing, ii) diagnosis & remediation, iii) ensure sufficient capacity to meet emergency needs.
- Investment should be made in crisis management and crisis communication skills.
- Reports should clearly document all suspected causes, subsequent investigations and outcome. The logical steps of an investigation must be transparent to the public.

**To prevent fish kills:**

- Manage the catchment in an integrated way to allow a greater resilience of the biota to pollution events under scenarios that include high summer temperatures and low flows.
- The EPA and IFI should commission and guide research to predict high risk locations for fish kills. Direct resources towards prevention. Anticipating and preparing for events will improve the response.
- Carry out a thorough economic evaluation otherwise the resource will remain undervalued.
- The deterrent to pollution under the Environmental Liability Directive and the Industrial Emissions Directive (including recent revisions) should be highlighted. However, without the identification of the pollutant and source, prosecutions and costs for remediation measures (under the Environmental Liability Directive) cannot be pursued.
- Prevention of future incidents is paramount. Increased efforts by national authorities are required to adequately implement relevant existing Community legislation such as the Water Framework Directive, the Nitrates Directive, the Industrial Emissions Directive, the Urban Wastewater Directive as well as the Habitats Directive. Further efforts should be made to achieve the environmental objectives set by these directives within the catchment. In addition, the Environmental Liability Directive should be fully implemented to provide a strong incentive to avoid polluting the environment.

# 1. Introduction

## 1.1. Background and document purpose

In August 2025 a major fish kill event occurred on the Munster Blackwater in county Cork, Ireland. It is estimated that up to 42,000 fish were killed. This represents the largest recorded fish kill in Ireland and it caused widespread upset in the community and across the country. The suspected cause and source of the pollution remains undetermined. Upon notification of the disaster the initial response of the principal agencies responsible – IFI (Inland Fisheries Ireland), CCC (Cork County Council) and the EPA (Environmental Protection Agency) was rapid with site investigations occurring within hours. Subsequent investigations, extended for weeks, included habitat inspections of the main channel and tributaries (IFI), macroinvertebrate and water samples of the river (EPA, CCC) and inspections of licenced industries (EPA) as well as smaller businesses and farms (CCC).

While a fungal agent was initially suspected by IFI, fish pathology results carried out by the Marine Institute shifted focus from pathogenic agents to a water-borne irritant. Following this, Minister Timmy Dooley (Department of Agriculture, Food and the Marine & Department of Climate, Energy and the Environment) established an inter-agency group led by the IFI to expand the investigation. A detailed fish-tissue residue analysis of 900 chemicals did not reveal a causal agent. While investigations are ongoing, the final inter-agency report could not conclude on the agent of harm or its source. The report considered that the pollutant could have entered the river on the 5$^{th}$ or 6$^{th}$ of August and subsequently dissipated before notification of fish deaths on the 11$^{th}$ of August.

The inter-agency report on the fish kill in the Munster Blackwater was published on the 25$^{th}$ of September 2025. A request was made in October 2025, on behalf of the Minister for the Department of Climate, Energy and the Environment by Inland Fisheries Ireland to the Joint Research Centre of the European Commission to carry out an independent review to cover:

- A review of the investigation (timelines, responses, methods, data availability),
- Assess the inter-agency report,
- Document lessons learned and recommendations,
- Identify any information or data that should have been considered,
- Identify any gaps in the framework of the statutory responsibility of the various agencies.

## 2. Key actors and roles in the investigation

In Ireland as in many other European countries, a wide range of organisations have a full or partial remit in the management of the aquatic resource in catchments. A total of ten organisations either initially or at a later stage, through the establishment of the inter-agency group (IAG), contributed to the investigation of the fish kill (Table 1). The next section on the timeline of events and responses will examine in more detail the actions taken by the core organisations. The purpose is to understand what parts of the investigation worked well and also to identify areas that could be improved in future.

**Table 1**. Key organisations in the inter-agency group and roles in the investigation into the fish kill on the river Blackwater (Munster) Ireland in August and September 2025.

| Agency | Role in the Investigation |
|---|---|
| **Inland Fisheries Ireland (IFI)** | **Coordinating Agency and Lead Investigator.** The first point of contact and acted to alert other agencies. Conducted habitat inspections, macroinvertebrate sampling, quantified mortalities and coordinated the inter-agency group (IAG). |
| **Environmental Protection Agency (EPA)** | **Water Quality and Regulatory Investigation.** Investigated EPA-regulated sites in the catchment for compliance and potential link to fish kill. Conducted water quality sampling and macroinvertebrate assessments. |
| **Marine Institute (MI)** | **Fish Health Diagnostic Testing.** Conducted initial diagnostic and laboratory testing on fish specimens to look for disease, viruses, or parasites. Their findings indicated that the damage was consistent with exposure to a chemical agent. |
| **Cork County Council (CCC)** | **Investigative Support and Inspections** of businesses licensed under Section 4 and agricultural activities. Water quality monitoring and macroinvertebrate sampling. |
| **Local Authorities Water Programme (LAWPRO)** | **Contributed to the multi-agency investigation**, provided expertise on macroinvertebrate sampling and community engagement. |
| **Uisce Éireann (Irish Water)** | **Reviewed activities of water and wastewater treatment facilities.** Monitored drinking water supplies. |
| **National Parks and Wildlife Service (NPWS)** | **Protected Species/Habitat Assessment.** Carried out survey to determine if there was any impact on protected species. |
| **Health Service Executive (HSE)** | **Public Health Assessment.** Provided expertise and attended IAG**.** |
| **Department of Agriculture, Food and the Marine (DAFM)** | **Animal Health/Welfare.** Provided expertise and attended IAG. |
| **Department of Climate, Energy and the Environment (DCEE)** | **Policy brief.** Provided leadership and direction establishing IAG. |

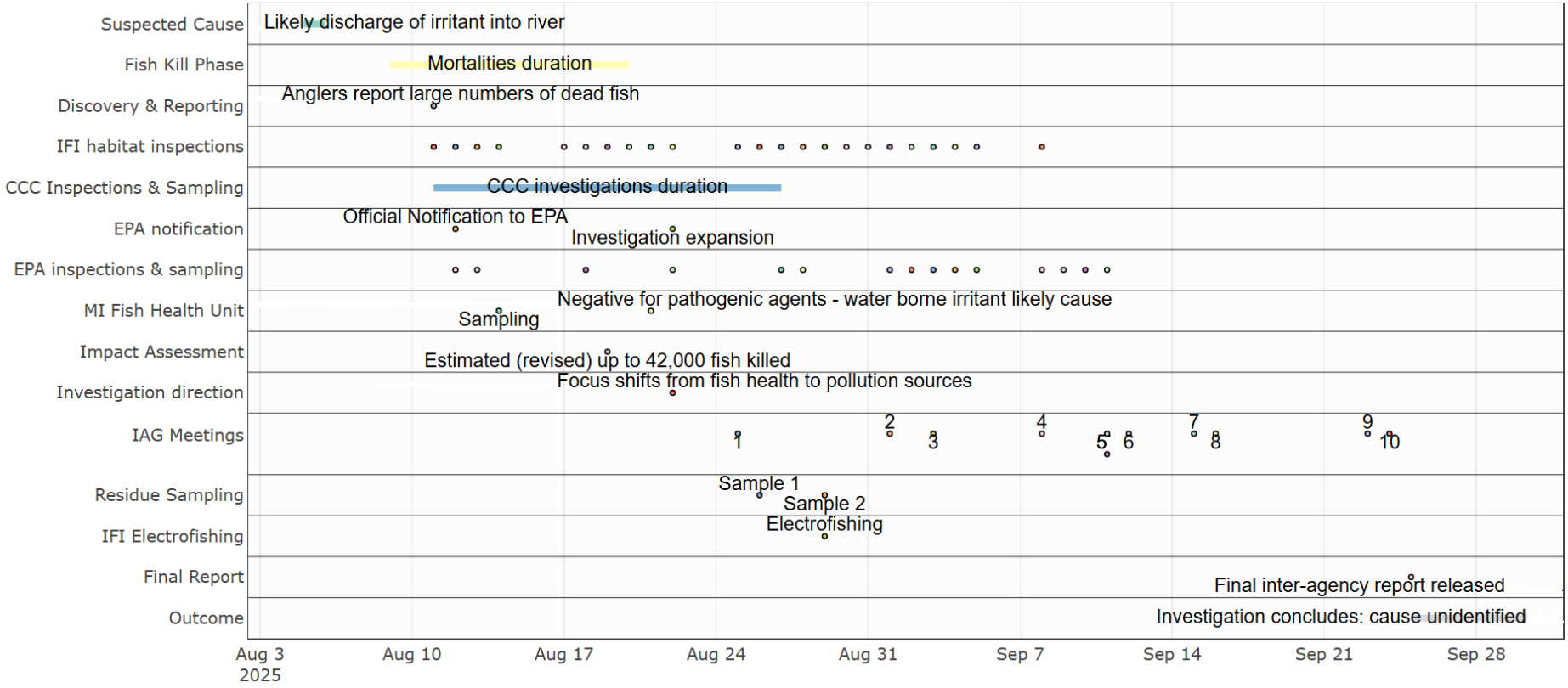
Source: Own elaboration.

## 3. Timeline of events and responses

This review focuses on the events and responses to the Blackwater River fish kill in Munster, County Cork, Ireland between August and September 2025. During a response to an environmental emergency the timeliness of actions is of key importance. The full report is available online and contains the specific details of the events: https://www.fisheriesireland.ie/news/media-releases/summary-report-of-the-investigation-into-fish-mortalities-in-the-blackwater. The summary timeline is presented in Figure 1. On Monday the 11th of August at 12:08 the IFI received notification from anglers of a large fish kill on the Munster Blackwater. The IFI arrived on site at 13:15 with CCC arriving at 14:30. An inspection was carried out upstream of Mallow bridge observing dead fish but no visible sign of pollution. On the 12th of August, within an hour of receipt of notification, the EPA sent three teams of inspectors to investigate regulated sites in Mallow and Kanturk. Inspections continued on the 13th but no evidence of spills or discharges linked to the incident were found. Macroinvertebrate surveys were also carried out by the EPA on the 13th and during September. The IFI commenced habitat inspections on the 12th and these continued for weeks throughout the catchment (198 inspections at 47 locations) with repeated inspections after the 8th of September (Figure 1). CCC carried out water sampling on the 12th of August and assisted the IFI with investigations thereafter as well as carrying out inspections of Section 4 facilities (20 light industry & commercial businesses). Initial inspections and the absence of clear evidence for pollution led to the initial suspicion that a pathogenic agent such as a fungal infection could be responsible. This considered evidence based on habitat inspections, macroinvertebrates, water chemistry and inspections of regulated sites that showed no clear evidence of pollution.

The Fish Health Unit of the Marine Institute was contacted and carried out sampling for specimens on the 14th August, returning preliminary results on the 21st of August. The tests indicated a waterborne irritant as responsible rather than pathogenic agents. Fungal infections were likely to have occurred subsequently to the impact of the pollutant. With no causal agent identified and no source of pollution evident an inter-agency group (IAG) led by the IFI to expand the investigation was set up by the Minister (Department of Agriculture, Food and the Marine & Department of Climate, Energy and the Environment). This led to a continuation and expansion of the investigation and frequent meetings of the IAG to review progress (Figure 1). A detailed fish-tissue residue analysis of 900 chemicals did not reveal a causal agent. Electrofishing was also carried out to assess the fish stocks in comparison to previous surveys. Habitat inspections were continued by IFI as did EPA inspections to cover all licenced industrial, wastewater and drinking water treatment facilities (31). While no evidence was found in licenced facilities some breaches were detected but considered not to have caused the incident. While investigations are ongoing, the inter-agency report could not conclude on the agent of harm or its source. The report considered that the pollutant could have entered the river on the 5th or 6th of August and subsequently dissipated before notification of fish deaths on the 11th of August. The summary report of the IAG was published on the 25th of September 2025. It is satisfactory that the inter-agency report was produced together with data sources in a little over six weeks.

**Figure 1**. Timeline of events and responses to the Blackwater River fish kill in Munster, County Cork, Ireland between August and September 2025.




*Source: own elaboration*

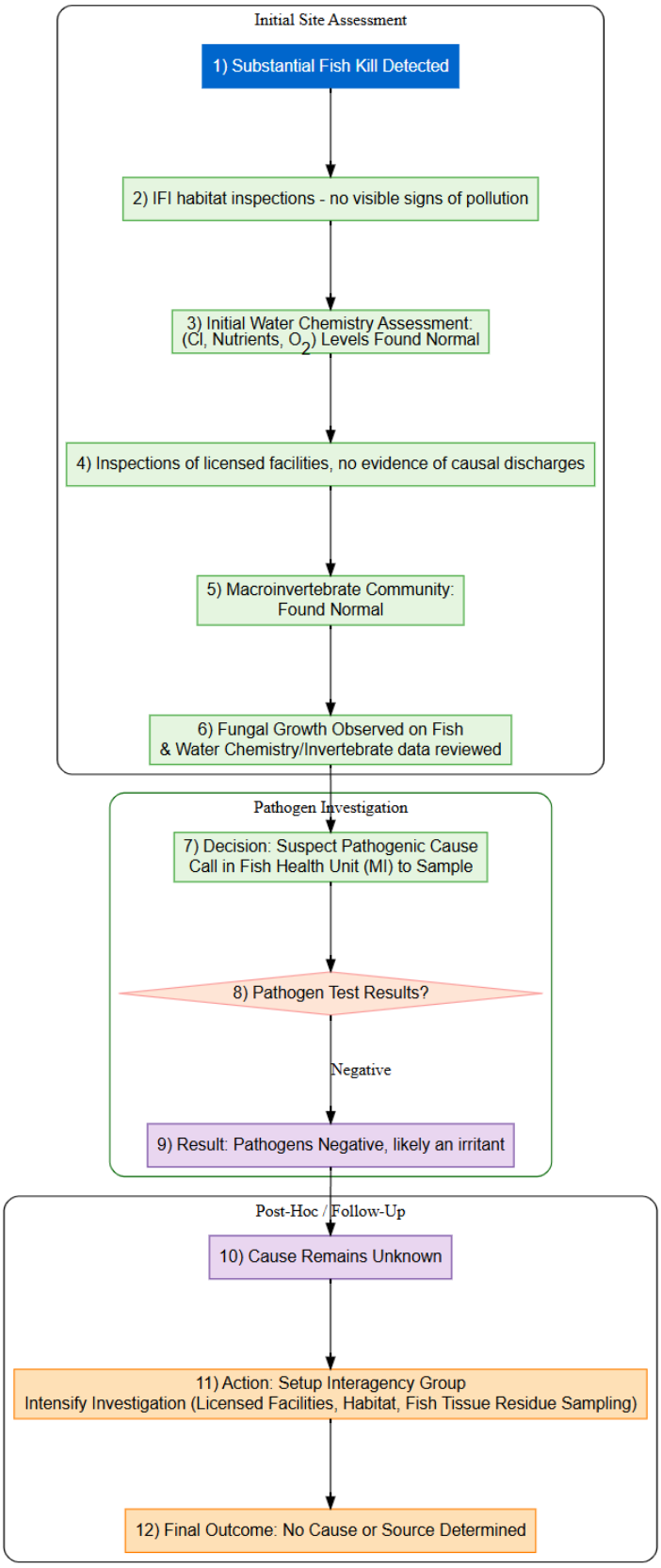
## 4. Reconstructing the logic of the investigation

As with all investigations, there is a logical progression of actions over time. For clarity, these are shown in Figure 2. These could be separated into three components: the initial site assessment, the pathological investigation and the post hoc follow up phase. In summary, the reconstructed logic was:

1. Substantial fish kill detected
2. IFI habitat investigations revealed no obvious sigh of pollution (plumes etc)
3. Chemical samples revealed normal levels of nutrients and oxygen (indicator of eutrophication or organic discharges – from e.g. wastewater treatment or farm sources). In addition, Cl levels were normal indicating that a spill of polyaluminum chloride, as occurred in June 2024 from the Freemount water treatment plant in the river Allow (tributary of the Blackwater), was unlikely.
4. Initial inspections from licenced facilities also did not reveal evidence of causal spills/discharges.
5. Macroinvertebrate community was normal (an integrative indicator responding to nutrient/low $O_2$ and also chemical pollutants - pesticides etc).
6. Fungal growth on fish together with environmental conditions such as warm dry weather and low flows leads IFI staff to suspect a pathogenic cause. This may have seemed probable given the lack of evidence for pollution from habitat investigations, water chemistry, inspections and invertebrates.
7. MI called on to sample and test for pathogens.
8. The tests for bacteria, viruses, fungi and parasites were carried out.
9. Pathogenic tests were negative with a water borne irritant suspected.
10. The cause and source of pollution remained unknown.
11. Action was taken to set up an interagency group to uncover the pollutant and source including further investigation into EPA and section 4 licensed facilities. These intensified as well as a continuation of catchment habitat investigations and fish tissue residue analysis.
12. The final outcome was that no cause or source could be determined.

In general, the logical progression of the investigation was appropriate. There were four strands of initial evidence indicating that the fish kill was not driven by pollution (points 2 to 5 above). Attention turned to pathogenic agents, but these returned negative indicating instead a water borne irritant (points 5 to 8 above). This was when the interagency group was set up to better coordinate, intensify and uncover the pollutant and source (point 10 above). However, one of the purposes of this report is to try to locate areas where procedures could be improved as well as identifying good practice during the response. These are detailed below in subsequent sections.

**Figure 2.** A reconstruction of the logic followed during the investigation.




*Source: own elaboration*

## 5. Consultation with stakeholders

As part of this investigation several stakeholders were contacted to gather opinions on the fish kill and subsequent investigation. The main points of concern included:

- There was an overfocus on the potential role of a pathological cause when there was clear evidence of it being a pollution event.
- Lack of health and safety notification to the public.
- Information flow from agencies was too slow and not detailed enough.
- A perceived overall lack of urgency and deployment of resources.
- A lack of confidence in the behaviour and regulation of certain licenced facilities in the catchment.
- Insufficient sampling of the river to determine pollution.
- Substantial concern for future recovery prospects and ongoing financial losses.

# 6. Review of organisational responses and recommendations

## 6.1. Improve knowledge and monitoring

One of the key conclusions of the inter-agency report is that the pollutant could have entered the river on the 5th or 6th of August before the IFI was notified of the fish kill on the 11th of August (Inter-Agency Group (IAG), 2025). This was a crucial period that could potentially have been used to detect and stop at an early stage the discharge thereby preventing damage to the environment. It is recommended that major rivers (>100 km length) should have automated **continuous monitoring with current and historical results available and downloadable online** on a centralised website. The Department of Climate, Energy and the Environment should decide which state agency should be responsible for implementation. Existing infrastructure used for hydrometric measurements of flow may be suitable location points. Resources for frequent maintenance should be provided. Basic parameters to include are: conductivity, pH, oxygen, temperature, turbidity, flow and chlorophyll-a for larger slower rivers (e.g. the Shannon). This should be provided together with 'travel time' catchment maps for different flow scenarios or dynamic estimates. Using the flow to estimate travel time would allow a pollution event, indicated by conductivity for example to be traced upstream to discharge locations. This would enable faster and more targeted inspections by either the EPA or CCC. In addition, it could be used to pass alerts to downstream locations to take timely mitigation action. Having continuous monitoring available publicly would also act as a deterrent to pollution, encourage compliance and thereby reduce the pollutant load on the environment. Such stations have proven useful in previous disasters such as the Oder river disaster where changes in conductivity and chlorophyll-a were used to track a harmful bloom (e.g. River Oder monitoring at Frankfurt).

Following notification of the fish kill, spot chemistry samples were taken by the EPA and CCC that ruled out elevated ammonia, low oxygen, biochemical oxygen demand and chloride. Further chemical sampling was focused on facilities in the catchment. However, it would also have been appropriate to take samples throughout the catchment including tributaries to include a wider suite of parameters over successive days. The changing spatial and temporal patterns in background chemistry (major ions) and other parameters may have helped in the investigation. The initial suspicion of a pathogenic cause may have influenced the decision not to conduct wider environmental sampling. In future, as well as inspecting facilities, **catchment wide water samples should be taken for complete background and pollutant specific chemistry** until a definite cause is identified. Chemical samples should be taken immediately when a fish kill is identified. Local authorities should follow clear protocols to achieve this. During the Oder River disaster, Polish authorities took chemistry samples daily at accessible locations (bridges) and reported results on a public website (Free et al., 2023).

Given that the first notification of the fish kill was provided by the public there is a clear opportunity to **engage further with the community** to leverage this as a vital resource in protection of the river. Following the notification on the 11th further contact was made by another member of the public that had noted an issue on the 9th. Engaging further with the public, specifically in the observation of fish kills, could help improve response times through the existing 24-hour hotlines. This may be possible through further support of existing initiatives run by LAWPRO. Consider offering courses for 'water wardens' with training in basic fish and aquatic biology, water sampling and water chemistry. Engagement with the public during major fish kills could benefit from staff trained in crisis communication skills and social media management (Grelowska et al., 2024).

## 6.2. Major fish kill action plan

The key agencies (IFI and CCC) were on site within a couple of hours of receiving notification of the fish kill on the 11th of August and represents an example of best practice in reaction time. In addition, inspections of industrial sites by the EPA were also rapid with deployment of three teams within an hour of receipt of notification on the 12th of August However, some time in the investigation was lost through achieving a formal fish health diagnosis where laboratory analysis screening for pathogens takes time (Figure 1). In general, there is always a risk of delay in a multiagency response where resources may already be deployed elsewhere in the country. However, having a dedicated **plan of action agreed across the agencies** to deal with major fish kills is essential. It is recommended that:

- IFI should develop procedures to quickly classify and quantify fish kill extent. Major fish kills need to be recognised as such and treated with a higher level of priority.
- Designate one agency to be responsible for leading and directing the response.
- Develop and agree a clear multi-agency operating procedure to deal with major fish kills. This should guide all agencies to urgently explore all possible avenues until a cause is clearly determined. As part of this, the EPA and IFI should review investigative monitoring protocols for local authorities.
- Establish clear reaction time goals for i) cross-agency information sharing, ii) diagnosis & remediation, iii) ensure sufficient capacity within agencies to meet emergency needs (invest in resources, capacity and maintain an emergency budget).
- Explore potential for IFI field staff to have more advanced training on fish health.
- Examine if an extension or better definition of roles in WFD investigative monitoring to include the IFI is appropriate legislatively.
- Ensure sufficient capacity for short term mitigation (e.g. aeration/fish translocation).
- Host a technical workshop and invite national and international fish kill experts to share knowledge.

## 6.3. Improve regulation of licences

The deployment of three inspection teams to regulated sites within an hour of notification is clearly an example of best practice by the EPA. The follow-on inspections, reviewing practices, monitoring data and collection of samples from up to 31 facilities was thorough. Similarly, CCC inspected 20 light industries and 14 locations of agricultural activities. Evidence was not found to link any of these with the fish kill.

However, a limited number of facilities were present in the catchment that had breached their licence. While not being linked to the fish kill, **frequent pollution above regulated levels will reduce the assimilative capacity of the river and increase the burden of multiple pressures** the cumulative effect of which is borne by the river biota. This reduces the chance of fish surviving pollution events. Licences should be reviewed in the context of the low flows, and reduced capacity for dilution, observed in the catchment during the summer of 2025. Consider refining allowed discharges in accordance with river flows dynamically.

Another recommendation is to review national policy as to the adequacy of the deterrence of financial penalties, including application of the Environmental Liability Directive (European Parliament and Council of the European Union, 2004). Recently, the Industrial Emissions Directive has been updated and includes an increase in minimum penalties (at least 3 % of the annual Union turnover of the operator in the financial year preceding the year in which the fine is imposed, for the most serious infringements) (European Parliament and Council of the European Union, 2024; European Parliament and Council of the European Union, 2010).

## 6.4. Maintain a high level of vigilance in the catchment

Given that the pollutant or its source has not been identified, **vigilance should be maintained in the catchment**. Monitoring should be intensified in the river and its tributaries. Historical data on river chemistry and WFD biological quality should be reviewed for signs of episodic pollution. It may be helpful to estimate the exported load of pollutants and major ions from the river and compare with those reported from facilities. However, rivers are very dynamic systems and pollutants can cause damage and dissipate rapidly. IFI has documented over 2000 fish kills since 1969 and reported that 30.8% of fish kills were undiagnosed. The most common causes of fish kills were reported as agriculture (22.7%), eutrophication (13.3%), industrial (11.7%), other (8.7%), municipal (8.3%), mining (2.9%) and construction (1.6%) (Matson and Kelly, 2024).

## 6.5. Response times and dealing with uncertainty

The response to environmental emergencies is laid out in the Environmental Liability Directive and is centred on responding immediately and without delay (European Parliament and Council of the European Union, 2004). The first focus is on the operator responsible for the pollution who must notify the competent authorities (in Ireland – the EPA) and take all practicable steps to immediately control, contain, remove or otherwise manage the relevant contaminants and/or any other damage factors in order to limit or to prevent further environmental damage, as well as effects on human health and services. The operator must also take the necessary remedial measures. In the case of the Munster Blackwater the pollutant and its source remains unknown. The concept of the 'golden hour' is also applicable to environmental disasters and in this case the opportunity to take immediate action was obviously not taken by the entity responsible for the pollution.

The EPA and IFI have decades of experience in dealing with pollution events and fish kills and responded within hours of notification. Initial lines of evidence did not confirm the presence of the usual pollutants associated with a fish kill and suspicion moved to a fish health issue with less focus on specific pollutants. In hindsight, in the context of a major fish kill, it would have been better to pursue all lines of inquiry intensively until official pathology results were received. Uncertainty around causes can lead to delays in communication and action as also happened with the River Oder disaster in 2022 (Free et al., 2023). It is recommended that the agencies **include a specific approach in a major fish kill action plan when the pollutant and source are undetermined**. This should ensure fast, open communication and monitoring of a comprehensive suite of parameters to cover fish health, river physical and chemical parameters as well as inspections of licenced and other catchment activities. In most cases the cause of the fish kill can be attributed (Matson and Kelly, 2024).

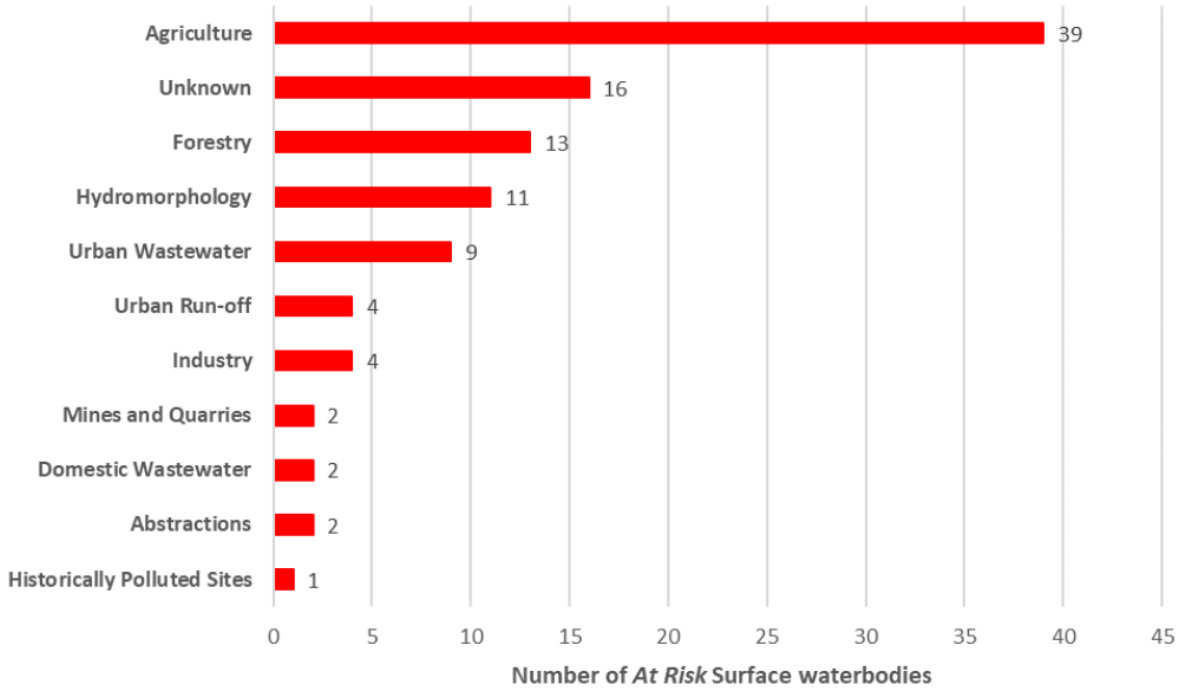
## 6.6. Quantify damage and plan restoration

The availability of previous electrofishing data allowed IFI to carry out a repeat exercise and quantify the loss at between 20% (16,720) and 50% (41,801). This underlines the usefulness of IFI monitoring under the WFD in management of ecosystems. Future plans could include more detailed information on the mortalities removed such as species, age structure, weight etc. It is recommended that follow on work is done to **quantify the damage** such as ecological and food-chain implications, impact on pearl mussel populations and population age structure impact. IFI have previously reported a significant delay in the recovery of population age structure resulting in a lower ecological status (Matson and Kelly, 2024). It is important that the loss of natural heritage, the protection of which is at the core of the WFD, should also be clearly documented. The economic costs of fish kills should be calculated to include recreation costs, recovery plans, minimum replacement costs of stocks and the cost of the investigation as without a **proper economic evaluation** of such incidents the resource will remain undervalued (Koehn, 2021). The costs of negating the work of ongoing restoration efforts in the catchment should also be included.

## 6.7. Environmental management

The fish kill is likely to have been caused by a specific pollution event and the EPA correctly concluded from monitoring data that levels of chronic pollution in the Blackwater are not high enough to directly cause a large fish kill (data available at https://www.catchments.ie/). However, the cumulative burden of pressures reduces the chances of survival in such events. Often fish kill events have some multifactorial components (Free et al., 2023; Koehn, 2021). The Water Framework Directive (WFD), supported by the now revised Industrial Emissions Directive, are the appropriate pieces of EU legislation for managing water quality and industrial emissions. As part of the WFD river basin management plan the EPA published its third cycle catchment report in 2024 for the Munster Blackwater. For the 158 river water bodies in the Munster Blackwater catchment, 42% are failing to reach good status. Additionally, among these 158 water bodies, 32 have an environmental objective set to high status, and only 38% of them reach this target. The EPA catchment report documents a loss of high status sites in the catchment since 2007. The significant pressures driving risk (of not achieving good ecological status) for surface water bodies in the Munster Blackwater are shown in Figure 3 with agriculture, forestry and hydromorphology dominating, and also a significant amount of water bodies with unknown pressure. Measures for the third cycle to improve status are distributed in a total of 18 Areas for Restoration, one Area for Protection and two Catchment Projects. It is recommended that, given the setback caused by the fish kill, effort is intensified in the catchment to **make faster progress in achieving environmental objectives**. In the context of the fish kill, further research should be undertaken to characterise the unknown pressures in the catchment. In addition, ecological flows, i.e. the flow regime consistent with the achievement of environmental objectives under the Water Framework Directive, should be defined and respected (European Commission, 2015).

**Figure 3.** Significant pressures driving risk (not achieving Good Ecological Status) for surface water bodies in the Munster Blackwater.




*Source: www.catchments.ie*

## 6.8. Research

Fish kills often happen during summer when temperatures are high, oxygen concentrations are low (less solubility at higher temperatures and increased night-time respiration) and when river levels are low. These conditions are becoming more common because of climate change, which as an additional consequence will lead to an increase in abstraction resulting in a lower volume to dilute pollutants. Research should be carried out to produce a model to **predict high risk locations for fish kills** in the country under different climate scenarios, building on the work of Matson & Kelly (2024). This should consider the effect of cumulative pollutant loads in the catchment on the receiving environment. Include also the role of altered hydromorphology in accentuating the risk of fish kills, including any local barriers to fish seeking refuge, as well as potential solutions especially with regard to the Nature restoration law (European Parliament and Council of the European Union, 2024). Anticipating and preparing for events will improve the response.

## 7. Conclusions

The major fish kill event on the Munster Blackwater in August 2025 was the largest recorded in Ireland. It is estimated that up to 42,000 fish were killed. It caused widespread upset in the community and across the country. The suspected cause and source of the pollution remains undetermined. Upon notification of the disaster the initial response of the principal agencies responsible – IFI (Inland Fisheries Ireland) CCC (Cork County Council) and the EPA (Environmental Protection Agency) was rapid with site investigations occurring within hours. While a fungal agent was suspected, fish pathology results carried out by the Marine Institute shifted focus from pathogenic agents to a water-borne irritant. Following this an inter-agency group was established led by the IFI to expand the investigation.

Overall, the agencies responded rapidly to the major fish kill and the logic of the investigation was correct with four initial lines of enquiry that found no evidence for pollution: habitat investigations, macroinvertebrate samples, ambient chemical sample and immediate inspections of licenced facilities. It was postulated that the pollution event could have occurred up to a week before notification of the fish kill and this is likely to have been the principal barrier to a successful investigation. However, it is also clear that the interagency response to major fish kills could be improved and this report identified eight areas where improvements could be made.

The most useful area to improve would be early warning and prevention. Continuous online monitoring would allow rapid action to be taken and should be part of a new programme for major Irish rivers with support for long-term maintenance. Given the public were the first to notice the incident, a focus on citizen science initiatives could also improve early warning. Research should also identify key risk locations in Ireland so that preventative measures can be taken. It is apparent from the investigation that the public service institutions have a high level of expertise and capability but that in the context of major fish kills an action plan needs to be formulated and regularly tested to ensure a faster and more coordinated response. A communication strategy should be focused on immediately passing on knowledge, specifying any uncertainties, investigative steps being taken, as well as immediate advice for the public.

During a major fish kill event it is recommended to immediately take catchment-wide ambient samples from the river over successive days so that any dissipating residual pollution can be mapped. A broad spectrum of parameters should be analysed. It may have been the case with the Blackwater that notification came too late for such a sampling strategy to be of value or that the suspicion of a causal fungal infection shifted focus.

The ongoing levels of chronic pollution in the Munster Blackwater were correctly identified as not being causal in the fish kill. However, it is recommended to review the pollutant loads in the catchment in an integrated way in order to reduce pressure on the environment and foster recovery. This should include loads from all sources with particular attention paid to the summer period when fisk kills are most likely. Currently the 6$^{th}$ Nitrates Action Plan lists the Munster Blackwater as one of the 'catchments of concern' (Government of Ireland, 2025). Ongoing restoration efforts in the catchment should be further supported and intensified to achieve environmental objectives under the Water Framework Directive.

From an EU policy perspective this case and that of the Oder River disaster highlight a 'detection gap' in pollution events that leads to substantial environmental damage. Without detection, the chances for stopping the pollution at source, remediation or downstream mitigation measures can't take place. It also obstructs evidence gathering and any subsequent prosecution. Implementing continuous monitoring would be in keeping with the EU's zero pollution and water resilience strategy

building digital ‘water-smart’ solutions to increase sustainability, tackle water scarcity, and to help prevent water pollution (European Commission, 2024; European Commission, 2021).

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## List of abbreviations and definitions

| Abbreviations | Definitions |
|---|---|
| CCC | Cork County Council |
| DAFM | Department of Agriculture, Food and the Marine |
| DCEE | Department of Climate, Energy and the Environment |
| EPA | Environmental Protection Agency |
| HSE | Health Service Executive |
| IAG | Inter-Agency Group |
| IFI | Inland Fisheries Ireland |
| LAWPRO | Local Authorities Water Programme |
| MI | Marine Institute |
| NPWS | National Parks and Wildlife Service |
| WFD | Water Framework Directive |

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