NIEA Northern Ireland Environment Agency
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Part III: INDEX TO EVIDENTIAL ITEMS

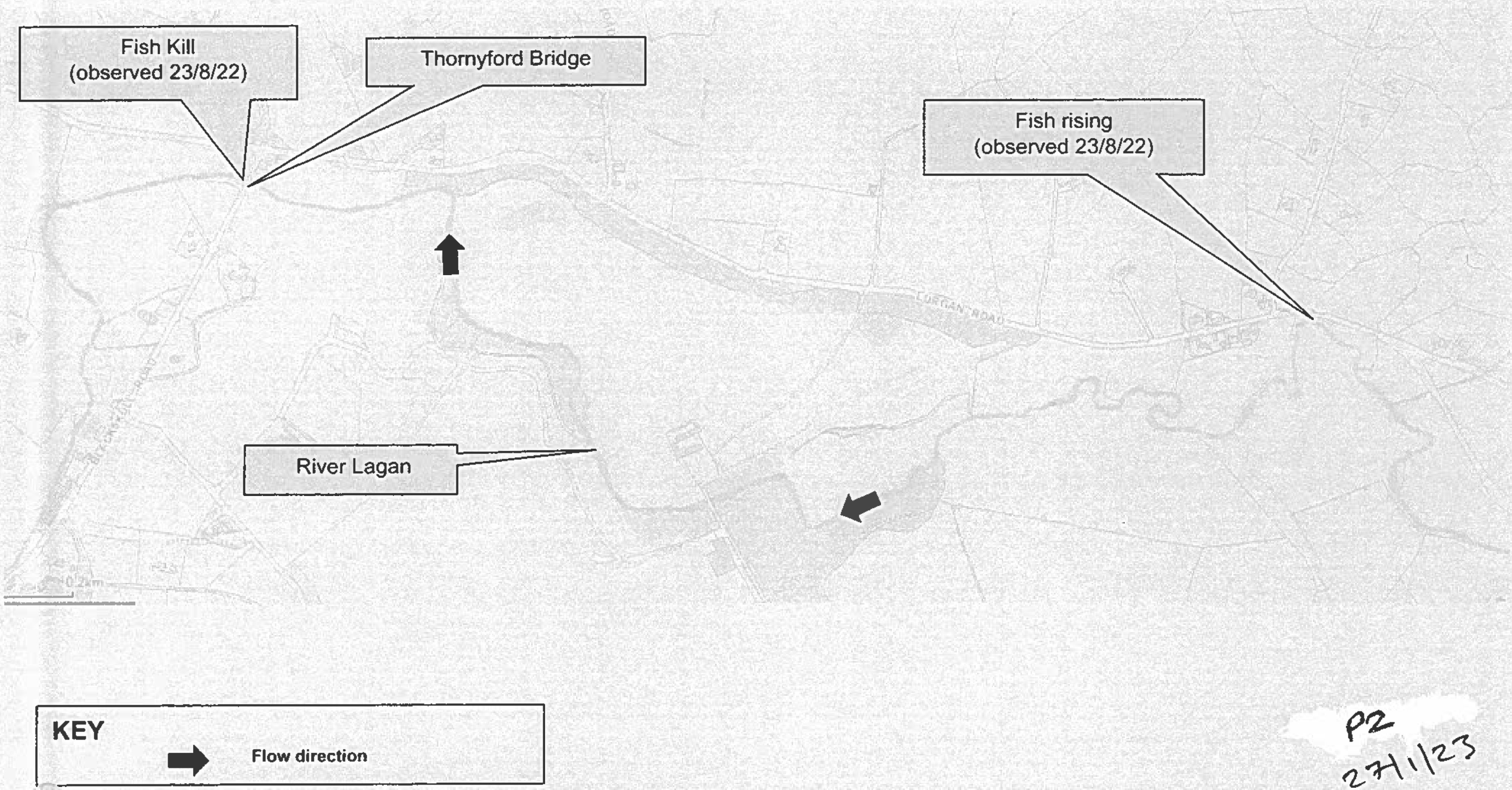
(form PPS 9 (Departmental))

NIEA Ref: PR12/22

ID MARK.	DESCRIPTION	PRODUCED BY	HELD BY/ ON FILE	Page No (s)
P21	Location Map indicating extent of River Lagan Fish Kill observed on 23/08/2023	P2	On File	1
P31	Map of Area	P3	On File	1
P32	River Lagan at Thornyford Bridge	P3	On File	1
P3 3	Where Investigative Sample was taken	P3	On File	1
P34	Effluent from Discharge Pipe	P3	On File	1
P35	Discharge Pipe on Farm (Blue in Colour)	P3	On File	1
P41	Dead fish seen below discharge pipe to river Lagan on 24 August 2022	P4	On File	1
P42	Discharge pipe to river Lagan with brown discolouration below it as seen on 24 August 2022	P4	On File	1
P43	Discharge pipe near dwelling house at REDACTED on 24 August 2022. Strong Ammonia odour noted at this location	P4	On File	1
P44	Statutory sample portions left at dwelling house at REDACTED on 24 August 2022 in accordance with REDACTED request	P4	On File	1
P45	Postal Caution sent to REDACTED from P4 – NIEA dated 24 October 2022	P4	On File	3
P46	Response to Postal Caution sent to REDACTED – NIEA from P4	P4	On File	2
P91	An assessment of carcass counting surveys with increasing time lapse following a simulated fish kill on a small upland stream (Kennedy et al, 2017)	P9	On File	6

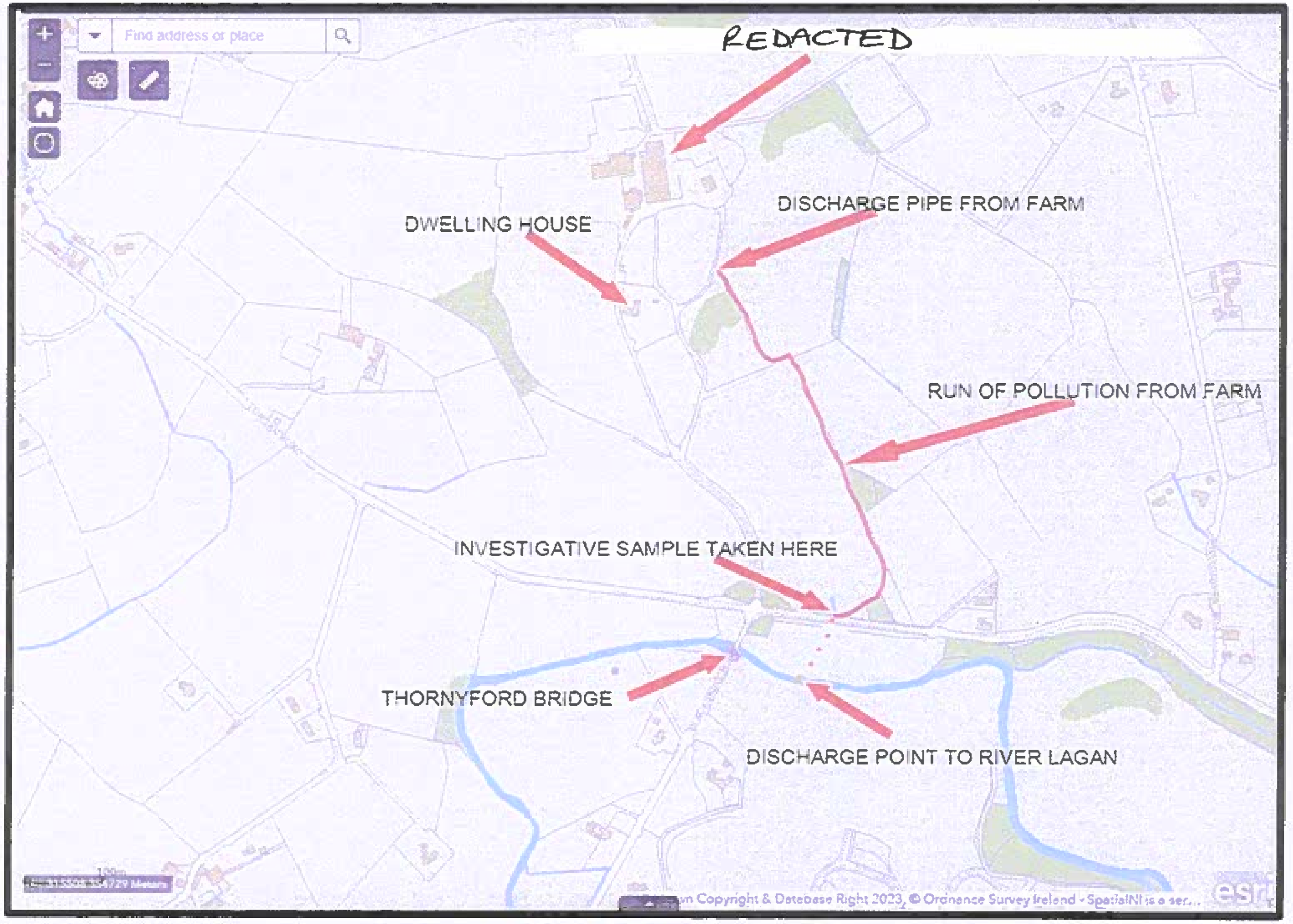
EXHIBIT P2-1– Pollution Investigation WR 4/22/0710

Location map indicating extent of River Lagan fishkill observed on 23/08/22

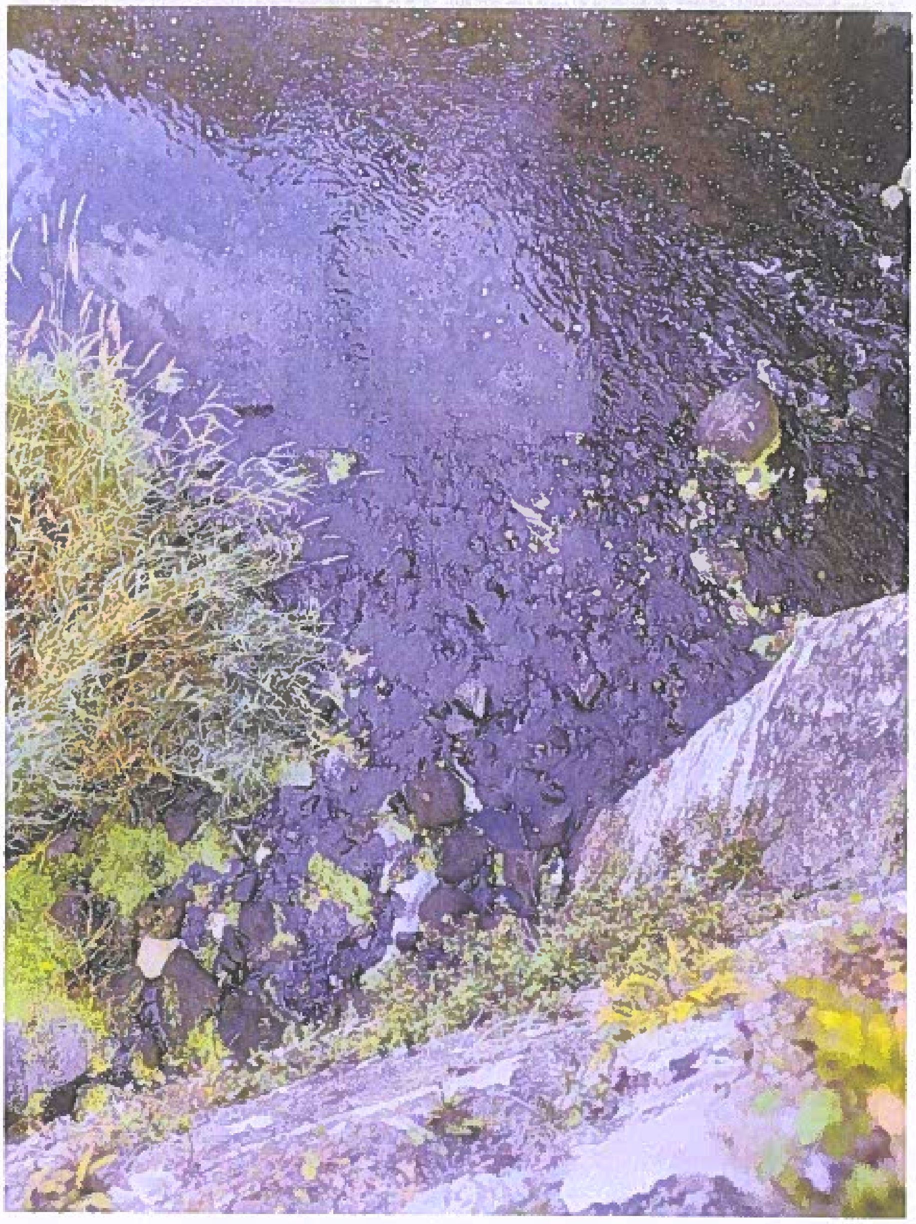


P2
27/1/23

MAP OF AREA



MAP EXHIBIT PB 1



PHOTOGRAPH EXHIBIT P3 2

RIVER LAGAN AT THORNYFORD BRIDGE

PHOTOGRAPH EXHIBIT P3 3

WHERE INVESTIGATIVE SAMPLE WAS TAKEN

PHOTOGRAPH EXHIBIT P3 4

EFFLUENT FROM DISCHARGE PIPE

PHOTOGRAPH EXHIBIT P3 5

DISCHARGE PIPE ON FARM (BLUE IN COLOUR)

Exhibit P4 1 – Dead fish seen below discharge pipe to River Lagan on 24 August 2022.

Exhibit P4 2 – Discharge pipe to River Lagan with brown discolouration below it as seen on 24 August 2022.

Exhibit P4-3 – Discharge pipe near dwelling house at REDACTED on 24 August 2022. Strong Ammonia odour noted at this location.

Exhibit P4 4 – Statutory sample portions left at dwelling house at REDACTED on 24 August 2022 in accordance with REDACTED request.

EXHIBIT P4 5

Northern Ireland Environment Agency
www.daera-ni.gov.uk

17 Antrim Road
Tonagh
LISBURN
BT28 3AL

REDACTED

Our Ref: WR 4/22/0710

24 October 2022

Dear Sir

WATER (NORTHERN IRELAND) ORDER 1999 – ALLEGED POLLUTION INCIDENT AFFECTING THE RIVER LAGAN NEAR ISLAND DAIRIES, LURGAN ROAD, DROMORE.

I, a Senior Water Quality Inspector, acting on behalf of The Northern Ireland Environment Agency (NIEA), investigated a pollution incident and fish kill affecting the River Lagan near Lurgan Road on 24th August 2022. I identified a brown discharge to the River upstream of Thornyford Bridge on the Lurgan Road side of the river.

The source of this brown colour was found to be a ponded ditch on the other side of the Lurgan Road which was also a dark brown colour and had an agricultural smell. At this point, I, and my colleague, spoke to your son and he confirmed that the field where this ditch was located was owned by yourself.

We called at your premises at REDACTED and met with you. Having been shown round the site, it was determined that there was a discharge to the ditch which ran along the side of your field. There was a very distinct Ammonia smell around this discharge pipe.

I informed you that I would be collecting a statutory sample of this discharge, the results of which could be admissible as evidence in court and a further statutory sample at the River Lagan, which you did not wish to witness. Having taken the tripartite statutory samples and also an investigatory sample from the ponded ditch beside the Lurgan Road, I left a portion of the two statutory samples at your dwelling house as requested by you before the samples were taken.

Analysis of the samples has confirmed that all three are polluting in nature. I subsequently spoke to you on the phone and you have indicated that you believe that the problem is linked to material which was spread on the land.

EXHIBIT P4 5

NIEA
www.daera-ni.gov.uk
Northern Ireland Environment Agency

17 Antrim Road
Tonagh
LISBURN
BT28 3AL

This incident is potentially a serious breach of The Water (Northern Ireland) Order 1999 (as amended by The Water and Sewerage Services (Northern Ireland) Order 2006). If the circumstances warrant, this may result in a file being forwarded to the Public Prosecution Service.

Given that this incident may result in legal action, I am offering you the opportunity to make a statement regarding this incident. If you wish to make such a statement in person, please inform me in writing to arrange a suitable time. Alternatively, a statement may be made in writing but I must caution you that,

> **"You do not have to say anything but I must caution you that if you do not mention when questioned something which you later rely on in court, it may harm your defence. If you do say anything it may be given in evidence."**

You may obtain legal advice if they so wish. If the company has any such statement to make, I would ask that this is made within 28 days of the date on this letter. If, within 28 days of the date of this letter, you have not contacted me to make an appointment to discuss this incident or I have not received a written statement, I will assume that you do not wish to make any statement on the matter.

If you wish to make a statement in writing, you should start it with the following:

> **"I make this statement, on behalf of my own free will. I understand that I need not say anything unless I wish to do so and that what I do say may be given in evidence. I also understand that if I fail to mention any fact which I may rely upon in my defence in court, my failure to mention it now may harm my defence. I have been advised that I may seek legal advice if I so wish".**

Any written statement, which should be signed and dated, should be sent to me at the address on this letter. If you wish to make a written statement, I would invite you to answer the following questions and provide the following information:

1. Details of the circumstances which led to the polluting discharge entering the waterway on the 24th August 2022.

2. The nature of the material that had been applied to your lands in the week before the 24th August 2022.

3. The dates and method of application of this material.

4. The areas on where this material was applied – a map may be useful in demonstrating this.

EXHIBIT P4 5

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17 Antrim Road
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5. Confirmation of the ownership of the business responsible for polluting discharge i.e. Details of the company or individual including date of birth.

6. Actions you took subsequent to our visit to reduce the impact of the polluting discharge.

7. Any other information or comment which you wish to provide with regard to this matter.

Yours Sincerely

P4

P4
Senior Water Quality Inspector
Water Management Unit

P4

EXHIBIT P4 6

WMU LISBURN
10 FEB 2023
RECEIVED

24th November 2022

Your Ref: WR 4/22/0710

Dear P4

Thank you for your letter dated 24th October 2022 offering me the opportunity to provide an explanation of the circumstances that led to this incident. I/we are extremely disappointed and annoyed that this incident has occurred as a consequence of my negligent oversight**.

As per the instructions in your letter I attach the following statement: "I make this statement, on behalf of my own free will. I understand that I need not say anything unless I wish to do so and that what I do say may be given in evidence. I understand that if I fail to mention any fact which I may rely upon in my defence in court, my failure to mention it now may harm my defence. I have been advised that I may seek legal advice if I so wish".

As requested I will list my responses under the seven heading as outlined in your correspondence.

1. The circumstances which led to this incident in connected with the washing of the tractor mounted field sprayer machine which was used to apply liquid synthetic Urea based fertiliser. I should add that this was the first year we had used this method to apply fertiliser. The sprayer machine has to be washed out and rinsed following the application on the fertiliser. These washings were returned to grass paddocks following previous applications.

   However on the 19th August 2022** the driver of the machine took the vehicle to the front on the cattle sheds (approached by an access off to the left near the top of the main farm access) where a stainless steel tank holds the drinking water to supply al livestock and this proves a ready water supply. This is a large turning area finished off with coarse clean 100mm stones. Because of the extremely dry conditions which prevailed during August 2022 when only a small fraction of the normal rainfall fell, the driver having washed the machine sprayed the residue on the stoned area and not on grass paddocks as previously.

2. The fertiliser material applied was Urea based liquid fertiliser.

3. This same product had been applied to all grassland and to silage ground on three previous occasions during 2022. For silage ground these applications were in April, May and July** 2022

4. This Urea based product was used on all grassland during 2022. We farm approx 700 acres and this area is split approx 50/50 for grazing and silage cutting.

5. I am REDACTED I am a director in this company business and we operate a large dairy enterprise, currently milking approx 400

EXHIBIT P4 6

cows. Other staff members**? We take 4 cuts of silage (occasionally 5 depending on the season) each year and grow all the herbage required for our stock on farm**.

6. Following the visit by NIEA staff I immediately organised for the water in the open drain at the bottom of our fields to be sucked out by vacuum tanker and undertook the 'scouring' of the nearby water course by 360⁰ digger to prevent any further loss of run-off to the nearby waterway.
7. I am perplexed by this incident and deeply regret the occurrence of it. I trust you will find this explanation satisfactory and recognise the efforts made on becoming aware of it. In discussion with family about this incident we have agreed that we will not wash the sprayer (following the application of Urea) on the stoned area in future. Instead there is a very suitable area where the cows are collected. At that location there is an unroofed slatted tank ($81m^3$) with the surrounding concrete sloping towards the tank, thereby providing complete containment. We think this is entirely suitable and allow for the full power washing of the sprayer and as washed off residue is fertiliser and not pesticides – this should be fully complian.

8. If I can be of further assistance please do get in touch.

Yours sincerely

REDACTED

....

REDACTED

P4 1

DOI: 10.1111/fme.12245

ORIGINAL ARTICLE

WILEY Fisheries Management and Ecology

An assessment of carcass counting surveys with increasing time lapse following a simulated fish kill on a small upland stream

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Funding information
Department of Agriculture, Environment and Rural Affairs for Northern Ireland

Abstract

A simulated fish kill was conducted on a small upland stream in Northern Ireland by planting out hatchery-produced brown trout *Salmo trutta* L. carcasses of various size categories. Standard, post-fish kill, assessment walkover surveys were conducted over time intervals to determine the number of carcasses visible. The sample variance between individual surveyors was generally low, with good agreement between the observed counts for the three, discrete, size fractions of fish up to 72 hr after the simulated fish kill. Despite low discharge rates, shallow water and good accessibility to the experimental stream, only 52% of the small category fish (<8 cm L_F) were recorded 4 hr after the start of the simulated fish kill. Larger carcasses (>17 cm L_F) were more visible, and >90% were detected 48 hr after the start of the simulated fish kill. After 96 hr, all size fractions of carcasses had reduced significantly, and the variability between replicate surveys increased markedly.

KEYWORDS
brown trout, distribution, fish kill, mortality, stock assessment, visual survey

1 | INTRODUCTION

Determination of losses following a fish kill incident is an unfortunate necessity for modern fishery managers across the globe. In many cases, a post-fish kill investigation is undertaken to determine the cause, spatial extent and numbers of fish lost (American Fisheries Society, 1982; Brown, Morley, Sanderson & Tait, 1983). The assessment of mortalities after a fish kill incident can involve a variety of techniques, dependant on the scale and nature of the event as well as the type of water course impacted (Hill, 1983; Patterson, Skibo, Barnes, Hills & Macdonald, 2007). The most direct assessment, employed on streams and smaller water bodies, involves a walkover survey of the impacted water and a visual count and/or collection of fish carcasses (Meyer & Barclay, 1990). Extensive incidents may necessitate subsampling a portion of the affected areas to facilitate extrapolation of losses to the entire impacted area. Post-fish kill surveys can provide important information on the different fish species affected. Additionally, biological data collated from carcasses can yield information on the age classes of fish killed and the likely subsequent impact of the incident on future productivity and recruitment (Kennedy, Rosell & Hayes, 2012). Post-fish kill investigations must be capable of accurately assessing the overall losses incurred by a fishery to provide a sound basis for subsequent compensation claims and mitigation actions. The relative paucity of scientific studies that evaluate potential investigatory methods or describe fish kill dynamics is a significant challenge to this management process. Fish kills are temporally and spatially unpredictable, and the undesirable losses thereof generally restricts the study of fish kill dynamics and subsequent recovery patterns to opportunistic investigations for which pre-kill baseline data are available (Kennedy et al., 2012; King, 2015). A review of fish kill related literature concluded that few studies have evaluated the different approaches for assessing mortality incidents and that more experimental work was urgently required, to improve understanding of fish kill dynamics and assessment (La & Cooke, 2011).

The accuracy of direct visual-count methods to determine the number of mortalities arising from a fish kill incident is dependent on a

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range of environmental and biological factors. Fish can drift considerable distances downstream after they have died in a river (Havn et al., 2017), and an increase in discharge rate may increase water velocities, carrying carcasses away from an affected section of water course. Also, scavengers may remove carcasses before a follow-up survey can be conducted (Fahy, 1985). Surface glare, turbulence, elevated turbidity, excessive depth, poor accessibility and complex stream characteristics can all reduce the efficacy of direct visual-count methods (Hankin & McCanne, 2000), often leading to an underestimate of actual losses (Hayne, Ober, Schaff & Scott, 1980). In an attempt to understand fish kill dynamics, some researchers have undertaken simulated fish kills (Labay & Buzan, 1999; Muhametsafina, Midwood, Bliss, Stamplecoskie & Cooke, 2014). No published information is currently available on the relationship between time lapse from mortality incident to follow-up survey and consequent post-kill, survey-derived estimates of fish losses.

In Northern Ireland, a fish carcass count is undertaken, where possible, after every fish kill event reported to the inland fishery authority. The survey is generally conducted as soon as possible after the incident is reported, irrespective of the time lapse since the incident. This time lapse can vary considerably, depending on how quickly the kill event is discovered, reported and assigned to fisheries staff for investigation. To improve confidence in the efficacy and value of carcass counts with increasing time lapse between incident and follow-up survey, a field experiment was conducted in which a fish kill event was simulated in a natural stream environment with replicated, controlled carcass counts over time.

The main objectives were to investigate the following: the accuracy of carcass counts between surveyors with increasing time lapse between the simulated mortality event and the follow-up survey; the persistence of carcasses in relation to size and time lapse between the simulated mortality event and the follow-up survey; and dispersal patterns of the simulated mortality event within the experimental stream over time.

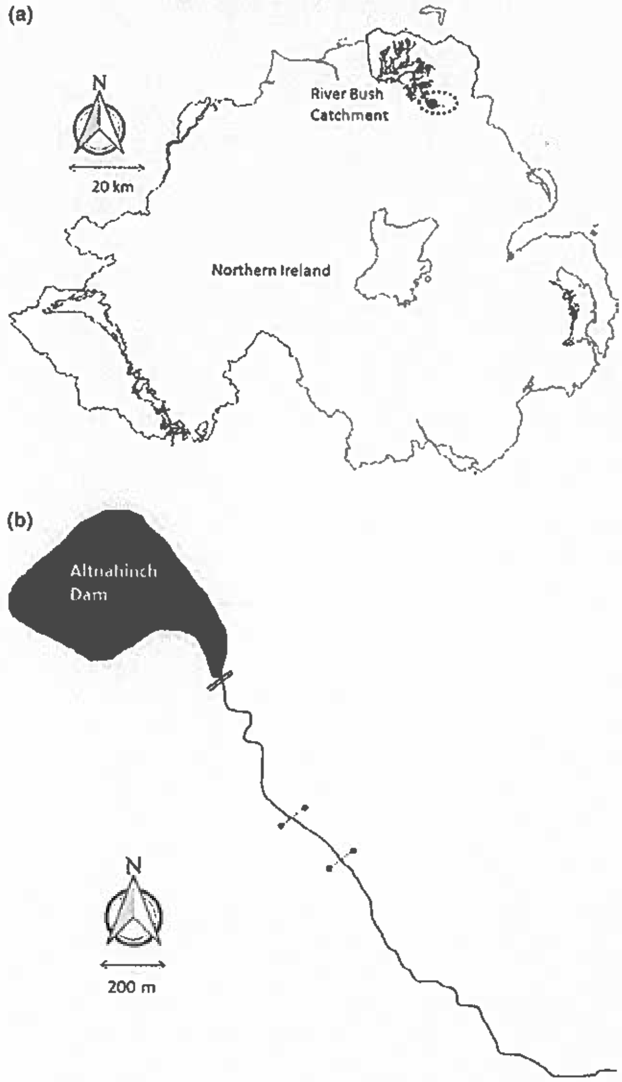

FIGURE 1 (a) The location of the River Bush catchment and Altnahinch stream in Northern Ireland and (b) Altnahinch experimental stream indicating the simulated fish kill area (dashed lines) and the bottom stop net (double lines)

2 | MATERIALS AND METHODS

The study was conducted in Altnahinch Stream, a small upland water course that feeds an extensive man-made reservoir in the headwaters of the River Bush catchment in Northern Ireland (Figure 1). The stream has a mean width of ≈3.7 m and rises at an altitude of ≈360 m on heather moorland, which has been the subject of coniferous re-afforestation. The stream is dominated by shallow (<30 cm), riffle stretches with a cobble substratum (64–256 mm particle size), although there are also a number of shallow pools (≈60–80 cm). Under normal non-spate discharge rates, the stream is transparent with a slight peat stain and the streambed is clearly visible. Brown trout, *Salmo trutta* L., are resident within the stream but migratory fish species, for example Atlantic salmon, *Salmo salar* L., are absent due to the barrier presented by the downstream reservoir. The riparian strip on both sides of the stream was relatively open, and the experimental section was entirely accessible along both banks.

A fish kill was simulated by scientific staff from the Agri-Food and Biosciences Institute (AFBI) for Northern Ireland, using hatchery-reared brown trout, reflective of the age structure and population density that would be expected naturally in Altnahinch Stream (Kennedy & Strange, 1986). A batch (614 in total) of disease-free, healthy, hatchery-reared brown trout were obtained from the Department of Agriculture, Environment and Rural Affairs (DAERA) aquaculture facility on the Lower Bann River, N. Ireland. These fish were culled by an overdose of anaesthetic (tricaine methanesulphonate) on the morning of 23 June 2014. The fish were then disinfected with potassium permanganate at 4 mg/L concentration and then rinsed with distilled water twice, and within an hour, the carcasses (347 fish <8 cm L_F; 169 fish of 11–14 cm L_F; 98 fish >17 cm L_F) were transported in iced containers and placed directly into the experimental stream in a random, scattered manner throughout a pre-designated 227-m section of the

TABLE 1 The fork length size class, associated simulated age class, number and density of brown trout carcasses introduced to simulate a fish kill in Altnahinch Stream, Northern Ireland

Size class	Age class	No. of carcasses	Density (no. /100 m^2)
<8 cm	0+	347	41.3
11–14 cm	1+	169	20.1
≥17 cm	>1+	98	11.7
Total		614	73.1

stream. The fish were chosen to reflect the respective natural 0+, 1+ and >1+ L_F categories (Table 1). A stop net was secured in the stream 505 m below the experimental fish kill zone, just above where the stream enters the downstream reservoir. This net was checked daily, and any carcasses discovered were measured, recorded and removed.

2.1 | Fish kill surveys and data analysis

Post-incident surveys were undertaken following the simulated fish kill during daylight hours by experienced DAERA fishery enforcement staff (surveyors) with previous experience in conducting post-fish kill counts. Surveyors were equipped with a survey sheet, a 1:10,000 scale map of the stream and a 30-cm fish measuring board with 1-cm intervals, but they were given no background information on the simulated kill: they were asked to survey the stream (walking on either bank), taking as much time as needed to note the extent of the kill on the map, and to conduct a visual count of mortalities by species and age class. Surveyors were instructed not to disturb or remove any carcasses and not to confer with any other surveyors during or after the survey.

Surveys were conducted at 4, 24, 48, 72 and 96 hr after the simulated fish kill. Replicate surveys were undertaken by six different surveyors at each time interval. At the start of each replicate survey, surveyors began at the same starting position, ≈150 m above the simulated fish kill area, but with a staggered starting time to avoid concurrent surveying and the possible interaction amongst surveyors that could potentially occur. The datasheets were collected at the end of each replicate survey, when AFBI staff immediately checked the downstream stop net—any carcasses collected in it were measured, recorded and removed. AFBI staff then walked upstream and noted the number, L_F and position of any carcasses that had dispersed below the original simulated fish kill zone, but these fish were not removed. Following the final survey (at +96 hr), and after the downstream stop net catch and dispersed fish were noted, all remaining carcasses that could be seen were removed from the stream for disposal.

A residual maximum-likelihood (REML) model (VSN International, 2013) was used to analyse the carcass count data generated from the repeated walk over surveys, to test for significant differences in the main effects of fish size (<8, 11–14, >17 cm L_F), the time-lapse period (4, 24, 48, 72, 96 hr) and their interaction. The surveyor and time-lapse period variability was accounted for with a power function fitted to the lag period term as the time interval between successive surveys was unequal.

3 | RESULTS

The number of brown trout carcasses observed by surveyors declined during the study. Of the initial 614 carcasses introduced to the stream, 391 were observed 4 hr after placement, 368 after 24 hr, 318 after 48 hr, 195 after 72 hr and 81 after 96 hr. The smallest size class (<8 cm L_F) showed the highest reduction, with 52% of the initial number of introduced carcasses observed at 4 hr, and only 2% observed at 96 hr (Table 2). The intermediate and larger size classes declined more slowly, with 18% of 11–14 cm L_F fish and 43% of >17 cm L_F fish still observed at the experiment's conclusion (Table 2).

The interaction between survey time lapse and fish L_F was highly significant (REML model: Wald Statistic 82.7, $p < .001$). When the time-lapse series was examined within each fish size class, distinctive patterns were observed with significant differences at various time points. A significant decrease was observed between the number of small (<8 cm L_F) trout initially introduced ($n = 347$) and the mean carcass count (181; least significant difference (LSD) = 18) at 4 hr. The observed number of small trout continued to decline significantly between sequential surveys (Figure 2). The number of 11–14 cm L_F trout detected at 4 hr decreased significantly from the initial 169 to a mean count of 119 carcasses (LSD = 18). No significant differences were then detected for 11–14 cm L_F fish at 24 hr or 48 hr (120 and 104 fish, respectively), but a further significant decline (Figure 2) in the carcass count was detected at 72 hr (65 fish) and again at 96 hr (31 fish). The >17 cm L_F class showed no significant difference between the 98 introduced fish and the mean carcass count (91; LSD = 18) after 4 hr. No significant decline in the number of observed carcasses was detected for >17 cm L_F fish within the first 48 hr of the simulated fish kill, with a mean count of 94 and 93 fish recorded at 24 hr and 48 hr, respectively. The number of >17 cm L_F fish counted after 72 hr decreased significantly to 68 carcasses, decreasing further to 42 carcasses at 96 hr (Figure 2).

The coefficient of variation (CV) between the surveyors was generally low (<0.2) for most fish classes across most time periods. Two exceptions to this tendency were observed, initially for >17 cm L_F fish at 4 hr, when CV = 0.33, and secondly for <8 cm and 11–14 cm L_F classes at 96 hr, when CV increased markedly to 0.93 and 0.51, respectively (Figure 3).

Downstream dispersal of carcasses from the planting zone was very limited during the initial 24 hr of the experiment, with no displaced fish carcasses observed. A small number (12 fish) of <8 cm L_F trout were observed to have dispersed up to 227 m downstream from the introduction area at 48 hr, and this downstream displacement

TABLE 2 The mean percentage of brown trout carcasses by fork length size class observed at increasing time lapse following introduction into Altnahinch Stream

Size class	4 hr	24 hr	48 hr	72 hr	96 hr
<8 cm	52	44	35	18	2
11–14 cm	71	71	60	38	18
>17 cm	93	96	99	69	43

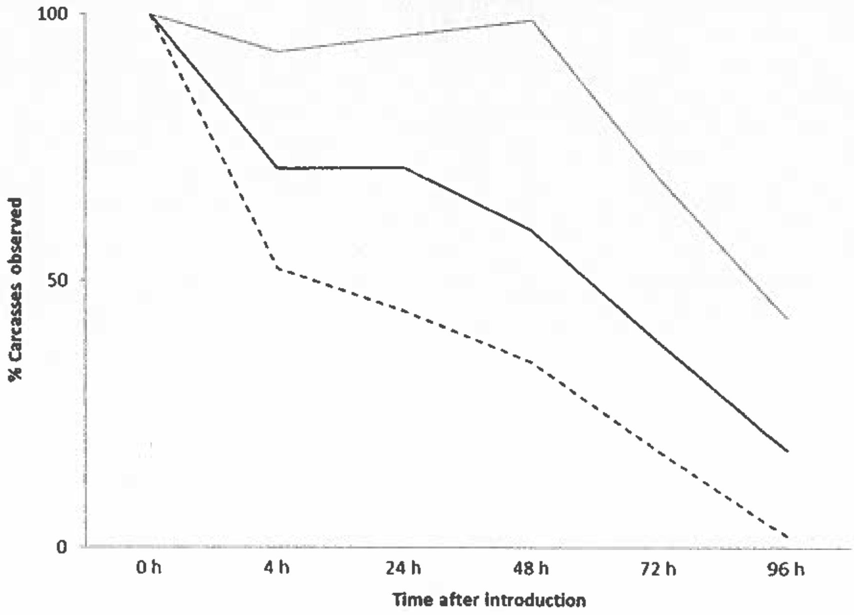

FIGURE 2 The mean percentage of brown trout carcasses observed at increasing time lapse after introduction to Altnahinch stream; where the dashed line shows trout <8 cm L_F, the black line shows 11–14 cm L_F trout and the grey line shows larger trout >17 cm L_F

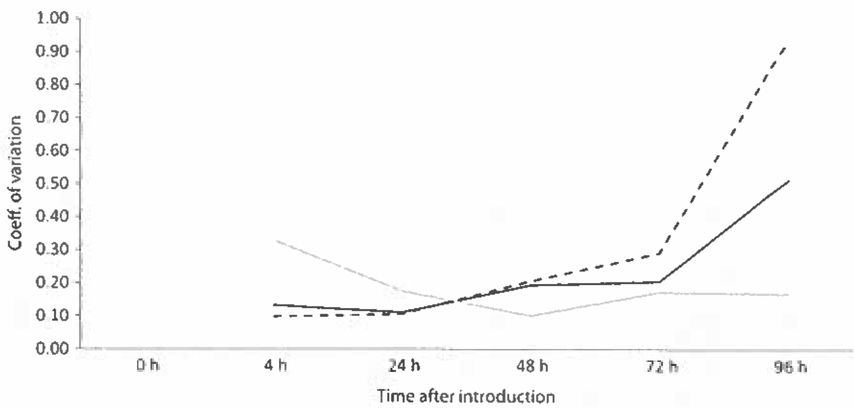

FIGURE 3 The coefficient of variation associated with carcass counts of dead brown trout in Altnahinch stream; where the dashed line shows trout <8 cm L_F, the black line shows 11–14 cm L_F trout and the grey line shows larger trout >17 cm L_F

further extended to 505 m at 96 hr (Table 3). There was only limited downstream displacement of larger fish carcasses during the experiment, with six 11–14 cm L_F fish displaced 35 m downstream at 96 hr and no fish of >17 cm L_F observed downstream of the initial introduction area during the study (Table 3).

4 | DISCUSSION

This small-scale fish kill simulation showed that the number of carcasses visible to surveyors declined with increasing time lapse between carcass planting and the follow-up survey. Direct visual surveys of carcasses showed good consistency between the observed counts for the three discrete size fractions of fish during the first 72 hr of the experiment (Figure 3). This relatively close agreement may have been due, in part, to the artificially well-segregated size distribution of hatchery fish used in the experiment. This distinct size segregation was different to the often overlapping, multimodal, length-frequency distributions usually seen in wild fish populations, and this made it easier for the experienced surveyors to differentiate between the simulated size classes. The greatest variation between individual surveyor's carcass counts was at the 96-hr survey for the smallest (<8 cm L_F) size category. After 4 days, relatively few small fish remained visible, and the visible carcasses had dispersed throughout the stream. By the final survey, the combined effect of low numbers of small fish carcasses and high dispersal levels leads to an increased variation between the counts and reinforces the need to undertake prompt post-kill investigations.

The present work was conducted during low discharge conditions in a small, clear, oligotrophic upland stream that afforded good access, with virtually no riparian cover. These circumstances amounted to near optimal conditions for the maximum retention and subsequent detection of fish carcasses in the stream. The detection of only half of the smallest (<8 cm L_F) fish just 4 hr after the simulated kill was surprising, which indicates underestimation of that size class was most likely due to surveyors not observing these smaller fish rather than

	4 hr		24 hr		48 hr		72 hr		96 hr	
Size class	n	(m)	n	(m)	n	(m)	n	(m)	n	(m)
<8 cm	0	0	0	0	12	227	8	227	5	505
11–14 cm	0	0	0	0	0	0	9	30	6	35
>17 cm	0	0	0	0	0	0	0	0	0	0

TABLE 3 The number (n) of brown trout carcasses (by fork length size class) that had displaced downstream (maximum distance in m) out of the initial simulated fish kill area at increasing time lapse after initial introduction

any translocation or scavenging of the carcasses. Following initial introduction into Altnahinch Stream, the carcasses sank and then settled on the stream bed, with the smaller fish more easily concealed from view after settling amongst the dark basalt cobble substratum. While it is true that these smaller fish would be more susceptible to removal from the survey area through scavenging, more rapid decomposition and more rapid downstream translocation by the flow than larger carcasses (Hankin & McCanne, 2000), these factors did not start to take effect until 24 hr after the simulated kill. Some potential scavengers such as red fox *Vulpes vulpes*, L. and grey heron *Ardea cinerea*, L. are found in the Altnahinch Stream area but none were observed during daylight hours of the experiment, most likely because of the more-or-less continuous presence of surveyors and scientists during the experiment. This lack of initial biological and physical influences and the close agreement between the carcass counts at 4 hr and 24 hr indicates that size-mediated limitation of the visual survey technique was the primary determinant of the results during the first day of the experiment. Small fish (<15 cm T_L) and less abundant species were underestimated to a much larger degree in fish kill counting procedures on a small stream study elsewhere (Labay & Buzan, 1999). In the present study, the high count of larger carcasses (>17 cm L_F) relative to the introduced number (>90%) during the first 48 hr after the simulated kill suggests that these larger fish were more visible and thus more readily counted (Table 2). In addition, the high persistence of the larger carcasses also indicated the relative lack of activity by scavengers at the site during the first 48 hr.

4.1 | Biological processes—scavenging, decomposition and natural dispersal

The number of observed 11–14 cm L_F carcasses declined markedly by the 48-hr survey, and >17 cm L_F carcasses declined sharply by 72 hr (Table 2), with increasing evidence of scavenging activity at the site, mainly by foxes. The longer-term patterns in carcass counts were therefore more likely driven by site-specific biological processes, such as dispersal on bloating, decomposition and scavenger consumption rates. Simulated fish kills in small North American streams have shown that fish carcasses were rapidly scavenged, with reported removal rates of >60% after 16 hr (Labay & Buzan, 1999), 40%–90% after 2 days (Ryon et al., 2000) and up to 86% after 24 hr (Muhametsafina et al., 2014). Similar high scavenging rates were also observed in a lake environment where 82% of carcasses were rapidly consumed by other fish and turtles (Schneider, 1998). During the present study, no larger carcasses (>17 cm L_F) were found to have dispersed downstream from the initial carcass planting area. Relatively limited dispersal patterns of white sucker, *Catostomus commersonnii* Lacepède, carcasses (127–140 mm L_T) were observed in a small stream where the mean daily dispersal distances for PIT tagged fish ranged from 0.0 to 7.6 m/day and included downstream and lateral dispersal (Muhametsafina et al., 2014). In a telemetry study in Germany, radio-tagged dead salmon *Salmo salar* L. smolts (mean L_F = 15.2 cm) exhibited relatively limited dispersal with most drifting only a few metres to a few hundred metres by the end of the study (Havn et al., 2017). Smaller fish, by contrast, had dispersed downstream by over 500 m after 96 hr in the present study (Table 3). Decomposition rates of fish carcasses vary according to a range of factors, including fish size and water temperature (Parmenter & Lamarra, 1991), with decomposition rate more rapid for fish remaining in-stream compared to those removed onto the adjacent shore (Muhametsafina et al., 2014). Freshly dead adult sockeye salmon *Oncorhynchus nerka*, Walbaum, were observed to sink initially, and the time taken for the carcass to surface was inversely related to water temperature and ranged from one to 3 days at 20°C to 12–18 days at 6°C (Patterson et al., 2007). Water temperature in Altnahinch Stream varied between 10 and 14°C, and as time progressed during the study some of the carcasses started to decompose, bloat and then be translocated by the stream. As decomposition rates were higher on smaller fish, this may have accounted for the differential distribution of small and large carcasses at 96 hr (Table 3).

The time lapse between a fish kill incident and the follow-up survey is of critical importance to the accurate visual count of losses since increased time lapse reduces count viability due to translocation, decomposition and scavenging of carcasses (Ryon et al., 2000). A carcass count conducted on the Blackwater River in Northern Ireland several days after a fish kill event only accounted for ≈ 5% of the actual number of salmonids killed (Kennedy et al., 2012). The present study has further indicated that, even given ideal survey conditions, smaller fish can be grossly underestimated after a relatively short time lapse (4 hr); this highlights the limitations in achieving a full account of losses for even the most timely follow-up investigation and should be considered by managers using visual survey data for fish kill investigations. Fishery managers should be aware that the patterns of fish carcass distribution following a mortality event will be influenced by the assessment method (visual underestimates), environmental conditions (discharge, temperature, substratum, depth, turbidity, accessibility) and biological processes (scavenging, decomposition) with all these processes likely to be context specific and interactive. In addition, a telemetry study conducted in Germany indicated that the species of fish killed may also influence subsequent carcass distribution patterns, as dead eels drifted over 12 times further than salmon smolts after placement of the carcasses in a river (Havn et al., 2017). Carcass count data may, at best, provide a partial estimate of total losses following a fish kill, and there is clear scope for the application of upward expansion factors from visual counts for post-kill assessments of stock losses, accounting for fish size, species and any significant local biological and environmental factors.

The inability to mimic the behaviour of stressed fish, upon exposure to a pollutant, before they die and settle is a major disadvantage of artificial simulated fish kills. Zięba et al. (2014) showed that acoustically tagged barbel *Barbus barbus* (L.) exhibited high site fidelity despite exposure to a water pollution incident in a southern English river. Hesthagen (1989), by contrast, suggested that stressed, dying salmonids can exhibit a general downstream migration pattern in response to exposure to noxious substances. This behaviour could potentially result in carcasses translocated over an extended area and even remove a proportion of subsequent losses from the perceived pollution or fish kill area, a phenomenon that cannot be readily replicated or studied artificially.

Most experimental work on fish kill assessment methods has occurred on small streams to facilitate access and experimental convenience. The efficacy of direct counting procedures in larger rivers is likely to be reduced due to increased depth and lower visual accessibility. Future work investigating the dynamics of fish kill events in larger, deeper rivers would be challenging but of significant value for fishery managers.

In conclusion, direct carcass counts can be a useful tool to assess the distribution and magnitude of fish mortalities after a fish kill incident and can be reflective of losses particularly for larger fish in small streams with low scavenging rates. The time lapse between the kill event and the follow-up survey is critical, as the count accuracy declines, and the coefficient of variation around visual estimates increases, with increasing time lapse. However, even with good conditions (low discharge rate, good access, a relatively short lapse time between the kill, and the follow-up survey and low scavenging rates), smaller fish can still be grossly underestimated in cobble/gravel salmonid nursery streams.

ACKNOWLEDGMENTS

This work was funded by the Department of Agriculture, Environment and Rural Affairs for Northern Ireland. Sincere thanks to DAERA fishery enforcement staff and to Water Service NI and Forest Service NI for assisting with the experiment.

REFERENCES

American Fisheries Society (1982). *Investigation and valuation of fish-kills*. Special Publication No. 24. Bethesda, MD: American Fisheries Society.

Brown, T. E., Morley, A. W., Sanderson, N. T., & Tait, R. D. (1983). Report of a large fish-kill resulting from natural acid water conditions in Australia. *Journal of Fish Biology*, *22*, 335–350.

Fahy, E. (1985). Fish-kills in Ireland: An analysis of incidents in 1983 and 1984. *Fishery Leaflets Ireland*, *128*, 1–19.

Hankin, D., & McCanne, D. (2000). Estimating the numbers of fish and crayfish-killed and the proportions of wild and hatchery rainbow trout in the Cantara spill. *Californian Fish and Game*, *86*, 4–20.

Havn, T., Økland, F., Teichert, M., Heerman, L., Borcherding, J., Saether, S., ... Thorstad, E. (2017). Movements of dead fish in rivers. *Animal Biotelemetry*, *5*, 7.

Hayne, D., Ober, R., Schaff, L., & Scott, D. (1980). Comparison of second day pick up with numbers estimated by pollution committee counting guidelines – Barkley lake study. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies*, *33*, 738–752.

Hesthagen, T. (1989). Episodic fish-kills in an acidified salmon river in southwestern Norway. *Fisheries*, *14*, 10–17.

Hill, D. (1983). Fish-kill investigation procedures. In L. Nielsen, & D. Johnson (Eds.), *Fisheries techniques* (pp. 261–274). Bethesda, Maryland: American Fisheries Society.

Kennedy, R. J., Rosell, R., & Hayes, J. (2012). Recovery patterns of salmonid populations following a fish-kill event on the River Blackwater, Northern Ireland. *Fisheries Management and Ecology*, *19*, 214–223.

Kennedy, G. J. A., & Strange, C. D. (1986). The effects of intra- and inter-specific competition on the distribution of stocked juvenile Atlantic salmon, *Salmo salar* L., in relation to depth and gradient in an upland trout, *Salmo trutta* L., stream. *Journal of Fish Biology*, *29*, 199–214.

King, J. (2015). Ecology and economics of fish-kills: Mortality and recovery of brown trout (*Salmo trutta* L.) and Atlantic salmon (*Salmo salar* L.) in an Irish river. *Biology and Environment: Proceedings of the Royal Irish Academy*, *115*(B), 157–170.

La, V. T., & Cooke, S. (2011). Advancing the Science and Practice of Fish-kill Investigations. *Reviews in Fisheries Science*, *19*, 21–33.

Labay, A., & Buzan, D. (1999). A comparison of fish-kill counting procedures on a small narrow stream. *North American Journal of Fisheries Management*, *19*, 209–218.

Meyer, F. P., & Barclay, L. A. (1990). Field manual for the investigation of fish-kills. . *U. S. Fish and Wildlife Service, Resource Publication Series*, *177*, 1–120.

Muhametsafina, A., Midwood, J., Bliss, M., Stamplecoskie, K., & Cooke, S. (2014). The fate of dead fish tagged with biotelemetry transmitters in an urban stream. *Aquatic Ecology*, *48*, 23–33.

Parmenter, R. R., & Lamarra, V. (1991). Nutrient cycling in a freshwater marsh: The decomposition of fish and waterfowl carrion. *Limnology & Oceanography*, *36*, 976–987.

Patterson, D. A., Skibo, K., Barnes, D., Hills, J., & Macdonald, J. (2007). The influence of water temperature on time to surface for adult sockeye salmon carcasses and the limitations in estimating salmon carcasses in the Fraser River, British Columbia. *North American Journal of Fisheries Management*, *27*, 878–884.

Ryon, M., Beauchamp, J., Roy, W., Schilling, E., Carrico, B., & Hinzman, R. (2000). Stream dispersal of dead fish and survey effectiveness in a simulated fish-kill. *Transactions of the American Fisheries Society*, *129*, 89–100.

Schneider, J. C. (1998). Fate of dead fish in a small lake. *The American Midland Naturalist*, *140*, 192–196.

VSN International (2013). *GenStat for Windows*, 16th edn. Retrieved from http://GenStat.co.uk

Zięba, G., Stakėnas, S., Godard, M. J., Ives, M., Seymour, J., Carter, M. G., & Copp, G. H. (2014). Long-term decline of barbel *Barbus barbus* in a highly urbanised river of southeastern England, with particular reference to the survival and movements of tagged fish during a water pollution incident. *Fundamental & Applied Limnology*, *185*, 43–53.

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Part IV: INDEX TO MISCELLANEOUS ITEMS Page 1 of 1

(form PPS 10)

CONTENTS	HELD BY / ON FILE	Page No(s)
Notebook Entry - P2	On File	1
Notebook Entry - P3 (Pages 5, 6, 7, 8 and 9)	On File	3
Notebook Entry - P4	On File	7

WR 4/22/0710

23/8/22 Checked River Lagan at
2030 Junction of Dublin Hill Rd
& Lagan Rd. Observed
fish Rising, no dead fish
seen. Continued down
fish at Blackskull Rd
2045 Bridge walked upstream
one dead fish spotted
approx 100m upstream of
bridge - none observed
further upstream. Witnessed
colleague P1
lift fish kill samples
Rechecked River at Dublin
Hill Rd. No dead fish
observed.

P2
2/2/23

WED 24/8/22

AT APPROX 9:10 INSPECTED RIVER LOCATION AT THORNYFORD BRIDGE BLACKSKULL RD DROMORE. WATER LOOKED CLEAR BUT DEAD FISH WERE OBSERVED AT THE BRIDGE. 2 DEAD FISH WERE OBSERVED FOR APPROX 100M UPSTREAM OF THE BRIDGE. NO DEAD FISH WERE OBSERVED ABOVE THIS POINT. SEVERAL SPOTS UPSTREAM WERE INSPECTED BUT NO DEAD FISH WERE NOTED. I PHONED P4 (S&I) AND ARRANGED TO MEET UP AT A LATER TIME. I MET UP WITH P4 @ APPROX 1430 BY THIS TIME P4 HAD FOUND A PIPE DISCHARGING INTO THE

6

RIVER LAGAN APPROX 100 M
UPSTREAM OF BLACKSCULL RD
WE CONTINUED OUR INVESTIGATION
ACROSS THE LURGAN RD APPROX
100M FROM THE ENTRANCE TO
REDACTED WE INSPECTED
A DITCH / SHEUGH IN A FIELD AND
OBSERVED A BROWN COLOURED
LIQUID IN IT. PHOTO TAKEN. THIS
HAD/WAS COMING DOWN A SMALL
WATERWAY FROM REDACTED
THE FARM OWNED BY REDACTED
HIS SON ARRIVED AND WE EXPLAINED
THE REASON FOR OUR VISIT WE THEN
WENT UP AND MET REDACTED
AND EXPLAINED THE REASON FOR
OUR VISIT AFTER INSPECTING THE
WATERWAY AND DITCH / SHEUGH WITH

7

REDACTED WE OBSERVED A PIPE
ON THE FARM DISCHARGING THE
SAME TYPE OF LIQUID THAT
WAS IN THE DITCH / SHEUGH / WATER
WAY. AT THIS POINT WE TOLD
REDACTED WE WOULD BE TAKING
STATUTORY SAMPLES OF THE
DISCHARGE ON HIS FARM AND THE
POINT WHERE THE DISCHARGE
WAS ENTERING THE RIVER LAGAN.
HE WAS GIVEN THE OPPORTUNITY TO
WITNESS THE TAKING OF THE
SAMPLES BUT HE WAS HAPPY ENOUGH
FOR US TO TAKE THEM ON OUR
OWN. I WITNESSED P4
TAKE A STATUTORY
SAMPLE FORM THE DISCHARGE
PIPE ON THE FARM @ 16.10.

IT WAS SEALED AND LABELLED I THEN WITNESSED P4 TAKE A STATUTORY SAMPLE FROM THE DISCHARGE PIPE THAT WENT INTO THE RIVER LAGAN @ 16.55 IT WAS SEALED AND LABELLED I THEN WITNESSED P4 TAKE AN INVESTIGATIVE SAMPLE FROM THE DITCH AREA 100M BELOW THE ENTRANCE TO REDACTED @ 17.25

DURING OUR CONVERSATION WITH REDACTED ABOUT THE SOURCE/ CAUSE OF THE DISCHARGE HE SAID THAT THE PIPE THAT THE DISCHARGE WAS COMING OUT OF WAS JUST FROM THE SEPTIC

8

9

TANK AS FAR AS HE KNEW
WE LOOKED AT THE SEPTIC
TANK THE EFFLUENT IN THE TANK
LOOKED SIMILAR TO WHAT WAS
IN THE [illegible] / DITCH

P3

24/5/22
1820

24/8/22 AT 12.00 I INSPECTED THE RIVER LAGAN AT BANUGE I OBSERVED DEAD FISH IN THE RIVER AND STAFF FROM INLAND FISHERIES WERE ON SITE. I INSPECTED THE RIVER FURTHER UPSTREAM NEAR DONAGHCLONEY WEIR BUT DID NOT OBSERVE ANY DEAD FISH THERE. I THEN WENT TO THORNYFORD BRIDGE, A CONSIDERABLE DISTANCE UPSTREAM AND

SAW A CONSIDERABLE
NUMBER OF DEAD FISH
WHICH HAD BEEN REPORTED
THE PREVIOUS EVENING. I
WALKED UP THE RIVER FROM
THE BRIDGE AND COULD SEE
SIGNIFICANT NUMBERS OF
DEAD FISH ON THE BED
OF THE RIVER ROUGHLY
100 METRES UPSTREAM OF
THE BRIDGE I STOPPED SEEING
DEAD FISH AND THEN OBSERVED
A LIVE ONE. I SLOWLY
RETRACED MY STEPS UNTIL
I FOUND A POINT WHERE
DEAD FISH STARTED TO APPEAR.
I CLOSELY INSPECTED BOTH
SIDES OF THE RIVER AND

FOUND A BLACK PLASTIC
DRAINAGE PIPE DISCHARGING
A BROWN LIQUID THE
DEAD FISH COULD BE SEEN
BELOW THIS PIPE BUT
NOT ABOVE IT. I TOOK A
PHOTOGRAPH OF THIS PIPE
AT 14 09. I CONTACTED
MY COLLEAGUE P3
WHO MET ME ON SITE. WE
EXAMINED THE LURGAN ROAD
IN THE AREA THIS PIPE RAN
FROM AND FOUND A PONDED
DITCH BEHIND THE HEDGE ON
THE OPPOSITE SIDE OF THE
ROAD FROM THE RIVER. WE
ENTERED THE FIELD TO
LOOK AT THIS AND NOTED

IT TO BE A BROWN COLOUR. THE PONDED AREA WAS FED BY A SMALL DITCH RUNNING ALONG THE SIDE OF THE FIELD FROM THE DIRECTION OF FARM PREMISES. WE WERE APPROACHED BY A MAN WHO IDENTIFIED HIMSELF AS THE LAND OWNERS SON. WE EXPLAINED THE SITUATION AND SHOWED HIM THE BROWN PONDED AREA. HE CONFIRMED THAT THERE WAS A PIPE THAT DRAINED THIS AREA UNDER THE LURGAN ROAD. WE TOLD HIM THAT WE WOULD CALL UP TO THE FARM AND

SPEAK TO HIS FATHER. AS I WAS DRIVING UP THE LANEWAY, I MET AN AGRICULTURAL VEHICLE COMING THE OTHER WAY. THE DRIVER STOPPED AND SPOKE TO ME. HE INTRODUCED HIMSELF AS REDACTED WHO OWNED THE FARM BUSINESS. I EXPLAINED THE SITUATION AND WHAT WE HAD SEEN AT THE BOTTOM OF THE FIELD. WE SHOWED HIM THE PONDED AREA AND EXAMINED THE DITCH RUNNING DOWN TOWARDS IT. HE WAS OF THE OPINION THAT THIS FLOW WOULD ONLY BE THE DISCHARGE

FROM THE DWELLING HOUSE
SEPTIC TANK AND SHOWED
US WHERE THIS DISCHARGE
EMERGED FROM A PIPE. I
NOTICED A VERY DISTINCT SMELL
OF AMMONIA IN THE AREA
AROUND THIS DISCHARGE PIPE,
WE THEN WENT TO LOOK
AT THE DWELLING HOUSE
SEPTIC TANK. AN AMMONIA
SMELL WAS NOTICEABLE HERE
TOO. I INFORMED REDACTED
THAT WE WOULD BE REQUIRED
TO COLLECT A STATUTORY SAMPLE
OF THE DISCHARGE TO THE
DITCH AND TO THE RIVER
LAGAN. I EXPLAINED THAT
THE RESULTS OF THE ANALYSIS

OF THIS SAMPLE COULD
BE ADMISSIBLE AS EVIDENCE
IN COURT. I ALSO TOLD
HIM THAT HE HAD THE
RIGHT TO WITNESS THE
SAMPLES BEING TAKEN, WHICH
HE DECLINED TO DO, AND
THAT HE WOULD HAVE
THE CHOICE OF ONE OF
THE THREE PORTIONS OF
EACH STATUTORY SAMPLE.
HE ASKED ME TO LEAVE
THEM FOR HIM AT THE
REAR OF THE DWELLING
HOUSE. I NOTED DOWN
THE PARAMETERS WE
WOULD BE LIKELY TO GET
THE SAMPLES ANALYSED FOR

AND LEFT THAT WITH
MY CONTACT DETAILS AT
HIS REQUEST I THEN
PROCEEDED TO COLLECT
STATUTORY SAMPLES OF
THE DISCHARGE TO THE
DITCH (16.10) AND AT THE
BLACK PIPE DISCHARGING TO
THE RIVER LAGAN (16.55). A
SAMPLE (INVESTIGATORY) WAS
ALSO TAKEN FROM THE
PONDED AREA AT THE SIDE
OF THE LURGAN ROAD AT
17.25. ALL OF THESE SAMPLES
WERE TAKEN AS WITNESSED
BY P3 WITH
THE STATUTORY SAMPLES BEING
DIVIDED INTO 3 PORTIONS, SEALED

AND LABELLED I THEN
LEFT ONE PORTION OF
EACH STATUTORY SAMPLE
AT THE REAR OF THE
DWELLING HOUSE AS
REDACTED HAD REQUESTED
I THEN PROCEEDED TO
THE NIEA LISBURN LABORATORY
WHERE I PLACED THE REMAINING
STATUTORY SAMPLE PORTIONS
AND THE INVESTIGATORY SAMPLE
IN THE DESIGNATED OUT OF
HOURS STORAGE FRIDGE

P4 24/8/22

2

GE
THE
OW

[illegible] SYSTEM

P4 25/8/22

25/8/22 I SPOKE TO REDACTED

ON THE PHONE TO
ENQUIRE IF HE HAD BEEN
ABLE TO DETERMINE THE
CAUSE OF THE STRONG
SMELLING EFFLUENT. HE
SAID THAT FIELDS HAD
BEEN SPREAD WITH A
FERTILISER THAT WOULD
EXPLAIN THE AMMONIA ODOUR.
I ADVISED HIM TO TANKER
OUT THE BROWN LIQUID
PONDED BESIDE THE ROAD TO
REDUCE ANY FURTHER DISCHARGE
TO THE RIVER, WHICH HE
AGREED TO DO.

– P4 25/8/22

11/1

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Part V: DISCLOSURE

(form PPS 13 (Departmental))

CONTENTS	PAGE NO (s)
DISCLOSURE OFFICER'S REPORT	4

DISCLOSURE OFFICER	
I certify that all disclosure obligations have been discharged by NIEA in connection with the material arising from this investigation. **Signature of Disclosure Officer:** PIO	
Date:	04/09/2023
Full name:	PIO
Grade:	STAFF OFFICER
Telephone number:	PIO
Email:	PIO
Fax:	

If different from above, who should PPS contact if requiring further information/clarification on this file?

CONTACT OFFICER	
Full name:	
Grade:	
Telephone number:	
Email:	
Fax:	

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DISCLOSURE OFFICER'S REPORT - NOT TO BE DISCLOSED

DAERA NIEA -v- REDACTED

The following items might reasonably be considered capable of undermining the case for the prosecution against the accused, or of assisting the case for the accused and are required to be supplied under Section 7.3 of the Code.

Enter NS or S to denote Non-sensitive or Sensitive schedule and enter Item Number from schedule. If item not on schedule (e.g. previous conviction of witness) enter 'NOT ON'.

Schedule	Item No	Reason	Enter: F – if on file A – if copy attached
		NONE	

I certify that to the best of my knowledge and belief, all material which has been retained and made available to me has been revealed to the prosecutor in accordance with the Criminal Procedure and Investigations Act 1996 Code of Practice and the Attorney General's Guidelines.

Signed by Disclosure Officer: PIO

Date: 04/09/2023

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PPS Ref: ____________

SCHEDULE OF NON-SENSITIVE MATERIAL

DAERA NIEA -v- REDACTED

The disclosure officer believes that the following material is NOT sensitive

Item No	Description	Location e.g. on file, held by investigator etc.	For PPS/Prosecutor use only. Enter E (Evidence) Enter DC (Disclosure Copy) Enter DI (Disclose by inspector) Plus comment if necessary
1	One portion of each Statutory Sample: WR 4/22/0710 taken at 16:10 on 24/08/2022 WR 4/22/0710 taken at 16:55 on 24/08/2022	Held in NIEA Lab Lisburn	
2	Witness Statement of: P1 (2 pages dated 01/08/2023)	On File	
3	Witness Statement of: P2 (1 page dated 15/01/2023)	On File	
4	Witness Statement of: P3 (2 pages dated 25/01/2023)	On File	
5	Witness Statement of P4 (3 pages dated 14/04/2023)	On File	
6	Witness statement of Laboratory Analyst: P6 (2 pages dated 19/07/2023)	On File	
7	Witness Statement of Laboratory Analyst: P5 (3 pages dated 04/10/2022)	On File	
8	Witness Statement of: P7 (1 page dated 25/08/2022)	On File	
9	Witness Statement of: P8 (1 page dated 25/08/2022)	On File	
10	Witness Statement of: P9 (3 pages dated 24/08/2023)	On File	
11	Photograph and Map Exhibits P2 Location Map indicating extent of River Lagan Fish Kill observed on 23/08/2023 P3 1 Map of Area P3 2 River Lagan at Thornyford Bridge P3 3 Where Investigative Sample was taken P3 4 Effluent from Discharge Pipe	On File	

	P3 5 Discharge Pipe on Farm (Blue in Colour) P4 1 Dead fish seen below discharge pipe to river Lagan on 24 August 2022 P4 2 Discharge pipe to river Lagan with brown discolouration below it as seen on 24 august 2022 P4 3 Discharge pipe near dwelling house at REDACTED on 24 August 2022. Strong Ammonia odour noted at this location P4 4 Statutory sample portions left at dwelling house at REDACTED on 24 August 2022 in accordance with Alan Wilson's request P4 5 Postal Caution sent to REDACTED from P4 – NIEA dated 24 October 2022 P4 6 Response to Postal Caution sent to P4 – NIEA from REDACTED P9 1 An assessment of carcass counting surveys with increasing time lapse following a simulated fish kill on a small upland stream (Kennedy et al, 2017)		
12	Copies of Notebook	On File	
13	Notebook Entries	Held by Officer	

Signed: P10

Disclosure Officer

Date: 04/09/2023

Signed:

____

PPS Prosecutor

Date:

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Item No	Description	Location e.g. on file, held by investigator etc.	For PPS/Prosecutor use only. Enter E (Evidence) Enter DC (Disclosure Copy) Enter DI (Disclose by inspector) Plus comment if necessary
1.	NONE		
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Signed: PIO

Disclosure Officer

Date: 04/09/2023

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Date:

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SCHEDULE OF SENSITIVE MATERIAL

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Item No	Description	Reason for sensitivity	Location State if supplied to Prosecutor/ otherwise state location
1.	NONE		
2.			
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Date: 04/09/2023

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