

Report on investigations into wild Atlantic salmon mortalities in the lower Ballisodare catchment in late June to mid-July 2024

IFI/2024/1-4735



Iascach Iníre Éireann
Inland Fisheries Ireland

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Foras na Mara
Marine Institute

DOCUMENT CONTROL SHEET

Name of Document:	Report on investigations into wild Atlantic salmon mortalities in the lower Ballisodare catchment in late June to mid-July 2024.				
Author (s):	Michael Millane, Aishling Donegan, Fiona Geoghegan, Seán Kelly, Mary Walsh, Samantha White and Michael Wilson				
Authorised Officer:	Michael Millane				
Description of Content:	This document provides a report on investigations into the wild Atlantic salmon mortalities that occurred in the lower Ballisodare catchment in late June to mid-July 2024.				
Approved by:	Cathal Gallagher				
Date of Approval:	11 September 2024				
Assigned review period:	n/a				
Date of next review:	n/a				
Document Code	IFI/2024/1-4735				
This document comprises	TOC	Text	List of tables	List of Figures	No. Appendices
	YES	YES	NO	NO	4

Version Control Table

Version No.	Status	Authors(s)	Reviewed by	Approved by	Date of issue
1.0	Issued	Michael Millane ¹ , Aishling Donegan ¹ , Fiona Geoghegan ² , Seán Kelly ¹ , Mary Walsh ¹ , Samantha White ² , Michael Wilson ¹	Barry Fox ¹ Cathal Gallagher ¹ Fiona Geoghegan ² Mary Walsh ¹	Cathal Gallagher	23/08/2024
2.0	Issued	Michael Millane ¹ , Aishling Donegan ¹ , Fiona Geoghegan ² , Seán Kelly ¹ , Mary Walsh ¹ , Samantha White ² , Michael Wilson ¹	Aishling Donegan ¹ Barry Fox ¹ Cathal Gallagher ¹ Samantha White ²	Cathal Gallagher	11/09/2024

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1 Scope

This document provides a report on investigations into the wild Atlantic salmon mortalities that occurred in the lower Ballisodare catchment in late June to mid-July 2024.

2 Background

Inland Fisheries Ireland (IFI) were made aware of initial reports of mortalities of wild Atlantic salmon and distressed salmon displaying signs of disease at the Ballisodare Fishing Club CLG (BFC) stretch of water in the lower Ballisodare system in Co. Sligo in early July 2024 (Figure 1). These incidences commenced in late June, with the first records of small numbers of mortalities from the 28th June 2024. It was observed that certain dead and moribund fish presented with varying combinations of *Saprolegnia*-like fungal infections around the gills and dorsal region, haemorrhaging and some minor abrasive damage on the underside and apparent gill abnormalities which included paleness, excess mucous and damaged gill filaments. These observations were made concerning both fresh run fish and fish already in the lower stretches of the river from the sea pool to the town bridge. Only wild Atlantic salmon mortalities were recorded and no disease signs were observed in any other fish species in the river.



Figure 1 Location of recorded Atlantic salmon mortalities in Lower Ballisodare system (designated in red) in 2024.

Water levels in the river had been low in the affected stretch in recent weeks, prior to, and during the mortality event. Despite this, healthy salmon were considered to typically have the capacity to navigate from the sea pool through the fish pass and falls stretch and into slower resting river waters further upstream under such conditions. BFC who operate the fish pass indicated that, in their experience, salmon undertake such migration successfully at baseline water levels of 0.36 m to 0.37 m. BFC typically close the fish pass at a minimum threshold water level of 0.34 m (Figure 2).

IFI Western River Basin District (WRBD) staff initially visited the fishery on the 3rd July to investigate the issue after notification from BFC. IFI WRBD staff then contacted IFI Research & Development (IFI R&D) who informed the Marine Institute (MI) Fish Health Unit (FHU) of the matter and requested their expert advice. The MI FHU is the competent authority for fish health in Ireland. The MI FHU communicated with IFI/BFC on 4th and 5th of July and visited the fishery on the 11th July, when they undertook representative disease sampling of six of the moribund salmon. The MI FHU undertook further disease testing of five salmon on the 19th July.

- In line with recommendations, the BFC formally closed angling in their stretch of water on the 11th July and implemented standard biosecurity/disinfection measures at the site with the support of IFI. Appropriate signage was erected to inform the public of this and the related biosecurity concerns.
- IFI initially advised on the 10th July that the fish pass should be closed as a precaution to limit the potential spread of disease until the MI FHU investigated the matter and it should remain closed until water levels were sufficient for salmon to freely navigate the falls stretch.
- Based on their site visit on the 11th July, MI FHU advised that the fish pass should remain open to:
 - reduce potential stress on salmon prevented from migrating and the associated potential for increased infection below the falls;
 - enable healthy fish to migrate upstream to fresh water; and
 - better facilitate the collection of mortalities by minimising the wash out of mortalities with the tide.
- Based on this, IFI further advised that if there was adequate water for fish to migrate through the falls stretch then the fish pass should remain open but not if salmon were likely to be held up there.
- BFC closed the fish pass on the 13th July as the water levels were approaching the minimum threshold for fish passage. It was agreed to keep the fish pass closed until the low water conditions abated and to wait until significant rainfall was forecast to consider reopening the pass to better enable fish to migrate through the lower reaches of the river.

After significant mortalities on the weekend of the 13th and 14th July, the IFI WRBD Director, and IFI R&D Senior Research Officer, and the FHU Manager, and two Department of Agriculture, Food and Marine (DAFM) veterinarians attended the fishery on the 15th July to advise further on the situation. IFI WRBD staff who maintained an on-site presence throughout the event were also in attendance. Two scientific staff from Atlantic Technical University Sligo (ATU) were also separately present in the affected river stretch undertaking water quality monitoring at the request of BFC. During their initial on-site observations, MI FHU noted that the fungal infection observed (*Saprolegnia*) is typically a secondary infection. These infections are considered to be opportunistic in nature, occurring in compromised fish, previously exposed to other stressors and are not thought to be the primary or sole cause of the observed mortalities. In addition, the MI FHU/ DAFM veterinarians advised that where feasible (i.e. in accessible areas), any fish which were moribund and unlikely to survive, should be removed from an animal welfare/infection pressure perspective. Such removals were undertaken by IFI WRBD staff and BFC members with all recovered mortalities disposed of *via* a licenced operator, in accordance with Regulation (EC) 1069/2009.

On the 16th July, the IFI Deputy CEO; and two IFI Environmental staff attended the fishery along with other IFI scientific and IFI WRBD staff. During this visit, IFI Environmental staff inspected the affected stretch and vicinity and undertook a series of water samples (n=17) throughout this area, including in the estuary, below and at the lower falls, in the vicinity of discharge points of potential concern and from the lower falls to the town bridge. In addition, water samples were taken in Lough Arrow on the 19th July. Samples were sent to CLS for analyses. ATU staff also undertook water monitoring at the request of BFC on the 15th and 17th July. An angling bye-law formally suspending fishing activities on the whole Ballisodare catchment was enacted on the 19th July as a precaution against any potential disease spread that could occur in the absence of information that no such risk was posed. IFI, MI FHU, DAFM vets and BFC met again on-site on the 23th July to review the situation and discuss recommendations to reduce the potential for such mortality events to occur in future.

In advance of the expected significant rainfall on the weekend of the 20th July, IFI undertook a risk assessment to set out the conditions to re-open the fish pass. Consideration was given to the risks associated with 1) not opening the pass which would prevent salmon (including potential new returns) transcending the lower falls and 2) re-opening the fish pass to allow any fish below the lower falls the opportunity to transcend the falls stretch and migrate to the slower resting river section further upstream. As preliminary indications from the FHU were that transmissible fish disease was not a likely factor in the mortalities, and that salmon held up below the lower falls for too long could become unduly stressed, it was decided to re-open the

fish pass if significant rainfall occurred and the river rose to levels to ensure with confidence that fish could migrate through the falls stretch, with ease. As the river levels rose after the significant rainfall overnight on the 19th and 20th July, the pass was re-opened on the 20th July and has remained open since then as river levels have remained high (Figure 2). No new fish mortalities were observed since that time and any such records were recoveries of fish clearly dead for a number of days.

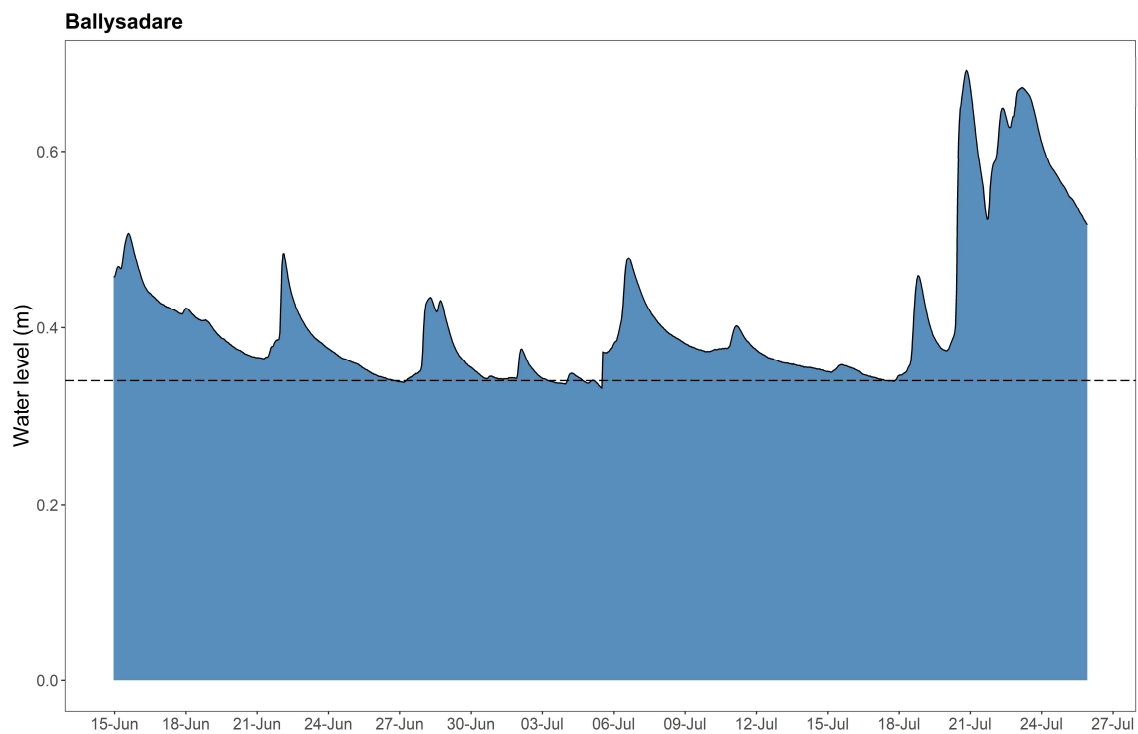


Figure 2 OPW water level data mid-June to late July 2024 in Lower Ballisodare (Station 35005). Threshold of 0.34m is indicated by horizontal dashed line.
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Figure 3a Satellite view of section of Lower Ballisodare from river mouth to immediately above the lower falls (WWTP = wastewater treatment plant). Inset image shows inner estuary and location of quarry (Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community).

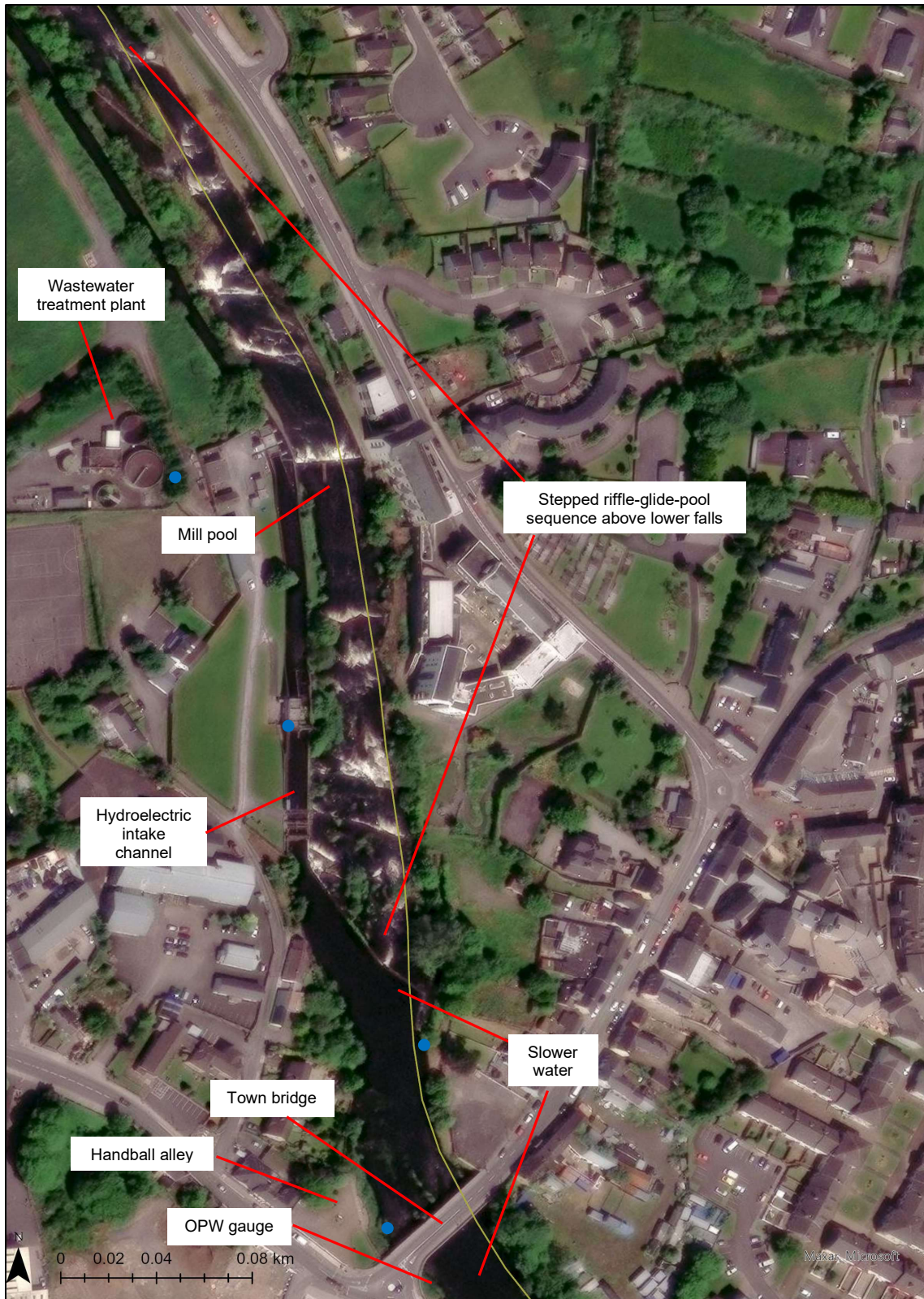


Figure 3b Satellite view of section of Lower Ballisodare river from above the lower falls to Ballisodare town bridge showing series of stepped riffle-glide-pool reaches above lower Ballisodare falls. Blue dots = storm water outflow points (Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community).

3 Mortalities and salmon returns

3.1 Mortalities

Detailed records of fish mortalities have been maintained throughout the course of the incident. In total, 1,079 mortalities were recorded (587 below lower falls; 470 in the stretch above the lower falls and 22 in the fish pass). The first records of mortalities are from the 28th June. Up to the end of June, 14 mortalities were recorded. Between the 1st and 7th July, 55 mortalities were recorded. There was a significant increase in recorded incidences of mortalities and observations of diseased fish from the 8th July. However, no new mortalities were evident after the 19th July with the sole mortality removed from the river on 21st July considered to be dead for at least a few days based on its degraded condition (Table 1).

Table 1 Records of Atlantic salmon mortalities recovered in the Lower Ballisodare river in late-June to July 2024.

Date	River (above lower falls to town bridge)	Below lower falls	Fish pass	Sub-total
28/06/24	2	0	2	4
29/06/24	5	0	2	7
30/06/24	2	1	0	3
01/07/24	3	0	2	5
02/07/24	2	0	2	4
03/07/24	10	0	0	10
04/07/24	5	5	2	12
05/07/24	7	3	0	10
06/07/24	6	0	0	6
07/07/24	4	2	2	8
08/07/24	6	20	0	26
09/07/24	11	28	5	44
10/07/24	30	23	0	53
11/07/24	40	44	0	84
12/07/24	52	29	2	83
13/07/24	41	104	3	148
14/07/24	36	51	0	87
15/07/24	87	51	0	138
16/07/24	50	137	0	187
17/07/24	31	41	0	72
18/07/24	31	40	0	71
19/07/24	8	8	0	16
20/07/24	0	0	0	0
21/07/24	1	0	0	1
22/07/24	0	0	0	0
Totals	470	587	22	1079

Data compiled by BFC in association with IFI

It should be noted that the records are of recovered fish mortalities observed in the river. They may not reflect all mortalities that occurred. In addition, an unknown proportion of the mortalities below the lower falls may have been 'fall back' from the stretch above.

3.2 Returns

Based on the fish counter from January 2024 to the end of July (31/07/24), 8,451 salmon have run into the system with c. 3,000 to 3,500 salmon entering the system between the 1st to 13th July (Table 2). This suggests a provisional mortality rate for the stock of 12.8%.

Table 2 Number of wild Atlantic salmon returning to the Ballisodare system from January to July 2024.

Month	Salmon returns (no. fish)
January	0
February	2
March	11
April	61
May	324
June	4,046
July	4,007
Total	8,451

4 Results of water sampling and MI FHU disease screening

4.1 IFI water sampling

In general, the results of the IFI water sampling (Appendix 1) identified no specific issues of concern that could be deemed responsible for the fish mortalities observed. However, it is acknowledged that these water samples were taken in mid-July so are unlikely to have detected any single pollution event which could have been responsible for initiating the mortalities observed in late June and the subsequent mortalities observed to mid-July.

Water samples taken in the Ballisodare estuary including in the vicinity of Harringtons Quarry showed it was compliant with its Discharge Licence DL (W)25. Samples taken at two locations upstream of Ballisodare town show good water quality with no evidence of pollution. Samples taken from the discharge of the Ballisodare Wastewater Treatment Plant (BWWTP) showed it was compliant with its Wastewater Discharge Licence D0095-01 for all parameters, except ammonia which showed an exceedance of the licence limit for this parameter. IFI have issued a letter to Uisce Éireann requesting measures to be put in place to prevent further exceedances of ammonia concentrations in their licenced discharge. The Environmental Protection Agency (EPA) were also informed in relation to this exceedance. The EPA are the licensing authority for the BWWTP and have informed IFI they are carrying out inspections in relation to this issue. In relation to this, it should be noted that recent Annual Environmental Reports on the BWWTP have found that its discharge was not compliant with the Emission Limit Values (ELVs) in particular for ammonia-Total (as N) mg/l in 2021 and 2022; with ambient monitoring recording a deterioration in ammonia (mg/l) concentrations downstream of the effluent discharge in 2023. Furthermore, two ELV breaches of ammonia-total (as N) were recorded in 2024 on the 11th April (over twice the ELV) and the 31st May (over four times the ELV). However, regulatory results from the 26th June (just prior to the first recorded incidence of mortalities) show the ammonia level under the 10mg/l ELV (reference: pertinent reports published on the Licence and Enforcement Access Portal <https://leap.epa.ie> under Discharge Licence D0095-01).

IFI staff did respond to a report of pollution in the lower Ballisodare on the 7th July specifically in relation to observations of some ponded discharge in the vicinity of a storm water outflow (SWO) SW002 discharge point at the Ball Alley in the upper-section of the affected stretch. This was related to a blockage in the network which caused a temporary uncontrolled release to the river (reference: reports published on the Licence and Enforcement Access Portal). There was no flow from the SWO discharge pipe at the time of inspection by IFI but material had ponded in a pool adjacent to the SWO. At the time, juvenile fish were observed swimming in the area with no signs of distress. The low flow in the river had likely resulted in the discharge

remaining in the pool and not being washed out. This pool was sampled on the 16th July and the results showed elevated levels of nutrients. It is considered that this outflow was very unlikely to be responsible for the mortalities observed. IFI have highlighted this discharge point to Uisce Éireann for follow-up mitigation as necessary and issued them a letter advising that the discharge will be monitored and if a polluting discharge is found, samples will be taken with a view to prosecution. In addition, the EPA made a site visit to this location on the 17th July and have opened a compliance investigation in relation to the matter (<https://leap.epa.ie/docs/a398e867-f6c0-4966-b4d5-0c69b297cd68.pdf>). Uisce Éireann is required to take appropriate actions to resolve this issue without any undue delay and to continue to provide updates to the EPA as per the site visit report.

In addition to the above, dissolved oxygen readings were taken on the 16th and 17th July in the affected stretch of river and were within the normal range expected. Additional water sampling taken on the 19th July in Lough Arrow showed the water quality to be good with no evidence of pollution.

4.2 ATU water quality monitoring

Dissolved oxygen was measured at a number of locations above and below the lower falls on the 15th July and all readings were within 9 to 10 mg/l O₂, with a water temperature of 18.2 °C recorded. On the 17th July a water quality sonde was deployed in the Mill Pool above the lower falls to ascertain water quality conditions in the river. The sonde measured water quality every 15 minutes and conditions were found to be suitable for salmonids over the deployment period. Dissolved oxygen was measured again at a number of locations above and below the falls on the morning of 20/07/2024 following heavy rainfall, and all readings were within 9.5 to 10.5mg/l O₂, with water temperature of 16.1 °C. Refer to Appendix 2 for a report on this monitoring.

4.3 MI FHU disease screening

The MI FHU fish health reports can be found in Appendix 3 (11th July samples) and 4 (19th July samples). Results indicated that there was no evidence of notifiable diseases and/or transmissible diseases of concern in the samples analysed. Chronic spleen inflammation and liver necrosis was observed in some of the samples taken. This is considered possibly to be linked to the secondary *Saprolegnia* (fungal) infection, gill pathology and/or skin lesions observed. Functionally significant gill pathology was observed in a number of samples with varying levels of severity. This was considered to be consistent with exposure of the fish to an environmental insult (waterborne irritant), which could have resulted in compromised respiratory function. It was noted that standard phytoplankton monitoring coordinated by MI as

part of their shellfish phytoplankton surveillance programme, recorded very high levels of a diatom (*Chaetoceros* spp.) in their Drumcliff Bay site on the 17th June (1.1 million cells per litre). This site is around 8 km from Ballisodare estuary and is the closest site where such sampling is currently undertaken (Figure 4). This diatom has long spines which can affect fish gills and is documented to result in finfish mortalities including of salmonids. Two other readings on the 1st and 8th July were much lower at 136,000 and 143,000 cells per litre respectively, and a sample on the 15th July had a much lower reading again at 35,000 cells per litre.



Figure 4 Shellfish production areas in Sligo (Ballisodare, Sligo Harbour and Drumcliff), with designated sample points for biotoxin and phytoplankton sample submission and analysis within classified production areas.

Although gill damage was present, it was considered not to be at a level sufficient to be the sole cause of the observed mortality. It is considered that the fungal infection observed (*Saprolegnia*) is likely to be secondary in nature, as were the lesions, some of which were infected with bacteria. Mechanical damage is also a likely contributing factor, causing lesions which were then colonised by *Saprolegnia* and opportunistic bacteria. These infections were considered to be opportunistic in nature, occurring in compromised fish, but are likely contributing factors to morbidity, once present.

5 Consideration of potential factors responsible for mortalities

The investigations undertaken have not identified any specific single factor to comprehensively explain the unprecedented number of mortalities observed in the Lower Ballisodare between late June and mid-July 2024. Based on the various sources of information available, it is considered that a number of cumulative factors may have acted in combination to cause the significant mortalities observed.

There is some evidence to suggest that a proportion of the affected salmon could have had exposure to the excessive levels of the *Chaetoceros* diatom present at sea in the vicinity of the Ballisodare estuary on their return journey to the river. Such an insult to the gills would have negatively affected normal gill function and therefore, hampered normal oxygen uptake. Without additional stressors, such as infection with *Saprolegnia* and bacterial infection of lesions, such fish may have survived to be able to successfully run into and through the lower system on their return despite the low water conditions. However, the low water conditions experienced on return to the river mouth in combination with this insult to the gills, and the very large numbers of salmon that returned to the river in a confined period, may have placed additional stress on these fish when attempting to successfully traverse through the fish pass and the stretch immediately upstream. It should be noted that there were no other incidences of significant salmon mortalities reported in other river systems in the wider vicinity of the MI phytoplankton sampling site in Drumcliff Bay, including the Drumcliff River, in the same period as the Ballisodare mortalities.

Some salmon had signs of abrasions on their underside which could have been a result of attempts to directly jump the impassible falls and/or from evasive action from excessive predator pressures in circumstances where large numbers of fish were confined to the river mouth; smaller river pools; or by sand banks further out in the estuary at low tide. Some abrasions may also have been a consequence of running the fish pass, although the experience of BFC who operate the fish pass, consider that this is very unlikely to be the case at the water levels encountered at the time of passage.

Salmon that successfully traversed the fish pass (and potentially impacted by the diatom) may not have had the ability to migrate further upstream as they had expended their otherwise normal energetic capacity to do so. As a consequence, this may have resulted in significant numbers of salmon congregating in the pools above the falls in the low water conditions than otherwise would be the case. These combination of stressors (and the abrasions in particular) may have facilitated an increased susceptibility to infection by *Saprolegnia* and opportunistic

bacteria, and ultimately hindered their normal ability to traverse the falls stretch to reach the slower resting river waters further upstream and caused at least some of them to fall back down again to below the lower falls.

In general, the results of the IFI water sampling identified no specific factors in the affected stretch of river that would be considered substantial enough as the primary responsible cause for the fish mortalities. It is acknowledged that the IFI water samples taken in mid-July are unlikely to have detected any single pollution event which could have been responsible for initiating the mortalities observed in late June and the subsequent mortalities observed to mid-July. Nevertheless, the extended time period over which the mortalities occurred suggest that a single pollution event in June or early July is unlikely to have been the cause. Indeed, a single pollution event is likely to have affected other life stages or fish species present in the river and potentially the inner estuary and this was not apparent in this case. The falls and the stretch immediately above it appear to have been well-oxygenated at the time of water sampling at least and in general, water temperatures were not unduly high for the time of year throughout the period of mortalities. As such, a lack of dissolved oxygen alone in the river is considered unlikely to be a notable contributory factor in the mortalities observed.

Although there were no significant ongoing or persistent discharges visually identified during the site investigations, the recurrent pattern of ELV breaches for total ammonia at Ballisodare Wastewater Treatment Plant in recent years and indeed for some periods sampled for the year to date in 2024 is of general concern. Excessive levels of the un-ionized form of ammonia in water (NH_3) in particular is known to be toxic to fish. This parameter is not specifically monitored as part of the discharge licence, with ammonia total (as N) assessed as standard. Having said that, it is unknown whether this factor contributed individually or in combination with other potential stressors to the mortalities observed in the Ballisodare from late June to mid-July 2024.

6 Recommendations

In order to mitigate for any future potential incidences of similar mortalities occurring in the lower Ballisodare river, the following actions are recommended:

- A risk analysis should be undertaken to assess all aspects of the river environment that may have contributed to the mortalities observed and identify where any precautionary and mitigation measures could be considered and implemented. This will be led by IFI.
- Weekly phytoplankton sampling should be undertaken in the Ballisodare estuary in 2025 immediately before and during the main return period of salmon to the river (early May to late July). If this proceeds, MI will provide IFI with the sampling equipment and IFI will conduct the sampling. Samples will be archived and analysed by MI in-season if notable mortalities become apparent. The value of this undertaking should be reviewed in advance of the 2026 season.
- IFI to issue a letter to Uisce Éireann requesting measures to be put in place to prevent further exceedances of ammonia concentrations in their licenced discharge (already actioned).
- IFI to forward a copy of this report to the EPA for their further consideration particularly concerning the exceedance of licence levels for ammonia (IFI to action).
- IFI WRBD Ballina should be notified of any future monthly breaches of ELVs at the BWWTP as soon as they are known (IFI to request this).
- Consideration should be given by the responsible authorities to the feasibility of monitoring for NH_3 and $[\text{NH}]_4^+$ in the BWWTP discharge and appropriate limits defined for ELV purposes.
- The feasibility of salvage/translocation of fish should be considered if similar circumstances arise in future. IFI will consider this in further detail but a preliminary assessment suggests that in practice this may be very difficult to undertake and potentially prohibitively stressful for the fish.
- The IFI Barriers team should be engaged to assess where fish passage could be improved in the affected stretch (IFI to action).
- Consideration should be given to implementing mitigation measures to reduce the risk of mechanical damage / abrasive injuries to salmon where it may be feasible to do this. BFC with the support of IFI WRBD should assess the fish pass and falls stretch in this regard, taking parameters such as depth of water and numbers of fish into account.
- Consideration should be given to implementing water temperature monitoring during the summer period in the lower Ballisodare system to enable the timely identification of warm water conditions that may affect salmon and better inform their fisheries

management there. This could be done *via* regular manual readings and/or installation of an on-site temperature logger.

- It was agreed by IFI and BFC that a more precautionary approach to determining the appropriate levels to operate the fish pass should be implemented for the remainder of the season with a preliminary threshold of 0.4m on the OPW gauge chosen to determine this. BFC noted that salmon can typically run the fish pass fine at an OPW gauge level of 0.36 m to 0.37 m and that 0.34 m is the minimum threshold that the fish pass is typically closed. IFI WRBD and BFC will further consider and identify the criteria for the future operation of the fish pass. In this regard, particular consideration should be given to the appropriate precautionary minimum threshold water level for operation. It was noted that other factors may also need to be considered in this context including water temperature and the abundance of returning fish expected to be or present during key periods.
- The quota for salmon harvest in the Ballisodare is 218 for 2024 with the system assessed as attaining 103% of its conservation limit. 1,079 returning adult salmon were recorded as mortalities during the recent fish kill. It should be noted that these represent the documented mortalities recovered from the river and the number of actual mortalities may be somewhat higher than this. The stock assessment model conservatively forecast (75% likelihood) that 6,601 salmon would return to the river in 2024. Verified returns based on the fish counter in 2024 to end of July are 8,451. Although up to date harvest figures are not immediately available, it is likely that a good proportion of the quota is already taken. As a precautionary measure, it was advised that management should give consideration to removing the harvest quota for the remainder of the season and implement C&R-only angling to minimise angling mortalities. A bye-law reflecting this was put into operation on 22nd August.

In addition to the above, to further aid in the mitigation of any significant mortality event in future, BFC intend to install a real-time water quality sonde monitoring platform in the bay in order to provide an early warning system should any measured parameters be exceeded.

7 Acknowledgements

The Ballisodare Fishing Club board, management and members are acknowledged for their cooperation in working with Inland Fisheries Ireland, the Marine Institute Fish Health Unit and the Department of Agriculture, Food and Marine veterinarians throughout this incident and facilitating their on-site investigations. The following IFI staff are acknowledged for their contributions to the report and on-site investigations: WRBD Fisheries Inspector Michael Wilson and team (Frank Byrne, John Luke Flanagan, Brian Flannery, Jimmy Frazer, Ciaran Jennings, Colin Jinks, Bernard McDermott and Philip Thornton); and NWRBD Senior Environmental Officer Ailish Keane and NWRBD Environmental Officer Seán Gallanagh. The MI FHU staff are acknowledged for their fish health assessments. The DAFM veterinarians are acknowledged for their expert input (Brian Gormley and Gaetano Durso). Lisa Cronin (ATU Sligo) is acknowledged for contributing the ATU water monitoring report.

8 Appendices

8.1 Appendix 1 IFI water sampling results



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CERTIFICATE OF ANALYSIS

Client : David Harrington (Investigative)
 Inland Fisheries
 Teach Breac
 Earls Island
 Galway

Report No. : 565151
 Date of Receipt : 16/07/2024
 Start Date of Analysis : 16/07/2024
 Date of Report : 01/08/2024
 Order Number : N/A
 Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units		
1766431	1A Ballysadare Estuary 16/07/2024 @ 10:34 am 300m downstream from Butt	Suspended Solids	I,R	7	mg/l		
		TON as N	I,R	<0.1	mg/l		
		COD	I,R	21	mg/l		
		pH	I,R	8.4	pH		
		Nitrate as N Calculated	I,R	<0.1	mg/l		
		Nitrite as N	I,R	<0.005	mg/l		
		Phosphorus as PO4-P	I,R	0.01	mg/l		
		Copper, total	I,R	<1.2	ug/l		
		Ammonia as N	I,R	0.029	mg/l		
		Arsenic, total	I,R	<0.6	ug/l		
		Zinc, total	I,R	<6	ug/l		
		Chromium, total	I,R	<0.6	ug/l		
		Nickel, total	I,R	1	ug/l		
		Lead, total	I,R	<0.6	ug/l		
		Antimony, total	I,R	<0.6	ug/l		
		Cadmium, total	I,R	<0.6	ug/l		
		Cobalt, total	I,R	<0.6	ug/l		
		Selenium, total	I,R	<0.6	ug/l		
		Tellurium, total	I,R	<0.6	ug/l		
		Thallium, total	I,R	<0.6	ug/l		
		Vanadium, total	I,R	<0.6	ug/l		
		Molybdenum, total	I,R	1	ug/l		
		Tin, total	I,R	<0.6	ug/l		
		Beryllium, total	I,R	<0.6	ug/l		
		Total Heavy Metals	R	<15.6	ug/l		
		1766432	2A Ballysadare Estuary 16/07/2024 @ 10:57am Opposite Quarry Main Channel 1km D/S of Butt	BOD Automated	I,R	1	mg/l
				BOD Automated	I,R	3	mg/l
Beryllium, total	I,R			<0.6	ug/l		
Total Heavy Metals	R			<15.6	ug/l		
Thallium, total	I,R			<0.6	ug/l		
Molybdenum, total	I,R			2	ug/l		
Tin, total	I,R			<0.6	ug/l		
Vanadium, total	I,R			2	ug/l		
Tellurium, total	I,R			<0.6	ug/l		
Selenium, total	I,R			<0.6	ug/l		
Cobalt, total	I,R			<0.6	ug/l		
Lead, total	I,R			2	ug/l		
Cadmium, total	I,R			<0.6	ug/l		
Antimony, total	I,R			<0.6	ug/l		
Arsenic, total	I,R			1	ug/l		
Chromium, total	I,R	1	ug/l				
Nickel, total	I,R	1	ug/l				
Zinc, total	I,R	<6	ug/l				
Ammonia as N	I,R	0.025	mg/l				

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 Co. Galway

Complete Laboratory Solutions (Medpharma),
 Unit 3A & Unit B,
 Small Business Park,
 Tuam Road, Galway.

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Complete Laboratory Solutions

Complete Laboratory Solutions
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		Copper, total	I,R	<1.2	ug/l
		Phosphorus as PO4-P	I,R	<0.01	mg/l
		pH	I,R	8.3	pH Units
		Nitrite as N	I,R	<0.005	mg/l
		Nitrate as N Calculated	I,R	<0.1	mg/l
		TON as N	I,R	<0.1	mg/l
		COD	I,R	34	mg/l
		Suspended Solids	I,R	44	mg/l
1766433	3A Ballysadare Estuary 16/07/2024 @ 10:59am 150m From Quarry Outflow Pipe	Suspended Solids	I,R	393	mg/l
		COD	I,R	97	mg/l
		TON as N	I,R	<0.1	mg/l
		Nitrate as N Calculated	I,R	<0.1	mg/l
		Nitrite as N	I,R	<0.005	mg/l
		pH	I,R	8.1	pH Units
		Phosphorus as PO4-P	I,R	0.102	mg/l
		Copper, total	I,R	<1.2	ug/l
		Arsenic, total	I,R	9	ug/l
		Ammonia as N	I,R	1.21	mg/l
		Zinc, total	I,R	285	ug/l
		Nickel, total	I,R	11	ug/l
		Chromium, total	I,R	6	ug/l
		Antimony, total	I,R	2	ug/l
		Cadmium, total	I,R	1	ug/l
		Lead, total	I,R	25	ug/l
		Cobalt, total	I,R	2	ug/l
		Selenium, total	I,R	2	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	14	ug/l
		Tin, total	I,R	<0.6	ug/l
		Molybdenum, total	I,R	11	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Total Heavy Metals	R	369	ug/l
		Beryllium, total	I,R	<0.6	ug/l
1766436	4A Ballysadare Estuary 16/07/2024 @ 11:30am 2km D/S of Butt.	BOD Automated	I,R	<4	mg/l
		BOD Automated	I,R	3	mg/l
		Beryllium, total	I,R	<0.6	ug/l
		Total Heavy Metals	R	<15.6	ug/l
		Molybdenum, total	I,R	4	ug/l
		Tin, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	1	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Selenium, total	I,R	<0.6	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Cobalt, total	I,R	<0.6	ug/l
		Lead, total	I,R	<0.6	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Antimony, total	I,R	<0.6	ug/l
		Chromium, total	I,R	<0.6	ug/l
		Nickel, total	I,R	1	ug/l
		Zinc, total	I,R	<6	ug/l
		Ammonia as N	I,R	0.802	mg/l
		Arsenic, total	I,R	1	ug/l
		Copper, total	I,R	<1.2	ug/l

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		Phosphorus as PO4-P	I,R	<0.01	mg/l
		Nitrite as N	I,R	<0.005	mg/l
		Nitrate as N	I,R	<0.1	mg/l
		Calculated			
		TON as N	I,R	<0.1	mg/l
		pH	I,R	8.3	pH Units
		COD	I,R	33	mg/l
		Suspended Solids	I,R	53	mg/l
1766438	5A Ballysadare Estuary 16/07/2024 @ 12:35pm Quarry Outflow Discharge Pipe Sample 1	Suspended Solids	I,R	<2	mg/l
		COD	I,R	<10	mg/l
		pH	I,R	7.6	pH Units
		TON as N	I,R	0.585	mg/l
		Nitrate as N	I,R	0.607	mg/l
		Calculated			
		Nitrite as N	I,R	<0.005	mg/l
		Phosphorus as PO4-P	I,R	<0.01	mg/l
		Copper, total	I,R	<1.2	ug/l
		Arsenic, total	I,R	<0.6	ug/l
		Ammonia as N	I,R	0.725	mg/l
		Zinc, total	I,R	105	ug/l
		Nickel, total	I,R	38	ug/l
		Chromium, total	I,R	<0.6	ug/l
		Lead, total	I,R	<0.6	ug/l
		Antimony, total	I,R	3	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Cobalt, total	I,R	2	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Selenium, total	I,R	1	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	<0.6	ug/l
		Tin, total	I,R	<0.6	ug/l
		Molybdenum, total	I,R	15	ug/l
		Total Heavy Metals	R	164	ug/l
		Beryllium, total	I,R	<0.6	ug/l
1766439	6A Ballysadare Estuary 16/07/2024 @ 12:37pm Quarry Outflow Discharge Pipe Sample 2	BOD Automated	I,R	<1	mg/l
		BOD Automated	I,R	<1	mg/l
		Total Heavy Metals	R	168	ug/l
		Molybdenum, total	I,R	15	ug/l
		Beryllium, total	I,R	<0.6	ug/l
		Tin, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	<0.6	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Selenium, total	I,R	1	ug/l
		Thallium, total	I,R	1	ug/l
		Cobalt, total	I,R	2	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Antimony, total	I,R	3	ug/l
		Lead, total	I,R	<0.6	ug/l
		Chromium, total	I,R	<0.6	ug/l
		Nickel, total	I,R	39	ug/l
		Zinc, total	I,R	107	ug/l
		Ammonia as N	I,R	0.691	mg/l
		Arsenic, total	I,R	<0.6	ug/l
		Phosphorus as PO4-P	I,R	<0.01	mg/l

		Nitrite as N	I,R	<0.005	mg/l
		Copper, total	I,R	<1.2	ug/l
		Nitrate as N	I,R	0.682	mg/l
		Calculated			
		TON as N	I,R	0.58	mg/l
		pH	I,R	7.7	pH Units
		COD	I,R	<10	mg/l
		Suspended Solids	I,R	<2	mg/l
1766440	7A Ballysadare River 16/07/2024 @ 15.05pm Opposite Apt Outflow (54.1240.2.W 8° 30,38.2W)	Suspended Solids	I,R	<2	mg/l
		TON as N	I,R	0.116	mg/l
		COD	I,R	20	mg/l
		pH	I,R	8.2	pH Units
		Nitrate as N	I,R	0.118	mg/l
		Calculated			
		Nitrite as N	I,R	<0.005	mg/l
		Phosphorus as PO4-P	I,R	<0.01	mg/l
		Copper, total	I,R	<1.2	ug/l
		Ammonia as N	I,R	0.069	mg/l
		Arsenic, total	I,R	<0.6	ug/l
		Zinc, total	I,R	<6	ug/l
		Chromium, total	I,R	<0.6	ug/l
		Nickel, total	I,R	1	ug/l
		Lead, total	I,R	<0.6	ug/l
		Antimony, total	I,R	<0.6	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Cobalt, total	I,R	<0.6	ug/l
		Selenium, total	I,R	<0.6	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	<0.6	ug/l
		Molybdenum, total	I,R	<0.6	ug/l
		Tin, total	I,R	<0.6	ug/l
		Beryllium, total	I,R	<0.6	ug/l
		Total Heavy Metals	R	<15.6	ug/l
		BOD Automated	I,R	<1	mg/l



Approved by:

Ann Marie Nee

AnnMarie Nee
 Environmental Account
 Manager

See below for test specifications and accreditation status.
 This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.
 est. is an estimated count.
 CLS will test food, water and swabs samples within 24 hours of receipt.
 Where samples have been taken by the Client, results apply to the samples as received.

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In-House Test	Specification	Expanded Measurement of Uncertainty	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	+/- 20.84 %	Yes	No	Yes
TON as N	Konelab CLS 38	+/- 8.51 %	Yes	No	Yes
COD	CLS 52	+/- 4.48 %	Yes	No	Yes
pH	CLS 26	+/- 0.133 pH units	Yes	No	Yes
Nitrate as N Calculated	Konelab CLS 39	+/- 0.45 @ 4 mg/l NO3-N	Yes	No	Yes
Nitrite as N	Konelab CLS 37	+/- 5.83 %	Yes	No	Yes
Phosphorus as PO4-P	Konelab CLS 35	+/- 24.55 %	Yes	No	Yes
Copper, total	ICP-MS CLS 129	+/- 11.28 %	Yes	No	Yes
Ammonia as N	Konelab CLS 40	+/- 5.13 %	Yes	No	Yes
Arsenic, total	ICP-MS CLS 129	+/- 9.34 %	Yes	No	Yes
Zinc, total	ICP-MS CLS 129	+/- 9.38 %	Yes	No	Yes
Chromium, total	ICP-MS CLS129	+/- 8.38 %	Yes	No	Yes
Nickel, total	ICP-MS CLS129	+/- 7.91 %	Yes	No	Yes
Lead, total	ICP-MS CLS 129	+/-20@100ug/l	Yes	No	Yes
Antimony, total	ICP-MS CLS 129	+/- 13.23 %	Yes	No	Yes
Cadmium, total	ICP-MS CLS 129	+/- 10.42 %	Yes	No	Yes
Cobalt, total	ICP-MS CLS129	+/-0.7@5ug/l	Yes	No	Yes
Selenium, total	ICP-MS CLS129	+/-0.9@5ug/l	Yes	No	Yes
Tellurium, total	ICP-MS CLS129	+/-0.8@5ug/l	Yes	No	Yes
Thallium, total	ICP-MS CLS129	+/-8.3@100ug/l	Yes	No	Yes
Vanadium, total	ICP-MS CLS 129	+/- 11.72 %	Yes	No	Yes
Molybdenum, total	ICP-MS CLS129	+/- 8.82 %	Yes	No	Yes
Tin, total	ICP-MS CLS129	+/-0.6@5ug/l	Yes	No	Yes
Beryllium, total	ICP-MS CLS129	+/- 11.67 %	Yes	No	Yes
Total Heavy Metals	Calculation includes sum of: Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Se, Te, Tl, Sn, V, Zn		No	No	Yes
BOD Automated	CLS 214	+/- 35.29 %	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA Inspected facility (MedPharma site only).

**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysis on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
1766431	1A Ballysadare Estuary 16/07/2024 @ 10:34 am 300m downstream from Butt	Good condition	16/07/2024
1766432	2A Ballysadare Estuary 16/07/2024 @ 10:57am Opposite Quarry Main Channel 1km D/S of Butt	Good condition	16/07/2024
1766433	3A Ballysadare Estuary 16/07/2024 @ 10:59am 150m From Quarry Outflow Pipe	Good condition	16/07/2024
1766436	4A Ballysadare Estuary 16/07/2024 @ 11:30am 2km D/S of Butt	Good condition	16/07/2024
1766438	5A Ballysadare Estuary 16/07/2024 @ 12:35pm Quarry Outflow Discharge Pipe Sample 1	Good condition	16/07/2024
1766439	6A Ballysadare Estuary 16/07/2024 @ 12:37pm Quarry Outflow Discharge Pipe Sample 2	Good condition	16/07/2024
1766440	7A Ballysadare River 16/07/2024 @ 15.05pm Opposite Apt Outflow (54.1240.2.W 6' 30,38.2W)	Good condition	16/07/2024

CERTIFICATE OF ANALYSIS

Client : David Harrington (Investigative)
 Inland Fisheries
 Teach Breac
 Earls Island
 Galway

Report No. : 565152
 Date of Receipt : 16/07/2024
 Start Date of Analysis : 16/07/2024
 Date of Report : 01/08/2024
 Order Number : N/A
 Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units	
1766442	18 C.Jinks 16/07/2024 @ 14:40pm Union Wood Road, Dwenmoe River (54.1946028, -8.4892261)	Suspended Solids	I,R	<2	mg/l	
		TON as N	I,R	<0.1	mg/l	
		COD	I,R	19	mg/l	
		pH	I,R	8.4	pH Units	
		Nitrate as N	I,R	<0.1	mg/l	
		Calculated				
		Nitrite as N	I,R	<0.005	mg/l	
		Phosphorus as PO4-P	I,R	<0.01	mg/l	
		Copper, total	I,R	<1.2	ug/l	
		Ammonia as N	I,R	0.036	mg/l	
		Arsenic, total	I,R	<0.6	ug/l	
		Zinc, total	I,R	<6	ug/l	
		Chromium, total	I,R	<0.6	ug/l	
		Nickel, total	I,R	1	ug/l	
		Lead, total	I,R	<0.6	ug/l	
		Antimony, total	I,R	<0.6	ug/l	
		Cadmium, total	I,R	<0.6	ug/l	
		Cobalt, total	I,R	<0.6	ug/l	
		Selenium, total	I,R	<0.6	ug/l	
		Tellurium, total	I,R	<0.6	ug/l	
		Thallium, total	I,R	<0.6	ug/l	
		Vanadium, total	I,R	<0.6	ug/l	
		Molybdenum, total	I,R	<0.6	ug/l	
Tin, total	I,R	<0.6	ug/l			
Beryllium, total	I,R	<0.6	ug/l			
Total Heavy Metals	R	<15.6	ug/l			
1766443	28 C.Jinks 16/07/2024 @ 13:29pm U/S of Collooney Bridge Mill Falls, Owenmore River (54.186771, -8.4922154)	BOD Automated	I,R	<1	mg/l	
		Beryllium, total	I,R	<0.6	ug/l	
		BOD Automated	I,R	<1	mg/l	
		Total Heavy Metals	R	<15.6	ug/l	
		Tin, total	I,R	<0.6	ug/l	
		Vanadium, total	I,R	<0.6	ug/l	
		Thallium, total	I,R	<0.6	ug/l	
		Molybdenum, total	I,R	1	ug/l	
		Tellurium, total	I,R	<0.6	ug/l	
		Cadmium, total	I,R	<0.6	ug/l	
		Selenium, total	I,R	<0.6	ug/l	
		Cobalt, total	I,R	<0.6	ug/l	
		Antimony, total	I,R	<0.6	ug/l	
		Nickel, total	I,R	1	ug/l	
		Chromium, total	I,R	<0.6	ug/l	
Lead, total	I,R	<0.6	ug/l			
Zinc, total	I,R	<6	ug/l			

		Copper, total	I,R	<1.2	ug/l
		Arsenic, total	I,R	<0.6	ug/l
		Ammonia as N	I,R	0.036	mg/l
		Phosphorus as PO4-P	I,R	<0.01	mg/l
		Nitrate as N	I,R	<0.1	mg/l
		Calculated			
		pH	I,R	8.4	pH Units
		Nitrite as N	I,R	<0.005	mg/l
		COD	I,R	21	mg/l
		Suspended Solids	I,R	<2	mg/l
		TON as N	I,R	<0.1	mg/l
		TON as N	I,R	<0.1	mg/l
1766444	3B AK S.1 16/07/2024 @ 13.30pm S1 @ Sea Pool Ballysadare Falls	Suspended Solids	I,R	2	mg/l
		COD	I,R	22	mg/l
		Nitrite as N	I,R	<0.005	mg/l
		pH	I,R	8.3	pH Units
		Nitrate as N	I,R	<0.1	mg/l
		Calculated			
		Phosphorus as PO4-P	I,R	<0.01	mg/l
		Ammonia as N	I,R	0.027	mg/l
		Arsenic, total	I,R	<0.6	ug/l
		Copper, total	I,R	<1.2	ug/l
		Zinc, total	I,R	<6	ug/l
		Lead, total	I,R	<0.6	ug/l
		Chromium, total	I,R	<0.6	ug/l
		Nickel, total	I,R	1	ug/l
		Antimony, total	I,R	<0.6	ug/l
		Cobalt, total	I,R	<0.6	ug/l
		Selenium, total	I,R	<0.6	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Molybdenum, total	I,R	<0.6	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	<0.6	ug/l
		Tin, total	I,R	<0.6	ug/l
		Total Heavy Metals	R	<15.6	ug/l
		BOD Automated	I,R	<1	mg/l
		Beryllium, total	I,R	<0.6	ug/l
1766445	4B AK S.2 16/07/2024 @ 13:40pm S2 @ Seapool Ballysadare Falls	Beryllium, total	I,R	<0.6	ug/l
		BOD Automated	I,R	<1	mg/l
		Total Heavy Metals	R	<15.6	ug/l
		Tin, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	<0.6	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Molybdenum, total	I,R	<0.6	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Selenium, total	I,R	<0.6	ug/l
		Cobalt, total	I,R	<0.6	ug/l
		Antimony, total	I,R	<0.6	ug/l
		Nickel, total	I,R	1	ug/l
		Chromium, total	I,R	<0.6	ug/l
		Lead, total	I,R	<0.6	ug/l

		Zinc, total	I,R	<6	ug/l
		Copper, total	I,R	<1.2	ug/l
		Arsenic, total	I,R	<0.6	ug/l
		Ammonia as N	I,R	0.028	mg/l
		Phosphorus as PO4-P	I,R	<0.01	mg/l
		Nitrate as N Calculated	I,R	<0.1	mg/l
		pH	I,R	8.5	pH Units
		Nitrite as N	I,R	<0.005	mg/l
		COD	I,R	18	mg/l
		Suspended Solids	I,R	2	mg/l
		TON as N	I,R	<0.1	mg/l
1766446	5B AK S.3 16/07/2024 @ 13:50pm S3 @ Seapool Ballysadare Falls	TON as N	I,R	<0.1	mg/l
		Suspended Solids	I,R	<2	mg/l
		COD	I,R	20	mg/l
		Nitrite as N	I,R	<0.005	mg/l
		pH	I,R	8.4	pH Units
		Nitrate as N Calculated	I,R	<0.1	mg/l
		Phosphorus as PO4-P	I,R	<0.01	mg/l
		Ammonia as N	I,R	0.061	mg/l
		Arsenic, total	I,R	<0.6	ug/l
		Copper, total	I,R	<1.2	ug/l
		Zinc, total	I,R	<6	ug/l
		Lead, total	I,R	<0.6	ug/l
		Chromium, total	I,R	<0.6	ug/l
		Nickel, total	I,R	1	ug/l
		Antimony, total	I,R	<0.6	ug/l
		Cobalt, total	I,R	<0.6	ug/l
		Selenium, total	I,R	<0.6	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Molybdenum, total	I,R	<0.6	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	<0.6	ug/l
		Tin, total	I,R	<0.6	ug/l
		Total Heavy Metals	R	<15.6	ug/l
		BOD Automated	I,R	<1	mg/l
		Beryllium, total	I,R	<0.6	ug/l
1766447	6B AK S.4 16/07/2024 @ 13:55 24 @ Seapool Ballysadare Falls	Total Heavy Metals	R	<15.6	ug/l
		BOD Automated	I,R	<1	mg/l
		Tin, total	I,R	<0.6	ug/l
		Beryllium, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	<0.6	ug/l
		Molybdenum, total	I,R	<0.6	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Cobalt, total	I,R	<0.6	ug/l
		Selenium, total	I,R	<0.6	ug/l
		Antimony, total	I,R	<0.6	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Nickel, total	I,R	1	ug/l
		Lead, total	I,R	<0.6	ug/l

	Zinc, total	I,R	<6	ug/l
	Chromium, total	I,R	<0.6	ug/l
	Ammonia as N	I,R	0.031	mg/l
	Arsenic, total	I,R	<0.6	ug/l
	Phosphorus as PO4-P	I,R	<0.01	mg/l
	Copper, total	I,R	<1.2	ug/l
	Nitrate as N Calculated	I,R	<0.1	mg/l
	Nitrite as N	I,R	<0.005	mg/l
	COD	I,R	17	mg/l
	pH	I,R	8.5	pH Units
	Suspended Solids	I,R	<2	mg/l
	TON as N	I,R	<0.1	mg/l



Approved by: *Ann Marie Nee*
AnnMarie Nee
Environmental Account
Manager

See below for test specifications and accreditation status.
 This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.
 est. is an estimated count.
 CLS will test food, water and swabs samples within 24 hours of receipt.
 Where samples have been taken by the Client, results apply to the samples as received.

In-House Test	Specification	Expanded Measurement of Uncertainty	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	+/- 20.84 %	Yes	No	Yes
TON as N	Konelab CLS 38	+/- 8.51 %	Yes	No	Yes
COD	CLS 52	+/- 4.48 %	Yes	No	Yes
pH	CLS 26	+/- 0.133 pH units	Yes	No	Yes
Nitrate as N Calculated	Konelab CLS 39	+/- 0.45 @ 4 mg/l NO3-N	Yes	No	Yes
Nitrite as N	Konelab CLS 37	+/- 5.83 %	Yes	No	Yes
Phosphorus as PO4-P	Konelab CLS 35	+/- 24.55 %	Yes	No	Yes
Copper, total	ICP-MS CLS 129	+/- 11.26 %	Yes	No	Yes
Ammonia as N	Konelab CLS 40	+/- 5.13 %	Yes	No	Yes
Arsenic, total	ICP-MS CLS 129	+/- 9.34 %	Yes	No	Yes
Zinc, total	ICP-MS CLS 129	+/- 9.38 %	Yes	No	Yes
Chromium, total	ICP-MS CLS129	+/- 8.38 %	Yes	No	Yes
Nickel, total	ICP-MS CLS129	+/- 7.91 %	Yes	No	Yes
Lead, total	ICP-MS CLS 129	+/-20@100ug/l	Yes	No	Yes
Antimony, total	ICP-MS CLS 129	+/- 13.23 %	Yes	No	Yes
Cadmium, total	ICP-MS CLS 129	+/- 10.42 %	Yes	No	Yes
Cobalt, total	ICP-MS CLS129	+/-0.7@5ug/l	Yes	No	Yes
Selenium, total	ICP-MS CLS129	+/-0.9@5ug/l	Yes	No	Yes
Tellurium, total	ICP-MS CLS129	+/-0.8@5ug/l	Yes	No	Yes
Thallium, total	ICP-MS CLS129	+/-8.3@100ug/l	Yes	No	Yes
Vanadium, total	ICP-MS CLS 129	+/- 11.72 %	Yes	No	Yes
Molybdenum, total	ICP-MS CLS129	+/- 8.82 %	Yes	No	Yes
Tin, total	ICP-MS CLS129	+/-0.6@5ug/l	Yes	No	Yes
Beryllium, total	ICP-MS CLS129	+/- 11.67 %	Yes	No	Yes
Total Heavy Metals	Calculation includes sum of: Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Se, Te, Tl, Sn, V, Zn		No	No	Yes
BOD Automated	CLS 214	+/- 35.29 %	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
1766442	1B C.Jinks 16/07/2024 @ 14:40pm Union Wood Road, Owenmore River (54.1946028, -8.4892261)	Good condition	16/07/2024
1766443	2B C.Jinks 16/07/2024 @ 13.29pm U/S of Collooney Bridge Mill Falls, Owenmore River (54.186771, -8.4922154)	Good condition	16/07/2024
1766444	3B AK S.1 16/07/2024 @ 13.30pm S1 @ Sea Pool Ballysadare Falls	Good condition	16/07/2024
1766445	4B AK S.2 16/07/2024 @ 13:40pm S2 @ Seapool Ballysadare Falls	Good condition	16/07/2024
1766446	5B AK S.3 16/07/2024 @ 13:50pm S3 @ Seapool Ballysadare Falls	Good condition	16/07/2024
1766447	6B AK S.4 16/07/2024 @ 13:55 24 @ Seapool Ballysadare Falls	Good condition	16/07/2024

CERTIFICATE OF ANALYSIS

Client : David Harrington (Investigative)
 Inland Fisheries
 Teach Breac
 Earls Island
 Galway

Report No. : 565153
 Date of Receipt : 16/07/2024
 Start Date of Analysis : 16/07/2024
 Date of Report : 01/08/2024
 Order Number : N/A
 Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units		
1766448	1C Handball Alley U/S of Discharge Pipe Ballysadare River 16/07/2024 @ 14:42 pm	Suspended Solids	I,R	13	mg/l		
		TON as N	I,R	<0.1	mg/l		
		COD	I,R	29	mg/l		
		pH	I,R	8.4	pH Units		
		Nitrate as N	I,R	<0.1	mg/l		
		Calculated					
		Nitrite as N	I,R	<0.003	mg/l		
		Phosphorus as PO4-P	I,R	<0.01	mg/l		
		Copper, total	I,R	<1.2	ug/l		
		Ammonia as N	I,R	0.023	mg/l		
		Arsenic, total	I,R	1	ug/l		
		Zinc, total	I,R	<5	ug/l		
		Chromium, total	I,R	<0.6	ug/l		
		Nickel, total	I,R	1	ug/l		
		Lead, total	I,R	1	ug/l		
		Antimony, total	I,R	<0.6	ug/l		
		Cadmium, total	I,R	<0.6	ug/l		
		Cobalt, total	I,R	<0.6	ug/l		
		Selenium, total	I,R	<0.6	ug/l		
		Tellurium, total	I,R	<0.6	ug/l		
		Thallium, total	I,R	<0.6	ug/l		
		Vanadium, total	I,R	1	ug/l		
		Molybdenum, total	I,R	1	ug/l		
		Tin, total	I,R	<0.6	ug/l		
		Beryllium, total	I,R	<0.6	ug/l		
		Total Heavy Metals	R	<15.6	ug/l		
		1766449	2C Handball Alley Below Discharge Pipe in Ballysadare River 16/07/2024 @ 14:42 pm	BOD Automated	I,R	1	mg/l
				BOD Automated	I,R	112	mg/l
Total Heavy Metals	R			298	ug/l		
Tin, total	I,R			4	ug/l		
Molybdenum, total	I,R			2	ug/l		
Beryllium, total	I,R			<0.6	ug/l		
Vanadium, total	I,R			8	ug/l		
Selenium, total	I,R			1	ug/l		
Thallium, total	I,R			<0.6	ug/l		
Tellurium, total	I,R			<0.6	ug/l		
Cobalt, total	I,R			3	ug/l		
Antimony, total	I,R			2	ug/l		
Lead, total	I,R			28	ug/l		
Cadmium, total	I,R			1	ug/l		
Nickel, total	I,R			9	ug/l		
Arsenic, total	I,R			3	ug/l		
Chromium, total	I,R			7	ug/l		
Zinc, total	I,R	187	ug/l				
Ammonia as N	I,R	0.015	mg/l				

		Phosphorus as PO4-P	I,R	0.036	mg/l
		Nitrite as N	I,R	<0.005	mg/l
		Copper, total	I,R	43	ug/l
		Nitrate as N	I,R	<0.1	mg/l
		Calculated			
		TON as N	I,R	<0.1	mg/l
		pH	I,R	7.3	pH Units
		COD	I,R	378	mg/l
		Suspended Solids	I,R	416	mg/l
1766450	3C Handball Alley D/S 10M Below Discharge Pipe Ballysadare River @ 14:35pm	Suspended Solids	I,R	154	mg/l
		COD	I,R	152	mg/l
		pH	I,R	7.7	pH Units
		TON as N	I,R	<0.1	mg/l
		Nitrate as N	I,R	<0.1	mg/l
		Calculated			
		Copper, total	I,R	14	ug/l
		Nitrite as N	I,R	<0.005	mg/l
		Phosphorus as PO4-P	I,R	0.016	mg/l
		Ammonia as N	I,R	0.024	mg/l
		Zinc, total	I,R	62	ug/l
		Chromium, total	I,R	3	ug/l
		Arsenic, total	I,R	2	ug/l
		Nickel, total	I,R	4	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Lead, total	I,R	9	ug/l
		Antimony, total	I,R	1	ug/l
		Cobalt, total	I,R	2	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Selenium, total	I,R	1	ug/l
		Vanadium, total	I,R	3	ug/l
		Beryllium, total	I,R	<0.6	ug/l
		Molybdenum, total	I,R	1	ug/l
		Tin, total	I,R	2	ug/l
		Total Heavy Metals	R	104	ug/l
1766451	4C Treated Effluent WWTP Ballysadare @ 15:18pm	BOD Automated	I,R	37	mg/l
		Total Heavy Metals	R	16	ug/l
		BOD Automated	I,R	7	mg/l
		Tin, total	I,R	<0.6	ug/l
		Beryllium, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	5	ug/l
		Molybdenum, total	I,R	1	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Cobalt, total	I,R	1	ug/l
		Selenium, total	I,R	<0.6	ug/l
		Antimony, total	I,R	1	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Nickel, total	I,R	2	ug/l
		Lead, total	I,R	<0.6	ug/l
		Zinc, total	I,R	6	ug/l
		Chromium, total	I,R	<0.6	ug/l
		Ammonia as N	I,R	23.9	mg/l
		Arsenic, total	I,R	<0.6	ug/l
		Phosphorus as PO4-P	I,R	0.266	mg/l

In-House Test	Specification	Expanded Measurement of Uncertainty	17025	GMP/FDA*	ISO**
Suspended Solids	CLS 13	+/- 20.84 %	Yes	No	Yes
TON as N	Konelab CLS 38	+/- 8.51 %	Yes	No	Yes
COD	CLS 52	+/- 4.48 %	Yes	No	Yes
pH	CLS 26	+/- 0.133 pH units	Yes	No	Yes
Nitrate as N Calculated	Konelab CLS 39	+/- 0.45 @ 4 mg/l NO3-N	Yes	No	Yes
Nitrite as N	Konelab CLS 37	+/- 5.83 %	Yes	No	Yes
Phosphorus as PO4-P	Konelab CLS 35	+/- 24.55 %	Yes	No	Yes
Copper, total	ICP-MS CLS 129	+/- 11.28 %	Yes	No	Yes
Ammonia as N	Konelab CLS 40	+/- 5.13 %	Yes	No	Yes
Arsenic, total	ICP-MS CLS 129	+/- 9.34 %	Yes	No	Yes
Zinc, total	ICP-MS CLS 129	+/- 9.38 %	Yes	No	Yes
Chromium, total	ICP-MS CLS129	+/- 8.88 %	Yes	No	Yes
Nickel, total	ICP-MS CLS129	+/- 7.91 %	Yes	No	Yes
Lead, total	ICP-MS CLS 129	+/-20@100ug/l	Yes	No	Yes
Antimony, total	ICP-MS CLS 129	+/- 13.23 %	Yes	No	Yes
Cadmium, total	ICP-MS CLS 129	+/- 10.42 %	Yes	No	Yes
Cobalt, total	ICP-MS CLS129	+/-0.7@5ug/l	Yes	No	Yes
Selenium, total	ICP-MS CLS129	+/-0.9@5ug/l	Yes	No	Yes
Tellurium, total	ICP-MS CLS129	+/-0.8@5ug/l	Yes	No	Yes
Thallium, total	ICP-MS CLS129	+/-8.3@100ug/l	Yes	No	Yes
Vanadium, total	ICP-MS CLS 129	+/- 11.72 %	Yes	No	Yes
Molybdenum, total	ICP-MS CLS129	+/- 8.82 %	Yes	No	Yes
Tin, total	ICP-MS CLS129	+/-0.6@5ug/l	Yes	No	Yes
Beryllium, total	ICP-MS CLS129	+/- 11.67 %	Yes	No	Yes
Total Heavy Metals	Calculation includes sum of: Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Se, Te, Tl, Sn, V, Zn		No	No	Yes
BOD Automated	CLS 214	+/- 35.29 %	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).
 **Laboratory Analysis, Sampling, Food Safety Monitoring and Analysis on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
1766448	1C Handball Alley U/S of Discharge Pipe Ballysadare River 16/07/2024 @ 14:42 pm	Good condition	16/07/2024
1766449	2C Handball Alley Below Discharge Pipe in Ballysadare River 16/07/2024 @ 14:42 pm	Good condition	16/07/2024
1766450	3C Handball Alley D/S 10M Below Discharge Pipe Ballysadare River @ 14:33pm	Good condition	16/07/2024
1766451	4C Treated Effluent WWTP Ballysadare @ 15:18pm	Good condition	16/07/2024

CERTIFICATE OF ANALYSIS

Client : David Harrington (Investigative)
 Inland Fisheries
 Teach Breac
 Earls Island
 Galway

Report No. : 565730
 Date of Receipt : 19/07/2024
 Start Date of Analysis : 19/07/2024
 Date of Report : 01/08/2024
 Order Number : N/A
 Sample taken by : Client

Lab No	Sample Description	Test	Ref.	Result	Units
1767888	1 A Outflow of Lough Arrow @13.25pm	TON as N	I,R	<0.1	mg/l
		COD	I,R	15	mg/l
		pH	I,R	8.2	pH Units
		Nitrate as N Calculated	I,R	<0.1	mg/l
		Nitrite as N	I,R	<0.005	mg/l
		Phosphorus as PO4-P	I,R	0.01	mg/l
		Copper, total	I,R	<1.2	ug/l
		Ammonia as N	I,R	0.058	mg/l
		Arsenic, total	I,R	<0.6	ug/l
		Zinc, total	I,R	<6	ug/l
		Chromium, total	I,R	<0.6	ug/l
		Nickel, total	I,R	<0.6	ug/l
		Lead, total	I,R	<0.6	ug/l
		Antimony, total	I,R	<0.6	ug/l
		Cadmium, total	I,R	<0.6	ug/l
		Cobalt, total	I,R	<0.6	ug/l
		Selenium, total	I,R	<0.6	ug/l
		Tellurium, total	I,R	<0.6	ug/l
		Thallium, total	I,R	<0.6	ug/l
		Vanadium, total	I,R	<0.6	ug/l
		Molybdenum, total	I,R	<0.6	ug/l
		Tin, total	I,R	<0.6	ug/l
		Beryllium, total	I,R	<0.6	ug/l
		Total Heavy Metals	R	<15.6	ug/l
		Suspended Solids	I,R	<2	mg/l
		BOD Automated	I,R	<1	mg/l
		1767889	2 A Ballinafod Slipway Lough Arrow @ 12.40pm	Suspended Solids	I,R
TON as N	I,R			<0.1	mg/l
Total Heavy Metals	R			<15.6	ug/l
BOD Automated	I,R			2	mg/l
Tin, total	I,R			<0.6	ug/l
Beryllium, total	I,R			<0.6	ug/l
Vanadium, total	I,R			<0.6	ug/l
Molybdenum, total	I,R			<0.6	ug/l
Tellurium, total	I,R			<0.6	ug/l
Thallium, total	I,R			<0.6	ug/l
Cobalt, total	I,R			<0.6	ug/l
Selenium, total	I,R			<0.6	ug/l
Antimony, total	I,R			<0.6	ug/l
Cadmium, total	I,R			<0.6	ug/l
Nickel, total	I,R			<0.6	ug/l
Lead, total	I,R			<0.6	ug/l
Zinc, total	I,R			<6	ug/l
Chromium, total	I,R	<0.6	ug/l		
Ammonia as N	I,R	0.047	mg/l		
Arsenic, total	I,R	<0.6	ug/l		
Phosphorus as PO4-P	I,R	<0.01	mg/l		

		Copper, total	I,R	<1.2	ug/l
		Nitrate as N Calculated	I,R	<0.1	mg/l
		Nitrite as N	I,R	<0.005	mg/l
		COD	I,R	99	mg/l
		pH	I,R	8.0	pH Units



Approved by:

Ann Marie Nee

**AnnMarie Nee
 Environmental Account
 Manager**

See below for test specifications and accreditation status.
 This report only relates to items tested and shall not be reproduced but in full with the permission of CLS.
 est. is an estimated count.
 CLS will test food, water and swabs samples within 24 hours of receipt.
 Where samples have been taken by the Client, results apply to the samples as received.

In-House Test	Specification	Expanded Measurement of Uncertainty	17025	GMP/FDA*	ISO**
TON as N	Konelab CLS 38	+/- 8.51 %	Yes	No	Yes
COD	CLS 52	+/- 4.48 %	Yes	No	Yes
pH	CLS 26	+/- 0.133 pH units	Yes	No	Yes
Nitrate as N Calculated	Konelab CLS 39	+/- 0.45 @ 4 mg/l NO3-N	Yes	No	Yes
Nitrite as N	Konelab CLS 37	+/- 5.83 %	Yes	No	Yes
Phosphorus as PO4-P	Konelab CLS 35	+/- 24.55 %	Yes	No	Yes
Copper, total	ICP-MS CLS 129	+/- 11.28 %	Yes	No	Yes
Ammonia as N	Konelab CLS 40	+/- 5.13 %	Yes	No	Yes
Arsenic, total	ICP-MS CLS 129	+/- 9.34 %	Yes	No	Yes
Zinc, total	ICP-MS CLS 129	+/- 9.38 %	Yes	No	Yes
Chromium, total	ICP-MS CLS129	+/- 8.38 %	Yes	No	Yes
Nickel, total	ICP-MS CLS129	+/- 7.91 %	Yes	No	Yes
Lead, total	ICP-MS CLS 129	+/-20@100ug/l	Yes	No	Yes
Antimony, total	ICP-MS CLS 129	+/- 13.23 %	Yes	No	Yes
Cadmium, total	ICP-MS CLS 129	+/- 10.42 %	Yes	No	Yes
Cobalt, total	ICP-MS CLS129	+/-0.7@5ug/l	Yes	No	Yes
Selenium, total	ICP-MS CLS129	+/-0.9@5ug/l	Yes	No	Yes
Tellurium, total	ICP-MS CLS129	+/-0.8@5ug/l	Yes	No	Yes
Thallium, total	ICP-MS CLS129	+/-8.3@100ug/l	Yes	No	Yes
Vanadium, total	ICP-MS CLS 129	+/- 11.72 %	Yes	No	Yes
Molybdenum, total	ICP-MS CLS129	+/- 8.82 %	Yes	No	Yes
Tin, total	ICP-MS CLS129	+/-0.6@5ug/l	Yes	No	Yes
Beryllium, total	ICP-MS CLS129	+/- 11.67 %	Yes	No	Yes
Total Heavy Metals	Calculation includes sum of: Sb, As, Be, Cd, Cr, Co, Cu, Pb, Mo, Ni, Se, Te, Tl, Sn, V, Zn		No	No	Yes
Suspended Solids	CLS 13	+/- 20.84 %	Yes	No	Yes
BOD Automated	CLS 214	+/- 35.29 %	Yes	No	Yes

*Analysis carried out in a GMP approved, FDA inspected facility (MedPharma site only).

**Laboratory Analysis, Sampling, Food Safety Monitoring and Analysts on Contract are all ISO 9001 certified.

Lab No	Sample ID	Sample Condition on Receipt	Sampling Date
1767888	1 A Outflow of Lough Arrow @13.25pm	Good condition	19/07/2024
1767889	2 A Ballinacod Slipway Lough Arrow @ 12.40pm	Good condition	19/07/2024

8.2 Appendix 2 ATU water monitoring results

Ballisodare Fishery Water Quality Monitoring

The sensor was deployed upstream of the Fishery in July 2024 to monitor dissolved oxygen levels in the Ballisodare river following a large number of fish mortalities at the river mouth, with deployment details in

Table 1.

Table 1: Deployment details for AP-2000 sensor in Ballisodare river

Sensor	Aquaread AP-2000
Location deployed	Above fish pass in Mill Pool, Ballisodare river
Monitoring interval	15 minutes
Date & time deployed	17/07/2024 13:00
Date and time removed	19/07/2024 12:19
Total deployment time	47 h 40 mins
Deployed by	Lisa Cronin, ATU



Figure 1: Deployment location of AP-2000 water quality sonde in Mill Pool, Ballisodare River.

Antecedent weather conditions were dry and warm with no rainfall for two days prior to the sensor deployment. The rainfall data from Met Eireann at Markree Castle weather station is plotted with the water quality data (<https://www.met.ie/climate/available-data/daily-data>).

Data gathered by the AP-2000 sensor show suitable water quality conditions for salmonids over the deployment period with summary statistics in Table 2.

Table 2: Summary statistics for data collected by AP-2000 sensor in Ballisodare river from 17/07/2024 to 18/07/2024

Statistic	N	Mean	St. Dev.	Min	Max
Hourly rainfall (mm)	48	0.2	0.4	0.0	1.4
Temperature (deg.C)	190	17.4	0.5	16.3	18.4
Dissolved Oxygen (% saturation)	190	101.0	2.6	97.8	107.4
Conductivity (uS/cm)	190	547.9	52.0	429	587
pH	190	8.3	0.1	8.2	8.5
Ammonia (NH3) mg/l	190	0.01	0.004	0.0	0.01
Ammonium (NH4) mg/l	190	0.1	0.01	0.07	0.13

N = no. of readings/observations

Rainfall

Over the deployment period, rainfall commenced in the late afternoon on 17/07/2024 peaking at an hourly rainfall of 1.4mm at 21:00 with rainfall ceasing by 11:00 on 18/07/2024.

Dissolved Oxygen

The amount of dissolved oxygen present in water is dependent on temperature with warmer waters holding less dissolved oxygen than colder waters. The dissolved oxygen levels over the deployment period remained greater than the 80% saturation preferred by salmonids although levels as low as 70%¹ can be tolerated without adverse effects.

Dissolved oxygen values over 100% air saturation can be a common occurrence and were measured over the deployment period. This can be caused by photosynthetically active species (plants, algae, etc.) adding additional dissolved oxygen to the water and also due to agitation over the rocky substrate in fast flows.

Temperature

Water temperature ranged between 16.3 and 18.4 °C, well below the upper limit of 21.5°C for salmonids² outside of the reproduction season.

pH

pH varied little over the deployment period with values ranging between 8.2 and 8.5, which is within the pH range for salmonids of ≥pH 6 and ≤pH 9³.

¹ (Kelly *et al.*, 2007)

² (Irish Statute Book (eISB), 1988)

³ (EPA Catchments Unit, 2016)

Conductivity

Conductivity in Irish freshwaters varies from $10\mu\text{S}/\text{cm}$ to $1000\text{mS}/\text{cm}$ and in unpolluted waters reflects the type of soils and bedrock over which the water flows, dissolving ions which is measured as conductivityⁱⁱⁱ. Conductivity values were in the mid range, ranging from 429 to $587\mu\text{S}/\text{cm}$, with higher values during the dry weather when initially deployed, and decreasing then due to dilution after the rainfall

Ammonia

Ammonia occurs in freshwater in two forms, n-ionised and ionised. Un-ionised ammonia (NH_3) is the most toxic to fish with more NH_3 forming at higher pH. Ammonia affects the gills of fish by destroying the mucous layer but sub lethal concentrations of ammonia can also impair immune system leading to increased susceptibility to disease.

Concentrations of ammonia (NH_3) were below the recommended level of ≤ 0.02 mg/litre NH_3^a for salmonids and ammonium (NH_4) was also below the ammonium limit of ≤ 1 mg/litre NH_4^b .



Lisa Cronin

25/07/2024

8.3 Appendix 3 Report on disease testing (11th July samples)

Form No. A-155; Vt No.2.2; Status: **Current**; Approved Date: 22/07/2024

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FISH HEALTH REPORT

FHU REPORT NUMBER: F/074/24	DATE ISSUED: 02/08/2024
CUSTOMER: Competent Authority	SAMPLE LABORATORY I.D.: F/074/24
ADDRESS: Marine Institute Rinville Oranmore Co. Galway	SAMPLE RECEPTION FORM: A110-24-24
SITE: Ballisodare River	DATE/TIME SAMPLED: 11/07/2024 11:30
SAMPLE DETAILS: 6 x Atlantic salmon	DATE RECEIVED: 11/07/2024

DETAILS:

Six Atlantic salmon were sampled by the Fish Health Unit and screened for the pathogens detailed below. The sample was taken in response to reports of high levels of mortality in fish returning to the Ballisodare River. Fish 1-4 were sampled from below the fish ladder and fish 5 and 6 were sampled from above the fish ladder. Water temperature at the time of sampling was recorded as 14.8°C. This report includes an annex (1) which details the phytoplankton results for Drumcliff Bay and Sligo Harbour since May 2024. This annex report has been provided by the Phytoplankton Unit, Shellfish Safety of the Marine Institute.

GROSS PRESENTATION OF FISH EXAMINED & SAMPLED

Fish 1, 2, 3, 5 and 6 presented with lesions on the dorsal and ventral areas. Fish 1 exhibited *saprolegnia*-like infection on the gills and dorsal region. Fish 2, 3, 5 and 6 presented with haemorrhaging on the abdomen. Fish 4 presented without any obvious lesions, fungal infection or haemorrhaging.

VIROLOGY

Date/time processed: 12/07/2024 10:12

Tissue samples (one pool of 4 fish; one pool of 2 fish) were tested for the presence of viral haemorrhagic septicaemia (VHS), infectious haematopoietic necrosis (IHN) and infectious pancreatic necrosis (IPN) viruses by cell culture (**Test Method FHU-65**).

The results of these tests were negative.

BACTERIOLOGY*

Kidney swabs from six fish were plated onto tryptone soya agar (TSA) and Colombia blood agar (CBA) plates. After incubation under standard conditions no significant bacterial fish pathogens were isolated.

*Non-accredited method

HISTOLOGY*

Six fish were sampled for histopathology.

Histopathological examinations were completed by Pharmaq Analytiq Ireland, on behalf of the Marine Institute.

The findings are as follows:

None of the pathology observed indicated that the mortality was caused by a systemic infectious disease.

Saprolegnia like hyphae were present on some lesion sections, but not all. *Saprolegnia* is common on compromised fish and is often a component of mortality in salmon migrating into freshwater. The primary significance is however, uncertain in this case.

Spleen samples were indicative of chronic inflammation in all fish sampled. A link to skin lesions and *Saprolegnia* infection is possible, and lesions are the likely explanation for the widespread mild systemic pathologies described. It is uncertain whether *Saprolegnia* is the primary cause of skin lesions; mechanical damage is a likely contributing factor and could be the initial cause of lesions, which were then colonized by *Saprolegnia* and opportunistic bacteria. Internal parasitic infections may also be part of the spleen presentation.

Varying gill pathology was present, including indications of water borne irritation, with the pathology observed considered to be functionally significant in some fish. Elevated diatom levels (see Annex 1) recorded in the area are a plausible cause for much of the pathology seen, but the severity of this presentation is too mild to be considered the primary cause of mortality. The gill necrosis implies a more acute insult, but this presentation was inconsistent. Bacteria were present in some fish, but their primary clinical significance is uncertain. These are most likely opportunistic infections on compromised fish, but are likely contributing factors to morbidity once present. There was no obvious cause for excess mucus described on gills, but not all waterborne irritants would be visible on histology and other factors can lead to excess mucus production.

MOLECULAR

Date processed: 18/07/2024

Kidney tissue from six fish were screened for *Renibacterium salmoninarum* (Test Method MBU-125) by real-time PCR. All samples tested negative



Dr. Samantha White
Finfish Health Team Leader

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Michael Millane, Inland Fisheries Ireland.
Gerry Merrick, Ballisodare Fishing Club.

*Non-accredited method

ANNEX 1



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PHYTOPLANKTON REPORT

The following document details the results of Phytoplankton screening for Drumcliff Bay and Sligo Harbour since May 2024, provided by the Phytoplankton Unit on behalf of the Fish Health Unit, Marine Institute.

Report:

The Marine Institute operates a weekly nationwide programme in active classified production areas for the identification and enumeration of phytoplankton species (627/2019), focusing on those which give rise to Harmful Algal Bloom events and those which produce toxins which accumulate in filter feeding shellfish species.

In Sligo, there are three classified production areas: Drumcliff, Sligo Harbour and Ballisodare (Figure 1.). Whilst the Ballisodare production area is fully classified for mussels (Class B) there has been no active commercial mussel production in the area since 2017, hence no samples have been submitted for toxin and phytoplankton analysis since this time.

The adjacent shellfish aquaculture production areas of Sligo Harbour (approx. 6km away from Ballisodare) and Drumcliff (approx. 10km from Ballisodare) are in active production. A review of the weekly phytoplankton analysis (Table 1.) results for these 2 areas since May 2024 shows the elevated presence of species of the chain forming diatom genus *Chaetoceros*, which is a known organism which can impact on the health of fish. These species have been a continual presence in the Drumcliff and Sligo Harbour areas, where bloom levels of *Chaetoceros* species reached high cell densities in Drumcliff of >2.5 million cells/L on the 20th May 2024, and on a second occasion, > 1.1 million cells/L observed on the 17th June 2024.

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Figure 1. Shellfish production areas in Sligo (Ballisodare, Sligo Harbour and Drumcliff), with designated sample points for biotoxin and phytoplankton sample submission and analysis within classified production areas.

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Location Code	Location Name	Sample Date	Species	Result (cells/L)
SO-DB-DB	Drumcliff Bay	22/07/2024	Chaetoceros (Hyalochaete) spp.	163,323
SO-DB-DB	Drumcliff Bay	15/07/2024	Chaetoceros (Hyalochaete) spp.	35,397
SO-DB-DB	Drumcliff Bay	08/07/2024	Chaetoceros (Hyalochaete) spp.	143,038
SO-DB-DB	Drumcliff Bay	01/07/2024	Chaetoceros (Hyalochaete) spp.	135,999
SO-DB-DB	Drumcliff Bay	24/06/2024	Chaetoceros (Hyalochaete) spp.	15,525
SO-DB-DB	Drumcliff Bay	17/06/2024	Chaetoceros (Hyalochaete) spp.	1,137,121
SO-DB-DB	Drumcliff Bay	10/06/2024	Chaetoceros (Hyalochaete) spp.	177,295
SO-DB-DB	Drumcliff Bay	04/06/2024	Chaetoceros (Hyalochaete) spp.	22,356
SO-DB-DB	Drumcliff Bay	27/05/2024	Chaetoceros (Hyalochaete) spp.	52,200
SO-DB-DB	Drumcliff Bay	20/05/2024	Chaetoceros (Hyalochaete) spp.	2,525,108
SO-DB-DB	Drumcliff Bay	13/05/2024	Chaetoceros (Hyalochaete) spp.	40,986
SO-DB-DB	Drumcliff Bay	07/05/2024	Chaetoceros (Hyalochaete) spp.	1,480

Table 1: Cell densities (Cells/L) of the *Chaetoceros* species observed in Drumcliff from May – July 2024. Elevated bloom densities observed on 20th May and 17th June 2024.

Yours sincerely,

Mr. Dave Clarke

Section Manager, Shellfish Safety.

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*Non-accredited method

8.4 Appendix 4 Report on disease testing (19th July samples)

Form No. A-155; V1; No.2.2; Status: Current; Approved Date: 22/07/2024

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FISH HEALTH REPORT

FHU REPORT NUMBER: F/076/24	DATE ISSUED: 08/08/2024
CUSTOMER: Competent Authority	SAMPLE LABORATORY I.D.: F/076/24
ADDRESS: Marine Institute Rinville Oranmore Co. Galway	SAMPLE RECEPTION FORM: A110-25-24
SITE: Ballisodare River	DATE/TIME SAMPLED: 19/07/2024 11:45
SAMPLE DETAILS: 5 x Atlantic salmon (3 x male; 2 x female)	DATE RECEIVED: 19/07/2024

DETAILS:

Five Atlantic salmon were sampled by the Fish Health Unit (FHU) and screened for the pathogens detailed below. This subsequent sample was taken in response to continued reports of mortality in fish returning to the Ballisodare River. Fish 1-3 were sampled from above the fish ladder and fish 4 and 5 were sampled from below the fish ladder. At the time of sampling, mortality had decreased on the river system and very few moribund fish were noted. The testing detailed herein, complements the initial sampling (F/074/24) carried out by the FHU on 11/07/2024, with findings reported to stakeholders on 02/08/2024.

GROSS PRESENTATION OF FISH EXAMINED & SAMPLED

Fish 1 to 4 presented with lesions on the dorsal and ventral areas, mild haemorrhaging on the abdomen, and pale gills. Fish 5 exhibited moderate levels of lesions and haemorrhaging on the abdomen, with severe damage and mucosal discharge on the gills.

VIROLOGY

Date/time processed: 23/07/2024 16:15

Tissue samples (one pool of 3 fish; one pool of 2 fish) were tested for the presence of viral haemorrhagic septicaemia (VHS), infectious haematopoietic necrosis (IHN) and infectious pancreatic necrosis (IPN) viruses by cell culture (**Test Method FHU-65**).

The results of these tests were negative.

BACTERIOLOGY*

Kidney, lesion and gill swabs taken from five fish were plated onto tryptone soya agar (TSA) and Columbia blood agar (CBA) plates. After incubation under standard conditions, growth of two specific bacterial isolates were noted for 4/5 fish on TSA plates. Identification of both bacterial isolates were confirmed through the use of primary and secondary biochemical tests, alongside partial 16S ribosomal DNA conventional PCR and sequencing.

*Non-accredited method

Isolates were identified as *Aeromonas Hydrophila* and *Aeromonas sobria*. These bacteria were found in low levels and are most likely opportunistic infections on compromised fish.

HISTOLOGY*

Five fish were sampled for histopathology.

Histopathological examinations were completed by Pharmaq Analytiq Ireland, on behalf of the Marine Institute.

The findings are as follows:

Saprolegnia infection and related gill pathology was severe on two fish, including one sampled below the ladder indicating that this fish has been in freshwater for a significant amount of time. Gill pathology consistent with water borne irritation is widespread and largely chronic, pathology is considered functionally significant in some fish, most notably in fish 3. Bacteria were present on the gills of fish 4, but primary clinical significance is uncertain.

Liver necrosis seen in fish 1 and fish 5 is likely related to severe gill pathology, but could also be related to hypoxia, toxic insult or infectious disease. Mild liver necrosis is also present in fish 3. Fish 3 showed significant gill pathology but no *Saprolegnia*, indicating that *Saprolegnia* is not the key component in this presentation.

No signs of systemic disease were seen in other organs sampled in these fish.

Spleen samples are indicative of chronic inflammation in all fish sampled. A link to skin lesions, gill pathology and *Saprolegnia* infection is possible. Skin pathologies are mild and non-specific; no infectious elements were seen. Parasites are a common incidental finding in wild fish, cestodes and nematodes were present in the fish sampled but a significant clinical impact is considered unlikely. Indications of catabolic metabolism and inappetence are likely normal in migrating wild salmon.

MOLECULAR

Date processed: 02/08/2024

Kidney tissue from five fish were screened for *Renibacterium salmoninarum* (Test Method MBU-125) by real-time PCR. All samples tested negative.



Dr. Samantha White
Finfish Health Team Leader

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Gerry Merrick, Ballisodare Fishing Club.

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