West Cumbria Rivers Trust

Caring for our Lakes and Rivers

River Derwent Fish and
Habitat Surveys Project

Fish and Habitat Survey Report 2022

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The focus of this report is the River Derwent and its tributaries. West Cumbria Rivers Trust conduct fish and habitat surveys in other areas of West Cumbria, and the data and reports for these are available upon request/online. Please email info@westcumbriariverstrust.org if you would like more information.

Contents

1 Executive Summary

1.1.1 The River Derwent fish and habitat survey project started in 2015 and is now in its eighth year. The project aims to complete yearly fish and habitat surveys in order to determine the health and state of the catchment of the River Derwent and its tributaries. The data collected is used to monitor the inter-annual variations of the juvenile populations of Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*) – collectively referred to as salmonids. It is also used to: determine underperforming areas in order to direct where habitat improvement projects are needed, monitor the effectiveness of previous habitat improvement projects, locate ecological threats such as invasive species and build up a database to ultimately determine long-term trends.

1.1.2 As well as the usual aims and objectives of the project, the 2022 surveys were part funded by the Environment Agency (EA) and form part of a collaborative project between West Cumbria Rivers Trust (WCRT), The Rivers Trust, EA and other local rivers trusts, looking at methodologies for data collection and analysis, and improving the sharing of data.

1.1.3 Surveys were conducted between July and September. To conduct the fish surveys, WCRT use the semi-quantitative electrofishing method adopted from Crozier and Kennedy (1993). This involves using an electrofishing backpack to create an electric field within the water, which draws out and temporarily immobilises the fish, making them easier to catch. The survey is conducted by working upstream in a zigzag pattern for 5 minutes (survey time is the constant variable between survey sites). Once the survey is completed, the fish caught are identified, measured, recorded and then returned to the river unharmed. Alongside the fish data, habitat details are also recorded, including: type of channel substrate, presence and absence of aquatic plants and large woody debris, barriers to fish migration, bank material and vegetation, riparian land use, and presence and absence of invasive species.

1.1.4 Semi-quantitative (5 min surveys) were undertaken at 183 sites in the Derwent catchment, during the summer of 2022. At 27 of these sites quantitative surveys were also undertaken as part of a calibration exercise. For the purpose of this report, the semi-quantitative data will be displayed as fish per minute indices and the classification boundaries are based on the percentiles of the entire WCRT eight year data set. The quantitative data will be displayed as fish per $100m^2$ densities, and assigned a classification according to the EA's National Fisheries Classification Scheme (NFCS) boundaries.

1.1.5 The spring and summer of 2022 was warm, with prolonged dry periods and heatwaves, leading to another summer of low river levels and warm waters throughout the months of April to September, when the fry are most vulnerable.

1.1.6 In total, 4,980 salmonids were recorded, of which 3,209 were trout and 1,771 were salmon. Of these 2,765 were trout fry and 1,443 were salmon fry (fry being less than a year old); and 444 were trout parr and 328 were salmon parr (parr being over a year old). Of the 183 sites surveyed 156 sites (85%) had trout fry present and 94 sites (51%) had salmon fry present.

1.1.7 The number of trout fry recorded was slightly lower in 2022 compared to previous years, when looking at the core 112 sites that have five or more years of data. The decline is most likely due to the warm and dry weather, leading to low flows and warm water temperatures causing additional stress for trout fry. The number of salmon fry recorded also decreased compared to previous years across the 112 sites, but this was expected due to low adult returns the previous winter.

1.1.8 Despite both trout and salmon recording decreases in fry numbers in 2022, compared to previous years, the overall trend is still in the upward trajectory since surveys began in 2015. Whilst this is

encouraging, care should be taken in interpreting this upward trend as an increase in adult numbers. Fry numbers as well as adult numbers, remain much lower than historic levels in the River Derwent catchment.

1.1.9 A case study of the Lonscale culvert upgrade on Whit Beck in the River Greta sub catchment, shows the importance of removing barriers or obstacles along watercourses. The works were undertaken by WCRT as part of their Glenderamackin Catchment Restoration Project funded by the Water Environment Grant.

1.1.10 By upgrading the culvert, natural fluvial and geomorphological processes were restored to Whit Beck, access to approximately 500m of good spawning gravels/habitat upstream of the barrier were made available to salmonids and 1.3km of salmonid habitat downstream was improved through enabling some downstream gravel movement. Post-works surveys have shown trout have since moved into the section of watercourse upstream of the old barrier, where they had previously not been present. This supports the case for continued delivery of river restoration, habitat improvements and barrier removals/easements as a conservation tool to improve salmonid numbers across the catchment.

2 Introduction

2.1 Background

2.1.1 WCRT aims to complete annual salmonid fish and habitat surveys across the Derwent catchment. These types of fisheries surveys are ideal for providing information to determine spawning success, characterise the habitat and provide a general indication of the health of stretches of river. The data collected also helps to evaluate the success of river restoration and habitat improvement projects and provide evidence of where further work to improve habitat, water quality and fish migration is needed. This evidence helps to elicit further funding to undertake projects.

2.1.2 The source of the River Derwent is Sprinkling and Styhead Tarns in the Borrowdale Fells, and it flows all the way to Workington where it joins the Solway Firth. Major tributaries include the River Greta/Glenderamackin, Newlands Beck, River Cocker and River Marron. The River Derwent and its tributaries are designated as a Site of Scientific Interest (SSSI) and a Special Area of Conservation (SAC) for its population of Atlantic salmon alongside other species including brook, river and sea lamprey, otter, marsh fritillary butterfly and various flora such as floating water plantain. Other important fish species found within the Derwent catchment include European eel, vendace in Derwent Water and Bassenthwaite Lake and Arctic charr in Crummock Water.

2.1.3 Natural England is responsible for the conservation and ecology of the River Derwent SSSI and SAC whereas the EA is responsible for fisheries, and their fisheries monitoring programme provides coverage of the catchment at a level appropriate to current legislative responsibilities. Monitoring by the EA has however been greatly reduced due to funding cuts over recent years. WCRT aims to share all the results, experience and knowledge from this project with them and other interested parties. WCRT has also designed its programme to complement, rather than duplicate, the EA's programme and collaboration will take place to deliver many aspects of this work.

2.1.4 In particular, the 2022 surveys were part funded by the EA and form part of a collaborative project/ partnership between WCRT, The Rivers Trust, EA, and other local Rivers Trusts, looking at data collection and analysis methodologies and improving the sharing of data.

2.2 Project Objectives

2.2.1 The objective of WCRT's Derwent fish and habitat survey project is to determine the health and state of the River Derwent and its tributaries, by assessing the status and distribution of the juvenile salmonid population, alongside the corresponding habitat data.

2.2.2 The data gathered will be used to achieve the following aims:

1. Assess the overall status of the juvenile population of salmonids;
2. Monitor the inter-annual variations of the juvenile salmonid population;
3. Determine which areas are underperforming and identify where habitat improvement works are needed. This data is then fed into a catchment action plan to help facilitate prioritisation of funding and projects by WCRT, partner organisations and stakeholders;
4. Evaluate the effectiveness of habitat improvement river restoration and barrier easement projects;
5. Provide evidence in support of grant bids and funding applications;
6. Locate ecological threats posed by invasive species, pollution incidents etc; and
7. Build up a database of fish and habitat data to ultimately determine long-term trends.

3 Methodology

3.1 Fish Survey Method

3.1.1 Electrofishing is a common method used to survey fish populations. It involves creating an electric field in the water to draw the fish out and temporarily immobilise them, making them easier to catch with a hand net. Prior to surveying, conductivity and temperature readings are taken to help the user determine the appropriate settings for the electrofishing equipment.

3.1.2 WCRT have two different types of electrofishing kit available to use when surveying, E Fish 500W electrofishing backpack and Hans-Grassl IG600L. The latter is more suitable for low conductivity areas such as the upper reaches of the catchment as these sites are at the upper limits of the E fish kit's capabilities.

3.1.3 There are several methods of conducting electrofishing surveys; WCRT adopt the semi-quantitative survey method as set out in Crozier and Kennedy (1993). The semi-quantitative survey method requires fishing for a set length of time, usually a standard 5 minutes. The 5-minute time period is programmed into the kit which only times when the electric pulse is being used. The river is then fished in a zigzag pattern, working upstream against the flow, (see Figure 1), until the time runs out. The distance fished during the 5 minutes is measured along with the width of the survey site. No stop nets are used during the surveys.

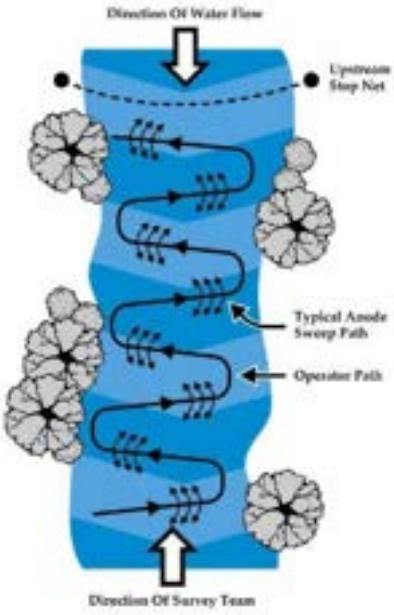

Figure 1: *A diagram to show the survey method of the quantitative survey but is also similar to semi quantitative in terms of the zigzag pattern and the direction of travel. (Diagram from E Fish 500W kit manual, 2012).*

3.1.4 Most survey sites are located on smaller tributary streams and the aim is to cover both pool and riffle habitat within the 5-minute survey by starting with a riffle and ending in a pool. Main river sites are surveyed during low flows and surveys tend to only cover shallow riffles or the edges of gravel bars due to the pools being too deep to survey.

3.1.5 All fish species caught are identified and recorded, however only the salmonids are measured. In order to measure the salmonids, they are placed on a board with an inbuilt ruler. Length is measured to the nearest 5 mm from their mouths to the fork in their tails.

3.1.6 Once recorded and measured, all fish are then returned to the river, unharmed.

3.1.7 Habitat survey data is also collected at each site alongside the fish data. This includes:

- Length and width of area surveyed within the 5 minutes, along with average depth (ankle, calf or knee);
- Conductivity, temperature and water clarity (optimal or sub optimal);
- Weather conditions, any previous floods or droughts, water levels (high, medium or low);
- Type of channel substrate (boulders, cobbles, gravel, silt etc.);
- Presence and absence of plant life, (submerged, emergent or algae);
- Presence and absence of large wooded debris (LWD);
- Barriers to fish migration such as weirs, culverts, waterfalls;

- Bank material, reinforcements or modifications including erosion or damage, and any signs of dredging;
- Riparian fencing, stock access, stock type and adjacent land use;
- Bankside vegetation, woody debris/tree roots and shading;
- Presence of invasive species such as Himalayan balsam, Japanese knotweed, American signal crayfish; and
- Other details such as potential pollution sources, human activity in the river and signs of terrestrial species, or invertebrates.

3.2 Licences and Consents

3.2.1 All survey work is undertaken under licence from the Fisheries Movement Team at the Environment Agency.

3.2.2 Landowner consent to access the survey sites is also sought.

3.3 Site Selection

3.3.1 The Derwent catchment, which has been broken down into sub-catchments for reporting purposes, is shown in Figure 2 on page 9.

3.3.2 Survey sites are selected to ensure an even coverage across the Derwent catchment.

3.3.3 Sites are also selected based on where habitat improvement works have happened or are proposed, project monitoring requirements, and potential to support funding bids. Sites can also be selected to determine whether fish can get over obstacles, to investigate particular issues further or help determine why previously surveyed areas are underperforming.

3.3.4 2022 marks the eighth consecutive year of surveying, with a total of 390 different sites having been surveyed during this time.

3.3.5 Approximately 100 sites are selected as priority and are surveyed every year. The other sites are on a two yearly cycle to allow even coverage across the whole Derwent catchment within the survey window, whilst allowing monitoring aims to still be met. Around 160 sites are surveyed in one survey season depending on the weather and river levels.

3.4 Survey Timings

3.4.1 Surveys are undertaken between July and September. July is the optimal time to begin, when the fry are big enough to identify and robust enough to endure the survey process without injury. The season ends at the end of September to prevent disturbance to returning adult salmon or sea trout.

3.4.2 Attempts are made to survey sites in a similar order to previous years to ensure that the data is collected at roughly the same time each year and that the data is comparable between the years. To do this, data is usually collected at the bottom of the catchment first and surveys progress in a systematic order to the top of the catchment by the end of the season.

3.4.3 Surveying is weather dependant. Efforts are taken to try and avoid fishing in the rain, as this can lead to reduced visibility and higher flows, thus reducing catch efficiency. Surveys are not undertaken in high temperatures or very low flows to ensure no additional stress or harm is caused to the fish by conducting the surveys.

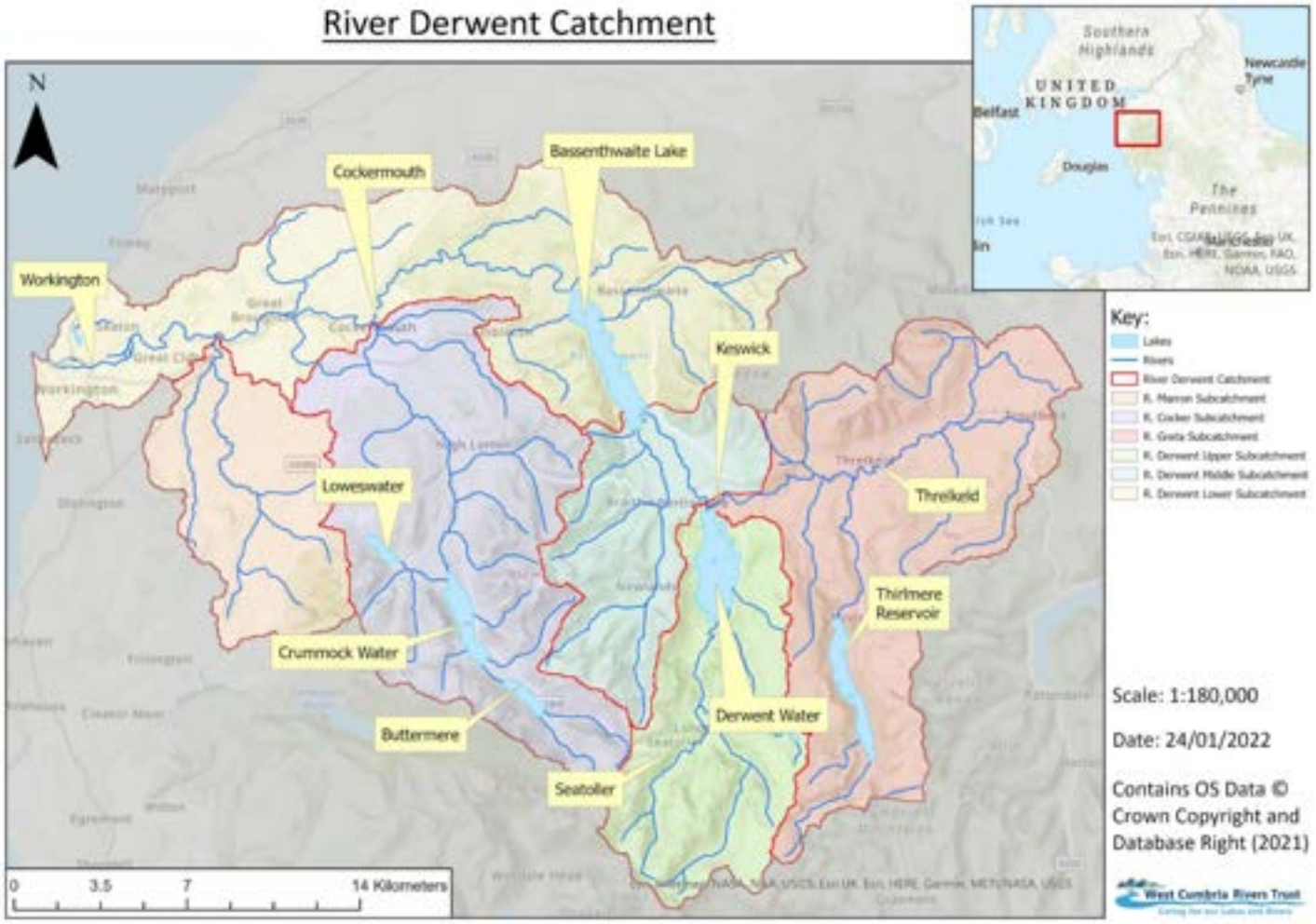

Figure 2: *Map of the River Derwent catchment showing the sub-catchments, major watercourses and settlements.* [1]

[1] Figure 2 Data Sources: Basemaps: Esri, USGS, NGA, NASA, CGIAR, Ordnance Survey, Intermap, Esri UK, HERE, Garmin, METI/ NASA, FAO, NOAA.
Catchment and subcatchment outlines: © Environment Agency copyright and/or database right 2015
Rivers layer: Uncredited in metadata, but likely contains Ordnance Survey data ©.
Lakes layer: © Environment Agency copyright and/or database right 2015. Contains Ordnance Survey data © Crown copyright and database right 2013.

3.5 Fish Data Analysis Methods

3.5.1 In the field, data is collected using survey sheets; an example survey sheet is in Appendix A on page 40. Then over the winter period, the data on the survey sheets is transferred to a spreadsheet for analysis.

3.5.2 Firstly, the salmonid fish data needs to be split into fry and parr. To do so, the frequency of each fish length is plotted as histograms. Sites in close proximity and surveyed at a similar time can be grouped together. The natural break in the data is the value taken as the upper value of fry size and the boundary between the two age classes. For example, Figure 3 shows a histogram that represents salmon at all the sites surveyed along the River Glenderamackin in 2022. The x-axis shows the length of fish in millimetres and the y-axis shows the frequency of each size. The cut-off value between fry and parr is where the natural breaks are in the distributions, or if no obvious break the intersecting point of the bell curves can be used. In Figure 3, the natural break is 90mm between salmon fry and parr at these sites.

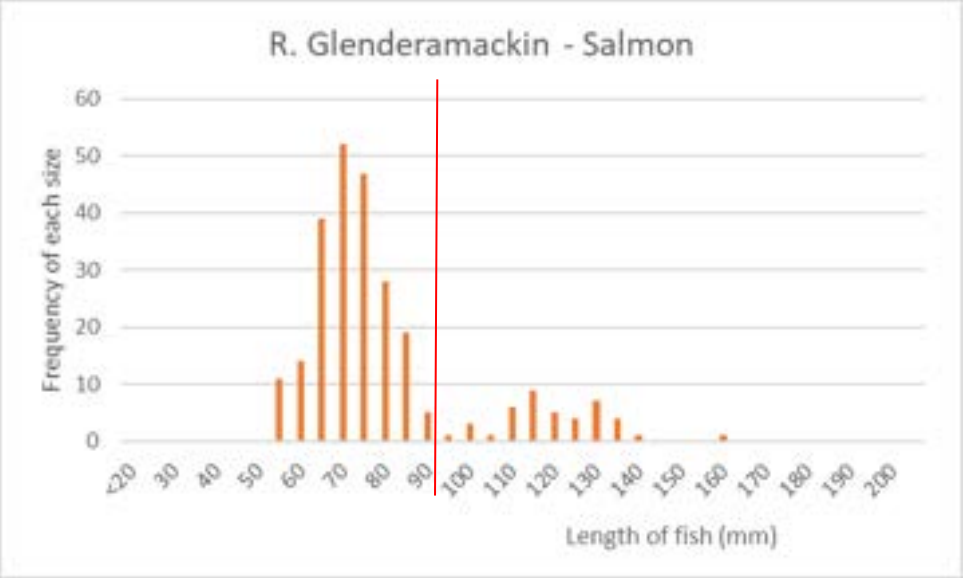

Figure 3: *An example histogram used to determine the cut off value between fry and parr for salmon in the River Glenderamackin sub catchment using data from 2022 survey season.*

3.5.3 Once fry and parr values have been determined, this data is then used to calculate an index of fry abundance, which can be a catch per unit of effort (time) or a fish density per unit area (Scottish Fisheries Co-ordination Centre (SFCC), 2007). Then this index of fry abundance is statistically assigned a classification of excellent to poor based on the value.

3.5.4 The classifications in the reports from previous years of WCRT fish surveys are based on the boundaries from the EA's National Fisheries Classification Scheme (NFCS). The NFCS scheme grades from A (the top 20% of fisheries performance in England and Wales) to E (the bottom 20% of fisheries performance in England and Wales), with F as no fish present. However, in order to use the NFCS scheme, the data needs to be translated into minimum fry densities per $100m^2$ and this requires the data to be calibrated.

3.5.5 Crosier and Kennedy (1993) show that the relationship between semi-quantitative surveys (data derived from 5 minute surveys) and quantitative surveys (data derived from three pass depletion surveys) provides a suitable linear regression which can be used to extrapolate semi-quantitative data into $100m^2$ densities, using the equation:

$$ln(y+1) = a + b\ ln(x+1)$$

Where:

x is 5 min fry result

y is number fry per100m^2

a is the intercept

b is the multiplier

3.5.6 During the summers of 2021 and 2022 several quantitative surveys were undertaken as part of a calibration exercise, to update WCRT's previous equation from 2016. Confidence in the 2016 equation had diminished and it was deemed to be producing unrealistic densities due to the fact it was derived from data that was collected during the summer post Storm Desmond when fry numbers were very low due to the washout of redds in the flood event.

3.5.7 Twelve full quantitative surveys were undertaken during the 2021 survey season, which is 10% of the overall number of sites surveyed that year. Whilst the resulting equations produced fairly realistic densities, a larger proportion of quantitative sites is needed to produce an accurate and reliable equation. Therefore, during the summer of 2022, 25 quantitative depletion surveys were undertaken, which is approximately 14% of the sites surveyed in 2022.

3.5.8 Using Zippin's (1956,1958) K-Pass Removal method and the FSA package in R version 3.1.0 (R core Team, 2019), fry densities per 100m² from the depletion of a known measured area, were calculated from the quantitative surveys.

3.5.9 These fry densities were then plotted against the known number of fish caught in the first '5 minutes' of the quantitative survey to produce the regression correlation. The resulting equations for both salmon and trout fry were then used to extrapolate the semi-quantitative survey data into fry densities per 100m^2.

3.5.10 However, the resulting equations appear to be producing overestimates, particularly for trout fry densities in upland streams that are trout dominated. Crozier and Kennedy (1993) do themselves acknowledge issues with this methodology for sites where you would expect low densities due to the probability of encountering fish being low when surveying for short periods of time, but this explanation would produce underestimates, not over estimates. Possible other alternative explanations include; site selection of the quantitative surveys sites favouring high-density sites, and/or poor rates of depletion on subsequent runs of the surveys.

3.5.11 After consultation with the EA and key representatives from the angling community, it was therefore deemed this equation was unsuitable/ unusable and for the purpose of this report the semi-quantitative five minute data would be expressed as fish per minute indices. This approach is similar to how data has been presented by Inland Fisheries Ireland (2022) and the Spey Fisheries Board (2022), particularly when looking at spatial and temporal trends in the data.

The fish per minute indices for the semi-quantitative data are derived by dividing the number of fry recorded by the number of minutes the survey was conducted for; in this case, five. For example:

Site 1 had 12 salmon fry recorded within the 5-minute survey.

12/5 = 2.4 (salmon fry/min)

3.5.12 Classification boundaries for the semi-quantitative data are based on the percentiles of the entire WCRT semi-quantitative data set from 2015-2022. The data across the eight years is collated together and the numbers ranked and split into 20% divisions, excluding sites where no fry were

recorded. Each percentile was given a classification indicating the relative number of fish caught per minute. The boundaries are detailed in Table 1 below.

Table 1: *Classification boundaries for the fry per minute indices (semi-quantitative data) based on the percentiles of the entire WCRT data set from 2015-2022.*

Grade		Trout Fry	Salmon Fry
A	Excellent	5.7 +	8.3 +
B	Good	2.7 - 5.6	3.3 - 8.2
C	Moderate	1.3 - 2.6	1.5 - 3.2
D	Fair	0.7 - 1.2	0.5 - 1.4
E	Poor	0.1 - 0.6	0.1 - 0.4
F	Absent	0	0

3.5.13 At the sites where quantitative surveys were undertaken, the data will be expressed as fish densities per 100m^2 using Zippin's (1956,1958) K-Pass Removal method and the FSA package in R version 3.1.0 (R core Team, 2019), and categorised using the EA's NFCS boundaries which are detailed in Table 2 below.

Table 2: *Classification boundaries based on the EA's National Fisheries Classification Scheme used for the fry densities per 100m^2 (quantitative data).* [2]

Grade		Trout Fry	Salmon Fry
A	Excellent	38 +	86 +
B	Good	17 - 37	45 - 85
C	Moderate	8 - 16	23 - 44
D	Fair	3 - 7	9 - 22
E	Poor	1 - 2	1 - 8
F	Absent	0	0

3.5.14 The data in this report focuses on fry for both salmon and trout. Parr are often caught, but as semi-quantitative methods tend to focus on the areas of watercourse that are more suitable to fry, the results cannot be used to estimate densities or indicate trends in parr numbers.

[2] © Environment Agency copyright and/or database right 1997

3.6 Habitat Data Analysis Methods

3.6.1 Alongside the fish data, corresponding habitat data is collected at all of the sites, which helps to inform the results and trends seen within the fish data. This data is also used to indicate where habitat improvement or river restoration works are needed. Each site is given a habitat classification. Unlike the fish classifications, the habitat classifications are not used nationally but are devised by WCRT in order to help analyse and present the data. The classifications are; Maintain, Repair and Restore.

3.6.2 Sites are classified as 'Maintain' if they have complex habitats, including: riffle-pool features, trees adjacent to the watercourse, dappled shade, in-stream vegetation and woody debris present; and no issues e.g. no stock access, available gravels with minimal silt, no barriers and no invasive species present.

3.6.3 Sites where habitat is poor would be classified as either 'Repair' or 'Restore'. This includes sites with issues such as: poor water quality due to large amounts of silt and nutrient inputs, presence of invasive species, minimal gravel or available spawning areas, minimal shade, tree roots or cover, and therefore a lack of shade and refuges for fish. Straightened rivers, which are fast flowing with unstable beds and large sediment loads, and over-widened rivers, which are slow flowing with uniform glide flow regimes, would all be classed as either 'Repair' or 'Restore'.

3.6.4 Classification of 'Maintain', 'Repair' or 'Restore' are dependent on the habitat scores for each site. The scoring criteria are shown in Table 3, on page 14. For a site to be classed as 'Maintain' it needs to score 11 or more points. Sites scoring between 6 and10 points are classified as 'repair' and sites scoring 0-5 points are classified as 'Restore'. Some of the classifications are adjusted slightly based on local knowledge and/ or the results of more specialist surveys.

3.6.5 The habitat classifications are an indication of the level of work required to provide the best habitat for fish and to achieve Excellent (A) or Good (B) fish classifications. The following bullet points outline the potential works needed for each habitat classification.

- **Maintain** - limited small-scale work may be required, such as insertion of large woody debris, tree management, planting of some riparian trees or encouragement of in river vegetation growth.
- **Repair** - modest work required, such as fencing off the watercourses to create buffer strips, provision of new gravels, creating more varied in-stream habitat through placement of larger cobbles or boulders, willow spiling or other bank stabilisation works, and invasive species control.

  Restore - major restoration works are required, such as: re-routing the channel; addressing pollution sources such septic tank, sewerage outfalls, misconnections or heavy metal contamination from old mine works; removing embankments or hard engineering; and addressing barriers to fish passage.

Table 3: Habitat classification scoring matrix/ criteria.

Good Habitat Criteria		
Water quality	**In river habitat**	**Bankside habitat**
Clarity - clear	Pool-riffle flow regime	Tree roots and/or overhanging vegetation
Conductivity – low/ medium, as an indicator of the number of ions/ particles in the water	In-river vegetation present	Dappled shade
Temperature – cool	Good gravel substrate	No bank protection
Minimal silt/ sources of silt	Large woody debris present	No Invasive Non Native Species (INNS)
No pollution sources (mine, sewage, septic, misconnections, building works, manure/slurry, etc)	No barriers to fish migration	No stock access
Invertebrates present	No or minimal modifications (not historically dredged, not straightened, no embankments, etc.)	

4 Fish Survey Results and Discussion

4.1 Conditions

4.1.1 The summer of 2022 was warm and dry, with the majority of the country experiencing a drought. Whist Cumbria did not officially reach drought level, it did experience a prolonged dry spring and summer similar to the year before. Figure 4 shows the monthly rainfall totals from the EA's rainfall gauge at Seathwaite in Borrowdale for the years 2015 to 2022. Between April and September 2022, 1173mm of rainfall was recorded, making it the second driest spring/summer since the surveys began in 2015, after 2021. Rankings and totals can be seen in Table 4 below.

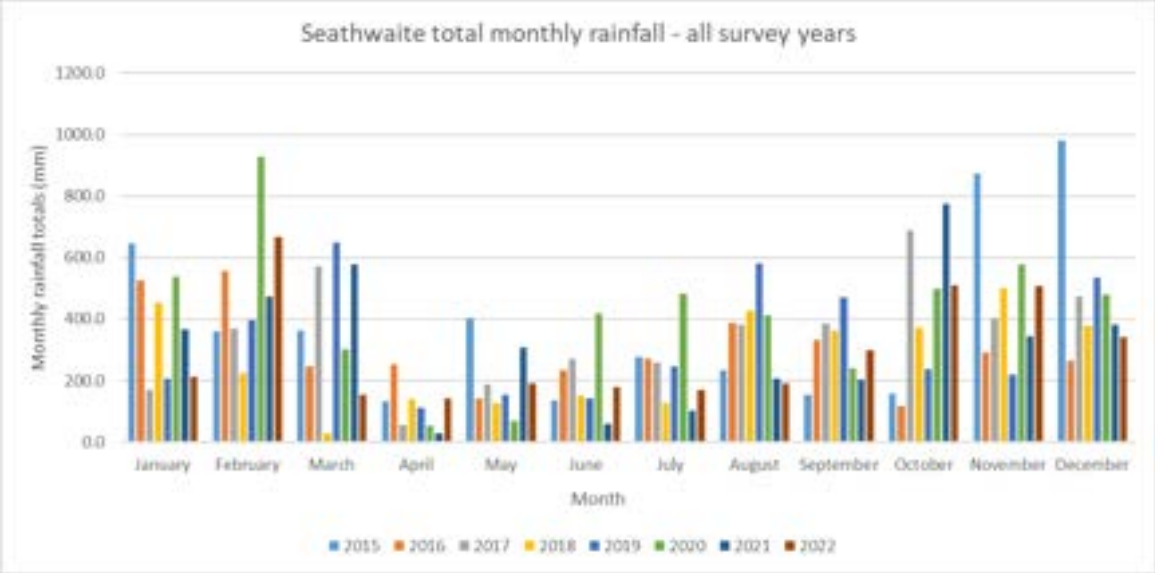

Figure 4: *Monthly rainfall totals from the Environment Agency's Seathwaite rainfall gauge for the 8 years of surveys.*[3]

Table 4: *Total rainfall and average rainfall values for the months of April to September for all surveys years, then ranked in terms of driest spring/ summers.*[4]

Seathwaite Rainfall Gauge Data	April to September Total Rainfall Recorded (mm)	April to September Average Rainfall (mm)	Ranking in terms of driest spring/ summers since surveys began
2015	1333.8	222.3	4th
2016	1619	269.8	6th
2017	1534.8	255.8	5th
2018	1332.8	222.1	3rd
2019	1701	283.5	8th
2020	1672.4	278.7	7th
2021	903.6	150.6	1st
2022	1172.8	195.5	2nd

[3] Environment Agency flood and river level data from the real-time data API (Beta), © Environment Agency copyright and/or database right 2023

[4] Same as 3.

4.1.2 The rainfall values are an indication of how dry conditions were, which will consequently affect the river levels. In some places rivers dried up completely for the second summer in a row. Many sites had very low water levels with little input of fresh water, which combined with hot sunny days and little shade, resulted in high water temperatures, increasing them to dangerous levels for salmonids, particularly during the fry stages of the life cycle when they are most vulnerable.

4.1.3 Air temperature records were also broken this summer, including the hottest day ever recorded in the U.K., with temperatures above 40°C in the south, and a joint warmest summer on record based on the mean average temperature (Met Office, 2023).

4.1.4 Warm springs when the fry emerge and hot, dry summers when the fry are feeding and growing will significantly affect fry development and their ability to thrive (Arevalo et al, 2018; Solomon and Lightfoot, 2008). Warm water and algal blooms will also reduce the available oxygen and could lead to death, which was experienced on Blumer Beck this summer, where dead fish were discovered with no obvious source of pollution.

4.2 Semi-Quantitative (5 minute) Survey Results – Survey Sites

4.2.1 The team successfully surveyed 183 sites across the Derwent catchment between the beginning of July and end of September 2022, which is the highest number of sites ever surveyed in one season. This was largely attributable to low flows in the main rivers allowing access, and very few really rainy days to stop the team going out.

4.2.2 Main river sites are those on the larger rivers such as the Rivers Derwent, Cocker and Greta and can only be surveyed when water levels are low. Of the 183 sites surveyed in 2022, 22 were main river sites.

4.2.3 Figure 5 shows the number of survey sites surveyed each year. This has been broken down into main river and non-main river sites, as this affects the trends seen in salmonid numbers. Since 2015, the number of survey sites has increased and then levelled out at about 150-160 sites a year, of which roughly 120-150 of those are non-main river sites, and 25 main river sites. The number of sites dipped in 2021 due to the drought/low river levels preventing surveys of a large proportion of non-main river sites that are usually surveyed. Fewer main river sites were surveyed in 2020 when water levels were consistently high for the duration of the survey season.

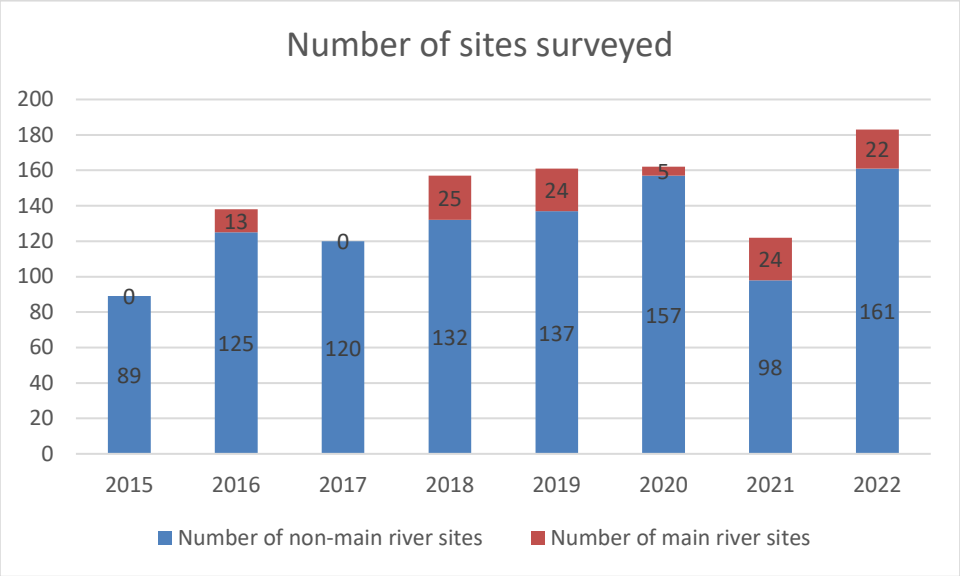

Figure 5: *Number of semi quantitative survey sites surveyed each year, broken down into main river and non-main river.*

4.2.4 Of the total 183 sites surveyed in 2022, 156 sites (85%) had trout fry present and 94 sites (51%) had salmon fry present. 81 sites (56%) had adult European eels (*Anguilla anguilla*) or elvers (young eels) present, 116 sites (63%) had other fish species present such as lamprey, sticklebacks, minnows, stoneloach and bullhead.

4.2.5 The following two sections discuss temporal trends based on figures for the whole catchment, however it should be noted that these trends, are to be viewed with the following caveats in mind:

- Fish populations are extremely variable, particularly salmonids which are migratory species. Therefore, the results just represent a snap-shot in time and are an indication of fry abundance.
- The weather conditions between the survey years has varied dramatically, the 2016 survey season was post Storm Desmond which brought large-scale flooding during spawning season and destroyed a lot of redds by mobilising spawning gravels and washing a lot of eggs out. In 2017, rivers were still in recovery from Storm Desmond. During the 2018, 2021 and 2022 survey seasons, drought/ warm weather with extended dry conditions were experienced during the season, 2020 was particularly wet with high flows throughout the summer.
- The number of survey sites has changed each year.
- The survey team differs from day to day due to the nature of using volunteer assistance to conduct the work, which may affect catch rates and efficiency, but the backpack operator is always the same, to try and minimise this variability.

4.3 Semi Quantitative (5 minute) Survey Results – Trout

4.3.1 During the 2022 survey season, a total of 3,209 trout were recorded across the 183 sites, of which 2765 were trout fry and 444 trout parr.

4.3.2 Figures 6 shows the total number of trout recorded each year, represented by the grey bars on the chart, this is then broken down into total number of fry (blue) and parr (orange).

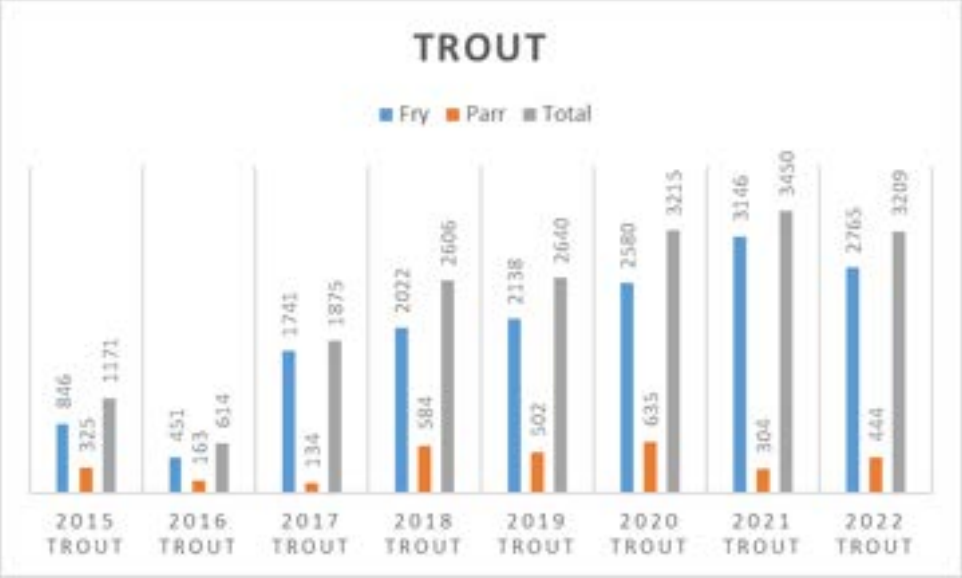

Figure 6: *Total trout recorded, broken down into fry and parr, between 2015 and 2022.*

4.3.3 Trout fry numbers have steadily risen since 2015 after a drop in numbers in 2016 caused by the impact of Storm Desmond, which occurred during spawning season and washed many eggs out. 2022 is the first decrease in trout fry numbers since 2016 but still had relatively high numbers of trout fry across the core 112 sites with five or more years of data, compared to when surveys started (Figure 7).

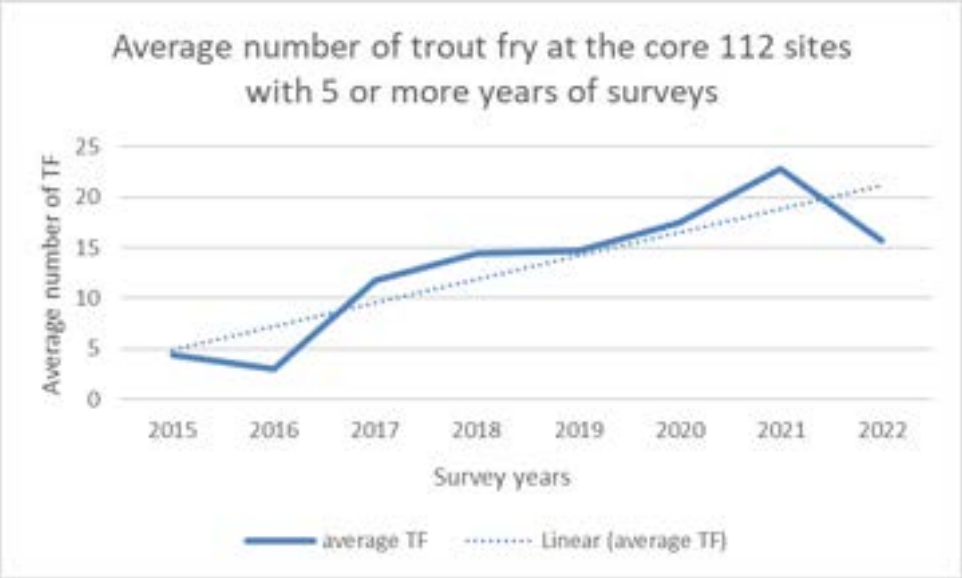

Figure 7: *Trend line for trout fry across the eight years of surveys, based on the average number of fry at the core 112 sites with five or more years of data.*

4.3.4 Last years (2021) report had a trend line for trout fry that showed a decrease in trout fry numbers in 2021 whereas Figure 7 in this report is showing an increase. Last year's trend line was based on the results from all sites surveyed across the years, in which many of the smaller watercourses were excluded in 2021, as they could not be surveyed due to dry riverbeds or too low flows. Figure 7, is just based on the subset of sites that have five or more years of data, and therefore is showing a slightly different trend in trout fry numbers in 2021.

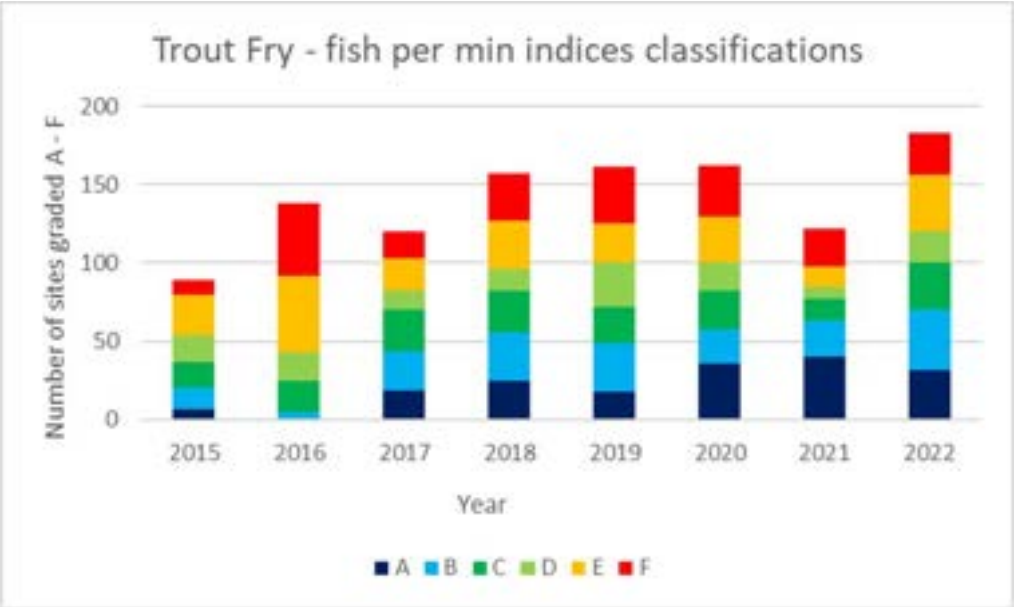

Figure 8: *Number of A-F classifications for trout fry across the eight years of surveys in the Derwent catchment. Classifications are based on the fish per minute indices.*

4.3.5 As discussed in section 3.5.14 each site is assigned a classification based on the fish per minute indices and the boundaries of the classifications are based on the percentiles of the entire WCRT dataset. Figure 8 (on page 18) shows how the number of classifications of A to F has changed across the eight years for trout fry. As shown, in 2022 there is a larger number of sites assigned classifications of B, C, D and E compared to previous years, whereas there are fewer sites graded A and F.

4.3.6 Figure 9 breaks down the 2022 trout fry results to show the percentage of sites that were assigned each classification. In 2022, the largest proportion of sites (21%) were assigned a classification of B 'Good' for trout fry, and the second largest (20%) was E 'Poor'. Only 11% of sites were assigned a classification of D 'Fair', which was the classification with the smallest number of sites in 2022.

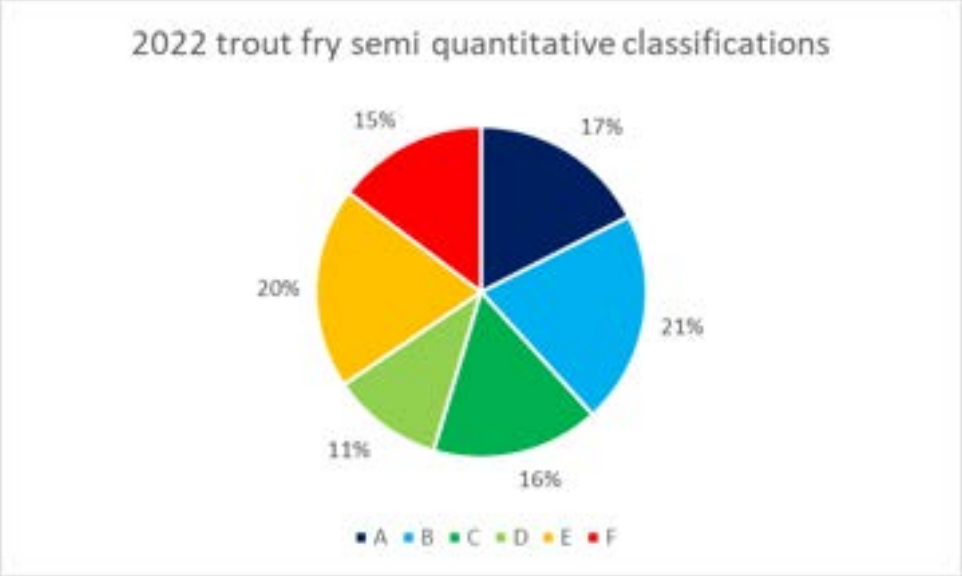

Figure 9: *Pie chart showing the percentage of semi quantitative survey sites classified A to F for trout fry, based on fish per minute indices and the percentiles of the WCRT dataset.*

4.3.7 Figure 10 on page 21, shows the spatial distribution of the classifications for trout fry, across the Derwent catchment. The majority of sites classified as A (Excellent) and B (Good) are found in the upper tributaries of the River Marron, such as Black Beck, Snary Beck, Wood Beck and Rakegill Beck, and the tributaries of the River Cocker such as Whit Beck, Hope Beck, Meregill Beck, Sandy Beck and the watercourses that feed into both Crummock Water and Buttermere. Other good areas for trout fry include Bitter Beck, Wythop Beck, Dash Beck, Chapel Beck, Glenderaterra Beck, How Beck and the watercourses upstream of Thirlmere Reservoir.

4.3.8 Areas where trout fry are Absent (F) or have Poor (E) classifications, include the main river sites along the River Derwent and River Cocker, the River Glenderamackin, St John's Beck and the tributaries around Loweswater.

4.3.9 Grouping sites in the same watercourse/area and averaging fry numbers across those sites, shows how certain areas or watercourses are performing over time, and whether they are improving or declining. Table 5 on page 22, shows the average trout fry per minute indices for each watercourse/area. The colours refer to the classification (A- F) for the average fish per minute index as a visual indication of how those watercourses/areas are performing.

4.3.10 Areas that are showing an improvement include Lostrigg Beck, the River Marron tributaries, Sandy Beck, Meregill Beck, Hope Beck, lower Newlands Beck and Raise Beck. These increases in average fish per minute indices, indicative of greater trout fry numbers, may be attributable to habitat and water quality improvement works undertaken by WCRT and the Derwent River

Corridor Group in these areas. Works include riparian fencing, spawning gravel introduction, tree planting, bank stabilisation and woody debris creation.

4.3.11 Areas that are showing a decline in fry numbers include Broughton Beck and Coal Beck where there are currently major siltation and possible water quality issues. Barrow Beck in the Glenderamackin catchment also saw a decline in numbers due to a pollution incident, despite efforts to improve habitat by the landowners. In the Loweswater tributaries trout fry numbers have declined to almost none existent, although the recent restoration of Dub Beck above Loweswater is hoped to improve this situation.

4.3.12 In conclusion, trout fry numbers, whilst showing an overall decline in 2022 compared to 2020 and 2021, are still reasonably stable in most areas of the catchment and maintaining a presence at similar levels to those seen the last few years. The decline in 2022 may be attributable to high flows in February followed by a very dry spring and summer, with hot weather and low flows.

4.3.13 The high flows in February were potentially significant enough to move gravels around the catchment, which could include unhatched eggs or trout alevins, which are too small to swim against the high flows. Alevins are trout that have hatched from their eggs and are living off their yolk sac. Trout tend to emerge from their eggs earlier than salmon and therefore with a warm winter/spring it is likely that they may have started to emerge in February (Arevalo et al, 2018).

4.3.14 The dry spring and hot/ dry summer, when the fry are the most vulnerable, will have caused additional stress and potentially mortality. In Solomon and Lightfoot (2008), it suggests that the lethal water temperature limit for trout is three degrees cooler than that of salmon, and it is possible that these temperatures were reached in certain trout dominated streams during the summer of 2022. The paper also suggests that when temperatures increase the fish will try to move to cooler areas of the river, which may include deeper pools where surveys are not conducted, which could influence the results seen.

4.3.15 The above points are the suspected reason for a decline in trout fry numbers seen in the results, but are not proven.

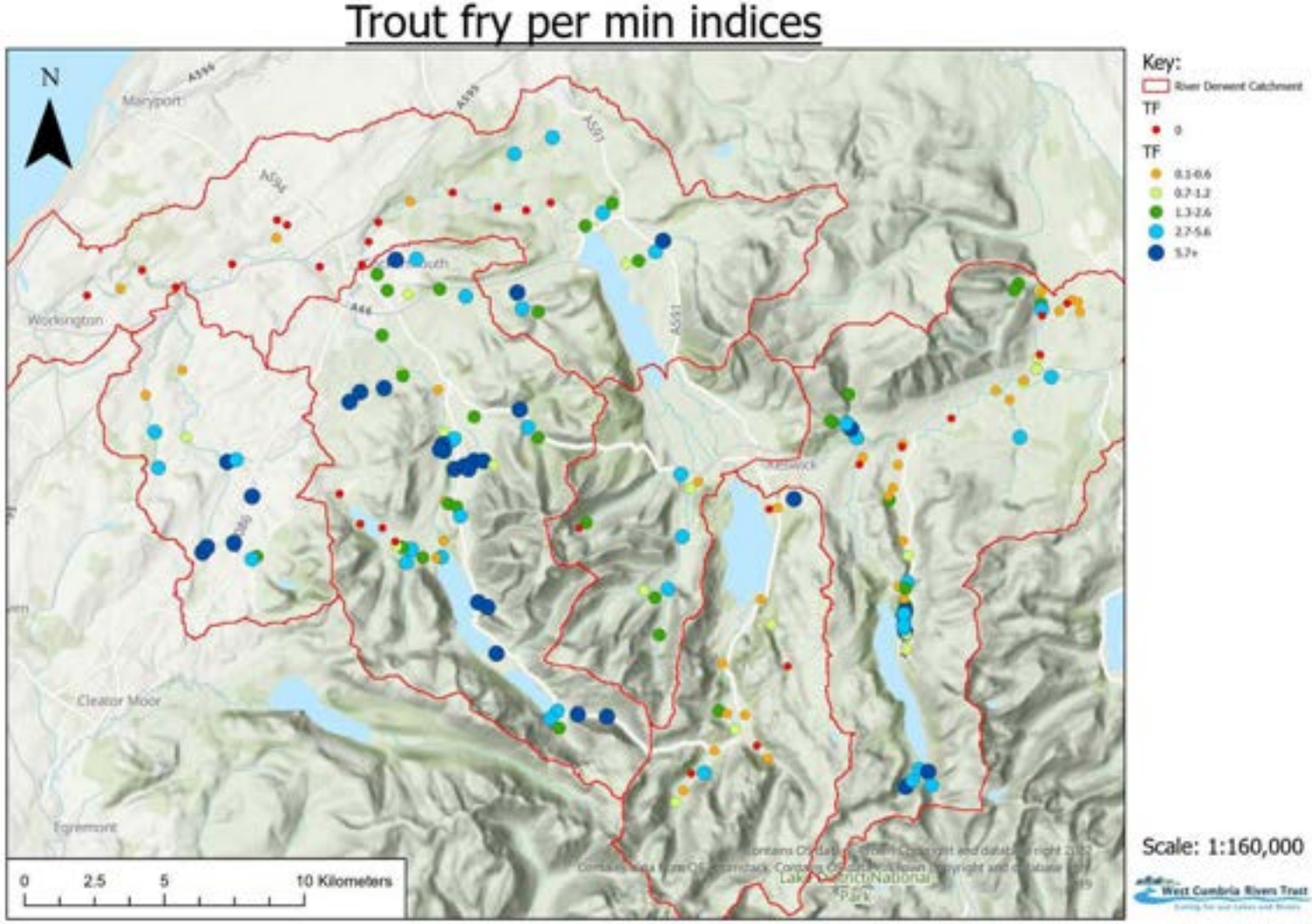

Figure 10: A map of the Derwent catchment showing the 2022 fry per minute classifications for trout fry.[5]

[5] Figure 10 data sources: Basemaps: Contains OS data © Crown Copyright and database right 2022 and 2019, Contains data from OS Zoomstack.
Catchment and subcatchment outlines: © Environment Agency copyright and/or database right 2015.
Fish per min indices layer: WCRT

Table 5: Averaged trout fry per minute indices for each watercourse or area.

	Trout fry/min average							
River	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
River Derwent Lower	No data	0.13	No data	0.07	0.01	0.00	0.05	0.06
Lostrigg Beck	0.60	0.85	0.47	1.00	2.25	1.00	No data	2.20
River Marron	2.07	1.55	2.20	6.47	8.20	7.15	14.30	4.90
Marron tribs	5.50	2.03	3.27	8.00	9.90	10.80	10.08	5.87
Broughton Beck	0.60	0.07	0.25	0.55	0.13	0.20	0.73	0.07
Broughton Beck tribs	No data	0.00	1.10	0.73	0.90	0.60	No data	No data
Bitter Beck	No data	1.10	10.80	3.70	5.67	4.07	9.60	4.20
Tom Rudd Beck	No data	0.30	2.60	4.10	2.55	3.85	8.10	2.70
River Cocker	No data	0.00	No data	0.63	0.68	No data	0.80	0.71
Paddle Beck	No data	0.13	0.40	No data	0.20	0.20	No data	No data
Little Sandy Beck	No data	No data	1.67	No data	0.40	0.80	No data	No data
Sandy Beck	No data	0.75	8.10	2.60	12.45	9.40	12.33	7.50
Whit Beck	2.05	0.53	7.28	4.12	2.80	2.68	10.40	3.96
Whit Beck Restoration Site	2.00	0.53	6.27	3.73	3.00	3.20	6.27	2.67
Blaze Beck	No data	No data	1.80	9.40	2.60	0.10	17.10	2.40
Meregill Beck	No data	No data	9.5	5.9	5.1	12.47	8.80	10.60
Hope Beck	3.90	1.10	7.93	3.80	2.90	8.04	10.90	11.20
Liza Beck	1.16	0.30	1.80	3.20	2.30	0.95	2.00	2.53
Park Beck	No data	1.20	No data	1.00	2.67	4.20	5.13	2.32
Mosedale Beck	No data	No data	No data	No data	2.00	1.20	No data	3.00
High Nook Beck	No data	No data	No data	No data	1.60	1.80	0.40	1.00
Loweswater Tribs	0.67	0.56	0.56	0.16	0.16	0.40	0.00	0.00
Rannerdale Beck	No data	No data	No data	No data	17.00	5.60	7.40	14.50
Mill Beck/ Sail Beck	No data	No data	3.20	3.80	9.80	6.00	11.40	12.00
Gatesgarth Beck	3.33	1.40	No data	7.47	7.53	6.60	21.33	9.67
Warnscale Beck	0.20	1.60	No data	2.10	2.00	6.40	6.60	2.20
Blumer Beck	3.57	1.47	3.40	5.40	5.07	8.05	No data	4.80
Coal Beck	6.60	0.50	8.13	6.20	No data	7.60	5.27	2.73
Wythop Beck	No data	0.60	4.15	7.00	5.35	7.20	15.53	5.13
Dash Beck	No data	0.00	3.15	2.40	2.50	3.20	3.50	0.80
Chapel Beck	4.50	0.12	5.80	5.04	3.53	2.72	8.53	5.20
Coledale Beck	No data	0.27	0.80	0.80	1.67	0.53	1.93	1.93
Newlands Beck Lower	0.70	0.93	1.40	2.53	1.30	1.60	No data	3.80
Newlands Beck Upper	1.80	0.20	3.67	5.25	3.80	1.92	No data	2.85
Pow Beck	No data	0.30	1.20	5.00	No data	3.00	No data	0.80
River Derwent Middle	No data	0.20	No data	0.00	No data	No data	No data	No data
Millbeck	No data	No data	1.67	3.80	0.60	0.00	No data	No data
Wath Beck	No data	No data	0.60	No data	No data	No data	No data	No data
Applethwaite Gill	No data	No data	3.27	4.40	0.60	0.00	No data	No data
Lair Beck	2.27	0.40	2.40	1.10	No data	4.00	No data	No data
Brockle Beck	0.40	0.10	0.40	1.67	0.70	0.00	No data	2.13
Watendlath Beck	No data	0.10	0.00	0.73	0.33	0.00	No data	0.40
Comb Gill	0.70	0.50	0.60	No data	No data	No data	No data	No data
Stonethwaite Beck	No data	0.00	No data	1.00	0.73	0.67	1.00	0.33
Tongue Gill	0.53	1.73	3.00	3.07	1.13	1.60	No data	2.40
River Derwent Upper	0.00	0.20	0.40	1.12	1.70	1.48	2.10	0.57
Black Syke	No data	2.33	2.60	1.20	1.60	9.50	No data	1.70
River Greta	No data	No data	No data	0.20	No data	No data	0.80	0.40
Glenderaterra Beck	No data	0.33	4.20	3.65	2.47	3.30	3.30	4.05
Whit Beck	No data	1.50	1.60	No data	1.60	1.60	4.40	1.93
Naddle Beck	0.56	1.72	No data	1.25	0.40	0.50	1.50	0.30
St Johns Beck	1.07	0.27	3.33	0.47	1.20	0.60	1.20	0.89
Mosedale Beck	No data	0.00	0.60	1.40	0.50	0.40	No data	1.80
Trout Beck	0.00	0.05	No data	2.93	0.40	0.00	1.90	2.00
River Glenderamackin Lower	0.90	0.40	0.40	0.67	0.33	0.70	1.07	0.20
River Glenderamackin Upper	1.40	0.00	1.60	3.52	1.52	0.32	2.80	1.65
Barrow Beck/ Naddles Beck	0.49	0.00	0.55	0.25	0.31	0.30	0.60	0.20
Wyth Burn	No data	No data	No data	No data	No data	0.60	3.33	5.47
Raise Beck	No data	No data	No data	No data	No data	0.10	3.40	6.20
How Beck	No data	No data	No data	No data	No data	No data	No data	3.47

4.4 Semi Quantitative (5 minute) Survey Results – Salmon

4.4.1 During the 2022 survey season, a total of 1,771 salmon were recorded across the 183 sites, of which 1443 were salmon fry and 328 salmon parr.

4.4.2 Figures 11 shows the total number of salmon recorded each year, represented by the grey bars on the chart, this is then broken down into total number of fry (blue) and parr (orange).

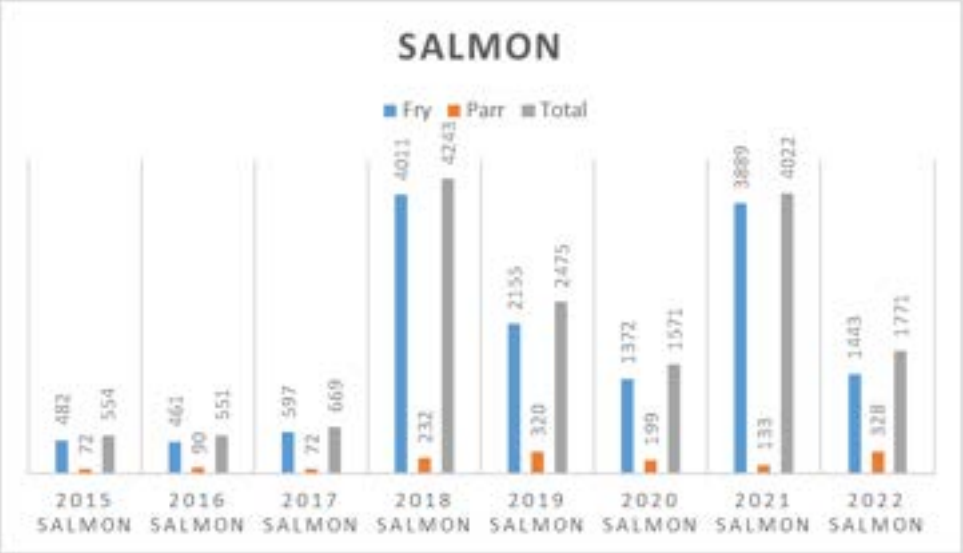

Figure 11: *Total salmon recorded, broken down into fry and parr, between 2015 and 2022.*

4.4.3 Salmon fry numbers have fluctuated over the eight years of surveys and the trend line for salmon fry shown in Figure 12, is based on the average number of salmon at the core 112 sites with five or more years of surveys.

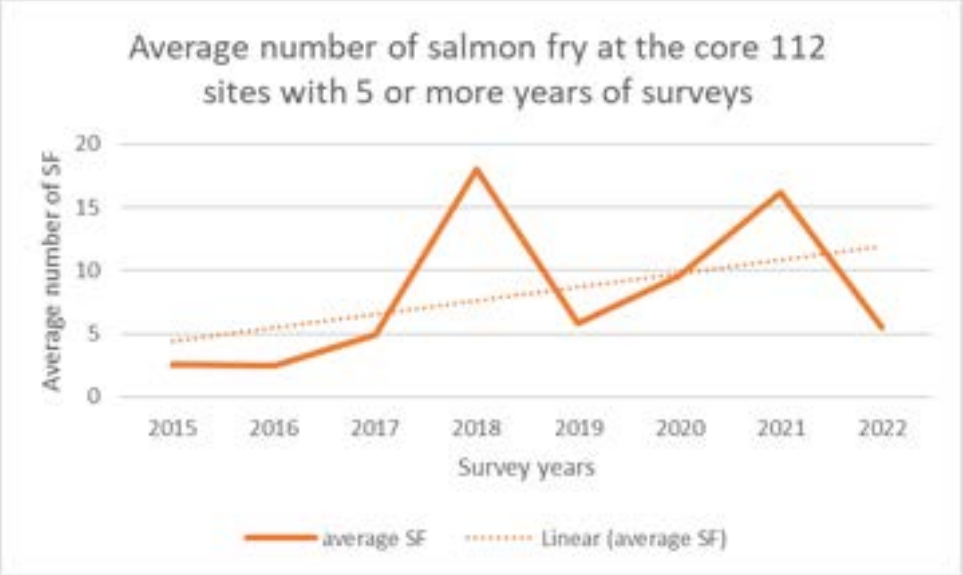

Figure 12*: Trend line for salmon fry across the eight years of surveys, based on the average number of fry at the core 112 sites with five or more years of data.*

4.4.4 Numbers were low in 2015 and decreased in 2016 because of the impact of Storm Desmond and the warm winter water temperatures that caused a crash in salmon fry numbers across the country (Gregory et al, 2020). Since then salmon numbers have slowly increased with good numbers recorded in both 2018 and 2021. Salmon fry numbers decreased in 2022 compared to

the previous year, which is consistent with the low adult returns reported by local anglers during the winter of 2021/22 and in the 'Salmon Stocks and Fisheries in England and Wales in 2021' report produced by the EA.

4.4.5 There are many possible reasons for the poor adult returns, but these include:

- A proportion of these adults could be from the cohort of salmon fry that were born in 2016, which had low fry survival chances due to Storm Desmond and warm winter water temperatures (Gregory et al, 2020).
- Poor marine survival due to changes in water temperatures and ocean currents in prime marine feeding grounds (Gillson et al, 2022; Friedland et al, 2009).

4.4.6 As for trout fry, each site is assigned a classification based on the fish per minute indices for salmon fry. Figure 13 shows how the number of sites classified from A to F has changed across the eight years for salmon fry. As seen below, 2022 had a low number of sites classified A compared to previous years, but a larger proportion of sites classified B, C, D and E.

Figure 13: *Number of A-F classifications for salmon fry across the eight years of surveys in the Derwent catchment. Classifications are based on the fish per minute indices.*

Figure 14: *Pie chart showing the percentage of semi quantitative survey sites classified A to F for salmon fry, based on fish per minute indices and the percentiles of the WCRT dataset.*

4.4.7 Figure 14, breaks down the 2022 salmon fry results to show the percentage of sites that were assigned each classification. In 2022, the largest proportion of sites (49%) were assigned a

classification of F 'Absent' for salmon fry. Of the sites with salmon fry present, the most common category was B 'Good' (14% of the sites), whilst a fairly even number of sites were categorised as C, D and E. Only 3% of sites were classified as A 'Excellent'.

4.4.8 Figure 15 on page 26, shows the spatial distribution of the classifications for salmon fry, across the Derwent catchment. The majority of sites classified as A (Excellent) and B (Good) are the main river sites of the River Derwent and River Cocker, as well as sites on the River Marron, Whit Beck (Lorton), River Glenderamackin and St John's Beck.

4.4.9 Areas where salmon fry are Absent (F) or have Poor (E) classifications include many of the upland smaller tributaries such as Blaze Beck, Rannerdale Beck, Gatesgarthdale Beck, Glenderaterra Beck and Barrow Beck where the natural population limit has been reached or the habitat is more suited to trout. Salmon were also absent from sites where there is a barrier to fish migration such as Coledale Beck, watercourses above Thirlmere Reservoir, Liza Beck, Tom Rudd Beck, Bitter Beck and Wood Beck. However, the barrier on Wood Beck has been eased recently and we would hope to see salmon fry upstream soon.

4.4.10 Following the same approach as for trout fry, sites were grouped together and averaged, to see how certain areas or watercourses are performing over time, and whether they are improving or declining. Table 6 on page 27, shows the average salmon fry per minute indices for each watercourse/area, the colours refer to the classification (A- F) for the average fish per minute index as a visual indication of how those watercourses/ areas are performing.

4.4.11 Changes in salmon fry numbers over time are not as clear as changes in trout fry, but areas that are showing an improvement include Whit Beck where a large-scale restoration project was undertaken in 2014. Sandy Beck, Liza Beck below the barrier, Dash Beck and Chapel Beck are also showing improvements in salmon fry numbers over time, and could be attributable to habitat improvement and water quality improvement works undertaken by WCRT and the River Corridor Group, in these areas. Works include riparian fencing, spawning gravel introduction, tree planting, bank stabilisation works and woody debris installation.

4.4.12 Areas that are showing a decline in salmon numbers include Broughton Beck, Blumer Beck and Newlands Beck. Broughton Beck currently has major siltation and possible water quality issues. Blumer Beck has some siltation and water quality issues but not to the same degree as Broughton Beck. For Blumer Beck and Newlands Beck the perceived decline could be due to surveying fewer sites on those watercourses in the more recent years.

4.4.13 In conclusion, salmon fry numbers declined in 2022 due to low adult returns the previous winter. The warm weather and prolonged dry period throughout the spring/ summer of 2022, will have caused additional stress and limited fry development. Therefore, tree planting and in-channel woody debris creation, to offer shade and additional cover/protection, is crucial to helping fry survive and thrive.

4.4.14 Despite the decline in 2022, the overall trend line across the eight years of surveying is still showing an increase in salmon fry numbers. After a decent run of adult salmon over the 2022/23 winter, it is expected/ hoped that there will be good numbers of salmon fry during the 2023 survey season.

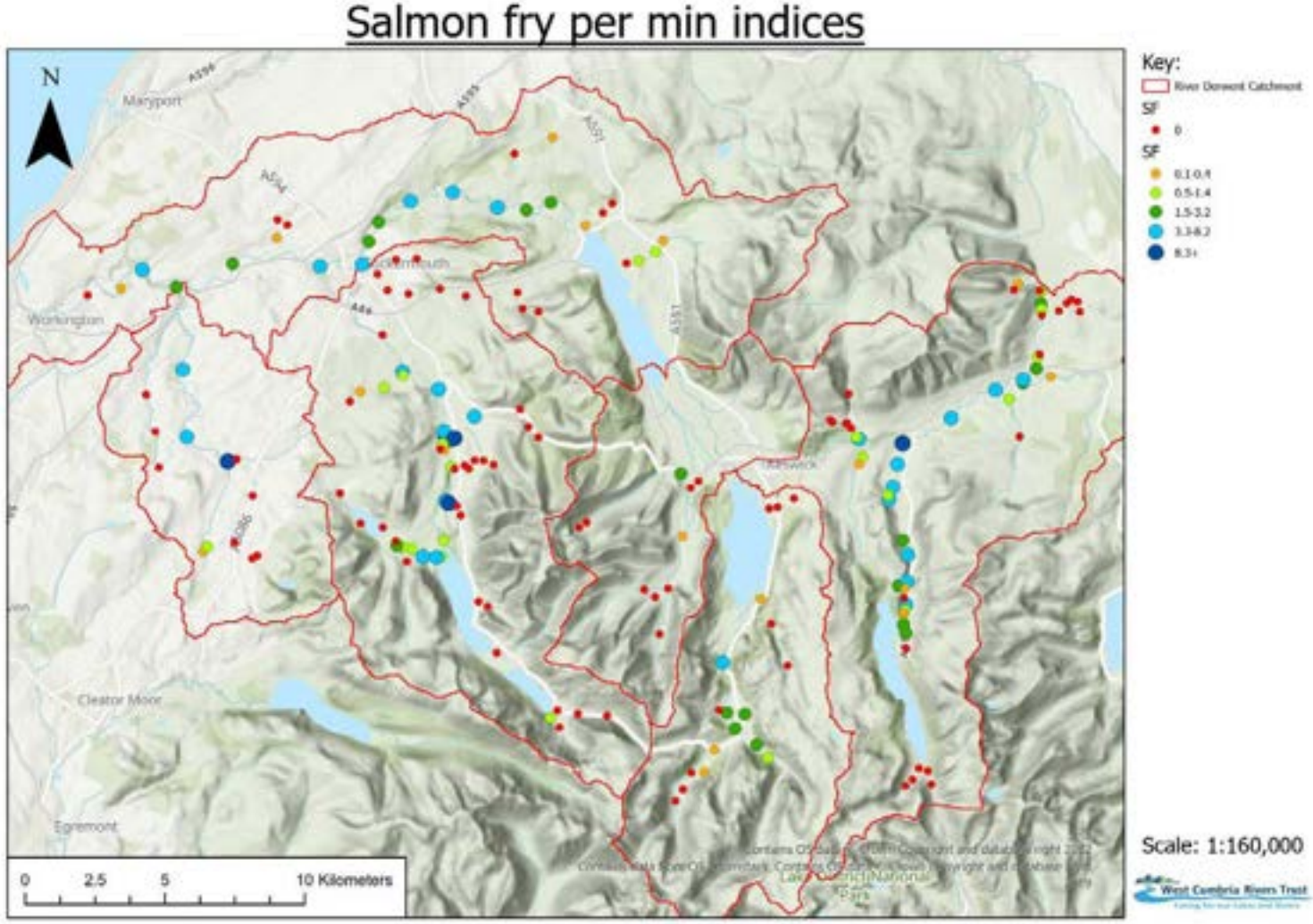

Figure 15: A map of the Derwent catchment showing the 2022 fry per minute classifications for salmon fry.[6]

[6] Figure 15 data sources: Basemaps: Contains OS data © Crown Copyright and database right 2022 and 2019, Contains data from OS Zoomstack.
Catchment and subcatchment outlines: © Environment Agency copyright and/or database right 2015.
Fish per min indices layer: WCRT

Table 6: Averaged salmon fry per minute indices for each watercourse or area.

	Salmon fry/min average							
River	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
River Derwent Lower	No data	2.17	No data	14.16	11.74	4.80	13.93	3.59
Lostrigg Beck	0.00	0.00	0.07	0.00	0.00	0.00	No data	0.00
River Marron	1.20	1.20	3.60	5.20	0.20	1.50	9.30	6.15
Marron tribs	0.00	0.53	1.53	2.28	0.00	0.10	1.96	0.17
Broughton Beck	1.13	0.60	1.10	1.15	0.40	0.25	1.53	0.07
Broughton Beck tribs	No data	0.00	0.00	0.33	0.20	0.40	No data	No data
Bitter Beck	No data	0.00	0.00	0.00	0.00	0.33	0.00	0.00
Tom Rudd Beck	No data	0.00	0.00	0.00	0.00	0.00	0.00	0.00
River Cocker	No data	1.64	No data	15.17	10.34	No data	21.23	4.26
Paddle Beck	No data	0.07	0.13	No data	0.00	0.20	No data	No data
Little Sandy Beck	No data	No data	0.07	No data	0.40	1.00	No data	No data
Sandy Beck	No data	0.65	1.05	0.00	0.85	4.05	4.73	0.65
Whit Beck	7.80	4.07	6.56	10.44	7.05	5.48	9.12	5.04
Whit Beck Restoration Site	6.40	4.07	9.80	16.33	8.07	9.13	7.73	6.67
Blaze Beck	No data	No data	0.00	0.00	0.00	0.00	0.00	0.00
Meregill Beck	No data	No data	0.40	2.00	0.00	4.33	0.25	0.40
Hope Beck	0.60	0.30	0.27	0.00	0.00	5.04	2.25	0.00
Liza Beck	0.80	0.40	3.80	4.27	5.40	3.25	8.30	7.07
Park Beck	No data	0.00	No data	3.60	6.47	4.93	11.33	2.40
Mosedale Beck	No data	No data	No data	No data	0.00	0.00	No data	0.00
High Nook Beck	No data	No data	No data	No data	9.40	1.00	5.00	2.20
Loweswater Tribs	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
Rannerdale Beck	No data	No data	No data	No data	0.00	0.00	0.00	0.00
Mill Beck/ Sail Beck	No data	No data	0.00	0.00	0.00	0.00	0.00	0.00
Gatesgarth Beck	0.00	0.00	No data	0.00	0.00	0.00	0.00	0.00
Warnscale Beck	0.00	0.00	No data	0.00	0.00	0.00	5.00	0.40
Blumer Beck	0.70	1.27	0.40	0.67	0.47	0.35	No data	0.10
Coal Beck	0.04	0.40	0.73	1.60	No data	0.40	1.40	0.07
Wythop Beck	No data	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dash Beck	No data	1.60	0.55	0.07	0.00	0.50	11.90	0.00
Chapel Beck	0.00	0.00	0.60	1.04	0.00	0.00	4.80	0.73
Coledale Beck	No data	0.00	0.00	1.65	0.00	1.00	0.07	0.67
Newlands Beck Lower	0.20	0.80	0.10	1.40	1.40	0.93	No data	0.20
Newlands Beck Upper	0.00	0.00	1.00	1.25	3.10	1.20	No data	0.00
Pow Beck	No data	0.00	0.00	0.00	No data	0.00	No data	0.00
River Derwent Middle	No data	0.80	No data	30.60	No data	No data	No data	No data
Millbeck	No data	No data	0.13	0.00	0.00	0.00	No data	No data
Wath Beck	No data	No data	0.20	No data	No data	No data	No data	No data
Applethwaite Gill	No data	No data	0.07	0.00	0.00	0.00	No data	No data
Lair Beck	0.33	0.13	0.00	0.10	No data	0.00	No data	No data
Brockle Beck	0.00	0.00	0.00	0.00	0.10	0.07	No data	0.00
Watendlath Beck	No data	0.00	0.60	0.00	0.00	0.00	No data	0.07
Comb Gill	0.00	0.30	1.90	No data	No data	No data	No data	No data
Stonethwaite Beck	No data	1.00	No data	5.00	0.73	8.00	11.40	2.60
Tongue Gill	0.00	0.67	0.00	0.00	1.27	3.20	No data	0.00
River Derwent Upper	0.00	0.30	0.13	0.96	0.35	1.60	3.90	1.43
Black Syke	No data	0.13	0.00	0.10	0.00	0.00	No data	0.20
River Greta	No data	No data	No data	8.20	No data	No data	6.00	4.60
Glenderaterra Beck	No data	0.07	0.50	4.45	0.07	0.50	3.25	0.30
Whit Beck	No data	0.00	0.00	No data	0.00	0.20	0.00	0.00
Naddle Beck	2.96	3.44	No data	5.70	7.80	7.70	6.70	0.40
St Johns Beck	3.53	2.87	12.33	38.13	6.60	12.40	25.07	3.87
Mosedale Beck	No data	0.00	0.00	1.87	1.10	1.00	No data	0.30
Trout Beck	1.20	0.10	No data	1.13	0.33	1.20	1.20	1.20
River Glenderamackin Lower	4.00	0.60	1.40	30.20	4.87	2.30	15.20	7.45
River Glenderamackin Upper	2.07	0.30	0.93	3.80	1.92	0.40	0.33	1.08
Barrow Beck/ Naddles Beck	0.20	0.00	0.05	0.05	0.26	0.00	0.30	0.00
Wyth Burn	No data	No data	No data	No data	No data	0.00	0.00	0.00
Raise Beck	No data	No data	No data	No data	No data	0.00	0.00	0.00
How Beck	No data	No data	No data	No data	No data	No data	No data	1.08

4.5 Sub-Catchment or Site Specific Results

4.5.1 WCRT has produced an online platform where classifications for all the WCRT electrofishing sites across the years can be viewed on a map, with the ability to zoom into the particular sites or areas of interest.

4.5.2 The platform can be accessed through the link on WCRT's website or directly at:

WCRT Fish Survey Results Dashboard

4.5.3 The dashboard also includes electrofishing data from other sites within WCRT's operational area, including surveys undertaken on the River Irt and River Ehen catchments.

4.6 Quantitative Survey Results

4.6.1 Quantitative surveys (triple pass depletion surveys) were conducted at 27 survey sites across the River Derwent catchment as part of a calibration exercise. At a further 14 sites, single run surveys covering 100m^2 with stop nets at either end were conducted as part of some other ongoing fisheries monitoring within the catchment. The data from these 41 sites can be expressed as fry densities per 100m^2 and classified using the EA's National Fisheries Classification Scheme (NFCS).

4.6.2 The trout and salmon fry densities per 100m^2 and the corresponding NFCS classification for these sites are shown in Table 7 on page 30.

4.6.3 All of the 41 sites had trout fry present, with 46% of the sites classified A 'Excellent' and only 2% of sites classified as E 'Poor', as shown in Figure 16.

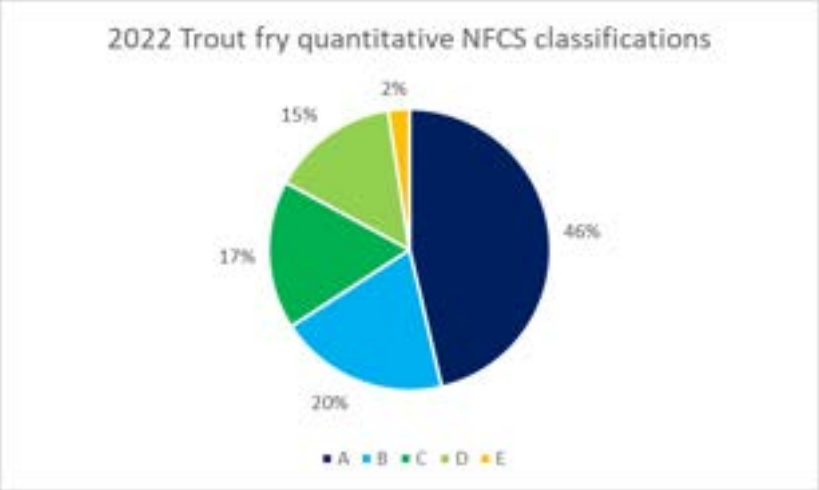

Figure 16: *Pie chart showing the percentage of quantitative survey sites classified A to F for trout fry, based on 100m^2 densities and using the NFCS classifications.*

4.6.4 Whereas only 34 of the 41 sites had salmon fry present, with 10% of the sites classified as A 'Excellent'. The majority of the sites were classified as either a D 'Fair' or E 'Poor', as shown in Figure 17.

Figure 17: *Pie chart showing the percentage of quantitative survey sites classified A to F for salmon fry, based on 100m2 densities and using the NFCS classifications.*

Table 7: Fry densities and the NFCS classification for the 41 sites with quantitative data.

Site Number	Watercourse	Trout Fry per 100m²	Salmon Fry per 100m²	Trout Fry NFCS Classification	Salmon Fry NFCS Classification
36	Wood Beck	68	0	A	F
54	Bitter Beck	103	0	A	F
82	Whit Beck	109	95	A	A
91	Hope Beck	708	0	A	F
97	Liza Beck	32	269	B	A
143	Coal Beck	56	0	A	F
151	Dash Beck	13	14	C	D
158	Chapel Beck	151	8	A	E
202	Brockle Beck	57	0	A	F
210	Stonethwaite Beck	4	28	D	C
226	Glenderaterra Beck	53	15	A	D
234	Naddle Beck	11	4	C	E
239	St John's Beck	6	23	D	C
260	River Glenderamackin	11	1	C	E
275	Meregill Beck	772	8	A	E
296	St John's Beck	1	18	E	D
297	St John's Beck	24	67	B	B
298	St John's Beck	28	92	B	A
299	St John's Beck	22	84	B	B
300	St John's Beck	13	72	C	B
301	St John's Beck	24	37	B	C
302	St John's Beck	6	132	D	A
303	River Glenderamackin	5	5	D	E
304	River Glenderamackin	18	27	B	C
305	River Glenderamackin	42	10	A	D
306	River Glenderamackin	18	19	B	D
307	River Glenderamackin	16	28	C	C
308	River Glenderamackin	14	13	C	D
309	River Glenderamackin	10	21	C	D
310	How Beck	29	34	B	C
311	How Beck	5	0	D	F
312	How Beck	121	7	A	E
313	How Beck	118	17	A	D
314	How Beck	138	62	A	B
315	How Beck	147	16	A	D
316	How Beck	56	15	A	D
317	How Beck	6	0	D	F
318	How Beck	49	8	A	E
319	How Beck	56	6	A	E
320	How Beck	69	2	A	E
321	How Beck	90	17	A	D

5 Habitat Survey Classifications

5.1 Habitats Classification Results 2022

5.1.1 The habitat classifications for the 2022 surveys sites are shown in Figure 18 on page 32. Overall, 27% of the sites were classed as 'Maintain', 69% were classed as 'Repair' and 4% were classed as 'Restore'.

5.1.2 The habitat data collected is vital for interpreting the fish results and generally it was noted that sites with greater fish densities reflect the sections of river with good habitat or 'Maintain' classifications.

5.1.3 The habitat data is fed into WCRT's catchment action plans, river restoration strategy and the invasive species control programmes in order to secure further funding to address some of the issues at each the survey sites and surrounding areas.

5.1.4 WCRT has produced an online platform, similar to the salmonid classifications one, where the habitat classifications for all the WCRT electrofishing sites in the Derwent catchment can be viewed on a map, with the ability to zoom into particular areas. The platform currently only includes the habitat classifications from the last three years of surveys

5.1.5 The platform can be accessed through link on WCRT's website or directly at:

Derwent Habitat Classifications Dashboard

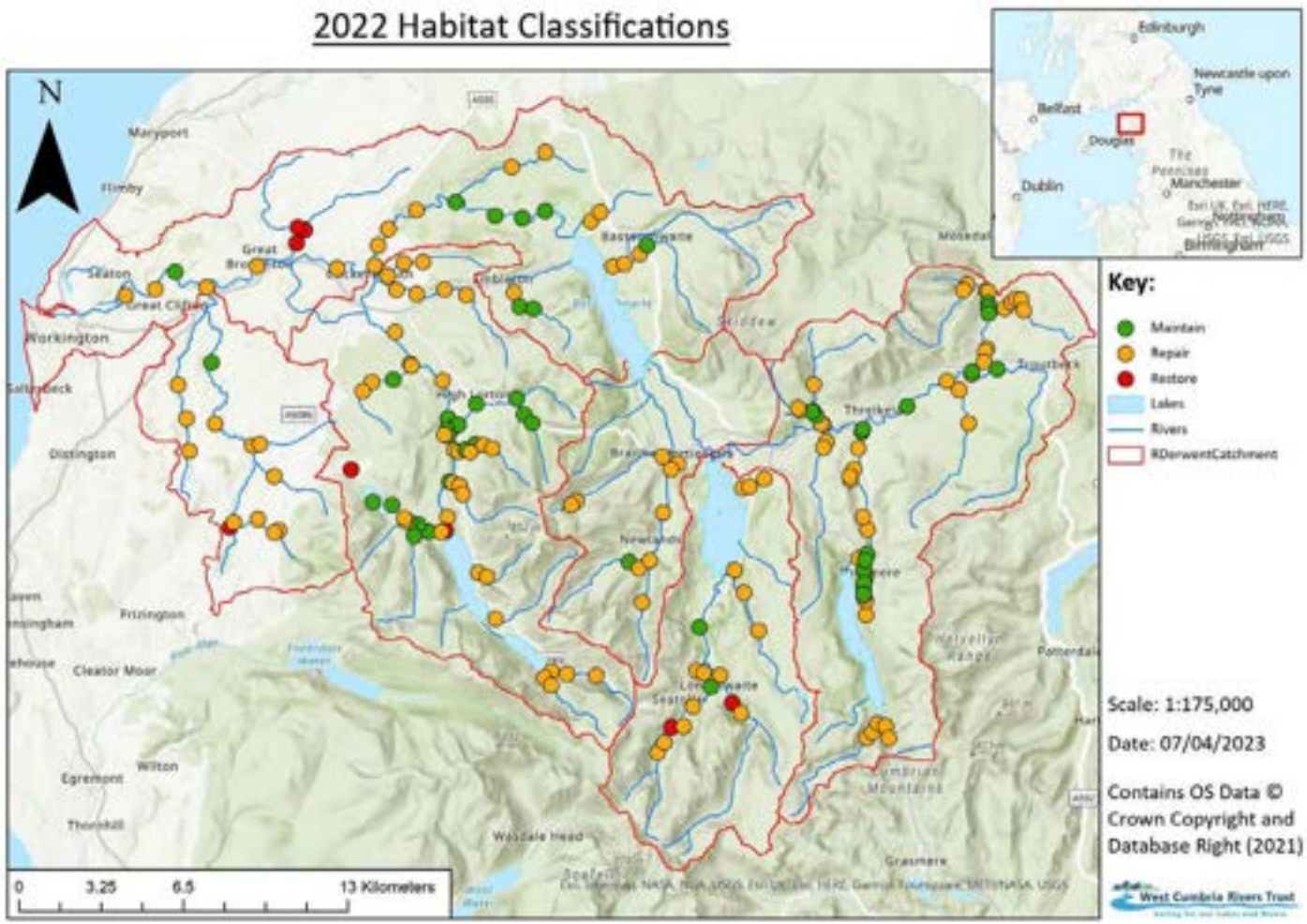

Figure 18: *Map showing the habitat classifications for the 2022 survey sites.*[7]

[7] Figure 18 data sources: Basemaps: Esri, USGS, NGA, NASA, CGIAR, Ordnance Survey Intermap, Esri UK, HERE, Garmin, METI/ NASA, FAO, NOAA, Foursquare.
Catchment and subcatchment outlines: © Environment Agency copyright and/or database right 2015
Rivers layer: Uncredited in metadata, but likely contains Ordnance Survey data ©.
Lakes layer: © Environment Agency copyright and/or database right 2015. Contains Ordnance Survey data © Crown copyright and database right 2013.
Habitat classifications layer: WCRT

6 A Case Study of Habitat Improvement Works – Lonscale Culvert Upgrade, Whit Beck

6.1 Introduction

6.1.1 This section provides a brief case study of where a project delivered by WCRT and partner organisations has had a positive impact on the habitat and fish numbers at a particular site or watercourse.

6.1.2 The case study chosen for this report is the Lonscale culvert upgrade on Whit Beck in the River Glenderamackin sub-catchment.

6.2 Whit Beck

6.2.1 Whit Beck arises at Flag Pots on Lonscale Fell and flows down the ghyll between Lonscale Fell and Jenkin Hill. As it reaches the back of Latrigg Fell, it starts flowing easterly through the valley past Lonscale Farm, before converging with the larger watercourse of Glenderaterra Beck. The Glenderaterra then flows in a south easterly and southerly direction before joining the River Greta at Brundholme. The location of Whit Beck and associated culvert upgrade is shown in Figure 20 on page 35.

6.3 The Project

6.3.1 As part of WCRT's Glenderamackin Catchment Restoration Project funded by the Water Environment Grant (WEG), works were undertaken on Whit Beck to upgrade a culvert, which was a barrier to fish and also restricting gravel movement downstream.

6.3.2 The photograph on the left in Figure 19 shows the culvert before the works were undertaken. The culvert consisted of two small pipes under a farm track, which were perched approximately 0.5m above the bed of the watercourse. The pipes restricted the flow of water downstream, especially during high flows, causing sediment deposition upstream. The size of the pipe also prevented gravels from moving downstream, effectively cutting off and starving the downstream section of Whit Beck of gravel and cobble substrate. The perched pipes of small diameter also prevented fish from migrating further upstream.

Figure 19: *Lonscale culvert upgrade before (left) and after (right) photographs.*

6.3.3 The culvert upgrade consisted of installing a much larger pipe under the track, dug into the bed of the watercourse with additional protection to the banks either side of the pipe. Ideally, a single span bridge would have been a better option, but this was cost-prohibitive. A photograph of the culvert after the works is on the right in Figure 19.

6.3.4 By upgrading the culvert, natural fluvial and geomorphological processes were restored to Whit Beck. Access to approximately 500m of good spawning gravels and habitat upstream of the barrier were made available to salmonids, and 1.3 km of salmonid habitat was improved downstream by enabling some downstream gravel movement.

6.4 Fish numbers

6.4.1 Pre-works surveys undertaken in 2019, upstream and downstream of the culvert showed, there were trout fry present downstream, but not upstream, confirming this was a barrier to fish movement.

6.4.2 Post works surveys conducted in 2022 showed that trout have since moved into the section upstream of the culvert and are utilising the available spawning habitat.

6.4.3 The upstream site went from a trout fry index of 0 fry/min (F) to a trout fry index of 1.4 fry/min (C).

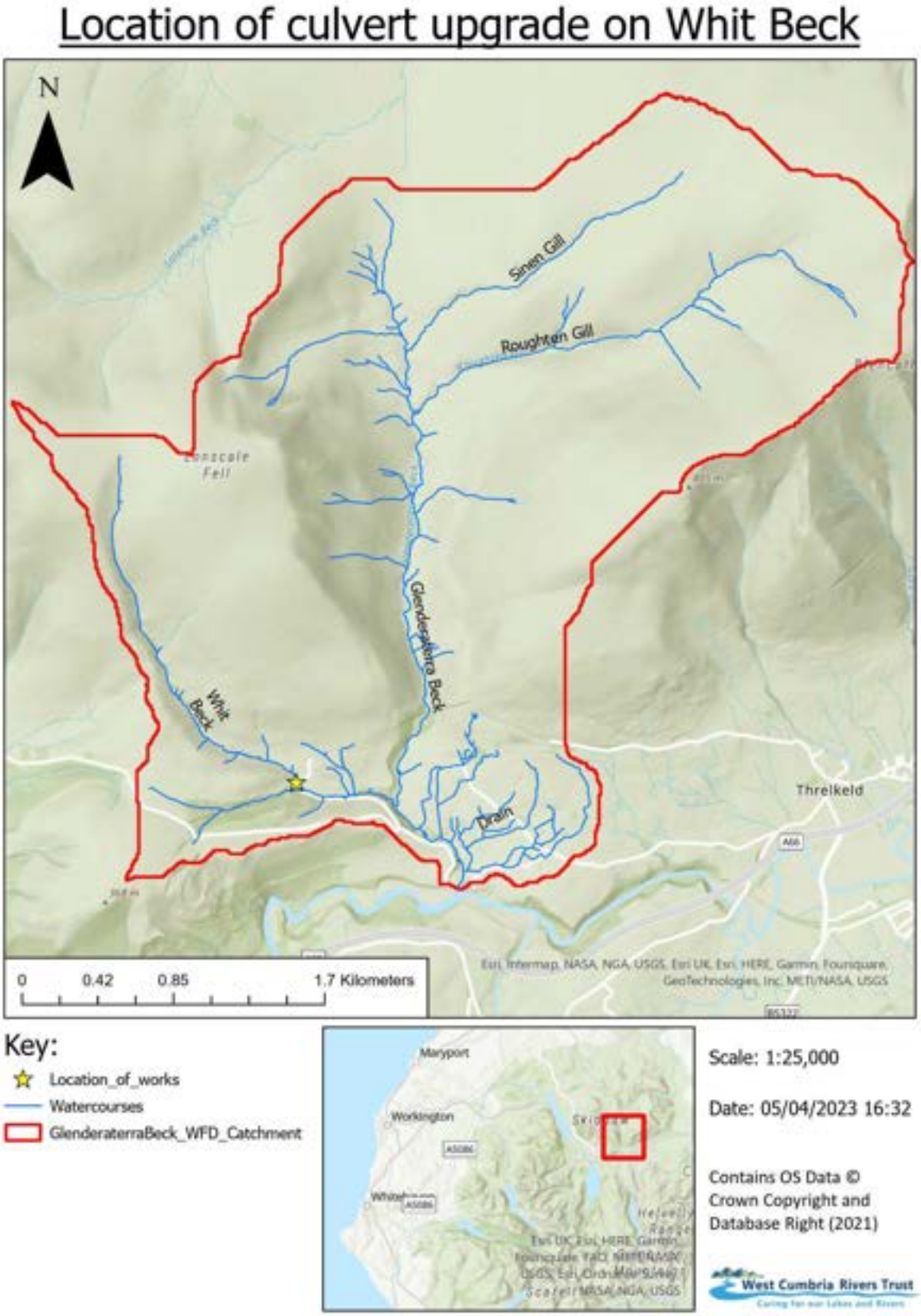

Figure 20: *Map showing the location of Whit Beck and the culvert upgrade.*[8]

[8] Figure 20 data sources: Basemaps: Esri, USGS, NGA, NASA, CGIAR, Ordnance Survey Intermap, Esri UK, HERE, Garmin, METI/ NASA, FAO, NOAA, Foursquare, GeoTechnologies, Inc.
Catchment and subcatchment outlines: © Environment Agency copyright and/or database right 2015
Watercourses layer: Subset of the Detailed River Network, © Environment Agency and © Ordnance Survey 2017.
All other layers: WCRT

7 Conclusion

7.1.1 This is the eighth year of WCRT surveys of juvenile salmonids in the River Derwent catchment. The last two springs/summers have really highlighted the parts of the catchment vulnerable to drought/low flow conditions and areas that desperately need shade to keep the waters cool. The current conditions at these sites are adding additional stress to fry during a critical stage of their life cycle, inhibiting their ability to thrive, and potentially leading to mortality.

7.1.2 Both salmon and trout fry numbers decreased this year compared to last year, but the overall trend for both species is still in the upwards direction across the eight years of surveys. The reasons for the decreases were discussed at length in other sections of the report, but the key point is that the UK is experiencing hotter and drier, springs and summers, which will have negative impacts on salmonids, particularly during the fry stage. It is more and more important to create shade by planting trees and shrubs along the banks of the watercourses, particularly in those upland areas where there is little or no shade at all. As well as tree planting, an increase in in-channel woody debris would offer shade, places to hide, protection from predation and stabilisation of gravels.

7.1.3 Increasing water temperatures and low flows are just one of the many pressures our salmonid populations are facing and projects such as river restoration, habitat improvements and barrier removal/easement remain an important tool in improving the salmon status in the River Derwent catchment. Data from these surveys is used to monitor projects that have been delivered on the ground to determine their success in improving the habitat and water quality and thus increasing fish numbers. The example discussed here was the Lonscale culvert upgrade, which was effective in allowing trout to move into the area upstream of the culvert. To effectively monitor habitat improvements, it is important that projects or work undertaken by organisations within the catchment are recorded, and this can be done by informing the West Cumbria Catchment Partnership on any works being delivered (www.westcumbriacatchmentpartnership.co.uk).

8 Acknowledgements

8.1.1 Many organisations and individuals have contributed to make this project a success. Without all those mentioned below, this project would not be possible and WCRT is extremely grateful to all those who helped in a variety of ways including;

- Approximately 100 landowners and tenants who gave permission to access the river from their land, encouraged us to do so and showed great interest in the results.
- Financial contributions from:
  - The Environment Agency via the collaborative project with The Rivers Trust and other local Rivers Trusts;
  - Local angling associations including: Derwent Owners Association, Cockermouth Anglers Association, Keswick Anglers Association and The Isel Fishings Association;
  - The Potato Pot Community Fund;
  - Lakes Distillery Water Fund via the Lake District Foundation;
  - Water Environment Grant via the European Agricultural Fund for Rural Development;
  - The National Trust;
  - United Utilities;
  - Lancaster University;
  - Lord and Lady Egremont.
- The 2022 survey team consisted of; two Lancaster University funded interns and four WCRT volunteer interns, and twenty of our regular WCRT volunteers. The help of interns and volunteers is crucial to ensuring the surveys go ahead and that this valuable data is collected. WCRT are very grateful and would like to thank them for all their help and hard work.
- Adam Wheeler from Ribble Rivers Trust, Brian Shields and Phil Ramsden from the EA for their advice and help with regards to calibration and data analysis methodologies.

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10 Appendix A: Survey Sheet

West Cumbria Rivers Trust
Caring for our Lakes and Rivers

WCRT 5 minute Electrofishing Survey

Date:	
Surveyors	
Start Time	
Site Name	
Watercourse	
Site Number	
Grid Reference	
Altitude	
Photo	Have you taken one?
Weather	
Water Level	L / M / H
Recent Conditions	Drought / Flood

Water Clarity	
Conductivity (µS/cm)	
Temperature (°C)	
pH	
Voltage (V)	
Frequency (Hz)	
Pulse Width (%)	
Length (m)	
Av Width (m) Take 3 readings	
Pool/ Riffle (%)	

Habitat Characteristics	LHB	RHB
Bank Material		
Bank Vegetation		
Erosion/ Undercut		
Bank Protection		
Modified		
Fenced/ Stock Access		
Barrier to fish passage		
INNS (Pres/Abs)		
% shade		
Tree Roots		
Overhanging Veg		
Large Woody Debris		
Emergent Veg		
Submerged Veg		
Algae		
Invertebrates		
Substrate (circle dominant)	Be, Bo, Co, Gr, Sa, Si	

Other fish species	
Eel	
Lamprey	
Bullhead	
Stoneloach	
Minnow	
Stickleback	
Crayfish	
Other (name)	

No of missed fish	
No of dead fish	

Notes:

mm	Trout	Salmon
<20		
25		
30		
35		
40		
45		
50		
55		
60		
65		
70		
75		
80		
85		
90		
95		
100		
105		
110		
115		
120		
125		
130		
135		
140		
145		
150		
155		
160		
165		
170		
175		
180		
185		
190		
195		
200		
>200		

Figure 21: *An example survey sheet used to record the fish and habitat data.*

11 Appendix B: 2022 Raw Fish Data

Table 8: *Raw fish data from the 2022 semi quantitative surveys.*

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
1	23/08/2022	River Derwent	0	0	0	1	13	0	0	61	6	0	0	0
2	22/07/2022	River Derwent	1	0	2	0	46	0	0	14	13	0	0	0
3	22/07/2022	River Derwent	0	0	33	0	20	0	0	42	0	0	0	0
4	22/07/2022	River Derwent	0	0	12	0	15	0	0	18	2	0	0	0
5	21/07/2022	River Derwent	0	0	14	0	28	0	0	65	6	0	0	0
7	20/07/2022	River Derwent	0	0	31	5	26	0	0	8	0	0	0	0
8	20/07/2022	River Derwent	0	0	21	0	21	0	0	15	1	1	0	0
9	19/07/2022	River Derwent	0	0	11	0	51	0	0	5	0	0	0	0
10	20/07/2022	River Derwent	0	0	8	3	45	0	0	7	1	0	0	0
11	21/07/2022	River Derwent	3	0	18	0	22	0	0	4	1	0	0	0
12	21/07/2022	River Derwent	0	0	40	1	72	0	0	9	1	0	0	0
13	18/07/2022	River Derwent	0	0	40	0	29	0	0	12	0	0	0	0
14	18/07/2022	River Derwent	0	0	10	0	18	0	0	7	0	0	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
15	18/07/2022	River Derwent	0	0	11	0	10	0	0	3	8	0	0	0
20	03/08/2022	Lostrigg Beck	1	1	0	0	1	0	0	45	52	16	0	0
22	03/08/2022	Lostrigg Beck	15	0	0	0	0	0	0	53	29	0	0	0
23	11/08/2022	Lostrigg Beck	17	1	0	0	0	0	0	22	236	0	0	0
25	11/08/2022	River Marron	2	0	17	2	5	0	0	18	0	1	0	0
28	11/08/2022	River Marron	4	2	20	4	8	0	0	6	0	0	0	0
30	01/08/2022	River Marron	37	1	85	0	2	0	0	0	0	0	0	0
31	01/08/2022	Black Beck	17	0	0	0	0	0	0	0	0	2	0	0
32	03/08/2022	Snary Beck	33	4	0	0	1	0	0	0	0	0	0	0
34	01/08/2022	River Marron	55	9	1	3	1	0	0	0	0	0	0	0
35	28/07/2022	Wood Beck	64	38	5	12	1	0	0	0	0	0	0	0
36	28/07/2022	Wood Beck	29	3	0	0	0	0	0	0	0	0	0	0
37	01/08/2022	Wisenholme Beck	12	17	0	0	0	0	0	0	0	0	0	0
38	03/08/2022	Rakegill Beck	21	5	0	0	5	0	0	0	1	0	0	0
42	29/09/2022	Broughton Beck	1	0	1	1	4	0	0	84	84	6	0	Roach - 2

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
44	29/09/2022	Broughton Beck	0	0	0	0	5	0	0	98	17	11	0	0
45	29/09/2022	Broughton Beck	0	0	0	0	0	0	0	1	43	0	0	0
52	25/07/2022	Bitter Beck	7	10	0	0	5	0	0	6	1	6	0	0
53	05/08/2022	Bitter Beck	29	2	0	0	1	0	0	5	0	0	0	0
54	04/08/2022	Bitter Beck	27	0	0	0	0	0	0	0	0	0	0	0
55	25/07/2022	Tom Rudd Beck	8	5	0	0	2	0	0	12	0	0	0	0
56	25/07/2022	Tom Rudd Beck	6	3	0	0	4	0	0	5	50	0	0	0
57	25/07/2022	Tom Rudd Beck	13	0	0	0	1	0	0	3	0	1	0	0
58	25/07/2022	Tom Rudd Beck	27	5	0	0	4	0	0	0	0	7	0	0
60	23/08/2022	River Cocker	9	0	0	0	1	0	0	6	15	0	0	0
61	11/07/2022	River Cocker	4	0	39	1	0	0	0	28	5	0	0	0
63	14/07/2022	River Cocker	1	0	17	0	2	0	0	39	0	0	0	0
64	14/07/2022	River Cocker	2	0	50	5	0	0	0	9	0	0	0	0
65	12/07/2022	River Cocker	5	0	3	0	0	1	0	1	0	0	0	0
66	12/07/2022	River Cocker	2	0	34	4	8	0	0	1	0	0	0	0
68	14/07/2022	River Cocker	2	0	6	0	12	0	0	0	7	0	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
75	11/07/2022	Sandy Beck	12	1	7	0	0	0	0	37	4	0	0	0
76	11/07/2022	Sandy Beck	51	9	5	13	1	0	0	3	0	0	0	0
77	05/08/2022	Sandy Beck	41	4	1	6	2	0	0	0	0	0	0	0
78	27/07/2022	Sandy Beck	46	0	0	0	1	0	0	0	0	0	0	0
80	08/07/2022	Whit Beck	4	0	40	1	3	0	0	4	21	0	0	0
81	08/07/2022	Whit Beck	16	1	15	0	1	1	0	1	52	1	0	0
82	08/07/2022	Whit Beck	20	5	45	8	1	0	0	0	0	0	0	0
84	06/07/2022	Whit Beck	12	8	26	7	2	0	0	0	0	0	0	0
86	07/07/2022	Aiken Beck	47	7	0	1	0	0	0	0	0	0	0	0
88	07/07/2022	Blaze Beck	16	7	0	0	0	0	0	0	0	0	0	0
89	14/07/2022	Meregill Beck	57	1	5	2	1	5	0	3	0	4	0	0
90	14/07/2022	Meregill Beck	46	0	1	0	0	0	0	2	0	0	0	0
91	05/07/2022	Hope Beck	87	3	0	3	0	0	0	0	0	0	0	0
92	05/07/2022	Hope Beck	38	14	0	1	0	0	0	0	0	0	0	0
93	06/07/2022	Hope Beck	78	3	0	1	0	0	0	0	0	0	0	0
94	06/07/2022	Hope Beck	73	3	0	0	0	0	0	0	0	0	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
96	06/07/2022	Hope Beck	4	16	0	0	0	0	0	0	0	0	0	0
97	12/07/2022	Liza Beck	10	0	106	3	1	1	0	1	0	0	0	0
99	13/07/2022	Liza Beck	13	0	0	0	0	0	0	0	0	0	0	0
101	13/07/2022	Liza Beck	15	2	0	0	0	0	0	0	0	0	0	0
104	26/07/2022	Park Beck	10	1	22	1	3	0	0	2	0	0	0	0
105	26/07/2022	Park Beck	19	0	3	2	4	0	0	1	1	0	0	0
106	26/07/2022	Park Beck	11	1	3	1	3	0	0	0	0	0	0	0
107	26/07/2022	Mosedale Beck	15	0	0	2	1	0	0	0	0	0	0	0
109	26/07/2022	Highnook Beck	5	0	11	3	1	0	0	0	0	0	0	0
110	27/07/2022	Dub Beck	0	6	0	0	8	0	0	0	32	0	0	0
111	27/07/2022	Crabtree Beck	0	1	0	0	1	0	0	0	0	0	0	0
112	27/07/2022	Holme Beck	0	1	0	0	1	0	0	0	2	0	0	0
114	27/07/2022	Dub Beck	0	0	0	0	1	0	0	0	44	0	0	0
115	13/07/2022	Rannerdale Beck	77	11	0	0	1	0	0	0	0	0	0	0
116	13/07/2022	Rannerdale Beck	68	7	0	0	0	0	0	0	0	0	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
117	09/08/2022	Mill Beck/ Sail Beck	60	0	0	0	1	0	0	0	1	0	0	0
120	10/08/2022	Gatesgarthdale Beck	23	0	0	0	0	0	0	0	5	0	0	0
122	10/08/2022	Gatesgarthdale Beck	47	2	0	1	0	0	0	0	0	0	0	0
123	10/08/2022	Gatesgarthdale Beck	75	2	0	0	1	0	0	0	0	0	0	0
126	10/08/2022	Warnscale Beck	14	0	4	0	0	0	0	0	2	0	0	0
128	10/08/2022	Warnscale Beck	8	0	0	0	0	0	0	0	3	0	0	0
135	12/08/2022	Blumer Beck	20	0	0	0	0	0	0	0	0	0	0	0
136	12/08/2022	Blumer Beck	28	3	1	0	0	0	0	18	6	0	0	0
142	28/09/2022	Coal Beck	10	9	1	4	3	0	0	27	121	0	0	0
143	28/09/2022	Coal Beck	19	1	0	0	1	0	0	5	0	0	0	0
144	28/09/2022	Coal Beck	12	1	0	0	0	0	0	10	0	0	0	0
148	05/08/2022	Wythop Beck	41	3	0	0	2	0	0	0	0	0	0	0
149	05/08/2022	Wythop Beck	23	8	0	0	2	0	0	0	0	0	0	0
150	05/08/2022	Wythop Beck	13	8	0	0	2	0	0	0	0	0	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
151	08/08/2022	Dash Beck	4	2	0	1	1	0	0	0	1	0	0	0
156	08/08/2022	Chapel Beck	10	1	6	0	1	0	0	0	0	0	0	0
157	30/08/2022	Chapel Beck	23	0	3	1	3	0	0	0	0	0	0	0
158	30/08/2022	Chapel Beck	45	3	2	0	1	0	0	0	0	0	0	0
164	31/08/2022	Coledale Beck	19	2	10	0	0	0	0	4	0	0	0	0
167	31/08/2022	Coledale Beck	10	7	0	0	0	0	0	0	0	0	0	0
168	31/08/2022	Coledale Beck	0	0	0	0	0	0	0	0	0	0	0	0
174	01/09/2022	Newlands Beck	19	2	1	2	4	0	0	1	0	0	0	0
176	01/09/2022	Keskadale Beck	6	2	0	0	1	0	0	0	0	0	0	0
178	01/09/2022	Scope Beck	11	5	0	0	0	0	0	0	0	0	0	0
179	01/09/2022	Newlands Beck	27	4	0	2	0	0	0	0	0	0	0	0
181	01/09/2022	Newlands Beck	13	0	0	1	0	0	0	0	0	0	0	0
183	31/08/2022	Pow Beck	3	5	0	0	2	0	0	2	0	1	0	0
199	15/09/2022	Brockle Beck	0	2	0	2	0	0	0	50	297	0	0	0
200	15/09/2022	Brockle Beck	2	0	0	0	0	0	0	26	51	0	0	0
202	08/09/2022	Brockle Beck	30	1	0	0	0	0	0	0	0	0	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
204	15/09/2022	Watendlath Beck	2	1	1	2	0	0	0	20	12	0	0	0
205	15/09/2022	Watendlath Beck	4	2	0	0	0	0	0	0	26	0	0	0
206	15/09/2022	Watendlath Beck	0	2	0	0	0	0	0	0	55	0	0	0
209	06/09/2022	Stonethwaite Beck	3	0	16	7	0	0	0	45	0	0	0	0
210	14/09/2022	Stonethwaite Beck	0	0	16	1	1	0	0	5	0	0	0	0
211	14/09/2022	Stonethwaite Beck	2	0	7	4	0	0	0	4	5	0	0	0
212	06/09/2022	Tongue Gill	12	2	0	0	1	0	0	6	15	0	0	0
215	06/09/2022	River Derwent	4	0	9	3	0	0	0	35	4	0	0	0
217	07/09/2022	River Derwent	3	0	2	3	0	0	0	1	0	0	0	0
219	07/09/2022	River Derwent	0	0	0	0	0	0	0	0	0	0	0	0
220	07/09/2022	River Derwent	6	0	0	5	1	0	0	1	0	0	0	0
221	07/09/2022	Black Syke	16	10	2	0	0	3	0	1	1	0	0	0
223	07/09/2022	Black Syke	1	4	0	0	0	0	0	0	0	0	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
225	17/08/2022	River Greta	2	0	23	2	0	0	0	3	0	0	0	0
226	18/08/2022	Glenderaterra Beck	20	7	6	5	0	0	0	0	0	0	0	0
227	15/08/2022	Glenderaterra Beck	34	3	0	2	0	0	0	0	0	0	0	0
228	19/08/2022	Glenderaterra Beck	15	2	0	1	0	0	0	0	0	0	0	0
229	19/08/2022	Glenderaterra Beck	12	1	0	2	0	0	0	0	0	0	0	0
230	19/08/2022	Whit Beck	14	2	0	0	0	0	0	0	0	0	0	0
231	22/08/2022	Whit Beck	8	6	0	0	0	0	0	0	0	0	0	0
232	22/08/2022	Whit Beck	7	0	0	0	0	0	0	0	0	0	0	0
234	22/08/2022	Naddle Beck	3	2	3	2	0	0	0	14	3	0	0	0
235	23/08/2022	Naddle Beck	0	0	1	3	0	0	0	50	75	0	0	0
239	20/09/2022	St John's Beck	0	0	2	0	2	0	0	4	51	1	0	0
241	02/09/2022	St John's Beck	3	2	22	12	1	0	0	5	39	0	0	0
243	17/08/2022	River Glenderamackin	1	1	58	11	0	0	0	3	2	0	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
244	16/08/2022	River Glenderamackin	0	1	36	3	0	0	20	41	2	0	0	0
245	17/08/2022	River Glenderamackin	2	0	30	4	1	0	0	28	0	0	0	0
246	17/08/2022	Mosedale Beck	3	0	3	4	0	0	0	22	0	0	0	0
248	17/08/2022	Mosedale Beck	15	1	0	0	0	0	0	0	0	0	0	0
250	16/08/2022	Trout Beck	5	1	10	6	0	0	4	34	32	0	0	0
251	16/08/2022	Trout Beck	15	1	2	2	0	0	2	16	9	0	0	0
255	16/08/2022	River Glenderamackin	1	0	25	2	0	0	0	30	12	0	0	0
260	23/09/2022	River Glenderamackin	4	0	0	7	0	0	0	1	0	0	0	0
261	15/08/2022	River Glenderamackin	9	0	1	4	0	0	0	0	0	0	0	0
262	15/08/2022	River Glenderamackin	9	4	0	1	0	0	0	0	0	0	0	0
264	27/09/2022	Barrow Beck	1	0	0	1	0	0	0	18	123	29	0	0
265	27/09/2022	Barrow Beck	0	0	0	0	0	0	0	5	40	51	0	0
266	27/09/2022	Naddles Beck	1	0	0	0	0	0	0	17	8	17	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
267	27/09/2022	Naddles Beck	2	0	0	0	0	0	0	16	7	23	0	0
268	27/09/2022	Naddles Beck	1	0	0	0	0	0	0	44	47	42	0	0
274	07/07/2022	Blaze Beck	8	9	0	0	0	0	0	0	0	0	0	0
275	15/07/2022	Meregill Beck	56	10	0	0	1	0	0	0	0	0	0	0
278	06/09/2022	River Derwent	1	0	22	1	0	0	0	71	0	0	0	0
280	21/09/2022	Wyth Burn	36	5	0	0	0	0	0	0	5	0	0	0
281	21/09/2022	Wyth Burn	26	2	0	0	0	0	0	0	0	0	0	0
282	21/09/2022	Wyth Burn	20	4	0	0	0	0	0	0	6	0	0	0
283	21/09/2022	Raise Beck	41	1	0	0	0	0	0	0	0	0	0	0
284	21/09/2022	Raise Beck	21	2	0	0	0	0	0	0	0	0	0	0
291	07/07/2022	Millbeck	41	0	0	0	0	0	0	0	0	0	0	0
292	09/08/2022	Park Beck	15	0	7	0	0	0	0	10	2	0	0	0
293	09/08/2022	Park Beck	3	0	25	1	7	0	0	13	1	0	0	0
294	31/08/2022	Pow Beck	5	1	0	0	2	0	0	3	0	5	0	0
295	06/09/2022	River Derwent	3	0	10	1	0	0	0	36	0	0	0	0
296	16/09/2022	St John's Beck	1	3	11	9	3	1	0	18	156	41	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
297	13/09/2022	St John's Beck	15	5	26	16	1	0	0	4	23	2	0	0
298	13/09/2022	St John's Beck	5	1	38	26	0	0	0	4	0	0	0	0
299	16/09/2022	St John's Beck	3	0	13	7	0	0	0	9	2	0	0	0
300	02/09/2022	St John's Beck	8	0	28	7	0	0	0	9	1	0	0	0
301	02/09/2022	St John's Beck	3	2	5	2	1	0	0	3	1	0	0	0
302	20/09/2022	St John's Beck	2	1	29	3	1	0	0	1	18	2	3	0
303	23/09/2022	River Glenderamackin	3	0	4	3	0	0	0	1	0	0	0	0
304	02/10/2022	River Glenderamackin	10	0	16	0	0	0	0	1	0	0	0	0
305	02/10/2022	River Glenderamackin	21	1	6	1	0	0	0	0	0	0	0	0
308	03/10/2022	River Glenderamackin	6	0	6	2	0	0	0	6	0	0	0	0
309	03/10/2022	River Glenderamackin	4	1	10	2	0	0	0	5	0	0	0	0
310	19/08/2022	How Beck	10	4	20	9	0	0	0	0	6	0	0	0
311	08/08/2022	How Beck	4	4	0	0	0	0	0	0	0	0	0	0

Site No	Date	Watercourse	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bull head	Stone loach	Minnow	Stickle back	Cray fish	Other
312	25/08/2022	How Beck	32	8	2	5	0	0	0	0	1	0	0	0
313	19/08/2022	How Beck	51	4	2	1	0	0	0	0	0	0	0	0
314	10/08/2022	How Beck	6	0	15	4	0	0	0	2	0	0	0	0
315	19/08/2022	How Beck	30	2	5	2	0	0	0	0	15	0	0	0
316	10/08/2022	How Beck	18	8	3	0	0	0	0	0	0	0	0	0
317	08/08/2022	How Beck	1	2	0	0	1	0	0	0	0	0	0	0
318	12/08/2022	How Beck	17	2	5	3	0	0	0	0	0	0	0	0
319	25/08/2022	How Beck	7	7	1	5	0	0	0	0	78	1	0	0
320	12/08/2022	How Beck	14	5	1	5	0	0	0	1	0	0	0	0
321	12/08/2022	How Beck	18	4	11	3	0	0	0	0	0	0	0	0