West Cumbria Rivers Trust

Caring for our Lakes and Rivers

River Derwent Fish and
Habitat Surveys Project

Fish and Habitat Survey Report 2021

Project	Report No.	Revision No.	Date of Issue
River Derwent Fish and Habitat Surveys Project	007	003	10/7/2022

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The focus of this report is the River Derwent and its tributaries. Fish and habitat surveys are conducted by West Cumbria Rivers Trust 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.

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1 Executive Summary

1.1.1 The River Derwent fish and habitat survey project started in 2015 and is now in its seventh 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 Surveys are conducted between July and September and sites are selected based on a number of factors. To conduct the fish surveys, West Cumbria Rivers Trust (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 (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.

1.1.3 The salmonid fish data is then processed to determine size categories for fry and parr and then an index of fry abundance is calculated. Each survey site is then assigned a grade of A to F, with 'A' being the highest quality sites with the most fry, based on the National Fisheries Classification Scheme (NFCS). A calibration exercise was undertaken during the 2021 survey season to update the equations used to extrapolate the semi quantitative data to 100m^2, which is the unit required in order to assign a NFCS grade.

1.1.4 The summer of 2021 was particularly dry, with very little rain, and low river levels throughout the months of July to September. The prolonged drought highlighted areas or sections of rivers that are not very resilient to drought conditions, particularly the River Derwent in Borrowdale and Newlands Beck between Braithwaite and Stair, both of which are modified watercourses. Due to the low river levels across the catchment, less survey sites were surveyed compared to previous years (122 sites compared to the usual number of around 160).

1.1.5 In total, 7,472 salmonids were recorded, of which 3,450 were trout and 4,022 were salmon. These numbers can be broken down further into fry and parr numbers; 3146 were trout fry and 3,889 were salmon fry (fry being less than a year old); and 304 were trout parr and 133 were salmon parr (parr being young fish over a year old). Of the total 122 sites surveyed 98 sites (80%) had trout fry present and 70 sites (57%) had salmon fry present.

1.1.6 Trout numbers recorded dropped slightly in 2021 compared to previous years, most likely due to the drought, as it is generally the smaller, upland tributaries that are mainly dominated by trout, and many of these were either dry or with very low water levels during the survey season. Salmon numbers recorded, on the other hand, increased to the most fry ever recorded in the non-main river sites. Again, however, the drought in 2021 is likely to have impacted these numbers with salmon being concentrated into smaller areas of river due to low flows.

1.1.7 Whilst it is encouraging to see a higher number of fry recorded, care should be taken in interpreting this as an upward trend in salmon fry numbers based on 2021 data alone, due to the impact of the drought on the survey. These numbers also remain much lower than historic levels.

1.1.8 A case study of the Blaze Beck river restoration works, undertaken by WCRT in 2020, highlights the benefits of river restoration to salmonids. Pre and post restoration surveys were conducted as part of the catchment wide surveys; with the results for Blaze Beck showing a huge 16,950% increase in the numbers of trout fry recorded in 100m^2 following the restoration works, (salmon cannot reach this beck due to natural barriers downstream). 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 yearly catchment characterisation surveys of the Derwent catchment, involving salmonid fish and habitat surveys. 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 helps to evaluate the success of projects such as river restoration and habitat improvement work. It also provides evidence of where further work to improve habitat, water quality and fish migration is needed, and helps to elicit further funding to undertake these 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 Derwentwater and Bassenthwaite Lake and Arctic charr in Crummock Water.

2.1.3 The Environment Agency (EA) is the statutory body responsible for fisheries, conservation and ecology and their fisheries monitoring programme provides comprehensive 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. 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.

2.2 Project Objectives

2.2.1 This project's objective 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 projects such as habitat improvement works, river restoration, fish easements;
5. Generate data and 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, temporarily immobilising them and therefore 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.

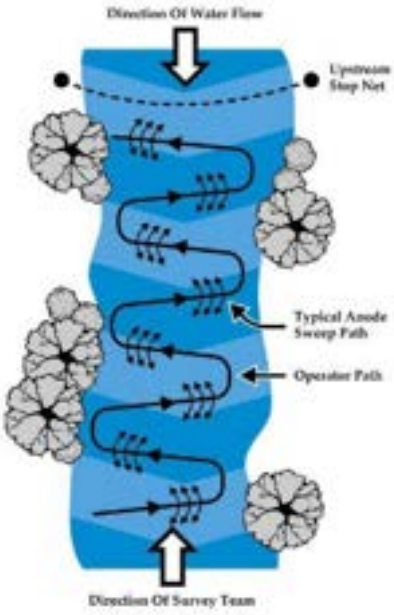

Figure 1: *A diagram to show the survey method of the quantitative method but is also similar to semi quantitative in terms of the zigzag pattern and the direction of travel. (Diagram from E Fish 500W kit manual, 2012).*

3.1.4 Most survey sites are located on tributaries 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, with their mouths at zero and the value is taken from where the fork in their tail falls and rounded to the nearest 5mm. 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).

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, 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 Site selection is also based on where habitat improvement works have happened or are proposed, to fulfil monitoring requirements, reporting requirements and in support of funding bids. Sites can also be selected to determine whether fish can get over obstacles, to monitor known sources of pollution or help determine sources of pollution.

3.3.4 2021 marks the seventh consecutive year of surveying, with a total of 290 different sites having been surveyed during this time.

3.3.5 Roughly 100 sites are selected as priority and are surveyed every year. The other sites are on a two yearly cycle to allow even coverage within the survey window, but also allowing monitoring aims to still be met. Around 160 sites get 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 survey 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; as well as not fishing in high temperatures and being careful with site selection during drought conditions to ensure no additional stress or harm is caused to the fish by conducting the surveys.

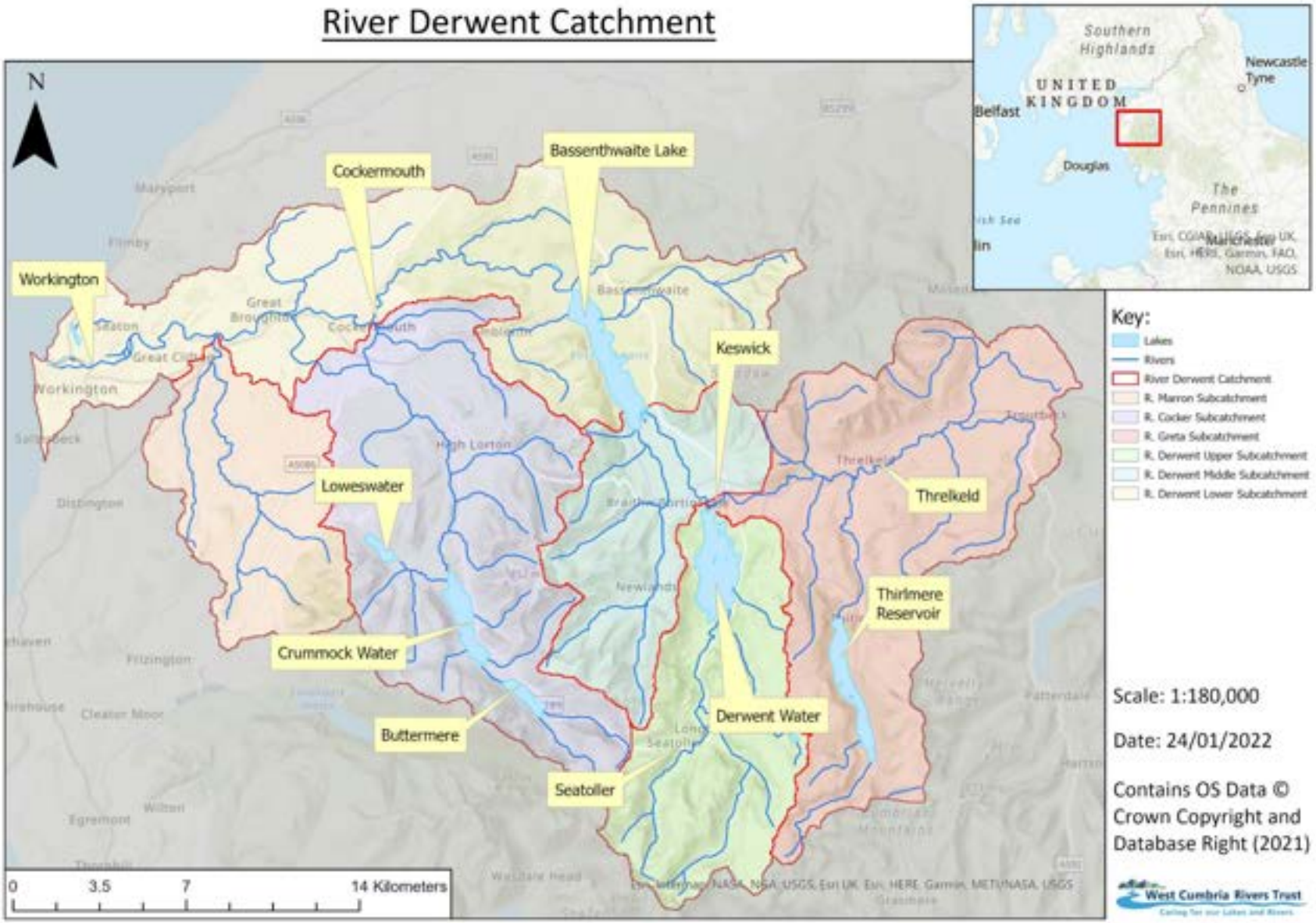

Figure 2: *Map of the Derwent catchment showing the sub-catchments, major watercourses and settlements.*

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 31. 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. Individual sites can be grouped together based on how close they are in location and when they were fished. 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. The histograms for the 2021 salmonid data are found in Appendix B on page 32.

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).

3.5.4 Then this index of fry abundance is statistically assigned a grade of excellent to poor based on the value. The classifications in this report are based on 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 fish population data needs to be translated into minimum fish densities per 100m^2. To do this data needs to be calibrated.

3.5.5 During the 2021 survey season, a calibration exercise was undertaken to update the equation used to extrapolate semi-quantitative data into minimum fish densities per 100m^2. The equation applied to the semi-quantitative results is formed from the relationship or fitted linear regression between the number of fry captured in the first '5 minutes' of the first pass of a full quantitative survey and the total electric fishing result (fry per 100m^2).

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

Where:

x is 5 min fry result

y is number fry per100m^2

a is the intercept

b is the multiplier

3.5.6 Twelve full quantitative surveys were undertaken during the 2021 survey season, which is 10% of the overall number of sites surveyed. 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 100m^2 from the depletion of a known measured area, were calculated from the quantitative surveys. 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 graphs for these correlations can be found in Appendix C on page 36. 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 and assigned a grade of A to F according to the NFCS boundaries set out in Table 1.

Table 1: The boundaries of the National Fisheries Classification Scheme, as used in this report.

Trout Fry

Range	Classification	
38+	A - Excellent	Q5
17 - 37	B - Good	Q4
8 - 16	C - Fair	Q3
3 - 7	D - Fair	Q2
1 - 2	E - Poor	Q1
0	F - Absent	

Salmon Fry

Range	Classification	
86 +	A - Excellent	Q5
45 - 85	B - Good	Q4
23 - 44	C - Fair	Q3
9 - 22	D - Fair	Q2
1 - 8	E - Poor	Q1
0	F - Absent	

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. It is also used to indicate where habitat improvement or river restoration works are needed. Each site, like the fish classifications, is given a habitat classification. Unlike the fish classifications, the habitat classifications aren't used nationally and are devised by WCRT in order to help analyse the data and provide a suitable means of presenting the data. The classifications are; Maintain, Repair and Restore.

3.6.2 For example, sites which have complex habitats, including: riffle-pool features, trees adjacent to the watercourse, dappled shade, no stock access, gravel provision with minimal silt, in stream vegetation, no barriers, no invasive species, and large wooded debris provision would be classified as Maintain.

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 as Maintain, Repair or Restore depends on how each site scores. The scoring criteria can be found in Appendix D, on page 37. For a site to be classed as Maintain it needs to score 11 or more points, Repair 6-10 points, Restore 0-5 points. Some of the classifications are also 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 and creating buffer strips, provision of new gravels, or creating more varied streambed within the channel 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.

4 Fish Survey Results and Discussion

4.1 Summary

4.1.1 The summer of 2021 was particularly dry with very little rainfall between July and September. The prolonged drought meant many watercourses were either bone dry, or very low, for a large part of the season. Between July and end of September, 512mm of precipitation fell, with the bulk of that 512mm falling in the last two weeks of the survey season, compared to 2020 when 1134mm fell over the same time period of July to September, (rainfall data sourced from the EA's Seathwaite Farm Rain Gauge records).

4.1.2 Figure 3 shows the average daily river levels for the River Derwent at the Kingfisher gauging station in Cockermouth. For the whole of the survey season, bar a small rise around the 15th August, the river levels stayed low, around the minimum typical range of 0.5m.

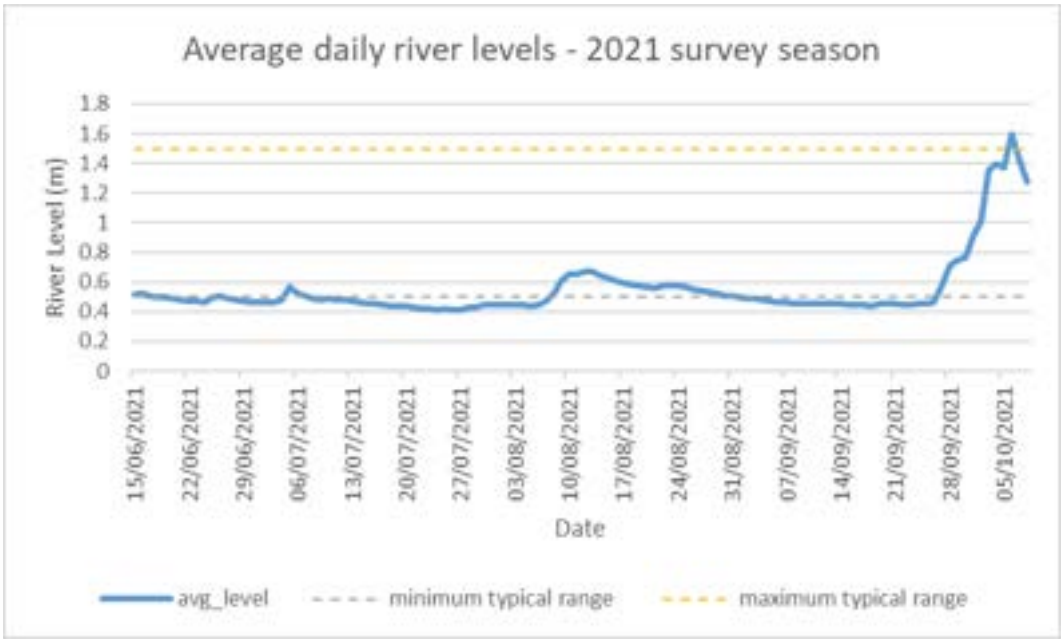

Figure 3: *Graph showing the average daily river levels for the River Derwent, from the Kingfisher Gauging station at Cockermouth (data for graph sourced from https://riverlevels.uk/derwent-north-west-catchment#.YH6yQehKhPY).*

4.1.3 Therefore, due to the low river levels across the catchment, fewer survey sites were surveyed compared to normal, with the focus switching to the main river sites and those with enough water and cool enough water temperatures to ensure no additional harm or stress to the fish would occur whilst conducting the survey. In total, 122 sites were surveyed across the Derwent catchment between beginning of July and end of September 2021.

4.1.4 A total of 3,450 trout were recorded of which 3,146 were trout fry and 304 trout parr; and 4,022 salmon were recorded of which 3,889 were salmon fry and 133 salmon parr.

4.1.5 Of the total 122 sites surveyed, 98 sites (80%) had trout fry present and 70 sites (57%) had salmon fry present. 64 sites (52%) had adult European eels (*Anguilla anguilla*) or elvers (young eels) present, 77 sites (63%) had other fish species present such as lamprey, sticklebacks, minnows, stoneloach and bullhead.

4.1.6 Two sites had juvenile bleak, a fish that hasn't been caught before whilst conducting these surveys. Bleak (*Alburnus alburnus*) are fish that live in large shoals, typically in open waters such as lakes, canals or wide, slow moving rivers. They are often found in large numbers where an inflow of food occurs from pumping stations, impounds or behind weirs. They are recognised by their upturned mouths, large eyes, bright silvery sides, which are almost pearlescent, small head, forked tail and their colourless and pointed fins. Their scales easily detach, so care is needed when handling, in the past the scales of a bleak were used to make artificial pearls. Bleak are not usually found in the River Derwent, so it is likely they were introduced at some point. Figure 4 is a photo of one of the juvenile bleak caught.

Figure 4: *A photograph of a juvenile bleak caught whilst conducting fish surveys on Broughton Beck. Photo Credit: Ruth Mackay.*

4.1.7 As stated in the methodology, each site is assigned a grade of A-F based on the NFCS boundaries shown in Table 1 on page 11. The pie charts in Figure 5, summarise the percentage of sites assigned each grade for both trout and salmon fry for the 2021 survey season. Of the 122 sites surveyed in 2021, 49% of sites were graded 'A', 12% 'B', 9% 'C', 7% 'D', 3% 'E' and 20% 'F', for trout fry. Whereas for salmon fry, 34% were graded 'A', 7% 'B', 3% 'C', 5% 'D', 8% 'E' and 43% 'F'.

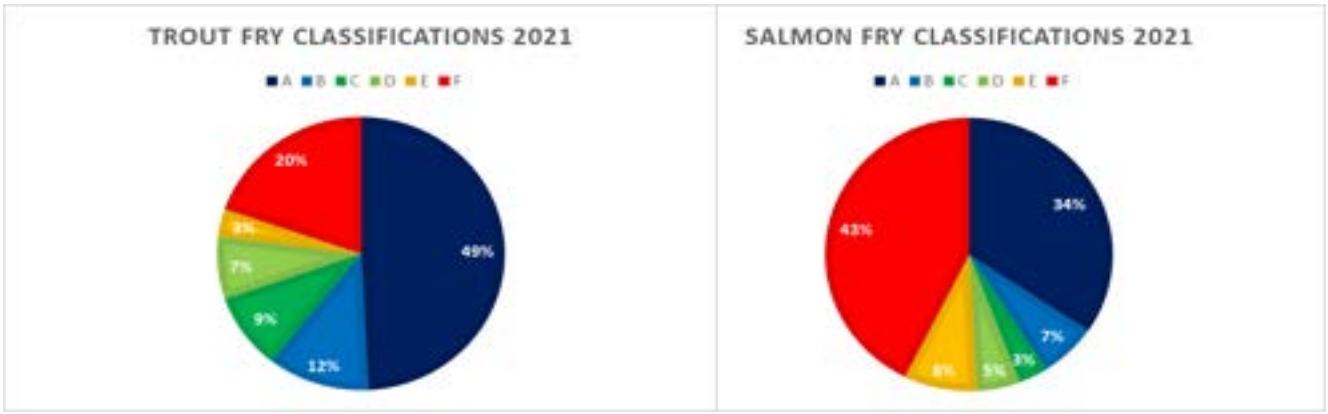

Figure 5: *Pie charts showing the percentage of sites assigned each grade (A to F) for both trout and salmon fry in 2021.*

4.2 Spatial distribution and classification of 2021 salmonid fry results

4.2.1 The spatial distributions of salmon and trout fry across the Derwent catchment recorded during the 2021 survey season can be seen in Figures 6 and 7 on pages 16 and 17. In the diagrams, the sites have been given a grade of A to F using the NFCS boundaries set out in Table 1.

4.2.2 Figure 6 on page 16, shows that for trout fry, the majority of sites are classified as A (Excellent) and B (Good) with these sites mainly found in the upper tributaries of the River Marron, the tributaries of the River Cocker such as Whit Beck, Meregill Beck, Sandy Beck and the watercourses that feed into both Crummock Water and Buttermere. Other good areas for trout fry include Tom Rudd Beck, Bitter Beck, Wythop Beck, Dash Beck, Chapel Beck and Coal Beck.

4.2.3 Areas where trout fry are Absent (F) or have Poor (E) classifications, include the main river sites along the River Derwent and River Cocker, and the tributaries around Loweswater.

4.2.4 Figure 7 on page 17, shows the site classifications for salmon fry. There are fewer A and B (Excellent and Good respectively) classifications for salmon fry. These were recorded on the main river sites along the River Derwent, River Cocker and River Glenderamackin and key spawning tributaries such as St John's Beck, Naddle Beck, Dash Beck, Chapel Beck and the lower sites on the Cocker tributaries such as Whit Beck, Sandy Beck, Hope Beck and Meregill Beck.

4.2.5 Due to the drought conditions, it is likely that in 2021 the main river sites were showing higher than usual densities for salmon fry, as salmon drop out of the tributaries into the main rivers as the water recedes. The low flows will also cause a concentration of fish, which will appear as an increase in numbers, as the usual number of fish are temporarily living in a smaller amount of available space within the watercourse, thus also increasing the catch efficiency.

4.2.6 Areas that are classed as poor or absent for salmon fry include Wood Beck, Tom Rudd Beck, Bitter Beck, Liza Beck, and the tributaries upstream of Thirlmere due to barriers to fish migration. Since the survey, works have been undertaken to improve the barrier at Wood Beck for fish passage, so we would expect to see the presence of salmon upstream of this in the next couple of years. Other areas that have classifications of absent or poor for salmon fry include Coal Beck and Broughton Beck due to poor water quality and habitat. The upper parts of many tributaries such as Hope Beck, Blaze Beck, Coledale Beck also lack salmon due to the natural population limit, as salmon prefer larger watercourses and trout tend to dominate in these places. Many of the watercourses around Crummock Water, Loweswater and Buttermere (bar Park Beck) lack the presence of salmon fry.

4.2.7 WCRT have been conducting juvenile fish surveys since 2015, and for the first time, some very small salmon fry were recorded on Warnscale Beck. Warnscale Beck is impacted by acidity and other potential water quality issues, and fish found in this beck are much further behind in their development compared to the neighbouring Gatesgarth Beck, which is usually surveyed on the same day. However, the presence of even some very small salmon fry is encouraging that water quality may be improving, but further investigations are needed to determine exactly what is going on here.

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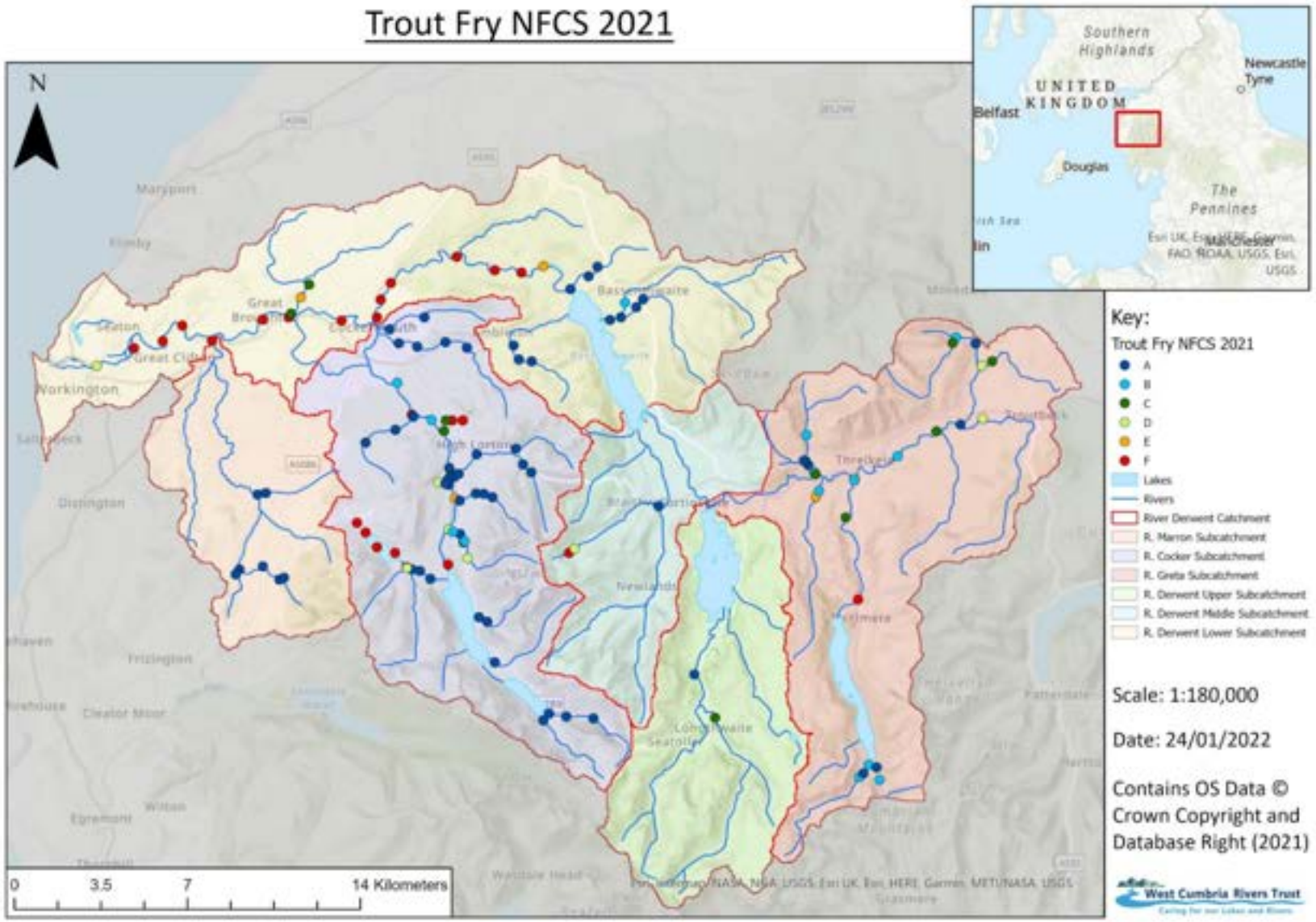

Figure 6: *A map of the Derwent catchment showing the 2021 NFCS classifications for trout fry.*

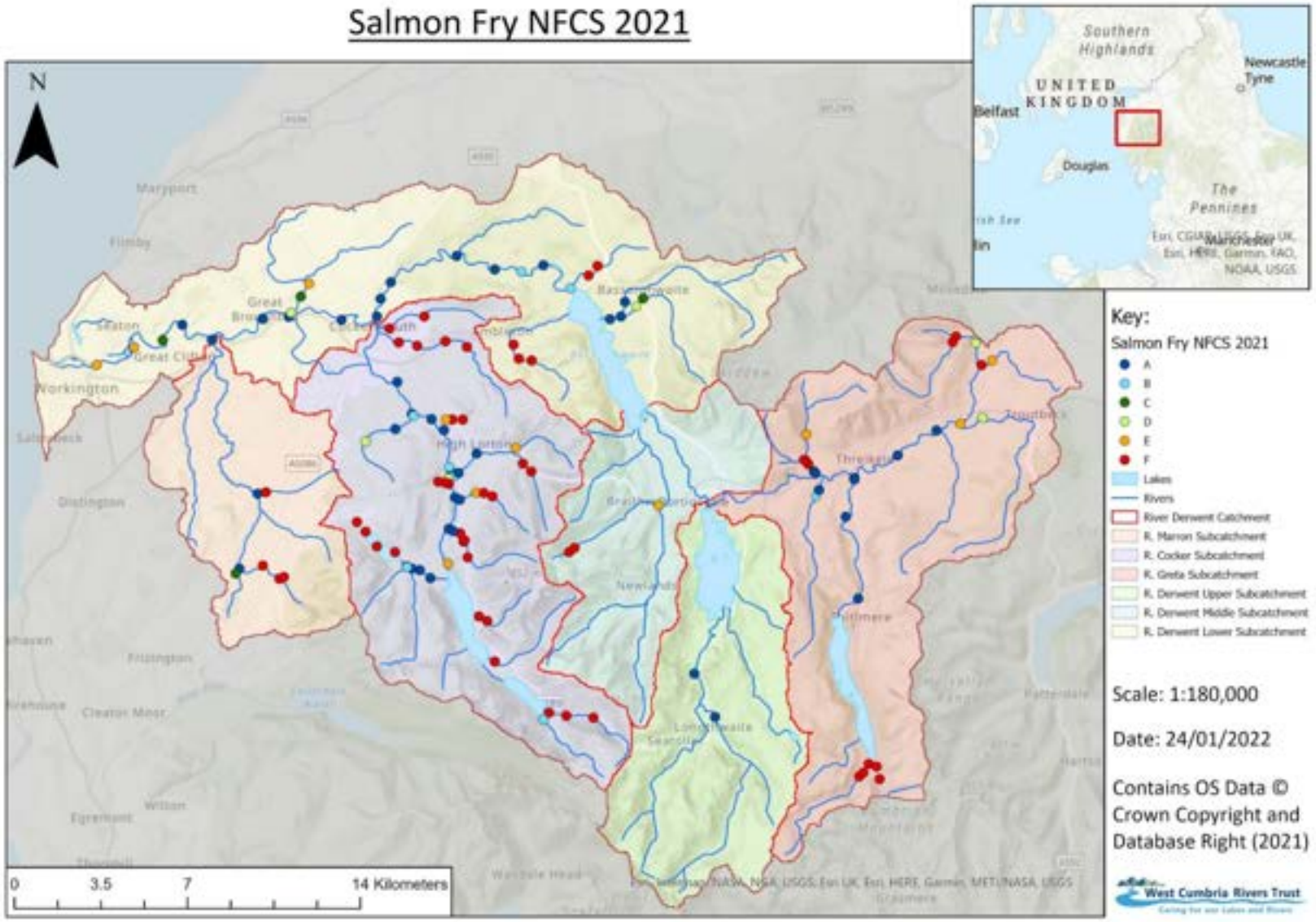

Figure 7: *A map of the Derwent catchment showing the 2021 NFCS classifications for salmon fry.*

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4.3 Sub-Catchment Specific Results

4.3.1 In previous reports, the sub-catchments or individual watercourses within the Derwent catchment have been discussed in more detail. Like the 2020 report, the focus of this report is just the overall 2021 survey season results.

4.3.2 However, 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 areas you are interested in.

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

WCRT Fish Survey Results Dashboard

4.3.4 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.

4.4 Drought

4.4.1 The spring and summer of 2021 highlighted areas or sections of rivers that are not resilient to drought conditions, are not natural or have been modified at some point in their history. The straightened or perched sections of the River Derwent in Borrowdale and Newlands Beck between Braithwaite and Stair were particularly impacted by drought. These sections dried up completely or had very low water levels that no discernible flow was obvious (Figures 8 -11). Fish in these areas will have perished or moved downstream as the levels receded. The Environment Agency rescued a lot of fish from being stranded in pools in the River Derwent around Seathwaite, Rosthwaite and Longthwaite.

4.4.2 Modified sections of watercourse are more susceptible to drought because they are not in their natural course in the lowest point of the valley, having being moved (often to the edge of a floodplain) for agricultural purposes. Often the riverbed sits higher than the surrounding floodplain and these sections also tend to have been straightened and embanked which results in poor diversity of flow types and poor available habitat for fish. As well as having low resilience to droughts, modified watercourses also speed up the flow of water during high rainfall events, removing water from the area quickly. This can cause localised flooding and gravel issues when embankments are overtopped, and/or increase the speed at which water hits downstream bottlenecks such as bridges, which are often in populated areas, increasing the likelihood of flooding in these areas.

Figure 8: *River Derwent at Longthwaite, near the YHA, summer 2021. Photo Credit: Vikki Salas.*

Figure 9: *Photo of a tributary of Gatesgarthdale Beck, Honister Pass, summer 2021. Photo Credit: Ruth Mackay.*

Figure 10: *River Derwent at Seathwaite, summer 2021. Photo credit: Ruth Mackay.*

Figure 11: *Newlands Beck, Little Braithwaite, summer 2021.*

4.5 Comparison of fry numbers between 2015 and 2021

4.5.1 The following paragraphs 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. In 2017, rivers were still in recovery from Storm Desmond. During the 2018 and 2021 survey seasons drought conditions were expereicned 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.

4.5.2 Normally this section includes a large table. The table can now be found in Appendix E, on page 38. Instead, there will be a series of graphs showing the trends between 2015 and 2021 that the table highlights.

Figure 12 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 120-130 of those are non-main river sites. However, in 2021, the number of non-main river sites surveyed was lower than usual due to the drought. Main river sites are those on the larger rivers such as the Rivers Derwent, Cocker and Greta. They can only be accessed for survey when river levels are low, hence fewer main river sites surveyed in 2020 when water levels were consistently high for the duration of the survey season.

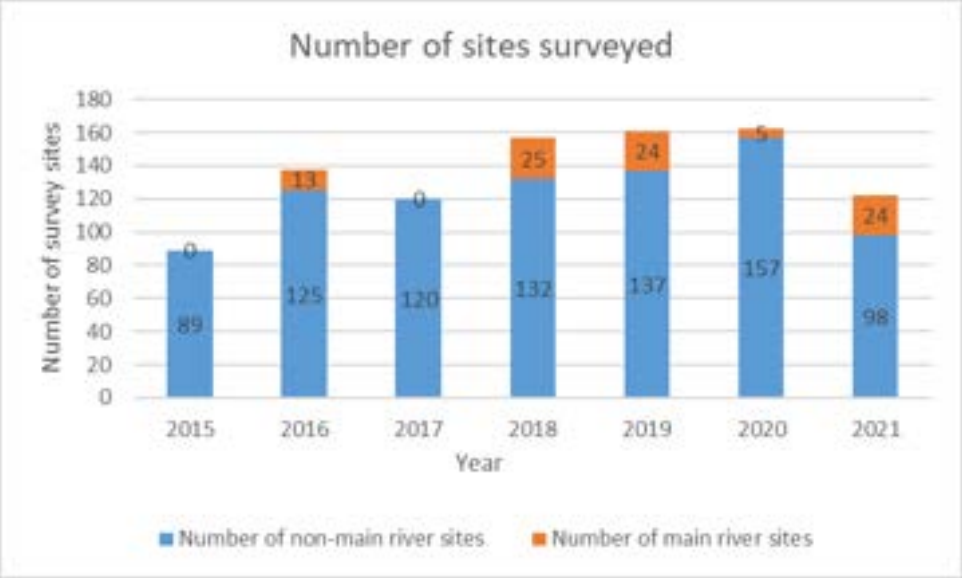

Figure 12: *Graph showing the number of sites surveyed each year broken down into main river and non-main river.*

4.5.3 Figures 13 and 14 show the total number of trout and salmon recorded each year, represented by the grey bars on the charts. This is then broken down into total number of fry (blue) and parr

(orange), for each species. Semi-quantitative surveys, particularly 5-minute surveys specifically target fry habitat rather than parr, therefore parr numbers seem low, because they are classed as a by-catch. As shown in Figure 12, the number of survey sites each year differs, which influences the total numbers of fish surveyed, so these figures cannot be used to show absolute trends in numbers, however they do give an indication of trends, which is substantiated in Figures 15 and 16.

4.5.4 Trout fry numbers have steadily risen since 2015 with a slight drop in 2016. The dip in numbers in 2016 if likely to be caused by the impact of Storm Desmond, which occurred during spawning season and washed many eggs out (Figure 13).

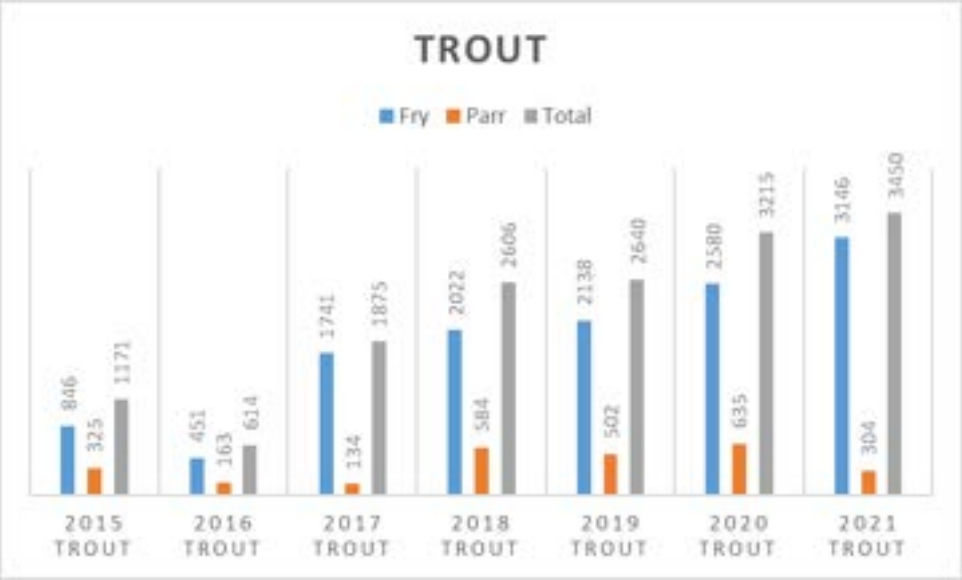

Figure 13: *Total trout recorded, broken down into fry and parr, between 2015 and 2021.*

4.5.5 Salmon fry numbers, on the other hand, have remained relatively low, with the exception of 2018 and 2021 (both drought years), which show large increases in the numbers of fry. The three years with the highest number of salmon fry, correspond to the three years where 24 main river sites were surveyed (Figure 14).

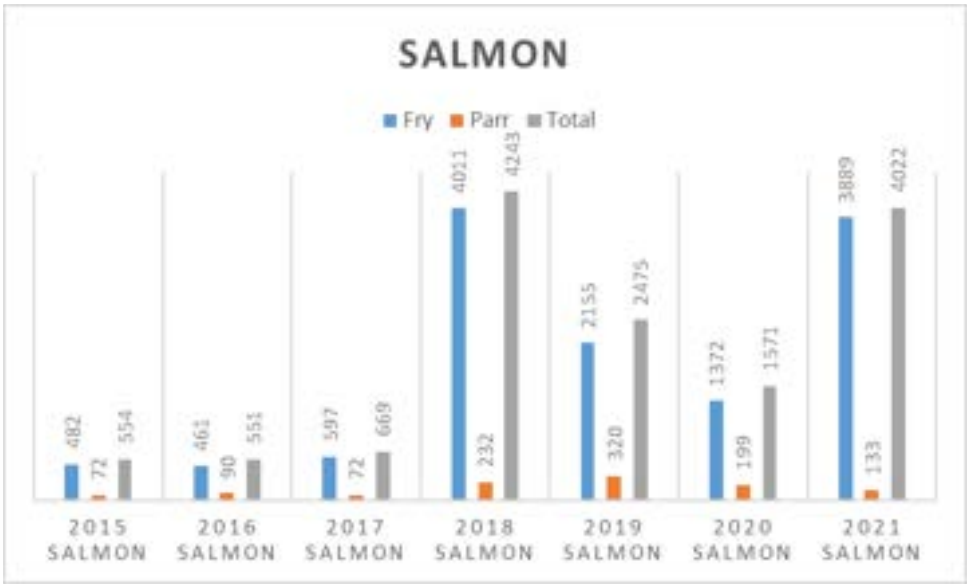

Figure 14: *Total salmon recorded, broken down into fry and parr, between 2015 and 2021.*

4.5.6 To get a realistic trend line without some of the influencing factors, values have been produced from extrapolating the 5-minute surveys to 100m^2 using the calibration equations, as discussed in section 3.5.5 and 3.5.6. These trends are shown Figure 15. The main river sites have also been discounted to reduce bias.

4.5.7 Figure 15 shows that both trout and salmon fry numbers are on the upward trend across the seven years of surveying in the Derwent catchment. Trout numbers dropped slightly in 2021 whilst salmon numbers increase to the best numbers yet in the non-main river sites in 2021. This decrease in trout fry numbers is most likely due to not being able to survey some of the smaller tributaries where they are usually found, due to the low flows, whereas the sites that were surveyed tended to the larger sites where salmon fry tend to dominate.

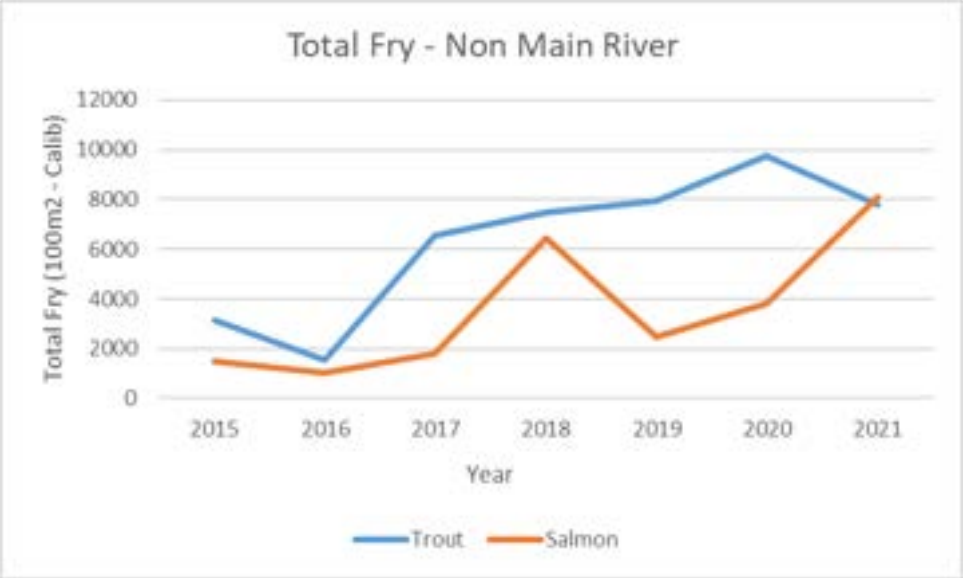

Figure 15: *Trout and salmon fry trend lines for the seven years of surveys in the Derwent catchment based on 100m^2 values, extrapolated using the calibration equation.*

4.5.8 The final figures in this section show the number of sites classified A-F across the seven years of surveys. Figure 16 shows the trout fry classifications and Figure 17 the salmon fry classifications. Again, the data is excluding the larger main river sites, which can only be surveyed in the years with low water levels, but which are generally consistent in their classifications from year to year. Note that as discussed in Section 3.3, sites are not always chosen because they are expected to be suitable for salmonids, as some sites are selected based on a requirement for pre & post-restoration data.

4.5.9 Figure 16 shows the number of sites classified as A for trout is relatively consistent over the last five years. Figure 17 shows an increase in the number of sites classified as A for salmon, in both 2018 and 2021 in line with the higher total numbers recorded in these years.

4.5.10 On the whole, despite the drought and reduction in the number of sites surveyed, 2021 was a good year for both trout and salmon fry, with only a small reduction in numbers of trout fry, but an increase in salmon fry in 2021.

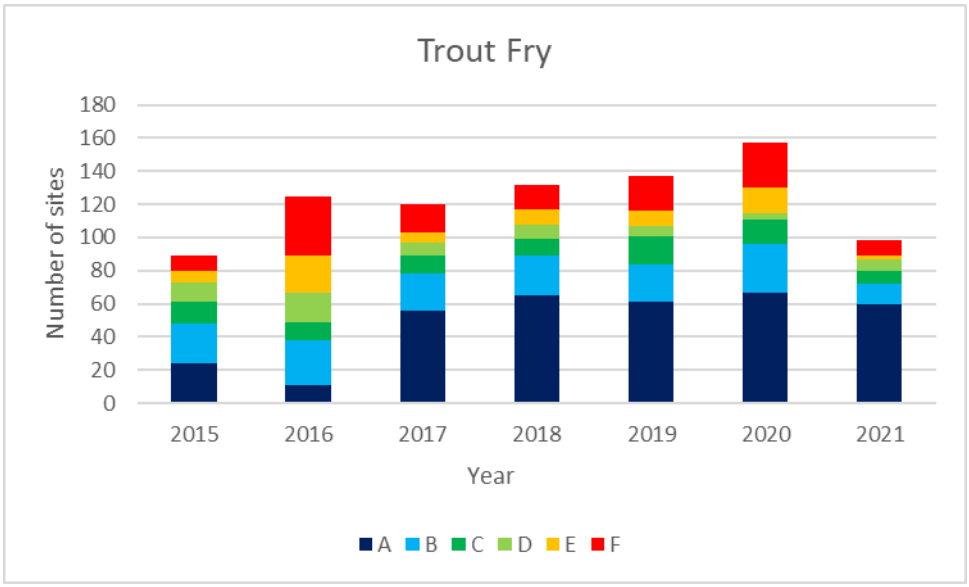

Figure 16: *Number of A-F NFCS classifications for trout fry across the seven years of surveys in the Derwent catchment.*

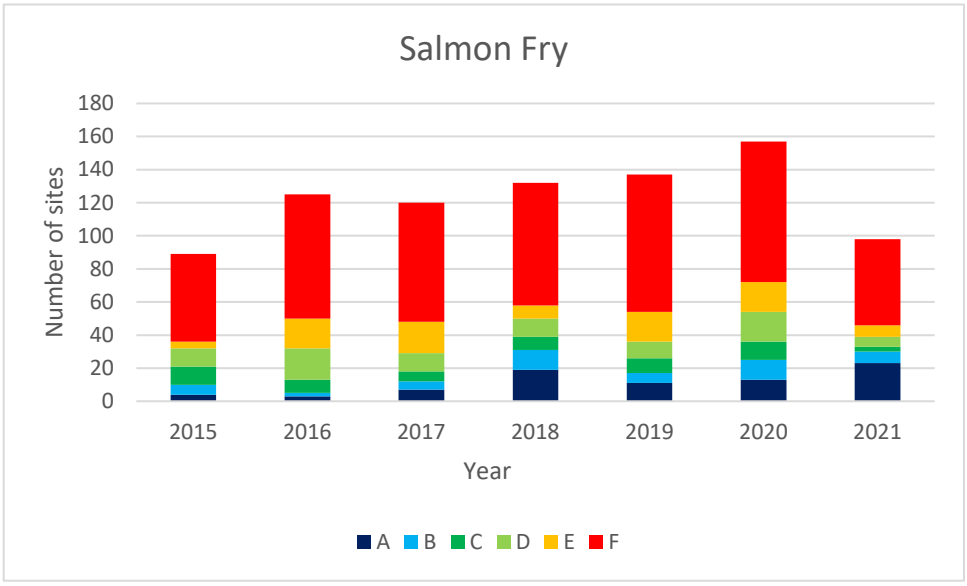

Figure 17: *Number of A-F NFCS classifications for salmon fry across the seven years of surveys in the Derwent catchment.*

5 Habitat Survey Classifications

5.1 Habitats Classification Results 2021

5.1.1 The habitat classifications for the 2021 surveys sites are shown in Figure 18 on page 25. Out of the 122 sites surveyed 37 (30%) were classed as Maintain, 78 (64%) were classed as Repair and 7 (6%) were classed as Restore.

5.1.2 The habitat data collected is vital to 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, across the years can be viewed on a map, with the ability to zoom into particular areas.

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

Derwent Habitat Classifications Dashboard

5.1.6 The platform currently only includes the habitat classifications from the 2020 and 2021 surveys.

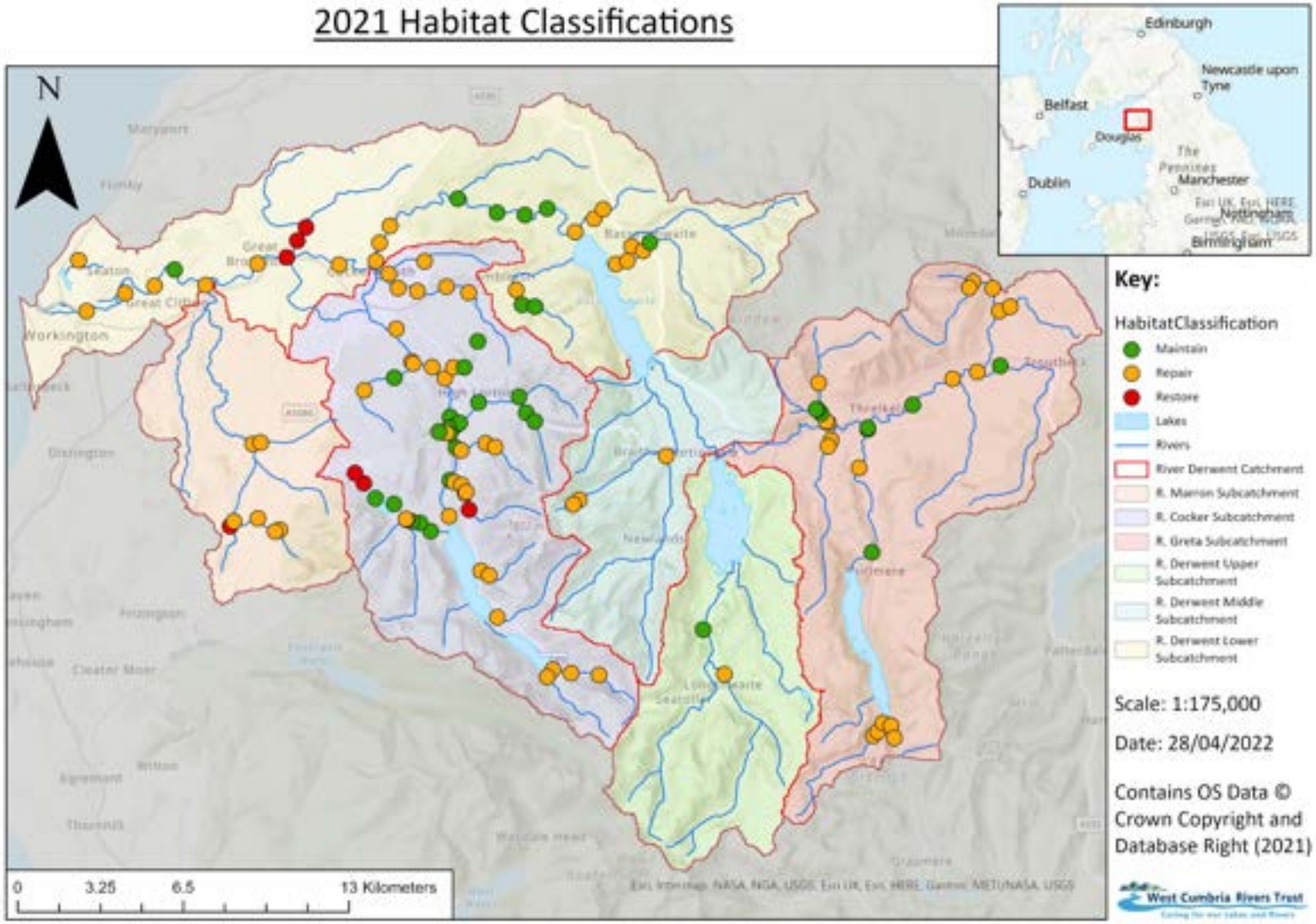

Figure 18: *Map showing the habitat classifications for the 2021 survey sites.*

6 A Case Study of Habitat Improvement Works – Blaze Beck

6.1 Introduction

6.1.1 This section outlines a brief case study of where works by WCRT and partner organisations have 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 that of Blaze Beck in the River Cocker sub-catchment.

6.2 Blaze Beck Case Study

6.2.1 Blaze Beck arises on Whinlatter Pass as three smaller watercourses, Whinlatter Gill, Hobcarton Gill and Littlethwaite Gill, which all flow off the surrounding fells such as Grisedale Pike, Hopegill Head, Ladyside Pike and Whinlatter (see Figure 20 on page 27). These tree becks converge to form Blaze Beck, which then flows in a northwestern direction before joining Aiken Beck and becoming Whit Beck. Whit Beck then flows west before joining the River Cocker in Lorton.

6.2.2 As part of our Cocker Catchment Natural Flood Management (NFM) Project funded by DEFRA, works were undertaken at Blaze Beck to reconnect it to its floodplain by creating a series of rapids. As well as having slow the flow benefits through ensuring the beck can utilise its floodplain in high flows (following disconnection through dredging in the past), it has also improved the habitat in this section by creating pools and rapids, mixed substrate and places of refuge. The trees planted in the large riparian corridor created will eventually provide shade and woody debris. Further, water quality will be improved by stock exclusion and creation of the large buffer strip.

6.2.3 Already the effects of this project are becoming evident with increased gravel storage, wetland areas developing on the floodplain, natural regeneration of vegetation on the banks and an increase in fish numbers following our latest survey. Figure 19 is a post works aerial image of the Blaze Beck restoration site.

6.2.4 Pre-works surveys deemed this site to be a category E, 'Poor' for trout fry and F, 'Absent' for salmon fry. Post-works surveys undertaken in 2021, saw a rise from 2 trout fry per 100m^2 to 341 trout fry per 100m^2 (a 16,950% increase), with the watercourse now classed as category A 'Excellent' for trout. Salmon cannot migrate upstream to this section of the watercourse due to the presence of natural waterfalls downstream, but the huge increase in trout fry present demonstrates the immediate success of the restoration works in terms of fish numbers.

Figure 19: *Aerial image of Blaze Beck restoration site, post works.*

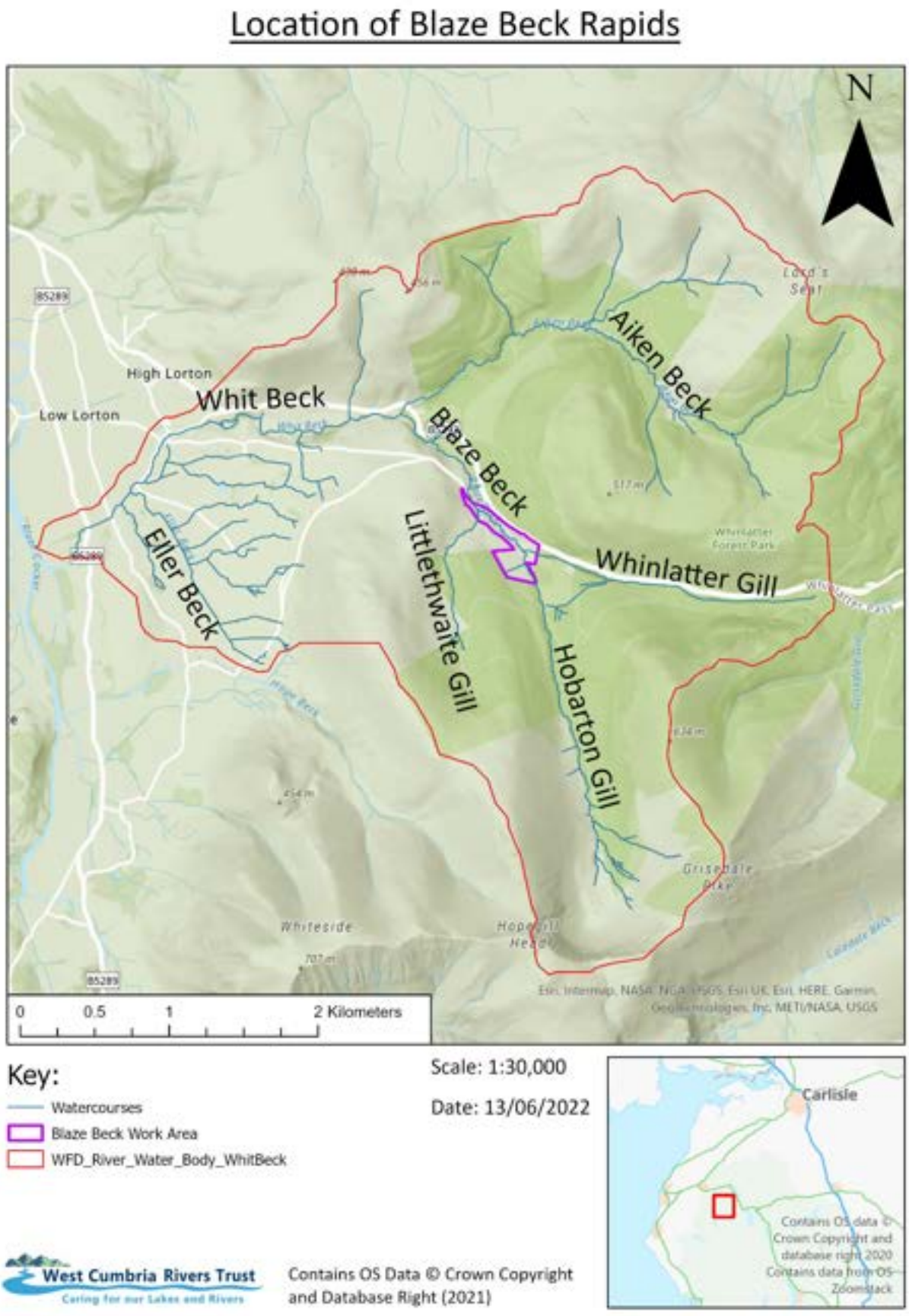

Figure 20: *Map showing the location of the Blaze Beck restoration site and the surrounding watercourses.*

7 Conclusion

7.1.1 This is the seventh year of surveying juvenile salmonids in the River Derwent catchment. Whilst the results cannot yet be used to detect long-term trends, a database is being compiled using the results, and minor comparisons between the years have been made (subject to various caveats).

7.1.2 In conclusion, the drought had a large impact on the 2021 survey season, changing the focus of the sites surveyed to larger, wider rivers where there was more water and flow. This is reflected in the results, with the number of salmon recorded increasing compared to 2020, whilst trout fry numbers recorded decreased slightly. This decrease in trout fry is most likely due to not being able to survey some of the smaller tributaries where they are usually found, due to the low flows, whereas the sites that were surveyed tended to the larger sites where salmon fry tend to dominate. Despite this, the decrease in trout fry numbers was small, and 2021 is still one of the better years for trout fry when comparing the full seven years of data. Whilst it is encouraging to see a higher number of salmon fry recorded, care should be taken in interpreting this as an upward trend in salmon fry numbers based on 2021 data alone, due to the impact of the drought on survey as discussed previously. Overall numbers of salmon are still much lower than historic levels.

7.1.3 Projects such as river restoration, habitat improvements and/or barrier removal/improvement remain an important tool in improving the salmon status in the 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. It is encouraging to see such an immediate and dramatic increase in trout numbers as a result of the Blaze Beck restoration works. 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).

7.1.4 More habitat improvement, fish easement and water quality projects are in the pipeline for 2022, and sites where works have already been undertaken in 2021, are due to be surveyed in the summer of 2022 for the first time post works. It will be interesting to see how fish numbers respond in these areas post-works.

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 Derwent Owners Association, Cockermouth Anglers Association, Keswick Anglers Association, The Isel Fishings Association, The National Trust, United Utilities, Lancaster University, Lord and Lady Egremont, the Green Recovery Challenge Fund and the Water Environment Grant funding scheme which is funded through the European Agricultural Fund for Rural Development. A breakdown of the costs of the 2021 survey season can be found in Appendix F, on page 39.
- The 2021 survey team including external support from two Lancaster University funded interns and two WCRT volunteer interns, and some of our regular WCRT volunteers who were able to join us once the Covid rules relaxed. Without this assistance, the project would have been unable to go ahead, and we are grateful for their dedication during difficult times.
- Adam Wheeler from Ribble Rivers Trust for his advice and help with regards to calibration.

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10 Appendix A: Survey Sheet

An example survey sheet used to record the fish and habitat data.

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)	

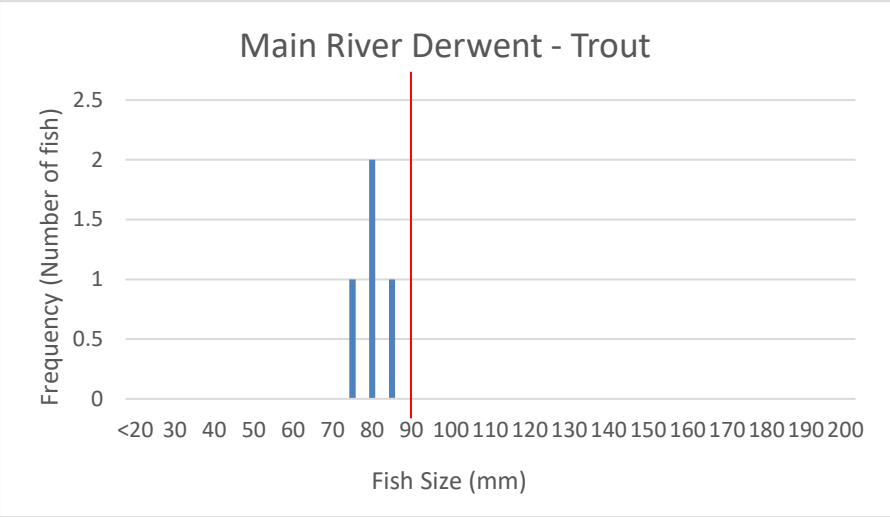
No of missed fish	
No of dead fish	

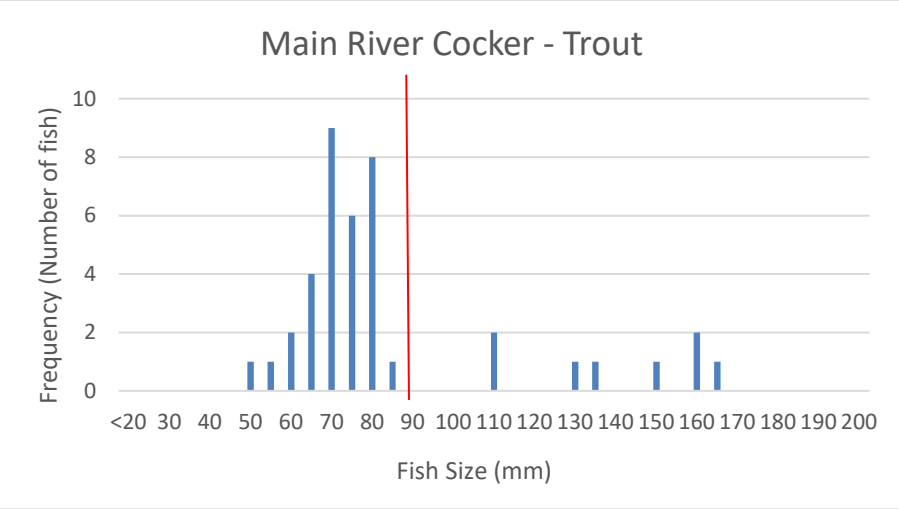
Notes:

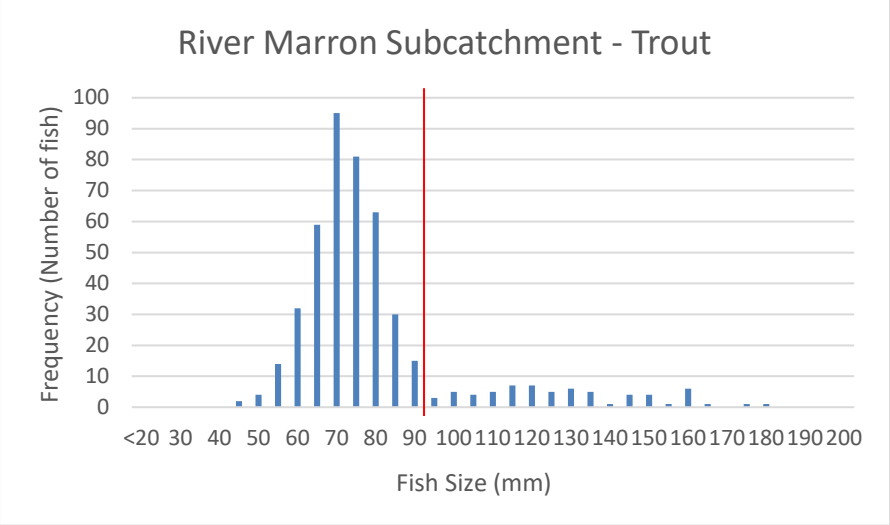
mm	Trout	Salmon
<20		
25		
30		
35		
40		
45		
50		
55		
60		
65		
70		
75		
80		
85		
90		
95		
100		
105		
110		
115		
120		
125		
130		
135		
140		
145		
150		
155		
160		
165		
170		
175		
180		
185		
190		
195		
200		
>200		

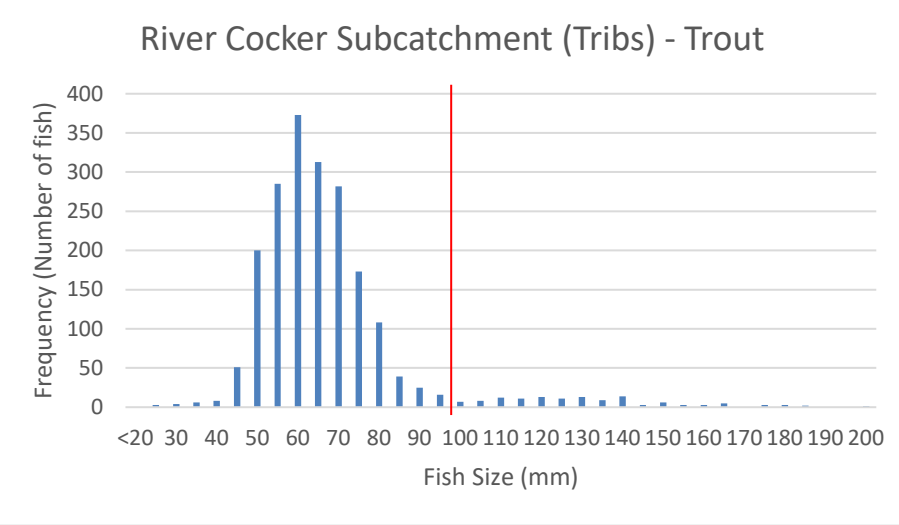
11 Appendix B: Fish Length Frequency Histograms

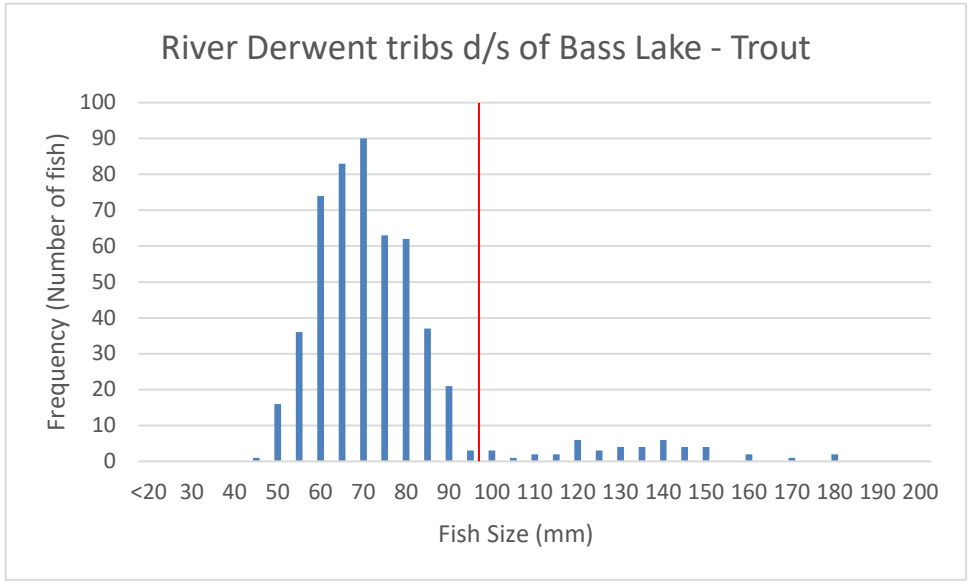
Histograms for boundaries between fry and parr class sizes, boundary depicted by the red line.

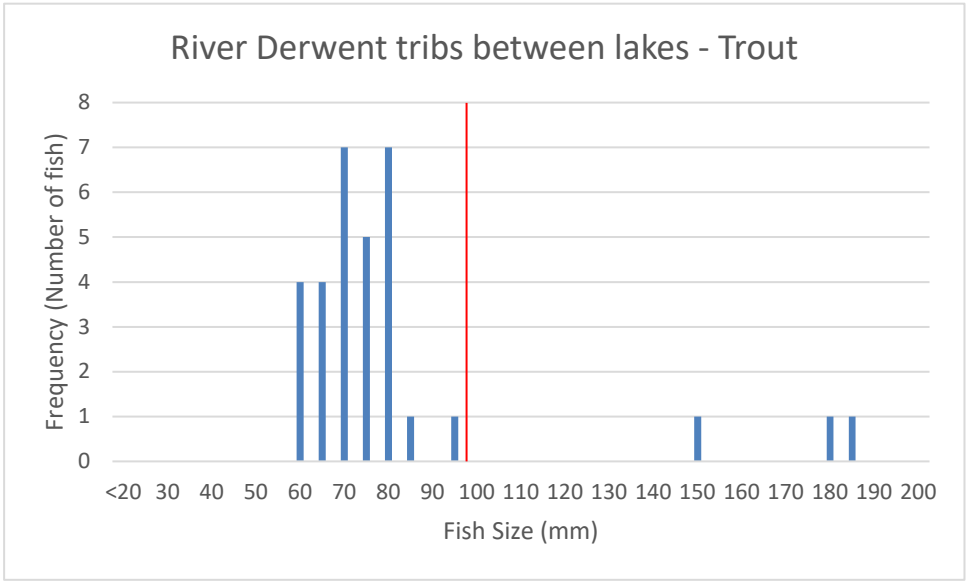


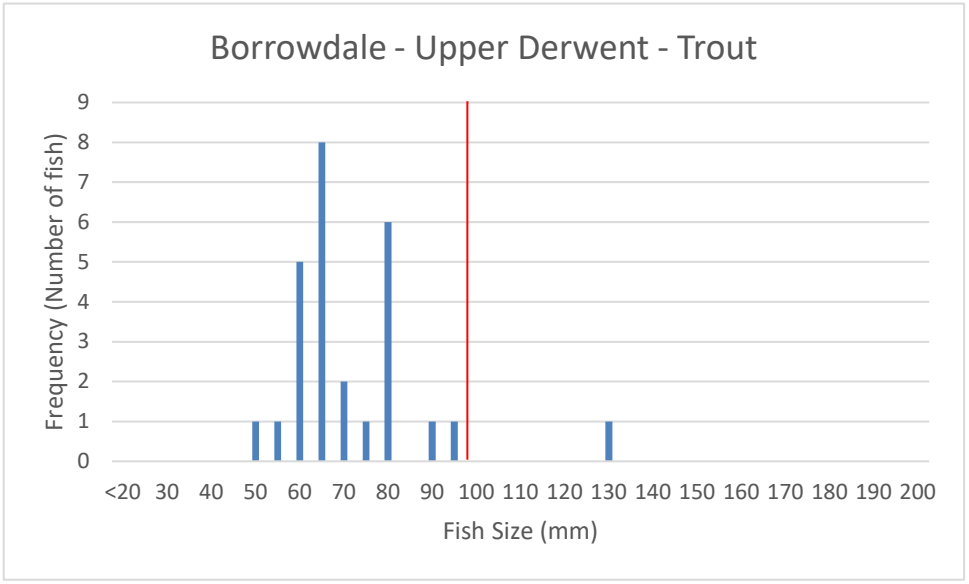


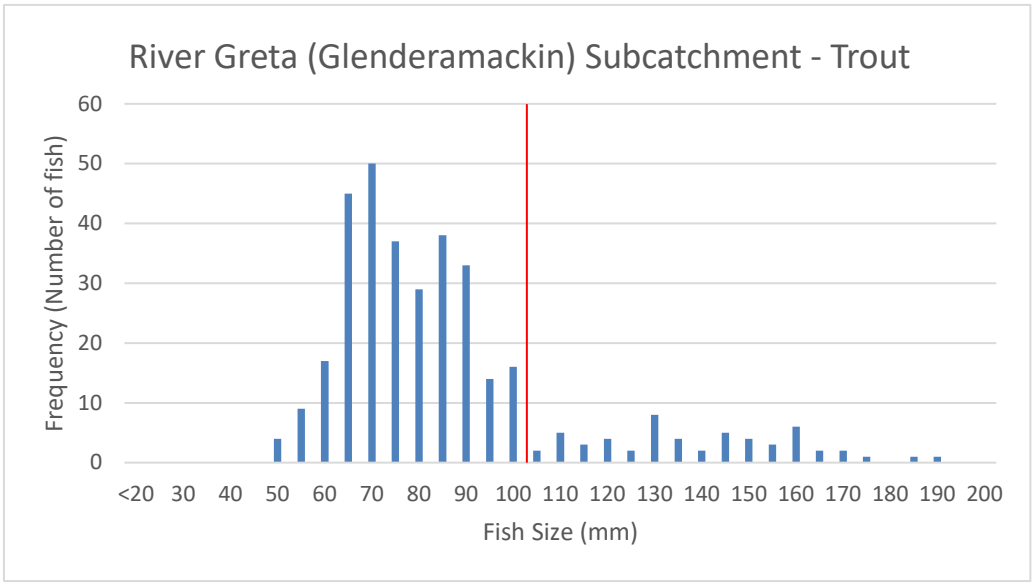


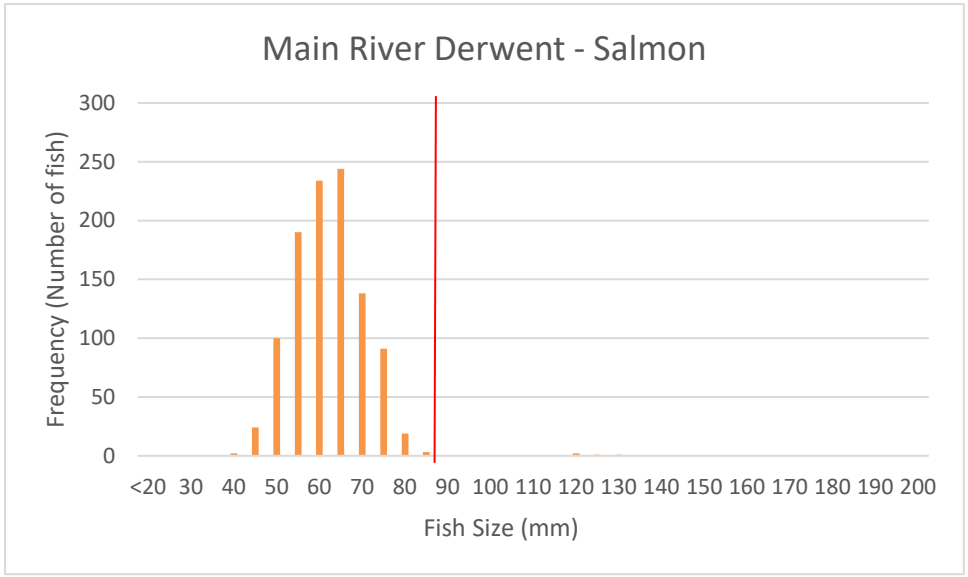


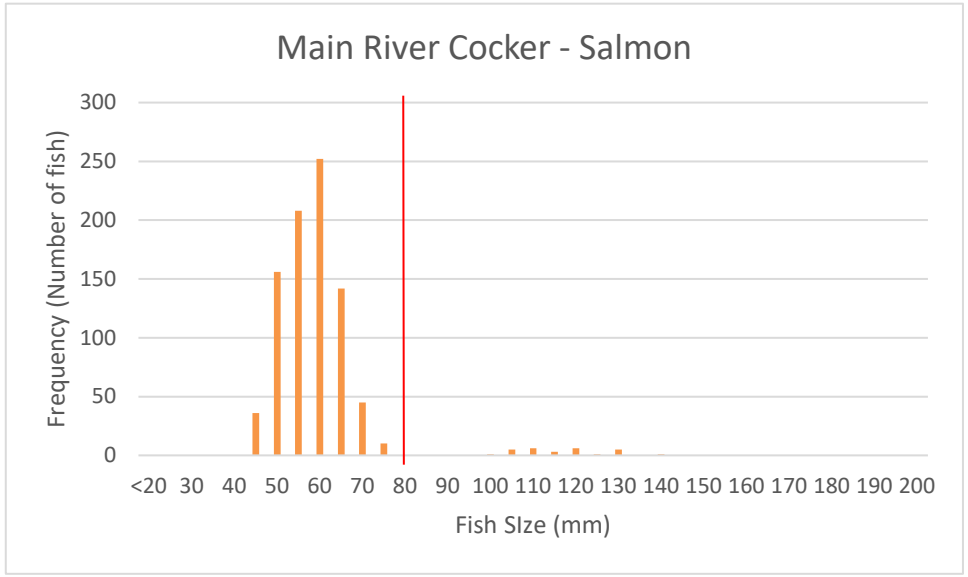

River Derwent tribs d/s of Bass Lake - Trout
Frequency (Number of fish)
0 10 20 30 40 50 60 70 80 90 100
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish Size (mm)

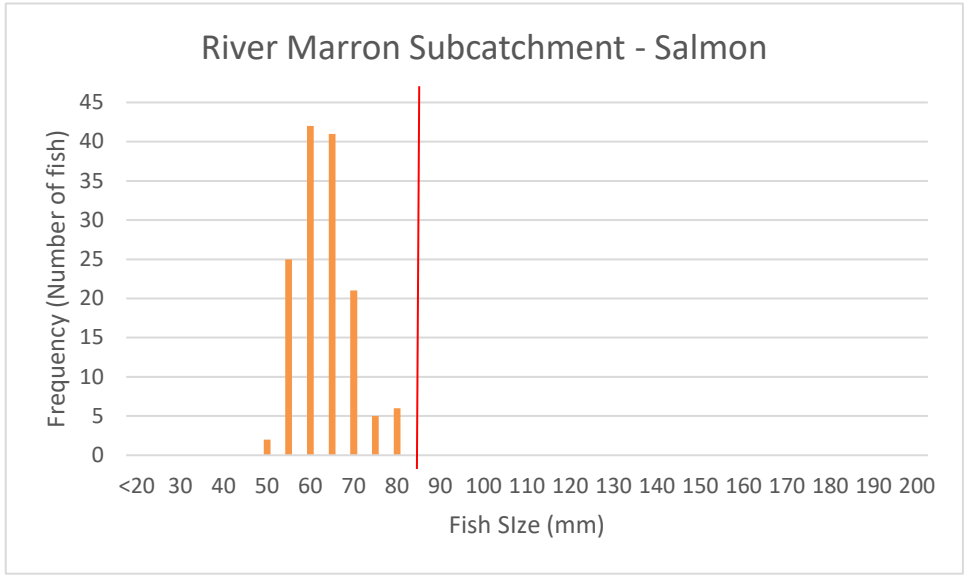

River Derwent tribs between lakes - Trout
Frequency (Number of fish)
0 1 2 3 4 5 6 7 8
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish Size (mm)

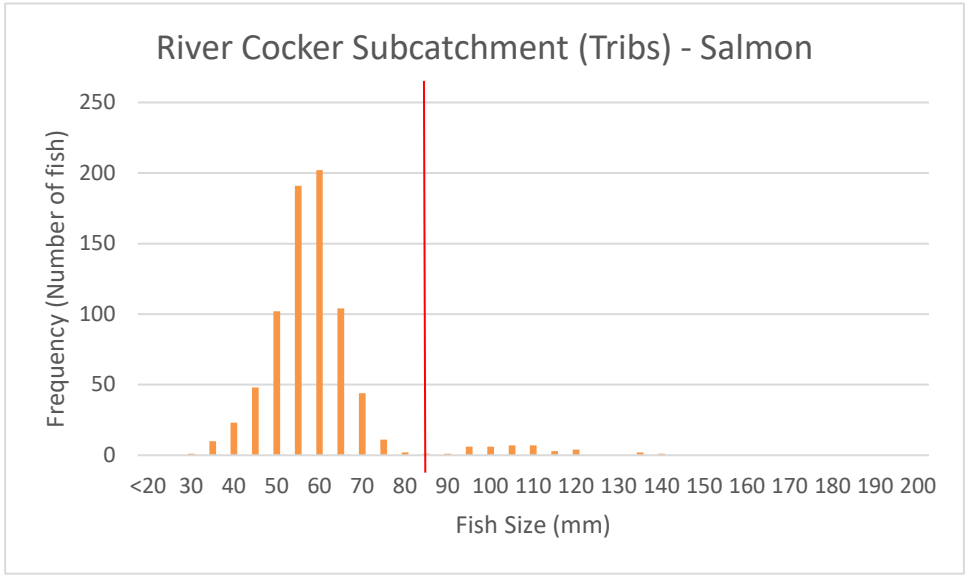

Borrowdale - Upper Derwent - Trout
Frequency (Number of fish)
0 1 2 3 4 5 6 7 8 9
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish Size (mm)

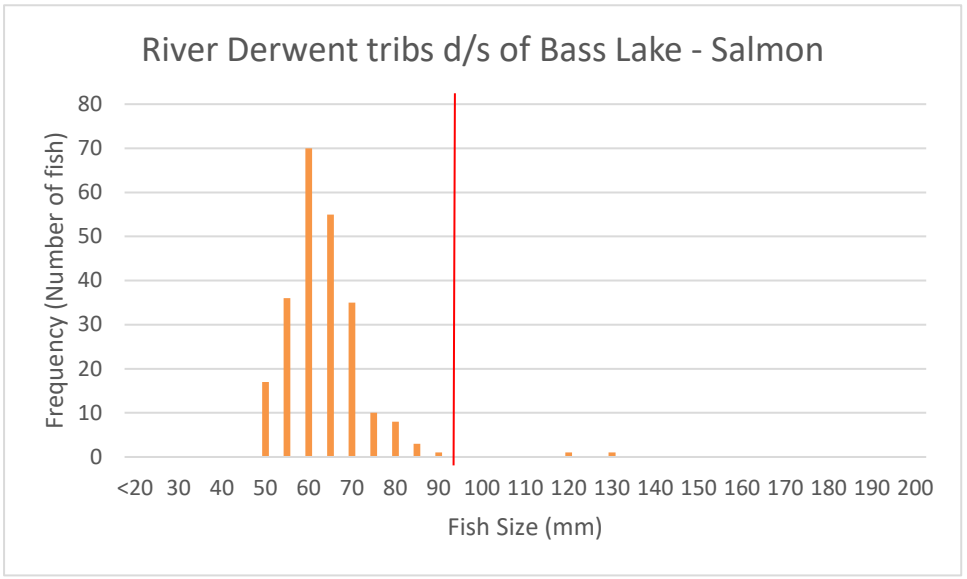

River Greta (Glenderamackin) Subcatchment - Trout
Frequency (Number of fish)
0 10 20 30 40 50 60
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish Size (mm)

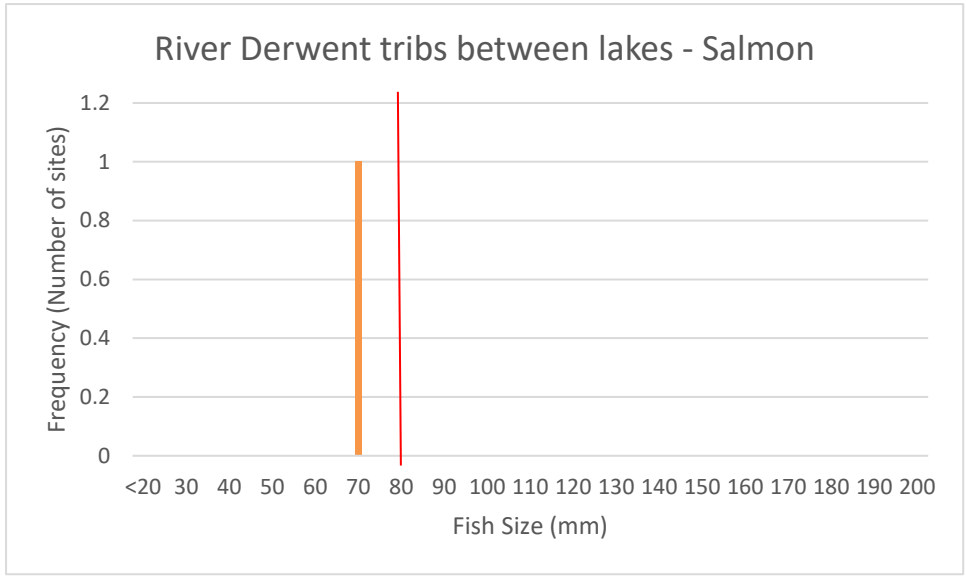

Main River Derwent - Salmon
Frequency (Number of fish)
300
250
200
150
100
50
0
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish Size (mm)

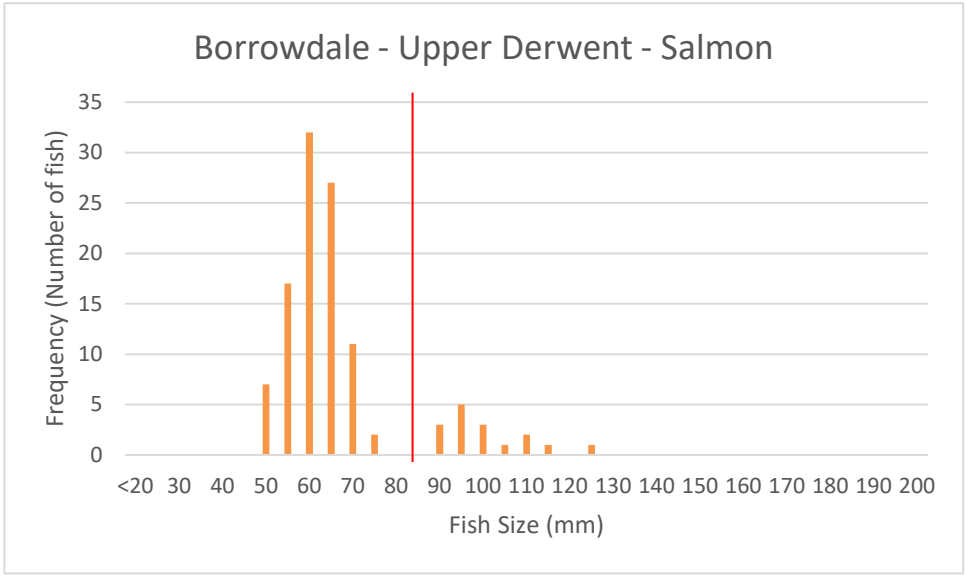

Main River Cocker - Salmon
Frequency (Number of fish)
300
250
200
150
100
50
0
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish SIze (mm)

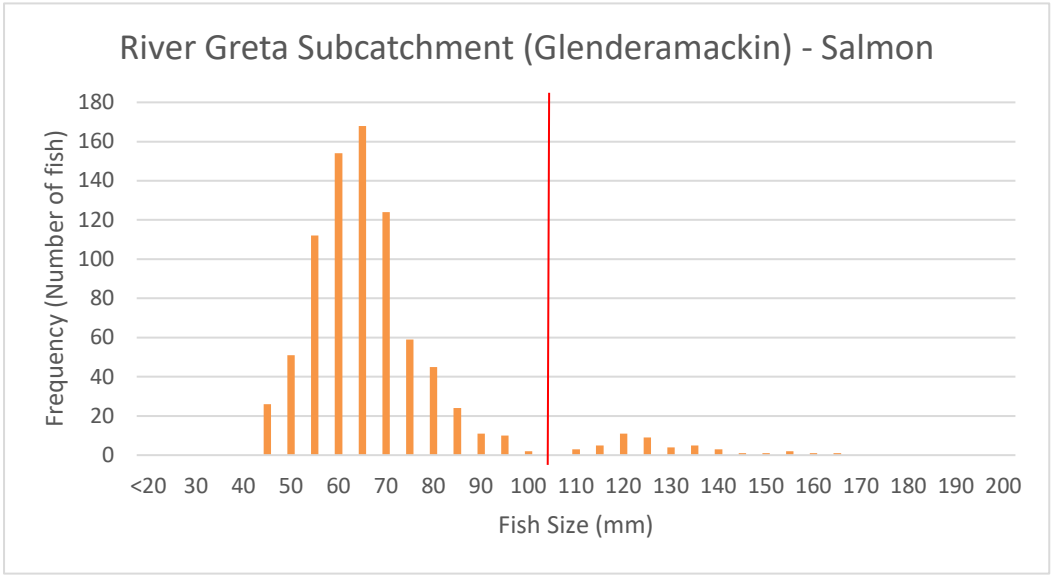

River Marron Subcatchment - Salmon
Frequency (Number of fish)
45
40
35
30
25
20
15
10
5
0
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish SIze (mm)


River Cocker Subcatchment (Tribs) - Salmon
Frequency (Number of fish)
250
200
150
100
50
0
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish Size (mm)


River Derwent tribs d/s of Bass Lake - Salmon
Frequency (Number of fish)
0 10 20 30 40 50 60 70 80
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish Size (mm)


River Derwent tribs between lakes - Salmon
Frequency (Number of sites)
0 0.2 0.4 0.6 0.8 1 1.2
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish Size (mm)


Borrowdale - Upper Derwent - Salmon
Frequency (Number of fish)
0 5 10 15 20 25 30 35
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish Size (mm)


River Greta Subcatchment (Glenderamackin) - Salmon
Frequency (Number of fish)
0 20 40 60 80 100 120 140 160 180
<20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200
Fish Size (mm)

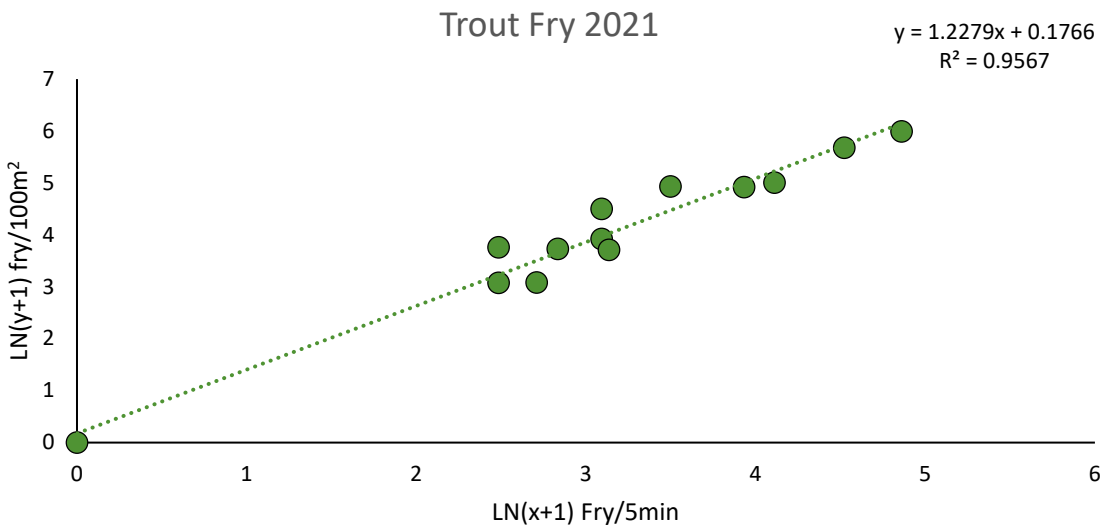
12 Appendix C: Regression Correlation Graphs

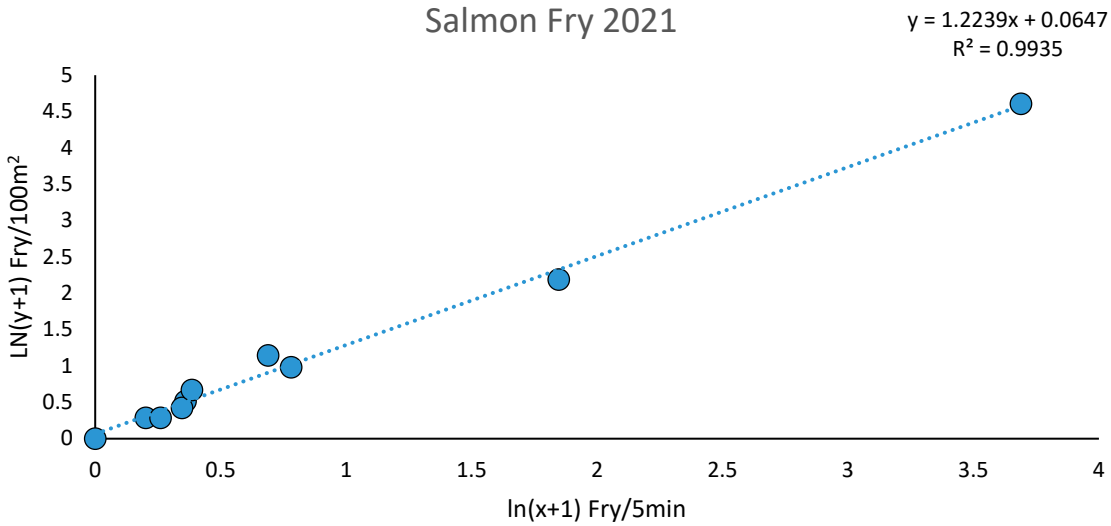
Regression correlation graphs used to determine the calibration equations used to extrapolate semi-quantitative data to 100m^2.

Where:

x is 5 min fry result

y is number fry per100m^2





13 Appendix D: Habitat Classification Scoring Matrix

Scoring matrix for habitat classifications.

Good Habitat Criteria	Score 1 point if present
Water Quality	
Clarity - clear	1
Conductivity - low	1
Minimal silt/ sources of silt	1
No pollution sources (mine, sewage, septic, misconnections, building works, manure/slurry, etc)	1
Invertebrates present	1
In river habitat	
Pool-riffle flow regime	1
In-river vegetation present	1
Good gravel substrate	1
Large woody debris present	1
No barriers to fish migration	1
Not modified (not historically dredged, not straightened, no embankments, etc.)	1
Bankside habitat	
Tree roots and/or overhanging vegetation	1
Dappled shade	1
No bank protection	1
No Invasive Non Native Species (INNS)	1
No stock access	1
Maximum Total Score	**16**

14 Appendix E: Summary table of WCRT semi-quantitative electrofishing data

	2015		2016		2017		2018		2019		2020		2021	
	2015 Trout	**2015 Salmon**	**2016 Trout**	**2016 Salmon**	**2017 Trout**	**2017 Salmon**	**2018 Trout**	**2018 Salmon**	**2019 Trout**	**2019 Salmon**	**2020 Trout**	**2020 Salmon**	**2021 Trout**	**2021 Salmon**
Number of sites surveyed	89		138		120		157		161		162		122	
Total number of fry recorded	846	482	451	461	1741	597	2022	4011	2138	2155	2580	1372	3146	3889
Total number of parr recorded	325	72	163	90	134	72	584	232	502	320	635	199	304	133
Total numbers of salmonids recorded	1171	554	614	551	1875	669	2606	4243	2640	2475	3215	1571	3450	4022
Number of sites with fry	80	36	92	61	103	48	127	83	125	78	130	77	98	70
Average number of fry per site	10	5	3	3	15	5	13	26	13	13	16	8	26	32
Number of sites with no salmonids present	4	46	29	66	10	63	23	67	23	67	14	72	20	47
Number of sites with no fish present	0		2		3		3		3		3		3	
	2015		2016		2017		2018		2019		2020		2021	
	2015 Trout	**2015 Salmon**	**2016 Trout**	**2016 Salmon**	**2017 Trout**	**2017 Salmon**	**2018 Trout**	**2018 Salmon**	**2019 Trout**	**2019 Salmon**	**2020 Trout**	**2020 Salmon**	**2021 Trout**	**2021 Salmon**
Non-main river sites - fry	846	482	445	347	1741	597	1993	2101	2103	816	2580	1252	3106	1965
Average number of fry per non-main river site	10	5	4	3	15	5	15	16	15	6	16	8	32	20
Number of non-main river sites	89		125		120		132		137		157		98	
Main river site – fry	0	0	6	114	0	0	29	1910	35	1339	0	120	40	1924
Average number of fry per main river site	0	0	0.5	9	0	0	1	76	1.5	56	0	24	1.5	80
Number of main river sites	0		13		0		25		24		5		24	

15 Appendix F: 2021 Project Finances

Financial breakdown of the cost of running the survey programme in 2021.

2021 Income	
Green Recovery Challenge Fund	£3,668
Water Environment Grant (WEG)	£2,342
National Trust - Riverlands Project	£3,000
Derwent Owners Association	£2,000
Angling Associations	£1,300
United Utilities - Thirlmere Resilience Project	£213
Consultancy Work	£2,909
Lancaster University (in kind)	£2,744
Total	**£18,176**

2021 Expenditure	
Staff costs	£17,092
Travel and subsistence	£1,186
Equipment costs	£561
Other	£85
Total	**£18,424**

16 Appendix G: 2021 Raw Fish Data

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
06/07/2021	River Derwent	NY 15466 33551	0	0	146	0	12	0	0	7	0	0	0	0
06/07/2021	River Glenderamackin	NY 3646 3003	23	4	5	2	0	0	0	0	0	0	0	0
06/07/2021	River Glenderamackin	NY 3568 3029	12	2	0	4	0	0	0	0	0	0	0	0
06/07/2021	River Glenderamackin	NY 3553 3005	7	4	0	3	0	0	0	0	0	0	0	0
06/07/2021	Barrow Beck	NY 3671 2913	2	0	0	0	Pres	0	0	Pres	Pres	Pres	0	0
06/07/2021	Barrow Beck	NY 3714 2931	4	0	3	0	Pres	0	0	Pres	Pres	Pres	0	0
08/07/2021	River Derwent	NY 12242 31098	0	0	57	0	19	0	0	2	0	0	0	0
08/07/2021	River Derwent	NY 03569 30130	0	0	11	0	43	0	0	11	1	0	0	0
08/07/2021	River Derwent	NY 00584 31137	0	0	167	0	27	0	0	24	3	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
09/07/2021	River Derwent	NY 12393 31816	0	0	58	1	28	0	0	23	0	0	0	0
09/07/2021	River Derwent	NY 12807 32481	0	0	102	0	34	0	0	3	0	0	0	0
09/07/2021	River Derwent	NY 17003 32993	0	0	52	0	19	0	0	5	2	0	0	0
09/07/2021	River Derwent	NY 18093 32903	0	0	28	0	38	0	0	20	0	0	0	0
12/07/2021	River Derwent	NY 00897 29126	3	0	2	1	33	0	0	6	0	0	0	Flounder - 16
13/07/2021	River Derwent	NY 07596 31000	0	0	73	0	7	0	0	39	0	0	0	0
13/07/2021	River Derwent	NY 04355 30760	0	0	41	0	26	0	0	22	0	0	0	0
13/07/2021	River Derwent	NY 02411 29845	0	0	3	0	19	0	0	75	0	0	0	0
14/07/2021	River Derwent	NY 05565 30155	0	0	104	0	8	0	0	58	0	0	0	0
14/07/2021	River Derwent	NY 18972 33168	1	0	44	0	27	0	0	2	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
16/07/2021	River Derwent	NY 10803 30952	0	0	157	2	26	0	0	14	8	0	0	0
19/07/2021	River Cocker	NY 14950 26490	6	0	166	4	0	0	0	13	1	0	0	0
19/07/2021	River Cocker	NY 13652 27147	0	0	92	0	2	0	0	12	0	0	0	0
20/07/2021	River Cocker	NY 15389 23770	1	0	154	0	3	0	0	1	0	0	0	0
20/07/2021	River Cocker	NY 15147 22492	3	2	71	2	4	0	0	5	0	0	0	0
21/07/2021	River Cocker	NY 15120 21085	0	1	1	4	16	0	0	0	17	0	0	0
23/07/2021	River Cocker	NY 14451 26932	8	4	117	8	4	0	0	10	0	0	0	0
23/07/2021	River Cocker	NY 15231 24804	6	0	60	1	2	0	0	2	0	0	0	0
26/07/2021	River Cocker	NY 13052 28434	8	1	188	9	0	0	0	22	0	0	0	0
26/07/2021	River Marron	NY 07409 23922	38	1	82	0	3	0	0	0	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
26/07/2021	St John's Beck	NY 31709 19669	0	0	103	7	0	0	0	2	4	0	0	0
27/07/2021	St John's Beck	NY 31214 22982	7	2	216	6	1	0	0	4	1	0	0	0
27/07/2021	River Glenderamackin	NY 33310 25464	9	2	61	4	1	0	26	18	9	0	0	0
27/07/2021	River Glenderamackin	NY 31553 24559	3	0	96	0	2	0	0	6	13	12	0	0
28/07/2021	Chapel Beck	NY 22735 31497	72	1	9	0	3	0	0	1	0	0	0	0
28/07/2021	Coal Beck	NY 21171 33128	38	1	0	0	0	0	0	2	0	0	0	0
28/07/2021	Wythop Beck	NY 18505 29313	74	4	0	0	0	0	0	0	0	0	0	0
29/07/2021	Gatesgarthdale Beck	NY 21002 14846	149	1	0	0	1	0	0	0	0	0	0	0
29/07/2021	Gatesgarthdale Beck	NY 19902 14926	117	1	0	0	1	0	0	0	0	0	0	0
29/07/2021	Gatesgarthdale Beck	NY 19200 15052	54	1	0	0	0	0	0	0	53	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
29/07/2021	Warnscale Beck	NY 18973 14769	33	0	25	0	0	0	0	0	42	0	0	0
03/08/2021	Whit Beck	NY 15167 24990	37	0	21	1	0	0	0	1	3	32	0	0
03/08/2021	Whit Beck	NY 15375 24634	36	1	24	0	2	0	0	1	9	10	0	0
03/08/2021	Whit Beck	NY 15541 24753	21	1	71	2	0	0	0	1	0	0	0	0
04/08/2021	Park Beck	NY 14392 20495	20	1	77	5	1	0	0	8	2	0	0	0
04/08/2021	Park Beck	NY 13972 20822	34	0	32	3	1	0	0	1	0	0	0	0
04/08/2021	Park Beck	NY 13653 20886	23	5	61	1	3	0	0	2	0	0	0	0
04/08/2021	Whit Beck	NY 16274 25553	49	6	111	6	2	0	0	0	0	0	0	0
05/08/2021	St John's Beck	NY 31555 24491	11	0	57	0	4	0	0	1	1	3	6	0
09/08/2021	Hope Beck	NY 16920 23801	21	10	0	0	0	0	0	0	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
09/08/2021	Hope Beck	NY 16242 23954	81	3	1	0	0	0	0	0	0	0	0	0
09/08/2021	Hope Beck	NY 16562 23944	66	17	0	0	0	0	0	0	0	0	0	0
09/08/2021	Blaze Beck	NY 18144 25139	43	1	0	0	0	0	0	0	0	0	0	0
09/08/2021	Blaze Beck	NY 17861 25773	117	5	1	0	0	0	0	0	0	0	0	0
10/08/2021	Blaze Beck	NY 18487 24807	128	6	0	0	0	0	0	1	0	0	0	0
11/08/2021	Rannerdale Beck	NY 16360 18942	36	5	0	0	0	0	0	0	0	0	0	0
11/08/2021	Rannerdale Beck	NY 16695 18766	38	2	0	0	0	0	0	0	0	0	0	0
11/08/2021	Liza Beck	NY 15906 21334	2	2	0	0	0	0	0	0	0	0	0	0
11/08/2021	Liza Beck	NY 15606 22315	20	3	0	0	0	0	0	0	0	0	0	0
11/08/2021	Liza Beck	NY 15739 21981	7	1	0	0	0	0	0	0	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
11/08/2021	Unnamed adj. Liza Beck	NY 15784 22031	11	4	0	0	0	0	0	0	0	0	0	0
12/08/2021	Sandy Beck	NY 11783 26021	112	1	5	5	0	0	0	0	0	0	0	0
12/08/2021	Black Beck	NY 07733 23976	48	2	0	0	0	0	0	0	0	4	0	0
12/08/2021	Wood Beck	NY 07622 21000	60	8	0	0	2	0	0	0	0	0	0	0
13/08/2021	Mill Beck/ Sail Beck	NY 17012 17115	57	0	0	0	0	0	0	0	19	0	0	0
13/08/2021	Rakegill Beck	NY 08284 20473	58	7	0	0	4	0	0	0	0	0	0	0
13/08/2021	Wisenholme Beck	NY 08475 20552	30	12	0	0	0	0	0	0	0	0	0	0
13/08/2021	Wood Beck	NY 06680 20884	56	18	49	0	2	0	0	0	0	0	0	0
13/08/2021	River Marron	NY 06524 20691	105	18	11	0	2	0	0	0	0	0	0	0
17/08/2021	Tom Rudd Beck	NY 13126 30039	17	7	0	0	2	0	0	16	1	35	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
17/08/2021	Tom Rudd Beck	NY 13873 29910	48	4	0	0	3	0	0	16	26	2	0	0
17/08/2021	Tom Rudd Beck	NY 15884 29856	56	2	0	0	0	0	0	4	0	3	0	0
17/08/2021	Bitter Beck	NY 12754 30604	46	10	0	1	1	0	0	25	0	1	0	0
17/08/2021	Bitter Beck	NY 14159 31093	50	9	0	0	0	0	0	0	0	0	0	0
18/08/2021	Tom Rudd Beck	NY 15012 30090	41	1	0	0	0	0	0	2	2	6	0	0
18/08/2021	Cass How Ditch	NY 15284 26923	0	0	0	0	0	0	0	0	0	0	0	0
18/08/2021	Cass How Ditch	NY 15711 26920	0	0	0	0	0	0	0	0	0	0	0	0
18/08/2021	Sandy Beck	NY 12978 26531	54	4	40	1	0	0	0	3	0	0	0	0
18/08/2021	Sandy Beck	NY 13716 27070	19	0	26	0	2	0	0	38	4	51	0	0
19/08/2021	Broughton Beck	NY 09500 32417	4	0	2	0	5	0	0	145	82	300	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
19/08/2021	Broughton Beck	NY 09164 31908	1	0	12	0	1	0	0	301	113	33	0	Bleak - 6
19/08/2021	Broughton Beck	NY 08754 31246	6	1	9	0	0	0	0	315	2	5	0	0
24/08/2021	Meregill Beck	NY 15110 24540	49	1	5	1	2	0	0	0	7	9	0	0
24/08/2021	Meregill Beck	NY 15145 24312	33	0	0	0	1	0	0	0	0	0	0	0
24/08/2021	Meregill Beck	NY 14718 24396	3	3	0	0	1	0	0	0	0	0	0	0
24/08/2021	Meregill Beck	NY 15014 24353	91	1	0	1	2	0	0	0	0	0	0	0
25/08/2021	Hope Beck	NY 15589 23671	50	0	44	1	1	0	0	0	0	0	0	0
25/08/2021	Liza Beck	NY 15320 22413	11	0	166	6	2	0	0	1	0	0	0	0
26/08/2021	Coal Beck	NY 20806 32755	21	1	0	0	0	0	0	10	0	0	0	0
27/08/2021	Dub Beck	NY 13433 20974	0	3	0	0	8	0	0	0	7	0	0	Pike - 1

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
27/08/2021	High Nook Beck	NY 13458 20939	2	2	25	2	1	0	0	1	102	0	0	0
27/08/2021	Holme Beck	NY 12229 21786	0	1	0	0	2	0	0	0	12	0	0	0
27/08/2021	Crabtree Beck	NY 12961 21560	0	2	0	1	0	0	0	0	8	0	0	0
27/08/2021	Dub Beck	NY 11773 22371	0	0	0	0	0	0	0	4	Hundreds	0	0	0
27/08/2021	Dub Beck	NY 11429 22772	0	0	0	0	0	0	0	0	2	0	0	0
07/09/2021	Glenderaterra Beck	NY 29707 25110	18	7	0	0	0	0	0	0	0	0	0	0
07/09/2021	Glenderaterra Beck	NY 29574 25273	19	0	0	0	0	0	0	0	0	0	0	0
07/09/2021	Whit Beck	NY 29519 25283	22	1	0	0	0	0	0	0	0	0	0	0
07/09/2021	Glenderaterra Beck	NY 29618 26320	13	10	3	1	0	0	0	0	0	0	0	0
02/09/2021	Chapel Beck	NY 23007 31828	32	6	14	0	0	0	0	0	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
03/09/2021	Dash Beck	NY 21675 20980	22	2	31	0	2	0	0	0	30	0	0	0
02/09/2021	Dash Beck	NY 22279 31687	13	4	88	2	0	0	0	0	0	0	0	0
03/09/2021	Chapel Beck	NY 22116 31098	24	1	49	0	0	0	0	0	1	0	0	0
08/09/2021	Glenderaterra Beck	NY 29924 24809	16	4	62	3	0	0	0	1	0	0	0	0
08/09/2021	River Greta	NY 29997 24745	4	0	30	2	1	0	0	6	2	0	0	0
09/09/2021	River Derwent	NY 25089 16632	21	1	39	4	1	0	0	25	10	0	0	0
09/09/2021	Stonethwaite Beck	NY 25923 14878	5	0	57	12	1	0	0	10	0	0	0	0
13/09/2021	Wythop Beck	NY 17981 29382	109	3	0	0	1	0	0	0	0	0	0	0
13/09/2021	Wythop Beck	NY 17762 29956	50	11	0	0	1	0	0	0	0	0	0	0
13/09/2021	Coal Beck	NY 20073 32242	20	9	21	0	7	0	0	24	125	0	0	Bleak - 11

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
14/09/2021	Trout Beck	NY 35855 26743	17	1	3	0	3	0	0	22	38	0	0	0
14/09/2021	River Glenderamackin	NY 34882 26478	4	0	71	5	2	0	0	96	3	0	0	0
14/09/2021	Trout Beck	NY 36754 26990	2	1	9	1	0	0	3	24	17	0	0	0
14/09/2021	Naddle Beck	NY 29999 23829	1	0	28	0	0	0	0	43	41	0	0	0
15/09/2021	Coledale Beck	NY 20001 21553	0	0	0	0	0	0	0	0	0	0	0	0
15/09/2021	Coledale Beck	NY 20237 21728	3	3	0	0	0	0	0	0	0	0	0	0
15/09/2021	Coledale Beck	NY 23638 23439	26	0	1	0	0	0	0	3	1	0	0	0
17/09/2021	Naddle Beck	NY 30120 24069	14	4	39	8	0	0	0	8	8	0	0	0
20/09/2021	Wyth Burn	NY 31763 12466	8	3	0	0	0	0	0	0	35	0	0	0
20/09/2021	Wyth Burn	NY 31932 12621	27	4	0	0	0	0	0	0	14	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eels	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Crayfish	Other
20/09/2021	Wyth Burn	NY 32137 12966	15	3	0	0	0	0	0	0	51	0	0	0
20/09/2021	Raise Beck	NY 32586 12370	9	0	0	0	0	0	0	0	0	0	0	0
20/09/2021	Raise Beck	NY 32461 12859	25	3	0	0	0	0	0	0	0	0	0	0