West Cumbria Rivers Trust

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River Derwent Fish and
Habitat Surveys Project

Fish and Habitat Survey Report 2020

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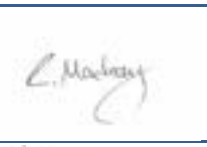
Author:	Ruth Mackay – Project Officer	
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The focus of this report is the River Derwent and its tributaries, other fish and habitat surveys are conducted by West Cumbria Rivers Trust in other areas of West Cumbria, and the data and reports for these are 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 sixth 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 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 working upstream in a zig zag pattern for 5 minutes (the constant variable between survey sites); this is the time that the electric current in the water is on. 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 such as 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 are also recorded. Surveys are conducted between July and September and sites are selected based on a number of factors.

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).

1.1.4 Spatial and temporal trends are then determined in the context of the whole catchment, but these trends, especially the temporal ones, are to be viewed with the following caveats in mind:

- Fish populations are extremely variable, particularly salmonids which are migratory species and 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 being post Storm Desmond which brought large-scale flooding during spawning season; and the 2018 & 2019 survey seasons, starting in drought conditions, with many becks and tributaries being bone dry or reduced to a trickle.
- The number of survey sites has increased 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.

1.1.5 During the 2020 survey season, WCRT conducted surveys at a total of 162 sites. In total, 4,786 salmonids were recorded, of which 3,215 were trout and 1,571 were salmon. These numbers can be broken down further into fry and parr numbers; 2,580 were trout fry and 1,372 were salmon fry (fry being less than a year old); and 635 were trout parr and 199 were salmon parr (parr being young fish over a year old). Of the total 162 sites surveyed, 130 sites (80%) had trout fry present and 77 sites (48%) had salmon fry present.

1.1.6 In order to compare the data across the six years of surveys, the data has been broken down into main river sites and non-main river sites. This is because the main river sites haven't been surveyed every year and can skew the trend lines. The main river sites also tend to be where the preferred salmon fry habitat can be found and usually where good numbers of salmon fry are recorded. Unfortunately, in 2020 due to high river levels in July, August and most of September, very few main river sites were surveyed.

1.1.7 The temporal trend lines for the non-main river sites, show that trout fry appear to be making modest gains since the surveys began, with 2020 being the best year for trout fry in the tributaries so far and are maintaining a presence in most watercourses. Salmon fry, on the other hand, were recorded in relatively low numbers for the first 3 years of the surveys, before numbers increased significantly in 2018, before decreasing slightly in 2019, and increasing again in 2020; 2020 was the second best year in the tributaries for salmon fry out of the six years and reflects the suitable conditions of that spawning season.

1.1.8 The spatial distributions are similar to previous years and showed that the majority of trout fry were found in the tributaries and the upper reaches of the catchments, whereas the salmon fry were mainly found in well-known spawning tributaries such as Whit Beck - Lorton, the River Glenderamackin and St John's Beck.

1.1.9 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. The data also helps to identify areas that are underperforming due to factors other than poor habitat, such as poor water quality. The habitat data helps to build up the picture of what is going on at individual sites but also within the overall catchment. This habitat database is then used to inform WCRT and partners where habitat work would provide the greatest benefit for fish populations. All the data recorded is adding to the fish and habitat databases that will ultimately be used to determine long-term trends and the effects of climate change and other factors on fish populations and the wider catchment.

1.1.10 To make the data more accessible, WCRT have created two online dashboards where the fish classifications and habitat classifications for the survey sites can be viewed across the years, with the ability to zoom into areas of interest.

The fish classifications can be found here:

https://arcg.is/1bbuj8

and the habitat classifications here:
https://www.arcgis.com/apps/dashboards/9ef98b1158e445d1bf779f18345f585b

Currently only the 2020 classifications are available but the previous years will be added shortly.

1.1.11 The River Derwent Fish and Habitat Survey Project in 2020 was funded through a variety of funding sources including; the Water Environment Grant funding scheme which is funded through the European Agricultural Fund for Rural Development (surveys within the River Cocker and Glenderamackin catchments only), The National Trust, The Hadfield Trust, United Utilities, the Derwent Owners Association, Cockermouth Anglers Association, Keswick Anglers Association, Bowland Game Fishing Association and Lancaster University.

1.1.12 A small team was set up to undertake the surveys during the COVID pandemic, as unfortunately working with many different volunteers, as is usually the case, was not possible. External support was provided by a Lancaster University funded intern and two WCRT volunteer interns. Without this assistance the project would have been unable to go ahead, and we are grateful for their dedication during difficult times.

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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 feeds into WCRT's monitoring programmes to help 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 main purpose of the fish surveys is to assess the status and distribution of the juvenile salmonid population, namely Atlantic salmon fry (*Salmo salar*) and Brown trout fry (*Salmo trutta*) - aged less than one year. This helps to determine the spawning success of the returning adult fish and is a key indicator in the health of the system. However, fish populations are naturally extremely variable, both within rivers and through time, due to the migratory nature of the species, and therefore individual surveys cannot provide statistically sound measures of spatial or temporal change. The results of the surveys undertaken must therefore be viewed within the context of the whole of the Derwent catchment, which this report aims to do.

2.1.3 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 Vendace in Derwentwater and Bassenthwaite Lake and Arctic Charr in Crummock Water.

2.1.4 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 and 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 salmonid population;
3. Determine underperforming areas and direct where habitat improvement works are needed; which 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 easement;
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.

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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 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 kits 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 zig zag 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.

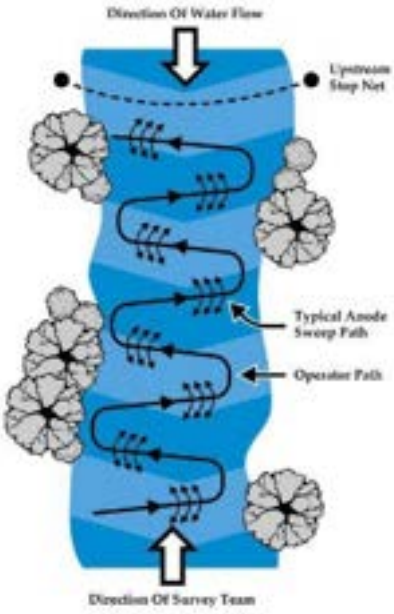

Figure 1: *A diagram to show the survey method of the quantitative method but is also similar to semi quantitative in terms of the zig zag pattern and the direction of travel. (Diagram from E Fish 500W kit manual, 2012).*

3.1.4 Most survey sites are located on tributaries and the aim within the 5-minute survey is to cover both pool and riffle habitat, by starting with a riffle and ending in a pool. Where main river sites are surveyed, this is during low flows and tend to only be in shallow riffles or off the edges of gravel bars.

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 which has an inbuilt ruler, 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 Prior to surveying, a licence to fish using electric survey methods is applied for 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 Sites are selected to ensure an even coverage across the catchment, mainly on primary and secondary rivers, however, due to limitations in the equipment and survey methods, sites tend to be on tributaries rather than the main rivers.

3.3.2 Site selection is also based on where 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.

3.3.3 Sites are also selected to complement the ones done by the Environment Agency rather than duplicate.

3.4 Survey Locations

3.4.1 2020 marks the sixth consecutive year of surveying, with a total of 275 sites having been surveyed during this time.

3.4.2 A total of 19 sites have been surveyed for six consecutive years, 26 have been surveyed for five consecutive years, 20 have been surveyed for four consecutive years and 39 sites for three consecutive years. These sites make up the core 100 sites of the survey programme.

3.4.3 As well as consecutive years, 18 sites have been surveyed five times within the six years, 30 have been surveyed four times within the six years and 36 have been surveyed 3 times within the six years.

3.4.4 The remainder have been surveyed just twice within the six years and 71 sites only once.

3.4.5 Roughly 100 sites are selected as priority, that 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. At the moment roughly 150 sites get surveyed in one survey season depending on the weather and river levels.

3.4.6 A total of 162 sites were surveyed in the 2020 survey season.

3.5 Survey Timings

3.5.1 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 without injury. The season ends at the end of September to prevent disturbance to returning adult salmon.

3.5.2 Attempts are made to try and 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 working in a systematic order to the top of the catchment by the end of the season.

3.5.3 Surveying is weather dependant and therefore 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.

3.5.4 The summer of 2020 was a reasonably wet one, with river levels high throughout the season, in particular at the main river sites on the Rivers Cocker & Derwent. Figure 2 shows the average daily river levels for the River Derwent at Cockermouth, for the 2020 survey season. In Figure 2, it can be seen that the river levels were high at the start of July with several rainfall events leading to peaks in river levels at the end of July and start of August, with another large rainfall event towards the end of August leading to another large peak. September on the whole was drier but it took some time for the river levels to drop to a level suitable for fish surveys.

3.5.5 Efforts to survey the main river sites would usually occur at the start of the survey season, but due to the high river levels in July and August, they were pushed back to the end of the survey season when levels had dropped a bit. However, levels only dropped for a short amount of time so therefore less main river sites were surveyed in 2020 compared to the previous two years.

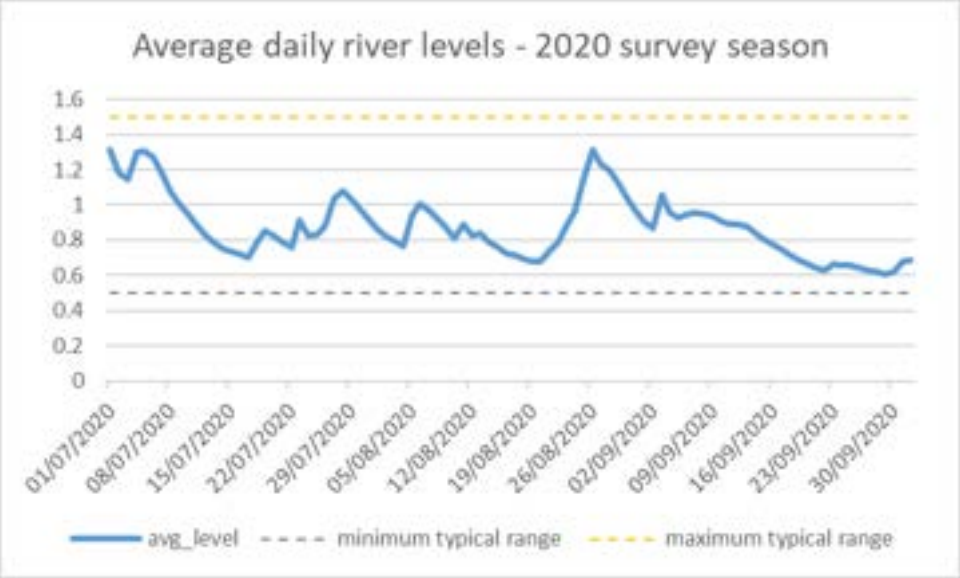

Figure 2: *Graph showing the average daily river levels for the River Derwent, from the Kingfisher Gauging station at Cockermouth (data for graph sourced from https://riverlevels.uk/derwent-north-west-catchment#.YH6yQehKhPY).*

3.6 Fish Data Analysis Methods

3.6.1 The data collected is recorded on survey sheets in the field, which is then transferred to a spreadsheet. An example of the survey sheet can be found in Appendix A on page 33.

3.6.2 Before any analysis can be undertaken the salmonid fish data needs to be split to determine 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. For example, Figure 3, shows a histogram which represents salmon at all the sites surveyed in the Marron sub-catchment in 2018, the x-axis shows the length of fish in mm 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 fry and parr for salmon in the Marron sub-catchment in 2018.

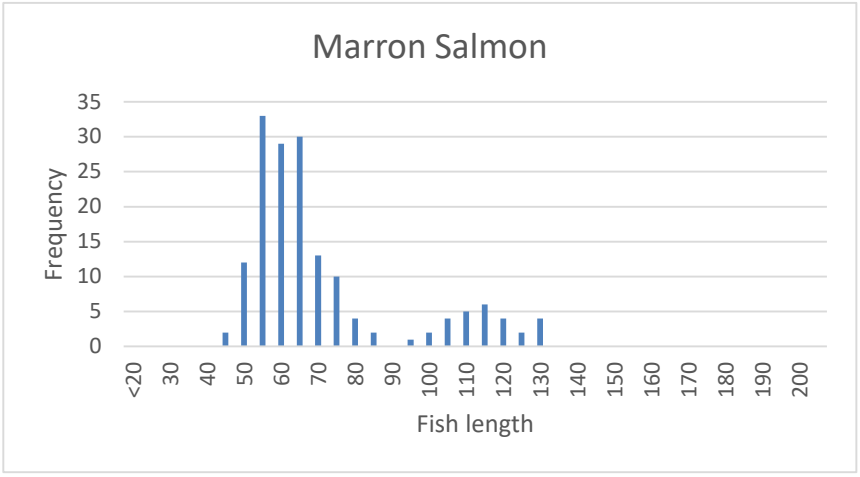

Figure 3: *An example histogram used to determine the cut off value between fry and parr for salmon in the Marron sub-catchment in 2018.*

3.6.3 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).

3.6.4 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. The most common form of calibration is to calibrate results from semi-quantitative methods against quantitative methods. In 2016, a calibration exercise was undertaken between the Environment Agency's quantitative surveys and WCRT's semi-quantitative surveys. During calibration WCRT would conduct the first run, using the middle section between the nets and counting the number of fish caught after five minutes (the semi-quantitative method). The EA would then do the second, third and fourth runs until no fish were left or had a depletion rate (the quantitative method). The results from the semi-quantitative survey are then plotted on a scatter graph against the results from the full quantitative survey to get a regression correlation. The equation or trend line that represents the correlation is then used to extrapolate the number of fry

caught in a five-minute survey to get a calibrated result per 100m^2. The correlation equation produced in 2016 can be seen below in Table 1.

Table 1: *Calibration trend lines with coefficients of determination which can be used to convert numbers of fish per 5-minute survey to number of fish per 100m2.*

	Calibration trend line	Coefficient of determination (r^2)
Trout	Y = 3.8712 x - 1.7945	0.6137
Salmon	Y = 3.0923 x - 05313	0.6326

3.6.5 Best practise would state that ideally calibrations between semi-quantitative methods and quantitative methods should occur every year to reduce the impact of catch efficiency errors on your results and the trends seen. Calibration equations represent the conditions the survey was conducted in and the survey team that was used and obviously these can change from year to year (Glover et al, 2018). Several papers (SFCC, 2007; Wyatt and Lacey, 1994), say that historical quantitative data can be used in producing calibration equations as long as the data is from the same site, or from similar or adjacent sites. However, the value of using historical data will depend on the relative importance of site characteristics (gradient, morphology, substrate) and survey characteristics (light, temperature, flow, water clarity and differing operators and catchers). If one of these factors differed between the two sets of data and potentially affected the number of fish caught, then the corresponding equation produced may not be a true representation and therefore calibration. Also historical calibration equations can be used to extrapolate, as long as the site and surveys conditions are similar.

3.6.6 There are also other means of calibrating as discussed in Farooqi and Aprahamian, (1993) and Wyatt and Lacey (1999) but the method described above is the most commonly used and the approach WCRT had adopted in 2016. The 2016 calibration equations were used to extrapolate the 2015, 2016 and 2017 data, but due to drought conditions in 2018 and 2019 at the start of the survey season, the equations were deemed not a true or accurate representation and were not used for those years and the data was un-calibrated. Unfortunately, due to lack of time and resources a calibration exercise hasn't been repeated to update the calibration equations since 2016.

3.6.7 In the 2019 report due to the lack of a suitable calibration equation and in order to make a five-year comparison of the data for the individual sites, WCRT switched to using the same approach as The Spey Foundation in their 2018 electrofishing report. They show their results as a catch per unit of effort (time) rather than fish density per unit area. This eliminates some of the bias/ errors involved in extrapolating the data to 100m^2 as well as providing a suitable method to compare all the data WCRT currently have. However, several objections were raised about this method, including the fact the classification boundaries change yearly due to the input of new data, making comparison going forward more difficult, plus using this method prevents comparison of the Derwent catchment results with other rivers around the country.

3.6.8 Therefore, in this report, the data has been extrapolated by dividing the number of fish caught in 5 minutes by the total area fished, and multiplying that by 100 to get a value for 100m^2, as set out in McCubbing & Locke, (1994) rather than using a calibration equation. The value for 100m^2 has

been assigned a grade according to the NFCS classification boundaries in Table 2 below, with the caveat that the data in this report hasn't been calibrated.

3.6.9 WCRT is currently planning to undertake a calibration exercise in the summer of 2021, and will aim to update the calibration equations, every three years, unless there has been a significant flood or drought, in which case the equation will need updating sooner. This is until a standard/ suitable calibration methodology, that is less time and resource intensive has been found.

Table 2: *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	

3.7 Habitat Data Analysis Methods

3.7.1 As well as the fish data, corresponding habitat data is collected at all of the sites, as the habitat data is a vital part of understanding 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.

3.7.2 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.

3.7.3 Sites where habitat is poor such as: areas with 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 which would normally provide cooler water temps and places to hide, straightened rivers which are fast flowing with unstable beds and large sediment loads, over-widened rivers which are slow flowing and deep glide like flow regimes; would all be classed as either Repair or Restore.

3.7.4 Classification as Maintain, Repair or Restore depends on how each site scores. Each site is accessed according to the criteria outlined in Table 3 on page 15. 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.

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3.7.5 The habitat classifications are a guide to 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 and shows an example photograph of a site classified as Maintain, Repair and Restore.

Figure 4: *A site classified as Maintain.*

- **Maintain** - limited small scale work required such as insertion of large woody debris, tree management or planting of some riparian trees or encouragement of in river vegetation growth. Figure 4 shows a site classed as Maintain; here there is good dappled shade, a good mixture of substrate including boulders, cobbles and gravels, some woody debris, pool-riffle flow regime, the water is clear and there are minimal sources of pollution, no stock access and no invasive species. Here minimal work is required to improve the fish habitat.

Figure 5: *A site classed as Repair.*

- **Repair** - modest work such as fencing off the watercourses and creating buffer strips, provision of new gravels, or creating more varied stream bed within the channel through placement of larger cobbles or boulders, willow spiling or other bank stabilisation works and invasive species control. Figure 5 shows a site classed as Repair; here the beck in the picture (though hard to tell from the picture) is very silty due to livestock access and bank erosion, just upstream is a regular crossing point and the beck was brown and turbid within seconds of the flock of sheep crossing, prior to the survey. Stock exclusion fencing is needed to solve the main issues, also provision of some more gravels, and bigger coarser material such as cobbles and boulders to create more in stream variety, some small scale tree planting to provide more shade and roots to protect the banks/ create in river habitat.

Figure 6: *A site classed as Restore.*

Restore - major restoration works such as re-routing the channel, addressing pollution sources such septic tank, sewerage outfalls, misconnections, heavy metal contamination from old mine works etc, removing embankments or hard engineering, addressing barriers to fish passage. Figure 6 shows a site classed as Restore; here the watercourse is

incredibly straight with very uniform or homogeneous in river habitat providing very few places for fish to reside or hide, very little variety in terms of substrate size, predominantly glide flow regime another indicator it is over wide and straight. There is very little tree cover and no in river vegetation, a large erosion face and source of sediment, just out of shot. It would take a much larger restoration project to bring this site up to Excellent or Good status.

Table 3: *Scoring system 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**

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4 Fish Survey Results and Discussion

4.1 Summary

4.1.1 During the 2020 survey season a total of 162 sites were surveyed across the Derwent catchment. A total of 3,215 trout were recorded of which 2,580 were trout fry and 635 trout parr, and 1,571 salmon were recorded of which 1,372 were salmon fry and 199 salmon parr.

Figure 7: *A photograph of the 145mm pike that was caught on Brockle Beck.*

4.1.2 Of the total 162 sites surveyed, 130 sites (80%) had trout fry present and 77 sites (48%) had salmon fry present. 67 sites (41%) had adult European eels (*Anguilla anguilla*) or elvers (young eels) present, 90 sites (56%) had other fish species present such as lamprey, sticklebacks, minnows, stoneloach and bullhead. At one site on Brockle Beck which is a tributary of Derwentwater a 145mm pike was recorded as shown in Figure 7. Full details of numbers and types of fish recorded at each site can be found in Appendix B on page 33.

4.1.3 Table 4 on page 17 summarises the 2020 survey sites and fish numbers and compares these to the previous five years. The number of sites surveyed has increased since 2015, but in the latter few years levelled out at about 160 sites per year. Due to the fact the main river sites haven't been surveyed every year, Table 5, on page 18 shows a breakdown of Table 4 into main river and non-main river.

4.1.4 As stated in the methodology, each site is assigned a grade of A-F based on the NFCS boundaries shown in Table 2 on page 13. The pie charts in Figure 8, summarise the percentage of sites assigned each grade for both trout and salmon fry for the 2020 survey season. Of the 162 sites surveyed in 2020, 12% of sites were graded 'A', 18% 'B', 16% 'C', 19% 'D' and 15% 'E' for trout fry. Whereas for salmon fry, only 1% graded 'A', 6% 'B', 4% 'C', 12% 'D' and 25% 'E'. A comparison of these percentages with those of previous years is shown in Table 6, on page 19.

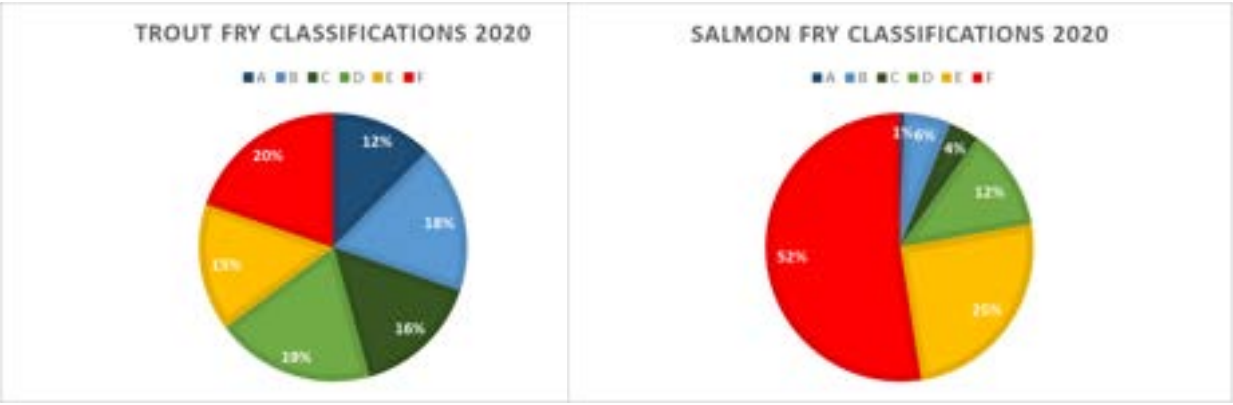

Figure 8: *Pie charts showing the percentage of sites assigned each grade (A to F) for both Trout and Salmon fry in 2020.*

Table 4: *Summary of WCRT semi-quantitative electrofishing data from past 6 years for the River Derwent catchment.*

	2015 Trout	2015 Salmon	2016 Trout	2016 Salmon	2017 Trout	2017 Salmon	2018 Trout	2018 Salmon	2019 Trout	2019 Salmon	**2020 Trout**	**2020 Salmon**
Number of sites surveyed	89		138		120		157		161		**162**	
Total numbers of salmonids recorded	1171	554	614	551	1875	669	2606	4243	2640	2475	**3215**	**1571**
Total number of fry recorded	846	482	451	461	1741	597	2022	4011	2138	2155	**2580**	**1372**
Total number of parr recorded	325	72	163	90	134	72	584	232	502	320	**635**	**199**
Number of sites with fry	80	36	92	61	103	48	127	83	125	78	**130**	**77**
Average number of fry per site	10	5	3	3	15	5	13	26	13	13	**16**	**8**
Number of sites with no salmonids present	4	46	29	66	10	63	23	67	23	67	**14**	**72**
Number of sites with no fish present	0		2		3		3		3		**3**	

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Table 5: *Splitting the fry analysis into main river and non-main river sites.*

	2015 Trout	2015 Salmon	2016 Trout	2016 Salmon	2017 Trout	2017 Salmon	2018 Trout	2018 Salmon	2019 Trout	2019 Salmon	**2020 Trout**	**2020 Salmon**
Non-main river sites - fry	815	464	422	325	1730	579	1964	2026	2028	813	**2518**	**1222**
Average number of fry per non-main river site	9	5	3	3	15	5	15	16	15	6	**16**	**8**
Number of non-main river sites	86		122		119		130		135		**154**	
Main river site - fry	31	18	29	136	11	18	58	1985	110	1342	**62**	**150**
Average number of fry per main river site	10	6	2	9	11	18	2	74	4	52	**8**	**19**
Number of main river sites	3		16		1		27		26		**8**	

Table 6: Number of sites and percentage of sites graded A to F for both salmon and trout fry across the years.

	Number of sites graded A-F						Percentage of sites (%) graded A-F					
Trout Fry												
Classification/ Grade	2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020
A	24	11	56	21	26	20	27	8	47	13	16	12
B	24	27	22	36	19	29	27	20	18	23	12	18
C	13	11	11	26	26	25	15	8	9	17	16	15
D	12	21	8	20	36	31	13	15	7	13	22	19
E	7	22	6	24	18	25	8	16	5	15	11	15
F	9	46	17	30	36	32	10	33	14	19	22	20
Total	89	138	120	157	161	162	100	100	100	100	100	100
Salmon Fry												
Classification/ Grade	2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020
A	4	4	7	17	2	1	4	3	6	11	1	1
B	6	2	5	12	15	9	7	1	4	8	9	6
C	11	13	6	17	14	6	12	9	5	11	9	4
D	11	23	11	18	17	20	12	17	9	11	11	12
E	4	19	19	19	30	41	4	14	16	12	19	25
F	53	77	72	74	83	85	60	56	60	47	52	52
Total	89	138	120	157	161	162	100	100	100	100	100	100

4.1.5 The following paragraphs discuss spatial and temporal trends based on figures for the whole catchment, however it should be noted that these trends, especially the temporal ones, are to be viewed with the following caveats in mind:

- Fish populations are extremely variable, particularly salmonids which are migratory species and 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 being post Storm Desmond which brought large-scale flooding during spawning season; and the 2018 & 2019 survey seasons, starting in drought conditions, with many becks and tributaries being bone dry or reduced to a trickle.
- The number of survey sites has increased 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.

4.2 Comparison of fry numbers between 2015 and 2020

4.2.1 The temporal trends for salmonid fry numbers between 2015 and 2020 for the Derwent catchment can be seen in Figure 9. This figure is minus the main river sites, as they haven't been surveyed every year and can skew the trend lines, especially for salmon.

4.2.2 Figure 9 shows, that for Trout Fry, 2020 was the best so far, out of the six years of surveys and for salmon fry the second best.

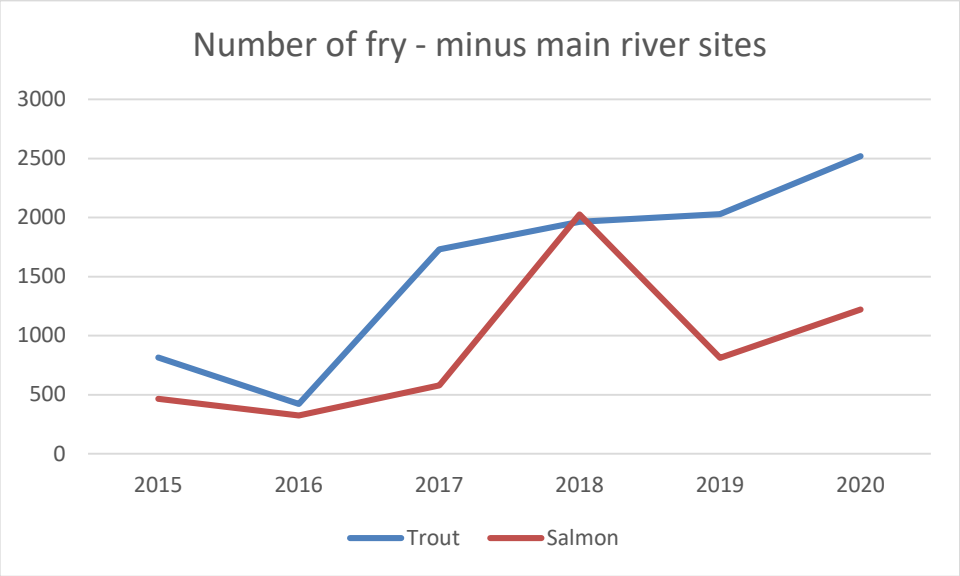

Figure 9: *Graph showing the temporal trend lines for number of salmonid fry caught between 2015 and 2020, minus the main river sites.*

4.2.3 To confirm this trend is not just because the number of sites surveyed has increased over the years, the average number of fry per site was calculated for all the years and then the averages plotted on a similar graph which can be seen in Figure 10 on the next page. The trend lines are very similar.

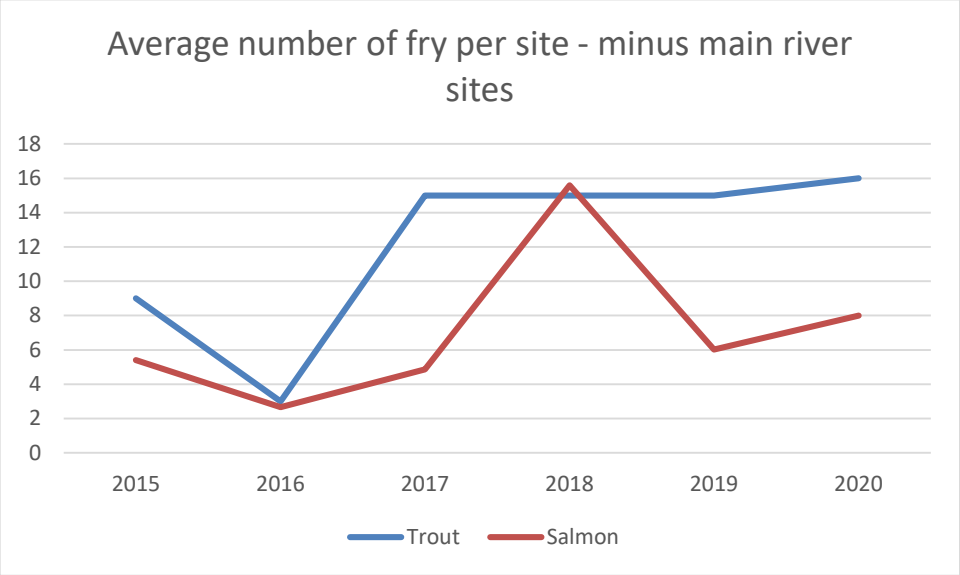

Figure 10: *Graph showing the temporal trend lines for the average number of fry per site for both trout and salmon, minus the main river sites.*

4.3 Spatial distribution and classification of 2020 salmonid fry results

4.3.1 The spatial distributions of salmon and trout fry across the Derwent catchment recorded during the 2020 survey season can be seen in Figures 11 and 12 on pages 23 and 24. In the diagrams, the sites have been given a grade of A to F using the NFCS boundaries set out in Table 2.

4.3.2 Figure 11 shows that for trout fry, more sites are classified as A (Excellent) and B (Good) and these sites are 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, Blumer Beck and Coal Beck. Areas where trout fry are absent (F) or have poor classifications (E) include the tributaries of Derwentwater such as Brockle Beck, Barrow Beck, Watendlath Beck, the upper areas of the Glenderamackin catchment, Lostigg Beck, Broughton Beck and the main river sites that were surveyed this year. For the first time this year, sites were surveyed above Thirlmere on Wyth Burn and Raise Beck as part of the Thirlmere Resilience project, as expected there are no salmon up here; some trout were present but not in large numbers, with classifications for trout fry for these five sites ranging from D to F.

4.3.3 Figure 12 shows the site classifications for salmon fry. There are less A and B classifications for salmon fry and these were recorded on the well-known spawning tributaries such as St John's Beck, Naddle Beck, and the lower sites on the Cocker tributaries such as Whit Beck, Sandy Beck, Liza Beck, Hope Beck and Meregill Beck. Other areas where there are salmon present but not in large quantities, and therefore had classifications of 'Fair' (C & D) include the River Glenderamackin, Upper Derwent in Borrowdale, Stonethwaite Beck, main River Marron sites and the few main River Derwent sites that were conducted towards the end of the season. Usually when surveyed at the start of the season these main river sites are classed as A's and B's. However naturally as the summer goes on, less fry are found as they outcompete each other for food and space and start to move away from the spawning areas they emerged from. We also had several large summer floods or periods of high flows and these will have displaced a lot of fry. Also when conducting the main river surveys whilst river levels were low, they still weren't as low as previous years and this will have affected the catch efficiency. These are highly feasible

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reasons why the classifications for the main river sites in 2020 weren't A's or B's and were instead C's & D's.

4.4 Sub-Catchment Specific Results

4.4.1 In previous reports, the sub-catchments or individual watercourses within the Derwent catchment have been discussed in more detail. Particularly last year when attempts were made to compare the results across the first five years of the survey programme.

4.4.2 As the main focus of this report is just the 2020 survey season results, this section has been moved online.

4.4.3 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.

4.4.4 The platform can be accessed through links on WCRT's website under the 'River Derwent Catchment Fish and Habitat Surveys' project page or directly at: https://arcg.is/1bbuj8

4.4.5 At the time of writing, the dashboard currently only includes the results from the 2020 surveys, the previous years will be added shortly. The dashboard also includes sites from other WCRT operational areas such as the River Irt and River Ehen catchments.

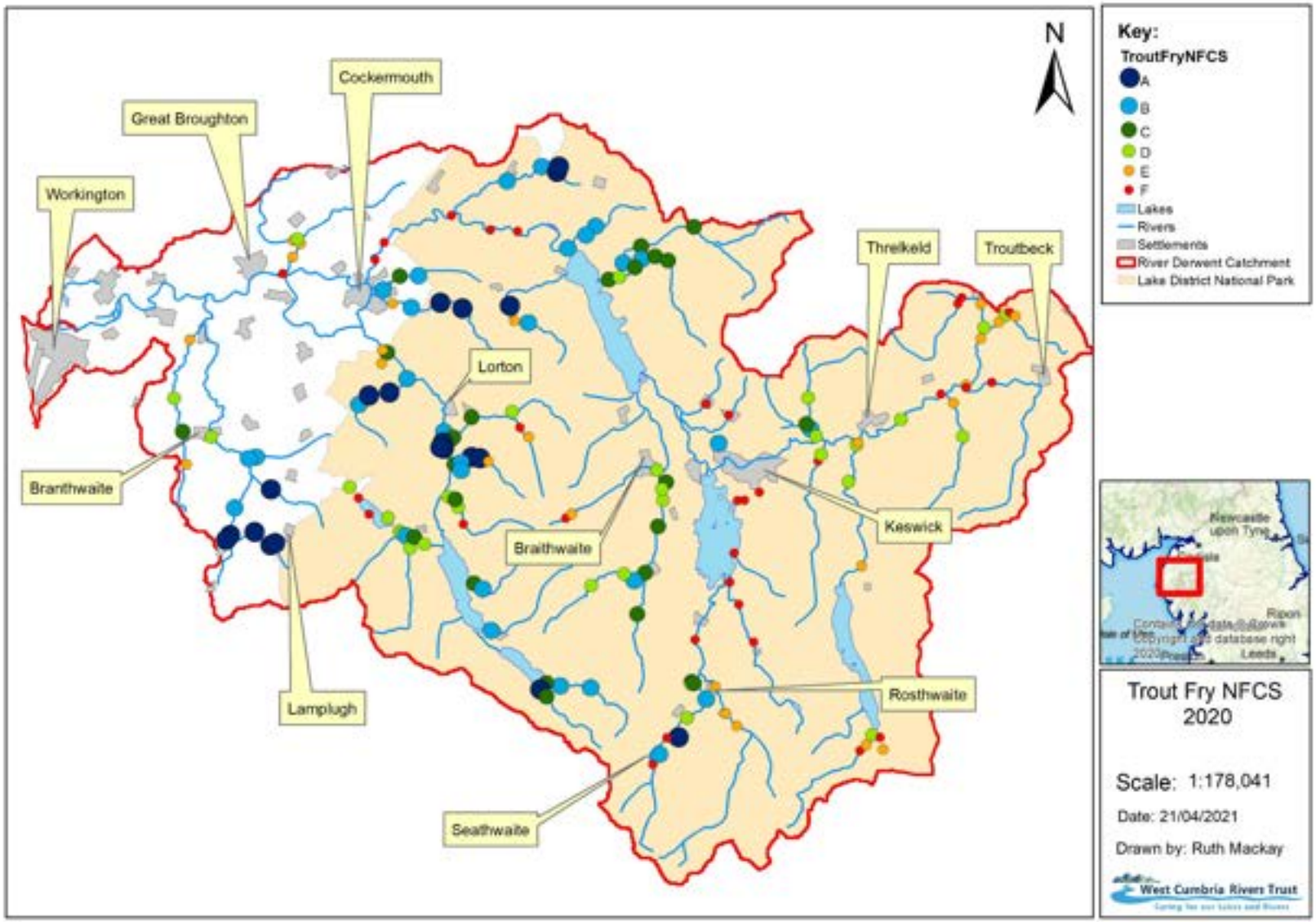

Figure 11: *A map showing the 2020 trout fry NFCS classifications across the Derwent catchment.*

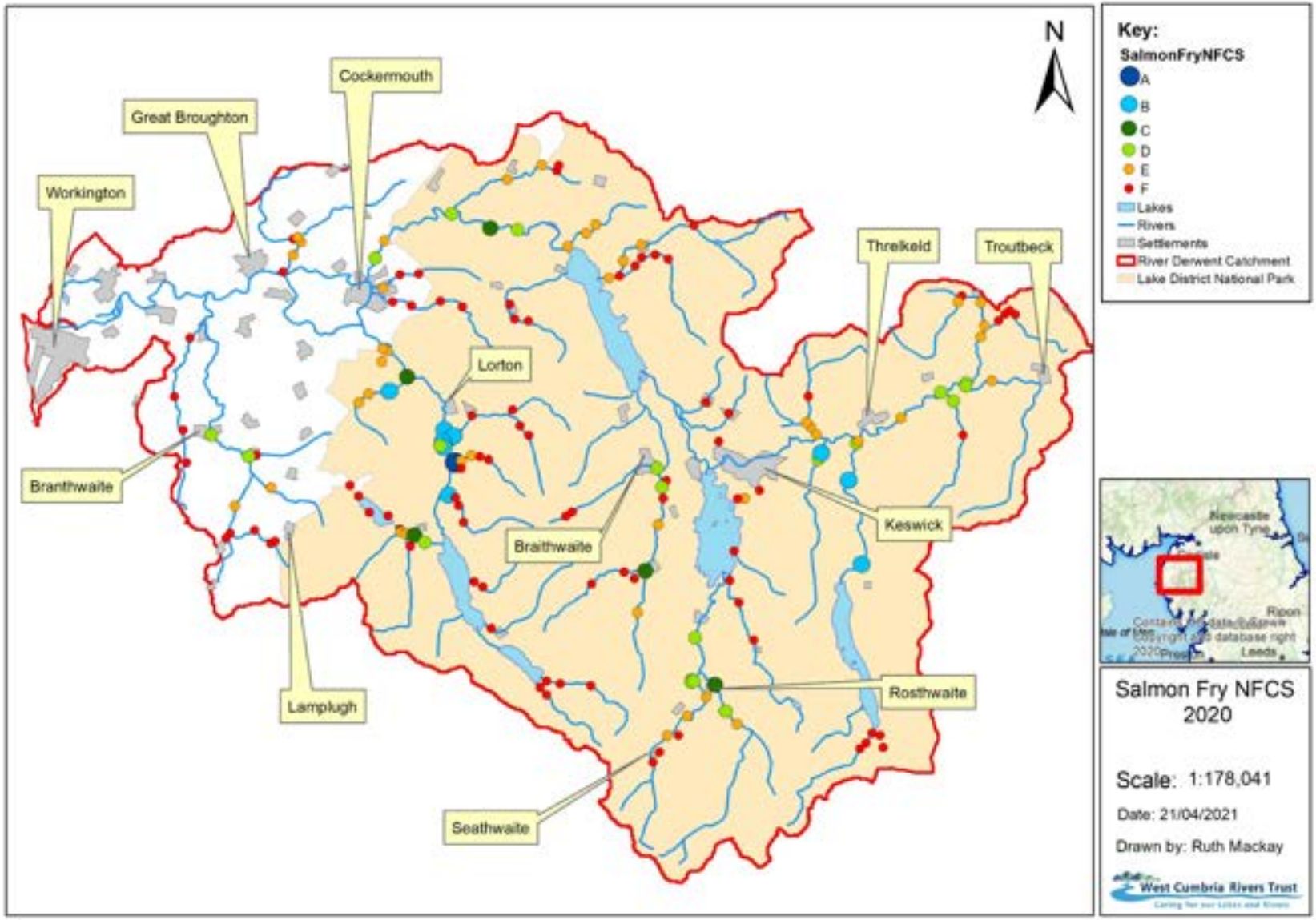

Figure 12: *A map showing the 2020 salmon fry NFCS classifications across the Derwent catchment.*

5 Habitat Survey Classifications

5.1 Habitats Classification Results 2020

5.1.1 The habitat classifications for the 2020 surveys sites are shown in Figure 13 on page 26. Out of the 162 sites surveyed 41 (25%) were classed as Maintain, 109 (67%) were classed as Repair and 12 (7%) were classed as Restore.

5.1.2 The habitat data is fed into WCRT's catchment action plans, river restoration 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.

5.1.3 WCRT has produced an online platform similar to the fish classifications one, where the habitat classifications for all the WCRT electrofishing sites across the years can be viewed on a map, with the ability to zoom into particular areas.

5.1.4 The platform can be accessed through links on WCRT's website under the 'River Derwent Catchment Fish and Habitat Surveys' project page or directly at:

https://www.arcgis.com/apps/dashboards/9ef98b1158e445d1bf779f18345f585b

5.1.5 At the time of writing, the platform currently only includes the habitat classifications from the 2020 surveys, the previous years will be added shortly.

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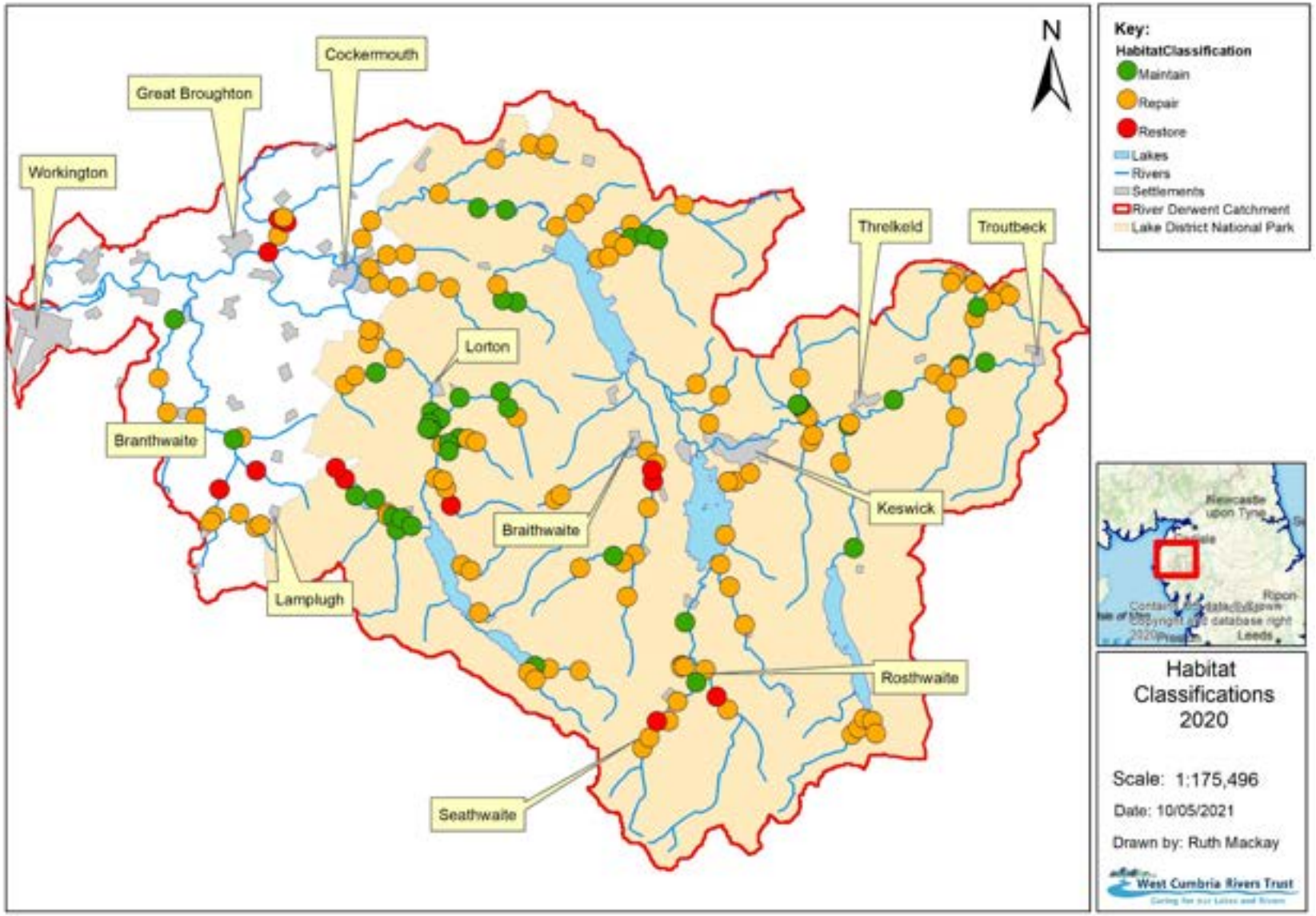

Figure 13: *Habitat classifications for all the 2020 survey sites.*

6 A Case Study of Habitat Improvement Works – Meregill Beck

6.1 Introduction

6.1.1 This section outlines a brief case study of where works by ourselves and/ or partner organisations have had a positive impact on the habitat and fish numbers at a particular site or watercourse, and will become a feature in the report going forward.

6.1.2 The case study chosen for this report is that of Meregill Beck in the River Cocker catchment.

6.2 Meregill Beck Case Study

6.2.1 Meregill Beck is a small tributary of the River Cocker, and an important spawning tributary and juvenile nursery for fish. It arises on Smithy Fell, before flowing north east, then north before joining the Cocker just upstream of the confluence of the Cocker and Whit Beck.

6.2.2 Meregill Beck is on the survey programme to monitor the results of works which have been undertaken to improve the habitat and water quality of the beck. There are now three survey sites on Meregill Beck, two downstream of the minor Thackthwaite road and one upstream. The location of Meregill Beck, the three surveys sites and a summary of the works undertaken is shown in Figure 15 on page 29.

6.2.3 In 2013, WCRT worked with the landowner and tenant to undertake works at works at sites 89 and 90. The works included, fencing off the watercourse downstream of the road, removing a pipe bridge and adding river gravels into the beck to replace those lost over the years from dredging. By erecting riparian fencing to keep livestock out and ceasing dredging, the beck has been allowed to thrive. Riparian vegetation has established which in areas overhangs, providing places in the edge of the watercourse for fish to hide. It is also stabilising the banks and providing protection during higher flows; this combined with no stock access, means there is less silt entering the beck. Whilst it can still be silty in places it is a vast improvement to what it was. By replacing lost gravels in the watercourse, it has improved spawning opportunities and provided more varied in river habitat and flow regimes, plus allowed in river vegetation to establish, again providing extra cover and places to hide within the watercourse. By removing the pipe bridge this has opened up a large section of watercourse to all fish species.

6.2.4 In 2020, WCRT worked with the farmer upstream of the Thackthwaite road to undertake further riparian fencing of Meregill Beck, through the River Cocker Catchment NFM project funded by the Water Environment Grant. Again, to prevent stock access to the watercourse upstream of the road, reduce the amount of silt and faeces entering the beck and allow vegetation to establish; it is hoped to have a similar impact to the works downstream. The culvert under the road was deemed a potential barrier to fish passage but when a survey was conducted at site 275, above the road in 2020, salmon and trout fry were found proving that fish passage under the road was not a problem.

6.2.5 Table 7, on page 28, shows the fish classifications for both trout and salmon fry for the four years that Meregill Beck has been surveyed. Pre works surveys weren't undertaken as the survey programme hadn't been set up then, but fish numbers were low prior to the works, as Meregill Beck had a very silty bed with a distinct lack of gravels and habitat, prohibiting what could live there.

Table 7: NFCS classifications for both trout and salmon fry across the four years of surveys on Meregill Beck.

	Trout Fry (NFCS) Classifications				Salmon Fry (NFCS) Classifications			
Site Number	2017	2018	2019	2020	2017	2018	2019	2020
89	A	A	A	A	C	C	F	B
90	A	B	A	A	F	E	F	B
275				A				D

Key: Classifications & Grade | A = Excellent | B = Good | C = Moderate | D = Fair | E = Poor | F = Absent | Not surveyed

6.2.6 Since the 2013 works, at sites 89 and 90, trout fry have been maintaining a presence with classifications of A 'Excellent'. In 2018 the classification for trout fry at site 90 did drop slightly but this could be due to catch efficiency (as the vegetation can make it quite hard to catch the fish), the fact the survey was undertaken later in the season compared to other years or the drought/ low river levels at the start of the survey season.

6.2.7 Salmon fry are present, more so at site 89 with classifications of C 'Moderate' increasing to B 'Good' in 2020. Site 90 fluctuates between presence and absence but increased to a B 'Good' classification in 2020. No salmon fry were recorded at either of the sites in 2019, this most likely indicates a pair(s) of returning adult salmon didn't make it up Meregill Beck in the winter prior to the 2019 surveys; as the trout numbers seem unaffected it is unlikely it was due to other factors.

6.2.8 As well as salmon and trout, Meregill Beck now supports a range of other species, including stoneloach, minnows and stickleback and the occasional eel.

6.2.9 Despite, having no pre data the surveys show that salmon numbers at sites 89 and 90 where the 2013 works were undertaken, have improved over the years, as the habitat has established; and that seven years after the works, Meregill Beck now has 'Good' or 'Excellent' classifications for both trout and salmon fry at both the survey sites. This also shows that relatively minor works on small tributaries can have an impact on fish numbers and not always big extensive restoration projects are needed.

6.2.10 There are still further improvements that could be made however to Meregill Beck to improve the habitat further, including Himalayan balsam control, and riparian tree planting to create dappled shade, provide further stabilisation of the banks (and once established, leaf litter), and woody debris and roots within the stream to increase the number of invertebrates and places for fish to hide and take cover.

6.2.11 Figure 14 shows the riparian fencing, the in stream and riparian vegetation at site 89 on Meregill Beck.

Figure 14: Photograph of site 89 on Meregill Beck showing the riparian fencing, the vegetation growth both instream and along the banks.

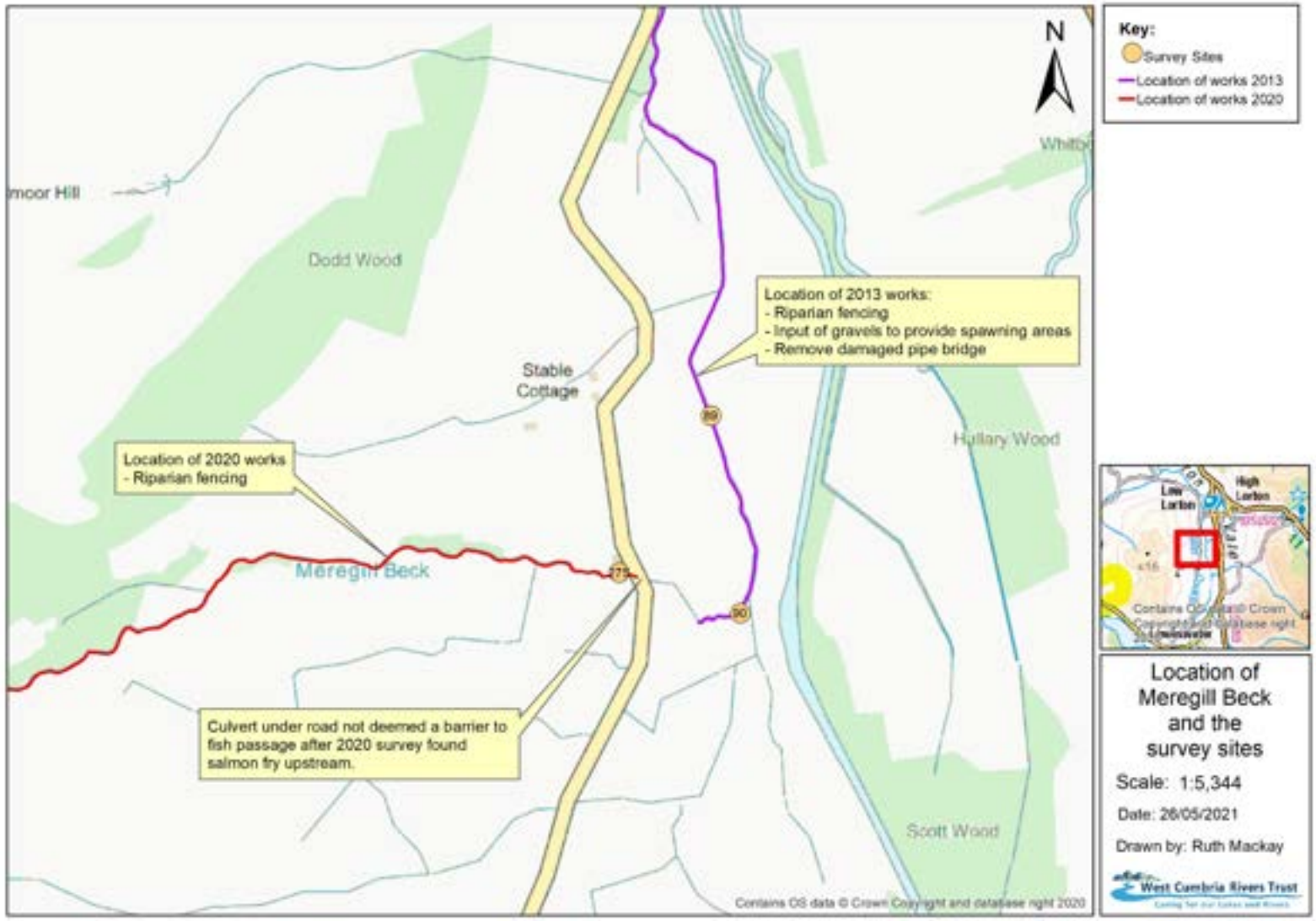

Figure 15: *Map showing the location of Meregill Beck and the three survey sites.*

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7 Conclusion

7.1.1 In conclusion, despite its challenges, 2020 was overall a successful survey season. The average number of salmon fry per site in 2020 was higher than 2019, and the second best since 2015 when the surveys started. 2020 was also the best year yet out of the six years of surveys for the average number of trout fry per site.

7.1.2 This is the sixth year of surveying juvenile salmonids in the River Derwent catchment so 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.

7.1.3 The data from the surveys is used to monitor projects that have or will be delivered on the ground to determine their success in improving the habitat and water quality and thus increasing fish numbers; such as the work at Meregill Beck which was discussed in the case study included in this report. Gathering data in these areas is vital to prove that these techniques work, although the impact of the works may take a few years to effect fish numbers, depending on the techniques used. However, 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 through the Catchment Partnership Portal available on the WCRT's website.

7.1.4 The data and reports from this project have been used by ourselves and partner organisations to submit grant applications to the Green Recovery Challenge Fund to continue the work in the Cocker and Glenderamackin catchments, and several smaller funding bids have also been submitted to various other funders for habitat improvement and fish easement projects within the River Marron catchment which have been identified as a result of the survey results. It shows how important this work is to help provide evidence for funding to make improvement works.

8 Acknowledgements

8.1.1 There are many organisations and individuals who have contributed to make this project, not only work, but to become 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, Bowland Game Fishing Association, The National Trust, The Hadfield Trust, Lancaster University, Lord and Lady Egremont 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 2020 survey season can be found in Appendix C, on page 50.
- The 2020 survey team including external support from a Lancaster University funded intern and two WCRT volunteer interns. Without this assistance the project would have been unable to go ahead, and we are grateful for their dedication during difficult times.

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10 Appendix A

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

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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

This table is a copy of the fish data collected during the 2020 survey season and is in date order from the start of the season to the end.

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
14/07/2020	Hope Beck	NY 15586 23686	12	2	121	5	1	0	0	0	0	0	0	0
14/07/2020	Liza Beck	NY 15324 22403	5	1	65	2	0	0	0	0	0	0	0	0
14/07/2020	Hope Beck	NY 16249 23966	76	6	4	6	1	0	0	0	0	0	0	0
14/07/2020	Hope Beck	NY 16585 23931	82	3	0	0	0	0	0	0	0	0	0	0
15/07/2020	Whit Beck	NY 17871 25776	6	22	0	0	0	0	0	0	0	0	0	0
15/07/2020	Blaze Beck	NY 18520 24776	1	1	0	0	0	0	0	0	0	0	0	0
15/07/2020	Blaze Beck	NY 18169 25148	0	8	0	0	0	0	0	0	0	0	0	0
15/07/2020	Hope Beck	NY 15846 23757	29	15	1	2	0	0	0	0	0	0	0	0

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Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
15/07/2020	Hope Beck	NY 16921 23811	2	12	0	0	0	0	0	0	0	0	0	0
16/07/2020	Rannerdale Beck	NY 16353 18970	16	9	0	0	6	0	0	0	0	0	0	0
16/07/2020	Rannerdale Beck	NY 16702 18762	40	7	0	0	0	0	0	0	0	0	0	0
16/07/2020	Liza Beck	NY 15928 21319	0	3	0	0	0	0	0	0	0	0	0	0
16/07/2020	Liza Beck	NY 15735 21987	5	2	0	0	0	0	0	0	0	0	0	0
16/07/2020	Liza Beck	NY 15623 22292	9	0	0	0	0	0	0	0	0	0	0	0
20/07/2020	Whit Beck	NY 15157 24990	27	2	47	2	0	0	0	2	6	1	0	0
20/07/2020	Whit Beck	NY 15401 24641	11	0	24	0	3	0	0	0	1	2	0	0
20/07/2020	Whit Beck	NY 15537 24748	10	0	66	2	1	0	0	0	0	0	0	0
20/07/2020	Whit Beck	NY 16268 25556	13	0	0	8	1	0	0	0	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
20/07/2020	Sandy Beck	NY 11782 26061	41	12	7	0	1	0	0	1	0	0	0	0
21/07/2020	Sandy Beck	NY 12993 26532	63	14	41	4	1	0	0	2	4	0	0	0
21/07/2020	Sandy Beck	NY 13705 27085	20	6	25	1	0	0	0	11	3	0	0	0
21/07/2020	Little Sandy Beck	NY 12918 28115	7	1	4	0	2	0	0	19	76	20	0	0
22/07/2020	Meregill Beck	NY 15109 24548	42	2	27	1	1	0	0	1	0	8	0	0
22/07/2020	Meregill Beck	NY 15143 24302	59	0	31	0	2	0	0	0	0	2	0	0
22/07/2020	Little Sandy Beck	NY 12696 27691	1	0	6	0	4	0	0	10	89	1	0	0
22/07/2020	Paddle Beck	NY 12726 28214	1	0	1	0	0	0	0	8	0	9	0	0
24/07/2020	Tom Rudd Beck	NY 13123 30051	1	8	0	0	3	0	0	0	0	1	0	0
24/07/2020	Tom Rudd Beck	NY 13873 29907	21	3	0	0	6	0	0	7	2	1	0	0

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24/07/2020	Tom Rudd Beck	NY 15885 29859	29	9	0	0	8	0	0	8	0	7	0	0
24/07/2020	Tom Rudd Beck	NY 15012 30089	26	2	0	0	1	0	0	1	0	35	0	0
24/07/2020	Bitter Beck	NY 12744 30620	18	18	5	1	1	0	0	8	0	1	0	0
24/07/2020	Bitter Beck	NY 14156 31176	25	8	0	0	1	0	0	0	0	0	0	0
28/07/2020	Holme Beck	NY 12195 21708	0	0	0	0	0	0	0	0	0	0	0	0
28/07/2020	Dub Beck	NY 11780 22362	0	1	0	0	2	0	0	0	11	0	0	0
28/07/2020	Dub Beck	NY 11421 22787	3	0	0	0	0	0	0	0	0	0	0	0
28/07/2020	Crab Tree Beck	NY 12956 21570	3	3	0	1	3	0	0	0	0	0	0	0
29/07/2020	Dub Beck	NY 13419 21035	4	1	0	1	6	0	0	0	33	0	0	0
29/07/2020	High Nook Beck	NY 13452 20923	9	1	5	5	0	0	0	0	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
29/07/2020	Gatesgarthdale Beck	NY 20975 14843	50	0	0	2	1	0	0	0	0	0	0	0
29/07/2020	Gatesgarthdale Beck	NY 19775 14920	34	1	0	0	0	0	0	0	0	0	0	0
29/07/2020	Gatesgarthdale Beck	NY 19228 15022	15	0	0	0	0	0	0	0	4	0	0	0
31/07/2020	Park Beck	NY 13651 20873	38	0	10	5	1	0	0	0	0	0	0	0
31/07/2020	Mosedale Beck	NY 13816 20364	6	7	0	0	0	0	0	0	0	0	0	0
31/07/2020	Park Beck	NY 13981 20813	20	0	49	1	0	0	0	1	1	0	0	0
31/07/2020	Park Beck	NY 14394 20516	5	0	15	1	1	0	0	2	0	0	0	0
03/08/2020	Warnscale Beck	NY 18968 14773	54	0	0	0	0	0	0	0	7	0	0	0
03/08/2020	Warnscale Beck	NY 19227 14484	10	0	0	0	0	0	0	0	4	0	0	0
03/08/2020	Meregill Beck	NY 15010 24352	86	4	7	0	0	0	0	0	0	0	0	0

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03/08/2020	Mill Beck, Buttermere	NY 17028 17118	30	1	0	0	2	0	0	0	0	0	0	0
06/08/2020	Wood Beck	NY 07640 21010	46	3	0	0	2	0	0	0	0	0	0	0
06/08/2020	Rakegill Beck	NY 08284 20472	31	6	0	0	2	0	0	0	0	0	0	0
06/08/2020	Wisenholme Beck	NY 08460 20562	46	5	0	0	0	0	0	0	0	0	0	0
06/08/2020	Sandy Beck	NY 12180 26411	64	21	8	1	3	0	0	1	0	0	0	0
06/08/2020	Bitter Beck	NY 13420 31139	18	22	0	0	2	0	0	4	0	0	0	0
07/08/2020	Snary Beck	NY 08296 22688	85	2	3	2	0	0	0	0	0	0	0	0
07/08/2020	Wood Beck	NY 06681 20886	77	19	0	0	0	0	0	0	0	0	0	0
07/08/2020	River Marron	NY 06523 20685	81	18	0	2	2	0	0	0	0	0	0	0
07/08/2020	Black Beck	NY 07721 23985	39	7	0	0	0	0	0	0	0	3	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
10/08/2020	Millbeck	NY 15845 23460	13	4	0	0	0	0	0	0	0	0	0	0
10/08/2020	River Marron	NY 07413 23919	25	0	12	1	3	0	0	0	0	0	0	0
10/08/2020	Broughton Beck	NY 08776 31253	0	0	0	0	1	0	0	79	1	1	0	0
10/08/2020	Broughton Beck	NY 09166 31908	1	0	4	2	2	0	0	85	38	2	0	0
10/08/2020	Broughton Beck	NY 09490 32431	2	0	1	2	0	0	0	64	10	1	0	0
11/08/2020	Wythop Beck	NY 18510 29299	38	5	0	0	1	0	0	0	0	0	0	0
11/08/2020	Wythop Beck	NY 17970 29383	3	7	0	0	0	0	0	0	0	0	0	0
11/08/2020	Wythop Beck	NY 17765 29963	67	14	0	0	1	0	0	1	0	0	0	0
12/08/2020	Blumer Beck	NY 19031 35503	38	3	4	1	1	0	0	13	2	0	0	0
12/08/2020	Blumer Beck	NY 17665 34918	44	3	3	2	1	0	0	3	0	0	0	0

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12/08/2020	Dash Beck	NY 22987 32328	20	8	2	0	0	0	0	0	0	0	0	0
13/08/2020	Chapel Beck	NY 22990 31816	24	4	0	1	3	0	0	0	0	0	0	0
13/08/2020	Dash Beck	NY 22278 31692	17	12	7	0	3	0	0	0	2	0	0	0
13/08/2020	Chapel Beck	NY 22739 31496	10	1	0	0	3	0	0	0	0	0	0	0
13/08/2020	Dash Beck	NY 21701 31005	10	0	1	0	2	0	0	0	18	0	0	0
13/08/2020	Chapel Beck	NY 22121 31091	5	0	0	0	1	0	0	0	0	0	0	0
14/08/2020	Bewaldeth Beck	NY 19631 35272	44	2	0	0	4	0	0	3	0	0	0	0
14/08/2020	Scalegill Beck	NY 19716 35487	35	1	0	0	3	0	0	5	0	0	0	0
14/08/2020	Chapel Beck	NY 23545 31931	14	10	0	0	0	0	0	0	0	0	0	0
14/08/2020	Chapel Beck	NY 24046 31759	15	2	0	0	1	0	0	0	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
14/08/2020	Dash Beck	NY 25069 33103	17	9	0	0	1	0	0	0	0	0	0	0
18/08/2020	Broughton Beck	NY 09183 32553	1	0	0	1	1	0	0	41	7	1	0	0
18/08/2020	Brides Beck	NY 09366 32614	3	1	2	0	1	0	0	18	9	0	0	0
18/08/2020	Lostrigg Beck	NY 04810 24978	13	7	0	0	0	0	0	53	62	0	0	0
18/08/2020	Lostrigg Beck	NY 04953 23692	1	2	0	0	0	0	0	19	336	0	0	0
18/08/2020	Lostrigg Beck	NY 04473 26311	5	0	0	0	0	0	0	55	60	1	0	0
19/08/2020	Lostrigg Beck	NY 05084 28619	1	3	0	0	10	0	0	30	35	3	0	0
19/08/2020	River Marron	NY 05944 24772	7	0	15	0	4	0	0	28	6	13	0	0
19/08/2020	River Marron	NY 06859 21965	30	3	3	0	0	0	0	0	0	0	0	0
19/08/2020	Coal Beck	NY 21175 33133	48	10	2	1	1	0	0	3	0	0	0	0

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20/08/2020	St John's Beck	NY 31723 19664	1	0	79	9	1	0	0	0	0	0	0	0
20/08/2020	St John's Beck	NY 31206 22994	3	1	89	4	0	0	0	8	2	0	0	0
20/08/2020	St John's Beck	NY 31521 24456	5	2	18	0	1	0	0	3	0	0	0	0
20/08/2020	River Glenderamackin	NY 31584 24540	1	1	4	0	0	0	0	1	0	0	0	0
20/08/2020	Naddle Beck	NY 30003 23828	0	1	12	1	0	0	0	48	76	0	0	0
20/08/2020	Naddle Beck	NY 30129 24079	5	6	65	10	0	0	0	1	0	0	0	0
24/08/2020	Brockle Beck	NY 27075 22270	0	1	1	0	1	0	0	4	159	0	0	0
24/08/2020	Brockle Beck	NY 26806 22249	0	1	0	0	0	0	0	38	416	0	0	Pike (145mm)
24/08/2020	Brockle Beck	NY 27663 22580	0	5	0	0	0	0	0	0	0	0	0	0
28/08/2020	Mill Beck	NY 25553 26081	0	8	0	0	0	0	0	0	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
28/08/2020	Applethwaite Gill	NY 26469 25638	0	3	0	0	0	0	0	0	0	0	0	0
28/08/2020	Lair Beck	NY 26060 24528	20	2	0	0	3	0	0	0	2	0	0	0
01/09/2020	Coal Beck	NY 20801 32786	36	3	1	0	2	0	0	1	0	0	0	0
01/09/2020	Coal Beck	NY 20074 32256	30	16	3	3	6	0	0	25	14	0	0	0
01/09/2020	River Glenderamackin	NY 36444 30036	2	2	1	7	0	0	0	4	0	0	0	0
01/09/2020	River Glenderamackin	NY 35699 30294	0	1	0	9	0	0	0	0	0	0	0	0
01/09/2020	River Glenderamackin	NY 35544 30058	0	5	1	5	0	0	0	0	0	0	0	0
02/09/2020	Tongue Gill	NY 24981 15061	12	6	20	2	0	0	0	1	3	0	0	0
02/09/2020	Scaleclose Gill	NY 24972 14977	5	0	14	0	0	0	0	1	66	0	0	0
02/09/2020	Tongue Gill	NY 25076 15001	7	1	14	1	0	0	0	1	58	0	0	0

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02/09/2020	Stonethwaite Beck	NY 25916 14877	3	4	66	0	0	0	0	4	0	0	0	0
03/09/2020	Barrow Beck	NY 26678 20168	0	0	0	0	0	0	0	1	43	0	0	0
03/09/2020	Watendlath Beck	NY 27434 16646	0	0	0	0	0	0	0	0	38	0	0	0
03/09/2020	Watendlath Beck	NY 26858 18134	0	1	0	0	0	0	0	0	0	0	0	0
04/09/2020	Barrow Beck	NY 37419 29574	4	0	0	0	0	0	0	2	24	87	0	0
04/09/2020	Barrow Beck	NY 37595 29704	0	1	0	1	0	0	0	7	4	9	0	0
04/09/2020	Naddles Beck	NY 37828 29561	1	2	0	0	0	0	0	10	4	24	0	0
04/09/2020	Barrow Beck	NY 37154 29324	1	2	0	1	1	0	0	24	39	42	0	0
04/09/2020	River Glenderamackin	NY 36446 28673	3	2	5	1	0	0	0	22	0	0	0	0
08/09/2020	Coledale Beck	NY 19999 21559	0	0	0	0	0	0	0	0	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
08/09/2020	Coledale Beck	NY 20235 21728	1	6	0	0	0	0	0	0	0	0	0	0
08/09/2020	River Derwent	NY 23443 11803	0	0	0	0	0	0	0	0	0	0	0	0
08/09/2020	Black Syke	NY 23710 12213	13	2	0	0	2	0	0	0	0	0	0	0
09/09/2020	Black Syke	NY 24465 12865	82	5	0	1	0	1	0	0	1	0	0	0
09/09/2020	Coledale Beck	NY 23619 23459	7	0	15	1	1	0	0	3	0	0	0	0
10/09/2020	Glenderaterra Beck	NY 29700 25108	36	4	1	1	0	0	0	0	0	0	0	0
10/09/2020	Glenderaterra Beck	NY 29928 24798	14	11	9	5	0	0	0	0	0	0	0	0
10/09/2020	Glenderaterra Beck	NY 29569 25271	12	3	0	1	0	0	0	0	0	0	0	0
10/09/2020	Whit Beck	NY 29529 25284	8	4	1	0	0	0	0	0	0	0	0	0
10/09/2020	Glenderaterra Beck	NY 29617 26321	4	11	0	0	0	0	0	0	0	0	0	0

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11/09/2020	Stonethwaite Beck	NY 26784 13317	3	2	13	4	0	0	0	2	1	0	0	0
11/09/2020	Stonethwaite Beck	NY 26348 13822	4	0	41	1	0	0	0	4	5	0	0	0
11/09/2020	River Derwent	NY 24805 13636	5	1	1	1	0	0	0	1	4	0	0	0
14/09/2020	River Derwent	NY 25114 16746	0	0	22	0	0	0	0	23	5	0	0	0
14/09/2020	River Derwent	NY 25559 14389	32	2	15	2	0	0	0	1	0	0	0	0
14/09/2020	River Derwent	NY 24012 12858	0	1	2	0	0	0	0	0	3	0	0	0
14/09/2020	Watendlath Beck	NY 26485 19011	0	0	0	3	0	0	0	18	13	0	0	0
15/09/2020	River Glenderamackin	NY 36585 29104	3	0	3	3	0	0	0	4	0	0	0	0
15/09/2020	Trout Beck	NY 36884 26938	0	2	1	3	0	0	1	7	0	0	0	0
15/09/2020	River Glenderamackin	NY 35872 26838	2	1	18	1	0	0	0	11	1	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
15/09/2020	Trout Beck	NY 35859 26724	0	1	11	2	0	0	0	9	7	0	0	0
16/09/2020	River Glenderamackin	NY 33291 25460	11	0	4	16	0	0	8	12	0	0	0	0
16/09/2020	River Glenderamackin	NY 34875 26468	0	0	20	8	0	0	0	5	1	0	0	0
16/09/2020	Mosedale Beck	NY 35371 26133	1	2	10	3	0	0	0	6	0	0	0	0
16/09/2020	Mosedale Beck	NY 35738 24788	3	4	0	0	0	0	0	0	0	0	0	0
17/09/2020	Newlands Beck	NY 23150 19399	9	11	29	2	0	0	0	0	0	0	0	0
17/09/2020	Newlands Beck	NY 22838 17744	9	0	1	7	0	0	0	0	0	0	0	0
17/09/2020	Scope Beck	NY 22706 19091	18	8	0	0	0	0	0	0	0	0	0	0
17/09/2020	Keskadale Beck	NY 22303 19345	7	9	0	0	0	0	0	0	0	0	0	0
18/09/2020	Pow Beck	NY 23974 22972	15	9	0	0	0	4	0	0	0	5	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
18/09/2020	Newlands Beck	NY 23863 22272	6	1	0	0	0	0	0	1	0	0	0	0
18/09/2020	Newlands Beck	NY 23817 22708	7	0	13	0	1	0	0	3	1	0	0	0
18/09/2020	Newlands Beck	NY 23663 21234	11	7	1	4	5	0	0	1	0	0	0	0
18/09/2020	Keskadale Beck	NY 21002 18877	5	2	0	0	0	0	0	0	0	0	0	0
28/09/2020	River Derwent	NY 18089 32920	0	0	22	1	1	0	0	13	7	3	0	0
28/09/2020	River Derwent	NY 16996 32981	0	0	35	0	2	0	0	16	3	1	0	0
29/09/2020	River Derwent	NY 12438 31790	0	0	21	0	1	0	0	15	0	1	0	0
29/09/2020	River Derwent	NY 12805 32486	0	0	14	6	5	0	0	9	31	1	0	0
29/09/2020	River Derwent	NY 15467 33558	0	0	28	3	12	0	0	18	8	2	0	0
02/10/2020	Wyth Burn	NY 31657 12337	0	6	0	0	0	0	0	0	0	0	0	0

Date	Watercourse	Grid Reference	Trout Fry	Trout Parr	Salmon Fry	Salmon Parr	Eel	Lamprey	Bullhead	Stone loach	Minnow	Stickle back	Signal Crayfish	Other
02/10/2020	Wyth Burn	NY 31907 12569	3	7	0	0	0	0	0	0	0	0	0	0
02/10/2020	Wyth Burn	NY 32137 12966	6	8	0	0	0	0	0	0	0	0	0	0
02/10/2020	Raise Beck	NY 32458 12870	0	6	0	0	0	0	0	0	0	0	0	0
02/10/2020	Raise Beck	NY 32583 12386	1	13	0	0	0	0	0	0	0	0	0	0

12 Appendix C

Financial breakdown of the cost of running the survey programme in 2020. Due to the pandemic, the staff costs are a lot higher than a normal survey year, due to not being able to use volunteers.

Project Income/ Spend			
2020 Income		**2020 Spend**	
Water Environment Grant (WEG)	£11,892	Staff costs	£18,325.51
National Trust - Riverlands Project	£3,000	Mileage	£1,089.10
Hadfield Trust Grant	£3,000	Equipment costs	£1,298.67
Derwent Owners Association	£2,000	Other	£40.00
Lancaster University	£1,638		
Angling Associations	£1,300		
United Utilities - Thirlmere Resilience Project	£562		
Total	**£23,392**	**Total**	**£20,753.28**