South Cumbria Rivers Trust
Electrofishing - 2022 Report

South Cumbria Rivers Trust

Contractor

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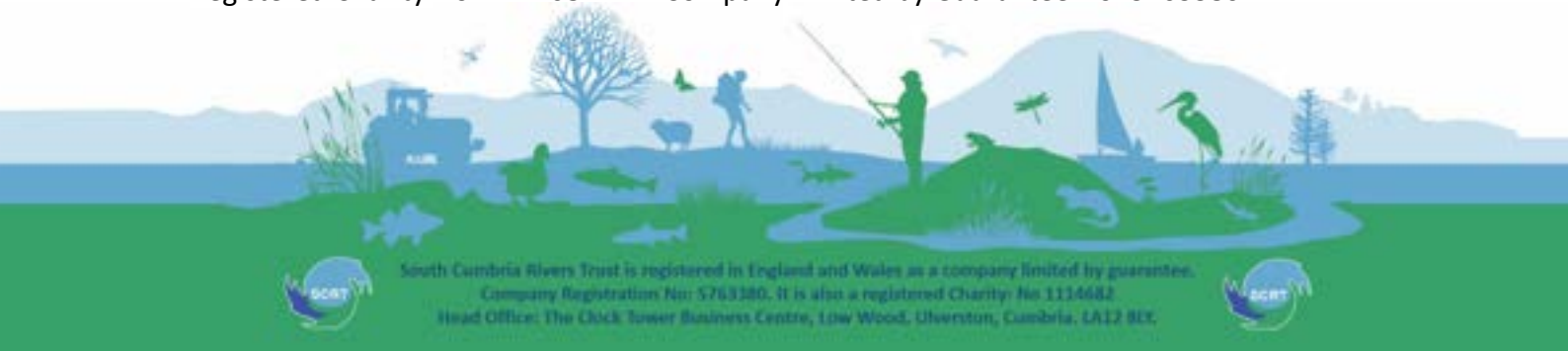

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1. Introduction

South Cumbria Rivers Trust (SCRT) undertake annual fish surveys across South Cumbria using the electrofishing method. This is an important assessment of juvenile salmonid (salmon and trout) populations to help understand trends over time and quantify the impacts of projects. It also gathers basic habitat information and is an important engagement tool for people interested in learning more about their local rivers. Salmonids are key indicators of freshwater health and general catchment functioning. Therefore, this monitoring provides evidence for catchment planning, data to support current projects and is used to inform the development of funding bids to deliver work on the ground. This information is used by the Becks to Bay catchment partnership and other local organisations such as the Environment Agency.

2. Project Aims

- Develop a robust scientific evidence base and on-going monitoring programme
- Investigate the effectiveness of habitat improvement work
- Assess trends in salmonid populations
- Inform the catchment plans and support Water Framework Directive monitoring
- Share data with the Becks to Bay partnership and wider public
- Identify opportunities for future habitat improvement work
- Engage public and partners with the issues facing our rivers

The project aims to undertake fish surveys on a rolling programme across the five main catchments covered by South Cumbria Rivers Trust. The programme is a mix of project sites and background sites; this will help to establish a baseline, monitor trends over time and assess the effectiveness of interventions. Fish populations are naturally variable, both within rivers and through time, therefore surveys for population estimates should be viewed at a catchment scale, particularly for migratory species such as salmonids. However, local variability can often be a good indicator of habitat quality.

The programme is run in conjunction with the Environment Agency's monitoring where possible to ensure they are complimentary and do not duplicate effort. The Environment Agency has undertaken fish surveys for several decades and therefore hold a large database of information which is accessible to SCRT. However, over recent years there has been less resource for monitoring, creating an evidence gap which SCRT aim to fill. SCRT have now been running an established electrofishing programme since 2016. Due to limited resource some surveys were undertaken prior to this, however these were on a smaller scale and not in the current programme format; SCRT hold some records running back to 2011.

3. Methodology

3.1 Electrofishing Methodology

Electrofishing is a humane, non-lethal means of surveying fish populations. The technique applies a small electric current to the watercourse which acts to cause temporary incapacitation and taxis of the fish towards the operator, thus rendering the fish easier to catch for bankside analysis. At each site an E-fish 500W electrofishing back-pack was used to survey an un-netted 50m reach using a single pass. Sites were fished following a zigzag pattern in an upstream direction, ensuring continuous coverage of the riverbed. Prior to surveying, water quality parameters, including temperature and conductivity were measured. This enabled adjustment of the E-fish backpack to the appropriate settings for each site, to ensure the safety and wellbeing of the fish and operators. The output frequency on the backpack was set to 50hz at all sites, as this is the most effective and safe setting for salmonids. Each survey was undertaken by a team consisting of a minimum of three people at each site, one operating the backpack and two people netting the fish using handheld nets. The method used is semi-quantitative as no stop nets are employed and there is only a single pass of the reach. Therefore, it is inevitable that some fish are missed during the survey; this is accounted for when calculating the results. Semi-quantitative surveys can be calibrated against the more detailed, but more time and resource intensive, quantitative surveys (Farooqi & Aprahamian, 1993). The semi-quantitative method is the most resource efficient method, maximizing coverage across the catchment. This is also the recommended method in the UK TAG framework for Water Framework Directive (WFD) monitoring.

Juvenile salmonids are the focus of the surveys. By recording the species and length we can gain an assessment of the size and age structure of the populations. Other fish species are recorded, but not measured; these include eels, bullhead, stone loach, minnow, lampreys, and sticklebacks. Further information on the river and surrounding habitat is also recorded to gain a more holistic picture. This includes details such as vegetation cover, bed substrate, water depth and basic water chemistry. This can then be used to inform the development of habitat improvement projects for fish spawning.

Surveys in this report were undertaken between July and September 2022. They are restricted to this timeframe so as not to disturb fish spawning and are only permitted under licence from the Environment Agency and with permissions from local landowners. Surveys record salmonid fry and parr, which are caught and analysed on site. Fry hatch from eggs spawned in the autumn and then emerge out of gravels during April/ May. Parr are fish which are one year or older; most salmon parr leave the river in spring as smolts when they are around 12cm in length. Trout parr will either migrate down into the main river to become brown trout or undergo smoltification and move out to sea as sea trout. Typically, juvenile salmon and trout spend between 1 and 3 years in freshwater before migrating to the sea as smolts. During the surveys the number of fish are recorded, and the length of each individual is measured to the fork in the tail (to the nearest 0.5cm). All fish are then returned to the water, unharmed. On rare occasions, a very small number of fish do not withstand the process and unfortunately mortalities do occur. South Cumbria Rivers Trust keeps a record of fish mortalities, and this is

reviewed to allow assessments of methods and surveyor technique. To date, fish mortalities have never exceeded 0.5% of the survey catches.

Within England and Wales it is an offence to electro-fish without an appropriate licence from the Environment Agency (EA). All licences from the EA and access permission from riparian landowners and fisheries owners were gained and granted prior to surveying.

3.2 Site Selection

During 2022 SCRT were granted a permit from the EA to undertake surveys across South Cumbria. Furthermore, this year additional funding from the EA via the Rivers Trust allowed us to expand the number of sites we survey on Priority Salmon Rivers. Therefore, a programme was established to cover project sites and expand the areas within priority salmon rivers for 'baseline' surveys to inform trends. The Duddon, Crake, Leven and Kent are all Priority Salmon Rivers. Table 1 shows the full list of sites surveyed, and Figure 1 shows their distribution across South Cumbria.

Table 1. Full list of sites surveyed by SCRT across South Cumbria in 2022.

No.	Site	Catchment	Waterbody	Waterbody ID
1	Colton Beck	Crake	Crake	GB112073071190
2	High Wood	Crake	Crake	GB112073071190
3	Langholme Beck	Crake	Crake	GB112073071190
4	Smithy Beck	Crake	Crake	GB112073071190
5	Black Hall - Roudley Beck	Duddon	Duddon	GB112074069940
6	Cockley Beck	Duddon	Duddon	GB112074069940
7	Dale Head	Duddon	Duddon	GB112074069940
8	Dubbs Beck	Kent	Gowan	GB112073071410
9	River Gowan	Kent	Gowan	GB112073071410
10	Lambrigg (upstream)	Kent	Flodder Beck	GB112073071340
11	Lambrigg (downstream)	Kent	Flodder Beck	GB112073071340
12	Patton Bridge	Kent	Mint Upper	GB112073074640
13	Sprint Mill	Kent	Sprint	GB112073071430
14	Hall beck	Kent	Kent - headwaters to conf Gowan	GB112073071390
15	Scandale Beck	Leven	Rothay	GB112073071140
16	Troutbeck	Leven	Troutbeck	GB112073071130
17	Satterthwaite - Farra Grain	Minor Catchment	Grizedale Beck	GB112073071360
18	Horrace Hill	Minor Catchment	Poaka Beck	GB112074069790
19	Rathmoss Beck	Minor Catchment	Poaka Beck	GB112074069790
20	Bela at Strickley	Bela	Stainton Beck	GB112073071100
21	Lickle at Croglinhurst	Duddon	Lickle	GB112074069880
22	Lickle at Appletreeworth	Duddon	Lickle	GB112074069880
23	Greenholme (upper)	Crake	Crake	GB112073071190
24	Greenholme (Lower)	Crake	Crake	GB112073071190

25	Cunsey Beck	Leven	Cunsey Beck	GB112073071400
26	Black Beck	Leven	Black Beck	GB112073071400
27	Tarn Beck	Duddon	Tarn Beck	GB112074069920
28	Long House Gill	Duddon	Tarn Beck	GB112074069920
29	School Knott - Scout Beck	Leven	Leven	GB112073071420
30	Arndale Beck	Winster & Gilpin	Winster	GB112073071440
31	River Kent - upstream of Hall Beck	Kent	Kent - headwaters to conf Gowan	GB112073071390
32	Poaka Beck	Minor Catchment	Poaka Beck	GB112074069790
33	Standish Cote	Minor Catchment	Poaka Beck	GB112074069790
34	School Knott - Mill Beck	Leven	Leven	GB112073071420

Figure 1. Sites surveyed for fish by SCRT during 2022

3.3 Calculating the classification

Fish surveys provide data on the number of fish present within a reach, this can then be converted to a density of fish. Once the density of salmonids per 100m^2 has been obtained each site can be graded based on the National Fisheries Classification Scheme (NFCS). This scheme has been used by the Environment Agency to classify fish populations since 1997. Following discussions with the Environment Agency the results obtained here have been calibrated and classified using the same method. This involves using a pre-calculated conversion factor to make the fish densities obtained from semi-quantitative surveys

comparable to those generated from quantitative surveys (Farooqi & Aprhamian, 1993). These values can then be assigned to one of 6 classes; 5 classes based on quintiles and 1 one for absent, see Table 2; these are absolute classifications meaning they aren't related to sites with a similar habitat but rather are related to all sites and therefore they only give a broad indication. Prior to calibration against quantitative surveys, semi-quantitative surveys will give a minimum density of fish present at each site. Converting these values to the national system allows for comparison of abundance over a wider geographical area.

Salmonid fry and parr classes were separated based on fish sizes deduced from length abundance graphs. Fish grow at different rates depending on the site conditions, it is therefore difficult to assign one value for all sites. At sites where only a small density of fish are caught it can be difficult to determine the break in age categories, therefore a best estimate based on data and comparison to nearby sites is made.

During surveys, the number of individuals of any other fish species caught are also recorded. These species are not routinely surveyed by the Environment Agency and do not form part of the classification scheme, therefore only broad assumptions on presence/ absence can be deduced. Furthermore, the E-fish backpack is set to be most effective for salmonids and therefore numbers of other species caught may not be entirely representative.

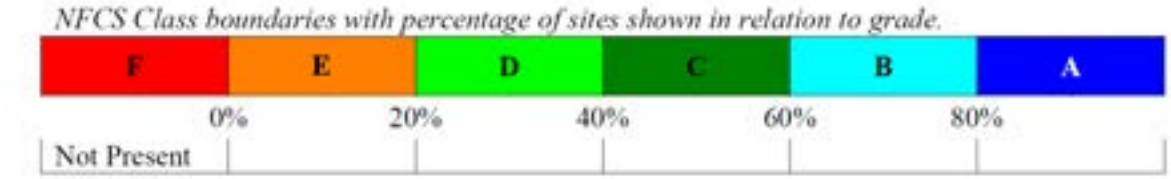
Table 2. Classification boundaries as provided by the Environment Agency

Salmonid abundance
(Values are No. per 100m^{-2})

Species group	CLASS				
	A →	← B →	← C →	← D →	← E	F
LEVEL ONE					
0+ Brown/sea trout	38	17	8	3	0
>0+ Brown trout	21	12	5	2	0
0+ Brown trout	86	45	23	9	0
>0+ Salmon	19	10	5	3	0
>0+ Rainbow trout	2	0.5	0.2	0.1	0
LEVEL TWO					
Brown/sea trout parr equivalents	47	28	15	6	0
Salmon parr equivalents	36	23	13	5	0
Total >0+ salmonids	31	18	11	4	0
>0+ Rainbow trout	2	0.5	0.2	0.1	0
LEVEL THREE					
Total salmonid parr equivalents	62	43	31	18	0

Table 3. National Fisheries Classification Scheme classes

Grade	Fish Density
A	Excellent
B	Good
C	Fair
D	Poor
E	Very Poor
F	No Fish Present



4. Results

4.1 Overview

The following maps (Figure 2 to Figure 5) show the National Fisheries Classifications Scheme (NFCS) classes for the sites surveyed across South Cumbria for salmon (fry and parr) and trout (fry and parr); full results are available in Appendix I.

Figure 2. Salmon fry abundance as classified under the National Fisheries Classification Scheme (NFCS) at sites surveyed across South Cumbria in 2022.

Figure 3. Salmon parr abundance as classified under the National Fisheries Classification Scheme (NFCS) at site surveyed across South Cumbria in 2022.

Figure 4. Trout fry abundance as classified under the National Fisheries Classification Scheme (NFCS) for sites surveyed across South Cumbria in 2022.

Figure 5. Trout parr abundance as classified under the National Fisheries Classification Scheme (NFCS) for sites surveyed across South Cumbria in 2022.

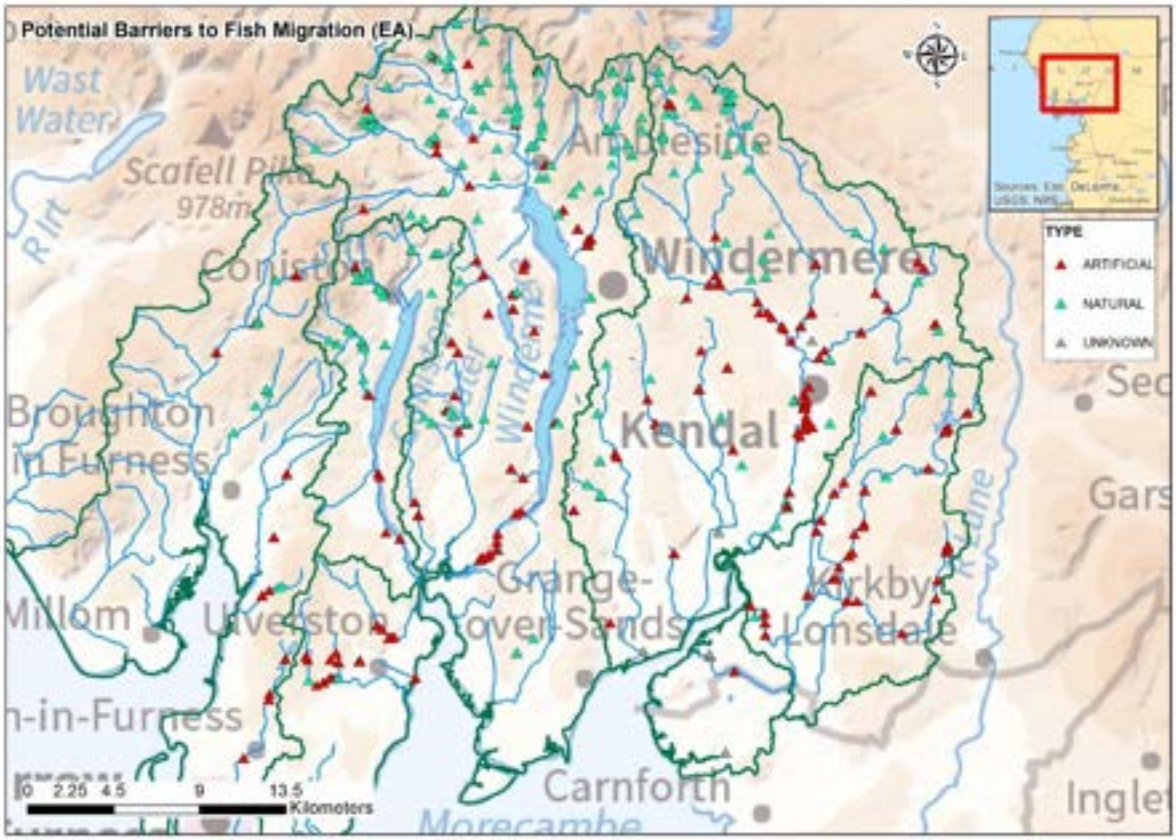


Figure 6. Potential barriers to fish migration across South Cumbria

4.2 Duddon

Figure 7: a photograph volunteers measuring fish beside the surveyed section of Roudley Beck

A total of 5 sites were surveyed in the Duddon catchment in 2022. Sites were largely decided upon due to their locality to ongoing or future work by SCRT. Three sites at the upper end of the catchment, Roudley Beck, Cockley Beck and Dale Head Beck buffer strip creation has been agreed, with fencing and tree planting to be completed along Roudley Beck by March 2023. Trout parr and salmon were found to be absent in all three becks, whilst trout fry were classified as poor, except for Roudley Beck where they were classified as fair (National Fisheries Classification). Along all three becks, there is visible livestock poaching which is likely to have caused increased nutrient and sediment run-off into the becks, decreasing the quality of habitat for spawning. The remaining two sites, Tarn Beck and Long House Gill are situated within the central reach of the catchment. Whilst salmon were still absent, trout populations were found to be more positive than in the upper catchment sites. Despite this parr were classified as 'very poor' and 'poor' respectively (National Fisheries Classification). Trout fry were also found to be 'poor' in Tarn Beck, which is in-line with records from a separate section of the Beck surveyed in 2021. This is likely to be influenced by factors such physical modifications, which have been identified along Tarn Beck. Fry populations at Long House Gill were recorded

as 'good'. The beck is steep sided, with little opportunity for high run-off into the beck upstream, however, tree cover could be improved. Eels were also identified within two sites, Cockley Beck and Long House Gill. All the sites surveyed in 2022 are within the area of a United Utilities funded project, allowing SCRT to be active in the catchment and improving aspects of water quality.

4.3 Coniston & Crake

During 2022 six sites were surveyed in the Crake catchment; these sites had been surveyed previously as part of the work associated with the Conserving Coniston and Crake project, which ran from 2017 to 2021. However, during 2022 a site at High Wood was also surveyed. This site is a new project site where work to de-culvert and open up this section of beck was completed later in summer 2022, after the fish survey, as part of the on-going legacy of work from the Conserving Coniston and Crake project. No fish were found in High Wood, it is hoped that the work completed here will increase connectivity and open up more spawning grounds. The majority of the work associated with the Conserving Coniston and Crake project was completed in 2018 and 2019, therefore, these sites have now had 3 or 4 years to establish. Greenholme is a good example; a new channel was created where the paleochannel was evident, by-passing a weir and opening up the beck to migratory fish, including salmon. The new channel is re-naturalising, trees were planted in 2020 and these are now starting to emerge from their tubes, with evidence of natural regeneration also happening within the fenced off section. The beck would benefit from a few trees closer to the banks to provide shade and cover, however, it is supporting a small population of salmon ('fair' and 'good', for salmon fry and parr, respectively) and an 'excellent' population of trout fry, see Figure 8. The upper section of this beck, where in previous surveys only 1 or 2 salmon had been recorded also supported salmon populations, although in small numbers. Issues with a blockage here where a water gate was due to be installed may have hindered some fish migration. It should be noted that since the new channel was created in September 2019 only a 25m has been surveyed downstream, this leads to potentially more variation in numbers as the results are extrapolated to an area of 100m^2.

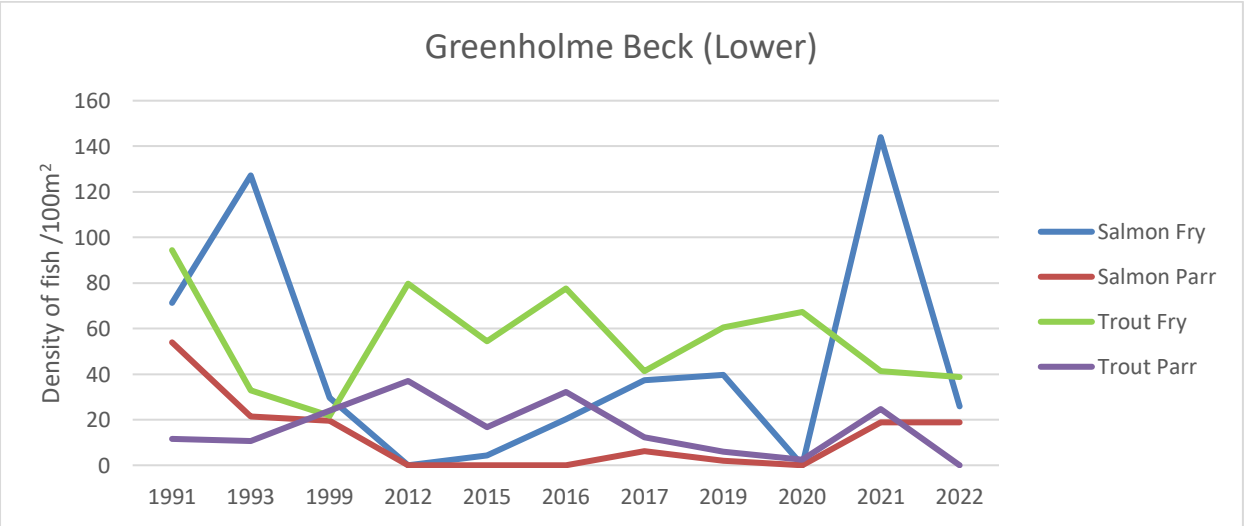


Figure 8. Salmon and Trout trends at Greenholme Beck (lower) between 1991 and 2022.

In 2021 salmon fry and parr were present in Langholme beck, comparatively in 2022 they were largely absent with only one salmon parr found. In general, across the Crake catchment salmon numbers are down compared to 2021, although 2021 was a notably good year for salmon in this catchment.

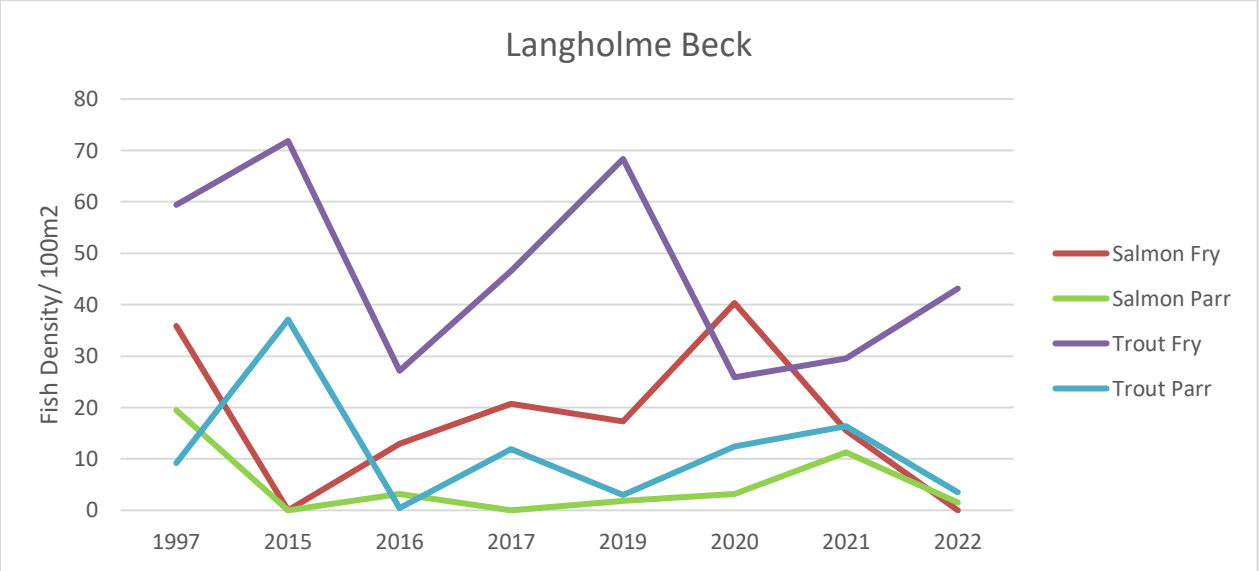


Figure 9. Trends in salmon and trout populations at Langholme beck between 1997 and 2022.

Smithy beck is a small beck, approximately 1m wide. It has often supported good trout populations, but in recent years there have been concerns for deteriorating water quality. During hot weather the beck may experience drought conditions. SCRT planted some trees around the area of survey which it is hoped will help keep the beck cool and provide additional habitat. Although it will take the trees a few years to establish, there was already evidence of natural regeneration.

Figure 10. Tree planting at smithy beck.

The last survey of Colton beck was in 2016 and was just upstream of the section surveyed in 2022. The section surveyed in 2022 was heavily wooded on one bank and open to livestock

on the other. No salmon were recorded, they were also absent in 2016 survey, however, trout fry and parr were both classed as 'good' under the NFCS.

4.4 Windermere & Leven

A total of six sites were also surveyed within the Leven catchment. At the lower end of the catchment, Black beck and Cunsey beck, into which Black beck flows via Esthwaite Water, were both surveyed. Salmon were absent in both becks. In Black beck, following the National Fisheries Classification Scheme, both trout parr and fry were classed as 'fair'. Eels and stoneloach were also identified. Trout were found to be absent in Cunsey beck, but perch and crayfish were seen during the survey. Absence of Salmon and Trout is likely to have been influenced by a pollution event earlier in the year.

Figure 11: A photograph of an eel caught on Black Beck.

At the upper end of the catchment, two sites were surveyed prior to scoping works for an ongoing SCRT project. Scout beck and Mill beck were new sites for SCRT. Both salmon and trout were absent from Scout beck. The downstream section of the beck is within a SSSI, however the section surveyed is upstream of a large culvert. Therefore, limited connectivity is likely to be the cause of absent populations. Salmon and trout fry were also absent on Mill Beck. Trout parr were classified as 'poor'. The beck has good potential for fish habitat; however, evidence of poaching and limited shading may be an influence in the low classifications of salmon and trout in the beck.

Salmon were present at both Scandale beck, near Ambleside, and Troutbeck, although populations were low. At Troutbeck, where SCRT undertook an embankment removal project in 2020, only salmon parr were present, categorised as 'very poor'. Both fry and parr were recorded at Scandale, but they still only classified as 'very poor' and 'fair' respectively. Trout populations at each site were healthier, with both recording a 'good' for fry and a 'poor' for parr at Troutbeck and 'very poor' at Scandale. In-river habitat at Scandale was variable providing a range of habtiats, however, the lower section of the survey reach was revetted; this had eroded away to create some habitat but was still constraining the beck. Troutbeck had a more natural form, with woody debris (some installed by SCRT as part of the works) creating a series of pool and riffle sequences, however, having previously been straightened and embanked this section of river was still developing. It should also be noted that catch efficiency in the woody debris was reduced, with the debris providing cover for the fish.

4.5 Kent & Winster

Seven sites were surveyed on the Kent catchment, all of these sites were linked to the R4ever Kent projects sites. Dubbs beck is a watercourse that has had a series of restoration work completed in 2016, 2017 and now in 2022. Over the years the site has had revetment removed from its banks, tree planting and the creation of buffer strips. Whilst this year restoration works mainly focused on improving fish habitat, through the creation of riffle-pool sequences for brown trout to have enhanced spawning sites and resting pools during

low flow conditions. Figure 12 shows the trends in fish densities at Dubbs beck since SCRT started undertaking fish surveys. The graph shows the trends are relatively stable, however, a decline in 2022 is potentially down to the very warm waters and low flows conditions we exhibited in Cumbria throughout the summer. Overall, Dubbs beck is classified as 'excellent' for trout fry and 'fair' for trout parr, under the National Fisheries Classification. There are no salmon present in this watercourse due to a reservoir downstream preventing migration.

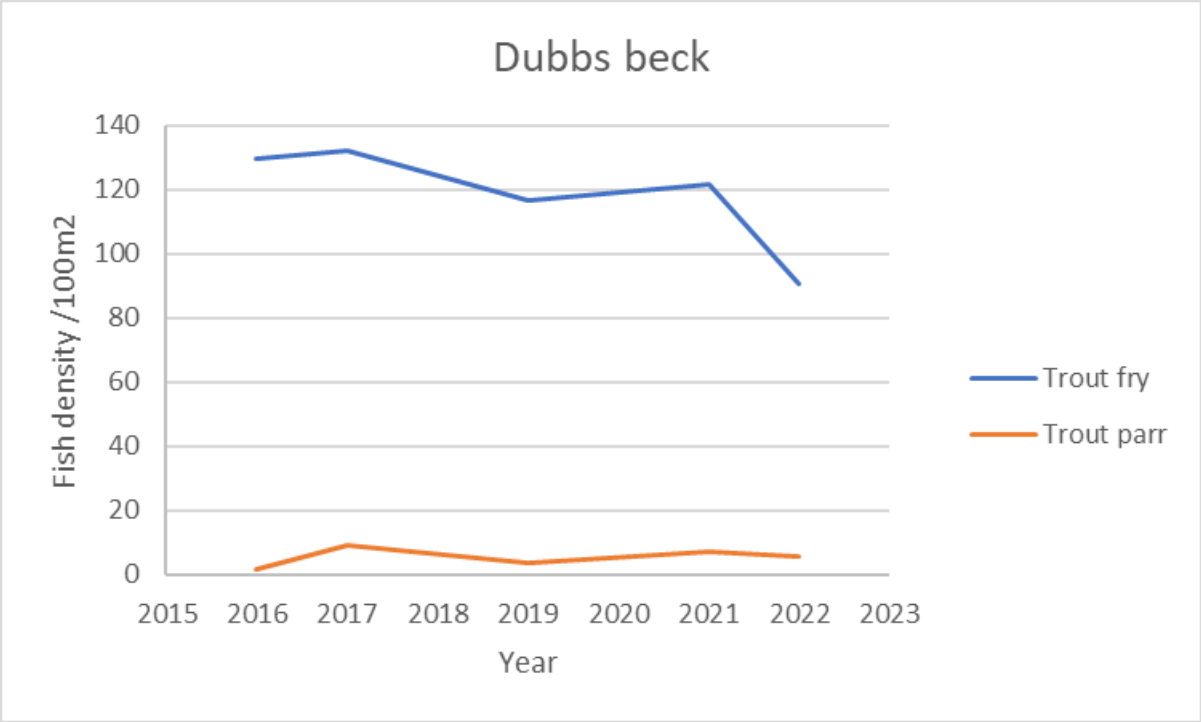


Figure 12: Fish densities per 100m^2 at Dubbs beck between 2016 and 2022. Note the irregular spacing of surveys.

Lambrigg beck was another site where SCRT have completed river restoration works in 2022, with the removal of a small weir to improve smolt migration downstream and upwards migration of all species. Further surveys will be conducted in future years to help quantify the benefits of the weir removal and the previous restoration works that were completed in 2021. The results show that both sites at Lambrigg beck were absent for salmon, where the sites were classed as 'good' for trout fry below the weir and 'fair' for trout fry above the weir. The difference is believed to be a result of the weir preventing upstream migration.

Other sites that were monitored include the River Gowan. These were monitored to gain a baseline understanding of fish populations prior to future restoration works. This section of the Gowan had a classification of 'good' for trout fry and 'poor' for trout parr. It is hoped that future river restoration works will create more in-channel habitat and flow diversity suitable for fish at all life stages, therefore, supporting healthier populations of fish. Repeat surveys will be conducted in the future years.

The main stem of the River Kent was monitored just upstream of Staveley (Figure 13), to gain an understanding of fish populations. The survey results showed that both salmon and trout were present, and the site was classed as 'excellent' for salmon fry and 'fair' for trout fry.

Figure 13: Section of the River Kent surveyed

One site was surveyed on the Winster in 2022. Arndale Beck, a tributary of the Winster, was picked due to project work to create buffer strips and woodland corridors being carried out at the site in 2021. Salmon were not present. Trout Parr were classified under the National Fisheries Classification as 'poor', whilst fry were classified as 'good'. Eels, lamprey, and Stickleback were also found to be present.

Figure 14: A photograph of the survey on Arndale Beck

4.6 Bela

Only one site was surveyed in the Bela catchment during 2022, this was at Strickley on Saint Sunday's beck where some restoration work was carried out by the landowner in 2021 . Restoration works included fencing the beck, see Figure 15, and re-connecting a short section into wet woodland. Only a short section of beck was surveyed due to poor weather coming in, however, the beck had plenty of tree and aquatic vegetation cover. Salmon were absent but trout were present in good numbers being classified as 'excellent' and 'fair' for fry and parr respectively.

Figure 15. Recently fenced section of beck on Saint Sundays.

4.7 Minor Catchments

Several surveys were undertaken on minor catchments, i.e. those outside of the five main catchments in South Cumbria. Four sites were located within the catchment of a SCRT United Utilities funded project (Poaka Catchment), primarily focused on improving water quality but with some aspects of habitat creation. At two sites within this catchment, both salmon and trout were absent. At Standish Cote the beck is small, and has previously been heavily poached by livestock, increasing nutrient and sediment run-off. A section of the beck was fenced off and planted with trees in 2021, aiming to reduce this.

Figure 16: Recent fencing and tree planting upstream at Standish Cote.

At the second site, on Poaka Beck, habitat potential looks promising, however a large section of the beck is culverted downstream, resulting in very poor connectivity. Salmon were also absent at the remaining two sites in the Poaka catchment, Horrace Hill and Rathmoss Beck. A

bufferstrip was installed at Rathmoss Beck in 2021, to replace a broken fence and reduce poaching. Trout fry were classified under the National Fisheries Classification as 'very poor', and parr were identified as 'poor'. The beck was heavily vegetated making it difficult to survey, which may have impacted this result. However, a history of intensive agriculture and modifications to the beck are also likely to have limited habitat potential. Despite there also being upstream modification to straighten a section of the beck on Horrace Hill, the picture was much more positive. Here, trout parr were classified as 'good' and fry as 'excellent' (National Fisheries Classification).

4.8 Environment Agency Classifications

SCRT work closely with the EA to share data and evidence, this partnership working helps to provide a more holistic picture of fish populations across South Cumbria. During 2022 the electrofishing programme has been part funded by the Environment Agency, as part of a collaborative project focusing on Priority Salmon Rivers and better sharing of data.

Additionally, the sites surveyed in South Cumbria by the EA can be seen in Figure 17 below; the Crake and Bela were relatively well covered by the EA teams during 2022. The raw data from the EA is now available via the Ecology and Fish Data Explorer, link below, however this is not yet available as National Fisheries Classifications.

EA Ecology and Fish Data Explorer. https://environment.data.gov.uk/ecology/explorer/

Figure 17. Environment Agency electrofishing sites 2022.

Redds were also counted on the Kent by the EA, with several salmon and trout redds being recorded between Staveley and Kendal town in December 2022.

4.9 Sources of Error

Although every effort is made to reduce sources in error it is inevitable that some occur. Firstly, as a small organisation, SCRT are not able to use the same team of people for each electrofishing survey and are reliant on the support of volunteers. There is naturally variation between different people both in terms of experience and technique. Furthermore, there can also be changes over time as surveyors become more used to the technique and potentially better at catching fish/ operating the equipment.

The same backpack and the same set up method are used at every site to help reduce variation in results. However, the conductivity of the water varies naturally, and although the backpack can be adjusted to take this into account, there are several sites across South Cumbria where the conductivity of the water is low, thereby reducing the catch efficiency. Most sites surveyed in 2022 had relatively good conductivity, although some reaches in the upper Duddon experience low conductivity. Similarly, habitat and flow variation can also impact catch efficiency. Typically overhanging branches and tree roots are good habitat for fish but can also hinder the netting, potentially skewing the data. To minimize this SCRT use a number of different nets appropriate to the stream type, for example a banner net is more practical in faster flowing, deeper sections whereas a small hand net is more appropriate in a small stream with variable bed substrate.

5. Historic Data

South Cumbria Rivers Trust have been undertaking a full electrofishing programme over the 5 main catchments covered by the trust since 2016. Prior to 2016 a number of surveys were done but these were limited in capacity and extent. A full timeseries can be viewed on the SCRT map, this shows all the locations where SCRT have surveyed since 2011, and enables a comparison of trends between years, particularly where sites have been revisited.

You can view a copy of the maps by clicking here.

6. The National Picture

The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) produce an annual report on the salmon stocks in England and Wales, these have been produced since 1997. This helps to set our data into wider context; however, the report is for the year before, 2021; 2022 data won't be available until next year. The report noted that overall there're has been a decline in the numbers of salmon returning to most rivers over the last decade, including in the North West; comparatively in southern England there is some evidence that stocks are

stablishing and moving towards recovery. There are 49 rivers in England which regularly support salmon and are therefore designated as 'principal salmon rivers', 4 of these rivers are within South Cumbria; the River Kent, River Leven, River Crake and River Duddon which have been a focus for this years electrofishing surveys by SCRT.

During electrofish surveys the Environment Agency found that 59% of sites surveyed between 2016 and 2021 were in the lowest two classes of the National Fisheries Classification Scheme (Class E -Very Poor or F - Absent). In 2021, 38% of sites were classed as A (Excellent) to C (Fair) which is just above the time series average between 2005 – 2021, see Figure 18 for the distribution.

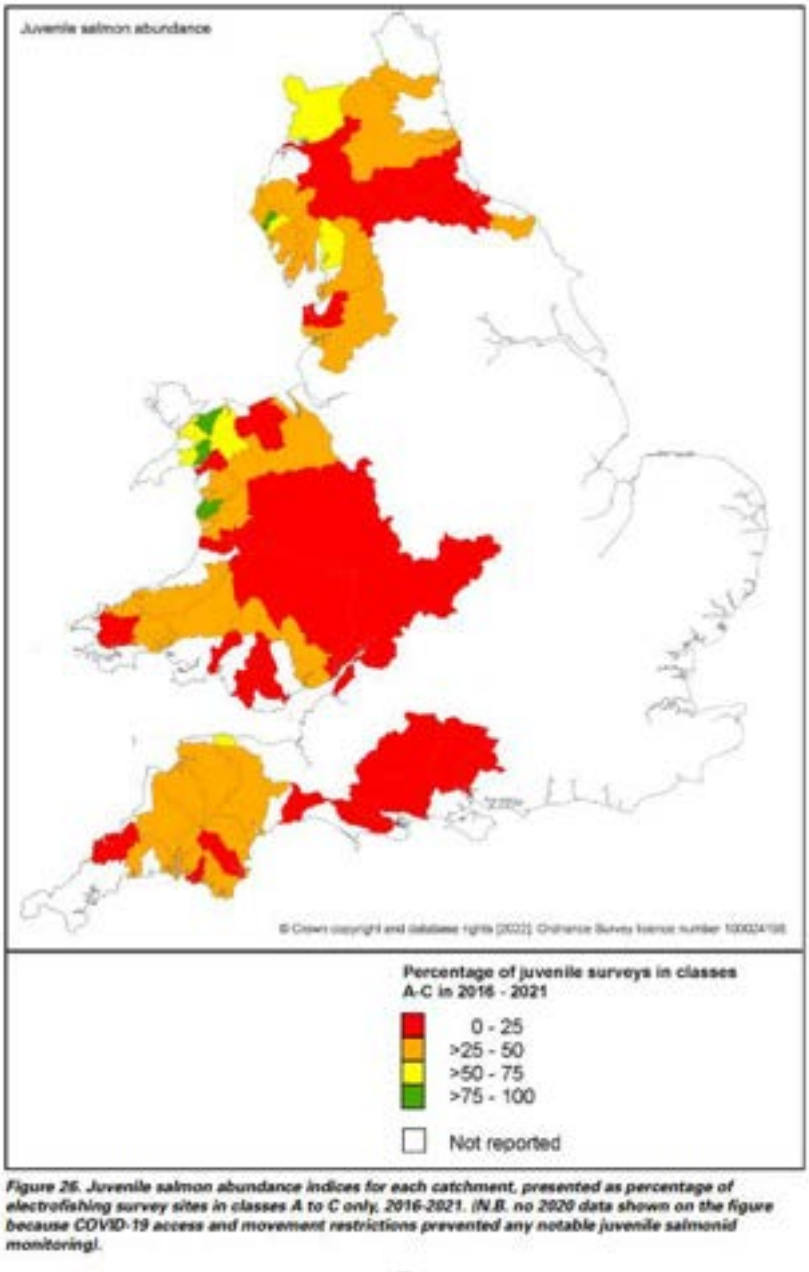


Figure 26. Juvenile salmon abundance indices for each catchment, presented as percentage of electrofishing survey sites in classes A to C only, 2016-2021. (N.B. no 2020 data shown on the figure because COVID-19 access and movement restrictions prevented any notable juvenile salmonid monitoring).

Figure 18. Screenshot from CEFAS (2021) salmon stocks report, showing the percentage of electrofish surveys classed as Excellent to Fair in 2016 -2021.

You can find the full CEFAS report here.

7. Other Species

During surveys all fish seen were caught; in addition to the salmonids, this also included bullhead *(Cottus gobio),* European eels *(Anguilla anguilla),* stoneloach *(barbutula barbutula).* Although these species were recorded, surveys were not targeted at these species and the e-fish kit was not set to be most effective for non-salmonids. Therefore, the following data should be taken with some caution. Additionally, the Environment Agency do not hold density data for non-salmonids therefore, there is no calculation to account for semi-quantitative surveys or a national fisheries classification scheme for comparison between rivers. Figure 19 shows the abundance and diversity of fish species within the sites sampled; these have been adjusted for density. Smithy beck had the highest density of fish, although was mainly dominated by trout fry. Comparatively, several becks recorded no species of fish, which can be indicator wider issues with the health of the system.

7.1 European eel

European eel, *Anguilla anguilla,* were recorded at 32% of the sites surveyed. Eels have seen huge declines since the 1980/90s and are classed as 'critically endangered', therefore their presence in the surveys is a good sign. Eels were recorded in all of the main catchments (Duddon, Crake, Leven and Bela) apart from the Kent, this reflects findings from 2021; the EA also didn't record any eels on the Kent in 2022 (although, they only surveyed 2 sites). SCRT have previously fitted eel passes to Stramongate weir, it may be pertinent to check these passes are still functioning. Conversely at Colton beck, 14 eels were recorded in a 50m stretch; the Lickle at Croglinhurst also had a relatively high number of eels.

7.2 Bullhead

Bullhead, *Cottus gobio,* are typically found in stony rivers or streams with fast flowing waters. Due to their nature to lie under rocks and dwell at the bottom of a river they can be harder to catch. They are relatively widespread across South Cumbria. Furthermore, where present they have typically been found at relatively good numbers; sites such as Lambrigg on the Kent, Scandale beck in the Leven catchment and Langholme in the Crake catchment all support relatively good densities of bullhead. They are relatively widespread across South Cumbria.

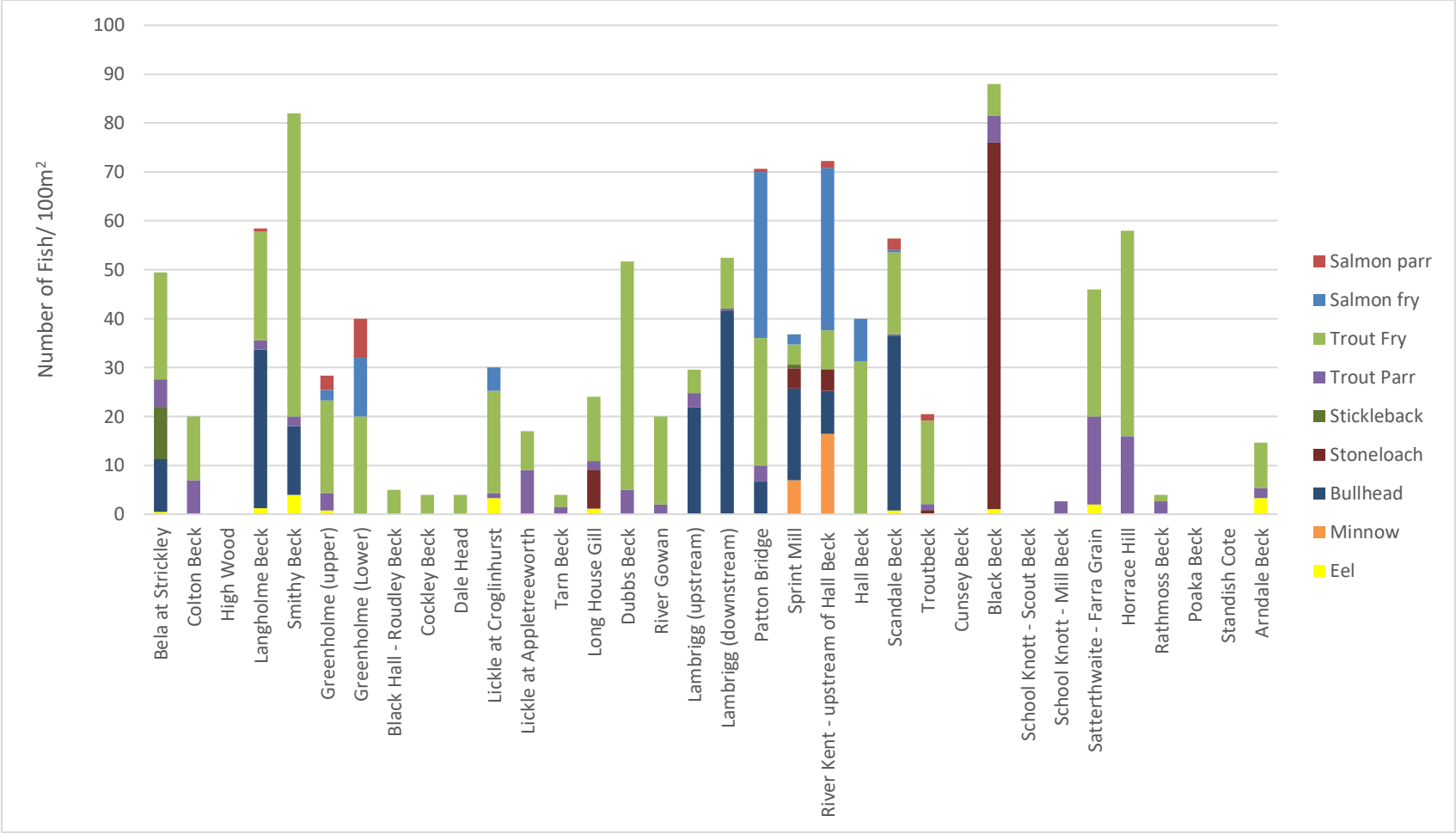


Figure 19. Abundance of all fish species recorded during 2022 surveys. Note this has been adjusted for density however, it has not been adjusted to take into account that surveys were semi-quantitative.

8. Next Steps for 2023

There will be a continued focus on expanding the programme, working with the national Rivers Trust and EA on priority salmon rivers. Additionally, SCRT project work will continue to support surveys in the Kent, Duddon and Poaka catchments. Further surveys in the Leven catchment will link with the development of the Windermere Community Partnership and the work of Love Windermere. Furthermore, the review of volunteer programmes across South Cumbria as part of the Windermere community partnership development will help to support the programme, which would not be possible without volunteers.

9. Acknowledgements

SCRT would like to thank all the volunteers who helped us survey, we couldn't undertake the programme without their support. Similarly, thanks must also go to the landowners for granting us permission to survey on their land. Funding to undertake the surveys this year came from the Environment Agency for the priority salmon rivers, United Utilities via the Raw Water project, European Union via the LIFE Project on the Kent and DEFRA via the catchment based approach, we are grateful for all contributions which support our on-going monitoring work.

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Appendix I

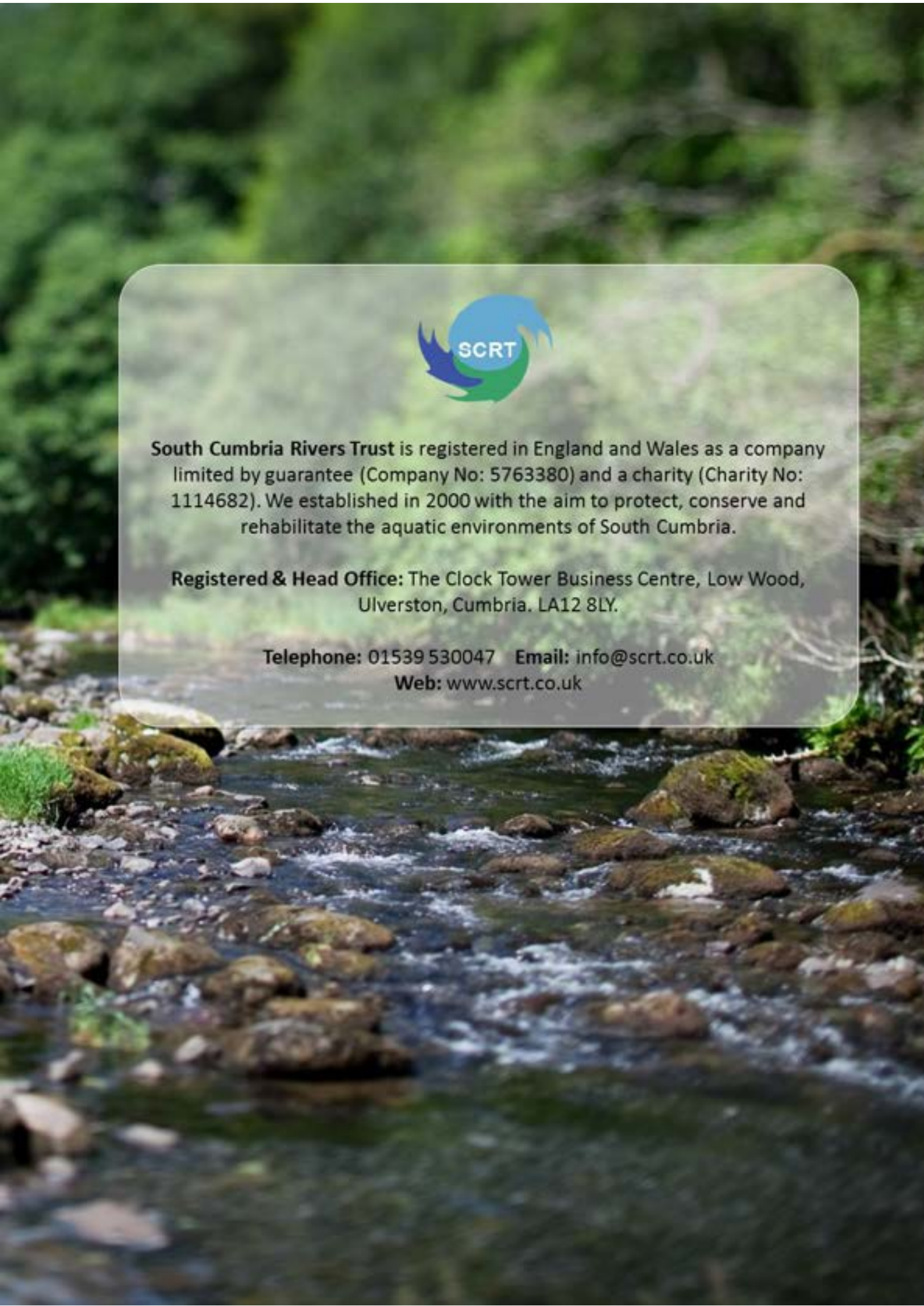
Raw data and National Fisheries Classification class by site for 2022.

No.	Site Name	Catchment	No. Salmon Fry	Total No./ 100m2	Salmon Fry NFCS Classification	No. Salmon Parr	Total No. per 100m2	S.Parr NCFS Classification	No. Trout Fry	Total No. per 100m2	T.Fry NCFS Classification	No. Trout Parr	Total No. per 100m2	T.Parr NCFS Classification
1	Bela at Strickley	Bela	0.00	0.00	F	0.00	0.00	F	43.00	42.60	A	11.00	10.41	C
2	Colton Beck	Crake	0.00	0.00	F	0.00	0.00	F	26.00	25.24	B	14.00	12.99	B
3	High Wood	Crake	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F
4	Langholme Beck	Crake	0.00	0.00	F	1.00	1.50	E	35.00	43.15	A	3.00	3.53	D
5	Smithy Beck	Crake	0.00	0.00	F	0.00	0.00	F	31.00	120.39	A	1.00	3.71	E
6	Greenholme (upper)	Crake	3.00	4.71	E	4.00	6.86	E	26.00	36.72	B	5.00	6.75	C
7	Greenholme (Lower)	Crake	3.00	25.92	C	2.00	18.87	B	5.00	38.83	A	0.00	0.00	F
8	Black Hall - Roudley Beck	Duddon	0.00	0.00	F	0.00	0.00	F	5.00	9.71	C	0.00	0.00	F
9	Cockley Beck	Duddon	0.00	0.00	F	0.00	0.00	F	3.00	7.77	D	0.00	0.00	F
10	Dale Head	Duddon	0.00	0.00	F	0.00	0.00	F	3.00	7.77	D	0.00	0.00	F
11	Lickle at Croglinhurst	Duddon	10.00	10.28	D	0.00	0.00	F	44.00	40.68	A	2.00	1.77	E
12	Lickle at Appletreeworth	Duddon	0.00	0.00	F	0.00	0.00	F	16.00	15.53	C	18.00	16.70	B
13	Tarn Beck	Duddon	0.00	0.00	F	0.00	0.00	F	5.00	4.85	D	3.00	2.78	E
14	Long House Gill	Duddon	0.00	0.00	F	0.00	0.00	F	23.00	25.52	B	3.00	3.18	D
15	Dubbs Beck	Kent	0.00	0.00	F	0.00	0.00	F	28.00	90.61	A	3.00	9.28	C
16	River Gowan	Kent	0.00	0.00	F		0.00	F	18.00	34.95	B	2.00	3.71	D
17	Lambrigg (upstream)	Kent	0.00	0.00	F	0.00	0.00	F	10.00	9.25	C	6.00	5.30	D
18	Lambrigg (downstream)	Kent	0.00	0.00	F	0.00	0.00	F	30.00	20.23	B	1.00	0.64	F
19	Patton Bridge	Kent	51.00	73.43	A	1.00	1.57	E	39.00	50.49	A	5.00	6.18	D
20	Sprint Mill	Kent	3.00	4.50	D	0.00	0.00	F	6.00	8.09	C	0.00	0.00	F
21	River Kent - upstream of Hall Beck	Kent	75.00	71.76	A	3.00	3.13	D	18.00	15.48	C	0.00	0.00	F
22	Hall Beck	Kent	7.00	18.90	D	0.00	0.00	F	25.00	60.68	A	0.00	0.00	F
23	Scandale Beck	Leven	1.00	0.86	E	6.00	4.66	C	42.00	32.62	B	1.00	0.74	E
24	Troutbeck	Leven	0.00	0.00	F	3.00	2.43	E	41.00	33.17	B	3.00	2.32	D
25	Cunsey Beck	Leven	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F
26	Black Beck	Leven	0.00	0.00	F	0.00	0.00	F	13.00	12.62	C	11.00	10.20	C
27	School Knott - Scout Beck	Leven	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F
28	School Knott - Mill Beck	Leven	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F	2.00	4.95	D
29	Satterthwaite - Farra Grain	Minor Catchment	0.00	0.00	F	0.00	0.00	F	39.00	50.49	A	27.00	66.79	B
30	Horrace Hill	Minor Catchment	0.00	0.00	F	0.00	0.00	F	21.00	81.55	A	8.00	29.68	B
31	Rathmoss Beck	Minor Catchment	0.00	0.00	F	0.00	0.00	F	1.00	2.59	E	2.00	4.95	D
32	Poaka Beck	Minor Catchment	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F
33	Standish Cote	Minor Catchment	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F	0.00	0.00	F
34	Arndale Beck	Winster & Gilpin	0.00	0.00	F	0.00	0.00	F	14.00	18.12	B	3.00	3.71	D

Appendix II

Densities per 100m² of all fish species caught. Note these are from semi-quantitative survey and have not been converted to quantitative.

Site Name	Eel	Lamprey	Minnow	Bullhead	Stoneloach	Stickleback
Bela at Strickley	1			11		11
Colton Beck						
High Wood	0			0		
Langholme Beck	1			32		
Smithy Beck	4			14		
Greenholme (upper)	1			0		
Greenholme (Lower)				0		
Black Hall - Roudley Beck						
Cockley Beck						
Dale Head						
Lickle at Croglinhurst	3					
Lickle at Appletreeworth						
Tarn Beck						
Long House Gill	1			0	8	
Dubbs Beck	0			0	0	
River Gowan	0			0	0	
Lambrigg (upstream)	0			22	0	
Lambrigg (downstream)	0			42	0	
Patton Bridge	0			7	0	0
Sprint Mill	0		7	19	4	1
River Kent - upstream of Hall Beck	0		16	9	4	0
Hall Beck						
Scandale Beck	1			36	0	
Troutbeck	0				1	
Cunsey Beck	0				0	
Black Beck	1				75	
School Knott – Scout Beck	0				0	
School Knott – Mill Beck	0				0	
Satterthwaite – Farra Grain	2				0	
Horrace Hill	0				0	
Rathmoss Beck	0				0	
Poaka Beck	0				0	
Standish Cote	0				0	
Arndale Beck	3	1			0	



South Cumbria Rivers Trust is registered in England and Wales as a company limited by guarantee (Company No: 5763380) and a charity (Charity No: 1114682). We established in 2000 with the aim to protect, conserve and rehabilitate the aquatic environments of South Cumbria.

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