South Cumbria Rivers Trust
Electrofishing - 2017 Report

Catchment Based Approach
Partnerships for Action

Life

SCRT

A project funded by CaBA & Natural Course

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SCRT Project Manager

SCRT's project manager for this contract was: Mike Sturt, Technical Manager

Report completed and signed off

Name: Dr Mike Sturt

Signature: 

Position: Technical Manager

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Introduction

As part of our monitoring programme South Cumbria Rivers Trust undertake annual catchment wide fish surveys using the electrofishing method. This enables assessment of juvenile salmonid (salmon and trout) populations and gathers some basic habitat information. The information gathered helps SCRT to monitor existing projects and deliver new projects where most needed. It also supports the work of the Becks to Bay partnership; informing future actions and providing evidence for the development of funding bids to deliver work on the ground.

Fish populations are naturally extremely variable, both within rivers and through time, therefore individual surveys cannot provide statistically sound measures of spatial or temporal change. The results of the survey should be viewed at a catchment scale, particularly for migratory species such as salmonids. Salmonids are key indicators of freshwater health and general catchment condition and it is therefore important that we gather information on current trends.

Project Aims:

i) Develop a robust scientific evidence base and on-going monitoring programme
ii) Investigate the effectiveness of habitat improvement work
iii) Assess trends in salmonid and other fish populations
iv) Inform the Catchment Plans and support Water Framework Directive monitoring
v) Share the data with the Becks to Bay partnership and wider public
vi) Identify opportunities for future habitat improvement work
vii) Assess future research requirements

This project aims to collect electrofishing data on a three-year rolling programme across the five catchments of South Cumbria Rivers Trust. This will enable the establishment of a baseline to be used in future electrofishing surveys. It will also be compared to the Environment Agency's (EA) data, both current and historic. Our programme is run in conjunction with the EA's monitoring to ensure it complements and does not duplicate effort. The Environment Agency has undertaken fish surveys for a number of decades and now holds a large database of information. However, reductions in Agency staff numbers has meant that it is harder to maintain and update this database thus creating an evidence gap – South Cumbria Rivers Trust therefore continue to supplement these statutory surveys so as to share resources. Therefore, each year SCRT is expanding their electrofishing programme to maximise coverage, and better understand the status of our catchments and fish populations. Results are used to support the delivery of a number of actions by South Cumbria Rivers Trust and the Becks to Bay partnership. All survey results are made available online and shared with partners following completion.

One of the key aims of the Becks to Bay partnership is to provide robust evidence, innovation and monitoring with the objective to *'develop an evidence base, shared knowledge hub and*

on-going monitoring strategy to co-ordinate delivery of strategic projects, promote research and enhance innovation'. By under-taking an extensive electrofishing monitoring programme, we are helping to establish an evidence base to monitor changes and trends across South Cumbria. This can then be used to target project activity and support funding applications to deliver more for the area of South Cumbria.

Methodology

Electrofishing Methodology

Electrofishing is a humane, non-lethal means of surveying fish populations. The technique applies an electric field in the watercourse which acts to cause taxis of the fish towards the operator and temporary incapacitation; thus rendering the fish easier to catch for bank-side analysis. At each site, an E-fish 500W electrofishing back-pack was used to survey an unnetted, single pass of 50m. Sites were fished following a zigzag pattern in an upstream direction, ensuring continuous coverage of the riverbed through riffle and pool habitat. Prior to surveying, water quality parameters including temperature and conductivity were measured, this allowed the appropriate output from the e-fish backpack to be set (the e-fish backpack allows for the adjustment of outputs dependent on local site parameters). The output frequency on the backpack was set to 50hz at all sites to enable for the most effective and safe monitoring of salmonids. A minimum team of three to four people undertook the surveys, thereby allowing for one person to carry and operate the backpack and two people to use hand held nets and carry a bucket to hold the captured fish. A 'Semi-Quantitative' catch-per-area methodology, as described above with no stop-nets and only one pass of a 50m reach, was employed as this is the most resource efficient survey method enabling a maximised coverage of the catchment. It is also a recommended method in the UK TAG framework for Water Framework Directive monitoring. Semi-quantitative surveys can be calibrated against more detailed but more time and resource intensive quantitative surveys (Farooqi & Aprahamian, 1993), such as those undertaken by the Environment Agency. Quantitative surveys require four operatives, multiple passes, stop nets and generator driven bankside electrofishing equipment (Dugdale *et al.,* 2006).

Prior to calibration against quantitative surveys, semi-quantitative surveys will give a minimum density of fish present at each site. However, larger individuals of both fry and parr are more readily caught than smaller individuals and therefore data will be skewed towards larger sizes (Scottish Fisheries Co-ordination Centre, 2007).

Juvenile salmonids (salmon and trout parr and fry) are the main focus of the surveys, which allow us to assess the size and age structure of populations. However, other fish species are recorded if caught; these include eels, bullhead, stone loach, minnow, lampreys and sticklebacks. Additionally, information about the river and surrounding habitat is recorded to give a more holistic picture; details such as vegetation cover, bed substrate, water depth and

basic water chemistry, including conductivity and temperature, are noted. 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 2017, under licence from the Environment Agency and with permissions from local landowners. Fry hatch from eggs spawned during the autumn and emerge out of gravels during April/ May; therefore, at the start of the survey season in July they are usually around 5-7cm in length. Parr are fish which are one year or older. Most salmon parr leave the river in the spring as smolts when they are around 12cm in length. Trout parr will either migrate down into the main river to become adult Brown Trout or undergo smoltification and move out to sea during the spring time as Sea Trout. Typically, juvenile salmon and trout spend between 1 and 3 years in freshwater before migrating to the sea as smolts. Fry and parr were caught and analysed on site. Numbers were recorded and the length of each individual is measured to the fork in the tail, to the nearest 0.5cm. After they have been recorded fish are returned to the water unharmed. On rare occasions, a very small number of fish do not withstand capturing without damage and unfortunately mortalities do occur. South Cumbria Rivers Trust keep records of fish mortalities during e-fish surveys and reviews allow assessments of surveyor technique. To date, fish mortalities have never exceeded 0.5% of the survey catches.

The Monitoring Officer manages all surveys to ensure they are carried out safely and meet the expected protocols. This is overseen by the Trust Director and Technical Officer. Only trained operatives were allowed to use the backpack and all volunteers were briefed on the survey method and health and safety requirements prior to undertaking each survey. Additionally, river levels and weather conditions were checked and recorded prior to each survey.

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 permissions from riparian landowners and fisheries owners were gained and granted prior to surveying.

Site Selection

The location of sites was planned to support existing project work undertaken by SCRT and the Becks to Bay partnership. Additional sites were included to ensure catchment wide coverage; these were co-ordinated with the EA's surveys to avoid duplication and to further extend the coverage. As the e-fish kit is only effective in relatively shallow water, and because we were only surveying for juvenile salmonids our surveys were focused mainly upon tributaries to the main rivers.

A total of 25 sites were surveyed across South Cumbria. This is far below the 57 sites proposed for survey, however, poor weather conditions and high-water levels frequently made it unsafe to survey. Conversely, all surveys at project sites, i.e. those where SCRT had recently undertaken projects or were planning projects were completed. Any sites not surveyed during 2017 will be reviewed for addition to the 2018 list.

Table 1. Full list of sites electro-fished by SCRT across South Cumbria in 2017

No.	Site Name	Catchment	Grid Reference
1	Greenholme Lower	Coniston	SD28718 89098
2	Greenholme Upper	Coniston	SD28289 89141
3	Hoathwaite	Coniston	SD30276 95360
4	Langholme Beck	Coniston	SD29114 86557
5	Smithy Beck	Coniston	SD27612 87111
6	Torver - Park Ground	Coniston	SD28566 93475
7	Torver - Sunny Bank Mill	Coniston	SD29046 92320
8	Yewtree Lower	Coniston	NY32159 00113
9	Yewtree Upper	Coniston	NY32218 00619
10	Bannisdale	Kent	NY52959 01935
11	Browfoot	Kent	NY45771 00656
12	Dubbs Beck	Kent	NY42359 00948
13	Kent nr Staveley	Kent	SD47516 97838
14	Ellerbank - Gilpin	Gilpin	SD46293 94782
15	Arndale Beck - Winster	Winster	SD42499 90316
16	Wood Farm - Winster	Winster	SD41040 90847
17	Black Beck - Esthwaite	Leven	SD35010 98742
18	Cunsey Beck - Esthwaite	Leven	SD36596 95162
19	Hall Beck - Esthwaite	Leven	SD34502 99812
20	Brathay at Skelwith	Leven	NY34474 03383
21	Broughton Beck	Leven	SD28537 82221
22	Little Langdale at Colwith	Leven	NY33113 03024
23	Little Langdale u/s Slaters Bridge	Leven	NY31738 03049
24	Miller Beck	Leven	SD37334 85808
25	Newlands Weir	Leven	SD30000 79797

Please see Appendix I for the full list of proposed sites.

Results

Calculating the classification

The densities of salmon and trout were calculated and assigned a grade based on the National Fisheries Classification System (NFCS). The NFCS has been used by the Environment Agency to classify fish populations since 1997, following discussions with the Environment Agency our results have been calibrated and classified using the same method for direct comparison. This involves using a pre-calculated conversion factor to convert fish densities from semi-quantitative surveys to correspond to quantitative surveys (Farooqi & Aprahamian, 1993) and then assigning the values to one of 6 classes. The system splits the data into quintiles, such

that the top 20% of sites from a given dataset are given a grade of A, the next 20% a grade of B and so on. There is also a class for 'no fish present'.

Fry and parr age classes were separated based on length abundance graphs; fish grow at different rates depending on the site conditions therefore it is not possible to assign one value for all sites.

During surveys, the presence and number of individuals of any other fish species caught are also recorded. Healthy fish populations depend not just on the abundance of fish but also the species diversity and the age structure of the population; therefore we record all species and measure the length of the juvenile salmonids as a proxy for age. For example, bullhead and eels are not routinely surveyed during EA surveys and are not part of the classification scheme, therefore, only broad assumptions on presence/ absence can be deduced.

Table 2. Classification boundaries as provided by the Environment Agency

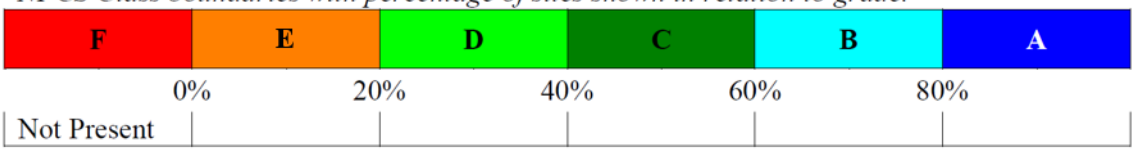
Salmonid abundance
(Values are No. per 100m^{-2})

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

NFCS Class boundaries with percentage of sites shown in relation to grade.



South Cumbria Overview – 2017

During the summer of 2017 we undertook surveys in the Kent, Leven and Crake catchments. Sites were planned for the Duddon and Bela however, poor weather conditions prevented these surveys; see Figure 1 or the full list of proposed sites. Additionally, the EA prioritised electrofishing surveys in the Kent & Duddon catchments this year and so to avoid duplication we concentrated our efforts on the other catchments.

Salmon abundance across South Cumbria was low and often entirely absent from the surveys at all life stages, as was also recorded in 2016. Trout populations were more variable, with a number of sites recording 'excellent' populations particularly at the fry life stage. Fry are the least mobile stages; therefore, it is valid to assume that their population is strongly influenced by local conditions (Dugdale *et al.,* 2006). Furthermore, there were a small number of sites where no salmonids were found, although other fish species were. Several sites have now been surveyed by SCRT over a number of years providing an evidence database for monitoring the successes (or failures) of project interventions. When combined with EA monitoring these can provide a longer-term dataset informing assessments of population trends.

It should be noted that these surveys are localised and targeted at juvenile fish. Additionally, it has also been established that many declines in fish populations can be attributed to problems at sea. While this is outside the scope of SCRT, there are still several measures which can be implemented in freshwaters to protect fish species and provide the best habitat to support healthy populations. Furthermore, it is evident from the results presented here that populations are variable at the local scale, reflecting habitat and local conditions. This offers opportunities for undertaking improvements to fish habitat to better support healthy populations of salmonids and other aquatic species.

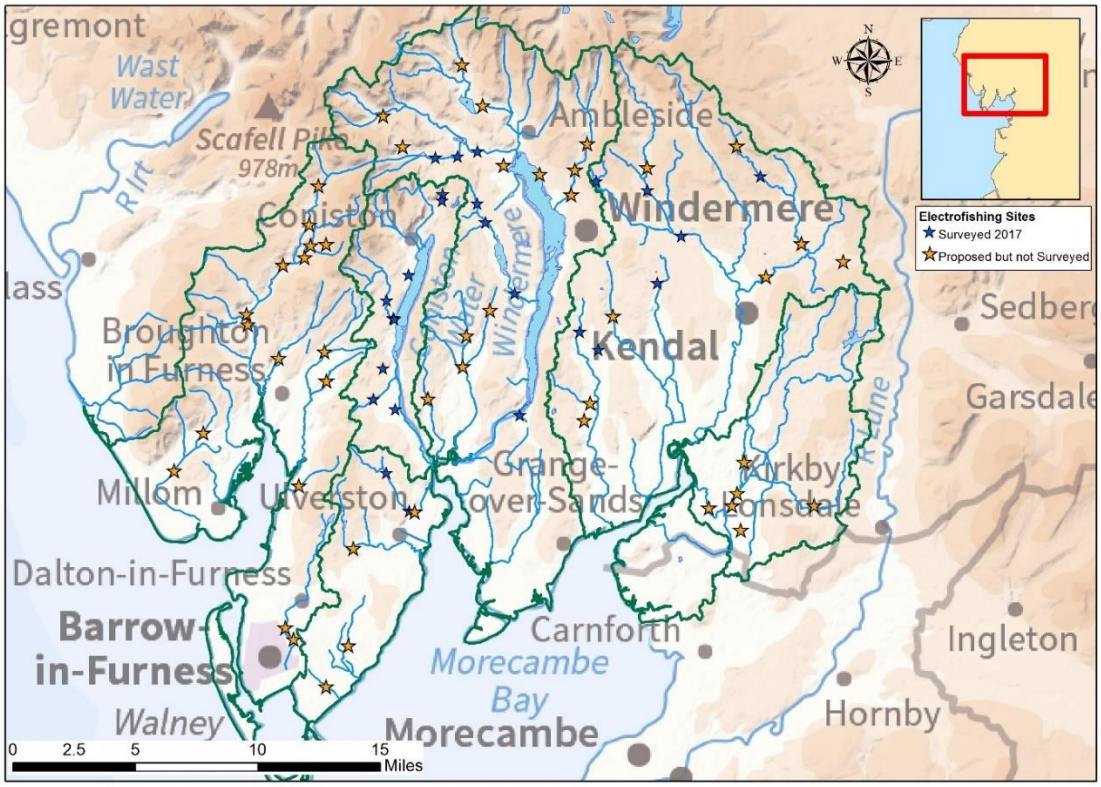


Figure 1. Map showing the full list of electrofishing sites which were proposed for survey and those which we successfully surveyed during 2017.

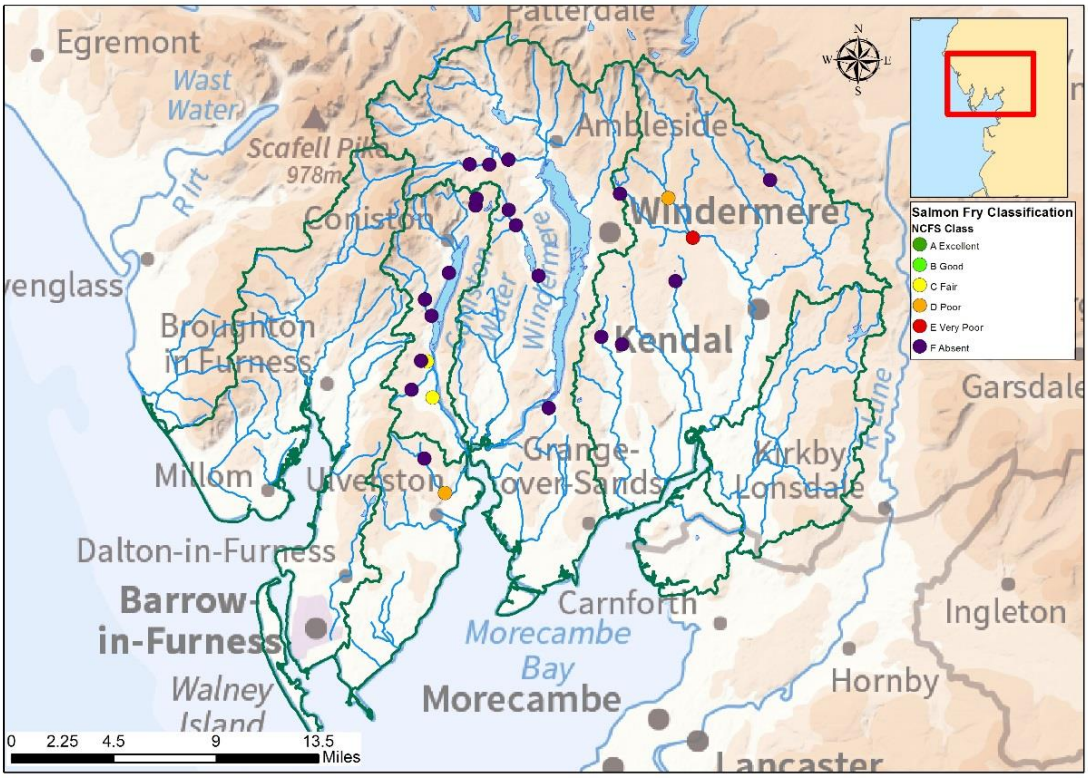


Figure 2. Salmon Fry abundance as classified under the National Fisheries Classification Scheme for South Cumbria.

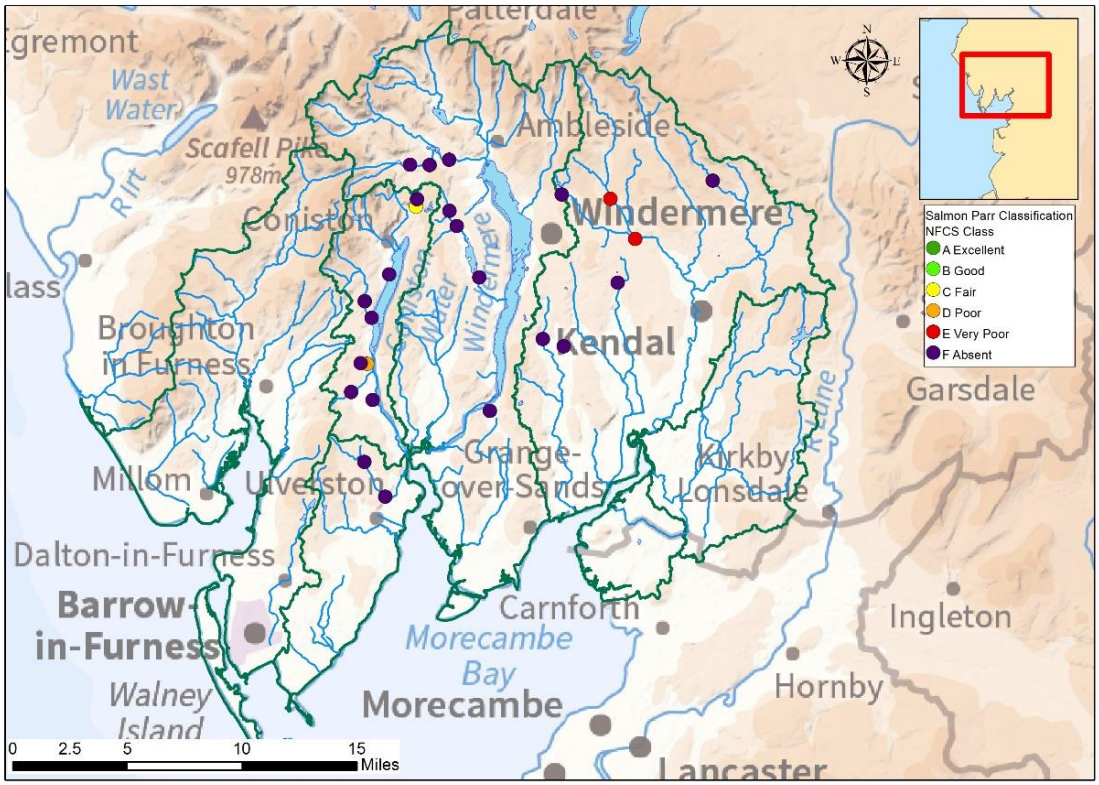


Figure 3. Salmon Parr abundance as classified under the National Fisheries Classification Scheme for South Cumbria.

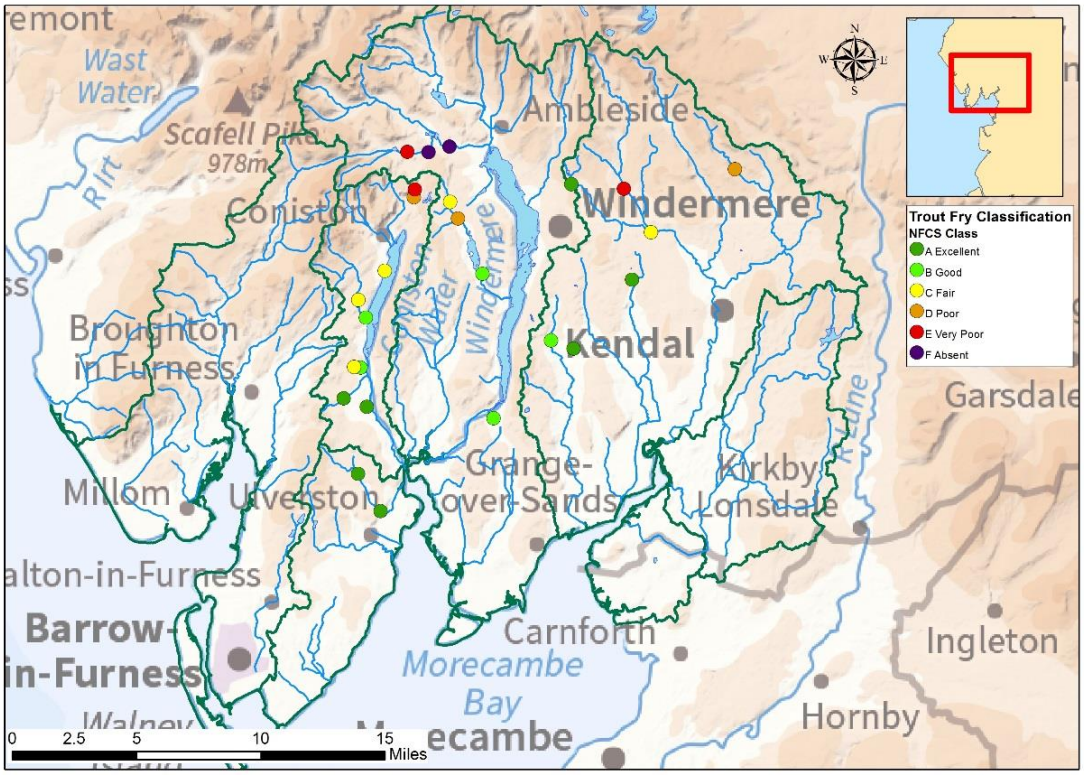


Figure 4. Trout Fry abundance as classified under the National Fisheries Classification Scheme for South Cumbria.

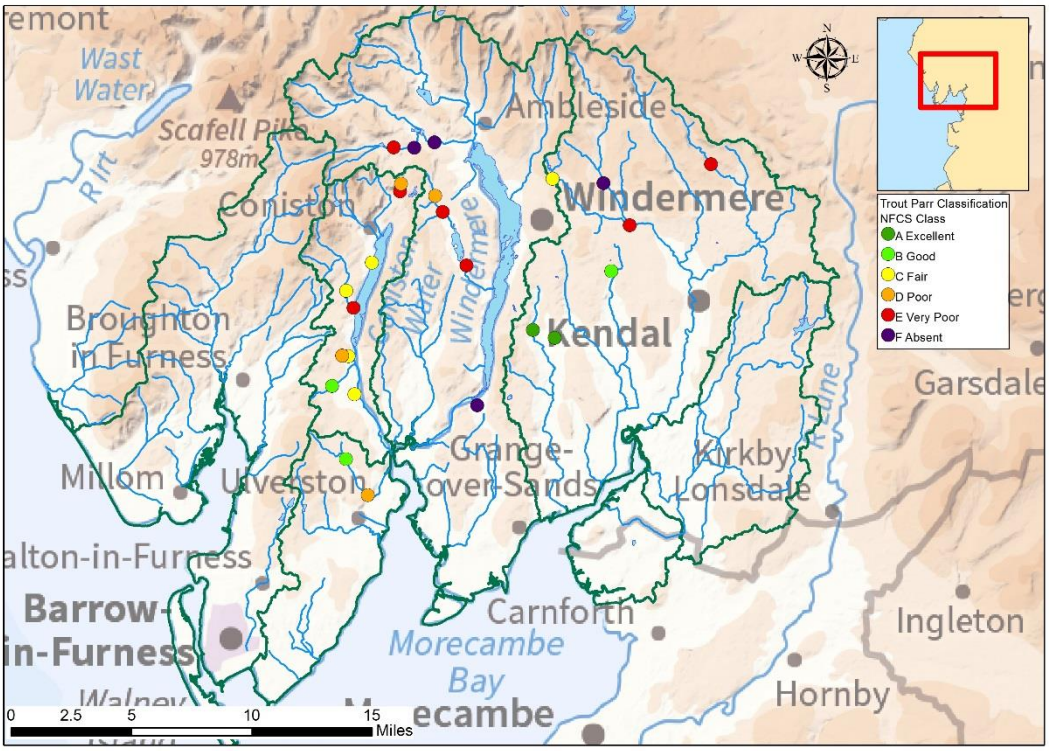


Figure 5. Trout Parr abundance as classified under the National Fisheries Classification Scheme for South Cumbria.

Duddon Catchment

No electrofishing surveys were carried out in the Duddon catchment this year. Sites were planned to expand last year's surveys; however, they were not prioritised because the EA had planned to undertake surveys in the area and it was felt that our efforts would be best placed elsewhere. If weather and time had permitted these surveys would have been undertaken, instead they will be surveyed next year.

Coniston and Crake Catchment

2017 saw the start of the development phase of the HLF funded Conserving Coniston and Crake project, therefore, electrofishing surveys were undertaken to support and provide evidence to the project. A number of habitat projects have been proposed for inclusion in the project over the next 3 years and these sites were surveyed to gain a better understanding of current status to provide a baseline for future comparisons.

Figure 6. The weir on Greenholme Beck

The only sites (from the 2017 surveys) where salmon fry were found in the Coniston catchment were Greenholme Beck and Langholme Beck. At Greenholme Beck, salmon were only found below the weir, see Figure 6, and were notably absent above the weir; the same pattern was observed in 2016. Results for Langholme beck showed the beck was 'poor' for salmon fry and salmon parr were absent. In 2016 both salmon fry and salmon parr were recorded, being classified as 'poor' for both.

Yewtree beck is another site where the Conserving Coniston and Crake project is investigating options, specifically looking at the fish pass below Yewtree Tarn. Therefore, for the past two years SCRT have surveyed both above and below the tarn. Salmon were only found below the tarn/fish pass and only at the parr life stage. In terms of trout, populations were 'very poor' to 'poor' both above and below the tarn and at both life stages, see Figure 4 & Figure 5. Comparatively, in 2016 trout parr were absent above the tarn and fry were classified as 'very poor'.

Figure 7. Fish survey on Yewtree Beck (above the tarn)

SCRT have surveyed Torver beck at Park Ground for a number of years, following habitat improvement works in 2013. No salmon have been recorded, probably due to the presence of waterfalls just below the site preventing migration. However, there is a resident population of brown trout which was classified as 'fair' for both fry and parr life stages. In comparison populations of trout fry were 'good' in 2016. Populations are naturally variable in time and efficiency with electrofishing technique and teams can differ; however, it was also noted that at the time of survey the beck was running quite fast and a lot of the riparian planting which had been allowed to establish was now becoming over-grown and would benefit from some coppicing. This coppicing is due to be completed during November 2017 through the Conserving Coniston and Crake Project.

Results for Torver Beck at Sunny Bank Mill showed an increase in trout fry from 'very poor' in 2016 to 'good' in 2017. This could be due to the after effects of storm Desmond and high flows during winter 2015 affecting recruitment for 2016. However, in 2015, prior to Storm Desmond trout populations were also classified as 'poor'. This reach has very little in-river habitat heterogeneity, is straightened and quite fast flowing. Caution should be taken when looking at electrofishing data for one season, as there are a wide variety of factors which can influence fish populations, and it is important to look at longer timescales. Therefore, it will be

interesting to see if populations remain good in 2018 or if they revert to the 'poor' classifications of 2015 and 2016.

Windermere and Leven Catchment

The Windermere and Leven catchment supports remnant populations of the endangered Freshwater Pearl Mussel *(Margaritifera margaritifera)*. As part of their lifecycle Freshwater Pearl Mussels rely on fish hosts (salmonids), therefore, good populations of salmonids within the catchment are vital to maintain healthy populations of Freshwater Pearl Mussels. Electrofishing surveys are an important assessment of salmonid populations, and also a measure of the success or failure of any project work in the area. No salmon (fry or parr) were found in the Windermere and Leven catchment during the 2017 surveys: note these surveys were not a comprehensive coverage of the catchment and it cannot be concluded that they are not present within the catchment. Trout populations were more variable, however, in many places they were still classified as 'absent – poor': this could suggest that the fish populations are not healthy enough to support populations of Freshwater Pearl Mussels and more habitat and water quality improvement needs to be considered across the catchment. It may also be that some of the project work completed to date will take a few years to fully establish and for the consequent changes to be seen in fish populations.

In previous years, Miller beck near Newby Bridge has locally been known as a good spawning beck, however, limited data exists to support this for recent years (past 5 years). In 2017 a section was surveyed near Newby Bridge filling station on the A590; salmon and trout parr were absent, however, trout fry were classified as 'good'. A habitat assessment showed that there was evidence of sedimentation and little heterogeneity in channel morphology, this is likely to affect fish populations and in particular the number of spawning fish in the area. In 2002 EA data shows that trout fry were classified as 'excellent' but parr were 'absent', similar to the results from SCRT's survey in 2017. It was proposed that in 2018 the beck would be surveyed in the upper reaches, provided access permissions could be sought.

Newlands Valley

In the past, Newlands beck near Ulverston has been known locally as an excellent tributary for fish spawning. Therefore, during 2017 SCRT undertook two surveys on the beck to gather data on current status. Initial results, taking into consideration that this is only one years' worth of data, suggest that the beck is still important for trout spawning with 'excellent' populations of trout fry recorded at both sites. Salmon fry (classification 'poor') were found at the site near Newlands weir, however, they were absent on Broughton beck; salmon parr were absent at both survey locations. Comparison with historic EA data from 1994 shows a very similar pattern in classifications, with trout fry and parr generally being 'excellent' along the beck and salmon frequently being absent (in 1994 they were only recorded in Newlands beck below the downstream of the A590).

Kent Catchment

Figure 8. A bucket of Salmon caught during the survey at Browfoot

Four sites on the River Kent were surveyed in 2017 together with additional sites within the Winster & Gilpin Catchment.

Salmon fry were present at two of the sites surveyed on the River Kent, including the main River Kent at Staveley and the upper Kent at Browfoot; some of the only locations surveyed in 2017 to record a presence of salmon. Populations at Browfoot were classified as 'poor'. At Staveley populations were classed as 'very poor'. Both of these sites also had a presence of salmon parr although classifications were 'very poor'. As is the case across South Cumbria trout populations were more variable. A site at the top of the River Gowan where SCRT has recently undertaken significant habitat improvement via a revetment removal had 'excellent' populations of trout fry and 'fair' populations of parr. Populations have increased in the three years SCRT have been undertaking habitat improvements in the area; in 2015 trout fry were classified as 'very poor' and parr were 'excellent'. This suggests that the juvenile habitat and juvenile survival is improving.

Winster & Gilpin

The Winster & Gilpin catchment surveys showed some of the highest densities of trout fry and parr across the catchments in South Cumbria. However, salmon were absent from surveys. Similar results were observed in 2016, however, the River Gilpin results were more variable and generally not as high in classification for trout as elsewhere in the catchment, although some salmon were found. The EA had planned 6 sites for survey during 2017 however, poor weather prevented these; therefore, these results should be interpreted with caution as they are only a small representation of the catchment. SCRT have recently started a three-year project on the Winster and Gilpin to investigate fish populations, improve habitat and engage communities. The results presented here will help support project delivery and inform future catchment management; further surveys will be undertaken in 2018 to reflect the work which is on-going.

Bela Catchment

SCRT didn't undertake any surveys in the Bela catchment this year. Sites were planned to expand last year's surveys; however, poor weather and high-water levels cancelled surveys on a number of occasions. Compared to other catchments in South Cumbria, there is a lack of fisheries information for the Bela and so this will be prioritised for survey in 2018. It is important to gather this data to support informed catchment management.

Environment Agency Electrofishing Classifications

Comparison of SCRT and EA datasets provides a more holistic picture of the catchments across South Cumbria. SCRT work with the EA to ensure that sites aren't duplicated, therefore both datasets should sit alongside each other to maximise coverage of the area. Like SCRT, during 2017 the EA survey team also completed a reduced survey profile due to high-water levels and adverse weather conditions during the survey season. However, results, mainly for the Kent catchment, show positive results for trout fry with all of them being classified as either 'Excellent' or 'Good'. Populations of other ages classes and salmon populations were more variable, dependent on local site conditions. Additionally, 2017 saw some of the best records, for the specific locations surveyed within the EA dataset.

SCRT electrofishing surveys for the Kent catchment likely reflect those of the EA. However, EA NFCS classes are often higher. This may be due to differences in technique or managing catch efficiency. Due to the nature of the surveys conducted by SCRT, which are semi-quantitative and rely on a variable team to maximise coverage in a short space of time, the efficiency may be lower resulting in a lower classification. On the other hand, the patterns observed by both organisations are similar, with records of trout fry being relatively good and the parr of all salmonids being lower and more variable. This may still be a reflection of some of the effects of flooding and high-water levels in winter 2015.

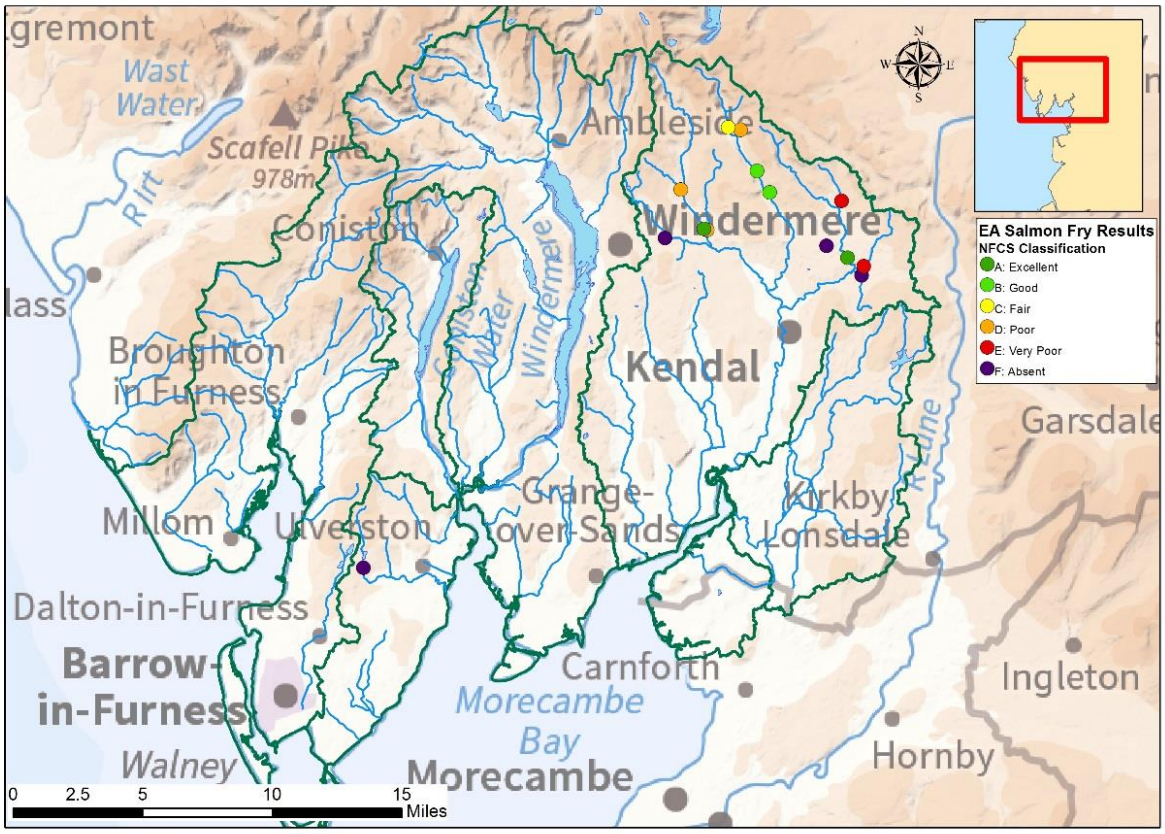


Figure 9. Environment Agency National Fisheries Classification for Salmon fry in South Cumbria during 2017

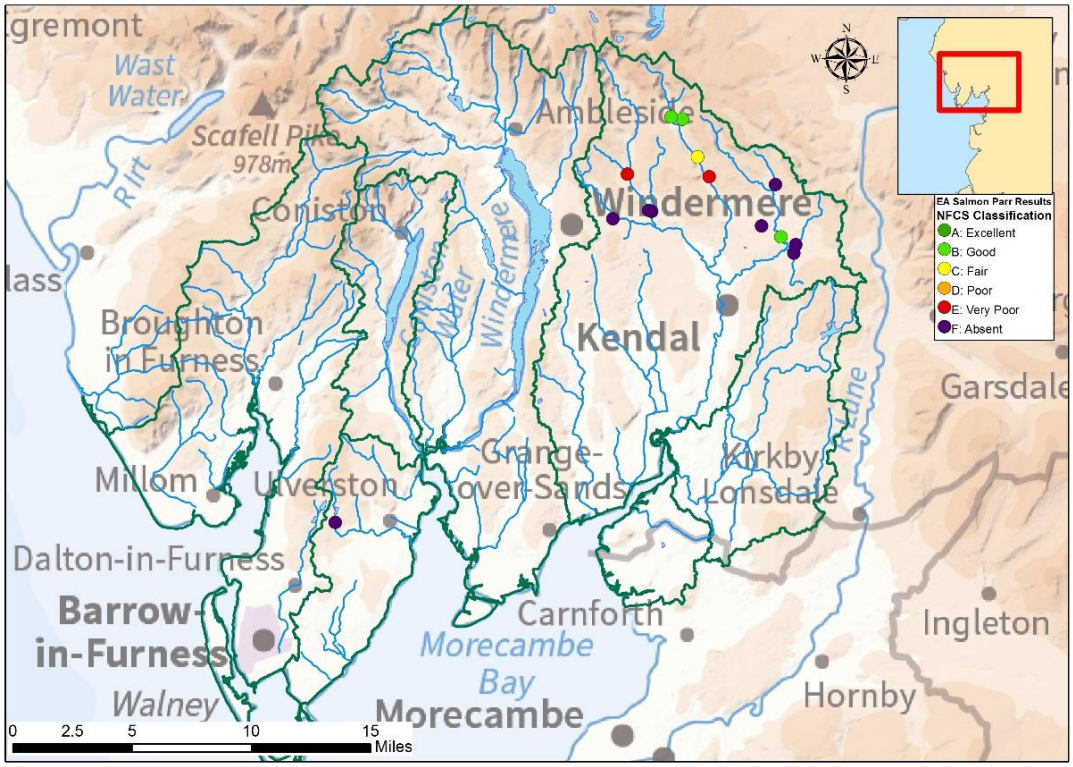


Figure 10. Environment Agency National Fisheries Classification for Salmon parr in South Cumbria during 2017

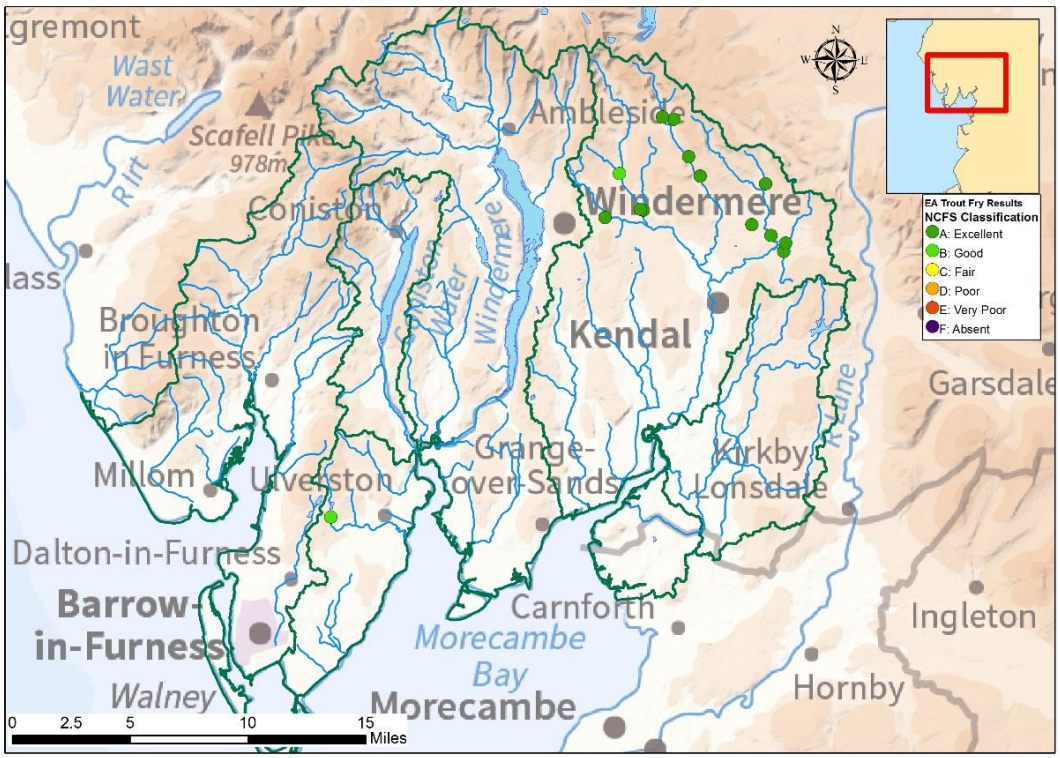


Figure 11. Environment Agency National Fisheries Classification for Trout fry in South Cumbria during 2017

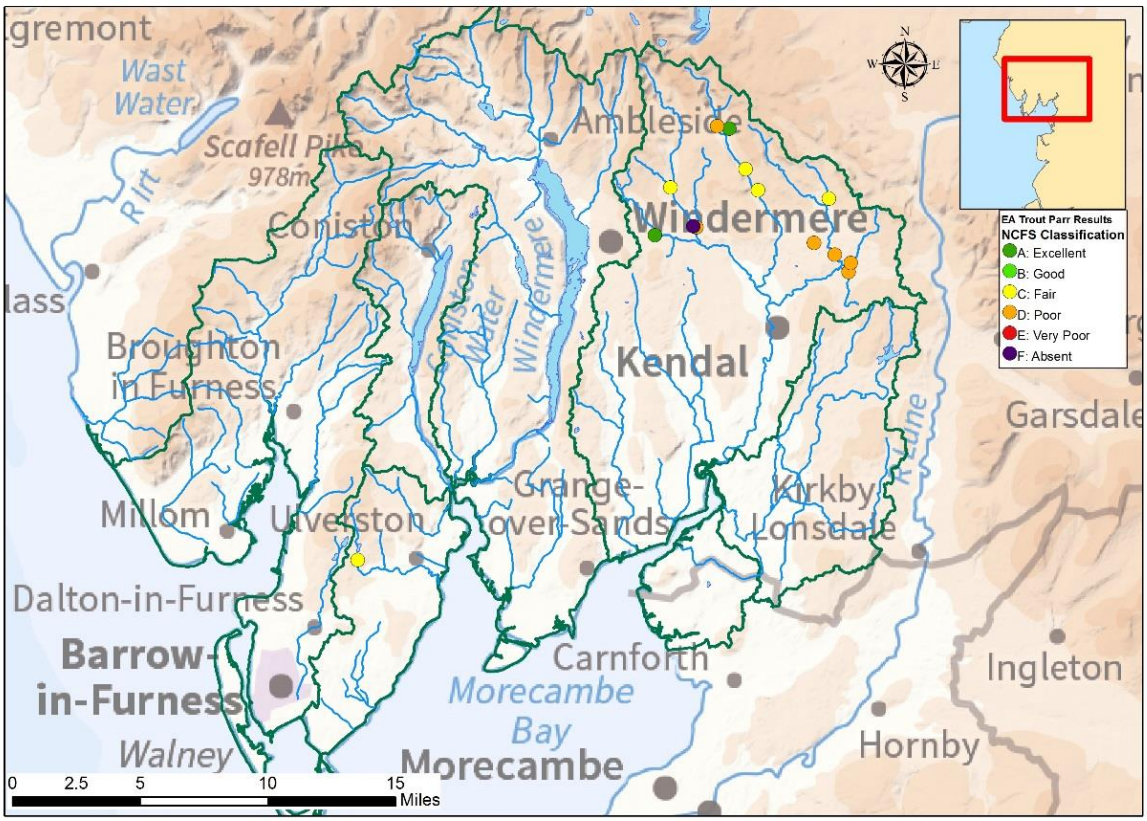


Figure 12. Environment Agency National Fisheries Classification for Trout parr in South Cumbria during 2017

Sources of Error

There are a number of potential sources of error which could account for differences in survey results, particularly when comparing between SCRT and EA data. It is not possible to eliminate a number of these sources, however, it is possible to minimise them and take them into account when reviewing the data. For example, the EA generally undertake a mix of quantitative and semi-quantitative surveys often focusing on main river reaches, whereas SCRT only undertake semi-quantitative surveys focussed on smaller spawning becks and upper tributaries.

Operation of the back-pack and electrofishing equipment can be a source of variation. Within SCRT the back-pack is set at standard values as specified by the manufacturers for electrofishing, such as 50hz for salmonids and a relevant duty pulse based on the water conductivity: this reduces variation in results. However, variation also occurs between electrofishing teams in terms of experience and technique. The practicalities of having the same electrofishing team through-out the survey season isn't an option and SCRT rely heavily on volunteers to support and help with the surveys. In order to reduce the variation further, prior to surveying SCRT brief the electrofishing team for the day and members of the team undertake the same roles through-out the day i.e. the person on the back-pack will operate the back-pack all day.

It has also been found that the type of stream bed and flow variation can make a big difference in the ease of catching a fish. To minimise this SCRT used a number of different nets appropriate to stream type, for example, a banner net is more practical in a faster flowing reach whereas a small hand net is better in a smaller stream with a variable bed substrate. Habitat variability itself affects catch efficiency, for example it can be harder to catch fish in dense vegetation cover or undercut banks. However, this is also an important factor in influencing fish populations.

In South Cumbria, another major factor affecting the catch efficiency is the conductivity of the site. Several of our sites have very low conductivity, particularly in the upper catchments rendering the electric current from the back-pack less effective. This can be minimised to a certain extent by adjusting the electrical output of the back-pack (increased voltage within manufacturers guidelines), however, at very low conductivity the effectiveness of this is limited and has little effect on the fish. Under these circumstances the number of fish seen but not caught is an important metric.

Other Fish Species

Native fish including bullhead (*Cotus gobio*), European Eels (*Anguilla anguilla*), brook lamprey (*Lampetra planeri*), minnow (*Phoxinus phoxinus*), stone loach (*Barbatula barbatula*) and stickleback (*Gasterosteus aculeatus*) were also recorded during the surveys. However, because the electrofishing surveys are targeted at salmonids (with the equipment set at optimal current, voltage and pulse frequency for salmonids), the results presented here may not be a true representation of other fish species. Therefore, the results are included for general information only and are particularly important at sites where no salmonids were recorded.

Eels

The European Eel, *Anguilla Anguilla* is critically endangered on the IUCN Red List of Threatened Species following a decline in populations over recent years. Eels are typically difficult to catch during electrofishing and settings on the backpack for salmonids are not optimal for eels therefore catch efficiency is lower. In 2017 Eels were found at a number of sites in South Cumbria, particularly within the Coniston catchment. An Eel pass is proposed for installation on the outfall at Yewtree tarn: the results from this years surveys suggest that this may help improve eel passage, with 5 eels being recorded below the tarn and only one above the tarn.

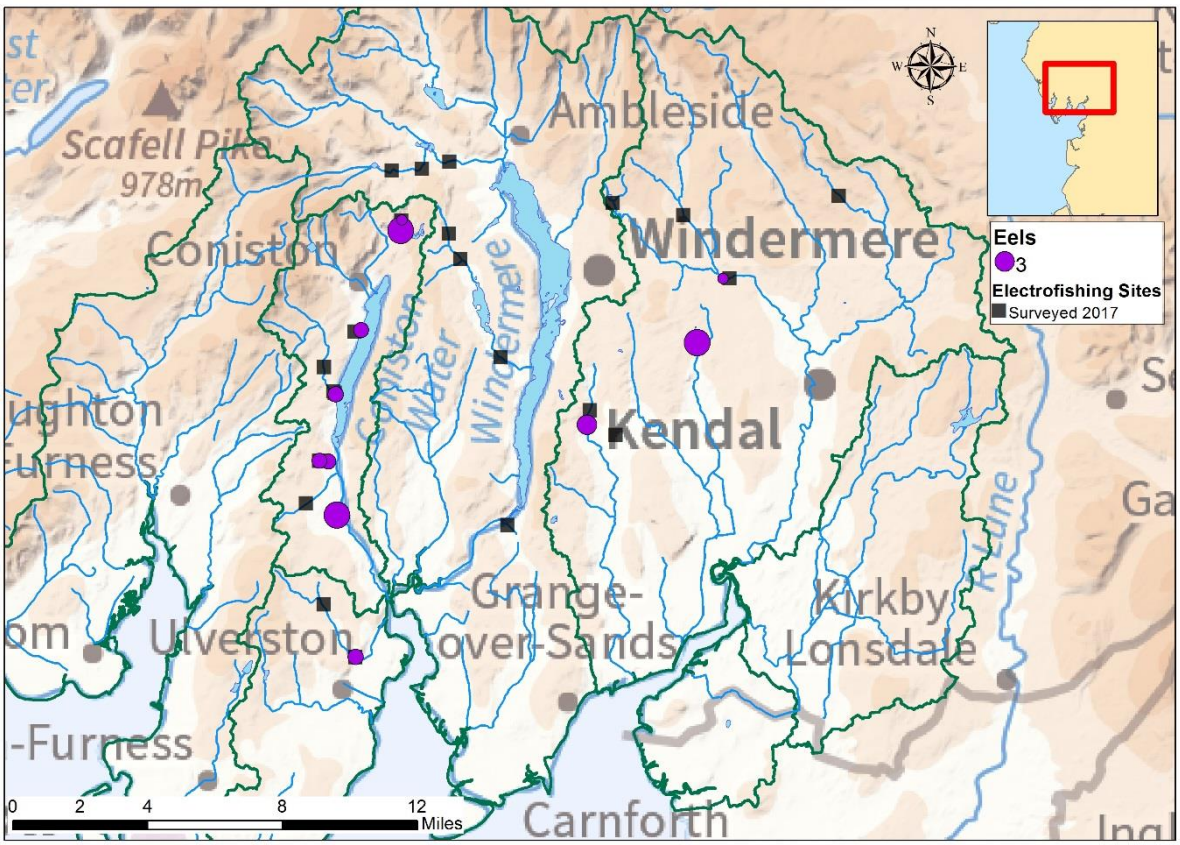


Figure 13. Relative Eel abundance for South Cumbria at the sites surveyed in 2017. Circles represent relative abundance compared to the legend. Note these figures haven't been adjusted for density.

Bullhead

Bullhead *(Cotus Gobio)* are generally widespread across Europe and are native to the UK. The Kent catchment in South Cumbria is designated a Site of Special Scientific Interest and Special Area of Conservation with one of the designated species being bullhead. Very few bullhead were caught during surveys on the Kent (Figure 14). Conversely, sites in the Coniston & Crake catchment recorded relatively high numbers of bullhead. As bottom dwelling fish, bullhead tend to hide under stones and cobbles and are particularly difficult to retrieve once stunned, therefore have a reduced catch efficiency. However, figures here give a good general indication of the presence of the species and whether population numbers are relatively healthy.

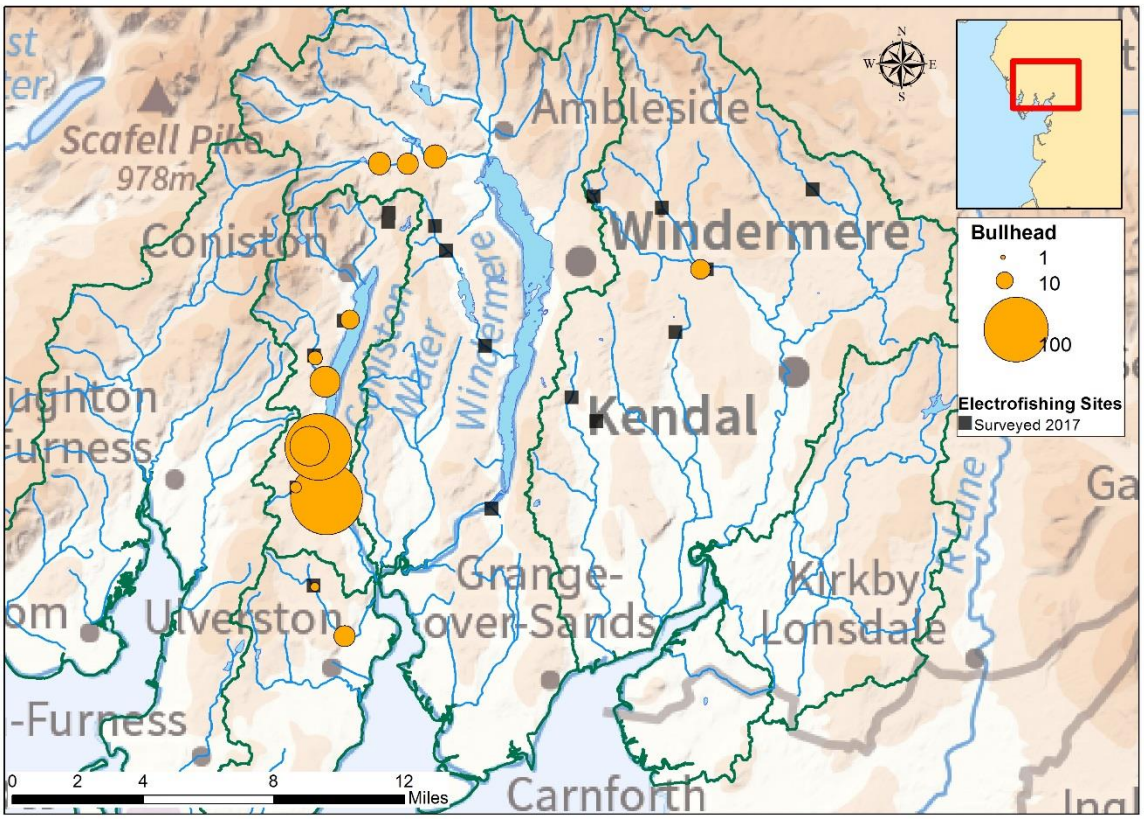


Figure 14. Relative Bullhead abundance for South Cumbria at sites surveyed in 2017. Note these figures haven't been adjusted for density.

Other Species

In addition to Eels and Bullhead other fish species recorded included minnow, stoneloach and stickleback. Minnow in particular were relatively prolific this year, especially in the Coniston and Crake catchment. A relatively high number of stoneloach were recorded in the Black Beck and Esthwaite catchments and similarly for stickleback in Torver Beck at Sunny Bank Mill. A graph of all the species recorded at each site can be found in the Appendices.

Catchment Management

The Becks to Bay Catchment Partnership takes a holistic approach to catchment management across South Cumbria. Data such as is presented here are most useful when combined with other tools and monitoring results, as is available on the Becks to Bay website (weblink). This creates a powerful dataset for holistic catchment management, identifying projects and facilitating future planning.

Additionally, SCRT now hold several years' worth of data for a number of additional sites. This enables more information to be drawn out about trends, informing concerns over declines in fish populations.

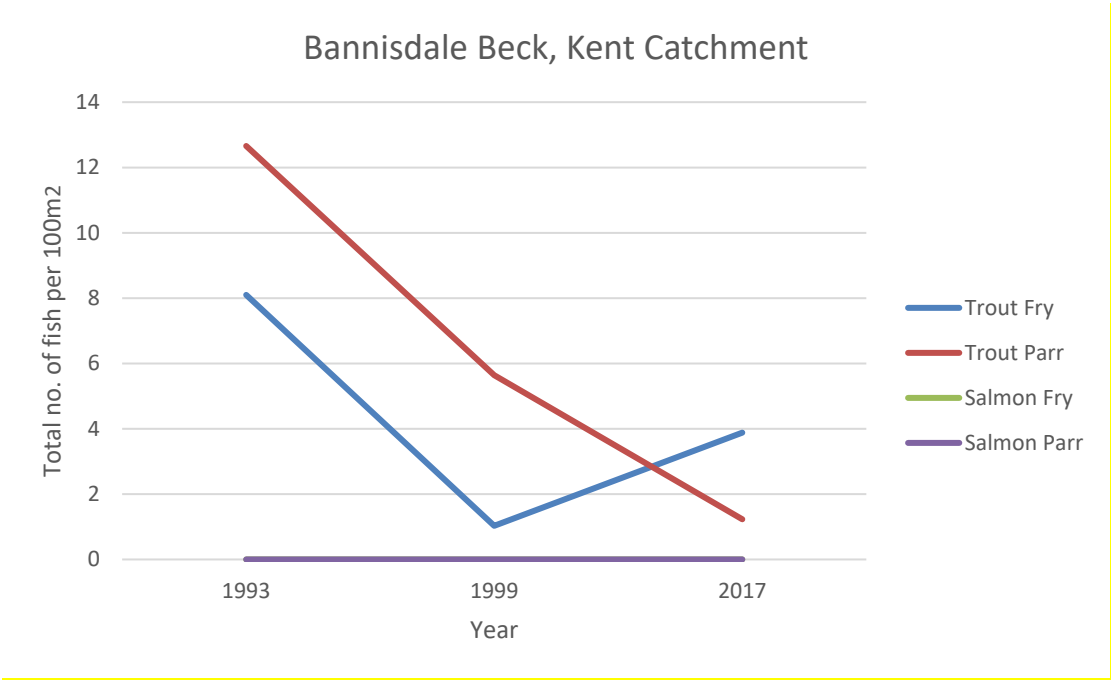


Figure 15. Historic fish density for Bannisdale Beck in the Kent Catchment.

Data for Bannisdale Beck is limited however, historic data is available from 1993 and 1999. SCRT in partnership with Natural England and Forestry Commission are delivering a project in the Bannisdale Valley during 2018. Therefore, this data is vital information to provide a baseline and follow up surveys will be completed during 2018 and for at least 3- 5 years after work completion.

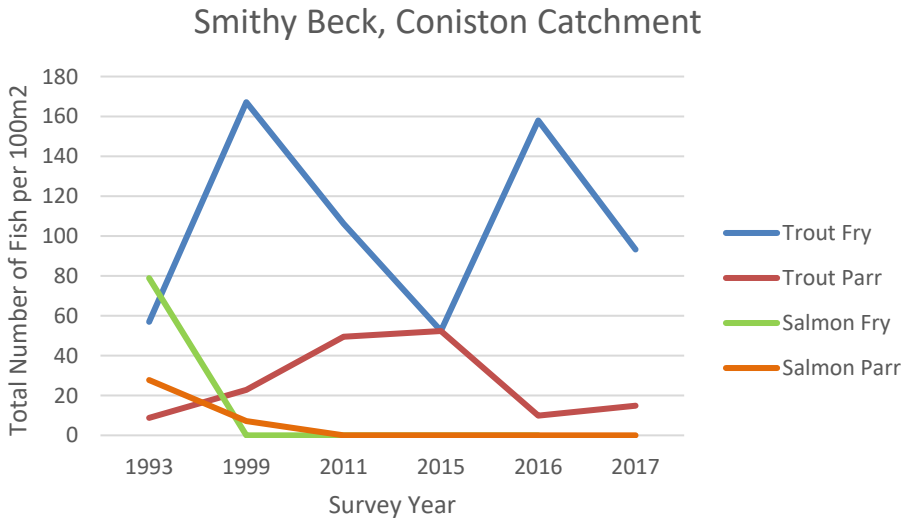


Figure 16. Total fish density for Smithy Beck in the Coniston Catchment

Data for Smithy Beck in the Coniston catchment is available since 1993. Note from 1993 to 1999 the data is provided from surveys by the Environment Agency, post 2011 the data is from SCRT surveys. Therefore, there may be some differences in comparability, however, it still provides a base indication of changes over time. It is interesting to note that salmon (fry and parr) were present in 1993 and a small population of parr in 1999 but have been absent in surveys since 2011. Trends in trout appear to be more variable.

Next Steps for 2018

The programme for 2018 will be developed to incorporate the sites which the survey team were unable to survey during 2017. It will also focus on gathering information for projects including Conserving Coniston & Crake and the Winster and Gilpin Habitat Improvement projects. Furthermore, it will be designed in conjunction with the Environment Agencies priorities to ensure maximum coverage and provision of evidence.

Additionally, to further ensure consistency a tape measure will be taken to record stream width more accurately at 10m intervals over the 50m reach. This will ensure an acute comparison of trends over time, when comparing fish densities.

Proposed Survey Sites for 2018

The priority catchment for the EA in 2018 is the Duddon, so this may be reviewed when sites are confirmed.

Table 4. Proposed sites for electrofishing surveys during 2018

Site No.	Site Name	Catchment	NGR
1	Gobling Beck	Duddon	SD225 99602
2	Old Park beck	Duddon	SD219 39591
3	Long House Gill	Duddon	SD235 39723
4	Dry Beck	Duddon	SD193 39273
5	Holehouse Gill	Duddon	SD194 09240
6	Press Beck	Duddon (Grizebeck)	SD242 2785954
7	River Lickle Near Broughton Mills	Duddon (Lickle)	SD222 3290720
8	Appletreeworth Beck	Duddon (Lickle)	SD23905 91950
9	Yewtree Upper	Crake	NY3269 101227
10	Yewtree Lower	Crake	NY31259 00199
11	Hoathwaite Beck	Crake	SD3001 495332
12	Sunny Bank Mill, Torver	Crake	SD30278 95336
13	Park Ground, Torver	Crake	SD28519 93606

14	Greenholme Beck - Upper	Crake	SD28177 89173
15	Greenholme Beck - Lower	Crake	SD28694 89101
16	Smithy Beck	Crake	SD27511 87113
17	Langholme Beck	Crake	SD29017 86377
18	Colton Beck @ Bandrake Head	Crake	SD30954 88325
19	Ellers Meadow	Bela	SD49688 79693
20	Hang Bridge	Bela	SD51277 80500
21	Burnside Farm	Bela	SD52095 78696
22	Badger Gate	Bela	SD56465 80170
23	Overthwaite	Bela	SD51942 81478
24	Rowell Bridge	Bela	SD51901 83138
25	Grizedale Beck	Leven	SD33761 91300
26	Rusland Pool	Leven	SD33530 89279
27	Way Beck	Kent (Winster)	SD41500 85746
28	Gilpin Mill	Kent (Gilpin)	SD43200 94100
29	Foxhole Bank	Kent (Gilpin)	SD43400 92600
30	Crossthwaite	Kent (Gilpin)	SD43500 91400
31	River Winster at Bowland Bridge	Kent (Winster)	SD41700 89600
32	Gilpin at Underbarrow	Kent (Gilpin)	SD46597 91510
33	Dubbs Beck	Kent	NY42281 01428
34	Bannisdale Beck	Kent	NY52733 02280
35	River Sprint @Longsleddale	Kent	NY50145 02784
36	River Mint @ Patton Bridge	Kent	SD55625 97521
37	River Mint @ Whelpside	Kent	NY55406 00920
38	Miller Beck	Leven	SD37152 84104
39	Troutbeck @ Limefitt	Leven	NY41585 03693
40	Bell Beck, Troutbeck	Leven	NY40820 00651

Acknowledgements

SCRT would like to thank everyone who has supported these surveys during 2017. In particular the Catchment Based Approach for the provision of funding to support catchment data collection. Similarly, Biffa Award, Winster & Gilpin project and Conserving Coniston & Crake (Heritage Lottery) for the supporting funding to allow this work to continue. However, without volunteers it would be impossible to undertake the number of surveys that we do, therefore our acknowledgement goes out to all our volunteers, catchment partnerships and Enviro-tech Ltd for their support. One further acknowledgement must also go out to all the landowners who kindly grant us permission to access their land to undertake the surveys. Finally, we would also like to acknowledge the Environment Agency for their collaboration and support in developing and delivering the programme.

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Farooqi M.A. & Aprahamian M.W. 1993. The Calibration of a Semi-Quantitative Approach to Fish Stock Assessment in the North West Region of the NRA. Environment Agency, Ghyll Mount, Penrith.

Scottish Fisheries Co-ordination Centre, 2007. Fisheries Management SVQ Level 3: Manage Electrofishing Operations, Inverness College.

Appendix I

Table 5. Full list of sites proposed for survey during 2017

Site No.	Site Name	Catchment	NGR	SSSI
1	Black Hall Beck	Duddon	NY24048 01247	No
2	Troutal Beck	Duddon	SD23606 98744	No
3	Long House Gill	Duddon	SD23713 97339	No
4	Quarry Gutter	Duddon	SD23644 96498	No
5	Rake Beck	Duddon	SD22193 95782	No
6	Blea Beck	Duddon	SD19241 92055	No
7	Kirkby Pool @ High Cross	Duddon	SD24639 88563	No
8	Kirkby Pool @ Steers Pool	Duddon	SD24452 90437	No
9	Gill House Beck @ Soutergate	Duddon	SD23292 82026	No
10	Croglinhurst Bridge	Duddon (Lickle)	SD21545 90158	No
11	Whitcham Beck (1)	Duddon	SD16562 85195	No
12	Whitcham Beck @ Po House Chapel	Duddon	SD14814 82715	No
12 b	Whitcham Beck @ Haverigg Pool	Duddon	SD13918 80440	No
13	Sarah Beck	Leven	SD24059 68695	No
14	Mill/Poaka Beck	Leven	SD22016 72605	No
15	Gleaston Beck	Leven	SD26025 71093	No
16	Grizedale Beck @ Low Bowkerstead	Leven	SD33663 92252	No
17	Ashes Beck: Rusland Pool	Leven	SD33530 89279	No
18	Dale Park Beck	Leven	SD35302 93227	No
19	Colwith Bridge, Little Langdale	Leven	NY33178 03053	No
20	High Birk Howe, Little Langdale	Leven	NY31603 02876	No
21	River Brathay @ Skelwith	Leven	NY34455 03376	No
22	River Rothay @ Tongue Gill	Leven	NY33561 09106	No
23	Blake Beck near Skelwith	Leven	NY35613 02987	No
24	Troutbeck @ Limefitt	Leven	NY41585 03693	No
25	Bell Beck, Troutbeck	Leven	NY40820 00651	No
26	Miller Beck - Lower	Leven	SD37717 85443	No
27	Miller Beck - Upper	Leven	SD37152 84104	No
28	Newlands Beck near Newland Bottom	Leven	SD29289 80595	No
29	Newlands Beck near Bowstead gates	Leven	SD29251 81213	No
30	Pennington Beck	Leven	SD26561 77523	No
31	Cunsey Beck	Leven	SD36929 94079	No
32	Hall Beck	Leven	SD34464 99973	No
33	Black Beck Near Hawkshead	Leven	SD34816 98493	No
34	Dubbs Beck	Kent	NY42281 01428	Yes
35	Browfoot	Kent	NY45647 00981	Yes
36	Kent near Staveley	Kent	SD47859 97830	Yes

Site No.	Site Name	Catchment	NGR	SSSI
37	Bannisdale Upper	Kent	NY51480 04205	Yes
38	Bannisdale Lower	Kent	NY52733 02280	Yes
39	Yewtree Upper	Crake	NY32691 01227	No
40	Yewtree Lower	Crake	NY31259 00199	No
41	Hoathwaite Beck	Crake	SD30014 95332	No
42	Sunny Bank Mill	Crake	SD30278 95336	No
43	Park Ground, Torver	Crake	SD28519 93606	No
44	Colton Beck @ Bandrake Head	Crake/ Colton	SD30954 88325	No
45	Greenholme Beck - Upper	Crake	SD28177 89173	No
46	Greenholme Beck - Lower	Crake	SD28604 89101	No
47	Smithy Beck	Crake	SD27511 87113	No
48	Langholme Beck	Crake	SD29017 86377	No
49	Ellers Meadow	Bela	SD49688 79693	No
50	Hang Bridge	Bela	SD51277 80500	No
51	Burnside Farm	Bela	SD52095 78696	No
52	Badger Gate	Bela	SD56465 80170	No
53	Overthwaite	Bela	SD51942 81478	No
54	Rowell Bridge	Bela	SD51901 83138	No
55	Winster near Wood Farm	Winster & Gilpin	SD41283 91642	No
56	Arndale Beck near High Birks	Winster & Gilpin	SD42354 90516	No
57	River Gilpin near Ellerbank Farm	Winster & Gilpin	SD46291 94776	No

Appendix II

Table 6. Table to show the number of salmonids per site and the corresponding National Fisheries Classification. Note, NFCS have been adjusted for density.

No	Site Name	Catchment	Grid Reference	No. Salmon Fry	NCFS	No. Salmon Parr	NCFS	No. Trout Fry	NCFS	No. Trout Parr	NCFS
1	Greenholme Lower	Coniston	SD28718 89098	13	C	2	D	16	B	5	C
2	Greenholme Upper	Coniston	SD28289 89141	0	F	0	F	15	C	4	D
3	Hoathwaite	Coniston	SD30276 95360	0	F	0	F	10	C	7	C
4	Langholme Beck	Coniston	SD29114 86557	12	D	0	F	30	A	8	C
5	Smithy Beck	Coniston	SD27612 87111	0	F	0	F	24	A	4	B
6	Torver - Park Ground	Coniston	SD28566 93475	0	F	0	F	10	C	6	C
7	Torver - Sunny Bank Mill	Coniston	SD29046 92320	0	F	0	F	48	B	2	E
8	Yewtree Lower	Coniston	NY32159 00113	0	F	4	C	5	D	1	E
9	Yewtree Upper	Coniston	NY32218 00619	0	F	0	F	1	E	4	D
10	Bannisdale	Kent	NY52959 01935	0	F	0	F	3	D	1	E
11	Browfoot	Kent	NY45771 00656	39	D	4	E	4	E	0	F
12	Dubbs Beck	Kent	NY42359 00948	0	F	0	F	68	A	5	C
13	Kent nr Staveley	Kent	SD47516 97838	5	E	1	E	22	C	1	E
14	Ellerbank - Gilpin	Gilpin	SD46293 94782	0	F	0	F	80	A	9	B
15	Arndale Beck - Winster	Winster	SD42499 90316	0	F	0	F	44	A	17	A
16	Wood Farm - Winster	Winster	SD41040 90847	0	F	0	F	17	B	20	A
17	Black Beck - Esthwaite	Leven	SD35010 98742	0	F	0	F	4	D	2	E
18	Cunsey Beck - Esthwaite	Leven	SD36596 95162	0	F	0	F	29	B	2	E
19	Hall Beck - Esthwaite	Leven	SD34502 99812	0	F	0	F	8	C	2	D
20	Brathay at Skelwith	Leven	NY34474 03383	0	F	0	F	0	F	0	F
21	Broughton Beck	Leven	SD28537 82221	0	F	0	F	46	A	7	B
22	Little Langdale at Colwith	Leven	NY33113 03024	0	F	0	F	0	F	0	F
23	L. Langdale u/s Slaters Bridge	Leven	NY31738 03049	0	F	0	F	1	E	1	E
24	Miller Beck	Leven	SD37334 85808	0	F	0	F	24	B	0	F
25	Newlands Weir	Leven	SD30000 79797	8	D	0	F	104	A	3	D

Appendix III

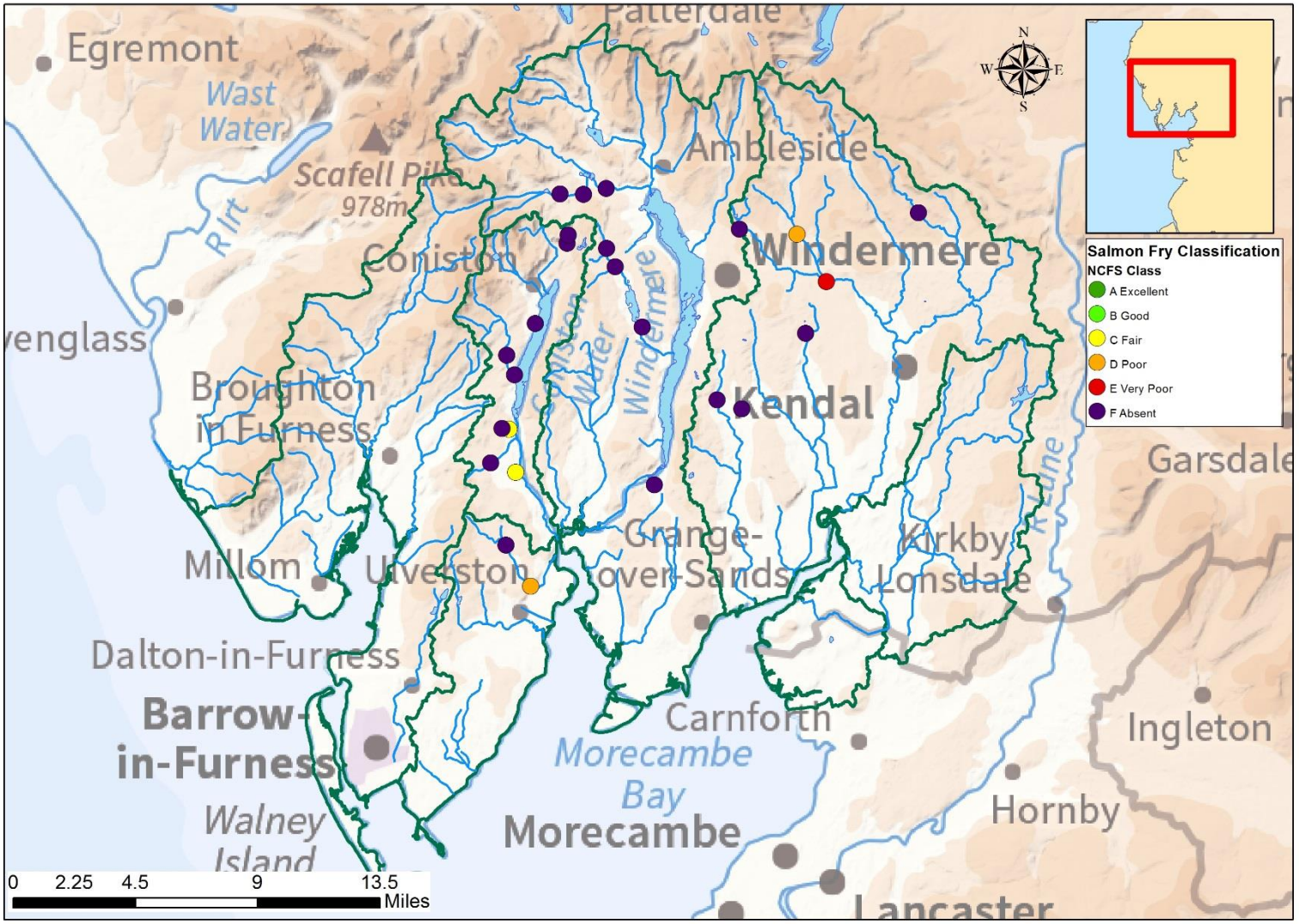


Figure 17. Map to show salmon fry abundance under the National Fisheries Classification Scheme across South Cumbria in 2017

Appendix IV

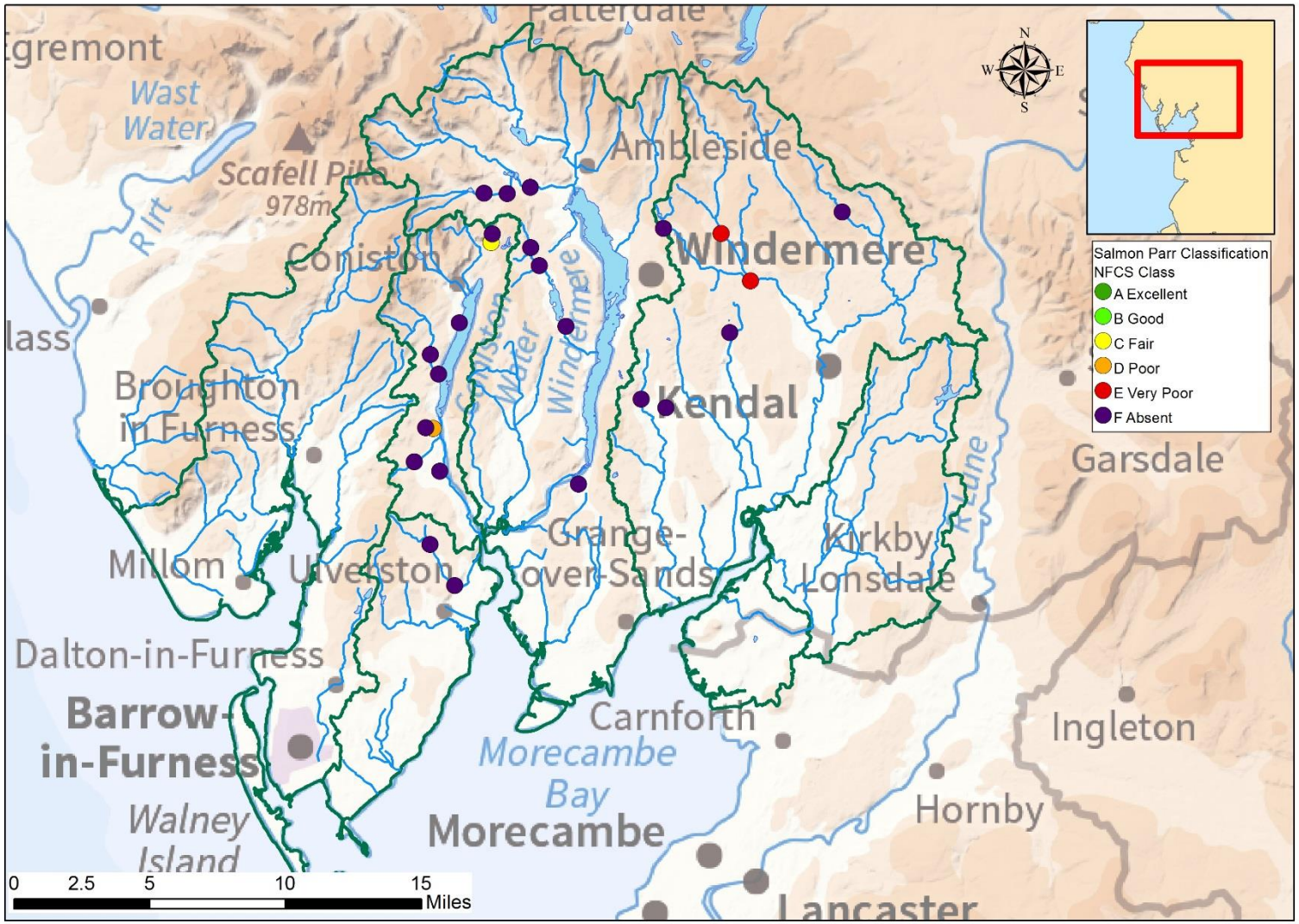


Figure 18. Map to show salmon parr abundance under the National Fisheries Classification Scheme across South Cumbria

Appendix V

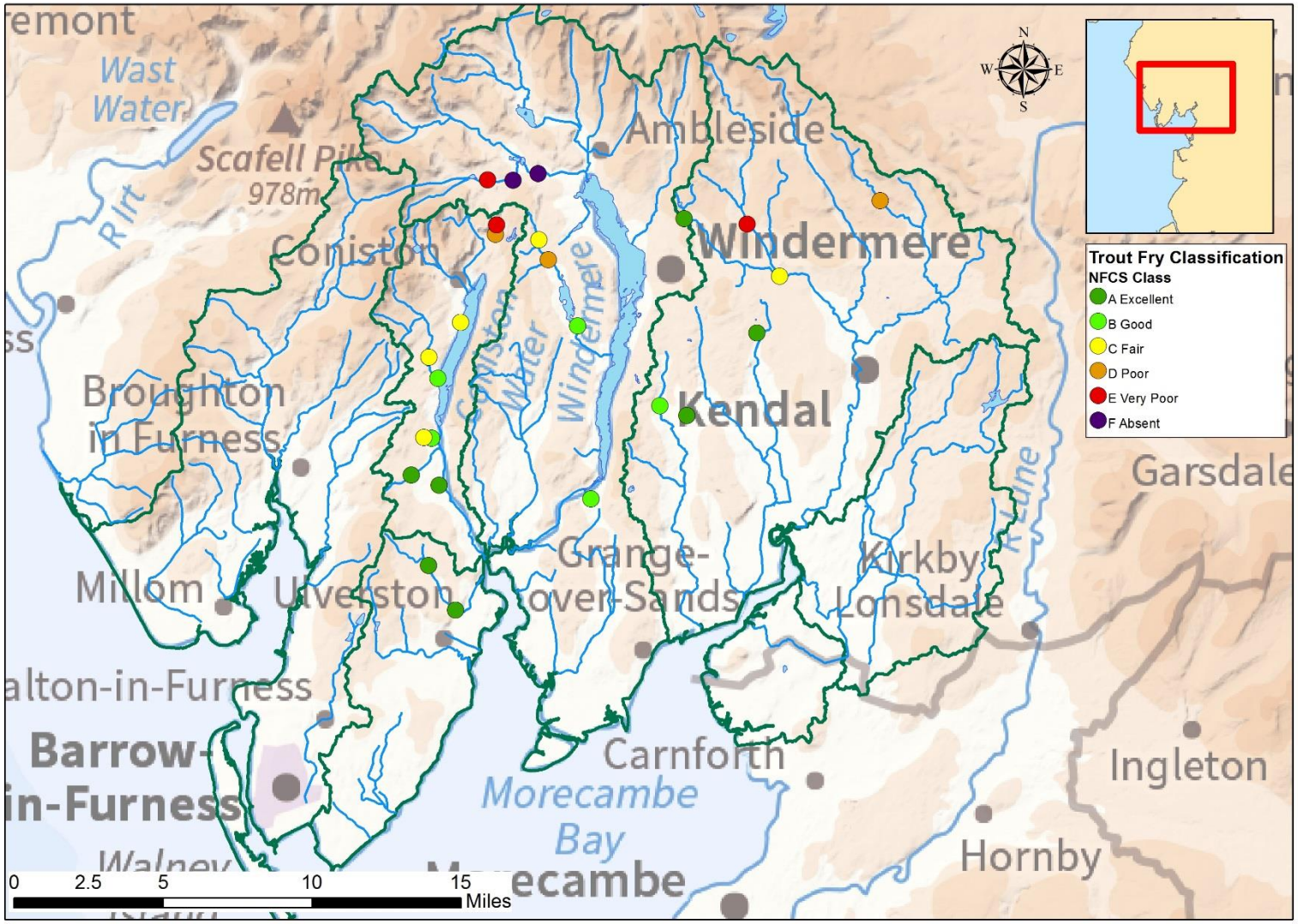


Figure 19. Map to show trout fry abundance under the National Fisheries Classification Scheme across South Cumbria

Appendix VI

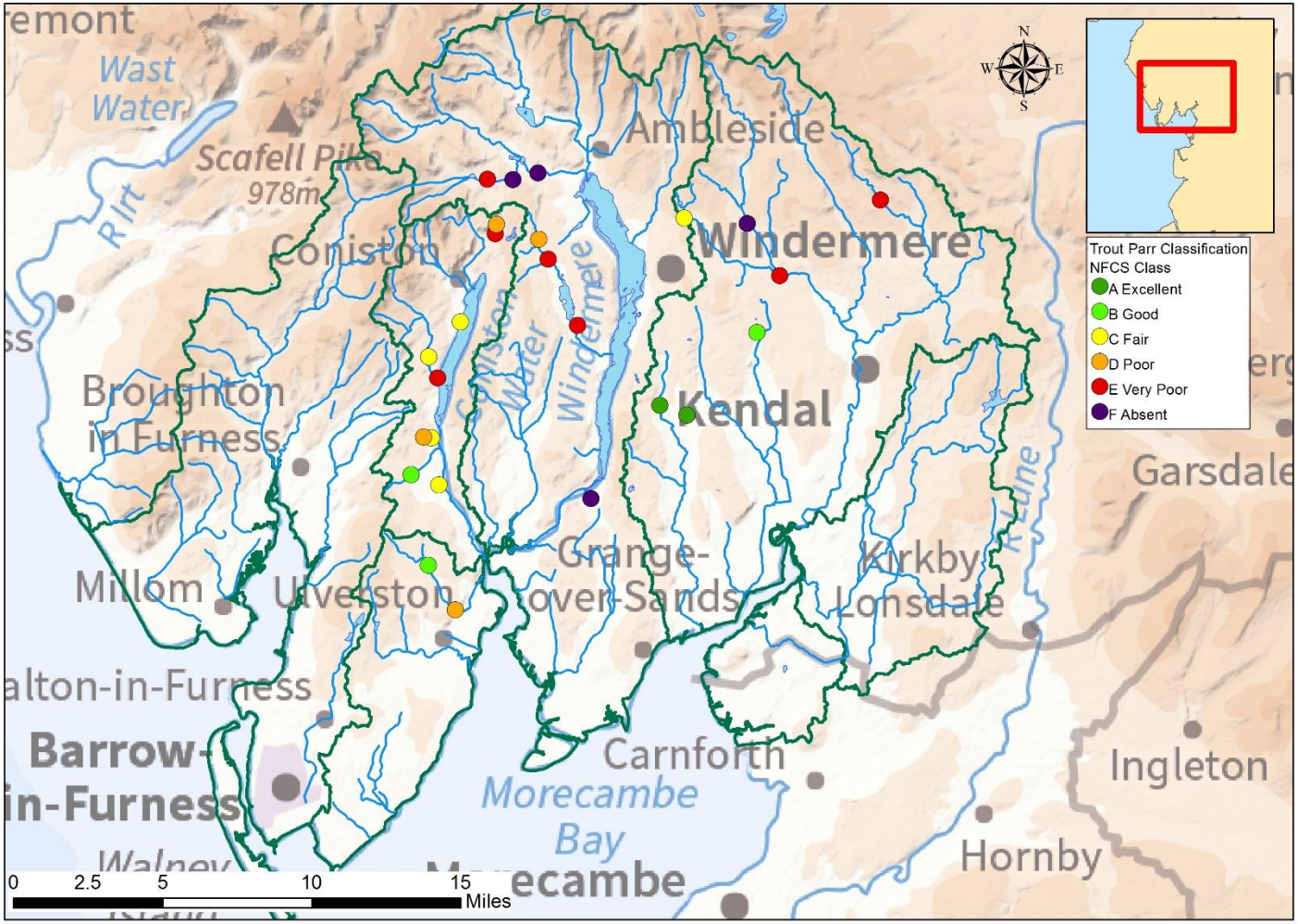


Figure 20. Map to show trout parr abundance under the National Fisheries Classification Scheme across South Cumbria for 2017

Appendix VII

Table 7. Raw electrofishing data for all sites. Note this has not been adjusted to show density.

No.	Site Name	Catchment	Grid Reference	Easting	Northing	Total Fish	Salmon	Trout	Bullhead	Eels	Minnow	Stoneloach	Stickleback
1	Greenholme Lower	Coniston	SD28718 89098	328718	489098	179	28	42	107	2			
2	Greenholme Upper	Coniston	SD28289 89141	328289	489141	83	0	38	43	2			
3	Hoathwaite	Coniston	SD30276 95360	330276	495360	296	0	17	12	2	265		
4	Langholme Beck	Coniston	SD29114 86557	329114	486557	176	12	38	121	5			
5	Smithy Beck	Coniston	SD27612 87111	327612	487111	33	0	28	5				
6	Torver - Park Ground	Coniston	SD28566 93475	328566	493475	23	0	16	7				
7	Torver - Sunny Bank Mill	Coniston	SD29046 92320	329046	492320	243		50	27	2		164	
8	Yewtree Lower	Coniston	NY32159 00113	332159	500113	21	4	6		5	6		
9	Yewtree Upper	Coniston	NY32218 00619	332218	500619	72		5		1	66		
10	Bannisdale	Kent	NY52959 01935	352959	501935	60		4					56
11	Browfoot	Kent	NY45771 00656	345771	500656	47	43	4					
12	Dubbs Beck	Kent	NY42359 00948	342359	500948	73		73					
13	Kent nr Staveley	Kent	SD47516 97838	347516	497838	54	6	23	13	1	11		
14	Ellerbank - Gilpin	Gilpin	SD46293 94782	346293	494782	94	0	89		5			
15	Arndale Beck - Winster	Winster	SD42499 90316	342499	490316	61	0	61					
16	Wood Farm - Winster	Winster	SD41040 90847	341040	490847	40	0	37		3			
17	Black Beck - Esthwaite	Leven	SD35010 98742	335010	498742	91		6				85	
18	Cunsey Beck - Esthwaite	Leven	SD36596 95162	336596	495162	45		31				14	
19	Hall Beck - Esthwaite	Leven	SD34502 99812	334502	499812	10		10					
20	Brathay at Skelwith	Leven	NY34474 03383	334474	503383	38			17		18	3	
21	Broughton Beck	Leven	SD28537 82221	328537	482221	56		53	3				
22	Little Langdale at Colwith	Leven	NY33113 03024	333113	503024	44			14		25	5	
23	Little Langdale Wilson Place	Leven	NY31738 03049	331738	503049	31		2	16		13		
24	Miller Beck	Leven	SD37334 85808	337334	485808	27		24					3
25	Newlands Weir	Leven	SD30000 79797	330000	479797	131	8	107	14	2			

Appendix VIII

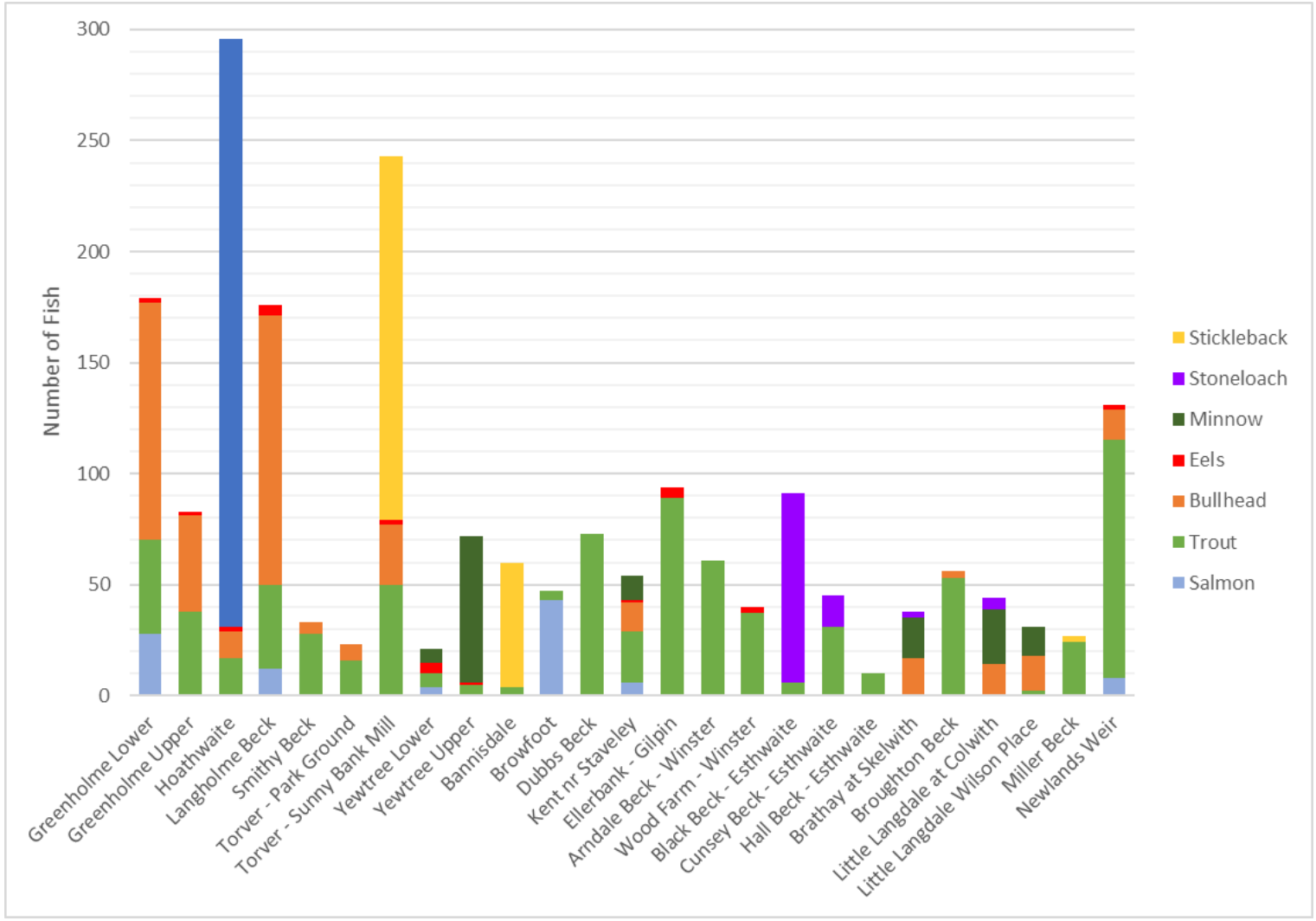
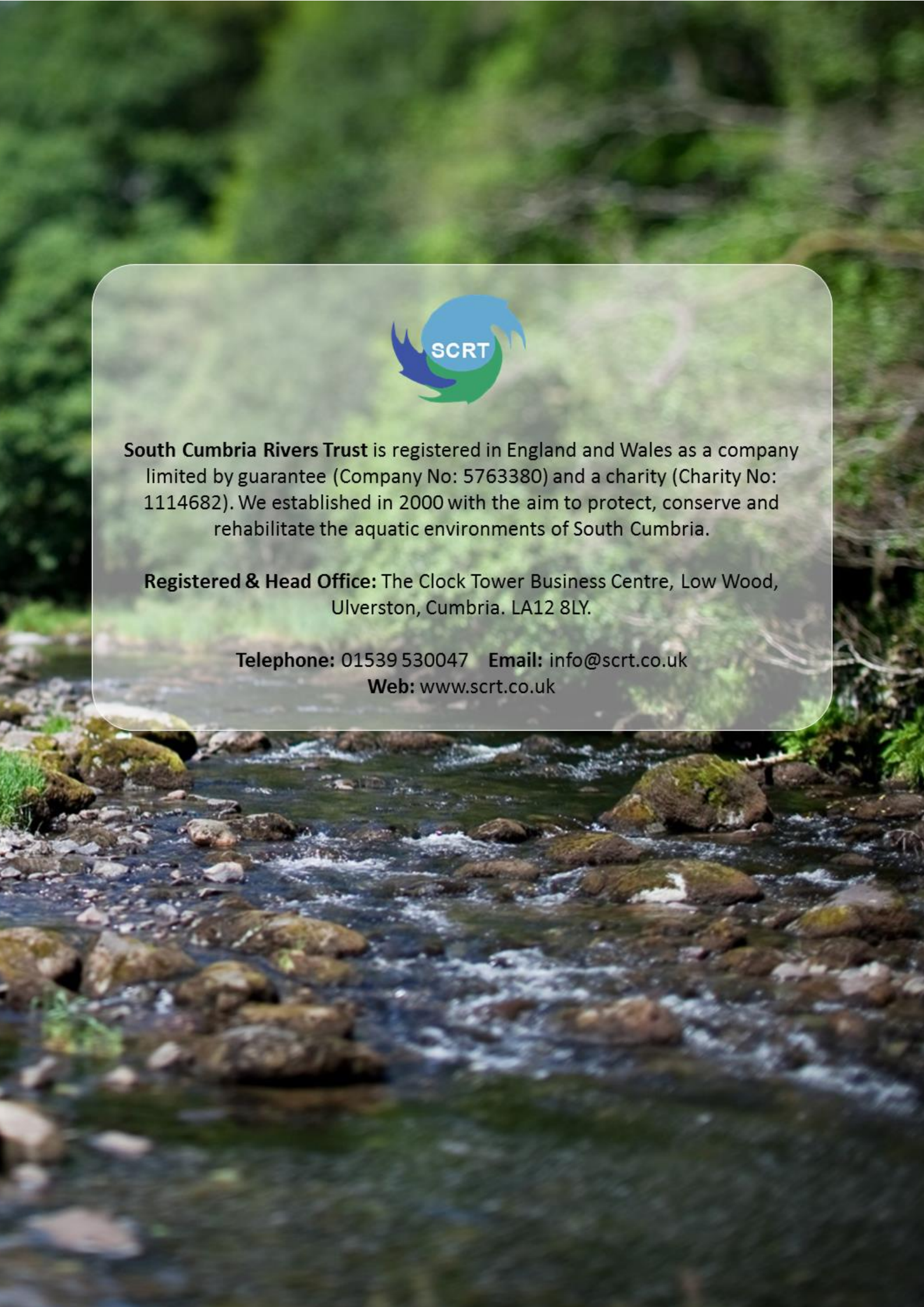


Figure 21. Abundance of all fish species recorded during 2017 electrofishing surveys. Note, this is total abundance and has not been adjusted for abundance.



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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