South Cumbria Rivers Trust Electrofishing - 2016 Report

Catchment Based Approach
Partnerships for Action

Life

SCRT

A project funded by CaBA & Natural Course

Contractor

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Note, all maps can be viewed full size in the appendix. Interactive maps will also be available on the Becks to Bay website: btob.scrt.co.uk.

Appendix

Introduction

As part of our monitoring programme South Cumbria Rivers Trust undertake annual catchment wide fish surveys using the electrofishing method. This enables us to assess juvenile salmonid populations and also gain some basic habitat information. The information gathered helps to support the work of the Becks to Bay partnership, particularly in informing future actions and developing funding bids.

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 must be viewed at a catchment wide scale, particularly for migratory species such as salmonids. Salmonids are considered a key indicator of freshwater health and general catchment condition.

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 populations
iv) Support Water Framework Directive monitoring and the catchment plans
v) Share the data with the Becks to Bay partnership and wider public

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. Results will then be used to support the delivery of a number of actions by South Cumbria Rivers Trust and the Becks to Bay partnership. All survey results will be made available and shared with partners following completion.

One of the key aims of the Becks to Bay partnership is: 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.

1.1 Floods of December 2015

During December 2015 Cumbria was hit by devastating floods affecting the catchments of South Cumbria, in particular the Kent, Bela and Leven. The flow levels in the River Kent and tributaries were the highest recorded (see table 1), this is

therefore likely to have had significant impacts upon the habitat and species composition in the river. For example, many redds were washed out during the flooding, banks collapsed, gravel moved and vegetation and in river-habitat were destroyed. It is hard to quantify these impacts but they should be considered when reviewing the data in this report.

Table 1. Recorded peak river flows in the River Kent catchment for recent flood events (Environment Agency, 2016)

Gauging Station	River	Area of upstream catchment (km^2)	Peak flow (m^3/s)			
			Dec 2015	Nov 2009	Jan 2005	Feb 2004
Bowston	Kent	71	177.0	118.9	122.5	109.0
Sprint Mill	Sprint	35	94.8	71.7	80.5	71.9
Mint Bridge	Mint	66	170.0	85.9	115.4	112.8
Victoria Bridge	Kent	183	403.0	248.4	286.5	253.6
Sedgwick	Kent	209	526.8	-	347.0	312.0

Methodology

2.1 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, a 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 output frequency on the backpack was set to 50hz at all sites to enable for monitoring of salmonids. A minimum team of two people was used although a team of three was preferable, 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). 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 were undertaken between July and September 2016. Fry are spawned as eggs 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 are caught and analysed on site. Numbers are 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.

The Monitoring Officers oversee all surveys to ensure they are carried out safely and meet the expected protocols. This was overseen by the Trust Manager 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.

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. All licences from the EA and access permissions from riparian landowners and fisheries owners were gained and granted prior to surveying.

2.2. 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 35 sites were surveyed across South Cumbria. An additional 6 sites were proposed for survey but were not completed for various reasons; see the table below, these will be incorporated into the 2017 monitoring programme.

Table 2. Sites not surveyed during 2016 season.

Site No.	Site Name	Catchment	Grid Reference		Reason not surveyed
1	River Kent: Staveley	Kent	U/S	SD 47859 97830	High water levels
			D/S	SD 47951 97881	
2	River Winster: near Witherslack	Kent	U/S	SD 41742 84327	Too deep; channel is canalised
			D/S	SD 42241 83894	
3	River Brathay at Skelwith Bridge	Leven	U/S	NY 34455 03376	Fish capture alongside freshwater pearl mussel project, but not a full e-fish survey
			D/S	NY 34593 03422	
4	Cunsey Beck	Leven	U/S	SD 36929 94079	High water levels
			D/S	SD 38099 93573	
5	Hall Beck, Esthwaite	Leven	U/S	SD 34464 99973	High water levels
			D/S	SD 34500 99796	
6	Grizedale Beck	Leven	U/S	SD 33663 92252	High water levels
			U/S	SD 33818 91226	

We are grateful to all the volunteers who helped us to carry out these surveys, in total 14 volunteers supported us in our surveys equating to roughly 100 hours of volunteer time.

3. Results

3.1 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 classified using the same method. 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 abundance was 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. In general fry were found be up to around 7.5cm with parr generally being 8-15cm.

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 composition of different species and the age structure of the population, it is for this reason we record all species and measure the length of the juvenile salmonid as a proxy for age. Bullhead and lamprey are not routinely surveyed during EA surveys and therefore are not part of the classification scheme, so only broad assumptions on presence/ absence can be deduced.

Table 3. Classification boundaries as provided by the Environment Agency

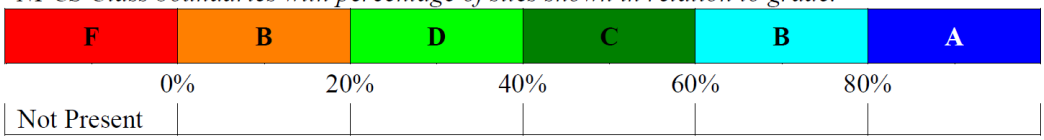
Salmonid abundance
(Values are No. per 100m^{-2})

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 4. 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.



3.2 South Cumbria Overview – 2016

Salmon abundance for both fry and parr was low; at most sites salmon were absent and where present they are classified as very poor or poor. Fry are the least mobile life stage and it is therefore valid to assume that their population is strongly influenced by local conditions (Dugdale et al., 2006). The site 'Greenholme Beck' in the Coniston and Crake catchment had the highest density of salmon fry recorded across South Cumbria at a density of twenty per $100m^2$ (no parr were present at this site). Rydal beck had the highest density of salmon parr, at a density nine parr per $100m^{-2}$ (fry were also present at this site at twenty one fry per $100m^{-2}$).

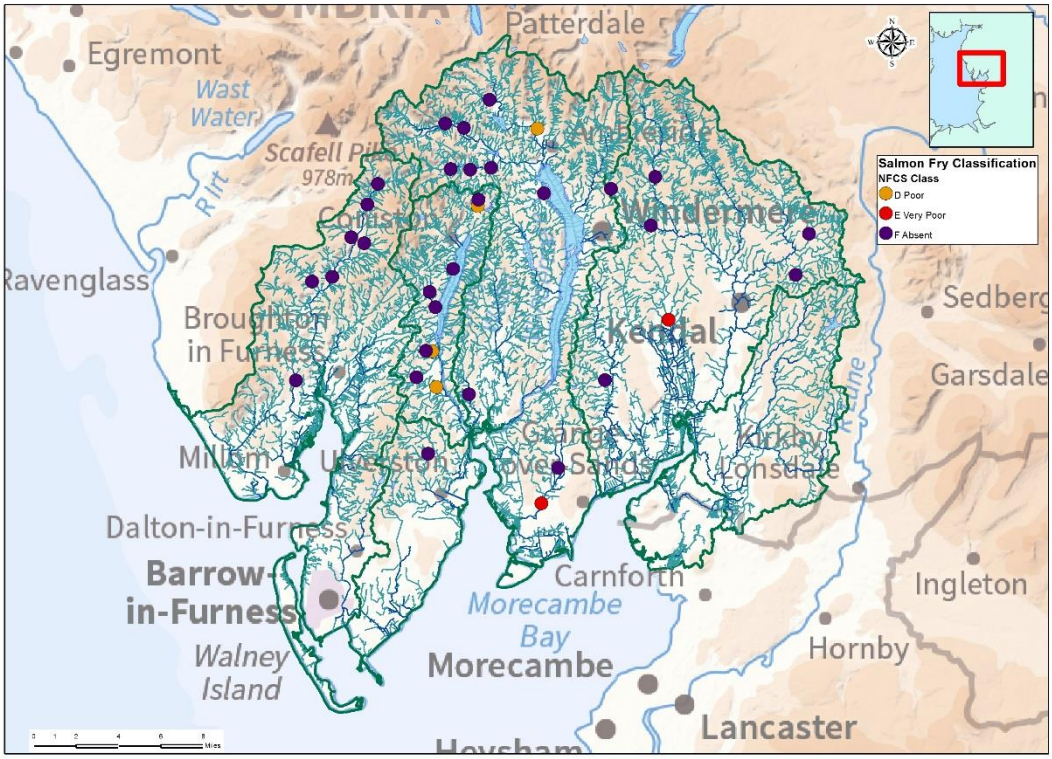


Figure 1: Salmon Fry abundance as classified under the National Fisheries Classification Scheme for South Cumbria.

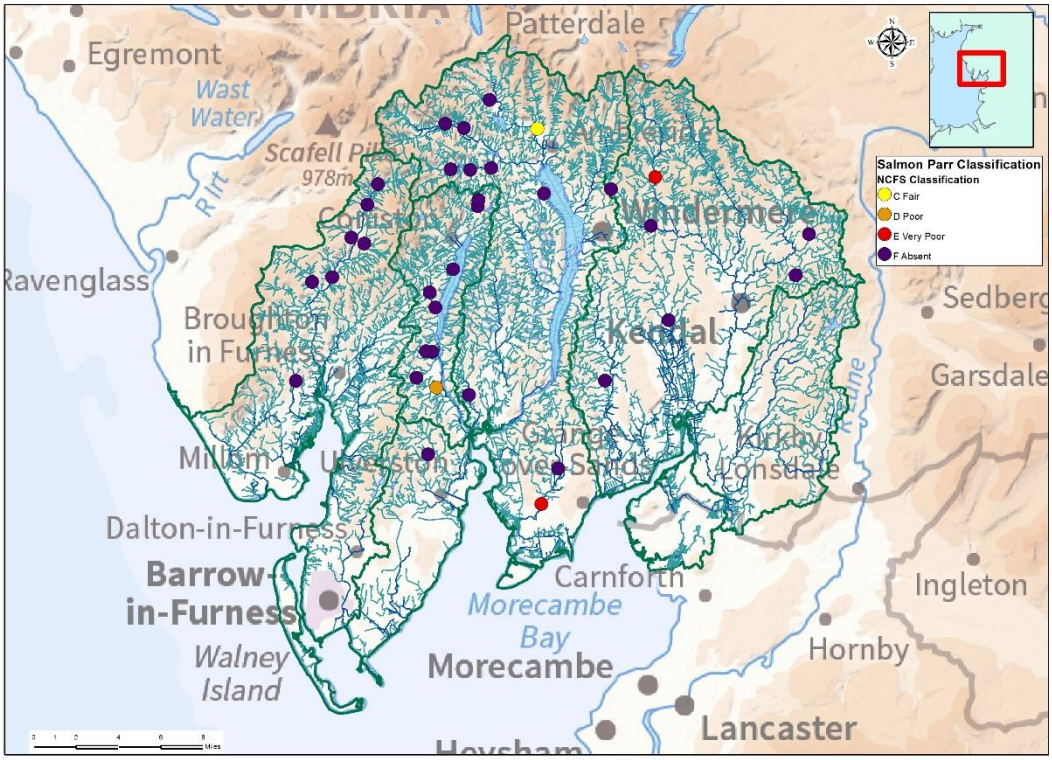


Figure 2: Salmon Parr abundance as classified under the National Fisheries Classification Scheme for South Cumbria.

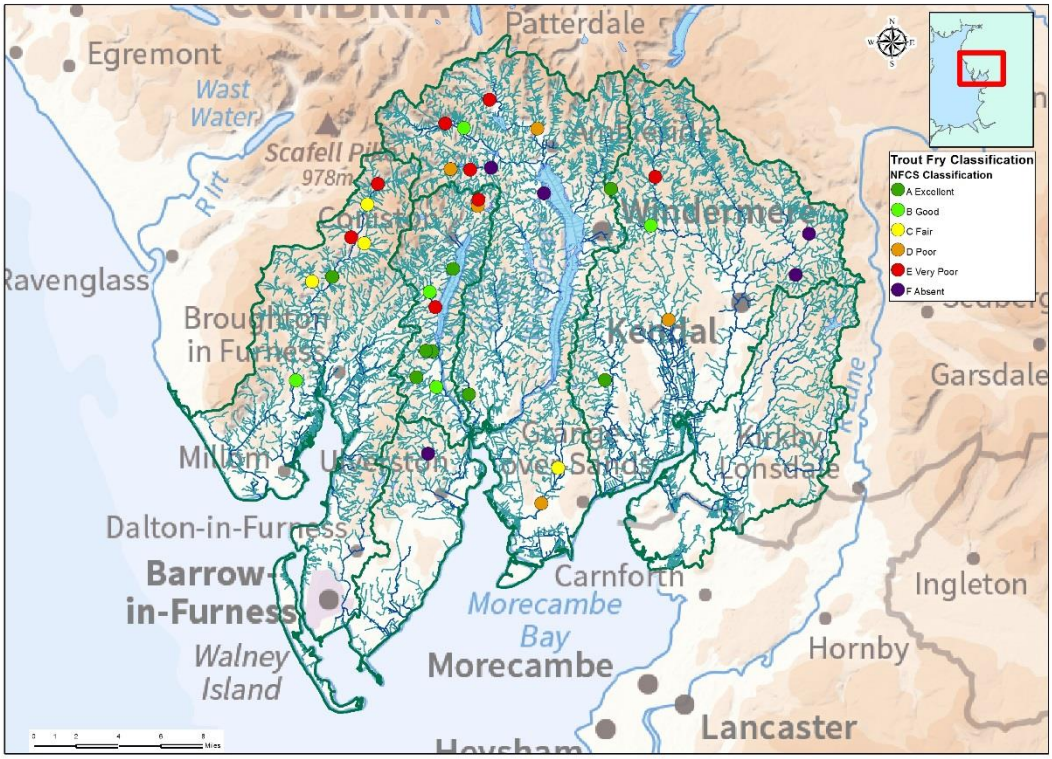


Figure 3: Trout Fry abundance as classified under the National Fisheries Classification Scheme for South Cumbria.

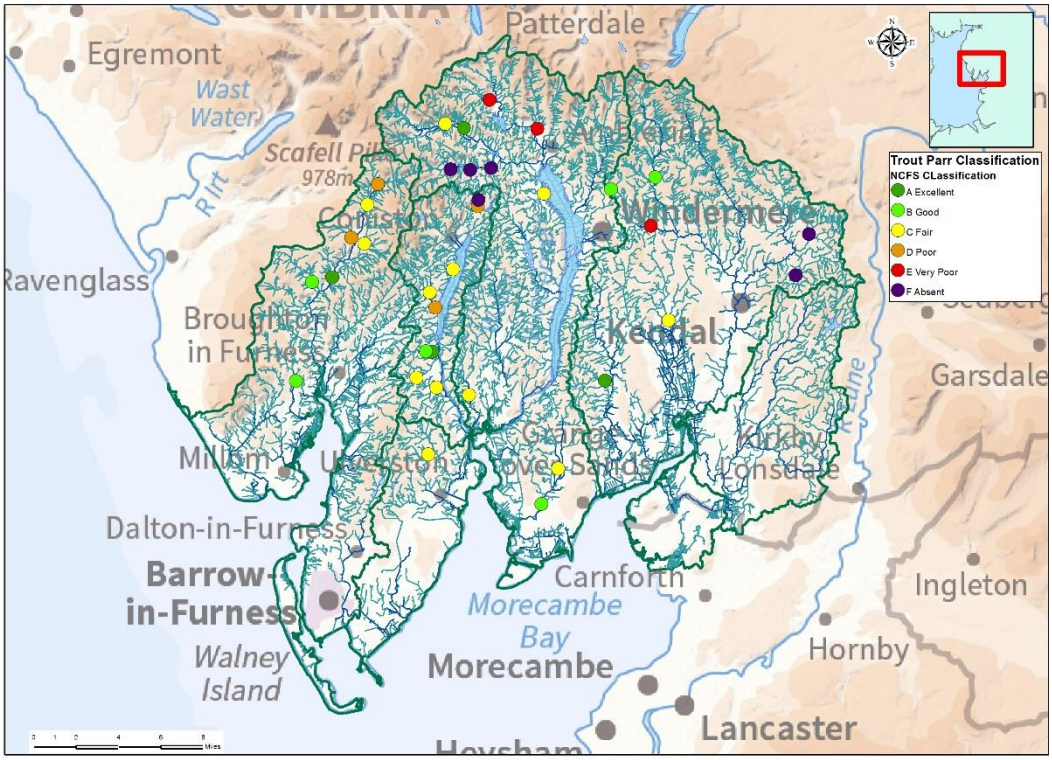


Figure 4: Trout Parr abundance as classified under the National Fisheries Classification Scheme for South Cumbria.

3.3. Duddon Catchment

No salmon fry or parr were caught during our electrofishing surveys of the Duddon catchment. However, trout fry and parr were more variable, with trout being caught at all sites although numbers were very poor in the upper catchment. It must be noted that the Duddon has a very low conductivity and therefore catch efficiency is often reduced, at some sites it was believed that at least half of the fish seen were not caught.

The site at Black Sike was the only site to record 'excellent' for fry and parr. This is promising as habitat improvement work had been undertaken by the Duddon Rivers Association on the site a couple of years previous and an increase in habitat and cover was evident, as seen in figure 5.

Figure 5. Black Sike beck following fencing and habitat improvement

3.4 Coniston and Crake Catchment

Salmon numbers were generally low across the Coniston and Crake catchment, fry and parr were recorded at three and one sites respectively however, no site was classified above 'poor' under the National Fisheries Classification. It was interesting to note that on Yewtree Beck, where surveys were undertaken above and below the existing fish pass, salmon fry were found below the fish pass but not above. In fact, only one fish, a trout fry, was caught above the tarn and the fish pass. There have been concerns over the accessibility of the fish pass and it is a potential project within the Conserving Coniston and Crake Heritage Lottery Funded (HLF) project. Similarly, at Greenholme Beck we carried out surveys above and below a water leat with a weir which is likely to restrict fish passage and is again being considered under the HLF project. Trout were

found both above and below this weir, however salmon were absent above the weir and classified as 'poor' below the weir.

Again, trout numbers were more variable and reflected the condition of the habitat at each site. Langholme Beck had relatively poor numbers of both trout and salmon. It was also noted that this site suffered from siltation as a result of livestock poaching and there could therefore be an opportunity for improvement.

Torver Beck at Sunny Bank Mill was 'very poor to poor' for trout, and salmon were completely absent. The reach here is confined and straightened with very little variability in habitat and flow diversity. Bankside trees and undercut walls provide some shelter as in figure 6.

Figure 6. Start of the survey reach at Torver Beck: Sunny Bank Mill.

3.5 Windermere and Leven Catchment

The Windermere and Leven catchment is a large catchment and is heavily influenced by Windermere, a significant tourist destination. Trout numbers were relatively low; with the majority of sites being classified as 'poor' or below for trout fry and 'fair' or below for trout parr. Colton beck was the only site to record 'excellent' numbers of trout fry, although salmon were completely absent here and trout parr were classed as 'fair'.

Rydal beck supported the highest density of salmon parr recorded during all our surveys across South Cumbria; it also supported a small number of salmon fry and was one of only a few sites where both salmon fry and parr were present.

3.6 Kent Catchment

Results were mixed across the Kent catchment and may have been influenced by the floods during December 2015, which is likely to have affected the redds and spawning fish during the winter months. Salmon were found on one tributary of the main Kent above Staveley. This tributary has suffered from siltation in the past and silt was still evident, however using BIFFA AWARD funding, project work has been undertaken this year to fence off sections of the beck and improve crossing points and trackways. The impacts on fish populations and instream habitat will be limited at this early stage therefore future surveys are recommended.

Similarly, a site at the top of the River Gowan has had several habitat improvement works undertaken both directly along the survey reach and in the catchment vicinity during the past two years. Trout fry populations at this site were classified as 'excellent', which is an increase from 'very poor' the year before. It is too early to draw any conclusions and further monitoring will be required however, these results look promising. The total number of trout parr caught in 2016 was slightly less than in 2015. Further work has been undertaken at this site following the electrofishing surveys and will be completed next summer which will increase flow and habitat diversity; impacts on the fish populations will be investigated with repeat surveys next year.

Conversely in the east of the catchment on tributaries of the River Mint around Flodder Beck no fish of any species were caught. Talking to local landowners provided additional information: one site dried up several times throughout the year. The survey also recorded a lack of habitat with very little cover from vegetation or variation in flow diversity i.e. no riffle and pool sequences were evident. However, it was noted that invertebrate life in this section was abundant. Furthermore, the site at Whinhowe Gill exhibited good habitat variation and large woody debris was present. The floods during December 2015 and the associated recovery work, such as at Sprint Mill, which blocked many fish migration routes could be factors in explaining these results. Future surveys would be recommended to further classify these results.

Figure 7. Flodder beck at Low Bank

In the Winster and Gilpin catchments, Spannel Beck, a small tributary of the Winster had 'excellent' populations of trout. No salmon were recorded during the surveys. However, on the Gilpin at Underbarrow some salmon fry were recorded giving the reach a classification of 'very poor'. Trout populations were also low, being 'poor' and 'fair' for fry and parr respectively.

3.7 Bela Catchment

SCRT didn't undertake any surveys on the Bela catchment during 2016 due to the extensive programme being covered by the Environment Agency. Therefore, in the interest of maximising resources we focused our surveys elsewhere but will review and incorporate Environment Agency data into our work plans.

3.8 Environment Agency Electrofishing Classifications

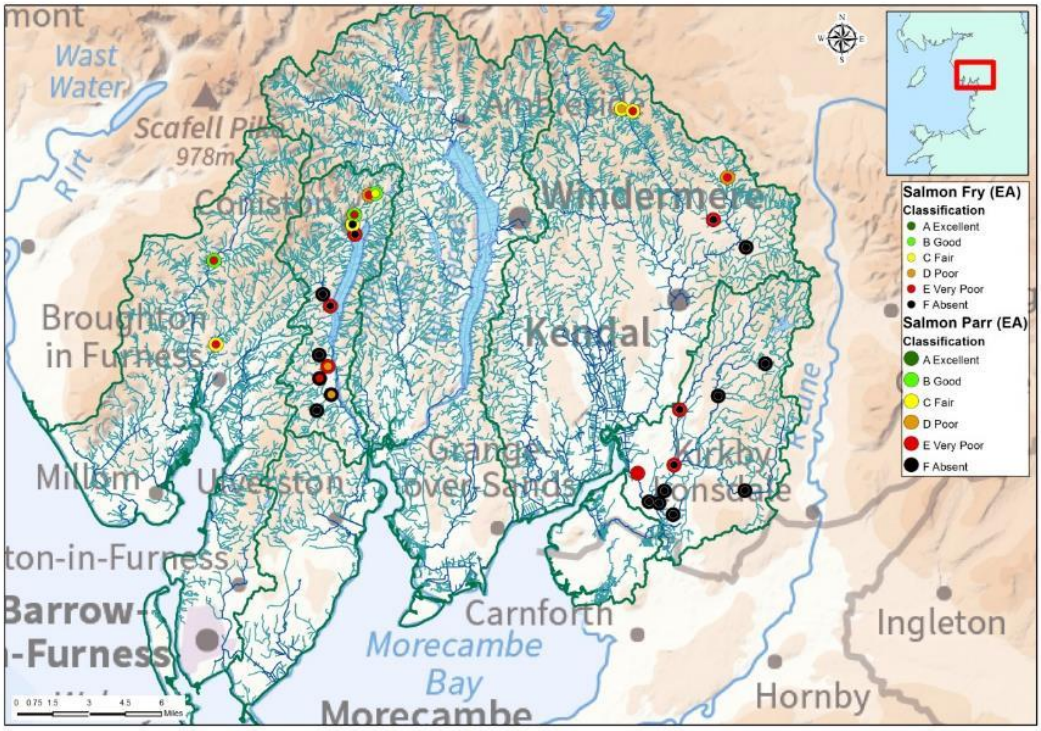


Figure 8. Environment Agency National Fisheries Classification for Salmon fry and parr during the 2016 electrofishing season.

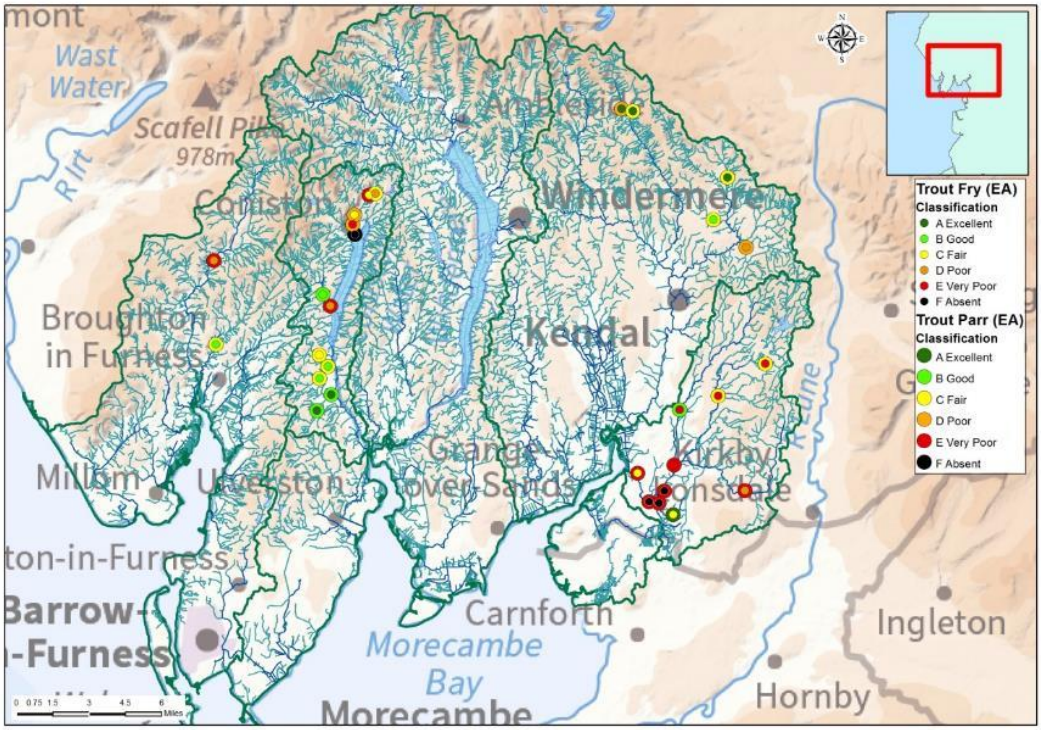


Figure 9. Environment Agency National Fisheries Classification for trout fry and parr during the 2016 electrofishing season.

Comparison of SCRT and EA datasets provides a more holistic picture. Following the floods of December 2015 the EA carried out a more extensive electrofishing programme than is routine. They had intended to carry out a more comprehensive survey of the River Kent but due to time and weather constraints not all of the proposed sites were surveyed. Both datasets (EA & SCRT) suggest that populations of salmon fry were low this year; however, the EA data shows a slightly better outlook for salmon parr, especially in the upper tributaries of the River Sprint. Similarly, the Bela and Coniston catchments were fairly extensively surveyed by the EA and both showed poor numbers of salmon fry whilst salmon parr densities were more variable in some of the upper tributaries. In general trout showed a more varied picture with some good populations of both fry and parr in the Crake catchment, especially at the southern end. Mixed results were also seen on the Bela where fry and parr were classified as very poor at a number of sites with only two sites classified as 'good' or higher for parr and no sites recorded as higher than 'fair' for fry.

3.9 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. A number of these sources can't be eliminated but can be minimised and taken account of when reviewing the data. For example the EA generally carry out a mix of quantitative and semi-quantitative surveys often focusing on main river reaches, whereas at SCRT surveys are focused to small tributaries and semi-quantitative surveys are undertaken. There may also be some variation in operation of the back-pack and electrofishing equipment (this can happen within organisations as well as between organisations).
A further source of error is changes within the electrofishing team and the subsequent experience of the team: although this is managed as much as possible at SCRT and all volunteers are briefed prior to carrying out a survey, the practicality of having the same team throughout the survey season isn't possible thereby meaning this is a potentially greater variable. However, it is ensured that during one survey all members of the team remain in the same role for the whole survey.

It has also been found that the type of hand net used makes a big difference dependent on the habitat present at the site. For example a banner net is more practical in a faster flowing reach whereas a small hand held net is better in a smaller stream with a variable bed substrate. Habitat variability e.g. the presence of large boulders and woody debris itself can affect the catch efficiency.

In our area, another major factor affecting the catch efficiency is the water conductivity of the site. A number of our sites had very low conductivity (15-20µm) particularly in the upper catchments and therefore the electric current isn't as effective. This can be minimised to a certain extent by adjusting the electrical output of the back-pack (increased voltage), however at very low conductivities the effectiveness of this is limited and consequently there is limited response from fish.

4. 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 were also recorded during the surveys. However, because the electrofishing surveys are focused upon recording juvenile salmonids other fish species may not be represented as a true record, therefore the results displayed here are for general information only.

4.1 Eels

There have been serious concerns in recent years over the decline in populations of the European Eel, *Anguilla anguilla.* During our surveys we record the number and length of any eels caught. However, it must be noted that the settings on the e-fish backpack, particularly the frequency (Hz) are set to maximise the catch efficiency for salmonids and it is therefore on the boundary for being effective in catching eels. Additionally, eels are notably difficult to catch and tend to hide in crevices in the banks. See appendix VIII for locations where eels were recorded.

4.2 Bullhead

Bullhead (*Cottus gobio)* are generally widespread across Europe and are native to the UK. The Kent catchment is designated as international importance for its populations of bullhead, however very few bullhead were found in this catchment during our surveys. As bottom living fish, Bullhead tend to hide under stones and cobbles and therefore are often more difficult to catch when electrofishing so the results here can't be taken as representative but give an indication of populations in each beck. See appendix IX for further information on the abundance of bullhead during our surveys.

5. Catchment Management

This information is most useful when combined with other tools and monitoring results to gain a holistic picture, creating a powerful dataset for holistic catchment management. It is also useful to combine this information with some of the historical datasets we hold, although comparison can be difficult due to due to limitations in how often the same sites are surveyed. There have been concerns over declines in fish populations and this is evident at some sites where repeat surveys have been conducted, for example, Greenholme Beck at Wateryeat in the Coniston catchment has seen declines in both trout and salmon over the last 15 years: see figure 10, although trout fry show more variation.

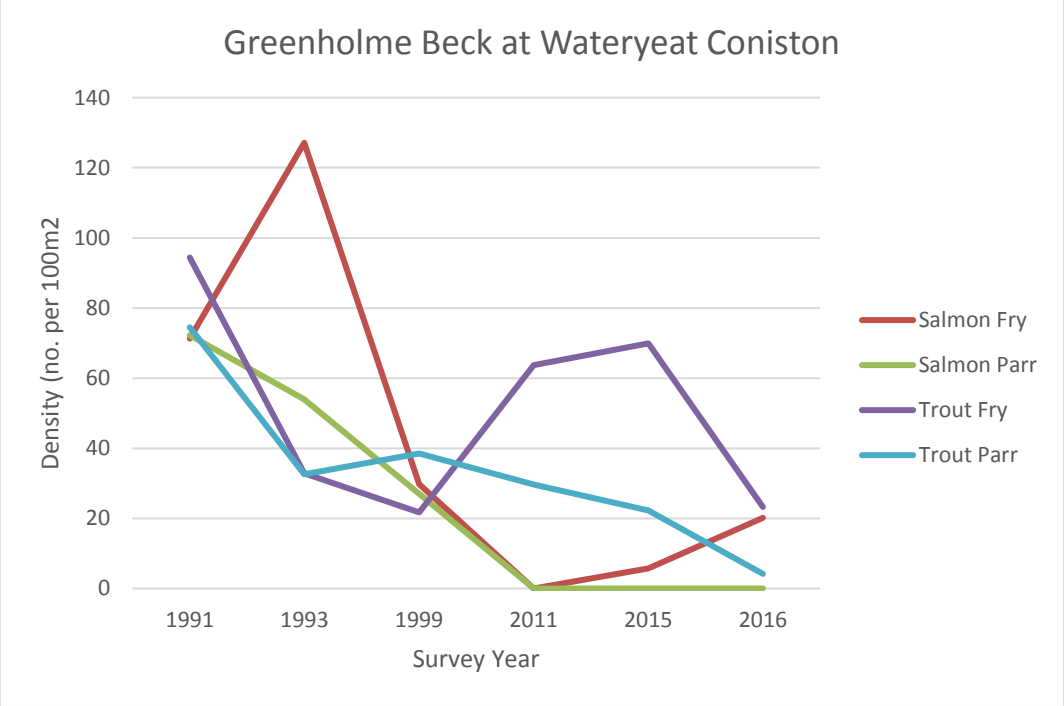


Figure 10. Trends in fish populations at Greenholme Beck at Wateryeat, Coniston, between 1991 and 2016. Please note that 1990-1999 data is Environment Agency and 200-2016 data is from SCRT.

The extent of future coverage depends on staff time, resources and continued funding and donations, however, we hope to complete a similar number of surveys next year. More information on how we are incorporating this into our catchment plan and our programme for monitoring next year can be found on the Becks to Bay website: btob.scrt.co.uk

6. Next Steps for 2017

This is our first year delivering a full electrofishing programme and a lot of lessons have been learnt. We will build upon these lessons to make the programme more effective and efficient for 2017, this includes more training for volunteers prior to the survey season to increase catch efficiency. We could also review the habitat data collected to record the presence of invasive species and other habitat attributes i.e. fencing condition.

Additionally, as we begin to build up a larger and more comprehensive dataset we will be able to better compare between years and identify trends over time. This will be useful information for informing the future delivery of our work.

6.1. Proposed Survey Sites for 2017

The current proposed sites for 2017 are shown below. However, these are likely to alter as others are added prior to the survey season.

Table 5. Proposed sites for electrofishing surveys during 2017

Site No.	Site Name	Catchment
1	Black Hall Beck	Duddon
2	Troutal Beck	Duddon
3	Long House Gill	Duddon
4	Quarry Gutter	Duddon
5	Rake Beck	Duddon
6	Blea Beck	Duddon
7	Kirkby Pool @ High Cross	Duddon
8	Kirkby Pool @ Steers Pool	Duddon
9	Gill House Beck @ Soutergate	Duddon
10	Croglinhurst Bridge	Duddon (Lickle)
11	Whitcham Beck (1)	Duddon
12	Whitcham Beck @ Po House Chapel	Duddon
12 b	Whitcham Beck @ Haverigg Pool	Duddon
13	Sarah Beck	Leven

Site No.	Site Name	Catchment
14	Mill/Poaka Beck	Leven
15	Gleaston Beck	Leven
16	Grizedale Beck @ Low Bowkerstead	Leven
17	Ashes Beck	Leven
18	Dale Park Beck	Leven
19	Colwith Bridge, Little Langdale	Leven
20	High Birk Howe, Little Langdale	Leven
21	River Brathay @ Skelwith	Leven
22	River Rothay @ Tongue Gill	Leven
23	Blake Beck near Skelwith	Leven
24	Scandale Beck (lower)	Leven
25	Troutbeck @ Ings Bridge	Leven
26	Upper Troutbeck	Leven
27	Bell Beck, Troutbeck	Leven
28	Miller Beck - Lower	Leven
29	Miller Beck - Upper	Leven
30	Newlands Beck near Newland Bottom	Leven
31	Newlands Beck near Bowstead gates	Leven
32	Pennington Beck	Leven
33	Cunsey Beck	Leven
34	Hall Beck	Leven
35	Near Hawkshead	Leven
36	Dubbs Beck	Kent
37	Browfoot	Kent
38	Kent near Staveley	Kent
39	Bannisdale Upper	Kent
40	Bannisdale Lower	Kent

Site No.	Site Name	Catchment
41	Kent near Gillthwaite	Kent
42	Yewtree Upper	Crake
43	Yewtree Lower	Crake
44	Hoathwaite Beck	Crake
45	Sunny Bank Mill	Crake
46	Park Ground, Torver	Crake
47	Colton Beck	Crake/ Colton
48	Greenholme Beck - Upper	Crake
49	Greenholme Beck - Lower	Crake
50	Smithy Beck	Crake
51	Langholme Beck	Crake
52	Ellers Meadow	Bela
53	Hang Bridge	Bela
54	Burnside Farm	Bela
55	Badger Gate	Bela
56	Overthwaite	Bela
57	Rowell Bridge	Bela
58	Winster near Wood Farm	Winster & Gilpin
59	Arndale Beck near High Birks	Winster & Gilpin
60	River Gilpin near Ellerbank Farm	Winster & Gilpin

7. Acknowledgements

SCRT would like to extend our thanks to all our volunteers, including Enviro-tech, the Kent Catchment Partnership, the Duddon Rivers Association, the Coniston and Crake Catchment Partnership. We would also like to thank the Environment Agency and National Trust for their kind help with arranging access permissions and support in surveying.

Our thanks must also go to all the landowners who kindly granted us permission to access their land to carry out the electrofishing surveys.

8. References

Dugdale, L.J., Brown, J, Lane, S.N., & Maltby, A. 2006. Rapid Assessment of River Environments.
http://www.theriverstrust.org/environment/downloads/appx_46_rare.pdf

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.

Environment Agency, 2016. Kendal Flood Investigation Report. Flood Event 5-6th December 2015.

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

Shaw B., 2015. River Spey flows, spates and impacts on rod catch. http://www.speyfisheryboard.com/wp-content/uploads/2016/01/Spey-flows-and-spates.pdf

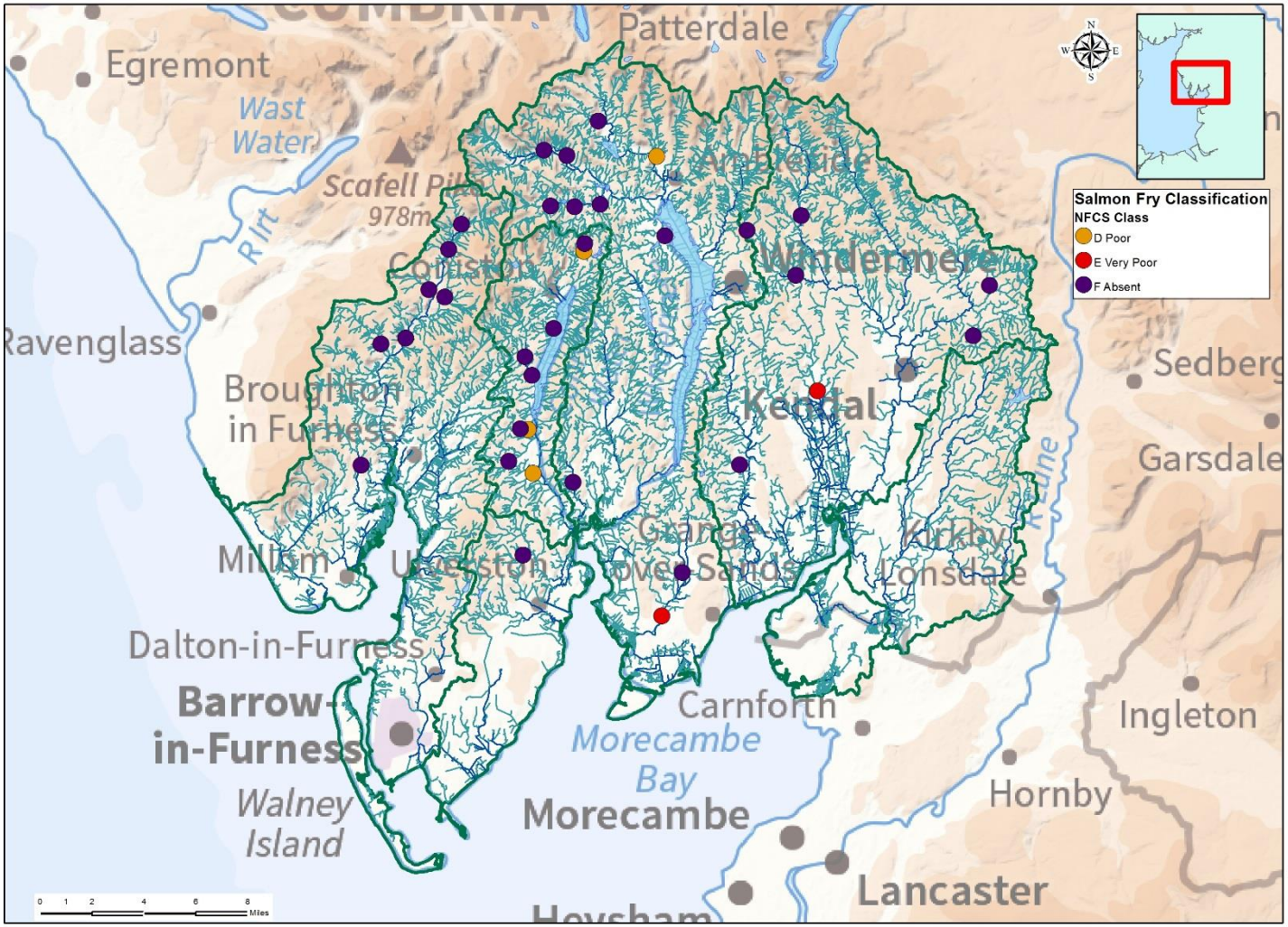
Appendix I

Table to show the number of salmonids per site and the corresponding National Fisheries Classification. Note the classification is after the values have been adjusted for density.

No.	Site Name	Catchment	Grid Reference	No. Salmon Fry	Width	Site Area (m2)	Total No. /100m2	Classification	No. Salmon Parr	Total No. /100m2	Classification	No. Trout Fry	Total No. /100m2	Classification	No. Trout Parr	Total No. /100m2	Classification
1	Greenholme Beck	Crake	SD28716 89097	7	1.5	75	20.15838733	D	0	0	F	30	77.6699	A	13	32.15832	A
2	Greenholme Farm	Crake	SD28227 89137	0	1.5	75	0	F	0	0	F	26	67.31392	A	6	14.8423	B
3	Hoathwaite Beck	Crake	SD30282 95364	0	2	100	0	F	0	0	F	22	42.71845	A	5	9.276438	C
4	Langholme Beck	Crake	SD29017 86377	9	3	150	12.95896328	D	2	3.144654088	D	21	27.18447	B	6	7.42115	C
5	Torver Beck: Park Ground	Crake	SD28519 93606	0	4	200	0	F	0	0	F	37	35.92233	B	8	7.42115	C
6	Smithy Beck	Crake	SD27511 87113	0	1.5	75	0	F	0	0	F	61	157.9288	A	4	9.894867	C
7	Sunny Bank Mill: Torver	Crake	SD28954 92447	0	7	350	0	F	0	0	F	5	2.773925	E	4	2.120329	D
8	Yewtree Beck Lower	Crake	NY32161 00131	16	4	200	17.27861771	D	0	0	F	5	4.854369	D	3	2.782931	D
9	Yewtree Beck Upper	Crake	NY32216 00623	0	3	150	0	F	0	0	F	1	1.294498	E	0	0	F
10	Dubbs Beck	Kent	NY42281 01428	0	1.5	75	0	F	0	0	F	50	129.4498	A	8	19.78973	B
11	Flooder Beck @ Low Bank	Kent	SD56303 94892	0	1	50	0	F	0	0	F	0	0	F	0	0	F
12	Gilpin @ Underbarrow	Kent	SD46638 91498	8	8	400	4.319654428	E	0	0	F	12	5.825243	D	22	10.20408	C
13	Kent @ Mill Riggs	Kent	NY45638 02338	0	2	100	0	F	1	2.358490566	E	1	1.941748	E	8	14.8423	B
14	River Gowan @ Ings	Kent	SD45303 98636	0	5	250	0	F	0	0	F	36	27.96117	B	2	1.48423	E
15	Spannel Beck - Winster	Kent	SD41809 86899	0	3	150	0	F	0	0	F	33	42.71845	A	37	45.76376	A
16	Whinhowe Gill	Kent	SD57315 98027	0	2	100	0	F	0	0	F	0	0	F	0	0	F
17	Black Beck	Duddon	SD18346 86883	0	6	300	0	F	0	0	F	31	20.06472	B	23	14.22387	B
18	Black Sike	Duddon	SD21114 94765	0	1	50	0	F	0	0	F	41	159.2233	A	19	70.50093	A
19	Castle Howe Beck	Duddon	NY23778 00264	0	2	100	0	F	0	0	F	7	13.59223	C	4	7.42115	C
20	Crosby Gill	Duddon	SD19578 94388	0	5.5	275	0	F	0	0	F	14	9.88526	C	21	14.16765	B
21	Grassguards Gill	Duddon	SD22570 97759	0	3.5	175	0	F	0	0	F	1	1.10957	E	3	3.180493	D
22	Mosedale Beck	Duddon	NY24567 01809	0	5	250	0	F	0	0	F	1	0.776699	E	5	3.710575	D
23	Tarn Beck	Duddon	SD23539 97304	0	3.5	175	0	F	0	0	F	15	16.64355	C	5	5.300822	C
24	Blelham Beck	Leven	NY37172 01089	0	4	200	0	F	0	0	F	0	0	F	8	7.42115	C
25	Colton Beck	Leven	SD31487 85823	0	5	250	0	F	0	0	F	73	56.69903	A	15	11.13173	C
26	Easedale Beck	Leven	NY33043 08194	0	3	150	0	F	0	0	F	2	2.588997	E	1	1.236858	E
27	Great Langdale: Dungeon Ghyll	Leven	NY29689 06398	0	7	350	0	F	0	0	F	3	1.664355	E	14	7.42115	C
28	Great Langdale @ Ellers	Leven	NY31116 06062	0	2.5	125	0	F	0	0	F	17	26.40777	B	32	47.49536	A
29	Greenburn Beck	Leven	NY30096 02946	0	3	150	0	F	0	0	F	3	3.883495	D	0	0	F
30	Little Langdale @ Colwith Bridge	Leven	NY33178 03053	0	10	500	0	F	0	0	F	0	0	F	0	0	F
31	Little Langdale @ High Birk Howe	Leven	NY31581 02895	0	6	300	0	F	0	0	F	2	1.294498	E	0	0	F
32	Newlands Beck @ Mansriggs	Leven	SD28386 81313	0	2	80	0	F	0	0	F	0	0	F	4	9.276438	C
33	River Eea @ Greenbank Farm	Leven	SD38254 80223	0	3	150	0	F	0	0	F	9	11.65049	C	5	6.184292	C
34	River Eea @ Low Bankside	Leven	SD37000 77538	1	5	250	5.399568035	E	1	0.943396226	E	7	5.436893	D	21	15.58442	B
35	Rydal Beck	Leven	NY36668 06027	5	4	200	21.59827214	D	8	9.433962264	C	6	5.825243	D	1	0.927644	E

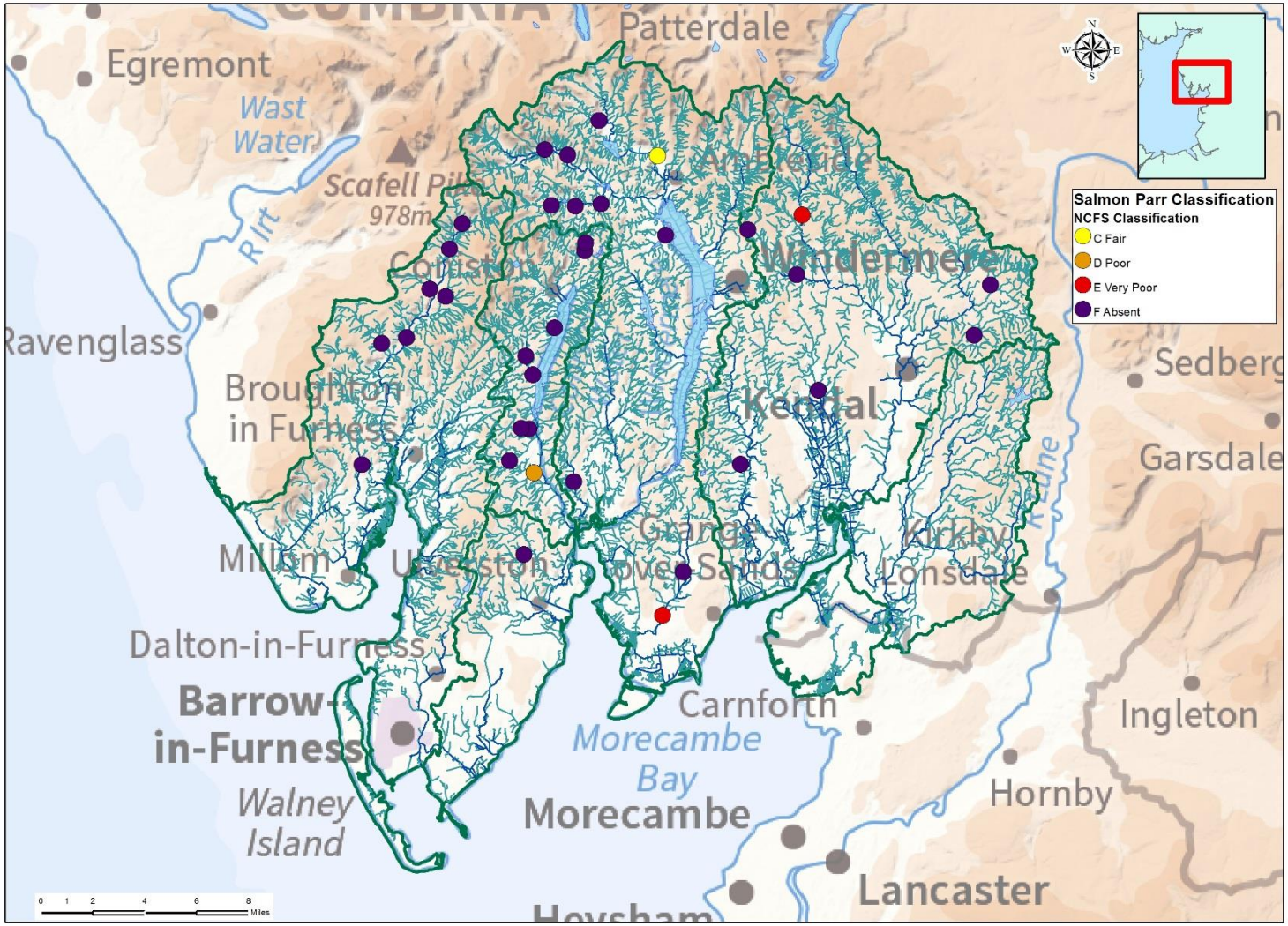
Appendix II

Map to show salmon fry abundance under the National Fisheries Classification Scheme across South Cumbria



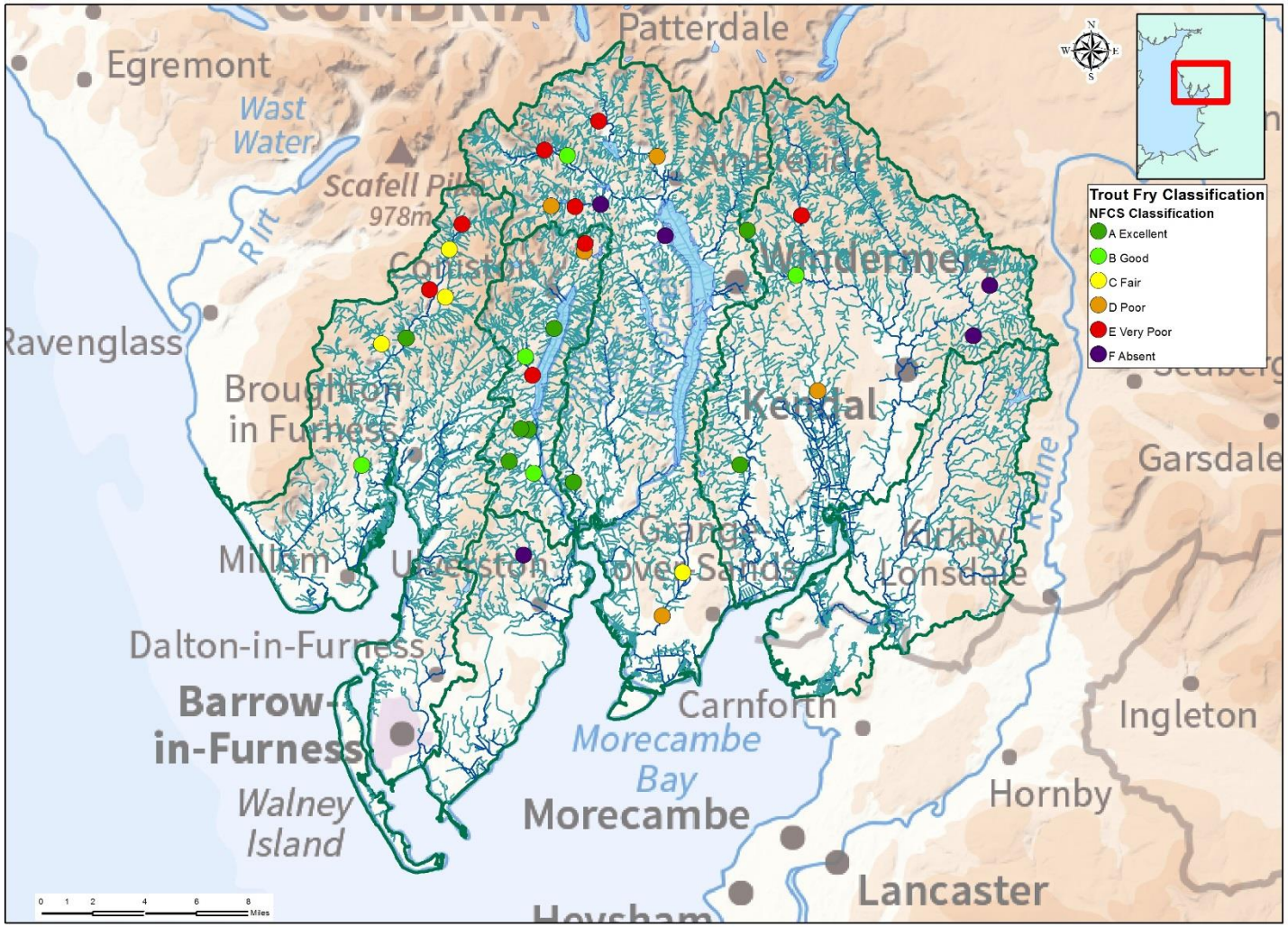
Appendix III

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



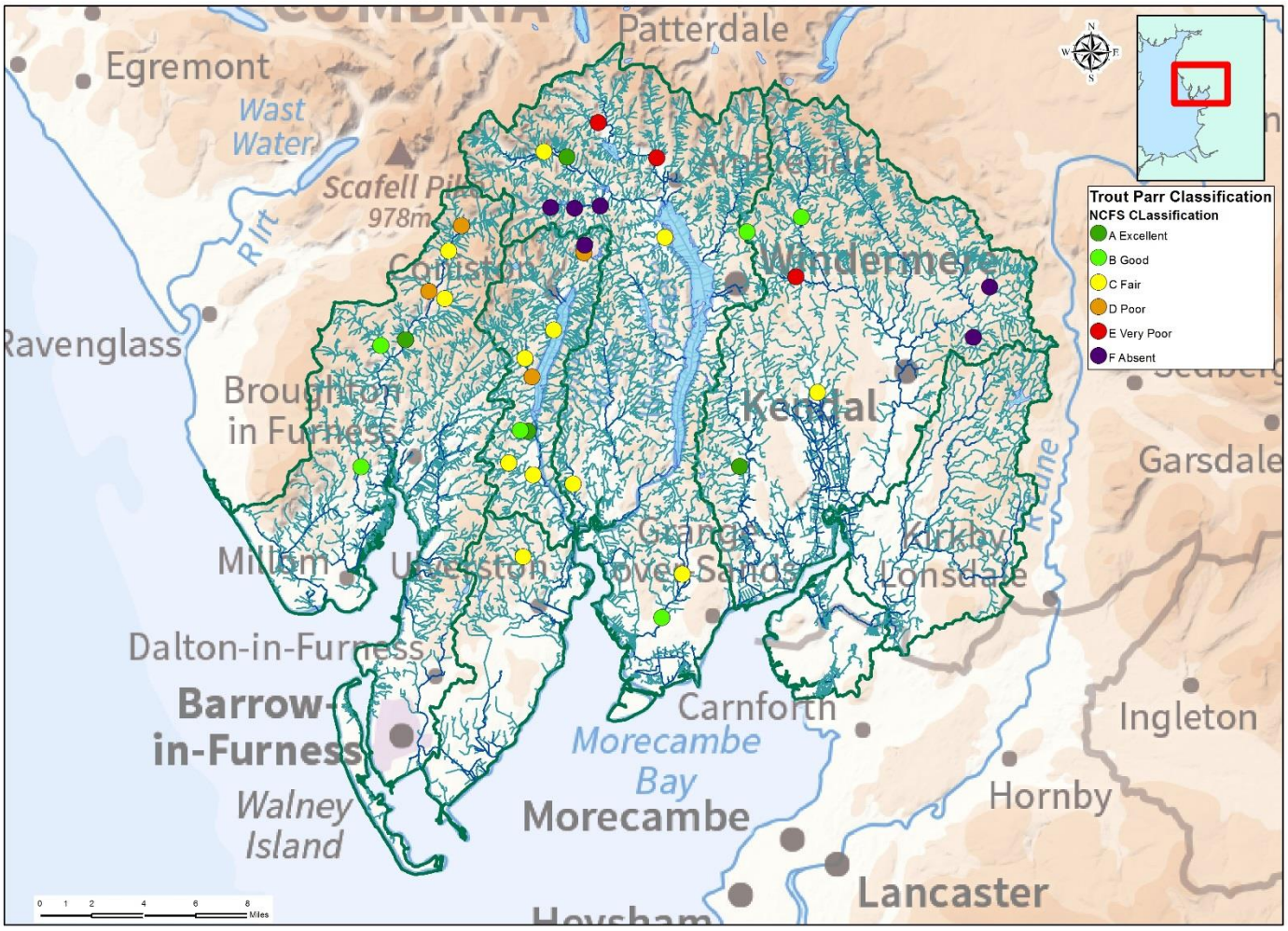
Appendix IV

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



Appendix V

Map to show trout parr abundance under the National Fisheries Classification Scheme across South Cumbria



Appendix VI

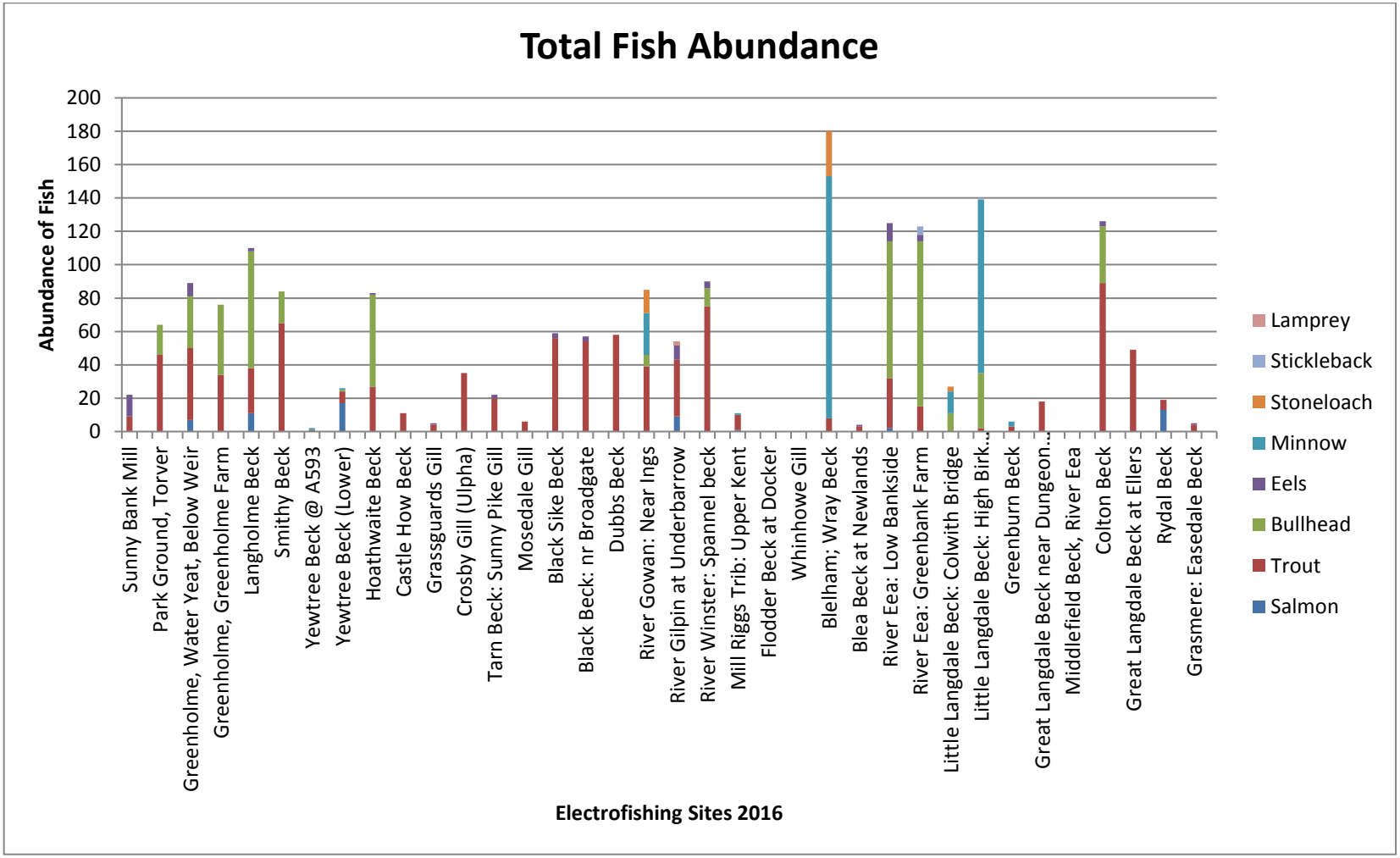
Raw electrofishing data for all sites. *Note this has not been adjusted to show density.*

Site Name	Catchment	NGR	Total Fish	Salmon	Trout	Bullhead	Eels	Minnow	Stoneloach	Stickleback	Lamprey
Sunny Bank Mill	Crake	SD 28954 92447	122	0	9	10-99	13	10-99	0	0	0
Park Ground, Torver	Crake	SD 28519 93606	64	0	46	18	0	0	0	0	0
Greenholme, Water Yeat, Below Weir	Crake	SD 28604 89101	89	7	43	31	8	0	0	0	0
Greenholme, Greenholme Farm	Crake	SD 28242 89144	76	0	34	42	0	0	0	0	0
Langholme Beck	Crake	SD29017 86377	110	11	27	70	2	0	0	0	0
Smithy Beck	Crake	SD27511 87113	84	0	65	19	0	0	0	0	0
Yewtree Beck @ A593	Crake	NY 32691 01227	2	0	1	0	0	1	0	0	0
Yewtree Beck (Lower)	Crake	NY31259 00199	26	17	7	1	0	1	0	0	0
Hoathwaite Beck	Crake	SD30014 95332	83	0	27	55	1	0	0	0	0
Castle How Beck	Duddon	NY 23778 00264	11	0	11	0	0	0	0	0	0
Grassguards Gill	Duddon	SD 22570 97759	5	0	4	0	1	0	0	0	0
Crosby Gill (Ulpha)	Duddon	SD 19949 93977	35	0	35	0	0	0	0	0	0
Tarn Beck: Sunny Pike Gill	Duddon	SD 23560 97290	22	0	20	0	2	0	0	0	0
Mosedale Gill	Duddon	NY 24567 01809	6	0	6	0	0	0	0	0	0
Black Sike Beck	Duddon	SD 21337 94891	59	0	56	0	3	0	0	0	0
Black Beck: nr Broadgate	Duddon	SD 18240 87299	57	0	54	0	3	0	0	0	0
Dubbs Beck	Kent	NY 42281 01428	58	0	58	0	0	0	0	0	0
River Gowan: Near Ings	Kent	SD45303 98636	85	0	39	7	0	25	14	0	0
River Gilpin at Underbarrow	Kent	SD 46472 91936	54	9	34	0	9	0	0	0	2
River Winster: Spannel beck	Kent	SD 41795 86913	90	0	75	11	4	0	0	0	0
Mill Riggs Trib: Upper Kent	Kent	NY45845 02331	11	1	9	0	0	1	0	0	0
Flodder Beck at Docker	Kent	SD56233 94816	0	0	0	0	0	0	0	0	0
Whinhowe Gill	Kent	SD 57611 98543	0	0	0	0	0	0	0	0	0

Blelham; Wray Beck	Leven	NY 36843 00517	180	0	8	0	0	145	27	0	0
Blea Beck at Newlands	Leven	SD 28705 82010	4	0	3	0	1	0	0	0	0
River Eea: Low Bankside	Leven	SD 36786 76947	125	2	30	82	11	0	0	0	0
River Eea: Greenbank Farm	Leven	SD 38207 80171	123	0	15	99	4	0	0	5	0
Little Langdale Beck: Colwith Bridge	Leven	NY 33178 03053	27	0	0	11	0	13	3	0	0
Little Langdale Beck: High Birk Howe Farm	Leven	NY 31603 02876	140	0	2	33	0	104	0	1	0
Greenburn Beck	Leven	NY30096 02946	6	0	3	0	0	3	0	0	0
Great Langdale Beck near Dungeon Ghyll	Leven	NY 29156 06069	18	0	18	0	0	0	0	0	0
Middlefield Beck, River Eea	Leven	SD 37286 80614	0	0	0	0	0	0	0	0	0
Colton Beck	Leven	SD 31462 86518	126	0	89	34	3	0	0	0	0
Great Langdale Beck at Ellers	Leven	NY 30421 06651	49	0	49	0	0	0	0	0	0
Rydal Beck	Leven	NY36626 06287	19	13	6	0	0	0	0	0	0
Grasmere: Easedale Beck	Leven	NY 32983 08194	5	0	4	0	1	0	0	0	0

Appendix VII

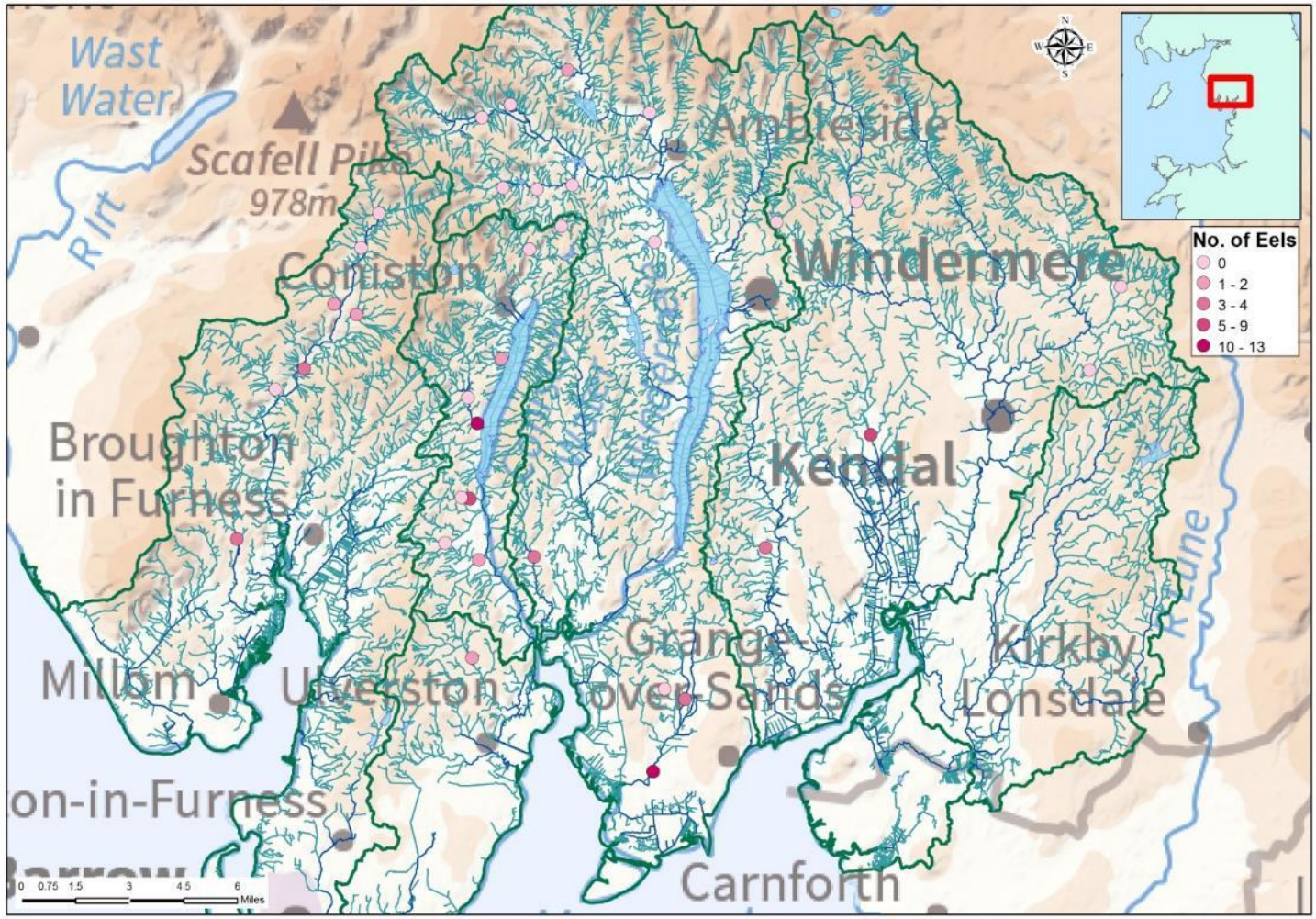
Abundance of all fish species caught during 2016 electrofishing



Appendix VIII

Number of Eels caught across South Cumbria

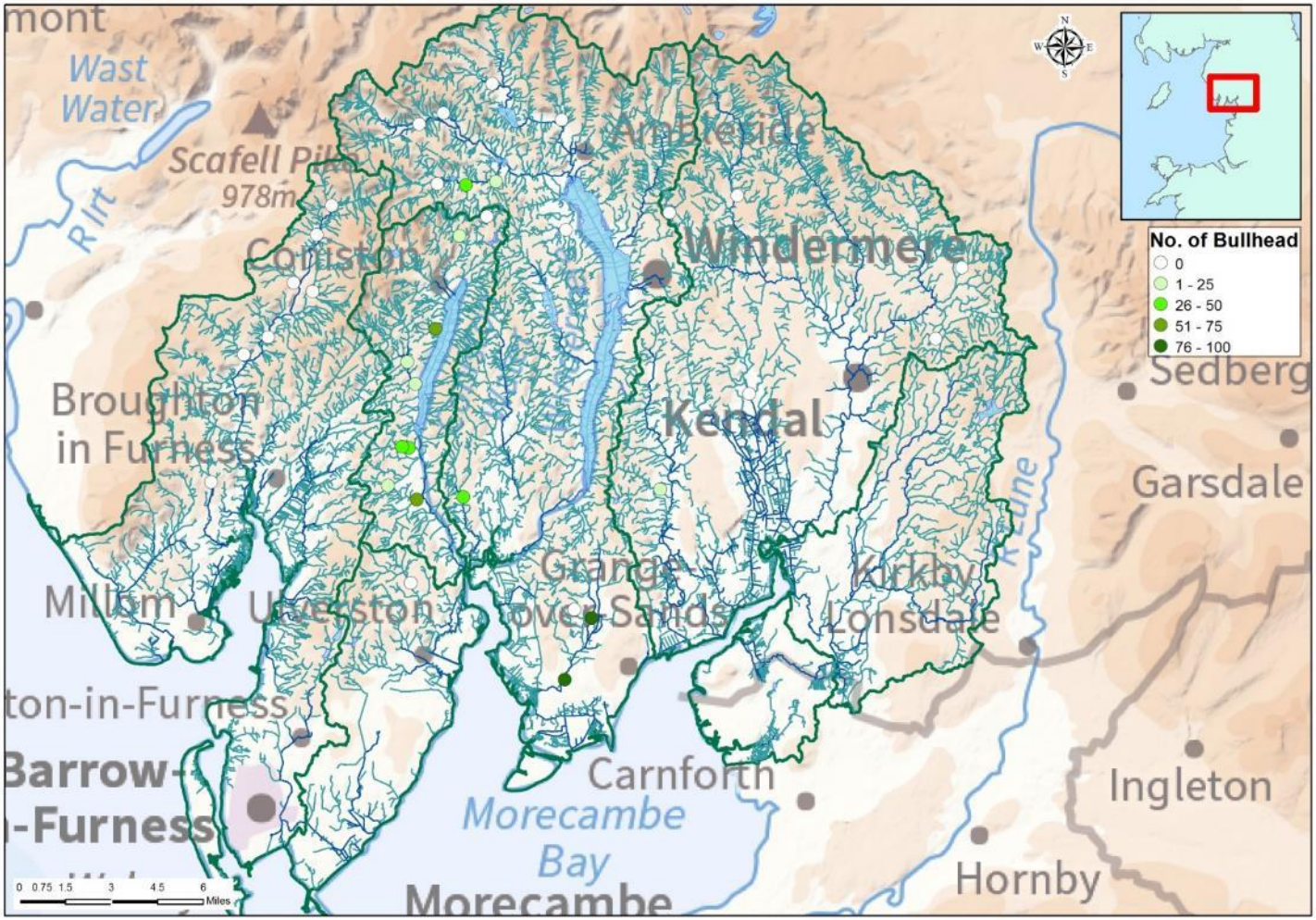
Note: eels were not a target species during electrofishing surveys and figures haven't been adjusted to reflect density per site.

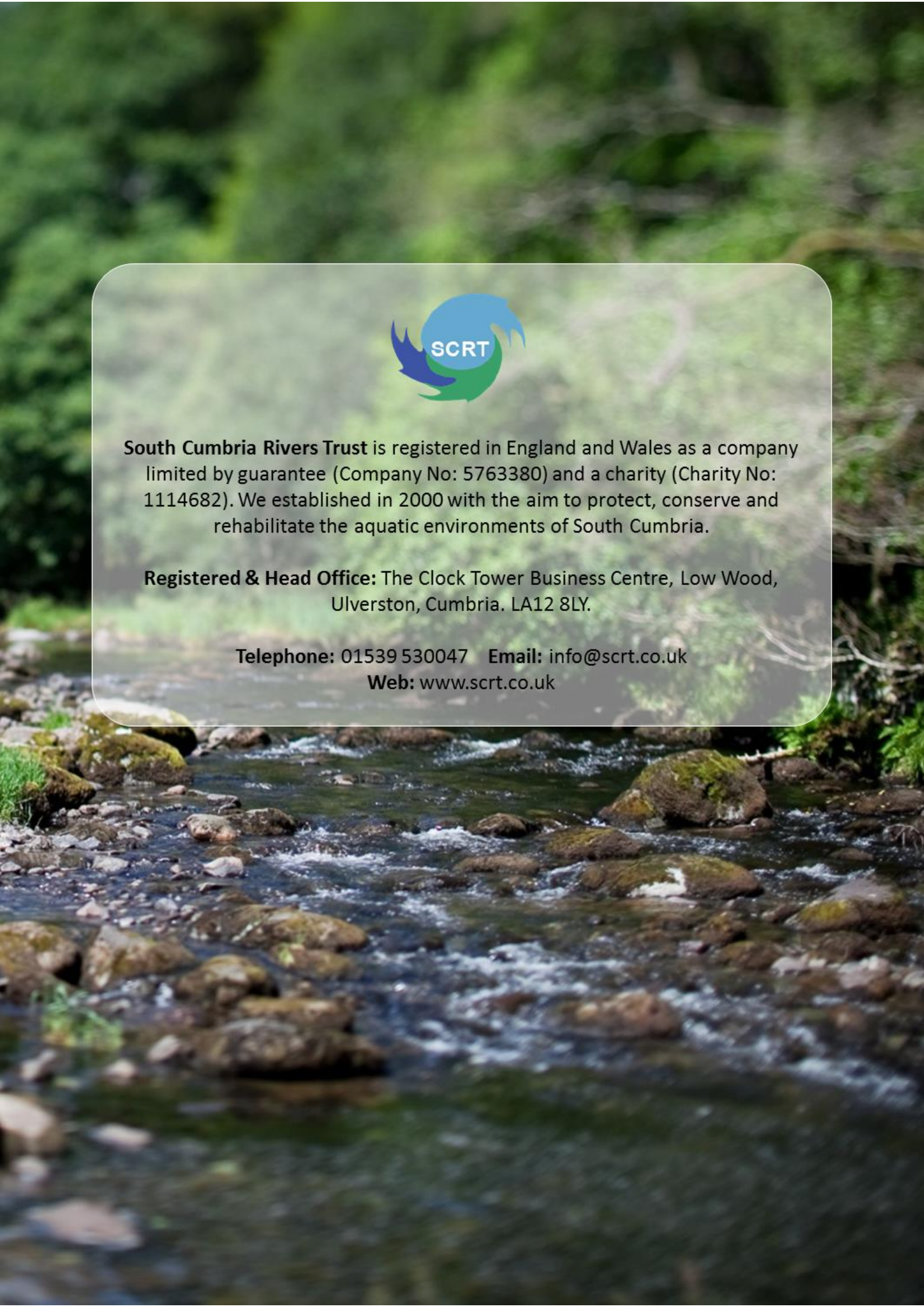


Appendix IX.

Number of Bullhead caught across South Cumbria

Note: bullhead were not a target species during electrofishing surveys and figures haven't been adjusted to reflect density per site.





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