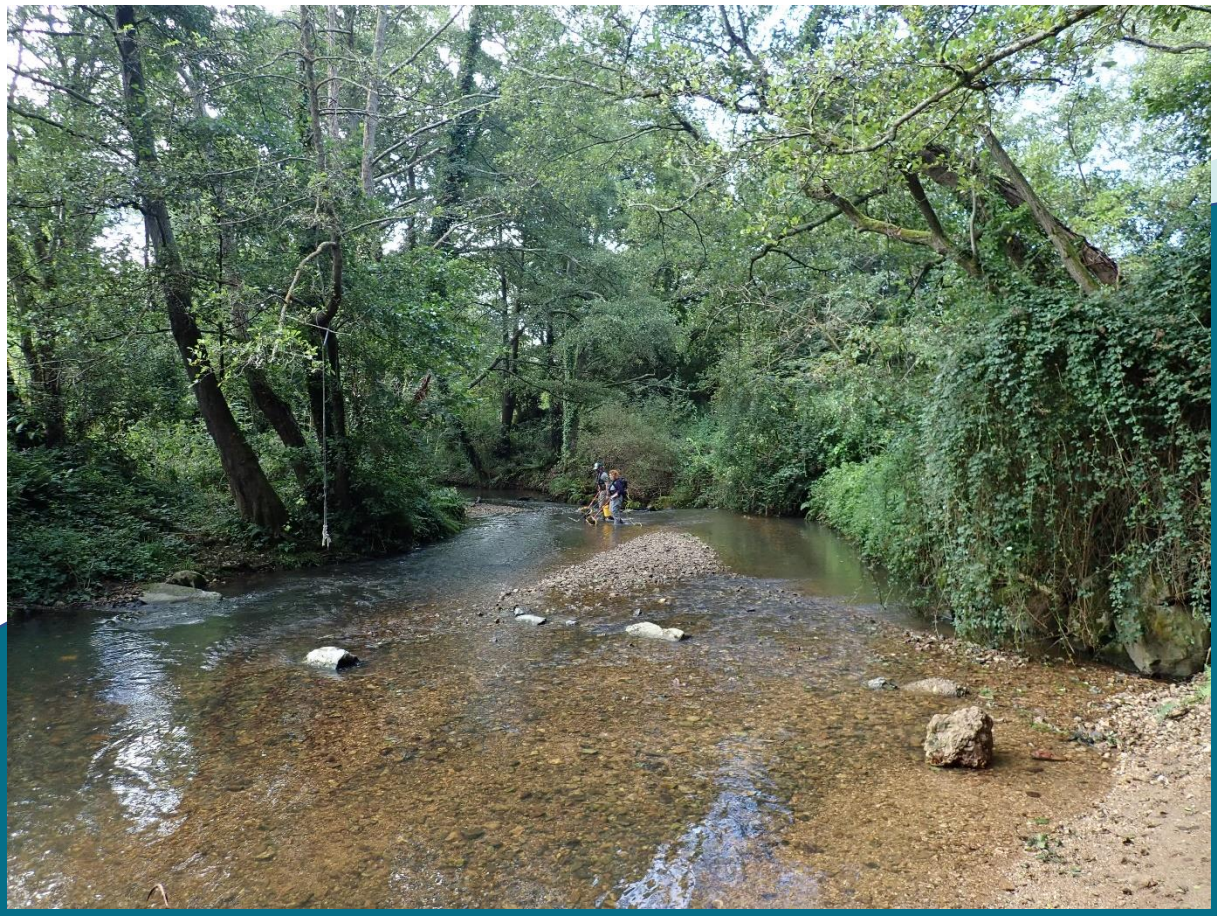
Westcountry Rivers Trust

Fry Index Survey
River Sid

January 2025

Hannah Parvin



Westcountry Rivers Trust is an environmental charity established in 1995 to restore, protect and improve the rivers, streams, and water environments in the region for the benefit of wildlife and people.

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Executive Summary

Westcountry Rivers Trust (WRT) undertook fry index surveys (FIS) throughout the Sid catchment during the summer of 2024. This is the second year of WRT surveys in the Sid catchment where six sites were selected to cover the catchment, with the intention to form a long-term data set. Surveys were funded through the Sid Valley Biodiversity Group and a collaboration with The Rivers Trust and Environment Agency. Results show that trout fry numbers were low within the catchment, however, trout parr were present at all main River Sid sites. No salmon were recorded during the surveys. Conservation strategy Defend/Repair/Restore has been applied on a sub-catchment level dependent on classifications received during the semi-quantitative surveys.

Contents

1. Introduction

Westcountry Rivers Trust (WRT) undertook semi-quantitative fry index surveys (FIS) of the Sid catchment in September 2024, which was funded by the Sid Valley Biodiversity Group and a collaboration between The Rivers Trust and Environment Agency. This was the second year of fisheries monitoring undertaken by WRT within this catchment, to establish baseline data of juvenile salmonid recruitment. Not being classified a principal salmon river, the Sid has previously received less statutory fish monitoring effort than other nearby larger catchments supporting Atlantic Salmon (*Salmo salar*). It is the intention to continue annual monitoring to enable understanding of trends and effects of any interventions within the catchment. A total of six sites were surveyed during the 2024 season across the catchment, with the majority on the main stem of the river. Sites were selected to cover the catchment and targeted not to duplicate surveys being undertaken by the Environment Agency. Four of the six survey sites were replicates of the 2023 survey programme, with two new sites to investigate other areas of the catchment. The new sites were located on the Burscombe Brook (in place of the site on the Woolbrook) and the site on the Roncombe Stream was moved further downstream for 2024 compared to 2023.

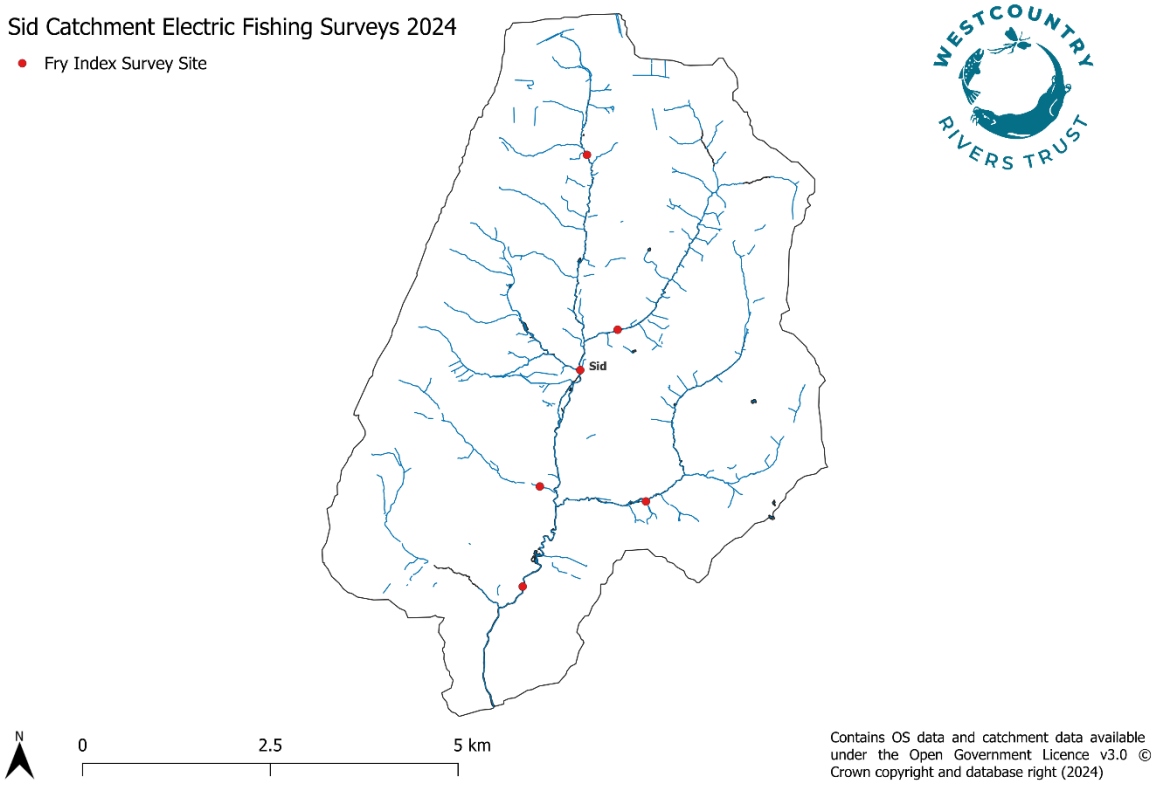

Figure 1: Survey site location, River Sid, 2024.

2. Methodology

2.1 Electric Fishing Protocols

Electric fishing uses a controlled electric current to induce fish to swim towards an anode and into a hand net, so that surveyors can record various biometric data. This occurs by the positive anode (a metal ring at the end of a pole with a dead-man switch) and negative cathode (a braided metal fibre tail) creating an electric field in the water, of which the gradient of the field is determined by the voltage output of the equipment. When fish enter into the electrical field, they are temporarily immobilised, thus move with the flow of water towards the anode and hand net. It is possible for a fish to be effected by the cathode, however, the electrical field is weaker, and once a fish has moved out of the field they fully recover. When carried out correctly by experienced and qualified surveyors it is not harmful to fish and once recovered, the fish are released back to the same reach from which they were caught. An electric fishing backpack is used as this is the most effective and practicable equipment for this purpose within the reaches typically surveyed by WRT.

There are several approaches to electric fishing assessments in rivers; fully-quantitative, area based semi-quantitative, and time based semi-quantitative methodologies. All three methods have their advantages and relevance depending on purpose, with fully quantitative surveys providing higher accuracy data across age classes at an individual location, whereas semi-quantitative can provide a greater resolution across a catchment for the same labour. For the Sid catchment, time based semi-quantitative was used.

A time-based, semi-quantitative electric fishing survey (otherwise known as fry index survey or FIS) is the preferred method (Crozier and Kennedy, 1994); where the independent variable is time. Five minutes of 'live' fishing is used to assess fry numbers over riffle habitat. No barrier nets are deployed as the survey area is defined by shallow fry habitat; therefore the catch efficiency is high. This method is relatively fast and is therefore well suited to catchment-wide programmes; providing a higher sample size for a representative understanding of juvenile recruitment across a catchment. In the event that a fish is missed, surveyors will record this so that a catch efficiency can be calculated. If catch efficiency is less than 60%, then the survey will be voided and the results labelled as such.

The aim of WRT's electric fishing programmes is to build up a historical data set on each catchment and provide baseline information on population status. Monitoring long term trends helps to identify issues and potential actions. To properly achieve this, a representative number of surveys should be fished across all tributaries of a catchment and these sites should be repeated over consecutive years. The trends in results help to identify potential issues within the catchment, these may include but are not limited to:

- Upstream barriers to fish-passage
- Changes in habitat quality
- Potential changes in water quality
- Chronic diffuse pollution

- To monitor habitat improvements delivered within projects.
- Targeted habitat interventions

2.2 Fisheries Conservation Strategy

The data collected by electric fishing programmes can be used to identify long term trends in salmonid populations. Further investigation can then be conducted to isolate a specific issue, to then be addressed through delivery. Figure 2 below shows an example of different habitat issues and their effects on populations.

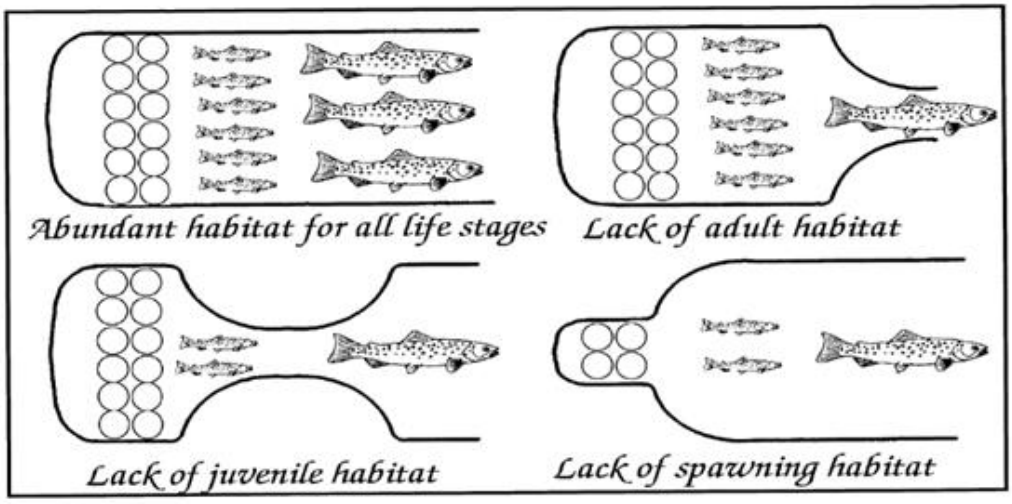

Figure 2: Diagrams defining salmonid habitat bottlenecks (Summers, Giles and Willis, 1996).

The 'Defend/Repair/Restore' strategy, developed by Ronald Campbell of the Tweed Foundation, is a widely accepted approach to riverine habitat restoration, suggesting proportionate responses to various states of habitat. The aim is to improve the quality of catchments to the point of 'Defend' to support robust fish populations.

Where these are in a very poor state, radical actions may be required to see a change. Conversely, where the stocks are already good, habitat re-engineering and stocking operations would be inappropriate. This concept helps divide catchment scale management for fisheries into priorities and therefore can help to maximise multiple benefits through targeted work.

2.3 Site Selection

Survey sites on the Fowey catchment were selected to provide representative samples from distinct river reaches, characterised by habitat type, proximity to barriers or proximity to targeted restoration works. Catchment programmes are developed in partnership with stakeholders and other organisations and are often based on existing historic programmes. In turn, these contributes to a long term fry index survey dataset where trends can be established, and positive or negative patterns of salmonid recruitment inferred from the findings.

2.4 Field Sampling and Data Analysis

Initially the survey programme is confirmed with the funder and stakeholders; permission is then sought from the Environment Agency in the form of an FR2 (a license to capture fish with equipment other than a rod and line). Landowner permission for all sites is obtained prior to surveying. For time-based surveys, two members of staff are required, for area-based electric fishing, a minimum of three surveyors are required. Once on site, the water temperature is taken to ensure it is below 18°C, this temperature limit is set by the Environment Agency to avoid excessive physiological stress to salmonids. The conductivity of the water is measured in order to set an appropriate voltage on the equipment. A frequency is set based on the target species, for salmonids this is between 40-60Hz, and a duty cycle is set, however 100% duty cycle (known as smooth) is preferential for fish welfare and when 100% duty cycle is set the frequency becomes obsolete. The chosen survey method is then conducted.

All salmonids are identified to species level and fork length is measured and recorded. Presence of other species within the survey are also recorded. The captured fish are placed in aerated containers until they are fully recovered. They are then released back to the reach they were caught. Following completion of the survey, the length and width of the site is measured and recorded.

Fish length data is plotted on a length frequency histogram, which allows thresholds for fry and parr to be determined. No salmon fry were caught during the FIS. Trout fry were considered to be any individual measuring up to 95mm (Figure 3). Length frequency histograms are repeated for each catchment each year to reflect the temporal and spatial differences in fry.

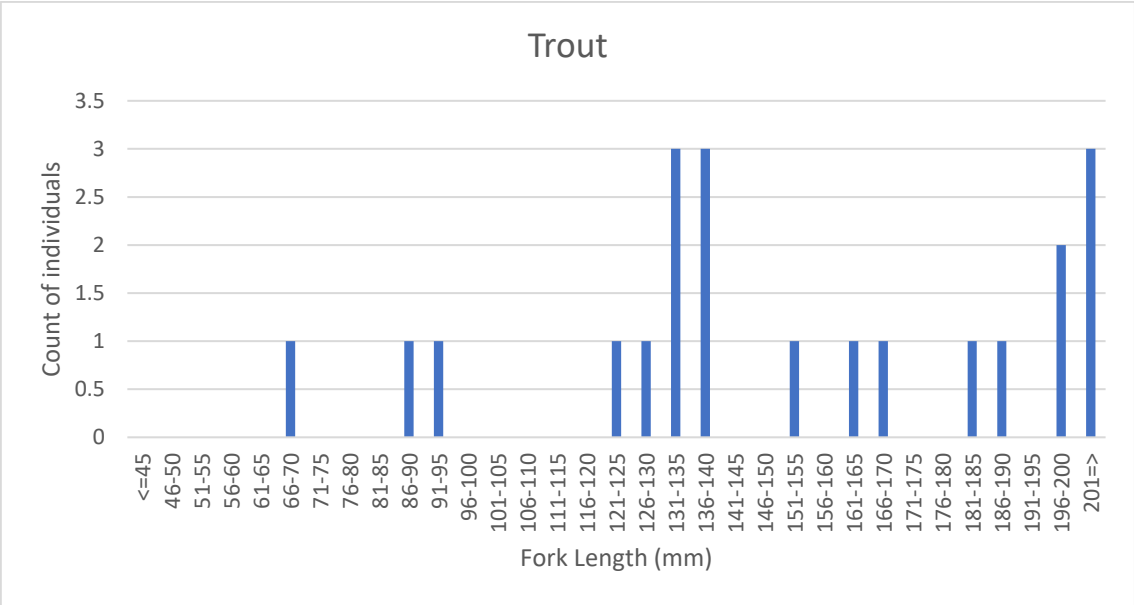

Figure 3: Length frequency histograms for brown trout (Salmo trutta) captured during electric fishing surveys within the Sid catchment, 2024. Count represents numbers of individuals within each length bin captured across all sites and size bins are given in fork length (mm).

Fry index surveys are classified according to Crozier and Kennedy (1994), the categories of which are displayed in Table 1.

Table 1: Semi-quantitative abundance categories for salmon fry (Crozier & Kennedy, 1994).

Density Classification	Semi-quantitative (n 5min fishing)	Quantitative (n 100m^2)
A (Excellent)	**>23**	**>114.7**
B (Good)	**11-23**	**69.1-114.6**
C (Fair)	**5-10**	**41.1-69.0**
D (Poor)	**1-4**	**0.1-41.0**
E (Absent)	**0**	**0**

3. Results and Discussion

WRT surveyed six FIS sites in the River Sid catchment during September 2024. Weather conditions were dry at the time of surveying, with low river levels conducive to high catch efficiency and operator safety.

The 2024 catchment survey demonstrates that the surveyed extent of the Sid catchment does not currently support salmon spawning, with all sites being absent of salmon. A major factor driving this is the presence of School Weir at the bottom of the catchment in Sidmouth, which prevents the migration of salmonids (Devon Wildlife Trust, 2014). Resident trout populations have poor recruitment across the catchment, with only two sites classified as poor of the total six sites surveyed, and only two trout fry recorded across all sites surveyed. A total of 21 trout fry and parr were caught across all sites in 2024, compared to a total of 25 trout fry and parr caught in 2023. Other minor species were recorded during the surveys, notably, bullhead were caught at all of the six survey sites.

Table 2: River Sid salmon and trout fry classifications for 2024.

Site Name	River	Grid Ref.	Salmon fry classification	Trout fry classification	No. of salmon parr	No. of trout parr
Plyford Farm	Sid	SY 14152 94651	**E (0)**	**D (1)**	0	4
Sidbury	Sid	SY 14106 91996	**E (0)**	**E (0)**	0	8
Gilchrist	Sid	SY 13296 88908	**E (0)**	**E (0)**	0	3
Sand	Roncombe Stream	SY 14560 92325	**E (0)**	**E (0)**	0	0
Snod Brook	Snod Brook	SY 14936 90040	**E (0)**	**D (1)**	0	3
Burscombe	Burscombe Brook	SY 13524 90239	**E (0)**	**E (0)**	0	0

Table 3: Approximate number of minor species in the River Sid catchment 2024.

Site Name	River	Bullhead	European Eel	Minnow	Stone loach	Lamprey *spp.*
Plyford Farm	Sid	23				3 (110mm, 95mm, 90mm)
Sidbury	Sid	35			2	
Gilchrist	Sid	20		30	8	
Sand	Roncombe Stream	45				
Snod Brook	Snod Brook	57	1 (230mm)			
Burscombe	Burscombe Brook	100+				

Table 4: Historic FIS dataset for the River Sid.

Grid Ref.	Site name	River	2023	2024		2023	2024
SY 14152 94651	Plyford Farm	Sid	E (0)	E (0)		C (5)	D (1)
SY 14106 91996	Sidbury	Sid	E (0)	E (0)		E (0)	E (0)
SY 13296 88908	Gilchrist	Sid	E (0)	E (0)		D (1)	E (0)
SY 15421 93279	Roncombe Stream	Roncombe Stream	E (0)			E (0)	
SY 14560 92325	Sand	Roncombe Stream		E (0)			E (0)
SY 14936 90040	Snod Brook	Snod Brook	E (0)	E (0)		D (2)	D (1)
SY 12186 89155	Woolbrook	Woolbrook	E (0)			E (0)	
SY 13524 90239	Burscombe	Burscombe Brook		E (0)			E (0)

One trout fry was recorded at Plyford near the headwaters of the River Sid and one trout fry was recorded on the Snod Brook, a reduction in fry numbers at both sites from 2023, and a reduction in classification for Plyford from 'Fair' to 'Poor'. Plyford had the lowest conductivity of all survey sites, however the spawning gravels at the site were heavily silted. There is also a potential barrier to migration downstream of the survey site in the form of a ford with a head drop formed below. The Snod Brook had suitably sized spawning gravels with a few areas of siltation, the brook was heavily incised with undercutting banks on the true left bank.

No trout were recorded on the Roncombe Stream or Burscombe Brook. For the Roncombe Stream this is likely due to barriers to migration, including the bridge footing downstream of Sand, as habitat at the survey site was good for supporting trout populations. The site consisted of suitable spawning sized gravels, with wood in the river to provide habitat heterogeneity and areas of refuge and feeding. However, the survey site at Sand could benefit from increasing light penetration to the river, and the banks were incised and disconnected from the floodplain. The lack of trout on the Burscombe Brook is likely due to a combination of barriers to migration, such as the ~2m weir face downstream of the Burscombe Brook site, and poor salmonid habitat. The Burscombe Brook was very exposed with no shading, with an extensive macrophyte cover of watercress. The gravels in the reach were silted and compacted and the channel was straightened with little heterogeneity. Housing development is proposed on the true left bank along the Burscombe Brook.

Only trout parr were recorded at Sidbury in the middle reaches of the River Sid, and Gilchrist in the lower reach of the River Sid. This is likely due to the site location not being preferable for fry, as there was low areas of riffle habitat and the sites largely consisted of parr and pool habitat types, more consistent with parr and adult life stages. Of the areas of riffle that were available at these two survey sites, spawning gravels were of a suitable size, freely moving with little to no sedimentation. As well as School Weir at the base of the Sid catchment, there were a number of smaller boulder weirs upstream and downstream of the Gilchrist survey site, which if not impeding fish passage, could have cumulative impact in reducing the migration of adults into spawning habitat. Within small coastal catchments, a large proportion of recruitment is typically driven by the spawning of anadromous (sea) trout, which disproportionately contribute a higher number of eggs given their larger body mass. The disconnection of the Sid to the sea by School Weir prevents such anadromous contribution, despite efforts led by EA and local volunteers to translocate individuals at the end of September 2024. This dysconnectivity to the wider population leaves the Sid trout population vulnerable to stressors and may have long-term consequences in reducing the population's viability.

Future surveys such as salmonid habitat walkovers and rapid barrier assessments, as well as continued electric fishing surveys, would provide a better understanding as to the reasons for the observed presence or absence of salmonids across the Sid catchment.

The parameters shown in Table 5 below are collected at each site to inform the survey. Water temperature is measured to ensure that the water is below limits for fish welfare at the time of survey and is not used as part of monitoring water quality. If the temperature exceeds 18°C, the survey cannot be conducted as this poses an unacceptable risk of fish mortality. Similarly, conductivity data collection is taken for the purposes of ensuring the electric fishing equipment is properly set up and is not used for water quality monitoring purposes.

Table 5: Parameter recorded during FIS, River Sid catchment, 2024.

Site Name	River	Conductivity (µS)	Temperature (°C)	Area (m)	Length (m)	Width (m)
Plyford Farm	Sid	167	13.4	116.82	35.4	3.3
Sidbury	Sid	251	13.8	144.54	43.8	3.3
Gilchrist	Sid	340	13	169.52	16.3	10.4
Sand	Roncombe Stream	245	14.5	56	28	2
Snod Brook	Snod Brook	352	12.9	48	40	1.2
Burscombe	Burscombe Brook	435	13.3	37.8	54	0.7

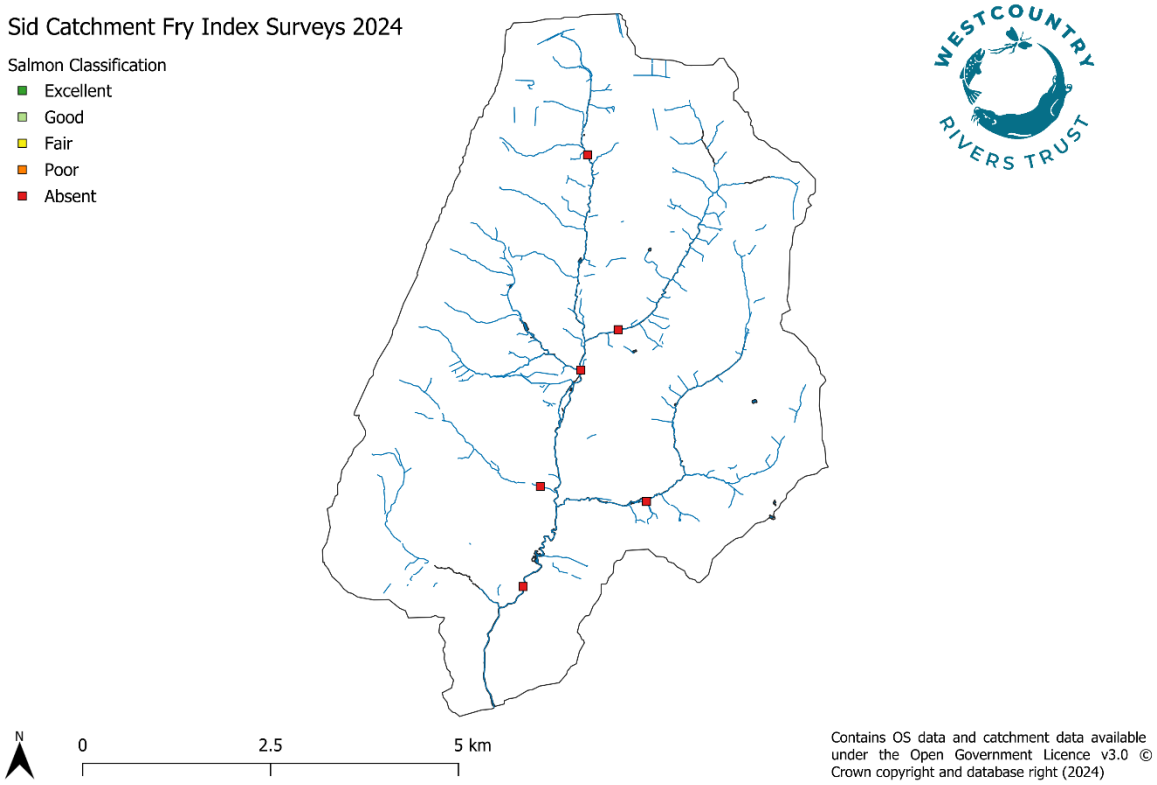

Figure 4: Salmon fry classifications, River Sid, 2024.

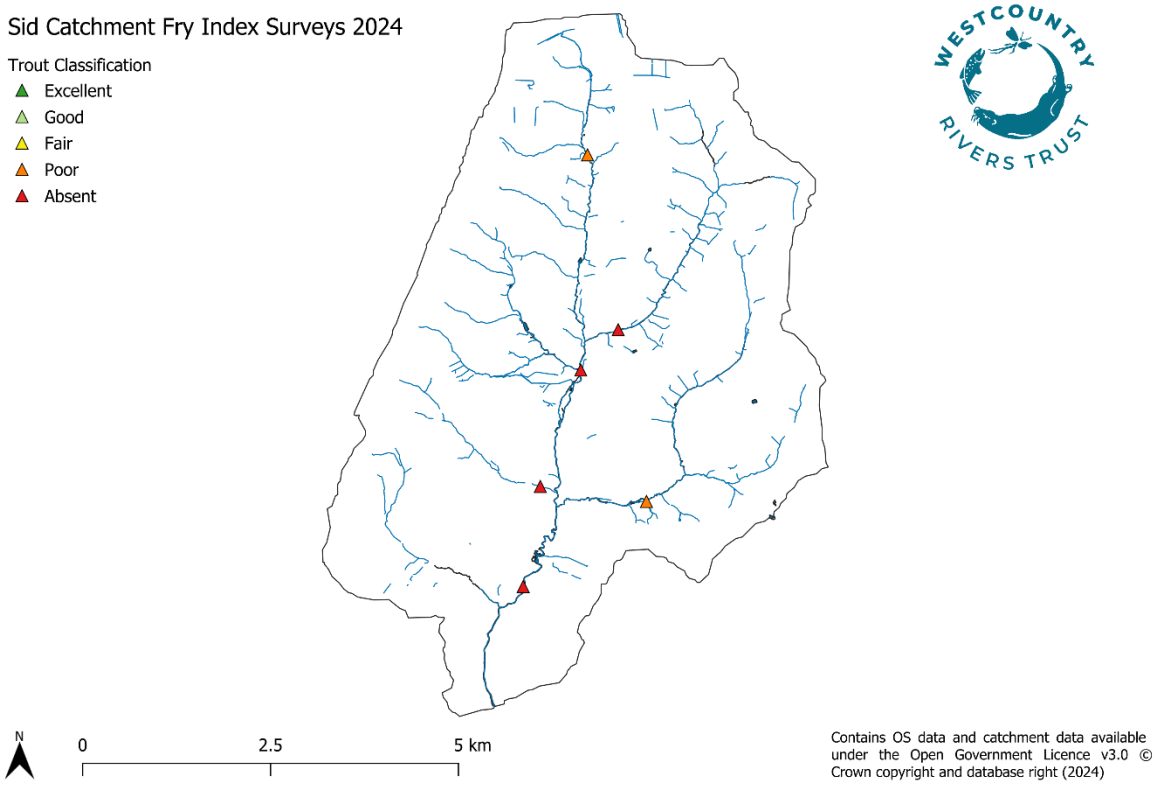

Figure 5: Trout fry classifications, River Sid, 2024.

4. Defend, Repair, Restore

The strategy for restoration and conservation of sites suggested here broadly follows the "Defend, Repair, Restore" (DRR) concept (Table 6) developed by Ronald Campbell of the Tweed Foundation and has in the past been applied to a catchment following results from the fry index surveys. The fry productivity of the rivers is assessed by a combination of historic semi-quantitative electric fishing results. Where available, these results are then applied in context of existing plans (e.g. DEFRAs Salmon Five Point Approach, habitat walkover surveys and genetic data) to produce assessments and recommendations for each sub-catchment of the river.

Despite the DRR strategy being a useful tool to identify and prioritise works in catchments, the requirements of waterbodies can rarely be quite so clear cut. The coloured arrow in Table 6 represents the continuum of the three strategies and the goal for each waterbody; to move all the Sid sites from their current position to somewhere in the *Defend* category, or to ensure they remain in this status if fish stocks are already good.

To determine specific actions based on the DRR allocations to tributaries, further investigation should be required to determine the cause (s) and the best route of action to improve salmonid populations.

Table 6: Defend/Repair/Restore strategy.

Category	Status	Action examples
Defend	These areas have good fish stocks and habitats, therefore require safeguarding actions to ensure no decline occurs.	Habitat safeguarding Catch and release
Repair	These areas have moderate fish stocks and habitat that is in a moderate condition, therefore these areas require assisted habitat recovery to move them into the defend category.	Assisted habitat recovery
Restore	These areas have poor fish stocks and the habitat is significantly degraded, therefore drastic interventions are required such as habitat re-engineering in order to improve their status.	Habitat re-engineering

The DRR strategy for each sub catchment is summarised in Table 7.

Table 7: Sid sub catchment classification and DRR strategy.

Sub-catchment	Average Fry Index Class & Conservation Strategy	
	Salmon	Trout
Sid	Absent	Poor
	Restore	Restore
Sid Tributaries	Absent	Poor
	Restore	Restore

5. Glossary

Term	Definition
Fry	A juvenile fish less than one year old that has matured past the stage of an alevin (hatched fish with yolk still attached) and is able to swim freely.
Parr	A fish that is greater than one years old.
Anadromous	A fish that migrates from the sea up a river to spawn.
Minor Species	Minor species in this report are referred to all fish that are not Atlantic salmon or brown trout.
Fork Length	The length of a fish measured from the tip of its nose to the fork of its tail.
Semi-quantitative Survey	A survey that is partially quantitative. There is a larger chance of error in the measuring of the data as the control variable is less robust.
Anode and Cathode	An anode is a positively charged electrode, whereas a cathode is a negatively charged cathode. Electricity flows in to an anode and out of a cathode.
Duty Cycle	A duty cycle is the period in which a system is active. In relation to electric fishing, the duty cycle is the ratio of on-to-off time of the electrical output of the equipment. A 100% smooth current is preferential for fish welfare as the current is continuous, compared to a pulsed current of 50% where the current is in a fluctuating cycle of on and off.

6. Acknowledgements

Thanks to the Sid Valley Biodiversity Group as well as The Rivers Trust and Environment Agency for funding the surveys. Thanks also to Charles Sinclair and Jan Metcalf at the Sid Valley Biodiversity Group for showing us the catchment, as well as thanks to all landowners involved for their kind permission and to the Environment Agency for providing consent for the surveys.

7. References

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