Westcountry Rivers Trust

Fry Index Survey
River Sid

April 2024

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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 2023. This is the first 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 Wild Trout Trust and Sid Valley Biodiversity Group. 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/Attack has been applied on a sub-catchment level dependent on classifications received during the semi-quantitative surveys.

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1. Introduction

Westcountry Rivers Trust (WRT) undertook semi-quantitative fry index surveys (FIS) of the Sid catchment in September 2023 which was funded by the Wild Trout Trust and Sid Valley Biodiversity Group. This was the first year of fish monitoring undertaken by WRT on this catchment, with the goal of these surveys to show the potential of regular FIS. Rivers, such as the Sid, have historically received little survey effort and these initial results help establish a long-term dataset of fry numbers. A total of six sites were surveyed during the 2023 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 collide with surveys being undertaken by the Environment Agency.

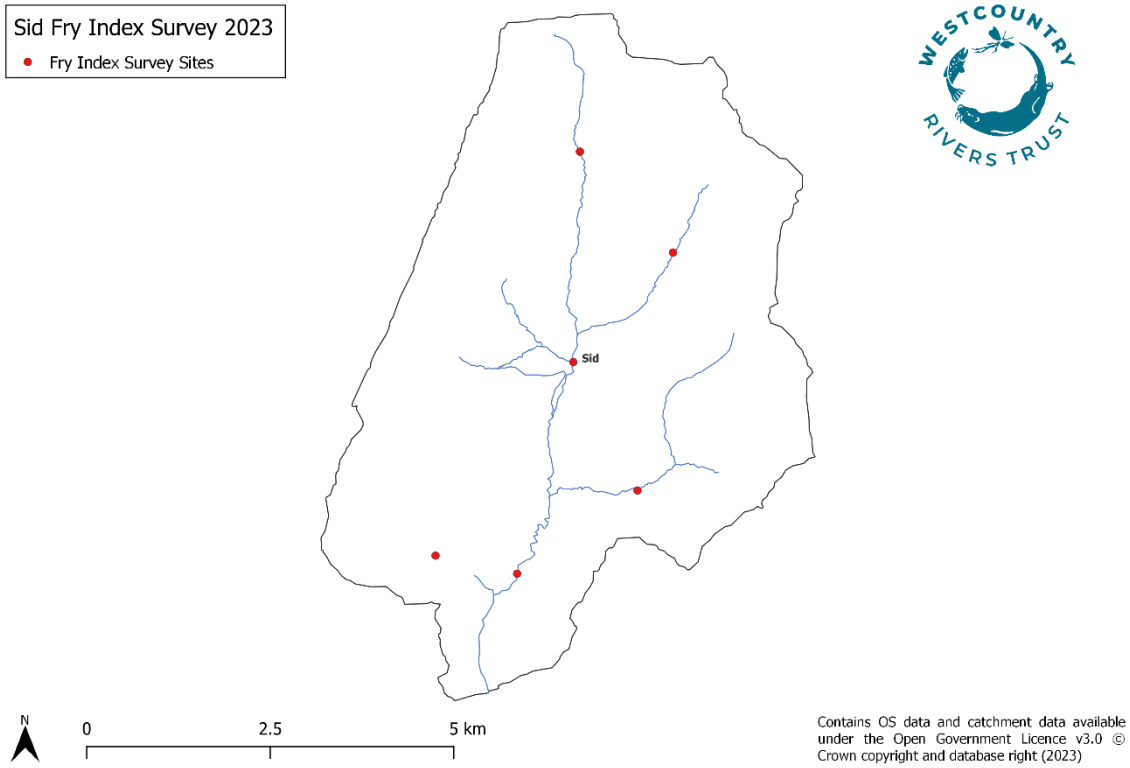

Figure 1: Survey site location, River Sid, 2023.
(Maps are generated using open source software obtained by OS and EA, rivers may be capped at a particular Strahler order.)

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 best method for targeting salmonids in the Westcountry, with improved ability to access a variety of watercourses.

There are several approaches to electric fishing assessments in rivers; quantitative, area based semi-quantitative and time based semi-quantitative methodologies. All three methods have their advantages and disadvantages. 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 compared to other methods and is therefore well suited to catchment wide programmes. 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 catchment scale electric fishing programme 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

At project level, 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 which can then be addressed through delivery. Figure 2 below shows an example of different habitat issues and their effects on populations.

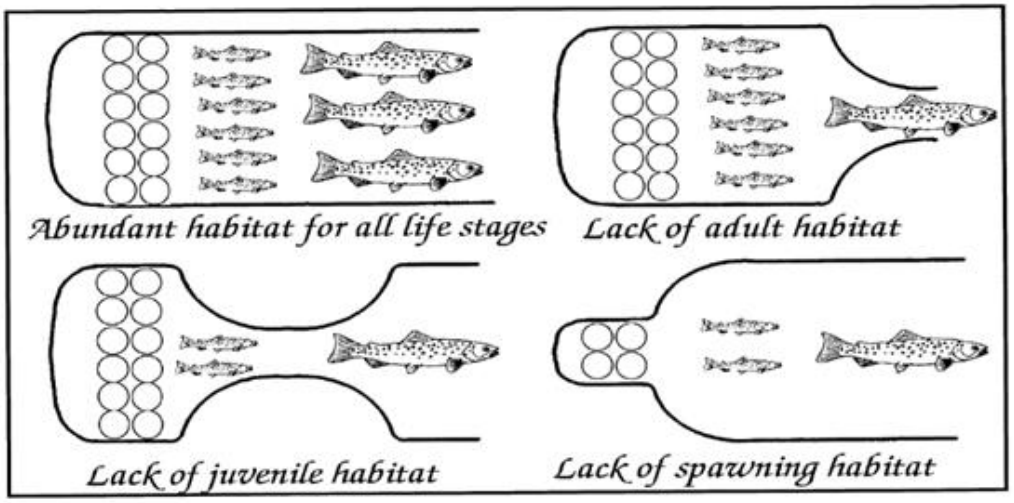

Figure 2: Diagrams defining salmonid habitat bottlenecks (Summers, Giles and Willis, 1996).

The 'Defend/Repair/Attack' 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 Sid 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 this 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 85mm (Figure 3). Length frequency histograms are repeated for each catchment each year to reflect the temporal and spatial differences in fry.

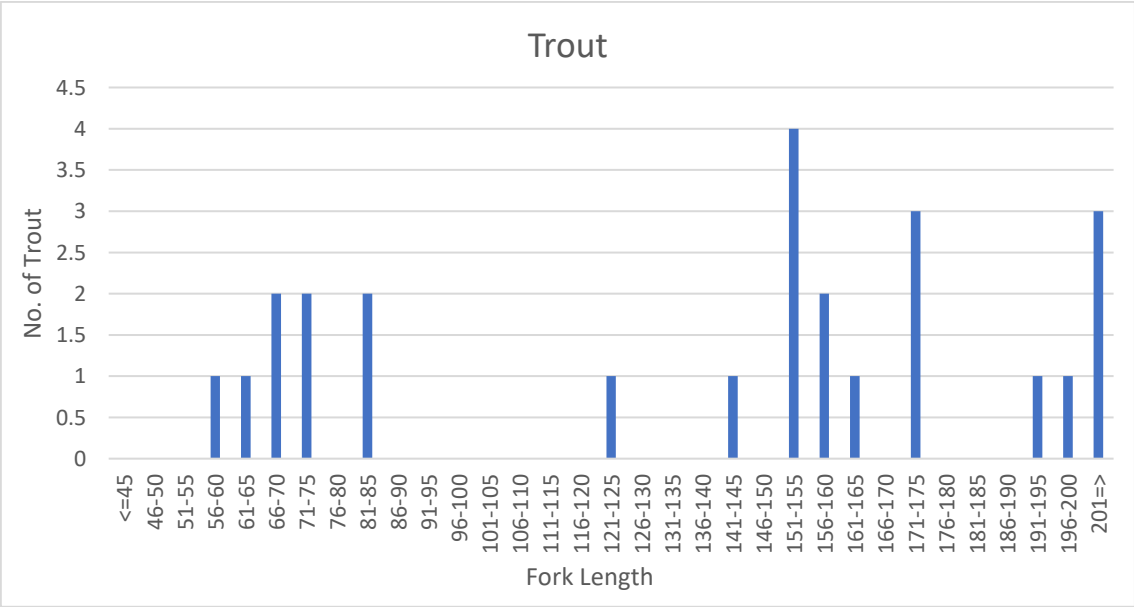

Figure 3: Trout length frequency distribution, River Sid, 2023.

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 2023. Weather conditions were dry at the time of surveying, with river levels on the main River Sid normal for what is expected of summer flows.

The 2023 catchment survey demonstrates that the Sid catchment does not currently support salmon spawning, with all sites being absent of salmon. A major factor for 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 are minimal, with two sites classified as poor and one site classified as fair of the total six sites surveyed. A total of 25 trout fry and parr were caught across all sites in 2023. Other minor species were recorded during the surveys, notably bullhead were caught at five of the six survey sites.

No trout were recorded on the Woolbrook or Roncombe Stream, this is likely due to unsuitable habitat. The Woolbrook was located in a built-up area which is likely affected by road run off, additionally flows were low and substrate was not preferable for spawning or riffle habitats. The area surveyed on the Roncombe Stream, located in the upper catchment, was a small relatively straight watercourse, that is heavily overshaded and would benefit from some shade management. Only trout parr were recorded at Sidbury in the middle reaches of the River Sid, this is likely due to the site location not being preferable for fry, as there was minimal riffle habitat and the site largely consisted of parr and pool habitat types, more consistent with parr and adult life stages. 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 presence or absence of salmonids in the Sid catchment. It should also be noted that the low fish numbers recorded during the 2023 surveys are not localised to the Sid catchment, a decline in salmonid fry numbers had been recorded across the south west and is likely to be a result of the 2022 drought conditions.

Table 2: River Sid salmon and trout fry classifications for 2023.

Site Name	River	NGR	Salmon fry classification	Trout fry classification	No. of salmon parr	No. of trout parr
Plyford Farm	Sid	SY 14152 94651	**E (0)**	**C (5)**	0	1
Sidbury	Sid	SY 14062 91788	**E (0)**	**E (0)**	0	9
Gilchrist	Sid	SY 15421 93279	**E (0)**	**D (1)**	0	3
Roncombe Stream	Roncombe Stream	SY 15453 90401	**E (0)**	**E (0)**	0	0
Snod Brook	Snod Brook	SY 12186 89155	**E (0)**	**D (2)**	0	4
Woolbrook	Woolbrook	SY 13298 88915	**E (0)**	**E (0)**	0	0

Table 3: Number of minor species in the River Sid catchment 2023.

Site Name	River	Bullhead	Eel	Minnow	Stone loach	Three-spined stickleback
Plyford Farm	Sid	20				
Sidbury	Sid	37		1		
Gilchrist	Sid	31		4	5	
Roncombe Stream	Roncombe Stream	63				
Snod Brook	Snod Brook	38	1 (40cm)			
Woolbrook	Woolbrook					1

The parameters shown in Table 4 below are collected at each site to inform the survey. Water temperature is measured to ensure that the water is below 18°C 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 puts the welfare of the fish at risk. 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 4: Parameter recorded during FIS, River Sid catchment 2023.

Site Name	River	Conductivity (µS)	Temperature (°C)	Area (m)	Length (m)	Width (m)
Plyford Farm	Sid	170	17.5	40	20	2
Sidbury	Sid	315	17	40	20	2
Gilchrist	Sid	370	17	80	20	4
Roncombe Stream	Roncombe Stream	270	17.5	60	30	2
Snod Brook	Snod Brook	380	16	20	15	2
Woolbrook	Woolbrook	530	17	20	20	1

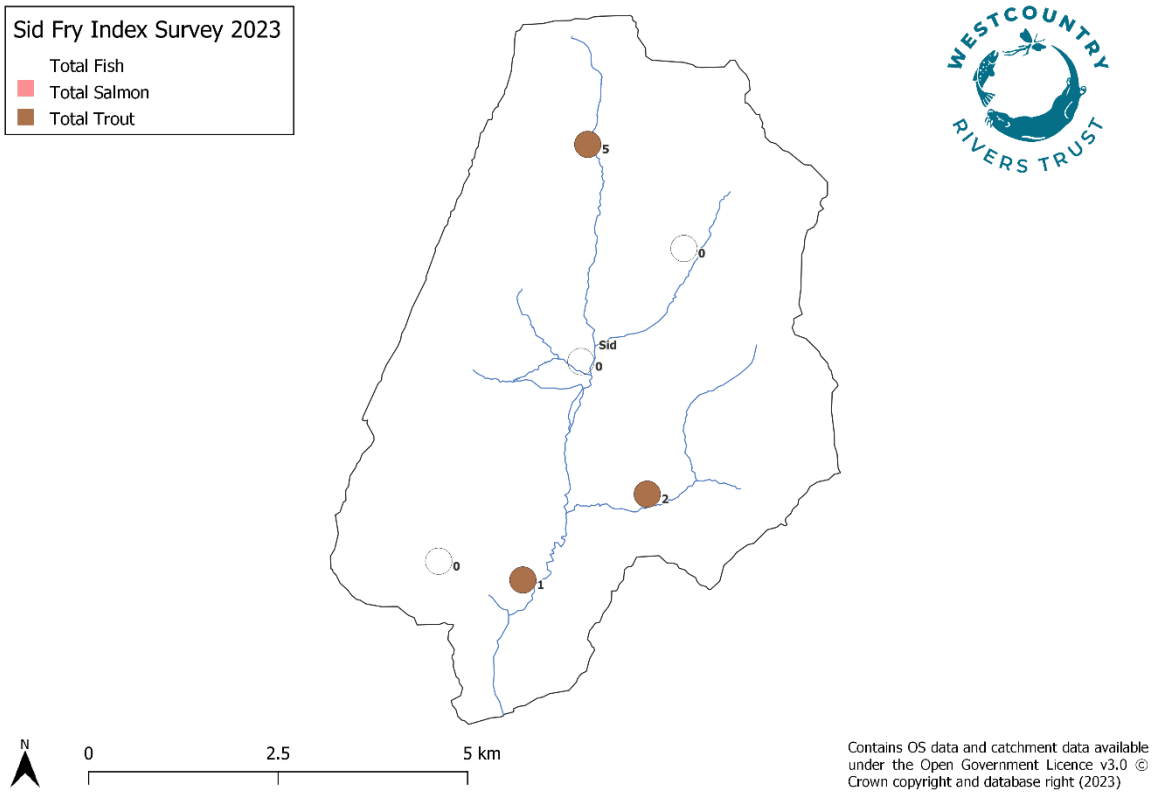

Figure 4: Total catch for salmon and trout fry, River Sid, 2023.

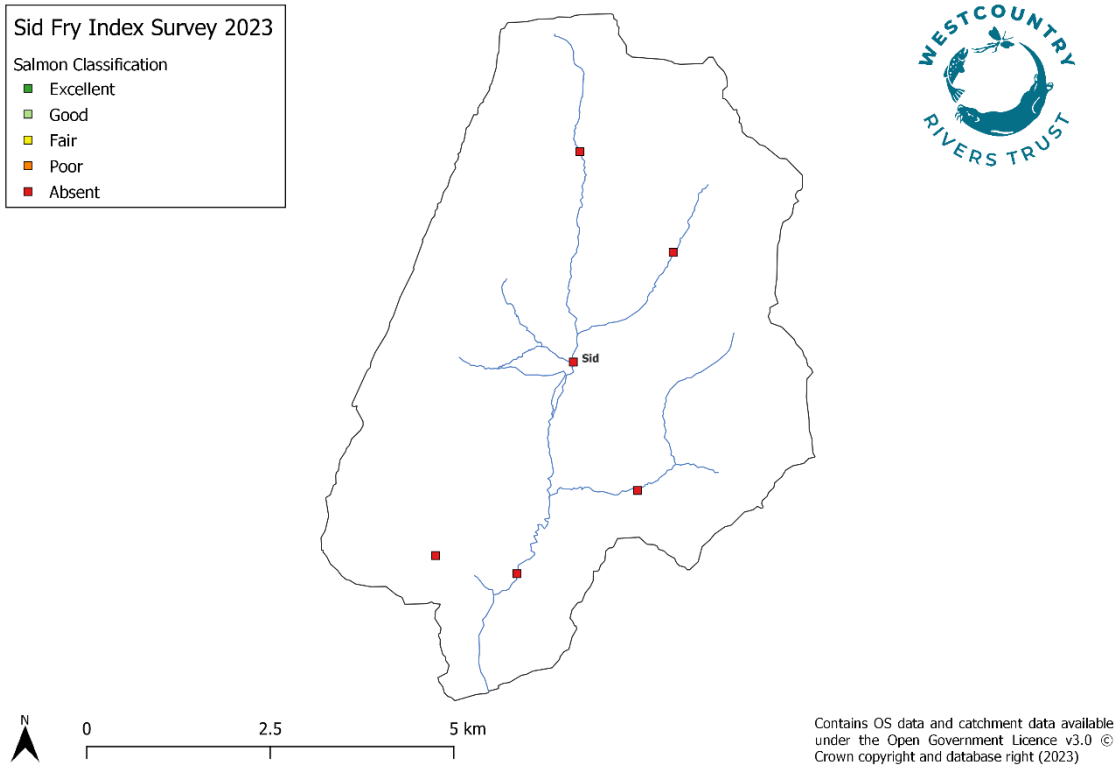

Figure 5: Salmon fry classifications, River Sid, 2023.

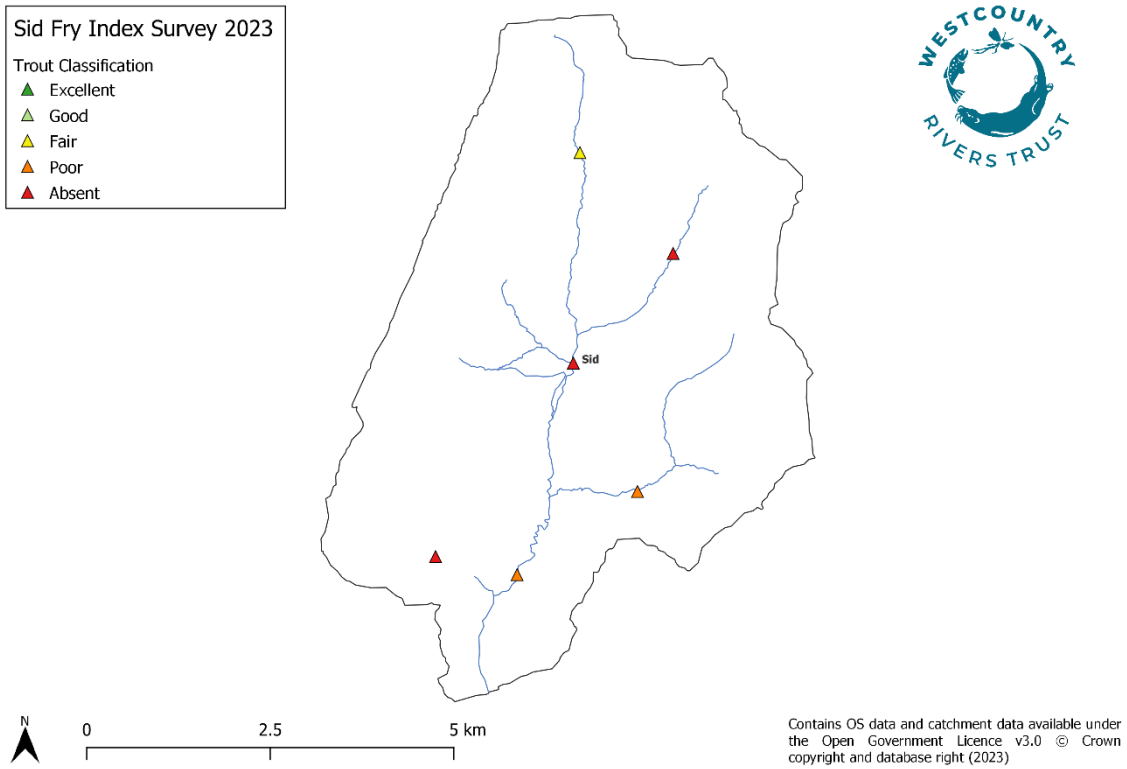

Figure 6: Trout fry classifications, River Sid, 2023.

4. Defend, Repair, Attack

The strategy for restoration and conservation of sites suggested here broadly follows the "Defend, Repair, Attack" (DRA) concept (Table 5) developed by Ronald Campbell of the Tweed Foundation and has in the past been applied to similar catchments 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 DRA 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 5 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 DRA allocations to tributaries, further investigation should be required to determine the cause (s) and the best route of action to improve salmonid populations.

Table 5: Defend/Repair/Attack strategy.

Category	Status	Action
Defend	These areas have **good** fish stocks and habitat and **need safeguarding** actions to ensure no decline occurs.	**Maintain bag limits** **Habitat Safeguarding**
Repair	These areas have **moderate** fish stocks, and fish habitat in a moderate condition; these areas **need assisted habitat recovery** to move them into the Defend category.	**Catch and release** **Assisted habitat recovery**
Attack	These areas have **poor** fish stocks, and the habitat is significantly degraded. These areas **need drastic intervention** such as habitat reengineering in order to improve their status.	**Stock action** **Habitat re-engineering**

The DRA strategy for each sub catchment is summarised in Table 6.

Table 6: Sid sub catchment classification and DRA strategy.

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

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.
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.

Term	Definition
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 Wild Trout Trust for funding the surveys and 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

Crozier, W. W. & Kennedy, G. J. A., (1994*). Application of semi-quantitative electrofishing to juvenile salmonid stock surveys*. Journal of Fish Biology, 45(1), pp. 159-164.

Devon Wildlife Trust. (2014). *Sid Vale Living Rivers Project 2012-14*. Devon Wildlife Trust, Exeter.

Summers, D. W., Glies, N. & Willis, D. J., (1996). *Restoration of Riverine Trout Habitats – A Guidance Manual*. Fisheries Technical Manual 1. Environment Agency, Bristol.