



## Avon 2016 Semi-quantitative Electro-Fishing Survey



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Report completed: December 2016

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## 1. Introduction

The Westcountry Rivers Trust (WRT) has undertaken semi-quantitative fry index electrofishing survey throughout the River Avon as part of the biological monitoring of effects of the SWW gravel augmentation project. This was the second year of fish monitoring for this project and the fourth successive year so far as an addition to surveys undertaken under the Catchment Restoration Fund in which monitoring began in 2013. The gravel augmentation project and subsequent monitoring is allowing for the establishment of a long-term data set for River Avon salmonid recruitment.

The surveys were targeted to complement the Environment Agency (EA) electric fishing monitoring undertaken in 2016, although both data sets use different methodologies with the primary difference being the use of fully quantitative depletion methods used by the EA and a semi-quantitative fry index method used by WRT (to be detailed in Field sampling and data analysis methods section). A total of 15 sites were electric fished on the Avon, 10 as part of the biological monitoring of the gravel augmentation funded by SWW and 5 sites which were funded by the Avon Fishing Association (AFA) in the lower catchment allowing for a catchment wide survey.

The strength of the fry index survey is to enable a quick, affordable baseline semi-quantitative catchment-wide view of the fry life stage only. As this survey is indicative of a single year, it is important to interpret the results with caution. This electro-fishing survey will aid as a tool to monitoring and inform appropriate habitat restoration works under the South West Water Gravel Augmentation project.

Survival of salmonid fry to the end of the first summer is known to be poor. Up to 90% of the alevins that emerge from redds will not survive. Even in good quality habitat with a rich food supply, high densities of fish will undergo strong competition for resources with each individual trying to gain a profitable feeding station. The fry index surveys are used as a coarse measure of fry numbers/abundance at each particular site. For each single year, it also gives a broad indicator of salmonid spawning success across a catchment.

The semi-quantitative methodology is primarily used as a means of guiding conservation and fisheries actions on the ground. It is less accurate than fully-quantitative depletion methodologies or single catch netted semi-quantitative surveys. However, the methodology is relatively rapid and allows for multiple sites to be surveyed per day. Using this method fisheries managers can trial and test conservation measures to best fit the catchment, using a repeating cycle of affordable monitoring and

action, building site-specific knowledge and improvements over time - this flexible and responsive approach is known as '*adaptive management*'.

The Dartmoor rivers are typically short and steep with a spate characteristic; rainfall falls on the oligotrophic moorlands where it flows quickly downstream picking up little in the way of nutrients until it meets with its lowland section, again typically short in relation to other catchments. Both sections (upper and lower) represent challenging environments with their own issues. Typically, these rivers have the following issues relating to the success of salmonid fish:

- Barriers to migration.
- Lack of functioning habitats.
- Degraded habitats (particularly at vital life cycle stages).
- Anthropogenic pressures in terms on modifications to aquatic environments, inputs from adjacent land management and in infrastructure.

This report will outline the available fisheries management tools and techniques used in relation to these rivers as well as making suggestions for future conservation efforts.



*Examples of the characteristics of Dartmoor rivers, in this case the Avon, upper (left) and lower (right).*

## **2. Site Selection and Permissions**

Survey sites were selected to provide representative samples from distinct river reaches, characterized by habitat type, proximity to barriers and proximity to targeted restoration works under the gravel augmentation project. Some additional sites were surveyed in 2016 to;

- Establish whether fry are utilising the habitats where gravels have been deposited post augmentation and post seasonal high flow events.
- Identify populations in tributaries where augmentation has not taken place to establish if other works to improve access and/or habitat are required and to identify salmon presence if any, away from the main river.
- To identify the upper most range of *Salmo salar* on the main Avon River for purposes of targeting future works.

Sites numbering from 1-10 were undertaken as part of the SWW Gravel Augmentation Project. A further site on the tributary at Lutton was suggested for investigation but due to a lack of permission in time for the survey season it could not be undertaken.

Sites numbering from 10-15 were undertaken as part of a wider catchment investigation and funded by the Avon Fishing Association. A 6<sup>th</sup> site at New Bridge, downstream of Avon Mill near Loddiswell was not fished due to poor weather conditions and Health and safety concerns.

Permissions for all sites was established before electric fishing surveys took place.

### **3. Field sampling and data analysis methods**

Each site was electro-fished by a two-person team using an E-fish 12V single anode backpack or a Smith Root LR-24 unit. The units were fished at the same settings in the upper catchment at 50Hz and 350v, although the frequency was reduced to 40Hz where the conductivity was found to be particularly low, particularly in the headwaters and moorland streams. Settings were adjusted accordingly for the increase in conductivity in the lower catchment.

The operatives fished continuously for a standard five minutes within fry habitat where sufficient area was available. All salmonids were identified to species and fork length was measured and recorded. Numbers or density estimates were recorded for all other species captured. Habitat features such as land use, substrate type and shading were recorded at each site.

Based on the lengths of fish captured during the survey fry were considered to be any individual that measured less than 80mm. Fry numbers recorded at each site were classified according to the methodology by Crozier & Kennedy (1994) (Table 1). The classification scheme has been taken from the original salmon fry index provided within this paper and was derived through establishing a

relationship with equivalent fry numbers captured within quantitative surveys at sample sites within Ireland. Within this assessment report, the salmon fry classification has also been used as a surrogate for trout fry. Results should therefore be treated with some caution. It would increase the robustness of the method to be calibrated to local conditions, and for trout, to conduct the method alongside Environment Agency quantitative electric fishing surveys in future years.

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

Density Classification	Semi-quantitative (n/5min fishing)	Quantitative (n 100m <sup>2</sup> )
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

Any fry that were missed or escaped during electro-fishing were assigned to either trout or salmon groups depending on the relative percentage of each species already recorded at the site

#### 4. Summary of 2016 data

Figure 1 and table 1 below both show a summary of the 2016 fish monitoring efforts. It was possible to complement SWW's survey sites in the upper Avon catchment with 5 sites in the lower catchment funded by the Avon Fishing Association. Table 2 shows the catch data for the Avon including both 0+ and 1+ age groups. Full catch data is presented in the Appendix.



# South Hams Electrofishing 2016 - Avon

Survey Sites

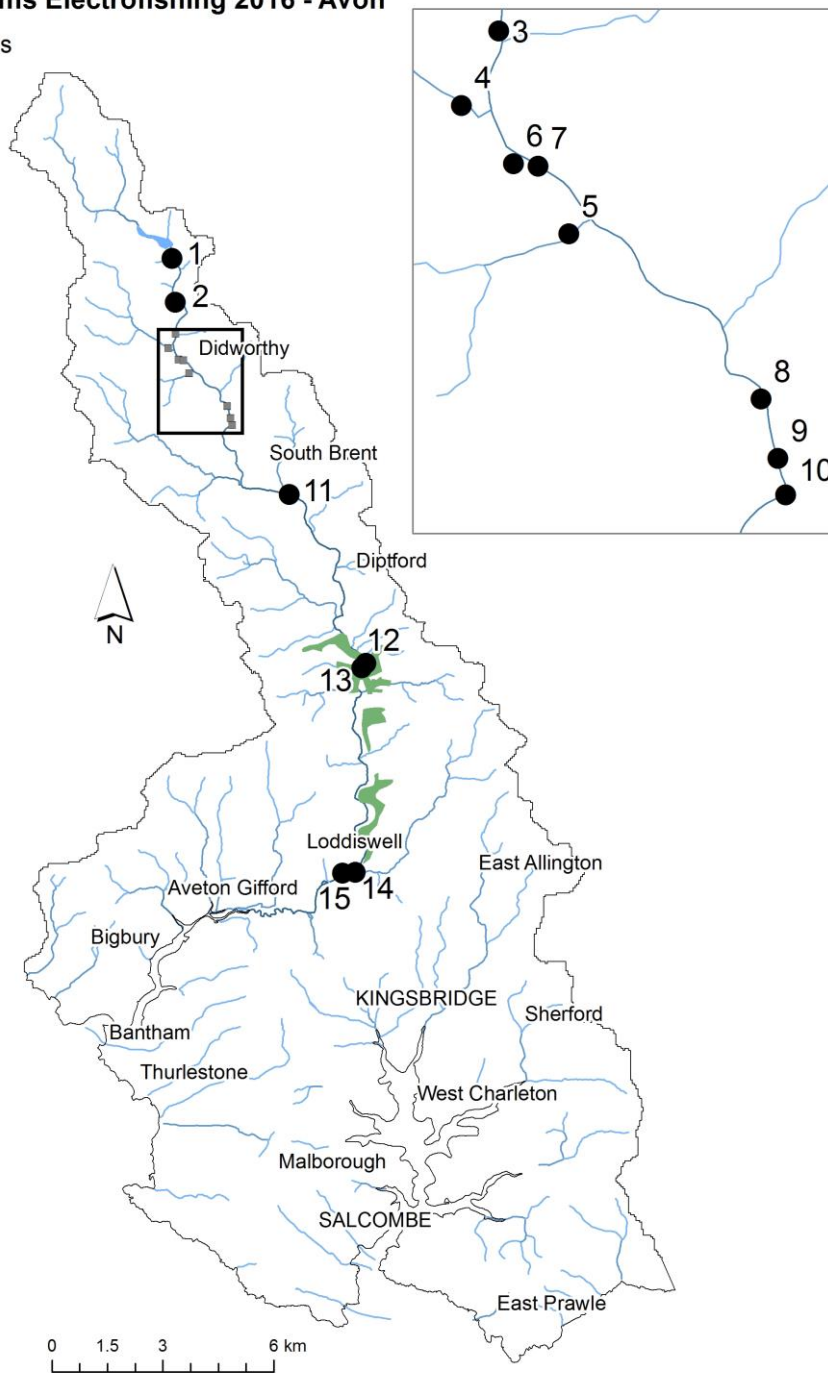


Figure 1 Survey site sampled in 2016 on the River Avon



Table 2 Summary of 2016 electrofishing efforts with salmonid classifications (Crozier & Kennedy, 1994)

	Site ref:	2016 Salmon Fry class	2016 Trout Fry Class
SWW sites	d/s dam	Absent	good
	u/s dam bridge 2	Absent	Fair
	ds Shipley Bridge	Absent	Poor
	Bala Brook	Absent	Good
	Badworthy Stream	Absent	Good
	Goosepool Copse	Absent	Fair
	Didworthy	Fair	Fair
	d/s Crackhill Weir	Poor	Fair
	d/s Lydia Bridge	Excellent	Poor
	Brent Island	Good	Fair
AFA sites	Humpy Bridge	Absent	Absent
	u-s Curtisknowle weir	Absent	Poor
	d-s Curtisknowle weir	Poor	Absent
	Upstream Avon Mill	Poor	Absent
	D-s Avon Mill	Absent	Absent

Table 3 Avon River 2016 survey catch data

		trout 0+	salmon 0+	trout 1+	salmon 1+
SWW Sites (WRT)	d/s dam	13	0	5	0
	u/s dam bridge 2	5	0	3	0
	ds Shipley Bridge	4	0	2	0
	Bala Brook	13	0	6	0
	Badworthy Brook	15	0	9	1
	Goosepool Copse	6	0	11	0
	Didworthy	10	10	12	5
	d/s Crackhill Weir	8	4	5	12
	d/s Lydia Bridge	3	38	2	13
	Brent Island	6	17	6	2
AFA Sites (WRT)	Humpy Bridge	0	0	1	1
	U-S Curtisknowle weir	1	0	1	3
	d-s Curtisknowle weir	0	4	1	0
	Loddiswell Station	0	1	1	1
	Avon Mill	0	0	0	1

#### 4.1 The Avon Catchment summary

##### Salmon

Salmon fry were absent from the upper reaches of the Avon above Shipley Falls. Didworthy was the most upstream site at which salmon were recorded. The two sites downstream of Lydia Falls were the most productive and were assigned 'Excellent' and 'Good' classifications at downstream Lydia Falls

(Site 9) and downstream Brent Island (Site 10). Didworthy is classified as Fair and all remaining sites were classed as Poor, with four or fewer individuals captured per survey with salmon fry completely absent at the site upstream of Curtisknowle Weir and either very poor or absent at the sites downstream.

Individual lengths of salmon captured ranged between 60mm and 150mm.

#### Trout

Trout fry densities are at their highest in the upper reaches of the Avon River and the tributaries of the Bala Brook and Badworthy Brook with Good and Fair. Classifications of Fair are recorded from Crackhill Weir but numbers are 'Poor' below Lydia Falls before becoming practically absent in the lower reaches of the Avon river catchment. Individual captured trout lengths ranged between 50mm and 200mm.

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## 5. Results

### South Hams Electrofishing 2016 - Avon Total Catch - Salmon & Trout

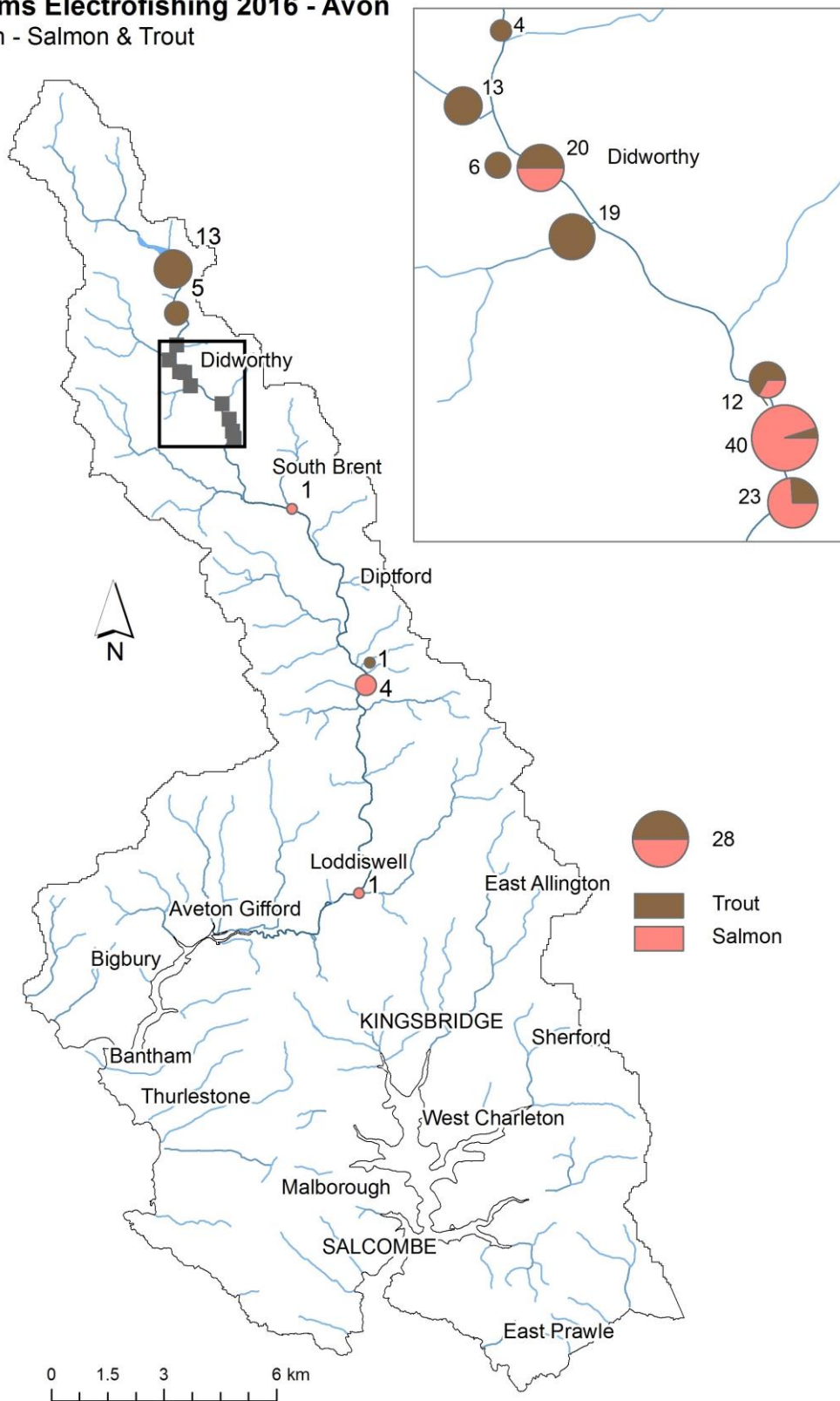


Figure 2 Total catch for salmon and trout in the Avon catchment, 2016

# South Hams Electrofishing 2016 - Avon

## Salmon Classification

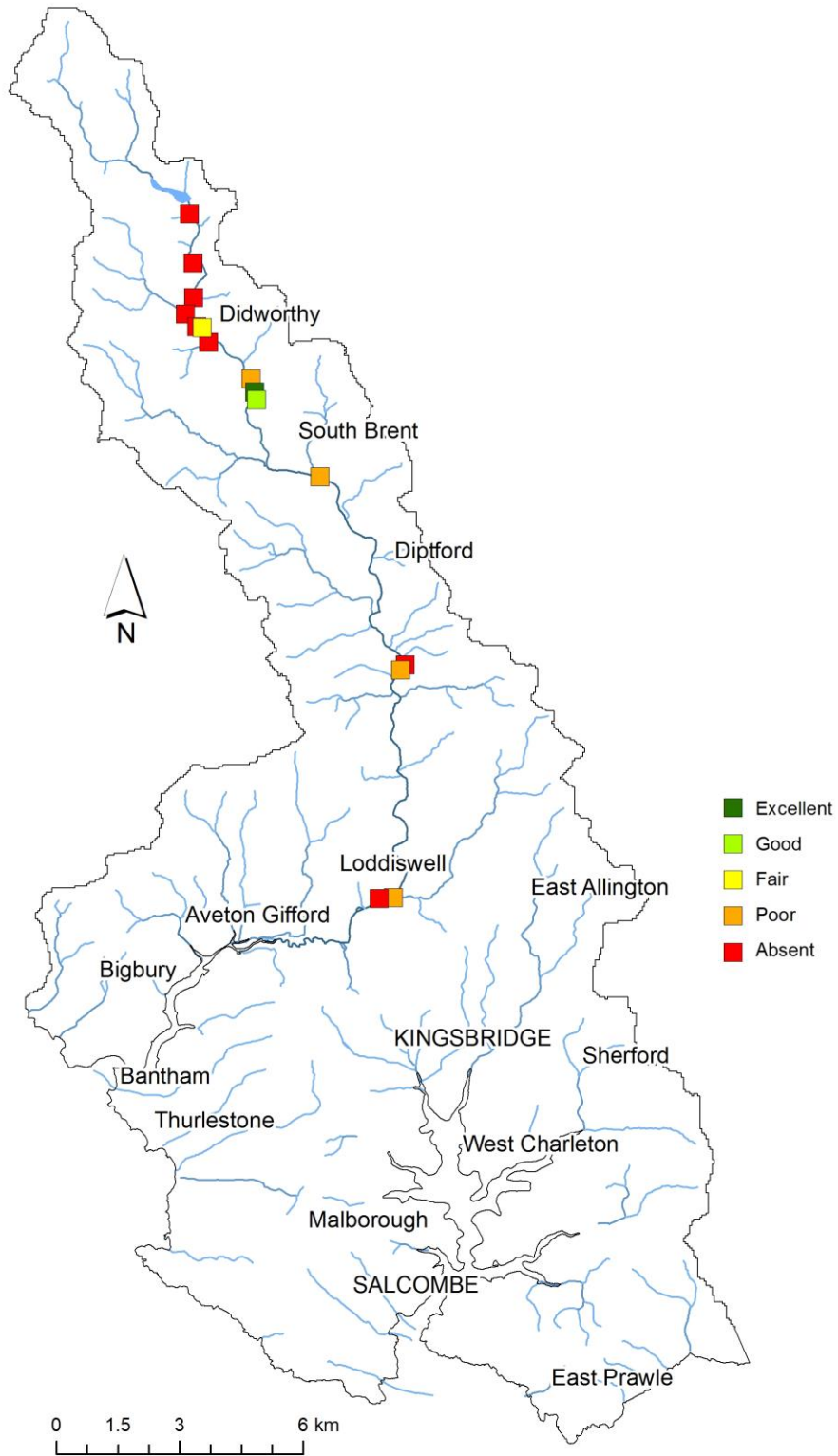


Figure 3 Salmon classification for the River Avon, 2016 (Crozier & Kennedt, 1994)

# South Hams Electrofishing 2016 - Avon

## Trout Classification

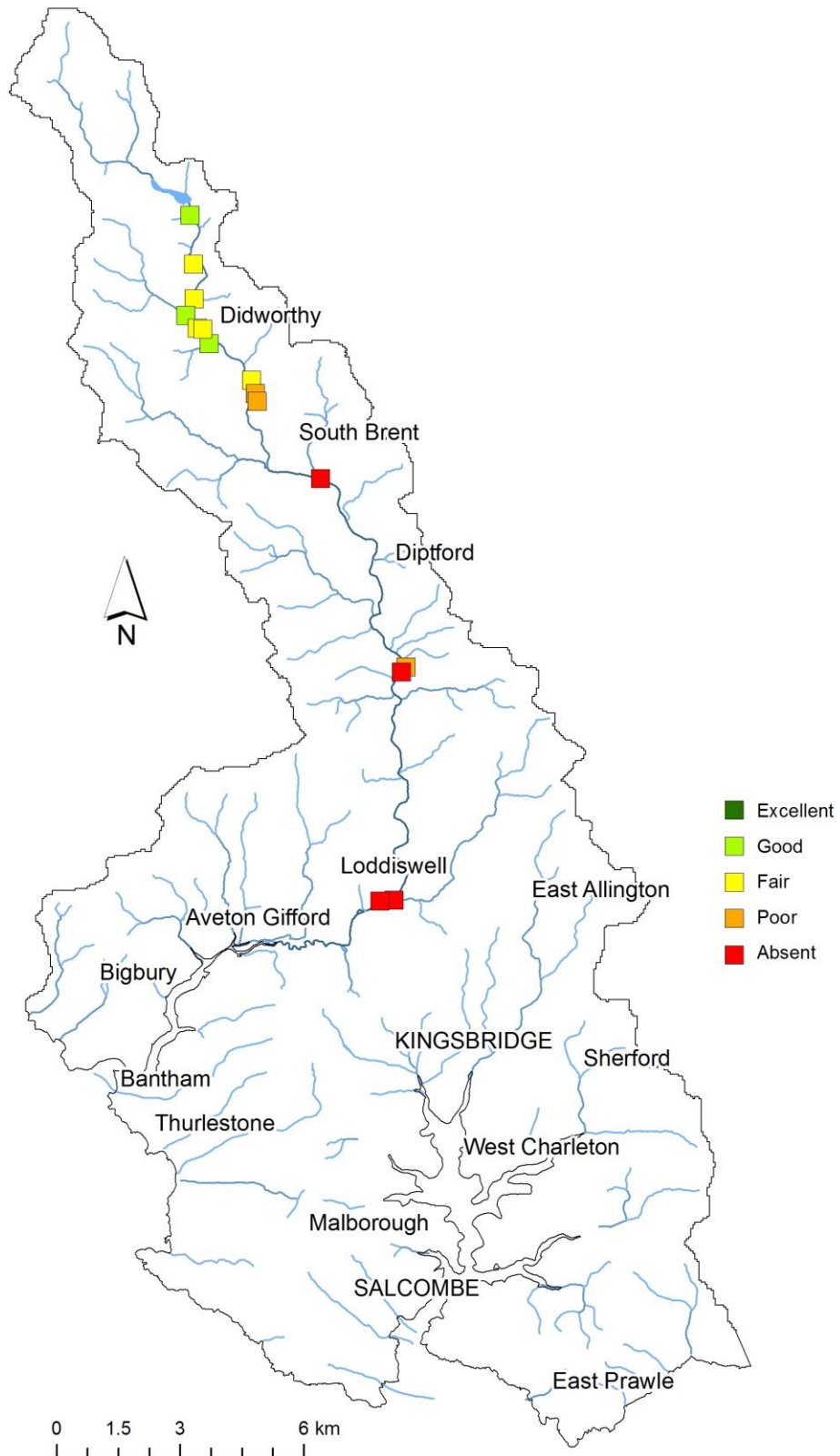


Figure 4 Trout classification for the River Avon, 2016 (Crozier & Kennedy, 1994)

Figures 3, 4 and 5 show the proportion of salmonids present at each site, the classifications for salmon at each site throughout the Avon catchment and the classification for trout and each site throughout the Avon catchment respectively.

## **5.1 Main River**

### **5.1.1 Salmon**

Salmon are absent both upstream and downstream of the Avon dam until the survey site at Didworthy. No salmon have been recorded above Shipley Falls in the 4 years that the surveys have been undertaken by WRT or in historic EA surveys dating back to 1997 and so it can be reasonably assumed that salmon do not make it past this point or that no suitable habitat is present for spawning conditions. Two new sites were fished on the main river in 2016; one downstream of Shipley Bridge and the other at Goosepool Copse. These sites were undertaken to establish the uppermost presence of Salmon on the main river. Neither salmon Fry or Parr were found at these sites which determines currently the site around Didworthy is the uppermost range.

At Didworthy the Salmon Fry classification has reduced from Good in 2015 (15 Fish caught) to Fair being recorded in 2016 with a catch of 10 Fry. It is important to remember that there is a wide banding between classifications and just one more salmon Fry in the 2016 survey would have changed the classification to Good. The site at Crackhill also saw a reduction in classification to Poor although a number of 1+ fish were caught during the survey (Table 2).

Lydia falls can be viewed as a natural partial barrier to migration, it is clear from this and previous sampling that under certain conditions salmonid fish can ascend this obstacle but it does pose a barrier to more fish migrating upstream. Directly below Lydia falls to South Brent exhibits the best fry sites for salmon on the Avon and this could be as a direct result of the impassability to some fish above Lydia Falls. An Excellent classification with a result of 38 fry was recorded downstream of Lydia Falls in 2016 and then a Good recorded at Brent Island indicating that salmon had a relatively productive year within this reach.

The sites fished in the lower catchment showed much poorer returns for Salmon Fry. The sites at Humpy Bridge and upstream of Curtisknowle Weir both returned a classification of Absent for Salmon Fry, although the habitat surveyed was appropriate for a fry population. The site downstream of Curtisknowle Weir and upstream of Avon Mill both returned a Poor classification with 4 and 1 fry caught respectively with salmon Fry absent at the site downstream of Avon Mill. Again, all sites surveyed were appropriate for a semi-quantitative fry survey.

### 5.1.2 Trout

Trout fry numbers were improved in the uppermost survey site on the Avon in 2016 with a classification of Good and a result of 13 compared to a Poor 3 in 2015. The survey site habitat has improved with the gravel augmentation work and this may be as a direct result of that work with fish utilizing the habitat for spawning and fry for feeding stations. Fair classifications are recorded for all other sites upstream of Lydia Falls except for the site downstream of Shipley Bridge and Lydia Bridge which returned a Poor classification.

Trout fry are absent from all sites in the lower catchment except for one Fry caught upstream of Curtisknowle Weir. This is not that unusual as trout will prefer to utilize the upper reaches of a watercourse or smaller side streams and tributaries for spawning.

### 5.2 Tributaries

In 2016 the tributaries of the Bala Brook and Badworthy Brook were also electric fished to determine the presence or absence of salmon. Both sites recorded a Good classification for trout but were Absent of Salmon Fry. The Badworthy Brook did however result in a single salmon Parr being caught indicating that the stream has been used by salmon for spawning in previous seasons.

A tributary at Lutton was due to be surveyed but it was not possible to get permission from the landowner within the survey season window. The confluence of the stream was visited however as part of a main river walkover survey, it was found to be accessible from the main river for migratory salmonids. It is not known at this time whether salmon will utilize the tributary and is only assumed that sea trout would find it favorable for spawning in the right conditions. It may be possible to revisit the site in 2017 to confirm absence or presence of both species.





*Figure 5 The confluence of the Bala Brook (left) and Avon River showing the barrier to migration*



*Figure 6 The confluence of the small tributary at Lutton and the Avon River*

### **5.3 Multi-year data and discussion**

The River Avon has now been surveyed consecutively for Fry since 2013 by WRT. There has been some variation on survey site selection in the Upper catchment due to the dynamic nature of the gravel augmentation project and determining presence or absence of salmonids. It is important to note that semi-quantitative surveying provides a snapshot in time and in the absence of any temporal comparisons the scope for detailed interpretation of the results is limited.

The Lower Avon was surveyed this year for the first time since 2014 thanks to a donation from the AFA and with this combined SWW and AFA data a catchment wide survey has been undertaken. The Environment Agency also undertook two surveys at Glazebrook and Avonwick. Although a repeat of exact sites would be preferable the data will still show a snapshot of catchment wide recruitment for the season and ultimately over time will allow for appropriate assessment of success and the sustainability of the SWW gravel augmentation project with regards to results in the upper catchment. It will also allow for the analysis of year on year data and considerations of other potential impacts upon salmonid recruitment as well as assessing success of the gravel augmentation project, which is the key driver for the surveys being undertaken.

Table 4 Multi-year Salmon classification and catch numbers.

	Site ref:	2013 Salmon Fry Class and catch no.	2014 Salmon Fry Class and catch no.	2015 Salmon Fry Class and catch no.	2016 Salmon Fry class and catch no.
<b>SWW Sites (WRT)</b>	d/s dam	absent	absent	absent	absent
	u/s dam bridge 2	absent	absent	absent	absent
	d/s Shipley Bridge	New site for 2016			absent
	Bala Brook	New site for 2016			Absent
	Badworthy Stream	New site for 2016			Absent
	Goosepool Copse	New site for 2016			absent
	Didworthy	poor-1	absent	Good-15	fair-10
	d/s Crackhill Weir	Poor-2	poor-1	fair-7	poor-4
	d/s Lydia Bridge	good-16	good-19	fair-7	excellent-38
	Brent Island	fair-9	good-16	fair-7	good-17
<b>AFA Sites (WRT)</b>	Humpy Bridge	New site for 2016			absent
	U-S Curtisknowle weir	New site for 2016			absent
	d-s Curtisknowle weir	Not fished	Fair-9	Not fished	Poor-4
	upstream Avon Mill	New site for 2016			Poor-1
	downstream Avon Mill	Poor-1	Poor-4	Not fished	absent
<b>SHRIMP sites (WRT)</b>	Weeks Farm, Horsebrook	Not fished	Poor-3	Not fished	Not fished
	Annabel coppice	Not fished	fair-8	Not fished	Not fished
	Bickham bridge	Not fished	Fair-7	Not fished	Not fished

Salmon Fry are clearly absent from the Upper reaches of the Avon River above the Didworthy survey site. At Goosepool Copse and downstream of Shipley Bridge this may be due to unsuitable habitat for spawning due to the lack of appropriately sized substrate, as there is a clear population at the Didworthy site downstream. The 2016 gravel augmentation sites have been slightly amended to

reflect this with more material being augmented at Shipley Bridge, Goosepool Copse and the Bala Brook.

Numbers and classifications have improved at Didworthy since the 2013 and 2014 surveys with a clear improvement in classification post gravel augmentation at the site in the autumn of 2014. Although the classification has dropped since the first year this short-term data set is not a cause of concern as overall this is an upward trend.

The Crackhill Weir site has had varied results but this is also a difficult site to fish. There is very little in the way of true fry habitat and is predominantly boulder/Parr habitat. It is useful however to maintain this as a site to continue to collect longer term data.

Table 5 Multi-year trout classification and numbers

	Site ref:	2013 Trout Fry class and catch no.	2014 Trout Fry Class and catch no.	2015 Trout Fry Class and catch no.	2016 Trout Fry Class and catch no.
SWW sites	d/s dam	Poor-4	Absent	Poor-3	Good-13
	u/s dam bridge 2	Poor-1	Poor-1	Fair-7	Fair-5
	ds Shipley Bridge	New site for 2016			Poor-4
	Bala Brook	New site for 2016			Good-13
	Badworthy Stream	New site for 2016			Good-15
	Goosepool Copse	New site for 2016			Fair-6
	Didworthy	Poor-3	Fair-7	Poor-4	Fair-10
	d/s Crackhill Weir	Poor-3	Good-20	Good-19	Fair-8
	d/s Lydia Bridge	Absent	Fair-6	Fair-9	Poor-3
	Brent Island	Poor-2	Good-13	Fair-5	Fair-6
AFA sites	Humpy Bridge	New site for 2016			Absent
	u-s Curtisknowle weir	New site for 2016			Poor-1
	d-s Curtisknowle weir	Not fished	Fair-5	Not fished	Absent
	Upstream Avon Mill	New site for 2016	New site for 2016	New site for 2016	Absent
	Downstream Avon Mill	Absent	Absent	Not fished	Absent
SHRIMP sites (WRT)	Weeks farm, Horsebrook	Not fished	Fair-6	Not fished	Not fished
	Annabel coppice	Not fished	Fair-6	Not fished	Not fished
	Bickham bridge	Not fished	Poor-3	Not fished	Not fished

The site downstream of Lydia Bridge recorded its best results since the WRT surveys began with an Excellent classification in 2016. The site was Good for two years in 2013 and 2014 before dropping off to a much lower Fair result in 2015. Successful recruitment here could be due to a number of factors such as increased number of fish spawning and greater survival rates of alevins due to better environmental conditions at the time.

The site at Brent island has alternated between fair and good for the past four years. The Good results at Brent Island do not necessarily correspond with results below Lydia Bridge although they are in close proximity. Even though Fry move downstream post spawning to find feeding stations it could be assumed that there is another spawning site downstream of Lydia Bridge and successful recruitment here is subject to its own environmental/temporal parameters.

Trout Fry numbers have seen an improvement in 2016 on the upper most site surveyed on the Avon. This may be due to the improved habitat created by the gravel augmentation in the upper reaches and during the survey new gravel deposits were clearly evident. This has either increased spawning or fish have moved into the site to utilise the improved habitat which offers refuge and the interstitial spaces create habitat for invertebrates and therefore food supply.

Didworthy has alternated between Poor and Fair for trout over the survey years. As the site is main river it is not the preferred spawning habitat for trout and so high Fry numbers would not be expected here. However 12 1+ trout were caught as part of the survey showing that Parr are using this habitat for feeding (table 3).

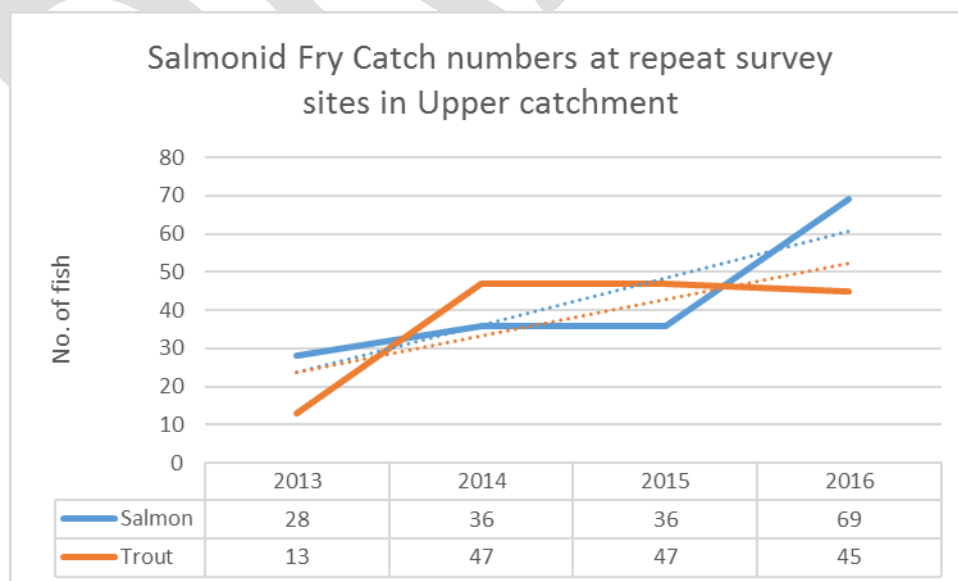


Figure 7 Upper catchment comparative total Fry catch numbers at repeat sites over multiple years



Figure 7 shows the total catch data for Fry over the past 4 years. Trout have held steady for the years 2014-2016 with only a very poor result in 2013 and salmon have had a sharp increase due to the Excellent and Good results and Lydia and South Brent where results to this were also very steady. With continued monitoring, we will be able to observe a longer-term pattern. It is far too early to determine whether the augmentation work is directly affecting salmonid numbers below Lydia Falls but given the distance from the lowest downstream augmentation site it is unlikely at the moment. Any successful recruitment from the augmentation works will not see a returning adult salmon or sea trout return for 3-4 years.

Sites in the lower catchment were very poor for Fry and this is discussed further in chapter 5.5 in comparison with historic EA data.

#### 5.4 Other species

No other species from salmonids were recorded at the sites in the upper catchment from Brent Island upstream whereas the lower catchment eel, bullheads and stoneloach were all present.

*Table 6 Other species caught or observed during the semi quantitative surveys*

Site	Species		
	Eel ( <i>Anguilla anguilla</i> )	Bullheads ( <i>Cottus gobio</i> )	Stoneloach ( <i>Noemacheilus barbatulus</i> )
u/s Humpy Bridge	2	10	1
u/s Curtisknowle Weir	0	20+	5
d/s Curtisknowle Weir	1	30+	10+
u/s Avon Mill	10	25+	15+
Downstream Avon Mill	15	30+	25+

Eels were not measured as this was not in the scope of the survey but those caught were predominantly juveniles. Bullhead and stone loach catches are approximate numbers caught over the 5min survey

#### 5.5 Environment Agency results and discussion

The EA methodology differs in approach from the 5-minute semi- quantitative Fry surveys undertaken by WRT. The EA fish a larger area of river thoroughly encompassing all life stage habitat types and therefore all life stages of salmonids are caught. Two sites were fished in 2016; one on the main river near Avonwick and another on the Glazebrook tributary but both sites have been fished historically since 1997 and give an indication of population estimates over time. Figure 9 shows results from near

Hatchbridge in the lower Avon and has been included as these 3 locations are WFD reference sites. The results analysed are first run catch data from a 3 sweep catch depletion survey and from a single sweep survey.

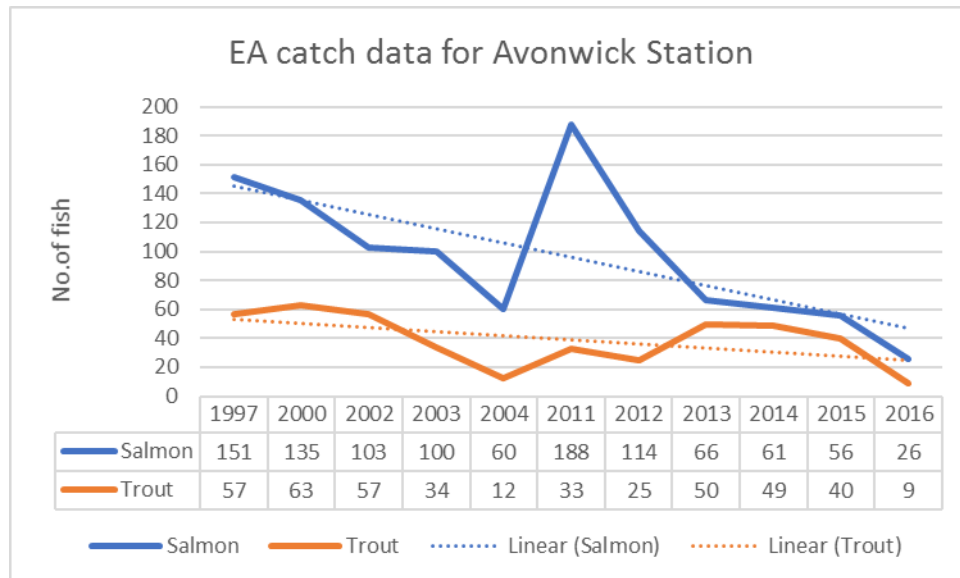


Figure 8 EA catch data for Avonwick Station showing a long term downward trend in salmonid numbers

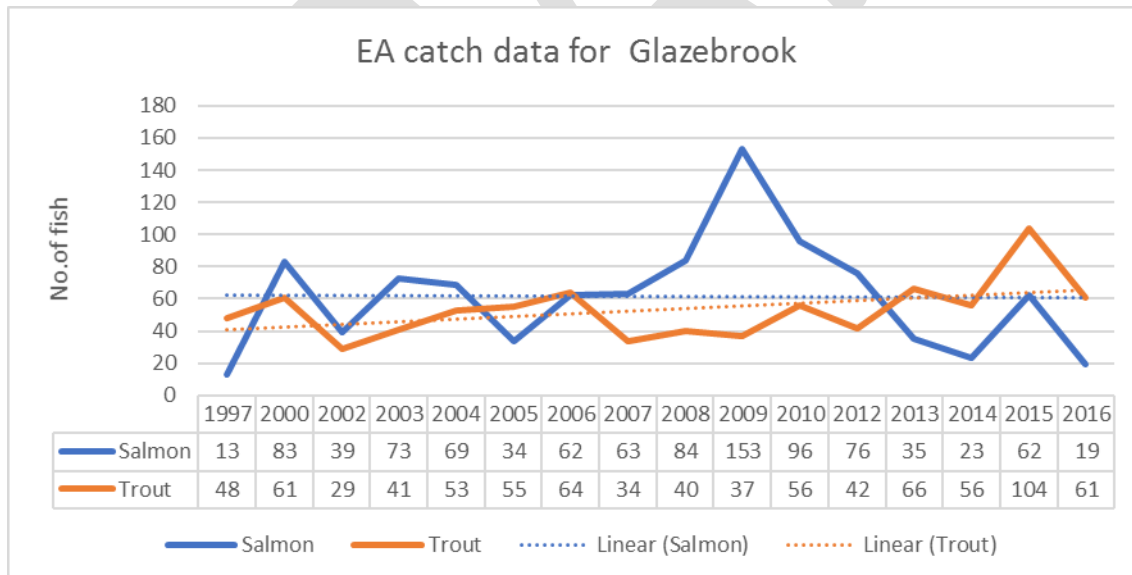


Figure 9 EA catch data for Glazebrook showing very little change in salmon numbers over the survey period and a slight increase in trout numbers.

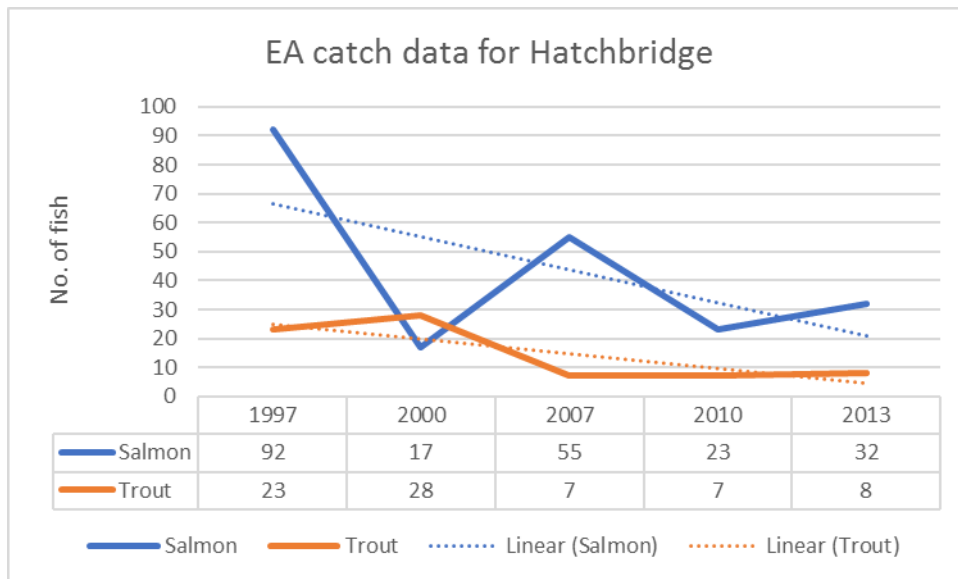


Figure 10 EA catch data for Hatchbridge in the lower Avon catchment showing a decline in salmonid numbers since 1997

Although these results are not directly comparable to the semi-quantitative data they do give an insight into catch numbers over a longer-term. Avonwick Station on the main river has shown a decrease in both Salmon and Trout catch numbers since 1997 as has the site at Hatchbridge in the lower catchment. This downward trend could correspond with the poor semi-quantitative Fry results in the lower catchment in 2016. Interestingly the catch data in figure 10 shows an increase in salmon catch numbers up to 2013 while WRT surveys downstream at Curtisknowle in 2016 were very poor for both Salmon and Trout. Results from SHRImP in 2014 at Bickham Bridge also reported Low numbers for salmon fry but a Fair result for Salmon and Poor for trout.

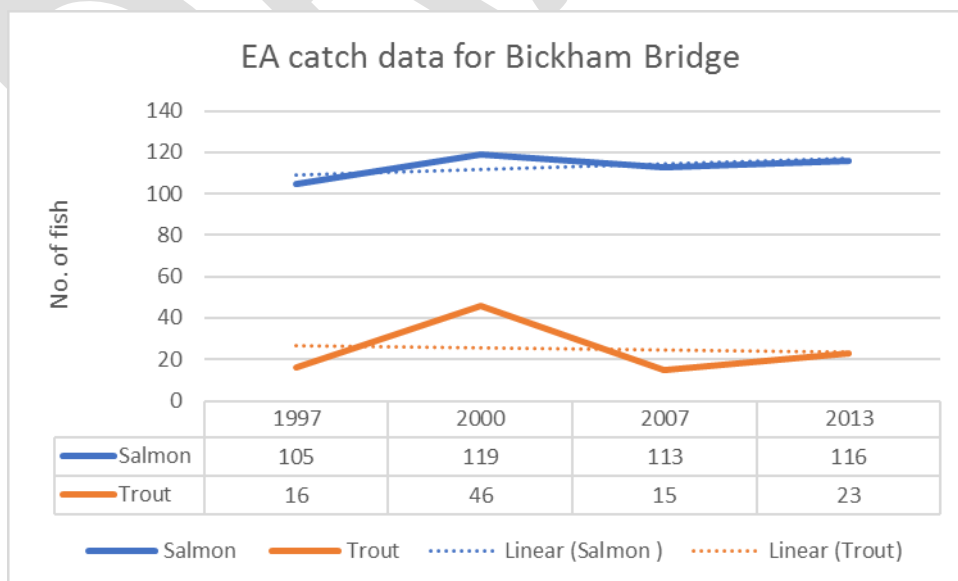


Figure 11 EA catch data for Bickham Bridge showing a slight increase in Salmon catch numbers and slight decrease in Trout catch numbers.



The Glazebrook tributary however is holding steady for Salmon and has seen a slight increase in trout catch numbers over the years although no survey was undertaken here in 2016. This existing data highlights the importance of this tributary to the overall population of salmonids in the Avon catchment.

Initial thoughts were that the sites in the lower catchment are very close to the Normal Tidal Limit and may be too far down to be used for spawning with the fish preferring the habitats and water quality further upstream but given the historic results this may not be the case. The data used does not give an indication of fish size and so Fry numbers cannot be established for a direct comparison to WRT semi-quantitative surveys and this information would be useful to establish a direct correlation between survey years and Fry recruitment. Further investigation would be needed to determine the cause for the downward trend in salmonid numbers in the lower catchment.

The Avon has been subject to netting which may be impacting upon successful migration upstream as well as activities that take place in the coastal area that cannot be monitored. Spawning gravels in the lower catchment may be impacted by sedimentation leading to a reduction in gamete survival or even the ability for adults to cut redds in accreted gravels. This could be due to a number of factors such as increased bank erosion leading to increased sedimentation to road run off carrying fine particulates where roads and drains act as pathways for fines directly to the river. High flows may wash out freshly cut redds which will significantly reduce recruitment numbers. Avian predation is also a possibility. Fry numbers nationally were low for the 2016 season in parts of the country but again longer term data will be needed to determine any impact upon future populations. Catch numbers recorded by the AFA were low for the 2015 fishing season (table 8) which would have produced the Fry for the 2016 EF season and have seen a decrease over the past 5 years. This is however not conclusive as many fish could have been missed during spates but on face value also shows a declining trend in catch numbers.

Table 6 Avon Fishing Association catch/ return data for 2008-2015

Year	Salmon	% Returned	Sea Trout	% Returned	Brown Trout	% Returned
2015	7	70	34	88	886	99.9
2014	8	100	90	74	653	99
2013	10	70	229	83	768	100
2012	22	77	73	72	853	99
2011	39	84	56	72	1037	99
2010	52	78	62	56	855	99
2009	16	75	86	60	616	98
2008	19	68	40	75	779	99
2007	15	80	17	35	1007	99
2006	45	66	46	34	359	97
2005	29		96		436	
2004	31		78		446	
Average	23		75		720	

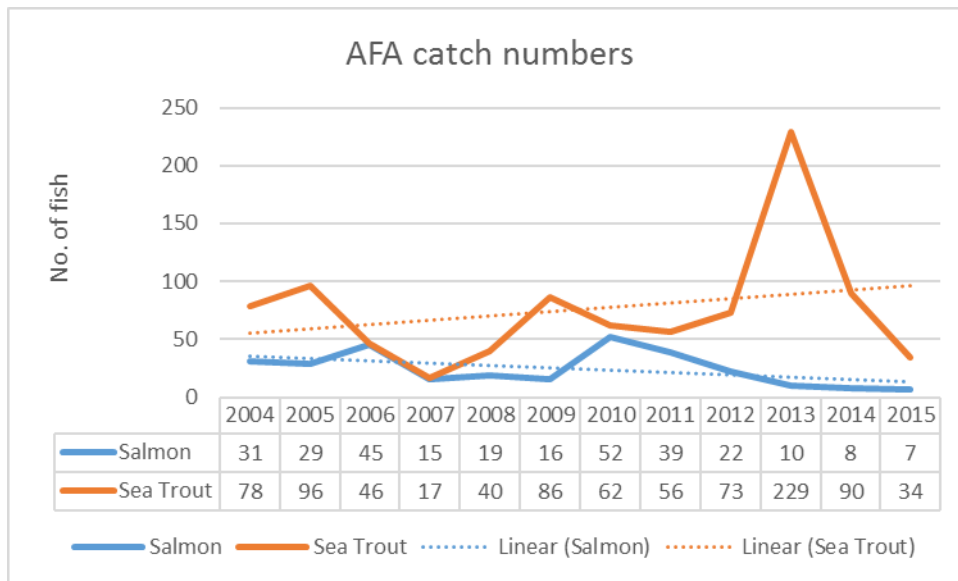


Figure 12 Total catch numbers for the Avon Fishing Association from 2004-2015

## 6. Recommendations

As well as establishing a baseline of the river’s juvenile salmonids, the results from the electro-fishing surveys completed as part of the SHRImp project, together with EA’s electric fishing and walkover survey data are vital in targeting priority areas for habitat creation and improvement works. In future years surveys will provide a crucial tool in monitoring the effectiveness of these works. These recommendations broadly follow the **Defend/Repair/Attack** concept developed by Ronald Campbell of the Tweed Foundation:

### Defend

These areas have good stocks and habitat, and need safeguarding actions to ensure no decline occurs.

### 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.

### 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.

Such actions can involve the third and volunteer sectors as well as statutory bodies, for example a fishing club may choose to adopt catch and release in a poorly performing tributary, but only maintain bag limits on those that are doing well, without the EA having to resort to Bylaw restrictions. Equally the work party efforts of angling clubs can be better focused on areas where limited resource can

achieve the best outcome. This concept helps divide catchment scale management for fisheries into priorities and therefore can help to attack funding through targeted work.

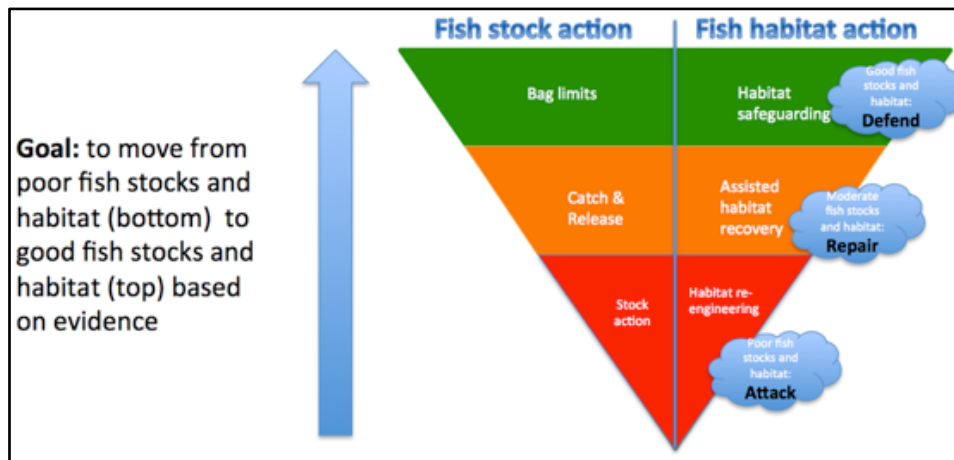


Figure 13 A diagrammatical explanation of Ronald Campbell's theory

Below are the key recommendations for the Avon catchment

## 6.1 Avon catchment

The recommendations are broken down into Upper and Lower Catchment and Tributaries of the Avon for ease of clarification.

### 6.2 Upper Catchment

#### Defend

- Protection of spawning habitats between Lydia Falls and South Brent through increasing awareness of the importance of the sites using signage and community events.

#### Repair

- Liaise with Avon Fishing Association to target work party efforts.
- Continued gravel augmentation and monitoring of this action between the Avon dam and the Bala Brook confluence.
- Continued electric fishing monitoring to determine success of gravel augmentation works and Fry recruitment

### 6.3 Lower Catchment (South Brent- Hatch Bridge)

#### Repair

- Liaise with Avon Fishing Association to target work party efforts.
- Gravel cleaning in spawning habitat

- Improve community awareness
- Continued electric fishing monitoring and further investigation into potential impacts on lower river and historic recruitment levels

#### **6.4 Avon tributaries**

##### **Defend**

- Glazebrook and its improving/steady population of salmonids
- Continued monitoring.

##### **Repair**

- Liaise with Avon Fishing Association to target work party efforts.

##### **Attack**

- Poorly functioning tributaries such as the Horsebrook
- Habitat improvements and bank stabilization where practicable

## **7. Acknowledgements**

Thanks to all landowners and organisations involved for their kind permission to access sites and support the project. We also thank the Environment Agency for providing their fish survey data to work alongside this project.

Thanks to the following WRT staff for their assistance and support:

Ross Cherington, Elly Greenway, Hazel Kendell, Phil Turnbull and Giles Rickard.