TAW CATCHMENT – GRAVEL CLEANING, 2019

Fisheries Improvement Management

Westcountry Rivers Trust
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Executive summary

Westcountry Rivers Trust (WRT), have been working in partnership with the River Taw Fisheries Association (RTFA) in a collaborative approach to improve fisheries in the River Taw catchment. Over the past seven years of research, observation and monitoring – key issues within the Taw catchment have been identified with the water quality and the quality of fishery habitat. An executive summary of these key issues highlighted soil ingress to the river as an associated and limiting factor to salmonid populations and to the ecology of the fisheries in the catchment. High levels of soil ingress are degrading the quality of spawning gravels to salmonids and decreasing larvae survival and fry recruitment, which is ultimately depriving the survival of future generations.

As a result, the Molland Yeo, Crooked Oak, River Mole, Upper Taw, Little Dart and Sturcombe Stream have been targeted this season throughout the Taw catchment as priority rivers for gravel cleaning works. Concentrated on the improvement of spawning gravels for salmonid species; Atlantic Salmon *(Salmo salar)* and Brown Trout *(Salmo trutta)*.

1. Introduction

RTFA have been key in undertaking and funding some of the fisheries management actions in previous years and have funded this gravel cleaning project as a form of direct habitat improvement.

After analysing one of the key issues of soil ingress in the catchment and observing the trend of declining salmonid populations, with the funding presently available, gravel cleaning was adopted as an immediate action to improve habitat and to encourage the salmonid spawning and survival. Although this is not a long-term solution, it is a relevant and appropriate management action. Other comprehensive actions to address root causes of salmonid population decline are being investigated, such as land management advice and sediment ingress reduction. A larger concentrated effort will be required when funds are available.

Gravel cleaning was conducted over a total of 52 km of the Taw catchment in selected reaches (Table 1), over double the 22km originally planned.

The benefits of gravel cleaning are to enable a quick, affordable and broad coverage of the catchment, to improve the quality of the spawning gravels. This is crucial for the forecast of each salmonid generation.

Habitat quality was observed before and during the cleaning work and suggestions of other direct habitat improvements have been made, aimed at continuing to support future salmonid populations and the river ecology as a whole.

2. Site Selection and Permissions

Consent was obtained from the Environment Agency for main river reaches. Access, riverbank and river right permissions along the selection of river reaches were arranged by telephone or cold calling on landowners and established before the contractors turned up to site, whereby the appropriate access details and landowner information was passed on.

Sites were whittled down to prioritised river reaches which were determined as stretches in need of gravel cleaning improvements. Furthermore, salmonid spawning sites were then identified, based on experienced habitat type characterisation from observations in the field.

Details of targeted site selection were determined by;

- Targeted river reaches within the catchment subject to sedimentation.
- Habitat type characterisation, in which specifically pool-riffle sequences, suited to salmonid spawning were observed and identified in the field.
- In addition, due to the event of a fish kill, the set km for the River Mole reach was extended after learning the location was hit by the recent digestate. It was decided to extend the gravel cleaning works in unaffected areas of the reach further upstream.

2.1 Sedimentation and Gravel Cleaning Site Selection

Substrate composition, cover, water quality, and water quantity are important habitat elements for salmonids before and during spawning *(Bjornn and Reiser, 2002)*. In extension, sedimentation deposition can degrade the water quality and quantity that flows through the redds which may result in the failure of eggs to hatch. The erosion of sediment into water is a natural process; however human disturbances have tended to significantly increase the amount of sediment input into stream flows. Wood & Armitage (1997), found that high levels of suspended sediment decreased egg fertilization success during spawning. For Atlantic salmon, increases of only a few percent of silt content can strongly decrease survival rates for salmon eggs. In reaches affected by sediment deposit as a result of mining waste, 98 – 100% of salmonid eggs died compared to 9% at a nearby control site *(Vanderhoof, 2007).*

Presence of pool-riffle sequences are critical for salmon redd site selection. Particularly at the tail of pools, which is also positioned at the crest of a riffle, whereby water can through-flow into the gravels and support other crucial requirements for salmonids in their egg-larval stages providing a steady flow of cool, oxygenated water *(Bjornn and Reiser, 2002).* An example of a site selected is illustrated (Figure 1);

Figure 1 Spawning site selection example

3. Gravel Cleaning Methodology

Throughout the duration of these works, it was ensured that all the sites targeted met all terms that are outlined in the registration of the exemption, (FRA17). This mainly outlined 1) restrictions of the activity to areas within a set of listed habitat designations, 2) that the gravels sites do not exceed 20m2 with a gap of at least 30m between sites, 3) that the works do not adversely affect the banks or established bed of the main river and 4) that all works strictly stop on the first day of October. The range of the reach was determined beforehand and as many spawning sites were cleaned within the reach.

Upon identifying the site of suited salmonid spawning gravels – operatives used a standard 50mm water pump that was mounted to the back of a quadbike in order to allow easy access to riverbank sites. The inlet to the pump uses the river water from one end of the hose and forces water to the outlet from the pump, which is connected to a hand-held lance made from a metal pipe which is throttled down to 10mm to achieve adequate pressure.

Starting upstream and working down river of the referenced reach (from provided landowner permissions). Operatives worked along the stretch and cleaned spawning gravel sites in accordance with good practice guidelines using a water pump method, whereby pressurised water cleans the gravels approximately 4-5 inches into the riverbed. See in Figure 2, the discoloration from the level of sediment behind the operator where the riffle drops off into a pool. As the operative flushes the sediment from the riffle/spawning habitat, the sediment drops downstream with the flow and settles in pools and eddies where the sediment is not in highly sensitive habitat zones.

Figure 2: Sediment release from riverbed

The objective of this activity is to break up any compaction of the gravel and to remove as much of the accumulated silt as possible, in order to allow better throughflow of well oxygenated river water, to increase successful salmon and trout spawning, egg survival and fry recruitment activity.

Dimensions of each site were restricted to 20m2, but varied at each site, based on the identification the spawning gravels and associated surrounding habitat. Sizing of the sites were also determined on the size of the river column. From smaller sites at the top of the Sturcombe to larger sites on the main river of the Upper Taw.

4. Results

A total of 38 days was contracted to identify salmonid spawning gravels habitat and carry out gravel cleaning methodology across an agreed km range per river reach targeted. Days were allocated to reaches predicted on best use of time. Results of our efforts are displayed below (Table 1);

Table 1 Gravel cleaning results summary

River	(u/s) start to (d/s) finish grid refence points	No. of days	Proposed Km coverage	Actual Km coverage	No. of sites
Molland Yeo	SS 82071 26298 - SS 73189 23924	10	3	10	93
Crooked Oak	SS 78293 23419 - SS 75793 23068	4	1.5	3	62
Mole	SS 74360 29845 - SS 67525 22966	10	4.5	20	123
Upper Taw	SS 65868 00821 - SS 70554 08344	8	7.75	10	49
Little Dart	SS 85594 18508 - SS 79654 14921	4	4.5	5	31
Sturcombe	SS 82774 20096 - SS 81252 15850	2		4	23
Total		38 days	21.25 Km	52 Km	381 sites

In comparison of the proposed Km coverage to the actual Km coverage that was achieved, we have exceeded double the proposed Km coverage planned. This has resulted in scanning more area for spawning sites to be improved and increased the chances of successful spawning, egg survival and fry recruitment.

5. Observations and Recommendations

Notes have been taken throughout the gravel cleaning season and summarised based on level of sedimentation within the gravels that have been observed. In extension, other potential habitat improvement methods have been suggested based on the quality of the surrounding habitat and land use.

To gauge the quality of the spawning site gravels, as no data was collected on sedimentation levels – feedback on sedimentation levels can only be valued by the observed visual upwelling of sediment when gravel cleaning was in practice. Each of the river reaches were also compared against each other within the catchment.

Molland Yeo

In comparison to other reaches cleaned within the catchment, the sediment concentration was one of the best. However, the amount of sediment release observed in the cleaning was by no means good but expected in today's applications and run-off inputs. Amongst this, there were a selection of great spawning sites identified within the reach with great potential. The best of the gravels was found in the upper reaches and habitat appeared well suited for trout.

A note for other potential beneficiary habitat works included; selective coppicing throughout the reach with the aim of exposing more light onto riffle habitat to encourage and support fry recruitment populations. Farm advice would also be beneficial to the river as a form of indirect river improvement: interrupting, attenuating and treating water inputs. In future gravel cleaning works, taking into consideration the extent of the stretch that has been cleaned this year, the best use of gravel cleaning on this reach next time around would be to incorporate sites upstream of Bottereaux Mill.

Crooked Oak

Highlighted with the highest levels of sedimentation for all the reaches cleaned, the Crooked Oak was in desperate need of gravel cleaning and has been highlighted for future works. High sediment upwelling was found throughout all sites and movement within the gravel beds was restricted. The stretch has potential habitat well suited to trout populations with improved habitat and water quality. With the Crooked Oak running parallel to the Molland Yeo within the catchment, similar recommendations also apply.

A note for other potential beneficiary habitat works also included selective coppicing and farm advice throughout the stretch. Future gravel works should encompass the same stretch and include the stretch downstream of Yeo Bridge. Dependent on the concentration of the sedimentation when gravel works are to commence again, if the stretch cleaned this year is still in fair condition or funds are restrictive, it is recommended to prioritise the stretch that was not reached this year; downstream of Yeo Bridge to the confluence.

Mole (Main River)

The Mole system was highlighted with the lowest levels of sedimentation overall. Good quality sites were noted downstream of North Molton to the A361, with some exceptional sites located throughout the system.

Other habitat improvement works also advise selective coppicing, downstream of the A361 to the River Bray confluence. Future work should include the same stretch and if possible, look into extending the works upstream of North Molton.

Upper Taw (Main River)

On the Upper Taw, sedimentation was not as concentrated as the Crooked Oak, but did not appear to have cleaner gravels compared to the Mole. The sub-catchment is subject to stock access and agricultural practices compared to the other targeted reaches within the catchment.

Therefore, key habitat improvement recommendations include farm advice and selective stock fencing to accessible areas. It is also advised that further gravel cleaning works should be carried out along the same stretch proposed this year.

Little Dart and Sturcombe Stream

Both the Little Dart and Sturcombe are known as historical salmon streams and both produced the best of the salmon spawning sites within the catchment. Unfortunately, salmon populations have greatly diminished within the stems along with the quality of the habitat.

Sedimentation levels on the Little Dart and Sturcombe were comparable to levels found on the Upper Taw. However, the impact is potentially higher as the Little Dart and Sturcombe are much smaller stems. Sedimentation found at sites greatly degraded the quality of the gravels, in habitat that has the potential to support salmon populations.

A note for other potential beneficiary habitat works included debris dam removal and farm advice. It is also highly recommended to continue with gravel cleaning improvements on both the Little Dart and Sturcombe in future, and to target the sites when there is sufficient water flow.

In summary of the sedimentation levels of each reach, based on observing the level of sedimentation upwelling seen during cleaning has been put into categories to compare the reaches cleaned within the catchment (Table 2);

Table 2 Sedimentation categories

River	Sedimentation
Molland Yeo	Average
Crooked Oak	Very poor
Mole	Average
Upper Taw	Poor
Little Dart	Poor
Sturcombe	Poor
Categories: 1) Excellent 2) Good 3) Average 4) Poor 5) Very Poor	

In extension, a summary of other habitat improvement methods noted are displayed (Table 3);

Table 3 Other direct habitat improvement suggestions

Actions	River					
	Molland Yeo	Crooked Oak	River Mole	Upper Taw	Little Dart	Sturcombe
Coppicing	✓	✓	✓		✓	✓
Farm advice	✓	✓		✓	✓	✓
Stock fencing				✓		
Debris dams					✓	✓

An additional action to consider is to build further data collection and knowledge within the catchment, to build on activity and evidence. This can be achieved through the installation of data loggers within the catchment. It will define the water quality indicators and produce a tracing mechanism for potential negative inputs to the river. Results can tailor management to target the correct areas in a logical order and tackle one of the key issues of water quality within the catchment.

The application of these monitoring and direct and indirect management systems are crucial for the survival and sustainment of future salmonid populations. To achieve a successful programme of improvement to the river there are 4 essential elements:

1) Monitoring baseline data and gauging positive impact of interventions.
2) Knowledge and prediction that target the correct areas for improvement in a logical order.
3) Direct river improvements: repairing, improving and protecting the river.
4) Indirect river improvement: interrupting, attenuating and treating water inputs.

All of the above contributes to a healthier and more sustainable environment and incorporates the ecosystem approach. For the meantime, the selection of remedial actions, including gravel cleaning to address immediate issues is crucial for the conservation of future salmonid populations until larger concentrated efforts can be made.

6. Acknowledgements

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