Macroinvertebrate, fish population and spawning surveys in six New Forest streams, September – December 2018

Higher Level Stewardship Agreement

The Verderers of the New Forest AG00300016

March 2019

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This report has been prepared for The Verderers of the New Forest Higher Level Stewardship Agreement. The HLS partners shall have the sole right to publish the report and results of the survey, with an appropriate acknowledgement of the work or material contributed by the Contractor. This report should be cited as: "Harrison A., Pinder A. and Davy-Bowker J. (2018) Macroinvertebrate, fish population and spawning surveys in six New Forest streams, September – December 2017. BU Global Environmental Solutions (BUG) report (BUG2780) to Forestry Commission. 108 pp. Higher Level Stewardship Agreement The Verderers of the New Forest AG00300016".

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Draft v0.1	18/12/2018	Draft for client review		
Draft v0.2	25/02/2019	Addition of macroinvertebrate and salmonid redd count sections		
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EXECUTIVE SUMMARY

Wetland restoration in the New Forest has been undertaken for decades. The current programme of works, under the Higher Level Stewardship scheme's main objectives, is to bring the New Forest riverine and wetland habitat to Favourable Condition, in accordance with its statutory designation as a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC).

This data report summarises the findings of electric fishing surveys, macroinvertebrate surveys and redd count surveys at 13 locations (in six different streams).

Surveys were undertaken at Harvestslade, Latchmore Brook, Mill Lawn Brook, Millersford Brook, Soldiers Bog, Wootton Phase 1 (Avon Water) and Wootton Phase 2 (Avon Water).

This report provides a record of survey data only, with a view to informing longer-term fish and macroinvertebrate population datasets aimed at tracking post-restoration ecological recovery.

NOTE: The data presented in this report should be considered within the context of heatwave conditions during 2018 and resultant uncharacteristically low flows.

Key findings are presented below:

FISH POPULATION SURVEYS

Table 1 summarises the fish species recorded at each location.

Table 1. Species recorded at each location (in numerical abundance order).

Location	Year restoration undertaken / planned	Fish species recorded
Harvestslade Site 1	2015	Minnow, bullhead, river/brook lamprey, eel, brown trout
Harvestslade Site 2	2015	Minnow, bullhead, river/brook lamprey, brown trout
Latchmore Brook Site 1	No plan to restore	Minnow, chub, stone loach, eel, brown trout, perch
Latchmore Brook Site 2	No plan to restore	Minnow, stone loach, chub, brown trout, eel, roach
Mill Lawn Brook	No plan to restore	Minnow, brown trout, bullhead
Millersford Brook Site 1	No plan to restore	No fish captured
Millersford Brook Site 2	No plan to restore	Brown trout
Millersford Brook Site 3	No plan to restore	Brown trout
Soldiers Bog	2013	Minnow, stone loach, bullhead
Wootton Phase 1 Site 1	2016	Bullhead, brown trout, stone loach, minnow, river/brook lamprey, 3-spined stickleback
Wootton Phase 1 Site 2	No plan to restore	Bullhead, brown trout, minnow, stone loach, river/brook lamprey
Wootton Phase 2 Site 1	No plan to restore	Bullhead, brown trout, stone loach, minnow, river/brook lamprey
Wootton Phase 2 Site 2	2018	Stone loach, bullhead, brown trout, minnow, river/brook lamprey, 3-spined stickleback

MACROINVERTEBRATE SURVEYS

Table 2 presents the lowest Observed/Expected ratios of biotic indices at each location.

Table 2. Lowest Observed / Expected ratios of biotic indices at each location.

Location	Year restoration undertaken / planned	Observed / Expected ratios of key biotic indices
Harvestslade Site 1	2015	Very Degraded
Harvestslade Site 2	2015	Slightly Degraded
Latchmore Brook Site 1	No plan to restore	Moderately Degraded
Latchmore Brook Site 2	No plan to restore	Very Degraded
Mill Lawn Brook	No plan to restore	Moderately Degraded
Millersford Brook Site 1	No plan to restore	Moderately Degraded
Millersford Brook Site 2	No plan to restore	Within expected range
Millersford Brook Site 3	No plan to restore	Within expected range
Soldiers Bog	2013	Very Degraded
Wootton Phase 1 Site 1	2016	Moderately Degraded
Wootton Phase 1 Site 2	No plan to restore	Within expected range
Wootton Phase 2 Site 1	No plan to restore	Slightly Degraded
Wootton Phase 2 Site 2	2018	Moderately Degraded

REDD COUNT SURVEYS

Table 3 summarises the number of redds recorded at each location.

Table 3. Number of redds recorded at each location.

Location	Year restoration undertaken / planned	Number of redds recorded	
		Sea trout	Resident brown trout
Harvestslade	2015	0	0
Latchmore	No plan to restore	1	1
Mill Lawn Brook	No plan to restore	2	0
Millersford Brook	No plan to restore	0	0
Soldiers Bog	2015	0	1
Wootton Phase 1	2016	5	0
Wootton Phase 2	2018	0	2

CONTENTS

1. INTRODUCTION

The New Forest HLS scheme objectives are to restore resectioned channels to their historic meanders to prevent further erosion of the specialist mire / wet heath habitats, increase the availability of in-channel habitat and reconnect the floodplain, with a view to bringing the SSSI units back into Favourable Condition according to their conservation objectives. The scheme is a catchment-based approach of naturalising and sustaining the landscape into the future, maintaining grazing and the complex biodiversity of the New Forest open habitats.

Geo- and hydromorphological restoration of flowing water bodies are widely regarded as being of positive environmental benefit; however, this can be difficult to justify to local land owners, interest groups and other organisations without sound supporting evidence. This project has been designed to focus specifically on freshwater fish and macroinvertebrate communities as indicators of in-stream ecological quality and to detect whether any temporal changes in community structure (positive or negative) can be attributed to the physical re-engineering of stream profiles.

This data report summarises the findings of electric fishing surveys, macroinvertebrate surveys and redd count surveys at 13 locations (in six different streams).

Surveys were undertaken at Harvestslade, Latchmore Brook, Mill Lawn Brook, Millersford Brook, Soldiers Bog, Wootton Phase 1 (Avon Water) and Wootton Phase 2 (Avon Water).

1.1 Aims and objectives

The specific aims and objectives of this report are as follows:

- Provide fish and macroinvertebrate survey data for the selected New Forest streams.
- Highlight any rare species afforded conservation protection under the following designations:
    - Schedule 5 Wildlife and Countryside Act (1981) Species
    - Red Data Book Species
    - UK BAP Priority Species
    - Nationally and Regionally Scarce Species

Note: This work is delivered under Call-Off Contract 1 under Framework 304/NF/16/1326 Specialist Ecological Surveys.

2. METHODOLOGY

2.1 Site selection

In advance of the surveys being undertaken, the Forestry Commission provided BUG with National Grid Reference (NGR) coordinates for the upstream and downstream extent of the area of interest, along with details of the survey requirements at each location (Table 2.1).

The extent of the area of interest for each location was mapped in ArcGIS, to provide an overview of the location of each area of interest in relation to the wider catchment (Figure 2.1).

Table 2.1. Upstream and downstream limits of area of interest, and survey effort, at each location.

Site	Status	Extent of area of interest		Length (km)	Fish survey site	Invert survey	Redd count
		Upstream	Downstream				
Bratley Arch View [1]	Benchmark	SU23660938	SU23190914	0.5	N/A	N/A	N/A
Harvestslade	Post-works	SU20850596	SU20660545	0.4	SU2070905601	Yes	Yes
					SU2063905381	Yes	
Latchmore	Benchmark	SU22761595	SU18151242	6.4	SU1911412660	Yes	Yes
					SU1817512460	Yes	
Mill Lawn Brook	Benchmark	SU19870582	SU20080540	0.4	SU2004105456	Yes	Yes
Millersford	Benchmark	SU19951680	SU18231610	2.2	SU1951816719	Yes	Yes
					SU1838416240	Yes	
					SU1907116841	Yes	
Pondhead [2]	Active	SU31400685	SU32370694	1.2	N/A	N/A	Yes
					N/A	N/A	
Soldiers Bog	Post-works	SU22930752	SU23050707	0.5	SU2307107140	Yes	Yes
Wootton Phase 1	Post-works	SU23860030	SZ24969969	1.3	SU2324600438	Yes	Yes
					SZ2500699679	Yes	
Wootton Phase 2 [3]	Pre- and Post-works	SZ25109966	SZ26449873	1.6	SZ2638498168	Yes	Yes
					SZ2576899463	Yes	
TOTAL				**14.5**	**13**	**13**	**8**

[1] Bratley Arch View was dry – no fish/invert survey undertaken. [2] Pondhead works active – No fish/invert survey undertaken. [3] Additional fish/invert survey site added to Wootton Phase 2.

Further details on the extent of the area of interest and the location of fish survey sites are provided in Sections 2.1.1 to 2.1.7 below. A more detailed description of site characteristics is provided within the introduction to each site in the results Section 3.

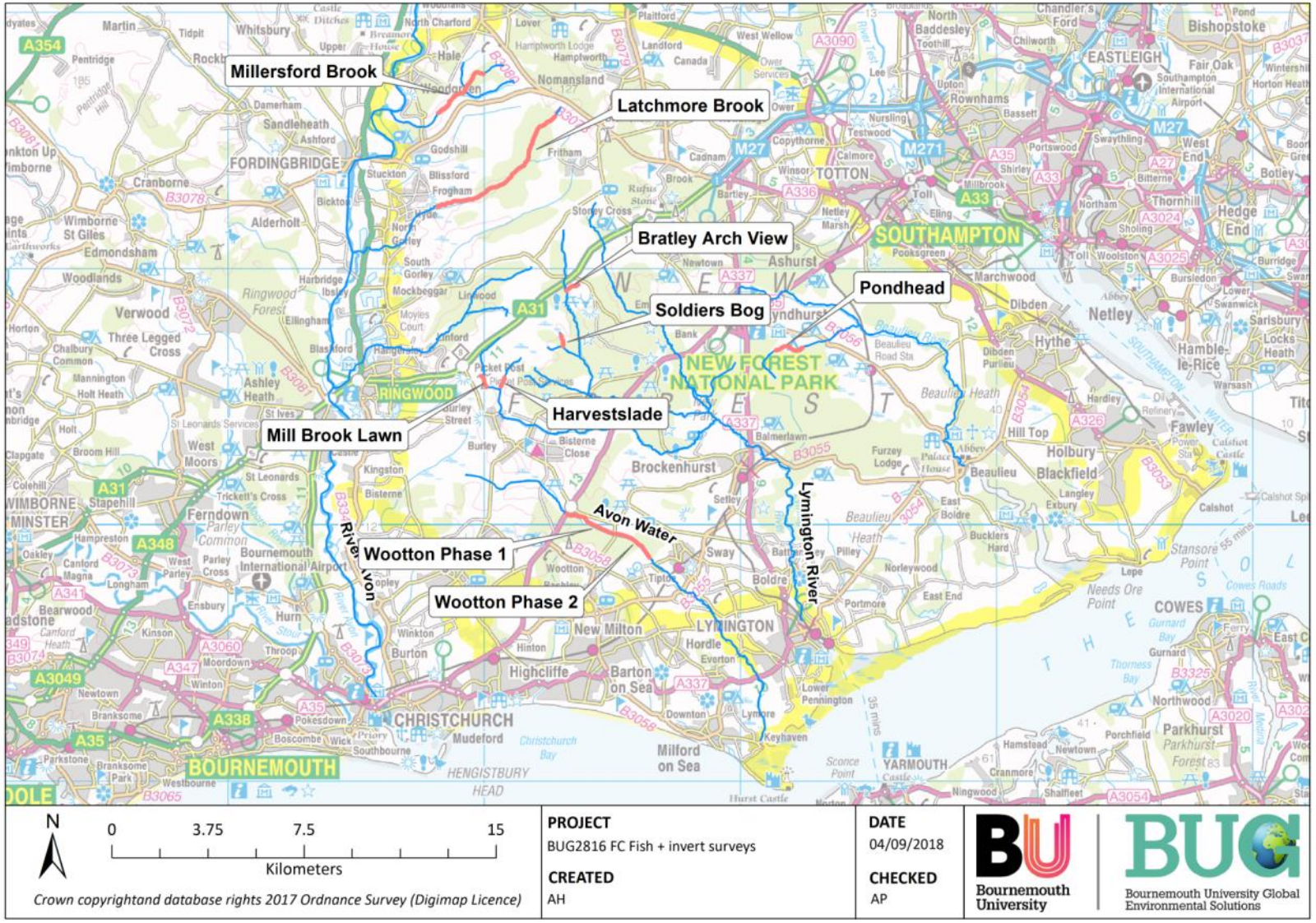

Figure 2.1. Extent of area of interest at each location.

2.1.1 Harvestslade

Harvestslade is located on a small tributary of Mill Lawn Brook, which flows into the Lymington River (Figure 2.1). The works area, shown in Figure 2.2, has a total length of 0.4 km. One site was surveyed within the works area at this location (Harvestslade Site 1); however, an additional site was surveyed downstream of the works area as a control site for in-stream habitat alteration (Harvestslade Site 2). The upstream and downstream extents of the 100 m electric fishing sites (blue dots) and invertebrate kick-sampling sites (green dots) are shown in Figure 2.2 and summarised in Table 2.2. Note: Harvestslade Site 1 is located within a new (un-mapped) channel, which was formed as part of the restoration works. Full descriptions of the survey sites are provided within the results Sections 3.1 and 3.2.

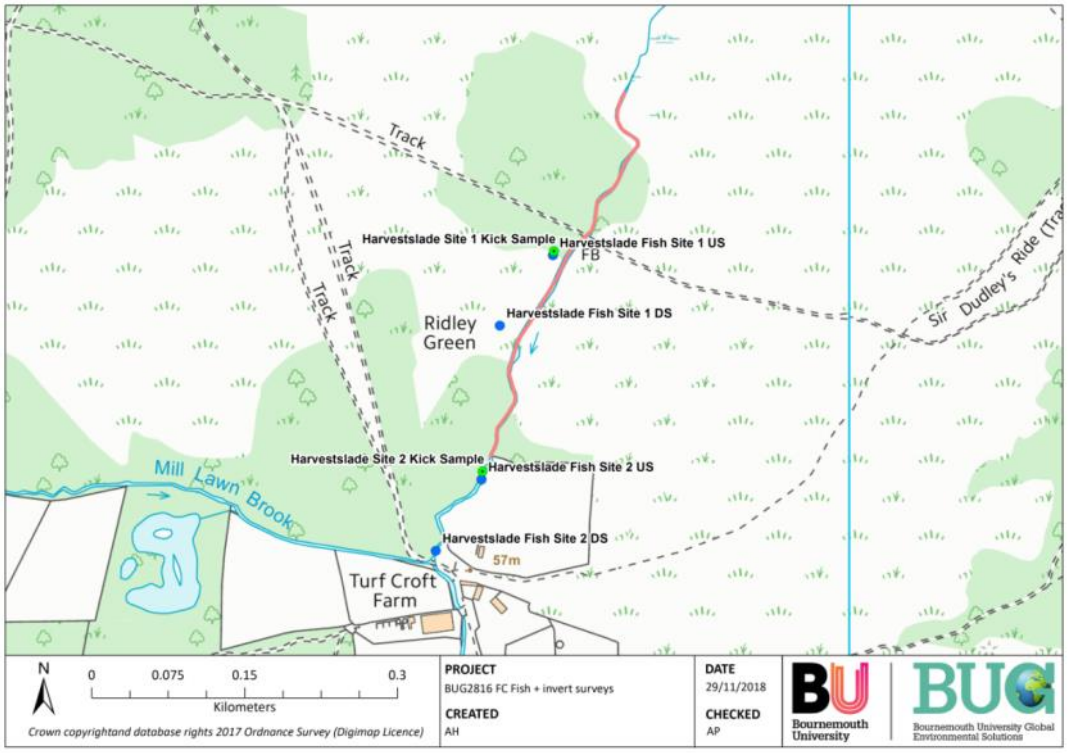

Figure 2.2. Upstream and downstream extent of survey sites at Harvestslade. Extent of area of interest is shown in pink shading.

Table 2.2. Upstream and downstream limits of survey sites at Harvestslade.

Site	Upstream extent of survey area	Downstream extent of survey area	Length of survey area (m)	Date of survey
Harvestslade Fish Site 1	SU2070905601	SU2065705532	100	13/09/2018
Harvestslade Fish Site 2	SU2063905381	SU2059405311	100	13/09/2018
Harvestslade Site 1 Kick Sample	SU2071005605	N/A	N/A	13/09/2018
Harvestslade Site 2 Kick Sample	SU2062905383	N/A	N/A	13/09/2018

2.1.2 Latchmore Brook

Latchmore Brook (changing downstream to Huckles Brook) is a small tributary of the River Avon (Figure 2.1). The area of interest, shown in Figure 2.3, has a total length of 6.4 km (to the top of the catchment). Two sites were surveyed within the area of interest at this location. The upstream and downstream extents of the 100 m electric fishing sites (blue dots) and invertebrate kick-sampling sites (green dots) are shown in Figure 2.3 and summarised in Table 2.3. A full description of the survey sites are provided within the results Sections 3.3 and 3.4.

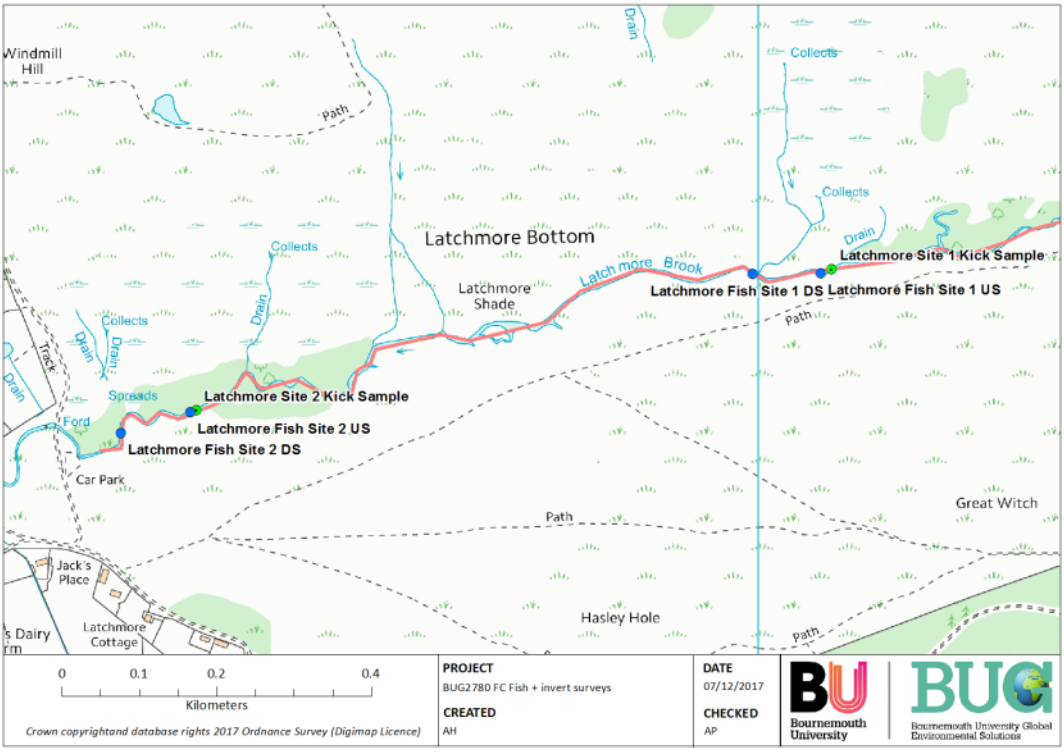

Figure 2.3. Upstream and downstream extent of survey sites at Latchmore Brook. Extent of area of interest is shown in pink shading. NOTE: Area of interest continues to top of catchment.

Table 2.3. Upstream and downstream limits of survey sites at Latchmore Brook.

Site	Upstream extent of survey area	Downstream extent of survey area	Length of survey area (m)	Date of survey
Latchmore Fish Site 1	SU1908112649	SU1899312648	100	18/09/2018
Latchmore Fish Site 2	SU1826712470	SU1817712443	100	18/09/2018
Latchmore Site 1 Kick Sample	SU1909612654	N/A	N/A	18/09/2018
Latchmore Site 2 Kick Sample	SU1827512472	N/A	N/A	18/09/2018

2.1.3 Mill Lawn Brook

Mill Lawn Brook (changing downstream to Ober Water) is a small tributary of the Lymington River (Figure 2.1). The works area, shown in Figure 2.4, has a total length of 0.4 km. A single electric fishing survey was undertaken at this location. The upstream and downstream extents of the 70 m electric fishing site (blue dots) and invertebrate kick-sampling site (green dot) are shown in Figure 2.4 and summarised in Table 2.4. Full descriptions of the survey site are provided within the results Section 3.5.

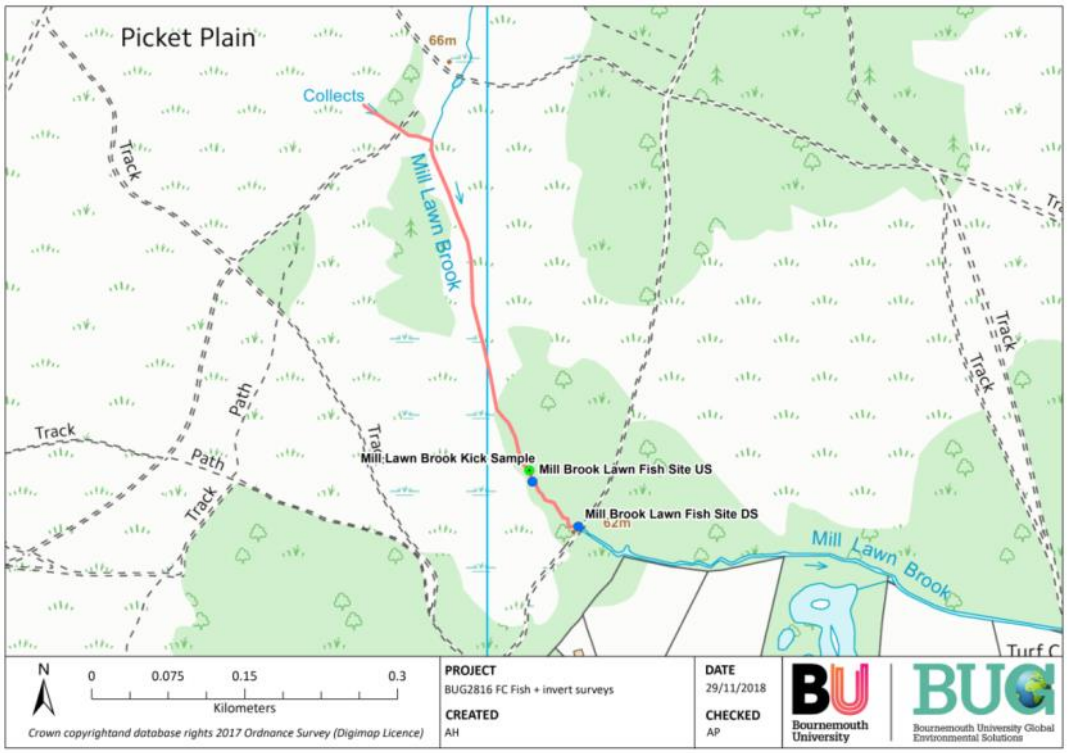

Figure 2.4. Upstream and downstream extent of survey site at Mill Lawn Brook. Extent of area of interest is shown in pink shading.

Table 2.4. Upstream and downstream limits of survey sites at Mill Lawn Brook.

Site	Upstream extent of survey area	Downstream extent of survey area	Length of survey area (m)	Date of survey
Mill Lawn Brook Fish Site	SU2004405448	SU2008905404	70	14/09/2018
Mill Lawn Brook Kick Sample	SU2004105459	N/A	N/A	14/09/2018

2.1.4 Millersford Brook

Millersford Brook is a tributary of the River Avon (Figure 2.1). The area of interest, shown in Figure 2.5, has a total length of 2.2 km. Three sites were surveyed at this location; one near the upstream extent of the area of interest (Millersford Brook Site 1), one toward the downstream extent (Millersford Brook Site 2) and one near the mid-point of the area of interest (Millersford Brook Site 3). The upstream and downstream extents of the three 100 m electric fishing sites (blue dots) and three invertebrate kick-sampling sites (green dots) are shown in Figure 2.5 and summarised in Table 2.5. Full descriptions of the survey sites are provided within the results Sections 3.6 to 3.8.

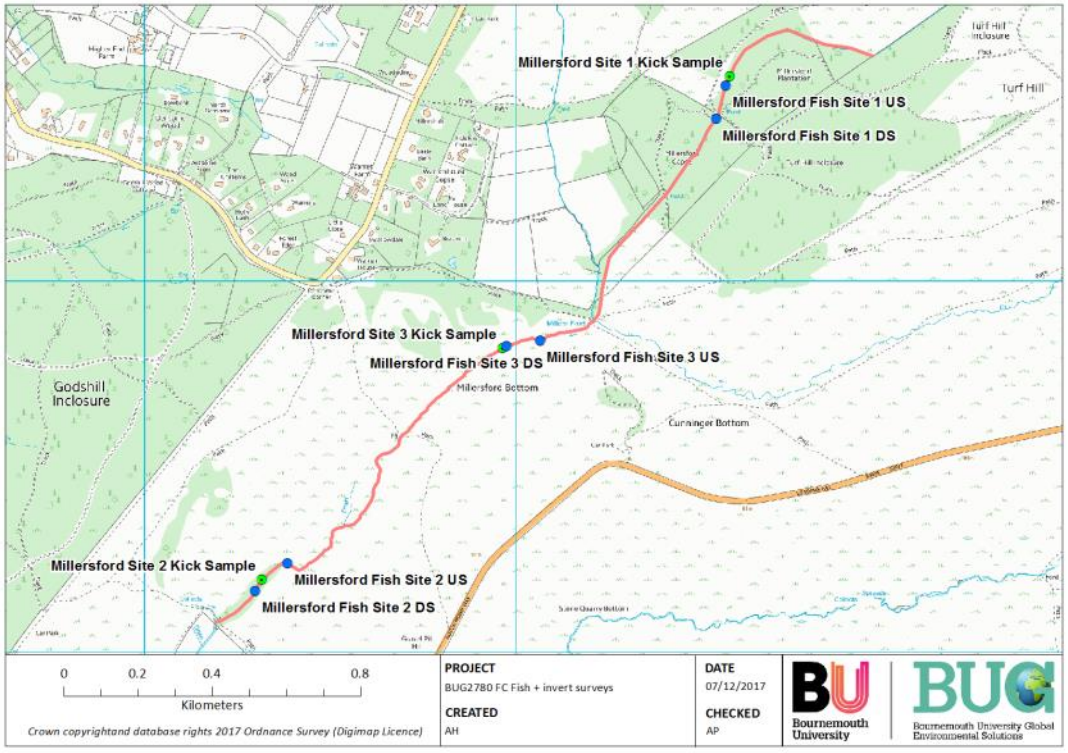

Figure 2.5. Upstream and downstream extent of survey sites at Millersford. Extent of area of interest is shown in pink shading.

Table 2.5. Upstream and downstream limits of survey sites at Millersford Brook.

Site	Upstream extent of survey area	Downstream extent of survey area	Length of survey area (m)	Date of survey
Millersford Fish Site 1	SU1956517527	SU1953917437	100	19/09/2018
Millersford Fish Site 2	SU1838416241	SU1829716167	100	19/09/2018
Millersford Fish Site 3	SU1906516840	SU1897516825	100	19/09/2018
Millersford Site 1 Kick Sample	SU1957717553	N/A	N/A	19/09/2018
Millersford Site 2 Kick Sample	SU1831816197	N/A	N/A	19/09/2018
Millersford Site 3 Kick Sample	SU1896616820	N/A	N/A	19/09/2018

2.1.5 Soldiers Bog

Soldiers Bog is located on Blackensfod Brook, a small tributary of the Blackwater which flows into the Lymington River (Figure 2.1). The works area, shown in Figure 2.6, has a total length of 0.5 km. One site was surveyed at this location, situated toward the downstream extent of the works area. The upstream and downstream extents of the 100 m electric fishing site (blue dots) and invertebrate kick-sampling site (green dot) are shown in Figure 2.6 and summarised in Table 2.6. A full description of the survey site is provided within the results Section 3.9.

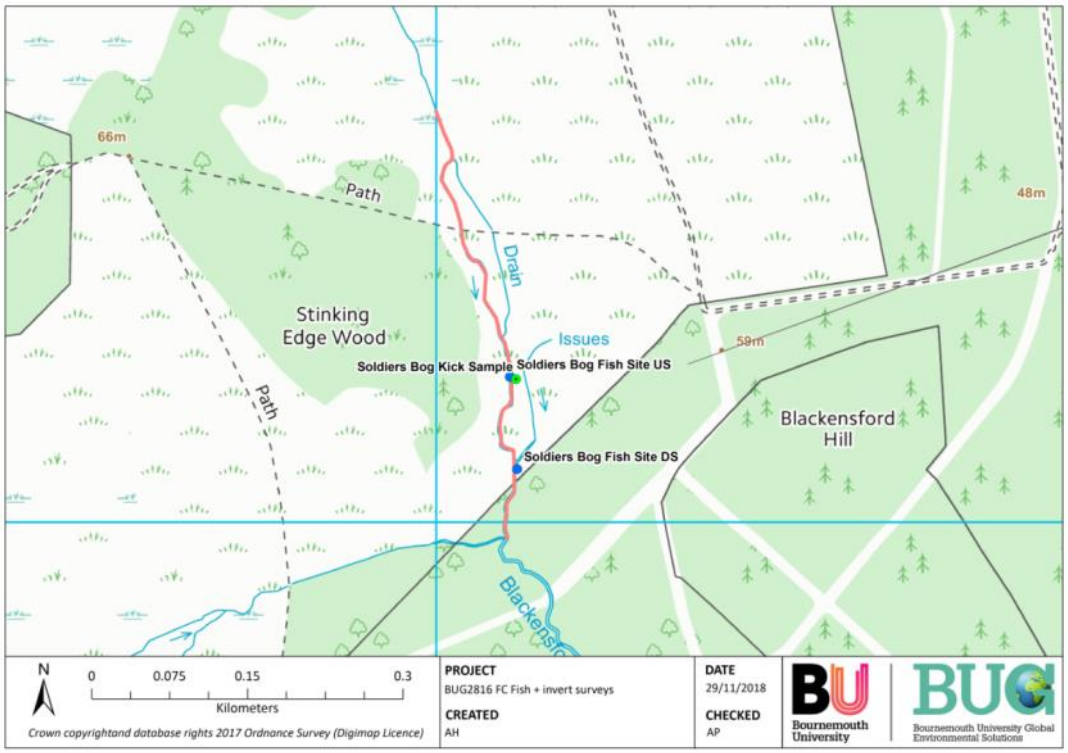

Figure 2.6. Upstream and downstream extent of survey site at Soldiers Bog.

Table 2.6. Upstream and downstream limits of survey sites at Soldiers Bog.

Site	Upstream extent of survey area	Downstream extent of survey area	Length of survey area (m)	Date of survey
Soldiers Bog Fish Site	SU2307107140	SU2307807051	100	14/09/2018
Soldiers Bog Kick Sample	SU2307707138	N/A	N/A	N/A

2.1.6 Wootton Phase 1

Wootton Phase 1 is located on the Avon Water (Figure 2.1). The area of interest, shown in Figure 2.7, has a total length of 1.3 km. Two sites were surveyed within the area of interest at this location. The upstream and downstream extents of the 100 m electric fishing sites (blue dots) and invertebrate kick-sampling sites (green dots) are shown in Figure 2.7 and summarised in Table 2.7. A full description of the survey sites are provided within the results Sections 3.10 and 3.11.

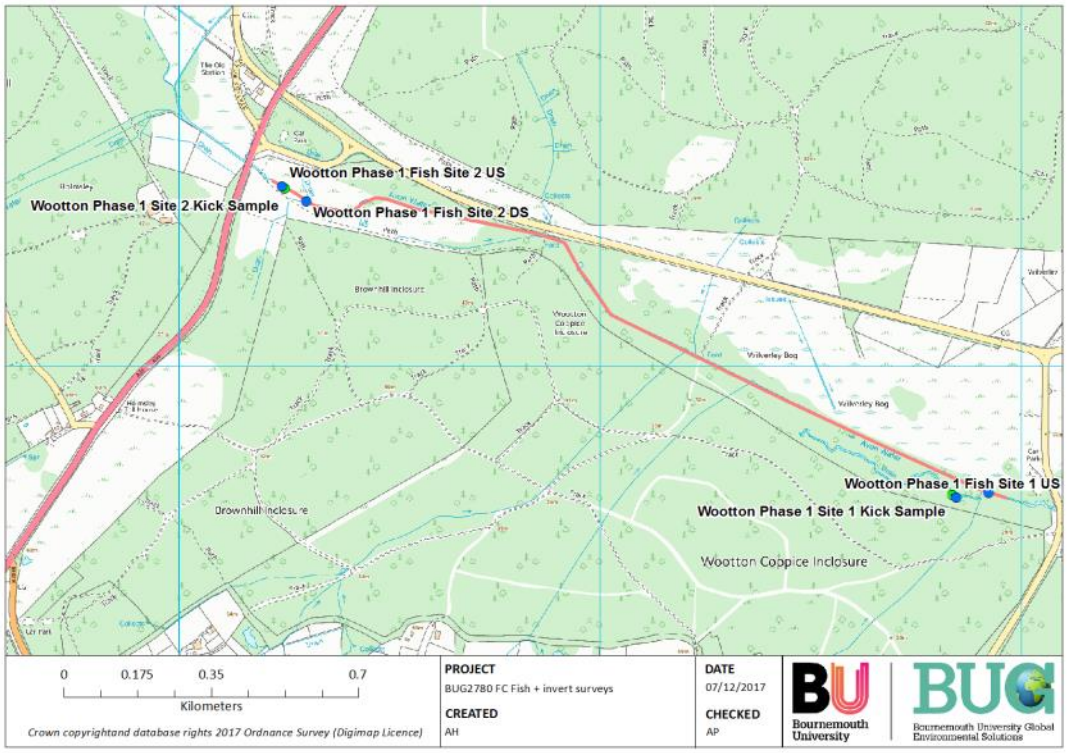

Figure 2.7. Upstream and downstream extent of survey sites at Wootton Phase 1. Extent of area of interest is shown in pink shading.

Table 2.7. Upstream and downstream limits of survey sites at Wootton Phase 1.

Site	Upstream extent of survey area	Downstream extent of survey area	Length of survey area (m)	Date of survey
Wootton Phase 1 Fish Site 1	SZ2484699689	SZ2492399700	100	11/09/2018
Wootton Phase 1 Fish Site 2	SU2324500427	SU2330200392	70	11/09/2018
Wootton Phase 1 Site 1 Kick Sample	SZ2483799696	N/A	N/A	11/09/2018
Wootton Phase 1 Site 2 Kick Sample	SU2325300422	N/A	N/A	11/09/2018

2.1.7 Wootton Phase 2

Wootton Phase 2 is located on the Avon Water (Figure 2.1). The area of interest, shown in Figure 2.8, has a total length of 1.6 km. Two sites were surveyed within the area of interest at this location. The upstream and downstream extents of the 100 m electric fishing sites (blue dots) and invertebrate kick-sampling sites (green dots) are shown in Figure 2.8 and summarised in Table 2.8. A full description of the survey site is provided within the results Sections 3.12 and 3.13.

NOTE: An additional site was added to Wootton Phase 2 in 2018. Therefore, the site referred to as Wootton Phase 2 Site 1 in this report is referred to as Wootton Phase 2 in the 2017 report.

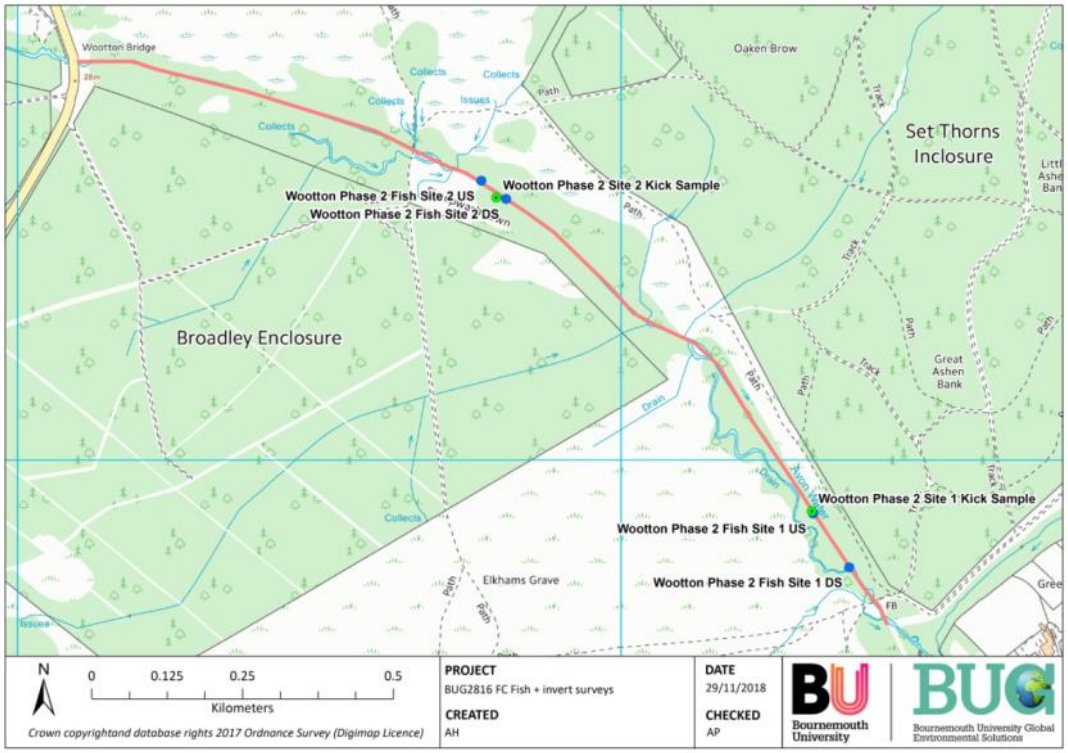

Figure 2.8. Upstream and downstream extent of survey sites at Wootton Phase 2. Extent of area of interest is shown in pink shading.

Table 2.8. Upstream and downstream limits of survey sites at Wootton Phase 2.

Site	Upstream extent of survey area	Downstream extent of survey area	Length of survey area (m)	Date of survey
Wootton Phase 2 Fish Site 1	SZ2631898912	SZ2637898823	100	12/09/2018
Wootton Phase 2 Fish Site 2	SZ2576899463	SZ2580999433	70	12/09/2018
Wootton Phase 2 Site 1 Kick Sample	SZ2631698916	N/A	N/A	12/09/2018
Wootton Phase 2 Site 2 Kick Sample	SZ2579399435	N/A	N/A	12/09/2018

2.2 Electric fishing

At each site, a fully-quantitative (triple run) electric fishing survey was conducted using backpack electric fishing kit. Stop-nets were positioned at both the upstream and downstream extent of the survey site to isolate a 100 m stretch (where possible). In combination with measurement of river habitat characteristics at 10 m intervals (e.g. width, depth and substrate), the total survey area was calculated for each site.

All fish captured were identified to species, a representative sub-sample of each species was measured, and all fish allowed to recover in aerated holding tanks prior to their release. Fish from each electric fishing run were processed separately to facilitate calculation of population densities using catch depletion models.

Fish capture, processing, data recording and analyses was completed in accordance with best practice guidance (e.g. Joint Nature Conservation Committee Common Standards Monitoring).

Where relevant, 0+ and 1++ brown trout densities were classified according to the National Fisheries Classification Scheme (NFCS), shown in Table 2.9 below.

Table 2.9. National Fisheries Classification Scheme for brown trout.

Classification	Density (No./100m^2)	
	Trout fry (0+)	Trout parr (1++)
A (Excellent)	>= 38	>= 21
B (Good)	17 – 37.9	12 – 20.9
C (Fair)	8 – 16.9	5 – 11.9
D (Fair / Poor)	3 – 7.9	2 – 4.9
E (Poor)	< 3	< 2
F (Fishless)	Absent	Absent

2.3 Invertebrate kick-sampling

2.3.1 Survey methodology

Macroinvertebrate samples were collected in accordance with the standard Environment Agency (EA) three-minute kick sampling procedure using a 1 mm mesh pond net (set out in '*Procedures For Collecting and Analysing Macroinvertebrate Samples*". BT001 3.0, Third Issue; 1991) and by the procedure for collecting and analysing macroinvertebrate samples for RIVPACS (Murray-Bligh *et al.* 1992).

At each sampling site, a basic suite of physico-chemical parameters (pH, temperature, conductivity, dissolved oxygen) and general habitat characteristics (water velocity category, width, depth and substratum composition) were recorded on standard RIVPACS/RICT '*Sample Area'* forms. These variables are useful both for describing the general sampling site characteristics, and also as predictor variables for running the RIVPACS (River Invertebrate and Prediction and Classification System) model (see Section 2.3.5).

All samples were accompanied by a GPS reading, and sampling site sketch map to facilitate subsequent return to the same location for re-survey work. In addition, the presence of aquatic macrophytes and other species observed incidentally during the macroinvertebrate sampling (e.g. fish) were also recorded.

All sampling equipment, chemical analysis probes and personal protective equipment had been thoroughly dried prior to visiting the site and all equipment was checked for foreign species, as recommended by the GB Non-Native Species Secretariat '*Check, Clean, Dry*' campaign (GB NNSS 2015). As an additional precaution, all equipment that might come into contact with the sampling sites was sprayed with '*Virkon® S*' (DuPont™) a powerful broad-spectrum virucidal, bactericidal and fungicidal disinfectant prior to visiting the sampling sites to prevent the transfer of crayfish plague or other pathogens.

Macroinvertebrate samples were fixed at the riverbank using 4% formaldehyde. The use of formaldehyde is considered superior to 70% Industrial Methylated Spirits due to its more rapid and thorough fixation of organic matter and the greatly enhanced shelf life of the samples and the invertebrate specimens they contain. Sample pots were clearly labelled both internally, using pencil and waterproof paper labels, and externally using a waterproof bullet marker. Samples were returned to the laboratory for processing.

2.3.2 Laboratory sample processing

Macroinvertebrate samples were sorted, identified and enumerated following the procedures set out in '*Procedures For Collecting and Analysing Macroinvertebrate Samples"*. BT001 3.0, Third Issue; 1991) and by the procedure for collecting and analysing macroinvertebrate samples for RIVPACS (Murray-Bligh *et al.* 1992). Samples were processed to species-level, specifically RIVPACS Taxonomic Level '*TL5*' (Davy-Bowker *et al.* 2010), and numerical abundances of all taxa were estimated and recorded on laboratory sample data sheets.

Examination of picked invertebrates was made using a binocular/compound microscope, as required. Appropriate taxonomic keys were used for identification, making reference to a reference collection, where necessary. All samples were reconstituted (put back into their original sample pots and re-preserved) and retained for subsequent quality assurance purposes. Where any specimens were retained for addition to a reference collection, this was clearly marked on the laboratory sample analysis sheets. All sample analyses were carried out by John Davy-Bowker.

2.3.3 Data entry and validation

Macroinvertebrate data from sample analysis laboratory datasheets were entered into a Microsoft® Access data entry database. Following data entry, sample validation reports (lists of entered species names and abundances) were printed out and manual data validation checks were performed to ensure that no errors arose due to data entry. Any data entry errors were corrected and the validation process was repeated until the data were error-free. Following validation, data were then exported for the calculation of biotic indices and RIVPACS/RICT Observed/Expected ratios.

2.3.4 Calculation of biotic indices

Data were imported into a Microsoft® Access database containing queries for the automatic calculation of a wide range of freshwater macroinvertebrate biotic indices at family and/or species levels.

Further information on the biotic indices is provided below (commonly used index abbreviations, the full name of each index, sources/references and typical types of environmental stress described by each index):

- **BMWP, NTAXA, ASPT**

  Name: Biological Monitoring Work Party

  Reference(s): Armitage *et al.* 1983; Hawkes 1997

  Stressor described: General degradation

- **WHPT, NTAXA, ASPT**

  Name: Whalley, Hawkes, Paisley, Trigg

  Reference(s): UKTAG 2014

  Stressor described: General degradation

- **AWIC(sp) Murphy**

  Name: Acid Water Indicator Community

  Reference(s): Murphy *et al.* 2013

  Stressor describe: Acidity/acidification stress

- **WFD AWIC(sp) McFarland**

  Name: *WFD Acid Water Indicator Community*

  Reference(s): McFarland 2010; UKTAG 2014

  Stressor described: Acidity/acidification stress

- **LIFE(sp)**

  Name: Lotic-invertebrate Index for Flow Evaluation

  Reference(s): *Extence et al. 1999*

  Stressor described: Flow stress

- **PSI(sp)**

  Name: Proportion of Sediment-sensitive Invertebrates

  Reference(s): *Extence et al. 2013*

  Stressor described: Sedimentation stress

- **SPEAR(sp)%**

  Name: Species At Risk

  Reference(s): Beketov *et al. 2008*

  Stressor described: Pesticide stress

- **CCI**

  Name: Community Conservation Index

  Reference(s): Chadd and Extence 2004

  Stressor described: Conservation value

2.3.5 RIVPACS/RICT Observed/Expected ratios

In addition to the calculation of observed biotic indices for the macroinvertebrate samples (described above) RIVPACS/RICT classification was undertaken using the RIVPACS IV predictive model (Davy-Bowker *et al*. 2008), run through the web-based RICT (River Invertebrate Classification Tool) software:

www.sepa.org.uk/environment/water/classification/river-invertebrates-classification-tool/

RIVPACS IV is the current RIVPACS model used by the Environment Agency and others to perform WFD quality assessments and is the industry standard for assessing the biological condition of running waters.

RIVPACS (River Invertebrate Prediction and Classification System) is a predictive model that uses environmental variables such as stream width and depth, distance from source, altitude, etc. to predict the reference (undisturbed) values of a range of biotic indices (Wright *et al.* 1997; Clarke *et al.* 2003). RIVPACS is based on a dataset of 685 GB reference sites that are grouped into similar 'end groups' whose biological communities are similar to each other. Predicted biotic indices for test samples were obtained by gathering the same environmental variables (environmental predictor variables) and running these through the model. Each test sample is assigned a probability of RIVPACS end group membership based on its environmental variables. The biotic index values of the reference sites in the various end groups then contribute to the predicted index values for the test sample. Rather than drawing the prediction solely from one end group of reference sites, the predictions of reference condition biotic indices are derived by the model as a weighted average depending upon probability of end group membership (Clarke *et al.* 2011).

The observed values of a wide range of commonly used biotic indices from the test samples were then compared to the RIVPACS expected values of the indices by the calculation of observed/expected ratios. For example, an observed biotic index value of 75 would be divided by an expected value of the same index, of say 85, to give an observed/expected (O/E) ratio of 0.882. An O/E ratio of greater than 1.0 indicates that a test sample has exceeded its predicted biotic index value (it is better than similar reference condition sites in the model); an O/E ratio of slightly below 1.0 (e.g. 0.882) indicates that a test sample is close to its predicted index value and is, therefore, only minimally impacted; an O/E ratio close to zero indicates that a test sample falls a long way short of its predicted biotic index value and it is, therefore, heavily stressed or degraded.

The O/E ratios of the Observed/Expected biotic indices were fitted into five bands, indicating the degree of disparity between the observed values and those expected by RIVPACS/RICT in the unstressed state. The five bands of O/E ratios used were as follows:

- > 1.3 Observed score better than expected
- 1.3 – 0.7 Observed score within expected range
- 0.7 – 0.5 Observed score slightly degraded compared to expected score
- 0.5 – 0.3 Observed score moderately degraded compared to expected score
- < 0.3 Observed score very degraded compared to expected score

It is important to note that the bands above are not WFD ecological status classes (which exist only for the WHPT biotic indices). They do, however, give a consistent framework to examine deviations of observed and expected biotic index values across all biotic indices used and, therefore, provide a framework to quantify the effects of a wider range of environmental stressors than WFD classification alone.

2.4 Redd counts

Redd count surveys were undertaken at all locations over three days during December 2018 and January 2019; Monday 17th December (Mill Lawn Brook, Harvestslade, Soldiers Bog and Millersford Brook), Tuesday 8th January (Latchmore Brook) and Wednesday 9th January (Wootton, Pondhead).

The full extent of the area of interest at each location was walked by two experienced fisheries scientists and all evidence of sea trout (and resident brown trout) spawning was recorded. This included established redds, 'scrapes' and adult fish observations. Other salient features, such as debris dams and barriers to upstream migration were also recorded.

In the absence of positively identifying fish during redd construction; there is an unavoidable element of uncertainty with regard to classifying redds as either sea trout or resident brown trout. For the purposes of the current surveys, we have classified any redds greater than 0.4 m long x 0.4 m wide as belonging to sea trout.

A handheld GPS was used to record the location of points of interest, and field notes (redd size, fish size, behaviour, habitat, etc.) were recorded in a waterproof notepad. All data were transcribed and mapped in GIS and are presented in Section 5.

3. RESULTS – ELECTRIC FISHING SURVEYS

3.1 Harvestslade Site 1

3.1.1 Site description

Harvestslade Site 1 is located within an area of moorland / heath, with limited canopy cover along the river stretch (see Section 2.1.1). Table 3.1 below summarises the key physical characteristics of the 100 m survey site, and Appendix 1 provides a photographic record of habitat variability. The mean wetted width was 2.01 m, with an overall surveyed area of 200.9 m^2.

The survey site was located in a new channel which has been created as part of the restoration works at this location. The old incised channel has been filled in and the new channel excavated to reinstate historic meanders with an elevated bed profile. Substrate was largely comprised of imported gravel, pebble and cobbles overlaid on soft clay. A fine layer of fine silt was evident throughout. Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.2.

Table 3.1. Habitat data recorded during the electric fishing survey at Harvestslade Site 1.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	40	20	20	10	5	5		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent		10		30	50	10		
Instream vegetation: **60 %**		Silted? **Yes**		Substrate: **Unstable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent		10		10		30	50	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	5							
Right bank %	5							
Total LB fish cover: **5 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **5 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / **Simple** / Complex				RB Bankface vegetation: Bare / Uniform / **Simple** / Complex				
LB Banktop vegetation: Bare / Uniform / **Simple** / Complex				RB Banktop vegetation: Bare / Uniform / **Simple** / Complex				
LB Overhanging Boughs (%): **0**			RB Overhanging Boughs (%): **0**			Canopy Cover (%): **0**		

Table 3.2. Physico-chemical parameters recorded during fish survey at Harvestslade Site 1.

Parameter	Value
Temperature (°C)	15.1
Dissolved Oxygen (%)	108.7
Dissolved Oxygen (mgl^{-1})	10.91
pH	8.15
Conductivity (μScm^{-1})	73.2

3.1.2 Electric fishing survey results

A total of 221 fish were captured at Harvestslade Site 1, comprising five species. Minnow comprised the majority of fish captured. (Figure 3.1).

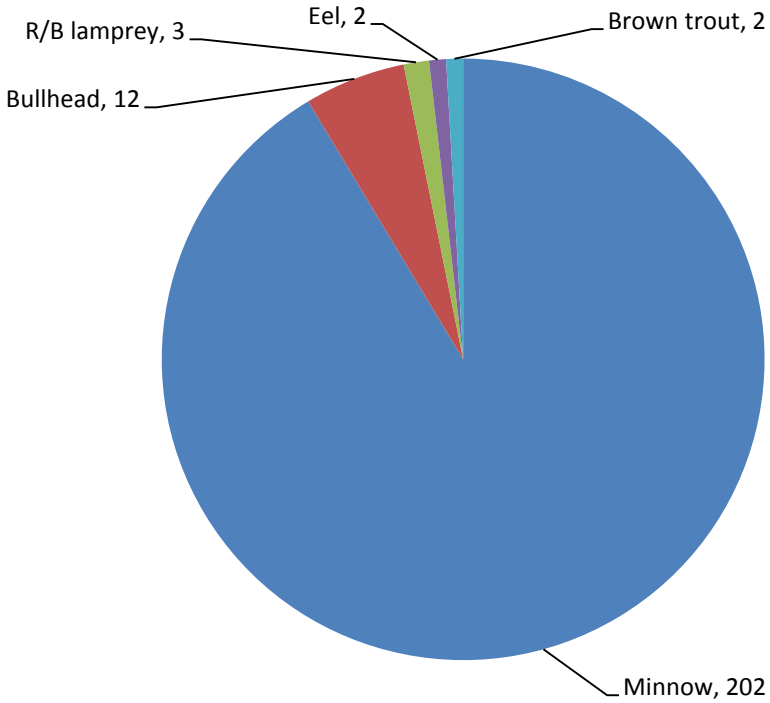

Figure 3.1. Species composition (total number captured) at Harvestslade Site 1.

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.3. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

Table 3.3. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Harvestslade Site 1. National Fisheries Classification Scheme (NFCS) grades are also provided for brown trout.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density (No./100m^2)	NFCS Classification
Minnow	202 (2.1-6.6)	270	0.37	217	323	134	N/A
Bullhead	12 (3.5-6.0)	N/A	N/A	N/A	N/A	N/A	N/A
R/B lamprey	3 (8.0-9.0)	N/A	N/A	N/A	N/A	N/A	N/A
Eel	2 (22.0-29.0)	N/A	N/A	N/A	N/A	N/A	N/A
Brown trout (1++)	2 (10.5-11.5)	2	0.67	1	3	1	E (Poor)
Brown trout (0+)	0	N/A	N/A	N/A	N/A	N/A	F (Fishless)
TOTAL	**221**						

Length frequency charts for the most abundant fish species recorded are provided in Figure 3.2 and Figure 3.3 below.

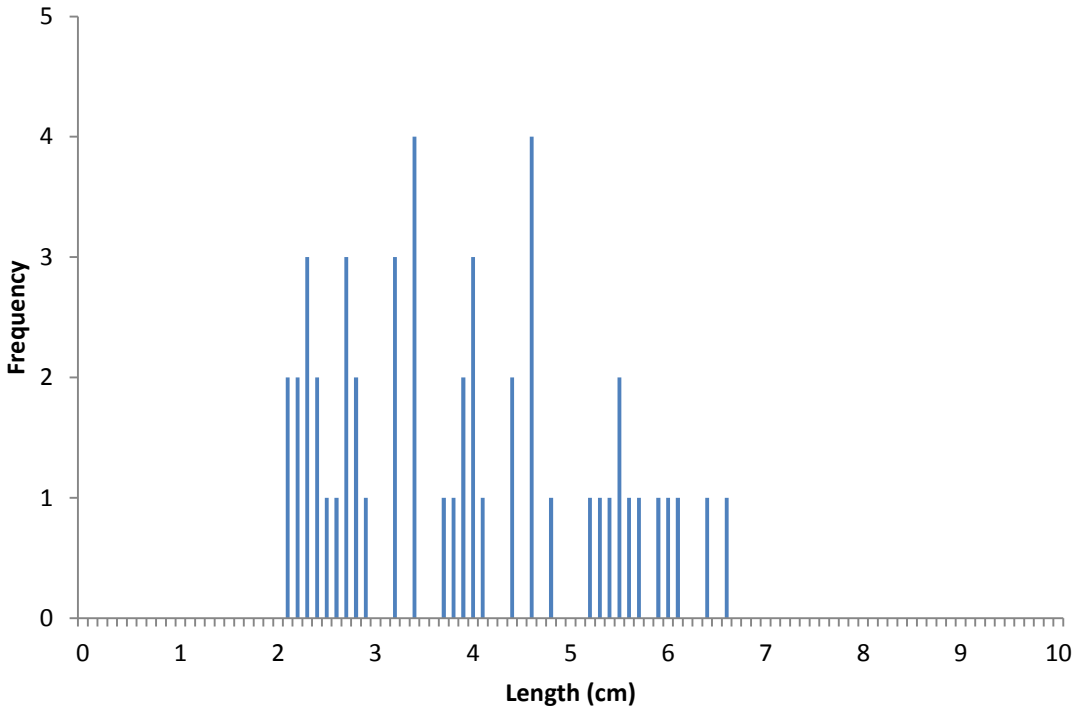

Figure 3.2. Length frequency of minnow captured at Harvestslade Site 1 (n=51).

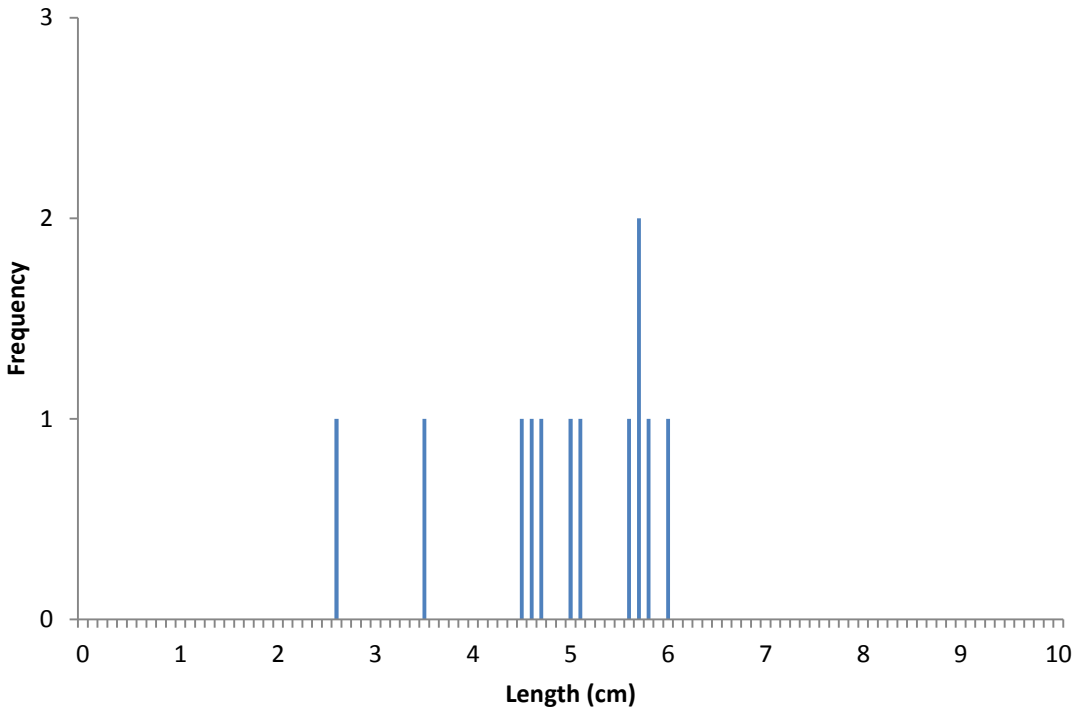

Figure 3.3. Length frequency of bullhead captured at Harvestslade Site 1 (n=12).

3.1.3 Fish species of conservation importance

Table 3.4 highlights the fish species of conservation importance that were recorded at Harvestslade Site 1 during the electric fishing survey.

Table 3.4. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Harvestslade Site 1.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	Y
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	Y
Lamprey (Brook)	Habitats Directive (Annex II)	Y	Y
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.2 Harvestslade Site 2

3.2.1 Site description

Harvestslade Site 2 is located within an area of broadleaf / mixed woodland, with approximately 90 % canopy cover along the river stretch (see Section 2.1.1). Table 3.5 below summarises the key physical characteristics of the 100 m survey site, and Appendix 2 provides a photographic record of habitat variability. The mean wetted width was 1.46 m, with an overall surveyed area of 146.4 m^2.

Being long-established; the river reach comprised a diversity of habitat types. Substrate was largely comprised of gravel, pebble and cobbles; however, a layer of fine silt was evident throughout and dominated the substrate in slower flowing stretches. Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.6

Table 3.5. Habitat data recorded during the electric fishing survey at Harvestslade Site 2.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	40	20	10	10	10	10		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent	5	15		70	5	5		
Instream vegetation: **0 %**		Silted? **Yes**		Substrate: **Stable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent	5	10	5	10		20	60	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	20	10			5			
Right bank %	20	10			5			
Total LB fish cover: **35%**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **35 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / Simple / **Complex**				RB Bankface vegetation: Bare / Uniform / Simple / **Complex**				
LB Banktop vegetation: Bare / Uniform / Simple / **Complex**				RB Banktop vegetation: Bare / Uniform / Simple / **Complex**				
LB Overhanging Boughs (%): **40**			RB Overhanging Boughs (%): **40**			Canopy Cover (%): **90**		

Table 3.6. Physico-chemical parameters recorded during fish survey at Harvestslade Site 2.

Parameter	Value
Temperature (°C)	10.6
Dissolved Oxygen (%)	101.7
Dissolved Oxygen (mgl^{-1})	11.3
pH	8.12
Conductivity (μScm^{-1})	66.8

3.2.2 Electric fishing survey results

A total of 171 fish were captured at Harvestslade Site 2, comprising four species. Minnow was the most abundant species captured, followed by bullhead and lamprey (Figure 3.4).

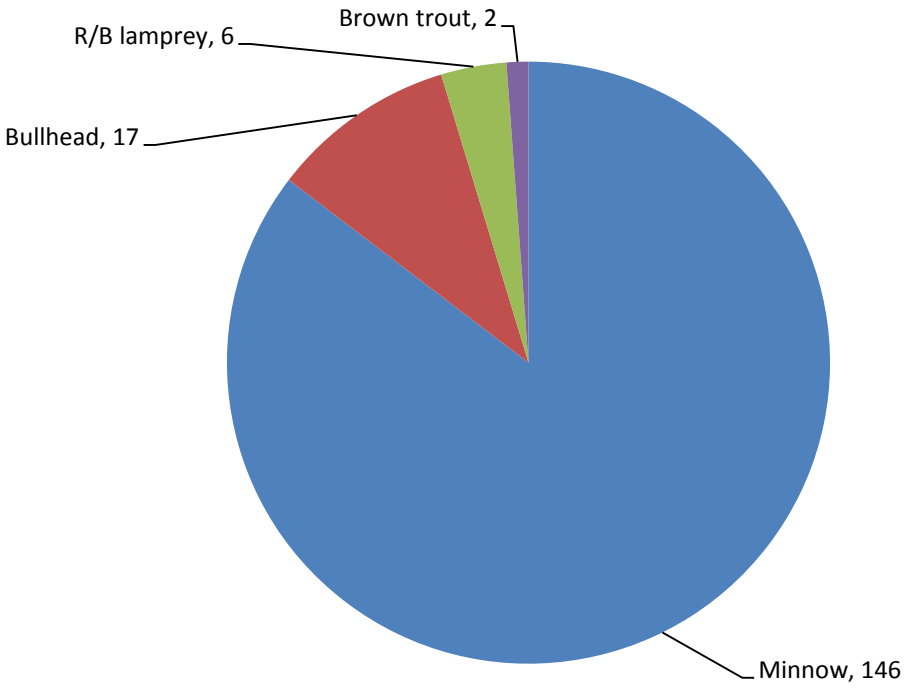

Figure 3.4. Species composition (total number captured) at Harvestslade Site 2.

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.7. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

Table 3.7. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Harvestslade Site 2.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density (No./100m^2)	NFCS Classification
Minnow	146 (1.7-8.0)	169	0.48	148	190	115	N/A
Bullhead	17 (2.0-5.2)	18	0.55	13	23	12	N/A
R/B lamprey	6 (7.6-10.0)	N/A	N/A	N/A	N/A	N/A	N/A
Brown trout (1++)	2 (12.9-22.4)	2	0.52	0	4	1	E (Poor)
Brown trout (0+)	0	N/A	N/A	N/A	N/A	N/A	F (Fishless)
TOTAL	**171**						

Length frequency charts for the most abundant fish species recorded are provided in Figure 3.5 to Figure 3.6 below.

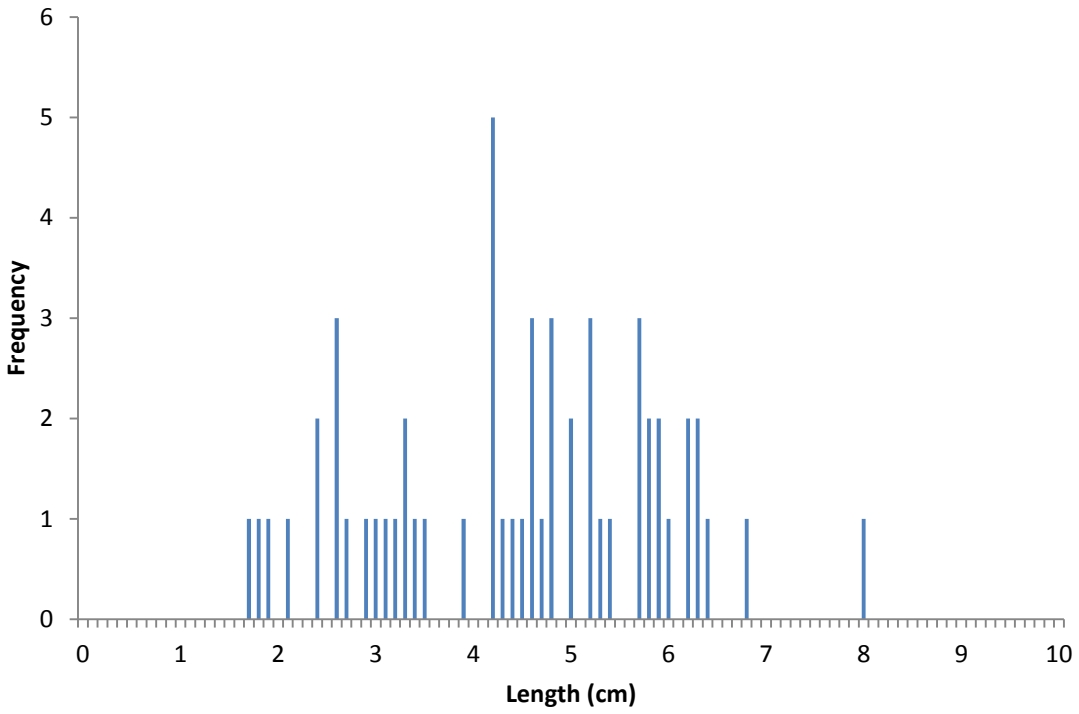

Figure 3.5. Length frequency of minnow captured at Harvestslade Site 2 (n=56).

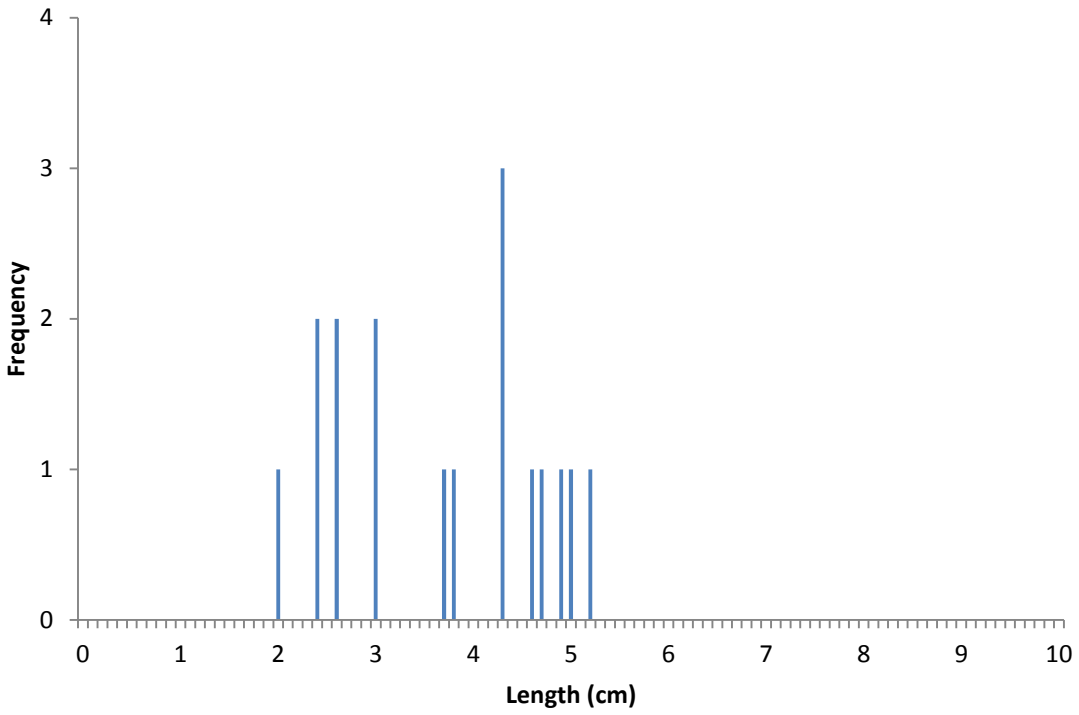

Figure 3.6. Length frequency of bullhead captured at Harvestslade Site 2 (n=17).

3.2.3 Fish species of conservation importance

Table 3.8highlights the fish species of conservation importance that were recorded at Harvestslade Site 2 during the electric fishing survey.

Table 3.8. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Harvestslade Site 2.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	Y
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	N
Lamprey (Brook)	Habitats Directive (Annex II)	Y	Y
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.3 Latchmore Brook Site 1

3.3.1 Site description

Latchmore Brook Site 1 is located within an area of open moorland / heath (see Section 2.1.2). Table 3.9 below summarises the key physical characteristics of the 100 m survey site, and Appendix 3 provides a photographic record of habitat variability. The mean wetted width was 2.85 m, with an overall surveyed area of 284.5 m^2.

A mixed substrate was present throughout, with minimal instream vegetation present in slower and shallower sections (Table 3.9). Fish habitat appeared suitable for a variety of lithophilic species, including salmonids; although, marginal vegetation and shading was largely lacking. Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.10.

Table 3.9. Habitat data recorded during the electric fishing survey at Latchmore Brook Site 1.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	20	20	20	20	10	10		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent		10	10	40	40			
Instream vegetation: **0 %**		Silted? **No**		Substrate: Stable & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent	10	30	50			5	5	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	10	25			5			
Right bank %	10	25			5			
Total LB fish cover: **40 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **40 %**								
Bankside land use								
LB Bankface vegetation: Bare / **Uniform** / Simple / Complex				RB Bankface vegetation: Bare / **Uniform** / Simple / Complex				
LB Banktop vegetation: Bare / **Uniform** / Simple / Complex				RB Banktop vegetation: Bare / **Uniform** / Simple / Complex				
LB Overhanging Boughs (%): **0**			RB Overhanging Boughs (%): **0**			Canopy Cover (%): **0**		

Table 3.10. Physico-chemical parameters recorded during fish survey at Latchmore Brook Site 1.

Parameter	Value
Temperature (°C)	17.9
Dissolved Oxygen (%)	100.3
Dissolved Oxygen (mgl^{-1})	9.54
pH	7.8
Conductivity (μScm^{-1})	65.6

3.3.2 Electric fishing survey results

A total of 346 fish were captured at Latchmore Site 1, comprising six species. Minnow was the most abundant species captured, followed by chub and stone loach (Figure 3.7).

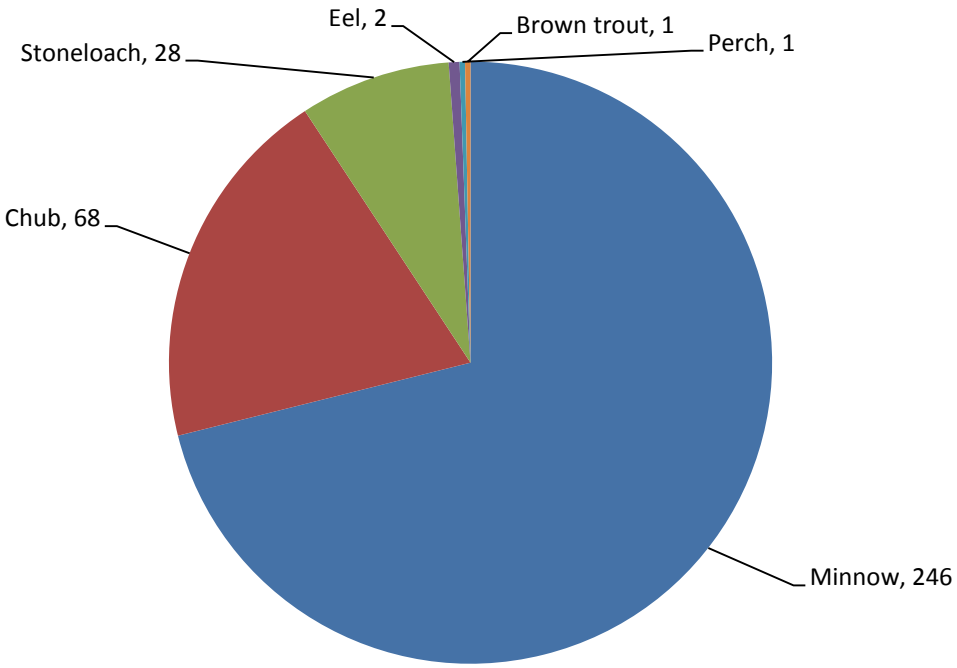

Figure 3.7. Species composition (total number captured) at Latchmore Brook Site 1.

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.11.

Table 3.11. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Latchmore Brook Site 1.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density (No./100m^2)	NFCS Classification
Minnow	246 (2.7-6.5)	279	0.51	256	302	98	N/A
Chub	68 (2.9-23.1)	77	0.35	64	90	27	N/A
Stone loach	28 (4.3-8.1)	38	0.35	15	61	13	N/A
Eel	2 (23.0-29.0_	N/A	N/A	N/A	N/A	N/A	N/A
Perch	1 (17.5)	N/A	N/A	N/A	N/A	N/A	N/A
Brown trout (0+)	1 (6.4)	1	1	N/A	N/A	0.4	E (Poor)
Brown trout (1++)	0	N/A	N/A	N/A	N/A	N/A	F (Fishless)
TOTAL	**346**						

Length frequency charts for the most abundant fish species recorded are provided in Figure 3.8 to Figure 3.10 below.

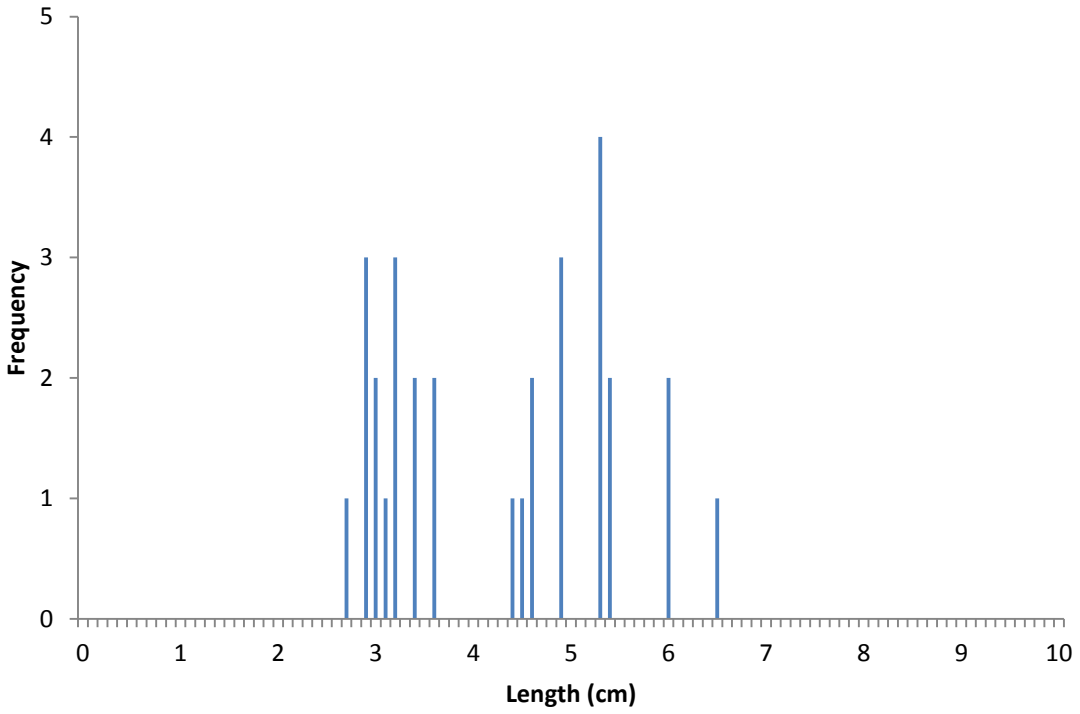

Figure 3.8. Length frequency of minnow captured at Latchmore Brook Site 1 (n=30).

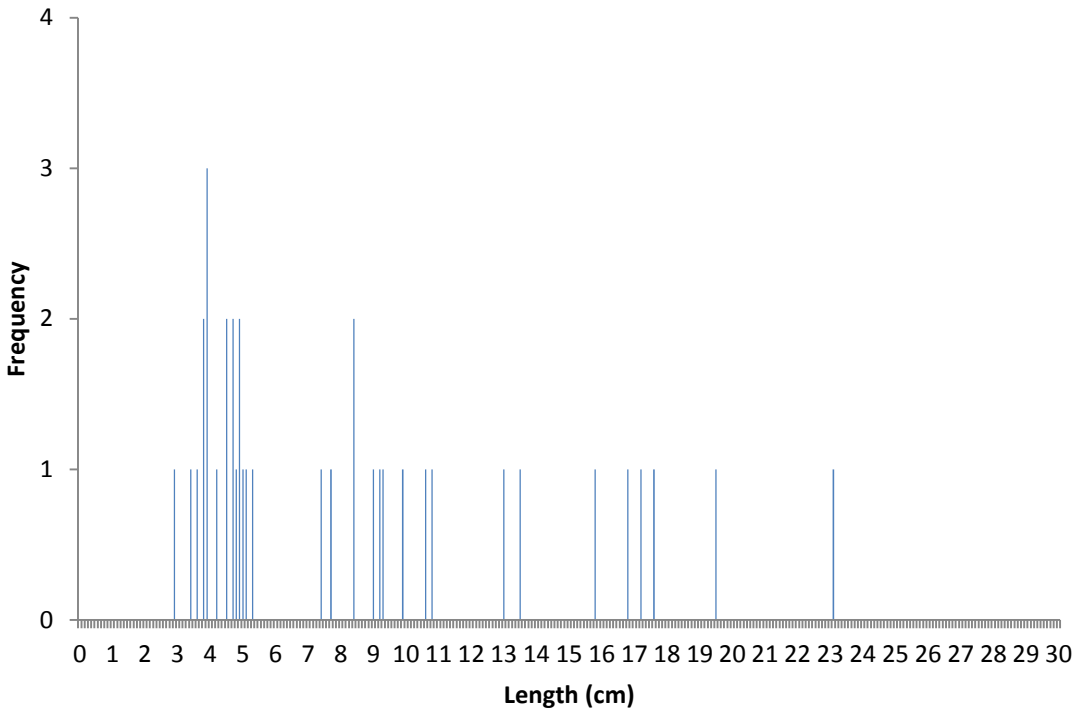

Figure 3.9. Length frequency of chub captured at Latchmore Brook Site 1 (n=37).

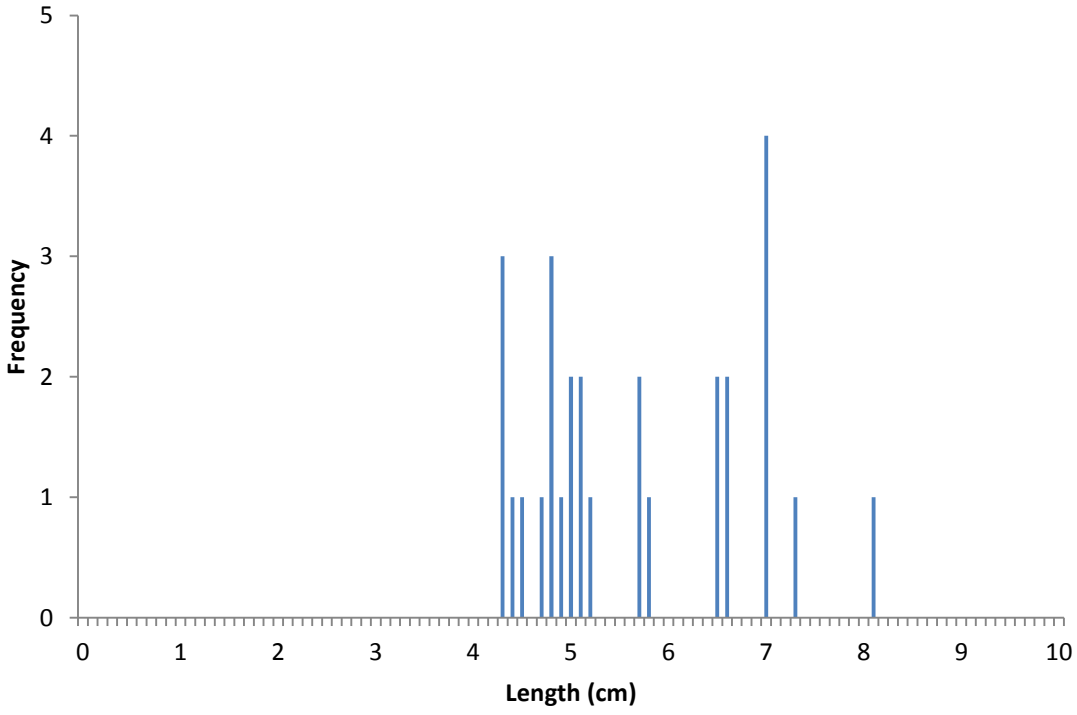

Figure 3.10. Length frequency of stone loach captured at Latchmore Brook Site 1 (n=28).

3.3.3 Fish species of conservation importance

Table 3.12 highlights the fish species of conservation importance that were recorded at Latchmore Brook Site 1 during the electric fishing survey.

Table 3.12. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Latchmore Brook Site 1.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	N
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	Y
Lamprey (Brook)	Habitats Directive (Annex II)	Y	N
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.4 Latchmore Brook Site 2

3.4.1 Site description

Latchmore Brook Site 2 is located within an area of broadleaf / mixed woodland and moorland / heath (see Section 2.1.2). Table 3.13 below summarises the key physical characteristics of the 100 m survey site, and Appendix 4 provides a photographic record of habitat variability. The mean wetted width was 2.41 m, with an overall surveyed area of 240.9 m^2.

A mixed substrate was present throughout, with minimal instream vegetation present in slower and shallower sections (Table 3.13). Fish habitat appeared suitable for a variety of lithophilic species, including salmonids, with abundant instream and marginal cover. Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.14.

Table 3.13. Habitat data recorded during the electric fishing survey at Latchmore Brook Site 2.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	20	20	20	20	10	10		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent		10		30	50	10		
Instream vegetation: **0 %**		Silted? **No**		Substrate: **Stable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent		30	30			20	20	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	20	10			5			
Right bank %	20	10			5			
Total LB fish cover: **35 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **35 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / Simple / **Complex**				RB Bankface vegetation: Bare / Uniform / Simple / **Complex**				
LB Banktop vegetation: Bare / Uniform / Simple / **Complex**				RB Banktop vegetation: Bare / Uniform / Simple / **Complex**				
LB Overhanging Boughs (%): **5**			RB Overhanging Boughs (%): **5**			Canopy Cover (%): **95**		

Table 3.14. Physico-chemical parameters recorded during fish survey at Latchmore Brook Site 2.

Parameter	Value
Temperature (°C)	16.0
Dissolved Oxygen (%)	75.0
Dissolved Oxygen (mgl^{-1})	7.39
pH	6.83
Conductivity (μScm^{-1})	63.9

3.4.2 Electric fishing survey results

A total of 325 fish were captured at Latchmore Brook Site 2, comprising six species. Minnow was the most abundant species captured, followed by stone loach and chub (Figure 3.11).

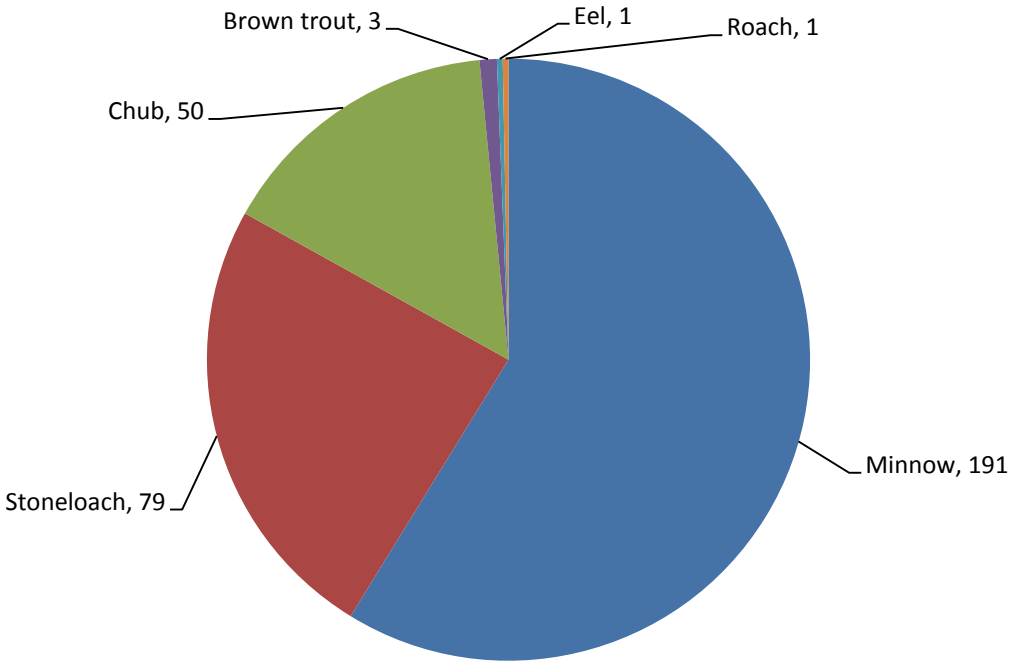

Figure 3.11. Species composition (total number captured) at Latchmore Brook Site 2.

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.15. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

Table 3.15. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Latchmore Brook Site 2. National Fisheries Classification Scheme (NFCS) grades are also provided for brown trout.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density (No./100m^2)	NFCS Classification
Minnow	191 (2.4-5.6)	236	0.42	201	271	98	N/A
Stone loach	79 (3.2-10.0)	111	0.33	70	152	46	N/A
Chub	50 (3.1-23.6)	53	0.60	47	59	22	N/A
Brown trout (1++)	2 (15.3-21.4)	2	1.00	N/A	N/A	N/A	D (Fair/Poor)
Brown trout (0+)	1 (6.7)	1	0.33	0	5	0.4	E (Poor)
Eel	1 (16.0)	N/A	N/A	N/A	N/A	N/A	N/A
Roach	1 (13.5)	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**325**						

Length frequency charts for the most abundant fish species recorded are provided in Figure 3.12 to Figure 3.14 below.

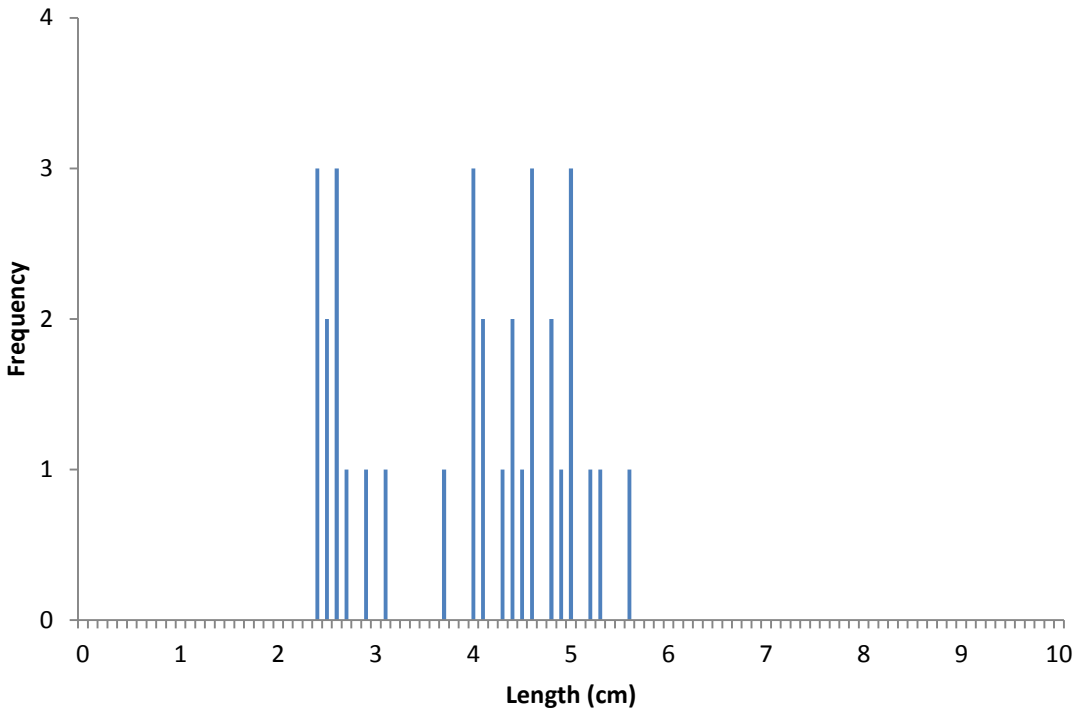

Figure 3.12. Length frequency of minnow captured at Latchmore Brook Site 2 (n=33).

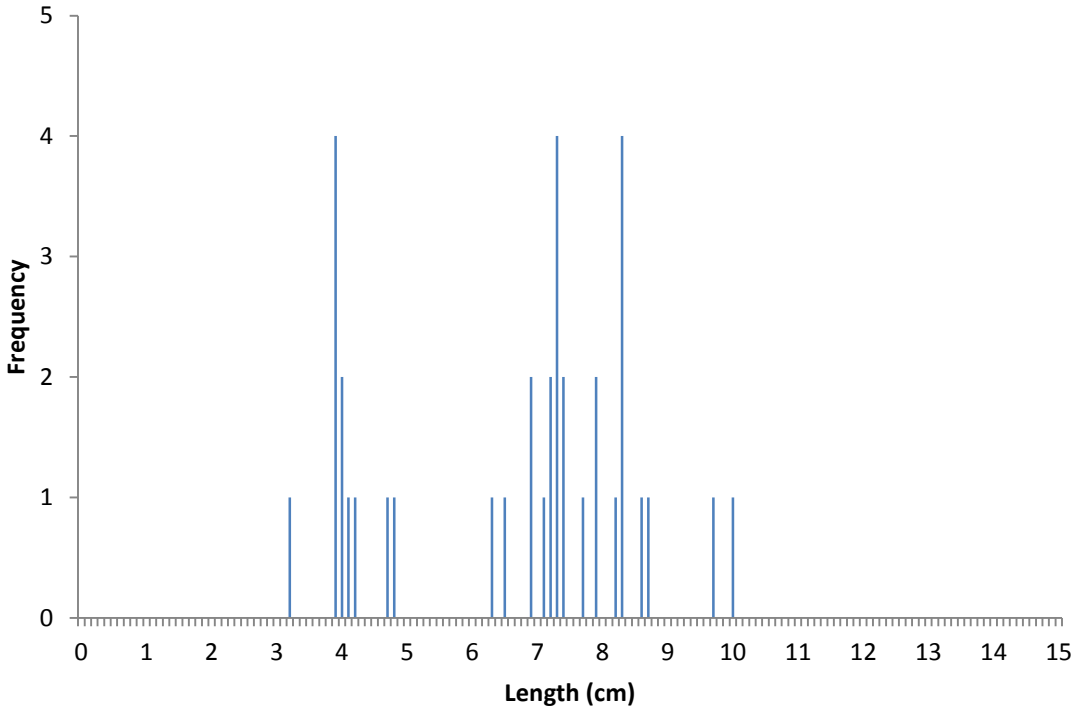

Figure 3.13. Length frequency of stone loach captured at Latchmore Brook Site 2 (n=36).

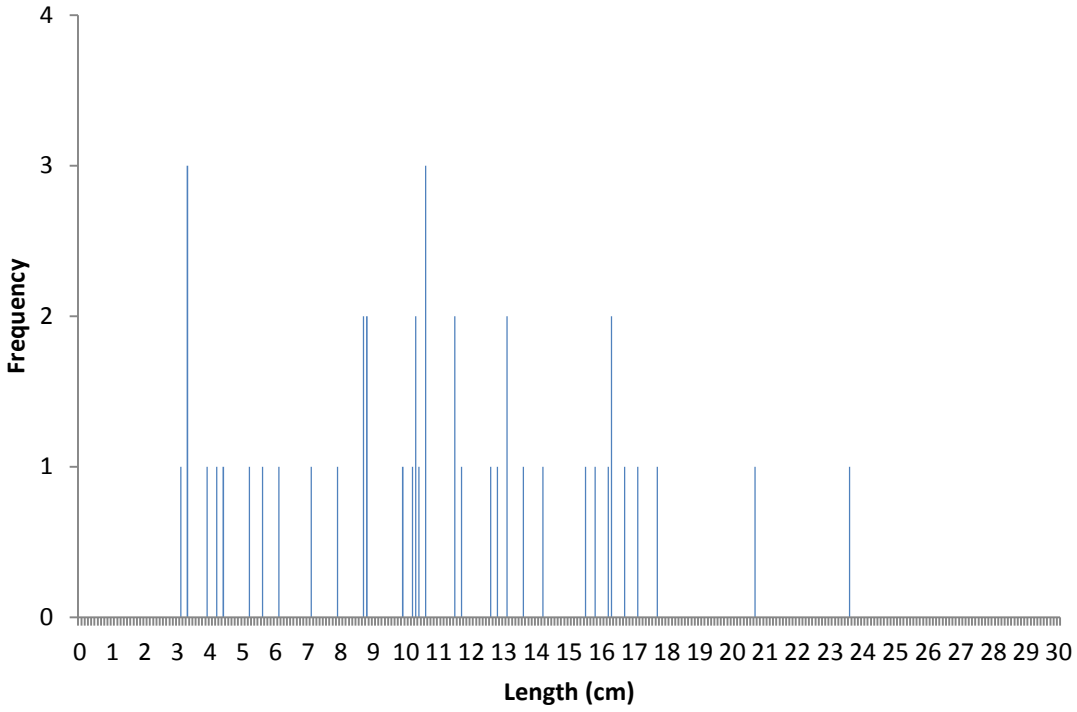

Figure 3.14. Length frequency of chub captured at Latchmore Brook Site 2 (n=43).

3.4.3 Fish species of conservation importance

Table 3.16 highlights the fish species of conservation importance that were recorded at Latchmore Site 2 during the electric fishing survey.

Table 3.16. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Latchmore Brook Site 2.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	N
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	Y
Lamprey (Brook)	Habitats Directive (Annex II)	Y	N
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.5 Mill Lawn Brook

3.5.1 Site description

Mill Lawn Brook is located within an area of broadleaf / mixed woodland (see Section 2.1.3). Table 3.17 below summarises the key physical characteristics of the 70 m survey site, and Appendix 5 provides a photographic record of habitat variability. The mean wetted width was 1.64 m, with an overall surveyed area of 114.6 m^2.

A mixed substrate was present throughout, dominated by gravel, pebble and sand (Table 3.17). Fish habitat appeared suitable for a variety of lithophilic species, including salmonids, with abundant instream and marginal cover. Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.18.

Table 3.17. Habitat data recorded during the electric fishing survey at Rhinefield.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	50	10	10	10	10	10		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent	10	10	10	50	20			
Instream vegetation: **0 %**		Silted? **Yes**		Substrate: **Stable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent	20	20	10		10		40	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	20	5			5			
Right bank %	20	5			5			
Total LB fish cover: **30 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **30 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / Simple / **Complex**				RB Bankface vegetation: Bare / Uniform / Simple / **Complex**				
LB Banktop vegetation: Bare / Uniform / Simple / **Complex**				RB Banktop vegetation: Bare / Uniform / Simple / **Complex**				
LB Overhanging Boughs (%): **10**			RB Overhanging Boughs (%): **10**			Canopy Cover (%): **90**		

Table 3.18. Physico-chemical parameters recorded during fish survey at Rhinefield.

Parameter	Value
Temperature (°C)	12.0
Dissolved Oxygen (%)	89.7
Dissolved Oxygen (mgl^{-1})	9.62
pH	8.14
Conductivity (μScm^{-1})	212.7

3.5.2 Electric fishing survey results

A total of 24 fish were captured at Mill Lawn Brook, comprising three species; minnow, brown trout and bullhead (Figure 3.15).

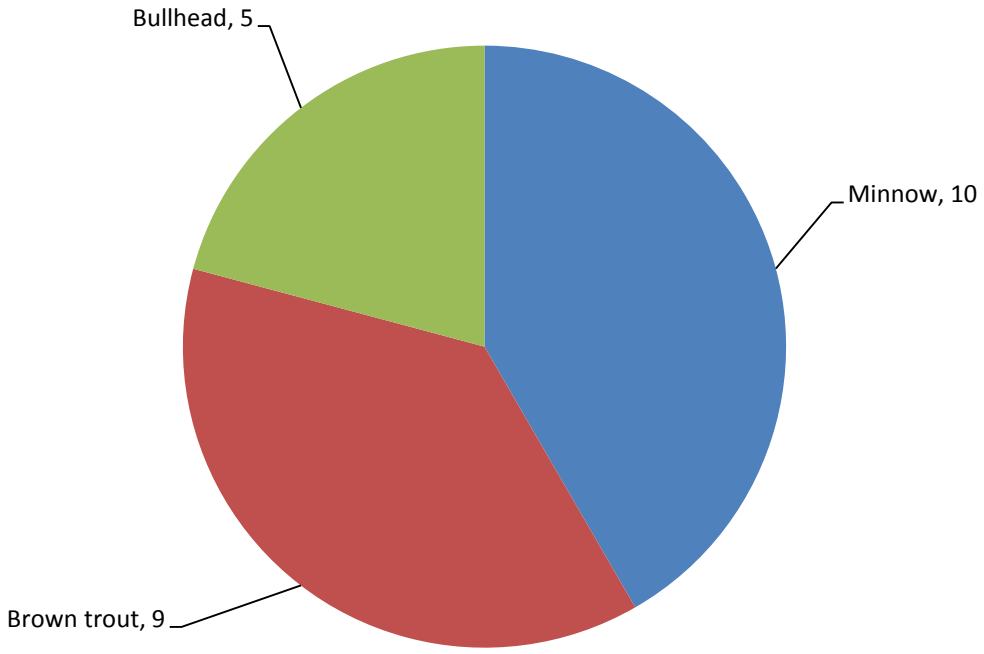

Figure 3.15. Species composition (total number captured) at Mill Lawn Brook.

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.19. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

Table 3.19. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Rhinefield. National Fisheries Classification Scheme (NFCS) grades are also provided for brown trout.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density (No./100m^2)	NFCS Classification
Minnow	10 (4.4-7.6)	10	0.83	9	11	9	N/A
Brown trout (1++)	8 (11.5-20.0)	8	0.89	7	9	7	C (Fair)
Bullhead	5 (4.6-6.4)	N/A	N/A	N/A	N/A	N/A	N/A
Brown trout (0+)	1 (4.4)	1	1.00	1	1	1	E (Poor)
TOTAL	**24**						

A length frequency chart for brown trout recorded is provided in Figure 3.16 below.

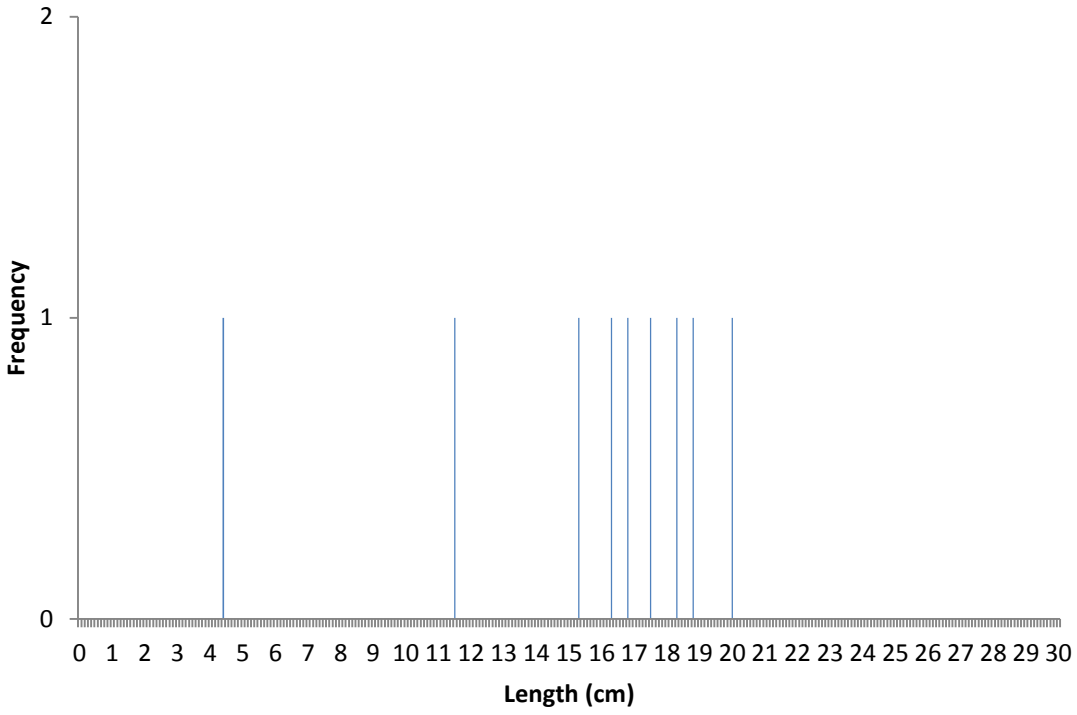

Figure 3.16. Length frequency of brown trout captured at Mill Lawn Brook (n=9).

3.5.3 Fish species of conservation importance

Table 3.20 highlights the fish species of conservation importance that were recorded at Mill Lawn Brook during the electric fishing survey.

Table 3.20. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Rhinefield.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	Y
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	N
Lamprey (Brook)	Habitats Directive (Annex II)	Y	N
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.6 Millersford Brook Site 1

3.6.1 Site description

Millersford Brook Site 1 is located within an area of broadleaf / mixed woodland (see Section 2.1.4); however, the area has been subject to intensive forestry activities and the drained channel is heavily incised. Table 3.21 below summarises the key physical characteristics of the 100 m survey site, and Appendix 6 provides a photographic record of habitat variability. The mean wetted width was 1.45 m, with an overall surveyed area of 144.5 m^2.

The stream was characterised by very shallow, uniform and channelised habitat, with few holding areas for fish and limited bankside cover. Furthermore, pH and conductivity during the time of the survey were very low. Flow conditions preceding and during the survey were very low. The relatively poor habitat quality was reflected in a lack of any fish captured during the survey.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.22.

Table 3.21. Habitat data recorded during the electric fishing survey at Millersford Brook Site 1.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	30	30	20	10	5	5		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent		10		20	50	20		
Instream vegetation: **0 %**		Silted? **Yes**		Substrate: **Stable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent		10	10	10	10	30	30	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	5			5				
Right bank %	5			5				
Total LB fish cover: **10 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl. fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **10 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / Simple / **Complex**				RB Bankface vegetation: Bare / Uniform / Simple / **Complex**				
LB Banktop vegetation: Bare / Uniform / Simple / **Complex**				RB Banktop vegetation: Bare / Uniform / Simple / **Complex**				
LB Overhanging Boughs (%): **5**			RB Overhanging Boughs (%): **5**			Canopy Cover (%): **5**		

Table 3.22. Physico-chemical parameters recorded during fish survey at Millersford Brook Site 1.

Parameter	Value
Temperature (°C)	16.3
Dissolved Oxygen (%)	99.2
Dissolved Oxygen (mgl^{-1})	9.73
pH	5.2
Conductivity (μScm^{-1})	64.9

3.6.2 Electric fishing survey results

No fish captured.

3.7 Millersford Brook Site 2

3.7.1 Site description

Millersford Brook Site 2 is located within an area of broadleaf / mixed woodland and moorland / heath (see Section 2.1.4). Table 3.23 below summarises the key physical characteristics of the 100 m survey site, and Appendix 7 provides a photographic record of habitat variability. The mean wetted width was 1.56 m, with an overall surveyed area of 156.4 m^2.

Substrate mainly comprised mixed gravel, pebble and cobble, with abundant bankside cover and marginal vegetation. Although the channel was relatively incised in areas; fish habitat appeared typical of salmonid habitat, and this was reflected in the fish survey data (Section 3.7.2). Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.24.

Table 3.23. Habitat data recorded during the electric fishing survey at Millersford Brook Site 2.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	20	10	10	10	20	30		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent		5	5	20	50	20		
Instream vegetation: **0 %**		Silted? **No**		Substrate: **Stable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent	10	40	30				20	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	40	20			10			
Right bank %	40	20			10			
Total LB fish cover: **70 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **70 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / Simple / **Complex**				RB Bankface vegetation: Bare / Uniform / Simple / **Complex**				
LB Banktop vegetation: Bare / Uniform / Simple / **Complex**				RB Banktop vegetation: Bare / Uniform / Simple / **Complex**				
LB Overhanging Boughs (%): **50**			RB Overhanging Boughs (%): **50**			Canopy Cover (%): **95**		

Table 3.24. Physico-chemical parameters recorded during fish survey at Millersford Brook Site 2.

Parameter	Value
Temperature (°C)	16.0
Dissolved Oxygen (%)	94.0
Dissolved Oxygen (mgl^{-1})	9.25
pH	7.92
Conductivity (μScm^{-1})	253.5

3.7.2 Electric fishing survey results

A total of 13 fish were captured at Millersford Brook Site 2, comprising a single species; brown trout.

The total number captured, length range (cm) and catch depletion density estimate is shown in Table 3.25. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

Table 3.25. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for brown trout recorded at Millersford Brook Site 2. National Fisheries Classification Scheme (NFCS) grades are also provided for brown trout.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density ($No./100m^2$)	NFCS Classification
Brown trout (1++)	10 (10.5-22.5)	10	0.91	9	11	6	C (Fair)
Brown trout (0+)	3 (5.7-9.4)	3	1.00	3	3	2	E (Poor)
TOTAL	**13**						

A length frequency chart for brown trout is provided in Figure 3.17 below.

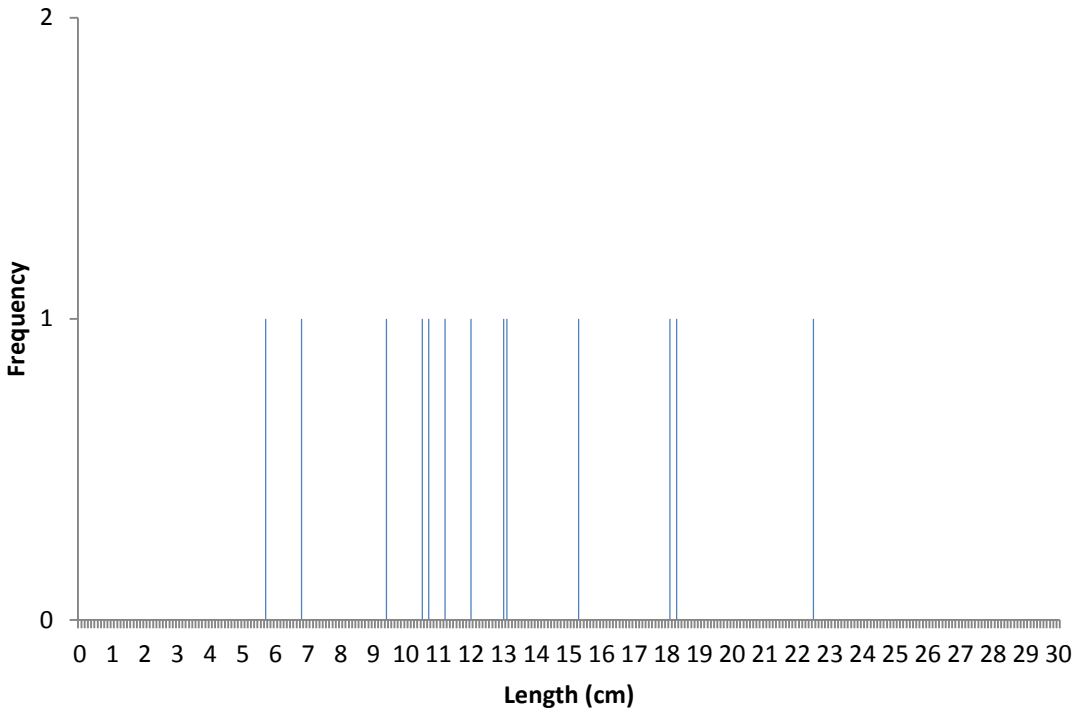

Figure 3.17. Length frequency of brown trout captured at Millersford Brook Site 2 (n=13).

3.7.3 Fish species of conservation importance

Table 3.26 highlights the fish species of conservation importance that were recorded at Millersford Brook Site 2 during the electric fishing survey.

Table 3.26. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Millersford Brook Site 2.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	N
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	N
Lamprey (Brook)	Habitats Directive (Annex II)	Y	N
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.8 Millersford Brook Site 3

3.8.1 Site description

Millersford Brook Site 3 is located within an area of broadleaf / mixed woodland and moorland / heath (see Section 2.1.4). Table 3.27 below summarises the key physical characteristics of the 100 m survey site, and Appendix 7 provides a photographic record of habitat variability. The mean wetted width was 1.85 m, with an overall surveyed area of 184.5 m^2.

Substrate mainly comprised mixed gravel, pebble and cobble, with abundant bankside cover and marginal vegetation. Although the channel was relatively incised in areas; fish habitat appeared typical of salmonid habitat, and this was reflected in the fish survey data (Section 3.8.2). Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.28.

Table 3.27. Habitat data recorded during the electric fishing survey at Millersford Brook Site 3.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	10	10	20	20	20	20		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent	10	10		20	40	20		
Instream vegetation: **0 %**		Silted? **Yes**		Substrate: **Stable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent		20	10		20	20	30	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	30	10			10	10		
Right bank %	30	10			10	10		
Total LB fish cover: **60 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **60 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / Simple / **Complex**				RB Bankface vegetation: Bare / Uniform / Simple / **Complex**				
LB Banktop vegetation: Bare / Uniform / Simple / **Complex**				RB Banktop vegetation: Bare / Uniform / Simple / **Complex**				
LB Overhanging Boughs (%): **50**			RB Overhanging Boughs (%): **50**			Canopy Cover (%): **90**		

Table 3.28. Physico-chemical parameters recorded during fish survey at Millersford Brook Site 3.

Parameter	Value
Temperature (°C)	16.7
Dissolved Oxygen (%)	99.0
Dissolved Oxygen (mgl^{-1})	9.62
pH	8.11
Conductivity (μScm^{-1})	299.1

3.8.2 Electric fishing survey results

A total of 56 fish were captured at Millersford Brook Site 3, comprising a single species; brown trout.

The total number captured, length range (cm) and catch depletion density estimate is shown in Table 3.29. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

Table 3.29. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for brown trout recorded at Millersford Brook Site 3. National Fisheries Classification Scheme (NFCS) grades are also provided for brown trout.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density ($No./100m^2$)	NFCS Classification
Brown trout (0+)	35 (5.7-8.8)	36	0.66	33	39	20	B (Good)
Brown trout (1++)	21 (10.5-20.6)	21	0.75	20	22	11	C (Fair)
TOTAL	**56**						

A length frequency chart for brown trout is provided in Figure 3.18 below.

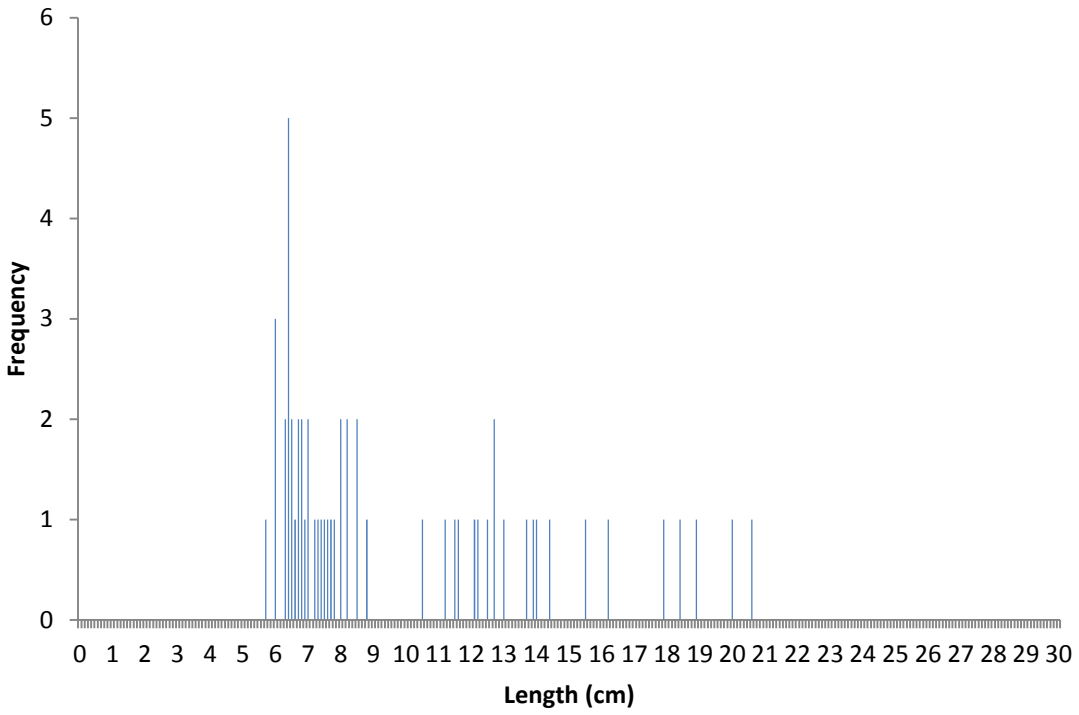

Figure 3.18. Length frequency of brown trout captured at Millersford Brook Site 3 (n=56).

3.8.3 Fish species of conservation importance

Table 3.30 highlights the fish species of conservation importance that were recorded at Millersford Brook Site 3 during the electric fishing survey.

Table 3.30. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Millersford Brook Site 3.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	N
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	N
Lamprey (Brook)	Habitats Directive (Annex II)	Y	N
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.9 Soldiers Bog

3.9.1 Site description

Soldiers Bog is located within an area of broadleaf / mixed woodland and moorland / heath; however, canopy cover was absent along the surveyed river stretch. The site is located toward the downstream extent of the works area (see Section 2.1.5). Table 3.31 below summarises the key physical characteristics of the 100 m survey site, and Appendix 9 provides a photographic record of habitat variability. The mean wetted width was 1.69 m, with an overall surveyed area of 169.1 m^2.

The river reach of this post-restoration site has been subject to in-channel modifications and raised bed levels. Substrate largely comprised imported gravel, pebble and cobbles overlaid on soft clay. A fine layer of fine silt was evident throughout. The channel comprised largely of shallow riffle and was dominated by instream vegetation. Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.32.

Table 3.31. Habitat data recorded during the electric fishing survey at Soldiers Bog.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	60	20	10		10			
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent		20			60	20		
Instream vegetation: **80 %**		Silted? **Yes**		Substrate: **Unstable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent	10		60			10	20	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	5			5				
Right bank %	5			5				
Total LB fish cover: **10 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **10 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / **Simple** / Complex				RB Bankface vegetation: Bare / Uniform / **Simple** / Complex				
LB Banktop vegetation: Bare / Uniform / **Simple** / Complex				RB Banktop vegetation: Bare / Uniform / **Simple** / Complex				
LB Overhanging Boughs (%): **0**			RB Overhanging Boughs (%): **0**			Canopy Cover (%): **0**		

Table 3.32. Physico-chemical parameters recorded during fish survey at Soldiers Bog.

Parameter	Value
Temperature (°C)	14.5
Dissolved Oxygen (%)	110.7
Dissolved Oxygen (mgl^{-1})	11.29
pH	8.05
Conductivity (μScm^{-1})	131.6

3.9.2 Electric fishing survey results

A total of 55 fish were captured at Soldiers Bog, comprising three species. Minnow was the most abundant species captured, followed by stone loach and bullhead (Figure 3.19).

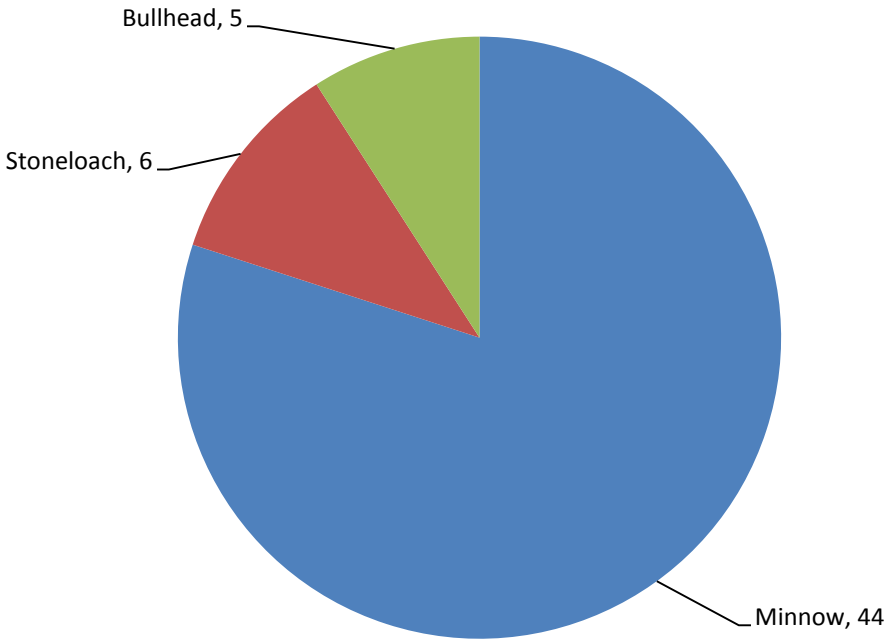

Figure 3.19. Species composition (total number captured) at Soldiers Bog.

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.33.

Table 3.33. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Soldiers Bog.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density (No./100m^2)
Minnow	44 (2.4-8.1)	55	0.54	35	75	33
Stone loach	6 (7.2-9.8)	N/A	N/A	N/A	N/A	N/A
Bullhead	5 (4.6-5.5)	N/A	N/A	N/A	N/A	N/A
TOTAL	**55**					

A length frequency chart for Minnow is provided in Figure 3.20 below.

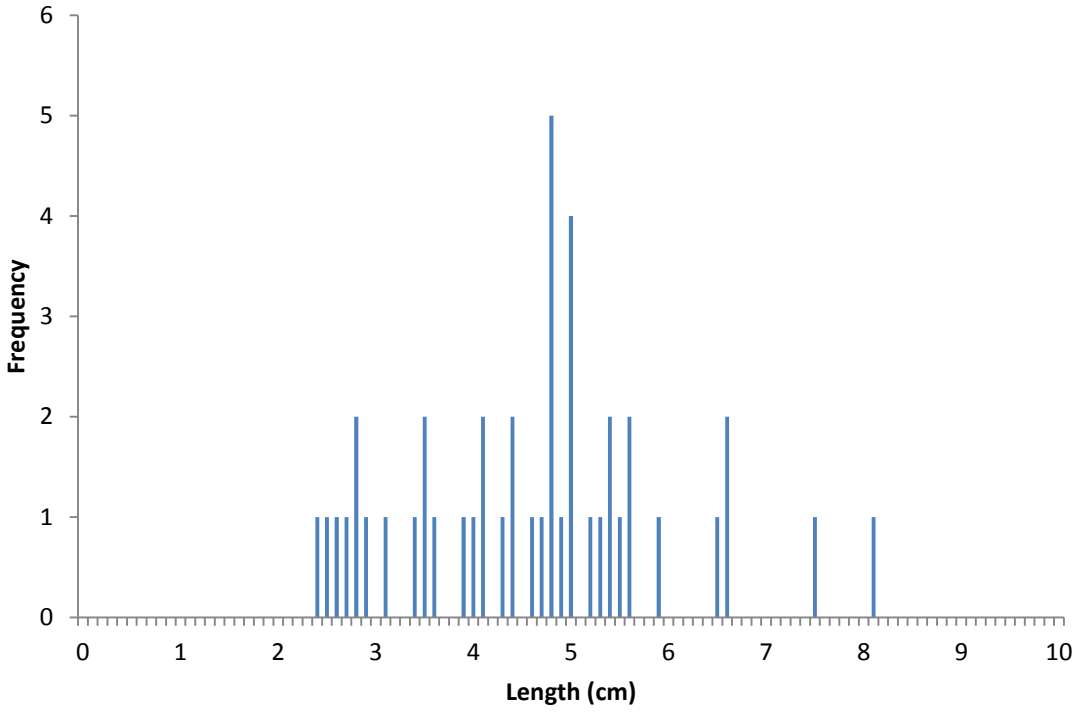

Figure 3.20. Length frequency of minnow captured at Soldiers Bog (n=44).

3.9.3 Fish species of conservation importance

Table 3.34 highlights the fish species of conservation importance that were recorded at Soldiers Bog during the electric fishing survey.

Table 3.34. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Soldiers Bog.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	N
Bullhead	Habitats Directive (Annex II)	Y	Y
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	N
Lamprey (Brook)	Habitats Directive (Annex II)	Y	N
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.10 Wootton Phase 1 Site 1

3.10.1 Site description

Wootton Phase 1 Site 1 is located within an area of broadleaf / mixed woodland (see Section 2.1.6). Table 3.35 below summarises the key physical characteristics of the 100 m survey site, and Appendix 10 provides a photographic record of habitat variability. The mean wetted width was 2.16 m, with an overall surveyed area of 216.4 m^2.

This site was a post-recent restoration works site. It is understood that the works at the survey site comprised reinstatement of a historic meandering channel. Substrate largely comprised gravel, pebble and cobbles overlaid on soft clay. Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.36.

Table 3.35. Habitat data recorded during the electric fishing survey at Wootton Phase 1 Site 1.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	20	40	20	10	5	5		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent	10	10		50	30			
Instream vegetation: **2 %**		Silted? **Yes**		Substrate: **Stable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent		5	5	10		40	40	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	10							
Right bank %	10							
Total LB fish cover: **10 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **10 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / **Simple** / Complex				RB Bankface vegetation: Bare / Uniform / **Simple** / Complex				
LB Banktop vegetation: Bare / Uniform / **Simple** / Complex				RB Banktop vegetation: Bare / Uniform / **Simple** / Complex				
LB Overhanging Boughs (%): **10**			RB Overhanging Boughs (%): **10**			Canopy Cover (%): **90**		

Table 3.36. Physico-chemical parameters recorded during fish survey at Wootton Phase 1 Site 1.

Parameter	Value
Temperature (°C)	14.5
Dissolved Oxygen (%)	102.5
Dissolved Oxygen (mgl^{-1})	10.4
pH	8.14
Conductivity (μScm^{-1})	123.1

3.10.2 Electric fishing survey results

A total of 352 fish were captured at Wootton Phase 1 Site 1, comprising six species. Bullhead was the most abundant species captured, followed by brown trout and stone loach (Figure 3.21).

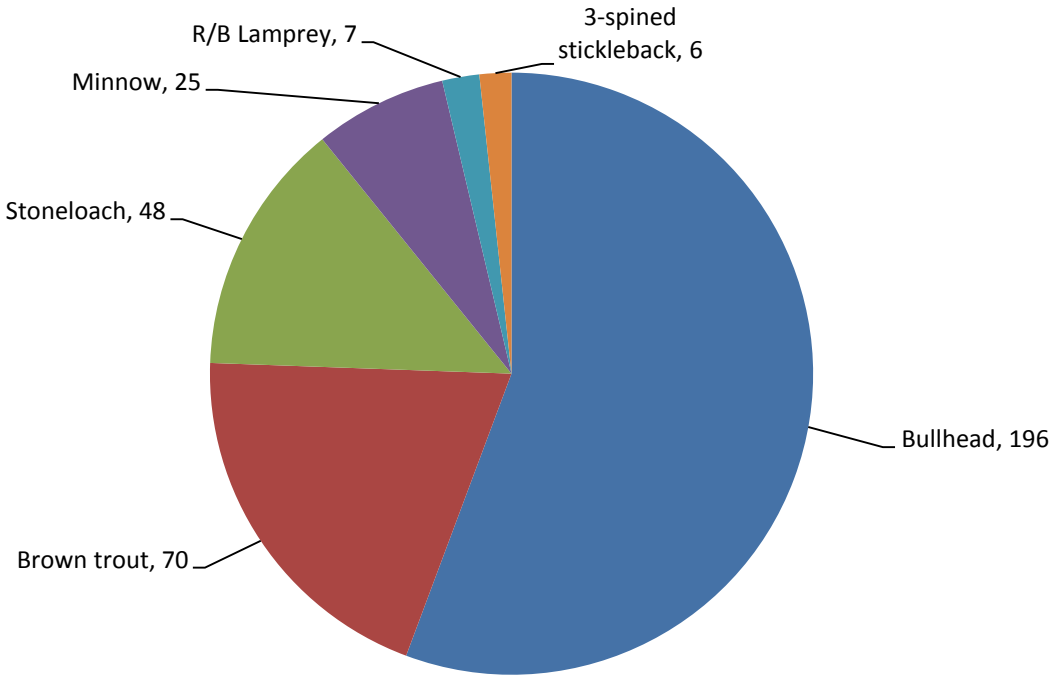

Figure 3.21. Species composition (total number captured) at Wootton Phase 1 Site 1.

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.37. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

Table 3.37. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Wootton Phase 1 Site 1. National Fisheries Classification Scheme (NFCS) grades are also provided for brown trout.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density (No./100m^2)	NFCS Classification
Bullhead	196 (2.3-7.4)	439	0.18	150	728	203	N/A
Brown trout (0+)	64 (3.9-9.5)	69	0.57	61	77	32	B (Good)
Stone loach	48 (2.8-10.2)	63	0.37	39	88	29	N/A
Minnow	25 (2.5-7.9)	27	0.54	21	33	12	N/A
R/B lamprey	7 (9.0-12.5)	N/A	N/A	N/A	N/A	N/A	N/A
3-spined stickleback	6 (2.6-3.0)	N/A	N/A	N/A	N/A	N/A	N/A
Brown trout (1++)	6 (10.7-20.5)	6	0.67	5	7	3	D (Fair/Poor)
TOTAL	**352**						

Length frequency charts for the most abundant fish species recorded are provided in Figure 3.22 to Figure 3.25 below.

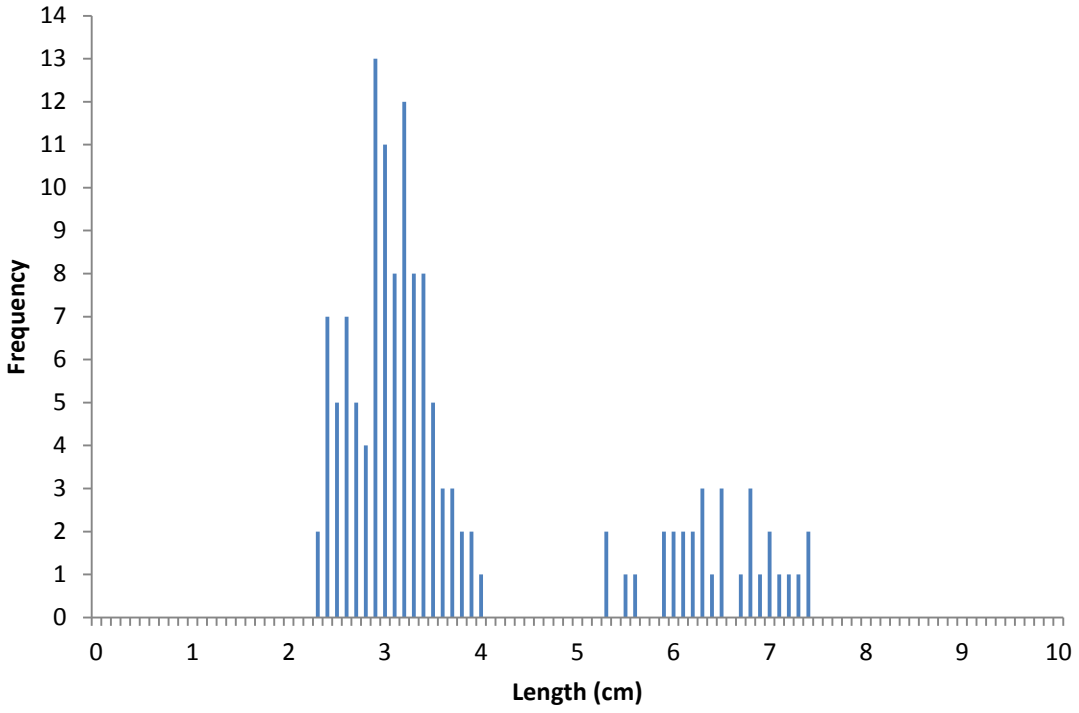

Figure 3.22. Length frequency of bullhead captured at Wootton Phase 1 Site 1 (n=137).

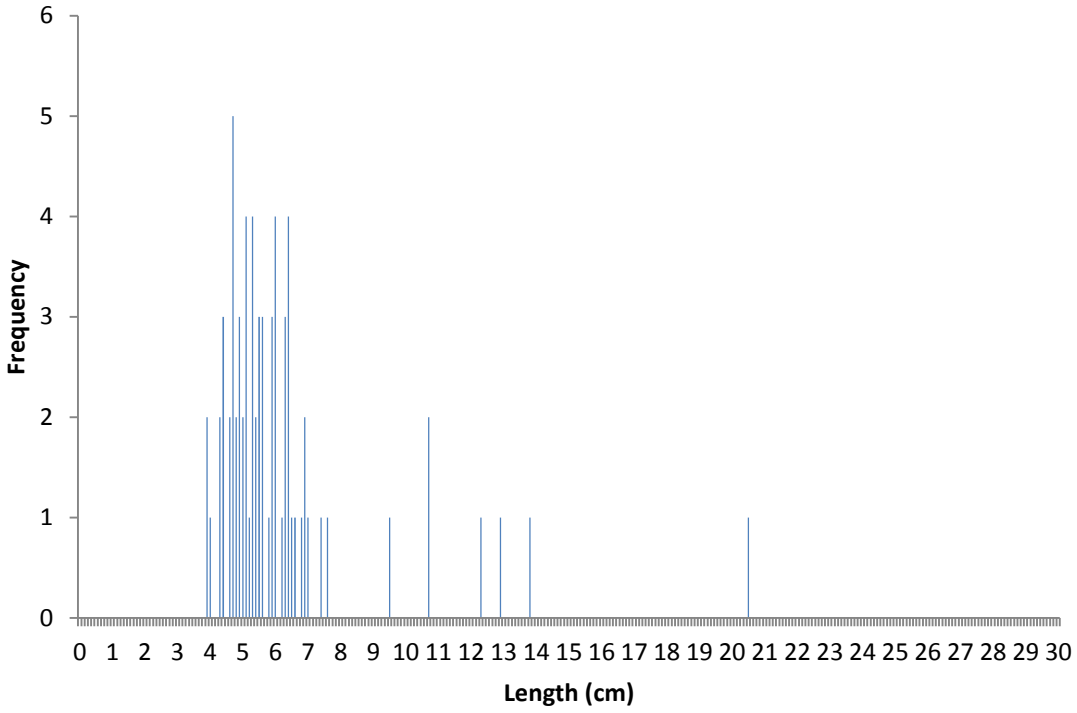

Figure 3.23. Length frequency of brown trout captured at Wootton Phase 1 Site 1 (n=70).

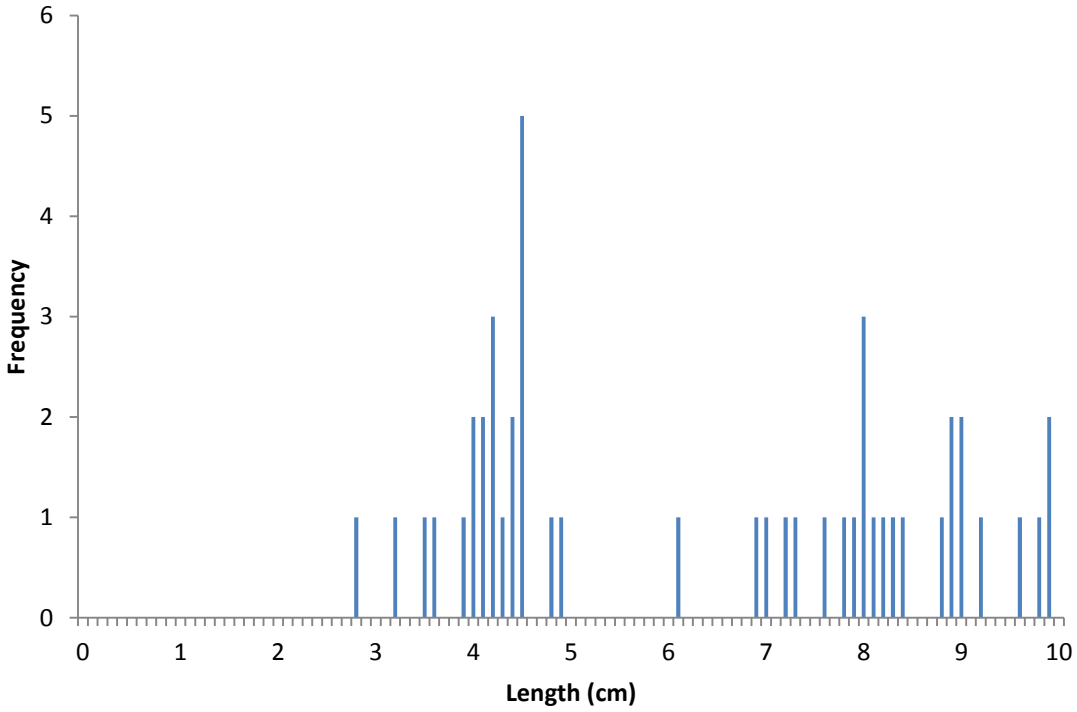

Figure 3.24. Length frequency of stone loach captured at Wootton Phase 1 Site 1 (n=48).

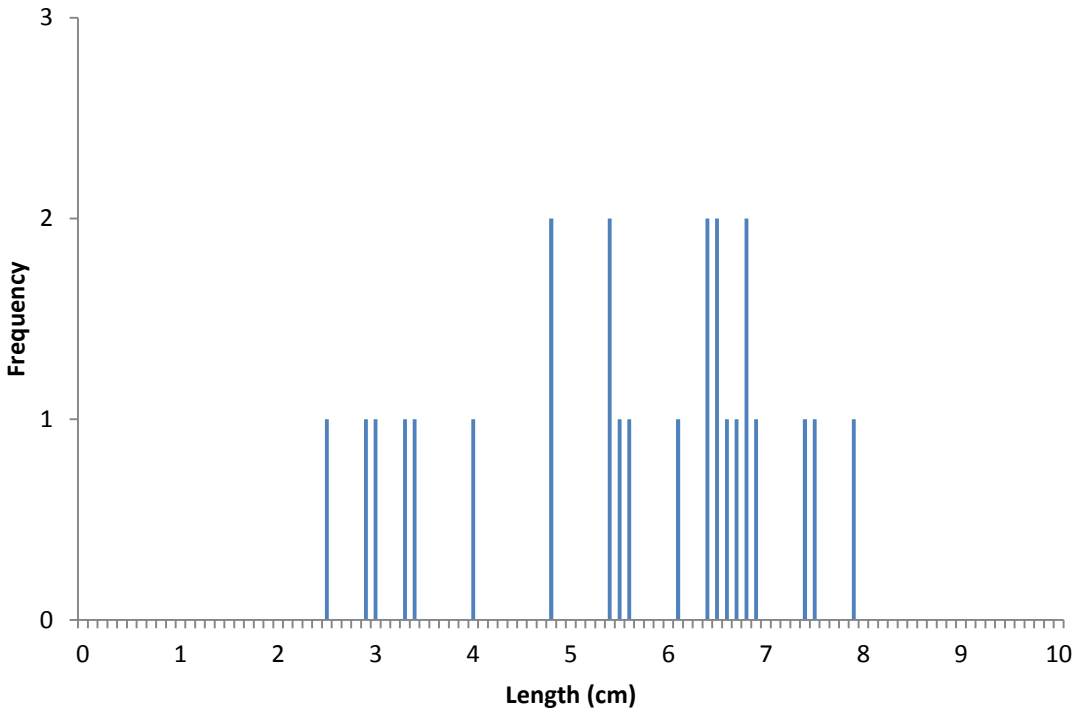

Figure 3.25. Length frequency of minnow captured at Wootton Phase 1 Site 1 (n=25).

3.10.3 Fish species of conservation importance

Table 3.38 highlights the fish species of conservation importance that were recorded at Wootton Phase 1 Site 1 during the electric fishing survey.

Table 3.38. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Wootton Phase 1 Site 1.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	Y
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	N
Lamprey (Brook)	Habitats Directive (Annex II)	Y	Y
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.11 Wootton Phase 1 Site 2

3.11.1 Site description

Wootton Phase 1 Site 2 is located within an area of rough pasture (see Section 2.1.6). Table 3.39 below summarises the key physical characteristics of the 80 m survey site, and Appendix 11 provides a photographic record of habitat variability. The mean wetted width was 2.13 m, with an overall surveyed area of 138.67 m^2 (taking account of 15 m of inaccessible river channel).

Substrate mainly comprised gravel and pebble, with some sand and silt. Although the channel was relatively straight in areas; abundant bankside cover and marginal vegetation was present throughout, and stream characteristics appeared typical of salmonid habitat. Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.40.

Table 3.39. Habitat data recorded during the electric fishing survey at Wootton Phase 1 Site 2.

Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	30	30	10	10	10	10		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent	10	10	10	30	30	10		
Instream vegetation: **30 %**		Silted? **No**		Substrate: **Stable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent		10	10	10	10	30	30	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	30	5		5	10			
Right bank %	30	5		5	10			
Total LB fish cover: **50 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **50 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / Simple / **Complex**				RB Bankface vegetation: Bare / Uniform / Simple / **Complex**				
LB Banktop vegetation: Bare / Uniform / Simple / **Complex**				RB Banktop vegetation: Bare / Uniform / Simple / **Complex**				
LB Overhanging Boughs (%): **50**			RB Overhanging Boughs (%): **50**			Canopy Cover (%): **70**		

Table 3.40. Physico-chemical parameters recorded during fish survey at Wootton Phase 1 Site 2.

Parameter	Value
Temperature (°C)	14.5
Dissolved Oxygen (%)	102.5
Dissolved Oxygen (mgl^{-1})	10.4
pH	8.14
Conductivity (μScm^{-1})	123.1

3.11.2 Electric fishing survey results

A total of 146 fish were captured at Wootton Phase 1 Site 2, comprising five species. Bullhead was the most abundant species captured, followed by brown trout and minnow (Figure 3.26).

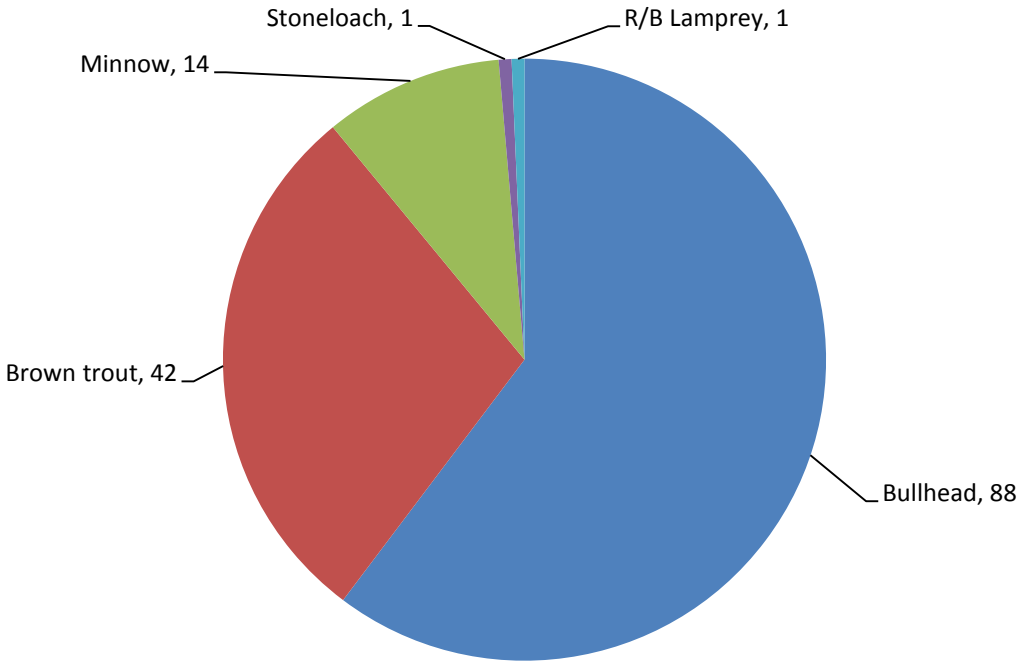

Figure 3.26. Species composition (total number captured) at Wootton Phase 1 Site 2.

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.41. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

Table 3.41. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Wootton Phase 1 Site 2. National Fisheries Classification Scheme (NFCS) grades are also provided for brown trout.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density (No./100m^2)	NFCS Classification
Bullhead	88	150	0.25	63	237	108	N/A
Brown trout (1++)	24	24	0.83	23	25	17	B (Good)
Brown trout (0+)	18	18	0.86	18	19	13	C (Fair)
Minnow	14	14	0.74	13	15	10	N/A
Stone loach	1	N/A	N/A	N/A	N/A	N/A	N/A
R/B lamprey	1	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**146**						

Length frequency charts for bullhead and brown trout are provided in Figure 3.27 and Figure 3.28 below.

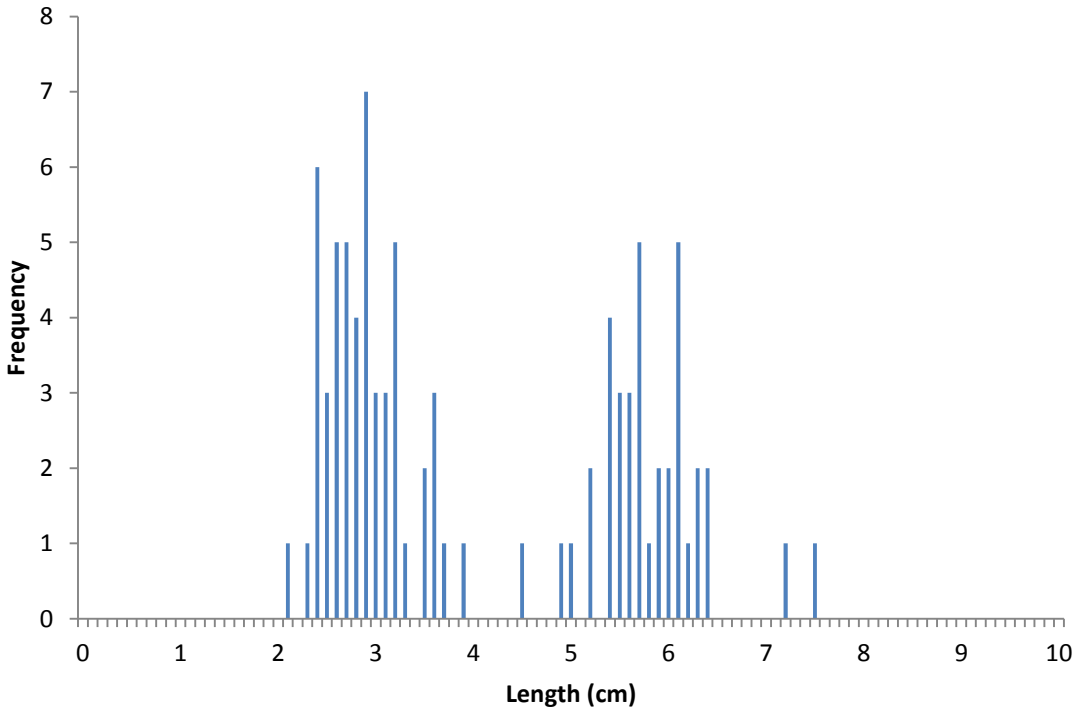

Figure 3.27. Length frequency of bullhead captured at Wootton Phase 1 Site 2 (n=88).

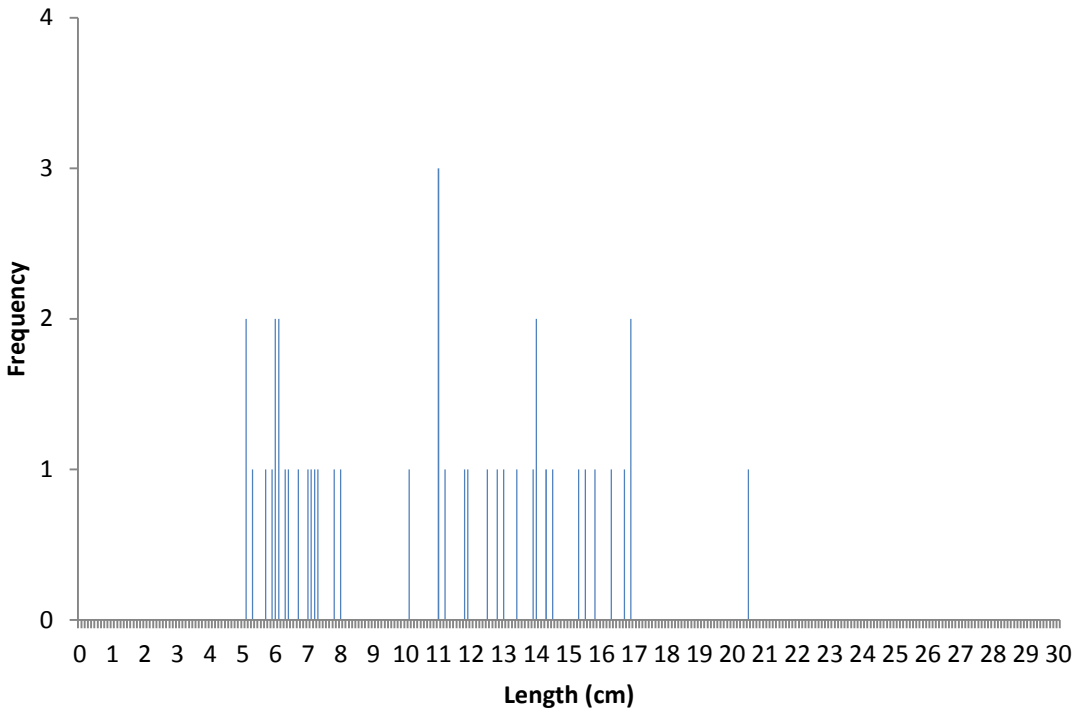

Figure 3.28. Length frequency of brown trout captured at Wootton Phase 1 Site 2 (n=42).

3.11.3 Fish species of conservation importance

Table 3.42 highlights the fish species of conservation importance that were recorded at Wooton Phase 1 Site 2 during the electric fishing survey.

Table 3.42. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Wootton Phase 1 Site 2.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	Y
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	N
Lamprey (Brook)	Habitats Directive (Annex II)	Y	Y
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.12 Wootton Phase 2 Site 1

3.12.1 Site description

Wootton Phase 2 Site 1 (referred to in previous reports as Wootton Phase 2) is located within an area of broadleaf / mixed woodland (see Section 2.1.7). Table 3.43 below summarises the key physical characteristics of the 100 m survey site, and Appendix 12 provides a photographic record of habitat variability. The mean wetted width was 3.75 m, with an overall surveyed area of 374.5 m^2.

Substrate mainly comprised gravel and pebble, with some sand and silt. Although the channel was relatively straight; abundant bankside cover, marginal vegetation and holding pools were present throughout, and stream characteristics appeared typical of salmonid habitat. Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in Table 3.44.

Table 3.43. Habitat data recorded during the electric fishing survey at Wootton Phase 2 Site 1.

Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	10	20	20	20	20	10		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent		5	5	40	50			
Instream vegetation: **0 %**		Silted? **No**		Substrate: **Stable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent		10	10	10	10	50	10	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	40	5			5			
Right bank %	40	5			5			
Total LB fish cover: **50 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **50 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / Simple / **Complex**				RB Bankface vegetation: Bare / Uniform / Simple / **Complex**				
LB Banktop vegetation: Bare / Uniform / Simple / **Complex**				RB Banktop vegetation: Bare / Uniform / Simple / **Complex**				
LB Overhanging Boughs (%): **25**			RB Overhanging Boughs (%): **25**			Canopy Cover (%): **90**		

Table 3.44. Physico-chemical parameters recorded during fish survey at Wootton Phase 2 Site 1.

Parameter	Value
Temperature (°C)	14.4
Dissolved Oxygen (%)	98.7
Dissolved Oxygen (mgl^{-1})	10.05
pH	7.66
Conductivity (μScm^{-1})	121.9

3.12.2 Electric fishing survey results

A total of 163 fish were captured at Wootton Phase 2 Site 1, comprising five species. Bullhead was the most abundant species captured, followed by brown trout, stone loach and minnow (Figure 3.29).

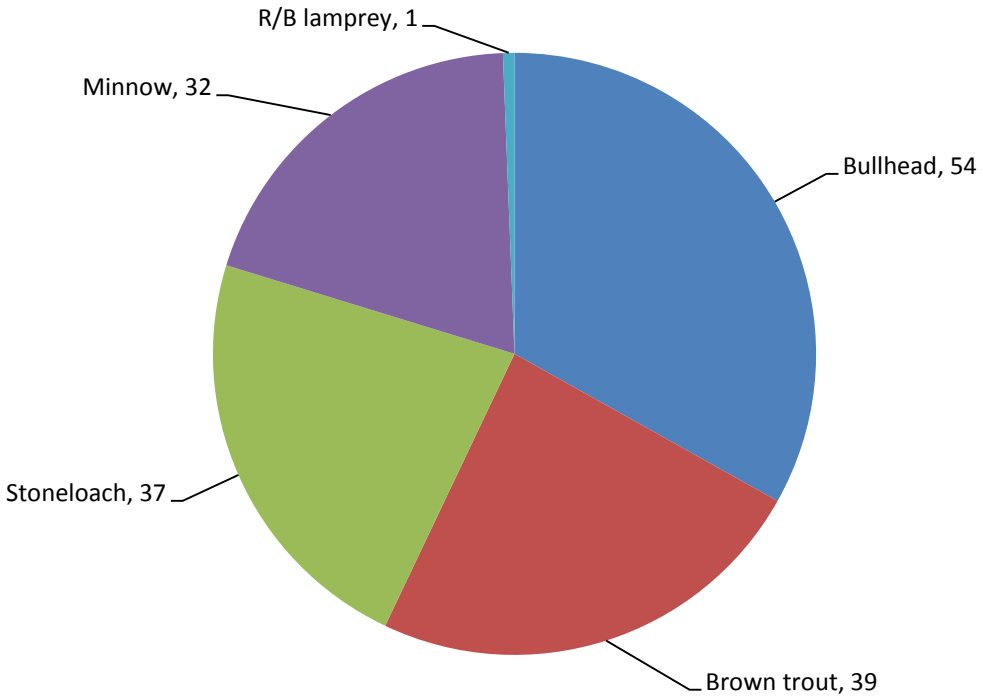

Figure 3.29. Species composition (total number captured) at Wootton Phase 2 Site 1.

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.45. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

Table 3.45. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Wootton Phase 2 Site 1. National Fisheries Classification Scheme (NFCS) grades are also provided for brown trout.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density (No./100m^2)	NFCS Classification
Bullhead	54 (2.2-7.4)	74	0.35	43	105	20	N/A
Stone loach	37 (1.9-10.9)	38	0.66	35	41	10	N/A
Minnow	32 (4.1-9.0)	33	0.63	29	37	9	N/A
Brown trout (1++)	24 (10.1-20.5)	25	0.60	21	29	7	C (Fair)
Brown trout (0+)	15 (4.2-9.6)	15	0.65	13	17	4	D (Fair/Poor)
R/B lamprey	1 (8.0)	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**163**						

Length frequency charts for the most abundant fish species recorded are provided in Figure 3.30 to Figure 3.33 below.

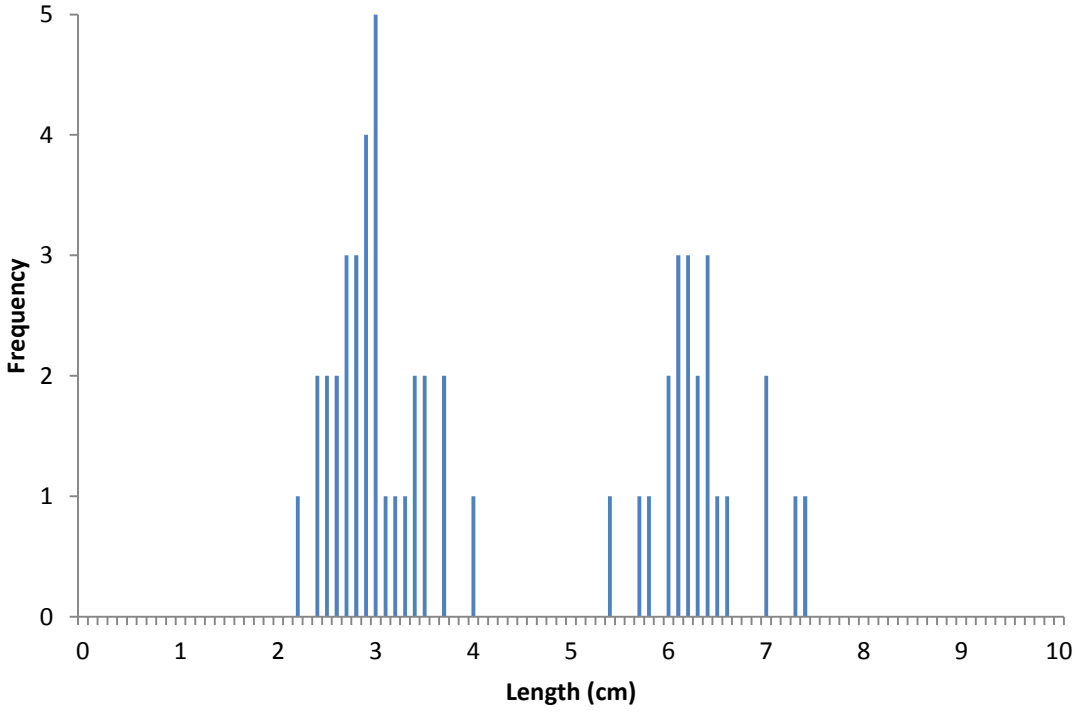

Figure 3.30. Length frequency of bullhead captured at Wootton Phase 2 Site 1 (n=54).

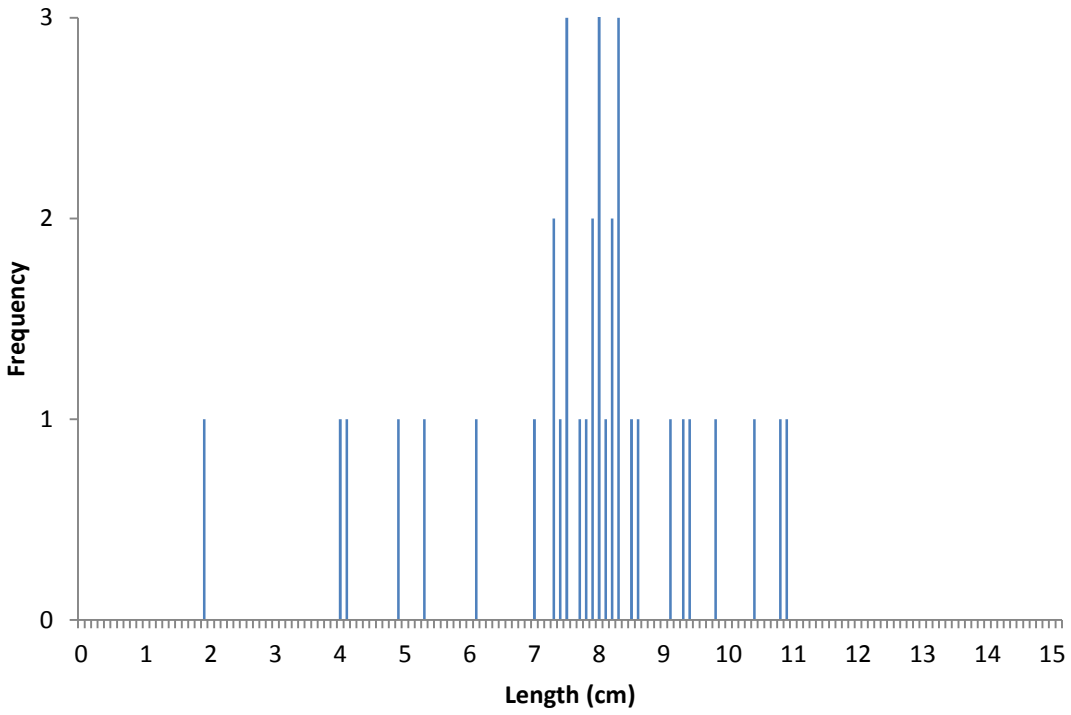

Figure 3.31. Length frequency of stone loach captured at Wootton Phase 2 Site 1 (n=37).

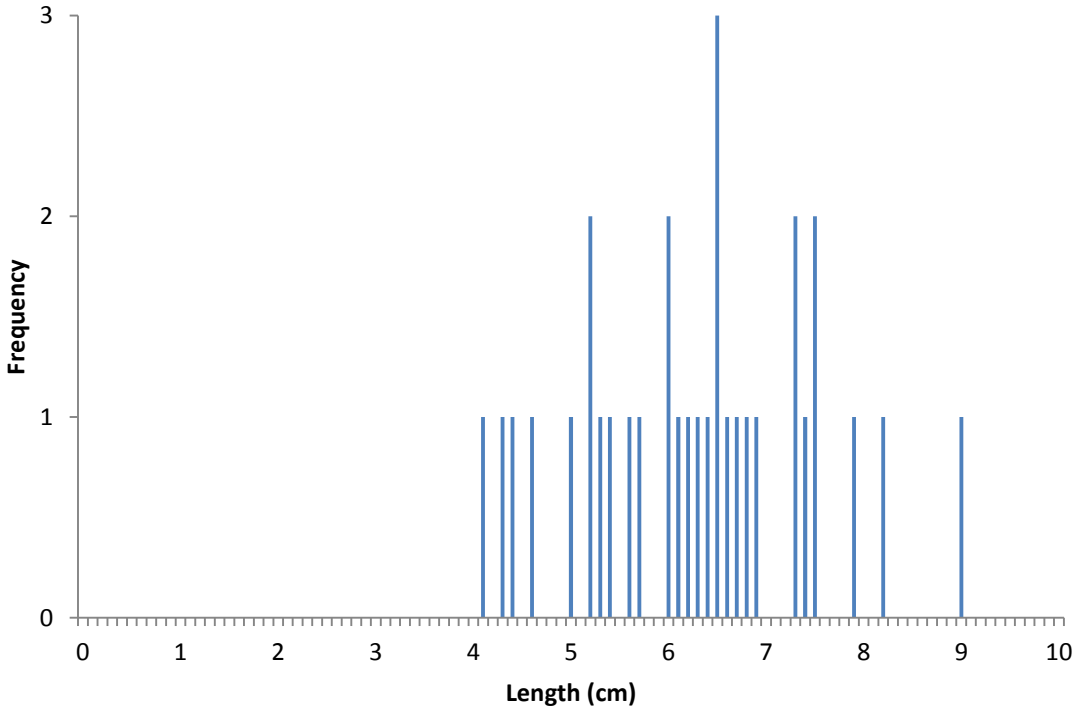

Figure 3.32. Length frequency of minnow captured at Wootton Phase 2 Site 1 (n=32).

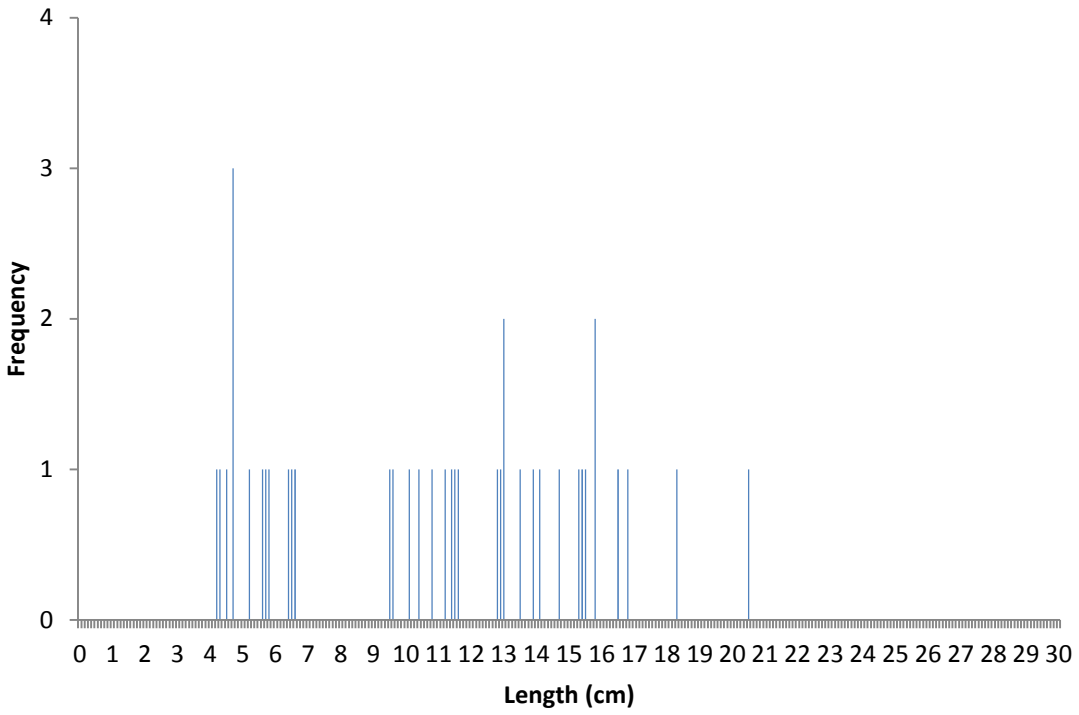

Figure 3.33. Length frequency of brown trout captured at Wootton Phase 2 Site 1 (n=39).

3.12.3 Fish species of conservation importance

Table 3.46 highlights the fish species of conservation importance that were recorded at Wootton Phase 2 Site 1 during the electric fishing survey.

Table 3.46. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Wootton Phase 2.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	Y
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	N
Lamprey (Brook)	Habitats Directive (Annex II)	Y	Y
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

3.13 Wootton Phase 2 Site 2

3.13.1 Site description

Wootton Phase 2 Site 2 is located within an area of broadleaf / mixed woodland (see Section 2.1.7). Table 3.47 below summarises the key physical characteristics of the 70 m survey site, and Appendix 12 provides a photographic record of habitat variability. The mean wetted width was 2.59 m, with an overall surveyed area of 181.1 m^2.

The survey site was located in a remnant meander which has been reactivated as the main channel as part of the restoration works at this location. The old channel has been filled in and the new channel excavated to reinstate historic meanders with an elevated bed profile. Substrate was largely comprised of gravel, pebble and cobbles overlaid on soft clay. A fine layer of fine silt was evident throughout. Flow conditions preceding and during the survey were low.

Physico-chemical parameters recorded during the time of the survey are provided in **Table 3.48**.

Table 3.47. Habitat data recorded during the electric fishing survey at Wootton Phase 2 Site 2.

Depths (cm)	**< 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**> 50**		
Percent	20	30	20	20	5	5		
Substrate	**Organic**	**Silt**	**Sand**	**Gravel**	**Pebble**	**Cobble**	**Boulder**	**Bedrock**
Percent	10	30	10	30	20			
Instream vegetation: 1**0 %**		Silted? **No**		Substrate: **Unstable** & **Uncompacted**				
Flow	**SM**	**DP**	**SP**	**DG**	**SG**	**RU**	**RI**	**TO**
Percent	10	5	5	10	10	30	30	
Speed / Level: **Low**	FLOW DEFINITIONS: SM <10cm still/eddy, smooth, silent; DP ≥30cm slow/eddy, smooth, silent; SP <30cm slow/eddy, smooth, silent; DG ≥30cm mod/fast, smooth, silent; SG <30cm mod/fast, smooth, silent; RU fast, unbroken waves, silent; RI fast, broken waves, audible; TO white water, noisy, substrate invisible							
Bankside cover	**UC**	**DR**	**BA**	**MA**	**RT**	**RK**	**OTH**	
Left bank %	5	5		10	5			
Right bank %	5	5		10	5			
Total LB fish cover: **25 %**	DEFINITIONS: UC undercut banks; DR vegetation rooted in riparian zone, branches/leaves touch or almost touch surface; BA no cover or fish can't get to cover due to lack of water; MA veg rooted in stream, excl fully aquatic veg; RT cover provided by exposed roots; RK cover from rocks within bank structure; OTH other bankside cover							
Total RB fish cover: **25 %**								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / **Simple** / Complex				RB Bankface vegetation: Bare / Uniform / **Simple** / Complex				
LB Banktop vegetation: Bare / Uniform / **Simple** / Complex				RB Banktop vegetation: Bare / Uniform / **Simple** / Complex				
LB Overhanging Boughs (%): **5**			RB Overhanging Boughs (%): **5**			Canopy Cover (%): **50**		

Table 3.48. Physico-chemical parameters recorded during fish survey at Wootton Phase 2 Site 2.

Parameter	Value
Temperature (°C)	14.4
Dissolved Oxygen (%)	98.0
Dissolved Oxygen (mgl^{-1})	9.97
pH	8.4
Conductivity (μScm^{-1})	120.2

3.13.2 Electric fishing survey results

A total of 235 fish were captured at Wootton Phase 2 Site 2, comprising six species. Stone loach was the most abundant species captured, followed by bullhead and brown trout (Figure 3.34).

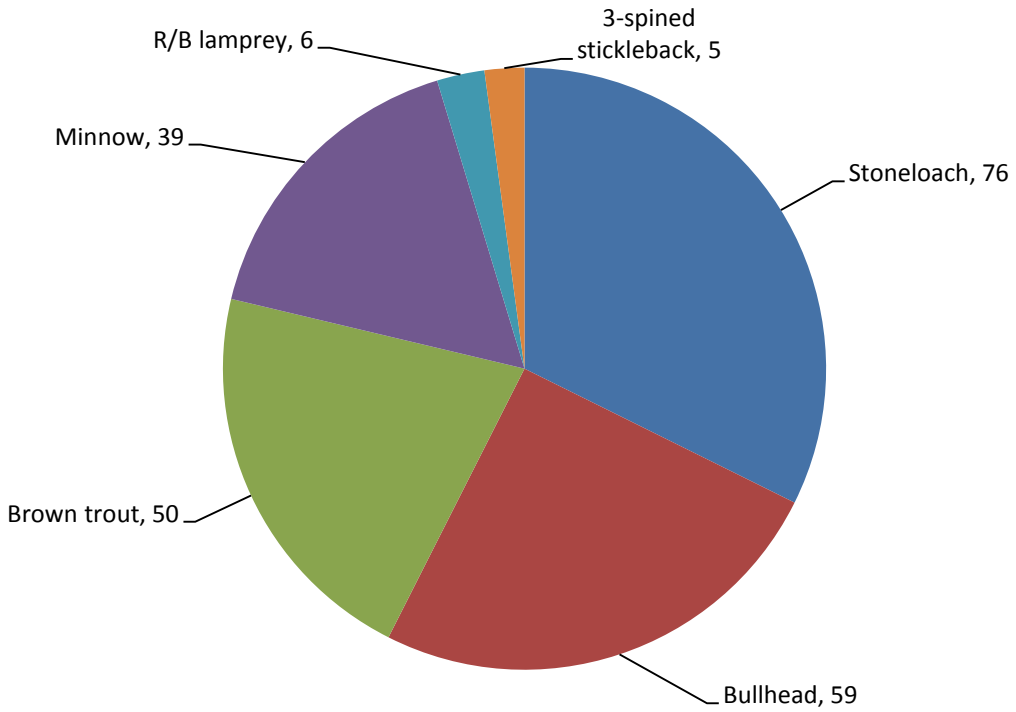

Figure 3.34. Species composition (total number captured) at Wootton Phase 2 Site 2.

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.49. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

Table 3.49. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Wootton Phase 2 Site 2. National Fisheries Classification Scheme (NFCS) grades are also provided for brown trout.

Species	No. captured (length range, cm)	Catch depletion population estimate	Catch depletion probability of capture	Catch depletion 95% LCI	Catch depletion 95% UCI	Catch depletion density (No./100m^2)	NFCS Classification
Stone loach	76 (2.5-11.5)	99	0.38	70	128	55	N/A
Bullhead	59 (3.0-8.6)	85	0.32	45	125	47	N/A
Minnow	39 (2.1-7.3)	40	0.68	37	43	22	N/A
Brown trout (0+)	39 (5.3-8.0)	40	0.68	37	43	22	B (Good)
Brown trout (1++)	11 (10.9-16.2)	11	0.73	10	12	6	C (Fair)
R/B lamprey	6 (9.0-11.5)	N/A	N/A	N/A	N/A	N/A	N/A
3-spined stickleback	5 (2.3-3.2)	N/A	N/A	N/A	N/A	N/A	N/A
TOTAL	**235**						

Length frequency charts for the most abundant fish species recorded are provided in Figure 3.35 to Figure 3.38 below.

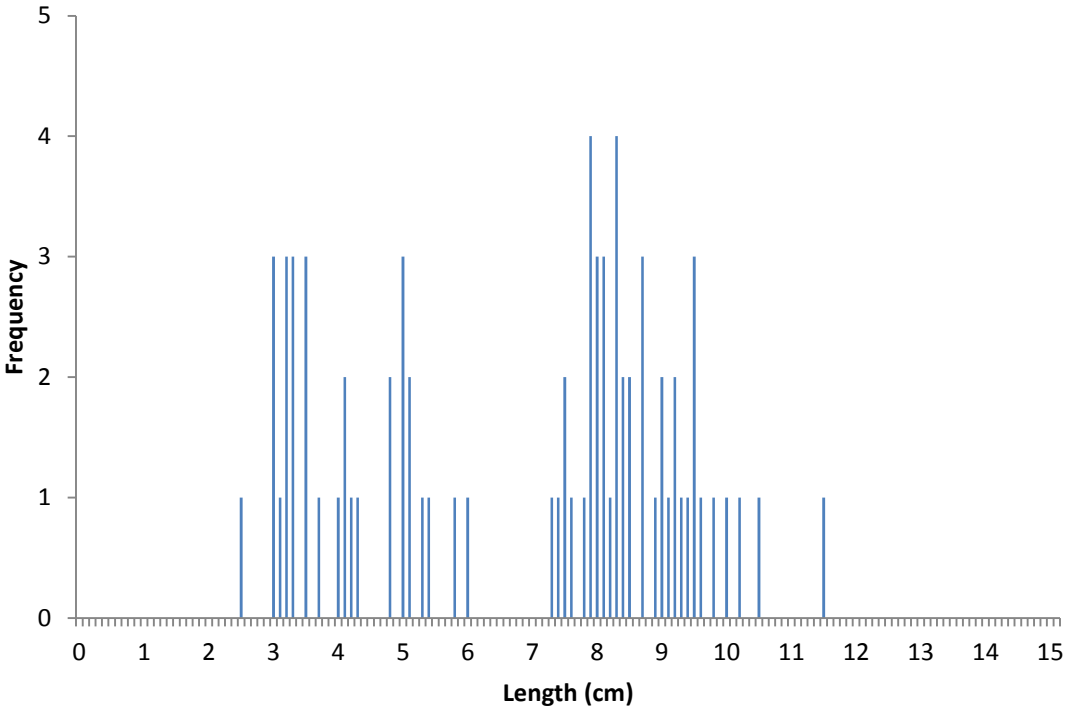

Figure 3.35. Length frequency of stone loach captured at Wootton Phase 2 Site 2 (n=76).

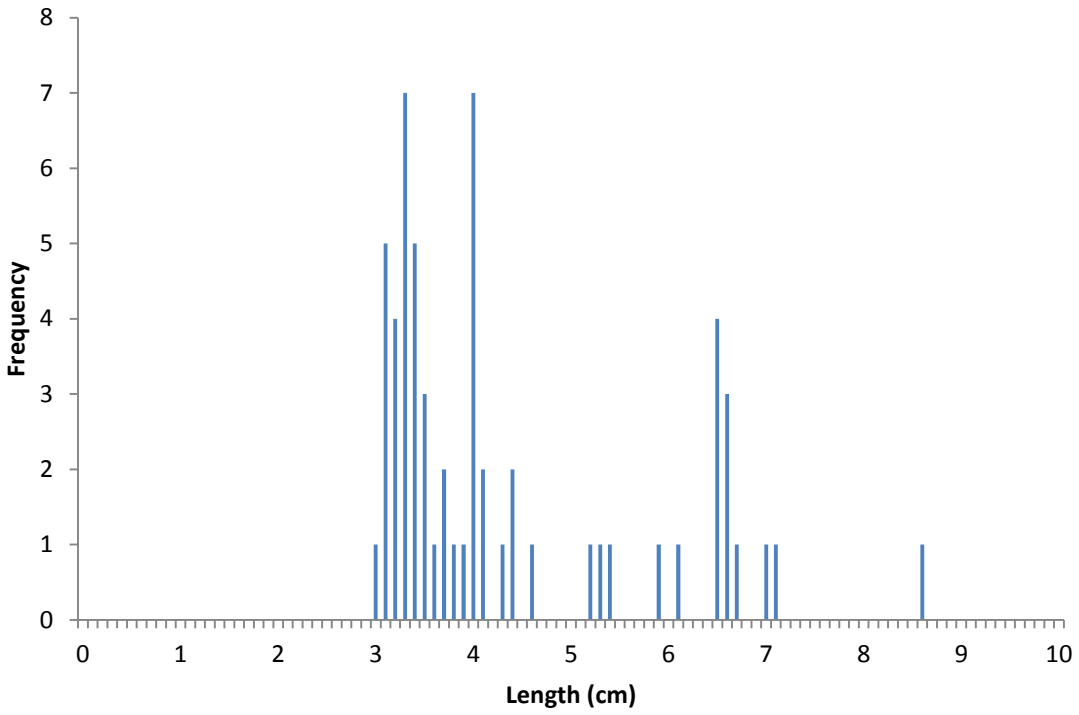

Figure 3.36. Length frequency of bullhead captured at Wootton Phase 2 Site 2 (n=59).

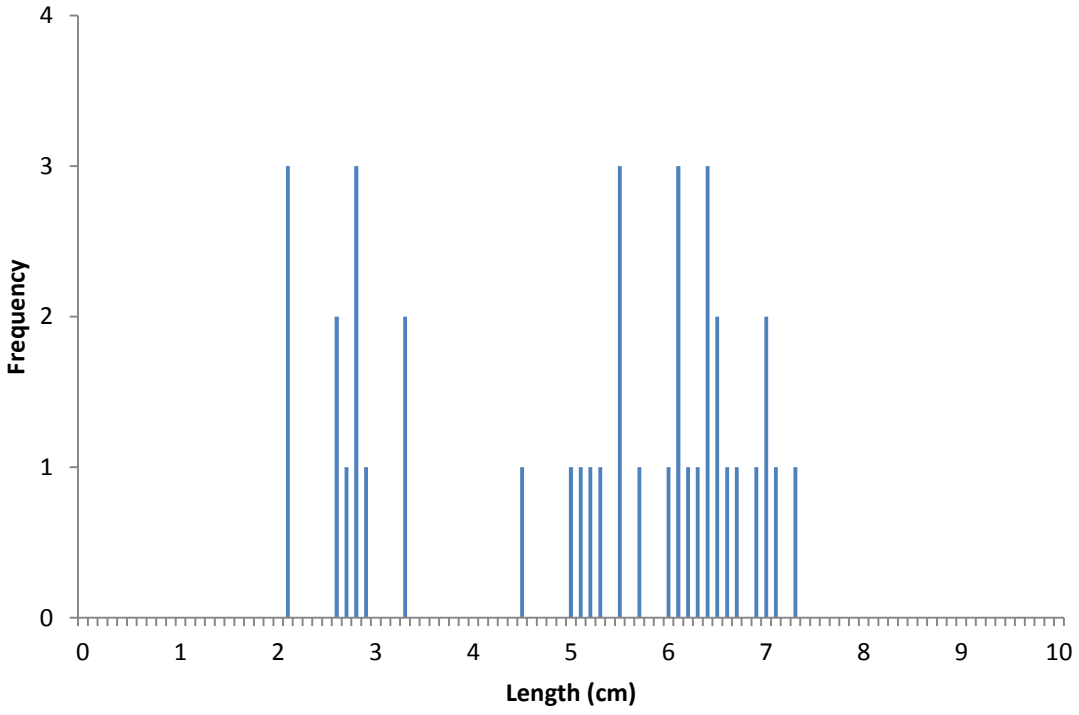

Figure 3.37. Length frequency of minnow captured at Wootton Phase 2 Site 2 (n=39).

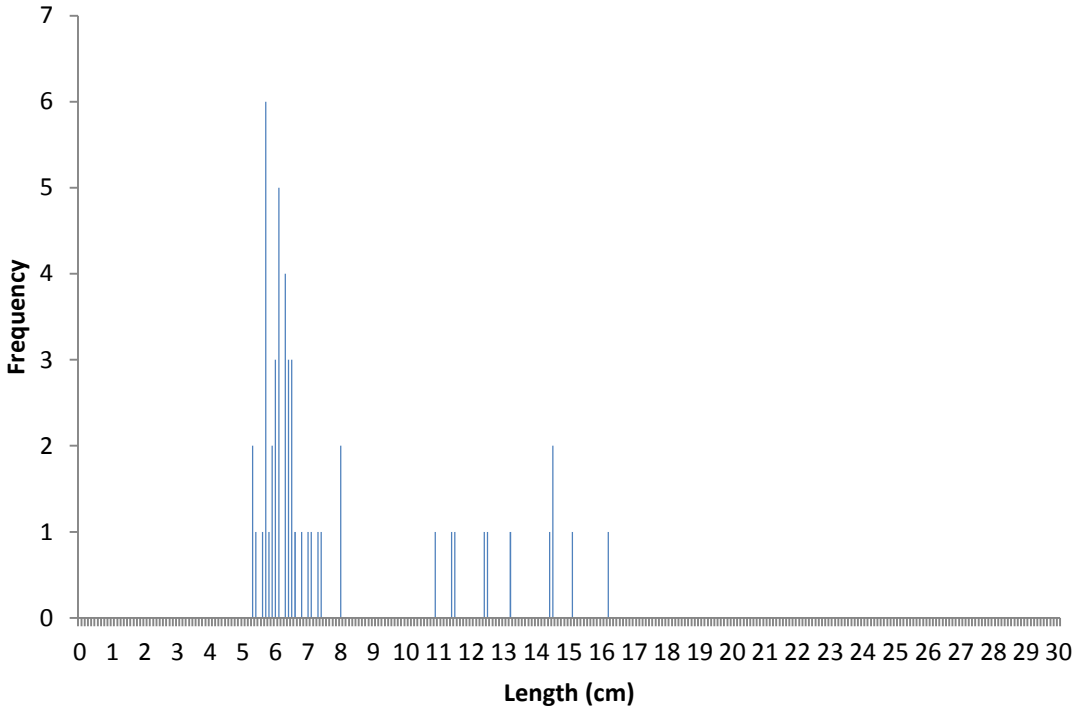

Figure 3.38. Length frequency of brown trout captured at Wootton Phase 2 Site 2 (n=50).

3.13.3 Fish species of conservation importance

Table 3.50 highlights the fish species of conservation importance that were recorded at Wootton Phase 2 Site 2 during the electric fishing survey.

Table 3.50. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Wootton Phase 2 Site 2.

Species	Conservation designation	Within natural range?[1]	Recorded?
Brown trout / Sea trout	UK BAP (Priority Species)	Y	Y
Bullhead	Habitats Directive (Annex II)	Y	Y
Eel	EC Eel Regulation (Eels [England and Wales] Regulations, IUCN Red List (Critically Endangered), UK BAP (Priority Species)	Y	N
Lamprey (Brook)	Habitats Directive (Annex II)	Y	Y
Lamprey (River)	Habitats Directive (Annex II)	Y[2]	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y[2]	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y[3]	N

[1] Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

[2] River and sea lamprey are anadromous species found around the coast of the UK and, therefore, both species could potentially colonise the New Forest streams. However, it is generally accepted that brook lamprey is the only species to inhabit the New Forest streams. All lamprey recorded are, therefore, assumed to be brook lamprey.

[3] As an anadromous species, salmon have the ability to colonise any rivers with access to/from the sea. However, it is generally accepted that sea trout is the only migratory salmonid species present within the New Forest Streams.

4. RESULTS – INVERTEBRATE SURVEYS

4.1 Species composition

Macroinvertebrate species composition for each site is shown in Table 4.1.

Table 4.1. Macroinvertebrate species composition at all sites in the New Forest, surveyed during September 2018.

Group	Species	WOO 1-1	WOO 1-2	WOO 2-1	WOO 2-2	HAR1	HAR2	MLB	SOL	LAT1	LAT2	MIL1	MIL2	MIL3
Horsehair Worms	Nematomorpha sp.			1										
Roundworms	Nematoda sp.													2
Snails	*Potamopyrgus antipodarum* (J.E.Gray, 1843)	7						60					17	632
	Radix balthica (Linnaeus, 1758)	1				13			2					
	Ancylus fluviatilis O.F. Müller, 1774	2		2										
Bivalves	Pisidium sp.	28	4	24	2		10	5	2	8			1	6
Worms	Oligochaeta	128	204	152	24	1	38	7	3	84	16	6	79	98
Leeches	*Glossiphonia complanata* (Linnaeus, 1758)	2	4	1										
	Helobdella stagnalis (Linnaeus, 1758)	2	20				3			14	3			7
	Erpobdellidae sp.		16	5										
	Erpobdella octoculata (Linnaeus, 1758)		4	8						2	1			
Water Mites	Hydracarina			1				3						3
Ostracods	Ostracoda sp.	2	36						1					
Crustaceans	Asellus sp.							1						
	Asellus aquaticus (Linnaeus, 1758)	2		9						9				
	Proasellus meridianus (Racovitza, 1919)		19											
	Crangonyx pseudogracilis Bousfield, 1958	1								180			49	53
	Gammarus pulex (Linnaeus, 1758)	212	528	124	44			19	19	12	232			
	Niphargus aquilex Schiodte, 1855			10										
Mayflies	Siphlonuridae sp.	1												
	Baetidae sp.		7											
	Baetis rhodani (Pictet, 1843-1845)	6	23	1	4								9	20
	Centroptilum luteolum (Müller, 1776)		1											
	Procloeon pennulatum (Eaton, 1870)					2								
	Leptophlebiidae sp.							8					1	1
	Leptophlebia sp.						29							
	Paraleptophlebia sp.			2		7			7	5				
	Serratella ignita (Poda, 1761)		68	1	1									
Stoneflies	Nemouridae sp.	56	172	64			4	5			2		33	27

Group	Species	WOO 1-1	WOO 1-2	WOO 2-1	WOO 2-2	HAR1	HAR2	MLB	SOL	LAT1	LAT2	MIL1	MIL2	MIL3
	Leuctra sp.								2				4	17
	Leuctra fusca (Linnaeus, 1758)	20	19	52	7		32	14	11		7		130	278
	Siphonoperla torrentium (Pictet, 1841)													3
Dragonflies and Damselflies	Coenagrionidae sp.		1			17	2		2	1			1	
	Ischnura elegans (Vander Linden, 1820)													2
	Coenagrion sp.											21		
	Calopteryx sp.	5	48	20				1						
	Calopteryx virgo (Linnaeus, 1758)		1										1	
	Anisoptera sp.					1			7					
	Cordulegaster boltonii (Donovan, 1807)		1				1	4		3		9	3	7
	Corduliidae sp.									1				
	Sympetrum sp.											1		
True Bugs	*Hydrometra stagnorum* (Linnaeus, 1758)							2						
	Gerridae sp.					1	1							
	Aquarius najas (DeGeer, 1773)			1										
	Notonecta glauca Linnaeus, 1758					1								
	Notonecta maculata Fabricius, 1794											1		
	Notonecta obliqua Gallén in Thunberg, 1787		1									2		
	Corixidae sp.		1											
	Hesperocorixa linnaei (Fieber, 1848)		1											
	Hesperocorixa sahlbergi (Fieber, 1848)		1											
Water Beetles	*Agabus bipustulatus* (Linnaeus, 1767)											1	1	
	Orectochilus villosus (O.F. Müller, 1776)	7	1	16	1		3							
	Helophorus sp.		1						1		1		1	
	Hydrochus nitidicollis Mulsant, 1844		1											
	Hydraena gracilis Germar, 1824	4											2	3
	Hydraena nigrita Germar, 1824			1										
	Elodes sp.		2										11	3
	Cyphon sp.												4	
	Elmis aenea (Müller, 1806)	7	3										1	6
	Limnius volckmari (Panzer, 1793)	13	100	40			1						9	21

Group	Species	WOO 1-1	WOO 1-2	WOO 2-1	WOO 2-2	HAR1	HAR2	MLB	SOL	LAT1	LAT2	MIL1	MIL2	MIL3
	Oulimnius sp.	44	6	3		1			1	7			4	9
	Oulimnius tuberculatus (Müller, 1806)	8	2	3										15
	Chrysomelidae sp.											1		1
Alderflies	*Sialis lutaria* (Linnaeus, 1758)		1				1							
Caddisflies	Rhyacophila sp.												1	3
	Rhyacophila dorsalis (Curtis, 1834)		1		1								1	1
	Agapetus sp.	1	2											1
	Oxyethira sp.								4			1		
	Wormaldia sp.												1	
	Polycentropodidae sp.		2											27
	Cyrnus trimaculatus (Curtis, 1834)						1			18				2
	Plectrocnemia conspersa (Curtis, 1834)							1				6	12	12
	Polycentropus flavomaculatus (Pictet, 1834)											1	62	56
	Polycentropus irroratus (Curtis, 1835)												9	
	Polycentropus kingi McLachlan, 1881													9
	Hydropsyche sp.													1
	Hydropsyche angustipennis (Curtis, 1834)		1	1										1
	Hydropsyche siltalai Döhler, 1963	19	6	5	1						2		33	282
	Phryganeidae sp.									2				
	Lepidostoma hirtum (Fabricius, 1775)	76	260	12							3		9	35
	Limnephilidae sp.	3	7	8										1
	Hydatophylax infumatus (McLachlan, 1865)		11											
	Potamophylax group	2	1	1										
	Limnephilus lunatus Curtis, 1834	11												
	Silo sp.		1										1	10
	Silo pallipes (Fabricius, 1781)	4												
	Sericostoma personatum (Spence in Kirby & Spence, 1826)	16	20	2			2				1		5	24
	Leptoceridae sp.	7	1	10	2					1				3
	Athripsodes sp.												1	
	Mystacides sp.		2	2										6
	Adicella reducta (McLachlan, 1865)	1												

Group	Species	WOO 1-1	WOO 1-2	WOO 2-1	WOO 2-2	HAR1	HAR2	MLB	SOL	LAT1	LAT2	MIL1	MIL2	MIL3
	Oecetis sp.	1	1	36										
True Flies	Tipulidae	3	3				1		1			1	1	
	Pediciidae	1	5	1	1		1							1
	Psychodidae		1								1		1	1
	Ceratopogonidae	1	1									3		2
	Simuliidae	16	3	5	5		8	5	7			44	43	174
	Chironomidae	60	360	196	32	43	10	7	65	80	16	18	71	127
	Tabanidae	8		1			2		2	1			1	3
	Empididae		1											1
TOTAL NUMBER OF SPECIES		**39**	**53**	**36**	**13**	**10**	**19**	**15**	**17**	**17**	**12**	**15**	**36**	**46**

4.2 RIVPACS Predictor Variables

RIVPACS predictor variables for each site are provided in Table 4.2.

Table 4.2. RIVPACS environmental predictor variables for the September 2018 RIVPACS samples (input values for RIVPACS).

End Group	WOO 1-1	WOO 1-2	WOO 2-1	WOO 2-2	HAR1	HAR2	MLB	SOL	LAT1	LAT2	MIL1	MIL2	MIL3
[1]Sample date	11/09/201	11/09/2018	12/09/2018	12/09/2018	13/09/2018	13/09/2018	14/09/2018	14/09/2018	18/09/2018	18/09/201	19/09/201	19/09/201	19/09/201
[1]Method	K/S	K/S	K/S	K/S	K/S	K/S	K/S	K/S	K/S	K/S	K/S	K/S	K/S
[1]Duration	3min	3min	3min	3min	3min	3min	3min	3min	3min	3min	3min	3min	3min
[1]Kick Sampler	AH	EN	AH	AH	AH	AH	PD	AH	EN	EN	AH	AH	EN
[1]Recorder	EN	PD/AH	EN	EN	EN	EN	EN	EN	AP	AP	EN	EN	AP
[2]NGR	SZ	SU	SZ	SZ	SU	SU	SU	SU	SU	SU	SU	SU	SU
	24837	23253	26319	25793	20710	20629	20068	23071	19096	18275	19577	18318	18966
	99696	00422	98912	99435	05605	05383	05449	07140	12654	12472	17553	16197	16820
[2]Altitude (m)	28	35	22	25	61	59	65	49	47	43	75	55	65
[3]Slope (m km^{-1})	4.1	4.0	4.1	4.1	7.0	7.0	10.0	8.0	6.2	6.2	14.0	11.0	13.0
[4]Discharge (category)	1	1	1	1	1	1	1	1	1	1	1	1	1
[1]Velocity (category)	2	1	2	1	1	1	1	1	1	1	1	1	1
[3]Distance from source	6.0	4.3	7.0	6.6	1.1	1.3	1.8	0.5	6.0	7.0	1.3	3.2	2.4
[1]Mean width (m)	2.0	2.3	4.0	2.1	2.2	2.2	1.5	2.0	3.2	2.4	1.2	2.1	2.3
[1]Depth at ¼ width (cm)	20	5	11	10	10	30	10	5	20	15	5	10	3
[1]Depth at ½ width (cm)	30	10	18	22	20	30	16	10	25	22	12	20	15
[1]Depth at ¾ width (cm)	10	15	15	12	10	10	8	5	20	10	6	12	10
[1]Mean depth (cm)	20.0	10.0	14.7	14.7	13.3	23.3	11.3	6.7	21.7	15.7	7.7	14.0	9.3
[1]Boulders and cobbles	5	0	0	0	0	5	20	20	30	10	80	50	30
[1]Pebbles and gravel (%)	50	80	87	50	50	75	50	40	60	90	20	40	60
[1]Sand (%)	5	5	10	10	0	0	20	0	5	0	0	5	0
[1]Silt and clay (%)	40	15	3	40	50	20	10	40	5	0	0	5	10
[5]pH	8.14	8.14	6.84	8.40	8.15	8.12	8.14	8.05	7.75	6.83	5.20	7.92	8.11
[5]Temperature (°C)	14.5	14.5	12.8	14.4	15.1	10.6	12.0	14.5	17.9	16.0	16.3	16.0	16.7
[5]Conductivity (µs)	123.1	123.1	123.6	120.2	73.2	66.8	212.7	131.6	65.6	63.9	64.9	253.5	299.1
[5]Dissolved Oxygen (%)	102.5	102.5	93.9	98.0	108.7	101.7	89.7	110.7	100.3	75.0	99.2	94.0	99.0
[5]Dissolved Oxygen (mg	10.40	10.40	9.94	9.97	10.91	11.30	9.62	11.29	9.54	7.39	9.73	9.25	9.62
[1]Water clarity	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
[1]Water colour	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear

End Group	WOO 1-1	WOO 1-2	WOO 2-1	WOO 2-2	HAR1	HAR2	MLB	SOL	LAT1	LAT2	MIL1	MIL2	MIL3
[1]Algae cover (%)	0	5	0	5	30	5	5	20	5	0	0	0	5
[1]Moss cover (%)	0	5	0	5	0	5	5	0	5	5	0	2	5
[1]Higher plant cover (%)	0	0	0	0	60	0	0	70	0	0	0	0	0
[1]Total cover (%)	0	10	0	10	90	10	10	90	10	5	0	2	10
[1]Detritus	Present	Present	Absent	Present	Present	Present	Present	Present	Present	Present	Absent	Present	Present

[1]measured *in situ* and recorded on RIVPACS sample area form

[2]recorded *in situ* from handheld GPS

[3]derived from 1:50,000 Ordnance Survey map

[4]derived from discharge category map

[5]measured *in situ* with YSI hand-held meter

4.3 RIVPACS Stream Type Associations

RIVPACS stream type associations for each site are provided in Table 4.3.

Table 4.3. Stream type (environmental end-group associations) for the September 2018 RIVPACS samples (output values from RIVPACS; associations <0.01 not shown).

End Group	WOO 1-1	WOO 1-2	WOO 2-1	WOO 2-2	HAR1	HAR2	MLB	SOL	LAT1	LAT2	MIL1	MIL2	MIL3
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25		0.01	0.03			0.01			0.44	0.42	0.01	0.01	
26		0.02	0.02				0.03		0.12	0.13	0.02	0.17	0.10
27	0.01	0.40	0.12	0.01	0.67	0.94	0.92	0.46	0.29	0.28	0.94	0.76	0.82
28		0.01					0.01			0.01	0.01	0.03	0.03
29		0.01			0.01				0.02	0.04			
30					0.03			0.54					
31													
32													
33													
34													
35		0.01	0.01										
36													
37													

End Group	WOO 1-1	WOO 1-2	WOO 2-1	WOO 2-2	HAR1	HAR2	MLB	SOL	LAT1	LAT2	MIL1	MIL2	MIL3
38			0.01										
39	0.02	0.01	0.01	0.02	0.03		0.01						0.01
40	0.96	0.52	0.80	0.96	0.26	0.04	0.03		0.12	0.11		0.02	0.02
41	0.00												
42													
43													
Probability of model fit	> 5%	> 5%	> 5%	> 5%	> 5%	> 5%	> 5%	> 5%	> 5%	> 5%	> 5%	> 5%	> 5%
Suitability code	1	1	1	1	1	1	1	1	1	1	1	1	1

4.4 RIVPACS Biotic Indices

Observed biotic indices, expected biotic indices and Observed/Expected ratios are provided in Table 4.4.

Table 4.4. Observed, Expected (reference condition), and Observed/Expected (O/E) ratios for the RIVPACS samples. Colour key: Blue = Better than expected, White = Within expected range, Yellow = Slightly degraded, Orange = Moderately degraded, Red = Very degraded.

End Group	WOO 1-1	WOO 1-2	WOO 2-1	WOO 2-2	HAR1	HAR2	MLB	SOL	LAT1	LAT2	MIL1	MIL2	MIL3
OBSERVED biotic index values													
TL1 BMWP	143	184	148	73	36	81	78	62	67	57	58	165	164
TL1 NTAXA	25	31	25	13	8	15	14	12	13	10	11	26	26
TL1 ASPT	5.720	5.935	5.920	5.615	4.500	5.400	5.571	5.167	5.154	5.700	5.273	6.346	6.308
TL2 WHPT Score (AbW,DistFam)	171.4	211.5	163.8	72.9	32.3	95.7	83.7	69.6	75.4	62.3	61.7	188.2	208.9
TL2 WHPT NTAXA (AbW,DistFam)	28	35	27	13	8	16	14	13	15	11	12	28	31
TL2 WHPT ASPT (AbW,DistFam)	6.121	6.043	6.067	5.608	4.037	5.981	5.979	5.354	5.027	5.664	5.142	6.721	6.739
TL5 AWIC(Sp) Murphy	7.462	6.333	7.125	7.000	7.000	5.500	7.667	9.000	7.000	7.500	5.000	6.909	6.538
TL5 WFD AWIC(Sp) Mcfarland	10.077	9.000	9.625	9.500	9.500	7.500	11.000	13.000	10.000	10.000	7.000	9.091	9.000
TL5 LIFE(Sp)	7.652	7.593	7.778	8.250	6.000	7.444	7.857	8.000	6.143	7.714	7.143	8.105	8.043
TL5 PSI(Sp)	65.116	61.111	77.143	87.500	25.000	50.000	50.000	55.556	23.529	81.818	25.000	66.667	71.739
TL5 SPEAR(Sp) %	30.524	36.371	29.194	25.537	12.333	26.480	21.426	21.855	17.530	21.720	17.010	39.334	38.018
TL5 CCI	4.143	10.800	14.778	3.857	11.667	6.000	5.500	1.000	5.143	1.143	15.833	9.412	8.333
RIVPACS EXPECTED biotic index values													
TL1 BMWP	166.137	151.325	162.038	166.242	139.261	133.374	132.792	106.634	152.150	151.443	132.122	134.857	133.513
TL1 NTAXA	28.961	25.943	28.005	28.988	23.713	22.365	22.262	18.405	24.827	24.717	22.077	22.378	22.296
TL1 ASPT	5.702	5.812	5.762	5.699	5.840	5.923	5.924	5.726	6.105	6.103	5.942	5.990	5.948
TL2 WHPT Score (AbW,DistFam)	188.945	176.197	185.822	189.013	164.799	160.415	159.834	128.581	181.445	180.793	159.375	162.525	160.791
TL2 WHPT NTAXA (AbW,DistFam)	32.474	29.213	31.410	32.502	26.852	25.437	25.303	20.860	27.690	27.567	25.090	25.273	25.246
TL2 WHPT ASPT (AbW,DistFam)	5.796	6.047	5.916	5.791	6.143	6.298	6.308	6.115	6.555	6.560	6.341	6.424	6.359
TL5 AWIC(Sp) Murphy	6.602	6.632	6.615	6.601	6.624	6.635	6.644	6.377	6.703	6.714	6.636	6.678	6.666
TL5 WFD AWIC(Sp) Mcfarland	9.248	9.234	9.238	9.247	9.206	9.180	9.194	8.917	9.196	9.213	9.173	9.224	9.219
TL5 LIFE(Sp)	7.591	7.930	7.723	7.585	8.117	8.296	8.309	8.381	8.280	8.293	8.337	8.375	8.341
TL5 PSI(Sp)	52.112	62.152	56.180	51.971	67.613	73.058	73.375	74.526	74.576	74.850	74.313	75.369	74.297
TL5 SPEAR(Sp) %	41.485	43.829	42.541	41.428	44.779	46.751	46.725	41.250	47.197	46.991	47.129	47.421	46.849
TL5 CCI	11.713	10.551	11.397	11.722	9.779	8.972	8.992	11.880	10.862	10.878	8.988	9.367	9.237
OBSERVED/EXPECTED ratios													
TL1 BMWP	0.861	1.216	0.913	0.439	0.259	0.607	0.587	0.581	0.440	0.376	0.439	1.224	1.228

End Group	WOO 1-1	WOO 1-2	WOO 2-1	WOO 2-2	HAR1	HAR2	MLB	SOL	LAT1	LAT2	MIL1	MIL2	MIL3
TL1 NTAXA	0.863	1.195	0.893	0.448	0.337	0.671	0.629	0.652	0.524	0.405	0.498	1.162	1.166
TL1 ASPT	1.003	1.021	1.027	0.985	0.771	0.912	0.940	0.902	0.844	0.934	0.887	1.059	1.061
TL2 WHPT Score (AbW,DistFam)	0.907	1.200	0.881	0.386	0.196	0.597	0.524	0.541	0.416	0.345	0.387	1.158	1.299
TL2 WHPT NTAXA (AbW,DistFam)	0.862	1.198	0.860	0.400	0.298	0.629	0.553	0.623	0.542	0.399	0.478	1.108	1.228
TL2 WHPT ASPT (AbW,DistFam)	1.056	0.999	1.026	0.968	0.657	0.950	0.948	0.876	0.767	0.863	0.811	1.046	1.060
TL5 AWIC(Sp) Murphy	1.130	0.955	1.077	1.060	0.000	0.829	1.154	1.411	1.044	1.117	0.753	1.035	0.981
TL5 WFD AWIC(Sp) Mcfarland	1.090	0.975	1.042	1.027	0.000	0.817	1.196	1.458	1.087	1.085	0.763	0.986	0.976
TL5 LIFE(Sp)	1.008	0.958	1.007	1.088	0.739	0.897	0.946	0.955	0.742	0.930	0.857	0.968	0.964
TL5 PSI(Sp)	1.250	0.983	1.373	1.684	0.370	0.684	0.681	0.745	0.316	1.093	0.336	0.885	0.966
TL5 SPEAR(Sp) %	0.736	0.830	0.686	0.616	0.275	0.566	0.459	0.530	0.371	0.462	0.361	0.829	0.812
TL5 CCI	0.354	1.024	1.297	0.329	1.193	0.669	0.612	0.084	0.473	0.105	1.762	1.005	0.902

4.5 Species with conservation designations

Species recorded with one or more conservation designations are presented in Table 4.5.

Table 4.5. Species found in the September 2018 RIVPACS samples with one or more current conservation designations.

Species	Designation	Source	Sites recorded
Aquarius najas (DeGeer, 1773) River Skater	Nationally scarce (occurring in 16-100 hectads in Great Britain)	A.A. Cook (2015) *A review of the Hemiptera of Great Britain: The aquatic and semi-aquatic bugs.* Natural England	WOO2-1
Hydrochus nitidicollis Mulsant, 1844 Brass Necked Beetle	BAP-2007	Biodiversity Action Plan UK list of priority species (2007)	WOO1-2
	England_NERC_S.41	Species of principal importance in England (Section 41) under Natural Environment and Rural Communities Act (2006)	
	GB Red List (post 2001) – Vulnerable	Foster G.N. (2010) A review of the scare and threatened Coleoptera of Great Britain part (3) – Water Beetles of Great Britain. Species Status 1. Joint Nature Conservation Committee, Peterborough	
Hydatophylax infumatus (McLachlan, 1865) Caddisfly	Nationally scarce (occurring in 16-100 hectads in Great Britain)	Wallace I.D. (2016) A review of the status of caddis flies (Trichoptera) in Great Britain. Species Status 27. Joint Nature Conservation Committee, Peterborough	WOO1-2

5. RESULTS – REDD COUNTS

5.1 Harvestslade

No evidence of trout spawning was observed within the area of interest at Harvestslade.

5.2 Latchmore Brook

A single sea trout redd and single resident trout redd were recorded within the Latchmore Brook area of interest. Summary details and spatial distribution of all features recorded are provided in Table 5.1 and Figure 5.1 respectively. Figure 5.2 shows a photo of the sea trout redd recorded.

Table 5.1. Observations recorded during the redd count survey at Millersford Brook (listed from upstream to downstream).

NGR	Feature	Size / Notes
SU2018913124	Resident trout redd	0.3 m x 0.3 m x 0.1 m
SU1984012868	Debris dam	Leaky, passability unknown
SU1817912457	Sea trout redd	0.6 m x 0.4 m x 0.2 m

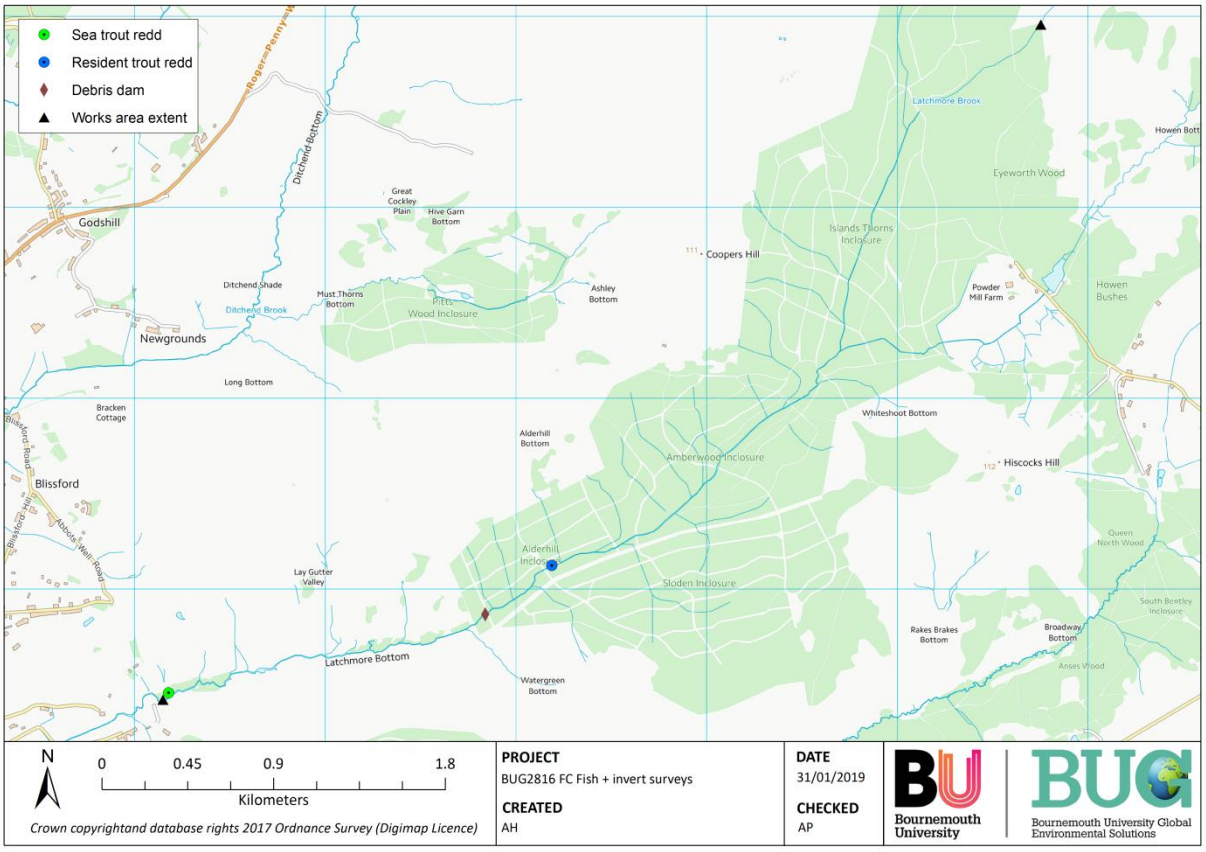

Figure 5.1. Observations recorded during the redd count survey at Latchmore Brook.

Figure 5.2. Sea trout redd recorded during the survey at Latchmore Brook.

5.3 Mill Lawn Brook

Two sea trout redds were recorded within the Mill Lawn Brook area of interest (the entire length of the brook was surveyed). Summary details and spatial distribution of all features recorded are provided in Table 5.2 and Figure 5.3 respectively. Figure 5.4 shows a photo of the sea trout redd recorded.

Table 5.2. Observations recorded during the redd count survey at Mill Lawn Brook (listed from upstream to downstream).

NGR	Feature	Size / Notes
SU2013105378	Sea trout redd	1.0 m x 0.5 m x 0.2 m
SU2017005369	Sea trout redd	1.5 m x 0.7 m x 0.2 m

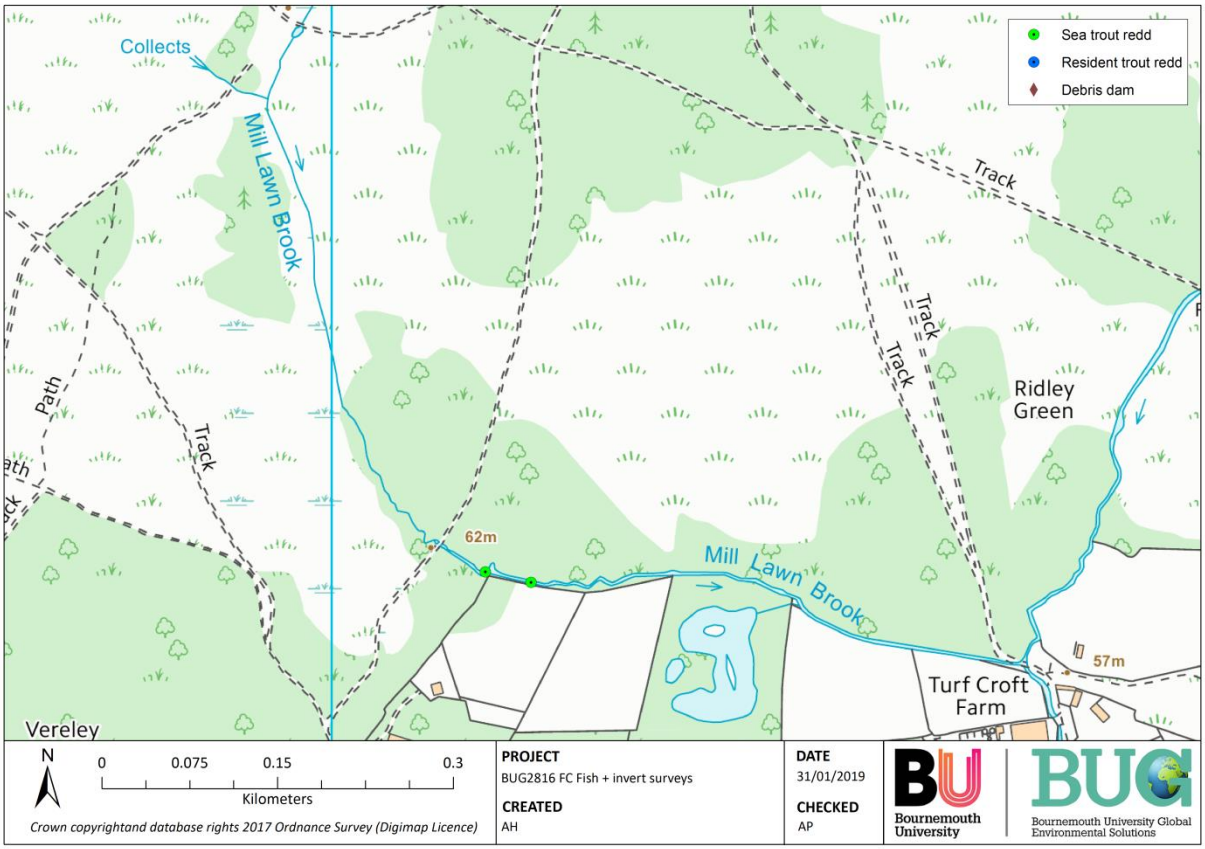

Figure 5.3. Observations recorded during the redd count survey at Mill Lawn Brook (the entire length of the brook was surveyed).

Figure 5.4. Sea trout redd recorded during the survey at Mill Lawn Brook.

5.4 Millersford Brook

No evidence of trout spawning was observed within the area of interest at Millersford Brook. However, multiple trout spawning 'scrapes' were recorded just downstream of the area of interest on a large riffle area below the footbridge at SU1818616070.

5.5 Soldiers Bog

A single resident trout redd was recorded within the Soldiers Bog area of interest. Summary details and spatial distribution of all features recorded are provided in Table 5.3 and Figure 5.5 respectively.

Table 5.3. Observations recorded during the redd count survey at Soldiers Bog.

NGR	Feature	Size / Notes
SU2306606995	Resident trout redd	0.3 m x 0.3 m x 0.2 m

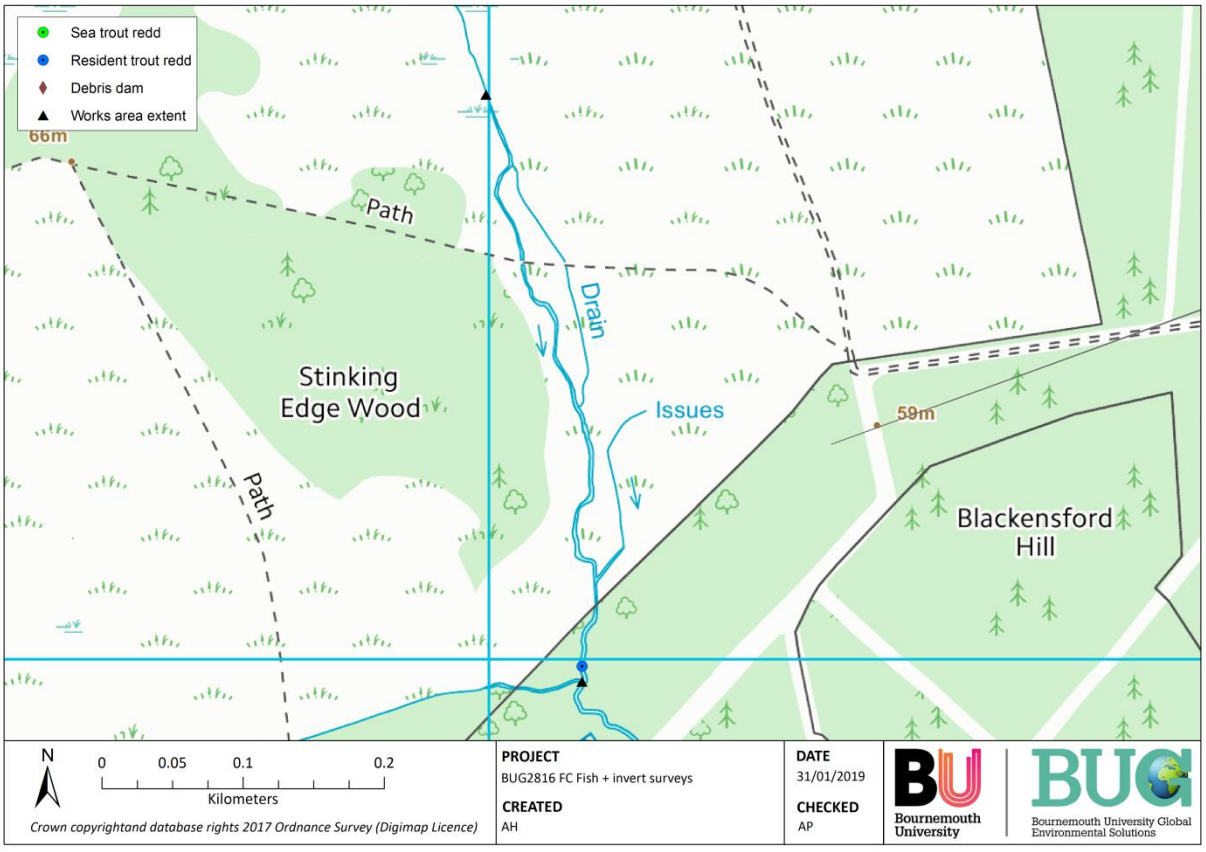

Figure 5.5. Observations recorded during the redd count survey at Soldiers Bog.

5.6 Wootton Phase 1

A total of five sea trout redds were recorded within the Wootton Phase 1 area of interest. Summary details and spatial distribution of all features recorded are provided in Table 5.4 and Figure 5.6 respectively. Figure 5.7 shows a photo of one of the sea trout redds recorded.

Table 5.4. Observations recorded during the redd count survey at Wootton Phase 1 (listed from upstream to downstream).

NGR	Feature	Size / Notes
SU2326700415	Debris dam	Leaky, passability unknown
SU2329700396	Sea trout redd	1.5 m x 1.5 m x 0.3 m
SU2331500384	Sea trout redd	1.5 m x 1.0 m x 0.3 m
SU2382000319	Sea trout redd	1.0 m x 0.6 m x 0.2 m
SZ2436899957	Sea trout redd	0.9 m x 0.5 m x 0.2 m
SZ2449499840	Sea trout redd	1.0 m x 0.5 m x 0.2 m
SZ2483799695	Debris dam	Leaky, passability unknown

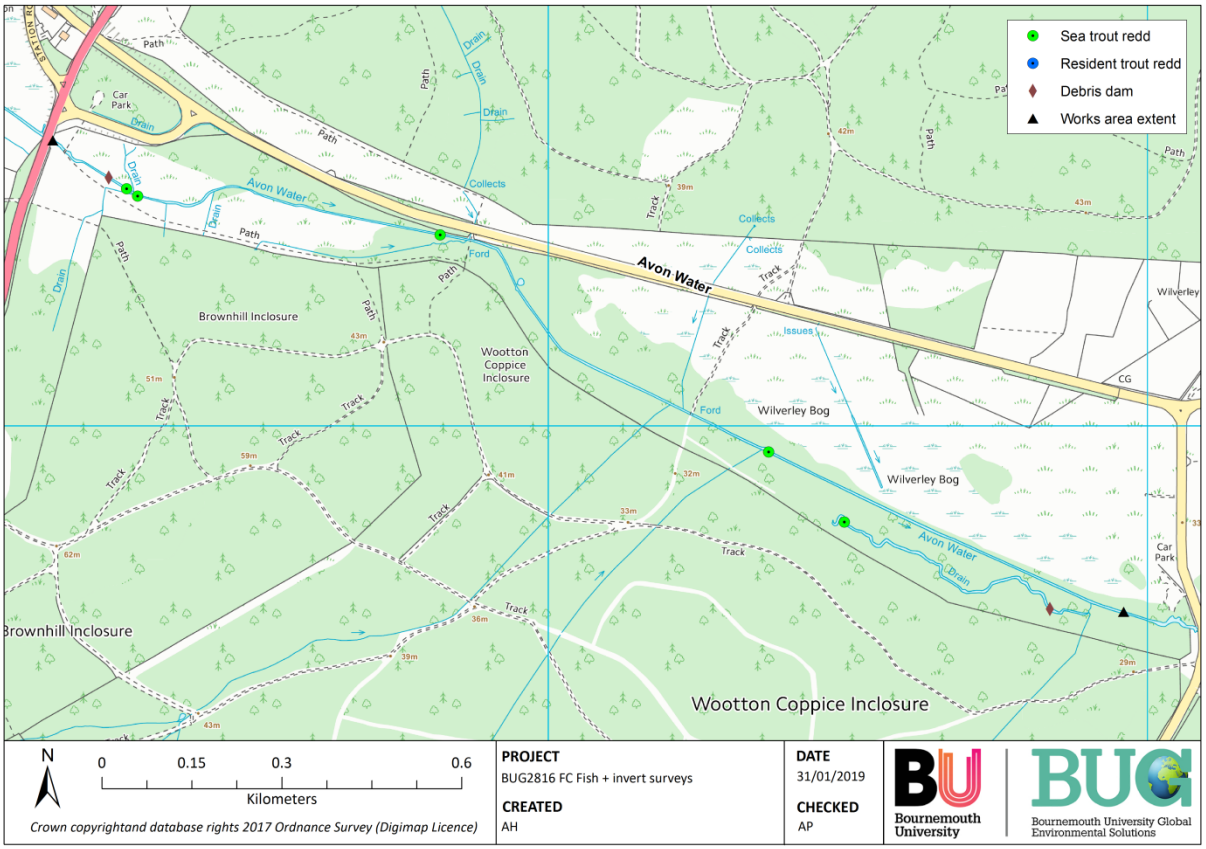

Figure 5.6. Observations recorded during the redd count survey at Wooton Phase 1.

Figure 5.7. Sea trout redd recorded during the survey at Wootton Phase 1.

5.7 Wootton Phase 2

Two resident trout redds were recorded within the Wootton Phase 2 area of interest. Summary details and spatial distribution of all features recorded are provided in Table 5.5 and Figure 5.8 respectively.

Table 5.5. Observations recorded during the redd count survey at Wootton Phase 2 (listed from upstream to downstream).

NGR	Feature	Size / Notes
SZ2582299425	Resident trout redd	0.3 m x 0.3 m x 0.2 m
SZ2584799408	Resident trout redd	0.4 m x 0.4 m x 0.1 m

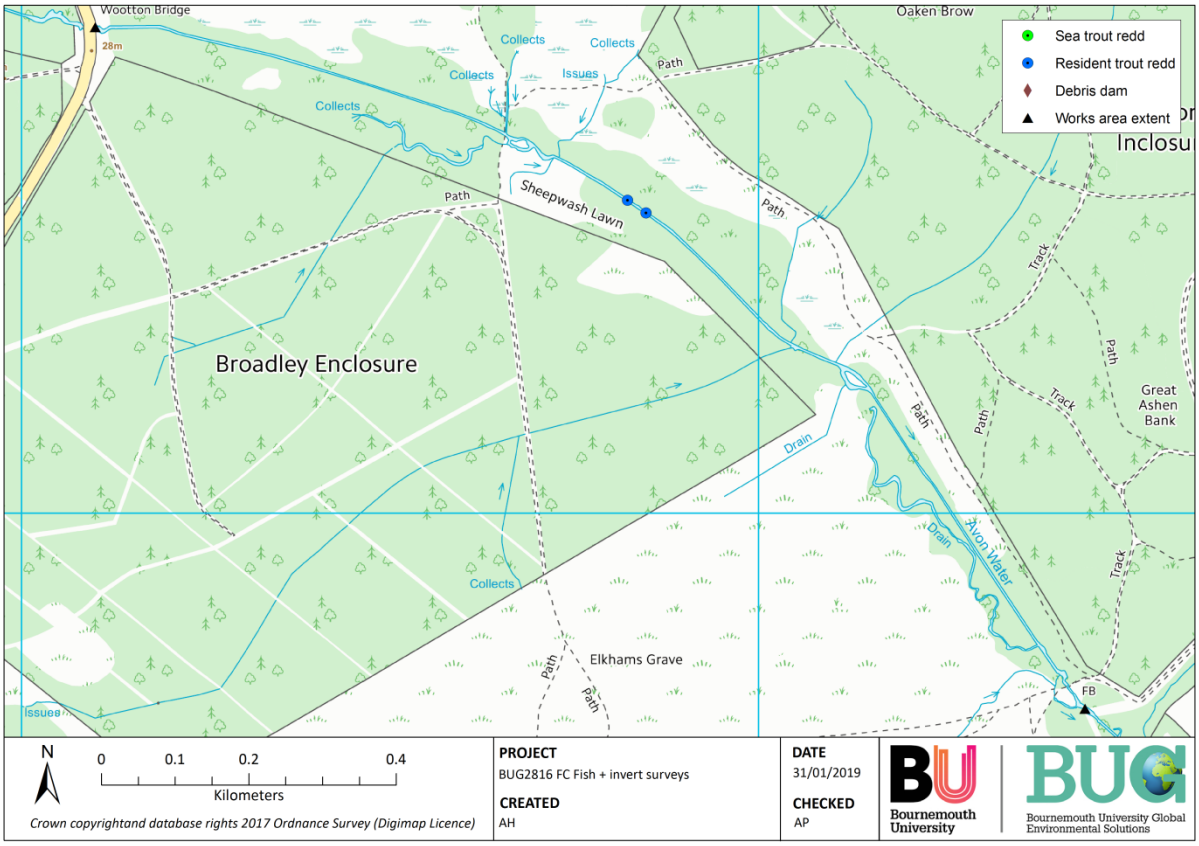

Figure 5.8. Observations recorded during the redd count survey at Wooton Phase 2.

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Figure A1.1. Upstream stop net and typical habitat at Harvestslade Site 1 (Sept 2018).

Figure A1.2. Typical habitat at Harvestslade Site 1 (Sept 2018).

Figure A1.3. Typical habitat at Harvestslade Site 1 (Sept 2018).

Figure A1.4. Typical habitat at Harvestslade Site 1 (Sept 2018).

Figure A1.5. Typical habitat at Harvestslade Site 1 (Sept 2018).

Figure A1.6. Downstream stop net and typical habitat at Harvestslade Site 1 (Sept 2018).

Figure A2.1. Upstream stop net and typical habitat at Harvestslade Site 2 (Sept 2018).

Figure A2.2. Typical habitat at Harvestslade Site 2 (Sept 2018).

Figure A2.3. Typical habitat at Harvestslade Site 2 (Sept 2018).

Figure A2.4. Typical habitat at Harvestslade Site 2 (Sept 2018).

Figure A2.5. Typical habitat at Harvestslade Site 2 (Sept 2018).

Figure A2.6. Downstream stop net and typical habitat at Harvestslade Site 2 (Sept 2018).

Figure A3.1. Upstream stop net and typical habitat at Latchmore Brook Site 1 (Sept 2018).

Figure A3.2. Typical habitat at Latchmore Brook Site 1 (Sept 2018).

Figure A3.3. Typical habitat at Latchmore Brook Site 1 (Sept 2018).

Figure A3.4. Typical habitat at Latchmore Brook Site 1 (Sept 2018).

Figure A3.5. Typical habitat at Latchmore Brook Site 1 (Sept 2018).

Figure A3.6. Typical habitat at Latchmore Brook Site 1 (Sept 2018).

Figure A4.1. Upstream stop net and typical habitat at Latchmore Brook Site 2 (Sept 2018).

Figure A4.2. Typical habitat at Latchmore Brook Site 2 (Sept 2018).

Figure A4.3. Typical habitat at Latchmore Brook Site 2 (Sept 2018).

Figure A4.4. Typical habitat at Latchmore Brook Site 2 (Sept 2018).

Figure A4.5. Typical habitat at Latchmore Brook Site 2 (Sept 2018).

Figure A4.6. Downstream stop net and typical habitat at Latchmore Brook Site 2 (Sept 2018).

Figure A5.1. Typical habitat at Mill Lawn Brook (Sept 2018).

Figure A5.2. Typical habitat at Mill Lawn Brook (Sept 2018).

Figure A5.3. Typical habitat at Mill Lawn Brook (Sept 2018).

Figure A5.4. Typical habitat at Mill Lawn Brook (Sept 2018).

Figure A5.5. Typical habitat at Mill Lawn Brook (Sept 2018).

Figure A5.6. Typical habitat at Mill Lawn Brook (Sept 2018).

Figure A6.1. Typical habitat at Millersford Brook Site 1 (Sept 2017).

Figure A6.2. Typical habitat at Millersford Brook Site 1 (Sept 2017).

Figure A6.3. Typical habitat at Millersford Brook Site 1 (Sept 2017).

Figure A6.4. Typical habitat at Millersford Brook Site 1 (Sept 2017).

Figure A7.1. Typical habitat at Millersford Brook Site 2 (Sept 2018).

Figure A7.2. Typical habitat at Millersford Brook Site 2 (Sept 2018).

Figure A7.3. Typical habitat at Millersford Brook Site 2 (Sept 2018).

Figure A7.4. Typical habitat at Millersford Brook Site 2 (Sept 2018).

Figure A7.5. Typical habitat at Millersford Brook Site 2 (Sept 2018).

Figure A7.6. Typical habitat at Millersford Brook Site 2 (Sept 2018).

Figure A8.1. Typical habitat at Millersford Brook Site 3 (Sept 2018).

Figure A8.2. Typical habitat at Millersford Brook Site 3 (Sept 2017).

Figure A8.3. Typical habitat at Millersford Brook Site 3 (Sept 2017).

Figure A8.4. Typical habitat at Millersford Brook Site 3 (Sept 2017).

Figure A9.1. Typical habitat at Soldiers Bog (Sept 2018).

Figure A9.2. Typical habitat at Soldiers Bog (Sept 2018).

Figure A9.3. Typical habitat at Soldiers Bog (Sept 2018).

Figure A9.4. Typical habitat at Soldiers Bog (Sept 2018).

Figure A9.5. Typical habitat at Soldiers Bog (Sept 2018).

Figure A9.6. Typical habitat at Soldiers Bog (Sept 2018).

Figure A10.1. Upstream stop net and typical habitat at Wootton Phase 1 Site 1 (Sept 2018).

Figure A10.2. Typical habitat at Wootton Phase 1 Site 1 (Sept 2018).

Figure A10.3. Typical habitat at Wootton Phase 1 Site 1 (Sept 2018).

Figure A10.4. Typical habitat at Wootton Phase 1 Site 1 (Sept 2018).

Figure A10.5. Typical habitat at Wootton Phase 1 Site 1 (Sept 2018).

Figure A10.6. Downstream stop net and typical habitat at Wootton Phase 1 Site 1 (Sept 2018).

Figure A11.1. Upstream stop net and typical habitat at Wootton Phase 1 Site 2 (Sept 2018).

Figure A11.2. Typical habitat at Wootton Phase 1 Site 2 (Sept 2018).

Figure A11.3. Typical habitat at Wootton Phase 1 Site 2 (Sept 2018).

Figure A11.4. Typical habitat at Wootton Phase 1 Site 2 (Sept 2018).

Figure A11.5. Typical habitat at Wootton Phase 1 Site 2 (Sept 2018).

Figure A11.6. Downstream stop net and typical habitat at Wootton Phase 1 Site 2 (Sept 2018).

Figure A12.1. Upstream stop net and typical habitat at Wootton Phase 2 Site 1 (Sept 2017).

Figure A12.2. Typical habitat at Wootton Phase 2 Site 1 (Sept 2017).

Figure A12.3. Typical habitat at Wootton Phase 2 Site 1 (Sept 2017).

Figure A12.4. Typical habitat at Wootton Phase 2 Site 1 (Sept 2017).

Figure A13.1. Upstream stop net and typical habitat at Wootton Phase 2 Site 2 (Sept 2018).

Figure A13.2. Typical habitat at Wootton Phase 2 Site 2 (Sept 2018).

Figure A13.3. Typical habitat at Wootton Phase 2 Site 2 (Sept 2018).

Figure A13.4. Typical habitat at Wootton Phase 2 Site 2 (Sept 2018).

Figure A13.5. Typical habitat at Wootton Phase 2 Site 2 (Sept 2018).

Figure A13.6. Downstream stop net and typical habitat at Wootton Phase 2 Site 2 (Sept 2018).