



## Macroinvertebrate and fish population surveys in six New Forest streams, September 2021

### Higher Level Stewardship Agreement

### The Verderers of the New Forest AG00300016



This project has been funded under the Rural Development Programme for England

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## EXECUTIVE SUMMARY

Wetland restoration in the New Forest has been undertaken since the 1990s. 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 12 electric fishing surveys and 13 macroinvertebrate surveys at 16 locations (in six different streams).

Surveys were undertaken at Cowleys (Dark Water), Harvestslade (tributary of Mill Lawn Brook, Lymington River catchment), Longwater (Beaulieu River), Pondhead (tributary of Beaulieu River), Sluffers (Bratley Water, Lymington River catchment) and Wootton (Avon Water).

Key findings are presented below:

### FISH POPULATION SURVEYS

Table 1 summarises the fish species recorded at each location.

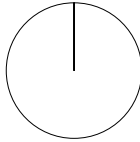
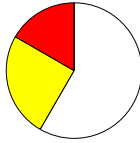
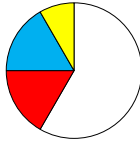
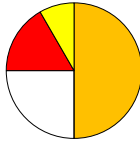
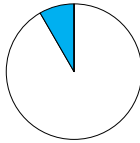
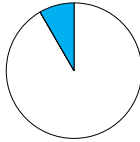
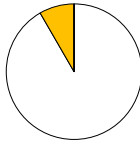
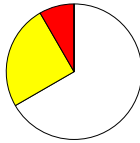
**Table 1. Species recorded at each location (in numerical abundance order).**

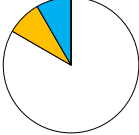
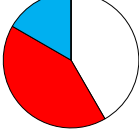
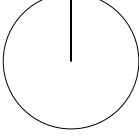
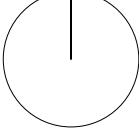
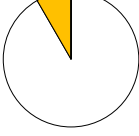
Location	Year restoration undertaken / planned	Fish species recorded
Harvestslade Site 1	2015	Minnow, bullhead, stone loach, brown trout, river/brook lamprey
Harvestslade Site 2	2015	Minnow, bullhead, brown trout, river/brook lamprey
Longwater Site 1	2011	Minnow, stone loach, river/brook lamprey, three-spined stickleback, bullhead
Longwater Site 2	2011	Minnow, stone loach, three-spined stickleback, bullhead, river/brook lamprey, roach
Pondhead Site 1	2018	Minnow, stone loach, bullhead, roach, brown trout, river/brook lamprey, three-spined stickleback, eel
Pondhead Site 2	2018	Minnow, bullhead, stone loach, brown trout, three-spined stickleback, river/brook lamprey
Pondhead Control	N/A	Bullhead, brown trout, three-spined stickleback, stone loach, eel
Sufters	2014	Minnow, brown trout, river/brook lamprey, stone loach, bullhead
Wootton Phase 1 Site 1	2016	Bullhead, minnow, stone loach, brown trout, river/brook lamprey, three-spined stickleback
Wootton Phase 1 Site 2	2017	Brown trout, bullhead, minnow, stone loach, river/brook lamprey
Wootton Phase 2 Site 1	2017	Bullhead, minnow, brown trout, stone loach, river/brook lamprey
Wootton Phase 2 Site 2	2018	Bullhead, minnow, stone loach, brown trout, river/brook lamprey, three-spined stickleback

## MACROINVERTEBRATE SURVEYS

A total of 12 different biotic indices were used to calculate impact classes based on the Observed/Expected ratios. Table 2 presents the proportion of Observed/Expected ratios (n=12) within each impact category at each location.

**Table 2. Proportion of biotic indices Observed/Expected ratios (n=12) within each impact category at each location. Colour key: Blue = Better than expected, White = Within expected range, Yellow = Slightly degraded, Orange = Moderately degraded, Red = Very degraded.**

Location	Year restoration undertaken / planned	Proportion of Observed / Expected ratios in each impact class
Cowleys Control	2015	
Cowleys East	2015	
Cowleys West	2015	
Harvestslade Site 1	2015	
Harvestslade Site 2	2015	
Harvestslade Control	N/A	
Pondhead Downstream	2018	
Pondhead Control	N/A	

Location	Year restoration undertaken / planned	Proportion of Observed / Expected ratios in each impact class
Slufters	2014	
Wootton Phase 1 Site 1	2016	
Wootton Phase 1 Control	2017	
Wootton Phase 2 Site 1	2017	
Wootton Phase 2 Site 2	2018	

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## 1. INTRODUCTION

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The New Forest HLS scheme objectives are to restore re-sectioned 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 12 electric fishing surveys and 13 macroinvertebrate surveys at 16 locations (in six different streams).

Surveys were undertaken at Cowleys (Dark Water), Harvestslade (tributary of Mill Lawn Brook, Lymington River catchment), Longwater (Beaulieu River), Pondhead (tributary of Beaulieu River), Sluffers (Bratley Water, Lymington River catchment) and Wootton (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

## 2. METHODOLOGY

### 2.1 Site selection

In advance of the surveys being undertaken, Forestry Commission provided BUG with National Grid Reference (NGR) coordinates for the upstream and downstream extent of each fish survey site and the NGR of each macroinvertebrate survey site (Table 2.1). The location of each stream surveyed was mapped in ArcGIS, to provide an overview of the location of each area of interest in relation to the wider New Forest area (Figure 2.1).

**Table 2.1. Location of fish and invertebrate sites and dates surveyed.**

Site name	Upstream limit	Downstream limit	Fish survey	Invert survey	Survey date
Cowleys Control	SU4239502523	N/A		✓	07/09/2021
Cowleys East	SU4199802508	N/A		✓	07/09/2021
Cowleys West	SU4141002443	N/A		✓	07/09/2021
Harvestslade Site 1	SU2070905601	SU2065705532	✓		06/09/2021
Harvestslade Site 2	SU2063905381	SU2059405311	✓		06/09/2021
Harvestslade Site 1	SU2071005605	N/A		✓	06/09/2021
Harvestslade Site 2	SU2063605377	N/A		✓	06/09/2021
Harvestslade Control	SU2059205305	N/A		✓	06/09/2021
Longwater Site 1	SU3206409054	SU3212608983	✓		07/09/2021
Longwater Site 2	SU3271808699	SU3278108659	✓		07/09/2021
Pondhead Site 1	SU3242706944	SU3250406973	✓		13/09/2021
Pondhead Site 2	SU3234006861	SU3240206908	✓		13/09/2021
Pondhead Control	SU3087707665	SU3096007665	✓		13/09/2021
Pondhead Downstream	SU3239106903	N/A		✓	13/09/2021
Pondhead Control	SU3086607667	N/A		✓	13/09/2021
Sufters	SU2313209868	SU2315909807	✓		15/09/2021
Slufters	SU2316409801	N/A		✓	15/09/2021
Wootton Phase 1 Site 1	SZ2484699689	SZ2492399700	✓		10/09/2021
Wootton Phase 1 Site 2	SU2324500427	SU2330200392	✓		10/09/2021
Wootton Phase 2 Site 1	SZ2631898912	SZ2637898823	✓		08/09/2021
Wootton Phase 2 Site 2	SZ2576899463	SZ2580999433	✓		08/09/2021
Wootton Phase 1 Site 1	SZ2483799696	N/A		✓	10/09/2021
Wootton Phase 1 Control	SU2325300422	N/A		✓	10/09/2021
Wootton Phase 2 Site 1	SZ2361698916	N/A		✓	08/09/2021
Wootton Phase 2 Site 2	SZ2579399435	N/A		✓	08/09/2021
<b>TOTAL NUMBER OF SITES</b>			<b>12 Fish</b>	<b>13 Inverts</b>	

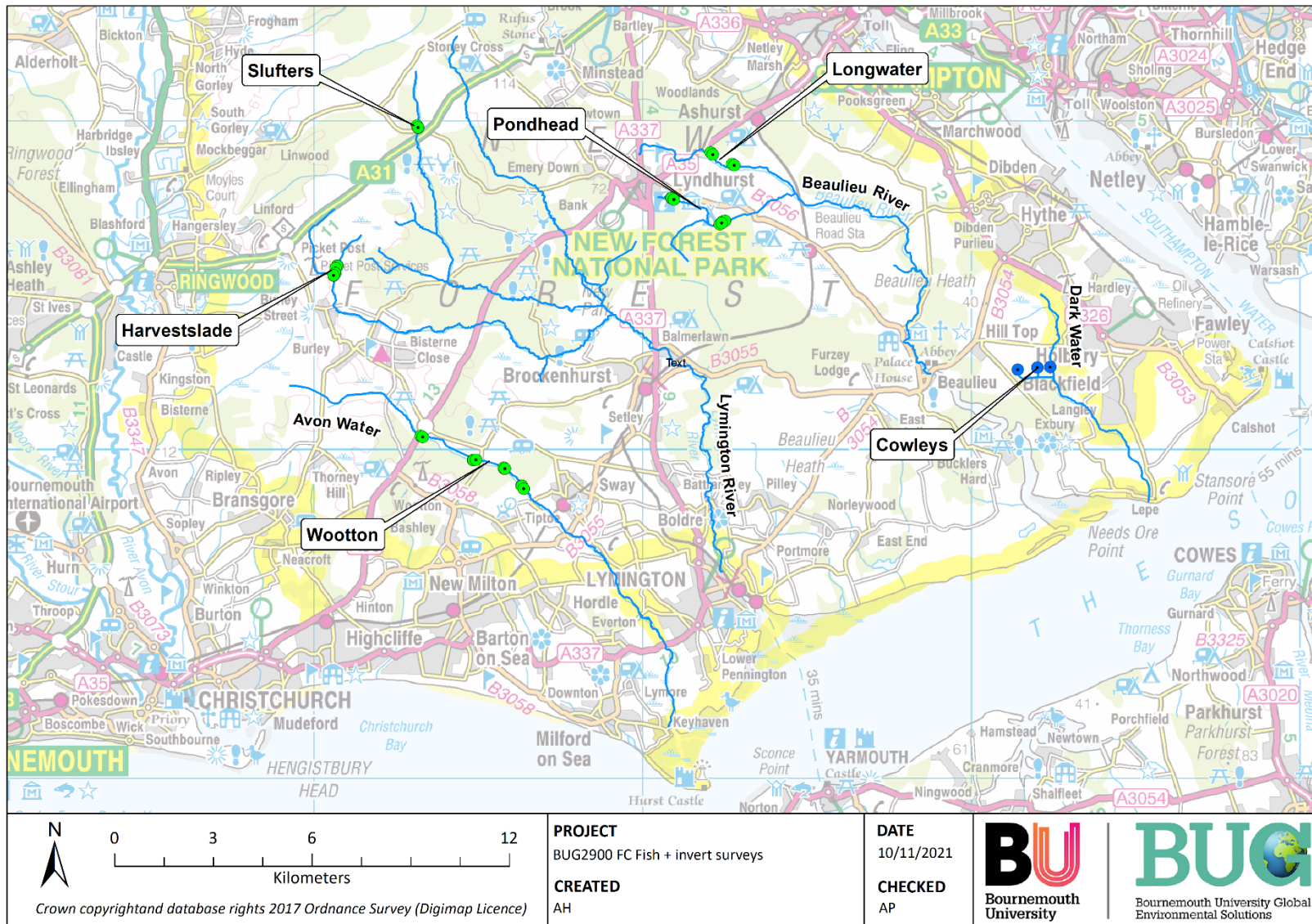


Figure 2.1. Location of each of the six streams surveyed during 2021.

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

### 2.1.1 Cowleys

Cowleys is located on the Stock Water, which becomes the Dark Water, flowing into the sea at Lepe (Figure 2.1). The locations of the invertebrate kick-sampling sites are shown in Figure 2.2 and summarised in Table 2.1.

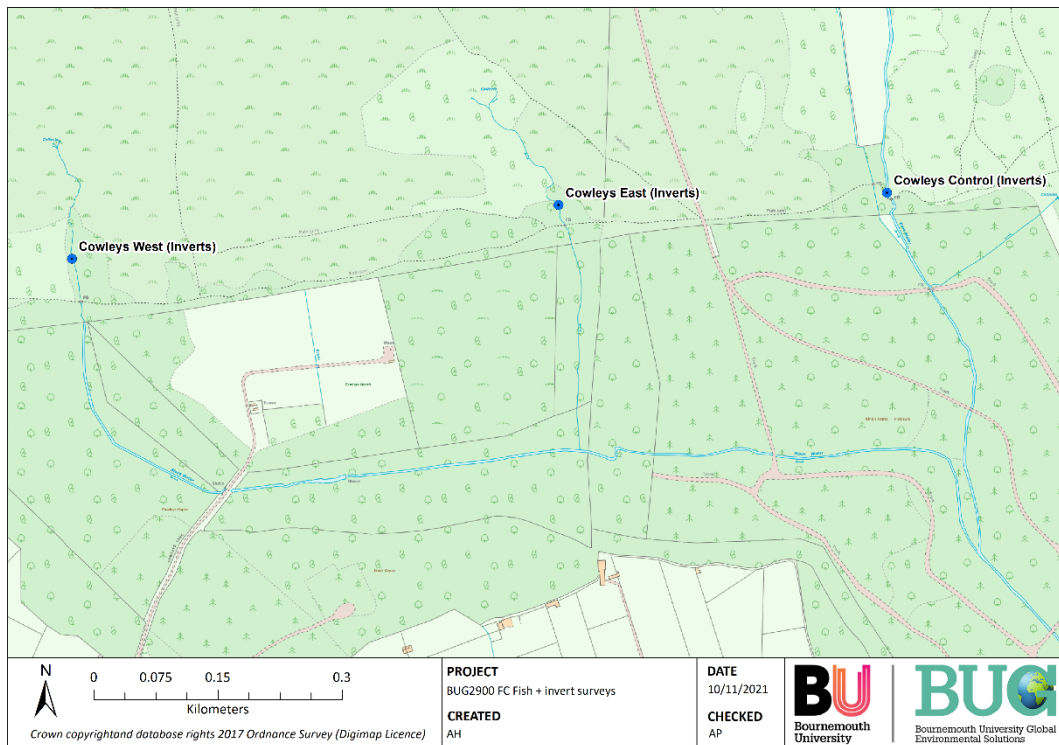


Figure 2.2. Location of survey sites at Cowleys.

### 2.1.2 Harvestslade

Harvestslade is located on a small tributary of Mill Lawn Brook, which flows into the Lymington River (Figure 2.1). The upstream and downstream extents of the 100 m electric fishing sites (green dots) and the invertebrate kick-sampling sites (blue dots) are shown in Figure 2.3 and summarised in Table 2.1. Full descriptions of the fish survey sites are provided within the results Sections 3.1 and 3.2.

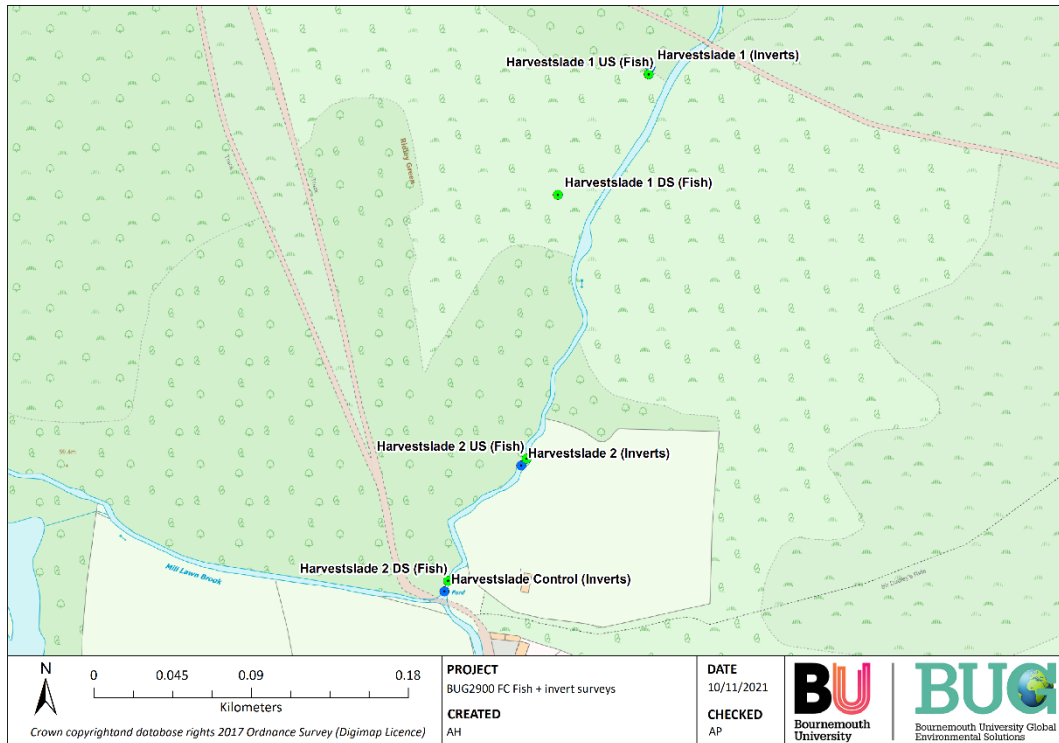


Figure 2.3. Location of survey sites at Harvestslade. Green = fish survey sites, blue = invertebrate survey sites.

### 2.1.3 Longwater

Longwater is located on the Beaulieu River (Figure 2.1). The upstream and downstream extents of the 100 m electric fishing sites are shown in Figure 2.4 and summarised in Table 2.1. Full descriptions of the fish survey sites are provided within the results Sections 3.3 and 3.4.

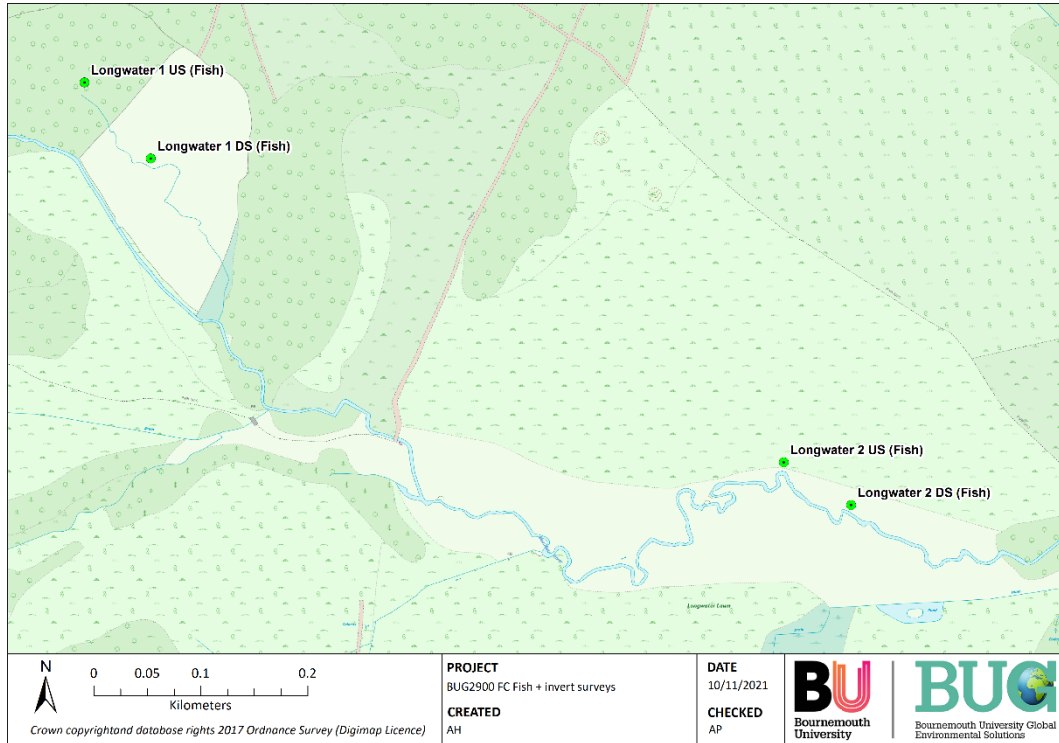
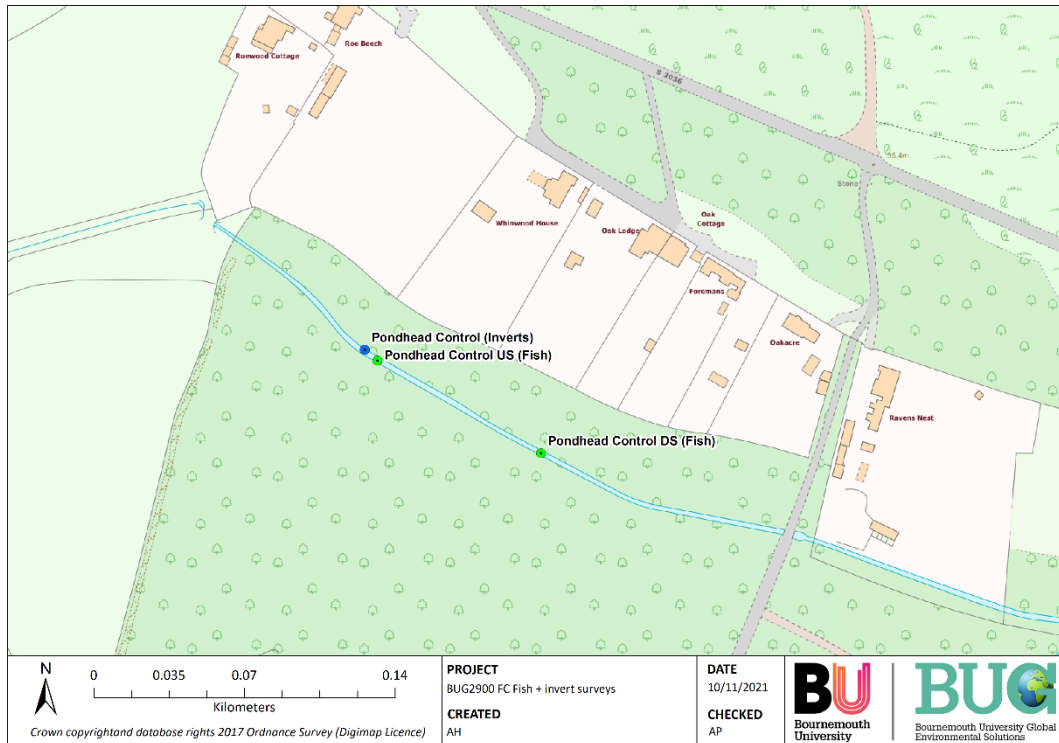


Figure 2.4. Location of survey sites at Longwater.

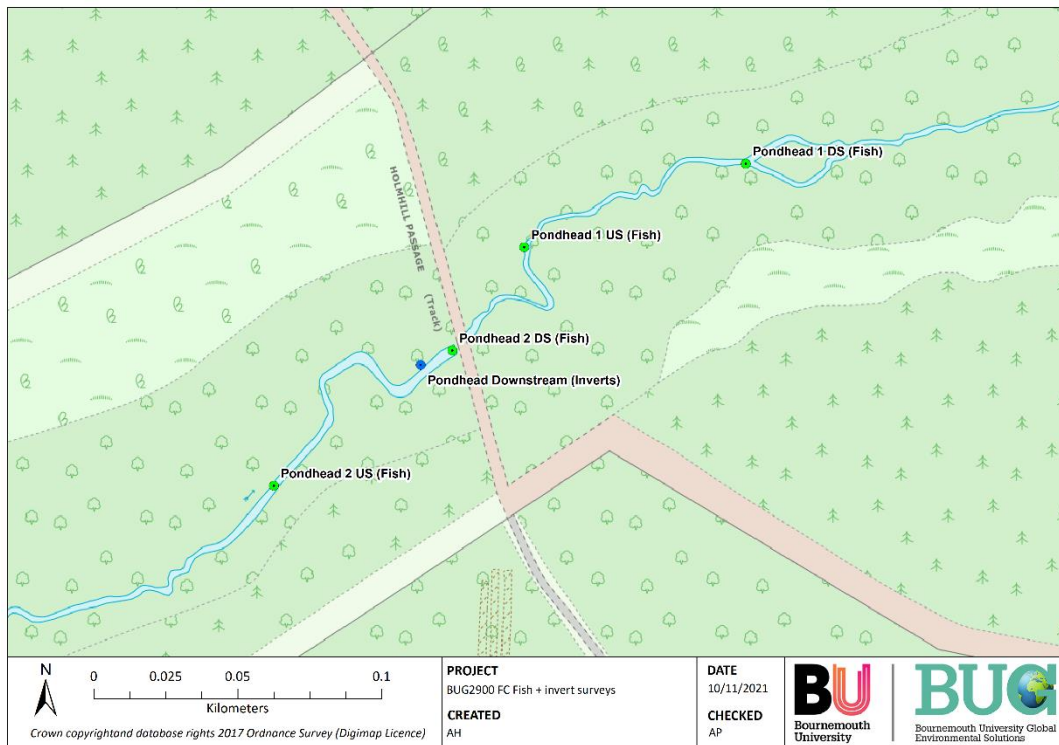


### 2.1.4 Pondhead

Pondhead is located on a small tributary of the Beaulieu River (Figure 2.1). The upstream and downstream extents of the 100 m electric fishing sites (green dots) and the invertebrate kick-sampling sites (blue dots) are shown in Figure 2.5 and Figure 2.6 and summarised in Table 2.1. Full descriptions of the fish survey sites are provided within the results Sections 3.5 to 3.7.



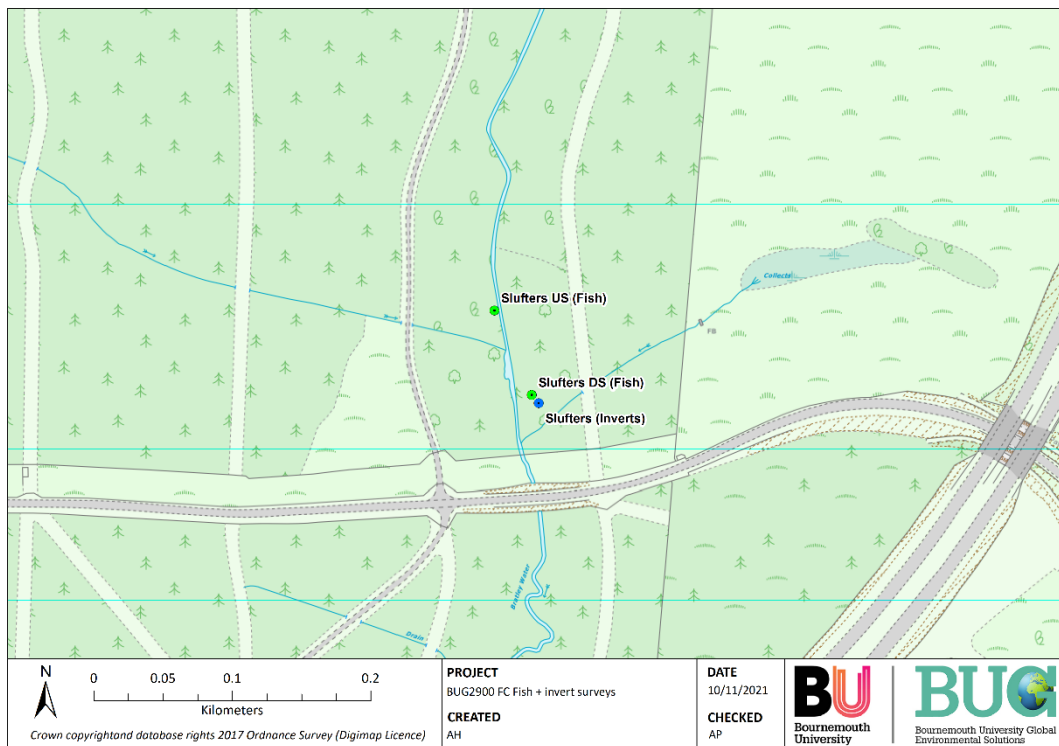
**Figure 2.5. Location of survey sites at Pondhead (upstream stretch). Green = fish survey sites, blue = invertebrate survey sites.**



**Figure 2.6. Location of survey sites at Pondhead (downstream stretch). Green = fish survey sites, blue = invertebrate survey sites.**

### 2.1.5 Sluffers

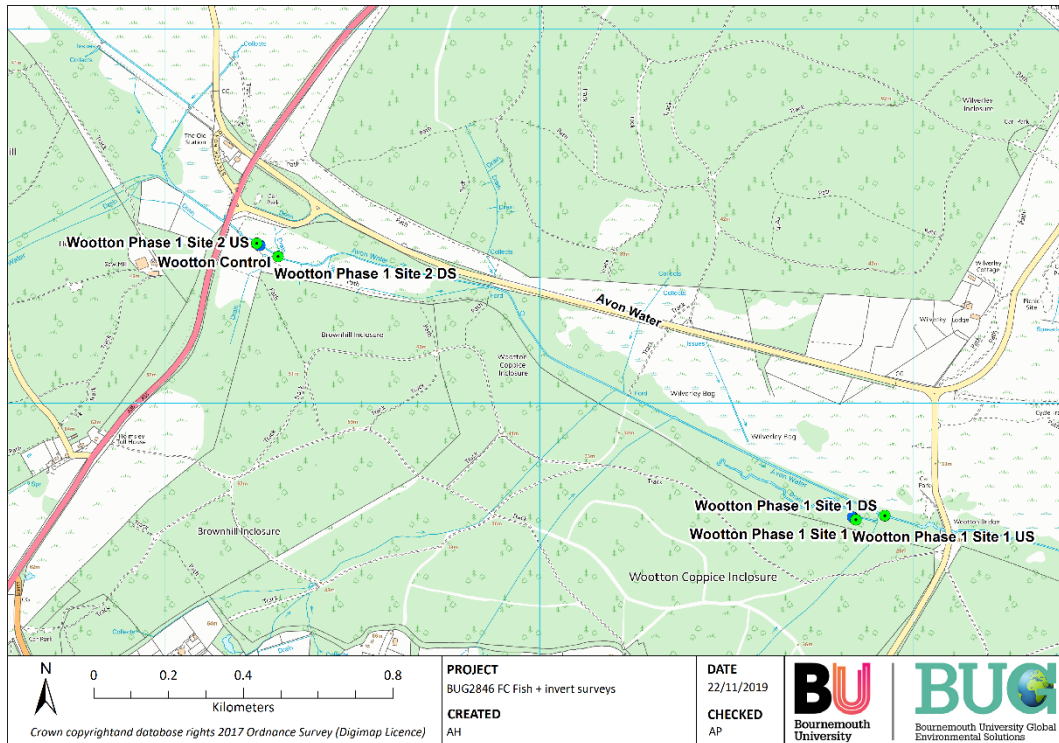
Sluffers is located on the Bratley Water, a small tributary of the Black Water which flows into the Lymington River (Figure 2.1). The upstream and downstream extents of the 100 m electric fishing site (green dots) and the invertebrate kick-sampling site (blue dots) are shown in Figure 2.7 and summarised in Table 2.1. A full description of the fish survey site is provided within the results Section 3.8.



**Figure 2.7. Location of survey sites at Sluffers. Green = fish survey site, blue = invertebrate survey site.**

### 2.1.6 Wootton Phase 1

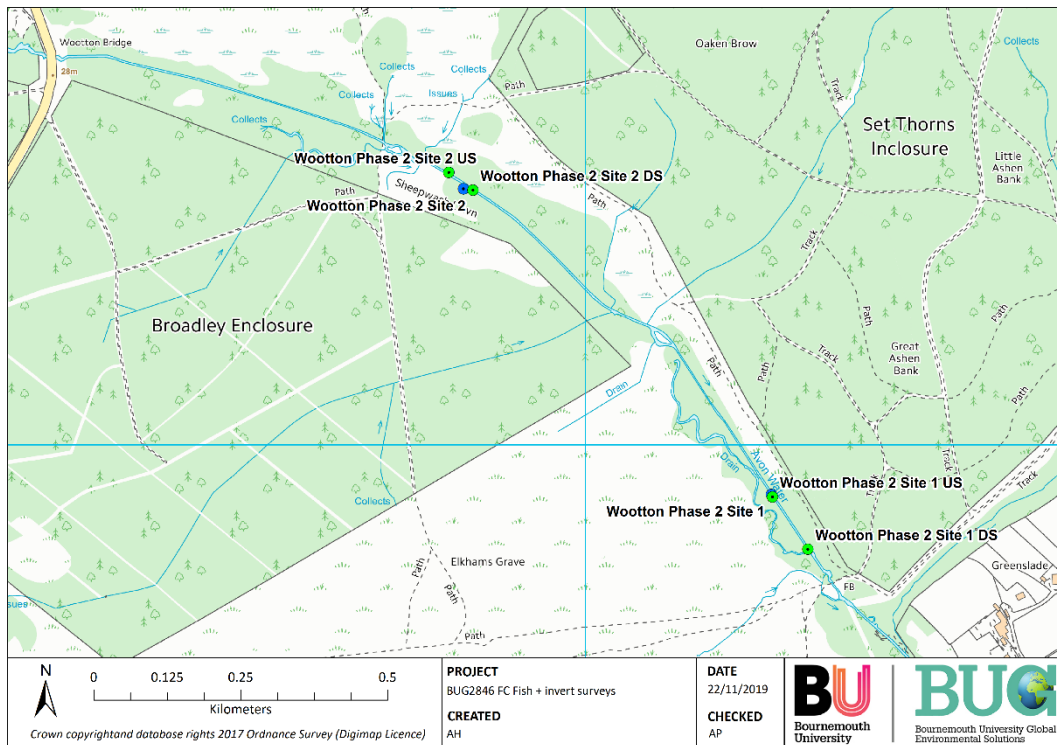
Wootton Phase 1 is located on the Avon Water (Figure 2.1). The upstream and downstream extents of the 100 m electric fishing sites (green dots) and the invertebrate kick-sampling sites (blue dots) are shown in Figure 2.8 and summarised in Table 2.1. Full descriptions of the fish survey sites are provided within the results Sections 3.9 and 3.10.



**Figure 2.8. Location of survey sites at Wootton Phase 1. Green = fish survey site, blue = invertebrate survey site.**

### 2.1.7 Wootton Phase 2

Wootton Phase 2 is located on the Avon Water (Figure 2.1). The upstream and downstream extents of the 100 m electric fishing sites (green dots) and the invertebrate kick-sampling sites (blue dots) are shown in Figure 2.9 and summarised in Table 2.1. Full descriptions of the fish survey sites are provided within the results Sections 3.11 and 3.12.



**Figure 2.9. Location of survey sites at Wootton Phase 2. Green = fish survey site, blue = invertebrate survey site.**

## 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 2.2 below.

**Table 2.2. National Fisheries Classification Scheme for brown trout.**

Classification	Density (No./100m <sup>2</sup> )	
	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/](http://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.

### 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 2.1.2). 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 1.7 m, with an overall surveyed area of 169.1 m<sup>2</sup>. Physico-chemical parameters recorded during the time of the survey are provided in Table 3.2.

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 thick layer of fine silt and abundant macrophyte growth was evident throughout. Flow conditions preceding and during the survey were low.

Low flow and mobilisation of excessive fine silt during the first electric fishing run precluded the possibility of multiple runs at this site. Accordingly, data are presented for a single run only.

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

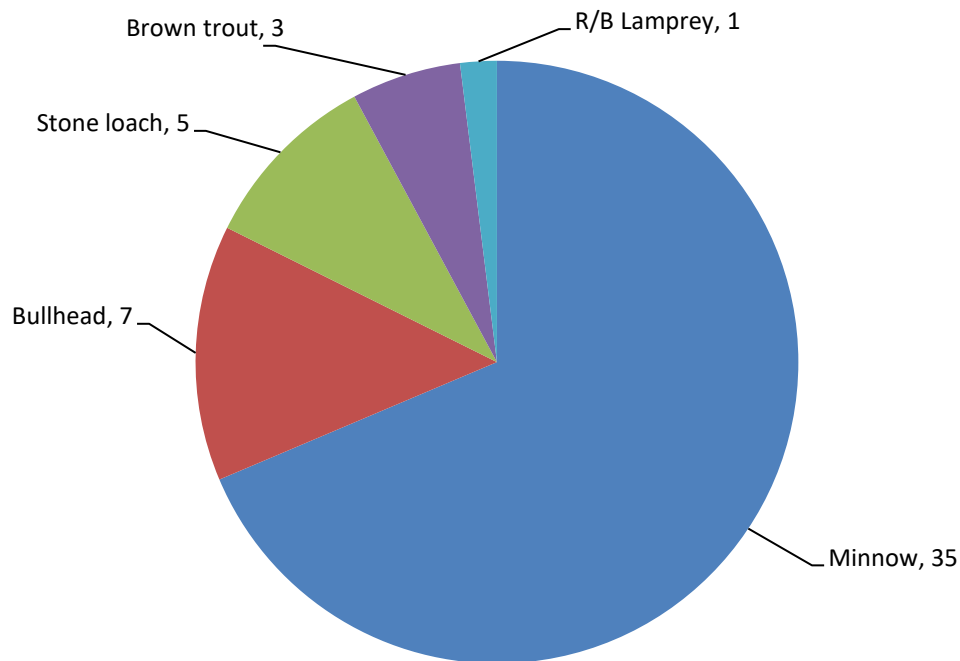
Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	40	20	20	10	5	5		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		50		30	10	10		
Instream vegetation: <b>80%</b>		Silted? <b>Yes</b>		Substrate: <b>Unstable &amp; Uncompacted</b>				
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent		10	30	10		30	20	
Speed / Level: <b>Low</b>	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		95					
Right bank %	5		95					
Total LB fish cover: <b>5 %</b>	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: <b>5 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Overhanging Boughs (%): <b>0</b>			RB Overhanging Boughs (%): <b>0</b>			Canopy Cover (%): <b>0</b>		

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

Parameter	Value
Temperature (°C)	24.3
Dissolved Oxygen (%)	101.8
Dissolved Oxygen (mg l <sup>-1</sup> )	8.53
Conductivity (µScm <sup>-1</sup> )	93.5
pH	7.4

### 3.1.2 Electric fishing survey results

A total of 51 fish were captured at Harvestslade Site 1 during a single electric fishing run, comprising five species. Minnow comprised the majority of fish captured, followed by bullhead and stone loach. (Figure 3.1).



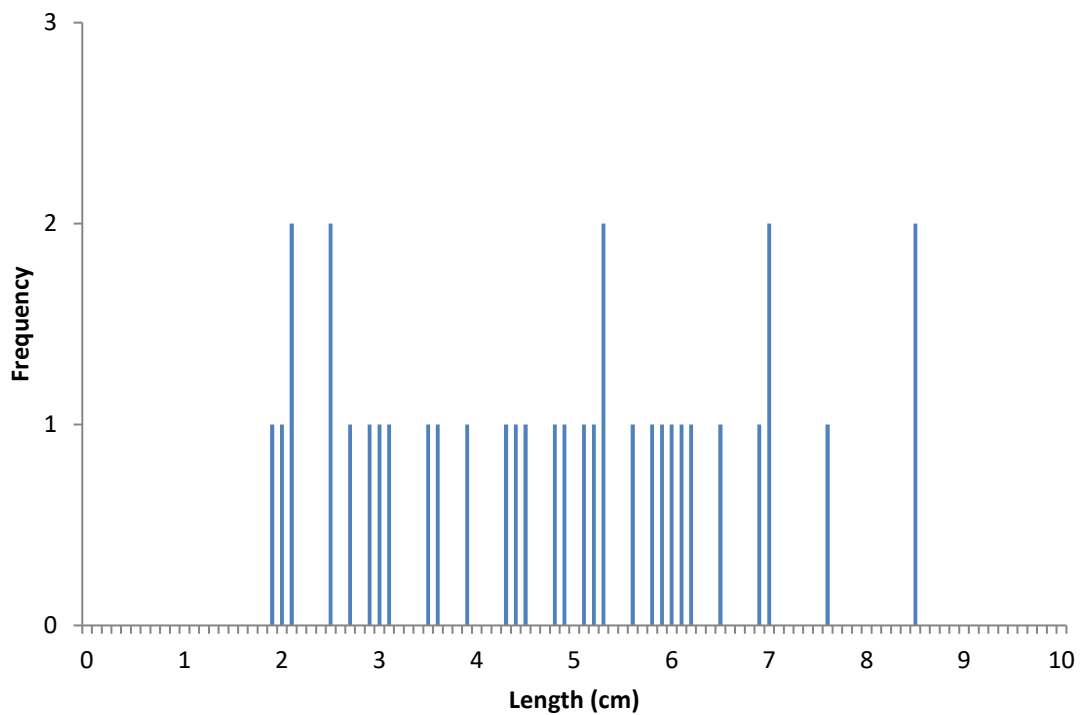
**Figure 3.1. Species composition (total number captured) at Harvestslade Site 1.**

The total number captured and length range (cm) for each fish species are shown in Table 3.3.

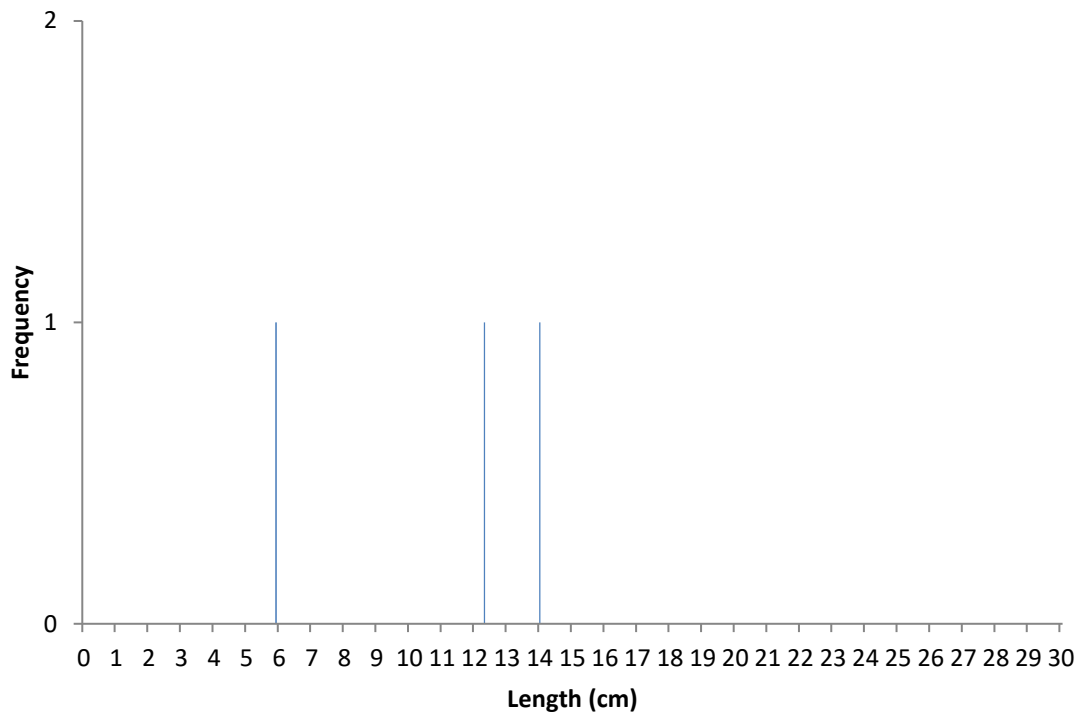
**Table 3.3. Number captured and length range (cm) for all species recorded at Harvestslade Site 1.**

Species	No. captured	Length range (cm)
Minnow	35	1.9 – 8.5
Bullhead	7	2.0 – 5.5
Stone loach	5	5.9 – 9.8
Brown trout	3	5.9 – 14.0
R/B lamprey	1	11.0
<b>TOTAL</b>	<b>51</b>	

Length frequency charts for minnow and brown trout are provided in Figure 3.2 and Figure 3.3 below.



**Figure 3.2. Length frequency of minnow captured at Harvestslade Site 1 (n=61).**



**Figure 3.3. Length frequency of brown trout captured at Harvestslade Site 1 (n=3).**

### 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? <sup>1</sup>	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 <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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 2.1.2). 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 2.23 m, with an overall surveyed area of 222.7 m<sup>2</sup>.

Being long-established; the river reach comprised a diversity of habitat types. Substrate was largely comprised of gravel, pebble and cobbles. 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	50	30	5	5	5	5		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		20		70	5	5		
Instream vegetation: <b>0 %</b>		Silted? <b>No</b>		Substrate: <b>Stable &amp; Uncompacted</b>				
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent	5	10	5	10		20	60	
Speed / Level: <b>Low</b>	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	65		5			
Right bank %	20	10	65		5			
Total LB fish cover: <b>35 %</b>	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: <b>35 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / Simple / <b>Complex</b>				RB Bankface vegetation: Bare / Uniform / Simple / <b>Complex</b>				
LB Banktop vegetation: Bare / Uniform / Simple / <b>Complex</b>				RB Banktop vegetation: Bare / Uniform / Simple / <b>Complex</b>				
LB Overhanging Boughs (%): <b>40</b>			RB Overhanging Boughs (%): <b>40</b>			Canopy Cover (%): <b>90</b>		

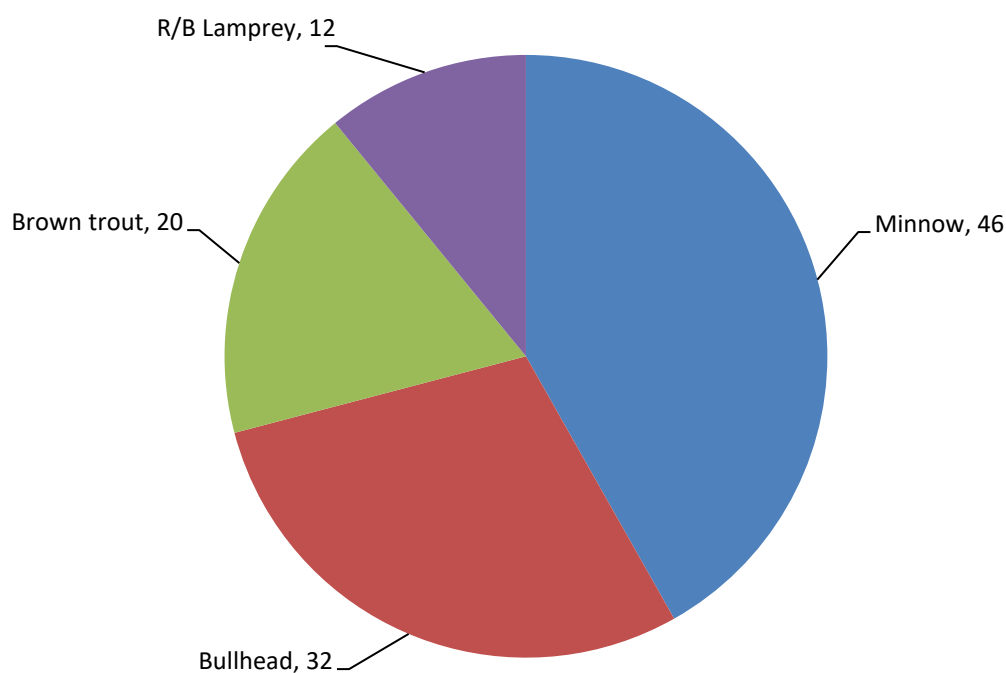


**Table 3.6. Physico-chemical parameters recorded during fish survey at Harvestslade Site 2.**

Parameter	Value
Temperature (°C)	17.6
Dissolved Oxygen (%)	95.2
Dissolved Oxygen (mg l <sup>-1</sup> )	9.09
Conductivity (µScm <sup>-1</sup> )	81.5
pH	8.4

### 3.2.2 Electric fishing survey results

A total of 220 fish were captured at Harvestslade Site 2 during two electric fishing runs, comprising four species. Minnow was the most abundant species captured, followed by bullhead, brown trout and lamprey (Figure 3.4).



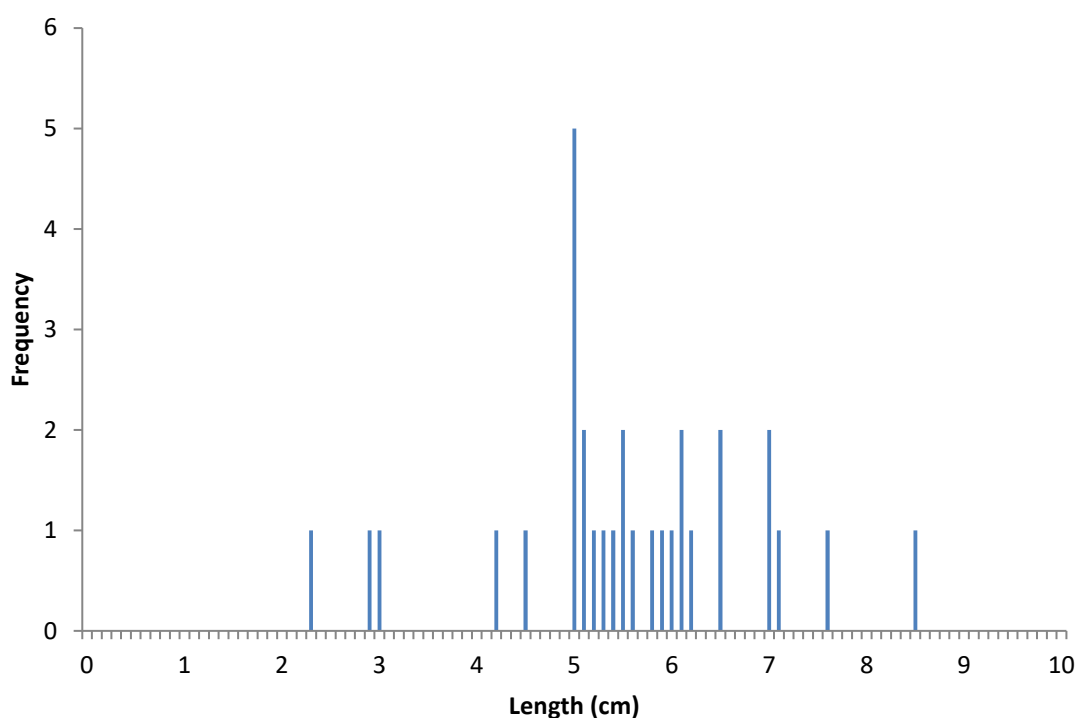
**Figure 3.4. Species composition (total number captured) at Harvestslade Site 2.**

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 <sup>2</sup> )	NFCS Classification
Minnow	46 (2.3 – 8.5)	51	0.68	42	60	23	N/A
Bullhead	32 (2.5 – 5.5)	35	0.68	27	43	16	N/A
R/B lamprey	12 (6.0 – 11.0)	17	0.43	-4	38	8	N/A
Brown trout (1++)	11 (10.3 – 19.0)	11	0.85	10	12	5	C (Fair)
Brown trout (0+)	9 (4.8 – 9.5)	9	0.90	8	10	4	D (Fair / Poor)
<b>TOTAL</b>	<b>110</b>						

Length frequency charts for minnow, bullhead and brown trout are provided in Figure 3.5 to Figure 3.7 below.



**Figure 3.5. Length frequency of minnow captured at Harvestslade Site 2 (n=31).**

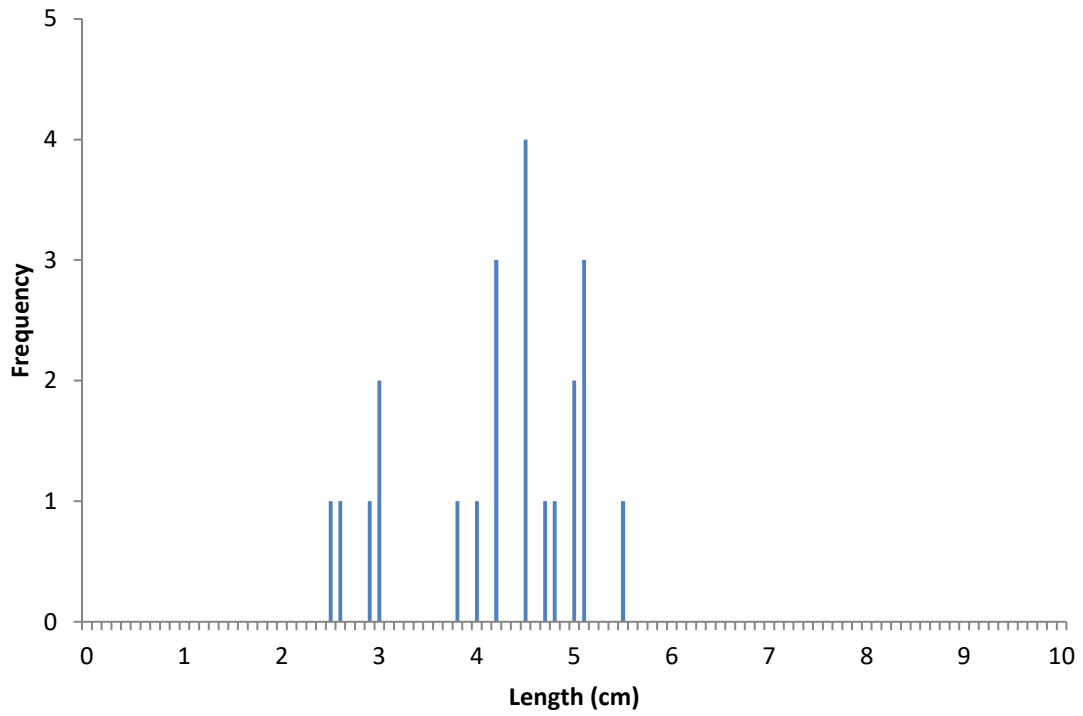


Figure 3.6. Length frequency of bullhead captured at Harvestslade Site 2 (n=22).

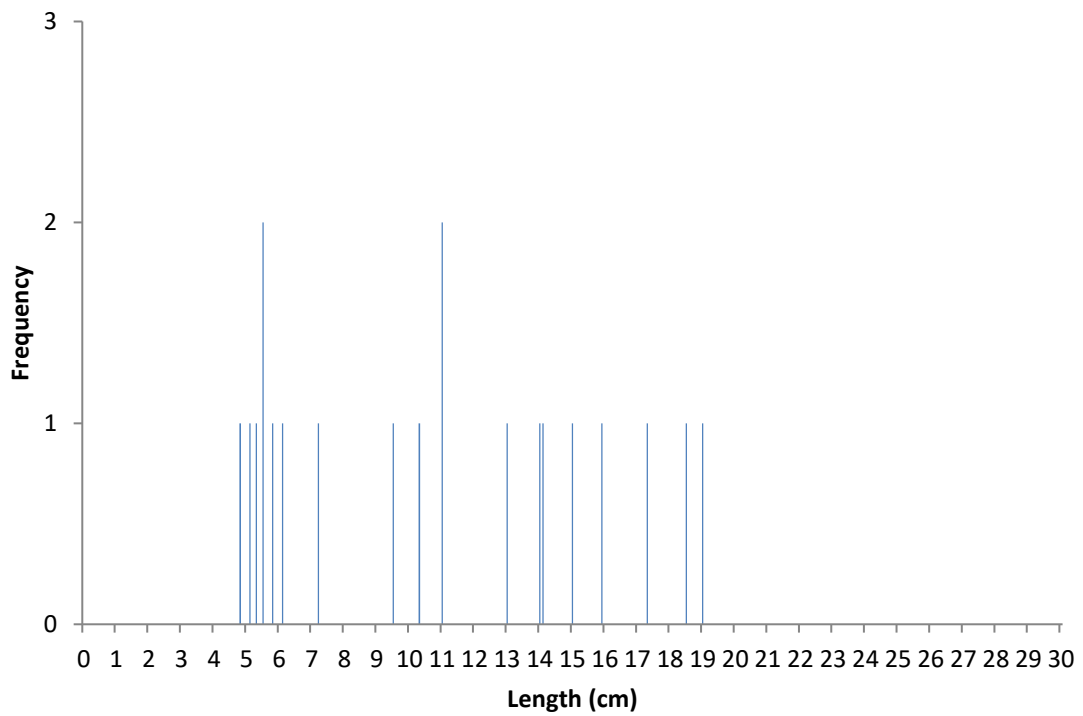


Figure 3.7. Length frequency of brown trout captured at Harvestslade Site 2 (n=20).

### 3.2.3 Fish species of conservation importance

Table 3.8 highlights 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? <sup>1</sup>	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 <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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 Longwater Site 1

#### 3.3.1 Site description

Longwater Site 1 is located within an area of broadleaf / mixed woodland and improved / semi-improved grassland, with canopy cover along approximately 50 % of the surveyed river stretch (see Section 2.1.3). 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 1.48 m, with an overall surveyed area of 148.2 m<sup>2</sup>.

The surveyed stretch comprised a new channel, based on paleo meanders, that had been created as part of the restoration works; this included infilling the old channel that flowed along the field edge tree line, and replacing it with a new meandering channel excavated through an open field. The new channel exhibited evidence of excessive poaching by livestock, bank erosion, shallow vegetation-choked channel and silted substrate.

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

Low flow and mobilisation of excessive fine silt during the first electric fishing run precluded the possibility of multiple runs at this site. Accordingly, data are presented for a single run only.

**Table 3.9. Habitat data recorded during the electric fishing survey at Longwater Site 1.**

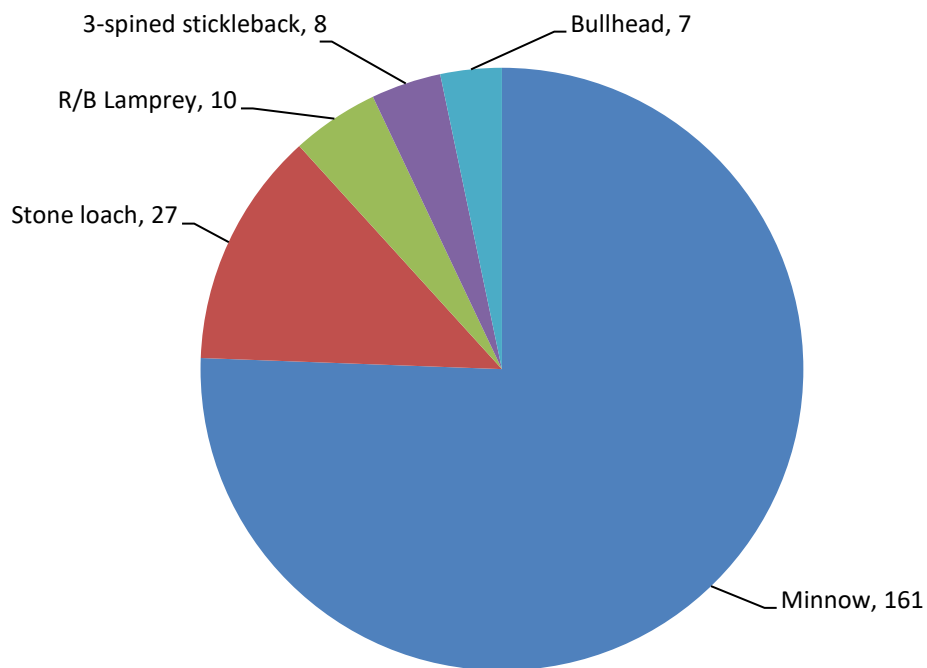
Depths (cm)	< 10	11 – 20	21 – 30	31 – 40	41 – 50	> 50		
Percent	35	30	20	5	5	5		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		50	30	20				
Instream vegetation: <b>10 %</b>	Silted? <b>Yes</b>		Substrate: <b>Unstable &amp; Uncompacted</b>					
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent	20	20	50				10	
Speed / Level: <b>Low</b>	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	10	80					
Right bank %	10	10	80					
Total LB fish cover: <b>20 %</b>	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: <b>20 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Overhanging Boughs (%): <b>10</b>			RB Overhanging Boughs (%): <b>10</b>			Canopy Cover (%): <b>50</b>		

**Table 3.10. Physico-chemical parameters recorded during fish survey at Longwater Site 1.**

Parameter	Value
Temperature (°C)	18.1
Dissolved Oxygen (%)	96.4
Dissolved Oxygen (mg l <sup>-1</sup> )	9.02
Conductivity (µScm <sup>-1</sup> )	347.5
pH	7.9

### 3.3.2 Electric fishing survey results

A total of 213 fish were captured at Longwater Site 1 during a single electric fishing run, comprising five species. Minnow was the most abundant species captured, followed by stone loach and lamprey (Figure 3.8).



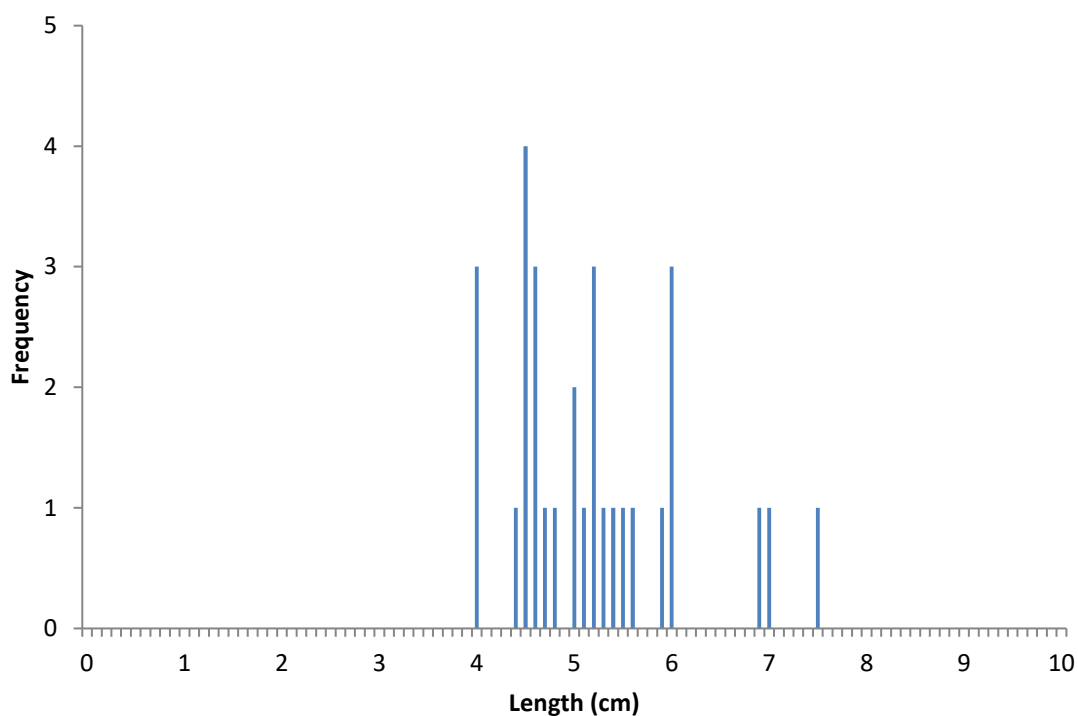
**Figure 3.8. Species composition (total number captured) at Longwater Site 1.**

The total number captured and length range (cm) for each fish species are shown in Table 3.11.

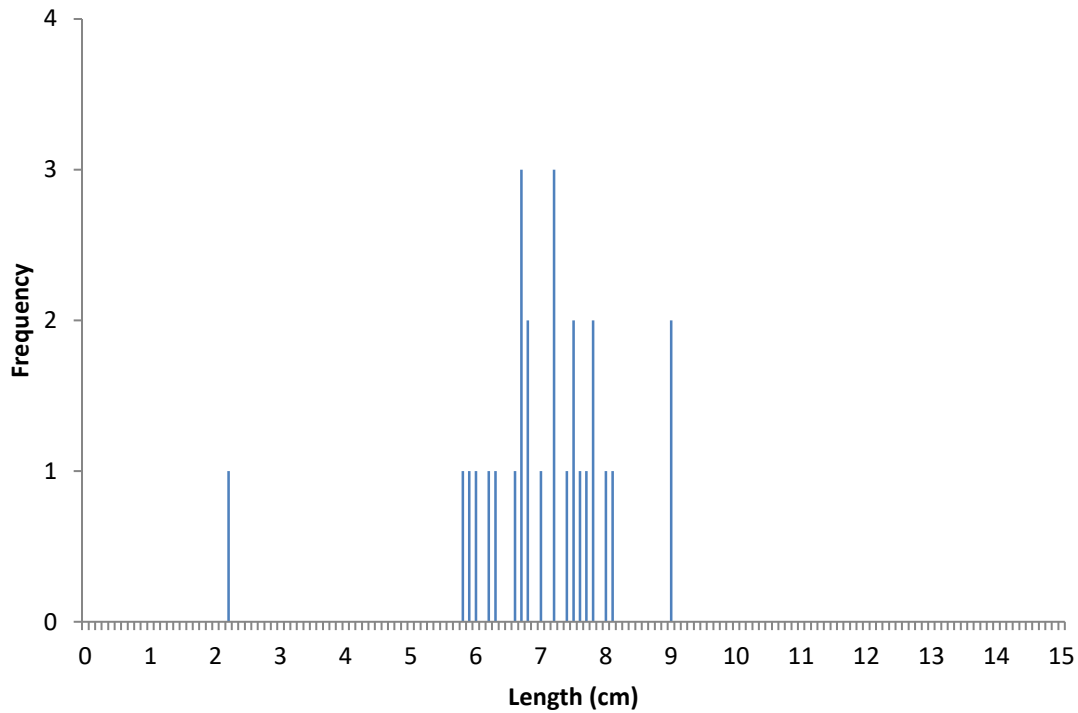
**Table 3.11. Number captured and length range (cm) for all species recorded at Longwater Site 1.**

Species	No. captured	Length range (cm)
Minnow	161	4.0 – 7.5
Stone loach	27	2.2 – 9.0
R/B lamprey	10	9.0 – 15.0
3-spined stickleback	8	2.2 – 4.2
Bullhead	7	2.1 – 5.7
<b>TOTAL</b>	<b>213</b>	

Length frequency charts for minnow and stone loach are provided in Figure 3.9 and Figure 3.10 below.



**Figure 3.9. Length frequency of minnow captured at Longwater Site 1 (n=30).**



**Figure 3.10. Length frequency of stone loach captured at Longwater Site 1 (n=27).**

### 3.3.3 Fish species of conservation importance

Table 3.12 highlights the fish species of conservation importance that were recorded at Longwater 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 Longwater Site 1.**

Species	Conservation designation	Within natural range? <sup>1</sup>	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	Y
Lamprey (River)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.



<sup>2</sup> 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.

<sup>3</sup> 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 Longwater Site 2

### 3.4.1 Site description

Longwater Site 2 is located within an area of improved / semi-improved grassland and moorland / heath, with a lack of any significant canopy cover along the surveyed river stretch (see Section 2.1.3). 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 1.60 m, with an overall surveyed area of 160.0 m<sup>2</sup>.

Longwater Site 2 appeared to be subject to similar pressures to Longwater Site 1, with evidence of livestock poaching and bank erosion. Where exposed substrate was present, this comprised mainly of relatively clean gravel. Physico-chemical parameters recorded during the time of the survey are provided in Table 3.14.

Low flow and mobilisation of excessive fine silt during the first electric fishing run precluded the possibility of multiple runs at this site. Accordingly, data are presented for a single run only.

**Table 3.13. Habitat data recorded during the electric fishing survey at Longwater Site 2.**

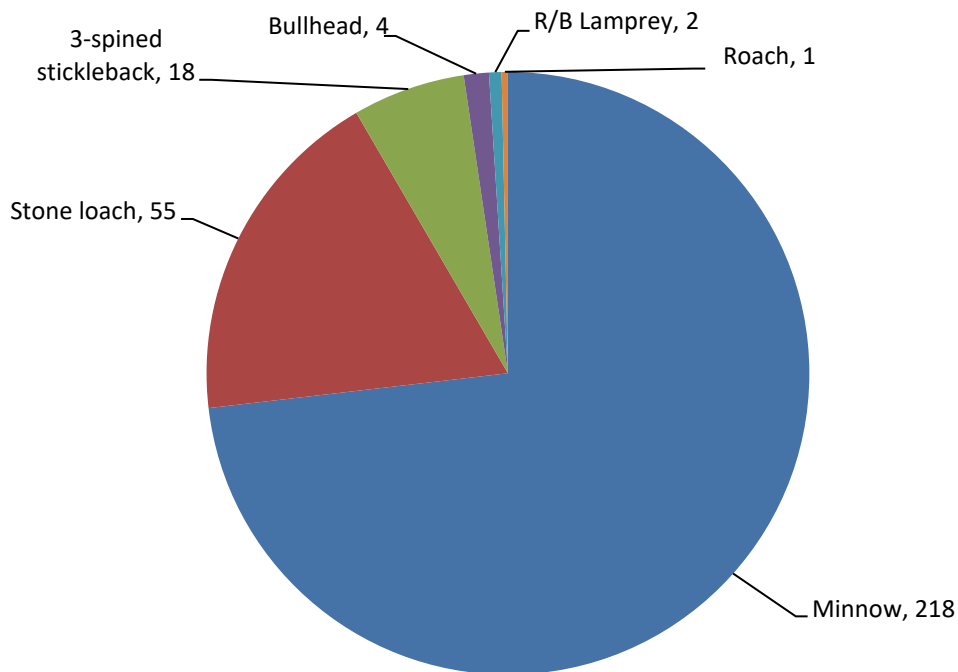
Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	30	30	20	10	5	5		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		60	20	20				
Instream vegetation: <b>70 %</b>		Silted? <b>Yes</b>		Substrate: <b>Stable &amp; Uncompacted</b>				
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent	10	20	50	10			10	
Speed / Level: <b>Low</b>	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		95					
Right bank %	5		95					
Total LB fish cover: <b>5 %</b>	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: <b>5 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Overhanging Boughs (%): <b>1</b>			RB Overhanging Boughs (%): <b>1</b>			Canopy Cover (%): <b>1</b>		

**Table 3.14. Physico-chemical parameters recorded during fish survey at Longwater Site 2.**

Parameter	Value
Temperature (°C)	17.2
Dissolved Oxygen (%)	53.8
Dissolved Oxygen (mg l <sup>-1</sup> )	5.15
Conductivity (µScm <sup>-1</sup> )	274.1
pH	7.8

### 3.4.2 Electric fishing survey results

A total of 298 fish were captured at Longwater Site 2 during a single electric fishing run, comprising six species. Minnow was the most abundant species captured, followed by stone loach and 3-spined stickleback (Figure 3.11).



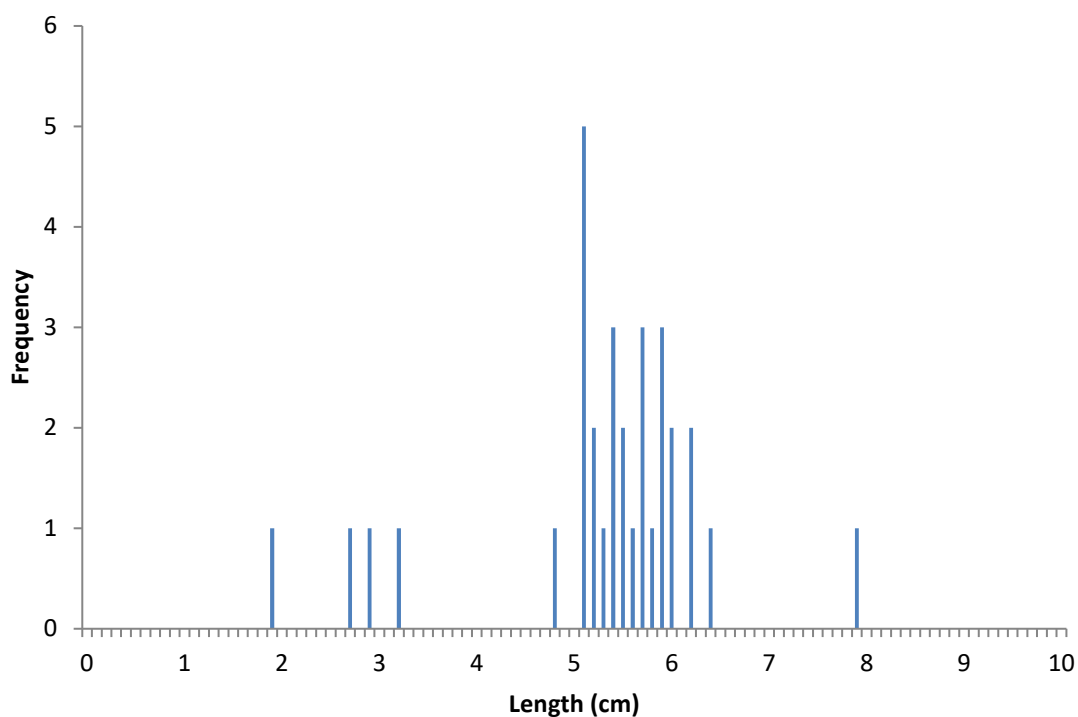
**Figure 3.11. Species composition (total number captured) at Longwater Site 2.**

The total number captured and length range (cm) for each fish species are shown in Table 3.15.

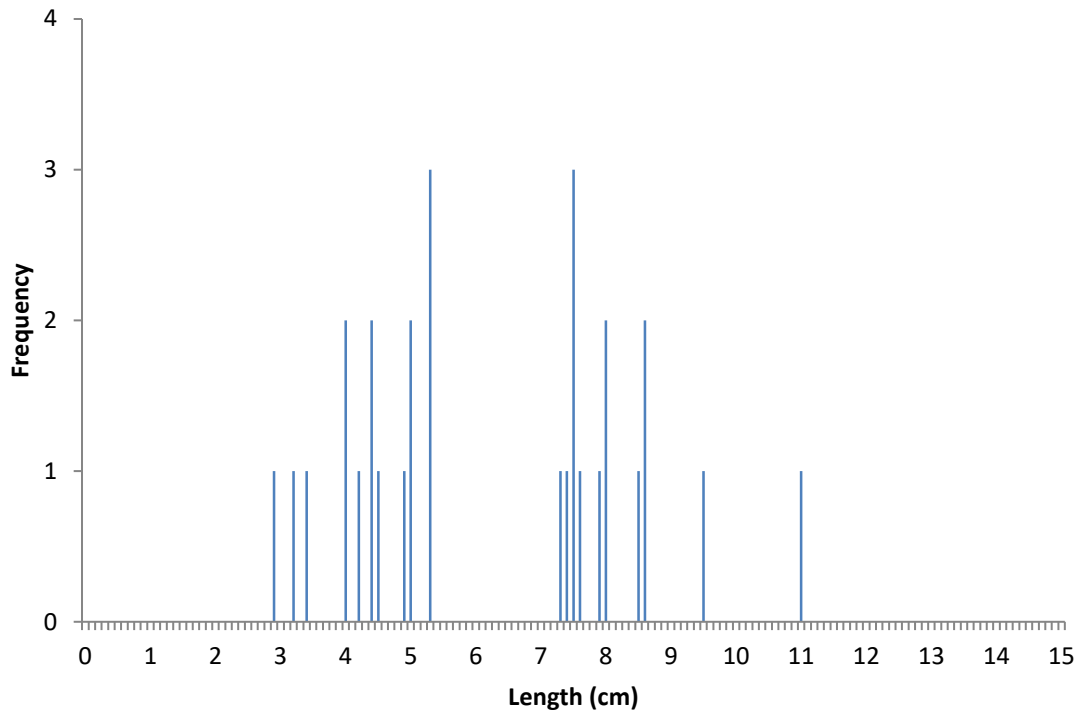
**Table 3.15. Number captured and length range (cm) for all species recorded at Longwater Site 2.**

Species	No. captured	Length range (cm)
Minnow	218	1.9 – 7.9
Stone loach	55	2.9 – 11.0
3-spined stickleback	18	1.8 – 3.7
Bullhead	4	3.4 – 8.3
R/B lamprey	2	13.0 – 14.0
Roach	1	8.8
<b>TOTAL</b>	<b>298</b>	

Length frequency charts for minnow and stone loach are provided in Figure 3.12 and Figure 3.13 below.



**Figure 3.12. Length frequency of minnow captured at Longwater Site 2 (n=32).**



**Figure 3.13. Length frequency of stone loach captured at Longwater Site 2 (n=29).**

### 3.4.3 Fish species of conservation importance

Table 3.16 highlights the fish species of conservation importance that were recorded at Longwater 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 Longwater Site 2.**

Species	Conservation designation	Within natural range? <sup>1</sup>	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	Y
Lamprey (River)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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 Pondhead Site 1

#### 3.5.1 Site description

Pondhead Site 1 is located within an area of broadleaf / mixed woodland, with canopy cover along approximately 90 % of the surveyed river stretch (see Section 2.1.4). Table 3.17 below summarises the key physical characteristics of the 100 m survey site, and Appendix 5 provides a photographic record of habitat variability. The mean wetted width was 2.35 m, with an overall surveyed area of 234.5 m<sup>2</sup>.

The river reach comprised a diversity of habitat types. Substrate was largely comprised of gravel, pebble and cobbles. Flow conditions 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 Pondhead Site 1.**

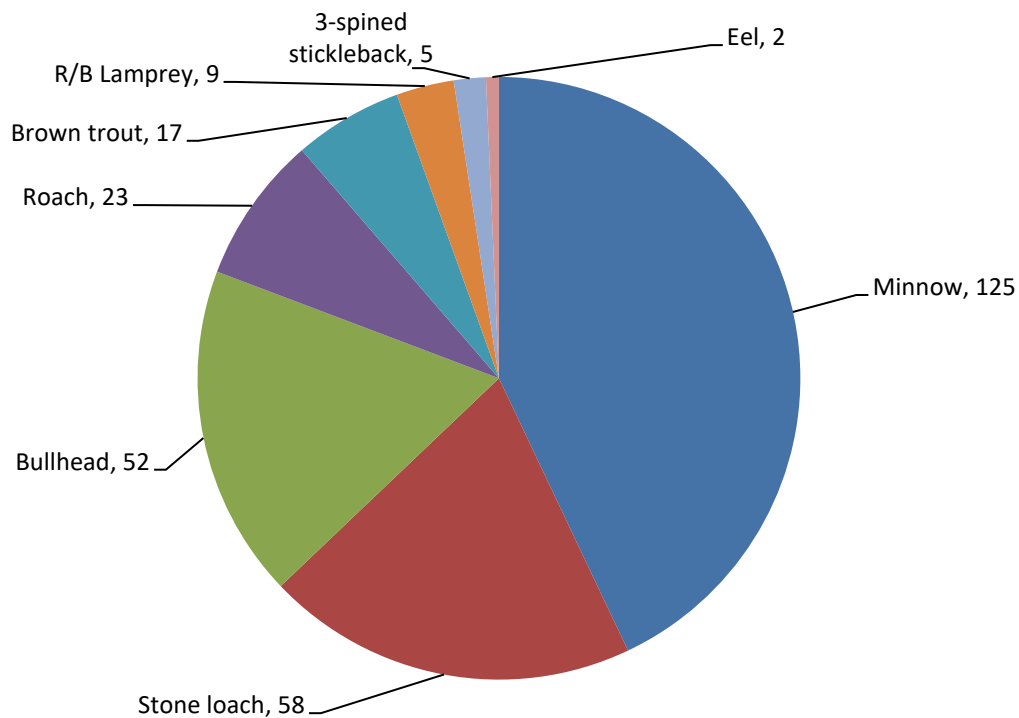
Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	30	30	10	10	10	10		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		20	10	30	40			
Instream vegetation: <b>0 %</b>		Silted? <b>Yes</b>		Substrate: <b>Stable &amp; Uncompacted</b>				
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent		30	10	10		30	20	
Speed / Level: <b>Low</b>	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	10	40		10			
Right bank %	40	10	40		10			
Total LB fish cover: <b>60 %</b>	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: <b>60 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Overhanging Boughs (%): <b>5</b>			RB Overhanging Boughs (%): <b>5</b>			Canopy Cover (%): <b>100</b>		

**Table 3.18. Physico-chemical parameters recorded during fish survey at Pondhead Site 1.**

Parameter	Value
Temperature (°C)	14.0
Dissolved Oxygen (%)	77
Dissolved Oxygen (mg l <sup>-1</sup> )	7.93
Conductivity (µScm <sup>-1</sup> )	324.4
pH	6.8

### 3.5.2 Electric fishing survey results

A total of 291 fish were captured at Pondhead Site 1 during three electric fishing runs, comprising eight species. Minnow was the most abundant species captured, followed by stone loach, bullhead and roach (Figure 3.14).



**Figure 3.14. Species composition (total number captured) at Pondhead Site 1.**

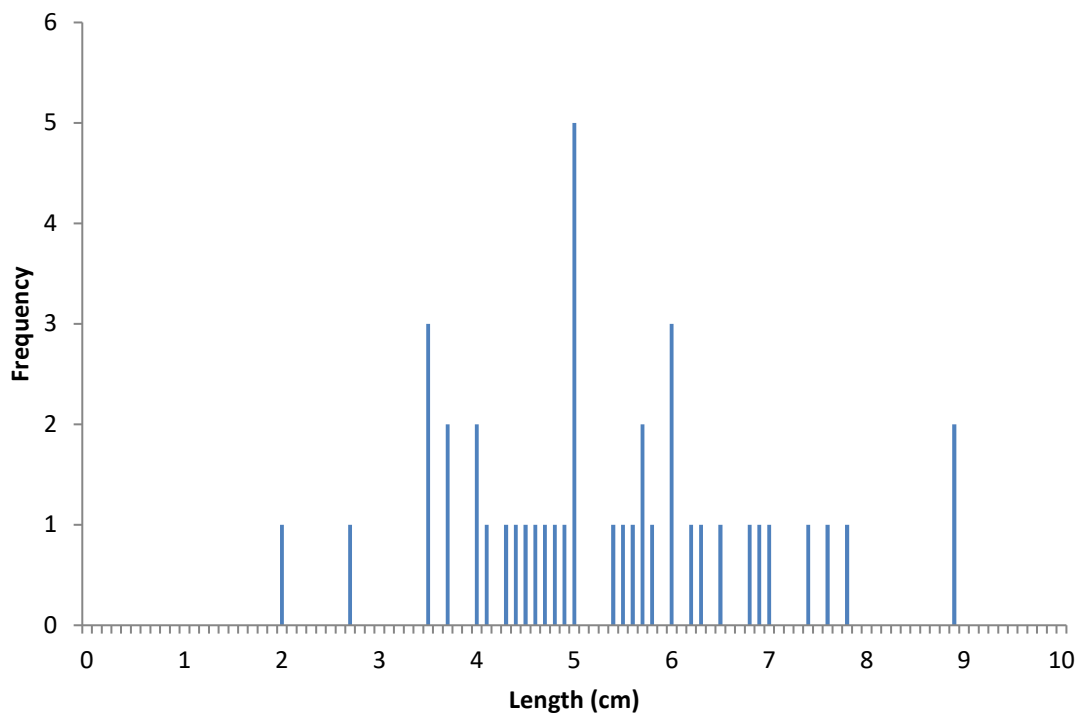
The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.19. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.



**Table 3.19. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Pondhead 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 <sup>2</sup> )	NFCS Classification
Minnow	125 (2.0 – 8.9)	135	0.57	124	146	58	N/A
Stone loach	58 (2.0 – 8.9)	63	0.55	55	71	27	N/A
Bullhead	52 (1.4 – 7.0)	68	0.37	43	93	29	N/A
Roach	23 (6.0 – 20.5)	23	0.77	22	24	10	N/A
Brown trout (1++)	10 (12.4 – 29.5)	10	0.83	10	10	4	D (Fair / Poor)
R/B lamprey	9 (8.0 – 13.0)	14	0.26	-11	40	6	N/A
Brown trout (0+)	7 (3.5 – 6.4)	7	0.78	6	8	3	D (Fair / Poor)
3-spined stickleback	5 (2.6 – 4.0)	5	0.63	3	7	2	N/A
Eel	2 (20.0 – 22.0)	2	0.67	1	3	1	N/A
<b>TOTAL</b>	<b>291</b>						

Length frequency charts for minnow, stone loach, bullhead, roach and brown trout are provided in Figure 3.15 to Figure 3.19 below.



**Figure 3.15. Length frequency of minnow captured at Pondhead Site 1 (n=42).**

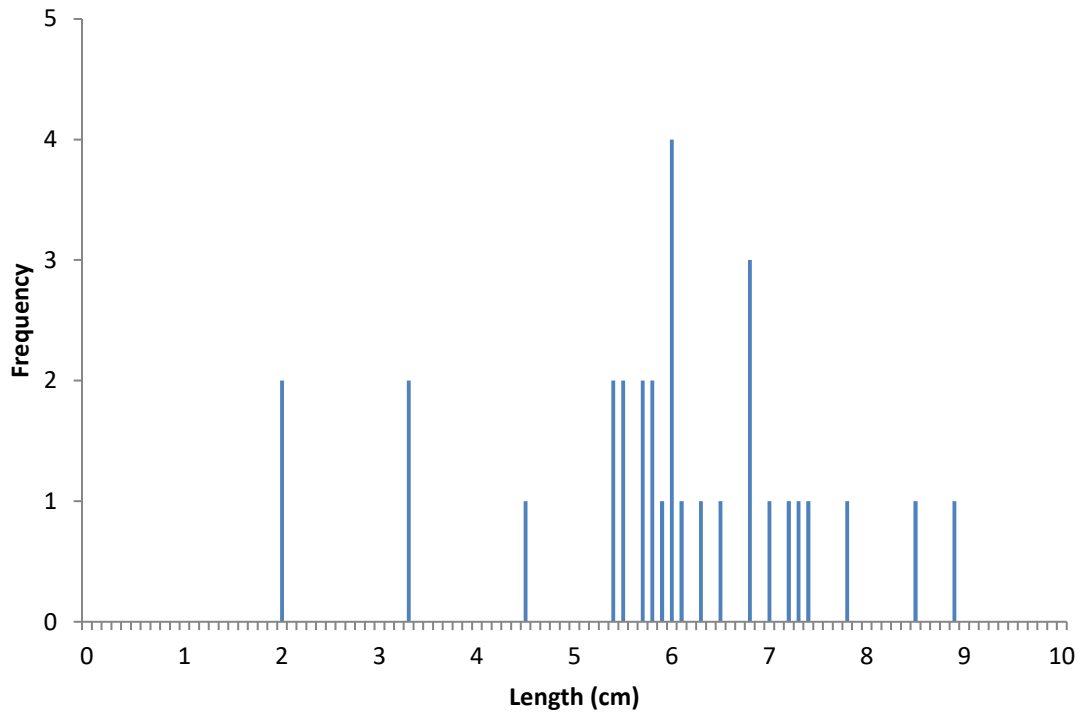


Figure 3.16. Length frequency of stone loach captured at Pondhead Site 1 (n=31).

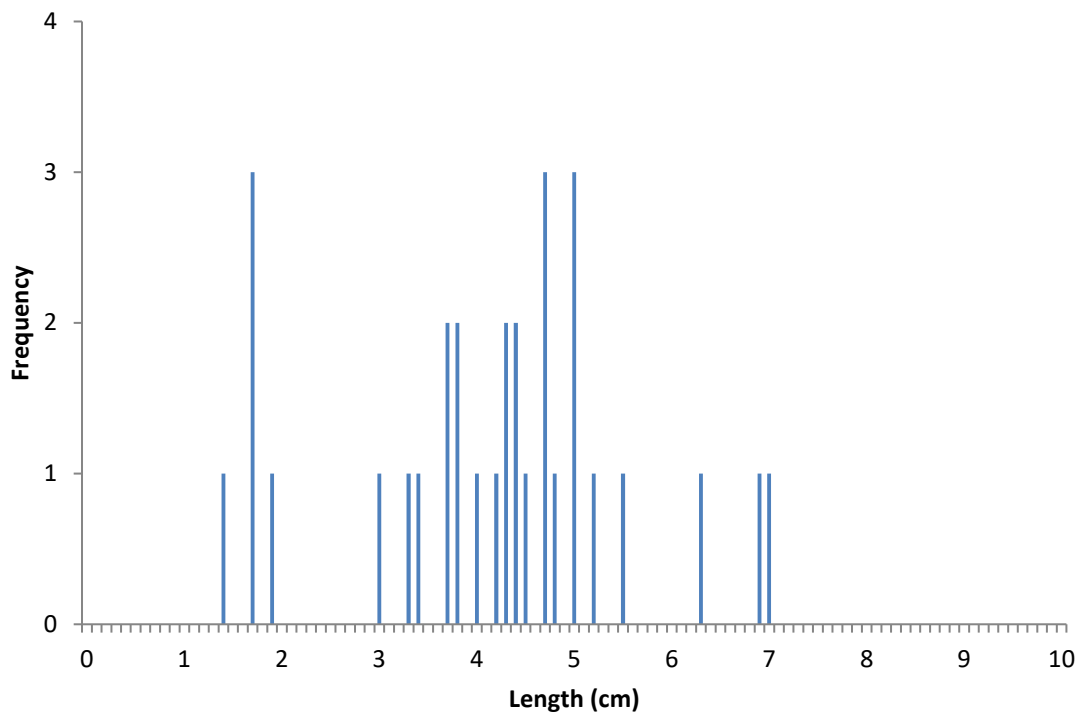


Figure 3.17. Length frequency of bullhead captured at Pondhead Site 1 (n=31).

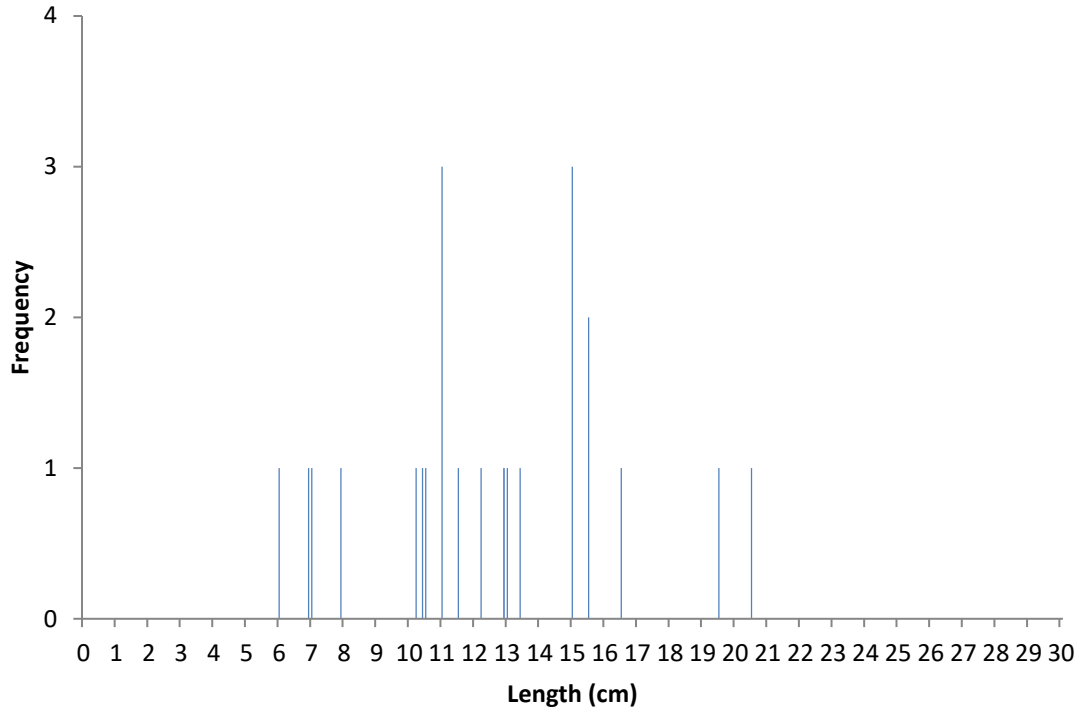


Figure 3.18. Length frequency of roach captured at Pondhead Site 1 (n=23).

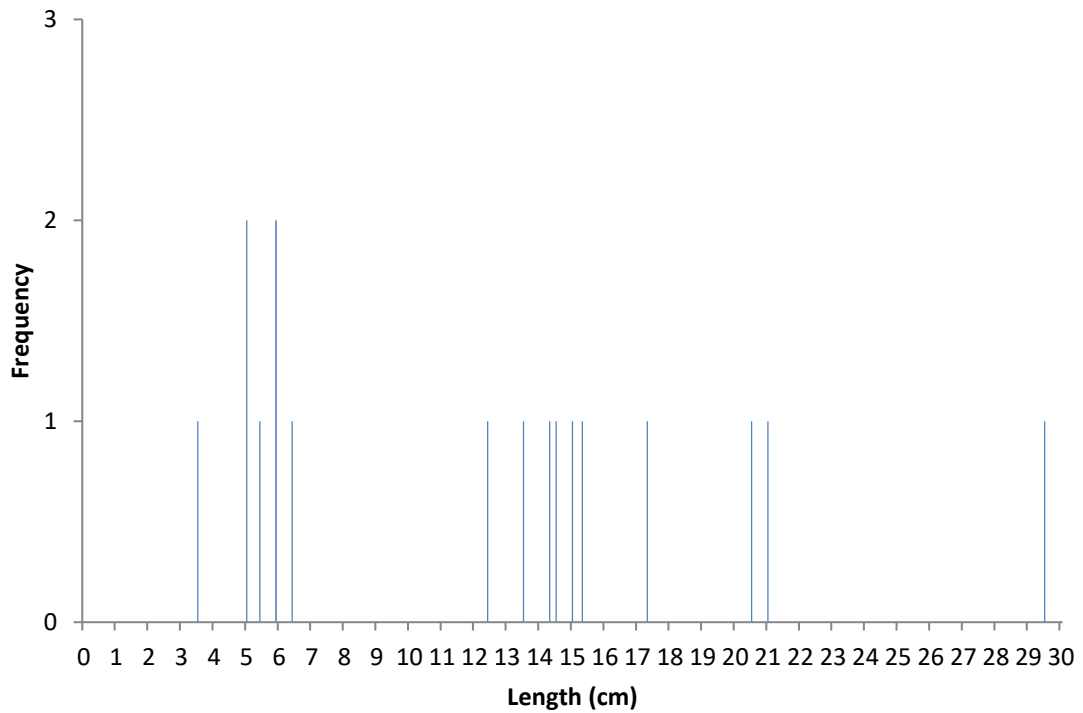


Figure 3.19. Length frequency of brown trout captured at Pondhead Site 1 (n=17).

### 3.5.3 Fish species of conservation importance

Table 3.20 highlights the fish species of conservation importance that were recorded at Pondhead Site 1 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 Pondhead Site 1.**

Species	Conservation designation	Within natural range? <sup>1</sup>	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 <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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 Pondhead Site 2

### 3.6.1 Site description

Pondhead Site 2 is located within an area of broadleaf / mixed woodland, with canopy cover along approximately 90 % of the surveyed river stretch (see Section 2.1.4). 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 1.84 m, with an overall surveyed area of 183.6 m<sup>2</sup>.

The river reach comprised mainly shallow riffle habitat, with limited deeper pools. Substrate was largely comprised of gravel and pebble overlain on a layer of soft clay. Flow conditions during the survey were low. 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 Pondhead Site 2.**

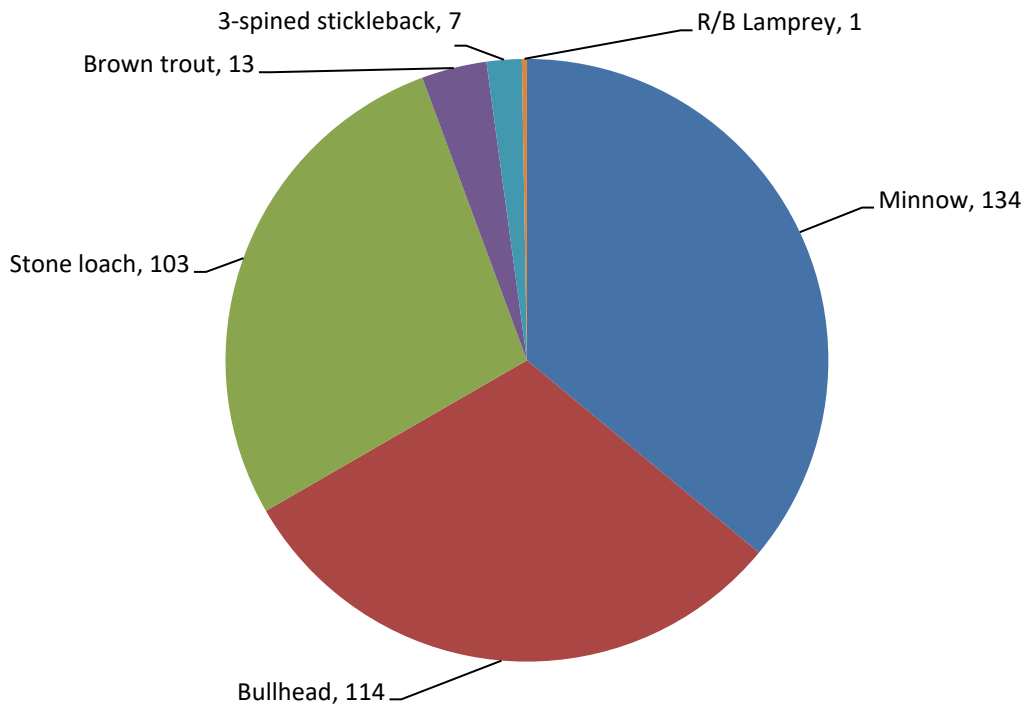
Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	20	30	20	10	10	10		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		20		20	60			
Instream vegetation: <b>0 %</b>		Silted? <b>Yes</b>		Substrate: <b>Unstable &amp; Uncompacted</b>				
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent		20	20	10	10	20	20	
Speed / Level: <b>Low</b>	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		95					
Right bank %	5		95					
Total LB fish cover: <b>5 %</b>	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: <b>5 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Overhanging Boughs (%): <b>5</b>			RB Overhanging Boughs (%): <b>5</b>			Canopy Cover (%): <b>100</b>		

**Table 3.22. Physico-chemical parameters recorded during fish survey at Pondhead Site 2.**

Parameter	Value
Temperature (°C)	14.0
Dissolved Oxygen (%)	77.0
Dissolved Oxygen (mg l <sup>-1</sup> )	7.93
Conductivity (µScm <sup>-1</sup> )	324.4
pH	6.8

### 3.6.2 Electric fishing survey results

A total of 372 fish were captured at Pondhead Site 2 during two electric fishing runs, comprising six species. Minnow was the most abundant species captured, followed by bullhead and stone loach (Figure 3.20).



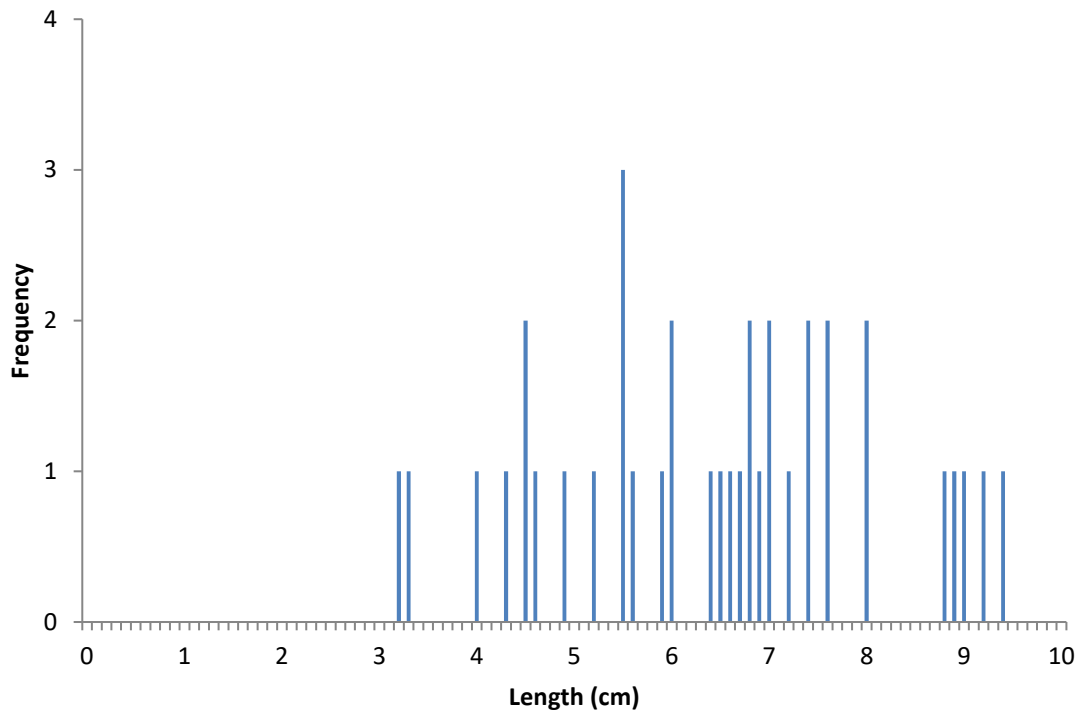
**Figure 3.20. Species composition (total number captured) at Pondhead Site 2.**

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.23. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

**Table 3.23. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Pondhead 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 <sup>2</sup> )	NFCS Classification
Minnow	134 (3.2 – 9.4)	174	0.52	133	215	95	N/A
Bullhead	114 (2.0 – 7.1)	226	0.29	55	397	123	N/A
Stone loach	103 (3.4 – 10.0)	123	0.59	100	146	67	N/A
Brown trout (0+)	9 (5.0 – 8.1)	9	0.75	6	12	5	D (Fair / Poor)
3-spined stickleback	7 (2.2 – 4.5)	7	0.78	5	9	4	N/A
Brown trout (1++)	4 (12.0 – 14.9)	4	0.80	3	5	2	D (Fair / Poor)
R/B lamprey	13.0	1	0.50	-2	4	1	N/A
<b>TOTAL</b>	<b>372</b>						

Length frequency charts for minnow, bullhead, stone loach and brown trout are provided in Figure 3.21 to Figure 3.24 below.



**Figure 3.21. Length frequency of minnow captured at Pondhead Site 2 (n=37).**

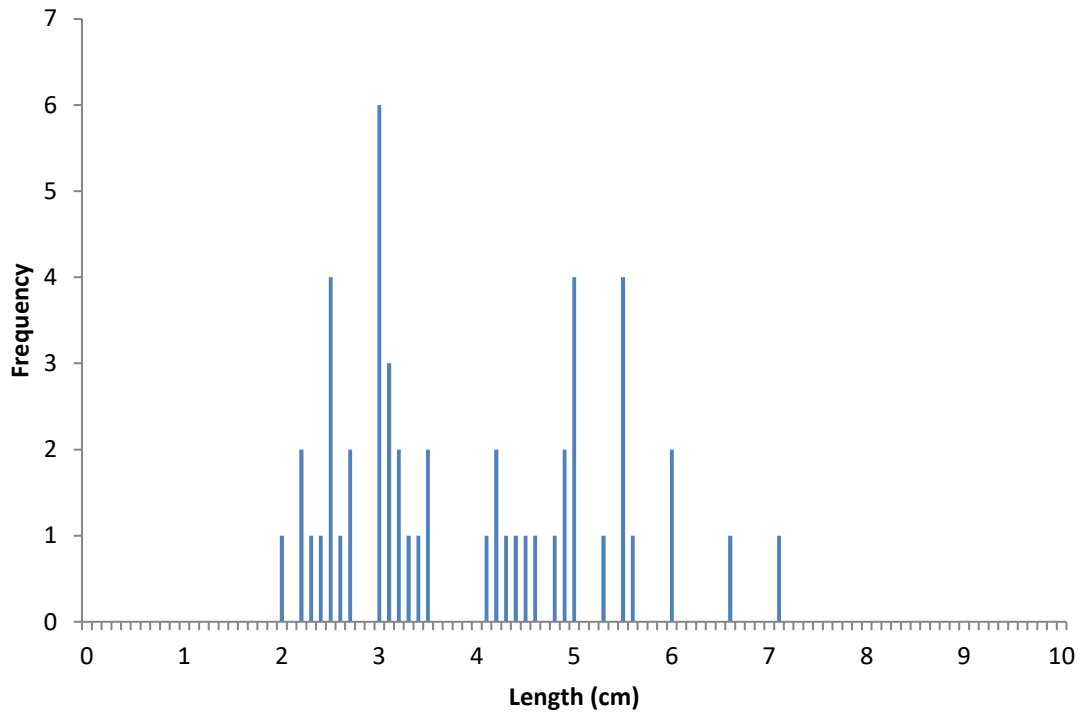


Figure 3.22. Length frequency of bullhead captured at Pondhead Site 2 (n=51).

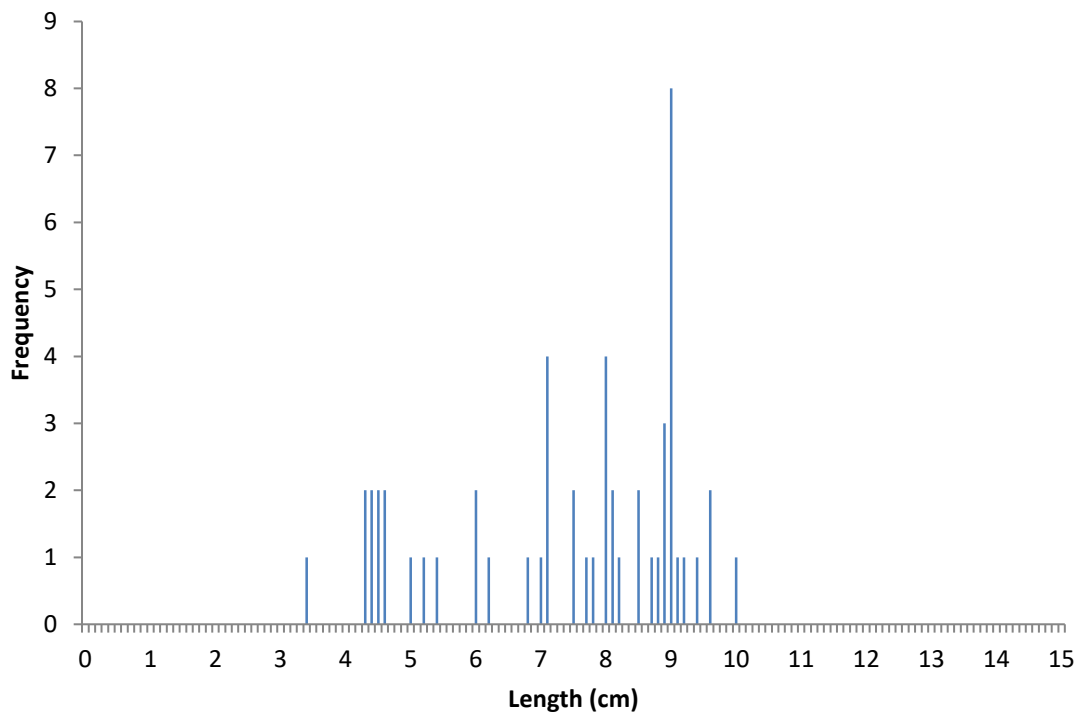
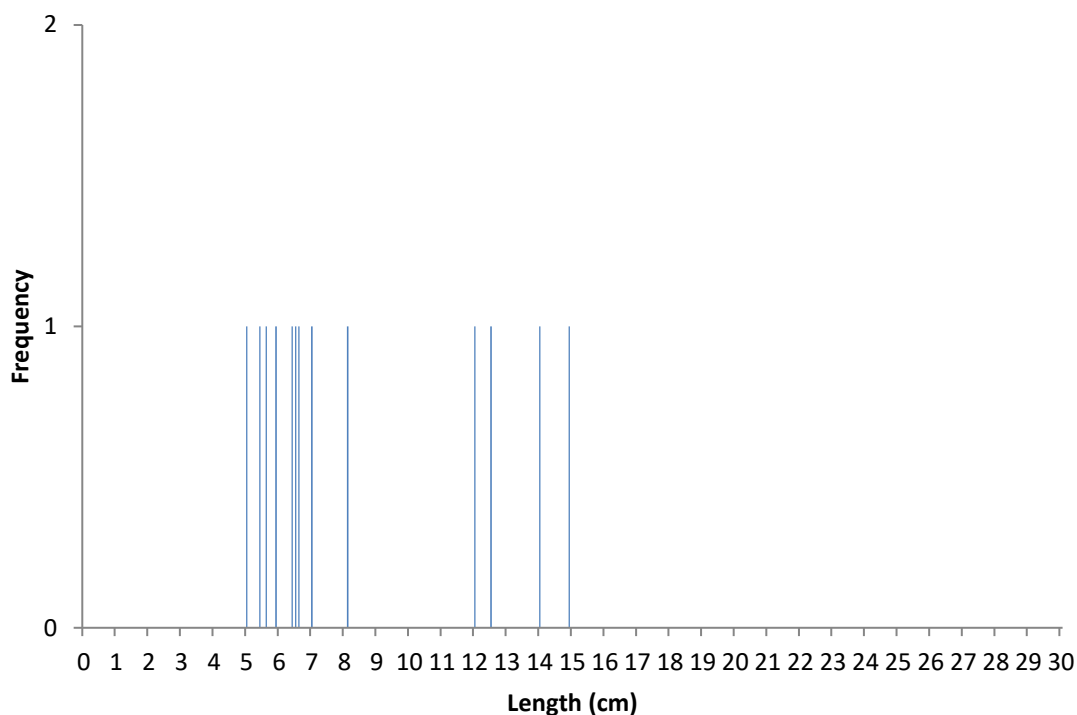


Figure 3.23. Length frequency of stone loach captured at Pondhead Site 2 (n=31).





**Figure 3.24. Length frequency of brown trout captured at Pondhead Site 2 (n=13).**

### 3.6.3 Fish species of conservation importance

Table 3.24 highlights the fish species of conservation importance that were recorded at Pondhead Site 2 during the electric fishing survey.

**Table 3.24. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Pondhead Site 2.**

Species	Conservation designation	Within natural range? <sup>1</sup>	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 <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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.

### 3.7 Pondhead Control

#### 3.7.1 Site description

Pondhead Control is located within an area of broadleaf / mixed woodland, with canopy cover along 100 % of the surveyed river stretch (see Section 2.1.4). Table 3.25 below summarises the key physical characteristics of the 90 m survey site, and Appendix 7 provides a photographic record of habitat variability. The mean wetted width was 1.50 m, with an overall surveyed area of 135.0 m<sup>2</sup>.

The straight river reach comprised an incised channel and exhibited mainly shallow habitat, with some deeper pools. Substrate was largely comprised of gravel and pebble. Flow conditions during the survey were low. Physico-chemical parameters recorded during the time of the survey are provided in Table 3.26.

**Table 3.25. Habitat data recorded during the electric fishing survey at Pondhead Control.**

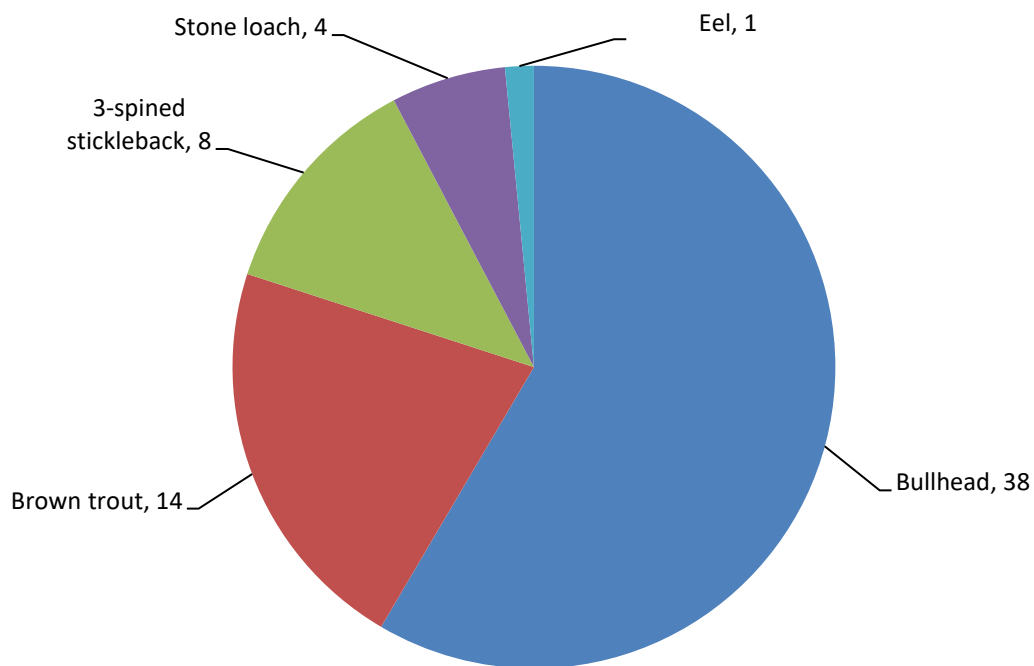
Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	40	40	5	5	5	5		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		20		30	40			
Instream vegetation: <b>0 %</b>		Silted? <b>Yes</b>		Substrate: <b>Stable &amp; Uncompacted</b>				
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent		30	40	10		10	10	
Speed / Level: <b>Low</b>	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	10			10			
Right bank %	40	10			10			
Total LB fish cover: <b>60 %</b>	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: <b>60 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / Simple / <b>Complex</b>				RB Bankface vegetation: Bare / Uniform / Simple / <b>Complex</b>				
LB Banktop vegetation: Bare / Uniform / Simple / <b>Complex</b>				RB Banktop vegetation: Bare / Uniform / Simple / <b>Complex</b>				
LB Overhanging Boughs (%): <b>10</b>			RB Overhanging Boughs (%): <b>10</b>			Canopy Cover (%): <b>100</b>		

**Table 3.26. Physico-chemical parameters recorded during fish survey at Pondhead Control.**

Parameter	Value
Temperature (°C)	14.7
Dissolved Oxygen (%)	66.6
Dissolved Oxygen (mg l <sup>-1</sup> )	6.73
Conductivity (µScm <sup>-1</sup> )	315.3
pH	7.6

### 3.7.2 Electric fishing survey results

A total of 65 fish were captured at Pondhead Control during two electric fishing runs, comprising five species. Bullhead was the most abundant species captured, followed by brown trout and 3-spined stickleback (Figure 3.25).



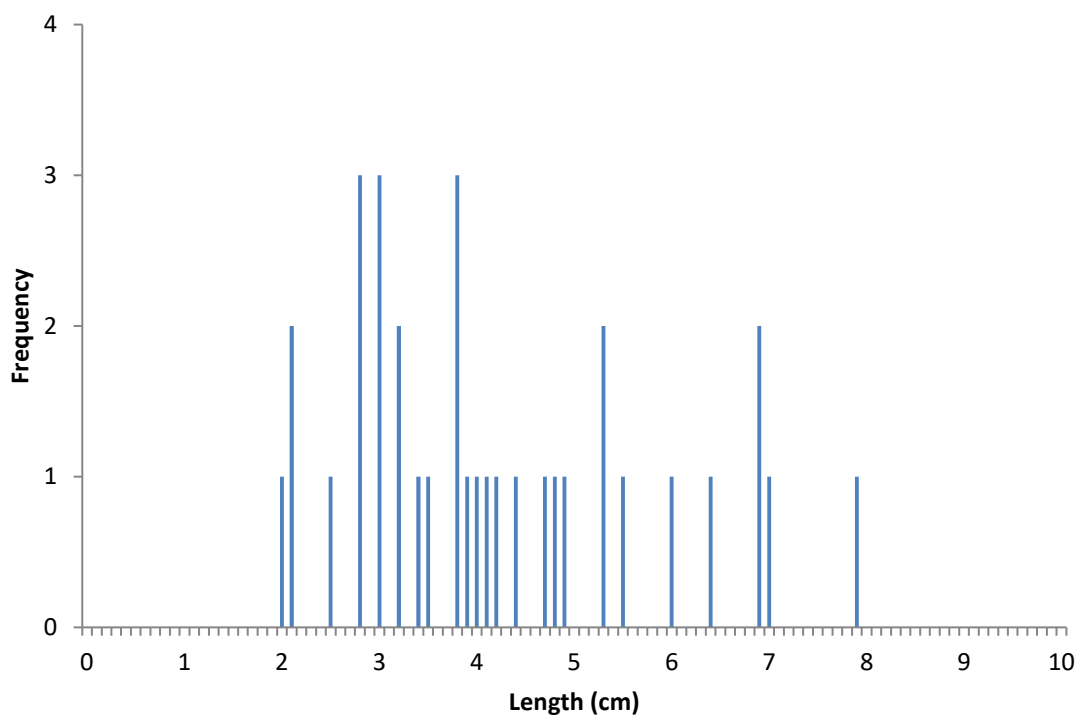
**Figure 3.25. Species composition (total number captured) at Pondhead Control.**

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.27. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

**Table 3.27. Number captured and catch depletion estimates (Carle & Strub), including Upper and Lower 95 % Confidence Intervals, for all species recorded at Pondhead Control. 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 <sup>2</sup> )	NFCS Classification
Bullhead	38 (2.0 – 7.9)	79	0.27	-37	195	59	N/A
Brown trout (0+)	12 (4.5 – 9.0)	12	1.00	12	12	9	C (Fair)
3-spined stickleback	8 (1.5 – 5.0)	8	0.89	7	9	6	N/A
Stone loach	4 (7.0 – 9.0)	4	0.67	1	7	3	N/A
Brown trout (1++)	2 (14.0 – 17.6)	2	1.00	2	2	1	E (Poor)
Eel	26.0	1	0.50	-2	4	1	N/A
<b>TOTAL</b>	<b>99</b>						

Length frequency charts for bullhead and brown trout are provided in Figure 3.26 and Figure 3.27 below.



**Figure 3.26. Length frequency of bullhead captured at Pondhead Control (n=34).**

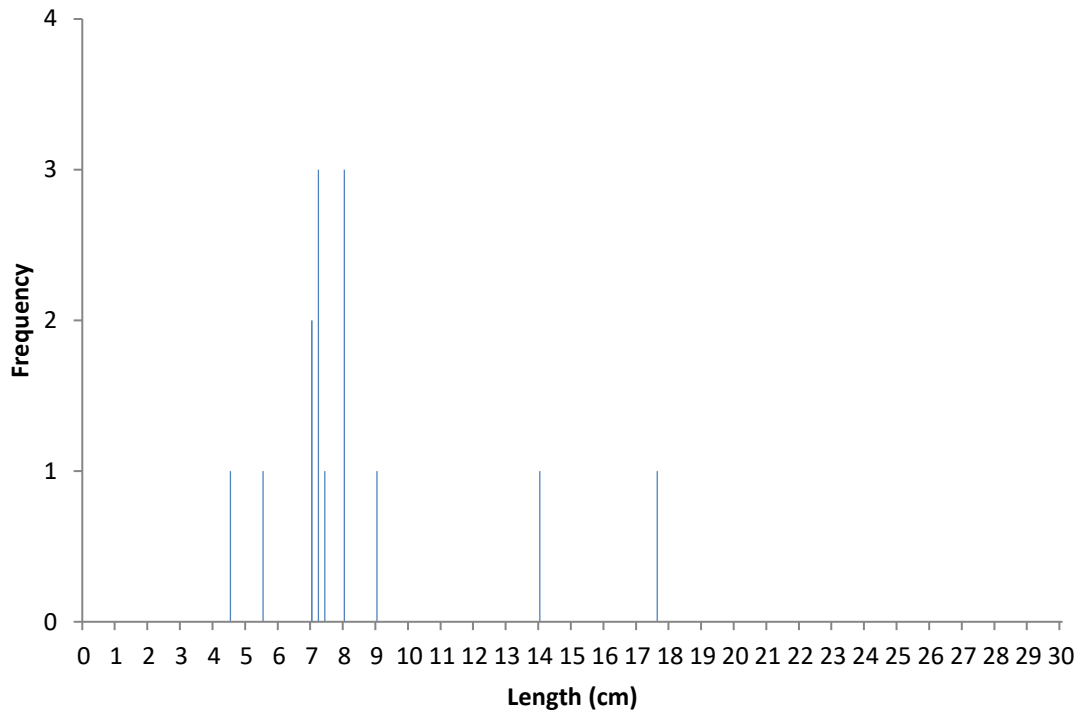


Figure 3.27. Length frequency of brown trout captured at Pondhead Control (n=14).

### 3.7.3 Fish species of conservation importance

Table 3.28 highlights the fish species of conservation importance that were recorded at Pondhead Control during the electric fishing survey.

**Table 3.28. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Pondhead Control.**

Species	Conservation designation	Within natural range? <sup>1</sup>	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	N
Lamprey (River)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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 Slufters

### 3.8.1 Site description

The Slufters site is located within an area of broadleaf / mixed woodland (see Section 2.1.5). Table 3.29 below summarises the key physical characteristics of the 100 m survey site, and Appendix 8 provides a photographic record of habitat variability. The mean wetted width was 0.72 m, with an overall surveyed area of 71.8 m<sup>2</sup>.

Substrate was mainly silt, with a deep layer of underlying soft clay. The channel exhibited evidence of excessive poaching by livestock, bank erosion, shallow vegetation-choked channel and silted substrate. Flow conditions during the survey were low, with large sections of the channel dry or choked with grasses and other vegetation. Physico-chemical parameters recorded during the time of the survey are provided in Table 3.30.

Low flow and mobilisation of excessive fine silt during the first electric fishing run precluded the possibility of multiple runs at this site. Accordingly, data are presented for a single run only.

**Table 3.29. Habitat data recorded during the electric fishing survey at Slufters.**

Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	50	30	5	5	5	5		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		20	10	20	30	20		
Instream vegetation: 50 %		Silted? <b>Yes</b>		Substrate: <b>Unstable &amp; Uncompacted</b>				
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent	20	20	40				20	
Speed / Level: <b>Low</b>	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		95					
Right bank %	5		95					
Total LB fish cover: <b>5 %</b>	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: <b>5 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Overhanging Boughs (%): <b>5</b>			RB Overhanging Boughs (%): <b>5</b>			Canopy Cover (%): <b>100</b>		

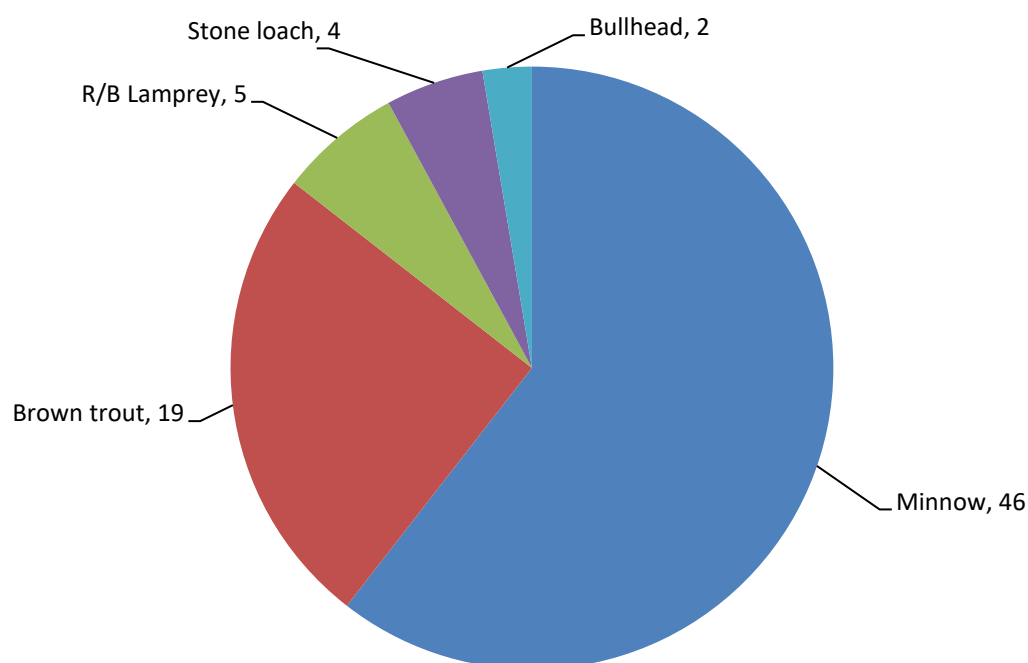


**Table 3.30. Physico-chemical parameters recorded during fish survey at Sluffers.**

Parameter	Value
Temperature (°C)	15.8
Dissolved Oxygen (%)	84.6
Dissolved Oxygen (mg l <sup>-1</sup> )	8.39
Conductivity (µScm <sup>-1</sup> )	200.0
pH	8.0

### 3.8.2 Electric fishing survey results

A total of 99 fish were captured at Sluffers during a single electric fishing run, comprising five species. Minnow was the most abundant species captured, followed by brown trout (Figure 3.28).



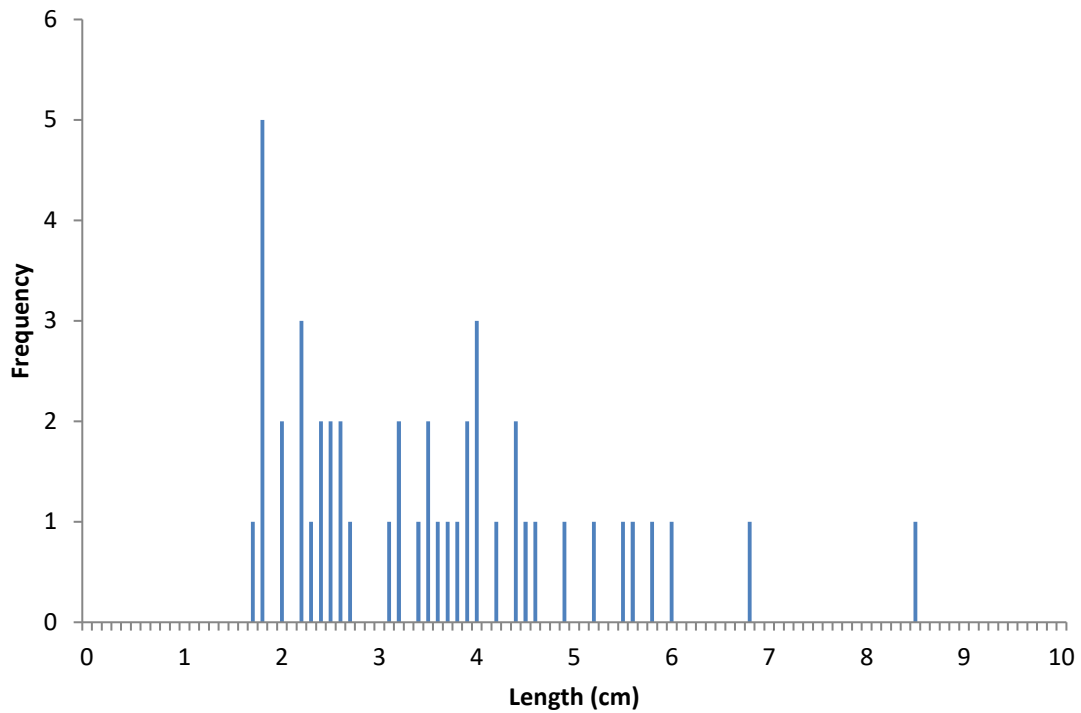
**Figure 3.28. Species composition (total number captured) at Sluffers.**

The total number captured and length range (cm) for each fish species are shown in Table 3.31.

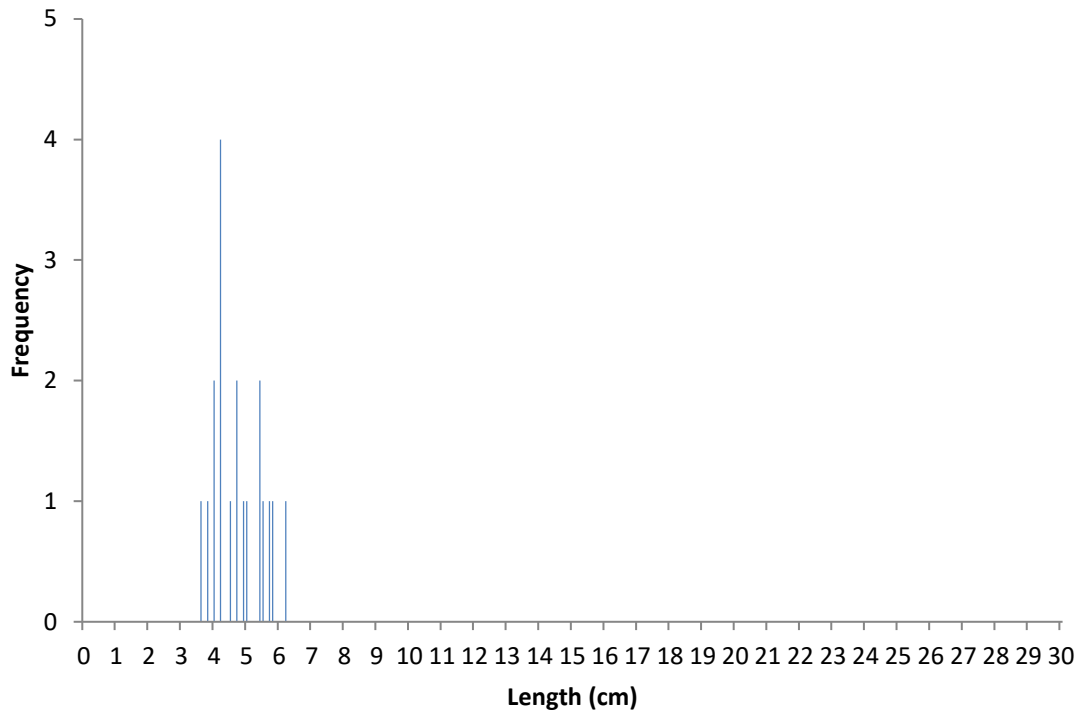
**Table 3.31. Number captured and length range (cm) for all species recorded at Slufers.**

Species	No. captured	Length range (cm)
Minnow	46	1.7 – 8.5
Brown trout	19	3.6 – 6.2
R/B lamprey	5	7.0 – 12.0
Stone loach	4	4.6 – 8.5
Bullhead	2	3.1 – 5.3
<b>TOTAL</b>	<b>76</b>	

Length frequency charts for minnow and brown trout are provided in Figure 3.29 and Figure 3.30.



**Figure 3.29. Length frequency of minnow captured at Slufers (n=46).**



**Figure 3.30. Length frequency of brown trout captured at Sluffers (n=19).**

### 3.8.3 Fish species of conservation importance

Table 3.32 highlights the fish species of conservation importance that were recorded at Sluffers during the electric fishing survey.

**Table 3.32. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Sluffers.**

Species	Conservation designation	Within natural range? <sup>1</sup>	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 <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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 Wootton Phase 1 Site 1

#### 3.9.1 Site description

Wootton Phase 1 Site 1 is located within an area of broadleaf / mixed woodland (see Section 2.1.6). Table 3.33 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 2.74 m, with an overall surveyed area of 273.6 m<sup>2</sup>.

The river reach comprised mainly shallow riffle habitat, with limited deeper pools. Substrate was largely comprised of gravel and pebble. Flow conditions during the survey were low. Physico-chemical parameters recorded during the time of the survey are provided in Table 3.34.

**Table 3.33. Habitat data recorded during the electric fishing survey at Wootton Phase 1 Site 1.**

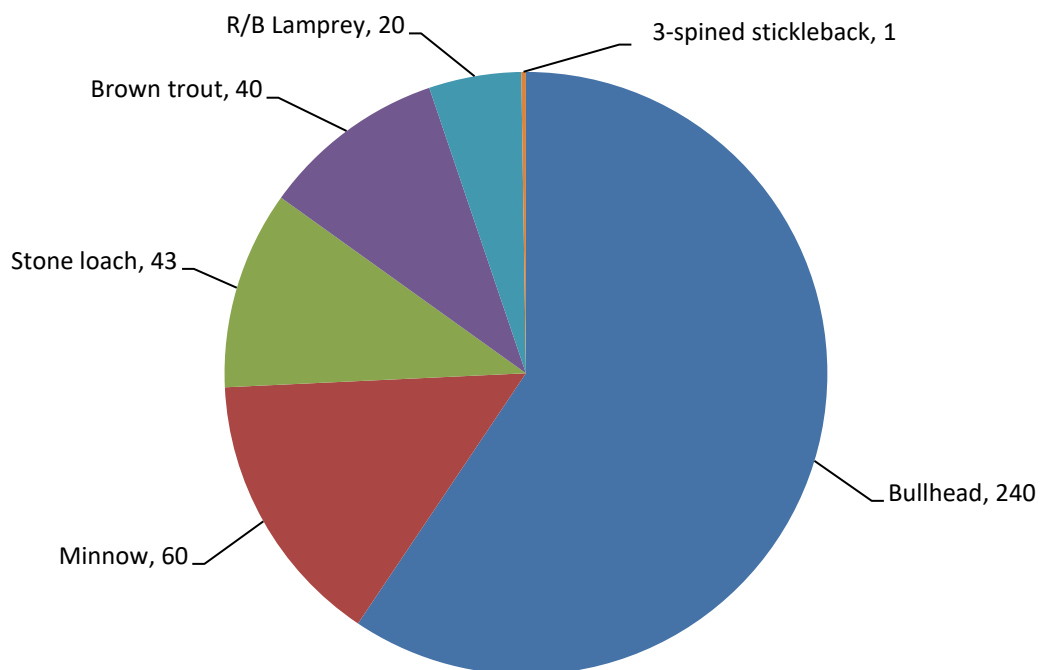
Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	20	20	20	20	10	10		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		20		30	40	10		
Instream vegetation: <b>0 %</b>		Silted? <b>No</b>		Substrate: <b>Stable &amp; Uncompacted</b>				
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent		20	10	10	10	30	20	
Speed / Level: <b>Low</b>	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	10	75		10			
Right bank %	5	10	75		10			
Total LB fish cover: <b>25 %</b>	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: <b>25 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Overhanging Boughs (%): <b>5</b>			RB Overhanging Boughs (%): <b>5</b>			Canopy Cover (%): <b>100</b>		

**Table 3.34. Physico-chemical parameters recorded during fish survey at Wootton Phase 1 Site 1.**

Parameter	Value
Temperature (°C)	15.5
Dissolved Oxygen (%)	96.6
Dissolved Oxygen (mg l <sup>-1</sup> )	9.59
Conductivity (µScm <sup>-1</sup> )	134.0
pH	7.9

### 3.9.2 Electric fishing survey results

A total of 404 fish were captured at Wootton Phase 1 Site 1 during three electric fishing runs, comprising six species. Bullhead was the most abundant species captured, followed by minnow, stone loach and brown trout (Figure 3.31).



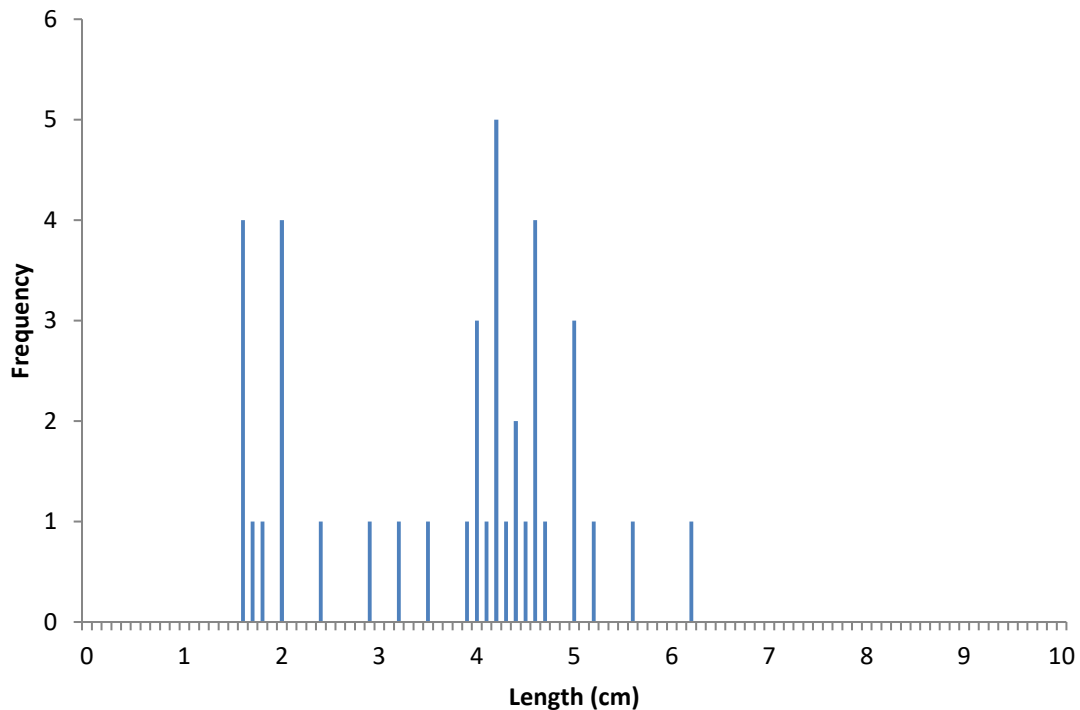
**Figure 3.31. Species composition (total number captured) at Wootton Phase 1 Site 1.**

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.35. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

**Table 3.35. 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 <sup>2</sup> )	NFCS Classification
Bullhead	240(1.6 – 6.2)	277	0.49	251	303	101	N/A
Minnow	60 (2.9 – 6.6)	73	0.43	54	92	27	N/A
Stone loach	43 (3.0 – 10.5)	50	0.47	38	62	18	N/A
Brown trout (0+)	25 (4.4 – 8.2)	31	0.40	17	45	11	C (Fair)
R/B lamprey	20 (7.0 – 12.0)	27	0.34	8	46	10	N/A
Brown trout (1++)	15 (10.0 – 21.0)	15	0.79	14	16	5	C (Fair)
3-spined stickleback	1 (2.8)	1	1.00	1	1	<1	N/A
<b>TOTAL</b>	<b>404</b>						

Length frequency charts for bullhead, minnow, stone loach and brown trout are provided in Figure 3.32 to Figure 3.35 below.



**Figure 3.32. Length frequency of bullhead captured at Wootton Phase 1 Site 1 (n=39).**

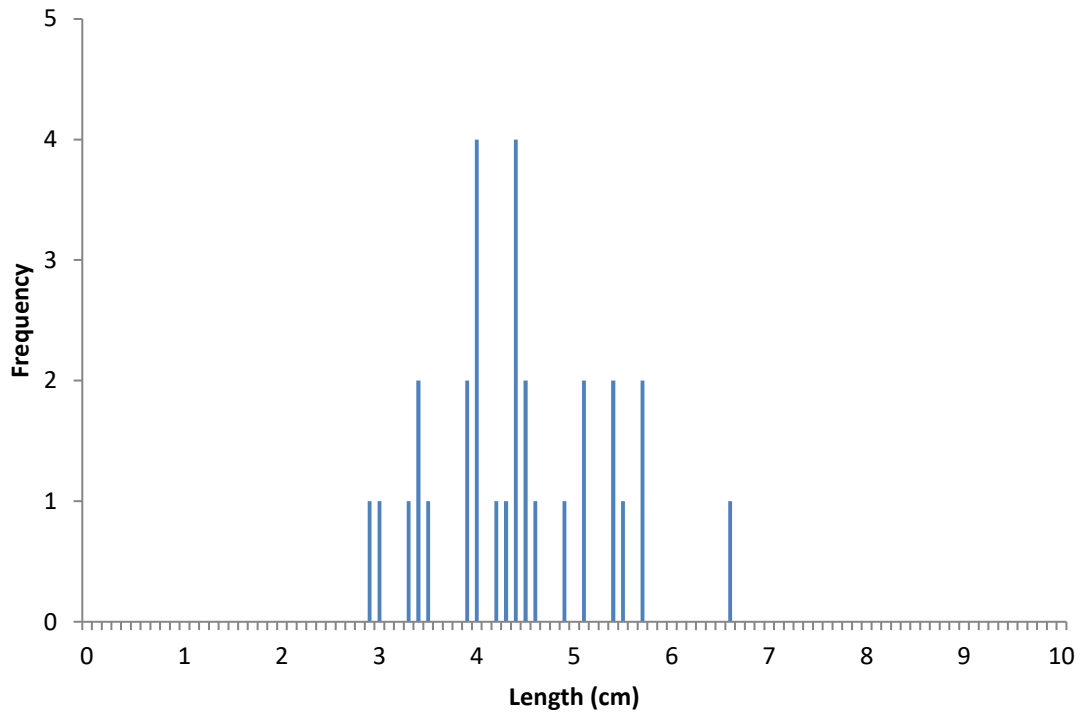


Figure 3.33. Length frequency of minnow captured at Wootton Phase 1 Site 1 (n=30).

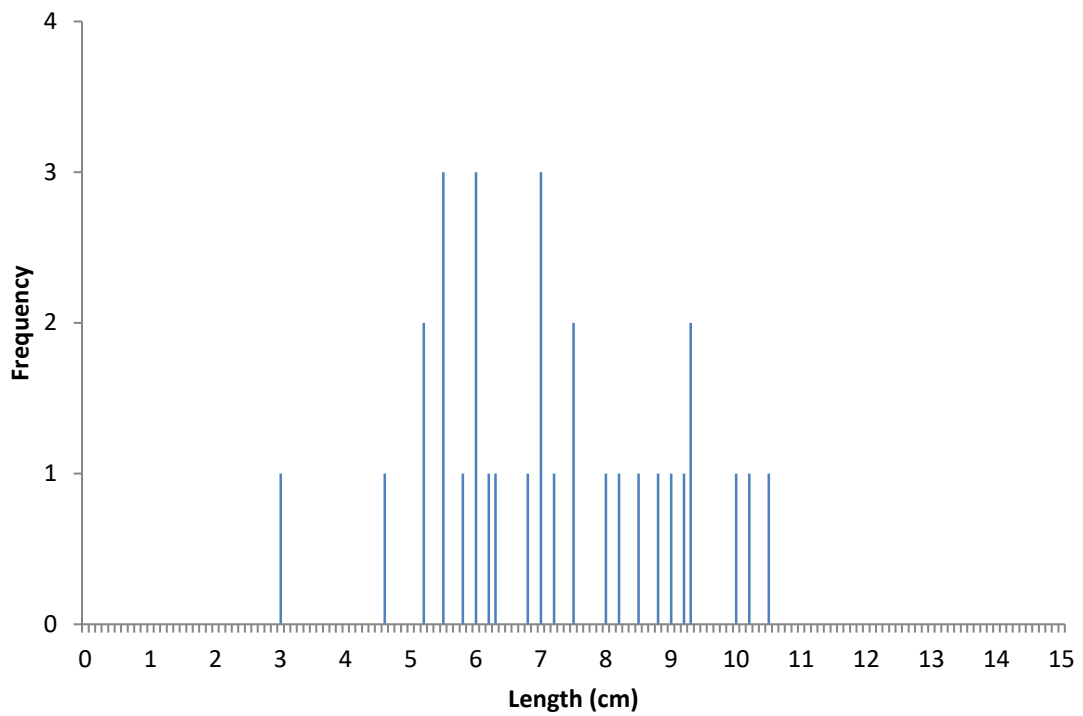


Figure 3.34. Length frequency of stone loach captured at Wootton Phase 1 Site 1 (n=31).



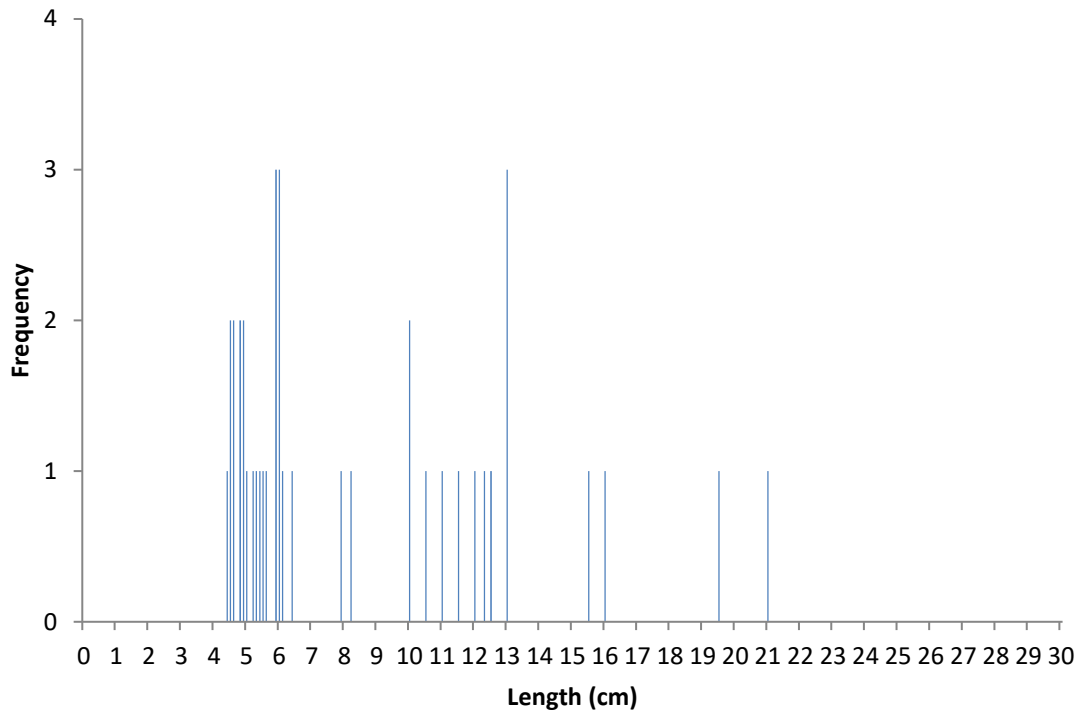


Figure 3.35. Length frequency of brown trout captured at Wootton Phase 1 Site 1 (n=40).

### 3.9.3 Fish species of conservation importance

Table 3.36 highlights the fish species of conservation importance that were recorded at Wootton Phase 1 Site 1 during the electric fishing survey.

**Table 3.36. 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? <sup>1</sup>	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 <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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 2

#### 3.10.1 Site description

Wootton Phase 1 Site 2 is located within an area of rough pasture (see Section 2.1.6). Table 3.37 below summarises the key physical characteristics of the 70 m survey site, and Appendix 10 provides a photographic record of habitat variability. The mean wetted width was 2.35 m, with an overall surveyed area of 141.0 m<sup>2</sup> (taking account of 10 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. Flow conditions during the survey were low. Physico-chemical parameters recorded during the time of the survey are provided in Table 3.38.

**Table 3.37. Habitat data recorded during the electric fishing survey at Wootton Phase 1 Site 2.**

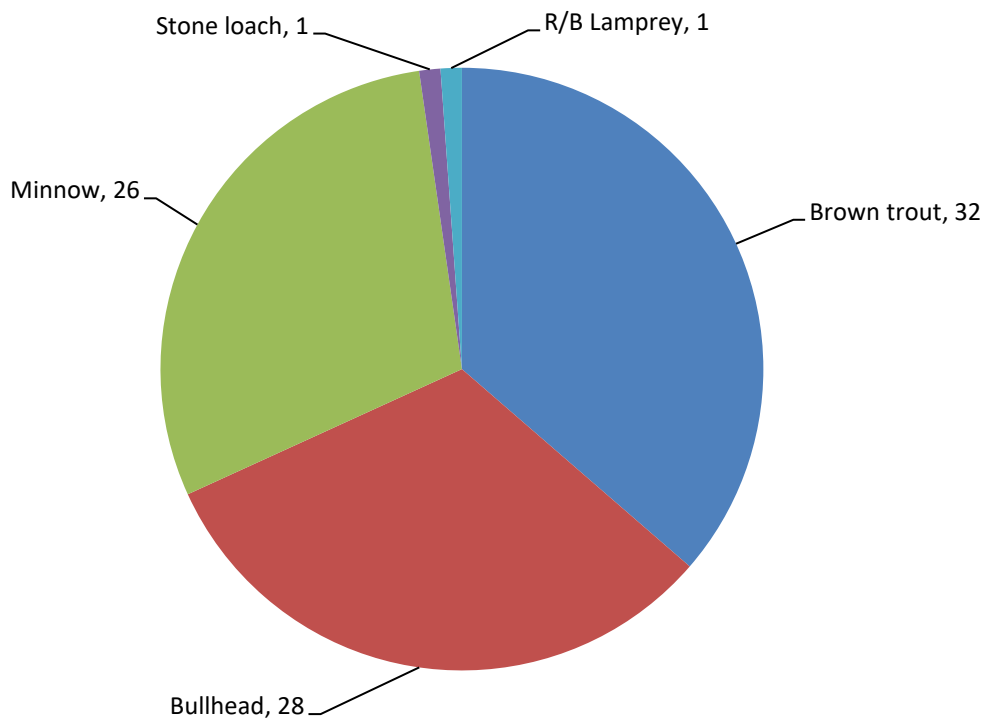
Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	20	20	20	20	10	10		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		10	10	30	50			
Instream vegetation: <b>15 %</b>		Silted? <b>No</b>		Substrate: <b>Stable &amp; Uncompacted</b>				
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent		30		10	10	30	20	
Speed / Level: <b>Low</b>	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	10	40		10			
Right bank %	40	10	40		10			
Total LB fish cover: <b>60 %</b>	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: <b>60 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Overhanging Boughs (%): <b>20</b>			RB Overhanging Boughs (%): <b>20</b>			Canopy Cover (%): <b>100</b>		

**Table 3.38. Physico-chemical parameters recorded during fish survey at Wootton Phase 1 Site 2.**

Parameter	Value
Temperature (°C)	14.9
Dissolved Oxygen (%)	92.3
Dissolved Oxygen (mg l <sup>-1</sup> )	9.31
Conductivity (µScm <sup>-1</sup> )	121.0
pH	7.1

### 3.10.2 Electric fishing survey results

A total of 88 fish were captured at Wootton Phase 1 Site 2 during three electric fishing runs, comprising five species. Brown trout was the most abundant species captured, followed by bullhead and minnow (Figure 3.36).



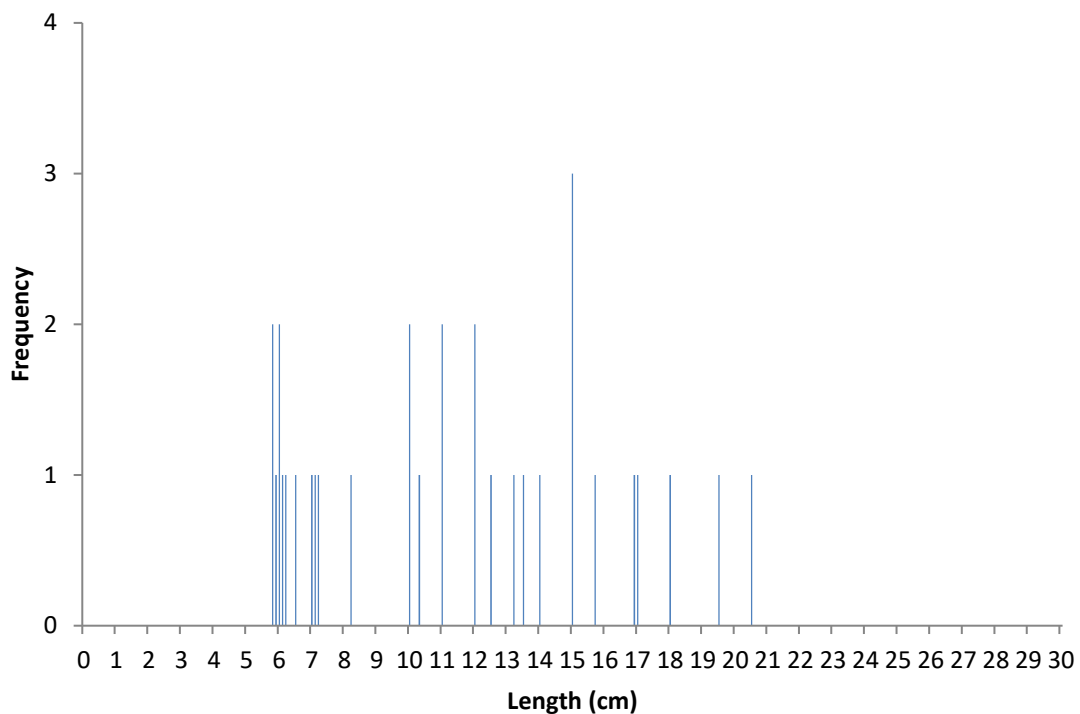
**Figure 3.36. Species composition (total number captured) at Wootton Phase 1 Site 2.**

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.39. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

**Table 3.39. 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 <sup>2</sup> )	NFCS Classification
Bullhead	28 (1.7 – 6.5)	31	0.51	23	39	22	N/A
Minnow	26 (1.6 – 6.9)	27	0.60	23	31	19	N/A
Brown trout (1++)	20 (10.0 – 20.5)	20	0.74	19	21	14	B (Good)
Brown trout (0+)	12 (5.8 – 8.2)	12	0.75	11	13	9	C (Fair)
Stone loach	1 (7.8)	1	0.33	-3	5	1	N/A
R/B lamprey	1 (10.0)	1	0.33	-3	5	1	N/A
<b>TOTAL</b>	<b>88</b>						

Length frequency charts for brown trout, bullhead and minnow are provided in Figure 3.37 to Figure 3.39 below.



**Figure 3.37. Length frequency of brown trout captured at Wootton Phase 1 Site 2 (n=32).**

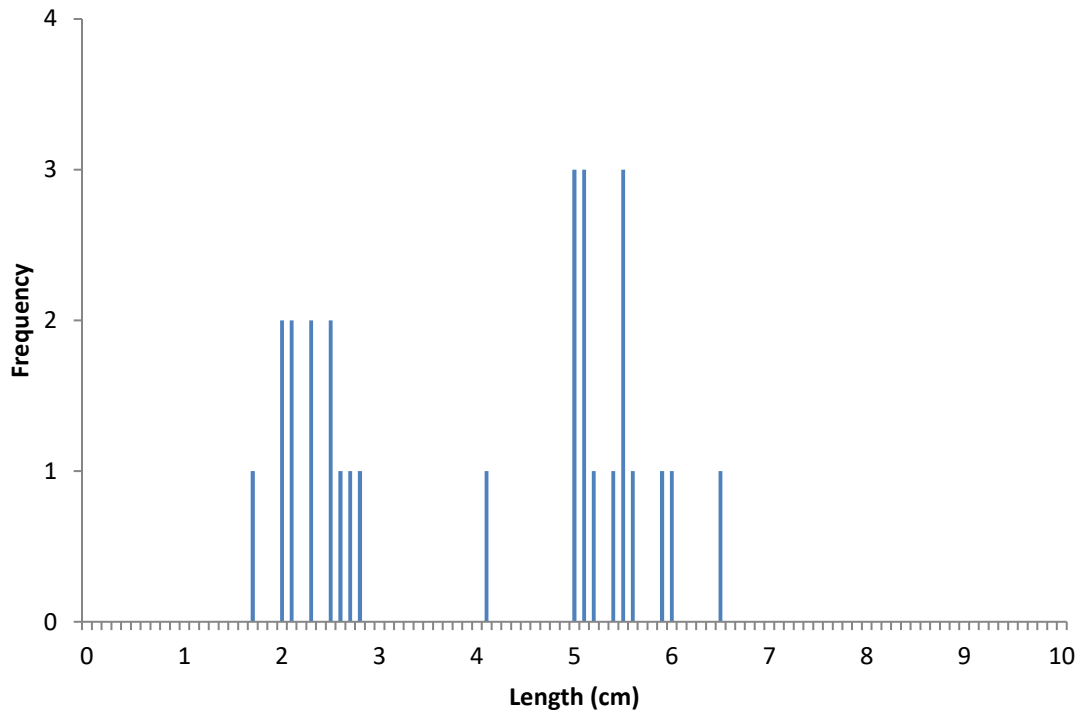


Figure 3.38. Length frequency of bullhead captured at Wootton Phase 1 Site 2 (n=28).

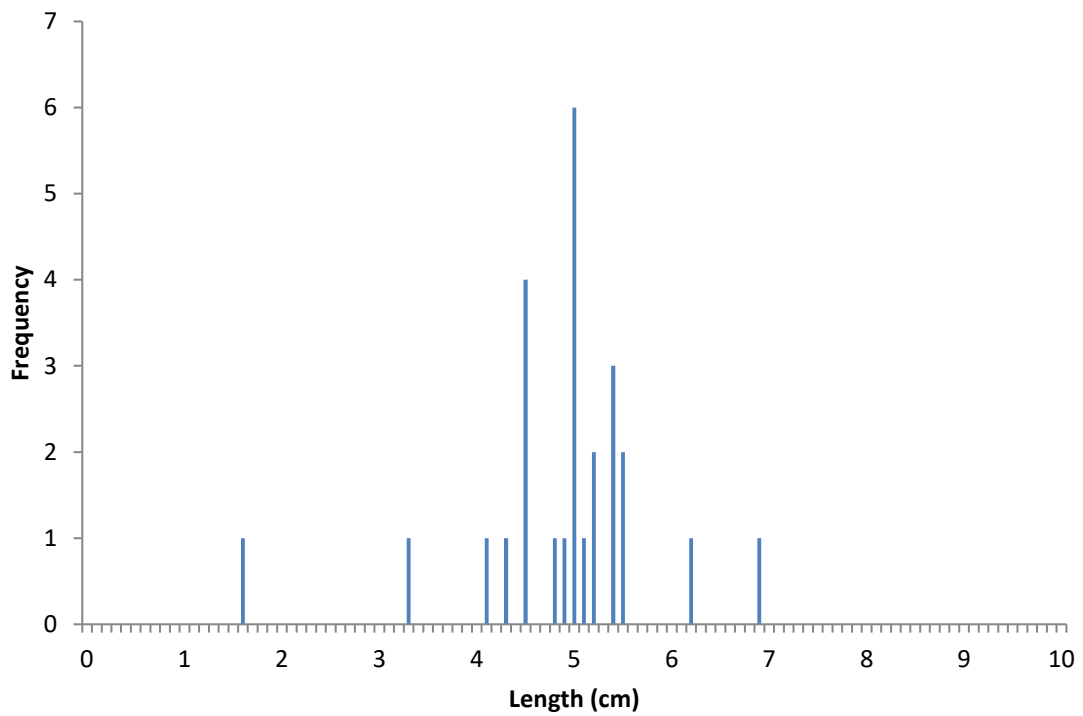


Figure 3.39. Length frequency of minnow captured at Wootton Phase 1 Site 2 (n=26).

### 3.10.3 Fish species of conservation importance

Table 3.40 highlights the fish species of conservation importance that were recorded at Wootton Phase 1 Site 2 during the electric fishing survey.

**Table 3.40. 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? <sup>1</sup>	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 <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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 2 Site 1

#### 3.11.1 Site description

Wootton Phase 2 Site 1 is located within an area of broadleaf / mixed woodland (see Section 2.1.7). Table 3.41 below summarises the key physical characteristics of the 100 m survey site, and Appendix 11 provides a photographic record of habitat variability. The mean wetted width was 3.98 m, with an overall surveyed area of 398.2 m<sup>2</sup>.

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. Flow conditions during the survey were low. Physico-chemical parameters recorded during the time of the survey are provided in Table 3.42.

**Table 3.41. 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		10	10	30	50			
Instream vegetation: <b>0 %</b>	Silted? <b>No</b>		Substrate: <b>Stable &amp; Uncompacted</b>					
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent		30	10	10	10	20	20	
Speed / Level: <b>Low</b>	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	10	40		10			
Right bank %	40	10	40		10			
Total LB fish cover: <b>60 %</b>	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: <b>60 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / <u>Simple</u> / <u>Complex</u>				RB Bankface vegetation: Bare / Uniform / <u>Simple</u> / <u>Complex</u>				
LB Banktop vegetation: Bare / Uniform / <u>Simple</u> / <u>Complex</u>				RB Banktop vegetation: Bare / Uniform / <u>Simple</u> / <u>Complex</u>				
LB Overhanging Boughs (%): <b>5</b>			RB Overhanging Boughs (%): <b>5</b>			Canopy Cover (%): <b>100</b>		

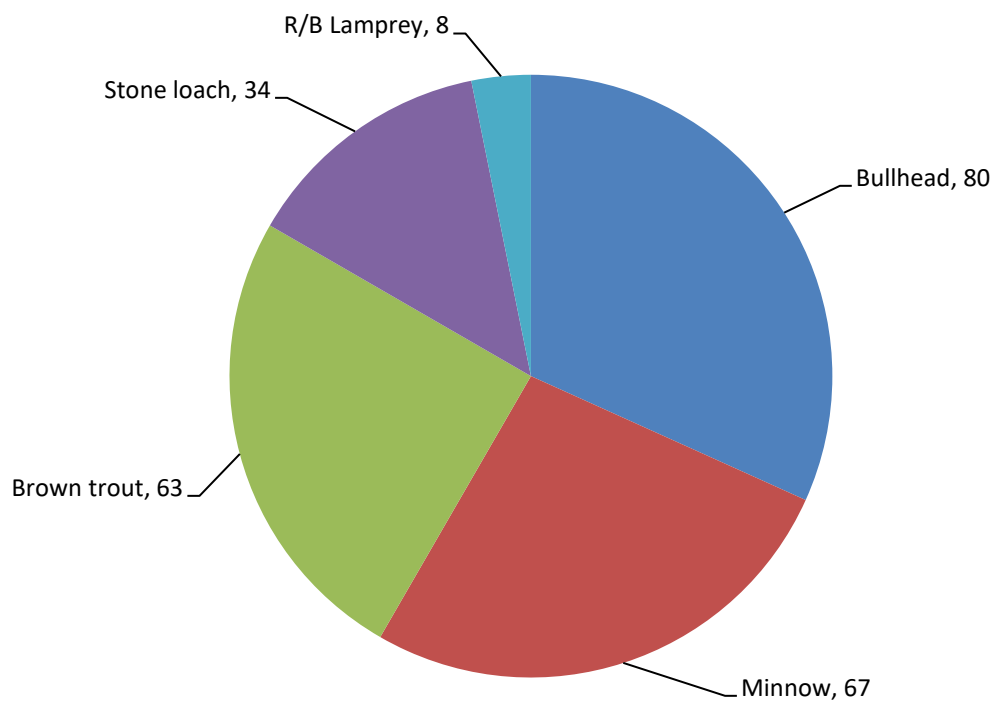


**Table 3.42. Physico-chemical parameters recorded during fish survey at Wootton Phase 2 Site 1.**

Parameter	Value
Temperature (°C)	16.0
Dissolved Oxygen (%)	94.7
Dissolved Oxygen (mg l <sup>-1</sup> )	9.38
Conductivity (µScm <sup>-1</sup> )	132.6
pH	7.9

### 3.11.2 Electric fishing survey results

A total of 252 fish were captured at Wootton Phase 2 Site 1 during three electric fishing runs, comprising five species. Bullhead was the most abundant species captured, followed by minnow and brown trout (Figure 3.40).



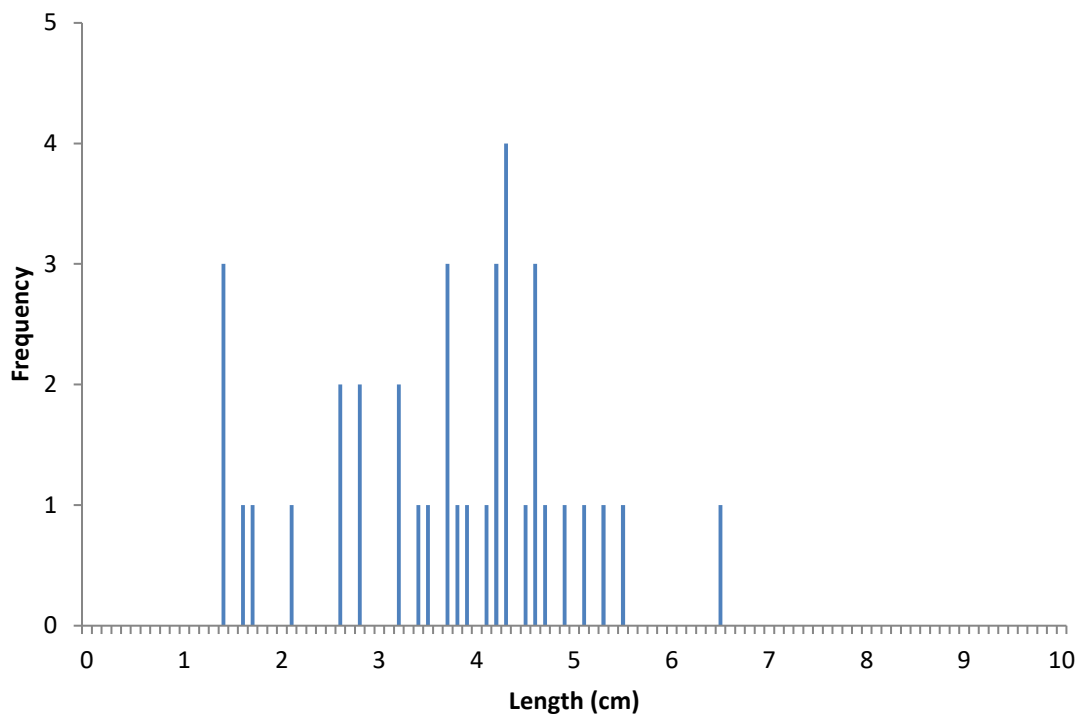
**Figure 3.40. Species composition (total number captured) at Wootton Phase 2 Site 1.**

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.43. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

**Table 3.43. 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 <sup>2</sup> )	NFCS Classification
Bullhead	80 (1.4 – 6.5)	144	0.23	45	243	36	N/A
Minnow	67 (3.2 – 6.2)	89	0.37	59	119	22	N/A
Brown trout (0+)	38 (4.1 – 9.4)	38	0.73	36	40	10	C (Fair)
Stone loach	34 (4.8 – 9.8)	138	0.09	-412	688	35	N/A
Brown trout (1++)	25 (10.0 – 21.0)	25	0.69	23	27	6	C (Fair)
R/B lamprey	8 (7.0 – 11.0)	10	0.36	0	20	3	N/A
<b>TOTAL</b>	<b>252</b>						

Length frequency charts for bullhead, minnow, brown trout and stone loach are provided in Figure 3.41 to Figure 3.44 below.



**Figure 3.41. Length frequency of bullhead captured at Wootton Phase 2 Site 1 (n=37).**

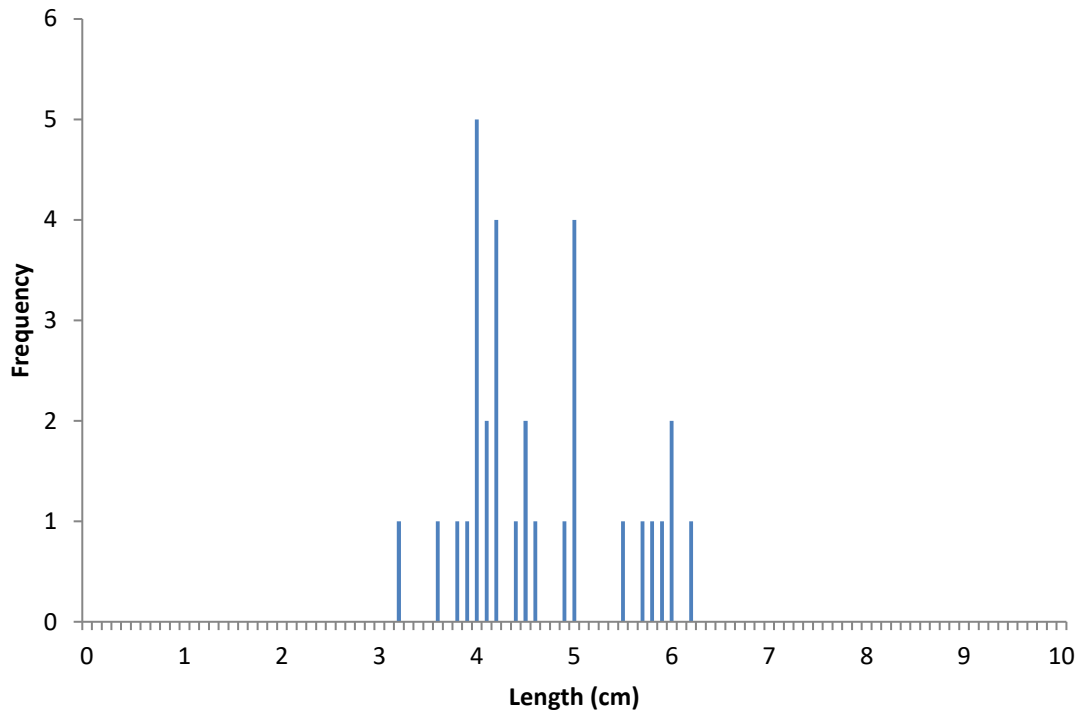


Figure 3.42. Length frequency of minnow captured at Wootton Phase 2 Site 1 (n=31).

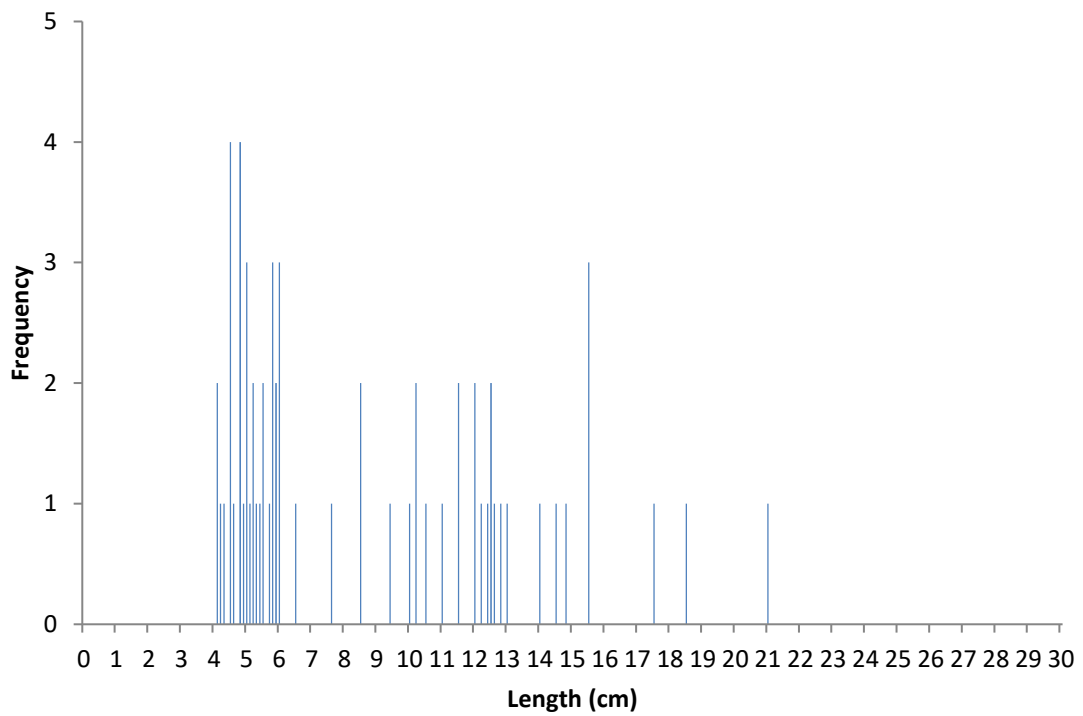


Figure 3.43. Length frequency of brown trout captured at Wootton Phase 2 Site 1 (n=8).

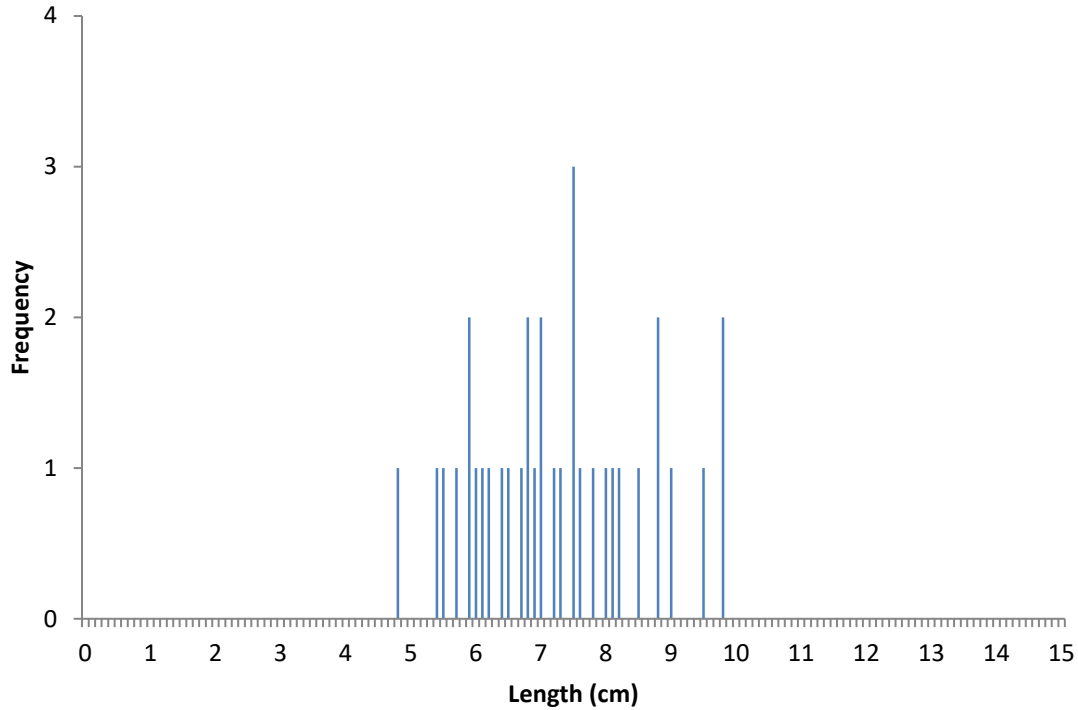


Figure 3.44. Length frequency of stone loach captured at Wootton Phase 2 Site 1 (n=34).

### 3.11.3 Fish species of conservation importance

Table 3.44 highlights the fish species of conservation importance that were recorded at Wootton Phase 2 Site 1 during the electric fishing survey.

**Table 3.44. Species of conservation importance that could potentially be present and species that were recorded during the fish survey at Wootton Phase 2 Site 1.**

Species	Conservation designation	Within natural range? <sup>1</sup>	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 <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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 2

#### 3.12.1 Site description

Wootton Phase 2 Site 2 is located within an area of broadleaf / mixed woodland (see Section 2.1.7). Table 3.45 below summarises the key physical characteristics of the 75 m survey site, and Appendix 12 provides a photographic record of habitat variability. The mean wetted width was 3.08 m, with an overall surveyed area of 230.8 m<sup>2</sup>.

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 largely comprised gravel and pebble, with some sand and silt. Flow conditions during the survey were low. Physico-chemical parameters recorded during the time of the survey are provided in Table 3.46.

**Table 3.45. Habitat data recorded during the electric fishing survey at Wootton Phase 2 Site 2.**

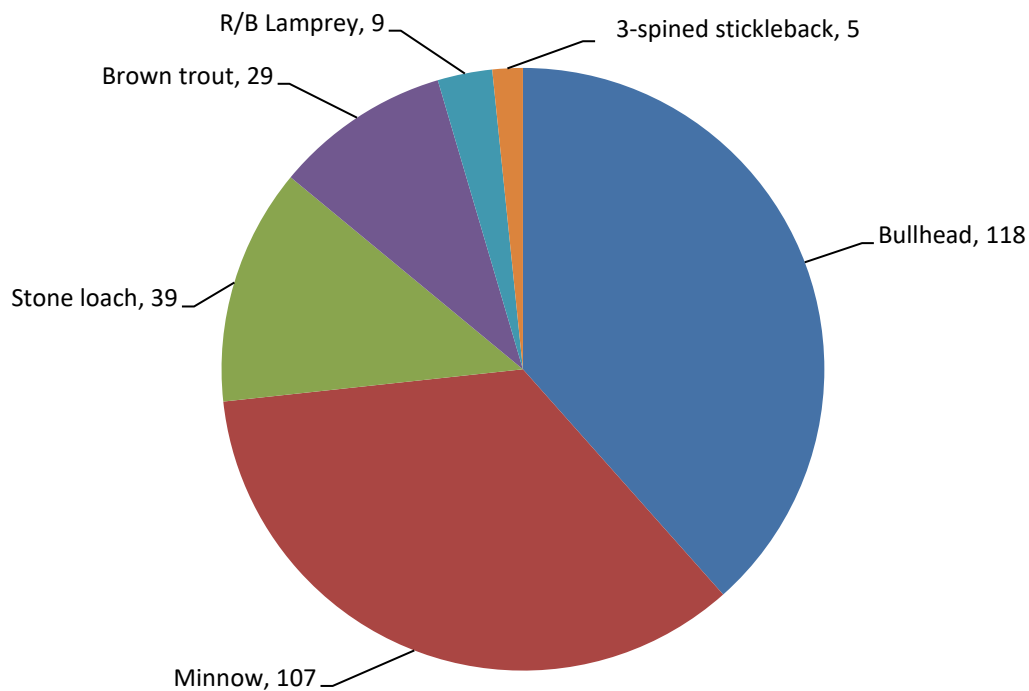
Depths (cm)	< 10	11 - 20	21 - 30	31 - 40	41 - 50	> 50		
Percent	5	15	20	20	20	20		
Substrate	Organic	Silt	Sand	Gravel	Pebble	Cobble	Boulder	Bedrock
Percent		10	10	30	50			
Instream vegetation: <b>0 %</b>		Silted? <b>Yes</b>		Substrate: <b>Stable &amp; Uncompacted</b>				
Flow	SM	DP	SP	DG	SG	RU	RI	TO
Percent		30	10	10		30	20	
Speed / Level: <b>Low</b>	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	70		5			
Right bank %	20	5	70		5			
Total LB fish cover: <b>30 %</b>	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: <b>30 %</b>								
Bankside land use								
LB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Bankface vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				RB Banktop vegetation: Bare / Uniform / <b>Simple</b> / Complex				
LB Overhanging Boughs (%): <b>5</b>			RB Overhanging Boughs (%): <b>5</b>			Canopy Cover (%): <b>100</b>		

**Table 3.46. Physico-chemical parameters recorded during fish survey at Wootton Phase 2 Site 2.**

Parameter	Value
Temperature (°C)	16.6
Dissolved Oxygen (%)	98.0
Dissolved Oxygen (mg l <sup>-1</sup> )	9.5
Conductivity (µScm <sup>-1</sup> )	135.5
pH	7.8

### 3.12.2 Electric fishing survey results

A total of 307 fish were captured at Wootton Phase 2 Site 2 during three electric fishing runs, comprising six species. Bullhead was the most abundant species captured, followed by minnow and stone loach (Figure 3.45).



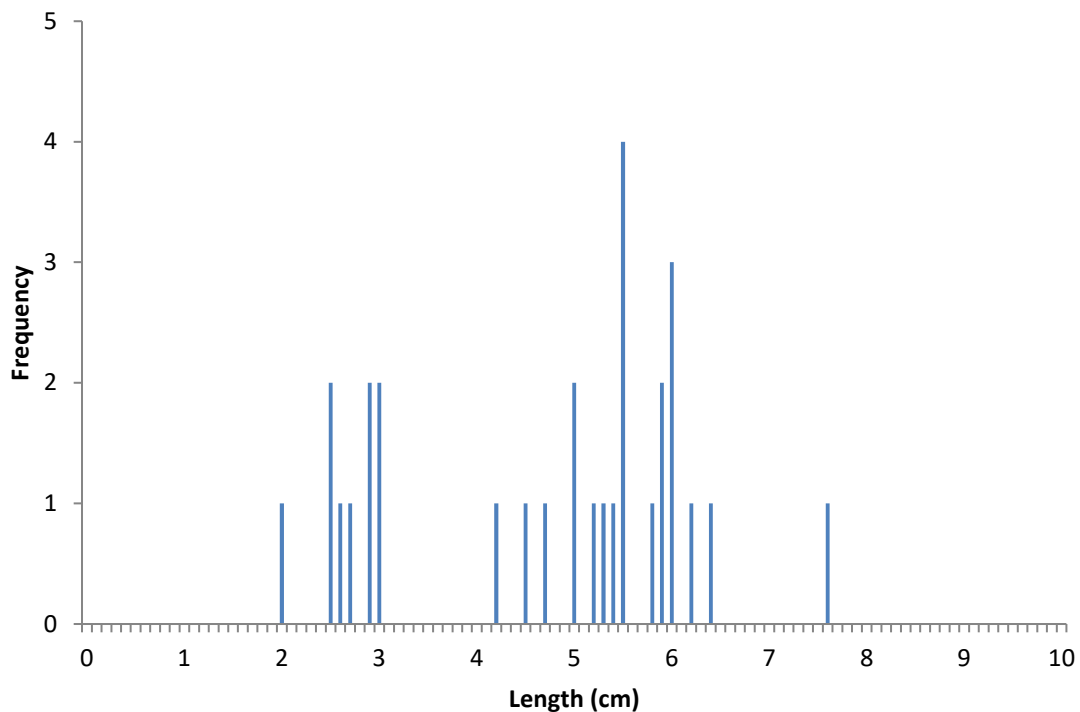
**Figure 3.45. Species composition (total number captured) at Wootton Phase 2 Site 2.**

The total number captured, length range (cm) and catch depletion density estimate (where relevant) for each fish species are shown in Table 3.47. The National Fisheries Classification Scheme (NFCS) classifications for 0+ and 1++ brown trout are also shown.

**Table 3.47. 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 <sup>2</sup> )	NFCS Classification
Bullhead	118 (2.0 – 7.6)	126	0.60	117	135	55	N/A
Minnow	107 (2.0 – 8.7)	118	0.54	105	131	51	N/A
Stone loach	39 (5.9 – 10.6)	39	0.61	36	46	18	N/A
Brown trout (1++)	15 (10.5 – 26.6)	15	0.65	13	17	6	C (Fair)
Brown trout (0+)	14 (4.9 – 7.3)	17	0.40	6	28	7	D (Fair / Poor)
R/B lamprey	9 (9.0 – 15.0)	16	0.21	-23	55	7	N/A
3-spined stickleback	2 (2.7 – 4.7)	8	0.23	-17	33	3	N/A
<b>TOTAL</b>	<b>307</b>						

Length frequency charts for bullhead, minnow, stone loach and brown trout are provided in Figure 3.46 to Figure 3.49 below.



**Figure 3.46. Length frequency of bullhead captured at Wootton Phase 2 Site 2 (n=30).**



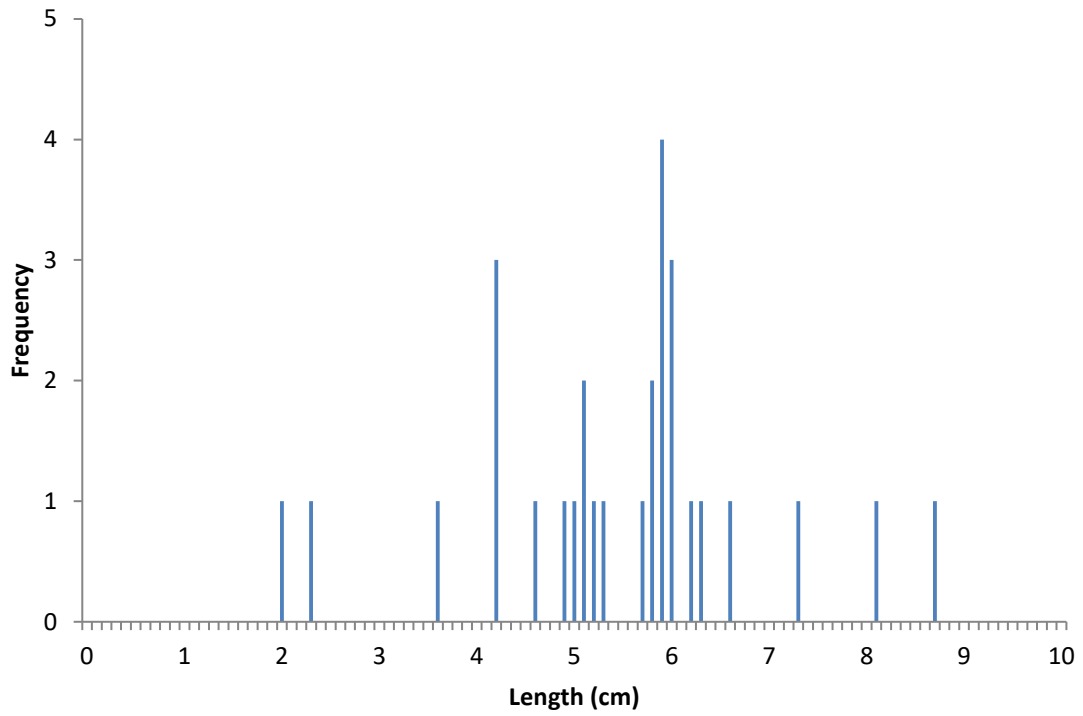


Figure 3.47. Length frequency of minnow captured at Wootton Phase 2 Site 2 (n=29).

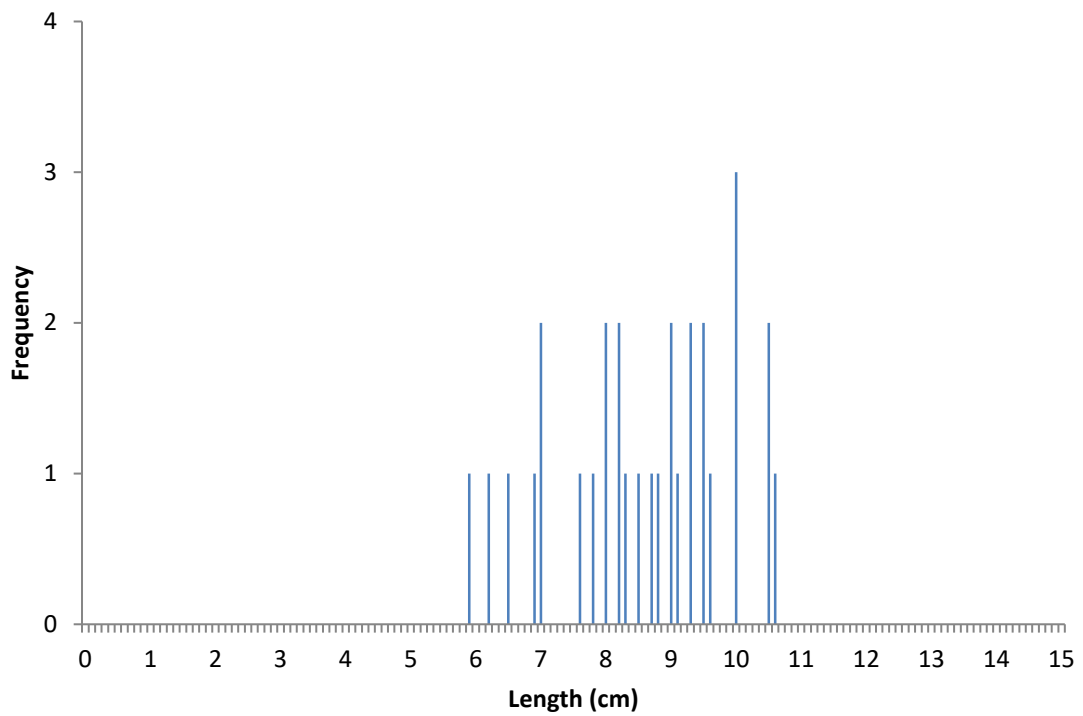


Figure 3.48. Length frequency of stone loach captured at Wootton Phase 2 Site 2 (n=30).

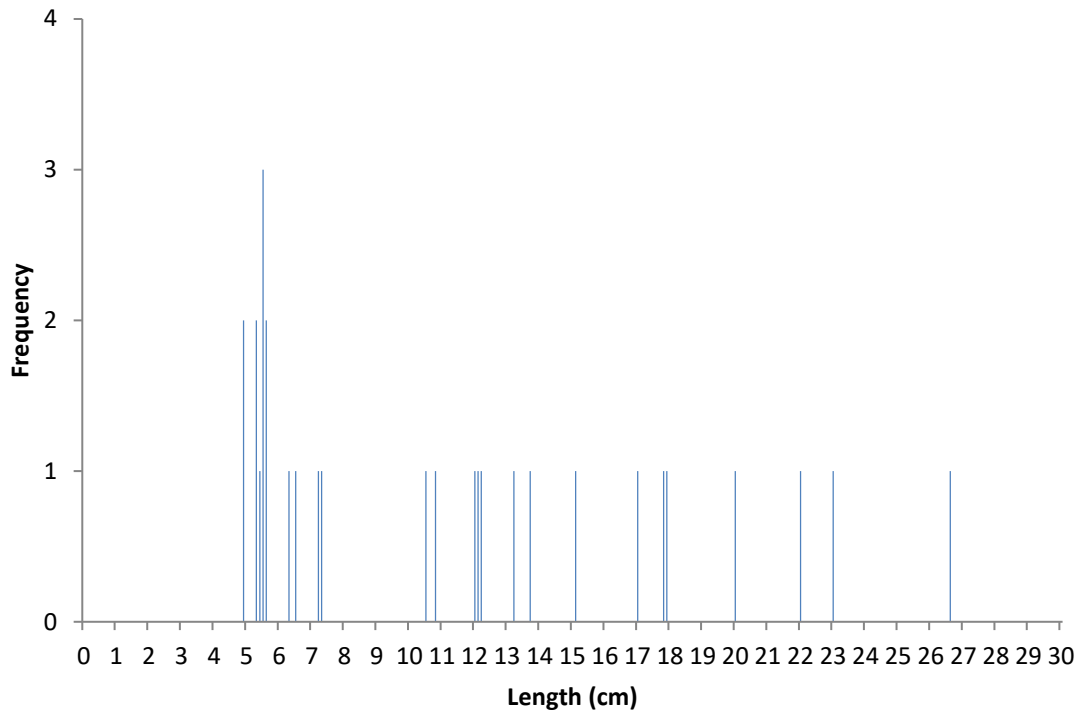


Figure 3.49. Length frequency of brown trout captured at Wootton Phase 2 Site 2 (n=29).

### 3.12.3 Fish species of conservation importance

Table 3.48 highlights the fish species of conservation importance that were recorded at Wootton Phase 2 Site 2 during the electric fishing survey.

**Table 3.48. 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? <sup>1</sup>	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 <sup>2</sup>	N
Lamprey (Sea)	Habitats Directive (Annex II)	Y <sup>2</sup>	N
Salmon	UK BAP (Priority Species), Habitats Directive (Annex II)	Y <sup>3</sup>	N

<sup>1</sup> Natural range as summarised in Maitland (2004) distribution maps of fish occurring in the fresh waters of Britain and Ireland.

<sup>2</sup> 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.

<sup>3</sup> 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

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### 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 2021.

Group	Species	Cowleys Control	Cowleys East	Cowleys West	Harvest Slade Site 1	Harvest Slade Site 2	Harvest Slade Control	Pondhead Downstream	Pondhead Control	Sluifers	Wootton Phase 1 Site 1	Wootton Phase 1 Site 2	Wootton Phase 2 Site 1	Wootton Phase 2 Site 2
Flatworms	<i>Tricladida sp.</i>			1										
	<i>Polycelis felina</i> (Dalyell, 1814)											1		
Snails	<i>Potamopyrgus antipodarum</i> (J.E.Gray, 1843)	5		160			14			121		19	6	7
	<i>Physa fontinalis</i> (Linnaeus, 1758)								2					
	<i>Lymnaeidae sp.</i>												1	
	<i>Lymnaea stagnalis</i> (Linnaeus, 1758)											1		
	<i>Radix balthica</i> (Linnaeus, 1758)		8	10	7	1		23		16		7		19
	<i>Planorbis (Planorbis) carinatus</i> (O.F. Müller, 1774)								11					
	<i>Ancylus fluviatilis</i> O.F. Müller, 1774	2						5		2		3	10	
Bivalves	<i>Pisidium sp.</i>	8	3		4	2	7	18	7	1		11	12	3
Worms	<i>Oligochaeta sp.</i>	41	24	52	24	44	76	56	40	23		25	116	23
Leeches	<i>Glossiphonia complanata</i> (Linnaeus, 1758)						1					1		
	<i>Helobdella stagnalis</i> (Linnaeus, 1758)			3		1		2	2					
	<i>Erpobdellidae sp.</i>											3		1
	<i>Erpobdella octoculata</i> (Linnaeus, 1758)											3		1
Water Mites	<i>Hydracarina sp.</i>	1										1		1
Water Fleas	<i>Cladocera sp.</i>			1				1						
Seed Shrimps	<i>Ostracoda sp.</i>									3				
Crustaceans	<i>Asellus aquaticus</i> (Linnaeus, 1758)		5	9				1	68	2		2		2
	<i>Crangonyx pseudogracilis</i> Bousfield, 1958		96	172				1						
	<i>Gammarus pulex</i> (Linnaeus, 1758)	120		36			2	6	100	8		452	148	14
Springtails	<i>Collembola sp.</i>											1		
Mayflies	<i>Baetidae sp.</i>	1	4			4	1					1	1	7
	<i>Baetis rhodani</i> (Pictet, 1843-1845)	1										3		
	<i>Centroptilum luteolum</i> (Müller, 1776)									3				
	<i>Cloeon sp.</i>		1							1				
	<i>Paraleptophlebia sp.</i>			2	8	4	13	1		25				
	<i>Ephemera danica</i> Müller, 1764						1	1	1	2				
	<i>Serratella ignita</i> (Poda, 1761)	3										116	11	1
	<i>Caenis luctuosa</i> group									6				
Stoneflies	<i>Nemouridae sp.</i>				2	92	63	3	1	21		20	6	11

Group	Species	Cowleys Control	Cowleys East	Cowleys West	Harvest Slade Site 1	Harvest Slade Site 2	Harvest Slade Control	Pondhead Downstream	Pondhead Control	Sluifers	Wootton Phase 1 Site 1	Wootton Phase 1 Site 2	Wootton Phase 2 Site 1	Wootton Phase 2 Site 2
	<i>Leuctra fusca</i> (Linnaeus, 1758)	22				21	22	2		2		9	56	2
Dragonflies and Damselflies	<i>Coenagrionidae sp.</i>		4	11	6	1				13				
	<i>Calopteryx sp.</i>	1		1		1		9	2	2		1		1
	<i>Cordulegaster boltonii</i> (Donovan, 1807)					4	4						1	
	<i>Aeshnidae sp.</i>		2	1						1				
	<i>Libellulidae sp.</i>		3	1						2				
True Bugs	<i>Hydrometra stagnorum</i> (Linnaeus, 1758)								2					
	<i>Veliidae sp.</i>											3		
	<i>Velia sp.</i>							2	1					
	<i>Gerridae sp.</i>	8	6	1	2	22	1			4		2		6
	<i>Gerris gibbifer</i> Schummel, 1832									3				
	<i>Gerris lacustris</i> (Linnaeus, 1758)				3					5				
	<i>Aquarius najas</i> (DeGeer, 1773)	1	4			1	1							
	<i>Notonecta glauca</i> Linnaeus, 1758		1	5										
	<i>Notonecta maculata</i> Fabricius, 1794			6										
	<i>Notonecta obliqua</i> Gallén in Thunberg, 1787											1		
	<i>Corixidae sp.</i>		25	2										
	<i>Hesperocorixa castanea</i> (Thomson, 1869)				1									
	<i>Hesperocorixa sahlbergi</i> (Fieber, 1848)		1	2	1									
	<i>Sigara (Sigara) sp.</i>		20	1										
	<i>Sigara (Subsigara) distincta</i> (Fieber, 1848)			1										
<i>Sigara (Pseudovermicorixa) nigrolineata</i> (Fieber, 1848)			3											
Water Beetles	<i>Haliplidae sp.</i>			6										
	<i>Dytiscidae sp.</i>		19					25	44	3				
	<i>Hydroglyphus geminus</i> (Fabricius, 1792)		1											
	<i>Hydroporus sp.</i>		2											
	<i>Platambus maculatus</i> (Linnaeus, 1758)								1					
	<i>Agabus bipustulatus</i> (Linnaeus, 1767)	1		1										
	<i>Gyrinidae sp.</i>	1										4	1	1
	<i>Helophorus sp.</i>		7											
	<i>Helophorus (Rhopalohelophorus) brevipalpis</i> Bedel, 1881		1							2		3		
	<i>Paracymus scutellaris</i> (Rosenhauer, 1856)									1				

Group	Species	Cowleys Control	Cowleys East	Cowleys West	Harvest Slade Site 1	Harvest Slade Site 2	Harvest Slade Control	Pondhead Downstream	Pondhead Control	Sluifers	Wootton Phase 1 Site 1	Wootton Phase 1 Site 2	Wootton Phase 2 Site 1	Wootton Phase 2 Site 2
	<i>Anacaena lutescens</i> (Stephens, 1829)									1		2		
	<i>Helochaeres punctatus</i> Sharp, 1869									2				
	<i>Hydrochus nitidicollis</i> Mulsant, 1844									2				
	<i>Elodes</i> sp.								2				1	
	<i>Dryops</i> sp.									1				
	<i>Limnius volckmari</i> (Panzer, 1793)	10					1				3	15	68	
	<i>Oulimnius</i> sp.	6					4	11		59	2	9	13	4
	<i>Oulimnius tuberculatus</i> (Müller, 1806)	1											4	
Alderflies	<i>Sialis lutaria</i> (Linnaeus, 1758)				1		1			6				
Caddisflies	<i>Rhyacophila dorsalis</i> (Curtis, 1834)											1	1	
	<i>Agapetus</i> sp.	84					1					40	5	
	<i>Hydroptila</i> sp.									5				1
	<i>Oxyethira</i> sp.				1					4		2		3
	<i>Psychomyiidae</i> sp.						1							
	<i>Polycentropodidae</i> sp.					1							1	
	<i>Cyrnus trimaculatus</i> (Curtis, 1834)						1							
	<i>Polycentropus irroratus</i> (Curtis, 1835)					1								
	<i>Hydropsyche</i> sp.								4					
	<i>Hydropsyche siltalai</i> Döhler, 1963	13	1			1						11	5	
	<i>Lepidostoma hirtum</i> (Fabricius, 1775)	60				6	19	136		3		380	16	
	<i>Limnephilidae</i> sp.							16	1				4	4
	<i>Micropterna</i> group								1			2	1	1
	<i>Potamophylax</i> group					1	1	1				1		
	<i>Goeridae</i> sp.	2												
	<i>Goera pilosa</i> (Fabricius, 1775)						1	11						1
	<i>Silo</i> sp.						1							
	<i>Silo nigricornis</i> (Pictet, 1834)												5	
	<i>Silo pallipes</i> (Fabricius, 1781)	1										1		3
	<i>Sericostoma personatum</i> (Spence in Kirby & Spence, 1826)	5		1		3	11	32	6	3	4	56	12	1
	<i>Leptoceridae</i> sp.						1							
	<i>Athripsodes</i> sp.	1						9		5		2	1	
	<i>Mystacides</i> sp.					3	1	80	1	3		3		

Group	Species	Cowleys Control	Cowleys East	Cowleys West	Harvest Slade Site 1	Harvest Slade Site 2	Harvest Slade Control	Pondhead Downstream	Pondhead Control	Sluifers	Wootton Phase 1 Site 1	Wootton Phase 1 Site 2	Wootton Phase 2 Site 1	Wootton Phase 2 Site 2	
	<i>Oecetis sp.</i>					3		2					4		
Butterflies and Moths	<i>Pyralidae sp.</i>				4										
True Flies	<i>Diptera sp.</i>													1	
	<i>Tipulidae sp.</i>		1		3							1	3		
	<i>Limoniidae sp.</i>											2		1	
	<i>Psychodidae sp.</i>		1					1							
	<i>Ptychopteridae sp.</i>	2							1						
	<i>Culicidae sp.</i>		52												
	<i>Ceratopogonidae sp.</i>													2	
	<i>Simuliidae sp.</i>			1		36							12		1
	<i>Chironomidae sp.</i>	25	132	24	54	48	25	32	80	28		140	28	75	
	<i>Tabanidae sp.</i>		1				9	6							1
	<i>Athericidae sp.</i>					7	5								
	<i>Empididae sp.</i>	1													
<i>Scathophagidae sp.</i>	1														
<b>Total number of species</b>		<b>29</b>	<b>27</b>	<b>27</b>	<b>30</b>	<b>15</b>	<b>24</b>	<b>21</b>	<b>28</b>	<b>38</b>	<b>3</b>	<b>43</b>	<b>30</b>	<b>29</b>	



## 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 2021 samples (input values for RIVPACS).

Variable	Cowleys Control	Cowleys East	Cowleys West	Harvest Slade Site 1	Harvest Slade Site 2	Harvest Slade Control	Pondhead Downstream	Pondhead Control	Slufers	Wootton Phase 1 Site 1	Wootton Phase 1 Site 2	Wootton Phase 2 Site 1	Wootton Phase 2 Site 2
Sample date	07/09/2021	07/09/2021	07/09/2021	06/09/2021	06/09/2021	06/09/2021	13/09/2021	13/09/2021	15/09/2021	10/09/2021	10/09/2021	08/09/2021	08/09/2021
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
Duration	3+1 min	3+1 min	3+1 min	3+1 min	3+1 min	3+1 min	3+1 min	3+1 min	3+1 min	3+1 min	3+1 min	3+1 min	3+1 min
Kick Sampler	BP	BP	BP	BP	BP	BP	VDA	BP	BP	BP	BP	BP	BP
Recorder	VDA	VDA	VDA	VDA	VDA	VDA	BP	VDA	VDA	VDA	VDA	AH	AH
NGR	SU	SU	SU	SU	SU	SU	SU	SU	SU	SZ	SU	SZ	SZ
	42395	41998	41410	20710	20636	20592	32391	30866	23164	24837	23253	26316	25793
	02523	02508	02443	05605	05377	05305	06903	07667	09801	99696	00422	98916	99435
Altitude (m)	24	20	21	61	59	58	23	28	65	28	35	22	25
Slope (m km <sup>-1</sup> )	5.0	25.0	11.0	7.0	7.0	7.0	5.0	4.0	8.0	4.1	4.0	4.1	4.1
Discharge (category)	1	1	1	1	1	1	1	1	1	1	1	1	1
Velocity (category)	1	1	1	1	1	1	1	1	1	1	2	2	2
Distance from source (km)	2.3	0.2	0.5	1.1	1.3	1.4	2.5	1.5	1.6	6.0	4.3	7.0	6.6
Mean width (m)	1.8	0.5 <sup>D</sup>	1.7	3.0	2.0	1.5	3.0	1.2	1.3	4.0	2.0	3.1	3.0
Depth at ¼ width (cm)	2	3 <sup>D</sup>	18	22	38	1	5	8	6	36	12	9	9
Depth at ½ width (cm)	2	17 <sup>D</sup>	14	27	32	3	0	4	8	39	15	12	9
Depth at ¾ width (cm)	2	5 <sup>D</sup>	23	22	10	3	4	7	10	36	15	9	9
Mean depth (cm)	2.0	8.3 <sup>D</sup>	18.3	23.7	26.7	2.3	3.0	6.3	8.0	37.0	14.0	10.0	9.0
Boulders and cobbles (%)	10	5	25	0	5	10	5	5	40	5	5	10	10
Pebbles and gravel (%)	85	55	60	0	80	60	45	70	30	80	85	85	70
Sand (%)	5	10	10	0	10	20	5	5	5	5	2	3	15
Silt and clay (%)	0	30	5	100	5	10	45	20	25	10	8	2	5
pH	7.3	7.2	6.9	7.4	8.4	8.4	6.8	7.6	8.0	7.9	7.1	7.9	7.8
Temperature (°C)	15.8	19.8	19.3	24.3	17.6	17.6	14.0	14.7	15.8	15.5	14.9	16.0	16.6
Conductivity (µs)	239.4	308.0	400.0	93.5	81.5	81.5	324.4	315.3	200.0	134.0	121.0	132.3	135.5
Dissolved Oxygen (%)	95.1	35.0	20.1	101.8	95.2	95.2	77.0	66.6	84.6	96.6	92.3	94.7	98.0
Dissolved Oxygen (mg l <sup>-1</sup> )	9.43	3.20	1.90	8.53	9.09	9.09	7.93	6.73	8.39	9.59	9.31	9.38	9.50
Water clarity	Clear	Cloudy	Clear	Turbid	Clear	Clear	Cloudy	Cloudy	Turbid	Clear	Clear	Clear	Clear
Water colour	Clear	Reddish	Clear	Humic	Humic	Humic	Cloudy	Clear	Dirty	Clear	Clear	Humic	Humic
Algae cover (%)	0	0	50	20	0	0	0	0	0	0	0	0	2
Moss cover (%)	0	0	0	0	5	0	0	5	0	0	0	0	0
Higher plant cover (%)	10	0	15	80	0	0	5	0	0	1	25	0	2
Total cover (%)	10	0	65	100	5	0	5	5	0	1	25	0	4
Detritus	Present	Present	Present	Present	Absent	Present	Present	Present	Present	Present	Present	Absent	Absent

### 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 2021 RIVPACS samples (output values from RIVPACS; associations <0.01 not shown).

End Group	Cowleys Control	Cowleys East	Cowleys West	Harvest Slade Site 1	Harvest Slade Site 2	Harvest Slade Control	Pondhead Downstream	Pondhead Control	Sluifers	Wootton Phase 1 Site 1	Wootton Phase 1 Site 2	Wootton Phase 2 Site 1	Wootton Phase 2 Site 2
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21												0.01	0.01
22													
23													
24	0.03											0.02	0.02
25											0.01	0.02	0.01
26					0.01				0.01	0.01	0.04	0.05	0.03
27	0.72		0.97		0.97	0.56	0.05	0.72	0.94	0.06	0.53	0.27	0.20
28	0.12					0.05		0.01	0.01		0.01	0.02	0.02
29													
30	0.04	1.00	0.01	0.01		0.38	0.07	0.06	0.01				
31													
32													
33													
34													
35	0.03						0.05	0.01			0.01	0.04	0.04
36													

End Group	Cowleys Control	Cowleys East	Cowleys West	Harvest Slade Site 1	Harvest Slade Site 2	Harvest Slade Control	Pondhead Downstream	Pondhead Control	Sluifers	Wootton Phase 1 Site 1	Wootton Phase 1 Site 2	Wootton Phase 2 Site 1	Wootton Phase 2 Site 2
37													
38	0.02						0.15	0.03				0.01	0.01
39			0.01	0.17			0.26	0.07	0.01	0.01	0.01	0.01	0.01
40	0.02			0.81	0.02		0.41	0.09	0.02	0.91	0.38	0.54	0.64
41													
42													
43													
<b>Probability of model fit</b>	<b>&lt;0.1%</b>	<b>&lt;5%</b>	<b>&lt;1%</b>	<b>&lt;1%</b>	<b>&gt;5%</b>	<b>&lt;2%</b>	<b>&lt;1%</b>	<b>&gt;5%</b>	<b>&gt;5%</b>	<b>&gt;5%</b>	<b>&gt;5%</b>	<b>&gt;5%</b>	<b>&gt;5%</b>
<b>Suitability code</b>	<b>5</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>1</b>	<b>3</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>

#### 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 September 2021 RIVPACS samples. Colour key: **Blue** = Better than expected ( $\geq 1.300$ ), **White** = Within expected range (0.700 – 1.299), **Yellow** = Slightly degraded (0.500 – 0.699), **Orange** = Moderately degraded (0.300 – 0.499), **Red** = Very degraded ( $< 0.300$ ).

Biotic Index	Cowleys Control	Cowleys East	Cowleys West	Harvest Slade Site 1	Harvest Slade Site 2	Harvest Slade Control	Pondhead Downstream	Pondhead Control	Sluffers	Wootton Phase 1 Site 1	Wootton Phase 1 Site 2	Wootton Phase 2 Site 1	Wootton Phase 2 Site 2
<b>OBSERVED biotic index values</b>													
TL1 BMWP	125	79	101	57	124	156	126	93	170	15	177	149	121
TL1 NTAXA	20	17	19	12	20	24	20	17	28	2	31	24	22
TL1 ASPT	6.250	4.647	5.316	4.750	6.200	6.500	6.300	5.471	6.071	7.500	5.710	6.208	5.500
TL2 WHPT Score (AbW,DistFam)	138.6	81.3	88.8	57.1	134.1	171.7	139.5	98.1	160.1	14.2	193.2	169.4	130.4
TL2 WHPT NTAXA (AbW,DistFam)	22	20	20	12	21	26	24	19	28	2	33	26	23
TL2 WHPT ASPT (AbW,DistFam)	6.300	4.065	4.440	4.758	6.386	6.604	5.813	5.163	5.718	7.100	5.855	6.515	5.670
TL5 AWIC(Sp) Murphy	7.545	6.000	8.667	3.000	6.500	7.222	8.000	8.500	7.714	7.000	7.636	7.000	8.500
TL5 WFD AWIC(Sp) Mcfarland	10.273	8.000	12.333	5.000	8.250	9.889	11.000	12.000	10.429	9.000	10.727	9.727	11.250
TL5 LIFE(Sp)	8.067	5.889	6.357	6.000	7.600	7.667	7.364	7.250	6.867	8.000	7.783	8.500	7.545
TL5 PSI(Sp)	80.645	11.111	11.538		56.250	61.538	42.308	43.750	22.581	100.000	64.000	80.000	55.000
TL5 SPEAR(Sp) %	43.849	5.682	8.138	17.240	37.067	40.646	37.344	26.233	38.923	53.724	41.654	33.446	31.941
TL5 CCI	7.857	8.125	8.077	1.250	11.667	9.643	3.818	1.250	12.600	1.500	7.619	8.846	3.900
<b>RIVPACS EXPECTED biotic index values</b>													
TL1 BMWP	130	85	131	157	133	114	134	130	132	165	146	153	156
TL1 NTAXA	22	15	22	28	22	19	25	22	22	29	25	26	27
TL1 ASPT	5.841	5.553	5.910	5.604	5.927	5.778	5.389	5.777	5.917	5.726	5.843	5.795	5.758
TL2 WHPT Score (AbW,DistFam)	155.6	102.3	157.9	179.2	159.8	137.3	154.3	154.8	158.9	188.1	171.7	177.7	180.0
TL2 WHPT NTAXA (AbW,DistFam)	25	17	25	31	25	22	28	25	25	32	28	30	30
TL2 WHPT ASPT (AbW,DistFam)	6.225	5.949	6.289	5.709	6.307	6.174	5.544	6.107	6.301	5.839	6.121	6.029	5.952
TL5 AWIC(Sp) Murphy	6.655	6.156	6.636	6.690	6.635	6.457	6.808	6.659	6.639	6.600	6.639	6.668	6.656
TL5 WFD AWIC(Sp) Mcfarland	9.241	8.693	9.186	9.407	9.180	9.001	9.620	9.270	9.189	9.235	9.229	9.296	9.295
TL5 LIFE(Sp)	8.290	8.436	8.313	7.606	8.311	8.369	7.696	8.178	8.314	7.635	8.037	7.908	7.819
TL5 PSI(Sp)	72.316	75.239	73.422	52.365	73.447	74.366	53.961	69.088	73.464	53.882	65.461	61.594	58.969
TL5 SPEAR(Sp) %	44.416	36.317	46.579	39.551	46.903	42.581	35.629	43.660	46.618	41.976	44.630	43.116	42.457
TL5 CCI	9.801	14.516	8.895	11.250	8.904	11.213	10.132	9.405	8.996	11.607	10.135	10.811	11.011
<b>OBSERVED/EXPECTED ratios</b>													
TL1 BMWP	0.964	0.932	0.771	0.362	0.935	1.370	0.937	0.716	1.289	0.091	1.210	0.973	0.775
TL1 NTAXA	0.907	1.117	0.864	0.432	0.900	1.231	0.813	0.762	1.265	0.070	1.243	0.912	0.815
TL1 ASPT	1.070	0.837	0.900	0.848	1.046	1.125	1.169	0.947	1.026	1.310	0.977	1.071	0.955
TL2 WHPT Score (AbW,DistFam)	0.891	0.795	0.563	0.319	0.839	1.250	0.904	0.634	1.008	0.075	1.125	0.953	0.724
TL2 WHPT NTAXA (AbW,DistFam)	0.882	1.167	0.799	0.385	0.830	1.177	0.871	0.751	1.112	0.062	1.173	0.881	0.760
TL2 WHPT ASPT (AbW,DistFam)	1.012	0.683	0.706	0.833	1.013	1.070	1.049	0.845	0.907	1.216	0.956	1.081	0.953
TL5 AWIC(Sp) Murphy	1.134	0.975	1.306	0.448	0.980	1.119	1.175	1.277	1.162	1.061	1.150	1.050	1.277
TL5 WFD AWIC(Sp) Mcfarland	1.112	0.920	1.343	0.532	0.899	1.099	1.143	1.295	1.135	0.975	1.162	1.046	1.210
TL5 LIFE(Sp)	0.973	0.698	0.765	0.789	0.914	0.916	0.957	0.887	0.826	1.048	0.968	1.075	0.965
TL5 PSI(Sp)	1.115	0.148	0.157	0.000	0.766	0.828	0.784	0.633	0.307	1.856	0.978	1.299	0.933
TL5 SPEAR(Sp) %	0.987	0.156	0.175	0.436	0.790	0.955	1.048	0.601	0.835	1.280	0.933	0.776	0.752
TL5 CCI	0.802	0.560	0.908	0.111	1.310	0.860	0.377	0.133	1.401	0.129	0.752	0.818	0.354

#### 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 2021 RIVPACS samples with one or more current conservation designations.**

Species	Designation	Source	Sites recorded
<i>Lissotriton vulgaris</i> (Linnaeus, 1758) Smooth Newt	Wildlife and Countryside Act 1981	Wildlife and Countryside Act Schedules 1, 5 and 8 (protected birds, animals and plants)	Harvest Slade Site 1
<i>Lissotriton vulgaris</i> (Linnaeus, 1758) Smooth Newt	Bern Convention Appendix 3	Convention on the Conservation of European Wildlife and Natural Habitats	Harvest Slade Site 1
<i>Aquarius najas</i> (DeGeer, 1773) River Skater	Nationally Scarce - Occurring in 16-100 hectads in Great Britain.	Cook A.A. (2015). A review of the Hemiptera of Great Britain: The Aquatic and Semi-aquatic Bugs.	Cowleys Control Cowleys East Harvest Slade Site 2 Harvest Slade Control
<i>Paracymus scutellaris</i> (Rosenhauer, 1856) A Water Beetle	Nationally Scarce - Occurring in 16-100 hectads in Great Britain.	Foster G.N. (2010) A review of the scarce and threatened Coleoptera of Great Britain part (3) – Water Beetles of Great Britain. Species Status 1. Joint Nature Conservation Committee, Peterborough	Slufters
<i>Helochares punctatus</i> Sharp, 1869 A Water Beetle	Nationally Scarce - Occurring in 16-100 hectads in Great Britain.	Foster G.N. (2010) A review of the scarce and threatened Coleoptera of Great Britain part (3) – Water Beetles of Great Britain. Species Status 1. Joint Nature Conservation Committee, Peterborough	Slufters
<i>Hydrochus nitidicollis</i> Mulsant, 1844 Gravel Water Beetle	GB Red List (post 2001) – Vulnerable	Foster G.N. (2010) A review of the scarce and threatened Coleoptera of Great Britain part (3) – Water Beetles of Great Britain. Species Status 1. Joint Nature Conservation Committee, Peterborough	Slufters
<i>Hydrochus nitidicollis</i> Mulsant, 1844 Gravel Water Beetle	BAP-2007	Biodiversity Action Plan UK list of priority species (2007)	Slufters
<i>Hydrochus nitidicollis</i> Mulsant, 1844 Gravel Water Beetle	England_NERC_S.41	Species of principal importance in England (Section 41) under Natural Environment and Rural Communities Act (2006)	Slufters



## 5. REFERENCES

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- Armitage P.D., Moss D., Wright J.F. and Furse M.T. (1983). The performance of a new biological water quality score system based on macroinvertebrates over a wide range of unpolluted running-water sites. *Water Research* 17: 333-347.
- Beketov M.A., Foit K., Biggs J.P., Sacchi A., Schäfer R.B., Schriever C.A. and Liess M. (2008) *Freshwater biological indicators of pesticide contamination – an adaptation of the SPEAR approach for the UK*. Science Report – SC030189/SR4. Environment Agency, Bristol.
- Chadd R.P. and Extence C.A. (2004) The conservation of freshwater macroinvertebrate populations: a community-based classification scheme. *Aquatic Conservation: Marine and Freshwater Ecosystems*. 14:597-624.
- Clarke R.T., Wright J.F. & Furse M.T. (2003) RIVPACS models for predicting the expected macroinvertebrate fauna and assessing the ecological quality of rivers. *Ecological Modelling* 160: 219–233.
- Clarke R. T., Davy-Bowker J., Dunbar M., Laize C., Scarlett P.M. and Murphy J.F. (2011) *Enhancement of the River Invertebrate Classification Tool (RICT)*. SNIFFER Project WFD119 Report. 75pp Edinburgh. Scotland & Northern Ireland Forum for Environmental Research.
- Davy-Bowker J., Clarke R., Corbin T., Vincent H., Pretty J., Hawczak A., Blackburn J., Murphy J. and Jones I. (2008) *River Invertebrate Classification Tool*. A report to the Scotland and Northern Ireland Forum for Environmental Research. [SNIFFER project WFD72C].
- Davy-Bowker J., Arnott S., Close R., Dobson M., Dunbar M., Jofre G., Morton D., Murphy J., Wareham W., Smith S. and Gordon V. (2010). *Further Development of River Invertebrate Classification Tool*. Scotland & Northern Ireland Forum for Environmental Research. Project WFD100 report. 48 pp & 10 Appendices.
- Extence C.A., Balbi D.M. and Chadd R.P. (1999) River flow indexing using British benthic macroinvertebrates: a framework for setting hydroecological objectives. *Regulated Rivers: Research & Management* 15: 543–574.
- Extence C.A., Chadd R.P., England A.J., Dunbar M.J., Wood C.P.J. and Taylor E.D. (2013) The assessment of fine sediment accumulation in rivers using macro-invertebrate community response. *River Research and Applications* 29: 17–55.
- GB NNS (2015) *Check-Clean-Dry*. Campaign poster. Great Britain Non-Native Species Secretariat. [www.nonnativespecies.org/checkcleandry/](http://www.nonnativespecies.org/checkcleandry/)
- Hawkes H.A. (1997) Origin and development of the Biological Monitoring Working Party score system. *Water Research* 32: 964-968.
- Maitland P.S. (2004) *Keys to the freshwater fish of Britain and Ireland, with notes on their distribution and ecology*. Freshwater Biological Association, Ambleside, U.K. 248 pp.
- McFarland B. (2010) *Developing typology and class boundaries for WFD-AWICsp to assess acidification in UK rivers using macroinvertebrates*. Report to Freshwater Task team FTT003a. (WFD-UKTAG).

- Murphy J.F., Davy-Bowker J., McFarland B. and Ormerod S.J. (2013) A diagnostic biotic index for assessing acidity in sensitive streams in Britain. *Ecological Indicators* 24: 562–572.
- Murray-Bligh J.A.D., Furse M.T., Jones F.H., Gunn R.J.M., Dines R.A. and Wright J.F. (1992) *Procedure for collecting and analysing macroinvertebrate samples for RIVPACS*. Environment Agency and Institute of Freshwater Ecology.
- UKTAG (2014) Invertebrates (Anthropogenic Acidification): WFD Acid Water Indicator Community (WFD-AWIC) *UKTAG River Assessment Method Benthic Invertebrate Fauna*. Water Framework Directive – United Kingdom Technical Advisory Group (WFD-UKTAG).
- Wright J. F. (1997) An Introduction to RIVPACS. In: Wright J.F., Sutcliffe D.W., Furse M.T. eds. (1997) *Assessing the biological quality of fresh waters: RIVPACS and other techniques*. FBA Ambleside ISBN: 0-900386-62-2.



Figure A1.1. Typical habitat at Harvestslade Site 1 (Sept 2021).



Figure A1.2. Typical habitat at Harvestslade Site 1 (Sept 2021).



Figure A1.3. Typical habitat at Harvestslade Site 1 (Sept 2021).



Figure A1.4. Typical habitat at Harvestslade Site 1 (Sept 2021).



Figure A2.1. Typical habitat at Harvestslade Site 2 (Sept 2021).



Figure A2.2. Typical habitat at Harvestslade Site 2 (Sept 2021).



Figure A2.3. Typical habitat at Harvestslade Site 2 (Sept 2021).



Figure A2.4. Typical habitat at Harvestslade Site 2 (Sept 2021).



Figure A3.1. Typical habitat at Longwater Site 1 (Sept 2021).



Figure A3.2. Typical habitat at Longwater Site 1 (Sept 2021).



Figure A3.3. Typical habitat at Longwater Site 1 (Sept 2021).



Figure A3.4. Typical habitat at Longwater Site 1 (Sept 2021).





Figure A4.1. Typical habitat at Longwater Site 2 (Sept 2021).



Figure A4.2. Typical habitat at Longwater Site 2 (Sept 2021).



Figure A4.3. Typical habitat at Longwater Site 2 (Sept 2021).



Figure A4.4. Typical habitat at Longwater Site 2 (Sept 2021).



Figure A5.1. Typical habitat at Pondhead Site 1 (Sept 2021).



Figure A5.2. Typical habitat at Pondhead Site 1 (Sept 2021).



Figure A5.3. Typical habitat at Pondhead Site 1 (Sept 2021).



Figure A5.4. Typical habitat at Pondhead Site 1 (Sept 2021).



Figure A6.1. Typical habitat at Pondhead Site 2 (Sept 2021).



Figure A6.2. Typical habitat at Pondhead Site 2 (Sept 2021).



Figure A6.3. Typical habitat at Pondhead Site 2 (Sept 2021).



Figure A6.4. Typical habitat at Pondhead Site 2 (Sept 2021).



Figure A7.1. Typical habitat at Pondhead Control (Sept 2021).



Figure A7.2. Typical habitat at Pondhead Control (Sept 2021).



Figure A7.3. Typical habitat at Pondhead Control (Sept 2021).



Figure A7.4. Typical habitat at Pondhead Control (Sept 2021).





Figure A8.1. Typical habitat at Sluffers (Sept 2021).



Figure A8.2. Typical habitat at Sluffers (Sept 2021).



Figure A8.3. Typical habitat at Sluffers (Sept 2021).



Figure A8.4. Typical habitat at Sluffers (Sept 2021).



Figure A9.1. Typical habitat at Wootton Phase 1 Site 1 (Sept 2021).



Figure A9.2. Typical habitat at Wootton Phase 1 Site 1 (Sept 2021).



Figure A9.3. Typical habitat at Wootton Phase 1 Site 1 (Sept 2021).



Figure A9.4. Typical habitat at Wootton Phase 1 Site 1 (Sept 2021).



Figure A10.1. Typical habitat at Wootton Phase 1 Site 2 (Sept 2021).



Figure A10.2. Typical habitat at Wootton Phase 1 Site 2 (Sept 2021).



Figure A10.3. Typical habitat at Wootton Phase 1 Site 2 (Sept 2021).



Figure A10.4. Typical habitat at Wootton Phase 1 Site 2 (Sept 2021).



Figure A11.1. Typical habitat at Wootton Phase 2 Site 1 (Sept 2021).



Figure A11.2. Typical habitat at Wootton Phase 2 Site 1 (Sept 2021).



Figure A11.3. Typical habitat at Wootton Phase 2 Site 1 (Sept 2021).



Figure A11.4. Typical habitat at Wootton Phase 2 Site 1 (Sept 2021).





Figure A12.1. Typical habitat at Wootton Phase 2 Site 2 (Sept 2021).



Figure A12.2. Typical habitat at Wootton Phase 2 Site 2 (Sept 2021).



Figure A12.3. Typical habitat at Wootton Phase 2 Site 2 (Sept 2021).



Figure A12.4. Typical habitat at Wootton Phase 2 Site 2 (Sept 2021)