# A358 Taunton to Southfields Dualling Scheme

## Ecological Baseline Report - Fish

HE551508-ARP-EBD-ZZ-RP-LE-000025

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# Executive summary

The A358 Taunton to Southfields Dualling scheme would provide a dual carriageway along the length of the A358 between Taunton and Ilminster in Somerset, connecting the M5 motorway to the A303 to the south.

Fish surveys were part of the suite of habitat and protected species surveys commissioned in relation to the scheme. This report presents the results of the fish surveys undertaken throughout 2021 and aims to inform the ecology baseline for the scheme.

The objectives of this report are to present the methodologies used, identify survey limitations, and present the results of the fish surveys; the results of which will be used to inform appropriate mitigation and enhancement (if required).

A desk study undertaken reviewing available third-party data found the following records of fish species within the study area:

- Broughton Brook: brown trout (*Salmo trutta)*, 3-spined stickleback (*Gasterostreus aculeatus*), European eel (*Anguilla anguilla*), bullhead (*Cottus gobio)* and stoneloach (*Barbatula barbatula*).
- Fivehead River: bullhead, minnow (*Phoxinus phoxinus*), stoneloach, brown trout, chub (*Squalius cephalus*), 3-spined stickleback, dace (*Leuciscus leuciscus*), European eel, and brook lamprey (*Lampetra planeri*).
- River Ding: European eel, bullhead, minnow and stoneloach.
- River Ilse: chub, dace, brown trout, minnow, bullhead, stoneloach, 3-spined stickleback and European eel.

Fish surveys were undertaken along a maximum 200 metre reach of any watercourses that were identified as being impacted by the scheme (100 metres upstream and downstream of the point the scheme intersects with the watercourse).

The majority of the watercourses within the study area were deemed unsuitable for electric fishing, due to either water depths/flow and/or the presence of dense vegetation/hedgerow inhibiting access and/or the application of electric fishing techniques.

At those sites which were suitable for electric fishing, a number of notable species were recorded including bullhead (Fivehead River Tributary 1 and Back Stream/River Ding drainage network), river lamprey (*Lampetra fluviatilis*)/brook lamprey (Fivehead River Tributary 1 and River Ding/River Ding drainage network) and brown trout (Fivehead River Tributary 1).

For those sites where the watercourse could not be seen clearly or where access was restricted due to the presence of dense vegetation, the need for further surveys when vegetation has died back (subject to avoiding fish spawning times and when water levels are suitable for surveying) has been identified.

For all sites where fish were encountered, mitigation is likely to be required where watercourses would be drained or diverted/realigned as part of scheme.

# 1 Introduction

## 1.1 Purpose and scope of this document

1.1.1 The A358 Taunton to Southfields Dualling scheme (hereafter referred to as 'the scheme') would provide a dual carriageway along the length of the A358 between Taunton and Ilminster in Somerset, connecting the M5 motorway to the A303. Electric fishing (fish) surveys were part of a suite of habitat and protected species surveys commissioned in relation to the scheme.

1.1.2 This report presents the results of the desk study and fish surveys and aims to inform the ecology baseline for the scheme.

1.1.3 The objectives of this report are to:

- summarise the results of the fish surveys, including analysis of the abundance, densities and age classes of each species
- highlight the presence of any fish species of conservation interest
- provide sufficient information to inform an assessment of the potential impacts to fish as a result of the scheme and design appropriate mitigation measures (where required)

## 1.2 Scheme overview

1.2.1 The scheme is part of a programme of improvements planned along the A303/A358 corridor aimed at improving connectivity between London, the south-east and the south-west. The A303, alongside the A30, forms part of the strategic road network (SRN) and together with the A358, provides the link between London, the south-east and the south-west.

1.2.2 The programme of improvements, as set out in the Government's *Road Investment Strategy* [1] made a commitment to, *"…upgrade all remaining sections of the A303 between the M3 and the A358 to dual carriageway standard, together with creating a dual carriageway link from M5 at Taunton to the A303"*.

1.2.3 The scheme directly addresses this long-term commitment and would provide a new rural all-purpose dual carriageway link from the M5 at Taunton to the A303 at Southfields roundabout. The new dual carriageway would comprise new and upgraded stretches of the existing A358 road. Full details of the scheme will be provided in Chapter 2 *The Project* of the Environmental Statement (ES). Please refer to Figure 1-1 for a scheme plan.

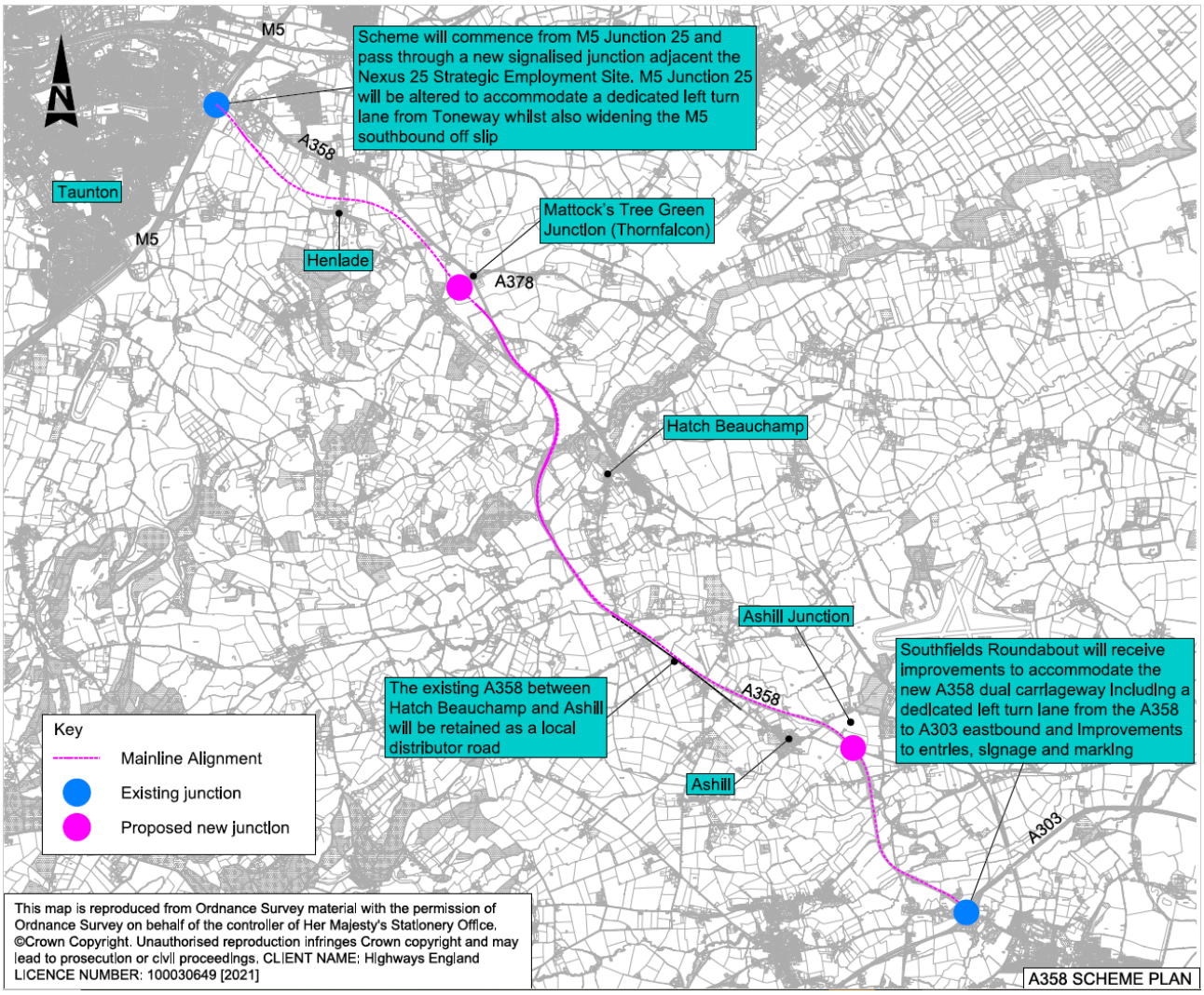



**Figure 1-1 Scheme plan**

## 1.3 Study area and zone of influence

1.3.1 The Chartered Institute for Ecology and Environmental Management (CIEEM) *Guidelines for Ecological Impact Assessment* [2] recommend that all potentially important ecological features that occur within the Zone of Influence (ZoI) for a scheme are investigated. The ZoI includes:

- areas to be directly within the land take for the scheme
- areas that would be temporarily affected during construction
- areas likely to be impacted by hydrological disruption
- areas where there is a risk of pollution and noise disturbance during construction and/or operation

1.3.2 The ZoI depends on the ecological features concerned. With regard to the watercourses likely to be affected by the scheme in relation to fish, the ZoI has been defined as all watercourses that cross the scheme and all aquatic habitat 100 metres upstream and downstream of the crossing point, a total stretch of 200 metres of riverine habitat for each crossing point. This ZoI is hereafter referred to as the study area.

## 1.4 Legislation

1.4.1 A framework of international, European, national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats. This legislation will be listed in full within Chapter 8 *Biodiversity* of the ES. Legislation relevant to and discussed within this report are:

- The Conservation of Habitats and Species Regulations 2017 (the 'Habitats Regulations)
- Wildlife and Countryside Act 1981
- Natural Environment and Rural Communities (NERC) Act 2006
- Invasive Alien Species (Enforcement and Permitting) Order 2019
- UK Post-2010 Biodiversity Framework
- The Water Framework Directive (WFD) 2000/60/EC
- Salmon and Freshwater Fisheries (SAFFA) Act 1975
- Eels (England and Wales) Regulations 2009

1.4.2 It is an offence under the Salmon and Freshwater Fisheries Act 1975 to wilfully disturb spawning fish of any species, or habitat in which spawn is likely to be present. Any in-channel works should be timed to avoid spawning periods (March – June for coarse fish and November – January for salmonids). In addition, subject to subsections (3) and (5), any person who knowingly takes, kills or injures, or attempts to take, kill or injure, any salmon, trout, lamprey, smelt, shad, freshwater fish or specified fish in any waters which is unclean or immature shall be guilty of an offence.

## 1.5 Status of notable fish species at the national level

1.5.1 The status of notable fish species at the national level and details on species-specific ecology are presented below. Only species for which there were desk study or field survey records are discussed.

1.5.2 Bullhead (*Cottus gobio)*: Bullhead is an EC Habitats Directive Annex II species. Core areas of habitats for species listed in Annex II are designated as sites of community importance (SCIs) and included in the Natura 2000 network.

1.5.3 River (*Lampetra fluviatilis*)/Brook (*Lampetra planeri*) lamprey: Lamprey are EC Habitats Directive Annex II species with core areas of habitats for these species listed in Annex II designated as SCIs and included in the Natura 2000 network. River lamprey is also listed as a species of principal importance (SPI) for the purpose of conserving biodiversity in accordance with the NERC Act 2006.

1.5.4 European eel (*Anguilla anguilla*): European eel is listed as Critically Endangered on the International Union for Conservation of Nature (IUCN) red list of threatened species. European eel is also listed as a SPI in accordance with the NERC Act 2006. The Eels (England and Wales) Regulations 2009 (Part 4) aims to maintain and improve the migratory routes of this species and requires specific mitigation around passage and screening in relation existing and proposed barriers to migration and abstractions.

1.5.5 Brown trout (*Salmo trutta)*: Brown trout is listed as a SPI in accordance with the NERC Act 2006.

## 1.6 Status of notable fish species at county level

1.6.1 Although the UK Biodiversity Action Plan (UK BAP) has been superseded, BAPs are still widely used at county level to support the subsequent *UK Post-2010 Biodiversity Framework* [3]. Within *The Somerset Biodiversity Strategy 2008 – 2018* [4] water and wetlands are identified as a priority habitat, but individual fish species are not identified.

## 1.7 Species-specific ecology for notable species

### Bullhead

1.7.1 Bullhead are a small bottom-dwelling fish with a preference for fast-flowing clear shallow water with a coarse substratum (gravel/cobble/pebble) [5]. Bullhead spawn from February to June, requiring a coarse substratum with large stones, providing habitat for the male to excavate a nest under a suitable large stone. Where large stones are not present, the bullhead may use woody debris or tree roots instead of large stones [6]. Newly hatched larvae are supported by a large yolk sac. Once the yolk has been exhausted, the fry are ready to disperse. Shallow, stony riffles are utilised by juvenile bullhead. Adult bullhead prefer sheltered sections created by woody debris, tree roots, leaf litter, macrophyte cover or large stones.

1.7.2 Generally, bullheads attain a length of 40–50mm after their first year, 60mm after their second and 70–90mm after their third. They do not generally live for more than three or four years [7].

### Lamprey

1.7.3 Lamprey are a ‘jawless’ fish of the infraphylum *Agnatha* and are some of the most primitive vertebrates known to man. Three species of lamprey are found in the UK, these include: brook lamprey, river lamprey and sea lamprey (*Petromyzon marinus*). River and sea lamprey are anadromous species, taking to the sea as adults and returning to cool, clear headwater streams or clear gravels of main rivers to spawn. Brook lamprey do not feed during the adult phase of their lives and spawn shortly after metamorphosing into adults. Lamprey spawn on a stone/gravel substrate between March and June, where they create nests or redds [8]. Adult lamprey die shortly after breeding. Larvae emerge after 1-2 weeks and are known commonly as ‘ammocoetes’.

1.7.4 Lamprey ammocoetes burrow themselves into the fine sand/silt, often found in river margins, where they feed by filtering micro-organisms such as algae, diatoms and detritus from the water column. After several years as ammocoete larvae, lamprey metamorphose into adult forms [9]. River and Sea lamprey migrate to estuaries and seas, where they adapt a hematophagous, parasitic, feeding strategy, before returning up-river to breed.

### European eel

1.7.5 The European eel is a catadromous species, meaning that it migrates from freshwater to the sea to spawn. The breeding ground of the European eel is thought to be the Sargasso Sea. The larvae (leptocephalus), drift via the currents in the surface waters in the Atlantic, migrating to Europe [10]. Towards the end of this migration the larvae transform into a glass eel, which enter estuaries and migrate upstream. As the glass eels migrate upstream into freshwater

environments, they metamorphose into elvers. After five to 20 years in freshwater the eels reach sexual maturity, following which they begin their migration to their breeding grounds.

1.7.6 The European eel is largely nocturnal, resting under stones or burrowing into mud during the day, emerging at dusk in search of food [11]. Their diet is varied and includes marine, estuarine and freshwater fauna although they do not feed during the colder months [11]. The principal food items are invertebrates and small fish. Small eels feed on insect larvae, molluscs, worms and crustaceans while the diet of larger specimens consists predominately of other fish species.

**Brown trout**

1.7.7 Brown trout and sea trout are the same species but sea trout are anadromous, meaning they migrate to the sea to feed and return to freshwater to spawn [12]. Both sea and brown trout spawn upstream in freshwater where they lay their eggs in redds between November and January. The habitat requirements include gravel, good flow and a high level of oxygen. The eggs hatch into alevin which live in the gravel feeding off the remaining egg yolk. Once the yolk has been consumed, the alevin develop into fry. At this stage the trout will emerge from the gravel and feed upon insects towards the surface of the river.

1.7.8 Juvenile fish have a preference for particular substrate (e.g. gravel and cobble) and vegetation within which they seek refuge. Mature trout are larger but still vulnerable to predation and seek refuge along riverbanks, particularly those with submerged or overhanging tree roots, rocks or fallen logs. Adult trout require heterogeneous habitat types to provide a good food resource, whilst providing opportunities for shelter away from predator.

# 2 Methodology

## 2.1 Desk study

2.1.1 A combination of aerial photographs, Ordnance Survey maps and existing scheme information was used to identify watercourse scheme crossing points.

2.1.2 Information was obtained from the Somerset Environmental Records Centre (SERC) and the Environment Agency's Ecology & Fish Data Explorer [13] was used to identify the presence of any notable fish species records (collected within the past 10 years) from within a 2 kilometre radius or 1 kilometre upstream and downstream of where each watercourses is crossed by the scheme.

2.1.3 The results of the desk study are discussed by watercourse rather than by each individual crossing point.

## 2.2 Field study

2.2.1 Fish surveys were undertaken between 13 and 17 September 2021. This is within the optimal survey period, which is considered to be between August and early October following the end of the coarse fish spawning season (March – August) and prior to the salmonid spawning season (November – January).

2.2.2 The field surveys were led by Matthew Davidson, a Principal Aquatic Consultant and full member of the Institute of Fisheries Management (IFM) with 15 years' professional experience working within the commercial and academic sector.

## 2.3 Survey consent

2.3.1 Under section 27a of the Salmon and Freshwater Fisheries Act 1975, an FR2 'Application for authorisation to use fishing instruments other than rod and line in England' was submitted to the Environment Agency (EA), who provided a section 27a exception for the fish surveys. A copy of the Section 27a exception was in place prior to field survey operations.

## 2.4 Fully-quantitative electric fishing survey

2.4.1 Where possible, fully quantitative, catch depletion, electric-fishing surveys were performed using Electrafish backpack equipment. Survey reaches were chosen to encompass the range of available habitats to ensure a representative sample of the fish population was achieved. Where on-site conditions were suitable, a minimum of 50 metres survey length was sampled within the 200 metre study area.

2.4.2 Prior to surveys commencing at each site, fish populations were isolated using stop nets at the downstream and upstream survey extents. A minimum of three survey runs were undertaken within the netted reach. Studies have shown that three runs are usually sufficient to produce an accurate catch depletion analysis.

2.4.3 Sampling reaches were fished in an upstream direction and fish captured were netted and transferred to aerated holding containers for recovery and processing.

2.4.4 Once recovered, fish were identified and measured (fork length to the nearest millimetre). After processing, fish were returned to the same stretch of watercourse from which they were captured. Quantitative population density estimates for each fish species (number per $m^2$) were calculated for each site,

based upon the depletion rate of consecutive catches taken from within the stop netted sections. Electric fishing was conducted by trained and highly experienced individuals following EA operational instruction guidance [14] and in accordance with BS EN 14011:2003 [15].

2.4.5 This approach enabled a population estimate for most sites/species to be made using the methodology provided by Carle & Strub (1978) [16]. This was calculated using the Pisces 2 'Population Estimation by Removal Sampling' software. In some instances, these calculations could not be made either due to insufficient numbers of captured fish or an irregular depletion (such as catching more fish in the second run than the first), in these instances population densities were calculated based upon the actual number of fish caught and as such can be viewed as a minimum estimate rather than a mathematical prediction of population densities.

## 2.5 Qualitative electric fishing survey

2.5.1 At site 39 (Venner's Water) a qualitative method was used to sample the fish population at this site. This method involved an electric fishing single run whereby fishing was undertaken by wading in an upstream direction as access allowed. This method enables a presence/absence assessment for the species present within the survey reach.

## 2.6 Juvenile lamprey surveys

2.6.1 Juvenile lamprey surveys, carried out between 13 and 17 September 2021, were undertaken at sites where suitable habitat was identified within or adjacent to the survey area. Suitable habitat for lamprey (fine sand or silt) was isolated with a net-walled quadrat and surveyed following standard methodology given in Natural England's publication *Monitoring the River, Brook and Sea Lamprey* [17]. A $1m^2$ section was surveyed using on-off (20 seconds on, 5 seconds off) cycle draws with the anode positioned approximately 10 – 15cm above the substrate. For depletion purposes this process was repeated a minimum of three times with a 5-minute break between sampling rounds. Survey timings (between August and October), were considered to be optimal for larval lamprey surveys, ensuring a range of larval size classes and life stages would be captured [18].

## 2.7 Habitat data and physico-chemical parameters

2.7.1 A basic site description was completed including details such as the survey reach length, average width and depth and notable habitat features such as macrophyte stands, the presence of woody debris and the substrate composition. Basic physico-chemical parameters including temperature, pH, dissolved oxygen concentration, salinity and conductivity were also measured and recorded using a hand-held multi-parameter probe. Photographs of each survey reach were also taken to provide a visual record of the habitat surveyed and these are provided in Section 3.2.

## 2.8 Biosecurity

2.8.1 During the surveys surveyors adhered to strict biosecurity protocol to reduce the risk of transmitting invasive non-native species. Surveyors worked in an upstream to downstream direction on each watercourse. Before moving between

hydrologically unconnected watercourses, all equipment was thoroughly checked and cleaned.

## 2.9 Site selection

2.9.1 A total of 16 watercourse crossing locations were identified that interacted with the scheme (Table 2-1). Fish surveys were undertaken along a maximum 200 metre reach, 100 metres upstream and downstream of the point the scheme intersects with the watercourse (see Appendix A *Fish survey study areas*).

**Table 2-1 Summary table of fish survey locations**

| Survey ID | Watercourse | Scheme crossing NGR | Survey methodology | Survey sample location | |
|---|---|---|---|---|---|
| | | | | Upstream NGR | Downstream NGR |
| 15a | Broughton Brook | ST 25593 24725 | Survey not possible | - | - |
| 17 | Black Brook Tributary 1 | ST 26005 24230 | Survey not possible | - | - |
| 19a | Black Brook | ST 25769 24572 | Survey not possible | - | - |
| 19b | Black Brook Tributary 3 | ST 26525 23807 | Survey not possible | - | - |
| 20 | Black Brook Tributary 2/5 | ST 26306 23938 | Survey not possible | - | - |
| 24 | Thornwater Stream | ST 27546 23555 | Survey not possible | - | - |
| 30 | Meare Stream | ST 29245 21573 | Survey not possible | - | - |
| 31 | Meare Stream Tributary 1 | ST 29452 20806 | Survey not possible | - | - |
| 34 | Fivehead River main channel 1 | ST 29721 19292 | 50 metres fully quantitative and lamprey ammocoete survey | ST 29673 19246 | ST 29641 19228 |
| 36 | Fivehead River main channel 2 | ST 30629 18516 | 50 metres fully quantitative | ST 30520 18474 | ST 30552 18478 |
| 37 | Fivehead River Tributary 5 | ST 30827 18374 | Survey not possible | - | - |
| 39 | Venner's Water | ST 31566 17915 | 10 metres qualitative | ST 31617 18020 | - |
| 51 | Cad Brook drainage network | ST 33212 16561 | Survey not possible | - | - |
| 52 | Cad Brook | ST 33224 10467 | Survey not possible | - | - |
| 54 | River Ding/River Ding drainage network | ST 33609 15773 | 50 metres fully quantitative | ST 33632 15815 | ST 33629 15794 |
| 55 | Back Stream/River Ding drainage network | ST 33764 15708 | 50 metres fully quantitative | ST 33792 15715 | ST 33826 15705 |

## 2.10 Assumptions and limitations

2.10.1 The survey results were affected by a number of issues as outlined below:

- Dense vegetation within and alongside the watercourse – dense vegetation coverage was encountered at the majority of the survey sites. The river channels were heavily vegetated and overgrown, primarily with rhizomatous and stoloniferous perennials and *Rubus* spp., amongst others; thus, making fully quantitative surveys impractical. The conditions encountered also presented an increased risk of injury or death to any fish populations from electric fishing due to the need for an increased number of runs to obtain a depletion and the likelihood of fish becoming entangled in the vegetation then being subjected to multiple runs (and therefore shocks) without capture.
- River hydrology – the majority of watercourses were observed to be slow flowing, ponded, and often dry and/or isolated in terms of their hydrology, therefore unsuitable for a fully quantitative survey. Aside from the conditions, if fish were present within those waterbodies the act of electric-fishing would put increased stress on them, potentially leading to mortality.

2.10.2 As a result of the constraints detailed above, it was only possible to undertake fully quantitative electric fishing surveys at four of the sixteen watercourse crossings, with a qualitative survey being undertaken at an additional site (site 39). Site locations and constraints are outlined in Table 2-2.

**Table 2-2 Summary table of fish survey constraints**

| Survey ID | Watercourse | Constraint | Comment |
|---|---|---|---|
| 34 | Fivehead River main channel 1 | substrate | Small species were difficult to catch due to nature of the substrate |
| 36 | Fivehead River main channel 2 | flow, water turbidity & substrate | No perceptible flow upstream & downstream of survey reach. Questionable connectivity to main channel at time of survey. Highly turbid water and substrate composition reduced catch efficiency. |
| 39 | Venner's Water | water turbidity | Highly turbid water reduced catch efficiency |
| 54 | River Ding/River Ding drainage network | water depth & water turbidity | Deep, highly turbid water reduced catch efficiency. |
| 55 | Back Stream/River Ding drainage network | substrate & water turbidity | Small species were difficult to catch due to nature of the substrate. Highly turbid water reduced catch efficiency. |

2.10.3 Where watercourses were listed as unsuitable for electric fishing, the assumption has been made that they are unlikely to support any notable fish species or significant fish population.

# 3 Results

## 3.1 Desk study

3.1.1 The SERC data search did not return any records of protected or notable fish species from within 2 kilometres of the study area.

3.1.2 The EA's Ecology & Fish Data Explorer [13] identified the presence of a number of notable fish species records, which are detailed below. The locations of the EA surveys are shown in Appendix B *EA desk study fish survey sites*.

**Broughton Brook**

3.1.3 A single run, semi-quantitative electric fishing survey of Broughton Brook was undertaken by the EA in March 2015 at New Barn Farm (ST 24997 23338) [13]. Analysis of the EA open data revealed the presence of brown trout, 3-spined stickleback (*Gasterostreus aculeatus*), European eel, bullhead and stoneloach (*Barbatula barbatula*).

**Fivehead River**

3.1.4 Two EA data sets were available for the Fivehead River, at Brandy Bridge (ST2900218966), to the south of the A358 and Elm Bridge (ST3139019670) to the north [13]. Electric fishing surveys were undertaken in July 2015 and April 2013. All sites had been completed using a single, semi quantitative electric fishing run.

3.1.5 The 2015 EA survey at Brandy Bridge revealed the presence of bullhead, minnow (*Phoxinus phoxinus*), stoneloach and brown trout. Elm Bridge was surveyed in 2010 and 2013 with the following species caught: chub (*Squalius cephalus*), 3-spined stickleback, minnow, dace (*Leuciscus leuciscus*), bullhead, European eel, brown trout, stoneloach and brook lamprey.

**River Ding**

3.1.6 The River Ding was surveyed by the EA in July 2015 at Broadway (ST3241715309) [13]. A single semi-quantitative electric fishing run was undertaken. The survey revealed the presence of European eel, bullhead, minnow and stoneloach.

**River Isle**

3.1.7 A semi-quantitative electric fishing survey undertaken by the EA at Hort Bridge (ST3464015326) in 2010 revealed the presence of chub, dace, brown trout, minnow, bullhead, stoneloach, 3-spined stickleback and European eels [13].

## 3.2 Field study

**Site 15a – Broughton Brook**

3.2.1 Site 15a was located to the east of the M5 junction 25, at the Nexus 25 roundabout, in an area of recent works associated with the new dual carriageway. The site was located under a pre-existing road crossing. The non-native invasive plant Himalayan balsam (*Impatiens glandulifera*) was extensive along both banks. The dense vegetation and hydrology made the site unsuitable for electric fishing within the study area.

**Figure 3-1 Site 15a – Broughton Brook**

### Site 17 – Black Brook Tributary 1

3.2.2 Site 17 was a partly dry ‘drainage ditch’ with little to no flow and ponded areas at the time of survey. The channel was heavily vegetated with bankside vegetation consisting of broad-leaved trees, herbaceous plants and grasses, which shaded or completely covered the majority of the channel. The dense vegetation and hydrology made the site unsuitable for electric fishing within the study area.

**Figure 3-2 Site 17 – Black Brook Tributary 1**

### Site 19a – Black Brook

3.2.3 Site 19a was located at the Nexus 25 roundabout, within an area of recent new development adjacent to the A358.The site was fenced and therefore inaccessible at the time of survey. The channel was heavily vegetated with bankside vegetation consisting of broad-leaved trees and herbaceous plants and grasses. River flow was minimal and consisted entirely of slack water, therefore conditions were unsuitable for electric fishing.

**Figure 3-3 Site 19a – Black Brook**

### Site 19b – Black Brook Tributary 3

3.2.4 Site 19b was unsuitable for electric fishing. The river channel was completely covered with vegetation at the time of survey, consisting of dense hedgerow and herbaceous plants and grasses along both banks. Where possible to observe, water depth was shallow (<10cm) and ponded during the survey.

**Figure 3-4 Site 19b – Black Brook Tributary 3**

### Site 20 – Black Brook Tributary 2/5

3.2.5 Site 20 was unsuitable for electric fishing. The site was heavily vegetated along both banks with dense hedgerow and low plants/grasses. The river channel was dry at the time of survey, both upstream and downstream of the scheme crossing point.

**Figure 3-5 Site 20 – Black Brook Tributary 2/5**

### Site 24 – Thornwater Stream

3.2.6 Site 24 was unsuitable for electric fishing within the study area. Access to the river channel was restricted due to dense vegetation and coarse woody debris. Bankside vegetation was dominated by broad-leaved trees and herbaceous plants and grasses. The dense vegetation and hydrology made the site unsuitable for survey.

**Figure 3-6 Site 24 – Thornwater Stream**

### Site 30 – Meare Stream

3.2.7 Site 30 was unsuitable for electric fishing within the study area. The river channel was bordered by dense bankside vegetation consisting of broad-leaved trees, dense hedgerow and herbaceous plants and grasses. The river channel was therefore inaccessible at the time of survey. Where observation allowed, water depth was shallow (<10cm), with little to no flow.

**Figure 3-7 Site 30 – Meare Stream**

### Site 31 – Meare Stream Tributary 1

3.2.8 Site 31 was unsuitable for electric fishing. Water depths were shallow (<10cm) with little to no flow at the time of survey and the channel was heavily shaded. Bankside vegetation consisted of broad-leaved trees and herbaceous plants and grasses.

**Figure 3-8 Site 31 – Meare Stream Tributary 1**

### Site 34 – Fivehead River main channel 1

3.2.9 The survey reach at site 34 was 50 metres in length and had an average width of approximately 5 metres. The approximate survey area was 250m$^2$. The maximum recorded depth was 0.4 metres with the average depth being approximately 0.25 metres. Dominant flow types included shallow run and glide, with some areas of slack water.

**Figure 3-9 Downstream view at Fivehead River main channel 1**

3.2.10 On the day of the survey the water was clear. The substrate consisted mainly of coarse sand/gravel, cobbles and fine sand/silt. Bankside vegetation consisted of broad-leaved trees, herbaceous plants and grasses. In-situ water quality readings are detailed in Table 3-1.

**Table 3-1 Site 34 – In-situ water quality**

| Parameter | Reading |
|---|---|
| Temp °C | 15.2 |
| DO (%) | 73.1 |
| DO (mg/l) | 7.35 |
| pH | 8.01 |
| SPC (µs) | 465.9 |
| Sal (PPT) | 0.23 |

3.2.11 A total of five species of fish were caught during the survey including minnow, stoneloach, 3-spined stickleback, brown trout and bullhead. The total number of individuals caught, catch depletion population estimates, densities and average (mean) lengths for each species are provided in Table 3-2 and further details are given in Appendix C *Raw fish data catch*. The community species composition is illustrated in Figure 3-10. Histograms showing the length-frequencies for minnow (Figure 3-10), bullhead (Figure 3-11) and stoneloach (Figure 3-12) are given below. Length-frequency histograms for the other species are not provided due to the low numbers of individuals caught.

**Table 3-2 Site 34 catch summary**

| Species | Number caught | Catch depletion population estimate | Density per $m^2$ | Fork length range (mm) | Average fork length (mm) |
|---|---|---|---|---|---|
| Minnow | 50 | 57 | 0.228 | 18 - 85 | 53 |
| Stoneloach | 22 | 24 | 0.096 | 34 - 90 | 53 |
| 3-spined stickleback | 1 | n/a | 0.004* | 30 - 30 | 30 |
| Brown trout | 2 | 3 | 0.012 | 52 - 64 | 53 |

| Species | Number caught | Catch depletion population estimate | Density per $m^2$ | Fork length range (mm) | Average fork length (mm) |
|---|---|---|---|---|---|
| Bullhead | 32 | 57 | 0.228 | 26 - 73 | 49 |

**minimum estimate*

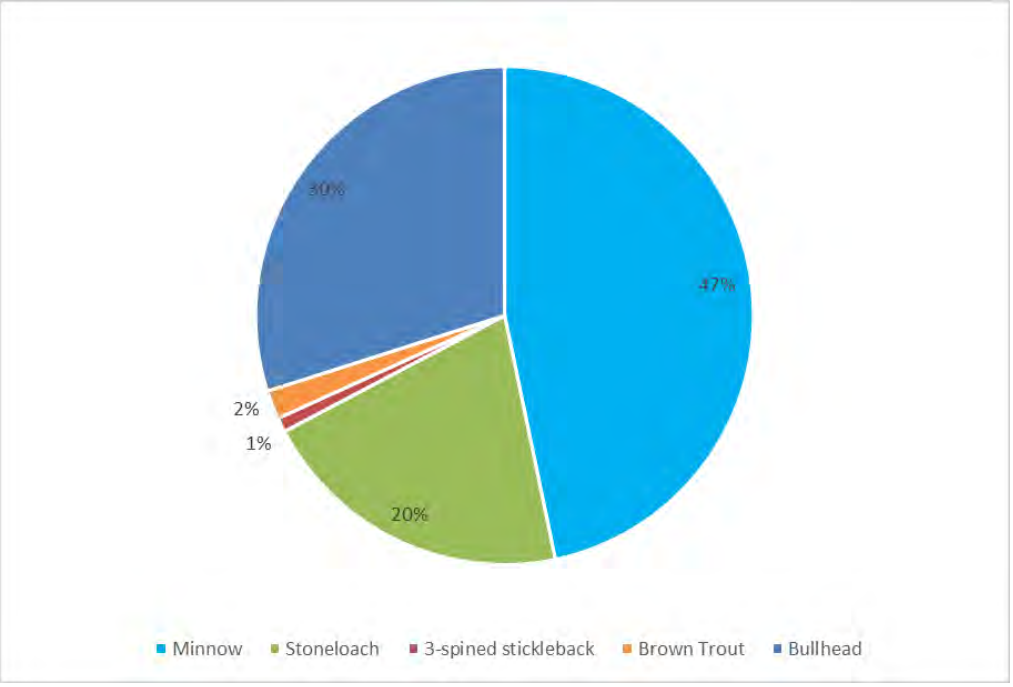



**Figure 3-10 Site 34 species composition (actual catch)**

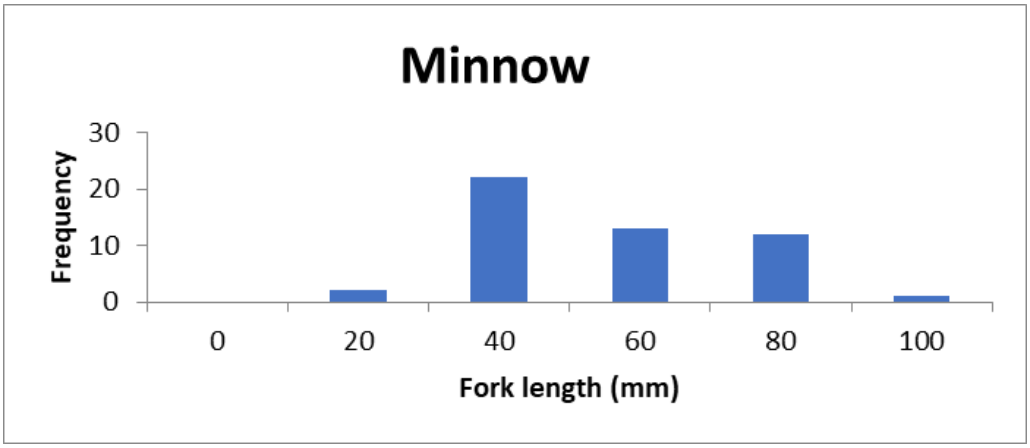



**Figure 3-11 Length-frequency histogram for minnow recorded at site 34**

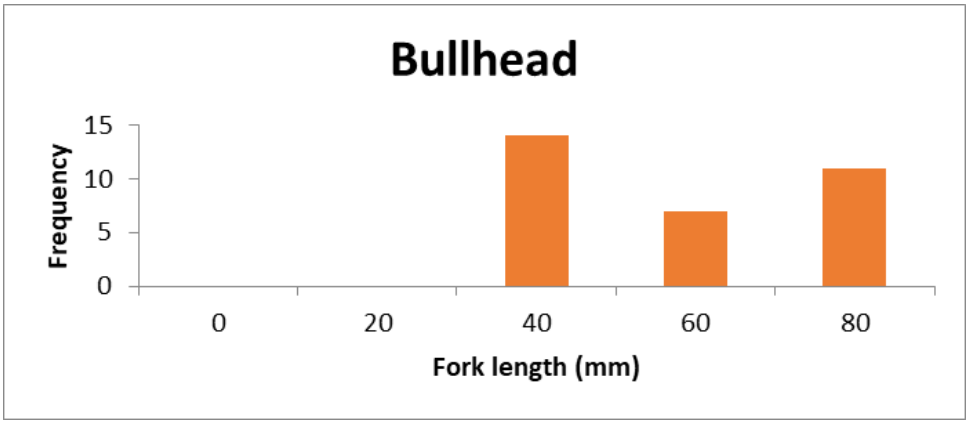



**Figure 3-12 Length-frequency histogram for bullhead recorded at site 34**

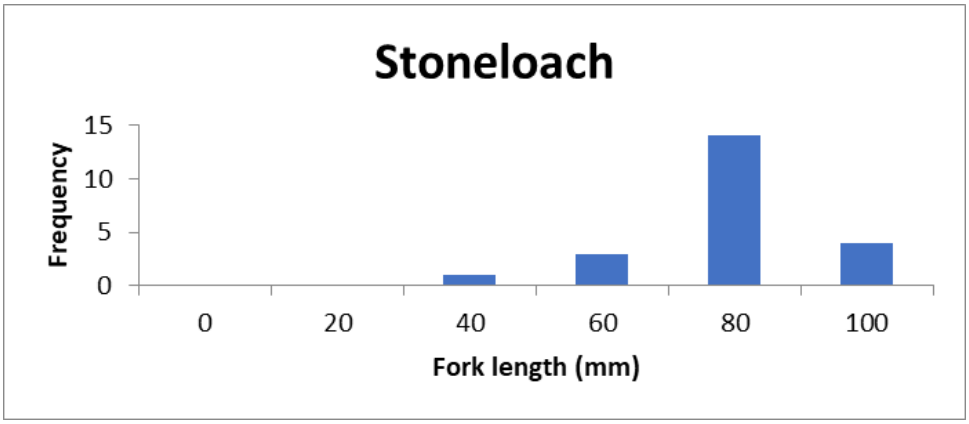



**Figure 3-13 Length-frequency histogram for stoneloach recorded at site 34**

3.2.12 A single juvenile lamprey (ammocoete) survey was undertaken at site 34, where a single 1m$^2$ quadrat of sub-optimal habitat was sampled. Ammocoetes were present and results are recorded in Table 3-3.

3.2.13 The habitat was sub-optimal, with substrate consisting of fine sand/silt. In this context, according to Harvey J & Cowx I (2003), optimal habitat is defined as "*stable fine sediment or sand > 15 centimetres deep, low water velocity and the presence of organic detritus. Sub-optimal habitat is defined as shallow sediment, often patchy and interspersed among coarser substrate*" [17]. Although it is recognised that the use of optimal/sub-optimal classification for lamprey habitat is no longer thought to be appropriate, as per recent guidance literature [18] it is considered a useful indicator for the purposes of this assessment in order to highlight the coarse substrate composition and therefore likely justification for the low numbers of lamprey spp. captured at the site.

**Table 3-3 Site 34 lamprey catch summary**

| Run number | Species and life stage | Length (mm) | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| 1 | River/brook ammocoete | 147 | 129 | 51 |
| 2 | River/brook ammocoete | 163 | 0 | 0 |
| 3 | No catch | 0 | 0 | 0 |

### Site 36 – Fivehead River main channel 2

3.2.14 Site 36 was 50 metres in length and had an average width of approximately 1.5 metres. The total approximate survey area was 75m$^2$. The maximum recorded depth was 0.4 metres with the average depth being approximately 0.2 metres. Observed flow types were comprised entirely of shallow slack water.

**Figure 3-14 Site 36 – Fivehead River main channel 2**

3.2.15 On the day of the survey the water was slightly turbid, but the riverbed was visible throughout the survey reach. The substrate consisted mainly of coarse sand/gravel, with areas of fine sand/silt and cobbles/boulders. Bankside vegetation consisted of broad-leaved trees and herbaceous plants and grasses which shaded the channel. In-situ water quality readings are detailed in Table 3-4.

**Table 3-4 Site 36 – In-situ water quality**

| Parameter | Reading |
|---|---|
| Temp °C | 14.1 |
| DO (%) | 44.6 |
| DO (mg/l) | 10.3 |
| pH | 7.86 |
| SPC (µs) | 1054 |
| Sal (PPT) | 0.53 |

3.2.16 A total of three species of fish were caught during the survey at site 36: minnow, stoneloach, and 3-spined stickleback. The total number of individuals caught, catch depletion population estimates, densities and average (mean) lengths for each species are provided in Table 3-5 and further details are given in Appendix C *Raw fish data catch*. Species composition is illustrated in Figure 3-14 below. Histograms showing the length-frequencies for stoneloach and 3-spined stickleback are represented in Figure 3-15 and 3-16 respectively. A length-frequency histogram is not provided for minnow due to the low number of individuals caught.

### Table 3-5 Site 36 catch summary

| Species | Number caught | Catch depletion population estimate | Density per $m^2$ | Fork length range (mm) | Average fork length (mm) |
|---|---|---|---|---|---|
| Minnow | 1 | n/a | 0.013* | 22 - 22 | 22 |
| Stoneloach | 6 | 7 | 0.093 | 102 - 132 | 67 |
| 3-spined stickleback | 11 | n/a | 0.147* | 25 - 58 | 43 |

**minimum estimate*

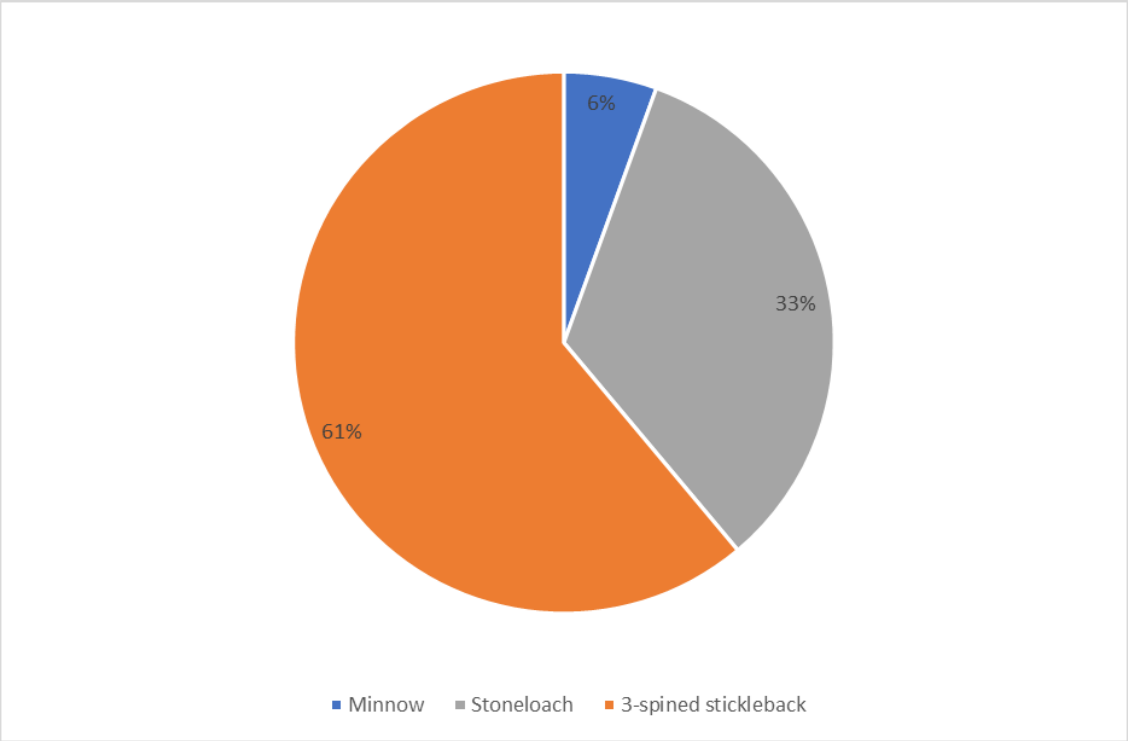



**Figure 3-15 Site 36 species composition (actual catch)**

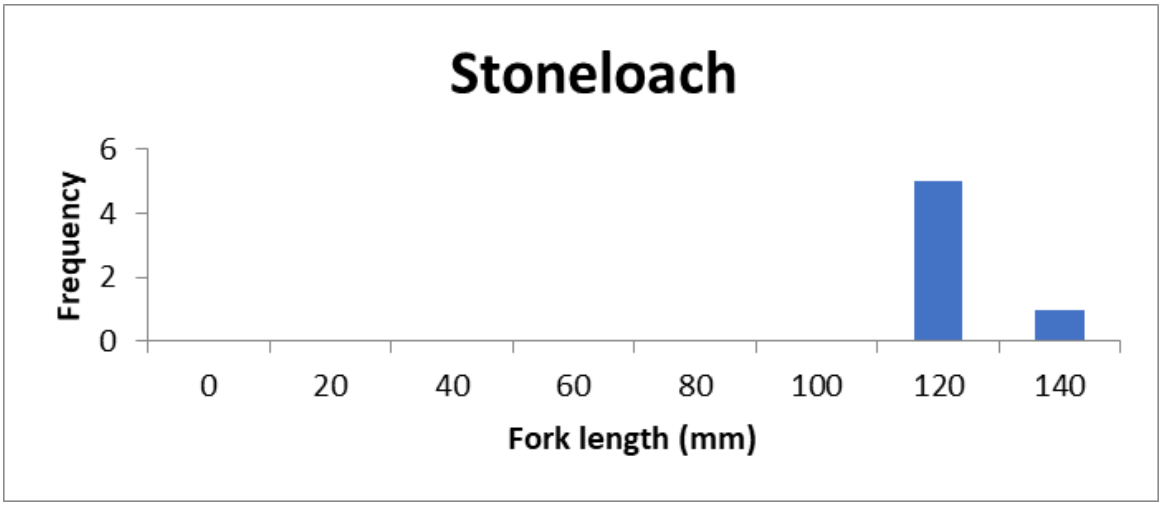



**Figure 3-16 Length-frequency histogram for stoneloach recorded at site 36**

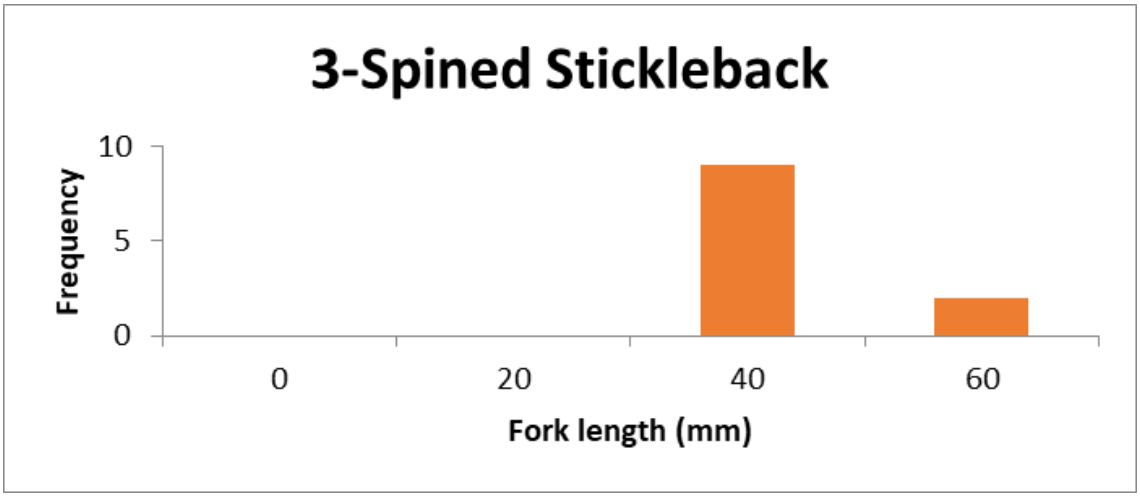



**Figure 3-17 Length-frequency histogram for 3-spined stickleback recorded at site 36**

### Site 37 – Fivehead River Tributary 5

3.2.17 Site 37 was a steep banked 'drainage ditch' unsuitable for electric fishing. The channel was heavily vegetated; bankside vegetation consisted of broad-leaved trees and herbaceous plants and grasses. Water depths were shallow (<10 centimetres) with little to no flow observed.

**Figure 3-18 Site 37 – Fivehead River Tributary 5**

### Site 39 – Venner's Water

3.2.18 Access to the river channel was limited due to dense overhanging vegetation. A qualitative electric fishing survey was, however, undertaken along an approximately 10 metre reach of the river in order to establish presence/absence for fish species.

3.2.19 The survey reach at site 39 was approximately 10 metres in length and had an average width of 2 metres. The approximate survey area was 20m$^2$. The maximum recorded depth was 0.4 metres with the average depth being approximately 0.3 metres. Dominant flow types included shallow run and glide, with some areas of slack water.

**Figure 3-19 Site 39 – Venner's Water**

3.2.20 On the day of the survey the water was highly turbid. The substrate consisted mainly of fine sand/silt, cobbles and coarse sand/gravel. Bankside vegetation consisted of broad-leaved trees, herbaceous plants and grasses and the river was heavily shaded. Himalayan balsam was also present along both banks. In-situ water quality readings are detailed in Table 3-6.

**Table 3-6 Site 39 – In-situ water quality**

| Parameter | Reading |
|---|---|
| Temp °C | 14.8 |
| DO (%) | 45.1 |
| DO (mg/l) | 4.45 |
| pH | 8.0 |
| SPC (µs) | 632 |
| Sal (PPT) | 0.31 |

3.2.21 A total of two species of fish were caught during the survey: stoneloach and 3-spined stickleback. The total number of individuals caught and average (mean) lengths for each species are provided in Table 3-7 and further details are given in Appendix C *Raw fish data catch*. Species composition is presented in Figure 3-19. Length-frequency histograms are not provided due to the low number of individuals caught.

**Table 3-7 Site 39 catch summary**

| Species | Number caught | Fork length range (mm) | Average fork length (mm) |
|---|---|---|---|
| Stoneloach | 1 | 115 - 115 | 115 |
| 3-spined stickleback | 5 | 32 - 41 | 37 |

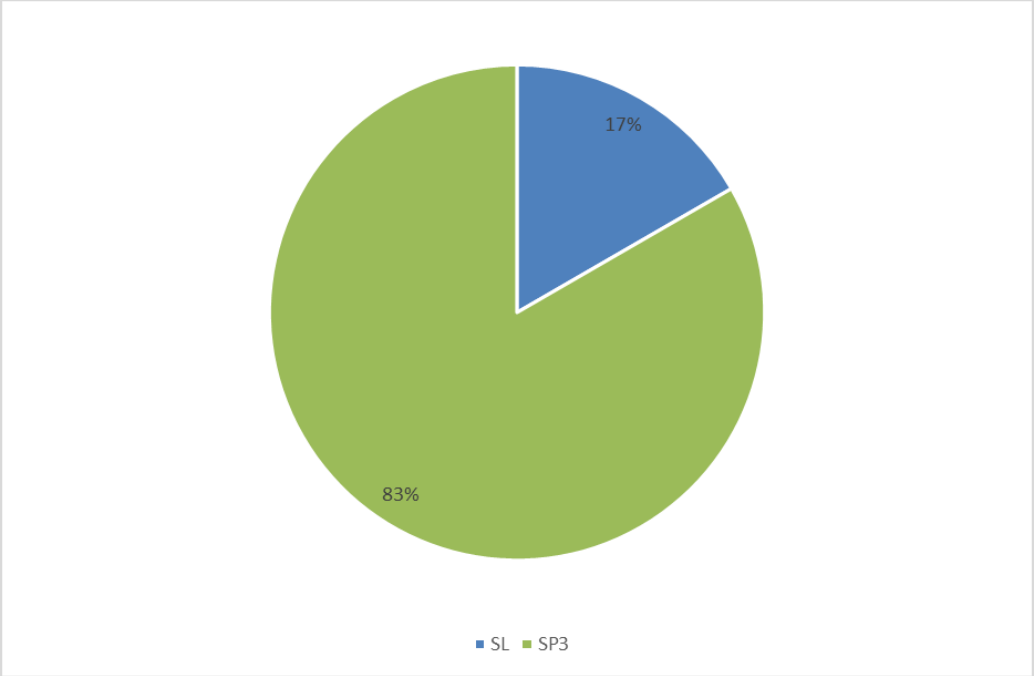



**Figure 3-20 Site 39 species composition (actual catch)**

### Site 51 – Cad Brook drainage network

3.2.22 Site 51 was a heavily overgrown ‘drainage ditch’, unsuitable for electric fishing. There was no observable flow within the channel at the time of survey. Bankside vegetation consisted of dense hedgerow, bramble and herbaceous plants and grasses.

**Figure 3-21 Site 51 – Cad Brook drainage network**

### Site 52 – Cad Brook

3.2.23 The river channel at site 52 was heavily vegetated at the time of survey; bankside vegetation consisted of herbaceous plants and grasses which obscured almost the entire channel. The dense vegetation and lack of open water made the site unsuitable for electric fishing at the time of survey.

**Figure 3-22 Site 52 – Cad Brook**

**Site 54 – River Ding/River Ding drainage network**

3.2.24 The survey reach at site 54 was 50 metres in length and had an average width of approximately 2 metres. The approximate survey area was 100m$^2$. The maximum recorded depth was 1.2 metres with the average depth being approximately 0.5 metres. Dominant flow types included deep run and glide, with some areas of marginal slack water.

**Figure 3-23 Site 54 -River Ding/River Ding drainage network**

3.2.25 On the day of the survey the water was highly turbid, which limited views of the substrate. Where substrate was visible, it consisted mainly of fine silt and clay. Bankside vegetation consisted of broad-leaved trees, herbaceous plants and grasses and the river was heavily shaded. In-situ water quality readings are detailed in Table 3-8.

### Table 3-8 Site 54 – In-situ water quality

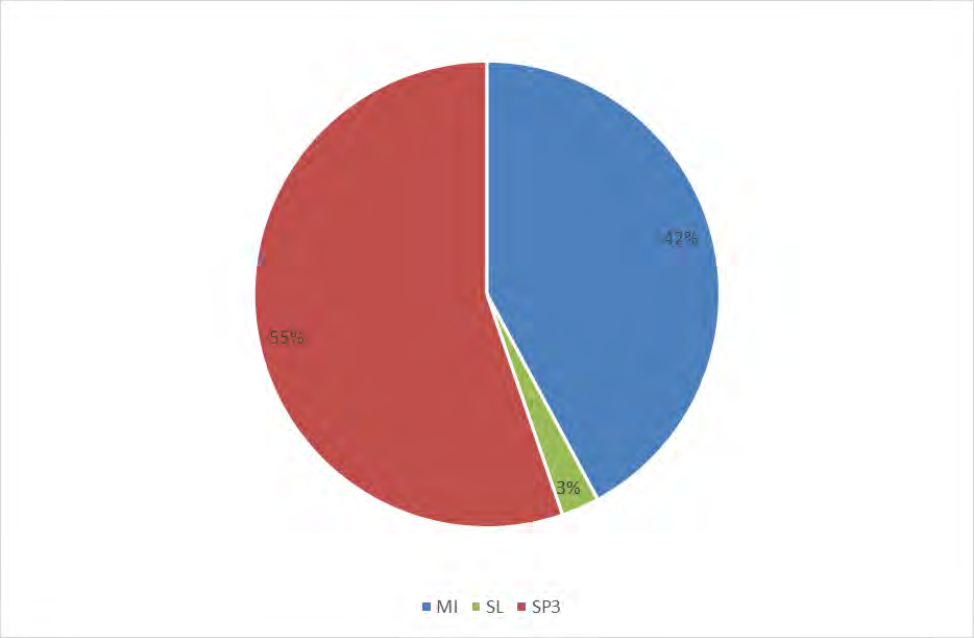
| Parameter | Reading |
|---|---|
| Temp °C | 15 |
| DO (%) | 50 |
| DO (mg/l) | 5.7 |
| pH | 7.64 |
| SPC (µs) | 423.6 |
| Sal (PPT) | 0.12 |

3.2.1 A total of three species of fish were caught during the survey: minnow, stoneloach and 3-spined stickleback. The total number of individuals caught, catch depletion population estimates, densities and average (mean) lengths for each species are provided in Table 3-9 and further details are given in Appendix C *Raw fish data catch*. Species composition is illustrated in Figure 3-23. Histograms showing the length-frequencies for 3-spined stickleback (Figure 3-24) and minnow (Figure 3-25) are given below. A length-frequency histogram for stoneloach is not provided due to the low numbers of individuals caught.

### Table 3-9 Site 54 catch summary

| Species | Number caught | Catch depletion population estimate | Density per $m^2$ | Fork length range (mm) | Average fork length (mm) |
|---|---|---|---|---|---|
| Minnow | 16 | 17 | 0.17 | 16 - 75 | 38 |
| Stoneloach | 1 | n/a | 0.01* | 47 | 87 |
| 3-spined stickleback | 21 | 29 | 0.29 | 17 - 51 | 27 |

**minimum estimate*




### Figure 3-24 Site 54 species composition (actual catch)

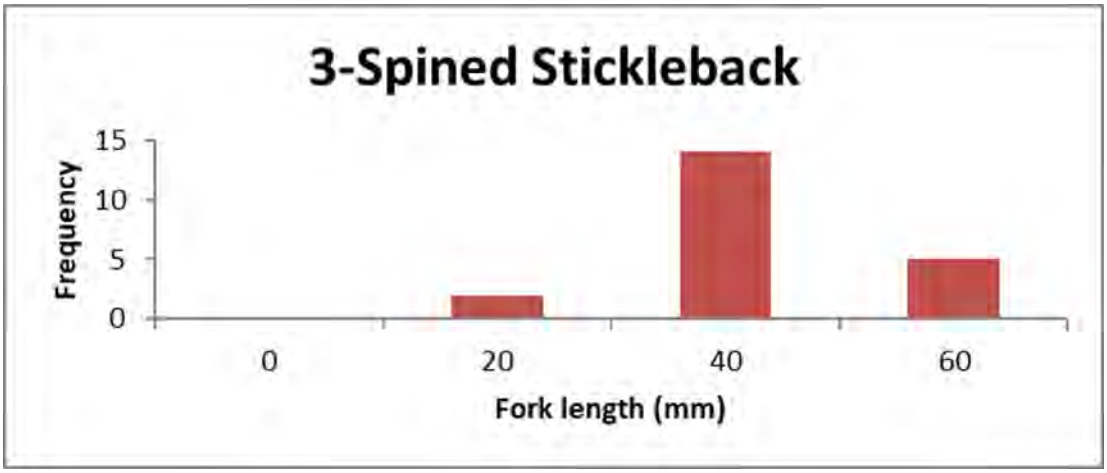



**Figure 3-25 Length-frequency histogram for 3-spined stickleback recorded at site 54**

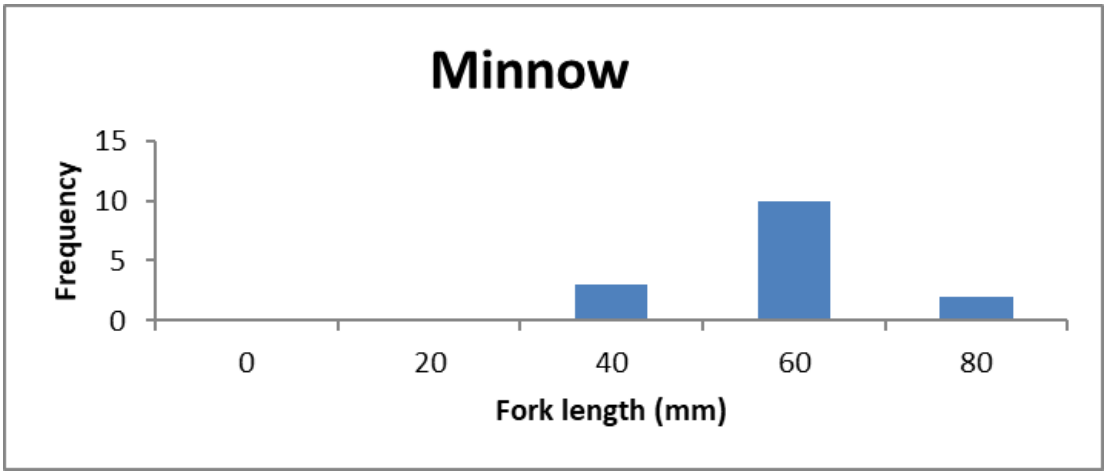



**Figure 3-26 Length-frequency histogram for minnow recorded at site 54**

3.2.2 A single, free-swimming sub-adult (macrophthalmia or transformer stage) brook lamprey was caught during the triple-shock survey. Following this, juvenile lamprey surveys were undertaken at the site, where a small area of suitable sub-optimal habitat was identified. No lamprey were caught.

**Site 55 – Back Stream/River Ding drainage network**

3.2.3 The survey reach at site 55 was 50 metres in length and had an average width of approximately 3 metres. The approximate survey area was 150m$^2$. The maximum recorded depth was 0.6 metres with the average depth being approximately 0.2 metres. Dominant flow types included shallow run and glide, with some areas of slack water and deeper glide and run.

**Figure 3-27 Site 55 – Back Stream/River Ding drainage network**

3.2.4 On the day of the survey the water was highly turbid, which limited views of the substrate. Where substrate was visible, it consisted mainly of coarse sand, gravel and cobbles with areas of fine sand/silt. Bankside vegetation consisted of broad-leaved trees, herbaceous plants and grasses and the river was heavily shaded by overhanging vegetation. In-situ water quality readings are detailed in Table 3-10.

**Table 3-10 Site 55 – In-situ water quality**

| Parameter | Reading |
|---|---|
| Temp °C | 15.7 |
| DO (%) | 70.7 |
| DO (mg/l) | 7.02 |
| pH | 7.86 |
| SPC (µs) | 430.9 |
| Sal (PPT) | 0.21 |

3.2.5 A total of four species of fish were caught during the survey: minnow, stoneloach, 3-spined stickleback and bullhead. The total number of individuals caught, catch depletion population estimates, densities and average (mean) lengths for each species are provided in Table 3-11 and further details are given in Appendix C *Raw fish data catch*. Species composition is illustrated in Figure 3-27. Histograms showing the length-frequencies for minnow (Figure 3-28) and bullhead (Figure 3-29) are given below. Length-frequency histograms for the other species are not provided due to the low numbers of individuals caught.

**Table 3-11 Site 55 catch summary**

| Species | Number caught | Catch depletion population estimate | Density per $m^2$ | Fork length range (mm) | Average fork length (mm) |
|---|---|---|---|---|---|
| Minnow | 15 | 16 | 0.11 | 27-73 | 50 |
| Bullhead | 23 | 24 | 0.16 | 35 - 68 | 50 |
| Stoneloach | 1 | n/a | 0.01* | 87 | 87 |
| 3-spined stickleback | 1 | n/a | 0.01* | 27 | 27 |

**minimum estimate*

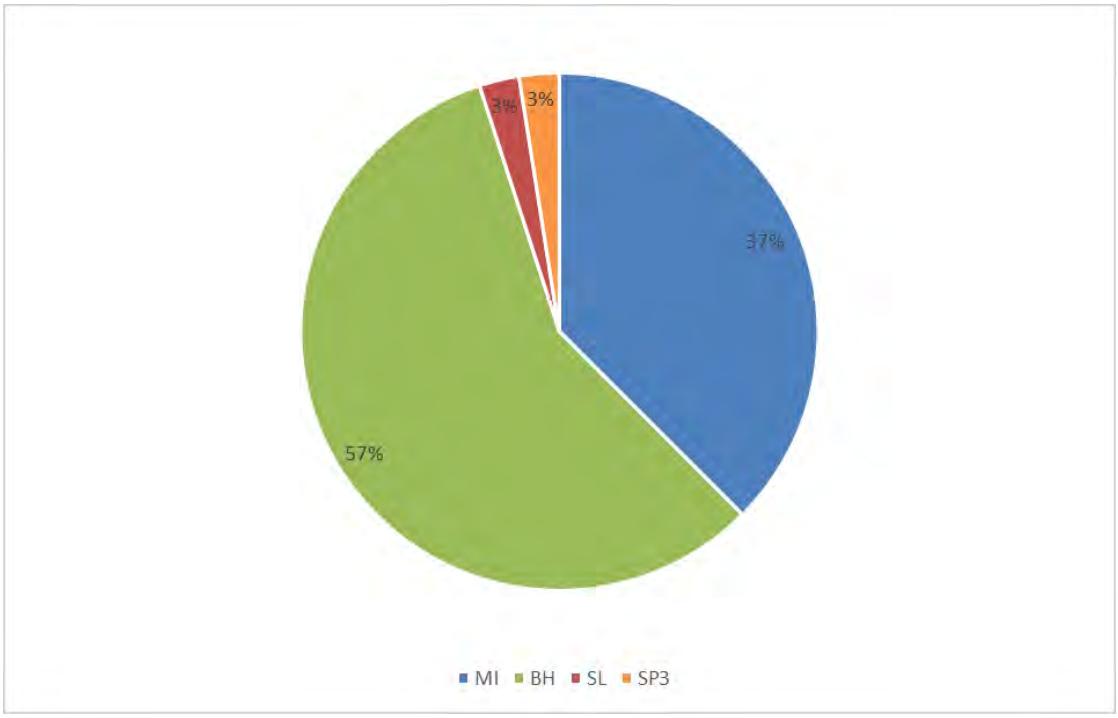



**Figure 3-28 Site 55 species composition (actual catch)**

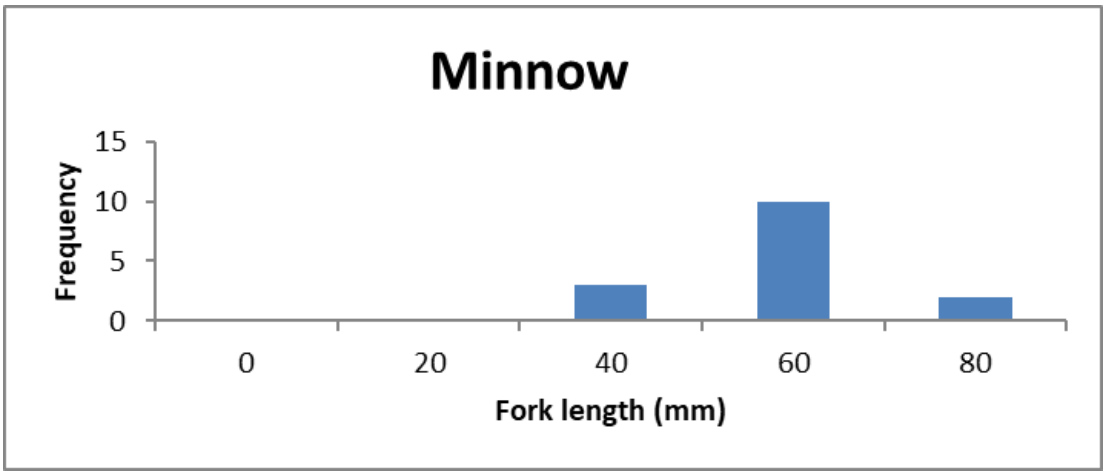



**Figure 3-29 Length-frequency histogram for minnow recorded at site 55**

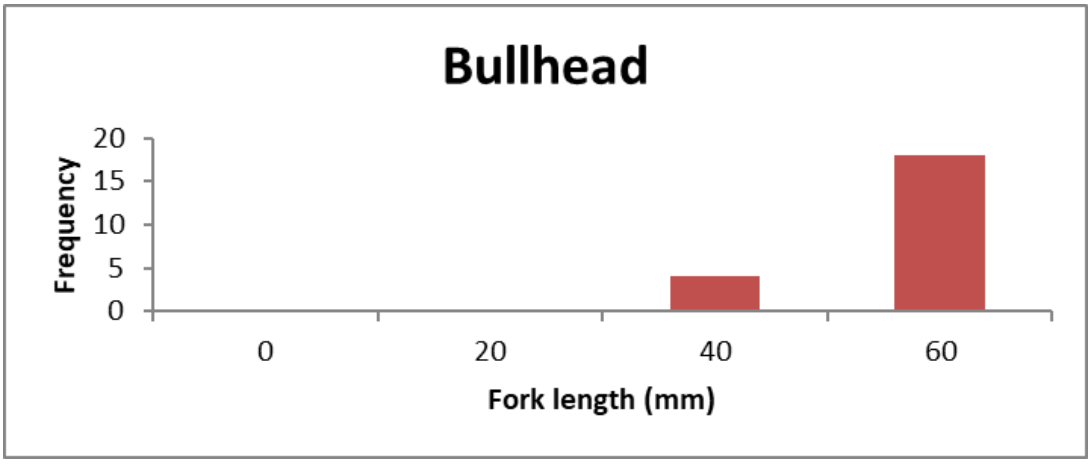



**Figure 3-30 Length-frequency histogram for bullhead recorded at site 55**

# 4 Conclusions

## 4.1 Survey constraints

4.1.1 Factors influencing the efficacy of surveys at each of the different sites are summarised in Table 4-1. Fully quantitative 50 metres surveys were undertaken at sites 34, 36, 54 and 55, whereas only a qualitative 10 metres survey was possible at site 39.

**Table 4-1 Summary table of fish survey constraints**

| Survey ID | Watercourse | Constraint | Comment |
|---|---|---|---|
| 34 | Fivehead River main channel 1 | substrate | Small species were difficult to catch due to nature of the substrate |
| 36 | Fivehead River main channel 2 | flow, water turbidity & substrate | No perceptible flow upstream & downstream of survey reach. Questionable connectivity to main channel at time of survey. Highly turbid water and substrate composition reduced catch efficiency. |
| 39 | Venner's Water | water turbidity | Highly turbid water reduced catch efficiency |
| 54 | River Ding/River Ding drainage network | water depth & water turbidity | Deep, highly turbid water reduced catch efficiency. |
| 55 | Back Stream/River Ding drainage network | substrate & water turbidity | Small species were difficult to catch due to nature of the substrate. Highly turbid water reduced catch efficiency. |

4.1.2 All the watercourses surveyed were small with narrow channel widths and predominantly shallow water depths. The fish species caught were typical for such watercourses, based on the habitat present. Although in some cases, specifically sites 36, 54 and 55, brown trout or eels could have been expected but were not encountered.

4.1.3 Species of note included bullhead, brown trout and river/brook lamprey ammocoete observed at the sites as summarised in Table 4-2.

**Table 4-2 Summary table of notable fish species recorded at field survey sites**

| Survey ID | Watercourse | Notable species recorded during field survey |
|---|---|---|
| 34 | Fivehead River main channel 1 | Bullhead, brown trout, river/brook lamprey ammocoete |
| 36 | Fivehead River main channel 2 | N/A |
| 39 | Venner's Water | N/A |
| 54 | River Ding/River Ding drainage network | Brook lamprey (transformer) |
| 55 | Back Stream/River Ding drainage network | Bullhead |

4.1.4 For those sites where the watercourse could not be seen clearly or where access was restricted due to the presence of dense vegetation, the need for further surveys when vegetation has died back (subject to avoiding fish spawning times and when water levels are suitable for surveying) has been identified. See Table 4-3 below for sites that have been identified as requiring further survey.

### Table 4-3 Sites requiring additional survey

| Survey ID | Watercourse | Survey timings* |
|---|---|---|
| 15a | Broughton Brook | Spring |
| 17 | Black Brook Tributary 1 | Spring |
| 19a | Black Brook | Spring |
| 19b | Black Brook Tributary 3 | Spring |
| 20 | Black Brook Tributary 2/5 | Spring |
| 24 | Thornwater Stream | Spring |
| 30 | Meare Stream | Spring |
| 31 | Meare Stream Tributary 1 | Spring |
| 37 | Fivehead River Tributary 5 | Spring |
| 39 | Venner's Water | Spring |
| 51 | Cad Brook drainage network | Spring |
| 52 | Cad Brook | Spring |

* Subject to relevant EA consent

4.1.5 For all sites where fish were encountered mitigation is likely to be required if the watercourses are to be drained or diverted/realigned as part of the proposed work. Mitigation is likely to include a fish translocation and the presence of an aquatic ecological clerk of works whilst works are being undertaken.

4.1.6 As discussed in Section 1.5 of this report, it is an offence under the Salmon and Freshwater Fisheries Act 1975 to wilfully disturb spawning fish of any species, or habitat in which spawn is likely to be present. Any in-channel works should therefore be timed to avoid spawning periods (March – June for coarse fish and November – January for salmonids).

# Abbreviations List

*Please refer to ES Report Chapter 17 Abbreviations.*

# Glossary

*Please refer to ES Report Chapter 18 Glossary.*

# References

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# Appendices

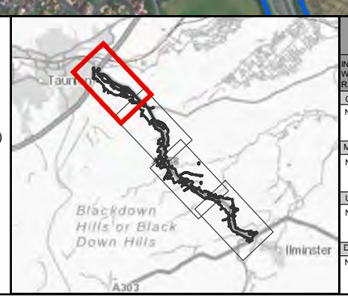
# Appendix A Fish survey study areas




LEGEND

- ECOLOGY SURVEY AREA
- ECOLOGY SURVEY AREA BUFFER - 100M
- WATERCOURSES
- FISH SURVEY EXTENT (100M EITHER SIDE OF SCHEME CROSSING POINT)

*LABELS SHOW SURVEY LOCATION ID*




**SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION**

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS (REFERENCE SHALL ALSO BE MADE IN THE DESIGN HAZARD LOG)

CONSTRUCTION
NONE

MAINTENANCE / CLEANING
NONE

USE
NONE

DECOMMISSIONING / DEMOLITION
NONE

| Rev. | Date | Description | By | Chk'd | App'd | Auth'd |
|---|---|---|---|---|---|---|
| P02 | 03/05/22 | ISSUE FOR INFORMATION | LL | MA | JS | SV |

Suitability: S2 — Drawing Status: SUITABLE FOR INFORMATION

Project Title: A358 TAUNTON TO SOUTHFIELDS

Drawing Title: FISH SURVEY STUDY AREAS SHEET 1 OF 4

| Scale | By | Checked | Approved | Authorised |
|---|---|---|---|---|
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| **Original Size** | **Date** | **Date** | **Date** | **Date** |
| A3 | 03/05/22 | 03/05/22 | 03/05/22 | 03/05/22 |

Drawing Number: HE PIN HE551508 - ZZ (Location) | Originator ARP | Volume VES | Type DR | Role LE | Number 000283

Revision: P02

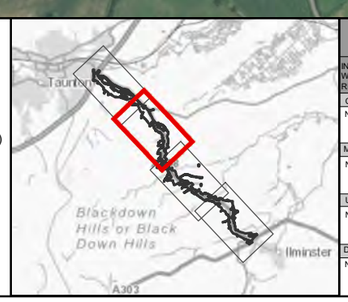
Client: national highways




LEGEND

- ECOLOGY SURVEY AREA
- ECOLOGY SURVEY AREA BUFFER - 100M
- WATERCOURSES
- FISH SURVEY EXTENT (100M EITHER SIDE OF SCHEME CROSSING POINT)

*LABELS SHOW SURVEY LOCATION ID*




**SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION**

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS (REFERENCE SHALL ALSO BE MADE IN THE DESIGN HAZARD LOG)

CONSTRUCTION
NONE

MAINTENANCE / CLEANING
NONE

USE
NONE

DECOMMISSIONING / DEMOLITION
NONE

| Rev. | Date | Description | By | Chk'd | App'd | Auth'd |
|---|---|---|---|---|---|---|
| P02 | 03/05/22 | ISSUE FOR INFORMATION | LL | MA | JS | SV |

Suitability: S2 — Drawing Status: SUITABLE FOR INFORMATION

TAYLOR WOODROW together @ VINCI | ARUP | RAMBOLL

Client: national highways

Project Title: A358 TAUNTON TO SOUTHFIELDS

Drawing Title: FISH SURVEY STUDY AREAS SHEET 2 OF 4

| Scale | By | Checked | Approved | Authorised |
|---|---|---|---|---|
| 1:10,000 | LL | MA | JS | SV |

| Original Size | Date | Date | Date | Date |
|---|---|---|---|---|
| A3 | 03/05/22 | 03/05/22 | 03/05/22 | 03/05/22 |

Drawing Number: HE551508 - ZZ | ARP - VES - DR - LE - 000284 (HE P/N | Originator | Volume | Location | Type | Role | Number)

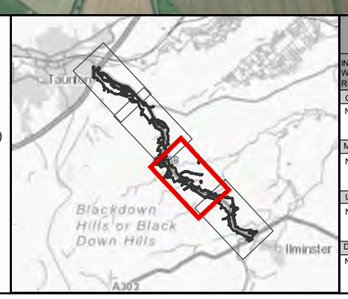
Revision: P02




LEGEND

- ECOLOGY SURVEY AREA
- ECOLOGY SURVEY AREA BUFFER - 100M
- WATERCOURSES
- FISH SURVEY EXTENT (100M EITHER SIDE OF SCHEME CROSSING POINT)

*LABELS SHOW SURVEY LOCATION ID*




**SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION**

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS (REFERENCE SHALL ALSO BE MADE IN THE DESIGN HAZARD LOG)

CONSTRUCTION
NONE

MAINTENANCE / CLEANING
NONE

USE
NONE

DECOMMISSIONING / DEMOLITION
NONE

| Rev. | Date | Description | By | Chk'd | App'd | Auth'd |
|---|---|---|---|---|---|---|
| P02 | 03/05/22 | ISSUE FOR INFORMATION | LL | MA | JS | SV |

Suitability: S2 — Drawing Status: SUITABLE FOR INFORMATION

TAYLOR WOODROW together @ VINCI | ARUP | RAMBOLL

Client: national highways

Project Title: A358 TAUNTON TO SOUTHFIELDS

Drawing Title: FISH SURVEY STUDY AREAS SHEET 3 OF 4

| Scale | By | Checked | Approved | Authorised |
|---|---|---|---|---|
| 1:10,000 | LL | MA | JS | SV |

| Original Size | Date | Date | Date | Date |
|---|---|---|---|---|
| A3 | 03/05/22 | 03/05/22 | 03/05/22 | 03/05/22 |

Drawing Number: HE551508 (HE P/N) - ZZ (Location) | ARP (Originator) - VES (Volume) - DR (Type) - LE (Role) - 000285 (Number)

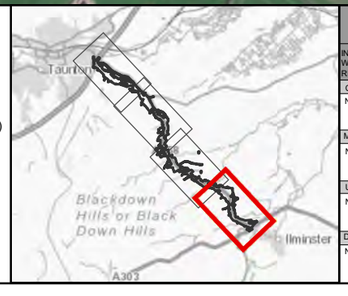
Revision: P02




LEGEND

- ECOLOGY SURVEY AREA
- ECOLOGY SURVEY AREA BUFFER - 100M
- WATERCOURSES
- FISH SURVEY EXTENT (100M EITHER SIDE OF SCHEME CROSSING POINT)

*LABELS SHOW SURVEY LOCATION ID*

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**CONSTRUCTION**
NONE

**MAINTENANCE / CLEANING**
NONE

**USE**
NONE

**DECOMMISSIONING / DEMOLITION**
NONE

| Rev. | Date | Description | By | Chk'd | App'd | Auth'd |
|---|---|---|---|---|---|---|
| P02 | 03/05/22 | ISSUE FOR INFORMATION | LL | MA | JS | SV |

Suitability: S2 — Drawing Status: SUITABLE FOR INFORMATION

TAYLOR WOODROW together @ VINCI | ARUP | RAMBOLL

Client: national highways

Project Title: A358 TAUNTON TO SOUTHFIELDS

Drawing Title: FISH SURVEY STUDY AREAS SHEET 4 OF 4

| Scale | By | Checked | Approved | Authorised |
|---|---|---|---|---|
| 1:10,000 | LL | MA | JS | SV |

| Original Size | Date | Date | Date | Date |
|---|---|---|---|---|
| A3 | 03/05/22 | 03/05/22 | 03/05/22 | 03/05/22 |

Drawing Number: HE551508 - ZZ | Originator: ARP | Volume: VES | Location: ZZ | Type: DR | Role: LE | Number: 000286

Revision: P02

# Appendix B EA desk study fish survey areas




LEGEND

- ECOLOGY SURVEY AREA
- ECOLOGY SURVEY AREA BUFFER - 100M
- EA DESK STUDY FISH SURVEY SITES

## SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS (REFERENCE SHALL ALSO BE MADE IN THE DESIGN HAZARD LOG)

**CONSTRUCTION**
NONE

**MAINTENANCE / CLEANING**
NONE

**USE**
NONE

**DECOMMISSIONING / DEMOLITION**
NONE

| Rev. | Date | Description | By | Chk'd | App'd | Auth'd |
|---|---|---|---|---|---|---|
| P01 | 03/05/22 | ISSUE FOR INFORMATION | LL | MA | JS | SV |

Suitability: S2 — Drawing Status: SUITABLE FOR INFORMATION

Client: national highways

Project Title: A358 TAUNTON TO SOUTHFIELDS

Drawing Title: EA DESK STUDY FISH SURVEY SITES

| Scale | By | Checked | Approved | Authorised |
|---|---|---|---|---|
| 1:50,000 | LL | MA | JS | SV |

| Original Size | Date | Date | Date | Date |
|---|---|---|---|---|
| A3 | 03/05/22 | 03/05/22 | 03/05/22 | 03/05/22 |

Drawing Number: HE PIN (Location) HE551508 - ZZ | Originator ARP | Volume VES - DR - LE - 000341 (Type - Role - Number)

Revision: P01

# Appendix C Raw fish catch data

# C.1 Species Codes

## Table C-1 Species codes

| Code | Common name | Latin name |
|---|---|---|
| SP3 | 3-spined stickleback | *Gasterostreus aculeatus* |
| SP9 | 9-spined stickleback | *Pungitius pungitius* |
| SA | Atlantic salmon | *Salmo salar* |
| BA | Barbel | *Barbus barbus* |
| BI | Bitterling | *Rhodeus sericeus* |
| BL | Bleak | *Alburnus alburnus* |
| LB | Brook lamprey | *Lampetra planeri* |
| BT | Brown trout | *Salmo trutta* |
| BH | Bullhead | *Cottus gobio* |
| CC | Carp (Common) | *Cyprinus carpio (common)* |
| CR | Carp (Crucian) | *Carassius carassius* |
| GC | Carp (Ghost) | *Cyprinus carpio (ghost)* |
| KC | Carp (Koi) | *Cyprinus carpio (koi)* |
| LC | Carp (Leather) | *Cyprinus carpio (leather)* |
| MC | Carp (Mirror) | *Cyprinus carpio (mirror)* |
| GRC | Carp (Grass) | *Ctenopharyngodon idella* |
| GF | Goldfish | *Carassius auratus* |
| CH | Chub | *Squalius cephalus* |
| CB | Common bream | *Abramis brama* |
| CBXSB | Common bream x silver bream hybrid | *Abramis brama x Blicca bjoerkna* |
| DA | Dace | *Leuciscus leuciscus* |
| EE | European eel | *Anguilla anguilla* |
| FL | Flounder | *Platichthys flesus* |
| GR | Grayling | *Thymallus thymallus* |
| GU | Gudgeon | *Gobio gobio* |
| LSP | Lamprey spp | *N/A* |
| MI | Minnow | *Phoxinus phoxinus* |
| MM | Motherless minnow/sunbleak | *Leucaspius delineatus* |
| OR | Orfe varieties | *Leuciscus idus* |
| PE | Perch | *Perca fluviatilis* |
| PI | Pike | *Esox lucius* |
| RT | Rainbow trout | *Oncorhynchus mykiss* |
| LR | River lamprey | *Lampetra fluviatilis* |
| RO | Roach | *Rutilus rutilus* |
| ROXCB | Roach x common bream hybrid | *Rutilus rutilus x Abramis brama* |
| ROXCH | Roach x chub hybrid | *Rutilus rutilus x Leuciscus cephalus* |

| Code | Common name | Latin name |
|---|---|---|
| ROXRU | Roach x rudd hybrid | *Rutilus rutilus x Scardinius erythrophthalmus* |
| RF | Ruffe | *Gymnocephalus cernua* |
| RU | Rudd | *Scardinius erythorphthalmus* |
| LS | Sea lamprey | *Petromyzon marinus* |
| ST | Sea trout | *Salmo trutta* |
| SB | Silver bream | *Blicca bjoerkna* |
| SL | Stoneloach | *Barbatula barbatula* |
| TE | Tench | *Tinca tinca* |
| TMG | Top mouth gudgeon | *Pseudorasbora parva* |
| ZA | Zander | *Sander lucioperca* |

# C.2 Site 34

## C.2.1 Fish Catch Data

**Table C-2 Site 34 – Catch data**

| Run No. | Fish No. | Species | Length (mm) |
|---|---|---|---|
| 1 | 1 | MI | 47 |
| 1 | 2 | SL | 86 |
| 1 | 3 | MI | 85 |
| 1 | 4 | SL | 70 |
| 1 | 5 | MI | 74 |
| 1 | 6 | SL | 67 |
| 1 | 7 | MI | 74 |
| 1 | 8 | BT | 64 |
| 1 | 9 | SL | 90 |
| 1 | 10 | SL | 79 |
| 1 | 11 | MI | 77 |
| 1 | 12 | MI | 73 |
| 1 | 13 | SL | 78 |
| 1 | 14 | BH | 60 |
| 1 | 15 | SL | 63 |
| 1 | 16 | SL | 74 |
| 1 | 17 | SL | 65 |
| 1 | 18 | BH | 62 |
| 1 | 19 | BH | 64 |
| 1 | 20 | BH | 67 |
| 1 | 21 | BH | 60 |
| 1 | 22 | BH | 29 |
| 1 | 23 | MI | 34 |
| 1 | 24 | BH | 68 |

| Run No. | Fish No. | Species | Length (mm) |
|---|---|---|---|
| 1 | 25 | SL | 63 |
| 1 | 26 | SL | 59 |
| 1 | 27 | BH | 48 |
| 1 | 28 | BH | 35 |
| 1 | 29 | BH | 35 |
| 1 | 30 | MI | 29 |
| 1 | 31 | MI | 40 |
| 1 | 32 | MI | 44 |
| 1 | 33 | MI | 52 |
| 1 | 34 | MI | 45 |
| 1 | 35 | MI | 47 |
| 1 | 36 | MI | 51 |
| 1 | 37 | MI | 44 |
| 1 | 38 | MI | 63 |
| 1 | 39 | MI | 23 |
| 1 | 40 | MI | 40 |
| 1 | 41 | MI | 44 |
| 1 | 42 | MI | 53 |
| 1 | 43 | MI | 40 |
| 1 | 44 | MI | 39 |
| 1 | 45 | MI | 25 |
| 1 | 46 | MI | 18 |
| 1 | 47 | MI | 20 |
| 1 | 48 | MI | 35 |
| 1 | 49 | MI | 24 |
| 1 | 50 | MI | 22 |
| 2 | 51 | MI | 26 |
| 2 | 52 | BH | 65 |
| 2 | 53 | SL | 81 |
| 2 | 54 | MI | 77 |
| 2 | 55 | SL | 77 |
| 2 | 56 | SL | 90 |
| 2 | 57 | MI | 27 |
| 2 | 58 | BH | 71 |
| 2 | 59 | BH | 61 |
| 2 | 60 | MI | 74 |
| 2 | 61 | BT | 52 |
| 2 | 62 | BH | 62 |
| 2 | 63 | BH | 65 |
| 2 | 64 | BH | 40 |
| 2 | 65 | SL | 77 |
| 2 | 66 | MI | 35 |

| Run No. | Fish No. | Species | Length (mm) |
|---|---|---|---|
| 2 | 67 | MI | 30 |
| 2 | 68 | SL | 64 |
| 2 | 69 | MI | 53 |
| 2 | 70 | MI | 50 |
| 2 | 71 | SL | 62 |
| 2 | 72 | BH | 49 |
| 2 | 73 | MI | 39 |
| 2 | 74 | BH | 56 |
| 2 | 75 | SL | 70 |
| 2 | 76 | BH | 30 |
| 2 | 77 | BH | 27 |
| 2 | 78 | SP3 | 30 |
| 2 | 79 | MI | 28 |
| 2 | 80 | BH | 28 |
| 2 | 81 | MI | 39 |
| 2 | 82 | MI | 39 |
| 2 | 83 | BH | 40 |
| 2 | 84 | BH | 27 |
| 2 | 85 | SL | 34 |
| 3 | 86 | MI | 72 |
| 3 | 87 | MI | 79 |
| 3 | 88 | MI | 74 |
| 3 | 89 | BH | 73 |
| 3 | 90 | MI | 74 |
| 3 | 91 | SL | 70 |
| 3 | 92 | MI | 68 |
| 3 | 93 | BH | 66 |
| 3 | 94 | BH | 54 |
| 3 | 95 | BH | 50 |
| 3 | 96 | BH | 28 |
| 3 | 97 | MI | 35 |
| 3 | 98 | MI | 47 |
| 3 | 99 | SL | 59 |
| 3 | 100 | MI | 55 |
| 3 | 101 | MI | 28 |
| 3 | 102 | SL | 53 |
| 3 | 103 | MI | 33 |
| 3 | 104 | BH | 30 |
| 3 | 105 | BH | 26 |
| 3 | 106 | BH | 28 |
| 3 | 107 | BH | 28 |

### C.2.2 Catch Depletion Analysis Statistics

**Minnow**

Result - Carle & Strub

Results

Estimated population = 57
Standard error = 4.829
Lower 95% confidence interval = 4.61387E6
Upper 95% confidence interval = 66.4651

Chi-squared = 1.33
Degrees of freedom = 1
Probability = 0.2485 Accept model (P>=0.2)
Number of observations = 50
Calculations

| | Observed | Expected | Probability of capture |
|---|---|---|---|
| 1 | 28 | 27.6699 | 0.485437 |
| 2 | 12 | 14.2379 | 0.485437 |

**Stoneloach**

Result - Carle & Strub

Results

Estimated population = 24
Standard error = 2.119
Lower 95% confidence interval = 4.61387E6
Upper 95% confidence interval = 28.1541

Chi-squared = 0.88
Degrees of freedom = 1
Probability = 0.3478 Accept model (P>=0.2)
Number of observations = 22

Calculations

| | Observed | Expected | Probability of capture |
|---|---|---|---|
| 1 | 11 | 12.5714 | 0.52381 |
| 2 | 8 | 5.98639 | 0.52381 |
| 3 | 3 | 2.85066 | 0.52381 |

**Bullhead**

Result - Carle & Strub

Results

Estimated population = 57
Standard error = 19.008
Lower 95% confidence interval = 4.61387E6
Upper 95% confidence interval = 94.2549

Chi-squared = 1.77
Degrees of freedom = 1
Probability = 0.1838 Reject model (P<0.2)
Number of observations = 32

Calculations

| | Observed | Expected | Probability of capture |
|---|---|---|---|
| 1 | 10 | 13.2174 | 0.231884 |
| 2 | 13 | 10.1525 | 0.231884 |
| 3 | 9 | 7.79829 | 0.231884 |

**Brown Trout**

Result - Carle & Strub

Results

Estimated population = 3
Standard error = 2.739
Lower 95% confidence interval = 4.61387E6
Upper 95% confidence interval = 8.36768

Chi-squared = 0.57
Degrees of freedom = 1
Probability = 0.4486 Accept model (P>=0.2)
Number of observations = 2

Calculations

| | Observed | Expected | Probability of capture |
|---|---|---|---|
| 1 | 1 | 1.2 | 0.4 |
| 2 | 1 | 0.72 | 0.4 |
| 3 | 0 | 0.432 | 0.4 |

## C.3 Site 36

### C.3.1 Fish Catch Data

**Table C-3 Site 36 – Catch data**

| Run No. | Fish No. | Species | Length (mm) |
|---|---|---|---|
| 1 | 1 | SL | 114 |
| 1 | 2 | SL | 132 |

| Run No. | Fish No. | Species | Length (mm) |
|---|---|---|---|
| 1 | 3 | SL | 105 |
| 1 | 4 | SL | 111 |
| 1 | 5 | SP3 | 49 |
| 1 | 6 | SP3 | 58 |
| 1 | 7 | SL | 102 |
| 1 | 8 | MI | 22 |
| 2 | 9 | SP3 | 29 |
| 2 | 10 | SP3 | 28 |
| 2 | 11 | SP3 | 25 |
| 2 | 12 | SP3 | 26 |
| 2 | 13 | SP3 | 29 |
| 2 | 14 | SL | 110 |
| 3 | 15 | SP3 | 28 |
| 3 | 16 | SP3 | 28 |
| 3 | 17 | SP3 | 27 |
| 3 | 18 | SP3 | 40 |

### C.3.2 Catch Depletion Analysis Statistics

**Stoneloach**

Result - Carle & Strub

Results

Estimated population = 7
Standard error = N/A error in method
Lower 95% confidence interval = N/A
Upper 95% confidence interval = N/A

Chi-squared = N/A
Degrees of freedom = N/A
Probability = N/A
Number of observations = 6

Calculations

| | Observed | Expected | Probability of capture |
|---|---|---|---|
| 1 | 5 | 4.66667 | 0.666667 |
| 2 | 1 | 1.55556 | 0.666667 |
| 3 | 0 | 0.518518 | 0.666667 |

# C.4 Site 39

## C.4.1 Fish Catch Data

### Table C-4 Site 39 – Catch data (qualitative)

| Run No. | Fish No. | Species | Length (mm) |
|---|---|---|---|
| 1 | 1 | SP3 | 32 |
| 1 | 2 | SP3 | 38 |
| 1 | 3 | SP3 | 38 |
| 1 | 4 | SP3 | 41 |
| 1 | 5 | SP3 | 36 |
| 1 | 6 | SL | 115 |

# C.5 Site 54

## C.5.1 Fish Catch Data

### Table C-5 Site 54 – Catch data

| Run No. | Fish No. | Species | Length (mm) |
|---|---|---|---|
| 1 | 1 | MI | 27 |
| 1 | 2 | MI | 27 |
| 1 | 3 | MI | 35 |
| 1 | 4 | SP3 | 30 |
| 1 | 5 | SP3 | 47 |
| 1 | 6 | SP3 | 45 |
| 1 | 7 | SP3 | 30 |
| 1 | 8 | SP3 | 42 |
| 1 | 9 | SL | 47 |
| 1 | 10 | SP3 | 27 |
| 1 | 11 | MI | 18 |
| 1 | 12 | MI | 22 |
| 1 | 13 | SP3 | 17 |
| 1 | 14 | MI | 20 |
| 1 | 15 | MI | 35 |
| 1 | 16 | MI | 42 |
| 1 | 17 | MI | 31 |
| 2 | 18 | MI | 75 |
| 2 | 19 | MI | 54 |
| 2 | 20 | MI | 32 |
| 2 | 21 | SP3 | 29 |
| 2 | 22 | SP3 | 26 |
| 2 | 23 | SP3 | 31 |
| 2 | 24 | SP3 | 49 |

| Run No. | Fish No. | Species | Length (mm) |
|---|---|---|---|
| 2 | 25 | SP3 | 32 |
| 2 | 26 | SP3 | 27 |
| 2 | 27 | SP3 | 32 |
| 2 | 28 | SP3 | 28 |
| 2 | 29 | MI | 17 |
| 2 | 30 | MI | 16 |
| 2 | 31 | MI | 18 |
| 2 | 32 | SP3 | 24 |
| 2 | 33 | LSP | 187 |
| 3 | 34 | MI | 66 |
| 3 | 35 | SP3 | 20 |
| 3 | 36 | SP3 | 28 |
| 3 | 37 | SP3 | 28 |
| 3 | 38 | SP3 | 51 |
| 3 | 39 | SP3 | 21 |

### C.5.2 Catch Depletion Analysis Statistics

**Minnow**

Result - Carle & Strub

Results

Estimated population = 17
Standard error = 1.480
Lower 95% confidence interval = 4.61387E6
Upper 95% confidence interval = 19.9015

Chi-squared = 1.26
Degrees of freedom = 1
Probability = 0.2616 Accept model (P>=0.2)
Number of observations = 16

Calculations

| | Observed | Expected | Probability of capture |
|---|---|---|---|
| 1 | 9 | 10.0741 | 0.592593 |
| 2 | 6 | 4.10425 | 0.592593 |
| 3 | 1 | 1.6721 | 0.592593 |

**3-spined stickleback**

Result - Carle & Strub

Results

Estimated population = 29

Standard error = 6.767
Lower 95% confidence interval = 4.61387E6
Upper 95% confidence interval = 42.2627

Chi-squared = 1.84
Degrees of freedom = 1
Probability = 0.1746 Reject model (P<0.2)
Number of observations = 21

Calculations

| | Observed | Expected | Probability of capture |
|---|---|---|---|
| 1 | 7 | 9.51563 | 0.328125 |
| 2 | 9 | 6.39331 | 0.328125 |
| 3 | 5 | 4.29551 | 0.328125 |

## C.6 Site 55

### C.6.1 Fish Data

**Table C-6 Site 55 – Catch data**

| Run No. | Fish No. | Species | Length (mm) |
|---|---|---|---|
| 1 | 1 | MI | 64 |
| 1 | 2 | MI | 53 |
| 1 | 3 | BH | 59 |
| 1 | 4 | BH | 58 |
| 1 | 5 | BH | 54 |
| 1 | 6 | BH | 56 |
| 1 | 7 | BH | 45 |
| 1 | 8 | BH | 47 |
| 1 | 9 | SP3 | 27 |
| 1 | 10 | BH | 52 |
| 1 | 11 | BH | 50 |
| 1 | 12 | BH | 48 |
| 1 | 13 | BH | 40 |
| 1 | 14 | BH | 59 |
| 1 | 15 | BH | 44 |
| 1 | 16 | BH | 42 |
| 1 | 17 | BH | 52 |
| 1 | 18 | BH | 46 |
| 1 | 19 | BH | 38 |
| 1 | 20 | MI | 52 |
| 1 | 21 | MI | 38 |
| 1 | 22 | MI | 56 |

| | | | |
|---|---|---|---|
| 1 | 23 | MI | 60 |
| 1 | 24 | MI | 53 |
| 1 | 25 | MI | 56 |
| 1 | 26 | BH | 35 |
| 1 | 27 | BH | 46 |
| 1 | 28 | BH | 46 |
| 1 | 29 | BH | 40 |
| 1 | 30 | BH | 52 |
| 1 | 31 | MI | 50 |
| 1 | 32 | MI | 50 |
| 2 | 33 | MI | 54 |
| 2 | 34 | MI | 44 |
| 2 | 35 | BH | 47 |
| 2 | 36 | MI | 38 |
| 2 | 37 | MI | 27 |
| 2 | 38 | SL | 87 |
| 3 | 39 | MI | 73 |
| 3 | 40 | BH | 68 |

### C.6.2 Catch Depletion Analysis Statistics

**Minnow**

Result - Carle & Strub

Results

Estimated population = 16
Standard error = 1.789
Lower 95% confidence interval = 4.61387E6
Upper 95% confidence interval = 19.5062

Chi-squared = 0.13
Degrees of freedom = 1
Probability = 0.7143  Accept model (P>=0.2)
Number of observations = 15

Calculations

| | Observed | Expected | Probability of capture |
|---|---|---|---|
| 1 | 10 | 10 | 0.625 |
| 2 | 4 | 3.75 | 0.625 |
| 3 | 1 | 1.40625 | 0.625 |

**Bullhead**

Result - Carle & Strub

Results

Estimated population = 24
Standard error = 3.025
Lower 95% confidence interval = 4.61387E6
Upper 95% confidence interval = 31.9294

Chi-squared = 0.77
Degrees of freedom = 1
Probability = 0.3810 Accept model (P>=0.2)
Number of observations = 23

Calculations

| | Observed | Expected | Probability of capture |
|---|---|---|---|
| 1 | 21 | 19.0345 | 0.793103 |
| 2 | 1 | 3.93817 | 0.793103 |
| 3 | 1 | 0.814793 | 0.793103 |

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