Norwich Western Link

Environmental Statement Chapter 10: Biodiversity Appendix 10.11: Aquatic Ecology Survey Report 2021

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Contents

1 Introduction

1.1.1 WSP UK Ltd was commissioned by NCC to complete a desk study and fish surveys to fulfil the following objectives:

- To determine the presence/likely absence of protected and/or notable fish species within the Survey Area; and
- Present the findings of the survey in a baseline report.

1.1.2 The findings of the desk study and surveys will be used to inform the impact assessment, proposed mitigation and enhancement opportunities for fish across the Scheme. Details of the impact assessment and mitigation will be included within the Biodiversity Chapter of the Environmental Statement for the Scheme.

1.1.3 We have included a summary of key information shown in this document in an accessible format. However, some users may not be able to access all technical details. If you require this document in a more accessible format please contact norwichwesternlink@norfolk.gov.uk

Norfolk County Council

Norwich Western Link Road

River Wensum Fish Report

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NORWICH WESTERN LINK ROAD

River Wensum Fish Report

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CONTENTS

TABLES

FIGURES

APPENDICES

1 Introduction

1.1 Project background

1.1.1. Norwich Western Link Road (NWL) is a highway scheme linking the A1270 Broadland Northway from its junction with the A1067 Fakenham Road to the A47 trunk road near Honingham.

1.1.2. The NWL, hereafter referred to as the Scheme, will comprise the following listed below

- Dualling the A1067 Fakenham Road westwards from its existing junction with the A1270 to a new roundabout located approximately 400m to the north west.
- Construction of a new roundabout.
- Constructing a dual carriageway link from the new roundabout to a new junction with the A47 near Honingham.

1.1.3. As part of a separate planned scheme, Highways England proposes to realign and dual the A47 from the existing roundabout at Easton to join the existing dual carriageway section at North Tuddenham. If that scheme proceeds, it is expected that Highways England will construct the Honingham junction and the Norwich Western Link will connect to the north-eastern side of that junction.

1.1.4. The Scheme will cross the River Wensum and its flood plain by means of a viaduct. The Scheme will also cross four minor roads by means of overpass or underpass bridges. The Scheme will include ancillary works such as provision for non-motorised users, necessary realignment of the local road network and the provision of environmental mitigation measures.

1.2 Ecological background

1.2.1. The requirement for fish surveys followed the identification of habitats within the River Wensum, and its floodplain, that may be affected by the Scheme. As part of the Scheme, a viaduct structure is required to carry the NWL across the River Wensum at NGR TG 13979 15483 and its adjoining floodplain. The floodplain contains several ordinary watercourses (hereafter referred to as “ditches”) which are connected to the River Wensum. A culvert crossing of Foxburrow Stream, a tributary of the River Tud, is also proposed at NGR TG 10514 13350.

1.2.2. It was therefore recommended that fish surveys be undertaken to establish a sufficient baseline to inform impact assessment, suitable mitigation and enhancement opportunities.

1.2.3. Fish surveys were carried out at representative locations where the proposed viaduct is to cross the River Wensum and connected ditches (Photographs A-1 and A-2 in Appendix A). A map displaying the electric fishing survey areas within the River Wensum and connected ditch network is provided below in Figure 3-1.

1.2.4. A fish survey was also conducted at the location of the culvert crossing point of Foxburrow Stream (Photograph A-10 in Appendix A). A map displaying the electric fishing survey area within Foxburrow Stream is provided below in Figure 3-2.

1.3 Brief and objectives

1.3.1. WSP UK Ltd was commissioned by NCC to complete a desk study and fish surveys to fulfil the following objectives:

- To determine the presence/likely absence of protected and/or notable fish species within the Survey Area; and
- Present the findings of the survey in a baseline report.

1.3.2. The findings of the desk study and surveys will be used to inform the impact assessment, proposed mitigation and enhancement opportunities for fish across the Scheme. Details of the impact assessment and mitigation will be included within the Biodiversity Chapter of the Environmental Statement for the Scheme.

2 Relevant legislation

2.1 Legal compliance

The Conservation of Habitats and Species Regulations 2017

2.1.1. The Conservation of Habitats and Species Regulations 2017 (HMSO, 2017a) transpose Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive) (EU Habitats Directive European Commission, 1992) into UK law. These regulations remain in force following the United Kingdom's exit from the European Union (EU) (HMSO, 2019a).

2.1.2. Brook lamprey *Lampetra planeri* and bullhead *Cottus gobio* are listed in Annex II a of the European Community Habitats and Species Directive (92/43/EEC) and are qualifying species of the River Wensum Special Area of Conservation (SAC) (JNCC, 2019).

2.1.3. Core areas of Annex II species habitat are designated as Sites of Community Importance (SCIs) and included in the Natura 2000 network. These sites, which include the River Wensum SAC, must be managed in accordance with the ecological needs of the ecological features that characterise them.

Natural Environment and Rural Communities Act 2006

2.1.4. The Natural Environment and Rural Communities (NERC) Act 2006 (HMSO, 2006) reinforces the duty upon all public authorities, including planning authorities, to have regard for the conservation of biodiversity when discharging their duties. The Act refines the definition of biodiversity conservation, stating that it includes restoring or enhancing a population or habitat.

2.1.5. Section 41 of the NERC Act requires the Secretary of State to list habitats and species of principal importance (HPIs and SPIs) for the conservation of biodiversity in England.

2.1.6. Fish SPIs include brown/sea trout *Salmo trutta*, European eel *Anguilla anguilla* and river lamprey *Lampetra fluviatilis*.

Salmon and Freshwater Fisheries Act 1975 (as amended)

2.1.7. The Salmon and Freshwater Fisheries Act 1975 (as amended) (HMSO, 1975) covers the regulation of fisheries in England and Wales and includes legislation that covers the introduction of polluting effluents, the obstruction of fish passage (screens, dams, weirs, culverts etc.), illegal means of fishing, permitted times of legal fishing and fishing licencing (which covers electric fishing).

2.1.8. Under this act any person who causes or knowingly permits to flow, or puts or knowingly permits to be put, into any waters containing fish or into any tributaries of waters containing fish, any liquid or solid matter to such an extent as to cause the waters to be poisonous or injurious to fish or the spawning grounds, spawn or food of fish, shall be guilty of an offence.

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

2.1.9. The Water Framework Directive (WFD) Regulations 2017 (HMSO, 2017b) establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater and for water all waterbodies (unless artificial or heavily modified) to achieve "good" ecological status. This is a retained EU law following United Kingdom's exit from the EU, as managed by The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019 (HMSO, 2019b).

2.1.10. Ecological Status is expressed in terms of five classes (High, Good, Moderate, Poor or Bad). These classes are established on the basis of specific criteria and boundaries defined against biological, physico-chemical and hydromorphological elements. Biological assessment uses numeric measures of communities of plants and animals (for example, fish, aquatic macroinvertebrates and macrophytes). Physico-chemical assessment looks at elements such as temperature and the level of nutrients, which support the biology. Hydromorphological quality looks at water flow, sediment composition and movement, continuity (in rivers) and the structure of physical habitat.

2.1.11. The overall Ecological Status of a water body is determined by whichever of these assessments is the poorer. For example, a water body might pass 'Good Status' for chemical and physico-chemical assessments but be classed as 'Moderate Status' for the biological assessment: In this case it would be classed overall as 'Moderate Ecological Status'. To achieve the overall aim of good surface water status, the Directive requires that surface waters be of at least Good Ecological Status and Good Chemical Status. To achieve High Status, the Directive requires that the hydromorphological Quality Elements are also in place.

2.1.12. When considering the effect of a development or activity on a waterbody it is a regulatory requirement under the WFD to assess if it will cause or contribute to a deterioration in status or jeopardise the waterbody achieving good status in the future.

2.1.13. Where a scheme is considered to cause deterioration, or where it may contribute to the failure of the water body to meet Good Ecological Status or Good Ecological Potential, then an Article 4.7 assessment would be required which makes provision for deterioration of status provided that certain stringent conditions are met.

3 Methods

3.1 Desk study

3.1.1. A desk study was undertaken in November 2020 to review relevant existing ecological baseline information available in the public domain and to obtain information held by relevant third parties. For the purpose of the desk study exercise, records were collated within various radii around the Survey Area. This approach is consistent with current good practice guidance published by the Chartered Institute of Ecology and Environmental Management (CIEEM) (2017).

3.1.2. Freely downloadable datasets (available from Natural England) were consulted for information regarding the presence of statutory designated sites within 2km of the Survey Area. This search was extended to 10km for Natura 2000 sites (Special Areas of Conservation (SAC) and Special Protection Areas (SPA)) of European importance and internationally designated Ramsar sites.

3.1.3. The current Water Framework Directive (WFD) status for the relevant catchment was obtained from the Environment Agency's Catchment Data Explorer Website (Environment Agency, 2020a).

3.1.4. Fish survey data for the River Wensum was obtained from the Environment Agency's Ecology and Fish Data Explorer (Environment Agency, 2020b).

3.2 Fish surveys

3.2.1. A 42-minute timed electric fishing survey was conducted over a 225m stretch of the River Wensum between NGRs TG 14012 15454 and TG 13841 15598 (see Figure 3-1) on 16 July 2020. The survey was carried out from a boat by a three-person fishing team using with a generator powered control box system operated from a boat.

Figure 3-1 – Map displaying electric fishing survey areas within the River Wensum and connected ditch network

3.2.2. A qualitative presence/absence electric fishing survey was conducted over a 65m stretch of the ditch network to be crossed by the proposed viaduct between NGRs TG 13711 15295 and TG 13652 15321 (see Figure 3-1) on 16 July 2020. The survey was carried out by a two-person fishing team who waded the watercourse whilst sampling using an E-Fish 500W Backpack System until a representative catch was collected.

3.2.3. A quantitative single run electric fishing survey was conducted over a 90m stretch of Foxburrow Stream between NGRs TG 10532 13314 and TG 10494 13367 (see Figure 3-2) on 17 July 2020. The survey was carried out by a two-person fishing team who waded the watercourse whilst sampling using an E-Fish 500W Backpack System. The surveyed section was isolated using stop nets.

Figure 3-2 – Map displaying the electric fishing survey area within Foxburrow Stream

3.2.4. Electric fishing is the term applied to a process that establishes an electric field in the water in order to capture fish. When exposed to the field, most fish become oriented toward the anode and as the density of the electric field increases, they swim toward it. In close proximity of the anode, they are immobilised.

3.2.5. Electric fishing methods and techniques following guidelines developed by the Environment Agency (Beaumont et al., 2002; EA, 2001; EA, 2007) and which conformed to British Standard BS EN 14011:2003 Water Quality. Sampling of Fish with Electricity (British Standards Institution, 2003).

3.2.6. During all surveys, one surveyor moved the anode side to side and up and down to “draw” fish towards the current. The second surveyor removed immobilised fish from the electrical field with the use of a dipnet. In the case of boat surveys, a third surveyor piloted the boat.

3.2.7. Following capture, fish were transferred to an aerated container from which they were identified to species level, measured from the tip of their snout to the end of the middle caudal fin rays (fork length), before being returned safely to the watercourse.

3.2.8. Once each electric fishing had ceased, a fish habitat survey was carried out. These surveys included an assessment of water depth channel width, flow types, substrate composition and bank characteristics. The vegetation types present, percentage canopy cover and percentage fish cover, were also recorded.

3.3 Limitations

3.3.1. Several studies have reported no statistically significant differences in pigmentation patterns and morphology between juvenile brook lamprey and juvenile river lamprey (Potter and Osbourne, 1975; Hardisty, 1986a; Hardisty, 1986b). Therefore, no attempt was made to distinguish between immature (0 to 2 years old) river lamprey and brook lamprey during electric fishing surveys.

3.3.2. In common with other benthic species, lamprey and European eel can be under-represented in electric fishing catches (Bohlin *et al*., 1989). This due to them being more susceptible to immobilisation than other fish and therefore not as readily attracted to the electric fishing anode (Zalewski and Cowx, 1989).

3.3.3. Smaller fish are more difficult to immobilise using electric fishing techniques and therefore may also be under-represented in electric fishing catches (Zalewski and Cowx, 1989).

3.3.4. Ecological survey data is typically valid for up to 18 months unless otherwise specified. The likelihood of surveys needing to be updated increases with time and is greater in circumstances where the habitat or its management has changed significantly since the surveys were undertaken. (CIEEM, 2019). No such changes to habitat or management have been identified with respect to aspects discussed in this report.

4 Results

4.1 Desk study

Designated Nature Conservation Sites

4.1.1. A single statutory site designated for fish species was identified within 10km of the Scheme. Namely, the River Wensum SAC (SAC EU Code UK0012647) for which brook lamprey (S1096) and bullhead (1163) are qualifying features.

Water Framework Directive

4.1.2. The River Wensum within the Survey Area falls within the WFD 'Wensum Upstream (US) Norwich' waterbody (GB105034055881) (Environment Agency, 2020a). The River Wensum is designated as a WFD watercourse, whilst the connected drainage ditch network, located to the south-west of the river within the Survey Area, is classed as an ordinary watercourse.

4.1.3. The 2019 WFD ecological status of the 'Wensum Upstream (US) Norwich' waterbody was Moderate (Environment Agency, 2020a), whilst the fish classification item was assessed to be High.

4.1.4. The hydromorphological designation of the 'Wensum Upstream (US) Norwich' waterbody is 'heavily modified', meaning it is considered to be heavily influenced by anthropogenic activity (Environment Agency, 2020a).

4.1.5. The River Tud, of which the Foxburrow Stream is a tributary, within the Survey Area falls within the WFD 'Tud' waterbody (GB105034051000) (Environment Agency, 2020a). The River Tud is designated as a WFD watercourse.

4.1.6. The 2019 WFD ecological status of the 'Tud' waterbody was Good (Environment Agency, 2020a), with the fish classification component also assessed as Good.

4.1.7. The hydromorphological designation of the 'Tud' waterbody is 'heavily modified', meaning it is considered to be heavily influenced by anthropogenic activity (Environment Agency, 2020a).

Environment Agency Fish Survey Records

River Wensum

4.1.8. The numbers of each species caught during a quantitative three-run Environment Agency electric fishing survey of a 175m stretch the River Wensum, carried out in September 2009, are displayed in Table 4-1.

Table 4-1 – Numbers of each fish species caught during a three-run electric fishing survey of the River Wensum, carried out by the Environment Agency at their "Attlebridge Hall Farm" survey site (NGR: TG 13875 15572) on 23 September 2009

Common name	Scientific name	Number of individuals caught
Roach	*Rutilus rutilus*	79
Minnow	*Phoxinus phoxinus*	35
Dace	*Leuciscus leuciscus*	29
Chub	*Squalius cephalus*	19
Gudgeon	*Gobio gobio*	14
Pike	*Esox lucius*	8
Bullhead	*Cottus gobio*	6
Perch	*Perca fluviatilis*	4
3-spined stickleback	*Gasterosteus aculeatus*	3
Brook / river lamprey	*Lampetra* sp.	3
European eel	*Anguilla anguilla*	1

4.1.9. A total of 11 species of fish were caught during the survey, with roach *Rutilus rutilus* being the most abundant species recorded.

4.1.10. Species of conservation importance caught included bullhead, brook/river lamprey and European eel.

River Tud

The numbers of each species caught during a quantitative two-run Environment Agency electric fishing survey of a survey of a 175m stretch the River Tud, carried out in July 2018, are displayed in Table 4-2.

Table 4-2 – Numbers of each fish species caught during a two-run electric fishing survey of the River Tud, carried out by the Environment Agency at their "D/S A47 Honingham" survey site (NGR: TG 10862 11674) on 4 July 2018

Common name	Scientific name	Number of individuals caught
Bullhead	*Cottus gobio*	93
Brown/sea trout	*Salmo trutta*	78
Brook/river lamprey	*Lampetra* sp.	11
Stone loach	*Barbatula barbatula*	9
Dace	*Leuciscus leuciscus*	9
3-spined stickleback	*Gasterosteus aculeatus*	5
European eel	*Anguilla anguilla*	3
Chub	*Squalius cephalus*	1
Rudd	*Scardinius erythrophthalmus*	1

4.1.11. A total of nine species of fish were caught during the survey, with bullhead being the most abundant species recorded.

4.1.12. Species of conservation importance caught included brook/river lamprey and European eel.

4.2 Fish surveys

River Wensum

4.2.1. A total of six fish species were caught during a 42-minute timed electric fishing survey the River Wensum. The species captured included dace *Leuciscus leuciscus*, pike *Esox lucius* and roach. No species of conservation importance were caught. These results are outlined in Table 4-3 below:

Table 4-3 – Numbers, lengths (fork lengths), and biomass of fish caught during a 42-minute timed electric fishing survey of a 225m stretch of the River Wensum, carried out on 16 July 2020

Common name	Scientific name	Number of individuals caught	Lengths of individuals (mm)	Number of individuals caught per minute	Biomass (g) caught per minute
Dace	*Leuciscus leuciscus*	18	Note 1*	0.43	15.93
Pike	*Esox lucius*	4	895, 647, 603, 467	0.10	262.65
Chub	*Squalius cephalus*	4	480, 316, 128, 114	0.10	52.57
Roach	*Rutilus rutilus*	2	215, 115	0.05	4.58
Gudgeon	*Gobio gobio*	2	117, 111	0.05	0.82
Minnow	*Phoxinus phoxinus*	1-9 (Note 2**)	Note 3***	Note 3***	Note 3***

Note 1* Presented separately in a length/frequency bar chart
Note 2** Log abundance assigned to minor species in accordance with Environment Agency methodology
Note 3*** Minnow are considered a minor species by the Environment Agency and it is there not standard practice to record numbers, lengths (fork lengths), and biomass of fish caught.

4.2.2. Dace were the most abundant species caught, accounting for 60% of the total number of individuals captured. The joint second most abundant species captured were pike and chub *Squalius cephalus*, with both accounting for 13% of individuals caught (Figure 4-1).

4.2.3. Pike accounted for 78% of the total fish biomass sampled (Figure 4-1), which reflects the large size (between 895mm and 467mm) of the four individuals caught (Table 4-3).

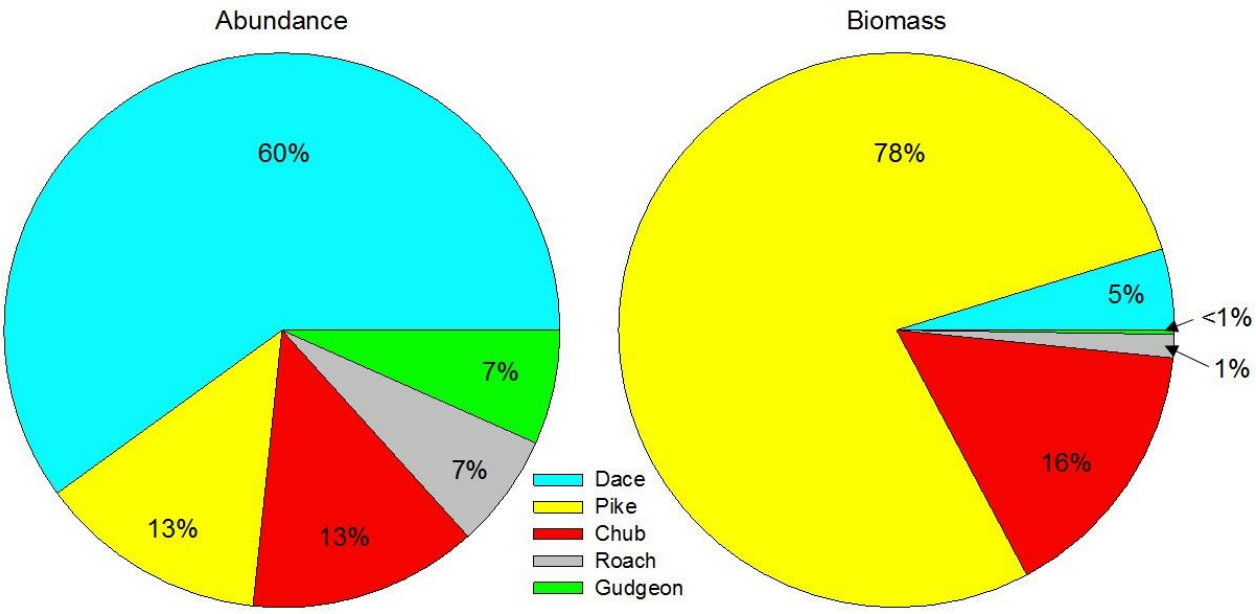

Figure 4-1 – Species percentage contribution to the total fish abundance and biomass of fish caught during a timed electric fishing survey of a 225m stretch of the River Wensum, carried out on 16 July 2020

4.2.4. Four size/age classes of dace were sampled; 31 to 40mm (0+ years old), 61 to 80mm (1+ years old), 111 to 150mm and (2+years old) and 151 to 210mm (3++ years old) (Figure 4-2). Figure 4-2 shows two samples of 31 to 40mm (0+years old), three samples of 61 to 80mm (1+year old), six samples of 111 to 150mm (2+years old) and seven samples of 151 to 210mm (3++ years old) were caught during the survey.

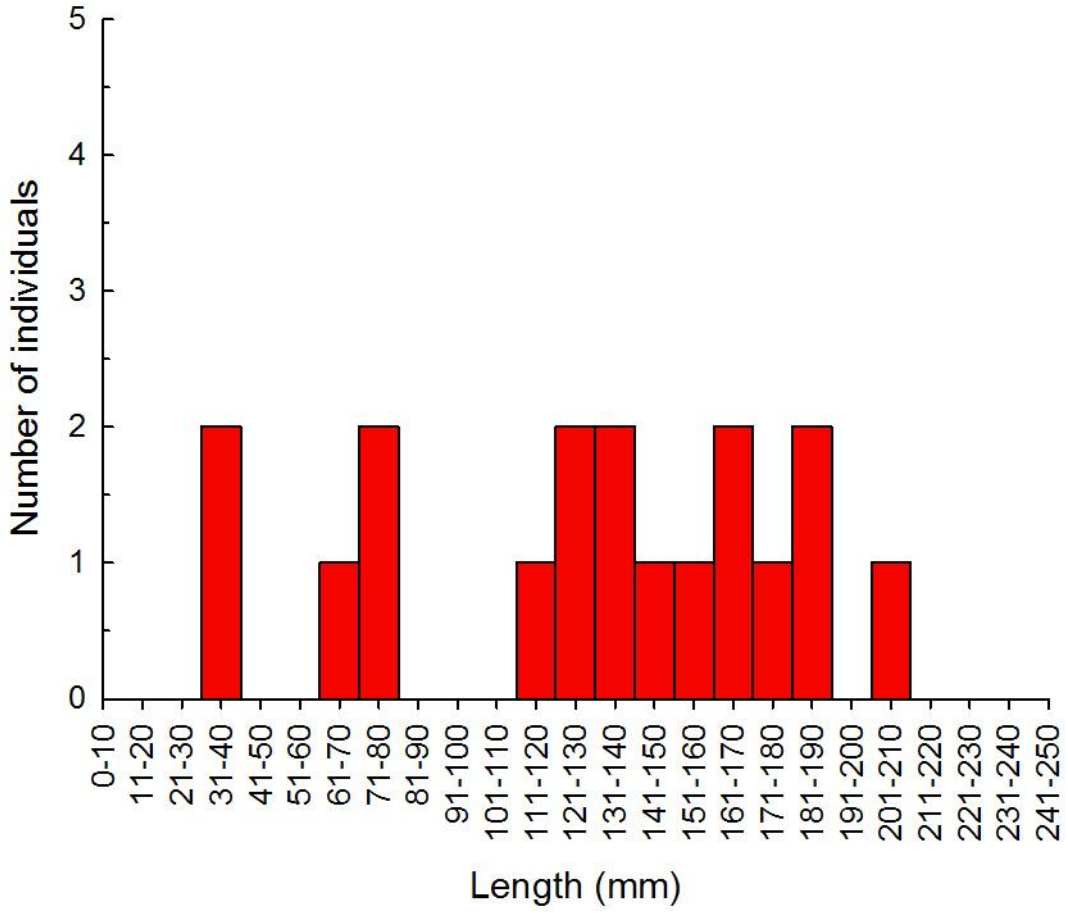

Figure 4-2 – Length frequency distribution of Dace *Leuciscus leuciscus* caught during a timed electric fishing survey of a 300m stretch of the River Wensum, carried out on 16 July 2020

4.2.5. The mean wet width of the watercourse along the surveyed stretch was location was 8m. The mean depth of water was in excess of 1m and was slightly turbidity.

4.2.6. Instream substrate consisted of sand (40%), gravel (40%) and pebble (20%). The substrate was free of silt, stable and uncompacted.

4.2.7. The flow types present consisted of a single deep glide (95%) and still margins (5%).

4.2.8. The surrounding land use close to the watercourse was improved pasture. The bank face vegetation structure along both banks was simple (two to three types).

4.2.9. Fish cover provided by undercut banks (70%). Canopy cover (shading) over the watercourse was 20%.

4.2.10. The physico-chemical properties of the water at the River Wensum survey location are displayed in Table 4-4.

Table 4-4 – The physico-chemical properties of the water sampled from the River Wensum on 16 July 2020

Parameter	Value
Temperature (°C)	17.2
Conductivity (µS/cm^{-1})	626
Dissolved oxygen (% saturation)	100.00
Dissolved oxygen (mg/l)	10.48
pH	8.18

Ditch network

4.2.11. A total of three species of fish were caught during the qualitative (presence/absence) survey of the ditch network, including brook/river lamprey, which are species of conservation importance (Table 4-5).

Table 4-5 – Number of each fish species caught during a qualitative (presence/absence) electric fishing survey of a 65m stretch of the ditch network, carried out on 16 July 2020

Common name	Scientific name	Number of individuals caught
Brook/river lamprey	*Lampetra* sp.	4
Minnow	*Phoxinus phoxinus*	9
Three-spined stickleback	*Gasterosteus aculeatus*	1

4.2.12. The mean wet width of the watercourse along the surveyed stretch was location was 1.5m. The mean depth of water was 60cm and noted to be slightly turbid.

4.2.13. Instream substrate consisted of silt (10%) sand (20%), gravel (65%) and pebble (5%). The substrate was stable and uncompacted.

4.2.14. The flow types present consisted of a single slow flowing deep glide (80%) and still margins (20%).

4.2.15. The surrounding land use close to the watercourse was improved pasture. The bank face vegetation structure along both banks was uniform (one type).

4.2.16. Fish cover provided by marginal vegetation (40%). Canopy cover (shading) over the watercourse was 5%.

4.2.17. The physico-chemical properties of the water at the ditch network survey location are displayed in Table 4-6.

Table 4-6 – The physico-chemical properties of the water sampled from the ditch network on 16 July 2020

Parameter	Value
Temperature (°C)	14.1
Conductivity (µS/cm^{-1})	588
Dissolved oxygen (% saturation)	91.3
Dissolved oxygen (mg/l)	9.35
pH	7.46

Foxburrow Stream

4.2.18. No fish were caught during the quantitative one-run electric fishing survey of Foxburrow Stream.

4.2.19. The mean wet width of the watercourse along the surveyed stretch location was 1.0m. The mean depth of water was 8cm and noted to be slightly turbid.

4.2.20. Instream substrate consisted of silt (30%) sand (20%) and gravel (50%). The substrate was stable and uncompacted. The flow types present consisted of a single slow flowing shallow glide (80%) and still margins (20%).

4.2.21. The surrounding land use close to the watercourse was meadowland. The bank face vegetation structure along both banks was complex (four or more types).

4.2.22. Fish cover was provided by draped vegetation (40%). Canopy cover (shading) over the watercourse was 0%.

4.2.23. The physico-chemical properties of the water at the Foxburrow Stream survey location are displayed in Table 4-7.

Table 4-7 – The physico-chemical properties of the water sampled from Foxburrow Stream on 17 July 2020

Parameter	Value
Temperature (°C)	14.1
Conductivity (µS/cm^{-1})	667
Dissolved oxygen (% saturation)	92.8
Dissolved oxygen (mg/l)	9.52
pH	8.36

5 References

Beaumont, W. R. C., Taylor, A. A. L., Lee, M. J. and Welton, J. S. (2002). *Guidelines for Electric Fishing Best Practice. Environment Agency R & D Technical Report W2-054/TR*. Bristol, Environment Agency.

Bohlin, T., Hamrin, S., Heggberget, T.G., Rasmussen, G., Saltveit, S.J. (1989). Electrofishing – theory and practice with special emphasis on salmonids. *Hydrobiologia* 173, 9–43.

British Standards Institution (2003). *BS EN 14011:2003: Water Quality Sampling of Fish with Electricity*. London, BSI.

CIEEM. (2017) *Guidelines for Preliminary Ecological Appraisal, 2nd edition*. Chartered Institute of Ecology and Environmental Management, Winchester.

CIEEM (2019). *Advice note on the lifespan of ecological reports and surveys*. Available at: https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf. [Accessed October 2019].

Environment Agency (2001). *Electric fishing Code of Practice. EAS/6100/4/02*. Environment Agency, Bristol.

Environment Agency (2007). *Technical reference material: WFD electric fishing in rivers. Operational instruction.* Environment Agency, Bristol.

Environment Agency (2020a). *Catchment Data Explorer*. Available online: https://environment.data.gov.uk/catchment-planning [Accessed November 2020].

Environment Agency (2020b). *Ecology and Fish Data Explorer*. Available online: https://defra-ecology-prod.publishmydata.com/ecology-fish/ [Accessed November 2020].

EU Habitats Directive European Commission (1992). *Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and wild fauna and flora.* Available online: http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm [Accessed: December 2020].

Hardisty, M.W. (1986a). *Lampetra fluviatilis* (Linnaeus, 1758). In: Holcík J (ed). The Freshwater Fishes of Europe.Vol. 1, Part I. Petromyzontiformes. Aula-Verlag,Wiesbaden, 249–278.

Hardisty, M.W. (1986b). *Lampetra planeri* (Bloch, 1784). In: Holcík J (ed). The Freshwater Fishes of Europe.Vol. 1, Part I.Petromyzontiformes. Aula-Verlag,Wiesbaden, 279–304.

Her Majesty's Stationary Office (HMSO) (1975). *The Salmon and Freshwater Fisheries Act (as amended)*. HMSO, Norwich. Available online: https://www.legislation.gov.uk/ukpga/1975/51 [Accessed: December 2020].

Her Majesty's Stationary Office (HMSO) (1981). *Wildlife and Countryside Act* (as amended by the Countryside and Rights of Way Act 2000). HMSO, Norwich.

Her Majesty's Stationary Office (HMSO) (2006). *Natural Environment and Rural Communities Act*. HMSO, Norwich. Available online: https://www.legislation.gov.uk/ukpga/2006/16/contents [Accessed: December 2020].

Her Majesty's Stationary Office (HMSO) (2017a). *The Conservation of Habitats and Species Regulations.* HMSO, Norwich. Available online: https://www.legislation.gov.uk/uksi/2017/1012/contents/made [Accessed: December 2020].

Her Majesty's Stationary Office (HMSO) (2017b). *The Water Environment (Water Framework Directive) (England and Wales) Regulations.* HMSO, Norwich. Available online: https://www.legislation.gov.uk/uksi/2017/407/contents/made [Accessed: December 2020].

Her Majesty's Stationary Office (HMSO) (2019a) *The Conservation of Habitats and Species Regulations (Amendment) (EU Exit) Regulations 2019*. HMSO, Norwich. Available online: https://www.legislation.gov.uk/ukdsi/2019/9780111176573 [Accessed: December 2020].

Her Majesty's Stationary Office (HMSO) (2019b). *The Floods and Water (Amendment etc.) (EU Exit) Regulations 2019*. HMSO, Norwich. Available online: https://www.legislation.gov.uk/uksi/2019/558/contents [Accessed: December 2020].

JNCC. (2019). *River Wensum – Designated Special Area of Conservation (SAC)*. Available at: https://sac.jncc.gov.uk/site/UK0012647. [Accessed: November 2019].

Potter, I.C. and Osborne, T.S. (1975). The systematics of British larval lampreys. *Journal of Zoology* 176, 311–329.

Zalewski, M., Cowx, I. (1989). Factors affecting the efficiency of electric fishing. In: Cowx, I. G., Lamarque, P. (Eds.), *Fishing with Electricity Applications in Freshwater Fisheries Management*. Fishing News Books, Blackwell Scientific Publications, Oxford, pp. 89-111.

Appendix A – Site photographs

Figure A-1 – Downstream extent of the River Wensum within the Survey Area

Figure A-2 – Upstream extent of the River Wensum within the Survey Area

Figure A-3 – Pike *Esox lucius* caught during the electric fishing survey of the River Wensum

Figure A-4 - Chub *Squalius cephalus* caught during the electric fishing survey of the River Wensum

Figure A-5 – Roach *Rutlius rutilus* caught during the electric fishing survey of the River Wensum

Figure A-6 - Dace *Leuciscus leuciscus* caught during the electric fishing survey of the River Wensum

Figure A-7 - Gudgeon *Gobio gobio* caught during the electric fishing survey of the River Wensum

Figure A-8 - River Wensum ditch network within the Survey Area

Figure A-9 – Fish, including brook/river lamprey *Lampetra* sp., minnow *Phoxinus phoxinus* and three-spined stickleback *Gasterosteus aculeatus*, caught during the electric fishing survey of the River Wensum ditch network

Figure A-10 – Foxburrow Stream within the Survey Area

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