GDG
GAVIN & DOHERTY
GEOSOLUTIONS

Illaunbaun Wind Farm - Environmental Impact Assessment Report

Appendix A08-06A: Fisheries Assessment Report

This report considers the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

INIS Environmental Consultants Ltd.

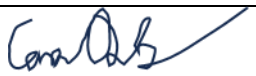
Suite 16,
Block A,
Clare Technology Park,
Gort Road,
Ennis,
County Clare
Ireland.

Quality Assurance

The findings outlined within this report and the data we have provided are to our knowledge true and express our bona fide professional opinions. This report has been prepared and provided in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) good practice guidelines. Where pertinent CIEEM Guidelines used in the preparation of this report include the *Guidelines for Ecological Report Writing* (CIEEM, 2017a), *Guidelines for Preliminary Ecological Appraisals* (CIEEM, 2017b) and *Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine*, (CIEEM, 2024). CIEEM Guidelines include model formats for Preliminary Ecological Appraisal and Ecological Impact Assessment. Also, where pertinent, evaluations presented herein take cognisance of recommended Guidance from the EPA such as *Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EPA, 2022), and in respect of European sites, *Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC* (European Commission, 2018).

Due cognisance has been given at all times to the provisions of the *Wildlife Act, 1976-2021,* the *European Union (Natural Habitats) Regulations*, the *European Communities (Birds and Natural Habitats) Regulations 2011-2021,* EU Regulation on Invasive Alien Species under *EU Regulation 1143/2014*, the EU Birds *Directive 2009/147/EC* and *Habitats Directive 92/43/EEC*.

No method of assessment can completely remove the possibility of obtaining partially imprecise or incomplete information. Any limitation to the methods applied or constraints however are clearly identified within the main body of this document.

Version	Date		Name	Signature
1	04/01/2024	**Report prepared by:**	Conor Daly MSc BSc ACIEEM	
1	14/03/2024	**Report checked by:**	Dr Alex Copland BSc PhD MIEnvSc MCIEEM	
3	30/04/2025	**Report Amended by:**	Conor Daly MSc BSc ACIEEM	
4	06/08/2025	**Report Amended by:**	Conor Daly MSc BSc ACIEEM	
Project Reference	2216	**Title**	Fisheries Assessment Technical Appendix	

Notice

This report was produced by INIS Environmental Consultants Ltd. (INIS) on behalf of GDG, for the specific purpose of assessing a bat baseline at Illaunbaun Wind Farm, Co. Clare, with all reasonable skill, care and due diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client.

This report may not be used by any person other than GDG**,** the client, without the client's express permission. In any event, INIS accepts no liability for any costs, liabilities or losses arising as a result of the use of or reliance upon the contents of this report by any person other than the client.

This report is confidential to the client and INIS accepts no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

Table of Contents

List of Tables

List of Figures

1 INTRODUCTION

1.1 Purpose of Technical Appendix

Inis Environmental Consultants Ltd. were commissioned to undertake a baseline fisheries assessment of numerous watercourses in the vicinity of the proposed Illaunbaun Wind Farm Project (from here on referred to as 'the Proposed Development'), located approximately 3.5 km north-east of Miltown Malbay, Co. Clare (**Figure 2.1**). All surveys and reporting were undertaken by Ross Macklin and Bill Brazier.

The surveys were undertaken to establish baseline fisheries data used in the preparation of the EIAR for the Proposed Development. In order to gain an accurate overview of the existing and potential value to fisheries of the riverine watercourses within the vicinity of the Proposed Development, a catchment-wide electro-fishing survey across 21 watercourses were undertaken (**Table 2.1; Figure 2.1**). Electro-fishing helped to identify the importance of the watercourses as nurseries and habitats for salmonids, European eel (*Anguilla anguilla*) and lamprey (*Petromyzon* and *Lampetra spp.*). A fisheries appraisal of Lough Keagh (Rockmount Lake) was also undertaken in conjunction with the collection of environmental DNA (eDNA) to validate site observations on the suitability to support a salmonid population and/or European eel. The fisheries survey also documented other fish species of lower conservation value and helped to further inform the impact assessment and subsequent mitigation requirements for the Proposed Development.

An application was made under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake a catchment-wide electro-fishing survey in the vicinity of the Proposed Development. Permission was granted on the 28th June 2022 and the survey was undertaken between the 2nd and 4th August 2022.

1.2 Fisheries asset of the survey area

The survey sites were located within the Inagh [Ennistymon]_SC_010 and Annagh [Clare]_SC_010 river sub-catchments. The proposed wind farm is not located within a European site. Fisheries survey sites were present on the Derrymore River (EPA code: 28D03), Illaunbaun Stream (28I03), Fahanlunaghta Beg Stream (28F08), Glendine River (28G02), Kilcorcoran Stream (28K11), Ballinphonta River (28B03), Drumbaun River (28D20) and several unnamed streams (**Table 2.1**).

The Glendine River, also known locally as the Annagh River, rises in the hills west of Miltown Malbay and flows for approximately 9 km before reaching the sea just south of Spanish Point. At Knockloskeraun Bridge (survey site B5), the river is known to support Atlantic salmon, brown trout and European eel (Kelly *et al*., 2010, 2014; IFI 2020 data[1]).

Fisheries data for the other watercourses within the survey area was not available at the time of survey.

[1] *Inland Fisheries Ireland data for Water Framework Directive Fish Ecological Status 2008-2021. Available at https://opendata-ifigis.hub.arcgis.com/datasets/IFIgis::water-framework-directive-fish-ecological-status-2008-2021/*

2 METHODOLOGY

2.1 Fish stock assessment (electro-fishing)

The catchment-wide electro-fishing (CWEF) survey was undertaken across 21 sites (see **Table2.1, Figure 2.1**), with a single anode Smith-Root LR24 backpack (12 V DC input; 300V, 100W DC output) used to electro-fish sites on watercourses in the vicinity of the Proposed Development on the 2nd to 4th August 2022, following notification to Inland Fisheries Ireland and under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank.

Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured (head to fork) to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach is considered representative of the receiving environment baseline present further along the length of the channel surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

2.1.1 Salmonids and European eel

For salmonid species and European eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute Catch per Unit Effort (CPUE), which follows an increasingly common standard approach for wadable streams (Matson *et al*., 2018). A total of approx. forty, 100 m length channels were surveyed at each site, where feasible, in order to gain a better representation of the fish stock assemblages present at each. At certain, more minor watercourse sites or sites with limited access, it was more feasible to undertake electro-fishing for a 5-minute CPUE. Discrepancies in fishing effort (CPUE) between sites are accounted for in the subsequent results section (**Table 3.1**).

Relative conductivity of the water at each site was checked *in-situ* with a conductivity meter and the electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the moderate conductivity waters of the sites (most draining calcareous geologies) a voltage of 200-230 v, frequency of 35-45 Hz and pulse duration of 3.5-4 ms was utilised to draw fish to the anode without causing physical damage.

2.1.2 Lamprey

Electro-fishing for lamprey ammocoetes (or larval stage) was conducted in objectively suitable areas of sand/silt where present along sampling points using targeted box quadrat-based electro-fishing (as

per Harvey & Cowx, 2003). As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30 Hz) burst DC pulse setting which also allowed detection of European eel in sediment, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water's surface, approx. 10–15 cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100 v of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

2.2 Fisheries habitat

A broad appraisal / overview of the upstream and downstream habitat at each site was also undertaken to evaluate the wider contribution to salmonid and lamprey spawning and general fish habitat. River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (Environment Agency, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the riverine sites (i.e., channel profiles, substrata etc.). The physical structure suitability for use by fisheries was identified based on the depth and width of the watercourse, sediment make-up of the stream/river bed, flow intensity and any other non-biological factors contributing to the site being of use for target species (See **Appendix A08-06** of the EIAR).

2.3 Biosecurity

A strict biosecurity protocol following Inland Fisheries Ireland (IFI) (2010) and the 'Check-Clean-Dry' approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation with the most upstream sample point being conducted first then to each point downstream in that order. Particular cognisance was given towards preventing the spread or introduction of crayfish plague (*Aphanomyces astaci*) given the known distribution of white-clawed crayfish (*Austropotamobius pallipes*) in the wider survey area. Furthermore, staff did not undertake any work in a known crayfish plague catchment for a period of at least 72 hours in advance of the survey as a biosecurity measure. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

Table 2.1: *Location of the 21 electro-fishing survey sites and fisheries appraisal site in the vicinity of the Illaunbaum Wind Farm proposed development.*

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Derrymore River	28D03	Illaunbaun	510235	682012
A2	Derrymore River	28D03	Illaunbaun	510895	682359
A3	Unnamed stream	n/a	Illaunbaun	510595	681573
A4	Unnamed stream	n/a	Illaunbaun	510728	681909
A5	Illaunbaun Stream	28I03	Illaunbaun	511085	682020
A6	Illaunbaun Stream	28I03	Illaunbaun	511135	682362
A7	Fahanlunaghta Beg Stream	28F08	Illaunbaun	511482	681501
A8	Fahanlunaghta Beg Stream	28F08	Illaunbaun	511913	682328
A9	Derrymore River	28D03	White's Bridge	511766	682675
A10	Derrymore River	28D03	Derrymore Bridge	515061	681712
[2]L1	Lough Keagh	n/a	Slievenalicka & Tooreen	510051	681168
B1	Glendine River	28G02	Tooreen	511200	680847
B2	Unnamed stream	n/a	Tooreen	509903	680034
B3	Kilcorcoran Stream	28K11	Ballynew	509568	680425
B4	Kilcorcoran Stream	28K11	Ballynew Bridge	508784	679868
B5	Glendine River	28G02	Knockloskeraun Bridge	505228	677447
C1	Ballinphonta River	28B03	Drumbaun	509271	681492
C2	Ballinphonta River	28B03	Drumbaun	508558	681320
C3	Drumbaun River	28D20	Lackamore	509328	682132
C4	Drumbaun River	28D20	Drumbaun	508136	681629
C5	Ballinphonta River	28B03	Carrowkeel Bridge	507059	680785
C6	Ballinphonta River	28B03	Cloonbony Bridge (N67)	504809	680257

[2] *Fisheries appraisal only (including eDNA sampling)*

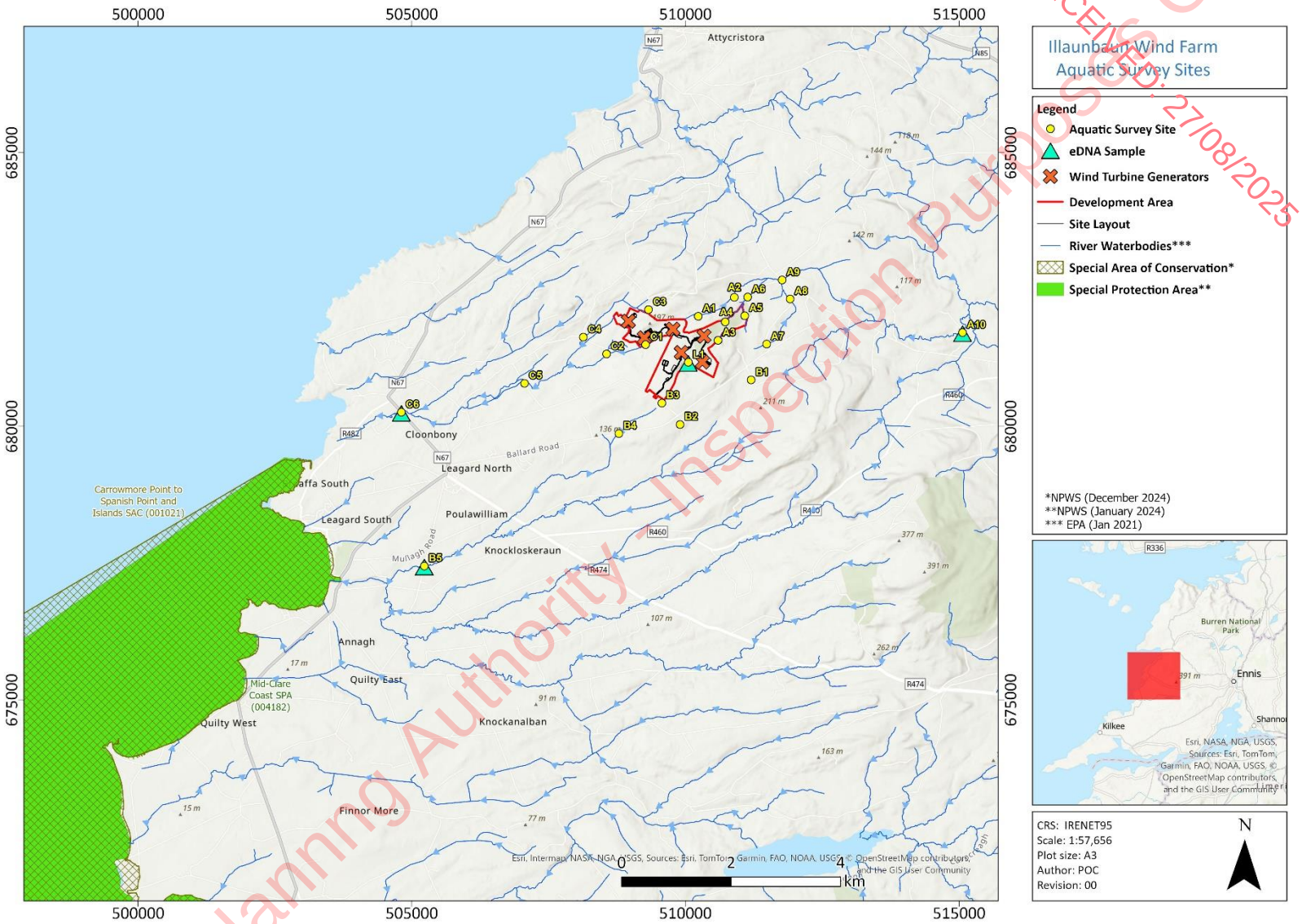


Figure 2.1: *Overview of the 21 electro-fishing survey site locations for the Proposed Development.*

3 RESULTS

A catchment-wide electro-fishing survey of 21 riverine sites in the vicinity of the Proposed Development was conducted on the 2nd to 4th August 2022 following notification to Inland Fisheries Ireland. A fisheries appraisal was also undertaken at Lough Keagh (Rockmount Lake). The results of the survey are presented below in terms of fish population structure, population size and the suitability and value of the surveyed areas as nursery and spawning habitat for salmonids, European eel and lamprey species.

3.1 Fish stock assessment (electro-fishing)

3.1.1 Site A1 – Derrymore River, Illaunbaun

No fish were recorded via electro-fishing at site A1. Despite some physical suitability, the site was not of value to fisheries given its location in the headwaters of the river and high natural gradients, resulting in poor connectivity with downstream habitats. The uppermost reaches also likely suffer from low seasonal flows, further reducing their value to fisheries.

Figure 3.1: *Representative image of site 1 on the upper reaches of the Derrymore River, August 2022*

3.1.2 Site A2 – Derrymore River, Illaunbaun

No fish were recorded via electro-fishing at site A2. Despite some low physical suitability, the site was not of value to fisheries given its location in the headwaters of the river and high natural gradients which precluded upstream fish passage. Spawning habitat for salmonids was also absent given the predominance of bedrock substrata. Furthermore, the uppermost reaches also likely suffer from low seasonal flows, further reducing their value to fisheries (often 0.1 m deep, even after heavy rainfall).

Figure 3.2: *Representative image of site A2 on the Derrymore River, August 2022*

3.1.3 Site A3 – unnamed stream, Illaunbaun

No fish were recorded via electro-fishing at site A3. The physical suitability at this site was not of value to fisheries given its location in the headwaters of the stream, high natural gradients, frequent natural barriers (cascades) and heavy siltation (from peat escapement).

Figure 3.3: *Representative image of site A3 on an unnamed Derrymore River tributary, August 2022*

3.1.4 Site A4 – unnamed stream, Illaunbaun

Despite some physical suitability for salmonids and European eel, no fish were recorded via electro-fishing at site A4. This was reflective of its location in the headwaters of the stream and frequent

impassable natural barriers (cascades). Furthermore, heavy siltation (peat escapement) further reduced the value to fisheries.

Figure 3.4: *Representative image of site A4 on an unnamed Derrymore River tributary, August 2022*

3.1.5 Site A5 – Illaunbaun Stream, Illaunbaun

Despite some low physical suitability for salmonids and European eel, no fish were recorded via electro-fishing at site A5. This was reflective of its location in the headwaters of the stream and frequent impassable natural barriers (cascades). Furthermore, the uppermost reaches also likely suffer from low seasonal flows, further reducing their value to fisheries (often 0.1 m deep even after heavy rainfall).

Figure 3.5: *Representative image of site A5 on the upper reaches of the Illaunbaun Stream, August 2022*

3.1.6 Site A6 – Illaunbaun Stream, Illaunbaun

Brown trout (*Salmo trutta*) was the only fish species recorded via electro-fishing at site A6, with a single juvenile captured (**Table 3.1**, **Table 3.2**, **Figure 3.6; Figure 3.7**).

Site A6 was of low value to fisheries. The bedrock-dominated substrata provided poor spawning opportunities for salmonids, and the shallow high energy nature of the site was of poor value as a nursery or holding habitat. Furthermore, siltation pressures and natural barriers (e.g. gradients, cascades) reduced the value for all fish species. The upland eroding spate channel was not suitable for lamprey.

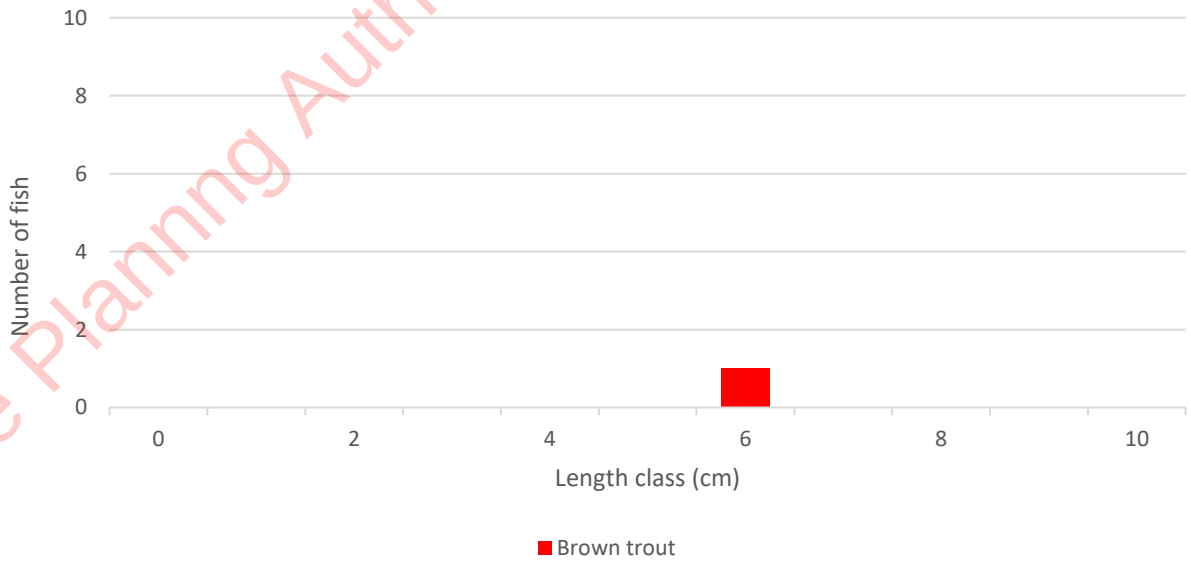


Figure 3.6: *Length frequency distribution recorded via electro-fishing at site A6 on the Illaunbaun Stream, August 2022*

Figure 3.7: *Juvenile brown trout recorded from site A6 on the Illaunbaun Stream, August 2022*

3.1.7 Site A7 – Fahanlunaghta Beg Stream, Illaunbaun

Despite some low physical suitability for salmonids and European eel, no fish were recorded via electro-fishing at site A7. The site was of low value to fisheries given its location in the headwaters of the stream, siltation pressures and frequent barriers within the catchment (**Figure 3.8)**. Furthermore, the shallow nature of the site (typically 0.05 m deep) and low seasonal flows further reduced the value to fisheries.

Figure 3.8: *Representative image of site A7 on the Fahanlunaghta Beg Stream, August 2022 (upstream of road culvert)*

3.1.8 Site A8 – Fahanlunaghta Beg Stream, Illaunbaun

Brown trout was the only fish species recorded via electro-fishing at site A8 (**Figure 3.9**). The site was of moderate value for salmonids and supported a small population of mixed-cohort brown trout (*n*=31) (**Table 3.1**, **Table 3.2, Figure 3.10**).

The spate nature and predominance of larger substrata reduced the stream's value as a spawning habitat at this location, although some moderate quality areas were present. The site was a moderate quality nursery. Holding habitat was typically poor (shallow, spate stream) although some good quality holding pools were present in association with natural and artificial cascades. The road culvert presented an impassable barrier to upstream fish migration given the fall of c.2.5 m. Despite some low suitability, no European eel were present. The upland eroding stream was unsuitable for lamprey and none were recorded.

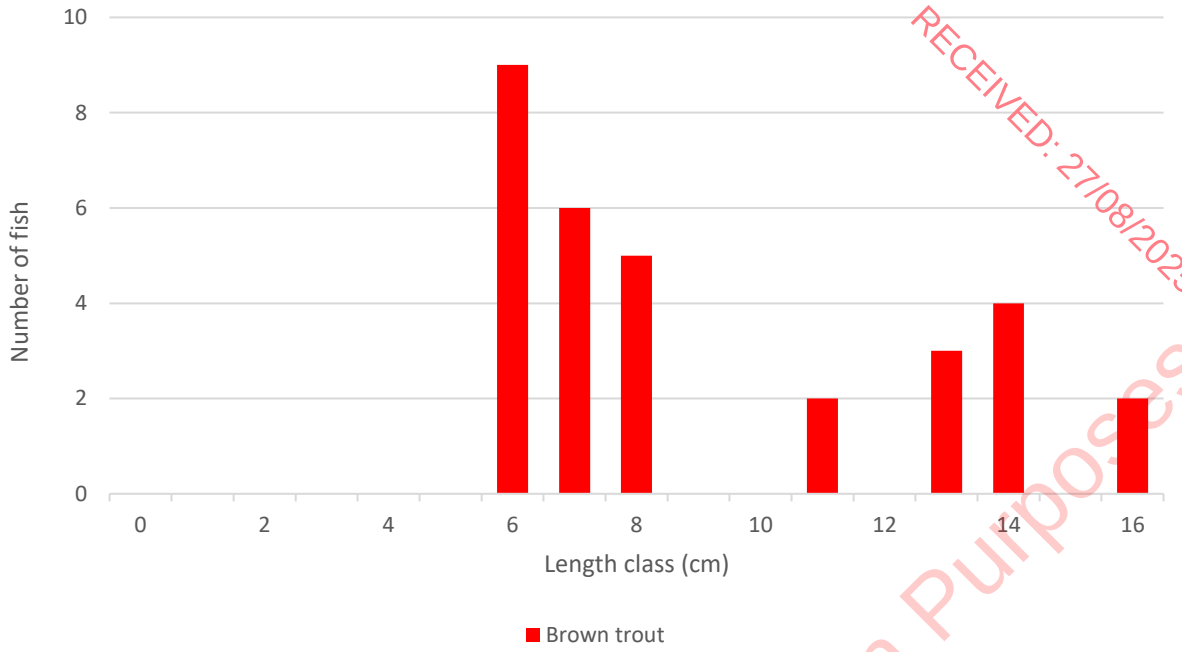


Figure 3.9: *Length frequency distribution recorded via electro-fishing at site A8 on the Fahanlunaghta Beg Stream, August 2022*

Figure 3.10: *Mixed-cohort brown trout recorded from site A8 on the Fahanlunaghta Beg Stream, August 2022 (downstream of fish-impassable road culvert).*

3.1.9 Site A9 – Derrymore River, White's Bridge

Brown trout was the only fish species recorded via electro-fishing at site A9 (**Figure 3.11**). The site was a good quality salmonid habitat, supporting a small population of mixed-cohort brown trout (*n*=21) (**Table 3.1**, **Table 3.2, Figure 3.12**).

The relatively mobile cobble and mixed gravels provided some good spawning habitat, although the value was reduced by siltation pressures. The site was evidently a good quality nursery with ample refugia by way of bank scours and cobble/boulder. Holding habitat, whilst present and shallow, was localised, e.g. under the bridge arch and box culvert. Despite some suitability for European eel, none were recorded. The spate channel was unsuitable for lamprey at this location.

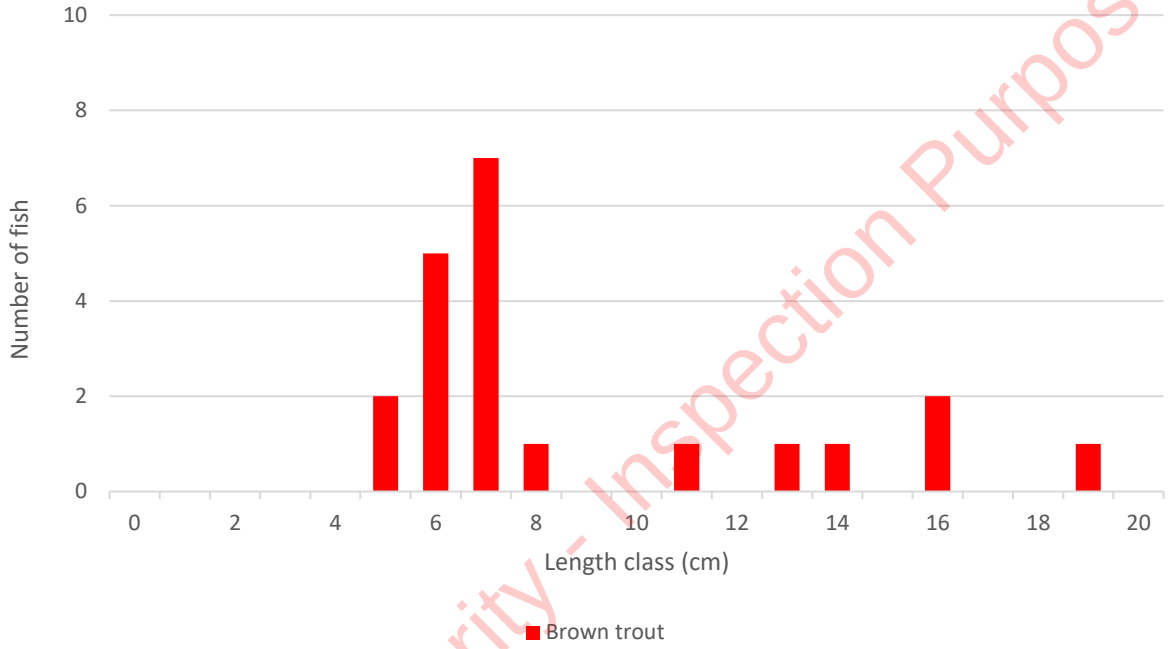


Figure 3.11: ***Length frequency distribution recorded via electro-fishing at site A9 on the Derrymore River, August 2022***

Figure 3.12: *Adult and juvenile brown trout recorded from site A9 on the Derrymore River, August 2022*

3.1.10 Site A10 – Derrymore River, Derrymore Bridge

Brown trout, European eel (*Anguilla anguilla*) and three-spined stickleback (*Gasterosteus aculeatus*) were recorded via electro-fishing at site A10 (**Table 3.1**, **Table 3.2, Figure 3.13; Figure 3.14**). The site was considered a very good salmonid habitat, supporting a population of mixed-cohort brown trout (*n*=32). A low number of three-spined stickleback were also record (*n*=4). Despite some good suitability for European eel, only a low density was recorded (*n*=2).

The predominance of uncompacted mixed gravels provided good quality spawning habitat. The site's value as a nursery was moderate owing to a general paucity of instream refugia. Although localised, some excellent quality holding habitat for adults was present, including deep pool and scoured banks. No Atlantic salmon were recorded via electro-fishing, despite some suitability. However, eDNA analysis at the site produced a positive, albeit weak result for Atlantic salmon, signifying the presence of the species at or upstream of the site (**Appendix A08-06** of the EIAR). Whilst some suitable soft sediment areas for lamprey ammocoetes were present in adjoining pool areas, these were typically located in very shallow water and sand-clay-dominated (i.e. sub-optimal). The spate nature of the site reduced the suitability for lamprey and none were recorded.

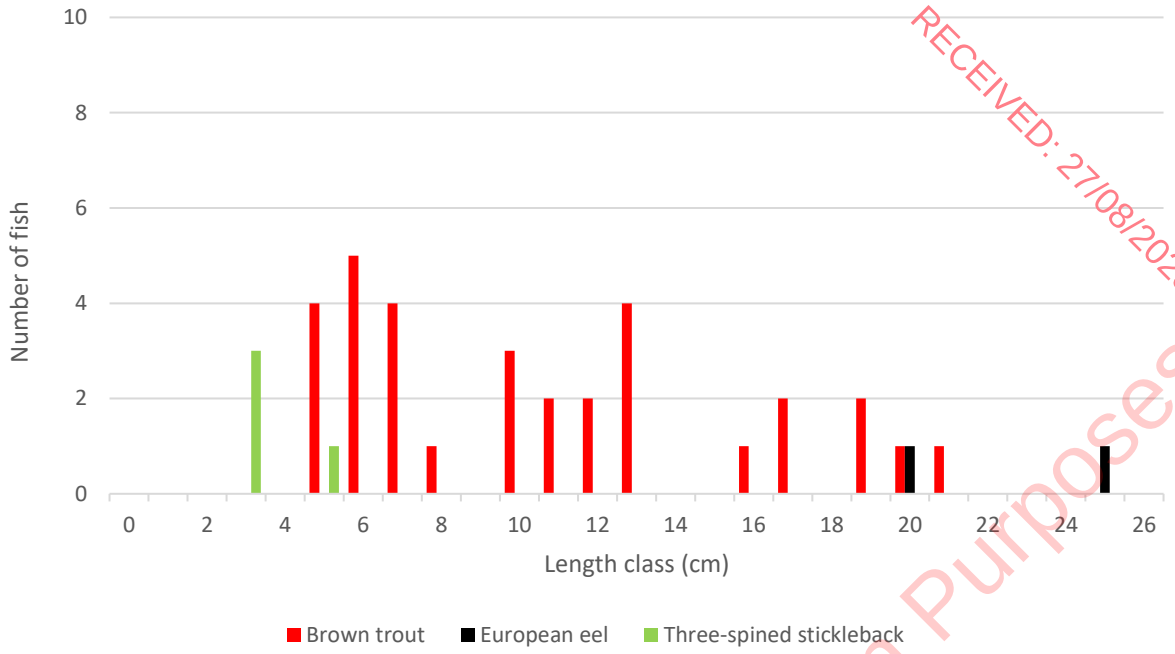


Figure 3.13: *Length frequency distribution recorded via electro-fishing at site A10 on the Derrymore River, August 2022*

Figure 3.14: *Juvenile European eel recorded from site A10 on the Derrymore River at Derrymore Bridge, August 2022*

3.1.11 Site L1 – Lough Keagh

A fisheries appraisal (no electro-fishing) was undertaken at Lough Keagh, a 7 ha upland lake (**Figure 3.15**). The site is known to support a recreationally valuable stock of wild brown trout, with supplemental stocking also undertaken by the local angling club. Wave-washed gravels and cobbles (windward shoreline) likely provide some limited spawning habitat for salmonids, given the absence of a suitable inflowing channel. The lake had no suitability for Atlantic salmon given poor accessibility. The lake had high suitability for European eel and likely supports three-spined stickleback. e DNA analysis confirmed the presence of brown trout and European eel (see accompanying baseline report).

Figure 3.15: *Representative image of Lough Keagh from the south-western shoreline, August 2022*

3.1.12 Site B1 – Glendine River, Tooreen

No fish were recorded via electro-fishing at site B1 (**Figure 3.16**). The river at this location represented a heavily silted drainage channel that was not of value to fisheries given its ephemeral nature, lack of flow and location in the uppermost reaches (i.e. headwaters) of the catchment.

Figure 3.16: *Representative image of site B1 at the headwaters of the Glendine River, August 2022*

3.1.13 Site B2 – unnamed stream, Tooreen

No fish were recorded via electro-fishing at site B2 (**Figure 3.17**). The stream at this location was not of value to fisheries given its ephemeral nature and location in the uppermost reaches of the catchment. The river was swift flowing following recent rainfall but was considered to likely suffer from low seasonal flows at this location. Evident recent modifications (instream excavation) further reduced its value to fisheries.

Figure 3.17: ***Representative image of site B2 on an unnamed Glendine River tributary, August 2022***

3.1.14 Site B3 – Kilcorcoran Stream, Ballynew

No fish were recorded via electro-fishing at site B3 (**Figure 3.18**). The stream at this location was not of value to fisheries given its very shallow nature (<0.1 m deep), small size (<1 m wide), historical modifications and location in the uppermost reaches of the catchment.

Figure 3.18: *Representative image of site B3 on the upper reaches of the Kilcorcoran Stream, August 2022 (downstream of box culvert)*

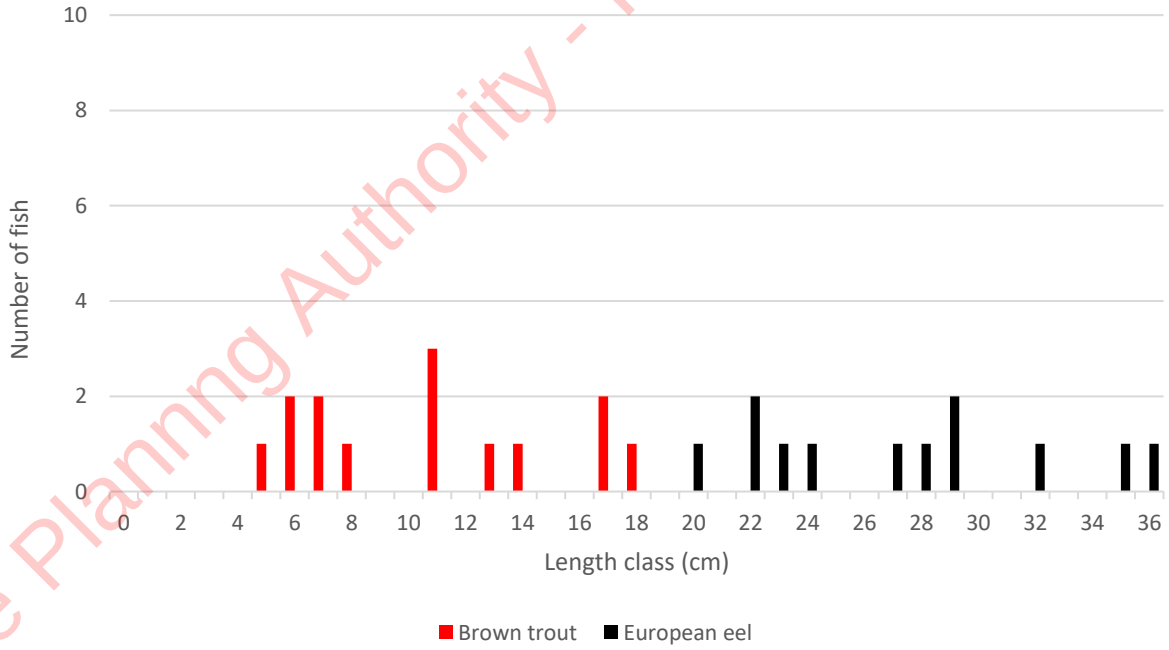
3.1.15 Site B4 – Kilcorcoran Stream, Ballynew Bridge

No fish were recorded via electro-fishing at site B4 (**Figure 3.19**). Despite some low physical suitability, the site was not of value to fisheries given its location in the headwaters of the stream, frequent natural barriers and evident water quality issues (e.g. heavy siltation). Furthermore, the uppermost reaches also likely suffer from low seasonal flows, further reducing their value to fisheries (often 0.1 m deep even after heavy rainfall).

Figure 3.19: *Representative image of site B4 on the Kilcorcoran Stream, August 2022 (downstream of road culvert)*

3.1.16 Site B5 – Glendine River, Knockloskeraun Bridge

Brown trout (*n*=23) and European eel (*n*=12) were the only fish species recorded via electro-fishing at site B5 (**Figure 3.20**



). The site was of high value for salmonids, with a mixed-cohort population of brown trout. Good quality salmonid spawning habitat was present in the vicinity of the bridge, though the value was reduced due to siltation pressures. Good quality nursery habitat was also present, though was considered sub-optimal due to a paucity of instream refugia. Whilst localised, good quality holding habitat for migratory adults was also present. Despite good suitability and proximity to the sea,

Atlantic salmon were not recorded which may reflect the presence of downstream barriers. Whilst Atlantic salmon are known from the site (Kelly *et al*., 2010, 2014), eDNA analysis at the site produced a negative result for Atlantic salmon, indicating the absence of the species at or upstream of the site (**Appendix A08-06** of the EIAR). The site was also of high value to European eel with a relatively high density recorded (**Table 3.1**, **Table 3.2, Figure 3.21**). The twin arch masonry bridge featured frequent crevices which provided highly suitable refugia for eel. Despite some suitability in terms of both spawning and soft sediment (ammocoete) habitat, no lamprey were recorded during targeted electro-fishing.

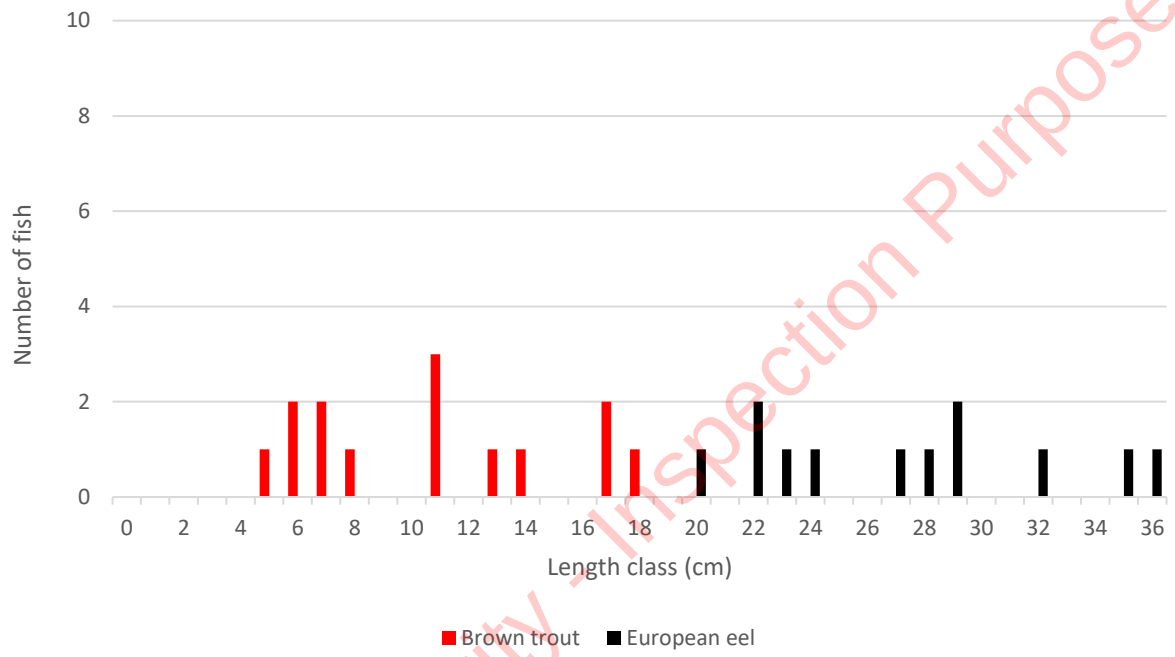


Figure 3.20: *Length frequency distribution recorded via electro-fishing at site B5 on the Glendine River, August 2022*

Figure 3.21: *Adult European eel recorded from site B5 on the Glendine River at Knockloskeraun Bridge, August 2022.*

3.1.17 Site C1 – Ballinphonta River, Drumbaun

European eel was the only fish species recorded via electro-fishing at site C1, with a single juvenile recorded (**Table 3.1**, **Table 3.2, Figure 3.22; Figure 3.23**).

The site was of low value to fisheries given its location in the headwaters of the river, significant siltation pressures (primarily from livestock poaching of embankment habitats) and high natural gradients which are likely to inhibit fish passage. Furthermore, the shallow nature of the site and likely low seasonal flows further reduced the value to fisheries.

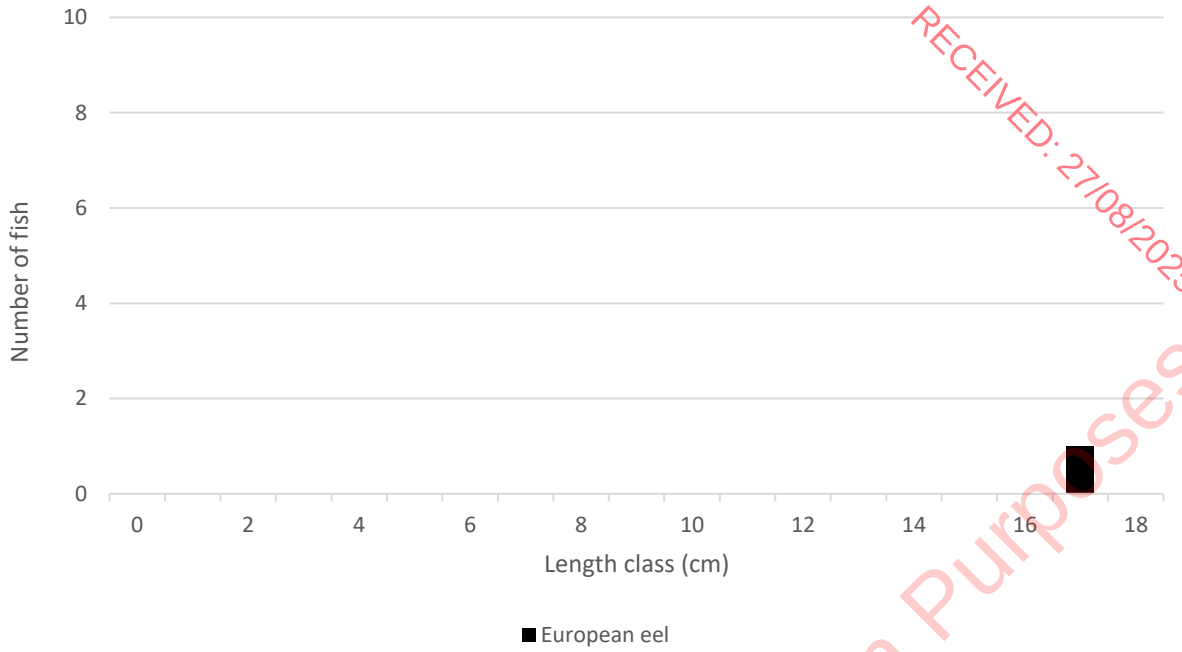


Figure 3.22: *Length frequency distribution recorded via electro-fishing at site C1 on the Ballinphonta River, August 2022*

Figure 3.23: *Representative image of site C1 on the uppermost reaches of the Ballinphonta River, August 2022.*

3.1.18 Site C2 – Ballinphonta River, Drumbaun

Brown trout and European eel were the only two species recorded via electro-fishing at site C2 (**Figure 3.24**). The site was of moderate value to salmonids, with only a small population of juvenile brown trout present (*n*=10) (**Table 3.1**, **Table 3.2, Figure 3.25**). A single juvenile eel was also recorded.

Significant siltation pressures (originating from various sources) reduced the quality of spawning and nursery habitat. Holding habitat by way of deeper pools and glides were absent and thus the holding habitat was of poor quality. Several instream barriers to migration were also present by way of natural and anthropogenic cascades and blockages. The site was of moderate value to European eel (plentiful refugia) with a very low density recorded. Whilst some organic-rich soft sediment accumulations were present, no lamprey ammocoetes were recorded via targeted electro-fishing. The upland nature of the site may preclude the species.

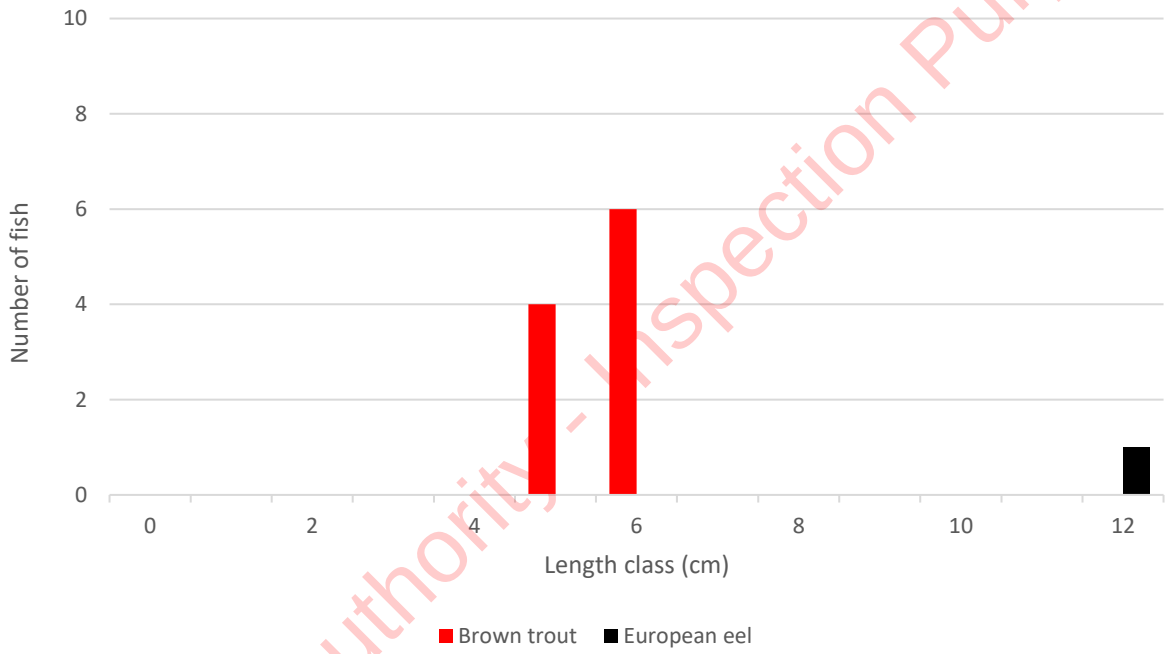


Figure 3.24: *Length frequency distribution recorded via electro-fishing at site C1 on the Ballinphonta River, August 2022*

Figure 3.25: *Juvenile brown trout recorded from site C2 on the upper reaches of the Ballinphonta River, August 2022*

3.1.19 Site C3 – Drumbaun River, Lackamore

No fish were recorded via electro-fishing at site C3 (**Figure 3.26**). The site was not of value to fisheries given its location at the headwaters of the stream, the narrow width (<0.5 m), shallow nature (<0.05 m), high natural gradients, frequent natural barriers (cascades) and heavy siltation (arising from livestock poaching of embankment habitats and afforestation).

Figure 3.26: *Representative image of site C3 on the uppermost reaches of the Drumbaun River, August 2022.*

3.1.20 Site C4 – Drumbaun River, Kilfarboy Church

Brown trout and European eel were the only two species recorded via electro-fishing at site C4 (**Table 3.1**, **Table 3.2, Figure 3.27; Figure 3.28**). Site C4 was of moderate value only for salmonids, supporting a very small mixed-cohort population of brown trout (*n*=4).

The low numbers of fish captured reflected poor spawning opportunities (compacted & silted substrata) and relatively poor nursery conditions. Whilst holding habitat was present in association with the rendered culvert apron, deeper areas for migratory adults was largely absent elsewhere. The river likely suffers from low seasonal flows at this location, further reducing its value to fisheries. The culvert apron was considered a barrier to fish at low flows. European eel habitat was moderate, with only a single juvenile eel recorded. Whilst there was some, albeit low suitability as a lamprey spawning habitat, soft sediment nursery areas were absent.

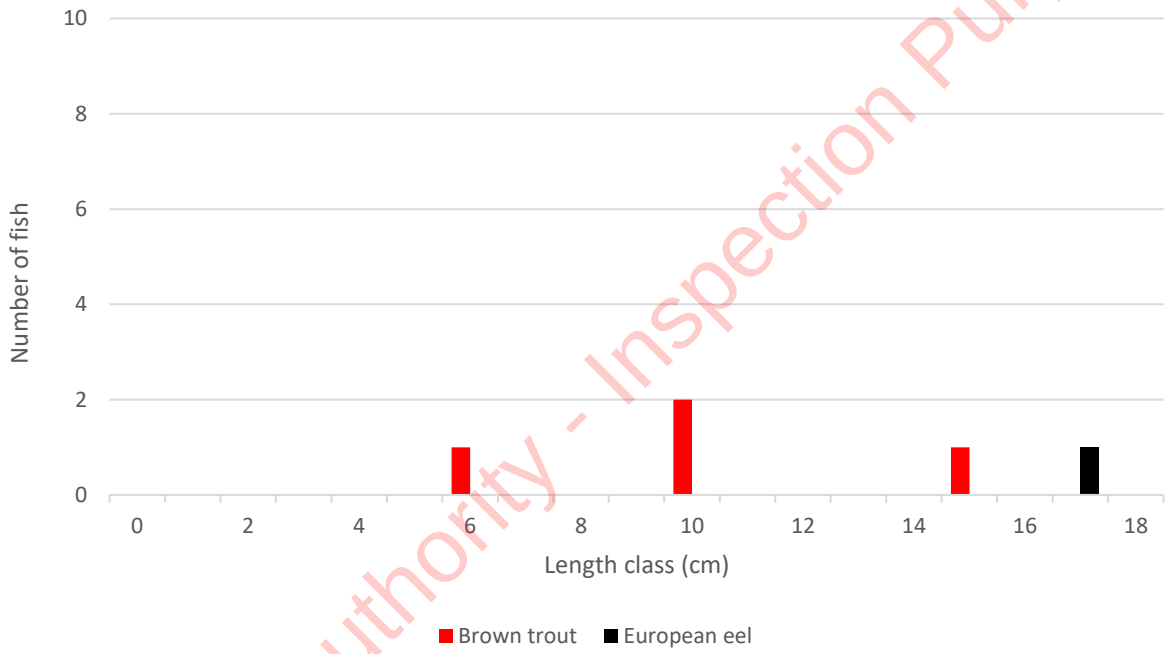


Figure 3.27: *Length frequency distribution recorded via electro-fishing at site C4 on the Drumbaun River, August 2022*

Figure 3.28: *Brown trout and European eel recorded from site C4 on the Drumbaun River at Kilfarboy Church, August 2022*

3.1.21 Site C5 – Ballinphonta River, Carrowkeel Bridge

Brown trout (*n*=24) and European eel (*n*=2) were the only two species recorded via electro-fishing at site C5 (**Table 3.1**, **Table 3.2, Figure 3.29; Figure 3.30)**.

The site was of moderate value to salmonids, with a population of mixed-cohort brown trout present. Salmonid spawning habitat was of moderate quality given compaction and siltation of the bed. Nursery habitat was also of moderate quality, with abundant boulder and cobble generally not accessible as refugia (due to compaction/bedding). Some good quality holding habitat was present but highly localised (e.g. under bridge). The site was of moderate value to European eel, with instream refugia present but compromised by compaction. The high energy site was unsuitable for lamprey and none were recorded.

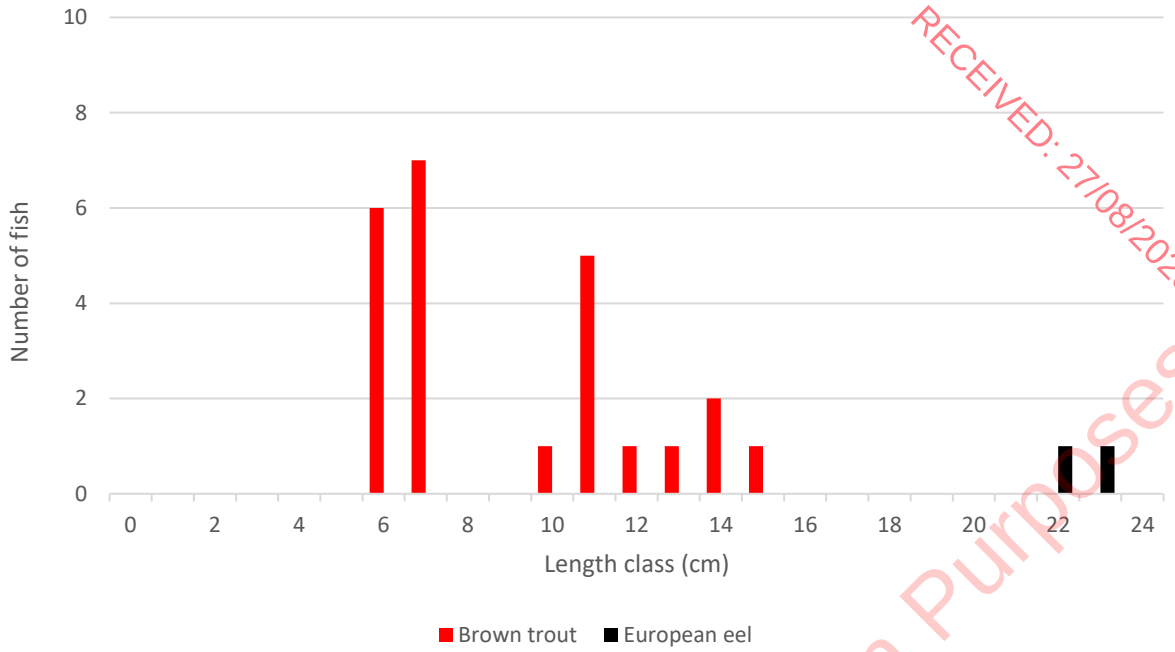


Figure 3.29: ***Length frequency distribution recorded via electro-fishing at site C5 on the Ballinphonta River, August 2022***

Figure 3.30: *Mixed-cohort brown trout recorded from site C5 on the Ballinphonta River, August 2022*

3.1.22 Site C6 - Ballinphonta River, Cloonbony Bridge

Brown trout (*n*=19) and European eel (*n*=14) were the only two species recorded via electro-fishing at site C6 (**Table 3.1**, **Table 3.2, Figure 3.31**).

The site was of moderate value to salmonids, with a population of mixed-cohort brown trout recorded. Salmonid spawning habitat was of moderate quality given compaction of the bed. Nursery habitat was

also of moderate quality, with abundant boulder and cobble generally not accessible as refugia (due to compaction/bedding). Some good quality holding habitat was present in the vicinity of the bridge (and underneath) but absent elsewhere. No Atlantic salmon were recorded via electro-fishing, despite some suitability. However, eDNA analysis at the site produced a positive, albeit weak result for Atlantic salmon, signifying the presence of the species at or upstream of the site (**Appendix A08-06** of the EIAR). The site was evidently of high value as a European eel nursery, with a relatively high density of juveniles recorded (**Figure 3.32**). However, the value of the site was reduced due to substrata bedding. Despite the presence of some localised soft sediment underneath the bridge, no lamprey ammocoetes were recorded.

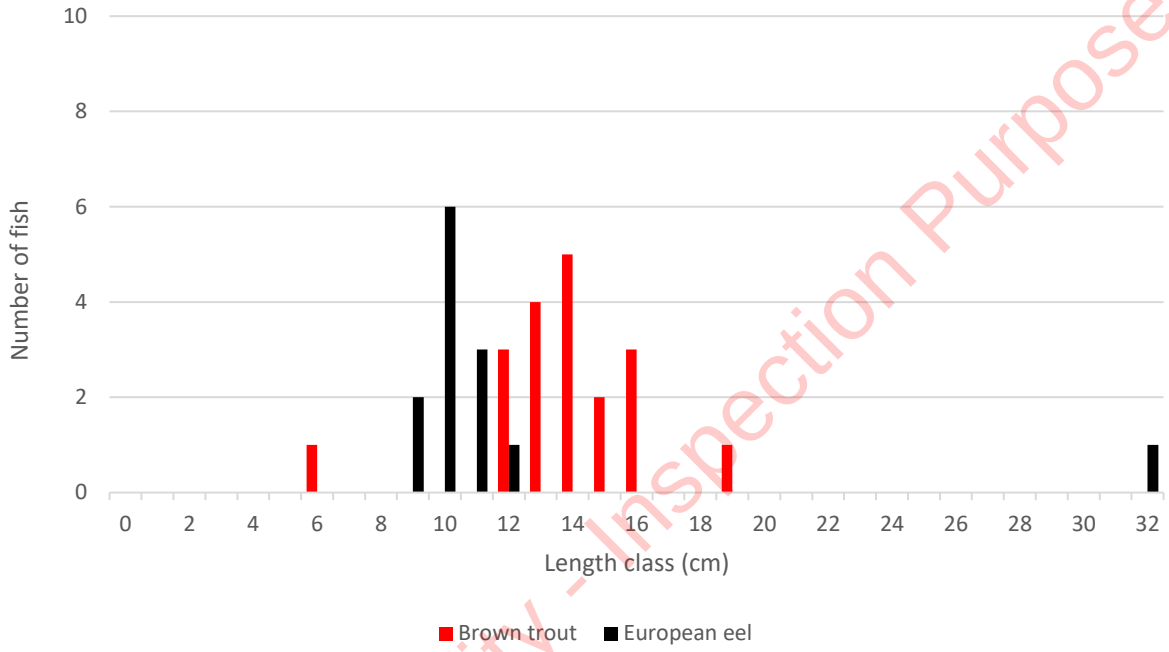


Figure 3.31: *Length frequency distribution recorded via electro-fishing at site C6 on the Ballinphonta River, August 2022*

Figure 3.32: *Adult and juvenile European eel (elvers) recorded from site C6 on the Ballinphonta River at Cloonbony Bridge, August 2022*

Table 3.1: *Fish species densities per m2 recorded at sites in the vicinity of the Proposed Development via electro-fishing in August 2022 (values in bold represent the highest densities recorded for each species, respectively)*

Fish density (number fish per m^2)						
Site	**Watercourse**	**CPUE (elapsed time)**	**Approx. area fished (m^2)**	**Brown trout**	**European eel**	**Three-spined stickleback**
A1	Derrymore River	5	25	0.000	0.000	0.000
A2	Derrymore River	5	67.5	0.000	0.000	0.000
A3	Unnamed stream	5	30	0.000	0.000	0.000
A4	Unnamed stream	5	140	0.000	0.000	0.000
A5	Illaunbaun Stream	5	20	0.000	0.000	0.000
A6	Illaunbaun Stream	10	150	0.007	0.000	0.000
A7	Fahanlunaghta Beg Stream	5	45	0.000	0.000	0.000
A8	Fahanlunaghta Beg Stream	10	140	0.221	0.000	0.000
A9	Derrymore River	5	90	0.233	0.000	0.000
A10	Derrymore River	10	150	0.213	0.013	**0.027**
B1	Glendine River	5	15	0.000	0.000	0.000
B2	Unnamed stream	5	35	0.000	0.000	0.000
B3	Kilcorcoran Stream	5	40	0.000	0.000	0.000
B4	Kilcorcoran Stream	5	25	0.000	0.000	0.000
B5	Glendine River	10	175	0.131	0.069	0.000
C1	Ballinphonta River	5	37.5	0.000	0.027	0.000
C2	Ballinphonta River	5	52.5	0.190	0.019	0.000
C3	Drumbaun River	5	10	0.000	0.000	0.000
C4	Drumbaun River	5	30	0.133	0.033	0.000
C5	Ballinphonta River	10	100	**0.240**	0.020	0.000
C6	Ballinphonta River	10	180	0.106	**0.078**	0.000

Table 3.2: *Summary of fish species of higher conservation value* recorded via electro-fishing per survey site in the vicinity of the Proposed Development, August 2022*

Site	Watercourse	Atlantic salmon	Brown trout	European eel	Other species
A1	Derrymore River	No fish recorded			
A2	Derrymore River	No fish recorded			
A3	Unnamed stream	No fish recorded			
A4	Unnamed stream	No fish recorded			
A5	Illaunbaun Stream	No fish recorded			
A6	Illaunbaun Stream	None	✓	None	
A7	Fahanlunaghta Beg Stream	No fish recorded			
A8	Fahanlunaghta Beg Stream	None	✓	None	
A9	Derrymore River	None	✓	None	
A10	Derrymore River	None	✓	✓	Three-spined stickleback
L1	Lough Keagh[3]	None	✓ (eDNA)	✓ (eDNA)	
B1	Glendine River	No fish recorded			
B2	Unnamed stream	No fish recorded			
B3	Kilcorcoran Stream	No fish recorded			
B4	Kilcorcoran Stream	No fish recorded			
B5	Glendine River	None	✓	✓	
C1	Ballinphonta River	None	None	✓	
C2	Ballinphonta River	None	✓	✓	
C3	Drumbaun River	No fish recorded			
C4	Drumbaun River	None	✓	✓	
C5	Ballinphonta River	None	✓	✓	
C6	Ballinphonta River	None	✓	✓	

**** Conservation value:*** *Atlantic salmon (Salmo salar) are listed under Annex II of the Habitats Directive [92/42/EEC] and under Annex V of the Habitats Directive [92/42/EEC]. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Fisheries Acts 1959 to 2019, brown trout and coarse fish species have no legal protection in Ireland.*

[3] Fisheries appraisal only (including eDNA sampling)

4 DISCUSSION

The watercourses in the vicinity of the Proposed Development were typically small, higher-gradient, upland spate channels draining upland areas of peatland. They supported a low diversity of fish species at generally low abundances. Such watercourses are typically unproductive in terms of fish (Wood & Budy, 2009; O'Grady, 2006; Amiro, 1993; Richardson, 1993). Over half of the survey sites (i.e. A1, A2, A3, A4, A5, A7, B1, B2, B3, B4 & C3) did not support fish at the time of survey. These sites provided poor quality habitat for salmonids, European eel and other fish species given their diminutive nature, historical modifications, siltation pressures, low or intermittent flows and/or high natural gradients (representing instream barriers) which precluded resident fish from accessing the upper reaches of some watercourses (e.g. Derrymore River). However, a total of nine survey sites supported brown trout at the time of survey, namely sites on the Illaunbaun Stream (A6), Fahanlunaghta Beg Stream (A8), Derrymore River (A9, A10), Glendine River (B1), Drumbaun River (C4) and Ballinphonta River (C2, C5 & C6) (**Table 3.1, Table 3.2**). As would be expected for higher-gradient, spate systems, better quality salmonid habitat was largely confined to the lower reaches of watercourses such as the Derrymore River, Glendine River and Ballinphonta River. These sites also supported higher salmonid densities (**Table 3.1**).

Despite some good habitat suitability in the Derrymore River and Ballinphonta River, and their known distribution within the Glendine River (Kelly *et al*., 2010, 2014; IFI 2020 data), no Atlantic salmon were recorded during the electro-fishing surveys. However, eDNA samples collected and analysed in August 2022 detected Atlantic salmon in both the Derrymore River (site A10) and Ballinphonta River (C6) (**Appendix A08-06** of the EIAR).

No lamprey were recorded during the electro-fishing surveys and habitat suitability was poor or absent throughout the watercourses surveyed. This reflected the upland, higher-energy, spate nature of the watercourses which reduces the extent of fine gravels required for spawning (Dawson *et al*., 2015; Rooney *et al*., 2013; Lasne *et al*., 2010) and discourages the deposition of fine, organic-rich sediment ≥5 cm in depth generally required by larval *Lampetra* spp. (Aronsuu & Virkkala, 2014; Goodwin *et al*., 2008; Gardiner, 2003). Peat-dominated substrata (i.e., humic deposits), such as those typically found in the vicinity of the Proposed Development, do not provide suitable burial/burrowing habitat complexity or structure for larvae (ammocoetes) given their invariably fine and flocculent nature (pers. obs.). Although located in close proximity to the sea, the lower reaches of the Glendine River and Ballinphonta River were not suitable for anadromous sea lamprey (*Petromyzon marinus*) or river lamprey (*Lampetra fluviatilis*) given poor fluvial accessibility due to instream barriers and natural gradients (e.g. **Figure 4.1**).

On both a global and Irish scale, the European eel is listed as 'critically endangered' (Pike *et al*., 2020; King *et al*., 2011). European eel were recorded at a total of seven sites during the electro-fishing s (i.e. sites A10, B5, C1, C2, C4, C5 & C6). Eel were typically present in very low numbers although sites B5 and C6 on the lower reaches of the Glendine River and Ballinphonta River respectively, supported significantly higher numbers of adult and, in particular, juvenile eel (elvers). This spatial abundance pattern is typically seen in European eel (Degerman *et al*., 2019; Moriarty, 2003).

Figure 4.1: *Outfall of the Ballinphonta River to the sea downstream of Cleedagh Bridge (low tide) demonstrating natural fish migration issues, August 2022*

5 REFERENCES

Amiro, P.G. (1993). Habitat measurement and population estimation of juvenile Atlantic salmon. In R.J. Gibson and R.E. Cutting [ed.]. Production of juvenile Atlantic salmon in natural waters. Can. Spec. Publ. Fish. Aquat. Sci. 118. P 81-97.

APEM (2004). Assessment of sea lamprey distribution and abundance in the River Spey: Phase II. Scottish Natural Heritage Commissioned Report No. 027 (ROAME No. F01AC608)

Aronsuu, K. & Virkkala, P. (2014). Substrate selection by subyearling European river lampreys (Lampetra fluviatilis) and older larvae (Lampetra spp.). Ecology of Freshwater Fish, 23: 644–655

CEN (2003) Water Quality – Sampling of Fish with Electricity. European Standard. Document CEN EN 14011:2000

CFB (2008). *Methods for the Water Framework Directive. Electric Fishing in Wadeable Reaches*. Central Fisheries Board. Unpublished report.

Central Fisheries Board (2008) Methods for the Water Framework Directive, Electric Fishing in Wadeable Reaches. Central Fisheries Board, Unpublished report.

CIEEM (2017a). *Guidelines For Ecological Report Writing*. Chartered Institute of Ecology and Environmental Management.

CIEEM (2017b). *Guidelines for Preliminary Ecological Appraisal: Vol. 2nd ed.* Chartered Institute of Ecology and Environmental Management.

CIEEM (2024) *Guidelines For Ecological Impact Assessment In The UK and Ireland Terrestrial, Freshwater, Coastal and Marine.* Chartered Institute of Ecology and Environmental Management.

Dawson, H. A., Quintella, B. R., Almeida, P. R., Treble, A. J., & Jolley, J. C. (2015). The ecology of larval and metamorphosing lampreys. In Lampreys: biology, conservation and control (pp. 75-137). Springer, Dordrecht.

Degerman, E., Tamario, C., Watz, J., Nilsson, P. A., & Calles, O. (2019). Occurrence and habitat use of European eel (Anguilla anguilla) in running waters: lessons for improved monitoring, habitat restoration and stocking. Aquatic ecology, 53(4), 639-650.

EA (2003). River Habitat Survey in Britain and Ireland: Field Survey Guidance Manual: 2003 Version. Forest Research. Environment Agency, UK.

Gardiner, R. (2003). Identifying lamprey. A field key for sea, river and brook lamprey. Conserving Natura 2000 Rivers, Conservation techniques No. 4. Peterborough. English Nature.

Goodwin, C.E., Dick, J.T.A. & Elwood, R.W. (2008). A preliminary assessment of the distribution of the sea lamprey (Petromyzon marinus L), river lamprey (Lampetra fluviatilis (L.)) and brook lamprey (Lampetra planeri (Bloch)) in Northern Ireland. Biology and Environment: Proceedings of the Royal Irish Academy 109B, 47-52.

Harvey & Cowx (2003). *Monitoring the River, Sea and Brook Lamprey, Lampetra fluviatilis, L. planeri and Petromyzon marinus.* Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough.

IFI (2010). Biosecurity Protocol for Field Survey Work. Available at http://www.fisheriesireland.ie/Invasive-Species/biosecurity-protocol-for-field-survey-work.html

Kelly, F.L., Harrison, A., Connor, L., Wightman, G., Matson, R., Hanna, G., Feeney, R., Morrissey, E., O'Callaghan, R., Wogerbauer, C., Rocks, K., Hayden, B. & Stafford, T. (2010). Sampling Fish for the Water Framework Directive – Rivers 2009. Shannon International River Bason District Rivers. Central and Regional Fisheries Boards.

Kelly, F.L., Matson, R., Connor, L., Feeney, R., Morrissey, E., Coyne, J. & Rocks, K. (2014). Water Framework Directive Fish Stock Survey of Rivers in the Shannon International River Basin District. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011). Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Lasne. E., Sabatie, M-R. & Evanno, G. (2010). Communal spawning of brook and river lampreys (Lampetra planeri and L. fluviatilis) is common in the Oir River (France). Ecology of Freshwater Fish 2010: 19: 323–325.

Matson, R., Delanty, K., Shephard, S., Coghlan, B., & Kelly, F. (2018). *Moving from multiple pass depletion to single pass timed electrofishing for fish community assessment in wadeable streams.* Fisheries Research, 198, 99-108.

Moriarty, C. (2003). The yellow eel. In Eel Biology, pp. 89-105). Springer, Tokyo.

Niven, A.J. & McCauley, M. (2013). Lamprey Baseline Survey No2: River Faughan and Tributaries SAC. Loughs Agency, 22, Victoria Road, Derry.

O'Grady, M.F. (2006). Channels and challenges: enhancing Salmonid rivers. Irish Fresh- water Fisheries Ecology and Management Series: Number 4. Central Fisheries Board, Dublin.

Pike, C., Crook, V. & Gollock, M. (2020). Anguilla anguilla. The IUCN Red List of Threatened Species 2020: e.T60344A152845178. https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T60344A152845178.en.

Potter & Osborne (1975). *The systematics of British larval lampreys*. Journal of Zoology, 176(3), 311-329.

Richardson, J. S. (1993). Limits to productivity in streams: evidence from studies of macroinvertebrates. Canadian Special Publication of Fisheries and Aquatic Sciences, 9-15.

Rooney, S.M., O'Gorman, N. & King, J.J. (2013). Aspects of brook lamprey (Lampetra planeri) spawning in Irish waters. Biology and Environment: Proceedings of the Royal Irish Academy 113B: 1-13

Wood, J., & Budy, P. (2009). The role of environmental factors in determining early survival and invasion success of exotic brown trout. Transactions of the American Fisheries Society, 138(4), 756-767.