# APPENDIX 7.7: AQUATIC ECOLOGY

Fisheries assessment of the proposed Oatfield wind farm, Co. Clare

Prepared by
Inis Environmental Consultants Ltd.
**October 2023**

---

**Table of contents**

# 1. Introduction

## 1.1 Background

Triturus Environmental Ltd. were commissioned by Inis Environmental Consultants Ltd. to undertake a baseline fisheries assessment of riverine watercourses in the vicinity of the proposed Oatfield wind farm project (the Proposed Development), located approximately 5km north-east of Sixmilebridge, Co. Clare (**Figure 2.1**).

The survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the Proposed Development, inclusive of potential grid cable routes (GCR). In order to gain an accurate overview of the existing and potential fisheries value of the riverine watercourses within the vicinity of the Proposed Development, a catchment-wide electro-fishing survey across *n*=56 riverine sites was undertaken (**Table 2.1; Figure 2.1**). Electro-fishing helped to identify the importance of the watercourses as nurseries and habitats for salmonids, Eel (*Anguilla anguilla*) and lamprey (*Petromyzon* and *Lampetra* spp.). The fisheries survey also documented other fish species of lower conservation value and helped to further inform impact assessment and any subsequent mitigation for the Proposed Development.

Triturus Environmental Ltd. made two applications (2022 & 2023) 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 Oatfield wind farm and associated infrastructure (i.e. GCR). The surveys were undertaken on the 21st, 22nd, 23rd, and 29th August and 1st September 2023.

## 1.2 Fisheries asset of the survey area

The survey sites were located within the Owenogarney_SC_010, Owenogarney_SC_020, Shannon[Lower]_SC_100 and Ballygirreen_SC_010 river sub-catchments. The proposed wind farm was not located within a European site. Fisheries survey sites were present on the Rocks Stream (EPA code: 27R07), Gortacullin Stream (27G05), Gortagonnella River (27G04), Broadford River (27B02), Snaty Stream (27S13), Clashduff Stream (27C44), Gortadroma Stream (27G12), Belvoir Stream (27B45), Ballyvorgal North Stream (27B47), Owenogarney River (27O01), Oatfield River (25O07), Snaty River (25S34), West Cloontra Stream (25W36), O'Neill's Stream (25O02), Knockshanvo Stream (25K82), Mountrice River (25M03), East Cloontra Stream (25E29), Mountrice Stream (27M38), River (Clare) Blackwater (2606), North Ballycannan Stream (27N17), South Ballycar River (25S75), West Roo Stream (25W38), Coolycasey Stream (27C57), Corlea Stream (27C63), Gourna River (27G02), Fortwilliam River (27F07), Reaskcamoge Stream (27R19), Island River (27I07), Gortnanool Stream (27G22), Carrownerribul Stream (27C86), Ballintlea South Stream (27B77), Rossmanagher Stream (27R23), Clovemill Stream (27C10), Ballycasey Beg Stream (27B70) and several unnamed streams (**Table 2.1**).

The Owenogarney (Owengarney) River, also known locally as the Doon River, Ahaclare River and, lower down, the Ratty River, rises near Moylussa Mountain and flows for some 37km through Doon Lough, Ballymulcashel (Pollagh) Lough and Castle Lough before joining the Shannon Estuary downstream of Bunratty. The river is known to support Salmon (*Salmo salar*), brown trout (*Salmo trutta*) and Eel (*Anguilla anguilla*) (Triturus data). Nationally the Owenogarney is ranked 45th in terms of the amount of fluvial habitat accessible to Salmon (0.41% of national; McGinnity et al., 2003). The Owenogarney

system, including Doon and Castle Loughs, is also known locally to contain stocks of coarse fish species including bream (*Abramis brama*), rudd (*Scardinius erythropthalmus*), tench (*Tinca tinca*), perch (*Perca fluviatilis*), pike (*Esox lucius*), gudgeon (*Gobio gobio)* and minnow (*Phoxinus phoxinus*) (pers. obs.). The non-native, invasive cyprinid species dace (*Leuciscus leuciscus*) has been recorded in the Owenogarney River system since 1980 (Caffrey et al., 2007), with invasive roach (*Rutilus rutilus*) present since the early 1980s (Brazier, 2018). Additionally, the lower reaches are known historically to support both river (*Lampetra fluviatilis*) and sea lamprey (Ross, 2017; Igoe et al, 2004) and a spawning site for European smelt (*Osmerus eperlanus*) has been recorded downstream of Sixmilebridge (Quigley et al., 2004).

The River (Clare) Blackwater is known to support Salmon and brown trout and Eel, with a wide range of coarse fish species, including non-native dace, in the lower reaches (Triturus data 2017-2022). Lamprey (*Lampetra* sp., likely *L. planeri*) have previously been recorded by Ross (2017) and Triturus (2022 data).

Salmon have been recorded from the Snaty Stream, Mountrice River and Clashduff Stream, with brown trout and, to a lesser extent, Eel widespread throughout the Owenogarney and lower Shannon catchments (Triturus data 2017-2022). Lamprey (*Lampetra* sp.) are known from the Cloontra West Stream and O'Neill's Stream.

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

# 2. Methodology

## 2.1 Fisheries assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on watercourses in the vicinity of the Proposed Development in August and September 2023 following notification to Inland Fisheries Ireland and under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The catchment-wide electro-fishing (CWEF) survey was undertaken across *n*=56 sites (see **Table 2.1, Figure 2.1**).

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, 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 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 could be determined as a longer representative length of channel can be surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

### 2.1.1 Salmonids and Eel

For salmonid species and Eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of approx. 40-100m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages. At certain, 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 provided in the 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 Eel to the anode without harm. For the moderate conductivity waters of the sites (mixed geologies) a voltage of 240-300v, frequency of 35-45Hz and pulse duration of 3.5-4ms was utilised to draw fish to the anode without causing physical damage.

### 2.1.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted quadrat-based electro-fishing (as per Harvey & Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of 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. 10-15cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V 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 fisheries habitat appraisal of all aquatic survey sites was undertaken to establish their fisheries value. The surveys focused on evaluating the spawning, nursery and or holding habitat for salmonids and lamprey species but also considered Eel and other fish species. The appraisals of salmonids and lamprey were cognisant of species-specific habitat requirements and preferences as outlined in O'Grady (2006), Hendry et al. (2003), Armstrong et al. (2003), Harvey & Cowx (2003), Maitland (2003) and Hendry & Cragg-Hine (1997). 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.).

## 2.3 Biosecurity

A strict biosecurity protocol following 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. Particular cognisance was given towards preventing the spread or introduction of crayfish plague (*Aphanomyces astaci*). Furthermore, staff did not undertake any work in a known crayfish plague catchment for a period of <72hrs in advance of the survey. 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 Triturus 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 *n*=56 electro-fishing survey sites in the vicinity of the proposed Oatfield wind farm, Co. Clare**

| Site no. | Watercourse | EPA code | Location | X (ITM) | Y (ITM) |
|---|---|---|---|---|---|
| A1 | Rocks Stream | 27R07 | Kyle | 558219 | 671385 |
| A2 | Gortacullin Stream | 27G05 | Hurdleston | 556947 | 671660 |
| A3 | Gortagonnella River | 27G04 | R466 road crossing | 557360 | 672617 |
| A4 | Broadford River | 27B02 | Killaderry Bridge | 555673 | 673479 |
| A5 | Snaty Stream | 27S13 | Snaty | 554067 | 671130 |
| A6 | Clashduff Stream | 27C44 | Snaty | 553313 | 670690 |
| A7 | Clashduff Stream | 27C44 | Druminakella Bridge | 552881 | 671880 |
| A8 | Gortadroma Stream | 27G12 | Crag Bridge | 551863 | 670582 |
| A9 | Belvoir Stream | 27B45 | Belvoir Bridge | 550819 | 669926 |
| A10 | Ballyvorgal North Stream | 27B47 | Glenwood Bridge | 550133 | 669294 |
| A11 | Owenogarney River | 27O01 | Sixmilebridge | 547794 | 665935 |
| B1 | Oatfield River | 25O07 | Oatfield | 553315 | 668494 |
| B2 | Oatfield River | 25O07 | R471 crossing, Oatfield | 554076 | 667363 |
| B3 | Snaty Stream | 25S34 | Ballykelly/Knockaphunta | 555008 | 670164 |
| B4 | Snaty Stream | 25S34 | Cloontra | 554575 | 669398 |
| B5 | Unnamed stream | n/a | Cloontra West | 555089 | 669210 |
| B6 | Snaty Stream | 25S34 | Aughnagoubrey Bridge | 555064 | 667195 |
| B7 | West Cloontra Stream | 25W36 | Callaghan's Bridge | 556667 | 666673 |
| B8 | O'Neill's Stream | 25O02 | R471 crossing, Cloontra East | 557521 | 666347 |
| B9 | Knockshanvo Stream | 25K82 | Mountrice | 557222 | 667725 |
| B10 | O'Neill's Stream | 25O02 | R471 crossing, Cloontra East | 557909 | 666230 |
| B11 | Mountrice River | 25M03 | Sallybank | 557156 | 670025 |
| B12 | Mountrice River | 25M03 | Mountrice | 557575 | 667913 |
| B13 | East Cloontra Stream | 25 E29 | Sallybank | 558145 | 668242 |
| B14 | Mountrice Stream | 25M38 | Sallybank | 558312 | 667277 |
| B15 | Mountrice River | 25M03 | Cloghera Bridge | 558168 | 666159 |
| B16 | River (Clare) Blackwater | 2606 | Killally's Bridge | 558950 | 665665 |
| B17 | River (Clare) Blackwater | 2606 | R463 road crossing | 559373 | 662463 |
| C1 | Oatfield River | 25O07 | Oatfield | 554217 | 667222 |
| C2 | River (Clare) Blackwater | 2606 | Ballycar North | 555101 | 665329 |
| C3 | North Ballycannan Stream | 25N17 | Ballycar South | 556486 | 663213 |
| C4 | North Ballycannan Stream | 25N17 | Ballycar South | 556508 | 663166 |

| Site no. | Watercourse | EPA code | Location | X (ITM) | Y (ITM) |
|---|---|---|---|---|---|
| C5 | Ballycar South River | 25S75 | L3056 road crossing, Castlebank | 557354 | 661782 |
| C6 | West Roo Stream | 25W38 | L3056 road crossing, Castlebank | 558028 | 662019 |
| D1 | Unnamed stream | n/a | R471 road crossing, Oatfield | 553620 | 667475 |
| D2 | Coolycasey Stream | 27C57 | R471 road crossing, Cloghoolia | 552348 | 667483 |
| D3 | Corlea Stream | 27C63 | Coolycasey | 551440 | 667049 |
| D4 | Corlea Stream | 27C63 | Coolycasey | 551463 | 666970 |
| D5 | Gourna River | 27G02 | Collycasey Bridge | 551629 | 666717 |
| D6 | Gourna River | 27G02 | Carrowmore | 548082 | 664195 |
| D7 | Fortwilliam Stream | 27F07 | Clogga | 551012 | 665076 |
| D8 | Reaskcamoge Stream | 27R19 | Clogga | 550835 | 664951 |
| D9 | Island River | 27I07 | Ballynbroughran | 549894 | 664286 |
| D10 | Island River | 27I07 | Ballynbroughran | 549719 | 664155 |
| D11 | Island River | 27I07 | Ballynbroughran | 549546 | 664088 |
| D12 | Carrownerribul Stream | 27C86 | Carrowmore | 549024 | 663834 |
| D13 | Ballintlea South Stream | 27B77 | Ballintlea South | 548337 | 662880 |
| D14 | Ballintlea South Stream | 27B77 | R462 road crossing, Ballinphunt | 547665 | 662656 |
| D15 | Island River | 27I07 | L7112 road crossing, Ballinphunt | 547520 | 662732 |
| D16 | Island River | 27I07 | L7112 road crossing, Ballinphunt | 547406 | 662837 |
| D17 | Owenogarney River | 27O01 | D'Esterre's Bridge | 547334 | 662915 |
| D18 | Unnamed stream | n/a | L7112 road crossing, Rossmanagher | 547112 | 663314 |
| D19 | Rossmanagher Stream | 27R23 | Newpark | 546145 | 663555 |
| D20 | Clovemill Stream | 27C10 | Cloghlea | 545126 | 663529 |
| D21 | Ballycasey Beg Stream | 27B70 | L3177 road crossing, Firgrive | 542420 | 663280 |
| E1 | Clovemill Stream | 27C10 | R471 road crossing, Cloghlea | 545255 | 663795 |

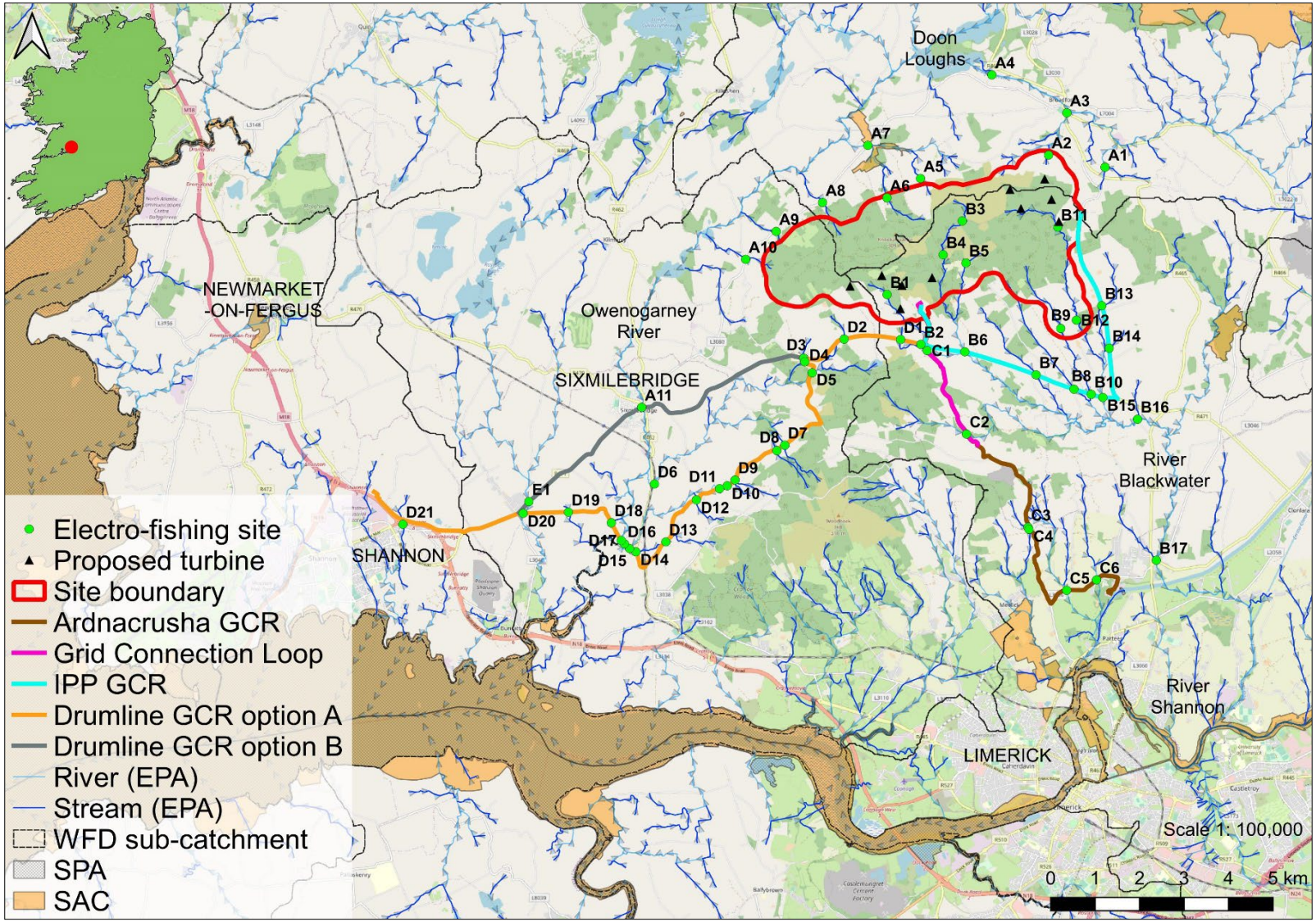


**Figure 2.1: Overview of the *n*=56 electro-fishing survey site locations for the proposed Oatfield wind farm, Co. Clare**

# 3. Results

A catchment-wide electro-fishing survey of *n*=56 riverine sites in the vicinity of the Proposed Development was conducted over several dates in August and September 2023 following notification to Inland Fisheries Ireland. The results of the survey are discussed 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, Eel and lamprey species. Scientific names are provided at first mention only.

## 3.1 Fisheries assessment

### 3.1.1 Site A1 – Rocks Stream, Kyle

No fish were recorded via electro-fishing at site C1. The site was not of fisheries value at the time of survey given very low flows and shallow depths, in addition to high natural gradients and poor connectivity to downstream habitats. Electro-fishing surveys in 2017 and 2022 in the vicinity of this site also failed to record fish (Triturus data).

**Plate 3.1 Representative image of site A1 on the Rocks Stream, August 2023 (semi-dry spate channel)**

### 3.1.2 Site A2 – Gortacullin Stream, Hurdleston

No fish were recorded via electro-fishing at site A2. The upland stream was not of fisheries value given naturally high gradients, fish accessibility issues (waterfalls/cascades) and poor connectivity with downstream habitats.

**Plate 3.2: Representative image of site A2 on the Gortacullin Stream, August 2023**

3.1.3 Site A3 – Gortagonnella River, R466 road crossing

Despite high physical suitability as a salmonid spawning habitat and nursery, no fish were recorded via electro-fishing at site A3. The absence of fish was taken to reflect the presence of a major instream barrier (waterfall) at the Broadford River confluence c.80m downstream (not accessible to salmonids but passable to eel) and a further waterfall c.100m upstream of the road crossing.

**Plate 3.3: Representative image of site A3 on the Gortagonnella River, August 2023**

### 3.1.4 Site A4 – Broadford River, Killaderry Bridge

Salmon (*Salmo salar*) (*n*=3), brown trout (*Salmo trutta*) (*n*=6), Eel (*Anguilla anguilla*) (*n*=1), gudgeon (*Gobio gobio*) (*n*=8) and invasive roach (*Rutilus rutilus*) (*n*=31) were recorded via electro-fishing at site A4 (**Figure 3.1**).

The site was a high quality salmonid habitat, supporting a low density of brown trout and juvenile Salmon. The site was of highest value as a salmonid spawning and nursery habitat (particularly for Salmon) given the abundance of clean mixed gravels and *Ranunculus* beds respectively. The site also provided high quality holding habitat for adult salmonids given the presence of deep pool and scours with overhanging vegetation (e.g. willow trees). Lamprey spawning habitat was widespread although sand accumulations and macrophyte beds did not support ammocoetes despite good suitability. Good quality Eel habitat was present with a single individual captured.

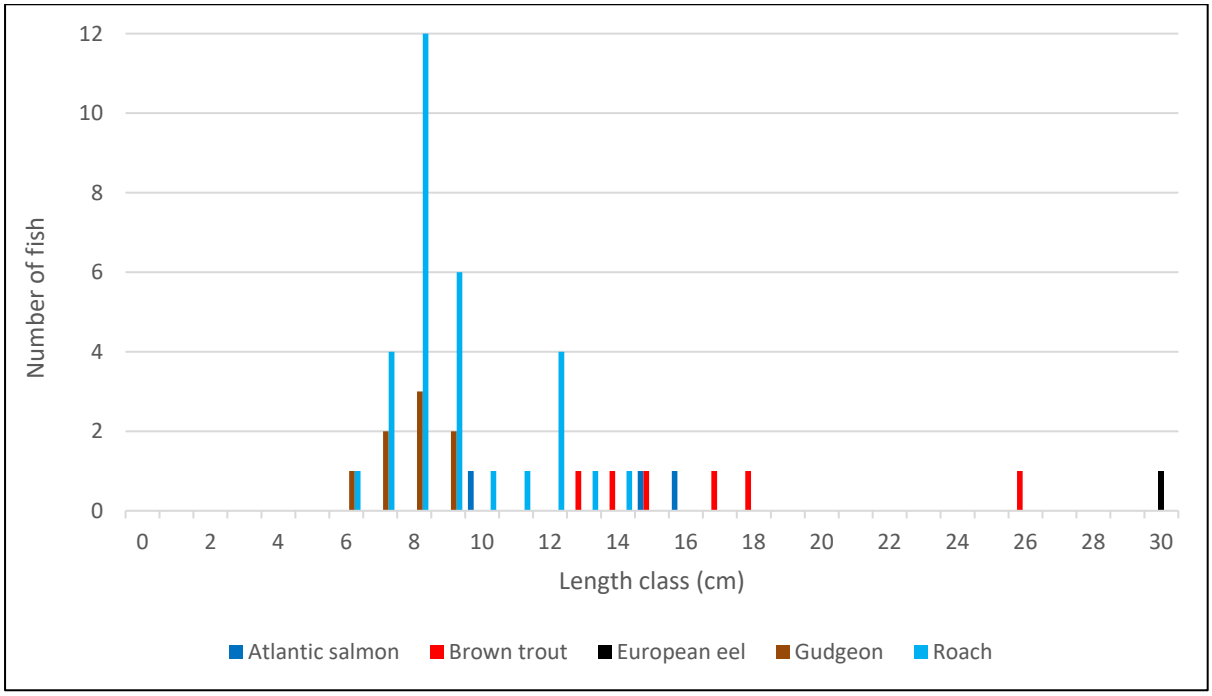


**Figure 3.1 Length frequency distribution recorded via electro-fishing at site A4 on the Broadford River, August 2023**

**Plate 3.4 Salmon parr and juvenile roach recorded at site A4 on the Broadford River, August 2023**

3.1.5 Site A5 – Snaty Stream, Snaty

No fish were recorded via electro-fishing at site A5. Despite some physical suitability as a salmonid habitat (spawning and nursery), naturally high gradients, shallow depths and the location in the upper reaches of the stream precluded resident fish. The upland stream was unsuitable for lamprey.

**Plate 3.5 Representative image of site A5 on the Snaty Stream, August 2023**

3.1.6 Site A6 – Clashduff River, Snaty

No fish were recorded via electro-fishing at site A6. The small upland channel was of low value for salmonids and Eel given a bedrock dominated bed, naturally steep gradients and its location in the upper reaches of the river. The upland site was unsuitable for lamprey.

**Plate 3.6 Representative image of site A6 on the upper reaches of the Clashduff River, August 2023**

3.1.7 Site A7 – Clashduff River, Druminakella Bridge

Salmon (*n*=22) and brown trout (*n*=6) were recorded via electro-fishing at site A7 (**Figure 3.2**).

The site was of good value as a salmonid nursery, supporting a moderate density of juveniles in well-oxygenated riffle and glide. Whilst a deep pool below the weir (barrier to fish migration) provided some holding habitat for larger salmonids, the paucity of deeper areas elsewhere reduced the value of the holding habitat for adult fish. Eel habitat was poor overall given a low frequency of suitable refugia. Whilst the site provided some low potential as a lamprey spawning habitat (i.e. finer gravels), the shallow, compacted marginal soft sediment accumulations were unsuitable for ammocoetes.

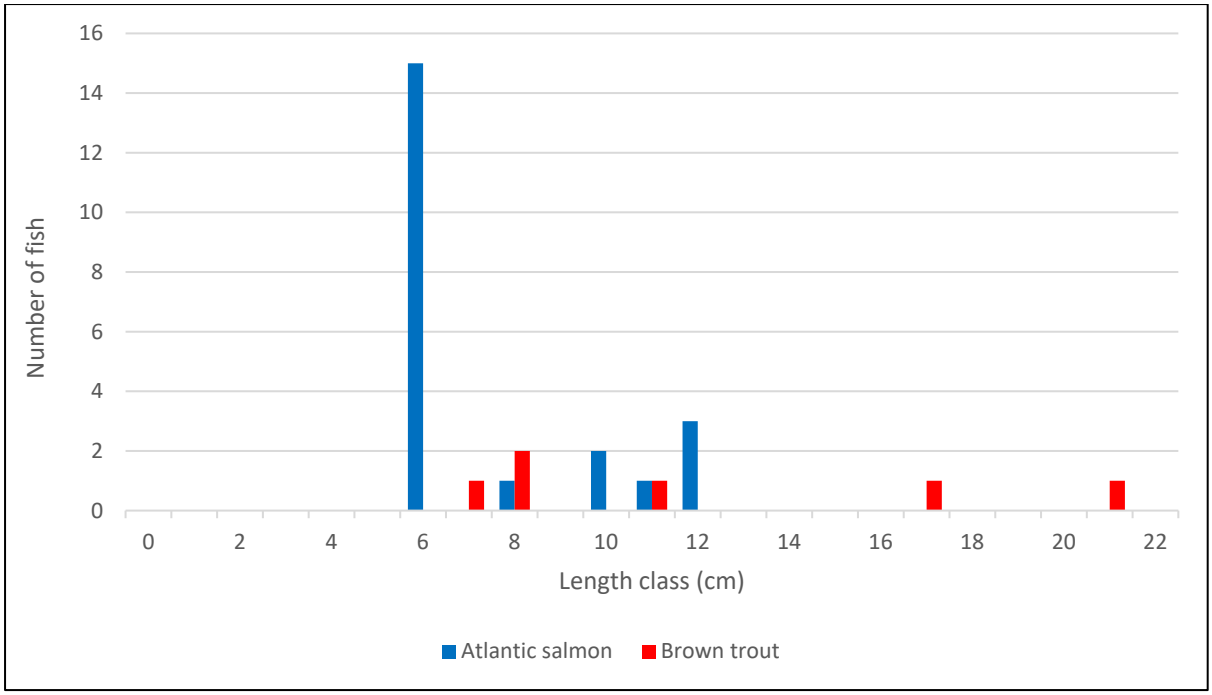


**Figure 3.2 Length frequency distribution recorded via electro-fishing at site A7 on the Clashduff River, August 2023**

**Plate 3.7 Brown trout (top) and Salmon parr recorded at site A7 on the Clashduff River, August 2023**

3.1.8 Site A8 – Gortadroma Stream, Crag Bridge

No fish were recorded via electro-fishing at site A8. However, brown trout have previously been recorded from the site (Triturus 2022 data) and the stream at this location provided some low physical suitability in terms of salmonid spawning and nursery habitat. The absence of trout in 2023 likely reflects the natural stochasticity of small, upland stream salmonid populations. Eel habitat was of poor quality given the predominance of bedrock

and paucity of accessible instream refugia in the shallow channel. Natural cascades downstream likely served as barriers to both salmonids and eel. The upland eroding stream was unsuitable for lamprey.

**Plate 3.8 Representative image of site A8 on the Gortadroma Stream, August 2023**

3.1.9 Site A9 – Belvoir Stream, Belvoir Bridge

Brown trout (*n*=6) were the only fish species recorded via electro-fishing at site A9 (**Figure 3.3**).

The site was of moderate value only for salmonids, supporting only a low density of small adult trout (no juveniles recorded). Although some good quality spawning habitat was present, the site was of reduced value as a holding and nursery habitat given the shallow nature of the stream in addition to siltation pressures and connectivity issues with downstream habitats (frequent instream blockages). Similarly, the site was of poor value for Eel for these reasons. There was limited suitability for lamprey (spawning) although nursery habitat was absent.

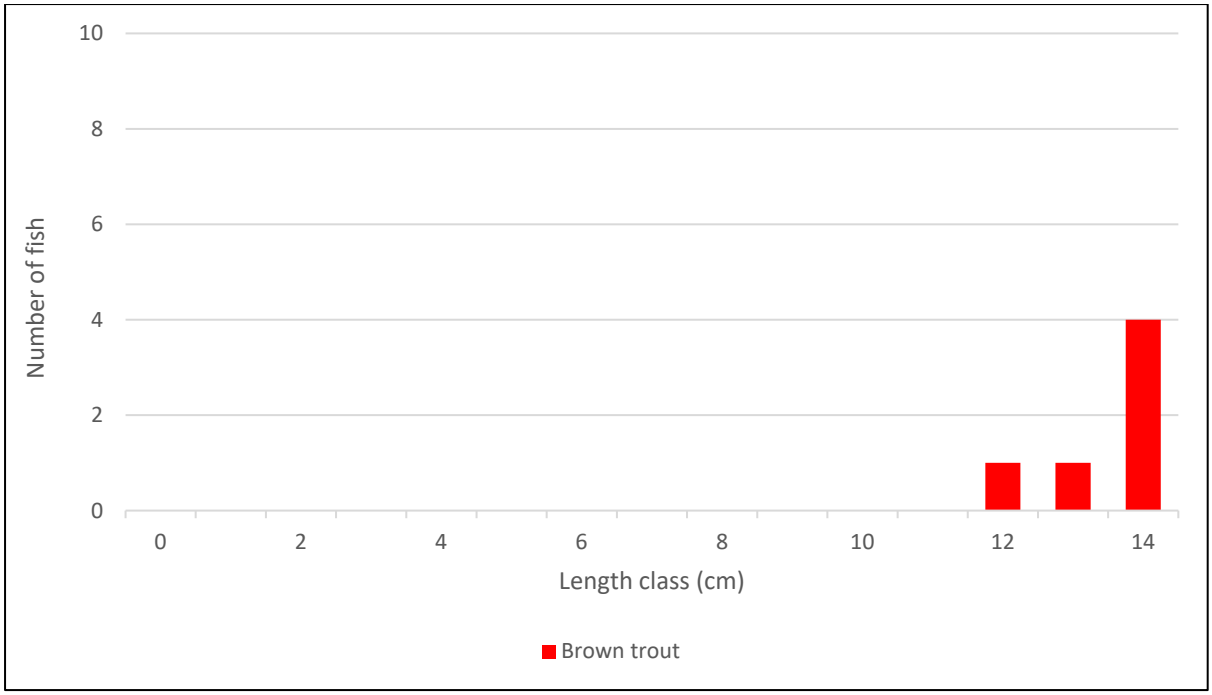


**Figure 3.3 Length frequency distribution recorded via electro-fishing at site A9 on the Belvoir Stream, August 2023**

**Plate 3.9 Adult brown trout recorded at site A9 on the Belvoir Stream, August 2023**

3.1.10 Site A10 – Ballyvorgal North Stream, Glenwood Bridge

No fish were recorded via electro-fishing at site A10, in keeping with previous surveys of the site (Triturus data 2017-2022). The site was not of fisheries value at the time of survey given low flows, shallow depths and siltation pressures.

**Plate 3.10 Representative image of site A10 on the Ballyvorgal North Stream at Glenwood Bridge, August 2023**

3.1.11 Site A11 – Owenogarney River, Sixmilebridge

Salmon (*n*=30), brown trout (*n*=1), Eel (*n*=9), gudgeon (*n*=6), flounder (*Platichthys flesus*) (*n*=1) and non-native roach (*n*=27) and dace (*Leuciscus leuciscus*) (*n*=7) were recorded via electro-fishing at site A11 (**Figure 3.4**). This was the highest species diversity (7) recorded during the survey.

The site was of excellent value as a salmonid nursery, supporting a high density of Salmon parr, with abundant instream refugia. Good quality spawning habitat was present also (mixed gravels and mobile cobbles) although impacted by evident enrichment. Holding habitat was relatively poor given the shallow, high energy nature of the site (although high quality areas were present downstream and also upstream of the weir). The site was also of high value for Eel with both elvers and adults present (silver & yellow) amongst abundant instream refugia. Small pools supported invasive roach and dace. The high energy site was unsuitable for lamprey ammocoetes although the site is a recognised sea lamprey spawning area (and suitable habitat indeed exists).

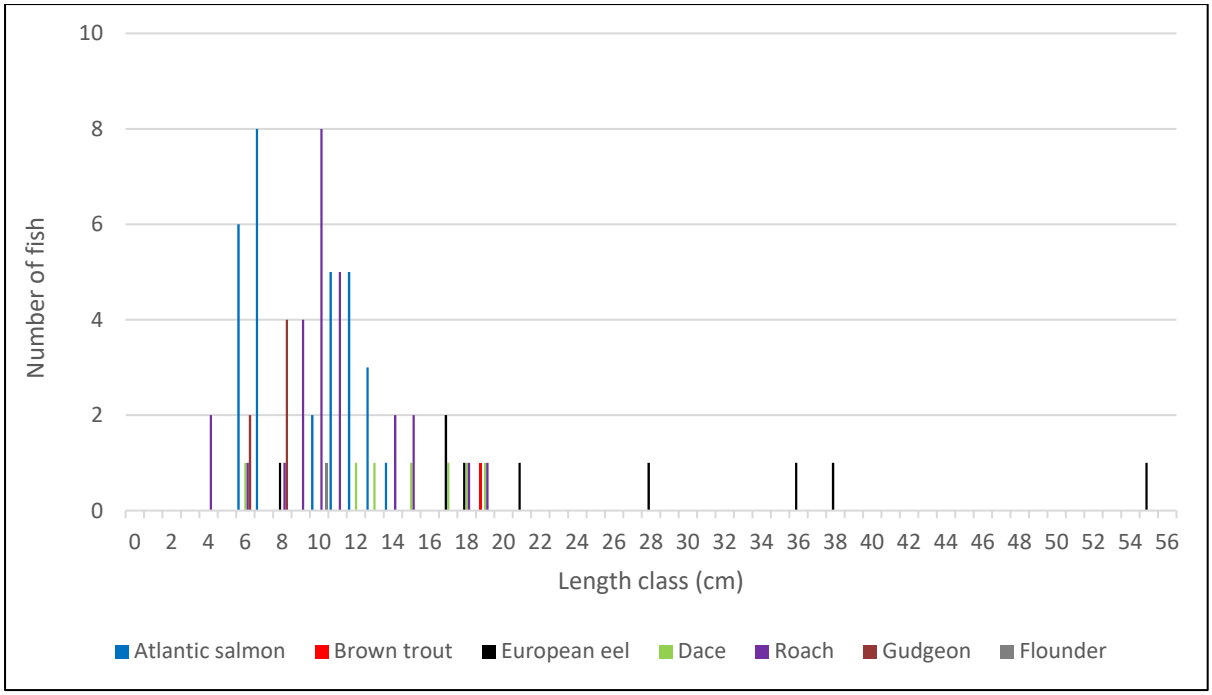


**Figure 3.4 Length frequency distribution recorded via electro-fishing at site A11 on the Owenogarney River, September 2023**

**Plate 3.11 Invasive dace (bottom) and roach recorded at site A11 on the Owenogarney River, August 2023**


**Plate 3.12 0+ and 1+ Salmon parr recorded at site A11 on the Owenogarney River, August 2023**

3.1.12 Site B1 – Oatfield River, Oatfield

No fish were recorded via electro-fishing from site B1. The river at this location was not of fisheries value given its steep gradient, shallow, cascading nature and location in the headwaters of the stream.

**Plate 3.13 Representative image of site B1 on the upper reaches of the Oatfield River, August 2023**

### 3.1.13 Site B2 – Oatfield River, Oatfield

Three-spined stickleback (*Gasterosteus aculeatus*) (*n*=5) was the only fish species recorded via electro-fishing at site B2 (**Figure 3.5**). With the exception of low densities of this species, the site was not of fisheries value given its diminutive nature, historical modifications, low summer flows and heavy siltation.

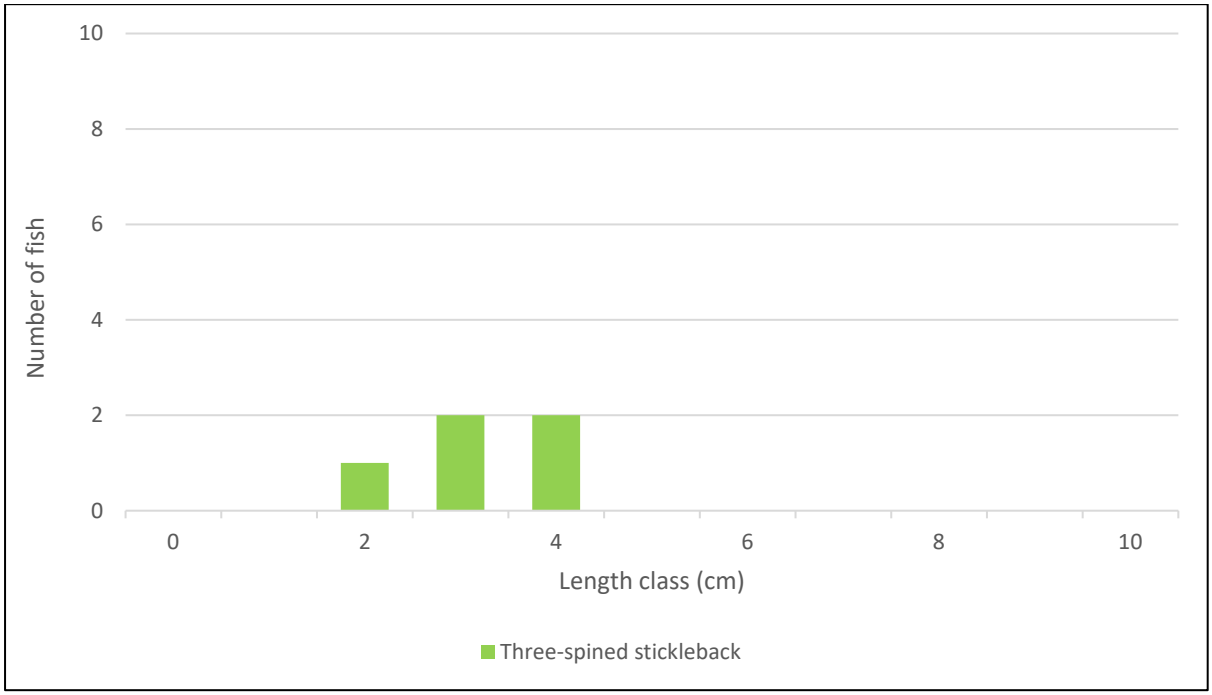


**Figure 3.5 Length frequency distribution recorded via electro-fishing at site B2 on the Oatfield River, August 2023**

**Plate 3.14 Representative image of site B2 on the Oatfield River, August 2023 (realigned along road)**

3.1.14 Site B3 – Snaty River, Ballykelly

No fish were recorded via electro-fishing at site B3. The site was not of fisheries value at the time of survey given very low flows, shallow depths, heavy siltation and the location at the headwaters of the watercourse.

**Plate 3.15 Representative image of site B3 on the upper reaches of the Snaty Stream, August 2023**

3.1.15 Site B4 – Snaty Stream, Cloontra

No fish were recorded via electro-fishing at site B4, in keeping with previous surveys of the site (Triturus 2022 data). However, a small brown trout population was present at the site in 2017 (Triturus data). The apparent extirpation of this salmonid population was likely due to adjacent clear-felling activity and associated impacts on water quality (e.g. eutrophication, siltation etc.). The fisheries value was further reduced given its location in the headwaters of the stream and high natural downstream gradients which limited upstream fish passage. Spawning habitat for salmonids was also absent given heavy siltation (peat) and smothering of the bed by iron-oxidising bacteria.

**Plate 3.16 Representative image of site B4 on the Snaty Stream, August 2023**

3.1.16 Site B5 – unnamed stream, Cloontra West

No fish were recorded via electro-fishing at site B5, in keeping with previous surveys of the site (Triturus 2022 data). The site was not of fisheries value given its evident siltation and eutrophication pressures in addition to high natural downstream gradients which precluded upstream fish passage. Spawning habitat for salmonids was also absent given heavy siltation (peat) and smothering of the bed by iron-oxidising bacteria.

**Plate 3.17 Representative image of site B5 on an unnamed Snaty River tributary, August 2023**

### 3.1.17 Site B6 – Snaty River, Aughnagourney Bridge

Salmon (*n*=2) and brown trout (*n*=18) were recorded via electro-fishing at site B5 (**Figure 3.6**).

The upland site was a good quality salmonid nursery habitat with ample boulder refugia. Good quality spawning habitat was also present although these areas were localised given the high gradient and boulder-dominated bed. Deep pools associated with cascades provided some good quality holding habitat for adult salmonids. While suitability for Eel existed in terms of refugia, the high gradient and high energy of the stream reduced suitability (none recorded). The high energy was unsuitable for lamprey.

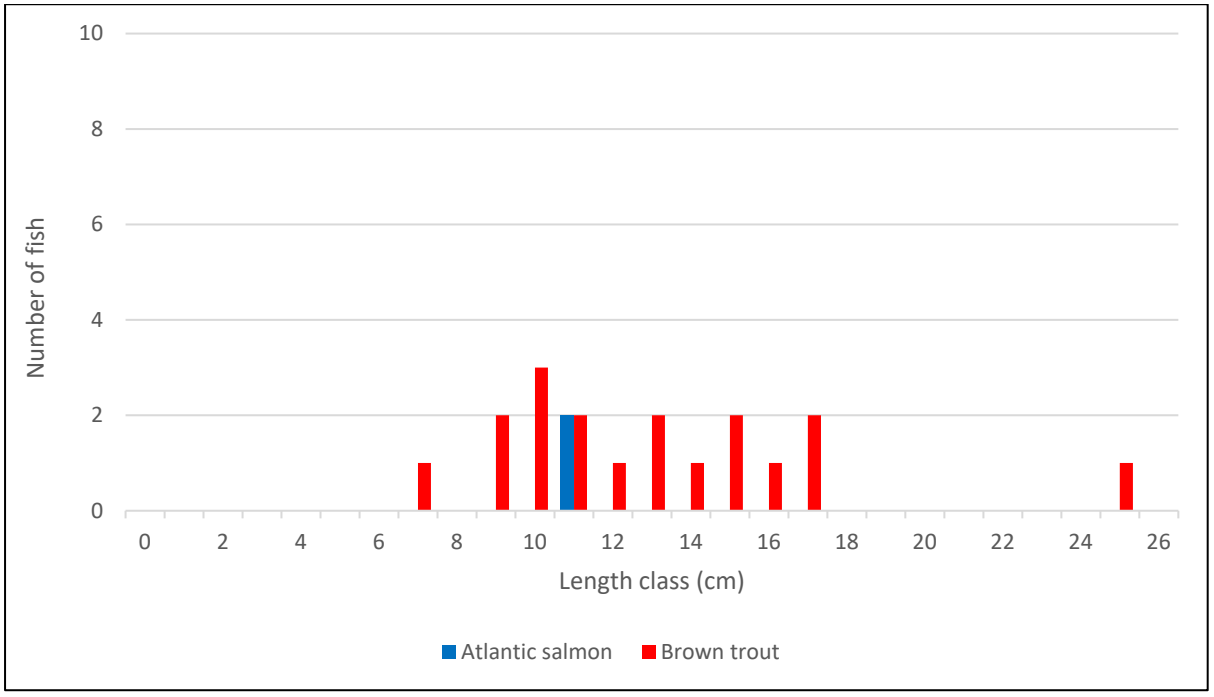


**Figure 3.6 Length frequency distribution recorded via electro-fishing at site B6 on the Snaty River, August 2023**

**Plate 3.18 Adult brown trout recorded at site B6 on the Snaty River at Aughnagourney Bridge, August 2023**

3.1.18 Site B7 – West Cloontra Stream, Callaghan's Bridge

Salmon (*n*=2), brown trout (*n*=5) and *Lampetra* sp. (*n*=2) were recorded via electro-fishing at site B6 (**Figure 3.7**).

The site was of moderate value for salmonids, supporting a low density of juvenile fish. Whilst present, the quality of salmonid and lamprey spawning habitat was compromised by siltation pressures, whilst the salmonid nursery value of the site was reduced due to the paucity of instream refugia. The shallow stream was not of value as an adult salmonid holding habitat at this location. There was limited suitability for Eel given limited large substrata and pool habitat (none recorded). Abundant sand deposits near the bridge provided sub-optimal nursery habitat for lamprey (*Lampetra* sp.) and supported a low density of ammocoetes (1 per $m^2$).

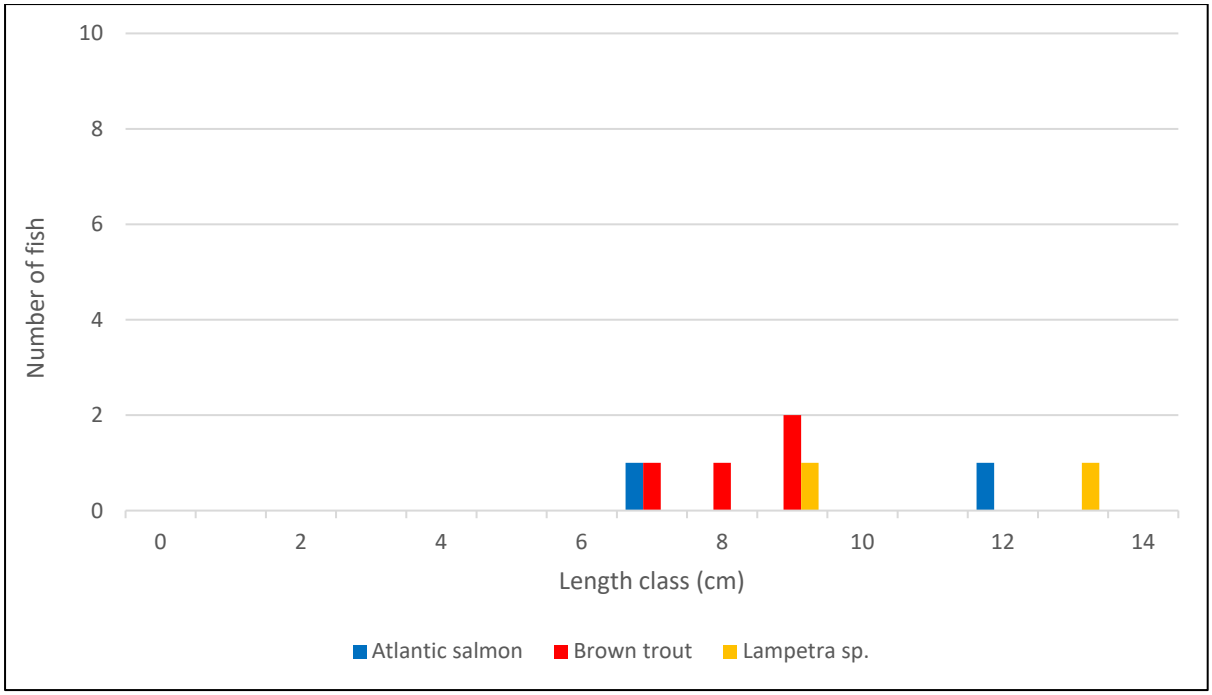


**Figure 3.7 Length frequency distribution recorded via electro-fishing at site B7 on West Cloontra Stream, August 2023**

**Plate 3.19 Salmon parr (left) and brown trout (right) recorded at site B7 on West Cloontra Stream, August 2023**

3.1.19 Site B8 – O'Neill's Stream, Cloontra East

Three-spined stickleback (*n*=9) and *Lampetra* sp. (*n*=3) were the only fish species recorded via electro-fishing at site B8 (**Figure 3.8**).

The quality of salmonid habitat quality was poor given historical modifications and siltation pressures. However, soft sediment deposits provided some locally good quality nursery habitat for *Lampetra* sp. and supported a low density of young-of-the-year ammocoetes

(0.5 per $m^2$). Superficial gravels provided only limited lamprey spawning habitat. Suitability for Eel was poor given a paucity of instream refugia and none were recorded.

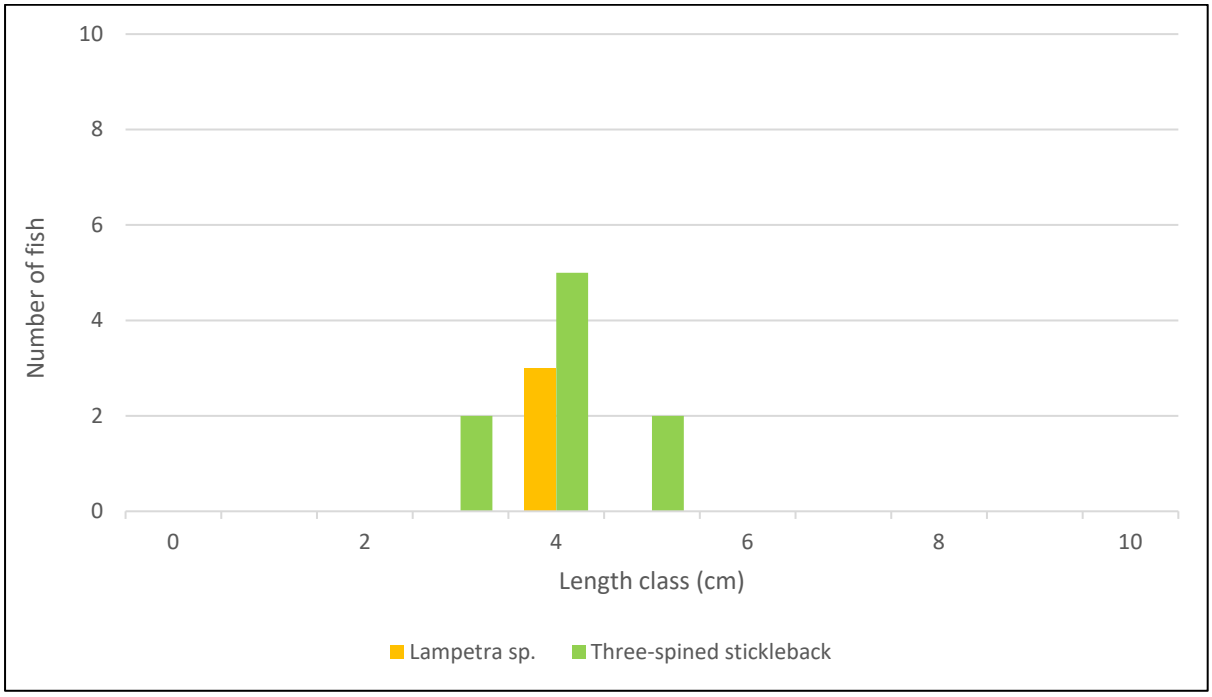


**Figure 3.8 Length frequency distribution recorded via electro-fishing at site B8 on O'Neill's Stream, August 2023**

**Plate 3.20 Representative image of site B8 on O'Neill's Stream, August 2023**

3.1.20 Site B9 – Knockshanvo Stream, Mountrice

Brown trout (*n*=22), stone loach (*Barbatula barbatula*) (*n*=9) and lamprey (*Lampetra* sp.) (*n*=1) were recorded via electro-fishing at site B9 (**Figure 3.9**).

Despite recent local modifications, the site was of good value as a salmonid nursery with abundant riffle and shallow glide. However, the overall shallow nature of the stream at this location, in addition to a paucity of instream refugia, reduced the value. Similarly, the shallow nature resulted in poor holding opportunities for adult salmonids. Good quality spawning habitat for both salmonids and lamprey was widespread, albeit impacted by siltation. Lamprey nursery habitat was sub-optimal (sand-dominated) and only a single *Lampetra* sp. transformer was recorded (**Plate 3.21**). The site was of poor suitability for Eel (none recorded).

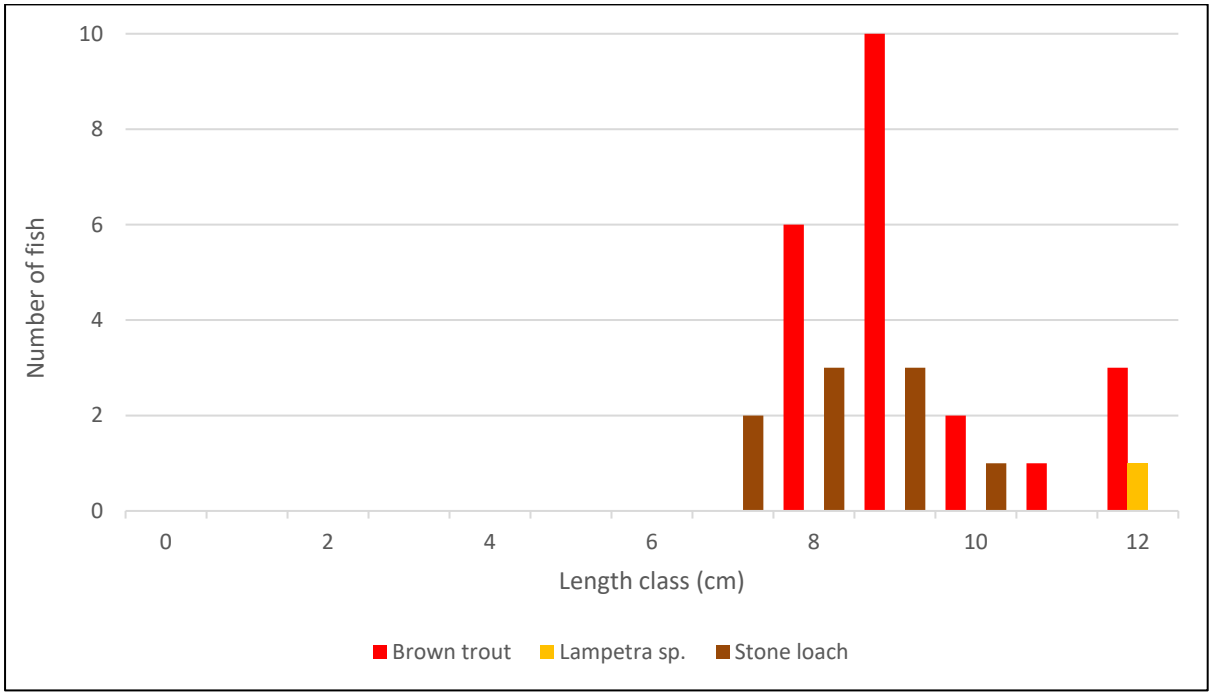


**Figure 3.9 Length frequency distribution recorded via electro-fishing at site B9 on the Knockshanvo Stream, August 2023**


**Plate 3.21: *Lampetra* sp. transformer recorded at site B9 on the Knockshanvo Stream, August 2023**

3.1.21 Site B10 – Knockshanvo Stream, Cloontra East

Brown trout (*n*=18), stone loach (*n*=12), minnow (*Phoxinus phoxinus*) (*n*=8) and three-spined stickleback (*n*=7) were recorded via electro-fishing at site B10 (**Figure 3.10**).

The site was a good quality salmonid nursery, supporting a relatively high density of brown trout. The site was also of high value as a salmonid spawning habitat due to the predominance of gravels. The paucity of pools in the small upland stream resulted in poor quality holding habitat for adult salmonids. Despite some physical suitability as a lamprey spawning habitat, the site was unsuitable for lamprey ammocetes given the absence of suitable soft sediment (i.e. sand dominated). The shallow stream was of poor value for Eel at this location.

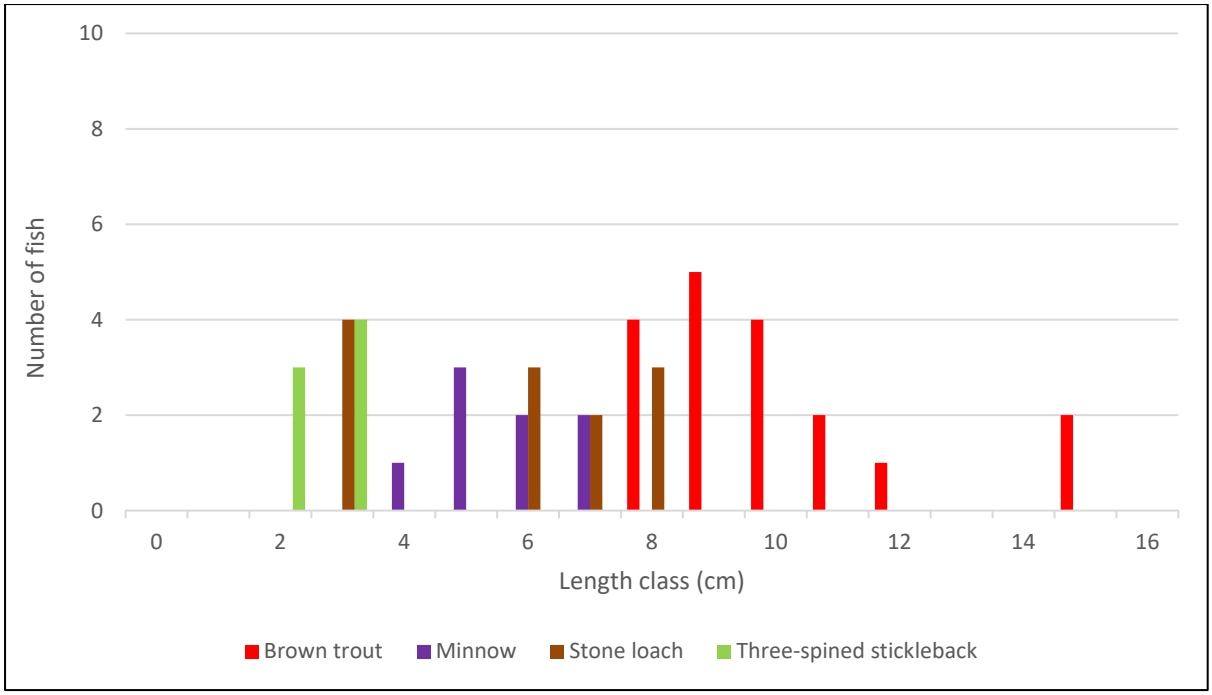


**Figure 3.10 Length frequency distribution recorded via electro-fishing at site B10 on the Knockshanvo Stream, August 2023**


**Plate 3.22 Brown trout, stone loach and minnow recorded at site B10 on the Knockshanvo Stream, August 2023**

### 3.1.22 Site B11 – Mountrice River, Sallybank

Brown trout (*n*=8) was the only fish species recorded via electro-fishing at site B11 (**Figure 3.11**).

The site was considered a moderate quality nursery for salmonids although siltation impacts reduced the overall value as a spawning habitat. The small upland site provided poor holding opportunities for adults given a paucity of deeper pool areas. Suitability for Eel was relatively poor given the shallow, high energy nature of the channel (none recorded). The upland site was unsuitable for lamprey.

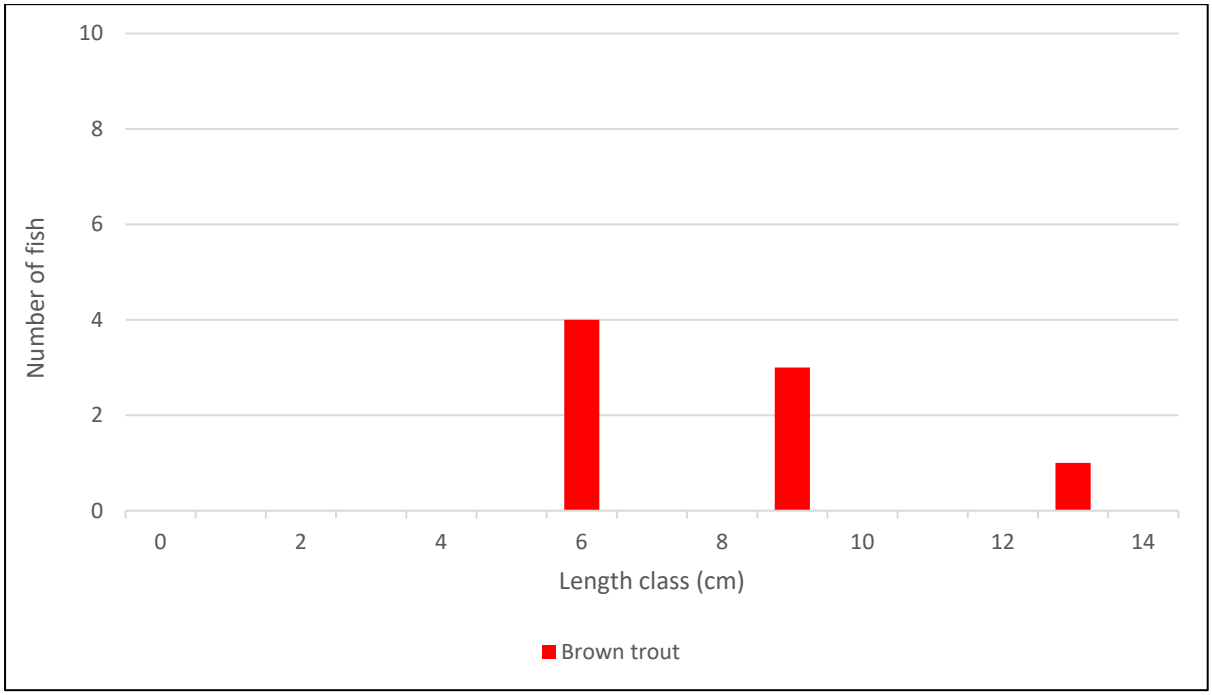


**Figure 3.11 Length frequency distribution recorded via electro-fishing at site B10 on the Knockshanvo Stream, August 2023**

**Plate 3.23 Representative image of site B11 on the Mountrice River, August 2023**

### 3.1.23 Site B12 – Mountrice River, Mountrice

Brown trout (*n*=44) and Eel (*n*=1) were the only fish species recorded via electro-fishing at site B12 (**Figure 3.12**).

The site was of high value for salmonids, supporting a relatively high density of mixed cohort brown trout. The site was a good quality nursery and holding habitat given the abundance of instream refugia and deeper pool areas, respectively. Frequent woody debris also contributed greatly to habitat heterogeneity with mature woodland buffers providing valuable thermal refugia. Whilst localised, good quality spawning habitat was present. Good quality Eel habitat was present with abundant instream refugia supporting a low density of eel. The upland spate channel was unsuitable for lamprey.

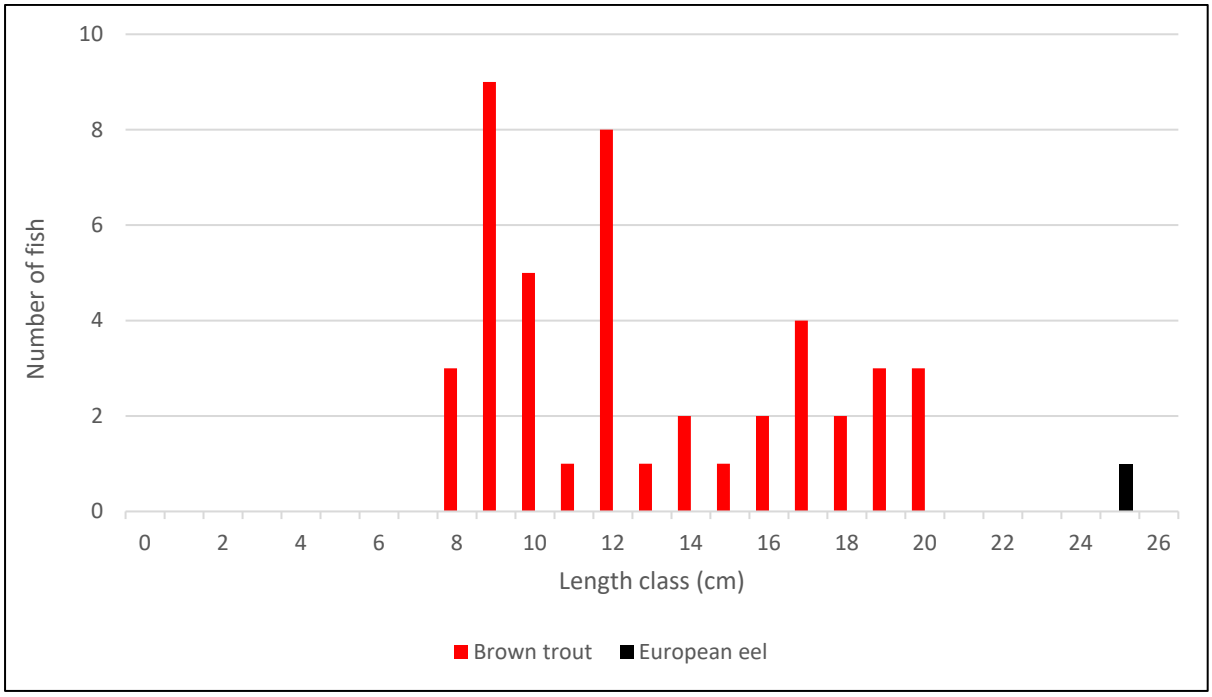


**Figure 3.12 Length frequency distribution recorded via electro-fishing at site B12 on the Mountrice River, August 2023**

**Plate 3.24 Adult brown trout recorded at site B12 on the Mountrice River, August 2023**

3.1.24 Site B13 – East Cloontra Stream, Sallybank

Brown trout (*n*=44) was the only fish species recorded via electro-fishing at site B13 (**Figure 3.13**).

The site was of moderate value for salmonids only, supporting a low density of brown trout. This was reflective of the naturally high gradients and spate nature of the channel which limited suitable spawning, nursery and holding habitat. The upland site was of poor suitability for Eel and none were recorded. The upland spate channel was unsuitable for lamprey.

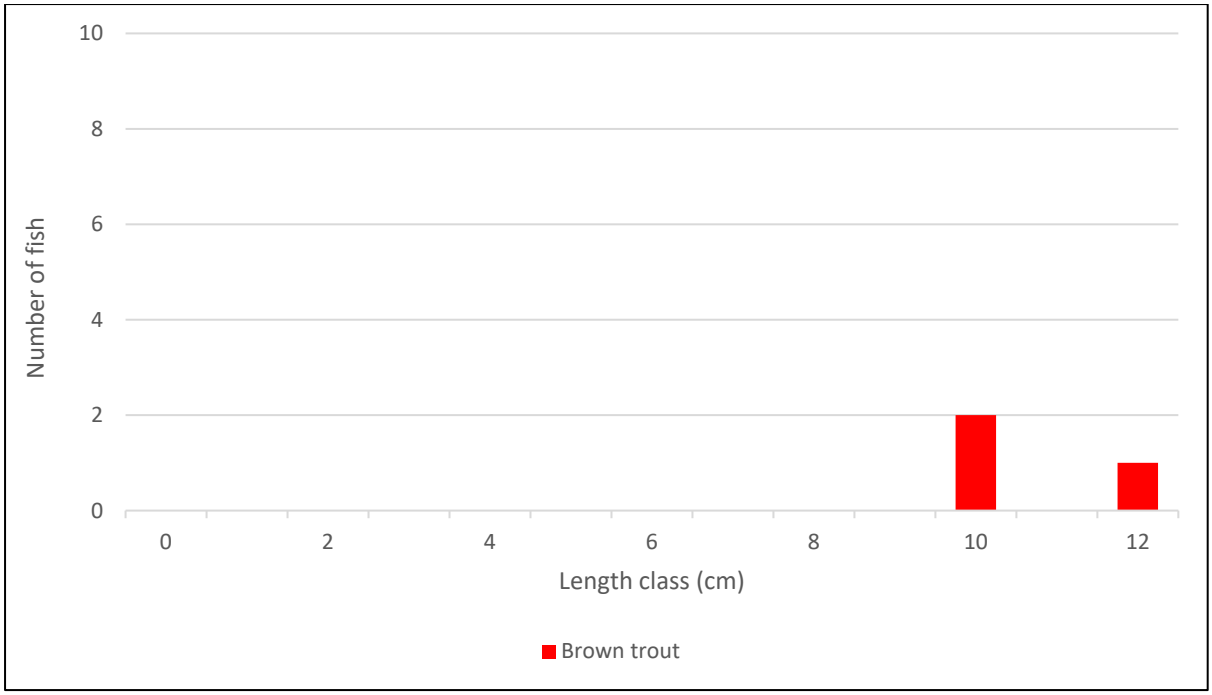


**Figure 3.13 Length frequency distribution recorded via electro-fishing at B13 on the East Cloontra Stream, August 2023**

**Plate 3.25 Representative image of site B13 on the East Cloontra Stream, August 2023**

3.1.25 Site B14 – Mountrice Stream, Sallybank

Brown trout (*n*=3) was the only fish species recorded via electro-fishing at site B14 (**Figure 3.14**).

The site was of poor value for salmonids, supporting a low density of brown trout only. This was reflective of the historically modified and shallow/narrow nature of the channel which limited suitable spawning, nursery and holding habitat. The upland site was of poor

suitability for Eel and none were recorded. Despite some soft sediment beds with some suitability for larval lamprey, none were recorded and this reflected the upland nature of the stream and the presence of instream barriers (e.g. weir).

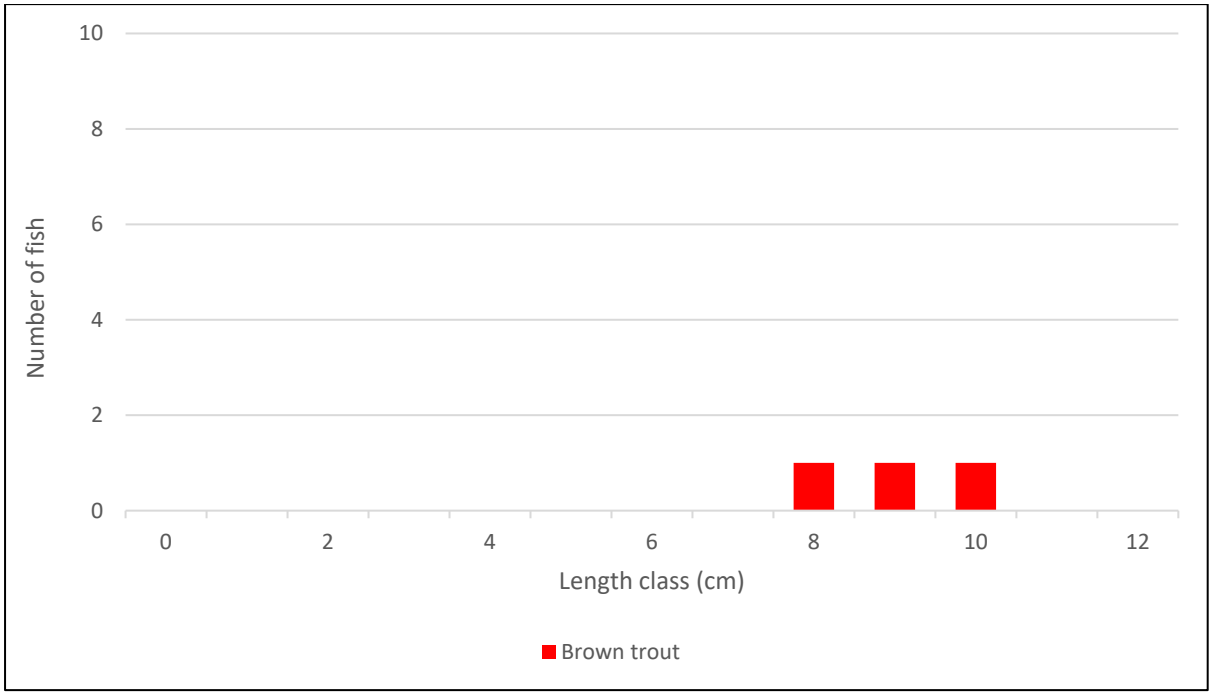


**Figure 3.14 Length frequency distribution recorded via electro-fishing at B14 on the Mountrice Stream, August 2023**

**Plate 3.27 Representative image of site B14 on the Mountrice Stream, August 2023**

### 3.1.26 Site B15 – Mountrice River, Cloghera Bridge

Salmon (*n*=3), brown trout (*n*=21), minnow (*n*=3) and stone loach (*n*=6) were recorded via electro-fishing at site B15 (**Figure 3.15**).

The site was of high value for salmonids, supporting a relatively high density of mixed cohort brown trout and a low number of Salmon. Whilst the site was of moderate quality only as a spawning habitat (compacted cobble/boulder), the site was evidently a good quality nursery. Frequent small pool and bank scours (often associated with overhanging trees and LWD) provided valuable refugia for adult salmonids and Eel, although the latter was not recorded (eel were present in 2017; Triturus data). The high energy site was unsuitable for lamprey.

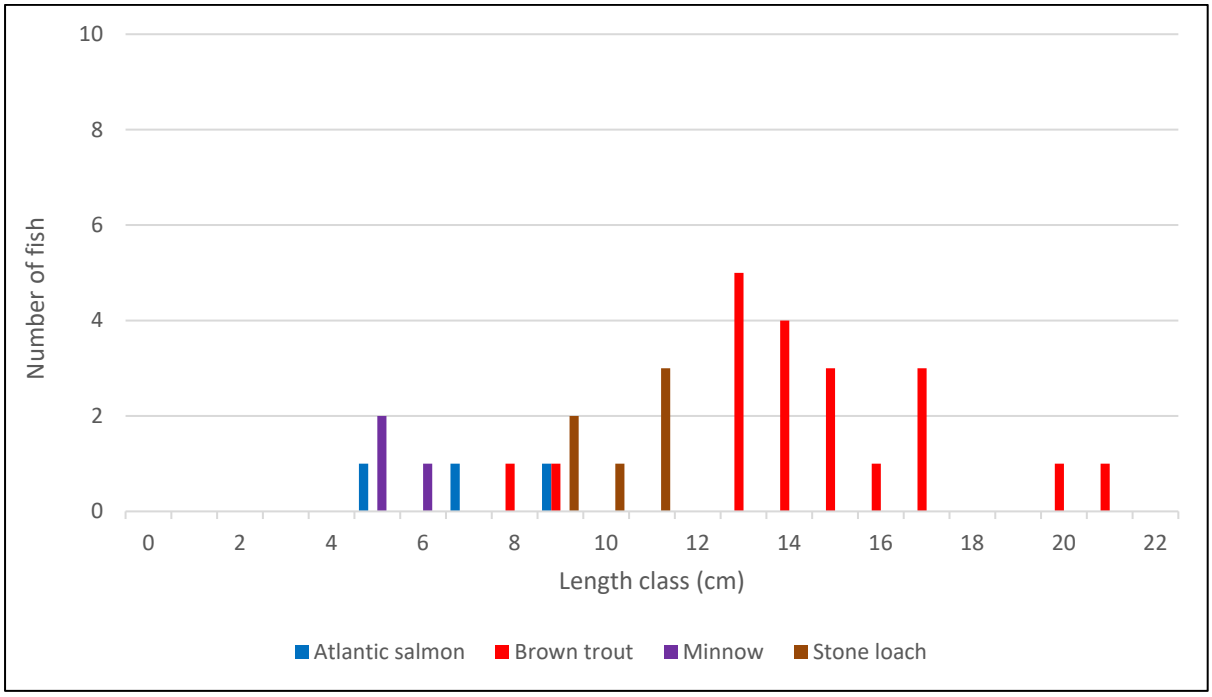


**Figure 3.15 Length frequency distribution recorded via electro-fishing at site B15 on the Mountrice River, August 2023**

**Plate 3.28 Mixed cohort brown trout recorded at site B15 on the Mountrice River, August 2023**

3.1.27 Site B16 – River Blackwater, Kilally's Bridge

Salmon (*n*=4), brown trout (*n*=35), *Lampetra* sp. (*n*=13), three-spined stickleback (*n*=4) and stone loach (*n*=20) were recorded via electro-fishing at site B16 (**Figure 3.16**).

The site was of high value for salmonids, supporting a relatively high density of mixed cohort brown trout and a low number of Salmon. The site was of highest value as a salmonid nursery and adult holding habitat given the presence of deep glide with abundant cobble and boulder refugia, in addition to bank scours/undercuts. Good quality spawning habitat for both salmonids and lamprey was present but localised and primarily present immediately upstream of the bridge. A small sand/silt accumulation between the middle bridge arches supported a relatively high density of *Lampetra* sp. ammocoetes (8.6 per $m^2$). Despite good suitability for Eel, none were recorded (as per 2017 & 2022; Triturus data).

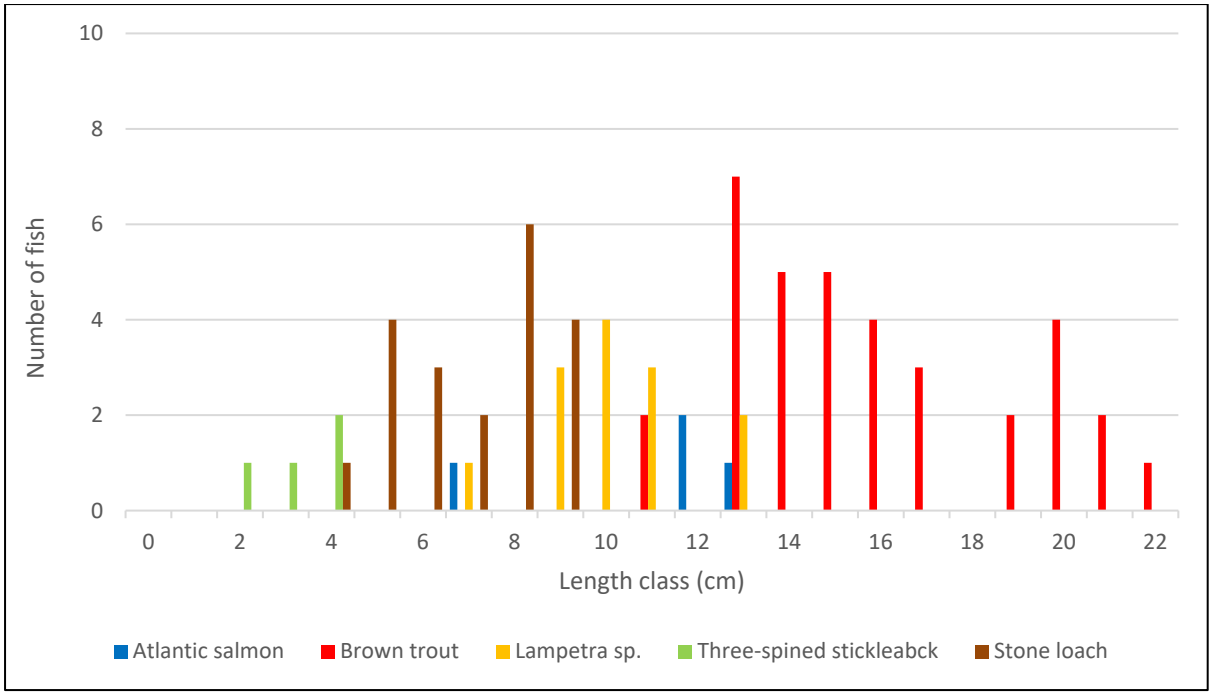


**Figure 3.16 Length frequency distribution recorded via electro-fishing at site B16 on the River Blackwater, August 2023**

**Plate 3.29 Brown trout and *Lampetra* sp. ammocoete recorded at site B16 on the River Blackwater, August 2023**

3.1.28 Site B17 – River Blackwater, Blackwater

Brown trout (*n*=6), stone loach (*n*=3), minnow (*n*=5) and lamprey (*Lampetra* sp.) (*n*=32) were recorded via electro-fishing at site B17 (**Figure 3.17**).

The site was of high value for salmonids, with abundant good quality spawning and nursery habitat in addition to excellent quality holding areas. However, no Salmon were recorded (only brown trout). The site was also of high value for lamprey with good quality spawning habitat. Soft sediment accumulations in the vicinity of LWD provided excellent quality nursery habitat and supported a high density of mixed cohort ammocoetes (12.8 per $m^2$). Despite good suitability, no Eel were recorded (although these would likely be confined to deep holding pools in daylight hours).

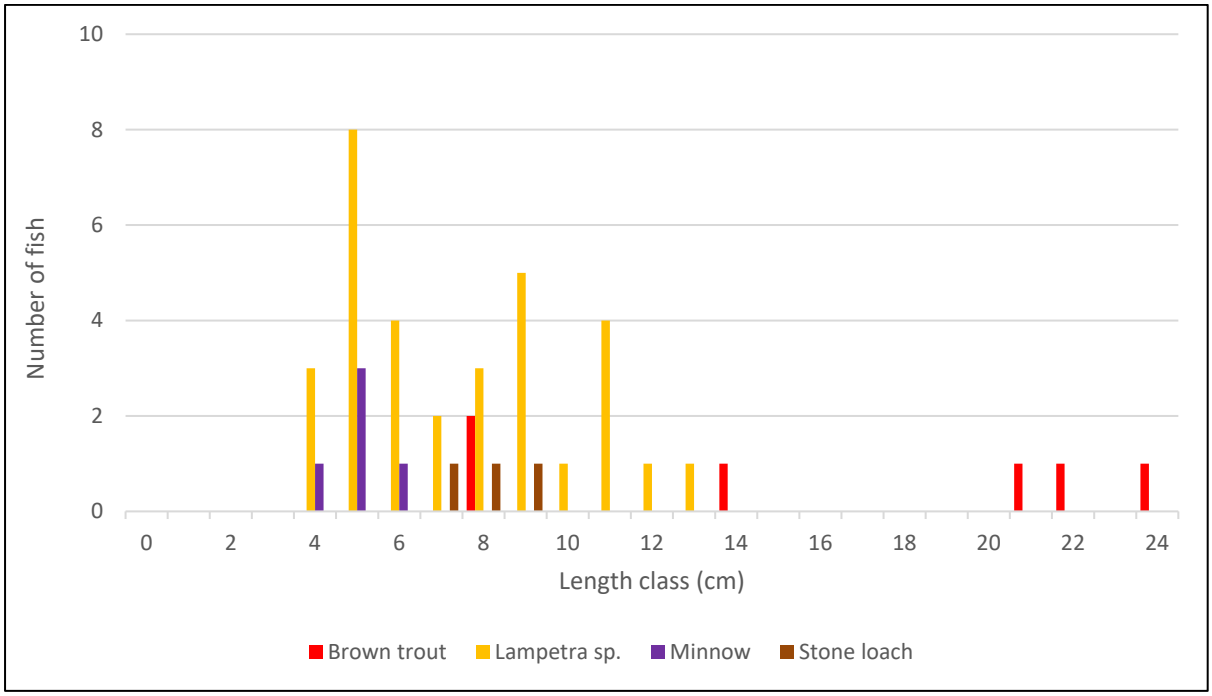


**Figure 3.17 Length frequency distribution recorded via electro-fishing at site B17 on the River Blackwater, August 2023**

**Plate 3.30 Stone loach and brown trout recorded at site B17 on the River Blackwater, August 2023**

3.1.29 Site C1 – Oatfield River, Oatfield

Brown trout (*n*=2) was the only fish species recorded via electro-fishing at site C1 (**Figure 3.18**).

The site was of relatively poor salmonid and Eel value given the shallow nature, compacted/bedrock bed and presence of natural instream barriers downstream (which restricted fish passage). However, a low number of adult trout were present. The upland site was unsuitable for lamprey.

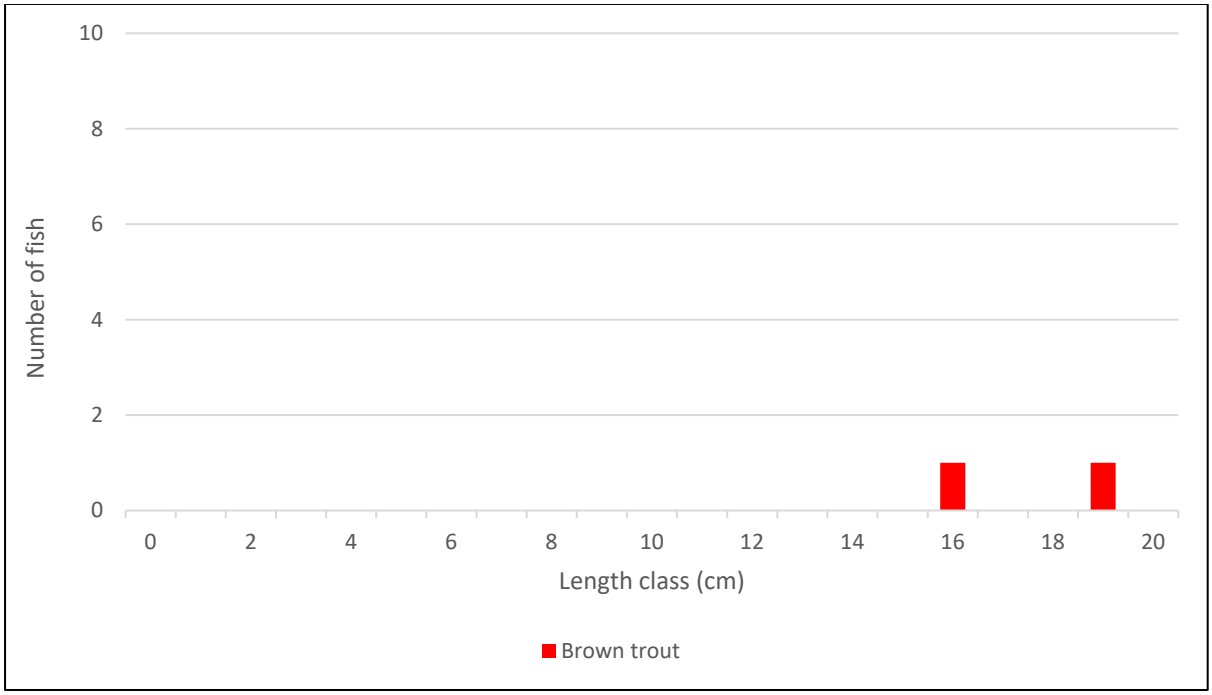

**Figure 3.18 Length frequency distribution recorded via electro-fishing at site C1 on the Oatfield River, August 2023**

**Plate 3.31 Adult brown trout recorded at site C1 on the Oatfield River, August 2023**

3.1.30 Site C2 – River Blackwater, Ballycar North

Brown trout (*n*=20) was the only fish species recorded via electro-fishing at site C2 (**Figure 3.19**).

The site was of good value as a salmonid nursery, supporting a relatively high density of juveniles. However, the shallow nature of the site did not provide optimal conditions for adult salmonids, with a paucity of pool and deeper glide. The site was also of poor suitability for Eel due to these characteristics (i.e. shallow, few refugia). Some good quality salmonid spawning habitat was present although this was compromised by siltation. Whilst there was limited lamprey spawning habitat, the high energy site was unsuitable as a lamprey nursery.

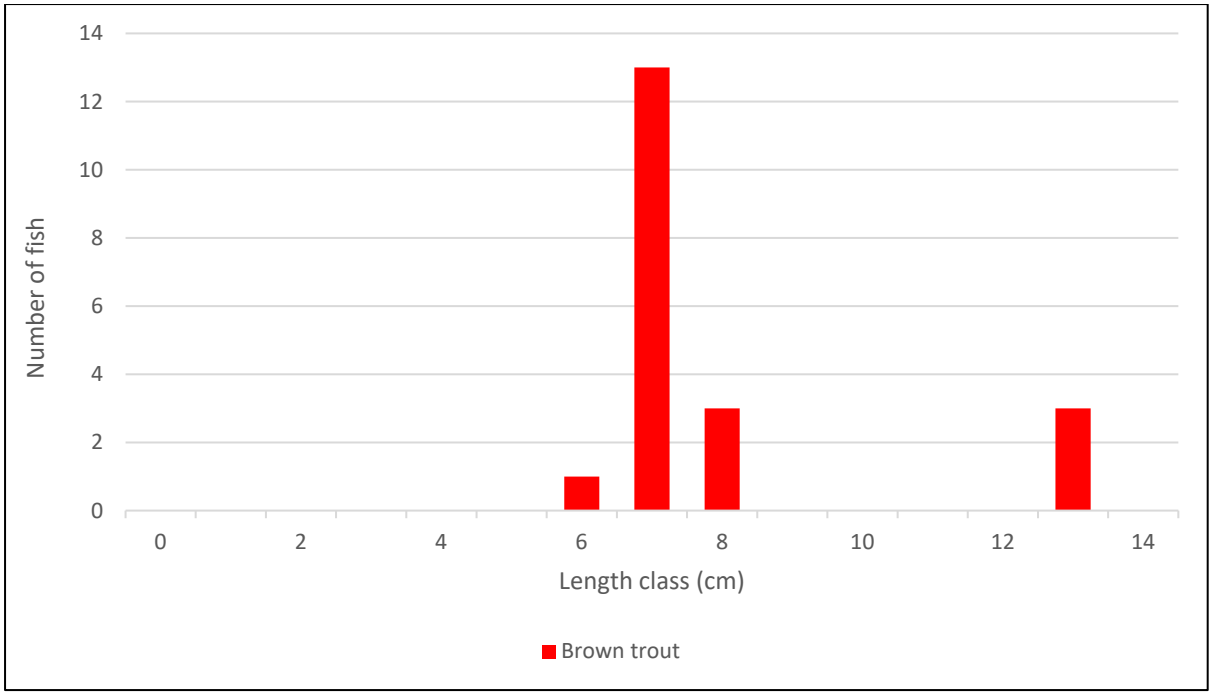


**Figure 3.19 Length frequency distribution recorded via electro-fishing at site C2 on the Oatfield River, August 2023**

**Plate 3.32 Representative image of site C2 on the River Blackwater, August 2023**

3.1.31 Site C3 – North Ballycannan Stream, South Ballycar

No fish were recorded via electro-fishing at site C3. The diminutive site was not of fisheries value given its very shallow (likely ephemeral) nature, location in the upper reaches of the catchment and connectivity issue with downstream habitats.

**Plate 3.33 Representative image of site C3 on the North Ballycannan Stream, August 2023**

3.1.32 Site C4 – North Ballycannan Stream, South Ballycar

No fish were recorded via electro-fishing at site C4. The diminutive site was not of fisheries value given its very shallow nature, location in the upper reaches of the catchment and connectivity issue with downstream habitats.

**Plate 3.34 Representative image of site C4 on the North Ballycannan Stream, August 2023**

3.1.33 Site C5 – South Ballycar River, Castlebank

Brown trout (*n*=5) was the only fish species recorded via electro-fishing at site C5 (**Figure 3.20**).

The site was of moderate value for salmonids, supporting a small population of adult trout. Despite some good suitability as a nursery habitat, no juveniles were recorded. Frequent small pools and overhanging vegetation provided valuable thermal refugia and holding areas for salmonids and Eel alike (the latter not recorded, likely due to downstream barriers; pers. obs.). The site was of poor value as a spawning habitat for salmonids and lamprey given the predominance of larger substrata (although some localised areas were present). The site was unsuitable as a lamprey nursery given the higher energy nature and shallow, sand-dominated soft sediments.

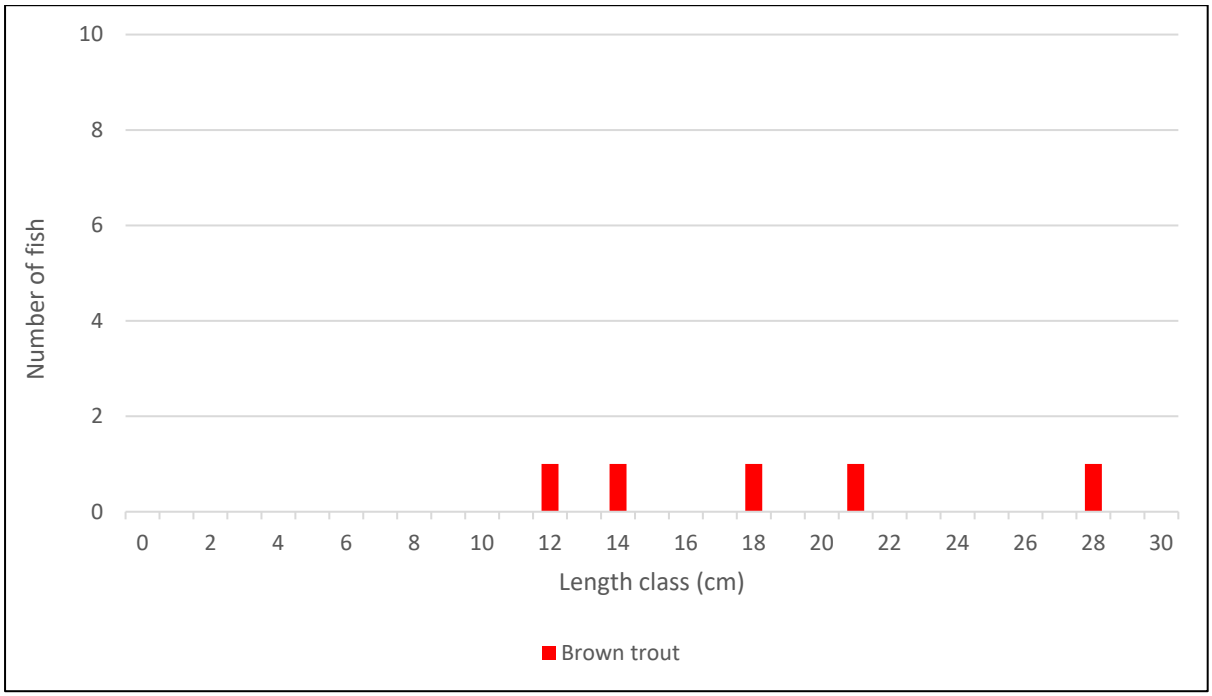


**Figure 3.20 Length frequency distribution recorded via electro-fishing at site C5 on the South Ballycar River, August 2023**

**Plate 3.35 Adult brown trout recorded at site C5 on the South Ballycar River, August 2023**

3.1.34 Site C6 – West Roo Stream, Castlebank

Despite some good physical suitability for salmonids in terms of spawning and nursery habitat, and some suitability for Eel, no fish were recorded via electro-fishing at site C6. This likely reflected known downstream water abstraction pressures and barriers to fish passage (pers. obs.). Both brown trout and *Lampetra* sp. were detected in the lower reaches of this watercourse via eDNA in May 2023 (Triturus 2023 data). However, the site was unsuitable for lamprey given the eroding/high energy nature and frequent natural cascades which would limit local movements of the species.

**Plate 3.36 Representative image of site C6 on the West Roo Stream, August 2023**

3.1.35 **Site D1 – unnamed stream, Oatfield**

Despite some physical suitability for salmonids and less so Eel, no fish were recorded via electro-fishing at site D1. However, a very low density of brown trout were recorded at the site in 2017 (Triturus 2017 data). The small shallow stream provided some suitability in terms of salmonid spawning habitat although siltation and historical modifications had reduced the value overall.

**Plate 3.37 Representative image of site D1 on an unnamed Oatfield River tributary, August 2023**

3.1.36 Site D2 – Coolycasey Stream, Cloghoolia

Eel (*n*=1) was the only fish species recorded via electro-fishing at site D2 (**Figure 3.21**).

However, the site was of poor fisheries value (including for salmonids) given its shallow nature, poor hydromorphology and poor connectivity with downstream habitats.

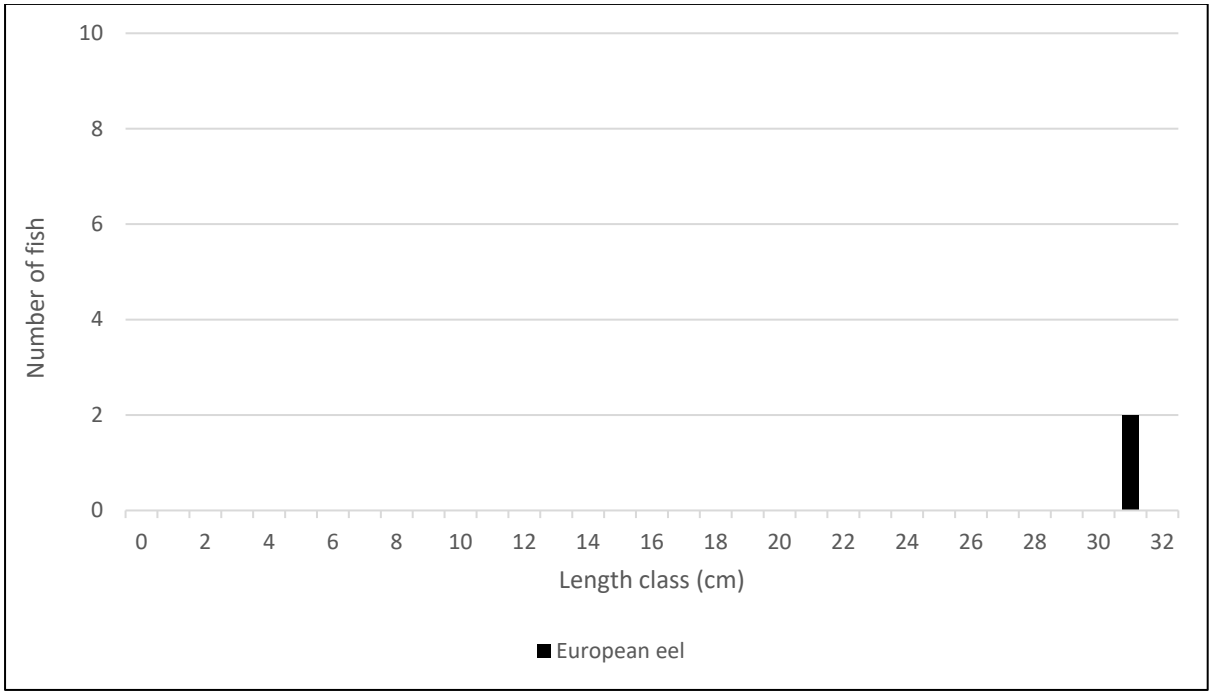


**Figure 3.21 Length frequency distribution recorded via electro-fishing at site D2 on the Coolycasey Stream, August 2023**

**Plate 3.38 Adult Eel recorded at site D2 on the Coolycasey Stream, August 2023**

3.1.37 Site D3 – Corlea Stream, Collycasey

Brown trout was the only fish species recorded via electro-fishing at site D3 (**Figure 3.22**).

However, despite supporting a low density of small adult trout (*n*=2), the site was of relatively poor salmonid value given the diminutive nature of the stream, shallow nature and evident siltation pressures. The site was of poor suitability for Eel given a paucity of deeper areas and instream refugia (the species was historically present (Triturus 2017 data) and was recorded downstream at site D4 in this survey). Despite some suitability as a lamprey spawning and nursery habitat, none were recorded.

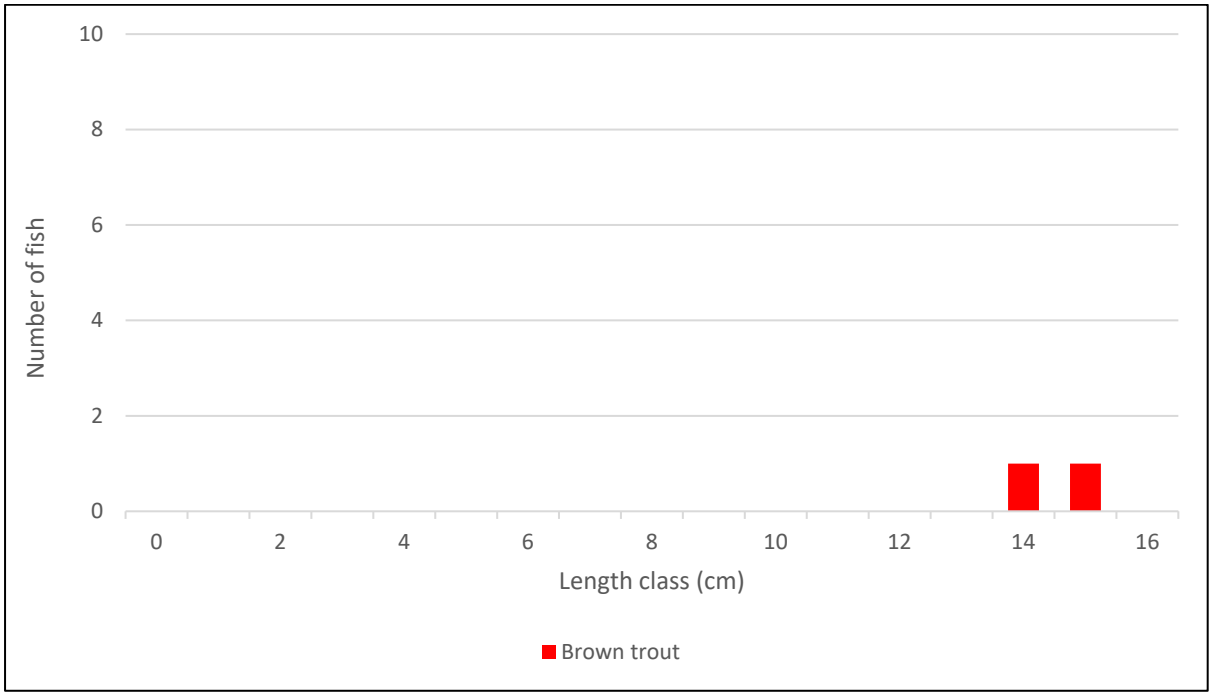

**Figure 3.22 Length frequency distribution recorded via electro-fishing at site D3 on the Corlea Stream, August 2023**

**Plate 3.39 Brown trout recorded at site D3 on the Corlea Stream, August 2023**

3.1.38 Site D4 – Corlea Stream, Coolycasey

Brown trout (*n*=1) and Eel (*n*=1) were recorded via electro-fishing at site D4 (**Figure 3.23**). However, despite supporting a low density of adult trout, the site was of relatively poor salmonid value given the diminutive nature of the stream, shallow nature and evident siltation pressures. The site was also of poor suitability for Eel given a paucity of deeper areas and instream refugia with only a single eel recorded. Despite some suitability as a lamprey spawning and nursery habitat, none were recorded.

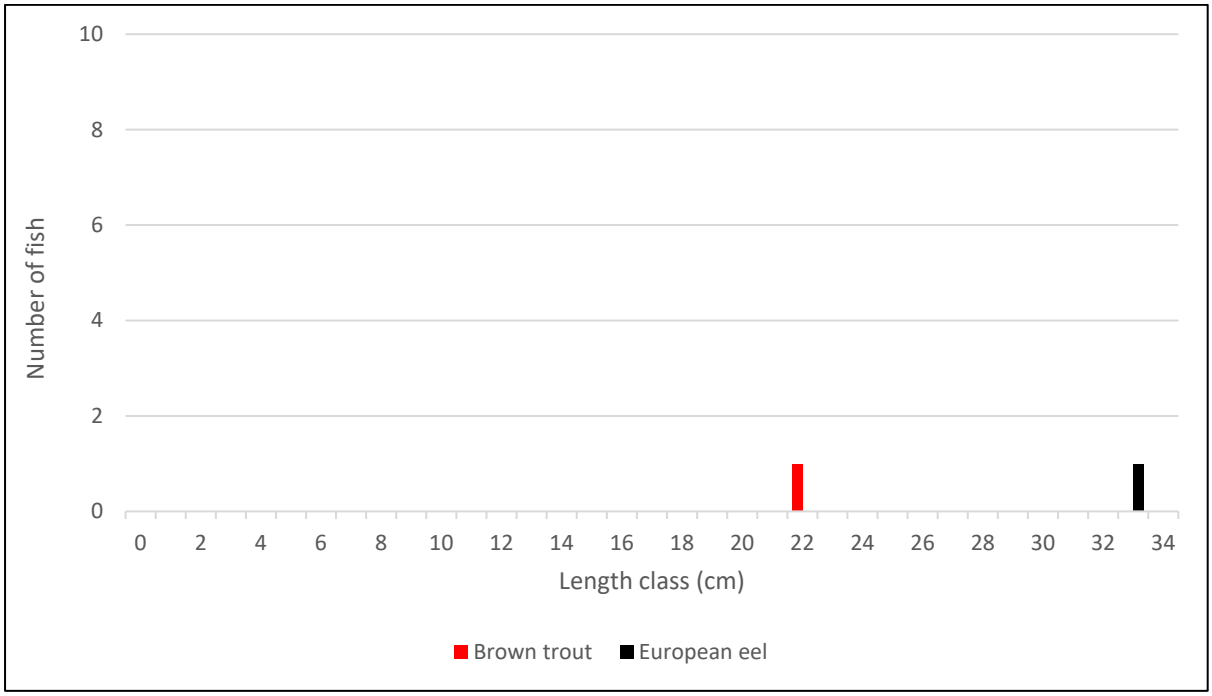

**Figure 3.23 Length frequency distribution recorded via electro-fishing at site D4 on the Corlea Stream, August 2023**

**Plate 3.40 Representative image of site D4 on the Corlea Stream, August 2023**

3.1.39 Site D5 – Gourna River, Coolycasey Bridge

Despite some physical suitability for salmonids and less so Eel, no fish were recorded via electro-fishing at site D5. However, Eel and three-spined stickleback were recorded historically from the site (Triturus 2017 data). The small shallow river provided some suitability in terms of salmonid spawning habitat (abundant gravels) and nursery areas. There were indications that the river at this location suffered from intermittent flows and this likely deterred resident fish. The upland eroding stream was unsuitable for lamprey.

**Plate 3.41 Representative image of site D5 on the upper reaches of the Gourna River at Coolycasey Bridge, August 2023**

3.1.40 Site D6 – Gourna River, Carrrowmore

Salmon (*n*=39), brown trout (*n*=27) and Eel (*n*=12) were recorded via electro-fishing at site D6 (**Figure 3.24**).

The site was of very high value for salmonids, supporting high densities of both Salmon parr and mixed cohort brown trout. Given the abundance of boulder and cobble refugia, the site was of excellent salmonid nursery value. These features also provided high quality Eel habitat, with a relatively high density recorded. Localised deeper pools and scours provided some moderate quality holding habitat for adult salmonids. Whilst some salmonid spawning habitat was present, this was limited in extent and superior in upstream riffle areas. The spate river was unsuitable for lamprey at this location, with only shallow compacted sand accumulations present (not suitable for ammocoetes).

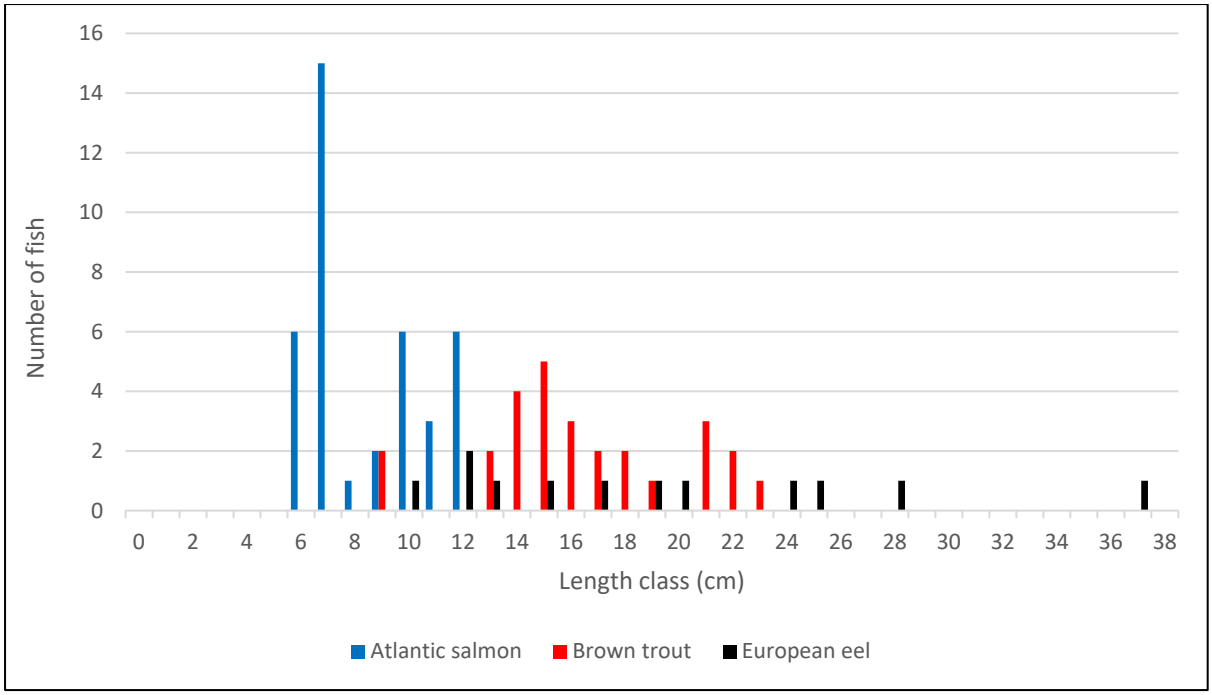


**Figure 3.24 Length frequency distribution recorded via electro-fishing at site D6 on the Gourna River, August 2023**

**Plate 3.42 Brown trout, Salmon parr (middle) & juvenile Eel recorded at site D6 on the Gourna River, August 2023**

3.1.41 Site D7 – Fortwilliam River, Clogga

No fish were recorded via electro-fishing at site D7. The upland stream was not of fisheries value at this location given naturally high gradients, the location of the site at the headwaters of the stream and poor connectivity with downstream habitats.

**Plate 3.43 Representative image of site D7 on the Fortwilliam River, August 2023**

3.1.42 Site D8 – Reaskcamoge Stream, Clogga

No fish were recorded via electro-fishing at site D8. The upland stream was not of fisheries value at this location given naturally high gradients, frequent barriers to fish passage, the location of the site at the headwaters of the stream and poor connectivity with downstream habitats.

**Plate 3.44 Representative image of site D8 on the Reaskcamoge Stream, August 2023**

3.1.43 Site D9 – Island River, Ballynbroughran

No fish were recorded via electro-fishing at site D9. The upland stream was not of fisheries value given naturally high gradients, frequent natural instream barriers, the location of the site at the headwaters of the stream and poor connectivity with downstream habitats.

**Plate 3.45 Representative image of site D9 on the upper reaches of the Island River, August 2023**

3.1.44 Site D10 – Island River, Ballynbroughran

Despite some physical suitability for salmonids, and low suitability for Eel, no fish were recorded via electro-fishing at site D10. This was reflective of the shallow nature of the river at this location and extensive historical modifications.

**Plate 3.46 Representative image of site D10 on the Island River, August 2023**

3.1.45 Site D11 – Island River, Ballynbroughran

Despite some physical suitability for salmonids, and low suitability for Eel, no fish were recorded via electro-fishing at site D11. This was reflective of the shallow nature of the river at this location, extensive historical modifications and instream barriers (e.g. perched culverts).

**Plate 3.47 Representative image of site D11 on the Island River, August 2023**

3.1.46 Site D12 – Carrownerribul Stream, Carrowmore

No fish were recorded via electro-fishing at site D12. The shallow, likely ephemeral site was not of fisheries value given its very shallow nature and poor connectivity with downstream habitats.

**Plate 3.48 Representative image of site D12 on the Carrownerribul Stream, August 2023**

3.1.47 Site D13 – Ballintlea South Stream, Ballintlea South

No fish were recorded via electro-fishing at site D13. Whilst some physical suitability was present for salmonids and less so Eel and *Lampetra* sp., the small stream (possibly ephemeral at this location), was considered too shallow to support resident fish. Frequent instream barriers such as road culverts also reduced the fisheries value.

**Plate 3.49 Representative image of site D13 on the Ballintlea South Stream, August 2023**

3.1.48 Site D14 – Ballintlea South Stream, Ballinphunt

No fish were recorded via electro-fishing at site D14. Whilst some physical suitability was present for salmonids and less so Eel and *Lampetra* sp., the small stream was considered too shallow to support resident fish. Frequent instream barriers such as road culverts also reduced the fisheries value.

Plate 3.50 Representative image of site D14 on the Ballintlea South Stream, August 2023

3.1.49 Site D15 – Island River, Ballinphunt

Brown trout (*n*=8) and Eel (*n*=2) were the only fish species recorded via electro-fishing at site D15 (**Figure 3.24**).

The site was of moderate value for salmonids, supporting a small, mixed cohort brown trout population. Whilst spawning habitat was present for both salmonid and lamprey, the quality was reduced by siltation pressures. Bedded refugia and an absence of instream macrophyte beds reduced the quality of salmonid nursery and Eel habitat (albeit the latter was recorded in low numbers). The site was of poor value for adult salmonids given the paucity of pool areas. Soft sediment accumulations were clay-dominated and unsuitable for lamprey ammocoetes (none recorded).

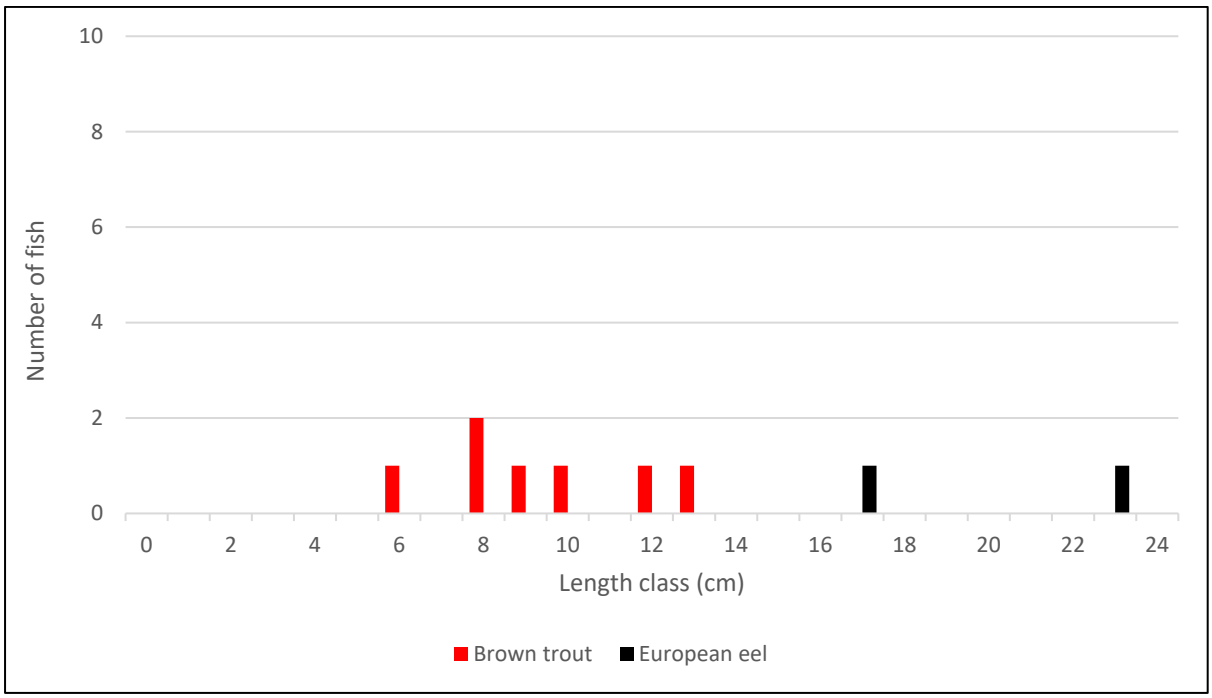


**Figure 3.24 Length frequency distribution recorded via electro-fishing at D15 on the Island River, September 2023**

**Plate 3.51 Representative image of site D15 on the Island River, September 2023**

3.1.50 Site D16 – Island River, Ballinphunt

Brown trout (*n*=2), Eel (*n*=4), three-spined stickleback (*n*=4), flounder (*Platichthys flesus*) (*n*=6) and lamprey (*Lampetra* sp.) (*n*=1) were recorded via electro-fishing at site D16 (**Figure 3.25**). The semi-tidal site was of highest value as a Eel and flounder nursery but also supported a low density of brown trout. Salmonid spawning habitat was not present although the site was of some low value as a nursery. The sluice valve was a significant barrier to upstream fish passage (especially for salmonids). Clay-dominated silt beds and marginal banks supported a low density of burrowing *Lampetra* sp. ammocoetes and Eel elvers.

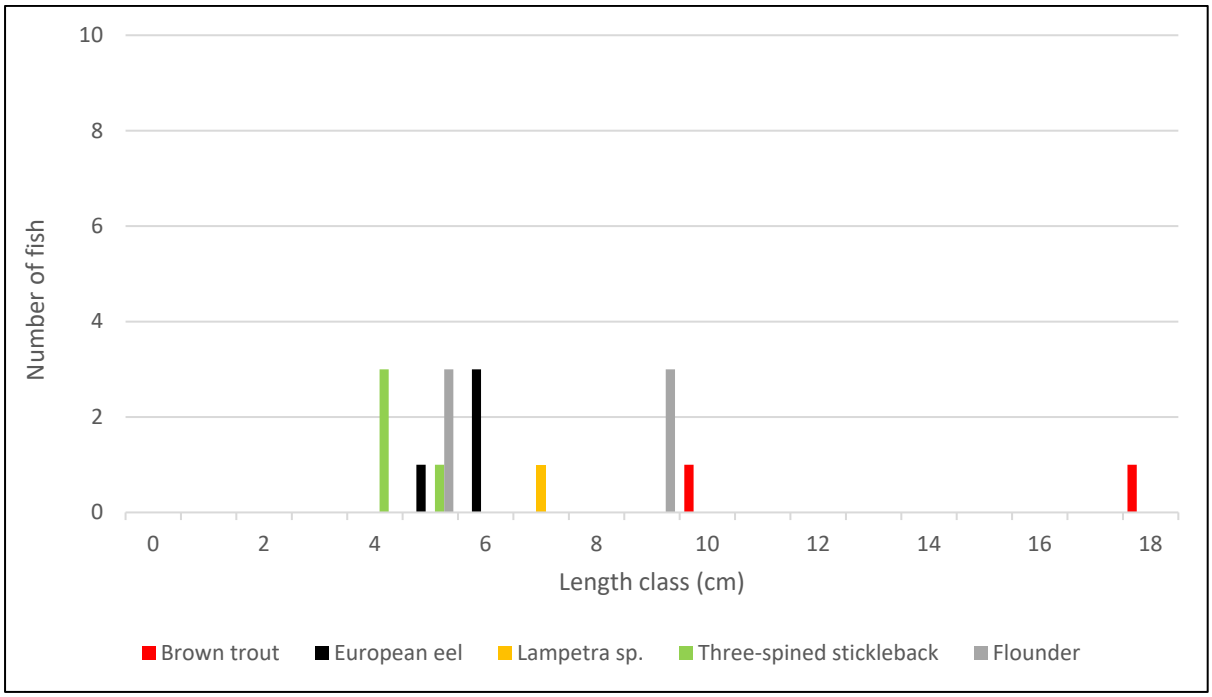

**Figure 3.25 Length frequency distribution recorded via electro-fishing at D16 on the Island River, August 2023**


**Plate 3.52 *Lampetra* sp., Eel, three-spined stickleback, flounder and brown trout recorded at site D16 on the Island River, August 2023**

3.1.51 Site D17 – Owenogarney River, D'Esterre's Bridge

Electro-fishing was not undertaken at site D17 due to prohibitive depths and flow rates. However, the tidal reaches of the Owenogarney River are known to support Salmon, brown trout and Eel, in addition to sea lamprey (*Petromyzon marinus*) and invasive dace. Littoral mud banks provided some low suitability for lamprey (*Lampetra* spp. & *Petromyzon marinus*) ammocoetes and burrowing elvers (albeit clay dominated and sub-optimal substrata).

**Plate 3.53** Representative image of site D17 on the Owenogarney River at D'Esterre's Bridge, August 2023

3.1.52 Site D18 – unnamed stream, Rossmanagher

No fish were recorded via electro-fishing at site D18. The heavily modified channel unsuitable for resident at this location fish given its shallow, stagnant nature, heavy siltation and connectivity issues with downstream habitats.

**Plate 3.54 Representative image of site D18 on an unnamed Owenogarney River tributary, August 2023**

3.1.53 Site D19 – Rossmanagher Stream, Newpark

Three-spined stickleback (*n*=6) were the only fish species recorded via electro-fishing at site D19 (**Figure 3.26**).

With the exception of low densities of stickleback, the site was not of fisheries value given its heavily modified, shallow, stagnant nature, heavy siltation and connectivity issues with downstream habitats.

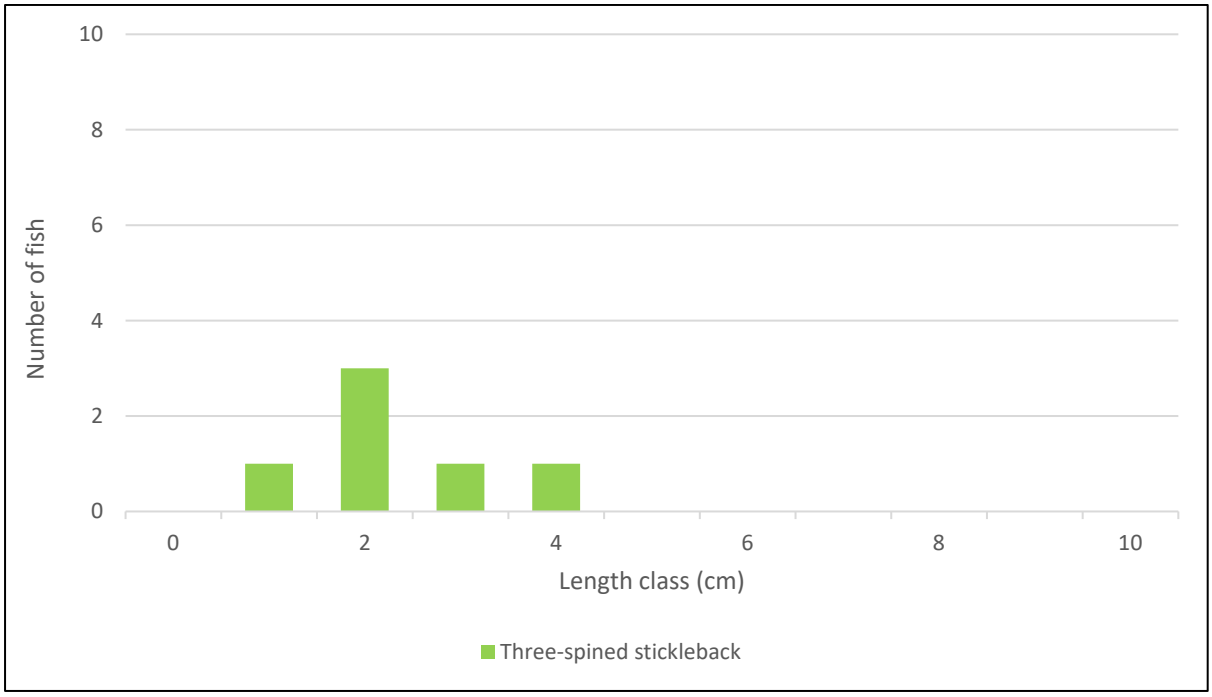


**Figure 3.26 Length frequency distribution recorded via electro-fishing at site D19 on the Rossmanagher Stream, August 2023**

**Plate 3.55 Representative image of site D19 on the Rossmanagher Stream, August 2023**

3.1.54 Site D20 – Clovemill Stream, Cloghlea

Salmon (*n*=12), brown trout (*n*=7) and Eel (*n*=1) were recorded via electro-fishing at site D20 (**Figure 3.27**).

The site was of very high value for salmonids, providing excellent quality nursery for both Salmon and brown trout (e.g. cobble/boulder zones with localised macrophyte beds). Holding habitat was limited given the generally shallow depth of the site although overhanging marginal vegetation and instream woody debris provided valuable areas for adult salmonids. Suitable spawning habitat for both salmonids and lamprey was present locally albeit impacted by siltation. Despite some good suitability as a lamprey nursery (soft sediment beds along margins), no ammocoetes were recorded. Suitability for Eel was good with a low density present.

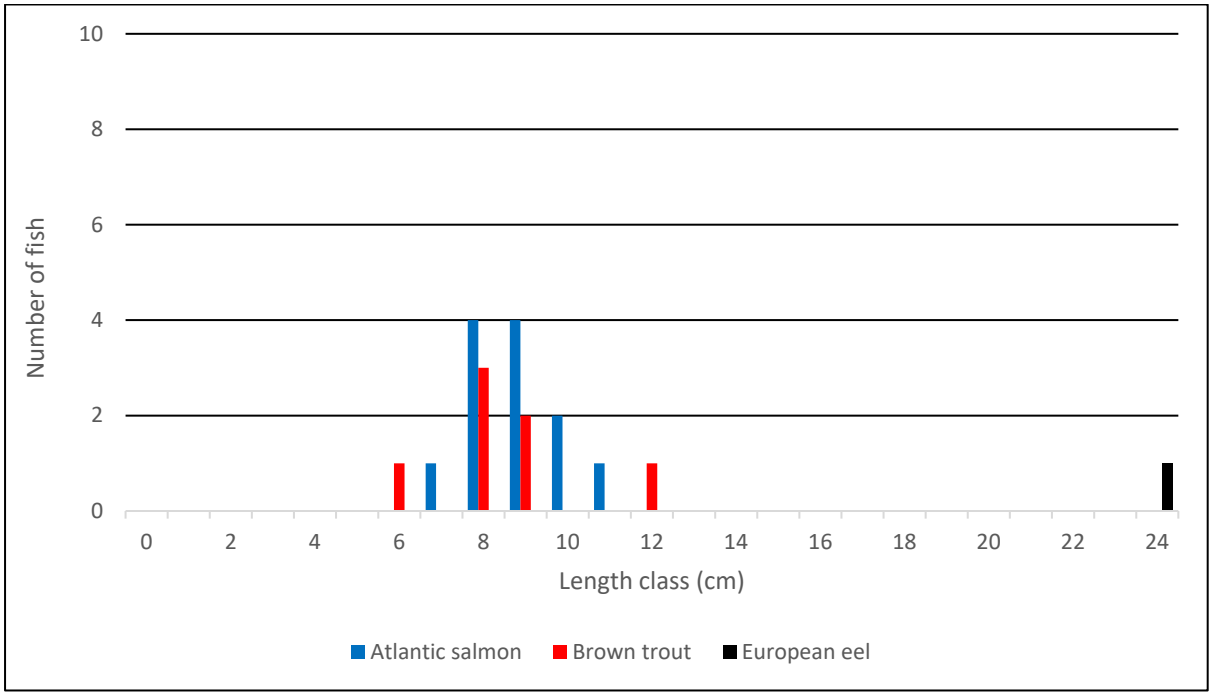


**Figure 3.27 Length frequency distribution recorded via electro-fishing at site D20 on the Clovemill Stream, August 2023**

**Plate 3.56 Juvenile brown trout and Salmon (bottom) recorded at site D20 on the Clovemill Stream, August 2023**

3.1.55 Site D21 – Ballycasey Beg Stream, Firgrive

Brown trout (*n*=3) and three-spined stickleback (*n*=7) were the only fish species recorded via electro-fishing at site D21 (**Figure 3.28**).

The site was of low value for salmonids, supporting only a low density of brown trout. This reflected significant hydromorphological modifications and siltation pressures. Natural calcification and siltation resulted in the presence of poor quality spawning habitat for salmonids or lamprey. Whilst of some low value as a salmonid nursery, the stream at this location was not of value for adult salmonids given an absence of suitable holding habitat in addition to multiple instream barriers. Soft sediment accumulations were typically shallow and unsuitable for lamprey ammocoetes. There was poor suitability for Eel given a paucity of suitable instream refugia (none recorded).


**Figure 3.28 Length frequency distribution recorded via electro-fishing at D21 on the Ballycasey Beg Stream, September 2023**

**Plate 3.57 Representative image of site D21 on the Ballycasey Beg Stream, September 2023**

3.1.56 Site E1 – Clovemill Stream, Cloghlea

Salmon (*n*=20), brown trout (*n*=12) and Eel (*n*=2) were recorded via electro-fishing at site E1 (**Figure 3.29**).

The site was of very high value for salmonids, providing excellent quality nursery habitat for both Salmon and brown trout (e.g. cobble/boulder zones with occasional macrophyte

beds). Holding habitat was limited given the generally shallow depth of the site although banks scours, submerged tree roots and instream woody debris provided valuable areas for adult salmonids. Suitable spawning habitat for both salmonids and lamprey was present locally albeit impacted by siltation. Suitability as a lamprey nursery was low due to the flocculent nature of the soft sediment deposits (no ammocoetes recorded). Suitability for Eel was good with a low density present.

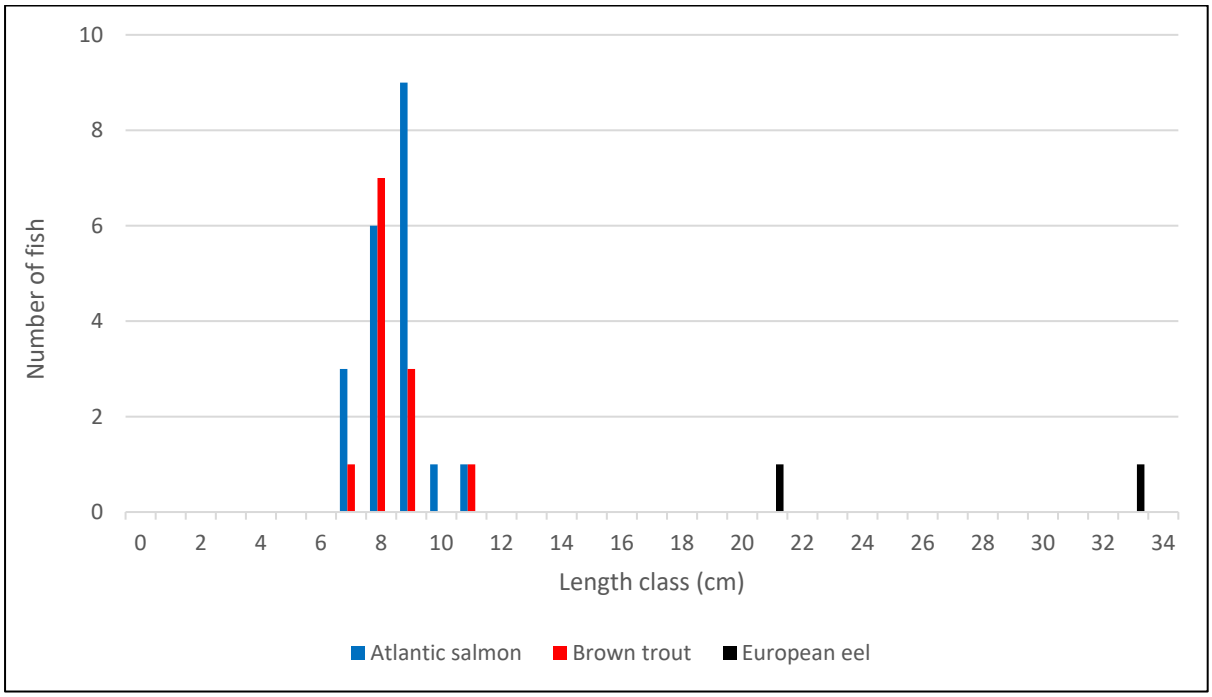


**Figure 3.29 Length frequency distribution recorded via electro-fishing at site E1 on the Clovemill Stream, August 2023**

**Plate 3.58 Juvenile brown trout and Salmon recorded at site E1 on the Clovemill Stream, August 2023**

**Table 3.1** Fish species densities per $m^2$ recorded at sites in the vicinity of the proposed Oatfield wind farm via electro-fishing in August-September 2023 (values in **bold** represent the highest densities recorded for each species, respectively)

| Site | Watercourse | CPUE (elapsed time) | Approx. area fished ($m^2$) | Salmon | Brown trout | *Lampetra* sp. | Eel | Stone loach | Gudgeon | Minnow | Roach | Three-spined stickleback | Flounder |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | Rocks Stream | 5 | 20 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| A2 | Gortagonnella River | 10 | 130 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| A3 | Gortagonnella River | 10 | 300 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| A4 | Broadford River | 10 | 165 | 0.018 | 0.036 | 0.000 | 0.006 | 0.000 | **0.048** | 0.000 | **0.188** | 0.000 | 0.000 |
| A5 | Snaty Stream | 5 | 40 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| A6 | Clashduff Stream | 5 | 30 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| A7 | Clashduff Stream | 10 | 180 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| A8 | Gortadroma Stream | 5 | 70 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| A9 | Belvoir Stream | 10 | 120 | 0.000 | 0.050 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| A10 | Ballyvorgal North Stream | 5 | 35 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| A11 | Owenogarney River | 10 | 200 | 0.065 | 0.005 | 0.000 | **0.045** | 0.000 | 0.030 | 0.000 | 0.135 | 0.000 | 0.005 |
| B1 | Oatfield River | 5 | 50 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| B2 | Oatfield River | 5 | 80 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.063 | 0.000 |
| B3 | Snaty Stream | 5 | 25 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| B4 | Snaty Stream | 10 | 100 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Site | Watercourse | CPUE (elapsed time) | Approx. area fished ($m^2$) | Salmon | Brown trout | *Lampetra* sp. | Eel | Stone loach | Gudgeon | Minnow | Roach | Three-spined stickleback | Flounder |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B5 | Unnamed stream | 5 | 45 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| B6 | Snaty Stream | 10 | 200 | 0.010 | 0.090 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| B7 | West Cloontra Stream | 5 | 45 | 0.044 | 0.111 | 1.0 per $m^2$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| B8 | O'Neill's Stream | 5 | 35 | 0.000 | 0.000 | 0.5 per $m^2$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | **0.257** | 0.000 |
| B9 | Knockshanvo Stream | 10 | 140 | 0.000 | 0.157 | 0.007 | 0.000 | 0.064 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| B10 | O'Neill's Stream | 10 | 160 | 0.000 | 0.113 | 0.000 | 0.000 | **0.075** | 0.000 | **0.050** | 0.000 | 0.044 | 0.000 |
| B11 | Mountrice River | 10 | 150 | 0.000 | 0.053 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| B12 | Mountrice River | 10 | 160 | 0.000 | **0.275** | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| B13 | East Cloontra Stream | 5 | 45 | 0.000 | 0.067 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| B14 | Mountrice Stream | 5 | 40 | 0.000 | 0.075 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| B15 | Mountrice River | 10 | 195 | 0.015 | 0.108 | 0.000 | 0.000 | 0.031 | 0.000 | 0.015 | 0.000 | 0.000 | 0.000 |
| B16 | River (Clare) Blackwater | 10 | 350 | 0.011 | 0.100 | 8.6 per $m^2$ | 0.000 | 0.057 | 0.000 | 0.000 | 0.000 | 0.011 | 0.000 |
| B17 | River (Clare) Blackwater | 10 | 300 | 0.000 | 0.043 | **12.8 per $m^2$** | 0.000 | 0.010 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 |
| C1 | Oatfield River | 5 | 125 | 0.000 | 0.016 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| C2 | River (Clare) Blackwater | 10 | 195 | 0.000 | 0.103 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| C3 | North Ballycannan Stream | 5 | 20 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Site | Watercourse | CPUE (elapsed time) | Approx. area fished ($m^2$) | Salmon | Brown trout | *Lampetra* sp. | Eel | Stone loach | Gudgeon | Minnow | Roach | Three-spined stickleback | Flounder |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C4 | North Ballycannan Stream | 5 | 25 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| C5 | Ballycar South River | 10 | 200 | 0.000 | 0.025 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| C6 | West Roo Stream | 10 | 150 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D1 | Unnamed stream | 10 | 150 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D2 | Coolycasey Stream | 5 | 45 | 0.000 | 0.000 | 0.000 | 0.022 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D3 | Corlea Stream | 5 | 50 | 0.000 | 0.040 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D4 | Corlea Stream | 10 | 130 | 0.000 | 0.008 | 0.000 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D5 | Gourna River | 10 | 120 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D6 | Gourna River | 10 | 270 | **0.144** | 0.100 | 0.000 | 0.044 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D7 | Fortwilliam Stream | 5 | 40 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D8 | Reaskcamoge Stream | 10 | 150 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D9 | Island River | 5 | 40 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D10 | Island River | 5 | 60 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D11 | Island River | 5 | 50 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D12 | Carrownerribul Stream | 5 | 30 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D13 | Ballintlea South Stream | 5 | 120 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

| Site | Watercourse | CPUE (elapsed time) | Approx. area fished ($m^2$) | Salmon | Brown trout | *Lampetra* sp. | Eel | Stone loach | Gudgeon | Minnow | Roach | Three-spined stickleback | Flounder |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D14 | Ballintlea South Stream | 5 | 50 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D15 | Island River | 5 | 80 | 0.000 | 0.100 | 0.000 | 0.025 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D16 | Island River | 10 | 170 | 0.000 | 0.012 | 0.006 | 0.024 | 0.000 | 0.000 | 0.000 | 0.000 | 0.024 | **0.035** |
| D17 | Owenogarney River | n/a | Too deep | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D18 | Unnamed stream | 5 | 20 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D19 | Rossmanagher Stream | 5 | 35 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.171 | 0.000 |
| D20 | Clovemill Stream | 10 | 150 | 0.080 | 0.053 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| D21 | Ballycasey Beg Stream | 10 | 180 | 0.000 | 0.017 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.039 | 0.000 |
| E1 | Clovemill Stream | 10 | 280 | 0.071 | 0.043 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

**Table 3.2** Relative abundance of fish species of higher conservation value recorded via electro-fishing per survey site in the vicinity of the proposed Oatfield wind farm, August-September 2023

| Site | Watercourse | Salmon | Brown trout | *Lampetra* sp. | Eel | Other species |
|---|---|---|---|---|---|---|
| A1 | Rocks Stream | No fish recorded | | | | |
| A2 | Gortacullin Stream | No fish recorded | | | | |
| A3 | Gortagonnella River | No fish recorded | | | | |
| A4 | Broadford River | Low | Low | | Low | Gudgeon, roach |
| A5 | Snaty Stream | No fish recorded | | | | |
| A6 | Clashduff Stream | No fish recorded | | | | |
| A7 | Clashduff Stream | **High** | Low | | | |
| A8 | Gortadroma Stream | No fish recorded | | | | |
| A9 | Belvoir Stream | | Low | | | |
| A10 | Ballyvorgal North Stream | No fish recorded | | | | |
| A11 | Owenogarney River | **High** | Low | | Medium | Dace, roach, gudgeon, flounder |
| B1 | Oatfield River | No fish recorded | | | | |
| B2 | Oatfield River | No fish recorded | | | | |
| B3 | Snaty Stream | No fish recorded | | | | |
| B4 | Snaty Stream | No fish recorded | | | | |
| B5 | Unnamed stream | No fish recorded | | | | |
| B6 | Snaty Stream | Low | Medium | | | |
| B7 | West Cloontra Stream | Low | Low | Low | | |
| B8 | O'Neill's Stream | | | Low | | Three-spined stickleback |
| B9 | Knockshanvo Stream | | High | Low | | Stone loach |
| B10 | O'Neill's Stream | | Medium | | | Minnow, stone loach, three-spined stickleback |
| B11 | Mountrice River | | Low | | | |
| B12 | Mountrice River | | **High** | | Low | |
| B13 | East Cloontra Stream | | Low | | | |
| B14 | Mountrice Stream | | Low | | | |
| B15 | Mountrice River | Low | Medium | | | Minnow, stone loach |
| B16 | River (Clare) Blackwater | Low | High | **High** | | Stone loach, three-spined stickleback |

| Site | Watercourse | Salmon | Brown trout | *Lampetra* sp. | Eel | Other species |
|---|---|---|---|---|---|---|
| B17 | River (Clare) Blackwater | | Low | **Very high** | | Minnow, stone loach |
| C1 | Oatfield River | | Low | | | |
| C2 | River (Clare) Blackwater | | Medium | | | |
| C3 | North Ballycannan Stream | No fish recorded | | | | |
| C4 | North Ballycannan Stream | No fish recorded | | | | |
| C5 | South Ballycar River | | Low | | | |
| C6 | West Roo Stream | No fish recorded | | | | |
| D1 | Unnamed stream | No fish recorded | | | | |
| D2 | Coolycasey Stream | | | | Low | |
| D3 | Corlea Stream | | Low | | | |
| D4 | Corlea Stream | | Low | | Low | |
| D5 | Gourna River | No fish recorded | | | | |
| D6 | Gourna River | **Very high** | **High** | | **High** | |
| D7 | Fortwilliam River | No fish recorded | | | | |
| D8 | Reaskcamoge Stream | No fish recorded | | | | |
| D9 | Island River | No fish recorded | | | | |
| D10 | Island River | | | | | |
| D11 | Island River | No fish recorded | | | | |
| D12 | Carrownerribul Stream | No fish recorded | | | | |
| D13 | Ballintlea South Stream | No fish recorded | | | | |
| D14 | Ballintlea South Stream | No fish recorded | | | | |

| Site | Watercourse | Salmon | Brown trout | *Lampetra* sp. | Eel | Other species |
|---|---|---|---|---|---|---|
| D15 | Island River | | Low | | Low | |
| D16 | Island River | | Low | Low | Low | Flounder, three-spined stickleback |
| D17 | Owenogarney River | Electro-fishing not undertaken (too deep) | | | | |
| D18 | Unnamed stream | No fish recorded | | | | |
| D19 | Rossmanagher Stream | | | | | Three-spined stickleback |
| D20 | Clovemill Stream | Medium | Low | | Low | |
| D21 | Ballycasey Beg Stream | | Low | | | Three-spined stickleback |
| E1 | Clovemill Stream | **High** | Medium | | Low | |

**Conservation value:** Salmon (*Salmo salar*), sea lamprey (*Petromyzon marinus*), brook lamprey (L*ampetra planeri*) and river lamprey (*Lampetra fluviatilis*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Salmon and river lamprey are also listed under Annex V of the Habitats Directive [92/42/EEC]. 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.

# 4. Discussion

The majority of surveyed watercourses in the vicinity of the Proposed Development (inclusive of potential GCRs) were small upland eroding spate or small lowland channels which had been historically modified (straightened and or deepened) and suffered from evident water quality pressures (chiefly siltation). Of the 56 no. survey sites, a total of 25 (i.e. A1, A2, A3, A5, A6, A8, A10, B1, B2, B3, B4, B5, C3, C4, C6, D1, D5, D7, D8, D9, D11, D12, D13, D14 & D18) did not support fish at the time of survey due to their diminutive nature, historical modifications, siltation pressures, low/intermittent flows and or high natural gradients and instream barriers which precluded resident fish from the upper reaches of some watercourses (e.g. Rocks Stream, Snaty Stream, Clashduff Stream, O'Neill's River, Mountrice River, Island River).

Nevertheless, salmonid populations were widespread in vicinity of the Proposed Development with Annex II Salmon recorded at a total of 10 no. sites on the Owenogarney River, River Blackwater and associated tributaries (sites A4, A7, A11, B6, B7, B15, B16, D6, D20 & E1). The highest salmon parr densities and highest quality habitats were present at sites on the Clashduff Stream (A7), Owenogarney River (A11), Gourna River (D6) and the Clovemill Stream (E1), located to the south-west of the proposed site (**Table 3.1**). Whilst densities were lower (expected given higher energy/spate characteristics; Amiro, 1993; Richardson, 1993), the River Blackwater and selected tributaries (e.g. Mountrice River) were also of high value as salmon spawning and nursery habitats.

Lamprey ammocoetes (*Lampetra* sp.) were recorded from 6 no. sites on the West Cloontra Stream (B7), O'Neill's Stream (B8), Knockshanvo Stream (B9), River Blackwater (B16 & B17) and Island River (D16). With the exception of site B17 on the lower reaches of the Blackwater (12.8 per $m^2$), densities of ammocoetes were low (<1 per $m^2$) and habitats were sub-optimal for *Lampetra* sp. (**Table 3.1**). Only single examples of *Lampetra* sp. transformers were recorded at sites B9 and D16. *Lampetra* sp. had not been previously recorded on the Knockshanvo Stream or Island River (Triturus data). The restricted distribution in vicinity of the Proposed Development reflected the upland, higher-energy/spate nature of most of the survey watercourses; characteristics which reduce 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 ≥5cm in depth generally required by larval *Lampetra* spp. (Aronsuu & Virkkala, 2014; Goodwin et al., 2008; Gardiner, 2003). No sea lamprey (*Petromyzon marinus*) were recorded during the survey. Both sea and river lamprey (*Lampetra fluviatilis*) are known to spawn on the lower Owengarney River, downstream of Sixmilebridge (Ross, 2017).

Eel were widespread but localised in low densities, being recorded at a total of 10 no. survey sites on the Broadford River (A4), Owenogarney River (A11), Mountrice River (B12), Coolycasey Stream (D2), Corlea Stream (D4), Gourna River, Island River (D15, D16) and Clovemill Stream (D20, E1) (**Table 3.1, 3.2**). Eel are Red-listed in Ireland (King et al., 2011) and are classed as 'critically endangered' on a global scale (Pike et al., 2020). The absence of eel from many physically suitable sites (i.e. ample refugia etc.) primarily reflects the upland nature of the majority of surveyed watercourses, which provide sub-optimal eel habitat (Matondo et al., 2021; Chadwick et al., 2007; Laffaille et

al., 2003), as well as known instream barriers in the wider catchments (e.g., Ardnacrusha hydroelectric dam).

## 5. References


Amiro, P.G. (1993). Habitat measurement and population estimation of juvenile Salmon. In R.J. Gibson and R.E. Cutting [ed.]. Production of juvenile 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).

Armstrong, J. D., Kemp, P. S., Kennedy, G. J. A., Ladle, M., & Milner, N. J. (2003). Habitat requirements of Salmon and brown trout in rivers and streams. Fisheries research, 62(2), 143-170.

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

Brazier, B. (2018). The spread of roach in Ireland (part 1). Off the Scale magazine issue 24, pp.36-42. September 2018. Available online at: https://www.offthescaleangling.ie/the-science-bit/spread-of-roach-ireland-pt1/

Caffrey, J. M., Hayden, B., & Walsh, T. (2007). Dace (*Leuciscus leuciscus* L.): an Invasive Fish Species in Ireland. Central Fisheries Board.

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

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

Chadwick, S., Knights, B., Thorley, J. L., & Bark, A. (2007). A long-term study of population characteristics and downstream migrations of the Eel *Anguilla anguilla* (L.) and the effects of a migration barrier in the Girnock Burn, north-east Scotland. Journal of Fish Biology, 70(5), 1535-1553.

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.

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.

Hendry, K., & Cragg-Hine, D. (1997). Restoration of Riverine Salmon Habitats: A Guidance Manual. Environment Agency.

Hendry, K., Cragg-Hine, D., O'Grady, M., Sambrook, H., & Stephen, A. (2003). Management of habitat for rehabilitation and enhancement of salmonid stocks. Fisheries Research, 62(2), 171-192.

Harvey, J. & Cowx, I. (2003). Monitoring the River, Sea and Brook Lamprey, *Lampetra fluviatilis, L. planer*i 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

Igoe, F., Quigley, D. T. G., Marnell, F., Meskell, E., O'Connor, W., & Byrne, C. (2004). The sea lamprey *Petromyzon marinus* (L.), river lamprey *Lampetra fluviatilis* (L.) and brook lamprey *Lampetra planeri* (Bloch) in Ireland: general biology, ecology, distribution and status with recommendations for conservation. In Biology and Environment: Proceedings of the Royal Irish Academy (Vol. 104, No. 3, pp. 43-56). Royal Irish Academy.

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.

Laffaille P., Feunteun E., Baisez A., Robinet T., Acou A., Legault A. & Lek S. (2003). Spatial organisation of Eel (*Anguilla anguilla* L.) in a small catchment. Ecology of Freshwater Fish 12, 254–264.

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.

Maitland, P.S. (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

Matondo, B. N., Benitez, J. P., Dierckx, A., Renardy, S., Rollin, X., Colson, D., ... & Ovidio, M. (2021). What are the best upland river characteristics for glass eel restocking practice?. Science of the Total Environment, 784, 147042.

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.

McGinnity, P., Gargan, P., Roche, W., Mills, P. & McGarrigle, M. (2003). Quantification of the Freshwater Salmon Habitat Asset in Ireland using data interpreted in a GIS platform. Irish Freshwater Fisheries, Ecology and Management Series: Number 3, Central Fisheries Board, Dublin, Ireland.

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 Freshwater 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, I. C., & Osborne, T.S. (1975). The systematics of British larval lampreys. Journal of Zoology, 176(3), 311-329.

Quigley, D.T.G, Igoe, F. & O' Connor, W. (2004). The European Smelt *Osmerus eperlanus* L. in Ireland: General Biology, Ecology, Distribution and Status with Conservation Recommendations. Biology and Environment: Proceedings of the Royal Irish Academy, Vol. 104B, No. 3, Threatened Irish Freshwater Fishes (Dec., 2004), pp. 57-66

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

Ross, E. (2017). A freshwater pearl mussel survey of the Ratty-Owenogarney River and Blackwater (Clare) River channels draining the Knockanuarha-Seefin uplands in County Clare.