FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE
& PLANNING

APPENDIX 8.B1

Fisheries Assessment Report

Fisheries assessment of Ballinagree wind farm, Co. Cork

Prepared by Triturus Environmental Ltd. for Fehily Timoney & Company

July 2021

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were contracted by Fehily Timoney & Company to undertake a baseline fisheries assessment of numerous watercourses in the vicinity of the proposed Ballinagree wind farm, located approximately 10km north of Macroom, Co. Cork (**Figure 2.1**).

The survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the proposed project (**Figure 2.1**). In order to gain an accurate overview of the existing and potential fisheries value of the riverine watercourses within the vicinity of the proposed project, a catchment-wide electro-fishing survey across *n*=37 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, lamprey and European eel (*Anguilla anguilla*), as well as other species, and helped to further inform impact assessment and any subsequent mitigation for the project.

Triturus Environmental Ltd. made an application 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 Ballinagree wind farm located near Macroom, Co. Cork. Permission was granted on 1st July 2020 and the survey was undertaken on several dates during July 2020.

1.2 Fisheries asset of the survey area

The proposed Ballinagree wind farm project was located in vicinity of numerous small streams and rivers within the Sullane_SC_010 sub-catchment, although several sites draining to the north of the site were located in the Blackwater [Munster]_SC_070. Two proposed grid cable connection (GCR) crossing points were located on watercourses in the Foherish_SC_010 sub-catchment, approx. 5.5km west of the site boundary.

Fisheries survey sites were present on the River Laney (EPA code: 19L01), Awboy River (19A03), Glen River (18G04), Carrigthomas Stream (19C48) and numerous other named and unnamed minor watercourses (**Table 2.1**).

The River Laney (locally pronounced 'Lane') was the most significant watercourse draining the wind farm site, rising at Musheramore in the Boggeragh Mountains within the wind farm boundary and flowing in a loosely southerly direction for some 25km before adjoining the River Sullane near Bealick Mill, Macroom. As a Sullane tributary, the Laney is known to hold brown trout (*Salmo trutta*) and is a valuable local recreational brown trout (*Salmo trutta*) fishery (O'Reilly, 2009). Historically the upper Lee system supported large runs of Atlantic salmon (*Salmo salar*) although salmon runs above Inniscarra Dam on the lower River Lee are now negligible (O'Donovan, 2018). However, small numbers of salmon are still known from the Sullane and tributaries (Kelly et al., 2015). The Laney was known to support small populations of freshwater pearl mussel (*Margaritifera margaritifera*) (Moorkens, 2007) although these now appear extirpated (see accompanying freshwater pearl mussel report). The Laney is a high-status watercourse (i.e. Q4-5, EPA data).

Although fisheries data was lacking for the Nadanuller Beg Stream and downstream Nad River, which drained to the north of the wind farm boundary, the connecting Glen River (18G04) was known to support Atlantic salmon and brown trout.

Given the more minor nature of the watercourses within the survey area, fisheries data was not available.

2. Methodology

2.1 Fish stock assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on both named and unnamed watercourses in the vicinity of the proposed Ballinagree wind farm during July 2020, following notification to Inland Fisheries Ireland (Macroom) and under the conditions of a Department of Communications, Climate Action & Environment (DCCAE) license. 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 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).

The catchment-wide electro-fishing (CWEF) survey was undertaken across *n*=37 sites (see **Table 2.1, Figure 2.1**). Length frequency graphs and species composition graphs for all species with numbers captured are illustrated in the Results section.

2.1.1 Salmonids and European eel

For salmonid species and European eel, as well as 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. ≥75-100m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages. 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 low to moderate conductivity waters of the sites (most draining upland/sandstone areas) a voltage of 250-300V, frequency of 40-45Hz and pulse duration of 3.5ms 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 box 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 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 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).

Table 2.1 *n*=37 electro-fishing survey site locations in the vicinity of the proposed Ballinagree wind farm project, Co. Cork.

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A1	Nadanuller Beg Stream	18N05	Carrigagulla	536890	587246
A2	Nadanuller Beg Stream	18N05	Carrigagulla	537742	587571
A3	Unnamed stream	n/a	Crinnaloo South	538409	587668
A4	Unnamed stream	n/a	Crinnaloo South	538946	587720
A5	Glen River	18G04	Inchamay South	540517	587756
B1	Carrigagulla Stream	19C22	Carrigagulla	536626	585034
B2	Unnamed stream	n/a	Knocknaguppal	534010	584604
B3	West Ballinagree Stream	19W12	Knocknaguppal	534023	583798
B4	Knocknaguppal 19 Stream	19K04	Knocknaguppal	534644	583730
B5	River Laney	19L01	Ballynagree West	535126	584076
B6	River Laney	19L01	Ballynagree West	535248	583913
B7	Unnamed stream	n/a	Ballynagree East	535968	584267
B8	River Laney	19L01	Ballynagree East	536600	583906
B9	Unnamed stream	n/a	Carrigagulla	538378	584701
B10	Ballynagree East Stream	19B21	Ballynagree East	536999	581849
B11	River Laney	19L01	Annagannihy	539060	582814
C1	Carrigthomas Stream	19C48	Knocknagappul	534443	582576
C2	Maulnahorna Stream	19M10	Rahalisk	533717	582074
C3	Carrigthomas Stream	19C48	Horsemount Bridge	534597	581268
C4	Rahalisk Stream	19R08	Knocknagappul	535030	580521
C5	Carrigthomas Stream	19C48	Coppeleenbawn Bridge	535286	579818

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
C6	Unnamed stream	n/a	Knocknagappul	536028	580673
C7	River Laney	19L01	Ballynagree West	536793	580028
C8	Lacknahaghny Stream	19L21	Lacknahaghny	536625	579348
C9	Unnamed stream	n/a	Carrigthomas	536313	579387
C10	Unnamed stream	n/a	Carrigthomas	535957	579674
C11	River Laney	19L01	Knocknagappul Bridge	535409	579769
C12	Awboy River	19A03	Awboy Bridge	534960	579216
C13	River Laney	19L01	Clonavrick Bridge	534605	578297
C14	Clonavrick Stream	19C74	Clonavrick	535048	577820
C15	Coolaniddane River	19C67	Caherbaroul	536466	577955
C16	Kilberrihert Stream	19K24	Derryroe	536269	577345
C17	Coolaniddane River	19C67	Caherbaroul	536005	577472
C18	Caherbaroul Stream	19C76	Caherbaroul	535712	577653
C19	Bealick Stream	19B45	Rockville	536620	577111
D1	Keel 19 Stream	19K02	Carrigacooleen	527230	584393
D2	Unnamed stream	n/a	Carrigacooleen	527645	584140

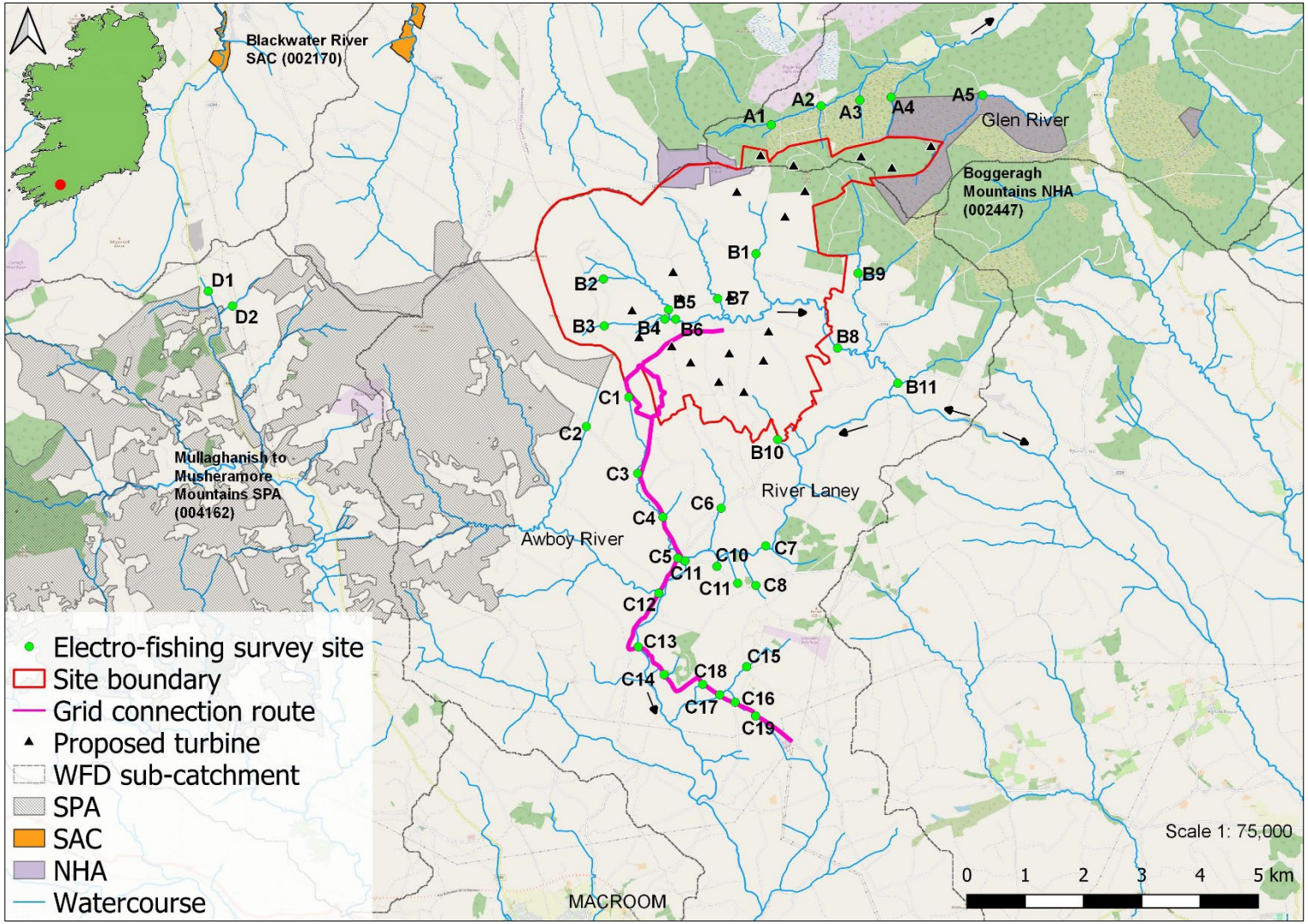

Figure 2.1 Location overview of the *n*=37 electro-fishing sites in vicinity of the proposed Ballinagree wind farm, Co. Cork.

2.2 Fisheries habitat

2.2.1 Salmonids

Fisheries habitat quality for salmonids was assessed using the Life Cycle Unit method (Kennedy, 1984; O'Connor & Kennedy, 2002) to map the *n*=37 riverine sites as nursery, spawning and holding habitat, by assigning quality scores to each type of habitat. Those habitats with poor quality substrata, shallow depth and a poorly defined river profile receive a higher score. Higher scores in the Life Cycle Unit method of fisheries quantification are representative of poorer value, with lower scores being more optimal despite this appearing counter-intuitive.

Table 2.1 Life Cycle Unit scoring system for salmonid nursery, spawning and holding habitat value (as per Kennedy, 1984 & O'Connor & Kennedy, 2002)

Habitat quality	Habitat score	Total score (three components)
Poor	4	12
Moderate	3	9-11
Good	2	6-8
Excellent	1	3-5

2.2.2 Lamprey

Lamprey habitat evaluation for each survey site was undertaken using the Lamprey Habitat Quality Index (LHQI) scoring system, as devised by Macklin et al. (2018). The LHQI broadly follows a similar rationale as the Life Cycle Unit score for salmonids. Those habitats with a lack of soft, largely organic sediment areas for ammocoete burrowing, shallow sediment depth (<10cm) or compacted sediment nature receive a higher score. Higher scores in this index are thus of poorer value (in a similar fashion to the salmonid Life Cycle Unit Index), with lower scores being more optimal. Overall scores are calculated as a simple function of the sum of individual habitat scores.

Larval lamprey habitat quality as well as the suitability of adult spawning habitat is assessed based on the information provided in Maitland (2003) and other relevant literature (e.g. Gardiner, 2003). Unlike the salmonid Life Cycle Unit index, holding habitat for adult lamprey is not assessed owing to their different migratory and life history strategies, and that electro-fishing surveys routinely only sample larval lamprey.

The LHQI scoring system provides additional information compared to the habitat classification based on the observations of Applegate (1950) and Slade et al. (2003), which deals specifically with larval (sea) lamprey settlement habitat. Under this scheme, habitat is classified into three different types: preferred (Type 1), acceptable (Type 2), and not acceptable for larvae (Type 3) (Slade et al. 2003). Type 1 habitat is characterized by soft substrate materials usually consisting of a mixture of sand and fine organic matter, often with some cover over the top such as detritus

or twigs in areas of deposition. Type 2 habitat is characterized by substrates consisting of shifting sand with little if any organic matter and may also contain some gravel and cobble (lamprey may be present but at much lower densities than Type 1). Type 3 habitat consists of materials too hard for larvae to burrow including bedrock and highly compacted sediment. This classification can also be broadly applied to other lamprey species ammocoetes, including *Lampetra* species.

Table 2.2 Lamprey Habitat Quality Index (LHQI) scoring system for lamprey spawning and nursery habitat value (Macklin et al., 2018).

Habitat quality	Habitat score	Total score (two components)
Poor	4	8
Moderate	3	6-7
Good	2	3-5
Excellent	1	2

2.2.3 General 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 fisheries 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 river sites (i.e. channel profiles, substrata etc.).

2.3 Biosecurity

A strict biosecurity protocol following the Check-Clean-Dry approach was employed during the survey. Equipment and PPE used was disinfected with Virkon® between survey sites to prevent the transfer of pathogens and/or invasive species between survey areas. Where feasible, equipment was also be thoroughly dried (through UV exposure) between survey areas. As per best practice, surveys were undertaken at sites in a downstream order (i.e. uppermost site surveyed first etc.) to prevent the upstream mobilisation of invasive propagules and pathogens. Any invasive species recorded within or adjoining the survey area were geo-referenced.

3. Results

A catchment-wide electro-fishing survey of *n*=37 sites in the vicinity of the proposed Ballinagree wind farm was conducted during July 2020 following notification to Inland Fisheries Ireland (Macroom). 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, European eel and lamprey species. Scientific names are provided at first mention only. Additional representative images are provided in Appendix A of this report.

3.1 Fish stock assessment (electro-fishing)

3.1.1 Site A1 – Nadanuller Beg Stream, Carrigagulla

No fish were recorded from site A1 via electro-fishing. The site was considered a poor salmonid habitat overall, with poor nursery, spawning and holding areas present. The small, upland stream was not considered of value to European eel and was unsuitable for lamprey given the high-energy nature. Fisheries potential improved further down the watercourse (i.e. site A2).

3.1.2 Site A2 – Nadanuller Beg Stream, Carrigagulla

Brown trout (*Salmo trutta*) was the only fish species recorded from site A2 via electro-fishing (**Figure 3.1**). The site was considered an excellent trout nursery, with the population dominated by juveniles. Spawning habitat was good, locally, although deeper holding habitat for adults was sparse (as were adult fish themselves). The small, upland stream was not considered of value to European eel and was unsuitable for lamprey given the high-energy nature.

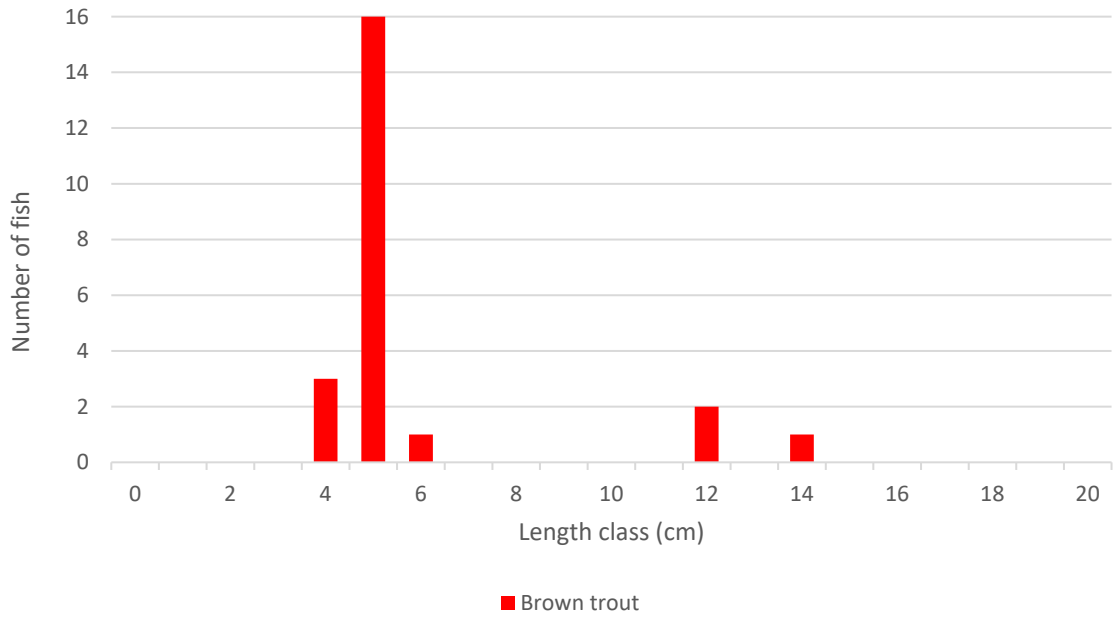

Figure 3.1 Fish stock length distribution recorded via electro-fishing at site A2 on the Nadanuller Beg Stream, July 2020.

3.1.3 Site A3 – unnamed stream, Crinaloo South

Brown trout was the only fish species recorded from site A3 via electro-fishing (**Figure 3.2**). Low numbers of adult trout were recorded, with an absence of juveniles. The site was considered of moderate value for salmonids, overall. The small, high-energy stream was considered of low value to European eel (none recorded) and was unsuitable for lamprey.

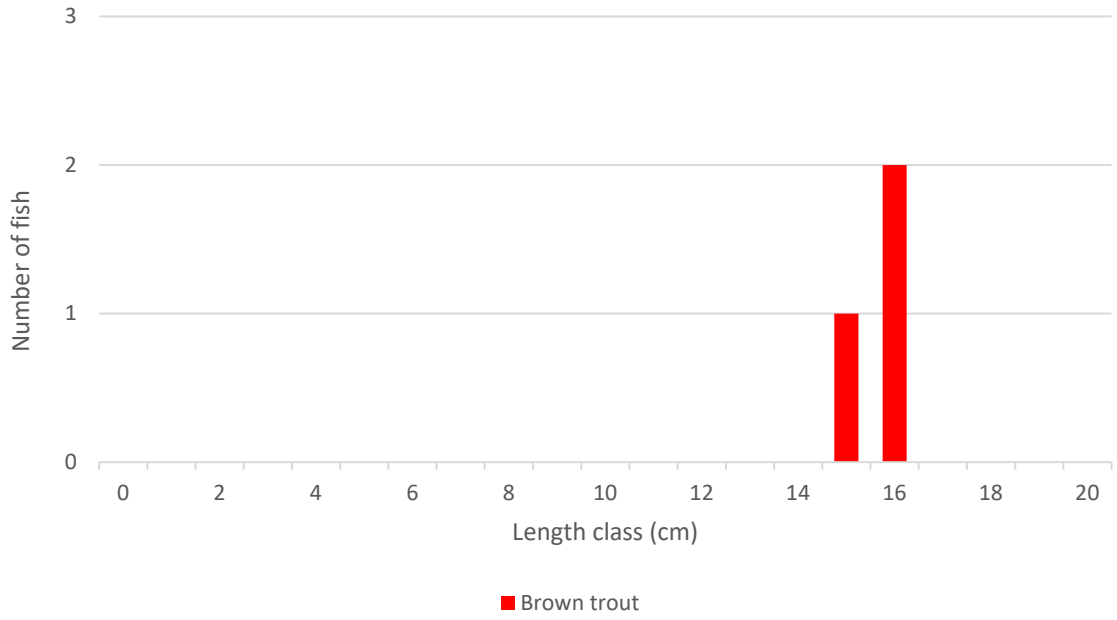

Figure 3.2 Fish stock length distribution recorded via electro-fishing at site A3 on an unnamed stream at Crinaloo South, July 2020

3.1.4 Site A4 – unnamed river, Letterlickey Middle

Brown trout and European eel (*Anguilla anguilla*) were the only two fish species recorded from site A4 via electro-fishing (**Figure 3.3**). Trout were present in moderate numbers, with both adults and a low number of juveniles present. A single adult eel was also recorded. The river was considered a moderate nursery with moderate quality spawning locally. Holding habitat was also considered moderate. Eel habitat was moderate overall but the high-energy site was considered unsuitable for lamprey.

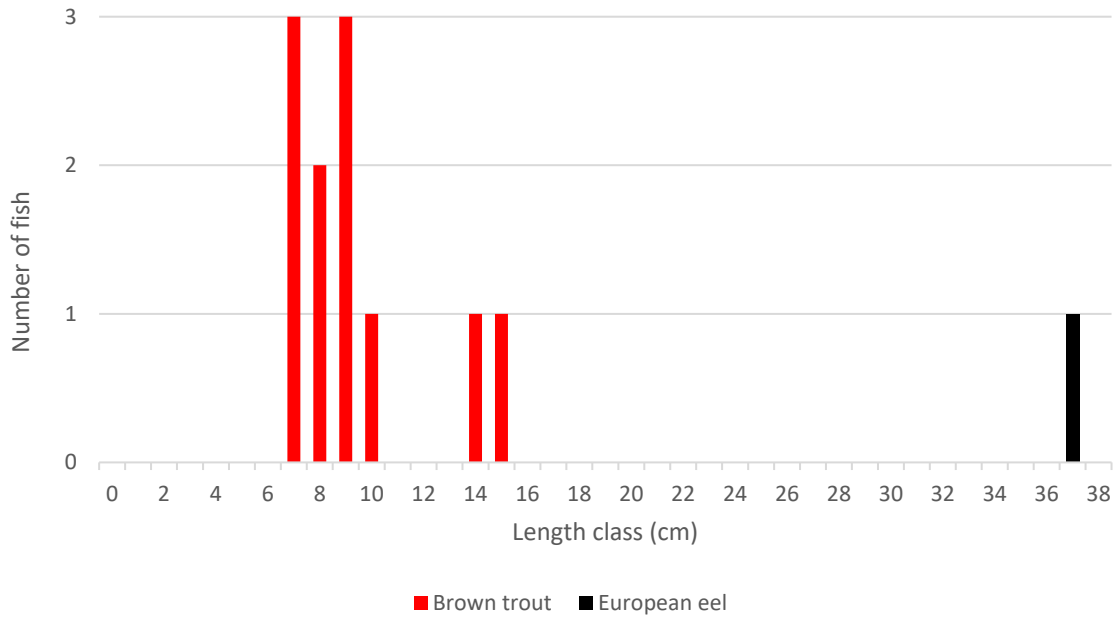

Figure 3.3 Fish stock length distribution recorded via electro-fishing at site A4 on an unnamed stream at Letterlickey Middle, July2020.

3.1.5 Site A5 – Glen River, Inchamay South

Brown trout was the only fish species recorded from the upper reaches of the Glen River at site A5 via electro-fishing (Figure 3.4). Trout were present in high numbers, with a high proportion of juveniles and a low number of adults present. The site was considered a very good nursery (*Ranunculus* beds present downstream of the bridge) with locally good quality spawning substrata. Holding habitat was also considered good in frequent, small deeper pools. Eel habitat was moderate overall but the high-energy site was considered unsuitable for lamprey.

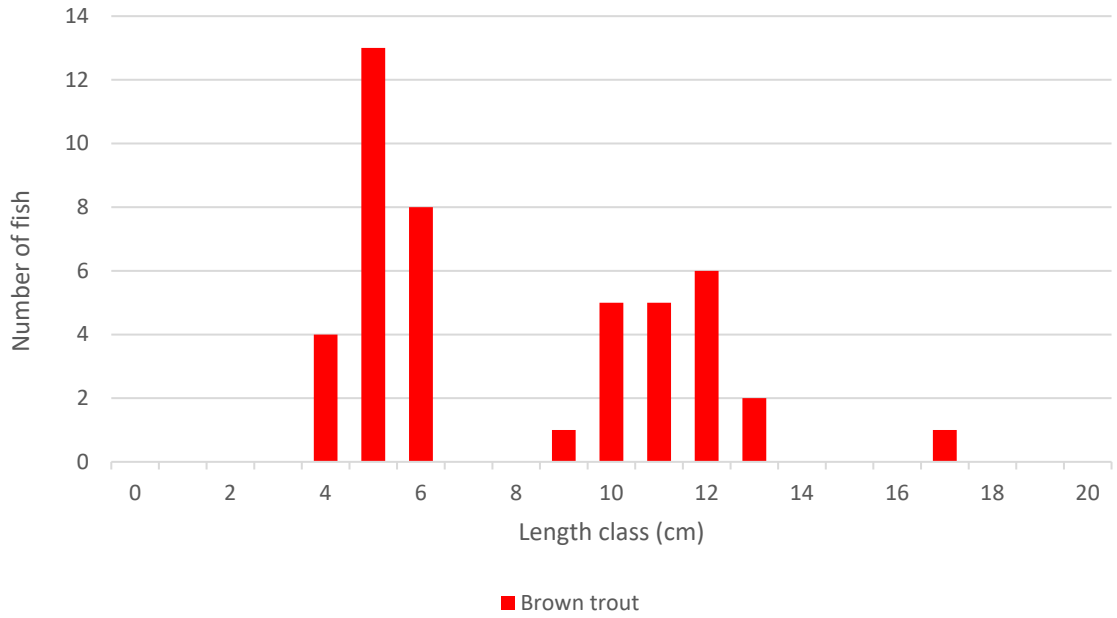

Figure 3.4 Fish stock length distribution recorded via electro-fishing at site A5 on Glen River, Inchamay South, July 2020.

3.1.6 Site B1 – Carrigagulla Stream, Carrigagulla

Brown trout was the only fish species recorded from site B1 via electro-fishing (**Figure 3.5**). Trout were present in low numbers (*n*=4), with only small adults recorded. Despite this, nursery habitat was moderate overall, with locally good spawning habitat present, However, the high-energy, steep-gradient of the site reduced the fisheries value considerably. The site was of limited value for eel and considered unsuitable for lamprey.

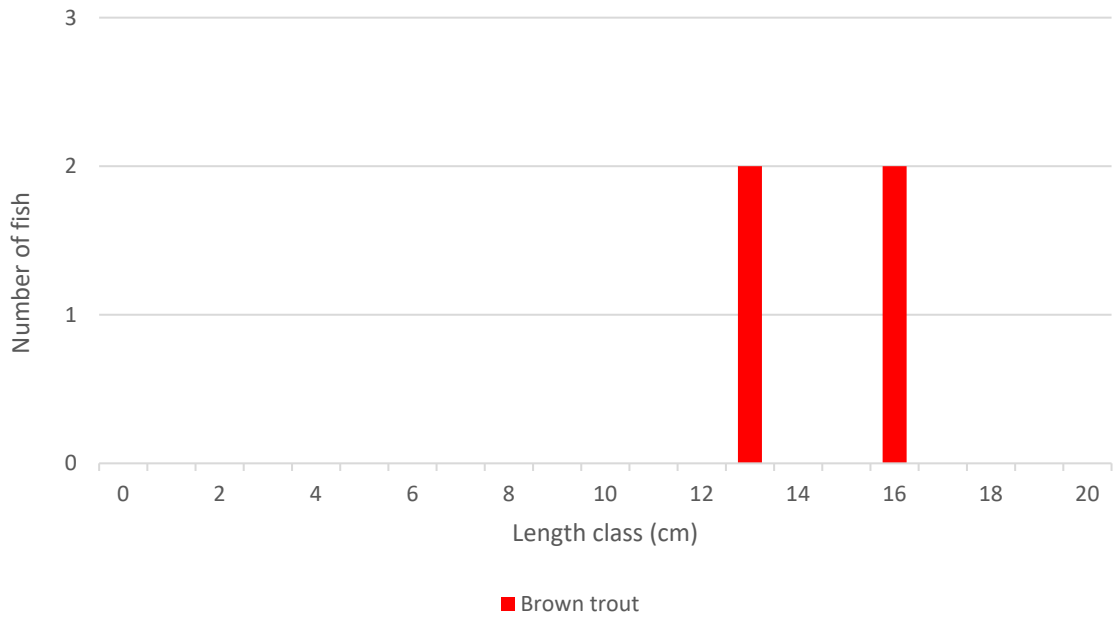

Figure 3.4 Fish stock length distribution recorded via electro-fishing at site A5 on Glen River, Inchamay South, July 2020.

3.1.7 Site B2 – unnamed stream, Knocknaguppal

No fish were recorded via electro-fishing from site B2 on the upper reaches of an unnamed stream at Knocknagappul. The stream offered no fisheries value at the time of survey (100% dry) and was considered to offer little if any fisheries value when conveying water given its small, high-gradient, high-energy upland nature.

3.1.8 Site B3 – West Ballinagree Stream, Knocknagappul

No fish were recorded via electro-fishing from site B3 on the upper reaches of West Ballinagree Stream. The stream offered no fisheries value at the time of survey (100% dry upland eroding channel) and was considered to offer little if any fisheries value when conveying water given its small, high-gradient, high-energy upland nature.

3.1.9 Site B4 – Knocknaguppal Stream, Knocknaguppal

Brown trout was the only fish species recorded from site B4 (**Figure 3.5**), located on the lower reaches of the Knocknagappul Stream, approx. 50m upstream of the confluence with the River Laney. Only a low number of juveniles were recorded. However, the site was of good value overall for salmonids given good nursery habitat, moderate spawning and moderate holding areas. Salmonid habitat improved in the downstream-connecting River Laney. The site was of moderate value for eel (albeit none recorded) but was considered unsuitable for lamprey (i.e. high-energy, upland eroding spate channel).

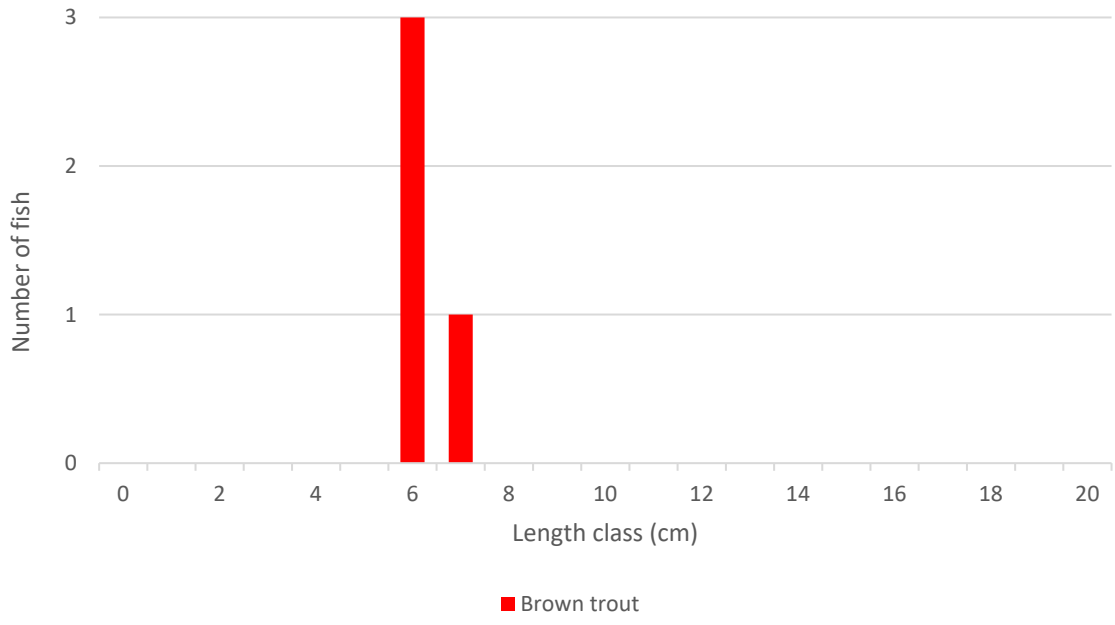

Figure 3.5 Fish stock length distribution recorded via electro-fishing at site B4 on the Knocknagappul Stream, July 2020.

3.1.10 Site B5 – River Laney, Ballynagree West

Brown trout was the only fish species recorded from site B5 (**Figure 3.6**), located on the upper reaches of the River Laney, approx. 0.1km upstream of the Knocknagappul Stream confluence. A moderate number of juveniles and adults were captured. Nursery habitat was considered good with locally good spawning habitat also present given the unbedded, clean nature of the smaller substrata. Holding habitat was limited but good nonetheless where present in localised deeper pools. European eel habitat was moderate but the value was reduced given the paucity of larger boulder refugia and deep pools. The Laney at site B5 was not considered of any value to lamprey given the high-energy.

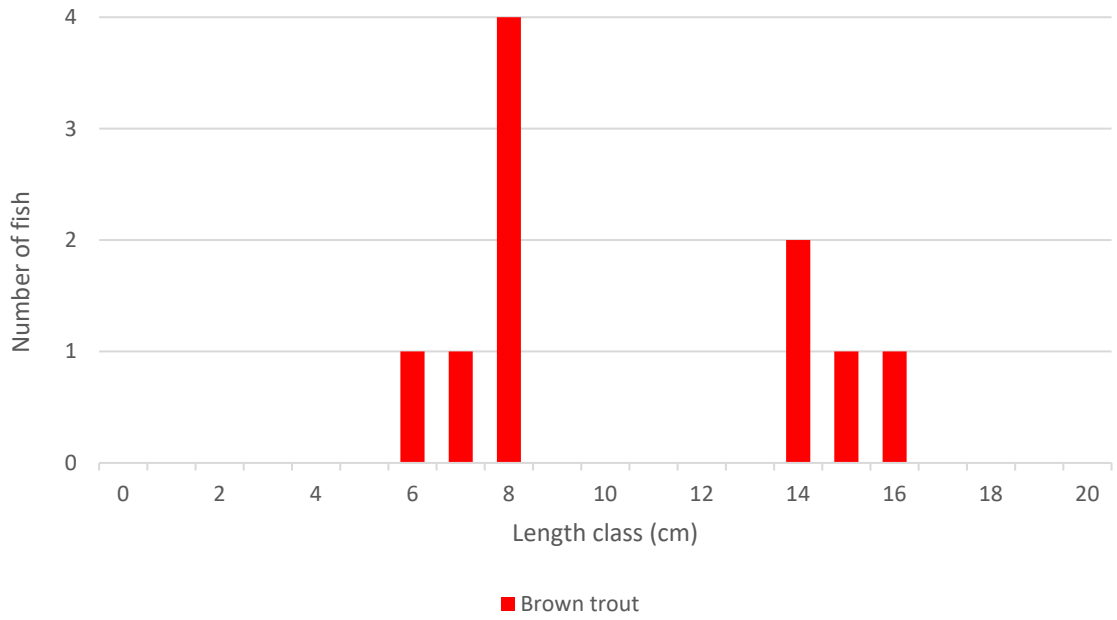

Figure 3.6 Fish stock length distribution recorded via electro-fishing at site B5 on the River Laney, July 2020.

3.1.11 Site B6 – River Laney, Ballynagree West

Brown trout was the only fish species recorded from site B6 (**Figure 3.7**), located on the upper reaches of the River Laney approx. 0.3km downstream from site B5. Both adults and a low number of juveniles were present. The site was considered a good salmonid habitat overall, with good quality spawning and moderate nursery habitat present, although deeper holding areas were scarce. European eel habitat was considered moderate (although none recorded) but the value was reduced given the paucity of larger boulder refugia and deep pools. The high-energy upland site was unsuitable for lamprey.

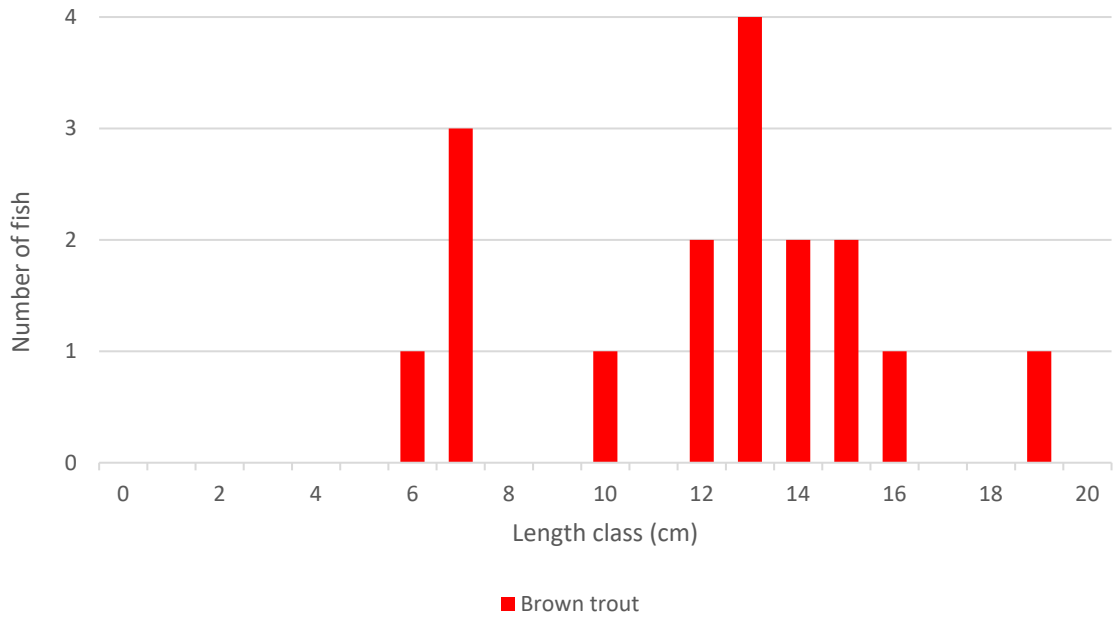

Figure 3.7 Fish stock length distribution recorded via electro-fishing at site B6 on the River Laney, July 2020.

3.1.12 Site B7 – unnamed stream, Ballynagree East

Brown trout was the only fish species recorded from site B7 via electro-fishing (**Figure 3.8**), located approx. 0.6km upstream from the River Laney confluence. A low number of adults and juveniles were present. The site was considered to have moderate nursery and spawning value for salmonids that would have been higher if not bordered by conifers (abundant pine needle deposition on bed and sedimentation visible). Holding habitat was moderate at best. European eel habitat was considered moderate but none were recorded. The high-energy upland site was unsuitable for lamprey.

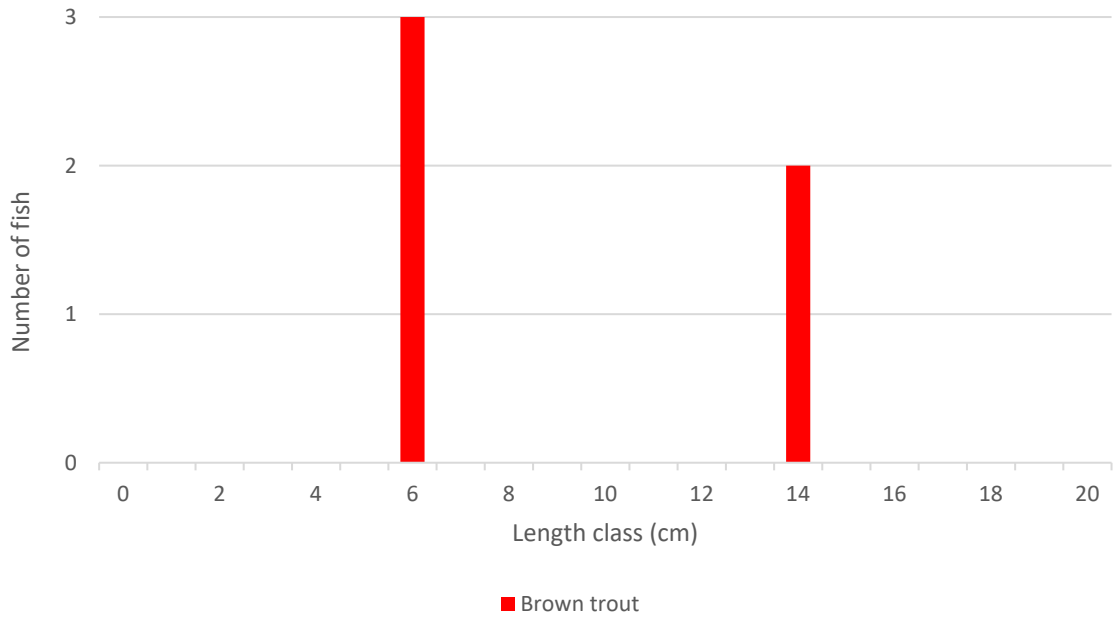

Figure 3.8 Fish stock length distribution recorded via electro-fishing at site B7 on an unnamed River Laney tributary, July 2020.

3.1.13 Site B8 – River Laney, Ballynagree East

Brown trout and European eel were the only fish species recorded from site B8 (**Figure 3.9**), located on the upper reaches of the River Laney approx. 4.7km downstream from site B6. The trout population was dominated by adults although smaller numbers of juveniles were present also. A single adult eel was also captured. The site was considered a very good salmonid nursery and spawning area, given the presence of *Ranunculus* vegetation and relatively clean, unbedded substrata. It was also a very good holding habitat given the presence of deeper glide and pool. This also provided ample refugia for European eel. Despite a moderate value for lamprey (localised sediment accumulations, mostly in association with *Ranunculus* beds) none were recorded.

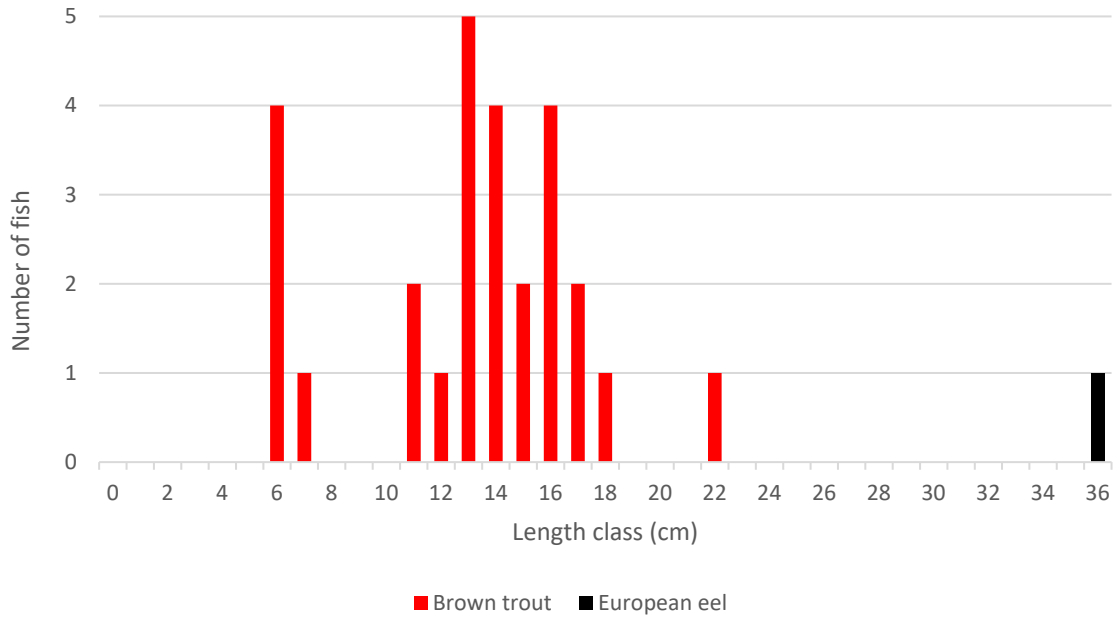

Figure 3.9 Fish stock length distribution recorded via electro-fishing at site B8 on the River Laney, July 2020.

3.1.14 Site B9 – unnamed stream, Carrigagulla

Brown trout and European eel were the only fish species recorded from site B9 (**Figure 3.10**). The trout population was dominated by juveniles. A single juvenile eel was also captured. The site was considered a good salmonid nursery with moderate quality spawning (diminished because of heavily bedded substrata). Holding habitat also considered moderate locally (a small number of deeper pools present). Eel habitat was of moderate quality. The high-energy upland site was unsuitable for lamprey.

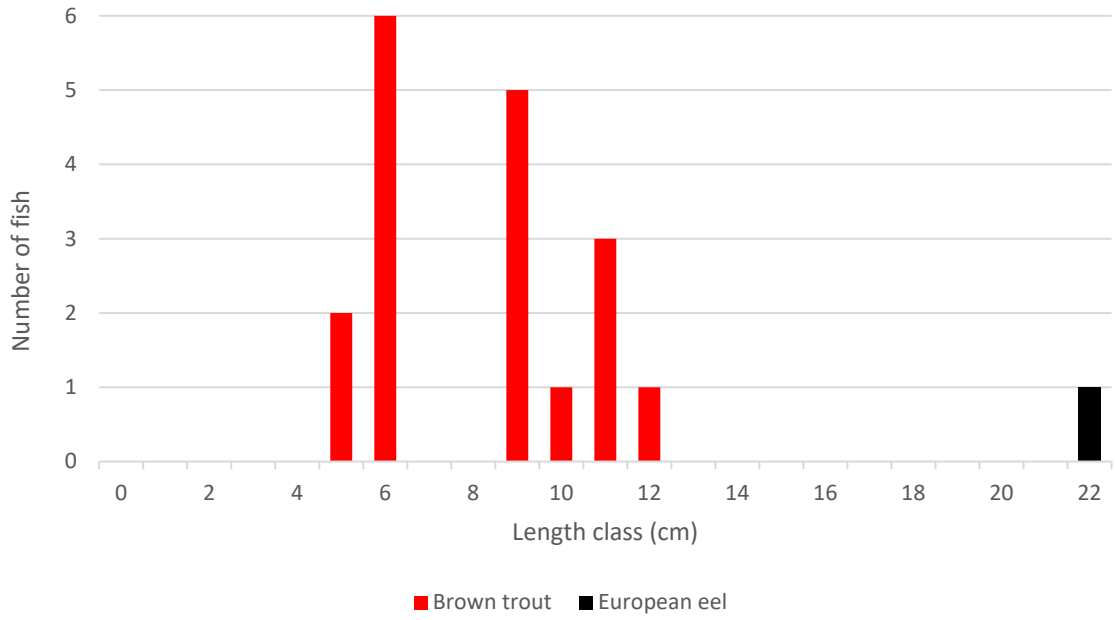

Figure 3.10 Fish stock length distribution recorded via electro-fishing at site B9 on an unnamed stream at Carrigagulla, July 2020.

3.1.15 Site B10 – Ballynagree East Stream, Ballynagree East

A single juvenile brown trout was the only fish recorded from site B10 (**Figure 3.11**), located on a small tributary of the River Laney. The small, shallow high gradient stream (with heavy siltation) provided poor spawning, nursery or holding habitat and also offered little value for European eel given the very shallow depth (0.05-0.15m deep). The upland eroding site was unsuitable for lamprey.

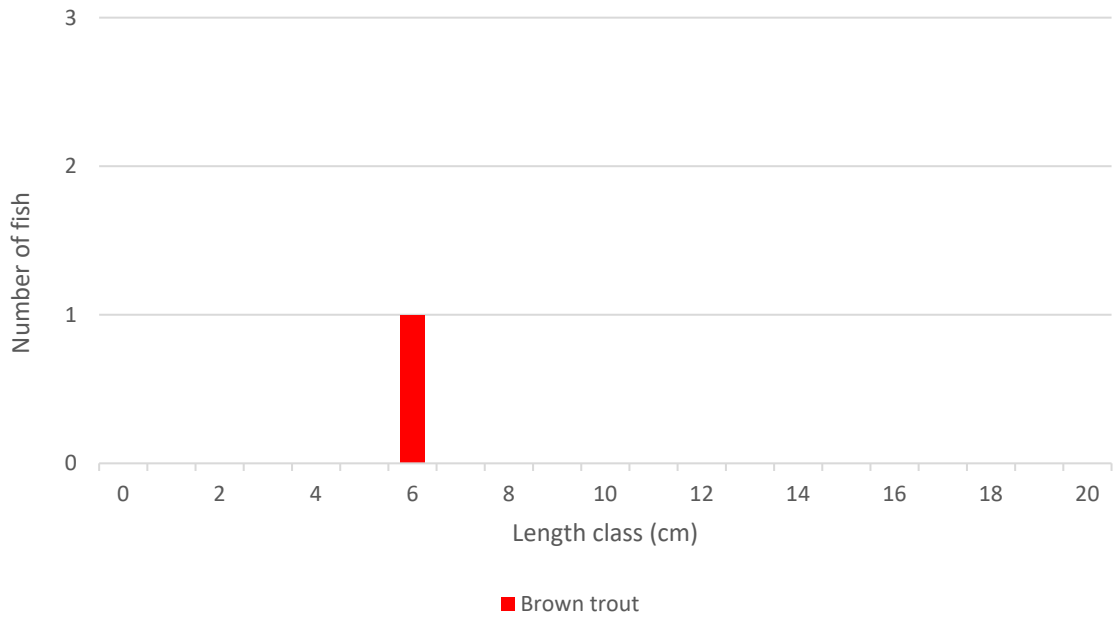

Figure 3.11 Fish stock length distribution recorded via electro-fishing at site B10 on the Ballynagree East Stream, July 2020.

3.1.16 Site B11 – River Laney, Annagannihy

Brown trout was the only fish species recorded from site B11 (**Figure 3.12**), located downstream of the confluence with the Annaginnihy Stream, approx. 0.3km downstream of Carrigagulla Bridge. Both juveniles and adults were present in moderate numbers. The site was a very good brown trout nursery, with moderate (locally good) spawning and some good (locally excellent) holding habitat. Instream macrophyte beds (*Ranunculus*) bolstered the nursery value of the site. European eel habitat was considered good throughout given undercut banks, ample boulder refugia and frequent pools although none were recorded. The high energy nature of the site precluded the presence of lamprey.

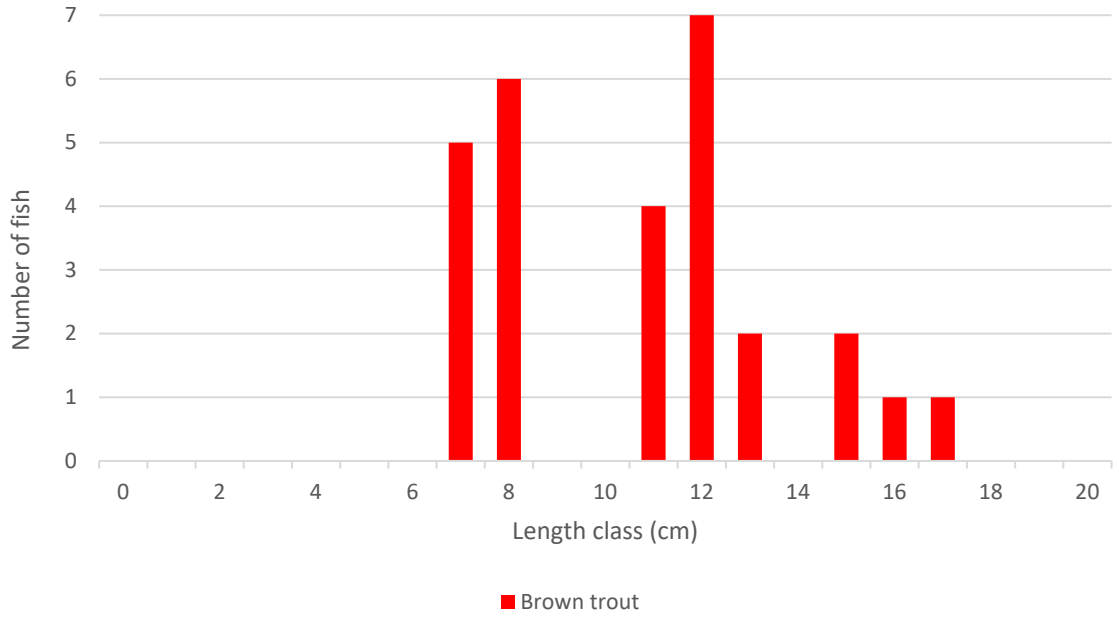

Figure 3.12 Fish stock length distribution recorded via electro-fishing at site B11 on the River Laney, July 2020.

3.1.17 Site C1 – Carrigthomas Stream, Knocknagappul

No fish species were recorded from site C1. The small, shallow, possibly seasonal site offered poor fisheries habitat overall, for both salmonids and eel. However, fisheries value improved significantly downstream (i.e. site C3). There was no suitability for lamprey given the site characteristics (upland eroding, likely seasonal channel).

3.1.18 Site C2 – Maulnahorna Stream, Rahalisk

No fish species were recorded from site C2. The narrow, shallow site was considered likely seasonal, which, despite some suitability as a salmonid nursery, precluded resident fish. There was no suitability for lamprey given the site characteristics (upland eroding, likely seasonal channel).

3.1.19 Site C3 – Carrigthomas Stream, Horsemount Bridge

Brown trout was the only fish species recorded from site C3 (**Figure 3.13**), located at Horsemount Bridge, approx. 1.5km downstream from site C1. Juveniles predominated in relatively high numbers. A small number of small adult trout were also recorded, mostly confined to deeper pool areas near the bridge. The site was evidently a very good brown trout nursery, although this was compromised somewhat by virtue of evident siltation and substrata compaction. Nevertheless, some limited spawning habitat was present, along with localised holding areas (more so downstream). European eel habitat was moderate give the shallow nature of the site (none recorded). The high energy nature of the site precluded the presence of lamprey.

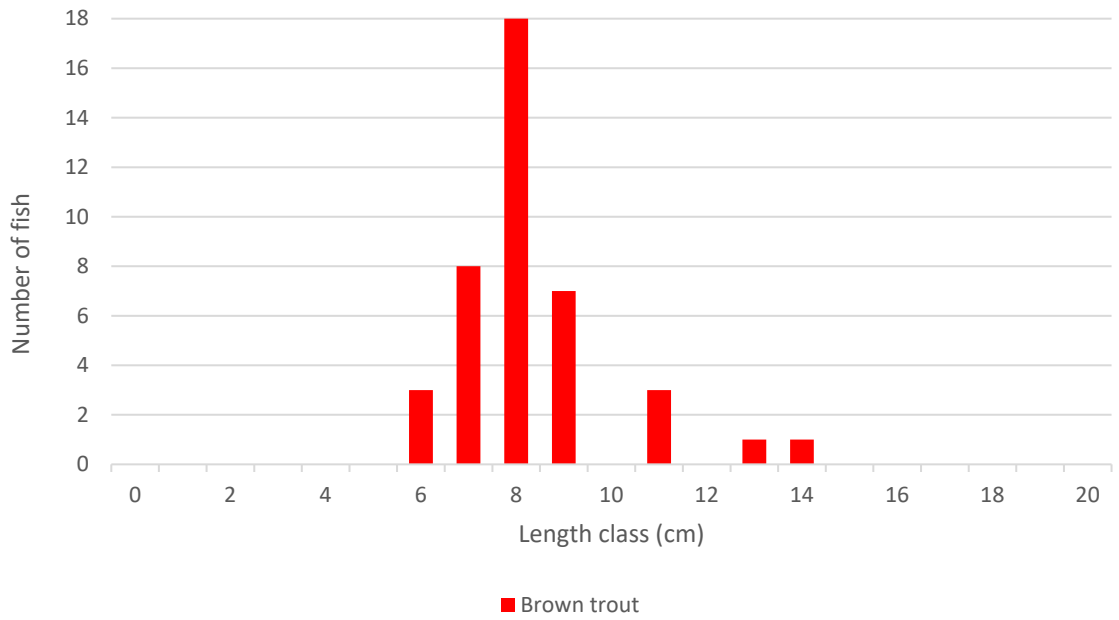

Figure 3.13 Fish stock length distribution recorded via electro-fishing at site C3 on the Carrigthomas Stream, July 2020.

3.1.20 Site C4 – Rahalisk Stream, Knocknagappul

No fish were recorded from site C4, located immediately upstream of the confluence with the Carrigthomas Stream (pipe culvert, fish passable). Overall, the stream offered little fisheries value given the extremely shallow (<0.05m) and overgrown nature of the channel. However, fisheries habitat improved in the downstream-connecting Carrigthomas Stream, underneath the local road crossing.

3.1.21 Site C5 – Carrigthomas Stream, Coppeleenbawn Bridge

Brown trout was the dominant species recorded from site C5 (**Figure 3.14**), located downstream of the L3418 road and proposed GCR crossing, approx. 100m upstream from the River Laney confluence. Juveniles predominating in relatively high numbers. A small number of adult trout were also present in addition to a low number of *Lampetra* sp. ammocoetes. The site was considered an excellent salmonid nursery (brown trout only), supporting mixed cohorts. Spawning habitat was good (locally very good, particularly near the Laney confluence in lower reaches) with holding habitat limited (moderate value). European eel habitat was moderate, at best, and none were recorded during electro-fishing. Two *Lampetra* sp. ammocoetes were recorded (likely brook lamprey given catchment migration barriers) – these were present in sub-optimal sand-flocculent silt heavily covered filamentous algae. Lamprey habitat was considered good given the presence of good spawning substrata although the lack of optimal soft sediment accumulations reduced the site's value overall.

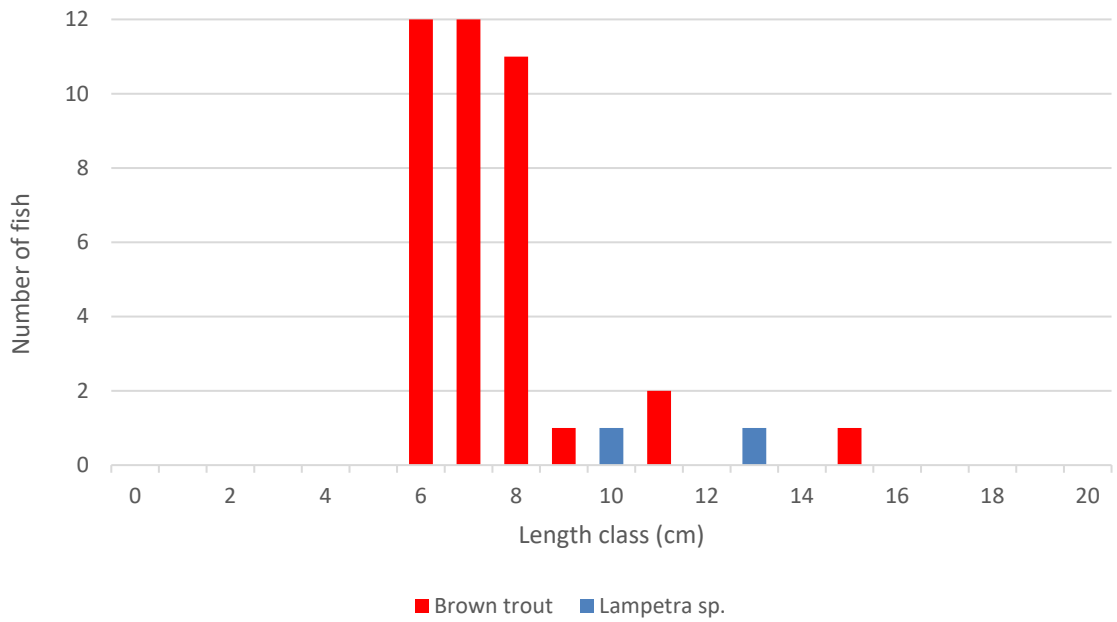

Figure 3.14 Fish stock length distribution recorded via electro-fishing at site C5 on the Carrigthomas Stream, July 2020.

3.1.22 Site C6 – Unnamed stream, Knocknagappul

Brown trout was the only fish species recorded from site C6 (**Figure 3.15**), located downstream of the L3418 road and proposed GCR crossing (pipe culvert), approx. 0.75km upstream of the River Laney crossing. Two small individuals were captured. The site offered only moderate quality salmonid habitat, with a lack of deeper holding areas and only moderate quality nursery and spawning (siltation). European eel habitat was poor with none recorded via electro-fishing. Potential for lamprey existed but was low, with poor quality spawning substrata present (silted, bedded) and a lack of suitable sediment accumulations for larval burial.

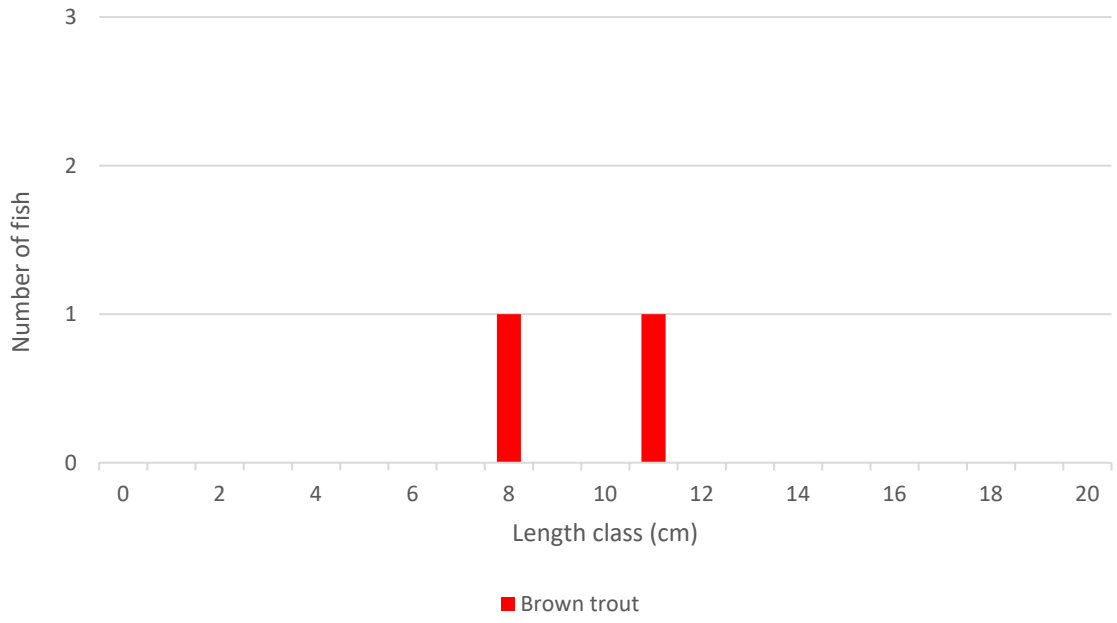

Figure 3.15 Fish stock length distribution recorded via electro-fishing at site C6 on an unnamed stream at Knocknagappul, July 2020.

3.1.23 Site C7 – River Laney, unnamed bridge, Ballynagree West

Brown trout was the only fish species recorded from site C7 (**Figure 3.16**), located at a local road crossing (twin arch masonry bridge), approx. 1km south of Ballinagree village. Mixed cohorts of brown trout were present, ranging from juveniles to larger adults. Site C7 offered excellent salmonid habitat overall, with combinations of excellent spawning (clean, unbedded gravels and cobble), excellent nursery habitat (particularly in the vicinity of *Ranunculus* beds and upstream of the bridge) and excellent holding habitat for adults (downstream of the bridge). European eel habitat was considered good given the presence of instream refugia although none were recorded during electro-fishing. Whilst optimal larval lamprey habitat was not present, areas of sub-optimal sand-dominated substrata were present in marginal areas and in association with *Ranunculus* beds. However, no ammocoetes were recorded during electro-fishing. Lamprey spawning habitat was of moderate quality locally, particularly in marginal slacks downstream of the bridge where lower flows were more amenable to the species

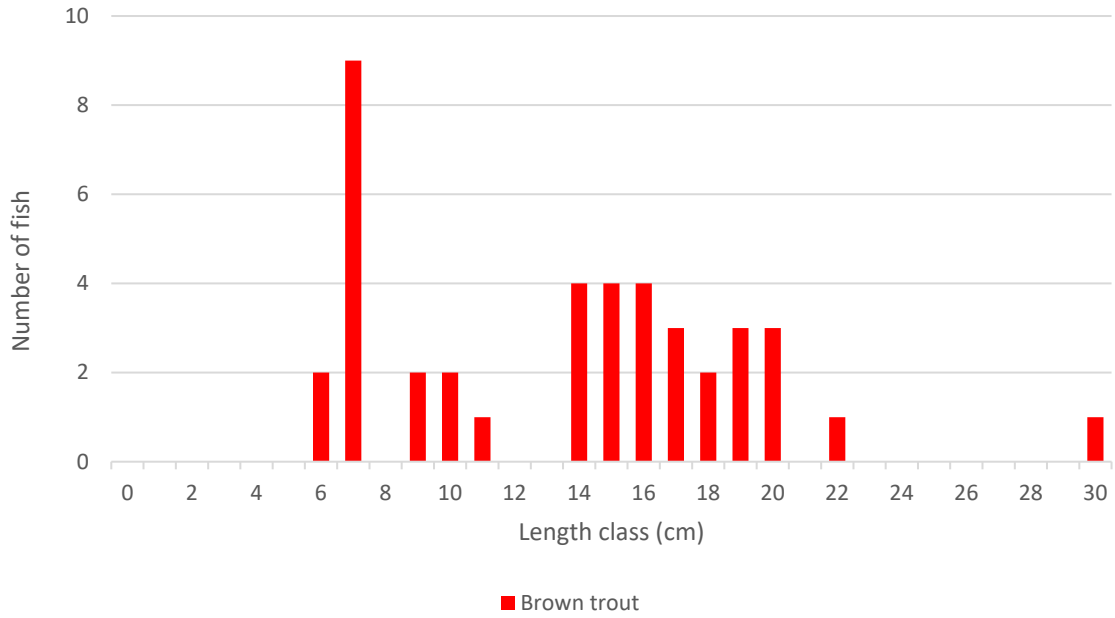

Figure 3.16 Fish stock length distribution recorded via electro-fishing at site C7 on the River Laney, Ballynagree West, July 2020.

3.1.24 Site C8 – Lacknahaghny Stream, Lacknahaghny

No fish species were recorded from site C8, located in the vicinity of a local road crossing (pipe culvert) and proposed GCR crossing. Site C8 averaged <0.75m wide and ≤0.05m deep at the time of survey and offered no fisheries value. The channel was considered likely seasonal in its upper reaches, thus precluding resident fish.

3.1.25 Site C9 – unnamed stream, Carrigthomas

No fish species were recorded from site C9, located in the vicinity in the vicinity of a local road and proposed GCR crossing, approx. 0.5km upstream of the River Laney confluence. Site C9

averaged <1m wide and <0.05m deep at the time of survey and offered no fisheries value. The channel was considered likely seasonal in its upper reaches, thus precluding resident fish.

3.1.26 Site C10 – unnamed stream, Carrigthomas

No fish species were recorded from site C10, located in the vicinity in the vicinity of a local road and proposed GCR crossing, approx. 185m upstream of the River Laney confluence. The water level was low at the time of survey, with only low flows present and depths of 0.05-0.1m. Site C10 offered very low fisheries value at the time of survey and the channel was considered likely seasonal, thus precluding resident fish. However, some limited, sub-optimal habitat was present for salmonids and European eel further downstream nearer to the Laney confluence (more deeper pools). The upland eroding site was unsuitable for lamprey.

3.1.27 Site C11 – River Laney, Knocknagappul Bridge

Brown trout was the dominant fish species recorded from site C11 (**Figure 3.17**), located at Knocknagappul Bridge, a proposed GCR crossing point. Relatively high numbers of mixed cohort brown trout were present, ranging from juveniles to larger adults. A single **Atlantic salmon (*Salmon salar*)** parr was also recorded (17.0cm FL). This was the only salmon recorded in the Ballinagree study area. The site was an excellent salmonid habitat, with good spawning substrata present throughout in addition to excellent quality nursery and holding habitat. The site was considered of good value to European eel given the presence of deeper pool areas, scoured banks and large woody debris/boulder refugia in stream (however, none were recorded). Lamprey spawning habitat was present but localised (site more suited to salmonids) with sand-dominated sediment accumulations present locally in vicinity of the bridge and some instream *Ranunculus* beds (none recorded).

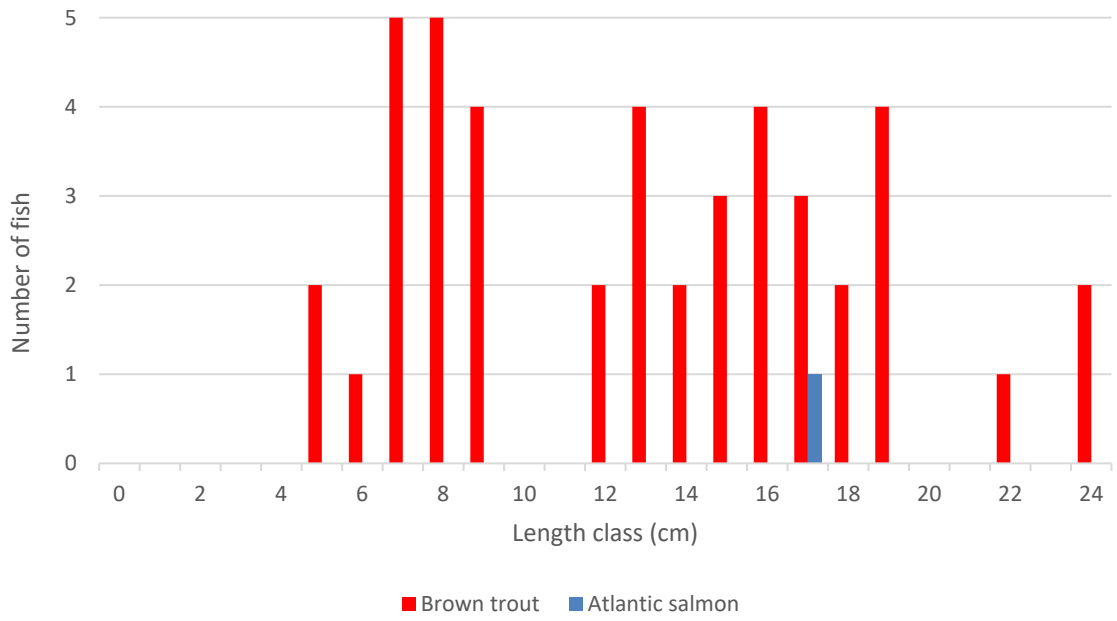

Figure 3.17 Fish stock length distribution recorded via electro-fishing at site C11 on the River Laney, Knocknagappul Bridge, July 2020.

3.1.28 Site C12 – Awboy River, Awboy Bridge

Brown trout was the only fish species recorded from site C12 (**Figure 3.18**), located downstream of Awboy Bridge (proposed GCR crossing) and 70m upstream of the River Laney confluence. Moderate numbers of mixed cohort brown trout were present, ranging from juveniles to larger adults. The site was evidently a good salmonid habitat, with good quality spawning, nursery and holding habitat present. Despite some good European eel suitability, particularly in vicinity of the bridge and in deeper pools, none were recorded. The high energy of the site and lack of sediment deposition precluded larval lamprey, despite some localised spawning habitat in slacker areas.

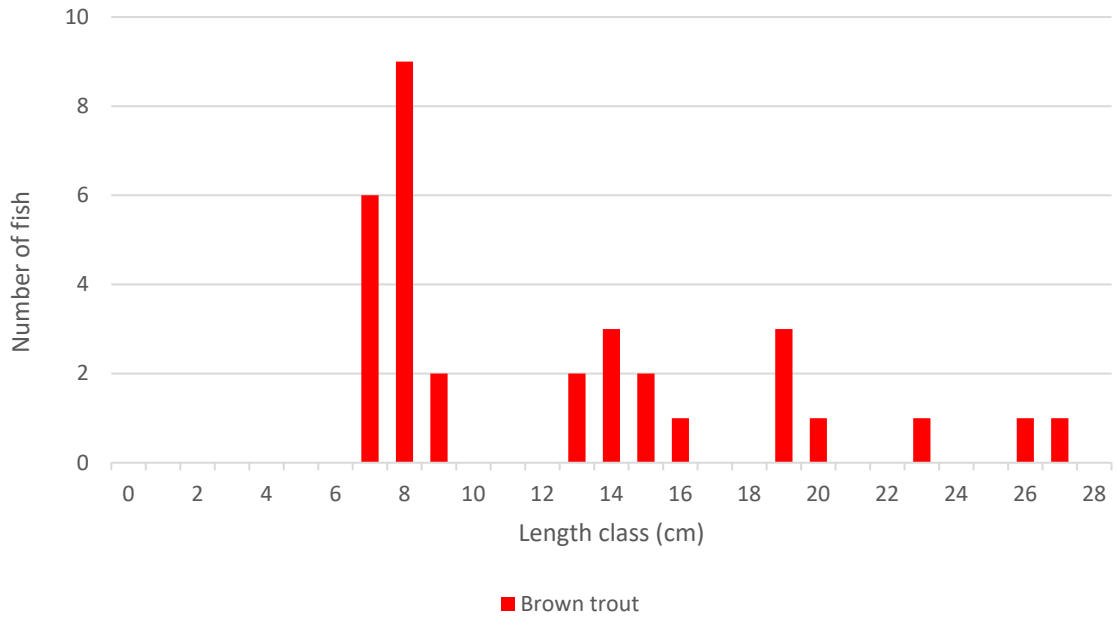

Figure 3.18 Fish stock length distribution recorded via electro-fishing at site C12 on the Awboy River, July 2020.

3.1.29 Site C13 – River Laney, Clonavrick Bridge

Brown trout was the only fish species recorded from site C13 (**Figure 3.19**), located at Clonavrick Bridge, a proposed GCR crossing point. Moderate numbers of mixed cohort brown trout were present, with juvenile size classes dominating over a smaller number of larger adults. Overall, site C13 was of excellent value to salmonids, with good spawning and nursery habitat in addition to excellent holding habitat (particularly downstream of the bridge) for larger adult trout. Despite good physical habitat for European eel (ample boulder refugia), none were recorded. The high-energy nature of the site precluded the presence of lamprey.

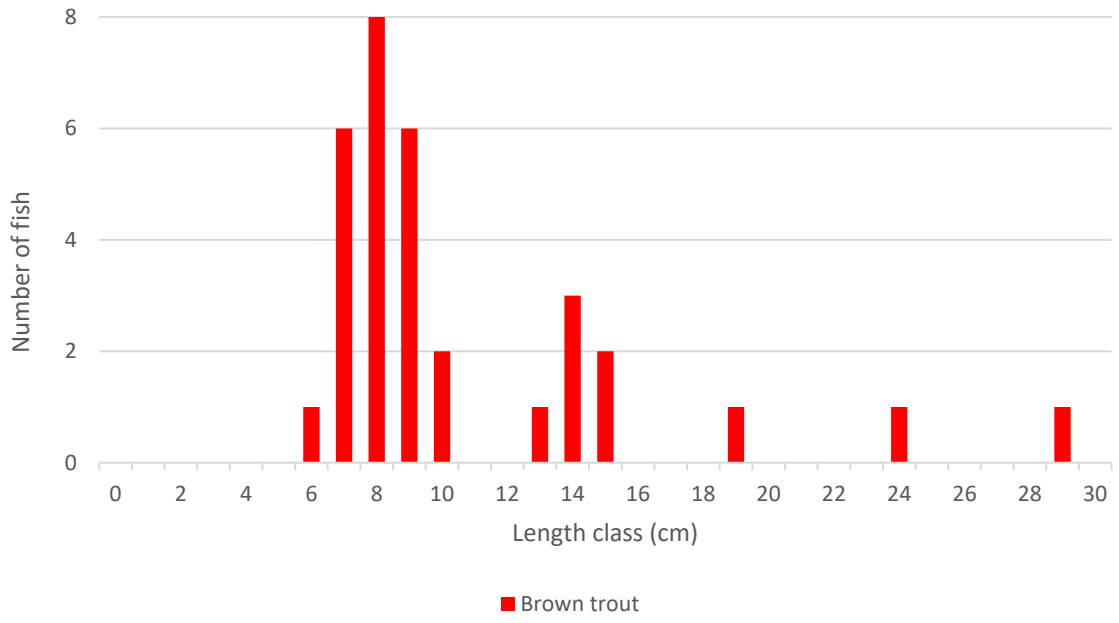

Figure 3.19 Fish stock length distribution recorded via electro-fishing at site C13 on the River Laney at Clonavrick Bridge, July 2020.

3.1.30 Site C14 – Clonavrick Stream, Clonavrick

No fish were recorded at site C14, located at local road and proposed GCR crossing, approx. 0.4km upstream of the River Laney confluence. The <1m wide stream was semi-dry at the time of survey (0.05m deep max) and the site was not of fisheries value given the lack of water and evidently poor water quality (i.e. siltation, enrichment etc.). However, fisheries habitat improved further downstream nearer the Laney confluence.

3.1.31 Site C15 – Coolaniddane River, Caherbaroul

No fish were recorded at site C15, located downstream of a local road and proposed GCR crossing, despite some physical habitat suitability. Whilst the foul odour present upstream (agricultural run-off) was not present downstream, enrichment was evident and it appeared upstream agricultural pressures had impacted the fisheries habitat of the river. Thus, the site had very poor fisheries value. Irrespectively, European eel habitat was poor given the small, shallow nature of

the site. The higher energy and lack of suitable sediment accumulations precluded the presence of lamprey.

3.1.32 Site C16 – Kilberrihert Stream, Derryroe

No fish were recorded at site C16, located downstream of a local road crossing, approx. 260m upstream of the Coolaniddane River confluence. The site was dry at the time of survey and thus had no fisheries value given the lack of water or flow. Being located in the uppermost reaches, with no connectivity to other watercourses nearby, the site was considered unlikely to serve as a migratory pathway for European eel.

3.1.33 Site C17 – Coolaniddane River, Caherbaroul

No fish were recorded at site C17, located downstream of a local road and proposed GCR crossing, approx. 0.8km downstream from site C15. Despite some physical suitability, enrichment was evident and it appeared upstream agricultural pressures had impacted the fisheries habitat of the river. Thus, the site had very poor fisheries value. European eel habitat was poor given the small, shallow nature of the site. The higher energy and lack of suitable sediment accumulations precluded the presence of lamprey.

3.1.34 Site C18 – Caherbaroul Stream, Caherbaroul

No fish were recorded at site C18, located downstream of a local road crossing and proposed GCR crossing. The site was semi-dry at the time of survey (local ponding only, max. depth 0.05m) and thus had no fisheries value given the lack of water or flow. Being located in the uppermost reaches, with no connectivity to other watercourses nearby, the site was considered unlikely to serve as a migratory pathway for European eel.

3.1.35 Site C19 – Bealick Stream, Rockville

No fish were recorded at site C19, located downstream of a local road crossing and proposed GCR crossing. The drainage channel site was semi-dry at the time of survey (local ponding only, max. depth 0.1m) and thus had no fisheries value given the lack of water or flow. However, the stream likely supports fish populations a considerable distance downstream, nearer the Laney confluence (i.e. >4km downstream). Being located in the uppermost reaches, with no connectivity to other watercourses nearby, the site was considered unlikely to serve as a migratory pathway for European eel.

3.1.36 Site D1 – Keel Stream, Carrigacooleen

Despite some apparent suitability, no fish were recorded at site D1, located on the upper reaches of the Keel Stream at a local road and proposed GCR crossing. The site had poor fisheries value given the small, shallow, heavily-silted nature of the site. Water quality pressures (from agriculture and or afforestation) appeared to have significantly impacted the fisheries habitat of the stream. It was considered possible that the stream may dry up periodically at this location

(which may have explained the absence of resident fish). Despite heavy siltation, sediment accumulations for larval lamprey were not present.

3.1.37 Site D2 – unnamed stream, Carrigacooleen

Brown trout was the only fish species recorded from site D2 (**Figure 3.20**), with low numbers of juveniles and adults present. The site was of good value to salmonids, with some localised spawning (moderate value), good nursery and good holding habitat. European eel habitat was moderate overall, but the high energy nature of the site was considered sub-optimal despite boulder refugia and deep pools. The high-energy site was unsuitable for lamprey.

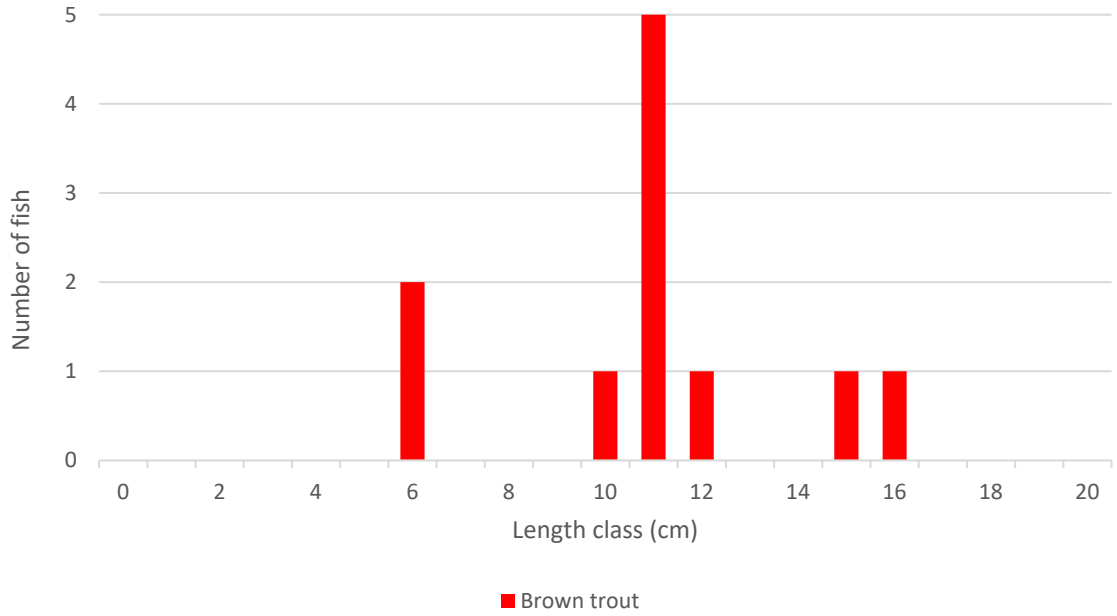

Figure 3.20 Fish stock length distribution recorded via electro-fishing at site D2 on an unnamed stream at Carrigacooleen, July 2020.

Table 3.1 Fish species densities per m^2 recorded at sites in the vicinity of Ballinagree wind farm via electro-fishing in July 2020. Values in **bold** represent the highest densities recorded for each species, respectively.

Site	Watercourse	CPUE (elapsed fishing time)	Approx. area fished (m^2)	Fish density (number fish per m^2)			
				Brown trout	European eel	Atlantic salmon	*Lampetra* sp.
A1	Nadanuller Beg Stream	5	100	0.000	0.000	0.000	0.000
A2	Nadanuller Beg Stream	5	97.5	0.236	0.000	0.000	0.000
A3	Unnamed stream	5	90	0.033	0.000	0.000	0.000
A4	Unnamed stream	5	110	0.127	**0.009**	0.000	0.000
A5	Glen River	10	130	**0.346**	0.000	0.000	0.000
B1	Carrigagulla Stream	5	105	0.038	0.000	0.000	0.000
B2	Unnamed stream	n/a	dry channel	n/a	n/a	n/a	n/a
B3	West Ballinagree Stream	n/a	dry channel	n/a	n/a	n/a	n/a
B4	Knocknaguppal 19 Stream	10	120	0.033	0.000	0.000	0.000
B5	River Laney	10	240	0.042	0.000	0.000	0.000
B6	River Laney	10	110	0.155	0.000	0.000	0.000
B7	Unnamed stream	10	125	0.040	0.000	0.000	0.000
B8	River Laney	10	420	0.064	0.002	0.000	0.000
B9	Unnamed stream	10	200	0.090	0.005	0.000	0.000
B10	Ballynagree East Stream	5	55	0.018	0.000	0.000	0.000

Site	Watercourse	CPUE (elapsed fishing time)	Approx. area fished (m^2)	Fish density (number fish per m^2)			
				Brown trout	European eel	Atlantic salmon	*Lampetra* sp.
B11	River Laney	10	400	0.070	0.000	0.000	0.000
C1	Carrigthomas Stream	5	45	0.000	0.000	0.000	0.000
C2	Maulnahorna Stream	10	90	0.000	0.000	0.000	0.000
C3	Carrigthomas Stream	10	187.5	0.219	0.000	0.000	0.000
C4	Rahalisk Stream	5	35	0.000	0.000	0.000	0.000
C5	Carrigthomas Stream	10	150	0.193	0.000	0.000	**0.013**
C6	Unnamed stream	5	60	0.033	0.000	0.000	0.000
C7	River Laney	10	490	0.092	0.000	0.000	0.000
C8	Lacknahaghny Stream	10	60	0.000	0.000	0.000	0.000
C9	Unnamed stream	5	40	0.000	0.000	0.000	0.000
C10	Unnamed stream	10	55	0.000	0.000	0.000	0.000
C11	River Laney	10	560	0.080	0.000	**0.002**	0.000
C12	Awboy River	10	350	0.091	0.000	0.000	0.000
C13	River Laney	10	520	0.062	0.000	0.000	0.000
C14	Clonavrick Stream	5	55	0.000	0.000	0.000	0.000
C15	Coolaniddane River	5	60	0.000	0.000	0.000	0.000
C16	Kilberrihert Stream	n/a	dry channel	n/a	n/a	n/a	n/a

Site	Watercourse	CPUE (elapsed fishing time)	Approx. area fished (m^2)	Fish density (number fish per m^2)			
				Brown trout	European eel	Atlantic salmon	*Lampetra* sp.
C17	Coolaniddane River	5	75	0.000	0.000	0.000	0.000
C18	Caherbaroul Stream	5	20	0.000	0.000	0.000	0.000
C19	Bealick Stream	5	15	0.000	0.000	0.000	0.000
D1	Keel 19 Stream	5	45	0.000	0.000	0.000	0.000
D2	Unnamed stream	10	112.5	0.098	0.000	0.000	0.000

3.2 Fisheries habitat

3.2.1 Salmonid habitat

The quality of salmonid habitat ranged from poor to excellent across the survey sites (**Table 3.2**). Of the *n*=37 sites, only three (8% of total) offered excellent quality salmonid habitat according to Life Cycle Unit scores. These were sites C7, C11 and C13 on the River Laney.

Fourteen sites (38% of total) provided good quality salmonid habitat according to Life Cycle Unit scores. Sites A2 (Nadanuller Beg Stream), A4 (unnamed river), A5 (Glen River), B1 (Carrigagulla Stream), B4 (Knocknagappul Stream), B9 (unnamed Laney tributary), C3 and C5 (Carrigthomas Stream), C12 (Awboy River) and D2 (unnamed stream) all offered good quality salmonid habitat, with sites B5, B6, B8 and B11 on the River Laney also offered good quality habitat overall.

Four sites (10% of total) provided moderate quality salmonid habitat, namely sites A3 (unnamed stream), B7 (unnamed Laney tributary), C2 (Maulnahorna Stream) and C6 (unnamed Laney tributary).

Twelve sites (32% of total) provided poor quality salmonid habitat according to Life Cycle Unit scores. Sites A1 (Nadanuller Beg Stream), B10 (Ballynagree East Stream), C1 (Carrigthomas Stream), C4 (Rahalisk Stream), C8 (Lacknahaghy Stream), C9 (unnamed Laney tributary), C10 (unnamed Laney tributary), C14 (Clonavrick Stream), C15 (Coolaniddane River), C18 (Caherbaroul Stream), C19 (Bealick Stream) and D1 (Keel Stream) offered little or no value for salmonids and scored as poor in terms of salmonid habitat.

Sites B2 and B3 (unnamed Laney tributaries) and C16 (Kilberrihert Stream) were 100% dry at the time of survey and thus a Life Cycle Unit score was not applicable (i.e. no fisheries habitat present).

Table 3.2 Life Cycle Unit scores for salmonid habitat at the sites surveyed in the vicinity of the proposed Ballinagree wind farm, September 2020.

Site no.	Salmonid habitat value	Spawning	Nursery	Holding	Total score	Salmonids recorded
A1	Poor	4	4	4	**12**	No
A2	Good	2	1	4	**7**	**Yes**
A3	Moderate	3	3	3	**9**	**Yes**
A4	Good	2	3	3	**8**	**Yes**
A5	Good	2	2	2	**6**	**Yes**
B1	Good	2	2	3	**7**	**Yes**
B2	No fisheries value - 100% dry channel					No
B3	No fisheries value - 100% dry channel					No
B4	Good	2	3	3	**8**	Yes

Site no.	Salmonid habitat value	Spawning	Nursery	Holding	Total score	Salmonids recorded
B5	Good	2	2	3	**7**	Yes
B6	Good	2	3	3	**8**	Yes
B7	Moderate	3	3	3	**9**	**Yes**
B8	Good	2	2	2	**6**	**Yes**
B9	Good	2	3	3	**8**	Yes
B10	Poor	4	4	4	**12**	Yes
B11	Good	3	2	2	**7**	Yes
C1	Poor	4	4	4	**12**	No
C2	Moderate	3	3	4	**10**	No
C3	Good	2	2	4	**8**	Yes
C4	Poor	4	4	4	**12**	No
C5	Good	2	1	3	**6**	Yes
C6	Moderate	3	3	4	**10**	Yes
C7	Excellent	1	1	1	**3**	Yes
C8	Poor	4	4	4	**12**	No
C9	Poor	4	4	4	**12**	No
C10	Poor	4	4	4	**12**	No
C11	Excellent	2	1	1	**4**	Yes
C12	Good	2	2	2	**6**	**Yes**
C13	Excellent	2	2	1	**5**	**Yes**
C14	Poor	4	4	4	**12**	No
C15	Poor	4	4	4	**12**	No
C16	No fisheries value - 100% dry channel					No
C18	Poor	4	4	4	**12**	No
C19	Poor	4	4	4	**12**	No
D1	Poor	4	4	4	**12**	No
D2	Good	3	2	2	**7**	Yes

3.2.2 Lamprey habitat

The majority of the survey sites were not physically suitable for lamprey given their upland, eroding/cascading/high-energy nature and, thus, Lamprey Habitat Quality Index was not applicable at a total of *n*=29 sites (i.e. 78% of total). These were sites A1, A2, A3, A4, A5, B1, B4, B5, B6, B7, B9, B10, B11, C1, C2, C3, C4, C8, C9, C10, C13, C14, C15, C16, C17, C18, C19, D1 and D2.

Sites C5 (Carrigthomas Stream) and C7 and C11 (River Laney) provided good quality lamprey habitat according to Lamprey Habitat Quality Index scores (**Table 3.3**). Site C5 was the only survey site found to support *Lampetra* sp. ammocoetes.

Sites B8 (River Laney), C6 (unnamed Laney tributary) and C12 (Awboy River) provided some moderate quality lamprey habitat, although none were recorded at these sites via electro-fishing.

Sites B2 and B3 (unnamed Laney tributaries) and C16 (Kilberrihert Stream) were 100% dry at the time of survey and thus a Life Cycle Unit score was not applicable (i.e. no fisheries habitat present).

Table 3.3 Lamprey Habitat Quality Index (LHQI) scores for lamprey habitat at the sites surveyed in the vicinity of the proposed Ballinagree wind farm, September 2020.

Site no.	Lamprey habitat value	Spawning	Nursery	Total score	Lamprey recorded
A1	n/a – site unsuitable for lamprey				
A2	n/a – site unsuitable for lamprey				
A3	n/a – site unsuitable for lamprey				
A4	n/a – site unsuitable for lamprey				
A5	n/a – site unsuitable for lamprey				
B1	n/a – site unsuitable for lamprey				
B2	No fisheries value - 100% dry channel				
B3	No fisheries value - 100% dry channel				
B4	n/a – site unsuitable for lamprey				
B5	n/a – site unsuitable for lamprey				
B6	n/a – site unsuitable for lamprey				
B7	n/a – site unsuitable for lamprey				
B8	Moderate	3	4	**7**	No
B9	n/a – site unsuitable for lamprey				
B10	n/a – site unsuitable for lamprey				

Site no.	Lamprey habitat value	Spawning	Nursery	Total score	Lamprey recorded
B11	n/a – site unsuitable for lamprey				
C1	n/a – site unsuitable for lamprey				
C2	n/a – site unsuitable for lamprey				
C3	n/a – site unsuitable for lamprey				
C4	n/a – site unsuitable for lamprey				
C5	Good	2	3	**5**	**Yes**
C6	Moderate	3	4	**7**	No
C7	Good	2	3	5	No
C8	n/a – site unsuitable for lamprey				
C9	n/a – site unsuitable for lamprey				
C10	n/a – site unsuitable for lamprey				
C11	Good	2	3	5	No
C12	Moderate	3	4	**7**	No
C13	n/a – site unsuitable for lamprey				
C14	n/a – site unsuitable for lamprey				
C15	n/a – site unsuitable for lamprey				
C16	n/a – site unsuitable for lamprey				
C17	n/a – site unsuitable for lamprey				
C18	n/a – site unsuitable for lamprey				
C19	n/a – site unsuitable for lamprey				
D1	n/a – site unsuitable for lamprey				
D2	n/a – site unsuitable for lamprey				

3.2.3 European eel habitat

European eel were recorded from a total of three sites, namely A4 (unnamed Nadanuller Beg tributary), B8 (River Laney) and B9 (unnamed Laney tributary). Eel habitat was generally poor to moderate at best across the majority of survey sites, with larger sites (e.g. River Laney) offering the best quality eel habitat.

4. Discussion

4.1 Most valuable sites

4.1.1 Salmonids

In summary, brown trout were recorded from a total of *n*=21 survey sites (i.e. sites A2, A3, A4, A5, B1, B4, B5, B6, B7, B8, B9, B10, B11, C3, C5, C6, C7, C11, C12, C13, D2). A single Atlantic salmon parr was recorded during the survey, from the River Laney at Knocknagappul Bridge (C11). Of the *n*=37 sites, only three offered excellent quality salmonid habitat according to Life Cycle Unit scores. These were sites C7, C11 and C13 on the River Laney.

In general, the Ballinagree survey sites were small, upland eroding spate channels located in the upper reaches of the respective catchments. Many were located in higher-gradient areas subject to more frequent water level and flow fluctuations. Stream gradient is known to be one of the principal determinants of juvenile salmonid production, with medium gradients most optimal in terms of successful recruitment and population persistence (Wood & Budy, 2009; O'Grady, 2006; Amiro, 1993). Furthermore, as would be expected in catchments exposed to pressures including afforestation, peat escapement and agriculture, such as those in the vicinity of the proposed Ballinagree wind farm, those survey sites on larger watercourses typically offered better quality salmonid habitat and supported higher densities of salmonids. For example, all seven survey sites on the River Laney provided good quality or better salmonid habitat, with the Glen River, Carrigthomas Stream and Awboy River also provided better quality salmonid habitat.

4.1.2 Lamprey

Site C5 on the lower reaches of the Carrigthomas Stream was the only survey site found to support *Lampetra* sp. Two ammocoetes were recorded (likely brook lamprey given catchment migration barriers) in a sub-optimal sand/flocculent silt accumulation, heavily covered in filamentous algae. Sites C7 and C11 (River Laney) also provided some good quality lamprey habitat, although this was primarily in terms of potential spawning habitat (finer gravels) rather than ammocoete habitat.

The majority of the survey sites were not physically suitable for lamprey given their upland, eroding/cascading/high-energy nature (i.e. sites A1, A2, A3, A4, A5, B1, B4, B5, B6, B7, B9, B10, B11, C1, C2, C3, C4, C8, C9, C10, C13, C14, C15, C16, C17, C18, C19, D1 and D2). Naturally such sites do not encourage the deposition of fine, organic rich sediment required by larval lamprey nor finer gravels required by spawning adults (Goodwin et al., 2008; Aronsuu & Virkkala, 2014).

4.1.3 European eel

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 from a total of three sites, namely A4 (unnamed Nadanuller Beg tributary), B8 (River Laney) and B9 (unnamed Laney tributary). Single maturing adults were recorded in each case. Eel habitat was generally poor to moderate at best

across the majority of survey sites given the predominance of small, shallow streams with upland eroding characteristics which featured a paucity of suitable refugia, deeper pool areas. However, whilst superior (often good-quality) eel habitat was present in the larger watercourses (e.g. River Laney), the distribution of the species within the survey area was evidently highly restricted. As with Atlantic salmon, this was considered likely a result of known significant instream barriers downstream, i.e. hydroelectric dams at Inniscarra and Carrigadrohid.

5. References

Amiro, P. G. (1993). Habitat measurement and population estimation of juvenile Atlantic salmon (*Salmo salar*). Canadian Special Publication of Fisheries and Aquatic Sciences, 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).

Applegate, V.C. (1950). Natural history of the sea lamprey, *Petromyzon marinus* in Michigan. Special Scientific Report of the US Fish and Wildlife Service, 55, 1-237.

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. Document CEN EN 14011:2000.

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

Environment Agency (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, 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.

Kelly, F.L., Connor, L., Matson, R., Feeney, R., Morrissey, E., Coyne, J. and Rocks, K. (2015). Sampling Fish for the Water Framework Directive, Rivers 2014. Inland Fisheries Ireland, 3044 Lake Drive, Citywest Business Campus, Dublin 24, Ireland.

Kennedy, G.J.A. (1984). Evaluation of techniques for classifying habitats for juvenile salmon (*Salmo salar* L.) Proceedings of the Atlantic Salmon trust workshop on stock enhancement. 23 pp.

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.

Macklin, R., Brazier, B. & Gallagher, C. (2018). Fisheries assessment of selected weir sites on the River Barrow, Counties Carlow & Kilkenny. Unpublished report prepared by Triturus Environmental Services for McCarthy-Keville O' Sullivan on behalf of Waterways Ireland.

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

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.

Moorkens, E. (2007). Survey and Condition Assessment of the population of the freshwater mussel *Margaritifera margaritifera* in the Sullane River, County Cork. Unpublished Report to the National Parks and Wildlife Service, DAHRRGA, Dublin.

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

O'Connor, L. & Kennedy, R.J. (2002). A comparison of catchment-based salmon habitat survey techniques on three rivers in N. Ireland. Fisheries Management and Ecology, 9, 149-161.

O'Donovan, D. (2018). Salmon of the River Lee. City Print Cork, July 2018. 207pp.

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.

O'Reilly, P. (2009). Rivers of Ireland: A Flyfishers Guide (7th edition). Merlin Unwin Books. 416pp.

Pike, C., Crook, V. & Gollock, M. (2020). *Anguilla anguilla*. The IUCN Red List of Threatened Species 2020: e.T60344A152845178

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

Slade, J. W., Adams, J. V., Christie, G. C., Cuddy, D. W., Fodale, M. F., Heinrich, J. W. & Young, R. J. (2003). Techniques and methods for estimating abundance of larval and metamorphosed sea lampreys in Great Lakes tributaries, 1995 to 2001. Journal of Great Lakes Research, 29, 137-151.

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.

6. Appendix A – survey images

Plate 6.1 Brown trout cohorts from River Laney (site B11)

Plate 6.2 Brown trout cohorts from Carrigthomas Stream (C3)

Plate 6.3 Brown trout cohorts from site River Laney (C7)

Plate 6.4 Brown trout cohorts from site River Laney (C11)

Plate 6.5 Atlantic salmon (top) & brown trout (bottom) from River Laney (C11)

Plate 6.6 Brown trout cohorts from Awboy River (C12)

Plate 6.7 Adult brown trout from site River Laney (C13)

Plate 6.8 *Lampetra* sp. from Carrigthomas Stream (C5)

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APPENDIX 8.B2

Biological Water Quality
(Q-Sample Results)

Table 8B.8-1: Macro-invertebrate Q-sampling results for survey sites A1, A2, A5, B6, B8, B9, B10 and B11, July 2020

Group	Family	Species	Site A1	Site A2	Site A5	Site B6	Site B8	Site B9	Site B10	Site B11	EPA class
Ephemeroptera	Heptageniidae	*Ecdyonurus venosus*			2		1		1	1	A
Ephemeroptera	Heptageniidae	*Rhithrogena semicolorata*				10	43	32	2	1	A
Ephemeroptera	Heptageniidae	*Heptagenia sulphurea*				1	2	1	3	1	A
Plecoptera	Chloroperlidae	*Siphonoperla torrentium*	7	8	16			2	1	2	A
Plecoptera	Nemouridae	*Protonemura meyeri*						2		2	A
Plecoptera	Perlodidae	*Isoperla grammatica*	2	3	21	3		7		1	A
Plecoptera	Leuctridae	*Leuctra hippopus*	9	1	4			1		8	B
Trichoptera	Glossosomatidae	*Agapetus fuscipes*						1			B
Trichoptera	Goeridae	*Silo pallipes*				9					B
Trichoptera	Limnephilidae	*Potamophylax cingulatus*		1	1		1				B
Trichoptera	Limnephilidae	*Chaetopteryx villosa*			6						B
Trichoptera	Limnephilidae	*Drusus annulatus*				1					B
Trichoptera	Limnephilidae	*Halesus radiatus*						1			B
Trichoptera	Odontoceridae	*Odontocerum albicorne*				1	1				B
Trichoptera	Sericostomatidae	*Sericostoma personatum*					1	1			B
Ephemeroptera	Baetidae	*Baetis rhodani*	8	68	17	2	13	4		38	C
Ephemeroptera	Caenidae	*Caenis rivulorum*								3	C
Ephemeroptera	Ephemerellidae	*Serratella ignita*			31	6	50	11		19	C
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*			15	2	4	4	1		C
Trichoptera	Philopotamidae	*Wormaldia occipitalis*			28				2		C
Trichoptera	Philopotamidae	*Philopotamus montanus*				3			1	1	C
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*	9	2	3					1	C
Trichoptera	Polycentropodidae	*Plectrocnemia geniculata*			5				1		C
Trichoptera	Polycentropodidae	*Polycentropus kingi*			1						C

Group	Family	Species	Site A1	Site A2	Site A5	Site B6	Site B8	Site B9	Site B10	Site B11	EPA class
Trichoptera	Polycentropodidae	*Polycentropus flavomaculatus*								1	C
Trichoptera	Rhyacophilidae	*Rhyacophila munda*	2	1		2	2				C
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*			3	1		1		1	C
Coleoptera	Dytiscidae	*Oreodytes sanmarkii*	1				2				C
Coleoptera	Elmidae	*Elmis aenea*		2	7		1	3		12	C
Coleoptera	Elmidae	*Limnius volckmari*				2	1	1		1	C
Coleoptera	Hydraenidae	*Hydraena gracilis*	1	2	1	1	1	2		4	C
Coleoptera	Scirtidae	Scirtidae larva						1	1		C
Diptera	Chironomidae	Chironomid larva	2	2	9		5	2		34	C
Diptera	Limoniidae	*Eloeophila* sp. larva								2	C
Diptera	Pediciidae	*Dicranota* sp.	2	2	7		1			6	C
Diptera	Simulidae	*Prosimulium* sp.				1		6	1	2	C
Amphipoda	Gammaridae	*Gammarus duebeni*		5	2	3	4	1	12	7	C
Mollusca	Planorbidae	*Ancylus fluviatilis*		3				2			C
Hemiptera	Veliidae	Veliidae *nymph*			1				1		C
Hemiptera	Veliidae	*Velia caprai*							1		C
Arachnida	Hydrachnidiae	Unidentified species			1					30	C
Annelidae	Oligochaeta	Unidentified species	2	2			1				n/a
Abundance			45	102	181	48	134	86	28	178	
Taxon richness			11	14	18	14	15	19	10	19	
Q-rating			**Q4**	**Q4**	**Q4**	**Q4**	**Q4**	**Q4-5**	**Q4**	**Q4**	
WFD status			**Good**	**Good**	**Good**	**Good**	**Good**	**High**	**Good**	**Good**	

Table 8B.8-2: Macro-invertebrate Q-sampling results for riverine survey sites C3, C5, C7, C11, C12, C13 and C17, July 2020

Group	Family	Species	Site C3	Site C5	Site C7	Site C11	Site C12	Site C13	Site C17	EPA class
Ephemeroptera	Heptageniidae	*Ecdyonurus venosus*				3	1	3		A
Ephemeroptera	Heptageniidae	*Rhithrogena semicolorata*	7		9	30		6		A
Ephemeroptera	Heptageniidae	*Heptagenia sulphurea*	1	1		1				A
Ephemeroptera	Heptageniidae	*Ecdyonurus insignis*			6					A
Plecoptera	Chloroperlidae	*Siphonoperla torrentium*	1							A
Plecoptera	Chloroperlidae	*Chloroperla tripunctata*					3	2		A
Plecoptera	Nemouridae	*Nemoura cinerea*								A
Plecoptera	Perlidae	*Perla bipunctata*			6	11	6	2		A
Plecoptera	Leuctridae	*Leuctra hippopus*		10	1	1	10			B
Trichoptera	Glossosomatidae	*Agapetus delicatulus*				1				B
Trichoptera	Glossosomatidae	*Glossosoma boltoni*			1					B
Trichoptera	Goeridae	*Silo pallipes*	3			1				B
Trichoptera	Odontoceridae	*Odontocerum albicorne*			3		1			B
Trichoptera	Limnephilidae	*Drusus annulatus*							1	B
Trichoptera	Limnephilidae	*Potamophylax latipennis*			2					B
Trichoptera	Sericostomatidae	*Sericostoma personatum*	1				1			B
Ephemeroptera	Baetidae	*Baetis rhodani*	9	13	19	15	10	17	16	C
Ephemeroptera	Caenidae	*Caenis rivulorum*		2		7	3	9		C
Ephemeroptera	Ephemerellidae	*Serratella ignita*	5	8	57	15		53	1	C
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*				24	3	18	1	C
Trichoptera	Philopotamidae	*Wormaldia occipitalis*								C
Trichoptera	Philopotamidae	*Philopotamus montanus*				1	1		1	C
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*	2							C
Trichoptera	Polycentropodidae	*Plectrocnemia geniculata*		1						C
Trichoptera	Polycentropodidae	*Polycentropus kingi*							2	C

Group	Family	Species	Site C3	Site C5	Site C7	Site C11	Site C12	Site C13	Site C17	EPA class
Trichoptera	Polycentropodidae	*Polycentropus flavomaculatus*					1	2		C
Trichoptera	Rhyacophilidae	*Rhyacophila munda*		1		1		1		C
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*	1		2	1	3	11	3	C
Coleoptera	Dytiscidae	*Oreodytes sanmarkii*	1	2						C
Coleoptera	Dytiscidae	*Hydroporus tessellatus*	1	1						C
Coleoptera	Dytiscidae	*Agabus guttatus*							2	C
Coleoptera	Dytiscidae	*Dytiscidae* larva							2	C
Coleoptera	Elmidae	*Elmis aenea*		7	5		5	4		C
Coleoptera	Elmidae	*Limnius volckmari*		5	1	1		1		C
Coleoptera	Haliplidae	*Haliplus ruficollis* group		1						C
Coleoptera	Hydraenidae	*Hydraena gracilis*		1		1	3			C
Coleoptera	Hydrophilidae	*Helophorus brevipalpis*							2	C
Coleoptera	Scirtidae	*Cyphon* sp. larva						1		C
Diptera	Chironomidae	Chironomid larva		5	4	2	18	5	8	C
Diptera	Limoniidae	*Eloeophila* sp. larva		2		1				C
Diptera	Pediciidae	*Dicranota* sp.	4	7		1	6		36	C
Diptera	Simulidae	Unidentified larva		2	1	8	1	3	6	C
Diptera	Tipuliidae	*Tipula* sp.							1	C
Amphipoda	Gammaridae	*Gammarus duebeni*	15	9	4	3	3	2		C
Mollusca	Planorbidae	*Ancylus fluviatilis*		2		1				C
Arachnida	Hydrachnidiae	Unidentified species		18			12			C
Annelidae	Oligochaeta	Unidentified species		3		1	3	1	8	n/a
Abundance			51	101	121	131	94	141	90	
Taxon richness			11	19	13	20	20	15	14	
Q-rating			**Q4**	**Q3-4**	**Q4**	**Q4**	**Q4**	**Q4**	**Q3**	
WFD status			**Good**	**Mod.**	**Good**	**Good**	**Good**	**Good**	**Poor**	

Table 8B.8-3: Macro-invertebrate Q-sampling results for riverine survey sites N1, N2, N3, N4 and B7 (May 2021) and N5 (December 2021)

Group	Family	Species	Site N1	Site N2	Site N3	Site N4	Site B7	Site N5	EPA class
Ephemeroptera	Heptageniidae	*Rhithrogena semicolorata*		19	5	28	15	22	A
Ephemeroptera	Heptageniidae	*Ecdyonurus venosus*			9	2	1	27	A
Plecoptera	Chloroperlidae	*Chloroperla tripunctata*		8				18	A
Plecoptera	Chloroperlidae	*Siphonoperla torrentium*			9		6		A
Plecoptera	Perlidae	*Perla bipunctata*						23	A
Plecoptera	Nemouridae	*Amphinemura sulcicollis*		2	1		1		A
Plecoptera	Perlodidae	*Isoperla grammatica*			1	4	11		A
Ephemeroptera	Baetidae	*Alainites (Baetis) muticus*		4	2		1		B
Plecoptera	Leuctridae	*Leuctra inermis*		6	3	1	17		B
Plecoptera	Leuctridae	*Leuctra hipposus*						18	B
Trichoptera	Goeridae	*Silo pallipes*		4		8	1		B
Trichoptera	Limnephilidae	*Drusus annulatus*		1		4	3		B
Trichoptera	Odontoceridae	*Odontocerum albicorne*				3	2		B
Trichoptera	Sericostomatidae	*Sericostoma personatum*					1	3	B
Ephemeroptera	Baetidae	*Baetis rhodani*		27	63	4	11	15	C
Ephemeroptera	Ephemerellidae	*Serratella ignita*					6		C
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*					1		C
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*						3	C
Trichoptera	Philopotamidae	*Philopotamus montanus*					1		C
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*			1		2		C
Trichoptera	Polycentropodidae	*Polycentropus flavomaculatus*					1		C
Coleoptera	Dytiscidae	*Oreodytes sanmarkii*			1	3	5		C
Coleoptera	Dytiscidae	Unidentified larva						1	C
Coleoptera	Elmidae	*Limnius volckmari*				1	1		C

Group	Family	Species	Site N1	Site N2	Site N3	Site N4	Site B7	Site N5	EPA class
Coleoptera	Elmidae	*Elmis aenea*					4	1	C
Coleoptera	Hydraenidae	*Hydraena gracilis*		1					C
Diptera	Chironomidae	Chironomid larva		2	2		7		C
Diptera	Pediciidae	*Dicranota* sp.		1	2		3		C
Diptera	Simuliidae	Unidentified larva		5	10		2	5	C
Crustacea	Gammaridae	*Gammarus duebenii*		8	19	2	3	8	C
Arachnida	Hydrachnidiae	Unidentified species		1					C
Annelidae	Naididae (Tubificidae)	Unidentified species	3	1			2		E
Oligochaeta	Lumbricidae	*Lumbriculus* sp.	1		3	1	3		n/a
Abundance			4	90	131	61	111	125	
Taxon richness			2	8	7	6	8	10	
Q-rating			***n/a**	**Q4**	**Q4-5**	**Q4**	**Q4-5**	**Q4**	
WFD status			***n/a**	**Good**	**High**	**Good**	**High**	**Good**	

*n/a - Whilst a Q-sample was taken in June 2021, the low numbers of macro-invertebrate individuals and species recorded (very low numbers of Tubificidae larvae and *Lumbriculus* sp.) was not sufficient to reliably calculate water quality status. This was considered an artefact of the non-perennial nature of the stream.

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APPENDIX 8.B3

Freshwater Pearl Mussel Survey Report

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FRESHWATER PEARL MUSSEL (*Margaritifera margaritifera*) SURVEY

IN WATERCOURSES DOWNSTREAM OF

BALLINAGREE WINDFARM SITE

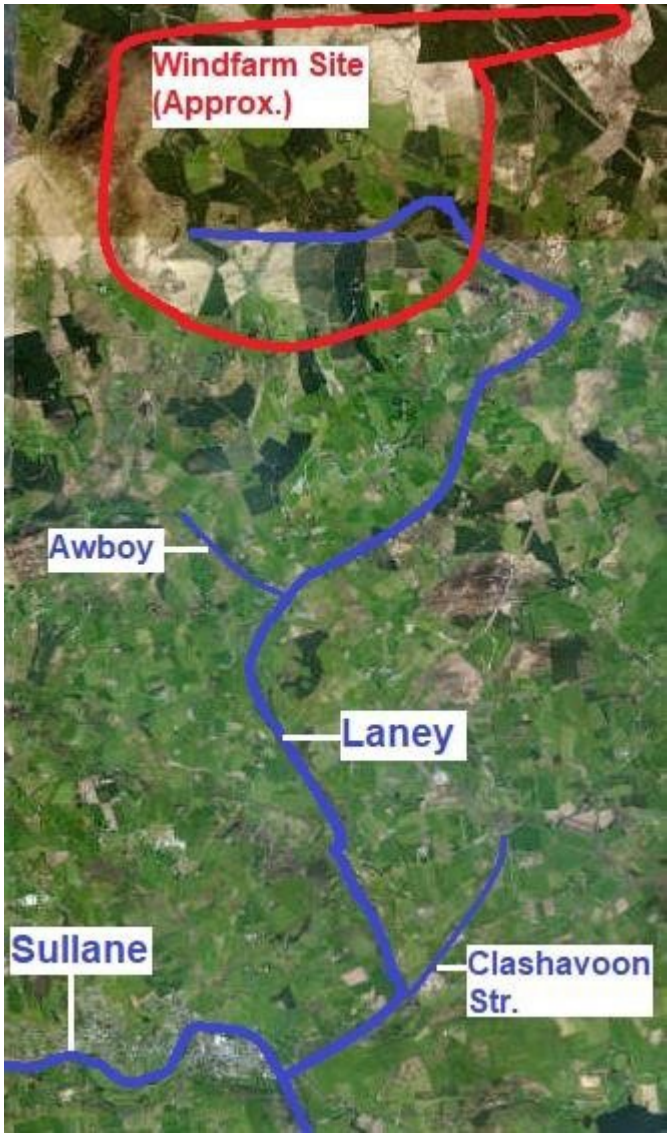
23 July 2020

TABLE OF CONTENTS

1.0 INTRODUCTION

The purpose of this report is to assess the occurrence of the legally protected freshwater pearl mussel (*Margaritifera margaritifera*) in the Laney River catchment downstream of the proposed Ballinagree Windfarm site in the Derrynasaggart Mountains. The windfarm site and proposed cable route are entirely within the catchments of the River Laney (EPA Code 19L01) (Fig. 1).

Figure 1: Watercourses



2.0 METHODOLOGY

2.1 DESKTOP ASSESSMENT

Available data on freshwater pearl mussel occurrence and water quality of the River Laney and tributaries downstream of the proposed windfarm site, or to be crossed by the grid route were examined.

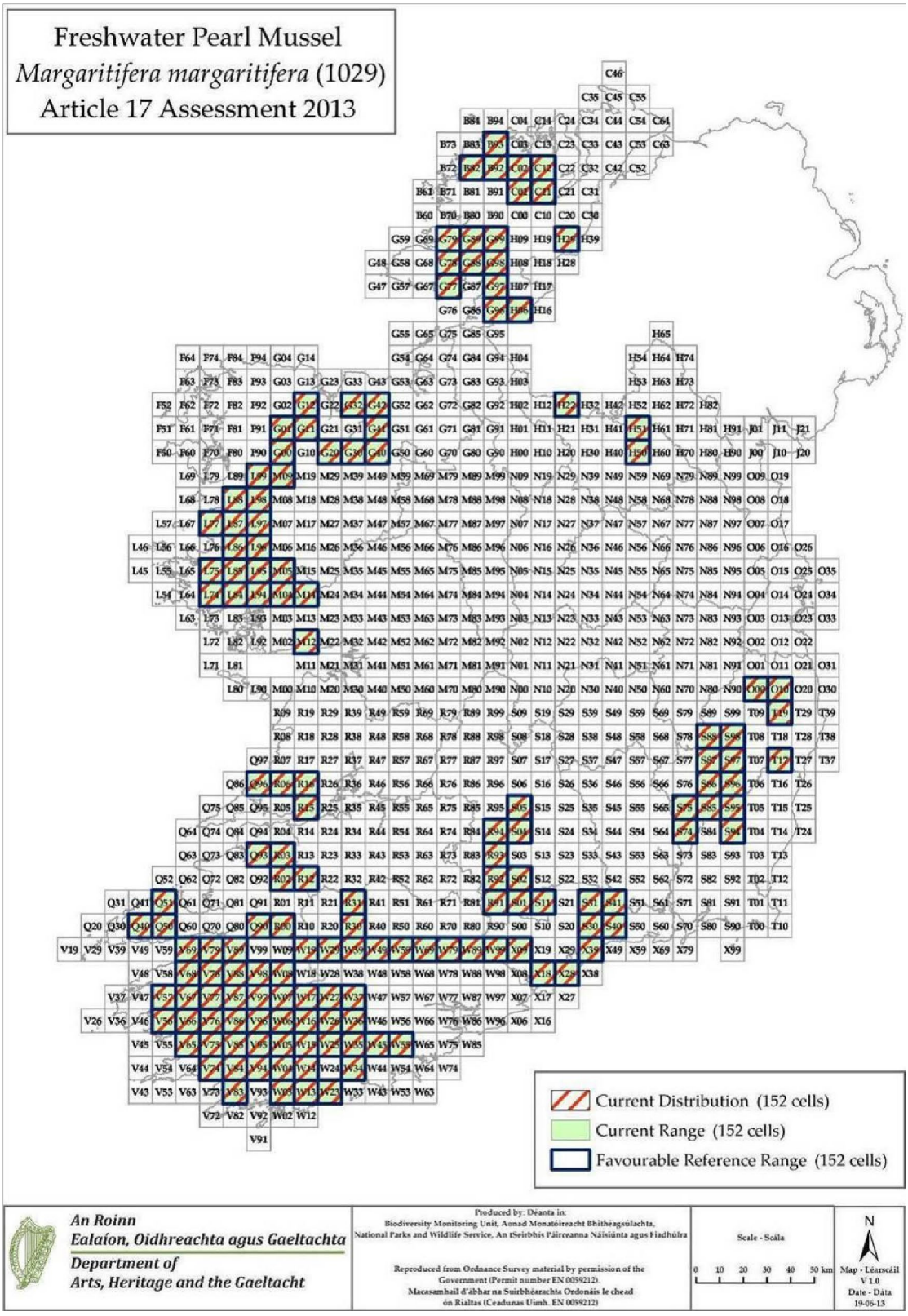
2.1.1 NPWS Distribution Data

The 2013 National Parks and Wildlife Article 17 report, indicates the presence of freshwater pearl mussels in the W37 10km square, where the downstream end of the River Laney flows into the Sullane River, but not in the W38 square, where the wind turbine site is proposed (Figure 2).

2.1.2 Previous Surveys

In the 1980's, while assessing EPA sites for biological water quality, John Lucey (*pers. comm.*) recorded mussels at Clonavrick Bridge (ITM 534615 578298), Morris's Bridge (ITM 535620 575686) and at Laney Bridge (ITM 535270 572808). In the only previous comprehensive survey of freshwater pearl mussels in the River Laney (Moorkens, 2007), a low population density was found, with the most upstream mussels located in the vicinity of Clonavrick Bridge (ITM 534615 578298), c. 10km downstream of the proposed wind turbine site and the highest density, estimated at approximately, 30 mussels per km, downstream of the Clashavoon Stream, but none at Morris's Bridge where they had been present in the 1980's.

Figure 2: Current distribution of Freshwater Pearl Mussel (*Margaritifera margaritifera).* From NPWS (2013) Article 17 report.


Freshwater Pearl Mussel
Margaritifera margaritifera (1029)
Article 17 Assessment 2013
Current Distribution (152 cells)
Current Range (152 cells)
Favourable Reference Range (152 cells)
An Roinn Ealaíon, Oidhreachta agus Gaeltachta
Department of Arts, Heritage and the Gaeltacht
Produced by: Déanta in:
Biodiversity Monitoring Unit, Aonad Monatóireacht Bhithéagsúlachta,
National Parks and Wildlife Service, An tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra
Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059212).
Macasamhail d'ábhar na Suirbhéarachta Ordonáis le cead ón Rialtas (Ceadunas Uimh. EN 0059212)
Scale - Scála
0 10 20 30 40 50 km
N
Map - Léarscáil V 1.0
Date - Dáta 19-06-13

2.2 FIELD ASSESSMENT

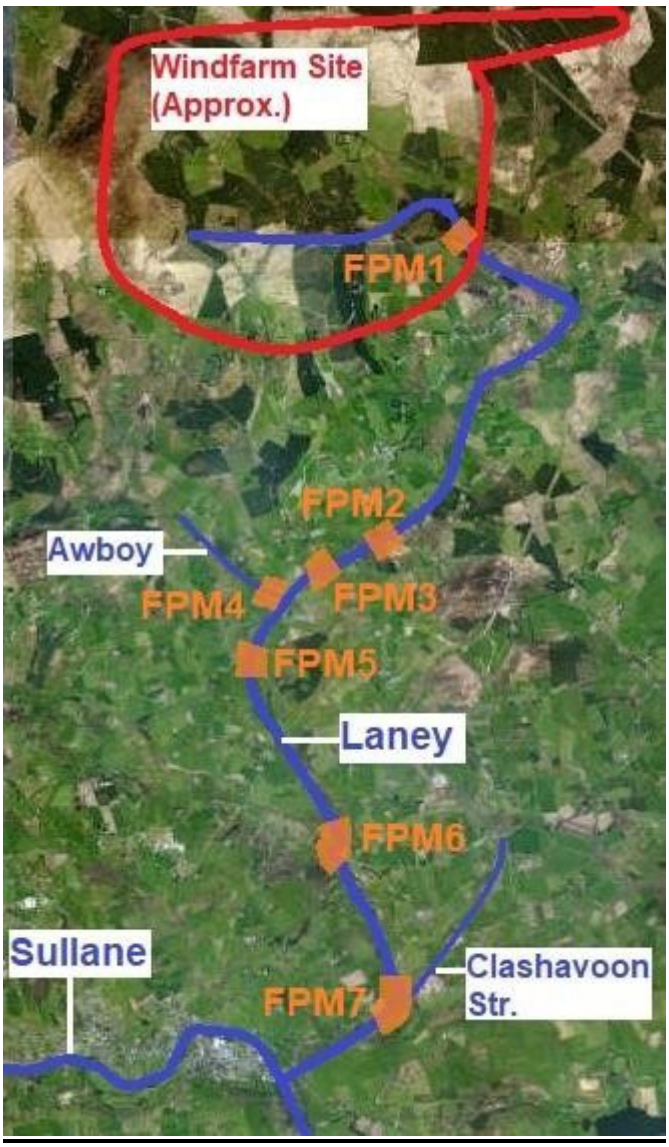
2.2.1 Survey Sites

Seven sites were selected for field surveying. Site locations are presented in Table 1 and illustrated in Figure 3. Site Photographs are presented in Appendix 1.

Table 1: Survey Sites

River Name	Site Code	Site Name	Grid Ref. upstream end (ITM)	Stretch Surveyed	Photos
Laney	FPM1	Windfarm Site downstream of turbines	538025 583419	Ford to 200m downstream	1
Laney	FPM2	Lacknahaghny Br.	536896 579983	Bridge to 100m upstream and downstream	2, 3, 4
Laney	FPM3	Knocknagappul Br.	535467 579825	Bridge to 200m downstream	5
Awboy	FPM4	Awboy Br.	534902 579260	Laney confluence to 100m upstream	6
Laney	FPM5	Clonavrick Br.	534592 578381	100m upstream to 100m downstream of bridge.	7, 8
Laney	FPM6	Morris's Br.	535701 575743	100m upstream to 100m downstream of bridge.	9, 10, 11
Laney	FPM7	Downstream of Clashavoon Stream confluence	536731 573787	Stream confluence to 200m downstream.	12, 13

Figure 3: Survey Sites FPM1 to FPM7



2.2.2 Survey Methods

Field surveys were carried out under Licence No. C15/2020, issued by the National Parks and Wildlife Service, downstream of the wind turbine site, in the vicinity of proposed cable route stream/river crossing points and at locations farther downstream where mussels were recorded in the past. The survey methodology used was in accordance with the guidelines given in Irish Wildlife Manual No. 12, NPWS (Anon., 2004). Surveying was carried out from June 8th and 9th, 2020, in bright weather, with good visibility. Following an initial safety inspection of stretches of river with habitat suitable for freshwater pearl mussels, the riverbed was examined visually with a bathyscope

and/or by snorkelling, depending on water depth. Biosecurity measures were strictly adhered to, with all equipment in contact with river water washed down with Virkon Aquatic disinfectant between sites. Assessments were made of the habitat suitability for freshwater pearl mussels, based on the criteria of Hastie *et al.* (2000) and Skinner *et al.* (2003).

3.0 Results

3.1 Freshwater Pearl Mussel Survey Results

No live freshwater pearl mussels were found at any of the sites surveyed.

The Awboy River, which would be crossed by one of the cable route options, does not have sufficient flow to support freshwater pearl mussels. The habitat in the River Laney should be excellent for mussels. However, the amount of silt present is greater than would be expected in a river of this type.

4.0 Conclusions

There is no indication of the current presence of freshwater pearl mussels in the River Laney.

The loss of the small population of freshwater pearl mussels from the River Laney is likely to be at least partly due to the amount of silt observed. Three possible sources of silt are considered: Forestry: An increase in suspended sediment loadings in rivers can occur during forestry operations (Allott et al., 2005).
Dredging and bankside clearance: This was observed in the upstream section of site FPM2 (see Photo 3).
Quarry discharge: A quarry in the Ummera townland discharges to the Clashavoon Stream. This stream has been seen to flow with a heavy silt load (Niamh Sweeney, *pers. comm.*). As the stream enters the River Laney at the upstream end of the section where Moorkens (2007) found the best population of mussels in the river, silt insults are the most likely cause of their demise here.

Another damaging activity to the River Laney is dumping. There are thousands of pet food cans in the river, dumped in from Clonavrick Bridge, where there is a considerable concentration of them, many still with paper labels intact (see Photo 9). Cans can be found all the way down to the confluence of the River Laney with the Sullane River.

Appendix 1 Photographs

Photo 1: Site FPM1

Photo 2: Site FPM2 upstream

Photo
3: Dredging and bank works at Site FPM2 upstream

Photo 4: Site FPM2 downstream

5: Site FPM3

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Photo

Photo 6: Site FPM4, Awboy river

7: Site FPM5 upstream

Photo

Photo 8: Site FPM5 downstream

Photo 9: Pet food cans in the river downstream of Clonavrick Br.

Photo 10: Site FPM6 upstream

Photo 12: Site FPM7 upstream

Appendix 2 References

Allott, N., Mcginnity, P. and O'Hea, B., 2005. Factors influencing the downstream transport of sediment in the Lough Feeagh catchment, Burrishoole, Co. Mayo, Ireland. Freshwater Forum 23: 126–138.

Anon (2004). *Margaritifera margaritifera*. Stage 1 and Stage 2 survey guidelines. *Irish Wildlife Manuals*, No. 12. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Hastie L.C., Boon P.J. and Young M.R. (2000). Physical microhabitat requirements of freshwater pearl mussel *Margaritifera margaritifera* (L.). *Hydrobiologia* 429 59-71

Moorkens, E. (2017). Survey and Condition Assessment of the population of the freshwater mussel *Margaritifera margaritifera* in the Sullane River, County Cork. Unpublished Report to the National Parks and Wildlife Service, DAHRRGA, Dublin.

Skinner, A, Young M. & Hastie, L. (2003). Ecology of the Freshwater Pearl Mussel. Conserving Natura 2000 Rivers Ecology Series No. 2 English Nature, Peterborough.