Appendix 5F
Sea lamprey (*Petromyzon marinus redd*) survey

OFFICE OF PUBLIC WORKS

Lower Lee (Cork City) Drainage Scheme

SEA LAMPREY, PETROMYZON MARINUS REDD SURVEY

December 2016

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1. Introduction

Triturus Environmental Services were contracted by Ryan Hanley Consulting Engineers to conduct a sea lamprey *Petromyzon marinus* redd survey on the main channel of the River Lee, Co. Cork to inform the preparation of an EIS for flood relief works on the Lower River Lee. The purpose of the survey was to assess the importance of the Lower River Lee for spawning sea lamprey, a species that are known to utilise the Lower River Lee for spawning. However, given that no previous sea lamprey surveys of the river have been undertaken it was important to note the distribution of spawning redds in order to establish its importance as a sea lamprey habitat. The baseline data and results of the surveys willhelp inform the detailed design and mitigation for the proposed flood relief works along the lower River Lee.

Background

The River Lee (EPA code: IE_SW_19_1663) is located in hydrometric area 19 and within the South Western river basin district (SWRBD), draining a catchment area of 1253km^2. The river is underlain by a mixed geology of Devonian old red sandstones and Dination mudstones and sandstones, with occasional, highly localised strikes of Tournasion limestone (Geological Survey of Ireland). The Lower River Lee is a lowland depositing watercourse (FW2; Fossit, 2000) and may be considered a 'C type' channel in its lower reaches (Rosgen, 1996). Given that C type channels meander and their banks are low enough to facilitate flooding they tend to have well sorted gravels and deeper channels. The larger 'C type' channels in rivers that would include the River Lee are characteristically suitable for large bodied sea lamprey. This is considered given that the species require coarse gravel substrata and deeper water for spawning.

According to the EPA the biological water quality on the River Lee achieved Q4, 'good status' at Leemount Bridge (on the R618 road) during 2011, which indicates it is meeting the requirements of the Water Framework Directive (2000/60/EEC). The River Lee is also a designated salmonid watercourse under S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988. The Lee contains 1.01% of the fluvial accessible habitat to Atlantic salmon *Salmo salar*, ranking it 22nd nationally according to the Quantification of the Freshwater Salmon Habitat Asset in Ireland (McGinnity et al., 2003). Larger salmonid bearing watercourses are also known to be good sea lamprey habitats with many Irish examples including the Rivers Blackwater, Suir, Nore, Shannon, Bann and Corrib.

Sea lamprey are known to migrate to European Rivers from April through May (Hardisty, 1969) and spawn typically between mid May to July (pers. obs.). The timing of spawning is known to be associated with water temperatures of 15°C (Maitland, 2003). Typically spawning areas are in water with depths over 0.5m and with current speeds greater than 0.4ms^{-1} (Curd, 2009) and up to 1-2ms^{-1} (APEM, 2004). Spawning adults favour coarse gravel, pebbles and sand where gravel diameter can vary between 1-11cm utilising pool tailings or the head of rapids (APEM, 2004). In Irish rivers Petromyzon typically spawn below weirs and other obstructions based on personal observations (e.g. Rivers Mulkear, Barrow, Bann & Lee) and from records in the literature (Igoe et al. 2004, O' Connor, 2007). This is most likely because lamprey cannot traverse steep weirs and also because of the higher velocity at these areas which the species favours for spawning (APEM, 2004). Nest sizes are variable with males and later in the process, females digging circular or oval shape nests with lengths varying between 0.80 and 2.25 m (mean 1.49 m ± 0.43 SD). Females then release large quantities of eggs, which become lodged in the redd pebbles, and die soon after (Curd, 2007).

The larvae hatch after approximately two weeks and drift downstream to burrowing substrata in current slacks where they feed on organic detritus and micro-organisms (Igoe et al. 2004). After 5-7 years in a

vermiform state, metamorphosis takes place at the end of the summer period (Curd, 2007). Juveniles known as transformers then swim downstream at night and reach the sea by the winter.

Status

Lamprey are listed on Annex II of the EU Habitats Directive [92/43/EEC]. The species has been designated in 10 SACs in the Republic of Ireland. According to King et al. (2011) very low levels of sea lamprey have been detected in catchment wide surveys for sea lamprey (O' Connor, 2004, King, 2006) meaning the species in Ireland is now regarded as 'Near Threatened'.

Status in the River Lee

Sea lamprey have historically been known to occur in the River Lee & tributaries according to Igoe et al. (2004). The species has been noted historically to rest en-route to migration grounds below Wellington Bridge and have been seen annually spawning below the turbines on the North Channel of the River Lee. However apart from casual observations no study on the distribution of sea lamprey spawning redds has ever been undertaken on the River Lee, Co. Cork. There is some evidence that lamprey may move upstream of Innishcarra Dam into Innishcarra Reservoir, as ring marks from parasitizing lamprey have been recorded on brown trout (Kennedy, 1960). However, it remains unknown whether these are anadromous lamprey or a land locked form as has been noted in Lough Derg. The absence of any incidental captures or sightings by anglers etc. above the County Hall Weir on the Lower River Lee would imply that the population size moving upstream of the Lower Weir sites on the system is comparably low and largely restricted to below the County Hall Weir.

2. Methods

Study Site

A sea lamprey redd survey was undertaken between O' Donovan's Bridge (Anglers Rest) and Wellington Bridge on the Lower River Lee during July 2015. While the counting of lamprey redds to estimate sea lamprey population size can be considered unreliable (Harvey & Cowx, 2003) it nonetheless provides a good indication of the utilisation of river habitat by sea lamprey by means of a non intrusive survey technique. Redd counting prevents any physical disturbance to breeding adults while excavating redd sites. Redd surveys were therefore conducted in early July 2015 following spawning by sea lamprey in order avoid such disruptions. The surveys were undertaken in stretches of river where adults had been observed conducting spawning behaviour during late May and June 2015 based during bank side observations. The redd surveys were undertaken by scuba diving to facilitate good fields of view and improve visibility at depth as snorkelling surveys are considered prone to missing redd sites given the stained colour of the River Lee. Scuba diving also accommodated neutral buoyancy at depth with the aid of a BCD jacket. The use of a BCD facilitated lateral positioning from red sites to prevent any physical disturbance with fins. Redd locations were recorded using a waterproof GPS and white board. Depth and approximate current velocities were also recorded.

It is known that subjectivity exists in the surveying of redd sites as has been documented by Schultz et al. (2014) and other references therein. While Sousa et al. (2010) state that lamprey nest depths vary between 0.20 and 0.40 m (mean 0.28 m $\pm$ 0.07 SD), Irish lamprey redds are typically deeper at depth of >0.5m as also found by APEM (2004) in their research. During this survey redds were defined as large oval depressions with distinct discoloration of gravels and the obvious displacement of larger substrata at known sites where adults had been observed. Surveys were typically conducted between 11.00 and 14.00 when natural light levels were best to view riverine substrata.

3. Results

Sea lamprey redds were concentrated downstream of the County Hall Weir on the River Lee. Redds were concentrated in the north channel of the river. Here they were located in the fisheries conservation area below the secondary weir and in the turbine channel to the north (see Figure 3.2). At these locations approximately five redds were counted. One redd was also found between shoot number one and two at the County Hall weir. The concentration of redds was evidently below weir structures.

Only one redd was found in the upper Lee Fields (west of the Grotto area, see Figure 3.1). Surveys between O' Donovan's bridge and the County Hall Weir did not uncover any other redd sites. This was supported by May and June river walkover surveys that did not identify any adults apart from one pair west of the Grotto area. A summary of the location and density of redds as broken down by channel segment are summarised in Table 3.1 below.

	
Redd Site at Fisheries Conservation Area North Channel	Redd Site at the County Hall Weir South Channel

Table 3.1 – Location of Sea Lamprey Redds on the Lower River Lee

Location	Redd Count	Notes	Depth & current velocity in parenthesis	IG coordinates (x, y)
North Channel (Fisheries Conservation Area)	2	2 Lamprey Redds in fast water at head of broken water in weir	1.7m (1.5ms^{-1})	164990, 071450; 165070, 071430
North Channel (Turbines)	3	Redds located between deeper water at outfall and *Ranunculus* beds downstream of steel bridge	1.4m (0.7ms^{-1})	164900, 071400; 162470, 072170; 165010, 071450
County Hall Weir	1	Redd located between shoot no.1 and shoot no. 2 on weir structure	2.2m (1.4ms^{-1})	165800, 071430
Lee Fields (West of Grotto)	1	Two adult lamprey excavating redds in deep glide habitat adjoining Ranunculus beds	1.5m (0.7ms^{-1})	165020, 071450
Total Number of Redds	7			

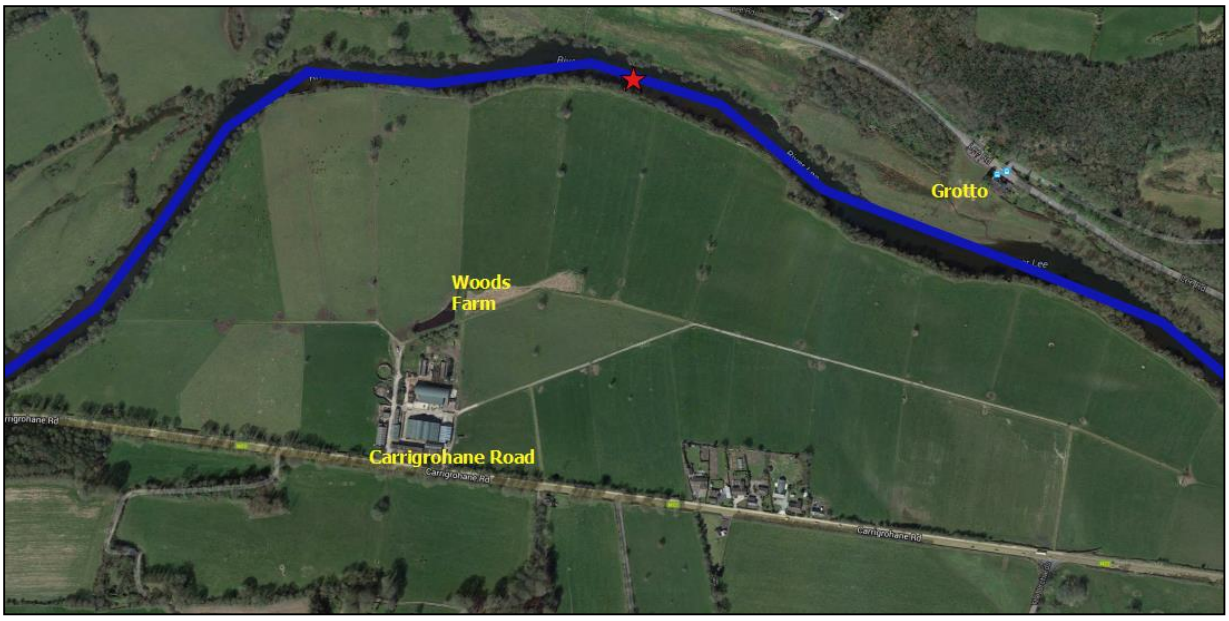

Figure 3.1 – Sea lamprey redd locations between O' Donovan's Bridge & Lee Fields (one redd site only)

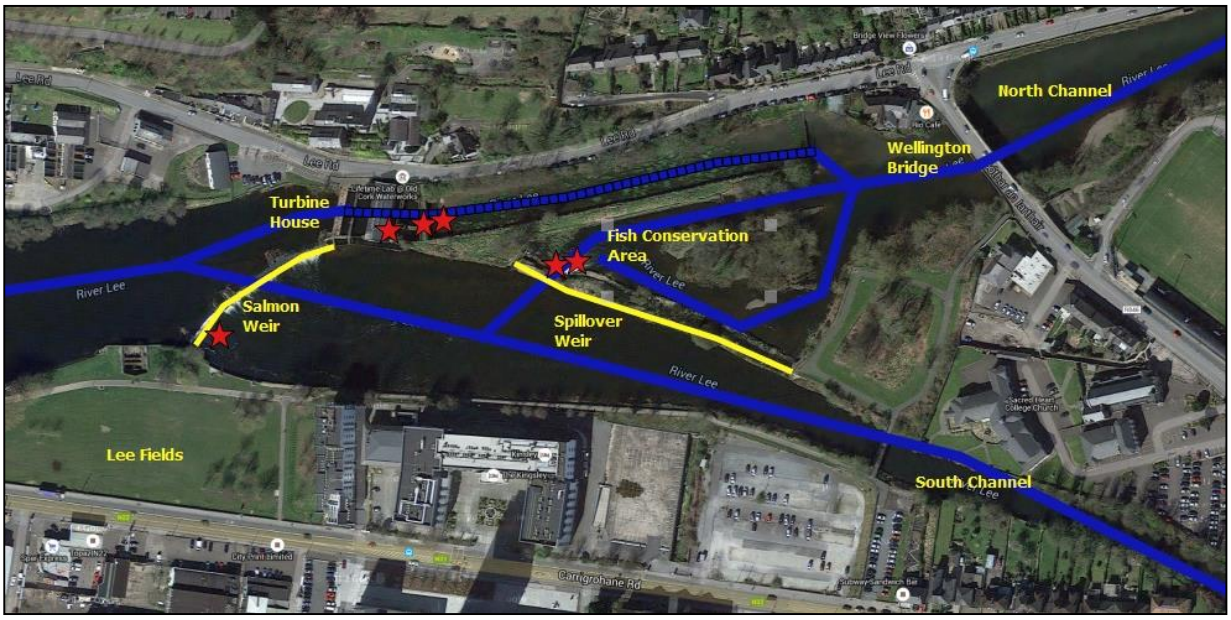

Figure 3.2 – Sea lamprey redd distribution between the Lee Fields and Wellington Bridge (six red sites)

4. Conclusions

Weirs are known to be a significant barrier to sea lamprey populations on many Irish Rivers including the Rivers Mulkear, Barrow, Corrib, Blackwater and Bann. On the River Lee it appears that adult lamprey are largely restricted below the County Hall Weir at the Lee Fields and the adjoining secondary weir at the fisheries conservation area. Only one redd site was identified between O' Dovovan's Bridge and the County Hall Weir indicating very low levels of spawning upstream. In mid June two adult sea lamprey were observed from the bank spawning in an area of deep glide adjoining beds of water crowfoot vegetation in this area. This is considered to be the first record of adult lamprey upstream of the County Hall Weir. It would appear that weir barriers to migration on the River Lee in part are likely to be responsible for the low levels of lamprey present in the system, as upstream spawning habitat is at least partially inaccessible.

In addition to physical migration barriers other threats to the species undoubtedly relate to predation. During 2013-2014 two sea lamprey were observed being manipulated before eaten by comorants. It is also likely that harbour seal which frequently access the County Hall weir during the summer predate on lamprey in addition to resident otter populations. Structures such as weirs also result in concentrations of spawning adults which make them more vulnerable due to visibility and poor evasiveness. The observed concentrations of redds in high velocity and deeper water or adjacent to macrophyte plant beds may relate to better cover from predators in the River Lee. Indeed in the north channel of the River Lee, lamprey redds were located in the very fast water immediately downstream of the weir cascades and in the cover of Ranunculus beds in the turbine channel.

Our surveys indicate that the numbers of sea lamprey redds present in the Lower River Lee are very low and indicate a small adult population size. The most important area of the River Lee for adult sea lamprey is downstream of the County Hall Weir and most notably between the fisheries conservation area and the turbine channel to the north. It is important to ensure that during the flood relief works that no impacts to the small population of sea lamprey occur as the population status appears to be poor in the River Lee.

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