National Programme: Habitats Directive and Red Data Book Fish Species

Summary Report

2021

IFI/2022/1-4619



lascach Intíre Éireann Inland Fisheries Ireland

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Habitats Directive Report 2021

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Executive Summary

Inland Fisheries Ireland (IFI), on behalf of the Department of the Environment, Climate and Communications (DECC), is responsible for monitoring and reporting on the Habitats Directive Annex II/V fish species (lamprey, shad, pollan and salmon). The monitoring programmes for lamprey and shad continued in 2021, which represented the third year in the 6-year Article 17 reporting cycle (2019 – 2024). With the exception of sea lamprey (*Petromyzon marinus*) floatover surveys, which could not be carried out due to Covid-19 public health restrictions, all surveys were carried out in the current year.

Larval lamprey surveys were conducted between the 16th August and 14th October in 2021. A total of 75 index sites within 10 catchments and 5 RBDs (Eastern, Western, South-Western, North-Western and Shannon) were sampled. These included the Boyne, Munster Blackwater, Bandon, Feale, Corrib (East) and Moy SACs and the Avoca, Clodiagh (Brosna – Lower Shannon), Swilly, Leannan and Annalee (Erne) non-SAC channels. A total of n=1,519 *Lampetra* spp. were recorded from the 75 sites while no sea lamprey larvae were captured. Data from the monitoring of index sites will be used to assess short-term and long-term trends in the population of brook lamprey (*Lampetra planeri*) for Article 17 reporting.

River lamprey spawning surveys were carried out on 6 catchments (Avoca, Deel, Nore, Owenavorragh, Slaney and Suir) in the current year. Sites where we previously observed spawning activity were visited on a number of occasions in 2021. Twenty new spawning locations in 5 catchments were identified and the lower stretches of the River Boyne will be targeted for river lamprey during the spawning season in 2022.

Sea lamprey spawning hotspot surveying was carried out from early June to mid-July 2021. Data from these surveys are used to assess timing, extent and annual consistency of breeding effort on a number of SAC rivers. Repeat visits across a network of traditional spawning locations confirmed typical levels of redd-building on the River Fergus in Ennis, the River Shannon at Plassey, the Mulkear River, at Annacotty and the River Barrow at St. Mullins. Less favourable results were recorded for other locations, for instance the River Nore at Thomastown and the River Suir at Clonmel.

Kayak and canoe-based floatover surveys to quantify spawning effort along main channel SAC rivers were not possible during 2021, with walk-over surveys conducted instead as viable alternatives on the Suir, Munster Blackwater and Slaney rivers during June and July. Little or no evidence of spawning activity was noted on any of these occasions.

Shad egg kick sampling was undertaken on the River Barrow at St. Mullins in 2021. Sampling occurred weekly from 30th April to 7th July. This survey method is used to

investigate the commencement and presence of shad spawning. Eggs were found consistently via kick sampling over a 9-week period with a total of 315 shad eggs collected across the 11 sampling days.

eDNA water sampling was undertaken on the River Barrow at St. Mullins between the 28th April to 5th July 2021. The aim of this survey is to use shad eDNA concentrations in order to assess the timing and duration of the shad spawning period and understand the impact of St. Mullins weir on shad migration. In total 55 water samples were collected within this time period (including controls). These were subsequently processed and adequately stored prior to further analysis.

As part of IFI's National Bass Conservation programme, seine netting surveys for juvenile bass (*Dicentrarchus labrax*) were carried out between 17^{th} and 19^{th} August 2021 at 3 locations on the Munster Blackwater, Barrow and Slaney estuaries, all of which are designated SACs for twaite shad (*Alosa fallax*). As young-of-year shad are often captured as bycatch in these surveys, they give an indication of successful spawning events for this species in the respective rivers. Seventeen shad, measuring 67 - 190 mm total length were captured from Lickey Point on the lower Munster Blackwater estuary/Youghal Harbour. Another 196 shad (52 - 164 mm) were captured at Fisherstown on the Barrow/Nore estuary while no shad were recorded from Mary's Point on the lower Slaney estuary.

Juvenile smelt (*Osmerus eperlanus*), a Red List species (King *et al.* 2011), were also recorded from the seine netting surveys of the Barrow and Munster Blackwater estuaries. Fifty-five young-of-year smelt (54 – 80 mm) were captured at Fisherstown while 2 smelt (80 & 81 mm) were recorded at Lickey Point. No smelt were recorded from the seine nets at Mary's Point on the Slaney estuary.

The fish communities in 3 estuaries (Munster Blackwater, Barrow-Suir and Slaney) were surveyed *via* trawled transects on 1st to 8th September 2021. These surveys are conducted annually primarily to provide data for IFI's National Bass Programme. Species of interest to the Habitats Directive Monitoring Programme are also occasionally encountered. Two shad (both measuring 95 mm) and 13 smelt (ranging in length from 162-200 mm) were captured from trawls on the Barrow-Suir estuary. A single shad (340 mm) was captured from the Slaney estuary while no shad or smelt were encountered in the Munster Blackwater estuary trawls.

1. Introduction

The EU Habitats Directive (Council Directive 92/43/EEC), along with the Bird's Directive and Water Framework Directive (WFD), is one of the most important legislative tools for the protection of nature in Europe. Habitats and species that are listed in the Directive's annexes are required to achieve favourable conservation status and a network of protected sites, called Special Areas of Conservation (SACs), have been established across Europe for their protection. Under Article 11 of the Directive, member states are required to carry out surveillance monitoring of the species and Article 17 requires reporting on the conservation status of species on a 6-year rolling cycle. Inland Fisheries Ireland (IFI), on behalf of the Department of the Environment, Climate and Communications (DECC), is responsible for reporting on the fish species (Table 1.1).

In addition to fulfilling the reporting requirements of the Directive, the HD team also monitors 2 fish species of conservation interest listed in the Red Data Book (King *et al.*, 2011), namely, Arctic char (*Salvelinus alpinus*) and smelt (*Osmerus eperlanus*).

Species	Habitats Directive Annex	Habitats Directive Conservation Status (2019)	Red Data Book
Sea Lamprey (<i>Petromyzon marinus</i>)	Annex II	Bad	Near Threatened
River Lamprey (<i>Lampetra fluviatilis</i>)	Annex II, V	Unknown	Least Concern
Brook Lamprey (<i>Lampetra planeri</i>)	Annex II	Favourable	Least Concern
Twaite Shad (<i>Alosa fallax fallax</i>)	Annex II, V	Bad	Vulnerable
Killarney Shad (<i>Alosa fallax killarnensis</i>)	Annex II, V	Favourable	Vulnerable
Pollan (Coregonus autumnalis)	Annex V	Bad	Vulnerable

Table 1.1. Habitats Directive Fish Species and Conservation Status.

Monitoring programmes are in place for twaite shad, smelt and lamprey and these involve surveying for the various different life stages, from March through to October annually. Killarney shad and pollan are surveyed as part of IFI's 3-year rolling cycle of Water Framework Directive (WFD) surveillance monitoring of fish communities in Irish lakes.

The current year represented the third year in the 6-year monitoring and reporting cycle (2019 - 2024) for Article 17. Despite COVID-19 restrictions being in place, all surveys, with the exception of sea lamprey floatover surveys, were carried out. These included nest count surveys for sea and river lamprey, larval lamprey electro-fishing surveys and netting and trawling surveys for juvenile shad and smelt.

2. Lamprey Monitoring Programme

2.1 Larval lamprey Sampling

A number of range and index sites will be sampled for larval lamprey over the current 6-year monitoring cycle (2019 – 2024) as part of Article 17 reporting for the Habitats Directive. These sites were selected from previous catchment-wide surveys carried out over the period 2009 – 2018. They will be used to assess the range and population size of brook lamprey (*Lampetra planari*) as well as the extent and quality of habitat for all 3 lamprey species. The anadromous river lamprey (*Lampetra fluviatilis*) is indistinguishable from brook lamprey at the larval stage and, while larval *L. fluviatilis* may be captured during the surveys, it is assumed the majority of larvae are *L. planeri*, particularly when occurring above natural or artificial barriers to migration. Once metamorphosis has occurred, it is possible to distinguish between the 2 species and, while rarely encountered, river and brook macrophthalmia (postmetamorphic juveniles) are noted during surveys. Sea lamprey (*Petromyzon marinus*), also an anadromous species, is distinguishable from *Lampetra* spp. at the larval stage but they are rarely encountered in surveys. This may be due to a number of reasons including a smaller distribution and population size. Further research is required to understand their habitat utilization at this early life stage.



Plate 2.1. Low water levels at an index site on the Clodiagh River in 2021.

A selection of index sites was targeted for larval lamprey sampling in 2021. Index sites have been allocated for 13 SAC and 10 non-SAC catchments within 7 River Basin Districts (RBDs) and will provide data for the assessment of short-term and long-term trends in the population size of *L. planeri*. In this regard, sites within SAC rivers will be sampled 3 times, while non-SAC sites will be sampled twice within the 6-year reporting cycle.



Plate 2.2. Larval Lamprey Index Site on the River Annalee in 2021.

Larval lamprey surveys were carried out between the 16th August and 14th October in 2021. A total of 75 index sites within 10 catchments and 5 RBDs (Eastern, Western, South-Western, North-Western & Shannon) were sampled (Table 2.1). These included the Boyne, Munster Blackwater, Bandon, Feale, Corrib (East) and Moy SACs and the Avoca, Clodiagh (Brosna – Lower Shannon), Swilly, Leannan and Annalee (Erne) non-SAC channels. Of these, the Boyne, Moy, Corrib, Feale (lower section), Clodiagh and Swilly (lower main channel) are OPW arterially drained channels. With the exception of the Boyne, the surveys in 2021 represented the first visit for these sites within the current reporting cycle. Index sites on the River Boyne were previously sampled in 2019.

A semi-quantitative sample was taken at each site by electro-fishing for 2 minutes in a defined area (1m²) of suitable nursery habitat, generally comprising fine sediments. A single anode backpack is used to electro-fish for lamprey using a pulsed DC and a low frequency (10Hz) setting. The anode is placed approximately 10–15cm above the sediment, energized for 20 seconds, switched off for 5 seconds and this cycle is repeated for a period of 2 minutes. Immobilised larvae are collected using a fine mesh net and transferred to a bucket of water. Once 5 mins have elapsed, a second fishing and, occasionally a third fishing, is carried out until an approximate 50% depletion is achieved. All lamprey are enumerated and measured to the nearest millimetre. As young-of-year larvae can be difficult to capture using this method, a quantitative pushnet sample is also taken from adjacent suitable areas of

deposition, if available. The spoil from these pushnet samples is emptied onto a tarpaulin sheet and any larvae present are collected for processing.

Water temperature and conductivity were measured at each site and habitat characteristics were noted, including sediment type, water depth, flow type, shading, channel modification etc. Water temperatures during the survey period ranged from 11.5°C to 21.4°C. Some of the higher temperatures were recorded from late August on the Bandon and Annalee. It is recommended that electro-fishing does not occur when water temperatures exceed 20°C due to the additional stress this would put on fish species.

A total of n=1,519 larval and juvenile *Lampetra* spp. were recorded from the catchments surveyed (Figures 2.6 to 2.15). No larvae were recorded from 7 sites on the Bandon, Annalee, Feale, Moy and Leannan and no *P. marinus* larvae were captured during the survey. Densities ranged from 1/m² at a small number of sites on the Bandon, Moy and Munster Blackwater to 179/m² on the Clodiagh River. Mean densities ranged from 4/m² on the Annalee to 98/m² on the Clodiagh (Table 1.2). Length-frequency data indicated a range of size classes across all catchments (Figures 2.1 to 2.5), with lengths measuring from 12 mm (young-of-year larvae) to 148 mm.

One of the targets of the Common Standards Monitoring protocol for assessing populations of brook and river lampreys (JNCC, 2015) is that, in order to achieve favourable condition, larval *Lampetra* spp. should have a mean density >5/m² in sites with suitable habitat within a catchment. They should also be present in not less than 50% of these sites and the full range of size classes, from 0+ to metamorphosis, should be present. In previous catchment-wide surveys, over the period 2009 - 2018, favourable condition was achieved for the Boyne (2015), Munster Blackwater (2014), Avoca (2009) and Bandon (2009) catchments. The Moy (2018), Leannan (2009) and Swilly (2009) catchments had mean larval *Lampetra* densities <5/m² and did not achieve favourable condition. Catchment-wide data are not available for the Erne, Brosna or Corrib catchments.

RBD	Channel (* SAC)	No. Sites	Min Density (No./m²)	Max Density (No./m²)	Mean Density (No./m²)	Min Length (mm)	Max Length (mm)
Eastern	Boyne *	7	2	28	17	37	148
Eastern	Avoca	5	25	76	42	15	117
South Western	Bandon *	7	0	58	14	19	123
South Western	M. Blackwater *	14	1	64	26	12	133
Western	Corrib (East) *	6	2	14	6	42	135
Western	Moy *	10	0	17	5	33	134
Shannon	Feale *	10	0	51	20	17	143
Shannon	Clodiagh	4	40	179	98	20	134
North Western	Annalee	5	0	8	4	31	115
North Western	Leannon	5	0	18	6	27	144
North Western	Swilly	2	6	7	7	20	125

Table 2.1. Density and population structure of larval lamprey from index sites on 11 channels in 2021.



Figure 2.1. Pooled length frequency data for larval lamprey from index sites on the Avoca & Boyne (Eastern RBD) in 2021.



Figure 2.2. Pooled length frequency data for larval lamprey from index sites on the Bandon & Munster Blackwater (South Western RBD) in 2021.



Figure 2.3. Pooled length frequency data for larval lamprey from index sites on the Moy & Corrib East (Western RBD) in 2021.



Figure 2.4. Pooled length frequency data for larval lamprey from index sites on the Clodiagh & Feale (Shannon RBD) in 2021.



Figure 2.5. Pooled length frequency data for larval lamprey from index sites on the Annalee & Swilly-Leannan (North Western RBD) in 2021.

Eight *L. planeri* macrophthalmia were recorded from sites on the Avoca and Feale ranging in length from 98 mm to 143 mm. Sixteen transformers were recorded from sites on the Avoca, Feale, Brosna and Leannan and these ranged in size from 76 mm to 144 mm.

As stated, the purpose of surveying the index sites is to assess trends in population size

over time. The selection of suitable sites is crucial for identifying population trends, fluctuations and any negative impacts at the catchment or larger scale. A number of sites on the Bandon, Annalee, Feale and Moy had low numbers of larvae, or were negative for lamprey. A review of sites in these catchments will be carried out to identify more suitable replacement sites for future monitoring.



Figure 2.6. Larval *Lampetra* spp. densities at index sites on the Boyne Catchment in 2021.



Figure 2.7. Larval *Lampetra* spp. densities at index sites on the Avoca Catchment in 2021.



Figure 2.8. Larval *Lampetra* spp. densities at index sites on the Bandon Catchment in 2021.



Figure 2.9. Larval *Lampetra* spp. densities at index sites on the Munster Blackwater Catchment in 2021.



Figure 2.10. Larval *Lampetra* spp. densities at index sites on the Corrib (East) Catchment in 2021.



Figure 2.11. Larval *Lampetra* spp. densities at index sites on the Moy Catchment in 2021.



Figure 2.12. Larval *Lampetra* spp. densities at index sites on the Feale Catchment in 2021.



Figure 2.13. Larval *Lampetra* spp. densities at index sites on the Clodiagh River (Brosna – Lower Shannon) in 2021.



Figure 2.14. Larval *Lampetra* spp. densities at index sites on the Annalee River (Erne) in 2021.



Figure 2.15. Larval *Lampetra* spp. densities at index sites on the Swilly-Leannan Catchments in 2021.

2.2 Adult lamprey investigations

2.2.1 Munster Blackwater & Suir walkover surveys

As was the case in 2020, it was inappropriate to undertake kayak & canoe-based floatover surveys due to COVID-19 health and safety restrictions. Instead, repeat walkover surveys were conducted on the Munster Blackwater and Suir rivers by small teams complying with IFI COVID-19 SOPs for safe working. An addition to 2021 was a survey on the River Slaney in Cos. Carlow and Wexford.

Sites along the Munster Blackwater were visited in July 2021 over 2 consecutive days(15th-16th). The first day covered locations between Mallow and Fermoy, specifically Mallow town (Castle section), Killavullen, Ballyhooly and Fermoy town, both upstream and downstream of the town bridge and breached weir. Day 2 focused on the stretch between Fermoy town and Lismore, specifically Carysville/Clondulane, Kilmurray, Ballyduff, Glenmore and Lismore town. Water temperatures ranged between 15-19°C (Figure 2.16). No adult fish or redds were observed at any of the river sections surveyed.





For the River Suir, a total of 4 walkover surveys were undertaken during June 2021 (10th, 16th-17th, 23rd and 30th), with each visit comprising visual inspections of suitable habitat at various locations between Cahir and Carrick-on-Suir, namely Swiss Cottage, Ardfinnan, Newcastle, Knocklofty and Kilsheelan, while also including hotspot surveys in the traditional Clonmel town section. Sites on tributaries were also visited during 2021, including locations on the Tar, Nier, Clodiagh (Portlaw), Anner and Lingaun rivers. A single redd was observed in Clonmel town (Table 2.2), however no activity was noted at any other locations on either

the main channel or tributaries. Temperatures fluctuated greatly across sites and between visits with an overall range of 12-17°C recorded for the period in question (Figure 2.17).



Prospective sites on the River Slaney were visited on June 23rd, namely Tullow, Clohamon, Ballycarney and Scarawalsh. No signs of sea lamprey spawning activity were in evidence.

Figure 2.17. River Suir levels and water temperatures measured in Clonmel town (OPW hydrometric gauging stations 16011 and 16148, respectively) during the 2021 sea lamprey migration and spawning period.



Plate 2.3. Sea lamprey spawning habitat on the Munster Blackwater River at Kilmurray, Co. Waterford.



Plate 2.4. Sea lamprey spawning hotspot in Clonmel town on the River Suir.

2.2.2 Monitoring Sea Lamprey Spawning Hotspots

Sea lamprey spawning hotspot surveys proceeded as per usual in 2021 Repeat visits were undertaken from early June through to mid-July at recognised spawning sites on individual SAC rivers across the south and southeast as well as within the Lower Shannon SAC (Figure 2.18), with the aim of recording timing, extent, and annual consistency of breeding effort. Details of hotspot visits as well as results are listed in Table 2.2.



Figure 2.18. Location of principal sea lamprey spawning 'hotspots' surveyed annually.

The River Fergus in Ennis town is a notable sea lamprey spawning location, specifically the 1 km urban stretch from Mill Street Bridge downstream through Wood Quay and Harvey's Quay, through Bank Place and onwards past Club Bridge, along Newbridge Road to Steele's Rock and the rear of Cusack Park. During June and July 2021, two separate visits to the urban section were undertaken with appreciable levels of sea lamprey activity recorded on both occasions (Table 2.2).



Plate 2.5. Sea lamprey spawning hotspot in Ennis town on the River Fergus.

The Mulkear River at Annacotty, Co. Limerick was visited on 5 occasions from early June to late-July 2021. The first visit on June 8th confirmed that spawning had commenced (Table 2.2). By the following week (June 15th) spawning activity had intensified with numerous and widespread nest excavation noted on this and subsequent visits. Presence of adult fish on redds was also noted. Spawning was still underway at the beginning of July. By late -July spawning had ceased, with all structures visibly aged. Water levels and temperatures at Annacotty for the spawning period are displayed in Figure 2.19.







Plate 2.6. Sea lamprey migration obstacle on the Mulkear River at Annacotty Weir, Co. Limerick.

For the Mulkear catchment in general, several locations on upstream tributaries exist where spawning is noted almost annually for some and less frequently for others. These sites were revisited in 2021 to detect upstream migration and to appraise the potential of Annacotty Weir to act as obstacle to passage. Sea lamprey redds were noted at Scart immediately downstream of the confluence of the Mulkear and Killeenagarriff rivers. Redds were also found during searches further upstream at Killeenagarriff Bridge (Figure 2.20). A previously noted spawning location a further distance upstream into the catchment on the Bilboa R. at

Cappamore had no redds in 2021, the 6th year in succession where none were recorded. This section of the Bilboa River was subject to significant disturbance in 2018 due to cattle encroachment during May and June. This issue has not been repeated since and perfect habitat conditions for sea lamprey spawning are present again. The presence of nests at selected locations in the mid/upper catchment implies passage was possible to an extent at Annacotty Weir. However, a general absence from other noted locations, such as on the Bilboa River at Cappamore, suggests ongoing passage issues posed by this structure amongst others, further exacerbated by low flow conditions during certain years.



Figure 2.20. Sea lamprey spawning locations on the Mulkear catchment.



Plate 2.7. Sea lamprey redds at Scart on the Mulkear River, Co Limerick.

Date	Location	Sea Lamprey	Redds	Temp (°C)
9/06/2021 13/07/2021	River Fergus, Ennis Town, Co. Clare	1 0	23 41	18.0 20.4
8/06/2021	Mulkear River, Annacotty,	2	21	16.1
15/06/2021	Co. Limerick	12	34	18.1
22/06/2021		8	51	16.1
1/07/2021		8	Numerous	18.5
22/07/2021		0	No new redds	22.4
8/06/2021	River Shannon, UL Living Bridge,	1	4	17.2
22/06/2021	Plassey, Co. Limerick	1	Numerous	18.5
1/07/2021		0	Numerous	21.1
9/06/2021	Owengarney River, Sixmilebridge	0	6	18.9
13/07/2021	Co. Clare	0	10	21.3
10/06/2021	River Suir, Clonmel Co. Tipperary	0	1	15.5
16/06/2021		0	1	16.5
23/06/2021		0	1	14.9
30/06/2021		0	1	17.8
10/06/2021	River Nore, Thomastown, Co. Kilkenny	0	0	16.5
16/06/2021		0	0	NA
24/06/2021		0	0	16.8
8/07/2021		0	0	NA
10/06/2021	River Nore, Inistioge, Co. Kilkenny	0	4	17.4
16/06/2021		0	6	17.1
24/06/2021		0	6	16.8
8/07/2021		0	9	17.1
11/06/2021	River Barrow, St. Mullins, Co. Carlow	2	18	NA
18/06/2021		12	34	16.1
25/06/2021		10	56	16.5
2/07/2021		8	58	18.5
7/07/2021		2	58	18.3

Table 2.2. Sea lamprey activity (counts of adult fish and redds) recorded during repeatvisits to recognised spawning hotspots during 2021.



Plate 2.8. Sea lamprey nests on the Owengarney River in Sixmilebridge, Co. Clare.

Redd building was recorded at other hotspots such as the River Barrow below St. Mullins Weir, the River Nore at Inistioge, the Owengarney River in Sixmilebridge and the River Shannon in the grounds of UL at Plassey (Table 2.2). Overall observations for this latter assemblage of hotspots in 2021 were similar to previous years in relation to timing and effort. On the Owengarney River in Sixmilebridge, Co. Clare, a total of 10 redds were recorded, including 2 immediately downstream of the village bridge. Noteworthy for a different reason was the lack of redds on the River Nore at Thomastown where at least a handful would typically be recorded.

Prevailing weather conditions for the entire period both before and during the sea lamprey spawning run were obtained from the Met Eireann synoptic weather station at Shannon Airport, Co. Clare, the data from which should be broadly representative of the Lower Shannon area where most hotspots are located. Air temperatures were slightly cooler than average for the initial period (Figure 2.21 (a)). Following a relatively dry April, rainfall amounts for May were high due to a bout of unsettled weather. followed in turn by a drier June (Figure 2.21 (b)).





90 80 70

April

May

Month

Rainfall (mm)

Figure 2.21. Monthly mean air temperatures (a) and total rainfall (b) from April 2021 to July 2021 recorded at Shannon Airport (Met Eireann) in comparison with both the 30 year (1981-2010) long-term average (LTA) and the preceding 7 year (2013-2020) average.

July

June

2.2.3 River lamprey spawning distribution

River lamprey are listed in Annex II and V of the Habitats Directive (Council Directive 92/43/EEC), as a result, they have designated Special Areas of Conservation (SACs).

The Habitats Directive team identified a deficiency of data on river lamprey distribution in the Article 17 reporting of 2018 with a conservation classification of 'unknown' given to the species. One of the main reasons for this lack of data was based on the life cycle of the river lamprey. As larvae, they cannot be distinguished from brook lamprey, as adults they have a short spawning season in spring, surveys can be disrupted by flooding and inclement river conditions during this time. In the most recent Article 17 report (NPWS 2019) the conservation status of river lamprey was assessed as unknown due to a lack of data on their distribution and population size. Challenges associated with monitoring river lamprey include the elusive nature of their spawning activity and the inability to distinguish between larval brook and river lamprey. A dedicated monitoring programme was initiated in the current reporting cycle (2019 - 2024) involving adult spawning/nest count surveys and targeted electro-fishing surveys for post-metamorphic juveniles (macrophthalmia). An additional objective is to investigate the timing and duration of the river lamprey spawning season in Ireland



Plate 2.10. Brook lamprey macrophthalmia (top) and river lamprey macrophthalmia (bottom).

The second facet of the river lamprey monitoring programme involves electro-fishing for lamprey at preselected sites in order to identify the presence of river lamprey macrophthalmia to gain further insight into the population structure, range and distribution of river lamprey. River lamprey make their downstream migration to estuaries from their nursery grounds over winter. Electro-fishing surveys were to be completed overwinter but could not be undertaken in 2021 due to high water levels and Covid 19 restrictions.

Adult river lamprey, spawning surveys were undertaken on the Rivers Avoca, Deel, Nore, Owenavorragh, Slaney and Suir (Figure 2.22). Sites were pre-selected based on former larval lamprey surveys which noted the presence of suitable spawning gravels and also on information from locally based IFI colleagues. In addition, known spawning locations or 'hotspots' on the Avoca and Slaney were visited over the course of the spawning season.



Figure 2.22. Map displaying sites surveyed for spawning river lamprey in 2021.

At each site a habitat survey was undertaken in order to determine if the site was worth revisiting or added to the 'hotspot' list of sites. Many of the sites surveyed across the Nore and Suir catchment were deemed unsuitable for spawning activity for reasons such as the gravels were not the right size or the flow conditions were not conducive to spawning.

The spawning surveys were undertaken between 25/03/2021 and 23/04/2021. Over this period 79 sites were surveyed on between one and three occasions (Table 2.3). Of these, evidence of river lamprey spawning was evident at 27 sites (Figure 2.22). River lamprey excavating redds were recorded at 10 sites from the date of the first surveys. Twenty new locations were observed with redds or where river lamprey actively excavating redds. These new locations were observed on the Deel (n=1), Nore (n=1), Owenavorragh (n=3), Slaney (n=3) and Suir (n=12).

River	Location	No. of visits	Redds	River lamprey	Temp. Range (°C)
Avoca					
Aughrim	u/s Woodenbridge	3	Present - 28	Absent	8.7-9.6
Aughrim	1km d/s Aughrim	1	Absent	Absent	8.6
Ow	u/s Aughrim	2	Present - 1	Absent	8.1
Aughrim	Coates Bridge	3	Present - 5	Present - 1	8.6
Aughrim	Woodenbridge	2	Absent	Absent	8.7-9.4
Aughrim	d/s Aughrim	1	Absent	Absent	
Avonbeg	Ballinaclash	1	Absent	Absent	10.9
Deel					
Deel	Ardee		Present	Present	
Nore					
Unnamed Trib	Inflow LHB ds Brownsbarn Bridge	1	Absent	Absent	
Nore	Inistioge	2	Absent	Absent	12.9
Nore	d/s Thomastown	1	Absent	Absent	11.8
Nore	u/s Thomastown Br	2	Absent	Absent	12.1
Arrigle	Ballyduff Br	1	Absent	Absent	10.3
Nore	Brownsbarn Br	2	Present - 6	Present	14.6
Dinan	Dinan Br	1	Absent	Absent	13
Kings	Kells	1	Absent	Absent	
Kings	Ennisnag Br	1	Absent	Absent	
Erkina	Durrow	2	Absent	Absent	10.3
Delour	Derrynaseera Br	1	Absent	Absent	8.3
Owenbeg	Castlemarket Br	1	Absent	Absent	10.4
Owenbeg	Rosconnell Br	1	Absent	Absent	11.5
Gully	N Durrow	1	Absent	Absent	9.4
Tonet	Mill Br, Anatrim	2	Absent	Absent	8.5-10.4
Nore	N Durrow	1	Absent	Absent	9.8
Nore	Tallyho Br	1	Absent	Absent	
Owenbeg	Attanagh Br	1	Absent	Absent	
Nore	Kilkenny	1	Absent	Absent	
Pocock	E Kilkenny	1	Absent	Absent	
Little Arrigle	Jerpoint Abbey	1	Absent	Absent	
Owenavorragh					
Owenavoragh	Ballywater Br	1	Present - 1	Present	11.3
Owenavoragh	d/s confluence River Bracken	1	Present	Present	10.8
Owenavoragh	Ballycannon	1	Present	Absent	10.8
Owenavoragh	Kilenagh	1	Absent	Absent	
Owenavoragh	River Owenavoragh, u/s	4	Dresent 2	Abaant	11.0
	Ballycannon	I	Fiesent - 3	ADSent	11.2
Slaney					
Derry	Shillagh	2	Present - 6	Present	8.3
Slaney	Rathvilly	2	Absent	Absent	8.3-9
Slaney	Straboe Cross Roads	1	Absent	Absent	9.1

Table 2.3. River lamprey activity (counts of adult fish and redds) recorded during repeat visits to recognised spawning 'hotspots' during 2020.

River	Location	No. of visits	Redds	River lamprey	Temp. Range (°C)
Slaney	Tomnafinnoge Woods	2	Present - 11	Present	8.6-8.9
Slaney	1km d/s Aghade Br	2	Present - 30	Present	8.7-9.5
Dereen	Rathglass	1			8.8
Slaney	Tullow	1	Present - 30	Present	8.6
Suir					
Suir	Suirville	1	Absent	Absent	11.9
Ara	Bansha Br	1	Absent	Absent	11.5
Aherlow	Stagdale Br	1	Absent	Absent	10.5
Aherlow	Killardy Br	1	Present	Absent	12.1
Tar	Kilganny Br	1	Absent	Absent	11.6
Suir	Knocklofty	2	Present – 3	Absent	11.3-11.5
Nier	Deerpark	1	Absent	Absent	9.8
Tar	Tar Br	1	Absent	Absent	11.8
Nier	Knockalisheen Br	1	Absent	Absent	9.4
Nier	Ballymacabry	1	Absent	Absent	9.3
Nier	Ballymackee Br	1	Absent	Absent	11.2
Suir	Ardfinnan	2	Present – 1	Absent	9.9-12.9
Tar	Goats Br	1	Present - 1	Present	9.2
Suir	Swiss Cottage	2	Present – 2	Absent	8.7-11.9
Tar	Ford at Kilgrogy	1	Absent	Absent	9.4
Suir	Clonmel	1	Present - 18	Absent	10.5
Anner	Saucestown	1	Absent	Absent	
Clashawley	Loughcapple	1	Present - 1	Absent	
Anner	Killusty	1	Absent	Absent	
Anner	Thorny Br	1	Absent	Absent	
Anner	Anner Br	1	Present - 1	Absent	
Suir	Kilsheelan	1	Absent	Absent	
Linguan	Baunreagh	1	Absent	Absent	8.6
Linguan	Castlejohn Br	1	Absent	Absent	8
Linguan	Scogh Br	1	Present - 7	Absent	9.1
Linguan	Br u/s The Three Bridges	1	Present - 1	Absent	10.1
Suir	Cahir	2	Present - 8	Absent	11
Clodiagh Portlaw	Craigvalla Br	1	Absent	Absent	9.5
Clodiagh Portlaw	Ross Br	1	Present – 1	Absent	8.4
Clodiagh Portlaw	Lowry Br	1	Present – 1	Absent	7.9
Clodiagh Portlaw	Portlaw Br	1	Present – 5	Absent	9.5
Clodiagh Portlaw	Clonea	1	Absent	Absent	8.2
Clodiagh Portlaw	Farney Br	1	Absent	Absent	10.1
Multeen	Falleenatinoga	1	Absent	Absent	10
Multeen	Clone Br	1	Absent	Absent	9.7

The results obtaining from this survey method will influence future monitoring. New spawning sites were identified such as in Tullow on the River Slaney and at a number of locations on the Suir which will now be monitored on an annual basis.



Plate 2.11. River lamprey redds identified from spawning surveys on the River Aughrim, Avoca catchment.

These spawning surveys have enabled us to expand our knowledge of the range and the distribution of river lamprey, the monitoring programmes will continue across the river lamprey SACs and known spawning locations. Over the course of these surveys, 20 spawning locations were identified in addition to the three areas which were known to support spawning fish.

2.3 EVOLAMP

EVOLAMP is a Portuguese project funded by FCT - Fundação para a Ciência e a Tecnologia, under which IFI are contributing. The project lead is Dr Catarina Mateus based in the University of Lisbon, the other partners include the University of Durham and the University of Basel. The aim of the project is to compare the Ribonucleic acid (RNA) in organs of brook and river lamprey across different life stages and in situations where there is allopatry (brook lamprey only) and sympatry (both species co-habiting). Samples are collected from four life stages, ammocoetes (juvenile lamprey), transformers (individuals transforming from juvenile to young adult), macrophthalmia (young adults) and adults. Ammocotes (juvenile lamprey) are indistinguishable between the two species and thus are only collected at the allopatry site where there can only be brook lamprey present.



Plate 2.12. River lamprey (*L. fluviatilis*)(left) and Brook lamprey (*Lampetra planeri*)(right) macrophthalmia from the Aughrim River, Aughrim.

Brook lamprey (*Lampetra planeri*) and River lamprey (*L. fluviatilis*) are closely related lamprey species, one which is parasitic (*L. fluviatilis*) and the other nonparasitic (*Lampetra planeri*). As adults, the paired species have adopted alternative life cycles. The river lamprey is anadromous and parasitic in contrast to the brook lamprey, which resides in freshwater and is nonparasitic. EVOLAMP proposes to use genomic and transcriptomic techniques in order to identify genes involved in the downstream trophic migration of lampreys. This will allow the identification of genes of adaptive importance and facilitate the understanding of adaptation and diversification in these ancestral species.

The Irish sampling locations were chosen based on locations known to IFI staff where there was sympatry between the two species and allopatry, where barriers impede the upward migration of river lamprey and thus only brook lamprey are present (Figure 2.23). The sympatry sites are located in the Avoca catchment on the Aughrim River in Aughrim. Ideally the allopatry and sympatry sites were to be located within the one catchment. This was not possible on the Avoca catchment so a neighbouring catchment was selected, the Liffey. In particular the River Dodder at Old Bawn. On the River Dodder there are a series of weirs and barriers which makes the upstream migration of river lamprey impassable.



Figure 2.23. EVOLAMP sampling locations on the Avoca and Liffey catchments.

Specimens are collected using a variety of methods including electric fishing, fyke netting and visually from the river bed during spawning activity. Once returned to the laboratory, the samples are frozen and dissected for organ collection. Organs which are collected for RNA analysis include: brain, gills, eyes, heart, liver kidney, stomach and gonads. The organs are stored in separate labelled vials which contain an RNA Later solution, this preserves the RNA in the sample for future analysis. Once the organs have been collected, the samples are refrigerated overnight before they are placed in a freezer at -20° Celsius. Two DNA samples are collected, tissue and fin, these stored in industrial strength alcohol. At both sites transformers, macropthalmia and adults are collected. At the sympatry site these different life stages are collected for both species.



Plate 2.13. EVOLAMP sampling locations – River Dodder (left) and Aughrim River (right).

3. Shad Monitoring Programme

3.1 Juvenile shad Investigations

3.1.1 Shad Egg surveys

Kick sampling for shad eggs is an established technique for assessing the spatial extent of allis and twaite shad spawning activity (JNCC, CSM, 2015). Since 2017, this survey method has been annually employed by the Habitats Directive team to obtain spawning data relating to shad. Collected eggs were genetically tested in 2017 and verified as shad eggs (it was not possible to distinguish between allis and twaite shad however). This confirmed the location in St. Mullins as a spawning site for shad. Kick sampling has been undertaken by Habitats Directive team members on several systems since 2017 including the River Barrow (at St. Mullins), River Nore (at Inistioge) and River Suir (Carrick on Suir), all of which are SACs for twaite shad. These locations are at the top of the tidal influence and they experience annual spawning runs of shad during May – July.

In 2021, kick samples were taken at one site only (St. Mullins) on a weekly basis from 30/04/21 to 07/07/21. St. Mullins in particular is well known for its run of shad and they are thought to spawn below the navigation weir which acts as a barrier to upstream migration. Samples were collected by kick sampling for 15sec upstream of a hand-held macroinvertebrate net (250 µm mesh). These samples were taken working upstream to avoid re-recording eggs dislodged from an earlier kick sample. Bed material from the net was sorted by hand and any eggs were placed in bottles containing 70% ethanol for verification at a later date.

Recently laid shad eggs are clear, non-adhesive, semi-buoyant and range in size from 1.5 to 5 mm in diameter (usually 2.4 mm) (See image below). Shad are broadcast spawners, meaning that females release large numbers of unfertilized eggs into the water column which then sink to the river bed and settle into weeds and rocky crevices. At the same time, a male (or several males) release a lot of sperm which will hopefully fertilize some of these eggs prior to their settlement. Incubation of these eggs takes approximately 72-120 hr prior to hatching, this is temperature dependent however and may vary between river systems.



Plate 3.1. Kick sample sorting/egg counting (left), example of clear shad eggs sitting on bed material (right).

The River Barrow was sampled at low tide each week. The first sample was collected in the main river channel approximately 10 m downstream of St. Mullins Lock. Water temperatures ranged from $11.3-18.5^{\circ}$ C across the survey period (Figure 3.1). Water depths ranged from 0.8 - 1.3 m on a slack to rising tide (Figure 3.2). Eggs were found consistently via kick sampling over a 9 week period in 2021. In total, 315 shad eggs were collected across the 11 sampling days (Table 3.1).

Date	No. Eggs	Moon phase	Water temp. (°C)	Water level (m)
30/04/2021	44	Waning Gibbous	12.4	0.228
07/05/2021	27	Waning Crescent	11.3	0.398
13/05/2021	82	Waxing Crescent	13	0.366
21/05/2021	77	Waxing Gibbous	11.6	0.842
27/05/2021	17	Waning Gibbous	12.5	0.553
02/06/2021	42	Third Quarter	16.4	0.583
11/06/2021	24	Waxing Crescent	18.4	0.218
18/06/2021	1	First Quarter	16.1	0.67
25/06/2021	2	Waning Gibbous	16.5	0.117
02/07/2021	0	Waning Crescent	18.5	0.393
07/07/2021	0	Waning Crescent	18.3	0.228

Table 3.1. Shad egg sampling data collected from St. Mullins 2021.







Figure 3.2. Number of shad eggs recorded per sampling date with accompanying water level data (water level data obtained from OPW gauging station 'St. Mullins').

3.1.2 Shad eDNA study

Overview

In the Republic of Ireland, four Special Areas of Conservation (SACs) have been designated for twaite shad (*Alosa fallax*). This designation is based on recent historical information regarding the presence and likely spawning activity of twaite shad within the lower reaches of specific Irish river catchments, namely, the Rivers Munster Blackwater, Suir, Barrow-Nore and Slaney (King and Roche, 2008). Although the populations of shad have declined considerably across Europe in the last century (Aprahamian et al., 2003), Inland Fisheries Ireland (IFI) has recorded the presence of this species within these SACs.

In 2021 IFI undertook eDNA water sampling on the River Barrow at the location of St. Mullins. The River Barrow was chosen as it is the most renowned Irish river for twaite shad with a known spawning area below St. Mullins weir in Co. Carlow. This area is frequented by

IFI annually to undertake various shad specific surveys in conjunction with the catch and release based angling effort which occurs every spring. Environmental DNA sampling is used in the aquatic environment as a method of detection for target species without invasive/ physical sampling. This makes it a favourable method of sampling for fish species which are sensitive to physical sampling such as shad.

The main aims of this study were as follows:

- Use shad eDNA concentrations to investigate the timing and duration of the shad spawning period across 3 different sites
- To understand the impact of St. Mullins weir on shad migration, specifically whether shad can navigate this barrier when moving upstream

Site Selection

Within the St. Mullins stretch of River Barrow, 3 sites were chosen to sample for eDNA (Figure 3.3):

- 1) This location is known as 'the scar' and is located approximately 2 km downstream of the weir.
- 2) Site 2 was labelled as 'Island', this is the known spawning area for shad located approximately 800 m below the weir
- 3) This site was the 'upstream' site located 2 km upstream of the weir, this was taken in an area of absolute freshwater

Considerations prior to sampling

Once the sites were selected, a specific sampling design was formulated prior to the commencement of sampling. The main aims within this design were: preventing contamination of the sample in both field and laboratory environments, ensure adequate sample preservation with minimal degradation, obtain accurate and reproducible results.

Summary of eDNA sampling 2021

Between the 28th April – 5th July 2021, a water sample was collected weekly at each site, a 'field control' and a 'laboratory control' were also obtained during these sampling days. In total 55 water samples were collected within this time period (including controls). These were subsequently processed in the hours immediately after collection and stored prior to further analysis.



Figure 3.3. River Barrow, eDNA shad sampling locations.

3.1.3. Beach seine netting surveys August 2021

As part of IFI's National Bass Conservation programme, seine netting surveys for juvenile bass (*Dicentrarchus labrax*) were carried out at 3 locations on the Munster Blackwater, Barrow and Slaney estuaries (Table 3.2 & Figure 3.4), all of which are designated SACs for twaite shad. As young-of-year shad are often captured as bycatch in these surveys, they give an indication of successful spawning events for this species in a given year.

Estuary	Date	Location		Mean	Mean	No.
		S		Salinity	Temp	Shad
				(ppt)	(°C)	
Barrow	17/08/2021	Fisherstown	11	14.96	18.72	196
Slaney	18/08/2021	Mary's Point	9	20.33	18.47	0
Munster	19/08/2021	Lickey Point	9	7.68	17.65	17
Blackwater						

Table 3.2.	Seine	netting	locations	as	part	of	the	Bass	Conservation	Programme	in
August 202	21.	-			-					-	

The surveys were conducted between the 17th and 19th of August, 2021. A Collins seine net was used to carry out the survey. This net measured 30.8 m x 2 m with a 14 mm mesh size

and a 5 m central panel with a 6.5 mm mesh. This net was deployed by boat in an arc shape and slowly drawn to shore with 30 m warps on each side of the net.



Figure 3.4. Locations of beach seining surveys of estuaries in 2021 as part of IFI's National Bass Conservation Programme, with presence/absence of juvenile *Alosa sp.*

Beach Seine netting survey of the Lower Munster Blackwater Estuary/Youghal Harbour

Beach seine netting on the Lower Munster Blackwater estuary/Youghal Harbour occurred at 9 locations on the 19th of August 2021. 9 seine net hauls were taken from the muddy littoral of Lickey Point. The survey was undertaken in low and flooding tide conditions with a mean salinity 7.68 ppt across the 9 hauls with a mean water temperature of 17.65°C. Seventeen shad were captured at Lickey point with lengths ranging from 67-190 mm (total length) (Figure 3.4). Ten species of fish were recorded at this site in 2021. In previous years, *Alosa sp.* were also captured within the Lower Munster Blackwater Estuary: 2020 (n=4), 2019 (n=15) and 2018 (n=3).

Beach Seine netting survey of the Barrow/Nore estuary (New Ross Port Waterbody)

Beach seine netting on the Barrow/Nore estuary was carried out at 1 location (Fisherstown) on the 17th of August 2021. This site is sampled annually by the Bass programme. A total of 11 hauls were undertaken at this location with 12 species of fish recorded. Mean salinity was 14.96 ppt and the mean water temperature was 18.72°C. 196 shad in total were captured ranging from 52 mm to 164 mm respectively in total length (Figure 3.5). These shad may have originated from spawning grounds located at the upper tidal limits of the River Barrow

at St. Mullins and/or the River Nore at Inistioge. In previous years, *Alosa sp.* were also recorded at this site: 2020 (n=4), 2019 (n=14), 2018 (n=32), 2016 (n=69) and in 2014 (n=7).



Figure 3.5. Length frequency of juvenile *Alosa* sp from the River Barrow and Munster Blackwater in the IFI Bass survey programme, August 2021.

Beach seine netting survey of the Lower Slaney Estuary

One location was sampled in the Lower Slaney Estuary in 2021 (Mary's Point). This location was surveyed on the 18th of August with 9 seine net hauls undertaken overall. Mean salinity at Marys point was recorded at 20.33 ppt with a mean water temperature of 18.47°C. In total, 8 species of fish were captured. As in previous years however no shad were captured in the Lower Slaney Estuary in 2021.

3.2 Trawling Surveys

The fish communities in 3 Irish estuaries were surveyed via trawled transects in September 2021. These surveys are conducted annually primarily to provide data for IFI's National Bass Programme. Species of interest to the Habitats Directive Monitoring Programme, namely twaite shad, smelt and lampreys, are also occasionally encountered. Repeat surveys for 2021 were undertaken on the Munster Blackwater Estuary, the Barrow-Suir Estuary and the Slaney Estuary from the 1st - 8th September. Towed transect trawling was undertaken by a commercial trawler and crew with IFI staff also on board to process catches and record data.

Munster Blackwater Trawling Survey

Trawling surveys on the Munster Blackwater took place over two days (September 1st & 2nd 2021). A total of 19 trawls were undertaken (Figure 3.6) across both days with each lasting

between 18 and 45 minutes (average 32 minutes). Trawling on the 1st was undertaken on a flooding and ebbing tide while trawling on the 2nd occurred in openwater and a flooding tide. The trawl locations stretched from the mouth of the estuary at Youghal to u/s of Lickey point near Clashmore. Mean water temperature recorded across the 19 trawls was 17.6°C (range 17.1–18.2°C). Depth of the water column recorded across each trawl varied from 2.8 m to 9.2 m. Mean salinity was recorded as 25.3 ppt (range 14 - 33.9 ppt). No twaite shad were captured during the Munster Blackwater trawl in 2021.



Figure 3.6. Incidence of capture of Shad (n=0) during the trawling survey transects (n=19) on the lower Munster Blackwater Estuary in August 2021. Barrow-Suir Estuary Trawling Survey

Trawling surveys on the Barrow-Suir Estuary/ Waterford Estuary took place over two days (September 3rd & 4th 2021). A total of 16 trawls were undertaken in the lower Barrow and Suir Estuary at locations including Fisherstown, Great Island, Woodstown, Passage strand, Creadon head and Duncannon (Figure 3.7). Each trawl lasted between 23 minutes and 1 hour 5 minutes (average 39 minutes). Temperature and salinity data is available for trawls 1-4 only, with an average water temperature of 16.5°C and salinity of 25.6 μ S. Depth of the water column sampled varied from 2 – 17m (average 7.2m) across all trawls, with trawling occurring across a mix of flooding and ebbing tides. A total of two twaite shad both measuring 95 mm respectively were captured from a single trawl (trawl 15).



Figure 3.7. Incidence of capture of Shad (n=2) during the trawling survey transects (n=16) on the Barrow-Suir/ Waterford Estuary in September 2021.

Lower Slaney Estuary Trawling Survey

Trawling surveys on the Lower Slaney Estuary were undertaken on the 7th and 8th of September 2021. A total of 16 trawls took place over both days (Figure 3.8). Water temperatures ranged from 17.7- 20°C across all 16 trawls with an average of 18.6°C. Depth of the water column across sampling sites varied from 2.5 - 12 m (average 4.4m) while trawling occurred across flooding and ebbing tides. One shad measuring 340 mm was captured over both survey days at trawl 9 near to Wexford bridge.



Figure 3.8. Incidence of capture of Shad (n=1) during the trawling survey transects (n=16) on the Slaney Estuary in September 2021.

4. Smelt Monitoring Programme

4.1 Juvenile smelt programme

Beach seine netting surveys August 2021

Beach seining surveys of the Barrow, Slaney and Munster Blackwater estuaries were carried out by the Bass Conservation Programme in August 2021 (Figure 4.1). European bass (*Dicentrarchus labrax*) were the target species however juvenile smelt (*Osmerus eperlanus*) were also recorded from the Barrow and Munster Blackwater estuaries. A Collins seine net was used to carry out the survey. This net measured 30.8 m x 2 m with a 14 mm mesh size and a 5 m central panel with a 6.5 mm mesh. This net was deployed by boat in an arc shape and slowly drawn to shore. All species of fish that were captured were counted and measured on site.



Figure 4.1. Locations of beach seine netting surveys in 2021 as part of IFI's National Bass Conservation Programme, with presence/absence of juvenile smelt.

Eleven seine net samples were taken at 'Fisherstown' in the Barrow/Nore Estuary on the 17th August 2021 (Figure 4.2). Mean salinity was 14.96 ppt with a mean water temperature of 18.72°C across the 11 net hauls. A total of 55 smelt were captured with their total lengths varying from 54- 80 mm (average length 65 mm). This site is surveyed annually by the Bass Programme, higher smelt numbers were recorded in 2021 compared to the previous 2 years (Figure 4.2).



Figure 4.2. Length frequency of juvenile smelt from the Barrow estuary from 2016-2021.

One location (Lickey Point) was surveyed in the Munster Blackwater Estuary on 19th of August 2021. 9 seine net samples were taken at Lickey Point with a total of 2 juvenile smelt recorded (Figure 4.3). These fish measured both 80 and 81 mm (average 80.5 mm) in total length respectively. Mean salinity was 7.7 ppt on the day with a mean water temperature of 17.7°C. The Slaney was also surveyed at Marys Point on 18th of August 2021, no smelt were recorded here in 2021.



Figure 4.3. Length frequency of measured juvenile smelt from the Munster Blackwater estuary 2019- 2021.

4.2 Trawling surveys

Smelt were captured during some of the trawling surveys documented previously for shad. 13 smelt, ranging in total length from 162- 200 mm (average 182 mm) were captured on the Barrow-Suir Estuary. These were captured in 3 out of the 16 transects that were carried out in the estuary (Figure 4.4). The highest abundance was recorded at trawls 10 and 13 (n=5 respectively). No smelt were captured during the trawling surveys on the Munster Blackwater (Figure 4.5) or the Slaney (Figure 4.6) estuary during the 2021 surveys.



Figure 4.4. Incidence of capture of Smelt (n=13) during the trawling survey transects (n=16) on the Barrow-Suir/ Waterford Estuary in September 2021.



Figure 4.5. Incidence of capture of Smelt (n=0) during the trawling survey transects (n=19) on the lower Munster Blackwater Estuary in August 2021.



Figure 4.6. Incidence of capture of Smelt (n=0) during the trawling survey transects (n=16) on the Slaney Estuary in September 2021.

5. Conclusions and Plans for Future Work

With the exception of the sea lamprey (*Petromyzon marinus*) floatover surveys, all planned surveys for lamprey, shad and smelt were carried out in 2021. Float-over surveys could not be conducted due to Government public health measures associated with the Covid-19 pandemic. The monitoring programmes for the Annex II/V and red data fish species will continue in 2022, which represents year 4 of the current 6-year reporting cycle under Article 17 of the Habitats Directive.

As the conservation status for river lamprey (*Lampetra fluviatilis*) is unknown (NPWS 2019), there is a particular focus on assessing the range of this species in the current monitoring cycle (2019 – 2024). Nest count surveys are providing data on the distribution of river lamprey and are enabling the identification of spawning hotspots in SAC and non-SAC catchments. Sites where we previously observed spawning activity were visited on a number of occasions in 2021 and these will continue to be surveyed on an annual basis. Twenty new spawning locations in 5 catchments were identified and the lower stretches of the River Boyne will be targeted for river lamprey during the spawning season in 2022.

Sea lamprey hotspot surveys of SAC rivers will continue in 2022 to assess annual variation in spawning effort. The roll-out of a revised larval lamprey programme is on-going with planned repeat visits to index sites in 2022 to assess trends in the population size of brook lamprey (*Lampetra planeri*). To investigate changes and trends in the range for this species at the national scale, a number of range sites (to be sampled once per 6-year cycle) will be surveyed in 2022.

In collaboration with the EU DiadES project (<u>https://diades.eu/</u>), on which IFI's R&D division is a partner, eDNA and egg surveys will continue next year at St. Mullins on the River Barrow. Data from these surveys will build on the valuable information obtained in 2021 on the spawning behaviour of twaite shad (*Alosa fallax*). The Lower River Suir SAC also experiences a shad run during the spawning season and egg surveys will be carried out at a number of sites in the lower freshwater & upper estuary to identify potential spawning locations.

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