Activity Report

of the

Standing Scientific Committee for Eel

2015

Report of the Standing Scientific Committee for Eel to Inland Fisheries Ireland and the Dept. of Communications, Energy and Natural Resources

May 2016

Disclaimer:	**This report includes data and analyses that are supplied by various agencies for the purposes of supporting the implementation of the Eel Management Plans in Ireland. The data will be subject to scientific review for the National Report to the EU in 2018.** **The data and analyses are part of an ongoing scientific assessment and are, therefore, preliminary and may be subject to change, updating or reanalysis. Some data may also be submitted for peer-review publication. The contents of this report should not be reproduced without the prior permission of the Standing Scientific Committee for Eel.**

Glossary of terms

Glass eel	Young, unpigmented eel, recruiting from the sea into continental waters. WGEEL consider the glass eel term to include all recruits of the 0+ cohort age. In some cases, however, also includes the early pigmented stages.
Elver	Young eel, in its first year following recruitment from the ocean. The elver stage is sometimes considered to exclude the glass eel stage, but not by everyone. To avoid confusion, pigmented 0+cohort age eel are included in the glass eel term.
Bootlace, fingerling	Intermediate sized eels, approx. 10–25 cm in length. These terms are most often used in relation to stocking. The exact size of the eels may vary considerably. Thus, it is a confusing term.
Yellow eel (Brown eel)	Life-stage resident in continental waters. Often defined as a sedentary phase, but migration within and between rivers, and to and from coastal waters occurs. This phase encompasses the elver and bootlace stages.
Silver eel	Migratory phase following the yellow eel phase. Eel characterized by darkened back, silvery belly with a clearly contrasting black lateral line, enlarged eyes. Downstream migration towards the sea, and subsequently westwards. This phase mainly occurs in the second half of calendar years, though some are observed throughout winter and following spring.
Assisted Upstream Migration	the practice of trapping and transporting juvenile eel within the same river catchment to assist their upstream migration at difficult or impassable barriers, without significantly altering the production potential (Bbest) of the catchment
Eel River Basin or Eel Management Unit	"Member States shall identify and define the individual river basins lying within their national territory that constitute natural habitats for the European eel (eel river basins) which may include maritime waters. If appropriate justification is provided, a Member State may designate the whole of its national territory or an existing regional administrative unit as one eel river basin. In defining eel river basins, Member States shall have the maximum possible regard for the administrative arrangements referred to in Article 3 of Directive 2000/60/EC [i.e. River Basin Districts of the Water Framework Directive]." EC No. 1100/2007.
River Basin District	The area of land and sea, made up of one or more neighbouring river basins together with their associated surface and groundwaters, transitional and coastal waters, which is identified under Article 3(1) of the Water Framework Directive as the main unit for management of river basins. The term is used in relation to the EU W F D.
Stocking	Stocking (not restocking) is the practice of adding fish [eels] to a waterbody from another source, to supplement existing populations or to create a population where none exists.
Trap & transport	Traditionally, the term trap and transport referred to trapping recruits at impassable obstacles and transporting them upstream and releasing them. Under the EMPs, trap and transport (or catch and carry) now also refers to fishing for downstream migrating silver eel for transportation around hydropower turbines.
EEL REFERENCE POINTS/POPULATION DYNAMIC	
B_0	The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the stock.
$B_{current}$	The amount of silver eel biomass that currently escapes to the sea to spawn.
B_{best}	The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the current stock.
ΣF	The fishing mortality rate, summed over the age-groups in the stock, and the reduction effected.
ΣH	The anthropogenic mortality rate outside the fishery, summed over the age-groups in the stock, and the reduction effected.
R	The amount of glass eel used for restocking within the country.
ΣA	The sum of anthropogenic mortalities, i.e. $\Sigma A = \Sigma F + \Sigma H$

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Executive Summary

Introduction

The EC Regulation (Council Regulation 1100/2007) for the recovery of the eel stock required Ireland to establish eel management plans for implementation from 2009. Under the EC Regulation, Ireland is also required to monitor the eel stock, evaluate current silver eel escapement and post-evaluate implemented management actions aimed at reducing eel mortality and increasing silver eel escapement. Each Member State is required to report to the Commission, initially every third year until 2018, and subsequently every six years.

The Irish Eel Management Plan submitted to the EU on the 9th January 2009 and accepted by the EU in June 2009 outlined the main management actions aimed at reducing eel mortality and increasing silver eel escapement to the sea. The first monitoring report was submitted by Ireland in June 2012 and this was accompanied by a scientific assessment report for the period 2009-2011. The second monitoring report (2012-2014) was submitted to the EU in June 2015 and the scientific assessment was included as an annex to that report.

The Irish Eel Management Plan outlines a national programme for sampling catch and surveys of local eel stocks. Appropriate scientific assessment will monitor the implementation of the plans. The Standing Science Committee for Eel (SSCE) was established by the Department of Energy, Communications and Natural Resources in March 2009 and appointed by the Minister. Consultation with the Department of Culture, Arts and Leisure in Northern Ireland ensures the co-operation with Northern Ireland agencies to cover the specific needs of the trans-boundary North Western International River Basin District eel management plan. The SSCE comprises scientific advisers drawn from the Marine Institute (MI), Inland Fisheries Ireland (IFI), The Loughs Agency, the Agriculture, Food and Biosciences Institute for Northern Ireland (AFBINI) and the Electricity Supply Board. Although the scientists are drawn from these agencies, the advice from the SSCE is independent of the parent agencies. The SSCE has also been supported by invited scientists from NUIG, AFBINI and NPWS.

The SSCE is required to compile an annual stock assessment and scientific advice report on the national eel monitoring plan and this also enables the three year report to the EU to be produced in a timely and accurate fashion. The compilation of the annual assessments also highlights any issues and problems which need to be resolved within the three year time frame.

International Advice; ICES - 2016

The International Council for Exploration of the Seas (ICES) is the primary source of scientific advice on the marine ecosystem to governments and international regulatory bodies that manage the North Atlantic Ocean and adjacent seas. The content of scientific advice is solely the Advisory Committees (ACOM) responsibility not subject to modification by any other ICES entity. ACOM has one member from each member country, under the direction of an independent chair appointed by the Council, and works on the basis of scientific analysis prepared in the ICES expert groups and the advisory process includes peer review of the analysis before it can be used as basis for the advice. In the case of eel, the relevant expert group is the joint EIFAAC/ICES/GFCM Working Group on Eel (WGEEL).

ICES considered the updated time-series of relevant stock status indices and issued advice for 2016:

"ICES advises that when the precautionary approach is applied for European eel, all anthropogenic mortality (e.g. recreational and commercial fishing on all stages, hydropower, pumping stations, and pollution) affecting production and escapement of silver eels should be reduced to – or kept as close to – zero as possible.

Stock status

The status of eel remains critical.

The annual recruitment of glass eel to European waters in 2015 decreased compared to 2014, from 3.7% to 1.2% of the 1960–1979 level in the 'North Sea' series, and from 12.2% to 8.4% in the 'Elsewhere Europe' series. The annual recruitment of young yellow eel to European waters decreased to 11% of the 1960–1979 level. These recruitment indices are well below the 1960–1979 un-impaired reference levels, and there is no change in the perception of the status of the stock."

National Advice

The SSCE received two requests for advice in 2015, the first in relation to the potential impacts of making eel available for exploitation in the various RBDs that are currently meeting their escapement target (40%) and the second in relation to options for the mitigation of the mortality of elvers that occurred in the traps on the Erne in 2014. The texts of this advice are included in the report and the agreement with the ESB for the mitigation is also included in this report.

Irish EMP Management Actions 2015

Under the EU Regulation (EC No. 1100/2007) four main management actions were included in the Irish Eel Management Plans aimed at reducing eel mortality and increasing silver eel escapement in Irish waters. These were a cessation of the commercial eel fishery and closure of the market, mitigation of the impact of hydropower, including a comprehensive silver eel trap and transport plan, ensure upstream migration of juvenile eel at barriers and improve water quality including fish health and biosecurity issues.

1. ***Reduction in Fishing***

   All regions confirmed a closure of the eel fishery for the 2015 season with no licences issued and the eel fishery, with the exception of L. Neagh, also remained closed in N. Ireland. Some illegal fishing was reported in one region which led to some seizures of gear in the Shannon IRBD. No dealers transport trucks were seized in 2015 although it is likely that eel sales may have occurred in the Shannon IRBD given the level of seizures of gear. Reliable trade (import/export) data remains unavailable to the SSCE.

   Following an announcement by Minister Joe McHugh TD, in November 2015, a new collaborative research initiative involving IFI scientists and former eel fishermen is being established. This will involve a network of monitored scientific fisheries for eel around Ireland with the aim of increasing the spread of data available for assessments.

2. ***Hydropower Impact***

   Mitigation of hydropower involved a comprehensive trap and transport system for migrating silver eels on the Shannon, Erne and Lee, the targets for 2009-2011 were set out in the Eel Management Plans and these were subsequently modified on the Erne for the 2015-2017 period to allow for the transport of 50% of the annual silver eel production and a rolling target based on a 3-year basis allowing shortfalls in one year to be made up the following year. A long-term shortfall should not be carried forward indefinitely.

   The total quantity of silver eel released from the three catchments was 75,190kg. The level of fishing mortalities was reported to be low.

   In the River Shannon the trap and transport total of 19,957 kg represented 28.2% of silver eel production. While the annual target was not achieved, the 3-year rolling mean was above target.

In the River Erne, the quantity (54,706kg) transported represented 70.1% of the estimated silver eel production (78,034kg) for the river system for the season. In addition to the EMP 50% T&T target (39,017kg), additional mitigation measures for potential future losses of silver eel production that might result from a 112.5kg elver loss at Ballyshannon in 2014 were addressed by ESB in the 2015 season. Thus, ESB purchased 8,450kg of silver eels from the L. Neagh Eel Fishermen's Cooperative Society Ltd which were then released to the lower River Bann and allowed to migrate freely to sea. However, the mitigation agreement also required ESB to increase T&T activities so that, prior to 2018, an additional 11,000kg of River Erne would be trapped and released (i.e. in addition to the annual 50% targets). The 2015 T&T programme, which involved additional fishing effort and increased efficiency of capture at several sites, resulted in a surplus of 15,689kg. Thus the normal (50%) 2015 target and the additional mitigation targets (8,450kg River Bann release and 11,000kg extra River Erne release) were all fully achieved. In addition, a surplus 4,689kg was achieved which can contribute to the ongoing 3-year rolling mean used to monitor the annual 50% T&T mitigation actions on the river system.

In the River Lee, a total 527 kg were trapped and transported downstream of the Inniscarra dam. The three year running average of the quantities transported has been above target since 2011.

The turbine mortality rates are being determined using acoustic tagged and tracked silver eel and these data are reported in the 2012 report to the EU (SSCE 2012). Additional data for the Erne were subsequently reported to the SSCE (McCarthy *et al*. 2014).

For the ***Shannon***, the exceptionally high discharge levels recorded in the 2015/2016 winter months had significant implications for downstream silver eel migration and for annual scientific monitoring. However, pending evaluation of potential use of Didson acoustic camera records and calibration of these, by reference to further 2016 observations, provisional estimates of escapement were determined on the assumption that silver eel production was similar to that recorded in 2014. On this basis, it was estimated that silver eel mortality at the Ardnacrusha Dam was 4,666kg (21.15% HPS passage mortality rate).

For the ***Erne***, during the 2015 silver eel season the patterns of generation and spillage at the hydropower stations were unusual, because of high rainfall and discharge. In the analyses of eel hydropower passage, varying mortality levels were incorporated, per calendar day, into the escapement model. These were based on dusk-dawn hydrometric data, power generation activity and results of previous years silver eel acoustic telemetry. Generation protocols and associated mortality rates have been described in previous reports. For the 2015 season mortality rates were applied as follows: ***Cliff HPS*** 0% (no flow or only spillage); 7.9% (Generation plus spillage) and 26.7% (Only generation), ***Cathaleen's Fall HPS***: 0% (no flow or only spillage); 7.7% (spillage plus half generation load); 15.4% spillage plus full generation load); 27.3% (only generation). Reduced overall generation levels occurred during the silver eel migration season, due to refurbishment of turbines. This resulted in relatively high spillage levels and reduced overall turbine passage mortality levels. This was estimated to have represented a cumulative 8.1% mortality of the total River Erne silver eel production, or 27.2% of the migrating eel (not including the trapped and transported component) at the two dams during 2015.

3. Obstacles to upstream migration

Obstacles to migration in river systems are one of several factors influencing the decline in the European eel population. Obstacles impede eels from accessing and colonizing large parts of catchments, thus reducing upstream density and additional production of silver eels. The National Eel Management Plan identified that upstream migrating juvenile eels require modified passage through existing fish passes or any new obstacles

to maximise escapement as traditional fish passes are not designed to accommodate eel passage. Barriers or potential obstacles which can be considered under this action include artificial structures such as weirs, hydrodams, fish passes, fish counter structures, millraces, road crossings/bridge aprons and forestry related operations. Over 47% of the available wetted habitat is above major hydropower barriers, although there will be a greater proportion of the potential silver eel production when the differences in relative productivity are taken into account.

The EU Habitats Directive (Directive 92/43/EEC) and Water Framework Directive (2000/60/EC) both require the assessment of barriers to fish migration. IFI established a National Barrier Group in 2011. This group is building on the earlier work to develop a standardised assessment of barriers nationally and is currently evaluating an IFI survey sheet and methodology. The long term aim is to develop a national database of barriers for rating fish pass ability which in turn will provide information to target mitigation measures at the most significant obstructions. The IFI group has developed a 'barrier' survey form template and this has been uploaded onto ruggedized laptops used by IFI staff, as one of a suite of forms for field recording.

The EPA has funded a project to examine issues relating to barriers/structures in Irish rivers for the collection of data on barrier occurrence in a series of sub-catchments – nominated by IFI. The IFI barrier form is to be used for data collection and the data collected must be made available for upload into the IFI barriers database.

IFI is a partner in an INTERREG cross-border funding application, focussed on improving waterbody quality in three catchments. A series of catchment actions is envisaged, including actions to improve the hydromorphology quality. This will include examination of barriers/structures in channels and it is possible that river continuity/passage issues relating to some of these structures (in NI and RoI) will be addressed

IFI, in conjunction with OPW and the Local Authorities continue to make progress on river continuity and fish passage issues. A series of barrier modification/removal projects are on-going in IFI Southeast RBD, with a rock ramp on the R. Nore at Castletown completed in 2015. The rock ramp was installed at a weir with an old denil pass which represented a significant barrier to fish. The project has been successful from a fish passage, stakeholder interaction, financial and civil planning perspective.

Assisted upstream migration of juvenile eel takes place at the ESB Hydropower Stations on the Shannon (Ardnacrusha, Parteen), Erne (Cathaleens Fall), Liffey and Lee. This has been a long-term objective to mitigate against the blockage of the HPSs under ESB Legislation (Sec 8, 1935). On the Erne and Shannon, elvers and bootlace eel were transported upstream from the fixed elver traps.

4. Improve Water Quality, fish health and biosecurity

In 2014, a comprehensive fish surveillance monitoring programme under the Waterframework Directive was conducted, with 68 river sites, 27 lakes and 7 transitional waters successfully surveyed throughout the country. Eel were ubiquitous across all sites, and were found in 96.2% of lakes surveyed and 55.7% of rivers.

There were 22 reported fish kills in 2014 (IFI 2014). This was a marked decrease on the numbers for 2013 (53), but still higher than those reported in 2012 (10). The majority of these fish kills were attributed to a cause other than those related to agriculture, industry or local authority infrastructure. There were 23 fish kills in 2015.

A number of pesticides, including Mecoprop, MCPA and 2 4-D, were detected at low levels in a significant number of rivers (26%-56%) during routine monitoring. However, apart from two (mercury and Polycyclic aromatic hydrocarbons) ubiquitous PBTs (persistent, bioaccumulative and toxic substances), the amount of non-compliance with the Environmental Quality Standards for priority substances and priority hazardous substances is very low and not of significant concern in Ireland confirming that bioaccumulation of toxins of eels in Ireland is likely to be less significant than in other EU countries.

Anguillicola crassus continues to spread and more than 70% of the wetted area is now infested.

Irish EMP Monitoring Actions

A close link between the management actions and eel-stock targets will be established by implementing a comprehensive monitoring and stock assessment programme. This will allow for a direct feedback to management based on response of the stock to management actions.

Silver Eel Assessment

Silver eels are being assessed by annual fishing of index stations on the Shannon, Erne, Burrishoole and Fane catchments and a pilot in 2014 on the Barrow. Trials will also be carried out at other locations identified in the EMP using coghill nets, mark-recapture and technology options such as electronic counters or DIDSON technology.

Shannon

The Killaloe catch in 2015 was 8,5449kg. Fishing was also undertaken by ESB contracted crews upstream of Killaloe and their catches (11,679kg) were also transported downstream. Due to flooding and high discharge the ESB was required to close the Killaloe eel weir from 10th of December to 19th of January. A total of 49 nights were fished and the final fishing event took place on 10th of February. The pattern of downstream migration at Killaloe, apart from the fishery closure period, was reflected in the daily catches recorded at the eel fishing weir. Most (8,323kg) of the catch at Killaloe was obtained prior to the closure period and only a small quantity (226kg) was caught in the final period.

The problems presented by the extreme flooding and extended period of fishery closure in the 2015 silver eel migration season were addressed on a provisional basis as follows and it was assumed that the annual production, which has not varied greatly in recent years, could be represented by the 2014 estimate (70,725kg). Likewise, it was decided to use the previous year estimate of eel weir capture efficiency (25.5%) and the usual (21.15%) index of hydropower mortality for eels passing through Ardnacrusha HPS.

Burrishoole

Silver eel trapping was continued in Burrishoole in 2015. The main run occurred in October (31%) and November (32%). The total run amounted to a count of 1074 eels or a production/escapement of 206kg. The run had a mean weight of 0.192kg and was composed of 44.7% male eels. The count and production values for 2015 were one of the lowest since 1970 and while extreme flooding affected the trapping in December it is not thought that this impacted on the data.

Erne

In the 2015 season the River Erne conservation fishery and the trap & transport programme were monitored by NUIG in conjunction with studies on silver eel production and escapement. The scientific protocols used in the 2015 season were those described in McCarthy *et al* (2014).

The silver eel production was estimated as 78,034kg and escapement as 71,650kg (91.8% of production). The combined Cliff HPS and Cathaleens Fall hydropower mortalities were estimated provisionally as 6,333kg (8.1% of production). In 2015 a relatively high proportion of male silver eel, also noted in 2011-2014, was observed in upper catchment sites as well as at Roscor Bridge.

The T&T annual target (50% of silver eel production) for the River Erne was exceeded in the 2015 season. The quantity (54,706kg) transported for safe release at Ballyshannon represented 70.1% of the estimated silver eel production (78,034kg) for the river system for the season. In addition to the EMP 50% T&T target (39,017kg), additional mitigation measures for potential future losses of silver eel production that might result from a 112.5kg elver loss at Ballyshannon in 2014 were addressed by ESB in the 2015 season (see above).

Fane

The Fane is a relatively small catchment with the silver eel fishery located in the upper reaches of the system approximately 28 km from the coast. The Fane has a riverine wetted area of 21 ha (84 ha 2012 wetted area) and a lacustrine wetted area of 553 ha. A research silver eel fishery was carried out on the Clarebane River on the outflow of Lough Muckno in the Fane catchment since 2011. The site was at the location of a previous commercial fishery until 2008. In 2015, the fishing commenced in November following low water levels in August through to October.

A total catch of 599kg was caught in 2015. In 2015, a mean recapture rate of 34% was recorded from a release of 294 eels. The length of eels caught during the season had a mean length of 54.0cm and a mean weight of 0.370kg.

R. Barrow

The Barrow catchment is a large riverine catchment located on the East coast of Ireland in the South Eastern River Basin District (SERBD). The SERBD is 60% calcareous bedrock which makes it a very productive habitat for eels. There was previously a commercial fishery on the River Barrow and the presence of historical catch will aid in the assessment of the current silver eel escapement levels from the river. The assessment of the silver eel stocks from a river dominated catchment will help highlight any difference in production and escapement of eels compared with catchments with large lake/lacustrine wetted areas.

Four nets were fished from openings on the Ballyteiglea Lock gates of the canal section of the River Barrow, upstream of Graiguenamanagh, during the silver eel season.

The first fishings for silver eels on the Barrow were attempted in August but no catch was recorded. Six nights were fished in October with a total catch of 146 eels (17.42kg). The peak of the silver eel catch was recorded in November with 584 eels (91.32kg) captured in 13 nights. The flooding on the Barrow near Graiguenamanagh became so intense that silver eel fishing was postponed in mid-December as conditions no longer supported fishing from the Ballyteiglea Lock. This effectively ended the silver eel fishing season for 2015 on the Barrow. A mark recapture study in conjunction with hydrometric data may provide estimates of escapement for the whole channel, not just through the canal section.

Yellow Eel Assessment

Yellow-eel stock monitoring is integral to gaining an understanding of the current status of local stocks and for informing models of escapement, particularly within transitional waters where silver eel escapement is extremely difficult to measure directly. Such monitoring also provides a means of evaluating post-management changes and forecasting the effects of these changes on silver eel escapement. The monitoring strategy aims to determine, at a local scale, an estimate of relative stock density, the stock's length, age and sex profiles, and the proportion of each length class that migrate as silvers each year.

2015 Survey

During 2015, three lakes were repeatedly sampled for yellow eels; Lough Ballynahinch, Lough Oughter, and Lough Inchiquin. Surveys were also carried out on Bunaveela L., L. Feeagh and the tidal lagoon, L. Furnace in the Burrishoole catchment. A semi-quantitative electric-fishing survey was also undertaken in on the Munster Blackwater (Bride catchment) in order to determine the extent of eel distribution in the rivers around the catchment area. The standard procedure for the lake surveys was to set chains of five fyke nets joined end to end, set overnight and lifted the following morning, as described by Moriarty (1975). The sampling process in 2015 consisted of setting approximately 6-8 chains of 5 fyke nets during two or three monthly sessions of two or three nights per session.

Of the lakes sampled by the EMP in 2015, Lough Inchiquin had the highest CPUE and catch numbers recorded (CPUE of 2.00 with 479 eels caught over 6 nights). These values were comparable with those gained during the previous sampling of this lake in 2011 (CPUE of 2.19 with 543 eels caught over 5 nights). Lough Ballynahinch had low CPUE and catch numbers in comparison to the 2011 sampling (2015; CPUE 0.51 with 123 eels caught over 6 nights; 2011: CPUE of 1.45 with 434 eels caught over 6 nights). Bunaveela Lough also had low CPUE (0.1) and catch with only three eels being caught. This could be due to continuing low recruitment in both catchments. As older silver eels migrate from the system, there has not been substantial recruitment to offset the loss of eel numbers in the lake.

The electric-fishing carried out this year on the Bride catchment, highlighted relatively uniform numbers of eels found at sites across the catchment possibly due to the completely riverine nature of the catchment (i.e. no lakes). The Fane and Kells Blackwater electric-fishing surveys (2013 and 2014, respectively) suggested that riverine eel populations use the main channels of these systems in order to reach the productive lake habitat within the catchments.

Recruitment

The ICES 2015 working group reported that annual recruitment of glass eel to European waters in 2015 decreased compared to 2014 from 12.2% to 8.4% in the 'Elsewhere Europe' series. This follows three years when an increase in recruitment was recorded (2012, 2013 and 2014). In Ireland, recruitment for the 2015 season indicated that there was a general decrease in the recruitment levels to Ireland in 2015 compared to 2014. Regular high water level patterns in Ireland in 2015 may have also reduced the trapping efficiency at some locations. The Erne was the only location to show an increase but it should be noted that this site also received considerable refurbishment of the traps.

Monitoring of young yellow eel migrating at Parteen Weir (Shannon) takes place using a fixed brush trap. The catch in 2014 increased from 20kg to 365kg and it was 301.1kg in 2015.

1 Introduction

1.1 EU Regulation

The EC Regulation (Council Regulation 1100/2007) for the recovery of the eel stock required Ireland to establish eel management plans for implementation in 2009. Under the EC Regulation, Ireland should monitor the eel stock, evaluate current silver eel escapement and post-evaluate implemented management actions aimed at reducing eel mortality and increasing silver eel escapement.

The Irish Eel Management Plan submitted to the EU on the 9th January 2009 and accepted by the EU in June 2009 outlined the main management actions aimed at reducing eel mortality and increasing silver eel escapement to the sea. The four main management actions were as follows;

- a cessation of the commercial eel fishery and closure of the market
- mitigation of the impact of hydropower, including a comprehensive trap and transport plan to be funded by the ESB
- to ensure upstream migration of juvenile eel at barriers
- to improve water quality

Under the EC Regulation (EC No. 1100/2007), each Member State shall report to the Commission initially every third year until 2018 and subsequently every six years. The most recent, was submitted before 30th June 2015, addressing the following;

- monitoring
- the effectiveness and outcome of the Eel Management Plans
- contemporary silver eel escapement
- non-fishery mortality
- policy regarding enhancement/stocking

1.2 Standing Scientific Committee on Eel

The Irish Eel Management Plan outlines a national programme for sampling catch and surveys of local eel stocks. Appropriate scientific assessment and monitoring by the Fisheries Boards and the Marine Institute will monitor the implementation of the plans. In the Irish plan, provision was made for the establishment of a Scientific Eel Group (SEG) which was established by the Department of Energy, Communications and Natural Resources in March 2009. The SEG in 2009 was nominated by the Dept. of Communications, Energy and Natural Resources and appointed by the Minister and comprises scientific advisers drawn from the Marine Institute (MI), Central Fisheries Board (CFB), The Loughs Agency, the Electricity Supply Board and the Agriculture, Food and Biosciences Institute for Northern Ireland (AFBINI). Consultation with the Department of Culture, Arts and Leisure in Northern Ireland ensures the co-operation with Northern Ireland agencies to cover the specific needs of the trans-boundary North Western International River Basin District eel management plan.

In 2010, the SEG was reconstituted as a Standing Scientific Committee for Eel under Section 7.5 (a) of the 2010 Inland Fisheries Act (Annex 1). The purpose of the committee is to provide independent scientific advice to guide IFI in making the management and policy decisions required to ensure the conservation and sustainable exploitation of the Ireland's eel stocks. IFI shall request the SSCE to provide an annual report on the status of Eel stocks for the purpose of advising IFI on the sustainable management of these stocks. IFI may also request the SSCE to offer scientific advice on the implications of proposed management and policy decisions on eel or seek advice on scientific matters in relation to eel. All scientific advice provided by SSCE will be considered as independent advice by IFI. Although the scientists are drawn from the agencies, the advice from the SSCE is independent of the parent agencies.

1.2.1 Terms of Reference

The EC Regulation (Council Regulation 1100/2007) for the recovery of the eel stock required Ireland to establish eel management plans for implementation in 2009. Under the EC Regulation, Ireland should monitor the eel stock, evaluate current silver eel escapement and post-evaluate implemented management actions aimed at reducing eel mortality and increasing silver eel escapement.

1. The SSCE shall carry out an appropriate assessment of eel stocks (juvenile, brown and silver) in accordance with the EU Regulation and with reference to the monitoring schedule as laid out in the National Eel Management Plan, for each Eel Management Unit and transboundary plan.

The appropriate assessment using internationally accepted best scientific practice should address the following issues:

(a) where possible update the historical silver eel production estimates
(b) estimate contemporary silver eel escapements
(c) establish and advise on biological reference points for monitoring changes in the brown eel stocks due to implementation of management actions, changes in recruitment etc.
(d) review and update long-term data series, such as annual recruitments, silver eel time series

The appropriate assessments for all fishery districts, River Basin Districts and transboundary plans shall take account different habitat types, lakes, rivers and transitional waters.

2. Oversee the updating of the national eel database and quality control of the data.

3. The SSCE shall complete and annual scientific assessment of the implementation of the management measures identified in the National EMP.
   These should include:
   a) Level of fishing, including IUU fishing (illegal, unreported, unregulated)
   b) Escapement estimates for Erne & Shannon
   c) Turbine mortalities and bypass efficiencies
   d) Quantities of silver eels trapped and transported on the Erne, Shannon & Lee
   e) Evaluation of the quality of the released silver eels
   f) Improvements to upstream migration
   g) Reviewing water quality indices collated under the Water Framework Directive

4. Update the national stock assessment framework in line with EU reporting requirements on an annual basis and assess the level of contemporary silver eel escapement with respect to the EU 40% target. Use a framework to facilitate extrapolation from data rich catchments to those with little or no data.

5. Assess possible stocking strategies as a useful tool to aid in the recovery of the stock. Where appropriate include the stocking option as an input to the stock assessment framework.

6. Compile an annual stock assessment and scientific advice report at the end of each year.

1.3 Meeting Activities

The SSCE met four times in 2015/2016 to monitor and report on the 2014 survey years and to prepare for the 2015 reporting to the EU on the progress in implementation of the EMPs;

19th March 2015	Galway
2nd April 2015	Galway
29th April 2015	Ballyshannon
10th February 2016	Galway
14th April 2016	Ballyshannon

2 International Advice from ICES

2.1 Introduction to ICES Advice

The International Council for Exploration of the Seas (ICES) is the prime source of scientific advice on the marine ecosystem to governments and international regulatory bodies that manage the North Atlantic Ocean and adjacent seas. The ICES Council has delegated its advisory authority to the Advisory Committee or ACOM. ACOM has established the mechanisms necessary to prepare and disseminate advice subject to a protocol satisfying the following criteria:

Objectivity and integrity;
Openness and transparency;
Quality assurance and peer review;
Integrated advice – based on an ecosystem approach;
Efficiency and flexibility;
National consensus.

Therefore, ACOM is the sole competent body in ICES for scientific advice in support of the management of coastal and ocean resources and ecosystems. It designs strategies and processes for preparation of advice, manage advisory processes, and create and deliver advice, subject to direction from the Council. The content of scientific advice is solely ACOM's responsibility not subject to modification by any other ICES entity. ACOM has one member from each member country under the direction of an independent chair appointed by the Council ACOM works on the basis of scientific analysis prepared in the ICES expert groups and the advisory process include peer review of the analysis before it can be used as basis for the advice. In the case of eel, the relevant expert group is the Joint EIFAAC/ICES/GFCM Working Group on Eel (WGEEL).

2.2 ICES Advice on Eel 2015

9.3.10 European Eel throughout its natural range (reproduced from the *ICES Advice 2015, Book 9) (October 2015)*

Advice

ICES advises that when the precautionary approach is applied for European eel, all anthropogenic mortality (e.g. recreational and commercial fishing on all stages, hydropower, pumping stations, and pollution) affecting production and escapement of silver eels should be reduced to – or kept as close to – zero as possible.

Stock status

The status of eel remains critical.

The annual recruitment of glass eel to European waters in 2015 decreased compared to 2014, from 3.7% to 1.2% of the 1960–1979 level in the 'North Sea' series, and from 12.2% to 8.4% in the 'Elsewhere Europe' series. The annual recruitment of young yellow eel to European waters decreased to 11% of the 1960–1979 level. These recruitment indices are well below the 1960–1979 un-impaired reference levels, and there is no change in the perception of the status of the stock.

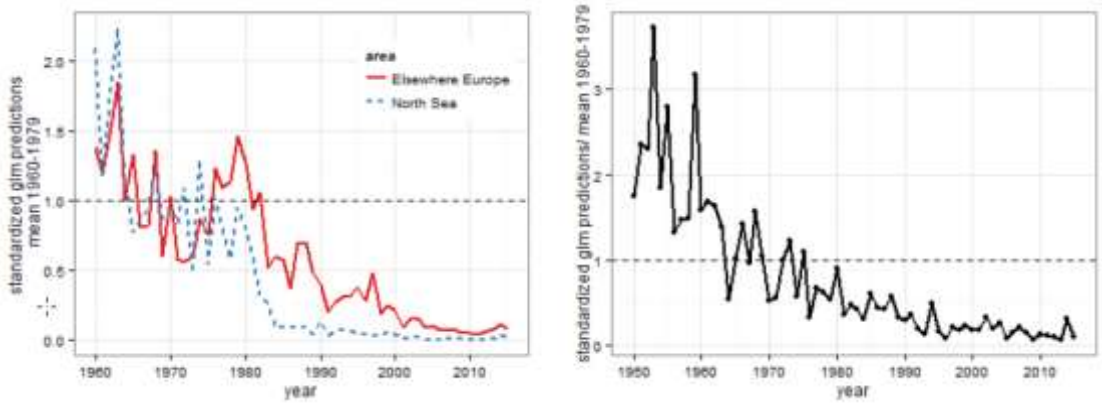


Figure 9.3.10.1 European eel. Left panel: Recruitment index, geometric mean of estimated (GLM) glass eel recruitment for the continental North Sea and "Elsewhere Europe" series. The GLM (recruit = [area year−1] + site) was fitted to 39 time-series, comprising either pure glass eel or a mixture of glass eels and yellow eels and scaled to the 1960–1979 average. The "North Sea" series are from Norway, Sweden, Germany, Denmark, the Netherlands, and Belgium. The "Elsewhere" series are from UK, Ireland, France, Spain, Portugal, and Italy. Right panel: Geometric mean of estimated (GLM) yellow eel recruitment and smoothed trends for Europe. The GLM (recruit = year + site) was fitted to 12 yellow eel time-series and scaled to the 1960–1979 average.

Stock and Exploitation Status

Table 9.3.10.1 European eel. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size			
		2012	2013	2014		2013	2014	2015	
Maximum sustainable yield	F_{MSY}	?	?	?	Undefined	$B_{trigger}$	?	?	?	Undefined
Precautionary approach	F_{pa}, F_{lim}	?	?	?	Undefined	B_{pa}, B_{lim}	?	?	?	Undefined
Management plan	F_{MGT}	-	-	-	Not applicable	SSB_{MGT}	-	-	-	Not applicable
Qualitative evaluation	-	?	?	?	Undefined	-	✗	✗	✗	Highly impaired recruitment

Catch Options

Total landings and effort data are incomplete and therefore ICES does not have the information needed to provide a reliable estimate of total catches of eel. Furthermore, the understanding of the stock dynamic relationship is not sufficient to determine/estimate the impact of any catch above zero (at glass, yellow, or silver eel stage) on the reproductive capacity of the stock.

Basis of the Advice

A management framework for eel within the EU was established in 2007 through an EU regulation (EC Regulation No. 1100/2007; EC, 2007), but there is no internationally coordinated management plan for the whole stock area. The objective of the EU regulation is the protection, recovery, and sustainable use of the stock. To achieve the objective, EU Member States have developed Eel Management Plans (EMP) for their river basin districts, designed to allow at least 40% of the silver eel biomass to escape to the sea with high probability, relative to the best estimate of escapement that would have existed if no anthropogenic influences had impacted the stock. ICES has evaluated the conformity of the national management plans with EC Regulation No. 1100/2007 (ICES, 2009a, 2010a) and progress in implementing EMP actions (ICES, 2013b). The EU Member States produced progress reports in 2012 and 2015. The 2015 reports have not been examined by ICES at the time of writing this advice.

The management plan has not been evaluated by ICES for its conformity with the precautionary approach and has for this reason not been used as the basis for the advice.

Quality of the Assessment

The advice is based on two glass eel recruitment indices and a yellow eel recruitment index. The indices are based on data from fisheries and scientific surveys and form the longest and most reliable time-series that constitute an index of abundance. This advice is based on the fact that these indices used by ICES are still well below the 1960–1979 levels.

Total landings and effort data are incomplete. There is a great heterogeneity among the time-series of landings because of inconsistencies in reporting by, and between, countries, as well as incomplete reporting. Changes in management practices have also affected the reporting of non-commercial and recreational fisheries.

Issues relevant for the advice

In September 2008, and again in 2014, eel was listed in the IUCN Red List as a critically endangered species.

The assessment and management of the fisheries and non-fisheries mortality factors are carried out by national and regional authorities. Fisheries take place on all available continental life stages throughout the distribution area, although fishing pressure varies from area to area, from almost nil to heavy overexploitation. Illegal, unreported and unregulated (IUU) fishing is believed to occur. The non-fishing anthropogenic mortality factors can be grouped as those due to (a) hydropower, pumping stations, and other water intakes; (b) habitat loss or degradation; and (c) pollution, diseases, and parasites. In addition, anthropogenic actions may affect mortality due to predators, e.g. conservation or culling of predators.

Environmental impacts in transitional and fresh waters, which include habitat alteration, barriers to eel passage, deterioration in water quality, and presence of non-native diseases and parasites, all contribute to the anthropogenic stresses and mortality on eels and also affect their reproductive success. It is anticipated that the implementation of the Water Framework and the Marine Strategy Framework Directives may result in improvements to the continental environment and that this may have a positive effect on the reproductive potential of silver eel.

ICES notes that stocking of eels is a management action in many eel management plans, and that this stocking is reliant on a glass eel fishery catch. There is evidence that translocated and stocked eel can contribute to yellow and silver eel production in recipient waters, but evidence of contribution to actual spawning is limited by the general lack of knowledge of the spawning of any eel. Internationally coordinated research is required to determine the net benefit of restocking on the overall population, including carrying capacity estimates of glass eel source estuaries as well as detailed mortality estimates at each step of the stocking process.

When stocking to increase silver eel escapement and thus aid stock recovery, an estimation of the prospective net benefit should be made prior to any stocking activity. Where eel are translocated and stocked, measures should be taken to evaluate their fate and their contribution to silver eel escapement. Such measures could be batch marking of eel to distinguish groups recovered in later surveys (e.g. recent Swedish, French, and UK marking programmes), or implementing tracking studies of eel of known origin. Marking programmes should be regionally coordinated.

A management framework for eel within the EU was established in 2007 through an EU Regulation (EC Regulation No. 1100/2007; EC, 2007), but there is no internationally coordinated management plan for the whole stock area.

The framework required EU Member States to report on progress in 2012 and 2015. In 2012, many EU Member States did not completely report stock indicators (22 of 81 EMPs did not report all biomass indicators, and 38 did not report all mortality indicators), and there are differences in the approaches used to calculate reported stock indicators. The 2015 reports were

not available to ICES at the time of writing. A complete reporting of verified indicators covering the distribution area of the European eel is required for a full assessment of the stock.

Reference Points

The EC Regulation sets an escapement limit of at least 40% of the silver eel biomass relative to the best estimate of escapement that would have existed if no anthropogenic influences had impacted the stock.

Recruitment at the 1960–1979 level is regarded as an un-impaired recruitment level.

ICES has advised the EC CITES Scientific Review Group on reference points for the eel stock that could be used in developing, and reviewing, an application for a non-detriment finding (NDF), under circumstances of any future improvement of the stock (ICES, 2015a). These reference points were developed specifically using CITES guiding principles for NDF.

Basis for the assessment

Table 9.3.10.3 European eel. Basis of the assessment.

ICES stock data category	3 (ICES, 2015b).
Assessment type	Trend analysis.
Input data	Glass eel and yellow eel recruitment indices.
Discards and bycatch	Not included.
Indicators	None.
Other information	Landing statistics are incomplete and reporting inconsistent. Stock indicators are incomplete from eel management units/countries in the EU. Stock indicators and other data are missing from non-EU states. There is no international legislative requirement to collect and provide data for the entire stock area.
Working group	Joint EIFAAC/ICES/GFCM Working Group on Eels (WGEEL; ICES, 2015c).

Information from stakeholders

Data on recruitment collected by stakeholders are included in the assessment where appropriate.

History of advice, catch and management

Table 9.3.10.4 European eel. History of ICES advice.

Year	ICES advice*	Predicted catch corresponds to advice*	TAC*	ICES catch** Total
1999	A recovery plan	-		
2000	No fishery and a recovery plan	0	-	-
2001	-	-	-	-
2002	No fishery and a recovery plan	0	-	-
2003	All anthropogenic mortality as close to zero as possible and a recovery plan	-	-	-
2004	-	-	-	-
2005	-	-	-	
2006	All anthropogenic mortality as close to zero as possible and a recovery plan	-	-	-
2007	All anthropogenic mortality as close to zero as possible and a recovery plan	-	-	-
2008	All anthropogenic mortality as close to zero as possible.	-	-	-
2009	All anthropogenic mortality as close to zero as possible.	-	-	-
2010	All anthropogenic mortality as close to zero as possible.	-	-	-
2011	All anthropogenic mortality as close to zero as possible.	-	-	-
2012	All anthropogenic mortality as close to zero as possible.	-	-	-
2013	All anthropogenic mortality as close to zero as possible.	-	-	-
2014	All anthropogenic mortality as close to zero as possible.	-	-	-
2015	All anthropogenic mortality as close to zero as possible.	-	-	-
2016	All anthropogenic mortality as close to zero as possible.	-	-	-

* No TAC ever for this stock.
** Catch estimates considered too incomplete to be presented.

History of catch and landings

Catch data were considered too incomplete to be presented.

Summary of the assessment

Table 9.3.10.5 European eel. Recruitment index, geometric mean of estimated (GLM) glass eel recruitment for the continental North Sea (NS) and "Elsewhere Europe" (EE) series. The GLM (recruit = [area year^{-1}] + site) was fitted to 39 time-series, comprising either pure glass eel or a mixture of glass eels and yellow eels and scaled to the 1960–1979 average.

Year	EE	NS	Year	EE	NS	Year	EE	NS	Year	EE	NS	Year	EE	NS	Year	EE	NS
1960	138	209	1970	103	95	1980	127	79	1990	40	14	2000	21.4	4.7	2010	4.9	0.5
1961	119	117	1971	58	84	1981	95	59	1991	20	3	2001	9.7	0.9	2011	4.3	0.5
1962	152	178	1972	57	109	1982	106	32	1992	27	8	2002	15.0	2.6	2012	6.3	0.5
1963	185	224	1973	60	48	1983	53	26	1993	31	7	2003	15.5	2.1	2013	8.6	1.1
1964	100	117	1974	87	129	1984	60	10	1994	31	7	2004	8.9	0.6	2014	11.2	4.3
1965	133	77	1975	75	54	1985	57	9	1995	38	5	2005	10.1	1.3	2015	8.4	1.2
1966	81	86	1976	123	102	1986	37	9	1996	28	5	2006	7.2	0.4			
1967	83	95	1977	109	80	1987	69	10	1997	48	4	2007	7.9	1.3			
1968	136	122	1978	114	58	1988	70	10	1998	19	3	2008	7.1	0.8			
1969	60	87	1979	146	95	1989	49	4	1999	25	6	2009	5.0	0.9			

Table 9.3.10.6 European eel. Geometric mean of estimated (GLM) yellow eel recruitment for Europe. The GLM (recruit = year + site) was fitted to 12 yellow eel time-series and scaled to the 1960–1979 average.

Year	Index	Year	Index	Year	Index	Year	Index	Year	Index	Year	Index	Year	Index
1950	175	1960	158	1970	52	1980	90	1990	30	2000	18	2010	13
1951	236	1961	168	1971	56	1981	37	1991	37	2001	18	2011	12
1952	230	1962	164	1972	100	1982	47	1992	21	2002	34	2012	11
1953	372	1963	139	1973	123	1983	43	1993	14	2003	20	2013	7
1954	184	1964	55	1974	58	1984	32	1994	50	2004	26	2014	31
1955	278	1965	102	1975	109	1985	62	1995	16	2005	9	2015	11
1956	132	1966	142	1976	34	1986	45	1996	9	2006	15		
1957	146	1967	97	1977	68	1987	44	1997	21	2007	22		
1958	148	1968	156	1978	62	1988	58	1998	18	2008	15		
1959	316	1969	104	1979	54	1989	33	1999	23	2009	8		

Sources and references

EC. 2007. COUNCIL REGULATION (EC) No. 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European eel. Official Journal of the European Union. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007R1100&from=EN.

ICES. 2009. European eel. *In* Report of the ICES Advisory Committee, 2009. ICES Advice 2009, Book 9, Section 9.4.9.

ICES. 2010. European eel. *In* Report of the ICES Advisory Committee, 2010. ICES Advice 2010, Book 9, Section 9.4.9.

ICES. 2013. European eel. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 9, Section 9.4.7.

ICES. 2015a. EU request on criteria for CITES non-detriment finding for European eel (*Anguilla anguilla*). *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 9, Section 9.2.3.2.

ICES. 2015b. Advice basis. *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 1, Section 1.2.

ICES. 2015c. Analysis of recruitment trend. Special meeting of EIFAAC/ICES/GFCM Working Group on Eels (WGEEL), 1 October 2015, by correspondence. To be annexed to the coming 2015 WGEEL report. Presently available at

http://www.ices.dk/community/groups/Pages/WGEEL.aspx.

3 National Advice

3.1 Request for Advice re: surplus above 40%

Request (31 July 2015): *"IFI would like to request advice from the SSCE in relation to the potential impacts of making eel available for exploitation in the various RBDs that are currently meeting their escapement target (40%). I would welcome your advice on the potential weight of eels (based on RBD portion of historic national catch or other factors) that could be exploited in each RBD and an estimate of the potential impacts of taking such catches of eels on the future of the RBD meeting it's escapement target. Advice is also sought on the number of years a fishery might operate in each RBD at various precautionary catch levels before the estimate of current silver eel production was to drop below the EU target. This request should not be interpreted as a potential opening of the eel fishery."*

See Annex 2 for the full document.

International ICES Advice

- There has been no change in the scientific perception of the status of the total eel stock since the 2012 review: it remains critical and urgent action is needed to prevent further depletion of the stock.
- ICES advises that all anthropogenic mortality (e.g. recreational and commercial fishing, hydropower, pumping stations, and pollution) affecting production and escapement of silver eels should be reduced to – or kept as close to – zero as possible.
- Over the last 3 years, glass eel recruitment has increased from historical lows to 12% of the 1960-1979 level in the Atlantic region and to 4% in the North Sea area. Recruitment is still below these 1960-79 reference levels.
- As eel is a long-lived species and anthropogenic mortalities occur over all of its continental lifespan, the effect of management measures to increase silver eel production and escapement and on subsequent reproduction and recruitment is expected to take several years, if not decades, to be detected. Recovery will be a slow process

Silver eel production and escapement

- The positive effect of the implemented management measures in Ireland and the NWIRBD catchments shared with NI (fishery closure and silver eel trap and transport) can be seen in the current escapements expressed as an average percentage of the historic production (pre 1982) increasing from 25.6% for 2008, to 36.7% for 2009-2011 and 54.5% for the 2012-2014 period. The increase in escapement to 54.5% as a national average for 2012-2014 period takes silver eel output above the EU Regulation target of 40% set to promote recovery of the stock and shows a contribution to international shared stock recovery. This does not mean that the whole stock has recovered to a sustainable level.

SSCE Advice

- While Ireland has reduced its anthropogenic mortality to low levels, it is unlikely that the increase in silver eel biomass in the last three years can be sustained much into the future due to the legacy of poor recruitment due to feed through to silver eel production at least for another decade. Current higher recruitment will only influence exploitable stock levels in a minimum of 8-10 years in the future. On this basis, it would be risky and contrary to scientific advice to consider the reopening of a fishery at this time.

Note: The SSCE is not currently in a position to provide silver eel production, escapement or 'surplus' advice for eels in transitional (saline) or coastal waters owing to an absence of data on silver eel production.

Summary of the analysis

The status of the eel stock remains critical and all anthropogenic mortality should be reduced to, or kept as, close to zero as possible.

The eel stock is panmictic and shared internationally.

Ireland is currently contributing as much as is possible to a potential recovery. Ireland (which accounts for less than 1% of the total EU stock) cannot deliver recovery of the European eel on its own without reciprocal management action being taken by other member states. To date other MS (whilst implementing a wide range of management measures) have typically not effected full closure of commercial eel fisheries or taken significant action against hydropower mortality (despite working to the same international advice as applies in Ireland that eel stocks remain outside safe biological limits).

Silver eel escapement is currently (2012-2014) at 54.5%, or lower if a more conservative assessment (i.e. Corrib 2009) is used.

The decline in recruitment is likely to lead to a (further) decrease in silver eel production. This has been estimated to lie between 0 & 15% per annum. This assessment has assumed a decline of 5% and 10% p.a.

A quantity of potential silver eel biomass therefore exists above the 40% target that could be exploited in the short-term (noting the advice above). While under more stable stock status conditions this might be safe, under the projected declining local stock status this carries with it considerable risk. While such harvest might allow escapement to meeting the strict requirements of the EU Regulation, it would still be contrary to more conservative international (ICES) advice.

As a yellow eel fishery of 5t, 20t or 60t pa open for 1, 2 or 3 years, the biomass remains above the target for 1 to 6 years (national) or 1 to 9 years (3 RBDs). However, due to the nature of maturation of yellow eel, the impact becomes cumulatively more severe with increased high landings or prolonged fisheries continuing to reduce the escapement well below 40% for at least 8 years after fishery closure. This makes reopening a yellow eel fishery risky and not in the interest of stock recovery.

Opening a silver eel fishery has a direct impact on escapement (unlike the delayed impact of a yellow eel fishery), is easier to quantify and therefore to manage. However, many traditional silver eel fisheries are now defunct, or employed in the ESB trap and transport conservation programme and are not therefore currently available for commercial exploitation.

At the current estimated levels of silver eel production and recruitment decline (and assuming no yellow eel harvest), it was estimated that a 'surplus' above 40% may exist, at diminishing annual amounts, for 6 years (5% decline) to 3 years (10% decline) or even less at the more conservative estimates.

Any reopening of a silver eel fishery would, at least, require new targets to be set for the ESB T&T programme and would more likely jeopardise the integrity and future of the T&T programme.

The SSCE also advise that should commercial fishing recommence measures should be put in place to ensure that commercial landings, ESB conservation landings, eel trade (imports and exports) and all illegal landings can be readily identified, reliably assessed and adequately

reported (as required under EU DCF and EU Regulation for Stock Recovery) in order to support robust stock assessment and reporting to the EU.

3.2 Request for Advice re: Options for Mitigation of the Erne Elver Mortality.

Request (31st March 2015): *IFI formally requests the advice of the SSCE on options for mitigation of the elver mortality that occurred on the Erne in 2014. It would also be very useful if the SSCE could approve calculations to support the proposed mitigation actions.*

Advice

The SSCE considered five possible options for mitigating the elver mortality in 2014 on the Erne:

1. Importation of Glass Eel
2. Upstream Transport of Erne Glass Eel from the Erne estuary
3. Silver Eel Mitigation on the Erne to negate the loss in future production
4. Silver eel purchase and release
5. Improved technology to increase future eel escapement

This advice is based on the mortality in 2014 of 112kg elvers +38kg morbid/displaced downstream (i.e. 150kg of elver lost to production). In order to comply with escapement and mortality rate reporting to the EU for the Erne and the NWIRBD, these amounts were converted into **silver eel equivalents (SEE)** lost from the Erne catchment (see Ch. 5.8 of the 2014 SSCE Report). The loss of potential spawning stock from the Erne was estimated to be **12,955kg** of silver eel equivalents.

It should be noted that this SEE production (12,955kg) would naturally be produced over an approximate 20 year period, mostly between years 2022 to 2036. The potential silver eel loss can be viewed as an amount brought forward to be acted on immediately (less risk), or more naturally spread over a number of years in the future (more natural). The SSCE provides this advice on the basis of the former, bringing forward the 12,955kg to be acted on immediately.

Note: There were two main issues that needed to be taken into account by management in deciding on the type of mitigation:

a) Is the objective to replace the potential yellow eel production lost to a future fishery?
b) Is the objective to make up for the loss of silver eel production to the potential spawning stock biomass produced by the catchment?

To address objective a/, intervention would need to be at the recruitment stage (Options 1 & 2 below) and to address objective b/, intervention would be most biologically cost-effective and risk averse at the silver eel stage (Options 3-5 below) although No. 2 is also a viable option.

1. Stocking Imported Glass Eel

Stocking with imported glass eel has not taken place in Ireland in at least the last 25 years.

Conversely in Northern Ireland periodic stocking of imported glass eel (mostly from the Severn) has taken place in L. Neagh since about 1984 after the collapse in natural recruitment reduced recruitment to the Lough below sustainable levels for supporting the commercial eel fishery.

Due to concerns relating to the possible introduction of pathogens and/or non-invasive species to Irish waters, the Standing Science Committee on Eel **advises against any introductions of live fish** imported from outside Ireland and especially from the continent. The SSCE **also advises against inter-catchment translocations** of live fish and/or water to minimise the spread of already introduced non-native species. The SSCE recommends that this advice should apply to the island of Ireland, including trans-boundary catchments.

2. Stock glass eel from the Erne Estuary

An option would be to fish the Erne estuary for incoming glass eel and transport these to upstream locations in the catchment, as previously practiced under the Erne Eel Enhancement Programme (EEEP). There is evidence that such a measure may reduce natural early mortality of glass eel although it is not known to what extent estuarine harvest of glass eel would reduce the quantity of elvers subsequently migrating upstream into freshwater for collection at Cathaleen's Fall station.

Early pigmented glass eel, younger than pigment stage VIAIII, undergo natural settlement mortality of up to approximately 80%. Taking this into account, it is advised that more than 150kg of early unpigmented glass eel would need to be captured in order to make up for the estimated loss of 12,955kg of silver eel. The amount of glass eel required would be dependent the eel pigment stage which is related to the temperature and date of capture but is likely to be in the order of 2-3x 150kg.

It could be argued that this option is not actually compensating for the real loss and may not address the elver mortality in full as it entails only moving eels (albeit at an earlier life stage) within the Erne catchment. As any harvest of glass eel in the Erne estuary would inevitably impact the eventual elver run to Cathaleen's Fall station to some (unknown) extent it would be impossible to accurately quantify the net benefit of this management option.

3. Silver Eel Trap and Transport Erne Option

An option would be to increase the level of annual silver eel trap and transport over a number of years to reduce the Hydropower Station (HPS) mortality to an equivalent amount lost (i.e. simply transporting an additional 12,955kg would not be sufficient; this would only save an extra ~3,500kg).

The calculation in advance of how this might take place is not simple due to changing annual silver eel production, varying water discharge rates and different generation protocols (e.g. one or two turbines operating, with and without spillage).

It should be noted that the annual T&T amount has been above the objective set in the Management Plan for the Erne over the last 3 years. Any amount above the objective could be set against the loss while ensuring the 3-year mean T&T amount remains above target.

Based on the averages of 2012-2014, the following scenarios, <u>for example</u>, would be possible: Trap and transport an extra 10,000kg per annum for 5 years, equivalent to a total T&T of 72% of the run (this proportion has not yet been achieved in any year under current fishing effort) or T&T an additional 7,000kg over 7 years, equivalent to a total T&T of 67% of the run. The ability to achieve this option may decline in the years to come as, based on recruitment history, we expect production to begin to fall possibly as soon as within five years.

Therefore, this management option would require an approximate total of 50,000kg of additional transported silver eel, spread over an agreed time period, in addition to the annual EMP programme (based on the averages of 2012-2014).

4. Silver eel purchase and release

If the objective is to negate the loss of silver eel production as a conservation measure and given the current view that the eel stock is panmictic (i.e. does not exhibit homing to a natal river), it would be possible to negate this loss by either ensuring an additional escapement from another catchment where the Eel Management Plan T&T objective is also being met and where additional silver eel capture may be more efficient than on the Erne; **and/or** by purchasing additional silver eel which would be released into the wild as potential spawning stock. The purchase of silver eel could be, for example, from a fishery where the catch is destined to be killed for consumption, such as L. Neagh. The release of these purchased eels would compensate the spawning stock for the potential loss from the Erne. Such a system of purchase could be applied over a number of years thereby spreading the risk and producing a more 'natural' response.

5. Improved technology to increase future eel escapement

Other management initiatives could be implemented on the Erne where alternative investment would be applied to, for example, fish passage facilities (e.g. Hydropower Station mortality on downstream silver eel, or on improved upstream elver recruitment) or other eel management (e.g. technologically improved trap and transport) issues. This should be agreed between ESB and the relevant Government Departments and might ameliorate eel mortality over a longer and more sustainable time period.

Agreed Measures in Mitigation of loss of 115kg Elvers on the River Erne (Extract from DCENR Press Release 23 October 2015)

1. A quantity of 8450kgs of silver eel to be acquired by ESB for immediate release to the sea. The release of eels to be overseen by DCAL and ESB will act as observers.
2. ESB trap and transport (T&T) operations on the Erne catchment shall be increased by a total quantity of 17,500kgs.
3. In recognition of the quantity (12,000kgs) above target transported (post event), by ESB, in 2014 a quantity of 6,500kgs of this 2014 overage shall be counted as part of the agreed additional quantity set out in 2 above.
4. The agreed net additional quantity for T&T is therefore 11,000kgs. This is to be achieved by exceeding the annual targets (set by SSCE) for T&T until such time as the net additional quantity (11,000kgs) has been exhausted, but in any event is to be completed within a maximum period of 4 years (i.e. no later than 2018), but may be achieved sooner.
5. The additional quantities transported by ESB shall be verified on an annual basis by SSCE. Progress in relation to the additional T&T quantities will be jointly reviewed on an annual basis by all parties.
6. In view of the suggestions of SSCE as regards "improved technology to increase future eel escapement", it is also agreed that, in addition to the mitigation actions above, ESB, having already upgraded eel traps to best available, will keep operational matters under review in the light of future developments in technology.

4 Management Actions – a scientific assessment

4.1 Introduction

There are four main management actions included in the Irish Eel Management Plans aimed at reducing eel mortality and increasing silver eel escapement in Irish waters. These are a cessation of the commercial eel fishery and closure of the market, mitigation of the impact of hydropower, including a comprehensive silver eel trap and transport plan, ensure upstream migration of juvenile eel at barriers and improve water quality including fish health and biosecurity issues.

Every three years, each Member State must submit details of;

- monitoring,
- effectiveness and outcome of Eel Management Plans
- contemporary silver eel escapement
- non-fishery mortality
- Policy regarding enhancement/stocking

4.2 Management Action No. 1 Reduction of fishery to achieve EU target

4.2.1 Introduction

The target set for the Irish Eel Management Plan 2012-2014 was to have zero fishing mortality and reduce illegal capture and trade to as near zero as possible.
In May of 2009 Eamon Ryan, Minister for Communications, Energy and Natural Resources passed two Bye laws closing the commercial and recreational eel fishery in Ireland. The byelaw which prohibited the issuing of licenses was continued. However, on expiry of Bye law C.S. 312 of 2012, a new byelaw was required to prohibit the fishing for eel, or possessing or selling eel caught in a Fishery District in the State for a further period until June 2018.

- Bye-Law No 858, 2009 prohibits the issue of eel fishing licences by the regional fisheries boards in any Fishery District.
- Bye-law No C.S. 303, 2009 prohibits fishing for eel, or possessing or selling eel caught in a Fishery District in the State until June 2012. (revoked).
- Bye-law No C.S. 312, 2012 prohibits fishing for eel, or possessing or selling eel caught in a Fishery District in the State until June 2015. (revoked).
- Bye-law No C.S. 312, 2015 prohibits fishing for eel, or possessing or selling eel caught in a Fishery District in the State until June 2018.

It should be noted that since EU Commission ratification of the Ireland/UK NWIRBD transboundary plan in March 2010, the fishery in the NI portion of the Erne was closed from April 2010.

Following a public consultation in June 2015, Minister McHugh signed a new byelaw (C.S. 319/2015) on the 23rd November 2015 prohibiting fishing for eel, or the possession or sale of eel caught in Ireland (Annex 3).

4.2.2 Action 1a: Report closure of fishery

All management regions confirmed a closure of the eel fishery for the 2015 season with no commercial or recreational licences issued (Annex 4). In the transboundary region, there were no licences issued and no legal fishery in the Foyle and Carlingford areas in 2015.

The eel fishery, with the exception of the strictly managed L. Neagh, also remained closed in N. Ireland in 2015.

4.2.3 Reports of illegal fishing activity

Ireland:

For the complete modelling of silver eel escapement, information is required on the levels of illegal fishing and illegal catch. Therefore, this information is required on an annual basis. A questionnaire was circulated to the IFI Regions and the Loughs Agency (Annex 4: Table 4.1).

One region reported significant amounts of illegal fishing which led to gear and equipment seizures (ShIRBD) with 68 fyke nets, 180m of longline and one Coghill net seized (Table 4.1).

No seizures of eel dealers transport trucks have been reported and no illegal activity was reported in relation to the silver eel trap and transport programmes. It is likely, however, that some illicit eel sales may have occurred in the Shannon IRBD given the level of seizures of gear mentioned previously.

The poor quality of the export data currently available to the SSCE makes it difficult to determine the level of illegal catch. There were no instances of seizures of illegal or undocumented eel shipments.

Transboundary:

No illegal activity was reported for the areas of the NWIRBD and Carlingford under the jurisdiction of the Loughs Agency.

No other information was available at report time.

4.2.4 Action 1b: Recreational Fishery

The legislation prohibits the possession of eel caught in Ireland and this extends to cover recreational angling. There was no legal recreational catch and rod angling for eel. Bycatch during angling for other species was on a catch and release basis, although the level of damage and mortality of released eels is unknown but could be high.

4.2.5 Action 1c: Diversification of the Fishery

Inland Fisheries Ireland (IFI) is establishing a network of scientific fisheries for eel around Ireland. The scientific fisheries will be distributed in key catchments around Ireland (Barrow, Boyne, Corrib, Fane, Moy, Munster Blackwater, Waterford Harbour and the Shannon Estuary). The purpose of the scientific fisheries is to increase the data and knowledge of eel in Ireland ahead of the 2018 EU review of our national eel management plan. The programme follows an announcement by Minister with responsibility for natural resources, Joe McHugh TD, in November 2015 of a new collaborative research initiative involving IFI scientists and former eel fishermen.

Table 4-1: Details of illegal activity within the regions and transboundary Northern Ireland, 2015

	ERBD	L AGENCY RoI/NI	NWRBD	SHRBD	SERBD	SWRBD	WRBD
Silver T&T programme	No	No	Yes	Yes	No	Yes	No
Illegal trading related to T&T	No	No	No	No (suspicions).	No	No	No
Estimated level of illegal fishing	None	None	None	Medium (L. Allen, Ree, Derg, R. Inny, East Clare)	None	Low-nil	Low-nil
Number of gear seizures	0	0	0	19	0	0	0
Gear types seized	-	-	-	~ 68 Fykes, 6 longlines (180m), 1 coghill	-	-	-
Number of eel dealer interceptions	0	0	0	0	0	0	0
Estimated tonnage on board:	-	-	-	-	-	-	-
Declared origin of cargos:	-	-	-	-	-	-	-

4.3 Management Action No. 2. Mitigation of hydropower

4.3.1 Action 2a: Trap and Transport

The targets were set for the trap and transport system in the Irish Eel Management Plan 2009-2011 and these were subsequently modified, following the experience of the three year programme, for the 2012-2014 and 2015-2017 periods as follows:

***Shannon*:** Trap and transport 30% of the annual production (unchanged)

***Erne*:** Trap and transport 50% of the annual silver eel production. A rolling target based on a 3-year basis allowing shortfalls in one year to be made up the following year. A consistent longterm shortfall could not be carried forward indefinitely.

***Lee*:** Trap and transport 500kg of the annual escapement (unchanged)

4.3.1.1 2014 Trap and Transport Results

The total amounts of silver eel trapped and transported in each of the three rivers in 2015 are presented in Table 4.2. The separate detail sheets of the amounts transported from each site on each date are presented as an annex to this report (Annex 5).

In the River Shannon the trap and transport total of 19,957kg represented 28.22% of silver eel production and, therefore, because of the fact that the previous year T&T (37.38%) exceeded the 30% target, the EMP requirement was met on the basis of the agreed (3 year rolling mean value) protocol.

In the R. Erne, the trap and transport annual target (50% of silver eel production) for the River Erne was exceeded in the 2015 season. The quantity (54,706kg) transported for safe release at Ballyshannon represented 70.1% of the estimated silver eel production (78,034kg) for the river system for the season. In addition to the EMP 50% T&T target (39,017kg), additional mitigation measures for potential future losses of silver eel production that might result from a 112.5kg elver loss at Ballyshannon in 2014 were addressed by ESB in the 2015 season. Thus, ESB purchased 8,450kg of silver eels from the L. Neagh Eel Fishermen's Cooperative Society Ltd which were then released to the lower River Bann and allowed to migrate freely to sea. These eels are not included in the current River Erne analysis. However, the mitigation agreement also required ESB to increase T&T activities so that, prior to 2018, an additional 11,000kg of River Erne would be trapped and released (i.e. in addition to the annual 50% targets). The 2015 T&T programme, which involved additional fishing effort and increased efficiency of capture at several sites, resulted in a surplus of 15,689kg. Thus the normal (50%) 2015 target and the additional mitigation targets (8,450kg River Bann release and 11,000kg extra River Erne release) were all fully achieved. In addition, a small surplus 4,689kg was achieved which can contribute to the ongoing 3-year rolling average calculation protocol used to monitor the annual 50% T&T mitigation actions on the river system.

In the River Lee, following protocols successfully used in 2011, 2012, 2013 and 2014, a contract fishing crew was authorized to fish on behalf of ESB in Inniscarra Reservoir (Fig. 4.1). In 2015 fishing crew used only fyke-nets.

Analysis of their fishing reports, ESB collection weight records and direct observations on selected catches indicated that 527 kg were trapped and transported. Eels were all released to

the River Lee downstream of the Inniscarra dam. NUIG researchers monitored the fishing activities and examined representative Inniscarra catches on 18/08/2015. Size frequency distributions of eel samples obtained from Inniscarra reservoir in 2015 are illustrated in Fig. 4.2. As can be seen in the bimodal pattern, there were a substantial quantity of large (>700mm) eels present in the catch this season and these are thought to be eels that had descended from the upper catchment waterbodies (Carrigadrohid reservoir and Lough Allua)..

Figure 4-1: Map of Inniscarra reservoir.

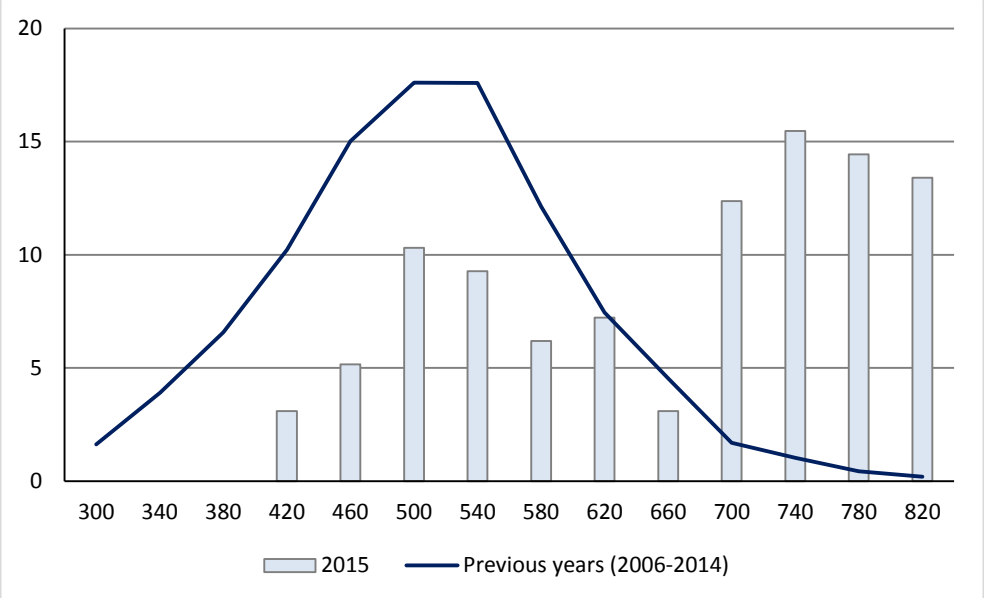


Figure 4-2: Relative size frequency distribution of Inniscarra eel sample.

The combined catches for 2012, 2013 and 2014 (234 kg, 824 kg and 670 kg) totalled were 1,728 kg. A shortfall in 2012 catches, relative to the EMP 500 kg target, was compensated for by the increased catches in 2013 and 2014. Total catch in 2015 (527 kg) was adequate to EMP target in this season and to 3 year rolling average calculation.

A sample (N=97) in which field observations were made on two criteria (body colouration and cloacal aperture) suggested that 92.7% (96.7% of the biomass) of the eels could be designated as having at least one clear indication of their potential silver eel status.

It was estimated that at least 509.6 kg of a contribution to the 2015 spawner biomass escapement from the River Lee resulted from the quantity of eels transported and released below the river section affected by the hydroelectricity production dams.

A decline in fyke-net CPUE, reported by the fishing crew in 2012, was not confirmed by either 2013, 2014 or 2015 analyses of catch records. The poor eel catch in 2012 seems to have been due to poor environmental conditions in the fishing period rather than stock decline. In 2015 the entire catch was obtained in just 18 fishing nights. Within 2015 season fishing crew set nets in four zones (Fig. 4.3) of the reservoir to maximise eel catch (CPUE). The number of nets, total catches and CPUE values varied between the zones. It was estimated that at least 509.6 kg of a contribution to the 2015 spawner biomass escapement from the River Lee resulted from the quantity of eels transported and released below the river section affected by the hydroelectricity production dams.

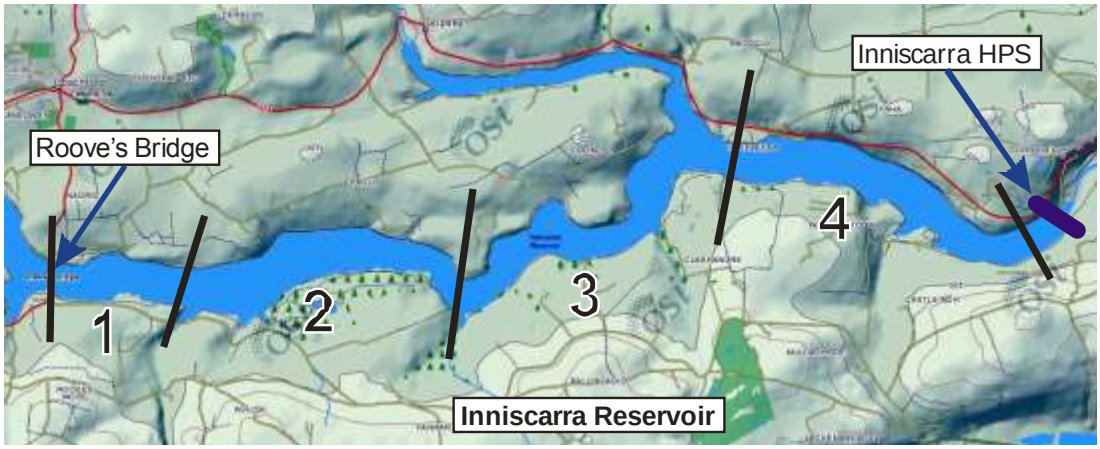


Figure 4-3: Four fishing zones on Inniscarra reservoir.

Table 4-2: Total amounts (t) of silver eel trapped and transported in the Shannon, Erne and Lee, 2009-2015, and the success relative to the targets set in the EMPs. Note change of target on the Erne in 2012.

Catchment	Year	T&T Target	Amount Transported (kg)	Relation to target	Annual Status	3 yr Running Average
R. Shannon	2009	30% of run	23,730	31%	Achieved	31.4%
R. Shannon	2010	30% of run	27,768	40%	Achieved	35.8%
R. Shannon	2011	30% of run	25,680	39%	Achieved	36.9%
R. Shannon	2012	30% of run	24,228	36%	Achieved	38.4%
R. Shannon	2013	30% of run	22,561	28%	Not achieved	34.3%
R. Shannon	2014	30% of run	26,438	37%	Achieved	33.8%
R. Shannon	2015	30% of run	19,957	28%	Not achieved	31.3%
R. Erne	2009	22t	9,383	42.6	Not achieved	
R. Erne	2010	34t	19,334	56.9	Not achieved	46.9
R. Erne	2011	39t	25,405	65.1	Not achieved	59.3
R. Erne	2012	50% of run	34,660	51.2%	Achieved	51.2%
R. Erne	2013	50% of run	39,319	53.6%	Achieved	52.4%
R. Erne	2014	50% of run	48,126	66.4%	Achieved	57.1%
R. Erne	2015	50% of run	54,706	70.1%	Achieved	58.7%[1]
R. Lee	2009	0.5t	79	16%	Not achieved	16%
R. Lee	2010	0.5t	278	56%	Not achieved	36%
R. Lee	2011	0.5t	731	146%	Achieved	73%
R. Lee	2012	0.5t	230	46%	Not achieved	83%
R. Lee	2013	0.5t	824	165%	Achieved	119%
R. Lee	2014	0.5t	670	134%	Achieved	115%
R. Lee	2015	0.5t	527	105%	Achieved	135%
Total	2009		33,192			
Total	2010		47,380			
Total	2011		51,816			
Total	2012		59,118			
Total	2013		62,704			
Total	2014		75,234			
Total	2015		75,190			

[1] The rolling average was calculated excluding 11,000kg set aside for elver mortality mitigation.

4.3.2 Action 2b: Quantify Turbine Mortality

4.3.2.1 Shannon

The exceptionally high discharge levels recorded in the River Shannon in the 2015/2016 winter months had significant implications for downstream silver eel migration and for annual scientific monitoring work undertaken by NUIG. However, pending evaluation of potential use of Didson acoustic camera records and calibration of these, by reference to further 2016 observations, provisional estimates of escapement were determined on the assumption that silver eel production was similar to that recorded in 2014. It was estimated that silver eel mortality at the Ardnacrusha Dam was 4,666kg (21.15% HPS passage mortality rate). However, higher discharge rates down the old river bypass channel are also likely to have had an influence on the run, possibly lowering the levels of mortality. This will be reviewed by NUIG in the subsequent analysis.

4.3.2.2 Erne

During the 2015 silver eel season the patterns of generation and spillage at the River Erne hydropower stations were unusual, because of high rainfall and discharge. In the analyses of eel hydropower passage, varying mortality levels were incorporated, per calendar day, into the escapement model. These were based on dusk-dawn hydrometric data, power generation activity and results of previous years silver eel acoustic telemetry. Generation protocols and associated mortality rates have been described in previous reports. For the 2015 season mortality rates were applied as follows: ***Cliff HPS*** 0% (no flow or only spillage); 7.9% (Generation plus spillage) and 26.7% (Only generation), ***Cathaleen's Fall HPS***: 0% (no flow or only spillage); 7.7% (spillage plus half generation load); 15.4% spillage plus full generation load); 27.3% (only generation). Reduced overall generation levels occurred during the silver eel migration season, due to refurbishment of turbines. This resulted in relatively high spillage levels and reduced overall turbine passage mortality levels. This was estimated to have represented a cumulative 8.1% mortality of the total River Erne silver eel production, or 27.2% of the migrating eel (not including the trapped and transported component) at the two dams during 2015.

4.3.3 Action 2c: Engineered Solution

Silver eel deflection experiments were undertaken at Killaloe Weir on the River Shannon in 2015. This involved weir-mounted LED lights and a floating pontoon with arrays of similar lights which was moored upstream of the weir. Effective light deflection was demonstrated by analysis of altered catch patterns at the eel weir. However, subsequent eel fishing weir closure, due to extreme flooding, resulted in termination of the experiments. Further deflection studies will be undertaken in the Lower Shannon in 2016 and at Roscor Bridge on the River Erne, where some preliminary site assessment studies were initiated at the end of the 2015 season.

4.4 Management Actions No. 3. Ensure upstream migration at barriers

Under the National Eel Management Plan, Objective 7 requires the evaluation of upstream colonisation: migration and water quality effects. Lasne and Laffaille (2008) found that while eels are capable of overcoming a wide array of obstacles the resulting delay in migration can have an impact on the eel distribution in the catchment. Knowledge of what constitutes a barrier for eels (at different life stages) will assist in the estimation of eel population densities and escapement for future management plan reviews.

The EU Habitats Directive (Directive 92/43/EEC) and Water Framework Directive (2000/60/EC) both require the assessment of barriers to fish migration. In order to tackle the issue on a multispecies level IFI established a National Barriers Group in 2011. This group is building on the earlier work to develop a standardised assessment of barriers nationally and is currently evaluating an IFI survey sheet and assessment methodology. The long term aim is to develop a national database of barriers for rating fish pass ability which in turn will provide information to target mitigation measures at the most significant obstructions.

4.4.1 Action 3a: Existing barriers (inc. small weirs etc.)

IFI Barrier mitigation work in 2015

The IFI working group has developed and revised a 'barrier' survey form template and this has been uploaded onto ruggedized laptops used by IFI staff, as one of a suite of forms. The barriers form on the tablet laptops is the standard mechanism for barrier data collection and all data collected should be available for insertion into a national database

A training course is to be run for IFI staff in Northwestern RBD in early summer 2016 with a view to data collection in areas of Cavan and Donegal

A series of county-based 'barrier' surveys have been undertaken by IFI staff, in conjunction with specific Local Authorities. These have had a major focus on road crossings and examined river continuity issues for fish as well as bridge issues for birds and mammals. Surveys completed to date in Wicklow and Monaghan and on-going in Waterford

IFI R&D commenced a catchment-wide survey of structures in the Barrow catchment in 2015 and it is envisaged that this will be completed in 2016, working with staff from Southeast RBD

IFI R&D is undertaking a secondary series of barrier surveys using the WFD111 (SNIFFER) fish passability tool. This is confined to (a) major barriers in main stem SAC channels designated for sea lamprey (and salmon) and to (b) structures of a size that are causing significant passage /continuity issues and that are scheduled for modification or removal. In the case of (b) WFD 111 surveys are planned both before modification and also subsequent to modification

The EPA has funded a 3-year €500k project to examine issues relating to barriers/structures in Irish rivers. A UCD team has been awarded this contract. IFI was involved in establishment of the project and its components. An integral part of the project is the collection of data on barrier occurrence in a series of sub-catchments – nominated by IFI. The IFI barrier form is to be used for data collection and the data collected must be made available for upload into the IFI barriers database

IFI is a partner in an INTERREG cross-border funding application, focussed on improving waterbody quality in three catchments. A series of catchment actions is envisaged, including actions to improve the hydromorphology quality. This will include examination of barriers/structures in channels and it is possible that river continuity/passage issues relating to some of these structures (in NI and RoI) will be addressed

Barrier modification is planned for sites on OPW channels and is being addressed through the IFI-OPW EREP Programme.

A series of barrier modification/removal projects are on-going in IFI Southeast RBD, with a rock ramp on the R. Nore at Castletown completed in 2015.

The Castletown River

IFI installed a large rock ramp structure at Castletown weir to improve fish passage. The rock ramp was installed at a weir with an old denil pass which represented a significant barrier to

fish. This was a very significant project both in planning and construction with a total cost in the region of €75,000 ex vat. It was funded by salmon conservation stamp funding. The project has been successful from a fish passage, stakeholder interaction, financial and civil planning perspective.

Figure 4-4: Castletown weir before remedial works.

Figure 4-5: Rock ramp installed at Castletown during August and September 2015.

4.4.2 Action 3b: New potential barriers

There is no new information since the 2012 report, 'Guidelines for Small Scale Hydro Schemes'.

4.4.3 Action 3c: Assisted migration and stocking

Assisted upstream migration takes place at the ESB Hydropower Stations on the Shannon (Ardnacrusha, Parteen), Erne (Cathaleens Fall), Liffey and Lee. This has been a long-term objective to mitigate against the blockage of the HPSs under ESB Legislation (Sec 8, 1935). On the Erne and Shannon, elvers and bootlace eel are transported upstream from the fixed elver traps. These programmes outlined in the EMP were continued in 2015. The catches shown in Tables 7.1-7.3 were transported upstream. On the Erne, the distribution of elvers throughout the catchment is by cross-border agreement between the ESB, IFI and DCAL.

4.5 Management Action No. 4 Improve water quality

Management Action No. 4: Improve water quality
Action 4a: Ensure compliance with the Water Framework Directive
Timescale: 2015
Review: 2012, 2015, 2018
Monitoring Actions: Include eel in the fish monitoring elements of the WFD
Undertake further eel quality monitoring (EUFP7 EELIAD)

4.5.1 General water quality – Compliance with the Water Framework Directive

The improvement of water quality in Ireland is primarily being dealt with under the workprogramme for the implementation of the Water Framework Directive (WFD). The objectives of the Water Framework Directive (WFD) are to protect all high status waters, prevent further deterioration of all waters and to restore degraded surface and ground waters to good status by 2015. A major programme is under way to achieve this target, with monitoring beginning in Dec 2006. National regulations for implementing the directive were put in place in 2003. The WFD reporting and monitoring runs on a six year cycle, so the next opportunity to assess whether water quality is improving will be with the publication of the second River basin management Plans (RBMP). This documentation is not available to date (mid 2016).

In the interim period, the Environmental Protection Agency (EPA) compile statistics on water quality in Ireland, the most recent of which covers the period 2010-2012 (Bradley et al., 2015). 53% of rivers, 43% of lakes, 45% of transitional waters, 93% of coastal waters and 99% of groundwater were satisfactory at good or high status. Rivers monitored, using the biological Q value scheme, were in high or good condition along 73% of the monitored river channels. This was up 4% from the last monitoring period (2007-2009), and includes an overall increase in high status sites. Serious pollution of rivers reduced to 17 km from 53 km since last reporting period. There was a 5% reduction (10 lakes) in the high or good status categories, and a corresponding increase in the moderate or worse status category compared to 2007-2009. Reported fish kills declined to an all-time low of 70 recorded between 2010 and 2012. In lieu of the complete documentation marking the end of the second reporting period of the WRFD, the EPA note that 47% of rivers, 57% of lakes, 55% of transitional waters and 7% of coastal waters require

improvement to satisfactory condition. The target of 13.6% improvement in ecological status for surface waters from the 2009 baseline by 2015 included in the first cycle river basin management plans is unlikely to be achieved. It is also worth noting that fish assessments (detailed below) downgraded the ecological status in 18% and 27% of surveillance rivers and lakes, respectively.

The Irish EPA reports (summarised above) refer to waterbodies within seven RBD's (Eastern, Neagh Bann, North western, South Eastern, Shannon, South Western, Western). The Neagh bann, Shannon and North western RBD's are transboundary, in that there are portions of them in northern Ireland. Only a very small portion of the Shannon RBD is in Northern Ireland, while the Neagh Bann RBD is not included in the Irish Eel Management reports. Therefore, the implementation of the WFD in the Northern Irish part of the North western RBD is also of interest in this report, as it is the major international RBD which is considered in this eel management report. The status classification for 2015 for surface waters in NW iRBD shows that 46% are at good or better status. This can be broken down to 46% of rivers, 25% of lakes, and 33% of transitional and coastal water bodies (by numbers) at good or better (NIEA 2015).

4.5.2 WFD monitoring – fish

Inland Fisheries Ireland (previously the Central and Regional Fisheries Boards) has been assigned the responsibility by the EPA for delivering the fish monitoring element of the WFD in Ireland. Eel are included in the WFD (fish) monitoring of rivers, lakes and transitional waters. While this data will be included in the overall assessment of the second cycle of WFD reporting for 2015, summary reports are available (www.wfdfish.ie). The most relevant of these summary reports is the report for 2014 (Kelly et al. 2015). In 2014, a comprehensive fish surveillance monitoring programme was conducted, with 68 river sites, 27 lakes and 7 transitional waters successfully surveyed throughout the country (Table 4.3). Eel are ubiquitous across all sites, and were found in 96.2% of lakes surveyed and 55.7% of rivers.

Table 4-3: Interim assessment of Irish waterbodies according to fish metrics, measured in 2014 and as part of the WFD monitoring program carried out by Inland Fisheries Ireland (Kelly et al. 2014).

Period		No. of sites analysed	High	Good	Moderate	Poor	Bad
2014	Rivers	68	3	38	25	2	0
	Lakes	27	5	11	6	3	2
	Transitional Waters	7	0	3	3	0	1

4.5.3 Fish Kills

There were 22 reported fish kills in 2014 (IFI 2014). This was a marked decrease on the numbers for 2013 (53), but still higher than those reported in 2012 (10). The majority of these fish kills were attributed to a cause other than those related to agriculture, industry or local authority infrastructure. There were 23 fish kills in 2015.

4.5.4 Eel Contaminants

A number of pesticides, including Mecoprop, MCPA and 2 4-D, were detected at low levels in a significant number of rivers (26%-56%) during routine monitoring (Bradley et al, 2015). However, apart from two (mercury and Polycyclic aromatic hydrocarbons) ubiquitous PBTs (persistent, bioaccumulative and toxic substances), the amount of non-compliance with the Environmental Quality Standards for priority substances and priority hazardous substances is very low and not of significant concern in Ireland (Bradley et al, 2015). This data confirms that bioaccumulation of toxins of eels in Ireland is likely to be less significant than in other EU countries.

ICES held a Workshop (WKBECEEL) in January 2016 on Eel and Contaminants and the report will be available on the ICES Website in mid-2016.

4.5.5 Prevalence of *Anguillicola crassus*

Two lakes sampled in 2011 as part of the Eel Monitoring Programme's first 3-year cycle had low prevalence and infection intensities when originally sampled. Lough Ballynahinch had a prevalence rate of 13% and an infection intensity of 1.00; Lough Inchiquin had a prevalence rate of 1% and an infection intensity, 1.00. These 2 lakes were resurveyed in 2015 to determine the extent of the spread of *A.crassus* infection. The prevalence rate for Lough Ballynahinch increased to 86% with an infection intensity of 12.57. The prevalence rate of Lough Inchiquin increased to 37% with an infection intensity of 4.85. These results suggest that the sampling in the 2011 showed these lakes in the early stages of anguillicolosis, which has since increased considerably (See Sections 6.1.1 Lough Ballynahinch and 6.1.3 Lough Inchiquin).

5 Silver Eel Assessment, 2015

(refers to Ch. 7.2.1 of the National EMP Report, 2008)

5.1 Introduction

The Council Regulation (EC) No 1100/2007 sets a target for silver eel escapement to be achieved in the long-term - 40% escapement of silver eels compared to the pristine level of escapement (pre 1980's). Ireland is therefore required to provide an estimate of contemporary silver eel escapement. The Regulation also requires post-evaluation of management actions by their impact directly on silver eel escapement. Quantitative estimates of silver eel escapement are required both to establish current escapement and to monitor changes in escapement relative to this benchmark. Furthermore, the sex, age, length and weight profile of migrating silver eels are important for relating recruitment or yellow eel stocks to silver eel escapement. Quantifying migrating silver eel between September and December, or even January/February the following year, annually is a difficult and expensive process but it is the only way of ultimately calibrating the outputs of the assessments.

Silver eels are being assessed by annual fishing of index stations on the Erne, Shannon, Burrishoole and Fane catchments (Table 5.1). A pilot study was carried out on the Barrow in 2014. It is proposed to survey a series of additional index locations on a three year rolling basis. Figure 5.1 shows the sampling locations in 2014.

There are three monitoring objectives in relation to silver eels:

1. Synthesise available information into a model based management advice tool.
2. Estimate silver eel escapement (in collaboration with ESB, NUIG, Marine Institute) and
3. Estimate silver eel escapement indirectly using yellow eels.

In Ireland escapement and mortality is calculated for two ESB catchments by the National University of Ireland Galway (Shannon, Erne), for the Burrishoole system by the Marine Institute and for the Fane system by Inland Fisheries Ireland. The Fane is the only east coast catchment currently being monitored for silver eels and the Barrow in the South East.

Table 5-1: The locations where silver eel escapement will be assessed.

Catchment	Priority	2015	2016	2017	Method
Erne	High	√	√	√	Coghill net / Mark-recapture
Shannon	High	√	√	√	Coghill net / Mark-recapture
Burrishoole	High	√	√	√	Trap
Fane	High	√	√	√	Coghill net / Mark-recapture
Barrow	High	√	√	√	Coghill net / Mark-recapture

The locations identified in the 2009 National Management Plan that have been excluded from the current programme (Table 5.1) are the Waterville site where it was proposed to use a resistivity fish counter to determine silver eel escapement. This will be re-evaluated once there is clear evidence of this technology being suitable for silver eel. The other site excluded from the programme is Lough Mask. This site was fished in 2010 and it was found to be difficult due to the geology of the region. With the suspension of the Galway Fishery on the outflow of the Corrib catchment any further work on Lough Mask has also been postponed with the redistribution of resources to the east coast.

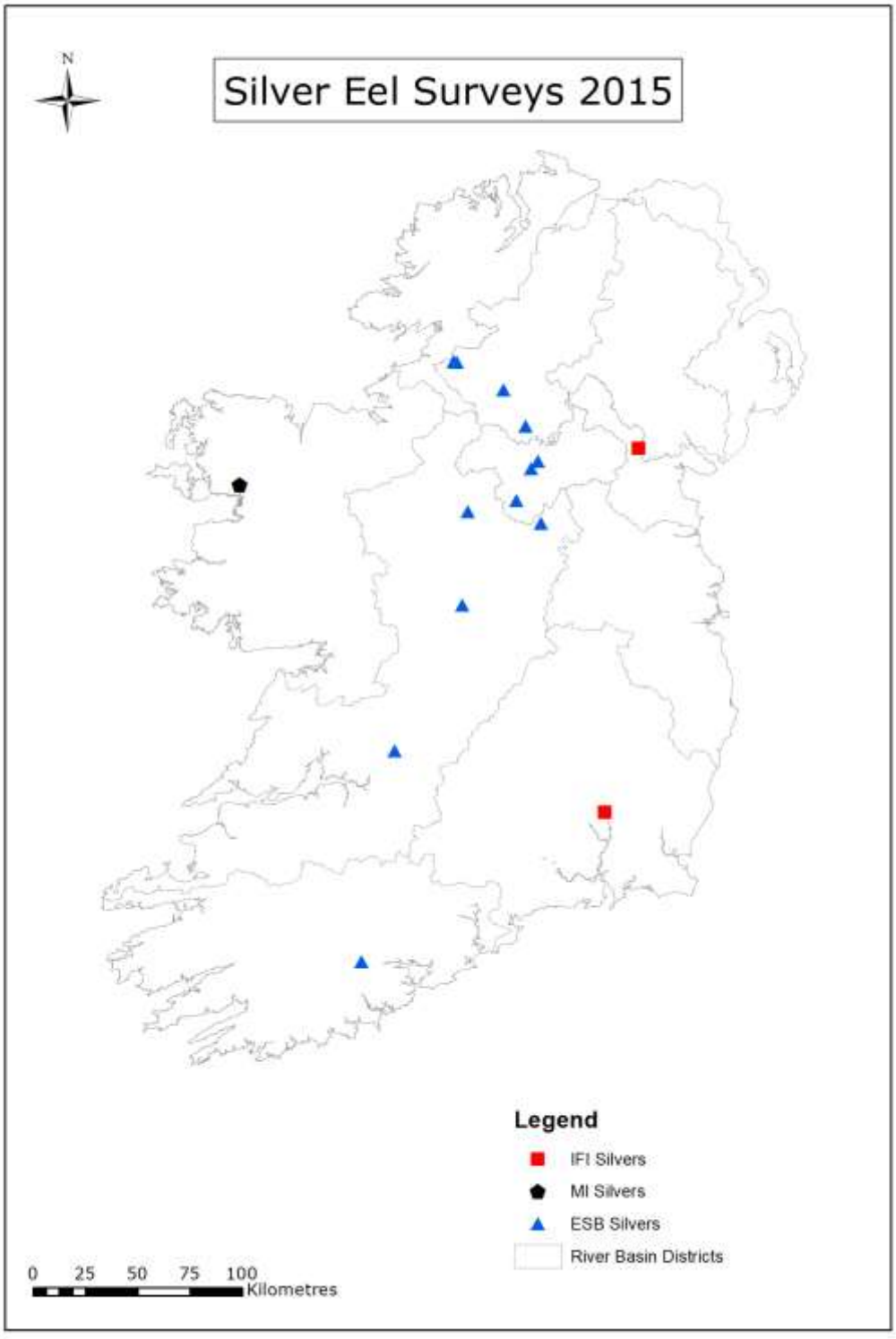


Figure 5-1: Silver eel monitoring locations, 2015.

5.2 Shannon

The silver eel populations of the River Shannon remain among the better researched examples in Europe, due to the availability of long-term fishery records and on-going research activities (e.g. MacNamara and McCarthy, 2013). In the 2015 season the conservation fishery and the trap & transport programme were again monitored by NUIG. However, the detailed scientific analyses undertaken annually for estimation of silver eel production and escapement rates for the river system were not possible in 2015 because of a prolonged period of eel weir fishery closure at Killaloe during the extreme flood conditions.

5.2.1 Catch

The 2015 fishing season for eels on the River Shannon extended from 29th of August to 14th of December for the conservation fishing sites in the upper Shannon (Fig. 5.2). At Killaloe test fishing at the eel weir during September and October showed no migration was occurring in the low flow conditions. However, as discharge increased at the beginning of November the main silver eel migration started with the first catches at Killaloe occurring on 8th of November in 2015. Due to flooding and high discharge the ESB were required to close the Killaloe eel weir from 10th of December to 19th of January. A total of 49 nights were fished and the final fishing event took place on 10th of February.

During the 2015 season 11,679 kg was captured at the upstream sites and 8,549 kg was captured at Killaloe. The relative catch contribution from the upstream sites and Killaloe weir to the ESB silver eel trap and transport programme in 2015 is summarised in Fig. 5.3. As can be seen, the proportion (41.5%) captured at Killaloe was much lower than in 2014 season (57%). Likewise, reflecting the reduced fishing at Killaloe the proportional contribution of sites in the upper catchment was higher in 2015 though the actual quantities caught there were similar to last year.

The pattern of downstream migration at Killaloe, apart from the fishery closure period, was reflected in the daily catches recorded at the eel fishing weir. These data are graphically presented, in relation variation in discharge and to the lunar cycle, in Fig. 5.4. Most (8,323kg) of the catch at Killaloe was obtained prior to the closure period and only a small quantity (226kg) was caught in the final period.

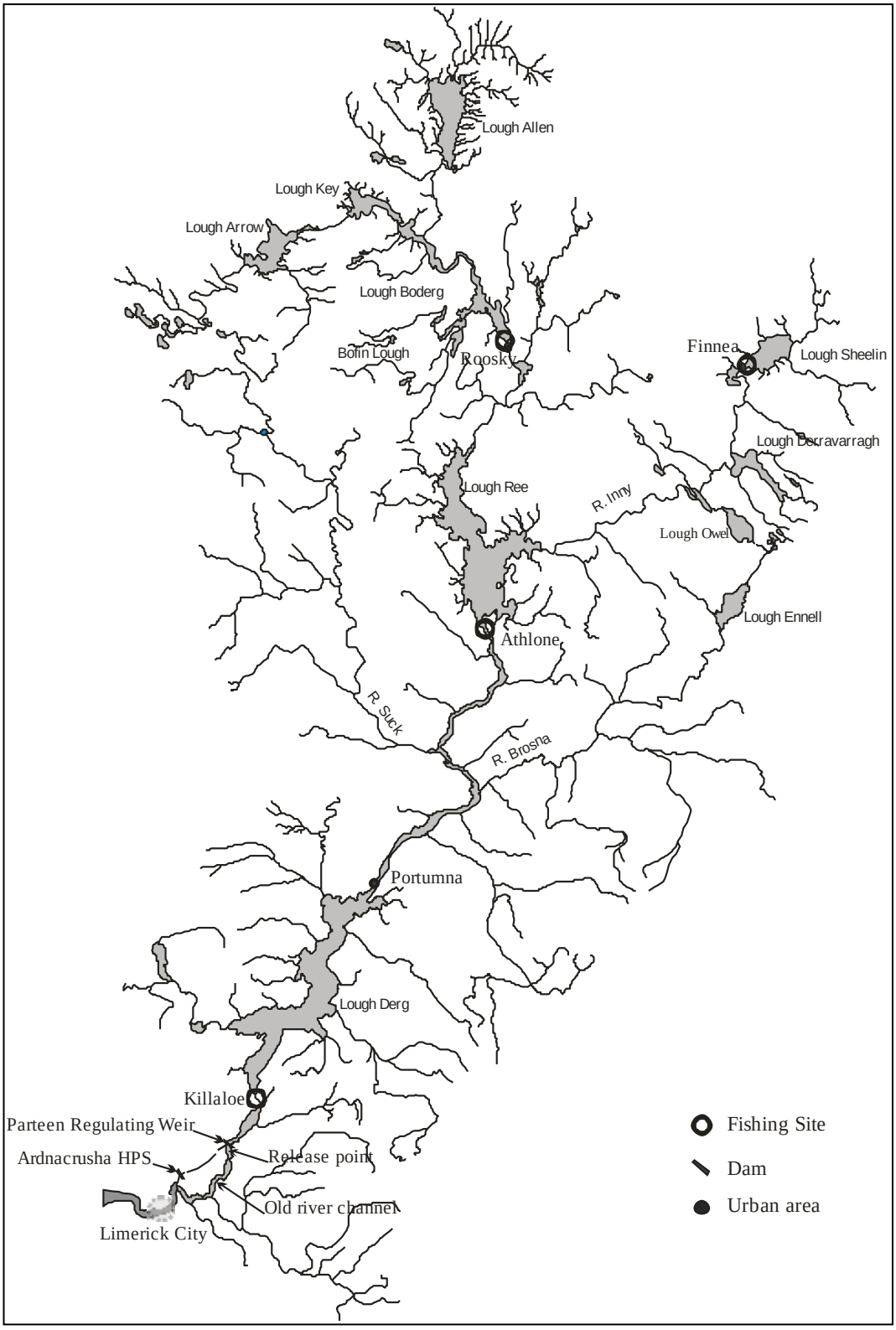


Figure 5-2: The River Shannon, with silver eel fishing sites and release point indicated.

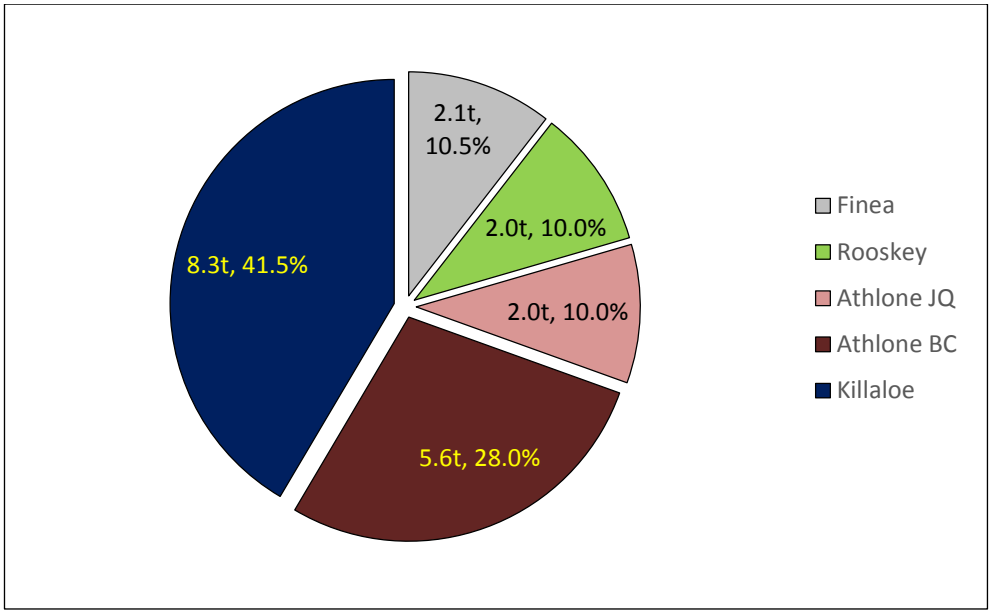


Figure 5-3: Proportion of annual Trap and Transport caught at the five River Shannon fishing sites (Athlone BC = Jolly Mariner & Athlone JQ = Yacht Club).

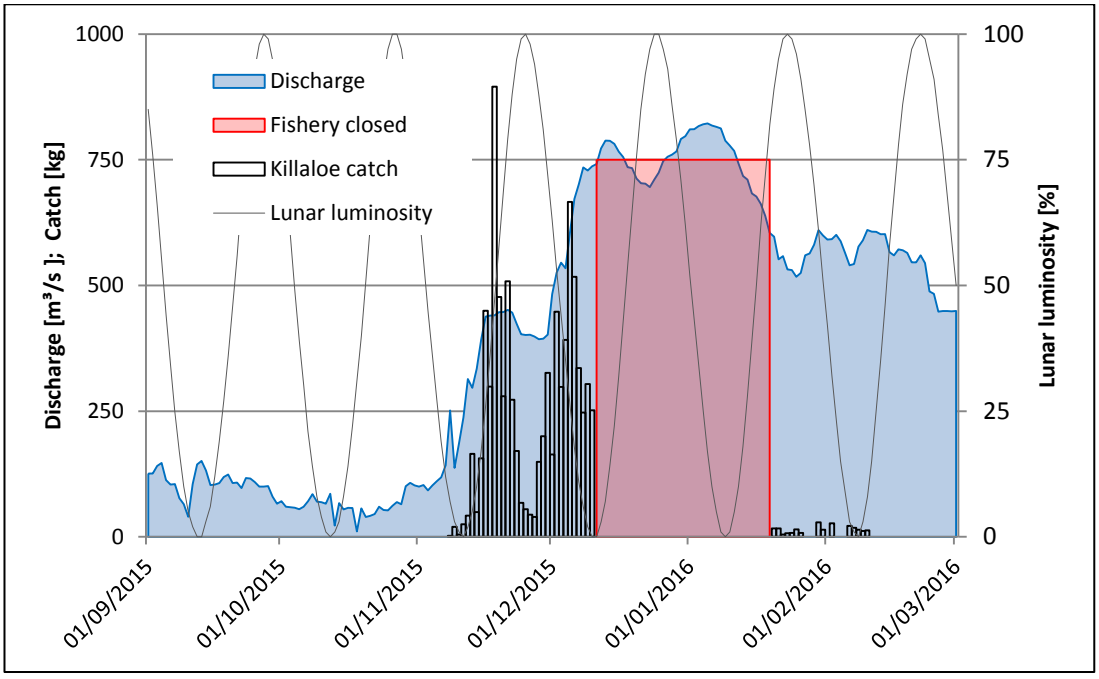


Figure 5-4: Killaloe weir eel catch (kg), discharge ($m^3 \cdot s^{-1}$) at pattern and lunar cycles during 2015 season.

5.2.2 Escapement

The problems presented by the extreme flooding and extended period of fishery closure in the 2015 silver eel migration season were addressed on a provisional basis as follows. It was considered best to assume that the annual production, which has not varied greatly in recent years, could be represented by the 2014 estimate (70,725kg). Likewise, it was decided to use the previous year estimate of eel weir capture efficiency (25.5%) and the usual (21.15%) index of hydropower mortality for eels passing through Ardnacrusha HPS.

The protocols adopted for the fishery closure period (40 nights) in the provisional analysis of production (P) and escapement (E) were as follows: Using the 2014 season parameters, as outlined above, it was estimated that a potential additional Killaloe catch of 6,484kg was missed in the 2015 season and that the missed catch quantity was distributed equally (162.1kg) between the 40 nights. These were used to calculate the biomass of eels migrating downstream during the non-fished 40 nights. These data were included with a time series of quantities estimated to have migrated nightly downstream to the Parteen Reservoir during the fished period at Killaloe. This combined time series was used, together with hydrometric data and the telemetry derived model, developed in previous years, to estimate quantities migrating via the alternative routes (old river channel or headrace canal) to the estuary. These results are summarized in Fig. 5.5 and, while noting the assumption about production, it can be seen that escapement (E) appears to have been high (93.03% of P) in the 2015 season and that this reflected the exceptionally high discharge (spillage) via the old river channel. The total T&T (19,957kg) represented 28.22% of P and, therefore, because of the fact that the previous year T&T (37.38%) considerably exceeded the 30% target the EMP requirement was met on the basis of the agreed (3 year rolling mean value) protocol. The provisional estimates of River Shannon production and escapement for the 2015 season presented here may be subsequently improved if it proves possible to use DIDSON surveys, undertaken on the headrace canal, to refine the analysis of daily migration patterns and route selection during the non-fished period at Killaloe (Figs. 5.4 & 5.6).

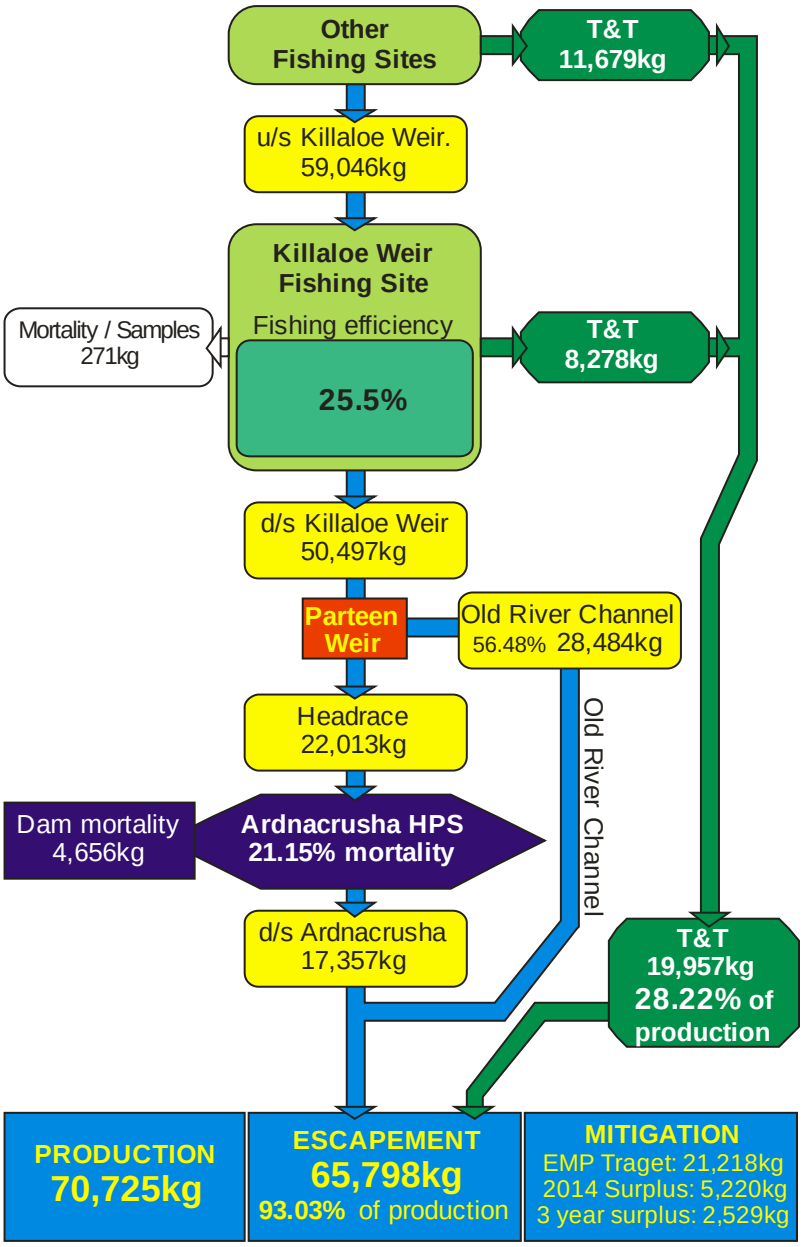


Figure 5-5: A summary of the analyses of silver eel production and escapement in the River Shannon during the 2015 eel migration season.

Figure 5-6: Killaloe weir on the Shannon River.

5.2.3 Length

Size frequency distributions for samples examined at the conservation fishing sites in the 2015 season are illustrated in Fig. 5.7. Variations in eel size and sex ratios along the river system in 2015 were broadly similar to those reported in previous years. The upper Shannon sites produced almost exclusively female eels (>430 mm), with only Athlone (5.2%) and Killaloe eel weir (6.3%) catching significant quantities of male eels (<430 mm). The sizes of female eels varied as is shown in Fig. 5.7. Seasonal bias & small sample size limited scope for interpreting the data especially at Killaloe. The mean female sizes at sites in this season were: Finea (N=76) 825.3mm; Rooskey (N=111) 689.8mm; Athlone (N=110) 643.2mm; Killaloe (N=59) 713.4mm.

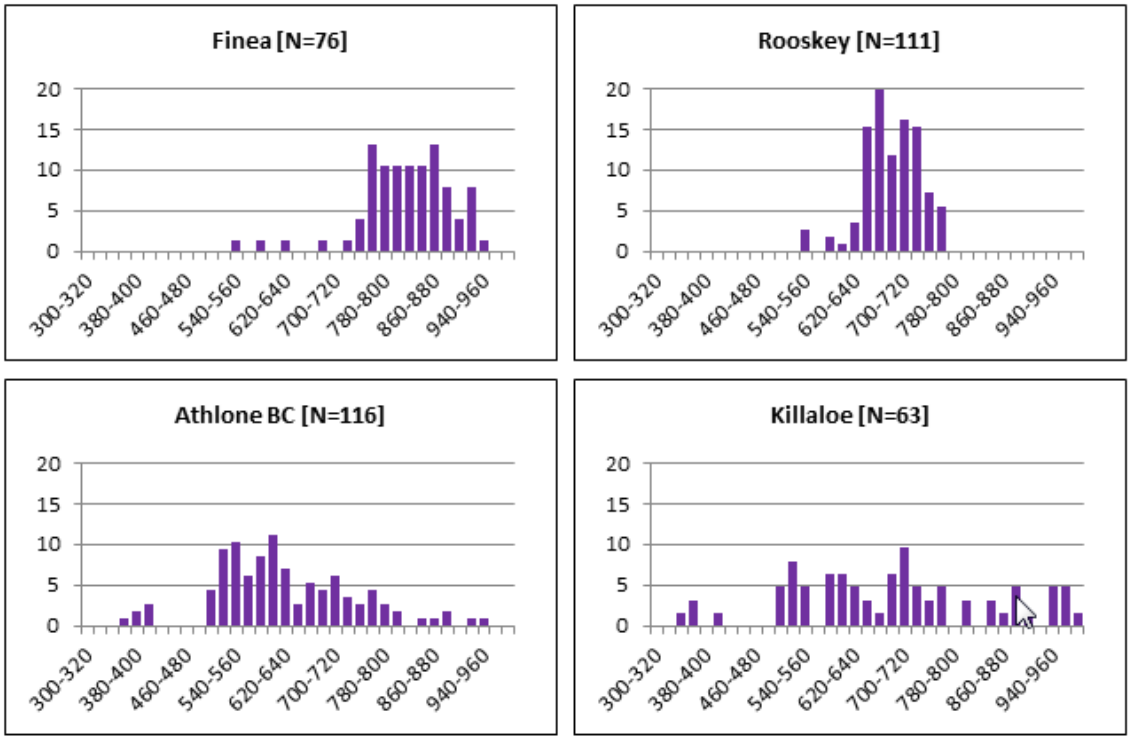


Figure 5-7: Length relative frequencies [%] of eels captured at River Shannon conservation fishing sites in the 2015 eel migration season.

5.3 Burrishoole

The only total silver eel production and escapement data available in Ireland is for the Burrishoole catchment in the Western RBD, a relatively small catchment (0.3% of the national wetted area), in the west of Ireland. The Burrishoole consists of rivers and lakes with relatively acid, oligotrophic, waters (Figure 5.8). The catchment has not been commercially fished for yellow eels, not been stocked and there are no hydropower turbines.

The eels have been intensively studied since the mid-1950s; total silver eel escapement from freshwater was counted since 1970 (Poole *et al*., 1990; Poole, data unpublished); and an intensive baseline survey was undertaken in 1987-88 (Poole, 1994). The detailed nature of the Burrishoole data makes it suitable for model calibration and validation (e.g. Dekker *et al.* 2006; Walker *et al*. 2011).

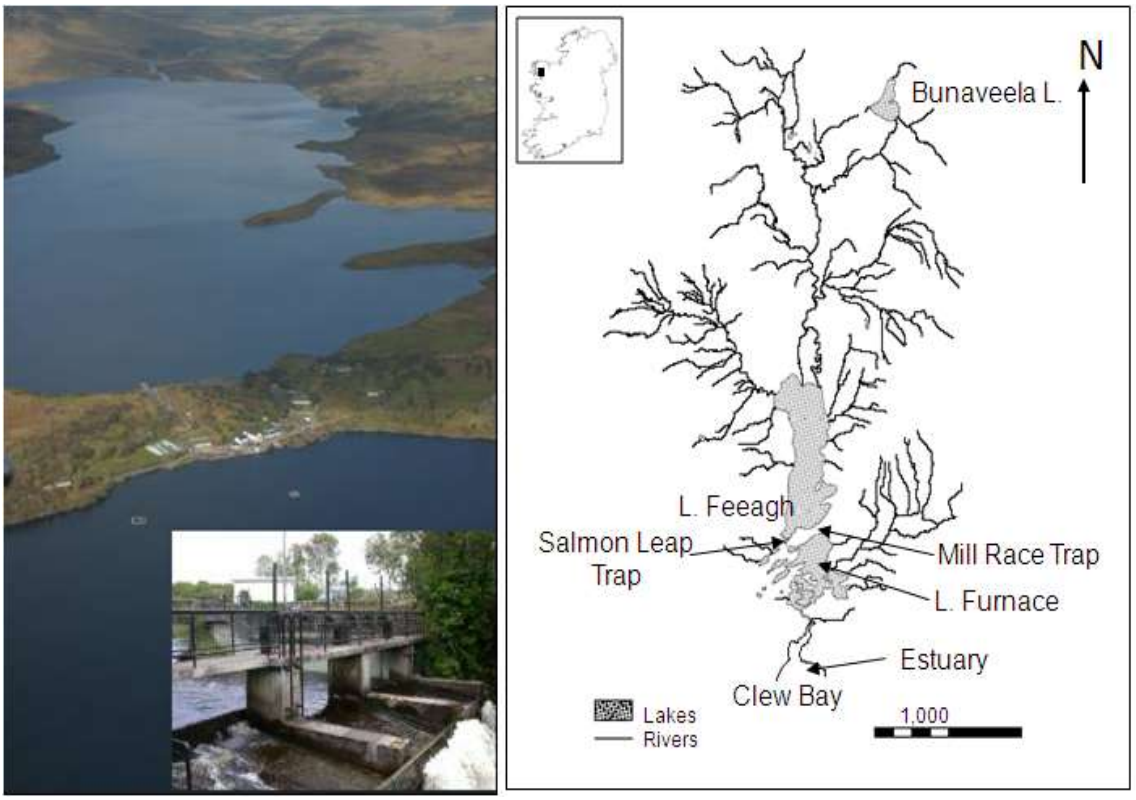


Figure 5-8: An aerial view of the Burrishoole catchment, looking north over the tidal Lough Furnace, in the foreground, and the freshwater Lough Feeagh: inset shows the silver eel downstream trap at the "Salmon Leap". A map of the Burrishoole catchment showing the locations of the silver eel traps at the lower end of the freshwater catchment.

5.3.1 Catch

Silver eel trapping was continued in 2015. In 2015, the timing of the run was different to the general pattern, with 31% migrating in October and 32% migrating in November (Table 5.2). Figure 5.9 shows the daily counts of silver eels with the water level. Note Table 5.2 has been reconfigured with the silver eel year going from May to April.

The total run amounted to 1073 eels. As in other years, the highest proportion of the total catch (79%) was made in the Salmon Leap trap.

There was considerable influence on the run timing due to low water levels in late September and early October but then a series of large floods occurred in late October, November and December. Some eels were noted lost from the Mill Race trap in the September flood and the data have been amended to account for that. However, the large floods in December completely inundated the whole Mill Race area and damaged a section of the Salmon Leap channel. No eels were observed damaged or caught against screening and it is thought that the losses were minimal. Once the traps were operational again the following week, in spite of continual high water through into February and March, few eels were counted.

Table 5-2: Timing and numbers of the 2015/'16 silver eel run.

	Salmon Leap	Mill Race	Total	%
May	0	0	0	0.0
June	0	1	1	0.1
July	42	18	60	5.6
August	63	44	107	10.0
September	190	42	231	21.5
October	275	55	330	30.8
November	288	55	343	32.0
December	0	0	0	0.0
Jan. 2016	0	0	0	0.0
February	0	0	0	0.0
March	0	0	0	0.0
April	1	0	0	0.0
Total	859	215	1074	

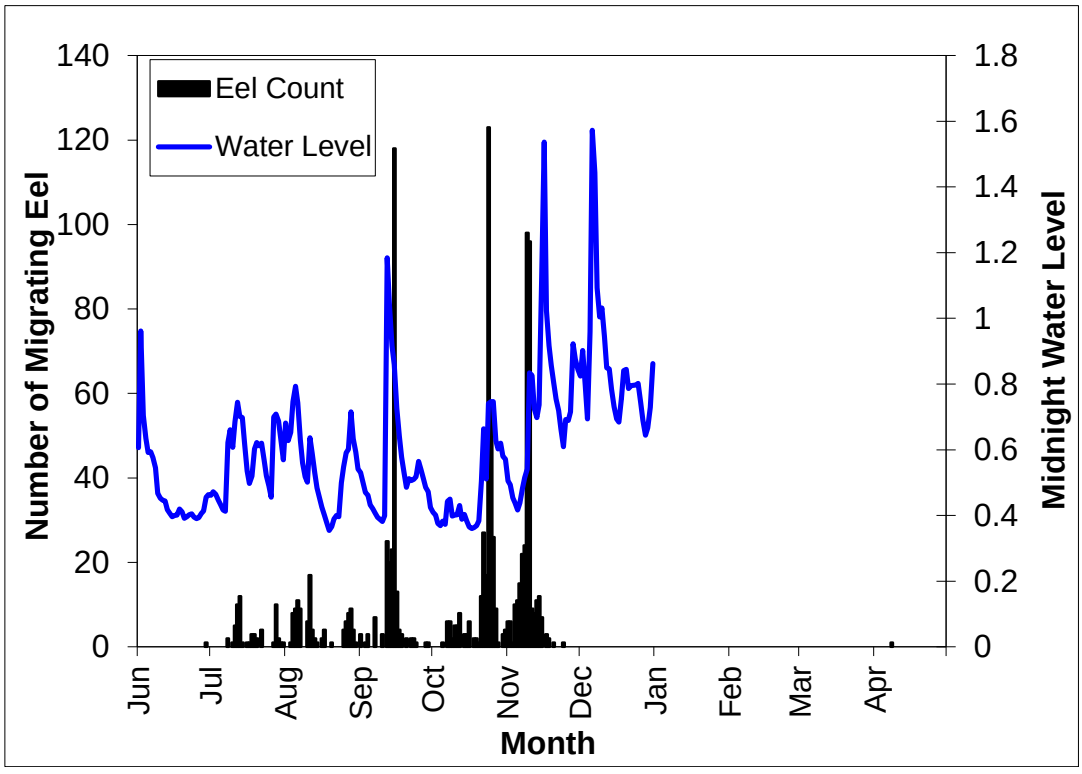


Figure 5-9: Daily counts of downstream migrating silver eel and mid-night water levels (m).

5.3.2 Length, weight & sex

Sampling of individual eels (n = 366) gave an average length of 43.8cm (range: 21.4 – 97.4cm) and an average weight of 192.4g. The length frequency distribution is presented in Fig. 5.10 along with those for 2013 and 2014 for comparison.

Counts of silver eel between the years 1971 (when records began) and 1982 averaged 4,400, fell to 2,200 between 1983 and 1989 and increased again to above 3,000 in the '90s (Fig. 5.11). There was an above average count in 1995, possibly contributed to by the exceptionally warm summer. The count in 2001 of 3875 eel was the second highest recorded since 1982. The average weight of the eels in the samples has been steadily increasing from 95 g in the early 1970s to 216 g in both the 1990s and the 2000s (Fig. 5.11). The annual count and average weight in 2010 and 2011 were both below the mean for the last decade.

In 2012, the majority of the eel run was sampled (n=3317; 99.5%). The run increased from 1969 in 2011 to 3335 in 2012 and the average weight decreased from 180 to 163.5g. The sex ratio changed from 24% to 45% over the past five years. Male eels have remained the same length over the past 15 years (36cm) whereas the females have changed from 53cm (1997-2005) to 50cm (2008-2012) and they were 49.2cm in 2012.

In 2015, the migration was 1073 eels and 366 were sampled. The mean weight was 192.4g and the proportion of male eels was 44.7%.

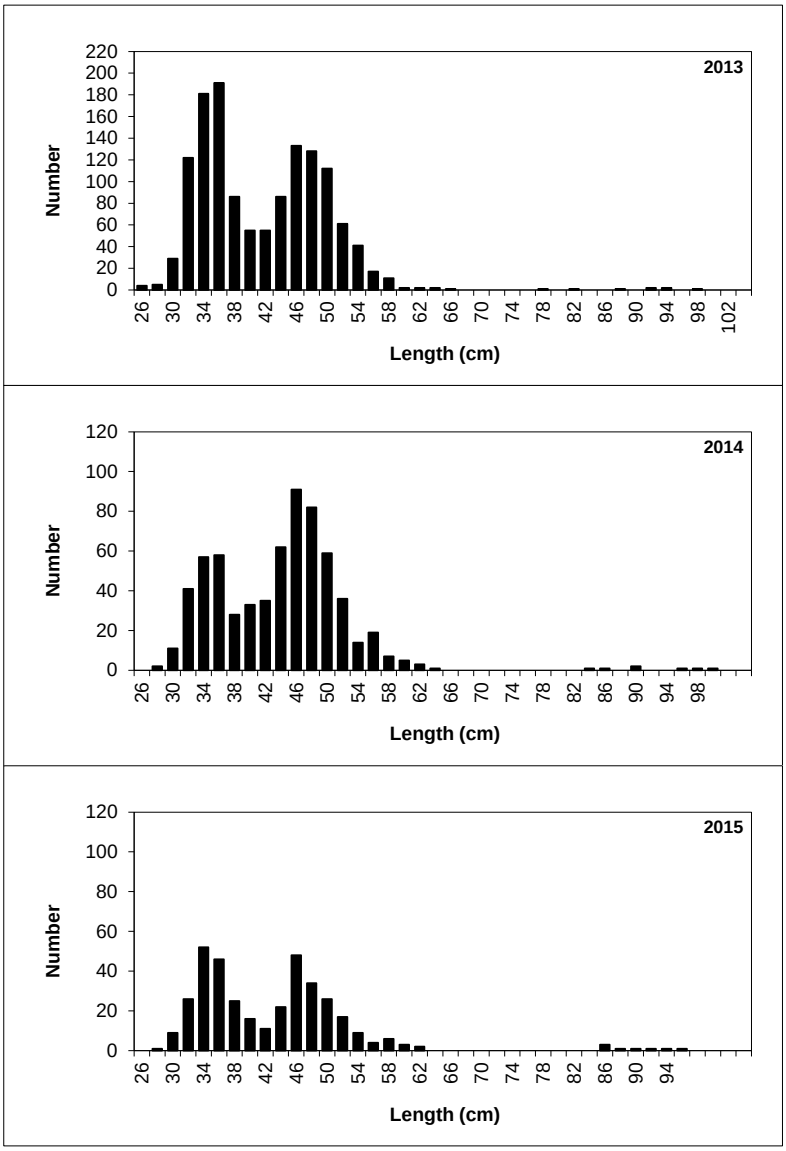


Figure 5-10: Length frequency of sub-samples of silver eels trapped in the downstream traps, 2013 (n=1329), 2014 (n=650) and 2015 (n=365). Note change of y-axis scales.

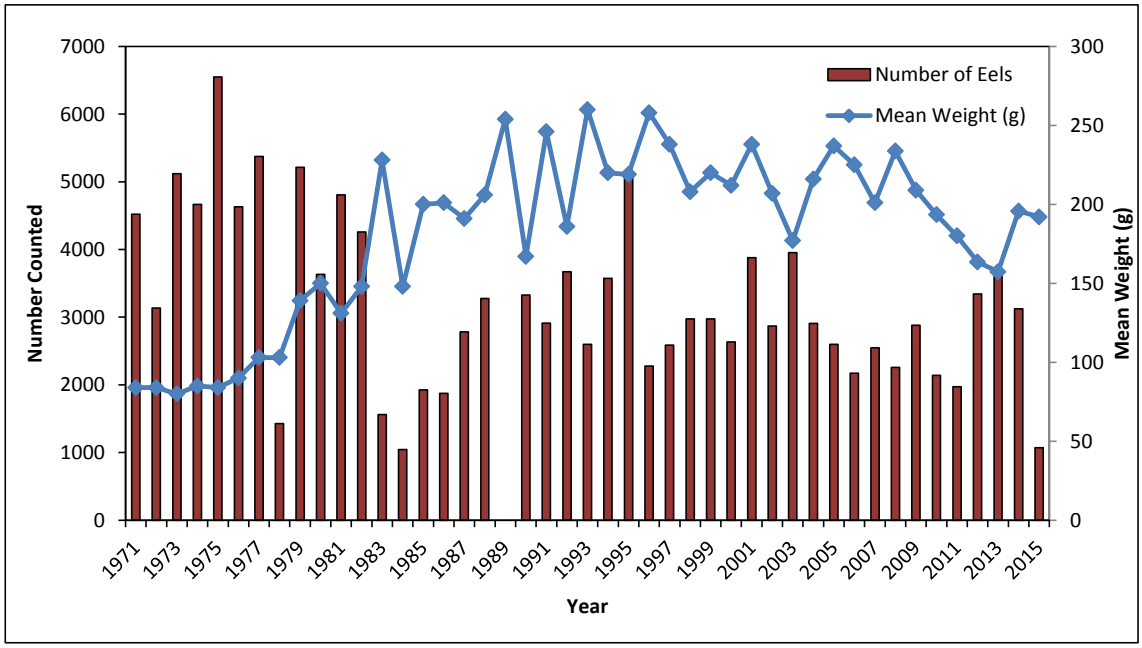


Figure 5-11: Annual number and mean weight of silver eels trapped in the Burrishoole downstream traps.

5.4 Erne Transboundary

The lack of reliable historical fishery data; delayed fishery closure in part of the river system; absence of an effective monitoring site in the lower part of the river and the need for development of appropriate research protocols prevented 2009 analysis of downstream migrating silver eel population dynamics in the River Erne. This led to the establishment in 2010 of an experimental fishing weir, scientifically monitored by NUIG, at Roscor Bridge which resulted in significant progress. Estimates of both silver eel production and escapement rates were subsequently obtained in the 2010, 2011, 2012, 2013 and 2014 seasons and these have been reported previously (SSCE 2015).

In the 2015 season the River Erne conservation fishery and the trap & transport programme were again monitored by NUIG team. This was undertaken in conjunction with studies on silver eel production and escapement. The scientific protocols used in the 2015 season were those described in previous reports and publications (e.g. McCarthy *et al* 2015).

5.4.1 Catch

The fishing activities of River Erne (Fig. 5.12) contract crews at the seven authorized fishing sites (Fig. 5.13) were all monitored by NUIG in 2015, though additional scientific studies were undertaken at Roscor Bridge and Urney. The fishing season on the Erne started on 29th August and finished on 15th December 2015 (with the exceptions of the Roscor Bridge and Urney experimental weir). The percentage contributions to the trap and transport programme in 2015 from each of the fishing sites are indicated in Fig. 5.14. Four sites (Urney, Portora, Ferny Gap and Killashandra) cumulatively contributed 78.75% of the total catches for 2015. The variation in Roscor Bridge experimental fishing weir daily catches is illustrated (Fig. 5.15 in relation to lunar cycles and variation in discharge. The fishing season at Roscor Bridge extended from 6th October 2015 to 13th January 2016 and a total of 67 nights were fished at that location. Fishing at the other sites ended at the beginning of December 2015.

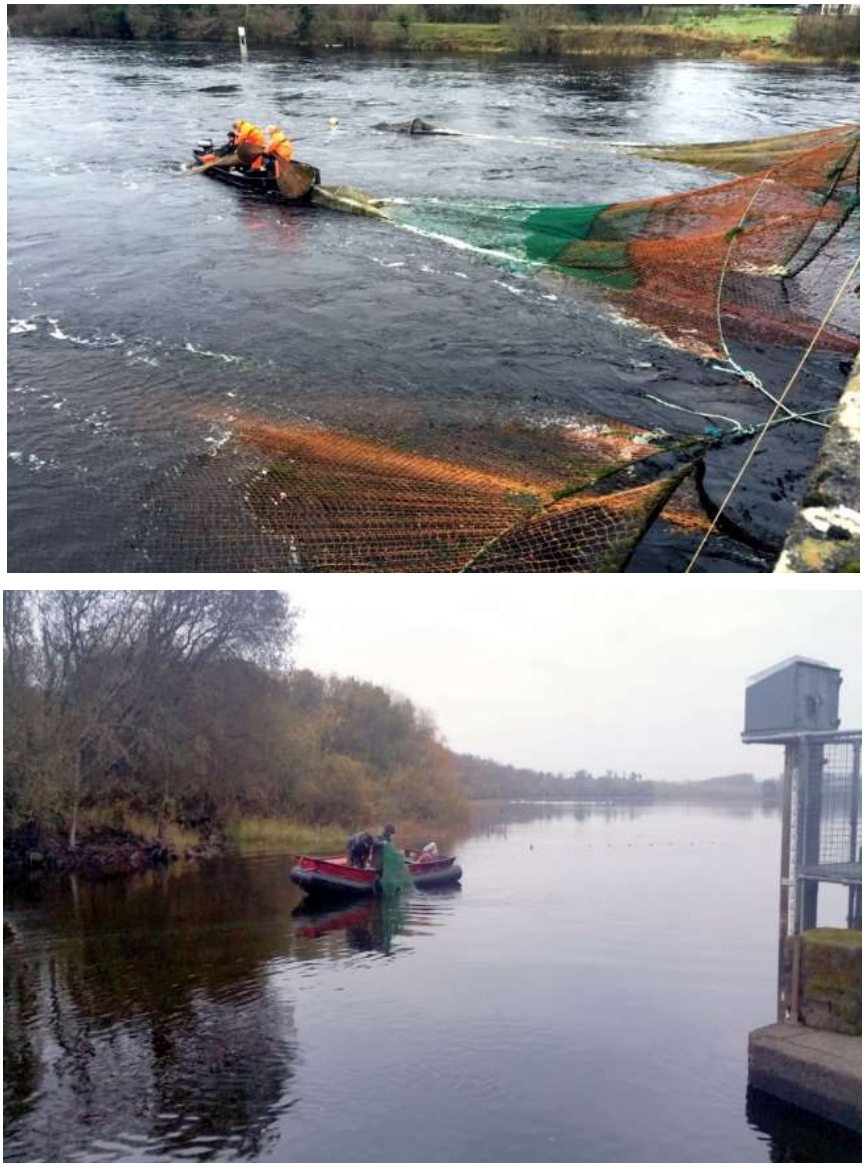


Figure 5-12: Roscor Bridge and Killashandra silver eel fishing sites.

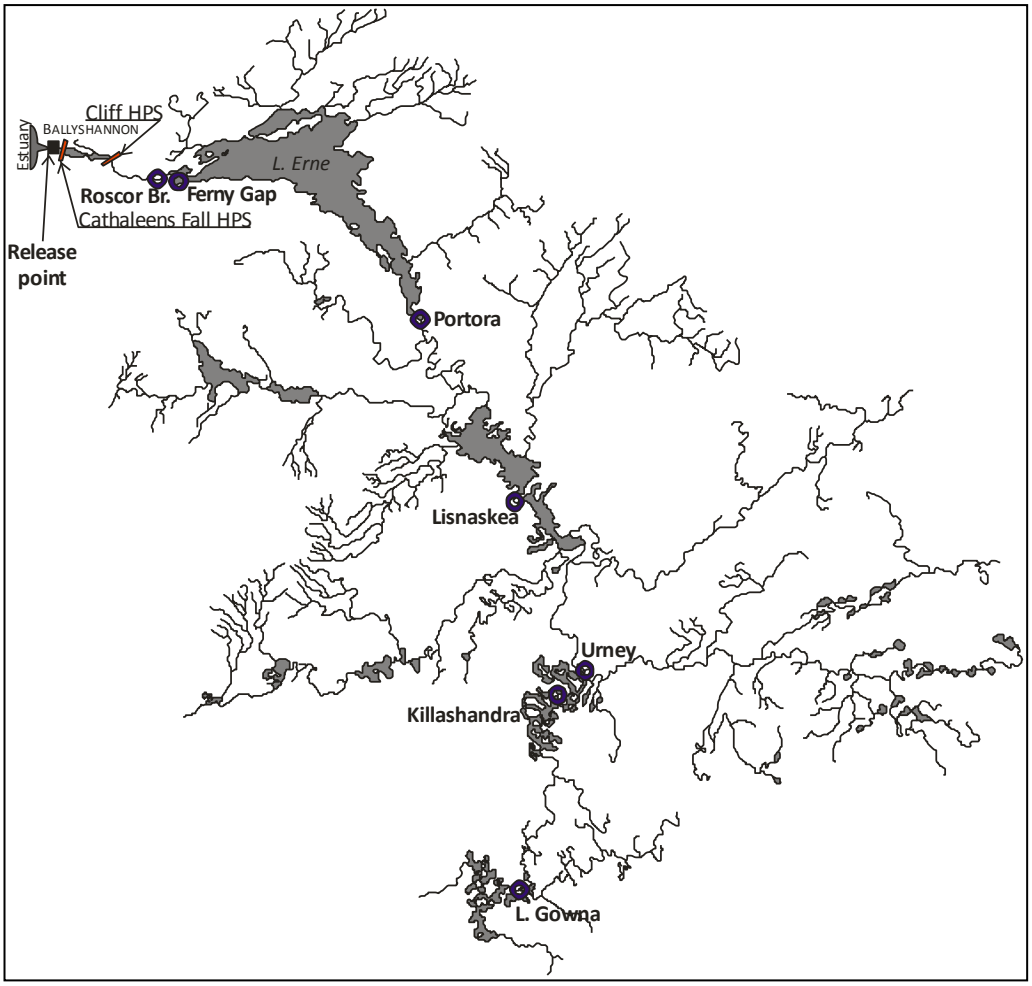


Figure 5-13: Map of River Erne catchment with conservation fishing sites, release point and hydropower dams indicated.

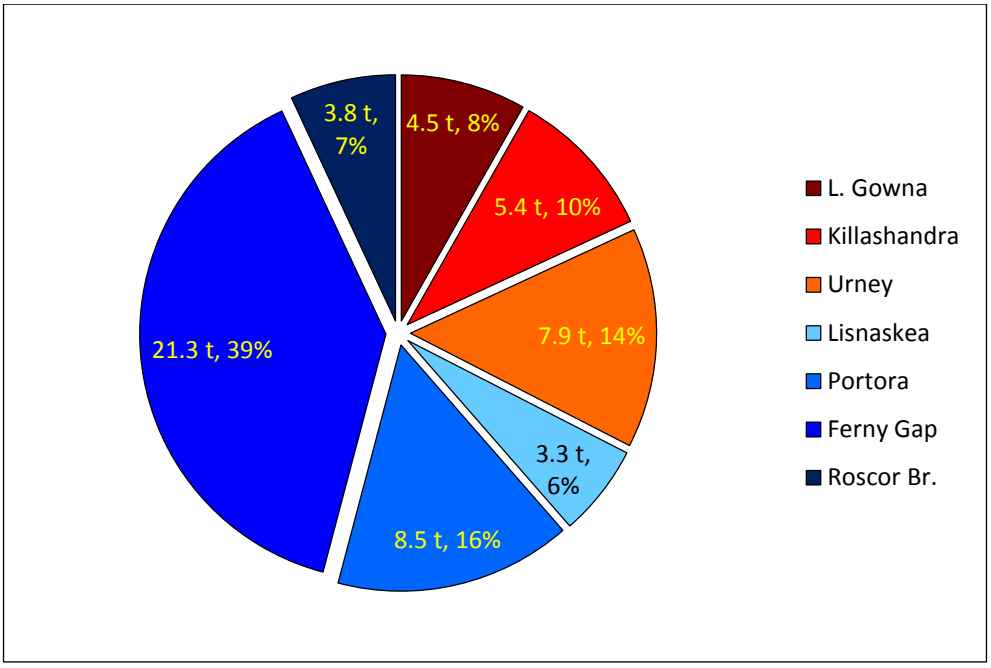


Figure 5-14: Proportions of the River Erne trap and transport catch obtained by different fishing crews in the 2015 season.

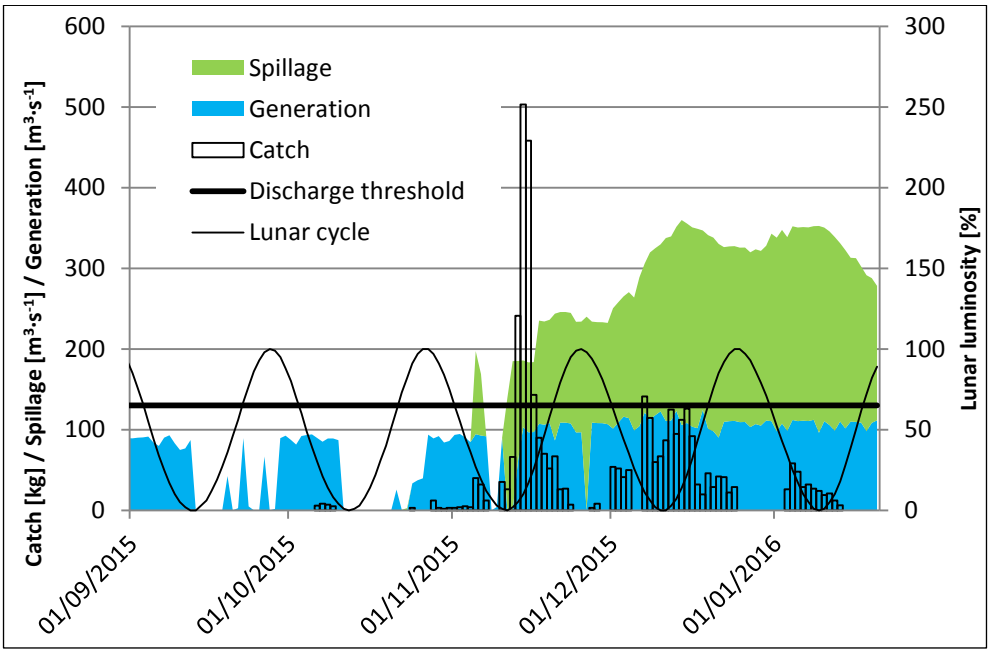


Figure 5-15: Variation in daily catches at the Roscor Bridge eel weir in relation to lunar cycle and discharge during 2015 season (the threshold discharge of 130 $m^3 \cdot s^{-1}$ used in population analyses is indicated by a black line). Lunar luminosity.

5.4.2 Escapement

The 2015 season River Erne silver eel population study results are summarized in Fig. 5.16. The silver eel production was estimated by NUIG as 78,034 kg and escapement was estimated to be 71,650 kg (91.8% of production). The trap and transport total (54,706 kg) represented 70.1% of silver eel production and exceeded the target (50%) by 15,689 kg. The 2015 calculations were based on estimations of production at Roscor Bridge and the threshold discharge of 130 $m^3 \cdot s^{-1}$, described in the 2012 report, was used in the analyses. A series of 7 mark-recapture experiments (7 batches of pit-tagged eels, N=700) were undertaken at Roscor Bridge. Batches of marked fish were released at dusk at the established release point upstream. All seven batches were released in high flow (>130 $m^3 \cdot s^{-1}$). The mean efficiency of the Roscor Bridge index nets was therefore estimated to have been 16.3% in high flow conditions during this season. The low flow (<130 $m^3 \cdot s^{-1}$) weir efficiency experiment was not possible due to persistent high discharge in this season (Fig. 4); therefore the 2013 estimate (8%) was used. The mark-recapture efficiency estimates were used, together with index net catch and hydrometric data, to calculate the biomass of eels approaching Roscor Bridge for each fishing date. Using catch data for this site and for the upstream sites, the silver eel production for the River Erne was calculated (Fig. 5). In the 2015 season the production was estimated to have been 78,034 kg.

The lower than expected capture efficiency (16.3%) observed at Roscor Bridge during the 2015 season seems to be due in part to the extreme rainfall which resulted in extensive river flooding and above average lake levels. It is also thought that the intensification of fishing at the Ferny Gap site, which contributed 39% (21,300kg) of the total T&T for the season, may have impacted on Roscor Bridge fishing because of increased quantities of floating debris. However, the low 2015 catch level (Fig. 5.14) at Roscor Bridge also reflected the overall impact of increased upstream fishing pressure.

The T&T annual target (50% of silver eel production) for the River Erne was exceeded in the 2015 season (Fig. 5.16). The quantity (54,706kg) transported for safe release at Ballyshannon represented 70.1% of the estimated silver eel production (78,034kg) for the river system for the season. In addition to the EMP 50% T&T target (39,017kg), additional mitigation measures for potential future losses of silver eel production that might result from a 112.5kg elver loss at Ballyshannon in 2014 were addressed by ESB in the 2015 season. Thus, ESB purchased 8,450kg of silver eels from the L. Neagh Eel Fishermen's Cooperative Society Ltd which were then released to the lower River Bann and allowed to migrate freely to sea. These eels are not included in the current River Erne analysis. However, the mitigation agreement also required ESB to increase T&T activities so that, prior to 2018, an additional 11,000kg of River Erne would be trapped and released (i.e. in addition to the annual 50% targets). The 2015 T&T programme, which involved additional fishing effort and increased efficiency of capture at several sites, resulted in a surplus of 15,689kg. Thus the normal (50%) 2015 target and the additional mitigation targets (8,450kg River Bann release and 11,000kg extra River Erne release) were all fully achieved. In addition, a small surplus 4,689kg was achieved which can contribute to the ongoing 3-year rolling average calculation protocol used to monitor the annual 50% T&T mitigation actions on the river system. The total estimated hydropower mortalities (6,333kg) represented 8.1 % of silver eel production and the escapement to sea (71,650kg) was estimated to have been 91.8% of production (Fig. 5.16).

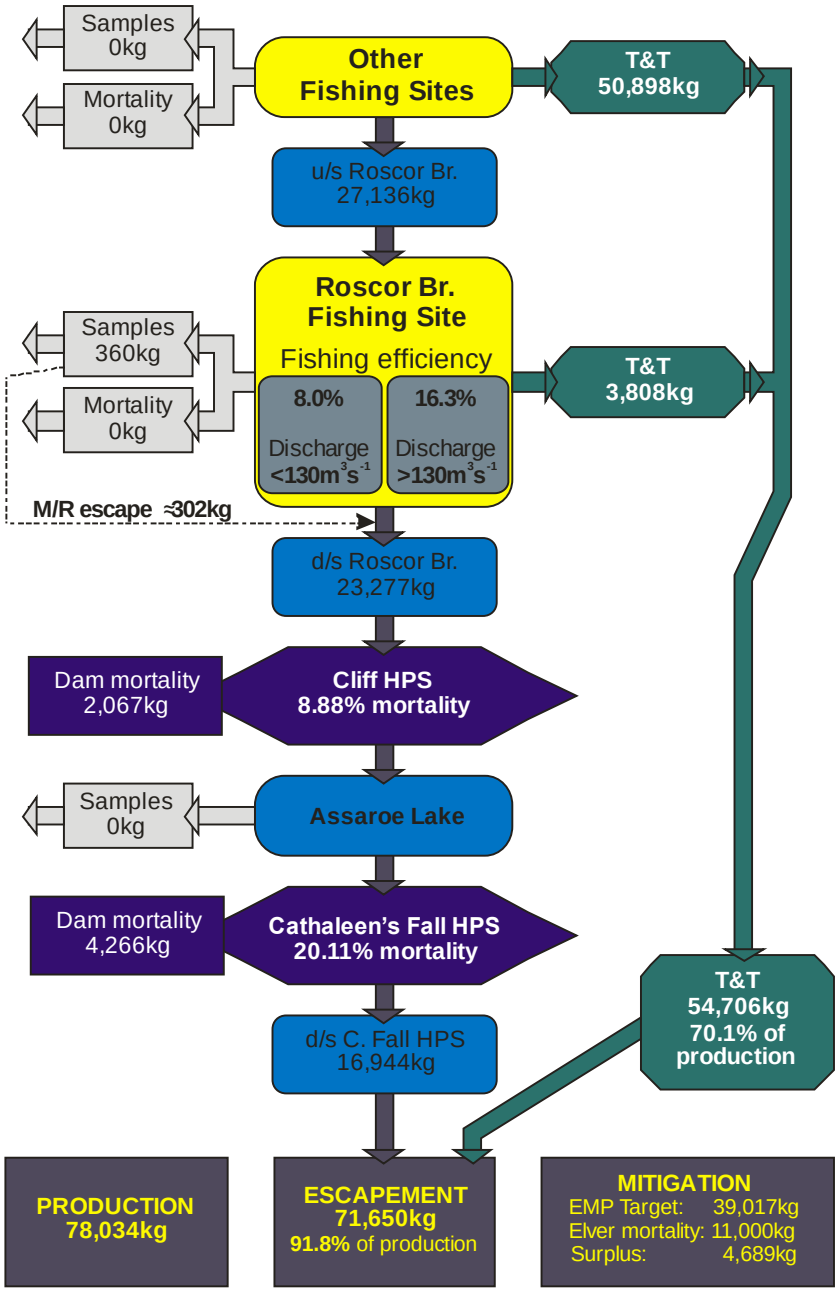


Figure 5-16: A summary of the analysis of silver eel production and escapement in the River Erne during the 2015 eel migration season.

5.4.3 Length and weight

Information compiled in the 2015 season on size frequency distributions of catches at River Erne conservation fishing sites is summarized in Fig. 5.17. An unusually high proportion of male silver eels, also noted in 2011-2015, in upper catchment sites as well as at Roscor Bridge was observed in 2015.

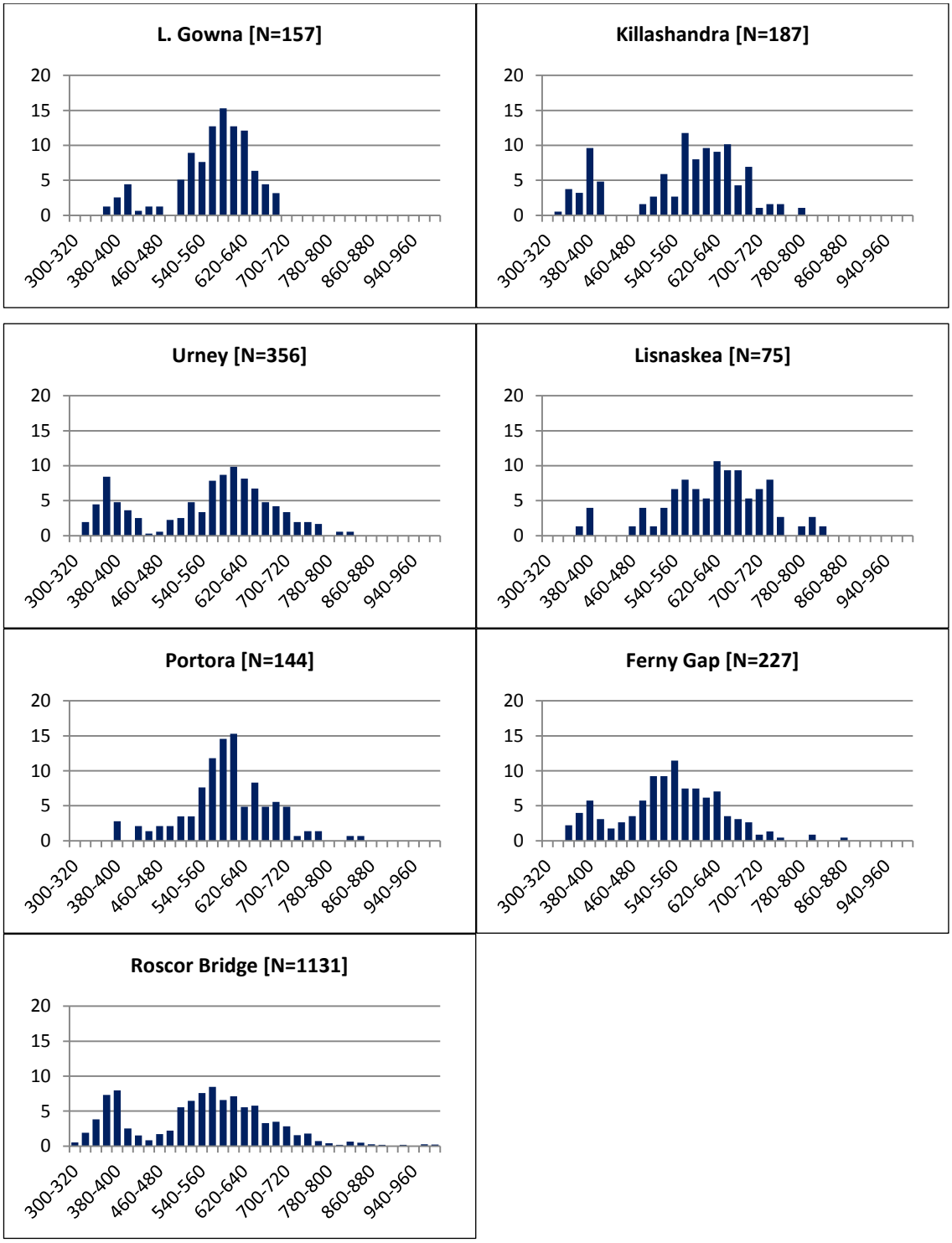


Figure 5-17: Length relative frequencies [%] of eels captured at River Erne conservation fishing sites in the 2015 eel migration season.

5.5 Fane

The Fane is a relatively small catchment with the silver eel fishery located in the upper reaches of the system approximately 28km from the coast. The Fane has a riverine wetted area of 84 Ha and a lacustrine wetted area of 553Ha. A research silver eel fishery was carried out on the Clarebane River on the outflow of Lough Muckno in the Fane catchment from 2011 to the present (Fig. 5.18 & 5.19). The site was the location of a commercial fishery until 2008. In 2015, a new depth gauge was added to the fishery to gain on-site depth readings during eel fishing (Fig. 5.20).

5.5.1 Silver Eel Catch

The Fane silver eel fishery is dependent on water levels in the river in order for the nets to be set. As the fishing site is located downstream of Lough Muckno and a water abstraction site there is a delay due to the lake absorbing rainfall before a rise in river water levels is observed in the Clarebane River. Silver eel catches at the Fane Fishery were initially quite low in 2015 due to unfavourable conditions for fishing. The heavy rainfall required to flood the site and float the coghill nets for fishing was absent during September and October (Fig. 5.21). This may be attributable to the strong El Niño affect during the sampling season for 2015. The result was a comparatively warm and dry autumn, which would be uncharacteristic of weather in Ireland at that time of year. However, by November, heavy rains began and flooding was wide spread throughout the country. Fig. 5.21 depicts the water flow (and moon phases) for the Fane Fishery in 2015. Table 5.3 shows the catches of silver eels (in kgs) and the numbers of nights fished from 2011 to 2015. Eight nights were fished in November with a total catch of 452kg. The nets were set for a further 15 nights in December with a lower catch of 147kg.

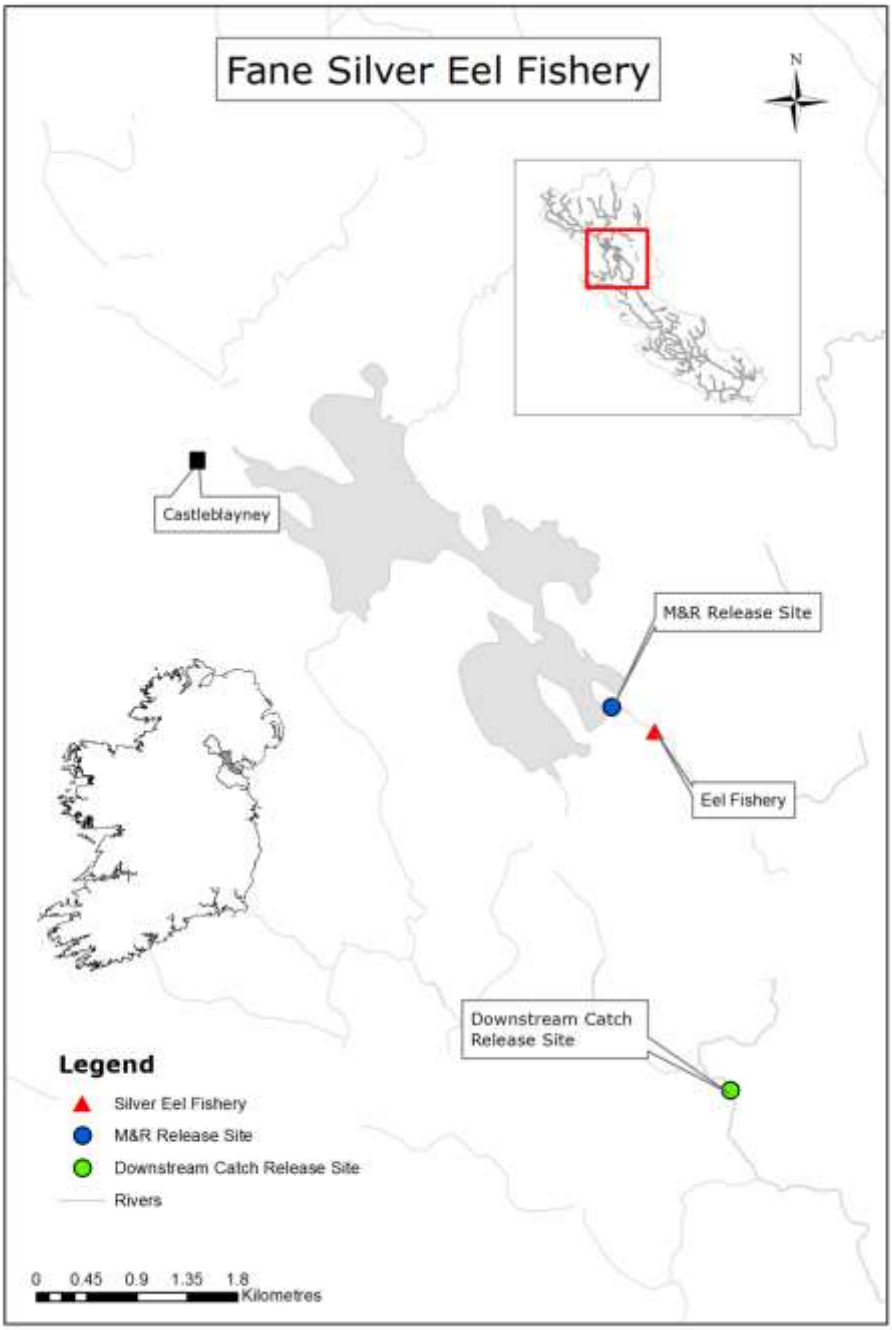


Figure 5-18: Location of Silver eel fishery on the Clarebane River.

Figure 5-19: Coghill net fishing for silver eels in the Clarebane River, 2013 (Photo: C. O'Leary)

Figure 5-20: Depth gauge installed at silver eel weir on Clarebane River, 2015, pictured at 0.5 metres depth on November 6th (left) and 1.3 metres depth on November 20th (right), (Photos: R. Cruikshanks)

Table 5-3: Fane Silver Eel Fishery Catches, 2011-2015.

Year	Month	Nights Fished	Weight Eels (kg)
2011	October	9	277
	December	4	13
	Total	**13**	**290**
2012	August	5	65
	September	3	79
	October	9	253
	November	4	44
	December	1	77
	Total	**22**	**518**
2013	October	3	28
	November	16	1123
	Total	**19**	**1151**
2014	October	6	88
	November	19	301
	Total	**25**	**389**
2015	November	8	452
	December	15	147
	Total	**23**	**599**

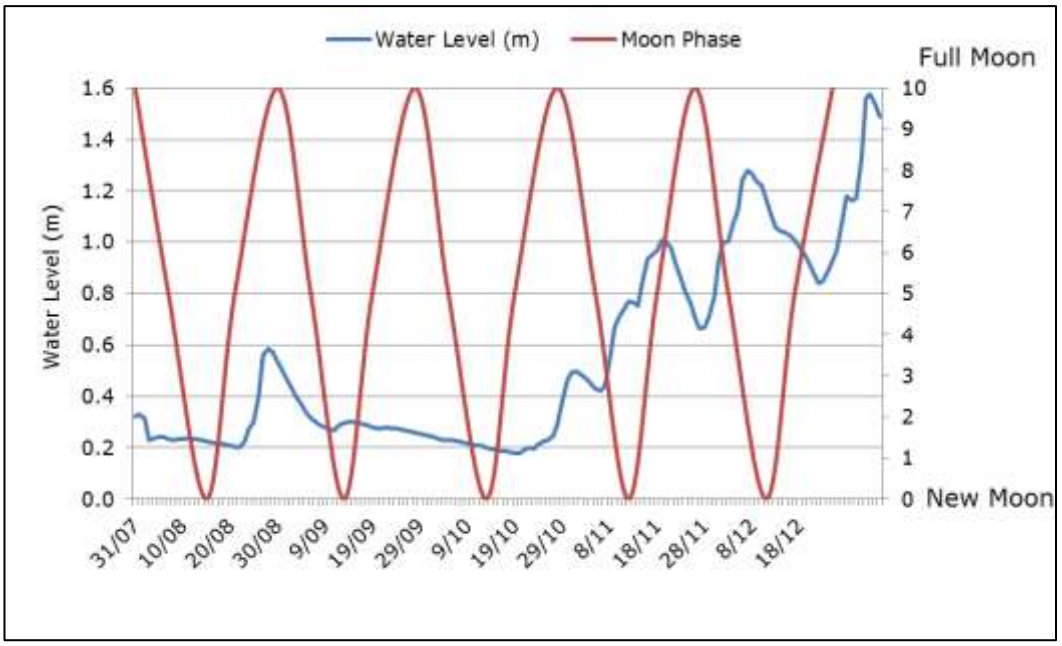


Figure 5-21: Water level and moon phase for the 2015 silver eel season.

5.5.2 Escapement /Mark Recapture Study

In 2015, 294 eels were PIT tagged with a recapture of 101 eels, yielding a % recapture of 34%. This is the largest within year recapture since monitoring of the Fane silver eel escapement began in 2011 (Table 5.4). Seven eels from the 2014 tagging season and 2 eels from the 2013 season were caught in the fishery in 2015. Five yellow eels tagged in 2012 in Lough Muckno were caught in the silver eel fishery. The within year efficiency of the fishing site is 28% with an overall efficiency for multiple years of 31%.

The response of selected eels to cease migration after tagging and remain in the area until the next dark could be a result of the 'startle response' reported by Richkus and Dixon (2003). The authors found that when eels tagged with acoustic tags encountered an obstacle they would swim upstream. Some eels might delay migration as a result of handling stress, the effects of the anaesthetic and stress associated with their capture in the fishing nets. This may be the explanation for the bimodal pattern seen in the recaptures of eels in 2015. A large proportion of eels were caught between 1 and 9 days after initial tagging. While the other extreme was noted, in which eels were recaptured between 22 and 36 days after initial tagging (i.e. in to the following darkness). This pattern was seen in November and December fishings and recaptures tended to coincide with the new moon (darkness).

Currently we do not know the proportion of eels displaced during the tagging study that delayed migration compared with the eels that managed to bypass the nets on the second meeting. Further investigation is needed and will be carried out over the next few years. Therefore the MR results reported here are subject to change as tagged eels are recaptured over the coming years.

Table 5-4: Mark Recapture preliminary results 2011 – 2015.

	Year	Tagged	Recaptured Within Year	Within Year MR %	Total Recapture	Overall MR %
u/s Fishery	2012	470	34	8%	92	20%
River	2011	173	47	29%	57	33%
River	2012	286	26	10%	52	18%
Lake	2011	160	23	15%	34	21%
Lake	2012	119	8	8%	28	24%
Mouth River	2013	303	61	22%	93	31%
Mouth River	2014	272	80	29%	87	32%
Mouth River	2015	294	101	34%		
Average MR % All Locations				19%		26%
Average MR % Mouth River				28%		31%

5.5.3 Eel Biology

Morphometric measurements were taken on 1,622 eels in 2015. The average length was 54.0 cm (range 31.2 – 96.6 cm), the average weight was 0.3695 kg (range from 0.030kg to 2.045 kg; Table 5.5). The population structure for 2015 is in line with what was caught in 2012 and 2013; however a greater number of large females were noted. The eels were generally in very good condition.

During the 2015 sampling, a total of 106 eels were retained for further analysis in the laboratory. Of these 30% were male, with 70% being female (Table 5.6). The sex ratio in 2014 and 2013 was 21% and 32% female respectively. The high female ratio is consistent between November and December (77% and 62%). This highlights a greater number of females caught in 2015 than in previous years (Figures 5.23 & 5.24).

5.5.3.1 *Anguillicola crassus* and Swimbladder Health Indices

A parasite prevalence rate of 57.55% with a mean infection intensity of 3.17 was recorded for 2015. These results are relatively comparable with 2013-2014 results (Table 5.6). The percentage prevalence results from 2011-2012 are lower and suggest that Fane silver eels were in an early stage of anguillicolsis at that time. While percentage prevalence was low in these years, the mean infection intensity was as high as recent years (Table 5.6). Fig. 5.25 shows that the majority of infected eels have <5 parasites in their swimbladders and infections with greater numbers of parasites are rarer.

The swimbladder health indices, SDI and LRI, were applied on the sample of silver eels from the Fane. Despite the moderately high percentage prevalence and infection intensity values, both the Swimbladder Degenerative Index (SDI) and the Length Ratio Index (LRI) returned results of only moderate swimbladder damage arising due to *A. crassus* infections (Figs 5.26 & 5.27).

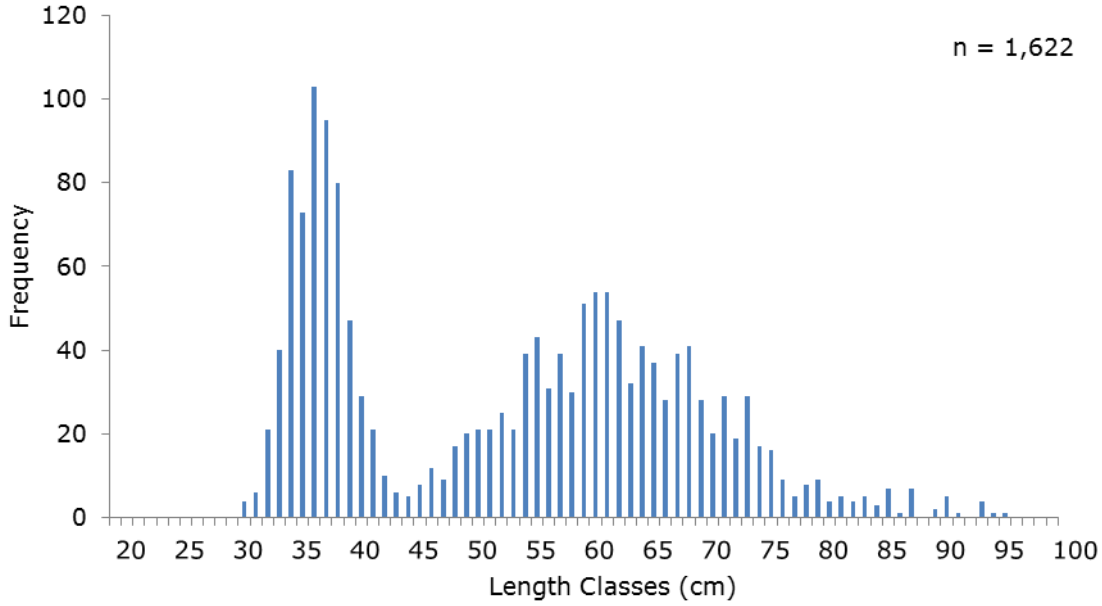


Figure 5-22: Length Frequency of silver eels in the Fane catchment, 2015.

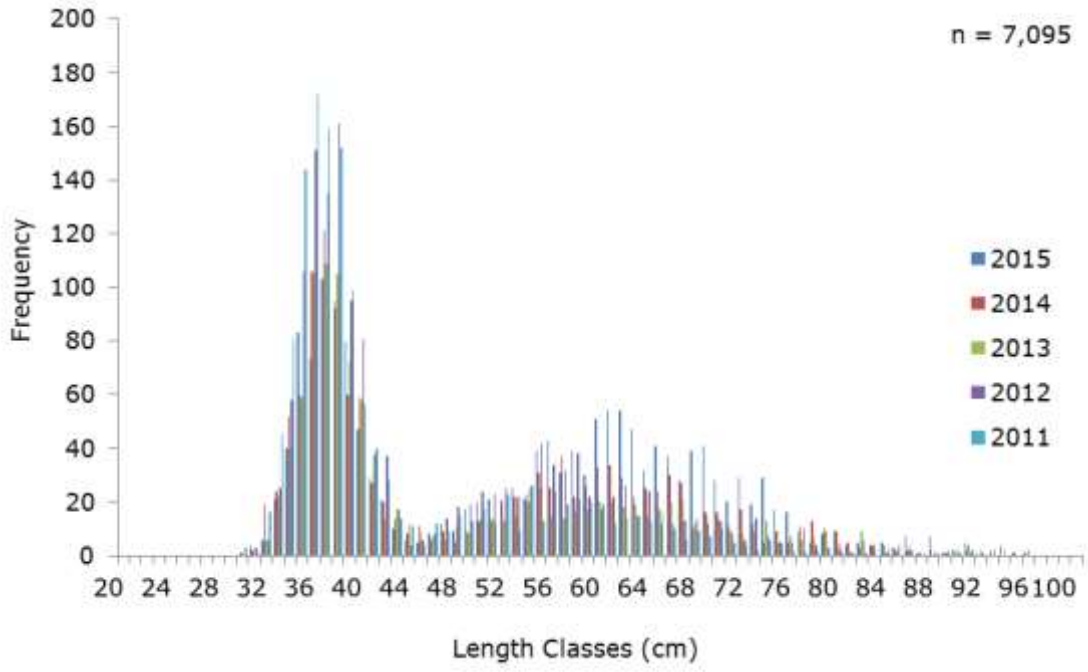


Figure 5-23: Length frequency for silver eels caught on Clarebane River (Fane Catchment), 2011 – 2015.

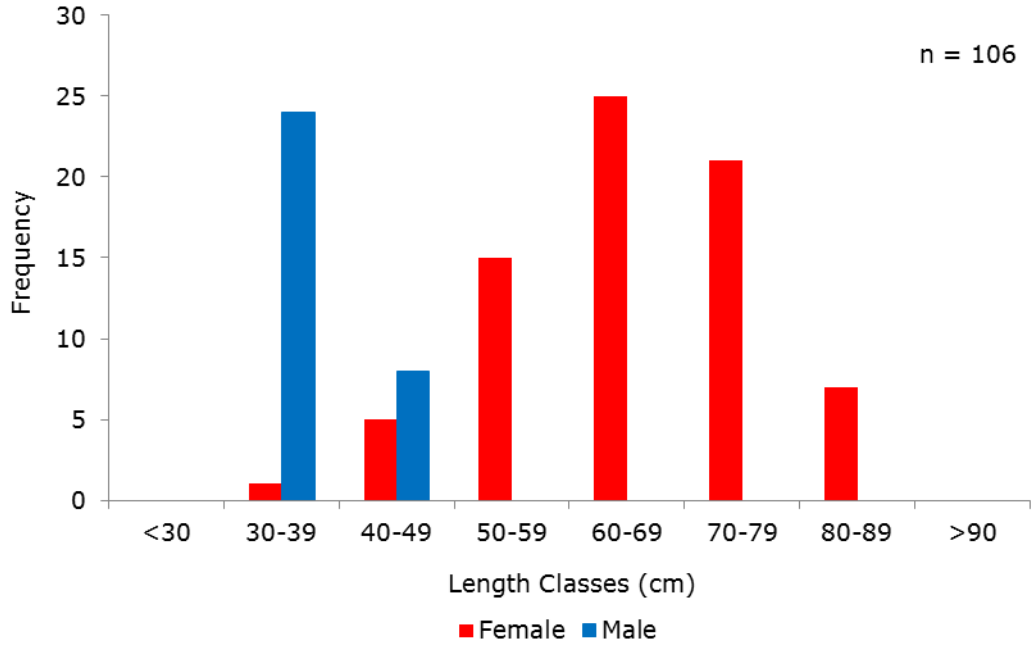


Figure 5-24: Sex distribution of sacrificed silver eels collected from the Clarebane River (Fane catchment), 2015.

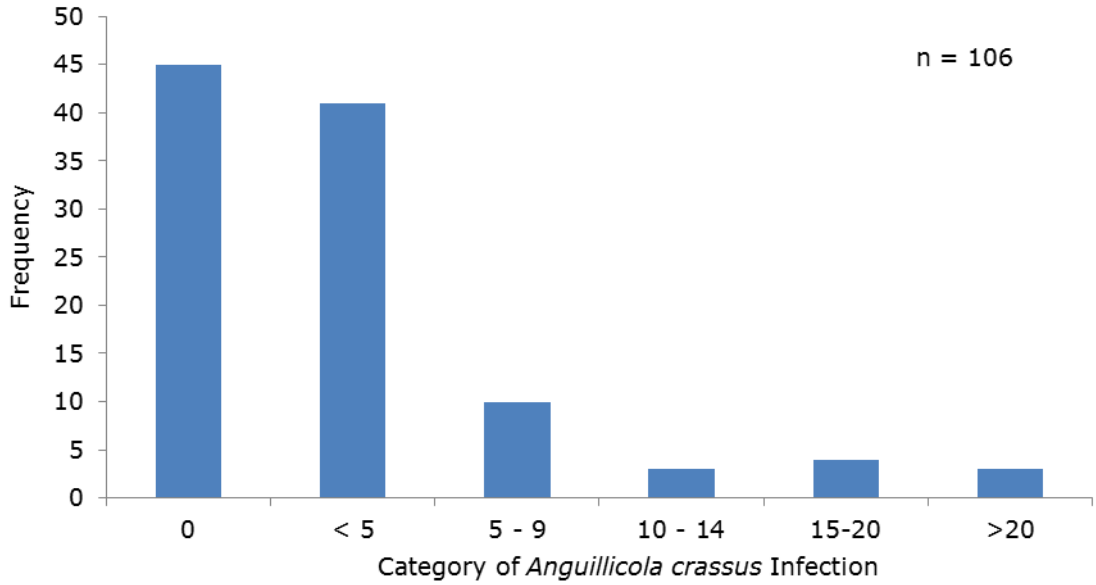


Figure 5-25: *Anguillicola crassus* infection intensity for sacrificed silver eels collected from Fane catchment, 2015

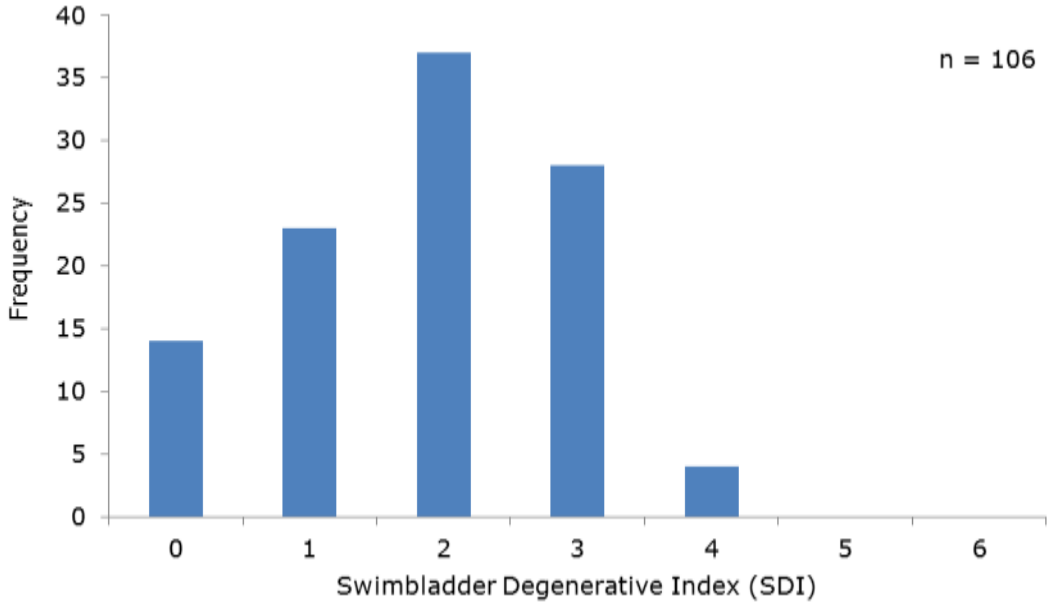


Figure 5-26: Swimbladder Degenerative Index (SDI) results for swimbladder health among sacrificed eels collected from Fane catchment, 2015

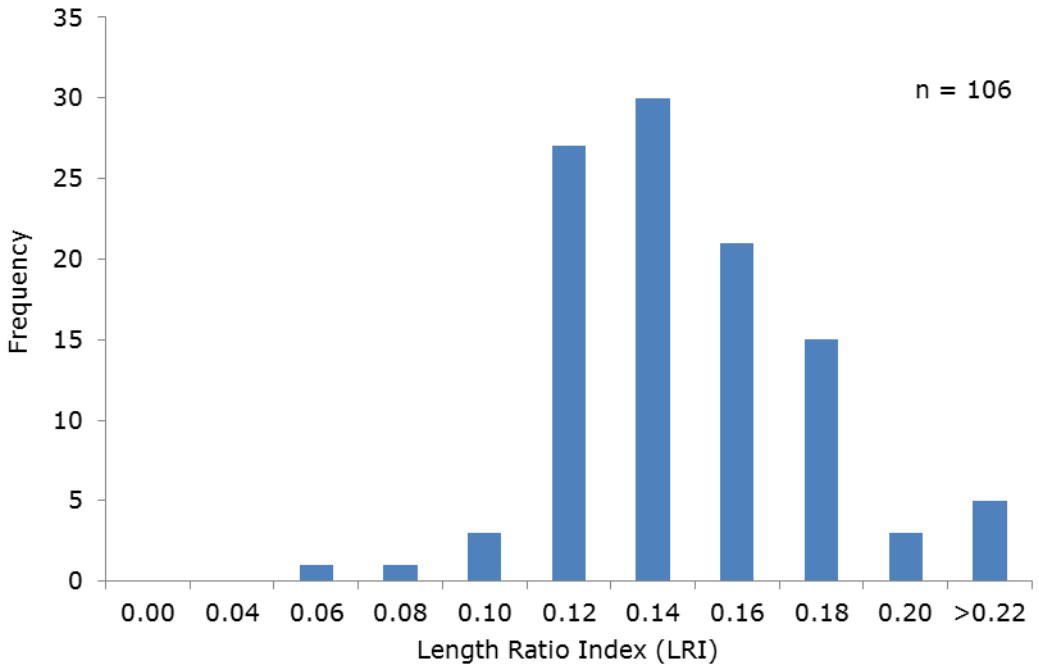


Figure 5-27: Length Ratio Index (LRI) results for swimbladder health among sacrificed eels collected from Fane catchment, 2015.

Table 5-5: Length and Weight data for Silver eels from the Fane catchment.

Year	No. Eels	Mean Length (cm)	Min. Length (cm)	Max. Length (cm)	Mean Weight (kg)	Min. Weight (kg)	Max. Weight (kg)	Total Weight (kg)
2011	1433	43.8	30.4	91.7	0.187	0.044	1.709	268.30
2012	1541	47.1	31.4	96.0	0.251	0.050	2.090	387.46
2013	1165	49.2	30.8	96.6	0.289	0.030	1.952	336.79
2014	1334	50.4	30.4	95.0	0.292	0.045	1.721	389.06
2015	1622	54.0	31.2	96.6	0.370	0.030	2.045	599.33

Table 5-6 : Biological data for silver eels from Fane catchment.

Year	No. Eels	No. Females	No. Males	% Female	% Male	% Prevalence *A. crassus*	Mean Intensity *A. crassus*	Count *A. crassus*
2011	158	47	110	30	70	28	3.71	167
2012	273 (212 sexed)	118	94	56	44	27	3.66	271
2013	152	48	104	32	68	53	3.94	319
2014	19	4	15	21	79	68	7.92	103
2015	106	74	32	70	30	57	3.17	336

5.6 River Barrow

The Barrow catchment is a large riverine catchment located on the east coast of Ireland in the South Eastern River Basin District (SERBD). The SERBD is 60% calcareous bedrock which makes it a very productive habitat for eels. There has historically been a commercial fishery on the River Barrow and the presence of historical catch will aid in the assessment of the current silver eel escapement levels from the river. There is also historical research data on the River Barrow from the Fisheries Research Centre which is available to Inland Fisheries Ireland. The assessment of the silver eel stocks from a river dominated catchment will help highlight any difference in production and escapement of eels compared with catchments with large lake/lacustrine wetted areas. The Barrow is the first riverine dominated silver eel index catchment assessed to date.

Four nets were fished from openings on the Ballyteiglea Lock gates of the canal section of the River Barrow during the silver eel season (Figs 5.28 & 5.29). The location fished is upstream of the town of Graiguenamanagh; approximately 5km upstream from the tidal limit (estuary) in the River Barrow. A second site was available at Clashganna Lock, further downstream from Ballyteiglea Lock, but was not fished in the 2015 season (Fig. 5.29). The location of the Ballyteiglea Lock fishing site means that over 99% of the River Barrow freshwater wetted area is above the fishing site. Due to the size of the River Barrow, it is currently not possible to fish the entire freshwater channel, however through a mark recapture study it is hoped to assess the efficiency rate of the fishing site and estimate what proportion of the run is bypassing the nets.

Tagged eels were released at one of two mark-recapture (MR) sites. Over the course of the season, 229 eels were PIT tagged and released at Ballyellin Lock approximately 3.2km upstream of the fishing lock (Fig. 5.29). Eels released at this location had several opportunities to leave the canal section and re-enter the Barrow main channel via several weirs between the release site and the Ballyteiglea Lock (with a potential loss of recovery of tags). In 2015, a second MR site was located approximately 150m above the Ballyteiglea fishing lock. A total of 50 eels were released here, to assess recapture rates. From this location, eels moving downstream toward the nets have no opportunities to rejoin the Barrow main channel via weirs.

In 2015, a new depth gauge was added to the Ballyteiglea Lock fishery in order to gain on-site depth readings during eel fishing.

Figure 5-28: Ballyteigelea Lock - location of research silver eel fishery on Barrow canal (Photo: C. O'Leary)

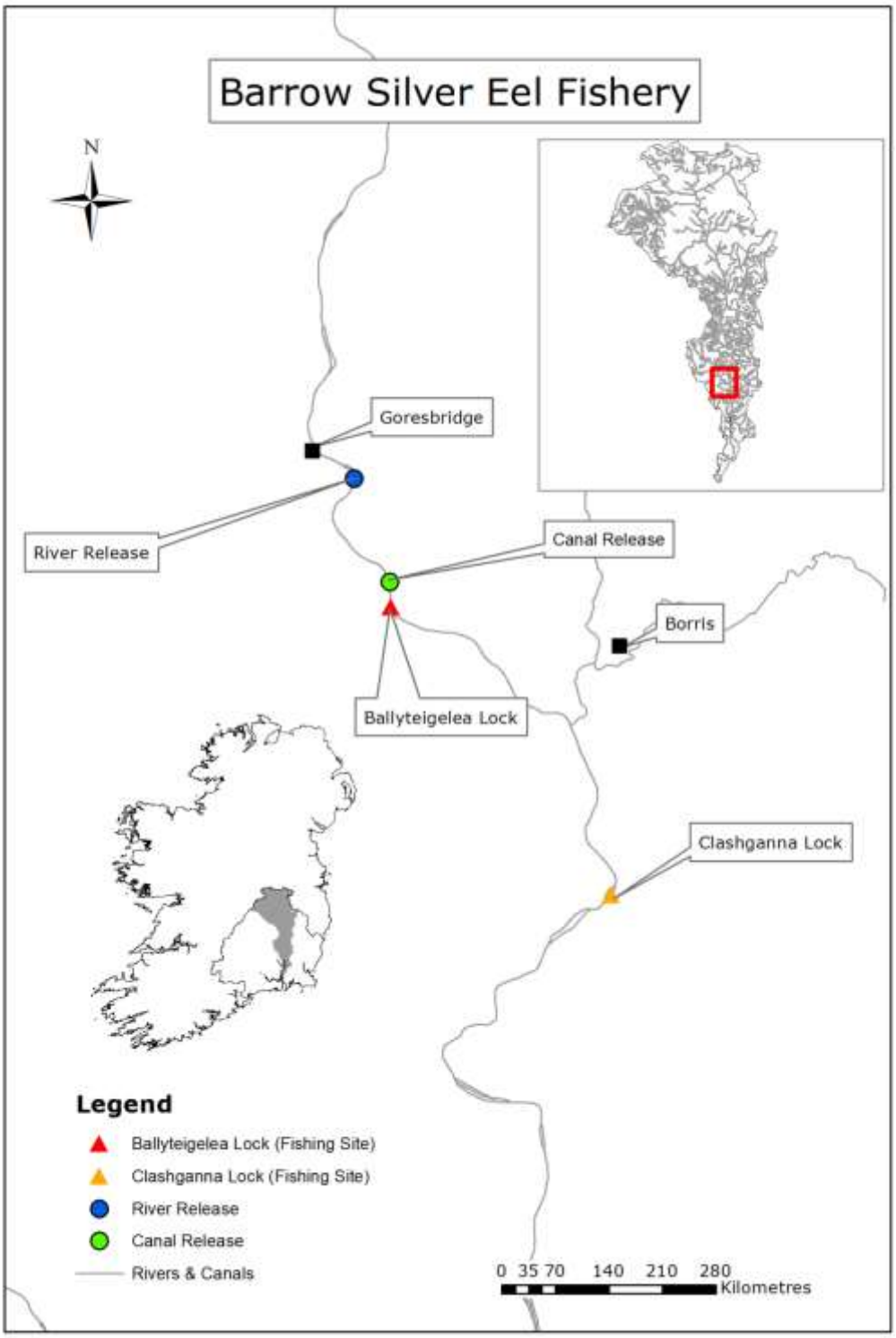


Figure 5-29: Map of silver eel fishing and release locations within the Barrow Catchment for 2015.

5.6.1 Eel catch

Silver eel catchs at the Barrow Fishery were initally low in 2015 due to unfavourable conditions for fishing. The water level in the river was very low during September and early October with insufficient water to float the nets for fishing. This may be attributable to the strong El Niño affect during the sampling season for 2015 which resulted in a comparatively warm and dry autumn. However, by November heavy rains began and flooding was seen throughout November and December. The first fishings for silver eels on the Barrow were attempted in August but but no catch was recorded. Six nights were fished in October with a total catch of 146 eels (17.42kg). The peak of the silver eel catch was recorded in November with 584 eels (91.32kg) captured in 13 nights (Table 5.7). The flooding on the Barrow near Graiguenamanagh became so intense that silver eel fishing was postponed in mid-December as conditions no longer supported fishing from the Ballyteiglea Lock. This effectively ended the silver eel fishing season for 2015 on the Barrow. Figure 5.30 depicts the water flow (and moon phases) for the Barrow Fishery in 2015.

Table 5-7: Barrow Silver Eel Fishery Catches, 2015

	Eel Numbers	Catch (kg)
August	0	0.00
October	146	17.42
November	584	91.32
Total Season	**730**	**108.73**

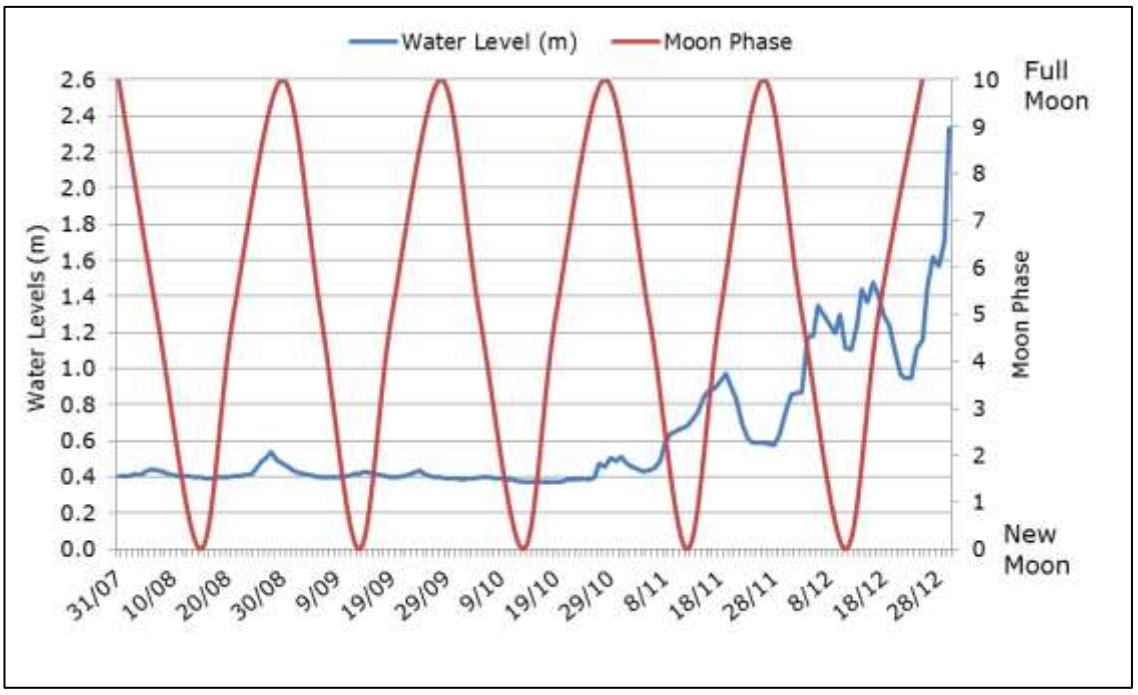


Figure 5-30: Barrow water levels and moon phase for the 2015 silver eel season

5.6.2 Mark Recapture

In order to determine the efficiency of the fishing site 50 eels were released into the canal 150m upstream of the fishing site. Twenty one eels were recaptured giving a recapture rate of 42% (Table 5.8, Fig. 5.29). Due to the environmental conditions of low flows in September, October followed by severe flood conditions in December only one mark recapture survey was undertaken in 2015. The aim will be to repeat this MR survey over the next few years.

To determine how many eels are recaptured in the fishing site and how many avoid the canal and migrate down the river channel 229 eels were tagged and released 2kms upstream into the barrow river. The eels were released over 3 occasions. The first tagging session reported a high recapture rate of 52% with the majority of eels recaptured 3-10 days after release. The second and third sessions saw a marked decrease in recapture rates with 3% and 2% respectively. The weather conditions for the 2nd and 3rd sessions saw higher flood conditions, affecting the recapture rate.

The weir upstream of the fishing lock holds back the water keeping the flow and depth in the canal resulting in good catches of eel at the lock gates. However, as the season progresses and the water level rises the spillover into the main channel increases and the catch at the lock decreases. This event is visible in the MR study undertaken in 2015, with a high recapture rate for the October session of 52% with a dramatic decrease in the November session.

Table 5-8: Mark Recapture preliminary results for the Barrow River, 2015.

	No. Tagged	**No. Recaptured**	**% Recapture**
Ballyellin Lock	229	20	8.73
u/s Ballyteiglea Lock	50	21	42.00
Total Season	**279**	**41**	**14.70**

5.6.3 Eel Biology

Morphometric measurements were taken on 730 eels in 2015. The average length was 41.8 cm (range 31.5 – 77.4 cm), the average weight was 0.149 kg (range from 0.050 to 0.873 kg; Table 5.9). The population structure for 2015 is in line with what was caught in 2014 (Figs 5.31 & 5.32).

During the 2015 sampling, a total of 55 eels were retained for further analysis in the laboratory. Of these 65% were male, with 35% being female (Fig. 5.33 & Table 5.10). The sex ratio in 2014 was 61% male, and therefore similar to the current year of sampling.

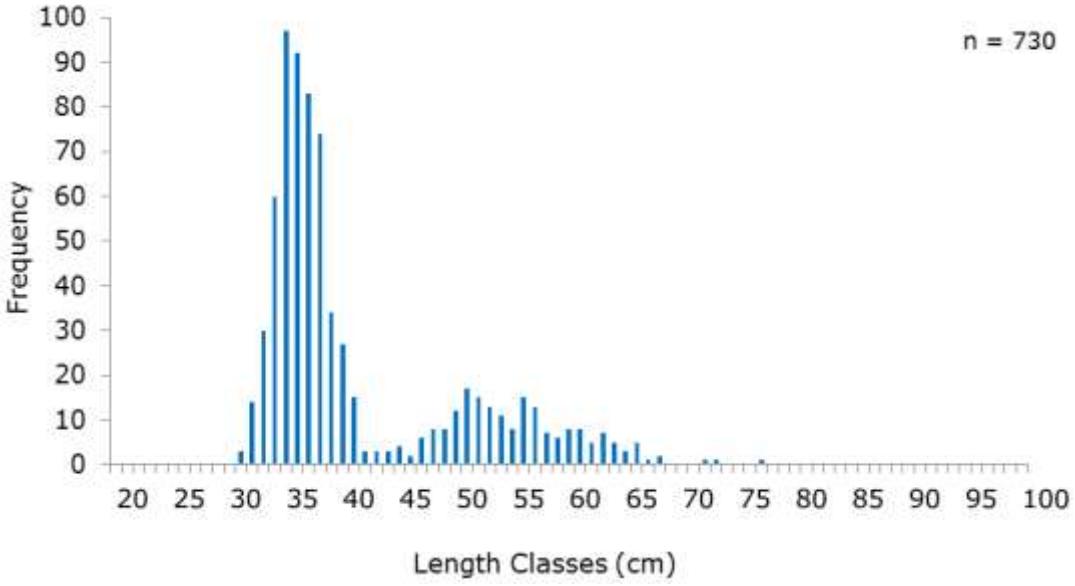


Figure 5-31: Length frequency for silver eels caught on Barrow catchment, 2015

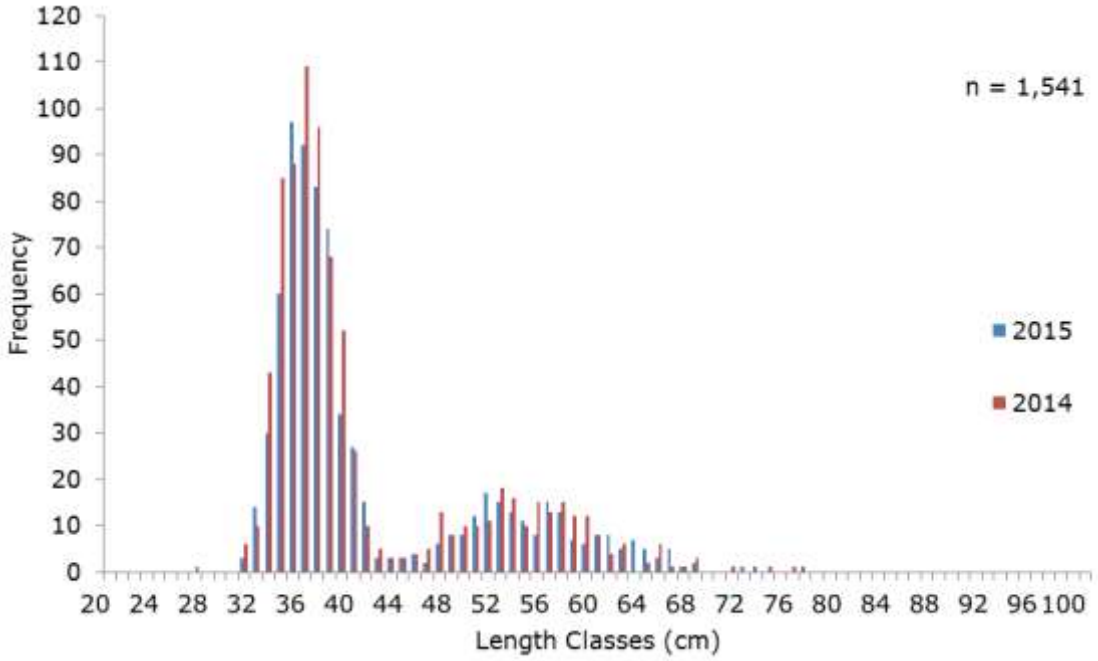


Figure 5-32: Length frequency for silver eels caught on Barrow catchment, 2014 - 2015

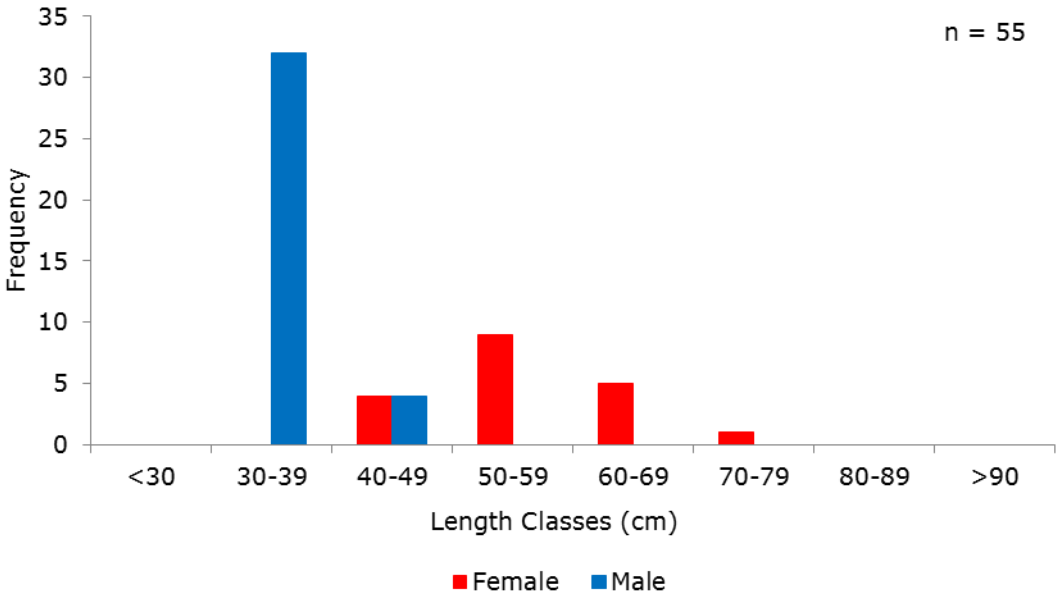


Figure 5-33: Sex distribution of sacrificed silver eels collected from Barrow River, 2015

5.6.3.1 *Anguillicola crassus* and Swimbladder Health Indices

In 2015, percentage prevalence of *A. crassus* was 56.36% with a mean infection intensity of 5.16 (with a total parasite count across the sample of 160 worms (n = 55 eels)). The 2014 values were 72.55% and 6.11, respectively, with a total parasite count across the sample of 226 worms (n = 51 eels, (Table 5.10). The majority of infected eels (32.7%) had <5 parasites in the swimbladder, with higher intensity infections being rarer in the sample (e.g. only 2 eels, or 3.6% of the sample, presented with between 10 and 14 parasites in the swimbladder, and only 1 eel presented an infection of >20 parasites. (Fig. 34).

The swimbladder health indices, SDI and LRI, were applied on the sample of silver eels from the Barrow River. Despite the 56% percentage prevalence, both the Swimbladder Degenerative Index (SDI) and the Length Ratio Index (LRI) returned results of only moderate swimbladder damage arising due to *A. crassus* infections (Figs 5.35 & 5.36).

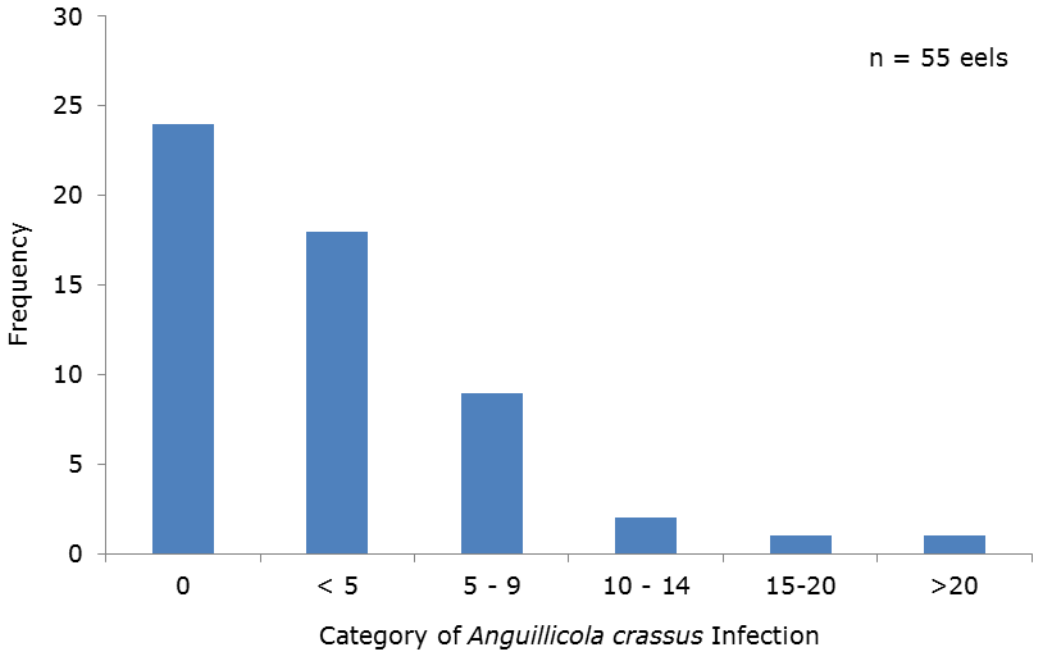


Figure 5-34: *Anguillicola crassus* infection intensity for sacrificed silver eels collected from Barrow catchment, 2015

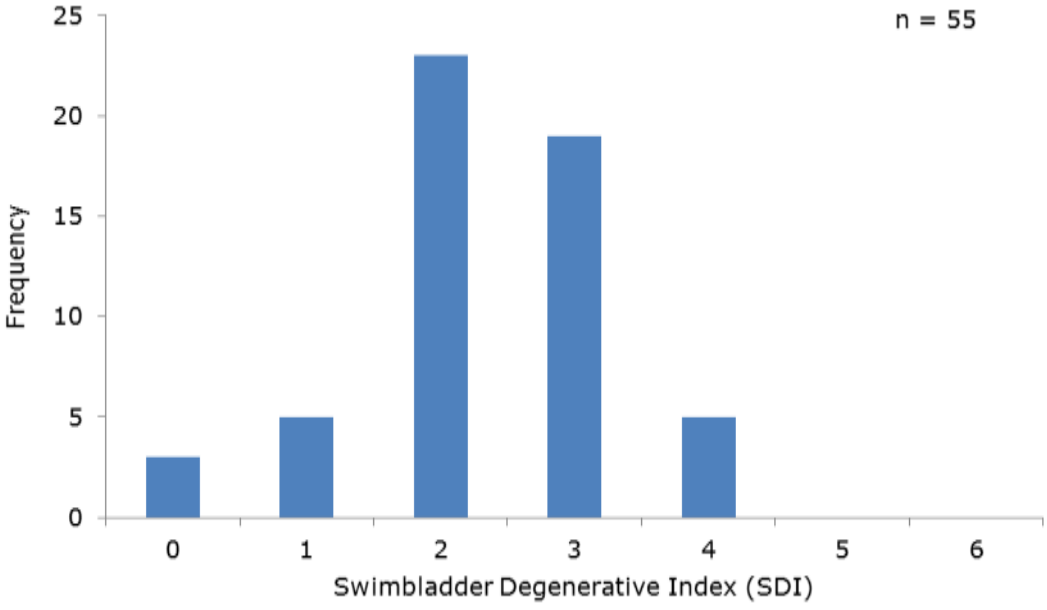


Figure 5-35: Swimbladder Degenerative Index (SDI) results for swimbladder health among sacrificed eels collected from Barrow catchment, 2015

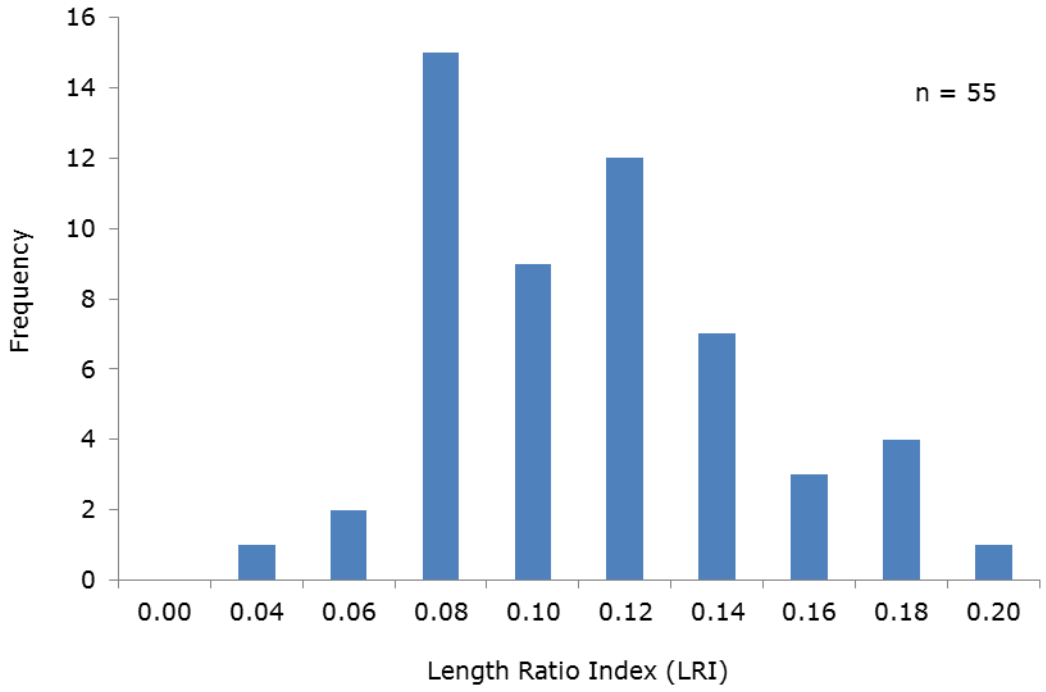


Figure 5-36: Length Ratio Index (LRI) results for swimbladder health among sacrificed eels collected from Barrow catchment, 2015

Table 5-9: Length and weight data for silver eels from the Barrow catchment, 2014 – 2015.

Year	No. Eels	Mean Length (cm)	Min. Length (cm)	Max. Length (cm)	Mean Weight (kg)	Min. Weight (kg)	Max. Weight (kg)	Total Weight (kg)
2015	730	41.8	31.5	77.4	0.149	0.050	0.873	108.73
2014	811	41.4	27.6	76.2	0.140	0.033	0.742	113.58

Table 5-10: Biological data from yellow and silver eels from the Barrow catchment.

Year	No. Eels	No. Females	No. Males	% Female	% Male	% Prevalence *A. crassus*	Mean Intensity *A. crassus*	Count *A. crassus*
2015	55	19	36	35	65	56	5.16	160
2014	51	20	31	39	61	73	6.11	226

6 Yellow Eel Stock Assessment

(refers to Ch. 7.2.2 of the National EMP Report, 2008)

Yellow-eel stock monitoring is integral to gaining an understanding of the current status of local stocks and for informing models of escapement, particularly within transitional waters where silver eel escapement is extremely difficult to measure directly. Such monitoring also provides a means of evaluating post-management changes and forecasting the effects of these changes on silver eel escapement. The monitoring strategy aims to determine, at a local scale, an estimate of relative stock density, the stock's length, age and sex profiles, and the proportion of each length class that migrate as silvers each year. Furthermore, individuals from this sample will be used to determine levels of contaminants and parasites to assess spawner quality. Two classes of survey methodologies will be employed; eel specific surveys and multi-species surveys, mainly involving standardised fyke netting and electro-fishing. Table 6.1 gives the locations for eel specific lake and transitional waters to be surveyed in the 2015 period.

Fyke net surveys carried out between 1960 and 2008 by State Fisheries Scientists will provide a useful bench mark against which to assess the changes in stock. The yellow eel monitoring strategy will rely largely on the use of standard fyke nets. Relative density will be established based on catch per unit (scientific-survey) effort.

Water Framework Directive general fish surveys were undertaken on lakes (fyke nets, gill-nets and hydroacoustics), rivers (electro-fishing and fyke nets) and transitional waters (fyke nets, seine nets & beam trawls) in 2012 which adds significantly to the national eel specific programme. The WFD is being undertaken on a three year rolling cycle by Inland Fisheries Ireland. The National programme of yellow eel monitoring in 2012, as laid out in the EMPs, was undertaken by Inland Fisheries Ireland with additional support from the Marine Institute (Table 6-1).

Under the Irish Eel Management Plan a number of key monitoring objectives were outlined. A monitoring programme for the years 2015 – 2017 will aim to meet these objectives:

2.1 Estimate silver eel escapement using indirect assessment from yellow eel stocks.

3. Monitor the impact of fishery closure on yellow eel stock structure.

4. Inter-calibration with water framework sampling.

5. Compare current and historic yellow eel stocks.

6. Establish baseline data to track changes in eel stock over time.

8. Determine parasite prevalence and eel quality.

6.1 Yellow Eel Survey 2015

During 2015, three lakes were repeatedly sampled for yellow eels; Lough Ballynahinch, Lough Oughter, and Lough Inchiquin. Surveys were also carried out on Bunaveela L., L. Feeagh and the tidal lagoon, L. Furnace in the Burrishoole catchment. A semi-quantitative electric-fishing survey was also undertaken in on the Munster Blackwater (Bride catchment) in order to determine the extent of eel distribution in the rivers around the catchment area (Fig. 6.1). The yellow eel surveys need to meet a number of objectives, to monitor the impact of fishery closure on yellow eel stock structure, compare with historic eels stocks, establish baseline data set, evaluate impedance of upstream migration and determine parasite prevalence within Ireland.

An additional objective of the yellow eel study was to carry out an indirect estimation of silver eel escapement. A long-term tagging programme was initiated in key lakes sampled since 2009. In 2015, during the sampling of Lough Oughter, all yellow eels captured in the fyke nets were tagged using Trovan Passive Integrated Transponders (PIT tags). The detection of these tagged eels in the silver eel run over subsequent years will provide information regarding the maturation rate of the yellow eel population.

In the field, there are two life stages encountered: the yellow resident stage and the silver stage. Stage determination is based on skin colour: an eel that displays a silver belly well separated from a black dorsal region by the lateral line is considered at the 'silver stage'. However eels are found with intermediate features so additional measurements are recorded (ICES 2009).

Eye measurements: horizontal and vertical right eye is measured (not just the iris but the whole visible eye, mm)

Pectoral fin measurements (corresponds to the tip of the fin to the greatest possible length, mm)

Total body length (cm)

Wet body weight (kg)

State of lateral line (presence of black corpuscles i.e. neuromasts)

Presence of metallic colouration (i.e. bronze)

Dorso-ventral colour differentiation

Eels were anaesthetized with a solution of 1,1,1–trichloro-2-methyl-2-propanol-hemihydrate and lake water (or a 1:10 solution of clove oil in ethanol dissolved in lake water, where appropriate). For each night's fishing, as many live samples as possible were measured for length, weight, and INDICANG style morphological features associated with silvering (see above). At each location approximately 100 eels (~50 per session) were sacrificed for further analysis in the laboratory. Total length (to nearest cm), weight (to nearest g) and silvering characteristics were determined on site. Otoliths were removed for age evaluation (using a variation of the cracking and burning method - Christensen 1964, Hu & Todd 1981, Moriarty 1983 and Graynoth 1999), gonads for sex determination (macroscopically), swimbladders for evaluation of nematode parasite, *Anguillicola crassus* (Kuwahara, Niimi & Hagaki 1974), and stomachs for diet composition.

During dissections, each eel is examined for the presence of the swimbladder parasite, with percentage prevalence, mean intensity of infection per eel, maximum burden per eel, maximum weight of infections and total parasite count across the dissected eels, all recorded. In the last three years, two indices for investigating swimbladder tissue health have also been used. The Swimbladder Degenerative Index (SDI) (Lefebrve *et al.* 2002), is a qualitative index which scores, swimbladder tissue transparency, presence of pigment and/or exudate and the thickness of the swimbladder wall (Molnár *et al.* 1994), in order to grade the health of the organ on a scale of 1-6. Slight damage is depicted by scores of 1-2, while moderate damage scores 3-4. Score of 5-6 being the most severely damaged. The second index used is the Length Ratio Index (LRI) (Palstra *et al.* 2007). This index is far more quantitative than SDI and relies on a measurement of the length of the swimbladder during dissection. This value of swimbladder length is divided by the total length of the eel and the resulting score is the Length Ratio Index (LRI). Values range from 0.2 to 0.0, with increasing damage approaching zero. When compared to values of SDI, LRI values of approximately 0.2 – 0.15 depict slight damage. Values of 0.14 – 0.09 denoted moderate damage. Finally, severe damage is demonstrated in values less than 0.08.

Table 6-1: Monitoring Programme 2015-2017.

RBD	Location	Water body	Life stage	1	2	2.1	3	4	5	6	7	8	2015	2016	2017	Notes
SHIRBD	ESB Shannon	Catchment	Silver	√	√		√		√	√			√	√	√	Scan for tagged eels
NWIRBD	ESB Erne	Catchment	Silver	√	√		√		√	√			√	√	√	Scan for tagged eels
WRBD	Burrishoole	Catchment	Silver	√	√				√	√			√	√	√	Scan for tagged eels
SERBD	Barrow	River	Silver	√	√		√			√			√	√	√	20 nights fishing; MR
ERBD/NBRBD	Fane	River	Silver	√	√		√			√			√	√	√	20 nights fishing; MR
SHIRBD	Maigue	River	Elver	√						√			√	√	√	
SHIRBD	Feale	River	Elver	√						√			√	√	√	
SHIRBD	Inagh	River	Elver	√						√			√	√	√	
ERBD	Liffey	River	Elver	√						√			√	√	√	
WRBD	Ballysadare	River	Elver	√						√			√	√	√	
WRBD	Corrib	River	Elver	√						√			√	√	√	
SHIRBD	Shannon	Catchment	Yellow	√			√	√	√	√			√	√		WFD
NWIRBD	Erne	Catchment	Yellow	√		√	√		√	√	√	√	√	√		PIT tag
SHIRBD	Inchiquin	Lake	Yellow	√					√	√	√	√	√			parasite study
WRBD	Ballynahinch	Lake	Yellow	√		√			√	√	√	√	√			parasite study
SWRBD	Blackwater	Catchment	Yellow	√			√		√	√	√	√	√	√		
ERBD/NBRBD	Broadmeadow	T. water	Yellow	√					√	√	√			√		
WRBD	Corrib	Catchment	Yellow	√		√	√	√	√	√	√	√		√	√	
SERBD	Barrow	Catchment	Yellow	√			√		√	√	√				√	
ERBD/NBRBD	Fane	Catchment	Yellow	√			√	√		√	√				√	
Ireland	WFD Parasite Free Lakes	Lakes	Yellow	√				√		√	√	√	√	√	√	
Ireland	WFD Alkaline lakes	Lakes	Yellow	√				√		√	√	√	√	√	√	
Ireland	WFD Rivers	Rivers	Yellow	√				√		√	√		√	√	√	
Ireland	WFD Transitional Waters	T. water	Yellow	√				√		√	√	√	√	√	√	Growth & parasite
WRBD	Lough Feeagh	Lake	Yellow	√			√		√	√		√	√	√	√	
WRBD	Lough Furnace	Lake	Yellow	√			√		√	√		√	√	√	√	

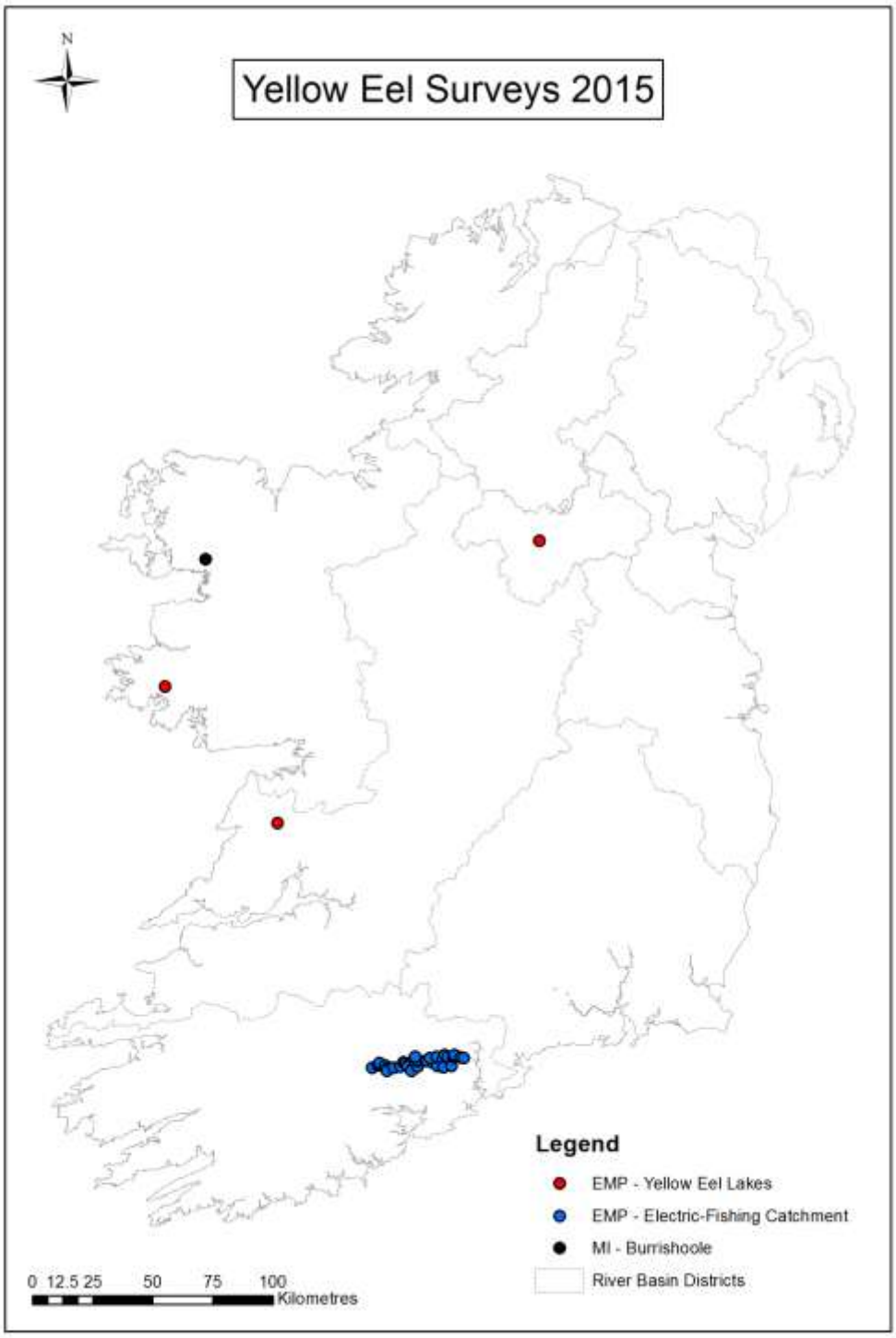


Figure 6-1: Locations of yellow eel survey work 2015.

6.1.1 Lough Ballynahinch

Lough Ballynahinch is located in Co. Galway in the Ballynahinch catchment and has a surface area of 165.52 Ha. An intensive fyke net survey was carried out over 6 nights (3 nights in May and 3 nights in August, 40 nets per night, set in chains of 5), (Fig. 6.2). A total of 123 eels were captured giving a catch per unit effort of 0.51 (Table 6.2). The eels ranged in length from 30.0 cm to 74.4 cm and in weight from 0.0480 kg to 1.0415 kg (Table 6.3 and Fig. 6.3). The survey was hampered on both sampling occasions by high winds, which led to the majority of the nets being set in the more sheltered, western side of the lake (Fig. 6.2). The overall catch was low in comparison to the last survey in 2011 when 434 eels were captured. While only half of the lake was intensively sampled in 2015 (due to poor weather conditions during both sampling trips) this does not appear to have affected the catch. In 2011, eel numbers were evenly distributed across the lake. Therefore, by not intensively sampling the eastern side of the lake in 2015 the survey most likely did not miss higher numbers of eels elsewhere in the lake. It was noted during the initial survey in May 2015, that water temperatures were particularly low. It is possible that the low catch for that survey (n=56 eels), was due to colder water conditions. However, on returning for the second survey in August 2015, (when warmer water conditions prevailed) a low catch was again recorded of just 67 eels. Overall the catch in 2015 was lower than that of 2011. This may possibly be attributed to continuing low elver recruitment and/or the weather conditions on the lake at the time of sampling.

In 2011, a particularly low prevalence of *Anguillicola crassus* was noted in Lough Ballynahinch eels (% Prevalence, 13.04 %; Mean infection intensity, 1 per eel; total parasite count, 12; eel sample size n = 92). In order to assess the spread of the parasite in the four years since the last survey the full catch of 123 eels was taken back to the laboratory for further analysis. The resulting prevalence was 86.18% with a mean infection intensity of 12.57 per eel, with a total parasite count of 1,332 nematode worms (Table 6.3 and Fig. 6.5). This suggests that the 2011 sampling simply presented the Ballynahinch eel population in an early phase of anguillicolosis, as opposed to any environmental factors existing in the lake which may have hampered the infection ability of the parasite. Despite the high % prevalence and infection intensity values, both the Swimbladder Degenerative Index (SDI) and the Length Ratio Index (LRI) returned results of only slight/moderate swimbladder damage arising from *A. crassus* infections (Figs 6.6 & 6.7). Of the 123 eels dissected, 59.35% were female, with 16.26% males and a further 24.39% immature eels (Fig. 6.4).

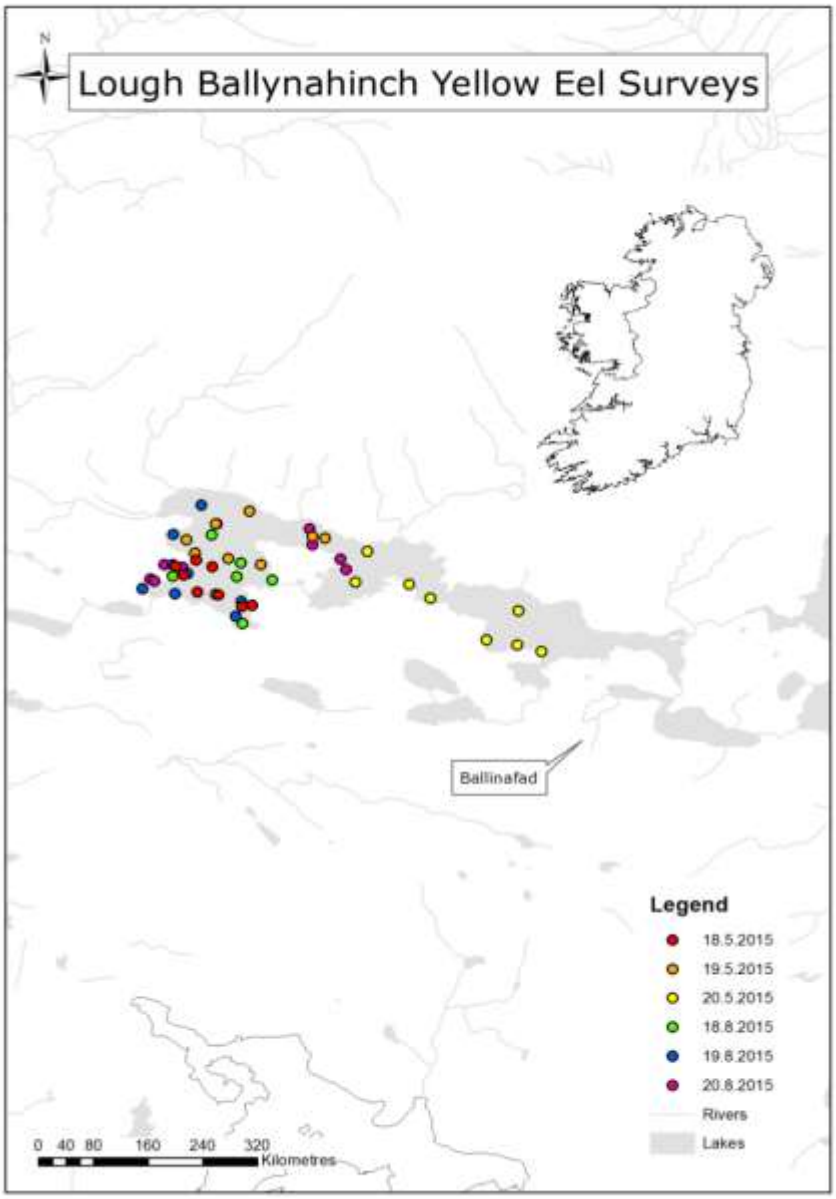


Figure 6-2: Locations of fyke nets sampled on L. Ballynahinch, 2015. (Inset: Map of Ireland with Ballynahinch catchment (shaded) and Western River Basin District (outlined))

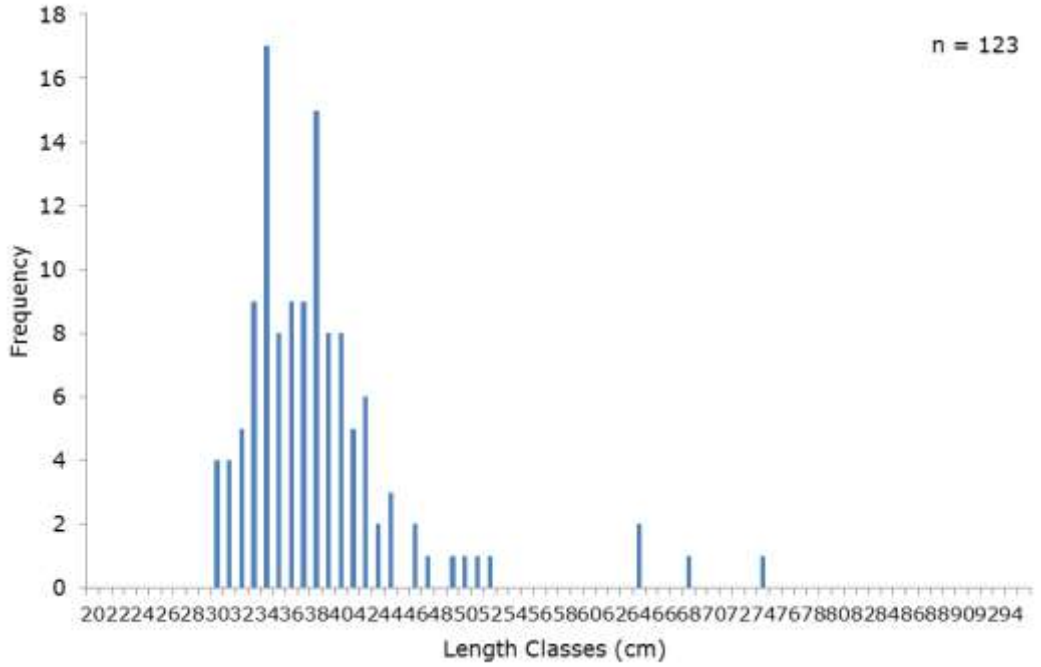


Figure 6-3: Length frequency of yellow eels captured at L. Ballynahinch, 2015

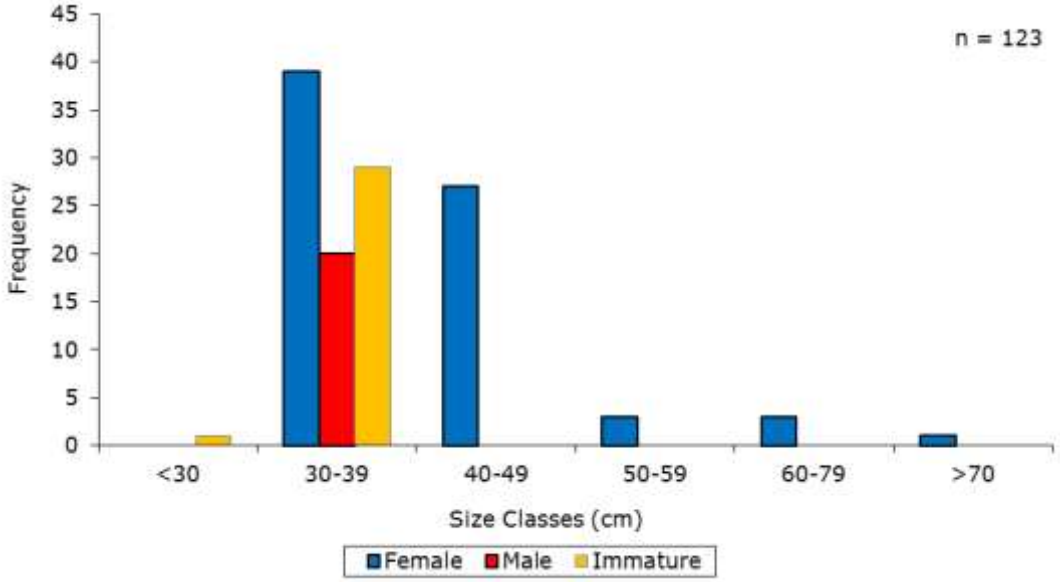


Figure 6-4: Sex distribution of sacrificed yellow eels in L. Ballynahinch, 2015

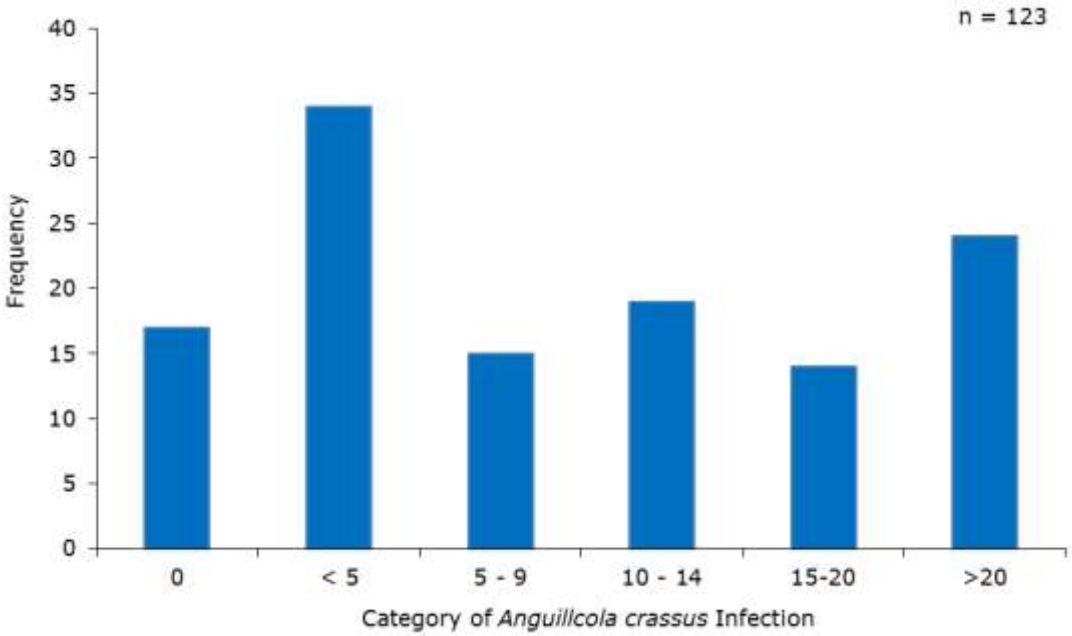


Figure 6-5: *Anguillicola crassus* infection intensity for sacrificed yellow eels collected from L. Ballynahinch, 2015

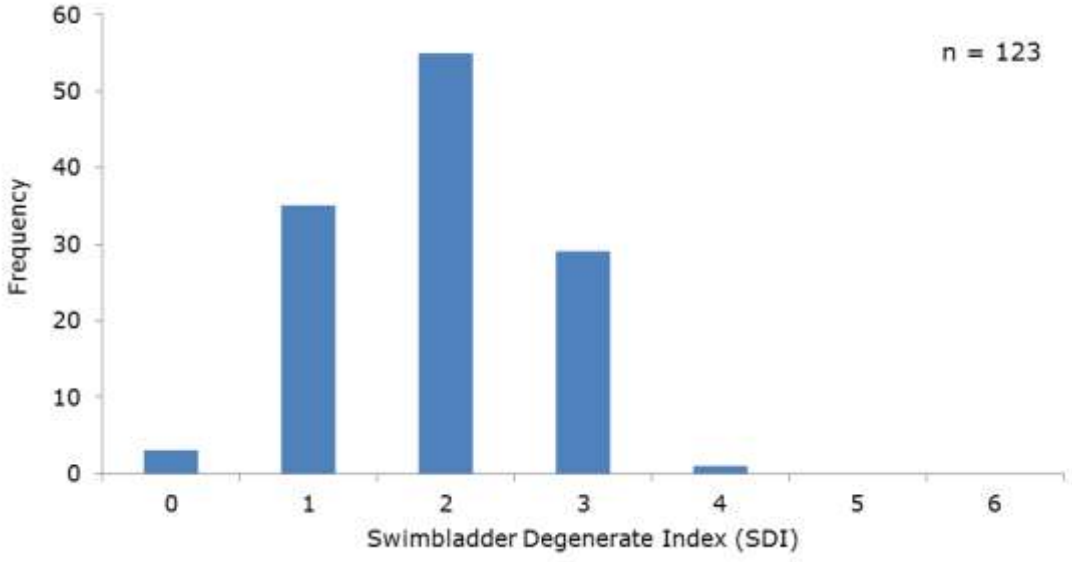


Figure 6-6: Swimbladder Degenerative Index (SDI) results for swimbladder health among sacrificed eels collected from L. Ballynahinch, 2015

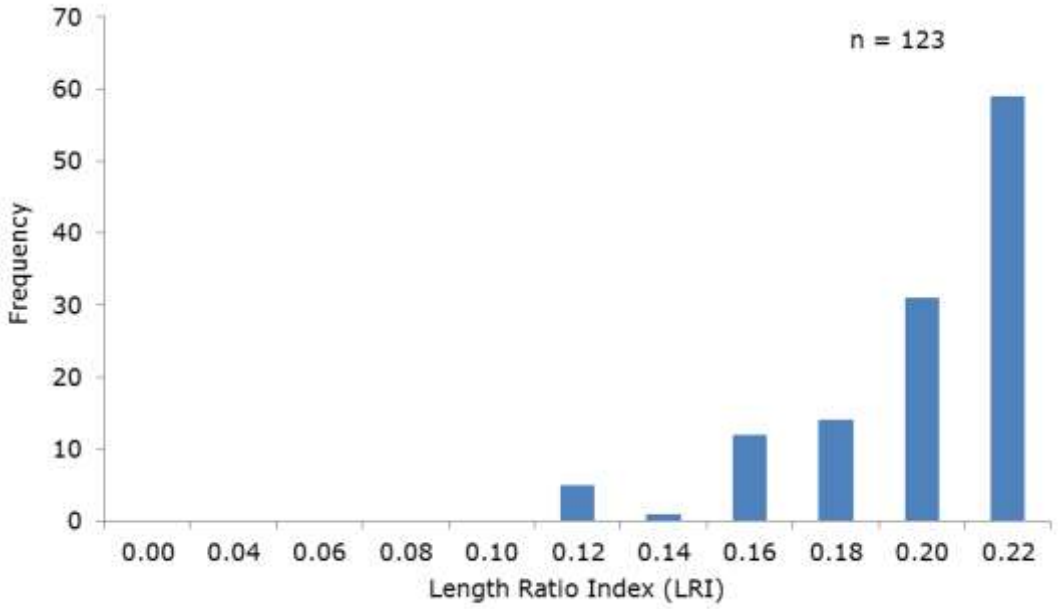


Figure 6-7: Length Ratio Index (LRI) results for swimbladder health among sacrificed eels collected from L. Ballynahinch, 2015.

6.1.2 Lough Oughter

Lough Oughter is a shallow glacial lake located in Co. Cavan in the Erne catchment. This lake can be considered as the best Irish inland example of a flooded drumlin landscape. It has a surface area of 706 ha. Lough Oughter was sampled for 6 nights (3 nights in July and 3 nights in August, 40 nets per night, set in chains of 5), (Fig. 6.8). In total 388 eels were caught with a catch per unit effort of 1.62 (Table 6.2). The eels ranged from 31.3cm to 79.4cm in length and from 0.043kg to 1.036kg in weight (Table 6.2 and Fig. 6.9). No eels were sacrificed from Lough Oughter during the 2015 sampling.

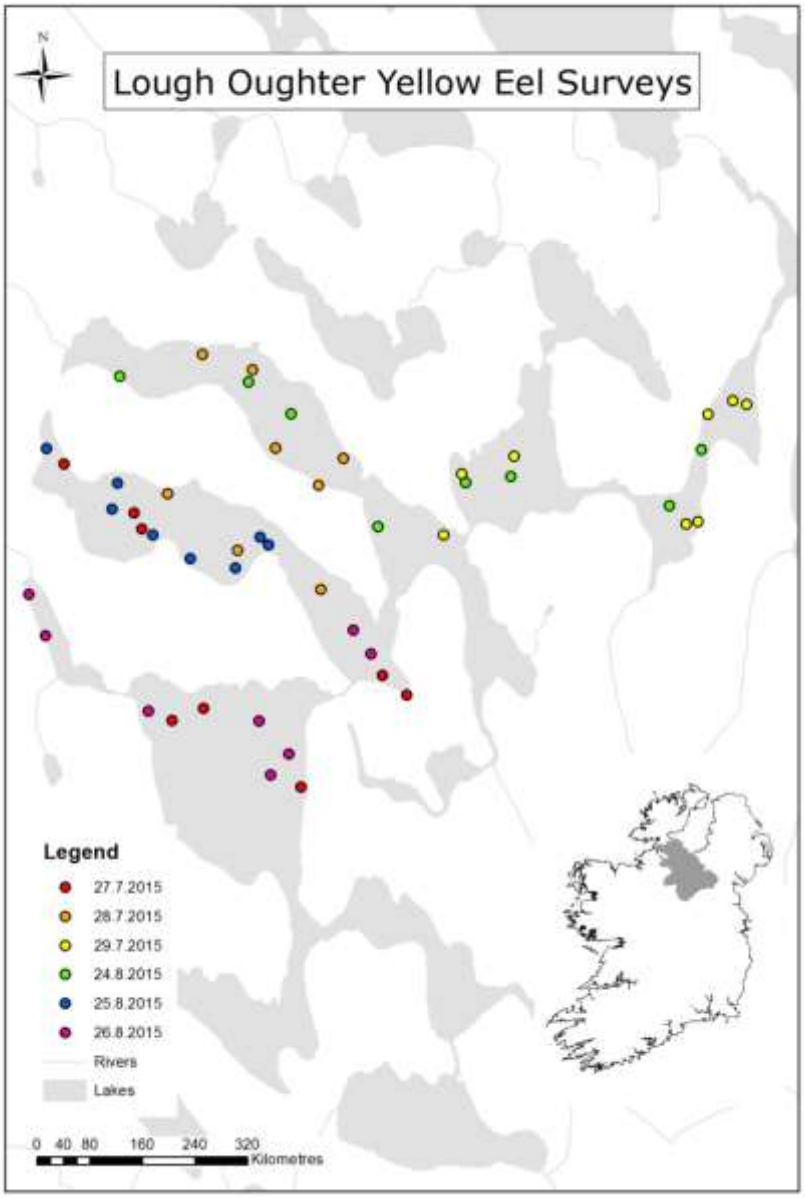


Figure 6-8: Locations of fyke nets sampled on L. Oughter, 2015. (Inset: Map of Ireland with Erne catchment (shaded) and Northern International River Basin District (outlined)).

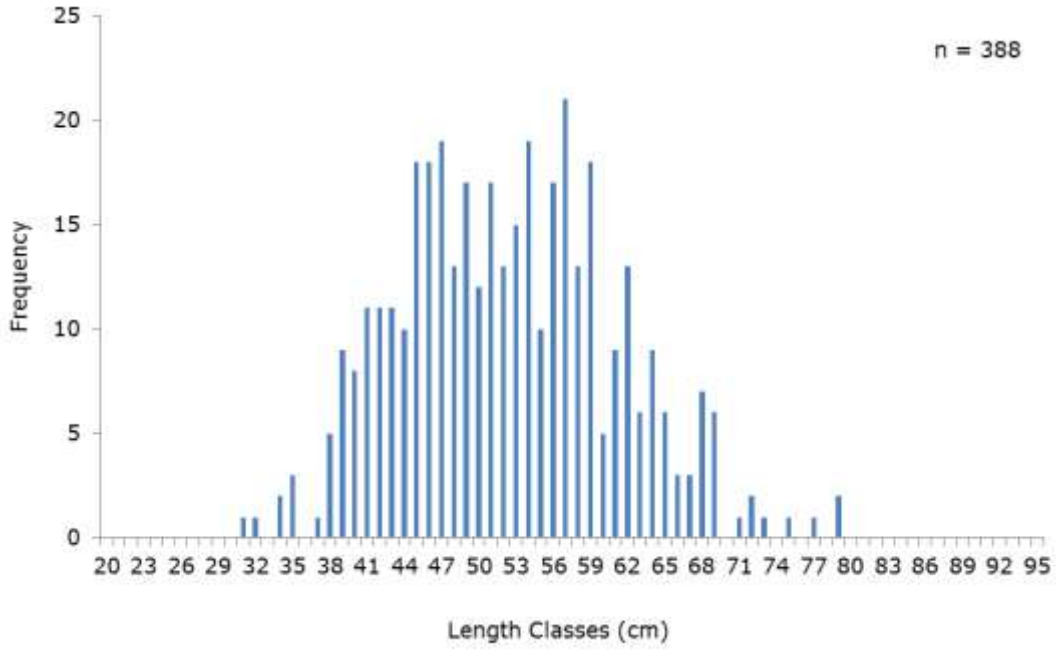


Figure 6-9: Length frequency of yellow eels captured at L. Oughter, 2015.

6.1.3 Lough Inchiquin

Lough Inchiquin is located in Co. Clare on the Fergus catchment, with a surface area of 106.88 Ha. The lake was sampled over 6 nights (3 nights in August and 3 nights in September, 40 nets per night, set in chains of 5) (Fig. 6.10). A total of 479 eels were captured giving a catch per unit effort of 2.00 (Table 6.2). The captured eels ranged in length from 33.3 cm to 78.3 cm and in weight from 0.0430 kg to 1.0125 kg (Table 6.2 and Fig. 6.11).

A total of 197 eels were sacrificed from this lake, 100% of which were female (Table 6.3 and Fig. 6.12). At the last survey of this lake in 2011, there was a prevalence rate of 1.03% infection of *A. crassus* across these eels, with a mean infection intensity of 1.00. In fact, there was only a single parasite noted in one eel on that occasion (eel sample size = 97). During the 2015 survey, this had risen to a prevalence of 36.55% and a mean infection intensity of 4.85 per eel (Table 6.3 and Fig. 6.13). Total parasite count had increased to 349 parasites in a sample of 197 eels. In 2009, nearby lakes sampled by WFD (Lough Cullaun, Lough Dromore and Lough Muckanagh), showed parasite free eels. However, WFD sampling on stretches of the River Fergus (Clonroad) downstream of these lakes in 2008 did show low levels of *A. crassus* infection (1.03% prevalence and 1.00 mean intensity, n=31 eels). It is likely that the parasite has been spreading through the catchment and had reached Lough Inchiquin at the time of the 2011 sampling. Anguillicolosis had continued to the current parasite levels in 2015. Despite the higher % prevalence and infection intensity values, both the Swimbladder Degenerative Index (SDI) and the Length Ratio Index (LRI) returned results of only slight/moderate swimbladder damage arising due to *A. crassus* infections (Figs 6.14 & 6.15).

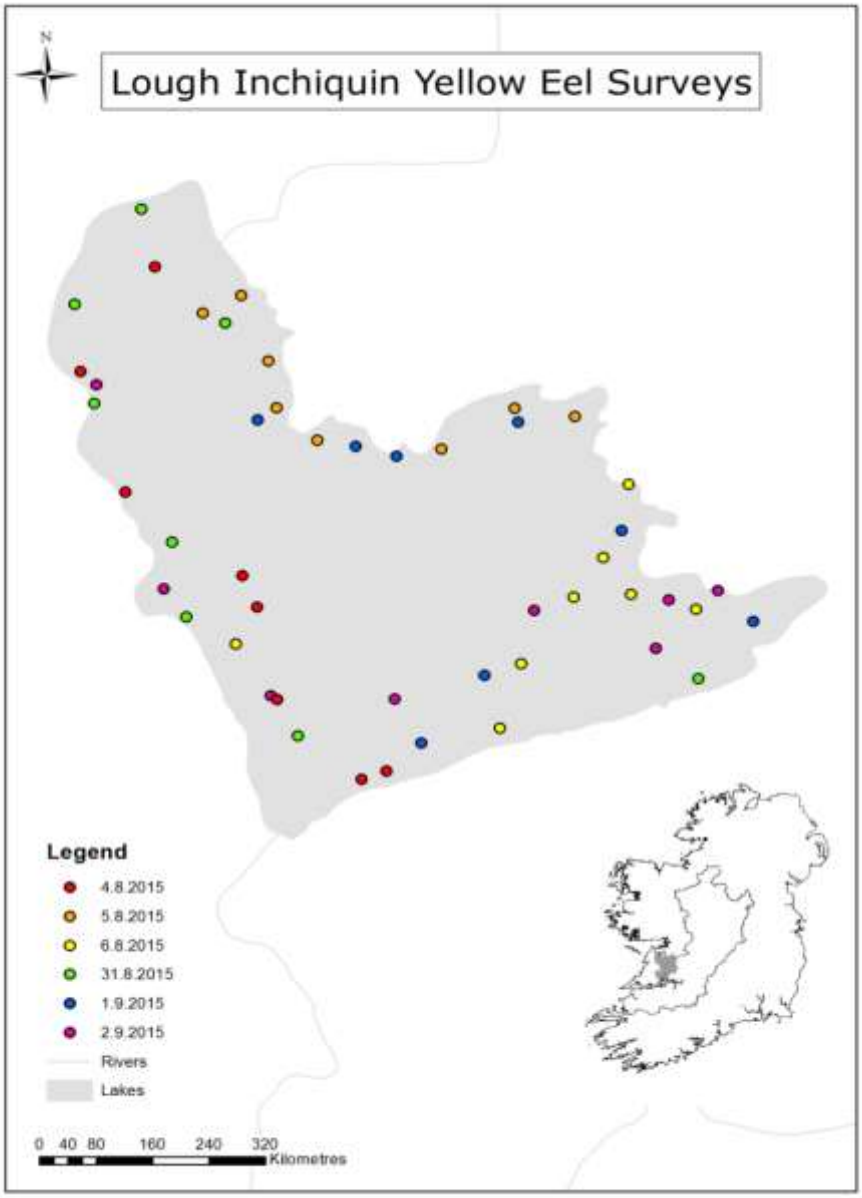


Figure 6-10: Locations of fyke nets sampled on L. Inchiquin, 2015. (Inset: Map of Ireland with Fergus catchment (shaded) and Shannon International River Basin District (outlined))

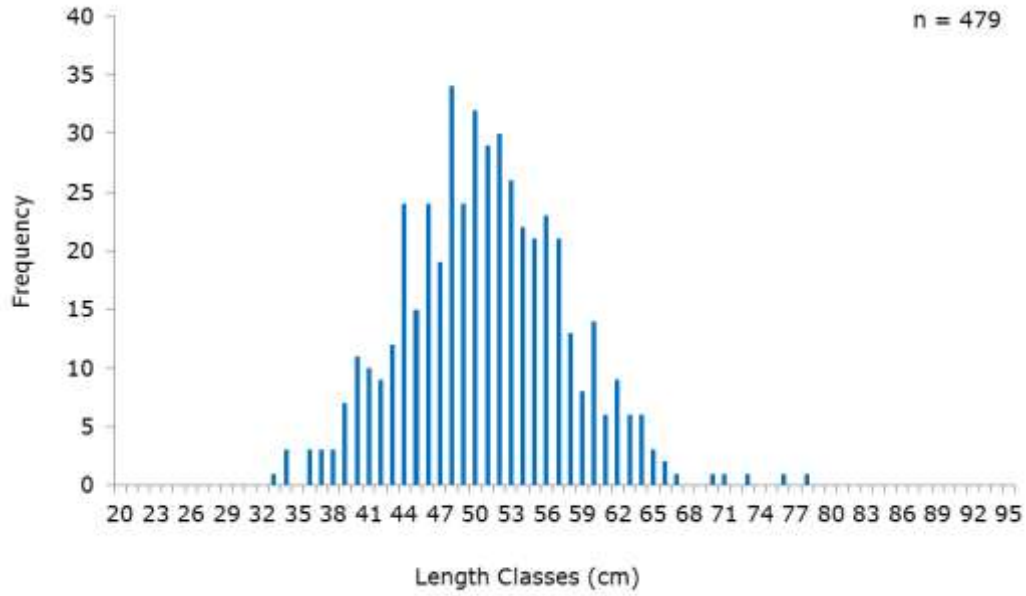


Figure 6-11: Length frequency of yellow eels captured at L. Inchiquin, 2015

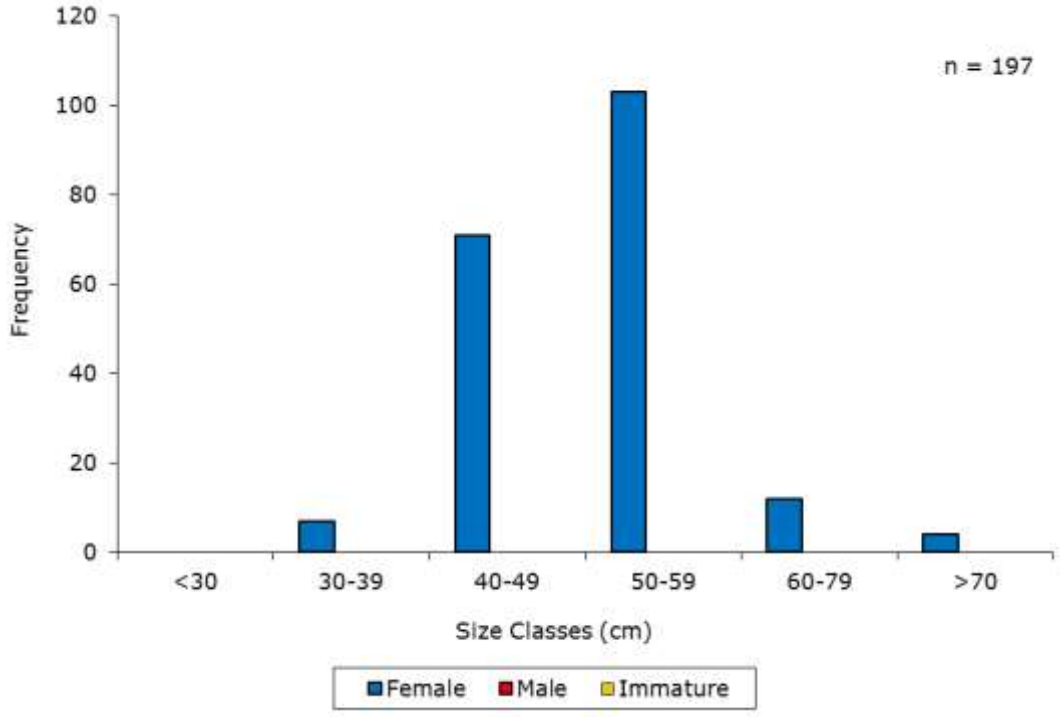


Figure 6-12: Sex distribution of sacrificed yellow eels in L. Inchiquin, 2015

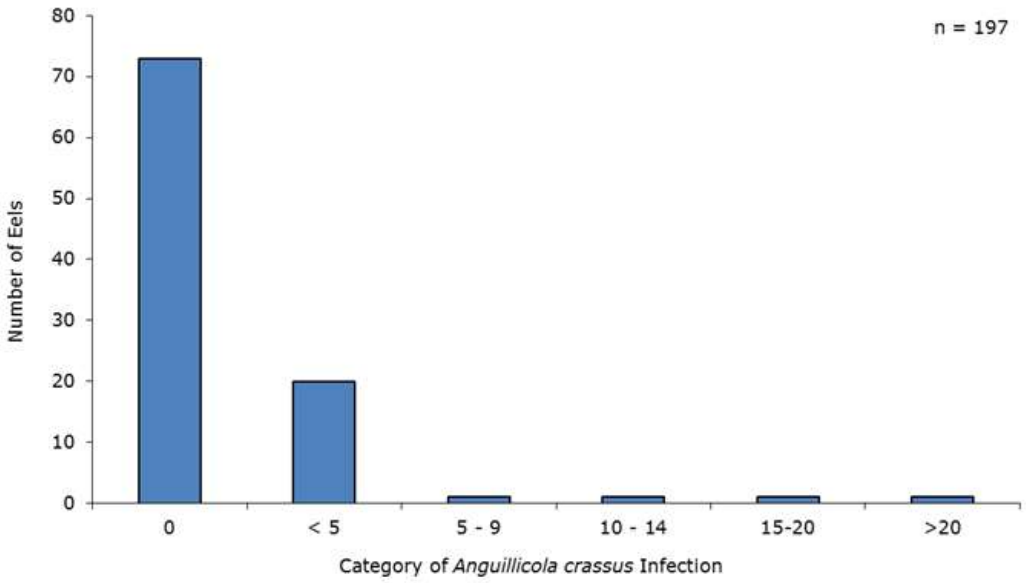


Figure 6-13: *Anguillicola crassus* infection intensity for sacrificed yellow eels collected from L. Inchiquin, 2015.

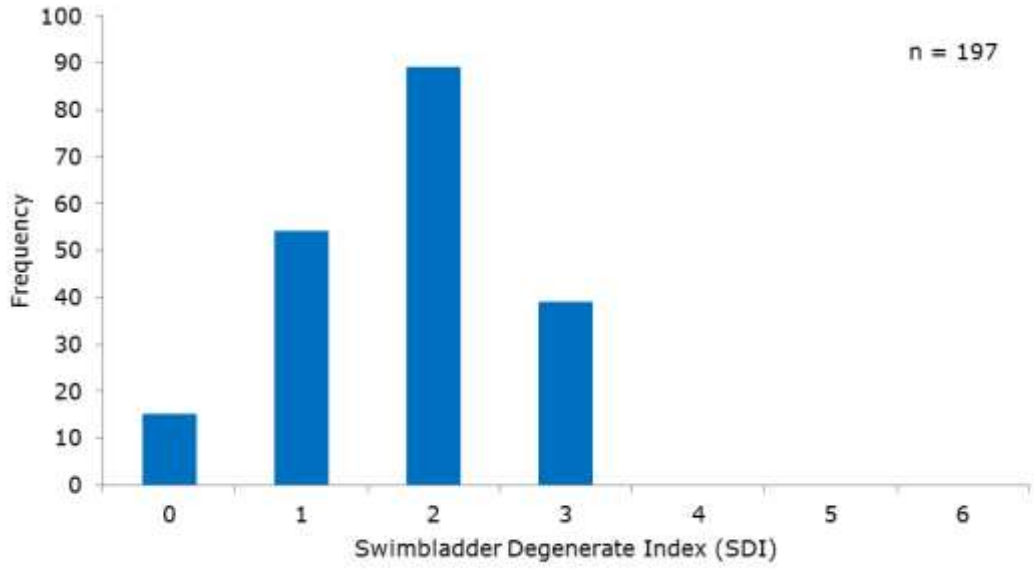


Figure 6-14: Swimbladder Degenerative Index (SDI) results for swimbladder health among sacrificed eels collected from L. Inchiquin, 2015.

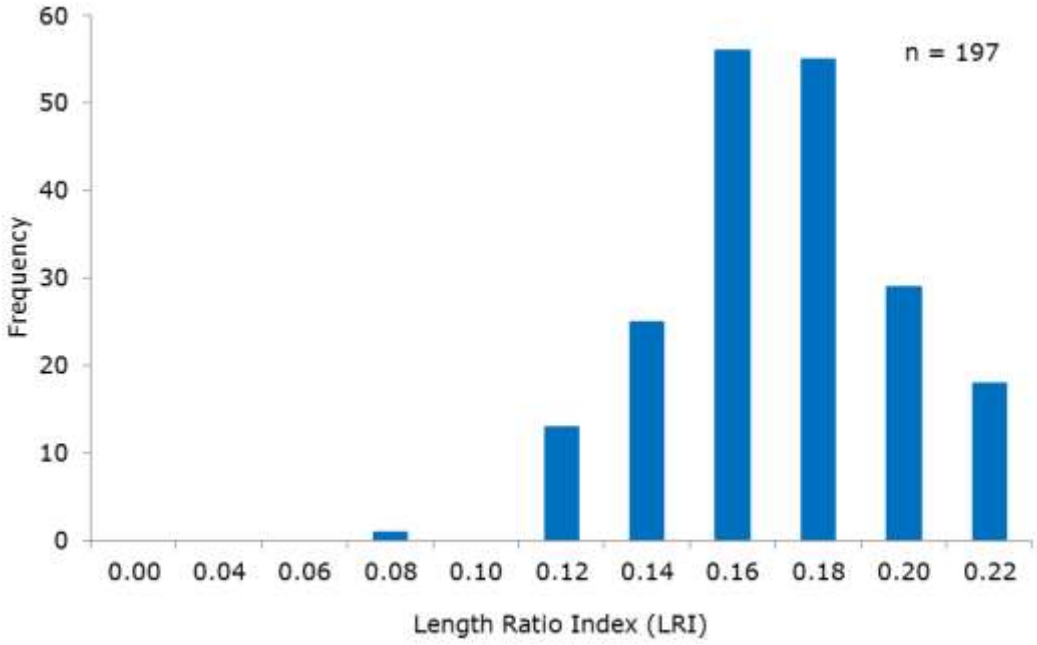


Figure 6-15: Length Ratio Index (LRI) results for swimbladder health among sacrificed eels collected from L. Inchiquin, 2015.

6.1.4 Burrishoole

Bunaveela Lough is located in the upper reaches of the catchment (Fig. 6.16). It has a surface area of 42ha and a maximum depth of 23m. Bunaveela L. was fished in the traditional style (sets of 10 nets perpendicular to the shore) in 2015 (7 July 2015), with chains of 10 nets fished at three sites (A, B, C). In total 3 eels were caught with a catch per unit of effort of 0.1 eels/net/night (Table 6.2). The average length was 52.6cm and ranged in length from 46.4cm to 64.1cm. No eels were PIT tagged and no recaptures were made.

Lough Feeagh has a surface area of 395ha and an average depth of 14.5m (with several areas >35m in depth). L. Feeagh was fished in the traditional style (sets of 10 nets perpendicular to the shore) in 2015 (22-23 July 2015), with chains of 10 nets fished at six sites (A, C, D, E, F, J) for one night each. In total, 73 eels were caught with a catch per unit effort (CPUE) of 1.22 eels/net/night (Table 6.2). The eels average length was 40.7cm and ranged in length from 30.3cm to 67.5cm, with a total weight of 9.57kgs caught in the two nights (Fig. 6.17). None of the catch was PIT tagged and no previously tagged eel were taken.

Eels were not sacrificed in this survey.

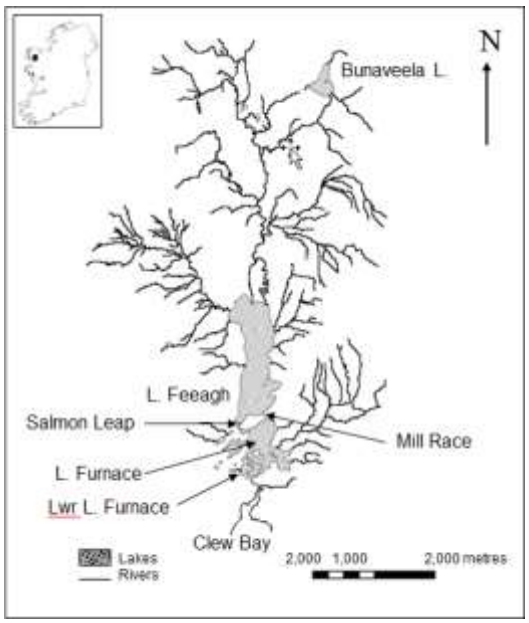


Figure 6-16: Map of Burrishoole showing the lakes surveyed.

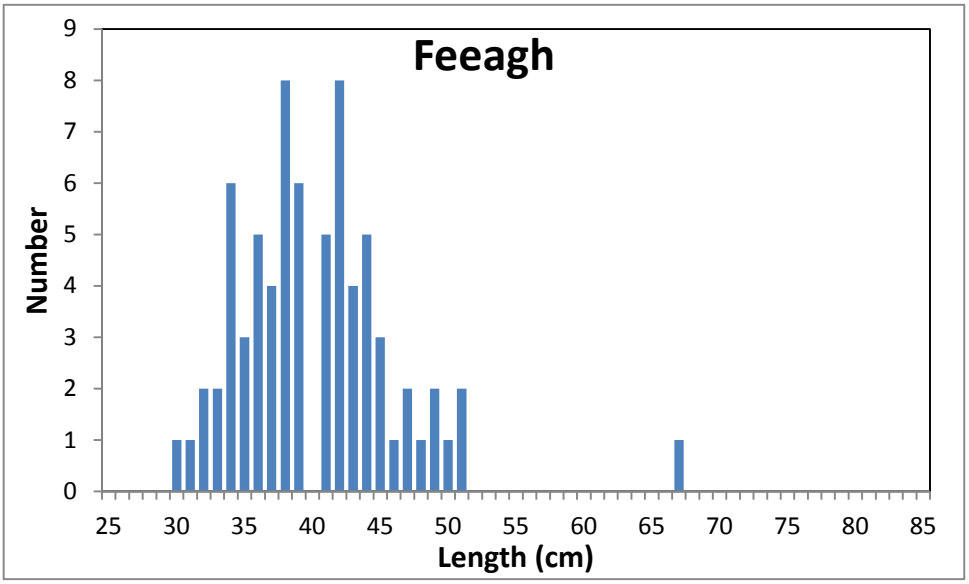


Figure 6-17: Length frequency of yellow eels captured at L. Feeagh, 2015.

6.2 Transboundary Yellow Eel

No surveys in 2015.

6.3 Transitional Waters

6.3.1 Burrishoole Transitional Waters

Lough Furnace, the tidal lough, has a surface area of 125ha north of Nixon's Island and 16ha between Nixon's Island and the mouth of the estuarine river (Lower Lough Furnace) (Fig. 6.16). The main lough has a maximum depth of 21.5m. Furnace is heavily stratified with significant areas of deoxygenated water in the main basin. L. Furnace was fished in the

traditional style (sets of 10 nets perpendicular to the shore) in 2014 (14-15 July 2015), with chains of 10 nets fished at six sites (A, B, C, D, E, F) in one night each and one night (30 July 2015) with two chains of nets at the Back of the House which is a shallow tidal area between the lough and the estuarine river. Eels were not sacrificed in this survey.

In L. Furnace, 74 eels were caught with a catch per unit effort (CPUE) of 1.22 eels/net/night (Table 6.2; Fig. 6.18). The eels average length was 40.6cm and ranged in length from 27.4cm to 68.6cm, with a total weight of 9.37kgs caught for the 2 nights (Table 10.1).

In Lwr L. Furnace, 61 eels were caught with a catch per unit effort (CPUE) of 3.05 eels/net/night (Table 6.2; Fig. 6.18). The eels average length was 47.2cm and ranged in length from 29.3cm to 84.3cm, with a total weight of 13.04kgs caught.

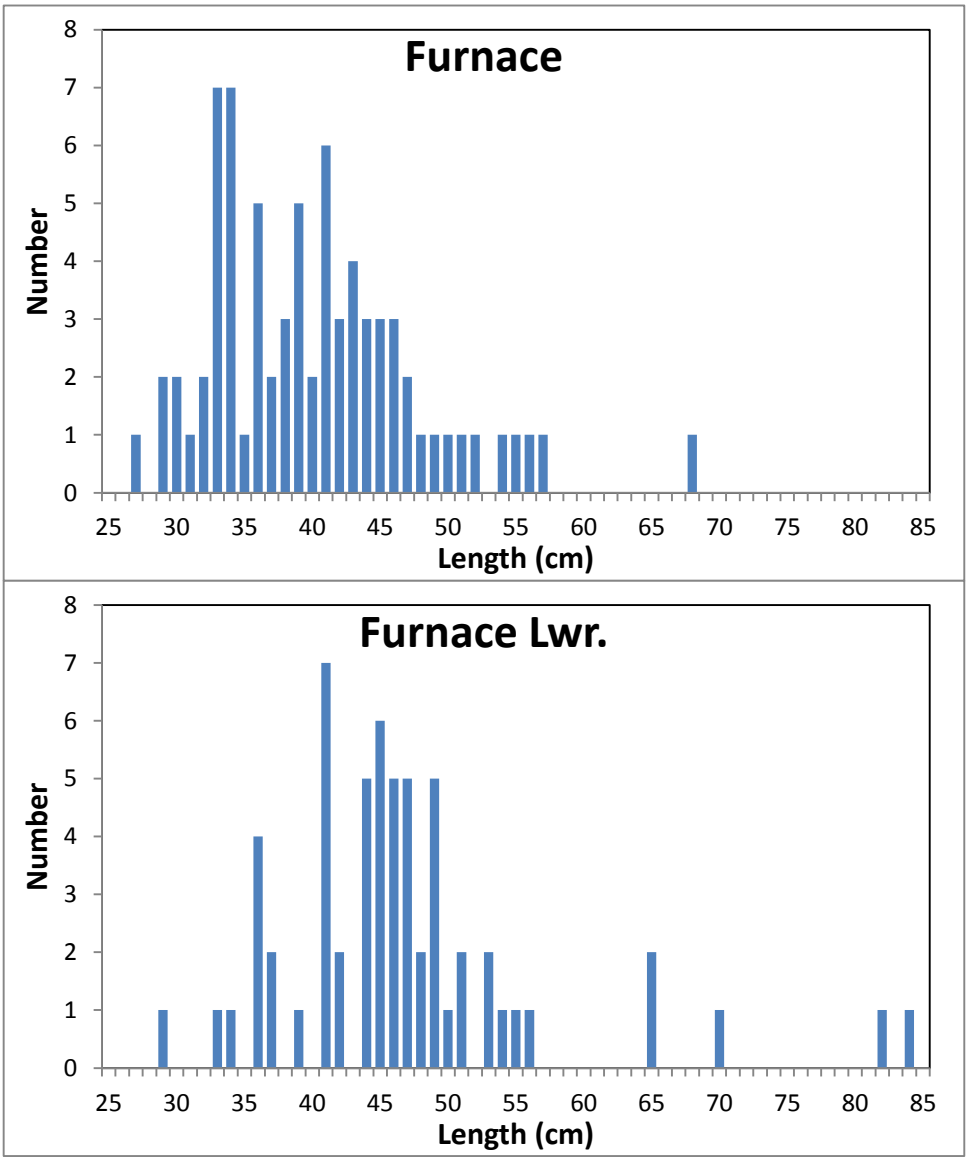


Figure 6-18: Length frequency of yellow eels captured at L. Furnace and L. Furnace Lower, 2015

Table 6-2: Catch detail from yellow eel lake surveys, 2015.

Site	Dates	No. Eels	Nets*Nights	CPUE	Total Weight (kg)	Mean Length (cm)	Min. Length (cm)	Max. Length (cm)	Mean Weight (kg)	Min. Weight (kg)	Max. Weight (kg)
L. Ballynahinch	19/05/2015	16	40	0.40	1.717	38.9	31.0	46.1	0.107	0.052	38.9
	20/05/2015	19	40	0.48	2.046	39.6	33.8	51.7	0.108	0.063	39.6
	21/05/2015	21	40	0.53	2.872	38.9	30.5	74.4	0.137	0.050	38.9
	19/08/2015	22	40	0.55	2.410	37.7	30.4	64.2	0.110	0.050	37.7
	20/08/2015	20	40	0.50	2.530	38.8	30.0	68.8	0.127	0.048	38.8
	21/08/2015	25	40	0.63	2.784	38.4	32.3	64.4	0.111	0.056	38.4
	2015	**123**	**240**		**14.358**	**38.7**	**30.0**	**74.4**	**0.117**	**0.048**	**1.042**
L. Oughter	28/07/2015	100	40	2.50	23.601	50.9	31.3	79.0	0.236	0.043	0.819
	29/07/2015	29	40	0.73	10.646	57.4	38.7	79.4	0.367	0.086	1.036
	30/07/2015	64	40	1.60	21.439	57.0	40.4	77.2	0.335	0.111	0.933
	25/08/2015	64	40	1.60	16.524	53.2	39.4	69.8	0.258	0.090	0.654
	26/08/2015	86	40	2.15	19.897	50.3	32.7	68.2	0.231	0.059	0.605
	27/08/2015	45	40	1.13	11.003	52.4	39.8	75.5	0.245	0.076	0.776
	2015	**388**	**240**		**55.686**	**55.1**	**31.3**	**79.4**	**0.313**	**0.043**	**1.036**
L. Inchiquin	05/08/2015	93	40	2.38	23.465	52.1	34.1	67.1	0.252	0.060	0.619
	06/08/2015	147	40	3.68	32.052	50.3	33.3	70.4	0.218	0.043	0.652
	07/08/2015	102	40	2.55	25.698	51.7	38.4	78.3	0.252	0.079	1.013
	01/09/2015	41	40	1.03	9.705	51.5	39.9	71.8	0.237	0.101	0.660
	02/09/2015	40	40	1.00	9.676	51.8	38.1	65.5	0.242	0.082	0.470
	03/09/2015	56	40	1.40	13.590	51.4	36.5	35.2	0.243	0.073	0.482
	2015	**479**	**240**		**81.215**	**51.2**	**33.3**	**78.3**	**0.238**	**0.043**	**1.013**
Bunaveela Lough	**07/07/2015**	**3**	**30**	**0.10**	**0.890**	**52.6**	**46.4**	**64.1**	**0.296**	**-**	**-**
Lough Feeagh	22/07/2015	38	30	1.27	5.170	40.6	30.3	67.5	0.136	0.055	0.640
	23/07/2015	35	30	1.17	4.400	40.9	32.9	51.8	0.126	0.060	0.240

Site	Dates	No. Eels	Nets*Nights	CPUE	Total Weight (kg)	Mean Length (cm)	Min. Length (cm)	Max. Length (cm)	Mean Weight (kg)	Min. Weight (kg)	Max. Weight (kg)
	2015	**73**	**60**	**1.22**	**9.570**	**40.7**	**30.3**	**67.5**	**0.131**	**0.055**	**0.640**
L. Furnace tidal	14/07/2015	27	30	0.90	4.230	43.1	30.7	68.6	0.157	0.045	0.660
	15/07/2015	47	30	1.57	5.140	39.05	27.4	55.1	0.109	0.035	0.315
	2015	**74**	**60**	**1.23**	**9.370**	**40.6**	**27.4**	**68.6**	**0.127**	**0.035**	**0.660**
Lwr L. Furnace	**30/07/2015**	**61**	**20**	**3.05**	**13.040**	**47.2**	**29.3**	**84.3**	**0.217**	**0.035**	**1.130**

Table 6-3 Biological data from yellow eel lake surveys, 2015

Location	Total Eels	No. Females	No. Males	No. Immature	% Female	% Male	% Immature	% Prevalence *A. crassus*	Mean Intensity *A. crassus*	Preferential Diet from Stomach Contents
L. Ballynahinch	123	73	20	20	59	16	24	86	12.57	*Asellus* sp.
L. Inchiquin	197	197	0	0	100	0	0	36	4.85	*Asellus* sp.

6.4 Electric-Fishing Surveys

Under the National Eel Management Plan 2009, IFI has been tasked with a number of monitoring objectives. These include establishing baseline data sets to track changes in the eel population over time; monitoring the impact of fishery closure on yellow eel stocks; determining the prevalence of parasites and the current quality of the eel stocks. The aim of the electric-fishing study was to carry out a catchment level assessment of the riverine eel population. This approach was carried out on the Fane catchment during the summer of 2013, and the Kells Blackwater subcatchment of the River Boyne in 2014. Due to financial and resource constraints an intensive quantitative electric-fishing survey is not always feasible and as a result a semi-quantitative method was employed. There have been many studies comparing the efficiency of single pass electric-fishing surveys with a multi pass survey (Imbert *et al.* 2008; Kruse *et al.* 1998; Laffaille *et al.* 2005; Mitro & Zale 2000; Reid *et al.* 2009; Vehanen *et al.* 2013). The semi quantitative method has proved adequate for sampling eel, salmon and trout populations in small wadeable streams and rivers.

Baldwin and Aprahamian (2011) concluded that when undertaking depletion passes they found no difference in the catch efficiency between eel specific surveys and multi species surveys. As a result of discussions with members of the Water Framework Directive Rivers team at IFI, it was decided that the benefit of a single pass electric-fishing programme for eels will not deliver the quantity of eels required. In their opinion, most eels are caught in the second and third pass after being disturbed in the first pass. Therefore, an alternative semi-quantitative method was assessed by using eel specific settings on the electric-fishing equipment.

Broad *et al.* 2001 found that 83% of longfin eels (*Anguilla dieffenbachii,* Gray 1842) were caught within 270mm from the bank. Based on these results, an eel specific survey concentrating on the banks of the river was carried out. The area fished corresponded to the stream lengths surveyed by the WFD team; however no stop nets were used in the semi-quantitative method. The equipment used included a back-pack electric-fishing unit and dip nets for the collection of eels. Eels and any other species collected were held separately and all fish containers were aerated.

Reid (2011) examined the difference in point and transect electric-fishing methods. The author found that the transect sampling captured more eels than the point sampling. The transect method involved a 1m wide transect with 50 transects per site. Each unit was separated by 2m across the channel and 10m along the channel. Each unit would be fished for mean of 49 seconds. The point abundance sampling involves placing the anode on the river bottom for 30 seconds the electrical field would represent an area $1m^2$. This is repeated on average 24 points per river section. A number of papers have reported on the PASE method (Laffaille *et al.* 2005, Lasne *et al.* 2008, developed by Nelva *et al.* 1979).

The WGEEL (ICES, 2007) reported that the density of eels assessed at the same site was substantially lower when all species were targeted as opposed to when only eel was the target species. The report also suggests a minimum number of stations (n=16) for a large coefficient of variation (0.8). Therefore, the EMP electric-fishing semi-quantitative (bankside) study targets approximately 30 sites. In order to calibrate with the quantitative electric-fishing method, 10-20% of sites were resurveyed using the 3 pass depletion method.

6.4.1 Munster Blackwater, Bride Catchment

The Bride has an area of approximately 42,456Ha, and is comprised of the main Bride channel and several tributaries including, the Coom, Bunnaglanna and Glashnabrack rivers

in the upper catchment. The main channel flows east through Rathcormack, meeting the Lisnagar, Shanowendrinnea and Flesk tributaries during its course. It continues east and passes through Tallow, where the Glenaboy River joins the main channel before draining into the Blackwater Estuary. There are no lakes in the system and no eels were retained from the electric-fishing.

A catchment-wide electric-fishing program was devised, which involved Bankside (semi-quantitative and Depletion (quantitative) electric-fishing. In each site a 30m stretch of river is fished, one bank was randomly selected and fished in a single timed pass and a second pass focuses on the opposite bank. On average, individual passes were between 3 and 9 minutes duration. A total of 31 sites were fished using the Bankside methodology (Fig. 6.19) and a further subset of these sites (n = 9) were fished using the standard quantitative Depletion fishing method (Fig. 6.20) using 3 passes (including the use of stop nets) in order to compare catch results between the two methodologies. The catchment was divided into upper, middle and lower zones and a comparable number of sites were fished in each zone, using each method. All equipment was biosecured before moving into the next zone to avoid the spread of diseases and/or invasive species when present. The electric-fishing survey was carried out using Hans-Grassl™ back-pack equipment (Plate 3.1). The packs were set to the recommended frequency for catching and not harming eels of 20Hz (Beaumont *et al.* 2002). Voltage was site dependent and was set between 200-375V (pulsed DC), in order to turn fish in differing conductivity conditions.

Plate 6-1: Bankside electric-fishing on the main channel of the upper Bride catchment, 2015 (Photo: K. Kelly).

6.4.1.1 Bride Catchment Electric-Fishing Results

Catches along the catchment were generally quite low, which was a similar result to the Kells Blackwater and Fane catchments electric-fishing results using the same methodologies in 2014 and 2013, respectively. The overall results for the Kells Blackwater and the Fane suggested that the main channel was essentially used as a habitat corridor for eels to reach the main lakes in those systems (i.e. Lough Ramor and Lough Muckno respectively), with the highest eel catches associated with the inflows and outflows of those lakes. The Bride catchment is, however, a completely riverine catchment with no such lakes, and it was hypothesised that a different distribution of eel catch would be noted. Interestingly, eel catches on the Bride catchment were fairly uniform throughout, with similar numbers of eels in catches in each of the lower, middle and upper zones of the catchment. It is believed, that, with no one highly productive, or highly eel-populated location within the catchment (such as a lake) that the eels of the Bride were generally dispersed throughout the main channel and tributary systems.

In total, 128 eels were captured using the combined electric-fishing methods in 31 sites. Of these, 84 eels were caught using the bankside fishing methodology (Fig. 6.21). The remaining 44 eels were captured across the 9 depletion fished sites (Fig. 6.22). The size class of eels captured by electric-fishing ranged from 19.0 to 35.7cm (Fig. 6.23). The proportion of eels below 30cm (i.e. juveniles) was 92.96% (Fig. 6.24). This is a greater proportion of the catch when compared to the Kells Blackwater (78.7%) and the Fane (67%). Eels of 14cm were caught in the river in the upper most catchment tributary (Coom River, Site 1), a distance of approximately 45km from the tidal limit. No sacrificed eels were taken during the Bride catchment-wide electric-fishing survey.

While the catches of eels were generally uniform in number across the catchment, slightly higher catches were noted in the middle reaches of the catchment, with two sites near Rathcormack gaining 12 and 19 eels captured in the bankside electric-fishing method (Sites 10 & 10b), (Fig. 6.22). It was theorised that these higher numbers may have been gained due to slight runoff from a nearby wastewater treatment plant during a recent flood, which may have attracted the eels to the area.

Overall, eels were absent at 11 sites of the 31 sites sampled during bankside electric-fishing on the Bride catchment (35.5% of the total sites). The absence of eels was confirmed at one of these sites (Site 4) during depletion fishing. The sites where eels were absent were a mixture of smaller channels and main channel sites, all with good eel habitat, and so no clear patterns explaining the absences were revealed.

There were no significant differences in total catch between the 2 methods (bankside and depletion fishing; Paired t-Test, $p>0.05$, $df=7$, $n=9$). A similar result was noted between the catches for the bankside method and the first pass of the depletion fishing only (Paired t-Test, $p>0.05$, $df=7$, $n=9$), (Fig. 3-23). However, it should be noted, that in previous years of electric-fishing (Kells Blackwater and Fane), while catches of eels were similar for sites located on small streams and minor tributaries off the main channel; the catches recorded using the two methods at sites located on the main channel itself were markedly different, with the depletion method recording higher numbers in each instance. In the smaller channels, the whole channel is effectively surveyed by the bankside method however in the larger channels the middle reaches are not covered. Therefore larger catches are expected in a single pass of the depletion method due to the larger area surveyed. One important result from this survey is where eels were absent both methods resulted in a zero catch. As a tool to record the presence, absence and minimum density of eels over a whole catchment the semi-quantitative (bankside) method shows promising results.

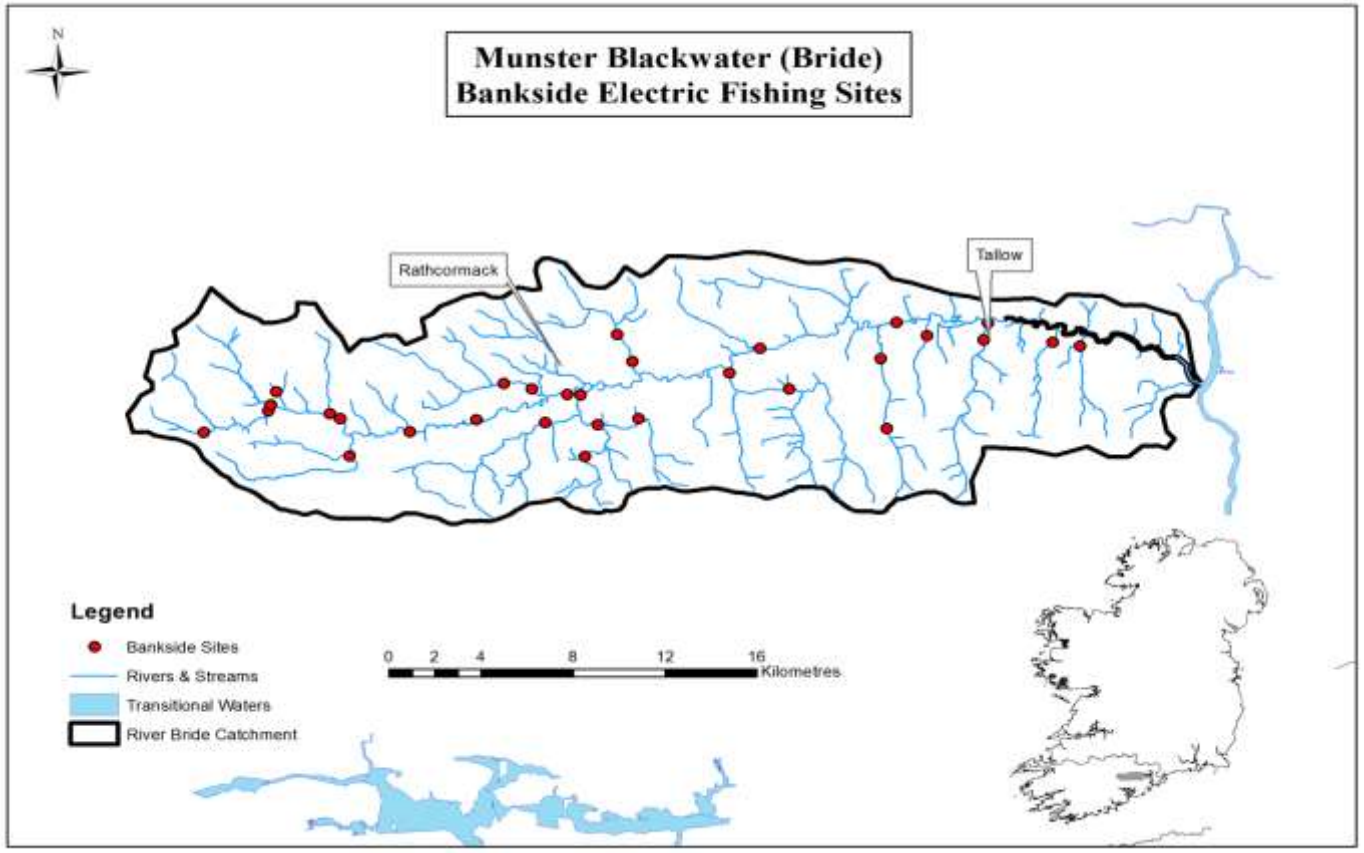


Figure 6-19: Locations of semi-quantitative (Bankside) electric-fishing sites sampled on Bride catchment, 2015. (Inset: Map of Ireland with Bride catchment (shaded) and South Western River Basin District (outlined))

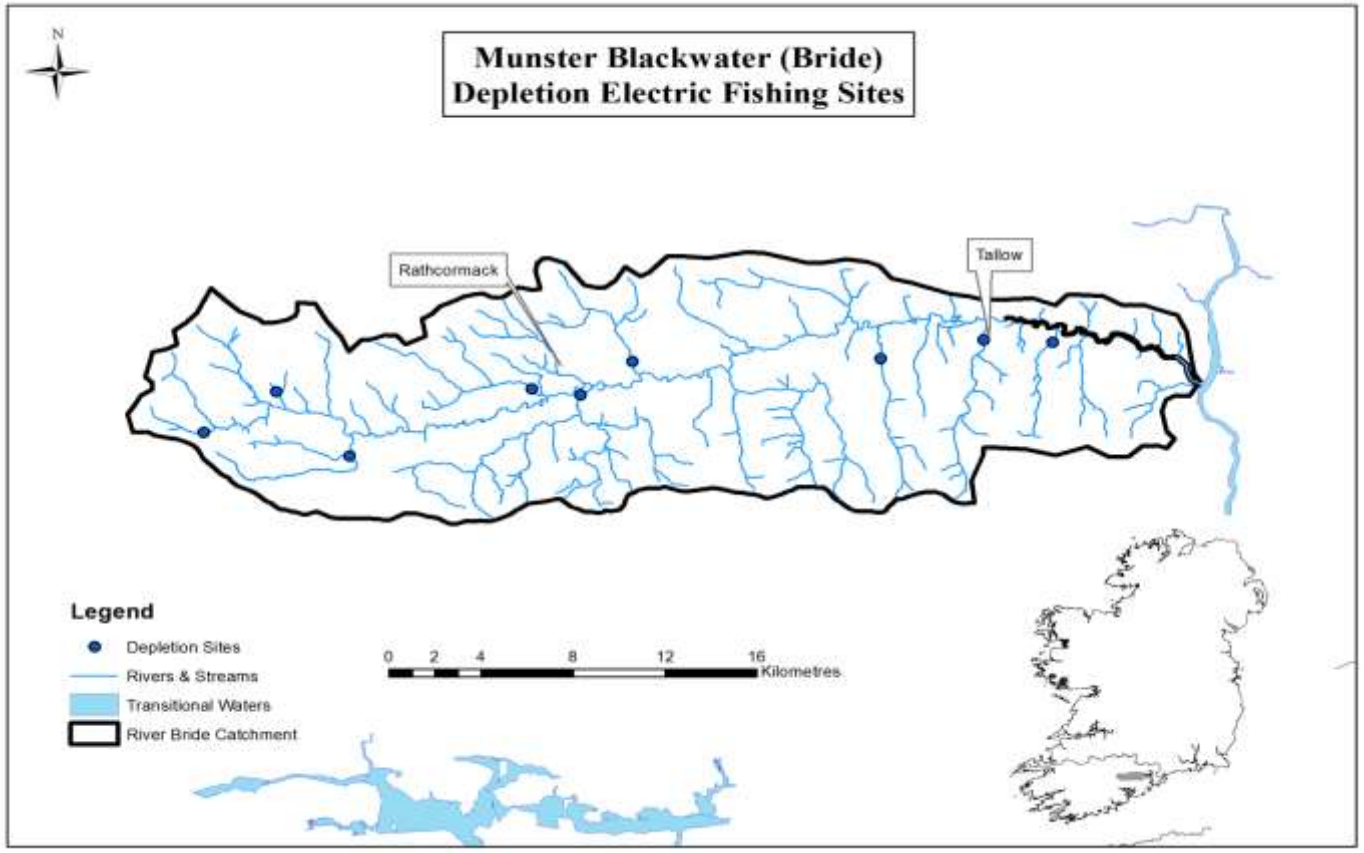


Figure 6-20: Locations of quantitative (Depletion) electric-fishing sites sampled on Bride catchment, 2015. (Inset: Map of Ireland with Bride catchment (shaded) and South Western River Basin District (outlined))

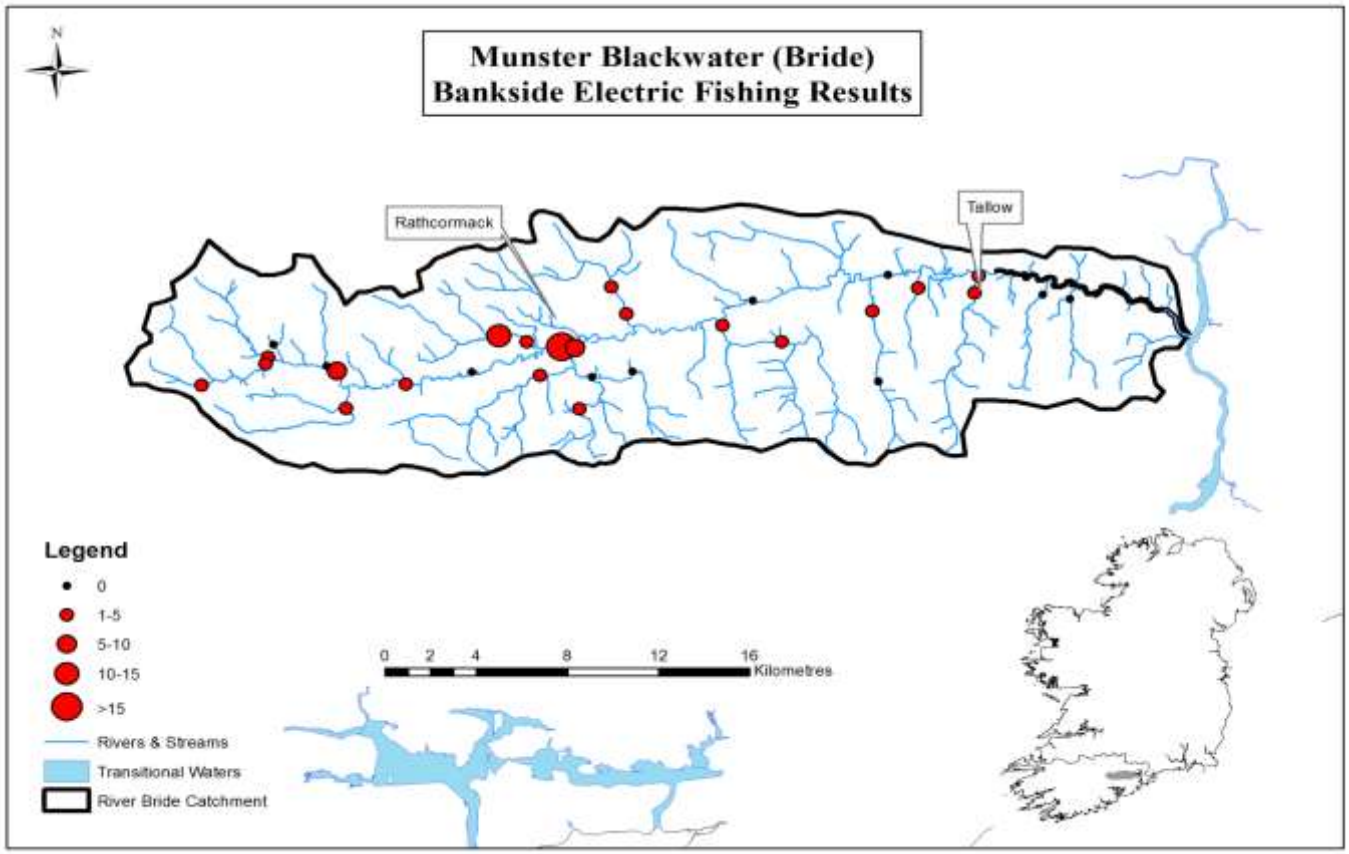


Figure 6-21: Results of semi-quantitative (Bankside) electric-fishing sites sampled on Bride catchment, 2015. (Inset: Map of Ireland with Bride catchment (shaded) and South Western River Basin District (outlined)).

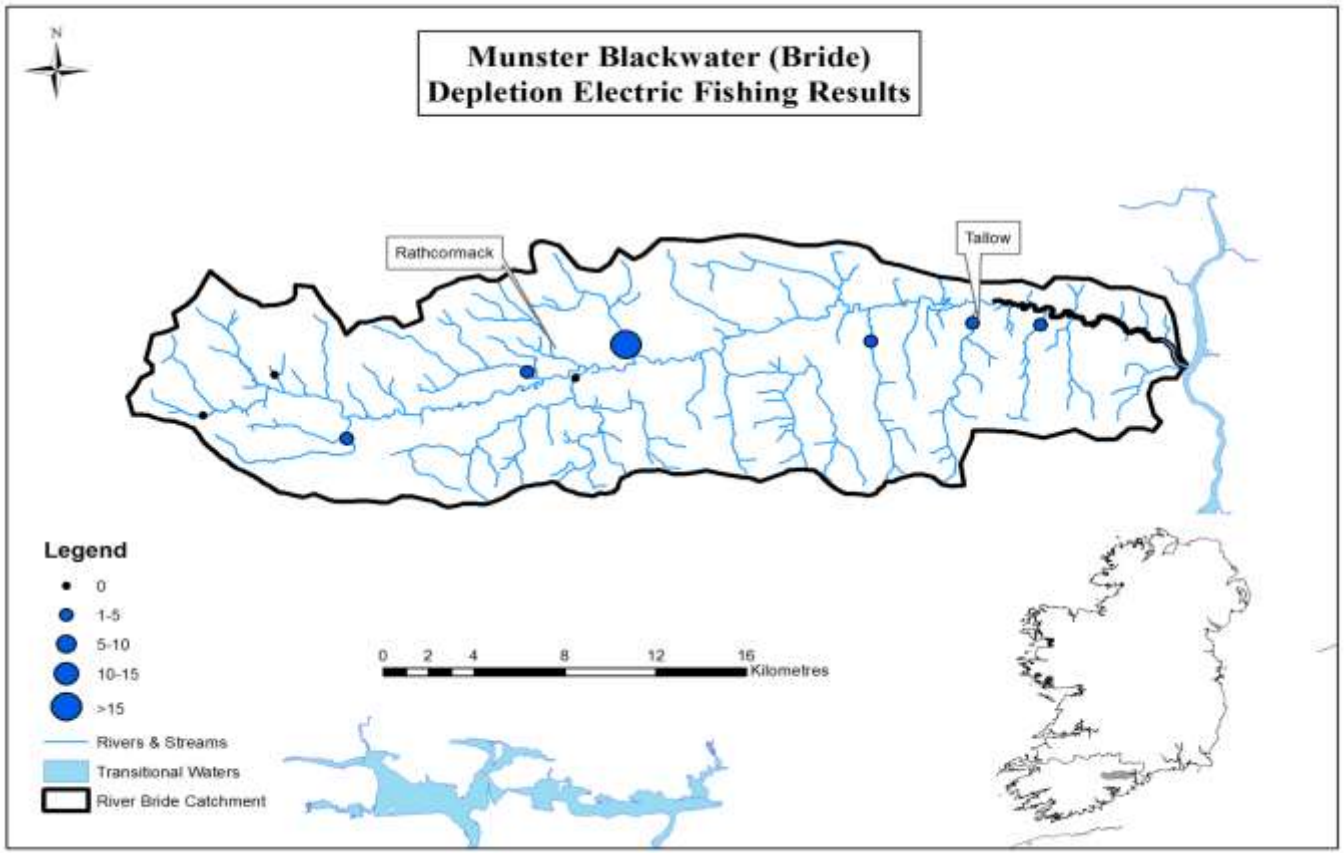


Figure 6-22: Results of quantitative (Depletion) electric-fishing sites sampled on Bride catchment, 2015. (Inset: Map of Ireland with Bride catchment (shaded) and South Western River Basin District (outlined)).

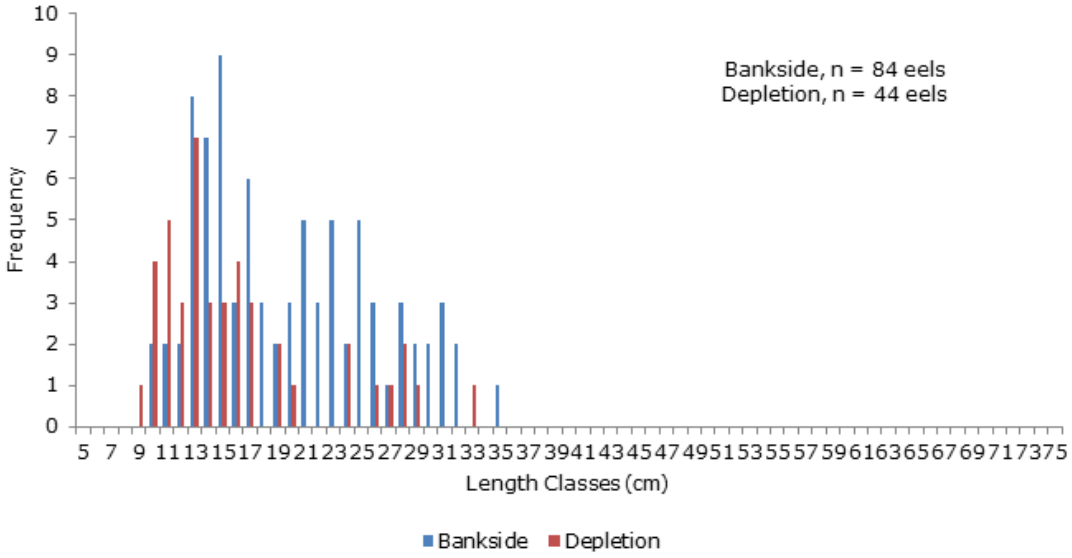


Figure 6-23: Comparison of length frequencies of yellow eels captured at quantitative (depletion) and semi-quantitative (bankside) sites during Bride electric-fishing, 2015.

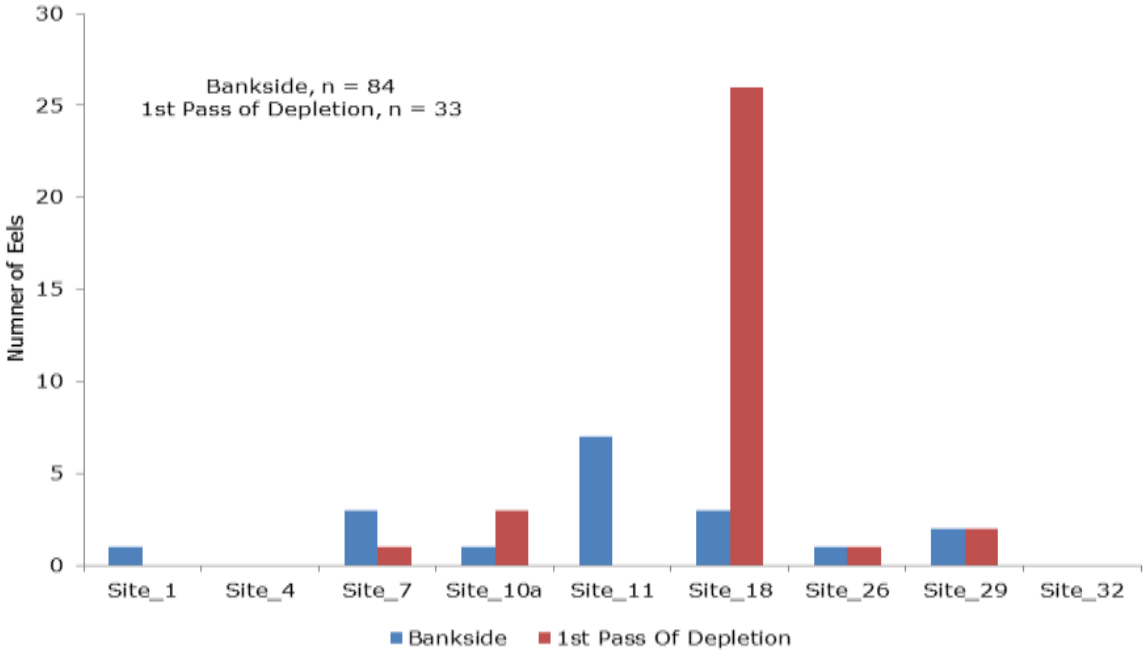


Figure 6-24: Semi-quantitative catches for sites fished using bankside and 1st pass depletion electric-fishing methods on Bride catchment, 2015

6.4.1 Electric-Fishing Summary

The electric-fishing surveys are supplying a lot of detailed information on the distribution of eels within the catchments surveyed. This information is not available without an extensive number of sites covering the area in question, and with those sites being representative of the

catchment. This style of survey is not feasible using the quantitative depletion method due to limiting resources such as time constraints and resources.

The electric-fishing on the Fane catchment (2013) and the Kells Blackwater (2014) have shown that, in catchments with a productive lake body, eels will generally use the main channel as a habitat corridor to the lake. Most eels were captured on the inflows and outflows of Lough Muckno and Lough Ramor, respectively, with very low numbers of eels caught in smaller tributaries and particularly up stream above the lakes themselves. The results from the Bride catchment, have suggested that, when no lake is in evidence, the eel distribution in the catchment is far more uniformly distributed. However, there is a need to repeat this method in more riverine catchments like the Bride, without the potential influence of a lake on the distribution of eels within the catchment.

6.5 Summary: Yellow Eel, 2015

Of the lakes sampled by the EMP in 2015, Lough Inchiquin had the highest CPUE and catch numbers recorded (CPUE of 2.00 with 479 eels caught over 6 nights). These values were comparable with those gained during the previous sampling of this lake in 2011 (CPUE of 2.19 with 543 eels caught over 5 nights). Lough Ballynahinch had low CPUE and catch numbers in comparison to the 2011 sampling (2015; CPUE 0.51 with 123 eels caught over 6 nights; 2011: CPUE of 1.45 with 434 eels caught over 6 nights). Bunaveela Lough also had low CPUE (0.1) and catch with only three eels being caught. This could be due to continuing low recruitment in both catchments. As older silver eels migrate from the system, there has not been substantial recruitment to offset the loss of eel numbers in the lake.

Sacrificed eels were taken at Lough Inchiquin and Lough Ballynahinch (n=197 and 123 eels, respectively). Of these locations, Lough Ballynahinch showed the highest percentage prevalence of *A. crassus* of 86.18% (mean intensity 12.57 parasites per eel). The total parasite count in the sample was 1,332 individual nematode worms. This is a substantial increase from the 2011 sampling of the lake when percentage prevalence was just 13.04% (mean infection intensity 1.00 and the total parasite count was just 12 worms (n = 92 eels)). The 2011 sampling had depicted the eel population in the early stages of anguillicolosis infection, which is now peaking in 2015, as one of the highest % prevalences noted from yellow eels during lake sampling by the EMP to date.

Despite such high parasite loading, the Swimbladder Degenerative Index (SDI) and Length Ratio Index (LRI) for Lough Ballynahinch, demonstrated only slight/moderate damage. This was also noted for the sacrificed eels from Lough Inchiquin. This result supports that of previous years of yellow eel lake sampling in other locations. Palstra *et al.* 2007 noted that severe swimbladder damage and high infection intensities may hamper the ability of the eels to complete migration to spawning grounds. Therefore, the indication is that while parasite prevalences and infection intensities may be variable across Ireland, the damage to eel swimbladders is comparatively low in relation to values from mainland Europe, and suggests that Irish eels maintain relatively healthy swimbladders which should be capable of the long migration.

The electric-fishing carried out this year on the Bride catchment, highlighted the relatively uniform numbers of eels found at sites across the catchment. This distribution of eels is believed to be a result of the completely riverine nature of the catchment (with no single highly productive or high eel density locations within the system such as a lake). The Fane and Kells Blackwater electric-fishing surveys (2013 and 2014, respectively) suggested that riverine eel populations use the main channels of these systems in order to reach the productive lake habitat within the catchments. The results showed that the greatest catches

were on the inflows and outflows the main lakes in the system (i.e. Lough Muckno and Lough Ramor, respectively).

It is believed that within these catchments, eels may have been following chemical and/or biological cues in order to locate the most productive, and/or the most highly eel populated regions. This may explain (for example), the low number of eels captured in some tributaries, despite the presence of suitable habitat and conditions. Eels were instead following the main channels to reach the more highly populated, and largely productive wetted area in the catchments. The highest catches in the Bride catchment (with no lake) were noted near a wastewater treatment plant near Rathcormack. Runoff from the plant during a recent flood may have attracted eels to the area. The bankside electric-fishing approach proved to be useful on small tributaries, with no differences in catch noted between it and the depletion method.

6.6 Water Framework Directive

6.6.1 Introduction

In December 2000, the European Union introduced the Water Framework Directive (WFD) (2000/60/EC) as part of a standard approach for all countries to manage their water resources and to protect aquatic ecosystems. The fundamental objectives of the WFD are to protect and maintain the status of waters that are already of good or high quality, to prevent any further deterioration and to restore all waters that are impaired so that they achieve at least good status by 2015.

A key step in the WFD process is for EU Member States to assess the health of their surface waters through national monitoring programmes. Monitoring of all biological elements including fish is the main tool used to classify the status (high, good, moderate, poor and bad) of each water body. The responsibility for monitoring fish has been assigned to Inland Fisheries Ireland. A national fish stock surveillance monitoring programme has been initiated at specified locations in a 3 year rolling cycle.

6.6.2 WFD Sampling Programme Methods

6.6.2.1 Lakes

Lakes are surveyed between June and September. Standard multi-mesh monofilament survey gill nets were used to sample the fish population. Surface floating nets, "Dutch" fyke nets and benthic braided single panel (62.5 mm mesh knot to knot) gill nets were used to supplement the gillnetting effort. Survey locations were randomly selected using a grid placed over the map of the lake and portable GPS instruments were used to mark the precise location of each net. All nets were set between 3 and 6 pm, fished overnight and lifted between 10.00 am and 12.00 midday in order to ensure that the activity peaks of each fish species were included.

6.6.2.2 Rivers

Electric fishing is the method of choice for WFD surveillance monitoring of fish in rivers to obtain a representative sample of the fish assemblage at each sampling site. The standard methodology includes fish sampling, hydrochemistry sampling, and a physical habitat survey.

A macrophyte survey was also carried out at selected sites. Surveys were carried out between July and early October (to facilitate the capture of 0+ salmonids) when stream and

river flows were moderate to low. Three fishings were carried out in a contained area. In small shallow channels (<0.5 - 0.7 m in depth), a portable (bank based) landing net (anode) connected to a control box and portable generator (bank-based) or electric fishing backpack was used to sample in an upstream direction. In larger deeper channels (>0.5 - 1.5 m), fishing was carried out from flat-bottomed boat(s) in a downstream direction using a generator, control box and a pair of electrodes. All habitats, in wadeable and deeper sections, were sampled (i.e. riffle, glide, pool).

6.6.2.3 Transitional Waters

A multi-method approach is used for sampling the transitional waters. Beach seining using a 30m fine-mesh net is used to capture fish in littoral areas. Beam trawling is used for specified distances (100 – 200 m) in open water areas adjacent to beach seining locations. Fyke nets were set overnight in selected areas adjacent to beach seining locations.

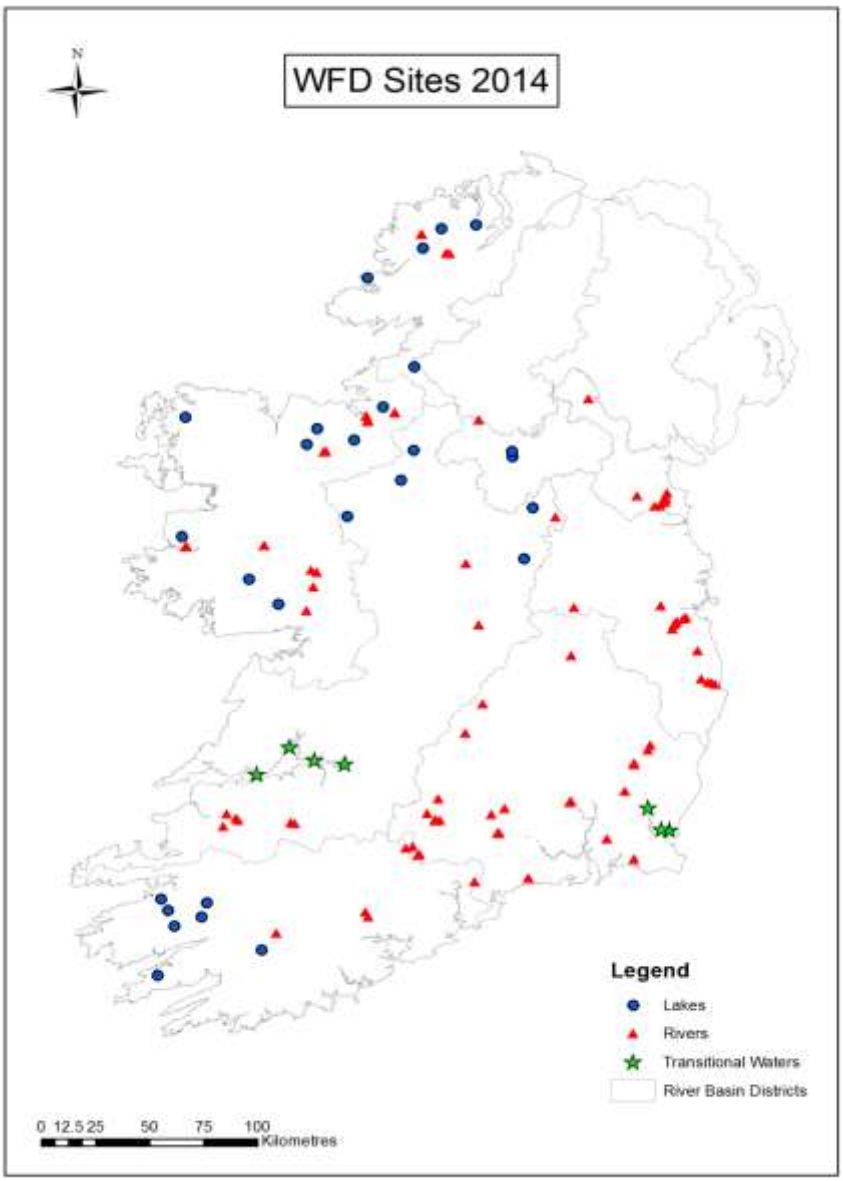


Figure 6-25: Location of WFD survey sites, 2014.

6.6.3 Results 2014

The Water Framework Directive programme works on a 3 year rolling programme. Summary tables detailing the work carried out by the WFD team in 2014 are provided in Appendix 6 (Tables a-1 to a-7). Locations for WFD sampling sites for 2014 surveys are shown for lakes, rivers and transitional waters (Fig. 6.25).

A total of 27 lakes (spanning 24 catchments), were sampled with eels present in 25 sampled lakes (93% of sites). A total of 330 eels were caught during lake surveys. They ranged in length from 8.8 to 87.2 cm (Appendix 6WFD Tables a-1 and a-2). A mean CPUE of 1.46 was found across all lake sites. While the highest CPUE values for eels were found in Lough Barra (Gweebara, CPUE = 6.67) and Lough Fern (Leannan, CPUE = 4.33), the lowest were noted in Lough Allua (Lee, CPUE = 0.33).

A total of 82 river sites (across 26 catchments) were covered in the 2014 surveys. The WFD river sites had a 55% eel presence rate, 75% of sites have ≤5 eels, 11% of sites caught between 5 and 10 eels and 11% had ≥10 eels. A total of 336 eels where caught, ranging from 6.0 to 110.5 cm (Appendix 6 WFD Tables a-3, a-4 and a-5). Densities ranged from 0.00009 to 0.09786 eels per m^2 in the Nore River (Kilmacshane_A) and Mahon River (ENE of Seafield House_A), respectively.

A total of 123 eels were caught in the sampled transitional waters. They ranged in length from 14 to 70 cm. CPUE values for transitional water sites ranged from 0.39 (Slaney Est. Lr) to 11.50 (North Sloblands) (Appendix 6 WFD Tables a-6 and a-7).

Length frequencies for the lake, river and transitional water sites from 2014 sampling are shown in Figures 6.26-6.29, respectively. A peak in the lake length frequency was found for eels of length equal to 40 - 50 cm. The WFD river surveys have supplied vital information on juvenile eels (<30cm) rarely encountered by the fyke net surveys. Length frequency across all river sites revealed a peak frequency for eels at 7 – 12 cm. The peak in transitional water eel length frequencies ranged between 32 and 38 cm.

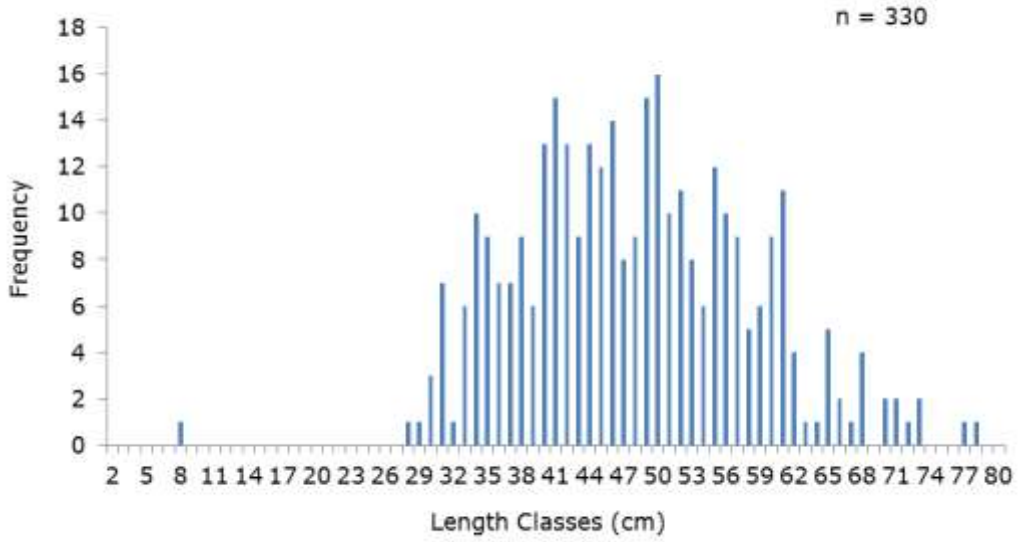


Figure 6-26: Length frequency for WFD lake sites, 2014

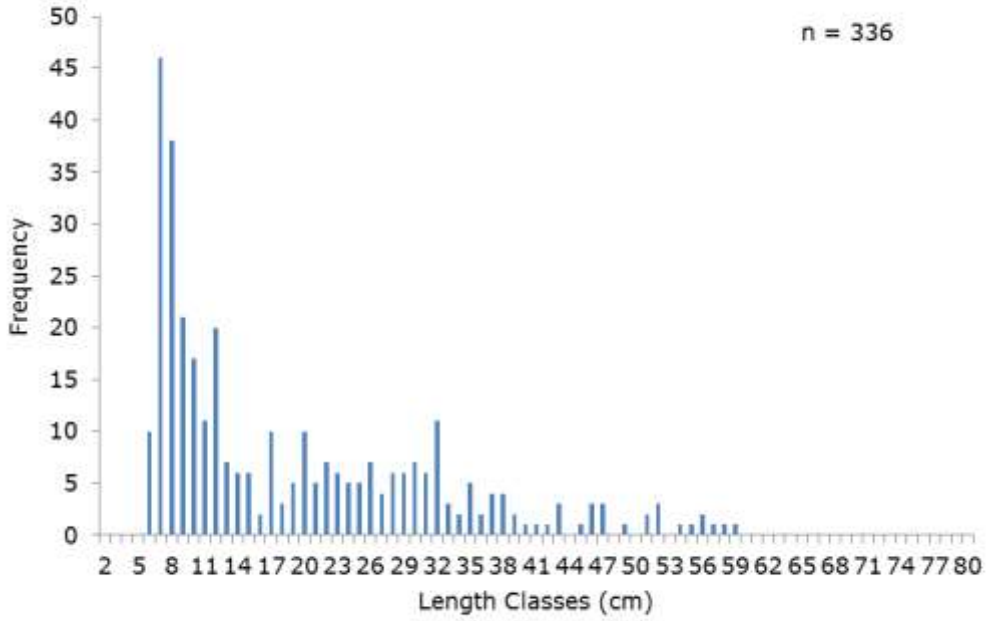


Figure 6-27: Length frequency for WFD river sites, 2014

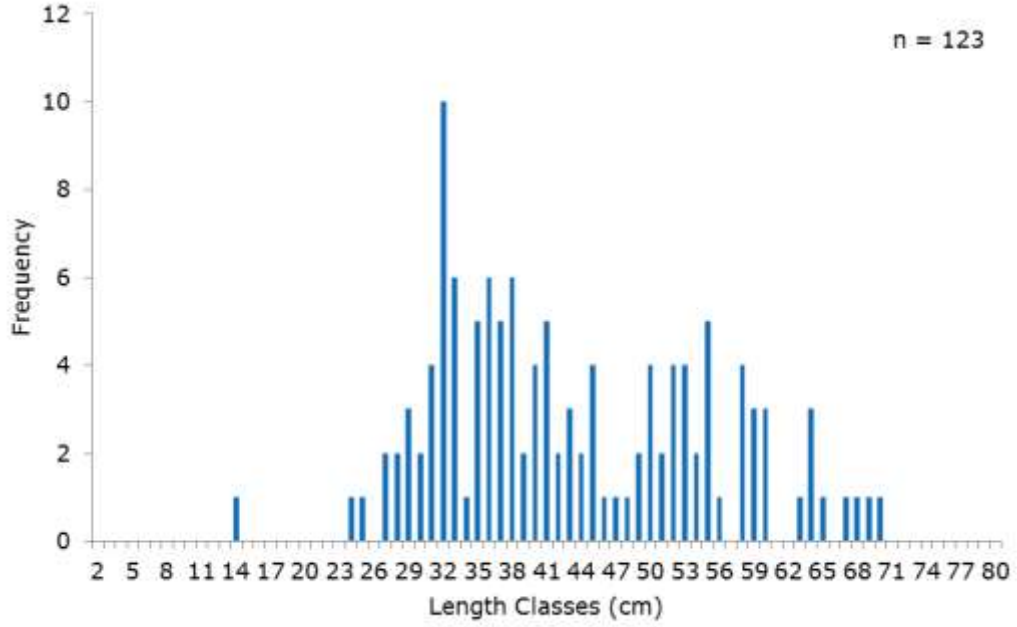


Figure 6-28: Length frequency for WFD transitional water sites, 2014

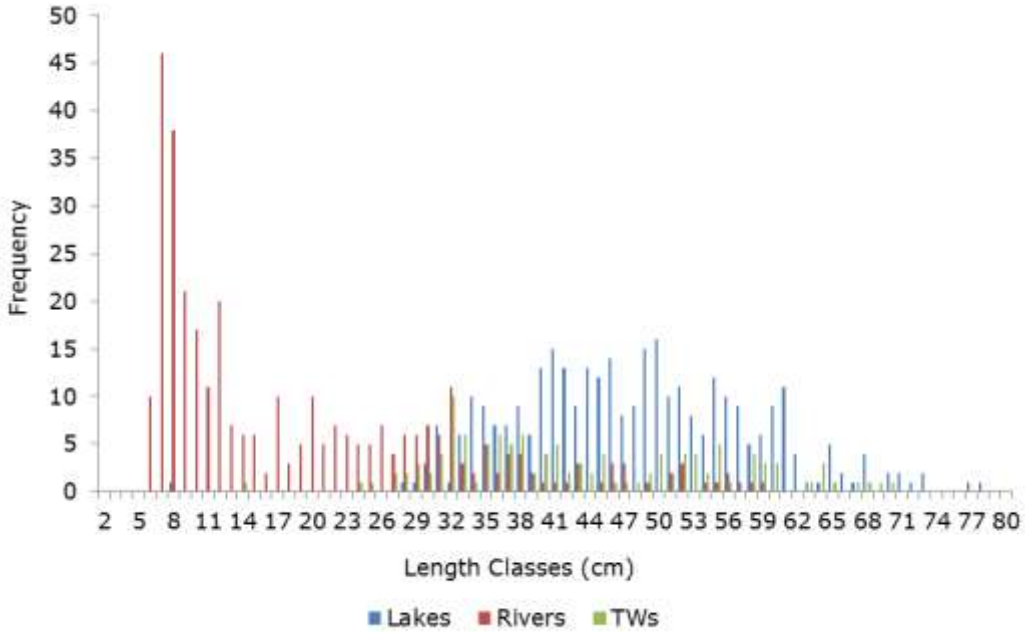


Figure 6-29: Length frequencies for WFD lakes, rivers and transitional water sites, 2014.

7 Recruitment

(refers to Ch. 7.3 of the National EMP Report, 2008)

7.1 Introduction

Changes in recruitment of glass eel / elver to Ireland will partly depend on Europewide management actions and will not provide a resource to directly post-evaluate Irish management actions. However, monitoring of recruitment is critical to evaluating the overall success of the eel regulation and is required by the joint EIFAAC/ICES/GFCM WGEEL for stock assessment. This information is also required to project forward in modelling the recovery in Irish eel stocks.

The monitored sites are shown in Figure 7.1. Long-term recruitment monitoring in fixed ladder traps by ESB of 0+ age glass eel (elvers) has taken place on the Shannon at Ardnacrusha and the Erne at Cathleens Fall, and a partial trap on the Lee at Iniscarra station (since August 2008) and of >0+ age recruits at Parteen on the Shannon. Improvements were carried out at Cathaleens Fall with straw ropes added to the ramps in 2013 and bristle mats in 2014.

Elver monitoring using partial trapping has been taking place on the Feale and the Maigue Rivers since 1994 and in the Inagh River since 1996. The programme was set up in conjunction with ESB through two studies by Trinity College Dublin and National University of Ireland Galway (Reynolds *et al* 1994 and O'Connor 2003). Subsequently the traps were maintained by the Shannon Regional Fishery Board staff and now by IFI-Limerick. Fixed ramp style traps are used at these locations.

The recruitment index data collected is used in Irelands monitoring report to the EU and is also provided to the EIFAAC/ICES/GFCM Eel Working Group where it is analysed and modelled to determine the eel production for Europe. Due to the uncertainty surrounding the glass eel fishery in Europe the Working Group has expressed concerns over this European dataset as there is a risk that a large number of the fishery sites used will be discontinued or the effort will be reduced due to quotas on glass eel catch. The Working Group have highlighted the importance of fishery independent monitoring programmes and have recommended that Member States protect the long term series and set up additional programmes. The elver monitoring programme has been expanded to include locations on the Ballysadare, Corrib and Liffey Rivers as it has proved to be successful in the Shannon RBD. Monitoring of elvers was ceased at two locations due to lack of suitable monitoring sites, (Barrow and Slaney Rivers). At all locations the catch is separated into elvers and yellow eels and batch weighed (Fig. 7.2).

The 2015 elver monitoring program consisted of the six national index catchments: Ballysadare, Corrib, Inagh, Maigue, Feale and the Liffey, locations can be seen on the map below (Fig. 7.1).

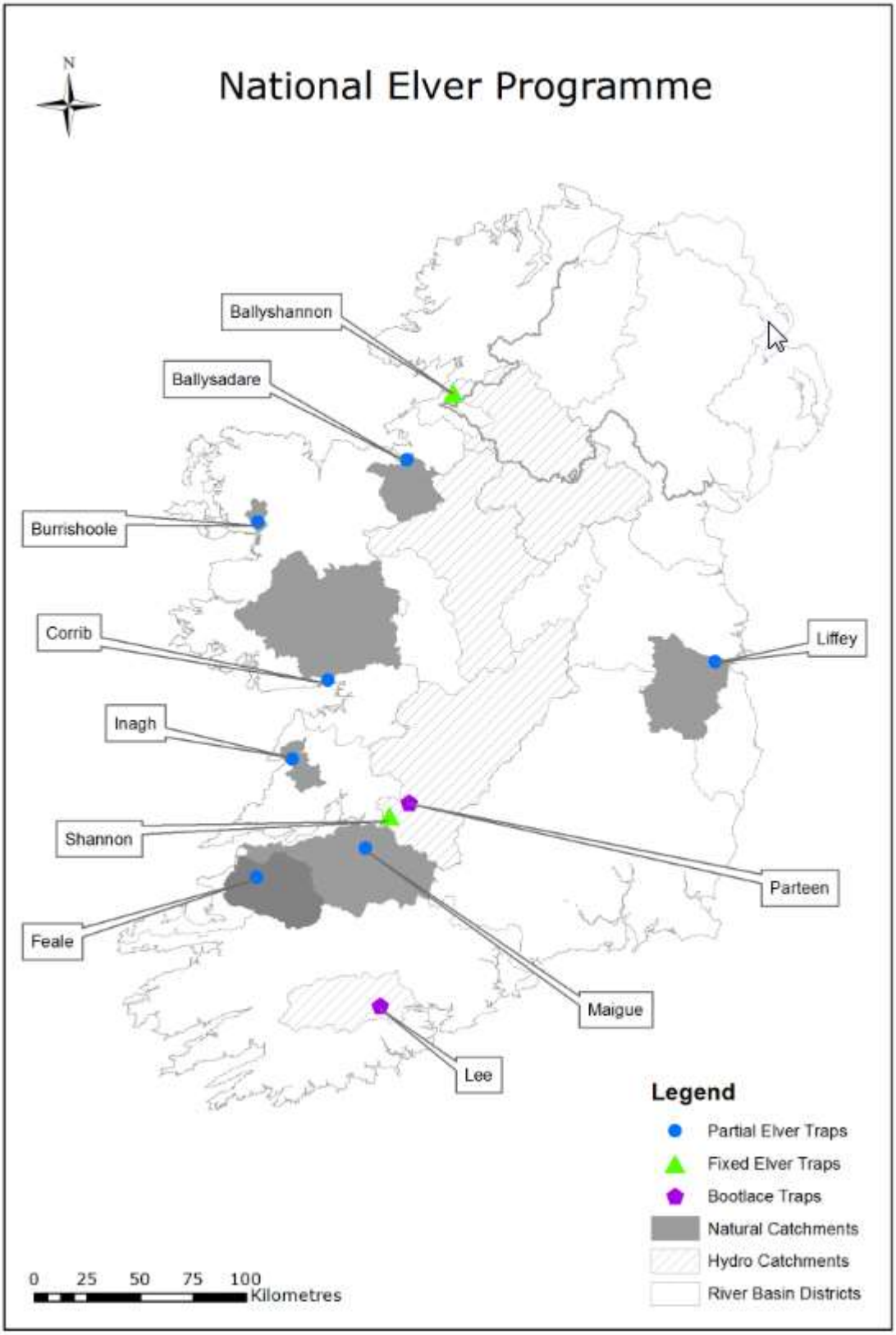


Figure 7-1: Location of recruitment monitoring stations in Ireland.

Figure 7-2: Elvers in the River Maigue, 2014 (Photos: C. O'Leary)

7.2 0+ Recruitment

There is no authorised commercial catch of juvenile eel in Ireland, but some fishing has been authorised in the past under Sec. 18 of the Fisheries Act for enhancement of the fisheries. Catches are made at impassable barriers and this is reported in the relevant Regional Eel Management Plans.

Long-term monitoring of elver migrating at Ardnacrusha (Shannon) and Cathaleen's Fall (Erne) is undertaken in fixed traps by the ESB (Fig. 7.4). In the Erne, recruitment has shown an increase each year since 2011.

Major refurbishment of the elver traps was undertaken in early 2015 and this may have improved the efficiency of the Erne traps thereby likely introducing a discontinuity into the time series. A third new trap was also installed and the data for this trap are being handled and reported separately in order to preserve the original time series.

Data for the Ardnacrusha Shannon trap have been low in recent years.

Long-term monitoring of migrating elvers also takes place at suitable locations where partial traps can be sited on the Feale, Inagh and Maigue Rivers and fishing was also previously undertaken in the Shannon Estuary for glass eels (Tables 7.1-7.2).

All catches reported in Tables 7.1-7.2 were transported upstream within the catchment and restocked. Additional elver monitoring is shown in Table 7.3.

Due to the unseasonal high rainfall during the summer of 2015, some of the trapping sites experienced difficulties with high water levels. High water levels also assisted elvers to cross partial barriers reducing the trapping efficiency at those sites (e.g. Liffey, Ballysadare).

The Ballysadare system has a natural falls acting as a potential barrier to elvers accessing the upstream reaches of the system. The elver migration is monitored by placing a fixed ramp trap in the fish pass which elvers utilise to ascend upstream. In 2015, due to high summer flows, the fish pass experienced longer periods of high water levels than usual. No elvers were captured within the trap. However, elvers were observed at times in the system throughout the monitoring period, particularly during the warm weather in April in the fish pass.

On the Corrib, pipe traps (since 2010) have been used in conjunction with a fixed ramp trap (since 2013) in the elver pass to actively monitor the migratory behaviour of elvers at the Galway weir. The traps in 2015 were in operation from the 21st June to the 31st August once the pipe traps indicated that elvers were in the system. During this period a total of 12.3kg of elvers were captured along with 50 yellow eels (Table 7.3).

The Inagh River trap which is located at the falls in Ennistimon was operational from the 24th April to the 31st August. This consisted of a fixed ramp trap. A total catch of 20kg elvers and

4.8kg of yellow eels was recorded. During the sampling season there were a number of incidents where the trap had been interfered with usually by removal of the bag holding the elvers.

The Maigue River monitoring consists of two fixed ramp traps, one at each river bank just above the crump weir at Adare Manor. Both traps were in operation from the 12th June to the 31st August. During a flood event in early June one of the traps was washed away, it was replaced within 24hrs when water levels allowed. A total catch of 15kg of elvers and 0.164kg of yellow eel was recorded.

The Feale River trap which is located at Listowel was operational from the 22nd March to the 31st August. It consisted of a single fixed ramp trap. A total of 2.5kg was captured; this consisted of 18 glass eels, 1,468 elvers and 471 yellow eels.

The Liffey River trap which is located at the Islandbridge weir was in operation from the 4th June to the 31st August. The IFI trap captured a total of 629 elvers, the majority (415) were captured in August and the least in June (3).

The weather in spring (March to May) leading up to the main sampling period of 1st June to 21st August was a spring where rainfall values were mainly on or above Met Eireanns Long-Term Averages (LTA), with mean air temperatures all below average for the time of year (Met Eireann 2015). This led into a very cool summer (June to August) with temperatures during the monitoring season recorded as below average. Rainfall was recorded as above average, with the south experiencing the wettest weather, however there were some short dry spells recorded particularly in Dublin between June 6th to 26th (Met Eireann 2015).

The environmental conditions (high discharge and low water temperatures) around the elver season may have resulted in a delay in the timing of the elvers migration from the estuaries into freshwater. The elver migration season extends from April to August, with migration influenced by water temperature and river discharge. White and Knights reported not catching juveniles eels in any numbers until temperatures rose above 15-16°C in mid-June /early July, peaking at temperatures of >20°C.

The Feale was particularly affected by a number of flood events in 2015, which occurred throughout May and the start of the first week in June as can been seen in Fig. 7.3, with water levels regularly above 0.6 metres and reaching a high of 1.7 metres. Elvers may not actively migrate upstream during periods of high and fast water which might account for the low numbers recorded and the time during which they were trapped coincided with the falling and low flows in June (Fig. 7.4).

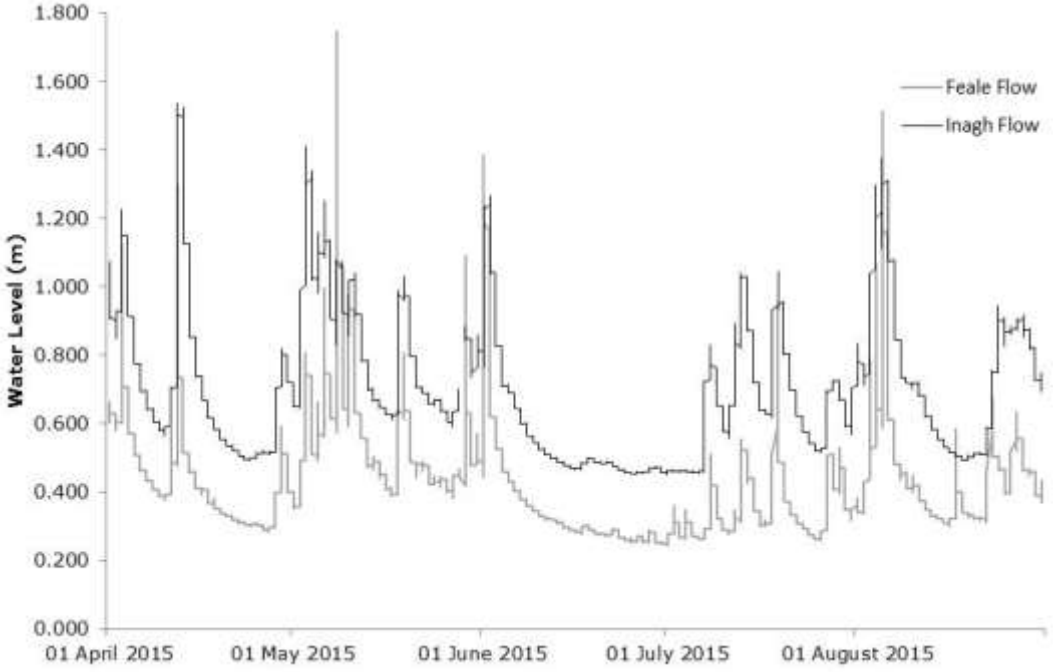


Figure 7-3: Graph displaying the water levels on the Feale and Inagh rivers during the elver monitoring season

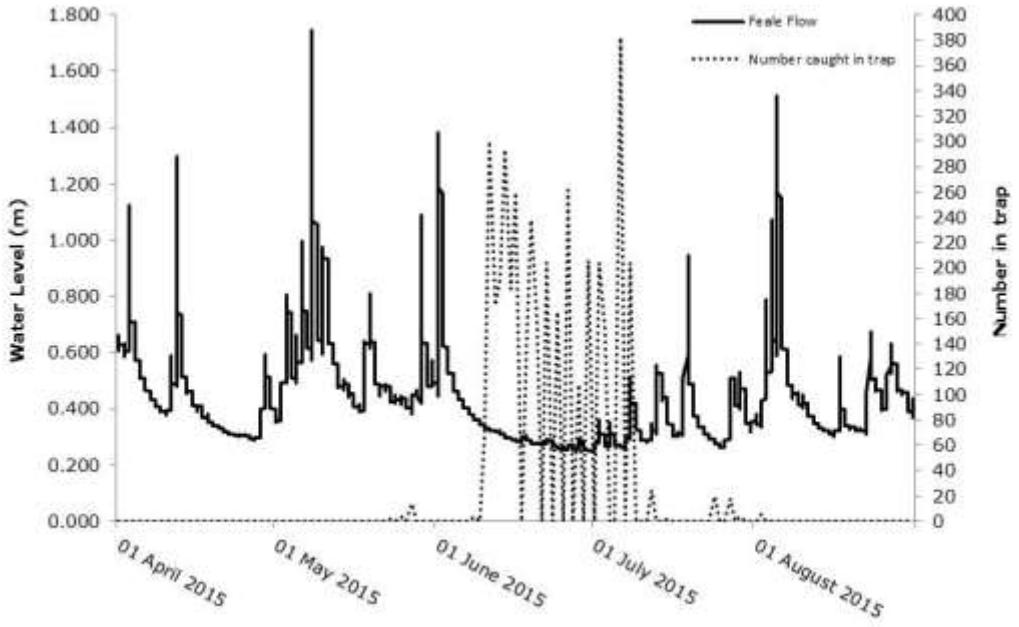


Figure 7-4: Graph displaying water levels on the Feale and the number and time which glass eels/elvers were trapped in the system

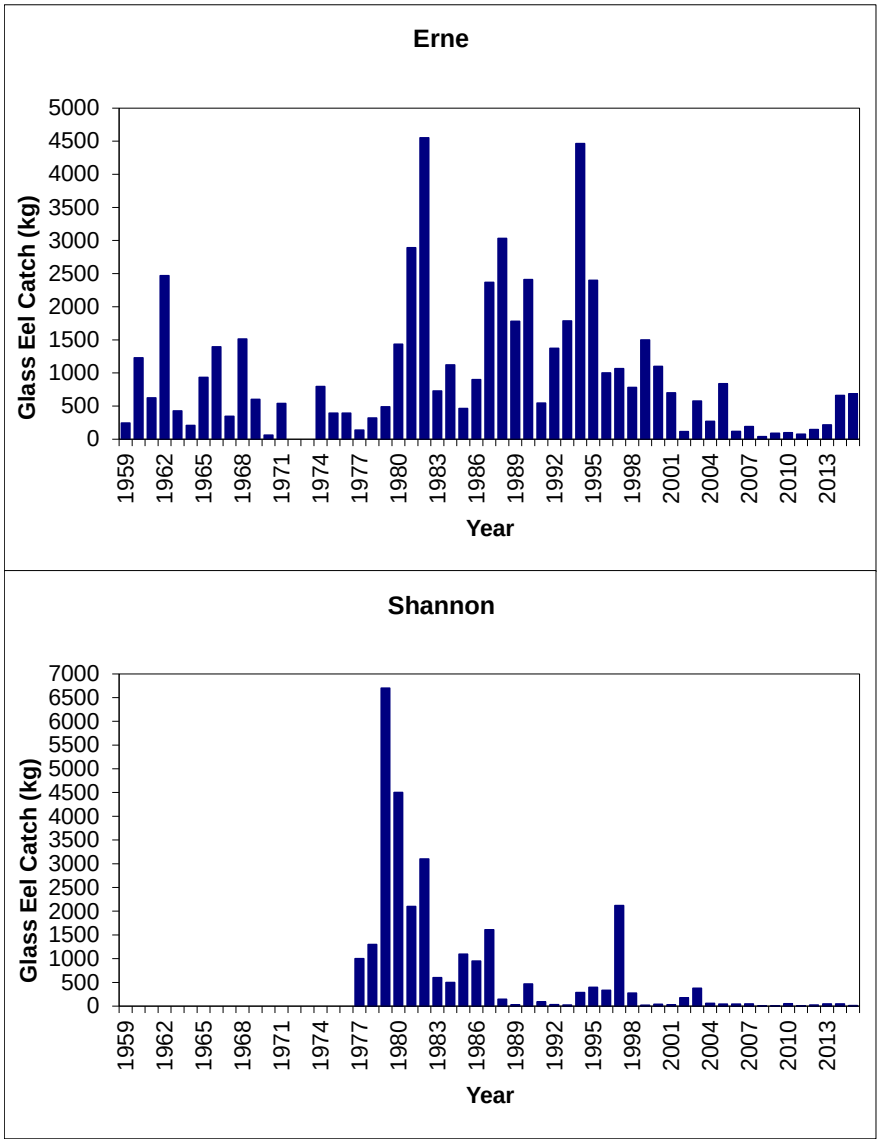


Figure 7-5: Annual elver catches (t) in the traps at Ardnacrusha (Shannon) and Cathaleen's Falls (Erne) – data from ESB. Full trapping of elvers took place on the Erne from 1980 onwards.

Table 7-1: Annual elver catches (kg) in the fixed traps at Ardnacrusha (Shannon) and Cathaleen's Fall (Erne).

Year	Erne (kg)	Shannon (kg)	Year	Erne (kg)	Shannon (kg)
1952			1984	1121	500
1953			1985	463	1093
1954			1986	898	948
1955			1987	2367	1610
1956			1988	3033	145
1957			1989	1781	27
1958			1990	2409	467
1959	244		1991	546	90
1960	1229		1992	1371	32
1961	625		1993	1785	24
1962	2469		1994	4463	287
1963	426		1995	2400	398
1964	208		1996	1000	332
1965	932		1997	1065	2120
1966	1394		1998	782	275
1967	345		1999	1500	18
1968	1512		2000	1100	39
1969	600		2001	699	27
1970	60		2002	113	178
1971	540		2003	576	378
1972			2004	269	58
1973			2005	838	41
1974	794		2006	118	42
1975	392		2007	189	45
1976	394		2008	39	7
1977	138	1000	2009	88	8
1978	320	1300	2010	97	50
1979	488	6700	2011	74	7
1980	1434	4500	2012	146	23
1981	2892	2100	2013	215	47
1982	4550	3100	2014	659	45
1983	728	600	2015	686	11

Table 7-2: Recruitment catches (kg), 1985 to 2015 (blanks = not fished) at partial trapping sites. These are often of mixed glass eel and young yellow eel.

Year	Erne Estuary	Moy Estuary	R Feale	R Maigue	Inagh R	Sh. Estuary Glass Eels	R. Liffey Fish Pass	R. Liffey Weir
1985			503					
1986								
1987								
1988								
1989								
1990								
1991								
1992								
1993								
1994			70	14				
1995			0	194				
1996			0	34	140			
1997			407	467	188	616		
1998	46		81	8	11	484		
1999	441		135	0	0	416		
2000	188		174	0	120	43		
2001		13	58	2	18	1		
2002		21	116	5		37		
2003		36	36	72	111	147		
2004		0	0	0	24	1		
2005		14	0	1	0	41		
2006		0	1	0	4	3		
2007		0	0	0	39	12		
2008		0	0	0	83	2		
2009		1	42					
2010		7	20	3	1.3	3		
2011		0	5	5	8			
2012		0	55		*		0.5	0.2
2013			68	14	43		1.1	2.7
2014			5	29**	40		0.3	0.3
2015			3	15	25		0.2	0.2

* trap flooded, ** partial trapping effort to avoid mortality due to large run

Table 7-3: Recruitment data from IFI & MI traps. Glass eel/elver and yellow eels are separated. ° elvers and yellow eels were not separated during weighing)

Location	Year	Total Wt. Elvers (kg)	Est. No. Elvers	Av Wt. Elver (g)	Total Wt. Yellow Eels (kg)	Est. Nos Yellow Eels	Av. Wt. Yellow Eel (g)
Ballysadare	2013	0.924	2,640	0.35	4.612	1,005	4.59
	2014	0.842	2,148	0.35	0.873	203	4.51
	2015	0	0		0	0	
Corrib pipe trap	2010	29.696	95,254	0.33	7.401	728	9.83
	2011	4.189	11,970	0.35	24.493	3,244	7.55
	2012	2.383	5,168	0.34	7.487	1,143	8.55
C Ramp and pipe	2013	14.260	42,064	0.34	12.520	2,149	5.41
Corrib Ramp trap	2013*	10.168	29,994	0.34	0	0	-
	2014	2.891	8,998	0.32	0.374	55	2.46
	2015	12.320	38,502	0.32		50	
Feale	2010	20.361	42,161	0.48			
	2011	1.099	3,139	0.35	6.298	834	7.55
	2012	35.975	102,785	0.35	10.860	1,601	5.47
	2013	44.661	71,854	0.62	23.313	6,133	4.31
	2014	3.224	6,466	0.48	1.343	301	4.88
	2015	0.712	1,468	0.46	1.90	471	4.57
Inagh	2010	1.417	2,931	0.5			
	2011	8.168	23,338	0.35	7.134	945	7.55
	2012	*	*	*	*	*	*
	2013	31.069	88,641	0.35	12.581	4,089	3.07
	2014	34.894	90,153	0.39	4.690	1,152	4.25
	2015	20.131	67,132	0.3	4.775	1,582	2.98
Liffey Weir	2012	0.213	608	0.35	-	-	-
	2013	2.742	7,849	0.35	-	-	-
	2014	0.285°	746				
	2015	0.270°	629	0.43			
Liffey Fish Pass	2012	0.454	1,298	0.35	-	-	-
	2013	1.144	3,359	0.36			
	2014	0.311	1,402	0.231		4	
	2015	0.159	690			0	
Maigue	2010	2.772	5,650	0.42	-	-	-
	2011	5.061	13,678	0.37	0.054	7	7.55
	2012	*	*	*	*	*	*
	2013	14.032	39,665	0.35	0.019	3	6.4
	2014	29.020	78,042	0.37	-	-	-
	2015	15.050	40,229	0.37	0.173	20	8.69
Burrishoole	2010	0.094	159	0.59	-	-	-
	2011	0.084	195	0.43	-	-	-
	2012	0.050	126	0.42	-	-	-
	2013	0.393	1062	0.37	-	-	-
	2014	2.000	3846	0.52	-	-	-
	2015	0.302	719	0.40	-	-	-

7.2.1 Elver Length Frequency, Pigmentation and Age Structure

In order to investigate the age of the elvers caught in the ramp traps a number of elvers and yellow eels were retained for age structure analysis from five of the monitoring locations (Corrib, Inagh, Maigue, Feale & Liffey (Table 7.4)). Are the elvers we see migrating upstream in the spring/summer, recent arrivals 0+ or older 1+ individuals having spent the previous year in the estuaries before starting their upstream migration? The length of each individual elver was recorded and otoliths samples were taken.

Table 7-4: Number of elvers and yellow eels sampled from elver monitoring locations, 2015

Sampling location	Number of elvers sampled	Number of yellow eels sampled
Corrib	51	7
Feale	50	7
Inagh	50	7
Liffey	50	4
Maigue	50	7

Table 7.5 shows the percentage of glass eels in each sample. The Pigmentation Score used was from Elie *et al* 1982 and allocates a score of 1 to 11 to each specimen in a sample (see below). The scoring starts with an unpigmented individual (stage 1/ VA) with the subsequent stages slowly developing pigmentation. In the final stages (as individuals reach estuarine/brackish waters) there can be a relatively strong degree of pigmentation present however, these individuals are still considered 'glass eels' with a pigmentation score of 9-10. A score of 11 denotes a fully pigmented specimen and these individuals are considered 'elvers' (resembles an adult eel). The majority of eels caught in the IFI traps are of pigmentation stage 9 – 11. While the percentage of glass eel tends to vary at each site the overall average of 23.8% is very close to the averages recorded during previous work by Russell Poole (Marine Institute) of c. 20%. Therefore, the majority of individuals taken in the June 2015 samples were considered fully pigmented elvers.

Table 7-5: Numbers of pigmented elvers and glass eels from retained samples (after separation of bootlace) from all sites, 2015

Site	Sample Size (n)	Number of Elvers Fully Pigmented	Number of Glass Eel	Percentage Glass Eels in Sample (%)
Inagh	50	42	8	16
Feale	50	35	15	30
Maigue	50	31	19	38
Corrib	51	38	13	25
Liffey	50	45	5	10

The length frequency of the retained elvers from June 2015 is presented in Fig. 7.6. From the graph it is clear that the Liffey sample had the greater numbers of small elvers recorded, while the River Feale sample had some of the largest elvers recorded in the sample after separation from bootlace / yellow eels.

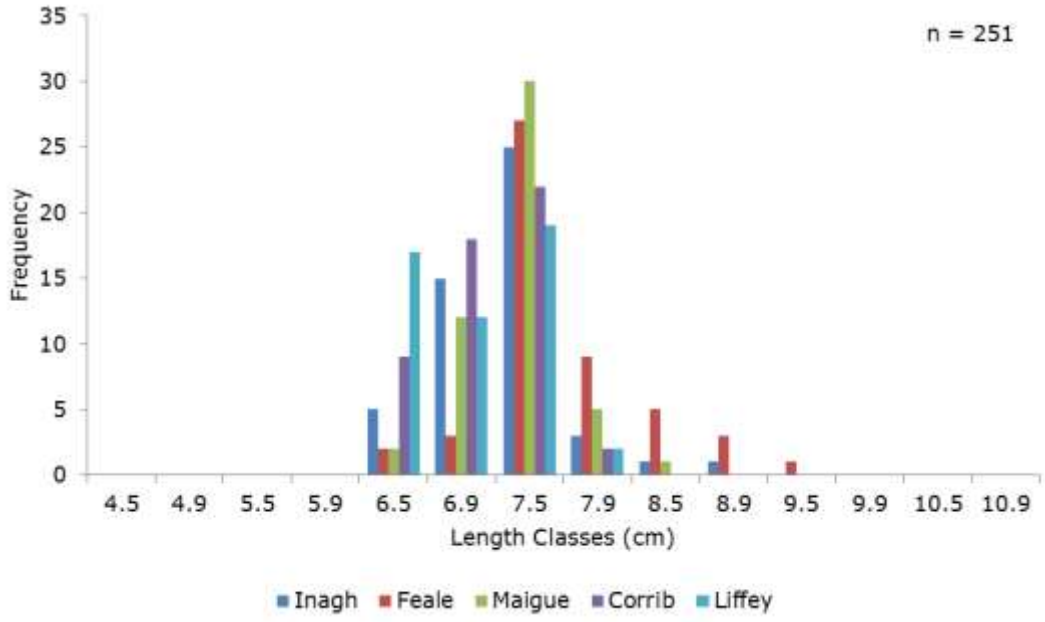


Figure 7-6: Length frequency of retained elvers (after bootlace separation) from all sites, 2015

Pigment Stages		Characteristics
1	VA	No pigment on the head or any part of the body between the dorsal and anal fin origins. Pigment only on the base of the caudal fin (the caudal spot).
2	early VB	No pigment on the back, body or the tail region. Pigment begins on the brain spot. Some rostral pigment.
3	late VB	Pigment is developing further on the head. The skull pigment has formed a completed circle. Rostral pigment doesn't reaches brain spot.The caudal spot begins to grow larger in dorsolateral direction.
4	VIA0	A new pigment stage between VB and VI A1 (Elie et al. 1982). Pigment develops further on the head, the first gill arch and the first pigment is visible from the caudal spot up the back. The end of the stage is limited by pigment on the dorsal surface extending back in line with the anus. Skull pigment has formed a complete circle.
5	early VI A1	Head: Brain spot assumes heart-shape.Rostral pigment reaches brain spot. Body: Development of pigment along the dorsum, postanal dorsolateral pigment. No clear mediolateral pigment. Pigment from he nose spreads back to meet the skull spot and further gill arches become pigmented.
6	late VI A1	Body: Post anal dorsolateral pigment (only surpass the anus a few times). Mediolateral pigment reaches half of the caudal region. Few ventrolateral spots at the end of caudal region. Head: The caudal and brain spot merge in the dorsal area.
7	early VI A2	Dorsolateral pigment stretches between preanal and postdorsal fin. Ventrolateral pigment reaches a third of the caudal region. Post anal development of mediolateral pigment.
8	late VI A2	Melanin increases both in the head and caudal areas. Dorsolateral pigment reaches dorsal fin. Mediolateral pigment reaches the anus fin. Ventrolateral pigment reaches half of the caudal region.
9	VI A3	Head: The brain spot is masked by dorsal pigment. Dorsolateral pigmentation is fully developed and stretches between dorsal and pectoral fins. Pre-anal mediolateral pigment develops. Ventrolateral pigment reaches the anus.
10	VI A4	Head: Melanin spots on nasal tubes. Pigment over upper jaw. Body: Pigmentation of anterior region is completed except for ventral part (incomplete melanin deposit). Myosepta are visible over all body. Dorsolateral pigment myosepta and intermyosepta stretches between pectorals and dorsal fin.
11	VI B	Elver resembles an adult eel. Head: Brain spot completed masked. Pigment rows along the myosepta becoming indistinct. Lateral line still recognisable, as are the individual melanophores on the head, behind and below the eyes and lower jaw.

7.2.2 Summary

The ICES 2015 working group reported that annual recruitment of glass eel to European waters in 2015 decreased compared to 2014 from 12.2% to 8.4% in the 'Elsewhere Europe' series. This follows three years when an increase in recruitment was recorded (2012, 2013 and 2014). In Ireland, recruitment for the 2015 season indicated that there was a general decrease in the recruitment levels to Ireland in 2015 compared to 2014. Regular high water level patterns in Ireland in 2015 may have also reduced the trapping efficiency at some locations. The Erne was the only location to show an increase but it should be noted that this site also received considerable refurbishment of the traps.

7.3 Elver Trap Updates (Recommendations)

In 2015, the process to start upgrading the traditional temporary wooden ramp traps (Fig. 7.7) with a more permanent and durable carbon fibre structure commenced. There are trap designs being used in the UK where elvers are stored out of the river in custom built storage containers. This design results in safer conditions for both the elvers and the operators of the traps as it negates the need to enter the river to service the traps. Since the introduction of the National Eel Management Plan in 2009 the importance of the recruitment series has increased and it is felt that improvement in the infrastructure of the traps is required in order to comply with best practice protocols when dealing with an endangered species.

The Maigue was chosen as the pilot location for this new type of trap design, due to its potential to catch a large number of elvers in a short period of time. A tender & procurement process was established and the pilot contract awarded to Aquatic Control Enginering LTD (ACE) in the UK on the bases of their extensive previous experience in constructing the new trap design. The trap will be installed before the 2016 monitoring season and its suitability assessed throughout 2016; it is hoped to calibrate any changes to the traps by running both the old and new trap for one season.

Figure 7-7: National elver monitoring traps top l-r: Ballysadare; Inagh; Liffey; bottom l-r: Feale; Corrib and Maigue (Photos: C. O'Leary)

7.4 Young Yellow Eel Recruitment

There is no authorised commercial or recreational catch of juvenile eel in Ireland as glass eel and elver fishing in Ireland is prohibited by law (1959 Fisheries Act, Sec. 173). Fishing for juvenile eel is also prohibited under the conservation bye-laws.

Monitoring of juvenile yellow eel migrating at Parteen Regulating Weir (Shannon) and Inniscarra on the R. Lee takes place using fixed brush traps.

The data for Parteen is presented in Fig. 7.8 and Table 7.6. In 2009 and 2010, due to maintenance work by ESB at the Parteen regulating weir the discharge patterns were less favourable than in 2008. This may partly account for the poor catches recorded in 2009 & 2010. However, catches in the original Parteen hatchery trap continued to decline in 2011, 2012 and 2013. The catch in 2014 was 365kg and in 2015 it was 301.1kg.

A new trap was installed in 2012 on the Shannon at Parteen, on the opposite bank (Co. Clare). The catch was 6.6kg and 6.8kg in 2013 and 7.8kg in 2014. The Co. Clare trap and a new one installed in 2015 near the hatchery (Tipperary), trapped 26.95kg in 2015.

In 2010, less than one kg was recorded in the Inniscarra trap on the River Lee and in 2011, 48kg were recorded. The catch has declined since 2011 with only 0.6kg recorded in 2014 and 0.94kg in 2015.

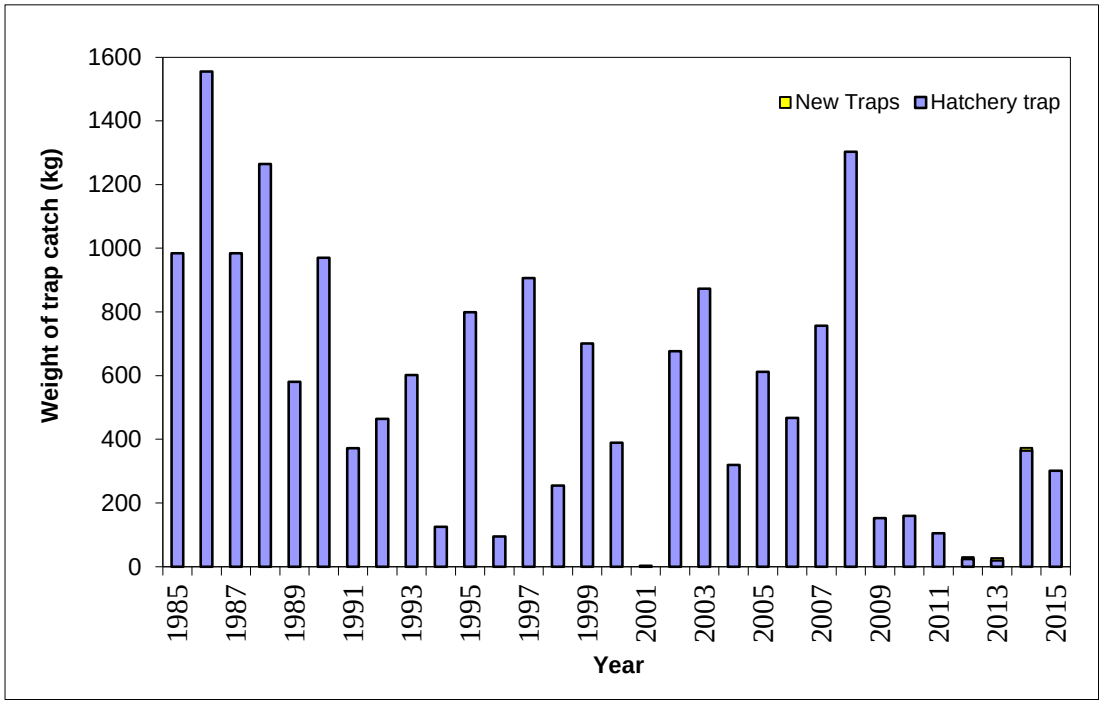


Figure 7-8: Juvenile yellow eel catches (kg) at Parteen Weir, 1985 to 2015. From 2012, a second trap was installed on the opposite bank (Clare) and in 2015 near the hatchery (Tipperary) and these data are included in the graph as separate bars.

Table 7-6: Juvenile yellow eel catches (kg), 1985 to 2015.

Year	Shannon Parteen hatchery	Shannon Parteen 2 New traps	Lee Inniscarra
1985	984		
1986	1555		
1987	984		
1988	1265		
1989	581		
1990	970		
1991	372		
1992	464		
1993	602		
1994	125		
1995	799		
1996	95		
1997	906		
1998	255		
1999	701		
2000	389		
2001	3		
2002	677		
2003	873		
2004	320		
2005	612		
2006	467		
2007	757		
2008	1303		
2009	153		
2010	159.5		1
2011	104.5		48
2012	23.9	6.6	23.8
2013	20.3	6.8	5
2014	365.3	7.8	0.6
2015	301.1	26.95	0.94

8 References

Baldwin, L. and Aprahamian, M. (2011). An evaluation of electric fishing for assessment of resident eel in rivers. *Fisheries Research,* Vol 123 – 124, pp 4-8.

Beaumont, W. R. C.; Taylor, A. A. L.; Lee, M. J. and Welton, J. S. (2002). Guidelines for Electric Fishing Best Practice. R&D Technical Report, W2-054/TR.

Bradley, C. et al., (2015). Water Quality in Ireland 2010-2012. 170 pp. Environmental Protection Agency, Wexford. http://www.epa.ie/pubs/reports/water/waterqua/waterqualityinireland2010-2012report.html

Broad, T. L.; Townsend, C. R.; Closs, G. P. and Jellyman, D. J. (2001). Microhabitat use by longfin eels in New Zealand streams with contrasting riparian vegetation. *Journal of Fish Biology,* 59: 1385- 1400.

Christensen, J.M. (1964). Burning of otoliths, a technique for age determination of soles and other fish. *Journal du Conseil Permanent International pour l'Exploration de la Mer*, **29**: 73-81.

DCENR (2007). Guidelines on the Planning, Design, Construction and Operation of small-scale hydro-electric schemes and fisheries. October 2007.; 52pp.

Dekker W., Pawson M., Walker A., Rosell R., Evans D., Briand C., Castelnaud G., Lambert P., Beaulaton L., Åström M., Wickström H., Poole R., McCarthy T.K., Blaszkowski M., de Leo G. and Bevacqua D. (2006). Report of FP6-project FP6-022488, Restoration of the European eel population; pilot studies for a scientific framework in support of sustainable management: SLIME. 19 pp. + CD.

Graynoth, E. (1999). Improved otolith preparation, ageing and back-calculation techniques for New Zealand freshwater eels. *Fisheries Research* 42: 137-146.

Hu, L.C., Todd, P.R., (1981). An improved technique for preparing eel otoliths for aging. *New Zealand J. Mar. Freshw. Res*. **15**, 445 -446.

ICES (2007). Report of the 2007 session of the joint EIFAC/ICES Working Group on Eels. Bordeaux, France from 3 – 7 September 2007. EIFAC Occasional Paper. No. 39. ICES CM 2007/ACFM: 23. Rome, FAO/Copenhagen, ICES. 2008. 138p.

ICES, (2009) Report of the 2009 session of the Joint EIFAC/ICES Working Group on Eels. Göteborg, Sweden, from 7 to 12 September 2009. EIFAC Occasional Paper. No. 45. ICES CM 2009/ACOM:15. Rome, FAO/Copenhagen, ICES. 2010. 540p. (Online).

IFI. 2014. Annual Report. 77 pp. Inland Fisheries Ireland, Dublin, Ireland.

Imbert, H.; de Lavergne, S.; Gayou, F.; Rigaud, C. and Lambert, P. (2008) Evaluation of relative distance as new descriptor of yellow Eureopean eel spatial distribution. *Ecology of Freshw. Fish* 17:520 – 527.

Kelly, F.L., Connor, L., Matson, R., Feeney, R., Morrissey, E., Coyne, J. and Rocks, K. (2015). Sampling Fish for the Water Framework Directive - Summary Report 2014. 132 pp. Inland Fisheries Ireland, Citywest Business Campus, Dublin 24, Ireland. http://wfdfish.ie/wp-content/uploads/2010/05/WFD_Report_2014_FINAL.pdf

Kruse, C. G.; Hubert, W. A. and Rahel, F. J. (1998). Single-pass electrofishing predicts Trout abundance in Mountain Streams with Sparse Habitat. *N. American Journal of Fisheries Management,* 18: 940-946.

Kuwahara, A.; Niimi, H. and Itagaki, H. (1974). Studies on a nematode parasitic in the air bladder of the eel I. Descriptions of *Anguillicola crassus* n. sp. (Philometridea, Anguillicolidae). *Japanese Journal for Parasitology* 23 (5): 275–279.

Laffaille, P.; Briand, C.; Fatin, D.; Lafage, D. and Lasne, E. (2005). Point sampling the abundance of European eel (*Anguilla anguilla*) in freshwater areas. *Arch. Hydrobiol.*, 162 (1); 91-98.

Lasne, E. and Laffaille, P. (2008). Analysis of distribution patterns of yellow European eels in the Loire catchment using logistic models based on presence-absence of different size –classes. *Ecol. Freshwater Fish*: 17:30-37.

Lefebvre, F., Contournet, P., Priour, F., Soulas, O. & Crivelli, A. J. (2002). Spatial and temporal variation in Anguillicola crassus counts: results of a 4 year survey of eels in Mediterranean lagoons. *Diseases of Aquatic Organisms* **50**, 181-188.

MacNamara, R. & McCarthy, T.K. (2013). Silver eel (*Anguilla anguilla*) population dynamics and production in the River Shannon, Ireland, Ecology of Freshwater Fish **23** (2), 181-192.

McCarthy, T.K., Nowak, D., Grennan, J., Bateman, A., Conneely, B. & MacNamara, R. (2014). Spawner escapement of European eel (*Anguilla anguilla*) from the River Erne, Ireland. *Ecology of Freshwater Fish* **23** (1), 21-32.

Mitro, M. G. and Zale, A. V. (2000). Predicting fish abundance using single-pass removal sampling. *Canadian Journal of Fisheries and Aquatic Sciences*, 57 (5)951-961

Molnár, K., Baska, F., Csaba, G. Y., Glávits, R., Székely, C. S. (1993). Pathological and histopathological studies of the swimbladder of eels (*Anguilla anguilla*) infected with Anguillicola crassus (Nematoda: Dracunculoidea). *Diseases of aquatic organisms* **15**, 41-50.

Moriarty, C., (1983). Age determination and growth rates of eels Anguilla anguilla (L). *J. Fish. Biol*. **23**, 257 - 264.

NIEA 2015. North Western River Basin Management Plan Summary. 75pp. NIEA, Lisburn, Northern Ireland. https://www.doeni.gov.uk/sites/default/files/publications/doe/water-report-north-western-river-basin-plan-2015.pdf

O'Connor, W. (2003) Biology and Management of European Eel (Anguilla anguilla, L) in the Shannon Estuary, Ireland. PhD thesis, National University of Ireland, Galway, March 2003. Online version, March 2014,European Eel Consultancy, www.EuropeanEel.com.

Palstra, A., Heppener, D. F. M., Van Ginneken, V. J. T., Székely, C. & Van den Thillart, G. E. E. J. M. (2007). Swimming performance of silver eels is severely impaired by the swim-bladder parasite *Anguillicola crassus*. *Journal of Experimental Marine Biology and Ecology* **352**, 244-256.

Poole, W.R. (1994). A population study of the European Eel (*Anguilla anguilla* (L.)) in the Burrishoole System, Ireland, with special reference to growth and movement. *PhD, Dublin University*; 416pp.

Poole, W.R., Reynolds, J.D.R. & Moriarty, C. (1990). Observations on the silver eel migrations of the Burrishoole river system, Ireland. 1959 to 1988. *Int. Revue Ges Hydrobiol*. **75** (6); 807-815.

Reynolds, J. D.; Donnelly, R.; Molloy, S. and Walsh, T. (1994). ESB Shannon Eel Management Group. River Shannon Glass Eel /Elver Management Programme. Final Report July 1994.

Reid, S. M.; Yunker, G. and Jones, N. E. (2009). Evaluation of single pass backpack electric fishing for stream fish community monitoring. *Fisheries Management and Ecology*, 16: 1-9.

Reid, S. M. (2011). Comparison of point and transect based electrofishing to sample American eel (*Anguilla rostrata*) in wadeable riverine habitats. *Aquatic Living Resources*, 24:79-83.

Richkus, W. A. and Dixon, D. A. (2003). Review of Research and Technology on Passage and Protection of downstream migrating Catadromous eels at hydroelectric facilities. *American Fisheries Soc. Symp*. 33: 377-388.

SSCE (2012). Report on the Status of the Eel Stock in Ireland, 2009-2011. DCENR, 204pp.

SSCE (2015). Report on the Status of the Eel Stock in Ireland, 2012-2015. Annex to the National Report to the European Commission. DCENR, 95pp.

Vehanen, T.; Sutela, T.; Jounela, P.; Huusko, A. and Maki-Petays, A. (2013). Assessing electric fishing sampling effort to estimate stream fish assemblage attributes. *Fisheries Management and Ecology*, 20 (1):10-20.

Walker, A.M., Andonegi, E., Apostolaki, P., Aprahamian, M., Beaulaton, L., Bevacqua, P., Briand, C., Cannas, A., De Eyto, E., Dekker, W., De Leo, G., Diaz, E., Doering-Arjes, P., Fladung, E., Jouanin, C.11, Lambert, P., Poole, R., Oeberst, R. & Schiavina, M. (2011). Report of Studies and Pilot Projects for carrying out the Common Fisheries Policy; LOT 2: Pilot projects to estimate potential and actual escapement of silver eel; POSE. DGMARE Contract: SI2.539598.

Annex 1: Members of the Standing Scientific Eel Committee 2015

The SSCE is comprised of the following representatives:

Dr. Russell Poole (Chair)	Marine Institute
Dr. Paddy Boylan	Loughs Agency
Dr. Denis Doherty	Electric Ireland
Dr. Elvira de Eyto	Marine Institute
Dr. Paddy Gargan	Inland Fisheries Ireland
Dr. Milton Matthews	Inland Fisheries Ireland
Dr. Ciara O'Leary (Secretary)	Inland Fisheries Ireland
Dr. Robert Rosell	Agri-Food & Bioscience Institute, N. Ireland (for issues relating to the transboundary plans)

Invited Contributors – 2015

Dr. Derek Evans	Agri-Food & Bioscience Institute, N. Ireland
Dr. Kieran McCarthy	NUI Galway
Dr. Karen Gaynor	National Parks & Wildlife

Annex 2: Request for Advice on surplus above 40%

IFI Request for Advice

31 July 2015

"IFI would like to request advice from the SSCE in relation to the potential impacts of making eel available for exploitation in the various RBDs that are currently meeting their escapement target (40%). I would welcome your advice on the potential weight of eels (based on RBD portion of historic national catch or other factors) that could be exploited in each RBD and an estimate of the potential impacts of taking such catches of eels on the future of the RBD meeting it's escapement target. Advice is also sought on the number of years a fishery might operate in each RBD at various precautionary catch levels before the estimate of current silver eel production was to drop below the EU target. This request should not be interpreted as a potential opening of the eel fishery."

International ICES Advice

- There has been no change in the scientific perception of the status of the total eel stock since the 2012 review: it remains critical and urgent action is needed to prevent further depletion of the stock.
- ICES advises that all anthropogenic mortality (e.g. recreational and commercial fishing, hydropower, pumping stations, and pollution) affecting production and escapement of silver eels should be reduced to – or kept as close to – zero as possible.
- Over the last 3 years, glass eel recruitment has increased from historical lows to 12% of the 1960-1979 level in the Atlantic region and to 4% in the North Sea area. Recruitment is still below these 1960-79 reference levels.
- As eel is a long-lived species and anthropogenic mortalities occur over all of its continental lifespan, the effect of management measures to increase silver eel production and escapement and on subsequent reproduction and recruitment is expected to take several years, if not decades, to be detected. Recovery will be a slow process

Silver eel production and escapement

- The positive effect of the implemented management measures in Ireland and the NWIRBD catchments shared with NI (fishery closure and silver eel trap and transport) can be seen in the current escapements expressed as an average percentage of the historic production (pre 1982) increasing from 25.6% for 2008, to 36.7% for 2009-2011 and 54.5% for the 2012-2014 period. The increase in escapement to 54.5% as a national average for 2012-2014 period takes silver eel output above the EU Regulation target of 40% set to promote recovery of the stock and shows a contribution to international shared stock recovery. This does not mean that the whole stock has recovered to a sustainable level.

SSCE Advice

- While Ireland has reduced its anthropogenic mortality to low levels, it is unlikely that the increase in silver eel biomass in the last three years can be sustained much into the future due to the legacy of poor recruitment due to feed through to silver eel production at least for another decade. Current higher recruitment will only influence exploitable stock levels in a minimum of 8-10 years time. On this basis, it would be risky and contrary to scientific advice to consider the reopening of a fishery at this time.

Note: The SSCE is not currently in a position to provide silver eel production, escapement or 'surplus' advice for eels in transitional (saline) or coastal waters owing to an absence of data on silver eel production.

Potential weight of eels available for a fishery

Introduction

The current assessments are as follows (Irish Report to EU 2015)

Historic Bo $_{pre1982}$	589t
Current production Bbest $_{2012-2014}$	339t
Current (2012-2014) escapement % of Bo	54.5%

The estimate of Bo was based on historic reported landings from 5 index sites and landings reported to the Fisheries Boards, by District. These were raised to account for non-reported licenses and illegal landings (raised by 30%). There is anecdotal evidence to suggest that the level of illegal landings was much higher than 30% but the SSCE has no basis for revising the figure at this time. To raise the illegal landings would lead to a higher Bo estimate, and hence a lower escapement % of Bo. If the anecdotal information is correct, 54.5% escapement would, therefore, represent an overly optimistic value.

The assessments reported in 2015 were based on the best available information at the time. However, silver eel escapement and glass eel recruitment data is sparse, variable and should be used with caution in identifying 'annual eel harvestable surplus' on a catchment by catchment basis, as applies, for example, in the case of salmon. In any event, the European eel is a single panmictic international stock so the concept of individual catchment/RBD surpluses is something of a misnomer in the context of the international stock (see advice above).

Therefore, the SSCE provides this advice on the basis of the Total National assessment (including the NI portion of the NWIRBD). The SSCE also provides advice on the basis of the three RBDs that historically supported yellow eel fisheries in freshwater and are currently above the EU target; the EEMU, the WRBD and the NWIRBD.

The assessment model depends on only a few index catchments (2 of which are impounded) with an extrapolation to the majority of catchments based on growth rate and geology. The Corrib catchment was included as an index in the 2012 assessment, but as the Galway Fishery was closed in 2010, the Corrib was included in the extrapolation for the 2012-2014 assessments (2015). This gives a considerable increase in production (>50t pa.) for the Corrib in the 2015 assessment, which may be real or may be overinflated by the extrapolation.

Other sites fished between 2009 and 2014 (e.g. Mask, Fane, Barrow) have not yet produced robust estimates of silver eel escapement to allow inclusion as index sites in the 2015 assessment.

Noting the previous comments on the critical nature of the stock, the single shared stock and the recruitment decline, providing data on a 'harvestable surplus' and a timeframe before going below the 40% is complex due to the following:

- The post-harvest response in silver eel output of the local stock depends whether the harvest is of yellow (May-August) or silver (Sept-Jan/Feb) eel
- The amount of any harvestable surplus and timeframe over which it is available is dependent on the response of the local stock to the recruitment decline of the last 15 years and the recent increases in recruitment. Local density dependent factors which are difficult to predict will alter the sex ratio and biomass of the stock.
- The history of recruitment decline dominates the analysis presented by driving outputs down.
- There is also an interaction between fisheries mortality, hydropower mortality and the silver eel quantity trapped and transported, with an increase in one putting additional pressures on and changing eel amounts available or subject to the other factors.
- The impact of the harvest of yellow eel is time lagged, spread and cumulative. This means that impact of fishing would not be immediate and is likely to impact on silver eel production over approximately 8 years or more.
- The impact of a silver eel fishery is immediate (within annual cohort) but interferes with the management and assessment of the silver eel trap and transport conservation effort.

Taking into account all of the above, we present the data for 4 options, a 5% and 10% decline in silver eel output due to recruitment, and each of these using the current assessment (2015), and using the current assessment inserting the 2009 Corrib production (conservative approach).

This analysis should be viewed as an exploration of the effects of reopening an eel fishery, in full knowledge of all the caveats presented above and with recognition of the wide margin of error around many of the variables.

We present the above 4 options for a/ the total national stock, including the NI portion of the NWIRBD and, b/ for the 3 RBDs (combined) that historically supported yellow eel fisheries in freshwater and are currently above the EU target; the EEMU, the WRBD and the NWIRBD.

Analysis

1. There was little difference between the biomass estimates for 2014, and those for the 2012-2014 average, so we have used the average values. Conservative values were calculated using the 2009 Corrib figure substituted into the 2015 assessment.

Bo	589t
Bbest $_{2012\text{-}2014}$	339t
Bbest $_{2012\text{-}2014}$ Conservative	289t
%SSB	54.5%
%SSB Conservative	48.9%

2 Hydropower Mortality: An average of 4% mortality per annum was used

3 Hydropower T&T: 50t p.a. was used as a static figure for the Total, & 40t for the 3 EMUs.

4 Yellow Eel to Silver Eel Conversion: Yellow eels grow and natural mortality acts on the stock. Therefore, a 1:1 conversion in biomass was used as growth more or less compensates for natural mortality in the larger eel size classes.

5 Yellow Eel to Silver Eel production: Not all yellow eels in a catch mature and silver in the same year. This yellow eel catch was converted to silver eel over an eight year time period using the following distribution:

Year	1	2	3	4	5	6	7	8
%	0.05	0.1	0.15	0.2	0.2	0.15	0.1	0.05

6 We assumed a 'fishery' commencing in 2016. The situation would change each year thereafter.

7 We assumed a yellow eel 'fishery' for 1, 2 or 3 years, or an annual silver eel 'fishery'

8 We determined the number of years that the local stock would stay above 40%, under the four conditions for 3 scenarios, Scenario A – No fishery, Scenario B - yellow eel fishery and Scenario C – silver eel fishery

9 The biomass of silver eels was determined as a silver eel 'harvestable surplus for the number of years above the 40%. This amount is in addition to the silver eel trapped and transported amount (50t or 40t).

10 There is an inevitable downward trend in silver eel output biomass in response to and lagged from previous recruitment decline. As the analysis was confined to the next 10 years, the increase in recruitment in 2013 and 2014 would be unlikely to have any marked influence on the analysis and was not taken into account.

11 The production forecast models presented in the 2012 report to the EU indicated a drop in silver eel production in the order of 12% for the Erne p.a. and for the Shannon of 15% p.a. after 2016. This current analysis has been presented using a production decline of 5% and 10% p.a. The anticipated decline in production dominates the outputs.

12 Projected current escapement was calculated as follows:

Bcurrent = Bbest(trended) – (fishery + HPS)

Quantity above 40% is presented as the 'Amount' + T&T (of 50t, or 40t)

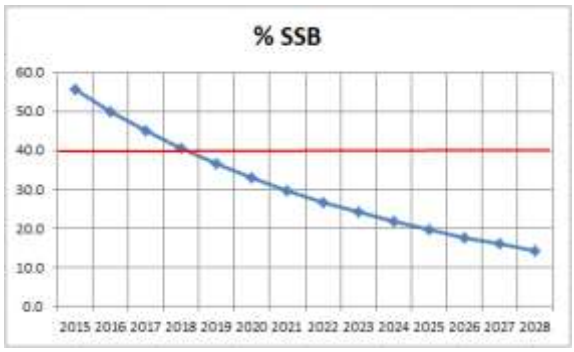
13 Yellow eel reported landings in 2007-2009 from freshwater ranged from 57t to 73.5t, or 38t to 49t not including the Shannon.

14 Silver eel reported landings in 2007-2009 ranged from 34t to 60t, with almost half the catch coming from Killaloe and Galway eel weirs. Killaloe is now engaged in the ESB conservation fishery and Galway weir is condemned as unsafe.

OUTPUT Scenario A - National

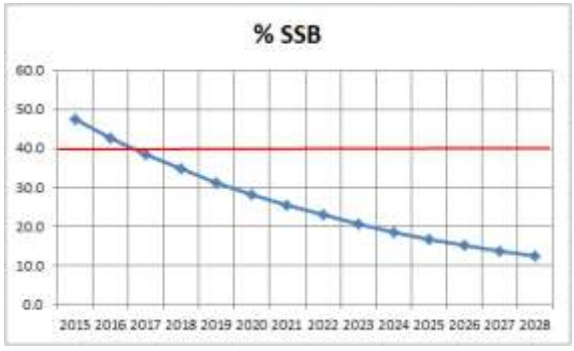
National, No Fishery, 5% Decline

National, No Fishery, 10% Decline



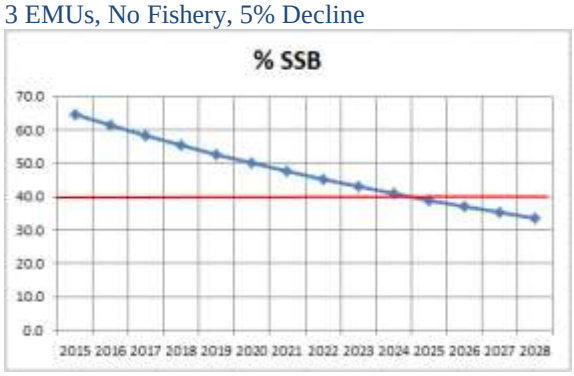
National, No Fishery, 5% Decline, 2009 Corrib

National, No Fishery, 10% Decline, 2009 Corrib



OUTPUT Scenario A – 3 Main EMUs

3 EMUs, No Fishery, 5% Decline



3 EMUs, No Fishery, 10% Decline

3 EMUs, No Fishery, 5% Decline, 2009 Corrib

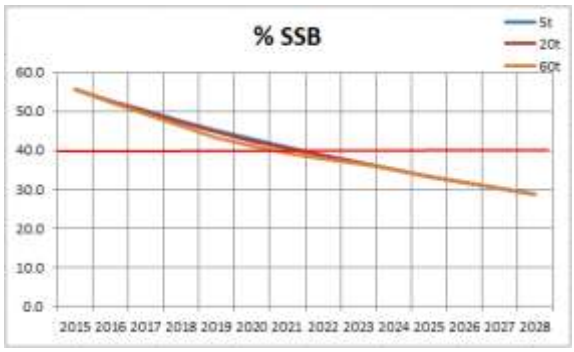
3 EMUs, No Fishery, 10% Decline, 2009 Corrib

Results presented as the number of years for the local stock to remain above 40% with No Fishery

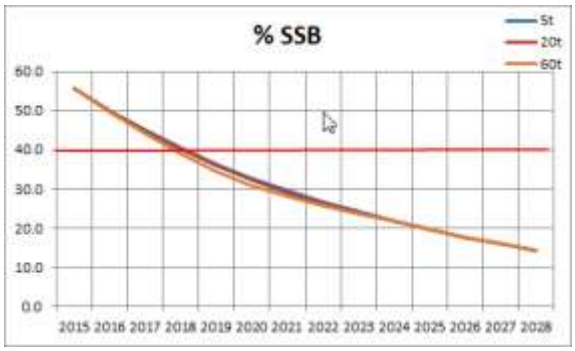
No Fishery			Current Assessment	Conservative Assessment
	National	**5% Decline**	6	3
		10% Decline	3	1
	3 EMUs	**5% Decline**	9	4
		10% Decline	4	2

OUTPUT Scenario B – National: 1 Year Yellow Fishery

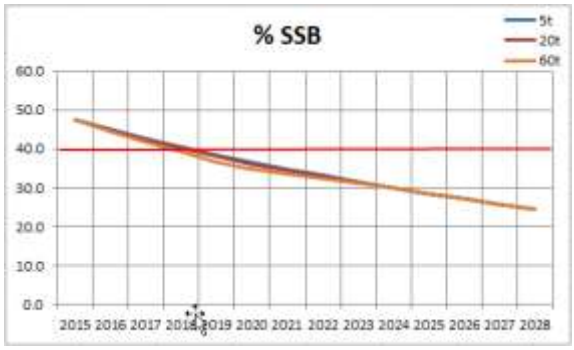
National, Fishery, 5% Decline



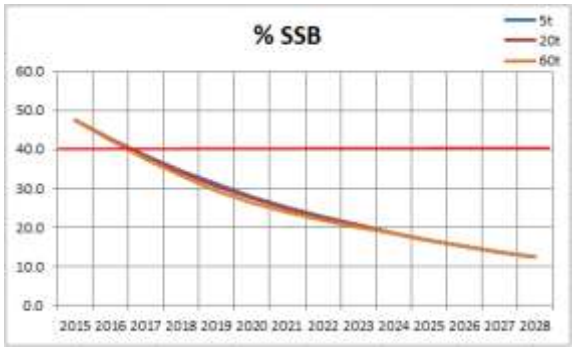
National, Fishery, 10% Decline



National, Fishery, 5% Decline, 2009 Corrib

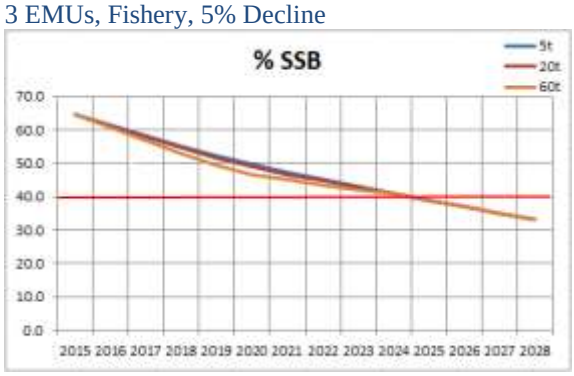


National, Fishery, 10% Decline, 2009 Corrib



OUTPUT Scenario B – 3 Main EMUs: 1 Year Yellow Fishery

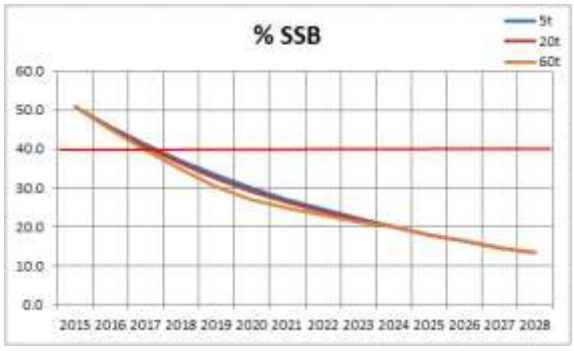
3 EMUs, Fishery, 5% Decline



3 EMUs, Fishery, 10% Decline

3 EMUs, Fishery, 5% Decline, 2009 Corrib

3 EMUs, Fishery, 10% Decline, 2009 Corrib



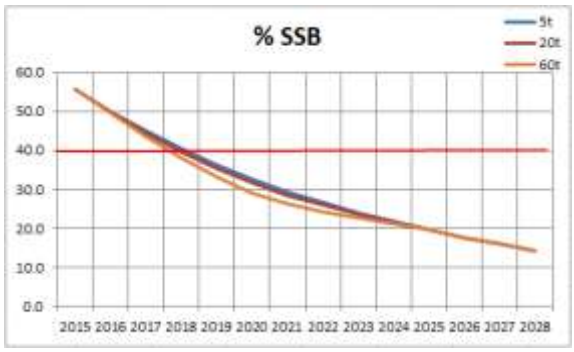
The number of years for the local stock to remain above 40% with a yellow eel fishery of 5t, 20t or 60t for **1 year**.

1 Year Fishery		Current Assessment			Conservative Assessment		
		5t	20t	60t	5t	20t	60t
National	5% Decline	6	3	5	3	3	2
	10% Decline	3	6	2	1	1	1
3 EMUs	5% Decline	9	9	9	4	4	3
	10% Decline	4	4	3	2	2	1

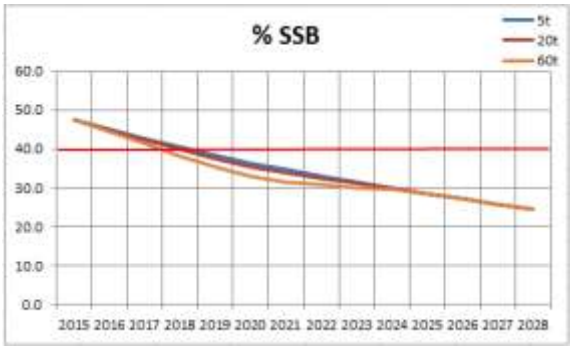
OUTPUT Scenario B – National: 2 Year Yellow Fishery

National, Fishery, 5% Decline

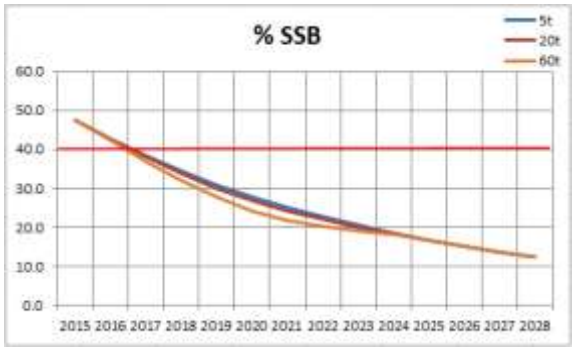
National, Fishery, 10% Decline



National, Fishery, 5% Decline, 2009 Corrib

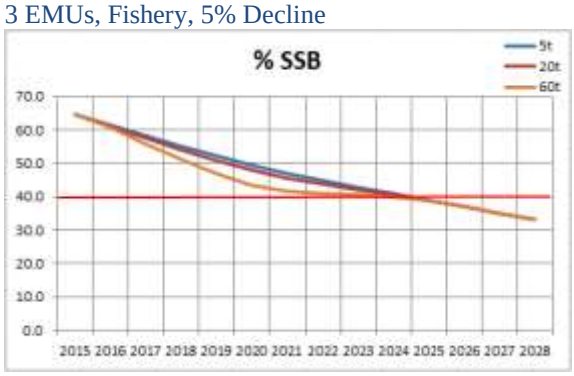


National, Fishery, 10% Decline, 2009 Corrib

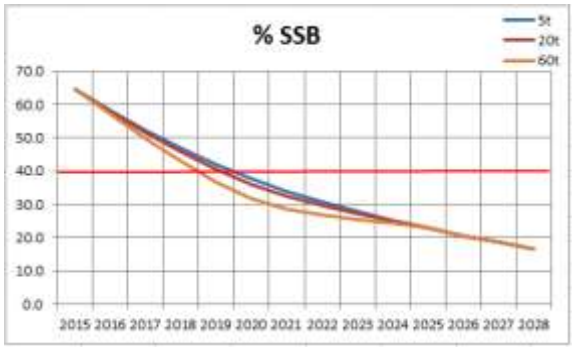


OUTPUT Scenario B – 3 Main EMUs: 2 Year Yellow Fishery

3 EMUs, Fishery, 5% Decline

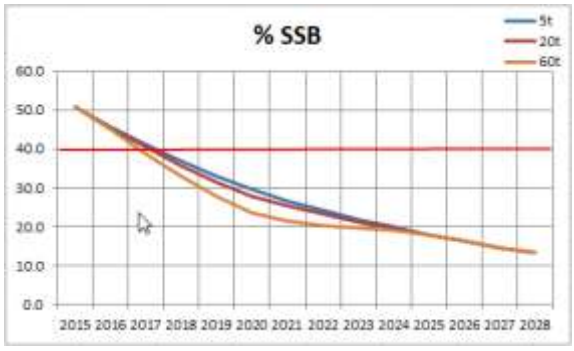


3 EMUs, Fishery, 10% Decline



3 EMUs, Fishery, 5% Decline, 2009 Corrib

3 EMUs, Fishery, 10% Decline, 2009 Corrib



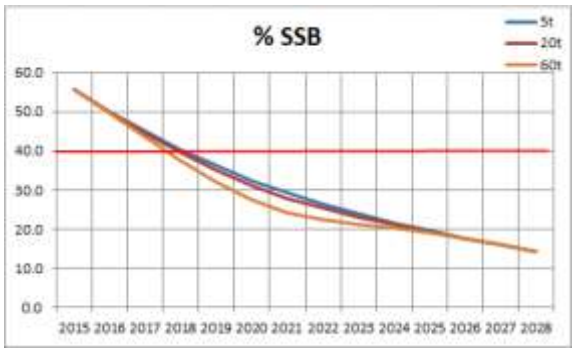
The number of years for the local stock to remain above 40% with a yellow eel fishery of 5t, 20t or 60t for **2 years**.

2 Year Fishery		Current Assessment			Conservative Assessment		
		5t	20t	60t	5t	20t	60t
National	5% Decline	6	5	4	3	2	2
	10% Decline	3	2	2	1	1	1
3 EMUs	5% Decline	9	9	9	4	3	2
	10% Decline	4	4	3	2	2	1

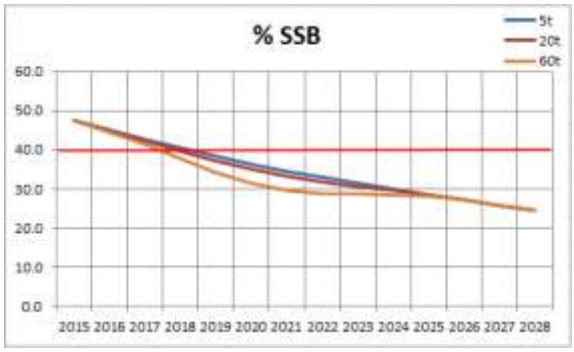
OUTPUT Scenario B – National: 3 Year Yellow Fishery

National, Fishery, 5% Decline

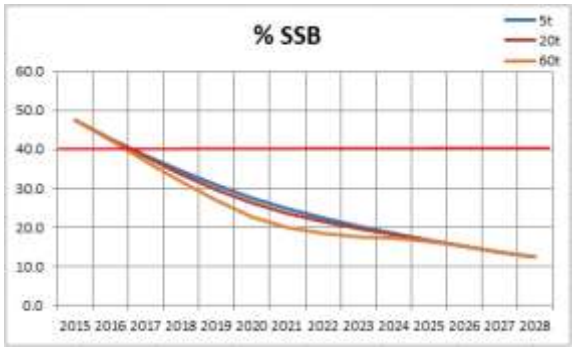
National, Fishery, 10% Decline



National, Fishery, 5% Decline, 2009 Corrib

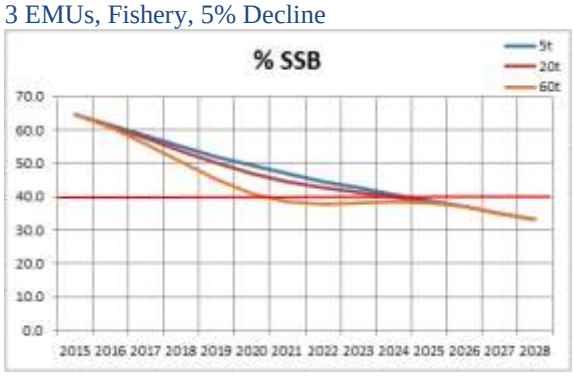


National, Fishery, 10% Decline, 2009 Corrib

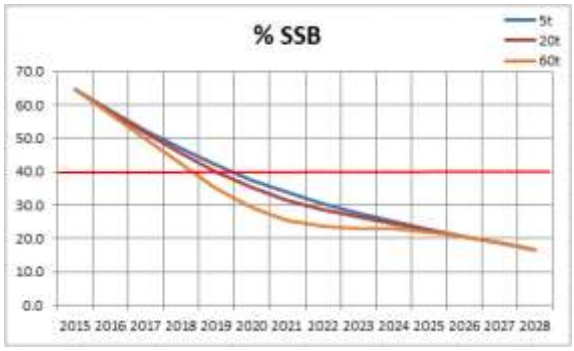


OUTPUT Scenario B – 3 Main EMUs: 3 Year Yellow Fishery

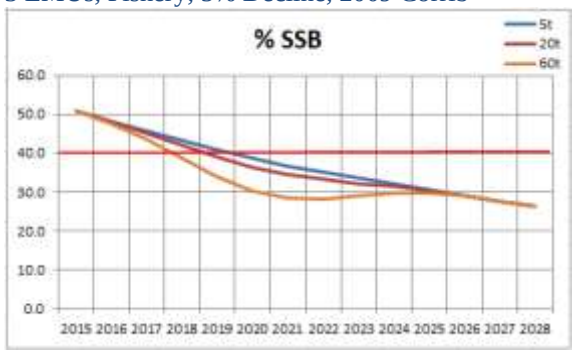
3 EMUs, Fishery, 5% Decline



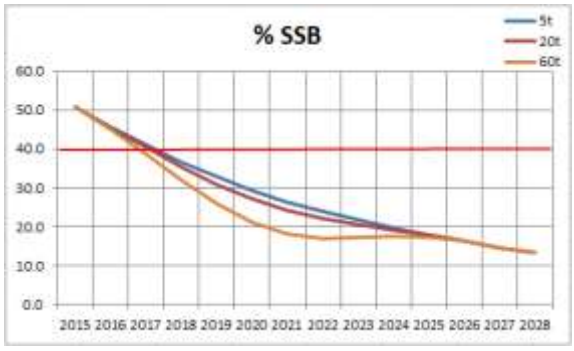
3 EMUs, Fishery, 10% Decline



3 EMUs, Fishery, 5% Decline, 2009 Corrib



3 EMUs, Fishery, 10% Decline, 2009 Corrib



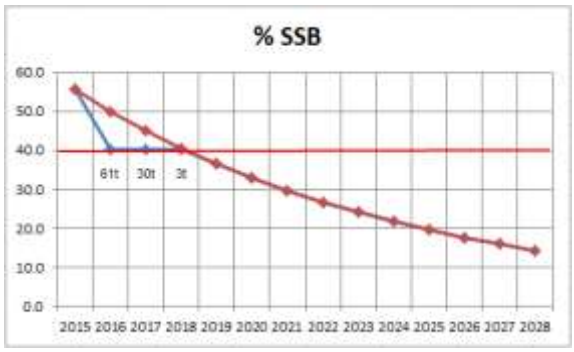
The number of years for the local stock to remain above 40% with a yellow eel fishery of 5t, 20t or 60t for **3 years**.

3 Year Fishery		Current Assessment			Conservative Assessment		
		5t	20t	60t	5t	20t	60t
National	**5% Decline**	6	5	4	3	2	2
	10% Decline	3	2	2	1	1	1
3 EMUs	**5% Decline**	9	9	5	4	3	2
	10% Decline	4	4	3	2	2	1

OUTPUT Scenario C – National: Silver Fishery

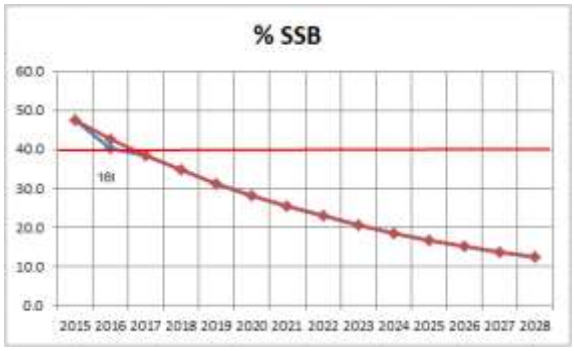
National, Fishery, 5% Decline

National, Fishery, 10% Decline



National, Fishery, 5% Decline, 2009 Corrib

National, Fishery, 10% Decline, 2009 Corrib



Quantities of silver eel (t) above the 40% EU target and the number of years for the local stock to remain above 40% with a silver eel fishery harvesting the 'annual surpluses'. Quantities in tonnes, not including trap & transported which have already been accounted for.

This table demonstrates that at the current estimated levels of silver eel production and recruitment decline, it was estimated that a 'surplus' above 40% may exist, at diminishing annual amounts, for 6 years (5% decline) to 3 years (10% decline) or even less at the more conservative estimates. These estimates also assume no yellow harvest

	Number of Years							
Assessment Option	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
5% Decline	78	62	47	32	18	5		
5% Decline Conservative	31	17	4					
10% Decline	61	30	3					
10% Decline Conservative	16							

.Summary

The status of the eel stock remains critical and all anthropogenic mortality should be reduced to, or kept as, close to zero as possible.

The eel stock is panmictic and shared internationally.

Ireland is currently contributing as much as is possible to a potential recovery. Ireland (which accounts for less than 1% of the total EU stock) cannot deliver recovery of the European eel on its own without reciprocal management action being taken by other member states. To date other MS (whilst implementing a wide range of management measures) have typically not effected full closure of commercial eel fisheries or taken significant action against hydropower mortality (despite working to the same international advice as applies in Ireland that eel stocks remain outside safe biological limits).

Silver eel escapement is currently (2012-2014) at 54.5%, or lower if a more conservative assessments (i.e. Corrib 2009) is used.

The decline in recruitment is likely to lead to a (further) decrease in silver eel production. This has been estimated to lie between 0 & 15% per annum. This assessment has assumed a decline of 5% and 10% p.a.

A quantity of potential silver eel biomass therefore exists above the 40% target that could be exploited in the short-term (noting the advice above). While under more stable stock status conditions this might be safe, under the projected declining local stock status this carries with it considerable risk. While such harvest might allow escapement to meeting the strict requirements of the EU Regulation, it would still be contrary to more conservative international (ICES) advice.

As a yellow eel fishery of 5t, 20t or 60t pa open for 1, 2 or 3 years, the biomass remains above the target for 1 to 6 years (national) or 1 to 9 years (3 RBDs). However, due to the nature of maturation of yellow eel, the impact becomes cumulatively more severe with increased high landings or prolonged

fisheries continuing to reduce the escapement well below 40% for at least 8 years after fishery closure. This makes reopening a yellow eel fishery risky and not in the interest of stock recovery.

Opening a silver eel fishery has a direct impact on escapement (unlike the delayed impact of a yellow eel fishery), is easier to quantify and therefore to manage. However, many traditional silver eel fisheries are now defunct, or employed in the ESB trap and transport conservation programme and are not therefore currently available for commercial exploitation.

At the current estimated levels of silver eel production and recruitment decline (and assuming no yellow eel harvest), it was estimated that a 'surplus' above 40% may exist, at diminishing annual amounts, for 6 years (5% decline) to 3 years (10% decline) or even less at the more conservative estimates.

Any reopening of a silver eel fishery would, at least, require new targets to be set for the ESB T&T programme and would more likely jeopardise the integrity and future of the T&T programme.

The SSCE also advise that should commercial fishing recommence measures should be put in place to ensure that commercial landings, ESB conservation landings, eel trade (imports and exports) and all illegal landings can be readily identified, reliably assessed and adequately reported (as required under EU DCF and EU Regulation for Stock Recovery) in order to support robust stock assessment and reporting to the EU.

Annex 3: Conservation of Eel Fishing Bye-law No. C.S. 319, 2015

I, Joe McHugh, Minister of State at the Department of Communications, Energy and Natural Resources, in exercise of the powers conferred on me by section 57 of the Inland Fisheries Act 2010 (No. 10 of 2010) and the Energy and Natural Resources (Delegation of Ministerial Functions) Order 2014(S.I. No. 585 of 2014), at the request of Inland Fisheries Ireland, and for the purpose of giving full effect to the State's Eel Management Plan under Council Regulation (EC) No. 1100/2007 of the 18 September 2007[1], hereby make the following bye-law:

1. (1) This Bye-law may be cited as the Conservation of Eel Fishing Bye-law No. C.S. 319, 2015.

(2) This Bye-law comes into operation on the day after the day of its making and ceases to have effect on 30 June 2018.

2. (1) Notwithstanding anything contained in any bye-law fixing the annual close season, it is prohibited for a person -

(a) to take, or attempt to take, or to fish for or to attempt to fish for, or to aid or assist in the taking or fishing for, eel, or

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[1] OJ No. L248, 22.09.2007, p.17.

(b) to be in possession of or sell or offer for sale or reward, or to purchase eel caught or taken by any means,

in any fishery district.

(2) In this Article "eel" means eel of the species *Anguilla anguilla*.

3. The Conservation of Eel Fishing Bye-Law No. C.S. 312, 2012 is revoked.

GIVEN under my hand,

23 November 2015.

JOE MCHUGH

Joe McHugh,

Minister of State at the Department of Communications,

Energy and Natural Resources.

EXPLANATORY NOTE

(This is not part of the Bye-law and does not purport to be a legal interpretation).

This Bye-law prohibits the taking, or attempting to take, fishing for or attempting to fish for, aiding or assisting the taking of or fishing for, eel in any fishery district in the State. It also prohibits being in possession of, selling or offering for sale or reward, or purchasing eel caught or taken by any means in any fishery district in the State.

FOOTNOTE

Section 57 (7) of the Inland Fisheries Act, 2010 provides that any person aggrieved by this Bye-law may within 28 days after its publication in the Iris Oifigiúil, appeal against same to the High Court.

Annex 4: Reports on Fisheries closures, illegal fishing and other management actions from the IFI RBD's and Loughs Agency.

1. IE_East

River District Basin: **Eastern / Neagh Bann (International) River Basin District**

IE_East

Date: **Jan-Dec 2015**

Management Action 1. Reduction of Fishery to achieve EU target

Confirm fishery ceased under **Conservation of Eel Fishing Bye-law No. C.S. 312, 2012**:

The eel fishery in the Eastern and Neagh Bann RBD remained closed throughout 2015.

Confirm no licences issued in 2009 under Conservation of Eel Fishing (Prohibition on Issue of Licences) Bye-law No. 858, 2009:

No eel fishing licences were issued by IFI Dublin (covering both Eastern / Neagh Bann (International) River Basin Districts) during 2015.

2 eel conservation fishing licences were issued relating to research activity in the Dundalk District (covering both Eastern / Neagh Bann (International) River Basin Districts).

Estimated level of illegal fishing:

The level of illegal activity was low for 2015 in the IFI Dublin area. Illegal activity targeting eels was not recorded during any of the traditional eel fishing seasons during the year. Patrols concentrated on lakes throughout the Region. Dundalk received a number of calls relating to supposed illegal eel fishing, it was however IFI Research Division carrying out elver surveys at the Clarebane River, Lough Muckno, Co. Monaghan (Further information below)

Main catchments where illegal activity occurred: **0**

Number of gear seizures: **Gear targeting eels was not recorded**

Gear types seized: **None**

Number of Eel Dealer Interceptions: **None**

Estimated tonnage on board: Declared origin(s) of cargos:

Describe Action taken:

General impression of levels of illegal activity since the cessation of the commercial fishery: **No illegal activity recorded, any eels recorded were a by-product when coarse fish were found in nets (however very few eels found in any nets in 2015)**

Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD?:

What was the total catch transported (kg)?: **No silver eel T&T**

Was there any evidence of illegal trading of eel in conjunction with the T&T programme:

General impression of the programme: **Clarebane River, (Fane catchment @ Lough Muckno) silver eel traps operated under the above licences for November and December 2015, due to high amount of rainfall experienced during these months. Purpose was to monitor silver eel survey on the Fane catchment. This was carried out by IFI Research Division and the following information has been supplied by them.**

Location Clarebane River	Year 2015	Total Wt. (kg)	Est. No.	
	November	451	1204	
	December	147	416	
	Total	599	1622	

Management Action 3. Ensure Upstream Migration at Barriers

In November 2012 Inland Fisheries Ireland published the "Wicklow Bridges Project, Assessment of the risk of barriers to migration of fish species in County Wicklow" Report to the Wicklow Heritage Forum. The broader project was coordinated by Wicklow County Council, through the Wicklow Heritage Forum and was part funded by the Heritage Council of Ireland. The County Wicklow Heritage Plan 2009-2014 forms the background to the project. Heritage Plan Action: 3.8 was to "Undertake a survey of Bridges and relevant culverts in County Wicklow to identify fauna usage and assess whether any impediments to passage exist, particularly in light of on-going changes in climate and rainfall patterns etc. Use this information to carry out retrofitting of features such as nest boxes, fish baffles and mammal ledges wherever possible". Project Partners included the Inland Fisheries Ireland, National Parks and Wildlife Service (NPWS) and Birdwatch Ireland.

Of the 103 structures assessed in the Wicklow Bridges Project 58 of these structures were deemed to represent a high risk to the upstream migration of Atlantic salmon and Brown trout while 68 of the structures were deemed to represent a high risk to the upstream migration of lamprey and eel.

Since the publication of the Wicklow Bridges Project Report, with the assistance of Wicklow County Council, the National Roads Authority, the Heritage Council and private citizens, works have been carried out at a number of sites which were identified as

significant barriers to the migration of eels. Fish passage has now been facilitated at these four sites, with Salmon and/or sea trout recorded upstream of the new fish pass structures and with salmon and/or sea trout spawning recorded upstream of two of the fish-passes in the Winter 2014-2015. We hope eventually to facilitate the free passage of fish at all of the identified barriers, the combined effect of which will be a very significant increase in the habitat for a number of threatened fish species.

Management Action 4. Improve Water Quality

Extensive and well documented water and habitat protection and improvement measures are ongoing as part of IFI's core remit.

Many thanks for taking the time to respond to this.

2. IE_NorW

River District Basin: NWIRBD River Basin District

IE_NorW

Date: Jan-Dec 2015

Management Action 1. Reduction of Fishery to achieve EU target

Confirm fishery ceased under **Conservation of Eel Fishing Bye-law No. C.S. 312, 2012**:

The eel fishery in the NWRBD remained closed throughout 2015.

Confirm no licences issued in 2009 under Conservation of Eel Fishing (Prohibition on Issue of Licences) Bye-law No. 858, 2009:

No eel fishing licences were issued by the NWRBD office of the NWRBD during 2015.

Estimated level of illegal fishing:

None encountered or reported.

Main catchments where illegal activity occurred:

Number of gear seizures: Gear types seized:

Nil

Number of Eel Dealer Interceptions:

Estimated tonnage on board: Declared origin(s) of cargos:

Describe Action taken:

General impression of levels of illegal activity since the cessation of the commercial fishery:

Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD?: **Yes.**

In the Ballyshannon district Eels were trapped in Lower & Upper Lough Erne. At (1) Rosscor bridge, (2) Ferny Gap 2km east of Rosscor bridge, and (3) Portora Lock. Eels were transported to Ballyshannon and released into the Tailrace below Cathleen's Falls hydro station.

The following sites were fished in the Upper Erne Catchment (1) Gowna (2) Urney Bridge & (3) Killeshandra.

What was the total catch transported (kg)?: **54,706 kg**

Was there any evidence of illegal trading of eel in conjunction with the T&T programme: **No**

General impression of the programme: **The programme was again very successful in 2015 transporting and releasing 54,706kg of live Eels. There was excellent co-operation between the different agencies (ESB, DCAL & NWRBD) and the Eel fishermen.**

However due to demands on IFI staff at present it is felt that the current levels of IFI staff assigned to supervision of the T&T programme need to be reduced. ESB contracted fishermen need to employ additional man-power during the main silver eel run to assist with efficient processing, monitoring and release of silver eels .

Management Action 3. Ensure Upstream Migration at Barriers

Consideration is given to eel and all fish migration when making submissions on projects impacting migration.

Management Action 4. Improve Water Quality

Many thanks for taking the time to respond to this.

3. IE_Shan

River District Basin: **ShRBD River Basin District**

Date: **Jan-Dec 2015**

Management Action 1. Reduction of Fishery to achieve EU target

Confirm fishery ceased under **Conservation of Eel Fishing Bye-law No. C.S. 312, 2012**:

The eel fishery in the ShRBD remained closed throughout 2015.

Confirm no licences issued in 2009 under Conservation of Eel Fishing (Prohibition on Issue of Licences) Bye-law No. 858, 2009:

No eel fishing licences were issued by the Limerick office of the ShRBD during 2015.

Estimated level of illegal fishing:

On the Upper Shannon - Illegal fishing of yellow and silver eels is an ongoing concern on Lough Ree and Lough Derg. There are known crews operating on these lakes. Routine patrols and surveillance was carried out on Lough Ree and on the River Inny.

Other illegal fishing occurred on Lough Allen with some seizures in 2015.

On the lower Shannon – from Lough Derg and the East Clare lakes there is a certain amount of illegal netting taking place each year and this seems to be ongoing and no matter how many seizures are made, it continues . The two seizures at Paddy Macs lake and Lough Gur which are both close to Limerick City were likely to be carried out by individuals.

Main catchments where illegal activity occurred:

Very little reports are received – seizures are made by officers doing targeted eel patrols and dragging certain areas of the lakes. Nets are sunken, unmarked. Lough Derg, Lough Bridget, Doon lake, Lough Gur

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Number of gear seizures: Gear types seized: See tables below

Date (exact date required)	Location	Type of Engine/ other seized	Number of Seizures (other than nets)	Number of Nets	Length of Net (metres)
06/04/2015	Lough Derg	2 fyke nets	0	2	30
11/06/2015	Lough Derg	1 d fyke net	0	1	25
21/08/2015	Lough Gur	1 fyke net	0	1	1
24/09/2015	Lough Bridget	1 Long line	1	0	50
12/10/2015	Paddy Macs Lake	2 longlines	2	0	20
22/11/2015	Doon Lake	2 longlines	2	0	10

Location	Type gear	no. longlines	No. nets	Length (m)
Lough Allen	fyke nets		5	41
Lough Allen - Dr	fyke nets		25	250
Lough Ennell	net		1	20
Lough Ennell	net		1	5
River Inny	fyke nets		7	21
Lough Ree (inner	fyke net		1	10
Lough Allen	fyke net		1	10
Lough Ree (The Cut, Lanesboro)			15	145
Lough Ree	fyke nets		1	10
Lough Ree	fyke net		6	60
Lough Ree	fyke nets		1	10
Lough Ree	Coghill	1	1	10
Lough Ree	Longline	1		100

Number of Eel Dealer Interceptions: **0**

Estimated tonnage on board:

Declared origin(s) of cargos:

Describe Action taken:

General impression of levels of illegal activity since the cessation of the commercial fishery:

There are some crews operating on the major Shannon lakes, possibly the same crews associated with the T&T licenses, i.e., tradition of commercial fishing. The geography and unsocial hours make it difficult to detect. The legal commercial operations across the land border in the north and a lack of coordinated efforts between jurisdictions complicate the procedure. More resources will be required (equipment and novel approaches) to deter the activities in totality. The payment discrepancies between both jurisdictions also make it more attractive (potentially) to transfer fish outside the state.

Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD?: **Yes**

(If yes, please insert quantity transported). 24,500 Kg

What was the total catch transported (kg)?: **24,500Kg**

Month	Weight	Trap Transport season
January	4343	2014/2015
February	0	2014/2015
March	0	no TT
April	0	no TT
May	0	no TT
June	0	no TT
July	0	no TT
August	0	no TT
September	1042	2015/2016
October	712	2015/2016
November	11845	2015/2016
December	6558	2015/2016
Total	24500	

Was there any evidence of illegal trading of eel in conjunction with the T&T programme:

No but staff have suspicions that there is illegal trading.

General impression of the programme:

There is no requirement for two agencies to monitor the T&T programme. ESB should verify catches and tonnage release. The illegal operations act independently of the T&T programme – nets set elsewhere. To verify all catches through the T&T crews would need to be in-situ every night, for every lift and verify weights with collection/release. This would require full time crews during the T&T operations.

Eels should be moved swiftly and there are concerns with staff about the number of cormorants around the release site in 2015. The monitoring of the released silvers by IFI staff draws a lot on local staffing resources but this may be reduced using the new pit tag reader. The high floods on the Shannon meant that Killaloe wasn't fished from the 11th December.

Management Action 3. Ensure Upstream Migration at Barriers

Management Action 4. Improve Water Quality

Many thanks for taking the time to respond to this.

4. IE_SouE

Management Action 1. Reduction of Fishery to achieve EU target

Confirm fishery ceased under **Conservation of Eel Fishing Bye-law No. C.S. 312, 2012**:

The eel fishery in the SERBD remained closed throughout 2015.

Confirm no licences issued in 2009 under Conservation of Eel Fishing (Prohibition on Issue of Licences) Bye-law No. 858, 2009:

No eel fishing licences were issued by the Clonmel office of the SERBD during 2015.

Estimated level of illegal fishing:

None known / reported

Main catchments where illegal activity occurred:

Number of gear seizures:

Gear types seized:

N/A

Number of Eel Dealer Interceptions: **None**

Estimated tonnage on board: Declared origin(s) of cargos:

Describe Action taken:

General impression of levels of illegal activity since the cessation of the commercial fishery:

None noted or reported

Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD?: **No**

What was the total catch transported (kg)?:

Was there any evidence of illegal trading of eel in conjunction with the T&T programme:

No

General impression of the programme: **n/a**

Management Action 3. Ensure Upstream Migration at Barriers

Consideration is given to eel and all fish migration when making submissions on projects impacting migration. A number of projects in the SERBD are also addressing existing barrier problems and eel migration is part of design changes

Management Action 4. Improve Water Quality

Many thanks for taking the time to respond to this.

5. IE_SouW

River District Basin: **South West River Basin District**

IE_SouW

Date: **Jan-Dec 2014**

Management Action 1. Reduction of Fishery to achieve EU target

Confirm fishery ceased under **Conservation of Eel Fishing Bye-law No. C.S. 312, 2012**:

The eel fishery in the SWRBD remained closed throughout 2014.

Confirm no licences issued in 2009 under Conservation of Eel Fishing (Prohibition on Issue of Licences) Bye-law No. 858, 2009:

No eel fishing licences were issued by IFI Dublin (covering SWRBD districts) during 2014.

Estimated level of illegal fishing:

The level of illegal activity was low to nil.

Main catchments where illegal activity occurred:

Number of gear seizures: **Gear targeting eels was not recorded**

Gear types seized:

Number of Eel Dealer Interceptions: **None**

Estimated tonnage on board: Declared origin(s) of cargos:

Describe Action taken:

General impression of levels of illegal activity since the cessation of the commercial fishery: **No levels of illegal activity recorded. Any eels recorded were a by-catch of when coarse fish were found in illegal nets. (However very few eels found in any nets in 2015).**

Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD?: **Yes**

Year	Kg			
2013	824			
2014	670			
2015	527			

What was the total catch transported (kg)?:

See above

Was there any evidence of illegal trading of eel in conjunction with the T&T programme: **N/A**

General impression of the programme:

Management Action 3. Ensure Upstream Migration at Barriers

Management Action 4. Improve Water Quality

Extensive and well documented water and habitat protection and improvement measures are ongoing as part of IFI's core remit.

Many thanks for taking the time to respond to this.

6. IE_West

River District Basin: **Western River Basin District**

IE_West

Date: **Jan-Dec 2015**

Management Action 1. Reduction of Fishery to achieve EU target

Confirm fishery ceased under **Conservation of Eel Fishing Bye-law No. C.S. 312, 2012**:

The eel fishery in the Western RBD remained closed throughout 2015.

Confirm no licences issued in 2009 under Conservation of Eel Fishing (Prohibition on Issue of Licences) Bye-law No. 858, 2009:

No eel fishing licences were issued by either the Ballina or Galway offices of the Western RBD during 2015.

Estimated level of illegal fishing: **There is no history of eel fishing in the Bangor, Ballinakill or Connemara fishery districts and there was, as expected, no evidence whatsoever of any illegal eel fishing in any of these districts during 2015. The other three fishery districts Sligo, Ballina and Galway all previously had well established eel fisheries largely based on the major lakes. Again, there was no evidence whatsoever of any illegal activity in the Ballina or Galway fishery districts.**

Main catchments where illegal activity occurred: **None.**

Number of gear seizures: **0** Gear types seized: **0**

1 IFI standard (survey) fyke net which had been lost on L Gill was recovered

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Number of Eel Dealer Interceptions: **0**

Estimated tonnage on board: **N/A** Declared origin(s) of cargos: **N/A**

Describe Action taken: **N/A**

General impression of levels of illegal activity since the cessation of the commercial fishery:

WRBD staff are firmly of the view that illegal eel fishing and transport activity has been nil in the WRBD since the closure of the eel fishery.

Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD?: **No**

N/A

What was the total catch transported (kg)?: **N/A**

Was there any evidence of illegal trading of eel in conjunction with the T&T programme: **N/A**

General impression of the programme: **N/A**

Management Action 3. Ensure Upstream Migration at Barriers

Note: All applications for infrastructural and other developments etc which could impact on upstream migrations are reviewed and submissions made to ensure that the free passage of fish is maintained. Natural barriers to upstream migration arising from floods etc were removed. Staff also monitored elver movements on the lower Ballisodare, Moy and Corrib Rivers.

Management Action 4. Improve Water Quality

The WRBD is represented on the WFD WRBD management group which works towards ensuring compliance with the requirements of the WFD. Furthermore, routine monitoring of planning, forestry, infrastructure developments and investigation and detection of water pollution contributed to the protection and improvement of water quality within the WRBD.

Many thanks for taking the time to respond to this.

IE_East Carlingford – Loughs Agency

River District Basin: **Neagh Bann River Basin District**

Date: **1 Jan- 31 Dec 2015**

Management Action 1. Reduction of Fishery to achieve EU target

Confirm fishery ceased under **Conservation of Eel Fishing Bye-law No. C.S. 312, 2012**:

The eel fishery in the Loughs Agency part of the NWRBD remained closed throughout 2015.

(The Foyle Area and Carlingford Area (Conservation of Eels) Regulations 2009)

Confirm no licences issued in 2009 under Conservation of Eel Fishing (Prohibition on Issue of Licences) Bye-law No. 858, 2009:

No eel fishing licences were issued by the Loughs Agency in the NBRBD during 2015.

Estimated level of illegal fishing:

No seizures or illegal fishing reported in 2015

Main catchments where illegal activity occurred:

Number of gear seizures:

Gear types seized:

Number of Eel Dealer Interceptions: **0**

Estimated tonnage on board:

Declared origin(s) of cargos:

Describe Action taken:

General impression of levels of illegal activity since the cessation of the commercial fishery:

Low

Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD?: **No**

What was the total catch transported (kg)?:

Was there any evidence of illegal trading of eel in conjunction with the T&T programme:

General impression of the programme:

Management Action 3. Ensure Upstream Migration at Barriers

All applications for infrastructural and other developments which could impact on upstream migrations are reviewed and submissions made to ensure that the free passage of fish is maintained. Natural barriers to upstream migration arising from floods were removed.

Management Action 4. Improve Water Quality

The Loughs Agency monitors water quality within the Foyle and Carlingford areas and will seek prosecutions in the event of a pollution incident.

Many thanks for taking the time to respond to this.

IE_NWIRBD – Loughs Agency

River District Basin: **NW River Basin District (Loughs Agency area)**

Date: **1 Jan- 31 Dec 2015**

Management Action 1. Reduction of Fishery to achieve EU target

Confirm fishery ceased under **Conservation of Eel Fishing Bye-law No. C.S. 312, 2012**:

The eel fishery in the Loughs Agency part of the NWRBD remained closed throughout 2015.

(The Foyle Area and Carlingford Area (Conservation of Eels) Regulations 2009)

Confirm no licences issued in 2009 under Conservation of Eel Fishing (Prohibition on Issue of Licences) Bye-law No. 858, 2009:

No eel fishing licences were issued by the Loughs Agency in the NWRBD during 2015.

Estimated level of illegal fishing:

No seizures or illegal fishing reported in 2015

Main catchments where illegal activity occurred:

Number of gear seizures:

0

Gear types seized:

Number of Eel Dealer Interceptions: 0

Estimated tonnage on board:

Declared origin(s) of cargos:

Describe Action taken:

General impression of levels of illegal activity since the cessation of the commercial fishery:

Low

Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD?: **No**

What was the total catch transported (kg)?:

Was there any evidence of illegal trading of eel in conjunction with the T&T programme:

General impression of the programme:

Management Action 3. Ensure Upstream Migration at Barriers

All applications for infrastructural and other developments which could impact on upstream migrations are reviewed and submissions made to ensure that the free passage of fish is maintained. Natural barriers to upstream migration arising from floods were removed.

Management Action 4. Improve Water Quality

The Loughs Agency monitors water quality within the Foyle and Carlingford areas and will prosecute in the event of a pollution incident.

Annex 5: Silver Eel Trap and Transport Tables: Erne, Shannon and Lee

River Shannon Silver Eel Weekly Collection Sheet 2015/16

Wk No.	Week Ending	Jolly Mariner, Athlone	Yacht club, Athlone	Rooskey	Finea	Kilaloe Eel Weir	Others (see comment)	Total for Week
Catch Quota per Location		5.5 T	2 T	2 T	1.5 T	No Quota		
1	05/09/15	0	0	0	0	Not fishing		0
2	12/09/15	0	0	0	0	Not fishing		0
3	19/09/15	0	0	0	611	0		611
4	26/09/15	221	82	0	128	Not fishing		431
5	03/10/15	0	0	0	0	Not fishing		0
6	10/10/15	0	0	0	0	Not fishing		0
7	17/10/15	0	0	0	216	Not fishing		216
8	24/10/15	96	204	0	196	Not fishing		496
9	31/10/15	0	0	0	0	Not fishing		0
10	07/11/15	69	99	305	0	Not fishing		473
11	14/11/15	617	801	0	344	308		2070
12	21/11/15	1599	863	1506	0	2550		6518
13	28/11/15	1625	0	0	0	1159		2784
14	05/12/15	0	0	0	585	2602		3187
15	12/12/15	1085	0	0	0	1659		2744
16	19/12/15	250	0	177	0	N/F		427
17	26/12/15	N/F	N/F	N/F	N/F	N/F		0
18	02/01/16	N/F	N/F	N/F	N/F	N/F		0
19	09/01/16	N/F	N/F	N/F	N/F	N/F		0
20	16/01/16	N/F	N/F	N/F	N/F	N/F		0
21	23/01/16	N/F	N/F	N/F	N/F	0		0
22	30/01/16	N/F	N/F	N/F	N/F	0		0
23	06/02/16	N/F	N/F	N/F	N/F	0		0
24	13/02/16	N/F	N/F	N/F	N/F	0		0
Total to Date(kgs)		5562	2049	1988	2080	8278	0	19957

River Erne Silver Eel Weekly Collection Sheet 2015/16

Week No.	Week Ending	Lisnaskea	Ferny Gap	Portora Gates	Killashandra	Urney Bridge	Roscor	Lough Gowna	Total for Week
1	**05/09/2015**	0	0	0	0	0	0	0	0
2	**12/09/2015**	470	637	631	0	0	0	0	1738
3	**19/09/2015**	0	0	0	0	0	0	0	0
4	**26/09/2015**	0	466	0	0	0	0	0	466
5	**03/10/2015**	95	125	275	0	15	0	0	510
6	**10/10/2015**	230	1097	223	0	461	0	0	2011
7	**17/10/2015**	125	175	122	0	25	0	0	447
8	**24/10/2015**	0	0	0	0	0	0	0	0
9	**31/10/2015**	0	1204	1453	0	0	0	0	2657
10	**07/11/2015**	203	2200	1408	537	1469	0	0	5817
11	**14/11/2015**	259	4201	1197	1179	1129	204	693	8862
12	**21/11/2015**	568	6212	1904	1811	1723	1945	893	15056
13	**28/11/2015**	662	1155	758	737	579	154	912	4957
14	**05/12/2015**	0	1281	243	0	318	200	384	2426
15	**12/12/2015**	0	1258	247	657	812	331	351	3656
16	**19/12/2015**	720	1289	0	485	934	498	1254	5180
17	**26/12/2015**	N/F	N/F	N/F	N/F	118	176	N/F	294
18	**02/01/2016**	N/F	N/F	N/F	N/F	0	0	N/F	0
19	**09/01/2016**	N/F	N/F	N/F	N/F	0	0	N/F	0
20	**16/01/2016**	N/F	N/F	N/F	N/F	329	300	N/F	629
Total to Date(kgs)		**3332**	**21300**	**8461**	**5406**	**7912**	**3808**	**4487**	**54706**

River Lee Silver Eel Weekly Collection Sheet 2015/16

Week No.	Week Ending	Inniscarra	Comment
1	**08/08/2015**	0	Started fishing 7/8/15
2	**15/08/2015**	0	
3	**22/08/2015**	355	
4	**29/08/2015**	172	Quota Reached on 25/8/15 and Fishing ceased
Total to Date(kgs)		**527**	

Annex 6: Water Framework Directive

Table a-0-1 WFD Lake summary data, 2014

RBD	Catchments	Lake Name	No. Nights	No. Nets	No. Eels	CPUE	Average Length (cm)	Min. Length (cm)	Max. Length (cm)	Average Weight (kg)	Min. Weight (kg)	Max. Weight (kg)	Total Weight (kg)
SWRBD	Caragh	Acoose, Lough	2	3	4	0.67	54.9	46.0	65.0	0.3029	0.1635	0.4470	1.2115
SWRBD	Lee	Allua, Lough	2	3	2	0.33	58.5	55.0	62.0	0.3310	0.2350	0.4270	0.6620
NWRBD	Gweebarra	Barra, Lough	1	3	20	6.67	45.2	30.6	65.2	0.1706	0.0420	0.4920	3.4130
NWRBD	Lackagh	Beagh, Lough	2	3	11	1.83	40.5	35.0	51.5	0.1139	0.0760	0.2550	1.2530
SWRBD	Blackwater	Brin, Lough	1	2	5	2.50	46.7	41.3	56.2	0.1766	0.1140	0.2790	0.8830
SWRBD	Caragh	Caragh, Lough	2	3	3	0.50	37.7	30.5	44.6	0.0837	0.0550	0.1100	0.2510
WRBD	Owenmore	Carromore, Lake	2	6	11	0.92	43.0	31.5	57.0	0.1704	0.0600	0.3780	1.8745
SHIRBD	Up Shannon	Cavetown, Lough	2	3	14	2.33	64.4	50.3	73.5	0.5257	0.2220	0.8450	7.3600
NWRBD	Erne	Corglass, Lough	2	3	2	0.33	51.1	42.0	60.2	0.2390	0.1380	0.3400	0.4780
WRBD	Corrib	Corrib (Lr), Lough	3	6	8	0.44	49.7	44.5	59.8	0.2355	0.1350	0.4840	1.8840
WRBD	Corrib	Corrib (Up), Lough	4	9	91	2.53	51.5	8.8	71.5	0.2586	0.0080	0.6310	23.5350
NWRBD	Erne	Derrybrick, Lough	1	2	4	2.00	47.3	41.0	53.0	0.1650	0.0780	0.2620	0.6600
WRBD	Easky	Easky, Lough	2	3	8	1.33	43.6	34.5	68.9	0.1952	0.0800	0.7620	1.5610
NWRBD	Leannan	Fern, Lough	2	3	26	4.33	35.3	29.8	47.6	0.0851	0.0420	0.2190	2.2120
WRBD	Garvogue	Gill, Lough	3	5	22	1.47	50.4	37.9	61.8	0.2140	0.0890	0.3630	4.7127
SWRBD	Coastal	Glenbeg, Lough	1	3	0	0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
WRBD	Bundorragha	Glencullin, Lough	1	2	2	1.00	44.8	37.8	51.8	0.1690	0.0960	0.2420	0.3380
NWRBD	Coastal	Kiltooris, Lough	1	3	3	1.00	63.7	46.2	78.5	0.6607	0.1850	1.1540	1.9820
SWRBD	Laune	Leane, Lough	3	6	25	1.39	44.4	28.7	56.7	0.1578	0.0430	0.3690	3.9450
SHIRBD	Lower Shannon	Meelagh, Lough	1	3	6	2.00	52.4	44.5	62.0	0.2740	0.1650	0.4450	1.6440
NWRBD	Drowes	Melvin, Lough	3	8	37	1.54	42.2	33.1	59.8	0.1245	0.0540	0.3260	4.6070
SHIRBD	Suck	O'Flynn, Lough	2	3	9	1.50	66.1	55.6	87.2	0.5019	0.2300	1.1440	4.5170
SHIRBD	Shannon	Owel, Lough	3	6	0	0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SHIRBD	Inny	Sheelin, Lough	2	6	4	0.33	64.5	59.0	72.0	0.4730	0.3430	0.6760	1.8920
NWRBD	Moy	Talt, Lough	2	3	3	0.50	54.4	48.5	65.0	0.3263	0.1730	0.5960	0.9790

RBD	Catchments	Lake Name	No. Nights	No. Nets	No. Eels	CPUE	Average Length (cm)	Min. Length (cm)	Max. Length (cm)	Average Weight (kg)	Min. Weight (kg)	Max. Weight (kg)	Total Weight (kg)
NWRBD	Ballysadare	Templehouse, Lake	2	3	8	1.33	57.3	46.2	62.5	0.3224	0.1650	0.4490	2.5790
SWRBD	Ovoca	Upper, Lake	1	3	2	0.67	36.3	31.5	41.0	0.0778	0.0465	0.1090	0.1555

Table a-0-2 WFD Lake length frequency data, 2014

RBD	Catchments	Lake Name	No. Eels	20-29 cm	30-39 cm	10-49 cm	50-59 cm	60-69 cm	70-79 cm	>80 cm
SWRBD	Caragh	Acoose, Lough	4	0	0	0	0	2	1	1
SWRBD	Lee	Allua, Lough	2	0	0	0	0	0	1	1
NWRBD	Gweebarra	Barra, Lough	20	0	0	0	5	10	2	3
NWRBD	Lackagh	Beagh, Lough	11	0	0	0	6	4	1	0
SWRBD	Blackwater	Brin, Lough	5	0	0	0	0	4	1	0
SWRBD	Caragh	Caragh, Lough	3	0	0	0	2	1	0	0
WRBD	Owenmore	Carromore, Lake	11	0	0	0	3	6	2	0
SHIRBD	Up Shannon	Cavetown, Lough	14	0	0	0	0	0	3	7
NWRBD	Erne	Corglass, Lough	2	0	0	0	0	1	0	1
WRBD	Corrib	Corrib (Lr), Lough	8	0	0	0	0	6	2	0
WRBD	Corrib	Corrib (Up), Lough	90	0	0	0	4	27	46	12
NWRBD	Erne	Derrybrick, Lough	4	0	0	0	0	3	1	0
WRBD	Easky	Easky, Lough	8	0	0	0	2	5	0	1
NWRBD	Leannan	Fern, Lough	26	0	0	1	22	3	0	0
WRBD	Garvogue	Gill, Lough	22	0	0	0	2	7	11	2
SWRBD	Coastal	Glenbeg, Lough	0	0	0	0	0	0	0	0
WRBD	Bundorragha	Glencullin, Lough	2	0	0	0	1	0	1	0
NWRBD	Coastal	Kiltooris, Lough	3	0	0	0	0	1	0	1
SWRBD	Laune	Leane, Lough	25	0	0	1	3	17	4	0
SHIRBD	Lower Shannon	Meelagh, Lough	6	0	0	0	0	3	2	1
NWRBD	Drowes	Melvin, Lough	37	0	0	0	14	17	6	0
SHIRBD	Suck	O'Flynn, Lough	9	0	0	0	0	0	3	3
SHIRBD	Shannon	Owel, Lough	0	0	0	0	0	0	0	0
SHIRBD	Inny	Sheelin, Lough	4	0	0	0	0	0	1	2
NWRBD	Moy	Talt, Lough	3	0	0	0	0	2	0	1
NWRBD	Ballysadare	Templehouse, Lake	8	0	0	0	0	1	5	2
SWRBD	Ovoca	Upper, Lake	2	0	0	0	1	1	0	0

Table a-0-3 Summary data from WFD Rivers Survey, 2014.

RBD	Catchment	River	Site	No. Sets	No. Runs	Area (m^2)	Density (no./m^2)	No. Eels	Total Weight (kg)
SERBD	Suir	Aherlow River	Killardy Br._A	2*	1	3512	n.a.	0	n.a.
SERBD	Suir	Aherlow River	Old Cappa Br._A	1*	3	2310	n.a.	0	n.a.
SERBD	Suir	Anner River	Drummon Br._A	2*	3	1281	0.00390	5	0.6730
SERBD	Suir	Anner River	Killusty_A	1*	3	831	0.00120	1	0.0890
SERBD	Suir	Ara River	Bansha_A	1*	3	788	0.00127	1	0.1335
SERBD	Suir	Ara River	Lisheen_A	1*	3	599	0.00334	2	0.0870
WRBD	Ballysadare	Ballysadare River	Ballysadare Br._A	3*	1	7840	0.00064	5	0.7165
WRBD	Ballysadare	Ballysadare River	Oakwood_A	3*	1	5824	n.a.	0	n.a.
SERBD	Barrow	Barrow, River	Pass Br._B	4*	1	11677	0.00026	3	0.7690
NBIRBD	Blackwater	Blackwater (Monaghan), River	Corvally_A	2	3	413	n.a.	0	n.a.
WRBD	Garvogue	Bonet River	1.8 km d/s Dromahaire Br._A	3*	1	6433	0.00031	2	0.1740
WRBD	Garvogue	Bonet River	Castle_A	3*	1	3046	n.a.	0	n.a.
ERBD	Boyne	Boyne, River	Boyne Br._A	1*	3	516	n.a.	0	n.a.
ShIRBD	Shannon Lwr	Brosna, River	0.5km NW of Pollagh_A	4*	1	11883	n.a.	0	n.a.
WRBD	Bundorragha	Bundorragha River	Rock Pool_A	2	3	466	0.01503	7	0.7170
WRBD	Clare	Clare, River	Corrofin Br._A	3*	1	6118	n.a.	0	n.a.
WRBD	Clare	Clare, River	Kiltroge Castle Br._A	2*	1	3519	0.00028	1	0.4320
NWIRBD	Clady	Cronaniv Burn	Br. u/s Dunlewy Lough_A	2	3	210	n.a.	0	n.a.
NWIRBD	Clady	Cronaniv Burn	Guinness Estate_A	3	3	356	n.a.	0	n.a.
ERBD	Dargle	Dargle River	Bahana_A	2	1	295	n.a.	0	n.a.
NBIRBD	Dee	Dee, River	Br. at Drumcar_A	3	3	500	0.02600	13	0.0120
NBIRBD	Dee	Dee, River	Burley Br._A	1*	3	1050	n.a.	0	n.a.
NBIRBD	Dee	Deel (Newcastlewest), River	Ballygulleen_A	2	3	362	n.a.	0	n.a.
NBIRBD	Dee	Deel (Newcastlewest), River	Br. near Balliniska_A	3	3	362	n.a.	0	n.a.

RBD	Catchment	River	Site	No. Sets	No. Runs	Area (m^2)	Density (no./m^2)	No. Eels	Total Weight (kg)
WRBD	Nanny	Demesne River	Curraghcreen_A	1	3	239	n.a.	0	n.a.
SERBD	Slaney	Derry River	Balisland Br._A	3	3	469	n.a.	0	n.a.
SERBD	Slaney	Derry River	Ballyknocker_A	2	3	498	0.00402	2	0.0550
ERBD	Liffey	Dodder, River	Bushy Park_A	3	3	385	0.01040	4	0.5160
ERBD	Liffey	Dodder, River	D/s Piperstown Stream, Bohernabreena_A	3	3	315	0.00636	2	0.1930
ERBD	Liffey	Dodder, River	Firhouse_A	2	3	238	n.a.	0	n.a.
ERBD	Liffey	Dodder, River	Knocklyon_A	2	3	264	n.a.	0	n.a.
ERBD	Liffey	Dodder, River	Mount Carmel Hospital_A	3	3	358	0.00279	1	0.0120
ERBD	Liffey	Dodder, River	Oldbawn_A	3	3	311	0.00322	1	0.2450
SERBD	Suir	Duag, River	Br. u/s Ballyporeen_B	1	3	150	n.a.	0	n.a.
SERBD	Suir	Duag, River	Kilnamona_A	2	3	204	n.a.	0	n.a.
ERBD	Coastal	Duncormick River	(W) Br. nr Duncormick Rly St_B	2	3	199	0.03515	7	0.0290
SHIRBD	Feale	Feale, River	Br. ENE of Duagh Ho_A	4*	1	6315	0.00079	5	0.1640
SHIRBD	Feale	Feale, River	Sluicequarter_A	2*	1	2247	0.01068	24	0.4745
SWRBD	Blackwater	Finisk River	Modelligo Br._A	3	3	444	0.02027	9	0.1395
SWRBD	Blackwater	Funshion, River	Brackbaun Br._A	3	3	371	0.00808	3	0.1560
SWRBD	Blackwater	Funshion, River	Kilbeheny_A	2	3	335	0.00598	2	0.0685
SWRBD	Glashaboy	Glashaboy River	Ardnabricka_A	2	3	216	0.01852	4	0.0665
SWRBD	Glashaboy	Glashaboy River	Ballyvorisheen Br._B	2	3	156	0.00641	1	0.0560
ShIRBD	Inny	Inny River	Br. 1 km S of Oldcastle_A	1	3	126	n.a.	0	n.a.
ShIRBD	Inny	Inny River	Shrule Br._A	4*	1	7093	n.a.	0	n.a.
ERBD	Liffey	Liffey, River	Lucan Br._A	4*	1	5179	0.00193	10	0.6690
SERBD	Mahon	Mahon, River	ENE of Seafield House_A	2	3	572	0.09786	56	0.1175
SERBD	Mahon	Mahon, River	Pumphouse Weir_A	2	3	337	0.08007	27	0.0845
SERBD	Suir	Multeen River	Ballygriffin Br._A	2*	3	2191	0.00183	4	0.1640

RBD	Catchment	River	Site	No. Sets	No. Runs	Area (m^2)	Density (no./m^2)	No. Eels	Total Weight (kg)
WRBD	Corrib	Nanny (Tuam), River	u/s Weir Br._A	1*	1	719	n.a.	0	n.a.
SERBD	Nore	Nore, River	Brownsbarn Br._A	4*	1	19445	0.00026	5	0.1670
SERBD	Nore	Nore, River	Kilmacshane_A	4*	1	11357	0.00009	1	0.0660
SERBD	Nore	Nore, River	Quakers Br._A	1*	3	1508	n.a.	0	n.a.
SERBD	Owenduff	Owenduff River	Rathnageeragh_A	2	3	232	0.05180	12	0.5965
WRBD	Ballysadare	Owenmore River (Sligo)	300 m u/s Unshin River confl_A	3*	1	3360	n.a.	0	n.a.
WRBD	Ballysadare	Owenmore River (Sligo)	Waterfall_A	3*	1	4207	0.00048	2	0.2225
WRBD	Bunndorragha	Owennaglogh River	Tawnynoran_A	2	3	314	0.00957	3	0.1330
WRBD	Corrib	Robe River	Akit Br._A	2*	1	7599	0.00013	1	0.3190
WRBD	Corrib	Robe River	Friarsquarter_A	2*	1	1036	n.a.	0	n.a.
SERBD	Slaney	Slaney, River	Bunclody_A	4*	1	6065	0.00049	3	0.0685
SERBD	Slaney	Slaney, River	Carrhill_A	4*	1	3763	n.a.	0	n.a.
SHIRBD	Feale	Smearlagh River	Ford u/s Feale R confl (LHS)_A	3	3	427	0.07500	32	0.2385
SHIRBD	Feale	Smearlagh River	Rathea_A	3	3	410	0.02927	12	0.0840
SERBD	Suir	Suir, River	Kilsheelan Br._A	4*	1	15666	0.00019	3	0.1280
SERBD	Suir	Suir, River	Knocknageragh Br._A	1*	3	607	n.a.	0	n.a.
SERBD	Suir	Suir, River	Poulakerry_A	4*	1	9031	0.00022	2	0.4000
SWRBD	Blackwater	Sullane River	Sullane Br._A	3	3	461	n.a.	0	n.a.
NWIRBD	Erne	Swanlinbar River	Swanlinbar Br. (Carpark)_A	3	3	393	0.01017	4	0.6445
NWIRBD	Swilly	Swilly, River	Altadush_A	2	3	224	n.a.	0	n.a.
NWIRBD	Swilly	Swilly, River	Swilly Br. (near Breenagh)_A	2	3	260	0.01538	4	0.0525
WRBD	Moy	Tobercurry River	Br. just u/s Moy River_C	1	3	114	n.a.	0	n.a.
WRBD	Moy	Tobercurry River	Tullanaglug_A	1	3	134	n.a.	0	n.a.
ERBD	Slaney	Urrin River	Buck's Br._A	2	3	321	0.01558	5	0.3220
ERBD	Vartry	Vartry River	Annagolan Br._A	2	3	231	n.a.	0	n.a.
ERBD	Vartry	Vartry River	Ashford Br._A	3	3	378	0.02912	11	0.0300

RBD	Catchment	River	Site	No. Sets	No. Runs	Area (m^2)	Density (no./m^2)	No. Eels	Total Weight (kg)
ERBD	Vartry	Vartry River	Newrath Br._A	3	3	324	0.08944	29	0.1060
ERBD	Vartry	Vartry River	Nun's Cross Br._A	3	3	369	0.01084	4	0.1310
NBIRBD	Dee	White River (Louth)	Athclare_A	2	3	212	n.a.	0	n.a.
NBIRBD	Dee	White River (Louth)	Coneyburrow Br._B	3	3	358	n.a.	0	n.a.
NBIRBD	Dee	White River (Louth)	Dunleer_A	2	3	212	0.00472	1	0.0660
NBIRBD	Dee	White River (Louth)	Gibber's Br._A	1	3	123	n.a.	0	n.a.
NBIRBD	Dee	White River (Louth)	Martinstown Br._A	1	3	103	n.a.	0	n.a.

* Boats used as opposed to handsets in runs

Table a-0-4 Summary length and weight data from WFD Rivers Surveys, 2014

RBD	Catchment	River	Site	Average Length (cm)	Min. Length (cm)	Max. Length (cm)	Average Weight (kg)	Min. Weight (kg)	Max. Weight (kg)	Total Weight (kg)
SERBD	Suir	Anner River	Drummon Br._A	38.2	27.1	52.0	0.1346	0.0285	0.3130	0.6730
SERBD	Suir	Anner River	Killusty_A	35.5	35.5	35.5	0.0890	0.0890	0.0890	0.0890
SERBD	Suir	Ara River	Bansha_A	39.6	39.6	39.6	0.1335	0.1335	0.1335	0.1335
SERBD	Suir	Ara River	Lisheen_A	28.0	25.0	31.0	0.0435	0.0360	0.0510	0.0870
WRBD	Ballysadare	Ballysadare River	Ballysadare Br._A	59.8	43.0	110.5	0.1433	0.1190	0.2480	0.7165
SERBD	Barrow	Barrow, River	Pass Br._B	53.3	52.0	55.5	0.2563	0.2150	0.3290	0.7690
WRBD	Garvogue	Bonet River	1.8 km d/s Dromahaire Br._A	37.8	32.5	43.0	0.0870	0.0540	0.1200	0.1740
WRBD	Bundorragha	Bundorragha River	Rock Pool_A	35.0	23.5	49.5	0.1024	0.0160	0.2890	0.7170
WRBD	Clare	Clare, River	Kiltroge Castle Br._A	59.8	59.8	59.8	0.4320	0.4320	0.4320	0.4320
NBIRBD	Dee	Dee, River	Br. at Drumcar_A	9.1	6.2	12.2	0.0009	0.0005	0.0020	0.0120
SERBD	Slaney	Derry River	Ballyknocker_A	25.7	22.5	28.8	0.0275	0.0170	0.0380	0.0550
ERBD	Liffey	Dodder, River	Bushy Park_A	36.8	20.5	56.0	0.1290	0.0110	0.3465	0.5160
ERBD	Liffey	Dodder, River	D/s Piperstown Stream, Bohernabreena_A	39.5	36.4	42.6	0.0965	0.0690	0.1240	0.1930
ERBD	Liffey	Dodder, River	Mount Carmel Hospital_A	20.0	20.0	20.0	0.0120	0.0120	0.0120	0.0120
ERBD	Liffey	Dodder, River	Oldbawn_A	51.0	51.0	51.0	0.2450	0.2450	0.2450	0.2450
ERBD	Coastal	Duncormick River	(W) Br. nr Duncormick Rly St_B	11.3	6.0	22.0	0.0041	0.0005	0.0165	0.0290
SHIRBD	Feale	Feale, River	Br. ENE of Duagh Ho_A	26.3	20.7	37.0	0.0328	0.0120	0.0840	0.1640
SHIRBD	Feale	Feale, River	Sluicequarter_A	21.4	12.5	35.0	0.0197	0.0025	0.0655	0.4745
SWRBD	Blackwater	Finisk River	Modelligo Br._A	20.3	12.4	29.9	0.0155	0.0030	0.0430	0.1395
SWRBD	Blackwater	Funshion, River	Brackbaun Br._A	28.4	20.5	32.5	0.0520	0.0230	0.0760	0.1560
SWRBD	Blackwater	Funshion, River	Kilbeheny_A	25.0	21.0	29.0	0.0343	0.0255	0.0430	0.0685
SWRBD	Glashaboy	Glashaboy River	Ardnabricka_A	21.5	17.4	25.9	0.0166	0.0075	0.0315	0.0665

RBD	Catchment	River	Site	Average Length (cm)	Min. Length (cm)	Max. Length (cm)	Average Weight (kg)	Min. Weight (kg)	Max. Weight (kg)	Total Weight (kg)
SWRBD	Glashaboy	Glashaboy River	Ballyvorisheen Br._B	33.2	33.2	33.2	0.0560	0.0560	0.0560	0.0560
ERBD	Liffey	Liffey, River	Lucan Br._A	31.4	15.2	46.4	0.0669	0.0050	0.1840	0.6690
SERBD	Mahon	Mahon, River	ENE of Seafield House_A	8.7	6.4	35.6	0.0020	0.0005	0.0715	0.1175
SERBD	Mahon	Mahon, River	Pumphouse Weir_A	9.7	6.2	30.5	0.0031	0.0005	0.0555	0.0845
SERBD	Suir	Multeen River	Ballygriffin Br._A	27.4	18.1	37.3	0.0410	0.0075	0.0740	0.1640
SERBD	Nore	Nore, River	Brownsbarn Br._A	30.1	20.7	38.0	0.0334	0.0120	0.0675	0.1670
SERBD	Nore	Nore, River	Kilmacshane_A	33.6	33.6	33.6	0.0660	0.0660	0.0660	0.0660
SERBD	Owenduff	Owenduff River	Rathnageeragh_A	27.7	10.0	41.9	0.0497	0.0080	0.1115	0.5965
WRBD	Ballysadare	Owenmore River (Sligo)	Waterfall_A	36.5	26.0	47.0	0.1112	0.0265	0.1960	0.2225
WRBD	Bunndorragha	Owennaglogh River	Tawnynoran_A	27.3	20.5	40.7	0.0443	0.0135	0.1050	0.1330
WRBD	Corrib	Robe River	Akit Br._A	57.0	57.0	57.0	0.3190	0.3190	0.3190	0.3190
SERBD	Slaney	Slaney, River	Bunclody_A	21.3	11.4	29.6	0.0228	0.0020	0.0470	0.0685
SHIRBD	Feale	Smearlagh River	Ford u/s Feale R confl (LHS)_A	15.6	9.6	32.6	0.0074	0.0010	0.0535	0.2385
SHIRBD	Feale	Smearlagh River	Rathea_A	13.8	9.7	31.3	0.0070	0.0010	0.0400	0.0840
SERBD	Suir	Suir, River	Kilsheelan Br._A	28.6	24.3	32.0	0.0426	0.0210	0.0560	0.1280
SERBD	Suir	Suir, River	Poulakerry_A	42.8	29.2	56.4	0.2000	0.0450	0.3550	0.4000
NWIRBD	Erne	Swanlinbar River	Swanlinbar Br. (Carpark)_A	46.2	34.5	58.3	0.1611	0.0720	0.2710	0.6445
NWIRBD	Swilly	Swilly, River	Swilly Br. (near Breenagh)_A	16.8	12.0	27.6	0.0131	0.0060	0.0330	0.0525
ERBD	Slaney	Urrin River	Buck's Br._A	32.9	26.7	37.8	0.0644	0.0280	0.0930	0.3220
ERBD	Vartry	Vartry River	Ashford Br._A	10.9	6.8	22.0	0.0027	0.0005	0.0175	0.0300
ERBD	Vartry	Vartry River	Newrath Br._A	10.0	7.2	32.4	0.0036	0.0005	0.0695	0.1060
ERBD	Vartry	Vartry River	Nun's Cross Br._A	25.9	21.5	30.2	0.0327	0.0180	0.0465	0.1310
NBIRBD	Dee	White River (Louth)	Dunleer_A	31.0	31.0	31.0	0.0660	0.0660	0.0660	0.0660

Table a-0-5 Length frequency data from WFD River Surveys, 2014.

RBD	Catchment	River	Site	No. Eels	5-9 cm	10-19 cm	20-29 cm	30-39 cm	40-49 cm	50-59 cm	60-69 cm	70-79 cm	>80 cm
SERBD	Suir	Anner River	Drummon Br._A	5	0	0	2	1	1	1	0	0	0
SERBD	Suir	Anner River	Killusty_A	1	0	0	0	1	0	0	0	0	0
SERBD	Suir	Ara River	Bansha_A	1	0	0	0	1	0	0	0	0	0
SERBD	Suir	Ara River	Lisheen_A	2	0	0	1	1	0	0	0	0	0
WRBD	Ballysadare	Ballysadare River	Ballysadare Br._A	5	0	0	0	0	3	1	0	0	1
SERBD	Barrow	Barrow, River	Pass Br._B	3	0	0	0	0	0	3	0	0	0
WRBD	Garvogue	Bonet River	1.8 km d/s Dromahaire Br._A	2	0	0	0	1	1	0	0	0	0
WRBD	Bundorragha	Bundorragha River	Rock Pool_A	7	0	0	4	1	1	1	0	0	0
WRBD	Clare	Clare, River	Kiltroge Castle Br._A	1	0	0	0	0	0	1	0	0	0
NBIRBD	Dee	Dee, River	Br. at Drumcar_A	13	10	3	0	0	0	0	0	0	0
SERBD	Slaney	Derry River	Ballyknocker_A	2	0	0	2	0	0	0	0	0	0
ERBD	Liffey	Dodder, River	Bushy Park_A	4	0	0	2	0	1	1	0	0	0
ERBD	Liffey	Dodder, River	D/s Piperstown Stream, Bohernabreena_A	2	0	0	0	1	1	0	0	0	0
ERBD	Liffey	Dodder, River	Mount Carmel Hospital_A	1	0	0	1	0	0	0	0	0	0
ERBD	Liffey	Dodder, River	Oldbawn_A	1	0	0	0	0	0	1	0	0	0
ERBD	Coastal	Duncormick River	(W) Br. nr Duncormick Rly St_B	7	4	2	1	0	0	0	0	0	0
SHIRBD	Feale	Feale, River	Br. ENE of Duagh Ho_A	5	0	0	4	1	0	0	0	0	0
SHIRBD	Feale	Feale, River	Sluicequarter_A	24	0	10	9	5	0	0	0	0	0
SWRBD	Blackwater	Finisk River	Modelligo Br._A	9	0	5	4	0	0	0	0	0	0
SWRBD	Blackwater	Funshion, River	Brackbaun Br._A	3	0	0	1	2	0	0	0	0	0
SWRBD	Blackwater	Funshion, River	Kilbeheny_A	2	0	0	2	0	0	0	0	0	0
SWRBD	Glashaboy	Glashaboy River	Ardnabricka_A	4	0	2	2	0	0	0	0	0	0
SWRBD	Glashaboy	Glashaboy River	Ballyvorisheen Br._B	1	0	0	0	1	0	0	0	0	0
ERBD	Liffey	Liffey, River	Lucan Br._A	10	0	2	0	7	1	0	0	0	0

RBD	Catchment	River	Site	No. Eels	5-9 cm	10-19 cm	20-29 cm	30-39 cm	40-49 cm	50-59 cm	60-69 cm	70-79 cm	>80 cm
SERBD	Mahon	Mahon, River	ENE of Seafield House_A	56	50	5	0	1	0	0	0	0	0
SERBD	Mahon	Mahon, River	Pumphouse Weir_A	27	21	4	1	1	0	0	0	0	0
SERBD	Suir	Multeen River	Ballygriffin Br._A	4	0	1	1	2	0	0	0	0	0
SERBD	Nore	Nore, River	Brownsbarn Br._A	5	0	0	2	0	0	0	0	0	0
SERBD	Nore	Nore, River	Kilmacshane_A	1	0	0	0	1	0	0	0	0	0
SERBD	Owenduff	Owenduff River	Rathnageeragh_A	12	0	4	2	5	1	0	0	0	0
WRBD	Ballysadare	Owenmore River (Sligo)	Waterfall_A	2	0	0	1	0	1	0	0	0	0
WRBD	Bunndorragha	Owennaglogh River	Tawnynoran_A	3	0	0	2	0	4	0	0	0	0
WRBD	Corrib	Robe River	Akit Br._A	1	0	0	0	0	0	1	0	0	0
SERBD	Slaney	Slaney, River	Bunclody_A	3	0	1	2		0	0	0	0	0
SHIRBD	Feale	Smearlagh River	Ford u/s Feale R confl (LHS)_A	32	1	26	4	1	0	0	0	0	0
SHIRBD	Feale	Smearlagh River	Rathea_A	12	2	8	1	1	0	0	0	0	0
SERBD	Suir	Suir, River	Kilsheelan Br._A	3	0	0	2	1	0	0	0	0	0
SERBD	Suir	Suir, River	Poulakerry_A	2	0	0	1	0	0	1	0	0	0
NWIRBD	Erne	Swanlinbar River	Swanlinbar Br. (Carpark)_A	4	0	0	0	1	2	1	0	0	0
NWIRBD	Swilly	Swilly, River	Swilly Br. (near Breenagh)_A	4	0	3	1	0	0	0	0	0	0
ERBD	Slaney	Urrin River	Buck's Br._A	5	0	0	2	3	0	0	0	0	0
ERBD	Vartry	Vartry River	Ashford Br._A	11	6	4	1	0	0	0	0	0	0
ERBD	Vartry	Vartry River	Newrath Br._A	29	21	7	0	1	0	0	0	0	0
ERBD	Vartry	Vartry River	Nun's Cross Br._A	4	0	0	3	1	0	0	0	0	0
NBIRBD	Dee	White River (Louth)	Dunleer_A	1	0	0	0	1	0	0	0	0	0

Table a-0-6 WFD Transitional Waters summary data, 2014.

RBD	Catchment	Estuary	No. Nights	No. Nets	No. Eels	CPUE	Average Length (cm)	Min. Length (cm)	Max. Length (cm)
SHIRBD	Fergus	Fergus Estuary	2	9	23	1.28	50.35	32	69
SHIRBD	Shannon	Limerick Dock	1	6	30	5.00	45.6	32	67
SERBD	Slaney	North Slob Channels	1	2	23	11.50	43.59	30	65
SERBD	Slaney	Slaney Est. Lr	3	11	13	0.39	30.23	24	36
SERBD	Slaney	Slaney Est. Up	1	6	6	1.00	29.92	14	43
SHIRBD	Shannon	Shannon Est. Up	2	11	28	1.27	43.39	27.5	70
SHIRBD	Shannon	Shannon Est. Lr	3	12	0	0.00	n.a	n.a	n.a

Table a-0-7 WFD transitional waters length frequency data, 2014

RBD	Catchment	Estuary	No. Eels	5-9 cm	10-19 cm	20-29 cm	30-39 cm	40-49 cm	50-59 cm	60-69 cm	70-79 cm	>80 cm
SHIRBD	Fergus	Fergus Estuary	23	0	0	0	7	2	9	5	0	0
SHIRBD	Shannon	Limerick Dock	30	0	0	0	10	11	5	4	0	0
SERBD	Slaney	North Slob Channels	23	0	0	0	9	6	7	1	0	0
SERBD	Slaney	Slaney Est. Lr	13	0	0	6	7	0	0	0	0	0
SERBD	Slaney	Slaney Est. Up	6	0	1	2	2	1	0	0	0	0
SHIRBD	Shannon	Shannon Est. Up	28	0	0	1	12	5	8	1	1	0
SHIRBD	Shannon	Shannon Est. Lr	0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.