## ACTIVITY REPORT

## OF THE

# TECHNICAL EXPERT GROUP ON EEL

# 2019

REPORT OF THE TECHNICAL EXPERT GROUP ON EEL TO THE NORTH-SOUTH STANDING SCIENTIFIC COMMITTEE ON INLAND FISHERIES (NSSSCIF)

June 2020

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 2021.
The data and analyses are part of an on going 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 Technical Expert Group on 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	Life-stage resident in continental waters. Often defined as a sedentary phase, but
(Brown eel)	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
	tollowing spring.
Assisted Upstream	the practice of trapping and transporting juvenile eel within the same river catchment to
Migration	assist their upstream migration at difficult or impassable barriers, without significantly
	altering the production potential (Bbest) of the catchment
Eel River Basin or	"Member States shall identify and define the individual river basins lying within their
Eel Management	national territory that constitute natural habitats for the European eel (eel river basins)
Unit	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
	Averticle 2 of Directive 2000/60/EC (i.e. Diver Pacin Districts of the Water Fremework
	Directivel " EC No. 1100/2007
Piwor Bacin District	The area of land and sea, made up of one or more paighbouring river bacing together with
River Dasin District	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 FUWED
Stocking	Stocking (not restocking) is the practice of adding fish [sels] to a waterbody from another
Stocking	source to supplement existing populations or to create a population where none exists
Tran &	Traditionally, the term tran and transport referred to transping recruits at impassable
transport	obstacles and transporting them unstream and releasing them
transport	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 POIN	NTS/POPULATION DYNAMIC
Bo	The amount of silver eel biomass that would have existed if no anthropogenic
20	influences had impacted the stock.
Bcurrent	The amount of silver eel biomass that currently escapes to the sea to spawn.
Bhest	The amount of silver eel biomass that would have existed if no anthropogenic
	influences had impacted the current stock.
$\Sigma F$	The fishing mortality rate, summed over the age-groups in the stock, and the reduction
	effected.
ΣΗ	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.
ΣΑ	The sum of anthropogenic mortalities, i.e. $\Sigma A = \Sigma F + \Sigma H$

## Contents

Exe	cutiv	e Summary	7
1	Intro	oduction	12
	1.1	EU Regulation	12
	1.2	Technical Expert Group on Eel (TEGE)	12
	1.3	Meeting Activities	14
2	Inte	rnational Advice from ICES	14
	2.1	Introduction to ICES Advice	14
	2.2	ICES Advice on Eel 2020	14
	2.3	Eel Regulation Evaluation 2019	21
3	Nati	ional Advice	21
4	Mar	nagement Actions – a scientific assessment	21
	4.1	Introduction	22
	4.2	Management Action No. 1 Reduction of fishery to achieve EU target	22
	4.3	Management Action No. 2. Mitigation of hydropower	25
	4.4	Management Actions No. 3. Ensure upstream migration at barriers	29
	4.5	Management Action No. 4 Improve water quality	30
5	Silv	er Eel Assessment, 2017	32
	5.1	Introduction	32
	5.2	Shannon	34
	5.3	Burrishoole	38
	5.4	Erne Transboundary	41
	5.5	Fane	46
	5.6	River Barrow	50
6	Yell	ow Eel Stock Assessment	54
	6.1	Surveys 2019	57
	6.2	Transboundary Yellow Eel	64
	6.3	Transitional Waters	64
	6.4	Water Framework Directive	70
8	Reci	ruitment	72
	8.1	Introduction	72
	8.2	0+ Recruitment	73
	8.3	Young Yellow Eel Recruitment	77
9	Refe	erences	78
Ap	pendi	x 1: Members of the Technical Expert Group on Eel 2018	79
Ap	pendi	x 2: Conservation of Eel Fishing Bye-law No. C.S. 319, 2015	80

Appendix 3: Reports on Fisheries closures, illegal fishing and other manager	ment
actions from the IFI RBD's and DAERA	83
Appendix 4: Silver Eel Trap and Transport Tables: Erne, Shannon and Lee 1	.02
Appendix 5: Water Framework Directive1	.05

## **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. At a meeting of the EU Fisheries Council in January 2018 it was agreed to continue to report every 3 years until there is scientific evidence of recovery signs for the eel population across Europe.

The Irish Eel Management Plan submitted to the EU on the 9<sup>th</sup> 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. Three monitoring reports have been submitted by Ireland in June 2012, 2015 and 2018.

The TEGE was 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 - 2018

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 2020:

"ICES advises that when the precautionary approach is applied for European eel, all anthropogenic impacts (e.g. caused by recreational and commercial fishing on all stages, hydropower, pumping stations, and pollution) that decrease production and escapement of silver eels should be reduced to, or kept as close as possible to, zero in 2020."

#### Stock development over time

#### "The status of European eel remains critical."

Indices of both glass and yellow eel recruitment strongly declined from 1980 to 2011. The glass eel recruitment compared to that in 1960–1979 in the "North Sea" index area was 1.4% in 2019 (provisional), 1.9% in 2018 (finalized), and the previous 5-year mean was 1.7% (2012–2016). In the "Elsewhere Europe" index series it was 6.0% in 2019 (provisional), 8.9% in 2018 (final), and the previous 5-year mean was 8.7%, based on available dataseries. The annual recruitment of

yellow eel to European waters in 2018 was 29% of the 1960–1979 level. The 2019 data was not available for inclusion in this advice.

## **National Advice**

There were no requests for advice in 2019.

In relation to the UK leaving the EU and the transboundary NWIRBD, the conservation work requiring cross-border transport of fish will continue unhindered (i.e. a CITES NDF is not required for conservation trap and transport) given that the activity is restricted to a conservation activity (no trade) and there is significant involvement of government agencies in this work.

## **Irish EMP Management Actions 2018**

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 2019 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 which led to some seizures of gear in the Shannon IRBD, the Eastern/Neagh Bann IRBD, the North West RBD and the SouthWest RBD. Reliable trade (import/export) data remains unavailable to the TEGE.

## 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 52,602kg. The level of fishing mortalities was reported to be low.

In the **River Shannon** the trap and transport total of 11,853 kg represented 31.2 % of silver eel production (using the escapement estimated adjusted to account for nights not fished) and, therefore, exceeded the 30% target, the EMP requirement was met on the basis of the agreed (3 year rolling mean value) protocol.

In the **River Erne**, the trap and transport annual target (50% of silver eel production) for the River Erne was exceeded in the 2019 season. The quantity (39,651 kg) transported for safe release at Ballyshannon represented 59.9 % of the estimated silver eel production (66,175kg) for the river system for the season.

In the **River Lee**, in the 2019 season, fishing took place on the R. Lee with nets placed at several locations for one night each between August 26<sup>th</sup> and October 17<sup>th</sup> 2019. The total catch was 1,098 kg.

AFBI undertook a turbine mortality study in the Erne catchment in 2018 and 2019; provisional results are presented here while a publication is in preparation.

For the Shannon, a mortality rate, used in previous years when no spillage took place at the hydropower dam, of 21.15% was applied to the 2019 data. The estimated silver eel mortality at Ardnacrusha hydropower station was 5,017 kg for the 2019 silver eel season.

For the *Erne*, the estimated mortality at the dams was 11,966 kg in the 2019/2020 migration period. Total mortality was estimated to be 6,759 kg at Cliff and 5,207 kg at Cathaleen's Fall. It was estimated that the cumulative mortality represented 22% mortality of the total River Erne silver eel production or 45% of the migrating eels reaching the dams during the season.

## 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, hydro dams, 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.

IFI established a National Barriers Programme to advance the above remit and this will be in train over the period 2018 – 2021. To date 15,058 structures have been assessed, 10,815 were classified as being not a barrier with 4,243 classified as a potential barrier requiring further work

Assisted upstream migration of juvenile eel takes place at the ESB Hydropower Stations on the Shannon (Ardnacrusha, Parteen), Erne (Cathaleen's 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 [RC]

The EPA published the "Water Quality in Ireland 2013-2018" report in 2019. The report found that 52.8% of surface water bodies assessed are in satisfactory ecological health being in either good or high ecological status. The remaining surface waters (which amount to 47.2%) were found to be in moderate, poor, or bad ecological status.

There were 20 reported fish kills in 2019

## **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 stations on the Shannon, Erne, Burrishoole, Fane and Barrow catchments in 2019.

## Shannon

In 2019/20 conservation eel fishing was conducted at three sites, two at Athlone, and one at Killaloe. A total of 5,364 kg of eels were caught at Athlone (4,660 kg at Jolly Mariner and 704 kg at Yacht Club), and a further 6,667 kg were caught at Killaloe, giving an overall catch for the Shanno of 12,031 kg.

Silver eel production, was estimated to have been 38,028kg. This low production level, which was comparable to the previous year, suggests that a collapse of the Shannon eel stock may be occurring though further years of monitoring would be needed to confirm such a trend.

## Burrishoole

Silver eel trapping was continued in Burrishoole in 2018/'19 and the total run amounted to 1,997 eels (end of April 2019); lower than recorded in 2016 or 2017. The total run in 2019/'20 amounted to 2225 eels (end of March 2020), higher than recorded in 2017 or 2018. As in other years, the highest proportion of the total catch (83%) was made in the Salmon Leap trap. Almost 70% of the run was completed by the end of October with the remainder in November.

## Erne

The total catch contributed to the Trap and Transport programme was 39,651 kg. The silver eel production was estimated to be 66,175 kg, and escapement was estimated to be 54,209 kg (81.9% of production). The trap and transport catch of 39,651 kg at the six fishing sites represented 59.9% of the production (exceeding the 50% target by 6,563 kg).

## Fane

Silver eel catches at the Fane Fishery in 2019 were down on 2018 numbers with a total catch of 500 kg (1,323 eels) and 26 nights fished. The Fane catch is made up of approximately 62% female eels and 40% male eels.

## R. Barrow

The River Barrow had a silver eel catch of 1,329 eels over 24 fishing nights. The majority of the catch (n = 1,159) was recorded during just 6 nights in September (relatively early in the silver eel season).

#### 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.

#### 2019 Survey

Yellow eel surveys took place in 2 lakes (Lough Feeagh and Bunaveela), 2 riverine catchment (Barrow and Munster Blackwater) and 2 transitional waters (Waterford Harbour and Lough Furnace).

In Lough Bunaveela, a total 27 eels were caught with a CPUE of 0. 45 eels/net/night. The average length was 44.3cm and ranged in length from 33.3cm to 62.5cm. Three recaptures were noted out of 24 tagged. While in Lough Feeagh, 52 eels were caught with a CPUE of 0.87 eels/net/night. The average length of eels was 41.7cm and ranged in length from 30.8cm to 63.2cm. 83.3% of the sacrificed eels contained *A. crassus* with an infection intensity of 6.9 continuing the rising trend in infection rates in the Burrishoole yellow eel stock.

The Barrow River results suggest a reduced distribution of eels within the Barrow catchment. The only locations where reasonable eel numbers were captured were downstream of St Mullins and the high water mark. Once sampling efforts were focused above the high water mark (HWM) on the Barrow, the catches reduced dramatically.

The IFI fyke netting surveys on the Munster Blackwater River (near Clondulane Weir) have delivered consistent results between years. The length frequencies presented appear to resemble that of eels captured in a productive lake system as the impounded habitat being examined essentially provides just such a habitat for eels growth and development.

#### **Transitional Waters**

In the Marine Institute sampling of Lough Furnace, 23 eels were caught with a CPUE of 0.38 eels/net/night. The average length was 37.5cm ranging from 30.7cm to 64.5cm. A total weight of 2.24kg was caught. In the Lower Lough Furnace, 43 eels were caught with a CPUE of 1.4 eels/net/night. The average length was 45.6cm ranging in length from 29.8cm to 66.3cm, with a total weight of 8.11kg caught.

The IFI survey of Waterford Estuary was repeated at the same locations as sampled in previous years. The survey yielded a total catch of 1,021 eels, with a total weight of 118.9 kg. The average length was 38.8cm, with a range from 22.5 to 70.0cm. The PIT tagging recapture results yielded a recapture rate of 3.9% (332 eels tagged with 13 recaptures).

## Recruitment

The annual recruitment of glass eel to European waters in 2019 is 1.4% of the 1960–1979 level in the "North Sea" series and 6% (provisional) in the "Elsewhere Europe" series. For the yellow eel dataseries, recruitment for 2018 was 26.4% of the 1960–1979 level and the previous 5-year mean was 16.6% (2013–2017); the 2019 data were not available for this advice.

Overall glass eel catches for 2019 were down from 2018. With the exception of the Feale and the Corrib all traps caught significantly less than in 2018 (Erne fell by 95%). Average yearly temperatures were higher in 2018 with temperatures month on month being higher in 2018 than 2019. Recent ICES advice has recruitment at 1.4% of historic levels in 2019 (provisional) this is down from 1.9% in 2018 and lower than the 5 year average from 2012 to 2016 (1.7%) (ICES, 2019).

## 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. At a meeting of the EU Fisheries Council in January 2018 it was agreed to continue to report every 3 years until there is scientific evidence of recovery signs for the eel population across Europe. The most recent report, was submitted before 30<sup>th</sup> June 2018, addressing the following;

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

The European Commission's Directorate-General for Maritime Affairs and Fisheries (DG MARE) has commissioned an external Study on the evaluation of the Eel Regulation. The purpose of the evaluation is to assess the measures to protect European eel under the Eel Regulation, and in particular the contribution of the national Eel Management Plans established and implemented under this Regulation to the recovery of the stock of European eel. The review is to run from September 2018 to March 2019.

## 1.2 Technical Expert Group on Eel (TEGE)

An expert group on eel has been in existence since 2010 formerly known as the Standing Scientific Committee on Eel and since 2017 as the Technical Expert Group on Eels.

#### 1.2.1 Background

The North-South Standing Scientific Committee for Inland Fisheries (NSSSCIF) was formed in 2017 to support the provision of scientific advice relating to the conservation and sustainable exploitation of the inland fisheries resource with advice provided in response to requests from Department of Communications, Climate Action and Environment (DCCAE) and its agency Inland Fisheries Ireland (IFI) from Ireland (IRL), the Department of Agriculture, Environment and Rural Affairs (DAERA) from Northern Ireland (NI) and the Loughs Agency (LA) a North-South Implementation Body. This group was also tasked to give consideration to the coordination and effective use of scientific resources for data collection and research projects linked to the above. The NSSSCIF Term of Reference (TOR) facilitates the formation of Expert Groups drawn from within the membership of the Committee, or additional invitees as required, to advise and contribute on any particular species, aquatic habitat or biosecurity issues. To this end the NSSSCIF has established an eel expert group to provide scientific advice to guide the NSSSCIF and IFI management in the decisions and policy development aimed at ensuring the recovery of Ireland's eel stocks as outlined in Ireland's National Eel Management plan.

#### 1.2.1.1 Purpose

The NSSSCIF requests the Expert Group on Eel to provide a report, details outlined in Appendix A, on the status of eel stocks for the purpose of reporting to the EU in line with the Eel Regulation (EC1100/2007). The NSSSCIF may also request the Expert Group on Eel to offer scientific advice on the implications of proposed management decisions or policies on eel or seek advice on scientific matters in relation to eel. All scientific advice provided by Expert Group on Eel will be considered by the NSSSCIF and presented as independent advice.

## 1.2.2 Term of Reference

1. The technical group shall carry out an appropriate assessment of eel stocks (juvenile, yellow and silver eel) in accordance with the EU Regulation for each Eel Management Unit and transboundary plan.

a. Update the national stock assessment framework in line with EU reporting requirements and assess the level of contemporary silver eel escapement with respect to the EU 40% target.

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

2. The technical group shall complete a scientific assessment of the implementation of the relevant monitoring and management objectives identified in the National EMP, in line with the reporting requirements for the regulation (see Appendix I for National Management plan objectives)

3. Compile a stock assessment report and scientific advice as required in support of the report to the EU in line with the timeframes outlined in the eel regulation.

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

- a. This should include the long term data series
- i. National recruitment time series
- ii. Silver eel index sites
- 5. Address any requests for scientific advice received from NSSSCIF.

## 1.3 Meeting Activities

The TEGE met twice times during the 2019/2020 to monitor and report on the 2019 survey year; a number of proposed meetings were cancelled due to unforeseen circumstances.

8th November 2020	Galway
11th March 2020	Galway
9th June 2020	Video conference

## 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, manages advisory processes, and creates and delivers 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 2020

## European Eel throughout its natural range (reproduced from the ICES Advice 2019,

ICES Advice 2019 – ele.2737.nea – https://doi.org/10.17895/ices.advice.4825 (November 2019)

## Advice

ICES advises that when the precautionary approach is applied for European eel, all anthropogenic impacts (e.g. caused by recreational and commercial fishing on all stages, hydropower, pumping stations, and pollution) that decrease production and escapement of silver eels should be reduced to, or kept as close as possible to, zero in 2020.

#### Stock development over time

The status of European eel remains critical.

Indices of both glass and yellow eel recruitment strongly declined from 1980 to 2011. The glass eel recruitment compared to that in 1960–1979 in the "North Sea" index area was 1.4% in 2019 (provisional), 1.9% in 2018 (finalized), and the previous 5-year mean was 1.7% (2012–2016). In the "Elsewhere Europe" index series it was 6.0% in 2019 (provisional), 8.9% in 2018 (final), and the previous 5-year mean was 8.7%, based on available dataseries. For the yellow eel dataseries, recruitment for 2018 was 26.4% of the 1960–1979 level and the previous 5-year mean was 16.6% (2013–2017); the 2019 data collection is ongoing so the data are not available for this advice. The annual recruitment of yellow eel to European waters in 2018 was 29% of the 1960–1979 level. Statistical analyses of the time-series from 1980 to 2019 show a change in 2011 in the trend of glass eel recruitment indices; the recruitment stopped decreasing and has been increasing in the period 2011–2019 at a rate that statistically differs significantly from zero. The highest value observed during the period from 2011 to 2019 occurred in 2014.



pure glass eel or a mixture of glass + yellow eels. The predictions were then scaled to the 1960–1979 average  $\overline{\mathbf{p}}_{1960-1979}$ . In the Baltic area, recruitment occurs at the yellow eel stage only. 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**: Estimated (GLM) yellow eel recruitment trends for Europe. The GLM was fitted to 13 yellow eel time-series and scaled to the 1960–1979 average  $\overline{\mathbf{p}}_{1960-1979}$ .

#### Stock and Exploitation Status

ICES cannot assess the exploitation status relative to the maximum sustainable yield (MSY) and precautionary approach (PA) reference points, because the reference points are undefined. While stock size reference points are also undefined, it is considered that the stock size is likely well below potential biological reference points.

Larope	an een stat	F	Ishing p	ressure		o reference pe	nines.		Stock size
	-	2016	2017		2018		2017	2018	2019
Maximum sustainable yield	F <sub>MSY</sub>	0	0	0	Unknown	MSY B <sub>trigger</sub>	۲	۲	Below potential reference points
Precautionary approach	F <sub>pa</sub> ,F <sub>lim</sub>	0	0	0	Unknown	B <sub>pa</sub> , B <sub>lim</sub>	۲	۲	Below potential reference points
Management plan	F <sub>MGT</sub>	-	-	-	Not applicable	B <sub>MGT</sub>	-	-	- Not applicable
Qualitative evaluation		0	0	0	Unknown		0	0	Highly impaired recruitment

## **Catch Scenarios**

Total landings and effort data are incomplete. There is also great heterogeneity among the timeseries of landings, due to inconsistencies in reporting by and between countries. Changes in management practices have also affected the reporting of commercial and noncommercial/recreational fisheries. ICES does not, therefore, 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 or estimate the level of impact that fisheries (at the glass, yellow, or silver eel stage) have on the reproductive capacity of the stock.

#### **Basis of the Advice**

The basis for the advice is the Precautionary Approach.

A management framework for eel within the EU was established in 2007 by an EU regulation (EC Regulation No. 1100/2007; EU, 2007), but there is no internationally coordinated management plan for the entire stock area; this extends beyond the EU. 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 (EMPs) for their river basin districts. These are designed to reduce anthropogenic mortalities, permitting with high probability the escapement to the sea of at least 40% of the silver eel biomass. This is 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, 2009, 2010), and progress in implementing EMP actions (ICES, 2013a, 2013b, 2018a). The EU Member States produced progress reports in 2012, 2015, and 2018. The 2015 reports were not post-evaluated. Elements of the 2018 reports have been post-evaluated by ICES (WKEMP; ICES, 2019a) and the EU is evaluating the Eel Regulation.

From 2018, the European Council and the EU Commission have jointly enforced a three-month closure for all eel stages in all Union waters of the ICES area, in Union and international waters of the Mediterranean Sea, and in brackish waters.

At its 42nd annual meeting in 2018, the General Fisheries Commission for the Mediterranean (GFCM) adopted Recommendation GFCM/42/2018/1 establishing management measures for European eel (*Anguilla anguilla*) in the Mediterranean Sea. These measures comprise a consecutive 3-month closure period to be defined by each EU Member State in accordance with its national management plan, the conservation objectives of Regulation (EC) No 1100/2007, and the temporal migration patterns of eel in the Member State. In consideration of the critical state of the stock, the recommendation shall apply to all activities catching European eel and include freshwaters as well as transitional brackish waters such as lagoons and estuaries.

Work is ongoing towards the development of an adaptive regional management plan for eel in the Mediterranean Region under the auspices of the GFCM. The Commission approved Recommendation GFCM/42/2018/1 on a multiannual management plan for European eel in the Mediterranean Sea. This details scope, general and operational objectives, and transitional management measures, while also addressing the need for improved scientific advice.

The EC Regulation No. 1100/2007 (EU, 2007), establishing measures for the recovery of the stock of European eel, 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. Work is progressing in this area.

#### Quality of the Assessment

Data for the most recent year are typically considered as "provisional", to allow for a small proportion of late reporting of data. These data are finalized the following year. ICES does not expect the finalization of data to materially affect the present advice.

An eel data call was issued for the first time in 2017, which substantially improved the coverage and completeness of the data being reported to ICES. A new call was issued in 2018 that built upon the previous one (ICES, 2018b); it included the national stock indicators and associated data as reported to the EU in the 2018 progress reports. Another call was issued in 2019 (ICES, 2019b). Data on fisheries, however, and other anthropogenic impacts across the whole stock, remain incomplete. There is no international legislative requirement to collect and provide data for the entire stock area.

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. The quality of the underlying recruitment data is variable and needs further investigation. The current advice is based on the fact that the indices used by ICES are still well below the 1960–1979 levels.

#### Issues relevant for the advice

Many fishery-based time-series are used to assess temporal trends in recruitment and escapement for this advice. Changes to these time-series, e.g. through new fishery regulations or changes to habitat, might introduce biases in those time-series and compromise their use in the analyses. Recent analyses, for example, indicate that losing fishery-based indices would increase the noise in the stock assessment. This means that the implementation of new fishery-independent time-series should be encouraged.

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

The European eel (*Anguilla anguilla*) is listed in CITES Appendix II (species that are not necessarily now threatened with extinction, but that may become so unless trade is closely controlled) and in the EU implementation of CITES rules (Annex B to Council Regulation (EC) No 338/97; EU, 1996) since 13 March 2009. Since 2010, import and export of eel from the EU has been prohibited. Some non-EU range states allow export of European eel, mostly to the Far East.

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 known to occur. The non-fishing anthropogenic mortality factors can be grouped into those resulting from the following: (a) hydropower, pumping stations, and other water intakes; (b) habitat loss or degradation; (c) pollution, diseases, and parasites; and (d) other management actions that may affect levels of predation, e.g. conservation vs. control of predators. Climate change may have effects, but these have not been quantified.

ICES has updated the quantification of the impacts of non-fishery factors and estimated that a total potential current loss of eel to all non-fishery anthropogenic factors (largely hydropower and pumps), from approximately half of the countries reporting to ICES, amounted to 1625 tonnes annually. The estimate would require further improvement through better and more consistent data delivery from EU Member States.

Eel picornavirus (EPV-1) was detected in organs from a diseased yellow eel in Lake Constance in Germany from 2005 with a potentially high mortality rate, and very recently in yellow eels in North Rhine (Germany). Information about EPV-1 infections and the impact of this virus on health and escapement is currently missing. This means that the potential risk for disease transfer cannot currently be evaluated.

Environmental impacts in marine, transitional, and freshwaters all contribute to the anthropogenic stresses on eels, their mortality, and their reproductive success; these include habitat alteration, barriers to eel passage, deterioration in water quality, and the presence of non-native diseases and parasites. It is anticipated that the implementation of the Water Framework (WFD) and the Marine Strategy Framework (MSFD) 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 the stocking of eels is considered a management action in the EU regulation and 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 information on contribution to actual spawning is missing due to the general lack of knowledge of the spawning of eel. Internationally coordinated research is required to determine any net benefit of restocking on the overall population, including carrying capacity estimates of glass eel source estuaries, detailed mortality estimates at each step of the stocking process, and performance estimates of stocked vs. non-stocked eels.

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. Stocking should take place only where survival to silver eel escapement is high, and should not be used as an alternative to reducing anthropogenic mortality. Where eel are translocated and stocked, measures should be taken to evaluate their fate and their contribution to silver eel escapement. Such measures should include regionally-coordinated mass marking of eels to distinguish stocked eels from natural recruits in future scientific surveys.

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

The framework required EU Member States to report on progress in 2012, 2015, and 2018. In 2012, many EU Member States did not completely report stock indicators (22 of 81 eel management plans did not report all biomass indicators, and 38 did not report all mortality indicators). There are also differences in the approaches used to calculate reported stock indicators. A complete reporting of verified indicators covering the distribution area of the European eel is required for a full assessment of the stock. It was not requested that ICES evaluate the 2015 reports. Elements of the 2018 reports have been post-evaluated by ICES (WKEMP; ICES, 2019a) and the EU is evaluating the Eel Regulation. In 2018, nine of 95 eel management plans did not report all biomass indicators, and 17 did not report all mortality indicators (ICES, 2019a).

### **Reference Points**

The EC Regulation No. 1100/2007 (EU, 2007) specifies that anthropogenic mortalities should be reduced, permitting with high probabability the escapement to the sea of at least 40% of the silver eel biomass. This is 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 currently regarded as an unimpaired recruitment level.

ICES has advised the EU 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); this would be under the circumstances of any future improvement of the stock (ICES, 2015). These reference points were developed using the specific CITES guiding principles for NDF.

#### Basis for the assessment

ICES stock data category	3 (ICES, 2018c).				
Assessment type	Trend analysis, GLM of glass and yellow eel recruitment indices.				
Input data	Glass eel and yellow eel recruitment indices.				
Discards and bycatch	Not included.				
Indicators	None.				
Other information	None.				
Working group	Joint EIFAAC/ICES/GFCM Working Group on Eels (WGEEL).				

Table 3	European eel.	Basis of	the assessment.
		1	the second s

#### Information from stakeholders

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

#### History of advice, catch and management

Year	ICES advice	Predicted catch corresponding to the advice	TAC*	ICES catch **
1999	A recovery plan			
2000	No fishery and a recovery plan	0		
2001	A recovery plan should be implemented for the eel stock and fishing mortality should be reduced to the lowest possible level until such a plan is agreed upon and implemented.			-
2002	Exploitation should be reduced to the lowest possible level until a recovery plan is agreed upon and implemented		-	
2003	All anthropogenic mortality as close to zero as possible, until a recovery plan is agreed upon and implemented		-	-
2004			-	
2005			-	
2006	All anthropogenic mortality as close to zero as possible, until a recovery plan is agreed upon and implemented		-	
2007	All exploitation and other anthropogenic impacts should be reduced to a level as close to zero as possible and a recovery plan for the whole stock should be implemented urgently			
2008	All exploitation and other anthropogenic impacts should be reduced to as low as possible, until there are clear signs of recovery		-	
2009	All exploitation and other anthropogenic impacts should be reduced to as close to zero as possible		-	-
2010	All anthropogenic impacts should be reduced to as close to zero as possible until stock recovery is achieved			
2011	All anthropogenic mortality as close to zero as possible until there is clear evidence that the stock is increasing		-	
2012	All anthropogenic mortality as close to zero as possible until there is clear evidence that both recruitment and the adult stock are increasing			-
2013	All anthropogenic mortality as close to zero as possible until there is clear evidence that both recruitment and the adult stock are increasing			
2014	All anthropogenic mortality as close to zero as possible, until there is clear evidence of sustained increase in both recruitment and the adult stock		-	-
2015	All anthropogenic mortality as close to zero as possible		-	-
2016	All anthropogenic mortality as close to zero as possible		-	
2017	All anthropogenic impacts as close to zero as possible		-	-
2018	All anthropogenic impacts as close to zero as possible	-		
2019	All anthropogenic impacts as close to zero as possible		-	
2020	All anthropogenic impacts as close to zero as possible			

able 4	Furanaan	anl	Histon	ALCEC	a duis
	curopean	and and a	HISTORY	OT ICES	a g v i

T

\* There has never been a TAC for this stock.

\*\* There are no ICES catch estimates for the complete stock to be presented.

#### History of catch and landings

Landings data are not complete for the entire natural range of the European eel. Tables 5, 6, 8, and 9, however, present the landings reported to ICES, the European Inland Fisheries and Aquaculture Advisory Commission (EIFAAC), and GCFM. Landings are reported either through responses to the 2018 and 2019 Data calls (ICES, 2018b, 2019b), in Country Reports (ICES, 2019c), or integrated by ICES in 2017 (ICES, 2017) using data from previous reports. Table 7 contains landings data reported to FAO for countries where data were not available to the working group (FAO, 2017). Not all countries have reported all their landings, so the values given here should be considered as a minimum. Care should also be taken with the interpretation of the landings as indicators of the stock, since the catch statistics now reflect the status of reduced fisheries activity as well as of stock levels.

Data deficiencies in reports for recreational fisheries (Tables 8–9) were described by ICES (2016). Though improvements have been evidenced since then, the overall impact of recreational fisheries on the eel stock remains largely unquantified; it is likely to be at the same order of magnitude as the commercial fisheries.

Information on fishing effort and the capacity of the fisheries is lacking, but is necessary to fully interpret the changes to the landings data over the years. The wide variety of fisheries and gear types makes this challenging.

Few countries reported the level of misreporting and illegal fisheries to ICES, EIFAAC, and GFCM, i.e. the seizure of illegal nets as well as the illegal trade of glass eels from countries both inside and outside the EU. There are indications from customs seizures however, that the illegal export of glass eel could be very substantial, potentially exceeding the legal market.

## [The Tables 5-9 referred to here are available in the online version on the ICES website]

Recommended Citation: ICES. 2019. European eel (Anguilla anguilla) throughout its natural range. In Report of the ICES Advisory Committee, 2019. ICES Advice 2019, ele.2737.nea. https://doi.org/10.17895/ices.advice.4825.

#### Sources and references

- EU. 1996. Council Regulation (EC) No 338/97 of 9 December 1996 on the protection of species of wild fauna and flora by regulating trade therein. Official Journal of the European Communities, L 61: 1–69. http://data.europa.eu/eli/reg/1997/338/oj.
- EU. 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, L 248: 17–23. http://data.europa.eu/eli/reg/2007/1100/oj.
- FAO. 2017. Fisheries and aquaculture software, 2006–2018. FishStat Plus Universal software for fishery statistical time series. *In:* FAO Fisheries and Aquaculture Department [online]. Rome. Updated 14 September 2017. [Cited 24 October 2018]. http://www.fao.org/fishery/statistics/software/en.
- ICES. 2009. European eel. *In* Report of the ICES Advisory Committee, 2009. ICES Advice 2009, Book 9, Section 9.4.9. 4 pp. https://doi.org/10.17895/ices.advice.5620.
- ICES. 2010. European eel. *In* Report of the ICES Advisory Committee, 2010. ICES Advice 2010, Book 9, Section 9.4.9. 9 pp. https://doi.org/10.17895/ices.advice.5621.
- ICES. 2013a. European eel. *In* Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 9, Section 9.4.7. 7 pp. https://doi.org/10.17895/ices.advice.5622.
- ICES. 2013b. Report of the Workshop on Evaluation of Progress of the Eel Management Plan 2013 (WKEPEMP), 13–15 May 2013, ICES Headquarters, Copenhagen. ICES CM 2013/ACOM:32. 757 pp. https://doi.org/10.17895/ices.pub.5624.
- ICES. 2015. 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. 7 pp. https://doi.org/10.17895/ices.advice.5625.
- ICES. 2016. Report of the Working Group on Eels (WGEEL), 15–22 September 2016, Cordoba, Spain. ICES CM 2016/ACOM:19. 107 pp. https://doi.org/10.17895/ices.pub.5626.
- ICES. 2017. Report of the Joint EIFAAC/ICES/GFCM Working Group on Eels (WGEEL), 3–10 October 2017, Kavala, Greece. ICES CM 2017/ACOM:15. 99 pp. https://doi.org/10.17895/ices.pub.5627.
- ICES. 2018a. Report of the Joint EIFAAC/ICES/GFCM Working Group on Eels (WGEEL), 5–12 September 2018, Gdańsk, Poland. ICES CM 2018/ACOM:15. 152 pp. https://doi.org/10.17895/ices.pub.5628.
- ICES. 2018b. WGEEL Joint ICES, EIFAAC, GFCM data call for advice on European eel.

   Published
   11
   July
   2018.
   6
   pp.

   http://www.incenter.org/linear/linea
- https://www.ices.dk/sites/pub/Publication%20Reports/Forms/DispForm.aspx?ID=34783.
  ICES. 2018c. Advice basis. *In* Report of the ICES Advisory Committee, 2018. ICES Advice 2018, Book 1, Section 1.2. https://doi.org/10.17895/ices.pub.4503.

- ICES. 2019a. Report of the Workshop for the Review of Eel Management Plan Progress Reports (WKEMP), 17–19 July and 13–16 November 2018, Copenhagen, Denmark. ICES CM 2018/ACOM:46. 100 pp. https://doi.org/10.17895/ices.pub.5629.
- ICES. 2019b. WGEEL Joint ICES, EIFAAC, GFCM data call for advice on European eel. Published 11 June 2019. 8 pp. https://www.ices.dk/sites/pub/Publication%20Reports/Forms/DispForm.aspx?ID=35633.
- ICES. 2019c. Annex 5: Country Reports 2018–2019. Separate annex to the report of the Joint EIFAAC/GFCM/ICES Working Group on Eels (WGEEL). ICES Scientific Reports, 1:50. 483 pp. Available at http://ices.dk/community/groups/Pages/WGEEL.aspx.
- ICES. 2019d. Joint EIFAAC/GFCM/ICES Working Group on Eels (WGEEL). ICES Scientific Reports, 1:50. 177 pp. https://doi.org/10.17895/ices.advice.5545.

## 2.3 Eel Regulation Evaluation 2019

During the December 2017 Fishery Council meeting the member states agreed to step up efforts to protect the European Eel. It was also agreed that the Commission would launch an external evaluation of the Eel Regulation to assess its effectiveness and its contribution to the recovery of the stock. The review found that:

- The eel regulation remains an important instrument in helping the European eel stock to recover. It ensures the management of eel in all its life stages and addresses both fisheries and non-fisheries related human impact.
- Despite noteworthy progress in reducing fishing efforts and a concerted attempt to develop a pan-EU management framework, the status of the European eel remains critical.
- The silver eel escapement is still well below the target of 40% biomass that would have existed if no human influence had impacted the stock.
- Whilst restocking works in some Member States, not all have achieved their restocking targets.
- Member States' annual reporting on glass eel prices is incomplete. Many countries fund glass eel stocking through the European Maritime and Fisheries Fund (EMFF).
- Non-fisheries related mortality has not declined significantly over the last decade. This has received insufficient focus in the EMPs and related actions.
- Although the eel regulation offers the necessary framework to help restore the stock, its recovery is still far from certain. It is widely recognised that the recovery of the European eel will take many decades, given the long life-span of the species.

A detailed report is available online

https://ec.europa.eu/fisheries/sites/fisheries/files/swd-2020-35\_en.pdf

## 3 National Advice

There were no requests for ad hoc advice in 2019.

In relation to the UK leaving the EU and the transboundary NWIRBD, the conservation work requiring cross-border transport of fish will continue unhindered (i.e. a CITES NDF is not required for conservation trap and transport) given that the activity is restricted to a conservation activity (no trade) and there is significant involvement of government agencies in this work.

## 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.

In late 2018 the Department of Communications, Climate Change and Energy announced the creation of a Support Scheme for Former Eel Fisherpersons to address the hardship experienced by commercial eel fisherpersons.

Conservation of Eel byelaw No. C.S. 319, 2015 ceased to have effect on 30 June 2018 and has not yet been renewed.

#### 4.2.2 Action 1a: Report closure of fishery

All management regions confirmed a closure of the eel fishery for the 2019 season with no commercial or recreational licences issued (Appendix 3). The eel fishery, with the exception of the strictly managed L. Neagh, also remained closed in N. Ireland in 2019.

## 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 Department of Agriculture, Environment and Rural Affairs (DAERA) in Northern Ireland (Appendix 4), summarised into Table 4.1. Some illegal fishing was reported which led to some seizures of gear in the Shannon IRBD, the Eastern RBD, the North West RBD and the SouthWest RBD (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. The poor quality of the export data currently available to the TEGE makes it difficult to determine the level of illegal catch. There were no instances of seizures of illegal or undocumented eel shipments.

#### Transboundary:

No seizures were reported by DAERA for 2019.

#### 4.2.4 Action 1b: Recreational Fishery

The Bye Law No CS 319 2015 prohibiting the possession of eel caught in Ireland expired in June 2018 and has not been renewed.

### 4.2.5 Action 1c: Diversification of the Fishery

The Scientific Eel Fishery operated by Inland Fisheries Ireland in collaboration with former eel fishers ran from 2016 to 2018 and is now complete.

	ERBD	DAERA	NWRBD	SHRBD	SERBD	SWRBD	WRBD
Silver T&T programme	No	Yes	Yes	Yes	No	Yes	No
Illegal trading related to T&T	No	No	No	No.	No	No	No
Estimated level of illegal fishing	Low	None	Low	High	None	Low	None
Number of gear seizures	3	0	1	6	0	2	0
Gear types seized	Home Made Traps / Nets	na	1 fyke net	11 fyke net	na	2 eel traps	na
Number of eel dealer interceptions	0	0	0	0	0	0	0
Estimated tonnage on board:	Na	na	Na	na	na	na	na
Declared origin of cargos:	Na	na	na	na	na	na	na

Table 4-1: Details of illegal activity within the regions and transboundary Northern Ireland,2019.

## 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 and 2018 – 2024 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 long-term shortfall could not be carried forward indefinitely.

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

## 4.3.1.1 2019 Trap and Transport Results

The total amounts of silver eel trapped and transported in each of the three rivers in 2019 are presented in Table 4-2. The separate detail sheets of the amounts transported from each site on each date are presented as an Appendix to this report (Appendix 4).

In the **River Shannon** the trap and transport total of 11,853 kg represented 31.2 % of silver eel production (using the escapement estimate adjusted to account for nights not fished) and, therefore, exceeded the 30% target, the EMP requirement was met on the basis of the agreed (3 year rolling mean value) protocol.

In the **River Erne**, the trap and transport annual target (50% of silver eel production) for the River Erne was exceeded in the 2019 season. The quantity (39,651 kg) transported for safe release at Ballyshannon represented 59.9 % of the estimated silver eel production (66,175kg) for the river system for the season.

In the **River Lee**, in the 2019 season, fishing took place on the R. Lee with nets placed at several locations for one night each between August 26<sup>th</sup> and October 17<sup>th</sup> 2019. The total catch was 1,098 kg. The relative size-frequency distribution is presented in Figure 4-1.



Figure 4-1 Relative size–frequency distribution of eels from the R. Lee.

HPS Silver Amount 3 yr P'tion Mort T&T Transported **Relation** to Running Catchment Bbest (kg) Status Average Year kg Target target 74,382 4,095 R. Shannon 2009 30% of run 23,730 31% Achieved 31% R. Shannon 2010 27,768 36% 68,920 8,210 30% of run 40% Achieved R. Shannon 2011 65,558 30% of run 25,680 39% Achieved 37% 7,673 R. Shannon 2012 67,931 9,095 30% of run 24,228 36% Achieved 38% 2013 79,970 R. Shannon 9,195 30% of run 22,561 28% Not achieved 34% R. Shannon 2014 70,725 6,950 30% of run 26,438 37% Achieved 34% 70725\* 19,957 31% R. Shannon 2015 4,656 30% of run 28.2%\* Not achieved R. Shannon 2016 38,608 3,062 30% of run 16,711 43% Achieved 36% R. Shannon 2017 34,139 2,948 30% of run 16,737 49% Achieved 40% 47% R. Shannon 2018 32,580 2,967 30% of run 16,411 50% Achieved R. Shannon 2019 38,028 5,017 30% of run 11,853 31% Achieved 44% 2009 R. Erne 20,960 22t 9,383 43% Not achieved 43% R. Erne 2010 41,232 3,047 34t 19,334 57% Not achieved 47% R. Erne 2011 42,855 2,394 39t 25,405 65% Not achieved 59% 2012 51% R. Erne 67,666 10,215 50% of run 34,660 51% Achieved R. Erne 2013 73,330 8,809 50% of run 39,319 54%Achieved 52% R. Erne 2014 72,493 5,859 50% of run 48,126 66% Achieved 57% 2015 54,706 59% R. Erne 78,034 6,333 50% of run 56% Achieved R. Erne 2016 62,871 11,494 50% of run 38,264 61% Achieved 61% 60% R. Erne 2017 68,810 10,271 50% of run 43,470 63% Achieved R. Erne 2018 83,033 14,896 50% of run 47,004 57% Achieved 60% R. Erne 2019 66,175 11,966 50% of run 39,651 60% Achieved 60% 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% R. Lee 2016 0.5t 44 9% Not achieved 83% R. Lee 2017 0.5t 542 108% Achieved 74% 2018 0.5t R. Lee 35 7% Not achieved 41% 2019 220% R. Lee 0.5t 1,098 Achieved 112%

Table 4-2: Total amounts (t) of silver eel trapped and transported in the Shannon, Erne and Lee, 2009-2019, and the success relative to the targets set in the EMPs. Note change of target on the Erne in 2012.

\* outcome estimated due to flooding

#### 4.3.1.2 Improvements to T+T programme

#### **DIDSON** acoustic camera:

In the 2019/20 eel season the DIDSON acoustic camera was again deployed at Clonlara on the headrace to Ardnacrusha dam. This study continued the refinement of a method for assessing route selection at Parteen weir, escapement via the ORC and mortality at the dam. Additionally, the data collected could be used to quantify eel abundance at Killaloe eel weir in the absence of catch data, if required.

We also deployed a second acoustic camera, the ARIS. Both cameras were deployed adjacent to one another with the same portion of the river viewed. This study aimed to assess how comparable the data collected using these two different cameras were. To date, all research on the Rivers Shannon and Erne using acoustic cameras has been conducted with the DIDSON. Therefore, if the ARIS is to be used for eel monitoring in future, using protocols developed for the DIDSON, it is important to ensure that the ARIS and DIDSON are comparable in the number of eels counted. Preliminary results show that both cameras gave very similar results. Additionally, it has previously been reported that ARIS cameras can be used to accurately measure the length of fish observed. This would be a distinct advantage over the DIDSON, which is known to give biased estimates of fish size and would allow the size-structure of eel populations to be assessed without catch data. To test this, eels of known length were released upstream of the cameras and allowed to swim through the cameras field of views. ARIS measurements did not differ significantly from known lengths, while DIDSON measurements did.

#### **Removal Sampling:**

Removal sampling is a widely used survey protocol used in the estimation of animal abundances. A population is sampled multiple times, using equal effort, and the individuals captured are removed from the population, hence the term. Population size is estimated based on the principle that successive removals of individuals will cause catches to decline at a rate indicative of initial population abundance. Removal sampling is appealing because it is conceptually simple and easy to implement. As such it could provide a simple means of estimating production and escapement for various river sections. It is well suited to any T&T site where two or more nets are sequentially set, for example, at the Jolly Mariner site in Athlone.

Depletion analysis was initially undertaken at Athlone in the 2018/2019 season (N = 30 nights) on the Shannon with paired nets fished to determine population size above this point. In 2019/20 further depletion records were collected and mark-recapture experiments (x2) were conducted to confirm the results.

As production on the Shannon has undergone a further decline this study aimed to develop a means of establishing production in the upper catchment and will help to identify the extent of this reduction and if it is limited to the lower catchment or is affecting the entire catchment. Results from the 2018/19 season showed that, although production in the entire catchment was low overall (0.76 kg.ha-1), there is also differential production within the catchment. Production in the upper catchment (0.63 kg.ha-1) is less than in the lower catchment (0.87 kg.ha-1).

#### 4.3.2 Action 2b: Quantify Turbine Mortality

#### 4.3.2.1 Shannon

No update for 2019

#### 4.3.2.2 Erne

AFBI undertook a silver eel turbine mortality study in the River Erne over the years 2018 and 2019.

## 2018

Sixty female silver eels (mean length 666mm & 710mm) were implanted with Vemco V7 hydro acoustic tags and placed into L. Erne at Belleek (under UK Home Office project licence 41436, D Evans personal licence PPL 2820). The taggings and associated releases were in 2 separate batches of 30 to coincide with low flow (6/12/18) and high flow (19/12/18) regimes out of the system.

## 2019

A further 60 Erne female silver eels (mean length 630mm & 715mm) were tagged as above, and similarly released in 2 batches to coincide with low flow (25/11/19) and high flow (16/12/19) regimes out of the system.

A receiver network of 4 listening stations had been installed 2 weeks prior which covered the silver eels migration route from above Cliff station (approx. 1.5 miles downstream of the Belleek release point), into and through Assaroe lake and out into the mid and outer edges of the Erne estuary (Figure 4-2).



Figure 4-2. AFBI Vemco receiver network through the exit of the Erne system (n = 5 for 2018/2019 season; n = 4 for 2019/2020 season)

## **Provisional Results**

Total mortality on the 2 batches of eels released in 2018 ranged from 46.7 - 66.7%, whilst in 2019, it was measured at 56.7% under both flow regimes.

These results indicate a significant difference to mortality figures reported previously for the 2 Erne hydroelectric stations - 2016/17 SSCE: report lists individual station impacts ranging from 7.7% - 27.5% under various generation and flow regimes: and cumulative of 18.3% mortality.

Individual assessments for each hydroelectric facility will be compiled following a review of these data by TEGE with the full suite of results presented for peer review publication and reported in subsequent Activity Report of the TEGE.

Consideration of these reviewed data will be necessary with particular emphasis on

a) the impact of this higher mortality rate on escapement data reported previously

- b) establishment of revised mortality figures under different flow regimes.
- c) associated implications of this in terms of EU conservation target compliance for NWIRBD based on the calculation derived in (a)
- d) additional conservation measures that could be recommended.
- e) the recent review on Hydro impacts carried out by ICES WGEEL (2019) which found the levels of eel mortality to be equitable to that associated with fishing (see Section 4.3).

## 4.3.3 Action 2c: Engineered Solution

No update for 2019

## 4.3.4 Action 2c: Other solutions

No update for 2019

## 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.

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

To fulfil its remit to produce a georeferenced database of barriers to fish passage on the Irish river network, the National Barriers Programme (NBP) team has performed a desk-based survey to identify potential barriers at a national scale, collating significant volumes of geospatial data from state agencies, such as the OPW, OSi, TII, Waterways Ireland, and Irish Rail, as well as historic IFI barrier surveys. This has produced a geodatabase of 73,055 potential barriers, which are being assessed using field surveys and desk-based analysis photographs or video of barrier sites. To date 15,058 structures have been assessed, 10,815 were classified as being not a barrier with 4,243 classified as a potential barrier requiring further work. Detailed assessments using the SNIFFER survey have been carried out on 121 structures in advance of mitigation works (Figure 4-3).

### 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 (Cathaleen's 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 2019. The catches

shown in Tables 7.1 were transported upstream. On the Erne, the distribution of elvers throughout the catchment is by cross-border agreement between IFI and DAERA.

## Potential barriers to fish passage identified on the Irish river network

- Barriers Countdown:
- 73,055 potential barriers recorded in the NBP geodatabase
- 15,058 Structure assessed using remote data and site visits
  - 5,827 Data supplied by other state agencies
  - 186 Historically assessed by IFI
  - 121 SNIFFER assessments
  - 1,974 IFI tablet barrier assessments
  - > 9,109 on-site field survey
- 10,815 Classified as not a barrier
- 4,243 Classified as a potential barrier

Figure 4-3 Summary description of barrier identification & mitigation

## 4.5 Management Action No. 4 Improve water quality

## 4.5.1 General water quality - Compliance with the Water Framework Directive

The EPA published the "Water Quality in Ireland 2013-2018" report in 2019. The report found that 52.8% of surface water bodies assessed are in satisfactory ecological health being in either good or high ecological status. The remaining surface waters (which amount to 47.2%) were found to be in moderate, poor, or bad ecological status. In comparison to the previous reporting period 2012-2015 when 55.4% of surface water bodies were noted as being at satisfactory status (a decrease of 2.6%).

Coastal waters have the highest proportion of water bodies in good or high ecological status (80%), followed by rivers (53%), lakes (50.5%) and estuaries (38%). Groundwater bodies fared best in the report as regards status, with 92% found to be in good chemical and quantitative status. This represents a 1% improvement in the number of water bodies in good chemical and quantitative status compared to the previous sampling round (2010-2015).

The 2013-2018 report found that 68.4% (1,831) of water bodies did not change in status, 18% (481) declined and 13.6% (364) improved. This related to an overall decline in 117 surface water bodies or 4.4% of the sampled area. This change was almost entirely an effect of declining status in river water bodies, specifically in 128 water bodies or 5.5%. Coastal waters showed a net improvement in water quality (a net improvement in 2 coastal water bodies) and lakes (a net improvement in 12 lakes).

The main drivers of change in the majority of cases are; agriculture, forestry and hydromorphological effects. However, in the case of the 5.5% loss of pristine river water bodies noted in the report, there is a shift in the causative drivers, with forestry and hydromorpology being more important than agriculture. This is mostly due to the fact that such river water bodies are found in upland areas and are upstream of most agricultural influences but under direct pressure from forestry and hydro-morphology effects.

#### 4.5.2 WFD monitoring - fish

Inland Fisheries Ireland is responsible 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. Summary reports are available for all sites surveyed (www.wfdfish.ie). All reports are uploaded to the website <u>http://wfdfish.ie/</u>. Results from 2018 are reported in section 6.6 of this report

## 4.5.3 Fish Kills

National fish kills are reported in the IFI annual reports and published online.

http://www.fisheriesireland.ie/Corporate/corporate-publications.html

There were 20 reported fish kills in 2019 (Table 4-3). This is a decrease on numbers recorded for for 2018 (40) but is an increase on 2017 (14).

Year	No of Fish Kills
2007	22
2008	34
2009	16
2010	34
2011	31
2012	10
2013	52
2014	22
2015	23
2016	31
2017	14
2018	40
2019	20

Table 4-3 Fish kill data 2007 - 2019

## 4.5.4 Eel Contaminants

No new data for 2019

#### 4.5.5 Prevalence of Anguillicola crassus

Considered ubiquitous across Europe and since last reported (Becerra-Jurado *et al.*, 2014) it continues to spread through Irish water courses.

## 5 Silver Eel Assessment, 2017

(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, Barrow and Fane catchments (Table 5-1). Figure 5-1 shows the sampling locations in 2019.

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)
- 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. An assessment site on the River Barrow in the South East river basin district has been monitored since 2014 however as it does not have 5 years of data it is not included in current assessment.

Catchment	Priority	2018	2019	2020	Method
Erne	High	$\checkmark$	$\checkmark$	$\checkmark$	Coghill net / Mark-recapture
Shannon	High	$\checkmark$	$\checkmark$	$\checkmark$	Coghill net / Mark-recapture
Burrishoole	High	$\checkmark$	$\checkmark$	$\checkmark$	Trap
Fane	High	$\checkmark$	$\checkmark$	$\checkmark$	Coghill net / Mark-recapture
Barrow	High	$\checkmark$	$\checkmark$	$\checkmark$	Coghill net / Mark-recapture

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



Figure 5-1: Silver eel monitoring locations, 2019

## 5.2 Shannon

The River Shannon is Ireland's largest river, and its extensive lake ecosystems offer some of the country's best eel habitat. It has been the focus of much of the eel population studies in Ireland to date.

## 5.2.1 Catch

In 2019/20 conservation eel fishing was conducted at three sites, two at Athlone, and one at Killaloe (Figure 5-2). Fishing began on 31st August at Athlone and 1st October at Killaloe. Fishing ceased at Athlone on 1st November, but continued at Killaloe until 20th February. A total of 5,364 kg of eels were caught at Athlone (4,660 kg at Jolly Mariner and 704 kg at Yacht Club), and a further 6,667 kg were caught at Killaloe, giving an overall catch of 12,031 kg (Figure 5-3). The quotas for the two sites at Athlone were 8 tonnes (Jolly Mariner) and 2 tonnes (Yacht Club); Killaloe operates without a quota as a designated fishing site. The overall capture in 2019/20 is down on captures from the previous 3 years (2018/19 = 16,411 kg; 2017/18 = 16,737 kg; 2016/17 = 16,711 kg). Seasonal variation in daily catches at the Killaloe eel weir during the 2019/20 fishing season are shown together with variation in discharge via Ardnacrusha and to the Old River Shannon channel in Figure 5-4.

Figure 5-2 Map of River Shannon catchment with conservation fishing sites, release point and hydropower dams indicated





Figure 5-3 The relative quantities of silver eels contributed by fishing crews to the River Shannon T&T during the 2019/2020 season



Figure 5-4 The seasonal variation in daily catches at the Killaloe eel weir during the 2019/20 fishing season together with variation in discharge via Ardnacrusha and as discharge to the Old River Shannon channel

## 5.2.2 Mark Recapture

5.2.3 NUI Galway conducted a series of three mark/recapture experiments, with a total of 300 tagged eels released upstream of the nets, to establish Killaloe weir efficiency. The overall percentage recapture rate, a measure of fishing efficiency was 20.3% (efficiency rates of 20%, 20% and 21% were recorded respectively for the three experiments). These rates are lower than recorded in previous seasons (recapture rates of 31% were recorded on average between 2015/16 and 2017//18), however they were conducted under flow conditions that occurred throughout the majority of the season and so were deemed accurate.

## 5.2.4 Production and Escapement

Production and escapement figures for the River Shannon are summarised in the flow diagram (Figure 5-5). Production of 38,028 kg is estimated by the trap and transport catch at Killaloe using the fishing efficiency rate of 20.3%, together with the catch from the two Athlone sites. In total 11,853 kg (31.2% of production) was moved beyond the hydropower station through trap and transport. Of the 26,175 kg that moved beyond Killaloe weir, it is estimated that 2,455 kg (9.4%) migrated via the Old River Channel. This is determined by the amount of spillage to the Old River Channel, using a regression model based on historical telemetry studies of route selection. An estimated 21.15% mortality (5,017 kg) at Ardnacrusha hydropower station of the 23,720 kg that entered the headrace, leaves 18,703 kg progressing downstream. This gives an escapement of 33,011 kg, or 86.8% of production. This compares with previous annual figures for the site as shown in Table 5-2.

## Table 5-2 Production and escapement estimations on the river Shannon from 2016

Year	Production (kg)	Escapement (kg)	% of Production
2019/20	38,028	33,011	86.8
2018/19	32,850	29,613	90.9
2017/18	34,139	31,191	91.4
2016/17*	38,608	32,920	85.3

\*Figure raised to account for gaps in fishing due to flood event


Figure 5-5 A summary of the analysis of silver eel production and escapement in the River Erne during the 2019/2020 eel migration season.

## 5.2.5 Length

Size frequencies of 541 eels measured at Killaloe are shown in Figure 5-6. 84.4% of the eels measured were determined to be female, based on their size. The mean length of eels measured from the River Shannon was 582 mm (n = 541, SD = 130 mm). The mean length for females was 619 mm (n = 458, SD = 106 mm) and for males was 383 mm (n = 83, SD = 32).



Figure 5-6 Relative size-frequency distribution of eels from Killaloe.

## 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 5-7). The catchment has not been commercially fished for yellow eels, has 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; Sandlund *et al.*, 2017; 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).

#### 5.3.1 Catch

The total run amounted to 2225 eels (end of March 2020), higher than recorded in 2017 or 2018. As in other years, the highest proportion of the total catch (83%) was made in the Salmon Leap trap.

There were two large flood events in the silver eel season in 2019, one in early September and one in November. A small flood in October brought down the largest daily run of eels.

In 2019, the timing of the run was 20% migrating in August, 18% in September and 25% in October (Table 5-3). 28% migrated in November mainly due to a peak in the first week of the

month. Almost 70% of the run was completed by the end of October with the remainder in November. Figure 5-8 shows the daily counts of silver eels.



Figure 5-7: 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.

	Salmon Leap	Mill Race	Total	%
May	0	0	0	0.0
June	6	4	10	0.4
July	60	31	91	4.1
August	368	66	434	19.5
September	310	97	407	18.3
October	454	90	544	24.4
November	558	61	619	27.8
December	90	23	113	5.1
Jan. 2020	3	0	3	0.1
February	2	1	3	0.1
March	1	0	1	0.0
April	0	0	0	0.0
Total	1852	373	2225	

Table 5-3: Timing and numbers of the 2018/2019 silver eel run.

## 5.3.2 Length, weight & sex

Sampling of individual eels (n = 637) gave an average length of 43.3 cm (range: 30.4 - 92.1cm) and an average weight of 170g and the proportion of male eels was 42.1%. The length frequency is presented in Figure 5-9 along with those for 2017 and 2018 for comparison. The lack of eels above 46/47cm (now 44/46cm) was once again notable.

The long-term trend in numbers and average weight is presented in Figure 5-10.



Figure 5-8: Daily counts of downstream migrating silver eel and mid-night water levels (m).



Figure 5-9 Length frequency of samples of silver eels trapped in the Burrishoole downstream traps, 2017 (n=481), 2018 (573) and 2019 (637).



Figure 5-10 Annual number and mean weight of silver eels trapped in the Burrishoole downstream traps.

# 5.4 Erne Transboundary

The River Erne, a transboundary system, is the second largest river system in Ireland, with an extensive lake habitat. The River Erne conservation fishery and trap and transport (T&T) programme was monitored by researchers from the Agri Food and Biosciences Institute (AFBI) and the National University of Ireland (NUIG) who also undertook mark-recapture experiments at Roscor Bridge.

## 5.4.1 Catch

During the 2019/20 season, fishing was conducted by conservation fishing crews on six sites, as shown in Figure 5-11. Fishing started from 1st September, except for Roscor Bridge, where fishing commenced on 25th September. Fishing ceased at all sites on 7th December. The total catch contributed to the Trap and Transport programme was 39,651 kg. The proportions caught at each site are shown in Figure 5-12.

The variation in the daily catches at the experimental fishing site at Roscor Bridge are shown in Figure 5-13, with catch levels (and therefore fish migration) affected by discharge level and lunar cycle stage.



Figure 5-8 Map of River Erne catchment with conservation fishing sites, release point and hydropower dams indicated



Figure 5-9 Proportions of the River Erne trap and transport catch obtained by each fishing crew in the 2019/2020 season.



Figure 5-10 Variation in daily catches at Roscor Bridge fishing site, in relation to lunar cycle and discharge during the 2019/20 season (the threshold discharge of 130 m<sup>3</sup>s<sup>-1</sup> used in population analyses is indicated by a dashed black line).

# 5.4.2 Production and Escapement

Production and escapement estimates for the River Erne are summarised in the flow diagram (Figure 5-14). The silver eel production was estimated to be 66,175 kg, and escapement was estimated to be 54,209 kg (81.9% of production). The trap and transport catch of 39,651 kg at the six fishing sites represented 59.9% of the production (exceeding the 50% target by 6,563 kg).

35,038 kg of eels were moved by trap and transport from the five fishing sites upstream of Roscor Bridge. Fishing efficiency rates for calculating production and escapement were based on several mark/recapture experiments carried out by NUI Galway at the experimental fishing site at Roscor Bridge from 2010/11 to 2015/16 at low discharge (< 130 m3s-1 = 9.78%) and high discharge (> 130 m3s-1 = 18.43%). These were used with the trap and transport catch at Roscor Bridge to calculate the biomass of eels arriving there based on the flow conditions throughout the season.

26,524 kg of eels are estimated to have passed Roscor Bridge, and moved through the hydropower stations at Cliff and Cathaleen's Fall. Mortality at each station is based on historic telemetry work conducted by NUI Galway at the two stations, depending on the operations of the dams throughout the season. Estimated mortality rates under different flow condition are given in Table 5-4. Total mortality was estimated to be 6,759 kg at Cliff and 5,207 kg at Cathaleen's Fall.

In total, 14,558 kg of eels are estimated to have navigated beyond the hydropower stations, and with the trap and transport quantity of 39,651 kg, a total escapement of 54,209 kg is estimated; 81.9% of the production.

Operation	Cliff	Cathaleen's Fall
No flow	0%	0%
Generation & Spillage	7.9%	7.7% (half load)
		15.4% (full load)
Generation only (no spillage)	26.7%	27.3%
Overall mortality 2018/19	19.6%	26.8%
Overall mortality 2019/20	23.9%	25.5%

Table 5-3 Mortality rates (based on unpublished NUIG telemetry results) at two hydropower stations, depending on station operation.

#### 5.4.3 AFBI Length Frequency

The wider EU calls for this data are discussed in the 2018 TEGE but Nationally this data has been a requirement under the EMP, but is now also required to fill out the eel data calls for eels being released. AFBI repeated the 2018 season long effort to measure the length frequencies of the silver eel caught at the Erne T&T sites (NI).

- Ferny Gap
- Portora
- Lady Craigavon Bridge (ULE).

As in 2018 these analyses were focused on the key lunar darks throughout Autumn and Winter of 2019 up until the point that fishing ceased mid-December. Every eel captured or held in tanks for that respective fishing period was measured. A total of 2,494 eels were measured for length with summary statistics presented in Table 5-5. Individual length frequencies for this data set have been submitted to the TEGE for necessary production calculations and for storage on the all Ireland database.

				Mean		
				Length		
Location	Date	n		(mm)	Min	Max
Ferny Gap	30-Sep		252	525	320	843
Ferny Gap	04-Nov		221	536	344	891
Ferny Gap	06-Dec		151	564	322	914
Portora	09-Sep		291	604	371	892
Portora	30-Sep		260	569	300	934
Portora	02-Nov		313	626	332	951
Portora	02-Dec		200	644	344	992
Craigavon Bridge						
(ULE)	01-Oct		298	636	333	905
Craigavon Bridge						
(ULE)	02-Nov		254	644	371	984
Craigavon Bridge						
(ULE)	25-Nov		254	655	310	990

Table 5-5 Erne sliver eel length measurements and summary stats for 2019 (NI sites only
---



Figure 5-11 A summary of the analysis of silver eel production and escapement in the River Erne during the 2019/2020 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 553 ha. 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 (Figures 5-16). The site was the location of a commercial fishery until 2008.

## 5.5.1 Silver Eel Catch

Silver eel catches at the Fane Fishery were down on 2018 numbers with a total catch of 500 kg (1,323 eels; Table 5-6) and 26 nights fished. Due to unusually high water levels fishing began in September with fishing also occurring in October and November, there was no fishing in December (Figure 5-17). Water temperature values across the season are shown in Figure 5-18.



Figure 5-16 Map of silver eel fishing and release locations within the Fane Catchment.

Year	No. Days Fished	Catch (kg)	No of Eels
2011	13	268	1,433
2012	21	448	1,195
2013	19	1,151	3,097
2014	25	797	2,542
2015	23	730	1,810
2016	9	76	206
2017	20	770	2,376
2018	34	725	1,974
2019	26	500	1,323



Figure 5-17 Catch, water levels and luminosity for the Fane fishery, 2019.



Figure 5-18 Water temperature and catch for the Fane fishery, 2019.

## 5.5.2 Mark Recapture

Of the 188 tags deployed at the Fane fishery during the 2019 silver eel season, 28 of those tagged silver eels were recaptured leading to a recapture rate of 14.9% (Table 5-7). Other tagged recaptures included silvers from 2018 and 2017 and yellow eels tagged on Lough Muckno in 2018, 2017, 2016, 2015 and two from 2012.

Year	No. Tagged	No. Recaptured	% Recapture
2014	272	80	29
2015	296	100	34
2016	0	0	0
2017	126	26	20.6
2018	365	46	12.6
2019	188	28	14.9
Average	208	47	18.5

Table 5-7 Mark Recapture study 2014 – 2019.

## 5.5.3 Eel Biology

The average length of eel was 50 cm (ranging from 23.4 cm to 91.4 cm), (Figure 5-19a and b, Table 5-8). The average weight was 0.313 kg (ranging from 0.052 kg to 1.461 kg), (Table 5-8). Out of 76 eels which had head width measurements recorded, 66% were recorded as being broad heads and 34% as narrow heads (Figure 5-20). Out of a total of 335 eels measured in 2019, 209 (62.4%) were above 40cm in length, 126 (37.6%) were under 40cm.

Table 5-8 Length and weight data for processed silver eels from the Fane catchment, 2011 – 2019.

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
2012	1541	47.1	31.4	96.0	0.251	0.050	2.090	387
2013	1165	49.2	30.8	96.6	0.289	0.030	1.952	337
2014	1334	50.4	30.4	95.0	0.292	0.045	1.721	389
2015	1622	54.0	31.2	96.6	0.370	0.030	2.045	599
2017	427	51.9	30.9	94.7	0.332	0.014	1.751	142
2018	634	54.1	27.5	95.5	0.367	0.042	2.2	232
2019	337	50.8	23.4	91.4	0.313	0.052	1.461	106.86



Figure 5-19a Length frequency for silver eels caught at the Fane fishery, 2019.



Figure 5-19b Length frequency for silver eels caught at the Fane fishery, 2011 – 2019.



Figure 5-20 Broad head and narrow head records for the Fane fishery (n = 75), 2019.

## 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. 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 fishing location is situated upstream of the town of Graiguenamanagh; approximately 5km upstream from the tidal limit (estuary) in the River Barrow (Figure 5-21). The location of the Ballyteiglea Lock fishing site means that over 99% of the River Barrow freshwater wetted area is above the fishing site. Four nets were fished from openings on the Ballyteiglea Lock gates of the canal section of the River Barrow during the silver eel season. Historically the commercial fishery in the River Barrow concentrated effort on the canal lock gates.

# 5.6.1 Eel catch

An initial rise in water levels in September began the season. This increase in flow led to the first fishing nights which continued consistently into October and a catch of 1,329 eels over 24 fishing nights (Table 5-9). While promising flow conditions occurred later in November and December, all fishing events thereafter yielded no catches. The majority of the catch (n = 1,159) was therefore recorded during just 6 nights in September (relatively early in the silver eel season).

Ballyellen Lock located upstream of Ballyteiglea Lock was fished for 3 nights out of the fishing season in order to detect previously tagged eels which may have remained in the system from early years of sampling. However, on these occasions no eels were captured. Rainfall levels, luminosity and catch levels are shown in Figure 5-22. Despite continuing rainfall and increasing flow conditions, the run of eels abruptly ended in November.

Year	No. Days Fished	Catch (kg)	No of Eels
2014	22	174	1,223
2015	20	128	687
2016	25	193	880
2017	24	273	1,388
2018	28	391	2,808
2019	24	183	1,329

Table 5-9 Silver eel catch record for Barrow 2014 – 2019.



**Figure 5-21** Map of silver eel fishing and release locations within the Barrow Catchment, 2019 (Insets: Map of Ireland with Barrow catchment (shaded) and South Eastern River Basin District (outlined) and detail of Barrow Catchment rivers)).



Figure 5-22 Catch, water levels and luminosity for the Barrow fishery, 2019.

## 5.6.2 Mark Recapture

Out of a total of 202 tags deployed during the silver eel season on the Barrow, 52 tagged fish were recaptured. This gives a (within-year) recapture percentage of 25.7%. Details of recapture rates from 2015 to 2019 are shown in Table 5-10.

Year	No. Tagged	No. Recaptured	% Recapture
2015	279	41	14.7
2016	48	21	43.7
2017	51	8	15.7
2018	432	61	14.1
2019	202	52	25.7

Table 5-10 Mark Recapture Preliminary Results for Barrow Fishery, 2015 - 2019.

## 5.6.3 Eel Biology

Of the 1,329 eels captured in total during these surveys, 292 were measured. The average length of eel captured was 32.8 cm (ranging from 31.6 cm to 69.3 cm), (Figure 5-23 and Table 5-11). The average weight of eels was 0.1084 kg (ranging from 0.052 kg to 0.6830 kg), (Table 5-11). A total of 20 head width readings were recorded during the processing of these catches and of these 50% were noted as being broadheaded eels (Figure 5-24).

A large number of small male eels were noted in the 2018 catches (Figure 5-25). A cursory look at the male female ratio of eels in the Barrow catchment taking 40 cm as a breakpoint, there wre 256 eels  $\leq$ 40cm or 89% of the measured catch, with 32 eels measured  $\geq$  40cm.



Figure 5-23 Length frequency for measured silver eels caught on Barrow fishery, 2019.



Figure 5-24 Broadhead and narrowhead eels from Barrow fishery, 2019.



Figure 5-25 Length frequency for measured silver eels caught on Barrow fishery, 2014 – 2019.

	No. of	Mean	Min	Max	Mean	Min	Max	Total
Year	Eels (cm)		Length (cm)	Length (cm)	Weight (kg)	Weigh t (kg)	Weight (kg)	Weight (kg)
2014	811	41.4	27.6	76.2	0.140	0.033	0.742	113.578
2015	730	41.8	31.5	77.4	0.149	0.050	0.873	108.730
2016	681	45.2	32.0	77.8	0.195	0.052	0.860	132.983
2017	351	45.5	26.2	81.8	0.203	0.025	1.078	71.337
2018	853	39.5	21.3	72.3	0.1212	0.0100	0.7390	103.379
2019	292	38.2	31.6	69.3	0.1084	0.0520	0.6830	31.538

Table 5-11 Length and weight data for processed silver eels from the Barrow fishery, 2014 – 2019.

# 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 2018 - 2020 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, gillnets and hydro acoustics), rivers (electro-fishing and fyke nets) and transitional waters (fyke nets, seine nets & beam trawls) in 2017 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 2017, 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 2018 – 2020 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.

RBD	Location	Water body	Life stage	1	2	2.1	3	4	5	6	7	8	2018	2019	2020	Notes
SHIRBD	ESB Shannon	Catchment	Silver	$\checkmark$			$\checkmark$		$\checkmark$	$\checkmark$			$\checkmark$		$\checkmark$	Scan for tagged eels
NWIRBD	ESB Erne	Catchment	Silver	$\checkmark$	$\checkmark$		$\checkmark$		$\checkmark$	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	Scan for tagged eels
WRBD	Burrishoole	Catchment	Silver	$\checkmark$	$\checkmark$				$\checkmark$	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	Scan for tagged eels
SERBD	Barrow	River	Silver	$\checkmark$	$\checkmark$		$\checkmark$			$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	20 nights fishing; MR
ERBD/NBRBD	Fane	River	Silver	$\checkmark$	$\checkmark$		$\checkmark$			$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	20 nights fishing; MR
SHIRBD	Maigue	River	Elver	$\checkmark$						$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	
SHIRBD	Feale	River	Elver	$\checkmark$						$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	
SHIRBD	Inagh	River	Elver	$\checkmark$						$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	
ERBD	Liffey	River	Elver	$\checkmark$						$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	
WRBD	Ballysadare	River	Elver	$\checkmark$						$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	
WRBD	Corrib	River	Elver	$\checkmark$						$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	
SHIRBD	Shannon	Catchment	Yellow	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$			$\checkmark$			
NWIRBD	Erne	Catchment	Yellow	$\checkmark$		$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	
SWRBD	Blackwater	Catchment	Yellow	$\checkmark$			$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
ERBD	Ramor	Lake	Yellow	$\checkmark$		$\checkmark$										
WRBD	Corrib	Catchment	Yellow	$\checkmark$		$\checkmark$										
WRBD	Moy	Lake	Yellow	$\checkmark$		$\checkmark$										
SERBD	Barrow	Catchment	Yellow	$\checkmark$			$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$		
ERBD/NBRBD	Fane	Catchment	Yellow	$\checkmark$			$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$		$\checkmark$		$\checkmark$	
Ireland	IFI/NRSP lakes	Lakes	Yellow	$\checkmark$				$\checkmark$		$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Ireland	IFI/ NRSP Rivers	Rivers	Yellow	$\checkmark$						$\checkmark$			$\checkmark$		$\checkmark$	

Table 6-1: Monitoring Programme 2018-2020.

RBD	Location	Water body	Life stage	1	2	2.1	3	4	5	6	7	8	2018	2019	2020	Notes
Ireland	IFI Transitional	T. water	Yellow	$\checkmark$				$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
WRBD	Lough Feeagh	Lake	Yellow	$\checkmark$			$\checkmark$		$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
WRBD	Lough Furnace	T. water	Yellow	$\checkmark$			$\checkmark$		$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	

## 6.1 Surveys 2019

Yellow eel surveys took place in 2 lakes, 2 transitional waters and 2 riverine catchments (Figure 6-1). The lakes surveyed were Lough Feeagh and Bunaveela in Burrishoole (by MI). The transitional water was Waterford Estuary and Lough Furnace in Burrishoole (by MI). River fyke netting was carried out in the Barrow main channel in 2019 in conjunction with a semi-quantitative electric-fishing survey in the upper shallow reaches of the main channel. A repeat fyke net survey was carried out at Clondulane weir on the River Blackwater to estimate the eel population in the impounded section behind the weir.

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 eel surveys, establish baseline data set, evaluate impedance of upstream migration and determine parasite prevalence within Ireland. Samples of eels are measured for length, weight, and INDICANG style morphological features associated with silvering (eye measurements, pectoral fin measurements, and pigmentation). At selected locations eels are retained for further analysis in the laboratory. These analyses include age, growth, sex determination, parasite prevalence and diet.

Figure 6-1: Locations of yellow eel surveys carried out in 2019.



#### 6.1.1 Burrishoole

Bunaveela Lough is located in the upper reaches of the catchment (Figure 6-2). 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 2019 (25-26 June 2018), with chains of 10 nets fished at six sites. In total 27 eels were caught with a catch per unit of effort of 0. 45 eels/net/night (Table 6-2). The average length was 44.3cm and ranged in length from 33.3cm to 62.56cm (Figure 6-3). Twenty four eels were PIT tagged and three recaptures were made of previously tagged fish.

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 2019 (2-3 July 2018), with chains of 10 nets fished at six sites for one night each. In total, 52 eels were caught with a catch per unit effort (CPUE) of 0.87 eels/net/night (Table 6.2). The average length of eels was 41.7cm and ranged in length from 30.8cm to 63.2cm (Figure 6-4), with a total weight of 7.07 kg caught in the two nights. Most of the catch (38) was PIT tagged and three previously tagged eels were recorded. Twelve eels were sacrificed in this survey. Ten of the 12 (83.3%) of the eels contained *A. crassus* with an infection intensity of 6.9 continuing the rising trend in infection rates in the Burrishoole yellow eel stock.



Figure 6-2 Map of Burrishoole showing the lakes surveyed.



Figure 6-3 Length frequency of yellow eels captured at Bunaveela L., 2019 (n=27).



Figure 6-4 Length frequency of yellow eels captured at L. Feeagh, 2019 (n=52).

## 6.1.2 IFI lake surveys 2019

There were no yellow eel lake surveys carried out by EMP in 2019.

## 6.1.3 River Fyke Net Surveys

#### 6.1.3.1 River Barrow

In 2019, the Athy, Graiguenamanagh and St Mullins sites on the River Barrow were surveyed for a second year. Fyke nets were set at these sites in June and August in order to determine the distribution of eels within the Barrow catchment. Each location was fished for 1 night in June and was repeated in August.

A total of 136 eels was captured from the 3 fyke netting locations (Table 6-3). The catches, despite having identical fishing effort, were very low in the freshwater site for both June and

August sampling. Four eels were caught in June in Athy and 7 in August. Five eels were caught in Graiguenamanagh in both June and August. The numbers increased greatly at the high water mark in St. Mullins where 115 eels were captured 54 eels in June and 61 eels in August. The 2019 results mirrored those of the previous year's data in which, the total catches in Athy, Graiguenamanagh and St. Mullins were 17, 21 and 83 eels respectively.

Head width measurements were taken from 63 eels and of these 25.4% were noted as being broadheaded eels (Figure 6-5). The length frequency for the 2019 fyke netting survey is shown in Figure 6-6. Figure 6-7 shows the combined length frequency for 2018-2019.



Figure 6-5 Broadhead and narrowhead eels from Barrow River fyke netting survey, 2019.



Figure 6-6 Length frequency results for Barrow Fyke Netting Sites, 2019.



Figure 6-7 Length frequency results for Barrow Fyke Netting Sites, 2018-2019.

## 6.1.4 Munster Blackwater

The freshwater survey on the Munster Blackwater River near Fermoy and the Clondulane Weir was repeated in order to verify results from previous years. The 4 km impounded section of the Munster Blackwater above the weir was split into three sections for fishing (Figure 6-8). A single chain of 5 fyke nets was fished in each zone per night over 2 nights in 2018 and 2019.

In 2019, 114 eels were captured at 3 fyke netting locations over two nights in 2019 (Table 6-3). This was comparable with the 2018 result with the same number of nets deployed for 2 nights (2018, n=139). The 2017 sampling while netted in the same locations saw sampling occurring over 5 nights, and a total eel catch of 578 eels.

Of the 3 fishing locations, Sites 1 and 2 consistently represent approximately a quarter of the overall catch in these surveys. While Site 3, located nearest to the Clondulane Weir itself has consistently yielded half of the entire eel catch in these surveys.

Table 6-1 shows the mark-recapture results for the three years of sampling. While no further PIT tags were deployed in 2019, surveillance for recaptured tags was carried out with a total of 10 tags detected across the 2 nights of sampling.

Table 6-1	Tagging	results fo	or Munster	Blackwater	surveys, 20	17-2019.
	00 0				<i>, ,</i>	

	No	No	%
Year	Tagged	Recaptures	Recaptures
2017	498	34	6.8
2018	111	18	16.2
2019	0	10	-



Figure 6-8 Locations of survey zones and points sampled on Munster Blackwater above Clondulane weir, 2017-2019 (Inset: map of Republic of Ireland with Munster Blackwater river catchment shaded).

Out of the 114 eels measured, 111 had head width readings recorded and it was noted that 70% of those were broadheaded eels (Figure 6-9). The length frequency for the eels captured during The Munster Blackwater surveys (2017 to 2019) are shown in Figure 4.12. The range of lengths of eels remained relatively consistent across the three sampling years. Figures 6-10 and 6-11 show length frequencies for 2017-2019 and 2018-2019 respectively.



Figure 6-9 Broadhead and narrowhead eels from Munster Blackwater River fyke netting survey, 2019.



Figure 6-10 Length frequency results for Munster Blackwater Sites, 2017-2019.



Figure 6-11 Length frequency results for Munster Blackwater Sites, 2018-2019.

## 6.1.5 River electric fishing surveys

In 2018, electric fishing surveys were conducted with Hans Grassl back pack equipment on the upper reaches of the main River Barrow channel at Portarlington, Monasterevin and Rathcoffey Bridge. No eels were captured during any of the surveys in 2018.

The study was repeated in 2019 in conjunction with the River Barrow fyke netting (section 6.1.3.1), only two eels were captured. Both eels were caught at Portarlington Bridge and were relatively large eels at 48 cm and 51cm. Both were narrowheaded eels. A summary of the results is shown in Table 6-3. These eels were captured in the July fishing but no eels were captured at Portarlington Bridge in the repeated fishing in September.

# 6.2 Transboundary Yellow Eel

Bi-ennial survey schedule, with last in 2018 and next in current 2020 season.

# 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) (Figure 6-12 map). 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 2019 (8-9 July), with chains of 10 nets fished at six sites in one night each. Three chains of nets were fished at the Back of the House (24 July), which is a shallow tidal area between the lough and the estuarine river.



Figure 6-12 Location of Lough Furnace in Burrishoole catcment.

In L. Furnace, 23 eels were caught with a catch per unit effort (CPUE) of 0.38 eels/net/night (Table 6-4). The average length was 37.5cm ranging from 30.7cm to 64.5cm (Figure 6-13). A total weight of 2.24kg was caught.

In the Lower Lough Furnace, 43 eels were caught with a catch per unit effort (CPUE) of 1.4 eels/net/night (Table 6-4). The eels average length was 45.6cm ranging in length from 29.8cm to 66.3cm (Figure 6-13), with a total weight of 8.11kg caught. Eight eels were PIT tagged and released and two previously tagged eels were recorded

Twelve eels were sacrificed in this survey from Lough Furnace. Six of the 12 (50.0%) of the eels contained *A. crassus* with an infection intensity of 3.8. *A. crassus* has been established in the lough since about 2011.



Figure 6-13 Length frequency of yellow eels captured at L. Furnace (n = 23) (top) and L. Furnace Lower (n = 45) (bottom), 2019.

### 6.3.2 Waterford Estuary

The Waterford Estuary surveys saw 5 sites netted on the lower reaches of the Suir River (from Suir Port as far upstream as Giles' Quay) and 5 sites netted on the Barrow River (from White Horse upstream of Barrow Bridge as far as Kearney's Bay). Un-baited fyke nets set in chains of 5 were fished overnight at each location and lifted the following morning. The sites are shown in Figure 6-14.



Figure 6-14 Waterford estuary fyke netting sites on Suir and Barrow rivers, 2018-2019.

In 2019, the Waterford Estuary was repeated at the same locations (Figure 6-14). The survey yielded a total catch of 1,021, with a total weight of 118.9 kg. The summary results are presented in Table 6-4.

The PIT tagging recapture results for 2019 yielded a recapture rate of 3.9% (332 eels tagged with 13 recaptures). The previous year gave the same percentage recapture result of 3.9% at the same sites (634 eels tagged with 25 recaptures detected).

A total of 360 eels had head widths recorded and of these 72% were broadheaded eels (Figure 6-15). The length frequency for the measured eels captured in the 2019 survey is presented belowin Figure 6-16.



Figure 6-15 Broadhead and narrowhead eels from Waterford Estuary fyke netting survey, 2019.



Figure 6-16 Length frequency results for Waterford Estuary Sites, 2019.

Site	Months	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)
Bunaveela L.	June	27	60	0.45		44.3	33.3	62.5	0.157	0.060	0.425
L. Feeagh	July	52	60	0.87		41.7	30.8	63.2	0.136	0.050	0.505

 Table 6-2 Catch detail from yellow eel lakes surveys 2019.

# Table 6-3 Catch detail from yellow eel rivers surveys 2019.

Site	Months	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)
Barrow (Fykes)	June, August	124	80	1.55	11.11	35.2	20.9	64.0	0.0896	0.0200	0.4690
Barrow (E-fishing)	June, August	2	n.a.	n.a.	0.415	50.3	48.6	51.9	0.2075	0.1940	0.2210
Munster Blackwater	July	114	18	6.33	19.381	42.4	24.1	71.7	0.1700	0.0230	0.9910

Site	Months	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)
Waterford Estuary	June, July, August, September	924	90	10.26	107.41	38.8	22.5	70.0	0.1162	0.0150	0.6900
L. Furnace Upper	July	23	60	0.38		37.5	30.7	64.5	0.102	0.040	0.465
L. Furnace Lower	July	45	30	1.5		45.6	29.8	66.3	0.180	0.040	0.505

# Table 6-4 Transitional Waters yellow eel survey data 2019.

# 6.4 Water Framework Directive

# 6.4.1 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.

Locations for WFD sampling sites for 2018 surveys are shown for lakes, rivers and transitional waters (Figure 6-17).

# 6.4.2 2018 Results

# 6.4.2.1 Lakes:

A total of 20 lakes (spanning 13 catchments), were sampled with eels present in 16 lakes (80% of sites). A total of 172 eels were caught during lake surveys, 135 eels from 4 lakes. They ranged in length from 33 to 80 cm. A mean CPUE of 0.6 was found across all lake sites. While the highest CPUE value for eels was found in White Lough (Ballybay) (Erne, CPUE = 2.7) the lowest were noted in Loughs Cullin (Moy, CPUE = 0.1) Gur (Shannon, CPUE = 0.1), Loughapreaghaun (Owenriff, CPUE = 0.1) and Muckanagh (Fergus, CPUE = 0.1). No eels were captured in Loughs Ateeaun, Corrinshigo, Owel and Shannaghree (Appendix 5, Tables 5-1 and 5-2).

# 6.4.2.2 Rivers:

A total of 144 river sites (across 13 catchments) were covered in the 2018 surveys. The WFD river sites had a 20% eel presence rate, 17% of sites with eels have  $\leq 5$  eels, 3% of sites caught between 5 and 10 eels, no sites had >10 eels. A total of 76 eels were caught, ranging from 7 to 48 cm (Appendix 5, Tables 5-3, 5-4 and 5-5). Densities ranged from 0.0001 eels per m<sup>2</sup> in the Suir River (Kilsheelan Br\_A and Swiss Cottage\_A) to 0.0598 eels per m<sup>2</sup> in the Bride (Shanowennadrimia) River (Stable Crossroads\_A).

# 6.4.2.3 Transitional Waters:

A total of 7 estuaries (across 7 catchments) were covered in the 2018 surveys. A total of 188 eels were captured ranging in length from 7 to 72 cm. The majority of the catch (n=131) was recorded in the Avoca Estuary. CPUE values for transitional water sites ranged from 0.2 (Ballysadare Estuary and Castlemaine Harbour) to 7.3 (Avoca Estuary) (Appendix 5, Tables 5-6 and 5-7).



Figure 6-3 Location of WFD survey sites, 2018.

# 8 Recruitment

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

## 8.1 Introduction

Many studies have focused on sampling the active phase of elver migration into freshwater (Gollock *et al.*, 2011; Jessop 2000; Knights and White 1998; Moriarty 1986, Naismith and Knights 1988; O'Connor 2003; Piper *et al.*, 2012; Reynolds *et al.*, 1994). Elvers exhibit counter current behaviour once they start actively migrating upstream. This means that instead of moving with the current as they do in the estuary, they now avoid the river current which will carry them downstream. To avoid the current, the elvers tend to migrate along the banks of the river and seek out slack water. At this time the elvers are congregated in schools near the bank of the river where they can be trapped.

The sites monitored are shown in Figure 7-1.

The elver traps used on the Erne and the Shannon by the ESB are permanent brush ladders, based on the fixed ramp style traps designed by O'Leary and reported in an EIFAC technical paper on 'Eel Fishing gear and techniques in 1971, leading to holding boxes fitted with freshwater supplies. They are sited at the main hydro installations at Ardnacrusha and Parteen on the Shannon, Cathaleen's Fall on the Erne and Inniscarra Dam on the Lee. They are described in more detail in the Irish SSCE reports.

The elver traps used by IFI are also based on the fixed ramp style traps. They have been cited in various studies with modifications being made to the traps (Gollock *et al.*, 2011; Jessop 1995; Jessop 2000, Moriarty 1986, Naismith and Knights 1988). Elvers and young yellow eels will encounter the ramp and ascend due to the flow of water attracting them upstream. The elver migration season extends from April to August, with migration influenced by water temperature and river discharge. White and Knights 1997 reported not catching juveniles eels in any numbers until temperatures rose above 15-16°C in mid-June /early July, peaking at >20°C. The pattern of distribution across a season has been described as waves of runs of short duration but repeated over the season (Jessop 2000). Where possible the traps are located downstream of a structure (e.g. weir or waterfalls) in order to get a flow of water to feed the traps. The structure also acts as a bottleneck restricting the ability of elvers utilising the whole river to ascend.

Elver traps on the Burrishoole (IE\_West) and the Liffey (IE\_East) are O'Leary type bristle ramp traps with gravity fed water supplies.

The aim of the long term monitoring programme is to set up a number of sites as an index of recruitment in order to get an understanding of changes to recruitment since the implementation of the Eel Regulation. It is not intended to make assumptions on the whole catch entering the river as the proportion of elvers avoiding the traps is not known and is difficult to quantify. The elver traps sample a proportion of the elver migration in a standardised way and when operating for a number of years a trend in recruitment is recorded.


Figure 8-1 Location of recruitment monitoring stations in Ireland.

# 8.2 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.

#### 8.2.1 Shannon & Erne

Long-term monitoring of elver migrating at Ardnacrusha (Shannon) is undertaken by the ESB and at Cathaleen's Fall (Erne) by th ESB in conjunction with DAERA and AFBI (Figure 7-2).

In the Erne recruitment has shown an increase each year since 2011 with the highest catch in 2018 since 1995. The data for 2019 was low with 94.06kg captured for the season (95% drop on 2018 catches).

Major refurbishment of the Erne 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. 2016 saw a marked improvement in recruitment in the Shannon in both glass eel (elvers) and young yellow eel. Major refurbishment of the Shannon Ardnacrusha trap took place in early 2017 with a new water supply and brushes on the ladder. The increase seen in the Shannon in 2016 was not repeated in 2017 or 2018. The data for 2019 was low with 37.5kg captured at Ardnacrusha.

# 8.2.2 Other Locations

Long-term monitoring of migrating elvers also takes place at on the Feale, Inagh and Maigue Rivers.

Ballysadare elver monitoring is part of a citizen science initiative which first began in 2017, the local Ballysadare angling club monitor the trap with very successful results. The catch for 2019 was 5kgs of elvers and 3.6kgs of yellow eels.

The trap on the Corrib is located within the elver pass of the Galway weir. The trap caught 122kgs of elvers in 2019, the trap operated from the 18<sup>th</sup> May until the 9<sup>th</sup> September. Catches rose steadily throughout the season with the highest catches occurring in August.

The Feale trap at Listowel ran from March to August. During the survey season a total of 7.6kg of elvers and 1.7 kg of yellow eels were caught for the entire season with the highest catch in July.

The elver trap on the River Inagh in Ennistymon ran from the 1<sup>st</sup> April to the 31<sup>st</sup> July, total catch of elvers for the season was 2.12kg, 400g of yellow eels were also caught during the survey period.

Very low catches were recorded at the Maigue elver station this year with only 580 g being recorded for the entire season, the highest catches occurred over June and July. 1kg of yellow eels were caught along with river lamprey. Electric fishing surveys were conducted upstream and downstream of the trap to investigate presence/absence of elvers however this yielded no results. Further investigations will take place this year to try and establish a reason for the low catch on the Maigue.

Overall catches for 2019 were down from 2018. With the exception of the Feale and the Corrib all traps caught significantly less than in 2018. Average yearly temperatures were higher in 2018 with temperatures month on month being higher in 2018 than 2019. Recent ICES advice has recruitment at 1.4% of historic levels in 2019 (provisional) this is down from 1.9% in 2018 and lower than the 5 year average from 2012 to 2016 (1.7%) (ICES, 2019).



Figure 8-2 Annual elver catches (t) in the traps at Ardnacrusha (Shannon) and Cathaleen's Fall (Erne) – data from ESB. Full trapping of elvers took place on the Erne from 1980 onwards indicated by the arrow. Erne 2015 onwards does not include the additional new trap.

Year	Erne	Shannon Ardnacrusha	R Feale	R Maigue	Inagh R	Sh. Estuary Glass Eels	R. Liffey Fish Pass
1985	463	1093	503				
1986	898	948					
1987	2367	1610					
1988	3033	145					
1989	1781	27					
1990	2409	467					
1991	546	90					
1992	1371	32					
1993	1785	24					
1994	4463	287	70	14			
1995	2400	398	0	194			
1996	1000	332	0	34	140		
1997	1065	2120	407	467	188	616	
1998	782	275	81	8	11	484	
1999	1500	18	135	0	0	416	
2000	1100	39	174	0	120	43	
2001	699	27	58	2	18	1	
2002	113	178	116	5		37	
2003	576	378	36	72	111	147	
2004	269	58.126	0	0	24	1	
2005	838	41.36	0	1	0	41	
2006	118	42	1	0	4	3	
2007	189	45	0	0	39	12	
2008	38.7	7	0	0	83	2	
2009	88.3	7.75	42				
2010	96.6	49.7	20	3	1	3	
2011	74.34	7.239	7	5	15		
2012	145.71	22.525	47		*		0.5
2013	214.7	46.615	68	14	44		1.1
2014	659.37	45.085	5	29**	40		0.3
2015	686.17	11.42	3	15	25		0.2
2016	805.06	317.2	30.5	29	51		0.4
2017	94.95	29.7	15	9	20		0.5
2018	1508.4	165.2	3.2	n/a	5.4		6.3
2019	83.99	34.6	7.6	n/a	2.12		1.5

Table 8-1: Glass eel catches (kg), 1985 to 2019 (blanks = not fished).

#### 8.3 Young Yellow Eel Recruitment

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 Figure 7-3. 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 2015 was 301.1kg and in 2016 it was 890kg.

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 and 23.1kg in 2016.

In Parteen in 2017, the main catch was 121 kg and the new traps catch was 15kg.

In Parteen in 2018, the main catch was 1339 kg and the new traps catch was 2.4kg.

In Parteen in 2019, the main catch was much lower at 374kg and the new traps catch was 2.1kg.

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. The catch remained low in 2016 (1.1kg) and in 2017 it was 13.8kg.

In 2018, the Inniscarra trap only trapped 0.8kg, likely due to low water levels and closure of the fish pass.

In 2019, the Inniscarra trap only trapped 0.8kg, likely due to low water levels and closure of the fish pass.



Figure 8-3 Juvenile yellow eel catches (kg) at Parteen Weir, 1985 to 2019. 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.

#### 9 References

Becerra-Jurado, G., Cruikshanks, R., O'Leary, C., Kelly, F., Poole, R. and Gargan, P. (2014). Distribution,

prevalence and intensity of Anguillicola crassus (Nematoda) in Anguilla aguilla in the Republic of Ireland. Journal of Fish Biology, 84(4), 1046-1062.

- 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.
- Gollock, M., Curnick, D. & Debney, A. (2011). Recruitment trends of juvenile eels in tributaries of the River Thames. *Hydrobiologia*, 672: 33-37.
- Jessop, B.M., (1995). Justification for and status of American eel elver fisheries in Scotia-Fundy Region. DFO Atl. Fish. Res. D c, 95/2, 10 p.
- Jessop B.M., (2000). Estimates of population size and instream mortality rate of American eel elvers in a Nova Scotia river. *Trans. Am. Fish. Soc.*, 129, 514:526.

Knights, B. and White, E. M. (1998). Enhancing immigration and recruitment of eels: the use of passes and associated trapping systems. Fisheries Management and Ecology 5: 459-471.

- 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.
- Moriarty, C. (1986). Observations on the Eels of Meelick Bay, Lough Derg, 1981 1984. *Vie Milieu*, 36 (4) 279-283.
- Naismith, I. A. and Knights, B. (1988). Migrations of elver and juvenile European eels, *Anguilla anguilla* L., in the River Thames. Journal of Fish Biology 33 (Supplement A), 166-175.
- O'Connor, W. (2003). Biology and management of the European eel in the Shannon estuary, Ireland. Unpublished Ph.D. thesis. In Faculty of Science, Department of Zoology: National University of Ireland, Galway.
- Piper, A. T.; Wright, R. W. and Kemp, P. S. (2012). The influence of attraction flow on upstream passage of European eel (*Anguilla anguilla*) at intertidal barriers. Ecological Engineering 44: 329-336.
- 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.
- Sandlund, O.T., Diserud, O. H., Poole, R., Bergersen, K., Dillane, M., Rogan, G., Durif, C., Thorstad, E. B., and Vøllestad, L. A. (2017). Timing and pattern of annual silver eel migration in two European watersheds are determined by similar cues. *Ecology and Evolution*, DOI:10.1002/ece3.3099; 11pp.
- 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.
- White, E. M. and Knights, B. (1997). Environmental factors affecting migration of the European eel in the River Severn and Avon, England. *Journal of Fish Biology* 50:1104-1116.

# Appendix 1: Members of the Technical Expert Group on Eel 2018

The TEGE is comprised of the following representatives:

Dr. Ciara O'Leary	Inland Fisheries Ireland
Dr. Colm Fitzgerald	Inland Fisheries Ireland
Dr. Russell Poole	Marine Institute
Dr. Denis Doherty	Electric Ireland
Dr. Paddy Gargan	Inland Fisheries Ireland
Dr. Derek Evans	Agri-Food & Bioscience Institute, N. Ireland
Dr. Sarah McLean	The Loughs Agency

# Appendix 2: 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<sup>1</sup>, hereby make the following byelaw:

(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.

 (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

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.

Appendix 3: Reports on Fisheries closures, illegal fishing and other management actions from the IFI RBD's and DAERA.

River District Basin:Eastern / Neagh Bann (International) River Basin DistrictsDate:1 Jan- 31 Dec 2019

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 / Neagh Bann (International) RBD remained closed throughout 2019.

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 Eastern / Neagh Bann (International) RBD during 2019.

**IFI Research Division** 

IFI licences were issued to trap eels relating to research activity in IFI Dublin again in 2019 (covering both Eastern / Neagh Bann (International) River Basin Districts). Ex-commercial eel fishermen were contracted by IFI Research Division to undertake surveys. Results are awaited from IFI Research Division.

Estimated level of illegal fishing:

Main catchments where illegal activity occurred:

The level of illegal activity was low for 2019 in the IFI Dublin area. Illegal activity targeting eels was recorded at a very low level. Patrols concentrated on lakes / rivers throughout the RBD.

Number of gear seizures: 3 Traps / Nets Gear types seized: Home Made

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:

Low levels of illegal activity recorded, any eels recorded were a by-product when coarse fish were found in crayfish traps / nets (however very few eels found in any nets in 2018)



Photograph 1. Trap seized from the River Boyne at Dunmoe (May).

# Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD? No

(If 'Yes', please insert quantity transported).

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

(List any sites etc where barriers were removed or elver access improved etc)

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

Management Action 4. Improve Water Quality

# (List any sites or actions which have significantly improved WQ to the benefit of eels)

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

#### River District Basin: South Eastern River Basin Districts

Date: 1 Jan- 31 Dec 2019

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 2019.

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 SERBD during 2019.

Estimated level of illegal fishing: None

Main catchments where illegal activity occurred:

Number of gear seizures: Nil Gear types seized:

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? No

(If 'Yes', please insert quantity transported).

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							
(List any sites etc where barriers were removed or elver access improved etc)							
Ardfinnan Bridge	Suir Main Channel						
Newcastle Bridge	Trib Suir						
Hollyford Bridge	River Multeen, Trib Suir						
Clonea Power Bridge	River Clodiagh, Trib Suir						
Colligan Wood Bridge	River Colligan						
Rathnure Bridge	River Borough, Trib Slaney						
Gully Bridge	River Erkina, Trib Nore						
Mounthrath Bridge	Trib WhiteHorse River, Trib Nore						
Rosconnell Bridge	Owenbeg River, trib Nore						
Saleens Bridge	Coastal River, (Tramore)						
Donard Bridge	Browns Beck Brook, Trib Slaney						
Donard Ford	Browns Beck Brook, Trib Slaney						
See photos below							

# Management Action 4. Improve Water Quality

(List any sites or actions which have significantly improved WQ to the benefit of eels)



Donard Bridge – Pre works



Donard Bridge – Post works



Donard Ford – Pre works



Donard Ford – Post works

# River District Basin:South West River Basin DistrictDate:1 Jan- 31 Dec 2019

# 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 2019.

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 SWRBD during 2019.

Estimated level of illegal fishing: Low

Insert No. of alleged or confirmed reports: 2 (confirmed)

River Argideen, 08/06/19 – eel trap

River Bandon, 12/08/19 – eel trap

Main catchments where illegal activity occurred:

Argideen and Bandon, West Cork

Number of gear seizures:

2 eel traps

Gear types seized:

Insert quantity/length of gear seized

Number of Eel Dealer Interceptions: Nil

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, not viewed as serious attempts to poach eels on a commercial scale.

#### Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD? Yes

Over 5 dates : 24-25/09 and 15-17/10.

24/09 : 20kg

25/09 : 10kg

15/10 : 385kg

16/10 : 238kg

17/10 : 46kg

What was the total catch transported (kg)? 1,098kg

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

General impression of the programme:

Compliant

Management Action 3. Ensure Upstream Migration at Barriers

(List any sites etc where barriers were removed or elver access improved etc) :

Nil by design, however collapse of weir at Fermoy, (Munster Blackwater) Co. Cork has resulted in significant improvement in eel passage.

Management Action 4. Improve Water Quality

(List any sites or actions which have significantly improved WQ to the benefit of eels): Nil

Please include any relevant photographs of elver and/or silver eel trap & truck activities or seized gear.

# River District Basin: Shannon River Basin District

**Date:** 1 Jan- 31 Dec 2019

#### 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 Shannon RBD remained closed throughout 2019.

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 Shannon RBD during 2019.

Estimated level of illegal fishing:

Insert No. of alleged or confirmed reports

Main catchments where illegal activity occurred: Lough Ree, River Inny.

A report of dead silver eels at Ringmoylan Pier on the Shannon estuary was received on the 15th of January. There was no apparent cause for the dead eels and there were no signs of pollution in the area.



Eels at Ringmoylan.

**Elver Monitoring** 

An initial meeting took place between the research team looking after eels to trouble shoot some of the issues and also to discuss the season ahead. Modifications are being carried out to the new Maigue elver trap and all traps; Feale, Inagh, Maigue were in operation by the end of the March.



First Elvers caught in 2019 at Inagh, Ennistymon.

River	Date of commissi	Kg of elvers	Total 2019					
	on	Marc h	April	May	June	July	Aug	
Inagh	03/2019	0	0.314	0.799	0.838	0.340		2.291
Feale	03/2019	0	0.189	0.789	0.213	6.743		7.934
Maigue	03/2019	0	0.00	0.014	0.19	0.269	0.527	1
Total		0	0.503	1.602	1.241	7.352	0.527	11.225

The silver eel fishing season finished in March with the last eel release on the 31<sup>st</sup> March 2019. The catches were very poor on the Shannon for 2019.

ESB Trap and Transport Programme.

Month	Weight in Kgs
September 2018	334kg
October 2018	1,481kg
November 2018	1,318kg
December 2018	6,909kg

January 2019	3,441kg
February 2019	1,43kg
March 2019	2,785kg
Total	16,411kg

No eel fishing was observed or reported during April. However staff expect some net and lines to be set in the coming weeks as the water temperatures rise. Officers monitored this in the Lough Ree catchments. A number of boat patrols targeting illegal eel fishing took place during May. Two fyke nets were recovered from the water just to the North-West of Pollagh Point, Co.Longford. On a separate patrol a crayfish trap (set to catch roach fry) was recovered from the water in a remote location in Elfeet Bay, Newtowncashel. We believe these fry are being used to bait long lines. In a follow up search of the area a week later, two officers were met with some hostility when entering the area.



Two fyke nets recovered from the water in Lough Ree.

Eel surveillance and patrols were increased for June, as illegal activity was still occurring in the traditional areas. Surveillance and checks for illegal eel activity is resource heavy, given the techniques used and is commonly carried out late into the night. A capture remains a priority and efforts will continue to gather the necessary evidence. Two illegal fyke nets were seized in the Inny Bay area of Lough Ree, a traditional hotspot for eel fishing. The nets were set in shallow water and observed by an Inland Fisheries boat crew who were specifically looking for nets in this general area. In total approximately twenty live eel were released.



Fyke nets being seized at Inny Bay.

Illegal nets were discovered in five different locations on the eastern side of Lough Ree during July. In total over 100 eel, 14 pike and approx. 20 coarse fish were released from the nets. The approximate monitory value of the seizure is €1700.



One of the illegal nets seized in Inny Bay during

July.

The main focus on protection for the ShRBD for the month of September was on potential illegal eel activity. As water levels rise and winter approaches, silver eel migration increases and with it, the potential for illegal activity. The Shannon eel 'truck and transport' scheme resumed again this month and numerous checks were carried out by Roscommon Officers at Athlone, where two crews are operating.

The mouth of the Boyle River and the main River Shannon at Hartley Bridge were dragged for illegal nets by members of the Leitrim/Sheelin teams with no illegal items discovered. Vehicle patrols of Lough Gara, Strokestown and Lough Allen didn't yield any evidence of eel-fishing, however, officers continued to remain vigilant as the peak Silver-Eel migratory season approached.

The ESB Tra December 201	p and Trar 9.	nsport Pro	ogramme o	ommenced	l in Sep	otember an	nd concluded in
Month				Weight in	n Kgs		
September 20	19			479			
October 2019				4,249			
November 2019				2,146			
December 2019				3,299			
January 2020							
Total				10,173			
Date       05/05/2019       01/06/2019       27/07/2019	Location Pollagh Inny Bay Inny Bay	Gear types seized:     Insert quantity/length of gear seized     Description of Item seized (no numeric values)   If items seized are nets - enter length of net in metres- enter length of net in metres- no text)     Fyke Net   2   30     Fyke Net   2   30     Fyke Net   4   60					
22/10/2019 22/10/2019 22/12/2019	IFI Shannon IFI Shannon IFI Shannon	Roscommon Mullingar	Inny Bay Inny Bay river Inny Total	Fyk	ie Net	1 1 1	15 50 200
Number of Ee	el Dealer Inte	erceptions	: 0				
Estimated ton Describe Actio	Estimated tonnage on board: Declared origin(s) of cargos: Describe Action taken:						
General impro There is evide were down to catchments wa	General impression of levels of illegal activity since the cessation of the commercial fishery: There is evidence of illegal activity ongoing on Lough's Ree and Derg and while the seizures were down this year it is unlikely that the illegal activity has decreased. These two catchments will remain the focus for 2020.						

Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD?

(If 'Yes', please insert quantity transported).

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

(List any sites etc where barriers were removed or elver access improved etc)

Management Action 4. Improve Water Quality

(List any sites or actions which have significantly improved WQ to the benefit of eels)

River District Basin: Western River Basin District

**Date:** 1 Jan- 31 Dec 2019

#### 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 2019. No poaching was detected.

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 Western RBD during 2019.

Estimated level of illegal fishing: There was no evidence of illegal eel fishing during 2019 in the WRBD.

Insert No. of alleged or confirmed reports

Number of gear seizures:

Gear types seized:

Insert quantity/length of gear seized

Number of Eel Dealer Interceptions: Nil

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:

Overall, apart from the occasional fyke net, there has been very little evidence of any significant illegal eel fishing activity in the WRBD since the cessation of the commercial fishery. "We have had very little activity in relation to Eels for the last number of years. We continue to monitor during patrols, for the possible presence of fyke nets or long lines, and we have checked some of the Coghill net facilities during periods of the "darks". It would appear that as there are no dealers available or doing collections in the west anymore, activity appears to have completely dried up. (Inspector Pat Gorman, IFI-Galway).

Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD? N/A

(If 'Yes', please insert quantity transported).

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

(List any sites etc where barriers were removed or elver access improved etc) N/A

Improvements to elver passage and counting facilities which had been installed at the Galway (Corrib), Moy and Ballisodare fisheries were operated during 2019.

The Elver trap on Ballysadare Fishery is monitored by Ballysadare Fishery employees/members under The Citizen Science' initiative, and coordinated by the IFI eel monitoring programme.

Photos attached are of the trap and fish pass.

The elver survey took place at Ballysadare Falls from 05/03/19 to 09/09/19. In total 8.7kg were caught. 5.1kg of which were elvers and 3.6kg were yellows. The majority of elvers were taken in May (3.9kg); the majority of yellows were caught in August (1.7 kg).

#### **Management Action 4. Improve Water Quality**

Staff continued to monitor water quality throughout the WRBD on an ongoing basis and appropriate action was taken where indicated. 15 warning letters were issued in WRBD in 2019.





Elver trap and pass at Ballysadare, Co. Sligo

#### River District Basin: Northern River Basin District

Date: 1 Jan- 31 Dec 2019

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 2019.

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 during 2019.

Estimated level of illegal fishing:

Main catchments where illegal activity occurred:

None encountered or reported.

Number of gear seizures:

Gear types seized:

1 fyke net retrieved from New Lake, Dunfanaghy, Co. Donegal (see photo)

1

Number of Eel Dealer Interceptions: Nil

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: The level of illegal activity remains very low.

#### Management Action 2. Trap & Transport

Was trap & transport undertaken in your RBD? Yes

In the Ballyshannon district 25,497kg of Eels were released from Lower & Upper Lough Erne. The Eels were caught at (1) Roscor bridge, (2) Ferny Gap 2km east of Roscor bridge, (3) Portora Lock (4) Urney bridge and Lough Gowna. Eels were transported to Ballyshannon and released into the Tailrace below Cathleen's Falls hydro station. What was the total catch transported (kg)?: 25,497kg

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 2019. A total of 25,497 kg of live Eels were captured, transported and released into the Erne estuary (downstream of the two hydropower stations). This was down by 2,238kg on last year's total release.

Initially there were some protection issues relating to proper marking of authorised silver eel nets in the Upper Erne, but this was quickly rectified once raised with the ESB. Overall there was excellent co-operation again between the different agencies (ESB, DAERA & IFI) and the contracted silver eel fishermen.

Management Action 3. Ensure Upstream Migration at Barriers

Elver bristle matting was installed at fish counter / crump weir installations on both the River Eske and Eany, Co. Donegal in 2019.

#### Management Action 4. Improve Water Quality

Please include any relevant photographs of elver and/or silver eel trap & truck activities or seized gear.



A fyke net retrieved from New lake in Dunfanaghy in August 2019

#### Fitting of Elver pass on the Ballintra River

Development staff installed a new Elver pass on a small stream hydropower facility on the Ballintra River, Co. Donegal.



Elver pass at Ballintra

#### Completion of Elver Pass on the Eany River

Development installed the remainder of the Elver pass on the Eany river when water levels dropped



Completion of Elver bristle matting on River Eany counter and crump weir

Wk No.	Week Ending	Jolly Mariner, Athlone	Yacht Club, Athlone	Kilaloe Eel Weir	Total for Week
1	07/09/19	0	0	Not Fishing	0
2	14/09/19	336	143	Not Fishing	479
3	21/09/19	0	0	Not Fishing	0
4	28/09/19	0	0	Not Fishing	0
5	05/10/19	1245	132	260	1637
6	12/10/19	2162	207	243	2612
7	19/10/19	0	0	0	0
8	26/10/19	0	0	0	0
9	02/11/19	917	222	295	1434
10	09/11/19	Not fishing	Not Fishing	0	0
11	16/11/19	Not fishing	Not Fishing	0	0
12	23/11/19	Not fishing	Not Fishing	0	0
13	30/11/19	Not fishing	Not Fishing	712	712
14	07/12/19	Not fishing	Not Fishing	502	502
15	14/12/19	Not fishing	ot fishing Not Fishing 1175		1175
16	21/12/19	Not fishing	Not Fishing	625	625
17	28/12/19	Not fishing	Not Fishing	1267	1267
18	04/01/20	Not fishing	Not Fishing	870	870
19	11/01/20	Not fishing	Not Fishing	95	95
20	18/01/20	Not fishing	Not Fishing	Not Fishing	0
21	25/01/20	Not fishing	Not Fishing	Not Fishing	0
22	01/02/20	Not fishing	Not Fishing	Not Fishing	0
23	08/02/20	Not fishing	Not Fishing	25	25
24	15/02/20	Not fishing	Not Fishing	Not Fishing	0
25	22/02/20	Not fishing	Not Fishing	324	324
Т	otal to				
Da	ate(kgs)	4660	704	6393	11757
Wk No.	Week Ending	Jolly Mariner, Athlone	Yacht Club, Athlone	Kilaloe Eel Weir	for Week
Cat	ch Ouota			_	
per	Location	8 Tonnes	2 Tonnes	No Quota	

Appendix 4- 1 River Shannon Silver Eel Weekly Collection Sheet 2019/20

								Total
Week	Week		Ferny		Urney	Roscor	Lough	for
No.	Ending	Lisnaskea	Gap	Portora	Bridge	Bridge	Gowna	Week
			Not					
1	07/09/2019	839	Fishing	0	338	71	152	1400
			Not					
2	14/09/2019	205	Fishing	1361 111		0	0	1677
		0	Not				0	
3	21/09/2019	0	Fishing	0	0	0	0	0
4	28/09/2019	1032	1793	1010	993	0	576	5404
5	05/10/2019	800	1075	270	823	240	1910	5118
6	12/10/2019	335	490	335	260	392	1477	3289
7	19/10/2019	0	0	0	0	0	0	0
8	26/10/2019	246	787	104	202	433	461	2233
9	02/11/2019	300	4813	178	225	351	509	6376
10	09/11/2019	182	329	623	731	626	352	2843
11	16/11/2019	733	0	832	262	298	536	2661
12	23/11/2019	300	1692	801	90	1138	0	4021
13	30/11/2019	0	1446	0	0	918	0	2364
14	07/12/2019	263	0	149	214	0	414	1040
15	14/12/2019	193	189	491	206	146	0	1225
Total t	o Date(kgs)	5428	12614	6154	4455	4613	6387	39651
Week No.	Week Ending	Lisnaskea	Ferny Gap	Portora	Urney Bridge	Roscor Bridge	Lough Gowna	Total for Week

Appendix 4- 2 River Erne Silver Eel Weekly Collection Sheet 2019/20

Catchment	Collection Location	Date of Collection	Total Weight of Catch kg	Less weight of mortalities	Total weight of Healthy Catch Transported kg	Total Weight Transported to date kg
Lee	Boat Centre	28/08/2019	50	na	50	50
Lee	Boat Centre	11/09/2019	58	na	58	108
Lee	Boat Centre	12/09/2019	46	na	46	154
Lee	Boat Centre	17/09/2019	69	na	69	223
Lee	Boat Centre	18/09/2019	85	na	85	308
Lee	Boat Centre	24/09/2019	20	na	20	328
Lee	Boat Centre	25/09/2019	101	na	101	429
Lee	Boat Centre	15/10/2019	385	na	385	814
Lee	Boat Centre	16/10/2019	238	na	238	1052
Lee	Boat Centre	17/10/2019	46	na	46	1098

Appendix 4- 3 River Lee Silver Eel Weekly Collection Sheet 2019/20

RBD	Catchments	Lake name	No. Night	No. Net	No. Eels	CPUE	Average Length	Min Length (cm)	Max Length (cm)	Average weight (kg)	Min weight (kg)	Max Weight (kg)	Total Weight (kg)
WRBD	Owenriff	Adrehid, Lough	1	9	2	0.2	63.6	57	70.2	0.466	0.358	0.574	0.932
WRBD	Ballysadare	Arrow, Lough	3	9	2	0.2	55.5	48	63	0.306	0.164	0.448	0.612
WRBD	Owenriff	Ateeaun, Lough	1	6	0	0.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NWIRBD	Erne	Bawn Lough	1	6	5	0.8	63.8	55.5	76	0.44	0.274	0.685	2.201
SHIRBD	Owencashla	Caum, Lough	1	6	3	0.5	37.3	33.5	39.5	0.078	0.055	0.09	0.235
WRBD	Corrib	Corrib Lower, Lough	2	18	18	1.0	47.6	39.7	54.7	0.205	0.102	0.361	3.693
WRBD	Corrib	Corrib Upper, Lough	5	27	64	2.4	53.4	41	74	0.275	0.114	0.605	17.64
SWRBD	Fane	Corrinshigo, Lough	1	3	0	0.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
WRBD	Moy	Cullin, Lough	3	18	2	0.1	39.76	33	47.4	0.107	0.065	0.186	0.323
WRBD	Bundorragha	Doo Lough	1	3	1	0.3	46.2	46.2	46.2	0.149	0.149	0.149	0.149
ERBD	Boyne	Drumkeery Lough	1	6	2	0.3	57	53.5	60.5	0.336	0.306	0.367	0.673
NWIRBD	Erne	Garadice Lough	3	18	29	1.6	51.5	41.6	69.4	0.236	0.112	0.509	6.846
SHIRBD	Shannon Est Sth	Gur, Lough	2	9	1	0.1	64.5	64.5	64.5	0.461	0.461	0.461	0.461
WRBD	Owenriff	Loughaphreaghaun	2	9	1	0.1	62	62	62	0.32	0.32	0.32	0.32
SHIRBD	Fergus	Muckanagh Lough	2	9	1	0.1	49.4	49.4	49.4	0.194	0.194	0.194	0.194
SHIRBD	Inny	Owel, Lough	3	18	0	0.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SHIRBD	Shannon Est Upr	Rinn, Lough	2	9	6	0.7	69.4	56.5	80	0.605	0.259	1.045	6.36
WRBD	Owenriff	Shannaghree, Lough	1	6	0	0.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NWIRBD	Erne	White Lough (Ballybay)	1	9	24	2.7	54.7	45.5	67	0.294	0.124	0.59	7.074

# Appendix 5: Water Framework Directive

# Appendix 5-1 WFD Lake summary data, 2018

RBD	Catchments	Lake name	No. Eels	20-29cm	30-39cm	40-49cm	50-59cm	60-69cm	70-79cm	>80cm
WRBD	Owenriff	Adrehid, Lough	2	0	0	0	1	0	1	0
WRBD	Ballysadare	Arrow, Lough	2	0	0	1	0	1	0	0
WRBD	Owenriff	Ateeaun, Lough	0	0	0	0	0	0	0	0
NWIRBD	Erne	Bawn Lough	5	0	0	0	3	0	2	0
SHIRBD	Owencashla	Caum, Lough	3	0	3	0	0	0	0	0
WRBD	Corrib	Corrib Lower, Lough	18	0	1	12	5	0	0	0
WRBD	Corrib	Corrib Upper, Lough	64	0	0	20	37	6	1	0
SWRBD	Fane	Corrinshigo, Lough	0	0	0	0	0	0	0	0
WRBD	Moy	Cullin, Lough	2	0	2	0	0	0	0	0
WRBD	Bundorragha	Doo Lough	1	0	0	1	0	0	0	0
ERBD	Boyne	Drumkeery Lough	2	0	0	0	1	1	0	0
NWIRBD	Erne	Garadice Lough	29	0	0	13	14	2	0	0
SHIRBD	Shannon Est Sth	Gur, Lough	1	0	0	0	0	1	0	0
WRBD	Owenriff	Loughaphreaghaun	1	0	0	0	0	1	0	0
WRBD	Owenriff	Adrehid, Lough	2	0	0	0	1	0	1	0
SHIRBD	Fergus	Muckanagh Lough	1	0	0	1	0	0	0	0
SHIRBD	Inny	Owel, Lough	0	0	0	0	0	0	0	0
SHIRBD	Shannon Est Upr	Rinn, Lough	6	0	0	0	1	2	2	1
NWIRBD	Erne	Scur, Lough	10	0	0	1	5	4	0	0
WRBD	Owenriff	Shannaghree, Lough	0	0	0	0	0	0	0	0
NWIRBD	Erne	White Lough (Ballybay)	24	0	0	9	10	5	0	0

# Appendix 5-2 WFD Lake length frequency data, 2018

RBD	Catchment	River Name	River Site	Methodology	No. Sets/Boats	No. Runs	Area (m²)	Density (no./m²)	No. Eels	Total Weight (kg)
SWRBD	Bride	Bride (Curraglass) River	Curraglass_A	TEF (Handset)	1	1	54	0.0370	2	n.a
SWRBD	Bride	Bride (Flesk) River	Ballinaltig BrA	TEF (Handset)	1	1	107	0.0093	1	n.a
SWRBD	Bride	Bride (Glashanabrack) River	Graigue BrA	TEF (Handset)	1	1	154	0.0065	1	n.a
SWRBD	Bride	Bride (Glenkeen) River	Ballyvolane BrA	TEF (Handset)	1	1	118	0.0255	3	n.a
SWRBD	Bride	Bride (Kilwinny) River	Kilwinny BrA	TEF (Handset)	1	1	118	0.0084	1	n.a
SWRBD	Bride	Bride (Knockdromaclough) River	Grange BrA	TEF (Handset)	1	1	65	0.0308	2	n.a
SWRBD	Bride	Bride (Shanakill) River	Shanagkill Crossroads_A	TEF (Handset)	1	1	103	0.0097	1	n.a
SWRBD	Bride	Bride (Shanowennadrimia) River	Stable Crossroads_A	TEF (Handset)	1	1	117	0.0598	7	n.a
SWRBD	Bride	Bride (Toor) River	Red Bog_A	TEF (Handset)	1	1	110	0.0091	1	n.a
SWRBD	Bride	Bride River	Bride BrA	TEF (Handset)	1	1	279	0.0108	3	n.a
SWRBD	Bride	Bride River	Gearagh_A	TEF (Handset)	1	1	373	0.0027	1	n.a
SWRBD	Bride	Bride River	Mass Rock_A	TEF (Handset)	1	1	146	0.0068	1	n.a
NBIRBD	Fane	Fane (Clarebane) River	Clarebane BrA	TEF (Handset)	1	1	250	0.0120	3	n.a
NBIRBD	Fane	Fane River	Br. d/s of Inniskeen_A	TEF (Handset)	1	1	261	0.0038	1	n.a
NBIRBD	Fane	Fane River	Castlering BrA	TEF (Handset)	1	1	514	0.0117	6	n.a
NBIRBD	Flurry	Flurry River	Drumad_A	TEF (Handset)	1	1	259	0.0039	1	n.a
SWRBD	Glashaboy	Glashaboy (Bultlerstown) River	Butlerstown BrA	TEF (Handset)	1	1	168	0.0119	2	n.a
ERBD	Dargle	Glencullen River	Knocksink Woods_A	TEF (Handset)	1	1	245	0.0041	1	n.a
SWRBD	Licky	Licky River	Br. NE of Glenlicky_A	TEF (Handset)	1	1	179	0.0056	1	n.a
SWRBD	Licky	Licky River	Grallagh BrA	TEF (Handset)	1	1	331	0.0030	1	n.a
SWRBD	Licky	Licky River	N25 Gorteen_A	TEF (Handset)	1	1	135	0.0074	1	n.a

# Appendix 5-3 Summary data from WFD Rivers Survey, 2018

RBD	Catchment	River Name	River Site	Methodology	No. Sets/Boats	No. Runs	Area (m²)	Density (no./m²)	No. Eels	Total Weight (kg)			
SWRBD	Martin	Martin River	Blarney Woolen Mills A	TEE (Handset)	1	1	263	0.0038	1	(Rg)			
SWRDD	Iviaitiii	Wartin, Kiver	Diamey Woolen Wills_A	i Er (Handset)	1	1	205	0.0058	1	11.a			
WRBD	Owenriff	Owenriff River	d/s of Glengowla Mine_A	Single Pass (Boat)	2	1	854	0.0012	1	n.a			
SERBD	Suir	Suir, River	Ferryhouse_A	Single Pass (Boat)	2	1	18515	0.0002	3	n.a			
SERBD	Suir	Suir, River	Kilmaneen_A	Single Pass (Boat)	2	1	29832	0.0000	1	n.a			
SERBD	Suir	Suir, River	Kilsheelan BrA	Single Pass (Boat)	2	1	43274	0.0001	3	n.a			
SERBD	Suir	Suir, River	Swiss Cottage_A	Single Pass (Boat)	2	1	14062	0.0001	2	n.a			
ERBD	Vartry	Vartry River	Ashford BrA	ADEF (Handset)	3	3	422	0.0237	10	n.a			
ERBD	Vartry	Vartry River	Newrath BrA	ADEF (Handset)	3	3	370	0.0162	6	n.a			
ERBD	Vartry	Vartry River	Nun's Cross BrA	ADEF (Handset)	2	3	392	0.0153	6	n.a			
				No	5.0	10_10	20-20	30- 20	10-10	50- 50	60- 69	70- 79	<b>\</b> 80
--------	------------	--------------------------------	-------------------------	------	-----	-------	-------------	-----------	-------	-----------	-----------	-----------	-------------
RBD	Catchments	River Name	<b>River Site</b>	Eels	cm	cm	20-29 cm	cm	cm	cm	cm	cm	cm
SWRBD	Bride	Bride (Curraglass) River	Curraglass_A	2	0	1	1	0	0	0	0	0	0
SWRBD	Bride	Bride (Flesk) River	Ballinaltig BrA	1	0	0	0	1	0	0	0	0	0
SWRBD	Bride	Bride (Glashanabrack) River	Graigue BrA	1	0	1	0	0	0	0	0	0	0
SWRBD	Bride	Bride (Glenkeen) River	Ballyvolane BrA	3	2	1	0	0	0	0	0	0	0
SWRBD	Bride	Bride (Kilwinny) River	Kilwinny BrA	1	0	0	0	1	0	0	0	0	0
SWRBD	Bride	Bride (Knockdromaclough) River	Grange BrA	2	0	1	1	0	0	0	0	0	0
SWRBD	Bride	Bride (Shanakill) River	Shanagkill Crossroads_A	1	0	1	0	0	0	0	0	0	0
SWRBD	Bride	Bride (Shanowennadrimia) River	Stable Crossroads_A	7	1	4	2	0	0	0	0	0	0
SWRBD	Bride	Bride (Toor) River	Red Bog_A	1	1	0	0	0	0	0	0	0	0
SWRBD	Bride	Bride River	Bride BrA	3	0	1	2	0	0	0	0	0	0
SWRBD	Bride	Bride River	Gearagh_A	1	0	0	1	0	0	0	0	0	0
SWRBD	Bride	Bride River	Mass Rock_A	1	0	0	0	1	0	0	0	0	0
NBIRBD	Fane	Fane (Clarebane) River	Clarebane BrA	3	0	0	0	1	2	0	0	0	0
NBIRBD	Fane	Fane River	Br. d/s of Inniskeen_A	1	0	0	1	0	0	0	0	0	0
NBIRBD	Fane	Fane River	Castlering BrA	6	0	5	1	0	0	0	0	0	0
NBIRBD	Flurry	Flurry River	Drumad_A	1	0	1	0	0	0	0	0	0	0
SWRBD	Glashaboy	Glashaboy (Bultlerstown) River	Butlerstown BrA	2	0	0	1	1	0	0	0	0	0

## Appendix 5-4 Length frequency data from WFD River Surveys, 2018

								30-		50-	60-	70-	
RBD	Catchments	River Name	River Site	No. Eels	5-9 cm	10-19 cm	20-29 cm	39 cm	40-49 cm	59 cm	69 cm	79 cm	>80 cm
ERBD	Dargle	Glencullen River	Knocksink Woods_A	1	0	0	1	0	0	0	0	0	0
SWRBD	Licky	Licky River	Br. NE of Glenlicky_A	1	0	0	0	1	0	0	0	0	0
SWRBD	Licky	Licky River	Grallagh BrA	1	0	0	0	1	0	0	0	0	0
SWRBD	Licky	Licky River	N25 Gorteen_A	1	0	0	1	0	0	0	0	0	0
SWRBD	Martin	Martin, River	Blarney Woolen Mills_A	1	0	0	0	0	1	0	0	0	0
WRBD	Owenriff	Owenriff River	d/s of Glengowla Mine_A	1	0	1	0	0	0	0	0	0	0
SERBD	Suir	Suir, River	Ferryhouse_A	3	0	0	2	1	0	0	0	0	0
SERBD	Suir	Suir, River	Kilmaneen_A	1	0	0	0	1	0	0	0	0	0
SERBD	Suir	Suir, River	Kilsheelan BrA	3	1	2	0	0	0	0	0	0	0
SERBD	Suir	Suir, River	Swiss Cottage_A	2	0	0	1	0	1	0	0	0	0
ERBD	Vartry	Vartry River	Ashford BrA	10	0	9	0	1	0	0	0	0	0
ERBD	Vartry	Vartry River	Newrath BrA	6	0	5	1	0	0	0	0	0	0
ERBD	Vartry	Vartry River	Nun's Cross BrA	6	0	5	1	0	0	0	0	0	0

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	Bride	Bride (Curraglass) River	Curraglass_A	16.5	13	20	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride (Flesk) River	Ballinaltig BrA	32	32	32	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride (Glashanabrack) River	Graigue BrA	18	18	18	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride (Glenkeen) River	Ballyvolane BrA	9.3	8	12	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride (Kilwinny) River	Kilwinny BrA	30	30	30	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride (Knockdromaclough) River	Grange BrA	18	11	25	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride (Shanakill) River	Shanagkill Crossroads_A	14.5	14.5	14.5	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride (Shanowennadrimia) River	Stable Crossroads_A	14.28	8.5	21	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride (Toor) River	Red Bog_A	20	20	20	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride River	Bride BrA	22.8	18	27	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride River	Gearagh_A	28.5	28.5	28.5	n.a	n.a	n.a	n.a
SWRBD	Bride	Bride River	Mass Rock_A	34	34	34	n.a	n.a	n.a	n.a
NBIRBD	Fane	Fane (Clarebane) River	Clarebane BrA	39.83	31	45	n.a	n.a	n.a	n.a
NBIRBD	Fane	Fane River	Br. d/s of Inniskeen_A	22	22	22	n.a	n.a	n.a	n.a
NBIRBD	Fane	Fane River	Castlering BrA	15.41	12.6	21	n.a	n.a	n.a	n.a
NBIRBD	Flurry	Flurry River	Drumad_A	19	19	19	n.a	n.a	n.a	n.a
SWRBD	Glashaboy	Glashaboy (Bultlerstown) River	Butlerstown BrA	26.5	21	32	n.a	n.a	n.a	n.a
ERBD	Dargle	Glencullen River	Knocksink Woods_A	22	22	22	n.a	n.a	n.a	n.a
SWRBD	Licky	Licky River	Br. NE of Glenlicky_A	35	35	35	n.a	n.a	n.a	n.a
SWRBD	Licky	Licky River	Grallagh BrA	30.5	30.5	30.5	n.a	n.a	n.a	n.a
SWRBD	Licky	Licky River	N25 Gorteen_A	20.7	20.7	20.7	n.a	n.a	n.a	n.a
SWRBD	Martin	Martin, River	Blarney Woolen Mills_A	48	48	48	n.a	n.a	n.a	n.a
WRBD	Owenriff	Owenriff River	d/s of Glengowla Mine_A	17	17	17	n.a	n.a	n.a	n.a

Appendix 5-5 Summary length and weight data from WFD Rivers Surveys, 2018

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	Suir, River	Ferryhouse_A	27	24	30	n.a	n.a	n.a	n.a
SERBD	Suir	Suir, River	Kilmaneen_A	33	33	33	n.a	n.a	n.a	n.a
SERBD	Suir	Suir, River	Kilsheelan BrA	13.5	7	17.5	n.a	n.a	n.a	n.a
SERBD	Suir	Suir, River	Swiss Cottage_A	34.5	29	40	n.a	n.a	n.a	n.a
ERBD	Vartry	Vartry River	Ashford BrA	16.1	10.5	35	n.a	n.a	n.a	n.a
ERBD	Vartry	Vartry River	Newrath BrA	12.8	10	20	n.a	n.a	n.a	n.a
ERBD	Vartry	Vartry River	Nun's Cross BrA	16	10.5	28	n.a	n.a	n.a	n.a

## Appendix 5-6 WFD Transitional Waters summary data, 2018

RBD	Catchments	Transitional Water	No. Nights	No. Nets	No. Eels	CPUE	Average Length (cm)	Min. Length (cm)	Max. Length (cm)
ERBD	Ovoca	Avoca Estuary	1	18	131	7.3	37.5	18	61
WERBD	Ballysadare	Ballysadare Estuary	2	24	5	0.2	60.1	45	72
ERBD	Boyne	Boyne Estuary	2	21	33	1.6	35.2	20	70
SWRBD	Laune	Castlemaine Harbour	2	24	5	0.2	26.3	11	41
NWIRBD	Erne	Erne Estuary	1	18	7	0.4	36.2	13.5	54
NWIRBD	Gweebarra	Gweebarra Estuary	1	27	7	0.3	31.2	7	49
WERBD	Kinvara	Kinvarra Bay	1	18	0	0.0	n.a.	n.a.	n.a.

RBD	Catchment	Estuary	No. Eels	0-9 cm	10-19 cm	20-29 cm	30-39 cm	40-49 cm	50-59 cm	60-69 cm	70-79 cm	>80 cm
ERBD	Ovoca	Avoca Estuary	131	0	1	23	47	22	15	1	0	0
WERBD	Ballysadare	Ballysadare Estuary	5	0	0	0	0	1	1	2	1	0
ERBD	Boyne	Boyne Estuary	33	0	0	6	20	3	3	0	1	0
SWRBD	Laune	Castlemaine Harbour	5	0	2	0	2	1	0	0	0	0
NWIRBD	Erne	Erne Estuary	7	0	1	2	1	1	2	0	0	0
NWIRBD	Gweebarra	Gweebarra Estuary	7	1	0	1	4	1	0	0	0	0
WERBD	Kinvara	Kinvarra Bay	0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Appendix 5-7 WFD transitional waters length frequency data, 2018