Report on the eel stock, fishery, and other impacts in:

UK

2023-2024

Note to the reader – this document accompanies a series of spreadsheet tables that provide the bulk of the data in a format most suitable for the working practices of WGEEL. Summaries of these data are provided in this document.

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Reporting Period: This report was completed in September 2024 and contains finalised data up to and including 2023 and some provisional data for 2024.

Acknowledgments:

This report has been compiled jointly by staff from the Centre for Environment, Fisheries and Aquaculture Science (Cefas), Agri-Food & Biosciences Institute Northern Ireland (AFBI), the Environment Agency (EA), Marine Directorate of Scotland (MDS) and the Natural Resources Wales (NRW). The monitoring and assessment of eel throughout the UK is funded by the Department for the Environment, Food and Rural Affairs (Defra), the Department of Agriculture & Environment & Rural Affairs (DAERA), Scottish Government and Welsh Government. All participating organisations would like to extend their thanks and recognition to the various operational fisheries staff who have collected and compiled the data for this report. Thanks to other contributors from the Environment Agency including Chris Williams, John Price, Ros Wright, and Ryan Shepherd, and to John Taylor from Natural Resources Wales. All commercial catch data for Lough Neagh and the River Bann in Northern Ireland are provided by the Lough Neagh Fishermen's Cooperative Society (LNFCS).

Contents

FOREWORD

Annual reports on the state of eel stock and fisheries throughout the UK have been produced since 2003. These reports present an update for the most recent year to assist the International Council for the Exploration of the Sea (ICES) in providing scientific advice to the European Commission, UK and others on the state of the international eel stock.

Until 2016, each annual report was designed to stand alone, to provide a single reference source of data and supporting information for the Working Group on Eel (WGEEL), a joint group of the European Inland Fisheries and Aquaculture Advice Commission (EIFAAC), ICES and the General Fisheries Commission for the Mediterranean (GFCM). Since 2017, however, ICES has issued annual Data Calls requesting updates on fishery catches, recruitment indices, aquaculture production and restocking levels, and triennial updates on silver eel escapement biomass and mortality rates caused by human factors. These Data Calls are answered using a series of spreadsheet tables (Annexes) containing the data and associated metadata. Therefore, lengthy time series of data are no longer provided in this report, but are summarised where considered necessary.

It should be noted that the data and information in the most recent year herein are provisional (with some exceptions) and will be updated and confirmed as complete later (usually in the next year's report).

1 Summary of national and international stock status indicators

1.1 Escapement biomass and mortality rates

This summary chapter presents the most recent stock indicators of silver eel escapement biomass, mortality rates, and assessed habitat area, for the 14 different Eel Management Units (EMU) reported on by the UK (Table 1.1; EMU codes explained in Table 1.2).

The international transboundary IE_NorW EMU which is shared between Northern Ireland and the Republic of Ireland, is reported by the latter so not included in this table.

Stock indicators for EMUs in England and Wales were updated this year (2024) and were based on data sets for the years 2020-2022. These stock indictors will not be updated until the next triennial ICES reporting in 2027, in which the 2023-2025 data sets will be used. Those for GB_NorE and GB_Neag in Northern Ireland and GB_Scot in Scotland are updated annually. However, closure of a key monitoring site in Scotland resulted in no assessment for 2023.

The impacts of COVID-19 in England and Wales resulted in reduced yellow eel data for 2020 and 2021 available for the Scenario-based Model of Eel Production II (SMEP II), leading to using only those rivers with five or more 'eel present' sites in the SMEP II modelling. Therefore, we must treat the outputs with caution. In addition, in 2022 a proportion of the catch data was lost, thus fisheries impacts may have been underestimated, adding further to the uncertainty. In Northern Ireland, following COVID-19 related impacts and lack of detailed information, assessment reverted to pre-2018 format, However the comparative analysis showed only 3-5% variation between the two methods.

Table 1.1. Stock indicators of silver eel escapement, biomass and mortality rates, and assessed habitat areas for each of the Eel Management Unit across the UK, showing most recent data available in the EMP report (2022 for England, Wales and Scotland, 2023 for Northern Ireland). ND: No data for GB_Humb as only 40% of reaches provided data for SMEP II leading to a lower escapement modelled estimate than anthropogenic impact estimates and thus a negative $B_{current}$.

Year	EMU_code	Area (ha)	B_0 (kg)	B_{curr} (kg)	B_{best} (kg)	B_{curr}/B_0 (%)	∑F	∑H	∑A
2022	GB_Nort	11816	60876	2292	6412	3.8	0.00	1.03	1.03
2022	GB_Humb	57853	137859	ND	ND	ND	ND	ND	ND
2022	GB_Angl	54373	341084	36638	80523	11.5	0.21	0.57	0.79
2022	GB_Tham	42811	251699	4491	26776	1.8	0.00	1.78	1.79
2022	GB_SouE	11443	121340	37056	53322	30.4	0.00	0.36	0.36
2022	GB_SouW	35850	1327684	15415	75173	1.2	1.17	0.41	1.58
2022	GB_Seve	75071	899687	77410	187669	8.6	0.42	0.48	0.90
2022	GB_Wale	26570	429944	16712	19679	3.9	0.00	0.16	0.16
2022	GB_Dee	14130	636166	37247	57890	5.9	0.01	0.44	0.44
2022	GB_NorW	46783	865449	52093	77368	5.9	0.00	0.39	0.40
2022	GB_Solw	87496	1473755	15177	19820	1.0	0.00	0.27	0.27
2022	GB_Scot	214241	267717	112982	140023	71.8	0.00	0.21	0.21
2023	GB_NorE	5000	4000	232	232	17.9	0.00	0.00	0.00
2023	GB_Neag	40000	500000	136000	216300	28.7	0.46	0.00	0.46

Key:

EMU_code = Eel Management Unit code (see Table 1.2 for list of codes); B_0 = the amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the stock (kg); B_{curr} = the amount of silver eel biomass that currently escapes to the sea to spawn (in the assessment year) (kg); B_{best} = the amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the current stock (kg); ∑F = mortality due to fishing, summed over the age groups in the stock (rate); ∑H = anthropogenic mortality excluding the fishery, summed over the age groups in the stock (rate); ∑A = all anthropogenic mortality summed over the age groups in the stock (rate); Assessed area (ha) = combined area total (ha) of transitional and inland waters. ND = no data, NP = not pertinent. B_{curr}/B_0 (%) represents mean compliance over the most recent three years.

Table 1.1. Names and abbreviations for the 15 Eel Management Units (EMU) across the UK, and the ICES ecoregion(s) that they discharge into. Jurisdiction codes: Sco = Scotland, NI = Northern Ireland, Eng = England, RoI = Republic of Ireland, Wal = Wales.

EMU code	ICES Ecoregion	River Basin District (RBD)	Jurisdiction
GB_Scot	Celtic Sea & North Sea	Scotland	Sco
GB_Neag	Celtic Sea	Neagh Bann	NI
GB_NorE	Celtic Sea	Northeastern	NI
*IE_NorW**	*Celtic Sea*	*Northwestern IRBD*	*NI + RoI*
GB_Nort	North Sea	Northumbria	Eng
GB_Humb	North Sea	Humber	Eng
GB_Angl	North Sea	Anglian	Eng
GB_Tham	North Sea	Thames	Eng
GB_SouE	North Sea	Southeast	Eng
GB_SouW	Celtic Sea	Southwest	Eng
GB_Seve	Celtic Sea	Severn	Eng + Wal
GB_Wale	Celtic Sea	Western Wales	Wal
GB_Dee	Celtic Sea	Dee	Wal + Eng
GB_NorW	Celtic Sea	Northwest	Eng
GB_Solw	Celtic Sea & North Sea	Solway-Tweed	Eng + Sco

** = international, transboundary EMU shared with the Republic of Ireland (reporting on this EMU is led by RoI so it has the country code IE, hence shown in italics here).*

1.2 Recruitment time series

The joint EIFAAC/ICES/GFCM Working Group on Eel (WGEEL) uses these time series data, and others collected from 40+ sites across the natural range of the European eel, to calculate the Recruitment Indices, relative to the reference period of 1960-1979, and the overall results form the basis of the annual Whole-Stock Advice that ICES provides to the European Commission and UK. This ICES Advice, and hence these whole-stock Recruitment Indices, are also used by the EU CITES Scientific Review Group (SRG) in their annual review of their position with regard to eel trade into and out of the European Union.

1.2.1 UK Recruitment time series contributing to the WGEEL Whole-Stock Recruitment Indices

There are 23 recruitment series reported to ICES, but not all are used in The Recruitment Analysis by the WGEEL. This is because multiple series from the same site are available that are not independent, or the series are too short to be included (at least 10 years of data are required before a time series will be included). Thus, only one fishery-dependent (glass eel series) and 16 fishery-independent time series of recruitment data (four glass eel series, four mixed elver and yellow eel series, and eight yellow eel recruitment series) from the UK are currently used in the Recruitment Analysis and presented in the annual ICES Advice.

Fishery-dependent series

The longest running time series used is that detailing the total UK commercial glass eel catch, as shown in Figure 1.1 below. These catch data are reported to the Environment Agency (EA) as a condition of the fishing authorization (see Section 3.1.1. for greater detail). The data for this time series are provided to ICES in the UK response to the annual Data Call (Data Call Annex 1). Since 2021, fishing effort and catches have been affected by EU-exit, thus data from 2021 onwards have been omitted from WGEEL analysis.

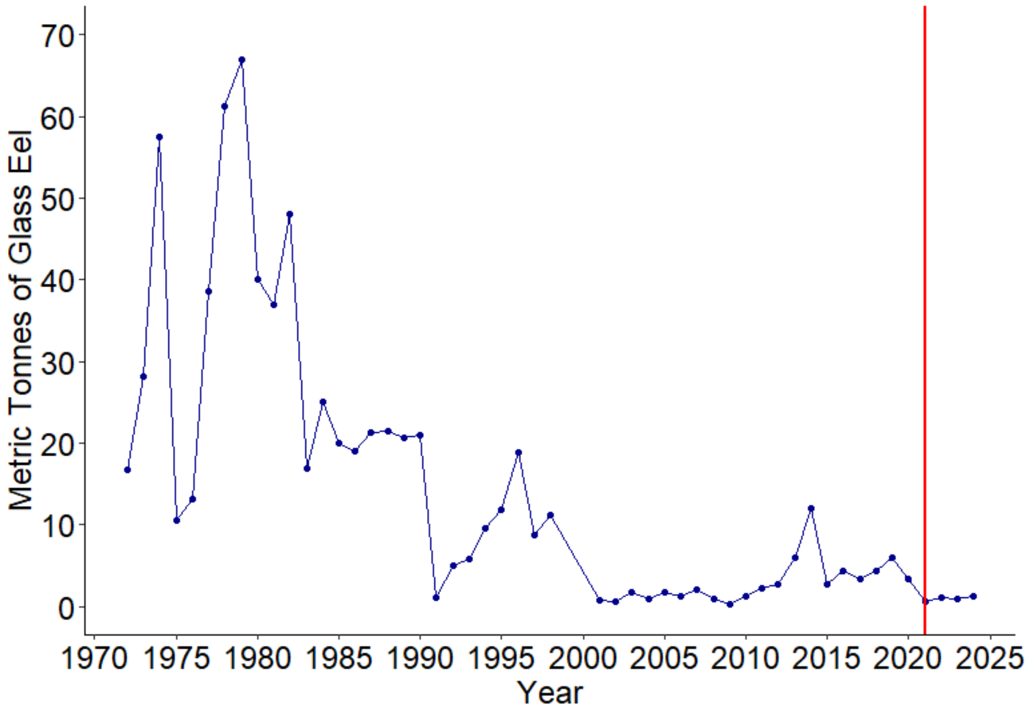

Figure 1.1 Time series of total UK glass eels catch (t) which is provided as one of the eel recruitment time series for the ICES Whole-Stock Glass Eel index calculations. Note – 2024 data are provisional. Data since 2021 not used in the assessment as affected by EU-exit (red vertical line).

Fishery independent

Sixteen fisheries-independent eel recruitment time series are currently used by the WGEEL from 13 sites across six EMUs around the UK (Figure 1.2a and 1.2b). The full time series index of glass eel recruitment for North West International River Basin District EMU (IE_NorW), the trans-boundary EMU between Northern Ireland and the Republic of Ireland, is reported in the Republic of Ireland Country Report.

Anglian (GB_Angl)

Glass eel (< 80 mm) data are available from the traps on the River Chelmer (Beeleigh Weir site) and the River Stour (Flatford, Judas Gap site) since 2006 and 2007, respectively. In, addition, glass eel data are also available from the Brownshill site on the River Great Ouse from 2011, although in 2012 and 2020 the trap was not operational for periods due to flooding and represent a partial count. The trap operation in other years was consistent throughout the time series. The numbers of yellow eel (> 120 mm) are also recorded at Brownshill and Beeleigh traps since 2011, and at Flatford since 2012. Data from the trap at New Mills on the River Wensum are available from 2009 onwards with the possibility to report data on glass/elver/yellow eel separately from 2020.

Southwest (GB_SouW)

The numbers of elvers and yellow eel traversing a 'camera trap' at the Greylake site on River Parrett (GB_SouW) are available from 2009–2020. The majority of the counts are yellow eel (> 120 mm) with around 10-15% elvers (80-120 mm).

Thames (GB_Tham)

Four sites within the Thames EMU have been monitored by the Zoological Society of London for several years. Data were added to the analysis in 2021, as ten years of collecting data had been reached. However, the MillY series (River Hogsmill, tributary of the River Thames) was discontinued in 2023 and will not be re-instated.

Scotland (GB_Scot)

An ascending yellow eel monitoring trap was set up in 2008 on the Girnock Burn, fishing from May to September. The trap was destroyed by flooding in December 2015 and rebuilt to different design in April 2017.

A glass eel monitoring site, consisting of 20 tidal pinhole traps, was set up at the mouth of the Shieldaig River, Wester Ross (N 57°30.65, W 5°38.72) in 2014, fishing from March-August inclusive. It reached the 10-year threshold for inclusion in the WGEEL recruitment analysis in 2023.

Neagh Bann (GB_Neag)

The LNFCS catch glass eels using dragnets with an area of 0.94 m^2, fished below a river-spanning sluice gate, which creates a barrier to upstream juvenile eel migration on the River Bann. Total catch per night is recorded, but not catch per individual net. These glass eels, and elvers trapped at the same location, are transported upstream to be stocked into the Lough. These catches provide a time series of 'natural' recruitment into the Lough. Recruitment had shown an overall downward trend to only 16 kg (approximately 48 000 glass eel) in 2011, which was the lowest catch on record. In 2024, the recruitment was estimated at 365 kg, and as in 2023, the first run (earliest caught) glass eels were noticeably longer (80 mm vs 72 mm), and heavier (approximately 2140 eels per kg) than the long-term averages spanning 20 years of recruitment biometry.

Northeastern (GB_NorE)

The collection of this data set has progressed beyond a continual ten-year standard in 2022. Recruitment trends recorded at this site over the 12-year period are shown in Figure 1.3 and illustrate the typical inter-annual variation seen at the other N. Ireland index sites (from GB_Nea and IE_NorW).

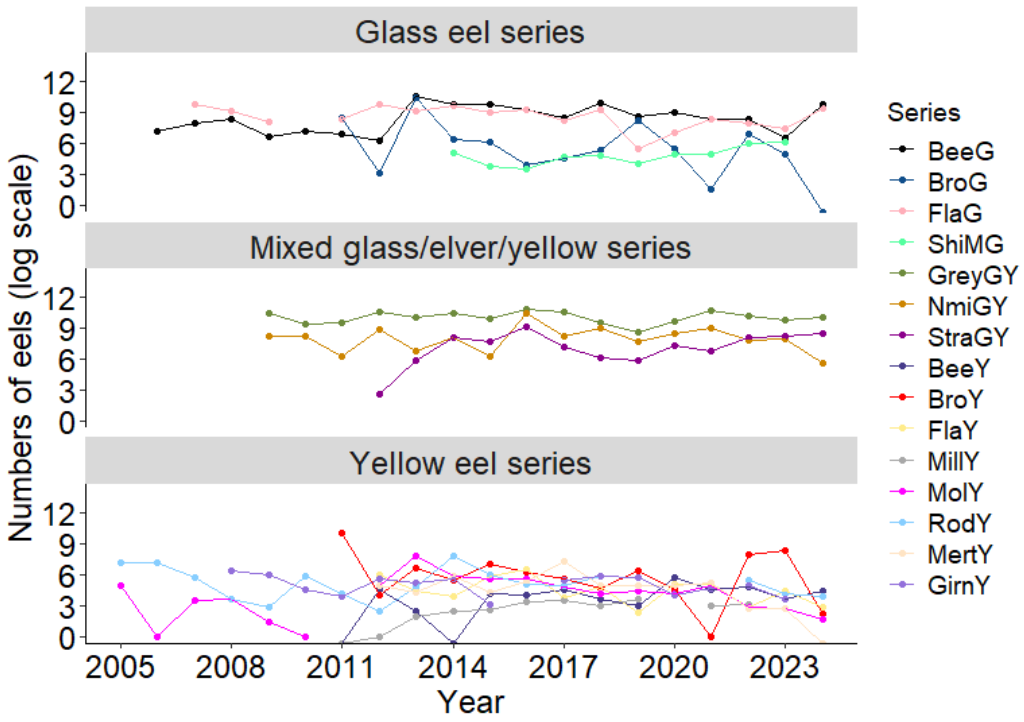

Figure 1.2.a Fishery-independent time series of UK eel recruitment on a log scale used in the WGEEL recruitment analysis, where: BeeG – Beeleigh glass eel, BroG – Brownshill glass eel, FlaG – Flatford glass eel, ShiMG – Shieldaig mouth glass eel, GreyGY – Greylake elver and yellow eel, NmiGY – New Mills elvers and yellow eel, StraGY - Strangford Lough glass and elver, BeeY – Beeleigh yellow eel, BroY – Brownshill yellow eel, FlaY – Flatford yellow eel, MillY – Middle Mill yellow eel, MolY - Molesey weir yellow eel, , RodY - River Roding yellow eel, MertY – Merton Abbey Mills yellow eel, GirnY - Girnock Burn. Data for 2024 are provisional. ***.*** *Note all series show numbers of eels.*

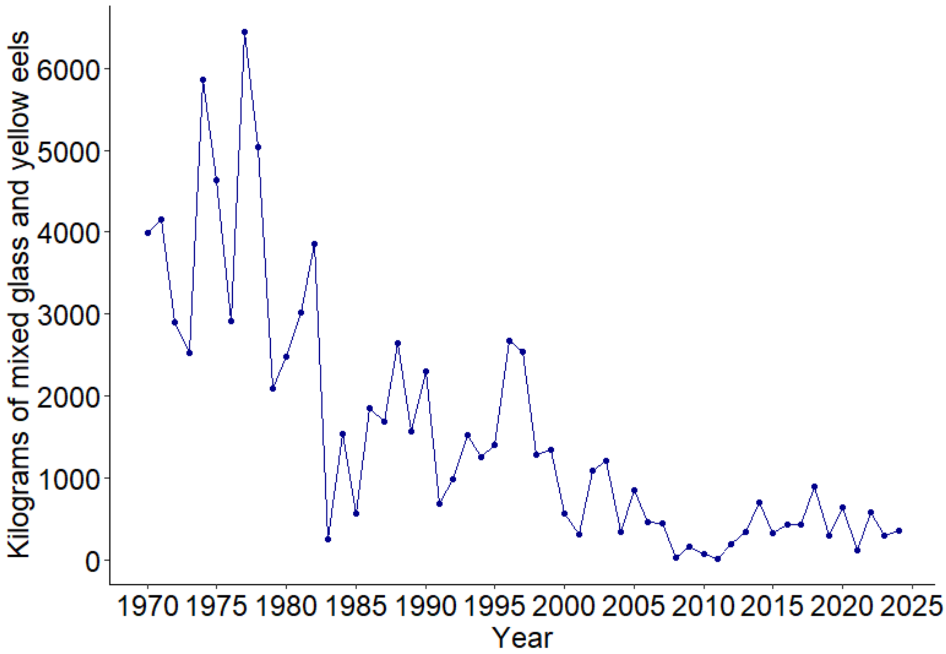

Figure 1.2.b Fishery-independent time series of mixed glass and yellow eels in the Neagh Bann (in kg) since 1970s, used in the WGEEL recruitment analysis. Note data go back to 1933 but are not shown here.

1.2.2 Other recruitment time series

Shorter time series are being generated from fisheries-independent glass eel monitoring in two EMUs (Figure 1.3). These have not been adopted in the WGEEL Recruitment Indices yet as they have not been collecting data for the required ten years. In addition, three time series in the GB_Angl are not included in the analysis despite having more than ten years of data as they are not independent of the glass eel series from the same sites already used in the analysis (Figure 1.3).

Anglian (GB_Angl)

Elver and yellow eel data (> 80 mm and < 120 mm) from the River Stour and from the trap on the River Chelmer (Beeleigh Weir site) have been available since 2007. In, addition, elver and yellow eel data are also available from the Brownshill site on the River Great Ouse from 2011.

Southwest (GB_SouW)

The combined numbers of elvers and yellow eel are collected from the camera trap at Oath Lock on the River Parrett since 2013, with data missing for 2017 and 2018 because of major water pump failure. Data were also not available for 2024 due to trap malfunctioning as a results of high river flows.

Scotland (GB_Scot)

A time series using skirt traps in still water at the barrier formed by the Shieldaig trap (50 m upstream of the tidal limit), was instituted in 2017, fishing from March to September inclusive (Table 1.3). This series terminated in 2022 as the Shieldaig trap was decommissioned in January 2023.

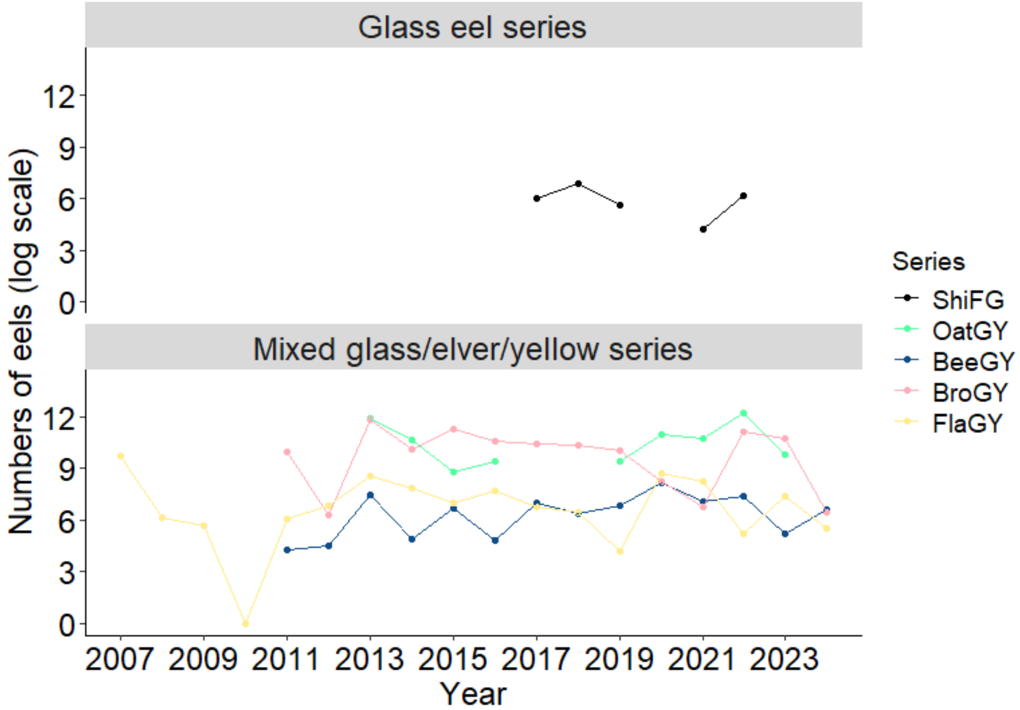

Figure 1.3. Other fishery-independent time series of UK eel recruitment on a log scale (currently not used in WGEEL recruitment analysis), where ShiFG - Shieldaig river glass eel, OatGY – Oath Lock elver and yellow eel, BeeGY – Beeleigh elver and yellow eel, BroGY – Brownshill elvers, FlaGY – Flatford elvers and yellow eel. Data for 2024 are provisional. Note all series show numbers of eels.

2 Overview of the national stock and its management

2.1 Describe the eel stock and its management

This chapter provides brief descriptions of the approaches used across the UK to manage eel and human impacts, including management units, authorities and regulations, to assess the status of eel, quantifying the human impacts because of fisheries (commercial and recreational) and other human impacts.

2.1.1 Eel Management Units (EMUs)

Eels are widespread throughout estuaries, rivers and lakes of the UK, with the exception of the upper reaches of some rivers, particularly in Scotland, due to difficulties of access. There are 15 EMUs across the UK, including one shared with the Republic of Ireland (Table 1.2; Figure 2.1). Most of the UK EMUs have been set at the River Basin District (RBD) level, as defined under the Water Framework Directive (WFD; EC, 2000). The RBDs in Northern Ireland deviate slightly from those defined for the WFD, owing to their transboundary nature. An Eel Management Plan (EMP) has been implemented for each EMU (see Cefas *et al.*, 2021).

2.1.2 Management authorities

Responsibility for the management of eel, including human impacts, and the delivery of EMPs rests with the EA (EA) in England and with Natural Resources Wales (NRW) in Wales – the EA leads on the cross-border Severn EMP whereas the NRW leads on the Dee EMP. In Scotland, Marine Directorate of Scotland (MDS) is responsible for the management of all anthropogenic impacts and for the conservation of stocks and the delivery of the Scotland EMP (the EA is responsible for delivery of the Solway-Tweed EMP). In Northern Ireland, overall responsibility for the supervision of commercial eel fisheries, the sustainable harvest of eel populations within these, and for the establishment and development of those fisheries rests with the Department of Agriculture Environment & Rural Affairs (DAERA). The Agri-Food and Biosciences Institute for N. Ireland (AFBI) is employed by DAERA to provide the scientific basis for eel management in Northern Ireland. Whilst all aspects of eel conservation and compliance measures assessment are shared between NI and RoI, the Inland Fisheries Ireland (IFI) is responsible for the delivery of information relating to the transboundary Northwest International EMP (IE_NorW).

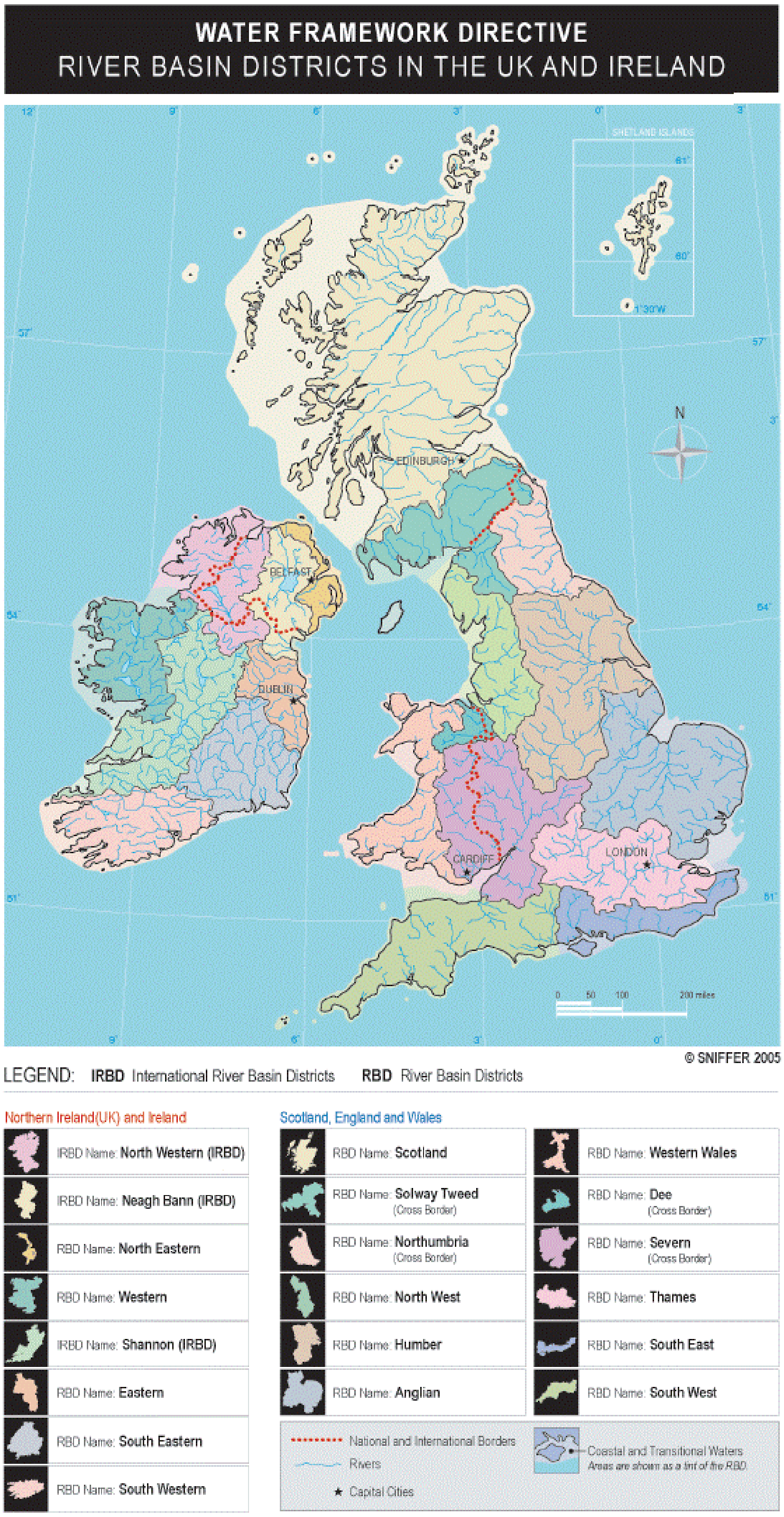

Figure 2.1. Map of the 15 Eel Management Units across the UK (after SNIFFER, 2005).

2.1.3 Fisheries and their regulations

2.1.3.1 England

All fishing for eel in England requires authorisation from the EA. Eels can only be taken by established commercial net fisheries, and there is no recreational take of eels. All rod and line-caught eel must be returned. Glass eel and adult (yellow and silver) eel fisheries are managed separately and have different regulatory controls accordingly. All fishers are required by law to submit catch returns detailing their catch by weight, date and location.

Glass eel fisheries

Since 2021, glass eel fisheries in England have been severely affected by loss of market access as a result of the consequences of the UK's exit from the EU – specifically the EU's ban on imports of eels. This means that glass eel fishing effort and catch have been significantly reduced in response to market demand. As such, the glass eel catch dataset since 2021 can no longer be used as a direct proxy for trends in recruitment.

As a result of the control measures required to issue CITES export permits, glass eel fishing since 2021 has only been authorised in two rivers, the River Severn and the River Parrett (which is in the South West RBD), as only these rivers were able to demonstrate non-detriment for eel population as per the UK Non-Detriment Finding (NDF; Fleming et al., 2023). In both 2023 and 2024, the season length was 66 nights, instead of the traditional 100 nights, as part of the control measures.

Yellow and Silver eel fisheries

As a response to the 2021 ICES advice on fishing opportunities for eel (ICES, 2021), the fisheries for adult eel in England have been placed into a managed decline. Eligibility criteria for fenviro an authorisation, and may only fish in their historic fishing sites. In 2023, only 33 fishers applied for authorisations.

Fishing is only allowed using permanently fixed silver eel traps (four commercial traps remain in England); fyke nets or small moveable or temporary nets or traps. Each fisher has a personal allocation of the maximum number of instruments and are limited to the number of sites they may fish, based on their historic activity. Most fishers are limited to a single site (e.g. river, or estuary), although some have a broader footprint across more than one river basin. Fishing is also limited by season. Although this is primarily for administrative purposes, it does mean there are no-fishing periods (11 December until 31 March inclusive for all waters).

Appendix 1 in the 2007 UK report to the WGEEL provides a summary description of netting and trapping methods used to catch eels in England and Wales (ICES, 2007).

Annual eel and elver net authorization sales and catches are summarized by the instrument type for England and reported in the "Salmonid and Freshwater Fisheries Statistics for England and Wales" series (https://www.gov.uk/government/collections/salmonid-and-freshwater-fisheries-statistics-reports-and-supplementary-data-tables).

2.1.3.2 Wales

Since 2021, fisheries for eel of all life stages in Wales have been closed, mainly based on the 2021 ICES advice, 2021 EMP review and a lack of local recruitment data.

2.1.3.3 Scotland

Eel fisheries have never been regulated in Scotland, but the last known fishery closed in 2005. Legislation was introduced in 2009 requiring that anyone wishing to fish for eel in Scotland by any method must obtain a licence from the Scottish ministers. Since 2013, three applications have been received but none have been approved.

2.1.3.4 Northern Ireland

Lough Neagh in Northern Ireland (GB_Neag) is the largest freshwater lake in the UK. Prior to 1983, estimates of annual recruitment of glass eel to the Lough regularly exceeded 4000 kg (12M fish) and averaged 3858 kg (11.6 M) (based on a mean weight of 3000 glass eel per kg) from 1923-1982. Productivity is such that the Lough sustains a large population of yellow eel and produces many silver eels that emigrate via the outflowing Lower River Bann.

The system sustains the largest (by catch weight) commercial wild eel fishery in Europe, producing approximately 12% of total EU landings and supplying ~3% of the entire EU market (wild-caught + aquaculture) in 2020. Fishing rights to all eel life stages are owned by the LNFCS. The fishery is managed to enable the capture of approximately 250–350 t of yellow eel and 75–100 t of silver eels annually, with an escapement of silver eels at least equivalent to the catch of silvers. However, as a consequence of the historic drop in recruitment these output figures have reduced and continue to fall. While it is illegal to fish for glass eels in N. Ireland, provision is made whereby LNFCS staff are allowed to catch glass eels using dragnets below a river-spanning sluice gate, which creates a barrier to upstream juvenile eel migration, for onward placement into Lough Neagh. Elvers are also trapped at the same location and placed into the Lough.

The yellow eel fishery (May–September, five days a week) supported a peak season average of 85–95 boats, each with a crew of two men using draftnets and baited longlines. In recent years this has decreased, especially following COVID-19 restrictions, with a daily average of 52 boats in 2021. The fleet return number in 2022 has remained depressed with around 6-70 vessels daily. This number fell again in 2023 to a max of 52 vessels, which was reduced further by the impact of a lough wide blue-green algal bloom resulting in weeks with only 1 or 2 boats fishing and a yellow eel season closure by the start of September (though many boats had ceased fishing by the end of June). A similar fishing pattern continued in 2024 both in terms of fleet size and algal bloom impacts on fishing, albeit no fish kills or impacts on actual fish were reported. Eels are collected and marketed centrally by the Cooperative. Silver eels are caught at two weirs in the Lower River Bann. Profit from the less labour-intensive (five to six men) silver eel fishery sustains the management of the whole cooperative venture, providing working capital for policing, marketing and stocking activity.

Natural recruitment has been supplemented since 1984 by the purchase of glass eel from outside the EMU. As of 2024, approximately 131.2 million (43.7 t) additional glass eel have been stocked by the LNFCS. No GB-origin glass eels were stocked in Lough Neagh in 2024 as a consequence of the EU CITES regulation EC 338/97 banning the import of glass eels into the EU (EC, 2023) and consequently NI (under the Windsor Framework), effectively ending the 40-year UK internal trade in glass eel from the Rivers Parrett and Severn. Reviews on the fishery, its history and operation can be found in Kennedy (1999), Rosell et al. (2005) and Aprahamian & Evans et al., (2021).

The transboundary Erne system (IE_NorW* and reported in the Ireland Country Report) is comparable in size to Lough Neagh and produced a fishery yield in the region of 33 t of eels per year. Within N. Ireland, the Upper and Lower Lough Erne sustained a small-scale yellow eel fishery until this was closed in 2010 under the terms of the EMP. There has been no commercial silver eel fishery on the Erne since 2001, but a trap and transport conservation silver eel fishery was instigated in 2009. Elvers are trapped at the mouth of the River Erne, using ladders placed at the base of the hydroelectric facility that spans the Erne, and trucked upstream into the Erne lake system. A comprehensive study into the structure, composition and biology of the eel fisheries on the Erne was conducted by Matthews & Evans *et al.* (2001).

2.1.4 Management actions

2.1.4.1 England and Wales

In January 2010, the Eels (England and Wales) Regulations, 2009 Statutory Instrument came into force. This legislation was specifically developed to facilitate the implementation of Council Regulation No 1100/2007 (EC, 2007) in England and Wales. The England and Wales legislation makes provisions for the regulation of the fishery and gives powers to require the installation of eel passes at obstructions and to screen intakes for eels. As part of the UK's withdrawal from the EU, the European Union (Withdrawal) Act transposed Regulation 1100/2007 into UK law (HMSO, 2019). The requirements of Regulation 1100/2007 therefore continue to apply in the UK.

2.1.4.2 Scotland

In Scotland (GB_Scot), the principal management measure is the prohibition of fishing for eel of any stage by any method without a licence from Scottish ministers (under The Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008). To date (September 2024) no licences have been issued for commercial or recreational fisheries.

2.1.4.3 Northern Ireland

In N. Ireland, DAERA produce an annual Fisheries Statistics Digest online, containing statistics on all aspects of eel catches including both commercial trade and conversation trap and transport catches (https://www.daera-ni.gov.uk/publications/digest-statistics-salmon-and-inland-fisheries-daera-jurisdiction-2021).

2.1.4.4 Summary of management actions across the UK

Since the implementation of EMPs in 2009/2010, new management actions have been delivered.

England and Wales

- Introduction of 100% catch and release for eel by angling throughout the UK;
- Close season for commercial net and trap fishing for eel, where such fishing is authorized;
- Limits on the geographical extent of the commercial eel fishery;
- Creation of 'no commercial eel fishing' areas;
- Restrictions on commercial and recreational eel fishing methods and gear;
- New legislation to require the installation of eel passes and eel screens at structures impacting safe eel passage (introduced 2010);
- Regulation of impacting industries including Water Companies, Internal Drainage Boards (IDBs), Power Generation and Hydropower sector representatives under the Eels (England and Wales) Regulations 2009;
- 53 new eel passes in 2020-2022 restoring access to over 900 ha of river habitat (totalling 938 passes restoring access to over 10 200 ha since 2009);
- 33 new eel exclusion screens at water intakes during 2020-2022 (totalling 85 eel screens since 2009, estimated to be protecting over 1600 kg of silver eel equivalents per year);
- 2 Fish Recovery & Return/bywash systems at water intakes;
- 46 "fish-friendly", or Less Damaging Pumps (LDPs) installed at pumping stations in England during 2020-2022 (totalling 155 LDPs since 2011, estimated to be improving access to over 652 ha of upstream habitat);

- Four combustion power stations decommissioned during 2020-2022 (estimated to be saving 2790 kg of silver eel equivalents per year) and one converted to no longer draw cooling water;
- A reduction in the 2018 fishing season in in Union waters of ICES area including the Baltic Sea by 40 days (compared to pre-EMP) as a result of EC Regulation 2018/120 (EC, 2018);
- A reduction in the 2019 fishing season in all fisheries by 10 days (fishing season increased by 30 days compared to 2018) as a result of EC Regulation 2019/124 (EC, 2019);
- Closure of all eel fisheries in Wales since 2021;
- Commencement of a managed decline of the yellow and silver eel fisheries in England, through restrictions in fishing authorisations and tightened eligibility criteria (since 2022);
- Raised awareness and widespread engagement with key stakeholder groups regarding management measures needed to support eels.

Scotland

- The principal management measure was to prohibit fishing for eel, by any method, without a licence, via legislation introduced in 2009 (with the exception for some small-scale scientific sampling).

Northern Ireland

National measures:

- Removal of fyke net as a legal fishing engine in 2010;
- Raising of Minimum Landing Size (MLS) for yellow eel from 300 to 400 mm in 2010;
- Ban on the taking of eel by recreational fishing in 2010;
- Establishment of yellow and silver eel commercial traceability system in 2009.

Neagh Bann RBD:

- Closure of one silver eel fishing weir in the River Bann since 2012;
- LNFCS direct funding of PhD project investigating male eels, their silver phase and run timings, differential capture rates and parasite burdens to provide biological information used in the stock assessment method (2014-2021);
- Initiatives to reduce capture of undersized eels (<400 mm total length) in long line harvest, by (i) increase in commercial long line hook size (from size 4 to 3) since 2016, and (ii) MRes research project into the development of an alternative eel fishing bait derived from marine discards in 2017;
- LNFCS commissioned an investigation into the prevalence of eel viruses in the Neagh Bann RBD in 2016;
- Refurbishment of six eel passes within the Neagh Bann RBD since 2016;
- Improvement and modernisation of LNFCS fisheries enforcement vessels since 2017.

North Eastern RBD:

- Creation of glass eel monitoring site since 2012: now established as a new annual index site and reported to ICES since 2017;
- Glass eel stocking of this RBD in 2014 (funded by LNFCS);
- Assessment of recruitment, yellow eel population and migrating silver eel within one region (Killough) of the RBD in 2017.

2.2 Significant changes since last report

Northern Ireland

The Neagh Bann EMP (GB_NEAG) has not met its 40% target in 2020-2023 reporting period (28.7 % of B0, versus 54.1 % in 2017-2020). As a result, DAERA has actioned outputs from the EMP reviews and demands are now with fisheries to bring in restrictions.

In addition, following comments made by the LNFCS in relation to the sampling of eels on Lough Neagh, requesting temporary suspension of the eel sampling until catches increased to a level large enough to withstand AFBI sampling (which is 500 eels) (ICES, 2023), a sample procurement was instigated in 2024 at the request of the LNFCS. This request came within a week of the beginning of the yellow eel fishing season which opens at the start of May. The creation and installation of the procurement system meant a delay to the start of sampling which began on 16 June, ending 31 August. Sampled eels are now bought from the LNFCS fishery rather than fishers (as is common practice elsewhere) and paid for by DAERA.

Scotland

There was no change in the assessment method for the latest EMP report, but following the closure of a key monitoring site, an assessment was not available for 2023.

England and Wales

All the EMUs in England and Wales continue to fail the 40% escapement target. However, COVID-19 impacts mean that there were very limited yellow eel monitoring data for 2020 throughout England and Wales, which resulted in reduced confidence in the biomass estimates and the compliance assessments for the 2020-2022 period. The number of eel index rivers used to estimate B_{best} and $B_{current}$ was reduced from 41 (in 2021) to 24 (in 2024). For Humber RBD (GB_Humb) only 40% of reaches provided suitable data for SMEP II modelling. The resultant output was a very low modelled silver eel escapement estimate of 0.1 $kg \cdot ha^{-1}$ due to the lack of input data and it was hence not possible to produce a mortality estimate ($\sum A$). In addition, in 2022 a proportion of the English commercial catch data was unavailable, which means that the impact of the fisheries during this year may be an underestimate, adding further uncertainty to the biomass and mortality outputs for the 2020-2022 reporting period.

3 Human factors impacting on the national stock

There are a broad range of human-induced factors that impact on eels. The WGEEL has grouped these factors into six categories (fisheries, restocking, aquaculture, entrainment, habitat, others), to simplify reporting. This chapter provides updates on the impact levels of these factors, and the methods used to quantify these impacts.

3.1 Fisheries

The WGEEL uses these data to report trends in catches and landings in the ICES Single Stock Advice. The Agreement between ICES and the UK explicitly requests annual updates on catches by fisheries.

Catches are defined as the quantity of eel that are caught by fishing gears (defined by the FAO as the 'gross catch') i.e., the quantity of eel that is removed from the water, but which can include those that are subsequently returned alive to this or other waters.

Landings are defined as the quantity of eel that are retained after capture (defined by the FAO as the Retained Catch), or to put it another way, removed from the water basin or management unit. So, landings should not include any eels subject to assisted migration within the same river basin, or scientific studies where they are returned alive to the waters where they were caught. Therefore, landings are effectively the quantity of eel that is killed or transported to a different river basin (restocked).

Fishing effort and catch per unit effort (CPUE) are presented and discussed where available.

3.1.1 Glass eel fisheries

3.1.1.1 Commercial

Commercial glass eel fisheries currently exist in only two rivers and consequently two EMUs: the River Severn in GB_Seve and River Parrett in GB_SouW (Table 3.1). A fishery in GB_SouE has not been authorised since 2010 and any commercial fishing for glass eel in other UK EMUs is forbidden.

Glass eel fishers are required to report their annual catch by weight, effort in terms of days and gears fished, location and water type (coastal, river, still water).

In 2009, legislation was introduced to improve the traceability of eel caught, such that there are now three sources of data, as presented here in Table 3.1:

1) Catch returns to the EA provided by individual fishers;
2) The quantity of glass eel bought by traders from the fishery (consignment notes, reported to the EA by any aquaculture production business operator under the requirements of Regulation 4 of The Eels (England & Wales) Regulations, 2009 Statutory Instrument;
3) The quantity of glass eel exported from the UK or stocked within the UK, as reported by, in England and Wales, any person who imports or exports live eels under Regulations 5 and 6 of the Eels (England and Wales) Regulations to the EA and NRW, or in Northern Ireland, the consignment note issued by glass eel traders to Lough Neagh Fishermen's Cooperative Society and checked at site upon delivery by DAERA Fishery Protection Officers before onwards transportation for restocking.

The impact of trade restrictions continues to severely affect the amount of effort and catch of glass eels in England. For 2023, only a small market was available and so fishing effort was restricted to a very limited number of nights fished across the 66 night fishing season. Traders declared purchasing 0.93 t (Table 3.1) and this resulted in shipments to Northern Ireland (297 kg) and Kaliningrad (Russia, 500 kg). No other exports took place. The trader reported an increased amount of shrinkage / mortality due to increased handling times pending the approval of export documentation.

Cultural interest in glass eel fishing remains important in the local communities around the River Severn and River Parrett. In both 2023 and 2024 when commercial orders had been fulfilled, fishers provided further catches free of charge, or at reduced rates to contribute to local restocking initiatives or educational programmes (e.g. Eels in the Classroom).

The CPUE figures for 2023 (1.47 kg/day) and 2024 (1.67 kg/day) are significantly improved on the long-term average for the period 2010-2021 of 0.64 kg/day. There are several possible inferences from this: it may be due to more targeted fishing activity around the peak spring tides when traders were buying fish to fulfil orders. It could also be an indication of a stronger abundance of glass eels in the rivers, although this might be explained by the lower level of exploitation.

Table 3.1. Time series of 'UK' glass eel commercial fishery catches reported to EA, and as estimated from dealers' purchase at first sale and from the consignment notes, with catch per unit effort based on fisherman returns from 2010 onwards (older data can be found in previous country reports). 2024 reported catches are provisional.

Year	Catch reported to the EA (t)	Dealers purchase (t)	Consignment notes (t)	CPUE (kg/day) EA catch returns
2010	1.32	1.89	1.72	0.37
2011	2.24	3.64	3.28	0.31
2012	2.77	3.82	3.61	0.29
2013	5.91	8.66	7.79	0.65
2014	11.77	11.60	12.30	1.98
2015	2.70	2.80	2.18	0.43
2016	4.04	4.28	3.82	0.53
2017	3.29	3.53	3.36	0.45
2018	4.26	4.66	4.37	0.65
2019	6.03	6.95	6.09	0.81
2020	3.43	3.76	3.56	1.05
2021	0.08	0.58	0.06	0.15
2022	1.12	1.59	1.27	NR
2023	0.88	0.93	0.80	1.47
2024	1.35	1.12	1.00	1.64

Note: 2021 Dealers Purchase figures also include 0.5t used for assisted migration, but not included in catch returns reported to the EA. The CPUE figure, based only on catch returns, is therefore lower than if all catches were included. 2021 Consignment Notes only include transfers within the UK (i.e., from England to Northern Ireland).

Since 2005, catches, and fishing effort, have been reported per "nearest waterbody", allowing the catch data to be assigned to EMUs (Table 3.2).

Table 3.2. Commercial catches (kg) of glass eel from England and Wales RBDs from 2005 to 2024 (catch returns to the EA). 2024 catches are provisional. No glass eel fisheries operate in missing EMUs, NP = not pertinent (glass eel fishing has not been authorised).

Year	GB_NorW	GB_Dee	GB_Wal	GB_Seve	GB_SouW	GB_SouE
2005	166	39	437	474	627	0.0
2006	116	6	177	497	483	2
2007	200	6	627	559	665	0
2008	92	2	122	270	349	0
2009	20	1	14	64	195	0
2010	30	5	95	438	761	NP
2011	89	13	3	898	1250	NP
2012	53	17	0	1152	1569	NP
2013	96	15	23	2693	3095	NP
2014	138	0	34	6233	5626	NP
2015	125	17	0	1308	1378	NP
2016	78	5	37	1968	1954	NP
2017	79	10	10	1595	1610	NP
2018	105	55	25	2318	1731	NP
2019	134	43	24	3926	2476	NP
2020	45	0	31	1671	1688	NP
2021	0.7	NP	NP	151	0	NP
2022	NP	NP	NP	713	402	NP
2023	NP	NP	NP	577	336	NP
2024	NP	NP	NP	924	431	NP

NOTE: Fishery catches were impacted by Covid-19 in 2020 and 2021, and by EU-exit/CITES trade restrictions since 2021, as described above.

3.1.1.2 Proportion retained for stocking

Here we report on the proportion of the catch used for restocking (Table 3.3) – the remainder of the catch is sold to aquaculture or direct consumption (direct meaning as glass eel and not on-grown in aquaculture).

Table 3.1. Percentage of glass eel caught in the UK that is then sold for restocking, according to first sale registrations. Note the subsequent fate of glass eel after first sale is sometimes difficult to trace and therefore there is some uncertainty around these values.

Year	Stocking
2009	100.0
2010	55.4
2011	34.8
2012	88.8
2013	50.4
2014	62.6
2015	72.7
2016	54.0
2017	56.3
2018	80.5
2019	72.2
2020	82.9
2021	100.0
2022	100.0
2023	98.0
2024	99.0

3.1.1.3 Recreational fisheries for glass eel

There are no recreational landings of glass eel across the UK.

3.1.2 Yellow eel fisheries

3.1.2.1 Commercial

Commercial fisheries for yellow eel deploy fyke nets in six EMUs of England. Historic fisheries in GB_Nort and GB_Seve have not been authorised since 2010 and 2011, respectively (Table 3.4). Commercial fisheries for yellow eel have been closed in Wales since 2021. A draftnet and longline fishery exists in GB_Neag in NI. There are no commercial fisheries for yellow eel in the other EMUs: GB_Scot, GB_NorE, IE_NorW or GB_Solw. Note that 2024 data are not available yet because the fishing season is open at the time of writing.

Prior to 2005, catches were reported as annual values for the whole of England and Wales, and for yellow and silver eel combined. Since 2005, catches have been reported separately by stage and EMU (Table 3.4).

Lough Neagh fishery in NI accounts for the bulk of the national catch year on year (Table 3.4), thus fishery and catch trends are discussed here in greater detail.

Commercial catches for yellow eel in the GB_Neag EMU since 2005 are presented in Table 3.4, but it must be noted that a daily quota operates per boat in this fishery. Eel fishing on Lough Neagh is controlled by the LNFCS who license the fishery. Around 1990, there were 200 boats (400 fishermen) fishing the Lough, but this number has steadily declined to the peak of season average of 56 boats as a result of an ageing fisher population, availability of alternative employment and falling market prices for eel. Boat size is restricted to 8.6 m long and 2.7 m wide. Information on licence applications, number of boats, fishing activity, recruitment to the fishery and the catch of yellow eel is collected and maintained by the LNFCS with several aspects of these data spanning

106 years. This information is made available to DAERA and AFBI for scientific analysis and the provision of management advice.

Over the last 20 years, approximately 40 % of the Lough Neagh yellow eel catch was derived from draftnets, the other 60 % from longline fishing using a maximum per boat of 1200 hooks baited with earthworms, ragworms, fish fry or the larvae of the flour beetle (meal worm). There was a noted change in this split in 2021, with more boats returning to longlining and these lines are now set in the early evening, rather than the morning – a return to historic practices. This change continued in 2022 as a consequence of improvement in lough water clarity, potentially driven by the rapid increase in abundance and distribution of the recently introduced zebra mussel (*Dreissena polymorpha)*. However, further disruptions were observed in 2023 and 2024 due to blue-green algal blooms.

The fishery is run on a quota-based system driven by management decisions in consideration of conservation target compliance and commercial needs (usually 50 kg per boat per day). Economic margins have decreased due to increasing operational and distribution costs in conjunction with currency fluctuations. A record is kept of each individual boat's daily (Monday–Friday) catch and noted against that day's quota. New technologies such as hydraulic draftnet haulers have been introduced over the last 20 years, thereby reducing the labour needed in the fishery or enabling fishermen to fish for longer if required.

Due to COVID-19 restrictions, 2020 yellow eel catches in Lough Neagh should be viewed with care given the reduction in both fleet (32 boats) and season (3 months instead of 5 months), with total catch of 97 t reported. This is the lowest yellow eel catch in the 100 years of catch records from Lough Neagh. Catches per boat per day in the longline and draftnet fisheries in the most recent years continue to meet daily quotas imposed by the Cooperative, implying that sufficient stocks are maintained for the steadily falling (1-2 boats decline per year) number of boats fishing in the Lough, but fishermen have commented that it takes longer to catch their quota. Data for 2021 suggested that the reduced fleet and market demand resulted in a very good fishing year with all boats consistently making quota. Fishery catches in 2022 were described as odd, often difficult, due to weather changes (frequent periods of continual wind) and likely influenced by reduced numbers of commercial sized eels in the lough given recruitment and stocking history for that period.

The quota-based catch management system combined with varying boat numbers (on an almost daily basis) mean it is impractical and uninformative to compare annual CPUEs for the yellow eel fishery. However, a comparison of catch against average boat numbers (95 boats) produces a mean catch of 3463 kg boat^{-1} in 2009–2013 and 2547 kg boat^{-1} in 2015–2019, (decrease of 26.5%). Similar comparisons of these metrics over recent years are not feasible given shortened seasons due to lockdowns, discouragement to fish due to furlough payments and the changing fleet patterns upon the resumption of commercial fishing, disrupted further with blue-green algal impacts in 2023 and again in 2024.

Analysis of the Lough Neagh data reveals no relationship between CPUE and time-lagged input stock density. This is most likely because (i) two different gears are operated (nets and baited longlines) with very different catch vs. effort parameters and with catch reported as a combined daily catch for both gear types, and (ii) there is a variable daily cap on the amount of eel that fishermen are allowed to catch.

Table 3.2. Commercial catch (t) of yellow eel for all UK EMUs (codes as per Table 3.1) with a fishery during the reporting period, together with total UK catch, 2008–2023. Data from previous years (before 2008) can be seen in the previous reports. NP = not pertinent (no fishery authorised in that year), NR = not reported. Data from 2022 reported for England and Wales are incomplete as some (*) or all (+) catch returns were lost.

Year	GB_Nort	GB_Humb	GB_Angl	GB_Tham	GB_SouE	GB_SouW	GB_Seve	GB_Wale	GB_Dee	GB_NorW	GB_Neag	Total
2008	0.00	1.43	9.90	5.55	0.60	6.63	0.03	0.12	0.64	0.47	290.00	315.37
2009	0.05	0.41	6.62	4.75	7.03	2.55	0.00	0.02	0.07	0.11	345.20	366.80
2010	0.06	3.03	10.71	5.66	1.43	2.72	0.15	0.35	0.05	0.15	337.40	361.71
2011	NP	4.86	16.48	6.08	1.88	3.79	0.35	0.25	1.08	1.48	342.00	378.25
2012	NP	3.27	15.34	1.82	2.12	5.97	0.00	0.65	0.48	2.97	302.00	334.60
2013	NP	3.87	9.32	3.99	0.29	8.69	0.00	0.10	0.15	0.67	321.00	348.07
2014	NP	3.52	16.88	3.22	0.28	10.12	NP	0.00	0.42	0.09	297.00	331.52
2015	NP	1.38	8.38	2.70	0.96	16.83	NP	0.00	0.07	0.09	255.50	285.91
2016	NP	0.16	12.27	2.47	0.83	10.26	NP	1.35	0.07	0.19	262.00	289.59
2017	NP	1.54	6.13	2.26	0.36	11.17	NP	0.00	0.33	0.33	237.00	259.13
2018	NP	4.84	11.80	1.97	0.22	13.35	NP	0.00	0.12	0.15	235.00	267.44
2019	NP	1.02	7.43	1.68	0.20	13.01	NP	0.00	0.61	0.25	221.00	245.21
2020	NP	0.20	2.27	0.03	0.23	12.41	NP	0.00	0.22	0.72	97.00	113.06
2021	NP	0.52	8.58	0.012	0.19	10.61	NP	NP	0.25	0.42	154.00	174.59
2022	NP	NR+	8.70*	0.037*	0.00*	12.54*	NP	NP	NR+	0.032*	96.00	117.31
2023	NP	1.20	6.31	0.163	0.44	10.74	NP	NP	0.25	0.29	36.00	55.10

3.1.2.2 Recreational fishing for yellow eels

No ‘take’ of yellow eel from recreational fisheries is permitted throughout the UK. Where eels are caught in rod-and-line fisheries they must be returned alive to the water where they were caught. No information is collected on these catch rates nor on post-release survival rates. However, Lough Neagh fishery samples 100 undersized yellow eels every month, with the attempt to quantify possible losses to the fishery through hooking-related mortalities (Evans & Rosell, 2008).

3.1.3 Silver eel fisheries

3.1.3.1 Commercial

Commercial fisheries in six EMUs of England operate using both fixed weir-traps and mobile fyke net gears (Table 3.5). Historic fisheries in GB_Nort and GB_Seve have not been authorised since 2010 and 2011, respectively (Table 3.5). Commercial fisheries for silver eel have been closed in Wales since 2021. There is a coghill net silver eel fishery in GB_Neag. Note that 2024 data are not available yet because the fishing season is open at the time of writing.

Prior to 2005, catches were reported as annual values for the whole of England and Wales, and for yellow and silver eel, combined. Since 2005, catches have been reported separately by stage and EMU (Table 3.5).

Lough Neagh fishery in NI accounts for the bulk of the national catch year on year (Table 3.5), thus fishery and catch trends are discussed here in greater detail.

Silver eel from Lough Neagh used to be caught in the River Bann using coghill nets fished on three weirs at two locations, but from 2012 the LNFCS reduced this to two weirs as an additional conservation measure. The number of coghill nets fished at each weir depends on weather and river flow conditions, and normally ranges from 2–4 nets per fishing night. The record of nightly catch is estimated at the end of the night, but the true daily catch is only obtained if the catch is processed and sold the following day. Otherwise, catches are retained in tanks and sold as and when market conditions are more favourable. Therefore, a ‘single’ catch sale record may be a total for several night’s fishing. This practice does not affect the annual catch reporting but would make it difficult to report on nightly CPUE. Fishing capacity is recorded as the number of licensed silver eel weirs in operation but note that the two weirs operate at different efficiencies dependent upon river flow rates, and the number of nets per weir varies over the season.

The annual catch of silver eel from Lough Neagh has shown a general decline throughout the period 2005 to 2022 – this decline was to be expected given trends in historic juvenile inputs (Aprahamian and Evans et al., 2021) (Table 3.5). The 2018 catch of 94 t was above expectations and believed to have been affected by an extended period of warm summer water temperatures which may have encouraged yellow eels to feed more and silver a year “earlier” than expected. The 2021 catch was 64 t, and the 2022 and 2023 catches were both about 44 t.

Table 3.3. Commercial catch (t) of silver eel for all UK EMUs (codes as per Table 3.1) with a fishery during the reporting period, together with total UK catch, 2008–2023. Data from previous years (before 2008) can be seen in the previous reports. NP = not pertinent (no fishery authorised in that year). Data from 2022 reported for England and Wales are incomplete as some (*) or all (+) catch returns were lost.

Year	GB_Nort	GB_Humb	GB_Angl	GB_Tham	GB_SouE	GB_SouW	GB_Seve	GB_Wale	GB_Dee	GB_NorW	GB_Neag	Total
2008	0.09	0.87	1.97	0.40	1.65	0.55	0.12	0.01	0.02	0.26	78.3	84.23
2009	0.01	0.11	0.59	0.12	3.20	0.30	1.22	0.04	0.01	0.08	87.9	93.58
2010	0.00	0.20	0.74	0.07	0.82	0.17	0.10	0.01	0.02	0.07	96.8	99.00
2011	NP	0.26	2.01	0.51	0.69	0.07	0.38	0.01	0.12	0.27	73.3	77.62
2012	NP	1.63	2.98	0.20	0.65	0.53	0.00	0.00	0.00	0.46	72.8	79.25
2013	NP	0.26	2.49	0.31	1.99	0.95	0.00	0.00	0.03	0.11	72.8	78.94
2014	NP	0.48	5.02	0.38	0.75	1.17	NP	0.00	0.03	0.03	66.8	74.66
2015	NP	0.74	3.76	0.20	0.11	0.91	NP	0.00	0.03	0.06	49.3	55.11
2016	NP	0.05	3.66	0.15	0.25	0.95	NP	0.15	0.02	0.03	52.5	57.76
2017	NP	0.02	2.11	0.01	0.03	1.12	NP	0.00	0.02	0.25	59.7	61.46
2018	NP	1.12	2.26	0.13	0.08	1.34	NP	0.00	0.02	0.22	94.1	99.27
2019	NP	0.04	2.81	0.004	0.06	1.46	NP	0.00	0.17	0.28	46.0	50.82
2020	NP	0.28	1.62	0.007	0.04	1.93	NP	0.00	0.002	0.304	65.0	69.18
2021	NP	0.27	2.75	0.0	0.023	2.04	NP	NP	0.085	0.22	64.0	69.39
2022	NP	NR+	3.38*	0.009*	0.028*	1.92*	NP	NP	NR+	0.030*	44.0	49.37
2023	NP	0.35	2.33	0.013	0.09	1.75	NP	NP	0.14	0.30	44.0	48.67

3.1.3.2 Recreational fishing for silver eels

No 'take' of silver eel is permitted from recreational fisheries throughout the UK. It is thought unlikely that silver eel would be accidentally caught in rod-and-line fisheries but if this were to occur then they must be returned alive to the water where they were caught. No information is collected on these catch rates nor on post-release survival rates.

3.1.4 Illegal, underreported or unrecorded catch

The limited information on underreporting rates for commercial glass eel fisheries in EMUs of England and Wales is provided in section 3.1.1.1 above. Enforcement operations by the EA, Natural Resources Wales and local Police forces uncover some illegal operations from time to time. No data are available for illegal, underreported or unrecorded catches of silver or yellow eels throughout England and Wales EMUs.

One illegal eel trafficking operation based in UK was successfully disrupted, resulting in prosecution and conviction in 2020. In this case, the eels being illegally traded were not derived from UK fisheries but had first been imported from France and/or Spain.

There is no data on the existence or extent of illegal fishing in Scotland.

Commercial fishing in Lough Neagh is tightly controlled by the LNFCS and underreporting is thought to be very minor if at all. In other EMUs in Northern Ireland, there have been no reports of illegal fishing for, or trade in, eel.

Additional measures were implemented in 2022 to prevent the supply of elvers to potential illegal markets – following concerns that lack of access to traditional markets could increase the risk of fishers supplying the illegal market. These measures include the conditioning of fishing authorisations so that no catch could be transported to any location other than the registered eel traders.

3.1.5 Bycatch of non-target species

Eel caught in gears targeting other fish species

No data are available on the bycatch of eel in gears targeting other fish species, but it is thought to be very small.

Other fish species caught in gears targeting eels

Few data are collected on the bycatch of other species in gears targeting eel but a series of surveys by AFBI from the Lough Neagh fishery confirmed previous assertions that any level of bycatch and its impact are small.

In 2018, Toome weir (four nets) in five nights caught 87 377 fish of which 9.1% was bycatch. Kilrea weir (three nets) caught 31 373 fish in five nights in 2018 of which 0.02% was bycatch.

In 2019, Toome weir (four nets) caught 15 710 fish in five nights of which 35% was bycatch. In the same year, Kilrea weir (three nets) caught 16 345 fish in five nights, of which 7.3% was bycatch. There are no data available for 2019 and 2020 due to COVID-19 restrictions.

The resumption of these analyses in 2021 found that over a three-night silver eel fishing period at Toome weir in November, 1.24% of caught fish was bycatch consisting mostly of gudgeon, roach and perch.

In 2022, over a four-nights fishing on the Toome weir in November, bycatch comprised 6.12% of all fish caught, consisting mostly of gudgeon, roach and lamprey.

3.2 Restocking

The WGEEL retains a time series of amounts of eel used for restocking from country to country. This information is periodically used to examine the fate of eel and trade routes.

Owing to there being inconsistencies in reporting on restocking actions by countries, the WGEEL broadly categorises them as ″releases", though the term "restocking" is still used for some circumstances. Here, we continue to use the term restocking for practices of moving fish of wild origin from one waterbody to another, separating it from short distance movements of fish inside the same system, categorised as assisted migration.

Restocking in the UK

Some trial restocking of glass eel has taken place across seven EMUs in England and Wales since 2009, plus annual restocking of glass eel into Northern Ireland until 2023 (Table 3.6), although only Lough Neagh in the Neagh-Bann EMU has received what might be considered significant quantities (100s as opposed to 1s and 10s of kg). Data on the amounts restocked are available from the Neagh-Bann EMU since 1984, and from other EMUs since 2009. In most years, the glass eel originated from the commercial fisheries in the Severn and Southwest EMUs.

Glass eel are not routinely quarantined before restocking into Lough Neagh, but arrive from UK Glass Eels Ltd with a Veterinary Health certificate and approved biosecurity protocols. However, following the recent purchases from outside the UK, 1 kg of each new delivery is held in tanks at the LNFCS HQ and survival rates monitored for several weeks by AFBI. In 2019 and 2020, 307 kg and 609 kg respectively of glass eels stocked into Neagh were of French (Gironde) origin. In 2021, 2022 & 2023, these numbers were 971 kg, 319 kg and 501 kg, respectively.

In 2021, Lough Neagh had access to glass eels for stocking both from the EU as part of the Northern Ireland Protocol (NIP), and following further legal advice received from the Department for the Environment, Food and Rural Affairs (Defra), GB-sourced glass eels could be used as well subject to CITES controls. Whilst the UK was considering legal advice, no glass eel shipments from GB to NI were authorised. A total of 971 kg of glass eel were flown direct from France to Lough Neagh in March/April of 2021 and in June a delivery of 62 kg of glass eel were road freighted across GB to NI and into Lough Neagh.

LNFCS continued to access early season glass eel from France under the arrangements described above, with 319 kg bought (Gironde region) in February 2022. UK glass eels were stocked from the Severn into Lough Neagh throughout the spring of 2022 with a total of 1123 kg stocked. The transit mode for 2022 had to be amended following the refusal of an application to the EU for permission to fly the glass eel into NI. As a consequence of the NIP, all live animals entering NI must transit through Belfast International Port. This was not practicable for the glass eel movements. Therefore, a new road transit method was developed, following a pilot and QA study developed and advised on by AFBI, whereby glass eel were driven from GB into NI in refrigerated lorries. In 2023, 501 kg of French glass eel were flown direct into NI from France, with a further 297 kg being driven across from GB under the provisions described above.

A total of 400 kg of French glass eels were stocked into Lough Neagh in April 2024. No UK-origin glass eels were stocked in Lough Neagh in 2024 as a consequence of the EU CITES regulation EC 338/97 banning the import of glass eels into the EU (EC, 2023), and consequently NI.

In England in 2023, around 3 kg of juvenile eel were released into the GB_SouW, partly through the assisted migration programme by the Sustainable Eel Group (~418 glass eels) and partly through the EA's research programme testing the efficacy of stocking reservoirs and the future potential for trap and transporting the silvers out (~8000 glass eels).

In 2024, approximately 950 kg of grown-on eels (approx. 60,000 eels) were stocked into the Warwickshire Avon, a tributary of the Severn, as part of a joint initiative between fishers and the glass eel trader. The eels had been caught as glass eels and donated by fishers in April 2023. A further 16 kg of glass eels were stocked into the Thames RBD as part of a stocking study, and a small amount into waters around the South West RBD through the Sustainable Eel Group's "Eels in the Classroom" project.

Table 3.4. Weights (kg) of restocked glass and on-grown eels into various UK EMUs since 2009. Data from previous years can be seen in the previous report. Note that the source of restocked materials was usually UK fisheries, except that the restocking of GB_Neag in 2010 was solely from France and Spain, in 2011 and 2012 was from France and UK, and in 2024 from France only. 2024 data are final.

	EMU									
Year	GB_Humb	GB_Angl	GB_Tham	GB_SouE	GB_SouW	GB_Seve	GB_Wale	GB_NorW	GB_Neag	GB_NorE
2009	18.5	4.6	0.0	0.0	0.0	0.0	0.0		215.0	
2010	38.0	15.2	0.0	0.0	0.0	0.4	0.0		996.0	
2011	0.0	11.3	0.0	0.0	0.0	38.8	0.0		1035.0	
2012	10.0	1.5	3.2	0.0	5.0	21.5	0.0		1300.0	
2013	3.0	9.1	2.00	7.0	12.8	37.0	1.0		1866.0	
2014	3.8	0.0	14.0	7.5	8.7	21.5	0.0	0.0	2690.0	20.0
2015	0.0	0.0	0.0	0.0	0.3	17.0	0.0	0.0	604.0	0.0
2016	0.0	0.0	0.0	0.0	0.6	17.0	0.0	0.0	0.0	0.0
2017	0.0	0.0	0.0	0.0	0.0	17.0	0.0	0.0	817.0	0.0
2018	0.0	0.0	0.0	0.0	0.0	17.0	0.0	0. 0	754.0	0.0
2019	0.0	0.07	0.0	0.0	0.0	0.4	0.0	0.03	1252.0	0.0
2020	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1714.0	0.0
2021[+]	0.0	0.0	0.0	0.0	125.3	378.6	0.0	0.0	1033.0	0.0
2022*	0.0	0.0	0.0	0.0	40.3	370.8	0.0	0.0	1442.0	0.0
2023	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	798.0	0.0
2024**	0.0	0.0	16.0	0.0	10.0	950.0	0.0	0.0	400.0	0.0

[+]Please note that all the figures reported for GB_Seve and GB_SouW in 2021 are eels released under the assisted migration programme. However, these are unverified declarations reported by the Sustainable Eel Group.

**Please note the figure reported for GB_Seve in 2022 includes 85 kg of eels stocked after being grown on from 3 kg of glass eel taken the year before and 65.84 kg reported under the assisted migration programme. All eels reported as released in GB_SouW in 2022 are from the assisted migration programme. However, these are unverified declarations reported by the Sustainable Eel Group and should be treated with caution.*

*** Eels stocked into GB_Seve in 2024 were juveniles grown on from 60,000 (20kg) glass eel caught in April 2023.*

Assisted migration

Northern Ireland

A form of assisted migration is conducted in the Neagh-Bann EMU, where glass eels are trapped in the lower reaches of the River Bann and then transported to Lough Neagh bypassing in-river obstacles. This catch is treated as natural recruitment in any stock analyses (Table 3.7).

Table 3.5. Quantities (kg) of glass eel trapped in the lower River Bann and assisted into Lough Neagh (GB_Neag EMU).

Year	Assisted migration (kg)
2006	456
2007	399
2008	24
2009	158
2010	68
2011	16
2012	203.3
2013	384
2014	698
2015	317
2016	432
2017	429
2018	890
2019	295
2020	637
2021	117
2022	575
2023	297
2024	365

England, Wales and Scotland

No significant assisted migration initiatives took place in 2023-24 in England, Wales or Scotland.

Restocking of glass eel from UK fisheries into other countries

Glass eel from UK fisheries are also restocked into other European countries (see Table 3.8). These data are provided by glass eel exporters, as required by Regulation 6 of the Eels (England & Wales) Regulations 2009. The purpose of each consignment is declared as either restocking, aquaculture or consumption.

Table 3.6. The export destinations and kg of glass eel caught in the UK since 2014. Data from previous years (before 2014) can be seen in previous reports. Note this does not include the restocking to Lough Neagh, Northern Ireland because this is a trade within the UK.

Country	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Belgium					2						
Bulgaria			70								
Czech Rep	594	32	80	63	70	65	70				
Denmark	400	250									
Estonia	420	250	152	150	162	608					
France	863	100	185		320	98					
Germany	1199	323	1074	1134	1081	904	359				
Greece	650	40	600	96							
Latvia	483		10	290	227	230					
Lithuania	330		120	158	505	805	404				
Netherlands	2232	350	51	109	309	1020	610				
Poland	15	5	127		35	120					
Russia									150	500	1000
Slovakia				14		60					
Spain	500		460								
Sweden	1400	672	892		1250	1250	1018				

3.3 Aquaculture

There is currently no commercial eel aquaculture in the UK. Some glass eels have been exported to other countries for aquaculture and these are reported in Table 3.9.

Pre-2009, there were historic issues of underreporting the catch which mean that it is not appropriate to derive a proportion stocked directly from historical catch data. The submission of catch returns, trade and restocking records is delivered via the Eels (England and Wales) Regulations 2009, thus data are available from 2009 onwards (Table 3.9). Through the EC 1100/2007 there was a legislative requirement to place a proportion of glass eel caught on the market for use in restocking. This was 35% in 2010, 40% in 2011, 50% in 2012 and 60% or more from 2013 onwards (apart from 2016 and 2017).

Table 3.7. Percentage of glass eel caught in the UK and sold for restocking, aquaculture or direct consumption, according to dealer's reports. [Note these percentages may not add up to 100% because of mortality and weight loss after capture].

Year	Restocking	Aquaculture	Direct consumption
2009	100.0	0.0	0.0
2010*	55.4	3.5	0.0
2011+	34.8	63.9	0.0
2012	88.8	11.2	0.0
2013	50.4	49.5	0.0
2014	62.6	30.9	6.8
2015	72.7	27.2	3.60
2016	54.0	45.7	0.3
2017	56.3	43.7	0.0
2018	80.5	19.5	0.0
2019	72.2	27.7	0.0
2020	82.9	17.1	0.0
2021	100.0	0.0	0.0
2022	100.0	0.0	0.0
2023	98.0	0.6	1.4
2024	99.0	0.0	1.0

*40.9% of exports purpose was not declared. Could have been restocking or aquaculture.
+1.22% of exports purpose was not declared. Could have been restocking or aquaculture.

3.4 Entrainment

Pumping stations

In 2015 in England and Wales, there were 336 pumping stations identified as having the greatest potential to impact on eel (Cefas *et al.*, 2021). This was based on: 1) distance from head of tide (shorter distance = greater impact) and 2) the predicted presence of eel. These structures are being reviewed in relation to the Eels (England and Wales) Regulations and cost-benefit eel measures implemented as and when funding becomes available through scheduled programmes of work, including routine maintenance and refurbishment programmes and planned capital investment programmes. As eel measures are implemented, the impact of pumping stations will reduce. To date, 55 of the 336 critical pumping stations in England and Wales have had eel-specific measures implemented.

To estimate the impact of those past and remaining pumping stations, it has been assumed that all the area upstream of the pumping station is lost to eel production. The total annual loss in terms of silver eel biomass is derived from wetted area upstream * SMEP II production (kg/ha) for the relevant EMU. This assumption will be reviewed in future, informed by findings from the REDEEM project (described in Section 6 of this report).

In Scotland which has little low-lying land, pumping stations are not considered to be an important influence on eel migration, and are not considered in stock assessment.

In Northern Ireland, which has little low-lying land, pumping stations are not considered to be an important influence on eel migration, and are not considered in stock assessment.

Surface water abstraction sites

Surface water is abstracted at 23,106 sites in England and Wales (Cefas *et al*., 2021). Those 530 (in 2015) sites with the greatest potential to impact on eel were identified using the following criteria: distance from head of tide, size of the abstraction, predicted presence of eel, the sensitivity of the waterbody to abstraction; and were quality assured by consultation. These structures are being reviewed in relation to the Eels (England and Wales) Regulations and cost beneficial eel measures implemented as and when funding opportunities arise through scheduled programmes of work, including routine maintenance and refurbishment programmes and planned capital investment programmes.

A study of eel entrainment and mortality has been carried out at ten surface water abstraction sites. The average number of eel entrained at these ten sites was 614 eels per year, with the average age of those eel being two years (~150 mm). The equivalent in terms of silver eel biomass is estimated to be 0.03 kg per entrained eel. This equates to 19.2 kg per year entrained per abstraction. As more eel screens are installed at these intakes, the impact on eel will reduce. This is accounted for in each triennial assessment. To date, 80 of the 530 critical intakes in England and Wales have been addressed.

Surface water extraction is regarded as likely to have only a minor impact on eel in Scotland and Northern Ireland, and does not contribute to stock-assessment.

Cooling water intakes at power stations

In 2015, 51 power stations were identified across England and Wales where eels were likely to be impacted by cooling water intakes (Cefas *et al*., 2021). This number is likely to fall over the coming years as coal-fired stations are gradually decommissioned. This is in line with the UK Government’s energy plan to introduce a greater mix of renewable energy. All existing power stations have been reviewed in relation to the Eels (England and Wales) Regulations and cost beneficial eel measures determined. These measures are being implemented. To date, 12 of the 51 power stations have been decommissioned or intakes screened to protect eel.

In Scotland and Northern Ireland, cooling water intakes at power stations are not considered to be an important influence on eel migration, and are not considered in stock assessment.

Hydropower facilities

In 2015, in England and Wales, there were 212 hydropower facilities in operation affecting 11 188 ha of eel producing habitat (Cefas *et al*., 2021). The impact of each hydropower facility on eel was estimated according to the B_{SMEP} production (kg/ha) for the relevant EMU, the area of habitat upstream, the presence or absence of screens (preventing eel entrainment) and the type of turbine. For those sites with screens, the proportion of eel entering the turbine(s) was assumed to be zero if the spacing between the bars/mesh was <15 mm, 50 % if the spacing was between 16–29 mm and 100 % if >30 mm: 27.6 % of hydropower schemes (excluding Archimedes screws) are adequately screened to prevent the entrainment of eel (i.e. spacing was <15 mm). The estimates of turbine mortality were taken from the WGEEL (ICES, 2011) report and were: Archimedes screw 0 %, Francis Turbine 32 %, Kaplan turbine 38 %. All hydropower facilities have some form of bypass channel that provides an alternative route for fish around the turbine. On this basis, it has been assumed that approximately 50 % of the silver eels produced upstream of a turbine will become entrained therein. It should be noted that these estimates only take account of impacts on downstream migrating silver eel and not on other life stages of eel.

On those river systems where there is more than one hydropower facility, the loss of production from the upstream turbine(s) has been accounted for in estimating the potential impact of turbines further downstream, i.e. the cumulative impact of all turbines has been calculated.

Existing facilities and new hydropower developments are being reviewed in relation to the Eels (England and Wales) Regulations and cost beneficial eel measures implemented where possible, including the installation of fine screening (2 mm gap size) to protect eel less than 300 mm.

In Scotland, a more conservative assessment approach has been adopted in which, in the absence of further information, eel production upstream of hydropower facilities is assumed to be zero.

In Northern Ireland, AFBI undertook a 2-year acoustic telemetry turbine mortality study begun in December 2018 assessing turbine passage and associated mortality at the two hydroelectric plants at the outflow of the River Erne into the Atlantic Ocean (Transboundary EMU IE_NorW). Sixty silver eels were tagged and released in December 2018 and 2019. The tagging and associated releases were in two separate batches of 30 to coincide with low flow and high flow regimes out of the system and to coincide with different turbine/spilling operating regimes. The findings from this study were presented at WGEEL 2019 (see ICES, 2019), with data included in that year's review on Hydropower Impacts. Having now been completed, this study is being written up.

Provisional results are that the total mortality on the two batches of eels released in 2018 were 46.7 and 66.7%, whilst in 2019, it was measured at 56.7% under both water flow regimes (high and low).

These results indicate a significant difference to mortality figures reported previously for the two Erne hydroelectric stations – The 2016/17 SSCE: All Ireland Eel Report listed individual station impacts ran ging from 7.7% - 27.5% under various generation and flow regimes, and a cumulative impact of 18.3% mortality.

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 a revised mortality figure;
c) associated implications of this in terms of EU conservation target compliance for IE_NorW based on the calculation derived in (b);
d) additional conservation measures that could be recommended;

At the Irish National level of the Technical Expert Group on Eel (TEGE), agreement has been reached with the Hydro facility owners that the new AFBI-derived mortality data will be used against all future escapement assessments in this transboundary EMP.

3.5 Habitat Quantity and Quality

Habitat Quantity

The quantities of eel habitat in each of the EMUs are reported in the Assessed Area column in Table 1.1 above, and according to gross habitat type (Freshwater, Estuary etc.) in Table 4.3 below.

England and Wales

Throughout England and Wales, it is assumed that all freshwater with connection to the sea constitutes potential eel habitat, based on presence/absence data from fish surveys. The seaward boundary of this habitat area is the boundary of the Transitional Waterbodies, as delineated for RBD in accordance with the Water Framework Directive (WFD).

In 2015, it was estimated that there were about 19,000 potential barriers (partial and complete barriers) to eel migration across England and Wales. The impact of barriers (including tidal gates) is estimated using a general linear model derived from eel data in 27 rivers from 2008 to 2013 ($r^2 = 0.196$), as described in Annex A of the UK EMP re-port 2021 (Cefas *et al.*, 2021).

Those barriers (not including tidal structures, see below) with the greatest potential to impact on eel were ranked using the following criteria:

- distance from head of tide;
- number of barriers downstream, and;
- potential extra habitat available if the structures were removed or an eel pass were installed at the structure.

These most impactful 'Priority' eel barriers are being reviewed in relation to the Eels (England and Wales) Regulations and cost beneficial eel passage measures implemented as and when funding opportunities arise through scheduled programmes of work, including routine maintenance and refurbishment programmes and planned capital investment programmes. Therefore, the impact of barriers will reduce over time as these structures are addressed and more habitat is made available for eel. This is accounted for in each triennial assessment.

Tidal structures

In 2012, it was estimated that a total of 1048 tidal sluices existed within England and Wales. A study was undertaken to produce a nationally consistent, prioritised list of tidal outfall structures in England and Wales where upstream and/or downstream fish passage is adversely affected (HIFI, unpublished). The decision of which sluices to assess was initially made on the basis of channel width, with the narrowest watercourses (those <5 m wide) rejected from the study because these are unlikely to provide large quantities of habitat for eel (even if channel length is long). This reduced the number of structures from 1048 to 449. These 449 were prioritised based on (1) fish stock status; (2) passage efficiency; (3) channel length; (4) channel width and (5) habitat quality.

An initial assessment of the impact on eel production was estimated for the top 106 of the prioritised tidal structures. Assuming that all the area upstream of the tidal gates/flaps is lost production, the total loss in terms of silver eel biomass was derived from total wetted area upstream * B_{best} production (kg/ha) in that EMU. In the absence of site-specific information on impacts, a conservative approach was taken to assume total loss of eel production upstream of the top 10% of tidal structures, and no loss of production from the remainder. This assessment will likely be revised as and when further information becomes available.

Since 2009, 938 eel passes have been installed at tidal and in-river structures across England and Wales, restoring or improving access to over 10 200 Ha of potential habitat for eel.

Scotland

In Scotland, it is assumed that eel has access to all freshwater connected to the sea except for all waters upstream of large hydropower facilities and other man-made impassable barriers, and some natural impassable barriers. The seaward boundary of eel habitat is similarly delineated as in England and Wales.

No tidal structures are considered to impact eel in Scotland.

Northern Ireland

In Northern Ireland, it is assumed that all freshwater with connection to the sea constitutes eel habitat, based on presence/absence data from fish surveys. All waters have been assessed for barriers to eel migration. All the information presented to ICES and elsewhere on GB_Nea and GB_NorE is on waters that have no or minimal impact to eel movement. The transboundary IE_NorW is different and the relevant data in relation to the impacts of hydroelectric dams are contained within the Ireland Country Report. The seaward boundary of this transboundary area is the outer boundary of the Transitional Water zones, as delineated for RBD in accordance with the Water Framework Directive (WFD).

Lough Neagh comprises 38 600 hectares of open water and has a mean depth of 9.5 m with a maximum of 30 m (Figure 3.1). It is the largest lake by surface area in the British Isles and due to the size of Lough Neagh, the remaining potential eel producing areas of small lakes and rivers in the catchment are minor by comparison, amounting to at most perhaps 5% of total water surface area. As the water in Lough Neagh does not stratify and is generally aerated by wind-driven circulation throughout the water column, the entire lake bed area is available to eel. It is classified as hypertrophic due to phosphorus and nitrogen nutrient inputs, now mainly from agricultural land but also from human domestic sources. For these reasons, the production of eel from rivers and lakes upstream and downstream of Lough Neagh is considered to be relatively minor and, therefore, the focus is primarily on eel production in Lough Neagh.

The outflow from Lough Neagh through the lower River Bann is regulated by a series of weirs and sluices (Figure 3.2). These sluices are operated by the Northern Ireland Rivers Agency under legislation designed to maintain water levels in Lough Neagh within narrow bounds to facilitate lake–shore agriculture, navigation, and drinking water abstraction. Eel passes are in place on all sluice gate systems, and these passes are annually maintained by LNFCS with traditional methods (straw rope coverings) to facilitate upstream migration of any young eels which bypass the trap and transport operation. However, given current recruitment levels are low, most are transported via upstream assisted migration programme. Under the high recruitment conditions in the early and mid-1900s there was considerable natural upstream migration, given the lack of anthropogenic influences in the system at that time.

Any silver eels which use the minimum 10% by river width free gap past active silver eel weirs are therefore free to run to sea. The outflowing River Bann is free of any turbine, power generation system or major water abstraction which might impede the escapement of silver eels to the sea.

The GB-NorE EMP covers the Northeast coastal fringe of Northern Ireland, comprising the Northeastern River Basin District as defined for Ecoregion 17 (The Island of Ireland) for WFD purposes, with the addition of those County Down coastal catchments draining into Carlingford Lough from Northern Ireland and those parts of the river catchments of South County Armagh not draining north to Lough Neagh but draining southward to the Irish Republic.

This EMP contains a diverse range of river and lake habitats, ranging from high gradient mountain streams of low productivity and little or no production of eel, to lowland inter-drumlin lakes in areas of high productivity and with significant capability, at least on a per unit area basis, to produce eel. The potential eel productive area in the region is largely in two of these sections or catchment groups, i.e. the River Lagan and associated rivers entering the Irish Sea at Belfast, and the collected catchments draining to the fjord-like Strangford Lough.

In Northern Ireland, which has little low-lying land, tidal flaps are not considered to be an important influence on eel migration and are not considered in stock assessment.

Habitat Quality

It is not possible to define habitat suitability criteria for eels from which to assess UK waters in terms of their quality for eel production. However, there are a range of water quality metrics that possibly/probably have some influence on eels – examples are provided below from Northern Ireland. No national-scale assessment of water quality is reported here but is probably available from other sources.

Chemical quality

The chemical quality of Lough Neagh and the River Bann is assessed by the Northern Ireland EA at sites in the Lough and the outflowing River Bann at quarterly intervals. Three determinants are used to score the quality: biochemical oxygen demand (BOD), dissolved oxygen (DO) and ammonia, and categorised under the UK General Quality Assessment (GQA) system. In this system, there are six quality classes ranging from Very Good through Fair to Bad. Monitoring results for rolling 3-year sampling periods are used. Lough Neagh currently scores at GQA class 3 (fairly good) which means that it is suitable for potable supply after treatment, all other abstractions, good cyprinid fisheries, and is capable of supporting a natural ecosystem.

Trophic status

AFBI monitors nutrient levels (forms of Nitrogen and Phosphorus, Silica, Algal species and quantity) on a fortnightly basis, along with Chlorophylla and Secchi disk transparency. These data class Lough Neagh as eutrophic or hypertrophic on the OECD/Vollenweider system, as a result of mainly agricultural but also some domestic N and P inputs. While this is a concern for other interests (e.g. the salmon and trout fisheries), the turbidity and high biological productivity are actually positive factors to the eel, and probably account for the Lake’s capability to produce extraordinary quantities of eel relative to glass eel inputs. Some eel food items, particularly chironomid larvae, were previously known to be present in very high abundances, but the introduction of zebra mussel into Lough Neagh is now having significant ecological implications in conjunction with a lough-wide reduction in the populations of chironomids.

Contaminants

Lough Neagh has an essentially agricultural catchment with very low levels of industrialisation and only small or medium sized towns. Hence, in the absence of routine monitoring of eel quality, it is inferred that there is no local problem of contamination of eel with organic chemical residues, heavy metals, or other pollutants which would give grounds for concern for human consumption or indeed for eel spawner viability. These assumptions were confirmed in subsequent contaminant analyses which were reported within sections of the ICES Workshops WKPGMEQ (ICES, 2015) & WKBECEEL (ICES, 2016) (see Section 5.4.2).

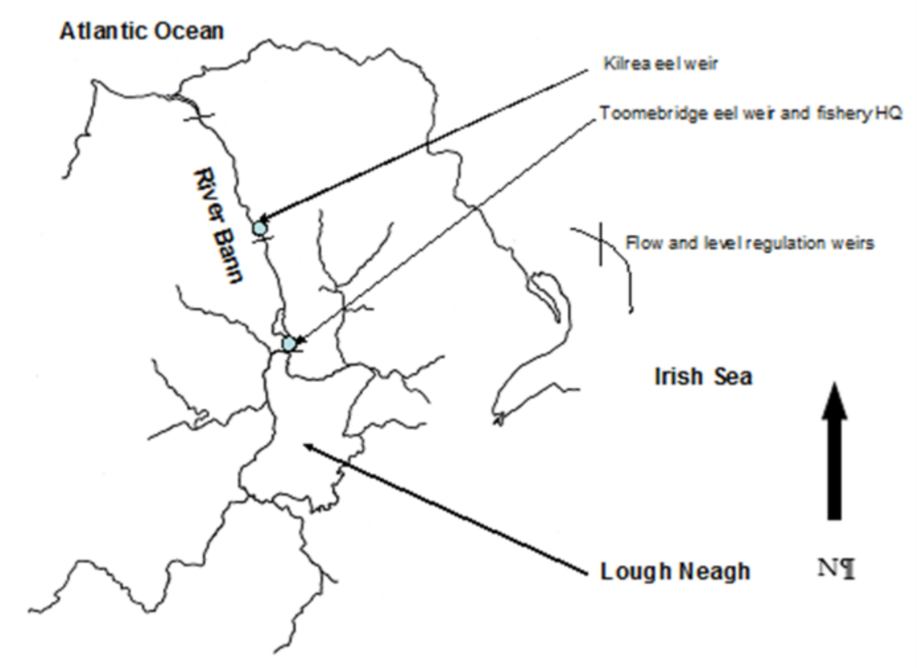

Figure 3.1 Schematic map of Lough Neagh in N. Ireland indicating silver eel weirs and sluice gates along the River Bann corridor.

Figure 3.2 Sluice gates on the River Bann.

3.6 Other impacts

There is no information available on other impacts.

4 National stock assessment

4.1 Description of Method

Reflecting the differing management authorities within the UK, eel stock assessments differ between England and Wales, Scotland and Northern Ireland.

England and Wales: GB_Nort, GB_Humb, GB_Angl, GB_Tham, GB_SouE, GB_SouW, GB_Seve, GB_Wale, GB_Dee, GB_NorW, GB_Solw

Silver eel escapement estimates for these EMUs are derived from yellow eel electric fishing surveys extrapolated to silver eel escapement using the SMEP II model and various analyses to estimate losses due to fisheries and other human impacts.

The numbers of potential silver eel emigrants arising from the yellow eel population in the survey year, is estimated from the abundance and length distribution of those yellow eels considered to be long enough to have a probability >0 of becoming silver eels in that year. The biomass of silver eels is estimated from the numbers-at-length using a length–weight relationship derived from data for over 16 000 eels sampled throughout England and Wales (Aprahamian *et al*., 2007; Walker *et al*., 2013). To estimate fishing mortality rate, the yellow and glass eel catches were first converted to silver eel equivalents. The biomass of yellow eel caught was considered to be the equivalent of the potential silver eel escapement as the instantaneous mortality rate of 0.139 yr^{-1} (Dekker, 2000) approximated to the instantaneous growth rate of 0.2 yr^{-1} (Aprahamian, 1986).

For the glass eel catch, 1 kg of glass eel was considered equivalent to 59.4 kg of silver eel, based on the instantaneous mortality of 0.00915 day^{-1} for the first 50 days post-settlement and thereafter a mortality of 0.139 yr^{-1}, a 50:50 sex ratio with males maturing at 12 (@90 g) and females at 18 years (@570 g) (Aprahamian, 1988).

The methods used to estimate other human-induced mortality rates are described in the most recently published 2021 UK EMP report (Cefas *et al*., 2021).

The most recent stock assessment was derived from yellow eel electric fishing survey data collected during the 2020-2022 period. However, due to the impact of COVID-19, very few surveys took place in 2020 and there was a reduced survey programme in 2021, resulting in fewer data for the assessment. A decision was made to use only those rivers with five or more ‘eel present’ survey sites in the SMEP II modelling to ensure a reasonable distribution of sites across river reaches and enable the model to be run. Only 24 rivers contributed to the 2024 assessment compared with 41 rivers in the 2021 assessment.

For the 2024 assessment, the yellow and silver eel catch figures must be considered as minimum estimates as a number of the catch returns were not available, so it is likely that the fishing mortality rate is greater than estimated.

Estimation of B_0

The 2015 triennial UK Eel Management Plan (EMP) progress report had an updated methodology for the calculation of historical biomass (B_0) compared to the 2012 and 2013 assessments. The improved model better reflected the actual state of eel stocks in rivers. Although the basic life-history model used for compliance calculations did not change, some of the assumptions and key datasets used within the model changed significantly (for more details on the methodology, see annex A in the 2021 UK EMP report; Cefas *et al.*, 2021). Although our model has been improved, the confidence limits around the biomass estimates are inherently wide.

Scotland: GB_Scot

Stock assessment methods have been developed for the Scotland EMU based on quantification of upstream and downstream eel movements at traps on three rivers. The estimates of B_0, $B_{current}$ and B_{best} rely heavily on the extrapolation of data from small study areas to the EMU as a whole, with the inherent possibility of bias. To derive an estimate of current production and anthropogenic mortality for the EMU from the available data has required a number of assumptions; these have tended to be precautionary in nature (i.e. likely to underestimate current production and overestimate current anthropogenic mortality (see Scotland RBD EMP; Anon., 2010a)). Some of these precautionary assumptions could be tested, and the production/mortality estimates adjusted accordingly, if resources become available. The Scotland RBD EMP is available at: https://www.gov.scot/publications/eel-management-plan/.

From 2013, and following the methods used in England and Wales, Scotland has adopted the inclusion of a silver eel production estimate for transitional waters based on the simplistic assumption that this is equivalent to silver eel production in the lowland rivers and lochs of Scotland (<240 m). Pristine production for transitional waters is assumed to be equivalent to pristine production in Scottish freshwaters during the reference period. For this reason, the inclusion of transitional waters has no effect on modelled silver eel output as a percentage of pristine output. However, because anthropogenic mortality ($\sum A$) is assumed to be zero in transitional waters, as there are no fisheries, the inclusion of transitional waters leads to a substantial reduction in the estimate of the value of $\sum A$ for the Scotland EMU.

Pristine escapement, B_0, was estimated via three different methods: one based on historical measures of escapement from the Girnock Burn 1967–1980; one based on reference to a similar habitat elsewhere (Burrishoole data); and one based on the Irish Catchment Geology model. Details are presented in the Scotland RBD EMP. All three methods yielded broadly similar results, and accordingly the mean value for pristine escapement of the three methods was adopted as B_0. Since the EMP was published the estimate of B_0 has been slightly increased to take account of trap efficiency in one of the estimated methods. Further details can be found in the 2021 UK EMP report (Cefas *et al.*, 2021).

There was no change in the assessment method for this latest report, but following a closure of a key monitoring site, an assessment was not available for 2023.

Northern Ireland

Neagh Bann RBD

For the only EMU in Northern Ireland with a fishery, the GB_Neag RBD, the estimate of pristine escapement (B_0) was determined using historic data including catch and sex ratio, input-output regression analysis and from known productivity of eel growing areas (Section 11.4 of GB_Neag EMP; Anon., 2010b). Using these three methods, a potential natural output in the range of 400 to perhaps 600 tonnes per annum was indicated given historical high natural glass eel supplies. This range would estimate the required 40% level at around 160 t to 240 t.

In Northern Ireland, the monitoring of silver eel migration and subsequent estimations of silver eel escapement ($B_{current}$) from the GB_Neag RBD are carried out by direct measurement (section 11.1 of the GB_Neag EMP). Given the geography of the RBD, in particular the single outflow point of Lough Neagh via the Lower River Bann at Toome, it was possible to initiate an annual mark-recapture programme in 2003, with the objective of estimating escapement of silver eels from Lough Neagh based on the non-recaptured proportion of those tagged silver eels taken back upstream and released. This work was further enhanced and corroborated by implementing a hydro-acoustic tracking study (a not foreseen but implemented measure) in 2011. To date, 12 098 eels have been tagged with Floy™ Tags since 2003 and recaptures recorded at both silver eel sites in the RBD.

Since 2018, the calculation for estimated escapement has been changed and further improved by the development of a model combining

- daily river flow metrics with;
- daily silver eel catch;
- against which daily tag recaptures are assessed.

This method has been used to hindcast and revise the calculations for escapement from 2009. Specific details of this mark recapture escapement assessment are outlined in Section 11.2 of the Neagh/Bann EMP (Anon., 2010b) and in Aprahamian & Evans *et al*. (2021). However, following COVID-19 related impacts on availability of detailed data, the calculations for the 2020-2024 period have reverted to the original format pre-2018. Comparative analyses between the two assessment calculations, found that silver eel escapement estimates varied little between the two methods, only 3-5%, thus can be considered almost equivalent.

North Eastern RBD

The estimate of pristine escapement from the North Eastern RBD was calculated with reference to the ecology and hydrology of similar systems as described in Section 2.4.1 of the North Eastern EMP. Historic escapement was unknown and not monitored as there are no fisheries in this RBD, but all rivers and upland lakes which are suitable for eel have been assessed as having no or minimal barriers to migration. As such under adequate recruitment levels and an adherence to the management actions laid down in the North Eastern EMP, this RBD should reach or better the 40% target naturally. Data relating to eel population densities and age distribution have been gathered for assessment purposes and are now included within Biomass and Mortality estimates. A glass eel index site has been established and the direct assessment of silver eel migration conducted in 2017 by netting. In the most recent reporting, the direct escapement assessments in this RBD were heavily impacted by flooding (2019 & 2023) and COVID-19 restrictions (2020).

IE_NorW*

The assessment methods for the Northwestern International RBD (IE_NorW*) are detailed in the original EMP (Section 8; Action 2a). Stock assessment was carried out on the Erne as part of the Erne Eel Enhancement Programme which ended in 2001 (Matthews & Evans *et al*., 2001).

The values for B_0 for the UK derived from these various assessment measures are shown in Table 4.1.

Table 4.1. Value and reference period for B_0.

EMU_CODE	B_0 (KG/HA)	REFERENCE TIME PERIOD	CHANGE FROM 2015 VALUE
GB_Nort	5.16	1983–1986	Y
GB_Humb	2.38	1983–1986	Y
GB_Angl	6.27	1983–1986	Y
GB_Tham	5.88	1983–1986	Y
GB_SouE	10.60	1983–1986	Y
GB_SouW	37.03	1977–1990	Y
GB_Seve	11.98	1983	Y
GB_Wale	16.18	1977–1990	Y
GB_Dee	45.02	1984	Y
GB_NorW	18.50	1977–1990	Y
GB_Solw	16.84	1977–1990	Y
GB_Scot	1.18	Pre-1980	N
IE_NorW	3.70	Pre-1980	N
GB_NorE	4.00	Pre-1980	N
GB_Neag	12.5	Pre-1980	N

Table 4.2. Results of mark–recapture estimation of silver eel escapement from the Lough Neagh silver eel fishery 2003–2023.

Year	No. tagged	Toome	Kilrea	Carry over to catch (T+1,T+2y)	Total	Rate (%)	Total annual silver catch (t)	Max.possible escapement estimate (t)
2003	189	33	7	7	47	24.9	114	343.0
2004	838	302	15	4	32	38.3	99	159.4
2005	792	118	0	7	125	15.8	117	623.0
2006	700	197	1	2	199	28.4	104	262.0
2007	0	*	*	*	*	*	76	
2008	950	193	18		211	22.2	76	266.2
2009	486	187	0	1	188	38.8	85	134.1
2010	491	167	14	0	181	36.9	97	165.9
2011	474	82	64	3	149	31.4	73	159.5
2012	452	65	19	2	86	19.0	74	315.9
2013	451	74	19	3	96	21.2	72	267.6
2014	956	139	57	3	196	20.5	66	253.2
2015	898	164	110	0	274	30.5	49	111.1
2016	776	151	42	0	193	24.9	52.5	158.3
2017	465	81	2	1	83	18.1	59.7	274.7
2018	1007	165	85	2	250	24.8	94	388.0
2019	1013	90	93	3	186	18.1	45.6	225.0
2020	646	194	5	11	210	32.5	65.6	134.0
2021	896	259	79	3	338	37.7	64	210.0
2022	661	128	2	4	130	19.4	46	189.0
2023	603	232	0	0	232	38.5	44	136.0
							19-year mean	238.8
							2009-2011 mean	153.2
							2012-2014 mean	278.9
							2015-2017 mean	181.4
							2018-2020 mean	249.0
							2021-2023 mean	178.3
							TARGET	200.0

**No tagging due to sporadic nature of silver eel run.*

4.1.1 Data collection

Data collection is managed through separate agencies in the four Devolved Authorities so there are variations between the methods. The following summarises the data collection strategy as applied in the UK's Annual Data Collection Workplan.

There are 15 EMUs, including one shared with the Republic of Ireland. Most EMUs have been set at the RBD level, as defined under the Water Framework Directive.

ICES (2012) recommended eel fisheries and stock data be collected annually, except stock abundance should be collected once per EMP-reporting period (presently every 3 years).

Commercial fisheries for eels (recruits, yellow and silver eels) in England are legally required to report catch quantities (weight), effort (days fished), the location and type of water fished. No data are collected on other biological characteristics: maturity and fecundity are not applicable for juvenile life stages exploited and other characteristics are not required for national stock assessments. The commercial fishery in Wales was closed in 2021. Catches from the commercial fishery in Lough Neagh (Northern Ireland) are reported to AFBI/DAERA by the LNFCS. Weekly sampling of 20 yellow eel over 20 weeks (May to September), and 100 silver eel over a 12 week period, provide age and length, weight, fat content, sex, age, stomach contents, and parasite load. Sex ratio of the silver eel population is estimated from size grading the catch into boxes of small (male) and large (female) eels. There are no commercial fisheries for eel in Scotland.

There are no recreational landings of eel across the UK, and any eel that are caught by recreational fisheries must be returned alive to the water.

The abundance of recruits is estimated from traps in six EMUs (Scotland, Anglian, Thames, Southwest, Neagh Bann, Northeastern) yielding numbers or batch weights of glass eel/elvers and numbers and lengths of yellow eel, and from dragnet surveys twice monthly from March/April to July/August in Northern Ireland (River Bann; Strangford Lough) yielding numbers per kg and length frequencies from 50 juveniles per sample.

The abundance of standing stock is collected from electric fishing surveys across most of the EMUs (apart from NI EMUs). Sites are fished every 1 to 3 years, depending on programme specification, and provide numbers per unit area, length frequency distribution and estimated individual weights.

In GB_Neag, eels are sampled regularly as part of a long-term research programme which investigates all life stages throughout the year. Yellow eel catches are sampled weekly over 20 weeks (from May to September), with a sample of 20 eels chosen to reflect all size ranges caught, and analysed for age and length. In addition, the entire, ungraded landing of two fishing crews on one day each month is sampled, usually comprising 400–600 eels captured by longline and a similar number by draftnet, to enable comparison between methods. Every eel is measured for length, and the total catch is recorded. Preliminary analysis indicates that a larger proportion of small eels (<40 cm) are captured by draftnets (34%, compared to 21.4% on longlines), whereas more of the larger eels (>60 cm) are taken on longlines. Furthermore, there was significant variation in the numbers of small eels captured by longlining dependent upon bait type (earthworms caught more) and hook size (larger hook caught fewer small eels).

In GB_NorE, a fykenet survey was undertaken in Killough in summer 2017 and was directly assessed for silver eel migration in autumn and winter of 2017 & 2018, data provided in the ICES datacall. The 2019 silver eel netting survey was wiped out in flood conditions with no data (ND) available for this year. All silver eel monitoring was halted because of COVID-19 restrictions in 2020 and similarly disrupted in 2021. In 2023, direct assessment of silver eel migration was again heavily impacted by flooding.

Information on the numbers or weight, and sex ratio of silver eels, is collected annually in Northern Ireland and Scotland using commercial catch sampling downstream and traps, respectively, and once in every three years (in accordance with the EU Withdrawal Act in relation to Article 9 of Regulation No. EC 1100/2007) for the remaining 12 EMUs using model-based estimates derived from yellow eel abundance surveys. The model-based methods are described in the 2015 (Defra, 2015) and 2018 (Defra, 2018) EMP Progress Report to the EU, at: http://sciencesearch.defra.gov.uk/Document.aspx?Document=12571_UKEMP2015report.pdf and 2021 report to Defra (Cefas *et al*., 2021; Implementation of UK Eel Management Plans 2017 to 2020 (publishing.service.gov.uk)).

4.1.2 Analysis

No information available.

4.1.3 Reporting

In addition to reporting the data and information in this report and the associated Data Call annexes to ICES on an annual basis, the stock indicators and other details were reported to the European Commission on a triennial basis until 2018. Following the UK exit from the EU, the EU Withdrawal Act (HMSO, 2019) transposed Regulation EC 1100/2007 (EC, 2007) into UK law. In line with the EU Withdrawal Act, the UK is no longer required to report to the EU Commission, thus the 2021 and 2024 EMP reports were submitted to all four UK administrations. The 2021 EMP report was published in December 2021 (Implementation of UK Eel Management Plans 2017 to 2020 (publishing.service.gov.uk)) and it is intended that the 2024 report will be published before the end of the year.

4.1.4 Data quality issues and how they are being addressed

No information available.

4.2 Trends in Assessment results

Chapter 1 provides the most recent assessment results at the spatial scale of the EMUs, whereas the most recently published EMP Progress report (Cefas *et al.*, 2021) provides the triennial time series since EMP implementation in 2009/10. Some additional details on habitat quantities and human-induced mortality rates are presented in this section.

4.2.1 Habitat quantities

The wetted areas used for calculating the stock assessment indicators for each EMU are shown in Table 4.3. Such wetted area habitats include rivers, lakes, inland waters, lagoons, coastal waters, and estuaries. The wetted area of rivers and lakes in Scotland, England and Wales were calculated from UK Ordnance Survey MasterMaps, scales 1:10 000 and 1:1250. Below a certain channel width (defined as normal winter flow width) the digital river network represents channels as a single line rather than a polygon, and thus provides no data on the width of river channels. On 1:10 000 scale maps this occurs nominally on channels below 5 m in width; at the 1:1250 scale, it is for channels below 1 m. To provide a reasonable measure of the true extent of water area represented by all non-determined widths of channels, these were attributed 1 m width in Scotland and 1.5 m width in England and Wales. In some cases, this will overestimate and in others underestimate the true width and hence wetted areas. The areas of the WFD defined transitional waters, combining estuarine and lagoon waters, were also calculated in GIS.

Table 4.3. The areas of habitat used in the assessment to determine B_0, $B_{current}$ and B_{best} for the 14 UK EMUs (transboundary IE_NorW not reported here), N/A indicates not applicable.

EMU CODE	RIVER		LAKE		ESTUARY		LAGOON		COASTAL	
	Area (ha)	Assessed (Y/N)	Area (ha)	Assessed (Y/N)	Area (ha)	Assessed (Y/N)	Area (ha)	Assessed (Y/N)	Area (ha)	Assessed (Y/N)
GB_Nort	5760	Y	3599	Y	2457	Y	0	N/A	70461	N
GB_Humb	15305	Y	9743	Y	32805	Y	0	N/A	32885	N
GB_Angl	12048	Y	9539	Y	32786	Y	0	N/A	225599	N
GB_Tham	34	Y	9162	Y	33615	Y	0	N/A	4268	N
GB_SouE	3954	Y	2061	Y	5428	Y	0	N/A	171207	N
GB_SouW	9798	Y	2621	Y	23431	Y	0	N/A	349787	N
GB_Seve	14372	Y	6157	Y	54542	Y	0	N/A	0	N/A
GB_Wale	8824	Y	4271	Y	13475	Y	0	N/A	433095	N
GB_Dee	1579	Y	1623	Y	10928	Y	0	N/A	0	N/A
GB_NorW	9076	Y	9780	Y	27927	Y	0	N/A	151109	N
GB_Solw	10933	Y	6760	Y	69803	Y	0	N/A	191300	N
GB_Scot	138557	Y	48104	Y	60502	Y	0	Y	4589412	N
GB_Neag	0	N	38000	Y	0	N	0	N/A	0	N
GB_NorE	0	N	5000	Y	0	N	0	N/A	0	N

4.2.2 Silver eel biomass indicators

See Table 1.1. for the most recent results and previous silver eel escapement estimates from the triennial reporting.

4.2.3 Human-induced mortality rates

Fisheries and other human-induced mortality for each EMU are shown in Table 4.4. Non-fisheries mortality includes hydropower, surface water abstractions, pumping stations, cooling water (recorded under Hydro & Pumps) and barriers (including tidal). All impacts are displayed as kg silver eel equivalents.

Commercial fisheries and hydropower installations have been assessed for all EMUs, with tidal gates, pumping stations and surface water abstractions being additionally assessed in the 11 EMUs of England and Wales. An assessment of the impacts of other man-made obstructions has been completed for these E&W EMUs and this barrier assessment methodology is detailed in Annex A of the UK EMP 2021 report (Cefas *et al*., 2021). The impacts of the recreational fishery (no take allowed), predators and contaminants and parasites are treated as part of natural mortality and therefore not accounted for in these estimates of anthropogenic impacts but are shown in the Table 4.4.

Table 4.4. Silver eel equivalents (kg) of fisheries and non-fisheries anthropogenic sources of mortality per EMU. The loss in kg for each impact or MI = not assessed, minor, MA = not assessed major, AB = impact absent. Where data are pooled for several years, the average annual loss for those years is shown.

YEAR	COUNTRY	EMU CODE	COMMERCIAL FISHING	RECREATIONAL FISHING	NON-FISHERIES MORTALITY	RESTOCKING	PREDATORS	INDIRECT IMPACTS
2009–2010	UK	GB_Nort	58	0	20066	0	MI	MI/MA
2011-2013	UK	GB_Nort	0	0	5098	0	MI	MI/MA
2014-2016	UK	GB_Nort	0	0	5268	0	MI	MI/MA
2017-2019	UK	GB_Nort	0	0	6412	0	MI	MI/MA
2020-2022	UK	GB_Nort	0	0	4116	0	MI	MI/MA
2009–2010	UK	GB_Humb	1877	0	67120	1678	MI	MI/MA
2011-2013	UK	GB_Humb	4711	0	90589	257	MI	MI/MA
2014-2016	UK	GB_Humb	952	0	41563	75	MI	MI/MA
2017-2019	UK	GB_Humb	2860	0	36111	0	MI	MI/MA
2020-2022	UK	GB_Humb	1298	0	16984	0	MI	MI/MA
2009–2010	UK	GB_Angl	9327	0	75832	588	MI	MI/MA
2011-2013	UK	GB_Angl	16212	0	65140	434	MI	MI/MA
2014-2016	UK	GB_Angl	13420	0	46371	0	MI	MI/MA
2017-2019	UK	GB_Angl	10844	0	24539	0	MI	MI/MA
2020-2022	UK	GB_Angl	9303	0	32107	0	MI	MI/MA
2009–2010	UK	GB_Tham	5293	0	116856	0	MI	MI/MA
2011-2013	UK	GB_Tham	4303	0	106564	64	MI	MI/MA
2014-2016	UK	GB_Tham	3043	0	43314	277	MI	MI/MA
2017-2019	UK	GB_Tham	2023	0	103377	0	MI	MI/MA
2020-2022	UK	GB_Tham	31	0	22287	0	MI	MI/MA
2009–2010	UK	GB_SouE	6241	0	33532	0	MI	MI/MA
2011-2013	UK	GB_SouE	2539	0	22538	139	MI	MI/MA

YEAR	COUNTRY	EMU CODE	COMMERCIAL FISHING	RECREATIONAL FISHING	NON-FISHERIES MORTALITY	RESTOCKING	PREDATORS	INDIRECT IMPACTS
2014-2016	UK	GB_SouE	5051	0	15853	149	MI	MI/MA
2017-2019	UK	GB_SouE	316	0	12336	0	MI	MI/MA
2020-2022	UK	GB_SouE	168	0	16258	0	MI	MI/MA
2009–2010	UK	GB_SouW	43294	0	29719	0	MI	MI/MA
2011-2013	UK	GB_SouW	179516	0	17424	257	MI	MI/MA
2014-2016	UK	GB_SouW	184799	0	11515	190	MI	MI/MA
2017-2019	UK	GB_SouW	142521	0	14947	0	MI	MI/MA
2020-2022	UK	GB_SouW	59641	0	15577	0	MI	MI/MA
2009–2010	UK	GB_Seve	26571	0	118230	12	MI	MI/MA
2011-2013	UK	GB_Seve	138715	0	65796	1380	MI	MI/MA
2014-2016	UK	GB_Seve	185892	0	62309	1099	MI	MI/MA
2017-2019	UK	GB_Seve	160346	0	17040	673	MI	MI/MA
2020-2022	UK	GB_Seve	53867	0	59267	792	MI	MI/MA
2009–2010	UK	GB_Wale	256	0	6223	0	MI	MI/MA
2011-2013	UK	GB_Wale	1091	0	7829	0	MI	MI/MA
2014-2016	UK	GB_Wale	1918	0	7037	0	MI	MI/MA
2017-2019	UK	GB_Wale	1291	0	3423	0	MI	MI/MA
2020-2022	UK	GB_Wale	2468	0	2967	0	MI	MI/MA
2009–2010	UK	GB_Dee	301	0	17714	0	MI	MI/MA
2011-2013	UK	GB_Dee	1927	0	19790	0	MI	MI/MA
2014-2016	UK	GB_Dee	654	0	10708	0	MI	MI/MA
2017-2019	UK	GB_Dee	2808	0	6940	0	MI	MI/MA
2020-2022	UK	GB_Dee	200	0	20373	0	MI	MI/MA
2009–2010	UK	GB_NorW	2335	0	24174	0	MI	MI/MA
2011-2013	UK	GB_NorW	7767	0	11704	0	MI	MI/MA

YEAR	COUNTRY	EMU CODE	COMMERCIAL FISHING	RECREATIONAL FISHING	NON-FISHERIES MORTALITY	RESTOCKING	PREDATORS	INDIRECT IMPACTS
2014-2016	UK	GB_NorW	6975	0	16377	0	MI	MI/MA
2017-2019	UK	GB_NorW	7539	0	16574	0	MI	MI/MA
2020-2022	UK	GB_NorW	1528	0	25682	0	MI	MI/MA
2009–2010	UK	GB_Solw	0	0	26993	0	MI	MI/MA
2011-2013	UK	GB_Solw	0	0	8960	0	MI	MI/MA
2014-2016	UK	GB_Solw	0	0	13659	0	MI	MI/MA
2017-2019	UK	GB_Solw	0	0	25380	0	MI	MI/MA
2020-2022	UK	GB_Solw	0	0	4643	0	MI	MI/MA
2009	UK	GB_Neag	433000	0	AB	217	MI	MI/MA
2010	UK	GB_Neag	434000	0	AB	996	MI	MI/MA
2011	UK	GB_Neag	415000	0	AB	1035	MI	MI/MA
2012	UK	GB_Neag	376000	0	AB	1300	MI	MI/MA
2013	UK	GB_Neag	393000	0	AB	1866	MI	MI/MA
2014	UK	GB_Neag	364000	0	AB	2690	MI	MI/MA
2015	UK	GB_Neag	305000	0	AB	604	MI	MI/MA
2016	UK	GB_Neag	314000	0	AB	0	MI	MI/MA
2017	UK	GB_Neag	295000	0	AB	817	MI	MI/MA
2018	UK	GB_Neag	329000	0	AB	754	MI	MI/MA
2019	UK	GB_Neag	267000	0	AB	1252	MI	MI/MA
2020	UK	GB_Neag	163000	0	AB	1714	MI	MI/MA
2021	UK	GB_Neag	218000	0	AB	1033	MI	MI/MA
2022	UK	GB_Neag	142000	0	AB	1442	MI	MI/MA
2023	UK	GB_Neag	80000	0	AB	798	MI	MI/MA
2009-15	UK	GB_NorE	0	0	AB	AB	MI	MI/MA
2016	UK	GB_NorE	0	0	AB	40	MI	MI/MA

YEAR	COUNTRY	EMU CODE	COMMERCIAL FISHING	RECREATIONAL FISHING	NON-FISHERIES MORTALITY	RESTOCKING	PREDATORS	INDIRECT IMPACTS
2017-2023	UK	GB_NorE	0	0	AB	AB	MI	MI/MA
2009	UK	GB_Scot	0	0	49782	AB	MI	MI/MA
2010	UK	GB_Scot	0	0	21734	AB	MI	MI/MA
2011	UK	GB_Scot	0	0	22006	AB	MI	MI/MA
2012	UK	GB_Scot	0	0	25666	AB	MI	MI/MA
2013	UK	GB_Scot	0	0	29125	AB	MI	MI/MA
2014	UK	GB_Scot	0	0	75183	AB	MI	MI/MA
2015	UK	GB_Scot	0	0	46394	AB	MI	MI/MA
2016	UK	GB_Scot	0	0	42659	AB	MI	MI/MA
2017	UK	GB_Scot	0	0	49825	AB	MI	MI/MA
2018	UK	GB_Scot	0	0	40633	AB	MI	MI/MA
2019	UK	GB_Scot	0	0	33093	AB	MI	MI/MA
2020	UK	GB_Scot	0	0	37124	AB	MI	MI/MA
2021	UK	GB_Scot	0	0	69488	AB	MI	MI/MA
2022	UK	GB_Scot	0	0	27040	AB	MI	MI/MA

5 Other data collection for eel

This section provides an overview of methods used to collect yellow and silver eel abundance indices and life history parameters.

5.1 Yellow eel abundance surveys

Rivers

England and Wales EMUs

The EA and NRW survey yellow eel abundance across EMUs using a combination of multi-species electric fishing surveys on a six-year rolling programme and a biennial eel-specific electric fishing programme. These data are used to assess the biomass of silver eel escaping from each EMU, using SMEP II + Impacts Models, every three years as required by the EU Eel Regulation (EC 1100/2007) and the EU Withdrawal Act, 2019. Survey data from 2020, 2021 and 2022 were processed for the 2024 EMP Report (Cefas *et al*., 2024 in prep) and the values from the most recent year available are shown in Table 1.1. Sites where eel numbers, individual eel length (mm), site length and average width are collected are used in the triennial assessment. In the 2024 triennial assessment, yellow eel survey data were available from a total of 795 sites across 24 river catchments in England and Wales.

Data from all quantitative sites (regardless of biometric data) are submitted for yellow eel index reporting in England and Wales and included in the annual ICES time series (Table 5.1). In 2024, this included updates for 35 yellow eel series in England (out of 38) and 1 yellow eel series in Wales (out of 4), of data collected in 2023.

Table 5.1. Number of yellow eel series and survey sites across EMUs in England and Wales.

EMU	River	Number of series	Total number of sites
GB_Solw	England (various)	3	523
GB_Nort	England (various)	2	278
GB_Humb	Humber catchment	1	2104
GB_Tham	England (various)	3	1126
GB_SouE	England (various)	3	244
GB_SouW	England (various)	11	961
GB_Angl	England (various)	7	1464
GB_NorW	England (various)	6	125
GB_Seve	England (various) and Wales (River Usk)	3	1254
GB_Dee	Dee catchment (Welsh part)	1	15
GB_Wale	Rivers Teifi, Tywi and Mawddach (Wales)	3	148

GB_Scot

Since 2008, the Scottish Environment Protection Agency (SEPA) has undertaken routine electrofishing surveys for all fish species, including eels, on a rolling six-year programme as part of commitments to the WFD. During the last six years of available data (2016-2021) a total of 366 sites were electric fished (119 multi-pass, 246 single-pass). Eels were recorded as present in 58 % of locations. SEPA's data collection was partially interrupted by COVID-19, and there has been a subsequent movement from multi-pass to single-pass electrofishing, which is why no more recent data are available.

Annual electric fishing is conducted by Marine Directorate of Scotland (MDS) at the Girnock Burn (five sites), Baddoch Burn (five sites) and River Shieldaig (12 sites). Densities from these sites are reported in the ICES Data Call.

One further site monitored by Marine Directorate of Scotland (MDS) is the Allt Coire nan Con Burn, which is situated in the Strontian region of western Scotland and drains into the River Polloch, an inflow to Loch Shiel. The catchment covers 790 ha and its altitude falls from 756 m to 10 m at the sampling point, where the river is 5–6 m wide. Riparian vegetation at the sampling sites is predominantly mature deciduous woodland. Annual electrofishing surveys show no clear evidence of declines in yellow eel densities since 1992 (Adams *et al*., 2013).

Standing waters

GB_Scot

Data from eel captured on trash screens of a pumping station (1982–2003) on Loch Lomond showed no evidence of a decline in yellow eels (Adams *et al*., 2013) during the period. No more recent data are available.

GB_NorE

Eel are known to be present but there are limited scientific data. Yellow eel populations are present in every lake examined thus far, though there were significant differences between two of these sites in the length and age distributions of eels. Results were incorporated into the reviewed EMP for this RBD in 2012. Killough (transitional waterbody) within the EMU was surveyed using fykenets for yellow eel during summer 2017 and assessed for silver eel migration in autumn 2017.

Within this EMU, a three-night netting survey took place in September 2020, as reported in the 2022 ICES Data Call. Given resource issues much of the focus in this EMU has been shifted towards real time live capture assessment of migrating silver eels which have been reported in current 2024 Data Call. This shift in focus has remained and is a better use of resources.

IE_NorW*

An intensive fyke net survey into the yellow eel population of Lower Lough Erne is carried out on a rolling biennial basis as part of the DCF commitment to this EMU. All reports are included in the Ireland Country Report under the agreed reporting terms for this Transboundary IRBD. Results from the 2018 survey can be found under Section 6. Additional studies into the yellow eel populations of Lower Lough Erne now form a major part of a Queens University Belfast PhD study which will examine changes and trends in abundance over longer time frames, incorporating these and additional future surveys. The two final surveys in this three-year series were completed in August 2021 and July 2022. The associated PhD is now in a write up phase with the metrics from these surveys to be released following the PhD publication. 2024 was the next survey in this series carried out from 1 to 6 July: outputs will be reported in the Irish Country Report in 2025.

GB_Neag

Eel are sampled regularly as part of a long-term research programme which investigates all life stages throughout the year. Yellow eel catches are sampled weekly over 20 weeks (from May to September). A sample of 20 eels is chosen to reflect all size ranges caught, and these are analysed for age and length. In addition, the entire, ungraded landing of two fishing crews on one day each month is sampled, usually comprising 400–600 eels captured by longline and a similar number by draftnet, to enable comparison between methods. Every eel is measured for length and the total catch recorded.

Results indicate that a larger proportion of small eels (<40 cm) are captured by draftnets (34%, compared to 21.4% on longlines), whereas more of the larger eels (>60 cm) are taken on longlines. Furthermore, there was significant variation in the numbers of small eels captured by longlining dependent upon bait type (earthworms caught more) and hook size (larger hook caught fewer small eels a finding used in direct management action by changing the legal size of hook used{increased}).

5.2 Silver eel escapement surveys

GB_NorW and GB_SouW

Downstream migrating silver eels are monitored annually at resistivity fish counters on the River Leven in GB_NorW and on the River Fowey in GB_SouW, producing estimates of the numbers moving downstream.

GB_Scot

Downstream migrating silver eels have been trapped at three sites in Scotland: the Girnock Burn and Baddoch Burn (two adjacent tributaries of the river Dee, emptying ultimately into the North Sea), and the Shieldaig (an entire small catchment on the western seaboard). The biomasses of migrating silver eels for each available year have been converted to area production rates ($kg.ha^{-1}$) and are reported in Table 5.3, with no correction for trap efficiency

Table 5.2. Silver eel escapement from three catchments in GB_Scot (kg.ha^{-1}) since 2000. Data from previous years can be seen in the previous report. Note revisions to time series due to recalculations of historic data. No correction for trap efficiency. NP = Not Pertinent, because the Shieldaig trap was decommissioned in January 2023.

Year	Girnock	Baddoch	Shieldaig
2000	-	-	
2001	-	-	-
2002			0.67
2003	1.03	-0.20	0.50
2004	0.56	0.08	0.86
2005	0.86	0.25	-
2006	0.21	0.32	1.57
2007	0.53	0.35	0.64
2008	0.44	0.58	0.56
2009	0.47	0.53	1.15
2010	-	0.10	0.53
2011	0.30	0.47	0.46
2012	0.78	0.45	0.43
2013	0.45	0.35	0.62
2014	0.24	0.67	1.87
2015	0.36	0.08	1.11
2016	0.49	0.46	0.95
2017	1.26	0.46	0.93
2018	0.64	0.60	0.85
2019	0.51	0.17	0.72
2020	0.53	0.10	0.83
2021	1.10	0.49	1.49
2022	0.44	0.44	0.56
2023	0.34	0.60	NP

GB_Neag

Samples of ten eel chosen to reflect the size range in the catch are removed every week over a 12-week period at Lough Neagh and analysed for age and length. At weekly intervals, the previous night's haul is measured for length. The number of lengths can vary widely but on average covers at least 400 fish within a night's catch of >1 t. In addition, the weekly silver eel samples are also analysed for length, weight, fat content, sex, the prevalence and intensity of *Anguillicola crassus*, stomach contents, and gastrointestinal endohelminths. Sex ratio of the silver eel population is also examined by counting the numbers of individuals contained in the graded (depending upon size) 15 kg boxes. The fishery records the number of boxes of small (male) and large (female) eels sold, and from this the sex ratio and number of silver eels can be estimated. This standardised method has remained in place now since 2003 and is not set to change. However, sampled eels are now being bought from the LNFCS fishery rather than fishers (as is common practice elsewhere) and paid for by DAERA. The creation and installation of this new procurement system meant a delay to the start of sampling in 2024.

GB_NorE

This EMU was assessed using modified large D ring fyke nets for silver eel migration in autumn and winter 2017 and 2018. The 2019 silver eel netting survey was wiped out in flood conditions with no data (ND) available for this year. The 2020 season was affected by COVID-19. The 2021 season was affected by floods; this entire EMU surveying strategy had been revised for 2022 with several new sites ear marked for trialling methods etc. This re-assessment was successful and provided reportable quantities of male and female silver eels listed in the Data Call for this EMU. This new netting site continued to be used in 2023 with all metrics noted in 2024 ICES Data Call. The same netting strategy is currently in place for the 2024 season, and a new project de-signed around this whereby nets will remain in place for a full year to note all migration activity periods.

IE_NorW*

In the Ireland Northwestern EMU, surveys on the migrating silver eel stock on the Erne system began in 2009, as an integral component of a conservation fishery designed to trap and transport silver eels around hydropower plants within this EMU. The results of this survey work are presented in the National Country Report of Ireland. For 2022 and 2023 the T&T conservation fishery within this EMU was extended either end in terms of seasonal operations, from late august 2022 through to the end of April 2023. This comes off the back of direct scientific observations and assessments on this T&T set up encouraging a fuller use of the season available and the provisions of additional scientific data on migrating eel from this catchment. This new extended T&T season has become the established time frame and restarted in August 2023, the earliest in its 12-year history. This extended T&T season continued in 2024 with fishing beginning in late August ending late February 2024.

5.3 Life-history parameters

England and Wales EMUs

Mean annual biometric yellow eel data (length in mm) from as early as 1976 for all 43 series in England & Wales have been supplied to ICES via the 2020 Data Call. This information has not been reproduced here. In 2022, 2023 and 2024, these data were updated, together with providing all available annual individual biometric data for each data series (measured length in mm).

GB_Scot

Individual growth rates of PIT tagged eels have been measured by Marine Directorate of Scotland (MDS) in two tributaries of the River Dee, and at the River Shieldaig. Growth rates for eels with a year or more between capture and recapture have ranged from 0.0 to 34.8 mm.yr^{-1}, with mean ± s.e growth of 7.8 ± 1.7 mm.yr^{-1} (n = 24) on the Shieldaig, and 0.0 to 35.2 mm.yr^{-1}, with mean ± s.e growth of 9.301 ± 0.53 mm.yr^{-1} (n = 117) on the Girnock. On the Baddoch, the range of growth rates was 0.8–21.0 mm.yr^{-1}, with mean ± s.e growth rates of 6.49 ± 0.68 mm.yr^{-1} (n = 32). These may be the lowest growth rates ever reported for the European eel.

In 2024 Data Call, all available annual individual biometric data were provided for each data series, with updates provided for 2023 where available.

Some Fisheries Trusts collect data on the length of eels captured during routine electric fishing surveys targeted at salmonids (1136 eels were measured between 1996 and 2008). The Scottish Fisheries Co-ordination Centre is currently attempting to improve and standardise routine data collection on eel by the Fisheries Trusts. Lochaber Fisheries Trust conducted an eel-specific survey in 2010, and data are available at http://www.lochaberfish.org.uk/cust_images/Lochaber_eel_report_2010%5B1%5D.pdf.

Eel otoliths (about 100 pairs) have been collected (by SEPA) and read (by Marine Directorate of Scotland (MDS)) from a number of sites around GB_Scot, see Oliver *et al*. (2015) for some further details.

Historical data are available for age (estimated from otoliths) and length composition at a variety of sites in Scotland from a survey conducted in the early 1970s (Williamson, 1975).

In 2018, a new national electrofishing scheme was implemented in Scotland deploying a generalised random tessellation stratified sampling design. Length and weight data for eels is collected at 801 sites. It is hoped that this scheme will be continued, but has been interrupted by COVID-19 and subsequent staffing issues.

GB_Neag

The sex ratio of the silver eel population is estimated by counting the numbers of individuals contained in the graded 15 kg boxes which the Fishery use for sales. Eels are graded as small (males) and large (females), based on a length–sex key derived from previous sampling. Sex ratios in the silver eels in 2004 to 2005 were numerically close to 1:1, but changed in 2006 and 2007 to 63 % and 62 % females (Table 5.4). However, in 2008, 2009 and 2010, this trend has reverted to close to 1:1 (48, 52 and 47 % females) and continues up to 2021 with 51 % females. However, in 2023 % of females dropped to 41%.

Table 5.4. Biological characteristics of silver eels emigrating from Lough Neagh, GB_Neag. Note: mean ages of males and females for 2005 and 2006 have been revised in light of additional data.

	MALES				FEMALES			
Year	%	Mean L (cm)	Mean Wt (g)	Age	%	Mean L (cm)	Mean Wt (g)	Age
1927	0				100		567	
1943	27				73			
1946	40				60			
1956	61				39			
1957	62				38			
1965	10		180		90		330	
2004	51	40.6	122	11.0	49	58.6	386	18.0
2005	52	41.4	126	11.4	48	58.1	393	18.2
2006	37	40.1	117	12.3	63	59.5	368	18.7
2007	38	40.2	121	11.0	62	62.3	370	18.4
2008	52	40.3	122	12.0	48	59.5	367	18.0
2009	54	40.9	128	11.7	46	61.7	378	17.7
2010	54	40.1	117	12.3	46	56.7	365	17.8
2011	57	40.2	118	12.2	43	61.4	375	20.1*
2012	54	38.4	117	11.9	46	61.2	396	19.6*
2013	51	41.1	125	12.8	49	61.4	372	18.1
2014	53	39.6	120	11.8	47	58.1	342	17.6
2015	51	40.3	121	11.1	49	62.3	380	16.9
2016	46	40.5	121	10.9	54	63.5	379	18.1
2017	43	39.7	120	12.6	57	61.3	374	18.4
2018	47	40.4	118	12.0	53	61.7	388	18.6
2019	54	40.2	117	12.3	46	62.1	404	17.5
2020	47	39.9	118	11.8	53	61.4	393	16.9
2021*	50	38.8	100	11.6	51	59.9	370	17.3
2022	55	39.7	115	12.1	45	62.3	365	17.8
2023	59	4.03	117	ND	41	63.7	380	ND

*age data to be QA verified.

Additional lipid content analysis is a routine part of the sampling assessments made by AFBI of Neagh yellow eels, as reported to the ICES Workshops WKPGMEQ (2014) & WKBECEEL (2015) and part of the reporting requirements for the Lough Neagh Eel EU PGI Award (Table 5.5). Fat levels within the yellow eels have been found to remain relatively consistent across this period with all mean values noted above the 20% level, indicative of high fat content and comparable with those reported historically.

Table 5.5. Biometrics recorded for Neagh Yellow eel 2020-2023 recoding length mm, weight g and % lipid content.

Year	2020	2021	2022	2023
	Length (mm)	Length (mm)	Length (mm)	Length (mm)
Mean	540	540	534	518
Max	717	818	856	798
Min	440	315	340	330
	Wt (g)	Wt (g)	Wt (g)	Wt (g)
Mean	295	358	281	264
Max	680	2909	1310	1780
Min	140	100	60	100
	% Fat	% Fat	% Fat	% Fat
Mean	23.1	21.2	21.6	21.9
Max	34.1	33.2	33.8	35.8
Min	10.5	4.0	5.9	7.6
Total count	82	320	307	300

5.4 Diseases, Parasites & Pathogens or Contaminants

5.4.1 Parasites & Pathogens

Anguillicola crassus

In Lough Neagh, the glass eel/elvers are monitored for the presence of *A. crassus*, and the weekly samples of yellow eels are also examined for the prevalence and intensity of *A. crassus*, and gastrointestinal endohelminths. The infection parameters of yellow and silver eels are recorded annually from Lough Neagh (Table 5.6).

In 2017, 61.3 % of yellow eels (N= 320) and 86 % of silver eels (N=100) sampled from Lough Neagh were found to be infected with the nematode *Anguillicola crassus*, the highest infection parameters observed since 2008. As noted in previous Country Reports, the mean intensity of individual worms per infected eel remains significantly higher in silver eels with on average ten worms per fish compared to four in yellow eels.

Table 5.6. A. crassus infection parameters from eel sampled in Lough Neagh, Northern Ireland. PREV – prevalence, MEAN INT = mean intensity.

YEAR	YELLOW			SILVER		
	PREV (N)	MEAN INT	RANGE	PREV (N)	MEAN INT	RANGE
2003	24.4 (340)	2.2	1-9	57 (100)	2.5	1-9
2004	69 (300)	3.6	1-47	90 (100)	4.3	1-47
2005	92.5 (190)	7.7	1-60	100 (100)	7.8	1-56
2006	78.2 (153)	12.9	1-54	89 (100)	16.6	1-129
2007	70.4 (340)	7.0	1-52	76 (100)	11.4	1-66
2008	67.3 (290)	6.4	1-67	86 (100)	13.0	1-73
2009	55.8 (280)	4.4	1-27	73 (100)	8.4	1-32
2010	48.8 (280)	4.4	1-28	80.7 (100)	9.9	1-143
2011	56.7 (290)	3.9	1-32	74 (100)	6.6	1-32
2012	40.5 (285)	3.7	1-17	55 (100)	5.0	1-34
2013	50.9 (290)	3.5	1-32	70 (100)	7.6	1-37
2014	52.6 (250)	4.1	1-21	76 (100)	10.1	1-32
2015	54.1 (320)	4.5	1-38	69 (100)	6.9	1-47
2016	49.1 (270)	4.6	1-29	76 (100)	7.3	1-39
2017	61.3 (240)	4.4	1-22	86 (100)	10.0	1-44
2018	58.4 (260)	3.8	1-21	78 (100)	9.7	1-51
2019	64.8 (305)	3.9	1-19	84 (100)	11.7	1-31
2020	59.4 (140)	4.3	1-12	88(100)	14	1-14
2021	49.8 (340)	3.7	1-17	86(100)	10	1-28
2022	51.2 (320)	3.4	1-21	89 (100)	12.3	1-34
2023	48.0 (280)	5.4	1-34	83 (100)	12	1-140

In Scotland, no *A. crassus* infections were detected in samples of silver eels from the River Shieldaig, Wester Ross (2020-2021, n = 58), or yellow eels from Loch Barvas, Isle of Lewis (2020, n = 37).

Viruses

Since 2009, *Anguillid herpesvirus* (AngHV-1) (formerly known as *Herpesvirus anguillae*, HVA) has been detected during mortality investigations of all life stages of eel in 24 fishery sites in England (as of early 2024). This figure is derived only from mortality events investigated and where AngHV-1 disease was a strong contributing factor to the mortality (as determined by diagnostic identification of the virus from samples obtained during these investigations). Most of these events have occurred in enclosed still waters, but also include disease in a small number of riverine populations. Four cases of eel AngHV-1 disease were recorded in 2023, although a further 3 eel-specific mortalities were reported in wild stocks but sampling for diagnostic investigation was not possible. Where sampling has been possible (4 cases in 2023, 1 so far in 2024), a positive result for AngHV-1 detection has been substantiated in each instance.

In addition, in a distribution study using antibodies indicating exposure to the virus, AngHV-1 virus had a relatively widespread distribution within wild eel populations in England, detected in ~ 50% or riverine populations, often at a very low prevalence.

Consistent pathological changes associated with this disease have included haemorrhaging in the fins, skin lesions, and necrosis and inflammatory changes within the gills, skin, kidney and liver. Morphological assessment of these fish has also revealed many to be in migratory or pre-migratory stages, with barriers to migration deemed to be a potential contributory stressor to expression of AngHV-1 disease. Other drivers include environmental conditions, notably warm temperatures and prolonged dry weather exacerbating low flows, eel aggregations and conditions for disease emergence.

Other eel viruses appear to have very restricted distribution, but there is limited sampling to provide more conclusive evidence. In summer 2018, Eel Virus European X (EVEX) was detected for the first time during an eel specific mortality in a river catchment in East Anglia. Unfortunately, only dead fish were available for examination, limiting understanding of the role of the virus in the observed losses. Co-infections with AngHV-1, eel birnavirus and *Vibrio anguillarum* further complicated the cause of these losses. This case represented the first detection of EVEX during a mortality event of wild eels in England. Monitoring of the affected water bodies is underway to improve understanding of this virus. Restrictions have been placed on the movement of eels out of this EVEX-positive catchment whilst further investigations are underway, and biosecurity guidance has been issued to fishermen operating on these rivers to raise awareness and avoid potential spread of pathogens between fisheries. To date, no further detections of EVEX have been recorded in England.

Collaborative projects to progress understanding of European eel health interactions are also ongoing. This includes development of standardised protocols to harmonise assessments of eel health, the development of non-destructive diagnostic tools for disease surveillance and better understanding of pathogen interactions on eel fitness and passage. Further to this it has been agreed in 2023 that any health checks undertaken in support of cross-catchment eel movements within England will be subject to viral screening against AngHV-1, EVE and EVEX. This move aims to protect against any transfer of such viruses to virus-free catchments or catchments where viral distribution data is yet to be determined.

In 2016, *Flavobacterium psycrophilum* was identified in dead eels found at the Girnock monitoring site on the River Dee catchment, GB_Scot. Dead eels were reported in other parts of the River Dee in May 2015 and May 2016, but not sampled.

In Northern Ireland, there has been no evidence of AngHV-1 in any life-history stage of the wild European eel population of Lough Neagh. EVE and EVEX were found but at a very low prevalence, suggesting that the presence of these diseases had not reached levels of concern to the population's health status (Evans *et al*., 2018). No further investigations into the viral aspects of Lough Neagh eels have been undertaken but the results from the above study have been included in the Annex 9 of the Data Call in 2022.

5.4.2 Contaminants

In England and Wales, the Prioritisation and Early Warning System (PEWS) for chemicals of emerging concern evaluates the risk of chemicals in the environment. In addition to water, the system allows the EA to consider risk to sediment and biota which are particularly important for organisms such as eel. Currently, collaboration with environmental protection agencies from the devolved administrations is underway to expand the scope of PEWS beyond England and consider the entirety of the UK and its many unique and critically important ecosystems. Substances of concern can be nominated for PEWS assessment by sending them to PEWS@environment-agency.gov.uk.

In Scotland, a comparison of lipid and pollutant levels in Scottish yellow eel tissue with data from 1980 showed lipid levels were notably higher in the more recent eel samples (Oliver *et al.*, 2015).

In Lough Neagh eels, levels of contaminants were generally extremely low, and in many cases, among the lowest recorded across Europe. Concentrations of those contaminants regulated by the European Commission (EC, 2006) with regard to human health (Pb, Cd, Hg, dioxins and PCBs) were all within current limits.

Analysis for 2018 for a sample of 20 silver eels also recorded that all results were less than the maximum permitted by current legislation, where such limits exist (Table 5.7).

A PhD funded by DAERA began in 2022 to examine the spawner quality of silver eels migrating from the Loughs Neagh and Erne in Northern Ireland. A significant component of this work has involved lipid and contaminant analyses yielding data for future submission to the WGEEL EEQD. The PhD is now entering its final year, ending September 2025.

Table 5.7. Levels of contaminants in 20 silver eels from Lough Neagh, sampled in 2018, and maximum recommended limits (MRL) specified in legislation at that time.

CONTAMINANT	VALUE
Sum of Dioxins	0.37pg/g (Limit is 3.5pg/g)
Sum of Dioxin & Dioxin like PCB's	1.28pg/g (Limit is 10.0pg/g)
Sum of PCB's	14ng/g (Limit is 300ng/g)
Arsenic	0.10mg/kg (No MRL)
Cadmium	0.04mg/kg (Limit is 0.05mg/kg)
Lead	0.05mg/kg (Limit is 0.3mg/kg)
Mercury	0.085mg/kg (Limit is 1.0mg/kg)

More details of contaminant analyses in Lough Neagh eels are included in the Annex 9 of the 2022, 2023 and 2024 Data Calls.

6 New Information, research programmes, etc.

The WGEEL has a recurring task to report on any New and Emerging Threats and Opportunities to eel. This section of the report provides new information that would support the WGEEL in delivering this task, including new research programmes, etc.

1) REDEEM project: Research and Development of fish and Eel Entrainment Mitigation at pumping stations

As well as abiding with the requirements of the EC Eel Regulation (1100/2007), the UK has specific legislation (Eels (England and Wales) Regulations 2009) for screening intakes, including pumping stations. Water is frequently pumped from or into rivers for flood protection, water level management, domestic supply, agriculture, industry and hydropower generation. Fish and eels can be entrained in pumps and water intakes, especially adult silver eels during downstream migration; providing flood protection and safe eel passage is a particular problem. However, the extent of the problem is not fully understood and gaps in our knowledge prevent identification of adequate, cost-effective mitigation measures.

This research consortium is focussing on understanding fish and eel behaviour to assess the effectiveness of existing and new technologies for minimising entrainment at pumping stations and develop innovative measures to provide applied outcomes. Specifically, the research focuses on understanding the spatial distribution of fish and eels in pumped catchments, the processes that lead to entrainment and the effectiveness of altered operating regimes, fish-friendly pumps and novel downstream bypass channels for minimising entrainment.

Funding has been provided by EA (EA), EU European Marine and Fisheries Fund (ENG2130), Internal Drainage Boards, Association of Drainage Authorities and the University of Hull (UoH). The research cluster brings together knowledge and expertise in state-of-the-art acoustic telemetry (under Home Office Licence), multi-beam imaging sonar, eDNA and flow modelling techniques performed by staff and researchers across the EA, UoH and other organisations to make major advances in the field and maximise research quality.

The knowledge arising from this strategic, inter-disciplinary and international applied research investigation is anticipated to inform and revise guidance for mitigating fish and eel entrainment at pumping stations and water intakes at national, European and global levels. REDEEM Phase 2 is now underway with four PhD students and postgraduate researchers continuing the research, including assessment of novel hydropower schemes to ensure carbon reducing initiatives do not negatively impact fish populations.

For more information about the project, please contact Jon Bolland (UoH research lead; J.Bolland@hull.ac.uk) or Ros Wright (EA research lead; ros.wright@environment-agency.gov.uk)

Publications (in alphabetical order):

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2) Understanding eel behaviour to improve protection and passage at river structures: a summary of several UK-based studies

These EA projects in partnership with the Zoological Society of London (ZSL), University of Southampton and other organisations studied the behaviour of eels to find better ways to improve passage and protection at flood control structures, weirs, hydropower sites and other intakes. The studies showed significant impacts of some river structures on migrating eels, and that by understanding eel behaviour in relation to flow at such structures and intakes operational changes can be made at critical times of year to minimise delays and entrainment and improve passage.

In 2023, controlled laboratory trials were conducted at the ZSL which have shown that upstream juvenile eel passes fitted with V-shaped bristle climbing channels offer significantly quicker transit time and overall efficiency advantage over flatbed bristle, and both flat and V-shaped peg pass designs. A second set of trials explored how modifications to conventional upstream juvenile eel pass crest shape and flow configuration can improve eel passage efficiency. These analyses are underway but have already revealed that radial crests with non-opposing flow show the most potential. This evidence will help to inform guidance for improving passage and provision of eel passes.

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Piper, A.T., Manes, C., Siniscalchi, F., Marion, A., Wright, R.M. & Kemp, P.S. (2015). Response of seaward-migrating European eel (*Anguilla anguilla*) to manipulated flow fields. *Proceedings of the Royal Society B: Biological Sciences*, 282 (1811). doi.org/10.1098/rspb.2015.1098.

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Piper, A.T., Wright, R.M. & 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. doi.org/10.1016/j.ecoleng.2012.04.019.

Piper, A.T., Wright, R.M., Walker, A.M. & Kemp, P.S. (2013). Escapement, route choice, barrier passage and entrainment of seaward migrating European eel, *Anguilla anguilla*, within a highly regulated lowland river. *Ecological Engineering*, 57, 88-96. doi.org/10.1016/j.ecoleng.2013.04.030.

3) Improving eel pass design and performance

A project undertaken by the EA in partnership with the ZSL is in progress to improve eel pass design and performance. In 2020, controlled laboratory trials conducted by the Institute of Zoology (IOZ), ZSL, quantified the effects of substrate, lateral slope and flow rate on the efficacy of passage facilities for enhancing the upstream migration of juvenile European eel. A novel pass design, which incorporates two lateral slopes to create a symmetrical V-shaped channel, was trialled alongside the traditional flat-channelled equivalent. The passes were furnished with either bristles or studs and tested under a range of flow rates. The experimental set-up emulated gravity-fed passes, for which there are currently large knowledge gaps regarding their optimum operating criteria and design. Results showed a clear benefit to incorporating lateral slope in the ascent ramp with higher passage rates and faster transit times, irrespective of flow rate. The bristle substrate consistently outperformed studs with 2.5 times more successful passages for the eel size range tested (60–80 mm). The key recommendation arising from this work is for the incorporation of a V-shaped ascent ramp furnished with bristle substrate within gravity fed passes which target small eels, particularly where flow rates are likely to be elevated (≥0.2 L s^{-1}).

A second set of trials explored how modifications to conventional upstream juvenile eel pass crest shape and flow configuration can improve eel passage efficiency. Data analysis was completed this summer, and the manuscript has just been submitted to 'Animal Conservation'. In summary, using controlled experiments and custom-built eel passes with contrasting crest shapes (curved vs sloped) and flow directions (ascending vs descending), the effect of crest conditions on the attempt success, passage efficiency and speed of ascending juvenile eel was quantified. In three of the treatments (sloped ascending, curved descending, and curved ascending) the proportion of successful attempts (i.e., passage efficiency) significantly exceeded 50%, which was not the case for the control and sloped descending treatments. In addition, transit speed at the crest was significantly quicker (~3.5 minutes) in passes with a curved crest shape and ascending flow compared to the control. These results suggest that simple modifications to the shape of the pass crest and the configuration of flow delivery can help minimise delay and enhance passage efficiency, with the curved crest shape and ascending flow outperforming the control, with no crest. This evidence will help to inform guidance for improving passage and provision of eel passes.

Publications (in alphabetical order):

Piper, A. T., Rosewarne, P. J., Pike, C, Wright, R.M. (2023). The Eel Ascending: The influence of lateral slope, climbing substrate and flow rate on eel pass performance. *Fishes*, 8, 612. DOI: 10.3390/fishes8120612

Williamson, M.J; Allen, B.E., Brand, J.A., Pike, C., Sergeant, C., Grzesiok, C., Wright, R.M. & Piper, A. (under review). Improving eel pass efficiency: the role of crest shape and water flow in facilitating upstream juvenile eel migration.

4) Improving eel protection and passage in water reservoirs and optimising trap and transport in landlocked waterbodies

Landlocked waterbodies such as large drinking water reservoirs hold significant stocks of European eel. Juveniles may enter reservoirs through natural or pumped water inputs and achieve good growth rates in reservoir habitat. However, for adult life-stages, structures such as large dams frequently prevent mature adult eels from contributing to the oceanic spawner stock by permanently precluding escapement from freshwater systems into the sea. In many reservoirs, the only means of connection between freshwater and marine habitats for seaward migrating adult eel is via dam/weir overspill which may happen rarely and may not reconnect with a viable migration path. Typically, the only other exit route from these water bodies is via abstraction pumps which provide no connectivity with possible seaward migration routes. In addition, screening of river intakes may prevent recruitment, so a future management strategy needs to be considered. Trap and transport of adult eels may be the only option, but efficiency is very variable, and we need to understand more on timing and location of their transferred eels to ensure successful onward migration. This project aimed to quantify eel behaviour and movement patterns in a large reservoir with multiple pumped input and output flow routes. It builds on baseline research - conducted by Cefas, EA and ZSL.

The main aims were:

1) Assess the influence of pumped input and output flow on eel behaviour and movement patterns in a large reservoir;

2) Develop a predictive model to enable forecasting of eel movement and behaviour under a range of management scenarios, thus providing an evidence-driven tool to inform protection and passage strategies and optimisation of trap and transport;

3) Assess onward migration of riverine and translocated yellow and silver eels.

For further information contact ros.wright@environment-agency.gov.uk or adam.piper@ioz.ac.uk.

In March 2023, 151 receivers were deployed at Abberton Reservoir with 10 reference tags. Netting for eels for tagging was carried out but low water temperatures during this period (4.5 – 6 ◦C) meant that no eels were caught. In June 2023, 91 large eels (mean length - 964 mm, mean mass – 1834 g) were caught, acoustically tagged and released in the reservoir.

A number of additional works have since been conducted at the site. In September 2023, February 2024 and June 2024, all 151 receivers were downloaded, re-batteried and re-deployed. In November 2023, 30 additional animals were acoustically tagged and released (mean length – 944 mm, mean mass – 1813 g), with fin clips taken for sex ID. In June 2024, additional 64 eels were tagged and released (mean length – 961 mm, mean mass – 1760 g), together with 24 small eels (mean length 337 mm, mean mass 70 g). High resolution Biobase bathymetry mapping of the whole reservoir was also conducted in June 2024. Retrieval of full array (all 151 receivers) is scheduled for November 2024.

A reservoir computational flow dynamics study has begun (September 2024) in collaboration with Bangor University. This will provide high resolution flow dynamics data to inform environmental drivers of eel movement and aggregation.

A sex identification methods study was done in collaboration with IOZ and the ZSL vet department. The efficacy of two minimally invasive methods of sex identification (ultrasonography and molecular markers taken from pectoral fin clips), were evaluated in 47 European silver eels compared to histological sex identification. Ultrasonography accurately identified female gonads in migrating silver eel without hormone treatment, with identification of males undertaken by deduction (i.e., those with no gonads identified were considered to be male). In contrast, there was no significant differential expression of the three molecular markers previously found to positively identify sex in Japanese eel, suggesting that these markers cannot be used to identify sex in European eel. In conclusion, the minimally invasive sampling using ultrasonography can be a reliable tool for identifying sex in European eel and can be highly valuable for studies that address ecological, behavioural, conservation and management issues in this Critically Endangered species. A manuscript on this is due to be submitted by the end of 2024.

Publications (in alphabetical order):

Piper, A.T., Rosewarne, P.J., Wright, R.M. & Kemp, P.S. (2020). Using 'trap and transport' to facilitate seaward migration of landlocked European eel (*Anguilla anguilla*) from lakes and reservoirs. Fisheries Research 228 105567 https://www.sciencedirect.com/science/article/pii/S0165783620300849

Williamson, M.J., Jacoby, D.M.P. & Piper, A.T. (2023). The drivers of anguillid eel movement in lentic water bodies: a systematic map. Rev. Fish. Biol. Fisheries **33**, 147–174. https://doi.org/10.1007/s11160-022-09751-6

Williamson, M.J., Jacoby, D.M., Bašić, T., Walker, A. & Piper, A.T. (2024). Social network analysis as a tool to inform anguillid eel conservation and management. ICES Journal of Marine Science, 81(2), pp.402-410.

5) Azores Eel Project Summary

The EU Eel Regulation (EC 1100/2007) has obligated Member States to implement eel management plans (EMPs) to increase the biomass of eels leaving EU waters on their way to the spawning area in the Sargasso Sea. However, these eels still have about 5-10,000 km to migrate across the ocean before spawning so EU targets cannot guarantee to increase the actual spawning stock and ensure stock recovery.

Locating where eels spawn is critical for understanding the reasons for their decline and conserving this globally important species. Many factors could influence migratory success, both in freshwater and in the marine environment. The fundamental questions of where do the eels spawn and how do they get there need to be answered before we can address questions about factors affecting migratory and spawning success and managing these factors to support stock recovery.

Several attempts have been made to monitor migrating silver eels from Europe. The waters around the Azores were the last point to which an eel had been tracked using satellite tags. A scoping study carried out by volunteers from EA, ZSL and Defra in December 2017 confirmed the presence of European eel on several islands within the Azores archipelago - which means there was the chance to track eels from a point closer to their speculative spawning area which greatly increases the chance of success using current technology. An international partnership project is underway to track the migration routes and behaviours of eel from the Azores to their spawning area. A total of 78 silver eels have been tagged in 2018, 2019, 2020, 2021, 2022 and 2023 revealing the next stage of their journey to the Sargasso Sea, A paper with initial findings was published October 2022. Further analysis on the data is underway by partners and a more detailed publication is in preparation.

Part of a match-funded PHD with EA, University of Bournemouth (BU), Research Institute for Nature and Forest (INBO) and University of Azores will study further aspects of glass eel recruitment in the Azores and the movements of yellow and silver eels in watercourses with extreme natural barriers using acoustic telemetry.

For further information on this project, contact Ros Wright (ros.wright@environment-agency.gov.uk).

Publications:

Wright, R.M., Piper, A.T., Aarestrup, K. ***et al.*** (2022). First direct evidence of adult European eels migrating to their breeding place in the Sargasso Sea. *Sci Rep* **12**, 15362. https://doi.org/10.1038/s41598-022-19248-8.

6) Phenology and ecology of the critically endangered European eel during their marine to freshwater transition (PhDs and Post doc with EA/University of Bournemouth)

6.1 The aim of this research was to understand the migration phenology of the critically endangered European eel with a focus on the ecology of their marine-freshwater transition through completing objectives at two spatial scales: (i) within the Poole Harbour basin (Rivers Frome and Piddle), Dorset, where the ecology of their transition from glass-eel through to yellow eel will be investigated; and (ii) across their wider range in the United Kingdom with assessment of their migration phenology.

The project aims were:

1) Investigate temporal patterns in the migration phenology of juvenile eels in three rivers in England, with assessment of changes in the timing of the initial, middle and end of the emigration period;

2) Evaluate the use of different eel tissues for the ecological application of stable isotope analysis, including those that can be collected non-lethally, and assess the effects of preservation on these**;**

3) Assess the duration and timing of the estuarine to freshwater transition of glass eels and elvers**;**

4) Evaluate the application of isoscapes to understand the movements and foraging areas of eel in the Poole Harbour basin, southern England;

5) Quantify the timing of arrival, length, and age composition of glass-eels and elvers arriving in UK rivers.

Publications (in alphabetical order):

Boardman, R., Pinder, A., Piper, A., Roberts, C., Wright, R.M. & Britton, J.R. (2022)**.** Non-lethal sampling for the stable isotope analysis of the critically endangered European eel *Anguilla anguilla*: how fin and mucus compare to dorsal muscle. *Journal of Fish Biology*, 100(3), pp.847-851.

Boardman, R.M., Pinder, A.C., Piper, A.T., Gutmann Roberts, C., Wright, R.M. & Britton, J.R. (2022). Effects of preservation by ethanol on $\delta^{13}C$ and $\delta^{15}N$ of three tissues of the critically endangered European eel *Anguilla anguilla. Journal of Fish Biology*, 103 (1), pp.179-182.

Boardman, R.M., Pinder, A.C., Piper, A.T., Gutmann Roberts, C., Wright, R.M. & Britton, J.R. (2024). Environmental influences on the phenology of immigrating juvenile eels over weirs at the tidal limit of regulated rivers. *Hydrobiologia*, pp.1-20.

Boardman, R.M., Pinder, A.C., Piper, A.T., Roberts, C.G., Wright, R.M. & Britton, J.R. (2024). Variability in the duration and timing of the estuarine to freshwater transition of critically endangered European eel *Anguilla anguilla*. *Aquatic Sciences*, 86(1), p.18.

6.2 A match-funded (EA/BU) PhD, working with the Game and Wildlife Trust (GWT) and Cefas has commenced to assess eel populations to improve methods of estimating silver escapement. The project is based on the River Frome and will use acoustic telemetry, silver eel traps, Wolf traps and counters to monitor eel populations.

6.3 A match-funded (EA/BU) PhD is working with Natural England to acoustically tag yellow and silver eels in the lower River Parrett and Bridgewater estuary to track yellow eel movements and silver eel migration in an estuarine environment.

6.4 Post-doctoral research into the movement and habitat use of eels in Poole Harbour basin: insights from otolith microchemistry

The migration patterns of pigmented and yellow eel in Poole Harbour basin (Poole Harbour, Rivers Frome and Piddle), Dorset, UK were investigated by analysing otolith microstructure and microchemistry.

The project aims were:

1) Assess habitat use and potential inter-habitat movement of eel by examining Sr:Ca ratios in otoliths;

2) Investigate variation in life-history traits;

3) Compare life history patterns of eel by age.

6.5 Post-doctoral research into the otolith microstructure of European eel *Anguilla anguilla* across a latitudinal and longitudinal gradient

The overarching aim of this research is to develop new understandings on timing of metamorphosis and arrival into European freshwaters through the application of otolith microstructure on eels collected from a series of European rivers. These rivers provided the ability to test differences in the ages of eels arriving into these rivers according to a latitudinal and longitude gradient.

The project aims are:

1) Determine the number of increments at metamorphosis;

2) Determine the number of increments at freshwater entry;

3) Analyse otolith characteristics (radius and increment width) to understand growth stages and transitions across a latitudinal and longitudinal gradient.

Samples of glass eels from a range of European countries are needed for this project. In 2020, some samples were provided by WGEEL members from outside UK, despite problems caused by COVID and CITES restrictions. Provision of further samples from European countries would be greatly appreciated if there is the opportunity. For methodology and transport guidance please contact: boardmanr@bournemouth.ac.uk or ros.wright@environment-agency.gov.uk.

Thank you to those who have helped, and the results will soon be available.

7) Status and conservation management of riverine populations of European eel *Anguilla anguilla* in England (part-time PhD with University of Bournemouth)

After nearly two decades of management action across Europe, glass eel and yellow eel recruitment remain at historically low levels. Thus, although Eel Management Plan actions may have halted the decline, eel stocks are not recovering. While successful management of fish stocks requires a thorough understanding of their current and historic distribution, life history traits, and how these all relate to biotic and abiotic factors, few of these factors have been thoroughly researched in eels. Accordingly, the mathematical models used to estimate current and historic escapement rely on old, extrapolated and often poor data. This research aims to to address some of the gaps in understanding concerning eel populations, using England as the study area.

The project aims are:

1. Quantify the spatial and temporal patterns in yellow eel population abundances of specific river basins in England, including testing the biotic and abiotic factors influencing these.

2. Assess the age structure and growth rates of riverine yellow eel populations in England, identifying spatial variation in the probable age of escapement.

3. Test the effect of glass eel/elver stocking as a conservation management tool, including assessment of their transition from marine to riverine environments, interactions with other species, their behaviours, and their indirect and direct influences on escapement rates.

For more information, contact darryl.clifton-dey@environment-agency.gov.uk

8) Spatial and temporal variation in the ecology and phenology of migratory eels at local to continental scales (EA/BU/Cyprus University of Technology)

Preliminary findings suggest that the freshwater systems of Cyprus could represent a crucial refuge for the European eel at the easternmost limit of its range. This is significant as it highlights the potential role of Cyprus' freshwaters in supporting the species, which is currently facing numerous threats across its geographical distribution. The importance of these findings is underscored by the urgent need for effective conservation strategies, not just in Cyprus but across the wider Mediterranean region, where climate change is expected to intensify issues such as drought and lead to further drying of river systems. For the purposes of our study, both traditional sampling and advanced molecular techniques will be applied to accurately assess the European eel populations in the highly fragmented freshwater bodies of Mediterranean islands, with Cyprus as a model habitat.

The research focuses on three broad objectives.

1) Map the current distribution of the European eel in the freshwater systems of Cyprus using environmental DNA techniques. This will develop a comprehensive understanding of their presence across various habitats. Sampling will be targeted during key eel life stage migration periods and in high and low river flow conditions. The latter will allow the identification of eel refugia during prolonged draught and will inform water management to support eel conservation on the island;

2) Understanding eel ecology in arid environments. O2 builds on O1 and incorporates physical capture and tracking eel movements through PIT and acoustic tag telemetry on the island. Glass eel migration will be monitored in key rivers;

3) The broader implications of climate change on the freshwater ecosystems of Cyprus, particularly in relation to drought and changing water levels, and their impact on the conservation prospects of the European eel will be assessed using climate data and European eel data from O1 and O2. These will be used in combination to generate practical recommendations for policymakers based on the findings, aimed at integrating eel conservation needs into broader water management and environmental protection policies in Cyprus.

9) Best Practice technical guidance on eel passes and eel screening

The EA's Eel Manual document on eel passage technical solutions was updated in March 2021, incorporating latest research and taking account of lessons learned since the publication of the first manual in 2011.

An update of the Eel Manual document on technical solutions for screening intakes to prevent the entrainment of eel and elver was completed in September 2022.

For more information and to request a copy of the guidance documents contact the EA (https://www.gov.uk/government/organisations/environment-agency#org-contacts). The document titles are 'Elver and Eel Passes - A guide to the design and implementation of passage solutions for eel and elver' and 'Screening at Intakes and Outfalls: Measures to Protect Eel and Elvers'.

10) AFBI/QUB University PhD within the EMU's of GB_Nea and IE_NorW

A PhD funded by the Department of Agriculture Environment and Rural Affairs (DAERA) began in 2022 to examine the spawner quality of silver eels migrating from Loughs Neagh and Erne in Northern Ireland. In addition, methods used to deflect silver eels from hydropower intakes are being developed in attempts to deflect eels into the nets of T&T fisheries. Such nets are much further upstream before the eels get close to the turbines intakes from which there are no bypasses to which eels can be deflected into. The PhD is now entering its final year, ending September 2025.

An MSc is investigating aspects of the biology and ecology associated with the broad head variant of European eel for completion in 2025. It is anticipated that elements of this research will transfer into a full PhD.

Publications:

Evans, D.W. & Aprahamian, M.W. (2024). How COVID-19 changed the dynamics of a fishery. *Aquatic Living Resources*, 37: 9.

Moore, A., Armstrong, F. & Evans, D.W. (2024). Fluorescence of European glass eel (*Anguilla anguilla* L.) under ultraviolet light. Aquaculture, *Fish and Fisheries*, 4, e167. https://doi.org/10.1002/aff2.16726938847, 2024.

11) Potential impact of Chinese Mitten Crab (*Eriocheir sinensis*)

The Chinese Mitten Crab is a highly invasive non-native species, which is known to be spreading across England's watercourses. It is thought to have been introduced into the Thames estuary, most likely in ballast water associated with shipping, through mariculture and/or clinging on to ships' hulls. There is a significant potential for the species to impact on eel populations, with observations already of juvenile crabs destroying elvers at migratory pinch points such as elver pass traps, where dozens of juvenile crabs have been found in a single trap.

A pilot trapping project was initiated in 2023 on the Counter Drain at Pode Hole Pumping Station in Lincolnshire. This is a collaborative project between the site owner, Welland and Nene Internal Drainage Board, Lincolnshire Wildlife Trust, the Natural History Museum and the EA. Due to the migratory life cycle of the crab, the objective was a total eradication from this location. However very few crabs have so far been captured in the purpose-built trap as of summer 2024. Research continues into possible management controls to limit the impact of Chinese mitten crabs.

The EA carried out a hydroacoustic study on Morton's Leam, Nene Washes, a fenland drain system in Cambridgeshire. This highlighted a very high density of Chinese Mitten Crab dominating the bed of the watercourse. Alongside this survey the team carried out a short tracking study using acoustic tags. They found the crabs were travelling more than 5 km per day along the watercourse. The EA also has evidence of Mitten Crabs actively damaging fyke nets to access prey, including yellow eels (J. Reeds pers comm).

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