Joint EIFAAC/ICES/GFCM Working Group on Eels (WGEEL)

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i Executive summary

The Joint EIFAAC/ICES/GFCM Working group on eels (WGEEL) met from September 6–9 and 12–20 September 2022 in Toombridge, Northern Ireland, to provide the scientific basis for the ICES advice on fishing opportunities and conservation aspects for the European eel and address requests from EIFAAC and GFCM.

WGEEL assessed the state of the European eel and its fisheries, collated and analysed biometric data, reviewed and summarized available data on eel quality, further identified issues specific to the Mediterranean region, discussed the use of landings data for the assessment (following WKFEA) and reported on any updates to the scientific basis of the advice, new and emerging threats or opportunities.

The recruitment of European eel declined markedly from 1980 to 2011. The glass eel recruitment compared to that in 1960–1979 in the "North Sea" index area was 0.5% in 2022 (provisional) and 0.6 % in 2021 (final). In the "Elsewhere Europe" index series it was 9.7 % in 2022 (provisional) and 5.5% in 2021 (final), based on available data series. For the yellow eel data series, recruitment for 2021 was 19% (final) of the 1960–1979 level; the 2022 data collection for yellow eel is ongoing. Time-series from 1980 to 2022 show that glass eel recruitment remains at a very low level.

Analyses of data series on yellow or silver eel abundance (162 series analysed) and grouped biometric data were re-run this year and show the potential of the yellow and silver eels' series to improve the stock assessment. A graphical analysis of the new biometric data integrated in the database, 1.2 million individual data and 4908 grouped data (combining length, weight and age data), was carried out to identify future analyses and information that might be missing. To identify the potential of Length-Based Models for stock assessment, a preliminary overview of the models, the input needed and of the assumptions was realised.

A collation and integration of available data relating to eel quality – lipid content, parasites and virus, and contaminants - was carried out and examples of analyses and visualisation presented. A review of recent publications relating to eel quality was carried out. Recommendations for improving submission and harmonisation of relevant data, and using eel quality in the context of stock assessments are proposed.

Available landings data was reviewed and scoped with potential methods for their use in the assessment of the European eel in preparation of a workshop foreseen in the WKFEA roadmap. Currently, landings data cannot be included in the assessment but follow up work for their use in a potential spatial assessment approach is recommended.

In summary, besides updating recruitment time series, further progress was made in collating and analysing individual biometric data and eliciting there use in future assessment, particularly for a spatial assessment approach. Significant progress was made towards utilizing data on eel quality but its use in the assessment is currently data limited.

ii Expert group information

Expert group name	Joint EIFAAC/ICES/GFCM Working Group on Eels (WGEEL)
Expert group cycle	Annual
Year cycle started	2022
Reporting year in cycle	1/1
Chair(s)	Jan-Dag Pohlmann
Meeting venue(s) and dates	6–9 September 2022, online meeting, 32 participants
	12–20 September 2022, Toombridge, Northern Ireland and online, 49 participants

1 Introduction

1.1 Main Tasks

The **Joint EIFAAC/ICES/GFCM Working Group on Eels** (WGEEL), chaired by Jan-Dag Pohlmann, Thünen Institute, Germany, met in a split meeting from 6–9 (online) and 12–20 September in Toombridge, Northern Ireland and online, to address the ToRs in the EG resolution (Annex 2):

The Working Group used data and information provided in response to the Eel data call 2022 (from 27 countries) and 15 Country Report Working Documents submitted by participants (Annex 6); other references cited in the Report are given in Annex 3. A list of acronyms and glossary of terms used within this document is provided in Annex 4.

1.2 Participants

50 experts attended the meeting, representing 21 countries, along with an observer from the European Commission DG MARE.

A list of the meeting participants is provided in Annex 1.

1.3 ICES Code of Conduct

In 2018, ICES introduced a Code of Conduct that provides guidelines to its expert groups on identifying and handling actual, potential or perceived Conflicts of Interest (CoI). It further defines the standard for behaviours of experts contributing to ICES science. The aim is to safeguard the reputation of ICES as an impartial knowledge provider by ensuring the credibility, salience, legitimacy, transparency, and accountability in ICES work. Therefore, all contributors to ICES work are required to abide by the ICES Code of Conduct.

At the 2022 WGEEL meeting, the chair raised the ICES Code of Conduct with all attending member experts. In particular, they were asked if they would identify and disclose an actual, potential or perceived CoI as described in the Code of Conduct. Three members from the UK mentioned a potential CoI due to their involvement in drafting a non-detriment finding concerning eel trade between the UK and EU. The group, in consultation with the secretariat, however concluded that it did not challenge the scientific independence, integrity, and impartiality of these members and therefore ICES.

1.4 The European eel: Stock Annex

The Stock Annex has been reviewed and updated in 2020 and is due for another revision latest in 2023. See Annex 7.

1.5 The European eel: life history and reproduction

During its continental phase the European eel (*Anguilla anguilla*) is distributed across the majority of coastal countries in Europe and North Africa, with its southern limit in Morocco (30°N), its northern limit situated in the Barents Sea (72°N) and spanning the entire Mediterranean basin.

The European eel life history is complex, being a long-lived semelparous and widely dispersed stock. The shared single stock is considered genetically panmictic and data indicate that the spawning area is in the southwestern part of the Sargasso Sea. The newly hatched leptocephalus larvae drift with the ocean currents to the continental shelf of Europe and North Africa, where they metamorphose into glass eels and enter continental waters. The growth stage, known as yellow eel, may take place in marine, brackish (transitional), or freshwaters. This stage may last typically from two to 25 years (and can exceed 50 years) prior to development into the "silver eel" stage, maturation and spawning migration. Strong sexual dimorphism occurs in eels with males maturing at a younger age and smaller size. For details on the eel life cycle see Stock Annex; Annex 7.

The abundance of glass eel arriving in continental waters declined dramatically in the early 1980s to a low in 2011 (and remaining on a low level since). The reasons for this decline are uncertain but anthropogenic impacts and oceanic factors are assumed to have major impacts on the stock. For a detailed description of factors affecting the eel stock see Stock Annex. These factors will likely affect local production differently throughout the eel's range. In the planning and execution of measures for the recovery, protection and sustainable use of the European eel, management must therefore account for the diversity of regional conditions.

1.6 The management framework for European eel

1.6.1 EU Member state waters

Within EU Member State waters, the stock, fisheries and other anthropogenic impacts, are currently managed in accordance with Council Regulation (EC) No 1100/2007, "*establishing measures for the recovery of the stock of European eel*" (so-called 'Eel Regulation', EU Council, 2007). This regulation sets a framework for the protection and sustainable use of the stock of European eel in EU Waters, coastal lagoons, estuaries, and rivers and communicating inland waters of Member States that flow into the seas in ICES Areas 3, 4, 6, 7, 8, 9 or into the Mediterranean Sea. For details see the Stock Annex. Eel fisheries in EU waters are further regulated in Council Regulation (EU) No 2019/124 'Fishing Opportunities' (EU Council, 2022a, b) and in the Commission Implementing Decision (EU) No 2018/1986 'Specific Control and Inspection Programme' (EC, 2018). Other EU legislation that has specific relevance to the European eel, in the context of ICES are Directive 2000/60/EC and 2008/56/EC, known as the Water Framework Directive (WFD; EU, 2000) and Marine Strategy Framework Directive (MSFD; EU 2008), and Council Regulation (EC) No 338/97 (EU Council, 1996) which relates to trade in CITES-listed species.

1.6.2 General Fisheries Commission of the Mediterranean (GFCM) state waters

Specifically, for the Mediterranean region, work is ongoing towards the development of an adaptive regional management plan for eel in the Mediterranean Region under the auspices of the GFCM. The GFCM Commission approved recommendation GFCM/42/2018/1 on a multiannual management plan, in the Mediterranean Sea, also promoting a specific research programme (FAO, 2019). The GFCM Research programme on European eel: towards coordination of European eel stock management and recovery in the Mediterranean has started officially in September 2020, and involves nine Countries in the Mediterranean area. The programme's general objective is to deal with issues relevant to the setting up of a coordinated framework for management, through data and information collation, collection, and analysis as well as the creation of a network of experts and institutions. Further details are given in Chapter 6 identify and address Mediterranean-specific issues on European eel (ToR d). For details see Stock Annex.

1.6.3 Other countries

WGEEL receives data from EU and non-EU countries and GFCM supports more countries to achieve this. The Eel Regulation only applies to EU Member States – although other states may engage in the case of transboundary management plans. Some non-EU countries are involved in the provision of data for many years (e.g. Norway, UK). Others have only recently been involved and further development of assessment procedures and feedback mechanisms might be required to involve them in future standardisation processes. For details see Stock Annex.

1.6.4 Other international actors

The European eel was listed in Appendix II of the **Convention on International Trade in Endangered Species of Wild Fauna and Flora** (**CITES**) in 2007 (CITES, 2022a). Since 2009 when the listing came into force, any international trade in this species needs to be accompanied by an export permit supported by a Non-Detriment Finding (NDF). Since 2010, export out of, and import to, the EU is not allowed. The **International Union for the Conservation of Nature** (**IUCN**) listed the European eels as Critically Endangered in 2008 (IUCN, 2022). It was reassessed in both 2013 and 2018, and the status remains unchanged. In 2014, the European eel was added to Appendix II of the **Convention on the Conservation of Migratory Species of Wild Animals** (**CMS**), whereby signatories call for cooperative conservation actions to be developed among Range States (CMS, 2018). The European eel *Anguilla anguilla* was included on the OSPAR List of threatened and/or declining species and habitats in 2008. In 2014, the **Convention for the Protection of the Marine Environment of the North-East Atlantic** (**"OSPAR Convention"**) issued a recommendation to strengthen the protection of the European eel at all life stages in order to recover its population and to ensure that it was effectively conserved (OSPAR, 2014). The Baltic Sea Action Plan (BSAP) of the **Baltic Marine Environment Protection Commission (HELCOM**) contains several targets for the European eel (HELCOM, 2007). For details see the Stock Annex. The overarching objectives of the **Ramsar Convention on Wetlands** of International Importance (the international treaty for the conservation and sustainable use of wetlands) are to stem the loss and progressive encroachment on **wetlands - an important European eel habitat** - now and in the future (UN, 1976). Most EU Member States are Contracting Parties, hence the wetlands protected under this Convention will benefit eel population.

1.7 Assessment to meet management needs

The European Commission obtains both recurring and ad hoc scientific advice from ICES on the state of the eel stock, the management of the fisheries and other anthropogenic factors that impact it, as specified in the Administrative Agreement between European Commission and ICES for 2022 (ICES and EU, 2022). In support of this advice, ICES is asked to provide the European Commission with: estimates of catches; fishing mortality; recruitment and spawning stock; relevant reference points for management; information about the level of confidence in parameters underlying the scientific advice and the origins and causes of the main uncertainties in the information available (e.g. data quality, data availability, gaps in methodology and knowledge). The Commission Implementing Decision (EU) No 2019/909 (Data Collection Framework, DCF; EC, 2019), requires Member States data, collected through this framework, to be made available to end-users, such as ICES.

ICES requests information from national representatives to the WGEEL on stock parameters, landings, restocking, and time-series (e.g. recruitment, yellow eel abundance, silver eel escapement). In May 2022 ICES issued a Data Call to collect this information; this call was also advertised by EIFAAC and GFCM to their memberships (see below for further details).

The status of eel production in EU and non-EU Eel Management Units (Figure 1.1) is assessed by national or sub-national fishery and/or environment management agencies. The terminology Eel Management Unit (EMU) has been used by WGEEL and others for several years now but with various and unrecorded definitions leading to some confusion. It most often represents a management area for eel, corresponding to a river basin district (RBD) as defined in the WFD (EU, 2000). However, in cases of stock assessments at other spatial scales, and for stock parts lying outside the EU, EMUs have also been defined, either as being the management units used by the country (e.g. Tunisia) or as the whole country. In practice, data provision from some EMUs can be divided into further geographical subunits. This is, for instance, the case for Sweden where the EMU is national, but data can be provided to the WGEEL according to Inland, West and East coasts subunits. The catch from coastal areas does include eels migrating from other countries or parts of the Baltic.

Since EU exit and becoming an independent coastal state, UK has signed a Memorandum of Understanding (MoU) with ICES, effective as of start of 2021, which recognises UK obligations to provide relevant data for ICES to undertake stock assessment and provide advice to the UK relating to the North Atlantic and its adjacent seas, including advice on fishing opportunities for the European eel.

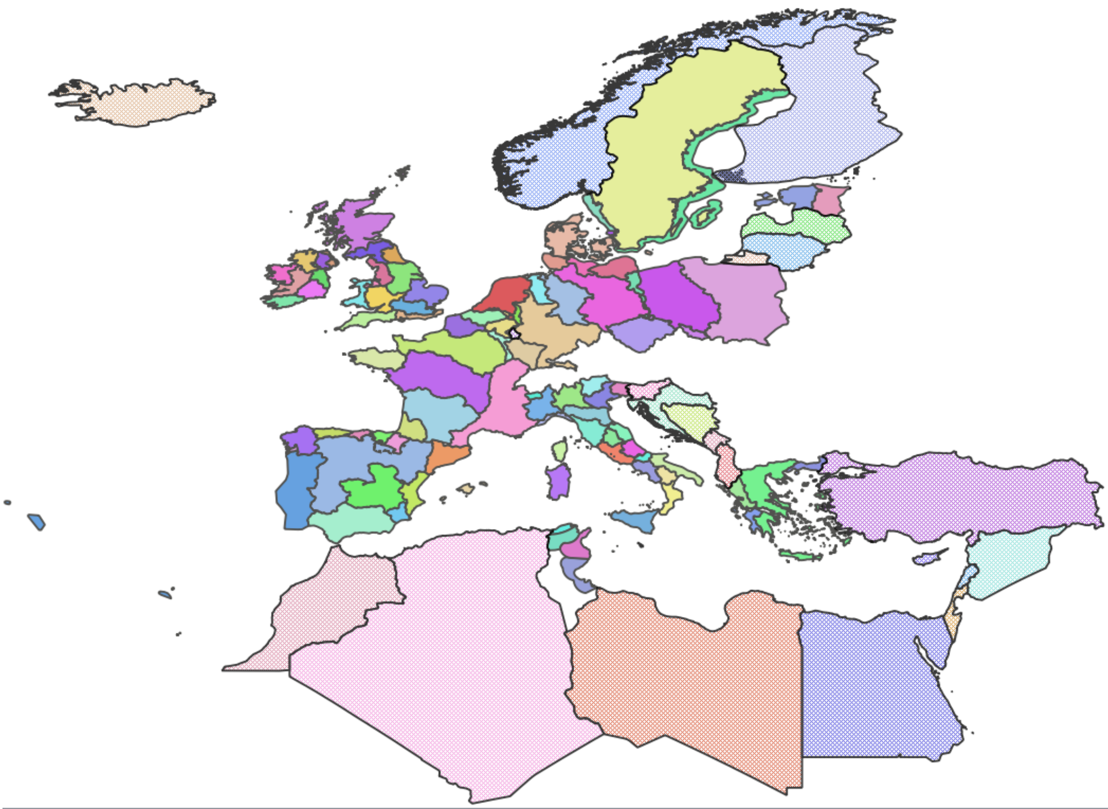


Figure 1.1. Current map of Eel Management Units (EMUs) as reported by countries or corresponding to national entities where no EMU is described at the national level.

The setting for data collection varies considerably between, and sometimes within, countries, depending on the management actions taken, the presence or absence of various anthropogenic impacts, but also on the type of assessment procedure applied. Accordingly, a range of methods may be employed to establish silver eel escapement limits (e.g. the Eel Regulation's ≥40% of B_0), management targets for individual rivers, river basins, RBDs, EMUs and nations, and for assessing compliance of current escapement with these limits/targets (e.g. for the Eel Regulation comparing $B_{current}$). These methods require various combinations of data on e.g. landings, recruitment length/age structure, restocking, abundance (as biomass and/or density) or maturity ogives, in order to estimate silver eel biomass, fishing and other anthropogenic mortality rates.

A description of data collection and methods used establish silver eel escapement and mortality is further detailed in the report on the technical evaluation of EU member states' progress reports for submission in 2021(WKEMP 3; ICES, 2022).

The ICES Study Group on International Post-Evaluation of Eel (SGIPEE) (ICES, 2010; 2011) and WGEEL (FAO and ICES, 2010; 2011) derived a framework for *post-hoc* combination of EMU / national 'stock indicators' of silver eel escapement biomass and anthropogenic mortality rates to an international total.

In 2020/2021, WKFEA (ICES, 2021b) addressed issues with the current advice, consider options for future assessment/advice and drafted a roadmap towards potential new or additional advice on fishing opportunities for the European eel to better suit the management needs. The roadmap provides detailed information on the future approach, acknowledging the complexity of the issue and the required efforts, this is, however, merely the first step in a long process which is aiming at a first benchmark in 2027; though this will largely depend on the realization (e.g. personnel, funding) of a model development project.

1.8 Data Call

The WGEEL annually collates data on eel in support of its work. A dedicated Data Call hosted by ICES, EIFAAC and GFCM and covering all natural range states of the European eel was first initiated in 2017 and is considered an effective mechanism to significantly improve the situation of data provision and use. For details see the Stock Annex.

In the 2022 Data Call, data on recruitment, fishery landings, recreational landings, aquaculture production, restocking, yellow eel abundance and silver eel escapement time-series, including biometry were requested. The call also required the provision of metadata associated with all data.

The Data Call consists of excel spreadsheets that are further incorporated in the WGEEL database using the shiny data integration tool. It first comprises time series. Recruitment series (Data Call Annex 1) include series made of glass eel (G), a mixture of glass eel and young yellow eel series (GY) and yellow eel migrant (Y) series. Yellow eel (Y) standing stock time series (as opposed to migrant (Y) time series in Data Call Annex 1) are collected in Data Call Annex 2. Silver eel annual time series are collected in Data Call Annex 3. Data Call Annexes 1, 2 and 3 collect annual numbers but also gather information about annual metrics collected for the series (group metrics like average length and weight) and individual data on biometry, contamination, parasites and pathogens.

The Data Call also collects information on commercial landings (Data Call Annex 4), recreational landings (Data Call Annex 5), and other landings (Data Call Annex 6). 'Other landings' are used to gather information about eel collection prior to their subsequent release. For instance, eel can be caught or trapped in one EMU and then released in another EMU. Since the release of those eels will be used in the national and foreseen international assessment of the stock, they are also removed from the stock in another place, and Data Call Annex 6 is the place for those eels when the collection is not covered by the commercial landings (which remains the source of most glass eel releases). Annexes 4, 5, 6 cover different stages, glass (G), yellow(Y), a mixture of yellow and silver eel (YS) and silver eel data (S).

Release (Data Call Annex 7) covers data about eel releases, the range of stages available is wider than in previous annexes and can cover G, QG (quarantined glass eel), OG (ongrown eel), GY (mixture of glass and yellow), Y (yellow), YS (yellow and silver) and S (silver). Aquaculture data are covered in Data Call Annex 8 and analysed by WGEEL because eels are first collected from the stock before going to aquaculture.

Data Call Annex 9 was not reported this year. It comprises information about biomass and mortality indicators.

Data Call Annex 10 reports data on sampling either from the DCF or other sources. The format of group and individual metrics is the same as in Data Call Annex 1 to 3 (time series) but the location of each fish collection, and information of the date (possibly rounded to year when not available) and details about the sampling scheme are provided.

1.9 Address the generic TORs from ICES, and any requests from EIFAAC or GFCM (ToR A)

a) Consider and comment on Ecosystem and Fisheries overviews where available;

A detailed review of ecosystem and fisheries overviews with a list of comments was provided in 2020, no further updates at this time.

b) For the aim of providing input for the Fisheries Overviews, consider and comment on the following for the fisheries relevant to the working group:

i) descriptions of ecosystem impacts on fisheries

See emerging threats in Chapter 4 and Chapter 5 of this year's Report

ii) descriptions of developments and recent changes to the fisheries

Since 2018, a closure of three consecutive months for eel commercial fishing has been in place at the EU level for eels above 12 cm in Union waters of ICES area, including in the Baltic Sea. This closure has been extended in 2019 to cover commercial and recreational fisheries for all eel life stages in EU marine and brackish waters in the North East Atlantic and the Mediterranean Sea and was rolled over to 2020, 2021 and 2022 (e.g. EU Council 2022a, b). Each Member State concerned needs to determine that period between 1 August and 28 February to ensure that the prohibition covers the periods of the highest migration of European eel. For the 2022/2023 fishing season, Member States had no later than 1 June 2022 to communicate the determined period to the Commission together with the supporting information justifying the chosen prohibition period.

iii) mixed fisheries considerations, and

No new information is available for eel as a bycatch in marine fisheries. And in addition in general not considered a significant issue.

iv) emerging issues of relevance for management of the fisheries;

In November 2022 ICES advised that given the uncertainties and potential harmful effects (ICES 2016), and following the precautionary approach, any catch for restocking should not be allowed.

c) Conduct an assessment on the stock(s) to be addressed in 2022 using the method (assessment, forecast or trends indicators) as described in the stock annex; - complete and document an audit of the calculations and results; and produce a **brief** report of the work carried out regarding the stock, providing summaries of the following where relevant:

i) Input data and examination of data quality; in the event of missing or inconsistent survey or catch information refer to the ACOM document for dealing with COVID-19 pandemic disruption and the linked template that formulates how deviations from the stock annex are to be reported.

See Chapter 3

ii) Where misreporting of catches is significant, provide qualitative and where possible quantitative information and describe the methods used to obtain the information;

See Annex 19

iii) For relevant stocks (i.e., all stocks with catches in the NEAFC Regulatory Area), estimate the percentage of the total catch that has been taken in the NEAFC Regulatory Area in 2021.

There is no eel fishing in the NEAFC area. NEAFC stretches from southern tip of Greenland, east to the Barents Sea and south to Portugal (from their website) but the map shows that it is only outside the national waters. There is no eel fishing in the NEAFC area.

iv) For category 3 and 4 stocks requiring new advice in 2023, implement the methods recommended by WKLIFE X (e.g. SPiCT, rfb, chr, rb rules) to replace the former 2 over 3 advice rule (2 over 5 for elasmobranchs). MSY reference points or proxies for the category 3 and 4 stocks

It is not possible to estimate MSY proxy reference points for the European eel; WGEEL considers that the establishment of an appropriate and effective framework for the advice under the principles of the precautionary approach is a matter of urgency. WKFEA has addressed the issue and provided a roadmap towards a benchmark in 2027, where reference points could be defined.

v) Evaluate spawning stock biomass, total stock biomass, fishing mortality, catches (projected landings and discards) using the method described in the stock annex;

see Chapter 3 (ICES,2021c) and ICES (2022).

1) for category 1 and 2 stocks, in addition to the other relevant model diagnostics, the recommendations and decision tree formulated by WKFORBIAS (see Annex 2 of https://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/Fisheries%20Resources%20Steering%20Group/2020/WKFORBIAS_2019.pdf) should be considered as guidance to determine whether an assessment remains sufficiently robust for providing advice.

2) If the assessment is deemed no longer suitable as basis for advice, consider whether it is possible and feasible to resolve the issue through an interbenchmark. If this is not possible, consider providing advice using an appropriate Category 2 to 5 approach.

vi) The state of the stocks against relevant reference points;

Consistent with ACOM's 2020 decision, the basis for Fpa should be Fp.05.

1) 1. Where Fp.05 for the current set of reference points is reported in the relevant benchmark report, replace the value and basis of Fpa with the information relevant for Fp.05

2) 2. Where Fp.05 for the current set of reference points is not reported in the relevant benchmark report, compute the Fp.05 that is consistent with the current set of reference points and use as Fpa. A review/audit of the computations will be organized.

3) 3. Where Fp.05 for the current set of reference points is not reported and cannot be computed, retain the existing basis for Fpa.

No reference points are defined for eel. For the time being, the 1960-1979 recruitment is considered as a likely limit reference point (R_{lim}; e.g. chapter 2 & ICES, 2021d).

vii) Catch scenarios for the year(s) beyond the terminal year of the data for the stocks for which ICES has been requested to provide advice on fishing opportunities;

Historical total landings and effort data are incomplete. In addition, there was a great heterogeneity among the time-series of landings due to inconsistencies in reporting by, and between, countries. However, there has been a considerable improvement in both data consistency and area coverage since the introduction of a standardised eel Data Call in 2017. Changes in eel management practices have also affected commercial and non-commercial/recreational fisheries and the reporting of these fisheries. Therefore, ICES does not have the information needed to provide a reliable retrospective time series of eel catch across the species' range, and as such, it is not used for the Advice. Furthermore, the understanding of the stock dynamic relationship is not sufficient to determine/estimate the level of impact that fisheries or non-fisheries anthropogenic factors (at the glass, yellow, or silver eel stage) have on the reproductive capacity of the stock. Hence, no catch scenarios can be provided.

To address issues with landings data and facilitate their use in the advice, WKFEA suggested a dedicated workshop which is planned in 2023. Also see Annex 19.

viii) Historical and analytical performance of the assessment and catch options with a succinct description of associated quality issues. For the analytical performance of category 1 and 2 age-structured assessments, report the mean Mohn's rho (assessment retrospective bias analysis) values for time series of recruitment, spawning stock biomass, and fishing mortality rate. The WG report should include a plot of this retrospective analysis. The values should be calculated in accordance with the "Guidance for completing ToR viii) of the Generic ToRs for Regional and Species Working Groups - Retrospective bias in assessment" and reported using the ICES application for this purpose.

As a category 3 stock, there is no analytical assessment of the eel stock. The performance of the current assessment has not been formally reviewed. However, the trends in recruitment indices have been validated using a different analytical approach (GEREM) (ICES, 2019). No catch options have been proposed so there is nothing to review.

d) Produce a first draft of the advice on the stocks under considerations according to ACOM guidelines.

i. In the section 'Basis for the assessment' under input data match the survey names with the relevant "SurveyCode" listed ICES survey naming convention *(restricted access)* and add the "SurveyCode" to the advice sheet.

A first draft of the advice on the European eel stock has been provided to ICES as a separate document.

e) Review progress on benchmark issues and processes of relevance to the Expert Group.

i) update the benchmark issues lists for the individual stocks in SID;

ii) review progress on benchmark issues and identify potential benchmarks to be initiated in 2023 for conclusion in 2024;

iii) determine the prioritization score for benchmarks proposed for 2023–2024;

iv) as necessary, document generic issues to be addressed by the Benchmark Oversight Group (BOG)

The European eel has not been benchmarked and this is not scheduled on the ICES calendar in the next few years. However, WKFEA proposed a roadmap towards a benchmark in 2027 and further a list of issues and potential of the collected and potentially collected data which is further explored WGEEL. An earlier benchmark for the current assessment will be explored intersessionally.

f) Prepare the data calls for the next year's update assessment;

g) Identify research needs of relevance to the work of the Expert Group.

See chapter 4 (ICES, 2021c) and ICES (2021b). In this report see chapter 4 & 5.

h) Review and update information regarding operational issues and research priorities on the Fisheries Resources Steering Group SharePoint site.

Information was updated according to WKFEA roadmap

i) If not completed in 2020, complete the audit spread sheet 'Monitor and alert for changes in ecosystem/fisheries productivity' for the new assessments and data used for the stocks. Also note in the benchmark report how productivity, species interactions, habitat and distributional changes, including those related to climate-change, could be considered in the advice.

A spreadsheet was provided in 2020

2 Stock assessment (ToR B)

This section of the report also relates to ToRs A, D & E, including examinations of data quality, and preparations for the data call next year.

The chapter presents:

- the current analysis of trends in recruitment, for both glass eel and yellow eel (dominated by recruits from the current year) and yellow eel series
- The application of a GLM to describe trends in recruitment
- Updated Trends in Fisheries and landings
- Information on Releases of eel (restocking activity and assisted migrations)
- Trends in aquaculture
- Preparation for next year's data call.

The methodology is further described in the Stock Annex (see Annex 7).

2.1 Recruitment

2.1.1 Data sources

In this section, the latest trends in glass and yellow eel recruitment are addressed. The time-series data are derived from fishery-dependent sources (i.e. catch records) and also from fishery-independent surveys across much of the geographic range of European eel. The stages are categorized as :

- glass eel (G), continental age 0 years,
- a mixture of glass eel and yellow eel dominated by recruits from the same year (GY), and
- yellow eel (Y) recruiting to continental habitats. The yellow eel series might consist of yellow eel of several ages. This is certainly the case for all series from the Baltic (mean age up to 6), some Irish sites, and sites located far upstream.

The glass eel recruitment time-series have been grouped into two geographical areas: 'continental North Sea' (NS) and 'Elsewhere Europe' (EE) (Fig. 2.1). Previous analyses by the working group (ICES, 2010, p19, Bornarel et al. (2017) have shown a different trend between the two sets. This is mostly due to a more pronounced decline of the North Sea series compared to the Elsewhere Europe area during the 1980s.

The WGEEL has collated information on recruitment from 100 time-series (Fig. 2.1). Some time-series date back to the beginning of 20th century (yellow eel, Göta Älv, Sweden) or 1920 (glass eel, Loire, France). Among those series 79 have been selected to calculate the WGEEL recruitment indices; see details on data selection and processing below. Depending on the standardization period, the number of series used can be lower and is given for each analysis.

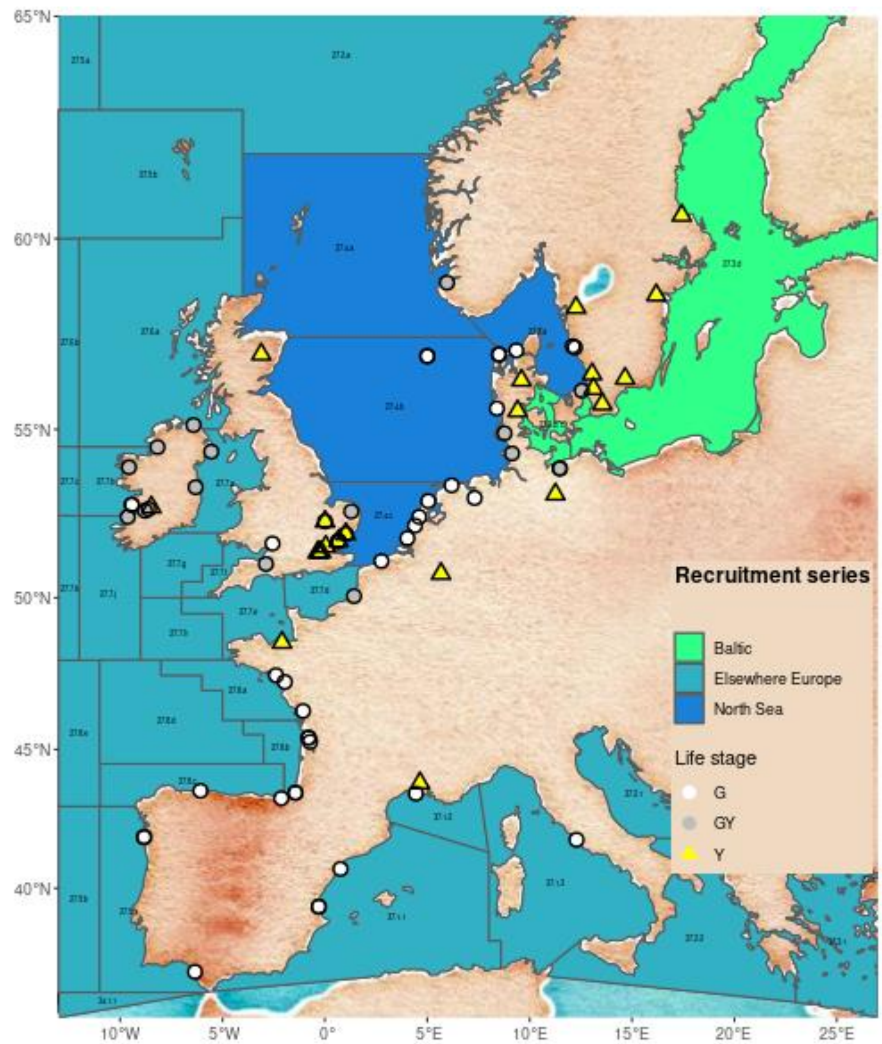


Figure 2.1. Map of recruitment sampling stations, colour according to stage (white = Glass eel (G); grey = Glass + Yellow eel (GY), yellow = Yellow eel (Y)). Full circles represent recruitment series currently used to build the GLM trend.

2.1.2 Details on data selection and processing

Three rules have been used for this selection procedure.

1. First, if there are two or more series from the same location, i.e. they are not independent, only one series is kept. For instance, the longer of two series has been kept for the Severn (Severn EA, a total of all the glass eel fisheries for England and Wales) while the second series (Severn HMRC) has been dropped from the list, as it was considered a duplicate being based on the same fishery.

2. The second rule is to exclude a series from the analysis when it is less than ten years long. The series are, however, still updated in the database until they are long enough to be included. If

there are missing years, or years excluded for data quality reasons, the data series will be included when the total number of "good" years of data meets the 10 year criterion. Within any series, individual annual data point or points can be excluded from the analysis where a one-off problem is identified which negates the value as an index for that year, such as a major reduction in effort (e.g. Covid or other effort related restriction).

3. Finally, it was decided to discard recruitment series that were obviously biased by restock- ing (e.g. Farpener Bach in Germany).

The following series have been left out due to the reasons mentioned above: SeHMG (GB), ShiFG (GB), ShiMG (GB), MiScG (PO), MondG (PO), EmsHG (DE), WaSG (DE), VeAmG (BE), EmsBGY (DE), FarpGY (DE), HHKGY (DE), HoSGY (DE), LangGY (DE), BroGY (GB), FlaGY (GB), OatGY (GB), SousGY (FR), WaSEY (DE), MeusY (BE), VeAmY (BE) and MiSpY (ES). Also see Annex 9.

12 time-series have been stopped or not updated beyond 2016 (12 for glass eel, 0 for glass eel + yellow eel and 0 for yellow eel) but are still included in the analysis (Annex 9, Table 1). Some have stopped reporting either because of a lack of recruits in the case of the fishery-based surveys (Ems in Germany, stopped in 2001; Vidaa in Denmark, stopped in 1990), a lack of financial support (the Tiber in Italy, 2006) or the introduction of quota from 2008 to 2011 that has disrupted the five fishery-based French time-series. The two English series (FlaE and BeeG) are still operating but data have not been updated since 2016.

In 2022 the Rhone (RhoY) yellow recruitment series was added to the recruitment trend analysis. This series is 14 years long and in the Mediterranean area where we currently have few series. In addition, InagG (Ireland) was added and replaces the InagGY for the years 2016-2022. This is not really a new series, but two series for the same site, with stages shifting in 2016 from GY to G. Data have been provided for year 2022 for for 51 recruitment series (26 for glass eel, 14 for glass + yellow eel and 11 for yellow eel). Although some of the reported series have reached the required condition of a minimum length of 10 years, they have not been incorporated because they did not have 10 years of data identified as good quality by the data providers.

Among the time-series based on trap indices, some have reported preliminary data for 2022 as their trapping season had not finished. As usual, the indices given for 2022 must be considered as provisional, especially those for the yellow eel.

2.1.3 Number of series available

The WGEEL has collated information on recruitment from 100 time-series (Table 2.1). Among those series, 79 have been selected for further analysis. For the calculation of the glass eel recruitment index, 57 series have been retained (37 glass eel series and 20 glass and yellow eel mixed series). For the calculation of the yellow eel recruitment index, 22 yellow eel series have been retained, most of the retained yellow eel series (18) coming from the North Sea region (Table 2.1, Fig. 2.2).

Table 2.1: Summary of the number of series that have been received (2022 Data Call) and incorporated (kept) for the determination of the recruitment index by area and stage. Elsewhere Europe (EE) and North Sea (NS). Life stage: GY = glass eel and yellow eel, G = glass eel, Y = yellow eel.

Life-Stage	Area	Submitted	Kept
G	EE	26	20
	NS	20	17
	Total	**46**	**37**
GY	EE	13	11
	NS	16	9
	Total	**29**	**20**
Y	EE	4	3
	NS	21	19
	Total	**25**	**22**
Total		**100**	**79**

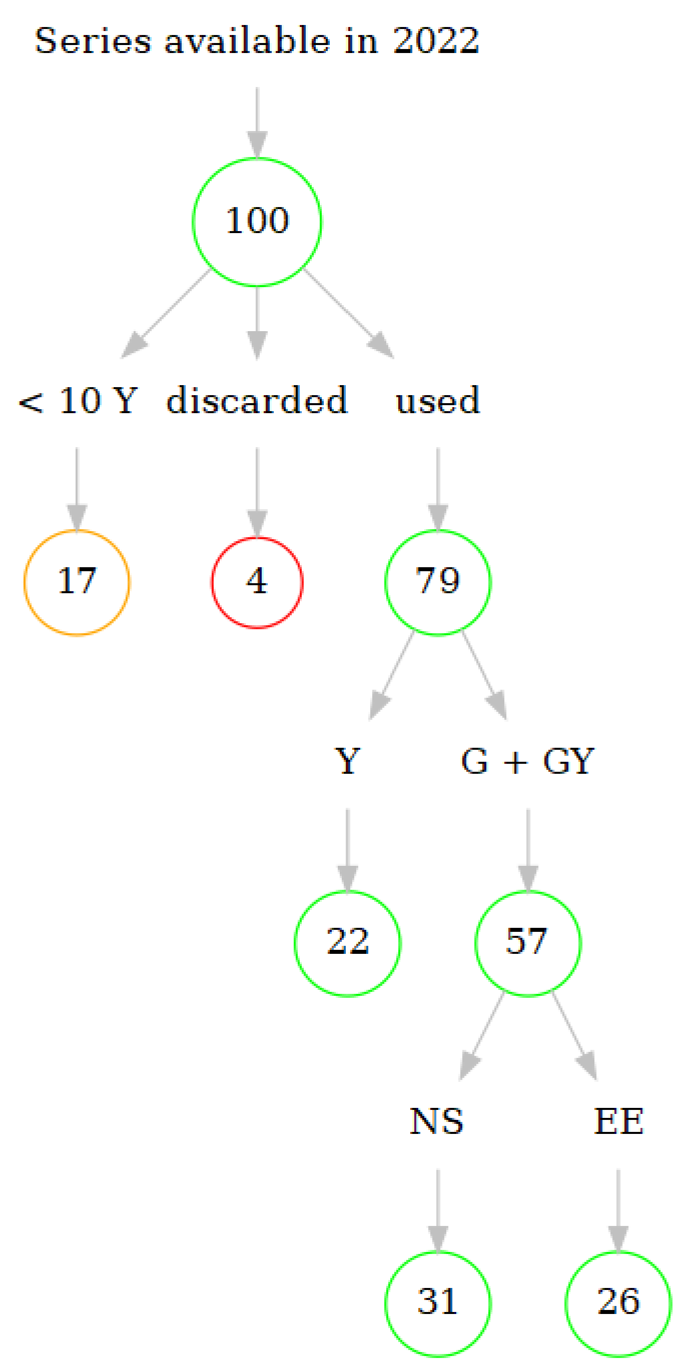


Figure 2.2. Schematic showing the recruitment series available by type and region, and numbers selected for analysis. Y = Yellow eel, G = Glass eel, GY = mixed Glass and yellow eel. NS = North Sea (including Baltic) EE = Elsewhere Europe regions (See Figure 3.1 above)

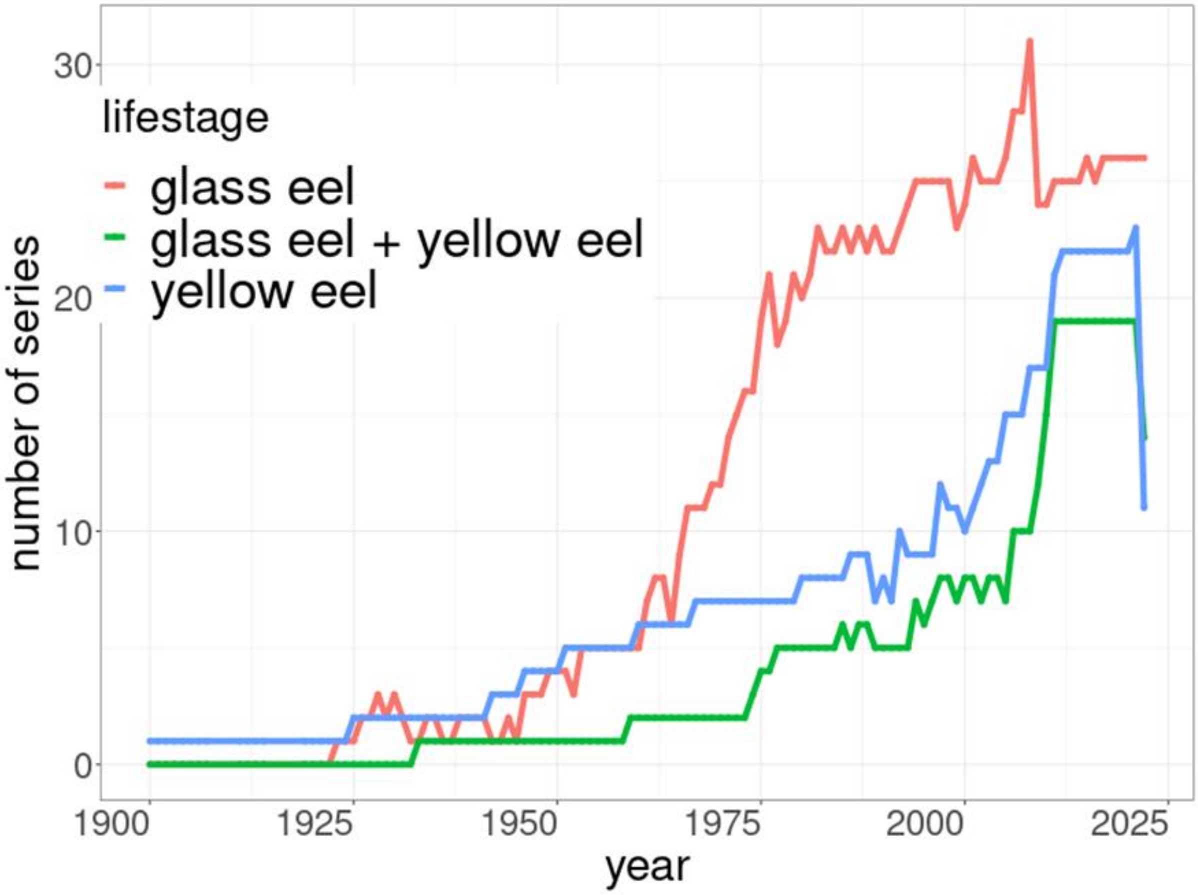


Figure 2.3. Temporal trends in the number of series that have been kept to perform the recruitment analysis per stage. Note that the number of 2022 series is not final as the year has not yet ended and there are still series to be reported.

The number of time series available between regions and life stages is not an even distribution, influenced by factors including variation in the behaviour of eel, traditions of fishery and usage of eel, and the history of scientific investigation and eel management (Figure 2.3 & 2.4). Thus, most of the glass eel series come from the Atlantic while the yellow eel series come from the Baltic and the North Sea.

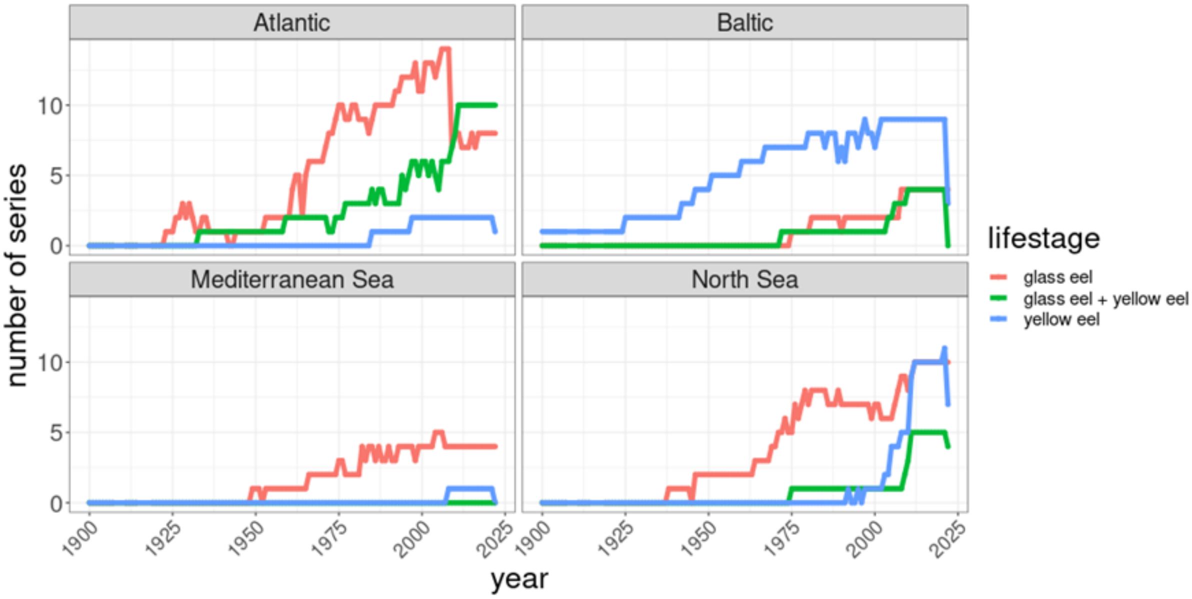


Figure 2.4. Temporal trends in the number of series that have been kept to perform the recruitment analysis per stage and area. Note that the number of 2022 series is not final as the year has not yet ended and there are still series to be reported.

2.1.4 GLM based trend

The WGEEL recruitment index used in the ICES Annual Stock Advice is fitted using a GLM with a Gamma distribution and a log link: *glass eel* ~ *year* : *area* + *site*, where:

- *glass eel* is the individual glass eel time-series, including both pure G series and those identified as a mixture of glass and yellow eel (GY),
- *Site* is the site monitored for recruitment,
- *Area* is either the continental 'North Sea' (NS) or 'Elsewhere Europe' (EE), and
- *Year* is the year coded as a categorical value.

For yellow eel time-series, only one estimate is provided: *yellow eel* ~ *year* + *site*.

The trend is hindcast using the predictions from 1960 onwards for 57 glass eel time-series and from 1950 onwards for 22 yellow eel time-series. Some zero values have been excluded from the GLM analysis: 20 for the glass eel model and 39 for the yellow eel model. This treatment has been tested and has no effect on the trend (ICES, 2017).

The reconstructed values are then aggregated using geometric means of the two reference areas (Elsewhere Europe EE, and North Sea NS). The predictions are given in reference to the geometric mean of the 1960-1979 period.

As for previous working groups, data call and meeting timing means that some data series on glass and yellow eel recruitment are not complete for this year at the date of submission to WGEEL. Therefore, each year the recruitment index is updated when the complete data from the previous year is available. Thus, in the case of the glass eel series, the recruitment of 2021 has been recalculated from 5.4% to 5.5% in the Elsewhere Europe series (Table 2.2). For the North Sea, recruitment for 2021 remains at 0.6 %

Analyses of provisional 2022 data show recruitment as a percentage of 1960-1979 levels at 0.5 % (North Sea) and 9.7 % (elsewhere Europe). (Figure 2.5; Table 2.2).

The increase in recruitment for the Elsewhere Europe region in 2022 compared to 2021 is largely due to the increase in the Irish series and was not observed in the Bay of Biscay (Annex 14, Fig.6) where a large proportion of recruitment occurs (Dekker, 2000, Bornarel et al., 2017). It's worth noting in this regard that the GEREM model (Annex 14), incorporating more refined spatial structure, estimates absolute recruitment for the whole range to have a less pronounced increase in 2022 (2021: 3.6%; 2022: 4%) than that of the WGEEL index for Elsewhere Europe region only (2021: 5.5%, 2022: 9.7%).

Table 2.2. Annual WGEEL recruitment index for the continental North Sea and Elsewhere Europe. The index was estimated using a GLM (glasseel ~ area : year + site) fitted on 56 time-series comprising either pure glass eel or a mixture of glass eels and yellow eels.

	1960		1970		1980		1990		2000		2010		2020	
	EE	NS	EE	NS	EE	NS	EE	NS	EE	NS	EE	NS	EE	NS
0	153	208	102	96	113	84	35	14	19.1	4.3	4.7	0.7	7.1	0.8
1	131	117	55	84	88	61	17	3	8.4	0.9	3.7	0.4	5.5	0.6
2	151	178	50	108	91	31	22	7	13.0	2.3	5.0	0.5	9.7	0.5
3	195	223	55	46	49	26	24	6	12.7	1.7	7.0	1.6		
4	121	116	83	129	54	10	24	6	7.2	0.6	12.0	2.3		
5	135	77	71	53	52	8	31	4	7.8	1.0	7.4	0.8		
6	76	87	116	97	34	8	25	5	5.7	0.5	11.3	1.6		
7	81	95	114	78	58	10	41	4	6.4	1.1	12.3	1.1		
8	129	122	109	60	69	9	16	3	5.7	1.1	9.9	1.6		
9	67	88	144	103	45	4	20	5	4.3	0.8	6.1	1.3		

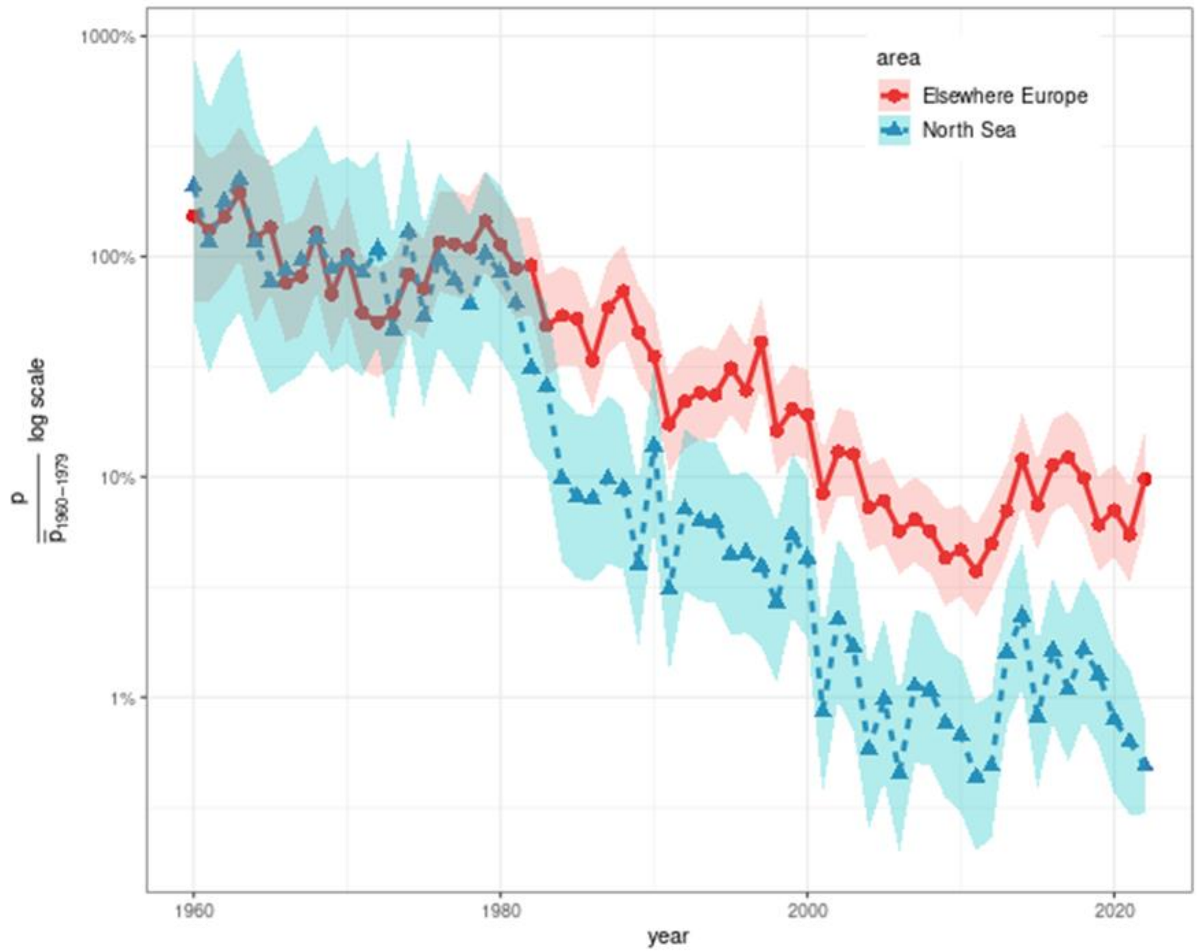


Figure 2.5. WGEEL glass eel recruitment index for the continental North Sea and Elsewhere Europe series with 95 % confidence intervals updated to 2022. The index was estimated using a GLM (*glasseel* ~ *area* : *year* + *site*) fitted on 57 time-series comprising either pure glass eel or a mixture of glass eels and yellow eels. Note the logarithmic scale on the y-axis. Number of series Elsewhere Europe = 31, North Sea = 26.

For yellow eel series, the autumn ascent has not been recorded yet and most of the series have only reported data till the middle of the summer. The 2022 yellow eel index is at 19.5 % of the 1960-1979 baseline (Fig. 2.6).

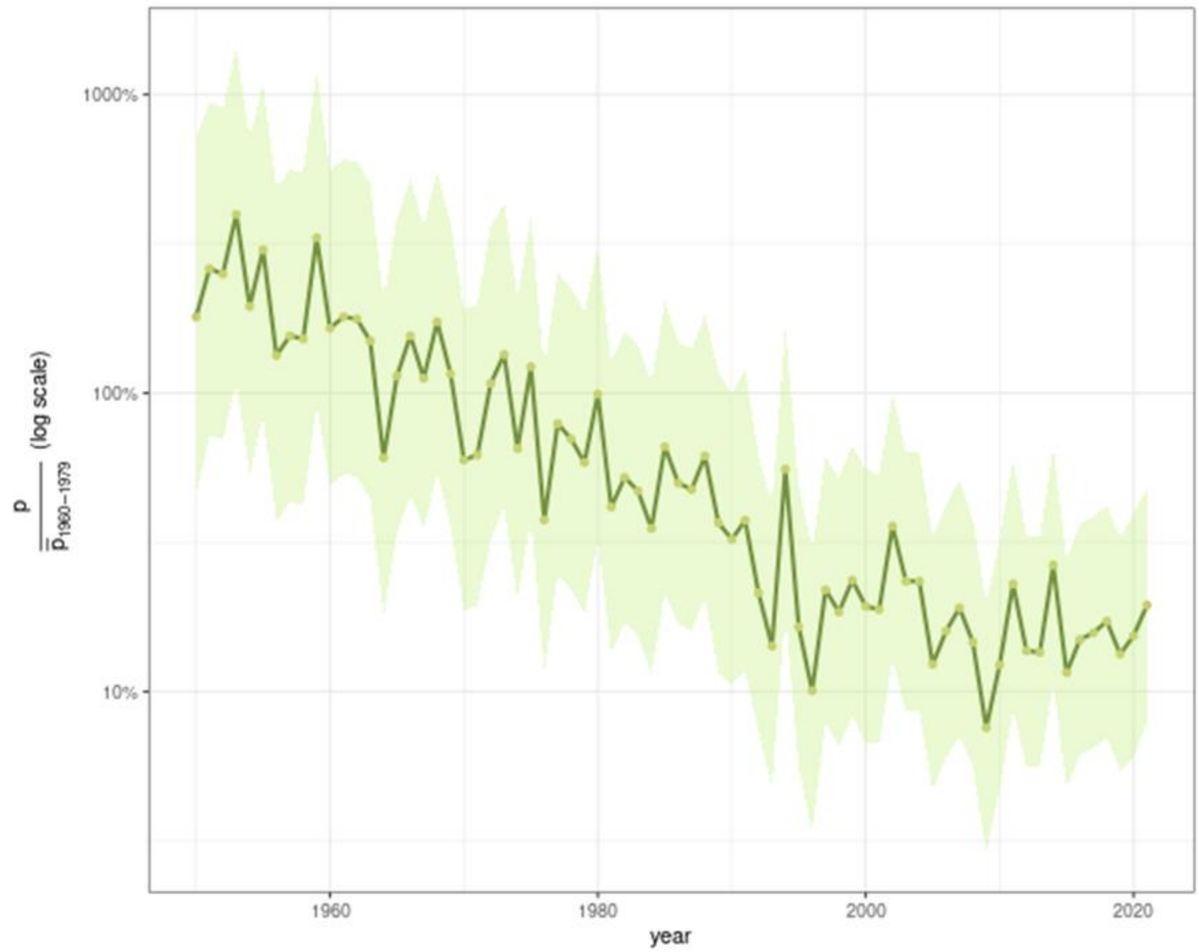


Figure 2.6. Geometric mean of of estimated yellow eel recruitment for Europe updated to 2021. The yellow recruitment was estimated using a GLM (*yelloweel ~ year*) fitted to 22 yellow eel time-series *p* scaled to the 1960-1979 average $p_{1960-1979}$. Note the logarithmic scale on the y-axis.

Table 2.3. Annual geometric mean of estimated yellow eel recruitment for Europe updated to 2021. The yellow recruitment was estimated using a GLM (*yelloweel ~ year)* fitted to 22 yellow eel time-series *p* and scaled to the 1960-1979 average $p_{1960-1979}$.

	1950	1960	1970	1980	1990	2000	2010	2020
0	180	165	60	99	32	19	12	15
1	261	180	62	42	37	19	23	19
2	251	177	108	52	21	36	14	
3	397	150	135	47	14	23	14	
4	195	61	65	35	56	23	27	

	1950	1960	1970	1980	1990	2000	2010	2020
5	302	114	123	66	16	12	12	
6	134	156	38	50	10	16	15	
7	155	112	79	48	22	19	16	
8	152	173	70	62	18	15	17	
9	331	116	59	37	24	8	13	

The yellow series comprise all series in Europe, with 5 series coming from the Baltic but also 17 sites outside from the Baltic. The Baltic does not provide glass eel series, so the recruitment estimates in the Baltic are calculated using yellow eel series only. Thus, it was decided to test the effect of separating Baltic yellow series from the other yellow series and provide estimates for Baltic- and non-Baltic yellow eel recruitment series (Fig.2.7, Table 2.4). This effect tested this year is not significant, which means that the yellow eel trends are not different between the Baltic and non-Baltic sites.

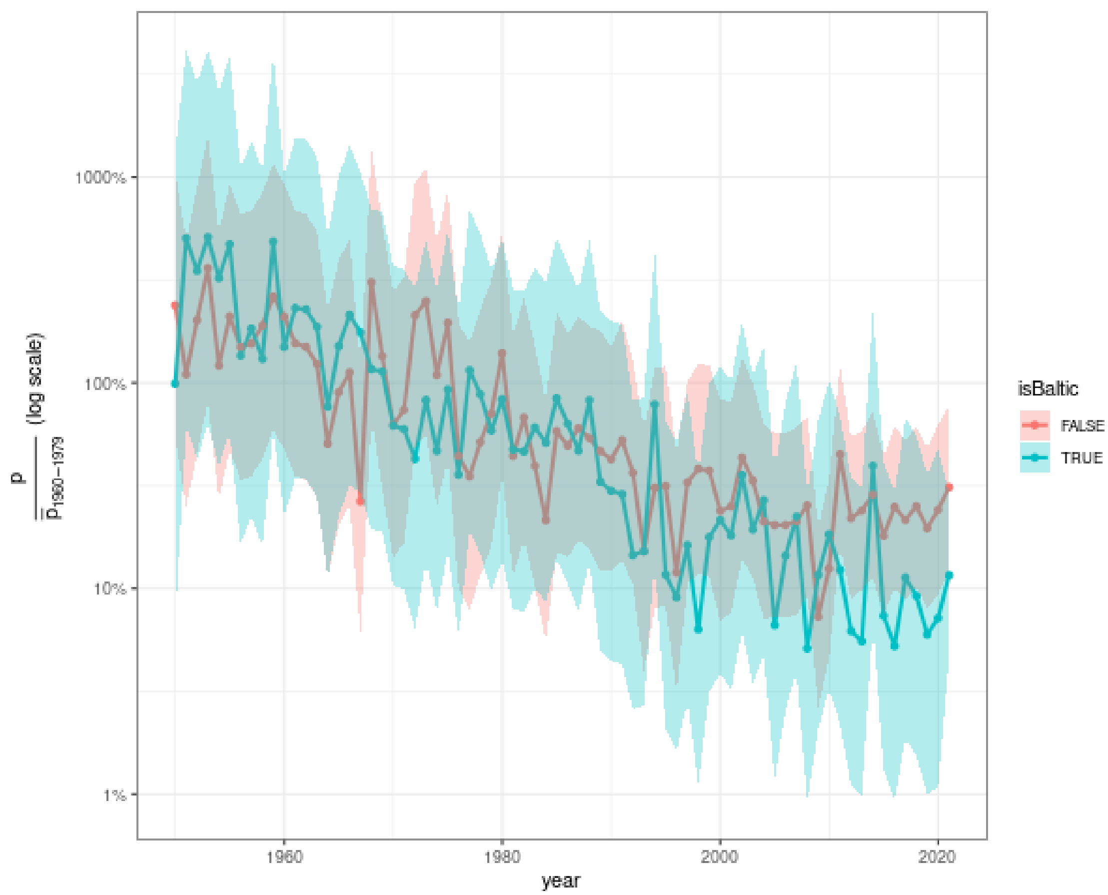


Figure 2.7. Geometric mean of of estimated yellow eel recruitment for Europe updated to 2021. The yellow recruitment was estimated using a GLM (yelloweel ~ year:area) fitted to 22 yellow eel time-series p scaled to the 1960-1979 average p1960–1979. True: Baltic area, False: Elsewhere Europe. Note the logarithmic scale on the y-axis.

T Table 2.4. Annual geometric mean of estimated yellow eel recruitment for Europe updated to 2021. The yellow recruitment was estimated using a GLM (*yelloweel ~ year:area)* fitted to 22 yellow eel time-series *p* and scaled to the 1960-1979 average $p_{1960–1979}$.

	1950		1960		1970		1980		1990		2000		2010		2020	
Year in decade	Out-side	Bal-tic	Out-side	Bal-tic	Out-side	Bal-tic	Out-side	Bal-tic	Out-side	Bal-tic	Out-side	Bal-tic	Out-side	Bal-tic	Out-side	Bal-tic
0	238	99	209	150	62	62	140	83	43	30	24	22	13	18	24	7
1	110	505	156	231	74	59	44	47	53	29	25	18	45	12	31	12
2	202	350	149	227	213	43	68	46	37	15	43	36	22	6		
3	362	513	123	187	249	82	40	61	15	15	34	19	24	6		
4	121	323	51	77	109	47	21	51	31	79	21	27	29	40		
5	210	472	90	151	196	93	58	84	32	12	20	7	18	7		
6	149	135	112	214	44	36	49	63	12	9	20	14	25	5		
7	156	184	27	175	35	115	60	47	33	16	21	22	22	11		
8	190	131	309	116	52	88	54	82	38	6	25	5	25	9		
9	263	486	135	113	71	59	47	33	37	18	7	12	20	6		a

Conclusion

After high levels in the late 1970s, the recruitment declined dramatically in the 1980s and remains low . WGEEL 2022 analysis records an annual recruitment data point for 2021 among the lowest on record. Recruitment remains low at 0.5% (North Sea) and 9.7 % (Elsewhere Europe) of pre-1980s levels.

2.2 Trend in fisheries

This section presents and describes data from commercial and recreational fisheries.. Data can be reported by eel life stage (glass, yellow, silver), habitat type (freshwater, transitional, marine) and by eel management unit (EMU) where possible. Historical series for which these details are not available are reported by country. The landings data presented are those reported to the WGEEL, either through responses to the 2022 data call, or integrated in previous WGEEL data calls.

2.2.1 Commercial fisheries landings

Landings data come from the Eel data call and the WGEEL database data for commercial fisheries. When data are absent and presumed missing for a country/year, a predicted catch is used. This "correction" is based on a simple GLM extrapolation of the log-transformed landings (after Dekker, 2003), with year and countries as the explanatory factors. This is applied as one means to account for non-reporting, but it is not a complete solution.

2.2.1.1 Glass eel

Figure 2.7 presents the time-series up to and including 2022 for total commercial glass eel landings as reported by four countries in the Eel data call.

Figure 2.8 presents the same time-series but corrected for missing data (see above), with an inset box showing the proportion of data corrected per year. This proportion is rather low, except for 2009. Glass eel landings show a sharp decline since 1980 from 2,000 tonnes to around 40–60 tonnes since 2009 onwards (Annex 13). The commercial glass eel fishery in 2021 was 51.63 t and raised to 59.48 t in 2022. Data relates to four countries (GB, FR, PT, ES). The mean glass eel commercial fisheries landings for the previous five years (2016–2020) was reported as 59.9t.

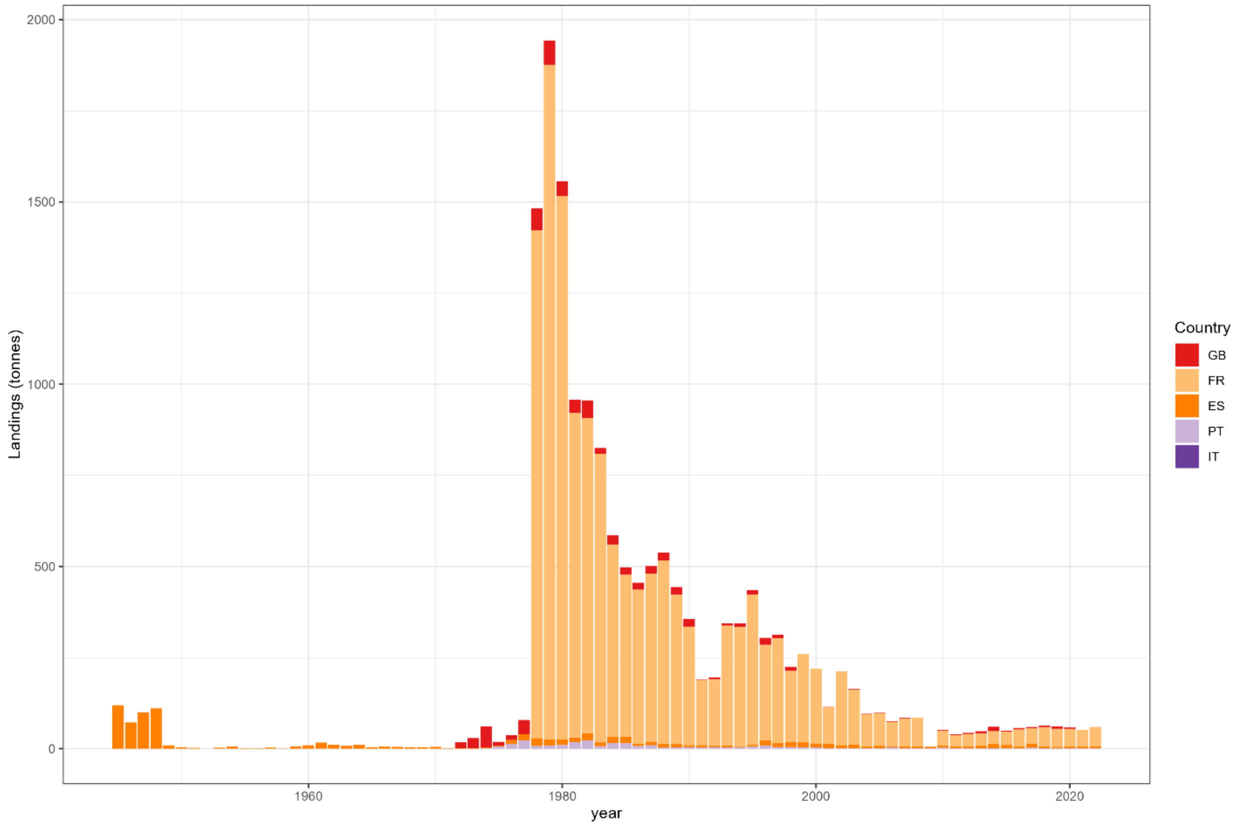


Figure 2.7. Time-series of reported commercial glass eel fishery landings (tonnes), 1945-2022, by country. United Kingdom (GB), France (FR), Spain (ES), Portugal (PT) and Italy (IT) are included, combining information from the data call 2022 and the WGEEL database. For further detail see Annex 13.

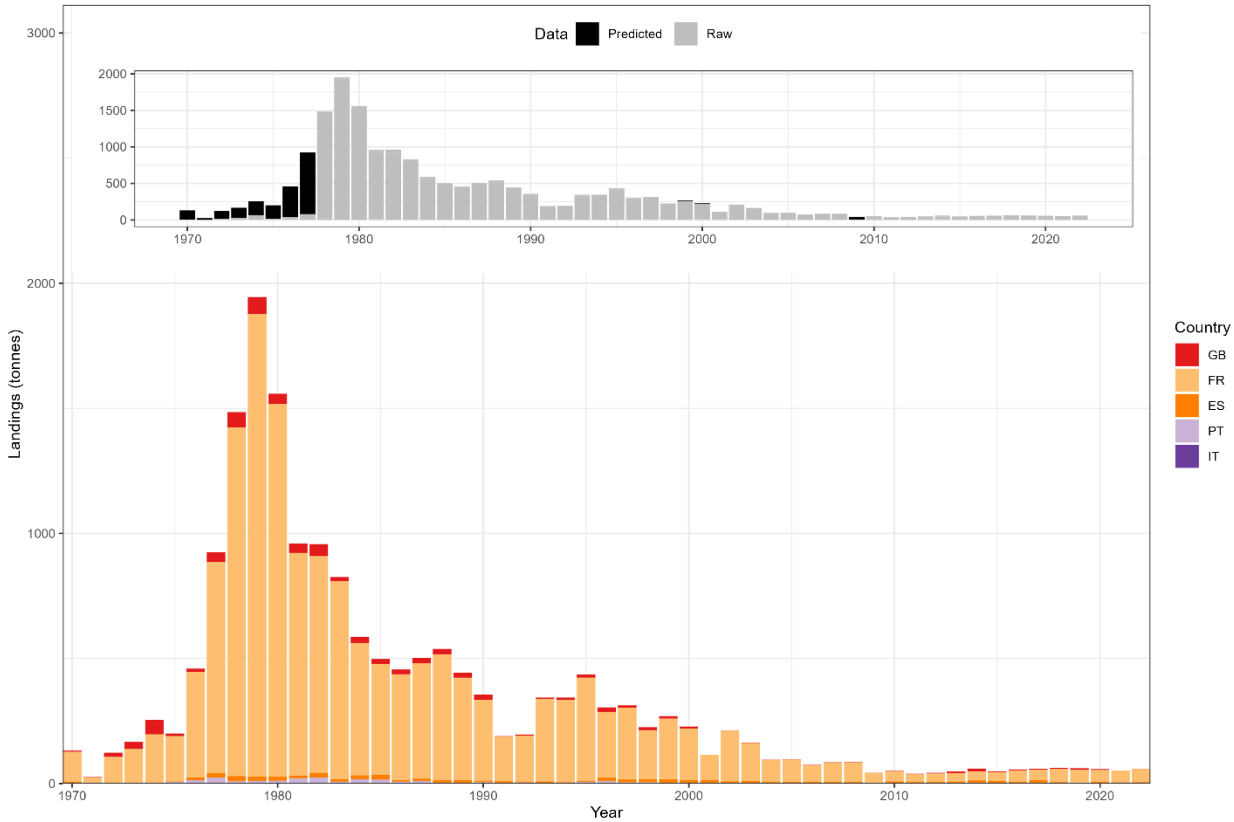


Figure 2.8. Time-series of reported or reconstructed commercial glass eel fishery landings (tonnes), 1970-2022, by country. United Kingdom (GB), France (FR), Spain (ES), Portugal (PT) and Italy (IT) combining information from the data call 2022 and the WGEEL database, and a reconstruction of the non-reported countries/years combinations (see text). The inset box shows the proportion of data reconstructed per year.

Exploitation Rates

By dividing the declared landings of glass eel by the WGEEL recruitment indexes, we can derive a relative indicator of exploitation rate that can inform on trends in glass eel fishing mortality. The analysis is restricted to Elsewhere Europe since no commercial fisheries have operated in the North Sea area in recent years, and, we restricted the analysis to the post 2000 period since recent ICES data calls have focused on this period. While some landings data are still missing, the diagram suggests that the exploitation rate for glass has decreased after the implementation of the Eel Regulation in 2009 (year 2009 was removed since France, which accounts for a significant part of the landings, has not reported data for that year) and reached its lowest level from 2014 to 2017. Since 2017, the exploitation rate risen again slightly re-increased though not reaching pre Eel Regulation levels. This type of analysis reinforces the need for a workshop on landings in order to reconstruct time series of landings and to explore how landings can be used can be used in the advice on fishing opportunities. This exercise is currently only feasible for glass eel recruitment: while landings data are available for other life-history stages, we are still missing abundance comprehensive indices of yellow eel standing stock and of silver eel abundance (see chapter 3).

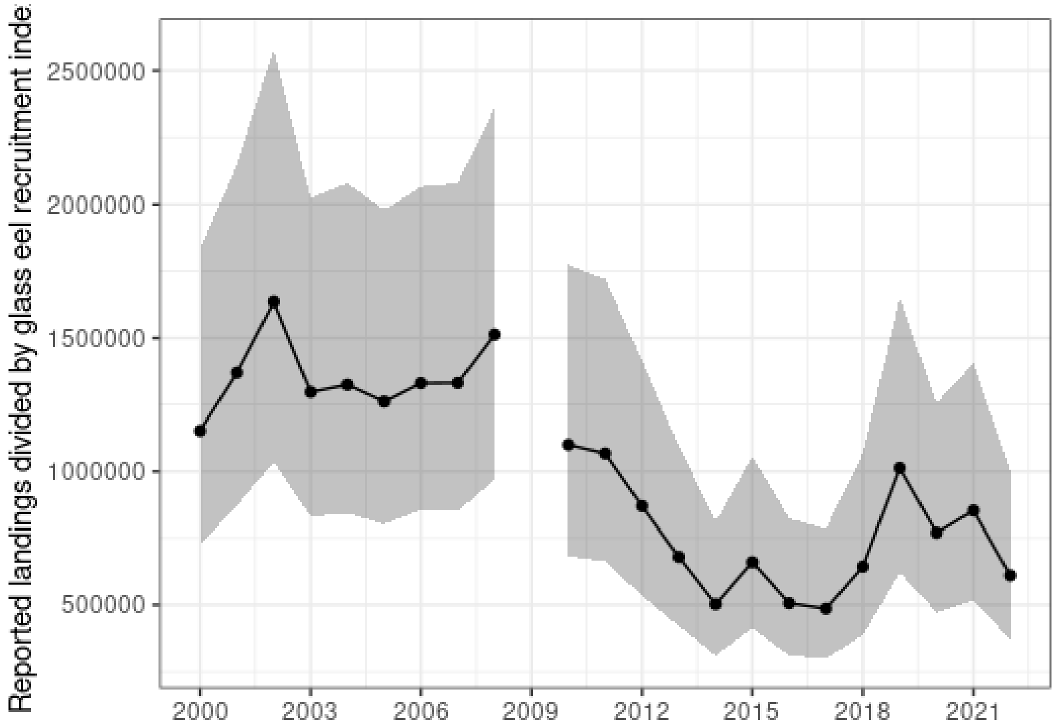


Figure 12: Reported G and GY commerical landings divided by recruitment index for EE (including landings reported in EMUs ES_Astu, ES_Cant, ES_Cata, ES_Minh, ES_Mino, ES_Vale, FR_Adou, FR_Arto, FR_Bret, FR_Garo, FR_Loir, FR_Sein, FR_total, GB_Dee, GB_NorW, GB_Seve, GB_SouE, GB_SouW, GB_total, GB_Wale, IT_Lazi, IT_Tosc, IT_Vene. The resulting ratio is a relative proxy for the exploitation rate, which informs on trends in fishing mortality. The graph is restricted to the post Eel Regulation period since landings data are thought to be of better quality since then. Note that 2000 landings data are not available for GB. Year 2009 was removed since France, which accounts for a significant part of the landings, did not report data for that year.

2.2.1.2 Yellow and silver eel

Figure 2.9 presents data for yellow and silver eels aggregated coming from 25 countries and Figure 2.10 presents the time-series including reconstructed data to fill the gaps (Annex 13). The proportion of "corrected" landings was as high as 50% in the 1950s, but rather low since the mid-1980s. Annex 13 presents the raw and corrected data for yellow and silver eel landings data. The total landings (including reconstructed) of yellow and silver eels decreased from 18000–20000 t in the 1950s to 2000–3500 t since 2009. Reported landings from yellow and silver eel commercial fisheries (Y, S, YS) add up to 2144 t in 2020 and 2201 t in 2021. Yellow and silver eel commercial fisheries averaged 2718 t over the five previous years (2015–2019).

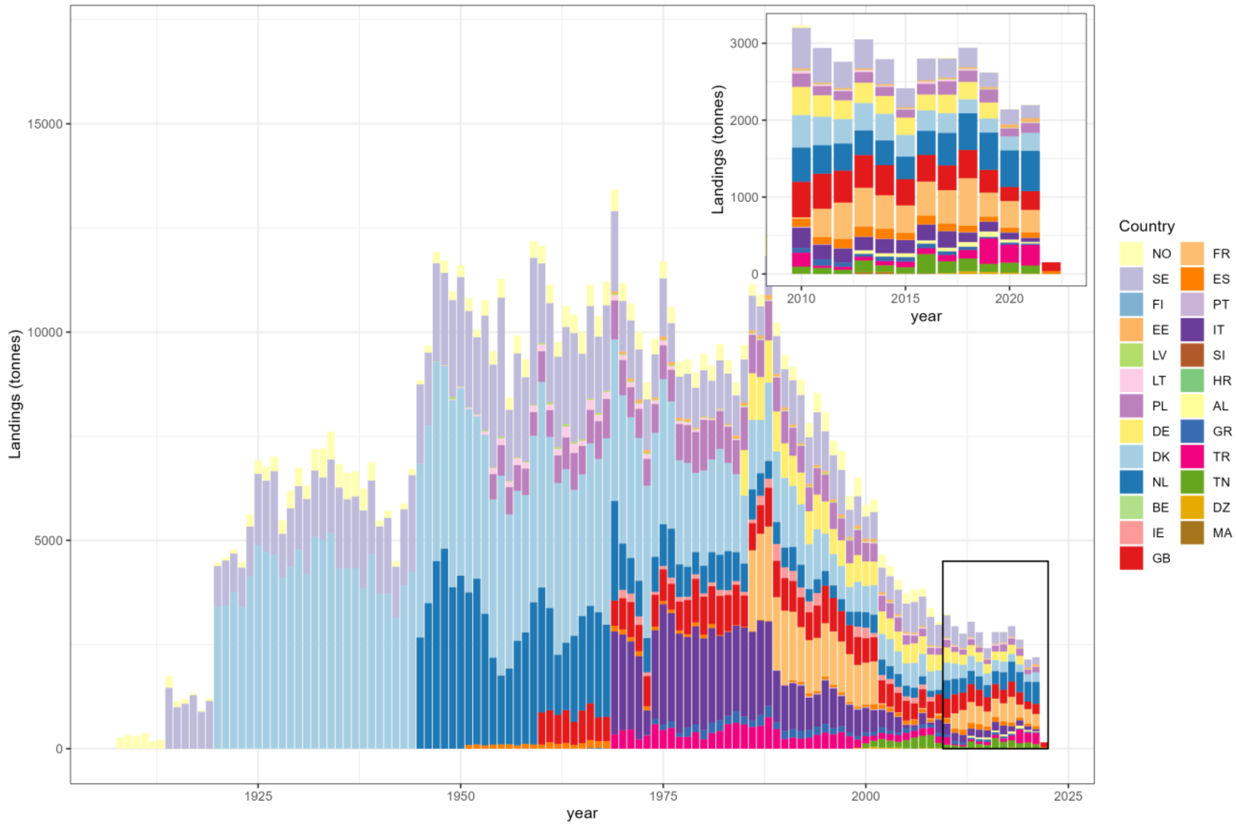


Figure 2.9. Time-series of reported commercial yellow (Y), silver (S) and yellow-silver (YS) eel fishery landings (tonnes), 1908-2022, by country, Norway (NO), Sweden (SE), Finland (FI), Estonia (EE), Latvia (LV), Lithuania (LT), Poland (PL), Germany (DE), Denmark (DK), Netherlands (NL), Belgium (BE), Ireland (IE), United Kingdom (GB), France (FR), Spain (ES), Portugal (PT), Italy (IT), Slovenia (SI), Croatia (HR), Albania (AL), Greece (GR), Turkey (TR), Tunisia (TN), Algeria (DZ) and Morocco (MA) combining information from the data call and the WGEEL database. Inset shows recent years at greater resolution.

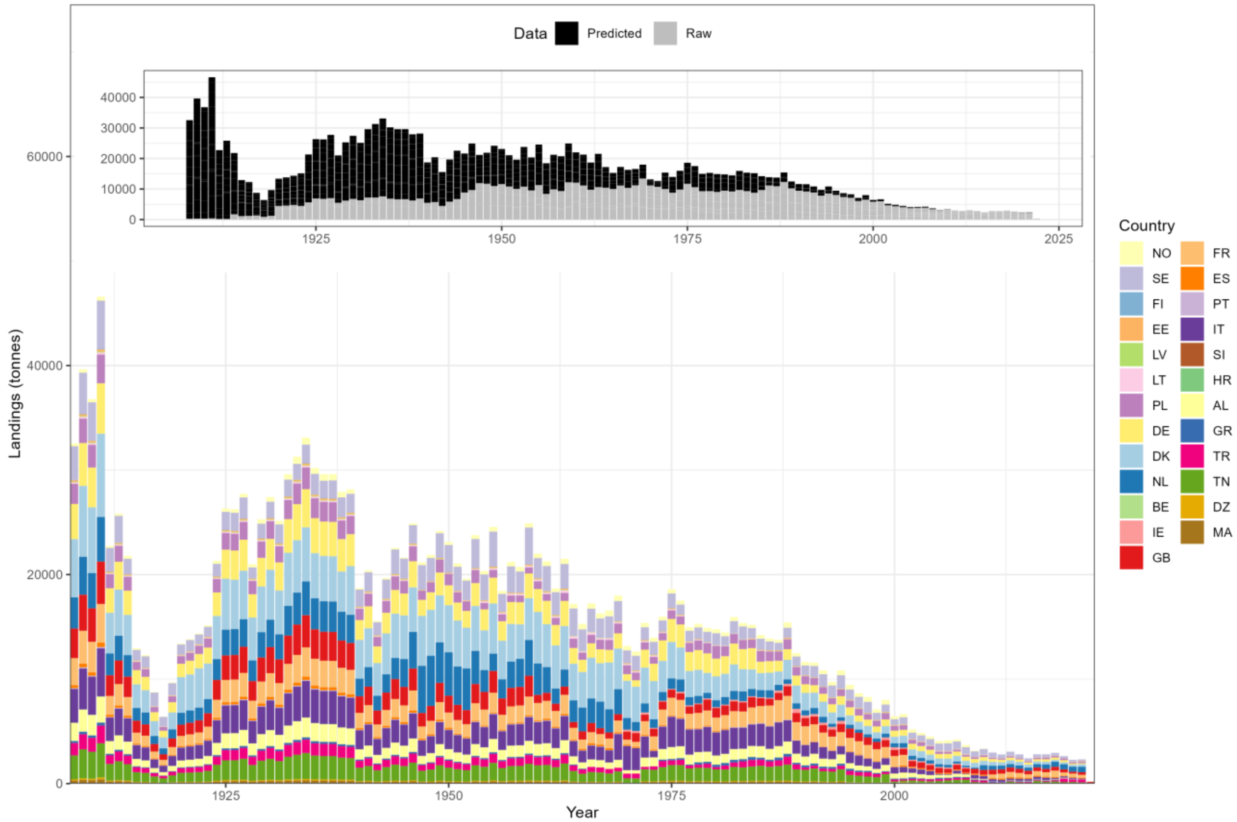


Figure 2.10. Time-series of reported or reconstructed commercial yellow and silver eel fishery landings (tonnes), 1908-2022, by country, Norway (NO), Sweden (SE), Finland (FI), Estonia (EE), Latvia (LV), Lithuania (LT), Poland (PL), Germany (DE), Denmark (DK), Netherlands (NL), Belgium (BE), Ireland (IE), United Kingdom (GB), France (FR), Spain (ES), Portugal (PT), Italy (IT), Slovenia (SI), Croatia (HR), Albania (AL), Greece (GR), Turkey (TR), Tunisia (TN), Algeria (DZ) and Morocco (MA) combining information from the data call, the WGEEL database and a reconstruction of the non-reported countries/years combinations. Inset box shows the proportion of reconstructed landings, per year.

2.2.2 Recreational fisheries landings

Recreational and non-commercial fishing is the capture or attempted capture of living aquatic resources mainly for leisure and/or personal consumption. Recreational and non-commercial fishery covers active fishing methods including rod and line, spear, and hand–gathering and passive fishing methods including nets, traps, pots, and setlines. In some countries, recreational angling for yellow and silver eel is popular, while in others passive gear, such as fyke nets, may be used to catch eel for personal consumption (e.g. Denmark). In other countries (e.g. UK, Portugal, Sweden), this is forbidden and all accidently caught eels must be returned alive. Recreational fisheries for glass eel continue to exist in Spain, while the former recreational glass eel fisheries in France were forbidden in 2010.

Figure 2.11 presents the data available to the WGEEL on recreational landings for glass eel from two countries: Spain and France. Spain is the only country allowing a recreational catch of glass eel, with landings estimated as 0.72t for 2022 (Annex 13). The mean glass eel recreational fisheries of the previous five years (2016 - 2020) was 1.298 t.

Figure 2.12 presents the data available on recreational landings of yellow and silver eel combined (Annex 13). Recreational landings for yellow and silver eel combined were 297.4 t for 2020 (11 countries reporting) and 200 t for 2021 (8 countries reported). FR has provided estimation for all freshwater recreational fisheries in 2006, while for other years FR provided declared catch by recreational fishers with gear in public rivers. The available data have been considered by the WGEEL jointly with the other series in Europe. The mean yellow and silver eel recreational fisheries for the previous five years (2015–2019) was 535.836 t.

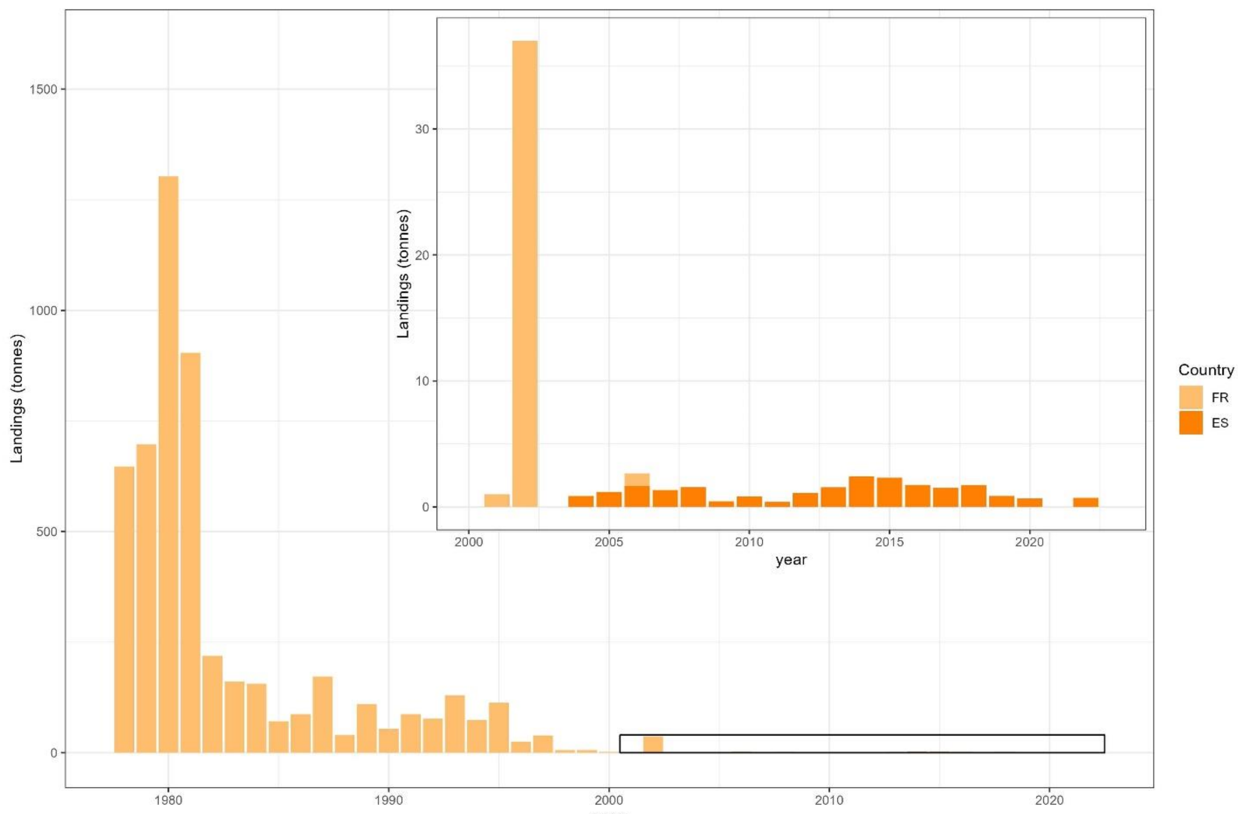


Figure 2.11. Time-series of reported recreational glass eel fishery landings (tonnes), 1978-2022, by country France (FR) and Spain (ES) combining information from the data call and the WGEEL database. Inset shows years since 2000 at greater resolution. Data for recent years are provisional or incomplete and may change in future data calls. For more details, see Annex 13.

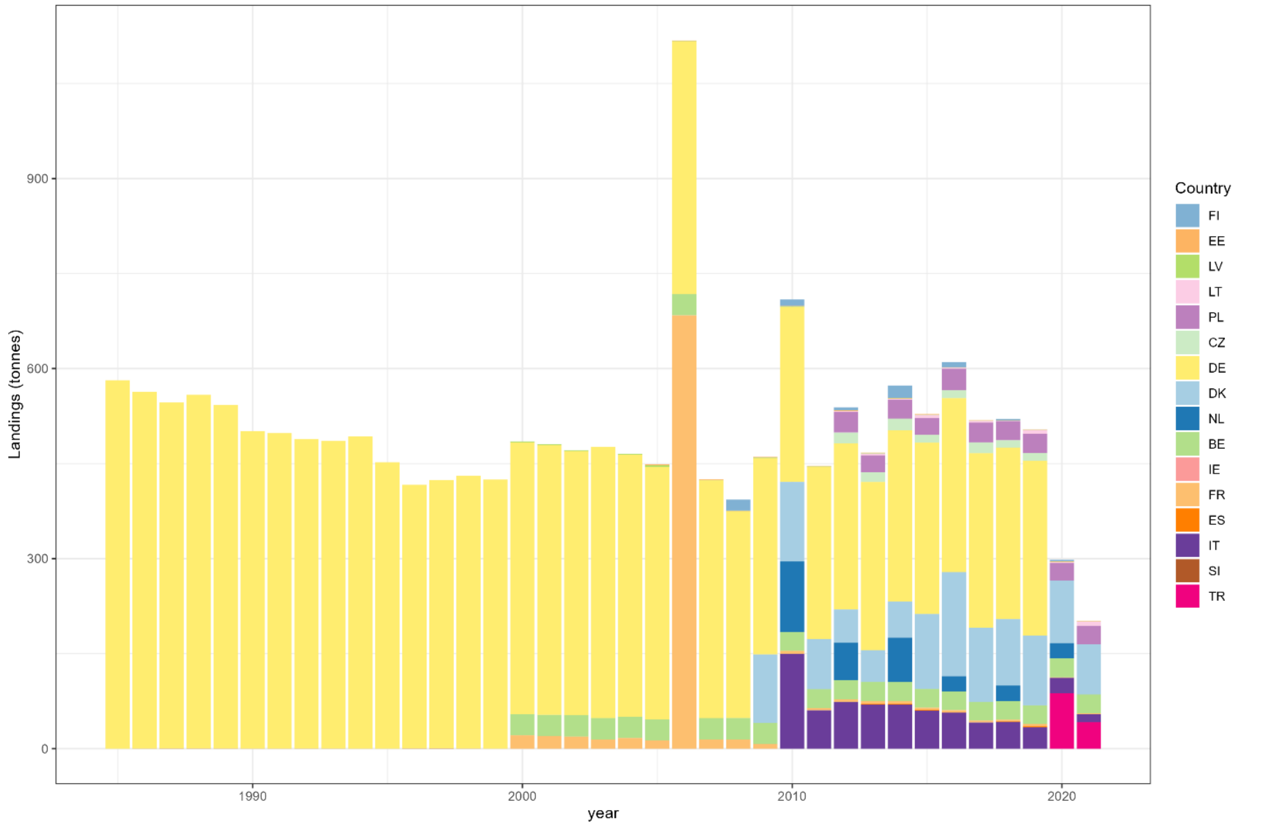


Figure 2.12. Time-series of reported recreational yellow and silver eel fishery landings (tonnes), 1985-2021, by country, Finland (FI), Estonia (EE), Latvia (LV), Lithuania (LT), Poland (PL), Germany (DE), Denmark (DK), Netherlands (NL), Belgium (BE), France (FR), Spain (ES), Italy (IT), Slovenia (SI) and Turkey (TR) combining information from the data call. Note, in 2006 FR has provided estimation for all freshwater recreational fisheries, while for other years FR provides declared catch by recreational fishers with gear in public rivers. Reporting is not considered complete in recent years and particularly before 2000 where DE is the only country reporting landings estimates (extrapolation based on regional studies and number of licenses). For more details, see Annex 13.

2.2.3 Illegal, unreported and unregulated landings

Illegal, unreported, and unregulated fishing (IUU) is by its nature very difficult to quantify, and misreporting may therefore be substantial. Organised illegal glass eel trade is supplied by legally caught and IUU caught eel. This trade is considered high priority by Europol (the European Union's law enforcement agency) among environmental crimes, due to its economic significance, the poor status of the eel stock, and the large number of organisms affected. Related police action and court decisions have been covered by many news reports during recent years. In addition, illegal eel trade from range states is an issue of concern for CITES (CITES, 2022b). To summarize, while IUU fisheries certainly exist for glass, yellow and silver eel, there are insufficient data available to quantify their effect on the total stock size or status with any level of certainty.

2.3 Releases

Data have been reported on restocking comprising eels released at the glass eel phase, either directly (G), or after a quarantine (QG), after a period of some months of growth in aquaculture (OG), at the yellow eel (Y) or silver eel (S) stage or mixed life stages: Glass + Yellow eel (G+Y) and Yellow + Silver eel (Y+S). There is also a spatial element that complicates matters, ranging from the capture and movement of eel only a few metres within the same waterbody to bypass an obstacle (assisted migration), to eel being moved between waterbodies and/or EMUs.

As there is still some inconsistency or variation in the way that countries report some of these actions, the WGEEL broadly categorizes them as "releases", though the term "restocking" is still used here for some circumstances. However, in future, releases related to assisted migration helping eels to bypass an obstacle should be clearly separated from releases for restocking purposes.

Data on the amount of restocked eel were obtained from the responses to the data call in 2022; however, the data for 2022 for restocking are incomplete due to the delayed data availability.

The data call requires the provision of both numbers and weights per EMU to evaluate the average weight of each line of data entered. As the database is not structured to handle two different columns for quantities, the initial checks on the consistency are done during data integration.

The restocking of glass eel peaked in the 1980s followed by a steep decline to a low level in 2009 (Figure 2.13 & 2.14; Annex 13). Even though not all countries reported data for the whole period the trend is consistent with the findings of Dekker and Beaulaton (2016). The amount of glass eels restocked has increased from 2010 with high numbers in 2014, 2018 and 2019 when the lower market prices guaranteed a larger number of glass eels could be purchased for fixed restocking budgets.

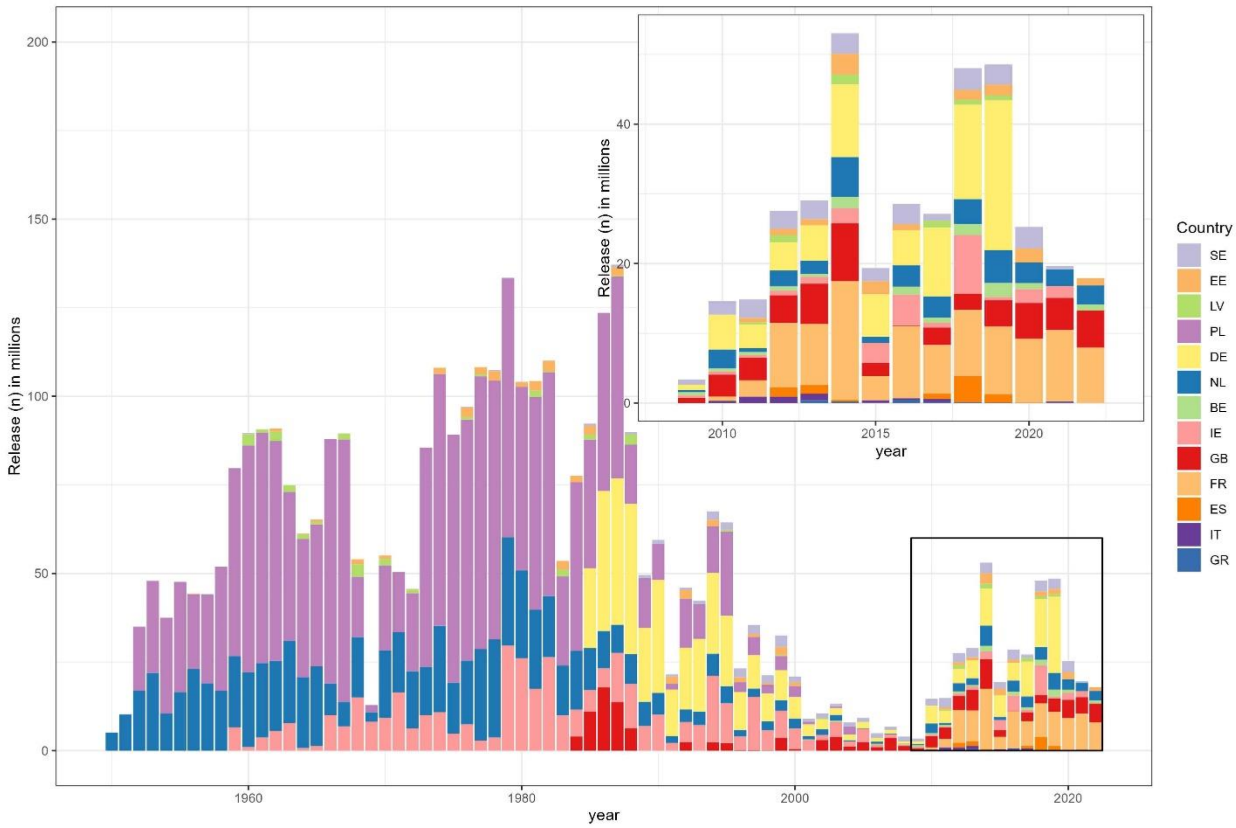


Figure 2.13. Reported releases of glass eel (in millions) per country, Sweden (SE), Estonia (EE), Latvia (LV), Poland (PL), Germany (DE), etherlands (NL), Belgium (BE), Ireland (IE), United Kingdom (GB), France (FR), Spain (ES), Italy (IT) and Greece (GR). Inset shows years since 2009 at greater resolution.

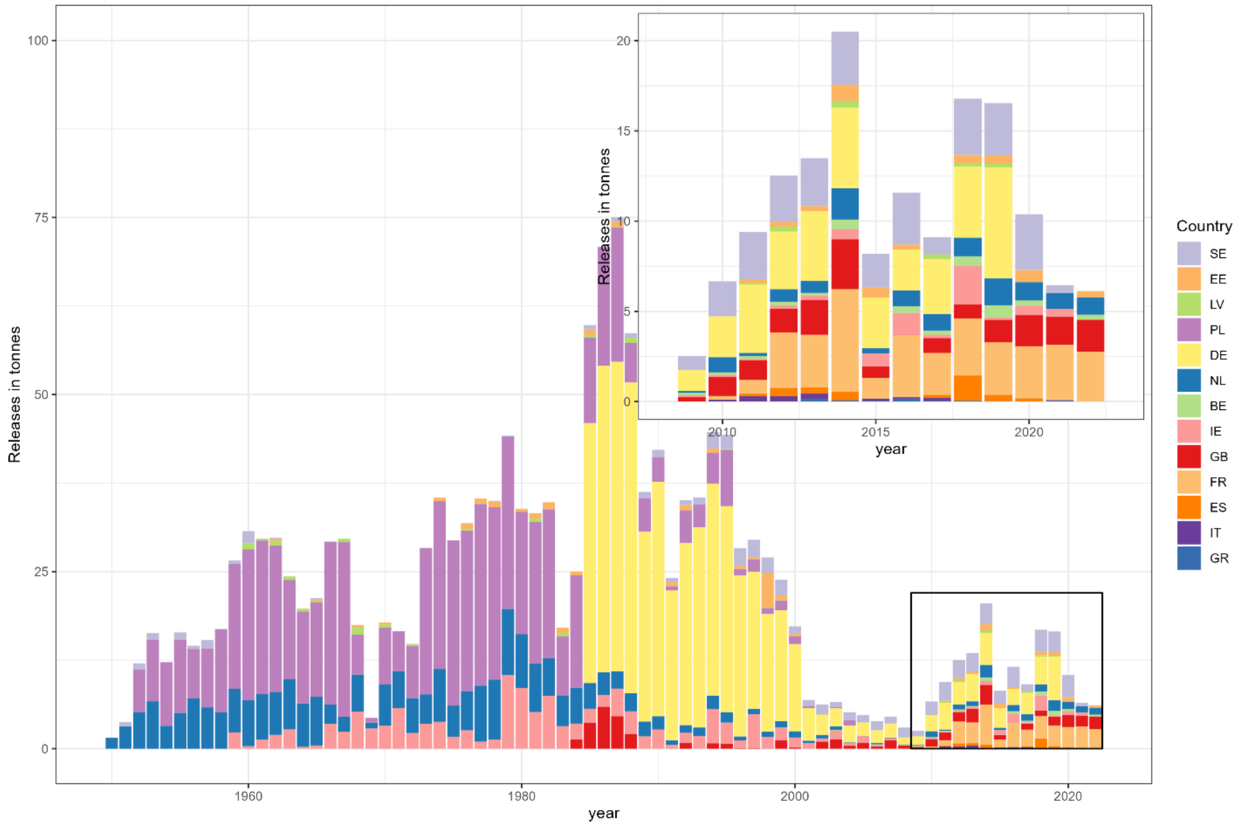


Figure 2.14. Reported releases of glass eel (in tonnes) per country Estonia (EE), Latvia (LV), Poland (PL), Germany (DE), Netherlands (NL), Belgium (BE), Ireland (IE), United Kingdom (GB), France (FR), Spain (ES), Italy (IT) and Greece (GR). Inset shows years since 2009 in greater resolution. Data for recent years are provisional and may be incomplete and might change in future data calls.

A small proportion of the releases corresponds to the collection of glass eel specifically for translocation within an EMU to mitigate the impact of barriers to migration (Fig 2.15 & 2.16). These types of movement were only reported by Ireland (since 1959, by numbers and mass) and the United Kingdom (since 1996, by mass only

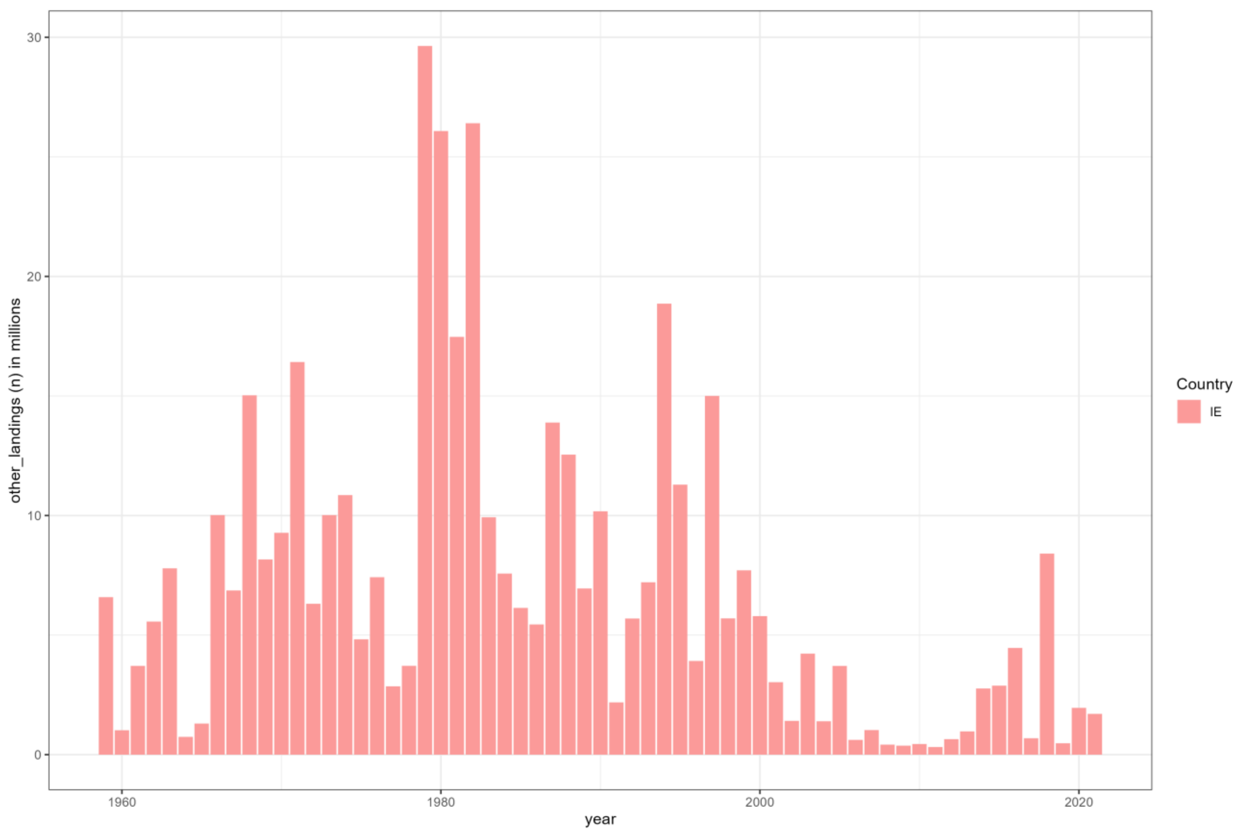


Figure 2.15. Other landings of glass eel (glass eel caught for transport operations, so not in formerly reported commercial or recreational fisheries) by number in Ireland (values in numbers not provided for UK).

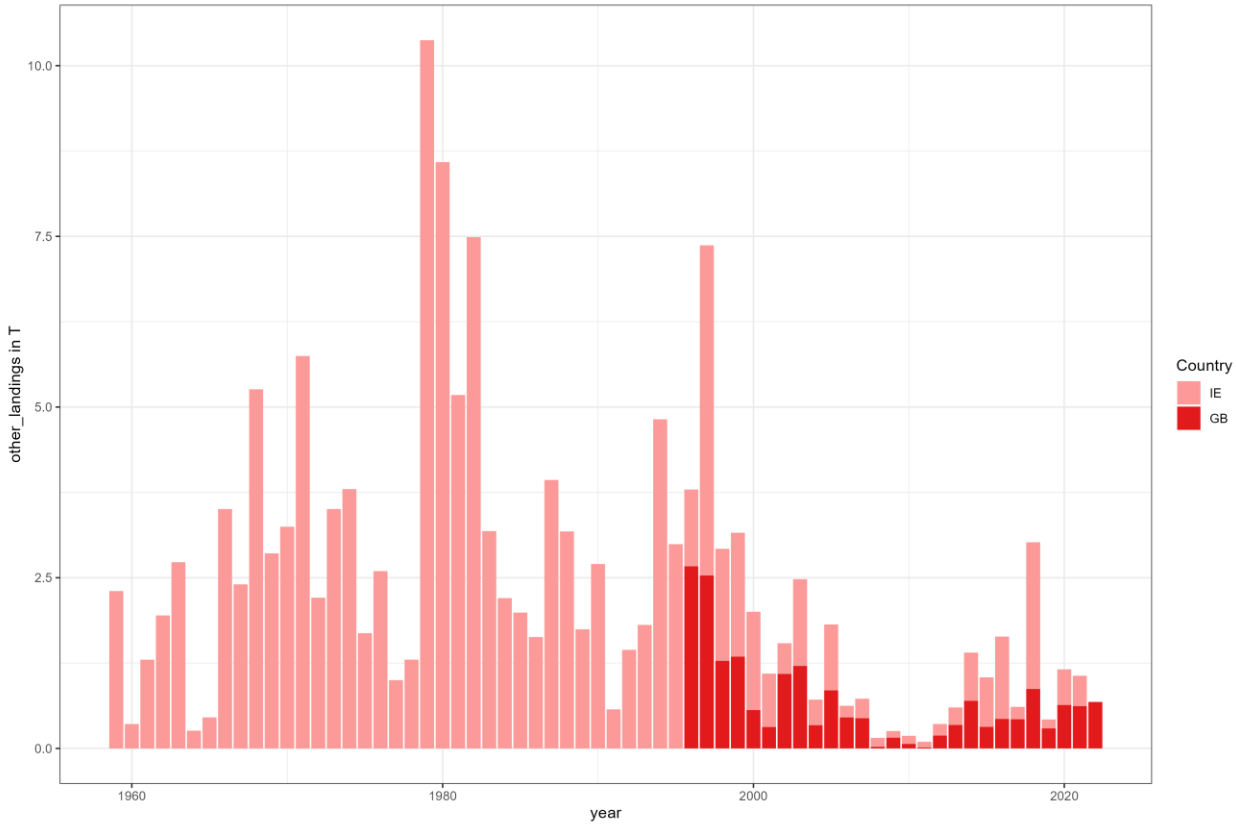
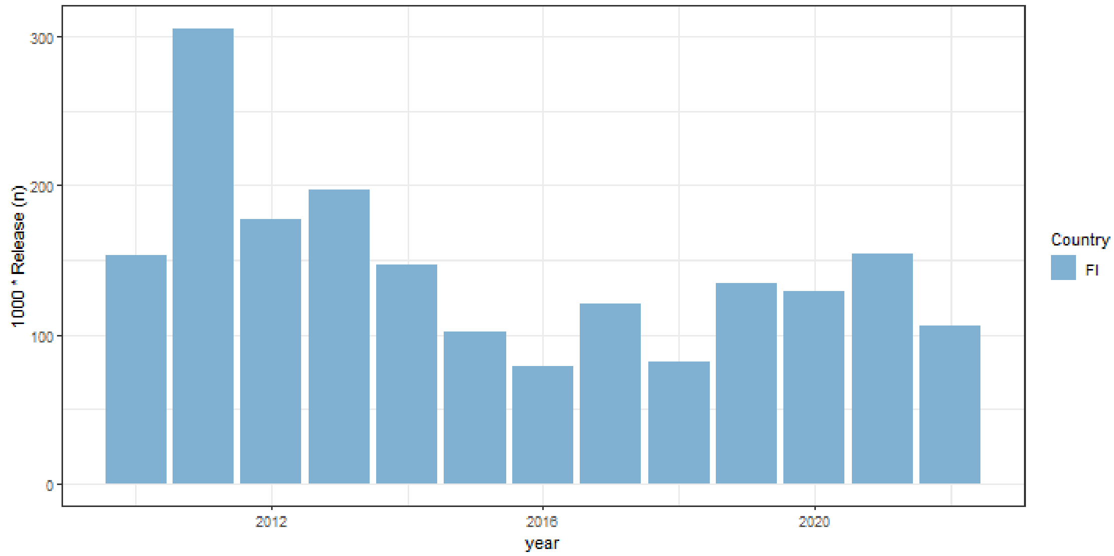
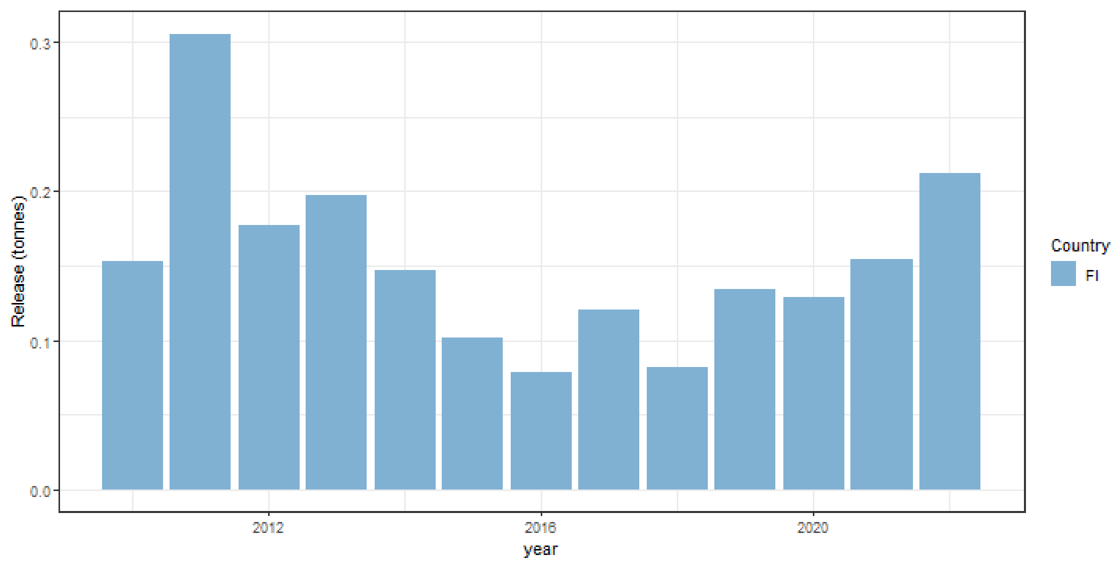


Figure 2.16. Other landings of glass eel (glass eel caught for transport operations, so not in formerly reported commercial or recreational fisheries) by mass in Ireland and the UK.

Only Sweden and Finland have reported quarantined glass eel restocking. However, Sweden is in the process of validating all data on quarantined glass eels releases, therefore Swedish data are omitted from the current report (Figure 2.17; Annex 13). Quarantined glass eel restocking peaked in the 1990s, decreased in the early 2000s and increased again after the implementation of the Eel Regulation.



(a)



(b)

Figure 2.17. Reported releases of Quarantined glass eel (in (a) thousands and (b) tonnes) in Finland (FI). Data for recent years are provisional or incomplete and may change in future data calls. For more details, see Annex 13.

Releases of yellow eel are represented in Figure 2.18 and 2.19. Sweden has recorded yellow eel release activity since 1900. On top of a continuous assisted migration programme for yellow eel, Sweden had a restocking programme for yellow eel from the early 20th century up to 2009. Germany started to stock yellow eels in 1985. Activity declined somewhat after 2005 and in recent years has been much reduced (Annex 13).

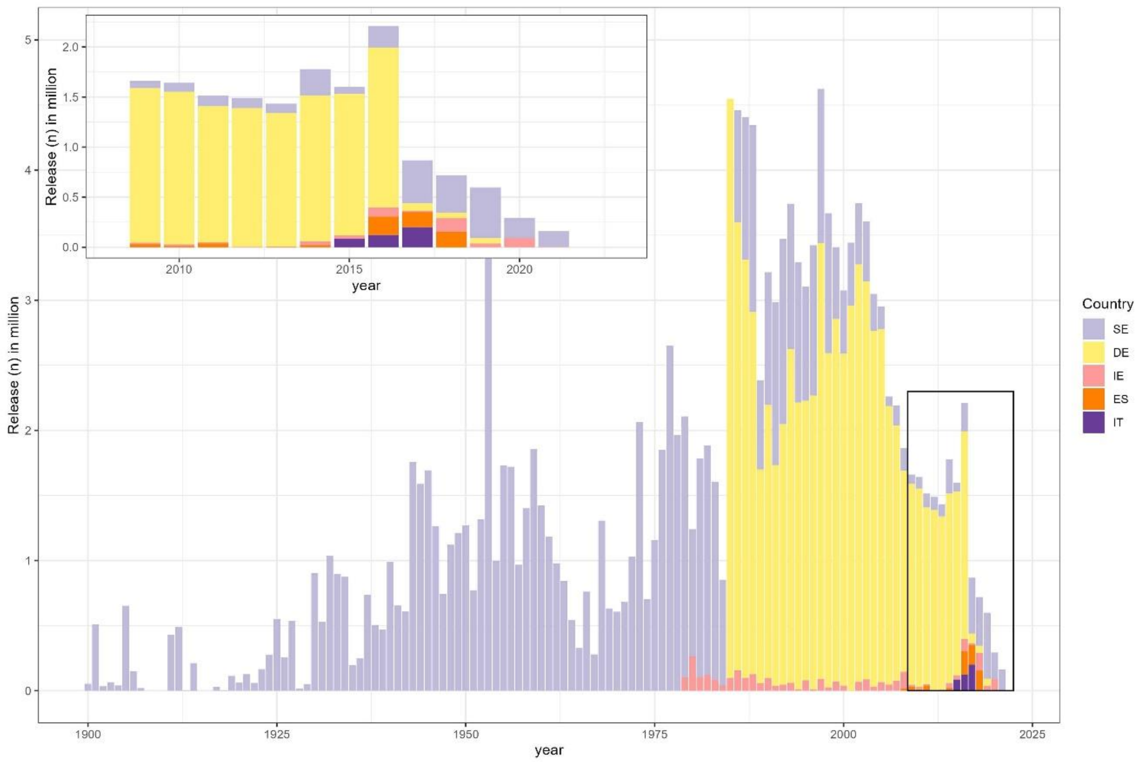


Figure 2.18. Reported releases of yellow eel (in millions) per country, Sweden (SE) Germany (DE), Ireland (IE), Spain (ES) and Italy (IT). Inset shows the last 13 years in more detail. Data for recent years are provisional or incomplete and may change in future data calls.

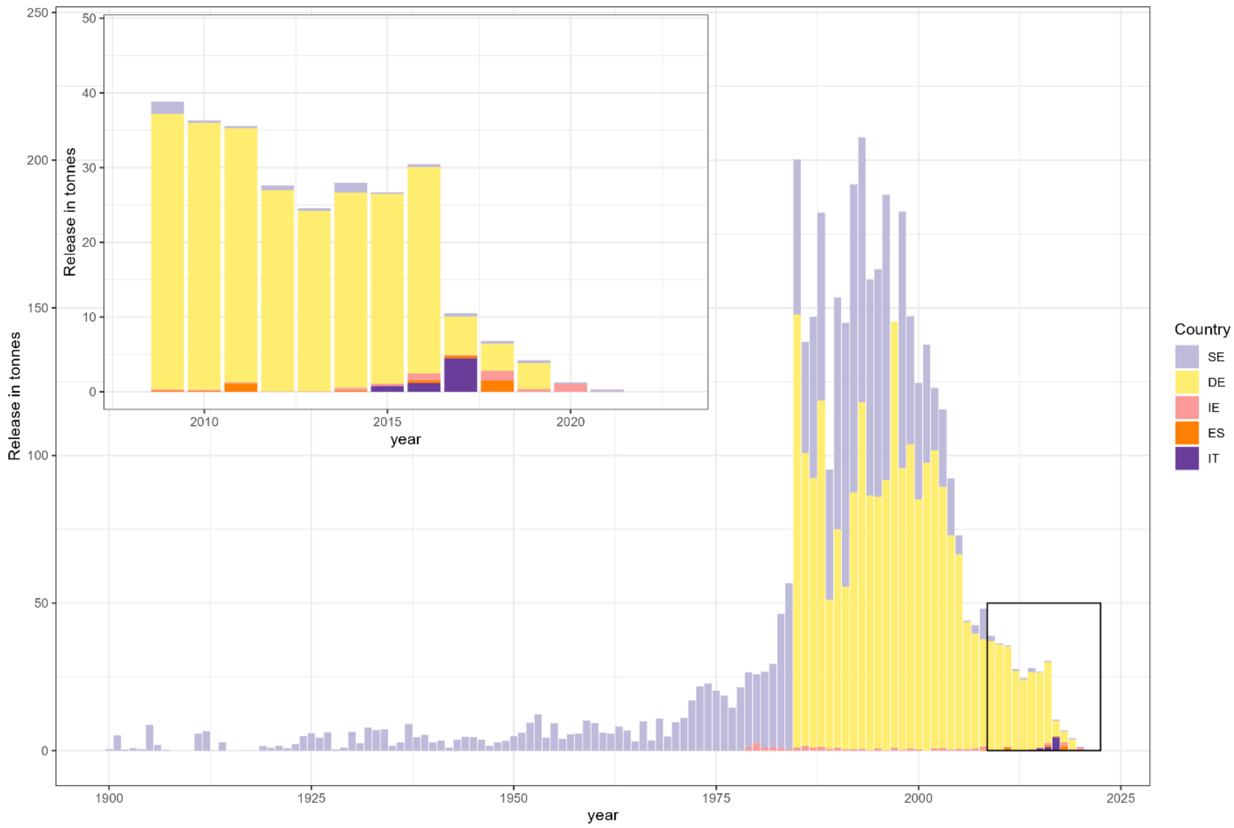


Figure 2.19 Reported releases of yellow eel (in tonnes) per country: Sweden (SE) Germany (DE), Ireland (IE), Spain (ES) and Italy (IT). Inset shows the last 13 years in more detail. Data for recent years are provisional or incomplete and may change in future data calls.

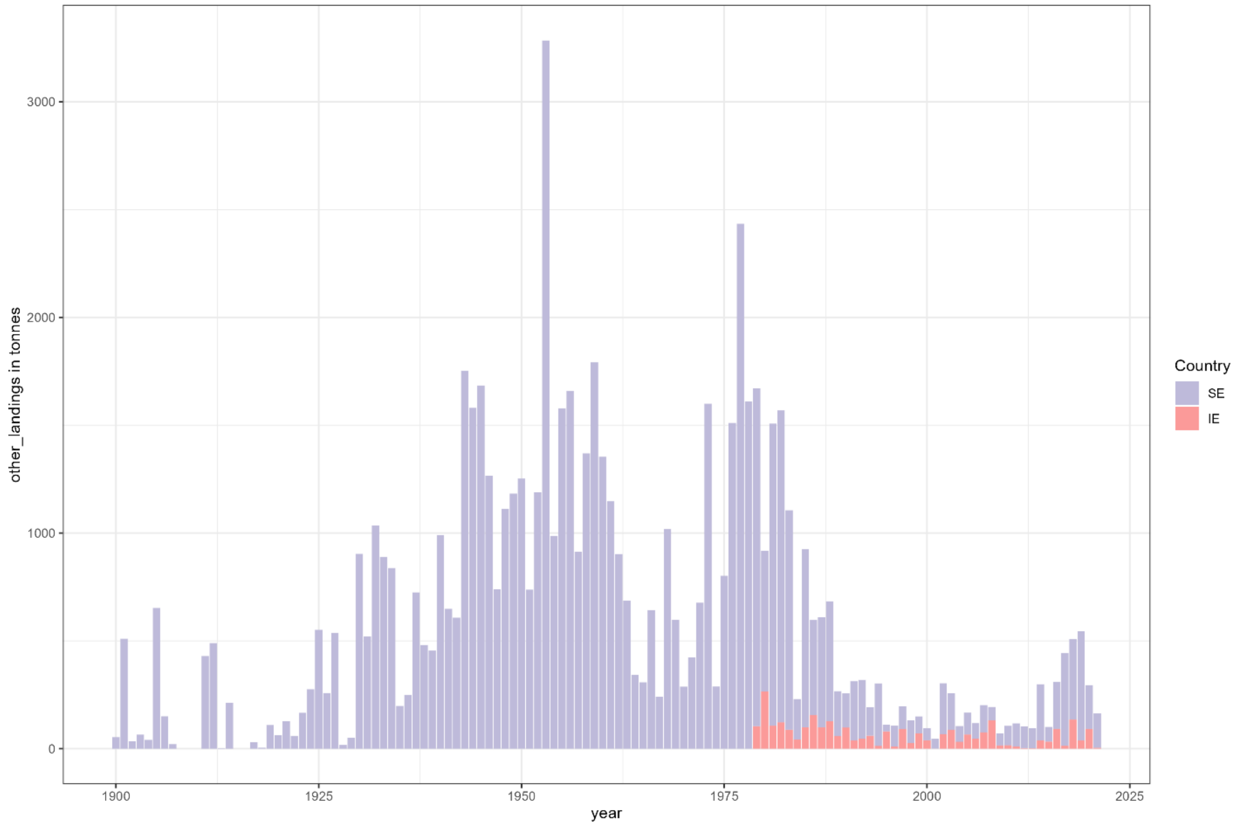


Figure 2.20. Reported values of yellow eel other landings (in tonnes) per country: : Sweden (SE) Ireland (IE) . Data for recent years are provisional or incomplete and may change in future data calls.

The restocking of on-grown eels has constantly increased since 2000 and reached a maximum in 2014 (Figure 2.21; Annex 13). Since the mid-1980s, Germany has restocked the most on-grown eels. In 2019-2022 Germany has restocked on-grown eel, but data were not reported.

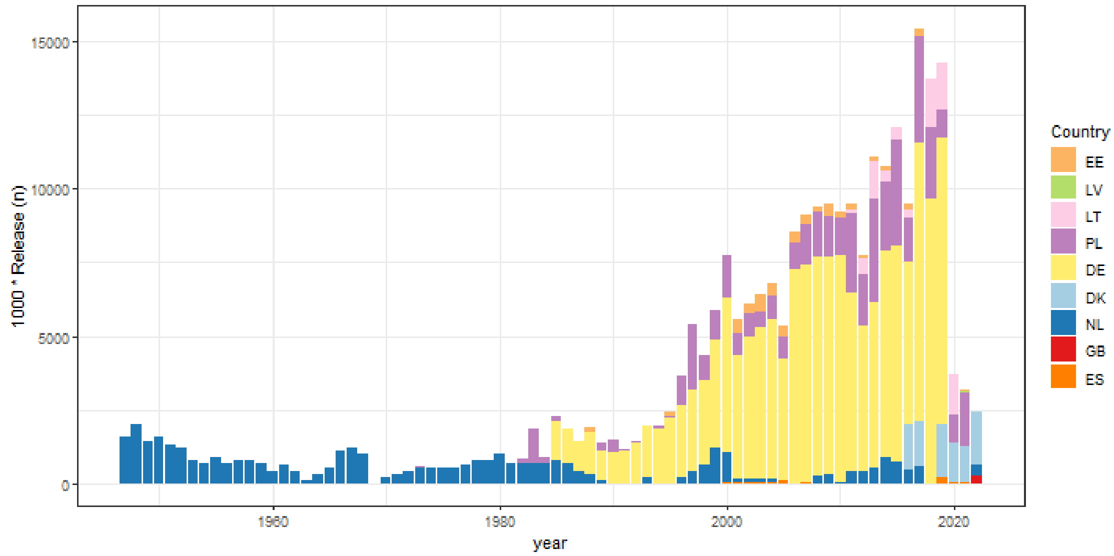


Figure 2.21. Reported releases of on-grown eel (in thousands) per country, Estonia (EE), Latvia (LV), Lithuania (LT), Poland (PL), Germany (DE), Denmark (DK), Netherlands (NL) and Spain (ES). Data for recent years are provisional or incomplete and may change in future data calls. For more details, see Annex 13.

Some silver eels caught by the fishery and therefore recorded as landings, are later released in the Mediterranean outside the lagoons in Greece and France, and they are reported as released silvers (Figure 2.22, Figure 2.23; Annex 13). In Ireland, the Netherlands and Sweden Trap and Transport (T&T, also called 'assisted migration') of silver eels from upstream to downstream sites in rivers have been implemented (Figure 2.22, Figure 2.23, Figure 2.24, Figure 2.25; Annex 13).

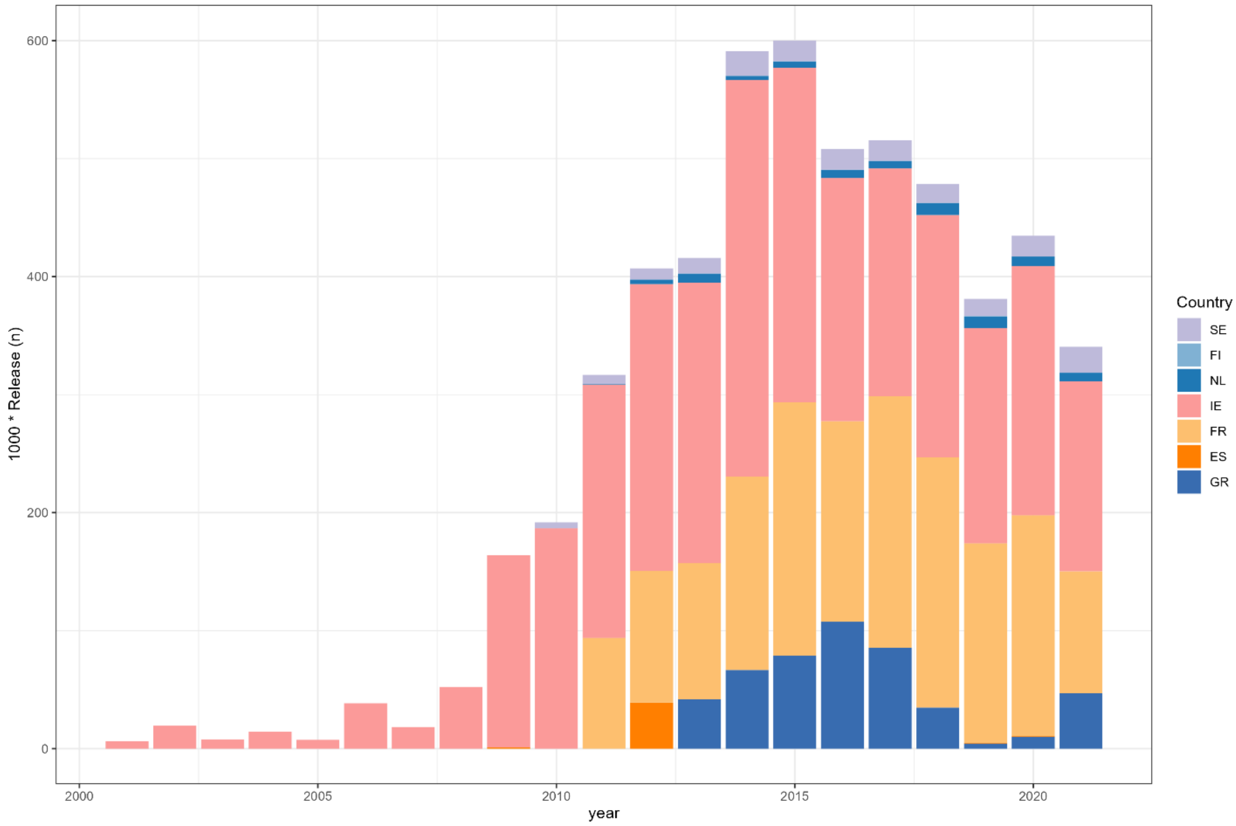


Figure 2.22. Reported releases of silver eel (in thousands) per country, Sweden (SE), Finland (FI), Ireland (IE), France (FR), Netherlands (NL), Spain (ES), and Greece (GR). Data for recent years are provisional or incomplete and may change in future data calls. For more details, see Annex 13.

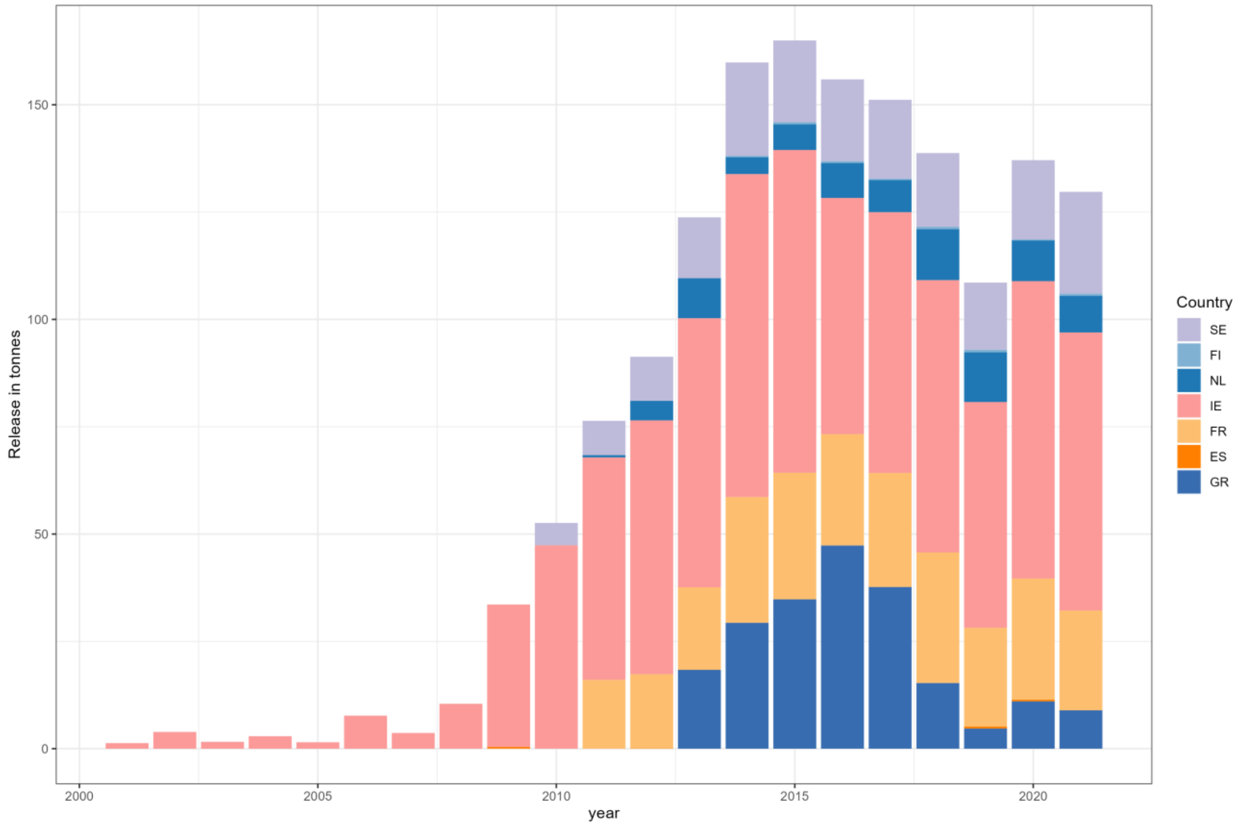


Figure 2.23. Reported releases of silver eel (in tonnes) per country, Sweden (SE), Finland (FI), Ireland (IE), France (FR), Netherlands (NL), Spain (ES), and Greece (GR). Data for recent years are provisional or incomplete and may change in future data calls. For more details, see Annex 13.

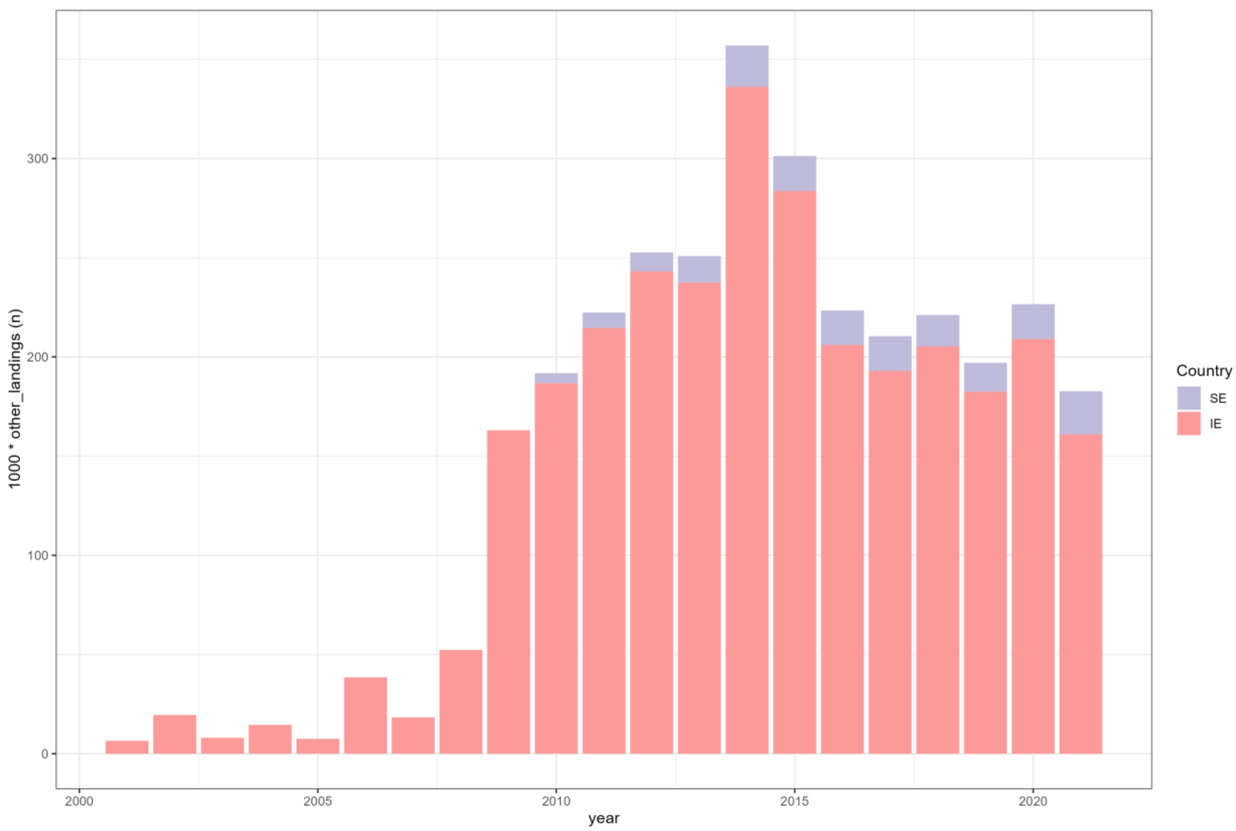


Figure 2.24. Other silver eel landings by number of individuals (n), comprising silver eel caught for the purpose of assisting their seaward migration past obstacles (Ireland and Sweden).

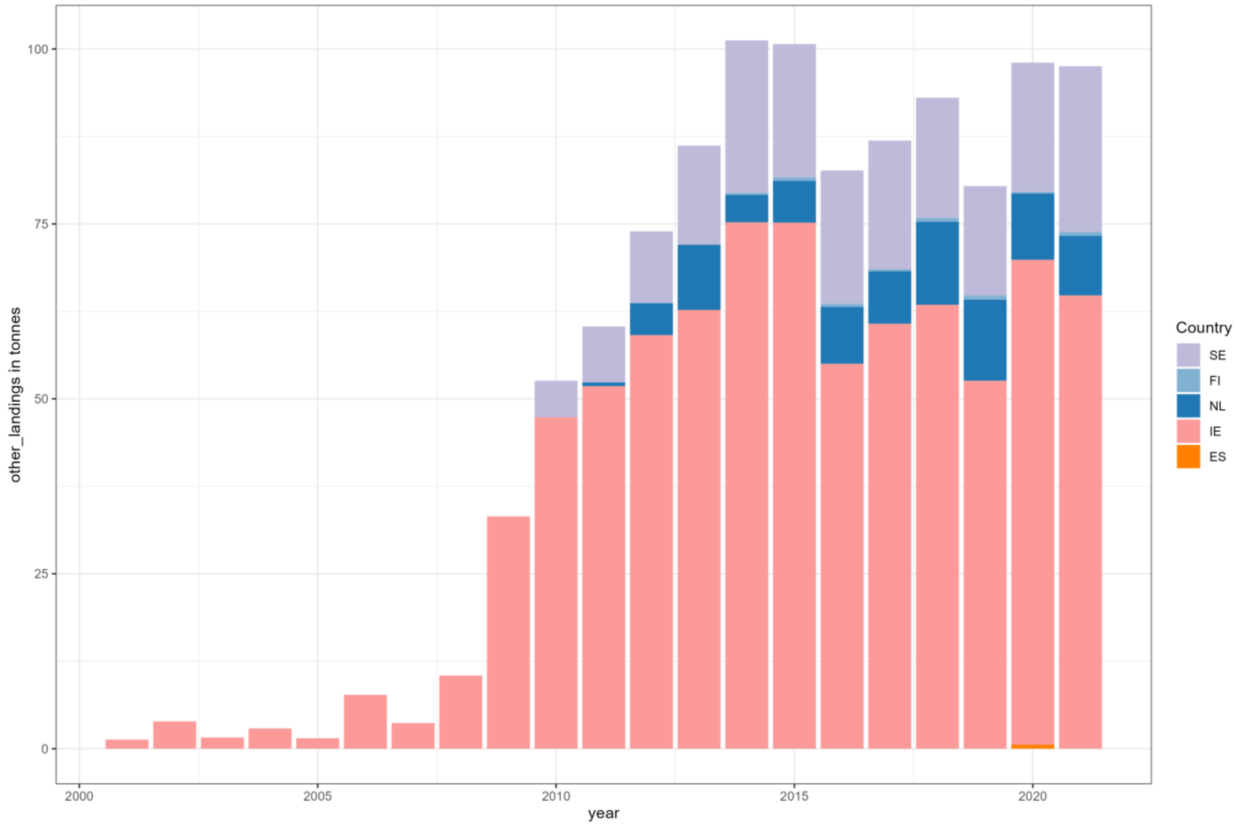


Figure 2.25. Other silver eel landings by mass, comprising silver eel caught for the purpose of assisting their seaward migration past obstacles (Ireland and Sweden).

2.4 Aquaculture

All aquaculture for eel currently depends upon wild eel for seeding, and thus aquaculture production reflects direct losses to the stock. Aquaculture production data are derived from responses to the data call 2022.

Aquaculture production increased from the 1980s, peaking in 2004 at just under 8,600 t. Since then it has steadily declined to approximately 5,000 t by 2020. In 2021, total aquaculture production was reported as 3855 t, but data are incomplete (countries reporting: five) (Figure 2.26; Annex 13). Lithuania had only a single farm in operation from 2017 to 2021 and therefore cannot report production for that period for reasons of confidentiality. For IT the data on aquaculture are expected to be available by the end of 2022.

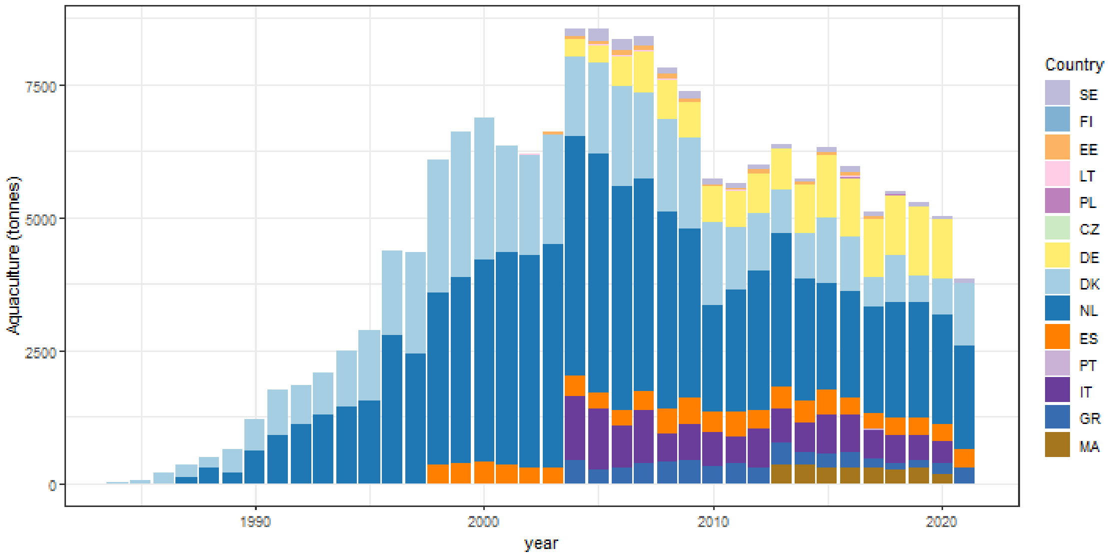


Figure 2.26: Reported aquaculture production of European eel in Europe from 1984 onwards, in tonnes, in Sweden (SE), Finland (FI), Estonia (EE), Lithuania (LT), Poland (PL), Czech Republic (CZ), Germany (DE), Denmark (DK), Netherlands (NL), Spain (ES), Portugal (PT), Italy (IT), Greece (GR) and Morocco (MA). Data for recent years are provisional or incomplete and may change in future data calls. For more details, see Annex 13.

2.5 Preparation of Data Call 2023

The Data Call in 2023 will largely resemble Annexes 1-8 of the 2022 Data Call. Following the roadmap provided by WKFEA, the collection of data will continue in 2023, and in response to the suggestions (see above and Chapters 3, 4 and 5), further changes to the current call need to be addressed. The most important changes are corrections brought to the data call excel template, further changes are to be integrated in the group and individual metrics, including adding stages to group and individual stages for series, and a reference to year and the ID from the source database in individual metrics.

3 Yellow/Silver eel time series and biometric data (of all life stages) (ToR B/C)

3.1 Introduction

Since 2020, ICES data call for eel includes data request for time series on yellow and silver eels abundance (ICES, 2020 – WGEEL) and since 2021, it includes aggregated biometrics data (ICES, 2021 – WGEEL). This year, the data call includes also individual biometrics data. Data can come from Data Call annex 1-3 (glass, yellow and silver eel time series) thereafter named 'time series' data and from Data Call annex 10 (other sampling), 'sampling' data.

This chapter intends to be an exploration of the potential use of these data and should not be taken as a final analysis.

This chapter updates the previous analyses (ICES, 2021 – WGEEL) of yellow and silver eel times series as well as the presentation of aggregated biometrics data. It gives also a first presentation of the individual biometrics data and a literature review of length-based data analysis for stock assessment. It finally gives some suggestions to improve future data call based on the experience gained during the data analysis.

3.1.1 WGEEL Data Calls context

Silver eel time series were first included in the ICES Eel data call in 2019 (ICES, 2018). Data requested included numbers, biomass, mean weight, mean length and sex ratio. The stated use for the data (ICES draft data call Letter) was to examine trends over time, and to cross-calibrate / validate aggregated data. However, in the official data call letter (2019), yellow eel abundance indices were also requested, noting, that these do not refer to yellow eel recruitment time series, but only to those that provide a measure of the standing stock.

The stated justification in the data call was that "WGEEL requires data on time series of yellow eel abundance (i.e. standing stock) as an independent measure in order to confirm reported local trends in the standing stock. Data should be based on empirical observations in a specific location, such as scientific surveys or fisheries-based surveys of yellow eel abundance (e.g. based on CPUE)." Biological information (average length, weight and age of yellow eels) related with the time series of yellow eel abundance was also requested.

In 2022 similar to previous years, historical time series, and updates or new data, including information on associated upstream factors, such as stocking, for both yellow eel standing stock (Data Call Annex 2) and silver eel (Data Call Annex 3) time series were requested by the data callIn 2022, the data providers were requested to submit individual biometric data available in relation to recruitment, yellow and silver eel time series under separate tabs on the time series templates and all eel biometric data available (with the respective 'metadata') from sampling schemes such as EU DCF, GFCM DCRF etc.

3.2 Time series

3.2.1 Types of Analysis that could be performed

The analysis of the index yellow eel and silver eel data may be undertaken to carry out a number of functions, some of which are only in the proof of concept stage or in the planning stage such as the road map for advice including a spatial stock assessment model (ICES, 2021b). We have identified three possible types of analyses and uses for these data as follows. Additionally, and through an extensive literature review, possible models that could assist in the assessment of the 'global' stock status were identified. The common detail of these models is that they are based on a Bayesian approach and utilizing length frequency based data excluding length at maturity data, which, due to the specifics of the eels' life cycle, are not possible to be acquired.

Trend Analyses

The analyses of time series data on yellow standing stock and silver eel production or relative abundance and their associated biological parameters should provide an independent view of the current status and changing trends of the stock, separate from the trend in recruitment and/or the bio-indicators reported as a requirement of the EU Regulation.

Independent analyses of yellow eel stock trends and silver indices, along with the recruitment time series, the reported silver eel Biomass indicators and other spawner quality indicators might also help to untangle the impacts of anthropogenic pressures and changes in the ocean that influence recruitment e.g. clarifying the relationships between yellow eel abundance, spawner escapement and recruitment.

Analyses of time trends in silver eel production will require additional information such as age profile and sex ratio, especially where a stock – recruitment relationship, or a recruit to stock analysis is performed. Considerable differences in growth, length at age and sex ratio occur throughout the range (see below).

Furthermore, local silver eel time series could be used as an independent verification of modelled estimates of Bcurrent (compare with trends in Bbest) while noting that those silver eel trends may have been used in the estimation of biomass in the first place and that silver eel time series might not be representative of the whole EMU. Trend analysis of index time series may facilitate a cross-validation/verification of aggregated or derived data, provided those index data are not part of the estimate being validated. Further, an examination of yellow eel standing stock trends may provide a more immediate measure of effectiveness of management actions than waiting for silver eel escapement (Bcurrent) to react in years or decades to come, either by the countries at the local level or by WGEEL at the international level.

Trends in direction of standing stock of yellow eel, and in silver eel production, or escapement, could be compared with previous recruitment history and combined in a lifetime model to cross-check silver eel reporting, and to provide additional information on the status of the stock for either ICES Advice, or for other parties to avail of, such as OSPAR's evaluation of the global status of the eel stock. This could be done on a local basis using reliable fisheries independent time series, or aggregated at a country, regional or species level to give a wider overview.

Data for supporting a "global" stock assessment model

The collection of independent time series data on yellow eel standing stock and silver eel pro-duction could be used in a wide-scale spatial model, such as EDA (Briand et al. 2018), or MED Eel/ESAM/DEMCAM (Bevacqua et al. 2007) for a stock-wide assessment for advice, or at more local level for models such as SMEPII (Aprahamian et al 2007) and GEM (Oeberst & Fladung 2012; Prigge et al. 2013). This type of assessment and modelling approach has been trialled in the three year SUDOANG project (https://sudoang.eu/en/). This “proof of concept” developed in SUDOANG has been proposed as a possible roadmap for applying a similar approach to the broadening of the Advice on eel (ICES, 2021b).

The SUDOANG project (https://sudoang.eu/en/) further developed a spatially explicit model of eel production, EDA, taking into account current local recruitment, yellow-eel standing stock and pre-migratory silvering eels, together with habitat characteristics including the location of barriers to migration, and the flow conditions that influence mortality at such barriers (https://sudoang.eu/en/task-groups/). The standing stock survey was conducted in rivers only, using electrofishing. Length and weight were collected for each eel caught, together with assessment of the silvering status of larger eels, and some details of the electrofishing site. However, due to the issue of a lack of assessment methodologies for large waterbodies including lakes, lagoons and deep rivers, these have not been included in the overall SUDOANG assessment and remain to be addressed.

The WKFEA (ICES, 2021b) road map (Figure 3.1) for strengthening the advice considers some complex preparatory tasks, such as hydrographic modelling, and a silver eel production model along with improved spatial data and the need for collating individual site and individual eel data into a new database. Such tasks will require both international coordination and research time to build the tools and the different models necessary to build the final Spatial Stock Assessment Model to be used in the ICES advice. As a consequence, the road map time frame is just indicative. The following steps are identified in the WKFEA report:

1. Time-series of yellow and silver eels and biological parameters (2022)

2. Landing reconstruction workshop (2023)

3. Habitat assessment, WFD data and HP/P mortality–Project 1 (2023–2025)

4. Design a population model–Project 2 (2023–2026)

5. Data compilation meeting and benchmark (2026–2027)

To complete this development process, a Data Compilation Workshop should take place in 2026 in order to review, discuss and quality-check the data gathered so far (recruitment time-series, yellow and silver eel series, biological parameters, spatial abundance of yellow and silver eel, hydropower and pumping station mortality and habitat data). The approved data will be used in the final benchmark in 2027 to evaluate the candidate Spatial Stock Assessment Models.

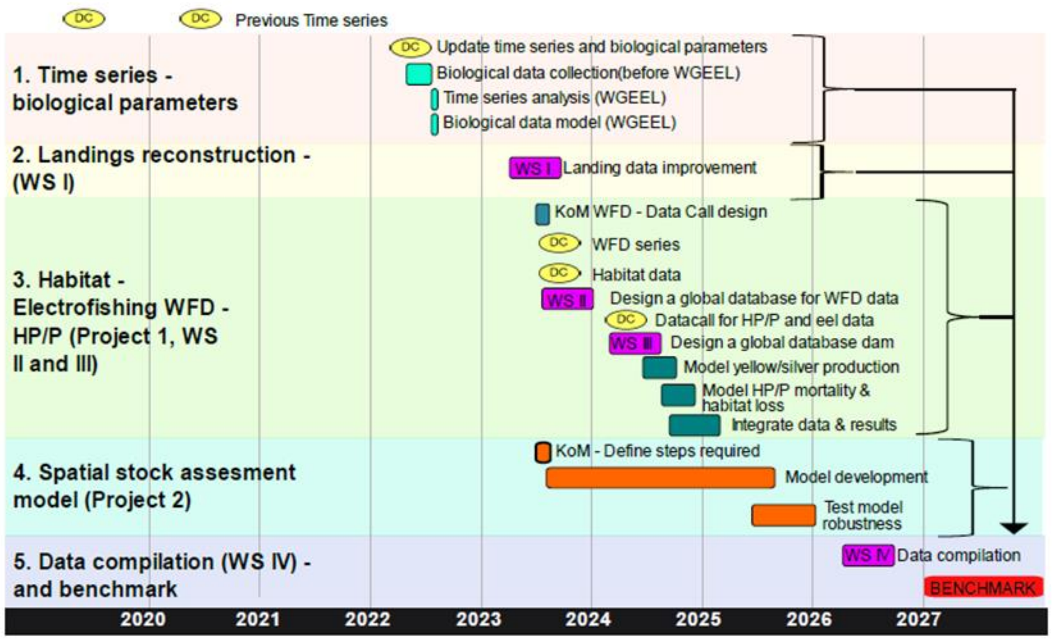


Figure 3.1. Proposed road map for future advice, reproduced from WKFEA (ICES, 2021b)

Assessment of the relative impact of different management measures

Analysis of the index series data, and their associated biological parameters may provide an independent insight into the effectiveness of applied management measures. The trends, especially in yellow eel standing stock series, can be compared with changes in ΣA as an independent means of verifying the effectiveness of applied management measures. However, the changing recruitment, and especially the recent low levels of recruitment will introduce an interaction term in these analyses.

The data may also be useful in investigating the rebuilding of local stocks when fisheries measures are put in place, provided recruitment is not impaired. A similar insight into the effectiveness of stocking in silver eel production may also be elucidated by some series.

The examination of a time series of size frequencies may assist in tracking change in the population dynamics such as the rebuilding of the stock with recruiting and growing small eel increasing in abundance. However, if recruitment is slow and outstripped by maturation and departure as silver eels, the shape of the size frequency may change in a different direction over time.

3.2.2 Summary of collected data

Yellow eel time series

The data call 2022 reported on 109 yellow eel time-series from 15 countries and 37 EMUs (Table 3.1, Figure 3.2). Most of the series are located in the United Kingdom (48 series) and France (19 series) (Figure 3.2 & 3.3).

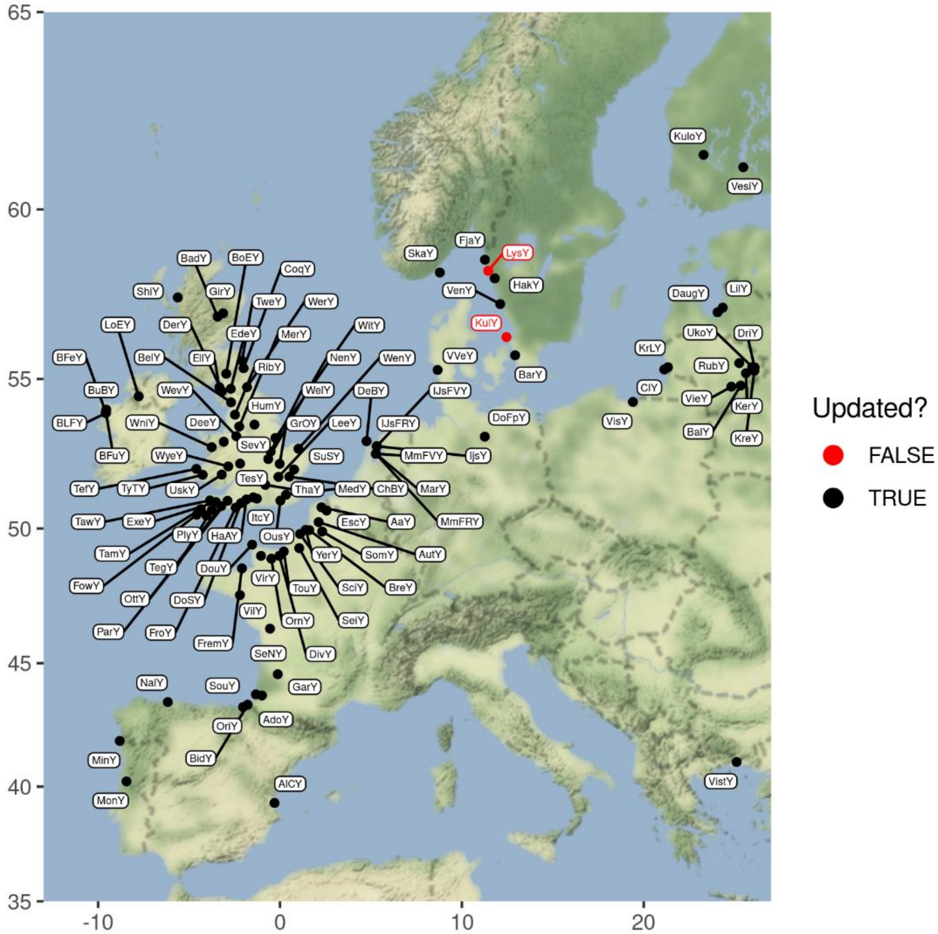


Figure 3.2. Map of available yellow time-series (standing stock). Updated time-series: TRUE = time-series for which at least one value was provided in the three last years, FALSE = not one value provided in the last three years. Not all series names are displayed on the map, for details see Annex 15.

Most of the data from the yellow eel series were collected in freshwater habitats by electrofishing gear and are reported as scientific estimates (Figure 3.3). Some series were missing quality information, but those with this information available were mainly described as of good quality (Figure 3.3; Table 3.1). Equally, each data entry was of good quality in majority of the cases, but quality rating was missing for 213 data entries. Only four data points were classified as being of bad quality, 13 were of questionable quality. Only one series was missing information on the influence of restocking, while 20 series were classified as being influenced by restocking and 89 as not being influenced by restocking (Figure 3.3, Table 3.1). In total 18 series were missing information on effort and only three series were missing data on distance to sea (Table 3.1). For more information on the total number of available series per each category and missing information per category please see Table 3.1.

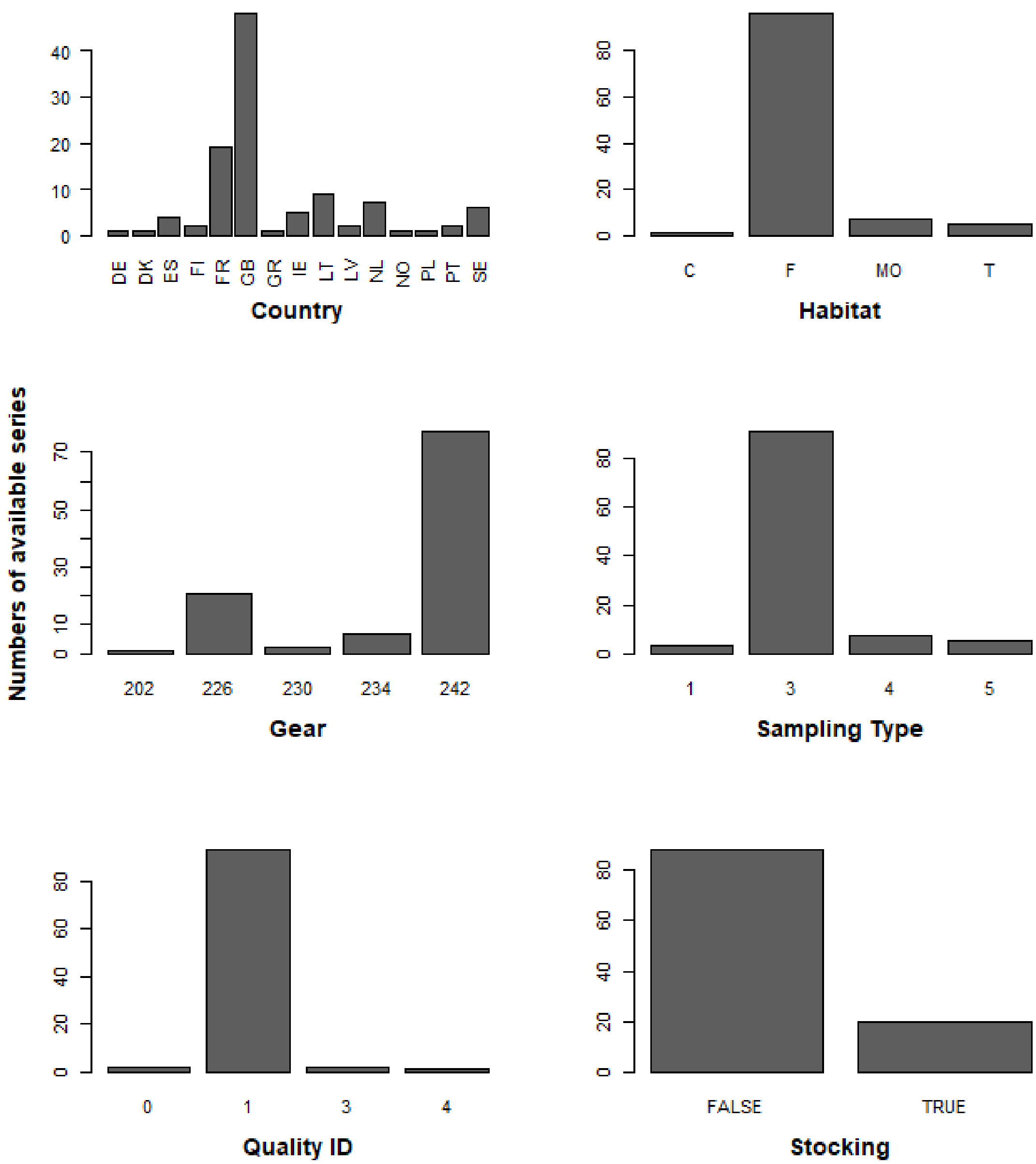


Figure 3.3. Summary of available yellow eel series per country; habitat: C = coastal water, F = freshwater, MO = marine water (open sea), T = transitional water (according to WFD); gear: 202 = beach seines, 226 = fyke nets, 230 = traps, 234 = longlines; 242 = electric fishing; sampling type: 1 = commercial catch, 3 = scientific estimate, 4 = trapping all, 5 = trapping partial; quality id: 0 = missing data, 1 = good quality data, 3 = bad quality data, 4 = data used but with warnings; and stocking: FALSE = no impacts of stocking, TRUE = impacts of stocking.

Table 3.1. Summary of available yellow eel series with more than 5 years of data, and with available quality id (rating), habi-tat, sampling type, effort, gear, restocking and distance to sea.

Category	Available data	Missing data
Nb of series >5 years	89	20
Nb of series with quality id	98	11
Nb of series with habitat data	109	0
Nb of series with sampling type	106	3
Nb of series with effort data	101	8
Nb of series with gear	108	1
Nb of series with restocking data	108	1
Nb of series with distance to sea	106	3

Since 2001, at least 30 series with annual data values were available each year and since then a constant increase in the numbers of series is visible until the peak in 2018 (Figure 3.4). Many series did not have data reported in 2020 due to COVID-19 restrictions (most English and Welsh series). In addition, only two series had 2022 data available at the time of writing the current report (Figure 3.4). This is to be expected due to the timing of most yellow and silver series data in relation to the timing of the data call, and as a consequence any analysis can at best only include data up to the previous year. Eighty-nine series had more than 5 years of data and 72 series more than ten years of data, but the continuity of each of those time series needs to be further inspected (Table 3.1). A detailed summary of all the series is presented in Annex 15.

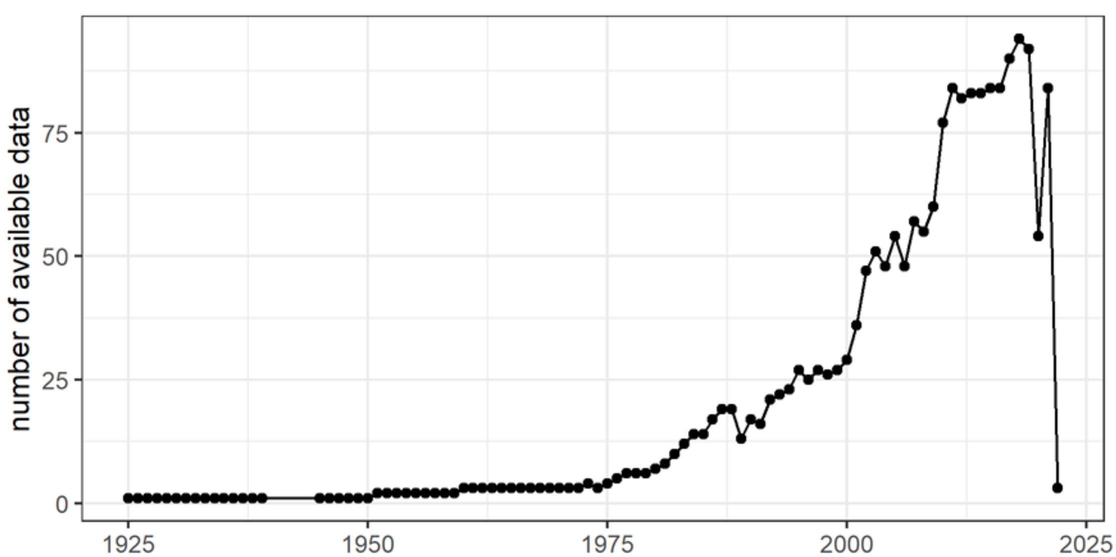


Figure 3.4. . Number of yellow eel time-series with available data per year.

Silver eel time series

In the 2022 data call, 53 silver eel time-series were available, located in 14 countries and 29 EMUs (Figure 3.5). The majority of these series are from Lithuania (9 series), Netherlands (7 series), United Kingdom (6 series) and France (6 series) (Figure 3.5 & 3.6). Four older time series were missing information on the majority of the investigated parameters, including the country.

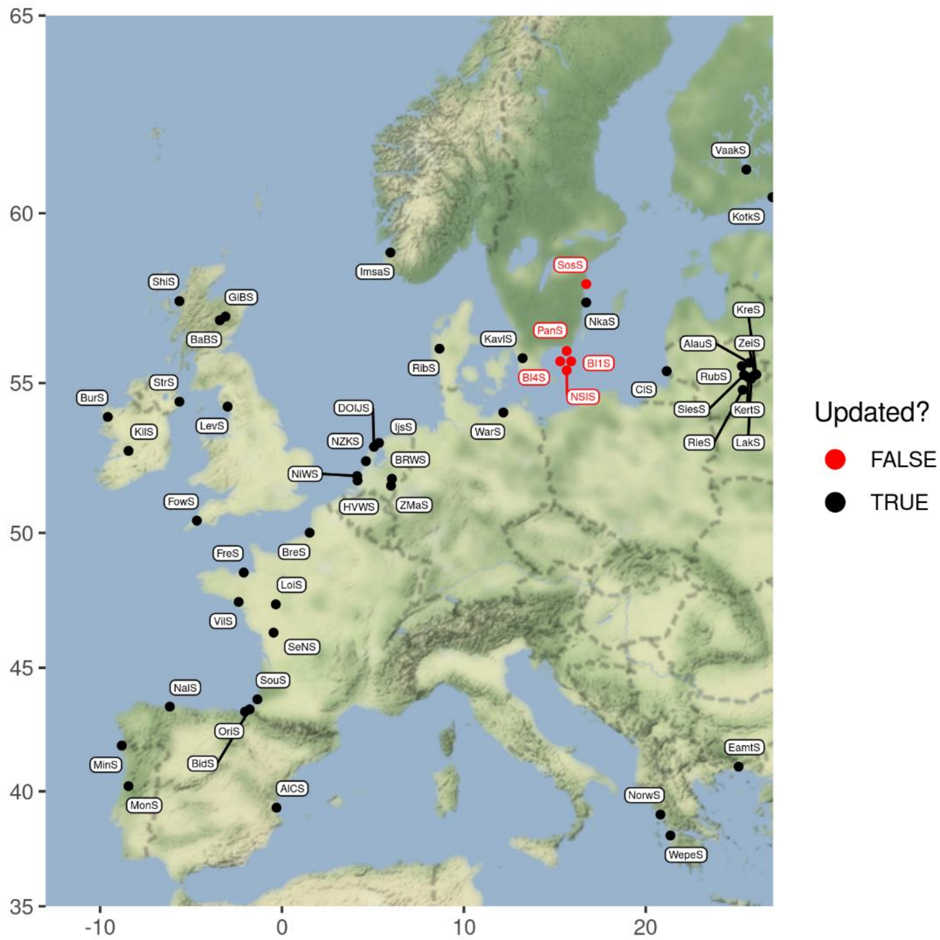


Figure 3.5. Map of available silver eel time-series. Updated time-series: TRUE = time-series for which at least one value was provided in the three last years, FALSE = not one value provided in the last three years.

Most silver eel series were collected in freshwaters via traps and fyke nets (Figure 3.6). In terms of sampling type, 10 series were from commercial catches, one series was reported as CPUE, six were assigned as full trapping series, 10 as partial trapping series and the rest was classified as scientific estimate, with four series missing this information (Figure 3.6, Table 3.2). Almost half of the series were missing quality information, but those with this information available were mainly described as of good quality (Figure 3.6, Table 3.2). Quality rating describing the data was missing for 114 data points, with 626 data entries assigned a good quality value. Only 10 data points were classified as being of bad quality, 30 were of questionable quality. Eight series were missing information on the potential impacts of restocking, with 16 series classified as being influenced by restocking and 29 as not being influenced by restocking (Figure 3.12, Table 3.4).

Nine series were missing information on distance to sea and effort data were missing for 34 series (Table 3.2). For more information on the total number of available series per category and missing data please see Table 3.2.

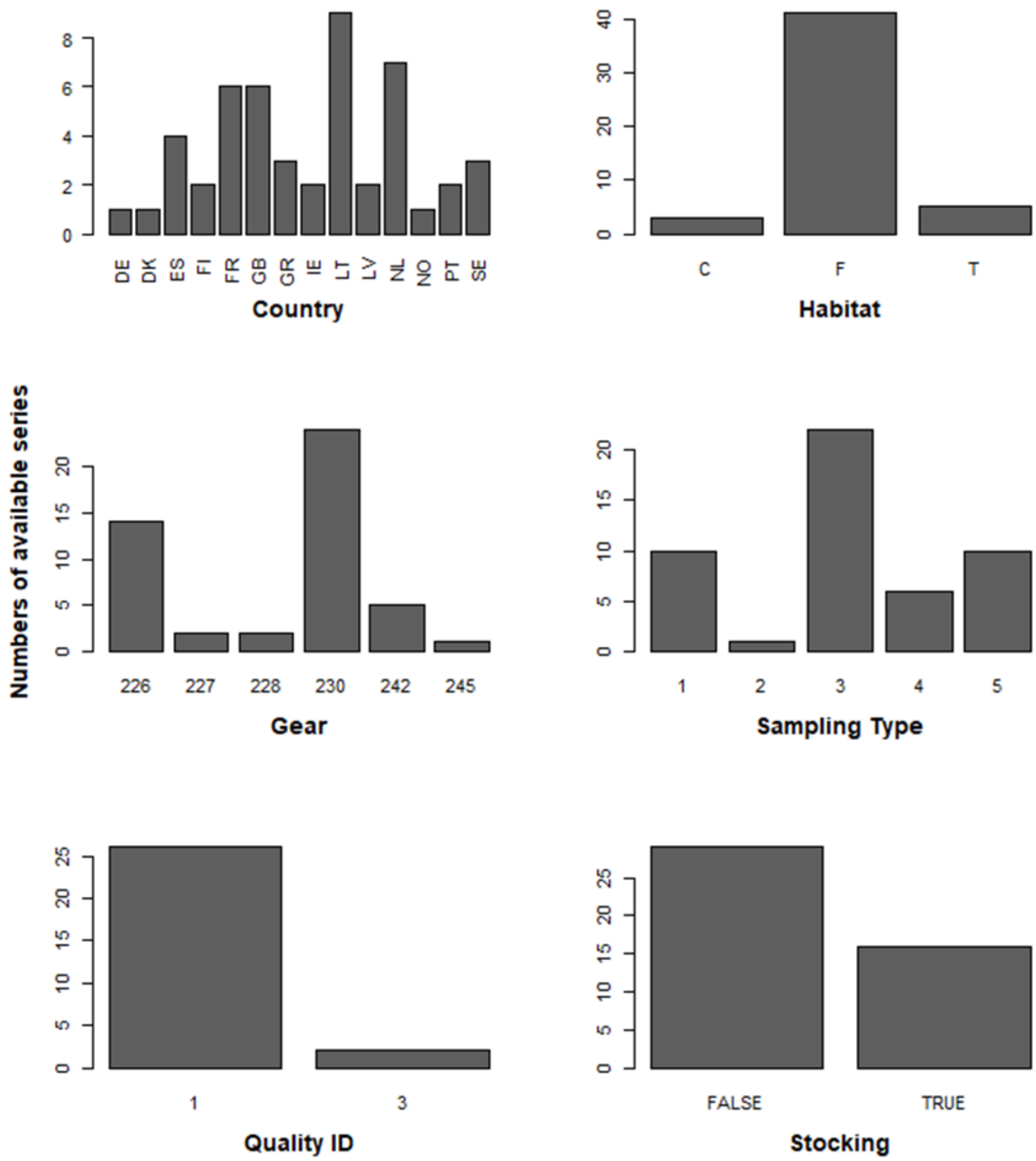


Figure 3.6. Summary of available silver eel series per country; habitat: C = coastal water, F = freshwater, MO = marine water (open sea), T = transitional water (according to WFD); gear: 226 = fyke nets, 227 =stow nets, 228 = barriers, fences, weirs, etc., 230 = traps, 234 = longlines, 242 = electric fishing, 245 = gear unknown; sampling type: 1 = commercial catch, 2 = commercial CPUE, 3 = scientific estimate, 4 = trapping all, 5 = trapping partial gear; quality id: 1 = good quality data, 3 = bad quality; and stocking: FALSE = no impacts of stocking, TRUE = impacts of stocking.

Table 3.2. Summary of available silver eel series with more than 5 years of data, and with available quality id (rating), habitat, sampling type, effort, gear, restocking and distance to sea.

Category	Available data	Missing data
Nb of series >5 years	38	15
Nb of series with quality id	28	25
Nb of series with habitat data	49	4
Nb of series with sampling type	49	4
Nb of series with effort data	23	30
Nb of series with gear	48	5
Nb of series with restocking data	45	8
Nb of series with distance to sea	44	9

The total number of series per year was highest between 2011 and 2020, with the peak in 2020. The majority of the series did not have 2022 data ready at the time of writing this report (Figure 3.7). Thus, these data have been excluded from the analysis this year. Thirty-eight series had more than five years of data and 23 series more than ten years of data. A detailed summary of all the series is presented in Annex 15.

Figure 3.7. Number of silver eel time-series with available data per year.

Mediterranean data

Spain, Greece and France provided non-empty time and biometry series on yellow and silver eel from the Mediterranean. In 2022 eight other countries (Albania, Algeria, Croatia, Egypt, Italy, Morocco, Turkey, Tunisia) provided data to the WGEEL, but no yellow and silver eel time series with related biometry data were ever provided.

In perspective, the ongoing work undertaken within the GFCM Eel project, from which results are foreseen in 2022, should allow to fill some of these gaps. The GFCM Eel Project also foresee a revision of the GFCM Data Collection Reference Framework (DCRF), which places obligations on Contracting Parties to collect and report data on eel fishery-related data. A reforming of Table 'VII.6 Eel' within the DCRF may incorporate data collecting time-series on yellow and silver eels and their associated biological parameters with an independent approach to commercial fishery. This will allow to provide more data from that part of the stock in the near future.

3.2.3 Update and correction during the WGEEL

The analysis conducted in 2021 was rerun including new data. In comparison to the analysis conducted in 2021, which used AIC for model selection, model selection for the trend analysis was conducted using AIC but corrected for small sample sizes, i.e. AICc.

3.2.4 Trend analyses

Yellow and silver eel series were previously analysed in ICES (2021b). During the current working group, we have redone this analysis trying to improve the overall process and to go further into the analysis. Among all the types of analyses that can be done (see chapter 3.1.2), only trend analysis is explored here. Major changes compared to the yellow eel series 2020 analysis will be shown here as an illustrative example. As regards to the state of the dataset (see chapter 3.2.2) there is no point in presenting a comprehensive analysis yet as we anticipate additional data and improved quality in the reporting of data in forth coming data calls and workshops.

Following the 2020 and 2021 reports, the first step has been to analyse the recent trend (2000-2021) with data series that have at least 10 observations in the period and having less than 10% of zero values. This leaves 64 time series. A simple General Additive Model (GAM) smoother on standardised series displays an overall and slowly decreasing trend, explaining 3.88% of the deviance. When separating the trends by country (figure 3.14), 12.9 % (note that DK and NO trends are not significant) of the deviance is explained. Other factors available in the data call, like habitat (figure 3.15, 8.57 % explained deviance), restocking (6.74 % explained deviance), sampling gear (4.95 % explained deviance) and distance to the sea (3.81 % explained deviance) explains the deviance to a smaller extent. However, those factors are not randomly distributed, e.g. series on open water are currently only available for Sweden.

Using country in this preliminary analysis is a convenient explanatory variable as a proxy for geo-location. It is also a geo-political variable that may include differences in eel management (that might influence the series), data collection and/or data handling. These will require further investigation.

In the 2020 report (ICES, 2020b) the long-term analysis indicates a generally higher level of abundance in the past. This should be kept in mind when interpreting the short-term analysis.

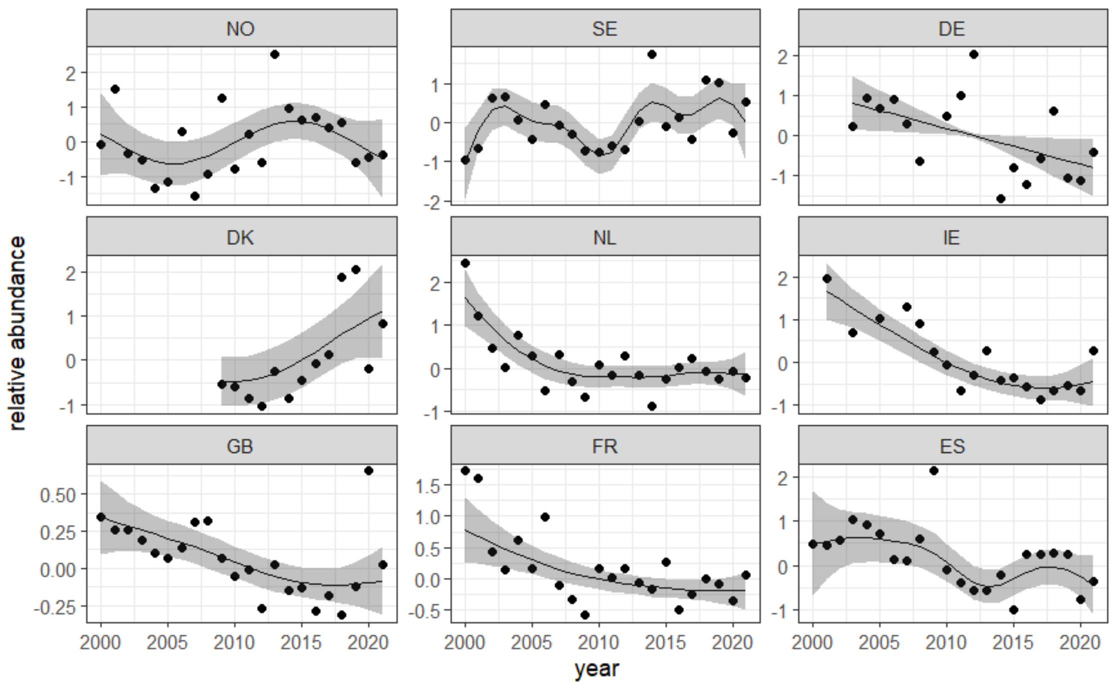


Figure 3.8. Trends per country in yellow eel abundance estimated by a GAM (line and 95 % confidence interval). Points display annual averages of standardized yellow eel abundances for different countries. Note that DK, DE, NO have only 1 series and trends for DK and NO are not significant.

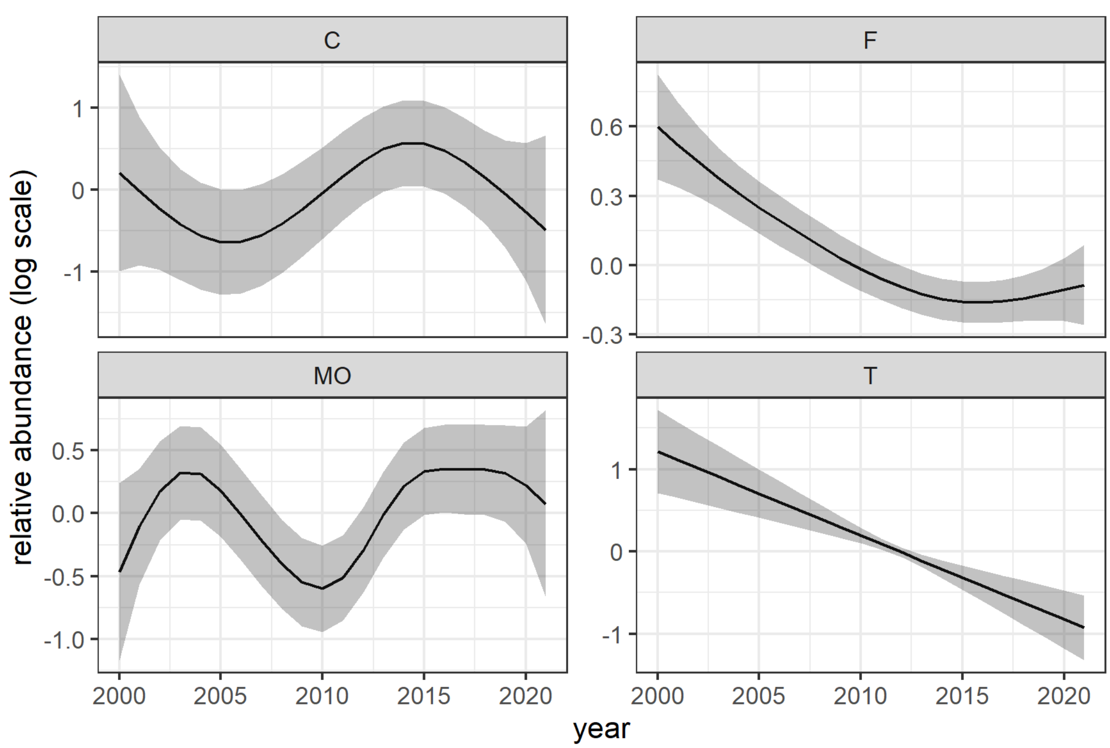


Figure 3.9. Trends per habitat in yellow eel abundance estimated by a GAM. Note trend for C is not significant. MO: open sea, C: coastal water, T: transitional water, F: freshwater.

A dynamic factor analysis (DFA) analysis (Zuur et al., 2003) can help in extracting common trends for the whole dataset. We have used the 2020 procedure (ICES, 2020b), updating the procedure by using AICc (that is, Aikaike information criteria with a correction for small sample sizes) rather than AIC. Using this procedure, a single trend model with the variance-covariance matrix being diagonal and equal (figure 3.16) is found as the most parsimonious model. The analysis shows an overall decreasing trend during the time period 2000 to 2021. Factor loading from the DFA gives the contribution of the trend to each individual time series. We can test the correlation between the factor loading and explanatory variables. We have tested the trend in a GLM with the following explanatory variables used simultaneously: restocking, habitat, sampling gear and the distance to sea. Both habitat type and gear type are found significant in the analysis. However, no significant effects of individual habitat types are found. Thus, the extent to which individual habitat types have positive or negative trends cannot be inferred from the current analysis. Further, according to the correlation analysis trends associated with fyke net sampling tend to be positive.

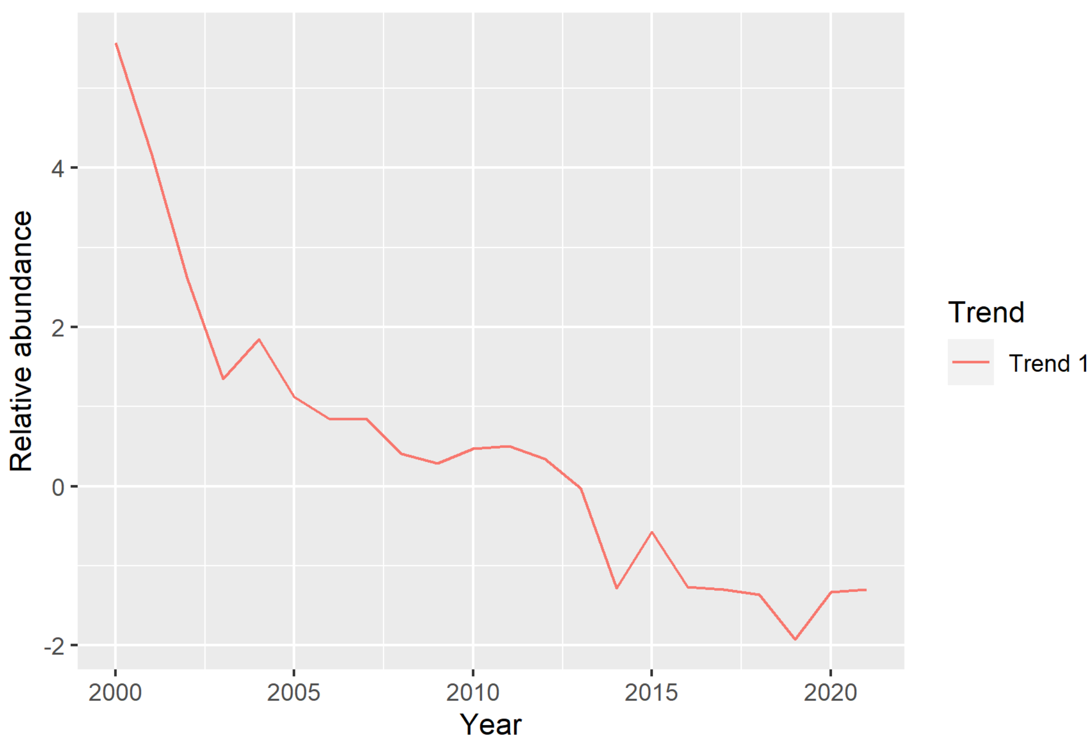


Figure 3.10. Estimated common trends in yellow eel time series from a DFA analysis.

3.3 Group biometry

Annex 16 gives more details of available data. Below a summary is given.

3.3.1 Summary on group time series and other sampling biometric data

The biometry section includes the description of the available data on glass eel, yellow eel standing stock, and silver eel, as well as on the recruitment series and mixed yellow-silver eel series. The recruitment series include glass eel, mixed glass eels and yellow eel, and yellow eel series and the mixed yellow-silver eel series includes both silver and yellow eels. However, these stages have very different sizes, thus any biometric analysis will not be suitable for series with mixed stages.

In addition to the time series information, other sampling information was also collected starting in 2022.

- Glass eel
- Yellow eel (recruitment)
- Yellow eel (standing stock)
- Silver eel

Glass eel

Of the 10 glass eel time series recorded, 7 have provided data on glass eel length and 8 for weight of glass eels (table 3.5). Six series have at least 5 years of data for length and weight.

In the other sampling series data exists on length and weight in 10 series. Only one of these series has at least 5 years of data.

The series with glass eel biometry data come from 7 countries. Three of these series are from the Mediterranean and the rest are for the Atlantic.

Recruitment yellow eel

Of the 20 yellow eel recruitment time series 9 have provided data on length and weight. Five of these series have at least 5 years of data for length and weight respectively. Age information exists in two series, of which one has information for at least 5 years. The series come from 6 countries, mostly from the northern part of the range and are located in fresh or transitional waters. No other sampling data exists for the recruitment yellow eel series.

Standing Stock yellow eel

Of the 113 standing stock yellow eel time series 104 have provided data on length, 94 on weight and 16 for age. Eighty-six and 77 of these series have at least 5 years of data for length and weight respectively. Only one series has at least 5 years of data for age. The series come from 16 countries, mostly from the northern part of the range and are located in fresh waters.

In the other sampling series data exist on length and weight in 83 series.

Mixed yellow and silver eel

In the other sampling data, 23 and 27 sampling have information on length and weight, respectively, without gender information. Three (weight) and four (length) of these have at least five years of data. Additionally, there were 15, 14, and 12 samplings that include female lengths, weights and age information and 4, 4, and 2 sampling that include male lengths, weights and age information, respectively. Only 1-3 of these samplings last for more than five years.

Silver eel

Of the 44 silver eel series, 37 have provided data on length and 29 on weight of silver eel (both sexes included) and 14 series have provided silver age data. Eighteen and 9 of the series have at least 5 years of data for length and weight data respectively. Only one of the series contains at least 5 years of age data. Thirty-three series have provided sex ratio data and 11 of those contains at least 5 years of data.

Twenty-three series have provided the length, 22 weight and 13 the age of females. Ten, 9 and 1 of the series have at least 5 years of data for length, weight and age respectively. Twenty series have provided the length, 19 weight and 7 the age of males. Six of those series have at least 5 years of data for length and weight and none for age.

In the other sampling series, data exists on length and weight measurements including gender information in 91 (female) and 43 (male) series. Similarly, 72 (female) and 35 (male) series had information on age. Additionally, other sampling series data exist on length and weight in 52 silver eel series with no gender information. Of these series, 14 % to 36 % have at least five years of data.

The silver eel time series with biometry data come from 14 countries.

3.3.2 Spatial and temporal trends in group biometry

Eel life-history traits are complex and interact with anthropogenic pressures (Mateo et al., 2017). The assessment of escapement can yield contrasted results if evaluated as number, biomass or egg production (Mateo et al., 2017; Briand et al., 2018) and a positive relation of glass eel length and recruitment has been found in some studies (Dekker, 1998; Briand et al., 2019). For that rea-son, biometric data have been included in the WGEEL Data Call since 2019 with the objective to bring insights to the eel assessment provided by the WGEEL. However, time series of abundance are often collected sporadically and at few monitoring sites, thus related biometric data are not necessarily representative of the biometric trends at a larger scale (e.g. EMUs). In 2022, following recommendations from WKFEA (ICES, 2021b) and the recent WKEMP (ICES, 2022a), Data Call 2022 has asked for other biometric data not already covered under glass, yellow and silver eel series, collected under programmes such as EU DCF. These will be important to inform on key population parameters, such as age-at-silvering, sex ratio etc., and are necessary for developing the final Spatial Stock Assessment Model as outlined in the WKFEA roadmap (ICES, 2021b). While individual data are preferable, group data (i.e. estimators of average biometry values over multiple fishes) will also be important as individual data might not always be available, and some sampling schemes might be based on specific statistical sampling strategies, thus requiring specific data aggregations.

An exploratory spatial and temporal analysis of both series and other sampling biometric data has been made of biometric data collected in this Data Call to detect if there are differences depending on the locations and types of habitats in eel length and weight.

Three types of analysis were carried out:

• To compare allometric growth among sites, a log-log linear regression was used to determine whether the change in weight was isometric or allometric regarding the growth in length. Higher slopes indicate higher weight gain and therefore better condition. The obtained slopes were compared to the distance to Gibraltar using a Mann Kendall correlation. In this analysis, time-series were treated independently for glass and silver eels, while data were pooled by country and habitat type for yellow eels. Series (i.e. row of the table) containing fewer than five data were excluded from the analysis.

• To detect spatial patterns in biometry (length, weight, per sex when available), average biometry per EMU, stage, habitat types and sex (when available) was computed. All years and time-series were pooled together. Mann Kendall tests were then used to detect correlations between the considered traits and spatial positions of the biometry measurements. Here, spatial coordinates are characterised by distances as the crow flies from Gibraltar: this distance is used as a proxy of latitude, which is known to be correlated to life-history traits (Kettle et al., 2011; Vøllestad, 1992), but allows the consideration of the Mediterranean basin. The glass eel has not been included in this analysis since their biometry is seasonal and therefore depend on the sampling protocol.

• To explore the existence of temporal trends in biometry, average biometry (length, weight, sex ratio) per EMU, habitat and year was computed in the case of yellow and silver eels. For glass eel and glass/yellow eel mixed series, the analysis was made at the series level since in those stage biometry is too sensitive to the timing of the sampling. Then, Mann-Kendall trend tests were used to detect significant temporal trends. The analysis was restricted to EMU/habitat in which at least five years of data were available.

The results of the analyses can be found in the Annex 16.

3.3.3 General overview of the group biometry time series

The information described in the previous sections is summarised in Table 3.6 and 3.7.

Table 3.3. Number of time series with more than five years of data for different parameters. G: glass eel series, YR: recruitment yellow series, Y standing stock yellow series, and S silver eel series.

									Female						Male					
	Length		Weigth		Age		% Female		Length		Weigth		Age		Length		Weigth		Age	
	Tot.	≥5	Tot.	≥5	Tot.	≥5	Tot.	≥5	Tot.	≥5	Tot.	≥5	Tot.	≥5	Tot.	≥5	Tot.	≥5	Tot.	≥5
G	7	6	8	6																
YR	9	5	9	5	2	1														
Y	104	86	94	77	16	1	9	0	7	0	7	0	3	0	5	0	5	0	3	0
S	37	18	28	8	10	1	34	12	23	10	22	9	13	1	21	6	20	6	8	0

Table 3.4. Number of other sampling series with more than five years of data for different parameters. G: glass eel series, yellow series, Y standing stock yellow series, YS mixed yellow-silver, and S silver eel series.

										Female						Male				
	Length		Weigth		Age		% Female		Length		Weigth		Age		Length		Weigth		Age	
	Tot.	>5	Tot.	>5	Tot.	>5	Tot.	>5	Tot.	>5	Tot.	>5	Tot.	>5	Tot.	>5	Tot.	>5	Tot.	>5
G	10	1	10	1																
Y	83	20	83	20			44	16	42	14	42	14	38	10	22	5	22	5	21	3
YS	23	3	27	4			15	3	15	3	14	3	12	2	4	1	4	1	2	1
S	52	14	52	14			44	14	91	18	43	13	72	12	43	8	14	5	35	5

The first exploration of group biometric data in comparison with time series group data already available indicated increase in biometric data available for transitional, coastal and marine open waters, given that time series data were mostly associated with fresh water, increasing overall habitat coverage (Table 3.8). Group biometric data available for silver eel substantially increased with addition of other biometric data (Table 3.9). Furthermore, the number of series increased for countries that were underrepresented before (Germany, Spain) and included some data for countries not covered under time series data (Poland, Italy), increasing overall spatial coverage (Table 3.10). However, the Mediterranean still remains underrepresented, and there is little information on biometrics at the earliest stages compared to the later stages. There is little information on age in the time series, but more information on age now exists in the other sampling series. Many series are too short at present but may be incorporated as soon as they reach five years.

Table 3.5. Number of time series (source=series) and other sampling series (source=sampling) per habitat.

habitat	source	nbsites
C	sampling	19
C	series	3
F	sampling	95
F	series	157
MO	sampling	6
MO	series	5
T	sampling	32
T	series	14
NA	sampling	48

Table 3.6. Number of time series (source=series) and other sampling series (source=sampling) per life stage.

life_stage	source	nbsites
G	sampling	10
G	series	10
GY	series	12
Y	sampling	83
Y	series	113
S	sampling	104
S	series	44
YS	sampling	27

Table 3.7. Number of time series (source=series) and other sampling series (source=sampling) per country.

country	source	nbsites
BE	series	1
GR	series	4
IE	sampling	5
IE	series	14
DE	sampling	64
DE	series	1
DK	series	7
FI	series	4
FR	sampling	16
FR	series	27
NO	series	3
PL	sampling	2
PT	sampling	1

country	source	nbsites
PT	series	6
SE	sampling	36
SE	series	15
IT	sampling	5
ES	sampling	56
ES	series	7
GB	sampling	8
GB	series	57
LT	series	15
LV	sampling	4
LV	series	4
NL	sampling	3
NL	series	14

Conclusion

The data exploration of other group biometric data highlighted some issues to be fixed in the future Data Call, including missing column for indicating gear type, missing habitat type (see Table 3.3) and sampling strategy information for some data (see Annex 16, Table S1). Sampling strategy should be constrained to several options (e.g. commercial, scientific etc.) to avoid creation of multiple subcategories that fall into the same category and better align with series data. For more detailed look into all group biometric data available please see Annex 16, Table S1.

The number of fish measured is still missing for some group series and other group sampling data. There is also an issue with only providing one column to indicate the number of fish measured, given that often different numbers of fish will be assessed for different metrics. In addition, mean lengths and mean weights will not align with each other in that case, rendering summary data of limited use if there are individual records available. However, group metrics are still valuable and should be collected especially when no other records exist. Therefore, it will be important to provide number of individuals measured per metric for those data. Apart from obtaining missing data, one of the next steps would be to determine which group metrics are available as individual data for the whole-time span as in that case using individual data would be advised. More explanatory analyses should be done once missing data become available (e.g. per sex, gear), but the focus should shift to exploring individual data where possible.

3.4 Individual biometry

Individual data for length, weight, age and sex have been provided through Data Call annex 1-3 (time series) and 10 (other sampling). In total 624374, 359194, 57799 and 148227 data were provided for respectively for length, weight, age and sex. These data have been summarised in annex 17.

3.5 Length-based model

The estimation of a species global stock status is a challenging process taking into considera-tion the lack of data, or incomplete data series. Additionally, the high uncertainty in the knowledge of the biological processes, model selection and parameters estimations are factors that increase even more the challenge of the stock assessment.

In order to overcome this problem and answer the request raised through National and Re-gional regulations for a science-based management, an interest on simple stock-reduction analysis, which uses available catch trends and life history data was raised (Froese et al. 2018).

Currently used models

A literature review was carried out to screen for possible models that could be used for the assessment of European eel's stock condition, using biometric data. Seven models were iden-tified as possible candidate for the task of the stock assessment following a Bayesian ap-proach to estimate the stock status.

These models are:

1. Length Converted Catch Curve (LCCC)
2. Length-Based Thompson and Bell (TB)
3. Length-Based Spawning Potential Ratio (LBSPR)
4. Length-Based Integrated Mixed Effects (LIME)
5. Length-Based Risk Analysis (LBRA)
6. Statistical Catch-at-Length Model (SCAL)
7. Length-Based Bayesian Biomass (LBB)

All above models, except SCAL, are contained in R packages and can be tested without the need to develop new code. These packages are:

1. 'TropFishR' for TB, LBRA and LBB (Mildenberger et al. 2017, Froese et al. 2018, Chong et al. 2020)
2. 'LBSPR' for LBSPR (Hordyk et al. 2015)
3. 'lime' for LIME (Rudd and Thorson 2018)
4. SCAL runs with the AD Model Builder software (Otter Research 2000).

Assumptions and requirements

Table 3.11 shows the inputs, assumptions and outputs of the selected length-based assessment models. All the models requiring length-at-maturity statistics (TB, LBSPR, LIME) are es-teemed inappropriate since eel achieves the length of first maturity towards the Sargasso Sea, where it dies after spawning. LCCC, LBRA, SCAL and LBB are models that require inputs deriving from length-frequency and the von Bertalanffy equation.

LCCC can provide information on the amount of fishing mortality within the fishery. This is achieved by using the rate of mortality between different size classes and by identifying how much can be attributed to fishing (Bridges 2018).

LBRA provides the ability to interpret length composition data even if direct information on mortality, fishery selectivity and recruitment compensation is unknown (Cope & Punt 2009). The sensitivity of LBRA to different life histories is low, thus LBRA can be applied to a wide range of stocks.

SCAL is a length-structured population model, which incorporates von Bertalanffy growth, and is used to determine the changes in population abundance over time (Sullivan et al. 1990). The model is using a catch-at-length algorithm to estimate relative abundance, fishing mortality, selectivity and the von Bertalanffy growth parameters L and K (Sullivan et al. 1990).

LBB seems to be the easiest to use model since the estimation of the size structure and stock status is based only on a length-frequency analysis, in which all relevant parameters are ex-amined concurrently using a Bayesian Monte Carlo Markov chain (MCMC) approach (Froese et al. 2018). A specific LBB-like model (ELSA: Eels Length Structure Analysis) was already developed to analyse eel length structures of the Garonne and Dordogne River basins stock (Lambert et al. 2006). ELSA includes an exponential trend of recruitment, a linear growth, a negative exponential mortality and a silvering process based on a gamma function. On the other hand, it excludes the effects of sex determinism and gear selectivity on length structure.

Table 3.8. Overview of the recently used length-based assessment models to assess the condition of the fish stock (modified from Chong et al. 2020) including details about input requirements, assumptions and outputs. Models requiring length-at-maturity inputs are indicated in red.

Method	Inputs	Assumptions	Outputs
Common assumption		Growth curve is assumed to be common among individuals	
LCCC	Length-frequency data (yearly catch vector) von Bertalanffy growth function (L_1, K, t_0) Natural mortality (M)	Total mortality is constant for all length classes Selectivity follows logistic curve (width of curve calculated from (L^s_{50} and L^s_{75})	Length at 50% and 95% selectivity (L^s_{50} and L^s_{96}) Total mortality (Z) (used to calculate F)
Length-based TB	Length-frequency data von Bertalanffy growth function (L_∞, K, t_0) Length–weight relationship (a and b) F-at-length-array (fishing mortality for each length class; calculated based on selectivity) Natural mortality (M) Total mortality (Z)	Stock is in equilibrium Natural mortality is constant Selectivity and maturity follow a logistic curve	Precautionary reference levels ($F_{0.1}$, $F_{0.5}$, $E_{0.5}$) Exploitation, yield, abundance and catch across vector of fishing mortalities Current exploitation, yield, abundance and catch Current F *SPR*

Method	Inputs	Assumptions	Outputs
	Length at 50% selectivity and maturity (L^s_{50} and L^m_{50}) Width of selectivity and maturity logistic curve		F/F_{Max} or F/F_{MSY} SPR_{MSY}
LBSPR	Length-frequency data Asymptotic length (L_∞) Coefficient of variation of L_∞ ($CV_{L\infty}$) *M/K* (calculated from *M* and *K*) Length–weight relationship (*a* and *b*) Length at 50% and 95% selectivity (L^s_{50} and L^s_{95}) Length at 50% and 95% maturity (L^m_{50} and L^m_{95})	Stock is in equilibrium Natural mortality and growth rates are constant Selectivity and maturity follow a logistic curve Both sexes have the same growth curve and the sex ratio is equal The lengths at each age are normally distributed around a mean length-at-age value.	*F/M* ratio Length at 50% and 95% selectivity (L^s_{50} *and* L^s_{95}) *SPR* F/F_{MSY} SPR_{MSY}
LIME	Length-frequency data von Bertalanffy growth function (L_∞, *K*, t_0) Length–weight relationship (*a* and *b*) Natural mortality (*M*) Length at 50% and 95% selectivity (L^s_{50} and L^s_{95}) Length at 50% maturity (L^m_{50})	Natural mortality is constant Selectivity and maturity follow a logistic curve	(Length data only) Recruitment Spawning biomass Mean length Length at 50% and 95% selectivity (L^s_{50} *and* L^s_{95}) Current *F* *SPR* F/F_{MSY} SPR_{MSY}
LBRA	Length-frequency data von Bertalanffy growth function (L_∞, *K*, t_0) Coefficient of variation of length at age (CV_{L_1}) Length–weight relationship (*a* and *b*) Natural mortality (*M*) Theoretical maximum age ($\tilde{a}_\lambda$)	Average annual constant recruitment Selectivity and maturity follow a logistic curve The lengths at each age are normally distributed around the mean length The observed maximum age ($\hat{a}_\lambda$) deviates are described by the exponential probability density function (used to calculate *M*)	B/B_{MSY} Total mortality (*Z)* [used to calculate fishing mortality (*F*)] *SPR* F/F_{MSY} SPR_{MSY}
SCAL	Total catch (mt) Catch at length or proportional catch at length Recruitment at a specified age Survey-indices of abundance of the larger/older fish Length-frequency distribution surveys	fishing mortality rates can be separated into an age-specific effect (selectivity) and a temporal effect (catchability) the age-specific effect is constant over time	Fishing mortality (*F*) Recruitment in each year Fishing mortality (*F*) to produce the initial population (F_{start})

Method	Inputs	Assumptions	Outputs
			logistic selectivity parameters for each year or blocks of years ($b_{1,y}$) *Qs* for each survey index, i.e. Fishery catchability.
LBB	Length-frequency data Optionally priors for: L_∞ length at first capture (*Lc*) relative natural mortality (*M/K*)	recruitment is constant growth is constant mortality is constant L-F data can be representative of the exploited stock	growth lengths at first capture (*Lc*) current relative biomass L_∞ *F/M* ratio *M/K*

Spatial heterogeneity

Due to the specifics of the eels' life cycle, length-frequency distributions are not uniform over the eels' home range (see Annex 17). On the one hand there is sexual differentiation in size and distribution - males are smaller and predominantly present in areas close to sea - and geographical differentiation with predominant smaller (silver) eels in southern countries of the home range compared to more northern areas. These features plea for a spatial analysis of the stock assessment based on length data within and between regions.

Model comparison and combination

All models are developed for data-limited length frequency time series and particularly tar-get fishery effects (Chong et al., 2020). Since the eels' stock is also subject to other pressures (e.g. climate change, pollution, migration barriers), the selected models for the stock assessment should be evaluated for their accuracy under different life history, exploitation and recruitment scenarios to determine their strengths and weaknesses on evaluating the stocks' status of a species with the life cycle of eel.

This can be done using simulations based on an operating model with pseudo-data (Chong et al. 2020; Pons et al. 2020; Rudd et al. 2021; Kell et al. 2022) which can be carried out using the R package 'fishdynr' (Taylor 2017). Decision support tools such as 'FishPath' (Dowling et al. 2016) may be useful to weight input requirements and assumptions to identify the most appropriate methods (Pons et al. 2020). Results of different models can be integrated to combine various sources of uncertainty by using a simple model averaging approach (e.g. GCV: generalized cross-validation) or alternative methods such as Akaike (AIC) or Bayesian (BIC) In-formation Criteria (Scott et al. 2016).

Ideally, a combination of different length-based methods should be applied to assess the stock so their performances can be compared, and a range of possible stock estimates defined (Chong et al 2020). The results of the spatial analysis may as well be combined into a final stock assessment.

3.6 Conclusion on Yellow and silver eel datal

While those data may be incorporated in some assessment models (see 3.5), it's beyond the scope of the working group of this year to test it. Only some exploratory analyses have been attempted. They illustrate the potential of the collected data, e.g. for use in a spatial assessment model. A specific workshop will be needed in order to fully utilize the data.

4 Eel Quality (ToR C)

In this chapter, we review updates in science relevant to management and protection of eel. In 2018, WGEEL identified a need to review scientific studies and new data on non-fishery factors contributing to direct and indirect losses of eel. A rolling programme of reviews was adopted, in which a WGEEL sub-group examines one theme per year. This started in 2019 with a review of the impacts of hydropower and pumping stations, and was followed by a focus on habitat loss in 2020, and on the effects of contaminants and parasites in 2021.

In 2022, a "quality data'' annex was added to the data call, consisting of *Anguillicola crassus* and virus prevalence, contaminants, and fat levels. This year, the subgroup focused on summarizing these data which were integrated in the database during the first part of the meeting. Other sources of data relating to eel quality were also reviewed to consider a future expansion of the WGEEL database.

Recent publications on new and emerging threats were also reviewed to answer terms of reference (ToR C: Report on updates to the scientific basis of the advice, including any new or emerging threats or opportunities).

4.1 Introduction

The concept of 'eel quality', and within it, the physical and physiological condition of different eel life stages culminating in spawning individuals, was first discussed by WGEEL in 2006 (ICES, 2006), when the group reviewed negative impacts on spawner quality and reproductive capacity. Successful migration and reproduction likely depend on: 1) lipid quality and quantity, as it is the primary source of energy during migration and maturation, 2) but also on the life-long impact of diseases and parasites, and contaminants accumulated by the eel during their continental growth stage (Freese et al. 2017, 2019; Bourillon et al. 2020). Due to their peculiar biology as long-lived, lipid-rich and semelparous predators, eels are explicitly prone to accumulating large amounts of potentially toxic compounds (Belpaire et al. 2019). Various studies have shown that individual eel quality reflects their growth habitat - in terms of contamination status, as well as the presence of diseases and parasites (Belpaire et al 2007, 2008; Freese et al. 2016; Bourillon et al. 2020). As a result, spatial differences in spawner quality may affect the reproductive capacity of the species on a stock level (Freese et al. 2017). However, when it comes to stock assessment on a broader scale, such as with eel management plans, currently only numbers of spawners but not their quality is being assessed.

The eel's spawning migration is poorly understood and by association the long-term impacts of factors that may affect the eel while swimming, are not fully understood and difficult to assess. As a result, contaminants, parasites, diseases, and other sub-lethal effects such as those resulting from passage through hydropower and other facilities, were identified as key factors to better understand (WGEEL, 2006). Further, it was suggested that 'spawner quality' should be included in the stock management advice, describing the capacity of silver eels to reach breeding grounds and produce viable offspring (ICES, 2006).

In 2007, the European Eel Quality Database (EEQD) was created and access shared among members of WGEEL, requesting data on fat composition, selected contaminants and diseases (WGEEL, 2007). Data were added to the EEQD in the following years, and while it was shown that the quality of eels leaving some parts of Europe was considered low, it was recognised that the impact of contaminants and diseases on the escapement of successful spawners remained unknown (ICES, 2010; 2011). Further, there was a need for better harmonization and standardization of eel quality assessments (ICES, 2010; 2011). In 2015, the first workshop was held to examine development of standardized and harmonized protocols for the estimation of eel quality (Workshop of the Planning Group on the Monitoring of Eel Quality, WKPGMEQ, ICES, 2015). The workshop concluded that there was an urgent need for an internationally coordinated research project aiming at improving the understanding and quantification of the effects of contaminants on the reproductive success of the European eel, in order to allow integration of quality indicators in stock wide assessments (ICES, 2015). These previous recommendations were re-iterated in the 2021 WGEEL report, in which the status of understanding of disease and contaminants was reviewed (ICES, 2021c). Further, the recent WKFEA report (ICES, 2021b) proposed it may be possible to draw on existing datasets - e.g. chemical pollution data collected as part of the Water Framework Directive (WFD) requirements - to perform and harmonize eel quality assessments.

4.2 Overview of data provided by WGEEL members

4.2.1 Issues related to the data request

The call for data relating to eel quality in Data Call Annexes 1, 2, 3 and 10 this year on disease (EVEX and Herpes-virus *anguillae* (HVA)) and parasites (*A. crassus*), selected contaminants (sum of the 6 ICES PCB, Toxic equivalent (TEQ), Hg, Cd, Pb) and muscle lipid levels, was not mandatory and any submitted were provided voluntarily. There is no legal obligation to collect data relating to eel quality, and the amount collected and provided varies among countries. Some countries were reluctant to upload data that had not yet been published. Also, data is not always easily accessible to country representatives in WGEEL, so while they may be aware of relevant information, they may not be able to upload them. In the case of large datasets, it was raised that the timing of the data call in the summer and shortly before the meeting was prohibitive. It was possible to upload either group and/or individual data, which each may have benefits and potential pitfalls. While group data are easier to handle, individual data provide more detail. Also, provided data did not undergo any quality checks or controls and may also have limitations in their comparability, if collected for differing purposes or analysed using different methodology.

4.2.2 Overview of the data integrated following the data call

Thirty two countries received the data call, of which eleven provided data on eel quality in the Data Call annexes. For some countries, there were neither provided nor known data sets, but for many countries, data sets existed but were not filled in the Data Call annexes (see 4.2.3 and Figure 1). The number of datasets, provided in response to the data call, ranged from single rows to thousands of data points, depending on the country and/or EMU (Table 4.1).

Seven countries (France, United Kingdom, Germany, Ireland, Netherlands, Spain and Sweden) provided data on *A. crassus* (prevalence and/or intensity) in Data Call Annex 10 (Table 4.1). Only the UK provided data on eel viruses. Only Germany and the UK provided data on lipids and contaminants. These data were provided both as group metrics (aggregated values) and at the individual level.

Concerning the time series (Data Call Annexes 1, 2 and 3), seven countries provided group data on parasites, six of which provided individual data. The United Kingdom and Ireland reported lipid data related to time series; only the United Kingdom provided individual data on lipids. No data related to the time series on viruses or contaminants were reported.

Table 4.1. Number of countries reporting eel quality data within the Data Call

		Crassus	Lipids	Evex	HVA	PCBs	TEQ	Cd	Hg	Pb
Samples (Data Call Annex 10)	Group	5	2	1	1	1	1	2	2	2
	Individuals	6	2	1	1	1	1	2	2	2
Time Series (Data Call Annexes 1, 2, 3)	Group	7	2	0	0	0	0	0	0	0
	Individuals	6	1	0	0	0	0	0	0	0

4.2.3 Other sources of data (not included in Data Call Annexes 1, 2 , 3 and 10)

All WGEEL data providers were approached during the meeting or by email and asked if data existed. Country reports were also screened to examine if data existed. Countries that did not provide data, but were found to have appropriate information, were asked why these were not provided. One reason is that 2022 was a test-year and filling eel quality parameters was optional. However, most often, data providers did not have enough time to gather the data before the deadline. An extended data call period would likely allow for more of the relevant data to be entered in the Data Call annexes. Another reason was lack of funding - financial limitations could be a limiting factor to data submission (in terms of acquisition of the data). Finally, some countries were reluctant to upload data that had not yet been published. For this reason, data was not always easily accessible by WGEEL data providers.

Countries were sorted in to four categories: 1) data were filled in the Data Call annexes and integrated in the WGEEL database, 2) data were filled in and integrated in the database, but other data exist, 3) data were not filled in nor integrated into the database, but they exist, and 4) no data exist, 5) country representatives could not be reached: unknown data (Figure 4.1). Table 4.2 shows the countries that had data, which wasn't integrated in the database. Data were grouped by year for each country and grouped into habitat (coastal, transitional, and freshwater).

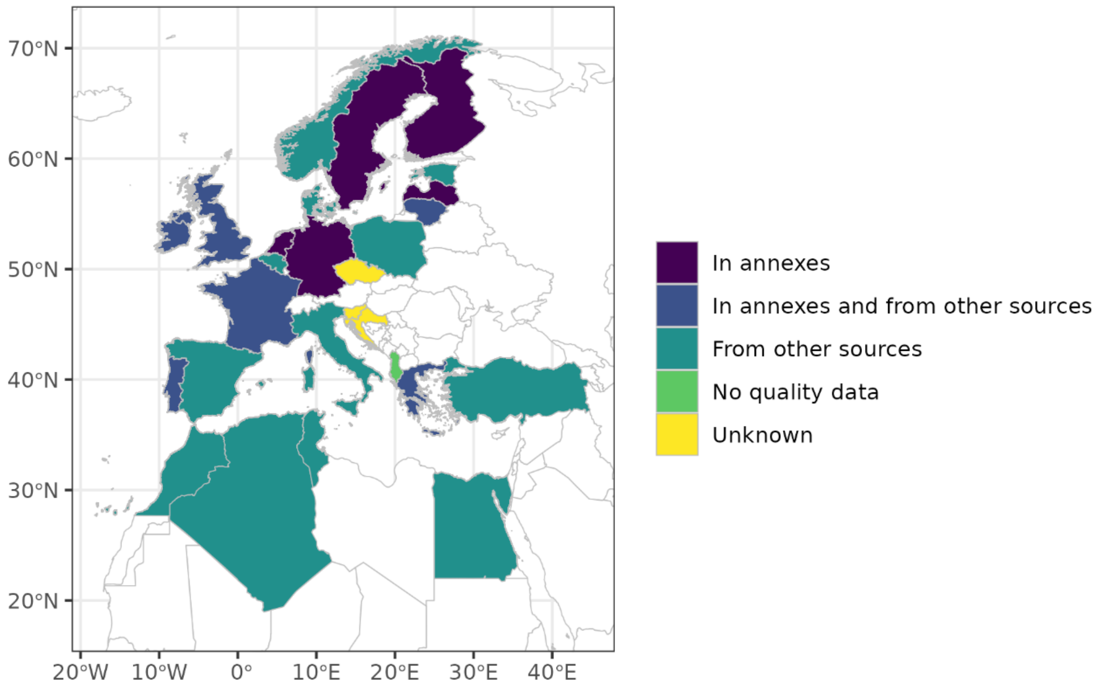


Figure 4.1. Overview of available data on eel quality that were filled in the Data Call annexes and/or coming from other sources. No eel quality date and unknown are also highlighted.

There are more eel quality data than were recorded in the Data Call annexes. However, this does not capture the number of individual data series that could be available. Many records corresponded to single year studies, although some countries recorded eel quality over five consecutive years, or more, e.g. Belgium for lipids and contaminants; Denmark, Algeria, Estonia, Great Britain, Greece, Ireland, Morocco, Norway for *A. crassus*. Only Norway recorded data in coastal water (Table 4.2).

Table 4.2. Records of the countries having data on yellow (Y) and silver (S) eel quality, which were not filled in the Data Call annexes, on lipids, *A. crassus* (AC), Virus, PCBs and metals. NA: not available information. Numbers correspond to the years when data were recorded. However, this does not capture the number of sites and the number of individual data series potentially available.

		Coastal					Transitional					Freshwater				
Country	**Stage**	**Lipids**	**AC**	**Virus**	**PCBs**	**Metals**	**Lipids**	**AC**	**Virus**	**PCBs**	**Metals**	**Lipids**	**AC**	**Virus**	**PCBs**	**Metals**
Belgium	S											2	2	2	2	
	Y											22	1		22	22
Denmark	Y							29					29			
Algeria	YS						2	7				3	14			1
Estonia	YS												5			
Egypt	YS							2								
Spain	NA							6	3		4		1	1	1	1
	Y												1			
	YS												2			
France	S						4	4	4	4	4	2	2	2	2	2
	Y												3			
	YS							1								
Great Britain	YS												13			
Greece	S							18								
Ireland	YS							14					14			
Italy	S						1	1	1	1	1					
	YS							4								
Lithuania	YS							3					3			
Marocco	NA							11			1					
Norway	Y	4	3		1							4	3		1	
	YS		10										10			
	NA												1			1
Portugal	YS												1			
Tunisia	S						3	3			3					
Turkey	YS										1		7			5

4.3 Example data analysis

Graphs were realized using the data that were integrated during part 1 of the WGEEL meeting. They are not a comprehensive representation of the data that was provided and purely highlight what is possible, and where additional submissions could fill gaps Therefore, these figures are presented in Annex 18. The amount of data that was provided by each country for their EMUs and for each requested category was variable, and as such only certain parameters and locations could be visualized. A dedicated workshop would allow time and resources to analyse the data more comprehensively, for example separating data between habitat, life-stage, and sex.

4.4 Changes to be made to Data Call annex 10 (future data calls)

A basic change to improve submission would be to make the data call reporting mandatory. Recognising that some countries were reluctant to upload unpublished data, a solution in these instances would be to provide only the metadata and a contact person instead of the raw data, with a view to the complete dataset being uploaded when appropriate. Due to the absence of a legal obligation to collect this data, the collation and integration by named providers could take a great deal of time and effort. As such, it was proposed that an appropriate mechanism for consolidating data is developed by each country to reduce the burden on the provider.

It would be valuable to add minimum, maximum, and standard deviation values to the 'group' measures spreadsheet for lipid levels, sum 6 PCB, TEQ, Hg, Cd and Pb.

4.5 Suggestions

- We strongly encourage national administrations to facilitate the acquisition of eel quality data by providers. Inclusion of eel quality in the data call is essential to identify eel and habitats associated with a high spawning potential
- It is highly recommended to report contaminants following the procedures presented by ICES (ICES 2015).
- If lethal sampling/eel mortality is occurring, such as during DCF monitoring, opportunities to measure eel quality metrics should be utilised.
- Further research on contaminant thresholds is essential for assessing the spawning potential of eels. The reports provided by the workshop on the biological effects of contaminants (WKPGMEQ and WKBECEEL) should be updated.

5 Science and Emerging threats (ToR C)

5.1 Scientific publication review

In this section, we aim to assess to what extent published research became available on the quality of eels during the last three years. To this aim, WGEEL participants were asked to provide recent publications, which were used to (a) assess if other new data than the ones supplied in response to the data call are available, and (b) to assess if new insights have been published on the impact and state of contaminants and diseases in relation to eel, which are relevant to the working group.

Twelve publications were provided, covering studies in four countries (Teunen et al., 2020, 2021a, b, c, 2022, Danne et al. 2022, Nzau Matondo et al., 2022, Kantzoura et al. 2021, Danne et al. 2021, Righton et al., 2021, Bajinskis et al. 2020, Bourillon et al. 2020). Bourillon et al. (2020) describe the quality of silver eels over a significant number of catchments throughout Europe, and Righton et al. (2021) reviewed the need for future work on the quality of eels. From this review, which was not comprehensive, it is obvious that in several countries data on the quality of eels are available, however those data were not accessible for analysis during WGEEL. It can be assumed that significantly more papers have been published in the past two years. For example, a number of contaminants are part of the reports of the mem-ber states on the WFD and many institutes analyse fish samples (some including eels) as part of consumer protection and environmental quality standards. Moreover, there is evidence provided that there is potential for extrapolation of data of some chemicals in other fish species to concentrations in eel.

Table 5.1. Literature review of articles published in 2021 and 2022 addressing eel quality. Summaries are provided where relevancy to WGEEL is highlighted.

Reference	Geography	Subject	Relevance for WGEEL
Righton et al., 2021	Europe	An expert review to assess the state of research and identify the future key research and management questions for conservation, management and policy of the eel.	The authors concluded that determining the role of pollution in eel population dynamics and health is critically important, and quantifying to what extent, and at what level, contaminants affect reproductive success is crucial. This research may benefit from the technological progress of new methods. Evidence was presented that a chronic infection of *A. crassus* alone, or associated with other impacts, will affect the ability of eels to migrate and reproduce effectively, but more studies are needed to confirm this.
Nzau Matondo et al., 2022	Belgium (Wallonia)	An eight-year study from Belgium assessing the life history traits and health status of eels restocked in upstream rivers of the Meuse catchment, presenting data on lipid levels and the state of viruses, *A. crassus* and organic pollutants.	The paper includes data that would fit to be included in the database. The authors suggested that the overall good quality of eels restocked in those rivers supports the idea of the relevance and value of restocking upland aquatic ecosystems to enhance riverine silver eel production.

Reference	Geography	Subject	Relevance for WGEEL
Teunen et al., 2021a	Belgium (Flanders)	Accumulated Per- and polyfluoroalkyl substances (PFAS) levels were measured in eel and perch at 44 sampling locations within the main water basins of Flanders (Belgium). Human health and ecological risks were assessed. Mean PFAS levels in eel did pose a human health risk. Ecological risk standard was exceeded for PFOS at about half of the sampling locations.	The paper includes data that would fit to be included in the database. PFAS chemicals high enough to cause health problems for humans and eels.
Teunen et al., 2021b	Belgium (Flanders)	Accumulated mercury concentrations were measured in muscle and liver tissue of eel at 26 locations in Flemish (Belgian) water bodies and effects of size and weight were assessed There was no difference between muscle and liver concentrations. Human health risk analyses revealed that only frequent consumption of local eel (> 71 g day-1) could pose risks to humans.	The paper includes data that would fit to be included in the database. Mercury levels in eel did not seem high enough to cause health problems for humans.
Danne et al. 2021	Germany	Health status of different eel stages (elvers, yellow eel and silver eel) from North Rhine-Westphalian rivers were investigated. The eels did not show bacterial infections, but frequent infections with *A. crassus* and/or viral infections.	The paper includes data that would fit to be included in the database. Regional information on eel quality: Occurrence and distribution of eel diseases
Danne et al. 2022	Germany	Investigation of viral infections in batches of eels intended for restocking. Samples of glass eels from certified fisheries and farmed European eels from different aquaculture farms were analysed. Via a combination of cell culture and qPCR-based techniques, infections of glass eels with the rhabdovirus eel virus European X and anguillid herpes virus 1 infections in farmed eels were detected	The paper shows some evidence that eels meant for restocking may contain disease agents and their stocking may help spreading those diseases.
Demirak et al. 2021	Turkey and Estonia	Concentrations of Mn, Cd, Zn, Pb, and Cu metals were measured in eel liver, gill, skin, and muscle taken from Lakes Köyceğiz (Turkey) and Võrtsjärv (Estonia)(2017 and 2018).	Health risk for consumers was assessed for both adults and children (through estimated weekly intake, hazard index, and lifetime cancer risk values) for both lakes.

Reference	Geography	Subject	Relevance for WGEEL
			Significant difference occur between both lakes (especially Cu, Cd, and Pb). Cancer risk values for Pb in Lake Võrtsjärv were very close to the danger limits.
Bajinskis et al. 2020	Latvia	The aim of the study was to evaluate the quality of eel in Lake Rāznas and to evaluate the feasibility and effectiveness of transporting eel from the lake to waters from where they can migrate downstream. Concentrations of heavy metals and polychlorinated biphenyl in eel muscle in Lake Rāznas were lower or similar to the lowest values found elsewhere in Europe, and below limits set by the European Commission.	The paper includes data that would fit to be included in the database. Regional information on eel quality.
Bourillon et al. 2020	Europe	Investigation of effects of multiple contaminants on the spawning migration of silver eels from 12 catchments across Europe. Assessment of muscular lipid content, infection with *A. crassus*, and contamination by persistent organic pollutants and trace elements Development of a standardized eel quality risks index (EQR).	The paper includes data that would fit to be included in the database. EQR represents a step forward in the standardization and mapping of eel quality risks.
Teunen et al., 2022	Belgium (Flanders)	Accumulated perfluoroctane sulfonate (PFOS), mercury (Hg), hexabromocyclododecane (HBCD), polybrominated diphenyl ethers (PBDEs), dioxins and polychlorinated biphenyls (PCBs) concentrations were measured in muscle tissue of eel of rivers and canals in Belgium (2015-2018). Threshold values were compared to current EQSbiota of WFD.	The paper includes data that would fit to be included in the database. The study advises on revising and fine-tuning the current EQSbiota, especially for ΣPBDE and HBCD.
Kantzoura et al. 2021	Greece	Morphology and pathogenicity of *A. crassus* in European eel were investigated. Morphometric variations of A. crassus seem to be differently expressed when exposed to different environments (Greece).	The paper includes data that would fit to be included in the database (*A. crassus*).
The Netherlands Country Report and references therein	The Netherlands	Data on contaminants (non dioxin like PCBs) in eel from nine sites during 2016-2021 are presented. In many sites thresholds were exceeded. Also 2021 data of lipid levels and contaminants from 29 sites were included.	The report includes data that would fit to be included in the database.
Teunen et al., 2021c	Belgium (Flanders)	This paper includes data of analysis of 11 compounds in eel muscle.	The paper includes data that would fit to be included in the database. A comparison with other data from other European catchments is provided. The paper provided some evidence that for some compounds extrapolation between data measured in other fish species could be extrapolated to eel.

Reference	Geography	Subject	Relevance for WGEEL
Teunen et al., 2020	Belgium (Flanders)	This report tabulates all data of analysis of eel muscle for reporting on the chemical status as required by the WFD. Data are from rivers and canals sampled during 2015-2018.	The paper includes data that would fit to be included in the database. For many compounds the levels are exceeding the EQSbiota thresholds (which were chosen to protect the most sensitive species from direct toxicity, including fish eating predators and humans via secondary poisoning).
Capoccioni et al., 2020	Italy	The paper reports on silver eel contamination profiles and health status in two Mediterranean lagoons (Fogliano and Capolace, Italy). Data on contaminants (29 polychlorinated biphenyls, 9 polybrominated diphenyl ethers, 5 dichlorodiphenyltrichloroethane, 5 chlordanes, hexachlorobenzene, 3 hexachlorocyclohexane, and 5 metals) were presented in addition to *Anguillicola crassus* and virus (EVEX and AngHV-1) infections levels. Overall, a good quality status of escaping silver eels, for both lagoons, was highlighted.	The paper includes data that could be included in the database. A comparison with other data from other Mediterranean lagoons is provided. The paper proposes an integrated assessment system: qualitative assessment, integrated through the use of quality indices associated to an evaluation of the ecological quality of the lagoon environments.
Giari et al., 2021	Italy	The paper provides a long-term dataset showing the dynamics of *A. crassus* in eels of the Comacchio Lagoon (Italy) from 1997 to 2019. Results show no significant temporal trend in the occurrence of *A. crassus*. In addition, no influence of *A. crassus* on condition factor, hepatosomatic and gonadosomatic index and swim bladder integrity was found, suggesting a minimal impact of the parasite on the eel health. Even though established in Comacchio Lagoon, *A.crassus* has not become invasive.	The paper includes data that could be included in the database. The paper highlights the importance of management of the lagoon for the past 30 years that has contributed to parasite containment through avoidance of restocking the eel population from external sources.

5.2 New and emerging threats and opportunities

In this section, we present updates in science, relevant for the management and conservation of the eel.

5.2.1 New science

5.2.1.1 Eel passage/screening solutions at river structures

Flood control structures such as weirs, hydropower stations and intakes can be barriers for eel migration. Numerous projects are now in progress to assess the effectiveness of existing or new technology to minimise entrainment such as the REDEEM project at Hull University and the UK Environment Agency (EA) has updated its 'Eel Manual' on technical solutions for screening intakes. Landlocked water bodies such as reservoirs for drinking water also hold large stocks of European eel with no connection to seaward migration other than overspill (Piper et al., 2020). A project was therefore developed to build upon baseline research conduct-ed by CEFAS, EA and ZSL, to quantify eel behaviour and movement patterns within a major reservoir with multiple input and output flow routes.

5.2.1.2 Azores tagging project

It is critical to locate where eels spawn to conserve the species and understand reasons for decline. To attempt the location of their spawning area and how they migrate there an international partnership known as the Azores Eel project was created with the objective of tracking migratory routes and eel behaviour starting from the Azores to the reproduction area. The article describing the initial findings of this project is to be published in October 2022 in the Nature Scientific Reports. A more detailed publication on the same data will follow and is currently in preparation.

5.2.1.3 New PhD research

Several PhDs are currently being undertaken or due to begin in 2022.

A PhD-research with the University of Bournemouth aims to fill knowledge gaps on the migratory phenology of eels across Britain and Europe as well as the ecology of the marine-freshwater transition of the European Eel within a local scale in England.

A PhD funded by DAERA Northern Ireland will be undertaken by Queen's University Belfast in conjunction with AFBI aiming to examine the spawner quality of migrating silver eels within two large lake systems (Neagh and Erne) in Northern Ireland. Additionally, methods used for deflection of silver eels from hydropower stations will be developed to guide eels into nets of trap and transport fisheries.

A PhD at the Thünen Institute of Fisheries Ecology in Bremerhaven investigates the assessment of silver eel escapement in large rivers. Using the German River Ems as a model system, it combines a "mark-recapture" study approach and acoustic telemetry to obtain a robust quantification of the actual silver eel escapement from the river. Empirical results are compared to predictions from a population model currently applied in the national eel management for validation and identification of refinement potential. A second PhD focuses on improving regional stock assessment and management of the European eel.

A PhD study at Hamburg University addresses the conservation effect of experimental stocking in two coastal regions of the federal state Mecklenburg-Western Pomerania with ARS marked glass eels in the years 2014 to 2016. Beside the change of the yellow eel density inside and outside the stocking areas, also individual eel criteria (e.g., growth rate of stocked eels and natural recruits) are investigated. Additionally, the potential ARS-accumulation in the eel muscle tissue and health related issues are addressed.

Four PhD studies are ongoing at the University of El Tarf - Chadli Bendjedid in Algeria. One deals with an evaluation of European eel as an indicator for ecosystem health in the cases of Lake Oubeira and the El Mellah lagoon. A second study looks at the same topic in the cases of Lake Tonga and the Mafrag estuary. A third study assesses the European eel stock in the water bodies of the El Kala National Park. A fourth study addresses genotoxic and biochemical effects of pollutants in the European eel, in the face of environmental stress. A fifth study is being conducted at the University of Annaba - Badji Mokhtar and investigates biology and ecology of local eel stocks in some Algerian habitats to contribute to a management plan for the species.

Two PhD studies on European eel are presently ongoing in Turkey. One at the Isparta Uygulamalı Bilimler Üniversitesi is targeting bioecological characteristics of European eel in the Saricay catchment. A second one at Cukurova Universitesi focuses on gear selection.

A PhD study at Karlstad University in Sweden focuses on eel passage solutions and habitat preference for elvers and yellow eel.

In France, there are three PhDs (ongoing or starting in 2022); one on population dynamics: spatial dynamics and quality of eels in a Mediterranean lagoon (Tour du Valat, Université de Marseille CNRS); the second study (INRAE, OFB) focuses on developing a population dynamics model to compare dynamics (growth, survival...) between sub-regions and developing reference points (Gerem model). The third (INRAE), investigates the outcomes of restocking practice for the conservation of the European eel, combining both ecological and economical aspects

5.2.2 New and emerging threats

At the time of writing thirteen country reports were available to WGEEL. Information on new and emerging threats were recorded from country reports and/or those presented to WGEEL 2022 by those attending. Only two countries highlighted any new or emerging threats within their country reports.

5.2.2.1 Chemical of emerging concern

Pharmaceuticals: Recent publications have highlighted concerns over the bioconcentration of pharmaceuticals within the European glass eel. One study (Alvarez-Mora et al., 2022) highlighted 63% of chemicals observed were of pharmaceutical origin, with diazepam and irbesartan noted as bioaccumulating in exposed glass eels. Due to these findings, the UK EA will include the substances in their Prioritisation and Early Warning System (PEWS) for chemicals of emerging concern to increase the understanding of the risks to biota, water, and sediment within England and Wales.

PFAS: Very recently, a growing concern has arisen in several countries due to the presence of PFAS related compounds in the environment. These compounds seem to be ubiquitous, and have been detected in (ground) water, air, river sediments, terrestrial and aquatic biota. A Belgian study (Teunen et al., 2021a) revealed that all eels sampled in Flanders are affected by these chemicals, and levels exceed the EU WFD thresholds.

5.2.2.2 UK exit from the EU and restocking:

Sweden and Finland had raised concerns under this ToR during the past three years, specifically linked to the availability of UK glass eels for their national stocking policies after EU exit. The Swedish 2022 Country Report noted that the UK's departure from the EU impacts glass eel restocking which may have adverse impacts on inland silver eel production. Countries such as Sweden reported a significantly reduced number of imported glass eels from France in 2021 and 2022 (~443 000 and ~817 000, respectively) compared to earlier years from England (2-3 million).

5.2.2.3 Climate change:

It is anticipated that changing climate may have other impacts on the eel stocks, including growth rate and migration phenology. Daverat et al. (2012) showed that many factors influence growth but tempera-ture above 13 ^{0}C had the greatest predictive power, indication that global warming had affected growth during the last century. New research in Burrishoole, Ireland, has indicated that the influence of rising temperature on growth of eel may be more complex than first thought (Vaughan et al., 2021). A decrease in eel somatic growth has occurred since the early 2000s, potentially driven by habitat and climatic changes. Growth was negatively correlated with early spring and winter temperatures, providing strong evidence that the length of the growing season impacts this metric. Growth was also positively correlated with summer temperatures and the number of days that exceeded 16˚C (GSL16˚C).

Changes in phenology are also being observed with earlier commencement of downstream silver eel migrating timing being observed in the Burrishoole, which has advanced by one month since 1970 (Sandlund et al. 2017, deEyto et al., 2022). Over the past 50 years in the Imsa River Norway and the Burrishoole River, water temperature and discharge have increased in both rivers during the downstream migration period from August to November (Arevalo et al., 2021). Silver eels preferentially migrated at temperatures between 10 and 20 °C combined with high discharge. Environmental changes have now resulted in the migration of silver eels under warmer water temperatures illustrating how changes in environmental cues have led to a growing mismatch between the migratory conditions preferentially selected and those actually used. This may threaten the completion of the eel's life cycle and ultimately the persistence of this already critically endangered species.

5.2.2.4 High mortality during nearshore marine migration of silver eels:

A telemetry study in December 2020 released acoustically tagged silver eels in Lough Neagh, Northern Ireland, to assess their migration patterns and measure compliance with EU escapement targets. Successful migration during the freshwater stage followed by low detection rates of only two tags at the outer Sea Monitor marine arrays between Ireland and Scotland indicated high loss rates during the nearshore marine migration phase of silver eels. Erratic aberrant behaviour exhibited by the two tags detected at the marine arrays was indicative of predation and subsequent movements by a predator such as a seal. Advances in acoustic technology, such as temperature tags offer the potential to quantify predation and eliminate speculation of lost individuals in nearshore stages. Whilst the tagging demonstrated some of the Lough Neagh eels were able to escape to the estuary, the finding that none of this cohort escaped to open sea, has enormous implications/consequences for wider stock management.

6 Identify and address Mediterranean-specific issues on European eel (ToR D)

With regards to ToR d) Identify and address Mediterranean-specific issues on European eel, an update of activities carried out at the Regional level for the Mediterranean area was given. The GFCM "Research programme on European eel: towards coordination of European eel stock management and recovery in the Mediterranean" (GFCM Eel RP) ended in February 2022. Its results were presented exhaustively in a Webinar (held online on 23rd February 2022) and are going to be disseminated by the publication of a Final Report due soon (November 2022). Therefore, during the WGEEL the focus of the update was on the final outcomes of the RP, on its deliverables, and on the way forward for what concerns coordinated actions in the Mediterranean. The RP was executed as a Concerted Action, achieved by joining forces of ongoing research activities and sharing expertise over a period of 18 (+3) months. The research programme involved nine partners and nine administration focal points from as many countries – Albania, Algeria, Egypt, France, Greece, Italy, Spain, Tunisia and Turkey – were involved, towards achieving elements for a coordinated framework for management towards the preparation of a long-term multiannual Management Plan for eel in the Mediterranean. Results allowed to gain a comprehensive knowledge basis (descriptive, quantitative) for European eel in the Mediterranean, and constituted the basis for an assessment for a management strategy appraisal, that provided elements to discuss management options in the Mediterranean, towards a Coordinated Management Plan. This discussion was the basis of the Scientific Advice provided by the RP to the GFCM Secretariat. The final deliverables of the RP are an exhaustive Final report, that will be published as a GFCM Studies & Reports, an on-line tool to share and disseminate results, and a Video that will be shared on YouTube FAO Channel. Other actions that took place related to Mediterranean eel, supported by the GFCM Secretariat, were a Working group on the management of European eel (WKMEASURES-EEL) (online, 23–25 February 2022), allowed to pursue further on the discussion on technical elements to provide advice on additional transitional measures and potential measures to be adopted in the future.

Specifically for the Scientific Advice that stemmed from the results of the RP, the need to address all sources of anthropogenically induced mortality was highlighted. First and foremost, immediate actions to advance habitat-related measures (with a priority on Mediterranean lagoons) for habitat improvement/maintenance were advised. In terms of fisheries-related measures, the RP proposed two alternative management avenues, under the condition to be applied across the entire distribution area of the species: 1) a three-year pilot phase of zero-catches, or 2) a three-year closure of the silver eel fishery accompanied by a total ban for recreational fisheries and glass eel fisheries of three years; both followed by a recruitment assessment over one season.

With a view to consolidating the provision of information for management, including data collection on fishing effort, the RP proposed a revision of DCRF TASK VII.6-EEL. This proposal was brought to the attention of WGEEL with a presentation, that was preceded by a presentation on results of the RP relative to the specific task of describing eel fisheries in the Mediterranean, including work done on fishing methodologies and fishing effort.

The proposed revision of DCRF TASK VII.6-EEL was described in the presentation. Within the RP, a main task was aimed at the revision of the current structure of the Task VII.6 European eel under the GFCM Data Collection Reference Framework (DCRF). Currently, the GFCM DCRF provides guidance on the information to be provided on European eel fisheries within the GFCM area of application. This data table is expected to be filled by national administrations, in line with the relevant GFCM recommendation, to provide information on the existing fisheries in their countries and does not necessarily cover the minimum requirements for the assessment of this stock at any level. Therefore, this chapter provides an analysis of the DCRF Task VII.6, carried out jointly by GFCM Secretariat and Partner Countries, involving both Scientific Partners and National Focal Points.

Results provide a review of the current state of fisheries data collection for eel as performed by Contracting parties and cooperating non-contracting parties (CPCs) of the GFCM. Most Partner Countries participating to the GFCM Eel Research Programme (RP), as well as some other CPCs not included, submit eel fishery-related data via the DCRF online platform, even if compliance reveals an uneven situation of data coverage by year among countries. Eel fishery-related data collection used for submission to GFCM stems from many different data collection frameworks, such as National Statistical systems and EU DC frameworks. As a result, the methodology is extremely variable among Countries.

A quality check of the submitted data was conducted, in comparison to fisheries data (landings, fishing effort) collected within WP3. The quality check highlighted discrepancies in most Countries for what concerns available fishery data and data submitted via the on-line platform.

A comparison of the GFCM requirements (DCRF) for eel with other frameworks (national and international) for eel data collection, also considering monitoring frameworks reviewed in the RP, was performed. The implementation of the DCRF Task VII with a dedicated system for European eel assessment-related input data was taken into consideration. The crucial need for fishery-independent monitoring (surveys) in the Mediterranean region to correctly assess the eel stock on a long-term basis is deemed essential, and additional data are needed both concerning biological variables, collected on a consistent basis with standardized methodologies, and specific indicators of recruitment (glass eel), yellow eel standing stock and silver eel escapement.

In addition, the RP highlighted the need of a second phase of research, including pilot studies in key sites implementing standardized fishery-independent monitoring of all eel life stages coupled with long-term monitoring efforts for fishery-dependent data, also involving fishers Work on socio-economic analysis of the proposed closures was also proposed, to envisage modalities for compensation schemes for fishers.

Finally, the creation of a permanent GFCM Expert Group on European eel in the Mediterranean was proposed, to consolidate the network of experts, ensure Mediterranean-wide coordination and provide mutual assistance in addressing stock-wide issues, also relevant to coordination within WGEEL.

7 WKFEA (ToR E)

The WGEEL has continued the implementation of the WKFEA roadmap. Specifically, biometric data for all life stages of the European eel were collected during the data call down to the individual level, many of which coming from DCF data collection. Further, the group prepared the proposed landings workshop in 2023 – a respective working document is provided in Annex 19.

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Annex 2: Resolutions

2022/2/FRSG12 The **Joint EIFAAC/ICES/GFCM Working Group on Eels** (WGEEL), chaired by Jan-Dag Pohlmann, Thünen Institute, Germany, will meet, in a split meeting from 6–9 September (virtually) and 12 September–20 September in Toombridge, Northern Ireland (hybrid) to:

a) Address the generic EG ToRs from ICES, and any requests from EIFAAC or GFCM;
b) Report on developments in the state of the European eel (*Anguilla anguilla*) stock, the fisheries on it and other anthropogenic impacts;
c) Report on updates to the scientific basis of the advice, including any new or emerging threats or opportunities;
d) Identify and address Mediterranean-specific issues on European eel
e) Implement the roadmap proposed by WKFEA

Material and data relevant for the meeting must be available to the group on the dates specified in the 2022 ICES data call.

WGEEL will report by Date, 11 October 2022 for the attention of ACOM, WGDIAD, FRSG and FAO, EIFAAC and GFCM.

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Annex 4: Acronyms and Glossary

ACRONYMS

Acronyms	Definition
AA	Administrative Agreement, typically the recurring agreement between ICES and the EC
ACFM (ICES)	Advisory Committee on Fisheries Management
ACOM (ICES)	Advisory Committee on Management
ADGEEL	Advice drafting group on eel, for ICES
AIC	Akaike Information Criterion
AngHV-1	Anguillid herpes virus 1
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
BERT	Bayesian Eel Recruitment Trend model
BIC	Bayesian Information Criterion
CCM	Catchment Characterisation and Modelling
CITES	Convention on International Trade in Endangered Species of Flora and Fauna
CMS	Convention on the Conservation of Migratory Species of Wild Animals
COMM	European Commission, also EC is used.
CPUE	Catch per unit of effort
CR	Country Report
C&R	Catch and release
CUSUM	Cumulative Sum Control Chart
DAERA	Department of Agriculture, Environment and Rural Affairs (N. Ireland)
DBEEL	Database on Eel (from EU POSE project)
DCF	Data Collection Framework of the European Union
DEMCAM	Demographic Camargue Model
DG-MARE	Directorate-General for Maritime Affairs and Fisheries, European Commission
DLS	Data-Limited Stocks
EC	European Commission, also COMM is used.
e-DNA	Environmental DNA
EDA	Eel Density Analysis (model, France)
EIFAAC	European Inland Fisheries & Aquaculture Advisory Commission
EIFAC	European Inland Fisheries Advisory Commission – became EIFAAC in 2008

Acronyms	Definition
EMP	Eel Managment Plan
EMU	Eel Management Unit
EFF	European Fisheries Fund
EQD	Eel Quality Database
EROD	Ethoxyresorufin-O-deethylase
ESAM	Eel Stock Assessment Model
EU	European Union
EU MAP	The European Multi-Annual Plan, previously the DCF
EVEX	Eel Virus European X
FAO	Food and Agriculture Organisation
FEAP	The Federation of European Aquaculture Producers
GAM	Generalised Additive Model
GEM	German Eel Model
GFCM	General Fisheries Commission of the Mediterranean
GIS	Geographic Information Systems
GLM	Generalised Linear Model
GlobAng	French Model of Eel Population Dynamics
GST	Glutathione-S-transferase
HPS	Hydropower Station
ICES	International Council for the Exploration of the Sea
IMESE	Irish model for estimating silver eel escapement
IUCN	International Union for the Conservation of Nature
IUU	Illegal, Unreported and Unregulated fisheries
LAM	Lifetime anthropogenic mortalities
LHT	Life History Trait
LVPA	Length-based Virtual Population Assessment
L50	L50 = the length (L) at which half (50%) of a fish species may be able to spawn
MS	Member State, typically used in reference to EU Member States but not only
MSY	Maximum Sustainable Yield
NAO	North Atlantic Oscillation
NA	Not applicable
NC	Not collected, code to explain an empty data value cell
ND	No data, code to explain an empty data value cell
NDF	Non-detriment Finding
NP	Not pertinent, code to explain an empty data value cell
NR	Not recorded, code to explain an empty data value cell

Acronyms	Definition
POSE	Pilot projects to estimate potential and actual escapement of silver eel (EU project)
RBD	River Basin District, typically as defined according to the EU Water Framework Directive
RGMAREEL	Workshop on Fisheries Related Impacts on Silver eels 2017
RG-TEMPP	Review of the Trans-border management plan for European eel, *Anguilla anguilla*, in the Polish-Russian zone of the Pregola River basin and Vistula Lagoon
RS_EMP	Review Service – Evaluation of Eel management Plans 2010
SAC	The GFCM Scientific and Advisory Committee on Fisheries
SCICOM	The Science Committee of ICES
SGAESAW	Study Group on anguillid eels in saline waters 2009
SGIPEE	Study Group on International Post-Evaluation on Eels 2010, 2011
SLIME	Restoration the European Eel population; pilot studies for a scientific framework in support of sustainable management (EU project)
SMEP II	Scenario-based Model for Eel Populations, vII (model applied in England and Wales, UK)
SPR	Estimate of spawner production per recruiting individual.
SQL	Special purpose programming language for managing data
SRG	Scientific Review Group of the European Commission
SSB	Spawning–Stock Biomass
STECF	Scientific, Technical and Economic Committee for Fisheries, European Commission
ToR	Terms of Reference
VPA	Virtual Population Analysis
WG	Working Group
WFD	Water Framework Directive, European Directive
WGEEL	Joint EIFAAC/ICES/GFCM Working Group on Eels
WKBALTEEL	Workshop on Baltic Eel 2010
WKBECEEL	Working Group on Biological Effects of Contaminants in Eel 2016
WKEELCITES	Workshop on Eel and CITES 2015
WKEELDATA	Workshop on Designing an Eel Data Call 2017
WKEELDATA2	Second Workshop on designing an Eel Data Call 2019
WKEELMIGRATION	Workshop on the Temporal Migration patterns of European Eels 2020
WKEMP	Workshop on Evaluating Management Plans – 2018
WKEPEMP	The Workshop on Evaluating Progress with Eel Management Plans 2013
WKESDCF	Workshop on Eels and Salmon in the Data Collection Framework 2012

Acronyms	Definition
WKFEA	Workshop on the future of eel advice 2021
WKLIFE	Workshop on the Development of Assessments based on LIFE-history traits and Exploitation Characteristics
WKPGMEQ	Workshop of a Planning Group on the Monitoring of Eel Quality under the subject "Development of standardized and harmonized protocols for the estimation of eel quality"
WKSTOCKEEL	Workshop on Eel Stocking 2016
WKTEEL	Workshop on Tools for Eel 2018
WGRFS	Working Group on Recreational Fisheries Surveys
YFS1	Young Fish Survey: North Sea Survey location
IYFS	International Young Fish Survey

GLOSSARY

Anthropogenic	**Caused by humans.**
Assisted migration	The practice of trapping and transporting juvenile eel within the same river catchment to assist their upstream migration at difficult or impassable barriers, without significantly altering the production potential (B_{best}) of the catchment
Bootlace, fingerling	Intermediate sized eels, approx. 10–25 cm in length. These terms are most often used in relation to restocking. The exact size of the eels may vary considerably. Thus, it is a confusing term.
Carrying Capacity	The average maximum biomass of eel that can be supported by a given habitat.
Catch	The WGEEL uses the term catch(es) to mean fish that are caught but not necessarily landed. See landings below
Depensation	The effect on a population when a decrease in spawners leads to a faster decline in the number of offspring than in the number of adults.
Eel River Basin or Eel Management Unit	"Member States shall identify and define the individual river basins lying within their national territory that constitute natural habitats for the European eel (eel river basins) which may include maritime waters. If appropriate justification is provided, a Member State may designate the whole of its national territory or an existing regional administrative unit as one eel river basin. In defining eel river basins, Member States shall have the maximum possible regard for the administrative arrangements referred to in Article 3 of Directive 2000/60/EC [i.e. River Basin Districts of the Water Framework Directive]." EC No. 1100/2007.
Elver	Young eel, in its first year following recruitment from the ocean. The elver stage is sometimes considered to exclude the glass eel stage, but not by everyone. To avoid confusion, pigmented 0+cohort age eel are included in the glass eel term.
Escapement	The amount of eel that leaves (escapes) a water body, after taking account of all natural and anthropogenic losses. Most commonly used with reference to silver eel – silver eel escapement.
Glass eel	Young, unpigmented eel, recruiting from the sea into continental waters. WGEEL consider the glass eel term to include all recruits of the 0+ cohort age group, including some pigmented eel.

Anthropogenic	**Caused by humans.**
Index river	To be defined
Landings	The WGEEL uses the term Landings to mean fish that are brought ashore.
Leptocephalus	Flat and transparent marine larval stage of eel, on migration from spawning ground to continental waters, between pre-Leptocephalus and metamorphosis to glass eel
Lifestage	Defined stage in the lifecycle of eel, whether leptocephalus, glass eel, yellow eel, or silver eel.
Limit reference point	A Limit Reference Point indicates a state of a fishery and/or a resource which is considered to be undesirable and which management action should avoid.
Non-detriment finding (NDF)	In relation to CITES, the competent scientific authority has advised in writing that the capture or collection of the specimens in the wild or their export will not have a harmful effect on the conservation status of the species or on the extent of the territory occupied by the relevant population of the species.
Ongrown eels	Eels that are grown in culture facilities for some time before being restocked. Whether the time is to meet quarantine requirements, for the receiving environment conditions to be suitable, or as part of the culture and grading purpose.
Pre-leptocephalus	First larval stage of eel, between hatching from ovum and leptocephalus
Production	The amount of fish produced from a waterbody. Sometimes referred to for silver eel in terms as escapement + anthropogenic losses, or production – anthropogenic losses = escapement.
River Basin District (RBD)	The area of land and sea, made up of one or more neighbouring river basins together with their associated surface and groundwaters, transitional and coastal waters, which is identified under Article 3(1) of the Water Framework Directive as the main unit for management of river basins. The term is used in relation to the EU Water Framework Directive.
Restocking	The practice of adding fish [eels] to a waterbody from another source, to supplement existing populations or to create a population where none exists
Silver eel	Migratory phase following the yellow eel phase. Eel in this phase are characterized by darkened back, silvery belly with a clearly contrasting black lateral line, enlarged eyes. Silver eel undertake downstream migration towards the sea, and subsequently westwards. This phase mainly occurs in the second half of calendar years, although some are observed throughout winter and following spring.
Target reference point	A Target Reference Point indicates to a state of fishing and/or a resource which is considered to be desirable and at which management action, whether during development or stock rebuilding, should aim. FAO, 1995.
To silver (silvering)	Silvering is a requirement for downstream migration and reproduction. It marks the end of the growth phase and the onset of sexual maturation. This true metamorphosis involves a number of different physiological functions (osmoregulatory, reproductive), which prepare the eel for the long return trip to the Sargasso Sea. Unlike smoltification in salmonids, silvering of eels is largely unpredictable. It occurs at various ages (females: 4 – 20 years; males 2 – 15 years) and sizes (body length of females: 50 – 100 cm; males: 35 – 46 cm) (Tesch, 2003).
Trap and Transport	Capturing downstream migrating silver eel for transportation around hydropower turbines

Anthropogenic	Caused by humans.
Yellow eel	Life-stage resident in continental waters. Often defined as a sedentary phase, but migration within and between rivers, and to and from coastal waters occurs and therefore includes young pigmented eels (‘elvers’ and bootlace).

STOCK REFERENCE POINTS and DATA CALL TERMS

Age	The age of eel in years., with part years as plus growth (e.g, 0+, 1+), starting at recruitment to coastal waters. Glass eel are defined as 0+.
Aggregate habitat (AL)	Data Call term for aggregrated habitats where data is commined across habitat categories
A_{lim}	Limit anthropogenic mortality: Anthropogenic mortality, above which the capacity of self-renewal of the stock is considered to be endangered and conservation measures are requested (Cadima, 2003).
A_{pa}	Precautionary anthropogenic mortality: Anthropogenic mortality, above which the capacity of self-renewal of the stock is considered to be endangered, taking into consideration the uncertainty in the estimate of the current stock status.
Aquaculture production	The biomass of eel harvested in aquaculture during a time frame; e.g., a year.
Baltic region	The countries bordering the Baltic Sea; sometimes other countries in the catchment are also included.
bio_age	mean age
bio_g_in_gy	proportion (in %) of glass eel [100 for only glass eel ; 0 for only yellow eel ; the proportion if mix of glass and yellow eel]
bio_length	mean length in mm
bio_sex_ratio	sex ratio express as a proportion of female; between 0 (all males) and 100 (all females)
bio_year	year during which biological samples where collected
bio_weight	mean individual weight in g
$B_{current}$ or B_{curr}	The Current escapement biomass: The amount of silver eel biomass that currently escapes to the sea to spawn, corressponding to the assessment year.
B_{best}	The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the current stock, included re-stocking practices, hence only natural mortality operating on stock. The Best achievable escapement biomass under present conditions: escapement biomass corresponding to recent natural recruitment that would have survived if there was only natural mortality and no restocking, corressponding to the assessment year.

Age	The age of eel in years., with part years as plus growth (e.g, 0+, 1+), starting at recruitment to coastal waters. Glass eel are defined as 0+.
B_0	The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the stock. Reference point for the theoretical maximum quantity of silver eel expressed as biomass that would have escaped from a defined eel producing area, in the absence of any anthropogenic impacts.
B_{lim}	Limit spawner escapement biomass, below which the capacity of self-renewal of the stock is considered to be endangered and conservation measures are requested (Cadima, 2003).
B_{MSY}	Spawning stock biomass (SSB) that is associated with the Maximum Sustainable Yield.
$B_{MSY-trigger}$	Value of spawning–stock biomass (SSB) which triggers a specific management action, in particular: triggering a lower limit for mortality to achieve recovery of the stock.
B_{pa}	Precautionary spawner escapement biomass: The spawner escapement biomass, below which the capacity of self-renewal of the stock is considered to be endangered, taking into consideration the uncertainty in the estimate of the current stock status.
Commercial Fisheries	Fisheries with sale of catch for commercial gain
Coastal waters	WFD coastal waters
das_comment	Comment (including comments about data quality for this year)
das_effort	Effort (if used)
das_value	Value
das_year	Year
Eel mannagement unit (EMU)	Eel management unit defined in an Eel Management plan under the Eel Regulation 1100/2007.
F	Fishing mortality rate
FAO areas	See http://www.fao.org/fishery/area/search/en
F_{lim}	F_{lim} is the fishing mortality which in the long term will result in an average stock size at B_{lim}.
F_{pa}	ICES applies a precautionary buffer F_{pa} to avoid that true fishing mortality is above F_{lim}.
F-rec	recreational fishing mortality, per reporting year, in kg
Fresh waters	Waters with zero salinity
F_{MSY}	F_{MSY} is estimated as the fishing mortality with a given fishing pattern and current environmental conditions that gives the long-term maximum yield.
G	Code in Data Call for data comprising Glass eel only as defined in Glossary

Age	The age of eel in years., with part years as plus growth (e.g, 0+, 1+), starting at recruitment to coastal waters. Glass eel are defined as 0+.
G+Y	Code in Data Call for data comprising a Glass eel with yellow eel mix
GEE-n	Glass eel equivalents in numbers – the quantity of eel expressed as equivalent number of glass eel. Method provided in ICES (2013) report p103.
Glass eel recruitment series	Time series enumerating glass eel recruiting from the sea into continental waters.
GLM	Generalized linear model (used by ICES to predict and fill in gaps in the data)
Habitat	Waters occupied by eel, whether fresh, transitional, coastal or marine
ICES statistical rectangles	See http://gis.ices.dk/sf/index.html?widget=StatRec
Inland waters	Fresh waters, not under the jurisdiction of Marine fisheries management (i.e. the CFP).
Landings from fisheries	Commercial landings include any eel taken from the water and landed on the market. Recreational landings include any eel taken from the water by recreational fisheries. Other landings include eel caught for assisted migration, translocation,
Length in mm	Total length measured from tip of nose to tip of tail (TL)
Longitude	x (longitude) EPSG:4326. WGS 84 (Google it)
Latitude	y (latitude) EPSG:4326. WGS 84 (Google it)
M	Natural Mortality
North Sea	For the purposes of ICES eel management, taken as ICES sea areas IV $_a$, IV $_b$, IV $_c$ and inflowing fresh water systems
Marine waters	(Abbreviated MO) Open marine waters
q_aqua_kg	Aquaculture production (kg) in reporting year
q_aqua_n	Aquaculture production (number of eel) in reportng year
Fisheries - Recreational	Recreational (= non-commercial) fishing is the capture or attempted capture of living aquatic resources mainly for leisure and/or personal consumption.
Releases	Eel released to the wild after capture
R_{target}	The Geometric Mean of observed recruitment between 1960 and 1979, periods in which the stock was considered healthy.
R(s)	The amount of eel (<20 cm) restocked into national waters annually
S	Code in Data Call for data comprising Silver eel

Age	The age of eel in years., with part years as plus growth (e.g, 0+, 1+), starting at recruitment to coastal waters. Glass eel are defined as 0+.
Sea region (division)	ICES Sea area statisitical rectangle. Where required for freshwater eel habitats, is the sea area the River basin drains to.
SEE–n	Silver eel equivalents in numbers – the quantity of eel expressed as equivalent number of silver eel
SEE_com	Commercial fishery silver eel equivalents
SEE rec	Recreational fishery silver eel equivalents)
SEE_hydro	Mortility in hydropower, pumps and water intakes etc expressed as Silver eel equivalents
SEE_habitat	Silver eel equivalents relating to anthropogenic influences on habitat (quantity/quality)
SEE_release	Silver eel equivalents relating to release activity
SEE_other	Silver eel equivalents from \`other\` sources
Silver eel abundance series	Time series of abundance of silver eel determined by consistent regular count or survey (usually by capturing migrating silver eel)
ser_nameshort	short name of the recruitment series, this must be 4 letters + stage name, e.g. VilG, LiffGY, FremS, the first letter is capitalised and the stage name too.
ser_namelong	long name of the recuitment series eg \`Vilaine estuary\` for the Vilaine;
ser_typ_id	type of series 1= recruitment series, 2 = yellow eel standing stock series, 3 silver eel series
ser_effort_uni_code	unit used for effort, it is different from the unit used in the series, for instance some of the Dutch series rely on the number hauls made to collect the glass eel to qualify the series, see units sheet.
ser_comment	This comment should at least include a short description of the methods, give an idea on the size of the eels and the proportion of glass eel, whether it is mixed (e.g. glass and yellow) or not, possible biases (e.g. by restocking) and a mention if the series is special in any way (e.g. very old/long) Note that this text will be displayed as a description of the series in the shiny app, thus consider the "readability".
ser_uni_code	Units used in the series, see tr_units_uni sheet
ser_lfs_code	Lifestage see tr_lifestage_lfs sheet
ser_hty_code	Habitat type see tr_habitattype_hty (F=Freshwater, MO=Marine Open,T=transitional, AL=aggregate...)
ser_locationdescription	This should provide a description of the site, e.g. if ist far inland, in the middle of a river, near a dam etc. Also please specify the adjectant marine region (Baltic, North Sea) etc. (e.g. "Bresle river trap 3 km from the sea" or IYFS/IBTS sampling in the

Age	The age of eel in years., with part years as plus growth (e.g, 0+, 1+), starting at recruitment to coastal waters. Glass eel are defined as 0+.
	Skagerrak-Kattegat" Note that this text will be displayed as a description of the site in the shiny app, thus consier the "readability".
ser_emu_nameshort	The codes of the emu (emu_nameshort) in sheet tr_emu_emu. In case you provide data for each EMU separately then you don't need to fill in for AL and vice versa
ser_cou_code	The cou_code in the tr_country_cou table
ser_area_division	Fao code of sea region (division level) see tr_fao_area (column division)(https://github.com/ices-eg/WGEEL/wiki). These codes are for use only in the case of Coastal and Marine Open waters – otherwise you can leave it blank. ICES statistical rectangles (http://gis.ices.dk/sf/index.html?widget=StatRec) and FAO areas map (http://www.fao.org/fishery/area/search/en)
ser_tblcodeid	This should refer to the id of the series once inserted in ICES station table, currently void : ignore
ser_x	x (longitude) EPSG:4326. WGS 84
ser_y	y (latitude) EPSG:4326. WGS 84
ser_sam_id	The sampling type corresponds to trap partial, trap total, see tr_samplingtype_sam (sam_id)
Silver eel abundance series	Time series of abundance of silver eel determined by consistent regular count or survey (usually by capturing migrating silver eel)
Skagerrak-Kattegat	For the purposes of ICES eel management, taken as ICES Sea areas III_b, III_c and inflowing fresh water systems
SPR	Spawner per recruit: estimate of spawner production per recruiting individual.
%SPR	Ratio of SPR as currently observed to SPR of the pristine stock, expressed in percentage. %SPR is also known as Spawner Potential Ratio.
Standing stock	The total stock of eel present in a waterbody at a point in time, expressed as a number of individuals or total biomass
sumA	total Anthropogenic mortality, per reporting year , in kg
sumF	total Fishing Mortality per reporting year, in kg
sumH	total non fishing Anthropogenic mortality, per reporting year in kg
sumF_com	Mortality due to commercial fishery, summed over age groups in the stock.
SumF_rec	Mortality due to recreational fishery, summed over age groups in the stock .

Age	The age of eel in years., with part years as plus growth (e.g, 0+, 1+), starting at recruitment to coastal waters. Glass eel are defined as 0+.
SumH_hydro	Mortality due to hydropower (plus water intakes etc) summed over the age groups in the stock (rate)
SumH_habitat	Mortality due to anthropogenic influence on habitat (quality/qauntity) summed over the age groups in the stock (rate)
SumH_other	Mortality due to other anthropogenic influence summed over the age groups in the stock (rate)
SumH_release	Mortality due to release summed over the age groups in the stock (rate: negative rate indicates positive effect of release)
Transitional waters	WFD transitional waters, implies reduced salinity
Transport/relocation operations	When eels have been collected somewhere in traps and transported to other places where they appear as “release” for the purposes of data recording
ΣF	The fishing mortality rate, summed over the age-groups in the stock.
ΣH	The anthropogenic mortality rate outside the fishery, summed over the age-groups in the stock.
ΣA	The sum of anthropogenic mortalities, i.e. $\Sigma A = \Sigma F + \Sigma H$.
Y	Code in Data Call for data comprising yellow eel only
Yellow eel abundance series	Time series of abundance of yellow eel determined by consistent regular count or survey
Yellow eel recruitment series	Time series enumerating yellow eel where this life stage is first observed at a site or is the stage at which eel enter freshwaters
Yellow eel standing stock series	Time series of abundance of yellow eel determined by consistent regular count or survey
“3Bs & ΣA”	Refers to the 3 biomass indicators (B_0, B_{best} and $B_{current}$) and anthropogenic mortality rate (ΣA).
40% EU Target	From the Eel regulation (1100/2007): “The objective of each Eel Management Plan shall be to reduce anthropogenic mortalities so as to permit with high probability the escapement to the sea of at least 40% of the silver eel biomass relative to the best estimate of escapement that **would have existed if no** anthropogenic influences had impacted the stock”. The WGEEL takes the EU target to be equivalent to a reference limit, rather than a target.

Annex 5: Meeting Agenda

Agenda PART 1 (CEST, Paris time)

Tuesday 6th September

10:00-11:00 Welcome & Introduction (all data providers)

11:00-13:00 Demonstration of the integration process (all data providers)

13:00-13:45 Lunch

13:45-16:15 Breakout: Data integration (solo sessions)

Wednesday 7th September

10:00-13:00 Breakout: Data integration (solo sessions)

13:00-13:45 Lunch

13:45-16:45 Breakout: Data integration (solo sessions)

Thursday 8th September

10:00-13:00 Breakout: Data integration (solo sessions)

13:00-13:45 Lunch

13:45-16:45 Breakout: Data integration (solo sessions)

Friday 9th September

10:00-13:00 Breakout: Data integration (solo sessions)

13:00-13:45 Lunch

13:45-15:45 Closing Session (everyone)

Additional explanations:

Solo sessions: Data providers will integrate their data via the online tool with the help of an operator. A schedule will be agreed at the start of the meeting and attendance of the data provider is only required at the countries scheduled date/time.

All data providers: These sessions will inform on the integration process and only the attendance of members participating in the integration process is required. Other members are welcome to join.

Everyone: Session which is of general interest to the WG. If possible, this session is of interest to all members planning to participate in the 2nd part of the 2021 WGEEL as well.

PART 2 (Belfast time)

Monday 12th September

09:00-10:15 Welcome & Introduction / Agree on agenda

10:15-11:00 Reporting: WKFEA roadmap

11:00-11:15 Introduction to TAF

11:15-13:00 SG assignments / discussion / breakouts

13:00-14:00 Lunch

14:00-17:20 SG Breakouts (Concepts)

17:20-17:30 Closing plenary

18:30 Social event: BBQ

Tuesday 13th September

09:00-09:10 Presentation & discussion of GFCM Eel RP outcomes, deliverables and proposals

09:10-13:00 SG breakouts

13:00-14:00 Lunch

14:00-14:45 Jack, Sargasso (Reinhold)

14:45-17:20 WGAMEEL meeting / SG Breakouts

17:20-17:30 Closing plenary

Wednesday 14th September

09:00-09:30 Plenary

09:30-13:00 GFCM Presentations

13:00-14:00 Lunch

14:00-14:45 Why a spatial approach? (Esti, Hilaire, JD, Cedric)

14:45-17:20 SG breakouts

17:20-17:30 Closing plenary

Thursday 15th September

09:00-09:30 Plenary

09:30-13:00 SG Breakouts / **ISSG meeting**

13:00-14:00 Lunch

14:00-14:45 Coastal time series (Malte)

14:45-17:45 SG breakouts

14:45-17:20 Advice drafting (parallel session)

17:20-17:30 Plenary

Friday 16th September

09:00-09:30 Plenary

09:30-13:00 SG breakouts

13:00-14:00 Lunch

14:00-14:45 Health status glass eel

14:45-17:30 Advice agreement

Saturday 17th September

09:00-09:30 Plenary

09:30-13:00 SG breakouts

13:00-14:00 Lunch

14:00-14:45 Age validation (Caroline)

14:45-17:00 SG breakouts **– 17:00 DEADLINE TO UPLOAD CHAPTERS!**

17:00-17:10 Closing plenary

19:30 Social event: Dinner

Sunday 18th September

09:00-13:00 Reading / Lunch

13:00 -14:00 Social event: Boat trip

14:00-17:30 Reading

Monday 19th September

09:00-13:00 Report discussion / amendments / agreement

13:00-14:00 Lunch

14:00-16:30 Report discussion / amendments / agreement

16:30-17:30 Planning for 2023

Tuesday 20th September

09:00-14:30 Report agreement / Tying up loose ends

Annex 6: Country Reports 2021–2022 Eel stock, fisheries and habitat reported by country

In preparation for the Working Group, participants of each country have prepared a Country Report, in which the most recent information on eel stock and fishery is presented. These Country Reports aim at presenting the best information that does not necessarily coincide with the official status.

Participants from the following countries provided an updated report to the 2022 meeting of the Working Group on Eels:

- Belgium
- Denmark
- Estonia
- Finland
- Germany
- Greece
- Ireland
- Italy
- Latvia
- Lithuania
- Norway
- Spain
- Sweden
- Tunisia
- The United Kingdom of Great Britain and Northern Ireland

For practical reasons, this report presents the Country Reports in electronic format only (URL).

Country Reports 2021/2022

Annex 7: Stock Annex

The table below provides an overview of the WGEEL Stock Annex. Stock Annexes for other stocks are available on the ICES website Library under the Publication Type “Stock Annexes”. Use the search facility to find a particular Stock Annex, refining your search in the left-hand column to include the *year*, *ecoregion*, *species,* and *acronym* of the relevant ICES expert group.

Stock ID	**Stock name**	**Last updated**	**Link**
Anguilla anguilla	European eel	September 2020	*Anguilla anguilla*

Annex 8: Response to recommendations

ID	EG	Year	Recommendation	Response
	16WKFEA	2021	WKFEA recommends to the WGEEL to propose the inclusion in the ToR of its annual meetings the work assigned to it in the road map until the benchmark is held.	WGEEL continousely addresses the tasks listed in the roadmap and therefore reviewed landings data in preparation of a workshop on eel landing s in 2023. The fullfillment of the roadmap will, however, largely depend on financing for a project to conduct the spatial modeling exercise
	17WKFEA	2021	WKFEA recommends that all the data compiled during the road map implementation are to be hosted by ICES. This will require liaison between the WGEEL, the data providers and the ICES Data Centre.	WGEEL discussed this issue and work will continue intersessionally with the ICES data center.
NA	WGRDBES-GOV	NA	Discuss and provide feedback about the possibility of using RDBES for the storage of catch data, and for estimation processes. (see section 1.8 Progress on Diadromous data & RDBES) .	WGEEL discussed the possibility of using RDBES for the storage of catch (or in the case of eel landings to be precise) data. Since WGEEL developed their own postgresSQL database, this is currently used and it is aimed to be hosted by ICES, which is currently a priority. Storage of eel landings data is not trivial, since most of it is from freshwaters and uses a different system for allocation of catches. However, if these issues can be sorted out, WGEEL suggests an automated output from the WGEEL database to the RDBES, to avoid double-work or inconsistencies, if needed.

Annex 9: Recruitment series Table

Table 1: Short description of the sampling sites for European eel. Min and max indicate the first year and last year in the records, and the values are given in the n+ and n- columns, indicate the number of years with values and the number of years when there are missing data within the series. Life stage: GY = glass eel and yellow eel, G = glass eel, Y = yellow eel. Unit for the data collected is given (nr = number; index = calculated value following a specified protocol, nr/m2 = number per square metre, nr/h = number per hour, kg/boat/d = kg per boat per day). Habitat: C = coastal water (according to the EU Water Framework Directive, WFD), F = freshwater, MO = marine water (open sea), T = transitional water with lower salinity (according to WFD). Kept: 0 = missing, 1 = good quality, 2 = WGEEL has modified the data, 3 = not used due to poor quality, 4 = data is used, but there are warnings on its quality

life stage	area	country	serie	min	max	n-	n+sampling type	unit	habitat	kept
G	EE	ES	AlbuG	1949	2022	5	74com. catch	kg	F	1
G	EE	ES	AlCPG	1982	2022	5	41com. cpue	kg/boat/d	F	1
G	EE	ES	EbroG	1966	2022	3	57com. catch	kg	T	1
G	EE	ES	GuadG	1998	2007	0	10sci. surv.	index	T	1
G	EE	ES	MiSpG	1975	2022	0	48com. catch	kg	T	1
G	EE	ES	NaloG	1953	2022	0	70com. catch	kg	T	1
G	EE	ES	OriaG	2006	2022	0	17sci. surv.	nr/m3	T	1
G	EE	FR	AdCPG	1928	2008	40	81com. cpue	kg/boat/d	T	1
G	EE	FR	AdTCG	1986	2008	0	23com. catch	t	T	1
G	EE	FR	GiCPG	1961	2008	1	48com. cpue	kg/boat/d	T	1
G	EE	FR	GiScG	1992	2022	0	31sci. surv.	index	T	1
G	EE	FR	GiTCG	1923	2008	28	86com. catch	t	T	1
G	EE	FR	LoiG	1924	2008	6	85com. catch	kg	T	1
G	EE	FR	SevNG	1962	2008	25	47com. cpue	kg/boat/d	T	1
G	EE	FR	VacG	2004	2022	0	19trap	nr	T	1
G	EE	FR	VilG	1971	2015	3	45trap	t	T	1
G	EE	GB	SeEAG	1972	2022	2	51com. catch	t	T	1
G	EE	GB	SeHMG	1979	2022	4	44com. catch	t	T	3
G	EE	GB	ShiFG	2011	2021	0	11trap	nr	F	0
G	EE	GB	ShiMG	2011	2022	0	12trap	nr	T	0

life stage	area	country	serie	min	max	n-	n+sampling type	unit	habitat	kept
G	EE	IE	InagG	2017	2022	0	6trap	kg	F	1
G	EE	IE	MaigG	1994	2022	4	29trap	kg	F	1
G	EE	IT	TibeG	1975	2006	0	32com. catch	t	T	1
G	EE	PT	MiPoG	1974	2022	0	49com. catch	kg	T	1
G	EE	PT	MiScG	2018	2022	0	5sci. surv.	nr/h	T	0
G	EE	PT	MondG	1989	2022	28	34sci. surv.	nr/h	T	0
G	NS	BE	VeAmG	2017	2022	0	6trap	kg	T	0
G	NS	BE	YserG	1964	2022	1	59sci. surv.	kg	T	1
G	NS	DE	EmsG	1946	2001	0	56com. catch	kg	T	1
G	NS	DE	EmsHG	2011	2021	0	11trap	nr	T	0
G	NS	DE	WaSG	2011	2021	0	11sci. surv.	nr	T	0
G	NS	DK	KlitG	2008	2022	0	15sci. surv.	nr/m2	F	1
G	NS	DK	NorsG	2008	2022	0	15sci. surv.	nr/m2	F	1
G	NS	DK	SleG	2008	2022	0	15sci. surv.	nr/m2	F	1
G	NS	DK	VidaG	1971	1990	0	20com. catch	kg	T	1
G	NS	GB	BeeG	2006	2022	0	17trap	nr	F	1
G	NS	GB	BroG	2011	2022	0	12trap	nr	F	1
G	NS	GB	FlaG	2007	2022	0	16trap	nr	F	1
G	NS	NL	KatwG	1977	2022	5	46sci. surv.	index	T	1
G	NS	NL	LauwG	1976	2022	4	47sci. surv.	nr/h	T	1
G	NS	NL	RhDOG	1938	2022	1	85sci. surv.	index	T	1
G	NS	NL	RhIjG	1969	2022	5	54sci. surv.	index	T	1
G	NS	NL	StelG	1971	2022	0	52sci. surv.	index	T	1
G	NS	SE	RingG	1981	2022	0	42sci. surv.	index	C	1
G	NS	SE	YFS1G	1975	1989	0	15sci. surv.	index	MO	1
G	NS	SE	YFS2G	1991	2022	0	32sci. surv.	index	MO	1
GY	EE	FR	BresGY	1994	2022	0	29trap	nr	F	1

life stage	area	country	serie	min	max	n-	n+sampling type	unit	habitat	kept
GY	EE	FR	SousGY	2013	2021	0	9trap	nr	F	0
GY	EE	GB	BannGY	1933	2022	0	90trap	kg	F	1
GY	EE	GB	GreyGY	2009	2022	0	14trap	nr	F	1
GY	EE	GB	OatGY	2011	2022	0	12trap	nr	F	0
GY	EE	GB	StraGY	2011	2022	0	12trap	nr	F	1
GY	EE	IE	BurrGY	1987	2022	18	36trap	kg	F	1
GY	EE	IE	CorG	2017	2022	0	6trap	kg	F	0
GY	EE	IE	ErneGY	1959	2022	2	64trap	kg	F	1
GY	EE	IE	FealGY	1985	2022	14	38trap	kg	F	1
GY	EE	IE	InagGY	1996	2022	4	27trap	kg	F	1
GY	EE	IE	LiffGY	2011	2022	0	12trap	kg	F	1
GY	EE	IE	ShaAGY	1977	2022	0	46trap	kg	F	1
GY	NS	DE	BrokGY	2011	2022	0	12trap	nr	T	1
GY	NS	DE	Ems-BGY	2011	2021	0	11trap	nr	F	0
GY	NS	DE	FarpGY	2007	2021	0	15trap	nr	F	3
GY	NS	DE	HHKGY	2010	2021	0	12trap	nr	T	0
GY	NS	DE	HoSGY	2010	2010	0	1trap	nr	T	0
GY	NS	DE	LangGY	2011	2022	0	12trap	nr	T	0
GY	NS	DE	VerlGY	2010	2022	0	13trap	nr	T	1
GY	NS	DE	WiFG	2006	2021	0	16trap	nr	T	1
GY	NS	DE	WisWGY	2004	2021	0	18trap	nr	F	1
GY	NS	DK	HellGY	2010	2021	0	12sci. surv.	nr	T	1
GY	NS	GB	BeeGY	2011	2022	0	12trap	nr	F	1
GY	NS	GB	BroGY	2011	2022	0	12trap	nr	F	3
GY	NS	GB	FlaGY	2007	2022	0	16trap	nr	F	3
GY	NS	GB	NmiGY	2009	2022	0	14trap	nr	F	1

life stage	area	country	serie	min	max	n-	n+	sampling type	unit	habitat	kept
GY	NS	NO	ImsaGY	1975	2021	0	47	trap	nr	F	1
GY	NS	SE	ViskGY	1972	2021	0	50	trap	kg	F	1
Y	EE	ES	MiSpY	2019	202	0	2	trap	kg	T	0
Y	EE	FR	FreY	1997	2021	0	25	trap	nr	F	1
Y	EE	FR	RhoY	2008	2021	0	14	trap	nr	F	1
Y	EE	IE	ShaPY	1985	2022	0	38	trap	kg	F	1
Y	NS	BE	MeusY	1992	2021	2	30	trap	nr	F	4
Y	NS	BE	VeAmY	2017	2022	0	6	trap	nr	T	0
Y	NS	DE	DoElY	2003	2021	0	19	trap	nr	F	1
Y	NS	DE	WaSEY	2011	2021	0	11	sci. surv.	nr	T	0
Y	NS	DK	GudeY	1980	2021	0	42	trap	kg	F	1
Y	NS	DK	HartY	1967	2021	0	55	trap	kg	F	1
Y	NS	GB	BeeY	2011	2022	0	12	trap	nr	F	1
Y	NS	GB	BroY	2011	2022	0	12	trap	nr	F	1
Y	NS	GB	FlaY	2012	2022	0	11	trap	nr	F	1
Y	NS	GB	GirnY	2008	2021	0	14	trap	nr	F	1
Y	NS	GB	MertY	2011	2022	0	12	trap	nr	F	1
Y	NS	GB	MillY	2011	2022	0	12	trap	nr	F	1
Y	NS	GB	MolY	2005	2022	0	18	trap	nr	F	1
Y	NS	GB	RodY	2005	2022	0	18	trap	nr	F	1
Y	NS	SE	DalaY	1951	2021	3	71	trap	kg	F	1
Y	NS	SE	GotaY	1900	2022	12	123	trap	kg	F	1
Y	NS	SE	KavlY	1992	2021	0	30	trap	kg	F	1
Y	NS	SE	LagaY	1925	2021	0	97	trap	kg	F	1
Y	NS	SE	MorrY	1960	2022	0	63	trap	kg	F	1
Y	NS	SE	MotaY	1942	2021	0	80	trap	kg	F	1
Y	NS	SE	RonnY	1946	2022	9	77	trap	kg	F	1

Annex 10: Recruitment series: data not reported in 2021 and 2022

Table 1: Data in 2021 and 2022 having problems causing the data in the specific year to be excluded from the analysis. Series for stages are G = glass eel, GY = glass eel + yellow eel, Y = yellow eel, Division = FAO marine division. Kept: 0 = missing, 1 = good quality, 2 = WGEEL has modified the data, 3 = not used due to poor quality, 4 = data is used, but there are warnings on its quality.

Stage	Country	Name	Division	Year	Kept	Comment
G	ES	NaloG	27.8.c	2020	4	Glass eel fishing
G	FR	GiScG	27.8.b	2020	4	Provisional data
G	FR	VacG	37.1.2	2020	4	Provisional data
G	GB	BeeG	27.4.c	2020	4	Provisional - partial count Mar- end June
G	GB	BroG	27.4.c	2020	3	Trap flooded out May and June. Count updated in 2022 from provisional 1 to final 5
G	GB	BroG	27.4.c	2020	4	Provisional - partial count Mar- end June
G	GB	FlaG	27.4.c	2020	4	Provisional - partial count Mar- end June
G	GB	SeEAG	27.7.f	2020	3	Update by Ayesha Taylor in 2022 from provisional 0.36 to final 0.636
G	GB	SeEAG	27.7.f	2020	3	Provisional value as not all catch returns yet submitted.
G	GB	SeHMG	27.7.f	2020	3	Value and qual id updated by Ayesha Taylor in 2022. Figure revised to remove the catch that was for assisted migration/re-stocking only. Final Figure given here is what was purchased by the dealer for commercial purposes.
G	GB	SeHMG	27.7.f	2020	3	
G	NL	RhIjG	27.4.c	2020	4	
GY	DE	BrokGY	27.4.b	2020	3	Provisional Figure

Stage	Country	Name	Division	Year	Kept	Comment
GY	DE	HHKGY	27.4.b	2020	0	No monitoring. Series ended in 2013
GY	DE	LangGY	27.4.b	2020	3	Provisional Figure
GY	DE	VerlGY	27.4.b	2020	3	Provisional Figure
GY	FR	BresGY	27.7.d	2020	4	Provisional data
GY	FR	SousGY	27.8.b	2020	4	Provisional data
GY	GB	BeeGY	27.4.c	2020	4	Provisional - partial count Mar- end June
GY	GB	BroGY	27.4.c	2020	3	Trap flooded out May and June. Count updated in 2022 from provisional 283 to final 862
GY	GB	BroGY	27.4.c	2020	4	Provisional - partial count Mar- end June
GY	GB	FlaGY	27.4.c	2020	4	Provisional - partial count Mar- end June
GY	GB	GreyGY	27.7.g	2020	4	Partial count only up to May 2022. Issues with data processing and run not complete at the time of the data call
GY	GB	NmiGY	27.4.c	2020	4	Provisional - partial count mid May- mid June (if separated 6 G, 376 GY, 230 Y)
Y	FR	FreY	27.7.e	2020	4	Provisional data
Y	FR	RhoY	37.1.2	2020	4	Left bank pump running 57% of the time right bank pump working 96% of the time
Y	GB	BeeY	27.4.c	2020	4	Provisional - partial count Mar- end June
Y	GB	BroY	27.4.c	2020	3	Trap flooded out May and June. Count updated in 2022 from provisional 2 to final 1
Y	GB	BroY	27.4.c	2020	4	Provisional - partial count Mar- end June
Y	GB	FlaY	27.4.c	2020	4	Provisional - partial count Mar- end June

Stage	Country	Name	Division	Year	Kept	Comment
Y	GB	MertY	27.4.c	2020	4	Provisional data to middle of July, expect migration to continue
Y	GB	MillY	27.4.c	2020	4	Provisional data to middle of July, expect migration to continue
Y	GB	MolY	27.4.c	2020	4	Provisional data to middle of July, expect migration to continue
Y	GB	RodY	27.4.c	2020	4	Preliminary data to middle of July, expect migration to continue
Y	SE	GotaY	27.3.a	2020	0	This eel pass is not running
Y	SE	GotaY	27.3.a	2020	0	This eel pass is not running
Y	SE	MorrY	27.3.d	2020	0	This eel-trap is closed
Y	SE	MorrY	27.3.d	2020	0	This eel-trap is closed
Y	SE	RonnY	27.3.a	2020	0	This eel-trap is closed
Y	SE	RonnY	27.3.a	2020	0	This eel-trap is closed

Annex 11: Recruitment, series reported in 2021, 2022 and with no reporting

Table 1: Series updated to 2022. Series for stages are G = glass eel, GY = glass eel + yellow eel, Y = yellow eel, Area NS = North Sea, EE = Elsewhere Europe, Division = FAO marine division. Series ordered by stage and from North to South.

Stage	Area	Coun.	Site	Name	Division	Kept
G	EE	ES	AlbuG	Albufera de Valencia commercial catch	37.1.1	1
G	EE	ES	AlCPG	Albufera de Valencia commercial CPUE	37.1.1	1
G	EE	ES	EbroG	Ebro delta lagoons	37.1.1	1
G	EE	ES	MiSpG	Minho spanish part commercial catch	27.9.a	1
G	EE	ES	NaloG	Nalon Estuary commercial catch	27.8.c	1
G	EE	ES	OriaG	Oria scientific monitoring	27.8.b	1
G	EE	FR	GiScG	Gironde scientific estimate	27.8.b	1
G	EE	FR	VacG	Vaccares	37.1.2	1
G	EE	GB	SeEAG	Severn EA commercial catch	27.7.f	1
G	EE	IE	MaigG	River Maigue	27.7.b	1
G	EE	PT	MiPoG	Minho portuguese part commercial catch	27.9.a	1
G	NS	BE	YserG	IJzer Nieuwpoort scientific estimate	27.4.c	1
G	NS	DK	KlitG	Klitmoeller A	27.3.a	1
G	NS	DK	NorsG	Nors A	27.3.a	1
G	NS	DK	SleG	Slette A	27.4.b	1
G	NS	GB	BeeG	Beeleigh_Glass_<80mm	27.4.c	1
G	NS	GB	BroG	Brownshill_Glass_<80mm	27.4.c	1
G	NS	GB	FlaG	Flatford_GE_<80mm	27.4.c	1
G	NS	NL	KatwG	Katwijk scientific estimate	27.4.c	1
G	NS	NL	LauwG	Lauwersoog scientific estimate	27.4.b	1
G	NS	NL	RhDOG	Rhine DenOever scientific estimate	27.4.c	1

Stage	Area	Coun.	Site	Name	Division	Kept
G	NS	NL	RhIjG	Rhine Ijmuiden scientific estimate	27.4.c	1
G	NS	NL	StelG	Stellendam scientific estimate	27.4.c	1
G	NS	SE	RingG	Ringhals scientific survey	27.3.a	1
G	NS	SE	YFS2G	IYFS2 scientific estimate	27.3.a	1
GY	EE	FR	BresGY	Bresle	27.7.d	1
GY	EE	GB	BannGY	Bann Coleraine trapping partial	27.6.a	1
GY	EE	GB	GreyGY	Greylake_Elvers/Yellow (mainly yellow>120mm with 20-25% elvers <120mm)	27.7.g	1
GY	EE	GB	StraGY	Strangford	27.7.a	1
GY	EE	IE	BurrGY	Burrishoole	27.7.b	1
GY	EE	IE	CorG	Corrib Galway Weir	27.7.b	1
GY	EE	IE	ErneGY	Erne Ballyshannon trapping all	27.7.b	1
GY	EE	IE	FealGY	River Feale	27.7.j	1
GY	EE	IE	InagG	River Inagh	27.7.b	1
GY	EE	IE	InagGY	River Inagh	27.7.b	1
GY	EE	IE	LiffGY	Liffey	27.7.a	1
GY	EE	IE	ShaAGY	Shannon Ardnacrusha trapping all	27.7.b	1
GY	NS	DE	BrokGY	Broklandsau Pumping Station	27.4.b	1
GY	NS	DE	VerlGY	Verlath Pumping Station	27.4.b	1
GY	NS	GB	BeeGY	Beeleigh_Elver_81-120mm	27.4.c	1
GY	NS	GB	NmiGY	New Mills Elvers/Yellow >80mm	27.4.c	1
Y	EE	IE	ShaPY	Shannon Parteen trapping partial	27.7.b	1
Y	NS	GB	BeeY	Beeleigh_Yellow_121mm+	27.4.c	1
Y	NS	GB	BroY	Brownshill_Yellow_>120mm	27.4.c	1
Y	NS	GB	FlaY	Flatford Yellow eel >120mm	27.4.c	1
Y	NS	GB	MertY	Thames - Wandle - Merton Abbey Mills	27.4.c	1
Y	NS	GB	MillY	Thames - Hogsmill Middle Mill	27.4.c	1

Stage	Area	Coun.	Site	Name	Division	Kept
Y	NS	GB	MolY	Thames-Molesey weir	27.4.c	1
Y	NS	GB	RodY	Thames - Roding	27.4.c	1
Y	NS	SE	GotaY	Göta Älv trapping all	27.3.a	1
Y	NS	SE	MorrY	Mörrumsån trapping all	27.3.d	1
Y	NS	SE	RonnY	Rönne Å trapping all	27.3.a	1

Table 2. Series updated to 2021 see Table 1 for series.

Stage	Area	Coun.	Site	Name	Division
GY	NS	DE	WiFG	Frische Grube	27.3.b, c
GY	NS	DE	WisWGY	Wallensteingraben	27.3.b, c
GY	NS	DK	HellGY	Hellebaekken	27.3.a
GY	NS	NO	ImsaGY	Imsa Near Sandnes trapping all	27.4.a
GY	NS	SE	ViskGY	Viskan trapping all	27.3.a
Y	EE	FR	FreY	Fremur	27.7.e
Y	EE	FR	RhoY	Rhone_Beaucaire	37.1.2
Y	NS	BE	MeusY	Meuse Lixhe dam trapping partial	27.4.c
Y	NS	DE	DoElY	Dove Elde eel ladder	27.4.b
Y	NS	DK	GudeY	Guden AA... Tange trapping all	27.3.a
Y	NS	DK	HartY	Harte trapping all	27.3.b, c
Y	NS	GB	GirnY	Girnock Burn trap scientific estimate	27.4.b
Y	NS	SE	DalaY	Dalälven trapping all	27.3.d
Y	NS	SE	KavlY	Kävlingeån trapping all	27.3.b, c
Y	NS	SE	LagaY	Lagan trapping all	27.3.a
Y	NS	SE	MotaY	Motala Ström trapping all	27.3.d

Table 10. Series not been used anymore 8 for series.

Stage	Area	Coun.	Site	Name	Division	Last Year

G	EE	ES	GuadG	Guadalquivir scientific monitoring	27.9.a	2007
G	EE	FR	AdCPG	Adour Estuary (CPUE) commercial CPUE	27.8.b	2008
G	EE	FR	AdTCG	Adour Estuary (catch) commercial catch	27.8.b	2008
G	EE	FR	GiCPG	Gironde Estuary (CPUE) commercial CPUE	27.8.b	2008
G	EE	FR	GiTCG	Gironde Estuary (catch) commercial catch	27.8.b	2008
G	EE	FR	LoiG	Loire Estuary commercial catch	27.8.a	2008
G	EE	FR	SevNG	Sevres Niortaise Estuary commercial CPUE	27.8.a	2008
G	EE	FR	VilG	Vilaine Arzal trapping all	27.8.a	2015
G	EE	IT	TibeG	Tiber Fiumara Grande commercial catch	37.1.3	2006
G	NS	DE	EmsG	Ems Herbrum commercial catch	27.4.b	2001
G	NS	DK	VidaG	Vidaa Hoejer sluice commercial catch	27.4.b	1990
G	NS	SE	YFS1G	IYFS scientific estimate	27.3.a	1989

Table 3. Series stopped or not updated to 2022 see Table 1 for series. Series ordered by last year.

Stage	Area	Coun.	Site	Name	Division	Last Year
G	EE	FR	VilG	Vilaine Arzal trapping all	27.8.a	2015
G	EE	FR	AdCPG	Adour Estuary (CPUE) commercial CPUE	27.8.b	2008
G	EE	FR	AdTCG	Adour Estuary (catch) commercial catch	27.8.b	2008
G	EE	FR	GiCPG	Gironde Estuary (CPUE) commercial CPUE	27.8.b	2008
G	EE	FR	GiTCG	Gironde Estuary (catch) commercial catch	27.8.b	2008
G	EE	FR	LoiG	Loire Estuary commercial catch	27.8.a	2008
G	EE	FR	SevNG	Sevres Niortaise Estuary commercial CPUE	27.8.a	2008
G	EE	ES	GuadG	Guadalquivir scientific monitoring	27.9.a	2007
G	EE	IT	TibeG	Tiber Fiumara Grande commercial catch	37.1.3	2006
G	NS	DE	EmsG	Ems Herbrum commercial catch	27.4.b	2001
G	NS	DK	VidaG	Vidaa Hoejer sluice commercial catch	27.4.b	1990
G	NS	SE	YFS1G	IYFS scientific estimate	27.3.a	1989

Annex 12: Additional graphs and analyses for recruitment

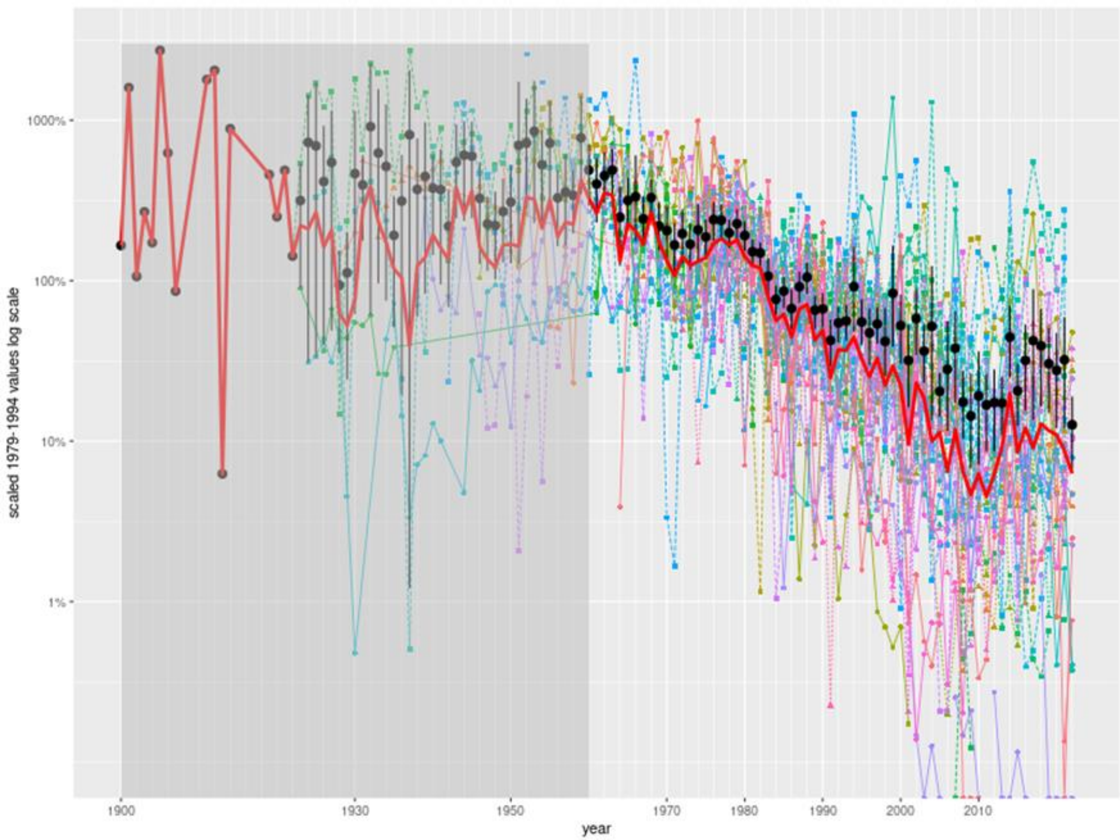

Figure 1. Time-series of glass eel and yellow eel recruitment in European rivers with time-series having data for the 1979-1994 period (45 sites). Each time-series has been scaled to its 1979-1994 average. Note the logarithmic scale on the y-axis. The mean values and their bootstrap confidence interval (95%) are represented as black dots and bars. Geometric means are presented in red.

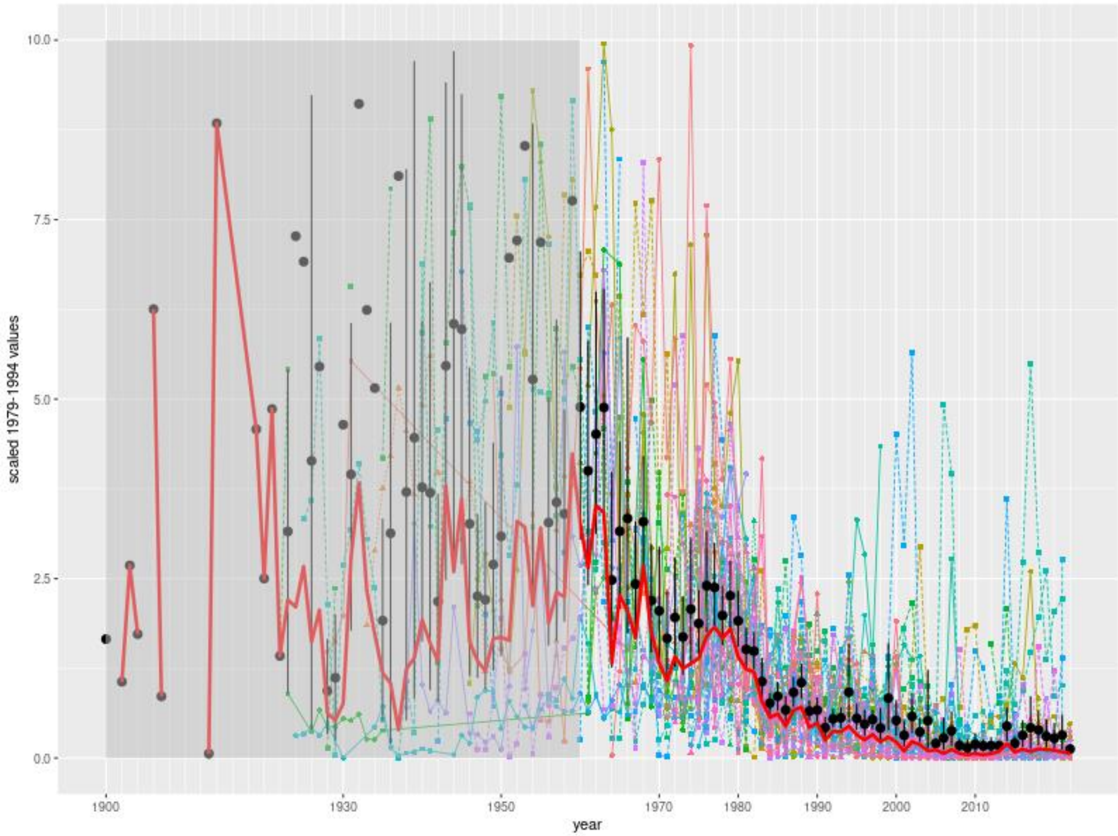

Figure 2. Time-series of glass eel and yellow eel recruitment in European rivers with time-series having data for the 1979-1994 period (45 sites). Each time-series has been scaled to its 1979-1994 average. The mean values and their bootstrap confidence interval (95%) are represented as black dots and bars. Geometric means are presented in red. Same Figure as 1 but with a natural scale.

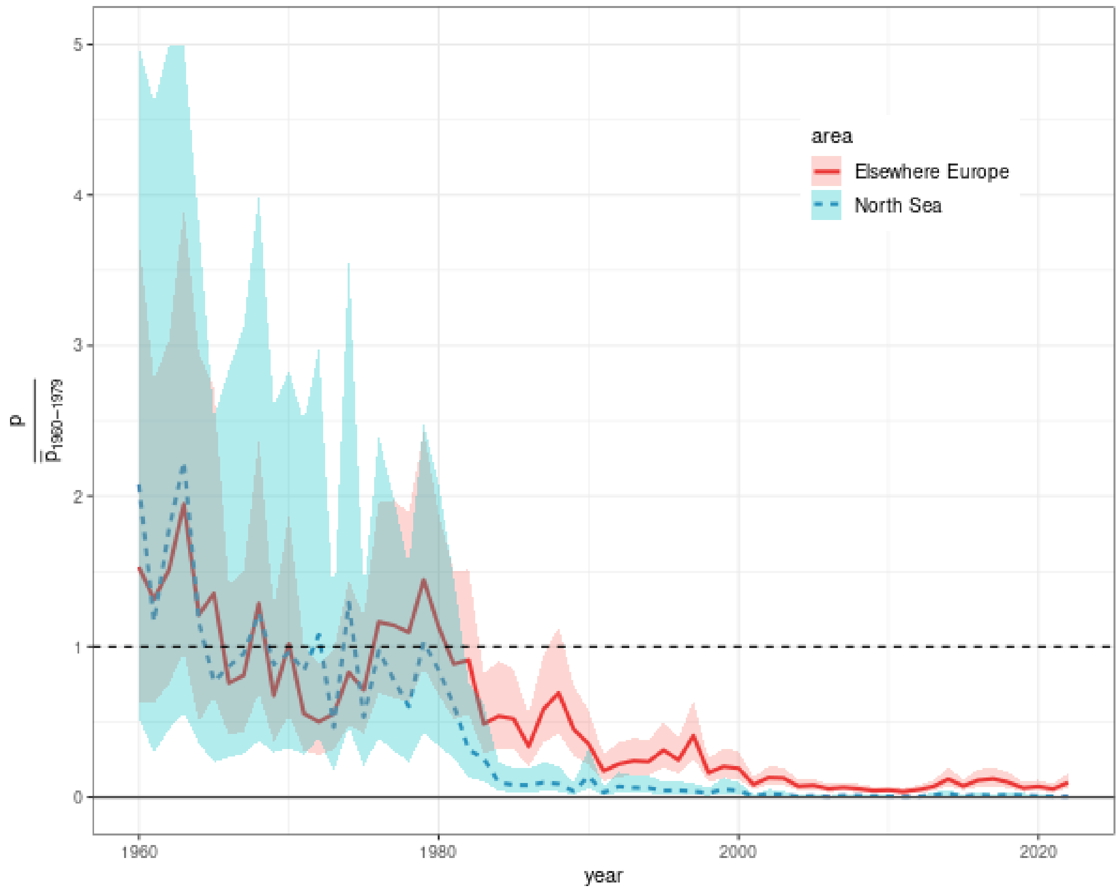

Figure 3. WGEEL glass eel recruitment index for the continental North Sea and Elsewhere Europe series with 95 % confidence intervals updated to 2022. The index was estimated using a GLM (*glasseel ~ area* : *year* + *site*) fitted on 58 time-series comprising either pure glass eel or a mixture of glass eels and yellow eels. The predictions *p* have been scaled to the 1960-1979 average $\bar{p}_{1960-1979}$. Number of series Elsewhere Europe = 30, North Sea = 26. Same Figure as 2.6 but with a natural scale.

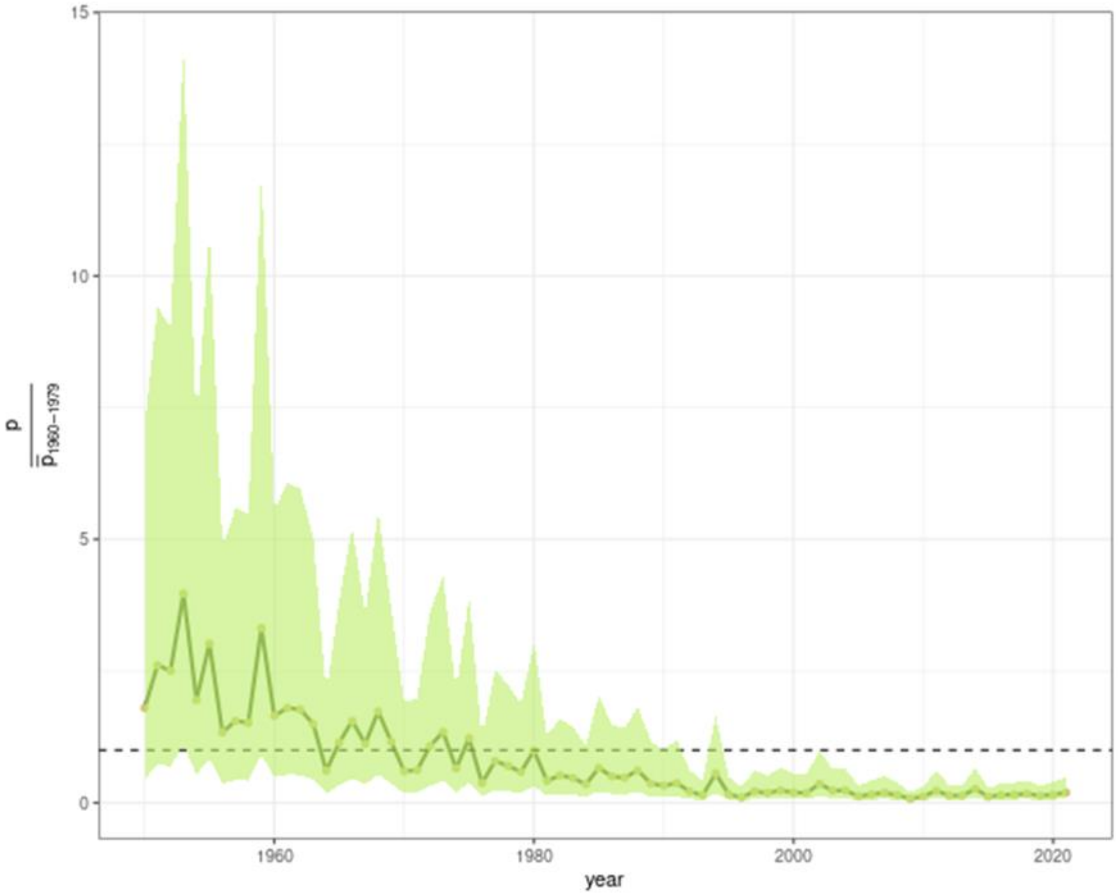

Figure 4. Geometric mean of of estimated yellow eel recruitment for Europe updated to 2021. The yellow recruitment was estimated using a GLM (*yelloweel ~ year*) fitted to 22 yellow eel time-series *p* scaled to the 1960-1979 average $p_{1960-1979}$. Note the logarithmic scale on the y-axis. Same Figure as 2.7 but with a natural scale.

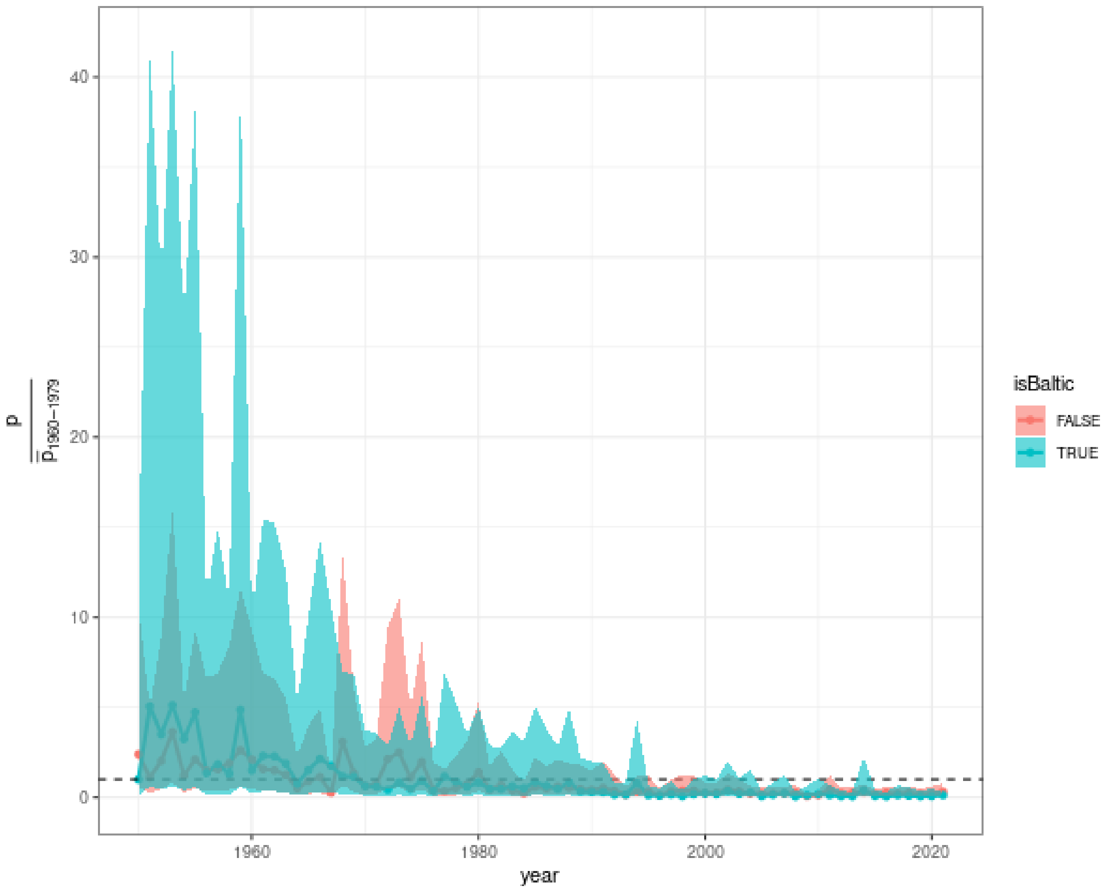

Figure 5. Geometric mean of of estimated yellow eel recruitment for Europe updated to 2021. The yellow recruitment was estimated using a GLM (*yelloweel ~ year:area*) fitted to 22 yellow eel time-series *p* scaled to the 1960-1979 average $p_{1960-1979}$. True: Baltic area, False: Elsewhere Europe. **Same Figure as 2.8 but with a natural scale.**

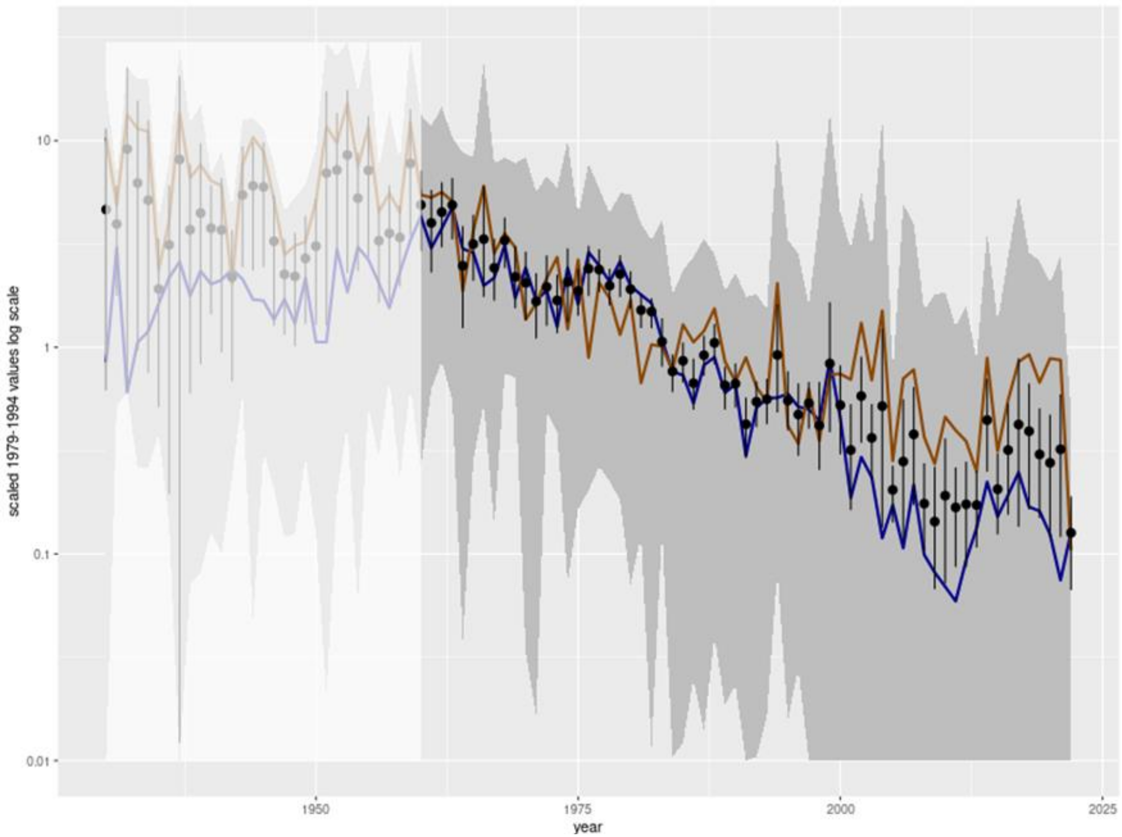

Figure 6. Time-series of glass eel and yellow eel recruitment in Europe with 77 time-series out of the 98 available to the working group. Each time-series has been scaled to its 1979-1994 average. The mean values of the combined yellow and glass eel time-series and their bootstrap confidence interval (95%) are represented as black dots and bars. The brown line represents the mean value for yellow eel, and the blue line represents the mean value for glass eel time-series. The range of these time-series is indicated by a grey shade. Note that individual time-series from Figure 6 were removed to make the mean value more clear. Also note the logarithmic scale on the y-axis.

Annex 13: Trend in landings, releases and aquaculture

Table 1: Glass eel commercial fisheries landings (in tonnes) from 1984 to 2022, reported by countries: GB United Kingdom, FR France, ES Spain, PT Portugal, IT Italy, sum.

Year	GB	FR	ES	PT	IT	sum
1945			119.246			119.246
1946			71.931			71.931
1947			100.09			100.09
1948			110.624			110.624
1949			9.319			9.319
1950			3.828			3.828
1951			2.093			2.093
1953			2.535			2.535
1954			5.91			5.91
1955			0.906			0.906
1956			0.884			0.884
1957			2.833			2.833
1958			0.402			0.402
1959			6.637			6.637
1960			9.453			9.453
1961			16.731			16.731
1962			11.088			11.088
1963			7.997			7.997
1964			11			11
1965			4			4
1966			6			6
1967			5			5
1968			4			4

Year	GB	FR	ES	PT	IT	sum
1969			4			4
1970			5			5
1971			1			1
1972	16.7		1			17.7
1973	28.2		1			29.2
1974	57.5		2	1.596		61.096
1975	10.5		2.6	5.578		18.678
1976	13.1		11.6	12.548		37.248
1977	38.6		17.5	22.637		78.737
1978	61.2	1393	21.6	7.344		1483.144
1979	67	1850	17.3	8.758		1943.058
1980	40.1	1491	15.4	10.11		1556.61
1981	36.9	890	13	18.05		957.95
1982	48	866	19.309	22.235		955.544
1983	16.9	791	10.34	6.74		824.98
1984	25	528	16.387	16.064		585.451
1985	20	444	18.28	14.843		497.123
1986	19	423	6.402	7		455.402
1987	21.3	461	9.384	9.51		501.194
1988	21.4	504	9.855	2.571		537.826
1989	20.6	410	9.872	2.834		443.306
1990	20.9	325	5.283	4.485		355.668
1991	1.1	179	6.822	2.8		189.722
1992	5	183	3.665	4.471		196.136
1993	5.73	329	5.248	3.626		343.604
1994	9.5	329	2.371	2.9		343.771
1995	11.9	413	4.9	5.3		435.1
1996	18.8	262	14.545	8.7		304.045
1997	8.7	287	11.978	4.44		312.118

Year	GB	FR	ES	PT	IT	sum
1998	11.2	195	14.119	4.46		224.779
1999		242	13.869	3.6		259.469
2000		206	10.987	3		219.987
2001	0.809	101	12.044	1.149		115.002
2002	0.521	202	8.577	0.804		211.902
2003	1.715	151	9.974	1.45		164.139
2004	0.97	89	5.12	0.814		95.904
2005	1.743	89	6.425	1.174		98.342
2006	1.28	67	4.143	2.736		75.159
2007	2.058	77	5.241	0.905		85.204
2008	0.835	79	5.148	0.75		85.733
2009	0.292		3.655	1.35		5.297
2010	1.329	41.018	6.466	2.36		51.173
2011	2.251	31.258	5.206	1.085		39.8
2012	2.79	34.296	5.326	0.808		43.22
2013	5.922	33.616	7.155	1.081		47.774
2014	12.031	35.341	11.28	1.176	0.425	60.253
2015	2.827	36.094	8.763	1.284	0.159	49.127
2016	4.041	46.371	6.114	0.409	0.06	56.995
2017	3.301	43.191	10.765	2.178	0.146	59.581
2018	4.234	53.405	4.501	1.048	0.243	63.431
2019	6.603	50.009	4.094	0.587	0.243	61.536
2020	3.435	47.756	5.962	0.891		58.044
2021	0.146	46.031	4.216	1.236		51.629
2022	0.473	53.361	4.734	0.913		59.481

Table 2a: Commercial fisheries landings (in tonnes) for yellow eel and silver eel from 1908 to 2022 (part 1), reported by countries: NO Norway, SE Sweden, FI Finland, EE Estonia, LV Latvia, LT Lithuania, PL Poland, DE Germany, DK Denmark, NL Netherlands, BE Belgium (to be continued for other countries in next table).

Year	NO	SE	FI	EE	LV	LT	PL	DE	DK	NL*	BE
1908	268.145										
1909	326.558										
1910	303.064										
1911	383.821										
1912	187.325										
1913	212.749										
1914	282	1460.605									
1915	143	996.92									
1916	117	1078.247									
1917	44	1283.643									
1918	35	884.351									
1919	64	1145.353									
1920	80	969.609							3413		
1921	79	1072.376							3443		
1922	94	925.85							3760		
1923	140	947.739							3396		
1924	290	1201.069							4130		
1925	325	1714.229							4880		
1926	341	1707.254							4726		
1927	354	2011.481							4648		
1928	325	1040.056							4117		
1929	425	1393.667							4375		
1930	450	1528.797							4773		
1931	329	1794.757							4195		
1932	518	1588.748							5088		
1933	694	1493.965							5014		

Year	NO	SE	FI	EE	LV	LT	PL	DE	DK	NL*	BE
1934	674	1768.74							5171		
1935	564	1950.935							4316		
1936	631	1654.478							4332		
1937	603	1725.109							4329		
1938	526	1870.504							3849		
1939	434	1774.362							4662		
1940	143	1625.714							3709		
1941	174	1821.767							3717		
1942	131	1226.46							3140		
1943	136	1827.842							3917		
1944	150	2319.761							4245		
1945	102	1906.104							4169	2668	
1946	167	1744.632							4269	3492	
1947	268	2346.809			10	8			4784	4502	
1948	293	2211.86			10	14			4386	4799	
1949	214	2329			50	21			4492	3873	
1950	282	2628			10	29			4500	4152	
1951	312	2311			10	32			4400	3661	
1952	178	1848			10	39			3900	3978	
1953	371	2756			20	80			4300	3157	
1954	327	2459			20	147	609		3800	2085	
1955	451	3338			40	163	732		4800	1651	
1956	293	1702			20	131	656		3700	1817	
1957	430	2494			20	168	616		3600	2509	
1958	437	2024			20	149	635		3300	2674	
1959	409	3522			24	155	566		4000	3413	
1960	430	1905			37	165	733		4937	2999	
1961	449	2387			43	139	640		4110	2452	
1962	356	2171			41	155	663		4122	1443	

Year	NO	SE	FI	EE	LV	LT	PL	DE	DK	NL*	BE
1963	503	2334			56	260	762		4166	1618	
1964	440	2612		3	37	225	884		3505	2068	
1965	523	2051		0.3	35	125	682		3402	2268	
1966	510	2219		1.9	33	238	804		3901	2339	
1967	491	1835		2.7	39	153	906		3679	2524	
1968	569	2052		2.9	28	165	943		4476	2209	
1969	522	1922		49	36	134	935		3878	2389	
1970	422	1209		61.5	29	118	847		3558	1111	
1971	415	1391		59.5	29	124	722		3378	853	
1972	422	1204		73.4	25	126	696		3429	857	
1973	409	1212		69	27	120	644.707		3656	823	
1974	368	1034		51.1	20	86	691.129		2977	840	
1975	407	1391		82.1	19	114	809.665		3485	1000	
1976	386	935		71.6	24	88	760.519		3054	1172	
1977	352	989		65.8	16	68	867.806		2502	783	
1978	347	1076		63.2	18	70	910.375		2492	719	
1979	374	954		28.5	21	57	978.932		1904	530	
1980	387	1112		25.7	9	45	1214.035		2288	664	
1981	369	887		21.9	10	27	943.503		2227	722	
1982	385	1161		13.9	12	28	911.289		2541	842	
1983	324	1212		28.84	9	23	867.978		2119	937	
1984	310	963		72.2	12	27	819.414		1871	691	
1985	352	1029		75.1	18	29	1022.467	1096.653	1630	679	
1986	272	827.689		61.1	19	32	920.661	1118.657	1672	721	
1987	282	699.389		66.7	25	20	886.569	1031.004	1279	538	
1988	513	932.679		109.7	15	23	943.271	1018.002	1878	425	
1989	313	901.969		54.8	13	21	812.85	963.611	1696	526	
1990	336	916.204		61.3	13	19	768.095	829.743	1675	472	
1991	323	1058.467		52.4	14	16	669.686	724.738	1465	573	

Year	NO	SE	FI	EE	LV	LT	PL	DE	DK	NL*	BE
1992	372	1152.483		39.4	17	12	638.191	761.654	1451	548	
1993	340	1119.366		59.2	19	10	567.994	790.061	1080	293	
1994	472	1261.954		46.9	19	12	635.126	833.051	1200	330	
1995	454	948.031		45.4	38	9.4	641.863	777.853	892	354	
1996	353	1053.309		55.1	24	8.6	628.986	602.967	751.5	300	
1997	467	1064.963		59.1	25	10.7	525.997	616.185	797	285	
1998	331	646.377		44.2	30	17.1	544.371	566.948	597	323	
1999	447	701.611		64.8	26	17.9	599.12	645.112	717	356.962	
2000	281	530.879		67	13.669	21.986	443.649	591.233	628	370.11	2.879
2001	304	643.153		67	17.404	22.968	434.509	569.024	707	439.494	2.879
2002	311	591.366		49.9	9.58	25.609	372.911	543.918	614	370.235	2.879
2003	240	565.089		48.6	10.347	23.532	365.522	497.903	648	309.765	2.879
2004	237	583.18		39.2	11.337	32.001	337.199	475.279	546	310.153	2.879
2005	249	675.817		30.7	10.267	44.563	219.91	454.761	534	255.176	2.879
2006	293	732.285		33.4	7.88	31.604	184.448	472.196	596	240.327	
2007	194	702.458		31.1	9.561	29.769	180.7	423.634	537	196.963	
2008	211	671.354	1	30.6	12.86	26.989	159.7	406.098	466	147.63	
2009	69	514.079	1.8	22.1	4.873	17.246	160.6	374.585	467	108.029	
2010	32	525.123	2.3	18.9	8.915	37.562	173.2	367.055	422	445.011	
2011	0	450.431	1.549	16.2	5.993	22.613	118.8	278.884	370	370.593	
2012	0	339.986	1.539	17.7	6.264	15.791	119.3	245.371	317	351.733	
2013	0	374.384	1.307	17.4	4.698	28.423	137.4	264.843	356	318.852	
2014	0	324.234	1.021	16.7	4.405	15.409	116.8	232.92	346	320.271	
2015	0	246.486	0.609	14.15	5.19	11.774	102.423	226.127	282	292.978	
2016	3	279.532	1.326	15.215	4.159	28.4	138.393	206.828	265	312.479	
2017	10.898	244.978	1.081	15.686	8.645	24.287	172.618	241.698	257.267	421.255	0
2018	3.403	250.993	1.095	18.319	5.784	20.279	146.49	226.936	181.806	476.864	
2019	4	188.198	0.394	21.731	6.088	4.62	167.535	209.122	183.257	483.972	
2020	4	194.431	0.352	38.8	6.676	6.841	103.632		182.2	475.462	

Year	NO	SE	FI	EE	LV	LT	PL	DE	DK	NL*	BE
2021	5	170.533	0.282	47.93	6.425	9.927	126.601		232.79	523.707	
2022											

* Landings from the Netherlands are incomplete before 2010.

Table 2b: Commercial fisheries landings (in tonnes) for yellow eel and silver eel from 1908 to 2022 (part 2), reported by countries and all countries: IE Ireland, GB United Kingdom, FR France, ES Spain, PT Portugal, IT Italy, SI Sovenia.

Year	IE	GB	FR	ES	PT	IT	SI
1951				90			
1952				102.2			
1953				80.2			
1954				97.7			
1955				102.9			
1956				106.12			
1957				80			
1958				115			
1959				100			
1960		771.655		98			
1961		768.37		153.837			
1962		696.1		114.941			
1963		787.819		136.853			
1964		548.918		91.5			
1965		783.816		130.444			
1966		881.045		191.518			
1967		568.717		163.826			
1968		585.615		175.601			
1969		605.628		136.356		2469	
1970	200	752.141		119.396		2300	
1971	200	842.231		107.37		2113	

Year	IE	GB	FR	ES	PT	IT	SI
1972	200	632.599		119.414		1997	
1973	91	723.24		100.198		588	
1974	67	765.03		93.403		2122	
1975	79	762.162		78.002		2886	
1976	150	621.718		82.729		2596	
1977	108	690.508		79.867		2390	
1978	76	823.576		67.034		2172	
1979	110	1045.034		96.823		2354	
1980	75	912.167		89.797		2198	
1981	94	907.102		97.706		2270	
1982	144	942.547		19.871		2025	0.795
1983	117	866.413		18.394		2013	0.67
1984	88	973.392		10.972		2050	1.154
1985	87	750.036		16.504		2135	2.456
1986	87	650.76	1944	13.448		2134	2.705
1987	230	684.122	2062	21.225		2265	1.595
1988	215	933.554	2265	13.913		2027	1.535
1989	400	874.679	1746	5.308	13.532	1243	1.303
1990	256	783.908	1778	8.696	13	1088	1.943
1991	245	736.922	1645	49.818	23.486	1097	1.399
1992	234	715.355	1321	54.285	29.665	1084	0.061
1993	260	670.679	1280	66.481	33.943	782	0.066
1994	300	777.838	1280	50.741	26.553	771	0.718
1995		899.576	1280	69.401	23.706	1047	0.01
1996		805.237	1280	61.732	25.566	953	0.012
1997		730.722	1223	61.452	24.707	727	0.002
1998		693.373	1150	43.592	23.277	666	0.003
1999	250	667.772	1005	48.298	23.143	634	
2000	250	587.224	1008.842	55.321	21.772	588	0.004

Year	IE	GB	FR	ES	PT	IT	SI
2001	98	582.715	1024.128	130.156	15.003	520	0.019
2002	123	551.139	30.392	105.596	26.863	415	0.009
2003	111	552.333	21.425	95.634	10.63	446	
2004	136	471.689	12.512	85.253	8.848	379	
2005	101	477.237	7.774	87.96	7.022	75	0.002
2006	133	383.496	14.976	115.583	10.131	56	0.014
2007	114	450.375	26.136	82.073	10.512	277	0.009
2008	108.323	400.626	31.398	65.611	6.954	56	0.031
2009	0	462.373	42.044	89.225	8.169	329.924	0.002
2010	0	461.146	20.2	104.557	11.031	265.052	0.003
2011	0	455.857	368	93.598	5.866	189.68	0
2012	0	415.06	472.581	121.551	3.814	182.427	0
2013	0	426.512	504.054	132.721	2.736	172.213	0.001
2014	0	392.752	434.359	130.384	3.348	184.612	0
2015	0	340.972	356.891	91.977	2.885	170.254	0
2016	0	347.178	442.602	115.058	2.435	205.028	0
2017	0	321.775	434.105	98.174	1.539	213.82	
2018	0	366.913	617.355	85.134	3.572	123.513	
2019	0	295.628	312.722	64.055	1.894	126.628	
2020	0	182.247	347.878	59.993	3.157	89.466	
2021	0	243.96	293.607	69.65	2.408	49.957	
2022	0	115		37.95			

Table 2c: Commercial fisheries landings (in tonnes) for yellow eel and silver eel from 1908 to 2022 (part 3), reported by countries and all countries: HR Croatia AL Albania, Greece, TR Turkey, TN Tunisia, DZ Algeria, MA Morocco, sum.

Year	HR	AL	GR	TR	TN	DZ	MA	sum
1908								268.145
1909								326.558
1910								303.064
1911								383.821
1912								187.325
1913								212.749
1914								1742.605
1915								1139.92
1916								1195.247
1917								1327.643
1918								919.351
1919								1209.353
1920								4462.609
1921								4594.376
1922								4779.85
1923								4483.739
1924								5621.069
1925								6919.229
1926								6774.254
1927								7013.481
1928								5482.056
1929								6193.667
1930								6751.797
1931								6318.757
1932								7194.748
1933								7201.965
1934								7613.74
1935								6830.935

Year	HR	AL	GR	TR	TN	DZ	MA	sum
1936								6617.478
1937								6657.109
1938								6245.504
1939								6870.362
1940								5477.714
1941								5712.767
1942								4497.46
1943								5880.842
1944								6714.761
1945								8845.104
1946								9672.632
1947								11918.809
1948								11713.86
1949								10979
1950								11601
1951								10816
1952								10055.2
1953								10764.2
1954								9544.7
1955								11277.9
1956								8425.12
1957								9917
1958								9354
1959								12189
1960								12075.655
1961								11142.207
1962								9762.041
1963								10623.672
1964								10414.418

Year	HR	AL	GR	TR	TN	DZ	MA	sum
1965								10000.56
1966			14.9					11133.363
1967			19					10381.243
1968			4.904					11211.02
1969			2.932	342				13420.916
1970			0	441				11168.037
1971			0	460				10694.101
1972			4.307	220				10005.72
1973			15.496	315				8793.641
1974			129.768	588				9832.43
1975			133.776	448				11694.705
1976			158.741	499				10599.307
1977			89.214	282				9283.195
1978			225.269	283				9342.454
1979			185.479	396				9034.768
1980			226.933	224				9470.632
1981			250.648	374				9200.859
1982			255.244	424				9705.646
1983			200.757	588				9325.052
1984			285.437	616				8790.569
1985			189.569	583				9694.785
1986			151.55	517				11144.57
1987			266.306	543				10900.91
1988			268.088	756				12337.742
1989			155.618	472				10213.67
1990			194.214	230				9444.103
1991			209.4	262				9166.316
1992			184.846	245				8860
1993			181.902	261				7815

Year	HR	AL	GR	TR	TN	DZ	MA	sum
1994			200.505	329				8546
1995			201.386	390				8072
1996			151.339	342				7396
1997			136.506	400				7154
1998			87.585	300				6064
1999			80.72	200		20.386		6505
2000			88.068	176	109.907	17.216		5853
2001			93.428	122	144.097	44.495		5981
2002			136.333	147	204.4	25.393		4657
2003			76.503	158	171.7	25.203		4380
2004			58.056	165	132.46	29		4052
2005			116.128	176	197	7.594		3730
2006			77.097	162	266.34	2.652		3812
2007			89.653	179	296.54	14.6		3845
2008			71.068	171	316.71	13.95		3375
2009			78.468	158	122.18	14.2		3044
2010			58.632	182	92.628	3.4		3231
2011			83.229	28.3	79.569			2939
2012			55.207	38	54.989	0.4		2759
2013		46.98	37.96	48.2	149.639	3	23	3050
2014	0.516	43.01	58.271	56	83.567	6	23	2794
2015	0.149	49.99	60.238	71	81.354	3	4	2414
2016	0.595	40.97	60.889	75	250.39	2	7	2803
2017	0.559	47.02	48.316	81	153.048	10.6	2	2810
2018	0.61	59.95	42.797	111	166.269	32.962	2	2944
2019	0.562	70	20.439	330	107.03	25.19		2623
2020		40	27.871	232.75	129.926	18		2144
2021		22	18.858	267.3	105.265	4.71		2201
2022								153

Table 3a: Recreational fisheries landings (in tonnes) for yellow eel and silver eel from 1980 to 2022 (part 1), reported by countries: FI Finland, EE Estonia, LV Latvia, LT Lithuania, PL Poland, CZ Czechia, DE Germany, DK Denmark, NL Netherlands, BE Belgium, IE Ireland (to be continued for other countries in next table).

Year	FI	EE	LV	LT	PL	CZ	DE	DK	NL	BE	IE
1980											
1981											
1982											
1983											
1984											
1985							581.602				
1986							562.815				
1987							546.318				
1988							558.477				
1989							542.533				
1990							501.281				
1991							498.119				
1992							488.506				
1993							485.559				
1994							492.858				
1995							452.21				
1996							416.32				
1997							423.748				
1998							430.477				
1999							424.756				
2000			1.663				428.91			33.6	
2001			1.241				425.86			33.6	
2002			1.133				417.336			33.6	
2003			0.418				427.86			33.6	
2004			0.655				413.941			33.6	

Year	FI	EE	LV	LT	PL	CZ	DE	DK	NL	BE	IE
2005		1.692	2.612				398.097			33.6	
2006		1.024	0.326				399.088			33.6	
2007		0.958	0.34				375.39			33.6	
2008	17	1.061	0.183				326.352			33.6	
2009		1.393	0.69				309.824	108		33.6	
2010	10	1.104	0.348				276.669	125.5	111	30	
2011		0.98	0.383				271.796	79.5		30	
2012	5	0.612	0.415	1.4	32.4	17.078	262.586	52.3	59	30	
2013		0.589	0.738	3	26.7	15.434	265.222	50.3		30	
2014	20	0.536	0.503	1.8	29.5	18.804	270.144	57	70	30	
2015		0.744	0.45	5	26.5	12.424	270.48	118.3		29.523	
2016	8	0.634	0.17	1.638	34.216	12.384	274.614	164.3	24	29.523	
2017		0.579	0.45	2.973	30.851	17.264	275.515	117.1		29.523	
2018	2	0.565	0.166	0.587	30	11.53	271.054	105	24	29.723	
2019		0.615	0.258	6.038	30.4	12.29	275.981	110		29.723	
2020	2	1.092	0.519	1.158	27.7			98.9	24	29.723	
2021		0.454	0.256	6.849	29.5			79		29.573	
2022											0

Table 3b: Recreational fisheries landings (in tonnes) for yellow eel and silver eel from 1980 to 2022 (part 2), reported by countries and all countries: FR France, ES Spain, IT Italy, SI Sovenia, TR Turkey, sum.

Year	FR	ES	IT	SI	TR	sum
1980				0		0
1981				0		0
1982				0		0
1983				0		0
1984				0		0

Year	FR	ES	IT	SI	TR	sum
1985				0		581.602
1986				0.07		562.885
1987				0.14		546.458
1988				0.134		558.611
1989				0.11		542.643
1990				0.06		501.341
1991				0.058		498.177
1992				0.092		488.598
1993				0.078		485.637
1994				0.036		492.894
1995				0.029		452.239
1996				0.143		416.463
1997				0.207		423.955
1998				0.088		430.565
1999				0.023		424.779
2000	20.91			0.004		485.087
2001	19.893			0.02		480.614
2002	19.043			0.033		471.145
2003	14.702			0.004		476.584
2004	16.813			0.006		465.015
2005	12.933			0		448.934
2006	683.894			0.004		1117.936
2007	14.646			0		424.934
2008	14.858			0		393.054
2009	7.134			0		460.641
2010	4.89		149.504	0		709.015
2011	3.209		60.623	0		446.491
2012	4.587		73.623	0		539.001
2013	4.664	1.029	69.653	0		467.329

Year	FR	ES	IT	SI	TR	sum
2014	4.299	1.028	69.816	0		573.43
2015	3.541	0.993	60.195	0		528.15
2016	3.144	0.814	56.84	0		610.277
2017	2.873	0.103	41.26			518.491
2018	2.547	0.876	42.3			520.348
2019	0.788	2.162	33.66			501.915
2020	0.535		24.531		87.25	297.408
2021			12.644		41.7	199.976
2022						0
Year	FI	EE	LV	LT	PL	CZ

Table 4: Raw recreational landings (tonnes) for glass eels (1978 - 2022) for FR France, ES Spain.

Year	FR	ES	sum
1978	647		647
1979	697		697
1980	1303		1303
1981	904		904
1982	219		219
1983	161		161
1984	156		156
1985	71		71
1986	87		87
1987	172		172
1988	40		40
1989	110		110
1990	54		54
1991	87		87

Year	FR	ES	sum
1992	77		77
1993	130		130
1994	74		74
1995	113		113
1996	25		25
1997	39		39
1998	6		6
1999	6		6
2000	2		2
2001	1		1
2002	37		37
2004		0.858	0.858
2005	0	1.181	1.181
2006	1	1.656	2.656
2007	0	1.339	1.339
2008	0	1.563	1.563
2009	0	0.439	0.439
2010	0	0.821	0.821
2011	0	0.389	0.389
2012	0	1.104	1.104
2013	0	1.555	1.555
2014	0	2.414	2.414
2015	0	2.316	2.316
2016	0	1.73	1.73
2017	0	1.511	1.511
2018	0	1.725	1.725
2019	0	0.865	0.865
2020	0	0.662	0.662
2022		0.716	0.716

Table 5a: Release of glass eel in millions from 1950 to 2022, reported by countries SE Sweden, EE Estonia, LV Latvia, PL Poland, DE Germany, NL Netherlands, BE Belgium (to be continued for other countries in next table).

Year	SE	EE	LV	PL	DE	NL	BE
1950						5.1	
1951	0.107					10.2	
1952	0.147			18		16.9	
1953	0.164			26		21.9	
1954				27		10.5	
1955	0.174			31		16.5	
1956	0.07	0.2		21		23.1	
1957	0.197			25		19	
1958	0.011			35		16.9	
1959	0.1			53		20.1	
1960	0.259	0.06	3.189	64		21.1	
1961	0.007		1	65		21	
1962	0.021	0.9	2.644	62		19.8	
1963			1.901	42		23.2	
1964	0.004	0.2	1.302	39		20	
1965	0.041	0.7	0.693	40		22.5	
1966				69		8.9	
1967			1.768	74		6.9	
1968		1.4	3.57	17		17	
1969				2		2.7	
1970	0.002	1	1.797	24		19	
1971				17		17	

Year	SE	EE	LV	PL	DE	NL	BE
1972	0.001	0.1	1.134	22		16.1	
1973	0.01			61.922		13.6	
1974		1.8		70.989		24.4	
1975				69.977		14.4	
1976	0.184	2.6	0.851	67.95		18	
1977		2.1	0.52	76.977		25.8	
1978	0.284	2.7		73.012		27.7	
1979	0.23			73.027		30.6	
1980	0.138	1.3		51.784		24.8	
1981		2.7	1.8	60.036		22.3	
1982	0.02	3	0.29	63.173		17.2	
1983		2.5	1.927	25.103		14.1	
1984		1.8		47.6		16.6	
1985	0.633	2.4	1.481	36.278	22.561	11.8	
1986	0.08			50.213	39.544	10.5	
1987	0.648	2.5	0.26	56.891	41.38	7.9	
1988	0.637		2.906	16.66	42.445	8.4	
1989	0.914			13.962	20.951	6.8	
1990	1.089			10.174	31.92	6.1	
1991	0.586	2		1.67	13.156	1.9	
1992	0.681	2.5		13.798	17.464	3.5	
1993	0.987			9.743	20.545	3.8	
1994	2.347	1.9		13.117	22.822	6.2	
1995	2.022		0.572	23.721	19.915	4.8	
1996	2.517	1.4		2.766	10.726	1.8	

Year	SE	EE	LV	PL	DE	NL	BE
1997	2.505	0.9		5.106	9.453	2.3	
1998	2.154	0.5		2.496	7.851	2.5	
1999	3.246	2.3	0.294	3.982	8.5	2.9	
2000	1.574	1.1		3.116	6.065	2.8	
2001	0.908			0.701	3.338	0.9	0.162
2002	1.393		0.251		2.858	1.6	
2003	0.702			0.506	1.994	1.6	0.324
2004	1.118		0.06	2.25	1.643	0.3	
2005	1.037		0.12		1.869	0.1	
2006	1.314		0.003		1.084	0.582	0.33
2007	0.959		0.015		1.001	0.216	
2008	1.377				0.51	0	0.351
2009	0.76				0.789	0.3	0.456
2010	1.937				5.009	2.714	0.429
2011	2.624	0.68	0.304		3.403	0.529	0.48
2012	2.566	0.91	1.03		4.033	2.287	0.618
2013	2.658	0.89			5.08	1.895	0.432
2014	2.953	3	1.386		10.449	5.698	1.62
2015	1.866	1.87			6.116	0.863	
2016	2.871	0.9			5.027	3.042	1.155
2017	0.947		1.03		9.879	3.044	0.727
2018	3.109	1.424	0.715		13.545	3.577	1.59
2019	2.872	1.58	0.69		21.512	4.677	2.028
2020	3.091	2.029	0			2.93	0.9
2021	0.443		0			2.39	0

Year	SE	EE	LV	PL	DE	NL	BE
2022		1.054				2.736	0.855

Table 5b. European eel. Release of glass eel in millions from 1950 to 2021, reported by countries: IE Ireland, GB United Kingdom, FR France, ES Spain, IT Italy, GR Greece, combining information from the 2021 data call and the WGEEL data-base.

Year	IE	GB	FR	ES	IT	GR	sum
1950							5.1
1951							10.307
1952							35.047
1953							48.064
1954							37.5
1955							47.674
1956							44.37
1957							44.197
1958							51.911
1959	6.586						79.786
1960	1.02						89.628
1961	3.711						90.718
1962	5.566						90.931
1963	7.791						74.892
1964	0.743						61.249
1965	1.3						65.234
1966	10.017						87.917
1967	6.866						89.534
1968	15.029						53.999
1969	8.163						12.863
1970	9.277						55.076
1971	16.42						50.42
1972	6.309						45.644
1973	10.017						85.549
1974	10.854						108.043

Year	IE	GB	FR	ES	IT	GR	sum
1975	4.823						89.2
1976	7.42						97.005
1977	2.857						108.254
1978	3.714						107.41
1979	29.637						133.494
1980	26.079						104.101
1981	17.473						104.309
1982	26.407						110.09
1983	9.926						53.556
1984	7.573	4					77.573
1985	6.136	11					92.289
1986	5.445	17.8					123.582
1987	13.888	13.7					137.167
1988	12.546	6.3					89.894
1989	6.949	0					49.576
1990	10.177	0					59.46
1991	2.185	0					21.497
1992	5.693	2.4					46.036
1993	7.209	0					42.284
1994	18.86	2.3					67.546
1995	11.291	2.1					64.421
1996	3.918	0.1					23.227
1997	15.003	0.2					35.467
1998	5.698	0.052					21.251
1999	7.708	3.6					32.53
2000	5.792	0.45					20.897
2001	3.03	0					9.039
2002	1.412	3					10.514
2003	4.224	3.9					13.25
2004	1.396	1.2					7.967
2005	3.71	2.4					9.236

Year	IE	GB	FR	ES	IT	GR	sum
2006	0.616	1					4.929
2007	1.027	3.6					6.818
2008	0.418	1.3					3.956
2009	0.375	0.719			0		3.399
2010	0.444	3.149	0.627		0.3		14.609
2011	0.318	3.255	2.35	0.014	0.9		14.857
2012	0.647	3.968	9.258	1.338	0.9		27.555
2013	0.972	5.763	8.775	1.259	0.9	0.419	29.043
2014	2.166	8.297	17.037	0.245		0.204	53.055
2015	2.885	1.864	3.464	0.045	0.366	0.017	19.356
2016	4.462	0.053	10.347	0.003	0.21	0.471	28.541
2017	0.685	2.481	6.986	0.767	0.437	0.149	27.132
2018	8.407	2.313	9.498	3.762		0.094	48.034
2019	0.476	3.758	9.703	1.22		0.046	48.562
2020	1.956	5.142	9.174	0.04			25.262
2021	1.705	4.611	10.252		0.188	0.035	19.624
2022		5.305	7.953				17.903

Table 6. European eel. Releases for yellow eel from 1900 to 2021 in millions, reported by countries SE Sweden, DE Germany, IE Ireland, ES Spain, IT Italy, combining information from the 2022 data call and the WGEEL database.

Year	SE	DE	IE	ES	IT	sum
1900	0.053					0.053
1901	0.51					0.51
1902	0.034					0.034
1903	0.065					0.065
1904	0.041					0.041
1905	0.652					0.652
1906	0.15					0.15
1907	0.021					0.021
1908	0					0
1909	0.43					0.43
1910	0.49					0.49
1911	0.004					0.004
1912	0.212					0.212
1913	0.03					0.03
1914	0.004					0.004
1915	0.113					0.113
1916	0.062					0.062
1917	0.128					0.128
1918	0.06					0.06
1919	0.166					0.166
1920	0.275					0.275
1921	0.551					0.551
1922	0.258					0.258
1923	0.536					0.536
1924	0.017					0.017
1925	0.052					0.052
1926	0.903					0.903
1927	0.53					0.53

Year	SE	DE	IE	ES	IT	sum
1928	1.037					1.037
1929	0.897					0.897
1930	0.876					0.876
1931	0.198					0.198
1932	0.249					0.249
1933	0.736					0.736
1934	0.505					0.505
1935	0.471					0.471
1936	0.249					0.249
1937	0.736					0.736
1938	0.505					0.505
1939	0.471					0.471
1940	0.99					0.99
1941	0.655					0.655
1942	0.608					0.608
1943	1.758					1.758
1944	1.589					1.589
1945	1.693					1.693
1946	1.266					1.266
1947	0.743					0.743
1948	1.122					1.122
1949	1.213					1.213
1950	1.271					1.271
1951	0.772					0.772
1952	1.317					1.317
1953	3.368					3.368
1954	0.998					0.998
1955	1.731					1.731
1956	1.72					1.72
1957	0.968					0.968

Year	SE	DE	IE	ES	IT	sum
1958	1.402					1.402
1959	1.856					1.856
1960	1.423					1.423
1961	1.186					1.186
1962	0.979					0.979
1963	0.843					0.843
1964	0.542					0.542
1965	0.329					0.329
1966	0.761					0.761
1967	0.279					0.279
1968	1.306					1.306
1969	0.632					0.632
1970	0.608					0.608
1971	0.683					0.683
1972	1.03					1.03
1973	2.064					2.064
1974	0.705					0.705
1975	1.159					1.159
1976	1.851					1.851
1977	2.652					2.652
1978	1.965					1.965
1979	2.003		0.105			2.108
1980	0.976		0.265			1.241
1981	1.677		0.107			1.784
1982	1.762		0.122			1.884
1983	1.519		0.088			1.607
1984	0.811		0.042			0.853
1985	1.599	4.449	0.099			6.147
1986	0.862	3.441	0.156			4.459
1987	1.095	3.213	0.099			4.407

Year	SE	DE	IE	ES	IT	sum
1988	1.436	2.783	0.127			4.346
1989	0.685	1.642	0.058			2.385
1990	1.019	2.098	0.098			3.215
1991	1.251	1.696	0.037			2.984
1992	1.422	2.002	0.047			3.471
1993	1.116	2.565	0.061			3.742
1994	1.078	2.202	0.013			3.293
1995	0.876	2.148	0.08			3.104
1996	1.154	2.259	0.01			3.423
1997	1.183	3.35	0.091			4.624
1998	1.075	2.568	0.026			3.669
1999	0.552	2.786	0.071			3.409
2000	0.486	2.551	0.039			3.076
2001	0.483	2.959	0			3.442
2002	0.47	3.207	0.068			3.745
2003	0.461	3.056	0.088			3.605
2004	0.284	2.733	0.032			3.049
2005	0.174	2.712	0.066			2.952
2006	0.074	2.14	0.047			2.261
2007	0.153	1.963	0.076			2.192
2008	0.174	1.544	0.131	0.016		1.865
2009	0.071	1.544	0.015	0.03		1.66
2010	0.09	1.524	0.016	0.013		1.643
2011	0.107	1.359	0.011	0.039		1.516
2012	0.1	1.386	0.003	0		1.489
2013	0.093	1.333	0.003	0.004		1.433
2014	0.261	1.457	0.038	0.021		1.777
2015	0.068	1.412	0.033		0.085	1.598
2016	0.217	1.596	0.092	0.183	0.122	2.21
2017	0.429	0.076	0.014	0.15	0.2	0.869

Year	SE	DE	IE	ES	IT	sum
2018	0.374	0.055	0.135	0.156		0.72
2019	0.507	0.054	0.038			0.599
2020	0.203		0.092			0.295
2021	0.159		0.004			0.163

*** Data for 2022 incomplete.**
0 = No catch.
Empty cell = No data or Not Collected or Not Pertinent.

Table 7. European eel. Releases for silver eel from 2001 to 2022 in millions, reported by countries SE Sweden, FI Finland, NL Netherlands, IE Ireland, Fr France, ES Spain, GR Greece. Combining information from the 2022 data call and the WGEEL database.

Year	SE	FI	NL	IE	FR	ES	GR	sum
2001				0.006				0.006
2002				0.02				0.02
2003				0.008				0.008
2004				0.015				0.015
2005				0.007				0.007
2006				0.038				0.038
2007				0.018				0.018
2008				0.052				0.052
2009				0.163		0.001		0.164
2010	0.005			0.187				0.192
2011	0.008		0	0.215	0.094			0.317
2012	0.01		0.004	0.243	0.111	0.039		0.407
2013	0.013		0.008	0.238	0.116		0.042	0.417

Year	SE	FI	NL	IE	FR	ES	GR	sum
2014	0.021	0	0.003	0.336	0.164		0.067	0.591
2015	0.018	0	0.005	0.284	0.214		0.079	0.6
2016	0.017	0	0.007	0.206	0.17		0.108	0.508
2017	0.017	0	0.006	0.193	0.213		0.086	0.515
2018	0.016	0	0.01	0.205	0.212		0.035	0.478
2019	0.015	0	0.01	0.182	0.169	0.001	0.004	0.381
2020	0.018	0	0.008	0.211	0.187	0.001	0.01	0.435
2021	0.022	0	0.007	0.161	0.103		0.047	0.34
2001				0.006				0.006

*** Data for 2022 incomplete.**
0 = No catch.
Empty cell = No data or Not Collected or Not Pertinent.

Table 8. European eel. Releases for quarantined glass eel from 2010 to 2022 in millions, reported by FI Finland. Combining information from the 2022 data call and the WGEEL database.

Year	FI
2010	0.15
2011	0.31
2012	0.18
2013	0.2
2014	0.15
2015	0.1
2016	0.08
2017	0.12
2018	0.08
2019	0.13

Year	FI
2020	0.13
2021	0.15
2022	0.11

Table 9. European eel. Releases for on-grown glass eel from 1973 to 2022 in millions, reported by countries: EE Estonia, LV Latvia, LT Lithuania, PL Poland, DE Germany, DK Denmark, ES Spain. Combining information from the 2022 data call and the WGEEL database.

Year	EE	LV	LT	PL	DE	DK	NL	GB	ES	sum
1973				0.06			0.5			0.56
1974				0.01			0.5			0.51
1977				0.01			0.5			0.51
1980				0			0.5			0.50
1982				0.14			0.6			0.74
1983				1.13			0.8			1.93
1984				0.2			0.8			1.00
1985				0.14	1.33		1			2.47
1986				0.05	1.12		0.7			1.87
1987				0	1.03		0.7			1.73
1988	0.18			0.01	1.42		0.7			2.31
1989				0.25	1.02		0.7			1.97
1990				0.44	1.04		0.8			2.28
1991				0.03	1.12		0.7			1.85
1992				0.06	1.37		0.4			1.83
1993				0	1.74		0.3			2.04
1994				0.14	1.82		0.1			2.06
1995	0.15			0.04	2.23		0			2.42
1996				1.02	2.46		0			3.48
1997				2.21	2.79		0			5.00
1998				0.85	2.9		0.2			3.95
1999				1.02	3.66		0			4.68
2000				1.43	5.26		0		0.04	6.73
2001	0.44			0.75	4.19		0.2		0.05	5.63
2002	0.36			0.75	4.88		0.4		0.02	6.41
2003	0.54			0.56	5.15		0.6		0.03	6.88
2004	0.44			0.81	5.38		1.2		0.06	7.89
2005	0.37			0.74	4.14		1		0.11	6.36

Year	EE	LV	LT	PL	DE	DK	NL	GB	ES	sum
2006	0.38			0.92	7.25		0.1		0	8.65
2007	0.33			1.39	7.39		0.1		0.02	9.23
2008	0.19			1.52	7.45		0.1			9.26
2009	0.42			1.4	7.36		0.1			9.28
2010	0.21			1.29	7.66		0.06			9.22
2011	0.2		0.15	2.67	6.06		0.41			9.49
2012	0.12		0.49	1.75	4.98		0.39			7.73
2013	0.13		1.3	3.48	5.65		0.51			11.07
2014	0.19		0.38	2.29	7.01		0.9			10.77
2015			0.45	3.63	7.29		0.74			12.11
2016	0.22		0.27	1.51	5.49	1.53	0.49			9.51
2017	0.31		0	3.58	9.47	1.52	0.57			15.45
2018		0	1.65	2.44	9.65				0.01	13.75
2019			1.59	0.98	9.68	1.81			0.22	14.28
2020			1.37	0.95		1.34			0.03	3.69
2021	0.08	0.03	0	1.82		1.23			0.04	3.20
2022						1.79	0.36	0.26		2.41

*** Data for 2022 incomplete.**
0 = No catch.
Empty cell = No data or Not Collected or Not Pertinent.

Table 10a: Aquaculture for all stages in tonnes from 1984 to 2020 reported by countries: SE Sweden, FI Finland, EE Estonia, LT Lithuania, PL Poland, DE Germany, DK Denmark. (to be continued for other countries in next table)

Year	SE	FI	EE	LT	PL	DE	DK
1984							18
1985							40
1986							200
1987							240
1988							195
1989							430
1990							586
1991							866
1992							748
1993							782
1994							1034
1995							1324
1996							1568
1997							1913
1998				2			2483
1999				2			2718
2000				1			2674
2001				5			2000
2002			20	17			1880
2003			40	20			2050
2004	158		50	9		328	1500
2005	222		80	8		329	1700
2006	191		100	12		567	1900

Year	SE	FI	EE	LT	PL	DE	DK
2007	175		100	13		774	1617
2008	124.4		90	10.6		749.4	1740
2009	142.6		60	12		667	1707
2010	92.8		40	8.3		681	1537
2011	91.4		50	12.6		692	1156
2012	93.4		70	3.5		744	1093
2013	91.7	0		3.45		758	824
2014	64.4	0.5	55.65	7.15		926	842
2015	104.3	0.5	52.45	0.2	0.6	1176	1234
2016	117.1	0	60.91	36.4	0.98	1099	1033
2017	75	0	50		2.81	1111	549.61
2018	64.6				3.09	1132	893.94
2019	81					1286	490.26
2020	73.9					1125.4	659
2021	89.2						1179.14

Table 10b: Aquaculture for all stages in tonnes from 1984 to 2020 reported by countries: NL Netherlands, IE Ireland, ES Spain, PT Portugal, IT Italy, GR Greece.

Year	NL	ES	PT	IT	GR	MA	sum
1984							18
1985							40
1986							200
1987	100						340
1988	300						495
1989	200						630
1990	600						1186
1991	900						1766
1992	1100						1848
1993	1300						2082
1994	1450						2484
1995	1540						2864
1996	2800						4368
1997	2450						4363
1998	3250	347.1					6082.1
1999	3500	383.09					6603.09
2000	3800	411.08					6886.08
2001	4000	339.07					6344.07
2002	4000	295.06					6212.06
2003	4200	292.05					6602.05
2004	4500	377.04		1220	429		8571.04
2005	4500	321.03		1131	261		8552.03
2006	4200	275.02		807	290		8342.02
2007	4000	369.01		1000	365		8413.01

Year	NL	ES	PT	IT	GR	MA	sum
2008	3700	460		550.74	396		7821.14
2009	3200	493		677.4	428		7387
2010	2000	392		647.19	320		5718.57
2011	2300	468		509.3	377.05		5656.91
2012	2600	373		736.98	281		5995.77
2013	2900	393	1.38	642.14	432	340	6385.29
2014	2300	406	0.92	571.9	220	350	5744.52
2015	2000	454		750	270.86	280	6323.8
2016	2000	330	1.06	710.1	289.46	282	5960.95
2017	2005	292.26	32.96	528.6	184.26	274	5105.54
2018	2155	346.17		509.35	128	257.41	5490.02
2019	2200	318.91		464.04	146.42	289.17	5276.57
2020	2065	338.05	0.12	406.55	184.41	183.03	5035.06
2021	1950	339.7			297.11		3855.15

Annex 14: GEREM working chapter

1. Introduction

GEREM is a Bayesian model aiming at estimating glass eel recruitment at different nested spatial scales (overall recruitment, sub-regions/zone, river basins) through the analysis of available recruitment time series (Drouineau et al., 2016). The model has already been applied in France (Drouineau et al., 2016), to a large part of Europe (Bornarel et al., 2018) and a specific application was carried out in the context of the Sudoang Interreg project (Drouineau et al., 2021). It had been used by WGEEL a few years ago (ICES, 2020) but had not been updated since then. It was decided to renew the exercice since GEREM is a candidate to feed the spatial assessment model promoted in the WKFEA roadmap (ICES, 2021) and is a good example of the hierarchy of spatial scales on which would be based such as spatial model would be based. The model assumes that each year, the overall recruitment R(y) is distributed among various zones (i.e. subregions) which receive recruitment R_z (y). Then, zone recruitment is distributed among river catchments as a function of their surface, leading to recruitment R_(c,z) (y). Basically, GEREM is a mixing of a Dynamic Factor Analysis (DFA) (Zuur et al., 2003) and a “rule of three”. Similarly to a DFA model, GEREM is a state-space model based on a random walk structure, which estimates common trends in a set of time series. The rule of three is used to extrapolate absolute recruitment estimates in a river basin to recruitment in other basins in the same zone, stating that the recruitment in each basin is a simple function of its surface. After having inventoried available time series and listed their characteristics, it is necessary to define zones. In each zone:

- river catchments should have similar trends in recruitment
- the rule of three must apply, i.e. it should be possible to extrapolate recruitment in a basin to another basin of the same zone as a simple function of their relative surfaces
- time series of recruitment should be available. Morevover, there should be at least one time series of absolute recruitment. If not available, it is possible to use time series such as trapping or commercial catch from which absolute recruitment can be inferred by introducing additional information on the scaling factors (trap efficiency and exploitation rate).

The model is detailed in (Drouineau et al., 2016) and (Bornarel et al., 2018). The current exercise is mainly an update from (Bornarel et al., 2018). We will use the same zones and the nearly the same time series but with updated values.

2. Material and Methods

2.1 Zone definition

We used the same zones as Bornarel et al. (2018) 1:

- a North Sea zone (NS)
- a Channel zone which covers Southwestern Great Britanny and NorthWestern France
- ATL_F which covers the French coast along the Bay of Biscay
- ATL_IB which extends from the Cantabrian Sea to the Gibraltar Strait
- Med which extends from the Gibraltar Strait to Sicilia
- A zone that covers Ireland and the Northwestern part of Great Britain (INWGB)

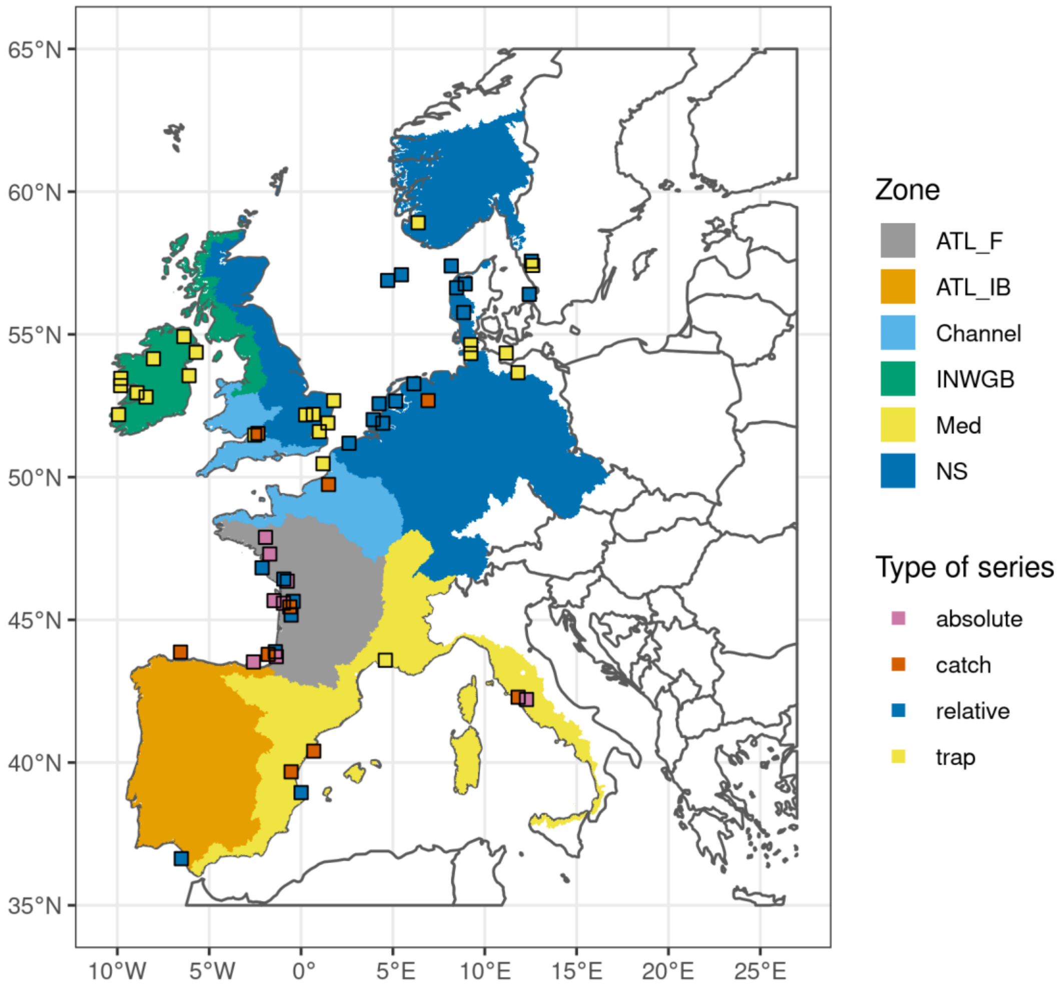

Figure 1: Zone definition and available data

2.2 Available Data

Table 1 summarises the data used to fit the model. Basically, we used the exact same dataset as for the WGEEL glass eel GLM analysis and added some absolutes estimates of recruitment following ICES (2020). While time series are available in all zones, most absolute estimates come from ATL_F. In other zones, trap monitoring and commercial catches can inform onbe used to derive absolute estimates given but this requires making assumptions about on trapping efficiency or on exploitation rates. We also note that the number of time series is limited in the Channel area. Conversely, there are many time series in ATL_F, but most of them ended after the implementation of the French Eel Management Plan (Minist´ere de l'Ecologie, de l'Energie, du Developpement durable et de l'Am'enagement du Territoire et al., 2010) and presently, there is only one still updated time series. We also note that the Mediterranean zone is large with only four available time series.

Table 1: Available time series of recruitment

Series	Type	Zone	Surface (km²)	First Year	Last Year	Nb data
AdCPG	relative	ATL_F	16,860.9	1,966	2,008	37
AdGERMA	absolute	ATL_F	16,860.9	1,999	2,005	7
AdTCG	catch	ATL_F	16,860.9	1,986	2,008	23
ChGEMAC	absolute	ATL_F	9,526.1	2,007	2,008	2
GiCPG	relative	ATL_F	79,605.1	1,961	2,008	47
GiGEMAC	absolute	ATL_F	79,605.1	1,999	1,999	1
GiScG	relative	ATL_F	79,605.1	1,994	2,022	29
GiTCG	catch	ATL_F	79,605.1	1,961	2,008	47
LoGERMA	absolute	ATL_F	116,981.0	2,004	2,006	3
LoiG	relative	ATL_F	116,981.0	1,960	2,008	49
SeGEMAC	absolute	ATL_F	754.6	2,007	2,010	4
SevNG	relative	ATL_F	3,398.4	1,962	2,008	22
VilG	absolute	ATL_F	10,490.4	1,971	2,015	42
GuadG	relative	ATL_IB	57,052.5	1,998	2,007	10
NaloG	catch	ATL_IB	4,886.5	1,960	2,022	63
Oria	absolute	ATL_IB	4,886.5	2,006	2,018	7
BeeGY	trap	Channel	993.9	2,011	2,022	12
BresGY	trap	Channel	743.0	1,994	2,022	29
GreyGY	trap	Channel	1,574.0	2,009	2,022	14
SeEAG	catch	Channel	11,381.5	1,972	2,022	49
Somme	catch	Channel	6,223.4	1,991	2,012	18
BannGY	trap	INWGB	5,810.9	1,960	2,022	63
BurrGY	trap	INWGB	108.1	1,987	2,022	18
ErneGY	trap	INWGB	4,338.7	1,960	2,022	61
FealGY	trap	INWGB	1,166.2	1,985	2,017	19
InagGY	trap	INWGB	252.6	1,996	2,017	17
LiffGY	trap	INWGB	1,208.1	2,012	2,022	11
MaigG	trap	INWGB	1,080.5	1,994	2,017	19
ShaAGY	trap	INWGB	11,618.6	1,977	2,022	46
StraGY	trap	INWGB	2.5	2,012	2,022	11
AlbuG	catch	Med	886.3	1,960	2,022	59
AlCPG	relative	Med	886.3	1,982	2,022	35

Series	Type	Zone	Surface (km²)	First Year	Last Year	Nb data
EbroG	catch	Med	85,611.8	1,966	2,022	54
TibeG	catch	Med	17,861.0	1,975	2,006	32
Tiber	absolute	Med	17,861.0	1,991	2,005	7
VacG	trap	Med	456.0	2,004	2,022	19
BeeG	trap	NS	993.9	2,006	2,022	17
BroG	trap	NS	8,442.7	2,011	2,022	12
BrokGY	trap	NS	3,404.6	2,012	2,022	11
EmsG	catch	NS	12,185.1	1,960	2,001	42
FlaG	trap	NS	877.9	2,007	2,022	15
HellGY	relative	NS	7.9	2,011	2,021	10
ImsaGY	trap	NS	127.0	1,975	2,021	47
KatwG	relative	NS	160,221.4	1,977	2,022	41
KlitG	relative	NS	85.2	2,008	2,022	15
LauwG	relative	NS	160,221.4	1,976	2,022	41
NmiGY	trap	NS	3,017.2	2,009	2,022	14
NorsG	relative	NS	85.2	2,008	2,022	15
RhDOG	relative	NS	160,221.4	1,960	2,022	63
RhIjG	relative	NS	160,221.4	1,969	2,022	45
RingG	relative	NS	36.7	1,981	2,022	42
SleG	relative	NS	25.8	2,008	2,022	15
StelG	relative	NS	160,221.4	1,988	2,022	35
VerlGY	trap	NS	1,386.7	2,010	2,022	13
VidaG	relative	NS	1,386.7	1,971	1,990	20
ViskGY	trap	NS	2,373.0	1,972	2,021	50
WiFG	trap	NS	148.8	2,006	2,021	16
WisWGY	trap	NS	148.8	2,004	2,021	18
YFS1G	relative	NS	21,330,000,000,000,000.0	1,975	1,989	15
YFS2G	relative	NS	21,330,000,000,000,000.0	1,992	2,022	30
YserG	relative	NS	1,485.8	1,964	2,022	57

Available time series are assumed to be proportional to real abundance in the river basin with a scaling factor constant through time (otherwise the time series would not be a recruitment abundance index). For absolute estimates, this scaling factor is set to 1 by definition (e.g. absolute estimates provide direct estimates of real abundance in average). For traps, we use vague priors on trap efficiency to give an insight on the possible recruitment (Figure 2), we used a vague prior between 0 and 0.35. Indeed, fishway passabilities are often estimated around 1/3 (Jessop, 2000; Briand et al., 2005; Noonan et al., 2012; Drouineau et al., 2015), therefore our prior assumes that the observed abundance, corrected for the passability (e.g. multiplied by 3) is a minimum bound for the overall recruitment. For commercial time series, the scaling factor corresponds to the exploitation rate and we used a uniform prior between 0 and 1 (e.g. commercial catch is a minimum value for recruitment), except for the Somme River, in which, based on expert knowledge and following Bornarel et al. (2018), we assumed a large exploitation rate.

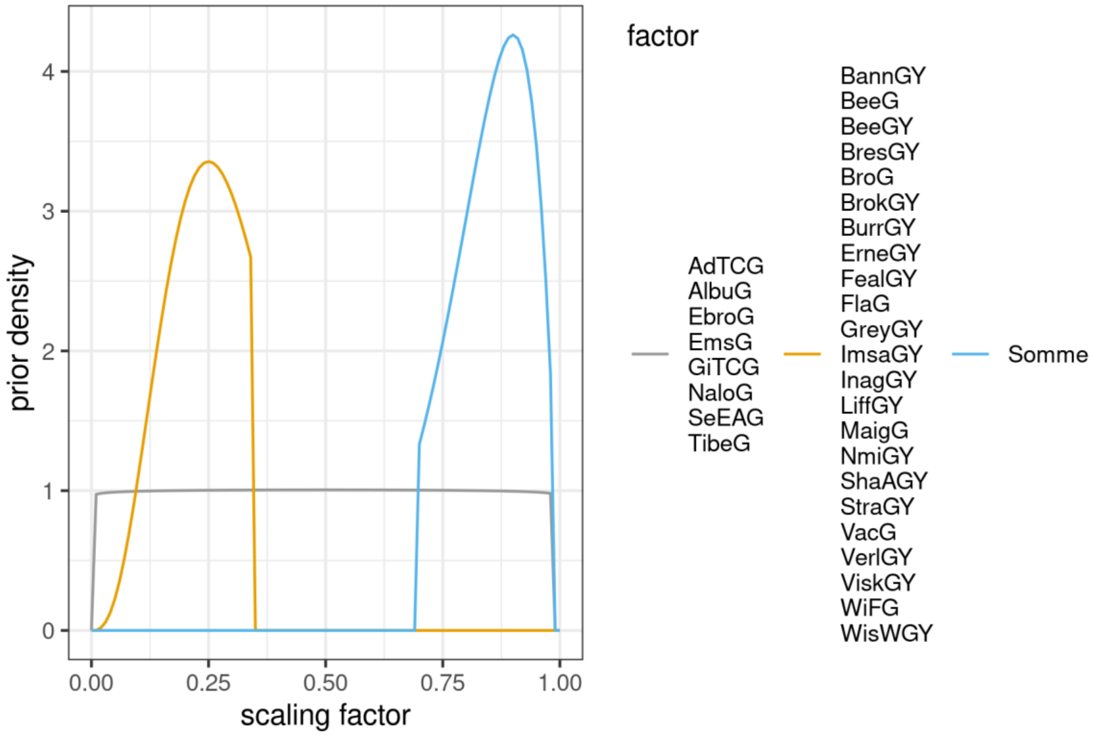

Figure 2: Priors for exploitation rates and trap efficiency. Exploitation rate and trap efficiency make make the link between observed data and models predictions of absolute recruitments

2.3 Running the model

Three independent MCMC chains are run in parallel using JAGS (Plummer, 2003) through R package runjags (Denwood, 2016). Chains were run 50000 iterations, with a thinning of 50 iterations, after an initial burnin period of 100000 iterations. Gelman and Rubin diagnostics were used to check model convergence (Gelman and Rubin, 1992).

3. Results

Gelman R hat statistics was below 1.05 for 76.5% of the parameters, demonstrating a good convergence of the model though not perfect for all parameters 3. In the future, it might be necessary to run the model for a longer number of iterations to achieve a perfect convergence.

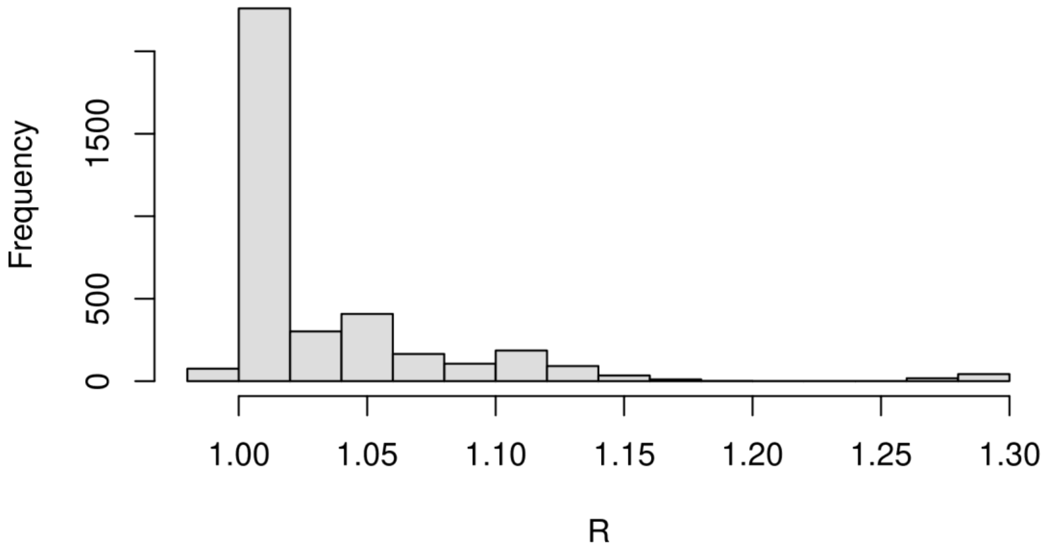

Figure 3: Distribution of Gelman R statistics

3.1 Overall recruitment and zone recruitment

Unsurprisingly, overall recruitment (Figure 4) shows a steep decline since the early 1980s, despite some oscillations. More recently, we observe a period of increase in the early 2010s but it seems to stabilise or slightly decrease after this. Credibility intervals are rather large at the end of the period partly because many time series (especially French fishery based time series) ended after the implementation of the Eel Regulation. The 2022 recruitment is estimated to be 4.01% (credibility interval [2.53%-6.16%]). In the last year, the recruitment shows a smaller increase than in the GLM analysis for Elsewhere Euope area.

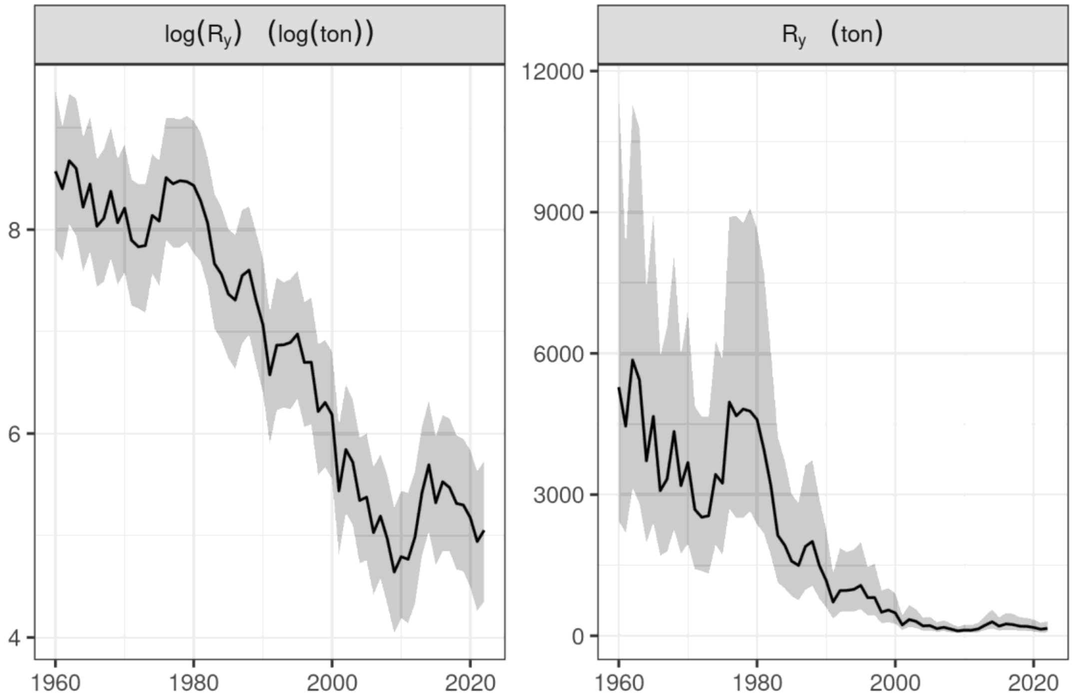

Figure 4: Overall trend in recruitment: median of the posterior distribution (solid line) and corresponding 95% credibility interval (shaded area)

At the zone level (Figure 5), all zones display a decrease of recruitment since 1960. As already observed by WGEEL, which provides separated estimates for the North Sea and Elswhere Europe series, the decline in North Sea started earlier than ATL_F and ATL_IB. In 2022, the recruitment seems to have increased mostly in the Mediterranean and in the INWGB regions. Since these two zones do not represent the largest part of the recruitment, those increases did not have a major effect on the overall effectestimate. On the other hand, since time series from INWGB are overrepresented, it has had a huge effect on the GLM analysis.

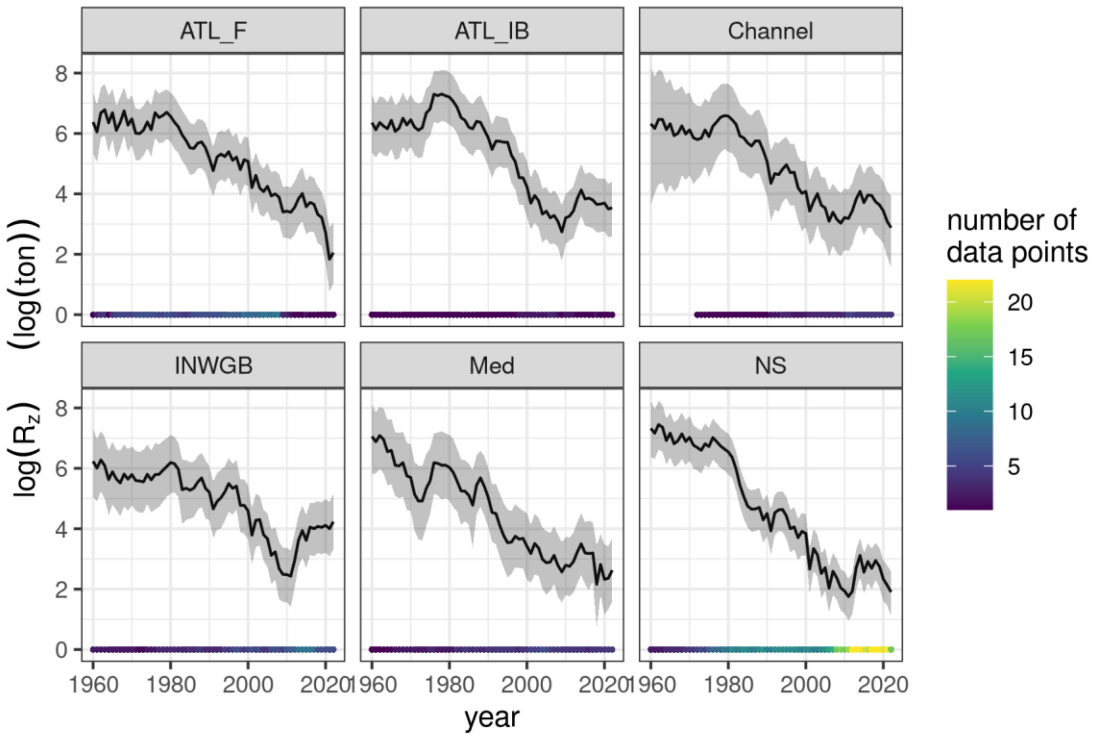

Figure 5: Trend in recruitment in each zone of the model: median of the posterior distribution (solid line) and corresponding 95% credibility interval (shaded area). The colour of the points on the x-axis indicates the number of available data series for the corresponding zone and year

It is also possible to analyse the proportions of recruitment arriving in each zone of the model (Figure 6). However, these results should be taken with great care: credibility intervals are large and some zones estimates are based on few absolute (or trap/commercial catch) time series.

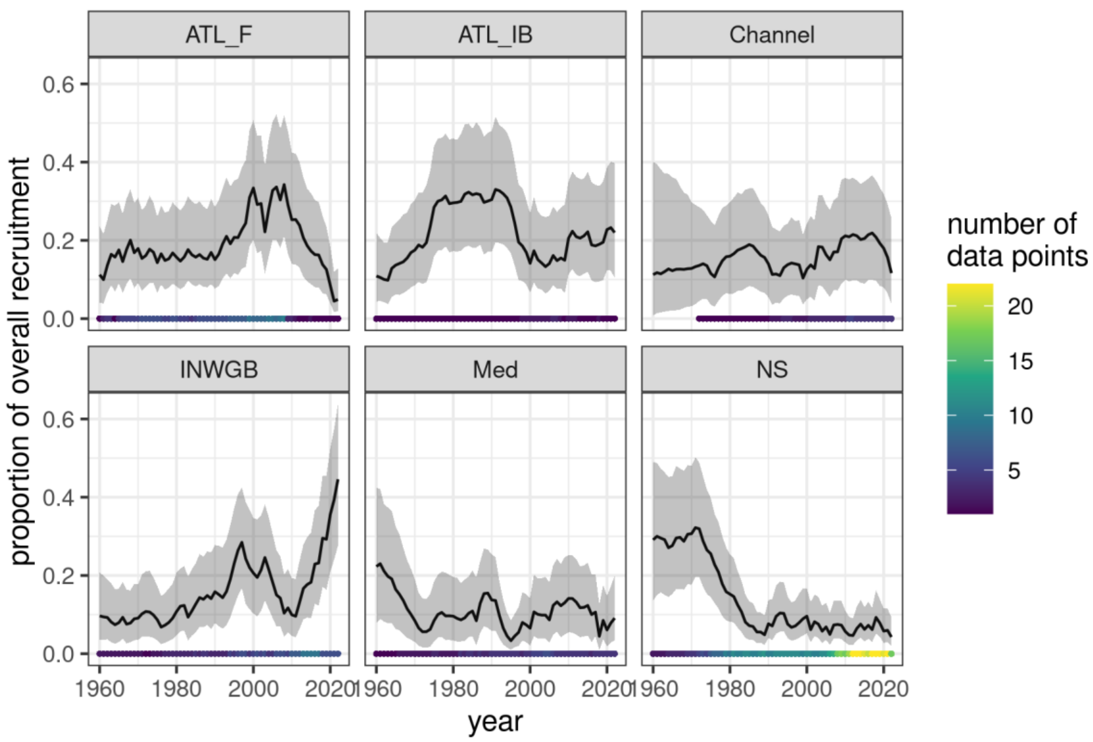

Figure 6: Proportions of overall recruitment arriving in each zone: median of the posterior distribution (solid line) and corresponding 95% credibility interval (shaded area)

4. Discussion

The use of GEREM does not change the overall image of the recruitment as provided by the GLM analysis. It confirms the decline of recruitment since the 1980s and the currently very low level of recruitment. However, it raises additional questions regarding some potential differences in trends among zones, such as the recent decline in the recruitment received in ATL_F. While definitive conclusions cannot be drawn, this result shows the importance of establishing new monitoring time series in areas where data are missing. As such, the monitoring network implemented in Sudoang appears to be an interesting opportunity. Regarding absolute recruitment, as already mentioned, results should be taken with great care since the number of time series is limited, the estimates are sensitive to some parameters and biases are observed in the model fits.

More importantly, the use of GEREM illustrates the potential benefit of a spatial assessment model for the European eel stock: combining data series from different regions without accounting for their relative importance in terms of biomass can bias the assessment, especially in the current situation in which data are not evenly distributed all other the distribution area.

5. Conclusion

The idea of presenting this modelling exercise was not to replace the GLM exercise nor to conduct a benchmark exercise of models but to provide an additional tool that provides complementary information. The two modelling approaches have two different levels of complexity and provide similar general picture of the trend of recruitment. While GEREM does not provide any definitive conclusions, it raises interesting complementary questions and highlights the need for new data in some regions and of new types. More importantly, it shows that combining time-series without weighting them according to the local level of abundance can potentially bias the results.

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Annex 15: Additional Information on Yellow and Silver eel Time Series

Abundance series

Table 1. Short description of the series of European eel yellow standing stock, where Habitat: C = coastal water, F = freshwater, MO = marine water (open sea), T = transitional water with lower salinity (according to WFD); gear: 202 = beach seines, 226 = fyke nets, 230 = traps, 234 = longlines; 242 = electric fishing; sampling type: 1 = commercial catch, 3 = scientific estimate, 4 = trapping all, 5 = trapping partial; quality id: 0 = missing data, 1 = good quality data, 3 = bad quality data, 4 = data used but with warnings; Unit for the data collected: kg = kilograms, nr = number; index = calculated value following a specified protocol, nr/m2 = number per square metre, nr/haul= number per haul, nr/net/d = number per net per day); Dist_sea is distance to sea (m); Restocking: FALSE = no restocking impacts, TRUE = there are potential restocking impacts; First year and Last year indicate the first year and last year in the time-series; n+ and n- columns indicate the number of years with values (n+) and the number of years when there are missing data (n-) within the series.

Series	EMU	Country	Habitat	Samp_typ	Unit	Dist_sea	Restocking	First year	Last year	n+	n-
DoFpY	DE_Elbe	DE	F	5	nr	224	TRUE	2003	2021	18	1
VVeY	DK_Inla	DK	F	3	nr/m^2	NA	FALSE	2009	2021	13	0
NalY	ES_Astu	ES	F	3	nr/m^2	NA	FALSE	2011	2020	10	1
OriY	ES_Basq	ES	F	3	nr/m^2	NA	FALSE	2004	2020	17	1
BidY	ES_Nava	ES	F	3	nr/m^2	28.777	FALSE	2010	2020	11	1
AlCY	ES_Vale	ES	T	1	kg	0	FALSE	1951	2021	66	5
KuloY	FI_Finl	FI	F	5	nr	120	TRUE	2017	2019	3	2
VesiY	FI_Finl	FI	F	5	nr	170	TRUE	2017	2021	5	0
AdoY	FR_Adou	FR	F	3	index	78.8	FALSE	2010	2021	12	0
SouY	FR_Adou	FR	F	3	index	10.5	FALSE	2010	2021	12	0
AaY	FR_Arto	FR	F	3	index	33	FALSE	2010	2021	9	3
AutY	FR_Arto	FR	F	3	index	51.9	FALSE	2010	2021	9	3

Series	EMU	Country	Habitat	Samp_typ	Unit	Dist_sea	Restocking	First year	Last year	n+	n-
EscY	FR_Arto	FR	F	3	index	204.4	FALSE	2011	2021	8	3
SomY	FR_Arto	FR	F	3	index	66.3	FALSE	2010	2021	12	0
FremY	FR_Bret	FR	F	3	nr/m^2	13.8	FALSE	1995	2021	27	0
VilY	FR_Bret	FR	F	3	nr/m^2	12	FALSE	1998	2021	19	5
GarY	FR_Garo	FR	F	3	nr/m^2	167.4	FALSE	2010	2018	9	3
SeNY	FR_Loir	FR	F	3	index	68.2	FALSE	2002	2021	20	0
BreY	FR_Sein	FR	F	3	index	29.3	FALSE	2012	2021	10	0
DivY	FR_Sein	FR	F	3	index	46.4	FALSE	2012	2021	8	2
DouY	FR_Sein	FR	F	3	index	43.6	FALSE	2011	2021	8	3
OrnY	FR_Sein	FR	F	3	index	61.8	TRUE	2010	2021	12	0
SciY	FR_Sein	FR	F	3	index	15.7	FALSE	2010	2021	11	1
SeiY	FR_Sein	FR	F	3	index	157.8	TRUE	2010	2021	12	0
TouY	FR_Sein	FR	F	3	index	37.2	FALSE	2011	2021	8	3
VirY	FR_Sein	FR	F	3	index	65.2	FALSE	2010	2021	12	0
YerY	FR_Sein	FR	F	3	index	14.4	FALSE	2010	2021	11	1
ChBY	GB_Angl	GB	F	3	nr/m^2	27.84	FALSE	1983	2021	34	5
GrOY	GB_Angl	GB	F	3	nr/m^2	110.588	FALSE	1986	2021	35	1
NenY	GB_Angl	GB	F	3	nr/m^2	119.795	FALSE	1979	2018	27	16
SuSY	GB_Angl	GB	F	3	nr/m^2	36.043	FALSE	1980	2021	33	9
WelY	GB_Angl	GB	F	3	nr/m^2	72.377	FALSE	1982	2019	31	9

Series	EMU	Country	Habitat	Samp_typ	Unit	Dist_sea	Restocking	First year	Last year	n+	n-
WenY	GB_Angl	GB	F	3	nr/m^2	91.213	FALSE	1986	2021	29	7
WitY	GB_Angl	GB	F	3	nr/m^2	50.015	FALSE	1985	2019	33	4
DeeY	GB_Dee	GB	F	3	nr/m^2	53.47	FALSE	2002	2019	12	8
HumY	GB_Humb	GB	F	3	nr/m^2	159.718	FALSE	1981	2021	40	1
KilY	GB_NorE	GB	F	3	nr	3	FALSE	2017	2017	1	4
LagY	GB_NorE	GB	F	3	nr	20	FALSE	2011	2021	3	8
CoqY	GB_Nort	GB	F	3	nr/m^2	54.494	FALSE	1993	2021	23	6
WerY	GB_Nort	GB	F	3	nr/m^2	77.051	FALSE	1995	2019	21	6
BelY	GB_NorW	GB	F	3	nr/m^2	16.537	FALSE	1992	2021	10	20
DerY	GB_NorW	GB	F	3	nr/m^2	43.491	FALSE	1991	2021	22	9
EllY	GB_NorW	GB	F	3	nr/m^2	16.904	FALSE	2005	2021	9	7
MerY	GB_NorW	GB	F	3	nr/m^2	73.181	FALSE	1994	2021	22	6
RibY	GB_NorW	GB	F	3	nr/m^2	66.842	FALSE	1984	2021	35	3
WevY	GB_NorW	GB	F	3	nr/m^2	49.235	FALSE	1994	2018	19	9
BadY	GB_Scot	GB	F	3	nr/m^2	122.7	FALSE	2009	2021	13	0
GirY	GB_Scot	GB	F	3	nr/m^2	3.2	FALSE	2009	2021	13	0
ShiY	GB_Scot	GB	F	3	nr/m^2	89.1	FALSE	2010	2021	12	0
SevY	GB_Seve	GB	F	3	nr/m^2	132.044	FALSE	1976	2021	45	1
UskY	GB_Seve	GB	F	3	nr/m^2	73.29	FALSE	2010	2019	10	2
WyeY	GB_Seve	GB	F	3	nr/m^2	122.431	FALSE	1985	2021	33	4

Series	EMU	Country	Habitat	Samp_typ	Unit	Dist_sea	Restocking	First year	Last year	n+	n-
BoEY	GB_Solw	GB	F	3	nr/m^2	30.801	FALSE	1985	2021	22	15
EdeY	GB_Solw	GB	F	3	nr/m^2	73.325	FALSE	1975	2021	24	23
TweY	GB_Solw	GB	F	3	nr/m^2	58.958	FALSE	2009	2019	4	9
ItcY	GB_SouE	GB	F	3	nr/m^2	28.012	FALSE	2001	2021	19	2
OusY	GB_SouE	GB	F	3	nr/m^2	32.147	FALSE	1998	2021	21	3
TesY	GB_SouE	GB	F	3	nr/m^2	31.123	FALSE	2001	2021	21	0
DoSY	GB_SouW	GB	F	3	nr/m^2	60.169	FALSE	2001	2019	19	2
ExeY	GB_SouW	GB	F	3	nr/m^2	56.933	FALSE	1995	2021	25	2
FowY	GB_SouW	GB	F	3	nr/m^2	27.162	FALSE	1977	2021	34	11
FroY	GB_SouW	GB	F	3	nr/m^2	46.171	FALSE	2003	2021	17	2
HaAY	GB_SouW	GB	F	3	nr/m^2	56.849	FALSE	2002	2021	19	1
OttY	GB_SouW	GB	F	3	nr/m^2	23.322	FALSE	1998	2021	16	8
ParY	GB_SouW	GB	F	3	nr/m^2	57.601	FALSE	1990	2021	26	6
PlyY	GB_SouW	GB	F	3	nr/m^2	17.069	FALSE	1982	2021	25	15
TamY	GB_SouW	GB	F	3	nr/m^2	70.157	FALSE	1984	2021	30	8
TawY	GB_SouW	GB	F	3	nr/m^2	50.696	FALSE	1996	2021	21	5
TegY	GB_SouW	GB	F	3	nr/m^2	34. 696	FALSE	1996	2021	20	5
LeeY	GB_Tham	GB	F	3	nr/m^2	48.87	FALSE	1987	2021	23	12
MedY	GB_Tham	GB	F	3	nr/m^2	55.479	FALSE	1993	2021	26	3
ThaY	GB_Tham	GB	F	3	nr/m^2	149.083	FALSE	1985	2021	37	0

Series	EMU	Country	Habitat	Samp_typ	Unit	Dist_sea	Restocking	First year	Last year	n+	n-
TefY	GB_Wale	GB	F	3	nr/m^2	54.2	FALSE	2010	2019	10	2
TyTY	GB_Wale	GB	F	3	nr/m^2	53.41	FALSE	2010	2029	10	2
WniY	GB_Wale	GB	F	3	nr/m^2	7.48	FALSE	2011	2029	9	3
VistY	GR_EaMT	GR	F	5	kg	NA	NA	2012	2022	10	0
LoEY	IE_NorW	IE	F	3	index	25	FALSE	2011	2022	6	5
BFeY	IE_West	IE	F	3	nr/net/day	2.5	FALSE	1973	2021	20	29
BFuY	IE_West	IE	T	3	nr/net/day	0	FALSE	1987	2021	18	17
BLFY	IE_West	IE	T	3	nr/net/day	0	FALSE	1987	2021	13	22
BuBY	IE_West	IE	F	3	nr/net/day	2.5	FALSE	1987	2021	17	18
BalY	LT_total	LT	F	NA	nr	440	TRUE	2020	2021	2	0
ClY	LT_total	LT	T	NA	nr	0	TRUE	2019	2021	3	0
KerY	LT_total	LT	F	NA	nr	560	TRUE	2020	2021	2	0
KreY	LT_total	LT	F	NA	nr	570	TRUE	2019	2021	3	0
KrLY	LT_total	LT	F	NA	nr	60	TRUE	2020	2021	2	0
RubY	LT_total	LT	F	NA	nr	268	TRUE	2020	2020	1	1
UkoY	LT_total	LT	F	NA	nr	305	TRUE	2019	2020	2	1
DaugY	LV_total	LV	F	5	kg	2.5	TRUE	2015	2021	7	0
LilY	LV_total	LV	F	4	kg	1.5	TRUE	2017	2021	5	0
DeBY	NL_Neth	NL	MO	3	index	0	FALSE	1960	2021	61	1
IJsFRY	NL_Neth	NL	F	3	index	30	TRUE	2007	2021	15	0

Series	EMU	Country	Habitat	Samp_typ	Unit	Dist_sea	Restocking	First year	Last year	n+	n-
IJsFVY	NL_Neth	NL	F	3	index	30	TRUE	2007	2021	15	0
IjsY	NL_Neth	NL	F	3	nr/m^2	30	FALSE	1989	2020	32	1
MarY	NL_Neth	NL	F	3	nr/m^2	60	TRUE	1989	2020	32	1
MmFRY	NL_Neth	NL	F	3	index	60	TRUE	2007	2021	15	0
MmFVY	NL_Neth	NL	F	3	index	60	FALSE	2007	2021	15	0
SkaY	NO_total	NO	C	3	nr/haul	0	FALSE	1925	2021	92	5
VisY	PL_Vist	PL	T	NA	nr	0	TRUE	2017	2021	5	0
MinY	ES_Minh	PT	F	3	nr/m^2	40	FALSE	2018	2021	4	0
MonY	PT_Port	PT	F	3	nr/m^2	35	FALSE	2017	2021	5	0
BarY	SE_East	SE	MO	4	nr	0	FALSE	1977	2020	42	3
FjaY	SE_West	SE	MO	4	nr	0	FALSE	1998	2021	23	1
HakY	SE_West	SE	MO	4	nr	0	FALSE	2002	2021	20	0
KulY	SE_West	SE	MO	4	nr	0	FALSE	2002	2012	11	9
LysY	SE_West	SE	MO	4	nr	0	FALSE	2002	2005	4	16
VenY	SE_West	SE	MO	4	nr	0	FALSE	1976	2020	43	3
DriY	LT_total	LT	F	3	nr	600	TRUE	2021	2021	1	0
VieY	LT_total	LT	F	3	nr	390	TRUE	2021	2021	1	0

Table 2. Short description of the series of European eel silver data, where Habitat: C = coastal water, F = freshwater, MO = marine water (open sea), T = transitional water with lower salinity (according to WFD); Gear: 226 = fyke nets, 227 =stow nets, 228 = barriers, fences, weirs, etc., 230 = traps, 234 = longlines, 242 = electric fishing, 245 = gear unknown; Samp_typ is sampling type: 1 = commercial catch, 2 = commercial CPUE, 3 = scientific estimate, 4 = trapping all, 5 = trapping partial; Unit for the data collected: kg = kilograms, nr = number; index = calculated value following a specified protocol, nr/m2 = number per square metre, nr/haul= number per haul, nr/net/d = number per net per day); Dist_sea is distance to sea (m); Restocking: FALSE no restocking impacts, TRUE there are potential restocking impacts; First year and Last year indicate the first year and last year in the time-series; n+ and n- columns indicate the number of years with values (n+) and the number of years when there are missing data (n-) within the series.

Series	EMU	Country	Habitat	Samp_typ	Unit	Dist_sea	Restocking	First year	Last year	n+	n-
WarS	DE_Warn	DE	F	3	nr	17	TRUE	2009	2021	13	0
RibS	DK_Inla	DK	F	2	kg/ha	0.5	NA	2001	2020	20	1
NalS	ES_Astu	ES	F	NA	nr/m^2	NA	FALSE	2011	2021	11	0
OriS	ES_Basq	ES	F	NA	nr/m^2	NA	FALSE	2007	2021	15	0
BidS	ES_Nava	ES	F	3	nr/m^2	28.777	FALSE	2010	2021	12	0
AlcS	ES_Vale	ES	T	1	kg	0	FALSE	1951	2022	67	5
KotkS	FI_Finl	FI	C	1	nr	0	TRUE	2017	2021	5	0
VaakS	FI_Finl	FI	F	4	nr	170	TRUE	2014	2021	8	0
SouS	FR_Adou	FR	F	5	nr	6.78	FALSE	2011	2021	9	2
FreS	FR_Bret	FR	F	4	nr	5.35	FALSE	1996	2021	26	0
VilS	FR_Bret	FR	F	5	nr	10	TRUE	2012	2020	9	1
LoiS	FR_Loir	FR	F	5	index	114.74	TRUE	1987	2019	33	2
SenS	FR_Loir	FR	F	5	nr	85.4	FALSE	2013	2021	9	0
BreS	FR_Sein	FR	F	5	nr	15.65	FALSE	1981	2021	38	3
StrS	GB_Nore	GB	F	4	nr	3	FALSE	2016	2021	5	1
LevS	GB_Norw	GB	F	3	nr	1.8	FALSE	2000	2021	21	0
BabS	GB_Scot	GB	F	5	nr	120.1	FALSE	2006	2021	16	0

Series	EMU	Country	Habitat	Samp_typ	Unit	Dist_sea	Restocking	First year	Last year	n+	n-
GibS	GB_Scot	GB	F	5	nr	85.7	FALSE	1966	2021	33	22
ShiS	GB_Scot	GB	F	5	nr	85.7	FALSE	1999	2021	19	4
FowS	GB_Souw	GB	F	3	nr	3	TRUE	2010	2020	10	2
EamtS	GR_Eamt	GR	T	1	kg	NA	NA	2009	2021	11	2
NorwS	GR_Norw	GR	T	1	kg	NA	NA	2012	2021	10	0
WepeS	GR_Wepe	GR	T	1	kg	NA	NA	2012	2021	10	0
KilS	IE_Shan	IE	F	3	kg	20	FALSE	2000	2021	22	0
BurS	IE_West	IE	F	4	nr	0	FALSE	1971	2021	50	1
AlauS	LT_Lith	LT	F	NA	nr	300	TRUE	2019	2021	3	0
KertS	LT_Lith	LT	F	NA	nr	300	TRUE	2019	2021	3	0
LakS	LT_Lith	LT	F	NA	nr	300	TRUE	2019	2020	2	1
RubS	LT_Lith	LT	F	1	nr	300	TRUE	2021	2021	1	0
SiesS	LT_Lith	LT	F	NA	nr	300	TRUE	2019	2020	2	1
ClS	LT_Total	LT	T	NA	nr	0	TRUE	2018	2021	4	0
KreS	LT_Total	LT	F	NA	nr	570	TRUE	2020	2020	1	1
RieS	LT_Total	LT	F	NA	nr	440	TRUE	2020	2020	1	1
ZeiS	LT_Total	LT	F	NA	nr	550	TRUE	2020	2020	1	1
DaugS	LV_Total	LV	F	5	nr	2.5	TRUE	2015	2021	7	0
LilS	LV_Total	LV	F	4	nr	1.5	TRUE	2017	2021	5	0
BrwS	NL_Neth	NL	F	3	index	160	FALSE	2013	2021	7	2

Series	EMU	Country	Habitat	Samp_typ	Unit	Dist_sea	Restocking	First year	Last year	n+	n-
DoijS	NL_Neth	NL	F	3	index	0	FALSE	2013	2021	7	2
HvwS	NL_Neth	NL	F	3	index	7	FALSE	2012	2021	9	1
IjsS	NL_Neth	NL	F	3	index	0	FALSE	2014	2021	7	1
NiwS	NL_Neth	NL	F	3	index	3	FALSE	2012	2021	10	0
NzkS	NL_Neth	NL	F	3	index	5	FALSE	2012	2021	9	1
ZmaS	NL_Neth	NL	F	3	index	160	FALSE	2012	2021	8	2
ImsaS	NO_Total	NO	F	4	nr	0.16	FALSE	1975	2020	46	1
MinS	ES_Minh	PT	F	NA	nr/m^2	8	FALSE	2018	2020	3	0
MonS	PT_Port	PT	F	NA	nr/m^2	21	FALSE	2018	2021	4	0
NkaS	SE_East	SE	C	3	index	0	FALSE	1979	2020	41	2
SosS	SE_East	SE	C	3	nr	0	FALSE	1974	2017	41	6
KavlS	SE_Inla	SE	F	5	nr	16	NA	2019	2021	3	0
Bi1S				NA	index	NA	NA	1991	2011	16	15
Bi4S				NA	index	NA	NA	1991	2010	20	11
NsiS				NA	index	NA	NA	1988	2011	22	12
PanS				NA	index	NA	NA	1984	2005	16	22

Biometry Annex

This annex details the number of years for which countries have provided data on biometrics in their time series for each of the parameters.

Table 3. number of years for which the glass eel series have length or weight data

Seeri	Country	habitat	length	weight
KlitG	DK	F	0	10
NorsG	DK	F	0	10
SleG	DK	F	0	10
VacG	FR	T	18	18
ShiMG	GB	T	8	1
ShiFG	GB	F	5	0
CorG	IE	F	2	1
RhDOG	NL	T	10	0
MiScG	PT	T	5	5
MondG	PT	T	5	5
Series with data			**7**	**8**
Series ≥ 5 years			**6**	**6**

Table 4. number of years for which the yellow eel recruitment series have length, weight or age data.

Serie	Country	habitat	length	weight	age
BannGY	GB	F	**19**	**18**	**1**
BresGY	FR	F	**27**		
BurrGY	IE	F	**1**	**1**	
CorG	IE	F	**2**	**1**	
ErneGY	IE	F	**1**		
HellGY	DK	T		**10**	
ImsaGY	NO	F	**11**	**11**	
LiffGY	IR	F			
ShaAGY	IE	F	**2**	**2**	
SousGY	FR	F	**6**	**8**	
StraGY	GB	F	**11**	**4**	**11**
ViskGY	SE	F		**13**	
	Series with biometry		**9**	**9**	**2**
	Series ≥ 5 years		**5**	**5**	**1**

Table 5. number of years for which the yellow eel series have length, weight or age data.

ser_nameshort	Habitat	Country	bio_length	bio_weight	bio_age
MeusY	F	BE	27	27	0
HartY	F	DK	0	10	0
VVeY	F	DK	0	10	0
AlCY	T	ES	1	1	0

ser_nameshort	Habitat	Country	bio_length	bio_weight	bio_age
BidY	F	ES	11	11	0
NalY	F	ES	10	10	0
OriY	F	ES	16	16	0
KuloY	F	FI	3	3	2
VesiY	F	FI	5	5	4
AaY	F	FR	9	9	0
AdoY	F	FR	11	11	0
AutY	F	FR	8	8	0
BreY	F	FR	9	8	0
DivY	F	FR	7	0	0
DouY	F	FR	7	0	0
EscY	F	FR	7	7	0
FremY	F	FR	26	24	0
FreY	F	FR	24	0	0
GarY	F	FR	9	9	0
OrnY	F	FR	11	0	0
SciY	F	FR	10	9	0
SeiY	F	FR	11	11	0
SeNY	F	FR	19	19	0
SomY	F	FR	11	11	0
SouY	F	FR	11	11	0
TouY	F	FR	7	1	0
VirY	F	FR	11	0	0
YerY	F	FR	10	8	0
BadY	F	GB	1	0	0
BelY	F	GB	8	8	0
BoEY	F	GB	20	20	0
ChBY	F	GB	17	17	0
CoqY	F	GB	12	12	0
DeeY	F	GB	10	10	0
DerY	F	GB	19	19	0
DoSY	F	GB	15	15	0
EdeY	F	GB	19	19	0
EllY	F	GB	9	9	0

ser_nameshort	Habitat	Country	bio_length	bio_weight	bio_age
ExeY	F	GB	15	15	0
FowY	F	GB	33	33	0
FroY	F	GB	17	17	0
GirnY	F	GB	13	13	0
GirY	F	GB	1	0	0
GrOY	F	GB	24	24	0
HaAY	F	GB	17	17	0
HumY	F	GB	30	30	0
ItcY	F	GB	16	16	0
KilY	F	GB	1	1	1
LagY	F	GB	3	3	3
LeeY	F	GB	20	20	0
MedY	F	GB	17	17	0
MerY	F	GB	18	18	0
NenY	F	GB	12	12	0
OttY	F	GB	14	14	0
OusY	F	GB	20	20	0
ParY	F	GB	26	26	0
PlyY	F	GB	23	23	0
RibY	F	GB	29	29	0
SevY	F	GB	41	41	0
ShiY	F	GB	1	1	0
SuSY	F	GB	19	19	0
TamY	F	GB	24	24	0
TawY	F	GB	14	14	0
TefY	F	GB	10	10	0
TegY	F	GB	13	13	0
TesY	F	GB	16	16	0
ThaY	F	GB	36	36	0
TweY	F	GB	4	4	0
TyTY	F	GB	10	10	0
UskY	F	GB	10	10	0
WelY	F	GB	14	14	0
WenY	F	GB	17	17	0

ser_nameshort	Habitat	Country	bio_length	bio_weight	bio_age
WerY	F	GB	13	13	0
WevY	F	GB	14	14	0
WitY	F	GB	15	15	0
WniY	F	GB	10	10	0
WyeY	F	GB	16	16	0
VistY	F	GR	1	1	0
BFeY	F	IE	19	18	2
BFuY	T	IE	18	18	3
BLFY	T	IE	13	13	1
BuBY	F	IE	17	12	1
LoEY	F	IE	5	5	5
ShaPY	F	IE	2	1	0
ClY	T	LT	3	3	3
KerY	F	LT	2	2	1
KreY	F	LT	3	3	1
KrLY	F	LT	1	1	0
RubY	F	LT	1	1	1
VieY	F	LT	1	1	1
DaugY	F	LV	5	5	4
LilY	F	LV	5	5	4
IJsFRY	F	NL	15	0	0
IJsFVY	F	NL	15	0	0
IjsY	F	NL	32	0	0
MarY	F	NL	31	0	0
MmFRY	F	NL	15	0	0
MmFVY	F	NL	15	0	0
SkaY	C	NO	23	0	0
MinY	F	PT	3	3	0
MonY	F	PT	4	4	0
BarY	MO	SE	18	0	0
DalaY	F	SE	0	67	0
FjaY	MO	SE	18	0	0
GotaY	F	SE	0	74	0
HakY	MO	SE	17	0	0

ser_nameshort	Habitat	Country	bio_length	bio_weight	bio_age
KavlY	F	SE	0	29	0
KulY	MO	SE	11	0	0
LagaY	F	SE	0	5	0
MorrY	F	SE	0	22	0
MotaY	F	SE	0	52	0
RonnY	F	SE	0	17	0
VenY	MO	SE	19	0	0
Series with data			**104**	**94**	**16**
Series with ≥ 5y			**86**	**77**	**1**

Table 6. number of years for which the silver eel series have length, weight or age data aggregated or disaggregated per sex.

Series	Country	**Female and male**			% female	**Female**			**Male**		
		length	weight	age		length	weight	age	length	weight	age
WarS	DE	0	0	0	12	0	0	0	0	0	0
RibS	DK	2	2	0	2	0	0	0	0	0	0
BidS	ES	0	0	0	11	10	10	0	11	11	0
NalS	ES	0	0	0	1	0	0	0	9	9	0
OriS	ES	0	0	0	14	14	14	0	14	14	0
KotkS	FI	0	0	0	5	5	5	4	0	0	0
VaakS	FI	0	0	0	8	8	8	8	0	0	0
BreS	FR	29	0	0	0	0	0	0	0	0	0
FreS	FR	25	25	0	25	25	25	0	25	25	0
SeNS	FR	8	8	0	8	8	7	0	8	7	0
SouS	FR	9	9	0	2	0	0	0	0	0	0
BaBS	GB	1	1	1	1	1	1	0	1	1	0
GiBS	GB	1	1	1	1	1	0	0	1	1	0
ShiS	GB	1	1	1	1	1	1	0	1	1	0
StrS	GB	4	4	0	4	4	4	0	4	4	0
EamtS	GR	10	10	4	1	10	10	4	0	0	0
NorwS	GR	5	5	0	0	0	0	0	0	0	0
WepeS	GR	1	1	1	0	0	0	0	0	0	0
BurS	IE	35	35	10	38	23	22	4	23	23	4
KilS	IE	6	1	0	7	5	0	0	4	0	0
AlauS	LT	2	2	2	2	2	1	1	0	0	0
ClS	LT	4	4	4	4	4	4	4	2	2	2
KertS	LT	2	2	2	2	2	2	2	1	1	1
KreS	LT	1	1	0	1	0	0	0	0	0	0
LakS	LT	2	2	0	1	1	1	0	1	1	0
RieS	LT	1	1	0	1	0	0	0	0	0	0
RubS	LT	1	1	1	1	1	1	1	1	1	1
SiesS	LT	2	2	2	2	2	2	2	1	1	1
ZeiS	LT	1	1	0	1	0	0	0	0	0	0
DaugS	LV	4	4	3	3	3	3	1	4	4	3
LilS	LV	5	5	4	4	3	3	3	4	4	4
BRWS	NL	7	7	0	0	0	0	0	0	0	0

Series	Country	Female and male			% female	Female			Male		
		length	weight	age		length	weight	age	length	weight	age
DOIJS	NL	7	0	0	0	0	0	0	0	0	0
HVWS	NL	9	0	0	0	0	0	0	0	0	0
IjsS	NL	7	0	0	0	0	0	0	0	0	0
NiWS	NL	10	0	0	0	0	0	0	0	0	0
NZKS	NL	9	0	0	0	0	0	0	0	0	0
ZMaS	NL	8	0	0	0	0	0	0	0	0	0
ImsaS	NO	10	10	0	9	9	9	4	0	0	0
MinS	PT	3	3	0	3	0	0	0	3	3	0
MonS	PT	3	3	0	3	2	2	0	3	2	0
KavlS	SE	3	3	2	3	0	3	2	0	0	0
SosS	SE	18	0	0	18	0	0	0	0	0	0
Series with data		**37**	**29**	**14**	**33**	**23**	**22**	**13**	**20**	**19**	**7**
Series ≥ 5y		**18**	**9**	**1**	**11**	**10**	**9**	**1**	**6**	**6**	**0**

Annex 16: Group biometric data

This annex intends to be an exploration of the potential use of these data; results may contain errors and should not be taken as a final analysis.

Table S1 Summary of group biometric data available for time series and other sampling data.

source	EMU	n_series	n_gear	n_samp type	n_habitat	n_life_stag e
sampling	DE_Eide	4	0	4	4	4
sampling	DE_Elbe	22	0	20	20	22
sampling	DE_Ems	10	0	9	9	10
sampling	DE_Oder	3	0	2	2	3
sampling	DE_Rhei	8	0	7	7	8
sampling	DE_Schl	8	0	7	7	8
sampling	DE_Warn	6	0	4	4	6
sampling	DE_Wese	3	0	2	2	3
sampling	ES_Anda	38	0	37	37	38
sampling	ES_Astu	3	0	2	2	3
sampling	ES_Bale	1	0	0	0	1
sampling	ES_Basq	2	0	0	0	2
sampling	ES_Cant	2	0	2	2	2
sampling	ES_Cata	2	0	2	2	2
sampling	ES_Gali	6	0	6	6	6
sampling	ES_Murc	1	0	1	1	1
sampling	ES_Vale	1	0	0	0	1
sampling	FR_Adou	3	0	2	2	3
sampling	FR_Arto	1	0	1	1	1
sampling	FR_Bret	2	0	2	2	2
sampling	FR_Garo	4	0	3	3	4
sampling	FR_Loir	4	0	3	3	4
sampling	FR_Rhon	1	0	1	1	1
sampling	FR_Sein	1	0	1	1	1
sampling	GB_Neag	3	0	3	3	3
sampling	GB_NorE	1	0	0	0	1
sampling	GB_Scot	1	0	0	0	1
sampling	GB_Seve	2	0	0	0	2
sampling	GB_SouW	1	0	0	0	1
sampling	IE_NorW	1	0	0	0	1

source	EMU	n_series	n_gear	n_samp type	n_habitat	n_life_stage
sampling	IE_Shan	1	0	0	0	1
sampling	IE_West	3	0	2	2	3
sampling	IT_Lazi	3	0	0	0	3
sampling	IT_Pugl	2	0	0	0	2
sampling	LV_Latv	4	0	0	0	4
sampling	NL_Neth	3	0	0	0	3
sampling	PL_Oder	1	0	1	1	1
sampling	PL_Vist	1	0	1	1	1
sampling	PT_Port	1	0	0	0	1
sampling	SE_East	19	0	12	12	19
sampling	SE_Inla	9	0	9	9	9
sampling	SE_West	8	0	6	6	8
series	BE_Meus	1	1	1	1	1
series	DE_Warn	1	1	1	1	1
series	DK_Inla	7	7	7	7	7
series	ES_Astu	2	2	2	2	2
series	ES_Basq	2	2	2	2	2
series	ES_Minh	3	3	3	3	3
series	ES_Nava	2	2	2	2	2
series	ES_Vale	1	1	1	1	1
series	FI_Finl	4	4	4	4	4
series	FR_Adou	4	4	4	4	4
series	FR_Arto	4	4	4	4	4
series	FR_Bret	4	4	4	4	4
series	FR_Garo	1	1	1	1	1
series	FR_Loir	2	2	2	2	2
series	FR_Rhon	1	1	1	1	1
series	FR_Sein	11	11	11	11	11
series	GB_Angl	7	7	7	7	7
series	GB_Dee	1	1	1	1	1

source	EMU	n_series	n_gear	n_samp type	n_habitat	n_life_stage
series	GB_Humb	1	1	1	1	1
series	GB_Neag	1	1	1	1	1
series	GB_NorE	4	4	4	4	4
series	GB_Nort	2	2	2	2	2
series	GB_NorW	6	6	6	6	6
series	GB_Scot	9	9	9	9	9
series	GB_Seve	3	3	3	3	3
series	GB_Solw	3	3	3	3	3
series	GB_SouE	3	3	3	3	3
series	GB_SouW	11	11	11	11	11
series	GB_Tham	3	3	3	3	3
series	GB_Wale	3	3	3	3	3
series	GR_EaMT	2	2	2	2	2
series	GR_NorW	1	1	1	1	1
series	GR_WePe	1	1	1	1	1
series	IE_East	1	1	1	1	1
series	IE_NorW	2	2	2	2	2
series	IE_Shan	4	4	4	4	4
series	IE_West	7	7	7	7	7
series	LT_Lith	5	5	5	5	5
series	LT_total	10	10	10	10	10
series	LV_Latv	4	4	4	4	4
series	NL_Neth	14	14	14	14	14
series	NO_total	3	3	3	3	3
series	PT_Port	3	3	3	3	3
series	SE_East	3	3	3	3	3
series	SE_Inla	7	7	7	7	7
series	SE_West	5	5	5	5	5

Figure 11

Spatial trends in group biometric parameters

Glass/yellow mixed eel

In this exercise, the recruitment series or other sampling data containing only glass eel were not included, since the biometry of glass eel vary a lot depending on season and can hardly be compared with recruitment time-series composed of mixed glass eels /yellow eel series.

The relationship between length and weight differed significantly between the different series (ANCOVA: $p < 0.000$) (Table 1, Figure 1). The BannGYF has a very high slope while glass eels have approximately the same length. This suggests that glass or young yellow eels are gaining weight very quickly, probably just after they have restarted feeding. Indeed, different experts (Rigaud, Evans and Briand, personal communication) have noticed that glass eels gain weight very quickly while their length does not grow when feeding is resumed. Other factors such as the sampling season can also play a since growth is higher in early stages and length might significantly increase from one month to another.

For the ImsaGYF and SousGYF series, the slope is lower than that of BannGYF, probably because the lengths are closer to the yellow eel phase where the weight gain is lower. It would be necessary to have a greater knowledge of the stages used to calculate the average lengths and the time of the season where the sampling was carried out to draw definitive conclusions.

Table 1. Relation of annual average glass/yellow eel mixed series weight (log gr eel) with standard length (log mm eel) in different GY series.

Series	Equation	r2	p
BannGYF	Intercept=-34.35, slope=7.89	0.72	<0.001
ImsaGYF	Intercept=-16.60, slope=3.64	0.98	<0.001
SousGYF	Intercept=-13.05, slope=2.89	0.91	0.002

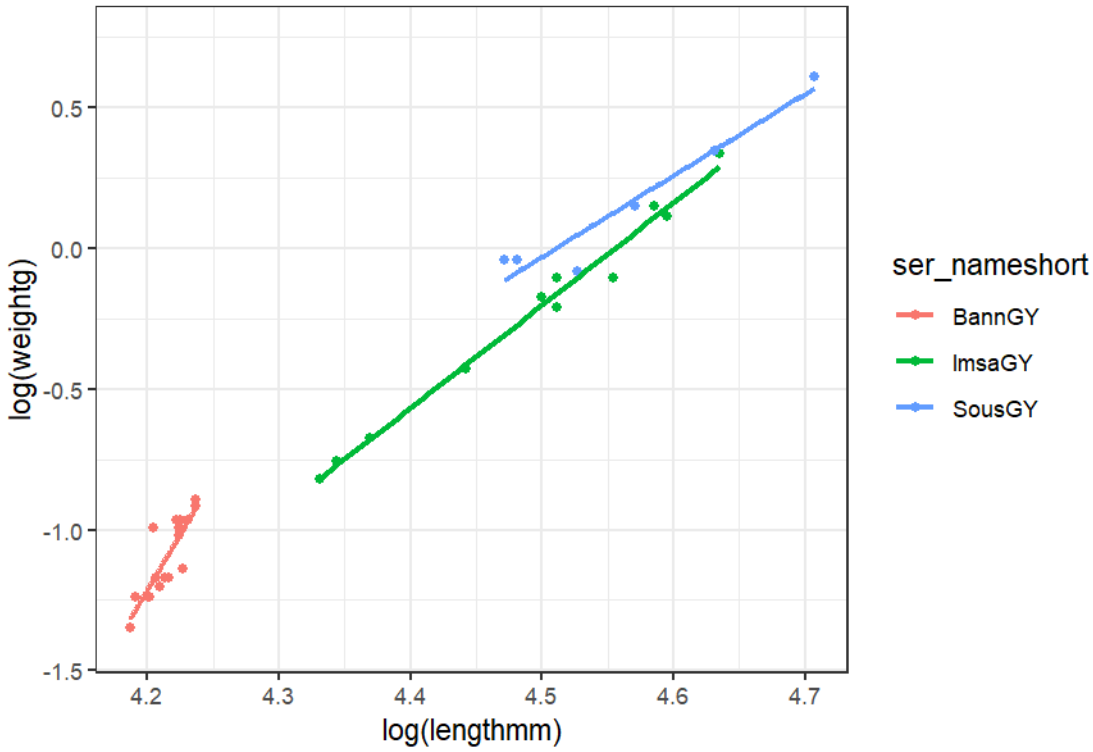


Figure 1. Relation of annual average glass/ yellow mixed eel weight (log gr eel) with standard length (log mm eel) in different GYF series (each line corresponds to a GYI monitoring time-series).

The slope of this relationship did not display any obvious latitudinal pattern (Figure 2), but the limited number of available dataseries makes it impossible to draw any conclusions.

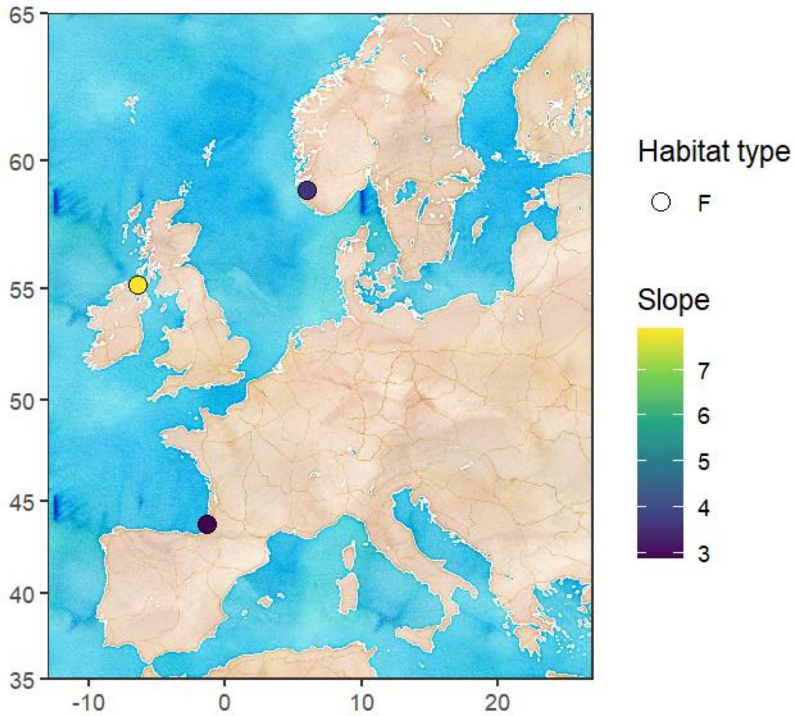


Figure 2. Slopes of length–weight regressions for different mixed glass/ yellow mixed time-series in freshwater habitat. A dot corresponds to a GY recruitment time-series.

Yellow eel standing stock

Many different gears are used to monitor yellow eel standing stock, each one having different selectivity. In addition, this information is currently not available for other sampling series. As such, the comparison of length is not straightforward. A rough comparison of the length of monitored standing stock yellow eel showed a positive relation with the distance to Gibraltar for time series (Kendall correlation test; tau=0.52, p.value < 0.001) and other sampling data (tau=0.38, p.value=0.03) (Figure 3). However, this is likely related to difference in sampling gears since most southern time-series use electrofishing which have a wide selectivity range, while many northern time-series uses fykenet which are selective towards large eel. Therefore, in order to draw definitive conclusion, it would be necessary to have detailed information on the catching methods and the bias they introduce in the size structure. Sex disaggregated data were scarce, thus sex-disaggregated yellow eel analysis was not performed.

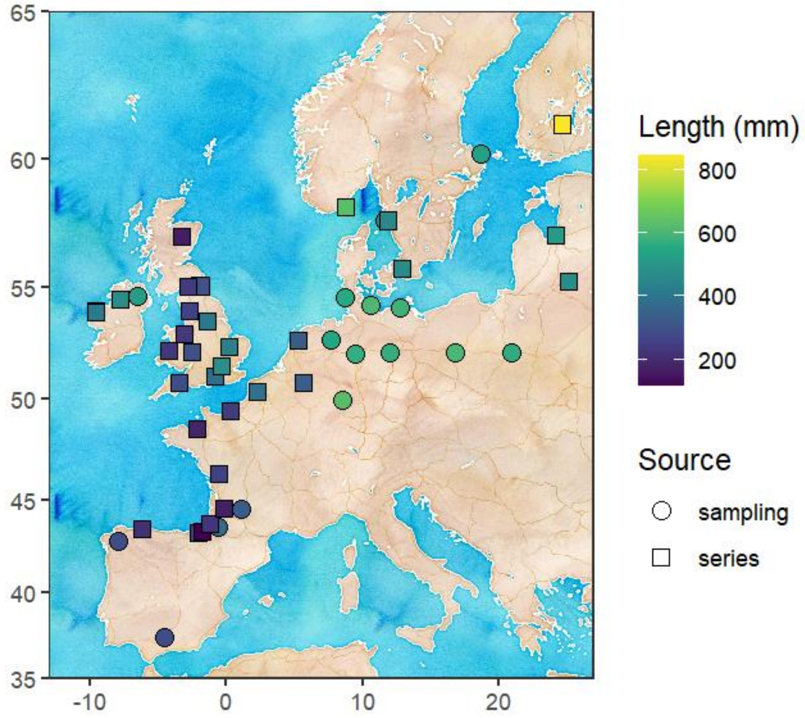


Figure 3. Average length of yellow eels. Each dot corresponds to the average value across years and time-series in a given EMU and habitat type. The length is indicated by the colour scale and the source (series or other sampling) by the geometric shape.

As for the weight, the monitored yellow eel standing stock weight showed no significant relationship with distance to Gibraltar for time series data (tau=0.15, p.value=0.25) but there was a significant relationship with distance to Gibraltar for other sampling data (tau=0.38, p.value=0.03) ((Figure 4), but as mentioned in the case of length, no definitive conclusions can be drawn as the analysis includes average weights obtained by different sampling gears.

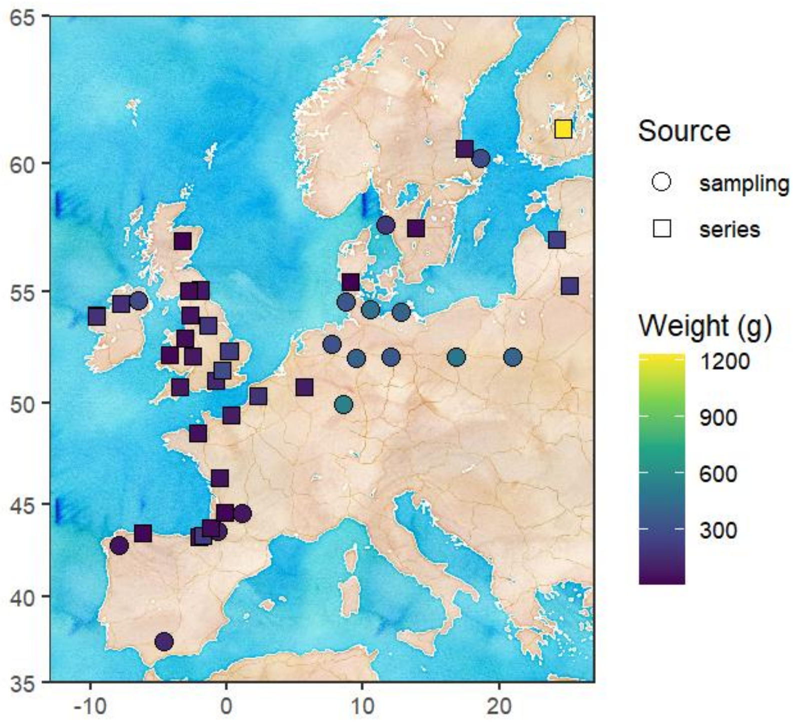
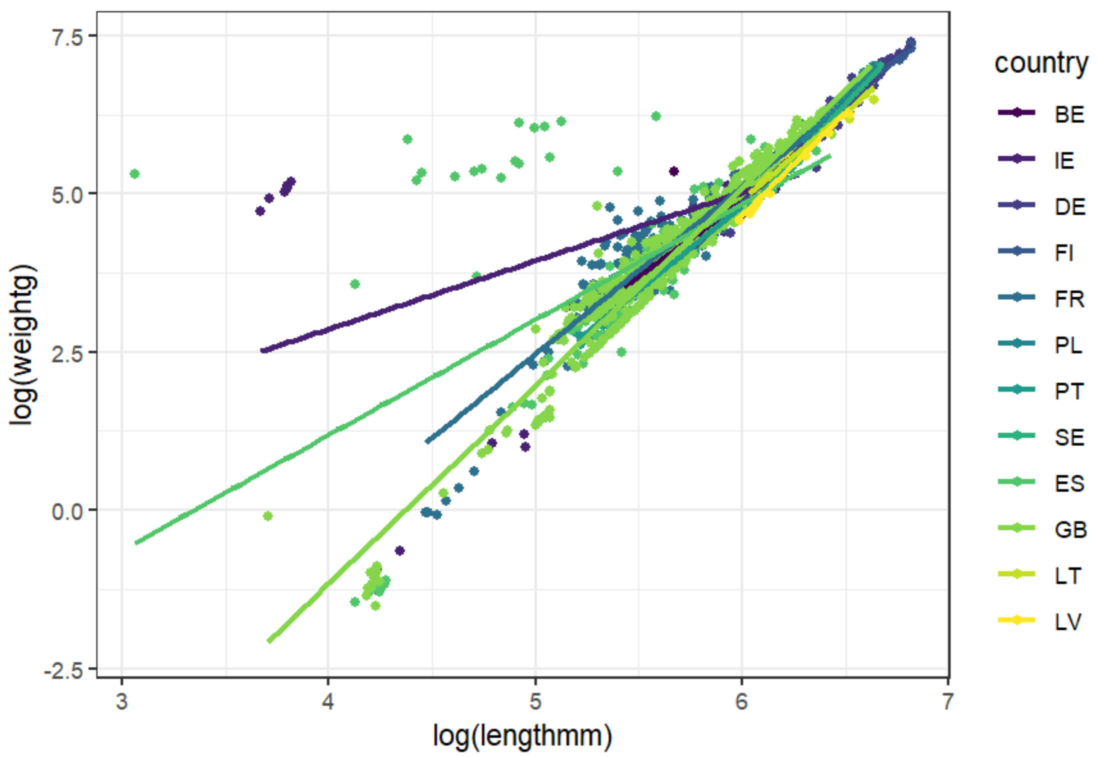


Figure 4. Average weight of yellow eels. Each dot corresponds to the average value across years and time-series in a given EMU and habitat type. The length is indicated by the colour scale and the source (series or other sampling) by the geometric shape.

The relationship between average annual length and weight differs significantly between the different yellow country x habitat (ANCOVA: $p < 0.000$) (Table 2, Figure 5). However, the differences between series were not as great as in the case of the GY series. This can be explained by different factors. First, standing stock yellow eel series corresponds to a more homogeneous sedentary stage, compared to GY recruitment, which brings together non-feeding glass eels and feeding elvers, migratory glass eel and sedentary small yellow eel. Furthermore, their growth is smoother than GY and consequently, the biometry is less sensitive to the monitoring seasonality. Finally, in this analysis, yellow eel data have been pooled by country, habitat and source (series and other sampling).



log(weightg)
log(lengthmm)
7.5
5.0
2.5
0.0
-2.5
3
4
5
6
7
country
BE
IE
DE
FI
FR
PL
PT
SE
ES
GB
LT
LV

Figure 5 Regression of annual average yellow eel weight (log gr eel) with average standard length (log mm eel) per country for both type of data combined (series and other sampling).

Table 2. Relation of annual average glass/yellow eel mixed series weight (log gr eel) with standard length (log mm eel) in different Y series. Most series are from fresh water as indicated by F at the end of the country name (e.g. BEF)

Series	Equation	r2	p
BEF	Intercept=--9.29, slope=2.36	0.59	<0.001
IEF	Intercept=-2.12 slope=1.19	0.32	<0.001
IET	Intercept=4.05, slope=0.18	0.06	0.10
DEF	Intercept=-13.24, slope=3.01	0.95	<0.001
DEMO	Intercept=-12.98, slope=2.98	0.95	<0.001
DET	Intercept=-14.46 slope=3.20	0.96	<0.001
FIF	Intercept=-9.06, slope=2.40	0.96	<0.001
FRF	Intercept=-10.75, slope=2.64	0.89	<0.001
PLF	Intercept=-15.53, slope=3.39	0.99	<0.001
PTF	Intercept=-11.12, slope=2.65	0.98	<0.001
SEC	Intercept=-16.09, slope=3.46	0.99	<0.001
ESF	Intercept=1.93, slope=0.41	0.02	0.05
EST	Intercept=-16.19, slope=3.54	0.99	<0.001
GBF	Intercept=-13.64, slope=3.12	0.96	<0.001
LTF	Intercept=-11.73, slope=2.77	0.97	<0.001
LVF	Intercept=-14.85, slope=3.25	0.97	<0.001

The slopes of the length–weight relationships did not show any clear relation with latitude (Figure 6).

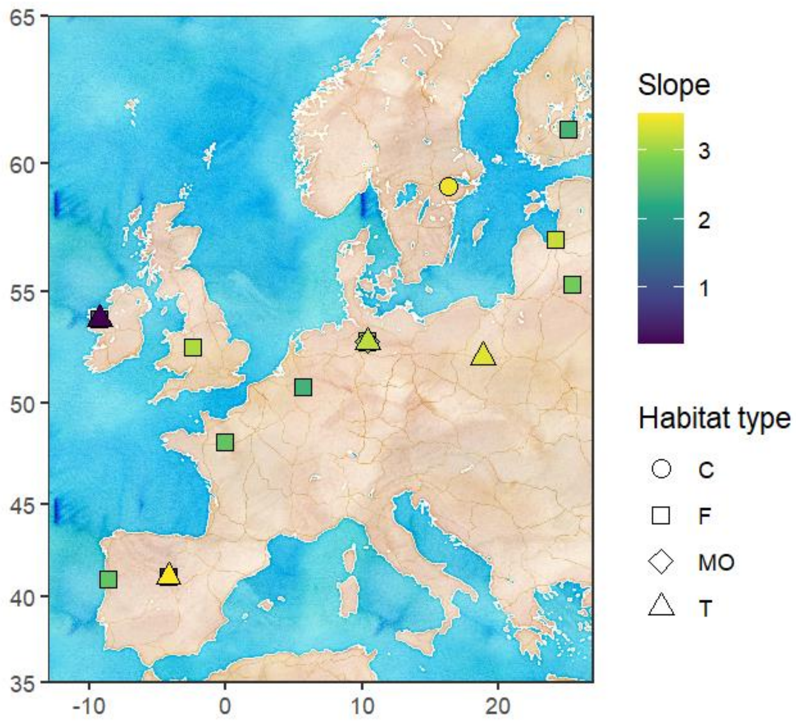


Figure 6. Slopes of length–weight regressions for yellow time-series and other sampling data combined. A dot corresponds to a country x habitat.

Silver eel series

As for yellow eel, different sampling gears are used for silver eels and difference in selectivity is likely to influence the length of caught silver eels. The Kendall correlation test does not detect any significant relation with the distance to Gibraltar for series data (tau=0.15, p.value=0.53), but there is significant relationship for other sampling data (tau=0.6, p.value=0.003). The same is true for weight, where no significant relationship with distance to Gibraltar exist for series data (tau=0.14, p.value=0.71), but is evident for other sampling data (tau=0.6, p.value=0.003). However, these data were pooled by EMU, which can explain some of the observed patterns, as no specific site coordinates existed for other group biometric data. There are not enough sex disaggregated data to detect sex-specific length-patterns.

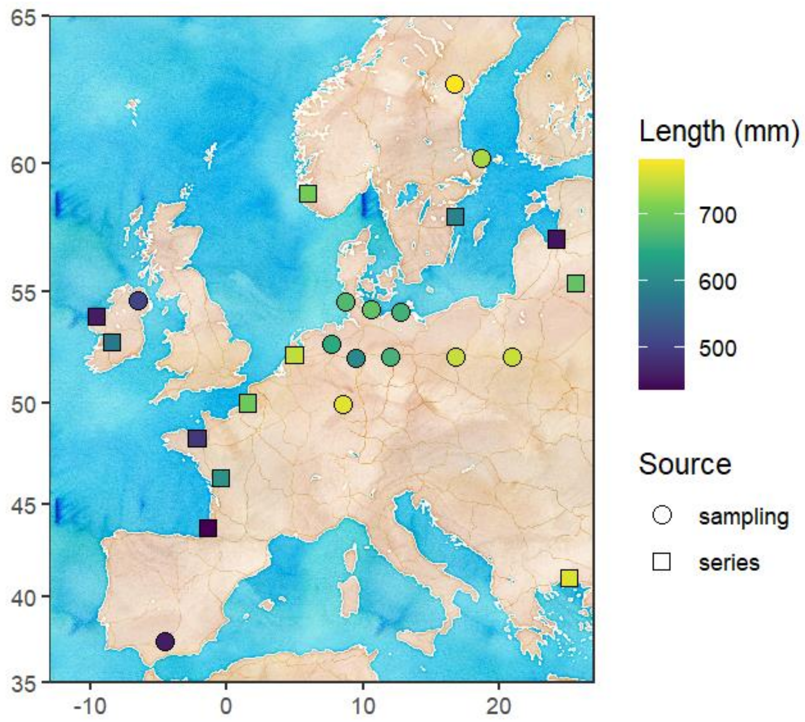


Figure 7. Average length of silver eels. Each dot corresponds to the average value across years and time-series in a given EMU and habitat type. The length is indicated by the colour scale and the source (series, other sampling) by the geometric shape.

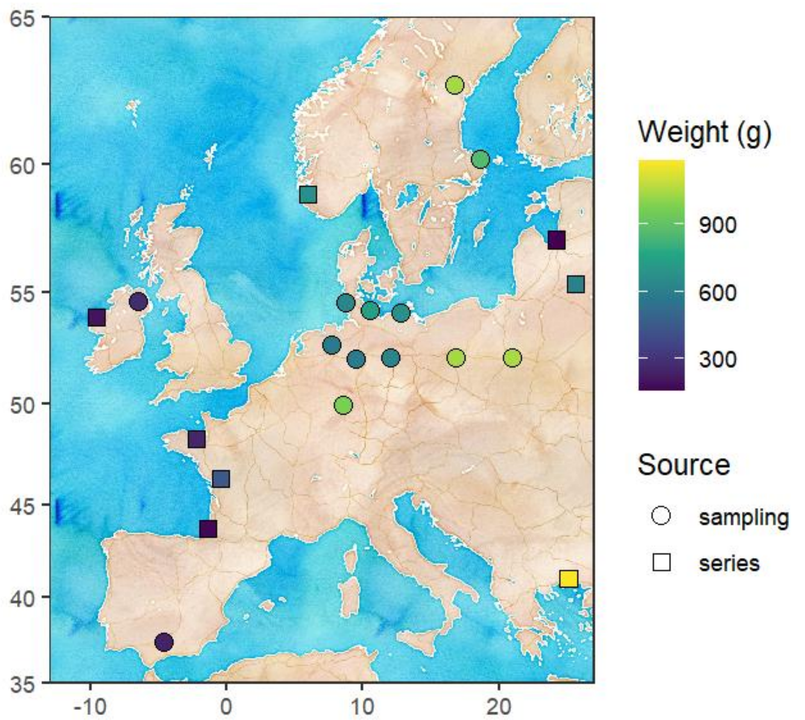


Figure 8. Average weight of silver eels (upper panel). Each dot corresponds to the average value across years and time-series in a given EMU and habitat type. The length is indicated by the colour scale and the source (series, other sampling) by the geometric shape.

The relationship between length and weight was significant for most of silver eel series (Table 3, Figure 9). However, no relationship was found between the slope of this relationship and latitude (Figure 10).

Table 3. Relation of average annual silver eel weight (log gr eel) with standard length (log mm eel). Note that the Imsa series only contains female data.

Series	Equation	r2	p
BurS	Intercept=-12.34, slope=2.88	0.89	<0.001
DE_Eide_Eider_DCF_F_S	Intercept=-11.34, slope=2.73	0.99	<0.001
DE_Elbe_Elbe_DCF_F_S	Intercept=-14.35, slope=3.20	0.97	<0.001
DE_Ems_Ems_DCF_T_S	Intercept=-12.00, slope=2.83	0.98	<0.001
DE_Rhei_Rhein_DCF_F_S	Intercept=-4.84, slope=1.78	0.82	0.003
DE_Schl_Schlei_DCF_MO_S	Intercept=-8.01, slope=2.24	0.67	0.03
DE_Warn_Other_DCF_F_S	Intercept=-15.51, slope=3.38	0.99	<0.001
DE_Wese_Weser_DCF_F_S	Intercept=-9.01, slope=2.39	0.99	<0.001
EamtS	Intercept=-14.07, slope=3.18	0.96	<0.001
FreS	Intercept=-14.79, slope=3.28	0.97	<0.001
GB_Neag_Neagh_Silver_Female_HIST	Intercept=-14.12, slope=3.15	0.56	0.02
GB_Neag_Neagh_Silver_Male_HIST	Intercept=-21.47, slope=4.37	0.83	<0.001
ImsaS	Intercept=-12.84, slope=2.95	0.91	<0.001
LilS	Intercept=-17.23, slope=3.65	0.92	0.006
NorwS	Intercept=5.43, slope=0.01	-0.33	0.9
PL_Oder_Szczecin_lagoon_HIST	Intercept=-12.45, slope=2.93	0.76	0.01
PL_Vist_Vistula_lagoon_HIST	Intercept=-10.57, slope=2.65	0.73	0.01
SE_East_Ble_CF_PN	Intercept=-18.33, slope=3.80	0.95	<0.001
SE_East_Sim_CF_PN	Intercept=-21.71, slope=4.30	0.86	<0.001
SE_East_Sve_CF_PN	Intercept=-9.62, slope=2.47	0.91	<0.001
SeNS	Intercept=-10.93, slope=2.65	0.84	<0.001
SouS	Intercept=-16.98, slope=3.64	0.91	<0.001

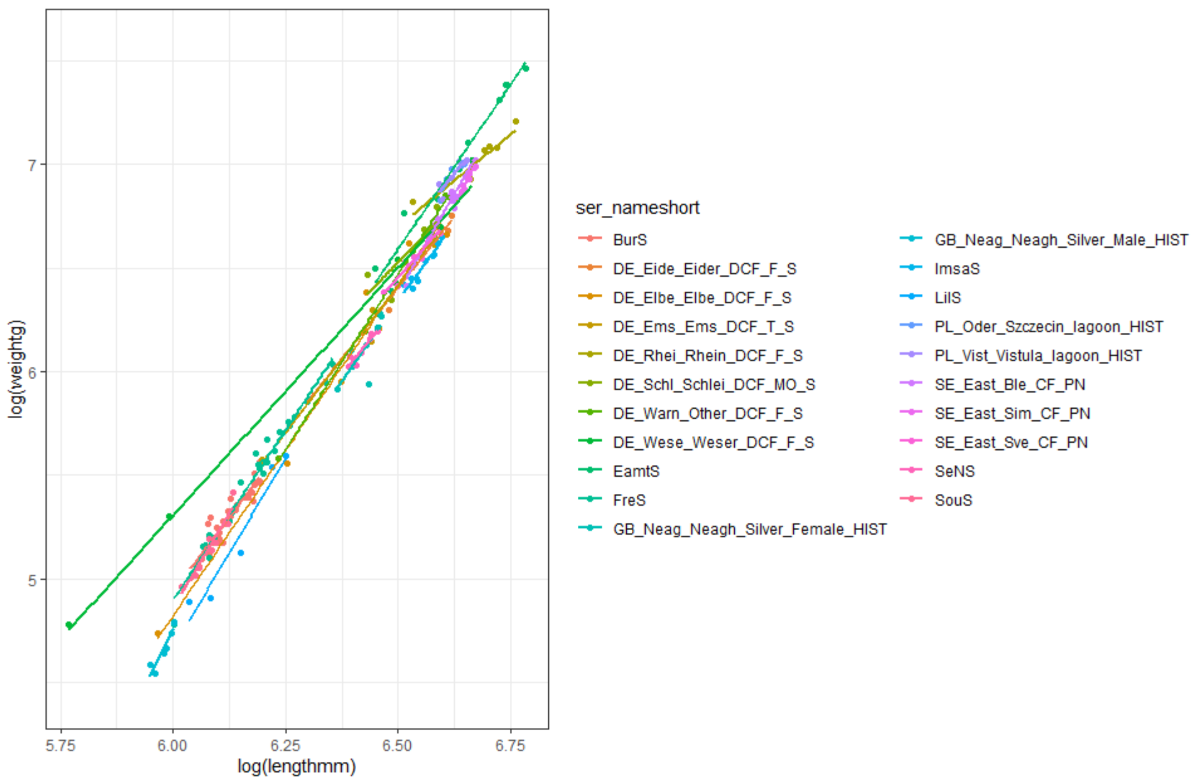


Figure 9. Relation of average annual silver eel weight (log gr eel) with standard length (log mm eel) in different sampling points (each line corresponds to a silver eel monitoring time-series). Note that the Imsa series only contains female data.

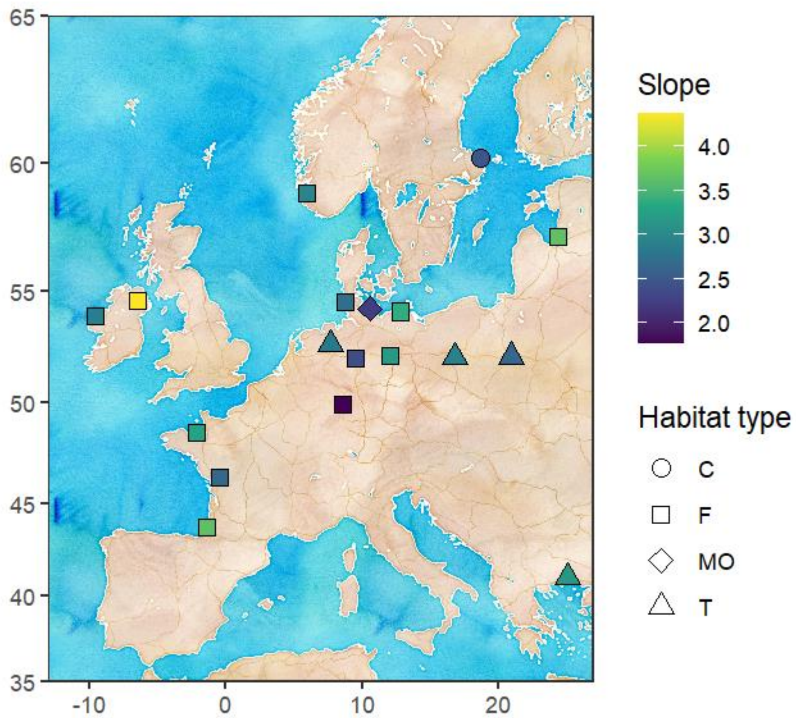


Figure 10. Slopes of length–weight regressions for different silver eel time-series in. A dot corresponds to a monitoring time-series.

Temporal trends in group biometric parameters

In this section, the existence of temporal trends in biometry is explored. For that purpose, we computed average biometry per EMU, habitat and year. Then we carry out Mann Kendall trend tests to detect time series with significant monotonic trend. We only keep EMUxHTY that have data for at least 5 years.

Glass eel

For glass eel, of mixed G and GY, we remain at the time series scale (i.e. we do not average per EMU) since biometry is too sensitive to the timing of the sampling.

Mean length of monitored eels has significantly increased over time in GB_NorE and NO_total (Table 4, Figure 11) and ES_Astu (Table 5, Figure 12). The results for mean weight were similar: the weight has significantly increased in NO_Total (Table 6, Figure 13) and ES_Astu (Table 7 and Figure 14)

Table 4. Analysis of temporal trends (Mann Kendall) for glass and mixed glass/yellow time series annual average length. Series with significant trends are shown in bold.[1]

EMU	habitat	life_stage	first year	last year	tau	p.value	signif
ES_Minh	T	G	2018	2022	0.11	1.00	ns
FR_Adou	F	GY	2013	2020	0.47	0.26	ns
FR_Rhon	T	G	2004	2021	0.11	0.59	ns
FR_Sein	F	GY	1994	2020	0.21	0.13	ns
GB_Neag	F	GY	2003	2022	0.01	0.97	ns
GB_NorE	**F**	**GY**	**2012**	**2022**	**0.53**	**0.03**	*****
GB_Scot	F	G	2017	2021	0.00	1.00	ns
GB_Scot	T	G	2014	2021	0.36	0.27	ns
NL_Neth	T	G	2012	2022	0.11	0.72	ns
NO_total	**F**	**GY**	**2012**	**2022**	**0.55**	**0.02**	*****
PT_Port	T	G	2018	2022	0.84	0.10	ns

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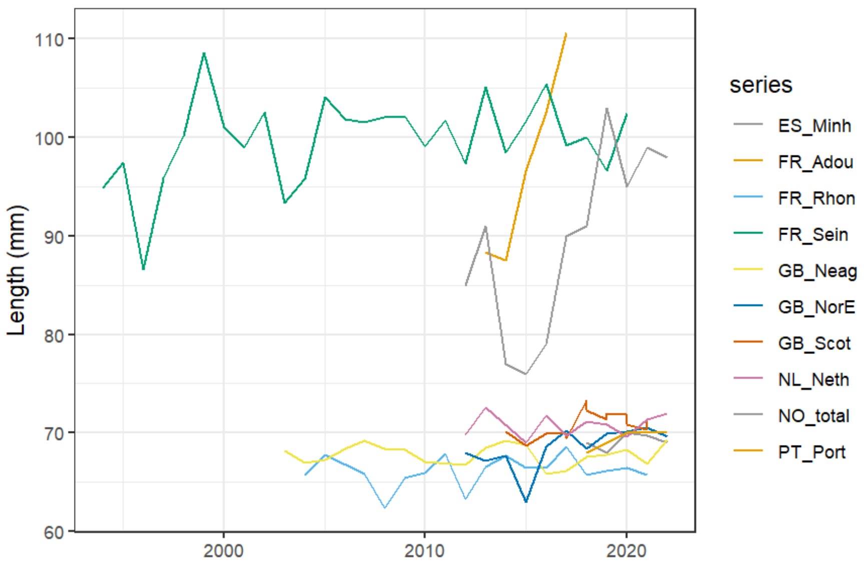

Figure 11. Glass and glass/yellow mixed: time series temporal trends in annual average length.

Table 5. Analysis of temporal trends (Mann Kendall) for glass and mixed glass/yellow other sampling series annual average length. Series with significant trends are shown in bold.

EMU	habitat	life_stage	first year	last year	tau	p.value	signif
ES_Astu	**T**	**G**	**2017**	**2022**	**0.78**	**0.02**	*****

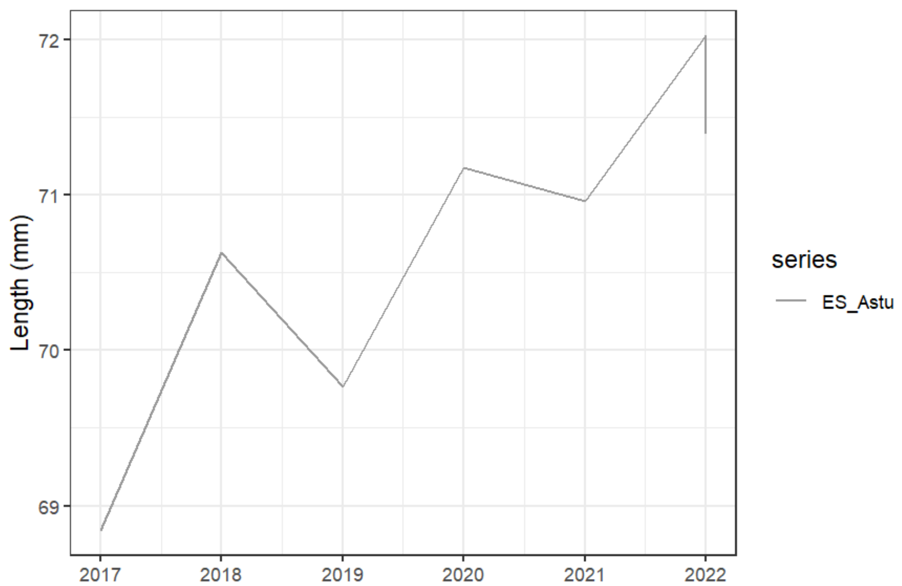

Figure 12. Glass and glass/yellow mixed: other sampling series temporal trends in annual average length.

Table 6. Analysis of temporal trends (Mann Kendall) for glass and mixed glass/yellow time series annual average weight. Series with significant trends are shown in bold.

EMU	habitat	life_stage	first year	last year	tau	p.value	signif
ES_Minh	T	G	2018	2022	0.11	1.00	ns
FR_Adou	F	GY	2013	2020	0.47	0.26	ns
FR_Rhon	T	G	2004	2021	0.11	0.59	ns
GB_Neag	F	GY	2003	2021	-0.11	0.57	ns
NO_total	**F**	**GY**	**2012**	**2022**	**0.55**	**0.02**	*****
PT_Port	T	G	2018	2022	0.84	0.10	ns

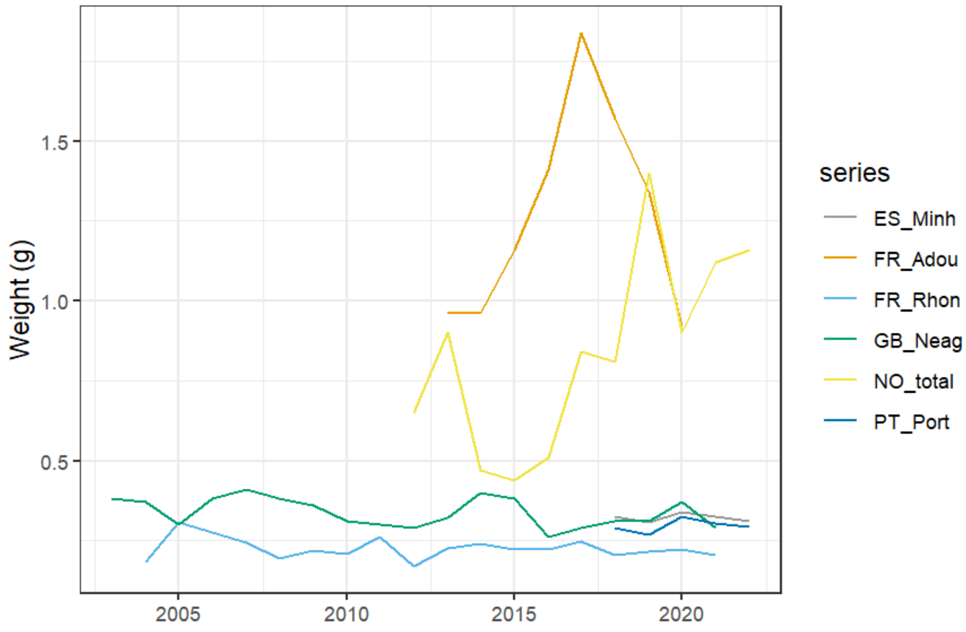

Figure 13. Glass and glass/yellow mixed: time series temporal trends in annual average weight.

Table 7. Analysis of temporal trends (Mann Kendall) for glass and mixed glass/yellow other sampling series annual average weight. Series with significant trends are shown in bold.

EMU	habitat	life_stage	first year	last year	tau	p.value	signif
ES_Astu	**T**	**G**	**2017**	**2022**	**0.78**	**0.02**	*****

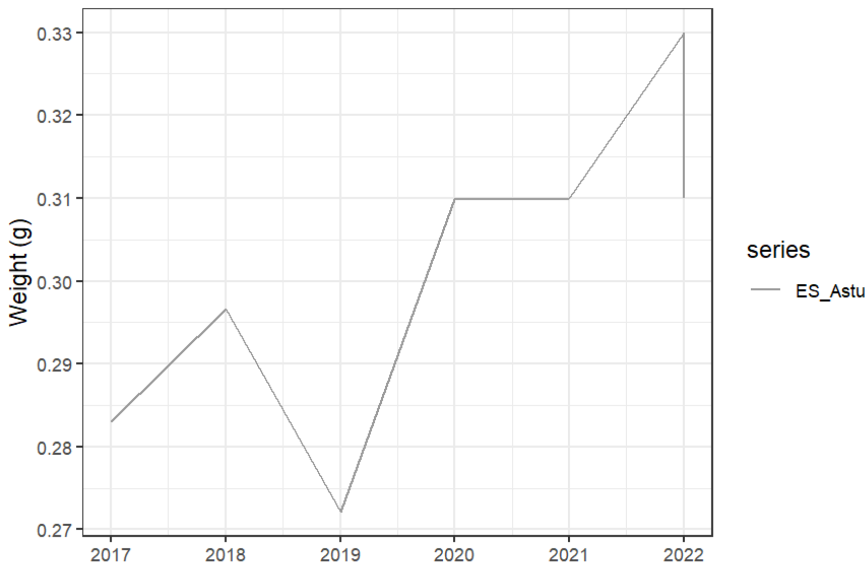

Figure 14. Glass and glass/yellow mixed: other sampling series temporal trends in annual average weight.

Yellow Eel

Significant trends are detected for 13 EMUs over 31 (Table 8, Figure 15), with a decrease of mean length in nine EMUs (ES_Astu, ES_Basq, ES_Nava, FR_Sein, GB_Angl, GB_Humb, GB_Nort, GB_Seve, IE_West) and an increase in four (BE_Meus, NL_Neth, SE_West, GB_SouW). In the other sampling series (Table 9, Figure 16), there was a significant positive trend in one (SE_West).

For weight, significant trends are detected for eleven EMUs over 30 (Table 10, Figure 17), with a decrease of mean weight in nine EMUs (ES_Astu, ES_Basq, ES_Nava, FR_Sein, GB_Angl, GB_Humb, GB_Nort, GB_Seve, IE_West) and an increase in two (BE_Meus, GB_SouW) time series. In the other sampling series (Table 11, Figure 18) only one positive significant increase was detected (SE_West)

Table 8. Analysis of temporal trends (Mann Kendall) for yellow eel time series annual average length. Series with significant trends are shown in bold.

EMU	habitat	first year	last year	tau	p.value	signif
BE_Meus	**F**	**1992**	**2021**	**0.43**	**0.00**	*******
ES_Astu	**F**	**2011**	**2020**	**-0.56**	**0.03**	*****
ES_Basq	**F**	**2004**	**2020**	**-0.47**	**0.01**	******
ES_Nava	**F**	**2010**	**2020**	**-0.56**	**0.02**	*****
FI_Finl	F	2017	2021	0.60	0.22	ns
FR_Adou	F	2010	2020	-0.16	0.53	ns
FR_Arto	F	2010	2020	0.02	1.00	ns
FR_Bret	F	1995	2020	0.06	0.66	ns
FR_Garo	F	2010	2018	-0.39	0.18	ns
FR_Loir	F	2002	2020	0.05	0.78	ns
FR_Sein	**F**	**2010**	**2020**	**-0.60**	**0.01**	******
GB_Angl	**F**	**1986**	**2021**	**-0.29**	**0.03**	*****
GB_Dee	F	2010	2019	-0.16	0.59	ns
GB_Humb	**F**	**1990**	**2021**	**-0.56**	**0.00**	*******
GB_Nort	**F**	**2005**	**2021**	**-0.50**	**0.01**	******
GB_NorW	F	1991	2021	-0.23	0.09	ns
GB_Scot	F	2008	2021	0.04	0.90	ns
GB_Seve	**F**	**1976**	**2021**	**-0.44**	**0.00**	*******
GB_Solw	F	1995	2021	0.04	0.83	ns
GB_SouE	F	2001	2021	-0.29	0.07	ns

EMU	habitat	first year	last year	tau	p.value	signif
GB_SouW	**F**	**1977**	**2021**	**0.32**	**0.01**	**
GB_Tham	F	1985	2021	-0.05	0.69	ns
GB_Wale	F	2010	2019	-0.11	0.72	ns
IE_NorW	F	2011	2020	0.32	0.61	ns
IE_West	F	1973	2021	-0.23	0.18	ns
IE_West	**T**	**1987**	**2021**	**-0.69**	**0.00**	***
LV_Latv	F	2017	2021	0.60	0.22	ns
NL_Neth	**F**	**1989**	**2021**	**0.64**	**0.00**	***
NO_total	C	1993	2021	0.28	0.06	ns
SE_East	MO	2002	2019	0.33	0.06	ns
SE_West	**MO**	**2002**	**2020**	**0.59**	**0.00**	***

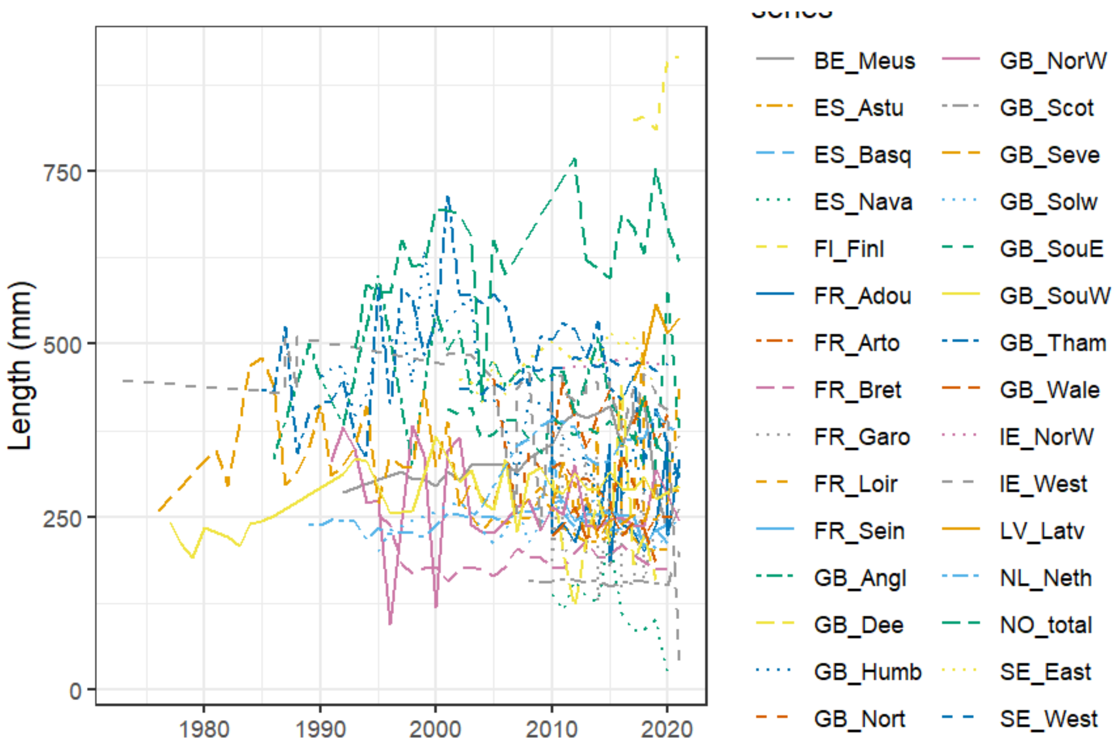

Figure 15. Yellow eel time series temporal trends in average annual length.

Table 9. Analysis of temporal trends (Mann Kendall) for yellow eel other sampling series annual average length. Series with significant trends are shown in bold.

EMU	habitat	first year	last year	tau	p.value	signif
DE_Eide	F	2011	2016	0.33	0.45	ns
DE_Elbe	F	2011	2017	0.05	1.00	ns
DE_Ems	T	2011	2020	-0.05	1.00	ns
DE_Rhei	F	2011	2017	-0.14	0.76	ns
DE_Schl	MO	2011	2017	-0.33	0.45	ns
DE_Warn	F	2011	2015	-0.20	0.81	ns
DE_Wese	F	2011	2017	-0.14	0.76	ns
ES_Anda	F	2013	2020	0.80	0.09	ns
ES_Gali	T	2016	2021	-0.60	0.13	ns
FR_Adou	F	2010	2021	-0.60	0.22	ns
FR_Garo	F	2010	2021	-0.33	0.25	ns
GB_Neag	F	2015	2021	0.43	0.23	ns
PL_Oder	T	2016	2021	0.33	0.45	ns
PL_Vist	T	2016	2021	0.47	0.26	ns
SE_East	C	2006	2020	0.18	0.37	ns
SE_West	**C**	**2006**	**2020**	**0.62**	**0.00**	*******

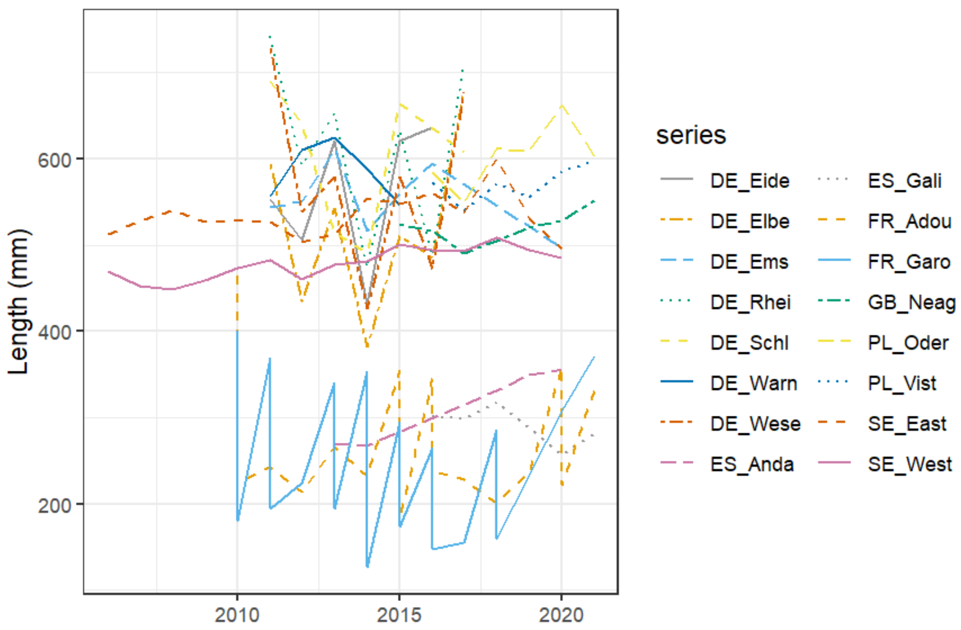

Figure 16. Yellow eel other sampling series temporal trends in average annual length.

Table 10. Analysis of temporal trends (Mann Kendall) for yellow eel time series annual average weight. Series with significant trends are shown in bold.

MU	habitat	first year	last year	tau	p.value	signif
BE_Meus	**F**	**1992**	**2021**	**0.43**	**0.00**	*******
DK_Inla	F	2011	2020	1.00	1.00	ns
ES_Astu	**F**	**2011**	**2020**	**-0.56**	**0.03**	*****
ES_Basq	**F**	**2004**	**2020**	**-0.47**	**0.01**	******
ES_Nava	**F**	**2010**	**2020**	**-0.56**	**0.02**	*****
FI_Finl	F	2017	2021	0.60	0.22	ns
FR_Adou	F	2010	2020	-0.16	0.53	ns
FR_Arto	F	2010	2020	0.02	1.00	ns
FR_Bret	F	1996	2020	0.17	0.26	ns
FR_Garo	F	2010	2018	-0.39	0.18	ns
FR_Loir	F	2002	2020	0.05	0.78	ns
FR_Sein	**F**	**2010**	**2020**	**-0.60**	**0.01**	******
GB_Angl	**F**	**1986**	**2021**	**-0.29**	**0.03**	*****
GB_Dee	F	2010	2019	-0.16	0.59	ns
GB_Humb	**F**	**1990**	**2021**	**-0.56**	**0.00**	*******
GB_Nort	**F**	**2005**	**2021**	**-0.50**	**0.01**	******
GB_NorW	F	1991	2021	-0.23	0.09	ns
GB_Scot	F	2008	2021	0.04	0.90	ns
GB_Seve	**F**	**1976**	**2021**	**-0.44**	**0.00**	*******
GB_Solw	F	1995	2021	0.04	0.83	ns

MU	habitat	first year	last year	tau	p.value	signif
GB_SouE	F	2001	2021	-0.29	0.07	ns
GB_SouW	**F**	**1977**	**2021**	**0.32**	**0.01**	**
GB_Tham	F	1985	2021	-0.05	0.69	ns
GB_Wale	F	2010	2019	-0.11	0.72	ns
IE_NorW	F	2011	2020	0.32	0.61	ns
IE_West	F	1987	2021	-0.19	0.29	ns
IE_West	**T**	**1987**	**2021**	**-0.69**	**0.00**	***
LV_Latv	F	2017	2021	0.60	0.22	ns
SE_East	F	1951	2021	1.00	1.00	ns
SE_Inla	F	1900	2021	1.00	1.00	ns

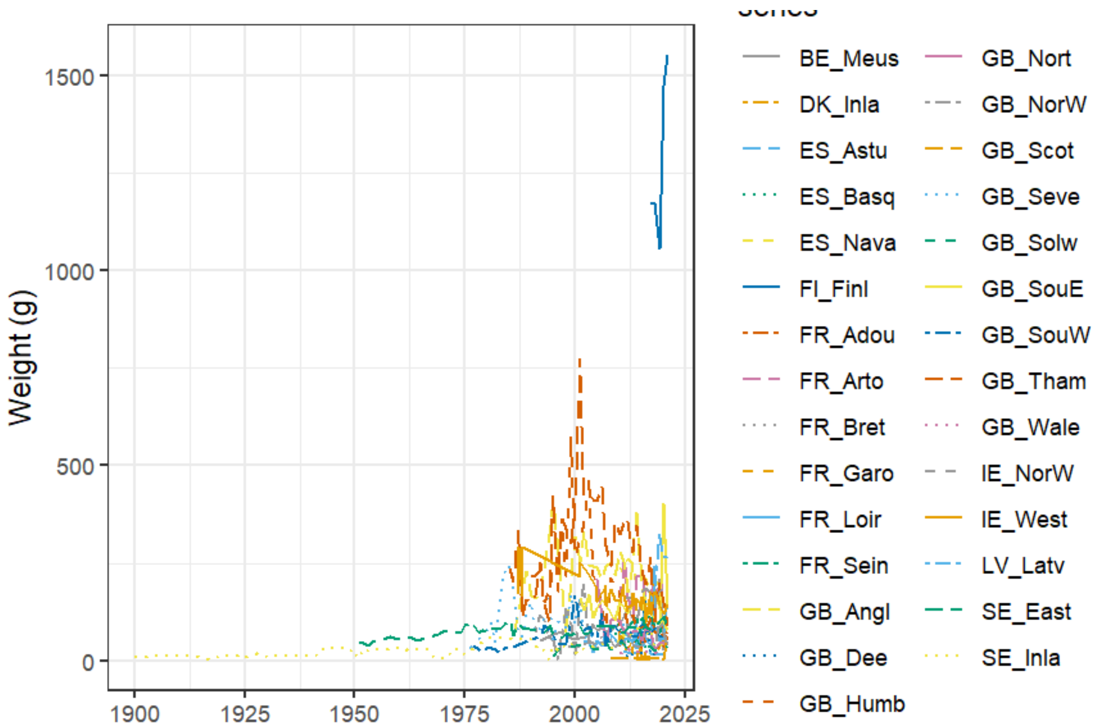

Figure 17. Yellow eel time series temporal trends in average annual weight.

Table 11. Analysis of temporal trends (Mann Kendall) for yellow eel other sampling series annual average weight. Series with significant trends are shown in bold.

EMU	habitat	first year	last year	tau	p.value	signif
DE_Eide	F	2011	2016	0.33	0.45	ns
DE_Elbe	F	2011	2017	0.05	1.00	ns
DE_Ems	T	2011	2020	-0.05	1.00	ns
DE_Rhei	F	2011	2017	-0.14	0.76	ns
DE_Schl	MO	2011	2017	-0.33	0.45	ns
DE_Warn	F	2011	2015	-0.20	0.81	ns
DE_Wese	F	2011	2017	-0.14	0.76	ns
ES_Anda	F	2013	2020	0.80	0.09	ns
ES_Gali	T	2016	2021	-0.60	0.13	ns
FR_Adou	F	2010	2021	-0.60	0.22	ns
FR_Garo	F	2010	2021	-0.33	0.25	ns
GB_Neag	F	2015	2021	0.43	0.23	ns
PL_Oder	T	2016	2021	0.33	0.45	ns
PL_Vist	T	2016	2021	0.47	0.26	ns
SE_East	C	2006	2020	0.18	0.37	ns
SE_West	**C**	**2006**	**2020**	**0.62**	**0.00**	*******

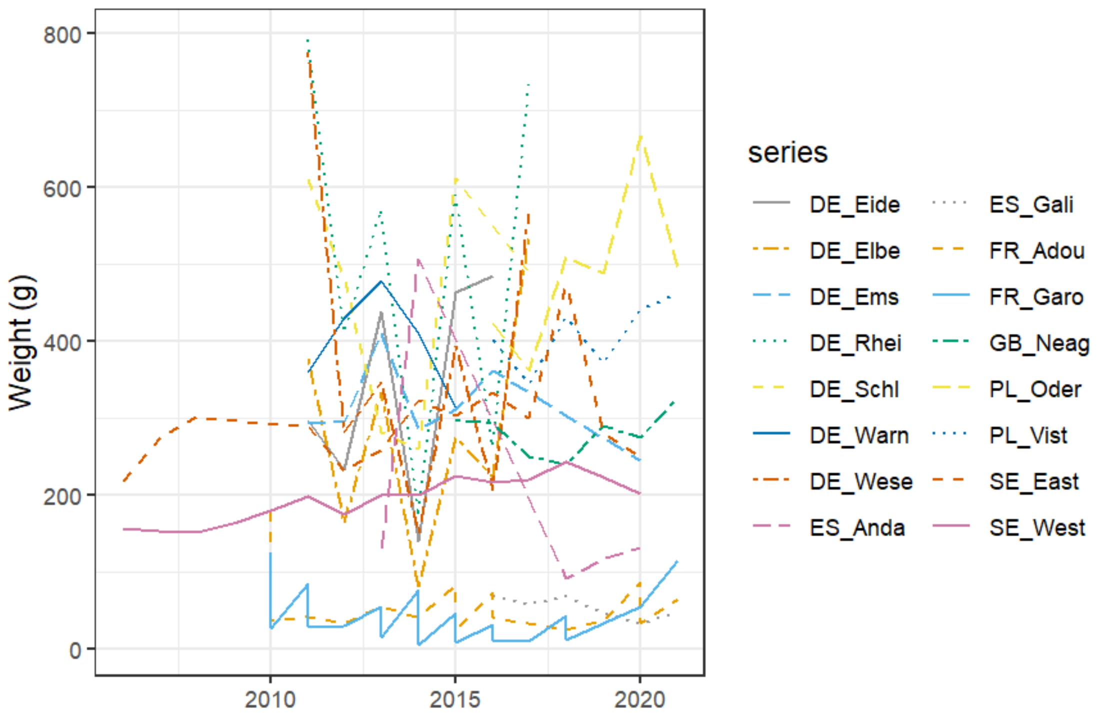

Figure 18. Yellow eel other sampling series temporal trends in average annual weight.

Silver Eel

Only those series for which information was available for both sexes have been included in this analysis.

Of the 11 available series, silver eel length has significantly increased in four series (FR_Bret, FR_Sein, NL_Neth, and NO_total) and decreased in three series (FR_Adou, FR_Loir, IE_West) (Table 12, Figure 19). In the other sampling series, only SE_East showed significant (increasing) trend (Table 13, Figure 20).

Results for weight are very similar as for length. Silver eel weight has significantly increased for the last years in two series (FR_Bret and NO_Total; Table 14, Figure 21) and decreased in three series (FR_adou, FR_Loir, IE_West; Table 14, Figure 21). In the other sampling series, only SE_East showed (increasing) trend (Table 15, Figure 22).

Four of the twelve analysed time series showed a significant trend in sex ratio (proportion of females); an increasing trend in FR-Bret and NO_Total and a decreasing trend in FR_Loir and IE.West. (Table 16, Figure 23). IN the other sampling series, a significant trend was detected in SE_East, where the proportion of females had increased over time (Table 17, Figure 24).

Table 12. Analysis of temporal trends (Mann Kendall) for silver annual average length per EMU in the time series. EMUs with significant trends are shown in bold.

EMU	habitat	first year	last year	tau	p.value	signif
FR_Adou	**F**	**2011**	**2019**	**-0.83**	**0.00**	*******
FR_Bret	**F**	**1996**	**2020**	**0.73**	**0.00**	*******
FR_Loir	**F**	**2013**	**2020**	**-0.86**	**0.00**	*******
FR_Sein	**F**	**1992**	**2020**	**0.58**	**0.00**	*******
GR_EaMT	T	2009	2020	-0.02	1.00	ns
IE_Shan	F	2009	2020	0.60	0.13	ns
IE_West	**F**	**1976**	**2021**	**-0.34**	**0.00**	*******
LV_Latv	F	2017	2021	0.00	1.00	ns
NL_Neth	**F**	**2012**	**2021**	**0.56**	**0.03**	*****
NO_total	**F**	**2012**	**2021**	**0.78**	**0.00**	*******
SE_East	C	2000	2017	0.16	0.36	ns

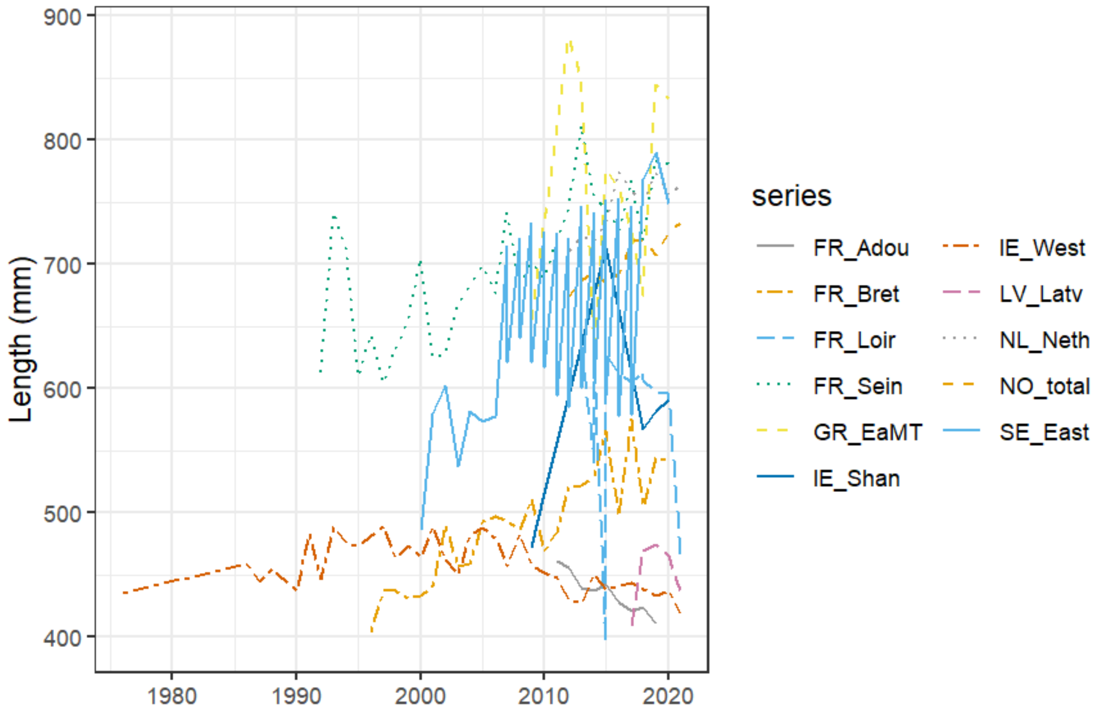

Figure 19. Silver time series temporal trends in annual average annual length (above both sexes included, below per sex).

Table 13. Analysis of temporal trends (Mann Kendall) for silver annual average length per EMU in the other sampling series. EMUs with significant trends are shown in bold.

EMU	habitat	first year	last year	tau	p.value	signif
DE_Eide	F	2011	2016	0.33	0.45	ns
DE_Elbe	F	2011	2017	-0.05	1.00	ns
DE_Ems	T	2011	2020	-0.05	1.00	ns
DE_Rhei	F	2011	2017	0.24	0.55	ns
DE_Schl	MO	2011	2017	-0.07	1.00	ns
DE_Warn	F	2011	2015	0.20	0.81	ns
DE_Wese	F	2011	2017	-0.14	0.76	ns
GB_Neag	F	2014	2021	0.07	0.90	ns
PL_Oder	T	2016	2021	0.28	0.57	ns
PL_Vist	T	2016	2021	0.47	0.26	ns
SE_East	**C**	**2007**	**2020**	**0.69**	**0.00**	*******
SE_Inla	F	2011	2021	-0.07	1.00	ns

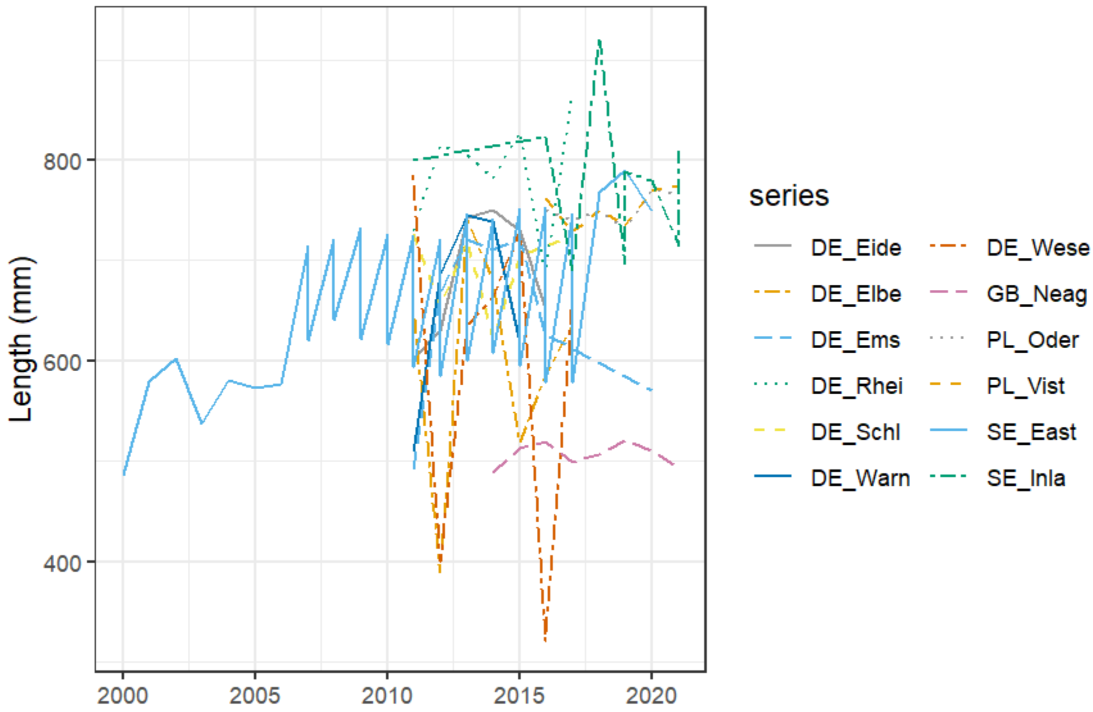

Figure 20. Silver series temporal trends in annual average annual length in the other sampling series. Note that there is an issue with SE_East (2 values per year) data that could not be solved in time for reporting. This figure intends to be an exploration of the potential use of these data; results may contain errors and should not be taken as a final analysis.

Table 14. Analysis of temporal trends (Mann Kendall) for annual average silver weight per EMU in the time series. EMUs with significant trends are shown in bold.

EMU	habitat	first year	last year	tau	p.value	signif
FR_Adou	**F**	**2011**	**2019**	**-0.83**	**0**	***
FR_Bret	**F**	**1996**	**2020**	**0.73**	**0**	***
FR_Loir	**F**	**2013**	**2020**	**-0.86**	**0**	***
GR_EaMT	T	2009	2020	-0.02	1	ns
IE_West	**F**	**1976**	**2021**	**-0.34**	**0**	***
LV_Latv	F	2017	2021	0.00	1	ns
NO_total	**F**	**2012**	**2021**	**0.78**	**0**	***

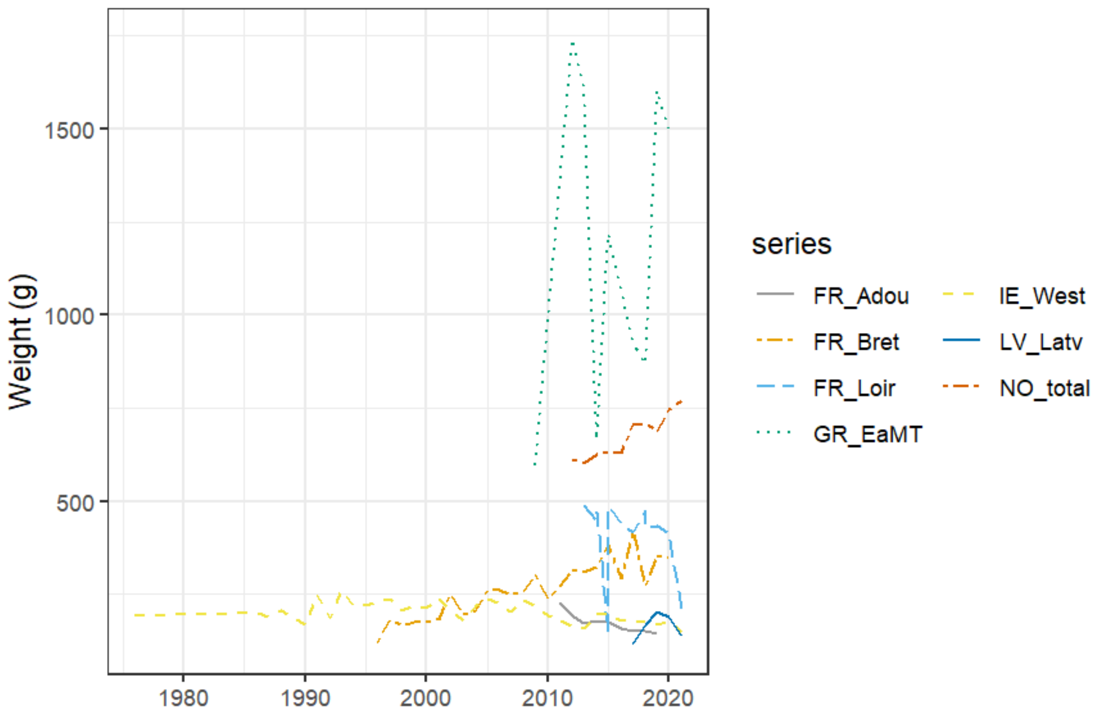

Figure 21. Silver series temporal trends in annual average annual weight in the time series.

Table 15. Analysis of temporal trends (Mann Kendall) in the other sampling series for annual average silver weight per EMU. EMUs with significant trends are shown in bold.

EMU	habitat	first year	last year	tau	p.value	signif
DE_Eide	F	2011	2016	0.33	0.45	ns
DE_Elbe	F	2011	2017	-0.05	1.00	ns
DE_Ems	T	2011	2020	-0.05	1.00	ns
DE_Rhei	F	2011	2017	0.24	0.55	ns
DE_Schl	MO	2011	2017	-0.07	1.00	ns
DE_Warn	F	2011	2015	0.20	0.81	ns
DE_Wese	F	2011	2017	-0.14	0.76	ns
GB_Neag	F	2014	2021	0.07	0.90	ns
PL_Oder	T	2016	2021	0.28	0.57	ns
PL_Vist	T	2016	2021	0.47	0.26	ns
SE_East	**C**	**2007**	**2020**	**0.69**	**0.00**	*******
SE_Inla	F	2011	2021	-0.07	1.00	ns

Figure 22. Silver series temporal trends in annual average annual weight in the other sampling series.

Table 16. Analysis of temporal trends (Mann Kendall) for annual average silver sex ratio (%female) per EMU in the time series. EMUs with significant trends are shown in bold

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EMU	habitat	first year	last year	tau	p.value	signif
DE_Warn	F	2009	2020	1.00	1.00	ns
ES_Basq	F	2007	2020	1.00	1.00	ns
ES_Nava	F	2010	2020	1.00	1.00	ns
FI_Finl	C	2017	2021	1.00	1.00	ns
FI_Finl	F	2014	2021	1.00	1.00	ns
FR_Bret	**F**	**1996**	**2020**	**0.73**	**0.00**	*******
FR_Loir	**F**	**2013**	**2020**	**-0.86**	**0.00**	*******
IE_Shan	F	2009	2020	0.60	0.13	ns
IE_West	**F**	**1976**	**2021**	**-0.34**	**0.00**	*******
LV_Latv	F	2017	2021	0.00	1.00	ns
NO_total	**F**	**2012**	**2020**	**0.72**	**0.01**	******
SE_East	C	2000	2017	0.16	0.36	ns

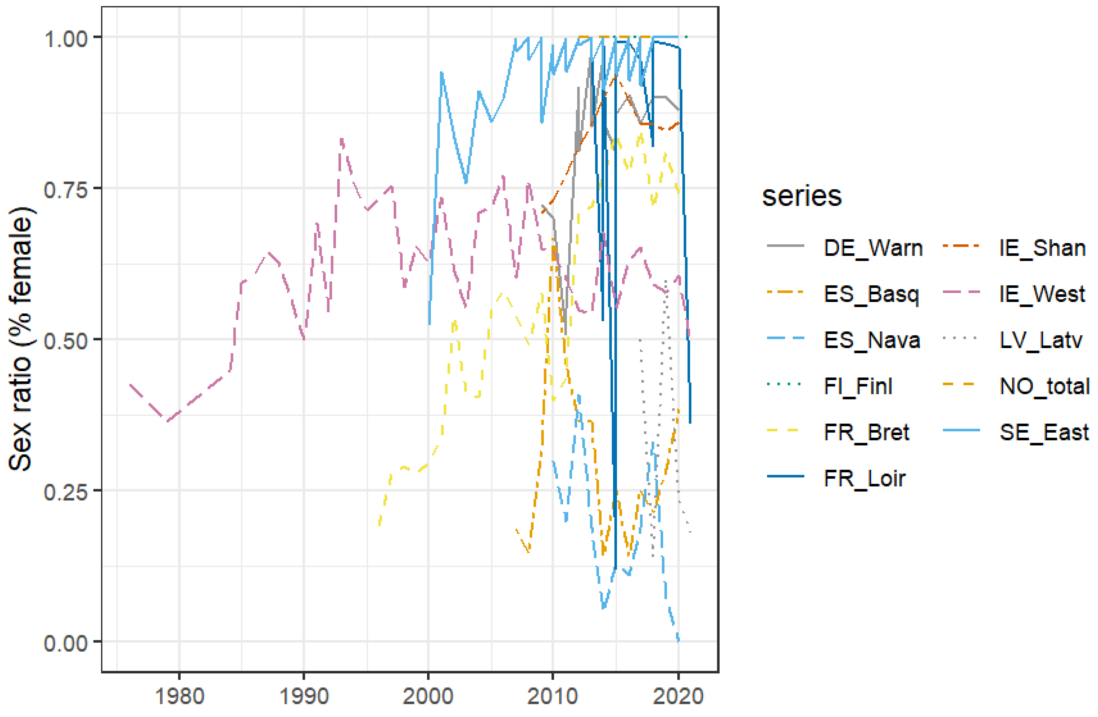


Figure 23. Analysis of temporal trends (Mann Kendall) for silver annual average sex ratio (%female) per EMU in the time series. EMUs with significant trends are shown in bold. Note that there is an issue with SE_East (2 values per year) data that could not be solved in time for reporting. This figure intends to be an exploration of the potential use of these data; results may contain errors and should not be taken as a final analysis.

Table 17. Analysis of temporal trends (Mann Kendall) for annual average silver sex ratio (%female) per EMU in the other sampling series.

EMU	habitat	first year	last year	tau	p.value	signif
DE_Eide	F	2011	2016	0.33	0.45	ns
DE_Elbe	F	2011	2017	-0.05	1.00	ns
DE_Ems	T	2011	2020	-0.05	1.00	ns
DE_Rhei	F	2011	2017	0.24	0.55	ns
DE_Schl	MO	2011	2017	-0.07	1.00	ns
DE_Warn	F	2011	2015	0.20	0.81	ns
DE_Wese	F	2011	2017	-0.14	0.76	ns
GB_Neag	F	2014	2021	0.07	0.90	ns
PL_Oder	T	2016	2021	0.28	0.57	ns
PL_Vist	T	2016	2021	0.47	0.26	ns
SE_East	**C**	**2007**	**2020**	**0.69**	**0.00**	*******
SE_Inla	F	2011	2021	-0.07	1.00	ns

Figure 24. Analysis of temporal trends (Mann Kendall) for silver annual average sex ratio (%female) per EMU in the other sampling series. Note that there is an issue with SE_East (2 values per year) data that could not be solved in time for reporting. This figure intends to be an exploration of the potential use of these data; results may contain errors and should not be taken as a final analysis.

Annex 17: Available individual biometric data

This annex intends to be an exploration of the potential use of these data; results may contain errors and should not be taken as a final analysis.

This is the first year where countries were asked to provided data on the individual metrics of eels. Together 12 countries gave data on 121 series/sampling. Of the 12 countries, 9 have provided individual series data and 7 have provided individual sampling data. France, Germany and Great Britain have provided the most series/samplings. All countries have data on length and weight, but almost half of the series and sampling data is missing the female proportion, pectoral length, mean eye diameter, age and the differentiated propor-tions. Five countries have provided data about glass eels, with France having provided the most. Most of the series/sampling (55) have data on yellow eels and 40 series/sampling are about silver eels. Together the number of individual eels which have their length provided are 556763, weight 393159, age 43481 and female proportion 171591. The lowest number of data has been provided for the age of the eels.

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	FR	FR_Adou	FR_Adou_G_biom	T	G	832	832	0	0	0	0	0
sam-pling	FR	FR_Arto	FR_Arto_G_biom	T	G	150	150	0	0	0	0	0
sam-pling	FR	FR_Bret	FR_Bret_G_biom	T	G	200	200	0	0	0	0	0
sam-pling	FR	FR_Garo	FR_Garo_G_biom	T	G	1,292	1,292	0	0	0	0	0
sam-pling	FR	FR_Loir	FR_Loir_G_biom	T	G	700	700	0	0	0	0	0
sam-pling	FR	FR_Sein	FR_Sein_G_biom	T	G	150	150	0	0	0	0	0
sam-pling	ES	ES_Astu	ES_Astu_Nalon_BIOM	T	G	1,298	1,298	0	0	0	0	0
sam-pling	ES	ES_Astu	ES_Astu_Sella_BIOM	T	G	200	200	0	0	0	0	0
sam-pling	ES	ES_Cant	ES_Cant_Deva_Nansa_HIST	T	G	431	431	0	0	0	0	0
sam-pling	ES	ES_Cata	ES_Cata_Ter_G	T	G	1,392	1,392	0	0	0	0	0
sam-pling	SE	SE_East	SE_East_Asp_CF_PN	C	Y	1	1	1	0	0	0	1
sam-pling	SE	SE_East	SE_East_Bar_SS_FN	C	Y	1,134	1,134	1,134	0	0	961	1,134

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	SE	SE_East	SE_East_Ble_CF_PN	C	Y	23	23	23	0	0	0	23
sam-pling	SE	SE_East	SE_East_Kul_SSCF_FN	C	Y	947	947	948	0	0	424	948
sam-pling	SE	SE_East	SE_East_Kva_CF_FN	C	Y	822	821	822	0	0	0	822
sam-pling	SE	SE_East	SE_East_Ore_CF_FN	C	Y	792	792	792	0	0	590	792
sam-pling	SE	SE_East	SE_East_Ore_SS_FN	C	Y	397	397	397	0	0	99	397
sam-pling	SE	SE_East	SE_East_OSk_SSCF_PN	C	Y	59	59	59	0	0	0	59
sam-pling	SE	SE_East	SE_East_Sim_CF_FN	C	Y	937	937	937	0	0	526	937
sam-pling	SE	SE_East	SE_East_Sim_SS_FN_Env	C	Y	2,148	2,147	2,148	0	0	0	2,148
sam-pling	SE	SE_East	SE_East_Sve_CF_PN	C	Y	10	10	10	0	0	4	10
sam-pling	SE	SE_West	SE_West_Fja_SS_FN	C	Y	1,935	1,935	1,935	0	0	1,686	1,935
sam-pling	SE	SE_West	SE_West_Kar_CF_FN	C	Y	454	456	456	0	0	219	456
sam-pling	SE	SE_West	SE_West_Lys_SSCF_FN	C	Y	1,573	1,576	1,576	0	0	676	1,576

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	SE	SE_West	SE_West_Ons_CF_FN	C	Y	205	205	205	0	0	204	205
sam-pling	SE	SE_West	SE_West_Rin_SS_FN	C	Y	1,536	1,536	1,536	0	0	1,396	1,536
sam-pling	SE	SE_West	SE_West_Ste_SSCF_FN	C	Y	2,693	2,694	2,693	0	0	1,780	2,694
sam-pling	SE	SE_Inla	SE_Inla_Bolmen_HIST	F	Y	6	6	6	6	6	6	6
sam-pling	SE	SE_Inla	SE_Inla_Hjalmaren_HIST	F	Y	20	20	20	20	20	20	20
sam-pling	SE	SE_Inla	SE_Inla_Malaren_HIST	F	Y	876	876	795	827	827	451	795
sam-pling	SE	SE_Inla	SE_Inla_MalarenGalten_HIST	F	Y	3	3	3	3	3	3	3
sam-pling	SE	SE_Inla	SE_Inla_Ringsjon_HIST	F	Y	22	22	22	22	22	20	22
sam-pling	SE	SE_Inla	SE_Inla_Roxen_HIST	F	Y	15	15	15	15	15	15	15
sam-pling	SE	SE_Inla	SE_Inla_Vanern_HIST	F	Y	22	22	22	22	22	20	22
sam-pling	SE	SE_Inla	SE_Inla_VanernDattern_HIST	F	Y	5	5	5	5	5	5	5
sam-pling	SE	SE_Inla	SE_Inla_Ymsen_HIST	F	Y	25	25	25	25	25	8	25

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	PL	PL_Oder	PL_Oder_Szczecin_lagoon_HIST	T	Y	865	865	865	865	865	865	865
sam-pling	PL	PL_Vist	PL_Vist_Vistula_lagoon_HIST	T	Y	1,629	1,629	1,629	1,629	1,629	1,629	1,629
sam-pling	DE	DE_Eide	DE_Eide_Eider_DCF_F_Y	F	Y	294	294	289	294	294	241	294
sam-pling	DE	DE_Eide	DE_Eide_Eider_QUAL_hg_F_Y	F	Y	5	5	5	5	5	5	5
sam-pling	DE	DE_Elbe	DE_Elbe_Elbe_DCF_F_Y	F	Y	495	495	430	495	495	375	457
sam-pling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_cd_F_Y	F	Y	27	27	26	27	27	27	27
sam-pling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_hg_F_Y	F	Y	74	74	73	74	74	73	74
sam-pling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_pb_F_Y	F	Y	27	27	26	27	27	27	27
sam-pling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_teq_F_Y	F	Y	27	27	27	27	27	27	27
sam-pling	DE	DE_Ems	DE_Ems_BALANCE_DCF_F_Y	F	Y	4	4	0	4	4	0	0
sam-pling	DE	DE_Ems	DE_Ems_Ems_DCF_F_Y	F	Y	124	124	117	124	124	0	117
sam-pling	DE	DE_Oder	DE_Oder_Oder_DCF_F_Y	F	Y	87	87	67	87	87	87	67

source	country	EMU	name	habitat	Life stage	length	weight	Female proportion	pectoral length	Eye_diam_mean	age	differentiated proportion
sampling	DE	DE_Rhei	DE_Rhei_Rhein_DCF_F_Y	F	Y	433	433	394	433	433	340	395
sampling	DE	DE_Rhei	DE_Rhei_Rhein_QUAL_hg_F_Y	F	Y	17	17	17	17	17	17	17
sampling	DE	DE_Schl	DE_Schl_Other_DCF_F_Y	F	Y	148	148	147	148	148	135	148
sampling	DE	DE_Schl	DE_Schl_Other_QUAL_teq_F_Y	F	Y	1	1	1	1	1	1	1
sampling	DE	DE_Warn	DE_Warn_Other_DCF_F_Y	F	Y	190	190	136	190	190	183	136
sampling	DE	DE_Wese	DE_Wese_Weser_DCF_F_Y	F	Y	490	490	431	490	490	345	432
sampling	DE	DE_Schl	DE_Schl_Schlei_DCF_MO_Y	MO	Y	184	184	183	184	184	171	183
sampling	DE	DE_Schl	DE_Schl_Schlei_QUAL_teq_MO_Y	MO	Y	3	3	3	3	3	3	3
sampling	DE	DE_Warn	DE_Warn_Other_DCF_MO_Y	MO	Y	8	8	8	8	8	8	8
sampling	DE	DE_Elbe	DE_Elbe_Elbe_DCF_T_Y	T	Y	94	94	84	94	94	92	94
sampling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_cd_T_Y	T	Y	4	4	3	4	4	4	4
sampling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_hg_T_Y	T	Y	33	33	32	33	33	33	33

source	country	EMU	name	habitat	Life stage	length	weight	Female proportion	pectoral length	Eye_diam_mean	age	differentiated proportion
sampling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_pb_T_Y	T	Y	4	4	3	4	4	4	4
sampling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_teq_T_Y	T	Y	5	5	4	5	5	5	5
sampling	DE	DE_Ems	DE_Ems_BALANCE_DCF_T_Y	T	Y	20	20	12	20	20	0	12
sampling	DE	DE_Ems	DE_Ems_Ems_DCF_T_Y	T	Y	464	464	438	464	464	411	456
sampling	NL	NL_Neth	NL_Neth_market	F	Y	8,734	8,731	8,734	4,140	4,149	450	8,734
sampling	GB	GB_Neag	GB_Neag_Neagh_Yellow_HIST	F	Y	460	460	460	0	0	70	460
sampling	FR	FR_Adou	FR_Adou_YS_biom	F	Y	493	493	172	201	201	398	493
sampling	FR	FR_Garo	FR_Garo_YS_biom	F	Y	1,266	1,266	219	424	424	1,145	1,267
sampling	FR	FR_Loir	FR_Loir_YS_biom	F	Y	698	698	492	253	253	636	698
sampling	ES	ES_Murc	ES_Murc_BIO	C	Y	56	56	0	0	0	0	0
sampling	ES	ES_Anda	ES_Anda_Adra_BIOM	F	Y	1	1	0	1	1	0	1
sampling	ES	ES_Anda	ES_Anda_Aguas_BIOM	F	Y	10	10	0	10	10	0	10

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	ES	ES_Anda	ES_Anda_Almanzora_BIOM	F	Y	3	3	0	3	3	0	3
sam-pling	ES	ES_Anda	ES_Anda_Antas_AC_EVEX_PCB	F	Y	10	10	0	0	0	0	0
sam-pling	ES	ES_Anda	ES_Anda_Antas_BIOM	F	Y	37	37	0	37	37	0	37
sam-pling	ES	ES_Anda	ES_Anda_Barbate_AC_EVEX_PCB	F	Y	8	8	0	0	0	0	0
sam-pling	ES	ES_Anda	ES_Anda_Barbate_BIOM	F	Y	463	387	0	387	388	0	463
sam-pling	ES	ES_Anda	ES_Anda_Cachon_BIOM	F	Y	3	3	0	0	0	0	3
sam-pling	ES	ES_Anda	ES_Anda_Conil_BIOM	F	Y	49	49	0	0	0	0	49
sam-pling	ES	ES_Anda	ES_Anda_Guadaira_BIOM	F	Y	19	19	0	14	14	0	19
sam-pling	ES	ES_Anda	ES_Anda_Guadalete_BIOM	F	Y	135	135	0	75	76	0	135
sam-pling	ES	ES_Anda	ES_Anda_Guadalfeo_AC_EVEX_PCB	F	Y	10	10	0	0	0	0	0
sam-pling	ES	ES_Anda	ES_Anda_Guadalfeo_BIOM	F	Y	25	25	0	25	25	0	25
sam-pling	ES	ES_Anda	ES_Anda_Guadalhorce_AC_EVEX_PCB	F	Y	8	8	0	0	0	0	0

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	ES	ES_Anda	ES_Anda_Guadalhorce_BIOM	F	Y	162	162	0	155	153	0	162
sam-pling	ES	ES_Anda	ES_Anda_Guadalmasa_BIOM	F	Y	2	2	0	0	0	0	2
sam-pling	ES	ES_Anda	ES_Anda_Guadarranque_BIOM	F	Y	49	49	0	37	37	0	49
sam-pling	ES	ES_Anda	ES_Anda_Guadiamar_BIOM	F	Y	31	31	0	27	27	0	31
sam-pling	ES	ES_Anda	ES_Anda_Guadiana_BIOM	F	Y	46	46	0	0	0	0	46
sam-pling	ES	ES_Anda	ES_Anda_Guadiaro_BIOM	F	Y	14	14	0	0	0	0	14
sam-pling	ES	ES_Anda	ES_Anda_Jara_BIOM	F	Y	18	18	0	0	0	0	18
sam-pling	ES	ES_Anda	ES_Anda_Morales_BIOM	F	Y	1	1	0	1	1	0	1
sam-pling	ES	ES_Anda	ES_Anda_Odiel_BIOM	F	Y	9	9	0	0	0	0	9
sam-pling	ES	ES_Anda	ES_Anda_Ojen_BIOM	F	Y	12	12	0	0	0	0	12
sam-pling	ES	ES_Anda	ES_Anda_Palmones_AC_EVEX_PCB	F	Y	6	6	0	0	0	0	0
sam-pling	ES	ES_Anda	ES_Anda_Palmones_BIOM	F	Y	27	27	0	16	17	0	27

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	ES	ES_Anda	ES_Anda_Piedras_AC_EVEX_PCB	F	Y	10	10	0	0	0	0	0
sam-pling	ES	ES_Anda	ES_Anda_Piedras_BIOM	F	Y	39	22	0	0	0	0	39
sam-pling	ES	ES_Anda	ES_Anda_Roche_BIOM	F	Y	1	1	0	0	0	0	1
sam-pling	ES	ES_Anda	ES_Anda_Salado_BIOM	F	Y	22	22	0	0	0	0	22
sam-pling	ES	ES_Anda	ES_Anda_SanctiPetri_BIOM	F	Y	58	58	0	0	0	0	58
sam-pling	ES	ES_Anda	ES_Anda_SanPedro_BIOM	F	Y	16	16	0	0	0	0	16
sam-pling	ES	ES_Anda	ES_Anda_Tinto_AC_EVEX_PCB	F	Y	21	21	0	0	0	0	0
sam-pling	ES	ES_Anda	ES_Anda_Tinto_BIOM	F	Y	47	46	0	0	0	0	47
sam-pling	ES	ES_Anda	ES_Anda_Torrox_BIOM	F	Y	2	2	0	0	0	0	2
sam-pling	ES	ES_Anda	ES_Anda_Valle_BIOM	F	Y	15	15	0	0	0	0	15
sam-pling	ES	ES_Anda	ES_Anda_Vega_BIOM	F	Y	28	28	0	0	0	0	28
sam-pling	ES	ES_Anda	ES_Anda_Verde_BIOM	F	Y	1	1	0	1	1	0	1

source	country	EMU	name	habitat	Life stage	length	weight	Female proportion	pectoral length	Eye_diam_mean	age	differentiated proportion
sampling	ES	ES_Anda	ES_Anda_VetaPalma_AC_EVEX_PCB	F	Y	50	50	0	0	0	0	0
sampling	ES	ES_Cant	ES_Gali_Eo	F	Y	199	199	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_ArousaF	F	Y	260	260	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_Ferrol	F	Y	36	36	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_Minho	F	Y	919	919	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_Otros	F	Y	2,376	2,376	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_Vigo	F	Y	30	30	0	0	0	0	0
sampling	ES	ES_Mino	ES_Gali_MinhOtros	F	Y	595	595	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_ArousaT	T	Y	3,426	3,426	0	0	0	0	0
sampling	SE	SE_East	SE_East_Asp_CF_PN	C	S	241	241	241	0	0	0	241
sampling	SE	SE_East	SE_East_Bar_SS_FN	C	S	27	27	27	0	0	0	27
sampling	SE	SE_East	SE_East_Ble_CF_PN	C	S	3,701	3,701	3,702	0	0	2,479	3,702

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	SE	SE_East	SE_East_Kul_SSCF_FN	C	S	9	9	9	0	0	0	9
sam-pling	SE	SE_East	SE_East_Kva_CF_FN	C	S	64	64	64	0	0	0	64
sam-pling	SE	SE_East	SE_East_OSk_SSCF_PN	C	S	1,050	1,050	1,050	0	0	497	1,050
sam-pling	SE	SE_East	SE_East_Sim_CF_PN	C	S	2,369	2,369	2,369	0	0	1,809	2,369
sam-pling	SE	SE_East	SE_East_Sve_CF_PN	C	S	2,612	2,613	2,613	0	0	2,161	2,613
sam-pling	SE	SE_West	SE_West_Fja_SS_FN	C	S	9	9	9	0	0	0	9
sam-pling	SE	SE_West	SE_West_Rin_SS_FN	C	S	12	12	12	0	0	0	12
sam-pling	SE	SE_West	SE_West_Ste_SSCF_FN	C	S	26	26	26	0	0	0	26
sam-pling	SE	SE_Inla	SE_Inla_Bolmen_HIST	F	S	632	632	630	631	631	495	630
sam-pling	SE	SE_Inla	SE_Inla_Hjalmaren_HIST	F	S	470	470	470	469	470	457	470
sam-pling	SE	SE_Inla	SE_Inla_Malaren_HIST	F	S	1,936	1,936	1,850	1,925	1,930	1,667	1,850
sam-pling	SE	SE_Inla	SE_Inla_MalarenGalten_HIST	F	S	73	73	73	73	73	68	73

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	SE	SE_Inla	SE_Inla_Ringsjon_HIST	F	S	229	229	229	229	229	210	229
sam-pling	SE	SE_Inla	SE_Inla_Roxen_HIST	F	S	484	484	484	484	484	477	484
sam-pling	SE	SE_Inla	SE_Inla_Vanern_HIST	F	S	1,279	1,279	1,279	1,264	1,264	1,230	1,279
sam-pling	SE	SE_Inla	SE_Inla_VanernDattern_HIST	F	S	429	429	429	402	429	418	429
sam-pling	SE	SE_Inla	SE_Inla_Ymsen_HIST	F	S	453	453	454	454	453	246	454
sam-pling	PL	PL_Oder	PL_Oder_Szczecin_lagoon_HIST	T	S	394	394	394	394	394	394	394
sam-pling	PL	PL_Vist	PL_Vist_Vistula_lagoon_HIST	T	S	476	476	476	476	476	476	476
sam-pling	DE	DE_Eide	DE_Eide_Eider_DCF_F_S	F	S	255	255	255	255	255	223	254
sam-pling	DE	DE_Eide	DE_Eide_Eider_QUAL_teq_F_S	F	S	5	5	5	5	5	5	5
sam-pling	DE	DE_Elbe	DE_Elbe_Elbe_DCF_F_S	F	S	179	179	179	179	179	53	60
sam-pling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_cd_F_S	F	S	5	5	5	5	5	5	5
sam-pling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_hg_F_S	F	S	5	5	5	5	5	5	5

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_pb_F_S	F	S	5	5	5	5	5	5	5
sam-pling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_teq_F_S	F	S	5	5	5	5	5	5	5
sam-pling	DE	DE_Ems	DE_Ems_BALANCE_DCF_F_S	F	S	33	33	33	33	33	0	0
sam-pling	DE	DE_Ems	DE_Ems_Ems_DCF_F_S	F	S	109	109	109	109	109	0	22
sam-pling	DE	DE_Oder	DE_Oder_Oder_DCF_F_S	F	S	97	97	97	97	97	97	57
sam-pling	DE	DE_Rhei	DE_Rhei_Rhein_DCF_F_S	F	S	372	372	372	372	372	356	349
sam-pling	DE	DE_Rhei	DE_Rhei_Rhein_QUAL_cd_F_S	F	S	10	10	10	10	10	10	10
sam-pling	DE	DE_Rhei	DE_Rhei_Rhein_QUAL_hg_F_S	F	S	30	30	30	30	30	30	30
sam-pling	DE	DE_Rhei	DE_Rhei_Rhein_QUAL_pb_F_S	F	S	10	10	10	10	10	10	10
sam-pling	DE	DE_Rhei	DE_Rhei_Rhein_QUAL_teq_F_S	F	S	10	10	10	10	10	10	10
sam-pling	DE	DE_Schl	DE_Schl_Other_DCF_F_S	F	S	153	153	153	153	153	95	145
sam-pling	DE	DE_Warn	DE_Warn_Other_DCF_F_S	F	S	225	225	225	225	225	202	148

source	country	EMU	name	habitat	Life stage	length	weight	Female proportion	pectoral length	Eye_diam_mean	age	differentiated proportion
sampling	DE	DE_Wese	DE_Wese_Weser_DCF_F_S	F	S	383	383	383	383	383	143	142
sampling	DE	DE_Schl	DE_Schl_Schlei_DCF_MO_S	MO	S	122	122	122	122	122	84	92
sampling	DE	DE_Schl	DE_Schl_Schlei_QUAL_teq_MO_S	MO	S	2	2	2	2	2	2	2
sampling	DE	DE_Warn	DE_Warn_Other_DCF_MO_S	MO	S	54	54	54	54	54	54	54
sampling	DE	DE_Elbe	DE_Elbe_Elbe_DCF_T_S	T	S	9	9	9	9	9	9	9
sampling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_cd_T_S	T	S	5	5	5	5	5	5	5
sampling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_hg_T_S	T	S	5	5	5	5	5	5	5
sampling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_pb_T_S	T	S	5	5	5	5	5	5	5
sampling	DE	DE_Elbe	DE_Elbe_Elbe_QUAL_teq_T_S	T	S	5	5	5	5	5	5	5
sampling	DE	DE_Ems	DE_Ems_BALANCE_DCF_T_S	T	S	8	8	8	8	8	0	8
sampling	DE	DE_Ems	DE_Ems_Ems_DCF_T_S	T	S	365	365	365	365	365	308	363
sampling	DE	DE_Ems	DE_Ems_Ems_QUAL_teq_T_S	T	S	5	5	5	5	5	5	5

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	NL	NL_Neth	NL_Neth_market	F	S	1,159	1,159	1,159	374	372	103	1,159
sam-pling	GB	GB_Neag	GB_Neag_Neagh_Silver_Female_HIST	F	S	401	401	401	0	0	63	401
sam-pling	GB	GB_Neag	GB_Neag_Neagh_Silver_Male_HIST	F	S	380	370	380	0	0	150	380
sam-pling	FR	FR_Loir	FR_Loir_YS_biom	F	S	198	198	198	50	50	194	198
sam-pling	ES	ES_Murc	ES_Murc_BIO	C	S	52	52	0	0	0	0	0
sam-pling	ES	ES_Murc	ES_Murc_CON	C	S	18	18	0	0	0	0	0
sam-pling	ES	ES_Anda	ES_Anda_Antas_BIOM	F	S	1	1	0	1	1	0	1
sam-pling	ES	ES_Anda	ES_Anda_Barbate_BIOM	F	S	18	16	0	18	18	0	18
sam-pling	ES	ES_Anda	ES_Anda_Guadalete_BIOM	F	S	6	6	0	2	2	0	6
sam-pling	ES	ES_Anda	ES_Anda_Guadalhorce_BIOM	F	S	7	7	0	7	7	0	7
sam-pling	ES	ES_Anda	ES_Anda_Morales_BIOM	F	S	4	4	0	4	4	0	4
sam-pling	ES	ES_Anda	ES_Anda_SanctiPetri_BIOM	F	S	2	2	0	0	0	0	2

source	country	EMU	name	habitat	Life stage	length	weight	Female proportion	pectoral length	Eye_diam_mean	age	differentiated proportion
sampling	ES	ES_Anda	ES_Anda_SanPedro_BIOM	F	S	1	1	0	0	0	0	1
sampling	ES	ES_Anda	ES_Anda_Tinto_BIOM	F	S	1	1	0	0	0	0	1
sampling	ES	ES_Cant	ES_Gali_Eo	F	S	8	8	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_ArousaF	F	S	16	16	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_Ferrol	F	S	6	6	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_Minho	F	S	3	3	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_Otros	F	S	162	162	0	0	0	0	0
sampling	ES	ES_Gali	ES_Gali_Vigo	F	S	6	6	0	0	0	0	0
sampling	ES	ES_Mino	ES_Gali_MinhOtros	F	S	37	37	0	0	0	0	0
sampling	FR	FR_Loir	FR_Loir_YS_biom	F	YS	449	449	200	199	200	431	449
sampling	FR	FR_Bret	FR_Bret_Obsv_biom	T	YS	0	235	0	0	0	0	0
sampling	FR	FR_Garo	FR_Garo_Obsv_biom	T	YS	0	870	0	0	0	0	0

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
sam-pling	FR	FR_Loir	FR_Loir_Obsv_biom	T	YS	0	684	0	0	0	0	0
sam-pling	FR	FR_Rhon	FR_Rhon_Obsv_biom	T	YS	0	4,765	0	0	0	0	0
sam-pling	ES	ES_Murc	ES_Murc_BIO	C	YS	4	4	0	0	0	0	0
sam-pling	ES	ES_Cata	ES_Cata_Ter_YS	F	YS	2,321	2,321	0	758	759	0	2,321
sam-pling	NL	NL_Neth	NL_Neth_market	F		5	5	5	2	2	0	5
series	IE	IE_Shan	InagG	F	G	23	23	0	0	0	0	0
series	GB	GB_Scot	ShiFG	F	G	2,556	0	0	0	0	2,556	2,556
series	GB	GB_Scot	ShiMG	T	G	2,436	429	0	0	0	2,436	2,436
series	FR	FR_Rhon	VacG	T	G	14,252	14,196	0	0	0	0	14,252
series	PT	ES_Minh	MiScG	T	G	3,209	3,209	0	0	0	0	0
series	PT	PT_Port	MondG	T	G	2,617	2,617	0	0	0	0	0
series	IE	IE_West	BurrGY	F	GY	424	424	0	0	0	0	0
series	IE	IE_West	CorG	F	GY	34	19	0	0	0	0	0
series	GB	GB_Neag	BannGY	F	GY	3,861	459	0	0	0	3,861	0
series	GB	GB_NorE	StraGY	F	GY	1,650	600	0	0	0	1,650	0
series	NO	NO_total	SkaY	C	Y	380	0	0	0	0	0	0

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
series	SE	SE_East	BarY	MO	Y	2,277	2,277	2,277	0	0	2,253	2,277
series	SE	SE_West	VenY	MO	Y	1,482	1,482	1,482	0	0	1,200	1,482
series	FI	FI_Finl	KuloY	F	Y	145	144	0	131	132	107	145
series	FI	FI_Finl	VesiY	F	Y	252	252	0	213	252	200	252
series	LV	LV_Latv	DaugY	F	Y	437	437	16	437	437	16	437
series	LV	LV_Latv	LilY	F	Y	125	125	4	125	125	4	125
series	IE	IE_West	BFeY	F	Y	9,417	9,393	0	4,479	4,482	0	0
series	IE	IE_West	BuBY	F	Y	2,013	1,788	0	423	423	0	0
series	IE	IE_West	BFuY	T	Y	12,777	12,693	0	1,824	1,824	0	0
series	IE	IE_West	BLFY	T	Y	3,933	3,924	0	750	750	0	0
series	GB	GB_Angl	ChBY	F	Y	4,795	4,795	0	0	0	0	0
series	GB	GB_Angl	GrOY	F	Y	1,509	1,509	0	0	0	0	0
series	GB	GB_Angl	NenY	F	Y	191	191	0	0	0	0	0
series	GB	GB_Angl	SuSY	F	Y	2,305	2,305	0	0	0	0	0
series	GB	GB_Angl	WelY	F	Y	2,899	2,899	0	0	0	0	0
series	GB	GB_Angl	WenY	F	Y	486	486	0	0	0	0	0
series	GB	GB_Angl	WitY	F	Y	2,062	2,062	0	0	0	0	0
series	GB	GB_Dee	DeeY	F	Y	2,687	0	0	0	0	0	0
series	GB	GB_Humb	HumY	F	Y	5,357	5,357	0	0	0	0	0

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
series	GB	GB_NorE	KilY	F	Y	26	26	26	0	0	0	26
series	GB	GB_NorE	LagY	F	Y	182	181	180	0	0	45	182
series	GB	GB_Nort	CoqY	F	Y	288	288	0	0	0	0	0
series	GB	GB_Nort	WerY	F	Y	1,832	1,832	0	0	0	0	0
series	GB	GB_NorW	BelY	F	Y	1,015	1,015	0	0	0	0	0
series	GB	GB_NorW	DerY	F	Y	1,477	1,477	0	0	0	0	0
series	GB	GB_NorW	EllY	F	Y	307	307	0	0	0	0	0
series	GB	GB_NorW	MerY	F	Y	453	453	0	0	0	0	0
series	GB	GB_NorW	RibY	F	Y	5,726	5,726	0	0	0	0	0
series	GB	GB_NorW	WevY	F	Y	236	236	0	0	0	0	0
series	GB	GB_Scot	BadY	F	Y	396	224	0	0	0	0	0
series	GB	GB_Scot	GirnY	F	Y	7,077	6,789	0	0	0	0	0
series	GB	GB_Scot	GirY	F	Y	1,458	1,023	0	0	0	0	0
series	GB	GB_Scot	ShiY	F	Y	573	132	0	0	0	0	0
series	GB	GB_Seve	SevY	F	Y	15,647	15,647	0	0	0	0	0
series	GB	GB_Seve	UskY	F	Y	2,389	0	0	0	0	0	0
series	GB	GB_Seve	WyeY	F	Y	205	205	0	0	0	0	0
series	GB	GB_Solw	BoEY	F	Y	1,850	1,850	0	0	0	0	0
series	GB	GB_Solw	EdeY	F	Y	2,910	2,910	0	0	0	0	0

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
series	GB	GB_Solw	TweY	F	Y	175	175	0	0	0	0	0
series	GB	GB_SouE	ItcY	F	Y	1,633	1,633	0	0	0	0	0
series	GB	GB_SouE	OusY	F	Y	1,072	1,072	0	0	0	0	0
series	GB	GB_SouE	TesY	F	Y	836	836	0	0	0	0	0
series	GB	GB_SouW	DoSY	F	Y	301	301	0	0	0	0	0
series	GB	GB_SouW	ExeY	F	Y	400	400	0	0	0	0	0
series	GB	GB_SouW	FowY	F	Y	5,444	5,444	0	0	0	0	0
series	GB	GB_SouW	FroY	F	Y	2,105	2,105	0	0	0	0	0
series	GB	GB_SouW	HaAY	F	Y	1,055	1,055	0	0	0	0	0
series	GB	GB_SouW	OttY	F	Y	223	223	0	0	0	0	0
series	GB	GB_SouW	ParY	F	Y	6,206	6,206	0	0	0	0	0
series	GB	GB_SouW	PlyY	F	Y	2,108	2,108	0	0	0	0	0
series	GB	GB_SouW	TamY	F	Y	2,488	2,488	0	0	0	0	0
series	GB	GB_SouW	TawY	F	Y	290	290	0	0	0	0	0
series	GB	GB_SouW	TegY	F	Y	105	105	0	0	0	0	0
series	GB	GB_Tham	LeeY	F	Y	389	389	0	0	0	0	0
series	GB	GB_Tham	MedY	F	Y	228	228	0	0	0	0	0
series	GB	GB_Tham	ThaY	F	Y	6,864	6,864	0	0	0	0	0
series	GB	GB_Wale	TefY	F	Y	1,566	0	0	0	0	0	0

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
series	GB	GB_Wale	TyTY	F	Y	479	0	0	0	0	0	0
series	GB	GB_Wale	WniY	F	Y	3,650	0	0	0	0	0	0
series	FR	FR_Adou	AdoY	F	Y	3,977	3,928	0	0	0	0	0
series	FR	FR_Adou	SouY	F	Y	13,843	13,835	0	0	0	0	0
series	FR	FR_Arto	AaY	F	Y	2,340	2,326	0	1,366	1,367	0	0
series	FR	FR_Arto	AutY	F	Y	664	655	0	491	491	0	0
series	FR	FR_Arto	EscY	F	Y	444	444	0	424	424	0	0
series	FR	FR_Arto	SomY	F	Y	4,547	4,352	0	1,577	1,577	0	0
series	FR	FR_Bret	FremY	F	Y	10,883	7,095	409	850	1,014	0	0
series	FR	FR_Bret	FreY	F	Y	179,363	3,374	0	0	0	0	179,366
series	FR	FR_Bret	VilY	F	Y	13,847	6,704	0	726	727	0	0
series	FR	FR_Loir	SeNY	F	Y	4,654	4,654	0	735	870	0	0
series	FR	FR_Sein	BreY	F	Y	1,244	938	0	0	0	0	0
series	FR	FR_Sein	DivY	F	Y	1,992	0	0	0	0	0	0
series	FR	FR_Sein	DouY	F	Y	2,421	0	0	0	0	0	0
series	FR	FR_Sein	OrnY	F	Y	3,382	0	0	0	0	0	0
series	FR	FR_Sein	SciY	F	Y	461	394	0	0	0	0	0
series	FR	FR_Sein	SeiY	F	Y	5,802	3,808	0	0	0	0	0
series	FR	FR_Sein	TouY	F	Y	2,222	97	0	0	0	0	0

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
series	FR	FR_Sein	VirY	F	Y	4,854	0	0	0	0	0	0
series	FR	FR_Sein	YerY	F	Y	965	739	0	0	0	0	0
series	PT	ES_Minh	MinY	F	Y	168	168	18	13	11	155	138
series	PT	PT_Port	MonY	F	Y	269	269	124	22	22	225	269
series	SE	SE_Inla	KavlS	F	S	52	53	53	53	53	33	53
series	FI	FI_Finl	KotkS	C	S	275	275	275	251	275	253	275
series	FI	FI_Finl	VaakS	F	S	2,347	2,368	2,371	687	713	43	2,371
series	LV	LV_Latv	DaugS	F	S	73	73	73	73	73	20	73
series	LV	LV_Latv	LilS	F	S	192	192	192	192	192	0	192
series	IE	IE_West	BurS	F	S	57,890	56,081	57,897	10,112	11,174	1,064	0
series	GB	GB_NorE	StrS	F	S	223	223	223	0	0	0	223
series	GB	GB_Scot	BaBS	F	S	694	658	0	0	0	0	694
series	GB	GB_Scot	GiBS	F	S	4,000	1,323	0	0	0	0	4,000
series	GB	GB_Scot	ShiS	F	S	2,986	2,164	0	0	0	0	3,005
series	FR	FR_Adou	SouS	F	S	41,727	42,562	41,727	13,771	13,771	0	0
series	FR	FR_Bret	FreS	F	S	10,483	9,422	10,483	4,571	6,112	0	0
series	FR	FR_Loir	SeNS	F	S	89	89	89	11	7	0	0
series	ES	ES_Astu	NalS	F	S	360	360	279	360	360	0	360
series	ES	ES_Basq	OriS	F	S	852	852	852	753	753	0	852

source	country	EMU	name	habi-tat	Life stage	length	weight	Female propor-tion	pectoral length	Eye_diam_mean	age	differentiated proportion
series	ES	ES_Nava	BidS	F	S	1,185	1,185	1,185	1,185	1,185	0	1,185
series	PT	ES_Minh	MinS	F	S	84	84	84	84	84	0	0
series	PT	PT_Port	MonS	F	S	63	63	63	63	63	61	0

Table 1. Number of available data in individual series and sampling with provided length, weight, female proportion, pectoral length, mean eye diameter, age and differentiated proportion.

Length data

Figure 3.11. shows that most of the data for the length of glass eels is obtained from glass eel data series. Data about the length of the unsorted yellow-silver eels only comes from fisheries and scientific sampling. This is because of the different methods and locations the data is obtained. There is still some missing data from fisheries sampling where the life stage of the eel is not provided. This is an area where the quality of gathered data should be improved.

According to the data provided by countries (Figure 3.12.), yellow and silver eels reach bigger length in northern regions (north-eastern part of the Baltic sea) compared to southern part of their distribution range.

According to the data provided (Figure 3.13.) there are no significant differences in glass eel length distribution in different countries but in United Kingdom average glass eel length is slightly bigger that in other countries that provided glass eel length data.

These results should however be taken with cares, with as these may not be representative of each EMU / country and can be biased by the sampling protocol (gear, habitat, …).

The figure 3.14 gives the spatial distribution of the available length data by life stage, by habitat and by source (Annex of the data call). Samples come mainly from Western and Northern Europe and from places close to the sea. Weight, age and sex data have a more spatially restricted distribution since they are mainly a sub sample of length data.

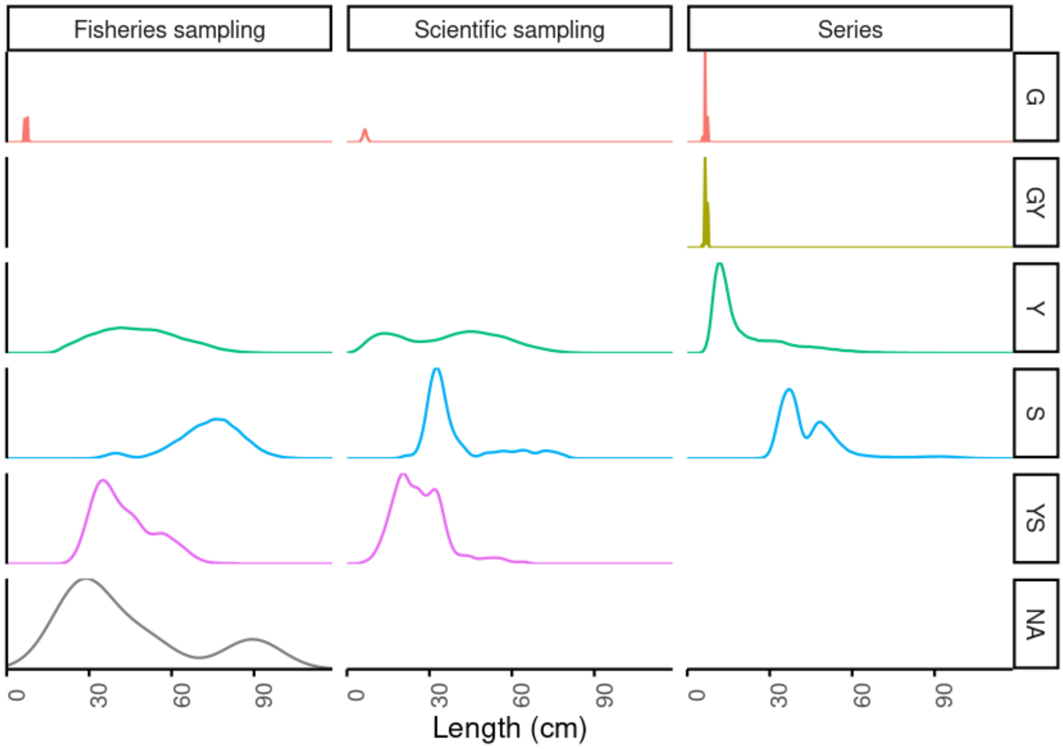


Figure 7.12. Length distribution by life stages and how they were obtained. 'fisheries sampling' = from annex 10 and fisheries sampling, 'scientific sampling' from annex 10 and scientific sampling, 'series' from annex 1-3.

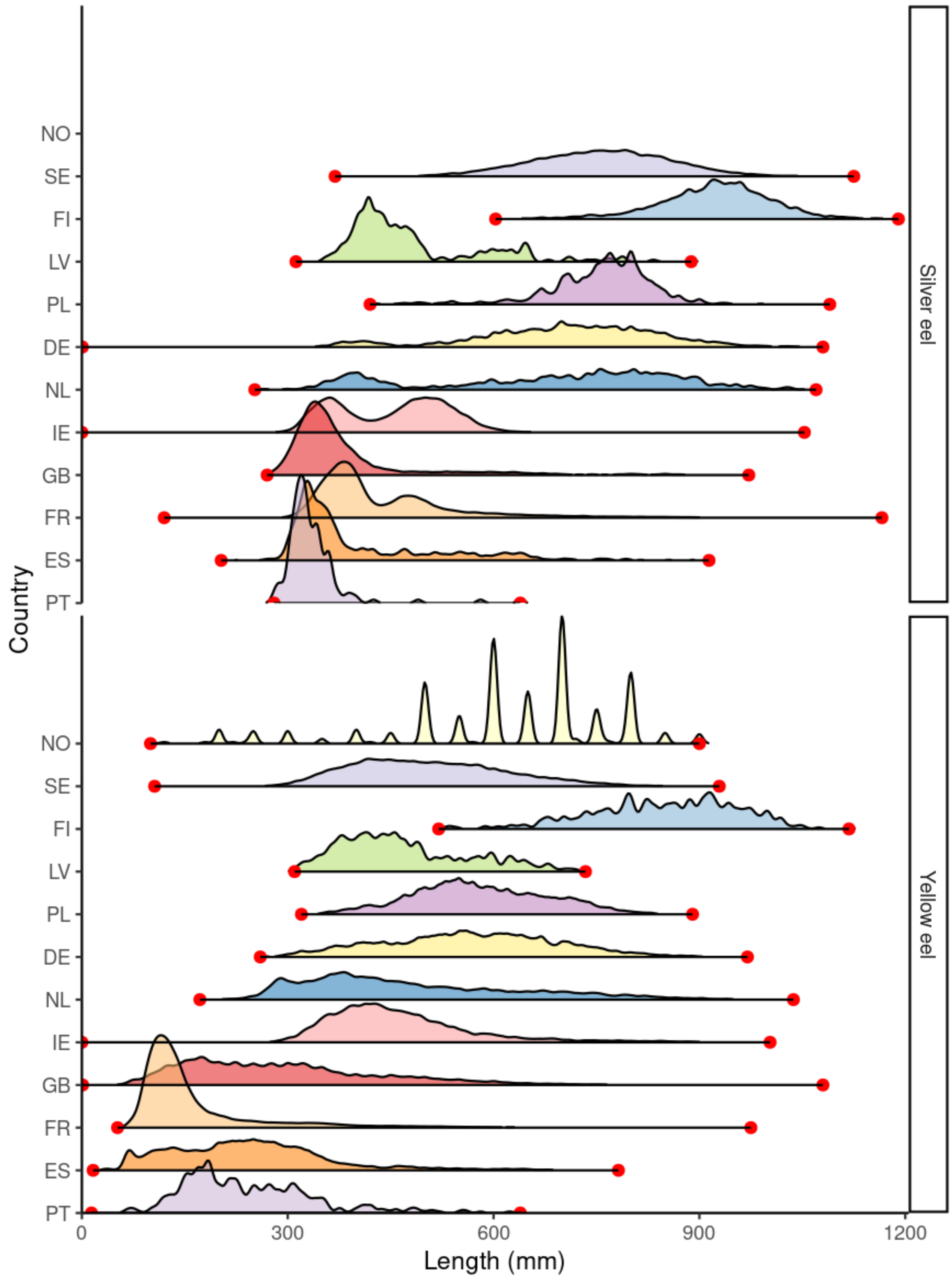


Figure 7.13. Length distribution by country and length for yellow and silver eel. Red dots give minimum and maximum value.

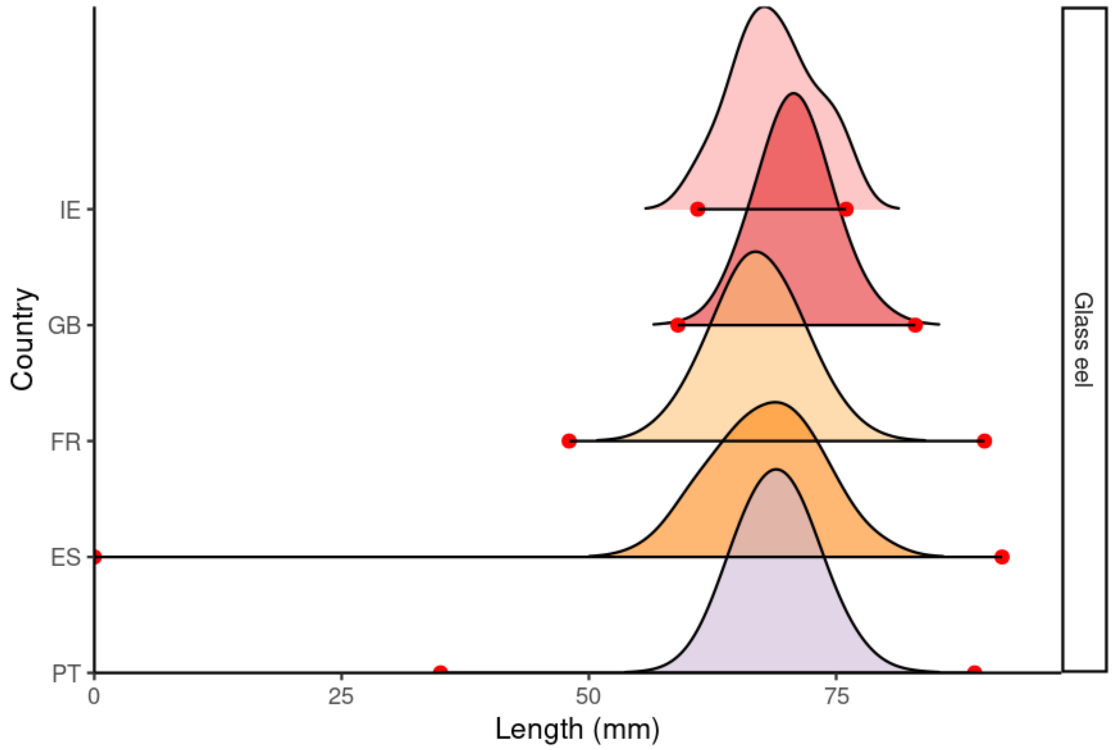


Figure 7.14. Length distribution of glass eel by country. Red dots give minimum and maximum value. Note that there is an issue with distributions being wider than min/max and ES minimum length being 0, which could not be solved in time for reporting.

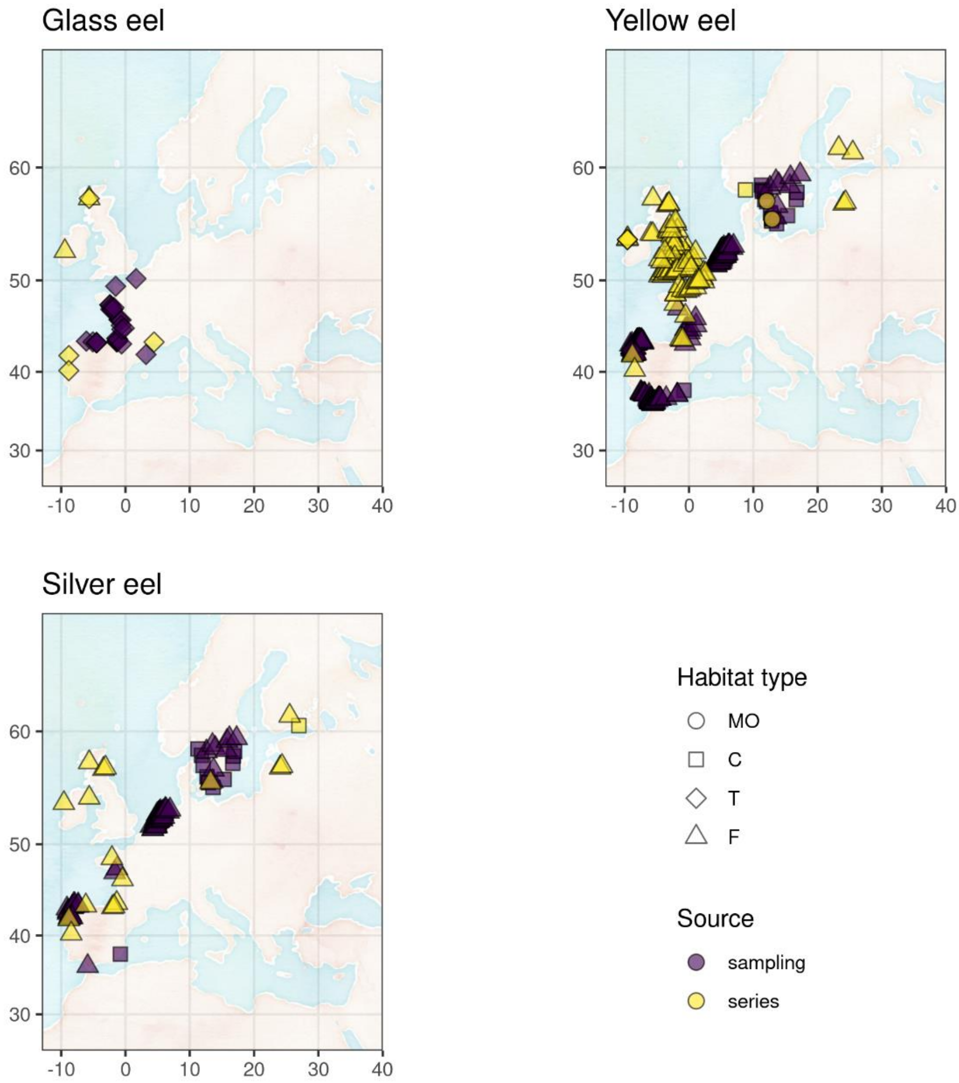


Figure 7.15. Localisation of length data by life stage, habitat and source (sampling: Annex 10 or series: Annexes 2,3). Only station with more than 5 samples are given.

Weight data

Figures 3.15 and 3.15 give the weight distribution for each life stage. The weight of glass eel spread around 0.3g for all countries, while for yellow and silver eel, weight distribution can be very different from one country to the other. This can be due to geographical difference but is also highly biased by the protocol used (e.g. scientific survey vs commercial sampling, gear used). This thus required more analysis considering this possible bias before drawing any conclusion.

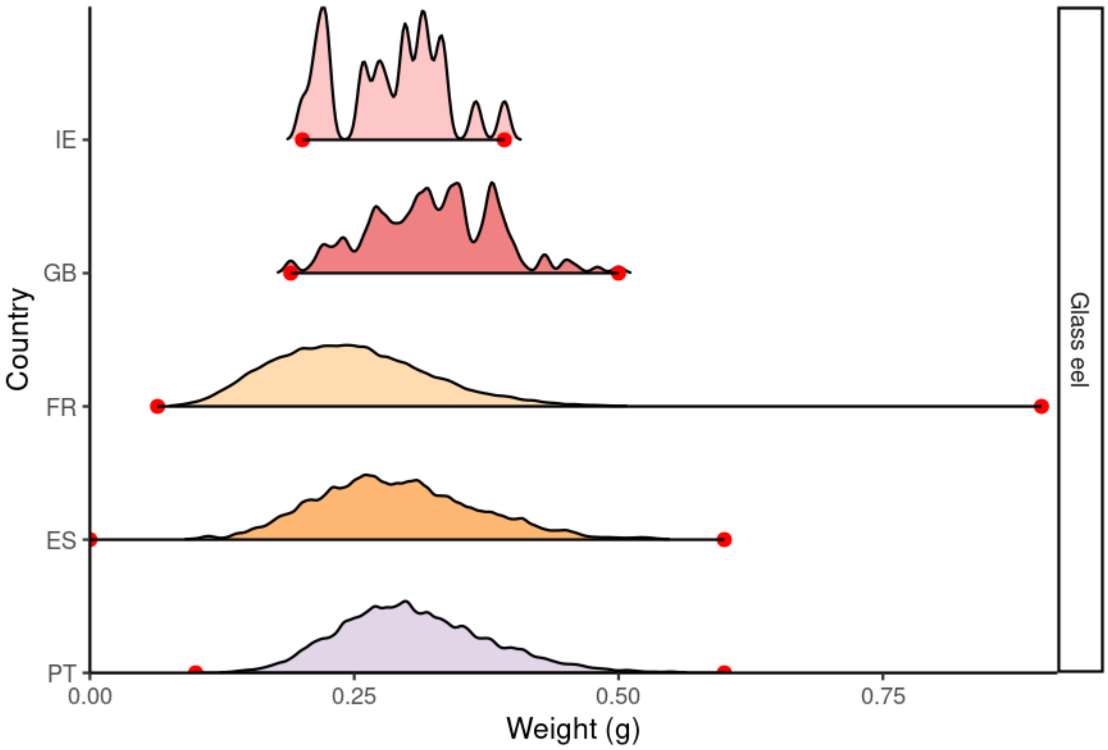


Figure 7.16. Weight distribution of glass eels by country. Red dots give minimum and maximum value. Note: 1 glass eel with a weight larger than 1g has been excluded. Note that there is an issue with distributions being wider than min/max and ES minimum length being 0, which could not be solved in time for reporting.

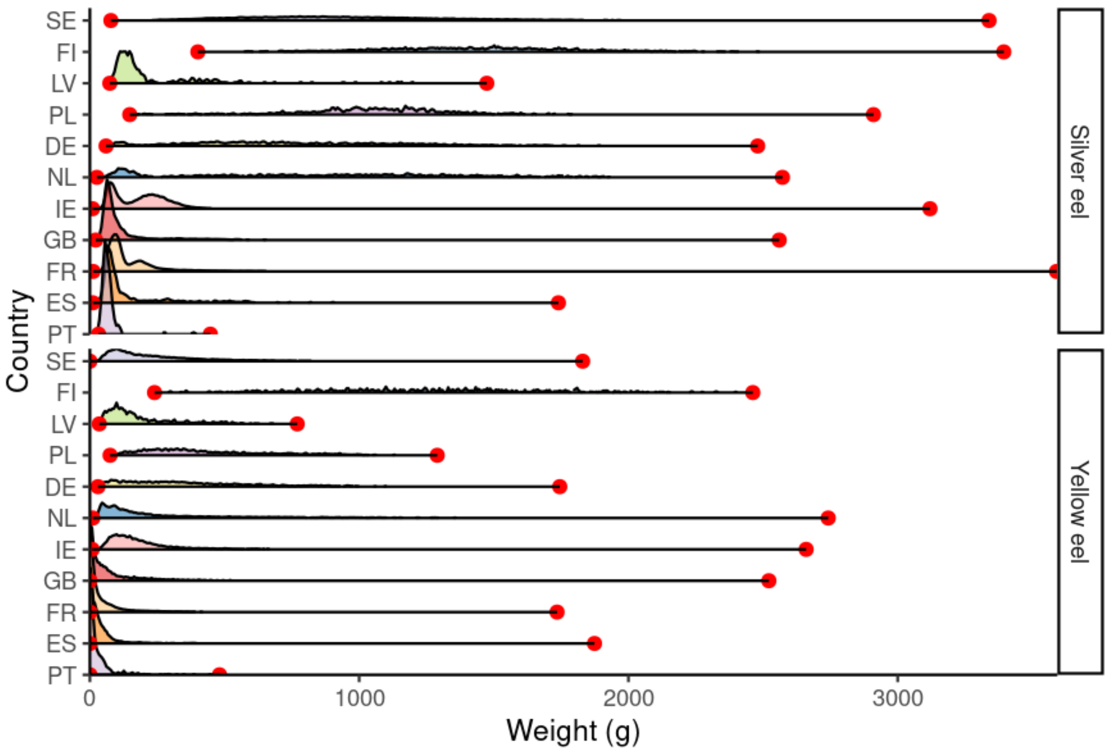


Figure 7.17. Weight distribution of yellow and silver eel by country. Red dots give minimum and maximum value.

Length-Weight relationship

Length-weight relationship is interesting to study the health condition of fish. Blackwell *et al.* (2000) recommend to use the relative weight Wr for this purpose. It is built as the ratio between the measured weight and a standard weight derived from the length-weight relationship. Blackwell *et al.* (2000) recommend to use a quantile regression (with 75% quantile) in log scale to calculate this standard weight. Figure 3.17 gives the raw data along the quantile regression line. Figure 3.18 gives the Wr that can be used to detect any wrong length or weight data (e.g. using thresholds of 25/200). Figure 3.19 shows how the relative weight can be used to analyse difference of condition by life stage, country or type of sampling (or gears, …). Note that the figures are given for illustrative purpose and further analysis are required before drawing any conclusion.

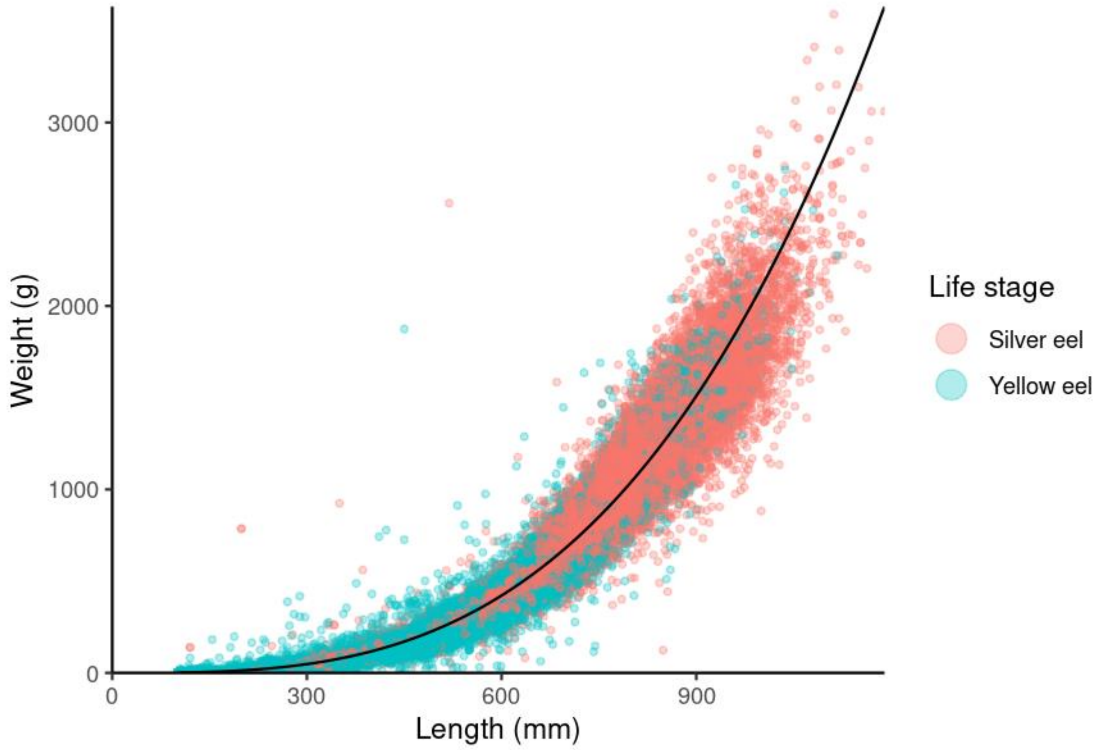


Figure 7.18. Length-Weight relationship by life stage (point) and 75% quantile regression (line). Note: only eel longer than 100mm are used.

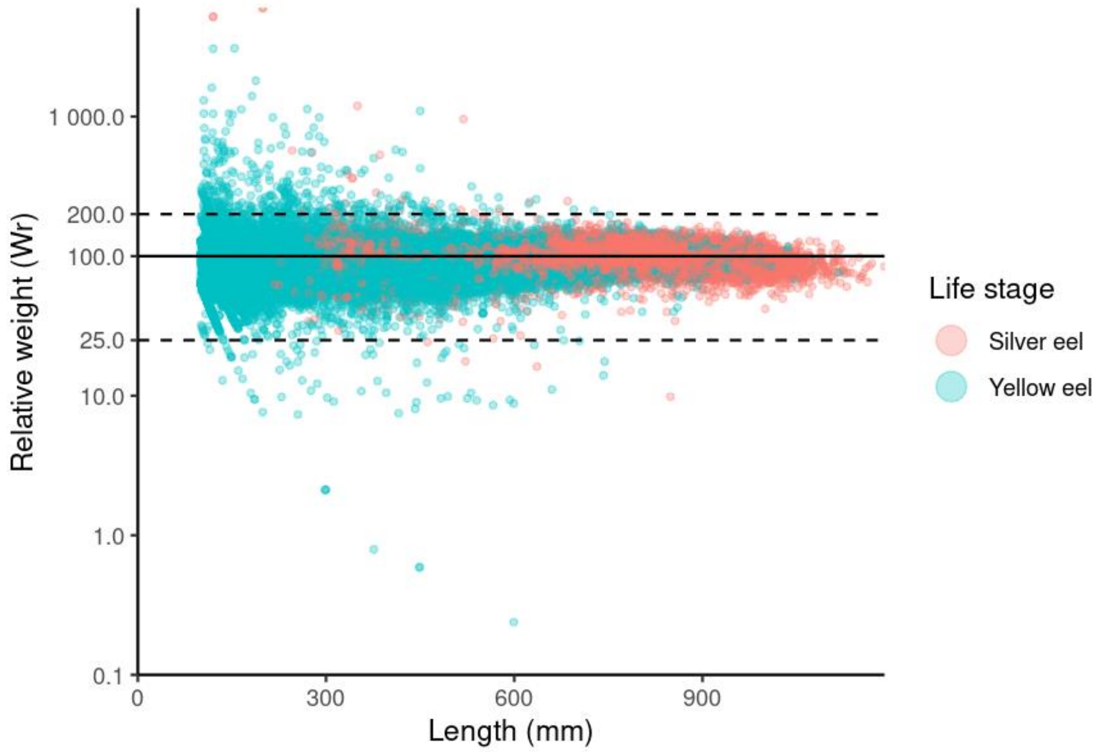


Figure 7.19. Relative Weight by length and life stage. Note: only eel longer than 100mm are used. Relative weight is given in percentage. Dotted lines give possible threshold to detect error in data. Note that some (extremely low) relative weights are ominous but this couldn't be solved in time for reporting.

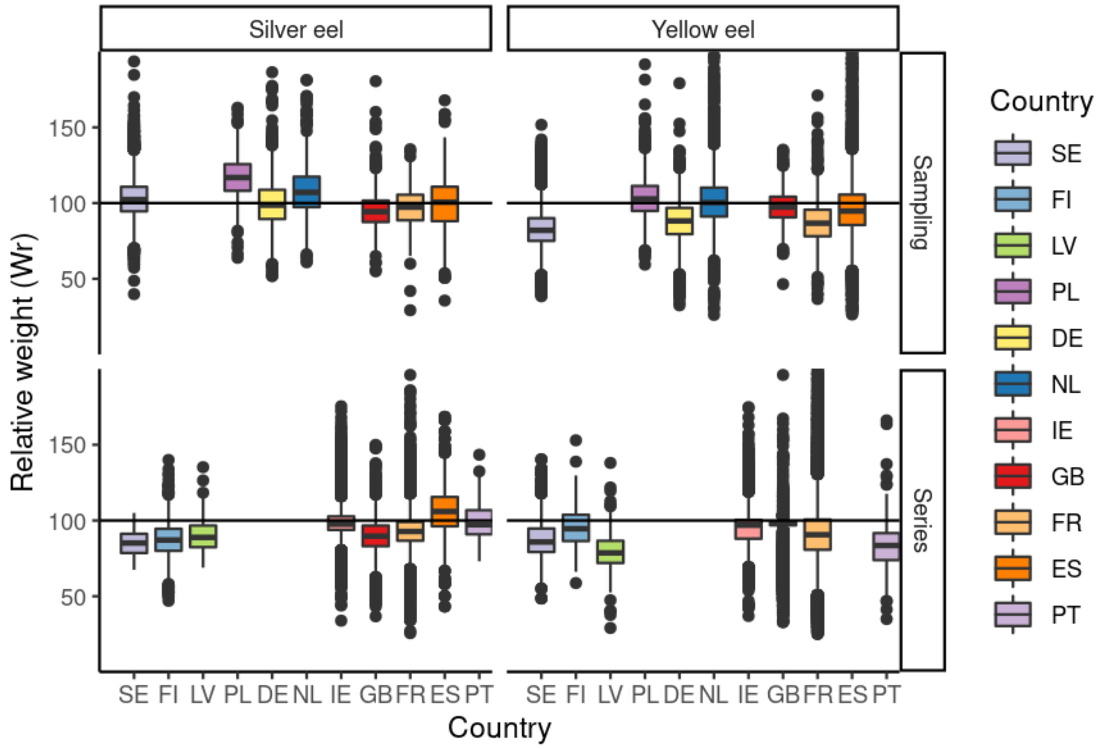


Figure 7.20. Relative Weight by life stage, country and source. Relative weight given in percentage.

Age

The figure 3.20 represents the age distribution by country and by life stage (only for yellow and silver stages, no age available for glass eel). This can be due to geographical difference but is also highly biased by the protocol used (scientific survey vs commercial sampling, gear used, …). Due to this possible bias, more analysis is required before further conclusion.

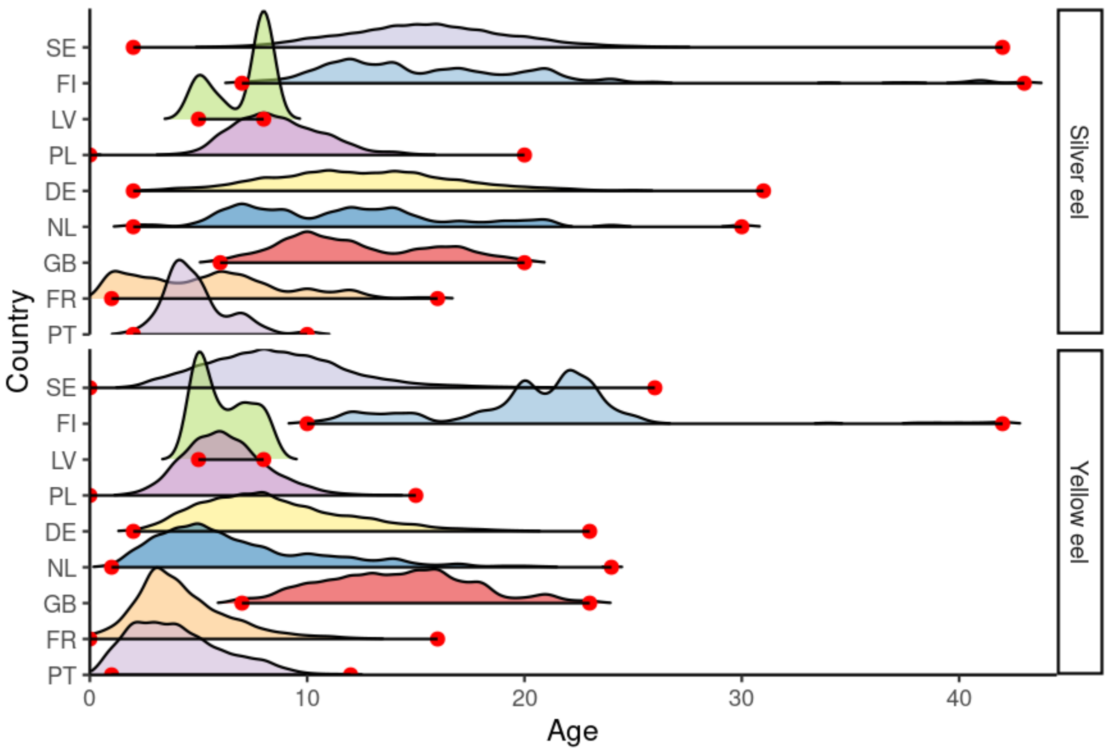


Figure 7.21. Age distribution by country and by life stage. Red dots give minimum and maximum value.

Growth

The figures 3.21 and 3.22 represents the age distribution by length and country for yellow and silver eels. For the same age, there is a wide range of length between countries but also within the same country. This variability was already observed (Vollestad, 1992; Daverat et al., 2012) but to carry out further analysis it is necessary to validate the data (example: eels of 800 mm with an age of 0) but also to identify the possible biases to be taken into account (type of monitoring: commercial or scientific survey, gear, geographical localisation, …)

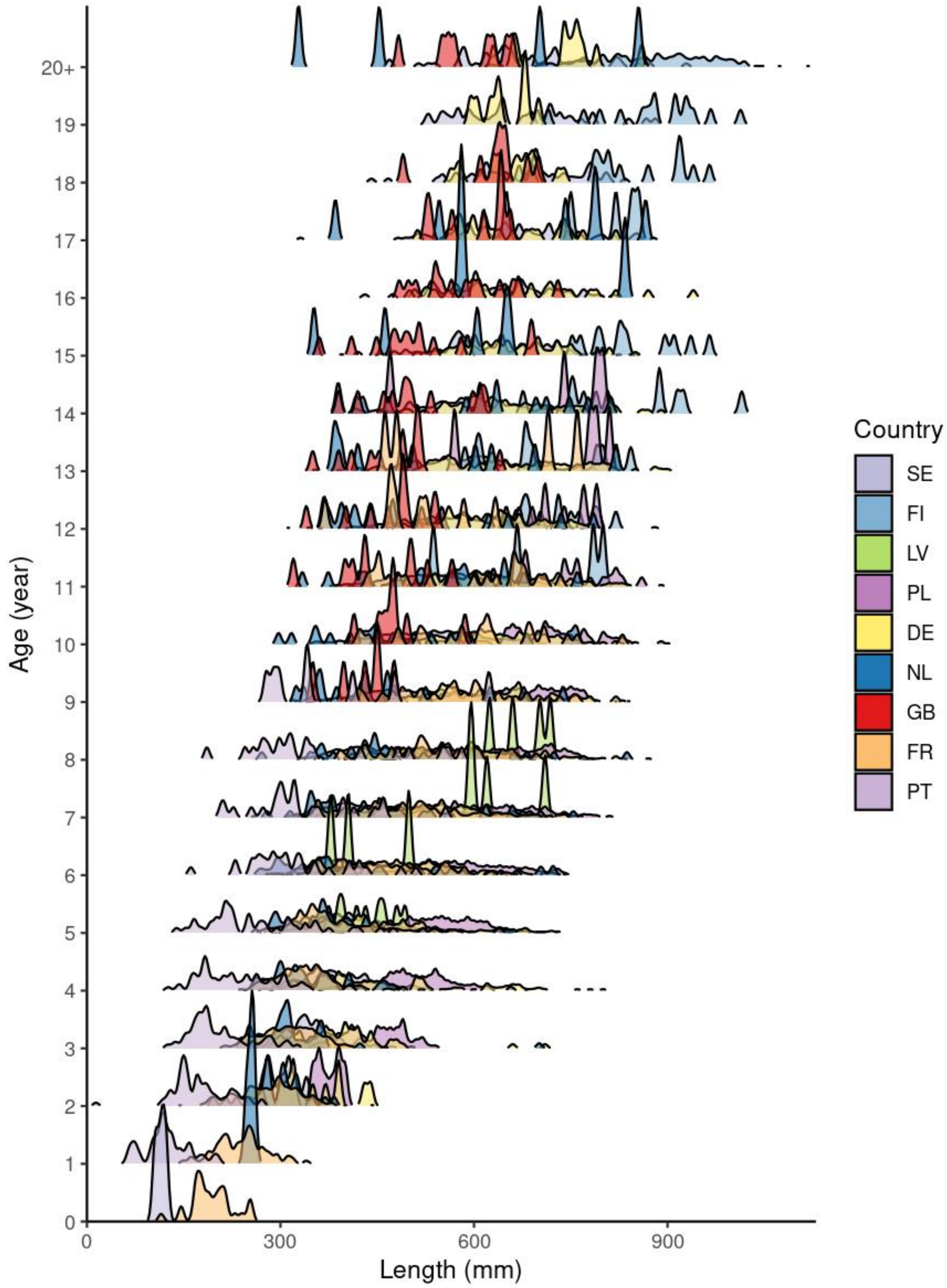


Figure 7.22. Length distribution by age and country for yellow eels. Note: this density plot does not represent low frequency data.

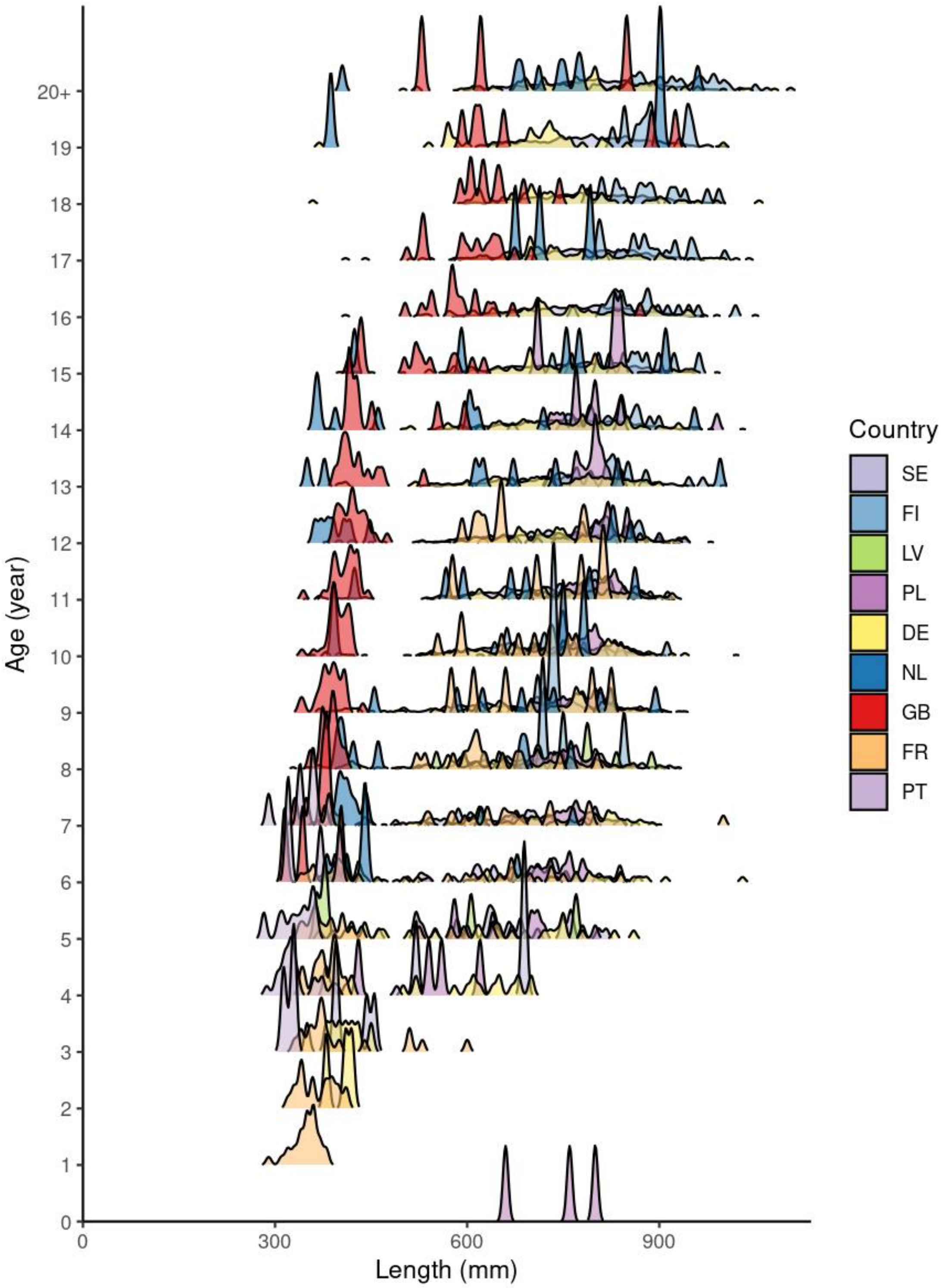


Figure 7.23. Length distribution by age and country for silver eels. Note: this density plot does not represent low frequency data.

Sex

Sex has been determined for some yellow and silver eels (Figure 3.23). Sex of eel is known to be determined by the environment, possibly related to density during juvenile stage (Davey and Jellyman, 2005; Huertas and Cerda, 2006; Geffroy and Bardonnet, 2016). These data may be used to infer juvenile / habitat during juvenile stage status and are also important to qualify the sex-ration of future spawners which is an important parameter of population dynamics.

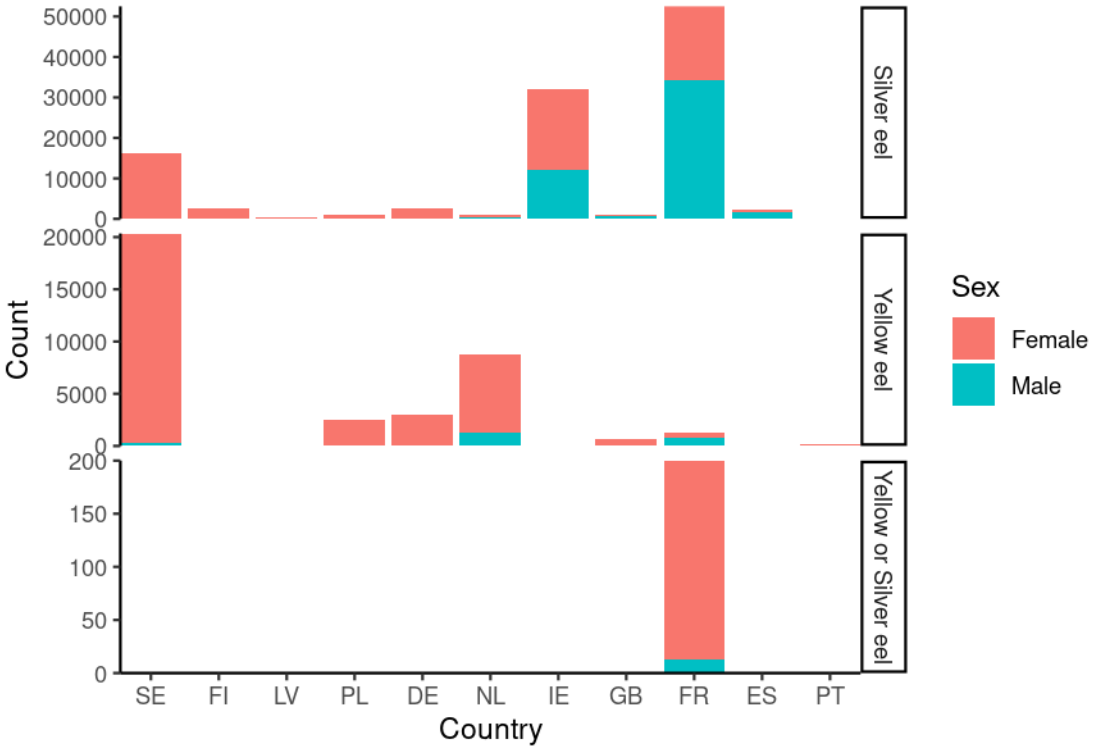


Figure 7.24. Sex distribution by life stage and country. NB: unknown sex not drawn

Annex 18: Example analysis of eel quality data

Fat content

Metrics relating to muscle lipids were included within the data call, this will allow comparison of EMUs within and between countries, and between different life stages (Figure 4.2). For some EMUs, it is also possible to visualize how these vary temporally. In the future it will be important to separate males and females as their fat levels can be considerably different. Additionally, data from fat meters need a correction factor. Neagh silver eel fat, as recorded by Distell fish fat meter was noted as being "off" [low] and subsequently the gravimetric measures for comparison were undertaken in 2015 (reported in annex 10 and previously at ICES WKCONTAMS workshop) which found that the metre consistently recorded lower lipid levels in silver eel but was however directly comparable for yellows, an observation noted elsewhere (Pohlmann et al 2018)-

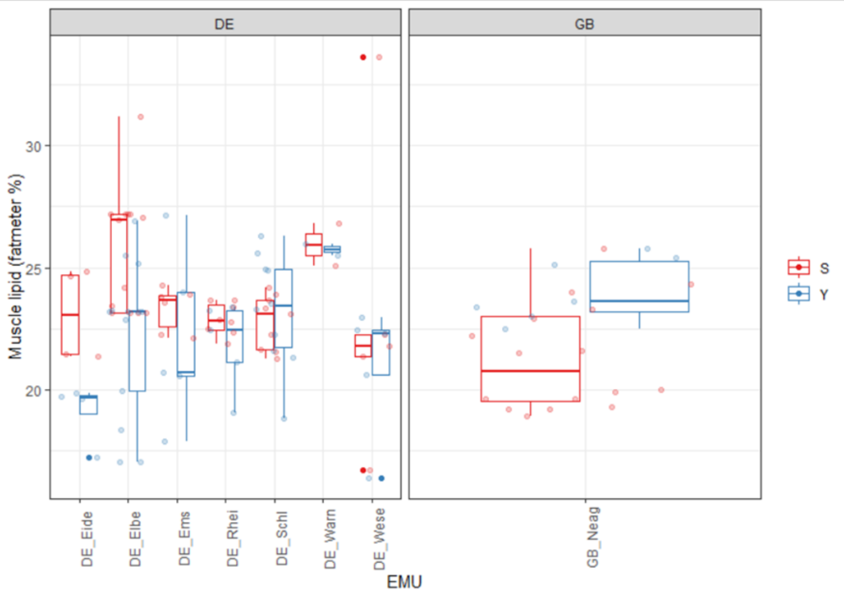


Figure 4.2. Grouped data of muscle lipid content (%) in yellow (Y) and silver S) (male and female combined) (eels from selected EMUs/countries. These data include both male and female eels.

Diseases and parasites

Data relating to *A. crassus*, EVEX and HVA viruses had been provided to the database. *A. crassus* data were by far the most abundant, and as before, comparison of EMUs within and between countries, and between different life stages are presented (Figures 4.3 to 4.5). For some EMUs, it is also possible to visualize how these vary between habitat types.

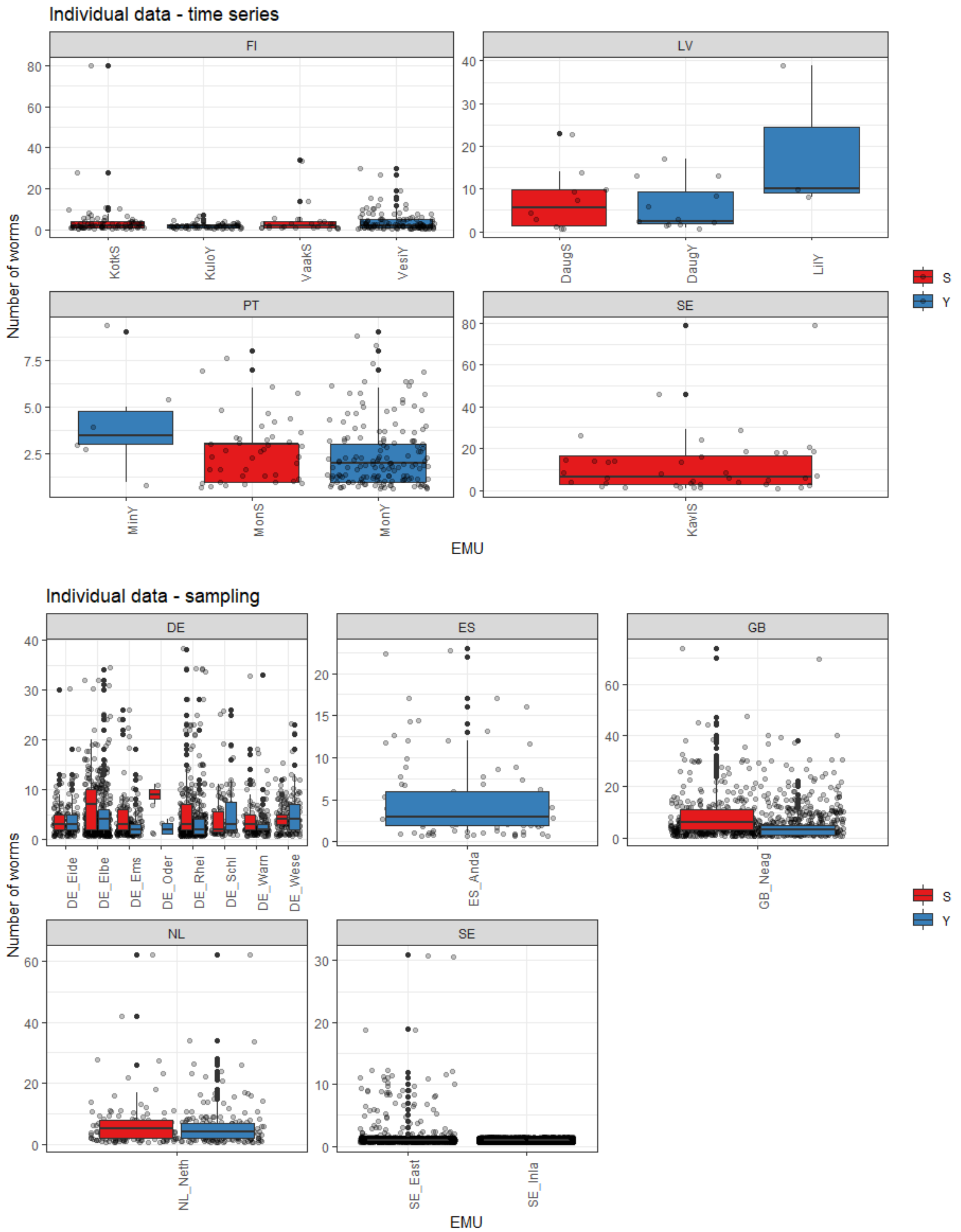
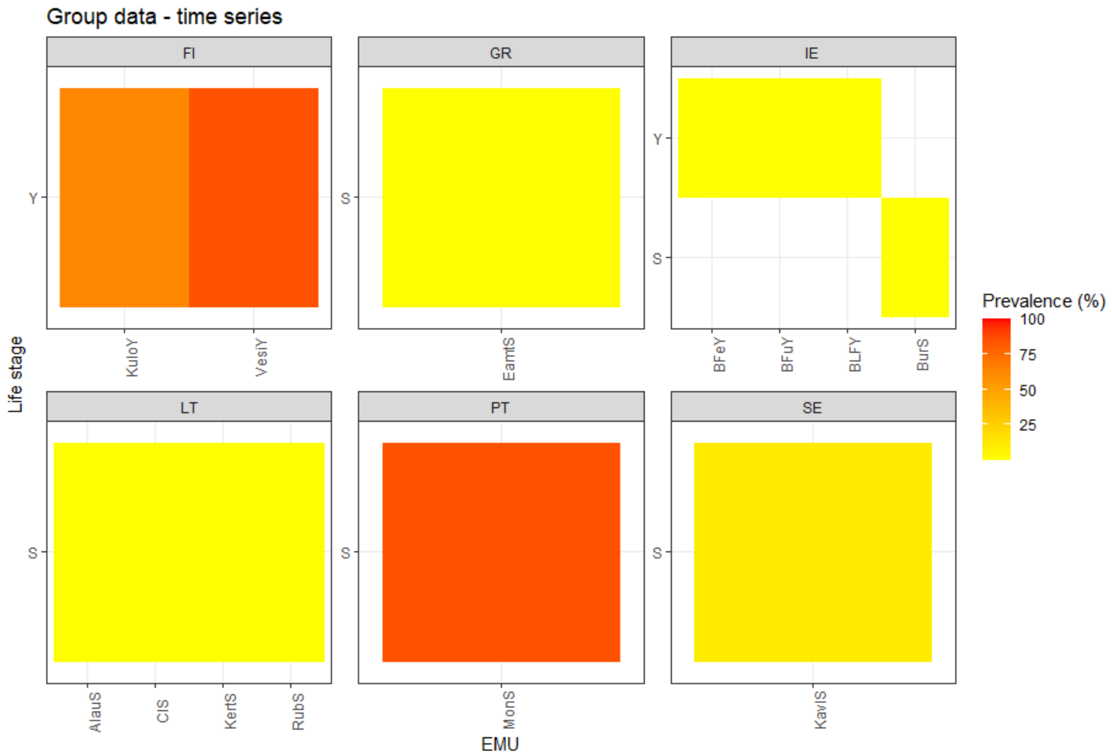


Figure 4.3. ***Anguillicola crassus*** **burden in yellow (Y) and silver (S) eels based on data that were filled in annexes 2 and 3 (time series) and annex 10 (sampling) and integrated into the WGEEL database. Individual data points (number of worms per eel) are represented as point while the boxplots indicate the median per EMU.**



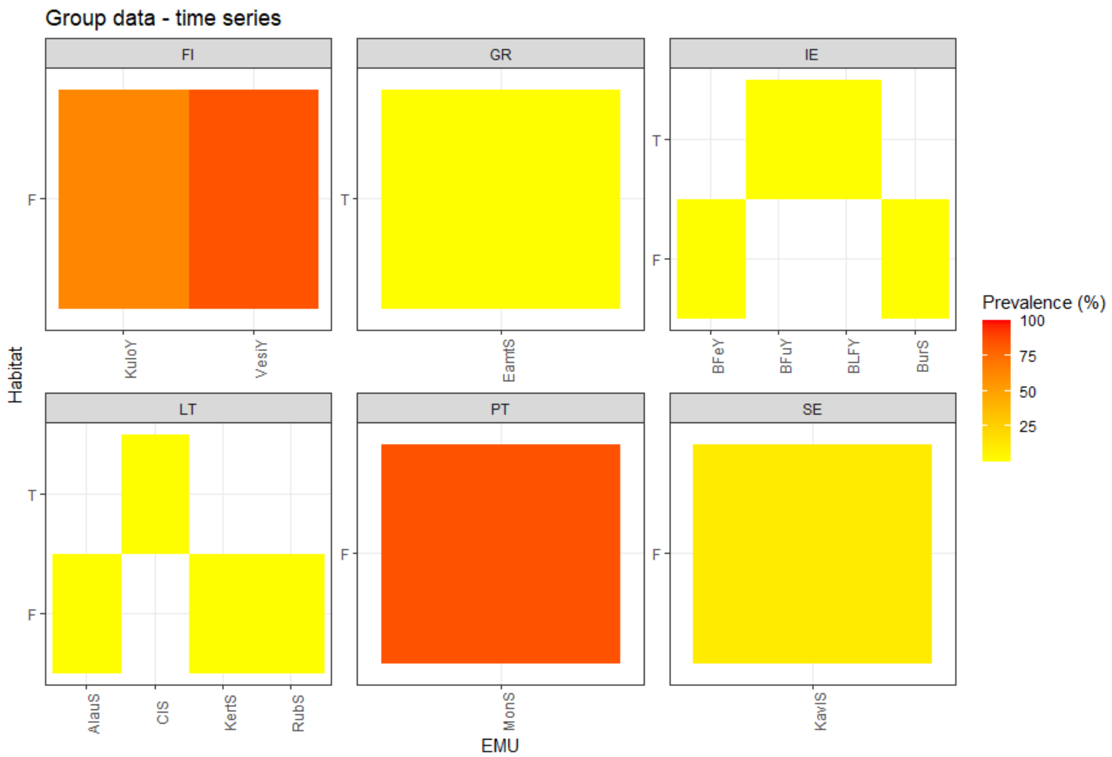


Figure 4.4. *Anguillicola crassus* prevalence eels based on data that were filled in annexes 2 and 3 and integrated into the WGEEL database. The percentage of infected eels per EMU is represented according to life stage (yellow (Y) and silver (S)) and habitat (F: freshwater, T: transitional water).

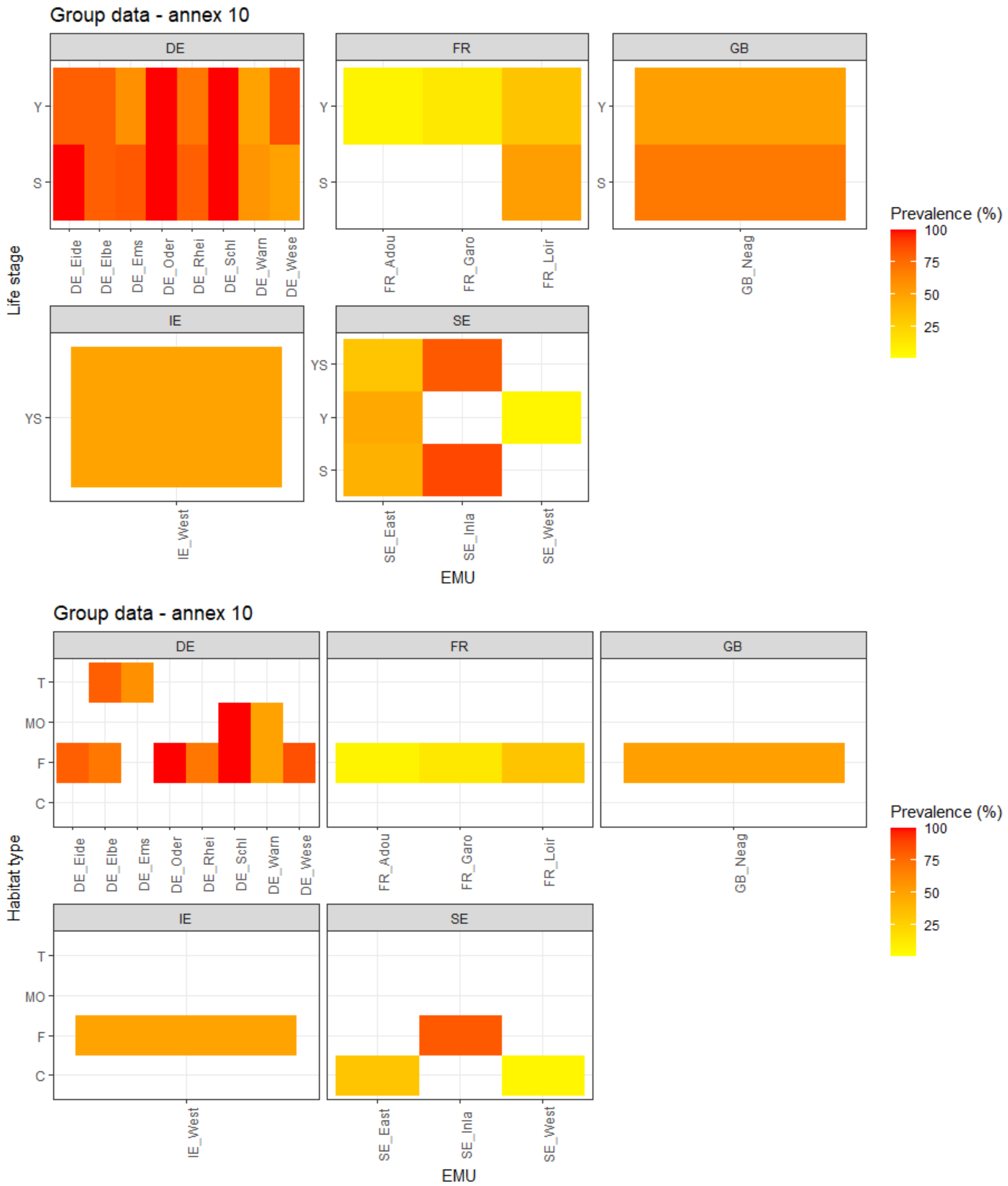


Figure 4.5. ***Anguillicola crassus*** **prevalence in eels based on data that were filled in annex 10 and integrated into the WGEEL database. The percentage of infected eels per EMU is represented according to life stage (yellow (Y) and silver (S)) and habitat (C: coastal water, F: freshwater, MO: marine water (open sea), T: transitional water).**

Contaminants

Data relating to a range of contaminants were provided in the data call. Temporal analysis, comparison of EMUs within and between countries, and between different life stages are presented (Figures 4.6 and 4.7).

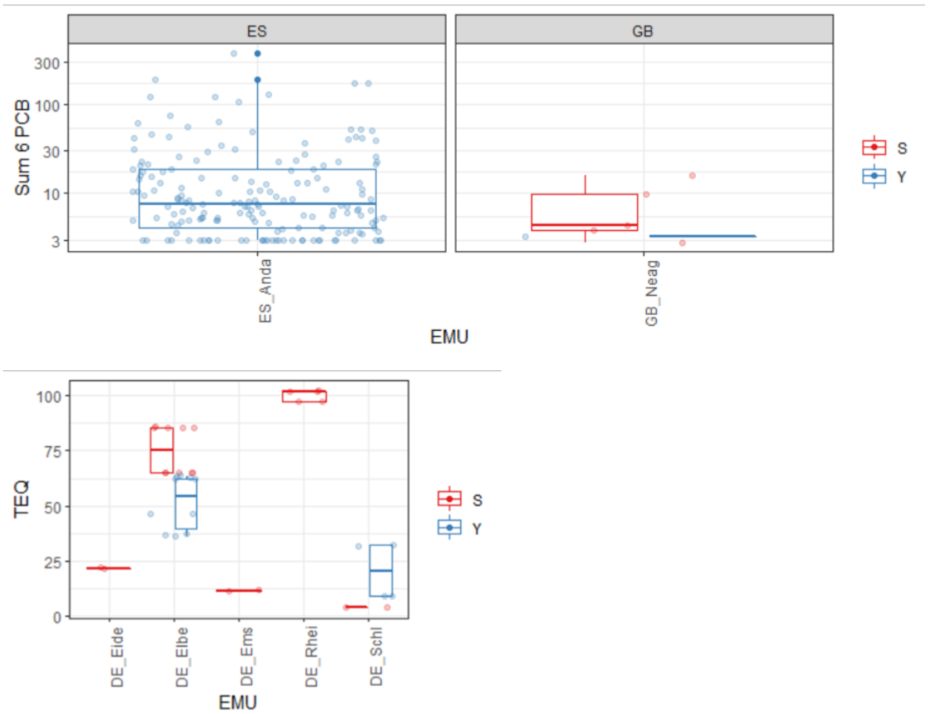


Figure 4.6 Concentration of Sum 6 PCB (ng/g wet weight) in yellow (Y) and silver (S) eels from the UK and Spain. Note the log scale on the y-axis. Sum of TEQ (Toxic Equivalent) of measured dioxin-like PCBs in ng/g wet weight in yellow (Y) and silver (S) eels in selected German EMUs.

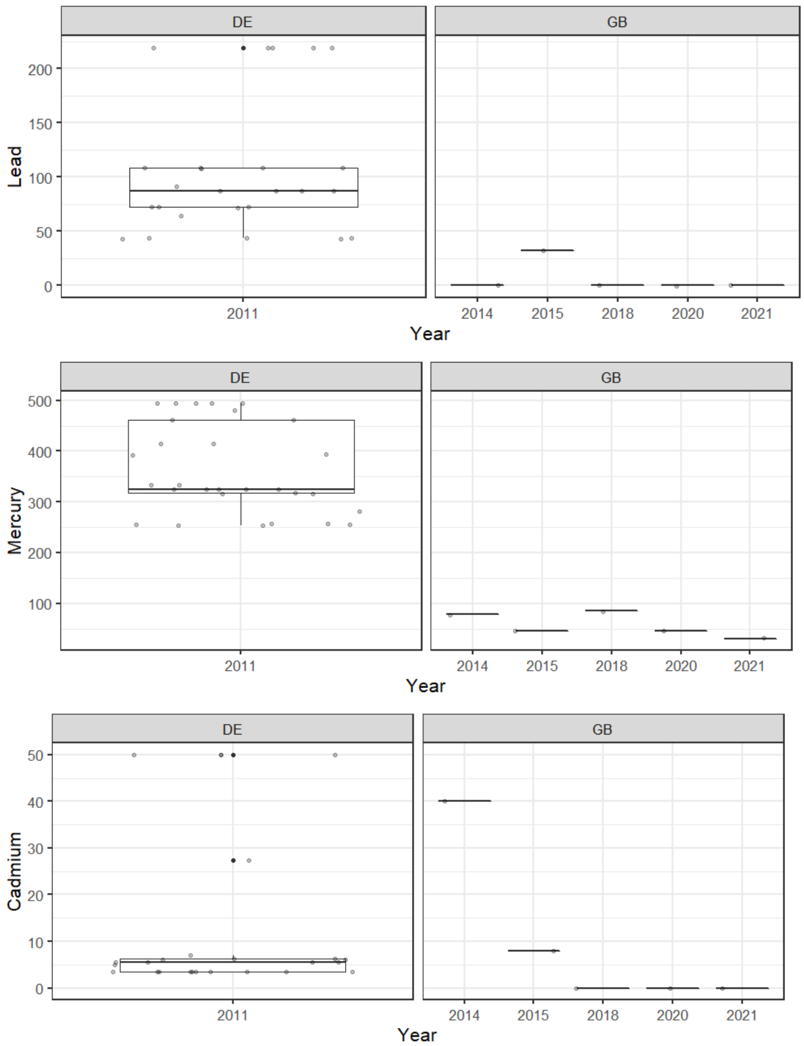


Figure 4.7 Heavy metal concentrations in eels in Germany (DE) and the UK (GB). Concentrations are in ng/g wet weight for the UK and Germany (only Cadmium) and per dry weight for Lead and Mercury (Germany). EMUs were pooled for Germany.

Annex 19: Preparation for landings workshop

Abstract

WGEEL explored possible approaches that could be used in a future workshop on using landings data in the assessment, and made an overview of possible points of consideration for such approaches. Landings data is currently not included in the international assessment due to the many issues associated with this data, including but not limited to: data deficiency, incomplete reporting, lack of CPUE/effort data, heterogeneity among time series, and lack of information on fishery management measures that might bias the time-series. During WKFEA, the question was raised whether landings data can be used in the international assessment. In order to provide background information to aid the decision whether a workshop on landings data would be useful, WGEEL made an overview of the current ICES guidelines for how to use landings data in assessments, available models to incorporate landings data in assessments, potential usage of national methods at international level, relevant working groups, and listed available landings data. Based on this, WGEEL recommends not to use landings data in the current assessment, and instead keep working towards a future assessment where landings are included in a spatial stock assessment model.

Premise

Within WKFEA in 2021, the question was raised whether landings data can be included and used in the assessment for the European eel at the entire population scale (ICES, 2021a). Presently, the eel is classified as a category 3 stock because there are not enough data available for a quantitative assessment (category 1 and 2 stocks), and an index is available which provides an indication for a trend in eel recruitment. The current category 3 trends-based approach used for eel only provides qualitative information on abundance at the population scale, and it was felt that the development of an appropriate stock assessment model would turn European eel into a category 2 (or 1) stock. For stocks of category 2 (stocks with analytical assessments and forecasts that are only treated qualitatively) and category 1 (stocks with quantitative assessments), stock assessment models are classically used, aimed at estimating trends in abundance and trends in mortality. They are also relevant to estimate standard reference points, and can provide mortality trends at the population scale, as well as spatially disaggregated estimates.

Periodic benchmarks to develop/improve methods for the stock assessment occur within specific expert groups that also address the selection of data series to be used. Benchmark reports are peer reviewed. The methods for assessment of European eel used by ICES have so far not been benchmarked. For eel, a benchmark is presently foreseen in 2027, as a concluding step of a road map towards the future advice for the European eel stock discussed and agreed in WKFEA (ICES, 2021a). This road map details the potential assessment approach, data needs, defines objectives and tasks to achieve them (also setting a time frame for the completion of these tasks), and two major improvements were foreseen. The first relates to improving the data that should be part of a stock analysis, and the second is to provide more holistic advice by taking greater account of the whole ecosystem and looking in more detail at the impacts of the different types of pressures affecting the eel population.

In WKFEA (ICES, 2021a) specific issues in the current assessment models and their potential solutions were discussed. These issues were ranked according to their priority in terms of improving the ICES advice and the probability of solving the respective issue (Ch. 5 of WKFEA Report). The issues ranked with highest priority in the current assessment methods were those related to fishing mortality and tuning new recruitment series.

In this context, the specific issue of the use of landings data for the advice and assessment approach was addressed and challenges for the use of landings data defined, with WKFEA specifically stating that *"working on an assessment of catch data, combined with their correction/raising for missing data and underreporting, is a prerequisite to their inclusion in the ICES advice"*. The main challenges for the use of landings data identified were: lack of effort data, data deficiency, heterogeneity among time-series, incomplete reporting, poor documentation for recreational landings, and issues with quantifying IUU. It was proposed that a workshop might be needed to investigate whether landings data can be included in the assessment. Such a workshop would need to address several aspects. First of all, would the stock assessment be improved by adding landings data? What model should be used? Can landings data be included in spatial modelling? The landing data series would also need to undergo a "rebuilding quality check process" (e.g., appropriate spatial and temporal scales, length of time series, quality of the datasets, meta-information on the data), before inclusion in assessment. Such a quality check would be valuable regardless whether using the data in the assessment or not.

In order to provide background information to aid the decision whether a workshop on landings data would be useful, and to help present an overview of possible points of consideration for such a workshop, SG5 of WGEEL made an overview of the following:

- ICES guidelines for how to use landings data in assessments
- Available models to incorporate landings data in assessments
- Potential usage of national assessment models at whole-stock level
- Relevant working groups
- Available landings data through WGEEL data call

Conclusion

The 2021 WKFEA workshop suggested looking into possible approaches for using landings data in the assessment of European eel until a more advanced spatial model can be developed. WGEEL identified several approaches to use landings data. All of these approaches, however, suffer from several caveats. These caveats, combined with the unique life cycle and the restricted data available for the European eel, make it very challenging to use any of these approaches for the assessment. Among others, issues include i) the uncertainty of whether the glass eel recruitment index can be used as an index of previous spawning stock biomass in the Sargasso Sea, ii) the large spatial variation in growth and maturity, iii) the fact that eel only spawn once in their life, iv) the large and spatially-varying time lag between harvest and that harvest's effect on production, v) missing landings data. WGEEL recommends thorough data quality checks on the landings data, e.g., corrections for missing data and underreporting. This way, landings data can be used in the upcoming spatial stock assessment model, as indicated by the WKFEA roadmap, instead of being used in less advanced assessment models that are likely to yield highly uncertain or outright erroneous results.

ICES guidelines for how to use landings data in assessments

To date ICES has provided advice almost exclusively for marine stocks. These stocks are fished in rather uniform marine habitats with a limited variability in gears used. For diadromous species and stocks, fishing operations may cover different environments, habitats, types of fisheries and life stages. This holds true in particular for European eel and poses special challenges for generation of landing data. European eel is considered as category 3 species in ICES systematics (ICES, 2022). The suggested approach for category 3 (empirical methods) includes methods following the MSY approach and, if this is not possible, alternative methods following ICES precautionary approach (PA). In general, including landing data would not open opportunities to follow the MSY approach until the data meets the requirements with regard to life history and length data needed for Management strategy evaluation (MSE).

The decision tree for applying ICES advice rules (Figure1) first points to method 2.1 (glass eel recruitment index as an index of abundance, length data is available, an estimate of k is available as well and would be between 0.1 and 0.3 depending on location). Method 2.1, in short, describes how to set catch advice for the next year, based on the previous year's catch advice multiplied with a number of multipliers: the biomass index trend, the mean catch length relative to an MSY proxy length, a biomass safeguard generally set by the lowest biomass index value, and a precautionary multiplier based on the von Bertalanffy k parameter.

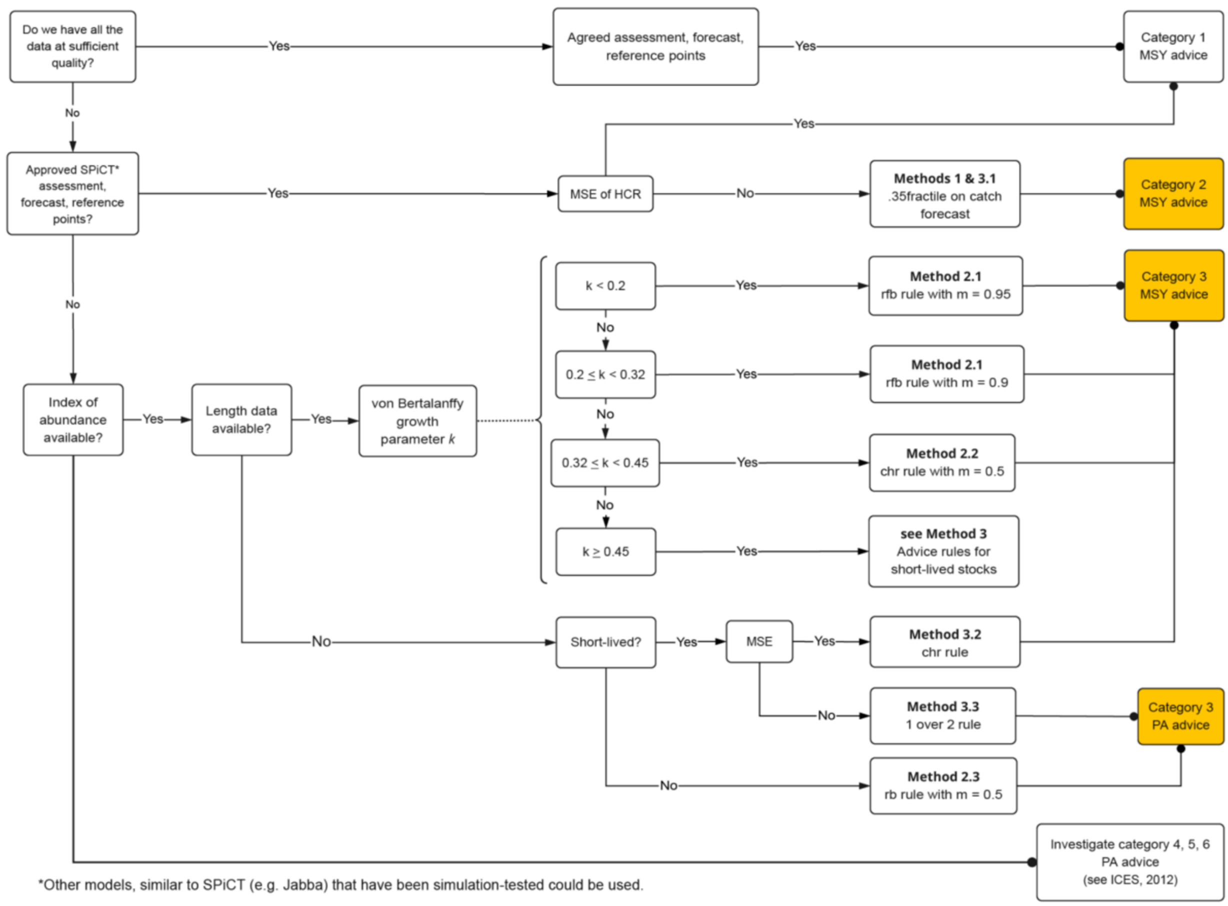


Figure 1. The decision tree for applying ICES advice rules, Figure 2 from ICES, 2022.

At a first glance this method does not look too far-fetched to use for eel, but there are a few caveats:

- A consensus should be reached on whether the index of glass eel recruitment is suitable to use as an index for past spawning stock biomass in the Sargasso Sea.
- With catch advice set at 0, results with new catch advice being 0 automatically (multiplying anything with 0 gives 0). However, the advice is 0 due to the precautionary approach and because advice from a method such as this has not been given yet. In that case, instead of using the previous year's catch advice, the previous year's total catch should be used.
- When determining the previous year's total catch, and when giving catch advice, which catch should be considered? Using the glass eel recruitment index as a biomass index implies that only silver eel biomass is considered (which is what the glass eel index might be correlated to), does that mean that this can only be used to advise on silver eel catch?
- Using mean catch length as a multiplier is problematic for eel. Eel landings consist of glass, yellow, and silver eel. In steady-state, fisheries on glass eel should not affect the length distribution of eel, as glass eel make up the first length class. Silver eel fisheries also do not affect the next year's length distribution, as silver eel migrate to the Sargasso Sea to reproduce and die thereafter. Thus, an MSY proxy length might only be informative in the case of yellow eel, which can be considered as future spawning stock. Such an approach would require to differentiate between glass, yellow, and silver eel in landing statistics. Furthermore, when setting the multiplier based on length data, consideration should then be given to the implications of excluding glass and silver eel landings (should the multiplier be set to a very high value when yellow eel landings are low, but silver eel landings for instance are high?). Furthermore, eel length-at-maturity is highly variable, especially across different latitudes. In addition, the use of an MSY proxy length probably better applies to species that spawn multiple times over their lifetime.
- How do we deal with missing landings data in any given year?
- Should hydropower mortality be considered?

Completely removing length data from the method would result in Method 2.3 from the decision tree, but as is mentioned there, this reduces catch advice over time unless the biomass index increases strongly. Nevertheless, it could be an approach to consider.

According to the decision tree, application of the SPiCT surplus production model could be considered. This may be possible if the glass eel recruitment index could indeed be used as a biomass index, but also faces several caveats:

- There should be a time lag between catch and production, as eel age-at-maturity typically lies between 2 to >30 years, after which they spawn once and then die

(presumably). Can this be done in SPiCT? How to deal with the spatially-variable age-at-maturity?
- Can all catches be aggregated together, or should there be some difference in the model for glass eel, yellow eel, and silver eel landings?

Considering the above, providing advice based on MSY modeling for eel, including landings data, would be challenging. Within ICES, a special working group on diadromous species has been established (ICES, 2020). Where the challenge for species such as salmon and trout was stressed; and as such it appears that there are no standards for the use of landings data which could be applied to European eel as well.

Available models to incorporate landings data in assessments

Several models are used to incorporate landings data into stock assessments, but they might not work for eel. Most species handled by ICES do not have such a complicated life cycle with different habitats etc as the eel. Below we mention several models designed to assess the status of data-poor stocks, when landings data are the primary data source available.

Surplus production models

Require not only landings data, but an index of abundance/biomass as well (usually CPUE data). Could yellow/silver eel survey data be used for this? The problem with that will probably be that any single survey is highly local, whereas the stock is geographically widespread, so there is likely no functional relation between a single survey and the overall stock development. However, if we were to assume that eel density is now so low that the glass eel recruitment index is directly correlated to the number/biomass of spawners, could the glass eel recruitment index then be used as an index of abundance? This is somewhat the case, already. In the current provision of advice, the recruitment trend is used as an indicator that the stock is below Blim, and therefore a PA of zero catch applies.

Surplus production models generally operate on the assumption that the harvest from a given year directly influences the production of the next year. Production, in that sense, refers to the biomass growth of the stock, as determined by recruitment and somatic growth. However, when using the glass eel recruitment index as a proxy for silver eel spawning biomass, that means that production of silver eel will be what is modeled by the surplus production model. However, eel reproduce only once in their lifetime, and when considering silver eel fisheries, there can be a time lag anywhere between 2 to >30 years (depending on the location) between the harvest and its effect on subsequent silver eel production.

Suppose we were to build such a time lag into a surplus production model, what would that time lag look like? The time it takes to mature varies greatly, depending predominately on latitude. Thus, such a time lag ought to either be spatial, or represent the average (but what would that mean for reliability of the results?). Another possible solution would be only to include females, which take longer to reach maturity. Including only females would reduce the variation in maturation time allowing a more realistic average maturation time. Females are more directly related to production (the eggs come from females). We have some information on the proportion of females in catch, so catch data could be corrected for this. But then this would only result in a catch advice for female eels.

Surplus production models ideally have high contrast in the provided data (a period of high abundance and a period of low abundance). This should be no problem if we can use data that goes back to around the 1960s.

There is also the issue of how to deal with missing landings data, and various levels of reporting from countries over the years?

SPiCT (Pedersen & Berg, 2017) is a recently-developed surplus production model which has already been used by ICES in the past.

Stock status plots

Many different methods have been developed to infer stock status from catch or landings data alone. The most straightforward of these methods simply makes conclusions about stock status based on trends in landings data, referred to as stock status plots (Grainger & Garcia, 1996; Froese & Kesner-Reyes, 2002; Pauly, 2007). However, trends in landings do not necessarily reflect underlying changes in biomass, so it would be best to avoid this type of approach as they can result in incorrect conclusions (Branch et al., 2011; Carruthers et al., 2012; Daan et al., 2011).

Catch-only models

Another type of method developed for inferring stock status from catch or landings data is often referred to as the catch-only model (COM). These models typically require a time-series of catch/landings, some life-history parameters, and make several assumptions (differs depending on the specific model) to deal with the absence of other data.

Mechanistic COMs: Have some form of underlying mechanistic model describing population dynamics, and fit this to the catch/landings data.

List of several ready-use mechanistic COMs: Catch-MSY (Martell & Froese, 2013), CMSY (Froese et al., 2017), COM-SIR (Vasconcellos & Cochrane, 2005), SSCOM (Thorson et al., 2013), OCOM (Zhou et al., 2018).

Empirical COMs: Take time series information of data rich assessed stocks, look for statistical correlations between for instance catch/landings, stock status, and other covariates, and then apply these to the data-poor stock in question.

List of several ready-use empirical COMs: mPRM (Rosenberg et al., 2014), zBRT (Zhou et al., 2017).

When using COMs, it is best to use them in an ensemble approach, as each COM has its own weaknesses. You could simply look at the average, but better yet would be to fit the results of all the COMs you have applied to another statistical model trained with simulated data, for instance a linear model, boosted regression tree, or a random forest. Such a procedure is described in Anderson et al. (2017).

Catch-only models rely on the assumption of a direct link between catch and biomass. However, this relationship could be distorted due to several factors including fisheries regulations, environmental forcing, and technological advances (Ovando et al, 2022). Potentially making COMs difficult to use in heavily regulated fisheries such as for eel unless there is data from before regulation on which to train the model (ib id).

For pretty much all mechanistic COMs, the underlying mechanistic model is some form of the Schaefer production model. This could raise an issue already mentioned above: this type of model is generally based on the assumption that a harvest in any given year affects the production of the next year. For eel there can be a large time lag here. It is doubtful that introducing such a time lag in the above-mentioned ready-use COMs is possible, so we would have to build our own.

COMs assume that you have the total landings available. This raises several questions:

- How to deal with missing landings data?
- We have landings data of glass eel, yellow eel, and silver eel. Should we use all of these? Glass eel landings are probably not helpful, as COMs measure everything in biomass and take no account of age structure. The fundamental difference in using yellow or silver eel landings is that yellow eel landings in a given year can affect the amount of yellow eel landings the next year (as well as the number of silver eel landings). Silver eel landings in a given year will have no effect on yellow or a little effect on silver eel landings the next year.

Length-based models

Length-based assessment models use the length structure of catch or landings data to infer fishing mortality. To put it simply, the more truncated the length structure is, the higher the estimated fishing mortality. It is unlikely that length-based models will work very well on the landings data of European eel though, for a number of reasons:

- European eel reproduce only once in their lifetime, and many landings consist of eels migrating to their spawning grounds (silver eel). Thus, fisheries on silver eel in a given year will have no effect on the length structure of the stock the following year, and silver eel fishing mortality can therefore not be assessed with length-based models. Looking at yellow eel landings may be more promising, however. Thus, it is important that eel landings are clearly labelled according to life stage.
- The growth of European eel is highly variable, depending both on sex and on how favourable local conditions are. So even if length-based assessment methods were considered to, for instance, infer fishing mortality on yellow eel, it should first be considered how this variability in growth could influence the interpretation of the results. Most likely, a spatial modelling approach would be required.

List of several ready-use length-based models: LIME (Rudd & Thorson, 2017), LBSPR (Hordyk et al, (2015).

Moving towards spatial models for eel stock assessment

Earlier approaches of eel stock modelling (e.g. Rossi 1979, Sparre 1979) were based on classical fishery modelling using cohort models or age-structured models. These early approaches provided first insights into certain eel stocks but lacked the inclusion of some key characteristics of eel population dynamics. A major step to develop a realistic model was made during the SLIME (Study Leading to Informed Management of Eels) project (Dekker et al. 2006). Generally, previous modelling approaches can be categorised as stage-specific models (e.g., GEMAC in SLIME), cohort models (Sparre 1979, Rossi 1979, Gatto and Rossi 1979), input-output models (Vøllestad and Jonsson 1998), size- and age-structured models (e.g., De Leo and Gatto 1995, Dekker 1996, Greco et al. 2003, Åström and Wickström 2004, DemCam in SLIME), models enabling an analysis of spatially distributed populations (Lambert and Rochard 2007) and global models (Dekker 2000, Åström and Dekker 2006, Bevacqua et al 2015). Accordingly, the focus and the modelling methods differ, with respect to the main purpose of the model, the availability of data and the accuracy needed. Most of the models consider eel stocks of a single water body, but some of them explicitly take spatial dynamics into account. Global models are however an exception, they aim to assess the entire European eel stock (Dekker 2000, Åström and Dekker 2006, Bevacqua et al 2015). Global models provide an estimate of the time scale of recovery of recruitment and give information about the scale of restrictions needed to pursue the way towards stock recovery.

European eel needs to be assessed at the population scale since it is a panmictic species (Als et al., 2011, Enbody et al., 2021), but it has been pointed out that assessing the population at this scale does not imply that spatial structure of a stock should be disregarded in the assessment. Spatialised stock assessment has been developed to address spatial heterogeneity in stock or fishery distributions. This kind of model allows estimating trends in mortality and abundance both at the population scale and at finer spatial scales. A spatial stock assessment model seems necessary to estimate trends in mortality at the eel population scale. This kind of model would have the advantage of providing spatially disaggregated estimates that are likely valuable for managers in the context of the implementation of Eel Management Plans.

Among the most recent approaches, in the SUDOANG project a model has been developed combining the GEREM model that provides pseudo-observations of recruitment per zone, and the EDA model, that provided pseudo-observations of yellow and silver eel abundance. Commercial landings are used as additional observations in the model, and allow an estimate of fishing mortality. The model describes the evolution of biomass of each stage through a time-varying zone-specific intrinsic growth rate (as in BREM or in surplus production model) corresponding to the balance between growth and survival, whilst a time-varying silvering proportion describes the transition from yellow to silver stage.

In addition to stage-structured models, several stock assessment models of different types have been developed for eel (e.g. Lambert et al., 2007; De Leo and Gatto, 1995; Van De Wolfshaar et al., 2014), but most of them were applied locally and can not necessarily be applied at larger scales due to a lack of available data. Recently, the ESAM model (Eel Stock Assessment Model) has also been used, within the GFCM Research Project, to appraise the effects on eel potential spawning biomass at the country level, of some current or feasible management scenarios. This model builds up on early work on eel demography and management by De Leo and Gatto (1995, 2001) for the Comacchio lagoons (Italy), on subsequent developments by Bevacqua et al. (2007) for the Camargue lagoons, and on a generalization at the European scale by Andrello et al. (2011) followed by a further improvement by Schiavina et al., (2015) for eel stock assessment. The model displayed reliability for the assessment of the eel stock and catches in spatially implicit environments such as lagoons, lower water systems or uniform stretches of rivers. This age-, sex- and stage-structured dynamic model, incorporating the main biological processes and anthropogenic pressures of eels at a single site scale, also incorporates exploitation characteristics of all stages, and hence also observed catches time series.

Potential usage of national assessment models at whole-stock level

Currently, several member states are using landings data in their national assessments, could any of those methods/models be applied for whole-stock modelling? This could be investigated during a potential workshop. For example, in the 2021 data call, in Annex 13, member states reported which data that are used for the assessment, with one point being landings. This source could hence be used to provide information on which member states that are currently including landings data in their assessment. The model/method used by each country can then be assessed.

Relevant working groups

Working group on commercial catches, WGCATCH

WGCATCH were asked for advice on aspects to consider if including landings data in the assessment. The former chair, Nuno Prista, responded that WGCATCH is mostly composed of people working under the DCF and mostly on coastal/offshore fisheries. This means that WGCATCH has knowledge of commercial data and commercial effort on those areas but usually not on freshwater or estuaries. WGCATCH has a subgroup working on landings and effort of small scale fisheries (SSF). That subgroup will know (or can investigate) what data different countries have/can provide in terms of landings/effort of European eel. They will also know the tricks and issues behind each data source (logbooks, etc), which could be helpful. At the very least they could provide (or help obtain) landings by region, vessel-size class, ICES square, etc. Nuno Prista also suggested that if collaboration with WGCATCH is needed, it is important to contact them well ahead of their meeting, to allow time for them to obtain the information that we need. This would allow, e.g., the chairs of the WG or members of the SSF subgroup to collaborate and potentially help to derive some sort of questionnaire. There are probably a lot of details requiring clear definitions, for example what is freshwater and not, what is a river, an estuary, coastal area, offshore. Also what types of effort measures are available, their advantages and disadvantages, etc.

Working group on recreational fisheries surveys, WGRFS

In the WGRFS 2020 report (containing outputs from the 2019 meeting), WGRFS recommended that recreational fisheries should be included in stock assessments and advice, hence, this working group might be able to assist with helpful advice.

Available landings data

Eel landings data is reported within the WGEEL data call (see below) and collected by the Food and Agriculture Organization of the United Nations (FAO) annually. Comparisons between landings statistics reported to WGEEL and FAO however reveal inconsistencies (e.g., ICES, 2006). It is therefore advised that landings data from the WGEEL data call should be used.

Present state of data available to the WGEEL

Landings data comes from the ICES Eel Data Call, which requires annual updates on i) landings for commercial fisheries; ii) landings for recreational fisheries; iii) landings related to transport/relocation operations. Annual updates are provided by filling Annexes and are stored on the WGEEL database. Where possible, data are provided by eel life stage, habitat type and at the EMU level. Landings data provided by countries through the Data Call are from different Data Collection Frameworks (DCF-EU Map for EU Member States, GFCM DCRF Task VII.6 for non-EU Countries), eventually integrated by other sources such as National Statistics or national information.

Landings are used in the WGEEL report for updates of trends but not for the advice since the total landings are incomplete and effort data are lacking; though for some gaps in available time-series, data has been reconstructed. In addition, great heterogeneity is present among the time series of landings owing to inconsistencies in reporting. Within ISSG Diad, an effort to coordinate and standardize the data collection under the DCF - EU Map, including landings data, is presently ongoing towards future coordination at the Regional level. In this perspective and at the Mediterranean level, a thorough revision of available landings data has been performed, considering both catch data collected within a specific work package of the GFCM Eel Research Programme, and the data collected since 2016 under the DCRF Task VII.6, already provided to WGEEL under the annual Joint GFCM/ICES Data Call. This revision also entailed a quality check control of the data (see Ch. 5 Tor D), which allowed the understanding of how to align discrepancies and inconsistencies. This exercise has highlighted the need for a quality check of landings data to be performed with dedicated work before any further use of these data.

Overall, the WGEEL has collected information on European eel commercial landings from 25 countries, accounting for a total of 90 EMUs. Regarding the recreational fishery, 16 countries for a total of 59 EMUs have provided landings data. Tables 1 and 2 show a summary of all the series available of glass eels both from commercial and recreational fisheries; Tables 3 and 4 report adult eel commercial and recreational landings (YS, Y, S). The tables account for data by country and EMU and display the length of the series, i.e. the first and last years in the records, the number of years with values, and the number of years missing data within the series. The following sections briefly describe the landings data series per life stage.

Glass eel commercial and recreational landings

The WGEEL has collected information on glass eel commercial landings from five countries (Spain (ES), France (FR), Great Britain (GB), Italy (IT) and Portugal (PT)), accounting for 23 EMUs data series (Table 1). Nineteen series are more than 10 years long. Some commercial data series date back to the ’70s (PT_Minh, ES_Mino, FR_total, GB_total, IT_Lazi), while one dates back to 1945 (ES_Vale). The series appear continuous, with fewer than five missing values each. Depending on the data selection and processing procedure, part of these commercial series have already been considered in the glass- and yellow eel recruitment trend analysis (see the latest report by WGEEL for details, ICES, 2021b).

Regarding the recreational glass eel landings (Table 2), data have been reported by Spain (ES_Basq, ES_Cant) and France. The latter dates back to the ‘80s, while the Spanish data have been available since 2000.

Yellow eel and silver eel commercial and recreational landings series

Table 3 shows a short description of the commercial landings not separating YS collected in the database with data from 21 countries and 51 EMUs. Thirty-eight data series have more than 10 years of data, while 13 EMUs reported shorter landing series. Twenty-four commercial landings series are more than 30 years long. Among these, the most extended series, > 50 years long - the majority being available since the late 40s - come from several countries (Latvia (LV), Lithuania (LT), ES, Estonia (EE), Turkey (TR), Poland (PL), Netherlands (NL)). Two series of 112 and 80 years long (Norway (NO) and DK, respectively) date back to the beginning of the 20th century and 1920.

Twenty-two EMUs from 12 countries collected information on recreational landings for adult eels, yellow and silver eel were not separated (Table 4). Fourteen data series have more than 10 years and show continuity with no empty values. Four series (LV_Latv, EE_Narv, EE_West, DK_total) range between 10 and 20 years. The most extended series, dating back to the 1980s, are provided by Germany (DE) and Slovenia (SI) and add up to 35 (nine EMUs) and 37 years long (one series), respectively. The rest of the EMUs have reported shorter series that are discontinuous with empty values.

Yellow eel commercial and recreational landing series

The database reported yellow eel commercial data from 15 countries and 52 EMUs (Table 3). Most commercial series are located in GB (12 EMUs), FR and IT (nine EMUs each). The majority of the data have been available since 2000. Thirty-four series, with continuous values or less than five missing each, have more than 10 years of data. Of those, 31 series range between 10 and 20 years long, two are >30 (PT_Port) and >60 years (GB_Neag) long, and one goes back to 1914 (SE_West, 105 years of data). Eighteen data series have less than 10 years of data.

Eight countries, adding up to 41 EMUs, reported recreational fishing of yellow eels (Table 4). Most of the data have less than 10 years long data series. Seven EMUs from Belgium (BE) and FR are more than 20 years long (BE_Meus, BE_Sche, FR_Adou, FR_Bret, FR_Rhin, FR_Garo, FR_Loir) and go back to 2000. Around 17 EMUs reported punctual information of recreational landings with one- or two-year maximum values.

Silver eel commercial and recreational landings series

Silver eel commercial landings data series have been reported from 11 countries and 47 EMUs. The majority of the data have been available since 2000 (Table 3). Thirty series have more than 10 years of data. Almost all commercial series are continuous with few exceptions; however, no more than one value is missing. GB, Ireland (IE) and IT report most of the data. Twenty-five series range between 10 and 20 years long. Denmark (DK) and GB_Neag reported landing data series >60 years long. A series of Sweden dates back to 1914 (SE_East). Seventeen data series have less than ten years of data.

Only Italy reports silver eel recreational landings coming from seven EMUs. All data date back to 2010/2011 according to the implementation of the Eel Reg 1100.

Table 1 Glass eel commercial landings series provided by country. Series are alphabetically ordered by EMU. Min and max indicate the first and last year in the records, and the values are given in the n+ and n- columns, displaying the number of years with values and the number of years when there are missing data within the series.

Country	EMU	n+	Min	Max	n-
ES	ES_Astu	27	1996	2022	0
ES	ES_Cant	12	2006	2022	5
ES	ES_Cata	24	1998	2022	1
PT	ES_Minh	49	1974	2022	0
ES	ES_Mino	48	1975	2022	0
ES	ES_Vale	72	1945	2022	6
FR	FR_Adou	13	2010	2022	0
FR	FR_Arto	12	2010	2022	1
FR	FR_Bret	11	2010	2022	2
FR	FR_Garo	11	2010	2022	2
FR	FR_Loir	11	2010	2022	2
FR	FR_Sein	12	2010	2022	1
FR	FR_total	31	1978	2008	0
GB	GB_Dee	16	2005	2020	0
GB	GB_NorW	17	2005	2021	0
GB	GB_Seve	18	2005	2022	0
GB	GB_SouE	5	2005	2009	0
GB	GB_SouW	18	2005	2022	0
GB	GB_total	31	1972	2004	2
GB	GB_Wale	16	2005	2020	0
IT	IT_Lazi	6	2014	2020	1
IT	IT_Tosc	3	2014	2016	0
IT	IT_Vene	1	2016	2016	0

Table 2 Glass eel recreational landings series provided by country. Series are alphabetically ordered by EMU. Min and max indicate the first and last year in the records, and the values are given in the n+ and n- columns, displaying the number of years with values and the number of years when there are missing data within the series.

Country	EMU	n+	Min	Max	n-
ES	ES_Basq	18	2004	2022	0
ES	ES_Cant	9	2006	2014	0
FR	FR_total	41	1978	2020	2

Table 3: Commercial landings series available provided by country. Series are alphabetically ordered. Min and max indicate the first and last year in the records, and the values are given in the n+ and n- columns, displaying the number of years with values and the number of years when there are missing data within the series. Codes for stages YS= yellow eel + silver eel, Y= yellow eel, S= silver eel.

		YS				Y				S			
Country	EMU	n+	Min	Max	n-	n+	Min	Max	n-	n+	Min	Max	n-
AL	AL_total	7	2013	2019	0	5	2013	2019	2	9	2013	2021	0
BE	BE_Sche	6	2000	2005	0	1	2017	2017	0	-	-	-	-
DE	DE_Eide	32	1985	2016	0	11	2009	2019	0	11	2009	2019	0
DE	DE_Elbe	35	1985	2019	0	-	-	-	-	-	-	-	-
DE	DE_Ems	35	1985	2019	0	-	-	-	-	-	-	-	-
DE	DE_Maas	29	1988	2016	0	3	2017	2019	0	3	2017	2019	0
DE	DE_Oder	35	1985	2019	0	-	-	-	-	-	-	-	-
DE	DE_Rhei	35	1985	2019	0	-	-	-	-	-	-	-	-
DE	DE_Schl	32	1985	2016	0	3	2017	2019	0	3	2017	2019	0
DE	DE_Warn	35	1985	2019	0	9	2011	2019	0	9	2011	2019	0
DE	DE_Wese	35	1985	2019	0	-	-	-	-	-	-	-	-
DK	DK_Inla	-	-	-	-	5	2017	2021	0	5	2017	2021	0
DK	DK_total	80	1920	1999	0	62	1960	2021	0	62	1960	2021	0
DZ	DZ_total	22	1999	2021	1	-	-	-	-	-	-	-	-
EE	EE_Narv	58	1964	2021	0	-	-	-	-	-	-	-	-
EE	EE_West	53	1969	2021	0	-	-	-	-	-	-	-	-
ES	ES_Anda	4	2015	2018	0	-	-	-	-	-	-	-	-
ES	ES_Astu	10	2006	2015	0	-	-	-	-	-	-	-	-
ES	ES_Bale	35	1977	2014	3	-	-	-	-	-	-	-	-
ES	ES_Cata	21	1999	2022	3	-	-	-	-	-	-	-	-
ES	ES_Gali	23	1997	2019	0	12	2010	2021	0	-	-	-	-
ES	ES_Mino	23	1985	2008	1	-	-	-	-	-	-	-	-
ES	ES_Murc	49	1961	2022	13	9	2014	2022	0	9	2014	2022	0

		YS				Y				S			
ES	ES_Vale	66	1951	2022	4	3	2020	2022	0	3	2020	2022	0
FI	FI_total	13	2008	2020	0	-	-	-	-	-	-	-	-
FR	FR_Adou	-	-	-	-	13	2000	2021	9	-	-	-	-
FR	FR_Bret	-	-	-	-	9	2012	2020	0	-	-	-	-
FR	FR_Cors					9	2012	2020	0	9	2012	2021	1
FR	FR_Garo	-	-	-	-	19	2000	2021	3	-	-	-	-
FR	FR_Loir	-	-	-	-	20	2000	2021	2	-	-	-	-
FR	FR_Rhin	-	-	-	-	4	2000	2003	0	-	-	-	-
FR	FR_Loir	-	-	-	-	-	-	-	-	18	2002	2021	2
FR	FR_Rhon	1	2011	2011	0	15	2000	2020	6	9	2012	2021	1
FR	FR_Sein					10	2000	2010	1	-	-	-	-
FR	FR_total	16	1986	2001	0	1	2011	2011	0	1	2011	2011	0
GB	GB_Angl	-	-	-	-	17	2005	2021	0	17	2005	2021	0
GB	GB_Dee	-	-	-	-	17	2005	2021	0	17	2005	2021	0
GB	GB_Humb	-	-	-	-	17	2005	2021	0	17	2005	2021	0
GB	GB_Neag	-	-	-	-	63	1960	2022	0	62	1960	2021	0
GB	GB_Nort	-	-	-	-	4	2005	2010	2	4	2005	2010	2
GB	GB_NorW	-	-	-	-	17	2005	2021	0	17	2005	2021	0
GB	GB_Seve	-	-	-	-	8	2005	2013	1	8	2005	2013	1
GB	GB_SouE	-	-	-	-	17	2005	2021	0	17	2005	2021	0
GB	GB_SouW	-	-	-	-	17	2005	2021	0	17	2005	2021	0
GB	GB_Tham	-	-	-	-	16	2005	2021	0	17	2005	2021	0
GB	GB_Wale	-	-	-	-	17	2005	2021	0	16	2005	2020	0
GB	GB_total	16	1987	2004	2	-	-	-	-	-	-	-	-
GR	GR_CeAe	-	-	-	-	-	-	-	-	2	2018	2019	0
GR	GR_EaMT	-	-	-	-	-	-	-	-	9	2013	2021	0
GR	GR_NorW	-	-	-	-	5	2017	2021	0	9	2013	2021	0

		YS				Y				S			
GR	GR_total	-	-	-	-	-	-	-	-	47	1966	2012	0
GR	GR_WePe	-	-	-	-	-	-	-	-	9	2013	2021	0
HR	HR_total	-	-	-	-	6	2014	2019	0	-	-	-	-
IE	IE_East	9	2009	2017	0	15	2008	2022	0	15	2008	2022	0
IE	IE_NorW	9	2009	2017	0	15	2008	2022	0	15	2008	2022	0
IE	IE_Shan	9	2009	2017	0	15	2008	2022	0	15	2008	2022	0
IE	IE_SouE	9	2009	2017	0	15	2008	2022	0	15	2008	2022	0
IE	IE_SouW	9	2009	2017	0	15	2008	2022	0	15	2008	2022	0
IE	IE_total	34	1970	2007	4	-	-	-	-	-	-	-	-
IE	IE_West	9	2009	2017	0	14	2008	2021	0	15	2008	2022	0
IT	IT_Emil	-	-	-	-	13	2009	2021	0	12	2009	2021	1
IT	IT_Frio	-	-	-	-	13	2009	2021	0	12	2009	2021	1
IT	IT_Lazi	-	-	-	-	13	2009	2021	0	12	2009	2021	1
IT	IT_Lomb	-	-	-	-	13	2009	2021	0	12	2009	2021	1
IT	IT_Pugl	-	-	-	-	13	2009	2021	1	12	2009	2021	1
IT	IT_Sard	-	-	-	-	13	2009	2021	0	12	2009	2021	1
IT	IT_Tosc	-	-	-	-	13	2009	2021	1	12	2009	2021	1
IT	IT_total	40	1969	2008	0	-	-	-	-	-	-	-	-
IT	IT_Umbr	-	-	-	-	13	2009	2021	0	6	2009	2021	7
IT	IT_Vene	-	-	-	-	13	2009	2021	0	12	2009	2021	1
LT	LT_Lith	2	2017	2019	1	-	-	-	-	-	-	-	-
LT	LT_total	73	1947	2020	1	22	2009	2021	-	22	2000	2021	0
LV	LV_Latv	75	1947	1999	0	-	-	-	-	-	-	-	-
MA	MA_total	6	2013	2018	0	-	-	-	-	-	-	-	-
NL	NL_Neth	77	1945	2021	0	-	-	-	-	-	-	-	-
NO	NO_total	112	1908	2019	0	2	2020	2021	0	-	-	-	-
PL	PL_Oder	49	1973	2021	0	-	-	-	-	-	-	-	-

		YS				Y				S			
PL	PL_total	20	1954	2018	45	-	-	-	-	-	-	-	-
PL	PL_Vist	49	1973	2021	0	-	-	-	-	-	-	-	-
PT	PT_Port	-	-	-	-	33	1989	2021	0	-	-	-	-
SE	SE_East	-	-	-	-	-	-	-	-	108	1914	2021	0
SE	SE_Inla	-	-	-	-	-	-	-	-	36	1986	2021	0
SE	SE_West	-	-	-	-	105	1914	2018	0	-	-	-	-
SI	SI_total	32	1982	2016	3	-	-	-	-	-	-	-	-
TN	TN_EC	22	2000	2021	0	-	-	-	-	-	-	-	-
TN	TN_NE	22	2000	2021	0	-	-	-	-	-	-	-	-
TN	TN_Nor	21	2000	2021	1	-	-	-	-	-	-	-	-
TN	TN_SO	22	2000	2021	0	-	-	-	-	-	-	-	-
TN	TN_total	1	2020	2020	0	-	-	-	-	-	-	-	-
TR	TR_total	53	1969	2021	0	-	-	-	-	-	-	-	-

Table 4 Recreational landings series available provided by country. Series are alphabetically ordered. Min and max indicate the first and last year in the records, and the values are given in the n+ and n- columns, displaying the number of years with values and the number of years when there are missing data within the series. Codes for stages YS= yellow eel + silver eel, Y= yellow eel, S= silver eel.

		YS				Y				S			
Country	EMU	n+	Min	Max	n-	n+	Min	Max	n-	n+	Min	Max	n-
BE	BE_Meus					22	2000	2021	0				
BE	BE_Sche	4	2018	2021	0	22	2000	2021	0				
CZ	CZ_total					8	2012	2019	0				
DE	DE_Eide	35	1985	2019	0								
DE	DE_Elbe	35	1985	2019	0								
DE	DE_Ems	35	1985	2019	0								
DE	DE_Maas	35	1985	2019	0								
DE	DE_Oder	35	1985	2019	0								
DE	DE_Rhei	35	1985	2019	0								

		YS				Y				S			
DE	DE_Schl	35	1985	2019	0								
DE	DE_Warn	35	1985	2019	0								
DE	DE_Wese	35	1985	2019	0								
DK	DK_Inla	7	2009	2020	5	1	2021	2021	0				
DK	DK_total	12	2009	2020	0	1	2021	2021	0				
EE	EE_Narv	17	2005	2021	0								
EE	EE_West	17	2005	2021	0								
ES	ES_Vale	7	2013	2019	0								
FI	FI_Finl	7	2008	2020	7								
FR	FR_Adou					21	2000	2020	0				
FR	FR_Arto					1	2006	2006	0				
FR	FR_Bret					21	2000	2020	0				
FR	FR_Cors					1	2006	2006	0				
FR	FR_Garo					19	2000	2018	0				
FR	FR_Loir					19	2000	2018	0				
FR	FR_Meus					1	2006	2006	0				
FR	FR_Rhin					21	2000	2020	0				
FR	FR_Rhon					16	2000	2015	0				
FR	FR_Sein					1	2006	2006	0				
IE	IE_East					1	2022	2022	0				
IE	IE_NorW					1	2022	2022	0				
IE	IE_Shan					1	2022	2022	0				
IE	IE_SouE					1	2022	2022	0				
IE	IE_SouW					1	2022	2022	0				
IE	IE_West					1	2022	2022	0				
IT	IT_Abru					1	2011	2011	0				
IT	IT_Basi					6	2011	2016	0				

		YS				Y				S			
IT	IT_Cala					8	2011	2018	0				
IT	IT_Camp					2	2010	2021	0	7	2010	2021	5
IT	IT_Emil					11	2010	2021	1	12	2010	2021	0
IT	IT_Frio					8	2010	2021	1	10	2010	2021	2
IT	IT_Lazi					11	2010	2021	0	10	2010	2021	2
IT	IT_Ligu					5	2010	2014	0				
IT	IT_Lomb					10	2010	2021	2	8	2010	2021	4
IT	IT_Marc					2	2010	2011	0				
IT	IT_Piem					9	2010	2018	0				
IT	IT_Sard					1	2021	2021	0				
IT	IT_Sici					9	2010	2018	0				
IT	IT_Tosc					11	2010	2021	1	12	2010	2021	0
IT	IT_Umbr					10	2010	2021	1				
IT	IT_Vene					12	2010	2021	0	10	2010	2021	2
LT	LT_Lith					2	2020	2021	0				
LT	LT_total	1	2017	2017	0	8	2012	2019	0				
LV	LV_Latv	22	2000	2021	0								
NL	NL_Neth	6	2010	2020	6								
PL	PL_Oder					5	2017	2021	0				
PL	PL_total	5	2012	2016	0								
PL	PL_Vist					5	2017	2021	0				
SI	SI_total	37	1980	2016	0								
TR	TR_total	2	2020	2021	0								

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