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

3–10 October 2017

Kavala, Greece

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

FAO FIAT PANIS

GFCM CGPM

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Executive Summary

The recruitment of European eel from the ocean remained low in 2017. The glass eel recruitment compared to the 1960–1979 was only 1.6% in the North Sea and 8.7% in the Elsewhere Europe series, based on available dataseries. For the yellow eel dataseries, recruitment was 24% of the level during the reference period.

Landings were for the first time in this report presented for each eel life stage, habitat and country. However, the landings data presented are only those reported to the WGEEL, either through responses to the 2017 Data call or in Country Reports, or integrated by the WGEEL using data from its previous reports. As some countries have not reported all their landings, even the raised versions reported here should be considered as minima.

Glass eel fisheries within the EU take place in France, UK, Spain, Portugal and Italy. Glass eel landings have declined sharply from 1980, when reported landings were larger than 2000 tonnes (6000 million eels) to 57 t (171 million eels) in 2017. Some non-EU countries (e.g. Morocco) also have glass eel fisheries, but data were not available.

Yellow and silver eel landings are not always reported separately, so are combined here. The total landings of yellow and silver eels decreased from 18 000–20 000 tonnes in the 1950s to 2000–3000 tonnes since 2009, and a reported 2280 tonnes in 2016. Most yellow and silver eel landings come from fresh, transitional and coastal waters.

Recreational catches and landings are poorly reported so amounts must be treated as a minimum but were estimated as 2 t for glass eel in 2017, and 241 tonnes for yellow and silver eel combined in 2016 (2017 data not available at time of writing). Overall, the impact of recreational fisheries on the eel stock remains largely unquantified although landings can be thought to be at a similar order of magnitude to those of commercial fisheries.

Aquaculture production was about 5000–6000 t in most recent years (reported data from the Eel Data call 2017 and WGEEL Country Reports). European eel aquaculture is only based on wild recruits. It should be noted that part of the production are eels subsequently released for stocking.

About 10 million stocked eels were reported in 2017, though these were stocked at a variety of life-history stages and times after first capture.

The working group has developed a Data call for 2018, as Part 2 following on from Part 1 in 2017. Part 2 requires updates for recruitment, landings, aquaculture and stocking, but also full time-series of silver eel biomass stock estimates, silver eel mortality biomass equivalents, mortality rate estimates and silver eel time-series. The call includes nine data spreadsheets, one overview spreadsheet, and one feedback spreadsheet, each to be supplied in separate Annexes. The overview sheet was added to the Data call based on experiences from 2017 to ensure a more systematic way of filling in the data spreadsheets.

A workshop to develop the process for data checks, etc. will be held in July 2018.

The European eel listing on Appendix II of the Convention on International Trade in Endangered Species (CITES) came into force in March 2009, so any international trade in this species needs to be accompanied by a permit. Since 2010, all trade into and out of the EU was banned. For 2017, Turkey had an export quota of 70 t. Other non-EU

countries have not reported any quotas to CITES (CITES export quotas database consulted 07/10/2017), however, it is understood that Tunisia intends to establish an export quota.

1 Introduction

1.1 Main tasks

The Joint EIFAAC/ICES/GFCM Working Group on Eel [WGEEL] (chaired by: Alan Walker, UK) met at the Fisheries Research Institute (FRI), Kavala, Greece, from 3rd to 10th October 2017 to address the terms of reference (ToR) set by ICES, EIFAAC and GFCM.

The meeting opened at 14:00 hrs on Tuesday 3rd October. The agenda for the meeting is provided in Annex 4. The terms of reference were met.

The report chapters are linked to ToR, as indicated in the table below.

ToR A	Report on developments in the state of the European eel (*Anguilla anguilla*) stock, the fisheries on it and other anthropogenic impacts	Chapter 2
ToR B	Produce the first draft of the ICES annual eel advice, and other advisory documents as requested	Separate document
ToR C	Report on updates to the scientific basis of the advice, including any new or emerging threats or opportunities	Chapter 4
ToR D	Address the generic EG ToRs from ICES, and any requests from EIFAAC or GFCM	Several chapters

In response to the ToR, the Working Group used data and information provided in response to the Eel Data Call 2017 (from 16 countries) and 19 Country Report Working Documents submitted by participants (Annex 5); other references cited in the Report are given in Annex 1. Additional information was supplied by correspondence, by those Working Group members unable to attend the meeting. A list of acronyms and glossary of terms used within this document is provided in Annex 2.

1.2 Participants

Thirty-one experts attended the meeting, representing 19 countries, along with four experts invited by the chair and representatives of the EU Commission DG MARE and the General Fisheries Commission of the Mediterranean (GFCM). A full address list for the meeting participants is provided in Annex 3.

1.3 The European eel: Stock Annex

A Stock Annex for the European eel was drafted by the WGEEL 2015 meeting, and is available from the ICES website here . This Stock Annex is intended as a reference document providing the background to the European eel. It describes the eel stock, the development of eel advice, the management frameworks for eel and the analysis of the recruitment for the provision of ICES Stock Advice. In principle, information contained in the Stock Annex should not be repeated in the annual reports of the WGEEL. However, some information is reported here where the WGEEL considered it appropriate.

It is intended that once the eel database development is well progressed in 2018 and the data being used in the advice is confirmed, that the SA should be updated in 2018 or 2019. The WG felt it premature to attempt any update in 2017.

1.4 The European eel: life history and production

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

European eel life history is complex, being a long-lived semelparous and widely dispersed stock. The shared single stock is genetically panmictic and data indicate the spawning area is in the southwestern part of the Sargasso Sea and therefore outside Community Waters. 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 could exceed 50 years) prior to metamorphosis to the "silver eel" stage and maturation. Age-at-maturity varies according to temperature (latitude and longitude), ecosystem characteristics, and density-dependent processes. The European eel life cycle is shorter for populations in the southern part of their range compared to the north.

The amount of glass eel arriving in continental waters declined dramatically in the early 1980s, and has been very low in all years after 2000. The reasons for this decline are uncertain but may include overexploitation, pollution, non-native parasites, diseases, migratory barriers and other habitat loss, mortality during passage through turbines or pumps, and/or oceanic-factors affecting migrations. These factors will affect local production differently throughout the eel's range. In the planning and execution of measures for the protection and sustainable use of European eel, Management must therefore take into account the diversity of regional conditions.

1.5 Anthropogenic impacts on the stock

Anthropogenic mortality may be inflicted on eel by fisheries (including where catches supply aquaculture for consumption), hydropower turbines and pumps, pollution and indirectly by other forms of habitat modification and obstacles to migration.

Fisheries exploit all continental life phases: glass eel recruiting to continental waters, the immature growing yellow eel and the maturing silver eel. There are multiple commercial and recreational fisheries: with registered and non-registered vessels using nets and/or longlines; without vessels using fixed traps and nets; with mobile (bank-based) net gears, and rod and line. The exploited life stage and the gear types employed vary between local habitat, river, country and international regions.

1.6 The management framework of eel

1.6.1 EU and Member State waters

The European eel is a panmictic stock with widespread distribution. Within EU and Member State waters, the stock, fisheries and other anthropogenic impacts, are currently managed in accordance with the European Eel Regulation EC No 1100/2007, "*establishing measures for the recovery of the stock of European eel*" (European Council, 2007).

This regulation sets a framework for the protection and sustainable use of the stock of European eel of the species *Anguilla anguilla* in Community Waters, in coastal lagoons, in estuaries, and in 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.

EU Member States must adopt national objectives, set out in Eel Management Plans (EMPs) in accordance with Article 2.4 of the Regulation 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 EMPs)… *shall be prepared with the purpose of achieving this objective in the long term.*" Each EMP constitutes a management plan adopted at national level within the framework of a Community conservation measure.

Under Article 9 of the Regulation, Member States must report on the monitoring, effectiveness and outcomes of EMPs, including: the proportion of silver eel biomass (relative to the target level of escapement) that escapes to the sea to spawn or leaves the national territory; the level of fishing effort that catches eel each year; the level(s) of anthropogenic mortality outside the fishery; the amount of eel less than 12 cm in length caught; and the proportions utilized for different purposes. These reporting requirements were further developed by the Commission in 2011/2012, and published as guidance for the production of the 2012 reports. This guidance adds the requirement to report fishing catches (as well as effort) and explains the various biomass, mortality rates and stocking metrics using the following definitions:

- Silver eel production (biomass):
  - B_0 The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the stock;
  - $B_{current}$ The amount of silver eel biomass that currently escapes to the sea to spawn;
  - B_{best} The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the current stock, included restocking practices, hence only natural mortality operating on stock.
- Anthropogenic mortality (impacts):
  - 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. $\Sigma A = \Sigma F + \Sigma H$. It refers to mortalities summed over the age groups in the stock.
- Stocking requirements:
  - R(s) The amount of eel (<20 cm) restocked into national waters annually. The source of these eel should also be reported, at least to originating Member State, to ensure full accounting of catch vs. stocked (i.e. avoid 'double banking'). Note that R(s) for stocking is a new symbol devised by the Workshop to differentiate from "R" which is usually considered to represent Recruitment of eel to continental waters.

In July 2012, Member States first reported on the actions taken, the reduction in anthropogenic mortalities achieved, and the state of their stock relative to their targets. In May 2013, ICES evaluated these progress reports in terms of the technical implementation of actions (ICES, 2013a). In October 2014, the European Commission reported to

the European Parliament and the Council with a statistical and scientific evaluation of the outcome of the implementation of the Eel Management Plans. EU Member States again reported on progress with implementing their EMPs in 2015 but no official post-evaluation has taken place. EU Member States will next report progress in 2018.

1.6.2 Non-EU states

The EC Eel Regulation only applies to EU Member States but the eel distribution extends much further than this. Some non-EU countries provide data to the WGEEL and more countries are being supported to achieve this through efforts of the General Fisheries Commission of the Mediterranean (GFCM), see Chapter 3. Most non-EU areas have only recently been involved in this data provision, and further development - of reference points, assessment procedures, and feedback mechanisms - might be required, to cope with unforeseen complications and/or to familiarise local experts, and involve them in future standardisation processes.

1.6.3 Other international drivers

The European eel was listed in Appendix II of the Convention on International Trade in Endangered Species (CITES) in 2007, although it did not come into force until March 2009. Since then, any international trade in this species needs to be accompanied by a permit. For 2017, all trade into and out of the EU was banned (i.e. zero quota) and Turkey had an export quota of 70 t. Other countries have not reported any quotas to CITES (CITES export quotas database consulted 07/10/2017); however, it is understood that Tunisia intends to establish an export quota for 2017. ICES (2015b) recently advised the EU CITES SRG on criteria and thresholds that might be used in forming a future application for a Non-Detriment Finding (NDF).

The International Union for the Conservation of Nature (IUCN) has assessed the European eel as 'critically endangered' and included it on its Red List in 2009. It renewed this listing in 2014, but recognised that: "*if the recently observed increase in recruitment continues, management actions relating to anthropogenic threats prove effective, and/or there are positive effects of natural influences on the various life stages of this species, a listing of Endangered would be achievable*" and therefore "*strongly recommend an update of the status in five years*". In addition, the IUCN Conservation Congress approved motion 005 - Promotion of Anguillid eels as flagship species for aquatic conservation in September 2016.

In 2014, the European eel has been added to Appendix II of the Convention on Migratory Species (CMS), whereby Parties (covering almost the entire distribution of European eel) to the Convention call for cooperative conservation actions to be developed among Range States.

1.7 Assessments to meet management needs

The European Commission obtains recurring 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 EU and ICES (2017). In support of this advice, ICES is asked to provide the EU 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 EU is required to arrange, through Member States or directly, for any data collected through the Data Collection Framework (DCF) and legally disclosable for scientific purposes to be available to ICES.

ICES requests information from national representatives to the WGEEL on the status of national eel production each year. ICES issued a Data call to request some of this information in August/September 2017, and this call was also advertised by EIFAAC to its membership (see below for further details). GFCM also produced a Data call within the structures of its Data Collection Reference Framework (DCRF), though the content was not identical with the ICES call and the DCRF call was not obligatory to GFCM countries. The national representatives to WGEEL were requested to provide this information within a series of spreadsheets and with an accompanying text (Country Report) explaining, e.g. management structures, data collection programmes and national assessment methods. These spreadsheets were substantially updated in advance of the 2017 WGEEL meeting.

The status of eel production in EU-EMUs and non-EU Eel Assessment Units is assessed by national or sub-national fishery/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 a little bit of confusion. When existing, it mostly corresponds to the management area corresponding to the "eel river basin" as defined in the EU Eel Regulation (EC No 1100/2007). But in cases of stock assessments at other spatial scales, and for stock parts lying outside from the EU, EMUs have also been defined, either as being the management units used by the country (e.g. Tunisia) or to the whole country. In practice, in the spatial reference table, geographical units have also been provided that refer to more consistent geographical areas, with the objective of providing consistent spatial units to assess shared stock 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.

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

The ICES Study Group on International Post-Evaluation of Eel (SGIPEE) (ICES, 2010a; 2011a) and WGEEL (ICES, 2010b; FAO and ICES, 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. This approach was first applied by WGEEL in 2013 based on the national stock indicators reported by EU Member States in 2012 in their first EMP Progress Reports, and will be applied again in 2018 using the data reported in 2018 Data call and Country Reports.

1.8 Data call

The WGEEL annually collates data on recruitment, landings from commercial and recreational fisheries, stocking, aquaculture production, rates of other human-induced mortalities on eel, biological characteristics of eel, etc. Prior to 2017, these data have been provided by countries attending the WGEEL in many complex spreadsheets. Reporting is far from complete at present. A Data call hosted by ICES, EIFAAC and GFCM is considered an effective mechanism to significantly improve the situation of data provision and use.

A Workshop on Designing an Eel Data Call (WKEELDATA), (chaired by: Caroline Durif, Norway), met in Rennes, France, from 28 February to 2 March 2017 to develop a Data call that was later sent to all countries having natural production of European eel.

The WKEELDATA participants developed a two-year plan. New spreadsheets were created to facilitate data entry.

The Data call 2017 (Part 1 of the two-year plan) requested data describing: recruitment; fishery catches; fishery landings (killed); aquaculture production and stocking. These data were requested for as far back as available, to form a starting point for the creation of a database. In future years, the call for these datasets will only be for the most recent year's data, plus any adjustments required to historic data. The call also required the provision of metadata associated with all data.

The WGEEL 2017 meeting developed Part 2 of the Data call, requesting data on the stock indicators (biomass) and mortality estimates, wetted area and silver eel time-series, as well as the annual update on recruitment data, landings (not catch), aquaculture production and stocking. This is fully described in Chapter 3 of this report.

1.9 Concluding remarks

This report of the Joint EIFAAC/ICES/GFCM Working Group on Eel is a further step in an ongoing process of documenting the stock of the European eel, associated fisheries and other anthropogenic impacts and developing methodologies for giving scientific advice on management to effect a recovery in the international, panmictic stock. This scientific advice has to be suitable for the purposes of EIFAAC, ICES and GFCM, and to this end the advisory process is being developed to suit these multiple and varied requirements.

2 Developments in the state of the stock, recruitment, fisheries, aquaculture and stocking

2.1 Introduction

Updates on the state of the eel stock in countries reporting to WGEEL are presented in this chapter, in response to Term of Reference A: *Report on developments in the state of the European eel (Anguilla anguilla) stock, the fisheries on it and other anthropogenic impacts*. Note there was no update on anthropogenic impacts other than fisheries because no new data were available: EU Member States are in the process of conducting new analyses and will present these in their Eel Management Plan Progress Reports in 2018.

Country representatives were asked to report time-series of recruitment, catches and landings, aquaculture production and quantities restocked through the Eel Data Call 2017, which was distributed through ICES, EIFAAC and GFCM (though the content of the GFCM call was different). Country representatives delivered reports for each country describing management, fisheries, restocking, aquaculture, habitat, stock assessments and other data. Each of the sections below describes trends in the dataseries, comments on any issues with the quality of the data and, where appropriate, explains the consequences for the status of the stock.

Note that since 2015, the bulk of the data on the longer time-series for European eel are held in a "Stock Annex" available via the ICES website here . This annual report only tabulates new data not available in the Stock Annex. As a change from previous reports, data are reported for eel management units when possible, and to country or region if necessary.

The WKEELDATA participants developed a two-year plan. New spreadsheets were created to facilitate data entry.

2.2 Data checking procedures

2.2.1 Data call treatment and quality insurance

The Data call files have been processed with R in a two-step process. First all files placed in a folder, with a subfolder structure (one folder per country) have been read into R. A function was programmed to issue structural warning regarding the files (number of column, column names, etc.) and a series of check utilities (click here for github files) have been programmed to ensure that the data returned were consistent with the dictionaries, did not contain text instead of number, and qualified all the lines with missing data, etc. The check was done file by file with corrections made in the original excel files until all the warnings could be safely ignored.

As a second step, the contents of the database were checked at the file insertion: including checking that there were no double entries for the same year for the same kind of data, nor the inconsistencies with the dictionary tables (as set by foreign keys in the database). The process was repeated for three Data call file input: landings, aquaculture, and stocking.

As a final result, three csv files were then produced for the WGEEL for inspection, quality check, and control.

For recruitment data, a different procedure was applied as these data are already in a database used by the WGEEL. Data from the previous years were sent to users using a script for recruitment which generates excel files. Those files were checked, filled in by

national correspondents, and then returned with a flagging of changes values. They were then integrated manually using a database interface.

2.2.2 Integration of historical data, and quality flag of the lines

When historical data existed in the WGEEL tables but were not reported in the Data call, then these historical data were inserted in the database using the available Data call sheets. However, this was only done to complete data of countries that did report to the Data call.

Also for all the lines, a quality screening was performed. Lines of good quality have been flagged with a 1 in the quality column. When judged of poor quality, the data have been kept in the database but flagged with a 0 (some data are missing) or 3 (bad quality). These choices have been commented upon. A modification of data from the Data call corresponds to the code 2. In some cases, lines of bad quality have been replaced with other data that were previously known to be good, and they have then been flagged WGEEL_2016 in a column describing the data source. If national reports to the WGEEL were considered more accurate, then a new line was inserted and flagged as WGEEL_2017.

Most of the data (>90%) were qualified as good (quality code 1) for the three sources of information (Table 2.1). One value in aquaculture dataset was changed (quality code 2). Only less than 4% of the aquaculture data were discarded due to poor quality (quality code 3). Missing data corresponded to 8.4% for aquaculture and 2.5% for landings and only one value for stocking. However, some data (one for aquaculture, 39 for landings and 162 stocking) still need to be qualified during the next WGEEL (quality code NA).

Table 2.1. The number of data used in aquaculture, landing and stocking analyses, according to WGEEL quality code.

quality code	aquaculture	landings	stocking
0	21	110	1
1	224	4122	1452
2	0	1	0
3	4	155	0
NA	1	39	162
Total	250	4427	1615

2.2.3 Feedback to design of Data call 2018

The restrictions placed in the excel sheets have ensured that the data provided were of good quality, but many errors were still reported and had to be corrected during the WGEEL 2017 meeting. Among them, the use of wrong codes should be avoided by forcing the data check to test more lines in the table, as they were probably too short in the Data call files.

A timely report of the files respecting the deadlines would help that at least some of the work could be done in preparation of the WGEEL. Data providers will be reminded of the importance of timely reporting.

The current values integrated into the database should be provided when issuing the next Data call so that national representatives know the current state of their data.

Some data in the Mediterranean have not been integrated into the database in 2017 due to their not being confirmed during the Data call or by 2017 Country Reports. Those series are available to the WGEEL however, and their integration is expected next year.

The request for both catch and landings caused some ambiguity in response because for eel the terms are sometimes interchangeable (although the definitions in the Data call were explicit). This year, data that were registered as catch have been converted to landings and only one set of values will be requested henceforth.

A new process for checking duplicates and updated data before entering into the database will be developed for 2018 (see Chapter 3). The check for duplicate entries was only done when entering data into the database. For next year, new checks should be developed to ensure no duplicate entries. This will be all the more important as we will have to check the data with those existing in the database. The idea is to return a set of tables to the WGEEL for inspection when duplications appear. The process will be more complex than this year and will need to be coded before WGEEL.

A workshop to develop the process for data checks, etc. will be held in July 2018; a draft Resolution has been submitted to ICES and is provided in Annex 6.

For the stocking data, it is necessary to know the stage stocked. For this reason, next year's Data call stocking sheet will contain two columns: one for kg, one for number. Filling both columns will be mandatory.

It has been decided that data should be reported per EMU, and that ICES division rectangles would be used only when catches are reported for coastal or marine data. The ICES rectangle has been dropped for all Freshwater habitats. However, there appear to be several definitions or delineations of freshwatervs.marine boundaries used for legislation such as the Common Fisheries Policy (CFP), Water Framework Directive (WFD), the Marine Strategy Framework Directive (MSFD) and the national eel basins designated by EU Member States for their eel Management Plans. The CFP baselines are described in European Commission (2010). WGEEL members will investigate their national baselines for other legislations.

Having the database available only on one computer creates in effect a bottleneck in the data treatment. WGEEL will test the database another year before handing it for hosting in ICES. A workshop to train some more WGEEL members to use the database will be held in the first half of 2019. Then a workshop at ICES Headquarters will be necessary in 2019 or 2020 to exchange on the database integration to the ICES database.

2.2.4 Change in reference tables (GIS)

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 a little bit of confusion. It was initially stated as the management area corresponding to the "eel river basin" as defined in the EU Eel regulation (EC No 1100/2007). But in cases of stock assessments at a different spatial scales, EMU has also been used to refer to any such assessment area.

For Sweden, the national eel river basin has been split into the west coast, inland, and east coast. Four EMUs have been created for Tunisia instead of the national one. An EMU has been created for the Minho at the boundary between Spain and Portugal, as

this EMU was missing from the WGEEL database, despite the existence of a Transboundary EMP for the International part of River Minho. The EMUs of Greece have been corrected. This work was done in postgis on the reference table of the EMU.

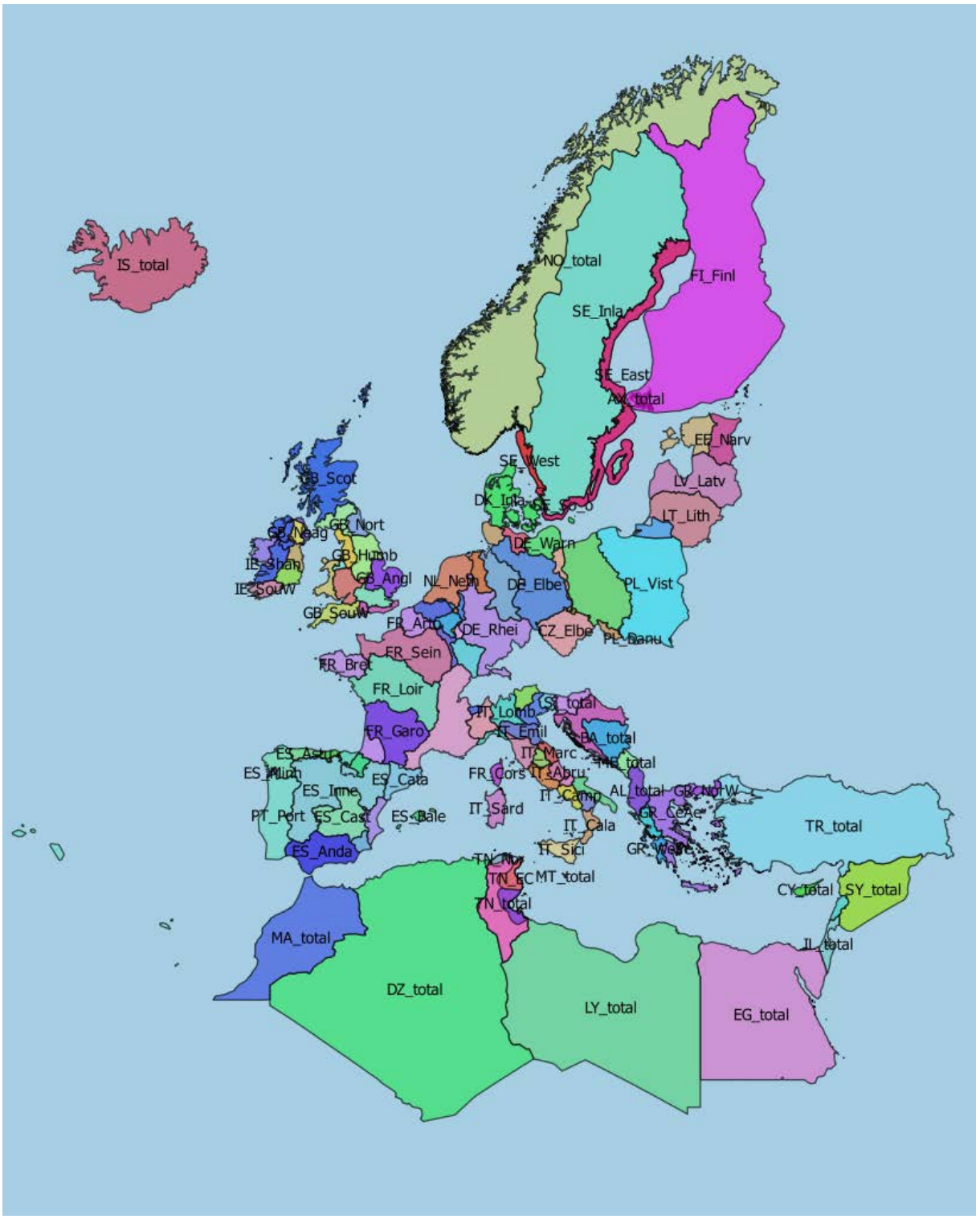

Figure 2.1. Current map of EMUs as reported by EU countries, or corresponding to national entities when no EMU is described at the national level. The map was updated for Tunisia, Greece, Portugal, Sweden and Iceland.

2.2.5 Application development

WGEEL now uses the GitHub areas CES provided by ICES to facilitate scientific collaboration. GitHub is an open source version control system. It permits the WGEEL members to have access to the R and SQL scripts that are useful for WGEEL activity.

Currently, there are scripts:

- To create the WGEEL database structure with georeferenced information (SIG layers).
- To export the spreadsheets to be fill in for recruitment data call.
- To upload the data from Data call spreadsheets for recruitment, aquaculture, landings and restocking with primary quality checks.
- For the shiny application that proposes an user-friendly interface to visualize the data in the database.
- For the analyses and graphs used in WGEEL report

In the next phase, the GitHub areas will be used to develop the codes

- to integrate the biomass and mortalities, habitat wetted areas, and the silver eel time-series from the 2018 Data call. Files will be uploaded by users via a shiny portal so that end-user can easily run checks on their data without advanced knowledge of R;
- to improve the shiny application (see below) with new visualization tools useful for quality check by the national delegates;
- to identify and solve duplicate problems.

Using the database and the GitHub, a shiny application and the code for all graphs has been developed for later use by WGEEL. While still in the development phase, such a tool will be invaluable to check WGEEL data and help reporting (Figure 2.2).

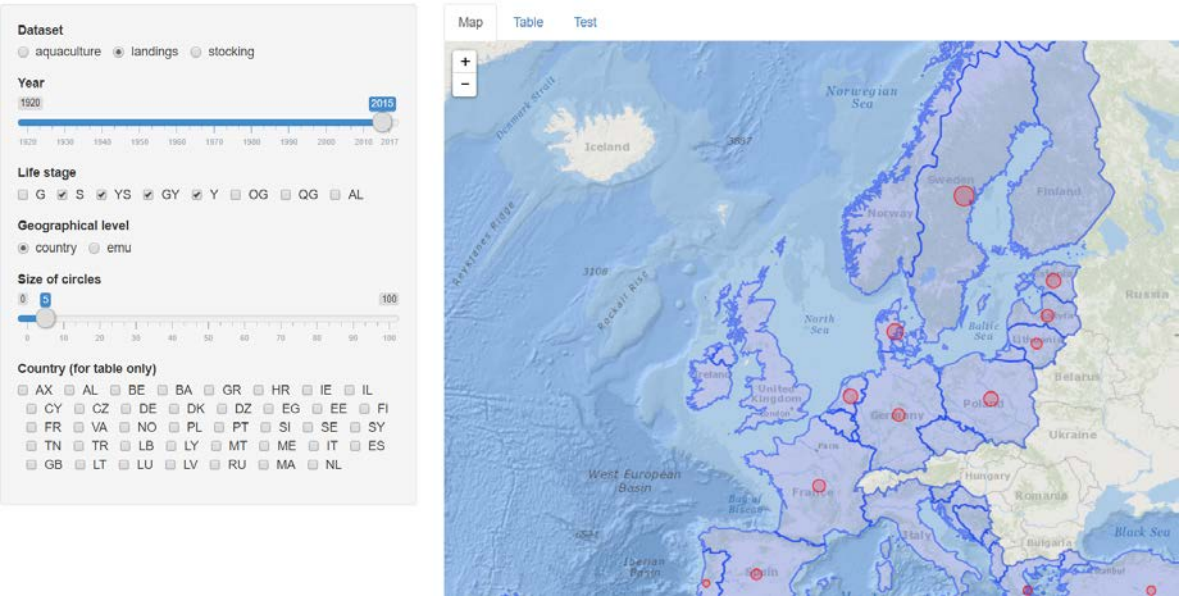

Figure 2.2. Screenprint example of the Shiny application, showing the left hand panel to select dataseries, and the right hand map to summarise the data available.

2.3 Trends in recruitment

In this section, the latest trends in glass and yellow eel recruitment are addressed. The time-series data on recruitment are derived from fishery-dependent sources (i.e. catch records) and fishery-independent surveys across much of the geographic range of European eel (locations of the sampling stations, differentiating according to eel stage and duration of time-series, are shown in Figure 2.2). The stages are categorized as glass eel (G), which includes all "young of the year" eel, mixture of glass eel and yellow eel dominated by recruits from the year (G+Y) and older yellow eel (Y) recruiting to continental habitats (Dekker, 2002). The yellow eel series might consist of yellow eel of several ages. This is certainly the case for all series from the Baltic, and sites located well into freshwater.

The glass eel recruitment time-series have been grouped into two geographical areas: 'North Sea' and 'Elsewhere Europe' (see Figure 2.3) (ICES, 2010b). Bornarel *et al.* (2017) adapted the Glass Eel Recruitment Estimation Model (GEREM) to estimate annual recruitment (i) at the river catchment level, a scale for which data are available, (ii) at an intermediate scale (six European regions), and (iii) at a larger scale (Europe). Results confirmed an overall recruitment decline, and highlighted a more pronounced decline in the North Sea area compared to the Elsewhere Europe area.

The WGEEL has collated information on recruitment from 72 time-series. Some series date back to the beginning of the 20th century (yellow eel, Göta Älv, Sweden) or 1920 (glass eel, Loire, France). Fifty-seven series have been selected for further analysis (see details on data selection and processing in Chapter 3). Depending on the period on which we standardised, the number of series really used can be lower and are given for each analysis.

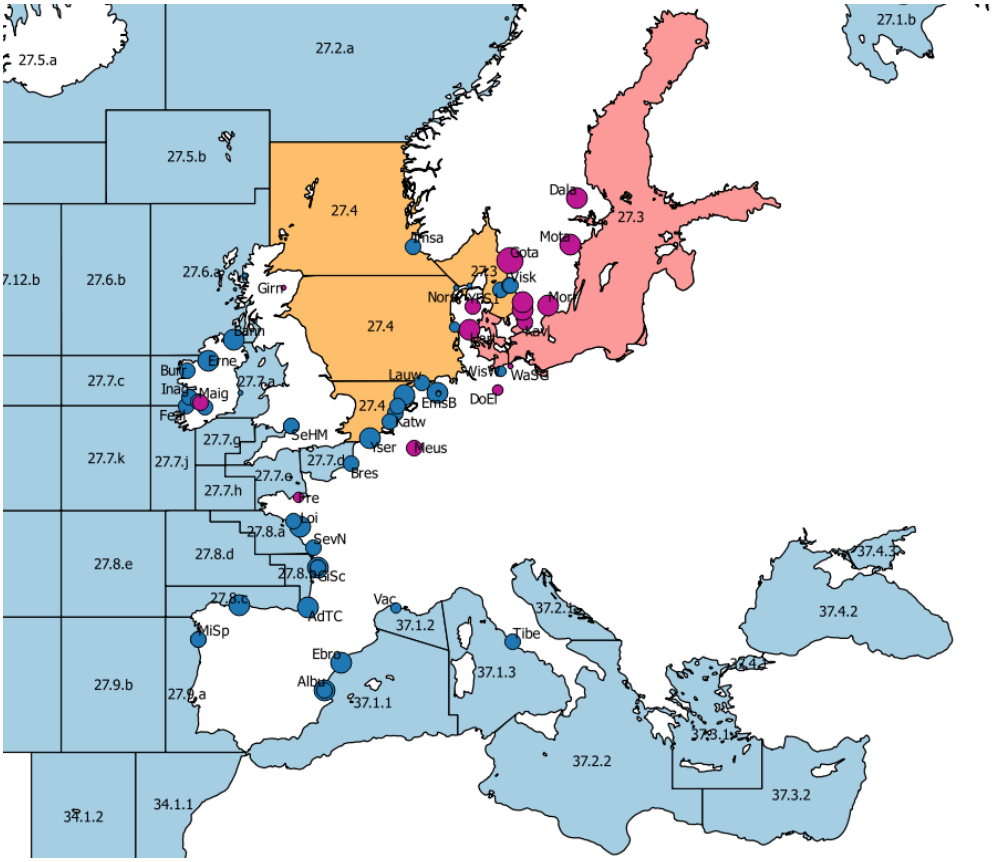

Figure 2.3. Map showing the sampling stations of European eel recruitment. Sampling stage colour shows life stage (blue = glass eel and yellow eel, purple = yellow eel). The size of the symbols is according to duration of the time-series: larger = older. The ICES rectangles (e.g. 27.4.c, etc) are shaded orange for the North Sea and the Baltic, and blue for the Elsewhere Europe index areas.

2.3.1 Details on data selection and processing

There has been a drop of 15 series from the analysis. For instance, only the longest series has been kept for the Severn (Severn EA) and the other (Severn HMRC) has been dropped from the analysis, as it was considered a double entry (i.e. not independent of the other Severn EA), but less consistent over time because some years were from analysis of HMRC data, whereas others were from dealer sales. The other cases are mostly series that are too short to be included in the analysis (less than ten years), but might be part of the indices in future (Table 2.2).

Among the time-series based on trap indices, some have reported preliminary data for 2017 as their trapping season had not finished at the time of writing (Lagan (SW), Kävlingeån (SW), Bresle (FR), ShaP IE)). **Therefore, the indices given for 2017 must be considered as provisional, especially those for the yellow eel.**

Updated historical data have been collected for the River Bann from 1933 to 1948. This new dataset, while leaving a period of missing data from 1949 to 1959 provides valuable new data at a period where only a few datasets were available (Ems, RhineDO, Albufera, Gironde, Loire).

New series have been added in the analysis for Scotland (Girnock ten years of data), Germany (Frische Grube and Wallensteingraben eleven years of data) and Ireland (Burrishoole, data in 1987 and 1988, and again from 2007 to 2017).

The Yser is now classified in the North Sea, while it was wrongly classified in the Atlantic.

Table 2.2. Short description of the sampling sites for European eel recruitment data. Area: NS = North Sea, EE = Elsewhere Europe. 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. 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 = 1 means that the dataseries is used in recruitment analyses.

Code	Area	min	max	n+	n-	Life stage	Sampling type	Unit	Habitat	Kept
Imsa	NS	1975	2016	42	0	GY	trap	#	F	1
YFS2	NS	1991	2017	27	0	G	sci. surv.	index	MO	1
Ring	NS	1981	2017	37	0	G	sci. surv.	index	MO	1
Visk	NS	1972	2017	46	0	GY	trap	kg	C	1
Sle	NS	2008	2017	10	0	G	sci. surv.	#/m2	F	1
Klit	NS	2008	2017	10	0	G	sci. surv.	#/m2	F	1
Nors	NS	2008	2017	10	0	G	sci. surv.	#/m2	F	1
Bann	EE	1933	2017	85	0	GY	trap	kg	F	1
Erne	EE	1959	2017	59	2	GY	trap	kg	T	1
Liff	EE	2012	2017	6	0	GY	trap	kg	F	0
Burr	EE	1987	2017	31	18	G	trap	kg	F	1
Feal	EE	1985	2017	33	14	GY	trap	kg	T	1
Maig	EE	1994	2017	24	4	G	trap	kg	T	1
Inag	EE	1996	2017	22	4	GY	trap	kg	T	1
ShaA	EE	1977	2017	41	0	GY	trap	kg	T	1
SeEA	EE	1972	2017	46	2	G	com. catch	t	T	1
SeHM	EE	1979	2017	39	4	G	com. catch	t	T	0
Girn	NS	2008	2017	10	0	Y	trap	#	F	1
ShiM	EE	2014	2017	4	0	G	trap	#	T	0
ShiF	EE	2017	2017	1	0	G	trap	#	F	0
Vida	NS	1971	1990	20	0	G	com. catch	kg	T	1

Code	Area	min	max	n+	n-	Life stage	Sampling type	Unit	Habi-tat	Kept
Ems	NS	1946	2001	56	0	G	com. catch	kg	T	1
Verl	NS	2010	2016	7	0	GY	trap	#	T	0
HHK	NS	2010	2013	4	0	GY	trap	#	T	0
HoS	NS	2010	2010	1	0	GY	trap	#	T	0
Brok	NS	2012	2015	4	0	GY	trap	#	T	0
Lang	NS	2015	2016	2	0	GY	trap	#	T	0
WaSG	NS	2015	2016	2	0	G	sci. surv.	#	T	0
WaSE	NS	2015	2016	2	0	Y	sci. surv.	#	T	0
Farp	NS	2007	2016	10	0	GY	trap	#	F	0
WiFG	NS	2006	2016	11	0	GY	trap	#	T	1
WisW	NS	2004	2016	13	0	GY	trap	#	F	1
DoFp	NS	2003	2016	14	0	Y	trap	#	F	0
DoEl	NS	2003	2016	14	0	Y	trap	#	F	1
EmsH	NS	2014	2016	3	0	G	trap	#	T	0
EmsB	NS	2013	2016	4	0	GY	trap	#	F	0
Lauw	NS	1976	2017	42	4	G	sci. surv.	#/h	T	1
RhDO	NS	1938	2017	80	1	G	sci. surv.	index	T	1
RhIj	NS	1969	2017	49	5	G	sci. surv.	index	T	1
Katw	NS	1977	2017	41	5	G	sci. surv.	index	T	1
Stel	NS	1971	2017	47	0	G	sci. surv.	index	T	1
Yser	NS	1964	2017	54	1	G	sci. surv.	kg	T	1
Bres	EE	1994	2017	24	0	GY	trap	nr	F	1
Vil	EE	1971	2015	45	3	G	trap	t	T	1
Loi	EE	1924	2008	85	6	G	com. catch	kg	T	1
SevN	EE	1962	2008	47	25	G	com. cpue	kg/boat/d T	T	1
GiSc	EE	1992	2017	26	1	G	sci. surv.	index	T	1
GiTC	EE	1923	2008	86	28	G	com. catch	t	T	1
GiCP	EE	1961	2008	48	1	G	com. cpue	kg/boat/d	T	1

Code	Area	min	max	n+	n-	Life stage	Sampling type	Unit	Habitat	Kept
								T		
AdTC	EE	1986	2008	23	0	G	com. catch	t	T	1
AdCP	EE	1928	2008	81	40	G	com. cpue	kg/boat/d T	T	1
Nalo	EE	1953	2017	65	0	G	com. catch	kg	T	1
MiSp	EE	1975	2017	43	0	G	com. catch	kg	T	1
MiPo	EE	1974	2017	44	0	G	com. catch	kg	T	1
Albu	EE	1949	2017	69	5	G	com. catch	kg	T	1
Ebro	EE	1966	2017	52	3	G	com. catch	kg	T	1
AlCP	EE	1982	2015	34	5	G	com. cpue	kg/boat/d .	T	1
Vac	EE	2004	2017	14	0	G	trap	#	T	1
Tibe	EE	1975	2006	32	0	G	com. catch	t	T	1
YFS1	NS	1975	1989	15	0	G	sci. surv.	index	MO	1
Dala	NS	1951	2017	67	3	Y	trap	kg	F	1
Mota	NS	1942	2016	75	0	Y	trap	kg	F	1
Morr	NS	1960	2016	57	0	Y	trap	kg	F	1
Kavl	NS	1992	2017	26	0	Y	trap	kg	F	1
Ronn	NS	1946	2016	71	9	Y	trap	kg	F	1
Laga	NS	1925	2017	93	0	Y	trap	kg	F	1
Gota	NS	1900	2017	118	12	Y	trap	kg	F	1
ShaP	EE	1985	2017	33	0	Y	trap	kg	T	1
Gude	NS	1980	2017	38	0	Y	trap	kg	F	1
Hart	NS	1967	2017	51	1	Y	trap	kg	F	1
Meus	NS	1992	2017	26	3	Y	trap	#	F	1
Fre	EE	1997	2016	20	0	Y	trap	#	F	1

2.3.2 Number of series available

The number of glass eel and glass eel + young yellow eel time-series available has declined from a peak of 38 in 2008. The maximum number of older yellow eel time-series has increased to 14 in 2016 (Figure 2.4).

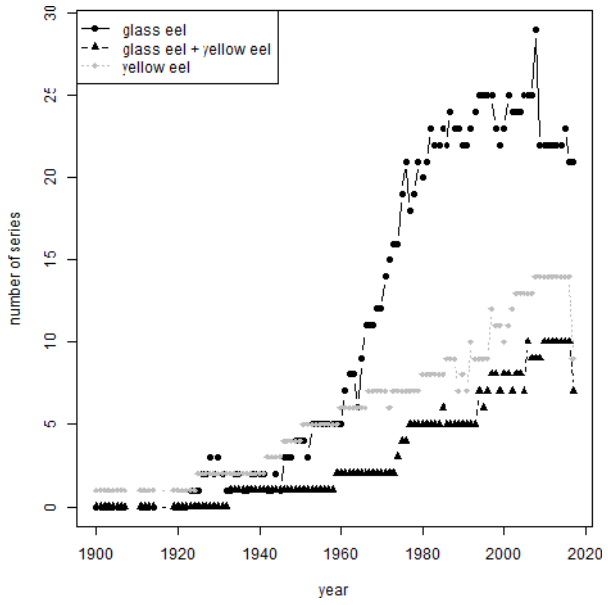

Figure 2.4. Trends in number of glass (black circle), glass+young yellow eel (grey triangle) and older yellow eel (black triangle) time-series giving a report in any specific year.

2.3.3 Checks on updates of series for the 2017 analyses

Thirty-seven time-series were updated to 2017 (28 for glass eel and nine for yellow eel Table 2.3). Eight time-series (three for glass eel and five for yellow eel) were updated to 2016 only (Table 2.4). Twelve time-series have been stopped over the time period: twelve for glass eel and none for yellow eel (Table 2.5). They 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.

Table 2.3. Recruitment series updated to 2017. Codes are as in Table 2.2.

SITE	NAME	COUN.	STAGE	AREA	DIVISION
YFS2	IYFS2 scientific estimate	SE	G	NS	27.3.a
Ring	Ringhals scientific survey	SE	G	NS	27.3.a
Visk	Viskan trapping all	SE	GY	NS	27.3.a
Sle	Slette A	DK	G	NS	27.4.b
Klit	Klitmoeller A	DK	G	NS	27.3.a
Nors	Nors A	DK	G	NS	27.3.a
Bann	Bann Coleraine trapping partial	GB	GY	EE	27.6.a
Erne	Erne Ballyshannon trapping all	IE	GY	EE	27.7.b
Burr	Burrishoole	IE	G	EE	27.7.b
Feal	River Feale	IE	GY	EE	27.7.j
Maig	River Maigue	IE	G	EE	27.7.b
Inag	River Inagh	IE	GY	EE	27.7.b
ShaA	Shannon Ardnacrusha trapping all	IE	GY	EE	27.7.b
SeEA	Severn EA commercial catch	GB	G	EE	27.7.e
Girn	Girnock burn trap scientific estimate	GB	Y	NS	27.4.b
Lauw	Lauwersoog scientific estimate	NL	G	NS	27.4.b
RhDO	Rhine DenOever scientific estimate	NL	G	NS	27.4.c
RhIj	Rhine IJmuiden scientific estimate	NL	G	NS	27.4.c
Katw	Katwijk scientific estimate	NL	G	NS	27.4.c
Stel	Stellendam scientific estimate	NL	G	NS	27.4.c
Yser	Ijzer Nieuwpoort scientific estimate	BE	G	NS	27.4.c
Bres	Bresle	FR	GY	EE	27.7.d
GiSc	Gironde scientific estimate	FR	G	EE	27.8.b
Nalo	Nalon Estuary commercial catch	ES	G	EE	27.8.c
MiSp	Minho Spanish part-commercial catch	ES	G	EE	27.9.a
MiPo	Minho Portuguese part-commercial catch	PT	G	EE	27.9.a
Albu	Albufera de Valencia commercial catch	ES	G	EE	37.1.1
Ebro	Ebro delta lagoons	ES	G	EE	37.1.1
Vac	Vaccares	FR	G	EE	37.1.2
Dala	Dalälven trapping all	SE	Y	NS	27.3.d
Kavl	Kävlingeån trapping all	SE	Y	NS	27.3.b, c
Laga	Lagan trapping all	SE	Y	NS	27.3.a
Gota	Göta älv trapping all	SE	Y	NS	27.3.a
ShaP	Shannon Parteen trapping partial	IE	Y	EE	27.7.b
Gude	Guden À Tange trapping all	DK	Y	NS	27.3.a
Hart	Harte trapping all	DK	Y	NS	27.3.b, c
Meus	Meuse Lixhe dam trapping partial	BE	Y	NS	27.4.c

Table 2.4. Recruitment series updated to 2016 only. Codes are as in Table 2.2.

SITE	NAME	COUN.	STAGE	AREA	DIVISION
Imsa	Imsa Near Sandnes trapping all	NO	GY	NS	27.4.a
WiFG	Frische Grube	DE	GY	NS	27.3.b, c
WisW	Wallensteingraben	DE	GY	NS	27.3.b, c
DoEl	Dove Elde eel ladder	DE	Y	NS	27.4.b
Mota	Motala Ström, trapping all	SE	Y	NS	27.3.d
Morr	Mörrumsån, trapping all	SE	Y	NS	27.3.d
Ronn	Rönne å, trapping all	SE	Y	NS	27.3.a
Fre	Frémur	FR	Y	EE	27.7.e

Table 2.5. Recruitment series not updated to 2016, or stopped in recent years. Codes are as in Table 2.2.

SITE	NAME	COUN.	STAGE	AREA	DIVISION	LAST YEAR
YFS1	IYFS scientific estimate	SE	G	NS	27.3.a	1989
Vida	Vidaa Højer sluice commercial catch	DK	G	NS	27.4.b	1990
Ems	Ems Herbrum commercial catch	DE	G	NS	27.4.b	2001
Tibe	Tiber Fiumara Grande commercial catch	IT	G	EE	37.1.3	2006
AdCP	Adour Estuary (cpue) commercial cpue	FR	G	EE	27.8.b	2008
AdTC	Adour Estuary (catch) commercial catch	FR	G	EE	27.8.b	2008
GiCP	Gironde Estuary (cpue) commercial cpue	FR	G	EE	27.8.b	2008
GiTC	Gironde Estuary (catch) commercial catch	FR	G	EE	27.8.b	2008
Loi	Loire Estuary commercial catch	FR	G	EE	27.8.a	2008
SevN	Sèvres Niortaise Estuary commercial cpue	FR	G	EE	27.8.a	2008
AlCP	Albufera de Valencia commercial cpue	ES	G	EE	37.1.1	2015
Vil	Vilaine Arzal trapping all	FR	G	EE	27.8.a	2015

2.3.4 Recruitment series data

The geometric mean of all time-series is presented in Figures 2.5 and 2.6.

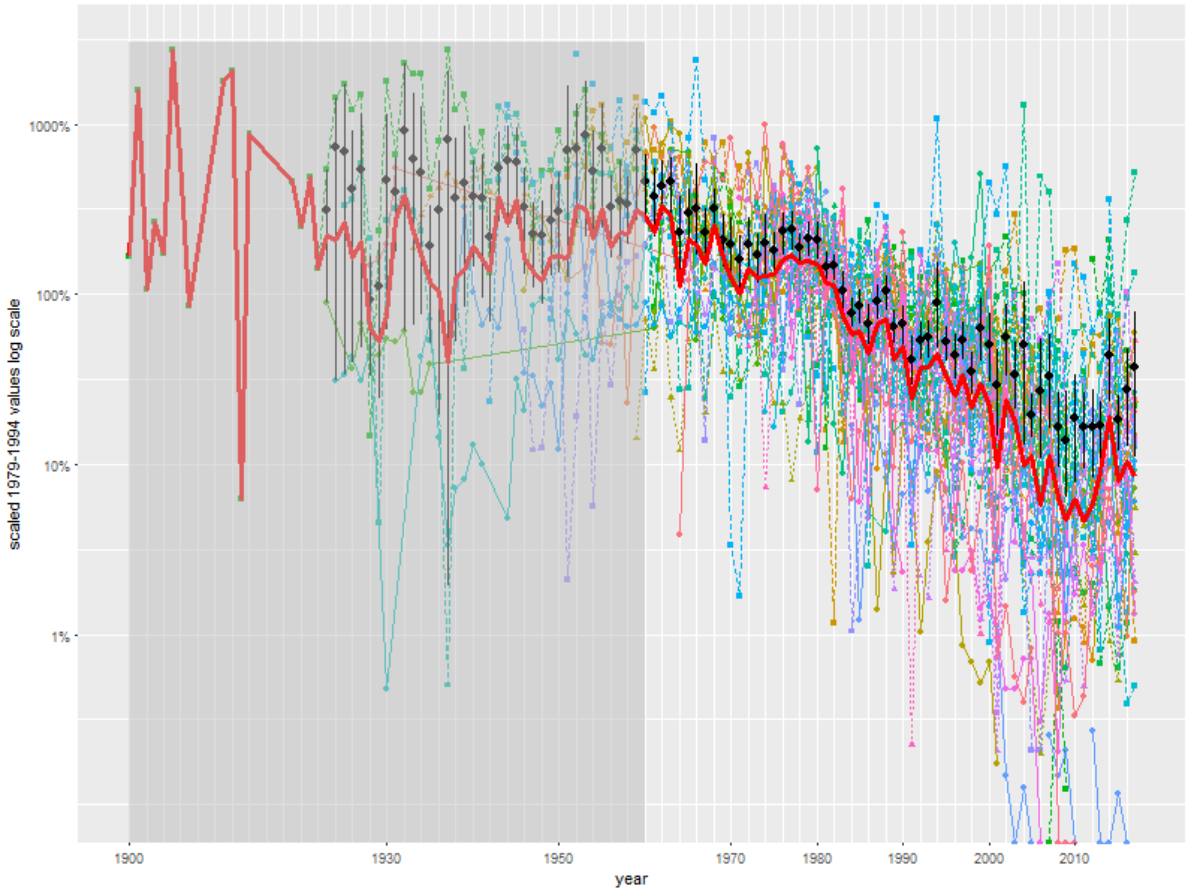

Figure 2.5. Time-series of glass eel and yellow eel recruitment in European rivers with time-series having data for the 1979–1994 period (45 sites). Each time-series has been scaled to its 1979–1994 average. The mean values and their bootstrap confidence interval (95%) are represented as black dots and bars. Geometric means are presented as a red line. Note the logarithmic scale on the y-axis.

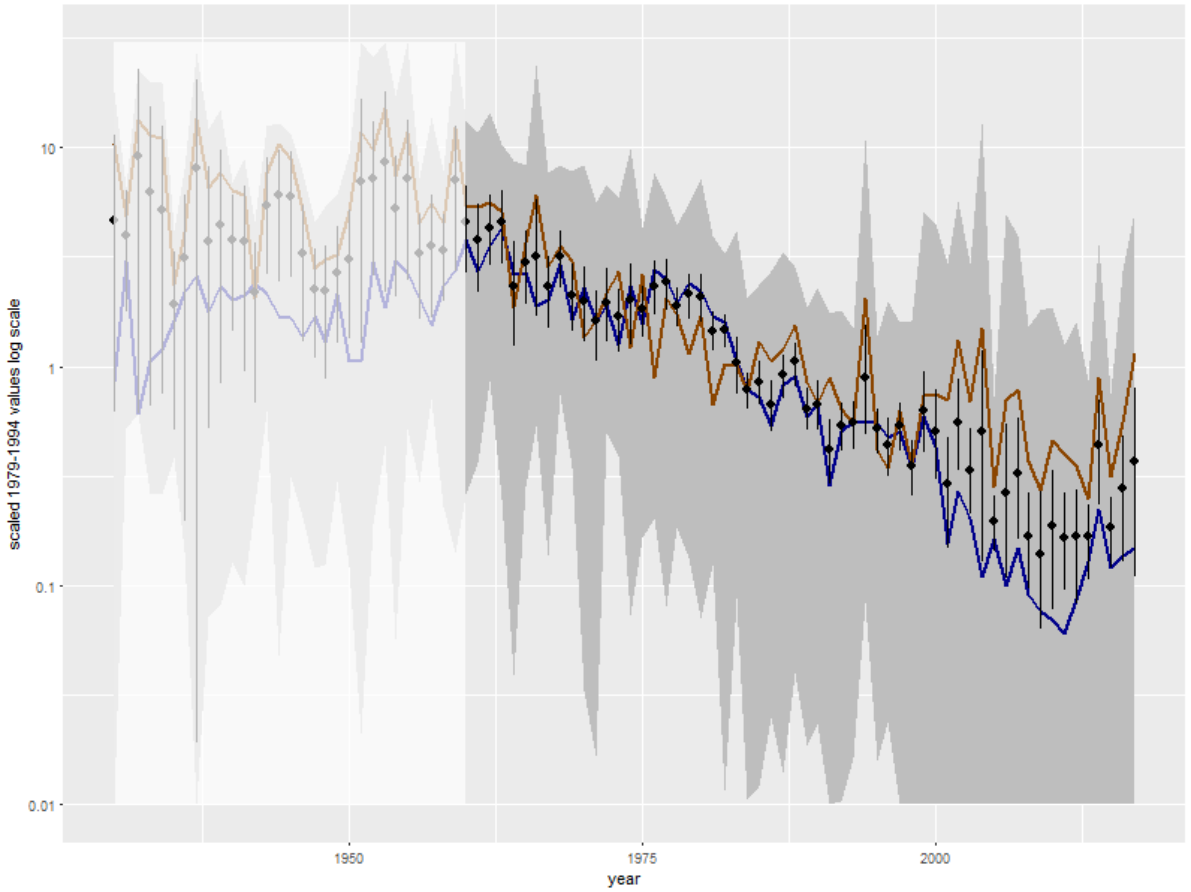

Figure 2.6. Time-series of glass eel and yellow eel recruitment in Europe with 45 time-series out of the 72 available to the Working Group. Each time-series has been scaled to its 1979–1994 average. The mean values of combined yellow and glass eel time-series and their bootstrap confidence interval (95%) are represented as black dots and bars. The brown line represents the mean value for yellow eel, 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 2.1 were removed to emphasize the mean value. Note also the logarithmic scale on the y-axis.

2.3.5 GLM based trend

The WGEEL recruitment index used in the ICES Annual Stock Advice is a reconstructed prediction using a GLM (Generalised Linear Model) with gamma distribution and a log link: glass eel ~ year : area + site, where glass eel is individual glass eel time-series, including both pure G series and those identified as a mixture of glass and yellow eel (G+Y), site is the site monitored for recruitment and area is either the North Sea or Elsewhere Europe. For yellow eel time-series, only one estimate is provided: yellow eel ~ year + site.

The trend is reconstructed using the predictions from 1960 onwards for 43 glass eel time-series and from 1950 onwards for 14 yellow eel time-series. Some zero values have been excluded from the GLM analysis and treated as missing values (this treatment is parsimonious and tests show it has no effect on the trends, see Section 2.3.6): 16 for the glass eel model and 10 for the yellow eel model.

The reconstructed values are aggregated using geometric means of the two reference areas (Elsewhere Europe and North Sea). The predictions are given in reference to the geometric mean of the 1960–1979 period. Note that a shift from arithmetic to geometric

means has been made here compared to analyses in previous years, because *post hoc* model checking confirmed that lognormal (or Gamma Distribution) and geometric means are the preferred choice.

After high levels in the late 1970s, eel recruitment declined, and has been very low in all years after 2000. (Figures 2.7 and 2.8).

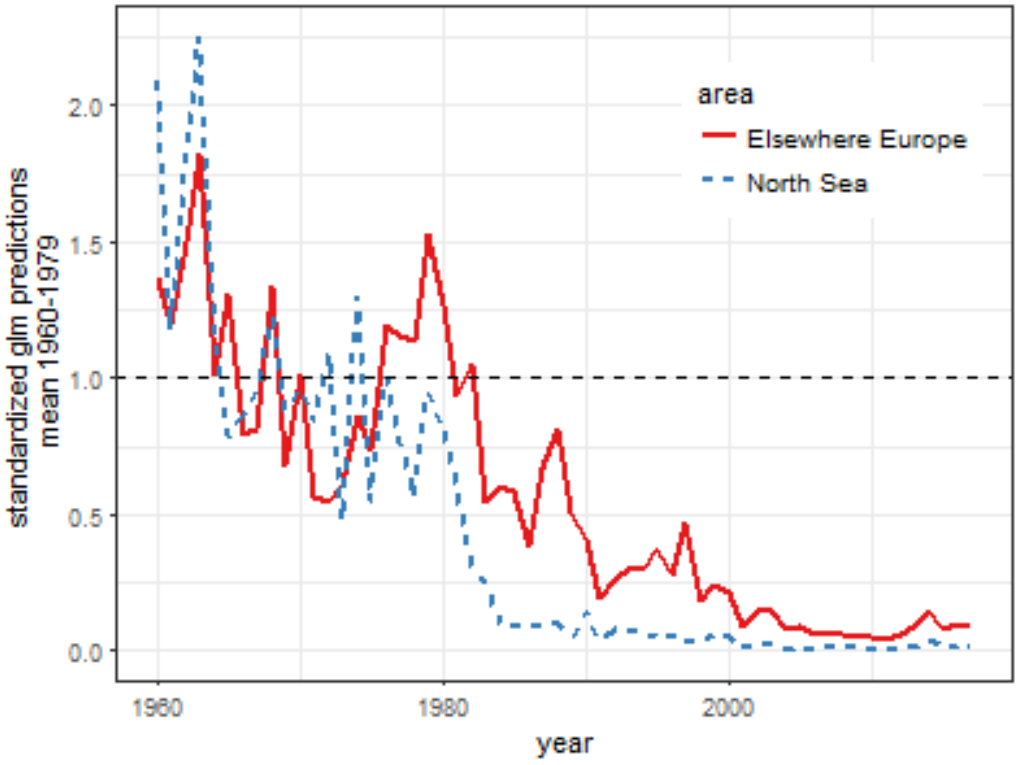

Figure 2.7. WGEEL recruitment index: geometric mean of estimated (GLM) glass eel recruitment for the continental North Sea and Elsewhere Europe series updated to 2017. The GLM (glass eel~area: year + site) was fitted on 43 time-series comprising either pure glass eel or a mixture of glass eels and yellow eels and scaled to the 1960–1979 average. No time-series are available for glass eel in the Baltic area.

The 2017 level of European eel recruitment compared to the 1960–1979 average is 1.6% for the North Sea and 8.7% for Elsewhere Europe (Table 2.6). The 2017 yellow eel index is 24% of the baseline (Table 2.7).

Both WGEEL recruitment indices decrease for 2017, but modelling a breakpoint of the trend (ICES, 2011) in 2011 still gives significant results when using the lower value from 2016 (p = 7*e* − 06 Elsewhere Europe and p = 5*e* − 054 North Sea.

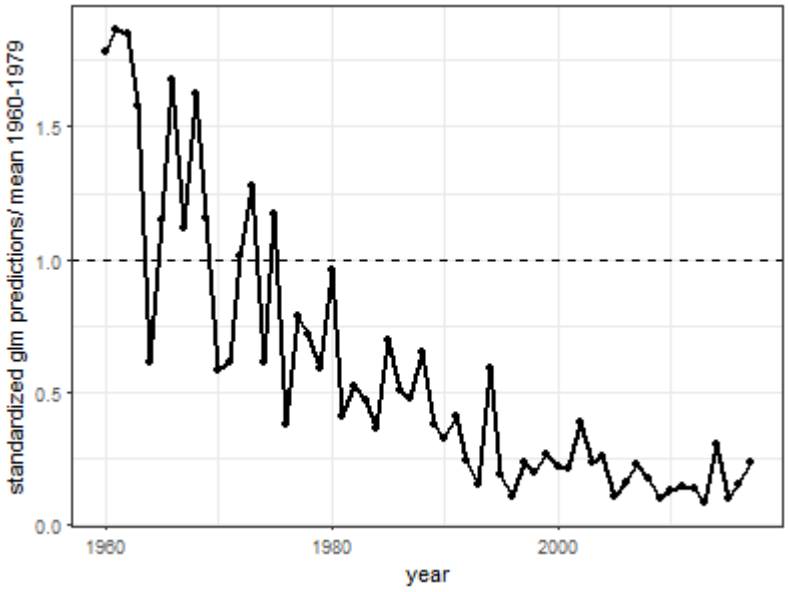

Figure 2.8. Geometric mean of estimated (GLM) yellow eel recruitment and smoothed trends for Europe updated to 2017 data. The GLM (yellow eel ~ year + site) was fitted to 14 yellow eel time-series and scaled to the 1960–1979 average. Note the logarithmic scale on the y-axis.

Table 2.6. GLM glass eel ~ year : area + site geometric means of predicted values for 43 dataseries on glass eel recruitment. Values are given as percentage of the 1960–1979 period. EE = Europe elsewhere dataseries and NS = North Sea dataseries. The rerun of the analysis after adding most recent years or correcting old data lead that all index values may change from those reported previously. These changes are however all small and do not affect previous or present advice.

	1960		1970		1980		1990		2000		2010	
	EE	NS	EE	NS	EE	NS	EE	NS	EE	NS	EE	NS
0	137	209	101	96	127	81	41	14	21.3	4.7	5.3	0.7
1	119	118	57	84	93	59	19	3	9.1	1.0	4.2	0.5
2	150	180	55	109	105	31	26	8	14.3	2.6	5.6	0.4
3	182	225	61	48	54	25	30	7	14.5	2.0	8.6	1.2
4	101	117	86	130	60	10	30	7	7.8	0.6	14.9	4.0
5	131	78	74	54	58	8	37	5	8.9	1.2	8.2	0.9
6	79	87	119	100	38	9	28	5	6.3	0.5	10.2	1.8
7	81	96	116	77	67	10	47	4	7.2	1.3	8.7	1.6
8	133	122	113	56	81	9	18	3	6.3	1.3		
9	68	88	153	95	51	4	24	6	4.8	0.9		

Table 2.7. GLM *yellow eel ~ year + site* geometric means of predicted values for 14 yellow eel dataseries. Values are given as percentage of the 1960–1979 period.

	1960	1970	1980	1990	2000	2010
0	178	58	96	33	22	13
1	187	61	41	41	21	14
2	185	102	52	24	39	14
3	158	128	47	15	23	9
4	61	61	36	59	26	31
5	115	117	69	19	10	10
6	168	38	51	11	16	15
7	112	78	48	24	23	24
8	162	72	65	20	17	
9	116	59	38	26	10	

2.3.6 Quality of the analysis of recruitment data, the recruitment indices

As an ultimate test of the quality of the recruitment index calculations, the analysis presented above was rerun from scratch, in a different software package, building upon the modelling details as described in the sections only, but not reusing any part of the software code. This reanalysis resulted in a list of remarks and recommendations, to improve the code, to streamline the data processing, and to complete the description in this report. For example, some site characteristics were documented in the data analysis code, some data items were represented in two data tables (possibility of conflict, though none was found now), some alternative statistical derivation methods were suggested to replace the current, error-prone approach. The final result of this reanalysis, the glass eel recruitment indices, turned out to be within rounding errors from the indices reported above, that is: for the analysis presented above, all suggested changes and improvements are essentially cosmetic, at this moment. The list of remarks and recommendations has been forwarded to the data analyst, to be processed before the next meeting.

The reanalysis has been restricted to the glass eel data only; no reanalysis has been made of the yellow eel data.

The analysis of recruitment data applies a GLM, using a log link and a Gamma error distribution. In this setting, no zero observations can be processed. The choice made so far, has been to delete all zero observations (13 observations out of a total of 1417 for glass eel). There is a tendency for dataseries generating zeroes, to stop sampling; hence, zero observations are rare. However, by removing zero observations, one selectively removes low observations, biasing the recruitment indices upwards. To assess the effect of this selective removal, a second analysis was made, transforming the observation y to $log(y+small)$, where *small* was set at 1% of the observed values for each series over the reference period (1960–1979), and analysing by a standard linear model (identity link). Though the results of this deviated slightly from the standard analysis, the deviations were that small, that no change in the analysis is currently recommended.

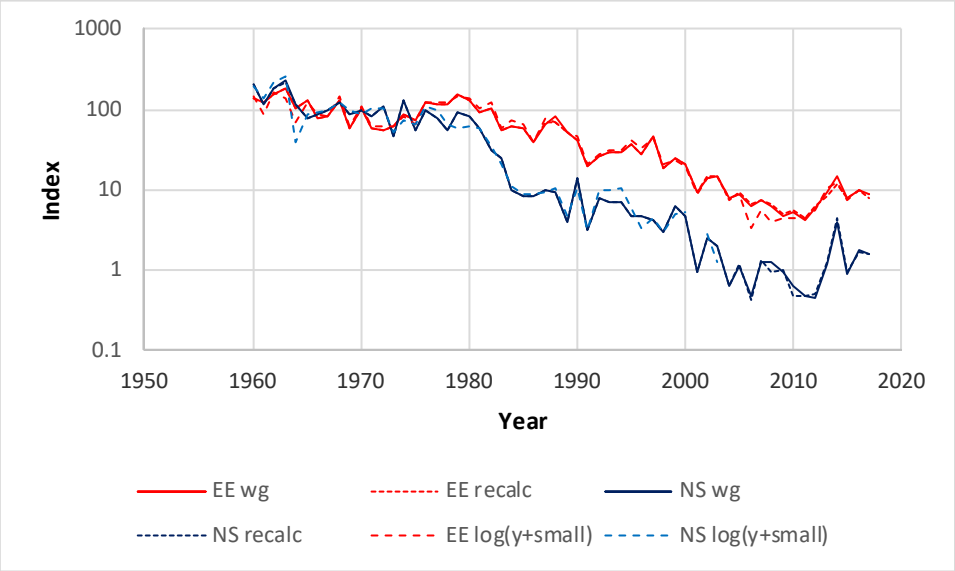

Figure 2.9. Comparing glass eel recruitment indices, for the standard analysis (wg), for the re-calculation (recalc), and for the log-transformed data (*log(y+small)*), for the North Sea area (NS) and Elsewhere Europe (EE).

2.4 Trends in fisheries, aquaculture production and stocking

2.4.1 Introduction

This section presents and describes data from commercial, recreational and non-commercial fisheries, aquaculture production and stocking of eel. The new database has introduced changes when we compare the data to previous reports. From this year data can be reported by eel life stage (glass, yellow, silver), habitat type (freshwater, tidal, marine) and by eel management unit (EMU) where possible. Historical series for which these details are not available are reported by country. The current database structure will allow to aggregate by country or region if necessary. Also, the landings data presented are only those reported to the WGEEL, either through responses to the 2017 Data Call or in Country Reports, or integrated by the WGEEL using data from its previous reports.

Note that for glass eel as well as for yellow and silver eels, some countries have not reported all their landings. **Thus even with the corrected version of the figures the total given here should be considered as a minimum.**

Care should also be taken with the interpretation of the landings as indicators of the stock, since the catch statistics now reflect the status of reduced activity as well as of stock levels.

In summary, commercial landings are declining, a long-term continuing trend, from a level of 10 000 tonnes in the 1960s (and probably closer to 20 000 t when trying to correct for missing countries report), commercial landings have now dropped to 2280 tonnes in 2016.

2.4.2 Commercial fisheries landings, effort and fishing capacity

Landings data for commercial eel fisheries are available from the Eel Data call and additional data provided via the Country Reports (Figure 2.10). 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 of accounting for non-reporting, but is not a complete solution.

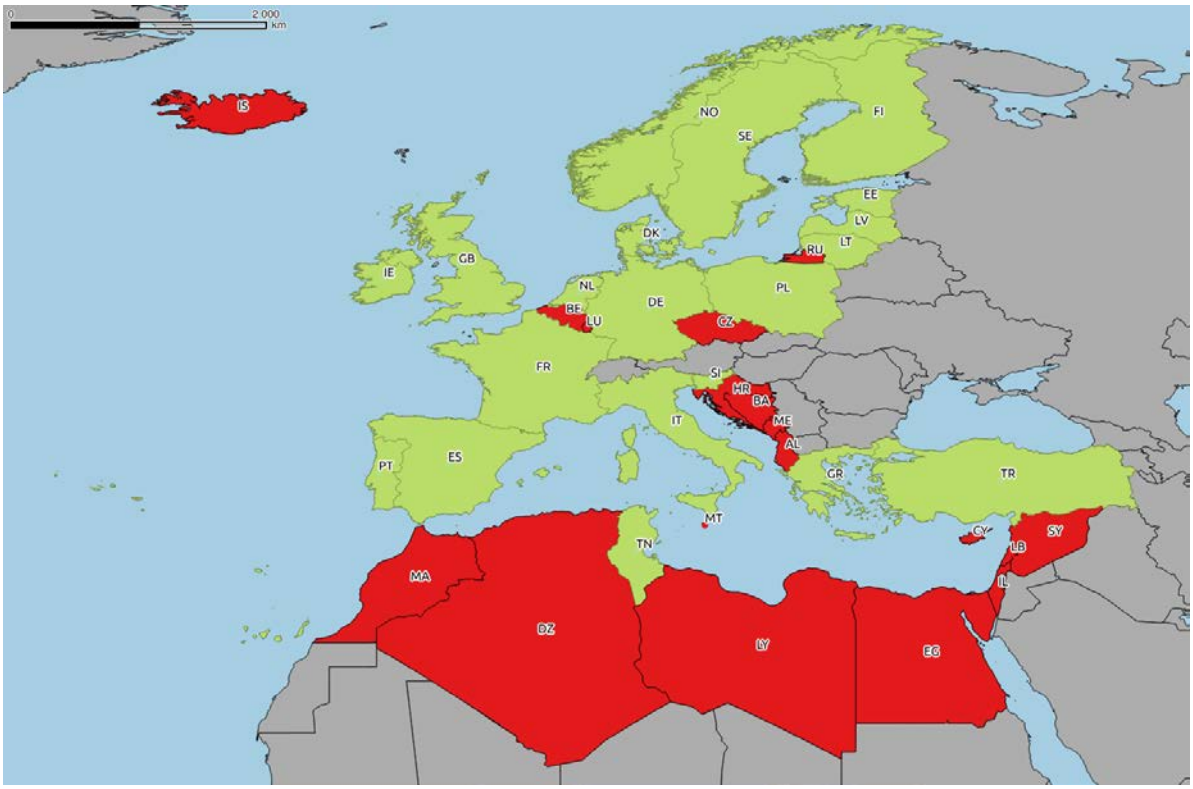

Figure 2.10. Map representation of the countries reporting commercial yellow and silver eel landings to the WGEEL (green shading)vs.not reporting (red shading). Note that the 'not reporting' countries might not have fisheries to report, but this is not certain.

Figure 2.11 presents the time-series up to and including 2017 for total glass eel landings as reported by five countries in the Eel Data Call and additional data provided via the Country Reports. Figure 2.12 presents the same time-series but corrected for missing data (see above), with an inset box showing the proportion of data corrected per year. Figure 2.13 presents a time-series of the reconstructed proportion. This proportion is rather low, except for 2009. Glass eel landings show a sharp decline since 1980 from 2000 tonnes to around 40–60 tonnes since 2009 onwards. In 2017, the corrected figure is 57 t.

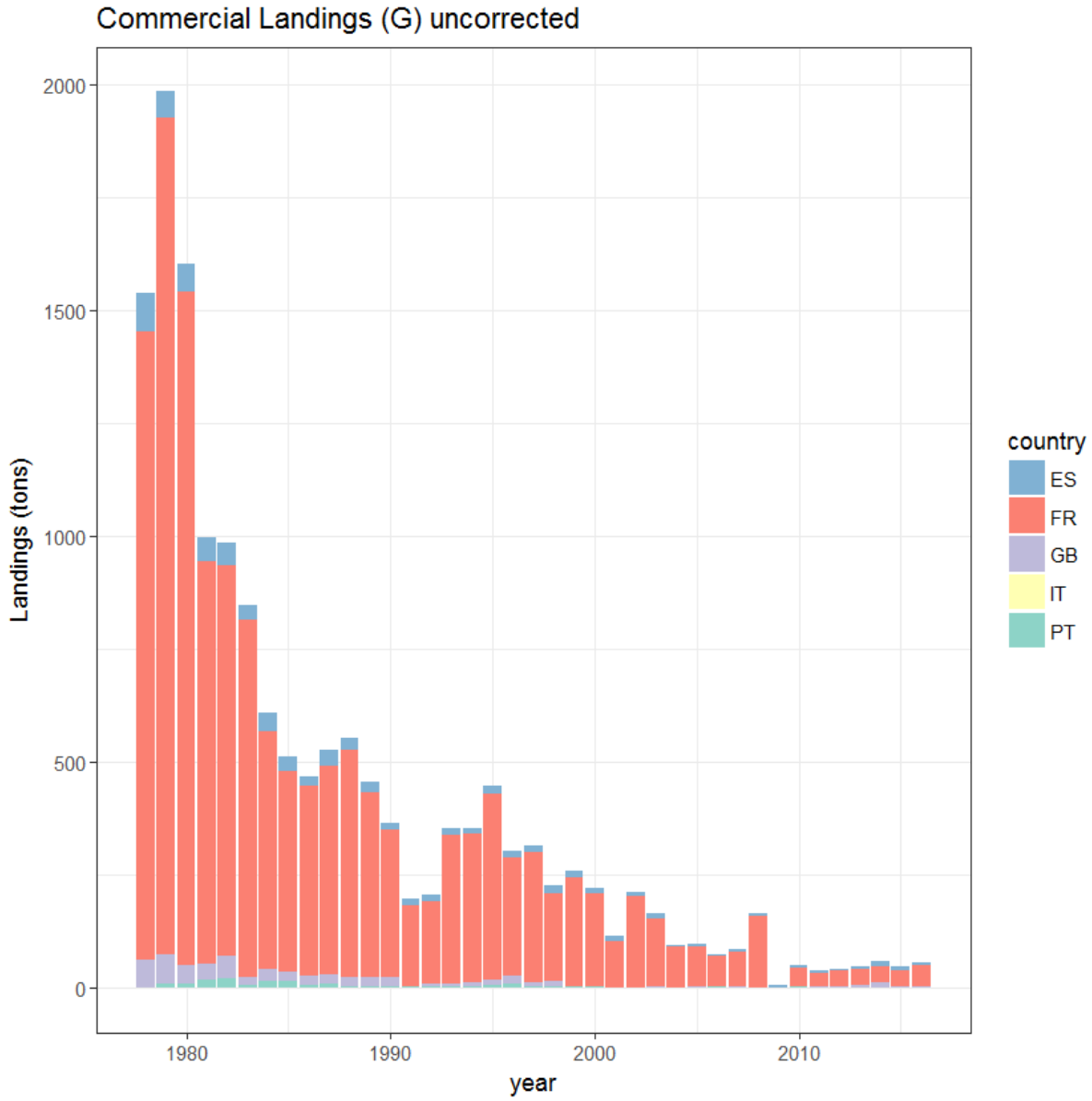

Figure 2.11. Time-series of reported commercial glass eel fishery landings (tonnes), by country, combining information from the country reports and Data Call as recorded (see text).

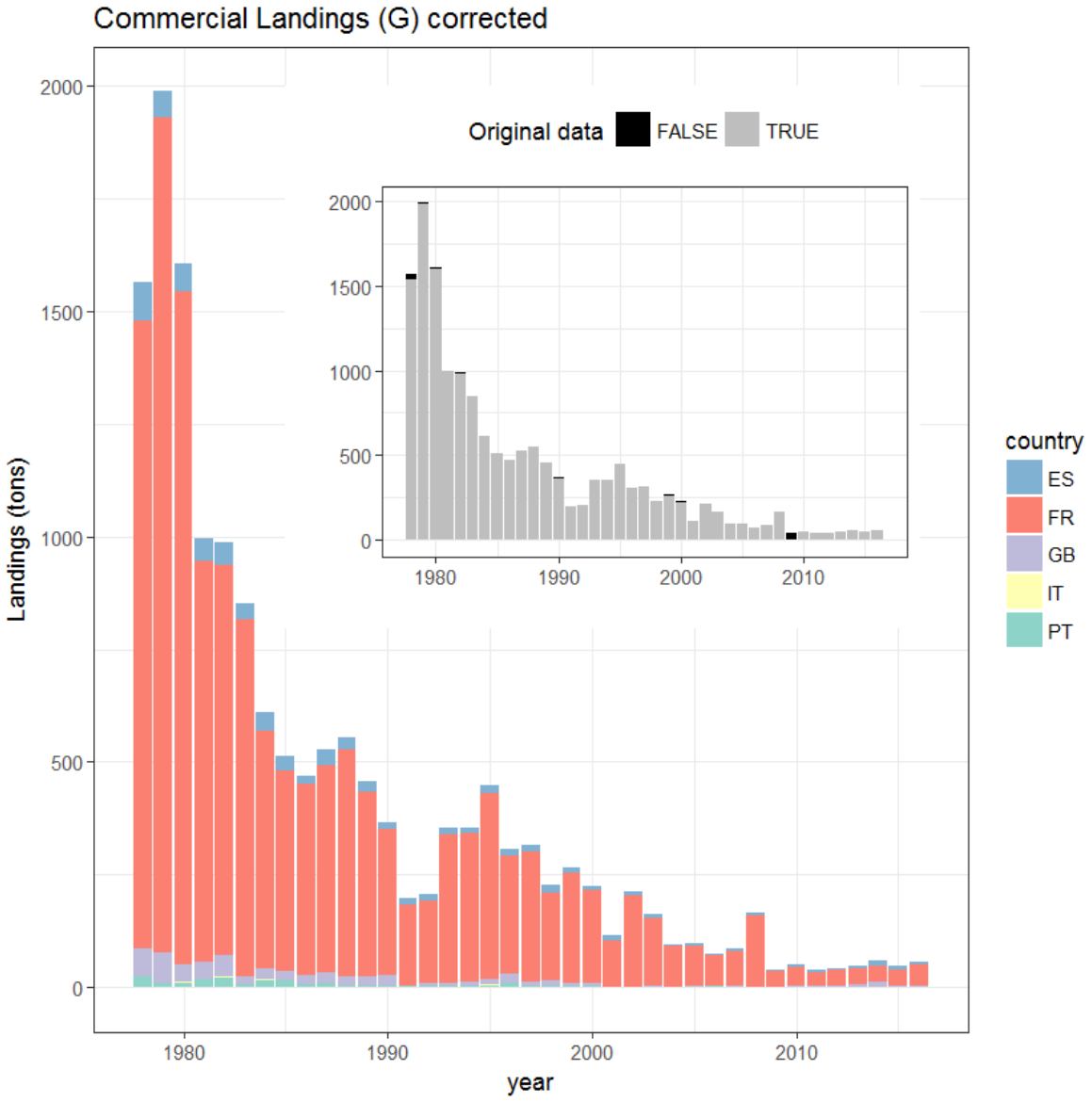

Figure 2.12. Time-series of reported commercial glass eel fishery landings (tonnes), by country, combining information from the country reports and Data Call and a reconstruction of the non-reported countries/years combinations (see text). The inset box shows the proportion of data reconstructed per year.

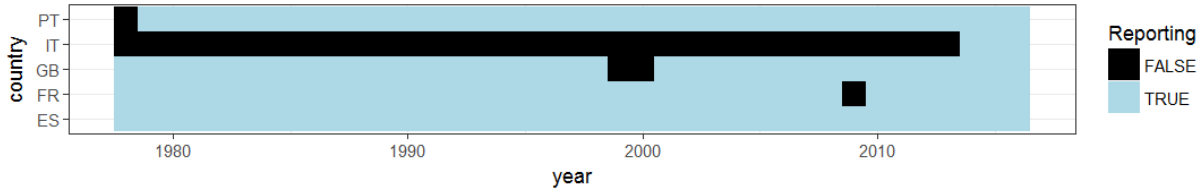

Figure 2.13. Schematic illustration of the commercial glass eel landings data, based on actual (TRUE) or reconstructed (FALSE) data, by reporting country and year.

Table 2.8. Commercial landings (tonnes) of glass eel (1978–2016) in Spain (ES), France (FR), United Kingdom (GB) and Portugal (PT). 0 = No stocking. Empty cells = No information.

Year	ES	FR	GB	IT	PT
1978	22	2131	61		
1979	17	2547	67		9
1980	15	2970	40		10
1981	13	1871	37		18
1982	19	1135	48		22
1983	10	969	17		7
1984	16	706	25		16
1985	18	516	20		15
1986	6	518	19		7
1987	9	658	21		10
1988	10	551	21		3
1989	10	520	21		
1990	5	392	21		
1991	7	280	1		
1992	4	264	5		
1993	5	456	6		
1994	2	414	10		
1995	5	552	12		
1996	15	282	19		
1997	12	314	9		
1998	14	195	11		
1999	14	248			
2000	11	214			
2001	12	101	1		
2002	9	202	1		
2003	10	151	2		
2004	5	89	1		
2005	6	89	2		
2006	4	67	1		
2007	5	77	2		
2008	5	158	1		
2009	4		0		
2010	6	41	1		
2011	5	31	2		
2012	5	34	3		
2013	7	34	6		1
2014	11	35	12	0.4	1
2015	9	36	3	0.1	1
2016	7	46	4	0.1	0

Figures 2.14, 2.15 and 2.16 present the same data but for yellow and silver eels aggregated coming from 18 countries. The proportion of "corrected" landing was as high as 50% in the 1950s, but rather low since the mid-1980s. Table 2.9 presents the raw data for yellow and silver eel combined. The total landings of yellow and silver eels decrease from 18 000–20 000 tonnes in the 1950s to 2000–3000 tonnes since 2009. In 2016, the figure was 2280 t for yellow and silver landings, combined. Data from Egypt, Morocco, and Algeria, have not been integrated.

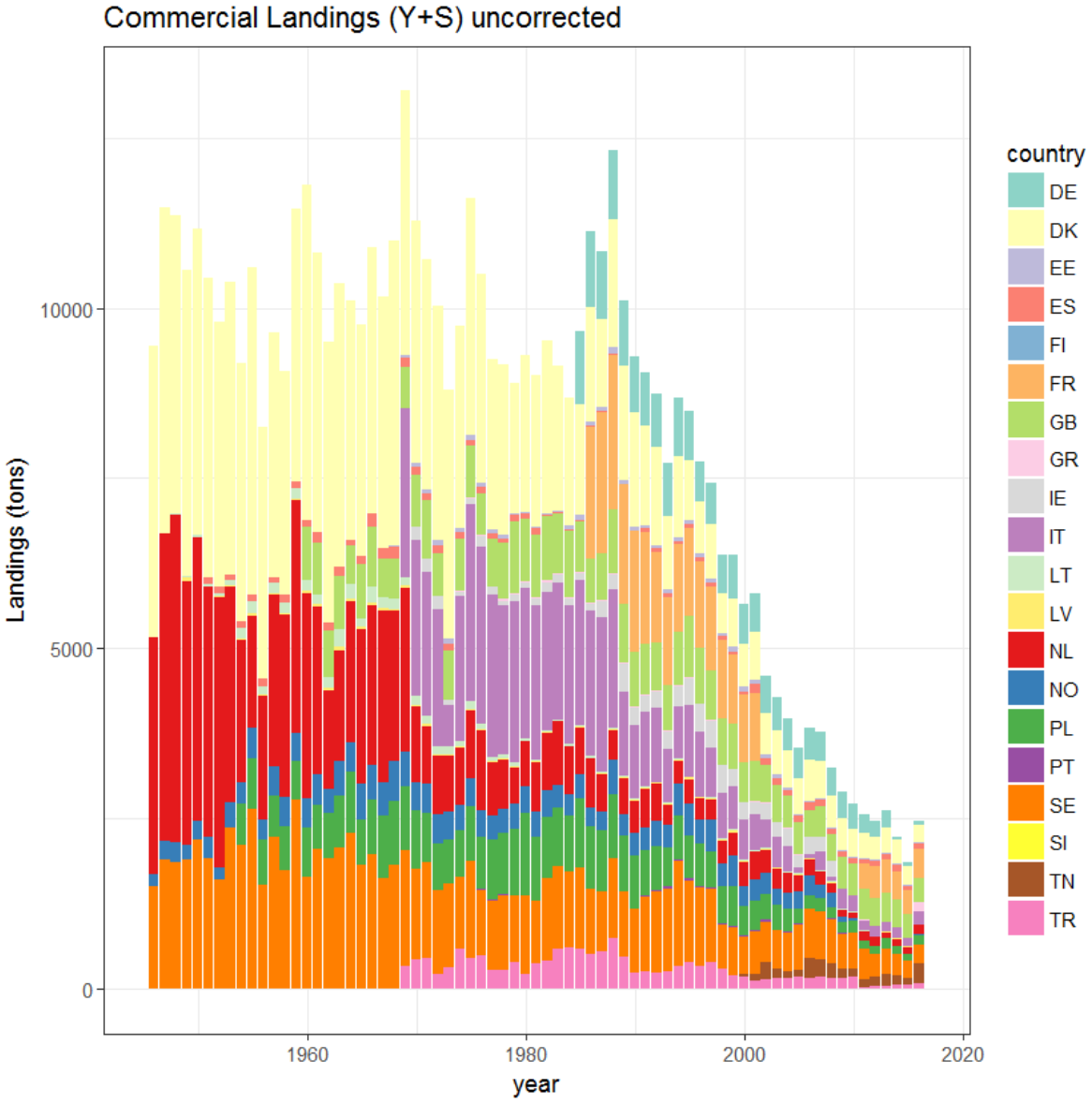

Figure 2.14. Time-series of reported commercial yellow (Y) and silver (S) eel fishery landings (tonnes), by country, combining information from the country reports and Data Call as recorded (see text). Noting German data are incomplete for 2014–2016.

Table 2.9. Commercial landings (tonnes) of yellow and silver eel (1945–2016) in Germany (DE), Denmark (DK) Estonia (EE), Spain (ES), Finland (FI), France (FR), United Kingdom (GB), Greece (GR), Ireland (IE), Italy (IT), Lithuania (LT), Latvia (LV), Netherlands (NL), Norway (NO), Poland (PL), Portugal (PT), Sweden (SE), Slovenia (SI), Tunisia (TN) and Turkey (TR). 0 = No fishing. Empty cells = No information. Noting German data are incomplete for 2014–2016.

Year	DE	DK	EE	ES	FI	FR	GB	GR	IE	IT	LT	LV	NL	NO	PL	PT	SE	SI	TN	TR
1945		4169											2668	102			1664			
1946		4269											3492	167			1512			
1947		4784									8	10	4502	268			1910			
1948		4386									14	10	4799	293			1862			
1949		4492									21	50	3873	214			1899			
1950		4500									29	10	4152	282			2188			
1951		4400		90							32	10	3661	312			1929			
1952		3900		102							39	10	3978	178			1598			
1953		4300		80							80	20	3157	371			2378			
1954		3800		98							147	20	2085	327	609		2106			
1955		4800		103							163	40	1651	451	732		2651			
1956		3700		106							131	20	1817	293	656		1533			
1957		3600		80							168	20	2509	430	616		2225			
1958		3300		115							149	20	2674	437	635		1751			
1959		4000		100							155	24	3413	409	566		2789			
1960		4937		98			772				165	37	2999	430	733		1646			
1961		4110		154			768				139	43	2452	449	640		2066			
1962		4122		115			696				155	41	1443	356	663		1916			
1963		4166		137			788				260	56	1618	503	762		2080			
1964		3505	3	92			549				225	37	2068	440	884		2300			
1965		3402	0	130			784				125	35	2268	523	682		1813			
1966		3901	2	192			881	15			238	33	2339	510	804		1982			
1967		3679	3	164			569	19			153	39	2524	491	906		1632			

Year	DE	DK	EE	ES	FI	FR	GB	GR	IE	IT	LT	LV	NL	NO	PL	PT	SE	SI	TN	TR
1968		4476	3	176			586	5			165	28	2209	569	943		1826			
1969		3878	49	136			606	3		2469	134	36	2389	522	935		1693			342
1970		3558	62	119			752	0	200	2300	118	29	1111	422	847		1327			441
1971		3378	60	107			842	0	200	2113	124	29	853	415	722		1410			460
1972		3429	73	119			633	4	200	1997	126	25	857	422	696		1224			220
1973		3656	69	100			723	15	91	588	120	27	823	409	645		1232			315
1974		2977	51	93			765	130	67	2122	86	20	840	368	691	2	1054			588
1975		3485	82	78			762	134	79	2886	114	19	1000	407	810	6	1428			448
1976		3054	72	83			622	159	150	2596	88	24	1172	386	761	13	957			499
1977		2502	66	80			691	89	108	2390	68	16	783	352	868	23	1017			282
1978		2492	63	67			824	225	76	2172	70	18	719	347	910	7	1098			283
1979		1904	28	97			1045	185	110	2354	57	21	530	374	979		978			396
1980		2288	26	90			912	227	75	2198	45	9	664	387	1214		1144			224
1981		2227	22	98			907	251	94	2270	27	10	722	369	944		920			374
1982		2541	14	20			943	255	144	2025	28	12	842	385	911		1199	1		424
1983		2119	29	18			866	201	117	2013	23	9	937	324	868		1212	1		588
1984		1871	72	11			973	285	88	2050	27	12	691	310	819		1115	1		616
1985	1073	1630	75	17			750	190	87	2135	29	18	679	352	1022		1190	2		583
1986	1117	1672	61	13		1944	651	152	87	2134	32	19	721	272	921		943	3		517
1987	1004	1279	67	21		2062	684	266	230	2265	20	25	538	282	887		896	2		543
1988	1006	1878	110	14		2265	934	268	215	2027	23	15	425	513	943		1162	2		756
1989	947	1696	55	5		1746	875	156	400	1243	21	13	526	313	813	14	952	1		472
1990	827	1675	61	9		1778	784	194	256	1088	19	13	472	336	768	13	941	2		230
1991	779	1465	52	50		1645	737	209	245	1097	16	14	573	323	670	23	1084	1		262
1992	779	1451	39	54		1321	715	185	234	1084	12	17	548	372	638	30	1180	0		245
1993	777	1080	59	66		1280	671	182	260	782	10	19	293	340	568	34	1210	0		261

Year	DE	DK	EE	ES	FI	FR	GB	GR	IE	IT	LT	LV	NL	NO	PL	PT	SE	SI	TN	TR
1994	865	1200	47	51		1280	778	201	300	771	12	19	330	472	635	27	1553	1		329
1995	720	892	45	69		1280	900	201	400	1047	10	38	354	454	642	24	1205	0		390
1996	600	752	55	62		1280	805	151	400	953	9	24	300	353	629	26	1145	0		342
1997	615	797	59	61		1223	731	137	400	727	11	25	285	467	526	25	1074	0		400
1998	565	597	44	44		1150	693	88	400	666	17	30	323	331	544	23	645	0		300
1999	639	717	65	48		1005	668	81	250	634	18	26	332	447	599	23	697			200
2000	591	628	67	55		986	588	88	250	588	11	17	363	281	444	22	528	0	54	176
2001	567	707	67	130		1002	584	93	187	520	12	15	405	304	435	15	638	0	94	122
2002	542	614	50	106			551	136	232	415	13	19	343	311	373	27	589	0	252	147
2003	492	648	49	96			552	77	209	446	12	11	293	240	366	11	559		138	158
2004	465	546	39	85			472	58	254	379	16	11	280	237	337	9	573		97	165
2005	446	534	31	88			476	116	187	75	22	11	238	249	220	7	667	0	109	176
2006	469	596	33	116			383	77	242	56	16	8	241	293	184	10	724	0	290	162
2007	427	537	31	82			451	90	211	277	15	10	197	194	181	11	699	0	258	179
2008	413	466	31	66	1		399	71	233	56	14	13	148	211	160	7	664	0	196	171
2009	389	467	22	89	2		460	78	0	290	9	5	109	69	161	8	515	0	141	158
2010	366	422	19	76	2		461	59	0	225	19	9	84	32	173	11	521	0	114	182
2011	283	370	16	61	2	368	456	83	0	150	11	6	127	0	119	6	438	0	123	28
2012	251	317	18	84	2	466	414	55	0	142	8	6	125	0	119	4	334	0	142	38
2013	270	356	17	82	1	490	427	45	0	132	14	5	96	0	137	3	369	0	181	48
2014	53	346	17	91	1	425	402	47	0	152	8	4	104	0	117	3	319	0	138	56
2015	48	282	14	60	1	344	349	55	0	123	6	5	97	0	102	3	248	0	95	71
2016	49	265	15	83	1	426	347	73	0	183	10	4	136	3	138	2	277	0	303	75

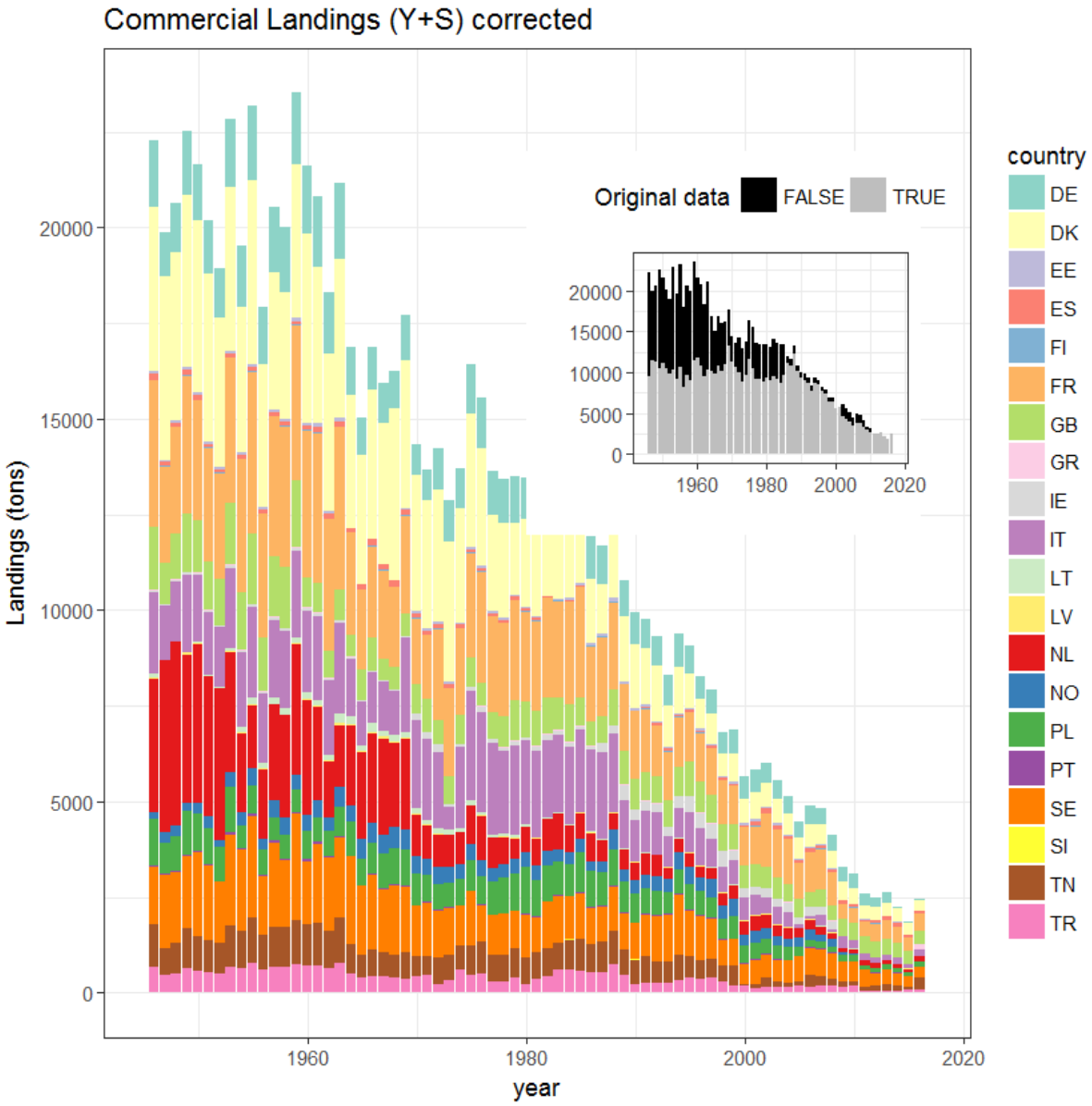

Figure 2.15. Time-series of reported commercial yellow and silver eel fishery landings (tonnes), by country, combining information from the country reports and Data Call and a reconstruction of the non-reported countries/years combinations (see text). Inset box shows the proportion of reconstructed landings, per year. Noting German data are incomplete for 2014–2016.

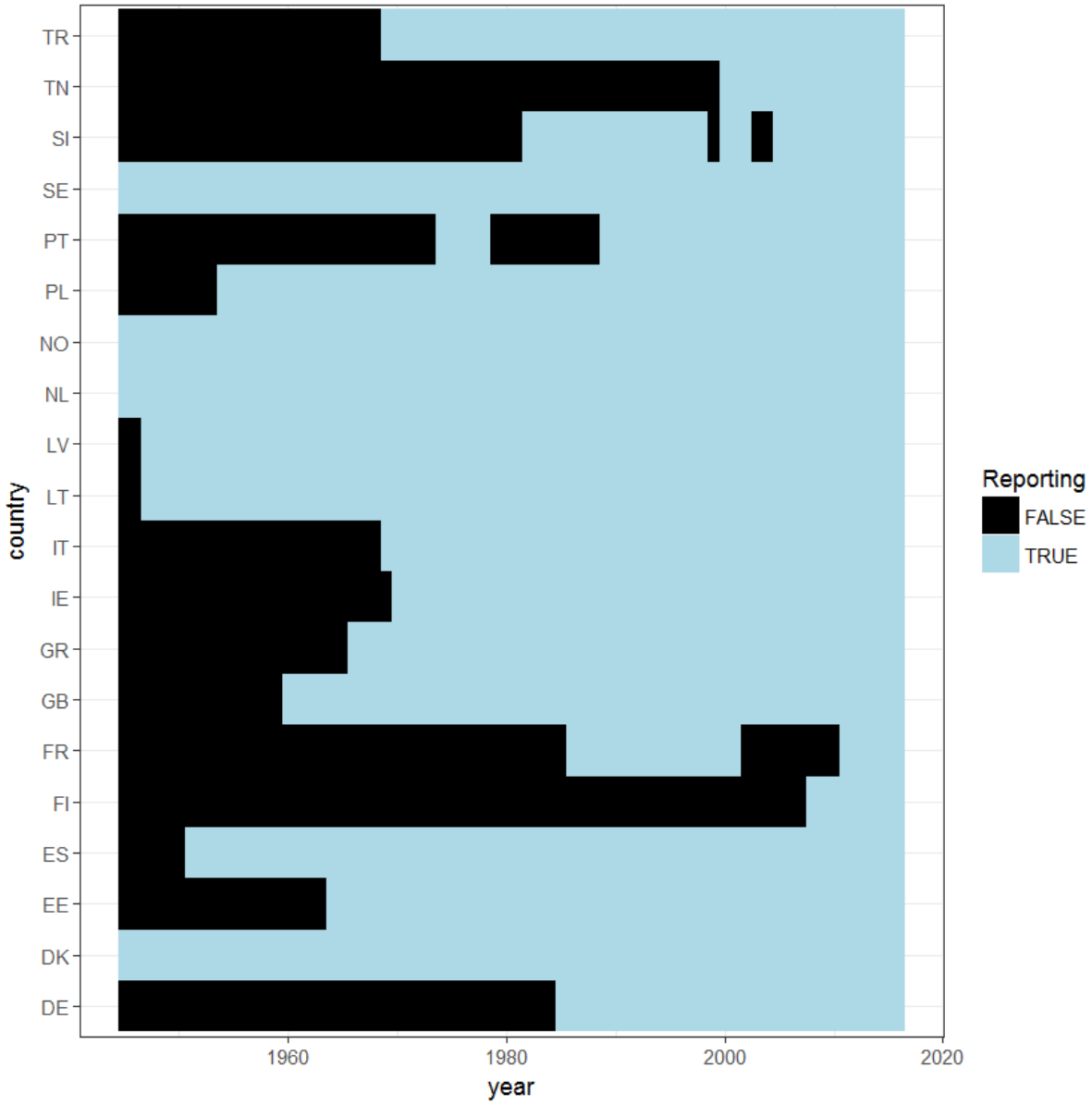

Figure 2.16. Schematic illustration of the years where country data were applied (TRUE) or not reported and therefore reconstructed (FALSE) for the commercial yellow and silver eel landings.

The Data call 2017 requested landings data according to habitat type (AL = habitats reported as combined; F = freshwater; T = transitional waters; C = coastal waters; MO = marine waters; NA = habitat type not reported. These data are presented by year in Figure 2.17 and by country in Figure 2.18. AL data have been used to report when the catch is zero for all habitats, so they don't show up in totals. These figures demonstrate that most yellow and silver eel landings come from fresh, transitional and coastal waters. In future years, these data, at least for EU countries, will be examined in relation to the baselines demarcating marine waters for the EU's Common Fisheries Policy (CFP); the Data call 2017 did not request data according to this demarcation.

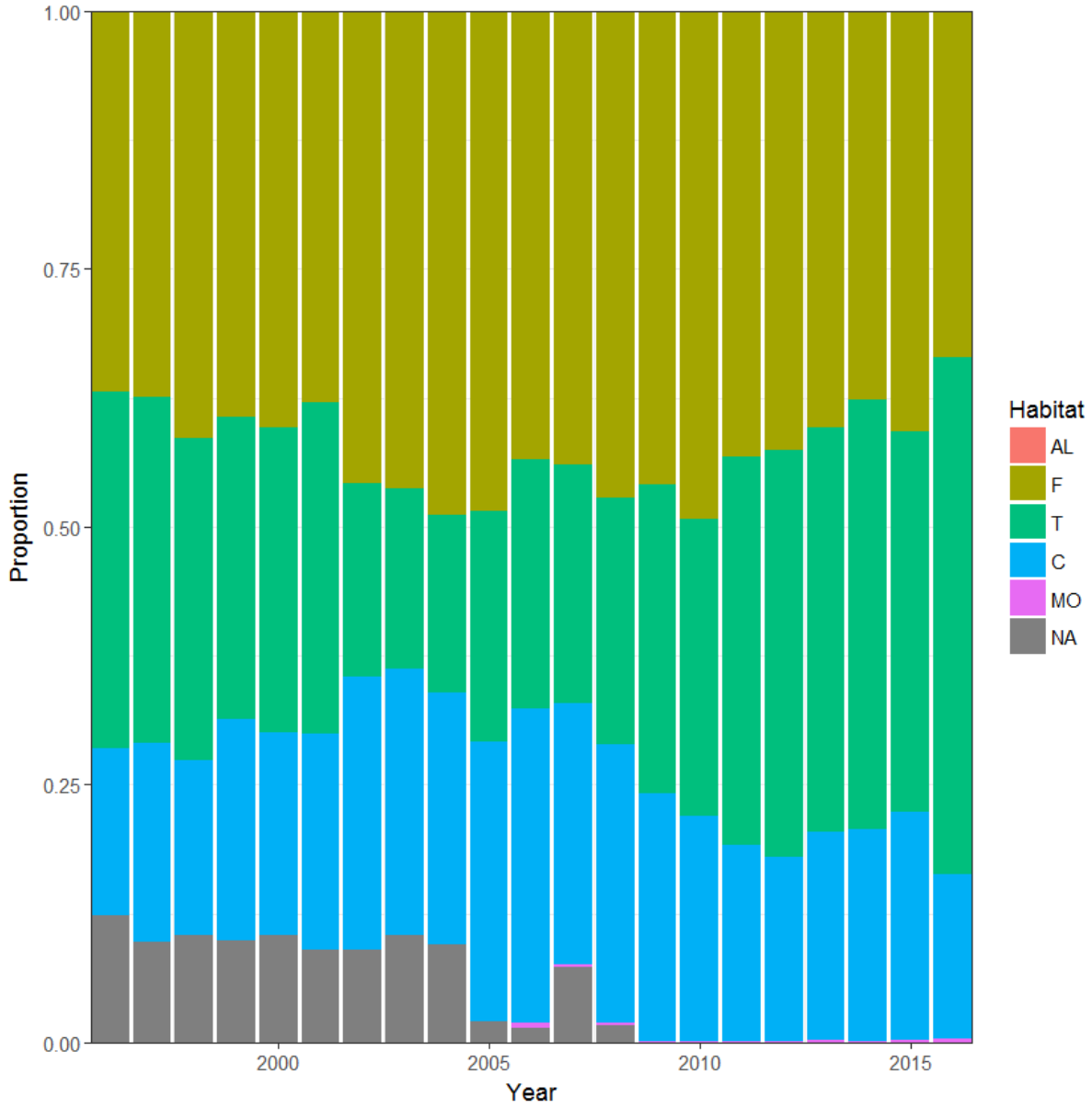

Figure 2.17. Schematic representation of the annual proportion of commercial yellow and silver eel landings (reported and reconstructed) across habitat types: AL = habitats reported as combined; F = freshwater; T = transitional waters; C = coastal waters; MO = marine waters; NA = habitat type not reported.

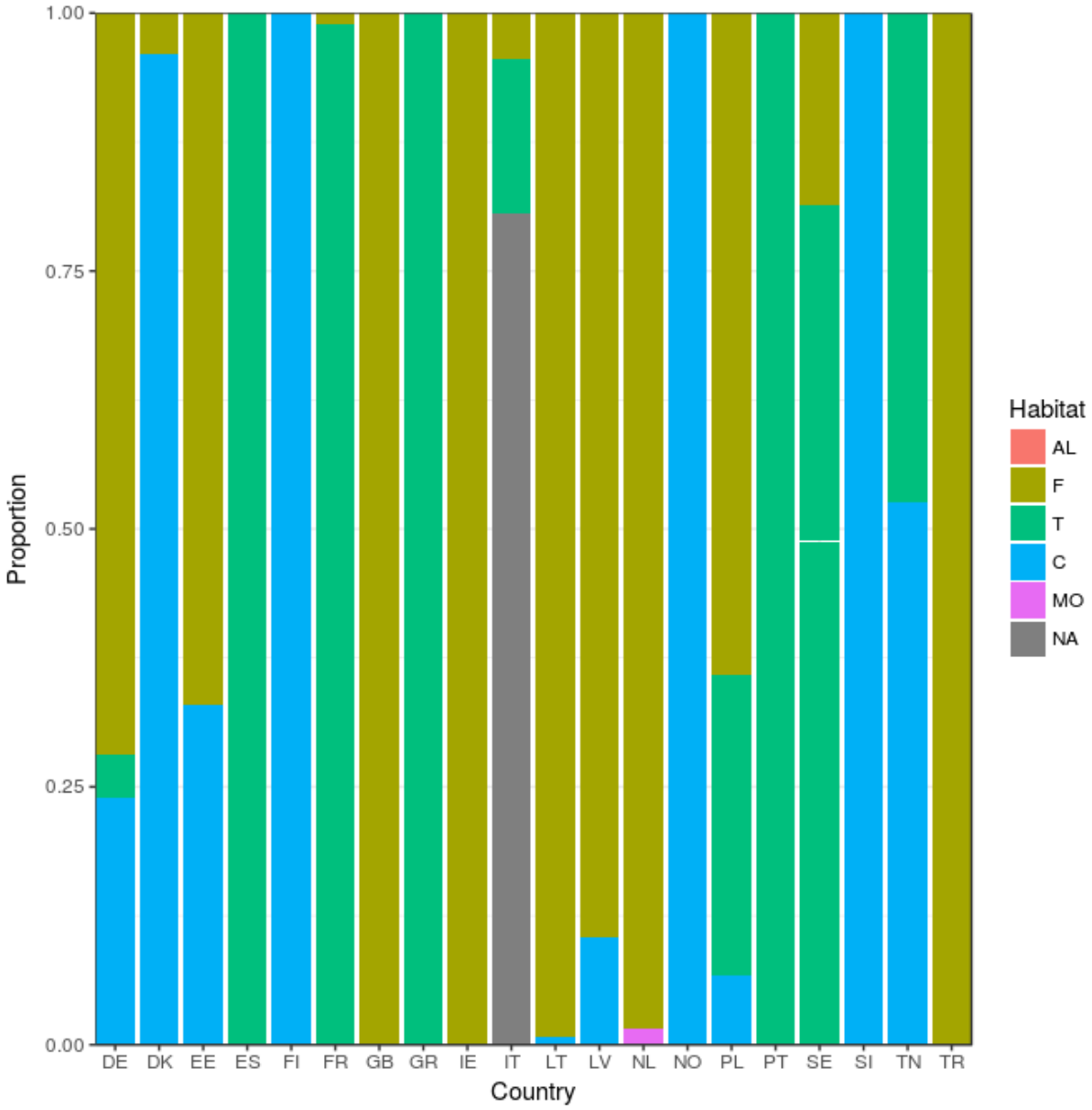

Figure 2.18. Schematic representation of the country-by-country proportion of commercial yellow and silver eel landings (reported and reconstructed) across habitat types: AL = habitats reported as combined; F = freshwater; T = transitional waters; C = coastal waters; MO = marine waters; NA = habitat type not reported.

2.4.3 Capacity and effort

The WGEEL is developing approaches to include and analyse fishing effort and capacity data in coming years. No data are presented here.

2.4.4 Recreational and non-commercial fisheries

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&line, spear, and hand-gathering and passive fishing methods including nets, traps, pots, and setlines. Recreational fisheries for glass eel used to exist in France and Spain, but have been forbidden in France from 2010 (Figure 2.18).

Figure 2.19 and Table 2.10 present the data available to the WGEEL on recreational landings for glass eel; Figure 2.20 and Table 2.11 presents the data available on recreational landings of yellow and silver eel combined. Both series show a sharp decline. Recreational landings were estimated as 2 t for glass eel in 2017, and 241 tonnes for yellow and silver eel combined in 2016 (2017 data not available at time of writing).

Data deficiencies were described by the WGEEL 2016 report, and no improvements have been evidenced since then. In summary, some countries do not include surveys of all gears and/or habitats and lack estimates of released eel. While Germany contributes by far the largest fraction of recreational catches of yellow and silver eel prior to 2014, it should be noted that these estimates are partly based on a limited dataset of average eel catch per angler and are therefore considered to have a high degree of uncertainty. Overall, the impact of recreational fisheries on the eel stock remains largely unquantified although landings can be thought to be at a similar order of magnitude to those of commercial fisheries.

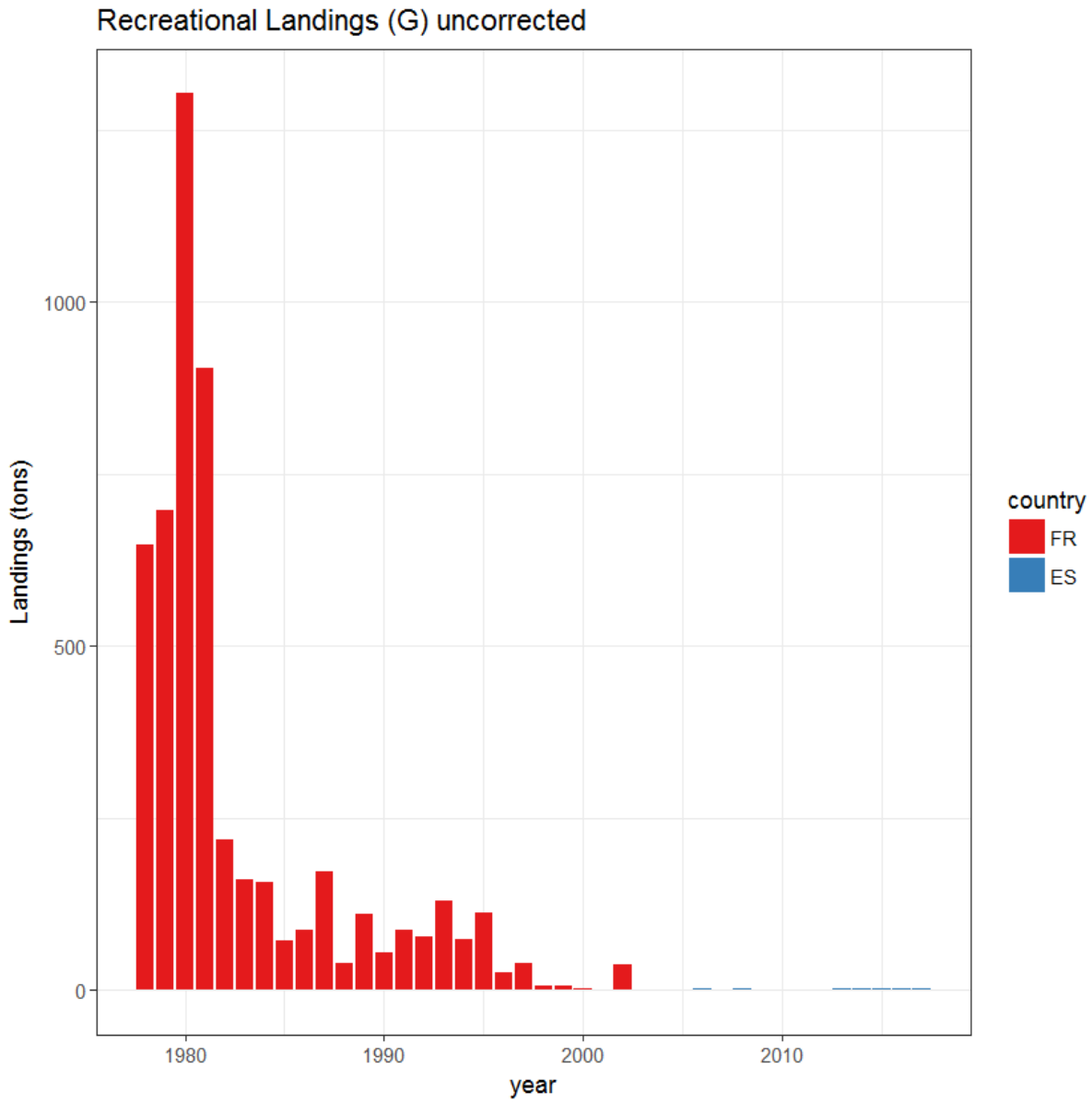

Figure 2.19. Time-series of reported recreational glass eel fishery landings (tonnes), by country, combining information from the country reports and Data Call.

Table 2.10. Recreational landings (tonnes) of glass eel (1978–2017) in Spain (ES) and France (FR). 0 = No fishing. Empty cells = No information.

Year	ES	FR
1978		647
1979		697
1980		1303
1981		904
1982		219
1983		161
1984		156
1985		71
1986		87
1987		172
1988		40
1989		110
1990		54
1991		87
1992		77
1993		130
1994		74
1995		113
1996		25
1997		39
1998		6
1999		6
2000		2
2001		1
2002		37
2004	1	
2005	1	
2006	2	1
2007	1	
2008	2	
2009	0	
2010	1	
2011	0	
2012	1	
2013	2	
2014	2	
2015	2	
2016	2	
2017	2	

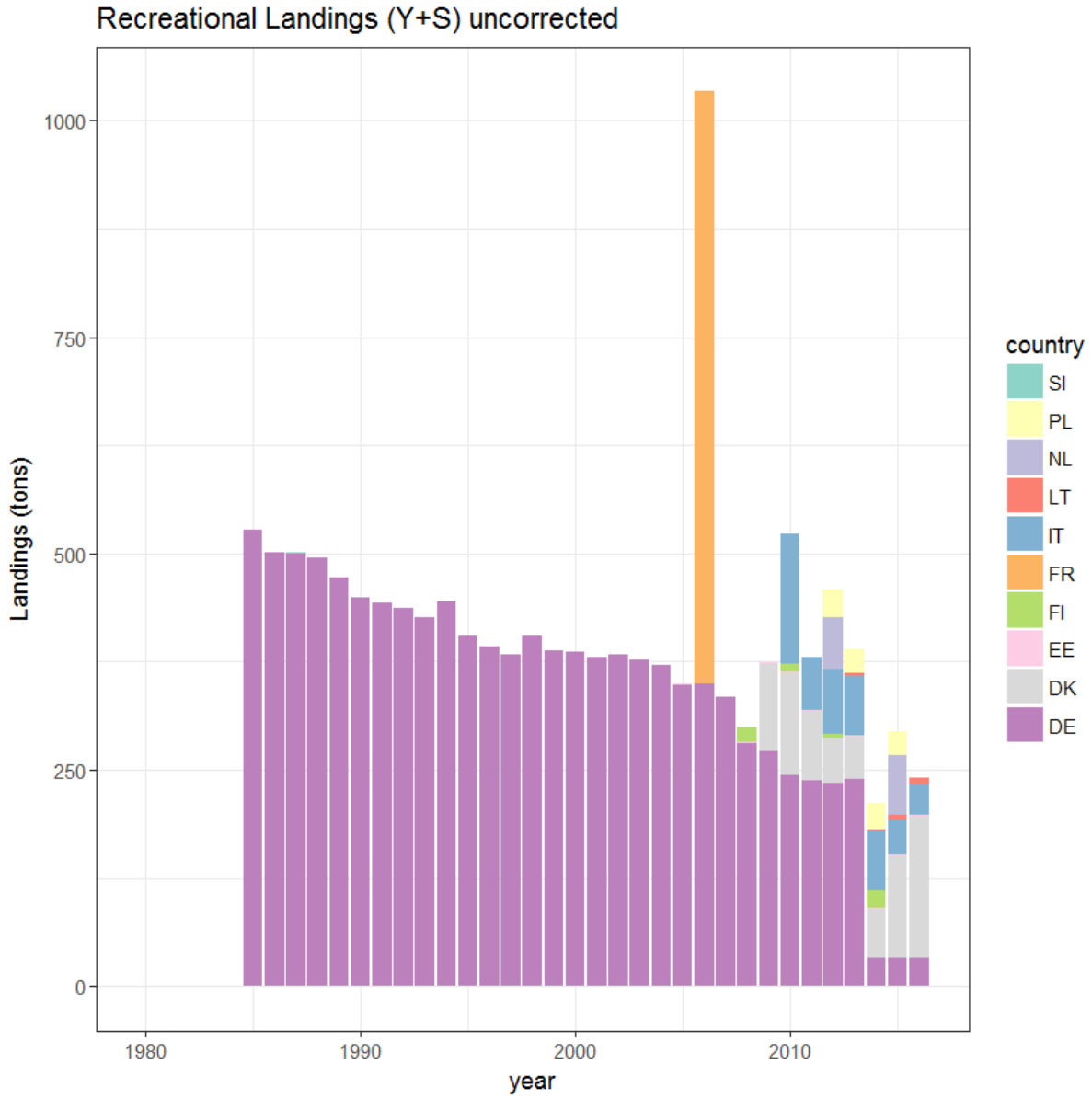

Figure 2.20. Time-series of reported recreational yellow and silver eel fishery landings (tonnes), by country, combining information from the country reports and Data Call. Noting German data are incomplete for 2014–2016.

Table 2.11. Recreational landings of yellow and silver eel (1980–2016) (tonnes) in Slovenia (SI), Poland (PL), Netherlands (NL), Lithuania (LT), Italy (IT), France (FR), Finland (FI), Estonia (EE), Denmark (DK) and Germany (DE). 0 = No fishing. Empty cells = No information. Noting German data are incomplete for 2014–2016.

Year	SI	PL	NL	LT	IT	FR	FI	EE	DK	DE
1980	0									
1981	0									
1982	0									
1983	0									
1984	0									
1985	0									528
1986	0									501
1987	0									500
1988	0									495
1989	0									472
1990	0									449
1991	0									443
1992	0									437
1993	0									426
1994	0									445
1995	0									405
1996	0									392
1997	0									384
1998	0									405
1999	0									387
2000	0									387
2001	0									381
2002	0									383
2003	0									377
2004	0									371
2005	0							2		348
2006	0					684		1		349
2007	0							1		334
2008	0						17	1		281
2009	0						0	1	100	272
2010	0		0		150		10	1	118	244
2011	0				61		0	1	80	239
2012	0	32	59	1	74		5	1	52	234
2013	0	27		3	70		0	1	50	239
2014	0	30		2	70		20	1	57	33
2015	0	26	70	5	41		0	1	118	33
2016	0			7	36		0	1	164	33

2.4.5 Misreporting of data, and illegal fisheries

Most countries did not report the level of misreporting and illegal fisheries in their Country Reports. Illegal activities have been noted in some Country Reports however,

with seizure of illegal nets reported for Sweden, Belgium, Ireland, Portugal and Spain, and illegal trade of glass eels in Spain and Portugal (See Chapter 4). Despite the existence of illegal practices, no data are available to quantify their impact at the stock level. Therefore, it is not possible to determine or even guess the effect of IUU on assessments of the state of the eel stock at this time.

2.5 Aquaculture production of European eel

Aquaculture production data are derived from either responses to the Data call or from the Country Reports. Compared to previous WGEEL reports, all the data available to WGEEL are presented here (20 years more), even if data are only complete from 2004 onwards. Data are provided for ten countries (Table 2.12).

The aquaculture production increased until the end of the 1990s. It clearly starts to decline since the mid-2000s from 8000–9000 tonnes to approximately 5000–6000 tonnes now (Figure 2.21).

It should be noted that eel aquaculture is based on wild recruits, and part of them is subsequently released as ongrown eel for stocking (around 10 million eels, making a mean weight of 20 g, 200 t).

Table 2.12. Reported aquaculture production of European eel in Europe from 1984 onwards, in tonnes.

	DE	DK	EE	ES	FI	GR	IT	LT	NL	SE
1984		18								
1985		40								
1986		200								
1987		240							100	
1988		195							300	
1989		430							200	
1990		586							600	
1991		866							900	
1992		748							1100	
1993		782							1300	
1994		1034							1450	
1995		1324							1540	
1996		1568							2800	
1997		1913							2450	
1998		2483		348				2	3250	
1999		2718		383				2	3500	
2000		2674		411				1	3800	
2001		2000		339				5	4000	
2002		1880	10	295				17	4000	
2003		2050	20	292				20	4200	
2004	328	1500	25	377		500	1220	9	4500	158
2005	329	1700	40	321		500	1131	8	4500	222
2006	567	1900	50	275		385	807	12	4200	191
2007	440	1617	50	369		454	1000	13	4000	175
2008	447	1740	45	460		489	551	11	3700	172
2009	385	1707	30	493		428	677	12	3200	139
2010	398	1537	20	392		428	641	8	2000	91
2011	409	1156	25	469		372	510	13	2300	94
2012	460	1093	35	373		304	737	4	2600	93
2013	471	824		393	0	250	642	3	2900	92
2014	642	842	56	405	0.5	250	572	7	2300	64
2015	1176	1234	52	454	0.5	271	496		2000	104
2016	1062	1072	61	330	0	290		36	2000	117

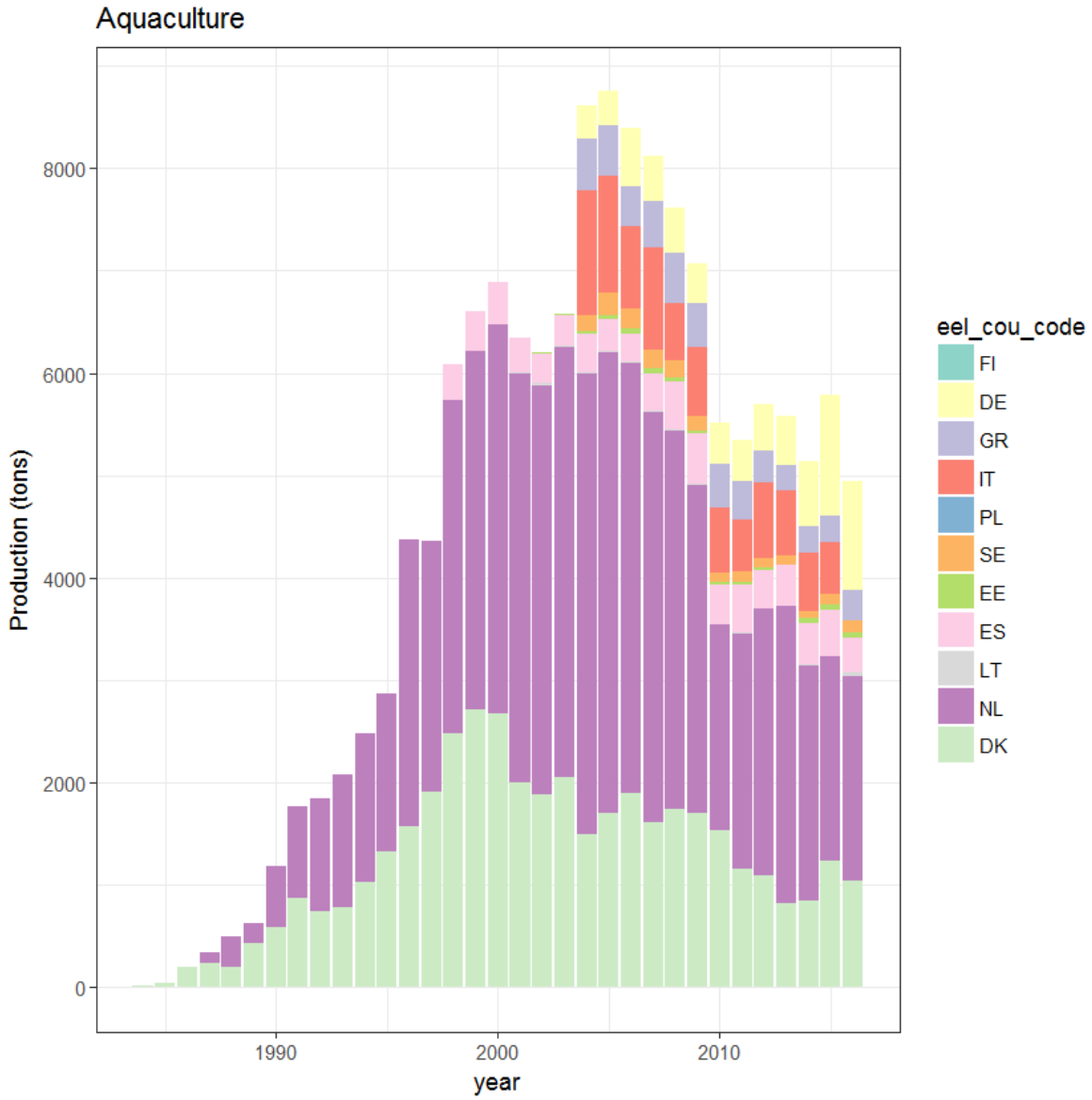

Figure 2.21. Reported aquaculture production of European eel in Europe from 1984 onwards, in tonnes.

2.6 Stocking

Stocking (Capture, translocation and stocking to new locations in the wild) of eel has increased over the period 2009 to 2016, as a result of the inclusion of this as a stock enhancement option in the EC Eel Regulation (EC 1100/2007). Scientific evidence is still lacking to definitively establish whether or not stocking has a significant potential for the recovery of the stock (ICES, 2016).

Data on the amount of stocked eel were obtained from the responses to the Data call and Country Reports. As WGEEL reports in September or October when some stocking programmes in various countries are still underway for the year, the data for 2017 are not complete and therefore data are only presented up till 2016. Note also that various countries use different size and weight classes of young yellow eels for stocking purposes, and this complicates the presentation of total weights.

Countries use a varied and broad definition of stocking, more varied than the definition in the Data call 2017. Data have been reported on stocking comprising eels stocked 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 or silver eel stage. The latter corresponds to silver eel caught by commercial fisheries and released in the Mediterranean Sea. These differing definitions cause inconsistencies in the data reported, and this is an element of the Data call and analysis that will be addressed in 2018.

The Data call for stocking enabled the countries to deliver information about eel stocked both in number and/or kilograms. An analysis of the data provided clearly indicates that the conversion from kilogramme to number requires a knowledge of the mean weight of stocked numbers. So the next Data call will ask for stocking quantity and number to be able to convert weight in number and give an idea of the weight at which the eels were stocked.

Meanwhile, we have analysed the present Data call values using the following assumptions about individual weights: 0.3 g for a glass eel, 1 g for a quarantined eel, 20 g for an ongrown eel, 50 g for a yellow eel and 200 or 250 g for a silver eel in France and Greece, respectively.

Figure 2.22 presents the time-series of eel stocking from before 1950 to 2016, according to all stages stocked. Figures 2.23 to 2.27 and Tables 2.13 to 2.17 present the time-series for separate stocking entities.

The stocking of glass eel peaked in the 1980s, followed by a steep decline to a low in 2009. The amount of glass eels stocked increased in 2014 when the lower market prices guaranteed a larger number of glass eels could be purchased for fixed stocking budgets. However, in 2016, the glass eel suppliers had problems fulfilling glass eel orders placed by several countries (most notably Belgium).

The stocking of young yellow eels started rising in the 1990s reaching its peak in 2013 with almost 16 million young yellow eels stocked across EMUs (Figure 2.26). In 2016, the proportions of glass eel and young yellow eel among reported eel stocked were almost equal with 10 million and 9.2 million individuals, respectively. Multiple factors affect the supply and demand of eel meant for stocking so any conclusions made on the proportions of different eel stocked would be complicated.

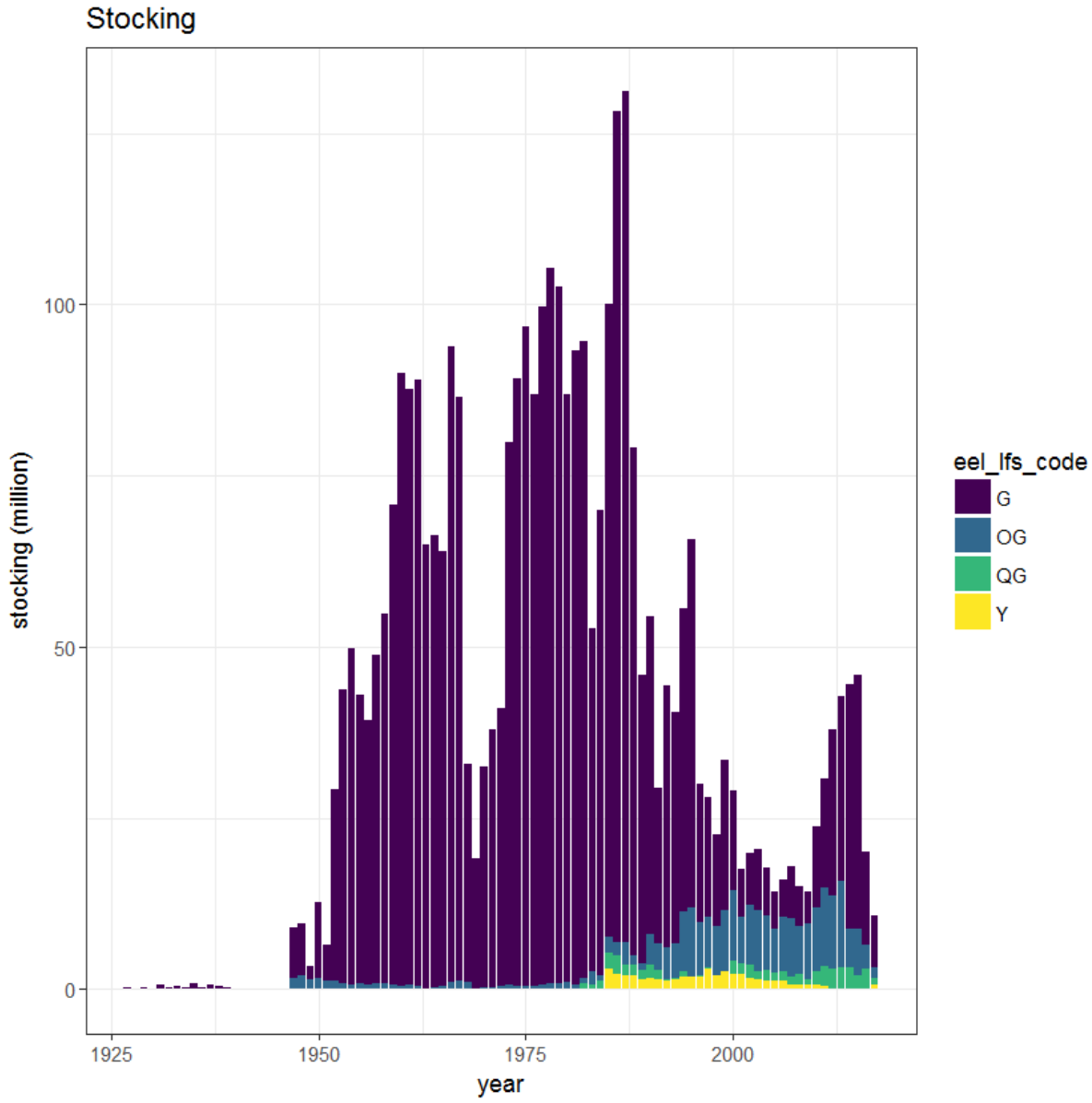

Figure 2.22. Annual amounts of eel stocked (millions), according to life stage when stocked.

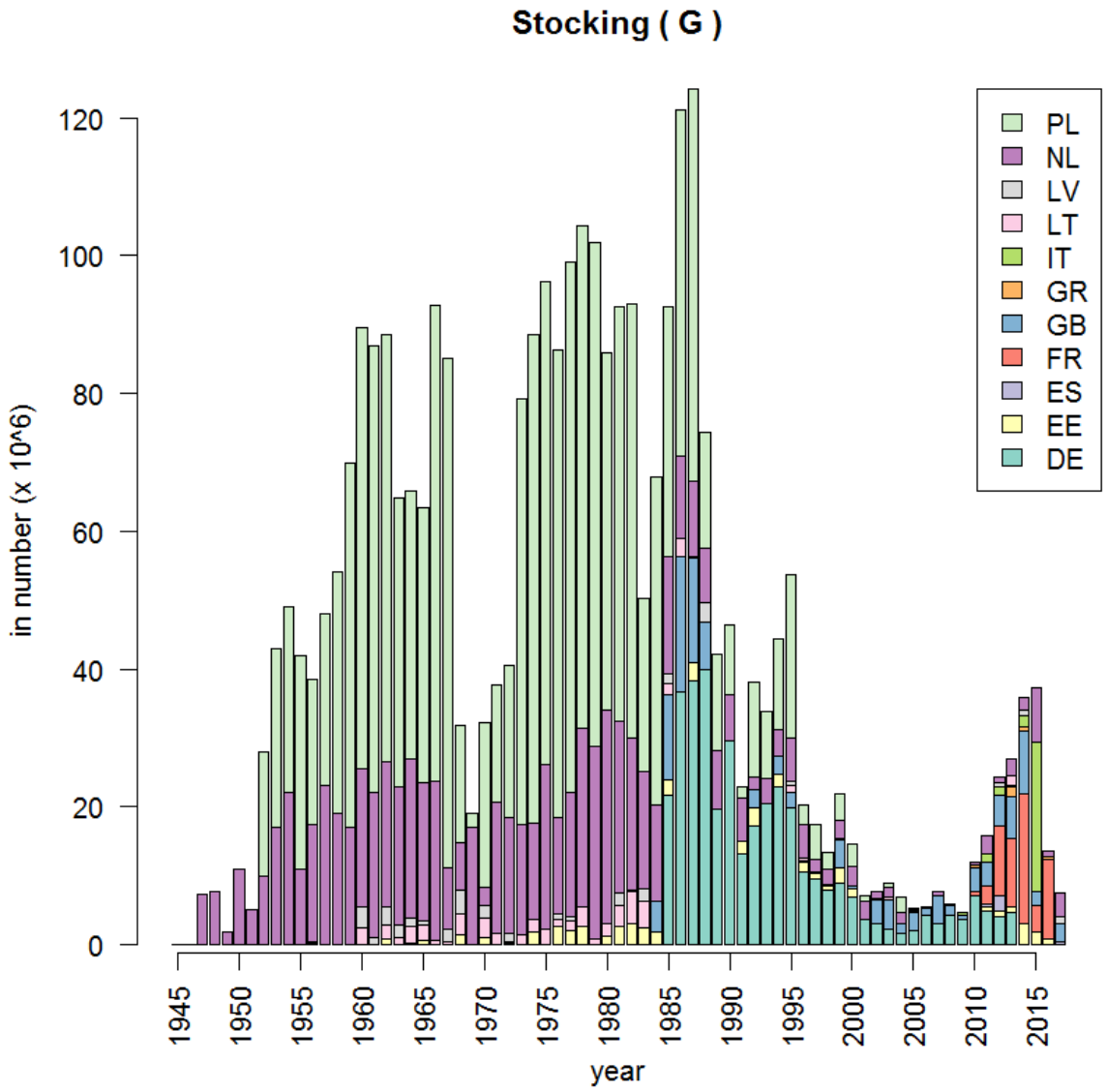

Figure 2.23. Reported stocking of glass eel not including those in quarantine by country (in million).

Table 2.13. Stocking of glass eel (1927–2017). Numbers of glass eels (in millions) stocked in Germany (DE), Estonia (EE), Spain (ES), France (FR), United Kingdom (GB), Greece (GR), Italy (IT), Lithuania (LT), Latvia (LV), Netherlands (NL) and Poland (PL). 0 = No stocking. Empty cells = No information.

Year	DE	EE	ES	FR	GB	GR	IT	LT	LV	NL	PL
1927									0.31		
1928								0.1			
1929								0.2			
1930								0			
1931								0.2	0.34		
1932								0.2			
1933								0.2	0.22		
1934								0.3			
1935								0.6	0.16		
1936								0.3			
1937								0.3	0.26		
1938								0.4			
1939								0.1	0.21		
1940								0			
1941								0			
1942								0			
1943								0			
1944								0			
1945								0			
1946								0			
1947								0		7.3	
1948								0		7.6	
1949								0		1.9	
1950								0		11	
1951								0		5.1	
1952								0		10	18
1953								0		17	26
1954								0		22	27
1955								0		11	31
1956		0.2						0.3		17	21
1957								0		23	25
1958								0		19	35
1959								0		17	53
1960		0.06						2.3	3.19	20	64
1961								0	1	21	65
1962		0.9						2	2.64	21	62
1963								1	1.9	20	42
1964		0.2						2.4	1.3	23	39
1965		0.7						2.1	0.69	20	40
1966								0.7		23	69
1967								0.5	1.77	8.9	74

Year	DE	EE	ES	FR	GB	GR	IT	LT	LV	NL	PL
1968		1.4						3	3.57	6.9	17
1969								0		17	2
1970		1						2.8	1.8	2.7	24
1971								1.6		19	17
1972		0.1						0.3	1.13	17	22
1973								1.4		16	61.92
1974		1.8						1.8		14	70.99
1975								2.2		24	69.98
1976		2.6						1	0.85	14	67.95
1977		2.1						1.4	0.52	18	76.98
1978		2.7						2.7		26	73.01
1979								0.8		28	73.03
1980		1.3						1.8		31	51.78
1981		2.7						3	1.8	25	60.04
1982		3						4.6	0.29	22	63.17
1983		2.5						3.7	1.93	17	25.1
1984		1.8			4.44			0		14	47.6
1985	21.58	2.4			12.22			1.6	1.48	17	36.28
1986	36.63				19.78			2.6		12	50.21
1987	38.36	2.5			15.22			0	0.26	11	56.89
1988	39.82				7			0	2.91	7.9	16.66
1989	19.74				0			0		8.4	13.96
1990	29.52				0			0		6.8	10.17
1991	13.07	2			0			0		6.1	1.67
1992	17.3	2.5			2.67					1.9	13.8
1993	20.52				0					3.5	9.74
1994	22.83	1.9			2.56			0.1		3.8	13.12
1995	19.84				2.33			1	0.57	6.2	23.72
1996	10.59	1.4			0.11			0.5		4.8	2.77
1997	9.47	0.9			0.22					1.8	5.11
1998	7.98	0.5			0.06			0.1		2.3	2.5
1999	8.87	2.3			4				0.29	2.5	3.98
2000	6.94	1.1			0.5					2.9	3.12
2001	3.54				0					2.8	0.7
2002	3.13				3.33				0.25	0.9	
2003	2.13				4.33			0.34		1.6	0.51
2004	1.65				1.33				0.06	1.6	2.25
2005	2.02				2.67	0.2			0.12	0.3	
2006	4.21				1.11	0.07			0	0.1	
2007	3.02				4	0.07			0.02	0.6	
2008	4.2				1.44	0.03				0.2	
2009	3.56				0.72	0.07	0.33			0	
2010	7.09			0.7	3.32	0.37	0.15			0.3	
2011	4.82	0.68	0.45	2.53	3.45	0	1.26			2.7	
2012	4.01	0.91	2.08	10.29	4.33	0.03	1.15		0.74	0.8	

Year	DE	EE	ES	FR	GB	GR	IT	LT	LV	NL	PL
2013	4.66	0.89	0.01	9.75	6.22	1.43	0.22	1.3		2.4	
2014		3		18.93	9.03	0.7	1.64		0.75	1.8	
2015		1.87		3.85	2.01	0.01	21.55			7.9	
2016		0.9		11.5	0	0.28				0.86	
2017			0.3		2.7				1.03	3.43	

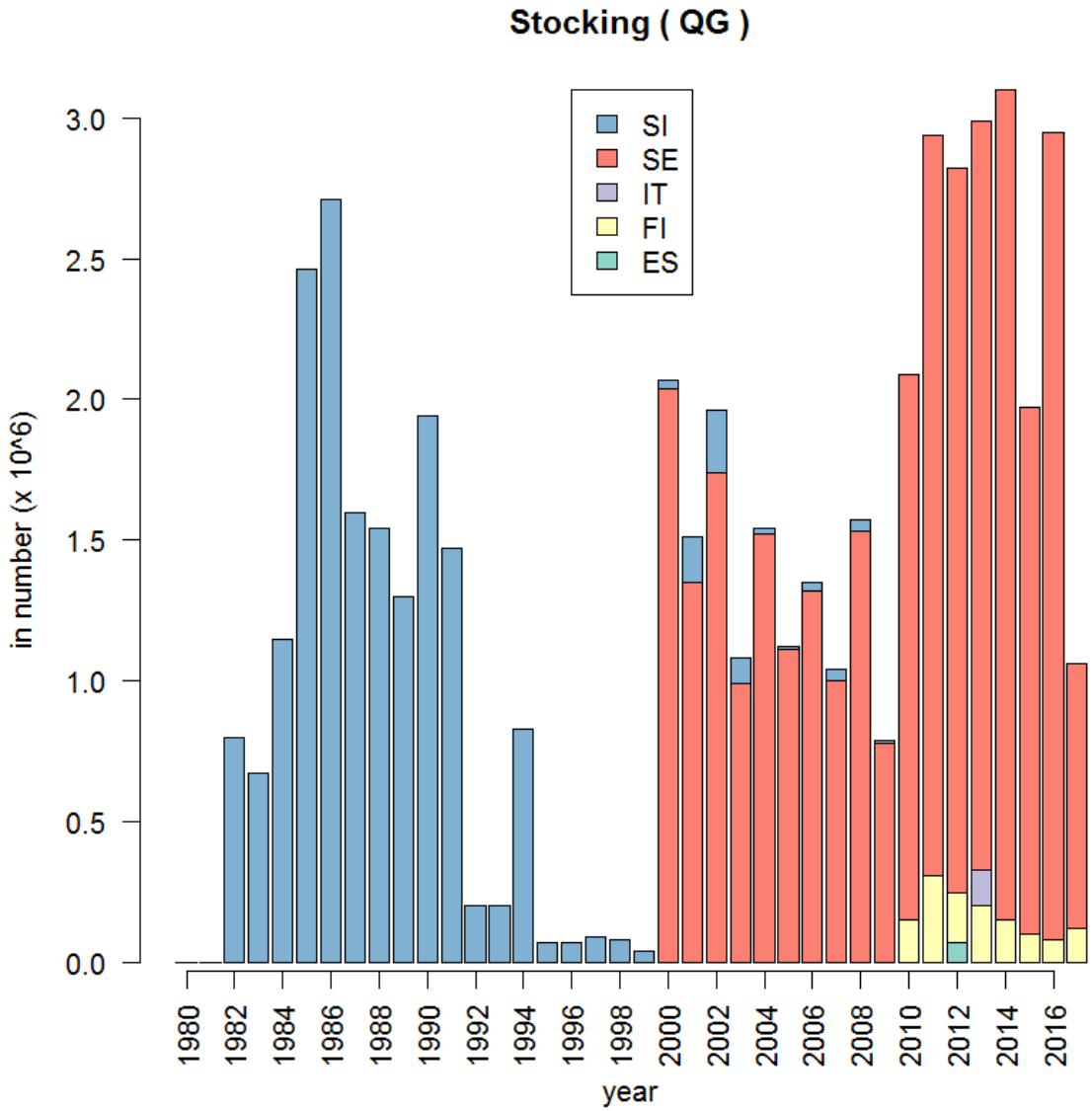

Figure 2.24. Reported stocking of quarantined eel by country (in million).

Table 2.14. Stocking of eel that have been held in quarantine (1980–2017). These are eels for which a holding and quarantine phase of eight to ten weeks is added, instead of stocking them directly after catch and transport. Numbers of stocked eels that have been in quarantine (in millions) in Spain (ES), Finland (FI), Italy (IT), Sweden (SE) and Slovenia (SI). 0 = No stocking. Empty cells = No information.

Year	ES	FI	IT	SE	SI
1980					0
1981					0
1982					0.8
1983					0.67
1984					1.15
1985					2.46
1986					2.71
1987					1.6
1988					1.54
1989					1.3
1990					1.94
1991					1.47
1992					0.2
1993					0.2
1994					0.83
1995					0.07
1996					0.07
1997					0.09
1998					0.08
1999					0.04
2000				2.04	0.03
2001				1.35	0.16
2002				1.74	0.22
2003				0.99	0.09
2004				1.52	0.02
2005				1.11	0.01
2006				1.32	0.03
2007				1	0.04
2008				1.53	0.04
2009				0.78	0.01
2010		0.15		1.94	0
2011		0.31		2.63	0
2012	0.07	0.18		2.57	0
2013		0.2	0.13	2.66	0
2014		0.15		2.95	0
2015		0.1		1.87	0
2016		0.08		2.87	0
2017		0.12		0.94	

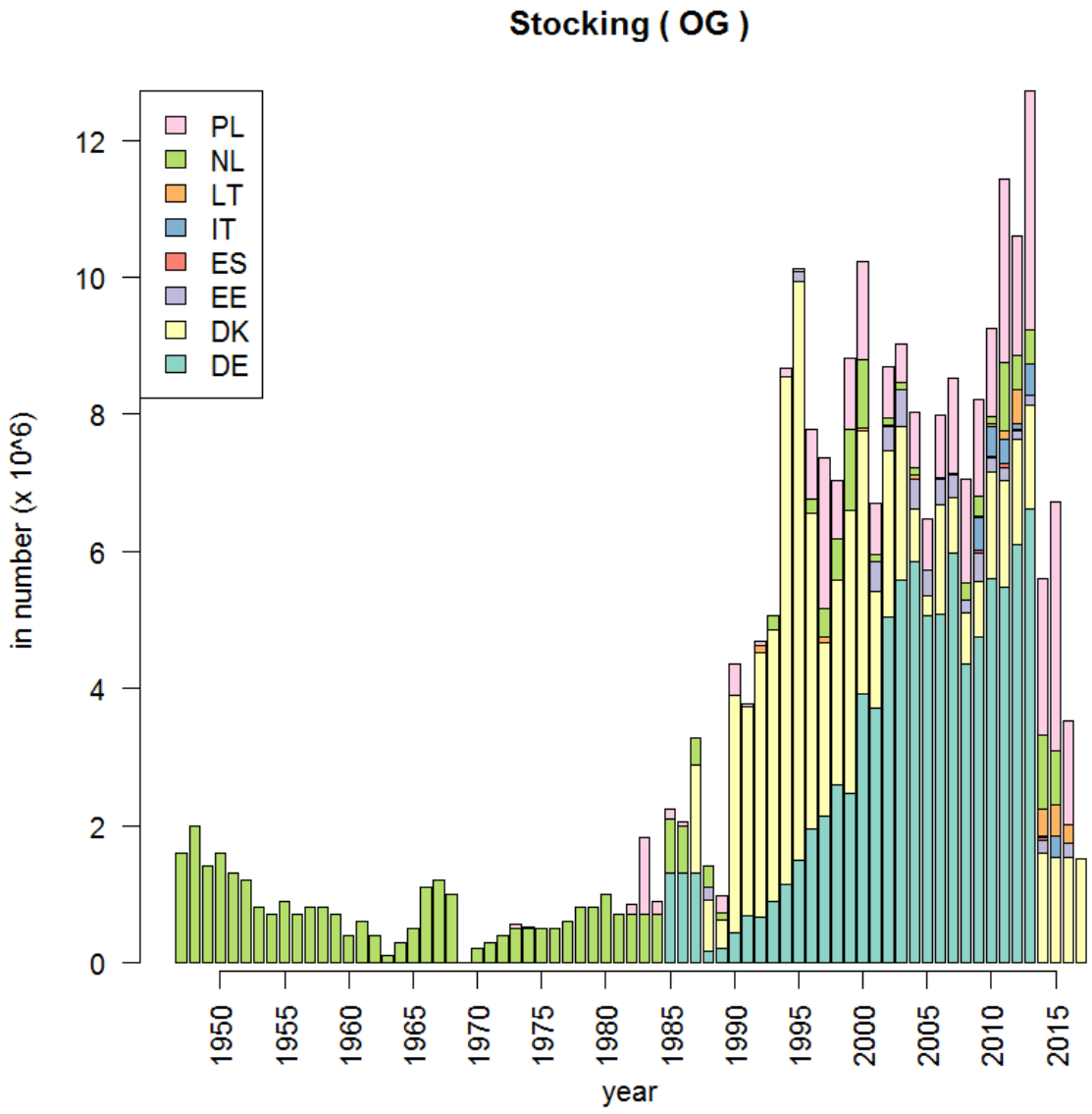

Figure 2.25. Stocking of ongrown eel by country (in million).

Table 2.15. Stocking of ongrown eel (1947–2017). Numbers of ongrown eels (in millions) stocked in Germany (DE), Denmark (DE), Estonia (EE), Spain (ES), Italy (IT), Lithuania (LT), Netherlands (NL) and Poland (PL). 0 = No stocking. Empty cells = No information.

Year	DE	DK	EE	ES	IT	LT	NL	PL
1947							1.6	
1948							2	
1949							1.4	
1950							1.6	
1951							1.3	
1952							1.2	
1953							0.8	
1954							0.7	
1955							0.9	
1956							0.7	
1957							0.8	
1958							0.8	
1959							0.7	
1960							0.4	
1961							0.6	
1962							0.4	
1963							0.1	
1964							0.3	
1965							0.5	
1966							1.1	
1967							1.2	
1968							1	
1969							0	
1970							0.2	
1971							0.3	
1972							0.4	
1973							0.5	0.06
1974							0.5	0.01
1975							0.5	
1976							0.5	
1977							0.6	0.01
1978							0.8	
1979							0.8	
1980							1	0
1981							0.7	
1982							0.7	0.14
1983							0.7	1.13
1984							0.7	0.2
1985	1.3						0.8	0.14
1986	1.3						0.7	0.05
1987	1.3	1.58					0.4	0
1988	0.17	0.75	0.18				0.3	0.01

Year	DE	DK	EE	ES	IT	LT	NL	PL
1989	0.21	0.42					0.1	0.25
1990	0.44	3.27					0	0.44
1991	0.68	3.06					0	0.03
1992	0.67	3.86				0.1	0	0.06
1993	0.9	3.96					0.2	0
1994	1.14	7.4					0	0.14
1995	1.49	8.44	0.15				0	0.04
1996	1.96	4.60					0.2	1.02
1997	2.14	2.53				0.1	0.4	2.21
1998	2.6	2.98					0.6	0.85
1999	2.47	4.12					1.2	1.02
2000	3.93	3.83				0.04	1	1.43
2001	3.71	1.7	0.44			0.01	0.1	0.75
2002	5.05	2.43	0.36			0.01	0.1	0.75
2003	5.58	2.24	0.54				0.1	0.56
2004	5.86	0.75	0.44			0.07	0.1	0.81
2005	5.06	0.3	0.37			0	0	0.74
2006	5.08	1.6	0.38			0.01	0	0.92
2007	5.97	0.83	0.33			0.01	0	1.39
2008	4.35	0.75	0.19	0.01		0	0.23	1.52
2009	4.75	0.8	0.42	0.04	0.48	0.02	0.3	1.4
2010	5.61	1.55	0.21	0.01	0.45	0.03	0.1	1.29
2011	5.47	1.56	0.2	0.06	0.34	0.13	1	2.67
2012	6.1	1.53	0.12	0.02	0.1	0.49	0.5	1.75
2013	6.61	1.53	0.13	0	0.47		0.5	3.48
2014		1.6	0.19	0.03	0.03	0.38	1.08	2.29
2015		1.53		0	0.32	0.45	0.8	3.63
2016		1.53	0.22			0.27		1.51
2017		1.52						

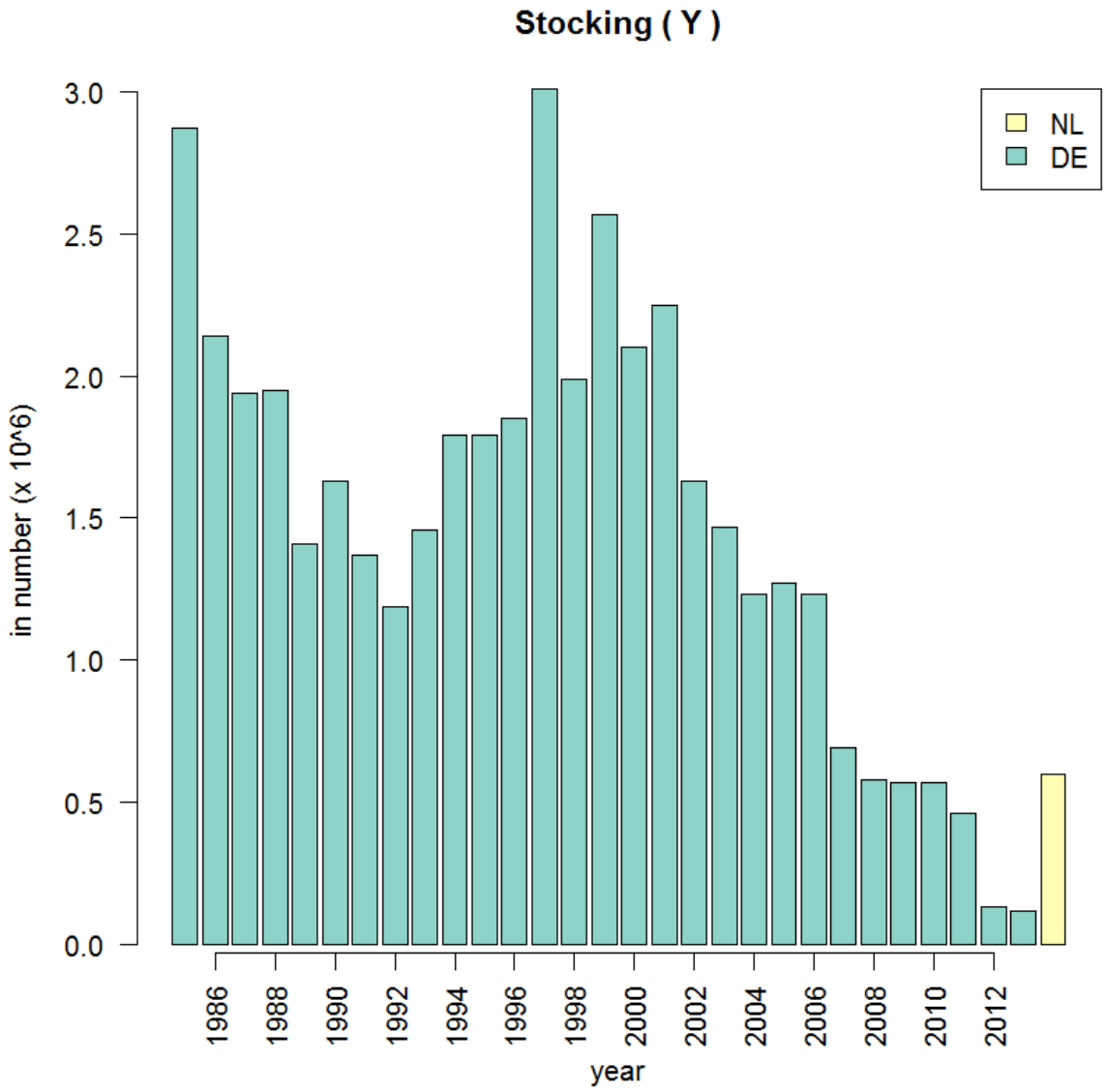

Figure 2.26. Reported stocking of wild-caught yellow eel by country (in million).

Table 2.16. Stocking of yellow eel (1985–2017). Numbers of yellow eels (in millions) stocked in Germany (DE) and Netherlands (NL). Empty cells or Missing Rows = No information.

Year	DE	NL
1985	2.87	
1986	2.14	
1987	1.94	
1988	1.95	
1989	1.41	
1990	1.63	
1991	1.37	
1992	1.19	
1993	1.46	
1994	1.79	
1995	1.79	
1996	1.85	
1997	3.01	
1998	1.99	
1999	2.57	
2000	2.1	
2001	2.25	
2002	1.63	
2003	1.47	
2004	1.23	
2005	1.27	
2006	1.23	
2007	0.69	
2008	0.58	
2009	0.57	
2010	0.57	
2011	0.46	
2012	0.13	
2013	0.12	
2017		0.6

Some silver eels, caught by the fishery and therefore recorded as landings, are further release in the Mediterranean outside the lagoons in Greece and France. They are reported as “stocked” silvers (Figure 2.27; Table 2.17).

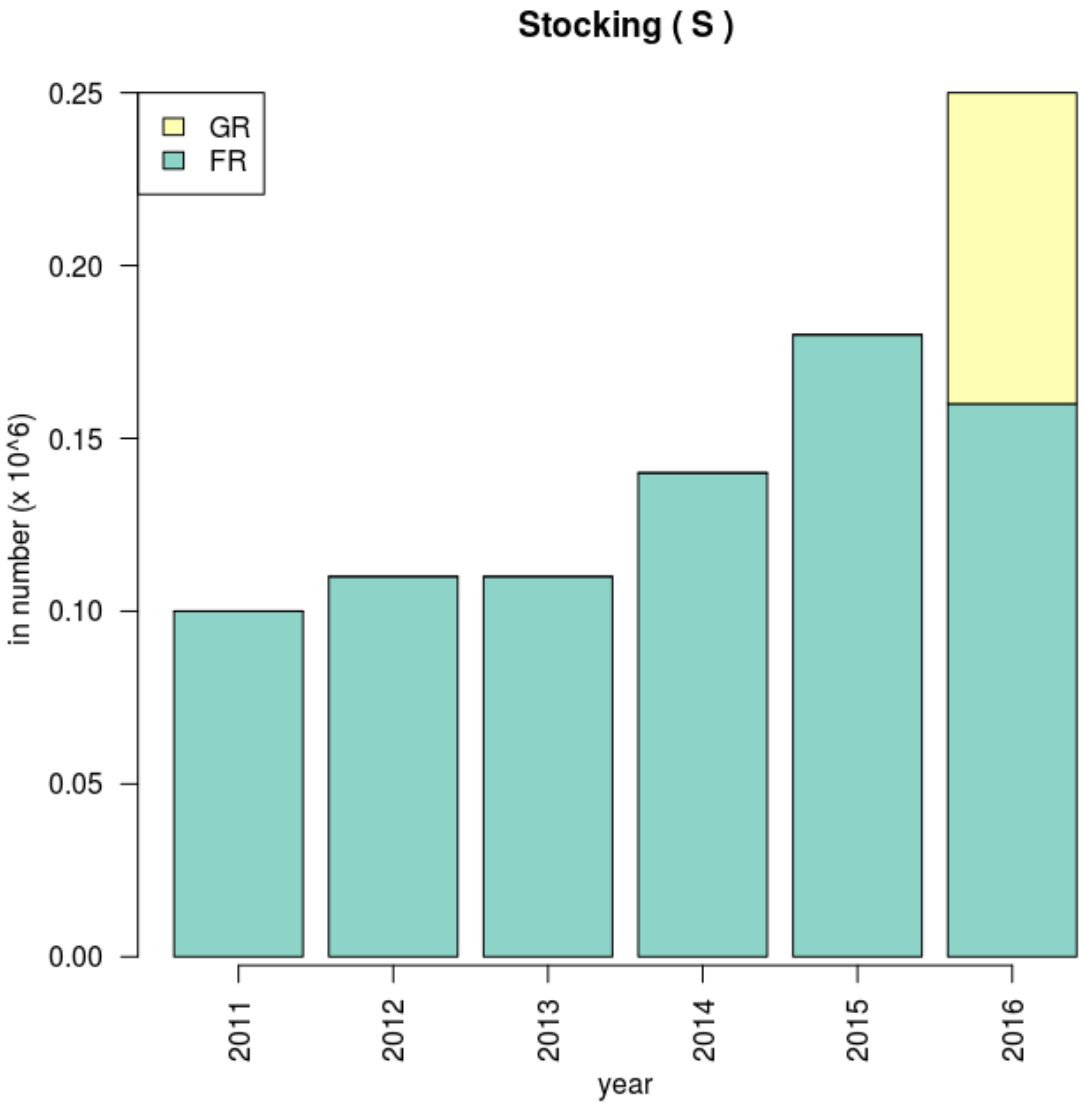

Figure 2.27. Reported stocking of wild silver eel by country (in million).

Table 2.17. Stocking of silver eel (2011–2016). Numbers of stocked silver eels (in millions) in France (FR) and Greece (GR). NA = Not applicable.

Year	FR	GR
2011	0.10	NA
2012	0.11	NA
2013	0.11	NA
2014	0.14	NA
2015	0.18	NA
2016	0.16	0.9

3 Data call 2017 and 2018

3.1 Introduction

This chapter addresses ToR 4: the generic EG ToRs from ICES, and any requests from (ICES), EIFAAC or GFCM. Specifically, this chapter addresses Generic ToR f) to *"Prepare the Data calls for the next year update assessment and for the planned data evaluation workshops"* and *Generic Terms of Reference f) to describe the quality of data used by the group*.

The data and information have up to 2016 been supplied to WGEEL through a Country Report text with associated figures and tables. They are now requested in the form of excel files, associated with a Data call, which have been formatted to ensure direct upload into the eel database that WGEEL are developing.

The process of designing and implementing an Eel Data call was improved based on the feedback received by data providers and by discussions during the WGEEL 2017 meeting. The feedback from data providers and resulting recommendations are summarized at the end of this chapter.

3.2 Data call for 2018

3.2.1 Overview of the Data call

ICES standard process for getting data for stock assessments is through Data calls. Stability in structure of the Data calls helps data submitters in national laboratories. The aim of the 2017–2018 Data call is to harmonise and officialise the data requirements across, ICES, EIFAAC and GFCM countries. The Data call has been designed using recent Data calls for marine species stock assessments as examples of best practice; the draft Data call was discussed and agreed with ICES, EIFAAC and GFCM and issued to all countries that support natural production of the European eel. It was developed as a two-year plan. The second part of the Data call was finalized during this WGEEL meeting.

3.2.1.1 2017 Data call: part 1

The Data call part 1 asked for data describing: recruitment; fishery catches; fishery landings (killed); stocking and aquaculture production.

In 2017, we requested data as far back as available, to form a starting point for the creation of a database. In future years, the call for these datasets will only be for the most recent year's data, plus any adjustments required to historic data. The call also required the provision of metadata associated with all data.

The Data call that sent in 2017 is given in Annex 7. The accompanying spreadsheets are described in ICES (2017).

3.2.1.2 2018 Data call: part 2

The year-2 Data call (2018) is an annual update of the data requested in 2017 as well as a request for the biomass indicators and mortality estimates (from 2009) which are part of the EU regulation 1100/2007 (European Commission 2007). For the 2018 Data call, the group has developed Data call spreadsheets for reporting on the Biomass (B_o, B_{best} and B_{curr}), mortality (silver eels equivalent biomass, and Lifetime mortality rates: $\sum F$, $\sum Hydro$, $\sum Restock$, $\sum Habitat$, $\sum Other$) indicators, wetted area of potentially available habitat, and various data from silver eel time-series. These are briefly explained below,

and more fully in the Data call 2018 covering letter, a draft of which is provided in Annex 8 to this report.

- Biomass indicators
  - B_0 The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the stock;
  - $B_{current}$ The amount of silver eel biomass that currently escapes to the sea to spawn;
  - B_{best} The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the current stock, included restocking practices, hence only natural mortality operating on stock.
- Anthropogenic mortality
  - SEE Silver eel Equivalents Biomass anthropogenic mortality;
  - 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; sum of $\sum F$, $\sum Hydro$, $\sum Restock$, $\sum Habitat$, $\sum Other$;
  - ΣA The sum of anthropogenic mortalities, i.e. ΣA = ΣF + ΣH. It refers to mortalities summed over the age groups in the stock.
- Habitat wetted area: which corresponds to the potential available habitat for eel production
- Silver eel time-series
  - Number of eels;
  - Total weight;
  - Mean weight;
  - Sex ratio;
  - And associated upstream factors, (landings, stocking, etc.)

The tables to fill in are organized into new data spreadsheets provided as Annexes to the Data call, the 2018 Data call is accompanied by 11 Annexes: nine for data, one for an overview and one for feedback on the process. A new overview sheet was proposed for requesting information on the data, methods, source references and extent of the assessments. This is to provide an initial level of quality control and visual cross-checking before undertaking any evaluation or analysis of the reported data. In the event of any of the indicators that were previously reported in 2012 or 2015 being changed in the current report, a reason for this change has been requested. Also, if there has been any change, over the time-series, in the assessment method, the extent of habitat or the data source used for the assessment, this should also be explained in the overview sheet.

With the exception of the GFCM area, the Data Call 2017 did not request data on fishing effort data. Effort data would improve the evaluation of yellow and silver eel catch statistics and therefore fishery mortality time-series. However, due to the variety of gear types, a definition of useful parameters is not yet available to effectively call for these data.

All of the files (listed as annexes to the Data call) were organized in the same way and consist of several tabs:

- A "readme" tab: this sheet contains the instructions for filling out the data tab.
- A metadata tab: where the datasets, methods, location, point of contact, and quality overview should be described.
- A data tab: this is where the data are filled in.
- Several tabs listing the codes for filling out the data tab.

Annex #0 consists of a single spreadsheet where one can leave comments and feedback intended to identify problems in filling out the spreadsheets and suggestions from data providers.

The data files are as follows:

- Annex 0: Feedback
- Annex 1: Recruitment
- Annex 2: Landings
- Annex 3: Stocking
- Annex 4: Aquaculture production
- Annex 5: Overview of Stock indicators
- Annex 6: Biomass indicators
- Annex 7: Habitat wetted area
- Annex 8: Mortality estimates SEE biomass
- Annex 9: Mortality rate Sigma
- Annex10: Silver Eel Time-series

3.2.2 Further developments towards a systematic assessment and treatment of data quality

In the absence of standard criteria for determining data quality or for its treatment within assessments, the WGEEL has further developed a data quality scoring system, and rules of procedure will be developed during 2018. The process is being implemented through the Data calls and Database development, and is described here to document this developing area, but this is not meant to represent the final product.

There are four different levels at which data quality can be assessed. These have been described in ICES (2017, WKEELDATA). The four quality checks are:

A. National data collection.
B. National Aggregations and Assessments.
C. Internal WGEEL quality assurance.
D. Health warnings and caveats on WGEEL outputs.

Quality checks #A and #B are necessary to decide whether a dataseries will be incorporated into the database or not, and a scoring system has been outlined based on four quality scores that can be used in the database (Table 3.1). The last two quality checks (#C and #D) will not be addressed here, but note that check #C has been implemented for the recruitment analyses this year (see Chapter 2).

Table 3.1. Definition of quality scores which must be incorporated in the database.

Quality score	name	description
0	missing	Missing data
1	good quality	The data passed the quality checks
2	modified	Retroactive data that have been modified
3	bad quality	The data have been judged of too poor quality to be used by the WGEEL. They are not used.

3.2.2.1 Quality score 1

We have retained the following requirements to assign a quality score of **1** (all conditions must be fulfilled):

- Existence of a project protocol/Standard operating procedure that describes how the data were collected/calculated. For example:
  - a peer-reviewed paper, report.
  - A brief description, or a reference to the data collection and processing methods which can be made available upon request by WGEEL.
- Information about ownership and/or point of contact of data

3.2.2.2 Quality score 2

Data that are assigned a quality score of **2** were **modified retroactively**. For example, if calculation methods were improved or a correction was applied to an earlier dataseries.

- Criteria are the same as for quality score 1.

3.2.2.3 Quality score 3

A quality score of **3** will be applied to data for which any of the following items may apply:

- Lack of a project protocol/Standard operating procedure that describes how the data were collected/calculated.
- No point of contact of data.
- Feedback from the data provider on the uncertainty of the data (though this has yet to be defined).
- The method was deemed unfit by the stock assessors of WGEEL.

It is important that the metadata give a clear description of the data. These should include:

- Definition and description of content of datasets.
- Methods used (reference to …).
- Location.
- Ownership, point of contact of data.
- Data quality overview.

Sufficient self-explanatory information and documentation should accompany the data so that they are adequately qualified and can be used with confidence by scientists/engineers other than those responsible for its original collection, processing and quality control. For the escapement biomass, mortality biomass and mortality rates, there is an accompanying Overview sheet to support this quality assessment.

A brief description of the sample and data processing procedures must be included and should contain information regarding, but not limited to:

- Data robustness (noting this still to be defined).
- Data coverage with respect to the original scope.
- Report on corrections, editing or quality control procedures applied to the data.
- Estimate of final uncertainty in the data (noting this still to be defined).

3.3 Summary of Data call feedback and recommendations

Six of the 18 countries that responded to the Data call provided feedback in the Annex 5 Data call sheets. This feedback was collated and divided into three categories; (1) quick fix items to be fixed on the Data call sheets, (2) items for discussion and decision before fixing on the Data call sheets and on the data uploaded to the new database and (3) data aggregation problems:

1) Comments that can be fixed directly
   - 1.1) Error in database table (catch eel value says 11 or 12 which is aquaculture, should be 4 or 5)
   - 1.2) Ongrown eels (fix drop down for OG_ in stocking)
   - 1.3) Check coding is appropriate and clearly explained
   - 1.4) Sea area divisions for Mediterranean?
   - 1.5) SE has wrong EMU divisions
   - 1.6) FAO areas could include a description column not just code (could have a read me in ICES and FAO divisions and subdivisions?)

2) Comments needing discussion
   - 2.1) Confusion between FAO region ICES square and EMU
   - 2.2) Metadata (1 per country or per dataset)
   - 2.3) No option to combine life stages or subdivisions, habitat or EMU
   - 2.4) What to do with no data vs. zero data, all options, i.e. do you have to fill them all in
   - 2.5) When do you decide that changes applied require new time-series (e.g. change traps or number of traps)?
   - 2.6) Life stage in landings table = Y is defined as eels from 1–10 years, but in yellow fisheries that is not correct (should be all ages). Definition of Y in life stage table needs to be revisited
   - 2.7) How far back to report time-series
   - 2.8) two time-series on same thing, giving different results collected different ways…which one to use. Data quality issue?

3) Data aggregation problems
   - 3.1) Problem not being able to combine habitat types in landings

3.2) Need a category for national aggregate where we don't have EMU split.

The issues in category 1 were resolved by the stock assessor, while those in categories 2 and 3 were raised in plenary and were subsequently resolved in the database.

There was some discussion on the feedback mechanism used and whether or not it was considered useful or could have been improved. It was considered that the feedback process had worked sufficiently well, although the relatively low response rate was noted.

3.4 Recommendations from Data providers and WGEEL

3.4.1 Implemented for 2018

There is a need to formally record exactly what data have been submitted by each country to facilitate compliance cross checking. In this regard, the Data Call instructions should be amended to make it clear that ALL Annex sheets must be returned, with at least a zero, or missing data entry, even if a particular activity is not relevant in the country (for example, if all fisheries are closed, the landings Annex should be returned with a 0 kg entry; if the sheet is not returned it will be recorded as "missing data"). It was noted that when the Data call becomes an automated process, non-submission of sheets will then become a "No Show" or "missing Data" and can't be assumed to be a "zero" data entry.

The next Data call should include a checklist of all the Annex Sheets indicating whether a sheet has been completed, submitted or is not relevant. The Stock Coordinator should have a Master Data Call Returns Form on which are recorded these for official cross-checking.

The need to add a separate sheet to cover silver eel time-series was agreed and actioned. This sheet would need to include numbers and weight, habitat, stocking, sex ratio, etc. The aim would be to convert the data to produce a figure of kg/ha. This sheet should be similar to the recruitment sheet and may just need an explanatory sheet behind it.

Although ICES rectangles include land, WGEEL is choosing not to apply them to inland waters. Some EMUs/Countries span more than one ICES/FAO area and this was causing confusion in the Data call. ICES Rectangles only need to reported for coastal and marine waters.

3.4.2 Not implemented for 2018 because require further development

There was some discussion on whether it would be useful to request information on fishing effort. The view was expressed that fishing effort would require a clear definition and indication of the method used. There was no agreement on the units that would be most useful and it was agreed that more discussion was required. It was decided that as there was no way to standardise, it was too early to request information concerning cpue within the development of the ICES Data call 2018 and database, but that it would be useful to flag that it is intended to ask for this information at a later stage to prepare countries for this eventuality.

There is a need to review the current definition used in the life-stage table for yellow eels.

In terms of metadata, there should be one set of metadata per dataseries. A standard metadata form should be developed (there may be an existing ICES template that could be used or modified) which includes the Who, What, When, Where and How. The Why should be reserved for the comments column of the data sheet.

3.5 Coordination of Data calls with the GFCM and DCRF

The Data call was launched jointly by ICES and by GFCM, with the purpose of compiling data required for experts of the WGEEL to perform their annual stock assessment and provide advice on the state of the eel.

The GFCM has recently included European eel as one of the priority species within the mid-term strategy (2017–2020) towards the improvement of Mediterranean and Black Sea fisheries, and in 2016 has adopted a transitory recommendation requesting Contracting Parties Countries (CPCs) to compile information in support of the provision of advice for this species. However, during the transitory phase countries are still allowed to choose whether to collect information on eel or not, and therefore information on this species at Mediterranean scale is still fragmented. This situation will be addressed at the upcoming 41st session of the GFCM, where a consolidated recommendation calling for the collection of data in support of the provision of advice of priority species, including European eel is expected to be discussed. Once the consolidated recommendation is adopted, a dedicated format to submit information in support of the assessment of the status of this stock should be used.

Currently the only guidance on the minimal information on European eel fisheries within the GFCM is provided by the GFCM Data Collection Reference Framework (DCRF). These tables are expected to be filled by national administrations to provide information on the existing fisheries in their countries and does not necessarily cover the minimum requirements for the assessment of this stock.

Upon a specific request, DCRF Tables to compile information on European eel fisheries were shared by GFCM Secretariat also with the National Focal Points Mediterranean experts nominated for eel, participating to the WGEEL, for the sake of facilitating data compilation and supporting the technical work at the WGEEL during the week of the meeting. Therefore, National Focal Points proceeded to comply with the filling of the Tables, by using national data provided by their Administration, or on a personal initiative on the basis of data available to them within their personal work. Tables will be sent to GFCM as soon as possible, and shared with CPCs.

While performing the task of compiling tables and evaluating data quality, it was soon evident that the Tables provided by ICES and the one provided by GFCM for DCRF differed substantially in their structure (data variables, data fields, etc.). This issue was widely discussed within the GFCM subgroup. As a result of this discussion, it was suggested to provide GFCM with some suggestions for consolidating a format for the compilation of information in support of the assessment of eel, in line with the procedure commonly used for the assessment of other GFCM priority species. This implies the identification of a minimum set of data needed; to be collected through a dedicated Stock Assessment Form (SAF). It was agreed to standardize as much as possible the format for the joint annual data call from ICES and GFCM for the stock assessment of eel.

4 Updates to the scientific basis, including new and emerging threats and opportunities

4.1 Introduction

This chapter answers ToR 3 and Generic ToR g: *Report on updates to the scientific basis of the advice, including any new or emerging threats or opportunities; Identify research needs of relevance for the expert group.* The information is drawn from that provided in Country Reports plus that brought to the attention of WGEEL by all those attending the 2017 meeting.

4.2 Updates to the scientific basis of the advice

There were no updates this year. However, the WGEEL conducted an internal, independent audit of the input data and the recruitment series analyses. Minor improvements were made but these had no significant effect on the index time-series, as described in Chapter 2.

4.3 New and emerging threats or opportunities

4.3.1 Opportunities; management and knowledge

4.3.1.1 CITES investigations of the trade in eels

In accordance with the provisions of the Convention on International Trade in Endangered Species (CITES), legal trade in Appendix II listed species, such as eels, requires an export permit issued by the Management Authority of the State of export. Under Article IV of the Convention, an export permit shall only be granted where…."a Scientific Authority of the State of export has advised that such an export will not be detrimental to the survival of that species". This science-based advice is referred to as a Non-Detriment Finding (NDF). Guidance on the sort of information that should be taken into consideration by a Scientific Authority when carrying out such an assessment can be found in Resolution Conf. 16.7 (1) on Non-Detriment Findings.

Based on an analysis of the reported trade data between 2010 and 2015, Tunisia, Morocco and Algeria were selected for *Anguilla anguilla* for inclusion in Stage 2 of the Review of Significant Trade at the 29th meeting of the Animals Committee (AC29, Geneva, July 2017) (2). Their selection was due to ongoing concerns regarding the conservation status of the species, recorded total volumes of global trade, a sharp increase in the global trade, as well as sharp increases in trade from Tunisia and Morocco (3). These countries will now be asked to provide the scientific basis by which they established that exports of *A. anguilla* from the country are not detrimental to the survival of the species concerned, and are compliant with Article IV of the Convention. Their responses will be considered in conjunction with a consultant's report about the biology and management of, and trade in, *A. anguilla*, for which they will also be consulted, at the next meeting of the Animals Committee (AC30), scheduled to take place in July 2018. Failure to respond or to provide adequate information could lead to a country being retained within the review process and the Animals Committee may then make recommendations to the range State, which if not implemented could lead to action by the Standing Committee, including ultimately the possibility of a suspension of trade in *A. anguilla* from that country.

4.3.1.2 CITES Decisions on eels

At its 17th meeting (CoP17, Johannesburg, 2016), the CITES Conference of the Parties adopted a number of Decisions 17.186 to 17.189 on Eels (*Anguilla* spp.) (4), which direct the Secretariat, Animals Committee, Standing Committee, as well as eel range States and those involved in eel trade to undertake certain tasks. As part of these Decisions, consultants will be appointed by CITES to undertake two studies.

1) The first study will compile information on the implementation of the Appendix II listing of *Anguilla anguilla*, including the making of Non-Detriment Findings, its enforcement and eel identification challenges, as well as illegal trade.

2) The second study will document use, trade levels and trade patterns, biology and population status, as well as information gaps, concerning non-CITES listed *Anguilla* species.

There will be a call for information through a CITES notification issued before the end of the year and members of the WGEEL can contribute relevant information through their CITES authorities or directly to the CITES Secretariat.

A technical workshop is also provisionally planned for March or April 2018, to discuss the reports produced by the consultants and focus on priority themes and/or knowledge gaps that will be identified through the studies. In relation to European eel, the focus could be on NDF, as well as enforcement of the Appendix II listing, including identification challenges. In relation to the other eel species, the focus could be to enable a better understanding of the effects of international trade, including trade in their various life stages, and possible measures to ensure sustainable trade in such species. This workshop will invite cooperation with and participation by the relevant range States, trading countries, the Food and Agriculture Organization of the United Nations (FAO), the WGEEL, the IUCN Anguillid Eel Specialist Group, industry and other experts, as appropriate. Based on the results of these studies and the outcome of the technical workshop, the Animals Committee will provide recommendations to ensure the sustainable trade in *Anguilla* species, for consideration at the 18th meeting of the Conference of the Parties ahead of CoP18 (to be held in 2019).

4.3.1.3 Convention on Migratory Species CMS COP12, meeting

The Twelfth Meeting of the Conference of the Parties to the Convention on the Conservation of Migratory Species of Wild Animals (CMS COP12) will be held in Manila, from 23 to 28 October 2017. One of the proposals that will be considered at this meeting include a proposal for a concerted action for the European Eel (*Anguilla anguilla*) (5), which is already listed on Appendix II of the CMS Convention.

4.3.1.4 Improvements to catch reporting

A tele-declaration system is being developed and applied in the UK by the Sustainable eel Group (SEG) and the Environment Agency allowing fishermen, collectors and traders to electronically report their catches through either a web-based interface or a phone, via text messages. This procedure will be repeated throughout the supply chain, i.e. collectors, trader, end customers like supermarkets. The intention is to implement the system onto the main English glass eel fisheries; first as a pilot on the River Parett, followed by full implementation there, and then on to the River Severn.

4.3.1.5 Minimum size limits

Pohlmann *et al.* (2016) conducted a conceptual study on the efficiency of minimum size limits (MLS) in European eels and the effect of different fishing intensities for yellow and silver eels. The results indicate that MLS need to be accompanied by additional management measures, since the desired effects could be counteracted by an increase in fishing effort. In addition, the study highlighted the importance of regulating yellow eel fisheries, since yellow eels are exposed to fisheries for much longer time periods than silver eels. Accordingly, the impact of yellow eel fisheries on escapement could be considerably higher in the long term.

4.3.1.6 Quantifying silver eel escapement

Collecting information on silver eel escapement is vital for the management of the Portuguese fishery and the implementation of the Portuguese EMP. The following two projects were implemented: (1) 'Rehabilitation of diadromous fish habitats in the River Mondego' and (2) 'Sustainable Management of the Eel Fisheries in Santo André Lagoon'. The projects aimed to provide information on silver eels, a life stage that is poorly known in Portugal. In the past, yellow and silver eels were not regarded separately and the implementation of the EMP contains a fishing ban between October and December that reduces the possibility to obtain any information. Silver eels were tagged with acoustic transmitters in two aquatic systems (River Mondego and Santo André Lagoon) to study their migratory behaviour and the success in escapement to the sea (Domingos *et al.*, 2016; Marques, 2016). The escapement success was 40%, in the first case, and this information has been submitted for publication.

For estimating the stock densities of eel in shallow lakes in Estonia, an enclosure fykenet system described by Ubl and Dorow (2015) may be used. However, the methodology must be modified and ground-truthed to suit the characteristics (such as depth, substrate) of the waterbody. It also has to be kept in mind that based on the mesh size (10–11 mm), the system selects eels with total length over 36 cm. The method is being field tested in various habitats around Europe including in France, Estonia and Ireland.

4.3.1.7 Glass Eel Recruitment Estimation Model (GEREM)

Bornarel *et al.* (2017) adapted the Glass Eel Recruitment Estimation Model (GEREM) to estimate annual recruitment (i) at the river catchment level, a scale for which data are available, (ii) at an intermediate scale (6 European regions), and (iii) at a larger scale (Europe). The study provides an estimate of the glass eel biomass, using all recruitment time-series available at the European scale. GEREM estimated an overall recruitment of 10 825 t in 1960 compared with 440 t in 2015, the latter corresponding to only 6% of the 1960–1979 average. Results confirmed an overall recruitment decline to dramatically low levels in 2009 (3.5% of the 1960–1979 recruitment average) and highlighted a more pronounced decline in the North Sea area compared to the other regions in Europe.

4.3.1.8 Silver and yellow eel migrations

Piper *et al*. (2017) showed that downstream movements of migrating adult eels were not solely determined by the proportion of the river discharge when encountering multiple potential passage routes on the river Stour (England). The distribution was partially explained by avoiding areas of floating debris and mostly within 2–4 m from channel walls.

Factors regulating the silver eel migration from freshwater to the sea were examined in Burrishoole, Ireland (1971–2015), and Imsa, Norway (1975–2015) (Sandlund *et al*., 2017). The migration season (90% of the run) generally lasted from 1 August to 30 November. Environmental factors acting in the months before migration impacted timing and duration of migration, likely through influencing the internal processes preparing the fish for migration and were highly similar in both rivers. Once the migration had started, environmental factors impacted the day-to-day variation in number of migrants, apparently stimulating migration among those eels ready for migration. Variables explaining day-to-day variation, including the presence of eels migrating the previous day, were all associated with conditions that may minimize predation risk; number of migrants was reduced under a strong moon and short nights and increased during high and increasing water levels. The onset of migration was explained mainly by water levels in August. Thus, the overall migration season seems governed by the need to reach the spawning areas in a synchronized manner, while during the actual seaward migration, antipredator behaviour seems of overriding importance.

For the first time, a study shows that silver eels from Mediterranean Sea are capable to migrate towards and into the Atlantic Ocean and therefore contribute to the Atlantic spawning migration (Amilhat *et al*., 2016). These results confirm that Mediterranean countries have an important role to play in contributing to conservation efforts to restore the eel population (also considering that eels have usually shorter generation time in this region).

Verhelst *et al.* (2017) identified that studies about the resident yellow stage are relatively scarce. They determined that large female yellow eels were most active at night in late summer and early autumn. A generalised linear mixed model showed that their movement is only slightly influenced by environmental variables. Moreover, as yellow eels show high-site fidelity (i.e. the majority was detected only in the habitat type of their catch-release location), they do not encounter many human-induced connectivity problems in these polder systems, which makes these systems highly suitable as eel growth habitat. These results can contribute to an effective eel management regarding habitat protection and restoration.

4.3.1.9 Larval feeding

Due to largely unknown spawning locations and habitats of their earliest life stages, as well as their transparency, these *Anguilla* leptocephali larvae are rarely observed in the wild. Therefore, information regarding the early life history of these larvae, including their exogenous feeding strategy and feeding performance, is rather scarce. To better understand the structural basis and functional performance of larval feeding in captivity, the functional morphology of the cranial musculoskeletal system in pre- and first-feeding engyodontic leptocephali of the European eel (*Anguilla anguilla*) was studied. Bouillard *et al.* (in press) hypothesize that leptocephalus larvae are functionally constrained to feed only on soft food particles. Additionally, potential prey items are size delimited, based on the theoretically estimated average gape of these larvae of about 100 μm. This hypothesis appears to be in line with recent observations of a diet consisting of particulate organic matter (POM) or marine snow, which at least partly contains contents of gelantinous zooplankton (Hydrozoa, Thaliacea, Ctenophora, Polycystenia).

4.3.1.10 Stocking

Pedersen *et al.* (2017) compared the survival and growth of wild eels (2–5 g) with that of "farmed" eels (3–6 g) in a series of shallow open ponds, to evaluate the efficiency of

eel stocking. After five and 12 months survival was high (34–88%) with no significant difference in survival between wild and farmed eel. Growth rates were significantly higher for farmed eels compared to wild eels in both experiments and the results showed that farmed eels performed better than wild eels.

4.3.2 Emerging threats

4.3.2.1 New Information on illegal trade in eels

Illegal exports in European eels to Asia remain a threat to European eel conservation efforts (Stein *et al*., 2016). In 2015, the European Police Office (Europol) initiated Operation LAKE in collaboration with several law enforcement agencies from France, Greece, Italy, Portugal, Spain, the UK, as well as EuroJust. The activities carried out during the 2016 to 2017 fishing season have led to the arrest of 48 people and the seizure of 4 tonnes of glass eels, valued at approximately EUR 4 million. Investigations proved that more than 10 tonnes of glass eels had been smuggled from the EU to China, with an estimated value of EUR 10 million (6). More detailed information on seizures of European eel between 2013 and 2017 has been collated by the European Union and highlights the scale of the problems, as well as the complex and shifting trade routes and modes of shipment (7).

The application of genetic species identification in relation to illegal traded eels (Stein *et al*., 2016) is limited since it can be claimed that seized eels originated from North African countries that are not affected by the European trade ban, but a new study conducted by SEG will evaluate if future spatial differentiation of eels' provenance can be achieved by stable isotope analyses (otoliths and muscle tissue) and fatty acid profiles.

4.3.2.2 Contaminants, diseases and parasites

In the Schlei Fjord in northern Germany eels were recently tested positive for anguillid herpesvirus 1 (AngHV 1). The fjord is the recipient water of a comprehensive European eel stocking programme, and it was concluded that the results of the study evidently show the urgent need for a disease contaminant strategy for eel stocking programmes (Kullmann *et al*., 2016).

A batch of 965 kg glass eels imported from France (S Bay of Biscay) to Sweden in spring 2017 for stocking purposes suffered from raised mortalities during the quarantine phase. An investigation revealed that the eels were infected with European Eel Virus X (EVEX). Therefore, they were all killed and destroyed (Swedish Country Report 2017 in Annex 6 and Wickström pers. comm.)

The Research Institute for Nature and Forest (INBO) in Belgium issued an advice on contaminants in freshwater fish (including European eel) and the potential risks for human health by consuming these fish (Belpaire *et al*., 2017), stating that the levels of pollutants in freshwater fish, and specifically in eels, at many locations in Flanders are worryingly high. There are indications that exposure to toxic substances affect the health of both fish populations and recreational fishing communities and therefore pose a risk to public health. Recent experimental field research in the Netherlands showed that serum levels of persistent organic pollutants in anglers fishing eels from polluted areas, have been greatly increased. According to a recent survey, in 2015 recreational fishers harvested about 30 tons of eel from the Flemish public waters for consumption, despite repeated recommendations not to eat eels.

Freese *et al.* (2016) revealed habitat-dependent and eel stage-related accumulation of targeted PCBs in European eel sampled in German waters. Migrant silver eels were found to be the most suitable life-history stage to represent their particular water system, presumably due to habitat dwell-time and their terminal contamination status.

Sühring *et al.* (2016) and Freese *et al.* (2017) provided analytical proof of maternal transfer of substituted diphenylamines and dioxine-like compounds (DLCs) in the European eel, respectively. Due to the strict, lipid-driven toxicokinetics and the resulting equilibrium between lipid-associated POPs in adipose tissue, it becomes possible to make predictions for expected egg concentrations, based on muscle concentrations in eels (Brinkmann *et al.* (2015); Freese *et al.* (2017)). In their work on the maternal transfer of DLCs in European eels, Freese *et al.* (2017) extrapolated DLC- transfer rates from analytically derived muscle and egg TEQ-concentrations and used them to make a superficial risk assessment for wild eel populations. As a result, the authors concluded that most of the DLC-toxicity measured in muscle of silver eels from five German river basins would lead to egg concentrations exceeding the critical thresholds for TEQ-induced teratogenic effects in eels.

Schneebauer *et al.* (2016) investigated the effects of *Anguillicola crassus* on the physiology of swimbladder tissue of the European eel. The authors conclude that the nematode not only impairs swimming capacity of the eel as shown by Palstra *et al.* (2007), but also the reactive oxygen species (ROS) defence in the swimbladder, which is essential to avoid the damaging effect of ROS during spawning migration. The data, therefore, provide additional support for the notion that the nematode infection represents a serious threat for a successful spawning migration.

4.3.2.3 Research needs

The research needs for European eel were discussed thoroughly in the WGEEL 2015 (ICES, 2015) and 2016 (ICES, 2016) reports and remain the same for 2017.

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Annex 2: Acronyms and Glossary

ACRONYMS	DEFINITION
ACFM (ICES)	Advisory Committee on Fisheries Management
ACOM (ICES)	Advisory Committee on Management
ADGEEL	Advice drafting group on eel, for ICES
AngHV-1	Anguillid herpes virus 1
BERT	Bayesian Eel Recruitment Trend model
CAGEAN	The Catch-at-Age Analysis Model
CITES	Convention on International Trade in Endangered Species
CMS	Convention on Migratory Species
Cpue	Catch per unit of effort
C&R	Catch and release mortality
DD	Density-dependent
DCF	Data Collection Framework
DEMCAM	Demographic Camargue Model
DG MARE	Directorate-General for Maritime Affairs and Fisheries, EU
DNA	Deoxyribonucleic acid
DPMA	Direction des Pêches Maritimes et de l'Aquaculture, France
e-DNA	Environmental DNA
EC	European Commission
EDA	Eel Density Analysis (modelling tool)
EIFAAC	European Inland Fisheries & Aquaculture Advisory Commission
EIFAC	European Inland Fisheries Advisory Commission
EMP	Eel Management 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 Union Multi Annual Plan
EVEX	Eel Virus European X
FAO	Food and Agriculture Organisation
FEAP	The Federation of European Aquaculture Producers
GEM	German Eel Model
GFCM	General Fisheries Commission of the Mediterranean
GIS	Geographic Information Systems
GLM	Generalised Linear Model
HPS	Hydropower Station
ICES	International Council for the Exploration of the Sea
IMESE	Irish model for estimating silver eel escapement
IUCN	The International Union for the Conservation of Nature
GST	Glutathione-S-transferase
LAM	Lifetime anthropogenic mortalities
MS	Member State

ACRONYMS	DEFINITION
MSY	Maximum Sustainable Yield
MoU	Memorandum of Understanding
NAO	North Atlantic Oscillation
NC	"Not Collected", activity / habitat exists but data are not collected by authorities (for example where a fishery exists but the catch data are not collected at the relevant level or at all).
NDF	Non-Detriment Finding
NP	"Not Pertinent", where the question asked does not apply to the individual case (for example where catch data are absent as there is no fishery or where a habitat type does not exist in an EMU).
ONEMA	Office National de l'Eau et des Milieux Aquatiques, France (ex-CSP)
PAH	Polyaromatic hydrocarbons
PBDE	Polybrominated diphenyl ether
PCB	Polychlorinated biphenyl
PFOS	Perfluorooctane sulfonate
POSE	Pilot projects to estimate potential and actual escapement of silver eel
RBD	River Basin District
RGEEL	Review Group on Eel (ICES)
SAC	The GFCM Scientific and Advisory Committee on Fisheries
SCICOM	The Science Committee of ICES
SGIPEE	Study Group on International Post-Evaluation on Eels
SLIME	Restoration the European Eel population; pilot studies for a scientific framework in support of sustainable management
SMEP II	Scenario-based Model for Eel Populations, vII
SPR	Estimate of spawner production per recruiting individual.
SRG	Scientific Review Group
SSB	Spawning–Stock Biomass
ToR	Terms of Reference
WG	Working Group
WGEEL	Joint EIFAAC/ICES/GFCM Working Group on Eel
WGRFS	The Working Group on Recreational Fisheries Surveys
WKAREA	Workshop on Age Reading of European and American Eel
WKBECEEL	Working Group on Biological Effects of Contaminants in Eel
WKEPEMP	The Workshop on Evaluating Progress with Eel Management Plans
WKESDCF	Workshop on Eels and Salmon in the Data Collection Framework
WKPGMEQ	The Workshop of a Planning Group on the Monitoring of Eel Quality
WFD	Water Framework Directive
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"
WGRFS	Working Group on Recreational Fisheries Surveys
YFS1	Young Fish Survey: North Sea Survey location
IYFS	International Young Fish Survey

Glossary

Bootlace	Intermediate sized eels, approx. 10–25 cm in length (fingerlings). These terms are most often used in relation to stocking. The exact size of the eels may vary considerably. Thus, it is a confusing term.
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 Management Unit (Eel River Basin)	"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 (silver eel)	The amount of silver eel that leaves (escapes) a water body, after taking account of all natural and anthropogenic losses.
Glass eel	Young, unpigmented eel, recruiting from the sea into continental waters. WGEEL consider the glass eel term to include all recruits of the 0+ cohort age. In some cases, however, also includes the early pigmented stages.
Non-detriment finding (NDF)	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 stocked.
Silver eel production	The amount of silver eel produced from a water body. Sometimes referred to as escapement + anthropogenic losses, or production-anthropogenic losses = escapement.
River Basin District	The area of land and sea, made up of one or more neighbouring river basins together with their associated surface and groundwaters, transitional and coastal waters, which is identified under Article 3(1) of the Water Framework Directive as the main unit for management of river basins. The term is used in relation to the EU Water Framework Directive.
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.
Stocking (restocking)	Stocking (formerly called restocking) is the practice of adding fish [eels] to a waterbody from another source, to supplement existing populations or to create a population where none exists.
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).

Yellow eel (Brown eel)	Life-stage resident in continental waters. Often defined as a sedentary phase, but migration within and between rivers, and to and from coastal waters occurs and therefore includes young pigmented eels ('elvers' and bootlace). Sometimes yellow eel is also called 'brown eel'.

EEL REFERENCE POINTS/POPULATION DYNAMICS	
$B_{current}$ or B_{curr} (Current escapement biomass)	The amount of silver eel biomass that currently escapes to the sea to spawn, corresponding to the assessment year.
B_{best} (Best achievable biomass)	Spawning biomass corresponding to recent natural recruitment that would have survived if there was only natural mortality and no stocking, corresponding to the assessment year.
B_0 (Pristine biomass)	Spawner escapement biomass in absence of any anthropogenic impacts.
B_{lim} (Limit spawner escapement biomass)	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 Maximum Sustainable Yield (MSY)
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.
F	Fishing mortality rate
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_{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.
M	Natural mortality
MSY	Maximum Sustainable Yield
MSY $B_{trigger}$	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.
Precautionary spawner escapement biomass (B_{pa})	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.
Pristine	Conditions not affected by humans
R(s)	The amount of eel (<20 cm) restocked into national waters annually
R^2	Determination coefficient
Spawner per recruitment (SPR)	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.

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

EEL REFERENCE POINTS/POPULATION DYNAMICS	
ΣA	The sum of anthropogenic mortalities, i.e. ΣA = ΣF + ΣH. It refers to mortalities summed over the age groups in the stock.
three Bs & ΣA	Refers to the three biomass indicators (B_0, B_{best} and $B_{current}$) and anthropogenic mortality rate (ΣA).

Definition: 40% EU Target: "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 3: Participants

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Annex 4: Meeting agenda

Tuesday 3rd

14:00–14:30 Welcome, Intro to Working Group, ToR, adopting the agenda.

14:30–15:30 Introduce tasks with short discussion, presentations on

WKEELDATA:

Task 1 (data): Alan overview, Cedric-Recruitment, Cedric-Task1,

Task 2 (data call): Alan overview, Cedric-Task2

16:00: assign people to Tasks 1 or 2

15:30–17:00 Breakout for tasks to plan work

17:00–18:00 Plenary to outline task plans

18:00 Schedule the CR presentations

Wednesday 4th

09:00–10:00 Presentations of five Country Reports (STRICT maximum ten minutes per country)

10:00–16:00 All Task Groups breakout

Lunch 13:00

16:00–18:00 Plenary to review progress and urgent actions

Thursday 5th

09:00–10:00 Presentations of six Country Reports (maximum ten minutes per country)

10:00–13:00 All Task Groups breakout

13:00–18:00 Trip to see lagoon fisheries

Friday 6th

09:00–10:00 Presentations of five Country Reports (maximum ten minutes per country)

10:00–17:00 All Task Groups breakout

17:00–18:00 Plenary to review progress and urgent actions (not required)

Saturday 7th

09:00–18:00 All Task Groups breakout

18:00 Report drafts submitted for collation

Sunday 8th

(working in hotels)

09:00–18:00 Reading the report

Monday 9th

09:00–18:00 Discussing the report, identifying changes, making changes

Tuesday 10th

09:00–13:00	Agreeing the changes, Finalising the report
13:00	Close Working Group

Annex 5: Country Reports 2016–2017: 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 2017 meeting of the Working Group on Eels:

- Belgium
- Denmark
- Estonia
- Finland
- Germany
- Greece
- Ireland
- Italy
- Latvia
- Lithuania
- Netherlands
- Norway
- Poland
- Portugal
- Spain
- Sweden
- Tunisia
- Turkey
- 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 2016/2017

Annex 6: Data Call 2017 covering letter

DCF national correspondents
Els Torreele, Simona Vasileva Nicheva, Ivana Vukov, Jørgen Dalskov, Elo Rasmann, Heikki Lehtinen, Maximilien Simon, Christoph Stransky, Apostolos Karagiannakos, Leonie O'Dowd, Evelina Carmen Sabatella; Didzis Ustups, Jolita Nečiūnienė, Inge Janssen, Zbigniew Karnicki, Emilia Batista, Jernej Švab, Maria del Pilar Vara del Rio, Anna Hasslow, Mathew Elliott, Marc Kreis, Vladimír Gall.
ICES ACOM members and observers
Els Torreele, Morten Vinther, Robert Aps, Matti Salminen, Alain Biseau, Christopher Zimmermann, Gudmundur Thordarson, Maurice Clark, Didzis Ustups, Tomas Zolubas, Nathalie Steins, Jan Horbowy, Fatima Borges, Francisco Velasco, Max Cardinale, Harald Gjøsæter, Yuri Efimov, Nick Bailey, Petur Steingrund, Jesper Boje

Our Ref: L.27/ACB/DM 16 August 2017

Subject: Joint ICES, EIFAAC and GFCM Data call: Data submission for advice for European eel under WGEEL – Part 1: 2017

Dear Reader,

Please find enclosed a document describing the rationale, scope and technical details of the data call for the 2017 work of the Joint EIFAAC/ICES/GFCM Working Group on Eel (WGEEL). Also, enclosed are five annexes with additional information and feedback provision.

The data will be used by WGEEL to conduct an assessment of the eel stock and factors affecting the stock.

For countries which are also EU members this data call is under the Council Regulation (EC) No 2017/1004. The deadline for this data call is 18 September 2017.

For questions about the content of the data call, please contact: advice@ices.dk. For questions on data submission, please contact: accessions@ices.dk.

Sincerely,

Anne Christine Brusendorff

Anne Christine Brusendorff
General Secretary

CC: Alan Walker (WGEEL co-chair), Cédric Briand (WGEEL Stock Assessor); Nathalie Florin (DG-Mare), Patrick Daniel (DG-Mare), Venetia Kostopoulou (DG-Mare, DCF); Bas Drukker (DG-Mare, DCF)

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Annex 7: Data Call 2018 covering letter (DRAFT)

1. Rationale

This Data call is intended to formalize data reporting across all countries with natural production of European eel. Therefore, this is a joint call from ICES and EIFAAC, facilitated by ICES. An associated Data call from GFCM will be distributed to its membership through a dedicated Stock Assessment Form (SAF).

Much of the historic eel data are available to WGEEL already, but often in multiple versions, some with subtle differences and with limited information from which to identify the most up-to-date version. Furthermore, the descriptions of methods used to collect and process the data are often held separately in some Country Reports, and without the contact details of data stewards. These associated 'metadata' should be held alongside the 'eel data'.

Recognizing that the collection and provision of all eel and metadata is a huge task, the Data call has been split over two years (2017 and 2018), giving time to clarify the process for those providing the data and for the WGEEL and ICES to organize the data in the most efficient manner. In 2017, the Data call focused on data directly required to achieve the annual stock assessment in support of the ICES Advice published in 2017.

The Data call 2018 includes the request for the data on silver eel stock indicators, biomass production and escapement and anthropogenic mortality rates, etc., as specified by the Eel Regulation 1100/2007 and EMPs.

Output

The data and metadata provided for the Data call 2018 will be used as the basis for the annual stock assessment in support of the advice for the eel stock. Ultimately, the output from these Data calls will be an electronic database for European Eel stock, held in a single repository and complying with data quality standards. This database will be used as a basis for timely and efficient drafting of stock status reports for ICES, the European Commission including fisheries and trade matters, and the provision of regional and whole stock advice across the natural range of the European eel.

Legal framework

The legal framework for the Data call is as follows, though noting that these don't all apply to every eel producing country:

- Council Regulation (EC) No 2017/1004 concerning the establishment of a Union framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy.
- Council Regulation (EU) No 1380/2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and E(EC) No 639/2004 and Council Decision 2004/585/EC.
- REC.DIR-GFCM/40/2016/2 on the progressive implementation of data submission in line with the GFCM Data Collection Reference Framework (DCRF).
- Council Regulation (EC) No 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European eel.

2. Scope of the Data call

This Data call is addressed to those countries within the geographic range of the European eel, though a separate Data call will be made to GFCM countries. These countries are distributed across different global and regional management organisations such as those represented in WGEEL (EIFAAC, ICES, GFCM).

Table 1. List of species.

Common name	Code	Scientific name
European eel	EEL	*Anguilla anguilla*

In this 2018 Data call we ask for submission of all available 'eel data', including historical data and previously submitted data for European eel on:

- Silver eel production (biomass)
- Anthropogenic mortality (impacts: silver eel equivalent biomass, and lifetime mortality rates)
- Potential wetted area habitat
- Silver eel time-series

In addition to the annual update on:

- Recruitment
- Landings
- Stocking
- Aquaculture production

Alongside each of these eel data, we request the following 'metadata':

- Data Steward: name and e-mail address of a person who can be contacted about the dataset.
- Method used: short description of the method used to collect the data.

These metadata are further described in the data input sheets of Annexes 1 to 10. The call also includes Annex 0 where you should record any suggestions for how this data call process might be improved in future. Annex 5 requests additional information pertaining to the Stock Indicators (Annexes 6–9). Annex 5 should have a separate sheet filled out for each reported Eel Management Unit, or area assessed.

3. Deadlines

ICES requests the data to be delivered to provide enough time for additional quality assurance prior to the WGEEL meeting. Therefore, data should be submitted by e-mail to the WGEEL stock coordinator (to be appointed) by 6th August, 2018. This deadline is set according to the ICES standards. Missing the reporting deadline will compromise the indispensable data quality checking (on a stock basis) before the use of that data to update assessments.

4. Data submission

The data should be submitted using the templates supplied in Annexes 0–10 to this Data call, along with an accompanying checklist confirming that all sheets have been completed. Suggestions for improvements to the process should be recorded in Annex 0. A detailed list of data formats, instructions and codes (e.g. treatment of nil values) to be used in the database can be found in Annexes 1–10. Note that once the database is developed, we would hope to make the data reporting process more efficient using an online system. This will come in future years.

5. Feedback on the process (Annex 0)

- List any comments here, especially any requiring attention for clarification or improvement in future Data calls.

6. Recruitment (Annex 1)

- Recruitment data are defined as the quantities of eel caught at specific (index) locations as they 'recruit' to the local vicinity. These captures can be either by fisheries or fishery-independent studies, which include handnets, fykenets or trapping ladders.
- The WGEEL uses these time-series data to calculate the Recruitment Indices, relative to the reference period of 1960–1979, and the results form the basis of the annual Single-stock Advice reported to the EU Commission. These recruitment indices are also used by the EU CITES Scientific Review Group in their annual review of the Non-Detriment Finding position.
- Data should be provided as annual total values.
- The units of data are either numbers or weight (kg) of eel, or indices.
- Those recruitment dataseries used in the Recruitment Indices are described in detail in the ICES European eel Stock Annex: (http://ices.dk/sites/pub/Publication%20Reports/Stock%20Annexes/2015/Anguilla_anguilla_S A.pdf). However, the Data call also seeks new dataseries not listed in the Stock Annex.
- The recruitment series are categorized as glass eel, young eel, and larger yellow eel recruiting to continental habitats. The glass eel recruitment series are either comprised only of glass eel (i.e. zero age cohort) or a mixture of glass and young yellow eel. The young or larger yellow eel may consist of multiple year classes of eel but they are all 'recruiting' to the stock past the survey point in the same year.

7. Landings (Annex 2)

- Landings are defined as the quantity of eel that are retained after capture (defined by the FAO as the Retained Catch), or to put it another way, removed from the water basin or management unit. So, Landings should not include any eels subject to assisted migration within the same river basin, or scientific studies where they are returned alive to the waters where they were caught.
- The WGEEL uses these data to report trends in landings in the ICES Single-stock Advice. This information is requested by the Administrative Agreement between ICES and the EU Commission.

- Data should be provided as annual total values, according to life stage (glass, yellow, silver) and fishing activity type (commercial or recreational).
- The units of data are kg.
- The Stock Annex notes that there is a great heterogeneity among time-series of landings (also catches) because of inconsistencies in reporting by, and between, countries, as well as incomplete reporting of non-commercial and recreational fisheries.

8. Stocking (Annex 3)

- Stocking data are defined as the quantity of eel that are released alive into waters of a basin or management unit other than the basin/management unit where they were caught (i.e. NOT including assisted upstream migration).
- The WGEEL uses these data to check against eel production estimates and anthropogenic mortality rates reported by countries.
- Data must be provided in annual totals both in weight (kg) and numbers, per eel management unit. If you do not have either one of the two values, calculate an estimate based on an average eel weight.
- The units of data are numbers and kg of eel when they are stocked.
- Note that a potential consequence of stocking could be that estimates of silver eel production for the stocked basin could be higher than those of historic production.

9. Aquaculture production (Annex 4)

- Aquaculture production data are defined as the quantity of eel produced on an annual basis from aquaculture facilities.
- The WGEEL uses these data in addressing its remit to report annually on the state of the stock, associated fisheries and other anthropogenic impacts.
- Data should be provided as annual total weights per country.
- The units of data are kg.
- Some aquaculture production data have previously been included in official landings statistics but this must be avoided.
- Some eels are grown in aquaculture for periods of time and then released alive to waters not necessarily those from where they were caught. This can be done for a variety of reasons. Such eels should be registered as stocked and not as aquaculture production.

10. Overview of Stock Indicators (Annex 5)

The WGEEL require this sheet describing the methods used for assessing the biomass and anthropogenic mortalities in each EMU. The sheet should also indicate any changes made to the data, or the assessments, over the time period and whether stocking has been taken into account in the derivation of the stock indicators. The overview also supports the initial quality review of the data supplied.

11. Biomass indicators (Annex 6)

- B_0 The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the stock;

- $B_{current}$ The amount of silver eel biomass that currently escapes to the sea to spawn;
- B_{best} The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the current stock, included re-stocking practices, hence only natural mortality operating on stock.

12. Mortality as Silver Eel Equivalents Biomass (Annex 7)

Biomass all measured in kg.

- SEE_com Commercial fishery silver eel equivalents.
- SEE rec Recreational fishery silver eel equivalents.
- SEE_hydro Silver eel equivalents relating to hydropower and water intakes, etc.
- SEE_habitat Silver eel equivalents relating to anthropogenic influences on habitat (quantity/quality).
- SEE_stocking Silver eel equivalents relating to stocking activity.
- SEE_other Silver eel equivalents from `other` sources.

13. Anthropogenic mortality Sigma (Annex 8)

- 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; sum of ∑F, ∑Hydro, ∑Restock, ∑Habitat, ∑Other;
- ΣA The sum of anthropogenic mortalities, i.e. ΣA = ΣF + ΣH. It refers to mortalities summed over the age groups in the stock.

14. Habitat Wetted Area (Annex 9)

- The Habitat_Wetted_Area is used for indicating the potential available area used as a habitat for the eels.
- It is used to provide data on the available areas of all possible habitat types, such as Freshwater (F), Marine open sea (MO), WFD Transitional (T), WFD Coastal (C) and an aggregate of all the above).
- This value is important for the calculation of the biomass indicators.
- The unit of area should be the hectare (ha).

15. Silver Eel Time-series (Annex 10)

This will be used for examining trends over time, and cross-calibration/validation of aggregated data.

- Number of emigrating eels;
- Total weight;
- Mean weight;
- Sex ratio;
- And associated upstream mortalities, (landings, stocking, etc.).

16. Contacts

The national response to the Data call should be sent to:

- Anon Anon. WGEEL Stock Coordinator. E-mail: to@be.completed

For support concerning issues about the data call please contact:

- Cédric Briand. WGEEL Stock Assessor. E-mail: Cedric.Briand@eptb-vilaine.fr

For support concerning other data issues, please contact:

- Alan Walker, chair of WGEEL. E-mail: Alan.walker@cefas.co.uk

For questions about the content of the data call, please contact: advice@ices.dk

For questions on data submission, please contact: accessions@ices.dk

Annex 8: Stock Annex for the European Eel

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 2016	*Anguilla anguilla*