WORKSHOP FOR THE TECHNICAL EVALUATION OF EU MEMBER STATES' EEL REGULATION PROGRESS REPORTS FOR SUBMISSION IN 2024/2025 (WKEMP4)

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

H.C. Andersens Boulevard 44-46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

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Editors

Alain Biseau • Alan Walker

Authors

Alain Biseau • Alan Walker • Ana Gavrilovic • Caroline Durif • Cedric Briand • Ciara O'Leary • Eirik Ryvoll Åsheim • Estibaliz Diaz • Hilaire Drouineau • Jan-Dag Pohlmann • Jani Helminen • Katarzyna Janiak • Marieke Desender • Niki Sporrong • Rob van Gemert • Sami Vesala • Sukran Yalcin Ozdilek • Tessa van der Hammen

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i Executive summary

The fourth Workshop for the Technical Evaluation of EU Member States' Eel Regulation Progress Reports (WKEMP4) prepared and reviewed scientific analyses to provide material to answer a special request from the European Commission. The report reviews, compiles, and analyses data and information received by ICES. In most instances, data gaps and inconsistencies curtailed evaluation of the effectiveness of Eel Management Plans (EMPs), management measures, and monitoring programs.

Employing best available data and analyses in assessing EMP trends, WKEMP4 concludes that in most EMPs escapement and mortality are still far from the explicit or implicit regulation targets. In addition, there is no evidence that escapement is increasing, as combined trends submitted by countries show a slight decreasing trend, and anthropogenic mortality remains generally high having decreased only in a limited number of EMPs.

Biomass indicators, as reported by the Member States, suggest that the management target of 40% of pristine silver eel escapement ($B_{current}/B_0 \geq 0.4$) has been achieved in 12 of 55 reporting EMPs, which is less than in the initial year of reporting (16). Relative trends suggest that escapement is lower today as compared to the initial year of reporting in 39 of the reporting EMPs escapements, 30 displaying a significant downwards trend. The biomass target implies a lifetime anthropogenic mortality of $\Sigma A = 0.92$.

Mortality indicators, as reported by the Member states show that in 34 of 55 reporting EMPs ΣA is lower than the implicit mortality target (0.92) compared to 23 that were below in the initial year of reporting. In 30 EMPs, mortalities are lower currently as compared to the initial reporting (14 with a significant decreasing trend), whereas an increase was reported for 19 EMPs (11 with a significant increasing trend).

Progress on implementing management measure is continuing for commercial and recreational fisheries, and trade; hydropower, pumping stations and obstacles; restocking; habitat improvement; governance; and scientific monitoring. A total of 467 measures (75% of the total) were deemed fully or partially implemented. The variation and gaps in the data submitted made it extremely challenging to determine the effectiveness of reported (types of) measures in the context of associated threats. In many instances, measures were not designed to be evaluated directly by biomass and mortality indicators. Ultimately, local expertise and adaptive monitoring and assessment plans of each EMP are needed to evaluate measure effectiveness.

Biomass and mortality indicators were not reported by all countries and those which reported had inconsistencies, mostly about whether and how restocking was included in the estimation of indicators, how pristine recruitment was estimated, and what estimation methods were used. This makes it difficult to reach conclusions for the whole stock. In addition, management targets are not consistently calculated which further impairs comparison between EMPs and evaluation of the status of the whole stock.

An analysis of the methods used to build the biomass and anthropogenic mortality indicators led to grouping the methods by type and evaluated possible threats and biases associated with each group. In the short term, using common methods to estimate anthropogenic mortalities should be possible and these should be applied for the next evaluation of the EU Member States progress report under the Eel Regulation in 2027. In the long-term, biomass, including pristine

biomass, should be estimated using common methods and approaches, to make the comparison between countries possible.

Management measures influence mortality directly, whereas the possibility to influence biomass for a single EMU are limited and strongly depend on recruitment which, in turn, depend on the progress made in all countries in the eel range. Mortality targets should be explicitly agreed in addition to the biomass escapement target and focus on the management should be on mortality targets.

ii Expert group information

Expert group name	Workshop for the Technical Evaluation of EU Member States' Eel Regulation Progress Reports 2024/2025 (WKEMP4)
Expert group cycle	Annual
Year cycle started	2024
Reporting year in cycle	1/1
Chair(s)	Alain Biseau (France)
	Alan Walker (UK)
Meeting venue(s) and dates	04-08 November 2024, online (17 participants)
	10-14 February 2025, online (18 participants)

1 Introduction

The European eel (*Anguilla anguilla*) is a catadromous fish, migrating long distances between its offshore spawning area and coastal or inland growth habitats. Larvae drift with oceanic currents until they reach the continental shelf where they metamorphose into glass eels. These become pigmented (elvers) and colonize brackish or freshwater systems in coastal areas and inland waters. After their growth period, as yellow eels, they prepare for reproduction and become silver eels which will sexually mature during the transatlantic migration. All European eels spawn in the Sargasso Sea and as yellow eels are distributed across most coastal countries in Europe and North Africa, with the southern limit in Morocco (30°N), the northern limit situated in the Barents Sea (72°N) and spanning the entire Mediterranean Basin.

The Joint EIFAAC/ICES/GFCM Working Group on Eels (WGEEL), assesses the European eel (*Anguilla anguilla*) throughout its natural range. As a results, ICES has advised to reduce all the anthropogenic mortality as close to zero for more than 20 years. Since 2022, it has advised to apply the precautionary approach corresponding to zero catch in all habitats.

The European eel was listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2007. The International Union for the Conservation of Nature (IUCN) listed the European eels as Critically Endangered in 2008 (IUCN, 2024). It was reassessed in both 2013 and 2018, and the status remains unchanged. The European eel is also included in the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and the OSPAR List of threatened and/or declining species and habitats. The Baltic Sea Action Plan (BSAP) of the Baltic Marine Environment Protection Commission (HELCOM) contains several targets for the European eel (HELCOM, 2021). Additional details can be found in the latest WGEEL report (ICES 2024).

A management framework for eel within the European Union (EU) was established in 2007 by Regulation (EU) No. 1100/2007 (EU, 2007; also referred to as the Eel Regulation). The objective of the Eel Regulation is the protection, recovery, and sustainable use of the stock. To achieve that objective, EU Member States (MS) have developed Eel Management Plans (EMP) for their river basin districts (RBD). These are designed to reduce anthropogenic mortalities, permitting with high probability the escapement to the sea of at least 40% of the silver eel biomass relative to the best estimate of escapement (B_0) that would have existed if no anthropogenic influences had impacted the stock (hereafter referred to as the pristine state).

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

Given that the EC request to ICES specifically referenced the EMPs of EU Member States, and the term EMUs can include non-EU areas, in this report we use the EMP acronym when referring to both the plans and their associated areas, targets, data and other information reported.

Data collection varies considerably between, and sometimes within, countries, depending on management actions taken, anthropogenic impact, and type of assessment procedure. Accordingly, a range of methods may be employed to establish silver eel escapement limits (e.g. the Eel Regulation's ≥ 40% of B_0), management targets for individual rivers, river basins, RBDs, EMPs and nations, and for assessing compliance of current escapement with these limits/targets (e.g. for the Eel Regulation comparing $B_{current}$). These methods require various combinations of data on e.g. landings, recruitment length/age structure, restocking, abundance (as biomass and/or density) or maturity ogives, in order to estimate silver eel biomass, fishing and other anthropogenic mortality rates. A description of data collection and methods used to establish silver eel escapement and mortality is further detailed in the report on the "technical evaluation of EU Member States' progress reports for submission in 2021" (WKEMP 3; ICES, 2022).

The European Commission requested ICES to advise, on the basis of the 2024 Member States progress reports as required under the Eel Regulation and any other available information:

I. In regard of the escapement target and the measures to attain this target as part of the EMP, including the transboundary EMP (Articles 2, 6, 9(1) and 9(1)(a) of the Eel Regulation):

1) The extent to which the 40% escapement target has been reached for each Member State river basin covered by each management plan.
Where possible, ICES should quantify the realised escapement level.

2) Where quantification is not possible, ICES is requested to advise based on alternative methods deemed suitable by ICES, whether the eel escapement levels in paragraph 1 are thought to be:

a. Likely to be at or above the target (40% or above)
b. Below, but close to the target (likely to be in the range 30% to 40%)
c. Well below the target (likely to be of the order of 20%)
d. Very low (likely to be of the order of 10%)
e. Negligible (little prospect of escapement being much above zero).

3) For each type of measures implemented by Member States, ICES is requested to quantify their effect in the river basin(s), covered by each management plan where feasible or at other appropriate geographical scale.

4) Where quantification is not possible, ICES is requested to advise based on alternative methods, deemed suitable by ICES, whether the effect of each type of measure implemented (or proposed to be implemented) is:

a. An appropriate and effective measure, sufficiently deployed in order to achieve the target
b. An appropriate and effective measure, but insufficiently deployed in order to achieve the target
c. A measure not likely to achieve the target even if deployed as widely as practicable.

5) In the case 4b above, ICES is requested to advise on the necessary increase in the deployment of the measure(s) needed to achieve a high likelihood of the target being reached.

6) To summarise the information provided in the MS reports or other information on whether the time schedule put forward by the Member State in its EMP has been met for the attainment of the target level of escapement in the long-term (Article 2(9) of the eel Regulation).

II. In regard of the 50% fishing effort/catches reduction target established by a Member State outside the EMP (Articles 4(2)-(3) and Article 9(1)b) of the Eel Regulation):

1) The extent to which this target has been reached, and where possible to quantify the realised level.

2) Where quantification is not possible, ICES is requested to advise on the attainment of this target based on alternative methods, deemed suitable by ICES.

3) The effects of each type of measure in quantitative terms and where not possible based on alternative methods, deemed suitable by ICES.

III. In regard of the reduction of mortality caused by factors outside the fishery (Articles 2(10) and 9(1)(c) of the Eel Regulation):

1) The level of the reduction effected, and where a Member State has put forward a specific target in the EMP – the extent to which this target has been reached, and where possible to quantify the realised level.

2) Where quantification is not possible, to advise on the attainment of the reduction effected based on alternative methods, deemed suitable by ICES.

3) The effects of each type of measure in quantitative terms and where not possible based on alternative methods, deemed suitable by ICES.

IV. In regard of eel less than 12cm/20cm in length used for different purposes (Article 9(1)(d) of the Eel Regulation, in conjunction with Article 7(4)):

1) The amount of eels less than 12cm caught by Member State and the proportions of this utilised for different purposes (such as restocking, aquaculture, consumption, leisure sport/recreational fishing, research).

2) The amount of eels less than 12 cm bought/marketed by Member State and the proportions of this utilised for different purposes (such as restocking, aquaculture, consumption, leisure sport/recreational fishing, research).

3) The amount of eels less than 20 cm in length transferred for restocking for the purpose of increasing escapement levels of silver eels.

V. In regard of the 60% restocking target applicable to Member States who allow glass eel fishing (Article 7(1) of the Eel Regulation, in conjunction with Article 2(8)):

1) The extent to which this target has been reached, and where possible to quantify the realised level.

2) Where quantification is not possible, ICES is requested to advise on the attainment of this target based on alternative methods, deemed suitable by ICES.

3) The effects of each type of measure in quantitative terms and where not possible, based on alternative methods, deemed suitable by ICES.

VI. In regard of any other target(s) established by Member States by themselves in their EMP(s) (e.g. restocking target set by those Member States who do not have glass eel fisheries but carry out restocking activities of eels below 12cm or 20cm in length) to provide information on

1) The extent to which the specific target has been reached, and where possible to quantify the realised level.

2) Where quantification is not possible, ICES is requested to provide information on the attainment of this target based on alternative methods, deemed suitable by ICES.

3) The effects of each type of measure in quantitative terms and where not possible based on alternative methods, deemed suitable by ICES.

The **Workshop for the Technical evaluation of EU Member States' Eel regulation Progress Reports 2024/2025** (WKEMP4 1 and 2), chaired by Alain Biseau, France, and Alan Walker, UK, met virtually during 04-08 November 2024 (WKEMP4 1) and virtually on 10-14 February 2025 (WKEMP4 2). The Workshop used data and information generated through the Data Call of the Joint EIFAAC/ICES/GFCM Working Group on Eels (WGEEL) in its activities for 2024.

There were 19 participants in the first meeting and 20 in the second meeting. Participants are listed in Report Annex 1 indicating in what meeting they participated.

The Chairs explained the ICES Code of Conduct and Conflict of Interest Guidelines. The participants were asked to formally state if they had a Conflict of Interest when introducing themselves. None were declared.

ACOM set the ToRs for the workshop as follows:

a) Prepare the data for evaluation.
b) Evaluate the overall effectiveness of EMPs in terms of changes in achieving specific target indicators (i.e. escapement target, fishing effort/catches reduction target, eel trade target, restocking target, any other target(s) established by Member States), and reductions in mortalities caused by factors outside the fishery.
c) Evaluate the effectiveness and outcome of types of measures in terms of: i) the status of implementation of planned measures; ii) where available, quantification of their effects; and iii) the likelihood that these measures need to be increased or others deployed to achieve the targets set for EMPs.
d) Provide alternative methods of monitoring, analysis and reporting in which the attainment of implementation efforts is possible, in the event that quantification under the present system is not possible.

The report addresses each Term of Reference in separate chapters. Chapter sub-headings are annotated with EC Questions, where appropriate.

2 ToR a) Prepare the data for evaluation

ICES issued a unique data call to i) conduct the eel assessment by WGEEL (data call annexes 1 to 9 required), and ii) to answer the EU Commission request by WKEMP4 (extra data call annexes 10-15). The JOINT EIFAAC/ICES/GFCM WORKING GROUP ON EELS (WGEEL) data call was issued on 15 May 2024. Because this was a combined call for WGEEL (that deals with the entire distribution of the eel stock) and WKEMP4 (dealing with an EU request specific to EU Member States), the call was originally sent by ICES to 20 EU countries (Belgium, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Croatia, Czechia, Ireland, Italy, Latvia, Lithuania, Luxemburg, Netherlands, Poland, Portugal, Slovenia, Sweden) and nine non-EU countries (Algeria, Albania, Egypt, Lybia, United Kingdom, Norway, Morocco, Tunisia, Turkey). Details of the data call can be found here: https://doi.org/10.17895/ices.pub.25816738.v2.

During the November 2024 meeting, WKEMP4 compiled and analysed the data received (see Report Annex 4). Some EU countries had not reported data to ICES or their reporting to the original call was incomplete. Therefore, a revised call, including an amended data call sheet for Data Call Annex 14, alongside a guidance document, was distributed by ICES in January 2025 as the data call, part 2 was sent to 20 countries on 17 January, 2025, with specific additions/revisions and explanations requested by 03 February 2025. This part 2 had the aim to clarify misunderstandings and specifically ask Member States to complete columns on the targets/level of achievement and the effectiveness of measures, where deemed technically quantifiable. Both data call parts are available at https://doi.org/10.17895/ices.pub.25816738.v3.

To summarize the data call request, as it pertained to the EC Request addressed in this report, it asked countries to provide several stock indicators for their EMPs:

- estimates of fishing lifespan mortality, denoted ΣF
- estimates of other anthropogenic lifespan mortality, denoted ΣH
- estimates of total lifespan anthropogenic mortality, denoted $\Sigma A=\Sigma F+\Sigma H$
- estimates of current escapement provided, both with (denoted $B_{current}$), and without ($B_{currentw}$) contributions of restocking
- estimates of the best estimates of biomass that would have occurred given the current level of recruitment in the absence of any anthropogenic influence (restocking being mentioned as an anthropogenic influence, i.e. not to be included in the estimation), denoted B_{best}
- estimates of the pristine escapement, B_0, defined as the escapement that would have occurred historically in the absence of any anthropogenic influence.

According to the regulation, estimates of $B_{current}$ and B_0, when reliable, can be used to assess if the target objective of 40% of the pristine escapement is achieved. Similarly, the maximum mortality ΣA of 0.92 (allowing a 40% pristine escapement) can be used to assess if the objective is met. Therefore, mortality indicators (ΣF, ΣH, ΣA) and biomass indicators ($B_{current}$, B_{best} and B_0) were collected in the Data Call Annex 11 and Data Call Annex 10 and the data reported are summarized in Annex 3 of this report.

Moreover, EU Member States were asked by the EU to provide additional data on:

- the number of recreational fishers (Data Call Annex 12)
- the fishing effort (Data Call Annex 15)
- Data Collection and Assessment of the Biomass and Mortality Indicators (Data Call Annex 13)
- final use of eels less than 12 cm (Data Call Annex 16)
- the implementation of management measures listed in EMPs (Data Call Annex 15)

Data call annexes 9 and 10 were evaluated during the 2024 WGEEL meeting. Some errors were detected and corrections asked to data providers. Here, an update of the data availability and quality check is presented. For the other annexes, data availability is presented and detailed reports are presented in Report Annex 4. Tests were developed to check that reported data were compliant with the requirements of the data call (e.g. integration of restocking), consistent among Member States (e.g. estimation of pristine escapement) and consistent with other data collected by WGEEL (time series of abundance of yellow and silver eels).

A total of 19 Member States responded to the data call, parts 1 and 2, though not all responded to part 2. Luxembourg did not respond at all. Slovenia wrote to ICES to explain why they would not submit any information on eel, while Croatia, Cyprus, and Malta in the Mediterranean, and Romania, Austria, and Slovakia in the Black Sea basin region, and Bulgaria for their rivers flowing to the Black Sea, are exempted from preparing EMPs, and therefore do not submit progress reports. The remaining Member States responded by making submissions to the data call, and in the case of six countries (France, Czechia, Latvia, Lithuania, Denmark, and the Netherland) providing separate text reports as well (FR, CZ, LV, LT to the EC, and DK and NL to ICES).

When the text reports provided data that differed from what was provided in the response to the data call, WKEMP4 used the values provided through the data call. For Latvia, only a written report was provided, and data were included in the data base.

Table 2.1 summarizes and illustrates the reporting rate across Member States for the data call annexes, with respect to the information requested for 2021 to 2024. Green cells represent full reporting, red cells represent no reporting despite it being deemed appropriate and necessary (i.e. a red colour was not used where a MS did not report but the request would be not applicable to that MS), amber cells represent incomplete reporting. None of the MS had green cells across all data call annexes.

Table 2.1: Reporting status of European Union Member States with obligations to report progress in their Eel Management Plans (total 82 EMPs), for the reporting period 2021 to 2024. The colour scheme is green = submitted and complete; amber = submitted but information missing; red = not submitted; grey = not pertinent. The Sub-Total row at the foot of the table indicates the numbers of EMPs that would be expected to report against each of the data call annexes.

Country	EMU number	Annex_10_Biomass indicators	Annex_11_Mortality indicators	Annex_12_Recreational_fishers	Annex_13_EMP_Overview
Belgium	4	Indicators missing for 2 EMPs	Indicators missing for 2 EMPs	The data reported concern general licenses for recreational fishing	
Croatia	-				
Czechia	2			Only data for 2023 reported. The data reported concern general licenses for recreational fishing	
Denmark	1			Data not reported. Number of recreational fishermen is said to be low in freshwater	
Estonia	2	No indicators provided for 1 (marine) EMP	No indicators provided for 1 (marine) EMP	Eel-specific licenses are reported at the country level	
Finland	1			The data reported concern general licenses for recreational fishing	
France	10	Updated to 2021 only. $B_{current}$ has not been reported	Updated to 2021 only		
Germany	9	Updated to 2022 only. $B_{currentw}$ not provided	updated to 2022 only	Eel-specific licenses are reported at the EMP level	
Greece	4	No answer to data call, part 2 in January 2025. $B_{currentw}$ not provided for most EMPs	No answer to data call, part 2 in January 2025		

Country	**EMU number**	**Annex_10_Biomass indicators**	**Annex_11_Mortality indicators**	**Annex_12_Recreational_fishers**	**Annex_13_EMP_Overview**
Ireland	6	Updated to 2022 only	Updated to 2022 only	Data not reported. There are no specific eel licenses. Recreational fisheries primarily target salmon, and eel is a very small bycatch	
Italy	20			Eel-specific licenses are reported. Data at the EMU level	
Latvia	1	$B_{currentw}$ not provided	Non-fishing anthropogenic mortality (ΣH) missing		
Lithuania	1	Updated to 2022 only. $B_{currentw}$ not provided	Updated to 2022 only	The data reported concern general licenses for recreational fishing. Data reported at the country scale	
Luxembourg	1				
Netherlands	1			Recreational fishing targeting eel is forbidden (any caught must be released). There are no specific eel licenses.	
Poland	2			There are no specific licenses for eel reported. Data reported only for 2023, and at the country level	

Country	**EMU number**	**Annex_10_Biomass indicators**	**Annex_11_Mortality indicators**	**Annex_12_Recreational_fishers**	**Annex_13_EMP_Overview**
Portugal	1		Non-fishing anthropogenic mortality (ΣH) reported as 0 while there are eels above hydropower plants	The data reported concern general licenses for recreational fishing. Data reported at the country scale. Eel recreational fisheries banned since 2014	
Slovenia	-				
Spain	13	2 national EMP and the International (transboundary) Miño River missing	Some EMPs missing all the indicators. Non-fishing anthropogenic mortality (ΣH) missing in most EMPs	Eel-specific licenses are reported, with data at the EMP level	
Sweden	3	Only one EMP provided all the indicators. B_{best} missing in one EMP, and all indicators missing in another	One (marine) EMU did not report Fishing Mortality (ΣF)	Data not reported. Recreational fishing for eel is forbidden in Sweden since 2007, except for inland waters that are upstream of at least three hydropower plants.	
Total	**82**				

Continued

Country	**Annex_14_Management_measures**	**Annex_15_Effort_nonEMP**	**Annex_16_Small_Eel_Utilization**	**Annex_17_Evaluation**	Other/additional Reporting
Belgium					
Croatia					Letter
Czechia					Word doc
Denmark					Word doc
Estonia					
Finland					
France			Trade or Restocking (trade code R) or Consumption (trade code C) identified, but destination country missing		Word doc
Germany					
Greece					
Ireland					
Italy					
Latvia					Word doc
Lithuania					Word doc
Luxembourg					
Netherlands					Word doc

Country	**Annex_14_Management_measures**	**Annex_15_Effort_nonEMP**	**Annex_16_Small_Eel_Utilization**	**Annex_17_Evaluation**	Other/additional Reporting
Poland					
Portugal			There is a glass eel fishery in the Minho but information is not recorded		
Slovenia					Letter
Spain			There is a glass eel fishery, but the required information is not recorded		
Sweden			The country of origin of farmed eels is not identified.		

2.1 Biomass (Data Call Annex 10) [EC request I.1]

Data availability

Amongst the EU Member States (MS) required to report on EMP progress, the Netherlands, Poland, and Portugal submitted their four biomass indicators for all years; Belgium, Denmark, Estonia, France, Germany, Greece, Ireland, Lithuania, Latvia, Spain, and Sweden submitted some biomass indicators for some years; whereas Croatia, Czechia, Finland, Italy, Luxembourg, and Slovenia did not report any biomass indicators (Table 2.1).

The materiality of these missing data from the MS that did not report at all was examined according to the relative size of eel fisheries in these countries, on the assumption that countries with significant eel production would have significant eel fisheries. Luxembourg has no eel fisheries, the annual catches for Czechia, Croatia, Finland, Italy, and Slovenia are presented in Table 2.2.

Table 2.2: Average annual landings (commercial + recreational) reported in Czechia, Croatia, Finland, Italy and Slovenia, and total landings for EU and all range states (2010-2023) (in tonnes). Eel codes: G = glass eel, Y = yellow eel, YS = yellow and silver eel reported as a combined catch, S = silver eel.

eel_cou_code	G	Y	YS	S
CZ*		14.7		
HR				0.5
FI				7.4
IT	0.1	98.4		86.7
SI			0.0	
OVERALL TOTAL EU	52.1	587.8	1,117.4	616.3
OVERALL TOTAL	55.6	826.7	1,413.5	698.2

*** (2012-2019)**

After 2020 on average, total reported landings from yellow and silver eel fisheries across all countries (EU and non-EU) amounted to 2 938 tonnes. In comparison, Italy reported average landings for five years reached 185 tonnes, contributing approximately for 6.3% to the total landings (Table 2.2). Landings in Slovenia (Sl) are almost inexistent.

Italy did not report data for biomass or mortality rates (see below). Italy had reported indicators in the past, but from 2019 onwards no new assessment estimates have been made by Italy.

To place the results of this reporting in the context of the entire stock, non-EU countries that did not respond to the ICES data call were Iceland, Russian Federation, Albania, Bosnia & Herzegovina, Algeria, Egypt, Lebanon, Israel, Libya, Morocco, Montenegro, Syria, Tunisia, and Turkey.

History of Biomass Indicator Reporting

The following table (Table 2.3) shows the most recent year reported per EMP for each of the four biomass indicators. Values in grey in the Country, EMP, and EMP names columns indicate that values were not reported for that EMP. More details are provided in Report Annex 3 (Table 3.1). Some indicators were reported using a code to explain the lack of a value, e.g. NC (not collected) or ND (no data), but since these reasons do not exempt the MS from the reporting obligation, those instances are shown in Table 2.3 as not reporting the indicator.

Table 2.3: Reported biomass indicators for *Anguilla anguilla. Eel Management Plans (EMPs)* for which $B_{current}$ was not reported during the 2024 data call are in grey, a blank "year" indicates a code was submitted rather than data. The table includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context. Only indicators from EU countries are analysed in this report.

Country	EMP	EMP name	$B_{current}$	$B_{currentw}$	B_{best}
BE	BE_Meus	Meuse	2023	2023	2023
BE	BE_Sche	Schelde	2023	2023	2023
BE	BE_Rhin	Rhine			
BE	BE_Sein	Seine			
CZ	CZ_Elbe	Elbe			
CZ	CZ_Oder	Oder			
DE	DE_Eide	Eider	2022	2022	2022
DE	DE_Elbe	Elbe	2022		2022
DE	DE_Ems	Ems	2022	2022	2022
DE	DE_Maas	Maas	2022		2022
DE	DE_Oder	Oder	2022	2022	2022
DE	DE_Rhei	Rhein	2022		2022
DE	DE_Schl	Schlei/Trave	2022		2022
DE	DE_Warn	Warnow/Peene	2022		2022
DE	DE_Wese	Weser	2022		2022
DK	DK_Inla	Inland water	2023		2023
EE	EE_Narv	Narva	2023	2023	2023
EE	EE_West	West Estonia	2023		2023
ES	ES_Anda	Andalusia	2017		2017
ES	ES_Astu	Asturias	2023	2021	2023
ES	ES_Bale	Balearic Islands	2017	2017	2017
ES	ES_Basq	Basque Country	2023	2023	2023
ES	ES_Cant	Cantabria	2023	2023	2023
ES	ES_Cast	Castilla-La Mancha	2023	2023	2023

Country	EMP	EMP name	$B_{current}$	$B_{currentw}$	B_{best}
ES	ES_Cata	Catalonia	2023	2023	2023
ES	ES_Gali	Galicia	2023	2023	2023
ES	ES_Inne	Inner Spain	2023	2023	2023
ES	ES_Murc	Murcia	2023	2023	2023
ES	ES_Nava	Navarra	2023	2023	2023
ES	ES_Vale	Valencia	2023	2023	2023
FI	FI_Finl	Finland			
FR	FR_Adou	Adour		2021	2021
FR	FR_Arto	Artois-Picardie		2021	2021
FR	FR_Bret	Bretagne		2021	2021
FR	FR_Cors	Corse		2021	2021
FR	FR_Garo	Garonne		2021	2021
FR	FR_Loir	Loire		2021	2021
FR	FR_Meus	Meuse		2021	2021
FR	FR_Rhin	Rhine		2021	2021
FR	FR_Rhon	Rhone Mediteranee		2021	2021
FR	FR_Sein	Seine-Normandie		2021	2021
GB	GB_Angl	Anglian	2022	2022	2022
GB	GB_Dee	Dee	2022	2022	2022
GB	GB_Humb	Humber	2019	2019	2022
GB	GB_Neag	Neagh Bann	2023	2023	2023
GB	GB_NorE	North Eastern	2023	2023	2023
GB	GB_NorW	North West	2022	2022	2022
GB	GB_Nort	Northumbrian	2022	2022	2022
GB	GB_Scot	Scotland	2022	2022	2022
GB	GB_Seve	Severn	2022	2022	2022
GB	GB_Solw	Solway	2022	2022	2022
GB	GB_SouE	South East	2022	2022	2022
GB	GB_SouW	South West	2022	2022	2022

Country	EMP	EMP name	$B_{current}$	$B_{currentw}$	B_{best}
GB	GB_Tham	Thames	2022	2022	2022
GB	GB_Wale	Western Wales	2022	2022	2022
GR	GR_CeAe	Central Greece – Aegean islands	2023		2023
GR	GR_EaMT	Eastern Macedonia	2023		2023
GR	GR_NorW	North western	2023		2023
GR	GR_WePe	Western Peloponnesos	2023		2023
IE	IE_East	Eastern	2022	2022	2022
IE	IE_NorW	North Western	2022	2022	2022
IE	IE_Shan	Shannon	2022	2022	2022
IE	IE_SouE	South Eastern	2022	2022	2022
IE	IE_SouW	South Western	2022	2022	2022
IE	IE_West	Western	2022	2022	2022
LT	LT_Lith	Lithuania	2020		2020
LU	LU_Luxe	Luxembourg			
LV	LV_Latv	Latvia	2023		2023
NL	NL_Neth	Netherlands	2023	2023	2023
NO	NO_total	Norway	2020		2020
PL	PL_Oder	Oder	2023	2023	2023
PL	PL_Vist	Vistula	2023	2023	2023
PT	ES_Minh	Minho transboundary, Portugal side	2023	2023	2023
PT	PT_Port	Portugal	2023	2023	2023
SE	SE_East	East Coast	2023		
SE	SE_Inla	Inland	2023	2023	2023
SE	SE_West	West Coast	2011		2011

The following maps (figures 2.1, 2.2, 2.3, and 2.4) summarize the spatial distribution of biomass indicators that were provided as a response to the ICES data call (2024/2025).

The first map (Figure 2.1) shows data availability, with colour symbols indicating whether the country has provided estimates for at least one (whatever year), two, three, or four distinct biomass indicators (B_0, B_{best}, $B_{current}$, $B_{currentw}$).

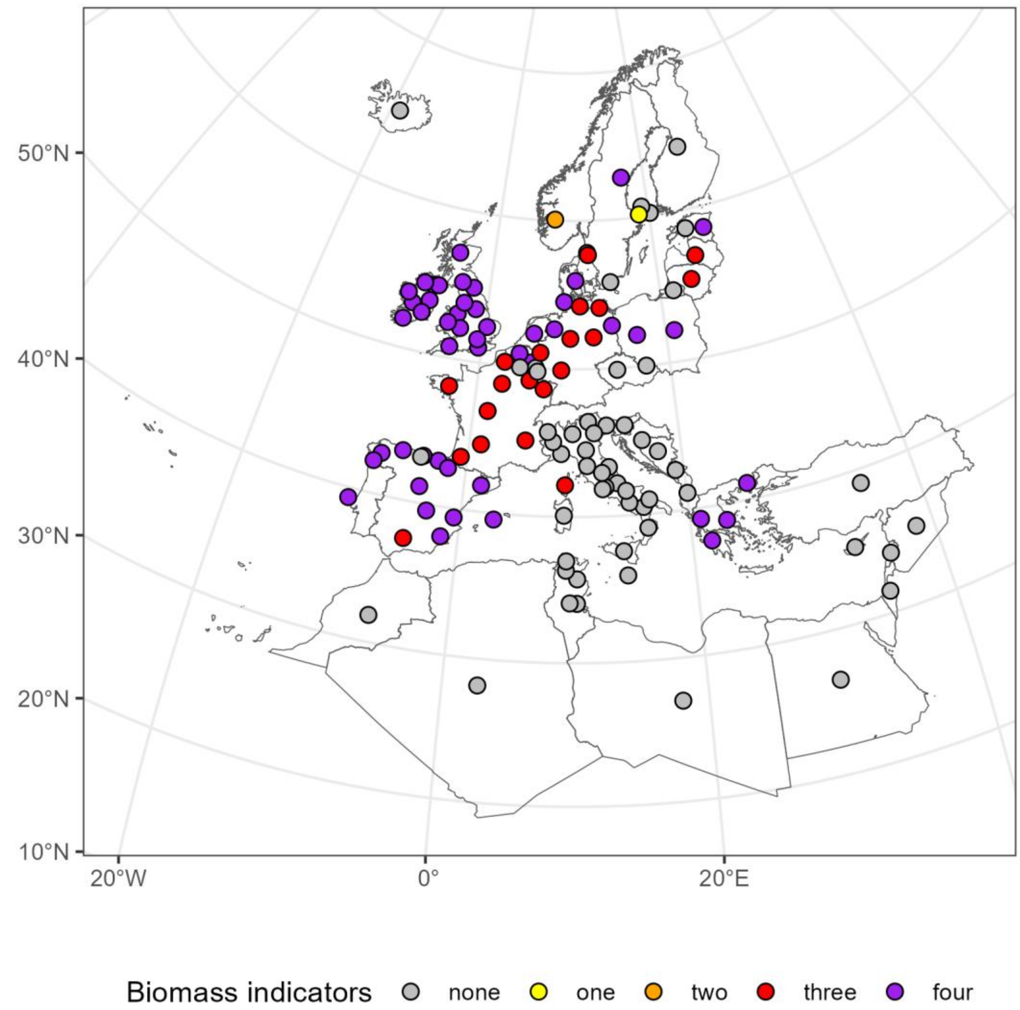

Figure 2.1: Biomass indicators (B_0, B_{best}, $B_{current}$, $B_{currentw}$) provided in each Eel Management Plan (EMP). The colour of the points indicates the number of distinct indicators for which estimates were provided (for at least for one year out of all required years). The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context. Only indicators from EU countries are analysed in this report.

The second map (Figure 2.2) provides the same information but with facets showing each indicator. The analysis will provide a point if an indicator was provided in any of the recent years. It illustrates that $B_{currentw}$ was more difficult to report. France has reported $B_{currentw}$ but not $B_{current}$.

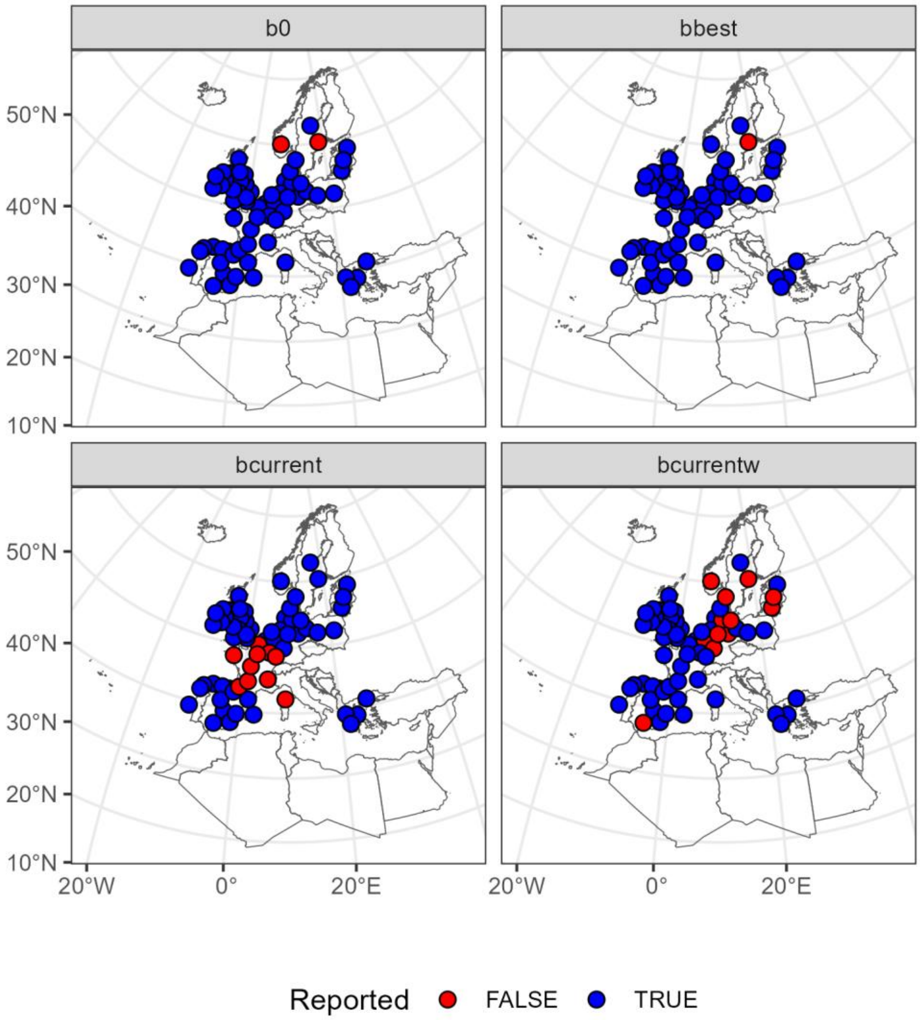

Figure 2.2: Review of biomass indicators that have been reported per Eel Management Plan (EMPs): B_0 **(top left);** B_{best} **(top right);** $B_{current}$ **(bottom left) and** $B_{currentw}$ **(bottom right). Blue: true (Reported), red: false (Not Reported) EMU where no indicators have been reported are not plotted. The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context. Only indicators from EU countries are analysed in this report.**

Figure 2.3 illustrates where $B_{current}$ is large, and which EMUs have a large $B_{current}$ in proportion to B_0.

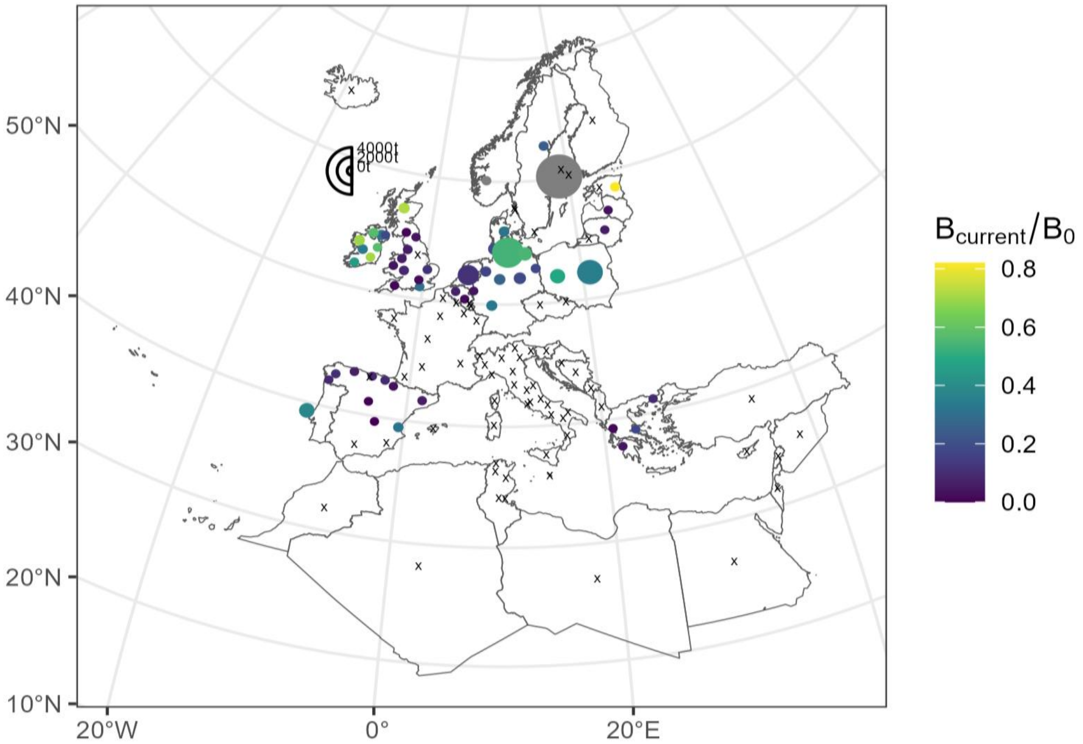

Figure 2.3: Map of biomass indicators per Eel Management Plan (EMP) (average from 2021 to 2023). The size of the circle is proportional to $B_{current}$ while the colour is indicative of the ratio between $B_{current}$ and B_0. A cross indicates that no data was reported. When B_0 is not available (only $B_{current}$), the circle is grey (e.g. Sweden, the Baltic). The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context. Only indicators from EU countries are analysed in this report.

The same map is provided for $B_{currentw}$, illustrating the comparatively large B_0 values reported for France (Figure 2.4).

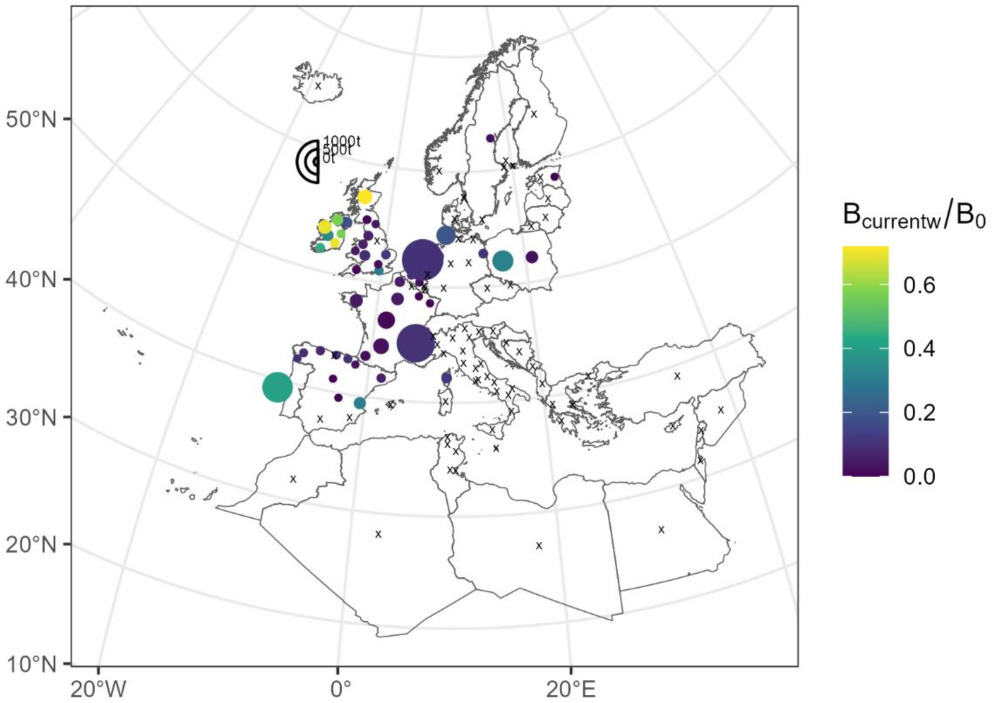

Figure 2.4: Map of biomass indicators per Eel Management Plan (EMP) (average from 2021 to 2023). The size of the circle is proportional to $B_{currentw}$ while the colour is indicative of the ratio between $B_{currentw}$ and B_0. A cross indicates that no data was reported. When B_0 is not available (only $B_{currentw}$), the circle is grey (e.g. Sweden, the Baltic). Here, reported B_0 were used. The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context. Only indicators from EU countries are analysed in this report.

The following figures (figures 2.5 – 2.7) summarize the years when the indicators ($B_{current}$: including restocking; $B_{currentw}$: without restocking) are available for a given EMP.

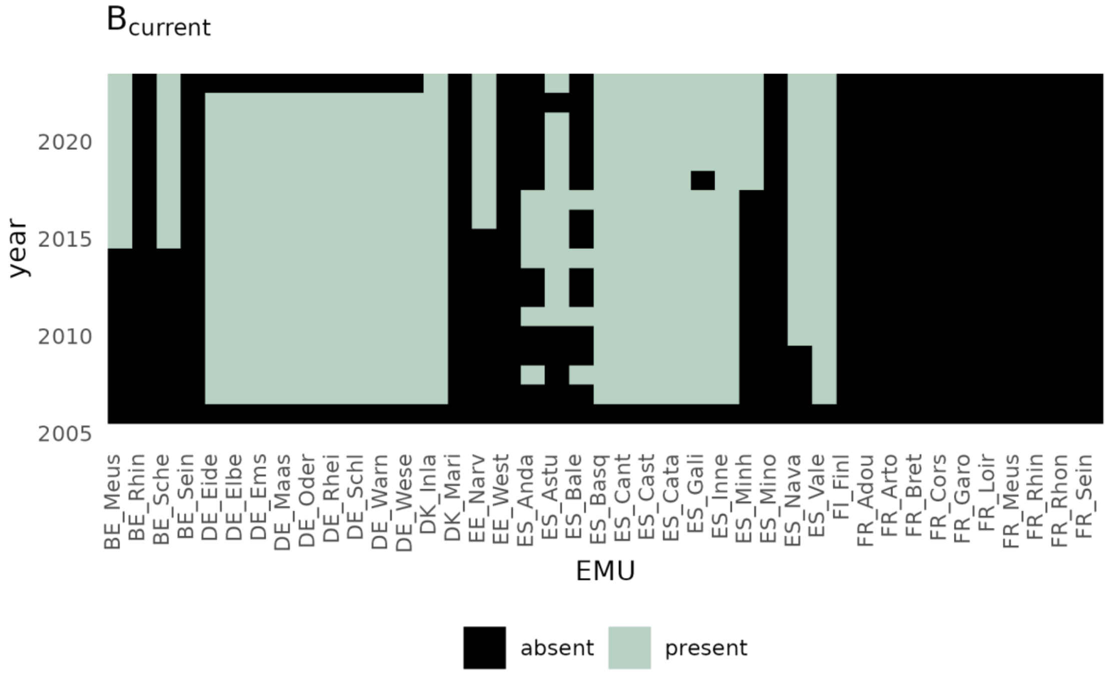

Figure 2.5a: Availability of $B_{current}$ indicators from 2006 to 2023 (note here EMU = EMP).

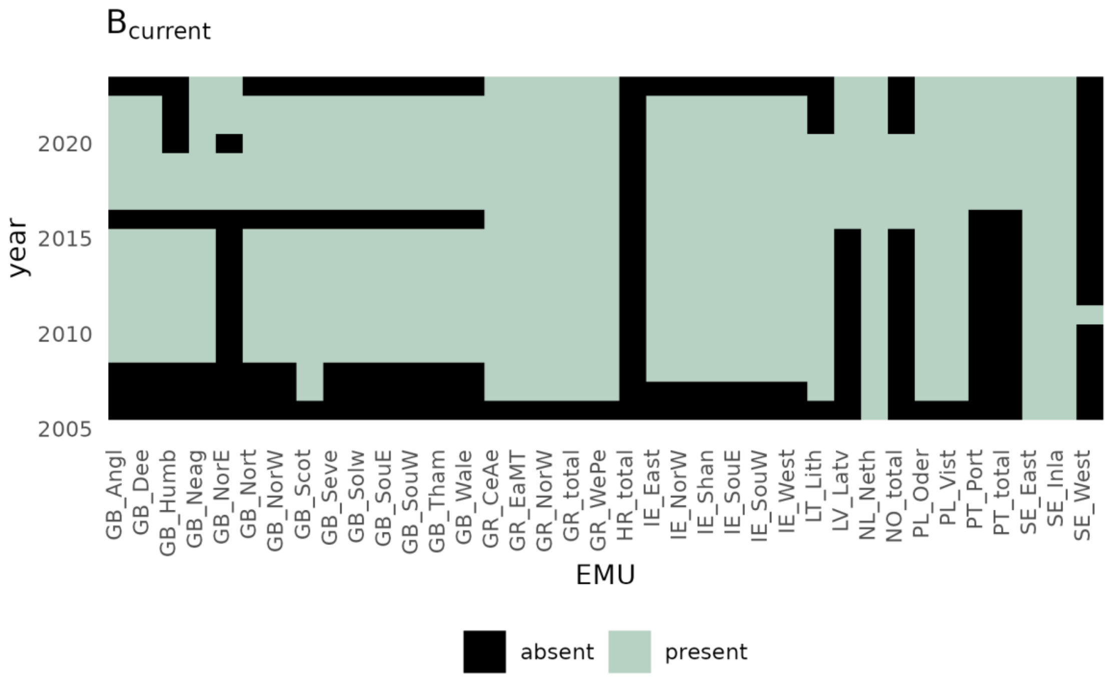

Figure 2.5b: Availability of $B_{current}$ indicators from 2006 to 2023 (continued). The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context (note here EMU = EMP).

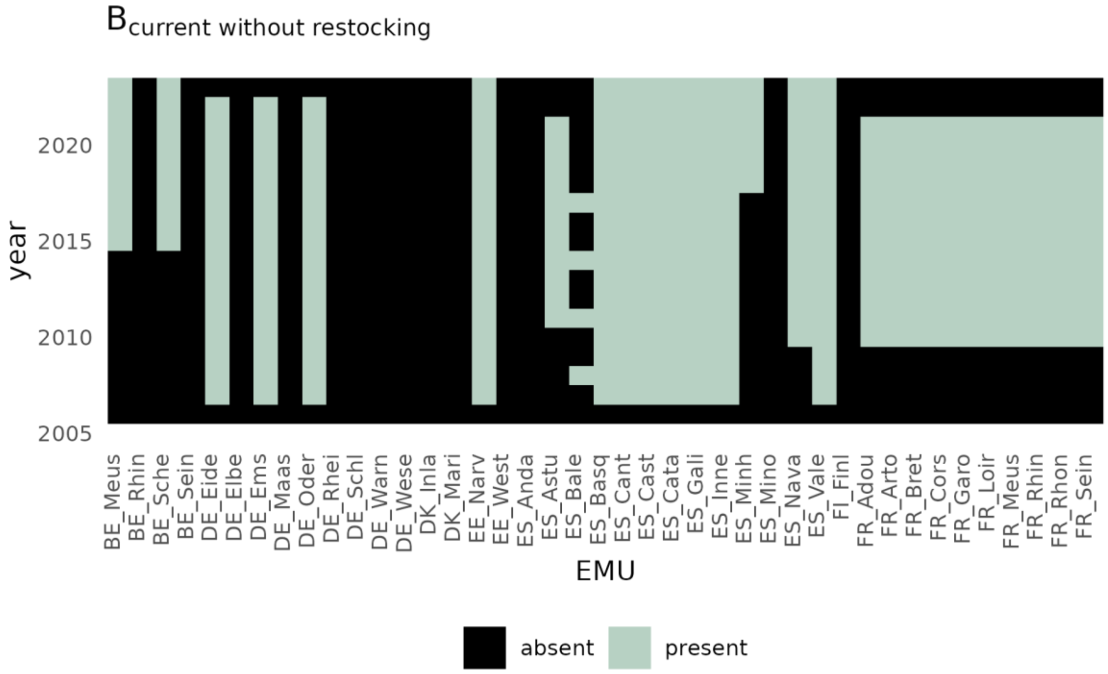

Figure 2.6a: Availability of $B_{currentw}$ indicators from 2006 to 2023 (note here EMU = EMP).

Figure 2.6b: Availability of $B_{currentw}$ indicators from 2006 to 2023 (continued). The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context (note here EMU = EMP).

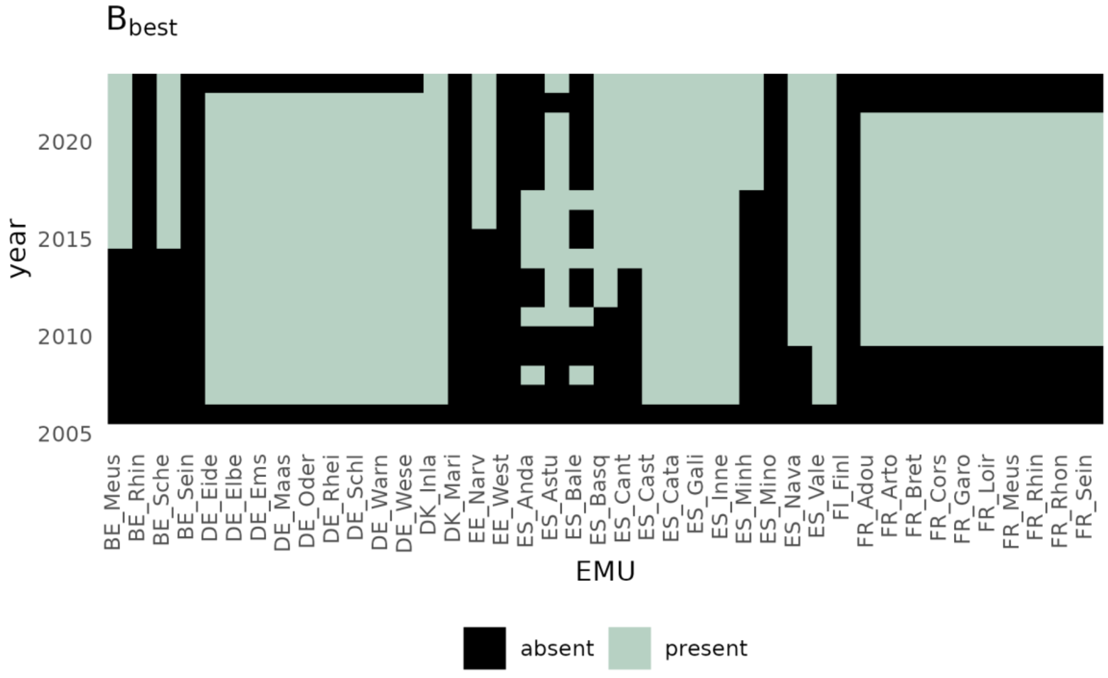

Figure 2.7a: Availability of B_{best} indicators from 2006 to 2023 (note here EMU = EMP).

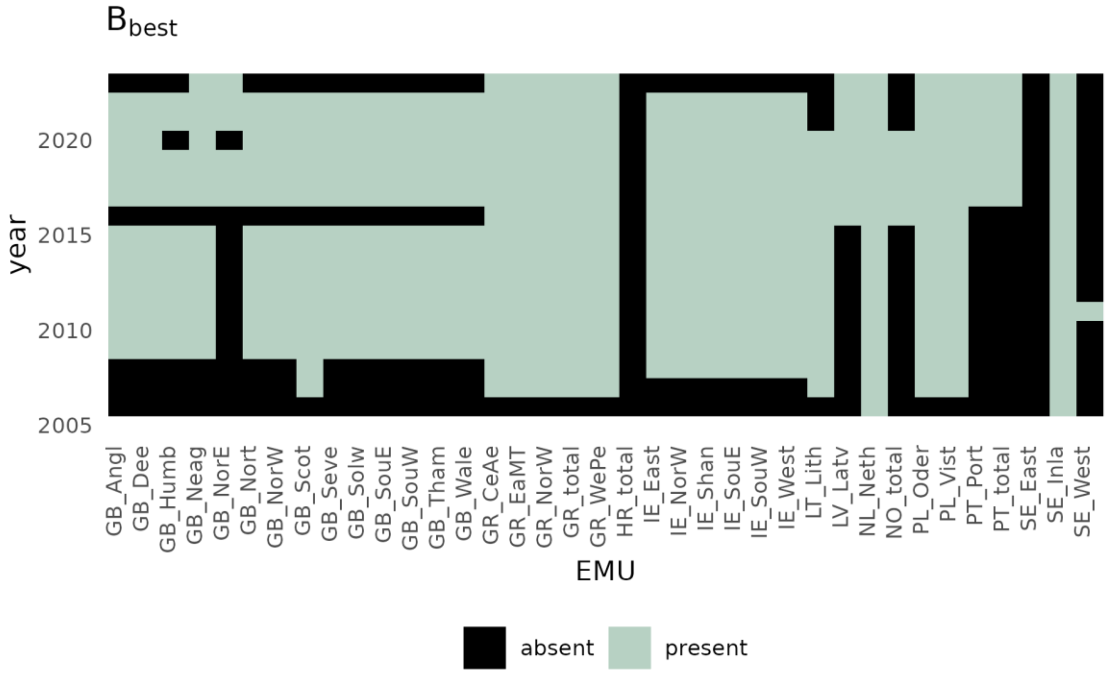

Figure 2.7b: Availability of B_{best} indicators from 2006 to 2023. The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context (note here EMU = EMP).

Data Consistency Summary

Reporting all indicators for all years is rarely done for most of the Member States. The reporting of indicators is not done in all EU Member States and hardly done in the Mediterranean.

Compiling an indicator can be the result of very simple model, or more complex ones. This illustrates that a standardization of methods is needed.

2.2 Anthropogenic mortalities (Data Call Annex 11)

Data availability

Amongst the EU Member States required to report on EMP progress, The Netherlands and Poland submitted their three mortality indicators for all years; Belgium, Denmark, Estonia, France, Germany, Greece, Ireland, Lithuania, Latvia, Portugal, Spain, and Sweden submitted some mortality indicators for some years; whereas Croatia, Czechia, Finland, Italy, Luxembourg, and Slovenia did not report any mortality indicators (Table 2.1).

The following table (Table 2.4) shows the most recent year when Mortality Stock Indicators were reported per EMP, values in grey in Country and EMP columns indicate that values where not reported for that EMP. More details are provided in Report Annex 3 (Table 3.2). Some indicators were reported using a code to explain the lack of a value, e.g. NC (not collected) or ND (no data), but since these reasons do not exempt the MS from the reporting obligation, those instances are shown in Table 2.4 as not reporting the indicator.

Table 2.4: Reported mortality indicator for EU Member States. EMPs for which ΣF was not reported during this data call are in grey, a blank "year" indicates that a code was used rather than reporting a data value. The table includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context.

Country	EMP	ΣF	ΣH	ΣA
BE	BE_Meus	2023	2023	2023
BE	BE_Sche	2023	2023	2023
DE	DE_Eide	2022	2022	2022
DE	DE_Elbe	2022	2022	2022
DE	DE_Ems	2022	2022	2022
DE	DE_Maas	2022	2022	2022
DE	DE_Oder	2022	2022	2022
DE	DE_Rhei	2022	2022	2022
DE	DE_Schl	2022	2022	2022
DE	DE_Warn	2022	2022	2022
DE	DE_Wese	2022	2022	2022
DK	DK_Inla	2023	2023	2023
EE	EE_Narv	2023	2023	2023
ES	ES_Anda	2017		2017
ES	ES_Astu	2023	2020	2023
ES	ES_Bale	2017		2017

Country	EMP	ΣF	ΣH	ΣA
ES	ES_Basq	2023		2023
ES	ES_Cant	2023		2023
ES	ES_Cast	2023	2023	2023
ES	ES_Cata	2023		2023
ES	ES_Gali	2023	2023	2023
ES	ES_Inne	2023	2023	2023
ES	ES_Murc	2023	2023	2023
ES	ES_Nava	2023		
ES	ES_Vale	2023		2023
FR	FR_Adou	2021	2021	2021
FR	FR_Arto	2021	2021	2021
FR	FR_Bret	2021	2021	2021
FR	FR_Cors	2021	2021	2021
FR	FR_Garo	2021	2021	2021
FR	FR_Loir	2021	2021	2021
FR	FR_Meus	2021	2021	2021
FR	FR_Rhin	2021	2021	2021
FR	FR_Rhon	2021	2021	2021
FR	FR_Sein	2021	2021	2021
GB	GB_Angl	2022	2022	2022
GB	GB_Dee	2022	2022	2022
GB	GB_Humb	2019	2019	2019
GB	GB_Neag	2023	2023	2023
GB	GB_NorE	2023	2023	2023
GB	GB_NorW	2022	2022	2022
GB	GB_Nort	2022	2022	2022
GB	GB_Scot	2022	2022	2022
GB	GB_Seve	2022	2022	2022
GB	GB_Solw	2022	2022	2022

Country	EMP	ΣF	ΣH	ΣA
GB	GB_SouE	2022	2022	2022
GB	GB_SouW	2022	2022	2022
GB	GB_Tham	2022	2022	2022
GB	GB_Wale	2022	2022	2022
GR	GR_CeAe	2023	2023	2023
GR	GR_EaMT	2023	2023	2023
GR	GR_NorW	2023	2023	2023
GR	GR_WePe	2023	2023	2023
GR	GR_total	2023	2023	2023
IE	IE_East	2022	2022	2022
IE	IE_NorW	2022	2022	2022
IE	IE_Shan	2022	2022	2022
IE	IE_SouE	2022	2022	2022
IE	IE_SouW	2022	2022	2022
IE	IE_West	2022	2022	2022
LT	LT_Lith	2020	2020	2020
LT	LT_total	2023	2023	2023
LV	LV_Latv	2023		
NL	NL_Neth	2023	2023	2023
NO	NO_total	2020	2020	2020
PL	PL_Oder	2023	2023	2023
PL	PL_Vist	2023	2023	2023
PT	ES_Minh	2023	2023	2023
PT	PT_Port	2023	2023	2023
PT	PT_total	2023	2023	2023
SE	SE_Inla	2023	2023	2023
SE	SE_West	2023	2023	2023

The following map (Figure 2.8) summarizes the spatial distribution of Mortality Indicators (ΣA, ΣF and ΣH) that were provided as a response to the ICES data call (2024/2025).

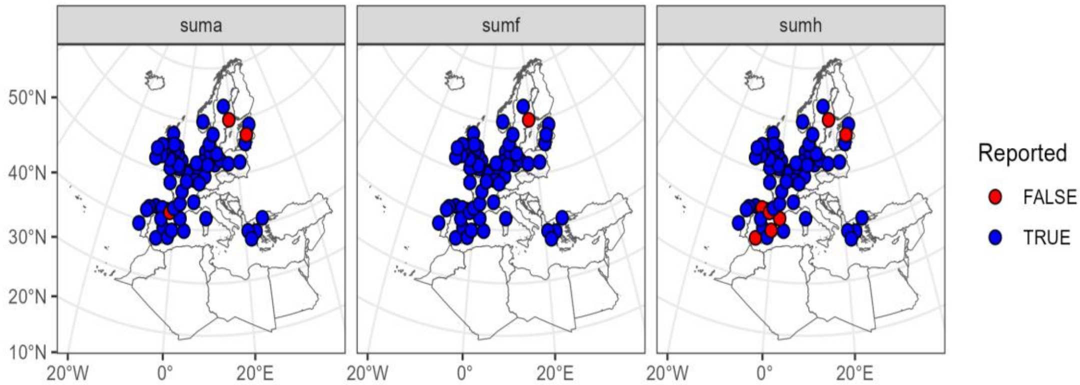

Figure 2.8: Review of Mortality indicators provided in each EMP. ΣA = total anthropogenic mortality, ΣF = fishery mortality, ΣH = other anthropogenic mortalities. Blue: true (Reported), Red: false (Not Reported). The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context. Only indicators from EU countries are analysed in this report.

History of Mortality Rate Indicator Reporting

The following figures summarize the time series of Mortality indicators (ΣA = total anthropogenic mortality, ΣF = fishery mortality, ΣH = other anthropogenic mortalities) reporting since EMPs were first implemented.

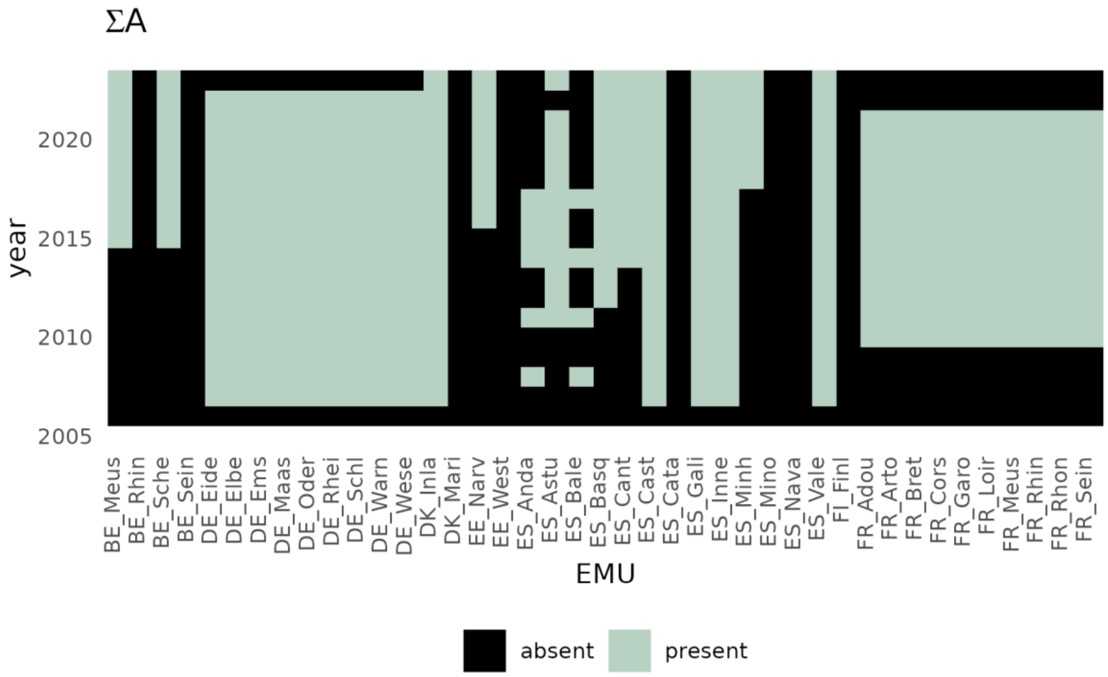

Figure 2.10a: ΣA availability from 2006 to 2023 (note here EMU = EMP).

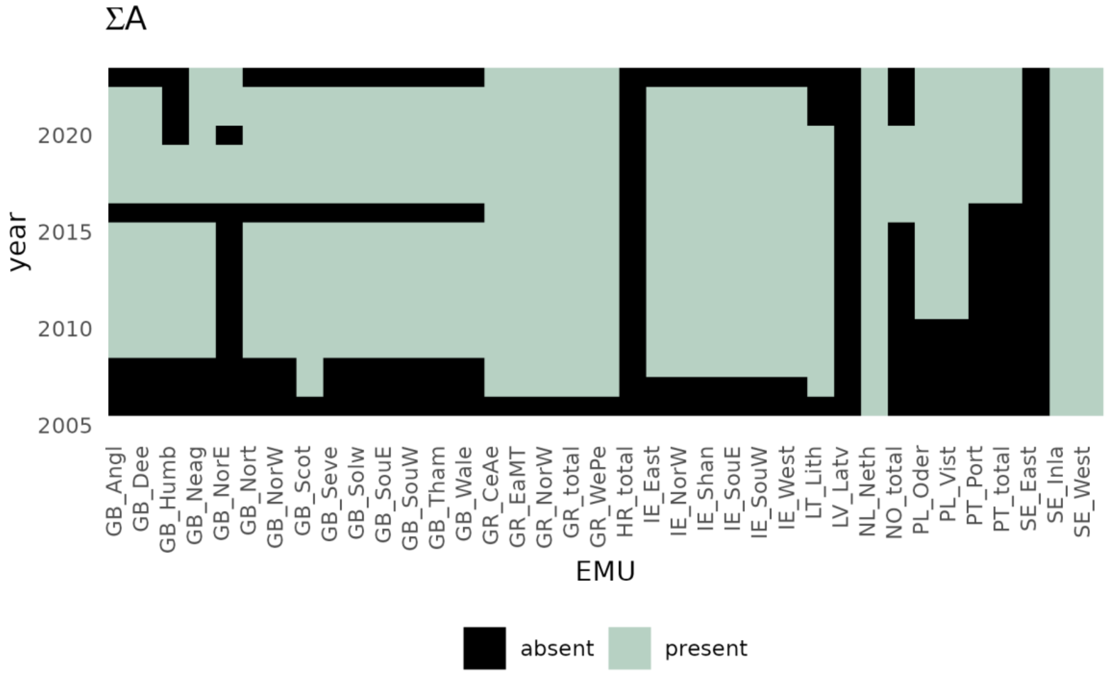

Figure 2.10b: ΣA availability from 2006 to 2023 (continued). The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context. (note here EMU = EMP).

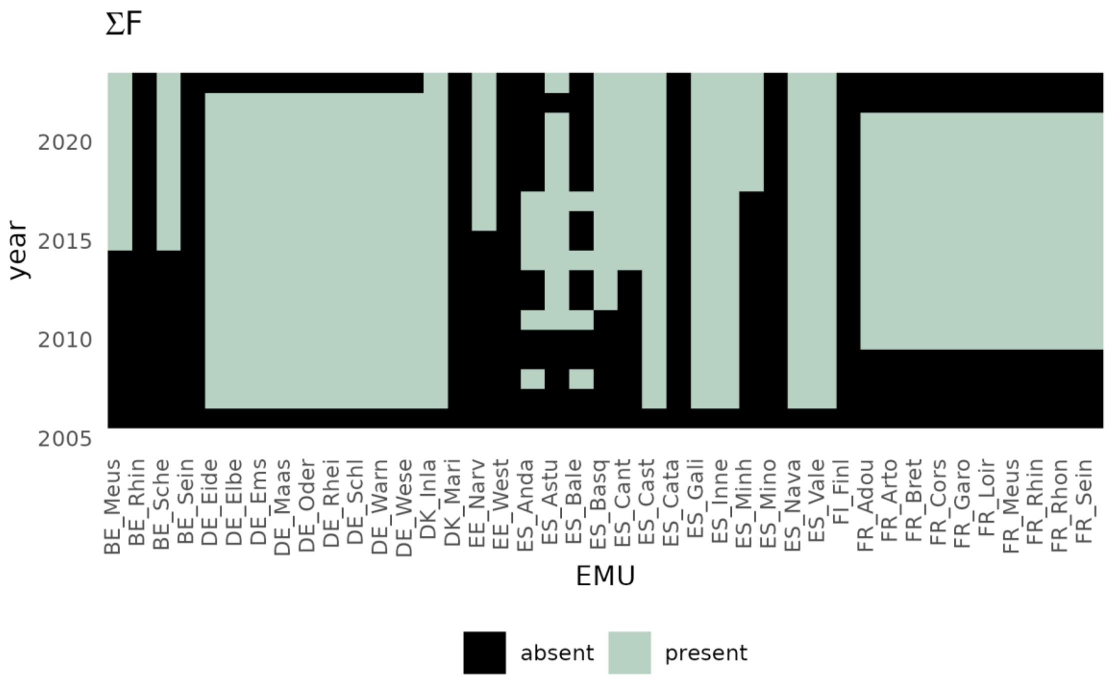

Figure 2.11a: ΣF availability per EMP from 2006 to 2023 (note here EMU = EMP).

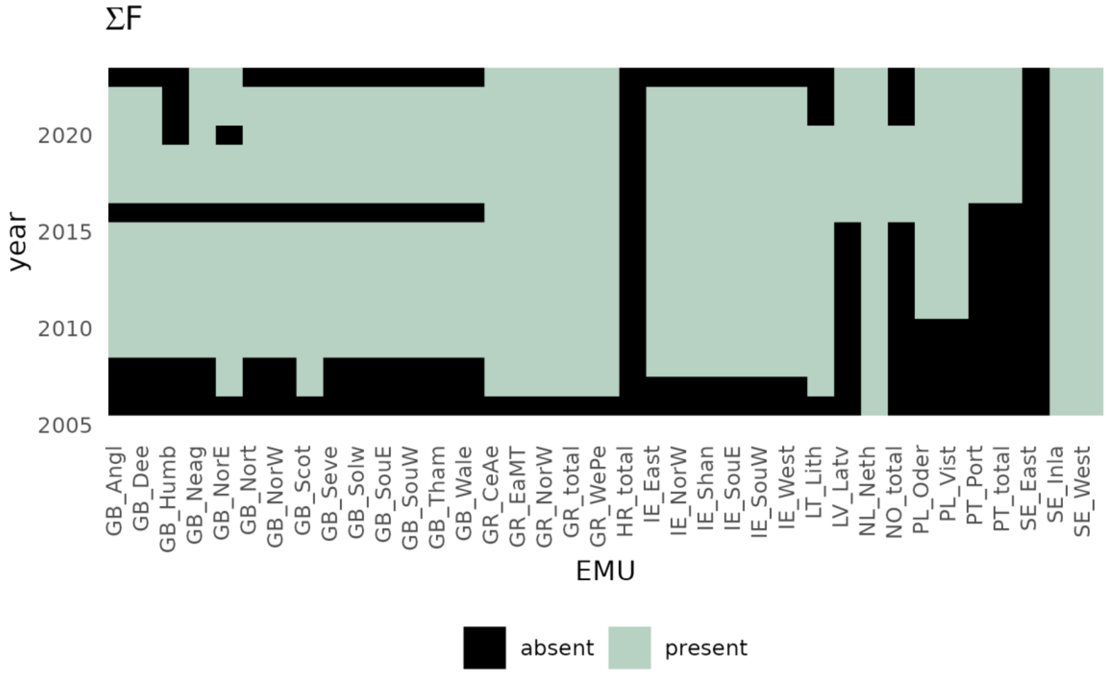

Figure 2.11b: ΣF availability per EMU from 2006 to 2023 (continued). The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context. (note here EMU = EMP).

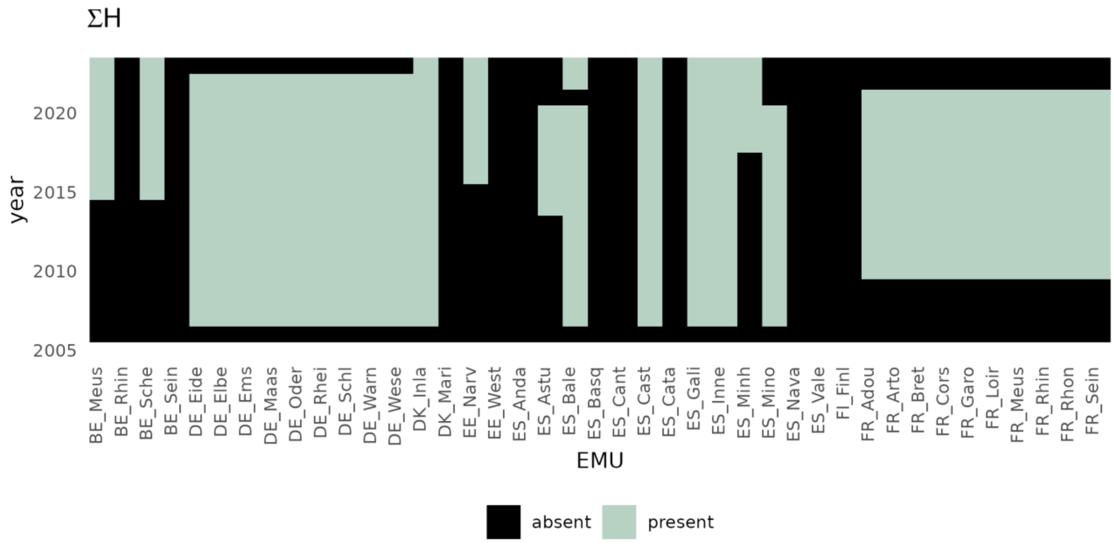

Figure 2.12: ΣH availability per EMP from 2006 to 2023 (note here EMU = EMP).

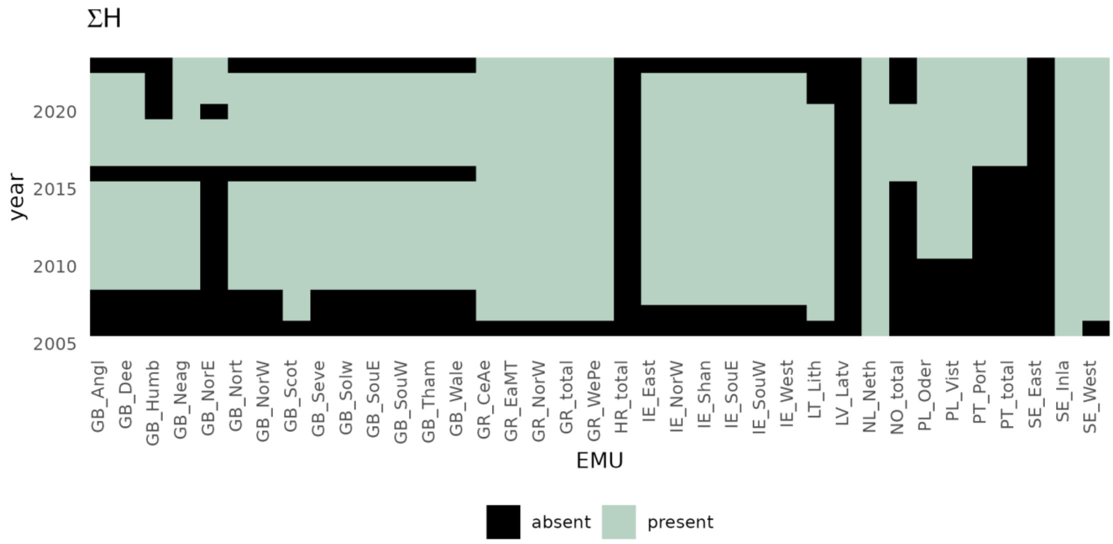

Figure 2.12: ΣH availability per EMP from 2006 to 2023 (continued). The figure includes EMPs from the United Kingdom (GB) and Norway (NO) that are not EU Member States but are presented here for added context. (note here EMU = EMP).

Figures 2.13 and 2.14 highlight that the reported levels of anthropogenic mortalities vary among EMPs and that there is a spatial pattern in the relative contribution of fisheries within this total anthropogenic mortality that displays a kind of latitudinal gradient.

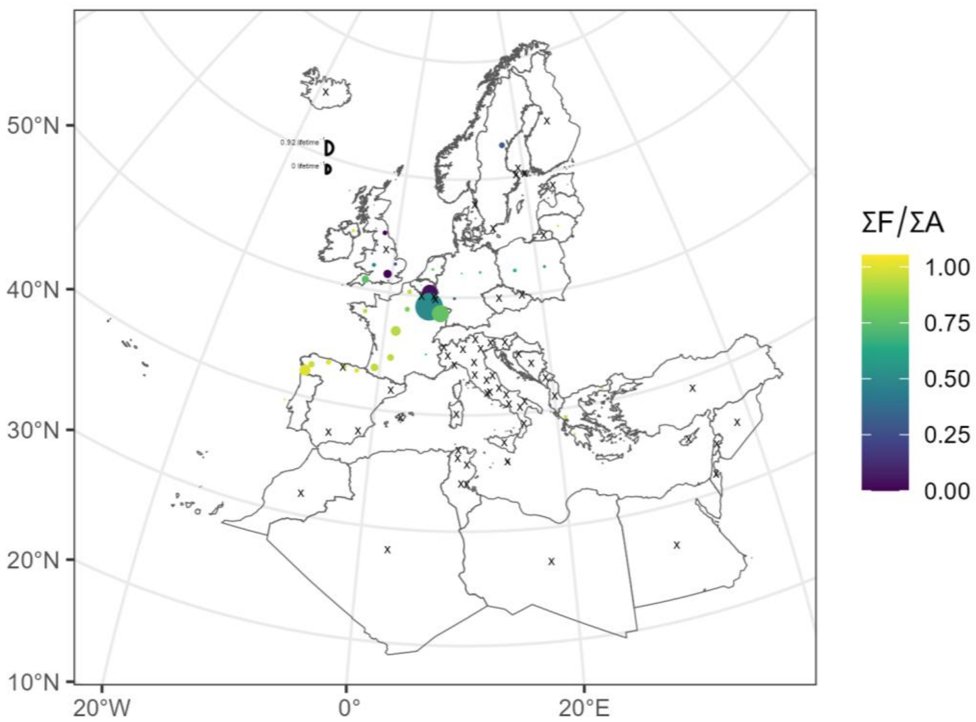

Figure 2.13: Mortality indicators per Eel Management Unit (EMPs in the EU and EMUs outside the EU) (average after 2018). The size of the circle reflects the magnitude of ΣA while the colour illustrates the ratio between ΣF and ΣA. A cross indicates that ΣA or both ΣF and ΣA are missing. The figure includes EMUs from outside the EU, presented here for added context. Only indicators from EU countries are analysed in this report.

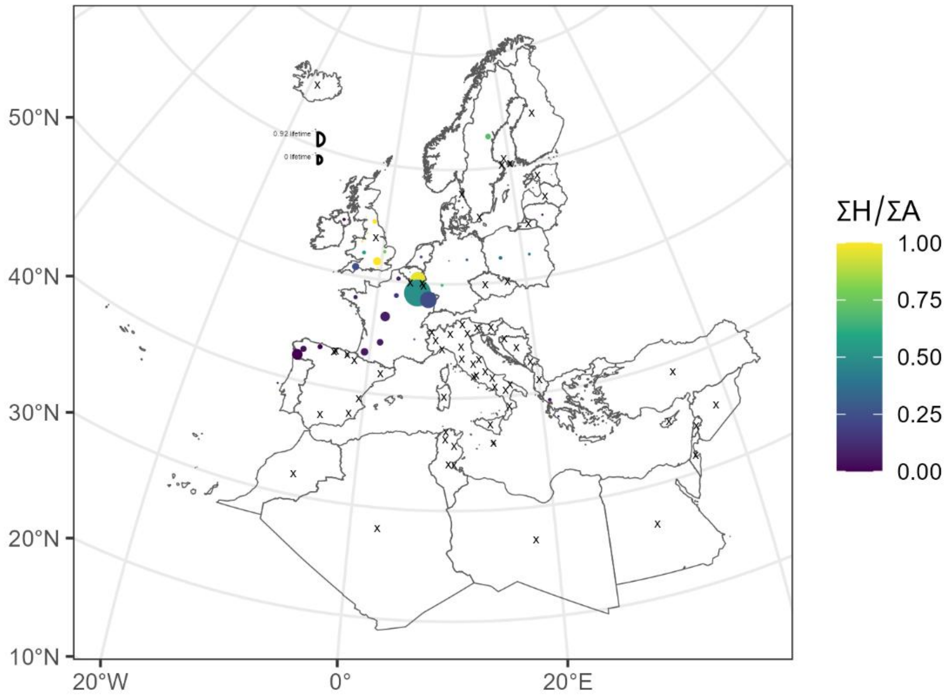

Figure 2.14: Mortality indicators per Eel Management Unit (EMPs in the EU and EMUs outside the EU) (average after 2018). The size of the circle reflects the magnitude of ΣA while the colour illustrates the ratio between ΣH and ΣA. A cross indicates that ΣH is missing. The figure includes EMUs from outside the EU, presented here for added context. Only indicators from EU countries are analysed in this report.

2.2.1 Anthropogenic mortalities and biomass habitat coverage (data call annexes 10 and 11)

Unlike in the data call for WKEMP3 in 2021, when data was collected per habitat, stock indicators were requested in 2024/2025 only at the EMU scale, and only to apply to the silver eel stage. However, to convey the importance of different habitats (MO marine open, T transitional, C coastal, and F Freshwater), during the data call each EMU was requested to report data on habitat coverage for stock indicators. If a given habitat was present in an EMU, the Member State was requested to report the percentage of that habitat that was included in their estimate of biomass and mortality indicators.

The data returned by the Member States shows that in some EMPs, the indicator does not account for the whole range of habitats where eel can be found. For example, eels that settle in "marine open" habitat (MO) are rarely accounted for. Table 2.5 summarizes this information, by listing the percentage of EMPs that report either 0 or 100% habitat coverage for all biomass indicators taken together, and for all mortality indicators taken together. For instance, Table 2.5 shows that 15% of all biomass indicators that have been reported for EMPs that contain freshwater habitat did not include any of this freshwater in their estimates of escapement biomass. This illustrates incomplete assessments, even when the provision of indicators suggests that reporting is complete.

Table 2.5: Percentage of EMUs in which a given habitat type was not accounted for, or fully accounted for in reported biomass and mortality indicators (F Freshwater, C Coastal, T transitional, MO Marine Open)

Indicator type	Not accounted for				Fully accounted for			
	C	F	MO	T	C	F	MO	T
Biomass	81	15	99	19	19	84	1	81
Mortality	57	20	100	16	43	79	0	84

To summarize, marine open and coastal waters are rarely accounted for in indicator estimates, and even some fresh and transitional waters also are not considered.

2.3 Recreational fisheries (Data Call Annex 12)

The EC request included the specific requirement to report on the numbers of recreational eel fishing licenses. The recreational catches of eel are important data also, which should contribute to fishing mortality stock indicators. Therefore, both aspects are considered in this section.

Data Call Annex 12 requested data on the number of recreational fishers per annum. Data Call Annex 5 requested the recreational landings.

Data available on the number of recreational fishers or their landings are often incomplete or inconsistent. Some countries have eel-specific licenses (Germany, Estonia, Spain, Italy), whereas other countries have general recreational fishing licenses. Those fishing under a general licence may catch eels, depending on fishing method and location, and whether on purpose (i.e. targeted for eels) or accidental (a bycatch) but controls on whether those eels are retained or must be released, and on whether they should be reported, vary between countries. Even when data are reported, landings or number of fishermen often incomplete (with data missing for some years).

Amongst the EU Member States required to report on the numbers of recreational fishing licenses, Estonia, Germany, Italy, and Spain reported on eel-specific licenses, although Estonia reported at the country level whereas the others reported at the EMP level. Belgium, Finland, Lithuania, The Netherlands, and Portugal all reported fully on their general recreational fishing licenses. Czechia and Poland only reported on their general licenses for 2023, not for other years. Croatia, Denmark, France, Greece, Ireland, Luxembourg, Slovenia, and Sweden did not report on recreational fishing licenses. None of these countries have eel-specific licenses, but all have recreational fishing, albeit eel catches may be very low in some countries.

Amongst the EU Member States required to report on recreational landings of eel, Belgium and Lithuania appears to report fully for yellow eels (has no recreational fishing for glass or silver eel), and Germany, Estonia, and Finland appear to report fully for combined yellow and silver eel catches. Spain reports combined landings of yellow and silver eel in the only EMU where this fishery was permitted (ES_Vale), and all recreational glass eel landings in those EMUs where this fishery is allowed (ES_Basq and ES_Cant). France's data on yellow eel fishing is known to be partial (only one year reported in the time series with a full assessment of the landings of all categories of fishermen), while Italy reports some missing values but very limited in EMPs with small landings for both silver and yellow eels. The databases of Latvia and The Netherlands are incomplete for yellow and silver eels. Sweden has not reported recent catch or landings data for yellow and silver eels because the last estimate of recreational catches of eel was made in 2006. Portugal reports only NP for landings, which is odd since the ban was implemented only in 2014.

Czechia only reported data between 2012 and 2019, showing a decreasing trend in yellow eel landings.

2.4 EMP overview (Data Call Annex 13)

Data Call Annex 13 requested information providing an overview of the EMP. This allows a sense check of the information reported or not reported in other data call annexes. Belgium, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Lithuania, Netherlands, Poland, Portugal, Spain, and Sweden all provided complete submissions of Data Call Annex 13. Whereas Italy, Latvia, and Luxembourg did not provide their Data Call Annex 13, Croatia did provide this annex, but it was mostly empty or contained Not Pertinent (NP) codes. Slovenia was exempt from reporting and therefore did not provide a Data Call Annex 13.

2.5 Measures and their effects (Data Call Annex 14, 17) [EC request I.3]

Data availability

Amongst the EU Member States required to report on EMP progress, Belgium, Czechia, Denmark, Finland, France, Germany, Greece, Ireland, Lithuania, Netherlands, Poland, Portugal, Spain, and Sweden provided complete submissions, whereas Croatia, Estonia, Italy, Latvia, and Luxembourg did not report on measures through the data call annexes (Table 2.1).

Slovenia responded to the data call with a letter to ICES explaining why they do not report.

Data Consistency Summary

Fourteen Member States responded to the data call, parts 1 and/or 2, providing data on 964 measures from 56 EMPs. In total, i.e. including information from previous data calls, data on 1 011 measures (653 as part of EMPs) from 18 countries and 69 EMPs was available to the workshop.

Comparability between Member States is difficult since measures are reported at the EMP level and the definition of EMP varies between countries; some have defined the whole country as a single EMP, while other countries have defined up to 12 EMPs, hence the same measure may be reported multiple times. Further, comparability to previous evaluations is difficult since the Data Call Annex 14 on measures, for practical reasons, is based on the data available from the respective last evaluation. However, measures may have been deleted (Member States are given an option to indicate deletion of redundant measures, e.g. duplicates or false entries) or definitions of measure/sub-measure types have changed.

Generally, the level of reporting on key parameters, such as the definition of quantitative targets of measures, their level of achievement or the estimated effect on mortalities/escapement (i.e. change in $\Delta\Sigma H$, $\Delta\Sigma F$, or $B_{current}$), was low, aggravating the evaluation of the effectiveness of single measures or measure types.

2.6 Fishing effort outside EMU (Data Call Annex 15)

Amongst the EU Member States required to report on fishing effort and/or catches in areas outside the EMP(s), Denmark provided a complete submission of Data Call Annex 15. Croatia, Luxembourg, and Slovenia may have fisheries outside of EMPs but did not report. The remainder of MS did not report because they do not have eel fisheries in waters outside their EMUs: Belgium, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Spain, and Sweden.

2.7 Small eel utilization/restocking/trade (Data Call Annex 16)

Traceability of glass eel landings is crucial for legal enforcement, conservation, population recovery, and adherence to international conservation agreements. The European Eel Regulation requires monitoring of glass eels (those under 12 cm) designated for restocking as well as those for consumption. It also mandates that EMPs specify the quantity of eels under 20 cm needed for restocking to enhance silver eel escapement levels. It is necessary to identify whether the eels are destined for restocking (R) or consumption (C). The consumption category encompasses both glass eels directly consumed and those raised in aquaculture for later consumption as adults.

Data availability

The Data Call Annex 16 requested those Member States that catch and trade eels <12 cm, and that trade (import or export) eels <20 cm to report on the amounts and proportions used for the following categories: restocking, consumption, trade, and aquaculture.

Amongst the EU Member States required to report on catches and trade of eels < 12 cm, France provided a partial submission, whereas Spain and Portugal did not report (Table 2.1).

Amongst the EU Member States required to report on trade (import or export) of eels <20 cm, the list of Member States is dependent on self-reporting, but Belgium, Czechia, Denmark, Germany, Greece, Ireland, Netherlands, and Poland provided complete submissions, whereas France and Sweden provided partial submissions. However, Croatia, Estonia, Finland, Italy, Latvia, Lithuania, Luxembourg, Slovenia, Spain, and Portugal did not report.

3 ToR b) Evaluate the overall effectiveness of EMPs in terms of trends (or recent changes) in achieving specific target indicators

3.1 Changes in achieving specific target indicators

3.1.1 Escapement and mortality targets

3.1.1.1 Escapement target [I.1 and I.2]

3.1.1.1.1 The extent to which the 40% escapement target has been reached for each Eel Management Plan

Table 3.1 presents the most recent reports of $B_{current}$ and the respective 40% escapement target for each EMP. According to these reports, 12 EMPs were exceeding their escapement target in the most recently reported year (2021, 2022 or 2023 depending on EMPs). However, the workshop notes that pristine biomass estimators are very inconsistent among EMPs and can often arise from different methods than $B_{current}$. This questions the reliability of reported $B_{current}/B_0$ and therefore, our ability to assess the achievement of the Eel Regulation escapement target.

Table 3.1: Achievement of Eel Regulation escapement target and of a mortality below 0.92. A green background indicates that a target has been achieved, i.e., $B_{current} / B_0 > 40\%$, or that $\Sigma A < 0.92$. A white background indicates that the target is not achieved. A grey background indicates missing data. A "x" indicates that WKEMP4 used $B_{currentw}$ to replace missing $B_{current}$.

		Mortality			Biomass		
Member State	EMP	2021	2022	2023	2021	2022	2023
BE	BE_Meus						
BE	BE_Sche						
DE	DE_Eide						
DE	DE_Elbe						
DE	DE_Ems						
DE	DE_Maas						
DE	DE_Oder						
DE	DE_Rhei						
DE	DE_Schl						
DE	DE_Warn						

		Mortality			Biomass		
Member State	EMP	2021	2022	2023	2021	2022	2023
DE	DE_Wese						
DK	DK_Inla						
EE	EE_Narv						
EE	EE_total						
ES	ES_Astu						
ES	ES_Basq						
ES	ES_Cant						
ES	ES_Cast						
ES	ES_Cata						
ES	ES_Gali						
ES	ES_Inne						
ES	ES_Murc						
ES	ES_Nava						
ES	ES_Vale						
FR	FR_Adou				x		
FR	FR_Arto				x		
FR	FR_Bret				x		
FR	FR_Cors				x		
FR	FR_Garo				x		
FR	FR_Loir				x		
FR	FR_Meus				x		
FR	FR_Rhin				x		
FR	FR_Rhon				x		
FR	FR_Sein				x		
GR	GR_CeAe						
GR	GR_EaMT						
GR	GR_NorW						
GR	GR_WePe						

		Mortality			Biomass		
Member State	EMP	2021	2022	2023	2021	2022	2023
GR	GR_total						
IE	IE_East						
IE	IE_NorW						
IE	IE_Shan						
IE	IE_SouE						
IE	IE_SouW						
IE	IE_West						
LT	LT_total						
LV	LV_Latv						
NL	NL_Neth						
PL	PL_Oder						
PL	PL_Vist						
PT	ES_Minh						
PT	PT_Port						
PT	PT_total						
SE	SE_Inla						
SE	SE_West						

In the absence of reported estimates from Member States, the workshop considers it is not able to propose alternative methods to suggest whether escapement in these EMPs is i) likely to be at or above target, ii) below but close to the target (30-40%), iii) well below the target (around 20%), iv) very low (around 10%), or v) negligible (the categories defined by the EC).

3.1.1.1.2 Reported time series of escapement

Figure 3.1 and Table 3.2 show the time series of reported escapement for each Member State. More details can be found in Report Annex 5. Given the uncertainty and inconsistencies in the estimation of B_0, the trends are likely to be more reliable than the absolute value, within and especially between MS. We observe for example that in some EMPs $B_{current} / B_0$ is above 40% before the implementation of EMPs, despite the recruitments that were already very low at that time, questioning the estimates of B_0. In each EMP, a Mann-Kendall trend test was used to test for the existence of a significant monotonic time trend (significance level 5%). Negative significant trends in escapement are still detected in 21 EMPs (Table 2.1), which might be due to a delayed effect of the decline in recruitment but might also be caused by still high level of mortalities.

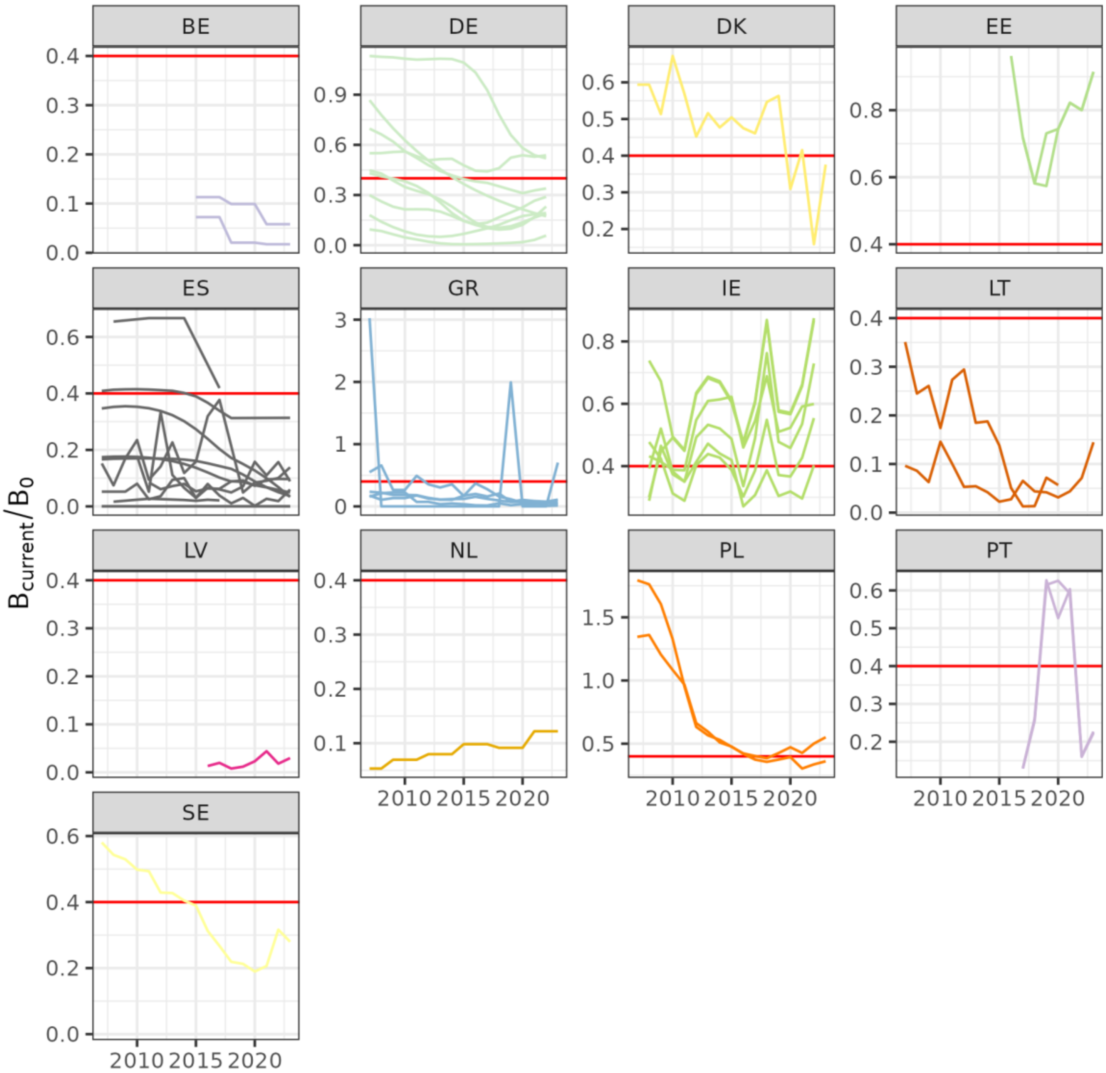

Figure 3.1: Reported $B_{current}/B_0$ per country. Each line corresponds to a specific EMP. The horizontal red line indicates the target set according to the Eel Regulation.

Among the 58 EMPs for which a trend could be estimated, 30 show a decreasing trend (including nine French EMPs for which $B_{currentw}$ restocking was considered), 24 do not show any significant trend (one French), and only four show an increasing trend.

Table 3.2: Results of Mann-Kendall tests for monotonic trends per EMP for $B_{current}$ (kg). 'n' represents the number of years for which estimates are available, while Δ is the difference between the earliest (Initial) and most recently (Final) reported values. Tau represents the direction of the trend (positive = increase, negative = decrease) and p-values indicate the significance of the trend. Arrows indicate the detection of a significant increasing (↗) or decreasing trend (↘). Some Member States (e.g. NL and FR) have been reporting the same value for several years and this might affect the results of the trend test. For France, $B_{currentw}$ is presented because $B_{current}$ was not reported.

EMP	Years	n years	Initial $B_{current}$	Final $B_{current}$	Δ	tau Kendall	p-value Kendall	Without restocking	trend
BE_Meus	2015-2023	9	2 331	558	-1 773	-0.87	0.00		↘
BE_Sche	2015-2023	9	23 429	12 027	-11 402	-0.87	0.00		↘
DE_Eide	2007-2022	16	1 481 795	295 299	-1 186 496	-1.00	0.00		↘
DE_Elbe	2007-2022	16	293 019	313 884	20 865	0.33	0.08		
DE_Ems	2007-2022	16	414 419	175 258	-239 161	-0.70	0.00		↘
DE_Maas	2007-2022	16	849	518	-331	-0.28	0.14		
DE_Oder	2007-2022	16	133 081	102 873	-30 208	-0.58	0.00		↘
DE_Rhei	2007-2022	16	376 555	183 339	-193 216	-0.93	0.00		↘
DE_Schl	2007-2022	16	2 313 504	2 259 462	-54 042	-0.25	0.19		
DE_Warn	2007-2022	16	1 021 774	469 200	-552 574	-0.92	0.00		↘
DE_Wese	2007-2022	16	356 603	239 620	-116 983	-0.47	0.01		↘
DK_Inla	2007-2023	17	261 231	165 300	-95 930	-0.57	0.00		↘
EE_Narv	2016-2023	8	86 563	82 302	-4 261	0.36	0.27		
EE_total	2017-2023	7	64 681	82 302	17 621	0.62	0.07		
ES_Anda	2008-2017	6	100 565	128 457	27 892	0.07	1.00		
ES_Astu	2011-2023	12	32 470	18 802	-13 668	-0.09	0.73		
ES_Bale	2008-2017	4	216 540	138 586	-77 954		1.00		
ES_Basq	2007-2023	17	40 048	22 207	-17 841	-0.76	0.00		↘
ES_Cant	2007-2023	17	59 434	5 758	-53 676	-0.91	0.00		↘
ES_Cast	2007-2023	17	0	0	0	1.00	1.00		
ES_Cata	2007-2023	17	103 599	22 614	-80 986	-0.81	0.00		↘
ES_Gali	2007-2023	16	35 171	31 966	-3 205	-0.07	0.75		
ES_Inne	2007-2023	17	0	0	0	1.00	1.00		
ES_Minh	2017-2023	7	4 278	2 320	-1 958	-0.14	0.76		
ES_Murc	2007-2023	17	7 031	11 951	4 920	0.39	0.03		↗

EMP	Years	n years	Initial $B_{current}$	Final $B_{current}$	Δ	tau Kendall	p-value Kendall	Without restocking	trend
ES_Nava	2010-2023	14	5 267	1 761	-3 507	-0.54	0.01		↘
ES_Vale	2007-2023	17	152 611	117 006	-35 605	-0.63	0.00		↘
FR_Adou	2010-2021	12	57 000	52 000	-5 000	-0.74	0.01	x	↘
FR_Arto	2010-2021	12	63 000	62 000	-1 000	-0.74	0.01	x	↘
FR_Bret	2010-2021	12	157 000	144 000	-13 000	-0.74	0.01	x	↘
FR_Cors	2010-2021	12	84 000	67 000	-17 000	-0.74	0.01	x	↘
FR_Garo	2010-2021	12	247 000	224 000	-23 000	-0.74	0.01	x	↘
FR_Loir	2010-2021	12	297 000	269 000	-28 000	-0.74	0.01	x	↘
FR_Meus	2010-2021	12	0	0	0	1.00	1.00	x	
FR_Rhin	2010-2021	12	2 000	1 000	-1 000	-0.74	0.01	x	↘
FR_Rhon	2010-2021	12	1 057 000	893 000	-164 000	-0.74	0.01	x	↘
FR_Sein	2010-2021	12	136 000	129 000	-7 000	-0.74	0.01	x	↘
GR_CeAe	2007-2023	17	4 866	1 132	-3 735	0.06	0.80		
GR_EaMT	2007-2023	17	16 008	1 463	-14 545	-0.69	0.00		↘
GR_NorW	2007-2023	17	23 730	14 756	-8 974	-0.27	0.14		
GR_WePe	2007-2023	17	21 069	1 162	-19 907	-0.67	0.00		↘
GR_total	2007-2023	17	65 673	18 513	-47 160	-0.79	0.00		↘
IE_East	2008-2022	15	13 645	25 367	11 722	0.24	0.23		
IE_NorW	2008-2022	15	73 979	102 645	28 666	0.35	0.07		
IE_Shan	2008-2022	15	82 311	114 642	32 331	-0.18	0.37		
IE_SouE	2008-2022	15	39 373	46 645	7 272	0.03	0.92		
IE_SouW	2008-2022	15	31 588	36 670	5 082	0.05	0.84		
IE_West	2008-2022	15	69 269	199 939	130 670	0.43	0.03		↗
LT_Lith	2007-2020	14	30 529	4 938	-25 591	-0.60	0.00		↘
LT_total	2007-2023	17	8 378	12 592	4 214	-0.22	0.23		
LV_Latv	2016-2023	8	3 420	7 717	4 297	0.43	0.17		
NL_Neth	2007-2023	17	555 000	1 269 000	714 000	0.80	0.00		↗
PL_Oder	2007-2023	17	2 158 797	663 505	-1 495 292	-0.60	0.00		↘
PL_Vist	2007-2023	17	6 340 203	1 701 611	-4 638 592	-0.85	0.00		↘

EMP	Years	n years	Initial $B_{current}$	Final $B_{current}$	Δ	tau Kendall	p-value Kendall	Without restocking	trend
PT_Port	2017-2023	7	210 336	368 406	158 070	0.05	1.00		
PT_total	2017-2023	7	214 614	370 726	156 112	0.05	1.00		
SE_East	2007-2023	17	3 356 000	3 677 000	321 000	0.91	0.00		↗
SE_Inla	2007-2023	17	174 194	83 953	-90 241	-0.82	0.00		↘
SE_West	2011-2011	1	12 000	12 000	0				

With the exception of a few countries whose escapements currently largely depend on restocking (e.g. EE, SE, PL), the patterns are very similar when $B_{currentw}$ is plotted (Figure 3.2), with the escapements often shifted downward. This suggests that restocking does not have a major effect on recent trends in escapement.

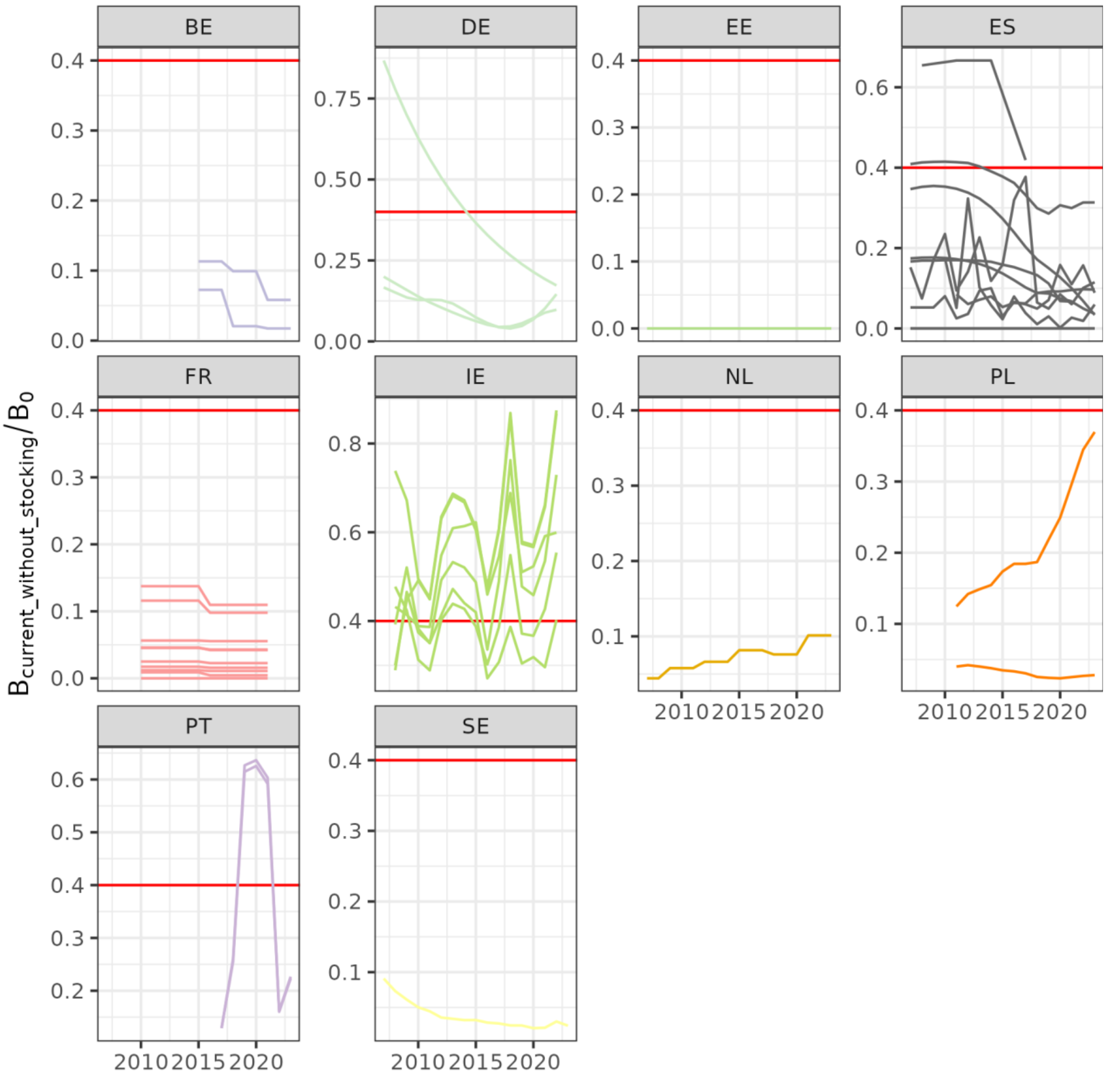

Figure 3.2: Reported $B_{currentw}$ / B_0 per Member State. Each coloured line represents a specific EMP. The horizontal red line indicates the target set by the Eel Regulation.

3.1.1.2 Mortality targets

3.1.1.2.1 Fishing Mortality (ΣF)

Figure 3.3 and Table 3.3 show the reported time series of fishing mortality rates per EMP and the results of the Mann-Kendall trend tests used to detect the existence of a monotonic trend in the EMPs. More details can be found in Report Annex 5.

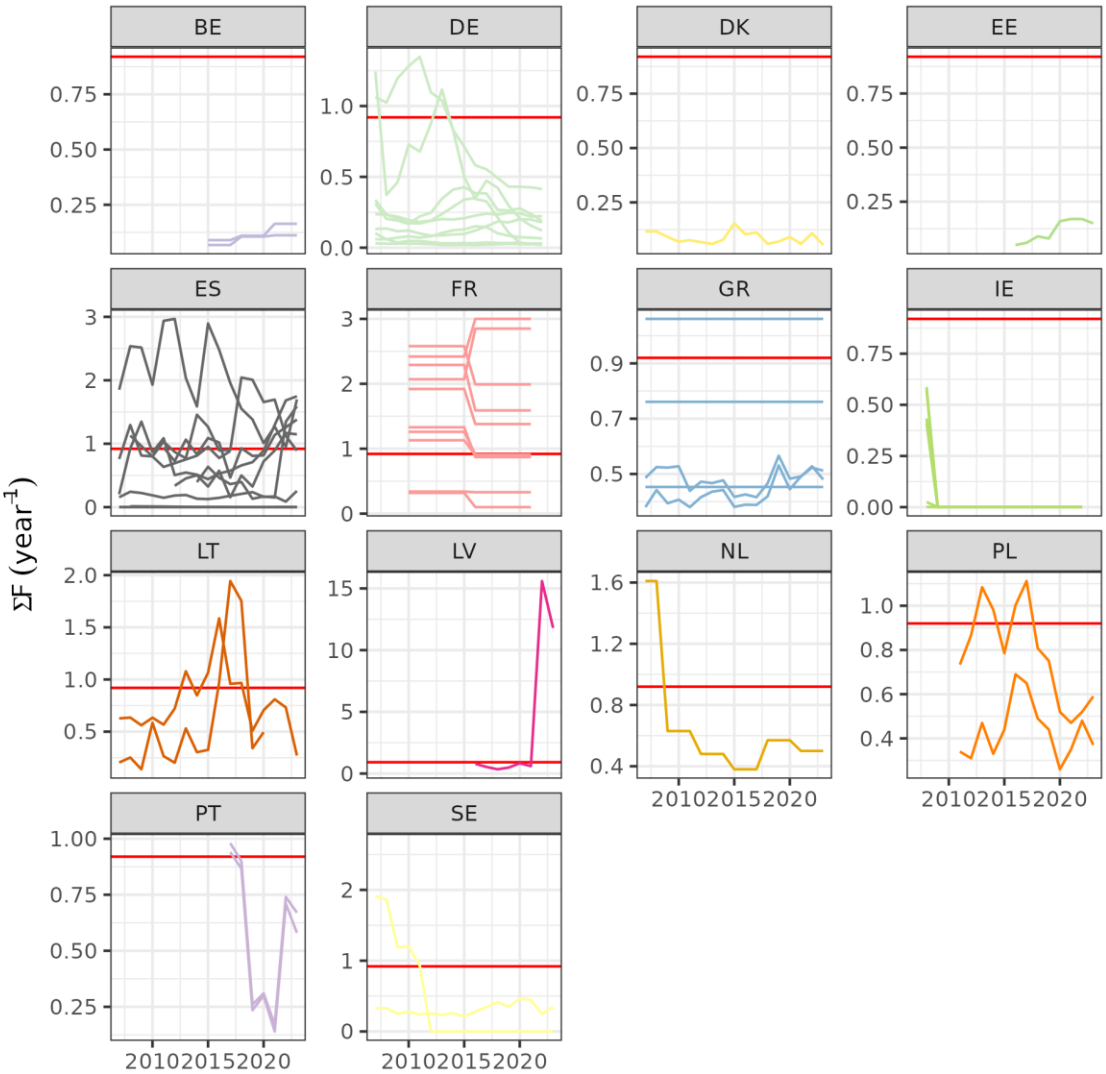

Figure 3.3: Reported fishing mortalities per Member State (ΣF). Each coloured line represents a specific EMP. The red horizontal line stands for the 0.92. The workshop suspects an error of unit in the last two years reported by Latvia.

Table 3.3: Results of Mann-Kendall test for monotonic trends per EMP for ΣF. 'n' represents the number of years for which estimates are available, while Δ is the difference between the earliest (Initial) and the most recently (Final) reported values. Tau represents the direction of the trend (positive = increase, negative = decrease) and p-value indicates the significance of the trend. Arrows indicate a significant increasing (↗) or decreasing trend (↘). Some Member States (e.g. NL and FR) report the same value for several years and this might affect the results of the trend test.

EMP	Years	n years	Initial	Final	Δ	tau Kendall	p-value Kendall	trend
BE_Meus	2015-2023	9	0.07	0.11	0.04	0.87	0.00	↗
BE_Sche	2015-2023	9	0.09	0.16	0.07	0.87	0.00	↗
DE_Eide	2007-2022	16	0.03	0.03	0.00	-0.23	0.24	
DE_Elbe	2007-2022	16	1.06	0.41	-0.65	-0.80	0.00	↘
DE_Ems	2007-2022	16	0.10	0.06	-0.04	0.07	0.75	
DE_Maas	2007-2022	16	1.24	0.02	-1.22	-0.67	0.00	↘
DE_Oder	2007-2022	16	0.24	0.12	-0.12	0.03	0.89	
DE_Rhei	2007-2022	16	0.34	0.22	-0.11	0.26	0.18	
DE_Schl	2007-2022	16	0.06	0.03	-0.03	-0.56	0.00	↘
DE_Warn	2007-2022	16	0.13	0.18	0.05	0.39	0.04	↗
DE_Wese	2007-2022	16	0.31	0.19	-0.12	0.07	0.75	
DK_Inla	2007-2023	17	0.12	0.05	-0.06	-0.26	0.16	
EE_Narv	2016-2023	8	0.05	0.15	0.10	0.69	0.02	↗
ES_Anda	2008-2017	6	1.13	0.88	-0.24	-0.07	1.00	
ES_Astu	2011-2023	12	0.94	1.38	0.44	0.18	0.45	
ES_Bale	2008-2017	4	0.01	0.00	-0.01		0.09	
ES_Basq	2012-2023	12	0.34	1.15	0.81	0.50	0.03	↗
ES_Cant	2014-2023	10	0.40	1.59	1.20	0.02	1.00	
ES_Cast	2007-2023	17	0.00	0.00	0.00	1.00	1.00	
ES_Cata	2007-2023	17	0.20	1.75	1.55	0.35	0.05	↗
ES_Gali	2007-2023	17	0.76	0.89	0.13	0.35	0.05	↗
ES_Inne	2007-2023	17	0.00	0.00	0.00	1.00	1.00	
ES_Minh	2017-2023	7	2.14	3.31	1.17	0.05	1.00	
ES_Murc	2007-2023	17	1.85	1.70	-0.15	-0.50	0.01	↘
ES_Nava	2021-2023	3	0.00	0.00	0.00			
ES_Vale	2007-2023	17	0.16	0.26	0.10	-0.07	0.71	

EMP	Years	n years	Initial	Final	Δ	tau Kendall	p-value Kendall	trend
FR_Adou	2010-2021	12	2.29	1.59	-0.70	-0.74	0.01	↘
FR_Arto	2010-2021	12	1.13	0.90	-0.23	-0.74	0.01	↘
FR_Bret	2010-2021	12	1.33	0.87	-0.46	-0.74	0.01	↘
FR_Cors	2010-2021	12	0.32	0.10	-0.22	-0.74	0.01	↘
FR_Garo	2010-2021	12	1.92	1.38	-0.54	-0.74	0.01	↘
FR_Loir	2010-2021	12	2.58	1.99	-0.59	-0.74	0.01	↘
FR_Meus	2010-2021	12	2.42	3.00	0.58	0.74	0.01	↗
FR_Rhin	2010-2021	12	2.07	2.85	0.78	0.74	0.01	↗
FR_Rhon	2010-2021	12	0.34	0.33	-0.01	-0.74	0.01	↘
FR_Sein	2010-2021	12	1.26	0.91	-0.35	-0.74	0.01	↘
GR_CeAe	2007-2023	2	1.06	1.06	0.00			
GR_EaMT	2007-2023	17	0.76	0.76	0.00	1.00	1.00	
GR_NorW	2007-2023	17	0.38	0.48	0.10	0.47	0.01	↗
GR_WePe	2007-2023	17	0.45	0.45	0.00	1.00	1.00	
GR_total	2007-2023	17	0.49	0.51	0.03	-0.01	1.00	
IE_East	2008-2022	15	0.41	0.00	-0.41	-0.37	0.13	
IE_NorW	2008-2022	15	0.43	0.00	-0.43	-0.37	0.13	
IE_Shan	2008-2022	15	0.57	0.00	-0.57	-0.37	0.13	
IE_SouE	2008-2022	15	0.03	0.00	-0.03	-0.37	0.13	
IE_SouW	2008-2022	15	0.00	0.00	0.00	-0.37	0.13	
IE_West	2008-2022	15	0.59	0.00	-0.59	-0.37	0.13	
LT_Lith	2007-2020	14	0.20	0.50	0.29	0.49	0.02	↗
LT_total	2007-2023	17	0.63	0.27	-0.36	0.09	0.65	
LV_Latv	2016-2023	8	0.79	11.80	11.01	0.43	0.17	
NL_Neth	2007-2023	17	1.61	0.50	-1.11	-0.38	0.05	↘
PL_Oder	2011-2023	13	0.73	0.59	-0.14	-0.40	0.07	
PL_Vist	2011-2023	13	0.34	0.37	0.03	0.06	0.81	
PT_Port	2017-2023	7	0.94	0.58	-0.36	-0.33	0.37	
PT_total	2017-2023	7	0.98	0.67	-0.31	-0.33	0.37	

EMP	Years	n years	Initial	Final	Δ	tau Kendall	p-value Kendall	trend
SE_Inla	2007-2023	17	0.33	0.34	0.02	0.29	0.12	
SE_West	2007-2023	17	1.91	0.00	-1.91	-0.70	0.00	↘

Interestingly, the reduction in fishing mortality is more visible than the increase in escapement, with 14 EMPs displaying a significant decrease (four still above 0.92). However, 11 are still displaying a significant increase of fishing mortality (four still above 0.92). Among the 32 EMUs that do not show a significant trend, 16 showed very low (close to zero) mortality, while 13 remained very high (above 0.92).

3.1.1.2.2 Other anthropogenic (non-fishing) mortalities (ΣH)

Figure 3.4 and Table 3.4 show the reported time series of other (non-fisheries) anthropogenic mortalities (ΣH) and the results of the Mann-Kendall trend tests. In many EMUs, ΣH is very small or equal to zero suggesting that only a part of the mortalities is accounted for. More details can be found in Report Annex 5.

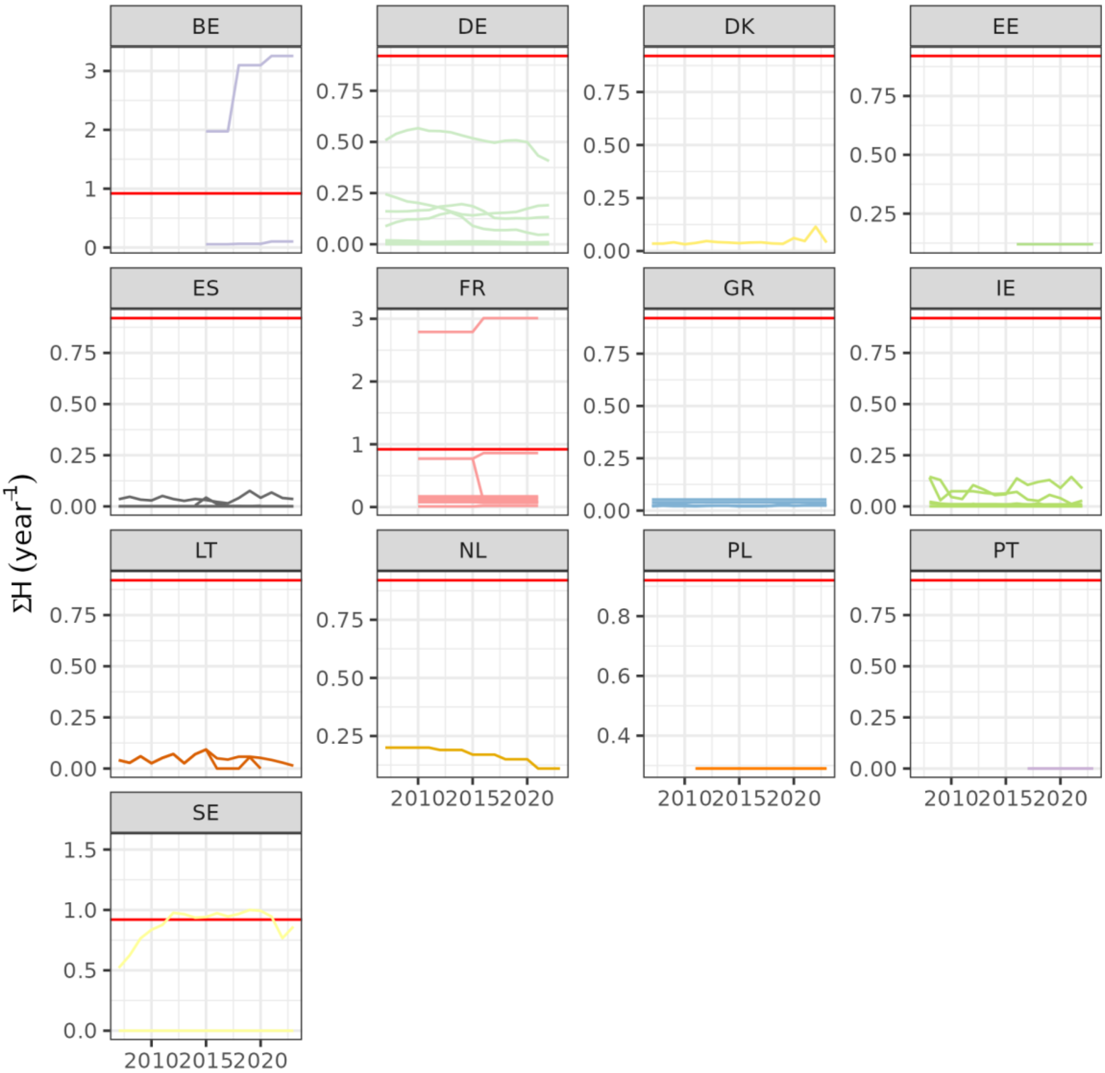

Figure 3.4: Reported non-fishing (other anthropogenic) mortalities (ΣH) per Member States. Each coloured line represents a specific EMP. The red horizontal line represents the 0.92 target.

Table 3.4: Results of Mann-Kendall test for monotonic trends per EMP for ΣH. 'n' represents the number of years for which estimates are available, while Δ is the difference between the earliest (Initial) and the most recently (Final) reported values. Tau represents the direction of the trend (positive = increase, negative = decrease) and p-value indicates the significance of the trend. Trend indicates a significant increasing (↗) or decreasing trend (↘). Some Member States (e.g. NL and FR) report the same value for several years and this might affect the results of the trend test.

EMP	Years	n years	Initial	Final	Δ	tau Kendall	p-value Kendall	trend
BE_Meus	2015-2023	9	1.97	3.26	1.28	0.87	0.00	↗
BE_Sche	2015-2023	9	0.06	0.10	0.05	0.87	0.00	↗
DE_Eide	2007-2022	16	0.01	0.01	0.00	-0.59	0.01	↘
DE_Elbe	2007-2022	16	0.24	0.19	-0.05	-0.33	0.09	
DE_Ems	2007-2022	16	0.01	0.01	0.00	-0.28	0.16	
DE_Maas	2007-2022	16	0.09	0.05	-0.04	-0.49	0.01	↘
DE_Oder	2007-2022	16	0.02	0.00	-0.02	-0.82	0.00	↘
DE_Rhei	2007-2022	16	0.51	0.41	-0.10	-0.67	0.00	↘
DE_Schl	2007-2022	16	0.00	0.00	0.00	-0.47	0.03	↘
DE_Warn	2007-2022	16	0.00	0.00	0.00	1.00	1.00	
DE_Wese	2007-2022	16	0.16	0.13	-0.03	-0.23	0.24	
DK_Inla	2007-2023	17	0.04	0.04	0.00	0.30	0.11	
EE_Narv	2016-2023	8	0.12	0.12	0.00	1.00	1.00	
ES_Astu	2014-2020	7	0.00	0.00	0.00	-0.49	0.17	
ES_Cast	2007-2023	17	0.00	0.00	0.00	1.00	1.00	
ES_Gali	2007-2023	17	0.04	0.04	0.00	0.12	0.54	
ES_Inne	2007-2023	17	0.00	0.00	0.00	1.00	1.00	
ES_Minh	2017-2023	7	0.00	0.00	0.00	1.00	1.00	
ES_Murc	2007-2023	17	0.00	0.00	0.00	1.00	1.00	
FR_Adou	2010-2021	12	0.77	0.09	-0.68	-0.74	0.01	↘
FR_Arto	2010-2021	12	0.08	0.07	-0.01	-0.74	0.01	↘
FR_Bret	2010-2021	12	0.08	0.07	-0.01	-0.74	0.01	↘
FR_Cors	2010-2021	12	0.01	0.02	0.01	0.74	0.01	↗
FR_Garo	2010-2021	12	0.10	0.09	-0.01	-0.74	0.01	↘
FR_Loir	2010-2021	12	0.16	0.15	-0.01	-0.74	0.01	↘
FR_Meus	2010-2021	12	2.79	3.01	0.22	0.74	0.01	↗

EMP	Years	n years	Initial	Final	Δ	tau Kendall	p-value Kendall	trend
FR_Rhin	2010-2021	12	0.77	0.86	0.09	0.74	0.01	↗
FR_Rhon	2010-2021	12	0.14	0.13	-0.01	-0.74	0.01	↘
FR_Sein	2010-2021	12	0.17	0.17	0.00	1.00	1.00	
GR_CeAe	2007-2023	2	0.05	0.05	0.00			
GR_EaMT	2007-2023	17	0.04	0.04	0.00	1.00	1.00	
GR_NorW	2007-2023	17	0.02	0.03	0.01	0.42	0.03	↗
GR_WePe	2007-2023	17	0.02	0.02	0.00	1.00	1.00	
GR_total	2007-2023	17	0.03	0.03	0.00	-0.02	0.97	
IE_East	2008-2022	15	0.02	0.01	-0.01	-0.60	0.01	↘
IE_NorW	2008-2022	15	0.14	0.09	-0.06	0.13	0.52	
IE_Shan	2008-2022	15	0.14	0.03	-0.11	-0.60	0.00	↘
IE_SouE	2008-2022	15	0.00	0.00	0.00	1.00	1.00	
IE_SouW	2008-2022	15	0.02	0.00	-0.02	-0.32	0.11	
IE_West	2008-2022	15	0.00	0.00	0.00	1.00	1.00	
LT_Lith	2007-2020	14	0.04	0.00	-0.04	-0.23	0.29	
LT_total	2007-2023	17	0.04	0.01	-0.03	-0.11	0.56	
NL_Neth	2007-2023	17	0.20	0.11	-0.09	-0.92	0.00	↘
PL_Oder	2011-2023	13	0.29	0.29	0.00	1.00	1.00	
PL_Vist	2011-2023	13	0.29	0.29	0.00	1.00	1.00	
PT_Port	2017-2023	7	0.00	0.00	0.00	1.00	1.00	
PT_total	2017-2023	7	0.00	0.00	0.00	1.00	1.00	
SE_Inla	2007-2023	17	0.52	0.86	0.34	0.38	0.04	↗
SE_West	2007-2023	17	0.00	0.00	0.00	1.00	1.00	

Fourteen EMPs display a significant decrease of ΣH, seven display a significant increase, but the majority show no significant trend; among them, 22 display a very low (<0.1) final ΣH.

The workshop was asked to provide further insights on trends per mortality types (e.g. hydropower, contamination). However, given that i) the number of significant trends for the combined "others anthropogenic mortalities" indicators is very small (Table 1.3) and ii) that it is unclear which mortalities were accounted for in the different EMPs (and many of them were seemingly not accounted for at all), the experts were not in position to answer precisely the request but consider that reported trends in ΣH did not indicate a likely change in any other types of mortalities.

3.1.1.2.3 Total anthropogenic mortalities (ΣA)

Figure 3.5 and Table 3.5 show reported time series of total anthropogenic mortalities and the results of the Mann-Kendall trend tests. More details can be found in Report Annex 5.

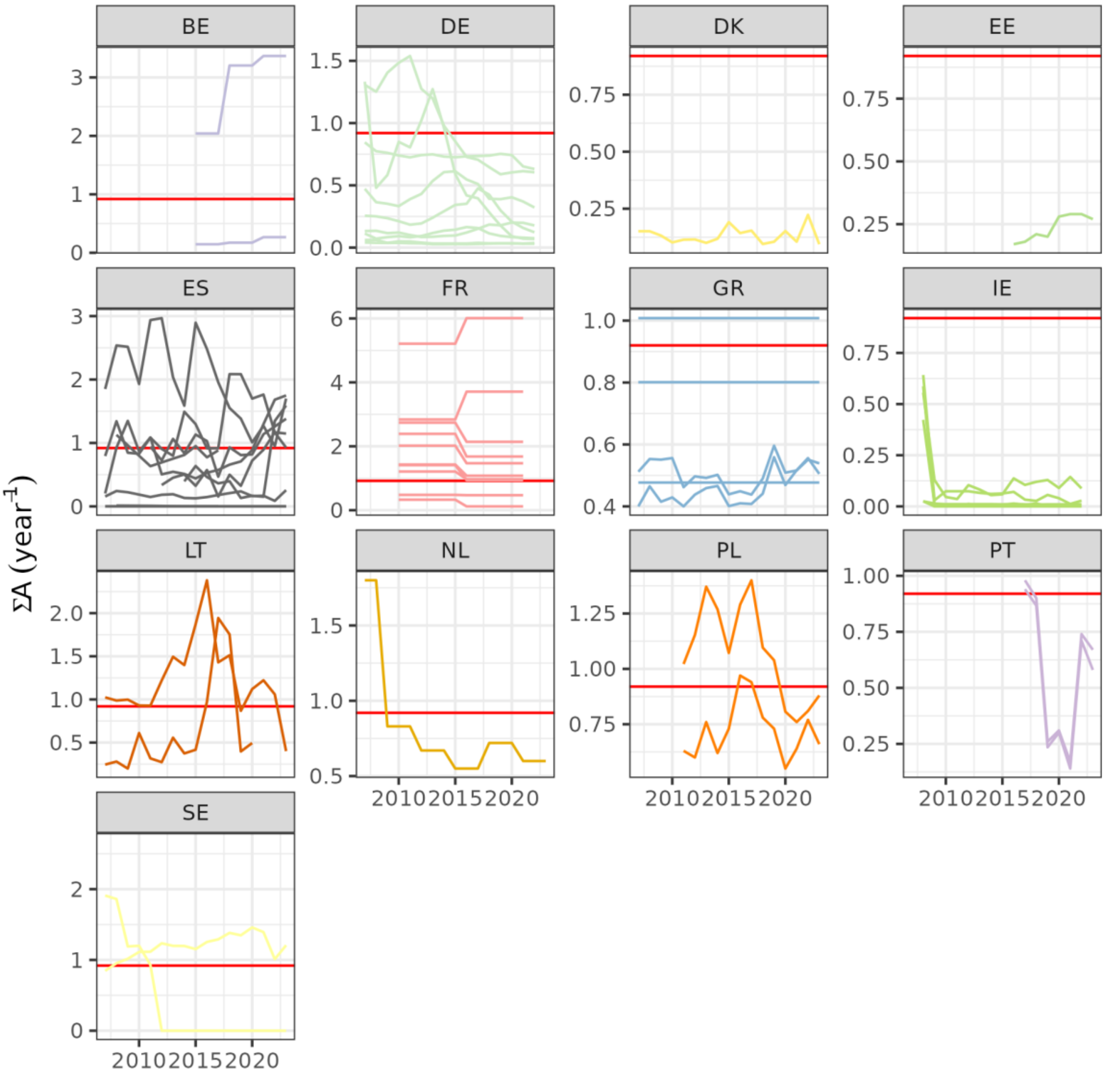

Figure 3.5: Reported total anthropogenic mortalities including fishing (ΣA) per Member State. Each coloured line represents a specific EMP. The red horizontal line stands for the 0.92 target.

Table 3.5: Results of Mann-Kendall test for monotonic trends per EMP for ΣA. 'n' represents the number of years for which estimates are available, while Δ is the difference between the earliest (Initial) and the most recently (Final) values reported. Tau represents the direction of the trend (positive = increase, negative = decrease) and p-value indicates the significance of the trend. Arrows indicate the detection of a significant increasing (↗) or decreasing trend (↘). Some member states (e.g. NL and FR) report the same value for several years and this might affect the results of the trend test.

EMP	Years	n years	Initial	Final	Δ	tau Kendall	p-value Kendall	trend
BE_Meus	2015-2023	9	2.04	3.37	1.33	0.87	0.00	↗
BE_Sche	2015-2023	9	0.15	0.27	0.12	0.87	0.00	↗
DE_Eide	2007-2022	16	0.04	0.04	0.00	-0.27	0.17	
DE_Elbe	2007-2022	16	1.31	0.60	-0.70	-0.75	0.00	↘
DE_Ems	2007-2022	16	0.11	0.07	-0.04	0.04	0.86	
DE_Maas	2007-2022	16	1.33	0.07	-1.26	-0.67	0.00	↘
DE_Oder	2007-2022	16	0.26	0.12	-0.13	-0.02	0.96	
DE_Rhei	2007-2022	16	0.84	0.63	-0.21	-0.41	0.03	↘
DE_Schl	2007-2022	16	0.06	0.03	-0.03	-0.58	0.00	↘
DE_Warn	2007-2022	16	0.13	0.18	0.04	0.39	0.04	↗
DE_Wese	2007-2022	16	0.47	0.32	-0.15	-0.04	0.86	
DK_Inla	2007-2023	17	0.15	0.09	-0.06	-0.07	0.71	
EE_Narv	2016-2023	8	0.17	0.27	0.10	0.69	0.02	↗
ES_Anda	2008-2017	6	1.13	0.88	-0.24	-0.07	1.00	
ES_Astu	2011-2023	12	0.94	1.38	0.44	0.18	0.45	
ES_Bale	2008-2017	4	0.01	0.00	-0.01		0.09	
ES_Basq	2012-2023	12	0.34	1.15	0.81	0.50	0.03	↗
ES_Cant	2014-2023	10	0.40	1.59	1.20	0.02	1.00	
ES_Cast	2007-2023	17	0.00	0.00	0.00	1.00	1.00	
ES_Cata	2007-2023	17	0.20	1.75	1.55	0.35	0.05	↗
ES_Gali	2007-2023	17	0.79	0.93	0.13	0.38	0.04	↗
ES_Inne	2007-2023	17	0.00	0.00	0.00	1.00	1.00	
ES_Minh	2017-2023	7	2.14	3.31	1.17	0.05	1.00	
ES_Murc	2007-2023	17	1.85	1.70	-0.15	-0.50	0.01	↘
ES_Vale	2007-2023	17	0.16	0.26	0.10	-0.07	0.71	
FR_Adou	2010-2021	12	2.39	1.68	-0.71	-0.74	0.01	↘

EMP	Years	n years	Initial	Final	Δ	tau Kendall	p-value Kendall	trend
FR_Arto	2010-2021	12	1.21	0.97	-0.24	-0.74	0.01	↘
FR_Bret	2010-2021	12	1.41	0.94	-0.47	-0.74	0.01	↘
FR_Cors	2010-2021	12	0.33	0.12	-0.21	-0.74	0.01	↘
FR_Garo	2010-2021	12	2.02	1.47	-0.55	-0.74	0.01	↘
FR_Loir	2010-2021	12	2.74	2.14	-0.60	-0.74	0.01	↘
FR_Meus	2010-2021	12	5.21	6.01	0.80	0.74	0.01	↗
FR_Rhin	2010-2021	12	2.84	3.71	0.87	0.74	0.01	↗
FR_Rhon	2010-2021	12	0.48	0.47	-0.01	-0.74	0.01	↘
FR_Sein	2010-2021	12	1.43	1.08	-0.35	-0.74	0.01	↘
GR_CeAe	2007-2023	2	1.01	1.01	0.00			
GR_EaMT	2007-2023	17	0.80	0.80	0.00	1.00	1.00	
GR_NorW	2007-2023	17	0.40	0.50	0.10	0.48	0.01	↗
GR_WePe	2007-2023	17	0.48	0.48	0.00	1.00	1.00	
GR_total	2007-2023	17	0.51	0.54	0.03	-0.01	1.00	
IE_East	2008-2022	15	0.42	0.01	-0.41	-0.60	0.01	↘
IE_NorW	2008-2022	15	0.56	0.09	-0.47	0.13	0.52	
IE_Shan	2008-2022	15	0.64	0.03	-0.61	-0.60	0.00	↘
IE_SouE	2008-2022	15	0.03	0.00	-0.03	-0.37	0.13	
IE_SouW	2008-2022	15	0.03	0.00	-0.02	-0.32	0.11	
IE_West	2008-2022	15	0.59	0.00	-0.59	-0.37	0.13	
LT_Lith	2007-2020	14	0.24	0.50	0.25	0.49	0.02	↗
LT_total	2007-2023	17	1.02	0.40	-0.62	0.04	0.84	
NL_Neth	2007-2023	17	1.80	0.60	-1.20	-0.52	0.01	↘
PL_Oder	2011-2023	13	1.02	0.88	-0.14	-0.38	0.08	
PL_Vist	2011-2023	13	0.63	0.66	0.03	0.06	0.81	
PT_Port	2017-2023	7	0.94	0.58	-0.36	-0.33	0.37	
PT_total	2017-2023	7	0.98	0.67	-0.31	-0.33	0.37	
SE_Inla	2007-2023	17	0.85	1.21	0.36	0.59	0.00	↗
SE_West	2007-2023	17	1.91	0.00	-1.91	-0.70	0.00	↘

Total anthropogenic mortalities ΣA are the sum of fishing ΣF and other anthropogenic mortalities ΣH, therefore it is not surprising to observe similar patterns for the fishing and non-fishing mortality indicators.

Fourteen EMUs display a significant decrease of ΣA, seven display a significant increase, but the majority show no significant trend; among them, 15 display a very low (<0.1) final ΣA.

3.1.1.3 Exploration of the possibility to achieve the management target given current recruitment levels

The Eel Regulation states that Eel Management Plans should enforce measures to reduce all sources of anthropogenic mortalities in their waterbodies to achieve an escapement of at least 40% of the escapement that would occur in a pristine situation. Theoretically, in a pristine situation, the absence of anthropogenic pressures for many generations leads the population to equilibrium in which, on average, the escapement B_0 produces a recruitment R_0. Of course, given the current depletion of the population (Dekker, 2003) and of the recruitment (ICES, 2024), current levels of recruitment are far below R_0 and it is questionable whether it is still possible to achieve the management target without first rebuilding recruitment.

In a pristine situation, and assuming an average natural mortality over the lifespan, escapement in an EMP e can be calculated as:

$$B_0(e) = \frac{w_S(e)}{w_R(e)} \cdot R_0(e) \cdot e^{-M_0(e) \cdot \Delta t(e)} \qquad (1.1)$$

with $\Delta t(e)$ the lifespan, $M_0(e)$ the average natural mortality, w_S and w_G the average weight of silver and glass eels, and $R_0(e)$ the recruitment in weight in the pristine situation in the corresponding EMP.

Conversely, in the absence of any anthropogenic mortalities, current escapement can be calculated in an EMP as:

$$B(e) = \frac{w_S(e)}{w_R(e)} \cdot R(e) \cdot e^{-M(e) \cdot \Delta t(e)} \qquad (1.2)$$

On average, current recruitment is estimated to be less than 10% of what it was in the pre-1980s (ICES, 2024). In this context, if the lifespan has remained the same, having $B(e)/B_0(e)$>40% while $R(e)/R_0(e)$<10% would require a drop of the natural mortality. This might occur because of compensatory density dependence mechanisms (Bevacqua *et al.*, 2011), but what would be the required decrease of natural mortality?

To achieve the target, assuming the lifespan hasn't changed, we need:

$$\frac{B(e)}{B_0(e)} \geq 0.4$$

$$\Leftrightarrow \frac{\frac{w_S(e)}{w_R(e)} \cdot R(e) \cdot e^{-M(e) \cdot \Delta t(e)}}{\frac{w_S(e)}{w_R(e)} \cdot R_0(e) \cdot e^{-M_0(e) \cdot \Delta t(e)}} \geq 0.4$$

$$\Leftrightarrow e^{(M_0(e) - M(e)) \cdot \Delta t(e)} \geq 0.4 \cdot \frac{R_0(e)}{R(e)}$$

$$\Leftrightarrow (M_0 - M) \cdot \Delta t \geq log\left(0.4 \cdot \frac{R_0(e)}{R(e)}\right)$$

$$\Leftrightarrow \left(M_0(e) - M(e)\right) \geq \frac{1}{\Delta t(e)} log\left(0.4 \cdot \frac{R_0(e)}{R(e)}\right)$$

The last equation indicates the reduction of natural mortality that would be required to achieve the target in the absence of anthropogenic mortality, given current levels of recruitment. $\frac{R_0(e)}{R(e)}$ is the ratio of pristine recruitment over current recruitment. Since recruitment trends are thought to be homogeneous across the distribution area, this ratio can be compared to the WGEEL indices.

Since lifespans vary among regions from a few years to decades and since the recruitment might still locally vary, we computed $\frac{1}{\Delta t(e)} log\left(0.4 \cdot \frac{R_0(e)}{R(e)}\right)$ for different levels of $\Delta t(e)$ and $\frac{R(e)}{R_0(e)}$.

Figure 3.6 indicates that for lifespans shorter than 15 years, the reduction of natural mortality should be larger than 0.138 $year^{-1}$, a value often used for the eel (Dekker, 2000). The situation is even worse if considering the North Sea index rather than the Elsewhere Europe index. Even at very long lifespan (30 years), the natural mortality should be reduced by 0.05 $year^{-1}$ (i.e. a reduction of M of about 36% compared to the standard 0.138 $year^{-1}$ value) when assuming that current recruitment is 8% of pristine recruitment (~ what Elsewhere Europe index indicates). This reduction is the average value over the whole lifespan of the individual, while density-dependent natural mortality is mainly restricted to younger ages.

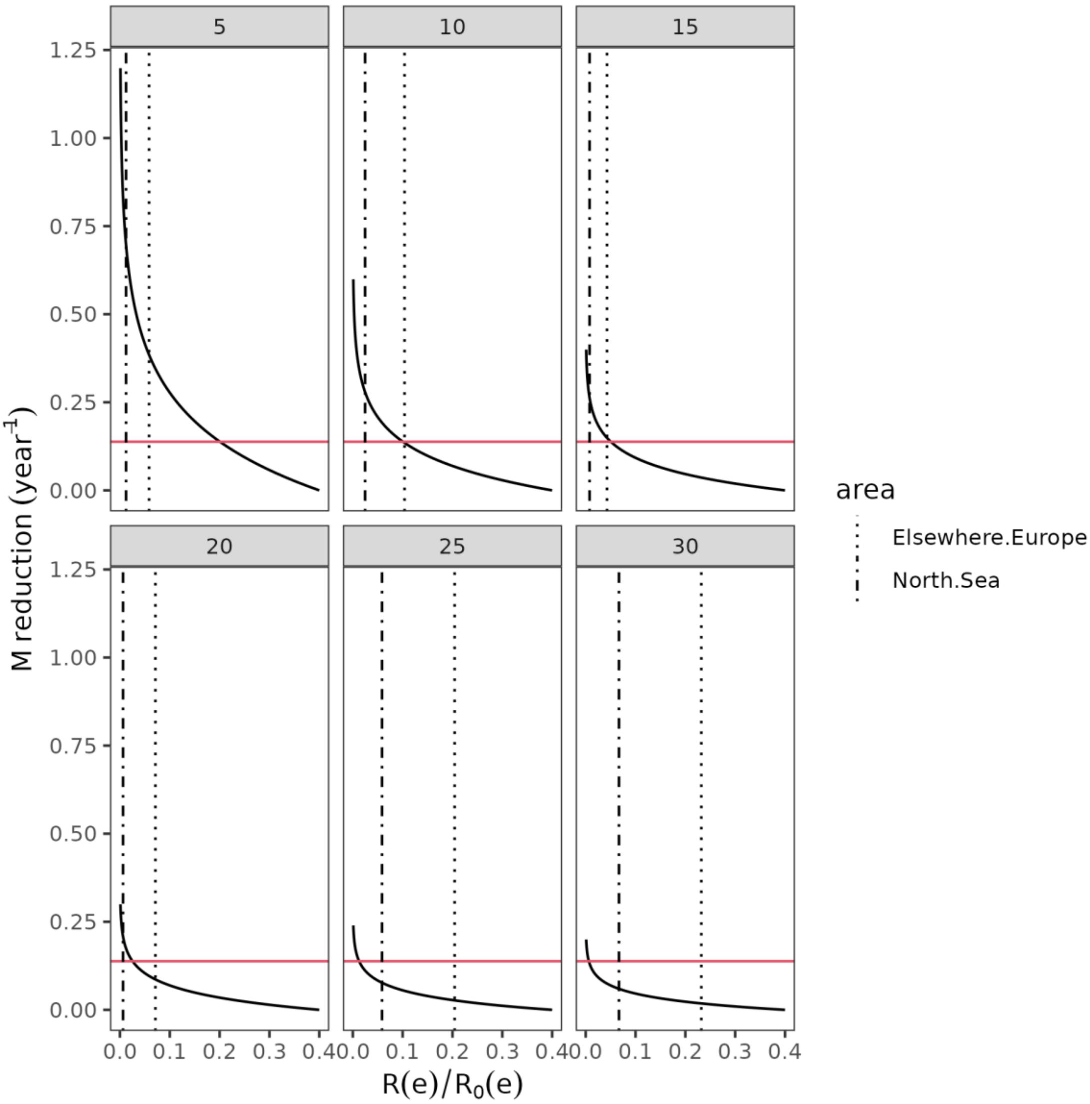

Figure 3.6: Reduction of average natural mortality over the lifespan that would be required to achieve the management target in an EMP given different levels of recruitment (x-axis) and lifespan (facet). The two vertical lines indicate the recruitment estimates from the WGEEL glass eel indices lagged according to the lifespan (i.e. lines for lifespan 5 corresponds to the recruitment estimates in 2024 - 5 = 1999). The horizontal line corresponds to a natural mortality of 0.138 year^{-1}

3.1.1.4 Biomass and Mortality Indicators Conclusions

As during the last WKEMP report (ICES, 2022), the caveats associated with the estimation of the different indicators and the lack of standardized methods among Member States to get these estimates, hinder the comparison of escapement and mortalities among Member States and with respect to the management target and mortality reference value. Moreover, a simulation exercise confirms that the current low recruitment all over the distribution area, drastically reduces the possibility to achieve the 40% escapement target of the Eel Regulation, in any EMPs. Although natural mortality decreases at low recruitment levels due to density-dependent mechanisms, the required reduction to compensate the low recruitment is unlikely to occur. Locally, current recruitment might be higher than the average 8% of pristine recruitment, but all WGEEL indices indicate that recruitment trends are generally homogeneous across the distribution. Following ICES (2022), we consider that trends are likely to be more reliable since methods used by Member

States are expected to often be consistent through time, although recognizing there can be issues with trends. Compared to ICES (2022), significant negative trends in anthropogenic mortalities are more frequent, suggesting an improvement in the situation. However, we still observe some increasing trends and some levels of fishing mortality that are of the same order of magnitude as 0.92, even in Member States in which escapement relies mainly on restocking. Reported values of other anthropogenic mortalities are smaller, but those estimates only account for a limited part of the stressors thought to apply to these areas.

Implementing the WKFEA roadmap (ICES, 2021) is critical to achieving or delivering the more standardized methods and more informative results in the future.

3.1.2 Fishing effort/catches target for outside EMPs [EC requests II.1, II.2]

The EU Eel Regulation stipulates that "catches of eels in Community waters seaward of the boundary of eel river basins defined by Member States as constituting natural eel habitats should be reduced gradually by reducing fishing effort or catches by at least 50% based on the average fishing effort or catches in the years 2004 to 2006". Member states were therefore asked to submit data on commercial eel fishing effort and/or catches outside of the area of their EMP(s).

Only Denmark reported that it had commercial eel fishing outside of the boundaries of the EMP, in marine open, coastal, and transitional waters. Denmark reported the total number of commercial gears used for eel fishing in these areas.

The reported data shows that in Denmark there has been a gradual reduction in number of gears used for eel fishing for all different gears used (figures 3.7 and 3.8), and that a 50% reduction in effort compared to the years 2004 to 2006 has been achieved. This reduction in fishing effort has been achieved by not issuing any new fishing licenses and not allowing the transfer of existing fishing licenses.

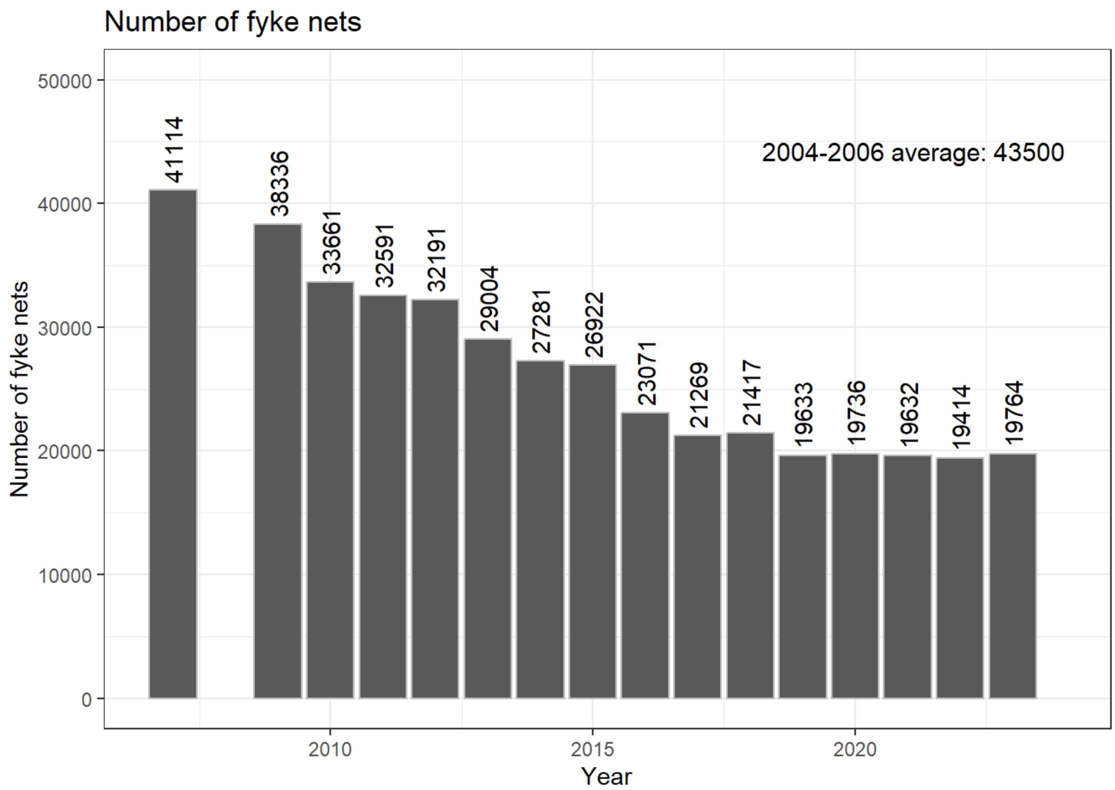

Figure 3.7: Trend in number of commercial fyke nets in areas outside of the Danish EMP. Numbers on the bars show the effort in individual years. In the top-right corner is listed the mean effort over the years 2004-2006.

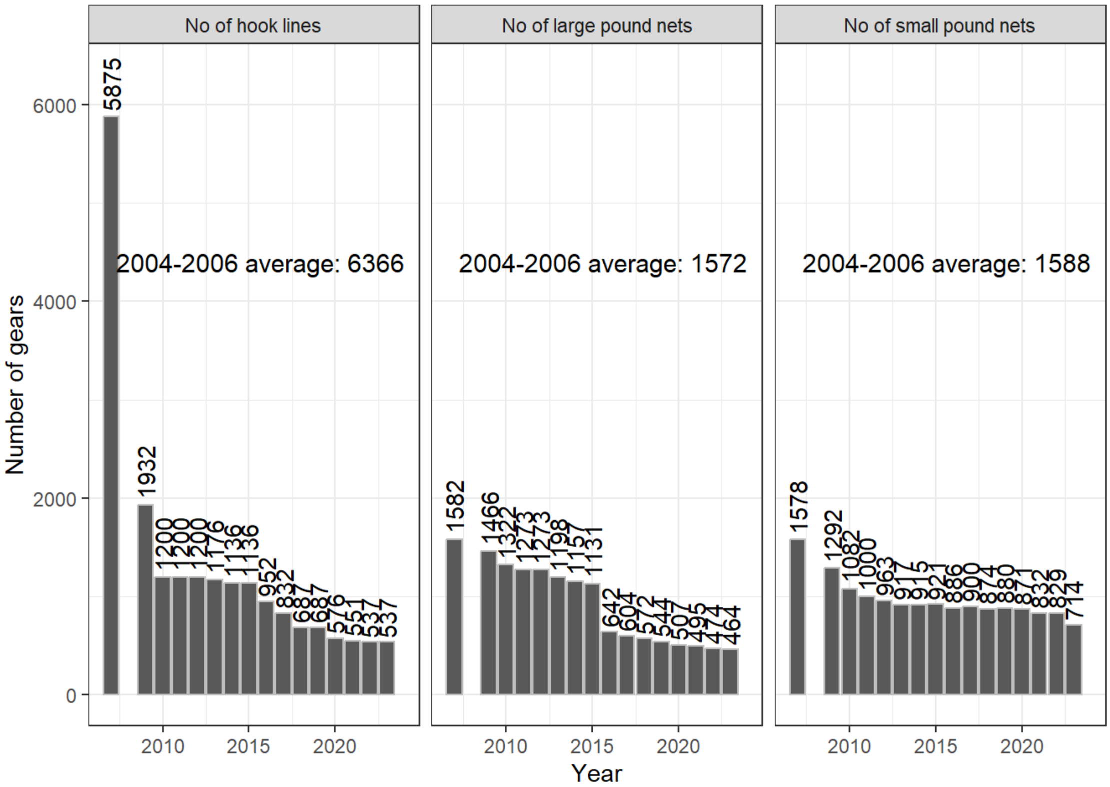

Figure 3.8: Trend in number of other commercial eel fishing gears (hook lines, large pounds nets, small pound nets) in areas outside of the Danish EMP. Large pounds nets are considered pound nets with a circumference of the pound of over 20 metres. Numbers on the bars show the effort in individual years. In the top-right corner is listed the mean effort over the years 2004-2006.

3.1.3 Small eels

3.1.3.1 Catch of eel <12 cm and their use [EC request IV.1, IV.2]

The European Eel Regulation requires monitoring of glass eel catches (those < 12 cm), and specifically reporting of the proportions designated for restocking as well as those for consumption.

The landings of glass eel are collected during annual data calls for ICES, with commercial landings dominated by French fisheries (Figure 3.9).

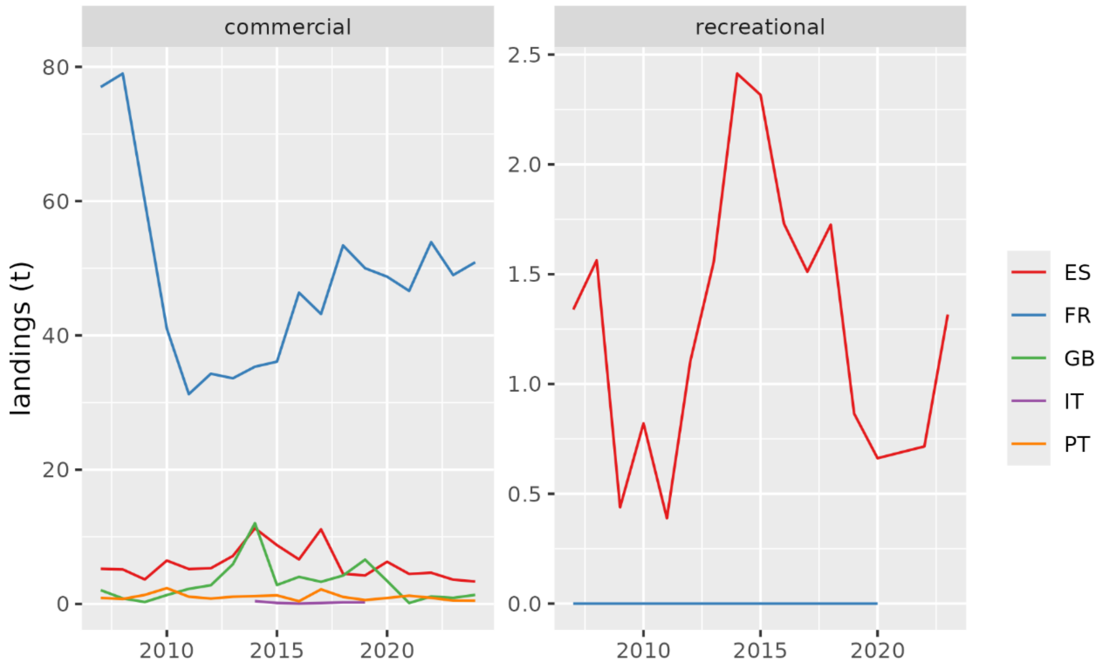

Figure 3.9. Reported landings of glass eel by the different EU Member States and other countries (United Kingdom), data provided via annual data calls for the WGEEL.

Among the glass eel producing countries of Europe, France monitors the RC category using a quota system, the UK monitors trade but has left the EU so does not take part in this reporting, Portugal has not reported any data, and Spain has no specific traceability system for glass eels, and a general system applied to all fishery products that does not allow the use (R or C) and country of destination to be identified. In France, quotas are divided among commercial fishers and other users, with a portion often designated for restocking purposes. Although France has an internal traceability system to follow the use of the glass eels landed (with the amount of reserved glass eel reported in Figure 3.10), once they leave France, the use for which they were exported (restocking or consumption) cannot be guaranteed. Ensuring this would require tracing the glass eels until they are released into the water in the glass eel source country or in others. While the implemented quota system in France aims to ensure that 60% of landed glass eels are used for restocking, we observe that the effective proportion is slightly lower (Figure 3.10).

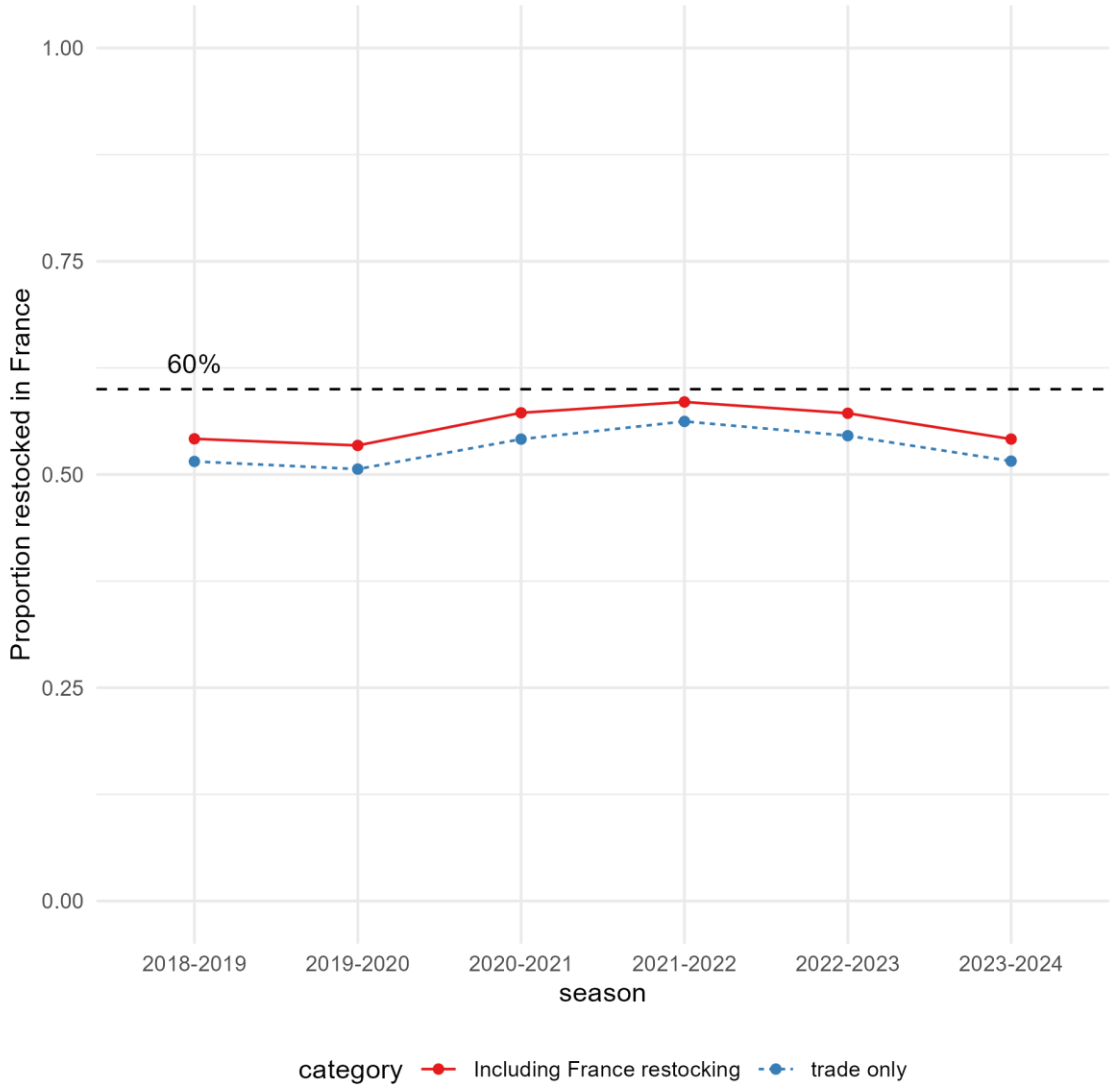

Figure 3.10: Proportion of glass eel marked as restocking material reported by France. Note that the trade only identifies the proportion of glass eel that was used in trade, 'including France restocking' includes the amount of glass eel released in France as part of its national restocking programme.

Figure 3.11 shows the reported final use of glass eels in other countries. WKEMP observes that CZ reports a large quantity of restocked glass eel but no import trade.

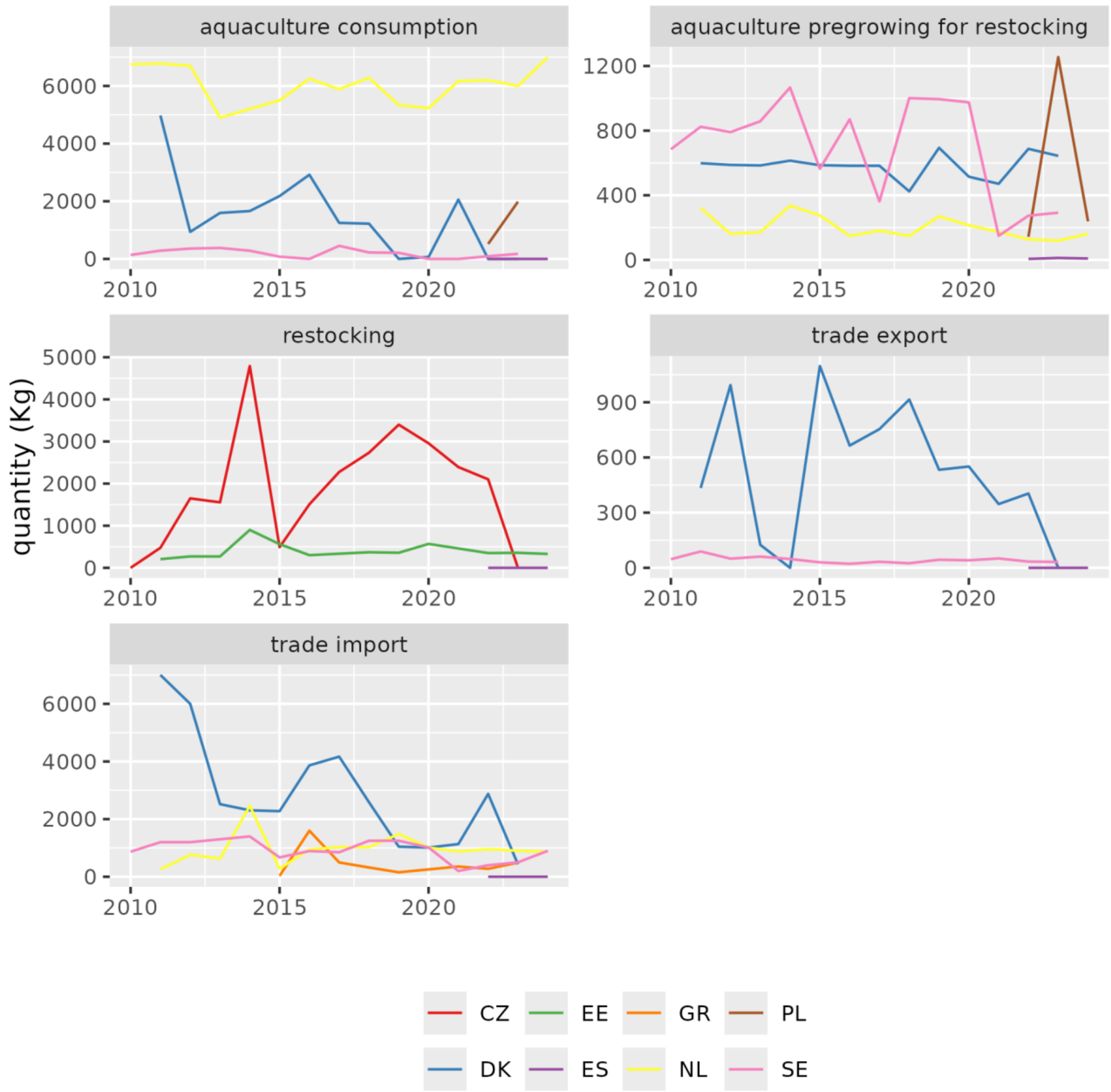

Figure 3.11: Use of glass eel <12 cm in the different Member States (for France, see Figure 3.10).

Among the Member States receiving eels <12 cm, the Netherlands, Finland, Greece, Poland, Czechia, and Sweden report import and export eels, including the RC category. The Netherlands have reported the import of glass eels from Spanish traders for the purposes of aquaculture, but since Spain is lacking a traceability system, this does not necessarily imply that the glass eels were caught in Spain. Greece claims to import glass eel for restocking from Spain but notes that the glass eels come from France. This could be explained by the fact that Spanish traders import glass eels from France.

Belgium, Germany, Italy, Latvia, and Lithuania did not report in Data Call Annex 16, (or reported it empty), while Latvia states it does not use small eels but it engages in restocking. Denmark reports the kilograms of eels used for aquaculture pre-growing for restocking, trade exports, and aquaculture consumption, but does not specify the countries of origin or destination. Albania, Turkey, Tunisia, and Norway do not use restocking or aquaculture and thus did not report.

3.1.3.2 Amount of eel < 20 cm transferred for restocking to increase escapement [EC request IV.3]

The European Eel Regulation mandates that EMPs specify the quantity of eels under 20 cm needed for restocking to enhance silver eel escapement levels.

Figure 3.12 shows the reported final use of eels less than 20 cm. All restocked eels < 20 cm were imported from other Member States (FR, SE, NL, DK, LT) that are consistent with the reported restocked quantity. Other Member States only reported restocking.

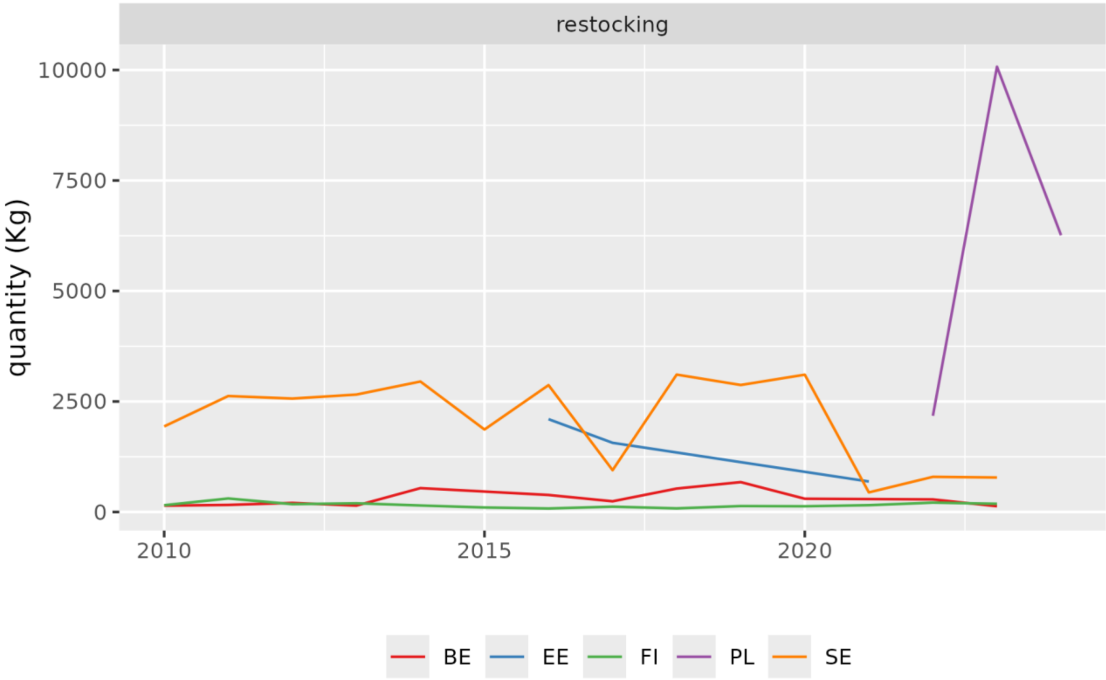

Figure 3.12: Use of eel < 20 cm in the different Member States (for France, see Figure 3.11).

3.1.3.3 Conclusions and Recommendations regarding the utilization of eels < 12 and < 20 cm

There is a clear need for an international traceability scheme during trade to monitor the destination of caught glass eels. Spain's failure to monitor the destination of glass eels and Portugal's lack of reporting mean that traceability cannot be applied at the source. The failure of many Member States (e.g. Belgium, Germany, Italy, Latvia, Lithuania, Denmark) to monitor trade origin, destination, or RC category means it is currently impossible to track the destination of glass eels.

The use of size categories like 12 cm and 20 cm is confusing to some. Reports of 20 cm eels are inconsistent, with some Member States reporting trade of larger eels but not in the 20 cm category. Due to significant growth variation in eels, separating them by size has little biological basis and quickly mixes different cohorts. Only the separation of glass eels and other categories should be used practically.

Even when RC categories are reported, they are not traced or separated, making it impossible to ensure that glass eels reserved for restocking are used for that purpose. Also, not having different categories for directly consumed glass eels or those used in the aquaculture complicates the tracking and management of eel stocks. Without clear categorization, there is a risk that eels meant for conservation efforts, such as restocking programs, could be diverted to the consumption or aquaculture markets. Additionally, combining these eels in one category can lead to inaccuracies in data on catch volumes and trade. Categorizing them separately, could improve traceability and ensure that eels destined for restocking programs are not diverted for other uses.

Finally, the lack of effective traceability severely impairs accurate eel stock assessments. Without it, data on catch volumes, origins, and destinations are unreliable, complicating efforts to estimate true fishing pressure and mortality rates. This gap not only weakens scientific assessments but also hinders conservation efforts, as much of the catch and trade may go unreported, often due to illegal fishing. Traceability is also essential for assessing the effectiveness of restocking programs and their impact on biomass indicators.

In conclusion, the glass eel traceability system in Europe is inefficient and fragmented:

- Some countries have reported internal traceability systems, but there is no traceability at the transnational level.
- The lack of transnational traceability raises concerns about the actual use of these eels, especially for restocking purposes.
- The size categories (<12 cm and 20 cm) lack a strong biological basis, as growth variations among eels make them difficult to classify. Only the separation of glass eels from other types should be considered in practice.
- The lack of effective traceability severely impairs accurate eel stock assessments.

Recommendations:

- Implementing a mandatory transnational traceability system to track eels from capture to their final destination to ensure the compliance with environmental regulations and international treaties and a proper stock assessment. In the case of restocked eels, this means that a separate monitoring of the material type (R or C) is carried out throughout the trade chain, until they are released into the water. This monitoring would avoid that glass eels are diverted to other, potentially illegal, uses.
- The traceability system should also separate glass eels intended for direct consumption from those intended for growing in aquaculture facilities.

3.1.3.4 Restocking target [EC request V.1]

In Spain, as there is no traceability system, it is not possible to assess if the 60% restocking target is met and none of the Spanish EMPs allowing glass eel fisheries have declared to meet their target.

France has been implementing a national restocking programme aiming to reserve 60% of its glass eel catch for restocking, with 5-10% of its glass eel catches stocked annually in France, and the remainder exported for restocking elsewhere. Figure 3.10 shows that the effective proportion is slightly lower.

3.1.4 Time schedule for achieving escapement target [I.6]

According to the Regulation, each EMP shall contain a time schedule for the attainment of the target level of escapement, following a gradual approach and depending on an expected recruitment level; it shall include measures that will be applied as of the first year of application of the

EMP. However, no time schedules for EMPs and their escapement targets have been reported in any data call annexes – admittedly, these were not explicitly requested. Thus, we currently lack data to evaluate this issue. The most relevant annex for this information would have been Data Call Annex 13 (EMP overview), but time schedules are not requested there.

3.1.5 Any other target(s) established by Member States) [EC request VI]

Member States could set other targets in their EMPs, in addition to those required by the Eel Regulation. WKEMP4 was tasked to identify such targets, and to quantify their levels of implementation and effectiveness. Therefore, in Data Call Annex 14, Member States were asked to identify those measures which had specific management targets (and units) defined, to quantify the achievement of these targets or, where it was not possible to quantify effectiveness, to give a subjective, semi-quantitative estimate of the level of achievement (none, low, intermediate, high, full).

Some targets and/or their level of achievement are reported outside the EMP Progress Reporting system, and some Member States made references to other documents here or in Data Call Annex 17.

4 ToR c) Evaluate the effectiveness and outcome of types of measures

4.1 Introduction

The EC request to ICES for technical evaluation specifically relates to types of management measures implemented by Member States. The EC is interested in quantifying the effect management measures have at a River Basin District (RBD) or Eel Management Plan area (EMP) level on the eel population. This chapter addresses the Terms of Reference c) and evaluating the effectiveness and outcome of different types of measures in terms of

i) the status of implementation of planned measures;
ii) where available, quantification of their effects; and
iii) the likelihood that these measures need to be increased, or others deployed to achieve the targets set for EMPs.

For the first time, Member States were also asked to provide measures relevant to the protection of eel outside the EMPs and these are summarized in Section 4.3.1. Further evaluation of measures was limited to measures reported as a part of an EMP or an amended EMP.

4.2 Data call and response to the data call

EU Member States were asked to report eel management measures at the EMP level (Data Call Annex 14). The data call annexes were pre-filled with measures building on previous reporting (see WKEMP 3; ICES, 2022) and Member States were asked to update these and report any new management measures. Importantly, an option was provided to delete entries (e.g. duplicates or redundant measures) and measure/sub-measure types may have been changed; hence, the data is not necessarily directly comparable to previous evaluations. Note that not all reported measures are necessarily fully implemented (see Section 4.3.2).

Member States were asked to report measures and the status of their implementation according to nine different types of measure: 'Commercial fishery', 'Recreational fishery', 'Stocking', 'Hydropower and obstacles', 'Habitat improvement', 'Eel trade and marketing', 'Eel governance', 'Scientific monitoring', and 'Other'. In the following section, the status of implementation will be described.

Thirteen Member States (BE, CZ, DE, DK, ES, FI, FR, GR, IE, LT, NL, PT, SE) responded to the data call in 2024. During the first meeting of WKEMP4, the responses were reviewed and a follow up request (including an amended Data Call Annex 14, alongside a guidance document) was distributed by ICES in January 2025 as the data call, part 2. This part 2 sought to clarify misunderstandings and specifically ask Member States to complete columns on the targets/level of achievement and the effectiveness of measures, where deemed technically quantifiable. Both data call parts are available at https://doi.org/10.17895/ices.pub.25816738.v3.

Eight Member States responded to the data call, part 2 (BE, DE, ES, FI, IE, NL, SE), including one that had not previously reported (PL). For Member States that did not respond, data as previously reported (ICES, 2022) was used. In total, data was available on 1 011 measures (653 as part of EMPs) from 18 Member States and 69 EMUs.

Comparability between Member States is not given since reporting is at the EMP-level and the considerable differences between Member States in the way they have defined their EMPs precludes direct like-for-like comparisons. Some have declared the entire territory under one EMP, whereas others have up to 12 EMPs. This makes it difficult to compare the number of measures between Member States, as the same measure may be reported multiple times in a Member State within several EMPs but only once in a Member State with a single EMP. Four Member States reported both on individual EMPs and an additional national-level total of measures. While in some cases these are seemingly country-wide measures not reported within the individual EMPs, in other cases they seem to be reported twice, effectively resulting in the duplication of measures. Since this distinction cannot be made by WKEMP with certainty and effectively resembles the issue with multiple vs a single EMP per Member State, measures reported as national totals were kept in the analysis.

4.3 List of measures for each MS/EMP and the status of implementation of planned measures

Six Member States only reported on measures that were planned in their EMPs (Figure 4.1). The other Member States also included measures that were planned in addition to their EMPs. Greece exclusively reported measures under the "other" category (e.g. according to EU closures and the WFD, rather than according to their EMPs). A total of 61% of all reported measures were planned in an original or amended EMP. Another 36% were not categorized and stated as "other" while approximately 1% of reported measures related to the EU closure (six-month fishing ban in coastal and transitional waters; Council Regulation (EU) 2024/257) or related to the implementation of the WFD.

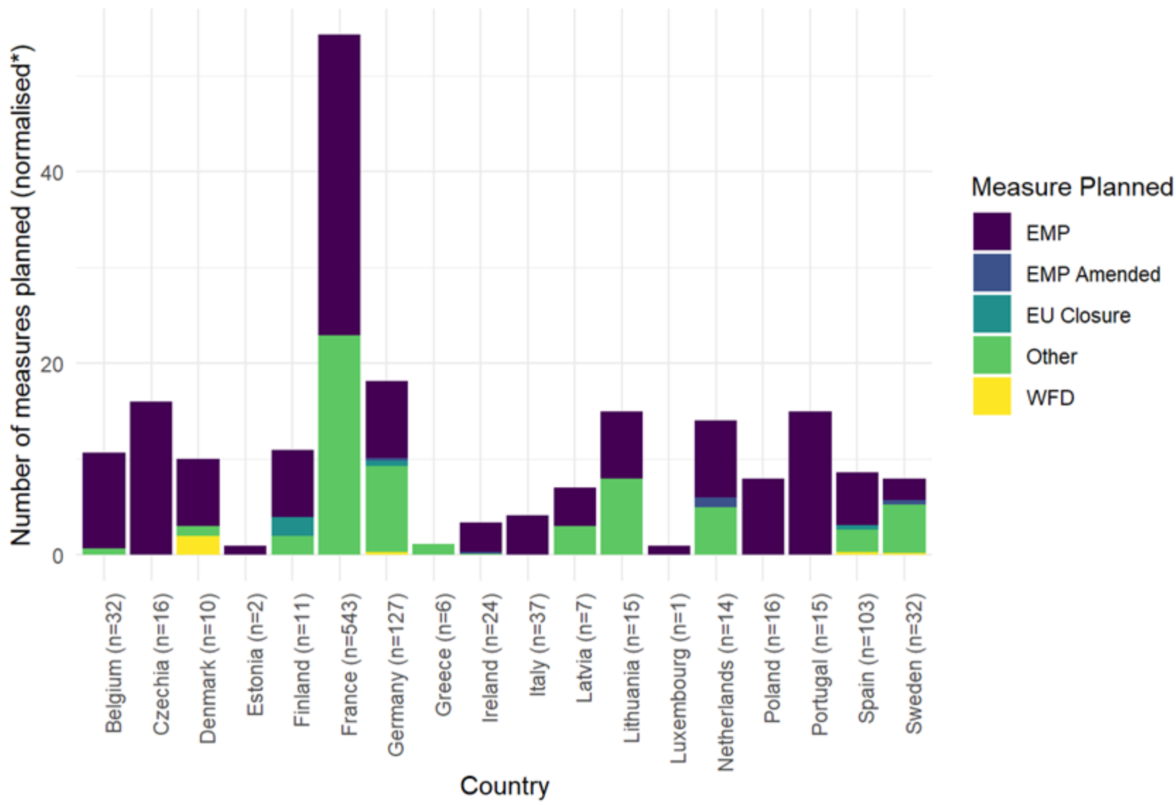

Figure 4.1. The normalized* number of reported measures reported on in the data call per EMP in each Member State (country). Colours indicate whether the reported measure was planned in the EMP and amendment of the EMP, or for the EU fishing closure, WFD or as part other frameworks.
*** Member state values are divided by the number of EMPs in that Member State, for visualization, while absolute values are given in the x-axis labels.**

4.3.1 Non-EMP measures

This section gives a brief overview of measures that were reported as not being part of the EMPs but have relevance for the management of the European eel. All following sections will only address measures that were reported as part of the original or amended EMPs.

Half of the 'Commercial fishery' measures were reported in the category "other". 'Commercial fishery' is by far the most dominant type of measure reported outside the EMPs (Figure 4.2); France contributed 219 measures, all about reducing the number of fishing licenses for each EMP and in each year since 2014. These are considered by the data providers as either intermediate or high impact measures, depending on the year.

For the lower impact type of measures 'Scientific monitoring', 34% were reported in the category "other". The way of reporting 'Scientific monitoring' seems to differ between Member States, sometimes mentioning one general measure, while other Member States, like Spain or Sweden, list up to 19 individual projects.

Within 'Hydropower and obstacles', 14% of the measures are reported in the category "other". Often trap and transport or installation of eel passages is mentioned along with research and general improvements to connectivity. The impact of these measures is mostly estimated by the data providers to be intermediate or high. For measures on 'Recreational fisheries', 24% are reported in "other" category, and (temporary) bans or bag limits are considered by the data providers to range from low to high impact. ‘Habitat improvement’, like predator control or water quality, and ‘Governance’, such as raising awareness, were less present in the “other” category, and sometimes stated as having respectively high but, by their nature, indirect impacts on the European eel.

The number of reported non-EMP measures per type of measure and the percentage of the level of impact in each measure type in each country is given in Annex 7, Fig A7.1.

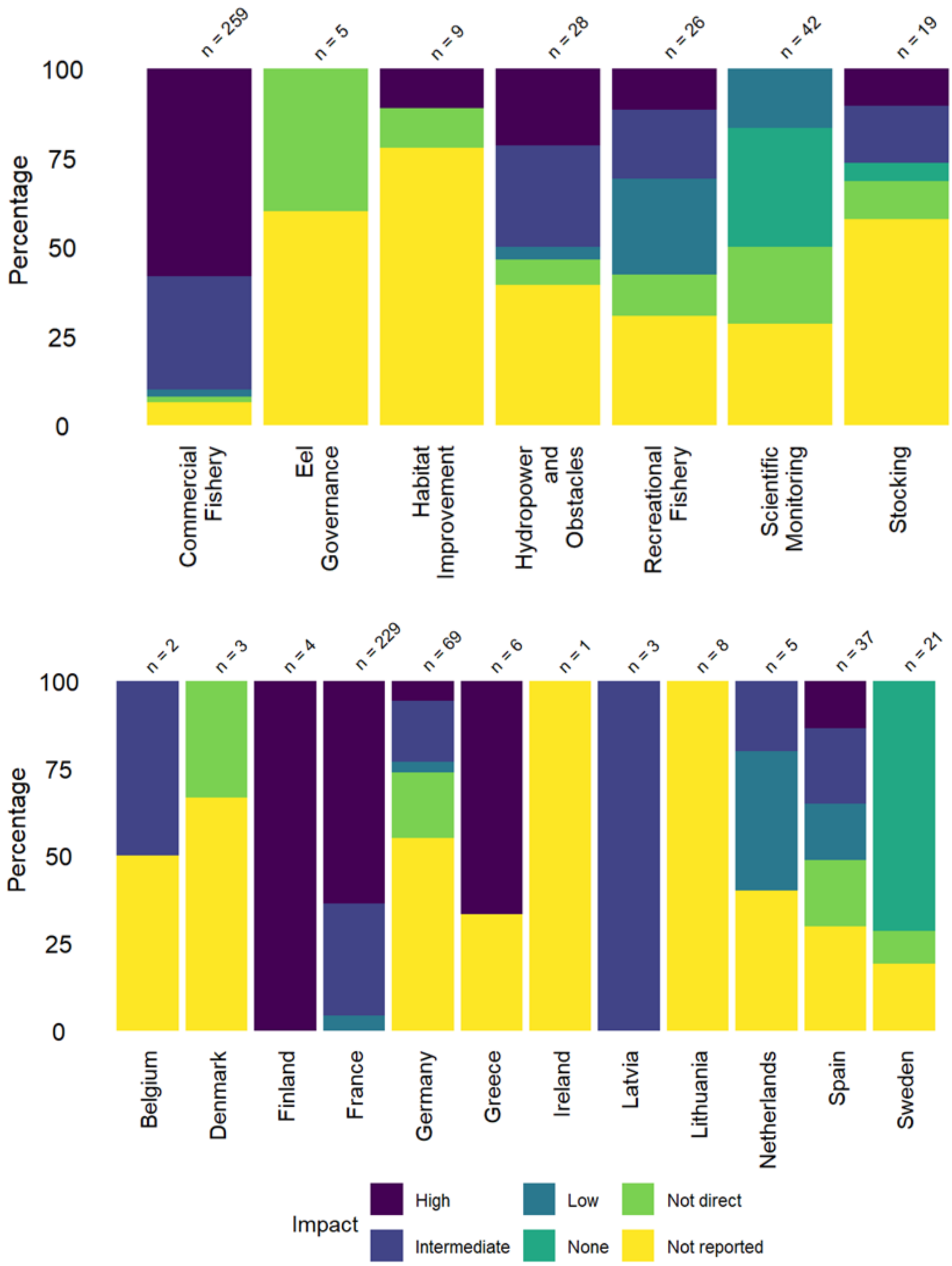

Figure 4.2 Percentage of the level of perceived impact of measures (reported by Member States), for non-EMP measures, by type of measure (top) and Member State (bottom). Absolute number of measures is displayed above the bars. See Annex 7, Fig A7.1 for percentage by type of measure in each Member State.

4.3.2 EMP measures

4.3.2.1 Status of implementation

A total of 623 measures planned within EMPs were reported from 17 Member States. Most common measures, by type, in ascending order, were 'Commercial fishery' (199), 'Hydropower and obstacles' (103), 'Scientific monitoring' (84), 'Recreational fishery' (82), 'Stocking' (61), 'Habitat improvement' (56), 'Eel trade and marketing' (22) and 'Eel governance' (16) (Table 4.1 and Figure 4.3). Most measures, as well as most judged by data providers to have high or intermediate impacts, were implemented in the first few years after the Eel Regulation (EC 1100/2007) was adopted (Figure 4.3).

Table 4.1 Reported number of EMP measures per type of measure in each Member State, the number of EMPs in each Member State, and the percentage of each measure type of the total number of measures in each Member State (in parentheses). One trap and transport measure in Czechia is listed here as Hydropower and Obstacles, although originally reported as "other". Due to reporting technicality, "country total" is included as one additional EMP in Ireland, Belgium, Sweden, and Czechia.

Member State	no. of EMPs	Commercial Fishery	Eel Governance	Eel Trade and Marketing	Habitat Improvement	Hydropower and Obstacles	Recreational Fishery	Scientific Monitoring	Stocking
Belgium	3	3 (10%)	2 (6.7%)	1 (3.3%)	5 (16.7%)	9 (30%)	5 (16.7%)	3 (10%)	2 (6.7%)
Czechia	1	1 (6.2%)	3 (18.8%)	0 (0%)	3 (18.8%)	3 (18.8%)	3 (18.8%)	1 (6.2%)	2 (12.5%)
Denmark	1	1 (14.3%)	0 (0%)	0 (0%)	2 (28.6%)	1 (14.3%)	1 (14.3%)	0 (0%)	2 (28.6%)
Estonia	2	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)
Finland	1	1 (14.3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (14.3%)	4 (57.1%)	1 (14.3%)
France	10	96 (30.6%)	3 (1%)	20 (6.4%)	29 (9.2%)	50 (15.9%)	38 (12.1%)	60 (19.1%)	18 (5.7%)
Germany	7	19 (32.8%)	7 (12.1%)	0 (0%)	5 (8.6%)	4 (6.9%)	8 (13.8%)	3 (5.2%)	12 (20.7%)
Ireland	7	0 (0%)	0 (0%)	1 (4.3%)	0 (0%)	13 (56.5%)	6 (26.1%)	3 (13%)	0 (0%)
Italy	9	21 (56.8%)	0 (0%)	0 (0%)	1 (2.7%)	2 (5.4%)	6 (16.2%)	0 (0%)	7 (18.9%)
Latvia	1	1 (25%)	0 (0%)	0 (0%)	0 (0%)	1 (25%)	0 (0%)	1 (25%)	1 (25%)
Lithuania	1	3 (42.9%)	0 (0%)	0 (0%)	1 (14.3%)	1 (14.3%)	1 (14.3%)	0 (0%)	1 (14.3%)
Luxembourg	1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)	0 (0%)	0 (0%)	0 (0%)
Netherlands	1	4 (44.4%)	0 (0%)	0 (0%)	0 (0%)	2 (22.2%)	2 (22.2%)	0 (0%)	1 (11.1%)
Poland	2	8 (50%)	0 (0%)	0 (0%)	0 (0%)	2 (12.5%)	4 (25%)	0 (0%)	2 (12.5%)
Portugal	1	11 (73.3%)	0 (0%)	0 (0%)	1 (6.7%)	1 (6.7%)	2 (13.3%)	0 (0%)	0 (0%)

Member State	no. of EMPs	Commercial Fishery	Eel Governance	Eel Trade and Marketing	Habitat Improvement	Hydropower and Obstacles	Recreational Fishery	Scientific Monitoring	Stocking
Spain	8	24 (36.4%)	0 (0%)	0 (0%)	9 (13.6%)	10 (15.2%)	5 (7.6%)	9 (13.6%)	9 (13.6%)
Sweden	4	5 (45.5%)	1 (9.1%)	0 (0%)	0 (0%)	3 (27.3%)	0 (0%)	0 (0%)	2 (18.2%)

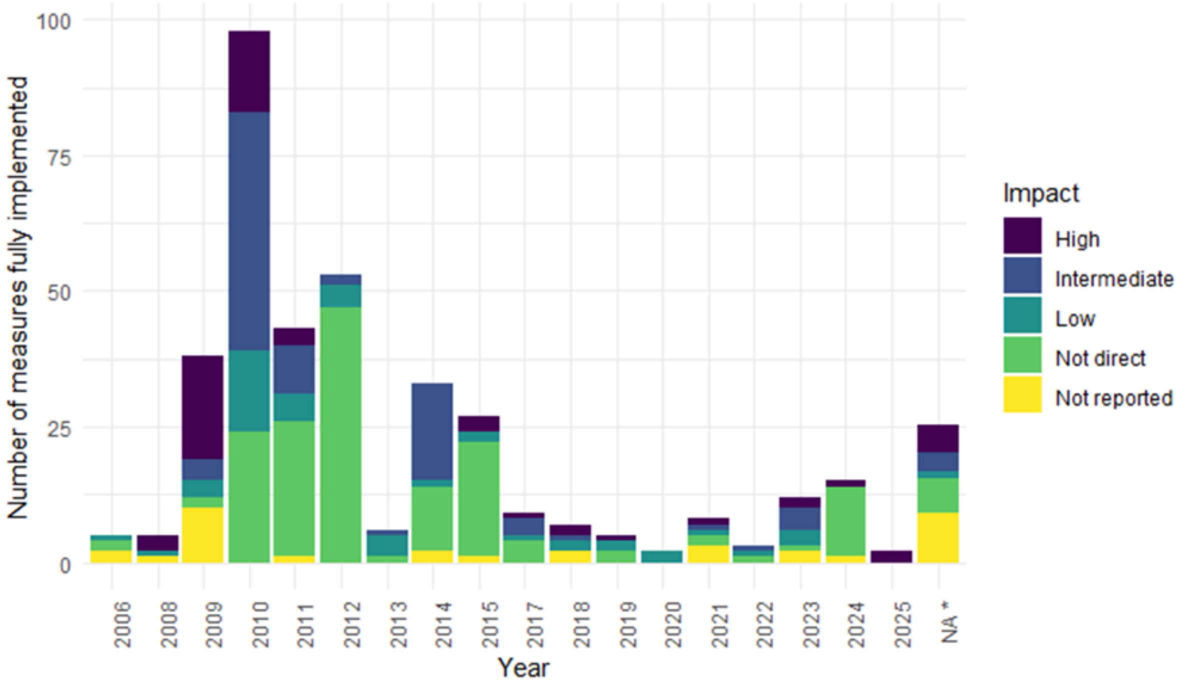

Figure 4.3 Number of fully implemented measures and their impacts, as reported by Member States, by year. NA * (no year reported); bar showing NA is divided by 10 for better visualization.

A total of 75% of the measures were deemed fully or partially implemented (Figure 4.4). The highest percentage of measures reported as fully implemented is 'Eel trade and marketing' but with only 22 measures in total, followed by 'Scientific monitoring' and 'Stocking' with 84 and 61, measures, respectively. For other types of measure approximately 50% or fewer measures have been fully implemented. Notably, in the type 'Habitat improvement' less than 20% of measures are fully implemented while for more than 50% no information was provided on the progress or it was considered not pertinent.

The progress reported by Member State shows considerable variation (Figure 4.4). While Estonia is the only Member State that reported all measures as fully implemented, though they only reported two measures, many countries have 75% or more of the measures fully or partly implemented. Ireland, Czechia, France, and Germany are the only Member States who have reported some measures as not implemented; stopped measures were reported for France and Spain only, although stopped measures from other Member States may have been deleted by the data call-responder. No data is available from Italy and Luxembourg.

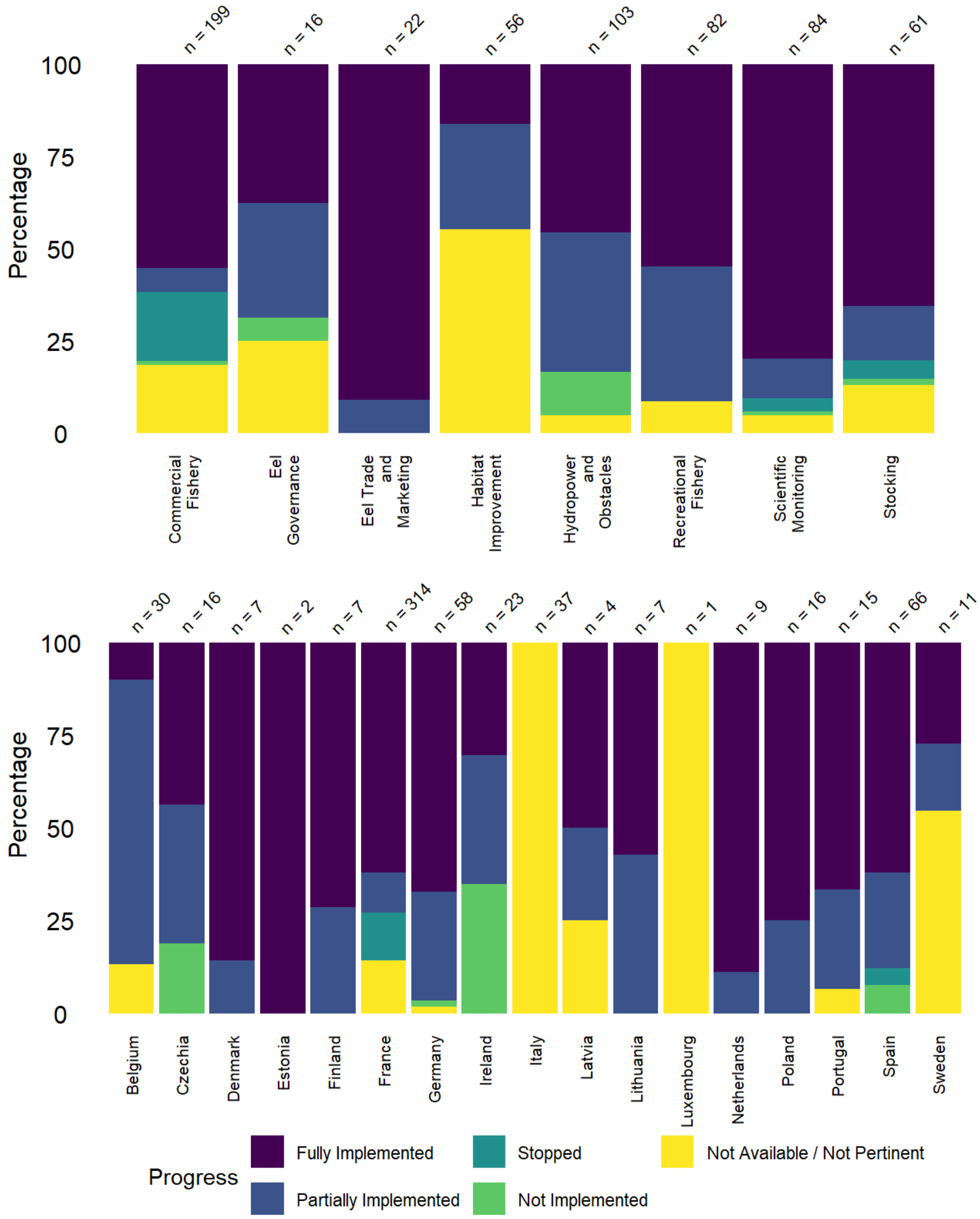

Figure 4.4: Percentage of the level of implementation of measures, by measure type (top) and Member State (bottom). Absolute number of measures is displayed above the bars. See Annex 7, Fig A7.2 for percentage by measure type in each Member State. Only measures reported as planned within EMPs are considered.

4.4 Quantify effects of measures [EC request III.3]

On the difficulty to assess EMP progress and measures effectiveness

Quantifying the effect of the reported measures was challenging for the WKEMP4, as in many cases there were no reported metrics or monitoring to indicate whether the measures were effective or not, and the absence of other data, such as the year of implementation further complicated the analysis. Even with full reporting, the quantification of direct effects on the eel stock is likely only possible for a few types of measures: 'Commercial fishing', 'Recreational fishing', and 'Hydropower and obstacles', making the effectiveness of other measure types – which may have indirect effects – more difficult to assess. Note, that 'Stocking' has a direct effect on a regional level and is thus also addressed below, but there is currently no evidence that it has a net beneficial effect on the whole stock level and is therefore not considered as a measure with direct effects on the panmictic stock.

Since the implementation of EMPs, Member States have submitted five progress reports to the EU, in four of which the results on the estimated indicators have been evaluated by ICES (this report, (ICES, 2013, 2018, 2022)). There are several issues that can affect the accuracy of mortality and biomass indicators, which makes it difficult to make like-for-like comparisons between indicators, especially between Member States using different methods to derive these indicators. This complicates an accurate assessment concerning some of the questions raised by the EC, i.e. to quantify the effectiveness of types of measures (WKEMP4) and progress with respect to the objectives in the Eel Regulation (in general). The key challenges are summarized below:

- **Diversity of anthropogenic pressures:** the European eel is affected by a diversity of anthropogenic threats, some of which cannot be directly quantified (e.g. fisheries or turbines instantaneously "kill" individuals, while degraded habitat quality, pollution or diseases usually have more indirect effects, or are hard to quantify) (Drouineau *et al.*, 2018). As such assessing the reduction in mortalities or the increase in escapement for more indirect measures is a highly challenging task and it is almost impossible to compare the relevance or outcomes of measures targeting threats of different natures.
- **Effects of measures have different time scales:** while a measure that reduces fisheries or turbine mortality has a direct and immediate effect, other measures (e.g. habitat restoration) usually take effect over a longer period, covering the lifetime of individuals or even over multiple generations. As such, assessing the effectiveness of measures expected to be 'slow acting' through indicators of escapement or mortality only, might suggest that management measures operating on long time scales are ineffective, whereas in the long run, they may have a very large effect.
- **No information on the oceanic phase:** Silver eels migrate to the spawning grounds in the Sargasso Sea, which is a very long journey (Wright *et al.*, 2022). Very little is known about this migration route. Although the Eel Regulation sets the escapement target for the seaward boundary of the EMP, not the spawning waters, so the oceanic phase is not strictly in the scope of WKEMP4, conservation of the eel population requires the maximization of spawner quality as well as abundance. Silver eels of low quality (e.g. due to pollution/diseases/parasites) might suffer high mortality during this route.

- ◦ **Different spatial scales**: the eel is panmictic and therefore, the dynamics should be analysed at a large spatial/biological scale, preferably at the whole stock scale. However, analyses at the whole stock scale are not feasible within the scope of an evaluation of EU Member States and their EMPs because not all 'range states' are EU Member States.
- ◦ The Eel Regulation has been adopted to evaluate the measures at the EMU scale, which is smaller than the stock scale, but still much larger than the local scale. However, many management measures have local effects on a small fraction of the EMP. So, while a measure might be relevant locally, it might have limited impact at the EMP-scale and hence judging it at the scale of the whole EMP does not make sense.
- ◦ **Post-evaluation of measures**: There is often no mechanism of post-evaluation integrated in the national management frameworks – certainly, EMP progress reports have shown little evidence of such post-evaluation. It is not possible to carry out post-evaluation at the international level, if it is not carried out at a more local level (Dekker, 2003, 2010).
- ◦ **Lack of baseline information:** Many EMUs started monitoring after implementation of measures. Without initial baseline information, it becomes difficult to determine whether the implemented measures have a significant impact or to quantify their effectiveness.
- **Some measures do not act in isolation of others, and therefore their effects should be taken into account together:** Particularly where escapement biomass indicators are used to determine change, the effects of some measures can be cumulative, e.g. increased recruitment leads to increased yellow eel abundance, reduced yellow eel exploitation leads to more silver eels, screening of turbines leads to increased escapement, but that increased escapement is the effect of all three measures, not any one alone. On the other hand, some measures depend on other measures to work. For example, it is not very effective to take measures at a location that is not safe either due to migration barriers or due to the occurrence of diseases/parasites or pollution. Another example is that restocking glass eels upstream from a hydropower stations will cause additional mortality when migrating downstream unless coupled with a Trap and Transport programme.

Representativeness of the data on the number of measures

The total number of measures within each type is unlikely to reflect the total sum of effort. Some measures are directly affecting (silver) eel mortality or escapement (e.g. fishing or hydropower mortality), whereas others only indirectly support the survival of eel (e.g. eel health by reducing contamination levels in eel habitats). Possibly, measures that indirectly influence eel survival are less likely to be fully reported as the effect is not always clear. An example is that some EMPs have reported measures obliged by the Water Framework Directive (e.g. improve water quality), whereas others have not, even though the WFD applies to all Member States. Also, the measures planned in the EMPs are more likely to be reported as they are clearly developed for eel and clearly stated as measures to decrease anthropogenic mortalities. Therefore, the sum of measures represents what is reported, but without a standard procedure to define what is and what is not a measure, the data call will be interpreted differently depending on who answered. This results in a difficulty in comparing the data across EMPs.

Representativeness of the data on monitoring the effectiveness of measures

The effectiveness of a large proportion of the measures was not reported in Data Call Annex 14 or is not monitored (Figure 4.5, Table 4.2). A reason might be that, especially for indirect measures, it is difficult to monitor their effect on the eel population and the monitoring would require a lot of effort. Therefore, it is not surprising that mainly measures in the types 'Commercial Fisheries', 'Recreational Fisheries' 'Stocking' and 'Hydropower and Obstacles' are reported as being monitored, as the effect of the measures in these types is easier to quantify in terms of their effects on $B_{current}$ and ΣA compared to the measures in the other types.

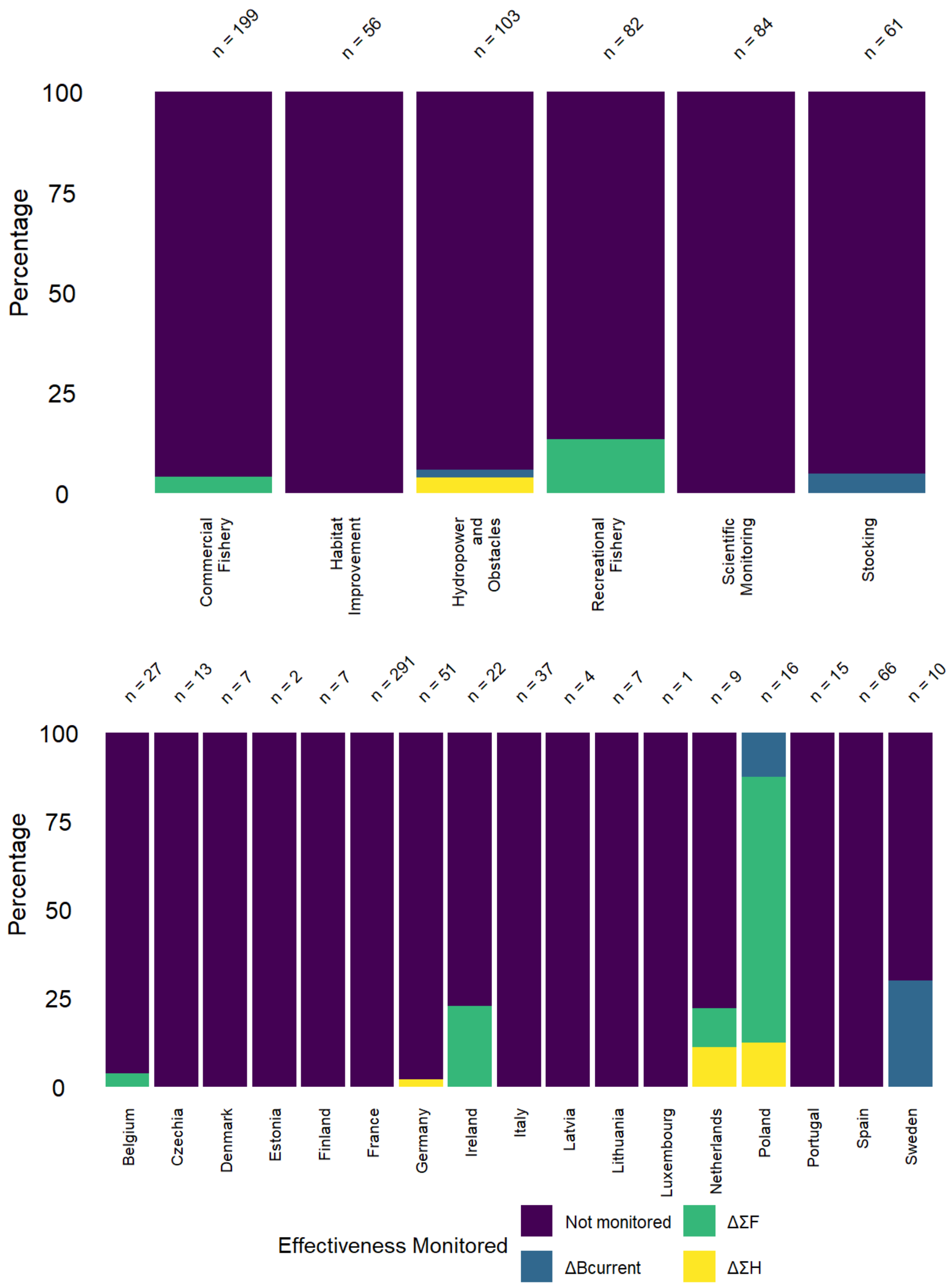

Figure 4.5: Percentage of available estimates for monitoring of measures effects on stock indicators (ΔΣF, ΔΣH, $B_{current}$ or "other") by type of measure (top) and Member State (bottom). Absolute number of measures is displayed above the bars. See Annex 7, Figure A7.3 for percentage by type of measure in each Member States. Only measures reported as planned within EMPs are considered.

Table 4.2: Count of measures with a direct effect on the eel stock and the percentage of measures where effects on the respective biomass and mortality indicator (ΔΣF, ΔΣH, $B_{current}$ or "other") was reported. Types of Measure 'Scientific monitoring', 'Eel governance' and 'Trade & marketing' and 'Habitat improvement' were not classified as direct measures and are therefore not included in this table.

Commercial fishing (submeasure type "other" excluded)

submeasure_type	total	Other	$\Delta B_{current}$	ΔΣH	ΔΣF	ΔΣA	Not monitored
Ban of fishery	9	11%	0%	0%	11%	0%	78%
Capacity reduction (licences/vessel)	4	25%	0%	0%	25%	0%	50%
Effort reduction (n/size of gears)	12	8%	8%	0%	17%	0%	67%
Effort reduction (others/not specified)	15	7%	13%	0%	7%	0%	73%
Effort reduction (spatial)	5	40%	0%	0%	0%	0%	60%
Effort reduction (temporary)	33	6%	3%	0%	30%	0%	61%
Min. size	11	0%	27%	0%	18%	0%	55%
Setting of quotas	11	9%	0%	0%	55%	0%	36%

Recreational fishing (submeasure type "other" excluded)

submeasure_type	total	Other	$\Delta B_{current}$	ΔΣH	ΔΣF	ΔΣA	Not monitored
Ban of fishery	4	0%	0%	0%	0%	0%	100%
Effort reduction (others/not specified)	8	12%	12%	0%	0%	0%	75%
Effort reduction (temporary)	11	9%	9%	0%	0%	0%	82%
Min. size	9	11%	33%	0%	22%	0%	33%
Setting of quotas	4	25%	0%	0%	50%	0%	25%

Stocking (submeasure type "other" excluded)

submeasure_type	total	Other	$\Delta B_{current}$	ΔΣH	ΔΣF	ΔΣA	Not monitored
Reservation of part of the catches for restocking	11	0%	0%	0%	0%	0%	100%
Stock glass eels	4	25%	0%	0%	0%	0%	75%
Stock pregrown eel	6	0%	17%	0%	0%	0%	83%
Stock wild eels	15	40%	47%	0%	0%	0%	13%

Hydropower and obstacles (submeasure type "other" excluded)

submeasure_type	total	Other	$\Delta B_{current}$	$\Delta\Sigma H$	$\Delta\Sigma F$	$\Delta\Sigma A$	Not monitored
Decreasing of eel mortality in HPP	12	0%	0%	42%	0%	0%	58%
Installation of eel passes	3	0%	0%	0%	0%	0%	100%
Removement of obstacles	17	0%	0%	6%	0%	6%	88%
Trap and transport	10	0%	30%	10%	0%	0%	60%

4.4.1 On escapement [EC request I.3]

In the Data Call Annex 14, Poland and Sweden reported measures where their effectiveness was estimated as a change in $B_{current}$ (Table 4.3). All measures were in the types of measure "Stocking" and "Hydropower and obstacles", either relating to direct stocking of eels or trap and transport. The low level of reporting does not facilitate any further evaluation.

Table 4.3: Summary of measures by EMP, types of measure and submeasure type, where an estimate for the change in escapement (i.e. $\Delta B_{current}$) was available.

EMP	Type of Measure	Submeasure	Parameter	Effect_size
PL_Oder	Stocking	Stock wild eels	$\Delta B_{current}$	+375 tonnes
PL_Vist	Stocking	Stock wild eels	$\Delta B_{current}$	+290 tonnes
SE_East	Hydropower_and_obstacles	Trap and transport	$\Delta B_{current}$	8 tonnes
SE_West	Hydropower_and_obstacles	Trap and transport	$\Delta B_{current}$	12 tonnes
SE_total	Stocking	Stock pregrown eel	$\Delta B_{current}$	77 tonnes

4.4.2 On fishing effort/catches outside EMPs [EC request II.2]

Denmark was the only Member State reporting fishing outside of its EMP. The measure to reduce fishing effort by limiting the number of fishing gears was implemented. The effectiveness was monitored via eel landings and the reduction was over 65% in commercial landings suggesting a respective change in ΣF. There was no data on what part of the landings derived from fishing outside of the EMP area.

4.4.3 On fishing mortality within EMUs [not a question from the EC but considered relevant to the scope]

Estimates of changes to fishing mortality as a result of management measures within EMPs were sought in the Data Call Annex 14. Only 19 EMPs from four countries (Poland, Ireland, Belgium, and the Netherlands) have estimates (Table 4.4), but it is difficult to evaluate the effect of these measures separately as in some circumstances multiple measures were implemented on the commercial fishery in the same EMP and it is not clear how combinations of multiple measures were taken into account.

Table 4.4: Summary of measures by EMP, type of measure and submeasure type, where an estimate for the change in fishing mortality (i.e. Δ ΣF) was available.

EMP	Type of Measure	Submeasure	Parameter	Effect_size [1]
BE_Sche	Recreational_fishery	Improve fishery management	ΔΣF	-2185
IE_East	Recreational_fishery	Catch and release	ΔΣF	1
IE_Shan	Recreational_fishery	Catch and release	ΔΣF	1
IE_SouE	Recreational_fishery	Catch and release	ΔΣF	1
IE_SouW	Recreational_fishery	Catch and release	ΔΣF	1
IE_West	Recreational_fishery	Catch and release	ΔΣF	1
NL_Neth	Recreational_fishery	Catch and release	ΔΣF	-199 tonnes
NL_Neth	Commercial_fishery	Temporary closure	ΔΣF	1.1
PL_Oder	Recreational_fishery	Setting of quotas	ΔΣF	-0.15
PL_Oder	Commercial_fishery	Effort reduction (temporary)	ΔΣF	-0.4
PL_Oder	Commercial_fishery	Min. size	ΔΣF	-0.4
PL_Oder	Commercial_fishery	Effort reduction (n/size of gears)	ΔΣF	-0.49
PL_Oder	Commercial_fishery	Effort reduction (temporary)	ΔΣF	-0.07
PL_Oder	Recreational_fishery	Min. size	ΔΣF	-0.4
PL_Vist	Recreational_fishery	Setting of quotas	ΔΣF	+0.03
PL_Vist	Commercial_fishery	Effort reduction (temporary)	ΔΣF	-0.31
PL_Vist	Commercial_fishery	Min. size	ΔΣF	-0.03
PL_Vist	Commercial_fishery	Effort reduction (n/size of gears)	ΔΣF	-0.1
PL_Vist	Commercial_fishery	Effort reduction (temporary)	ΔΣF	-0.11
PL_Vist	Recreational_fishery	Min. size	ΔΣF	-0.03

[1] No standardization of how effects are estimated; measure effects will depend on other measures but may be reported as the theoretic effect of a measure on its own. Hence, the sum of resulting mortality changes in an EMU is not necessarily realistic. Further, units may have been misinterpreted by data providers (e.g. BE).

4.4.4 On non-fishing mortality [EC requests III.1 + III.2]

In Data Call Annex 14, Germany, Poland, and the Netherlands reported measures where the effectiveness as a change in non-fishing mortality (ΔΣH) was estimated (Table 4.5). All measures were from the type of measure 'Hydropower and obstacles', which is not surprising, but it should be noted that other types of measure (e.g. 'Habitat improvement') could further reduce non-fishing mortalities but for which the effects are much more difficult to quantify and may be less "direct" (see above). These included submeasure types 'Trap and Transport' and decreasing of eel mortality in HPP (increase passability, measure description not shown). The low level of reporting does not allow for any further evaluation.

Table 4.5: Summary of measures by EMP, type of measure and submeasure type, where an estimate for the change in non-fisheries mortality (i.e. ΔΣH) was available.

EMP	Type of Measure	Submeasure	Parameter	Effect_size[1]
DE_Rhei	Hydropower_and_obstacles	Trap and transport	ΔΣH	-10
NL_Neth	Hydropower_and_obstacles	Trap and transport	ΔΣH	12000 kg
PL_Oder	Hydropower_and_obstacles	Decreasing of eel mortality in HPP	ΔΣH	-0.3
PL_Vist	Hydropower_and_obstacles	Decreasing of eel mortality in HPP	ΔΣH	-0.3

[1] No standardization of how effects are estimated; measure effects will depend on other measures but may be reported as the theoretic effect of a measure on its own. Hence, the sum of resulting mortality changes in an EMU is not necessarily realistic. Further, units may have been misinterpreted by data providers (e.g. BE).

4.4.5 On restocking [EC request V.3]

Considering the Member States with glass eel fisheries supplying eel for restocking (the donors), a total of 30 'Restocking' measures were reported for France and Spain, i.e. that have glass eel fisheries supplying restocking. Five submeasures within the 'Stocking' type were reported (there is overlap between these but they are what has been reported): 1) Stock glass eels, 2) Stock wild eels, 3) Stock pregrown eels, 4) studies on Stocking suitability, and 5) Reservation of part of the catches for restocking. Quantifiable targets are reported in only five of those 30 measures (17%). Twenty-one had been fully implemented and three partially implemented, while three had been stopped.

In Spain, the submeasure "Reservation of part of the catches for restocking" had associated targets in two EMPs, those being 60% of annual commercial catches in ES_Astu, and 60% of recreational fishery catches in ES_Cant. The workshop notes that recreational glass eel fishing is now banned in Spain. France has been implementing a national restocking programme reserving nearly 60% of its catch for restocking, with 5-10% of its glass eel catches stocked annually in France, and the remainder exported for restocking elsewhere.

Fifteen recipient Member States reported at least one measure of 'Stocking' (Czechia, Denmark, Estonia, Finland, France, Italy, Latvia, Lithuania, Belgium, Spain, Finland, Netherlands, Poland, Sweden, Germany).

Nine submeasures were reported amongst these recipient Member States: 1) stock glass eels, 2) stock wild eels, 3) develop a stocking plan, 4) stocking suitability studies, 5) reservation of part of the catches for restocking, 6) stock pregrown eel, 7) ban of stocking in closed water, 8) fish health, and 9) biosecurity issues. Targets are set for only 17 (21%) of the 80 measures reported –

only in five cases have these targets been achieved, while 50 measures were reported as fully implemented and a further 14 reported as partially implemented. There is limited monitoring of the effectiveness of these measures, with it reported only for the two submeasures: 6) stock pregrown eel and 1) glass eel, either as $\Delta B_{current}$ or % $B_{current}$.

Restocking programs should require the establishment of a unified traceability system at the international level to be certain the target is being achieved (see Section 3.2.3).

4.4.6 On other targets set within EMPs [EC requests VI.1 + VI.3]

Member States could set other targets in their EMPs, in addition to those required by the Eel Regulation. WKEMP4 was tasked to identify such targets, and to quantify their levels of implementation and effectiveness. Therefore, in Data Call Annex 14, Member States were asked to identify those measures which had specific management targets (and units) defined, to quantify the achievement of these targets or, where it was not possible to quantify effectiveness, to give a subjective, semi-quantitative estimate of the level of achievement (none, low, intermediate, high, full).

Some such that targets and/or or their level of achievement are reported outside the EMP Progress Reporting system, and some Member States made references to other documents here or in Data Call Annex 17. It is, however, beyond the scope of WKEMP4 to extract these values from the references, which would also introduce a possible source of error. Hence, ICES asked Member States to report the respective values in the data call and only data, as reported in Data Call Annex 14, parts 1 and 2 were considered in this report.

Based on the responses, measures were divided into four groups: 1) measures with no quantifiable target (“no target”, this includes measures where a target value without unit or a level of achievement but target value was defined), 2) measures where only a quantitative target was provided (“target only”), 3) measures where target and subjective, semi-quantitative estimate of achievement were provided (“semi-quantitative”) and 4) measures where both a quantitative target and a quantitative level of achievement were provided (Figure 4.6). Here only measures reported as planned in the EMP are considered.

Figure 4.6: Percentage of measures where targets and/or their achievement were reported, by type of measure (top) and Member State (bottom). The absolute number of measures is displayed above the bars. Only measures reported as planned within EMPs are considered here. Note that a level of achievement was reported (either quantitative or semi-quantitative) for only a few measures, but no target value was provided; these were counted as "No target". See Annex 7, Fig A7.4 for percentage of measure type in each Member State.

No target was defined for the vast majority of the 623 measures considered here, or at least no target value could be reported. In total, 50 measures had a quantitative target and a quantitative level of achievement. Only a small fraction of targets had a semi-quantitative estimate of the level of achievement and will not be further discussed.

While for "Eel governance" and "Eel trade and marketing" no targets were reported at all, for "Habitat improvement" a target was provided for a single measure out of 56 measures.

For all other types of measure, targets and level of achievement were reported, but only for a low percentage of the reported total measures, with "Stocking" having the highest percentage of reported targets (31%, 19 of 61 measures) and "Recreational fishery" having the highest percentage of measures where the achievement was quantified (13%, 11 of 82 measures).

Any judgement on whether these measures are sufficiently implemented requires detailed knowledge of the respective EMP and the related assessment model and is therefore beyond the scope of this workshop. Given the low number of measures where a specific target was defined and quantified, the data at hand is not sufficient to allow for further evaluation. Details of those measure types that mostly have a direct impact on the local eel population, and where target and achievement were reported, are presented in the following (tables 4.6 – 4.9).

Where reported, an estimate of the effectiveness (i.e. the related change in $\Delta\Sigma H$, $\Delta\Sigma F$ or $B_{current}$) is provided alongside the measure/target; however, these should be interpreted with care since they may reflect the effect of multiple measures (e.g. PL_Oder reported two measures with a change in ΣF of 0.4, which would imply a previous F >0.8, above 70% of all eels caught, which seems unrealistic) or the effect depends on other measures (e.g. the effect of minimum landing size depends on changes in effort).

Considering each of the submeasure types in turn, specific targets with quantitative monitoring were reported for 22 measures in 12 EMPs by six Member States for the measure type "Commercial fishery", the majority (13 measures) being the introduction or extension of closed seasons (partly including the EU fishing closure) (Table 4.6). One reported measure (collection of logbook data) has no direct effect on the stock. An estimate of the effectiveness was available for 10 measures. The low data availability makes further interpretation of the difficult.

Table 4.6: Table of measures, as reported by Member States, under the measure type "Commercial fishery", where quantitative estimates of both the target value and the level of achievement were available, grouped by EMU and submeasure type. Where available, a measure of the effectiveness (quantified as a change in the stock indicators ΣF, ΣH or $B_{current}$) is provided as reported by Member States. Only measures reported as planned within EMPs are considered.

EMP	Measure description	Target value	Value achieved	Target unit	Affected stock indicator	Effect size (stock indicator)[2]
DE_Maas	Increase minimum size limit	1	1	federal state	Not monitored	
DE_Rhei	Introduce closed season	5	5	federal states	Not monitored	
DE_Rhei	Establish or prolong closed season for eel fishery	5	5	federal states	Not monitored	
DE_Rhei	Increase minimum size limit	6	5	federal states	Not monitored	
ES_Anda	Introduce total closed fishery	0	0	kg catch	Not monitored	F = 0
ES_Anda	Introduce total closed fishery	0	0	kg catch	Not monitored	F = 0
ES_Astu	Introduce closed fishery	0	0	number of licences	ΔΣF	F = 0
ES_Astu	Reduce fishing season	36	30	number of fishing days	ΔΣF	Not estimated
ES_Cant	A reduction in fishing effort through the creation of a census that limits the maximum number of professional fishermen of glass eel	40	31	Number of professional fishermen of glass eel	Not monitored	
ES_Cant	Introduce closed fishery	8	8	Months of annual closed season	Not monitored	
ES_Vale	Extension of the annual closure period for the European eel fishery	2	2	days/week	Not monitored	Not estimated

[2] In some cases, positive changes in mortality were reported. All changes in mortality were changed to negative, all changes in escapement changed to positive by WKEMP, assuming that measures either aim at the reduction of mortality or increase in escapement (which is consistent with the measure descriptions/targets and was confirmed by national data providers).

EMP	Measure description	Target value	Value achieved	Target unit	Affected stock indicator	Effect size (stock indicator)[2]
ES_Vale	Extension of the annual closure period for the European eel fishery	6	6	months/year	Not monitored	Not estimated
FI_Finl	Logbook data of bycatches	100	100	Percentage of commercial fisheries reported	Not monitored	
NL_Neth	Closing fishing season	3	yes	months	ΔΣF	-1.1
PL_Oder	Closing fishing season	1	4	month	ΔΣF	-0.4
PL_Oder	Increasing minimum length	50	50	cm	ΔΣF	-0.4
PL_Oder	Closing fishing season - EU closure	4	6	month	ΔΣF	-0.07
PL_Vist	Closing fishing season	1	4	month	ΔΣF	-0.31
PL_Vist	Increasing minimum length	50	50	cm	ΔΣF	-0.03
PL_Vist	Closing fishing season - EU closure	4	6	month	ΔΣF	-0.11
SE_East	From 2008 and onwards, no new licenses are allowed, only existing licenses could be extended. Effort continuously decrease as license holders stop use existing permits.	0	107	Remaining commercial fishers	Not monitored	
SE_Inla	From 2008 and onwards, no new licenses are allowed, only existing licenses could be extended. Effort continuously decrease as license holders stop use existing permits.	0	50	Remaining commercial fishers	Not monitored	

Specific targets with a quantitative monitoring were reported for 11 measures in eight EMPs by five Member States for the type of measure "Recreational fishery", the majority being the introduction of minimum landing size (Table 4.8). One reported measure (Questionnaire for anglers) has no immediate effect on the stock. An estimate of the effectiveness was available for five measures. The low data availability makes further interpretation difficult.

Table 4.8 Table of measures, as reported by Member States, under the measure type "Recreational fishery", where a quantitative estimate of both the target value and the level of achievement were available, grouped by EMP and submeasure type. Where available, a measure of the effectiveness (quantified as a change in the stock indicators ΣF, ΣH, or $B_{current}$) is provided as reported by Member States. Only measures reported as planned within an EMP are considered.

EMP	Measure description	Target value	Value achieved	Target unit	Affected stock indicator	Effect size (stock indicator)[3]
DE_Maas	Increase minimum size limit	1	1	Federal state	Not monitored	
DE_Rhei	Increase minimum size limit	6	5	Federal states	Not monitored	
ES_Cant	Fishing is not allowed	0	0	Number of recreational fishermen of glass eel	Not monitored	
ES_Nava	Introduce closed fishery	0	0	Catches	Not monitored	
FI_Finl	Questionnaires every second year	0.5	0.5	Questionnaires/year	Not monitored	
NL_Neth	Eel releasing by anglers	200000	yes	kg	ΔΣF	-199000 kg
NL_Neth	Ban on recreational fishery using professional gears	100	yes	%	Other	
PL_Oder	Decreasing daily catch by anglers	2	2	individuals/day	ΔΣF	-0.15
PL_Oder	Increasing minimum lenght	50	50	cm	ΔΣF	-0.4
PL_Vist	Decreasing daily catch by anglers	2	2	individuals/day	ΔΣF	-0.03
PL_Vist	Increasing minimum length	50	50	cm	ΔΣF	-0.03

[3] In some cases, positive changes in mortality were reported. All changes in mortality were changed to negative, all changes in escapement changed to positive by WKEMP, assuming that measures either aim at the reduction of mortality or increase in escapement (which is consistent with the measure descriptions/targets).

Specific targets with a quantitative monitoring were reported for seven measures in 6 EMPs by four countries for the type of measure “Stocking” (Table 4.9). One reported measure (reservation of catches for restocking) has no immediate effect on the stock. An estimate of the effectiveness was available for two measures. The low data availability makes further interpretation difficult.

Table 4.9: Table of measures, as reported by Member States, under the type of measure “Stocking”, where a quantitative estimate of both the target value and the level of achievement were available, grouped by EMP and submeasure type. Where available, a measure of the effectiveness (quantified as a change in the stock indicators ΣF, ΣH or $B_{current}$) is provided as reported by Member States. Only measures reported as planned within an EMP are considered.

EMP	Measure description	Target value	Value achieved	Target unit	Affected stock indicator	Effect size (stock indicator)
ES_Cant	Reserve of the caught for stocking	60	60	% of recreational fishery catches		
ES_Nava	Stock pregrown eel	130	130	Kg	Not monitored	
ES_Nava	Stock pregrown eel	1500	1500	Kg	Not monitored	
FI_Finl	Restocking of wild pregrown and quarantined, disease-free imported juvenile eels.	1000000	100000	number of eel restocked	Not monitored	
NL_Neth	Stocking with glass eels	375000	yes	euro/year	Not monitored	
PL_Oder	Stocking	1200000	1050000	individuals/year	$\Delta B_{current}$	+375 ton
PL_Vist	Stocking	1400000	1400000	individuals/year	$\Delta B_{current}$	+290 ton

Specific targets with a quantitative monitoring were reported for five measures in three EMUs by three Member States for the type of measure “Hydropower and obstacles” (Table 4.10), including removal of barriers or assisting up- and/or downstream migration. An estimate of the effectiveness was available for one measure but this was not quantitative. The low data availability makes further interpretation difficult.

Table 4.10. Table of measures, as reported by Member States, under the type of measure "Hydropower and obstacles", where quantitative estimates of both the target value and the level of achievement were available, grouped by EMP and submeasure type. Where available, a measure of the effectiveness (quantified as a change in the stock indicators ΣF, ΣH or $B_{current}$) is provided as reported by Member States. Only measures reported as planned within an EMP are considered.

EMP	Measure description	Target value	Value achieved	Target unit	Affected stock indicator	Effect size (stock indicator)
BE_total	These measures include the resolving of all upstream migration obstacles for eel: removing physical barriers, installation of fish passes, installation of eel ladders and ATBM: adjusted tidal barrier management (limited barrier opening during tidal rise at sea-locks).	1700	961 (57%)	number		
BE_total	Ddecrease mortality at cooling water intake points	5	2	cooling water intake points	ΔΣH	
BE_total	Decrease mortality at pumps and facilitate and enhance downstream migration at pumps	29	10	pumping stations		
IE_Shan	Trap & Transport	30% of production	see comment	% of production	$\Delta B_{current}$	high % of production
NL_Neth	Hydroelectric stations/barriers reduction	reduce mortality with 35%	yes	%	ΔΣH	

In summary, the level of reporting on specific targets with a quantitative monitoring set by Member States and their achievement was very low and does not allow for any meaningful interpretation, comparison or evaluation.

Nevertheless, this result highlights a core issue for the evaluation of the effectiveness of measures: even for types of measures that directly affect the stock, and where it should be possible to define a target (or their level of achievement), this was either not defined or not reported in a usable format (see above). Importantly, specific targets with a quantitative monitoring should be defined ahead of the implementation of the measure including a timeframe for their achievement, stored in a usable format (ideally a database to ensure uniform data formats); they should be relevant to the management goal and must be achievable. Consequently, it is recommended EMPs should adopt a SMART system (so measures are Specific, Measurable, Achievable, Relevant, and Timebound) in order to allow for a meaningful evaluation (of measures) and management of the eel stock in the future.

4.5 The likelihood that these measures need to be increased, or others deployed to achieve the targets set for EMPs [EC request I.5 for escapement]

As highlighted in the sections above, the data provided in Data Call Annex 14 on management measures cannot be evaluated to determine their effect on the biomass targets set for EMPs. Therefore, it cannot be identified which measures should be increased. The text below outlines some guidance on which measures under the different measure types are likely to have a quantifiable response on the eel biomass and mortality indicators.

4.5.1 Fishery

The most frequently reported measures are in the type 'Commercial fisheries', of which measures to reduce fishing mortality was the most common (Table 4.2).

The following submeasures fall within this group (Table 4.4):

- Ban of fishery
- Capacity reduction (licenses/vessel)
- Effort reduction (number/size of gears)
- Effort reduction (others/not specified)
- Effort reduction (temporary)
- Setting of quotas
- Minimum landing size

Ban of fishery: A fishery ban reduces the fishing mortality directly and will positively contribute to the spawning stock biomass ($B_{current}$) if i) the ban is in an area were the eel can grow up in a healthy habitat, e.g. without high pollution and eel diseases/parasites, and ii) the ban is in an area were the silver eels can safely migrate to the sea, e.g. without multiple hydropower stations and obstacles causing mortality

Setting of quotas: If the implementation of a quota reduces fishing mortality it will contribute to an increase in $B_{current}$. However, whether a quota results in reduced fishing mortality depends on its size (the quotum) and its size relative to the current stock, which can only be quantified if the (local) stock size is monitored regularly.

Capacity and/or effort reduction: A reduction in the number of licenses, vessels, or number of gears is likely to reduce the fishing mortality and, in that case, will be an effective measure if habitat quality and migration possibilities are good. However, under some circumstances these measures are not effective, for example, i) when not every license or vessel was used before, the 'real' capacity might not be reduced, and ii) when the license and/or vessel owners that remain increase their effort (for example because there is more eel in the fished area). For these measures to have a substantial effect, the realized reduction in fishing mortality needs to be monitored and controlled.

Minimum landing size (MLS): Many Member States/EMPs have reported that there is a minimum landing size in place (see also Table 4.11). The rationale for the implementation of a minimum landing size in most fisheries is based on the exploited fish being able to spawn at least once in their lifetime. However, because eel is semelparous (spawning occurs only once during their life), the effect of a minimum landing size is less straightforward. If fishing mortality is high, eel will be caught before they mature and transform into silver eel and will thus not contribute to the spawning stock ($B_{current}$). In that case, implementation of a minimum landing size will likely result in eels being caught at a larger size and this will mainly support the fishery (Gatto *et al.*, 1982, Vøllestad, 1990, Pohlmann *et al*., 2016). In contrast, when fishing mortality is sufficiently low, a minimum landing size will increase the proportion of eels that are able to grow to silver eel stage and migrate to the ocean (see Pohlmann *et al*, 2016). The higher the minimum landing size and the lower the fishing mortality, the more eels will be able to migrate. As male and female silver eels differ substantially in size, the actual and desirable sex ratios also need to be considered. In conclusion, knowledge about the fishing mortality and sex ratio is needed to evaluate in which circumstances the implementation of a minimum landing size is an effective measure.

Table 4.11. Minimum landing sizes in various EU Member States and other countries, as reported to WGEEL.

Country	Minimum Landing Size (MLS)	Source
Finland	No MLS	J. Helminen, pers. comm.
France	No MLS	E. Amilhat, pers. comm.
Lithuania, inland waters	No MLS	L. Ložys, pers. comm.
Portugal	22 cm	Pohlmann et al, 2016
Netherlands	28 cm	ICES WGEEL country report 2024
Greece	30 cm	GFCM research report 2023 (Ciccotti and Morello, 2023)
Tunisia	30 cm	ICES WGEEL country report 2024
Algeria	30 cm	GFCM research report 2023 (Ciccotti and Morello, 2023)
UK, England	30 cm	A. Taylor, pers. comm.
Albania	35 cm	GFCM research report 2023 (Ciccotti and Morello, 2023)
Spain, Catalonia	35 cm	C. Fernández-Delgado, pers. comm.
Estonia, coastal waters	35 cm	ICES WGEEL country report 2024
Lithuania, Curonian lagoon	35 cm	L. Ložys, pers. comm.
Spain, Murcia	38 cm	C. Fernández-Delgado, pers. comm.
UK, Northern Ireland	40 cm	ICES WGEEL country report 2024
Albania	40 cm	ICES WGEEL country report 2024
Turkey	50 cm	Ş. Yalçın Özdilek, pers. comm.
Germany*	50 cm	Pohlmann et al, 2016
Poland	50 cm	Pohlmann et al, 2016
Latvia	50 cm	J. Bajinskis, pers. comm.
Estonia, inland waters	50 cm	ICES WGEEL country report 2024
Estonia, some specific lakes	55 cm	ICES WGEEL country report 2024

Country	Minimum Landing Size (MLS)	Source
Sweden	70 cm	ICES WGEEL country report 2024
Ireland	Fisheries closed	Pohlmann et al, 2016
UK, Scotland	Fisheries closed	ICES WGEEL country report 2024
UK, Wales	Fisheries closed	ICES WGEEL country report 2024
Spain, Andalusia	Fisheries closed	C. Fernández-Delgado, pers. comm.
Norway	Fisheries closed	Durif and Skiftesvik, 2018
Norway, for science**	300 g/eel	C. Durif, pers.comm

***Germany has 16 different landing sizes for each EMP; 50 cm is the most common size. ** Eel fishing is closed in Norway, but fishermen can fish for scientific purposes from July 15 to October 20, where fishermen are allowed to keep and sell their catch after making the catch and/or data available for research. The list is based on what could be found in the literature and from personal communication with people on the WGEEL mailing list.**

Recreational fisheries: A ban on recreational fisheries is expected to decrease eel mortality and thus contribute in a positive way to $B_{current}$. However, in most cases it is not the angling (or other recreational fishing activity) itself that will be banned, but instead there will be an obligation to release the eel (one cannot ban an eel from swallowing a bait). In that case, there might be mortality due to the handling of the eel. Catch limits can be set through several submeasures, including limits to the number of gears, numbers of individual eels per angler or bag limits.

4.5.2 Restocking

National data on restocking that have been reported to ICES in 2024 includes eels released at the glass eel phase, either directly, or after a quarantine, after a period of some months of growth in aquaculture, at the yellow eel or silver eel stage (ICES, 2024a). It was also emphasized in the WGEEL report that displacements of eel can range from a few metres within the same waterbody (i.e. assisted migration to bypass an obstacle), to eel being moved between waterbodies and/or eel management units. Furthermore, the inconsistencies and variations in how countries report these displacements were emphasized.

While it is recognized that a local increase in eel production may be apparent from restocking (ICES, 2016, and therefore contribute to achieving escapement targets for EMPs, the net benefit of restocking to the reproductive potential of the eel stock is unknown. This would require information on e.g. the carrying capacity of glass eel source estuaries, reliable mortality estimates at each step of the restocking process, and the spawning potential of stocked vs. non-stocked eels.

ICES (2024a) notes that the restocking of eels (the practice of moving eels from one waterbody to another) is intended as a *conservation measure* in EU Council Regulation (EC) No. 1100/2007 (EU Council, 2007) and is implemented in many eel management plans. However, restocking is reliant on a glass eel catch, which is in contradiction with the recurring ICES Advice (ICES, 2024a).

4.5.3 Hydropower and obstacles

The WGEEL (ICES, 2019) reviewed the impact of hydropower and water pumping operations [water abstraction related impacts on eels} and found that they are collectively a cause of significant direct mortality of eel, particularly on downstream migrating silver eels in freshwater. Hanel *et al*. (2019), in a report for the PECH committee of the European Parliament, also reviewed the impact of in-river constructions and hydropower on escapement and migration of the spawning stock. Estimates of the EU Member States suggest that hydropower mortality accounts for more than 50% of anthropogenic mortality in 33 of 62 EMPs, where data for fishing and hydropower mortality were reported.

Member States have reported 103 measures related to 'Hydropower and obstacles' (e.g. pumps), compared to 177 measures in 2021. Several of the sub-measures under this type of measure can have a direct or indirect effect on eel survival at all life stages, but particularly for migrating eels: decreasing of eel mortality in hydropower station; general connectivity improvement; installation of eel passes; removal of obstacles; and trap and transport.

In the data call for 2024/2025, four different types of sub-measures were reported on: decreasing mortality in HPP; installation of passes; removal of obstacles; and trap and transport. Almost half of these measures were reported as fully implemented, an increase compared to previous years (Figure 4.4). However, reporting on monitoring of their effectiveness was almost non-existent.

Increasing the number of measures that directly decrease hydropower mortality is needed to reduce the mortalities caused by non-fisheries factors (ΣH). According to Hanel *et al.* (2019), mitigation measures that can be implemented to reduce the impact of 'Hydropower and obstacles' include: bypasses, fish friendly turbines and pumps, undershot gate management, temporary turbine closures, and trap and transport. Eel mortality in both HPP and pumps can also be reduced through carefully constructed grids/screens that divert migrating eels, but they need to be designed so that eels do not get caught and crushed against them at high water flows. They also need regular maintenance, as debris will accumulate and reduce their effectiveness. Efforts to mimic more natural water flows are also being explored, such as limited opening to allow sediment and water through, or varying flow rates. In order for such measures to be effective for eels, one would have to consider eel migration patterns, such as at what flow rates they prefer to move and that they migrate mainly at night.

The workshop notes also that restocking should not be done above hydropower facilities because this risks the eels and note that such restocking contributes to some of the estimates of mortality associated with hydropower. Unless implemented with targets many of the eel above the obstacles are still likely to die when attempting their migration out to sea, as not all will be caught for transport. There is also concern about the handling before and during transport, which may cause damage. It can be a good interim measure while working on a more long-term solution to passage.

Clearly, there are a range of ways to seek to reduce or remove the impacts caused by 'Hydropower and obstacles', and the effects of many of these mitigations can be quantified with the appropriate monitoring. A range-wide inventory is required to fully take into account the hydropower mortality on the eel population. This inventory requires a list of parameters in relation to hydropower (turbines) but is a separate issue to the implementation of measures to reduce hydropower mortality. In the absence of detailed information on the effectiveness of those measures implemented, their distribution relative to the thousands of potential 'Hydropower and obstacles' known to exist, and the state of eel production in these waters, ICES is not able to make more specific recommendations about how these measures should be implemented.

4.6 Conclusions and recommendations

Across all types of measure, there is a large number of EMPs without monitoring or reporting of their effectiveness.

A review of conservation measures implemented in inland waters for Anguillid eels found 126 different conservation and/or management interventions could be carried out but only 36 of these had evidence of the effects on the eel population (Cutts *et al.*, 2024). This review lists the conservation measures with no evidence from the literature that these measures have an impact on the eel population. It is unclear if the lack of publications is as a result of no monitoring or because no effect was recorded and therefore the study was not published. There is a need to encourage the dissemination of both positive and negative results with a lesson learned element so measures that are not contributing to the recovery can be discontinued or efforts refocused on the measures that are having a larger impact.

There is also a lack of clear targets associated with individual measures, making it difficult to determine if measures are effective.

To carry out an evaluation at the EU level, standardization is required. There is currently too much inconsistency across the hundreds of measures reported to carry out a quantitative evaluation. It is recommended that EMPs should adopt the SMART system, so measures are Specific, Measurable, Achievable, Relevant and Timebound, and have clear targets.

While it is acknowledged that these management measures as recorded in Data Call Annex 14 are important in the individual EMPs and should continue, from an evaluation point of view selecting a small number of measures or pressures that are having the largest impact on the eel population and evaluating these in detail may be more fruitful. This is a process that is being undertaken by the North Atlantic Salmon Conservation Organisation (NASCO) in relation to Atlantic salmon.

It is expected that with the Nature Restoration Plan, Member States will be implementing conservation measures to restore habitat over the next five years, and that some of these will benefit eel. To take advantage of this process, a solution could be to align reporting for European eel with other EU directives. There is a list of 'pressures' and 'conservation measures' outlined in the Habitats Directive Article 17 reporting. Over the next three years, Member States could identify the most relevant pressures on European Eel in each EMP area and identify conservation measures that can tackle those pressures. Then identify the target for the measures and if these conservation measures are 'implemented' or 'planned'. An example is given below:

- Country
- EMU
- 1. Pressure (list provided)
    - Management/Conservation Measures type (list provided)
    - Subtype
    - Target
    - Timeframe
    - Relevant Biomass/Mortality Indicator
    - Implemented (yes, no, planned)
        - Year of implementation
- 2. Pressure (list provided)
    - Management/Conservation Measures type (list provided)
    - Subtype
    - Target
    - Timeframe
    - Relevant Biomass/Mortality Indicator
    - Implemented (yes, no, planned)
        - Year of implementation
        - Etc

5 ToR d) Provide alternative methods of monitoring, analysis and reporting in which the attainment of implementation efforts is possible, in the event that quantification under the present system is not possible

The request from the EC to ICES included several questions around the form of "Where quantification is not possible, ICES is requested to advise based on alternative methods deemed suitable by ICES, whether …."

(i) escapement levels are above or below target (I.2), the effect of each type of measure implemented (or proposed to be implement) is appropriate and effective or not, and sufficiently deployed or not to support attainment of the escapement biomass targets (I.4), and where insufficiently deployed what increase in deployment would be required (I.5),

(ii) fishing effort/catches outside of EMPs have attained their targets (II.2), and where not quantified by the Member States, the effect of each type of measure on attainment of said targets (II.3),

(iii) the attainment of reductions in mortality caused by factors outside the fishery (III.2), and where not quantified by the Member States, the effect of each type of measure on reducing mortalities outside (other than) fisheries (III.3),

(iv) no associated request

(v) the attainment of the 60% restocking target applicable to Member States who allow glass eel fishing (V.2), and where not quantified by the Member States, the effect of each type of measure on attaining the restocking target (V.3),

(vi) the attainment of any targets established by Member States in their EMPs, other than those defined in the Eel Regulation (VI.2), and where not quantified by the Member States, the effect of associated types of measure on the attainment of these targets (VI.3).

ToR d) was designed to capture the information available to answer these questions. This chapter draws on the information presented in sections 1 to 4, to answer these questions.

5.1 On escapement biomass [EC request I.2, I.4 and I.5]

5.1.1 Is escapement biomass above or below target?

The reasons for Member States not reporting progress against escapement targets can include the lack of a target (mostly due to a lack of estimation of B_0) or not having estimated escapement in the reporting years ($B_{current}$). ICES has previously proposed that escapement biomass targets could be estimated for non-reporting EMUs based on extrapolating from nearest neighbour (ICES, 2018), or from modelled estimates based on international recruitment profiles (ICES, 2022).

In the absence of information on the characteristics of eel production in these EMUs, ICES has no means to estimate $B_{current}$ where these are missing, nor to answer the EC's question of whether escapement in these EMPs is: i) likely to be at or above target, ii) below but close to the target (30-40%), iii) well below the target (around 20%), iv) very low (around 10%), or v) negligible. However, given that i) the majority of reporting EMPs are not meeting their targets, and ii) increasing trends are apparent in only four EMPs, it seems reasonable to assume that the EMPs and EMUs without escapement targets would probably not be meeting targets if they were available and reported on.

It remains the case, however, that Member States are in the best position to estimate escapement targets and recent escapement for their territories, and those not reporting either or both should be encouraged to do so.

5.1.2 The effectiveness of types of measures on escapement biomass, where not reported by MS, on attaining escapement targets

Regarding the effectiveness of types of measures on escapement biomass, as has been discussed in earlier sections, it is rarely possible to determine their effectiveness using stock indicators derived at the whole EMP scale. This would be possible if only a single type of measure was applied in the EMP, but this circumstance does not occur across any of the EC Member States where escapement indicators have been reported. The only EMP with a single type of measure is the national EMP for Luxembourg, which declares to have only measures addressing 'Hydropower and obstacles' (Table 4.1), but Luxembourg does not report escapement biomass indicators.

Management measures are complex to evaluate. They vary over time. They include different type of measures (e.g. size limit, gear specification, diminution of the number of licences, spatial fishing bans, reductions applying only to a type of fisherman). They have spatial variations. To better assess the relevance of management measures and since the objective of the Eel Regulation is to reduce anthropogenic mortalities, we suggest that each management measures should be associated with a measure of its effect on ΣF at the EMU scale.

5.1.3 On levels of deployment sufficient to meet escapement targets

Progress on implementing management measure is continuing for most types of measures. A total of 467 measures (75% of the total) were deemed fully or partially implemented. However, the variation and gaps in the data submitted made it extremely challenging to determine the effectiveness of types of measures in the context of associated threats, or to make judgements on i) whether the level of deployment is sufficient or not, and ii) if not then what level of deployment would be sufficient to meet escapement targets.

In many instances, measures were not designed to be evaluated directly by biomass and mortality indicators. Ultimately, local expertise and adaptive monitoring and assessment plans of each EMU are needed to evaluate the effectiveness of types of measures, including their required levels of deployment.

5.2 On attainment of effort/catches targets by fisheries outside EMPs, and associated types of measures [EC request II.2 and II.3]

Fishing effort and its link to fishing mortality has been discussed in previous WGEEL reports (ICES, 2019), reminding that while fishing effort is quantity that could be easily managed, the consequences on fishing mortality can be complex and are often non-linear (see for example various examples from Mediterranean fisheries (Scientific, 2022)). Recently, an example in the Minho River illustrated the potential ineffectiveness of fishing effort regulation and possible resulting biases in the analysis of CPUE (Stratoudakis *et al.*, 2024). As such, we consider that the effectiveness of any fishing effort reduction should be monitored through its final effect on the reduction of fishing mortality.

5.3 On mortalities caused by factors outside (other than) fisheries [EC request III.3]

Given the spread of trends in ΣH, in the reported EMPs, ranging from negative, through neutral, to positive (note, this is the undesired state), and the limited or complete absence of information on state of eel and/or implementation of management measures in the EMPs without mortality reports, ICES is not able to suggest alternative ways to quantify changes in ΣH for these EMPs.

Habitat degradation has clearly an effect on eel population. Local measures however will only have a local effect on the local eel population, that is difficult to relate at the scale of an EMP. This effect might be confounded by other effects (e.g. pollution, drought events), and will only show on escapement in the long term. While a monitoring of the change in biomass might demonstrate a positive effect, change in recruitment also have an effect on biomass. With a reduced recruitment, the restoration of habitat might only have a limited effect on density dependent increased mortality linked with barriers.

While these measures (restoring connectivity, enhancing habitats, diminishing delays or obstructions for downstream migration) are probably very important for the eel, the measure of their effect shall only be visible in the long term.

A first feasible option to deal with this difficulty to evaluate the effect of habitat restoration might be to use intermediate targets not necessarily focused on the effect on eel population. For example, the country might identify a list of the most impacting barriers or most useful habitat restoration and provide a report on the progress in restoring these barriers. Quantifying the current quantity of available habitat and the evolution of this habitat would be a relevant and useful proxy. This could be done for example by using spatial model as discussed during WKSMEEL. Specific studies on the effect of restoration of these habitats on the eel population could also be led to shed a light on the effect of these restorations. Monitoring growth trend and contaminant levels in restored site can be used to demonstrate the enhancement of the habitat quality.

However, in the long term, a quantification of the effect of those measure would be preferable. Doing so required as a first step to quantify the proportion/abundance of eels that is affected by the management measure. Indeed, a measure can be very relevant locally but have a limited effect at the EMP scale if the local abundance is small compared to the total abundance within the EMP. Therefore, any quantification at the EMP scale will require at some points data on the spatial distribution of eels. For downstream migration mortality, a combination of a repartition model (EDA like statistical repartition model as envisioned in the WKFEA roadmap) and dam data should be used to assess the effect of barriers (ICES, 2021b, SUDOANG, 2021). The effect of trap and transport or mitigation measures applied should be quantified at the regional level as modification/ reduction of ΣH.

A future listing of the barriers with in order:

- The location of hydropower plant without specification of type or equipment flow.
- The type of turbine (application of average mortality per dam / turbine type).
- Detailed data on turbine type (equipment flow of the turbine, type of turbine, rotation speed, diameter, height of dam) should allow for the application of model types ((Gomes et Larinier, 2008; Tomanova *et al.*, 2023)).
- A direct measurement or specific model allowing the evaluation of mortality on site.

For a measure of the gain in term of habitat, the identification of habitat surface restored along with a prediction of the density (using EDA like spatial repartition models) should also be used to evaluate the "gain" in term of potential silver eel production.

5.4 On attainment of restocking targets and associated measures [EC request V.2 and V.3]

Assessing the potential benefit of restocking requires at least to know whether the escapement from a from a stock eel is higher than what would have occurred otherwise. As such, we suggest that countries implementing restocking should report a separate measure of ΣF and ΣH applied specifically to the restocked eel. These would allow comparing the escapement per eel for the stocked eel with the escapement per eel in the donor area. This would also enable to check that eels are effectively stocked in area where anthropogenic pressures (ΣF and ΣH) are small. Historical transport should also be evaluated.

5.5 EMP targets other those specified in the Eel Regulation [EC request VI.2 and VI.3]

As no 'Other' targets were set in the EMPs, there is no answer to this specific part of the question. The additional activities that Member States are undertaking as part of their obligations to other legislations, e.g. WFD, MSFD, do warrant recognition and consideration for their potential contributions to eel restoration, but this is outside the scope of the present workshop and request. Perhaps in future versions of EMPs, these additional activities could be recognized as part of the 'overall package'. However, they will require quantifiable starting and end points that are relevant to eel production, and progress against these reported on, before their success or otherwise can be evaluated.

5.6 Chapter conclusions

De-prioritizing the effectiveness of measures for progress reporting is not ignoring the necessity of understanding the effectiveness of measures as a mean to guide their deployment. But the first task here should be post-evaluation, whereas driving change should be a resulting, future task and requires its own guidance framework. In conclusion, future post-evaluations should ask different questions from those asked so far.

In many instances, measures were not designed to be evaluated directly by biomass and mortality indicators. Ultimately, local expertise and adaptive monitoring and assessment plans of each EMU are needed to evaluate the effectiveness of types of measures, including their required levels of deployment.

6 Workshop conclusions and recommendations

Conclusions and recommendations are here presented according to the four Terms of Reference (A to D), and also to the six questions that were asked by the EC in its request to ICES. There will be some areas of overlap between these two groups, but they are presented here in this structure seeking to aid clarity of communications. The section ends with a subsection on any other recommendations.

6.1 ToR A - Prepare the data for evaluation

WKEMP4 compiled and analysed the data received from two data calls from 19 Member States. Not all provided all the requested indicators (biomass and mortality) and the requested management measures, their implementation and their effectiveness.

The data call on measures was interpreted differently by those who prepared the submissions (the data providers). Some mentioned every single measure, whereas others only mentioned the most important ones. It was impossible to analyse the data in a scientific way and to advice on which measures would be best to implement. In addition, as it is based on the local conditions from which measure the spawning stock would profit most, it is hardly possible to generalize what is needed and more effort should be done on a more local/regional scale, including studies which measures should be implemented.

The data call is complex with many annexes. This reflects the complexity of the task to evaluate the effectiveness of EMPs and types of measures. However, the complexity can lead to ambiguities, uncertainties, misunderstandings, and inconsistencies, and certainly requires a substantial resource to complete, all of which can lead to incomplete reporting. But a full evaluation across the EU, and ideally beyond, requires complete reporting. The process can be improved, but the most effective change could be to reduce the requirements of all, by targeting a select, small number of key questions and associated indicators.

6.2 ToR B – Evaluate the overall effectiveness of EMPs in terms of targets and reductions in mortalities

Inconsistencies in indicators reported by the Member States impair the analysis and comparisons of their absolute values. As such, while 12 EMPs have reported levels of escapement above the biomass target, and 34 EMPs reported a mortality rate below 0.92, such results should be taken with caution. Temporal trends of indicators are considered to be more reliable. Escapement appears to be still declining in many EMP areas. On the other hand, a decrease in fishing mortality has been detected in 14 EMPs, but with still 11 increasing trends, and a decrease in total anthropogenic was detected in 17 EMPs but 12 still show significant increases.

The development of standardized assessment methods is strongly recommended to allow comparison of indicators between EMPs and to be able to upscale indicators at larger spatial scales. This would also facilitate the assessment of the effectiveness of management measures. Given the long lifespan of the species, the effect of EMPs is not likely to be detected in the short term. The addition of alternative targets based on mortality would be valuable to monitor on the short term the effectiveness of EMPs.

Only three countries have a glass eel fishery, but only two reported information on measures in place for supplying restocking, and only one provide the percentage of glass eel caught used for restocking purposes, with a value close to 60%.

There is a clear need for an international traceability scheme during trade to monitor the destination of caught glass eels. The use of size categories like 12 cm and 20 cm is confusing to some. Reports of 20 cm eels are inconsistent, with some countries reporting trade of larger eels but not in the 20 cm category. Due to significant growth variation in eels, separating them by size has little biological basis and quickly mixes different cohorts. Only the separation of glass eels and other categories should be used practically.

In order to improve the assessment of the use of small eels, it is recommended to implement a mandatory transnational traceability system to track eels from capture to their final destination to ensure the compliance with environmental regulations and international treaties and a proper stock assessment. In the case of restocked eels, this means that a separate monitoring of the material type (R or C) is carried out throughout the trade chain, until they are released into the water. This monitoring would avoid that glass eels are diverted to other, potentially illegal, uses. The traceability system should also separate glass eels intended for direct consumption from those intended for growing in aquaculture facilities.

6.3 ToR C – Evaluate the effectiveness of types of measures

WKEMP4 has continued the previous practice (ICES, 2018, 2022) to group types of measures into the following categories: Commercial fisheries; Recreational fisheries; Stocking; Hydropower and obstacles; Habitat improvement; Eel trade and marketing; Eel governance; Scientific monitoring; and Other.

Despite about 75% of measures being reported as fully or partially implemented, there are very few instances of Member States quantifying the effects of types of measures. Poland reported increased tonnes (375 & 290) of silver eel escapement attributed to 'Stocking', and Sweden reported increased tonnes (8 & 12) due to trap and transport under the 'Hydropower and obstacles' type.

Those types of measures with direct effects on reducing mortalities could contribute to increased escapement biomass. One example is reducing or closing a fishery, where the eels that would have been removed by the fishery are, instead, allowed i) to contribute to escapement if the fishery had been for silver eels, or ii) to continue their lives and have the potential to contribute to escapement if the fishery had been for earlier life stages of eel. Note that the latter can only be described as a 'potential to contribute' because there will be natural and perhaps anthropogenic mortality factors that mean some of those 'saved' eels do not survive to escape as silver eels.

Further challenges discussed above (Section 4.4) include the diversity of anthropogenic pressures, that the effects of measures have different time and spatial scales, the lack of pre-implementation monitoring to define baselines.

Those types of measures that influence human behaviour and management decision making, rather than eel production per se, are unlikely to contribute 'directly' to increased escapement biomass. However, they may create conditions where other types of measures can be implemented that do have direct effects. An example would be a research study of eel mortality at an in-river obstacle, e.g. a hydropower turbine. The research in itself will not affect the local eel population, but it may support managers in introducing screening or changes to turbine operation that do affect the eels.

Ultimately, the spatial and temporal state of the question does not match those of the eel assessment and management. Metrics for the EMP as a whole can only be used to judge management effects if a single type of measure is implemented. The effectiveness of individual measures can only be truly measured at the place and time of their deployment, e.g. how many silver eels survived passing a turbine if it was screened vs not screened. But is unlikely that the resources are available to directly measure the effects of each measure at each instance of its deployment. And furthermore, the effects of other impacts, and measures, later in the continental life of eels may detract from the gains achieved by that first measure. Consider as an example if 100 eels are saved by a screen, but 50 are subsequently killed by a fishery downstream. The effective contribution of the screen is 50, not 100, eels. Also, the effect of many measures on impacts that have an indirect effect on escapement will only be realized much later and far away from its deployment. Thus, fully quantifying the effectiveness of measures or types of measures requires a complete understanding of all impacts on eel production throughout the waters covered by the EMP.

Progress on implementing management measure is continuing for most types of measures. A total of 467 measures (75% of the total) were deemed fully or partially implemented. However, the variation and gaps in the data submitted made it extremely challenging to determine the effectiveness of types of measures in the context of associated threats, or to make judgements on i) whether the level of deployment is sufficient or not, and ii) if not then what level of deployment would be sufficient to meet escapement targets.

The EU Eel Regulation stipulates that "catches of eels in Community waters seaward of the boundary of eel river basins defined by Member States as constituting natural eel habitats should be reduced gradually by reducing fishing effort or catches by at least 50% based on the average fishing effort or catches in the years 2004 to 2006". Member states were therefore asked to submit data on commercial eel fishing effort and/or catches outside of the area of their EMPs.

Only Denmark reported that it had commercial eel fishing outside of the boundaries of its EMP, in marine open, coastal, and transitional waters. They reported the total number of commercial gears used for eel fishing in these areas. The reported data shows that there has been a gradual reduction in number of gears used for eel fishing for all different gears used, and that a 50% reduction in effort compared to the years 2004 to 2006 has been achieved. This reduction in fishing effort has been achieved by not issuing any new fishing licenses and not allowing the transfer of existing fishing licenses.

The stock indicator covering factors outside/other than fisheries mortalities is ΣH. Although ΣH for the EMP as a whole cannot be used to judge the effect of a type of, or even individual, measure, a time series of ΣH for the EMP can illustrate the general direction of travel, i.e. aid in the consideration of whether mortality associated with factors other than fisheries is reducing (the EC question), not changing, or increasing.

Similar to the reporting of escapement biomass, reporting of ΣH was not complete across all EMPs or EMUs – some reports did not cover the full 2021-2023 reporting period, other reports did not provide estimates for any of this reporting period, and others had no reports.

Trends analyses for those EMPs with reports between implementation and 2020, 2021, 2022, or 2023 (the most recent year of data) suggested that while the desired significant decrease in ΣH was displayed in 14 EMPs, a significant increase (going in the wrong direction) was displayed in seven EMPs. The remaining 28 reported EMPs displayed no trend, although 22 of these had very low sum H (<0.1) so any trends might be very difficult to detect

Considering the Member States with glass eel fisheries supplying eel for restocking (the donors), a total of 30 'Restocking' measures were reported for France and Spain, i.e. that have glass eel fisheries supplying restocking. Quantifiable targets are reported in only five of those 30 measures (17%). Considering the 15 Member States that import eel for restocking (the recipients), there is limited monitoring of the effectiveness of these measures, with it reported only for the two sub-measures: stock pregrown eel, and stock glass eel, as a change in $B_{current}$ in absolute terms or as a percentage.

Restocking does not directly reduce a non-fisheries mortality. It may compensate for a non-fisheries mortality, such that the overall mortality is reduced, but may also have increased losses due to fishing in the donor water, hence the need to quantify 'net benefits'. Assessing the potential benefit of restocking requires at least to know whether the escapement from a group of stocked eel is higher than what would have occurred if those eels had been left in their original waters. As such, we suggest that countries implementing restocking should report a separate measure of ΣF and ΣH applied specifically to the restocked eel. These would allow comparing the escapement per eel for the stocked eel with the escapement per eel in the donor area. This would also enable to check that eels are effectively stocked in area where anthropogenic pressures (ΣF and ΣH) are small. Historical transport should also be evaluated.

Member States have reported 103 measures related to hydropower and obstacles (e.g. pumps), with almost half reported as fully implemented. Germany and The Netherlands quantified the effectiveness of trap and transport as a mean to reduce mortality from 'Hydropower and obstacles'. Poland quantified the effects of "decreasing of eel mortality in HPP" which was lacking in details but assumed to include solutions to increase passibility. The other EMPs had measures intended to address 'Hydropower and obstacles' but which were not quantified.

Habitat degradation has clearly an effect on eel population. Local measures however will only have a local effect on the local eel population, that is difficult to relate at the scale of an EMU. This effect might be confounded by other effects (e.g. pollution, drought events), and will only show on escapement in the long term. While a monitoring of the change in biomass might demonstrate a positive effect, a change in recruitment also have an effect on escapement biomass.

While these measures (e.g. restoring connectivity, enhancing habitats) are probably very important for the eel, the measure of their effect shall only be visible in the long term.

6.4 ToR D – Provide alternative methods of monitoring, analysis and reporting

Alternative methods of monitoring, analysis, and reporting could not be formally identified. Despite providing some suggestions, the WKEMP4 strongly reiterate the need for all MS to monitor, analysis, and report according to the current EMPs. In most cases, there is a lack of clear target associated to each measure. Setting such a target and reporting their achievement could not be considered as alternative methods but are of highly importance.

It is recommended that setting management measures should follow the SMART system, so measures are Specific, Measurable, Achievable, Relevant and Timebound. Management measures need to have a target to 'achieve' i.e. set number of barriers to be mitigated, close season of x months; but also have an effect on either biomass ($B_{current}$) or mortality indicators.

6.5 EC Question I, "In regard of escapement target and the measures…"

Inconsistencies in indicators reported by the Member States impair the analysis and comparisons of their absolute values. As such, while 12 EMPs have reported levels of escapement above the biomass target, and 34 EMPs reported a mortality rate below 0.92, such results should be taken with caution. Temporal trends of indicators are considered to be more reliable. Escapement appears to be still declining in many EMPs. On the other hand, a decrease in fishing mortality has been detected in 14 EMPs, but with still 11 increasing trends, and a decrease in total anthropogenic was detected in 17 EMPs (12 significant increase). The development of standardized assessment methods is strongly recommended to allow comparison of indicators between EMPs and to be able to upscale indicators at larger spatial scales. This would also facilitate the assessment of the effectiveness of management measures. Given the long lifespan of the species, the effect of EMPs is not likely to be detected in the short term. The addition of alternative targets based on mortality would be valuable to monitor on the short term the effectiveness of EMPs.

6.6 EC Question II, "In regard of the 50% fishing effort/catches reduction …"

Only Denmark reported that it had commercial eel fishing outside of the boundaries of their EMP. The reported data shows that in Denmark there has been a gradual reduction in number of gears used for eel fishing for all different gears used, and that a 50% reduction in effort compared to the years 2004 to 2006 has been achieved. This Danish reduction in fishing effort has been achieved by not issuing any new fishing licenses and not allowing the transfer of existing fishing licenses.

6.7 EC Question III, "In regard of the reduction of mortality caused by factors outside (other than) the fishery…"

Those sources of non-fisheries mortality are included in the other anthropogenic mortality ΣH indicators. In the absence of disaggregated data and given the limited number of detected significant trend in s ΣH, it was not possible to assess the contribution of each individual source of mortality. Moreover, the types of mortality reported in ΣH vary among countries.

6.8 EC Question IV, "In regard of eel less than 12 cm/20 cm…."

The lack of an international traceability scheme during trade to monitor the destination of caught small eels makes impossible to ensure that small eels reserved for restocking are used for that purpose. Furthermore, the distinction between <12 cm and <20 cm does not seem appropriate from a biological point of view. Only the separation of glass eels and other categories should be used practically.

6.9 EC Question V, "In regard of the 60% restocking target…."

Only three countries have a glass eel fishery, but only two reported information on measures in place for restocking, and finally only one provide the percentage of glass eel caught used for restocking purposes, with a value close to 60%.

6.10 EC Question VI, "In regard of any other target(s) established by Member States by themselves in their EMP(s)…."

A total of 623 measures planned within EMPs were reported from 17 Member States. Most common measures, by type, in ascending order, were 'Commercial fishery' (199), 'Hydropower and obstacles' (103), 'Scientific monitoring' (84), 'Recreational fishery' (82), 'Stocking' (61), 'Habitat improvement' (56), 'Eel trade and marketing' (22) and 'Eel governance' (16).

To carry out an evaluation at the EU level, standardization is required. There is currently too much inconsistency across the 623 measures reported to carry out a quantitative evaluation. It is recommended that setting management measures should follow the SMART system, so measures are Specific, Measurable, Achievable, Relevant and Timebound. Management measures need to have a target to 'achieve' i.e. set number of barriers to be mitigated, close season of x months; but also have an effect on either biomass ($B_{current}$) or mortality indicators. Without these, it is difficult to say if a measure was implemented (fully or partially) (step 1) and what its effect was on the eel population in the EMU (step 2). To date, approx. 75% of measures have been implemented fully or partially.

6.11 Any other conclusions and recommendations

6.11.1 Considering future post-evaluations

Developing on from the considerations about the effectiveness of measures on escapement biomass (Section 5.1.2) to consider the most appropriate and productive questions to ask in a post-evaluation process, we can return to the basics of the challenge to recover the eel population. The core assumptions of the Eel Regulation, EMPs and the escapement biomass targets are that i) if total continental escapement is increased to 40% (or more) of that which was possible in the 'pristine' state, then the panmictic eel stock will have recovered to a safe biological state, resilient to all (or at least most) human and natural pressures, and ii) that if every spatial sub-unit of the continental range of the eel (EMPs, EMUs, others) meets its own 40% escapement target (and these are all correct) then the total continental escapement (the sum of the parts) will achieve that overall 40%.

The big questions to ask are therefore:

1. Are all the 40% escapement biomass targets correct?
2. Do all eel-producing waters in the eel distribution range have 40% escapement biomass targets?
3. Where escapement biomass is less than 40% in any eel spatial sub-unit, are they being managed so that escapement biomass will increase to reach 40% in an appropriate time frame (time frame is uncertain)?

Question 3 introduces the post-evaluation. Given that escapement biomass may be slow to respond to management measures, however, the short-term focus (e.g. annual, biennial, triennial) should be on reducing mortalities from anthropogenic and natural factors. This leads to post-evaluation questions of:

4. Have all mortalities been identified?
5. Have all effective solutions to reduce or remove these mortalities been implemented?

Progress towards the escapement targets can only be expected on the long run. While monitoring should be continued, reporting progress every three years would not be needed. Therefore, asking whether there is an improvement in 10 years' time balances the knowledge return against the analytical investment.

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Annex 1: List of participants

WKEMP 4.1: From 04-08 November 2024

WKEMP 4.2: From 10-14 February 2025

Name	Address	Country
Alain Biseau (chair)	Ifremer	France
Alan Walker (chair)	CEFAS	United Kingdom
Ana Gavrilovic	University of Zagreb Faculty of Agriculture EIFAAC	Croatia
Caroline Durif	IMR	Norway
Cédric Briand	EPTB Vilaine	France
Ciara O'Leary*	Inland Fisheries Ireland	Ireland
Eirik Ryvoll Åsheim	Swedish University of Agricultural Sciences	Sweden
Estibaliz Diaz	AZTI-Tecnalia	Spain
Hilaire Drouineau	INRAE	France
Jan-Dag Pohlmann	Thunen Institute	Germany
Jani Helminen	Natural Resources Institute Finland	Finland
Katarzyna Janiak	European Commission	Belgium
Marieke Desender	Research Institute for Nature and Forest	Belgium
Niki Sporrong	The Fisheries Secretariat	Sweden
Rob van Gemert	Swedish University of Agricultural Sciences	Sweden
Sami Vesala	Natural Resources Institute Finland	Finland
Sukran Yalcin Ozdilek	Canakkale Onsekiz Mart University	Turkey
Tessa van der Hammen	Wageningen University & Research	Netherlands

***Attended WKEMP4.2 only**

Annex 2: Resolutions

The **Workshop for the Technical evaluation of EU Member States' Eel regulation Progress Reports 2024/2025** (WKEMP4 1 and 2), chaired by Alain Biseau, France, and Alan Walker, UK, and with XXX as external reviewer, will be established and will meet virtually on 04-08 November 2024 (WKEMP4 1) and virtually on 10-14 February 2025 (WKEMP4 2) to:

a) Prepare the data for evaluation.
b) Evaluate the overall effectiveness of EMPs in terms of changes in achieving specific target indicators (i.e. escapement target, fishing effort/catches reduction target, eel trade target, restocking target, any other target(s) established by Member States), and reductions in mortalities caused by factors outside the fishery.
c) Evaluate the effectiveness and outcome of types of measures in terms of: i) the status of implementation of planned measures; ii) where available, quantification of their effects; and iii) the likelihood that these measures need to be increased or others deployed to achieve the targets set for EMPs.
d) Provide alternative methods of monitoring, analysis and reporting in which the attainment of implementation efforts is possible, in the event that quantification under the present system is not possible.

WKEMP4 2024/2025 will report by 07 March 2025 for the attention of the Advisory Committee.

Supporting information

Priority	The EU Regulation (EC 1100/2007) and associated Guidance obliges EU Member States to report on the progress of their Eel Management Plans (EMPs) on a triennial basis. DGMARE has requested an independent external review of the 2024 progress reports.

Scientific justification

The Regulation and associated EMPs are the core framework within the European Union for assessing (i) the state of eel production in Member States, (ii) factors affecting that state and (iii) levels of management action implemented to recover and protect the panmictic eel stock. Triennial reviews of progress in implementing EMPs is key in determining the contributions of these towards the shared goal of eel recovery, informing (advising) Policy makers whether these efforts are moving eel production in these Eel Management Units in the right direction (towards recovery), and identifying measures that are successful in some circumstances and so could be implemented elsewhere.

Moving beyond the focus within single EMPs, the aim of the Regulation is the recovery of the panmictic stock. The task of providing solid estimates of stock parameters by Eel Management Units (EMUs) that are comparable among regions and can be summed in terms of biomass and mortality, is important to develop an overview of the eel stock and exploitation status in Europe. At present, national reports and estimated biomass and mortality indicators should be analysed to ensure that the current indicators are valid and consistent as there could be considerable differences between national approaches. At present, there is no indicator to evaluate how well management measures are implemented.

ICES is requested to advise, on the basis of the 2024 Member States progress reports as required under the Eel Regulation and any other available information:

VII. <u>In regard of the escapement target</u> and the measures to attain this target as part of the EMP, including the transboundary EMP (Articles 2, 6, 9(1) and 9(1)(a) of the Eel Regulation):

- **7)** The extent to which the 40% escapement target has been reached for each Member State river basin covered by each management plan.
  Where possible, ICES should quantify the realised escapement level.
- **8)** Where quantification is not possible, ICES is requested to advise based on alternative methods deemed suitable by ICES, whether the eel escapement levels in paragraph 1 are thought to be:
  - f. Likely to be at or above the target (40% or above)
  - g. Below, but close to the target (likely to be in the range 30% to 40%)
  - h. Well below the target (likely to be of the order of 20%)
  - i. Very low (likely to be of the order of 10%)
  - j. Negligible (little prospect of escapement being much above zero).
- **9)** For each type of measures implemented by Member States, ICES is requested to quantify their effect in the river basin(s), covered by each management plan where feasible or at other appropriate geographical scale.
- **10)** Where quantification is not possible, ICES is requested to advise based on alternative methods, deemed suitable by ICES, whether the effect of each type of measure implemented (or proposed to be implemented) is:
  - d. An appropriate and effective measure, sufficiently deployed in order to achieve the target
  - e. An appropriate and effective measure, but insufficiently deployed in order to achieve the target
  - f. A measure not likely to achieve the target even if deployed as widely as practicable.
- **11)** In the case 4b above, ICES is requested to advise on the necessary increase in the deployment of the measure(s) needed to achieve a high likelihood of the target being reached.
- **12)** To summarise the information provided in the MS reports or other information on whether the time schedule put forward by the Member State in its EMP has been met for the attainment of the target level of escapement in the long-term (Article 2(9) of the eel Regulation).

VIII. In regard of the 50% fishing effort/catches reduction target established by a Member State outside the EMP (Articles 4(2)-(3) and Article 9(1)b) of the Eel Regulation):

- **4)** The extent to which this target has been reached, and where possible to quantify the realised level.
- **5)** Where quantification is not possible, ICES is requested to advise on the attainment of this target based on alternative methods, deemed suitable by ICES.
- **6)** The effects of each type of measure in quantitative terms and where not possible based on alternative methods, deemed suitable by ICES.

IX. In regard of the reduction of mortality caused by factors outside the fishery (Articles 2(10) and 9(1)(c) of the Eel Regulation):

- **4)** The level of the reduction effected, and where a Member State has put forward a specific target in the EMP – the extent to which this target has been reached, and where possible to quantify the realised level.
- **5)** Where quantification is not possible, to advise on the attainment of the reduction effected based on alternative methods, deemed suitable by ICES.
- **6)** The effects of each type of measure in quantitative terms and where not possible based on alternative methods, deemed suitable by ICES.

X. In regard of eel less than 12cm/20cm in length used for different purposes (Article 9(1)(d) of the Eel Regulation, in conjunction with Article 7(4)):

- **4)** The amount of eels less than 12cm caught by Member State and the proportions of this utilised for different purposes (such as restocking, aquaculture, consumption, leisure sport/recreational fishing, research).
- **5)** The amount of eels less than 12 cm bought/marketed by Member State and the proportions of this utilised for different purposes (such as restocking, aquaculture, consumption, leisure sport/recreational fishing, research).
- **6)** The amount of eels less than 20 cm in length transferred for restocking for the purpose of increasing escapement levels of silver eels.

XI. In regard of the 60% restocking target applicable to Member States who allow glass eel fishing (Article 7(1) of the Eel Regulation, in conjunction with Article 2(8)):

- **4)** The extent to which this target has been reached, and where possible to quantify the realised level.
- **5)** Where quantification is not possible, ICES is requested to advise on the attainment of this target based on alternative methods, deemed suitable by ICES.
- **6)** The effects of each type of measure in quantitative terms and where not possible, based on alternative methods, deemed suitable by ICES.

XII. In regard of any other target(s) established by Member States by themselves in their EMP(s) (e.g. restocking target set by those Member States who do not have glass eel fisheries but carry out restocking activities of eels below 12cm or 20cm in length) to provide information on

- **4)** The extent to which the specific target has been reached, and where possible to quantify the realised level.
- **5)** Where quantification is not possible, ICES is requested to provide information on the attainment of this target based on alternative methods, deemed suitable by ICES.
- **6)** The effects of each type of measure in quantitative terms and where not possible based on alternative methods, deemed suitable by ICES.

Resource requirements	This work will require access to the ICES SharePoint, and potential hosting of two meetings. This work will also require access to the WGEEL database and associated shiny visualization apps.

Participants	The participation should reflect the diverse scientific competence needed to fulfil the objectives of the workshop. The initial workshop will invite a core group of experts: an experienced chair or chairs to oversee the whole process and ensure objectivity and respect of the outcomes; the WGEEL chairs, the stock coordinator and the stock assessor to ensure good linkages to relevant national experts; and data experts from the WGEEL. These experts would review data and methods and make new calculations where needed. The workshop will also open to other participants that wish to participate. If the workshop(s) are oversubscribed, ICES reserves the right, in consultation with the workshop chair to select the final workshop participants based on their expertise, and equitable makeup of the workshop. Preliminary data submissions and collation of those data will be discussed with data providers and stock assessors during WGEEL in September 2024. The final workshop of the core group of experts will complete the reporting.
Secretariat facilitie	ICES data call, Secretariat support, and Advisory process and Secretariat support
Financial	Covered by DG MARE special requests to ICES
Linkages to advisory committees	To ACOM through the recurring assessment of the eel stock by WGEEL and through the advisory process.
Linkages to other committees or groups	WGEEL, WGDIAD, SCICOM, ACOM, FRSG.
Linkages to other organizations	The work of this workshop is primarily to support EU DGMARE in evaluating the success of the national EMPs through the progress reports. This work also has links to the ICES Scientific Advice which is used by not only EU DG MARE, but also DG ENV, the CITES Secretariat, FAO EIFAAC and GFCM.

Annex 3: List of abbreviations and acronyms

ACRONYMS

Acronyms	Definition
AA	Administrative Agreement, typically the recurring agreement between ICES and the EC
ACFM (ICES)	Advisory Committee on Fisheries Management
ACOM (ICES)	Advisory Committee on Management
ADGEEL	Advice drafting group on eel, for ICES
CITES	Convention on International Trade in Endangered Species of Flora and Fauna
CMS	Convention on the Conservation of Migratory Species of Wild Animals
COMM	European Commission, also EC is used.
CPUE	Catch per unit of effort
CR	Country Report
DG-MARE	Directorate-General for Maritime Affairs and Fisheries, European Commission
DLS	Data-Limited Stocks
EC	European Commission, also COMM is used.
EDA	Eel Density Analysis (model, France)
EIFAAC	European Inland Fisheries & Aquaculture Advisory Commission
EIFAC	European Inland Fisheries Advisory Commission – became EIFAAC in 2008
EMP	Eel Management Plan
EMU	Eel Management Unit
EU	European Union
EU MAP	The European Multi-Annual Plan, previously the DCF
FAO	Food and Agriculture Organisation
GAM	Generalised Additive Model
GEM	German Eel Model
GFCM	General Fisheries Commission of the Mediterranean
GIS	Geographic Information Systems
GLM	Generalised Linear Model
HPS	Hydropower Station

Acronyms	Definition
ICES	International Council for the Exploration of the Sea
IMESE	Irish model for estimating silver eel escapement
IUCN	International Union for the Conservation of Nature
IUU	Illegal, Unreported and Unregulated fisheries
LHT	Life History Trait
LVPA	Length-based Virtual Population Assessment
L50	L50 = the length (L) at which half (50%) of a fish species may be able to spawn
MS	Member State, typically used in reference to EU Member States but not only
MSY	Maximum Sustainable Yield
NA	Not applicable
NC	Not collected, code to explain an empty data value cell
ND	No data, code to explain an empty data value cell
NDF	Non-detriment Finding
NP	Not pertinent, code to explain an empty data value cell
NR	Not recorded, code to explain an empty data value cell
RBD	River Basin District, typically as defined according to the EU Water Framework Directive
SAC	The GFCM Scientific and Advisory Committee on Fisheries
SCICOM	The Science Committee of ICES
SGIPEE	Study Group on International Post-Evaluation on Eels 2010, 2011
SMEP II	Scenario-based Model for Eel Populations, vII (model applied in England and Wales, UK)
SPR	Estimate of spawner production per recruiting individual.
SQL	Special purpose programming language for managing data
SRG	Scientific Review Group of the European Commission
SSB	Spawning–Stock Biomass
STECF	Scientific, Technical and Economic Committee for Fisheries, European Commission
ToR	Terms of Reference
VPA	Virtual Population Analysis
WG	Working Group
WFD	Water Framework Directive, European Directive

Acronyms	Definition
WGEEL	Joint EIFAAC/ICES/GFCM Working Group on Eels
WKEELCITES	Workshop on Eel and CITES 2015
WKEELDATA3	Second Workshop on designing an Eel Data Call 2022
WKEELMIGRATION	Workshop on the Temporal Migration patterns of European Eels 2020
WKEMP	Workshop on Evaluating Management Plans – 2012 2018 2021
WKEPEMP	The Workshop on Evaluating Progress with Eel Management Plans 2013
WKESDCF	Workshop on Eels and Salmon in the Data Collection Framework 2012
WKFEA	Workshop on the future of eel advice 2021
YFS1	Young Fish Survey: North Sea Survey location

GLOSSARY

Term	Definition
Anthropogenic	Caused by humans
Assisted migration	The practice of trapping and transporting juvenile eel within the same river catchment to assist their upstream migration at difficult or impassable barriers, without significantly altering the production potential (B_{best}) of the catchment
Bootlace, fingerling	Intermediate sized eels, approx. 10–25 cm in length. These terms are most often used in relation to restocking. The exact size of the eels may vary considerably. Thus, it is a confusing term.
Carrying Capacity	The average maximum biomass of eel that can be supported by a given habitat.
Catch	The WGEEL uses the term catch(es) to mean fish that are caught but not necessarily landed. See Landings below
Depensation	The effect on a population when a decrease in spawners leads to a faster decline in the number of offspring than in the number of adults.
Eel River Basin or Eel Management Unit	"Member States shall identify and define the individual river basins lying within their national territory that constitute natural habitats for the European eel (eel river basins) which may include maritime waters. If appropriate justification is provided, a Member State may designate the whole of its national territory or an existing regional administrative unit as one eel river basin. In defining eel river basins, Member States shall have the maximum possible regard for the administrative arrangements referred to in Article 3 of Directive 2000/60/EC [i.e. River Basin Districts of the Water Framework Directive]." EC No. 1100/2007.
Elver	Fully pigmented young eel, in its first year following recruitment from the ocean. The elver stage is sometimes considered to exclude the glass eel stage, but not by everyone. To avoid confusion, pigmented 0+cohort age eel are included in the glass eel term.
Escapement	The amount of eel that leaves (escapes) a water body, after taking account of all natural and anthropogenic losses. Most commonly used with reference to silver eel – silver eel escapement.
Glass eel	Young, unpigmented eel, recruiting from the sea into continental waters. WGEEL consider the glass eel term to include all recruits of the 0+ cohort age group, including some pigmented eel.
Index river	To be defined
Landings	The WGEEL uses the term Landings to mean fish that are brought ashore.
Leptocephalus	Flat and transparent marine larval stage of eel, dispersing and migrating from oceanic spawning regions to continental waters, between pre-Leptocephalus and metamorphosis to glass eel
Lifestage	Defined stage in the lifecycle of eel, whether leptocephalus, glass eel, yellow eel, or silver eel.
Limit Reference Point	A Limit Reference Point indicates a state of a fishery and/or a resource which is considered to be undesirable and which management action should avoid.
Non-detriment finding (NDF)	In relation to CITES, the competent scientific authority has advised in writing that the capture or collection of the specimens in the wild or their export will not have a harmful effect on the conservation status of the species or on the extent of the territory occupied by the relevant population of the species.
Production	The amount of fish produced from a waterbody. Sometimes referred to for silver eel in terms as escapement + anthropogenic losses, or production – anthropogenic losses = escapement.
River Basin District (RBD)	The area of land and sea, made up of one or more neighbouring river basins together with their associated surface and groundwaters, transitional and coastal waters, which is identified under

Term	Definition
	Article 3(1) of the Water Framework Directive as the main unit for management of river basins. The term is used in relation to the EU Water Framework Directive.
Restocking	The practice of adding fish [eels] to a waterbody from another source outside of the catchment, to supplement existing populations or to create a population where none exists
Silver eel	Migratory phase following the yellow eel phase. Eel in this phase are characterized by darkened back, silvery belly with a clearly contrasting black lateral line, enlarged eyes. Silver eel undertake downstream migration towards the sea, and subsequently westwards. This phase mainly occurs in the second half of calendar years, although some are observed throughout winter and following spring.
Target reference point	A Target Reference Point indicates the state of fishing and/or resource biomass/abundance which is considered to be desirable and at which management action, whether during development or stock rebuilding, should aim. (Caddy and Mahon, 1995).
To silver (silvering)	Silvering is a requirement for downstream migration and reproduction. It marks the end of the growth phase and the onset of sexual maturation. This true metamorphosis involves a number of different physiological functions (osmoregulatory, reproductive), which prepare the eel for the long return trip to the Sargasso Sea. Unlike smoltification in salmonids, silvering of eels is largely unpredictable. It occurs at various ages (females: 4 – 20 years; males 2 – 15 years) and sizes (body length of females: 50 – 100 cm; males: 35 – 46 cm) (Tesch, 2003).
Trap and Transport	Capturing downstream migrating silver eel for transportation around hydropower turbines
Yellow eel	Life-stage resident in continental waters. Often defined as a sedentary phase, but migration within and between rivers, and to and from coastal waters occurs and therefore includes young pigmented eels (‘elvers’ and bootlace).

STOCK REFERENCE POINTS and DATA CALL TERMS

Age	The age of eel in years, with fractions of years designated with a plus (e.g, 0+, 1+), starting at recruitment to coastal waters. Glass eel are defined as 0+.
Baltic region	The countries bordering the Baltic Sea; sometimes other countries in the catchment are also included.
$B_{current}$	The Current escapement biomass: The amount of silver eel biomass that currently escapes to the sea to spawn, corresponding to the assessment year.
$B_{currentw}$	The current escapement biomass without restocking. For demographic models using recruitment as an input, it means re-running the model without the glass eel that were restocked. Where there is no restocking taking place, $B_{currentw} = B_{current}$
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 is considered. The Best achievable escapement biomass under present conditions for a given Eel River Basin: escapement biomass corresponding to recent natural recruitment that would have survived if there was only natural mortality and no restocking, corresponding to the assessment year.
B_0	The amount of silver eel biomass that would have existed if no anthropogenic influences had impacted the stock. Reference point for the theoretical maximum quantity of silver eel expressed as biomass that would have escaped from a defined eel producing area, in the absence of any anthropogenic impacts.
Commercial Fisheries	Fisheries with sale of catch for commercial gain
Coastal waters	WFD coastal waters
Eel management unit (EMU)	Eel management unit defined in an Eel Management plan under the Eel Regulation 1100/2007.
Fresh waters	(Abbreviated F). Waters with zero salinity
G	Code in Data Call for data comprising Glass eel only as defined in Glossary
GEE-n	Glass eel equivalents in numbers – the quantity of eel expressed as equivalent number of glass eel. Method provided in ICES (2013) report p103.
Glass eel recruitment series	Time series enumerating glass eel recruiting from the sea into continental waters.
Habitat	Waters occupied by eel, whether fresh, transitional, coastal or marine
ICES statistical rectangles	See http://gis.ices.dk/sf/index.html?widget=StatRec
Inland waters	Fresh waters, not under the jurisdiction of Marine fisheries management (i.e. the CFP).
Landings from fisheries	Commercial landings include any eel taken from the water and landed on the market. Recreational landings include any eel taken from the water by recreational fisheries. Other landings include eel caught for assisted migration, translocation,
Longitude	x (longitude) EPSG:4326. WGS 84 (Google it)
Latitude	y (latitude) EPSG:4326. WGS 84 (Google it)
M	Natural Mortality

North Sea	For the purposes of ICES eel management, taken as ICES sea areas IV $_a$, IV $_b$, IV $_c$ and inflowing fresh water systems
Marine waters	(Abbreviated MO) Open marine waters
Fisheries - Recreational	Recreational (= non-commercial) fishing is the capture or attempted capture of living aquatic resources mainly for leisure and/or personal consumption.
Releases	Eel released to the wild after capture
S	Code in Data Call for data comprising Silver eel
Sea region (division)	ICES Sea area statisitical rectangle. Where required for freshwater eel habitats, is the sea area the River basin drains to.
Silver eel abundance series	Time series of abundance of silver eel determined by consistent regular count or survey (usually by capturing migrating silver eel)
SPR	Spawner per recruit: estimate of spawner production per recruiting individual.
%SPR	Ratio of SPR as currently observed to SPR of the pristine stock, expressed in percentage. %SPR is also known as Spawner Potential Ratio.
Standing stock	The total stock of eel present in a waterbody at a point in time, expressed as a number of individuals or total biomass
Transitional waters	(Abbreviated T). WFD transitional waters, implies reduced salinity
Transport/relocation operations	When eels have been collected somewhere in traps and transported to other places where they appear as "release" for the purposes of data recording
ΣF sumF	The fishing mortality rate, summed over the age-groups in the stock for all fishery types.
ΣH sumH	The subtotal anthropogenic mortality rate outside the fishery, summed over the age-groups in the stock.
ΣA sumA	The total sum of anthropogenic mortalities throughout the continental life phase, i.e. $\Sigma A = \Sigma F + \Sigma H$.
Y	Code in Data Call for data comprising yellow eel only
"3Bs & ΣA"	Refers to the 3 biomass indicators (B_0, B_{best} and $B_{current}$) and anthropogenic mortality rate (ΣA).
40% EU Target	From the Eel regulation (1100/2007): "The objective of each Eel Management Plan shall be to reduce anthropogenic mortalities so as to permit with high probability the escapement to the sea of at least 40% of the silver eel biomass relative to the best estimate of escapement that would have existed if no anthropogenic influences had impacted the stock". The WGEEL takes the EU target to be equivalent to a reference limit, rather than a target.

Annex 4: List of data reported to the data call

Table A4.1: Number of biomass indicators reported per country (reported), either with a numeric value (number) or as 'NC' not collected, 'NP' not pertinent, 'NR' not reported. The report is split per annex type (annex) and country.

country	annex	reported_2021	reported_2024	reported_2025	number_2021	number_2024	number_2025	nc_2021	nc_2024	nc_2025	np_2021	np_2024	np_2025	nr_2021	nr_2024	nr_2025
BE	biomass	64		48	24		48	0		0	0		0	40		0
DE	biomass	66	258		66	186		0	0		0	0		0	72	
DK	biomass	20	97		0	26		0	0		0	13		20	58	
EE	biomass	10	81	26	10	20	13	0	61	13	0	0	0	0	0	0
ES	biomass	164	290	31	116	253	31	28	37	0	20	0	0	0	0	0
FI	biomass		78			0			78			0			0	
FR	biomass		429			220			0			0			209	
GB	biomass	175	410		161	324		14	47		0	39		0	0	
GR	biomass		195			130			0			65			0	
HR	biomass		39			0			36			0			3	
IE	biomass	120	153		120	96		0	18		0	39		0	0	
LT	biomass	20	26		20	26		0	0		0	0		0	0	
LV	biomass	20	48		10	6		10	42		0	0		0	0	
NL	biomass			39			39			0			0			0
NO	biomass	20			10			10			0			0		
PL	biomass		52	26		52	26		0	0		0	0		0	0
PT	biomass	36	81		12	51		24	30		0	0		0	0	
SE	biomass	40	77		12	42		28	35		0	0		0	0	

Table A4.2: Number of mortality indicators reported per country (reported), either with a numeric value (number) or as 'NC' not collected, 'NP' not pertinent, 'NR' not reported. The report is split per annex type (annex) and country.

country	annex	reported_2021	reported_2024	reported_2025	number_2021	number_2024	number_2025	nc_2021	nc_2024	nc_2025	np_2021	np_2024	np_2025	nr_2021	nr_2024	nr_2025
BE	mortality	96		18	36		18	0		0	0		0	60		0
DE	mortality	107	217		107	217		0	0		0	0		0	0	
DK	mortality	30	87		0	39		0	0		0	0		30	48	
EE	mortality	18	9		15	9		0	0		0	0		3	0	
ES	mortality	278	210		133	169		115	39		30	2		0	0	
FI	mortality		78			0			78			0			0	
FR	mortality		429			330			0			0			99	
GB	mortality	295	290		283	205		12	46		0	39		0	0	
GR	mortality		195			159			0			36			0	
IE	mortality		273			216			18			39			0	
LT	mortality	30	39		30	39		0	0		0	0		0	0	
LV	mortality	30	48		5	3		25	45		0	0		0	0	
NL	mortality		39			39			0			0			0	
NO	mortality	30			15			15			0			0		
PL	mortality		78			78			0			0			0	
PT	mortality	10	107		10	53		0	54		0	0		0	0	
SE	mortality	60	57		30	48		30	9		0	0		0	0	

Table A4.3: Number of landing indicators reported per country (reported), either with a numeric value (number) or as 'NC' not collected, 'NP' not pertinent, 'NR' not reported. The report is split per annex type (annex) and country.

country	annex	reported_2021	reported_2024	reported_2025	number_2021	number_2024	number_2025	nc_2021	nc_2024	nc_2025	np_2021	np_2024	np_2025	nr_2021	nr_2024	nr_2025
AL	landings	32	2		32	2		0	0		0	0		0	0	
BE	landings	409	476		3	4		0	0		406	472		0	0	
CZ	landings	8			8			0			0			0		
DE	landings	560	611		168	191		0	0		392	420		0	0	
DK	landings	8	7		8	6		0	0		0	1		0	0	
DZ	landings	18	7		13	7		0	0		5	0		0	0	
EE	landings	6	32		4	2		2	0		0	30		0	0	
ES	landings	1048	105		29	28		3	0		1016	77		0	0	
FI	landings	17	15		2	3		0	4		10	8		5	0	
FR	landings	241	100		19	100		0	0		222	0		0	0	
GB	landings	397	34		45	20		0	0		352	14		0	0	
GR	landings	993	6		28	6		21	0		943	0		1	0	
HR	landings		29			3			0			26			0	
IE	landings	162	144		12	36		0	0		150	108		0	0	
IT	landings	528	296		64	83		21	0		443	213		0	0	
LT	landings	25	34		6	6		0	0		0	28		19	0	
LV	landings	10	4		0	4		0	0		10	0		0	0	
NL	landings	121	41		1	14		24	4		96	23		0	0	
NO	landings	12	1		1	1		0	0		11	0		0	0	
PL	landings	74	8		8	8		20	0		46	0		0	0	
PT	landings	26	26		2	2		0	0		24	24		0	0	
SE	landings	69	91		0	91		0	0		69	0		0	0	
TN	landings	3	48		3	13		0	0		0	35		0	0	
TR	landings	3			3			0			0			0		

Table A4.4: Number of restocking indicators reported per country (reported), either with a numeric value (number) or as 'NC' not collected, 'NP' not pertinent, 'NR' not reported. The report is split per annex type (annex) and country.

country	annex	reported_2021	reported_2024	reported_2025	number_2021	number_2024	number_2025	nc_2021	nc_2024	nc_2025	np_2021	np_2024	np_2025	nr_2021	nr_2024	nr_2025
BE	restocking	4	8		4	8		0	0		0	0		0	0	
DE	restocking	460	386		460	386		0	0		0	0		0	0	
DK	restocking		4			4			0			0			0	
EE	restocking	2	2		2	2		0	0		0	0		0	0	
ES	restocking	15	29		15	29		0	0		0	0		0	0	
FI	restocking	9	2		9	2		0	0		0	0		0	0	
FR	restocking	26	20		24	20		2	0		0	0		0	0	
GB	restocking	32	26		18	26		0	0		14	0		0	0	
GR	restocking	14	8		14	8		0	0		0	0		0	0	
IE	restocking	10	18		10	18		0	0		0	0		0	0	
LT	restocking	2	4		2	4		0	0		0	0		0	0	
LV	restocking	4	2		2	2		2	0		0	0		0	0	
NL	restocking	2	4		2	4		0	0		0	0		0	0	
PL	restocking	4	14		4	14		0	0		0	0		0	0	
SE	restocking	140	10		140	10		0	0		0	0		0	0	

Annex 5: Data quality checks

The data call has been done in two steps. After the first data call, WGEEL and WKEMP have analysed data and asked for clarifications. This part only reports data after the integration of new data in February 2025.

A5.1 B_{best} larger than B_0

Normally, B_{best} (that does not include restocking) stands for the best escapment that can occur in the absence of anthropogenic influence give the current recruitment. Since recruitment has collapsed, B_{best} is supposed to be smaller than B_0 which is the escapment that would occur in the absence of any anthropogenic influence, including a pristine recruitment, and is generally estimated using pre-1980s data.

A first check consisted of comparing B_{best} and B_0 (Table A4.2): both indicators refer to the escapement that would occur in the absence of any anthropogenic pressures, but B_{best} corresponds to the escapement with the current recruitment while B_0 corresponds to the escapement produced with a pristine recruitment. Given the decrease in recruitment since the early 1980s, B_{best} should be less than B_0. In a few situations, B_{best} is greather than B_0 (Figure 4.1): DE_Warn, EE_Narv, EE_total, ES_Minh, GB_Neag, GB_Scot, GR_CeAe, GR_WePe, PL_Oder, SE_Inla (Table 4.1). For SE_Inla, B_{best} estimates are greater than B_0 during the late 1980s / early 1990s, suggesting that B_0 might be based on historical data from the 1980s (an option suggested in the Regulation) rather than to a truly pristine situation. In Estonia, it was indicated that B_{best} was entirely dependent on B_0. Then the calculation of B_{best} remains wrong and should be 0.

In the other above listed EMUs, an underestimation of B_0 is probably the reason. For instance, in SE_Inla, this is likely related to using a B_{0} that is coming from the late 1980s situation.

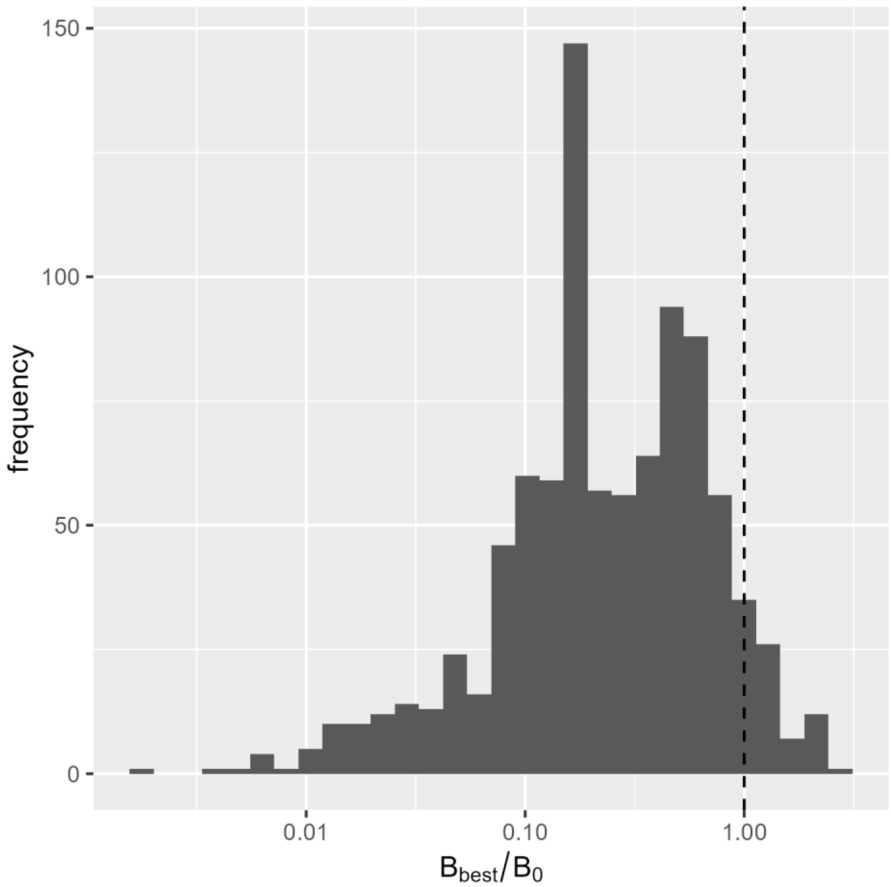

Figure A5.1: Histogram showing the frequency distribution of the B_{best}/B_0 ratio.

Table A5.1: Occurrence of B_{best} values larger than B_0. Either detail of years, or range and number of values if too long.

EMU	Years	B_{best}/B_0
DE_Warn	range:2007-2016, Number occurrences 10	1.19
EE_Narv	range:2016-2023, Number occurrences 5	1.14
EE_total	2020|2021|2022|2023	1.14
ES_Minh	2021|2023	1.45
GB_Neag	range:2009-2019, Number occurrences 9	1.20
GB_Scot	2009|2014|2021	1.34
GR_CeAe	2007|2019	2.49
GR_WePe	2007|2008|2011	1.19
PL_Oder	2008	1.33
SE_Inla	range:1960-1979, Number occurrences 20	1.83

A5.2 B_{best} less than $B_{current}$

A second check consisted of comparing B_{best} and $B_{current}$ (Table A5.2, Figure A5.2): in the absence of significant re-stocking, $B_{current}$ should be less than B_{best}. The analysis of the ratio $B_{current}/B_{best}$ clearly shows the large effect of restocking in Germany, in Poland (PL_Oder) and in Sweden (SE_Inla). The very large value for DE_Rhei also illustrates a specific issue raised by transboundary EMU: DE_Rhein has no direct access to the sea so that young eels have to migrate through the Netherlands to reach DE_Rhein while in the other direction, silver eels also have to migrate through NL to reach the sea. B_{best} is almost impossible to be estimated in such EMUs: it would require estimating the number of eels that would migrate to DE_Rhei given the current recruitment in the absence of any anthropogenic barriers in the Netherlands. The large $B_{current}/B_{best}$ values indicate that B_{best} is likely underestimated and that currently, the "natural recruitment" is almost insignificant compared to restocking in those EMUs. In some Irish EMUs, B_{best} is equal to $B_{current}$, these results are consistent with the very small anthropogenic mortality estimated in recent years for those EMUs. In countries without (or with limited) restocking, $B_{current}$ should be less than B_{best}. In Poland B_{best} was calculated using geometric average recruitment from years 2010-2014 and only natural mortality to get estimate of SSB and it has been assumed the same for all years. In some previous reports two options of Bbest were used as it was not clear from the guidelines how Bbest should be calculated: 1. Bbest1 is based on current recruitment (e.g. from years 2021-2023), 2. Bbest2 is based on recruitment from those year-classes, which form current escapement of silver eel to spawn.

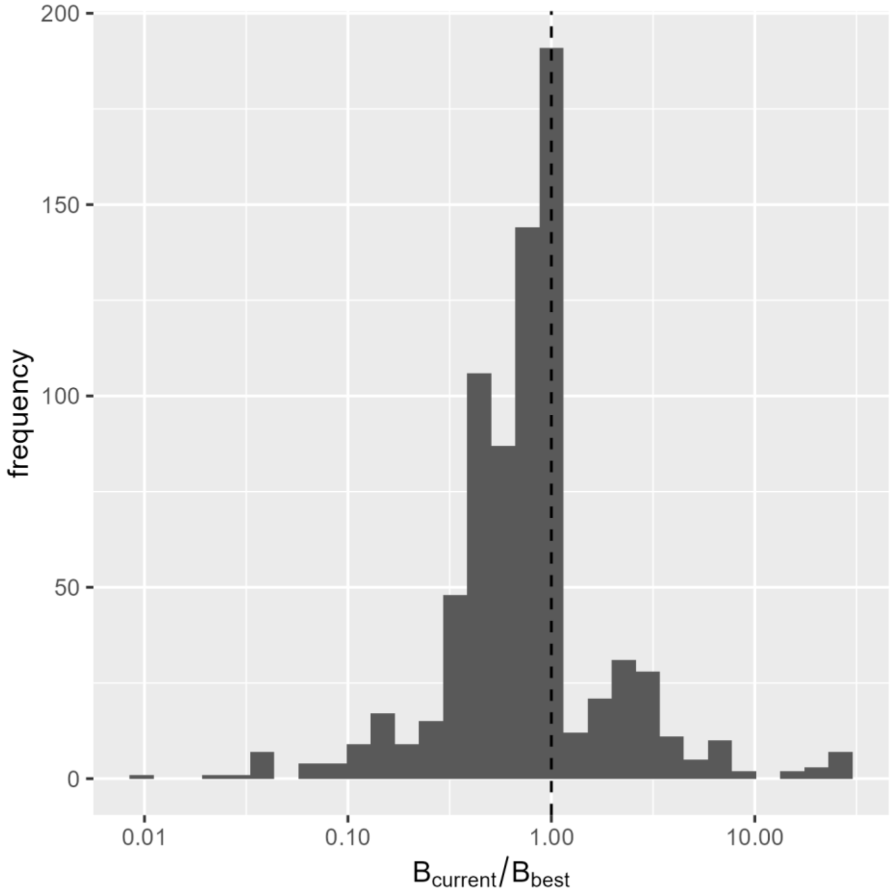

Figure A5.2: Histogram showing the frequency distribution of the $B_{current}/B_{best}$ ratio. Values higher than 1 indicate that $B_{current}$ is higher than B_{best} which can happen in the case of restocking.

Table A5.2: Table showing ratio of $B_{current}$ over B_{best} for those EMUs and years where $B_{current}$ larger than B_{best}. EMU from SE, NL, PL, DE excluded as obviously, in this case this is caused by restocking.

EMU	Years	$B_{current}/B_{best}$
DE_Rhei	range:2007-2022, Number occurrences 16	18.73
DE_Elbe	range:2007-2022, Number occurrences 16	3.73
PL_Vist	range:2007-2023, Number occurrences 17	3.67
DE_Maas	range:2017-2022, Number occurrences 6	3.09
PL_Oder	range:2007-2023, Number occurrences 17	2.94
DE_Wese	range:2007-2022, Number occurrences 16	2.79
SE_Inla	range:2002-2023, Number occurrences 22	2.79
DE_Ems	range:2007-2022, Number occurrences 16	1.83
ES_Nava	2012|2013|2014|2015	1.15
DE_Schl	range:2009-2022, Number occurrences 8	1.14
DE_Oder	range:2007-2022, Number occurrences 11	1.08
GR_CeAe	2007|2019|2023	1.01
IE_SouE	2015	1.00
IE_SouW	2019|2020	1.00
IE_West	2014|2018	1.00

For German EMUs, this shows the massive effect of restocking which is also visible in Sweden or in Poland. For Ireland, the anthropogenic mortality is so low in recent years that $B_{current}$ and B_{best} can be very similar. Results are more doubtful in ES_Anda.

A5.3 Only $B_{currentwithoutrestocking}$ reported

Before looking at EMUs where $B_{currentwithoutrestocking}$ exceeds either B_{best} or B_0, it is worthwhile to look at countries that have only reported $B_{currentwithoutrestocking}$, and no $B_{current}$ which may or may not include restocking.

Table A5.3: Table with $B_{currentwithoutrestocking}$ larger than B_{best}, and $B_{current}$ is not reported.

EMU	Years	$B_{currentw}/B_{best}$
FR_Cors	range:2010-2021, Number occurrences 12	0.81
FR_Rhon	range:2010-2021, Number occurrences 12	0.62
FR_Arto	range:2010-2021, Number occurrences 12	0.34
FR_Bret	range:2010-2021, Number occurrences 12	0.32
FR_Sein	range:2010-2021, Number occurrences 12	0.29
FR_Garo	range:2010-2021, Number occurrences 12	0.18
FR_Adou	range:2010-2021, Number occurrences 12	0.14
ES_Gali	2018	0.13
FR_Loir	range:2010-2021, Number occurrences 12	0.09
FR_Rhin	range:2010-2021, Number occurrences 12	0.04
FR_Meus	range:2010-2021, Number occurrences 12	0.00
EE_Narv	range:2007-2015, Number occurrences 9	

It is mostly French EMUs that have reported an estimate of $B_{currentwithoutrestocking}$ (Table A5.3), while not having reported on regular $B_{current}$. The reason is that the latest report is only based on regions where restocking didn't occur (so as not to bias EDA outputs….) so it was not provided. Theoretically another model could have been used to provide those estimates (e.g. A model estimating the production for segments of rivers affected by restocking).

A5.4 $B_{currentwithoutrestocking}$ higher than B_{best}

Compared to previous reports, all estimates of $B_{currentwithoutrestocking}$ are now lower than B_{best}. Two values were corrected and now the table only shows a rounding problem for IE_SouW (Figure A5.3, Table A5.4).

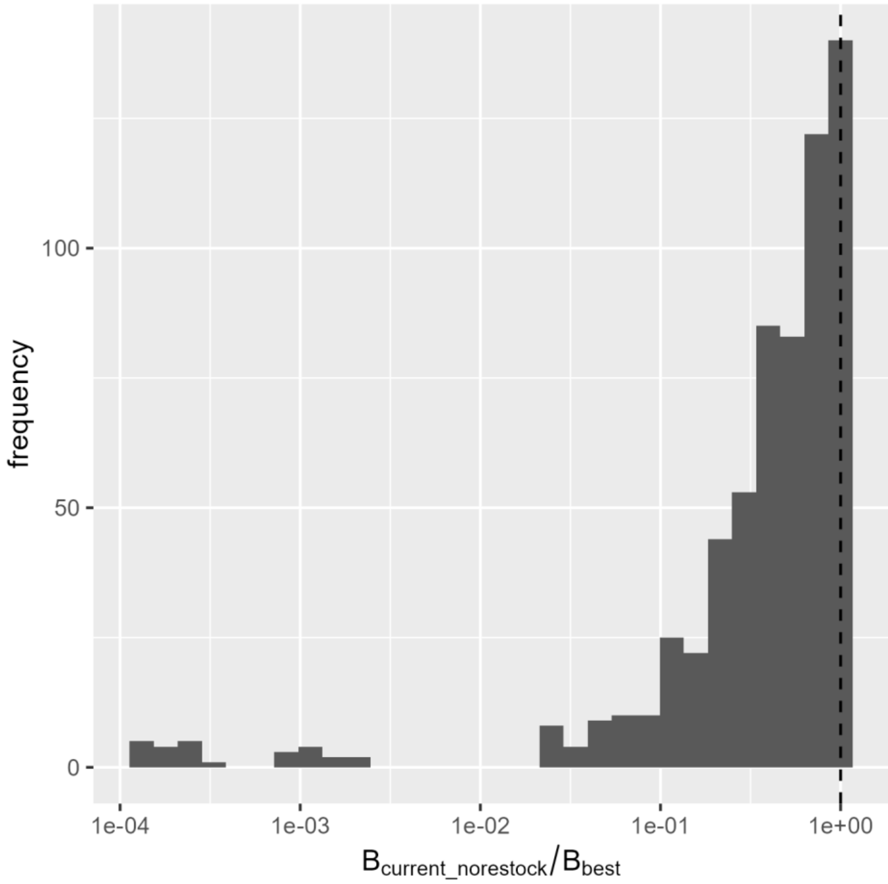

Figure A5.3: Histogram showing the frequency distribution of the $B_{currentwithoutrestocking}/B_best$ ratio. Values higher than 1 indicate that $B_{currentwithoutrestocking}$ is higher than B_best which should not happen.

Table A5.4: Table showing years and EMU where $B_{currentwithoutrestocking}$ is higher than B_{best}. There is only one and it's a rounding problem that can be saferly ignored.

EMU	Years	$B_{currentw}/B_{best}$
IE_SouW	2019|2020	1

A5.5 $B_{current}$ higher than B_{best} while $B_{currentwithoutrestocking}$ is not reported.

B_{best} calculation should not include restocking. So when $B_{current}$ is larger than B_{best} we expect that there is restocking. If $B_{currentwithoutrestocking}$ is not reported, then data are missing. Table A5.5 summarizes those data. Poland has reported missing values from 2011 so that is good, and only older estimates are missing (before 2010). Germany failed to report those data in time due to technical problem with the model (not being able to do such calculations). The problem identified for Greece also remains.

For GR_CeAe, indicators are strange. Sometimes $B_{current}$ is larger or equal to B_{best}, but at the same time $\sum A$ is also high. Sometimes, B_{best} and $B_{current}$ are 0, but $\sum A$ is also 0. I double-checked with the data provider, and all years with 0 values for biomass indicator estimates should be NC instead, since these are years with no landings (so $\sum A$ is 0). It remained unclear why B_{best} and $B_{current}$ were higher than B_0 for years with an estimate. It is advised to remove this series from WKEMP analysis until the methods for deriving these estimates are better looked at.

Table A5.5: EMU and years for which $B_{current}$ is larger than B_{best} and $B_{currentwithoutstocking}$ is not reported.

EMU	Years	$B_{current}/B_{best}$
DE_Rhei	2007/2008/2009/2010/2011/2012/2013/2014/2015/2016/2017/2018/2019/2020/2021/2022	18.73
PL_Vist	2007/2008/2009/2010	7.00
PL_Oder	2007/2008/2009/2010	4.46
DE_Elbe	2007/2008/2009/2010/2011/2012/2013/2014/2015/2016/2017/2018/2019/2020/2021/2022	3.73
DE_Maas	2017/2018/2019/2020/2021/2022	3.09
DE_Wese	2007/2008/2009/2010/2011/2012/2013/2014/2015/2016/2017/2018/2019/2020/2021/2022	2.79
DE_Schl	2009/2016/2017/2018/2019/2020/2021/2022	1.14
GR_CeAe	2007/2019/2023	1.01

A5.6 B_0 less than $B_{current}$

In countries without (or with limited) restocking, $B_{current}$ should be less than B_0. This is the case in most EMUs as shown Figure A5.4 and in Table A5.6.

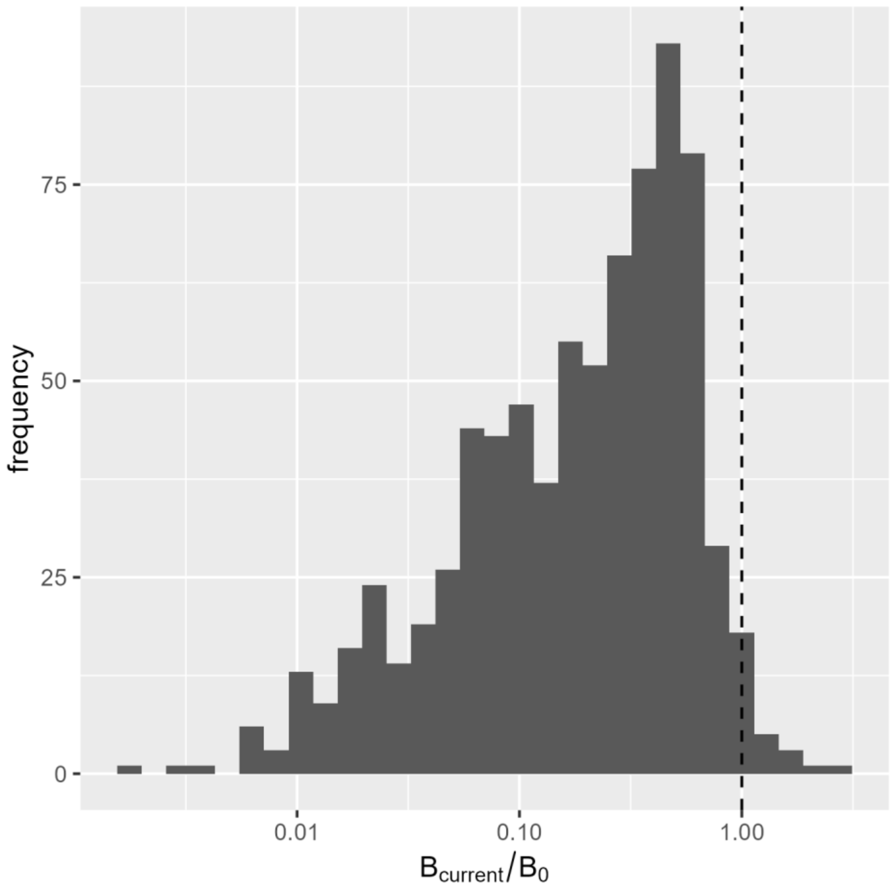

Figure A5.4: Histogram showing frequency distribution of the $B_{current}/B_0$. Values >1 would indicate a problem

Table A5.6: Situations in which $B_{current}$ is reported as greater than B_0.

EMU	Years	$B_{current}/B_0$
GR_CeAe	2007|2019	2.51
PL_Oder	2007|2008|2009|2010	1.62
PL_Vist	2007|2008|2009|2010	1.25
GB_Scot	2014|2021	1.23
DE_Warn	range:2007-2016, Number occurrences 10	1.11

A5.7 $B_{current}$ without restocking higher than B_0

There is only one case in which $B_{current\_\text{without\_restocking}}$ was reported as greater than B_0 (Figure A5.5, Table A5.7). As already mentioned above, without any restocking effects, $B_{current}$ for GB_Scot is still estimated as higher than B_0. This indicates an underestimate of B_0 which is confirmed by the data provider, and confirms once again the difficulty in estimating B_0 and consequently the difficulty to estimate $B_{current}/B_0$.

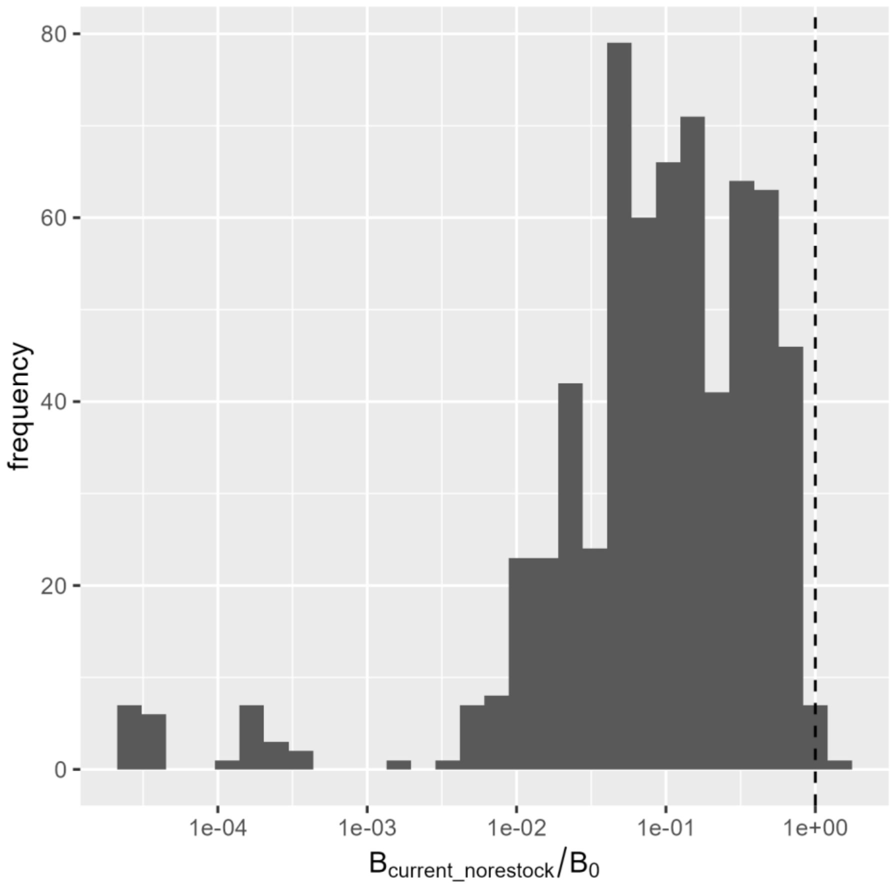

Figure A5.5: Histogram showing frequency distribution of the $B_{current}/B_0$. Values higher than 1 indicate a problem

Table A5.7: Situations in which $B_{current}$ without restocking was reported as greater than B_0.

EMU	Years	$B_{currentw}/B_0$
GB_Scot	2014/2021	1.231877

A5.8 Check irregularities in combinations of $B_{current}$, B_{best}, and $\sum A$

If there is no restocking, $B_{current}$ should roughly correspond to $B_{best} * \sum A$ (Figure A5.6 , Table A5.8). Only EMUs from Germany, Greece have a $B_{current}$ that differs from more than 10% from the expected $B_{current}$. For Germany, this is likely the result of restocking. For Greece, it might be restocking. $B_{current_without_restocking}$ estimates are consistent with $B_{best} * \sum A$. For this reason Table A5.9 has no value.

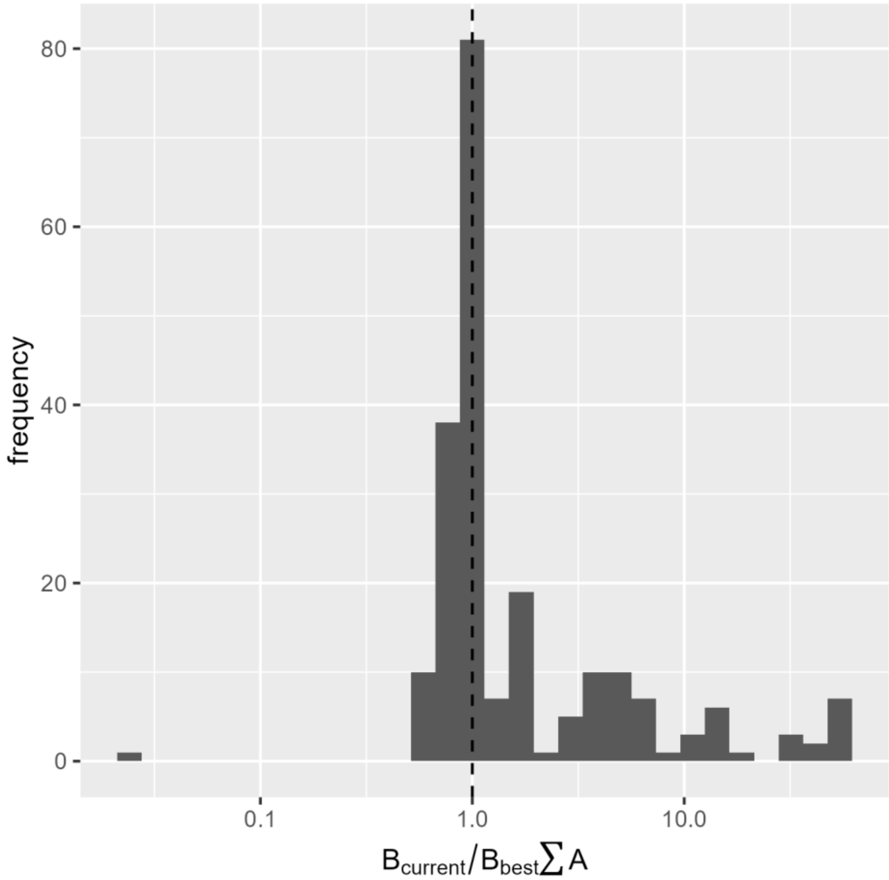

Figure A5.6: Histogram showing frequency distribution of $B_{current}/B_{best} * \sum A$ while $B_{currentwithoutrestocking}$ is not reported. Values higher than 1 indicate a possible problem.

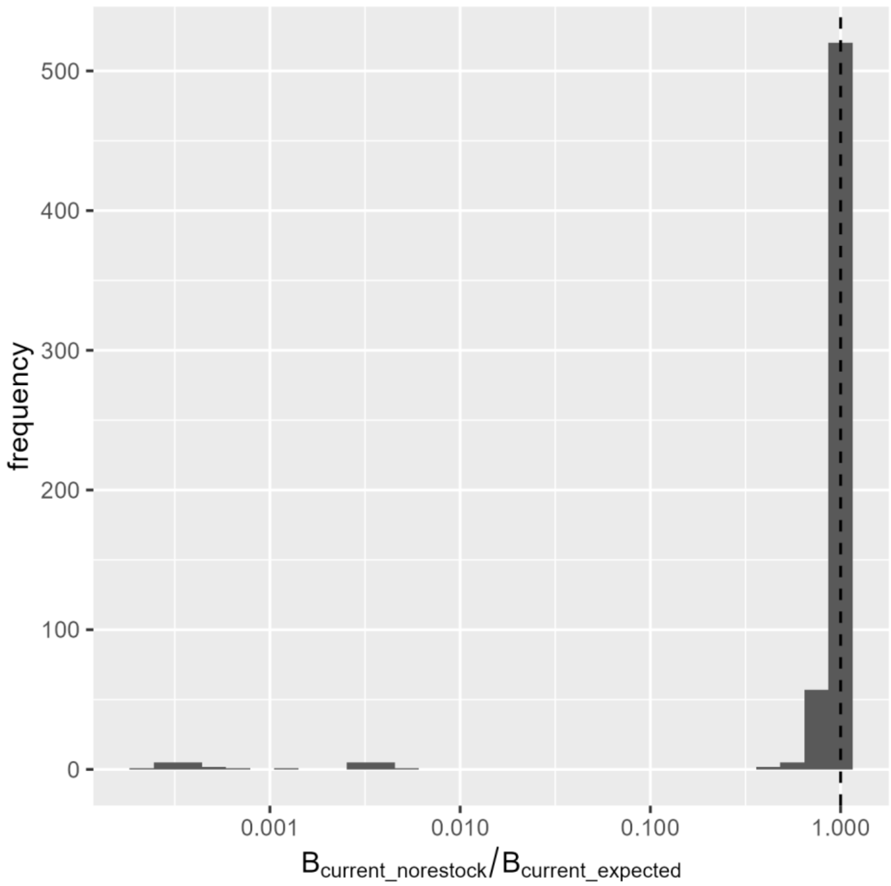

Figure A5.7: Comparison of $B_{currentWithoutRestocking}$ and $B_{currentExpected}$ calculated as $B_{best} * exp[-\sum A]$

Table A5.8: Comparison of $B_{current}$ and $B_{currentexpected} = B_{best}exp(-\sum A)$ for all series with no estimate for $B_{currentwithoutrestocking}$.

EMU	Years	$B_{current}/B_{current}$ expected
DE_Elbe	range:2007-2022, Number occurrences 16	8.646937
DE_Maas	range:2007-2022, Number occurrences 11	2.573014
DE_Rhei	range:2007-2022, Number occurrences 16	38.903806
DE_Schl	range:2018-2022, Number occurrences 5	1.263438
DE_Warn	2018|2019|2020|2021	1.112040
DE_Wese	range:2007-2022, Number occurrences 16	4.354206
GR_CeAe	2007|2023	2.761879
GR_EaMT	range:2007-2023, Number occurrences 17	1.784155
GR_NorW	2018	1.149310

Table A5.9: Comparison $B_{currentwithoutrestocking}$ to $B_{currentexpected} = B_{best}exp(-\sum A)$ for all series with no estimate for $B_{currentwithoutrestocking}$."

EMU	Years	$B_{currentw}/B_{current}$ expected

A5.9 Checking difference between $B_{current}$ without restocking and $B_{current}$

There are only few cases in which $B_{current}$ without restocking was reported greater than $B_{current}$ (Figure A5.8, Table A5.11).

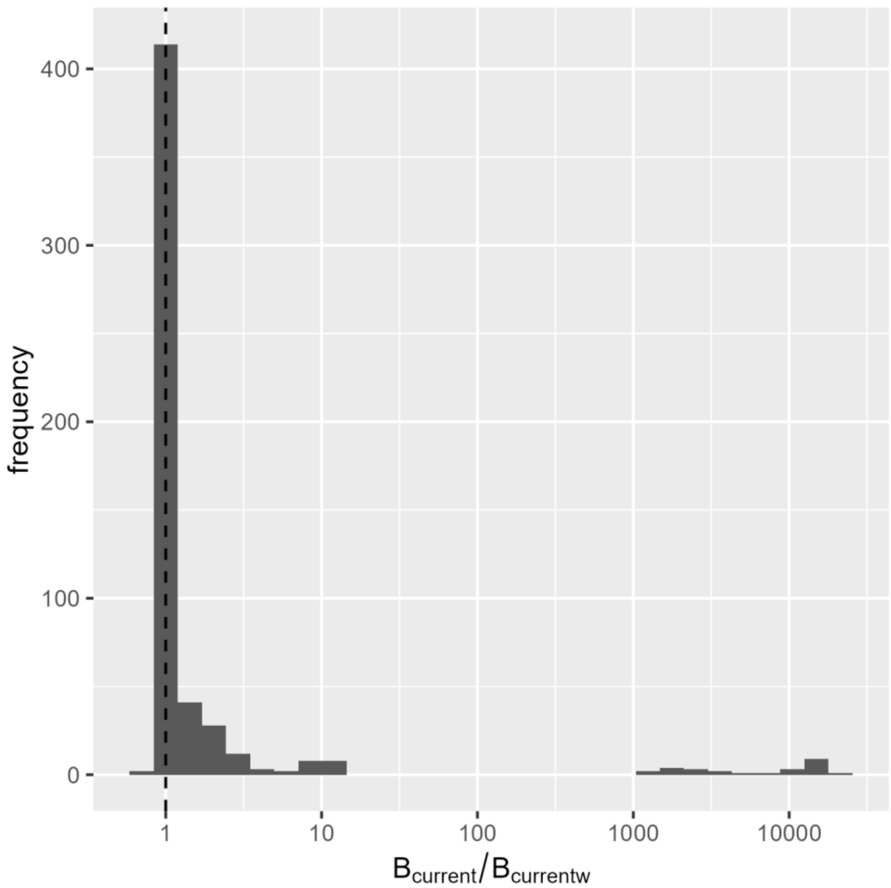

Figure A5.8: Histogram showing frequency distribution of the $B_{current}/B_{currentwithoutstocking}$. Values lower than 1 indicate a problem.

Table A5.11: Years and EMU for which $B_{currentwithoutrestocking}$ is reported as greater than $B_{current}$.

EMU	Years	$B_{currentw}/B_{current}$
ES_Basq	range:2013-2020, Number occurrences 5	1.265729
PT_Port	range:2013-2020, Number occurrences 5	1.208150
IE_SouW	range:2013-2020, Number occurrences 5	1.000028
IE_NorW	range:2013-2020, Number occurrences 5	1.000010
IE_NorW	range:2013-2020, Number occurrences 5	1.000010

A5.10 Comparing B_0 with an adjusted estimate

The EU regulation states that Member States should implement management measures to achieve an escapement equal to 40 % of the pristine escapement. However, the pristine situation is difficult to define and therefore, B_0 is difficult to estimate. Some countries have used observations of past productivity in some water bodies, multiplied by the total water surface to extrapolate pristine escapement as suggested in the Eel Regulation. However, the availability of historical data does not go back far enough in time, rarely before the 1980s, to be considered as pristine. Other countries have used the current escapement, corrected for anthropogenic mortality (i.e. Bbest) and used this to extrapolate B0. However, the extrapolation methods vary among countries, especially regarding the integration of density dependence (accounting for density dependent mortality leads to smaller B0 since it postulates that natural mortality increases with abundance). These difficulties impair the comparison among B0 estimates, and subsequently, the status of EMUs with respect to the EU regulation target. To avoid those inconsistencies, lasted WKEMP (ICES, 2022) proposed an alternative indicator based on B_{best} and current level of recruitment:

$$B_{0_{adj}} = \frac{R_0}{R_{current}} \cdot B_{best}$$

As explained in the latest report, this adjusted indicator does not account for any modification of natural mortality resulting from density-dependence (Bevacqua *et al.*, 2011) and requires some extra-assumption regarding lifespan per region and current levels of recruitment. We applied the exact same methods as in 2022 and use this adjusted indicator to check the consistency among countries and EMUs.

$B_{0_{adj}}$ takes current level of recruitment expressed a a fraction of pre-1980s values (from WGEEL indices, considering that pre-1980s is close to R_0), and use B_{best} (escapment that would have occured given current recruitment in the absence of anthropogenic mortality) to estimate a theoretical B_0. This could be repeated for every year for which B_{best} and recruitment indices are available. In the absence of any density dependent natural mortality, those adjusted $B_{0_{adj}}$ are expected to be stable through time. In period of declining recruitment, natural mortality is expected to decrease and consequently, $B_{0_{adj}}$ to increase. On the contrary, $B_{0_{adj}}$ is expected to decrease in periods of decreasing recruitment. In the last years, recruitment has been rather stable, so $B_{0_{adj}}$ were expected to be rather stable, but interestingly, we observe significant and contrasted trends depending on countries (Figure A5.9). This is likely related to heterogeneities in the methods to compute indicators.

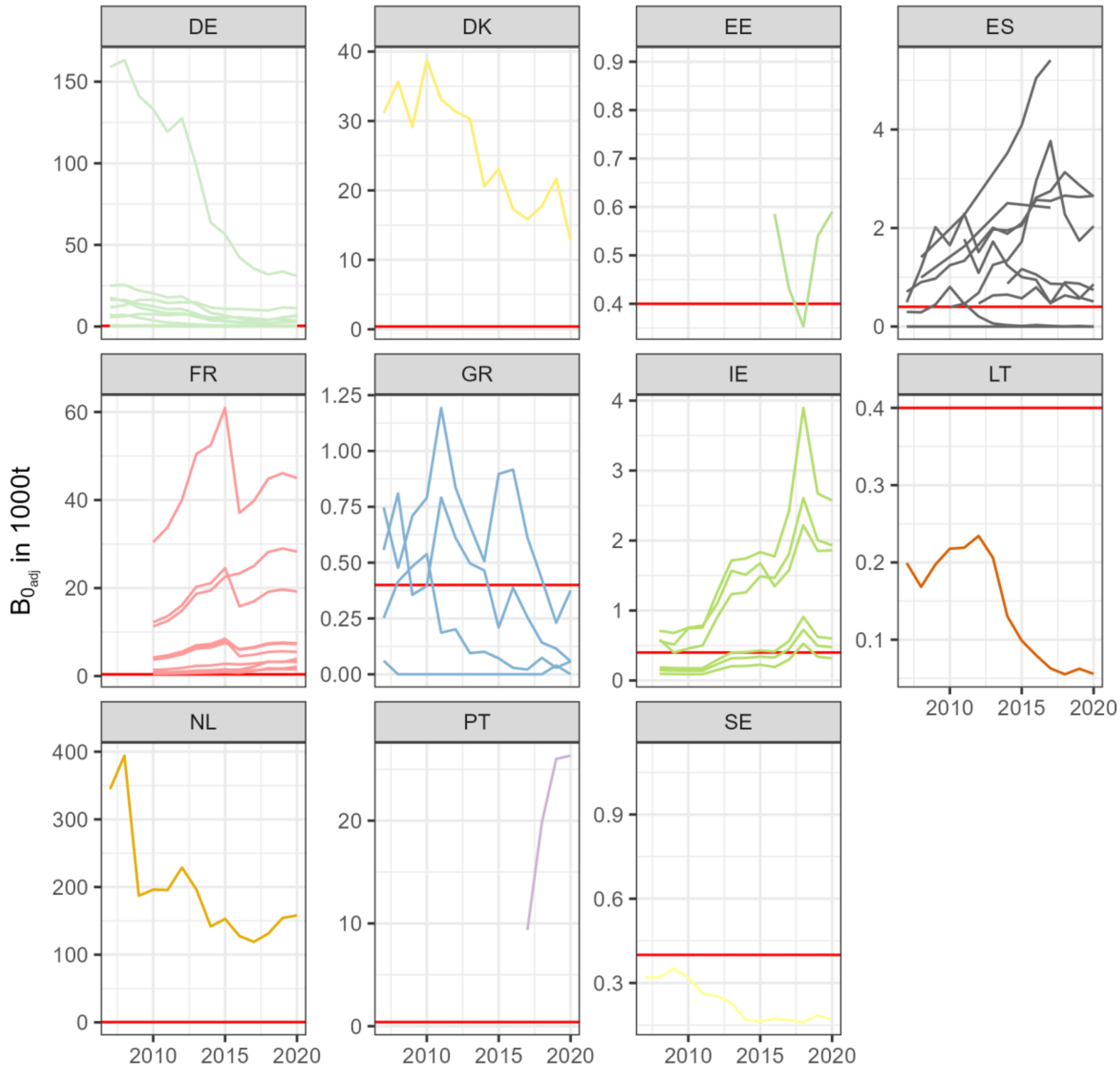

Figure A5.9: Trends in $B_{0_{adj}}$ per EMU. Each line stands for an EMU

In the absence of density dependence $B_{0_{adj}}/B_0$ is expected to be close to 1. In the presence of density dependent mortality, given the current recruitment decline, $B_{0_{adj}}/B_0$ might be higher than 1.

In Elsewhere Europe area (Figure A5.10), most of the ratio are between 1 and 10, the order of magnitudes appears to be roughly constant among countries. The only exception is ES_Anda that display a very low ratio. This would suggest either very strong values of B_0 or very pessimistic values of B_{best}. In this EMU, pristine escapement is estimated using current estimate of production per hectare corrected for recruitment loss without accounting for any density-dependance, and postulating multiplying it by the surface in pristine conditions. Ireland appears to have larger values than other countries, this is likely related to their difficulties in extrapolating b_0 mentioned in their Data Call Annex 13.

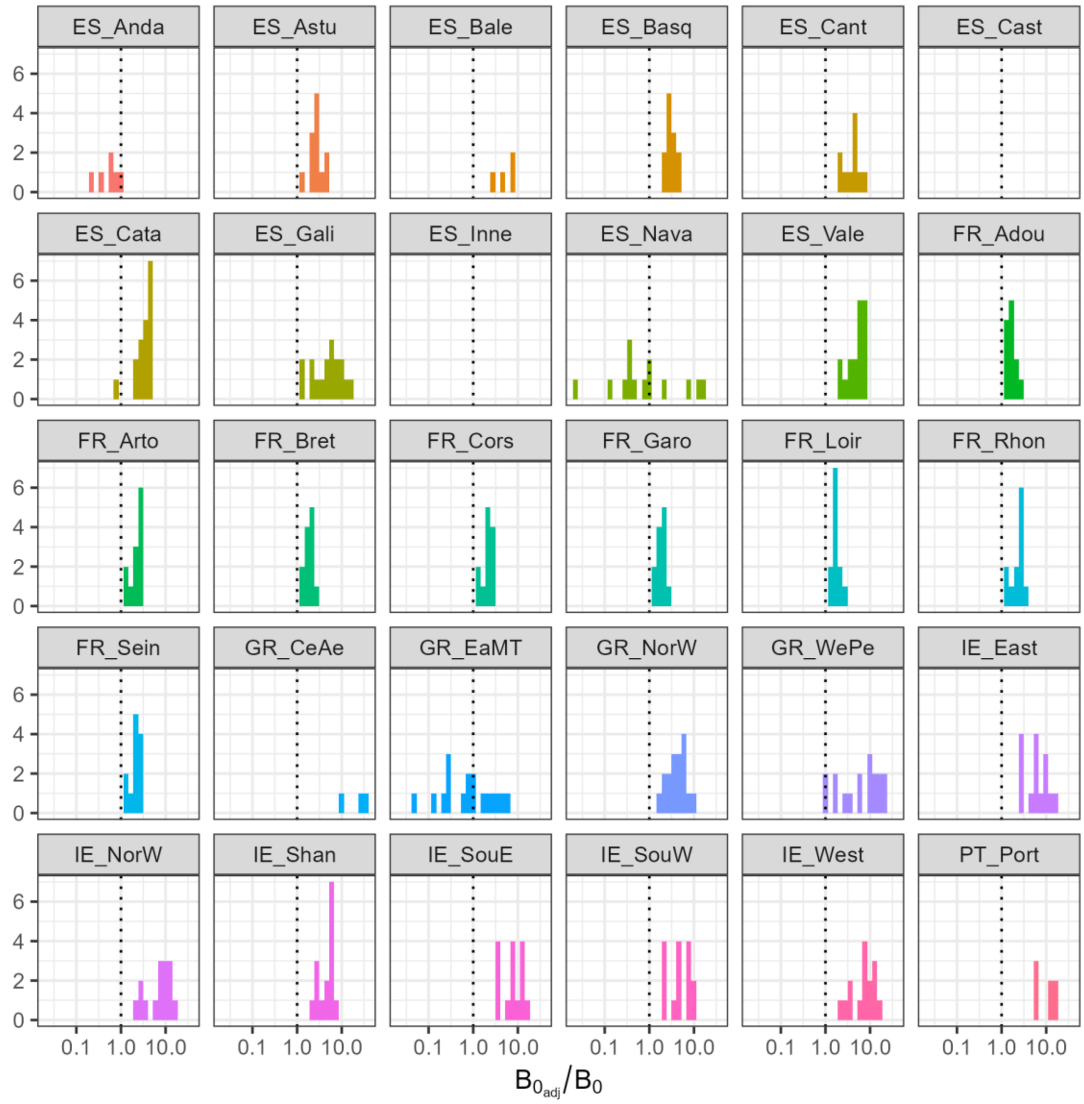

Figure A5.10: Ratio of $B_{0_{adj}}/B_0$ per EMU. Each bar stands for a year from Elsewhere Europe. Only EMUs for which it was possible to estimate $B_{0_{adj}}$ are plotted.

EMUs connected to the North Sea display very high values of ratios compared to what is observed in Elsewhere Europe (Figure A5.11). This is surprising since recruitment (and consequently density dependent natural mortality) is supposed to be lower in this area. A possible reason is the WGEEL North Sea index that might be over pessimistic, indicating overly low current recruitment and leading to overestimated *B0* as discussed in WGEEL 2024. However, the level of variations among countries, and among EMUs withing countries is still rather large.

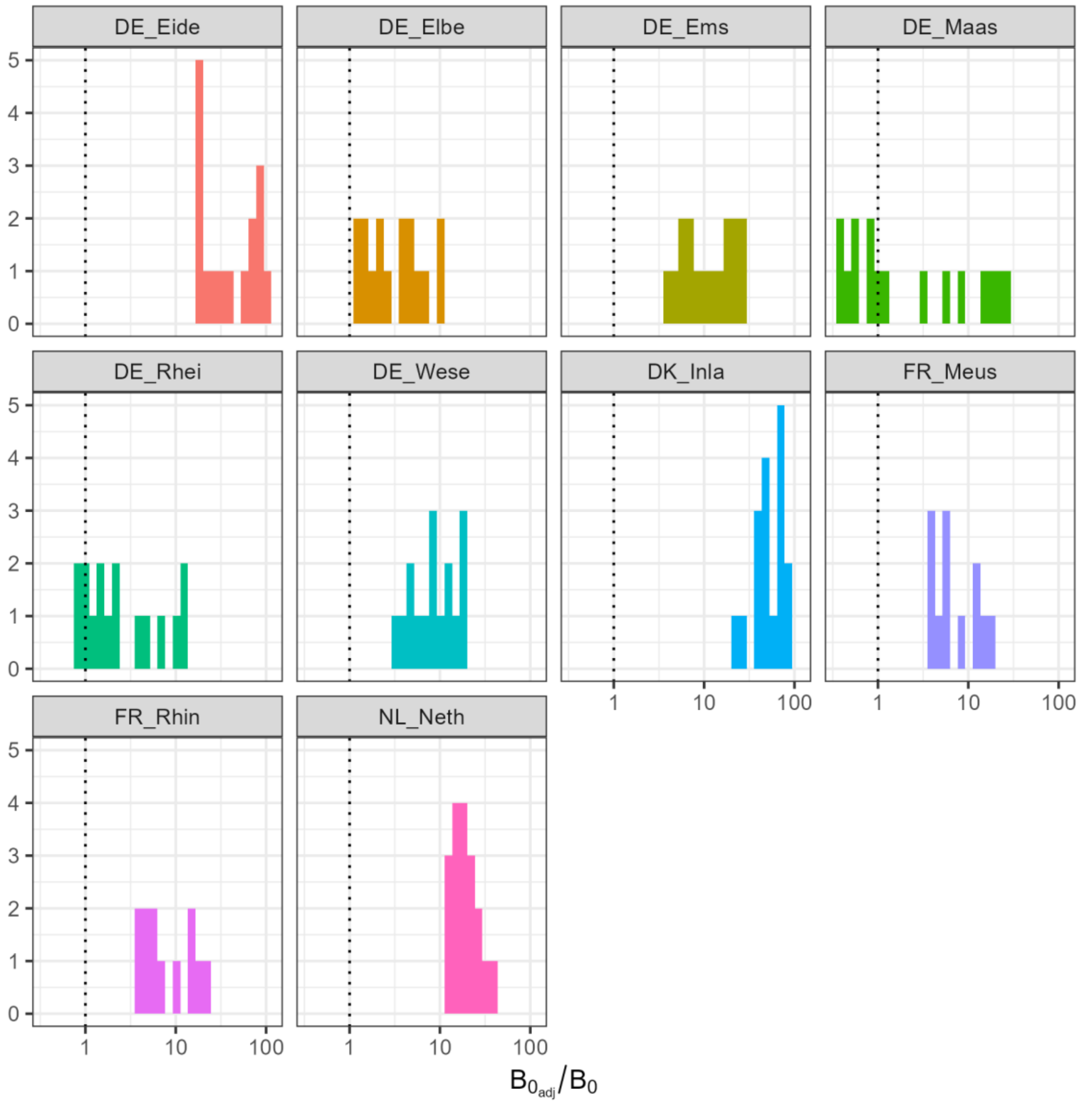

Figure A5.11: Ratio of $B_{0_{adj}}/B_0$ per EMU. Each bar stands for a year from North Sea. Only EMUs for which it was possible to estimate $B_{0_{adj}}$ are plotted.

In the Baltic region (Figure A5.12), the situation is similar to Elsewhere Europe. Here, two EMUs display negative ratio that could be surprising: DE_Oder and SE_Inla, questioning a possible overestimation of B_0.

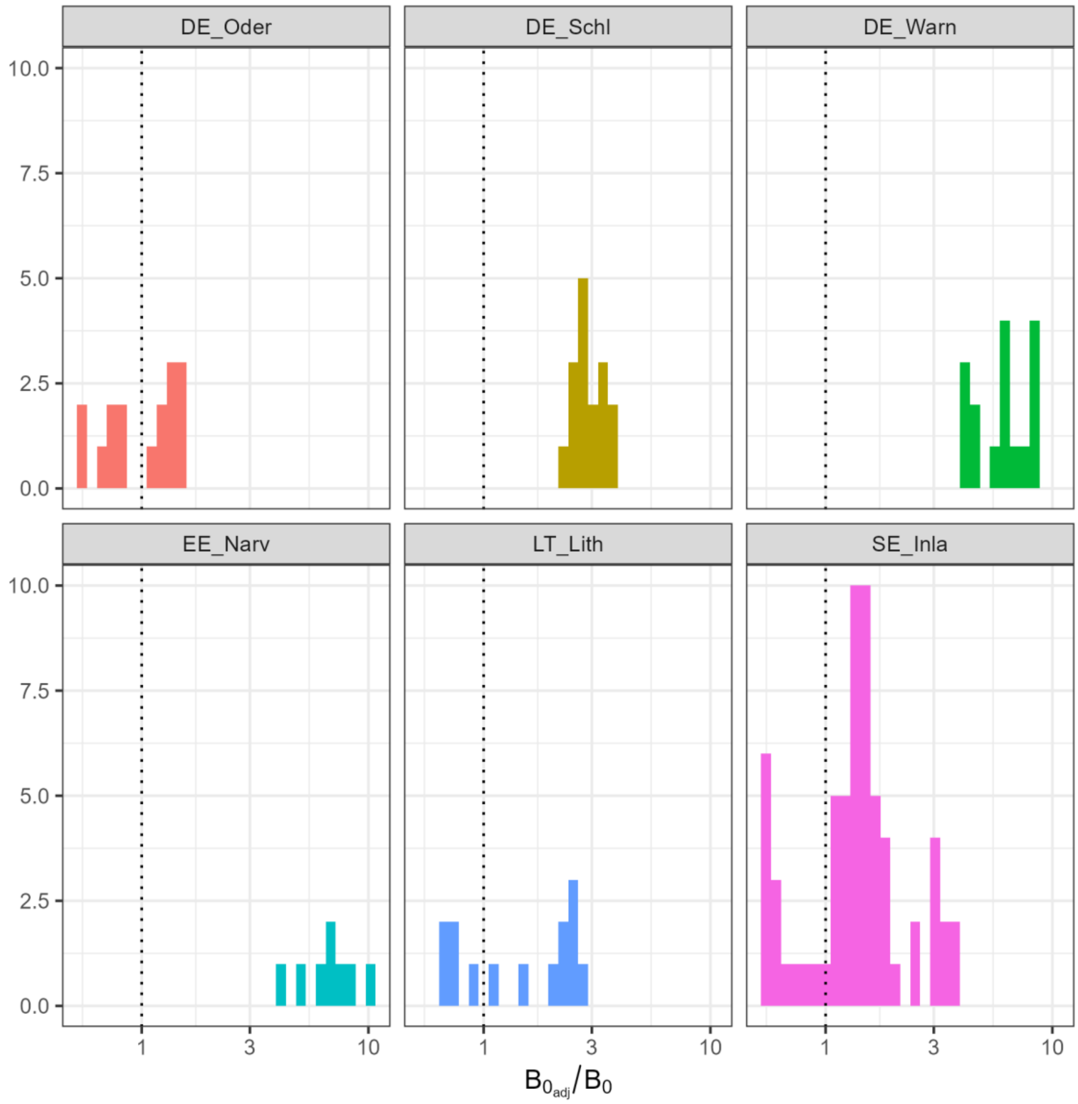

Figure A5.12: Ratio of $B_{0_{adj}}/B_0$ per EMU. Each bar stands for a year from the Baltic area. Only EMUs for which it was possible to estimate $B_{0_{adj}}$ are plotted.

A5.11 Conclusion

The aim of this exercise was not to check the validity of B_0 nor to say that $B_{0_{adj}}$ is a better indicator. It rather aims to detect differences in B_0 estimates that could be due to highlight differences in methods and in assumptions regarding natural mortality. Such differences affecting B_0 will mechanically affect the estimate of $B_{current}/B_0$ and consequently, the assessment of the achievement of the Eel Regulation target.

Bevacqua, D., Andrello, M., Melia, P., Vincenzi, S., De Leo, G. A., et Crivelli, A. J. 2011. Density-dependent and inter-specific interactions affecting European eel settlement in freshwater habitats. Hydrobiologia, 671: 259-265.

ICES. 2022. Workshop for the Review of EU Member States' Progress Reports for submission in 2021 (WKEMP3). Virtual.

Annex 6: Reported time series of biomass and mortality, from Section 3

Time series of biomass

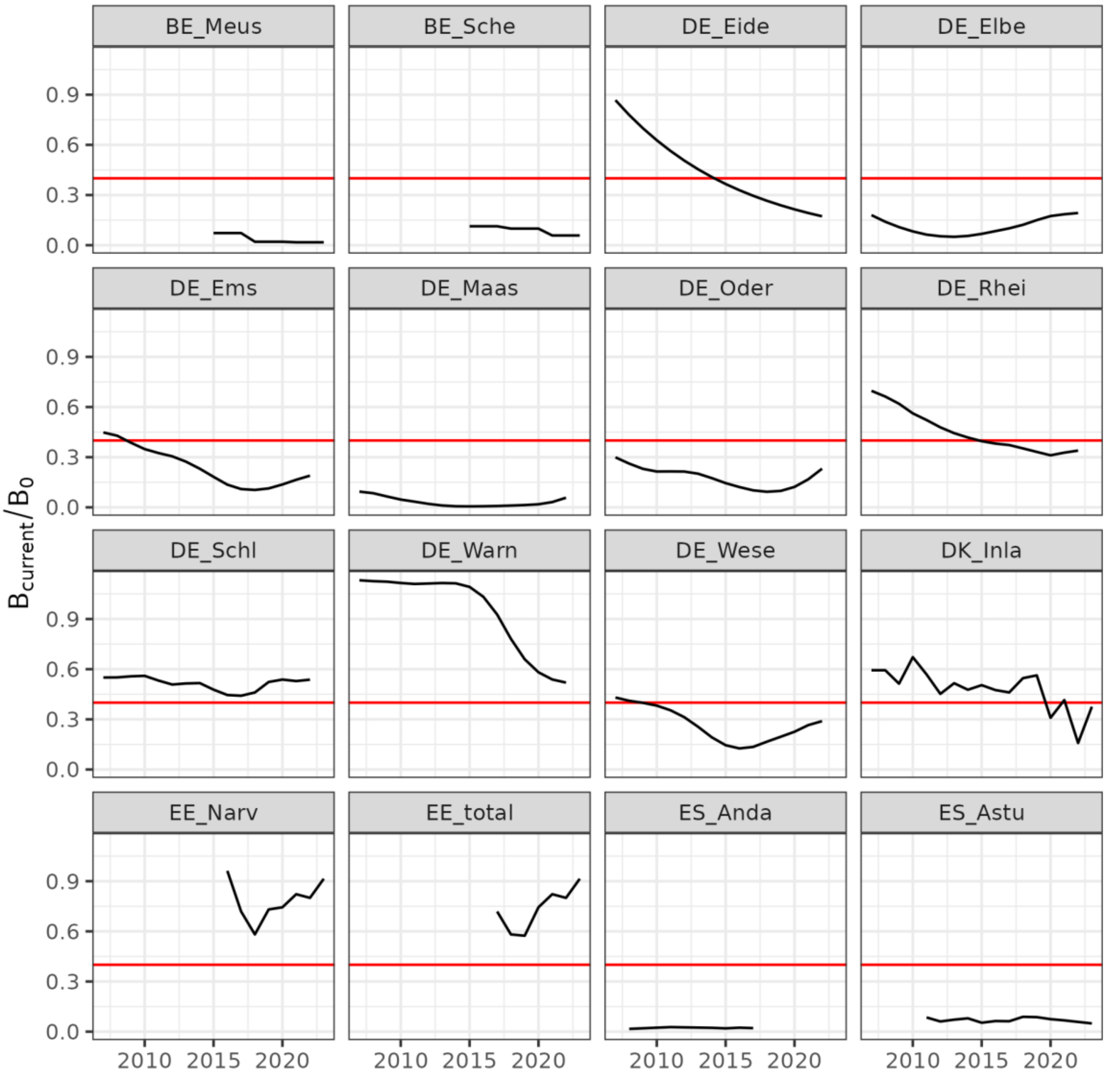

Figure A6.1: Reported time series of $B_{current}/B_0$. The horizontal red line indicates the target set in the Eel Regulation.

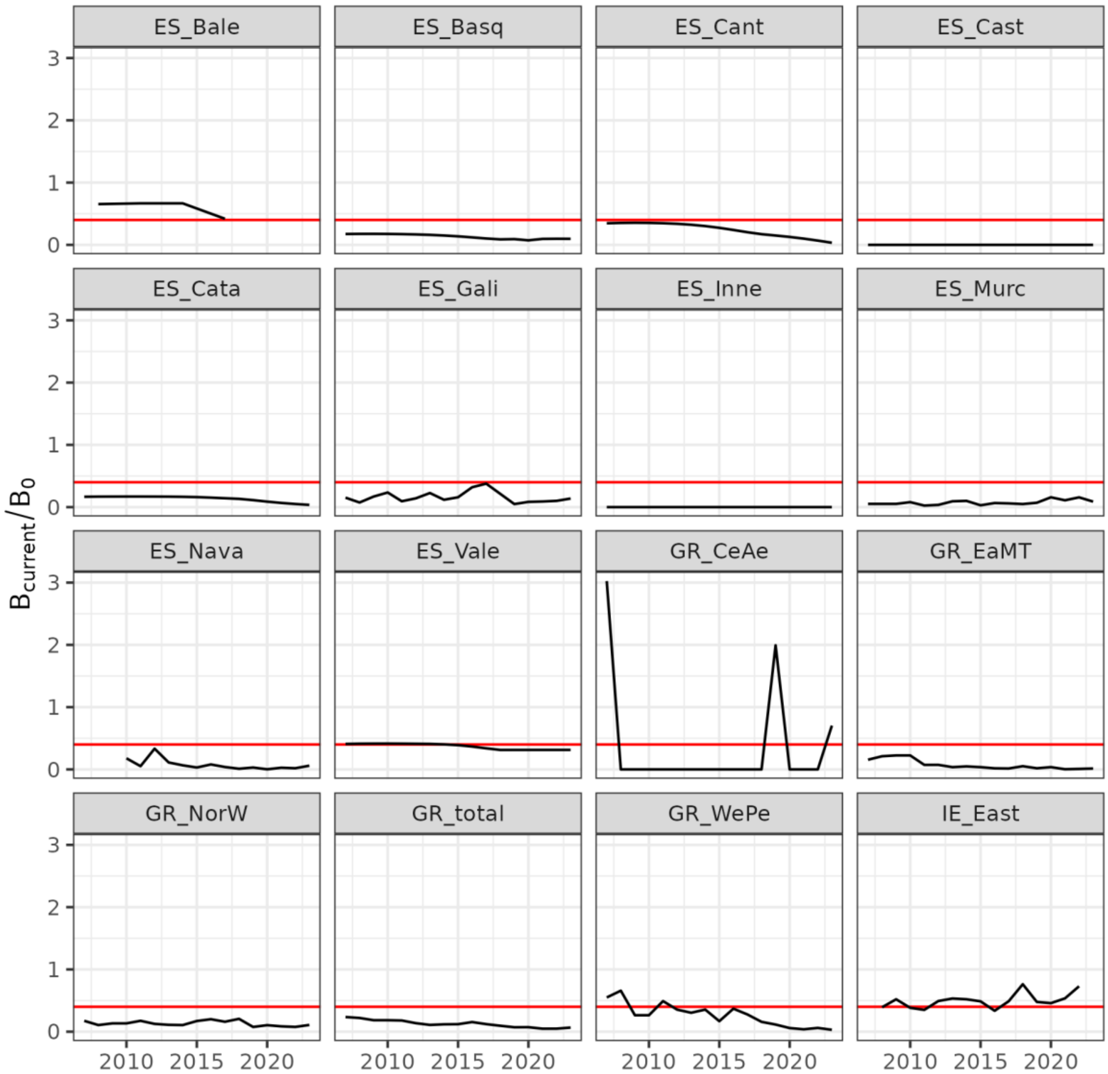

Figure A6.1 - continued

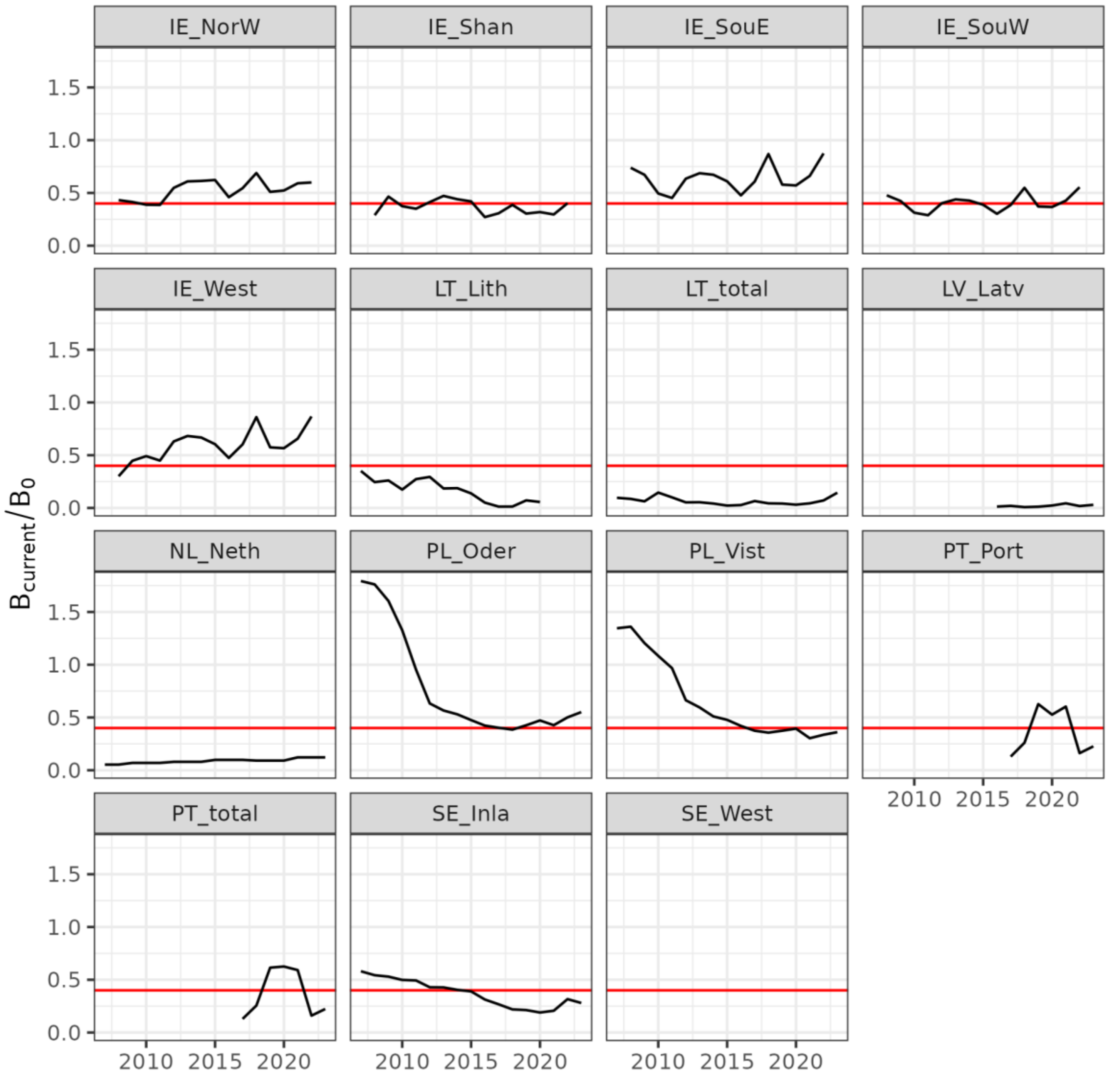

Figure A6.1 - continued

Time series of mortalities

i) Time series of fishing mortality

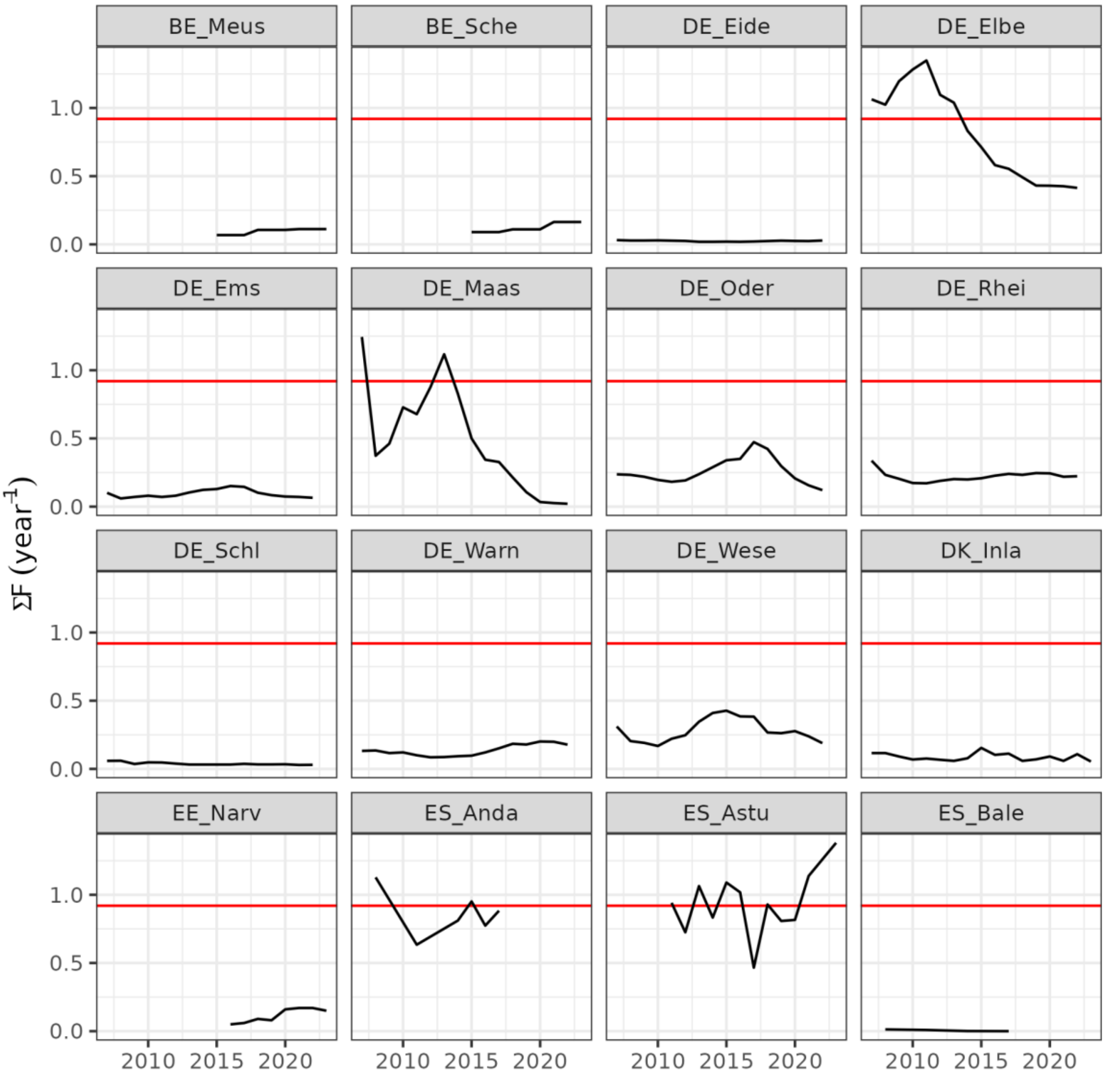

Figure A6.2: Reported time series of sumF. The horizontal red line indicates the 0.92 threshold

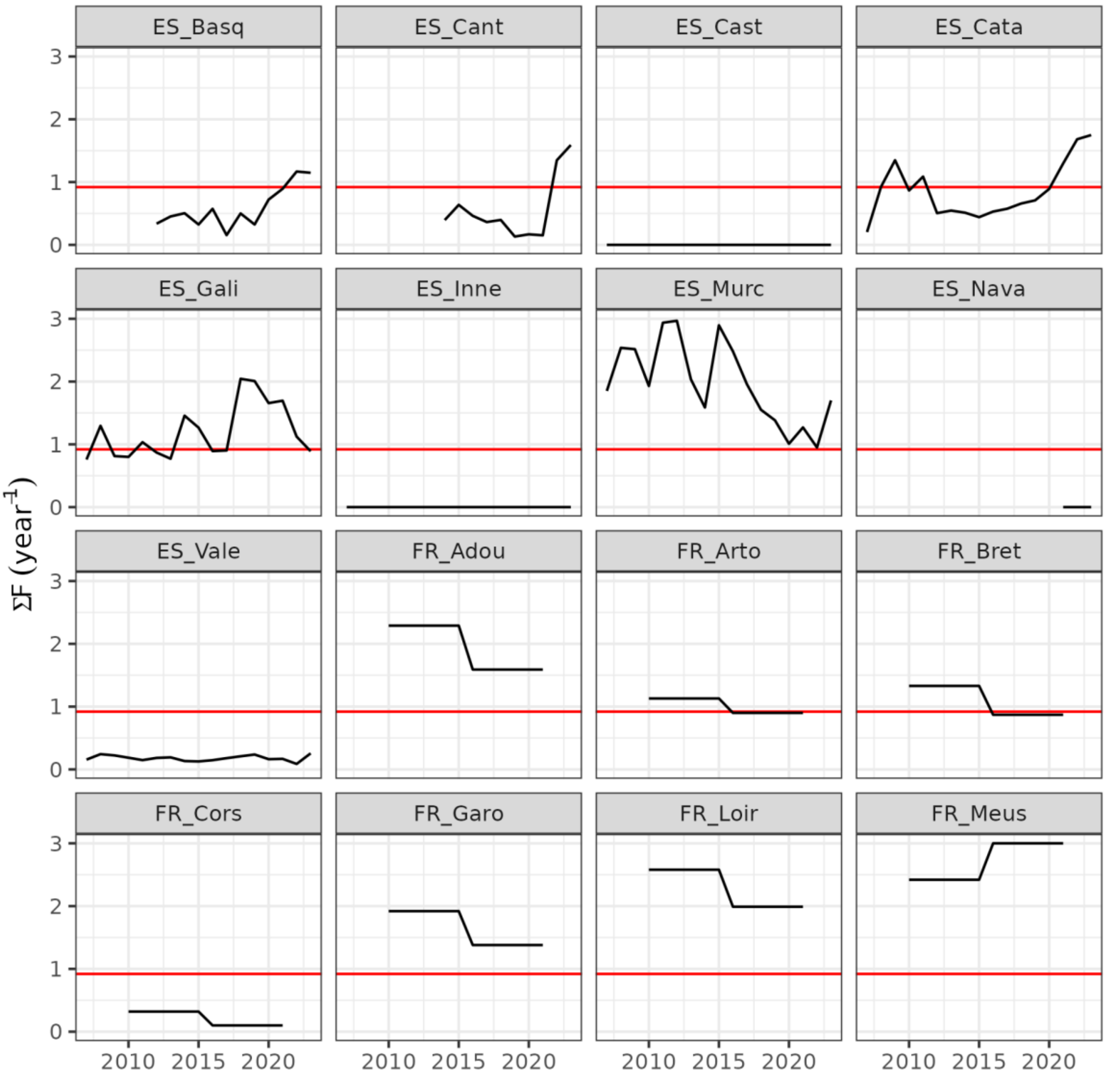

Figure A6.2 - continued

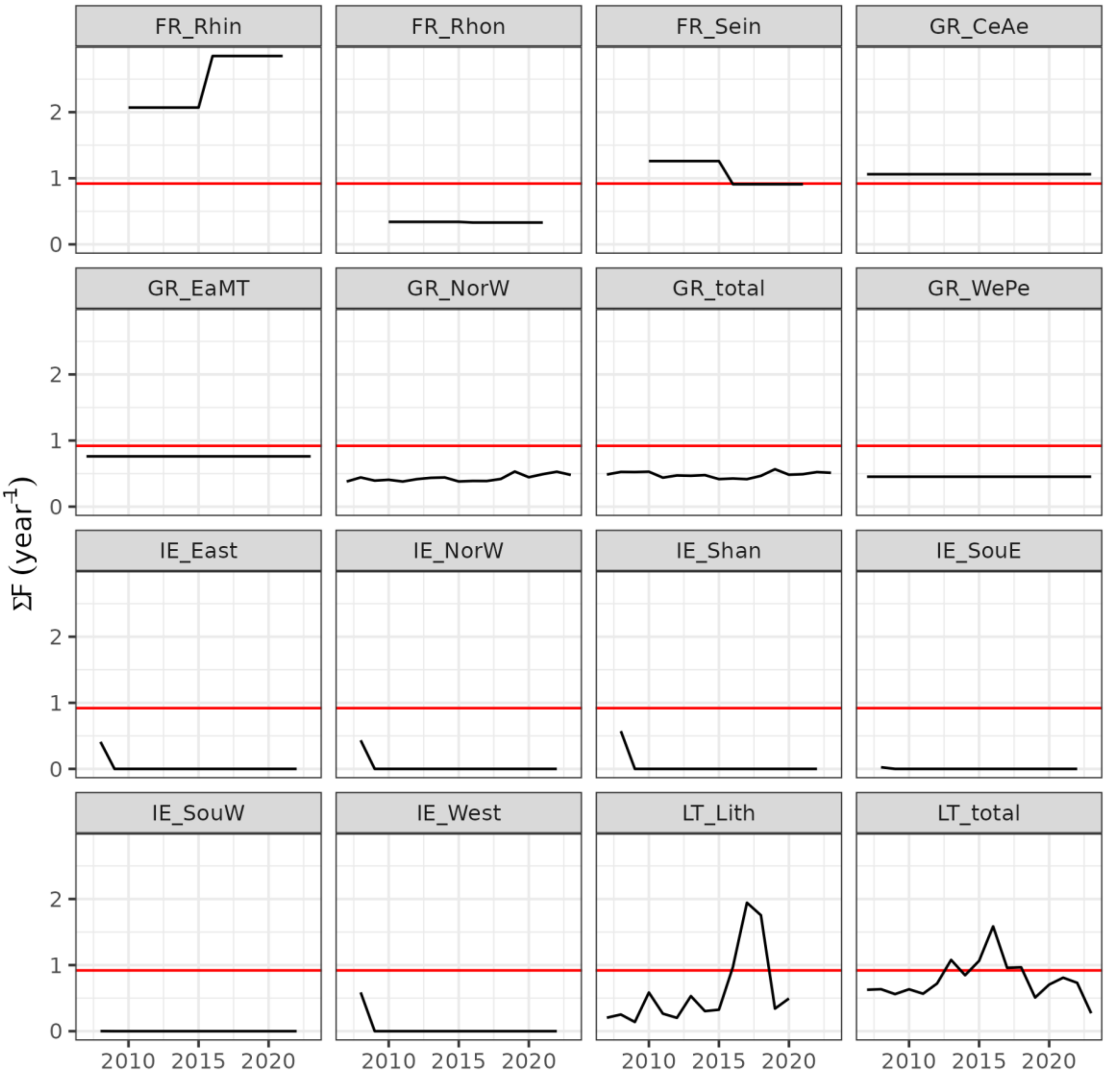

Figure A6.2 - continued

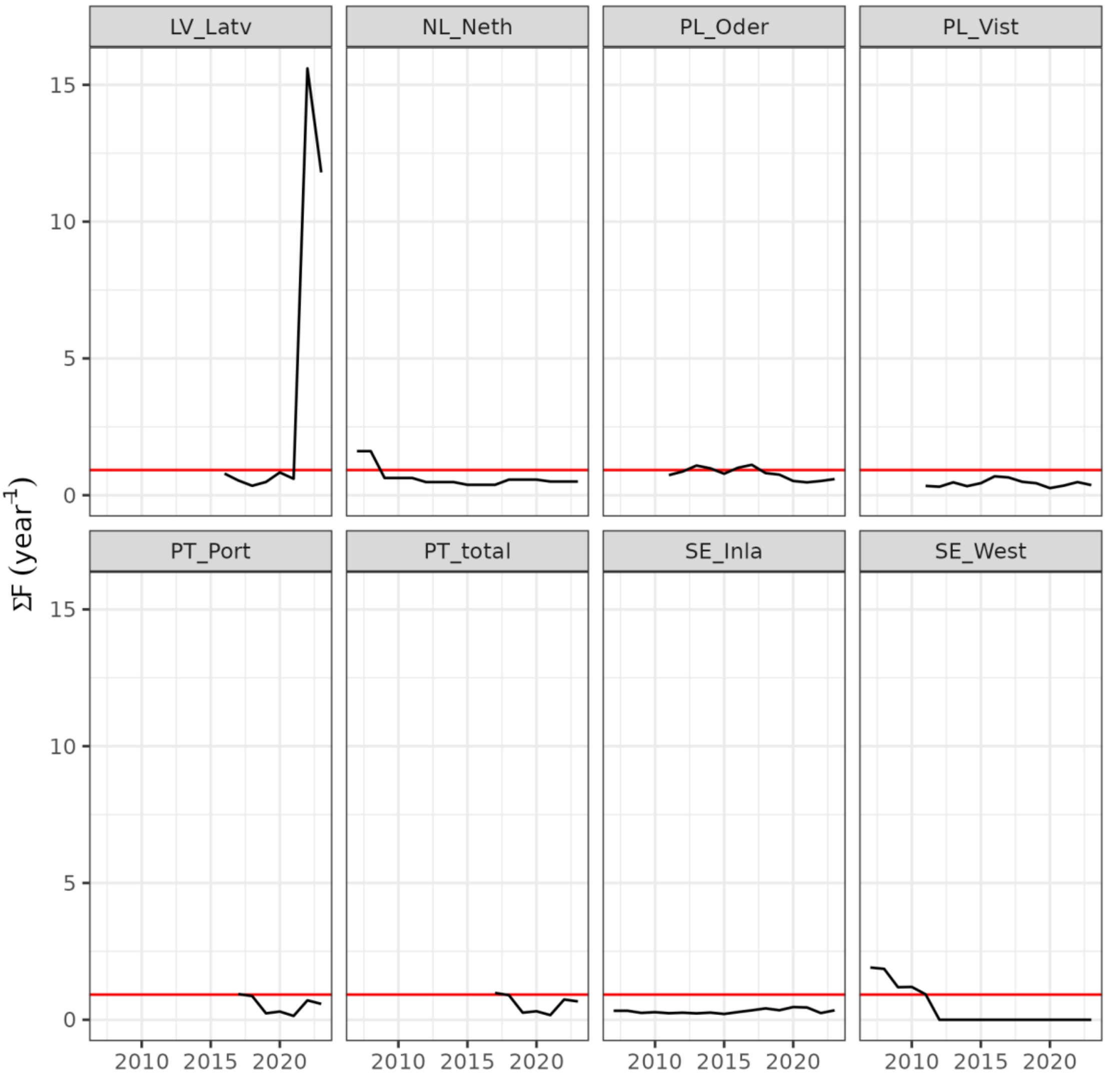

Figure A6.2 - continued – Note that WKEMP4 suspects that a unit error for the last two points reported by Latvia

ii) Time series of other anthropogenic mortalities

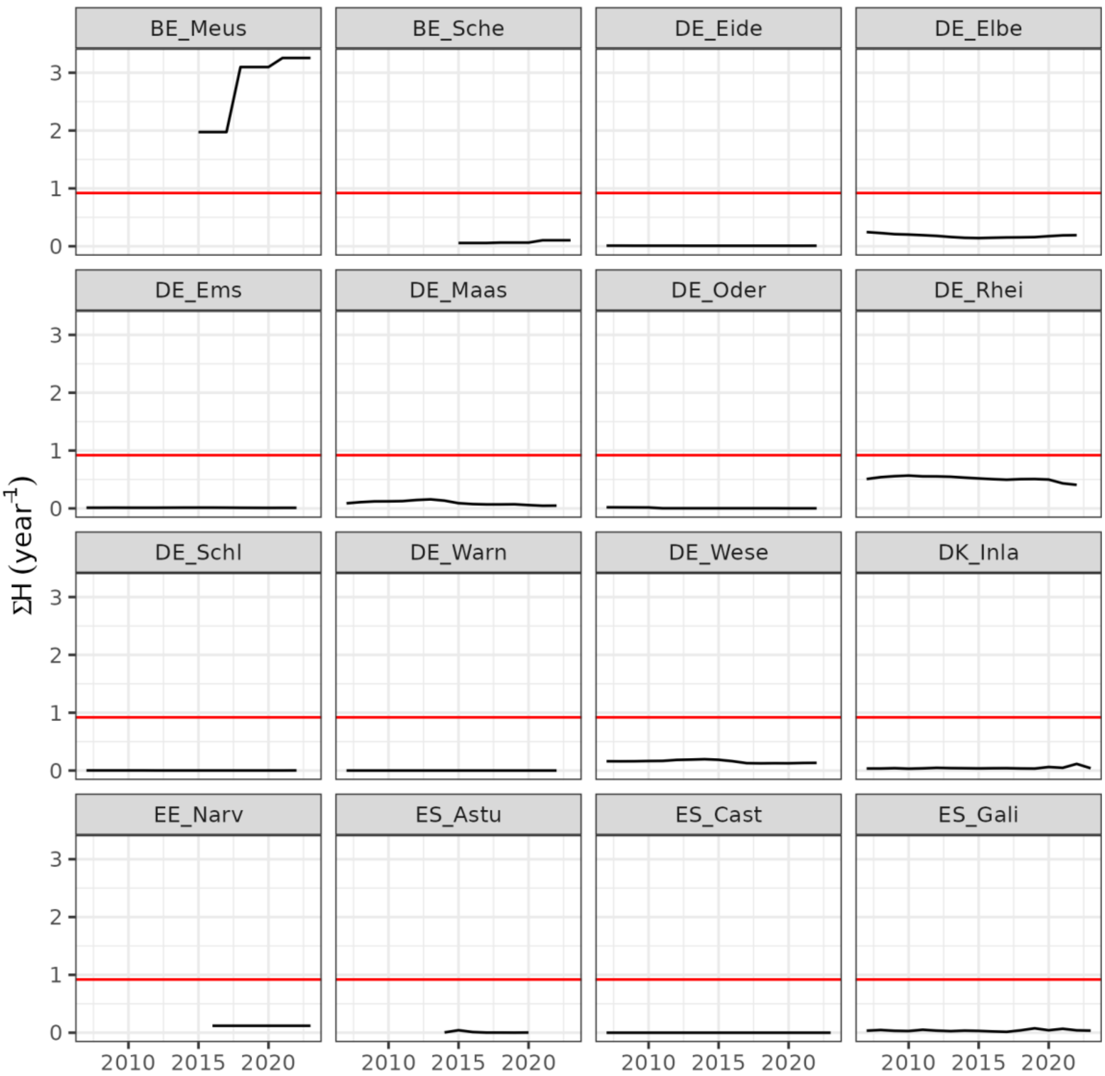

Figure A6.3: Reported time series of sumH. The horizontal red line indicates the 0.92 threshold

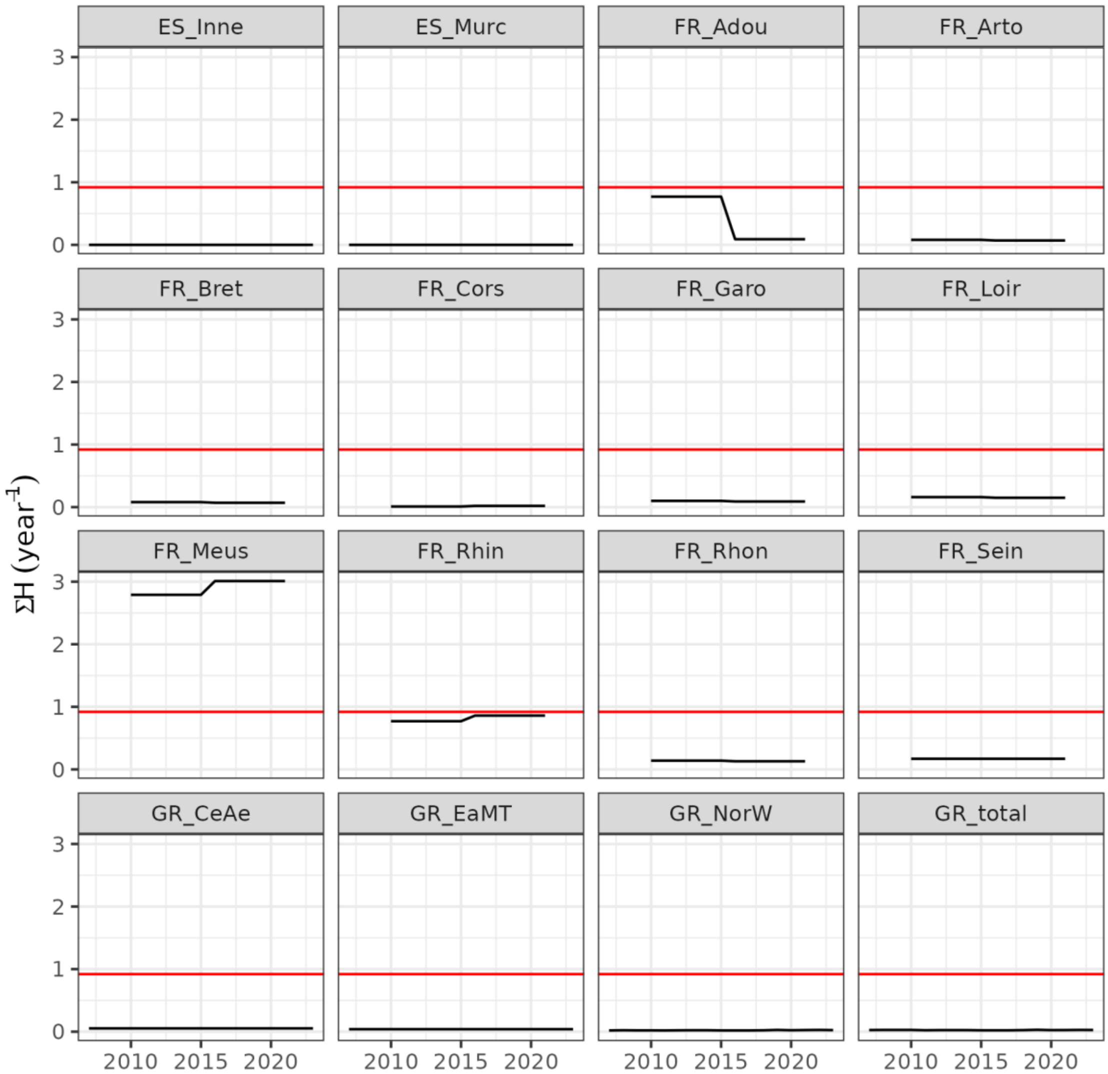

Figure A6.3 - continued

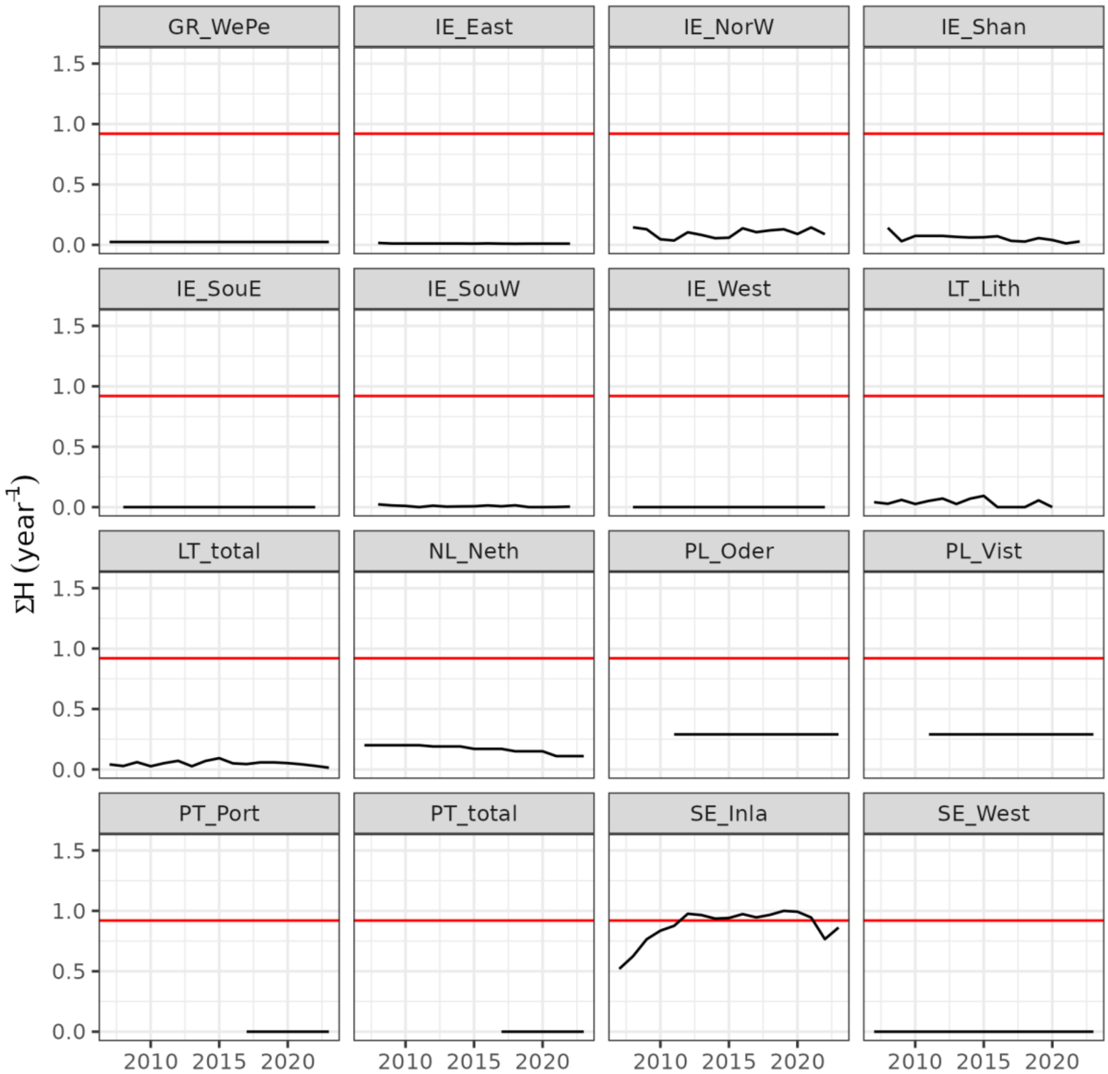

Figure A6.3 - continued

iii) Time series of total anthropogenic mortalities

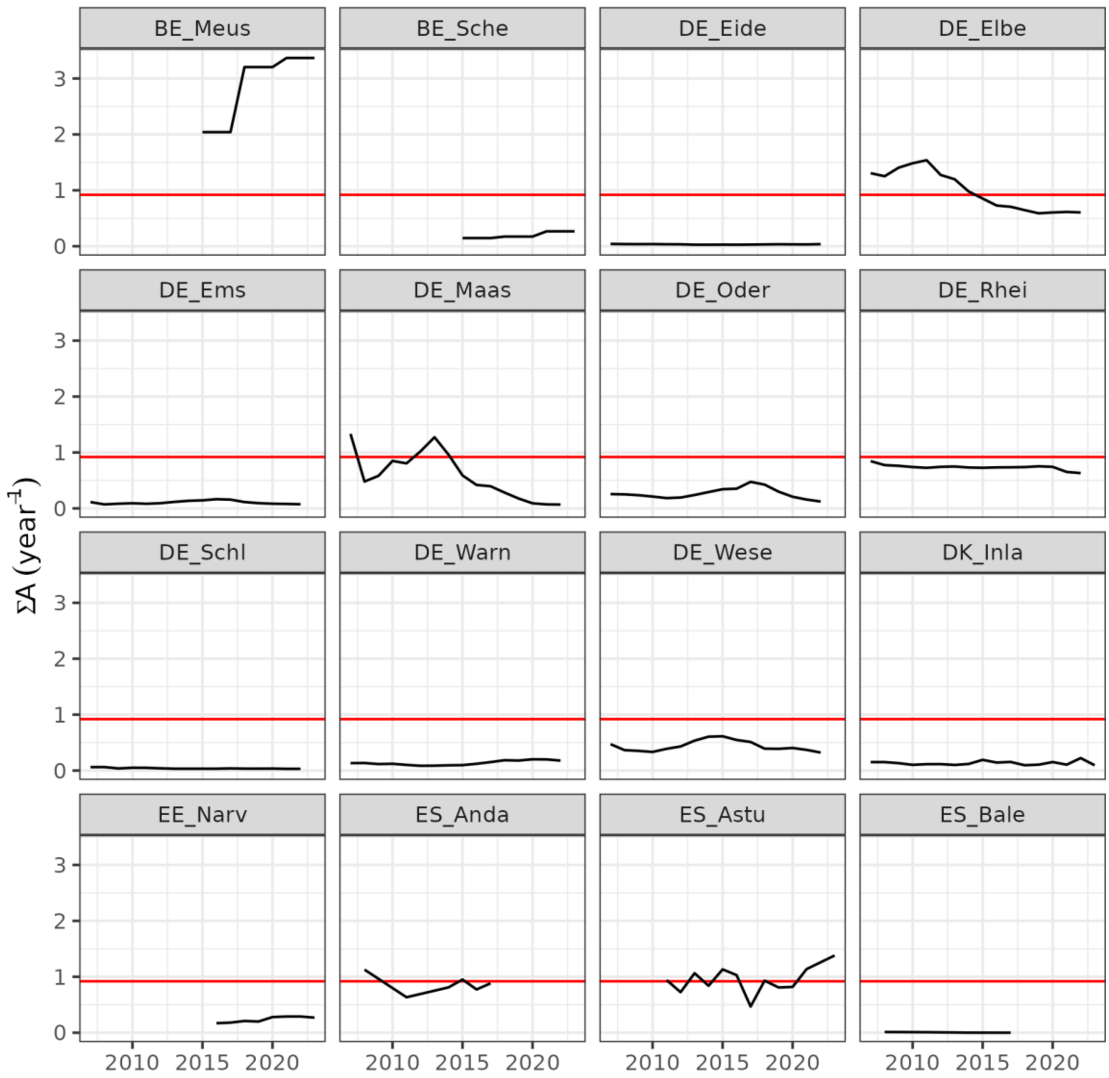

Figure A6.4: Reported time series of sumA. The horizontal red line indicates the 0.92 threshold

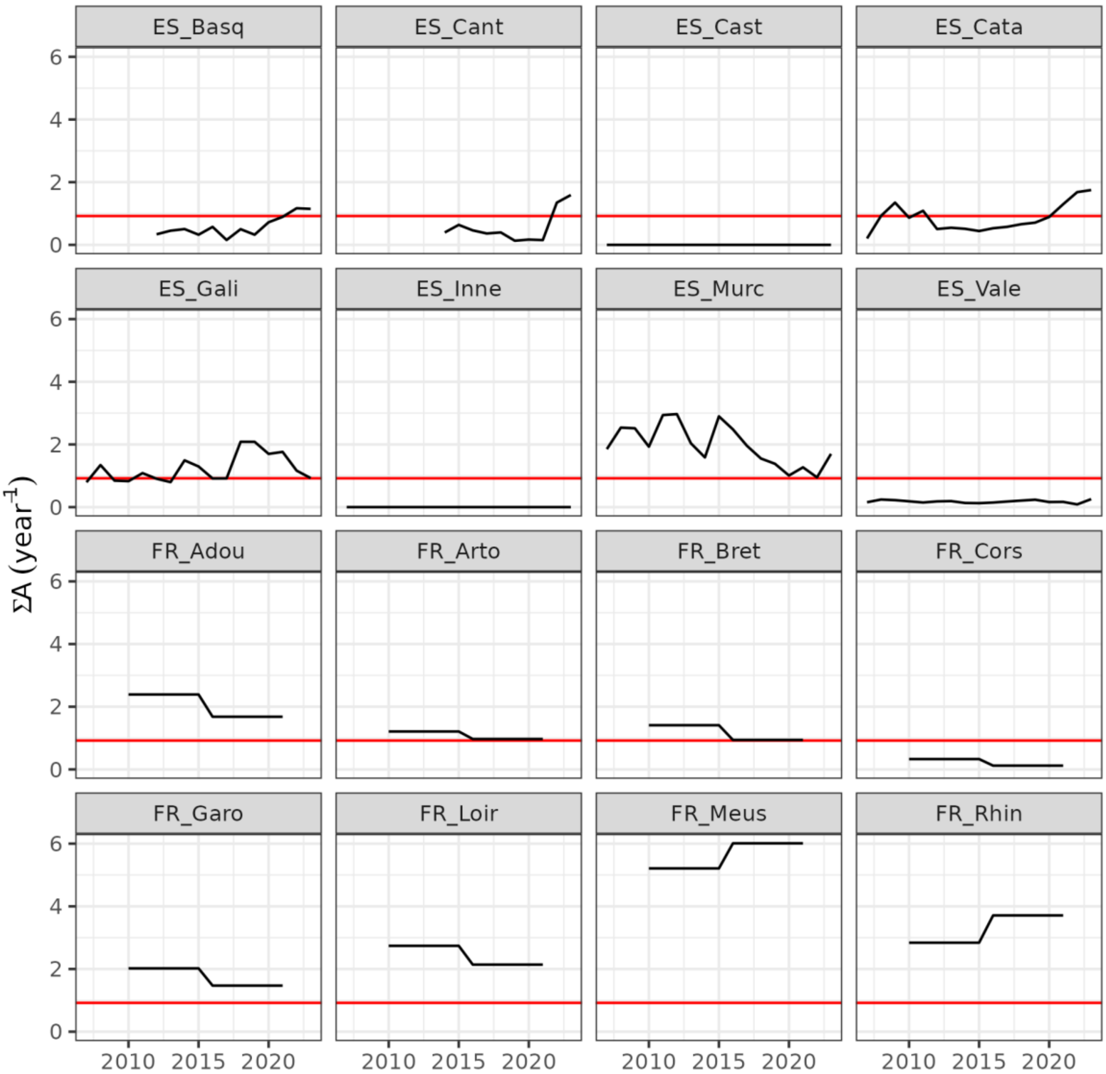

Figure A6.4 - continued

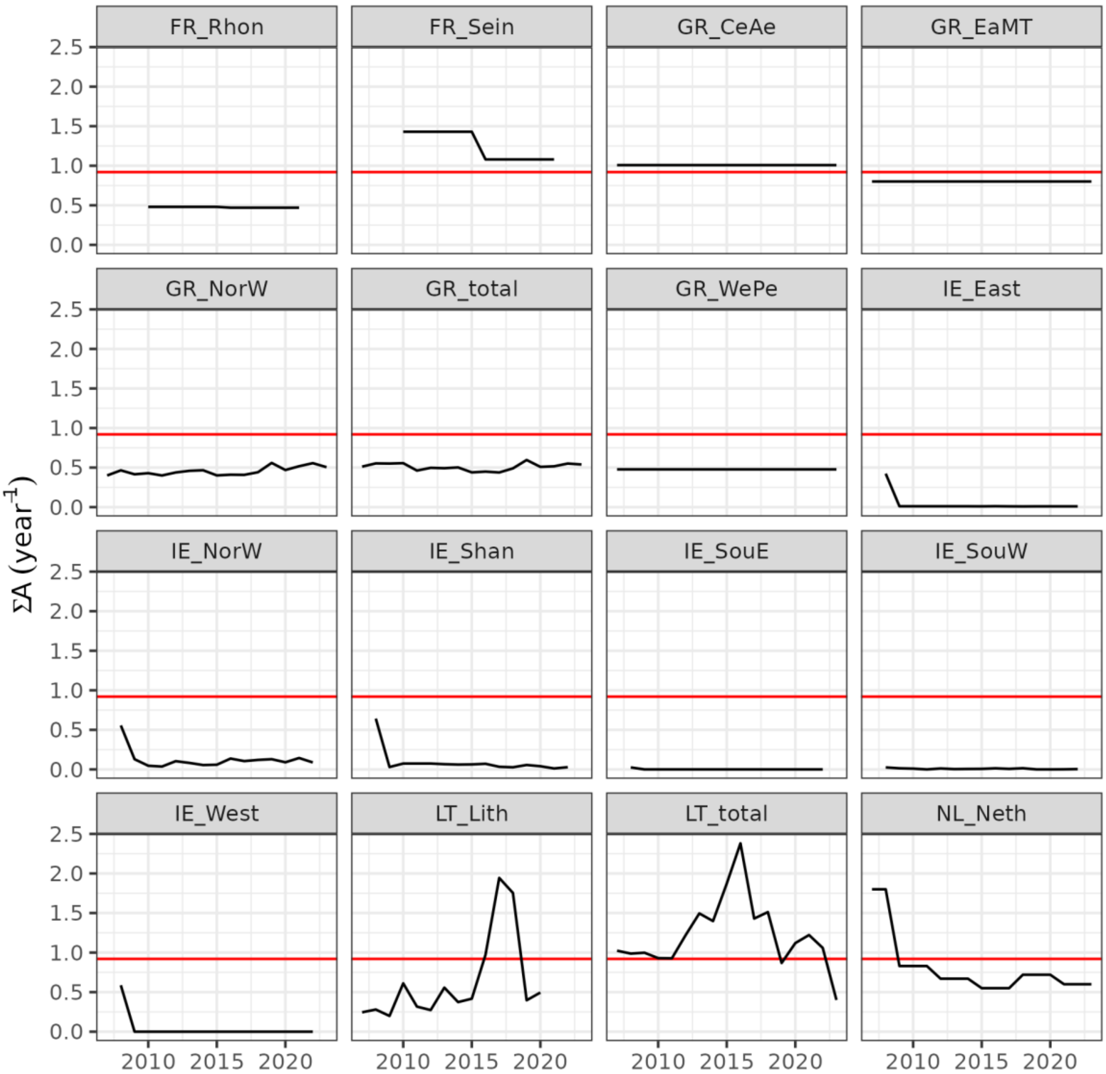

Figure A6.4 - continued

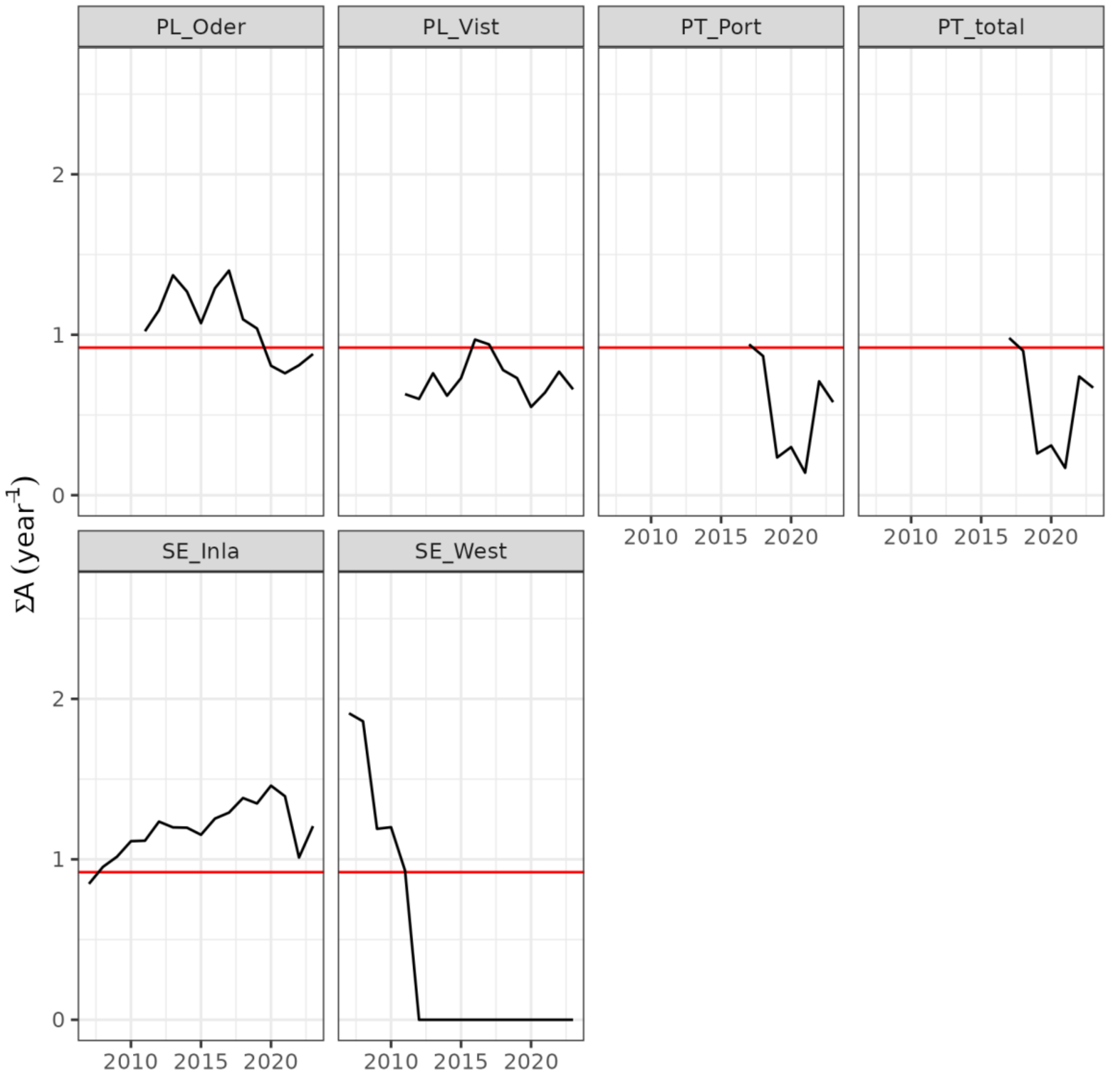

Figure A6.4 - continued

Annex 7: Additional information ToR C: Evaluate the effectiveness and outcome of types of measures

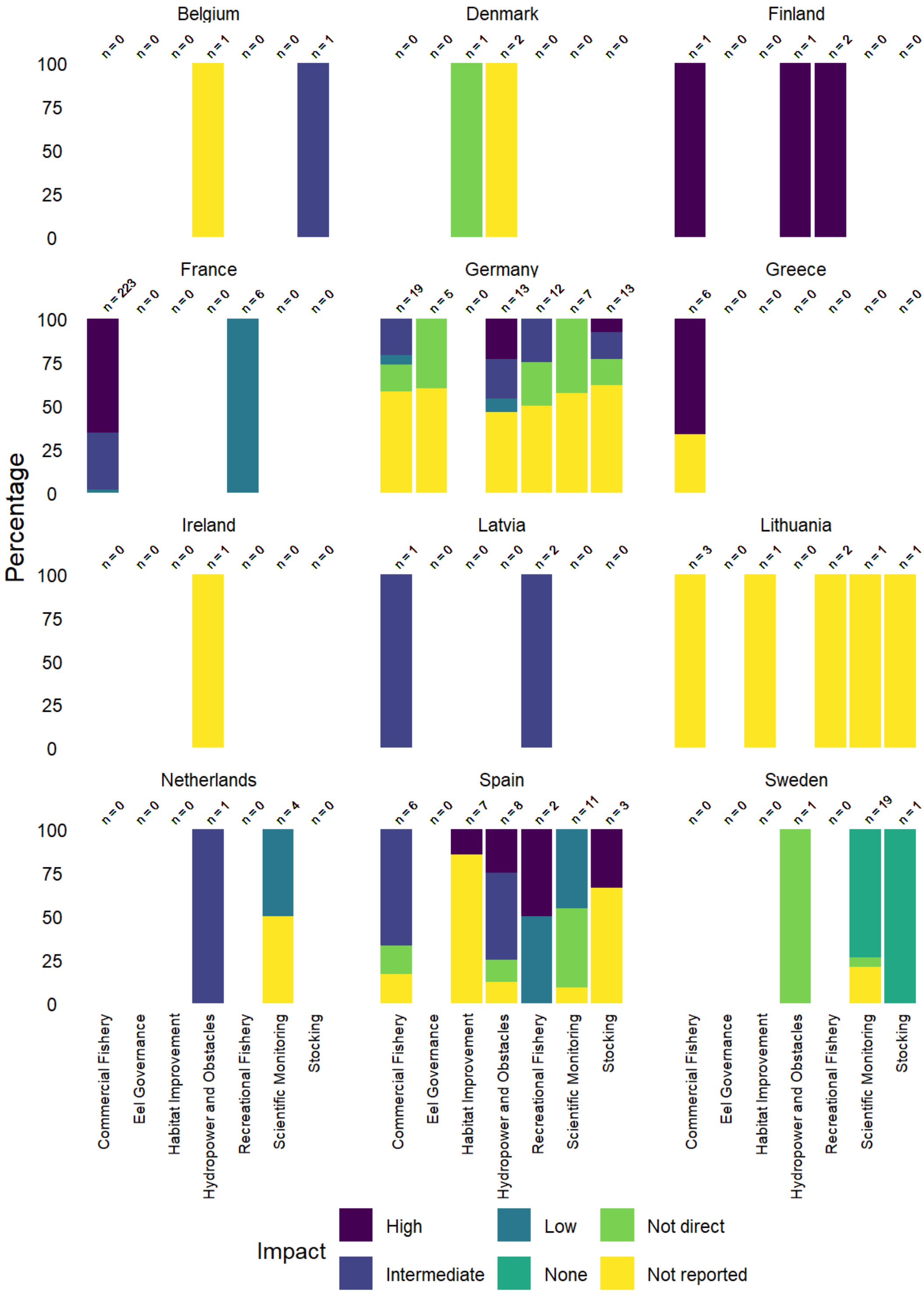

Figure A7.1 Percentage of the level of perceived impact of measures (reported by Member States), for non-EMP measures, by type of measure (top) and Member State (bottom). Absolute number of measures is displayed above the bars.

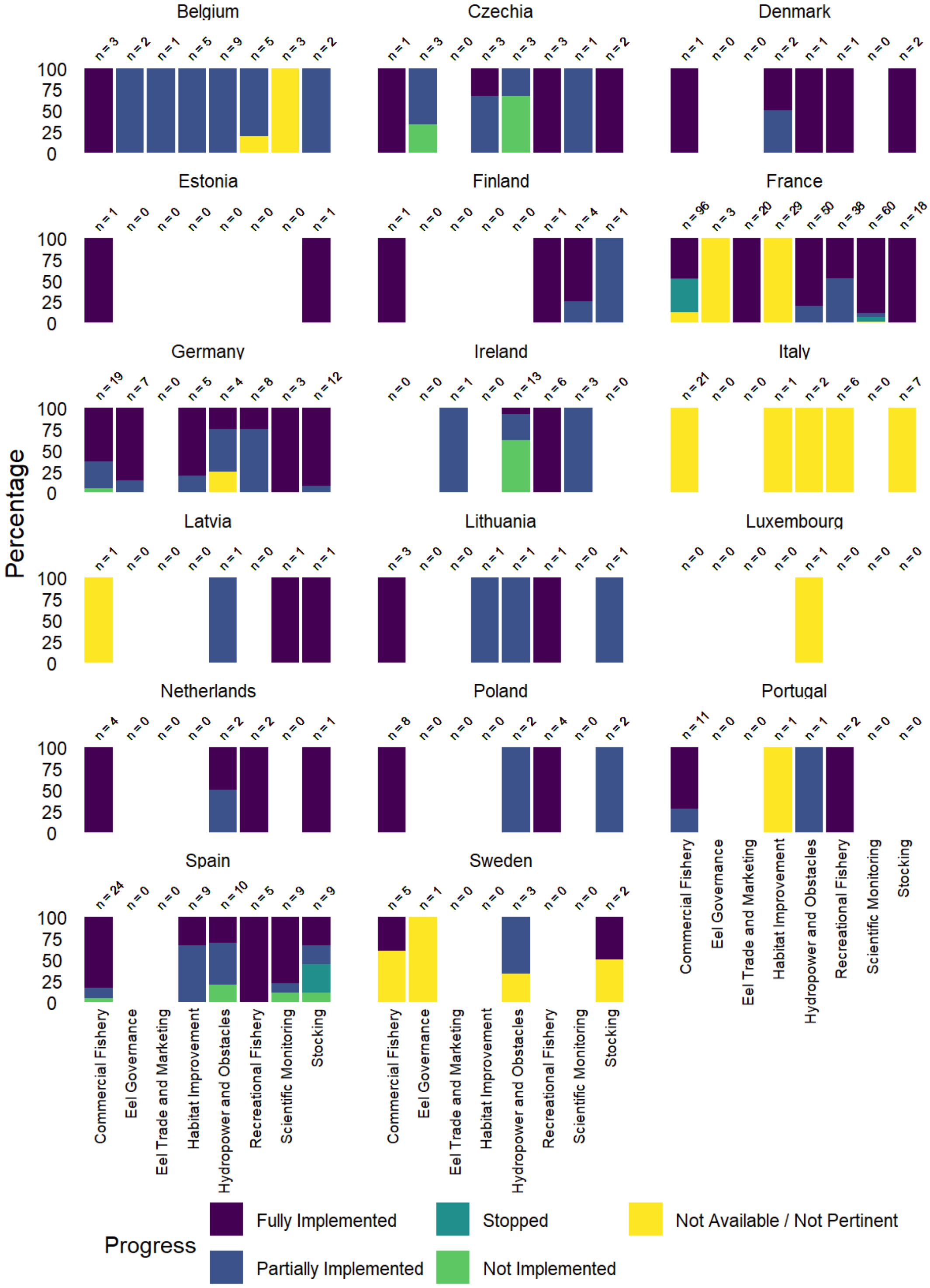

Figure A7.2 Percentage of the level of implementation of measures, by measure type (top) and Member State (bottom). Absolute number of measures is displayed above the bars. Only measures reported as planned within EMP are considered.

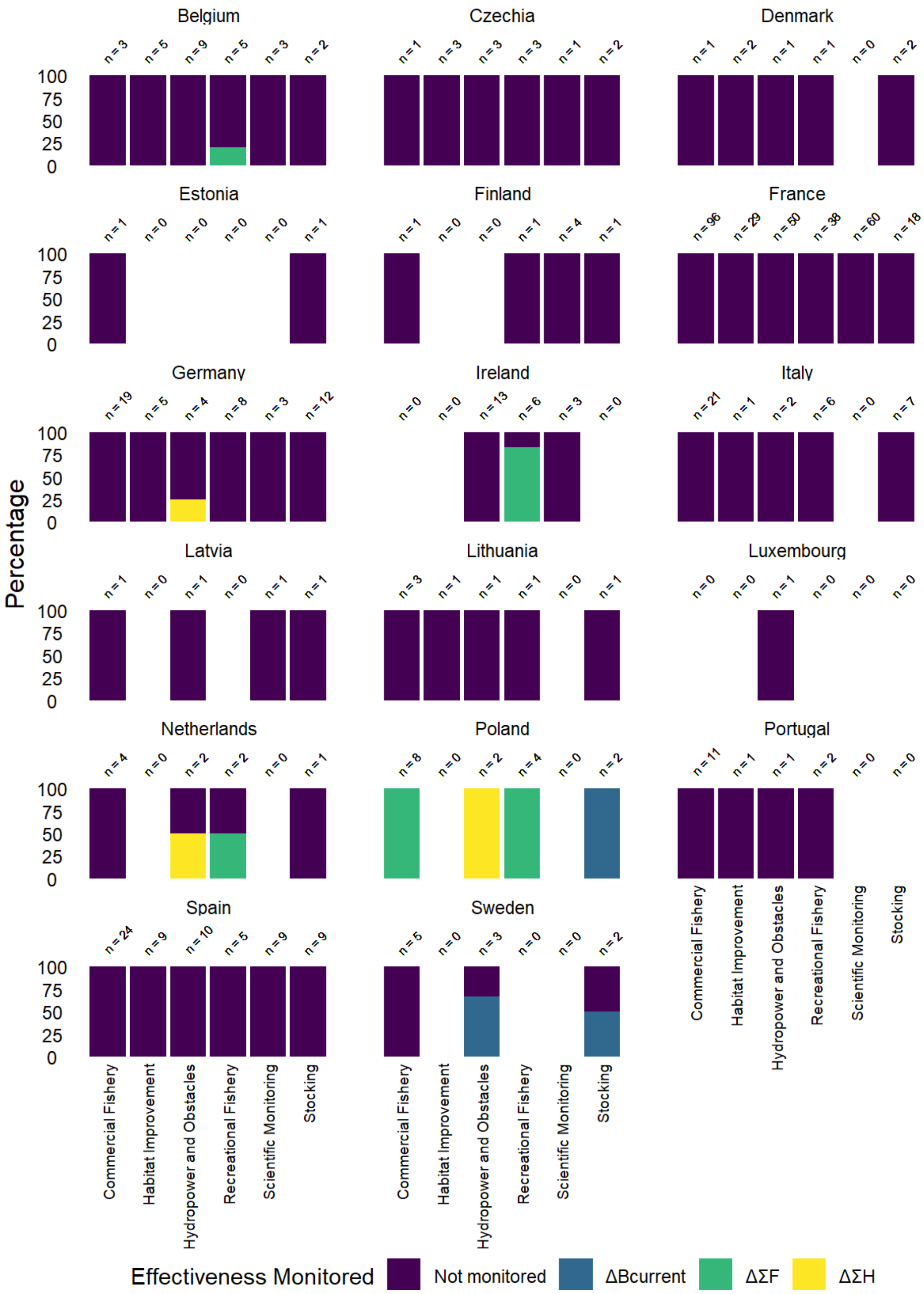

Figure A7.3 : Percentage of available estimates for monitoring of measures effects on stock indicators (ΔΣF, ΔΣH, Bcurrent or "other") by type of measure (top) and Member State (bottom). Absolute number of measures is dis-played above the bars. Only measures reported as planned within EMP are considered.

Figure A7.4 Percentage of measures where targets and/or their achievement were reported, by type of measure (top) and Member State (bottom). The absolute number of measures is displayed above the bars. Only measures reported as planned within EMPs are considered here. Note that a level of achievement was reported (ei-ther quantitative or semi-quantitative) for only a few measures, but no target value was provided; these were counted as "No target".

Table A7.1 Characteristics of measures and sub measures as defined by WKEMP. "Quantifiable" = Measures where a quantitative target can be defined, "immediate" = measures that immediately change either escapement or mortality or both, "direct" = measures that have a direct impact on the stock (as opposed to "immediate", this can be delayed, e.g. stocking directly changes the stock size but escapement will not be immediately affected).

measure_type	submeasure_type	quantifiable	immediate	direct	objective
Commercial_fishery	Ban of fishery	y	y	y	reduce landings to 0
Commercial_fishery	Capacity reduction (licences/vessel)	y	y	y	reduce effort
Commercial_fishery	Control and enforcement of fishery measures	n	n	n	improve management
Commercial_fishery	Effort reduction (n/size of gears)	y	y	y	reduce effort
Commercial_fishery	Effort reduction (others/not specified)	y	y	y	reduce effort
Commercial_fishery	Effort reduction (spatial)	y	y	y	reduce effort
Commercial_fishery	Effort reduction (temporary)	y	y	y	reduce effort
Commercial_fishery	Improve fishery management	n	n	n	np
Commercial_fishery	Min. size	y	y	y	increase survial of small fish
Commercial_fishery	Monitoring of effort and landings	n	n	n	improve management
Commercial_fishery	Setting of quotas	y	y	y	control landings
Commercial_fishery	Other				
Eel_trade_and_marketing	Establishment of a traceability system	n	n	n	enhance tracability
Eel_trade_and_marketing	Fish health and biosecurity issues	n	n	n	
Eel_trade_and_marketing	Eel price monitoring	n	n	n	
Eel_trade_and_marketing	Other				

measure_type	submeasure_type	quantifiable	immediate	direct	objective
Habitat_improvement	Establish protected areas	y	n	y	increase survivability in protected areas
Habitat_improvement	General habitat improvement/others/WFD				
Habitat_improvement	Identify areas/measures for habitat improvement	n	n	n	identify effective measures
Habitat_improvement	Improve water qualtity (contaminents, eutrophication)	y	n	y	increase survivability
Habitat_improvement	Limit the spread of parasites and diseases				
Habitat_improvement	Predator control	y	y	y	reduce predation mortality
Habitat_improvement	Other				
Hydropower_and_obstacles	Decreasing of eel mortality in HPP	y	y	y	reduce hpp mortality
Hydropower_and_obstacles	General conectivity improvement				
Hydropower_and_obstacles	Installation of eel passes	y	y	y	multiple
Hydropower_and_obstacles	Introduction of specific regulations or guidance to ensure eel connectivity	n	n	n	
Hydropower_and_obstacles	Removement of obstacles	y	y	y	multiple
Hydropower_and_obstacles	Research: Assesment and screening of barriers and HPP	n	n	n	
Hydropower_and_obstacles	Trap and transport	y	y	y	increase escapement
Hydropower_and_obstacles	Other				
Recreational_fishery	Ban of fishery	y	y	y	reduce landings to 0

measure_type	submeasure_type	quantifiable	immediate	direct	objective
Recreational_fishery	Capacity reduction (licences/vessel)	y	y	y	reduce effort
Recreational_fishery	Catch and release	n	n	n	reduce mortality
Recreational_fishery	Control and enforcement of fishery measures	n	n	n	
Recreational_fishery	Effort reduction (n/size of gears)	y	y	y	reduce effort
Recreational_fishery	Effort reduction (others/not specified)	y	y	y	reduce effort
Recreational_fishery	Effort reduction (spatial)	y	y	y	reduce effort
Recreational_fishery	Effort reduction (temporary)	y	y	y	reduce effort
Recreational_fishery	Improve fishery management	n	n	n	np
Recreational_fishery	Min. size	y	y	y	increase survial of small fish
Recreational_fishery	Monitoring of catches	n	n	n	improve management
Recreational_fishery	Setting of quotas	y	y	y	control landings
Recreational_fishery	Other				
Scientific_monitoring	Assesment model implementation/improvement	n	n	n	
Scientific_monitoring	Other scientific monitoring	n	n	n	
Scientific_monitoring	Monitoring recruitment (trends, abundance, or biology)	y	n	n	
Scientific_monitoring	Monitoring yellow eel (trends, abundance, or biology)	y	n	n	
Scientific_monitoring	Monitoring silver eel (trends, abundance, or biology)	y	n	n	
Scientific_monitoring	Other				

measure_type	submeasure_type	quantifiable	immediate	direct	objective
Stocking	Develop a stocking plan	n	n	n	identify effective measures
Stocking	Reservation of part of the catches for restocking	y	y	y	reduce mortality
Stocking	Stock pregrown eel	y	n	y	increase local stock size
Stocking	Stock wild eels	y	n	y	increase local stock size
Stocking	Stocking suitability studies	n	n	n	identify effective measures
Stocking	Stock glass eels	y	n	y	increase local stock size
Stocking	Fish health and biosecurity issues	n	n	n	
Stocking	Other				
Eel_governance	Awareness raising actions	n	n	n	
Eel_governance	Stake holder coordination improvement	n	n	n	
Eel_governance	Other				
Other	Other				

Table A7.2 Number of Measures Per Country and EMU

country	emu_name_short	Commercial_fishery	Eel_governance	Eel_trade_and_marketing	Habitat_improvement	Hydropower_and_obstacles	Other	Recreational_fishery	Scientific_monitoring	Stocking
Belgium	BE_Meus	0	1	0	2	3	0	1	0	1
Belgium	BE_Sche	1	1	0	2	2	0	3	0	1
Czech_republic	CZ_total	1	3	0	3	2	1	3	1	2
Denmark	DK_Inla	1	0	0	2	1	0	1	0	2
Estonia	EE_Narv	0	0	0	0	0	0	0	0	1
Estonia	EE_West	1	0	0	0	0	0	0	0	0
Finland	FI_Finl	1	0	0	0	0	0	1	4	1
France	FR_Adou	11	1	2	3	5	0	4	6	3
France	FR_Arto	11	1	2	3	5	0	4	6	3
France	FR_Bret	11	0	2	3	5	0	4	6	3
France	FR_Cors	8	0	2	3	5	0	3	6	0
France	FR_Garo	11	0	2	3	5	0	4	6	3
France	FR_Loir	12	0	2	3	5	0	4	6	3
France	FR_Meus	6	0	2	3	5	0	4	6	0

Table A7.2 Number of Measures Per Country and EMU

country	emu_name_short	Commercial_fishery	Eel_governance	Eel_trade_and_marketing	Habitat_improvement	Hydropower_and_obstacles	Other	Recreational_fishery	Scientific_monitoring	Stocking
France	FR_Rhin	6	1	2	3	5	0	4	6	0
France	FR_Rhon	9	0	2	3	5	0	3	6	0
France	FR_Sein	11	0	2	2	5	0	4	6	3
Germany	DE_Elbe	4	1	0	0	1	0	2	1	1
Germany	DE_Ems	3	1	0	1	1	0	1	1	1
Germany	DE_Maas	1	1	0	1	0	0	1	0	4
Germany	DE_Oder	2	1	0	0	0	0	1	1	1
Germany	DE_Rhei	3	1	0	1	1	0	1	0	3
Germany	DE_Warn	5	1	0	1	2	0	1	1	1
Germany	DE_Wese	4	1	0	1	0	0	1	1	1
Ireland	IE_East	0	0	1	0	2	0	1	0	0
Ireland	IE_NorW	0	0	0	0	3	0	1	1	0
Ireland	IE_Shan	0	0	0	0	5	0	1	2	0
Ireland	IE_SouE	0	0	0	0	0	0	1	0	0

Table A7.2 Number of Measures Per Country and EMU

country	emu_name_short	Commercial_fishery	Eel_governance	Eel_trade_and_marketing	Habitat_improvement	Hydropower_and_obstacles	Other	Recreational_fishery	Scientific_monitoring	Stocking
Ireland	IE_SouW	0	0	0	0	2	0	1	0	0
Ireland	IE_total	0	0	0	0	1	0	0	0	0
Ireland	IE_West	0	0	0	0	0	0	1	0	0
Italy	IT_Emil	2	0	0	0	0	0	1	0	1
Italy	IT_Frio	2	0	0	0	0	0	1	0	1
Italy	IT_Lazi	3	0	0	0	0	0	0	0	1
Italy	IT_Lomb	1	0	0	1	1	0	1	0	1
Italy	IT_Pugl	2	0	0	0	0	0	1	0	0
Italy	IT_Sard	4	0	0	0	0	0	0	0	0
Italy	IT_Tosc	2	0	0	0	0	0	1	0	1
Italy	IT_Umbr	2	0	0	0	0	0	0	0	1
Italy	IT_Vene	3	0	0	0	1	0	1	0	1
Latvia	LV_Latv	1	0	0	0	1	0	0	1	1
Lithuania	LT_Lith	3	0	0	1	1	0	1	0	1

Table A7.2 Number of Measures Per Country and EMU

country	emu_name_short	Commercial_fishery	Eel_governance	Eel_trade_and_marketing	Habitat_improvement	Hydropower_and_obstacles	Other	Recreational_fishery	Scientific_monitoring	Stocking
Luxembourg	LU_Rhin	0	0	0	0	1	0	0	0	0
Netherlands	NL_Neth	4	0	0	0	2	0	2	0	1
Poland	PL_Oder	4	0	0	0	1	0	2	0	1
Poland	PL_Vist	4	0	0	0	1	0	2	0	1
Portugal	PT_Port	11	0	0	1	1	0	2	0	0
Spain	ES_Anda	2	0	0	1	1	0	0	1	1
Spain	ES_Astu	3	0	0	1	3	0	0	2	1
Spain	ES_Basq	0	0	0	2	0	0	1	0	0
Spain	ES_Cant	3	0	0	1	1	0	1	0	1
Spain	ES_Cata	2	0	0	2	0	0	0	2	1
Spain	ES_Gali	11	0	0	1	2	0	1	3	1
Spain	ES_Nava	0	0	0	0	1	0	1	0	2
Spain	ES_Vale	3	0	0	1	2	0	1	1	2
Sweden	SE_East	3	0	0	0	1	0	0	0	0

Table A7.2 Number of Measures Per Country and EMU

country	emu_name_short	Commercial_fishery	Eel_governance	Eel_trade_and_marketing	Habitat_improvement	Hydropower_and_obstacles	Other	Recreational_fishery	Scientific_monitoring	Stocking
Sweden	SE_Inla	2	0	0	0	1	0	0	0	1
Sweden	SE_total	0	1	0	0	0	0	0	0	0
Sweden	SE_West	0	0	0	0	1	0	0	0	0

Annex 8: Reviewer Report

Review by David Cairns

The workshop that conducted the Technical Evaluation of Member States Eel Regulation Progress Reports was charged by ACOM with preparing the data for evaluation, evaluating the effectiveness of EMPs in achieving target indicators, evaluating the effectiveness of conservation measures, and proposing alternate methods for attainment of implementation.

In their report, the evaluation team laid out text, tables, and figures to synthesize the main points of the Progress Reports, while also pointing out certain shortcomings. The Progress Reports themselves use a diverse array of analytic workflows to convert raw field data to responses, or attempted responses, to Eel Regulation mandates. The current Technical Evaluation exposes a relatively small portion of these analytic workflows. The preceding Technical Evaluation (ICES 2022) exposed more.

This review does not attempt to comprehensively examine the tools used by the Progress Reports. Instead, it focuses on ACOM's fourth ToR, that being proposal of alternate approaches to implementation of Eel Regulation goals. In doing so, it takes the view that advancement in Eel Regulation implementation must start with consideration of the original principles upon which the Regulation was founded.

The spatial basis of the Eel Regulation

European eels spawn in the ocean, from which recruiting juveniles migrate to continental rearing habitats, which include lakes and ponds, streams and rivers, bays and estuaries, and, at certain times and places, open marine waters (ICES 2009) (Figure A7.1).

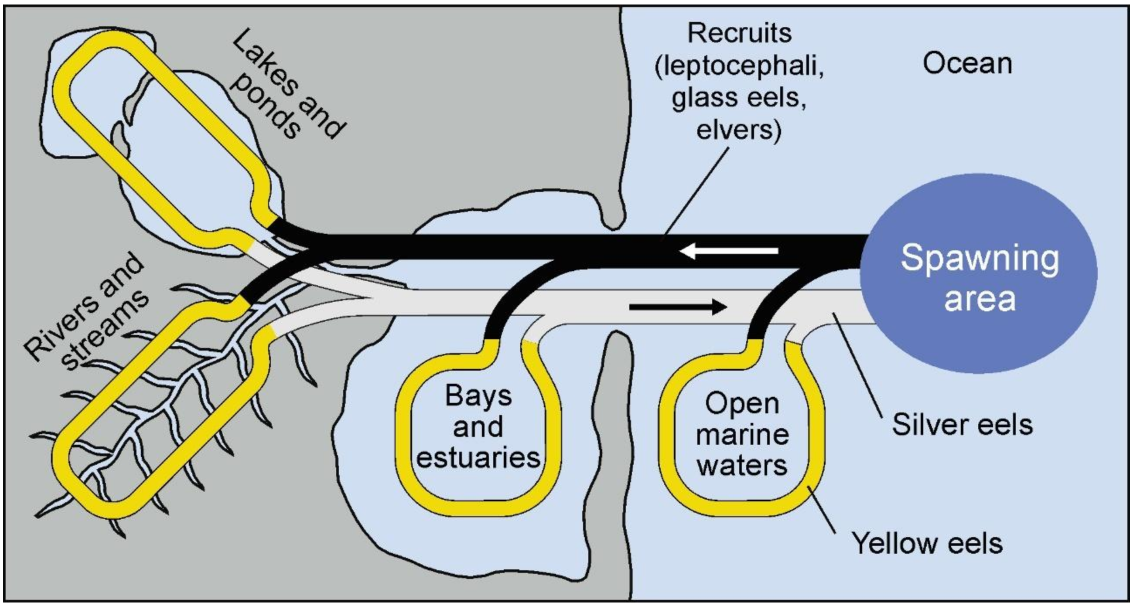

Figure A7.1. A diagrammatic representation of the eel life cycle, showing oceanic spawning and continental rearing habitats. Modified from Cairns et al. 2022.

Ideally, fish stocks are assessed by standardized data-gathering methods in an environmentally homogenous stock area. This is not possible for the wide-ranging European eel (although assessments founded on larval indices in the Sargasso Sea are at least conceivable; Westerberg *et al.*

2018, Cairns *et al.* 2022). Instead, the stock must be assessed from data gathered in rearing habitats. This is challenged by the vast geographic spread of these habitats. In addition, representative sampling is complicated by high variation in major demographic parameters according to sex, habitat salinity, waterbody type, and climate regime.

The Eel Regulation deals with these circumstances by positing two assumptions, as summarized by the Technical Evaluation Report:

> *i) if total continental escapement is increased to 40% (or more) of that which was possible in the 'pristine' state, then the panmictic eel stock will have recovered to a safe biological state, resilient to all (or at least most) human and natural pressures.*

This first assumption, based on a widely accepted principle of fisheries management, seems reasonable. But the assumption also gives rise to the question of how total continental escapement (or any other range-wide demographic value) can be estimated from local data. One way to do this is to measure population parameters within spatial sub-units that have relatively homogeneous life history characteristics, and then raise these parameters to range-wide values using weighting factors that reflect spatial sub-unit population size as a proportion of range-wide population size (Velez-Espino and Koops 2010). For example, silver eel mass in a spatial sub-unit that contains 10% of the range-wide population would have 10 times the influence on range-wide silver eel weight than would data from a spatial sub-unit that has 1% of the range-wide population.

The difficulty with this approach is that the scaling-up process requires estimates of absolute population size of the spatial sub-unit, which are often difficult to obtain.

The Eel Regulation tries to avoid this problem with its second assumption:

> *ii) if every spatial sub-unit of the continental range of the eel (EMPs, EMUs, others) meets its own 40% escapement target (and these are all correct) then the total continental escapement (the sum of the parts) will achieve that overall 40%.*

The logic of this is unassailable; if all spatial sub-units meet conservation requirements, then the whole stock is sure to meet conservation requirements. However, a difficulty arises if only some spatial sub-units meet conservation requirements. In such cases, estimates of absolute population are required to properly weight local data into a valid range-wide value. An alternate method, second-best but still meaningful, is to evaluate the proportion of sub-unit values that meet the conservation target. This is the approach taken in the Technical Evaluation.

Has Eel Regulation implementation worked in practice?

This question can be answered by comparing quotations from the first and the current Evaluations of Progress Reports:

> *"Some Eel Management Units (EMU) did not report all required stock indicators. This made it impossible to evaluate their contribution to stock protection and recovery." "Future evaluations might benefit from standardization and tighter coordination."* (ICES 2013).

> *"The variation and gaps in the data submitted made it extremely challenging to determine the effectiveness of reported types of measures in the context of associated threats" ". . . the WKEMP4 strongly reiterate the need for all MS to monitor, analysis, and report according to the current EMPs."* (current Technical Evaluation report)

The two evaluations, spaced 12 years apart, both found that incomplete data in Progress Reports prevent the drawing of firm conclusions, and both prescribe intensified application of current methods to solve the problem.

A first reason for the inability to robustly evaluate compliance with the Eel Regulation is that complexities of eel biology pose high barriers to obtaining the needed data (see Section 4.4 and elsewhere). A second reason is that eel assessments compete with many other stocks and issues for the finite resources of fisheries agencies. Eel biological complexity and agency resource limitations are both permanent features of the stock assessment landscape. I suggest that it is a vain hope that problems of eel assessments will be solved by applying more resources. Instead, the resources that are available must be applied with better effect.

Spatial shortfalls in data gathering

The checkerboard in Table 2.1, heavily dosed with red (no data) and amber (incomplete data) squares, shows that many EMUs lack the information needed to evaluate compliance with the Eel Regulation. The current Technical Evaluation gives only partial insights into sources of field data and how they were analysed. I have therefore turned to fuller descriptions in the preceding Technical Evaluation (ICES 2022), although thereby incurring the risk that methods might have shifted in the interim.

ICES (2022, Section 6) refers to widely used demographic and extrapolation models, and to mark-recapture models that are used only on the Swedish Baltic coast. Field methods include "electric dipping" near the shore, electrofishing (presumably by wading), electric beam trawling, and river trapping. Most reported field collections take place in freshwater rivers and lakes. ICES (2022) noted error risk in extrapolating from small sampling areas to broader areas, especially in habitats of different types, e.g. from shallow water to deep water. Estuaries are a particular problem in extrapolation because "the estuarine fraction of the stock is rarely quantified." In France, equal productivity of fresh waters and estuaries was assumed. In Spain, freshwater production was multiplied by 1.29 to estimate estuarine production. This raising factor is attributed to productivity measurements in France reported by Mateo et al. (2021). It is unclear why French data would be used in Spain but not in France. I am unable to consult Mateo et al. (2021) to resolve this because ICES (2022) has no Literature Cited and I can't locate the source in Google Scholar.

Habitat area is required to scale up density estimates to population estimates. Eels occupy estuaries, and the Water Framework Directive's definition of "transitional waters" coincides with a common definition of estuaries (https://www.eea.europa.eu/help/glossary/eea-glossary/transitional-waters). However, the seaward boundaries of eel occupancy in saline waters are often unknown, making it impossible to calculate area of occupancy. Available data for the North Sea (ICES 2009) and for American eels (*Anguilla rostrata*; Cairns *et al.* 2017) suggest that eel density falls off gradually with distance from land or river mouths, rather than forming a distinct edge (Figures A7.2 and A7.3). This means that eel populations in saline habitats cannot be estimated from one or a few density measurements.

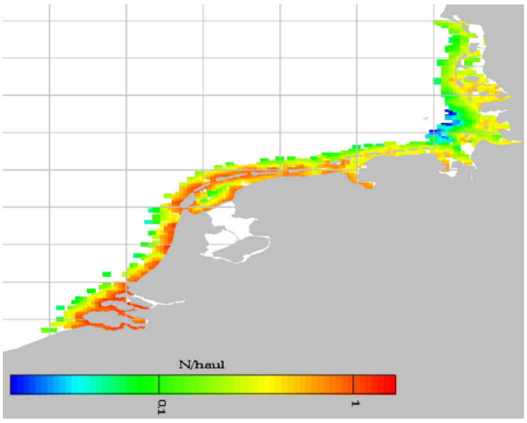

Figure A7.2. Modelled catch rate of European eels in beam trawl surveys along the Belgian, Dutch, German, and Danish coasts of the North Sea in 1982. From ICES 2009.

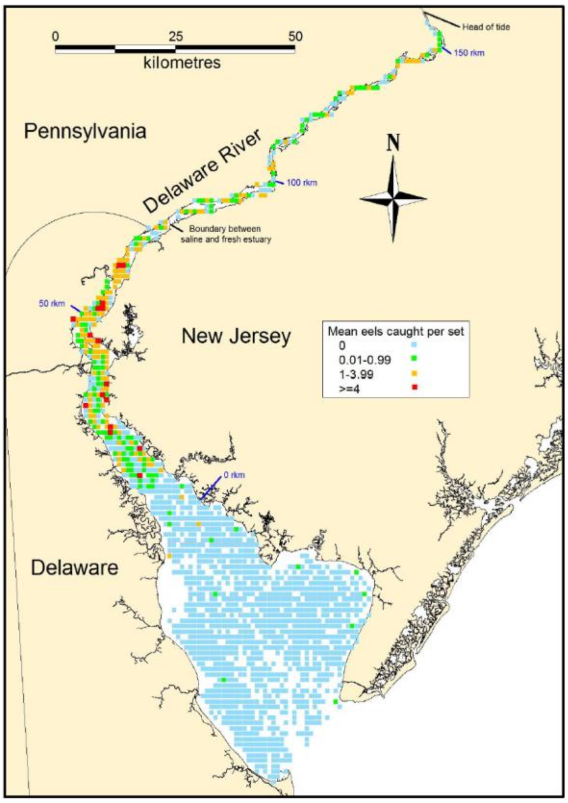

Figure A7.3. Catch rate of American eels in trawl sets in Delaware River and Delaware Bay, eastern U.S.A. From Cairns *et al.* 2017.

Do available data test compliance with the Eel Regulation's escapement target?

Table 2.1 shows that a high fraction of EMUs lack the information needed to evaluate Eel Regulation compliance. However, among 55 EMUs with adequate data, only 12 show biomass indicators that achieve the Eel Regulation's target of ≥40% of pristine silver eel escapement. This infers a general failure to achieve the Eel Regulation target in the classes of habitat that available data represent. The rub of the matter is whether this finding can be extrapolated to the total European eel population within the EU, or indeed range-wide.

To justify such an extrapolation, we first look for the relative proportions of eels that occupy fresh waters (reasonably well studied) and saline waters (poorly studied). If saline water eels are only a small fraction of the total, then target compliance in freshwaters will drive overall target compliance, and the saline water fraction can be ignored. Data on eel populations by salinity zone are unavailable to make this test.

Second, we ask whether the factors likely to drive population change are similar across salinity zones. Populations in both habitat types may be affected by fisheries and by water quality problems, but eels in freshwater are uniquely vulnerable to migration barriers and turbine mortalities. Incoming juvenile eels first encounter coastal and estuarine waters, and then choose whether to settle there, or ascend to fresh waters. At times of low recruitment (i.e. the present time), they may preferentially settle in saline waters because there is no density-dependent pressure to drive them upstream.

For these reasons, I suggest that the non-compliance inference for the Eel Regulation escapement target for eels in fresh water cannot be reliably extrapolated to eels in saline waters. If the non-compliance inference can't be reliably extrapolated to saline waters, then it can't be reliably extrapolated to the eel population as a whole.

Recommendations

1. The goal of covering all EMUs is unrealistic and should be abandoned. Current programs should be refocused with the aim of providing full datasets in a smaller number of locations.

2. Some of the resources freed by reducing current data collection programs should be directed to investigations of eel abundance, distribution, and population parameters in saline waters. Looking for extant survey programs that provide relevant data would be an obvious place to start. However, some new methods will surely be needed (Cairns et al. 2022, Hata et al. 2025).

3. The changes recommended above will require increased extrapolation of findings of studied locations to unstudied locations. The validity of such extrapolations should be tested through better understanding of spatial variability in eel parameters. Tools such as correlation strength vs. distance plots (Bradford 1999), variograms (Dekker 2000), and empirical orthogonal analysis (Gruss et al. 2021) may help.

4. Advances and shortfalls in spatial coverage of understudied habitats should be clearly documented in Progress Reports and in Technical Evaluations.

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