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

# Spain

# 2024

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

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**Reporting Period:** This report was completed in September and contains data up to 2024.

# Contents

# 1 Summary of national and international stock status indicators

## 1.1 Escapement biomass and mortality rates

European eel has disappeared from the inner communities due to the construction of large dams; thus, current indicators estimates are limited to Spanish coastal regions. Stock status indicators are compiled here as reported in the Spanish EMP post evaluation report (2024)

In the 2021 postevaluation report, several of the regions started to use the EDA model to estimate current silver eel biomass. SUDOANG provided annual biomass estimations up to 2018 using EDA (Table 1). As there has been no update of the EDA estimates since then, the trends from the samplings of each EMU have been used to apply those trends to the biomass estimates made by EDA. However, it should be bear in mind that this is the first time EDA is implemented and, in the future, it may be necessary to adjust the model; in particular, the estimates for transitional waters need to be improved.

To calculate the pristine situation some EMUs have used 20 kg per hectare as pristine productivity for freshwater (ICES, 2001). In the case of transitional waters, the 20 kg have been multiplied by 1.29 (25.8 kg/ha), because in a comparison using real data on the productivity of both systems in French basins, this is the productivity ratio that has been obtained (Mateo et al., 2021). Other EMUs multiplied the maximum Bbest for the period 2007-2020 by a factor (x3); this factor was obtained by comparing the estimated silver eel production in EDA for this EMU for the period 1960-1979 with that of 2018.

During the SUDOANG project, it has been observed that the percentage of habitat loss in surface area does not correspond to the same eel loss. Clavero and Hermoso (2015) estimated that 80% of the area had been lost due to obstacles in the Iberian Peninsula. However, when removing the effect of the obstacles, EDA estimated only 10% of eels would be lost. This is because the eel's production in the upper part of the catchment is very low (Mateo et al., 2021). **Thus, it is likely that pristine biomass is overestimated in Spain.**

To calculate fishing mortality, first landings were transformed into SEE (Silver Eel Equivalents) (Table 1). To do so, first, the weight in landings of each stage was transformed into numbers. For glass eel a settlement mortality of 80% (Briand, 2009) was applied and from then on, an annual mortality of 0.138 was considered (Dekker, 2000). The applied generation length and weight at different stages was different depending on the EMU. Fishery life mortality was estimated as = -Ln (Bcurr / (Bcurr + Landings in SEE).

*Table 1.Methods used by the Spanish EMUs to estimate indicators in the 2024 postevaluation report. NC: not collected.*

| EMU_code | $B_0$ (kg) | Bcurr | Bbest |
|---|---|---|---|
| ES_Anda | NC | NC | NC |
| ES_Astu | Application of a conversion factor to Bcurr | Extrapolation of area production rate (surveys) | Bbest = Bcurr + A (in SEE) |
| ES_Bale | NR | NR | NR |
| ES_Basq | Extrapolation of pristine area production rate | ≤2018: EDA<br>2019-2023: trend in sampling applied to 2018 EDA estimates | Bbest = Bcurr + A (in SEE) |
| ES_Cant | Extrapolation of pristine area production rate | ≤2018: EDA<br>2019-2023: trend in sampling applied to 2018 EDA estimates | Bbest = Bcurr + A (in SEE) |
| ES_Cast | Extrapolation of pristine area production rate | No current eel population | No current eel population |
| ES_Cata | Extrapolation of pristine area production rate | ≤2018: EDA<br>2019-2023: trend in sampling applied to 2018 EDA estimates | Bbest = Bcurr + A (in SEE) |
| ES_Gali | Extrapolation of pristine area production rate | Extrapolation of area production rate (surveys) | Bbest = Bcurr + A (in SEE) |
| ES_Inne | Extrapolation of pristine area production rate | No current eel population | No current eel population |
| ES_Murc | Application of a conversion factor to Bcurr | Based on fishery data and surveys and updated with annual CPUE | Bbest = Bcurr + A (in SEE) |
| ES_Nava | Extrapolation of pristine area production rate | Extrapolation of area production rate (surveys) | NC |
| ES_Vale | Extrapolation of pristine area production rate | ≤2018: EDA<br>2019-2023: trend in sampling applied to 2018 EDA estimates | Bbest = Bcurr + A (in SEE) |

Bcurr and $B_0$ can be used to assess the compliance with the Regulation aim (defined as 40% of the pristine escapement). Most Spanish regions do not achieve this 40%. But as indicated above, there is not enough scientific evidence to calculate $B_0$; for this reason, an anthropological mortality limit can be used to determine compliance with the recovery plan; 40% pristine escapement implies a maximum ΣA of 0.92. Only Galicia and Asturias provided hydropower plant (HPP) mortality. In both cases, HPP mortality is very low compared to fishing mortality. According to the 2024 report (Table 2) there are several EMUs that exceed this mortality limit. It should be noted that the calculation of mortality is highly dependent on the conversion of landings into SEE, which is based on various assumptions regarding weight, growth, age, and natural mortality. Therefore, the results should be interpreted with caution.

Nevertheless, as both, the methods for biomass and mortality indicators have remained consistent over the years, the trends reflected are reliable.

*Table 2. Stock indicators of silver eel escapement, biomass and mortality rates for 2023 (Spanish post evaluation report 2024). NC: not collected.*

| EMU | Bo | Bcurr _kg | %Bcurr / Bo | Bcurr r_without _stocking_kg | Bbest_kg | ∑F | ∑H | ∑A |
|---|---|---|---|---|---|---|---|---|
| ES_Anda | 6057545 | NC | NC | NC | NC | NC | NC | NC |
| ES_Astu | 63495 | 18802 | 30 | NC | 74793 | 1,38 | NC | 1,38 |
| ES_Bale | 330883 | | NC | NC | NC | NC | 0,00 | NC |
| ES_Basq | 245040 | 22207 | 9 | 22207 | 69985 | 1,15 | NC | 1,15 |
| ES_Cant | 9680 | 5758 | 59 | 5758 | 28239 | 1,59 | NC | 1,59 |
| ES_Cast | 23488,4 | 0 | 0 | 0 | NC | NP | NP | NP |
| ES_Cata | 364607 | 22614 | 6 | 22614 | 129954 | 1,75 | NC | 1,75 |
| ES_Gali | 110700 | 31966 | 29 | 26590 | 65758 | 0,89 | 0,04 | 0,93 |
| ES_Inne | 2420205 | 0 | 0 | 0 | NC | NP | NP | NP |
| ES_Murc | 26270 | 11951 | 45 | 11951 | 65428 | 1,70 | 0,00 | 1,70 |
| ES_Nava | 5448 | 1761 | 32 | 1761 | NC | 0,00 | NC | NC |
| ES_Vale | 698026 | 117006 | 17 | 117006 | 151801 | 0,26 | NC | 0,26 |
| Total/average | 10355387 | 232064 | 22,78 | 207886 | 585959 | | | |

Since the eel recovery plan was implemented in Spain, no improvement in silver eel biomass has been observed overall, and in fact, many of the EMUs have maintained a downward trend (Figure 1).

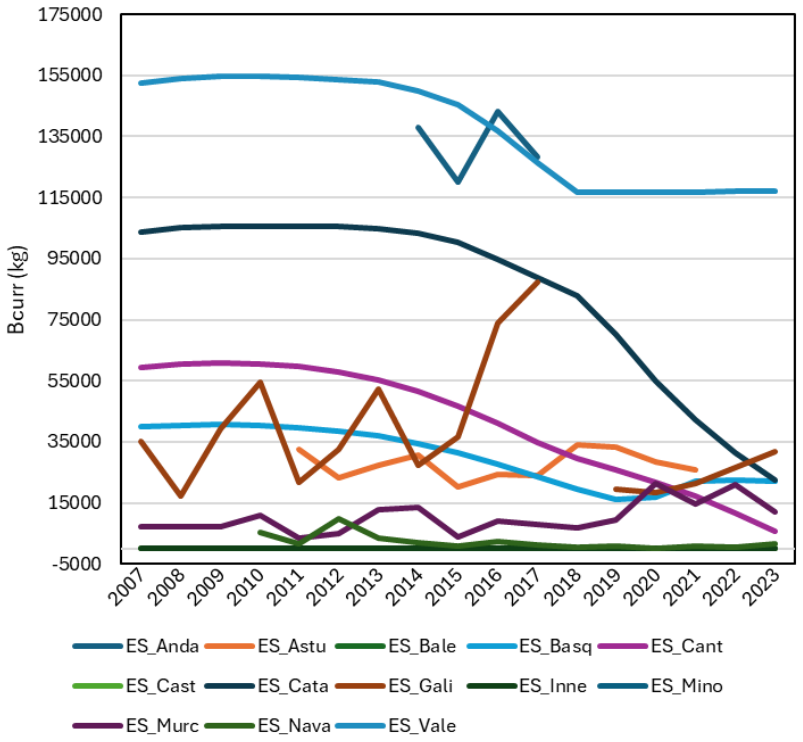


**Figure 1. Silver eel biomass (Bcurr ) trends of the Spanish EMUs (Spanish post evaluation report 2024).**

Fishing mortality is above the anthropological mortality needed to achieve the 40% pristine escapement (ΣA = 0.92). in many EMUs and does not show a decreasing trend in general terms (Figure 2).

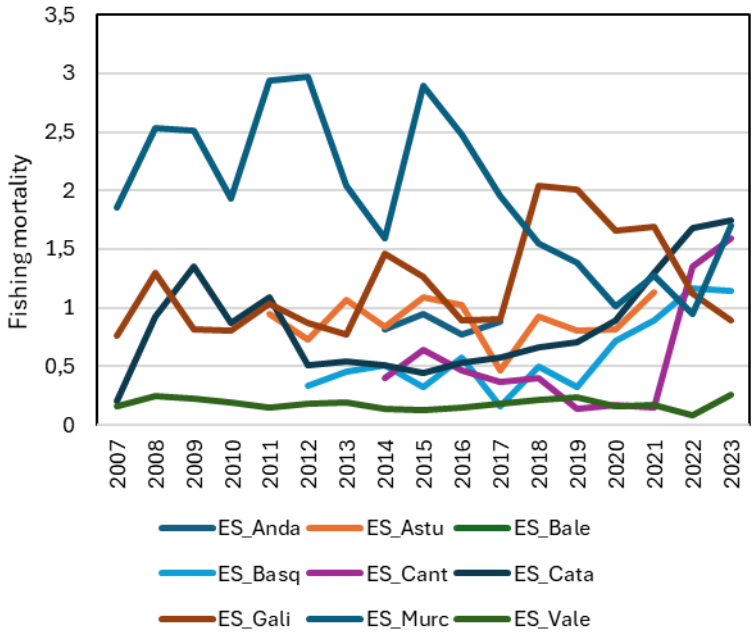


**Figure 2. Fishing mortality trends in the Spanish EMUs (Spanish post evaluation report 2024).**

## 1.2 Recruitment time series

Spain provides four series with pre-80ies data. These are the characteristics of those fishery dependent series:

- San Juan de la Arena fish market in Asturias: It includes almost all the landings from the Nalón River. Until the 70's only land fishing existed, then fishermen started to fish in boats, and the landings increased notably.
- The Albufera in C. Valenciana: During the 1949-2000 period, data were collected from fishermen guilds corresponding to three fishing points (Golas of Pujol, Perelló and Perellonet). From 2001 on, the administration of C. Valenciana also compiles data from other fishing points in the Albufera, and the rest of C. Valenciana. To maintain the coherence of the data series, the Pujol, Perelló and Perrellonet data will be considered for the historical data series of the Albufera. As this series also contains effort data, both the catch series and the catch-per-unit-effort series are provided.
- The Delta del Ebro lagoons in Catalonia: Data are obtained from the fish markets in the area. Since 1998, the administration from Catalonia compiles data for the fish markets corresponding to the Ebro River mouth, obtaining total landings in the Ebro. Additionally, since 1998 it also compiles information from the rest of Catalonian rivers.
- The Miño: the Miño River command compiles the Spanish landings data.

In addition, Spain contributes with other shorter three historical series to WGEEL recruitment index:

- AICPG: Albufera de Valencia comercial CPUE.
- OriaG: Oria scientific monitoring.
- GuadG: Guadalquivir scientific monitoring (until 2007).

The Spanish historical series show a decreasing trend since late 70ies. During the last years, the index remained low showing some interannual variability without any clear trend (Figure 3). Anyway, put in historical context, the conclusion is that recruitment remains at very low levels in Spain.

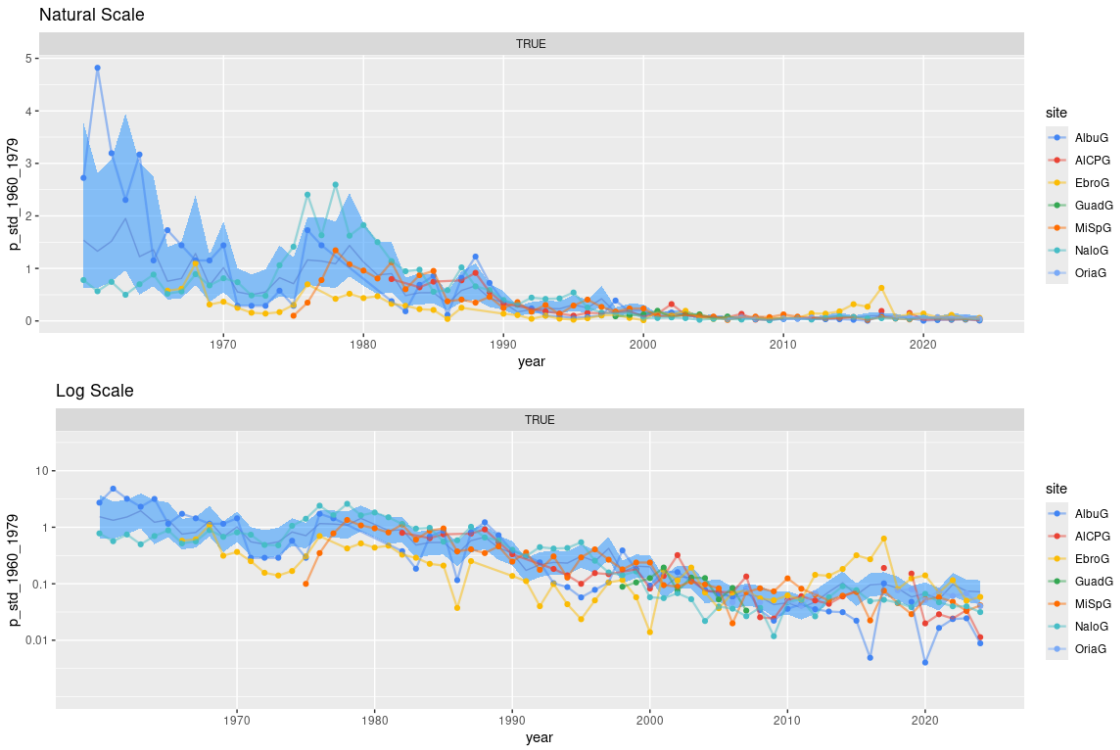


**Figure 3. Evolution of the seven Spanish recruitment series used in the calculation of the WGEEL recruitment index in natural and logarithmic scale (updated to 2024).**

# 2 Overview of the national stock and its management

No new information since 2018 report (Korta and Díaz, 2019).

# 3 Impacts on the national stock

## 3.1 Fisheries

For details about data gathering check Spanish Country report 2017 (Díaz and Korta, 2017). Although some interannual variability can be observed in both glass eel and yellow and silver eel landings in Spain, they both have decreased during the last decades.

In Spain different regions exploit different stages of the eel and use different fishing techniques and gears.

### 3.1.1 Glass eel fisheries

The evolution of landings since the 60ies must be analysed with caution as the amount of information available has been increasing over the years (Figure 4), which may lead to think that landings have increased when, as shown in the individual series in the recruitment section, it has been the opposite in the long term The trend since data has been available for the 5 EMUs with professional glass eel fisheries (1996) has been a decrease in landings.

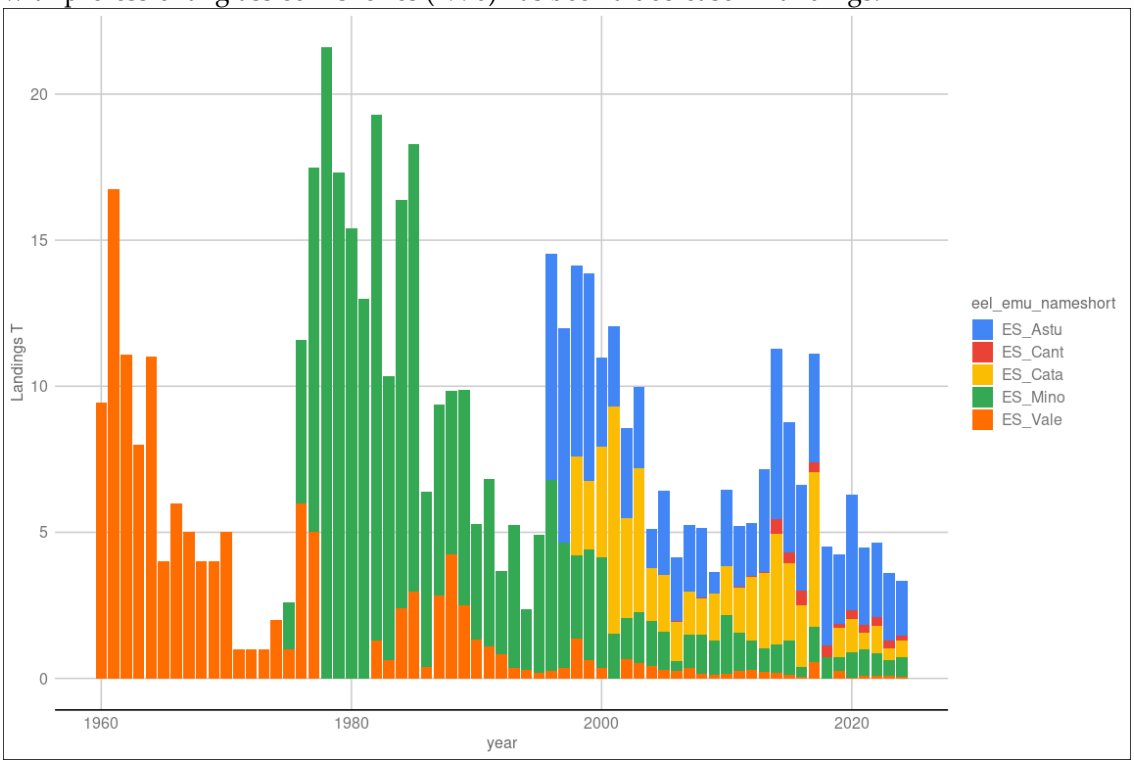


**Figure 4. Total glass eel landings in Spain since 1960 updated to 2024.**

Recreational glass eel fishery only takes place in the Basque Country nowadays, Cantabria used to allow this fishery but prohibited it from 2014 on (**Figure 5**). Since the data gathering system was established in 2004, the lowest landings were recorded in 2009 and 2014 in the EMUs of the Basque Country and Cantabria respectively. After landings increased reaching a maximum in 2014 in the Basque Country and decreased for three seasons following the same trend as the

commercial landings. In 2021 due to the restrictions imposed by COVID in the Basque Country, recreational glass eel fishermen were not allowed to fish. However, reported landings have increased over the last 3 seasons: from 662 kg in the 2019-2020 season (no fishing in 2020-2021 due to COVID restrictions) to 715 kg in 2021-2022 and 1,317 kg in 2022-2023. Glass eel recreational fishery was banned in 2023-2024 season, in agreement with the 2023 EU Council Regulation 2023/194 and 2023/195.

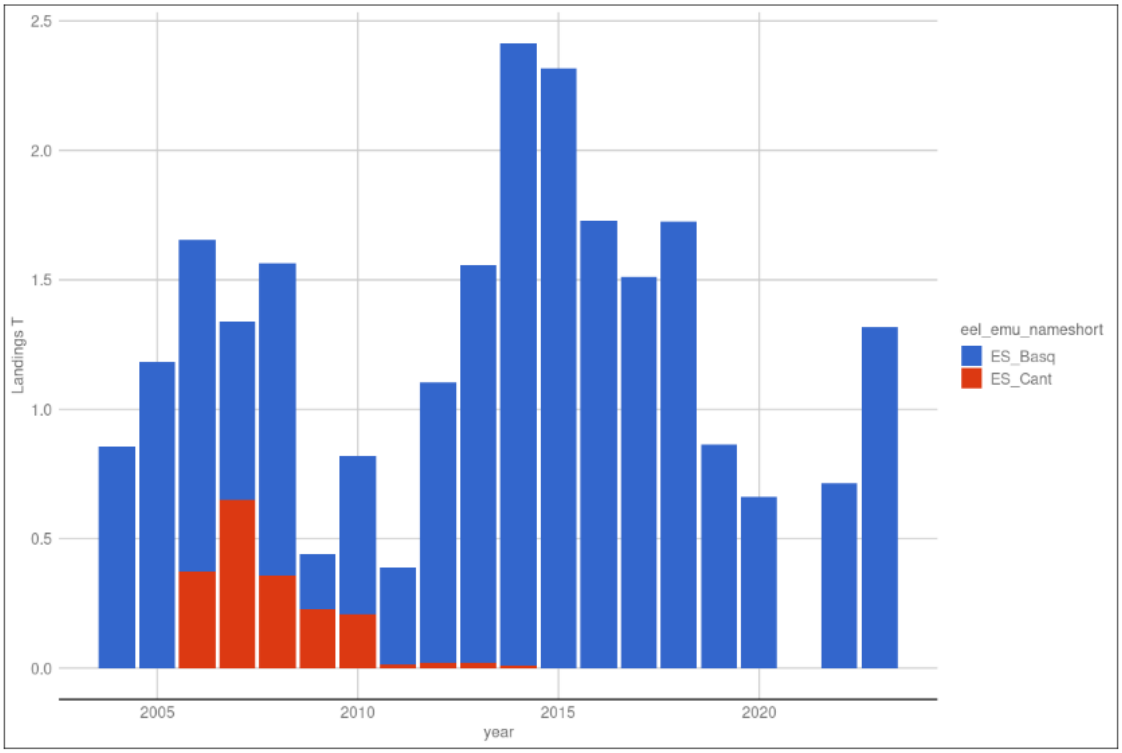


**Figure 5. Landings of glass eel recreational fishery in Spain updated to the 2022-2023 season (recreational fishery was totally banned after).**

### 3.1.2 Yellow and silver eel fisheries

Yellow and silver eel landings have decreased in general terms since the 80ies. (Figure 6)

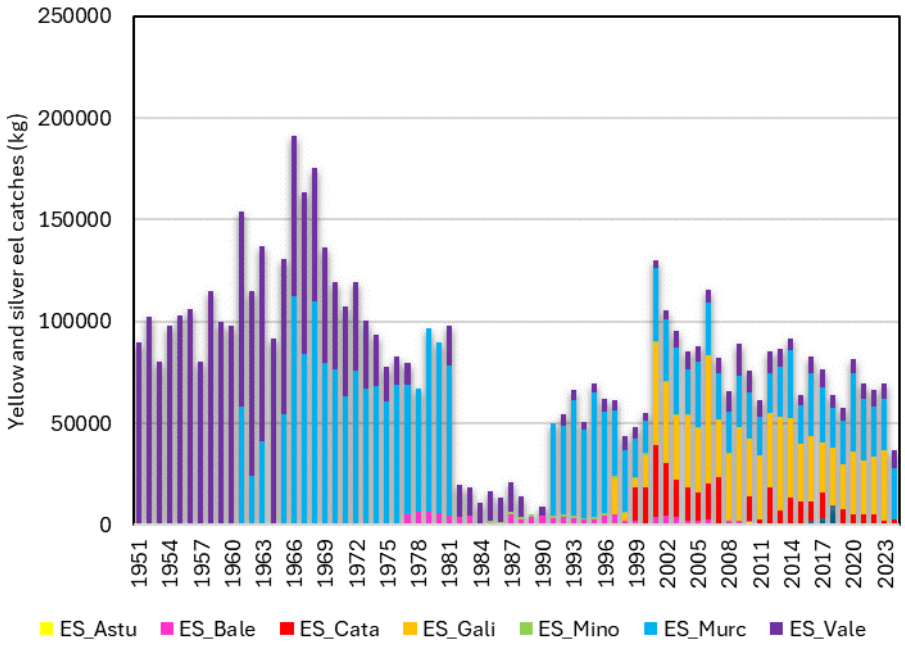


**Figure 6. Commercial Yellow and silver eel mixed landings (kg) by EMU. Notice that during the 80ies Murcia, did not report data.**

Although there is a silver eel fishery in Murcia and Valencia, landings by EMU are reported mixed with yellow eel, so there is no differentiated yellow eel and silver eel data.

## 3.2 Restocking

In Spain restocking is not a major activity, practically the only activity is the restocking of glass eels from seizures coming from police operations (**Figure 7**).

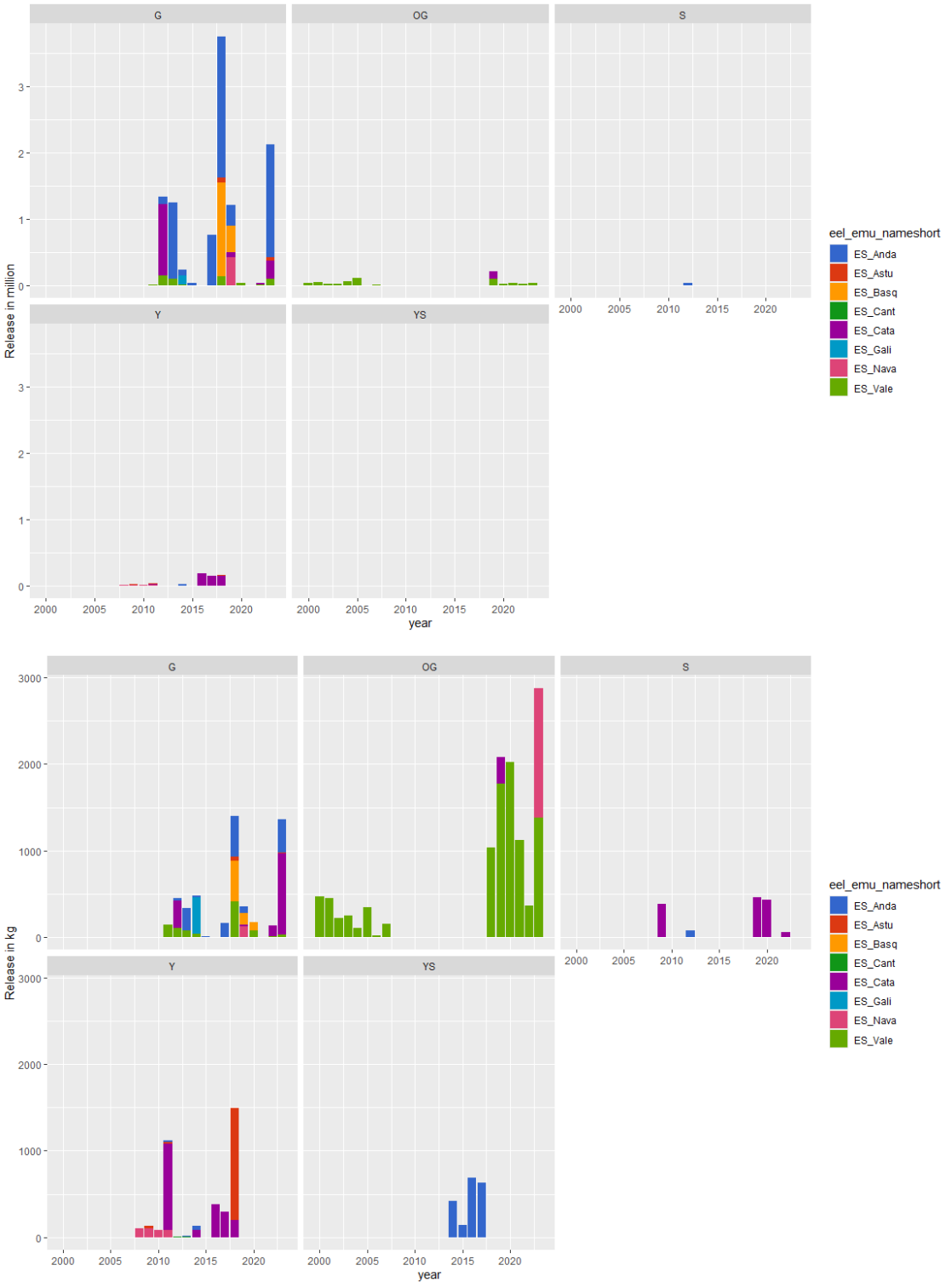


**Figure 7. Number (million) (above) and kilograms (below) of stocked eels in Spain by EMU. G: Glass eel, GY: glass + yellow eel, Y: yellow eel, YS: Yellow and silver eel OG: On grown eels.**

## 3.3 Aquaculture

Although there were different farms in Spain in the 90ies, nowadays almost all aquaculture production in Spain comes from a farm in Valencia (Figure 8).

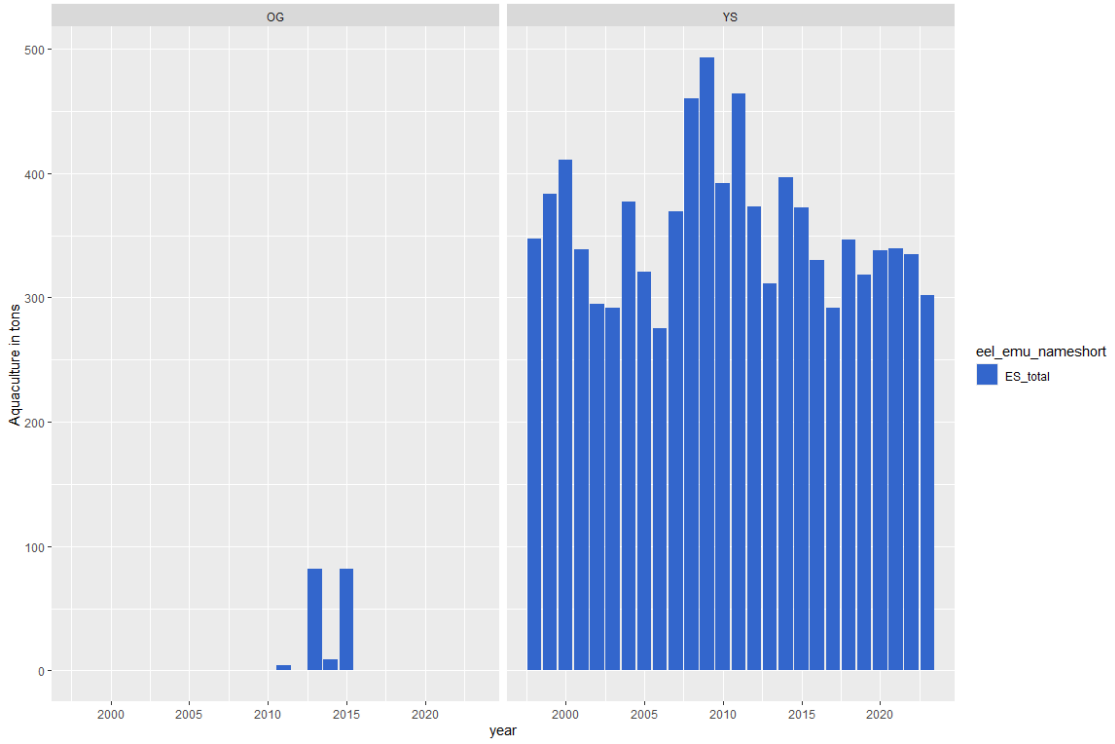


**Figure 8. Aquiculture production in the Spanish EMUs since 1998.**

## 3.4 Entrainment

Only Galicia and Asturias provided HPP mortality (Table 3). In both cases, HPP mortality is very low compared to fishing mortality. In fact, as shown in the SUDOANG project (Mateo et al., 2021) there almost no eel above hydropower stations.

*Table 3. Estimated HPP mortality in Asturias and Galicia EMUs.*

| Year | ES_Astu | ES_Gali |
|---|---|---|
| 2007 | NC | 0,04 |
| 2008 | NC | 0,05 |
| 2009 | NC | 0,03 |
| 2010 | NC | 0,03 |
| 2011 | NC | 0,05 |
| 2012 | NC | 0,04 |
| 2013 | 0,01 | 0,03 |
| 2014 | 0,03 | 0,04 |
| 2015 | 0,01 | 0,03 |
| 2016 | 0,00 | 0,02 |
| 2017 | 0,00 | 0,02 |
| 2018 | 0,00 | 0,04 |
| 2019 | 0,00 | 0,08 |
| 2020 | 0,00 | 0,04 |

## 3.5 Habitat Quantity and Quality

No new information see Díaz and Korta (2023).

# 4 National stock assessment

No new information since last year's report (Korta and Díaz, 2019).

# 5 Other data collection for eel

## 5.1 Yellow eel abundance surveys

Spain has four yellow eel time series with biometry data. Three of them are located in the Atlantic basin and are based on electrofishing surveys: the river Oria (OriY), Bidasoa (BidY) and Nalón rivers (NalY). The other series is located in the Mediterranean and corresponds to yellow eel landings in the Albufera lagoon (AlCY). The electric fishing series show a large inter-annual variability with no clear trend (Figure 9). The Albufera historical series, which is the longest, shows a downward trend.

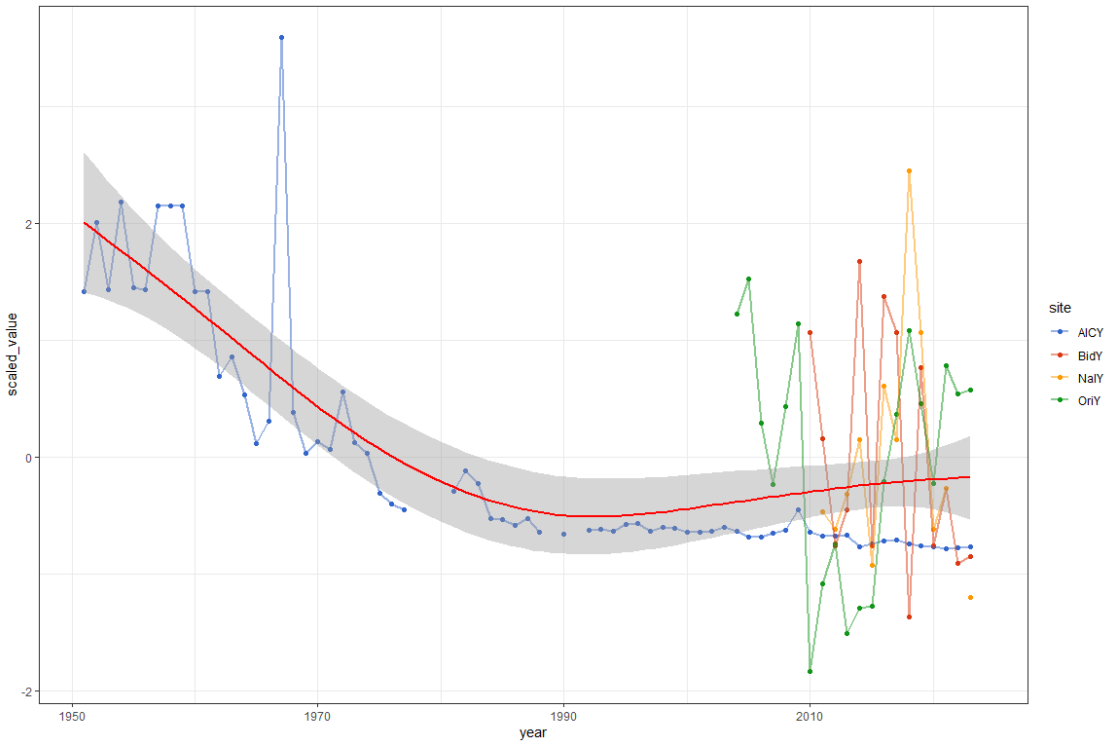


**Figure 9. Abundance trends in Spain for four yellow time series. ALCY: Albufera yellow cacthes, BidY: Bidasoa yellow eel abundance, NalY: Nalón yellow eel abundance and OriY: Oria yellow eel abundance. For the Bidasoa, Nalon and Oria series the estimation of eel abundance (number/m²) is calculated using the arithmetic mean of the different electrofishing sampling points in the river.**

## 5.2 Silver eel escapement surveys

Spain has four silver eel time series with biometry data. Three of them are located in the Atlantic basin and are based on electrofishing surveys: the river Oria (OriS), Bidasoa (BidS) and Nalón rivers (NalS). Sampling takes place in early autumn and the eels are classified according to Durif et al., (2005). After various marking experiments, the migrating silver eels are considered as MII

and F stages III, IV and V. The other series is located in the Mediterranean and corresponds to silver eel landings in the Albufera lagoon (AlCS). The electric fishing series show a large inter-annual variability (Figure 10). The Albufera catch historical series, which is the longest, shows a downward trend.

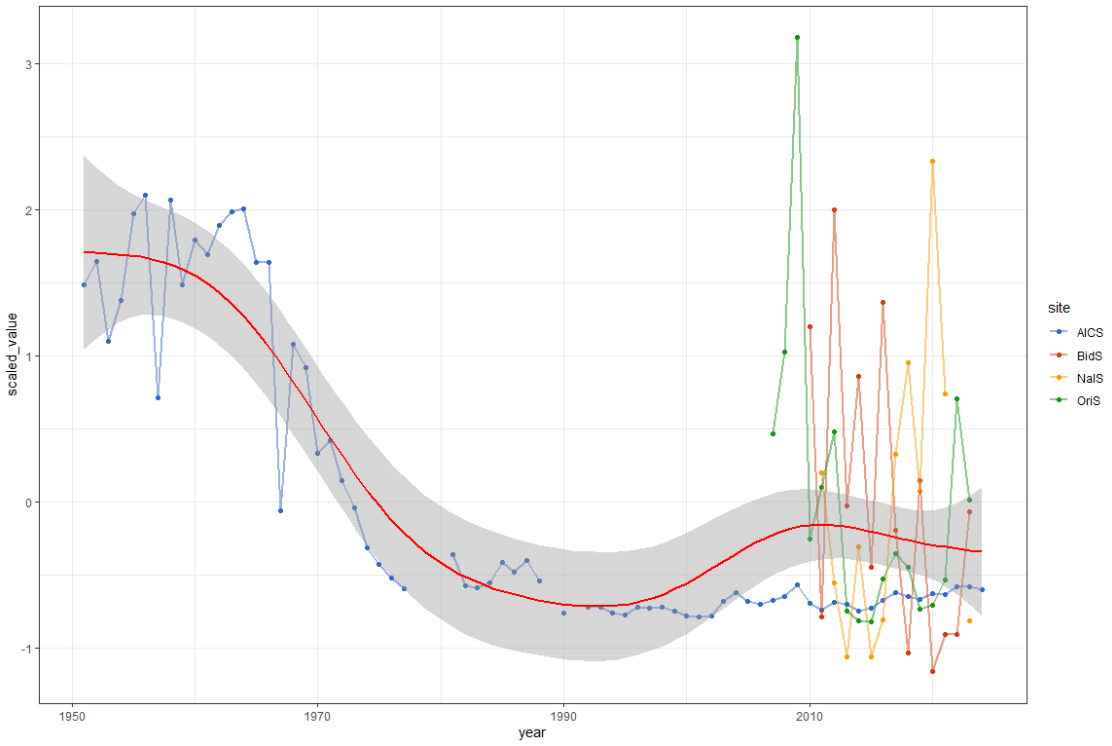


**Figure 10. Abundance trends in Spain for four silver time series. ALCS: Albufera silver cacthes, BidS: Bidasoa silver eel abundance, NalS: Nalón silver eel abundance and OriS: Oria silver eel abundance. For the Bidasoa, Nalon and Oria series the estimation of eel abundance (number/m$^2$) is calculated using the arithmetic mean of the different electrofishing sampling points in the river.**

## 5.3 Life history parameters

In the SUDOANG project, the percentage of silvering eels and the sex ratio in Spain, France and Portugal has been estimated (Figure 11). This information can be consulted at the level of river section, basin, EMU and country in the atlas hosted in VISUANG.

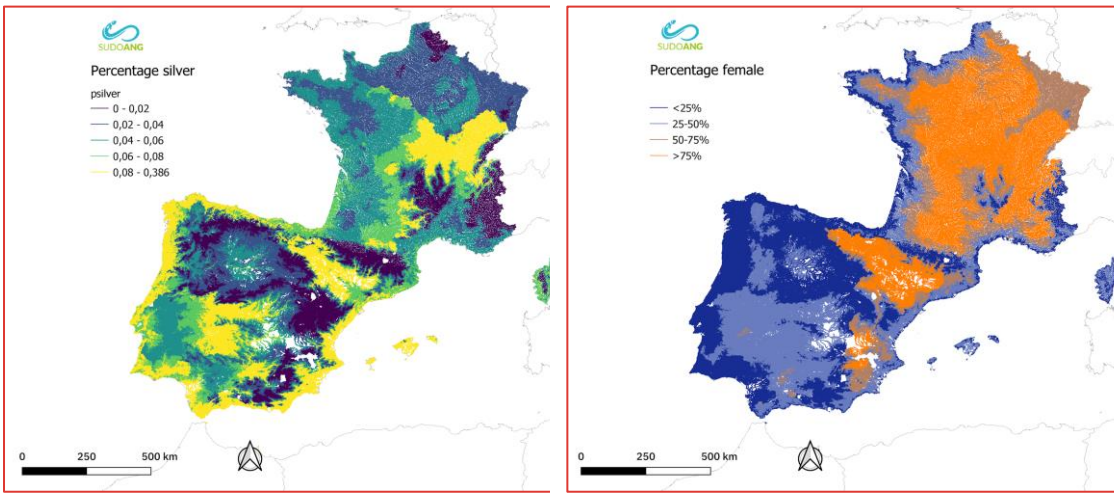


**Figure 11. Percentage of Silver eels for length >150 mm and the percentage of silver females estimated by the EDA model.**

## 5.4 Diseases, Parasites & Pathogens or Contaminants

The eel may be vulnerable to predation or injury from the blue crab during its inactive periods when it remains in the substrate (Clavero et al., 2022). A recent study demonstrates that blue crab poses a significant threat to eels, as the invasive potential of the blue crab overlaps considerably (63%) with the Iberian range of the European eel (Bedmar et al., 2024).

# 6 New Information

An Eel Atlas published containing the SUDOANG 1.0.4 database from the SUDOANG project has been published on Zenodo (https://zenodo.org/record/6701695) and a paper describing this data base is under review for publication now. A range-wide stock assessment requires the creation and standardisation of databases that include information on eels and their habitat in different countries throughout their distribution range. The SUDOANG 1.0.4 database provides a compilation of standardised data from rivers for France, Spain and Portugal. It focuses on providing the best available information on the current habitat for eels. By building a common river network from different databases available in the different countries, it provides tools to quickly accumulate information along the river or along the natural path of migration from/to the sea. It also compiles information about some human pressures (106400 obstacles) and provides eel abundance and biometric estimations derived from the Eel Density Analysis (EDA) model at the river reach scale for the reference year 2015. The river network and attribute tables support ecological assessment of the rivers and should also be useful for studies on other migratory species.

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