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Catch per unit effort (CPUE) analyses and characterisation of the North Island commercial freshwater eel fishery, 1990–91 to 2023–24

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Contents

PLAIN LANGUAGE SUMMARY

This report presents the updated fishery characterisations and standardised catch per unit effort (CPUE) analyses for the North Island commercial freshwater eel fishery from 1991 to 2024. CPUE analysis is a method used to index abundance of a species by comparing catch with the effort over long periods of time. Results are often used by Fisheries New Zealand to adjust commercial total allowable commercial catch (TACC) of eels.

Characterisations were carried out for shortfin (*Anguilla australis*) and longfin (*A. dieffenbachii*) eels for each of the 12 fishery management regions known as Eel Statistical Areas (ESA), and CPUE analyses for four key ESAs (AA, Northland; AB, Auckland; AC, Hauraki; AD, Waikato). The current analyses were split into pre-ERS (i.e., before the electronic reporting system was used to report commercial catch) (1991 to 2019), and post-ERS (2020 to 2024) periods.

For the four key North Island shortfin eel fisheries there were initially no trends in the pre-ERS CPUE indices of abundance, followed by strong increases beginning from around 2002, especially in the last three years.

Longfin pre-ERS CPUE indices of abundance, for three of the four areas initially declined, followed by an increase, particularly in the last few years, whereas Hauraki showed no clear trend.

Post-ERS CPUE analyses for both species included only five years of data, meaning that trends in CPUE abundance indices should be interpreted cautiously.

EXECUTIVE SUMMARY

Beentjes, M.P.[1] (2026). Catch per unit effort (CPUE) analyses and characterisation of the North Island commercial freshwater eel fishery, 1990–91 to 2023–24

***New Zealand Fisheries Assessment Report 2026/30.* 364 p.**

This report presents the updated fishery characterisations and standardised catch per unit effort (CPUE) analyses for the North Island commercial freshwater eel fishery from 1991 to 2024 (i.e., fishing years 1990–91 to 2023–24), extending the time period of the previous analyses by 6 to 34 years. Characterisations were carried out for shortfin (*Anguilla australis*) and longfin (*A. dieffenbachii*) eels separately for each of the 12 Eel Statistical Areas (ESA), and CPUE analyses for four North Island ESAs (AA, Northland; AB, Auckland; AC, Hauraki; AD, Waikato) with adequate data and fishers. In previous analyses the time series was continuous, whereas the current analyses were split into pre-ERS (electronic reporting system) (1991 to 2019), and post-ERS (2020 to 2024) periods. The latter period included destination G eels (i.e., released eels over the maximum legal size) recorded in the landing disposal report, in the catch response variable.

Total groomed estimated catch (legal-sized catch estimated by fishers at the riverbank) data from Catch Effort Landing Returns (CELR), Eel Catch Effort Returns (ECER), and the Electronic Reporting System (ERS) were extracted and used in the CPUE analyses. The estimated catch retained in the analyses after grooming, was 92% of the total reported landed catch over the 34 years. The trends in estimated and landed eel catch were similar, indicating that estimated catch was likely to be proportional to total landed catch, and hence suitable for CPUE analysis. Estimated catch was likely to include most eels of legal size released under destination X, for both species. Over the 34 years, shortfin comprised nearly three-quarters (74%) of the groomed estimated eel catch and over the last 15 years this has increased as longfin catch has decreased. The proportion of the shortfin catch in individual ESAs from 1990–91 to 2023–24 was two to six times greater than longfin in all ESAs except Rangitikei-Whanganui (AH) where catches were similar, and in Taranaki (AJ) and Wellington (AM), where longfin was dominant. Nearly half of the North Island total eel catch over the last 34 years was from Waikato (AD) and Northland (AA).

Standardised CPUE analyses were carried out separately for each species from the four ESAs, and also the Waikato Tainui Fisheries Area (WTFA) for core fishers using a Generalised Linear Model (GLM), where the response variable was the log-normal transformation of positive daily estimated catch. The three predictor variables — estimated target species, permit, and lifts — were included in all pre-ERS models, with target species often explaining the most variance in the GLM, especially for longfin. Post-ERS analyses variables offered to the models were the same as pre-ERS, but also included habitat type, sub-area, and proportion of the other eel species, whereas target was declared and not estimated.

For the pre-ERS shortfin CPUE indices in ESAs AB, AC and AD, there were initially no trends followed by strong increases beginning from around 2002, whereas for ESA AA there was a progressive increase over the entire time series. For ESAs AA, AB, and AD, indices were the highest in the last three years of the pre-ERS time series, and for ESA AC, all indices for the last ten years of the pre-ERS time series were above the time series mean.

Longfin pre-ERS CPUE indices from ESAs AA, AB, and AD initially declined followed by an increase, particularly in the last few years of the pre-ERS time series, whereas ESA AC showed no clear trend.

For all post-ERS CPUE analyses, including those from WTFA, there are only five years of data with relatively few core fishers, and despite narrow confidence intervals in many cases, trends in CPUE abundance should be interpreted with caution. All post-ERS CPUE indices were stable for shortfin and longfin.

[1] New Zealand Institute of Earth Sciences New Zealand

1. INTRODUCTION

This report presents the results of a catch per unit effort (CPUE) analysis for the commercial freshwater eel fishery for all North Island Eel Statistical Areas (ESA) for the fishing years 1990–91 to 2023–24, and updates previous analyses with a further six years of catch data (Beentjes & Bull 2002, Beentjes & Dunn 2003a, 2003b, 2010, 2013, Beentjes & McKenzie 2017, Beentjes 2020).

1.1 Commercial fishery

The commercial freshwater eel fishery in New Zealand developed in the late 1960s and landings consist of both the endemic longfin eel (*Anguilla dieffenbachii*), and the shortfin eel (*A. australis*), which is also found in southeast Australia, Tasmania, New Caledonia, Lord Howe Island, and Norfolk Island (McDowall 2000). Catches from the north of the North Island can include the occasional Australian longfin eel (*A. reinhardtii*), which is primarily found on the east coast of Australia, but also in temperate Islands around the Southwestern Pacific.

Total New Zealand eel landings peaked in 1972 at about 2100 t and from 1972 to 1998–99 fluctuated with no clear trend (Figure 1) and the annual average was about 1300 t (Fisheries New Zealand 2026). Landings then progressively declined.

Historical North Island catches

The North Island has contributed between 48 and 96% of New Zealand total eel landings, and over the last 10 years the average has been 65%. Shortfin has consistently been the dominant species in the North Island, representing, on average, about 76% of the landed catch since 1983, increasing to 90% over the last 10 years, and in 2023–24 it was the highest on record at 93% (Figure 1). Despite the dominance of shortfin, longfin is caught throughout the North Island and historically approached 50% or more of the landed catch in Rangitikei-Whanganui (AH), Taranaki (AJ), and in catchments of Waikato (AD) that drain westward to the coast (Beentjes 2005, 2008a, 2008b, 2013, 2019, 2022) (Figure 2). Shortfin landings have fluctuated but declined overall from 1995–96 to 2023–24 in the North Island (Figure 1). Similarly, longfin landings declined steeply from 1990–91 to 2008–09 and have since fluctuated between about 15 and 80 t with a slight downward trend. TACC cuts, markets and availability of ACE (Annual Catch Entitlement) have all contributed to the declines in longfin catch over the last 18 years.

The trends of declining landings preceded the introduction of eels into the Quota Management System (QMS) in the North Island (2004–05) and are, in part, a result of effort restrictions imposed on the fishery in the early 1990s.

Quota Management System (QMS)

The New Zealand eel fishery was introduced into the Quota Management System (QMS) in stages, beginning with the South Island in 2000–01, with five Quota Management Areas (Figure 3) and Total Allowable Commercial Catches (TACC) set for shortfin and longfin species combined. Shortfin and longfin in the South Island were split into separate stocks (SFE 11–SFE 16, and LFE 11–LFE 16 (Figure 3)). For shortfin the total South Island TACC was set at 242 t and the longfin TACC at 81 t, representing a net 98 t (23%) reduction in the South Island total eel TACC. Further, the longfin TACCs in LFE 11–LFE 14 (Figure 3) were set at a nominal 1 t, in effect closing the longfin target fishery in the north and north-east of the South Island.

The Chatham Island eel fishery was introduced into the QMS in 2004 as a single QMA with TACCs for each species.

The North Island eel fishery was introduced into the QMS on 1 October 2004 with four separate QMAs allocated to each species (SFE 20–23 and LFE 20–23) (Table 1, Figure 3). In 2007–08 the total shortfin TACC of 467 t was reduced to 347 t and the longfin TACC from 194 t to 82 t. In 2018–19 the TACCs for the four longfin stocks were further reduced with an overall reduction of 32% (Figure 1). This equates to longfin TACC reductions of 71% since introduction into the QMS on 1 October 2004. Further the TACC for LFE 23 was reduced to just 5 t in 2018–19, effectively relegating this stock to a bycatch species.

1.2 Catch Reporting

The introduction of the Catch Effort Landing Return (CELR) and Catch landing Return (CLR) in October 1989 replaced the Fisheries Statistics Unit (FSU) eel returns. Data quality for the first two years of the CELR system was poor (Jellyman 1993), and the data from 1989–90 were not suitable for inclusion in this analysis. The CELR form was replaced by an Eel Catch Effort Return (ECER) and an Eel Catch Landing Return (ECLR) on 1 October 2001 (Figure 4). Changes to the new forms included dedicated fields for shortfin and longfin estimated catch, the removal of target species, and EEU (unidentified) was no longer a valid species code (Figure 5). Before this last change, the proportion of total eel catch recorded as EEU ranged from about 0% (Te Waihora, ESA 21 and AS) to 83% (AD, Waikato), although the EEU code tended to be used more often in the North Island.

The electronic reporting system (ERS) replaced the paper forms (ECER and ECLRs) beginning in mid-2019 but had fully transitioned by the 2019–20 fishing year (Figure 4). There are some new variables recorded in the ERS that were not recorded in the ECER form, i.e., target species, start lifting position, finish lifting position, soak time, fyke net baited, vessel use, net type specific to Te Waihora (EFN), catch of eels over the maximum legal size (destination G) and under the minimum legal size (destination Y). Reporting of escape tube size was introduced in 2024–25. Conversely the ERS no longer records ‘catcher ID’ which provided the initials of the person fishing the permit in ECERs.

Eel Statistical Areas for reporting catch effort data were changed from numeric codes (1–23) to alpha codes (AA–AZ) in July 2000 (see Figure 2, Table 1). In this report ESAs are referred to by the current alpha codes, although some previous analyses used the numeric codes. Table 1 shows the relationship between ESAs (numeric and alpha), QMAs, and area names.

1.3 Fyke net specification

In the South Island, shortfin fyke nets are usually unbaited and have very long leaders, whereas longfin nets are smaller overall, have short leaders, and are usually baited (Beentjes & Dunn 2015). South Island shortfin fyke nets are commonly used in ponds, lagoons, and receding flood waters and capture few longfin, even if present. The long leader on shortfin nets tends to guide or direct eels into the net as they travel along riverbanks or out of flooded backwaters, i.e., there is often no attractant. Longfin fyke nets are commonly used in streams, rivers, and lakes and catch few shortfin, even if present, and are usually baited. For detailed descriptions and specifications of South Island fyke nets see Beentjes & Dunn (2015).

In contrast, the same type of fyke net is routinely used in the North Island for both shortfin and longfin and these nets are often baited, regardless of target species (Beentjes & McKenzie 2017). Bait is placed either at the leader or in the codend. A longer leader, however, may sometimes be used when targeting shortfin. Nets are generally about 2.5 m in length, have two valves, and a D ring about 600 mm high and 600 mm wide. Smaller versions of these fyke nets are sometimes used in small creeks.

1.4 Objectives

This is the final reporting requirement for Fisheries New Zealand research project EEL2024-01.

Overall objective

To characterise and update CPUE series for all North Island stocks of longfin and shortfin eels

Specific Objectives

1. To characterise North Island commercial eel fisheries.
2. To analyse CPUE trends in the North Island commercial eel fisheries (LFE 20, LFE 21, LFE 22, LFE 23, SFE 20, SFE 21, SFE 22, SFE 23) using data up to the end of the fishing year 2023–24.
3. To estimate the proportion of longfin habitat commercially fished[2].
4. Broader Outcomes.
5. To characterise and analyse CPUE trends for Waikato-Tainui Fisheries Area[3].

2. METHODS

In this report fishing years are often referred to by the second year, e.g., 1990–91 is referred to as 1991.

2.1 Data extraction

In the freshwater eel fishery, catch of eels is recorded using two methods: Firstly, the catch of each species is estimated by visual inspection of catches in the fyke nets or in holding bags at the riverbank or place of capture (standard fish bins containing separated species are not used). The catch of each species is subsequently weighed at the Licenced Fish Receiver (LFR), and this is the landed weight.

Estimated catch and effort for each day's fishing (fishing event) were recorded on CELR forms up to 30 September 2001, and then on ECERs after that date, although there was a transition period in early 2002 when either form was accepted. From 1 October 2019 paper forms were replaced with the electronic reporting system (ERS) using smartphone or tablet (Android or iOS) devices with the mobile logbook app installed. The most common platform for collecting commercial eel fishery data is *eCatch*. The eCatch app submits data to FishServe (the QMS data handling service) over cellular or wifi connections via eCatch Servers.

The estimated catch and effort data used in this report were extracted from the Fisheries New Zealand Enterprise Data Warehouse (EDW) and for each daily record (=fishing event) from fishing years (1 October to 30 September) 1991 to 2024, for all 12 North Island ESAs. The following variables were extracted.

Catch Effort Landing Return (1990–91 to 2001–02)
- Date nets were lifted
- Permit number (encrypted)
- Vessel registration number
- Location landed
- Method
- Form number
- Eel statistical area (ESA)
- Number of net lifts (subsequently referred to as 'lifts')

[2] Objective 3 is reported in Beentjes & Shankar (2026).
[3] Objective 5 was added under contract variation.

- Target species
- Total weight (weight of shortfin, SFE; longfin, LFE; unidentified, EEU; and bycatch)
- Weight of individual species (includes SFE, LFE, EEU, and bycatch species)

Eel Catch Effort Return (2001–02 to 2017–18)

- Date nets were lifted
- Permit number (encrypted)
- Method
- Eel statistical area (ESA)
- Number of net lifts
- Estimated catch weight of shortfin (SFE)
- Estimated catch weight of longfin (LFE)
- Catcher ID

Electronic Reporting System (2020 to 2024)

- Start date- date at start of nets lifted
- Start time – time at start of first net lift
- Start position – latitude and longitude of first net lift
- Finish date – date at finish of nets lifted
- Finish time – time at finish of last net lift
- Finish position – latitude and longitude of last net lift
- Method (FN, EFN, EP, FP)
- Number of net lifts
- Estimated catch weight of shortfin (SFE)
- Estimated catch weight of longfin (LFE)
- Target species
- Soak time
- Fyke-net baited-yes or no
- Is vessel used – yes or no (ERS potting only)

Landings data were extracted from CLRs (catch landing returns), ECLRs (eel catch landing returns) and the ERS disposal reports on landed catches by fishstock, and destination types. Of most interest were destination codes ‘L’ (landed to an LFR), destination X (legal sized eels 220 to 4000 g returned to the water alive; 300 to 2000 g for shortfins and 400 to 2000 g for longfins in Waikato Tainui Fisheries Area), and destination G (eels above the maximum size limit returned alive, 4000 g except in Waikato Tainui Fisheries Area where it is 2000 g).

The encrypted permit number represents the Fisheries New Zealand *Permit Holder FIN Number* (CELR) and *Client Number of Permit Holder* (ECER and ERS). A permit holder is entitled to employ others to fish on their permit, and hence one permit number may have catch landed from more than one fisher (= catcher). It is more usual, however, for the permit holder to also be the person listed as the ‘catcher’ on ECERs. The ‘catcher’ has been recorded since 2001–02 when ECERs were introduced but is not recorded in the ERS from 2020.

2.2 Data grooming

In the current analyses, data for the years 2001–02 to 2023–24 (23 years) for all North Island ESAs were extracted, groomed for errors or missing data, and appended to the existing groomed data sets from CELR data, creating a time series for each ESA from 1990–91 to 2023–24 (34 years) (Table 2). The CELR data were not re-extracted because there were considerable effort and resources applied to the original manual error checking and grooming of these data (Beentjes & Willsman 2000, Beentjes & Bull 2002, Beentjes & Dunn 2003a). The transition between CELR and ECER in 2001–02 and to the ERS in 2020 is considered to have had no effect on the continuity in the way in which estimated catches and effort data are recorded. All platforms record estimated catch of shortfin and longfin eels, the number of nets set per fishing event (usually overnight), and the statistical area where eels were caught, among other variables described. The only real difference is that EEU was not recorded on ECER forms or the ERS so all data after 2000–01 can be used in the species-specific analyses.

Inspection of the unencrypted data during the analyses up to 2006–07 revealed that a number of South Island fishers had been recorded as fishing in the North Island (Beentjes & Dunn 2010). After contacting some of these individuals and speaking with Fisheries New Zealand at this time, it was clear that this was implausible and more likely an error in reporting of statistical area or data punching. This resulted in data from 10 South Island permit holders being excluded from the analysis in 2001–02 and 2002–03, accounting for 76 t of catch (0.5% of the total data in the data set). The bulk of this misreporting was from ESAs AA (70%), AB (18%), and AM (10%). These data errors had not been corrected in the Fisheries New Zealand *warehou* database at the time of the current analyses, and these permits were again excluded.

Apart from the South Island fishers, there were few deletions and nearly all ECER and ERS records were retained in the current characterisation analyses. Exceptions were for zero lift records which were deleted as these were often associated with a wide catch range including zero catch. Other grooming procedures included imputing the variable 'number of net lifts' as the median from the fishing year if this was greater than 100, and reassigning method EP (eel pot) to FN (fyke net) in the CPUE analyses data set.

2.3 Environmental variables

Mean daily river flow data for some important rivers from or near each ESA were obtained from regional councils (Appendix 1). When river flow data from more than one river per ESA were used in standardised CPUE analyses, they were treated as separate variables.

Moon phase was included as a factor to account for possible changes in catchability with changes in the lunar cycle. The relative phase (0–1) of the moon (moon cycle) was determined for each record in the data set based on the date of each record, using an algorithm from Meeuse (1998).

In the previous analyses up to 2014–15 (Beentjes & McKenzie 2017), freshwater water quality data from the National Rivers Water Quality Network (NRWQN), operated by NIWA were included in the North Island CPUE analyses (Davies-Colley et al. 2011, Ballantine & Davies-Colley 2014). The water quality variables extracted from this database were water temperature, dissolved oxygen, water clarity, pH, dissolved nitrates, and dissolved phosphates. However, because none of these variables were accepted by the models, the water quality data were not included in the current analyses.

2.4 Linking permits pre- and post-QMS

The previous North Island CPUE analyses up to 2006–07 showed that after introduction of North Island eel stocks into the QMS in 2004–05, some of the new entrants were not new to the fishery, i.e., they had fished for existing permit holders during the permit moratorium and following introduction of eels into the QMS began fishing under their own permit entity (Beentjes & Dunn 2010). These fishers were all new entrants that had fished for someone else pre-QMS, and if they were the only fisher that had landed catch under a pre-QMS *Client_name*, and that client did not land catch pre- and post-QMS, the fishers were linked in the analyses, i.e., new entrant *Client_key* was changed to the existing *Client_key* of the previous employer. In all, there were 16 linkages made where existing permit entities were combined with permit entities that first appeared in 2004–05 (Beentjes & Dunn 2010). These linkages were retained in the current analyses.

2.5 Reconstructed target species

Target species was recorded in CELR forms, discontinued in ECER forms, and reinstated in the ERS. Target species was reconstructed for all ECER records, including those from CELR data (1991 to 2019), from CELR target species and species proportions using a simple optimisation to evaluate the best proportion to use (Cohen's kappa coefficient). The resulting level of concordance was a measure of how well the constructed target species matched that recorded in CELRs. A 'common sense' default minimum value of 80% was used in some cases because higher values tended to assign too many records to the category 'either', when kappa was above 80%.

2.6 Dealing with pre- and post-QMS data

South Island CPUE analyses are split between pre- and post-QMS data sets because of the discontinuity of fishers following the introduction of South Island eels into the QMS in 2000 (Beentjes & Dunn 2015). Unlike the North Island, it was not possible to link the identity of South Island fishers pre- and post-QMS because the ECER form, which includes a field identifying fishers that landed the catch (i.e., catcher), did not come into effect until 2001–02, a year after South Island eels were introduced into the QMS.

Despite linking permits in the North Island, following the introduction into the QMS in 2004–05, there was still a clear drop in both the numbers of existing fishers and the appearance of new entrants. To determine whether models spanning the entire period for each statistical area were able to reliably estimate fisher coefficients over the transition, Beentjes & Dunn (2015) carried out separate pre- and post-QMS CPUE analyses and compared these with continuous time series CPUE analyses for the period 1991–2012. For all ESAs, the continuous versus pre- and post-QMS CPUE trends showed no marked differences and the continuous time series were accepted as valid.

2.7 Dealing with pre- and post-ERS data

In the current analyses, CPUE analyses were initially carried out for the continuous time series (1991–2024) but the Eel Working Group (15 October 2025) recommended that this be split between pre- and post-ERS time series because of the differences in target species. That is, using reconstructed target species for the entire time series resulted in substantially different CPUE indices for the ERS period (2020 to 2024) than when the ERS declared target species was used. This is because target species has been almost exclusively shortfin in recent years and this contrasted with a mix of shortfin, longfin, and 'either' categories for reconstructed target. In addition, the Eel Working Group also specified that the post-ERS CPUE analyses should include Destination G eels (eels over the maximum legal size) in the estimated catch analysis data set, a variable only recorded since 2020 in the ERS. Destination G is recorded in the landing disposal report, and this was linked to the fish catch reports by trip ID.

Additional predictor variables ESA-subarea (see Figure 2) and habitat type (river, harbour, natural lake, hydro lake, and hydro river) were able to be determined for ERS data using the position of the fishing event. This was carried out under objective 3 (Beentjes & Shankar 2026).

Target species for the post-ERS time series did not enter CPUE models because shortfin was reported almost exclusively as the target despite longfin being caught as bycatch. To deal with this, the proportion of the other eel species in the catch was offered to the model as a predictor variable. This was suggested by the working group at the December 9th 2025 meeting and this variable has been used in the current analyses. At a subsequent meeting of the stock assessment plenary (13 April 2026), the use of this predictor variable was considered to be biasing the CPUE, and recommended that it be dropped for future analyses.

2.8 Waikato Tainui Fisheries Area

An additional objective was included in the present report as a contract variation to characterise and carry out CPUE analyses for the eel fisheries in the Waikato Tainui Fisheries Area (WTFA), and also for the Waikato catchment above Karapiro Dam (outside WTFA) (Figure 6). This was only possible for the post-ERS period where position data were available to categorise the fishing events into three areas for which separate analyses were required, i.e., the Waikato catchment, Waipa catchment, and Waikato catchment above Kārapiro Dam. As described above for the ESA post-ERS analyses, destination G was included in the estimated catch analysis data set as well as predictor variables ESA-subarea and habitat type. Declared target species was offered to the CPUE models as a predictor variable along with presence-absence of the other species. The proportion of the other eel species in the catch was not offered because this was recommended after the analysis had been completed and presented for the second time to the Eel Working Group on 9th December 2025.

2.9 Characterisation of data

Characterisations were carried out for eel fisheries in all 12 ESAs for the continuous data sets (1991–2024) for legal sized eels. Destination G (over the maximum legal size) was not included in the catch for characterisations for ERS data over the last 5 years, to preserve the continuity of the time series. Outputs include time series of catch by species, raw catch rates, lifts, median positive catch, percentage of zero catch, effort versus catch, target species, and seasonal catch. Catch increases from destination G in the last five years since it has been recorded, were negligible relative to the legal size catch totals, used for previous analyses (Beentjes 2020).

Similar characterisation outputs were produced for WTFA for the post-ERS period (2020 to 2024).

ERS 2020 to 2024 position data that shows the start and finish location of the sets plotted on a North Island map were presented to the Eel Working Group on 15 October 2025. However, Fisheries New Zealand Data Confidentiality rules (as documented in the data project release clauses for this extract) allow publication of these data in the following summarised form:

- *Latitudes and longitudes (maps or any other means of display) are truncated to a 1 degree level of resolution if they refer in any way to the magnitude of catches;*
- *Latitudes and longitudes (maps or any other means of display) are truncated to a 0.2 degree level of resolution if they do not refer in any way to the magnitude of catches;*
- *Information that identifies specific vessels or people is removed including any unique system identifiers of vessels or people (includes companies);*
- *Vessel attributes (e.g. length, breadth, tonnage, nationality etc.) are removed;*
- *Data is grouped such that no group contains data less than 3 vessels or 3 persons (includes companies).*

Plotting the catch location at the acceptable 0.2-degree level of resolution and restricting data to that representing 3 persons in each cell, results in little of the data being shown and is of no value in understanding the spatial nature of the eel fishery, hence these maps are not presented. The spatial distribution is, however, described in (Beentjes & Shankar 2026).

2.10 Analysis of CPUE data

CPUE analyses were carried out only for the four data rich areas ESA AA to ESA AD, for each species, pre- and post-ERS, resulting in 16 CPUE indices. In addition, CPUE analyses were carried out for the

WTFA areas (Waikato River, Waipa River) and the catchment above Karapiro Dam for each species, resulting in six CPUE indices (Table 2).

2.10.1 Unstandardised CPUE analyses

Unstandardised CPUE analyses were carried out for shortfin, longfin, and all eels (all eels include those recorded as EEU), and presented as the geometric mean of positive catch/total lifts per year for all raw data, and also for core fishers. The core fishers unstandardised CPUE indices are plotted alongside the standardised CPUE indices.

2.10.2 Standardised CPUE analyses

Core fishers

Standardised CPUE analyses were conducted separately for shortfin and longfin. A selection criterion was applied to each data set restricting data analysis to core fishers (identified by permit number). For ESA pre-ERS models (1991–2019), shortfin core fishers were defined as those that 1) caught shortfin eels in at least three years in each of which fishing took place on 10 days or more, and 2) caught more than 1000 kg over all years. Longfin core fishers were defined in the same way as shortfin but using only longfin catch data (Table 2). For all post-ERS models (2020–2024) including WTFA, with substantially less data, the core fishes were adjusted to ensure that enough permit holders were included in the models to include more than about 80% of the data (Table 2).

The Generalised Linear Model (GLM)

Estimates of year effects and associated standard errors were obtained using a forward stepwise Generalised Linear Model (GLM) (McCullagh & Nelder 1989), with daily estimated catch modelled as the response variable. Using daily estimated catch as the response variable and number of net lifts per day as a possible predictor allows the model to consider non-linear relationships between catch and effort.

The GLM model used the log-normal transformation of positive daily estimated catch (Gaussian family with log link) in which the log of the catch is approximately normally distributed[4]. This implies a multiplicative model, i.e., the combined effect of two predictors is the product of their individual effects. The predictor variables offered to the GLM in the pre-ERS models were *fishing year* (forced), *permit number*, *log number of lifts*, *month* (season), *river flow* (for selected rivers within each ESA or WTFA analysis), *estimated target species* (reconstructed), and *moon phase* (Table 2). Post-ERS variables were the same, but used *declared target species* in place of estimated target, and also included *ESA-subarea*, *habitat type*, and the *proportion of the other eel species* in the catch. Variables were treated as categorical, except *number of lifts*, *daily mean river flow*, *moon phase*, and *proportion of the other eel species* which were entered as continuous variables. Continuous variables, except proportion of other species, were fitted as separate cubic (third degree) polynomial segments to sections of the data points resulting in smooth continuous curves (i.e., cubic spline).

A stepwise regression procedure was used to fit the GLM of daily estimated catch on these predictor variables. The relative year effect from the model was then interpreted as the CPUE index and presented using the canonical form, scaled to have a mean of 1.0. Model fits were investigated using standard

[4] In a previous analyses up to 2014–15 the valid zeros were modelled using a binomial model that estimated the probability of a non-zero catch, with a binomial response and logit link function (Beentjes & McKenzie 2017). The GLM and binomial models were then combined giving a CPUE index. The binomial CPUE analyses were rejected by the Eel Working Group on the basis that target species could not be included as a predictor variable without resulting in biased indices, because catch composition was used to determine target species. Binomial analyses were therefore not carried out in subsequent eel CPUE analyses.

residual diagnostics. Plots of model residuals and fitted values were investigated for evidence of departure from model assumptions. Influence step plots and coefficient-distribution-influence plots (CDI) were used to interpret the standardisation effects of explanatory variables (Bentley et al. 2012).

The stepwise fitting method began with a basic model in which year was the only predictor and iteratively included predictors until there was insufficient improvement in the model. For all analyses, the improvement in the residual deviance, i.e., (new deviance - old deviance) / (saturated deviance - null deviance) and termed R^2, was used as the criterion for including predictors. At each step, the predictor giving the greatest improvement in R^2 was included, providing that its inclusion resulted in an improvement in R^2 of at least 0.5%.

The inclusion of first-order interaction terms was considered, but it was found that they generally required many additional degrees of freedom and often appeared to have a spurious significance. Interactions tended to be between permit number (typically the most important predictor) and the other variables. These interactions appeared to be a reflection of variability in predictor variables among fishers rather than relative changes in the CPUE index. Variables 'estimated target species' and the 'proportion of other species in the catch' were highly correlated and could not be offered to the model together.

Zero catch records

Zeros were not used in the CPUE analyses but are of interest for looking at trends in zeros of each species. Records with a catch of zero for either species occur in the following ways:

1. Fishers that record zero for one species are often fishing habitat preferred by the other. By including habitat and/or target species as explanatory variables the models are able to account for this behaviour to some extent. Habitat was not recorded on the catch effort forms or in the ERS, but was determined from the fishing event position in the post-ERS time series. Target species was reconstructed in the pre-ERS analyses, whereas declared target species and the proportion of the other species in the catch was used post-ERS. These are valid zeros.
2. Where catches comprise a mix of the two eel species, small proportions of one species are likely to be recorded as zeros because fishers tend to estimate catches based on a visual inspection of unsorted catches at the riverbank. The legitimacy of these recorded zeros cannot be verified, and not all are valid zeros.
3. There are many records before 2002 where eels were reported as EEU (unspecified species) and hence for these records shortfin and longfin catch are given a value of zero in the input data even though it is clearly not zero, but unknown. These are invalid zeros.

2.11 Reporting released legal-sized eels (destination X)

The weight of all eels of legal size (220–4000 g, except WTFA where it is 300–2000 g for shortfins and 400–2000 g for longfins) caught and released by commercial fishers, was required to be reported as part of the total estimated catch recorded on ECERs, and then later recorded on ECLRs under the destination code X. It was revealed at the Eel Working Group Meeting in April 2017 (EELWG 2017-06) that some fishers may have been incorrectly recording only their retained legal-sized eels on the ECERs. The confusion by eel fishers around this rule relates to the lack of destination code X as a legitimate code on ECLRs until about 2008, when Fisheries New Zealand sent out an information pamphlet explaining how to correctly report eel catch on statutory forms. Destination X released eels are now recorded in the ERS disposal report since 2020, again with the implicit assumption that the estimated catch on the water includes all legal sized eels, some of which may have been released and reported under destination X. In the current analyses, catch recorded under destination X was investigated by comparing estimated catch with landed weights and estimated quantities reported as destination X.

2.12 Reporting of destination code G (eels over maximum legal size)

The estimated weight and number of eels over the maximum legal size (4 kg, except WTFA where it is 2 kg), caught and released by commercial fishers, has only been recorded by Fisheries New Zealand since the introduction of the ERS in 2020, reported in the disposal report under destination code G. In the current analyses, catch recorded under destination code G was investigated and compared to the landed weights of each species. Eels over 4 kg are invariably female longfin.

3. RESULTS

3.1 Groomed estimated catch

A comparison of total groomed estimated catch for the North Island, (extracted from CELRs, ECERs and the ERS) with the reported landed catch (Fisheries New Zealand 2026) is shown in Figure 7. The groomed total estimated catch for all eels, including unidentified (EEU), was considerably less than the landed catch before 2002, in some years by as much as 20%, after which they were virtually identical. This is because the quality of the earlier CELR data before 2002 was poor and between 2 and 12% of records were rejected resulting in a lower total estimated catch over this period than was actually caught and landed (Beentjes & Dunn 2003a). Overall, total groomed estimated eel catch used in the CPUE analyses over the 34-year time series was 92% of the total reported landed catch for the North Island. With the introduction of the ECER form in 2002, the quality of the eel fishery catch effort data improved significantly and deletions to the extracted catch effort data sets have been negligible. Despite the removal of data from the early years through grooming, the total eel, shortfin and longfin estimated and landed catches have the same temporal trends (Figure 7).

When plotted by species, before 2002 the estimated catch as a proportion of the landed catch is much less than for total catch because EEU is not included, i.e., a species could not be assigned to the unidentified catch (Figure 7). Before 2002, however, the landed catch data by species is not of a high standard and was only estimated (Fisheries New Zealand 2026). For both shortfin and longfin, there is a good match from 2002 onward, with some departure in recent years as a result of the inclusion of destination X in estimated catches, but not in the landings.

A small proportion (less than 2%) of the shortfin catch over the last 34 years was caught using fine mesh set nets in estuaries and harbours where they are set across channels to capture eels on the receding tide (Figure 8). Of the set net catch, just over half was from ESA AC and just under half from AD. There was no longfin catch recorded by set net.

3.2 Spatial and temporal distribution of the species catch (ESAs)

The relative amounts of groomed estimated catch reported as SFE, LFE, or EEU in each ESA for all years combined are shown in Tables 3 and 4, and Figure 9, and by year for all ESAs combined in Figure 10. The groomed data set includes 124 450 records, comprising 9581 tonnes of shortfin, and 3333 tonnes of longfin (Table 3). Overall, the total recorded North Island catch from 1990–91 to 2023–24 was 60.9% shortfin, 21.2% longfin, and 17.9% EEU (Table 4). When EEU was a valid species code (i.e., pre-2002) it accounted for over one-third (36%) of the estimated North Island eels catch (Figure 10). Some proportion of annual catch was recorded as EEU in all North Island ESAs and this ranged from less than 0.05% (Poverty Bay, AF) to 71% (Waikato, AD) (Figure 9). EEU was not recorded in any ESA after 2001, when all catches were reported by species (LFE or SFE). This coincides with the introduction of the ECER in 2002 when EEU was no longer accepted as a valid reporting species code (see Figure 4). The proportion of the shortfin catch in individual ESAs from 1990–91 to 2023–24 was two to six times greater than longfin in all ESAs except Rangitikei-Whanganui (AH) where catches were similar, and in Taranaki (AJ) and Wellington (AM), where longfin was dominant (Table 4, Figure 9). Nearly half of the North Island total eel catch over the last 34 years was taken from just the two ESAs: Waikato (AD) and Northland (AA), which have contributed 26% and 20%, respectively (Table 4).

The largest proportion of the shortfin catch (21%) was from Northland (AA), with over half the catch from three ESAs (Northland AA, Waikato AD, and AG Hawke's Bay) (Table 4, Figure 9). Similarly, over half the longfin catch was from three ESAs (Northland AA, Waikato AD, and Rangitikei-Whanganui AH). Waikato (AD) and Northland (AA) contributed the bulk of the EEU reported catch (Table 4, Figure 9).

The temporal pattern of catches by ESA are shown in Figures 11 and 12 for shortfin and longfin, respectively. Shortfin catches have fluctuated annually within each ESA with no clear trends, whereas longfin catches have steadily declined from about 2000 onward in all ESAs.

3.3 Reporting release of legal-sized eels (destination code X)

Legal-sized eels caught and returned alive to the water are required to be recorded by fishers and can occur when fishers have insufficient ACE (Annual Catch Entitlement) to cover the catch, or processors do not have markets for certain size categories. For example, if a fisher catches 100 kg of legal-sized eels (220–4000g) and chooses to release 10 kg to the water, the fisher must record 100 kg on the ECER (estimated catch), and then 100 kg on the ECLR, split between 90 kg under destination code 'L' (estimated catch landed), and 10 kg under destination code X (estimated catch released), of which the latter does not count against the fisher's ACE. In this way, if the forms are correctly filled out by fishers, the sum of ECLR destination code 'L' and destination code X should approximate the sum of ECER estimated catch, assuming catch estimates are unbiased. From 2020 the same reporting protocols apply for the ERS, with estimated catch reported on the catch report, destination X catch reported on the disposal report and catch landed to an LFR (L) reported on a landings report.

Destination X was first reported in 2008 for shortfin and 2009 for longfin with its use generally increasing over the next ten years, after which there are no clear trends (Figure 13). A maximum of 19.4 t of longfin was declared as Destination X in 2021 (Figure 13). Similarly, a maximum of 12.7 t of shortfin was declared as Destination X in 2023 (Figure 13). The largest quantities of longfin caught and released under Destination X have been from LFE 20 (Northland and Auckland), with the least from LFE 23 (Taranaki and Rangitikei-Whanganui). For shortfin most reported Destination X was from SFE 20 and SFE 21 (Northland, Auckland, Hauraki and Waikato) with negligible amounts from SFE 23.

Compared to landings (destination code 'L'), the amounts reported as Destination X were relatively low for shortfin ranging from 0.5 to 6.9% of landed catch (Figure 14). In contrast, amounts reported as Destination X for longfin ranged from 2.1 to 115% of landed catch, and in the last four years averaged about 90% (Figure 14).

If legal sized eels returned alive are correctly recorded as destination X by all fishers, then the total estimated catch should be greater than the retained landed catch, by the amount recorded under destination X, notwithstanding the observation error around estimating the catch weight. This is largely the case for shortfin where the estimated catch is clearly larger than the landed catch in 2022 and 2023 (Figure 15, top panel). When destination X catch is added to the landed catch, the two catches are similar (Figure 15, bottom panel) which indicates that the recording of destination X by fishers, has been carried out correctly, overall.

For longfin, the difference between retained landed and estimated catch is relatively much greater than for shortfin because more longfin is caught and released under Destination X (Figure 16 top panel). The addition of Destination X to retained landed catch results in an improved correlation with estimated catch, but there is still substantially more estimated catch from 2021 to 2024 (Figure 16 bottom panel). Over these four years from 7 to 28 t of longfin catch was unaccounted for, and indicates that the recording of longfin destination X by fishers in the disposal reports has been carried out poorly, overall. This indicates that the estimated catch of legal sized eels for both species probably includes most destination X, but this is not true for longfin disposals (i.e. retained landed catch plus destination X). Hence the response variable (=estimated catch) and CPUE indices are unlikely to be biased down by unreported catch. There may, however, be some fishers who release legal-sized eels but fail to report these on either the estimated catch or as destination X. The net effect of this would be to bias CPUE down because the effort (number of nets) remains the same, but some of the catch is not included.

3.4 Reporting release of eels over the maximum legal size (destination code G)

Eels over the maximum legal size (4 kg except in WTFA where it is 2 kg) are legally required to be released alive. This regulation was introduced in 2007 for the North Island and in 2014 for WTFA, however this was recorded only since mid-2019 in the ERS under destination code G, by total weight and number. In the five years since the ERS has recorded catch and release of eels over the maximum legal size under destination code G, a total of 3616 kg and 2153 individual shortfin were captured and released, equating to a mean weight of 1.68 kg. Similarly, the equivalent quantities for longfin were 51 698 kg and 12 934 individuals, equating to a mean weight of 4.00 kg.

Most of the destination G catch was longfin in fishstocks LFE 20 and LFE 21, where between 2.9 to 7.7 t were caught and released annually (Figure 17). Shortfin destination G catch was virtually all from SFE 20 and SFE 21 in 2023 where between 1.3 and 2.2 t were caught and released annually (Figure 17). There were no trends in the destination G for any fishstock after 2020.

Destination G releases represented from 4 to 90% of the North Island longfin landed catch (destination ‘L’) from 2019 to 2024 (Figure 18), assuming that this was reported accurately by all fishers. Shortfin destination G catches were insignificant relative to the landings ranging from 0.01 to 2% (Figure 18).

3.5 Spatial and temporal distribution of the species catch (WTFA)

The relative amounts of groomed estimated catch reported as shortfin and longfin in each WTFA region (WTFA excluding Waipa River; WTFA Waipa River), for the five ERS years (2020 to 2024) combined are shown in Tables 5 and 6, and by year in Figure 19. Data are also shown for the Waikato catchment above Karapiro Dam, outside WTFA.

The WTFA groomed data set incudes 1731 records, comprising 134.9 tonnes of shortfin, and 45.4 tonnes of longfin (Table 5). Overall, the catch from 2020 to 2024 was 74.8% shortfin and 25.2% longfin (Table 6). Shortfin was the dominant species in WTFA (excluding Waipa River), but longfin was dominant in the WTFA Waipa River. Shortfin dominated above Karapiro Dam. Most WTFA catch was from the region excluding Waipa River (93%) (Table 5). The WTFA catch contributed 73.7% of the ESA AD (Waikato) catch, and this is 94.7 % when above Karapiro Dam catch is included (Table 5).

Shortfin catch within the WTFA areas, and above Karapiro Dam, was similar in each year, whereas longfin catch was more variable with the highest catch in 2023 in the WTFA excluding Waipa River (Figure 19).

The WTFA catch of destination G was 6.4 t of longfin and negligible amounts of shortfin (Table 5), accounting for 12.3% of the longfin catch (including destination G). The equivalent figure above Karapiro Dam is 0.46 t and 7.8% of longfin catch (Table 5).

3.6 Fishery characterisations and CPUE analyses

Results are presented for each ESA (Appendices A–M) and species, beginning with the characterisation of the fishery (continuous time series from 1991 to 2024), for legal sized eels, followed by CPUE analyses for 1) pre-ERS (1991 to 2019, legal sized eels) and 2) post-ERS (2020 to 2024, legal size plus destination G), and then diagnostics. CPUE analyses are presented only for ESAs AA to AD because the other ESAs have insufficient data for the post-ERS period. Regardless, pre-ERS characterisation and

CPUE analyses, excluding 2018–2019, for the data poor areas (AE to AM) are available in the previous analyses (Beentjes 2020).

For the WTFA, characterisations of the fisheries are presented for both regions (i.e., WTFA excluding Waipa River, and Waipa River) as well as for above Karapiro Dam. CPUE analyses (legal size plus destination G) are presented only for shortfin in WTFA excluding Waipa River, and shortfin above Karapiro Dam where there were sufficient data to provide meaningful indices which were accepted by the Eel Working Group (9 Dec 2025).

3.6.1 Northland (ESA AA)

Fishery characterisation 1991–2024

Catch – Reported annual shortfin catches in ESA AA have been variable but peaked in 2002 followed by a general decline (Figure A1 in Appendix A). Longfin catches peaked in 2002 then declined to a minimum in 2016, before increasing again (Figure A2). Over the 34-year time series, Northland has contributed 20% of the total North Island eel catch and shortfin has been the dominant species in the catch (SFE 64%, LFE 20%, EEU 16%) (Table 4, Figure 9). The amount of destination G catch recorded since 2020 in ESA AA was 21.8 t for longfin with no temporal trend, and negligible catch of shortfin (Table 3, Figures A1 and A2).

Season – The Northland shortfin and longfin fisheries operate all year round with no clear patterns (Figures A3 & A4).

Target species – Shortfin was the dominant target species (reconstructed) in all years, with a marked decline in longfin targeting in recent years, to the extent that longfin was not a target species in 2015 to 2018 for any fishing event (Figure A5). Declared target species (ERS), from 2020 was exclusively shortfin (Figure A5).

Lifts – The median number of lifts per day declined after 2000 from about 25 to 20, and then again after 2020 to between 10 and 15 lifts (Figure A6).

Zeros – There were very few zero records for total catch (15 records) (Figure A7). Apart from the spike in zero shortfin catch records in 1999, there were no trends for either species. The proportion of zero catch records in the last 15 years is less than 5% for shortfin and around 40–50% for longfin.

Catch per day – The median annual shortfin non-zero catch has fluctuated between about 50 and 120 kg per day with higher daily catch in the most recent years (Figure A8). The median annual longfin non-zero catch fluctuated between about 20 and 120 kg per day with lower daily catch between 2002 and 2018, increasing again after 2016 (Figure A9).

ESA AA shortfin CPUE analyses – pre-ERS (1991 to 2019)

Core fishers – The shortfin core data used in the pre-ERS CPUE analyses retain 93% of the catch and 34% (26) of the original fishers (Figure A10).

Standardised CPUE – The standardised pre-ERS CPUE for shortfin catch followed the same general pattern as unstandardised CPUE (core fisher data) with a progressive increase over time, steeper in the last three years (Figure A11). The narrow confidence intervals around the indices indicate that there were adequate fishers and catch data in these analyses. The variables target, permit, and lifts were included in the model in that order and explained 49.1% of the variation in CPUE (Appendix 2). The shortfin catch by core fishers does not follow the same trend as the CPUE indices (Figure A11), declining steadily since 2003, although before 2002 a large proportion of the catch was reported as EEU.

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure A12). Model step-plots showed that target had the strongest standardisation effect on the index, followed by the addition of lifts (Figure A13). CDI plots for each of the model predictor variables are shown in Figures A14–A16. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AA shortfin CPUE analyses – post-ERS (2020 to 2024)

Core fishers – The shortfin core data used in the post-ERS CPUE analyses retain 93% of the catch and 83% (5) of the original fishers (Figure A17).

Standardised CPUE – The standardised post-ERS CPUE for shortfin catch followed the same general pattern as unstandardised CPUE (core fisher data) (Figure A18). The confidence intervals around the indices indicate that there were adequate fishers and catch data in these analyses. CPUE indices were flat or trending slightly downward between 2019–20 and 2023–24, although with only five years of data and relatively few core fishers these indices should be viewed with caution. The variables lifts, proportion of longfin, permit, month, Wairoa River flow, and moon-phase were included in the model in that order and explained 58% of the variation in CPUE (Appendix 2). The shortfin catch by core fishers does not follow the same trend as the CPUE indices and generally increased over the five years (Figure A18).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure A19). Model step-plots showed that lifts had the strongest standardisation effect on the index, followed by the addition of the proportion of longfin in the catch (Figure A20). CDI plots for each of the model predictor variables are shown in Figures A21–A26. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AA longfin CPUE analyses – pre-ERS (1991–2019)

Core fishers – The longfin core data used in the CPUE analyses retain 90% of the catch and 29% (20) of the original fishers (Figure A27).

Standardised CPUE – The standardised CPUE for pre-ERS longfin catch followed the same general pattern as unstandardised CPUE for core fisher data with an overall slight decline until 2009, after which it shows a gradually increasing trend followed by a steep increase in the last three years (Figure A28). The narrow confidence intervals around the indices indicate that there were adequate fishers and catch data in these analyses. The variables target, permit, and lifts were included in the model in that order and explained 63% of the variation in CPUE (Appendix 2). The longfin catch by core fishers does not follow the same trend as the CPUE, although before 2002 a large proportion of the catch was reported as EEU. The core catch declined steeply after 2002, but was stable after 2010, increasing in the last three years (Figure A28).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure A29). Model step-plots showed that target had the strongest standardisation effect on the index, followed by the addition of lifts (Figure A30). Target species lowered the indices in the first nine years when longfin was the main target species, and raised the indices after that time when shortfin replaced longfin as the main target species. CDI plots for each of the model predictor variables are shown in Figures A31–A33. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AA longfin CPUE analyses – post-ERS (2020 to 2024)

Core fishers – The longfin core data used in the post-ERS CPUE analyses retain 72% of the catch and 50% (3) of the original fishers (Figure A34).

Standardised CPUE – The standardised post-ERS CPUE for longfin catch did not follow the same pattern as unstandardised CPUE (core fisher data) (Figure A35). CPUE indices were stable between 2019–20 and 2023–24, although with only five years of data and relatively few core fishers these indices should be viewed with caution. The variables proportion of shortfin, lifts, Wairua River flow, permit, and month were included in the model in that order and explained 79% of the variation in CPUE (Appendix 2). The longfin catch by core fishers does not follow the same trend as the CPUE indices and generally increased over the five years (Figure A35).

The model residual diagnostics were “acceptable” with no severe violations of normality assumptions (Figure A36). Model step-plots showed that the proportion of shortfin had the strongest standardisation effect on the index, followed by the addition of lifts in the catch (Figure A37). The longfin catch coefficients declined as the proportion of shortfin catch increased (Figure A38). CDI plots for each of the model predictor variables are shown in Figures A38–A42. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

3.6.2 Auckland (ESA AB)

Fishery characterisation 1991–2024

Catch – Reported annual shortfin catches in ESA AB have been variable, between and among years, with peak catches in 1999 and 2012 for shortfin (Figure B1 in Appendix B). Longfin catches were more variable than shortfin, peaking in 2001 (Figure B2). Over the 34-year time series, Auckland has contributed 9% of the total North Island eel catch, and shortfin have been the dominant species in the catch (SFE 67%, LFE 19%, EEU 13%) (Table 4, Figure 9). The amount of destination G catch recorded since 2020 in ESA AB was 1.4 t for shortfin all in 2023, and 3.6 t for longfin with no temporal trend (Table 3, Figures B1 and B2).

Season – The Auckland shortfin and longfin fisheries operate all year round, but catches are generally lower over the winter months for shortfin (Figures B3 and B4).

Target species – Shortfin was the dominant target species (reconstructed) in all years, with a marked decline in longfin targeting to the extent that it was negligible or non-existent from 2008 to 2019 (Figure B5). Declared target species (ERS), from 2020 was almost exclusively shortfin (Figure B5).

Lifts – The median number of lifts per day has been generally stable, ranging from about 20 to 30 nets per day (Figure B6).

Zeros – There were very few zero records for total catch (9 records) (Figure B7). The proportion of zero shortfin catch records before 2002 ranged from about 10 to 25%, after which it was always less than 5%. The proportion of zero longfin catch records has fluctuated over time from about 30 to 80% with no clear trends.

Catch per day – The median annual shortfin non-zero catch has fluctuated between about 50 and 200 kg per day with indications of higher daily catch in the last three years (Figure B8). The median annual longfin non-zero catch fluctuated between about 20 and 100 kg per day with lower daily catch from 2008 to 2019, followed by a marked increase from 2020 to 2023 before dropping off in 2024 (Figure B9).

ESA AB shortfin CPUE analyses – pre-ERS (1991 to 2019)

Core fishers –The shortfin core data used in the Auckland CPUE analyses retain 90% of the catch and 33% (16) of the original fishers (Figure B10).

Standardised CPUE – The standardised CPUE for shortfin catch followed the same general pattern as unstandardised catch rates for core fishers with a progressive increase over time since 2003 with the last four years the highest of the time series (Figure B11). The narrow confidence intervals around the indices indicate that there were adequate fishers and catch in these analyses. The variables permit, target and lifts were included in the model in that order and explained 63% of the variation in CPUE (Appendix

2). The shortfin catch by core fishers does not follow the same trend as the CPUE indices, peaking in 1999 and then variable but generally declining (Figure B11), although before 2002 a large proportion of the catch was reported as EEU.

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure B12). Model step-plots showed that permit had the strongest standardisation effect on the index, followed by the addition of target species (Figure B13). CDI plots for each of the model predictor variables are shown in Figures B14–B16. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AB shortfin CPUE analyses – post-ERS (2020 to 2024)

Core fishers – The shortfin core data used in the post-ERS CPUE analyses retain 93% of the catch and 29% (2) of the original fishers (Figure B17).

Standardised CPUE – The standardised post-ERS CPUE for shortfin catch followed the same general pattern as unstandardised CPUE (core fisher data) (Figure B18). The large confidence intervals around the indices reflect the lack of data and fishers. CPUE indices were stable between 2019–20 and 2023–24, although with only five years of data and relatively few core fishers these indices should be viewed with caution. The variables lifts, proportion of longfin, permit, month, subarea, Hoteo River flow, and moon-phase were included in the model in that order and explained 68% of the variation in CPUE (Appendix 2). The shortfin catch by core fishers does not follow the same trend as the CPUE indices and generally increased and then decreased over the five years (Figure B18).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions although the data are sparse (Figure B19). Model step-plots showed that lifts had the strongest standardisation effect on the index, followed by the addition of the proportion of longfin in the catch (Figure B20). CDI plots for each of the model predictor variables are shown in Figures B21–B26. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AB longfin CPUE analyses – pre-ERS (1991 to 2019)

Core fishers – The longfin core data used in the CPUE analyses retain 83% of the catch and 37% (15) of the original fishers (Figure B27).

Standardised CPUE – The standardised CPUE for longfin catch followed the same general pattern as unstandardised CPUE for core fishers with an overall slight decline until 2006, after which it was stable, followed by a steep increase in the last three years (Figure B28). The generally narrow confidence intervals around the indices indicate that there were adequate fishers and catch data in these analyses. The variables target, permit, and lifts were included in the model in that order and explained 68% of the variation in CPUE (Appendix 2). The longfin catch by core fishers does not follow the same trend as the CPUE indices, peaking in 2000, and declining thereafter, although before 2002 a large proportion of the catch was reported as EEU (Figure B28).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure B29). Model step-plots showed that target had the strongest standardisation effect on the index, followed by the addition of permit (Figure B30). CDI plots for each of the model predictor variables are shown in Figures B31–B33. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AB longfin CPUE analyses – post-ERS (2020 to 2024)

Core fishers – The longfin core data used in the post-ERS CPUE analyses retain 96% of the catch and 75% (3) of the original fishers (Figure B34).

Standardised CPUE – The standardised post-ERS CPUE for longfin catch does not follow the same pattern as unstandardised CPUE (core fisher data) (Figure B35). The large confidence intervals around the indices reflect the lack of data and fishers. CPUE indices were stable between 2019–20 and 2023–

24, although with only five years of data and relatively few core fishers these indices should be viewed with caution. The variables proportion of shortfin, lifts, month, permit subarea, moon-phase, and Hoteo River flow, and were included in the model in that order and explained 84% of the variation in CPUE (Appendix 2). The longfin catch by core fishers does not follow the same trend as the CPUE indices and generally increased and then decreased after 2021 (Figure B35).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions although the data are sparse (Figure B36). Model step-plots showed that the proportion of shortfin in the catch had the strongest standardisation effect on the index, followed by the addition of lift (Figure B37). CDI plots for each of the model predictor variables are shown in Figures B38–B43. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

3.6.3 Hauraki (ESA AC)

Fishery characterisation 1991–2024

Catch – Reported annual shortfin catches in ESA AC have been variable, between and among years, and apart from the highest catches in the last three years, there is no trend (Figure C1 in Appendix C). Longfin catches were highly variable, with an exceptionally large catch in 2022 (Figure C2). Over the 34-year time series, Hauraki has contributed 8% of the total North Island eel catch, and shortfin have been the dominant species in the catch (SFE 82.3%, LFE 12.3%, EEU 5.3%) (Table 4, Figure 9). The amount of destination G catch recorded since 2020 in ESA AC was 2.1 t for shortfin all in 2023, and 7.6 t for longfin with no temporal trend (Table 3, Figures C1 and C2).

Season – The Hauraki shortfin and longfin fisheries operate all year round, but catches are generally lower over the winter months (Figures C3 and C4).

Target species – Shortfin was the dominant target species (reconstructed) in all years, with longfin targeting negligible or non-existent in most years, including the declared target in ERS reporting years from 2020 onward (Figure C5).

Lifts – The median number of lifts per day has been variable, ranging from about 15 to 25 nets per day, except for the drop in lifts in 2020 and 2021. Overall, however, there was no trend (Figure C6).

Zeros – There were no zero records for total catch except for in 2019 (Figure C7). The proportion of zero shortfin catch records was less than 5% (and sometimes 0%) in most years. The proportion of zero longfin catch records has fluctuated over time with no clear trends, and in the last 10 years has averaged about 65%.

Catch per day – The median annual shortfin non-zero catch fluctuated between about 60 and 120 kg per day with no trend, although the highest catches were in the last two years (Figure C8). The median annual longfin non-zero catch ranged between about 5 and 50 kg per day with no trend, although highest catches were in the first few years (Figure C9).

ESA AC shortfin CPUE analyses – pre-ERS (1991 to 2019)

Core fishers – The shortfin core data used in the pre-ERS CPUE analyses retain 94% of the catch and 39% (18) of the original fishers (Figure C10).

Standardised CPUE – The standardised pre-ERS CPUE for shortfin catch closely followed the same pattern as unstandardised CPUE for core fishers. There was no trend until after 2010, when both indices increased, with some fluctuation, steeply in the last year, which was also the series maximum index (Figure C11). The narrow confidence intervals around the indices indicate that there were adequate fishers and catch in these analyses. The variables lifts, target, permit, month, and Waihou River flow were included in the model in that order and explained 39% of the variation in CPUE (Appendix 2). The shortfin catch by core fishers does not follow the same trend as the CPUE indices which fluctuated with no trend, although before 2002 a large proportion of the catch was reported as EEU (Figure C11).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure C12). Model step-plots showed that lifts had the strongest standardisation effect on the index, followed by the addition of target species (Figure C13). CDI plots for each of the model predictor variables are shown in Figures C14–C18. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AC shortfin CPUE analyses – post-ERS (2020 to 2024)

Core fishers – The shortfin core data used in the post-ERS CPUE analyses retain 98% of the catch and 80% (8) of the original fishers (Figure C19).

Standardised CPUE – The standardised post-ERS CPUE for shortfin catch followed the same general pattern as unstandardised CPUE (core fisher data) (Figure C20). The confidence intervals around the indices indicate that there were adequate fishers and catch data in these analyses. CPUE indices were stable between 2019–20 and 2023–24, although with only five years of data and relatively few core fishers these indices should be viewed with caution. The variables lifts, permit, proportion of longfin, and, month were included in the model in that order and explained 45% of the variation in CPUE (Appendix 2). The shortfin catch by core fishers does not follow the same trend as the CPUE indices and generally increased until 2022 then decreased (Figure C20).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure C21). Model step-plots showed that lifts had the strongest standardisation effect on the index, followed by the addition of permit (Figure C22). CDI plots for each of the model predictor variables are shown in Figures C23–C26. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AC longfin CPUE analyses – pre-ERS (1991 to 2019)

Core fishers – The longfin core data used in the CPUE analyses retain 80% of the catch and 31% (11) of the original fishers (Figure C27).

Standardised CPUE – The standardised CPUE for pre-ERS longfin catch followed the same general pattern as unstandardised catch rates for core fishers with a steep decline until 2001, after which it was variable with no clear trend (Figure C28). The generally narrow confidence intervals around the indices indicate that there were adequate fishers and catch in these analyses. The variables target, lifts, and permit were included in the model in that order and explained 57% of the variation in CPUE (Appendix 2). The longfin catch by core fishers does not follow the same trend as the CPUE, which fluctuated with peak catches in 2002 and 2005, although before 2002 a large proportion of the catch was reported as EEU (Figure C28).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure C29). Model step-plots showed that target had the strongest standardisation effect on the index, followed by the addition of lifts (Figure C30). Target species lowered the indices in the first three years when longfin was the main target species. CDI plots for each of the model predictor variables are shown in Figures C31–C33. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AC longfin CPUE analyses – post-ERS (2020 to 2024)

Core fishers – The longfin core data used in the post-ERS CPUE analyses retain 87% of the catch and 60% (6) of the original fishers (Figure C34).

Standardised CPUE – The standardised post-ERS CPUE for longfin catch did not follow the same pattern as unstandardised CPUE (core fisher data) (Figure C35). The confidence intervals around the indices reflect the low number of fishers in these analyses. CPUE indices were stable between 2019–20 and 2023–24, although with only five years of data and relatively few core fishers these indices should be viewed with caution. The variables permit, proportion of shortfin, lifts, month, and Waihou River flow were included in the model in that order and explained 79% of the variation in CPUE (Appendix 2). The longfin catch by core fishers does not follow the same trend as the CPUE indices with a strong peak in catch in 2022 (Figure C35).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions, although data were sparse (Figure C36). Model step-plots showed that permit had the strongest standardisation effect on the index, followed by the addition of the proportion of shortfin in the catch (Figure C37). CDI plots for each of the model predictor variables are shown in Figures C38–C42. The longfin catch coefficients declined as the proportion of shortfin catch increased (Figure C39). Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

3.6.4 Waikato (ESA AD)

Fishery characterisation 1991–2024

Catch – Reported annual shortfin catches in ESA AD have been variable but peaked in 2002 and 2010 followed by a general decline (Figure D1 in Appendix D). Longfin catches were more variable with a peak in 2001 followed by a general decline, except for the large catch in 2023 (Figure D2). Over the 34-year time series, Waikato has contributed 26% of the total North Island eel catch, the most of any ESA and shortfin has been the dominant species in the catch (SFE 47%, LFE 16%, EEU 37%) (Table 4, Figure 9). The amount of destination G catch recorded since 2020 in ESA AD was 7.8 t for longfin with no temporal trend, and negligible catch of shortfin (Table 3, Figures D1 and D2).

Season – The Waikato shortfin and longfin fisheries operate all year round, but catches are generally lower over the winter months, especially for longfin (Figures D3 & D4).

Target species – Shortfin was the dominant target species (reconstructed) in all years, with a marked decline in longfin targeting in the last ten years pre-ERS, to the extent that longfin was a negligible or non-existent target species (Figure D5). Declared target species (ERS), from 2020 was predominantly shortfin (Figure D5).

Lifts – The median number of lifts per day has ranged from about 20 to 30 nets averaging about 25, with a drop off after 2019 to about 18 lifts (Figure D6).

Zeros – There were 313 zero records for total catch, but the incidence was very low until 2012 to 2014 when, for about 5% of records, neither species was caught (Figure D7). There was a gradual declining trend in zero shortfin catch records over the time series, with negligible zero records in the last ten years. Longfin zero catch records have fluctuated with no trend and averaged about 40%.

Catch per day – The median annual shortfin non-zero catch has fluctuated between about 25 and 75 kg per day with indications of higher daily catch in the last 10 years (Figure D8). The median annual longfin non-zero catch fluctuated between about 10 and 70 kg per day with a gradual decline until 2003, and stable thereafter (Figure D9).

ESA AD shortfin CPUE analyses – pre-ERS (1991 to 2019)

Core fishers –The shortfin core data used in the CPUE analyses retain 98% of the catch and 49% (27) of the original fishers (Figure D10).

Standardised CPUE – The standardised CPUE for shortfin catch followed the same general pattern as unstandardised catch rates for core fishers, generally increasing after 2003 and the indices for the last three years are the highest of the time series (Figure D11). The narrow confidence intervals around the indices indicate that there were adequate fishers and catch in these analyses. The variables permit, target, lifts, month, and Waipa River flow were included in the model in that order and explained 51% of the variation in CPUE (Appendix 2). The shortfin catch by core fishers does not follow the same trend as the CPUE indices (Figure D11); although before 2002 a large proportion of the catch was reported as EEU. Shortfin catch by core fishers has fluctuated with no trend since 2002, when catch was recorded by species.

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure D12). Model step-plots showed that permit had the strongest standardisation effect on the index, followed by the addition of target (Figure D13). CDI plots for each of the model predictor variables are shown in Figures D14–D17. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AD shortfin CPUE analyses – post-ERS (2020 to 2024)

Core fishers – The shortfin core data used in the post-ERS CPUE analyses retain 93% of the catch and 42% (5) of the original fishers (Figure D18).

Standardised CPUE – The standardised post-ERS CPUE for shortfin catch followed the same general pattern as unstandardised CPUE (core fisher data) (Figure D19). The confidence intervals around the indices indicate that there were adequate fishers and catch data in these analyses. CPUE indices were stable between 2019–20 and 2023–24, although with only five years of data and relatively few core fishers these indices should be viewed with caution. The variables permit, lifts, proportion of longfin, month, and subarea were included in the model in that order and explained 48% of the variation in CPUE (Appendix 2). The shortfin catch by core fishers followed the same trend as the CPUE indices (Figure D19).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure D20). Model step-plots showed that permit had the strongest standardisation effect on the index, followed by the addition of lifts (Figure D21). CDI plots for each of the model predictor variables are shown in Figures D22–D26. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AD longfin CPUE analyses – pre-ERS (1991 to 2019)

Core fishers –The longfin core data used in the CPUE analyses retain 96% of the catch and 51% (26) of the original fishers (Figure D27).

Standardised CPUE – The standardised CPUE for longfin catch does not follow the same pattern as unstandardised CPUE for core fishers (Figure D28). The unstandardised indices decline over the time series whereas the standardised indices show a moderate decline in CPUE to 1998, and then generally increase with the steepest increase and highest indices in the three most recent years (2017 to 2019) (Figure D28). The narrow confidence intervals around the indices indicate that there were adequate fishers and catch in these analyses. The variables target, permit, lifts, and month were included in the model in that order and explained 65% of the variation in CPUE (Appendix 2). The longfin catch by core fishers does not follow the same trend as the CPUE indices (Figure D28); although before 2002 a large proportion of the catch was reported as EEU. Longfin catch by core fishers declined steeply after 2002, when catch was recorded by species.

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure D29). Model step-plots showed that target had the strongest standardisation effect on the index, followed by the addition of permit (Figure D30). Target species lowered the indices in the first 12 years when longfin was the main target species and raised the indices in the last ten years when shortfin replaced longfin as the main target species. CDI plots for each of the model predictor variables are shown in Figures D31–D34. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

ESA AD longfin CPUE analyses – post-ERS (2020 to 2024)

Core fishers – The longfin core data used in the post-ERS CPUE analyses retain 97% of the catch and 50% (5) of the original fishers (Figure D35).

Standardised CPUE – The standardised post-ERS CPUE for longfin catch followed the same pattern as unstandardised CPUE (core fisher data) (Figure D36). The confidence intervals around the indices indicate that there are adequate data and fishers in these analyses. CPUE indices were stable between 2019–20 and 2023–24, although with only five years of data and relatively few core fishers these indices should be viewed with caution. The variables proportion of shortfin, permit, month, subarea and lifts were included in the model in that order and explained 68% of the variation in CPUE (Appendix 2). The longfin catch by core fishers loosely follows the same trend as the CPUE indices (Figure D36).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure D37). Model step-plots showed that the proportion of shortfin in the catch had the strongest standardisation effect on the index, followed by the addition of permit (Figure D38). CDI plots for each of the model predictor variables are shown in Figures D39–D43. The longfin catch coefficients declined as the proportion of shortfin catch increased (Figure D39). Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

3.6.5 ESAs AE to AM

Fishery characterisation 1991–2024

The fishery characterisations for the eight data poor ESAs are shown in Tables 3 and 4, and Appendix Figures E to M for completeness, but are not described.

3.6.6 Waikato Tainui Fisheries Area (WTFA)

WTFA (excluding Waipa River) fishery characterisation post-ERS (2020–2024)

Catch – Reported annual total eel catches in the WTFA that excludes Waipa River (see Figure 6) from 2020 to 2024 have ranged between about 25 and 48 t (Figure X1 in Appendix X), with shortfin the dominant species in each year, overall accounting for 78% of the catch (Table 6). This area has contributed 97% of the shortfin catch and 83% of the longfin catch in the WTFA, mostly from the Waikato River catchment (Table 6), and 69% of all eels caught in ESA AD (Table 5). The amount of destination G catch recorded since 2020 in this area for longfin was 4.7 t with no temporal trend, and negligible catch of shortfin (Table 5, Figures X2 and X3).

Season – The shortfin and longfin fisheries in the WTFA that excludes Waipa River operate all year round, but catches are generally lower over the winter months for longfin (Figures X4 & X5).

Target species – Shortfin was the dominant target species (declared) in all years, with 100% targeted effort in 2022 (Figure X6).

Lifts – The median number of lifts per day has ranged from about 15 to 18 nets with no trend (Figure X7).

Zeros – There were almost no zero records for shortfin in the catch, and for longfin this was about 40% (Figure X8).

Catch per day – The median annual shortfin non-zero catch ranged between about 40 and 70 kg per day (Figure X9), compared to longfin which was between about 10 and 30 kg per day (Figure X10).

WTFA (excluding Waipa River) shortfin CPUE post-ERS (2020–2024)

Core fishers – The shortfin core data used in the WTFA (excluding Waipa River), post-ERS CPUE analyses retain 98% of the catch and 37% (3) of the original fishers (Figure X11).

Standardised CPUE – The standardised post-ERS CPUE for shortfin catch closely follows the same pattern as unstandardised CPUE (core fisher data) (Figure X12). The narrow confidence intervals around the indices indicate that these analyses were based on adequate amounts of data from the available core fishers. However, with only five years of post-ERS data and relatively few fishers, these indices should be interpreted cautiously. Tentatively, CPUE increased between 2020 and 2022 and was then relatively stable thereafter (Figure X12). The variables permit, month, lifts, and moon phase were included in the model in that order and explained 39% of the variation in CPUE (Appendix 2). The shortfin catch by core fishers closely follows the same pattern as the CPUE indices (Figure X12).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure X13). Model step-plots showed that permit had the strongest standardisation effect on the index, followed by the addition of lifts (Figure X14). CDI plots for each of the model predictor variables are shown in Figures X15–X18. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

WTFA (Waipa River) fishery characterisation post-ERS (2020–2024)

Catch – Reported annual total eel catches in the WTFA that includes only the Waipa River were relatively low with a total of 12 t (Table 5, see Figure 6) ranging from between about 1.5 and 4 t (Figure Y1 in Appendix Y). Longfin was the dominant species in three of the five years, overall accounting for 63% of the eel catch (Table 6). The Waipa River has contributed 17% of the longfin catch and 3% of the shortfin catch in the WTFA (Table 6), and 5% of all eels caught in ESA AD (Table 5). The amount of destination G catch recorded since 2020 in this area for longfin was 1.7 t with no temporal trend, and zero catch of shortfin (Table 5, Figures Y2 and Y3).

Season – The shortfin and longfin fisheries in the WTFA that includes only Waipa River operate all year round, but catches are generally lower over the winter months, particularly for longfin (Figures Y4 & Y5).

Target species – Shortfin was the dominant target species (declared) in all years except 2021, when targeted effort was 100% longfin (Figure Y6).

Lifts – lifts effort data were sparse with only 77 fishing events over the five years (Table 5). The median number of lifts per day has ranged from about 20 to 25 nets with no trend (Figure Y7).

Zeros – There were no zero records for shortfin in the catch after 2020, and for longfin this varied from zero to 40% (Figure Y8).

Catch per day – The median annual non-zero catch was highly variable and ranged between about 25 and 100 kg per day for shortfin (Figure Y9), compared to between about 20 and 200 kg per day for longfin (Figure Y10).

Above Karapiro Dam fishery characterisation post-ERS (2020–2024)

Catch – Reported annual total eel catches above Karapiro Dam (outside the WTFA) that includes a number of hydro lakes (i.e., lakes Karapiro, Arapuni, Waipapa, Maraetai, Whakamaru, and Atiamuri) (see Figure 6) ranged from between about 7 and 15 t (Figure Z1 in Appendix Z). Shortfin was the dominant species in all five years, overall accounting for 89% of the eel catch (Table 6). This area has contributed 20% of all eels caught in ESA AD (Table 5). The amount of destination G catch recorded since 2020 in this area for longfin was 0.46 t with no temporal trend, and zero catch of shortfin (Table 5, Figures Z2 and Z3).

Season – The shortfin and longfin fisheries above Karapiro Dam operate all year round, (Figures Z4 and Z5).

Target species – Shortfin was the dominant target species (declared) in all years, with zero targeted effort for longfin in 2023 (Figure Z6).

Lifts – The median number of lifts per day has ranged from about 30 to 35 nets with no trend (Figure Z7).

Zeros – There were no zero records for shortfin, and for longfin this varied from about 10 to 55% (Figure Z8).

Catch per day – The median annual non-zero catch was highly variable and ranged between about 70 and 140 kg per day for shortfin (Figure Z9), compared to less than 20 kg per day for longfin (Figure Z10).

Above Karapiro Dam shortfin CPUE post-ERS (2020–2024)

Core fishers – The shortfin core data used in the area above Karapiro Dam, post-ERS CPUE analyses retain 99% of the catch and 80% (4) of the original fishers (Figure Z11).

Standardised CPUE – The standardised post-ERS CPUE for shortfin catch generally follows the same pattern as unstandardised CPUE (core fisher data) (Figure Z12). The narrow confidence intervals around the indices indicate that these analyses were based on adequate amounts of data from the available core fishers. However, with only five years of post-ERS data and relatively few fishers, these indices should be interpreted cautiously. Tentatively, CPUE was stable between 2020 and 2022 (Figure Z12). The variables subarea, lifts, month, moon phase, Waikato River flow, and Waipa River flow were included in the model in that order and explained 57% of the variation in CPUE (Appendix 2). The shortfin catch by core fishers declined steadily and does not follow the same pattern as the CPUE indices (Figure Z12).

The model residual diagnostics were "acceptable" with no severe violations of normality assumptions (Figure Z13). Model step-plots showed that subarea (i.e. hydro lake) had the strongest standardisation effect on the index, followed by the addition of lifts (Figure Z14). CDI plots for each of the model predictor variables are shown in Figures Z15–Z21. Standardised indices and 95% confidence intervals are tabulated in Appendix 3.

4. DISCUSSION

4.1 General

This report presents the updated fishery characterisations and standardised CPUE analyses (GLM) for the North Island commercial freshwater eel fishery from 1991 to 2024, extending the time series by six years. Characterisation analyses were carried out at the level of Eel Statistical Area for all 12 ESAs for each species (shortfin and longfin). CPUE analyses were carried out initially for all ESAs except ESA AM where there is negligible data, for continuous time series (22 separate CPUE analyses). However, the EELWG (15 October 2025) recommended that the time series be split between pre-ERS (1991 to 2019) and post-ERS (2020 to 2024) periods because of the differences in post-ERS reconstructed and declared target species. Further, as most of the ESAs have little effort and catch data in recent years, updated CPUE analyses were confined to the data rich areas in the north (i.e., ESA AA, AB, AC and AD) resulting in 16 separate analyses. For the post-ERS time series (2020 to 2024), changes to the GLM included 1) adding in destination G catch (over the maximum legal size) to the legal sized catch used as the response variable, 2) including predictor variables sub area, and habitat type provided from the results of objective 3 on the proportion of longfin habitat fished (Beentjes & Shankar 2026), and 3) including the proportion of the other eel species as a predictor variable. The latter variable was considered exploratory and intended to account for the influence that catching one eel species might have on catch of the other species (as fishers had noted competition between the species). However, the stock assessment plenary (13 April 2026) considered that this variable could bias the CPUE trend and recommended that it be excluded from future analyses.

An additional objective was added to this project for the first time to carry out a characterisation and CPUE analyses of the Waikato Tainui Fisheries Area, and the Waikato River catchment above Karapiro Dam (outside WTFA), which together overlap with roughly two-thirds of ESA AD (Waikato) (see Figure 6).

The fishery characterisations and CPUE analyses provided in this report apply only to commercially fished areas throughout the North Island. For longfin eels the proportion of habitat fished over the period 2020 to 2024 for each ESA was shown to vary between 0% and 21% and overall was 7% for the North Island (Beentjes & Shankar 2026). Previously, the estimate of the proportion of longfin habitat fished was 22 % for the years 2010 to 2014 (Beentjes et al. 2016).

At Fisheries New Zealand Eel Working Group meetings, commercial fishers have raised concerns at the logistics of having to return large quantities of eels over the maximum legal size to the water, recorded as destination G. This is more of a problem for longfin where the quantities released were similar to those landed (see Figure 18) with more than 51 t and 13 000 individuals released since 2020, all exclusively longfin females. Add to this the large quantities of longfin eels of legal size released under destination X, fishers have released about twice as much longfin by weight as they have retained from 2021 to 2024.

4.2 Catch and species distribution

Over the 34-year North Island time series, ignoring catch from unidentified eel (EEU), shortfin estimated groomed catches accounted for nearly three-quarters (74%) of the total eel catch. Over the last 15 years this has increased as longfin catch decreased (see Figure 10). The groomed estimated shortfin catch was almost identical to the landed catch after 2001 when the EEU code was no longer accepted, but for longfin, estimated catch was greater than landed catch after 2016 when destination X was widely used by fishers. Shortfin is the dominant species with respect to catch proportions in all ESAs except Wellington (AM) and Taranaki (AJ), which have yielded more longfin, whereas proportions in Rangitikei-Whanganui (AH) are close to parity (see Table 4, Figure 9). Hauraki (AC) yielded the highest proportion of shortfin in the catch over the 34 years, at 82%, and Taranaki (AJ) the least, at 35% (ignoring EEU).

The relative proportions of the North Island eel catch contributed by each ESA from 1991 to 2024 have remained largely unchanged since the 1980s (Jellyman 1994). The largest contributing areas for shortfin, have been, in descending order, Northland (AA), Waikato (AD), Hawke's Bay (AG), Hauraki (AC), and Auckland (AB), together representing 75% of the total shortfin catch (see Table 4). For longfin, the key areas are Waikato (AD), Northland (AA), Rangitikei-Whanganui (AH), and Taranaki (AJ), which together represent 61% of the total longfin catch (see Table 4).

Historical reporting of catches as unidentified (EEU) has presented problems in the catch-effort analyses for individual eel species. The extent to which EEU rather than LFE or SFE was recorded by fishers varied between regions. It was used extensively in Waikato (71% of catch before 2002) and Northland (37% of catch before 2001), resulting in considerable data loss in the individual species CPUE analyses, although this was offset to some extent by the large data sets for both these areas. Replacement of the CELR form with the ECER and ECLR on 1 October 2001 did not give the option of recording EEU and there have been no records of EEU in the catch effort data since 2000–01.

4.3 Factors affecting eel CPUE indices

There are a number of potential factors to consider when assessing the veracity of the eel CPUE indices and these are discussed below.

Estimating catch

In the freshwater eel fishery, catch of each species is estimated by observation of catches in fyke nets or in holding bags at the point of capture, rather than from standard fish bins containing separated species, as in marine fisheries. There is the possibility, therefore, that in catches dominated by one species, the minor catch may be overlooked or underestimated. The strong correlation between landed and estimated catch, however, indicates that fishers are adept at estimating their catch by species on the riverbank (see Figure 7), notwithstanding unreported destination X catch.

Loss of data from grooming and use of EEU code

Overall, total groomed estimated eel catch used in the CPUE analyses was missing up to 12% of records before 2001 because of errors in reporting on CELRs (Beentjes & Willsman 2000, Beentjes & Dunn 2003a) (see Figure 4). With the introduction of the ECER form in 2001–02 and ERS in 2020, very few records were removed from the analyses during grooming from 2001–02 onward. Despite the grooming out of considerable numbers of records before 2001–02, the trends in estimated and landed total eel catch are similar, indicating that estimated catch is likely to be proportional to total landed catch, and hence can be legitimately used for CPUE analysis during this earlier period. The estimated eel species-specific catch as a proportion of the landed catch is even less because 36% of the catch before 2002 was reported as EEU and consequently is not included in the individual species analyses (see Table 4, Figure 10).

Destination X - reporting of legal-sized eels released

The longfin catch recorded as destination X code is much greater for the last than the previous ten years (see Figure 13), as quota cuts and 'shelving' (Beentjes 2019) have resulted in some fishers having insufficient Annual Catch Entitlement (ACE) to cover their catch of longfins, requiring legal sized eels to be returned to the water. Further, specific longfin size grades have become less marketable, and fishers have periodically been requested by processors not to land these eels. Fishers commented that destination X was not required as a reporting code before about 2010 because virtually all eels of legal size were accepted by processors (Eel WG meeting 7 April 2026).

Estimated catch of legal sized eels should include those that were released under destination X. Comparison of estimated, retained landed, and recorded destination X longfin catches in the last 20 years indicates that although destination X has been used correctly by many fishers, there is a shortfall in longfin catch recorded on destination X disposal reports from 2021 to 2023 (see Figure 16). The assumption is that estimated catches have been recorded correctly and include destination X catch, but, the latter has not consistently been reported in the disposal reports. Under this scenario the CPUE analyses are not biased down by the unreported destination X in disposal reports. However, there may be some fishers who have released legal sized eels but failed to report these on either the catch effort forms or as destination X in disposal reports. The net effect of this would be to bias CPUE down because the effort (number of nets) for each fishing event remains the same.

There is also a voluntary code of practice to release eels that are in a migratory condition when caught, many of which could be of legal size for both species. The extent of this practice, and whether these releases are correctly included in the estimated catch and recorded under destination X in the disposal reports is unknown.

The introduction of the ERS for the commercial eel fishery in April 2019 does not appear to have improved reporting of Destination X for longfin with the poorest reporting in ERS years 2021 to 2023 (see Figure 16).

Destination G – reporting of eels over the maximum legal size, released

Missing from the estimated catch before 2020 were eels over the maximum legal size (4000 g, except in the WTFA where the limit is 2000 g). These eels have been required by regulation to be returned alive to the water on capture since 2007 in the North Island and since 2014 in the WTFA, but were not reported separately until the introduction of the ERS in 2020, when they were recorded under disposal code Destination G. The introduction of the ERS for the eel fishery in April 2019 requires the weight and number of eels released under Destination G release to be recorded, as well as the catch location. For the WTFA, Destination G can include large shortfin, and longfin females, and outside the WTFA this is only large longfin females. While there have been anecdotal reports of increasing quantities of large longfin being released each year, this may have stabilised as the ERS data indicate no trends since 2020 (see Figure 17). The post-ERS CPUE analyses include the destination G eels, and it is assumed that this is being recorded accurately by fishers. The catch of destination G longfin eel is likely to have been influenced by the avoidance of longfin habitat in recent years, which might explain why this has not continued to increase over the five-year period.

Escape tube modifications

The legal escape tube size in the North Island eel fishery before 2013 was 25 mm and was designed to allow eels smaller than 220 g (minimum legal size, MLS) to escape from the fyke nets if captured, although in practice eels below the MLS were often caught. The increase to 31 mm became a legal requirement on 1 October 2013, consistent with the South Island where 31 mm has been the legal escape tube size since 1996–97. A 31-mm escape tube can be expected to retain eels larger than about 300 g; Further, processors agreed not to process eels less than 300 g since about 2009–10 and for one processor as far back as 2006–07 for longfin eels. Most of these small eels (220–300 g) caught by fishers are released at the point of capture, and any that are landed into processors are graded out and returned to local rivers without being weighed (Dale Walters, NZ Eel Processors, pers. comm.).

Some fishers are voluntarily using 35-mm escape tubes and larger to reduce catch of less marketable small eels. Commercial eel fishers were asked to voluntarily record escapement tube diameter in the comments section of their ERS reports from October 2023. Escape tube diameter subsequently became an ERS reporting requirement in 2024–25. While increasing escape tube size may reduce the catch initially, catch rates and CPUE would increase over time as eels grow to a size where they are selected with the larger escape tube.

Fyke net specifications

It is important in any fishery being monitored to understand the type of fishing gear being used, the specifications of the gear, and how the gear operates to catch fish. Any changes to gear that might affect the catchability and hence CPUE should be documented and be considered during any presentation of results that use catch and effort data. Fyke net method was the method used in nearly all North Island fishing events, except for a small number of events that used method set net which was used predominantly in the Firth of Thames. The North Island fyke net fishing gear described by Beentjes & McKenzie (2017) has remained unchanged over the time series of CPUE. If there are changes to these net specifications in the future it will be important to have this documented.

4.4 Standardised CPUE analyses (GLM)

Core fishers

The restriction of CPUE analyses to core fishers ensured that only committed and experienced fishers (having had at least three years in the fishery) were included in the analyses, hence reducing the overall variability in catch rates. This resulted in very little loss of data, but often considerable loss of fishers from the analyses.

Splitting the CPUE time series into pre- and post-ERS periods had little effect on the pre-ERS indices which had similar numbers of core fishers to the earlier continuous data set. The post-ERS time series was based on only five years of fishing data, hence the core fisher restrictions were necessarily relaxed to include enough fishers and data in the analyses (see Table 2).

Predictor variables

Standardised CPUE analyses adjust for the influence of explanatory variables on catch rates when estimating abundance trends.

Pre-ERS – pre-ERS variables offered to the GLM included lifts, estimated target species, fisher (permit), season (month), moon phase, and river flow (see Table 2). The three variables, target, permit, and lifts were included in all ESA models. Estimated target species often explained the most variance in the GLM, especially for longfin (see Appendix 2). This is not surprising since targeting of shortfin has become more common in the last 14 years pre-ERS, because the longfin TACC was reduced more than shortfin, longfin ACE was less available, and longfin markets were less favourable. For longfin, particularly, the effect on the unstandardised CPUE indices (geometric mean of catch rates including year effect) was to lower the indices initially when longfin was the main target species, and raise them in later years when shortfin became the main target species and longfin bycatch (see Figure D31). The step and influence plots were useful for explaining how the different variables entering the model altered the annual CPUE coefficients. The finding that month was an important variable affecting catch rates is understandable because water temperature varies seasonally and eel catch rates have been found to decline markedly in winter (Jellyman 1991, 1997). The inclusion of permit indicates the importance of fisher experience and/or ability on catch rates. Lifts was always included because it is the key indicator of relative effort. River flow entered the model for shortfin in two areas, and moon phase did not enter the pre-ERS models.

Post-ERS – The variables offered to the post-ERS models were the same as pre-ERS, but also included habitat type, sub-area, and proportion of the other eel species, whereas target was declared and not estimated. Post-ERS models tended to accept more explanatory variables than pre-ERS models, sometimes including moon phase and river flow (see Appendix 2). However, the inclusion of additional explanatory variables in shorter time series needs to be interpreted cautiously because increased model complexity may result in overfitting. The longer pre-ERS time series rely more on temporal structure and averaging. The post-ERS target species has been almost exclusively shortfin as markets for longfin have declined, ACE is scarce and TACCs are low often reducing longfin to a bycatch species. Because a GLM requires at least two factors in the predictor variables, target species did not enter any of the post-ERS models despite the catch having a mix of both species. The variable proportion of the other eel species entered the models in all four ESAs (AA to AD) post-ERS, for both species (see Appendix 2). For shortfin models the catch coefficients declined as the proportion of longfin in the catch increased (see Figure D23), and vice versa. Because the inverse of this covariate is not independent of the response variable for the species being modelled, it was considered to introduce circularity and, the stock assessment plenary (13 April 2026) recommended it be removed from future analyses. Habitat type did not enter any of the post-ERS models, but sub-area was included in AB and AD for both species, and for shortfin above Karapiro Dam.

Shortfin CPUE summary

Shortfin standardised CPUE analyses were carried out for four North Island ESAs (ESAs AA to AD) from 1991 to 2019 (pre-ERS), and 2020 to 2024 (post-ERS), with indices for all analyses accepted by the Eel Working Group (7 April 2026) and the stock assessment plenary (13 April 2026).

Standardised CPUE analyses for shortfin post-ERS WTFA excluding Waipa River, and above Karapiro Dam were accepted by the Eel Working Group (9 Dec 2025) but the analyses for WTFA Waipa River were rejected.

The indices and confidence intervals are shown in Figures 20–21. The trends in shortfin standardised CPUE are summarised as follows:

1. Northland (ESA AA): *Pre-ERS* – Increasing trend in CPUE since early 1990s, becoming much steeper in the last three years. The narrow confidence intervals around the indices indicate that there were adequate numbers of fishers and catch in these analyses.
2. Auckland (ESA AB): *Pre-ERS* – No trend in CPUE until 2003, after which it steadily increases with the last four years being the highest of the time series. The narrow confidence intervals around the indices indicate that there were adequate numbers of fishers and catch in these analyses.
3. Hauraki (ESA AC): *Pre-ERS* – No trend in CPUE until 2010, after which it generally increased with the last year being the highest of the time series. The narrow confidence intervals around the indices indicate that there were adequate numbers of fishers and catch in these analyses.
4. Waikato (ESA AD): No long-term trend in CPUE until 2003, after which it generally increased and the indices for 2017 to 2019 were the highest of the time series. The narrow confidence intervals around the indices indicate that there were adequate numbers of fishers and catch in these analyses.

For all shortfin post-ERS CPUE analyses, including those for the WTFA, only five years of data were available and there were relatively few core fishers. Therefore, despite the narrow confidence intervals in many cases, these indices should be viewed cautiously. The shortfin CPUE indices for ESAs AB, AC and AD from 2020 to 2024 were all stable without trend, whereas for ESA AA they were stable with indications of a slight decline in CPUE (Figure 20). For WTFA (excluding Waipa River) shortfin CPUE indices increased between 2020 and 2022 and were relatively stable thereafter. Above Karapiro Dam the shortfin indices were stable (Figure 21).

For ESAs AB, AC and AD, the pre-ERS shortfin CPUE indices, there were initially no trends followed by strong increases beginning from around 2002, a few years before the introduction of North Island eel stocks into the QMS in 2005 (Figure 20). In contrast, Northland (ESA AA) CPUE indices increased steadily throughout the time series (Figure 20). For ESAs AA, AB, and AD, in the last three years indices were the highest in the time series, and for ESA AC, all indices for the last ten years were above the time series mean. Subsequent shortfin reductions in catch through a 26% TACC reduction in 2007–08 are likely to have contributed to the improved CPUE for North Island shortfin at this time, along with a steady decrease in the numbers of fishers over time with few new entrants in the fishery, combined with the retirement of long-term fishers.

Longfin CPUE summary

Longfin standardised CPUE analyses were carried out for four North Island ESAs (ESAs AA to AD) from 1991 to 2019 (pre-ERS), and 2020 to 2024 (post-ERS), with indices accepted by the Eel Working Group (7 April 2026) for all analyses. Subsequently, the stock assessment plenary (13 April 2026) rejected all the pre-ERS CPUE analyses but accepted the post-ERS analyses.

The indices and confidence intervals are shown in Figure 20. The trends in pre-ERS longfin standardised CPUE are summarised as follows:

1. Northland (ESA AA): *Pre-ERS* – Slight downward trend in CPUE until 2009, after which it shows a gradually increasing trend followed by a steep increase in the last three years. The confidence intervals around the indices indicate that there were adequate numbers of fishers and catch data in these analyses.
2. Auckland (ESA AB): *Pre-ERS* – A slight decline in CPUE overall until 2006, after which it was stable, followed by a steep increase in the last three years. The confidence intervals around the indices indicate that there were adequate numbers of fishers and catch data in these analyses.
3. Hauraki (ESA AC): *Pre-ERS* – A steep decline in CPUE until 2001, after which it was variable with no trend. The confidence intervals around the indices indicate that there were adequate numbers of fishers and catch data in these analyses.
4. Waikato (ESA AD): *Pre-ERS* – A moderate decline in CPUE to 1998, and then generally increasing with the highest indices in the three most recent years. The confidence intervals

around the indices indicate that there were adequate numbers of fishers and catch data in these analyses.

For all longfin post-ERS CPUE analyses, there are only five years of data with few core fishers, and despite narrow confidence intervals in many cases, statements about trends in these indices should be viewed with caution. Tentatively, for ESAs AA, AB, AC, and AD, there were no trends in any of the post-ERS CPUE indices (Figure 20).

Standardised CPUE analyses for longfin post-ERS WTFA areas, and above Karapiro Dam were rejected by the Eel Working Group (9 Dec 2025) and are not presented.

There were fewer data for longfin analyses than for shortfin and indices were often more variable or associated with wider confidence intervals. The addition of reconstructed target species as an explanatory variable for pre-ERS analyses had a much greater impact on longfin CPUE indices than shortfin indices, tending to reduce the steepness of the initial decline and increase CPUE in recent years.

The North Island longfin TACC for all QMAs combined was reduced by 58% in 2007–08, probably contributing to the higher CPUE indices. A consequence of the lowered TACC was a steady drop off in the numbers of fishers over time with few new entrants, combined with the retirement of long-term fishers. In 2018–19 the TACCs for the four North Island longfin stocks were further reduced by 32% which resulted in a reduction in effort with minimal targeting, relegating longfin to bycatch, and the further loss of fishers as it became uneconomic to continue fishing.

5. FULFILMENT OF BROADER OUTCOMES

The broader outcomes of this research, in part, relate to assessing the sustainability of the commercial eel fisheries for shortfin and longfin eels. This is key for the endemic longfin eel for which the sustainability of the commercial fishery is of public interest. The CPUE indices tell us little about absolute abundance or what the abundance was historically before commercial fishing was established, but it does indicate whether the stocks in each fished area are declining or increasing. This is important for all stakeholders (Fisheries New Zealand, NZ Inc., iwi, the commercial fishing industry, environmental NGOs, Department of Conservation), and allows Fisheries New Zealand to manage these fisheries accordingly, and to determine if the current levels of exploitation are sustainable. Eels (tuna) are a highly prized taonga species for Māori, particularly large longfin eels, and this work will advance knowledge around tuna for the benefit of all North Island iwi. Since 2020, empirical data have been collected on the spatial distribution of catches of large eels that exceed the maximum legal size and are released.

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7. REFERENCES

Ballantine, D.J.; Davies-Colley, R.J. (2014). Water quality trends in New Zealand rivers: 1989–2009. *Environmental Monitoring and Assessment 186*: 1939–1950.

Beentjes, M.P. (2005). Monitoring the size grades and species composition of commercially processed eels in 2005 and 2006. Progress Report for Fisheries New Zealand Project EEL200402. 4 p. (Unpublished report held by Fisheries New Zealand, Wellington.)

Beentjes, M.P. (2008a). Monitoring commercial eel fisheries in 2003–04 and 2004–05. *New Zealand Fisheries Assessment Report 2008/19*. 43 p.
Beentjes, M.P. (2008b). Monitoring commercial eel fisheries in 2005–06 and 2006–07. *New Zealand Fisheries Assessment Report 2008/64*. 67 p.
Beentjes, M.P. (2013). Monitoring commercial eel fisheries: 2009–10 to 2011–12. *New Zealand Fisheries Assessment Report 2013/47*. 76 p.
Beentjes, M.P. (2019). Monitoring commercial eel fisheries: 2015–16 to 2017–18. *New Zealand Fisheries Assessment Report 2019/92*. 83 p.
Beentjes, M.P. (2020). Catch per unit effort (CPUE) analyses and characterisation of the North Island commercial freshwater eel fishery, 1990–91 to 2017–18 *New Zealand Fisheries Assessment Report 2020/24*. 258 p.
Beentjes, M.P. (2022). Monitoring commercial eel fisheries: 2018–19 to 2020–21. *New Zealand Fisheries Assessment Report 2022/58*. 97 p.
Beentjes, M.P.; Bull, B. (2002). CPUE analyses of the commercial freshwater eel fishery. *New Zealand Fisheries Assessment Report 2002/18*. 55 p.
Beentjes, M.P.; Dunn, A. (2003a). CPUE analysis of the commercial freshwater eel fishery in selected areas, 1990–91 to 2000–01. *New Zealand Fisheries Assessment Report 2003/54*. 47 p.
Beentjes, M.P.; Dunn, A. (2003b). Species composition and CPUE analysis for North Island commercial eel fishery stocks for the period 1990–91 to 2002–03. Final Research Report for Fisheries New Zealand Research Project MOF200301A. 53 p. (Unpublished report held by the Fisheries New Zealand, Wellington.)
Beentjes, M.P.; Dunn, A. (2010). CPUE analyses of the North Island commercial freshwater eel fishery, 1990–91 to 2006–07. *New Zealand Fisheries Assessment Report 2010/5*. 100 p.
Beentjes, M.P.; Dunn, A. (2013). Catch per unit effort (CPUE) analyses and characterisation of the North Island commercial freshwater eel fishery, 1990–91 to 2011–12. *New Zealand Fisheries Assessment Report 2013/62*. 292 p.
Beentjes, M.P.; Dunn, A. (2015). Catch per unit effort (CPUE) analyses and characterisation of the South Island commercial freshwater eel fishery, 1990–91 to 2012–13. *New Zealand Fisheries Assessment Report 2015/30*. 177 p.
Beentjes, M.P.; McKenzie, A. (2017). Catch per unit effort (CPUE) analyses and characterisation of the North Island commercial freshwater eel fishery, 1990–91 to 2014–15 *New Zealand Fisheries Assessment Report 2017/60*. 251 p.
Beentjes, M.P.; Shankar, U. (2026). Estimates of the total wetted-area commercially fished for eels in the North Island (2020 to 2024), and the proportion of longfin habitat fished. New Zealand Fisheries Assessment Report 2026/31. 29 p.
Beentjes, M.P.; Sykes, J.; Crow, S.K. (2016). GIS mapping of the longfin eel commercial fishery throughout New Zealand, and estimates of longfin habitat and proportion fished. *New Zealand Fisheries Assessment Report 2016/32*. 53 p.
Beentjes, M.P.; Willsman, A. (2000). Feasibility study of CPUE data for the eel fishery. Final Research Report for Fisheries New Zealand Research Project MOF804I. 20 p. (Unpublished report held by the Fisheries New Zealand, Wellington.)
Bentley, N.; Kendrick, T.H.; Starr, P.J.; Breen, P.A. (2012). Influence plots and metrics: tools for better understanding fisheries catch-per-unit-effort standardizations. *ICES Journal of Marine Science 69*: 84–88.
Davies-Colley, R.J.; Smith, D.G.; Ward, R.C.; Bryers, G.G; McBride, G.B.; Quinn, J.M.; Scarsbrook, M.R. (2011). Twenty years of New Zealand's national rivers water quality network: benefits of careful design and consistent operation. *Journal of the American Water Resources Association 47*: 750–771.
Fisheries New Zealand (2026). Fisheries Assessment Plenary, May 2026: stock assessments and stock status. Compiled by the Fisheries Science Team, Fisheries New Zealand, Wellington, New Zealand. 1990 p.
Jellyman, D.J. (1991). Factors affecting the activity of two species of eel (*Anguilla* spp.) in a small New Zealand lake. *Journal of Fish Biology 39*: 7–14.
Jellyman, D.J. (1993). A review of the fishery for freshwater eels in New Zealand. *New Zealand Freshwater Fisheries Report 10*. 51 p.

Jellyman, D.J. (1994). The fishery for freshwater eels (*Anguilla* spp.) in New Zealand. *New Zealand Fisheries Assessment Research Document* 94/14. 24 p. (Unpublished report held in NIWA library, Wellington.)

Jellyman, D.J. (1997). Variability in growth rates of freshwater eels (*Anguilla* spp.) in New Zealand. *Ecology of Freshwater Fish 6*: 108–115.

McCullagh, P.; Nelder, J.A. (1989). Generalised linear models. Chapman & Hall, London.

McDowall, R.M. (2000). The Reed field guide to New Zealand freshwater fishes. Reed Books, Auckland. 224 p.

Meeuse, J. (1998). Astronomical algorithms. 2nd Edition. Willmann-Bell, Richmond, VA, 476 p.

8. TABLES AND FIGURES

Table 1: Eel Quota Management Areas (QMAs) for longfin (LFE) and shortfin (SFE) eel stocks and both species combined (ANG), current Eel Statistical Areas (ESA, from October 2001), and the associated historical ESA up to October 2001. Before 2016–17, TACCs were set for South Island shortfin and longfin combined under QMAs ANG 11–16.

	QMA		ESA	
Area	LFE	SFE	Alpha (from 1 Oct 2001)	Numeric (before 1 Oct 2001)
Northland	LFE 20	SFE 20	AA	1
Auckland	LFE 20	SFE 20	AB	2
Hauraki	LFE 21	SFE 21	AC	3
Waikato	LFE 21	SFE 21	AD	4
Bay of Plenty	LFE 21	SFE 21	AE	5
Poverty Bay	LFE 21	SFE 21	AF	6
Hawke’s Bay	LFE 22	SFE 22	AG	7
Rangitikei-Whanganui	LFE 23	SFE 23	AH	8
Taranaki	LFE 23	SFE 23	AJ	9
Manawatu	LFE 22	SFE 22	AK	10
Wairarapa	LFE 22	SFE 22	AL	11
Wellington	LFE 22	SFE 22	AM	12
Nelson	LFE 11	SFE 11	AN	13
Marlborough	LFE 11	SFE 11	AP	14
South Marlborough	LFE 12	SFE 12	AQ	14
Westland	LFE 16	SFE 16	AX	15
North Canterbury	LFE 12	SFE 12	AR	16
South Canterbury	LFE 14	SFE 14	AT	17
Waitaki	LFE 14	SFE 14	AU	18
Otago	LFE 15	SFE 15	AV	19
Southland	LFE 15	SFE 15	AW	20
Te Waihora (outside-migration area)	LFE 13	SFE 13	AS1	21
Te Waihora migration area	LFE 13	SFE 13	AS2	21
Chatham Islands	LFE 17	SFE 17	AZ	22
Stewart Island	LFE 15	SFE 15	AY	23

Table 2: Generalised Linear Models fitted to the eel fishery catch effort data. For all models the response variable was log (positive catch) for shortfin or longfin, with a log normal error structure. Core fisher selection criteria thresholds for each model run with minimum number of years fished, minimum days per year of the fished years, and minimum total catch over all years. All post-ERS models included destination G in the catch. See Figure 2 for spatial representation of ESAs.

		Minimum to qualify			
Species area model name	Fish year	Years	Days per year	Total catch	Predictor variables offered to models
SFE ESA AA (pre-ERS)	1991–2019	3	10	1000	Log lifts, permit, month, estimated target species, river flow, moon-phase
SFE ESA AA (post-ERS)	2020–2024	2	10	1000	Log lifts, permit, month, river flow, moon-phase, target species, subarea, habitat type, prop other species
LFE ESA AA (pre-ERS)	1991–2019	3	10	1000	As for pre-ERS
LFE ESA AA (post-ERS)	2020–2024	2	10	1000	As above for post-ERS
SFE ESA AB (pre-ERS)	1991–2019	3	10	1000	As for pre-ERS
SFE ESA AB (post-ERS)	2020–2024	2	10	1000	As above for post-ERS
LFE ESA AB (pre-ERS)	1991–2019	3	10	1000	As for pre-ERS
LFE ESA AB (post-ERS)	2020–2024	2	5	500	As above for post-ERS
SFE ESA AC (pre-ERS)	1991–2019	3	10	1000	As for pre-ERS
SFE ESA AC (post-ERS)	2020–2024	2	10	1000	As above for post-ERS
LFE ESA AC (pre-ERS)	1991–2019	3	10	1000	As for pre-ERS
LFE ESA AC (post-ERS)	2020–2024	2	10	1000	As above for post-ERS
SFE ESA AD (pre-ERS)	1991–2019	3	10	1000	As for pre-ERS
SFE ESA AD (post-ERS)	2020–2024	2	10	1000	As above for post-ERS
LFE ESA AD (pre-ERS)	1991–2019	3	10	1000	As for pre-ERS
LFE ESA AD (post-ERS)	2020–2024	2	5	1000	As above for post-ERS
SFE WTFA_excl. Waipa (post-ERS)	2020–2024	2	10	500	Log lifts, permit, month, river flow, moon-phase, target, subarea, habitat type, prop other species
SFE WTFA_Waipa (post-ERS)	2020–2024	1	1	200	As above
SFE above Karapiro (post-ERS)	2020–2024	2	1	200	As above
LFE WTFA excl. Waipa (post-ERS)	2020–2024	2	10	500	As above
LFE WTFA_Waipa (post-ERS)	2020–2024	1	1	200	As above
LFE above Karapiro (post-ERS)	2020–2024	1	1	200	As above

Table 3: ESAs, regions, fishers (= permits), and the number of groomed records (equivalent to the number of fishing events), and estimated legal size eel catch for shortfin, longfin, and unidentified eels from 1991 to 2024, for method fyke net. The destination G (eels over the maximum legal size) catch is also shown for the years 2020 to 2024. ESA, eel statistical area. See Figure 2 for spatial representation of ESAs.

				Estimated legal catch (kg)				Estimated Dest G catch (kg)	
ESA	Region	Fishers	Records	Unidentified	Shortfin	Longfin	Total	Shortfin	Longfin
AA	Northland	88	28 295	502 888	1 989 158	621 041	3 113 087	40	21 789
AB	Auckland	64	10 162	196 311	987 134	283 414	1 466 859	1 350	3 576
AC	Hauraki	50	11 486	67 068	1 035 218	154 957	1 257 243	2130	7 644
AD	Waikato	66	49 436	1 528 776	1 970 050	656 950	4 155 776	20	7 794
AE	Bay of Plenty	28	3 879	35 090	366 268	129 280	530 638	0	376
AF	Poverty Bay	15	998	10	214 206	51 310	265 526	30	0
AG	Hawke’s Bay	42	6 245	21 125	1 178 488	288 690	1 488 303	0	3 054
AH	Rangitikei-Whanganui	40	4 805	46 282	560 474	477 681	1 084 437	0	148
AJ	Taranaki	31	3 911	44 043	175 662	286 029	505 734	0	120
AK	Manawatu	41	5 210	275 947	657 543	125 484	1 058 974	0	993
AL	Wairarapa	37	4 087	93 485	444 550	254 399	792 433	46	2 289
AM	Wellington	07	23	210	2 405	3 614	6 229	0	0
Totals		224	124 450	2 811 235	9 581 156	3 332 849	15 725 239	3 616	47 783

Table 4: Percent of groomed estimated legal sized catch of eels by species within and among ESAs from combined years 1991 to 2024 for method fyke net. The percent destination G (eels over the maximum legal size) catch among ESAs is also shown for the years 2020 to 2024. ESA, eel statistical area; LFE, longfin; SFE, shortfin; EEU, unidentified. See Figure 2 for spatial representation of ESAs.

		Percent species legal catch within ESA				Percent species legal catch among ESAs				Percent species Dest G catch among ESAs	
ESA	Region	SFE	LFE	EEU	Total	Total	SFE	LFE	EEU	SFE	LFE
AA	Northland	63.9	19.9	16.2	100	19.8	20.8	18.6	17.9	1.1	45.6
AB	Auckland	67.3	19.3	13.4	100	9.3	10.3	8.5	7.0	37.3	7.5
AC	Hauraki	82.3	12.3	5.3	100	8.0	10.8	4.6	2.4	58.9	16.0
AD	Waikato	47.4	15.8	36.8	100	26.4	20.6	19.7	54.4	0.6	16.3
AE	Bay of Plenty	69.0	24.4	6.6	100	3.4	3.8	3.9	1.2	0.0	0.8
AF	Poverty Bay	80.7	19.3	0.0	100	1.7	2.2	1.5	0.0	0.8	0.0
AG	Hawke’s Bay	79.2	19.4	1.4	100	9.5	12.3	8.7	0.8	0.0	6.4
AH	Rangitikei-Whanganui	51.7	44.0	4.3	100	6.9	5.8	14.3	1.6	0.0	0.3
AJ	Taranaki	34.7	56.6	8.7	100	3.2	1.8	8.6	1.6	0.0	0.3
AK	Manawatu	62.1	11.8	26.1	100	6.7	6.9	3.8	9.8	0.0	2.1
AL	Wairarapa	56.1	32.1	11.8	100	5.0	4.6	7.6	3.3	1.3	4.8
AM	Wellington	38.6	58.0	3.4	100	0.04	0.03	0.1	0.0	0.0	0.0
Overall		60.9	21.2	17.9	100.0	100	100	100	100	100	100

Table 5: Waikato Tainui Fisheries Area (WTFA) regions, and above Karapiro Dam (outside WTFA), groomed estimated legal size eel catch of shortfin, longfin, and total eels from 2020 to 2024, for method fyke net. The proportions of the legal sized eel catch from WTFA regions, and of ESA AD are shown. The destination G (eels over the maximum legal size) catch is also shown. excl, excluding; R, river. See Figure 6 for spatial representation of regions.

			Species legal size catch within region (kg)			% total of ESA AD	% total of WTFA	Estimated Dest G catch (kg)	
Region	Fishers	Records	Shortfin	Longfin	Total			Shortfin	Longfin
WTFA excl. Waipa R.	8	1 654	130 432	37 847	168 279	68.8	93.3	20	4 712
WTFA Waipa R.	5	77	4 482	7 536	12 018	4.9	6.7	0	1 670
Above Karapiro Dam	5	385	44 632	5 469	50 101	20.5	NA	0	462
Total WTFA	9	1 731	134 914	45 383	180 297	73.7	100	20	6 382
Total WTFA plus above Karapiro Dam		2 116	179 546	50 852	230 398	94.7	NA	20	6 844

Table 6: Percent of groomed estimated catch of legal sized eels by species within the Waikato Tainui Fisheries Area (WTFA) regions, and above Karapiro Dam (outside WTFA), and among regions from combined years 2020 to 2024 for method fyke net. Excl., excluding; R., river. See Figure 6 for spatial representation of regions.

	Percent species within regions			Percent species among WTFA regions	
Region	Shortfin	Longfin	Total	Shortfin	Longfin
WTFA excl. Waipa R.	77.5	22.5	100.0	96.7	83.4
WTFA Waipa R.	37.3	62.7	100.0	3.3	16.6
Above Karapiro Dam	89.1	10.9	100.0	NA	NA
Total WTFA	74.8	25.2	100.0	100	100
Total WTFA plus above Karapiro Dam	77.9	22.1	100	NA	NA

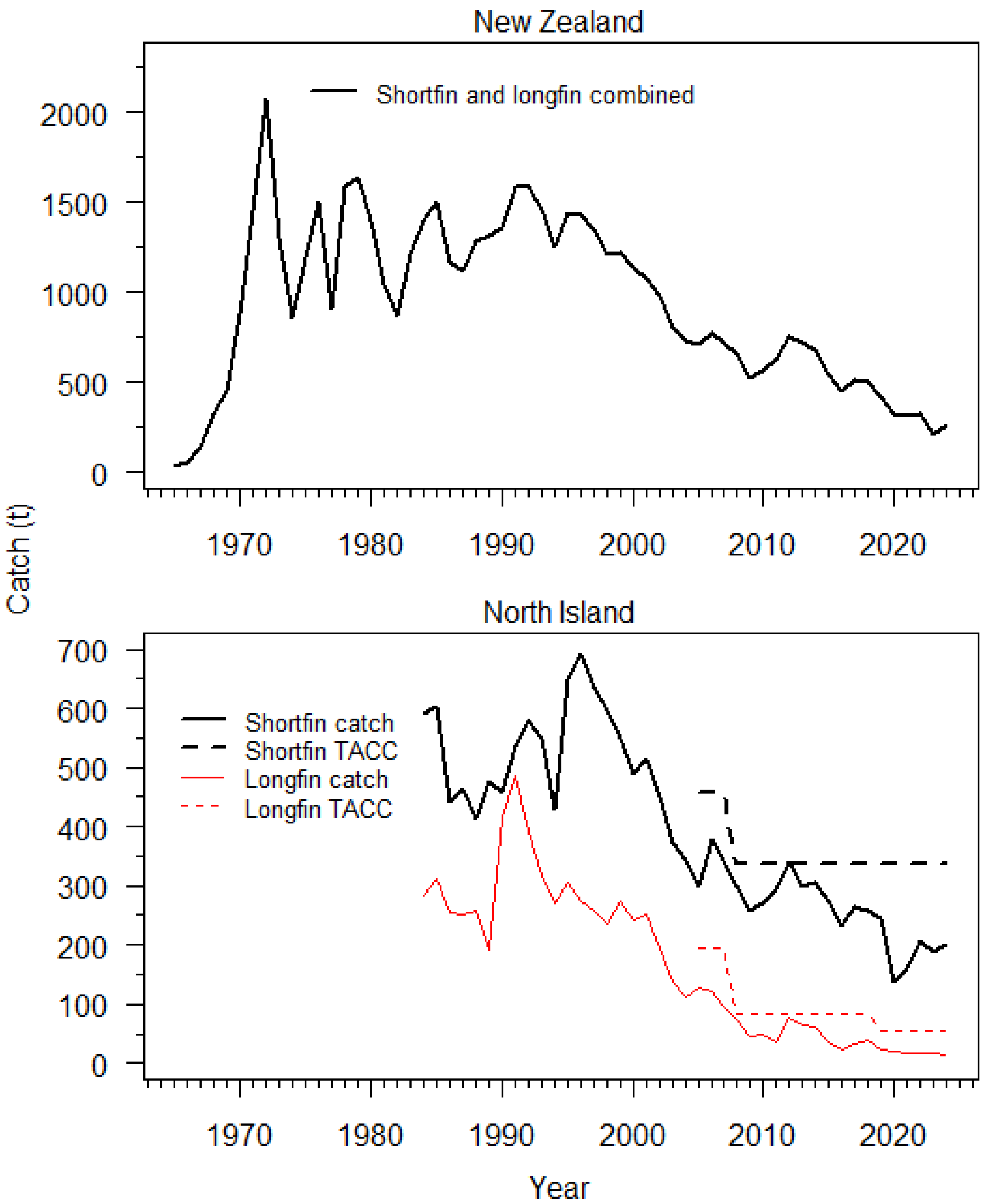


Figure 1: Landed catches of shortfin and longfin eels, and Total Allowable Commercial Catch (TACC) for each species up to 2023–24. Data are shown by calendar year up until 1988 and by fishing year from 1988–99 onward (Data from Fisheries New Zealand 2026). These catches are based on MAF Fisheries Statistics Unit (FSU), Licensed Fish Receiver Returns (LFRR), Quota Management Reports (QMR), and Monthly Harvest Returns (MHR).

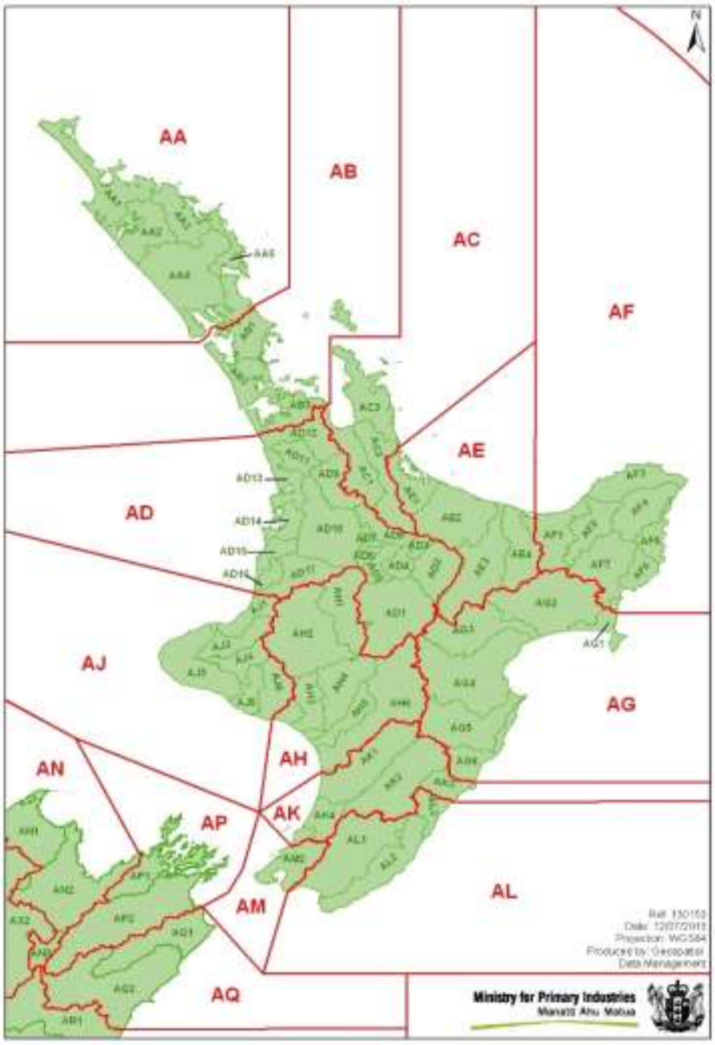


Figure 2: North Island Eel Statistical Areas (ESAs) and subareas. See Table 1 for old ESA numeric codes 13 to 23.

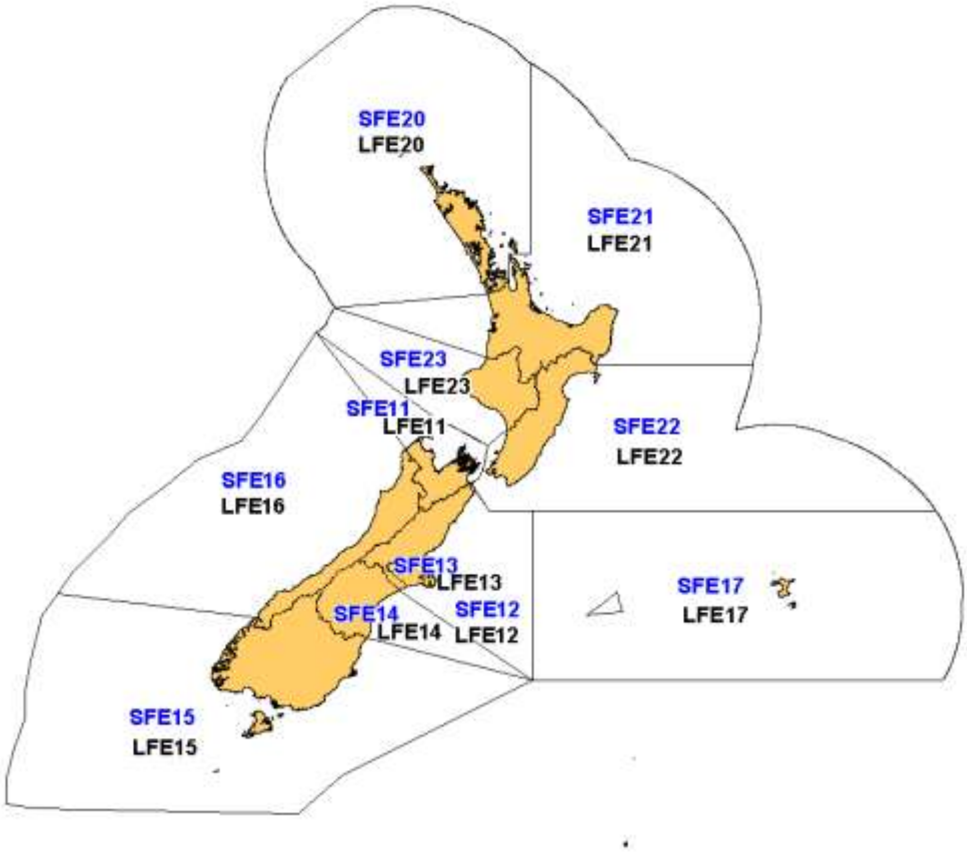


Figure 3: Quota Management Areas for the New Zealand eel fishery (see Table 1 for breakdown by Eel Statistical Areas). Shortfin stocks are denoted by the prefix SFE, and longfin by LFE. Before 2016–17, TACCs were set for South Island shortfin and longfin combined under QMAs ANG 11–16. (Figure from Fisheries New Zealand 2026).

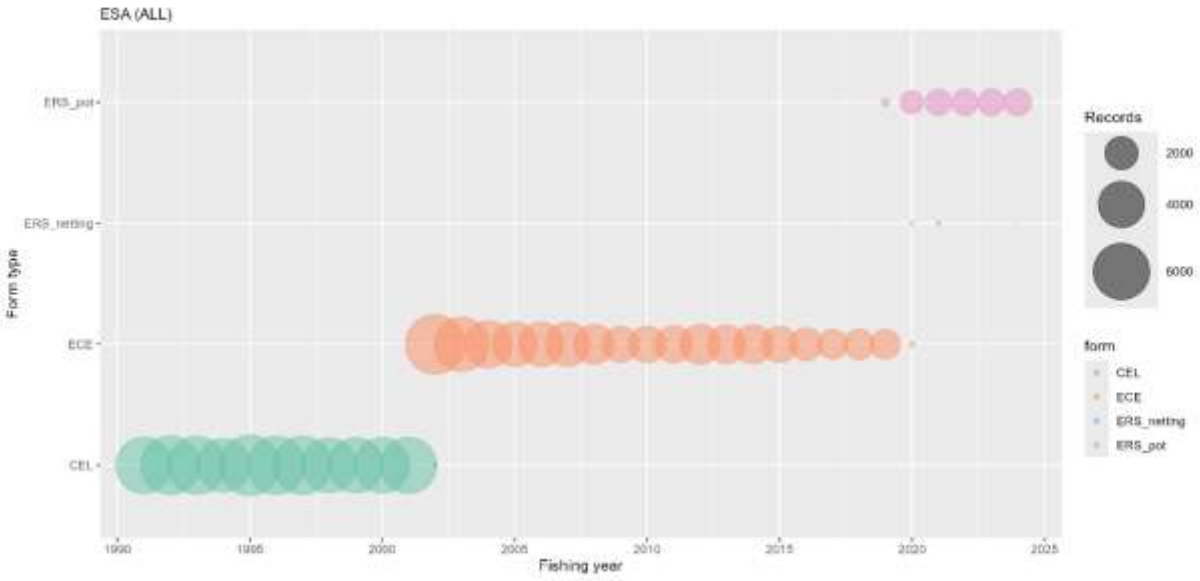


Figure 4: North Island groomed records by form type used in the commercial eel fishery from 1991 to 2024. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year. ERS, electronic reporting system; ECE, eel catch effort landing return; CEL, catch effort landing return.

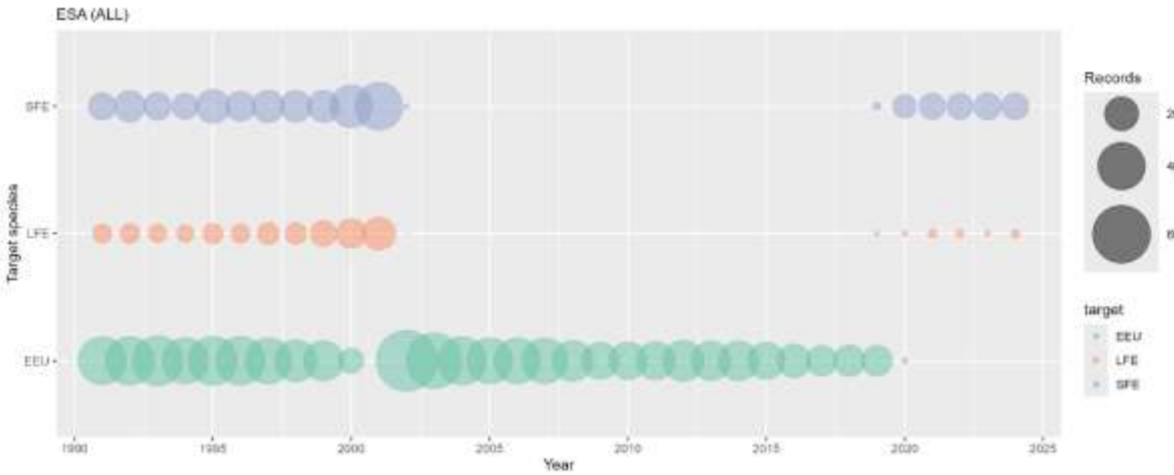


Figure 5: North Island groomed records by target species used in the commercial eel fishery from 1991 to 2024. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year. EEU, unidentified eels; LFE, longfin eel; SFE, shortfin eel.

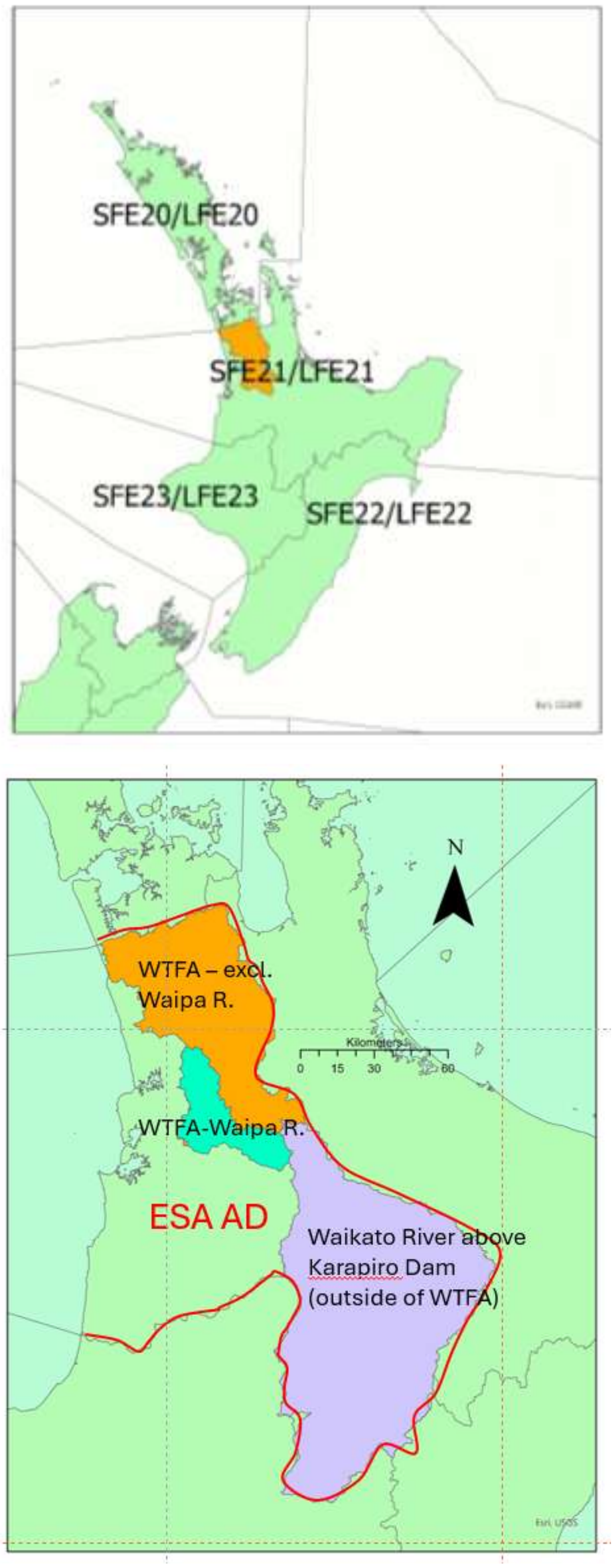


Figure 6: Top panel: Waikato Tainui Fisheries Area (WTFA) shown in orange, as well as eel QMAs. Bottom panel: WTFA area split between the Waikato River catchment (orange) and Waipa River catchment (green), as well as the Waikato catchment above Karapiro Dam (purple), outside the WTFA. The red line is the approximate boundary of ESA AD (Waikato).

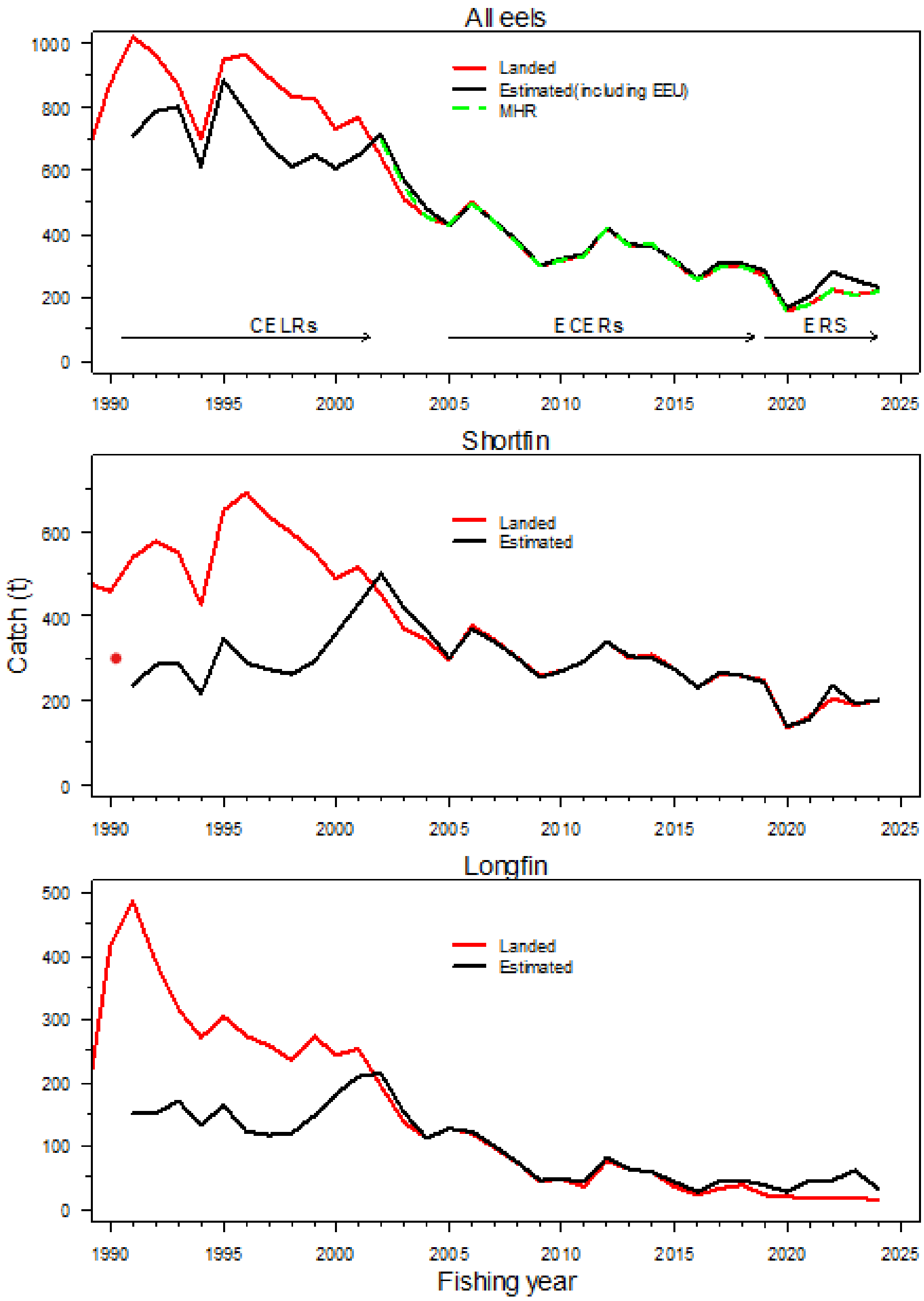


Figure 7: North Island groomed estimated commercial catch of all eels (top), shortfin (middle), and longfin (bottom) from 1991 to 2024, and landed catch from 1990 to 2024. Estimated catches are from CELR, ECER, ERS. The landed catches are from processors, and LFRR/QMR and, after 2001, from ECLRs and the ERS (Fisheries New Zealand 2026). Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year. EEU, unidentified eel catch; CELR, catch effort landing return; ECER, eel catch effort return; ERS, electronic reporting system; MHR, monthly harvest return.

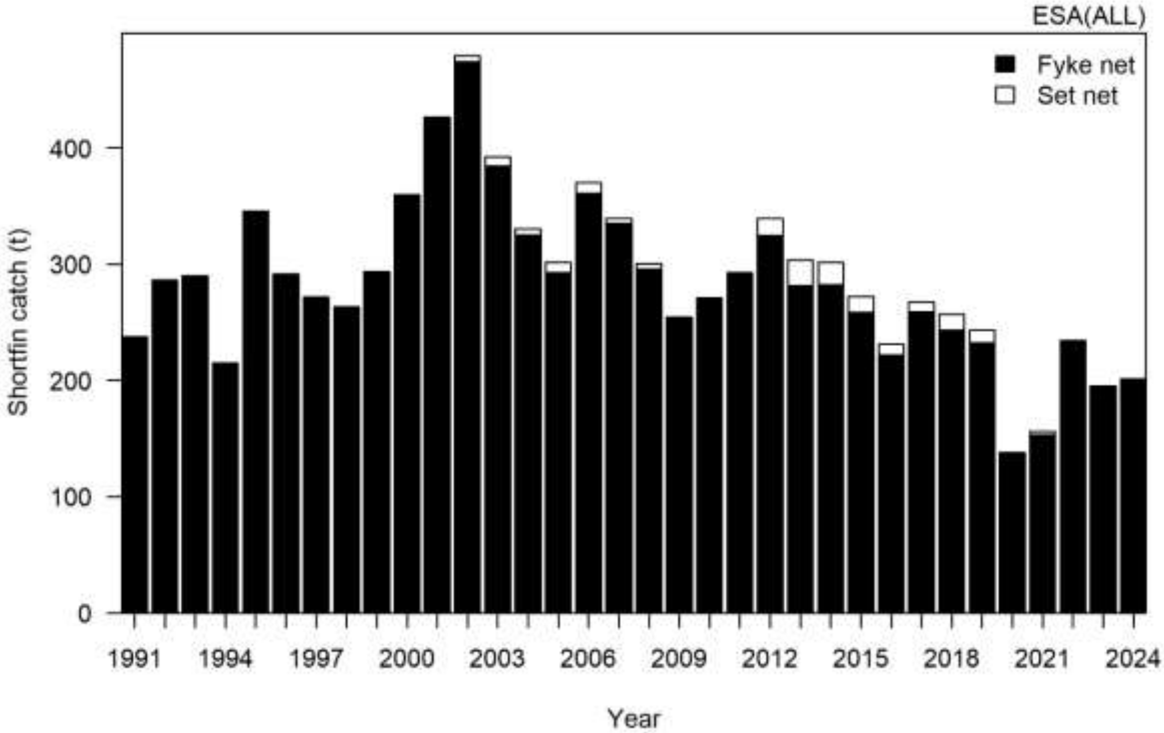


Figure 8: North Island groomed estimated commercial catch of shortfin by method for the years 1990–91 to 2023–24. All set net catch was mostly from ESAs AC, AD, and AL. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year. There was no catch of longfin by method set net.

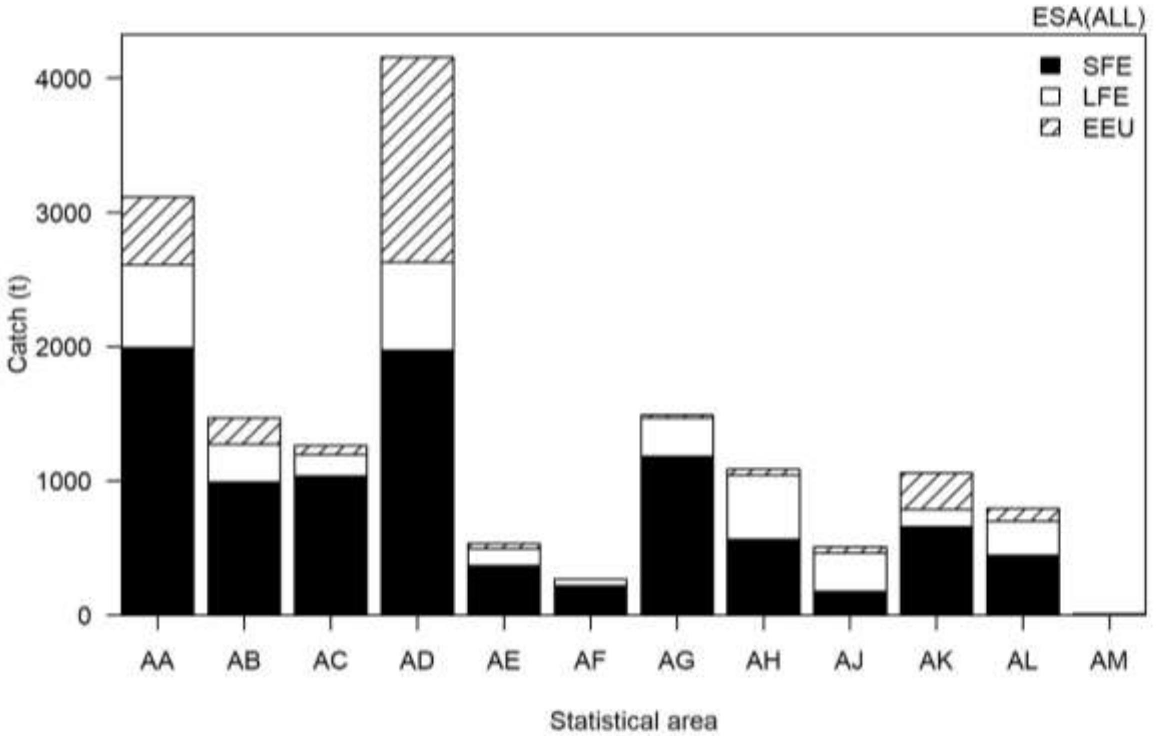


Figure 9: North Island groomed estimated commercial catch of legal sized shortfin (SFE), longfin (LFE), and unidentified eel catch (EEU) by statistical area for the combined years 1990–91 to 2023–24 for method fyke net. See Figure 2 for spatial representation of ESAs.

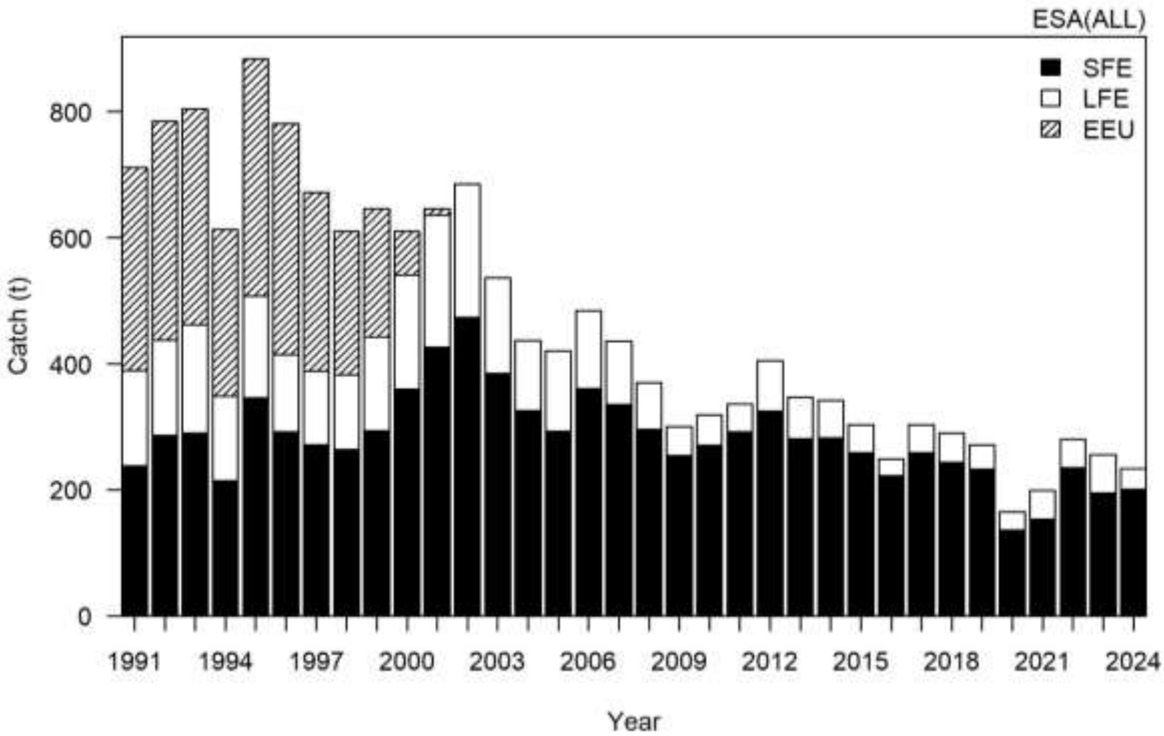


Figure 10: North Island groomed estimated commercial catch of legal sized shortfin (SFE), longfin (LFE), and unidentified eel catch (EEU) for the years 1990–91 to 2023–24 for method fyke net. Dates shown represent the end of the fishing year i.e., 1991 = 1990–91 fishing year.

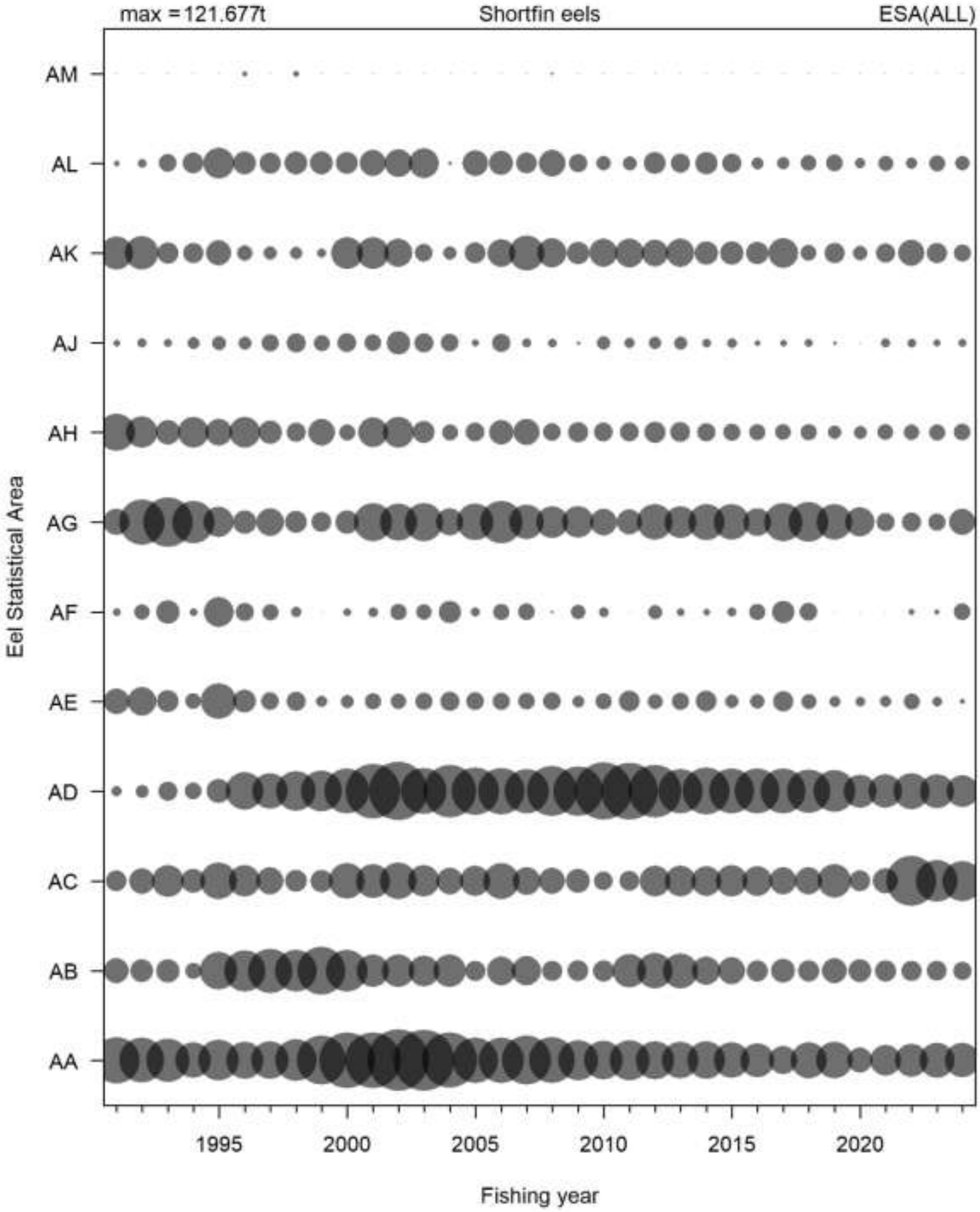


Figure 11: North Island groomed estimated commercial catch of legal sized shortfin for the years 1990–91 to 2023–24 for method fyke net. Dates shown represent the end of the fishing year i.e., 1991 = 1990–91 fishing year. See Figure 2 for spatial representation of ESAs.

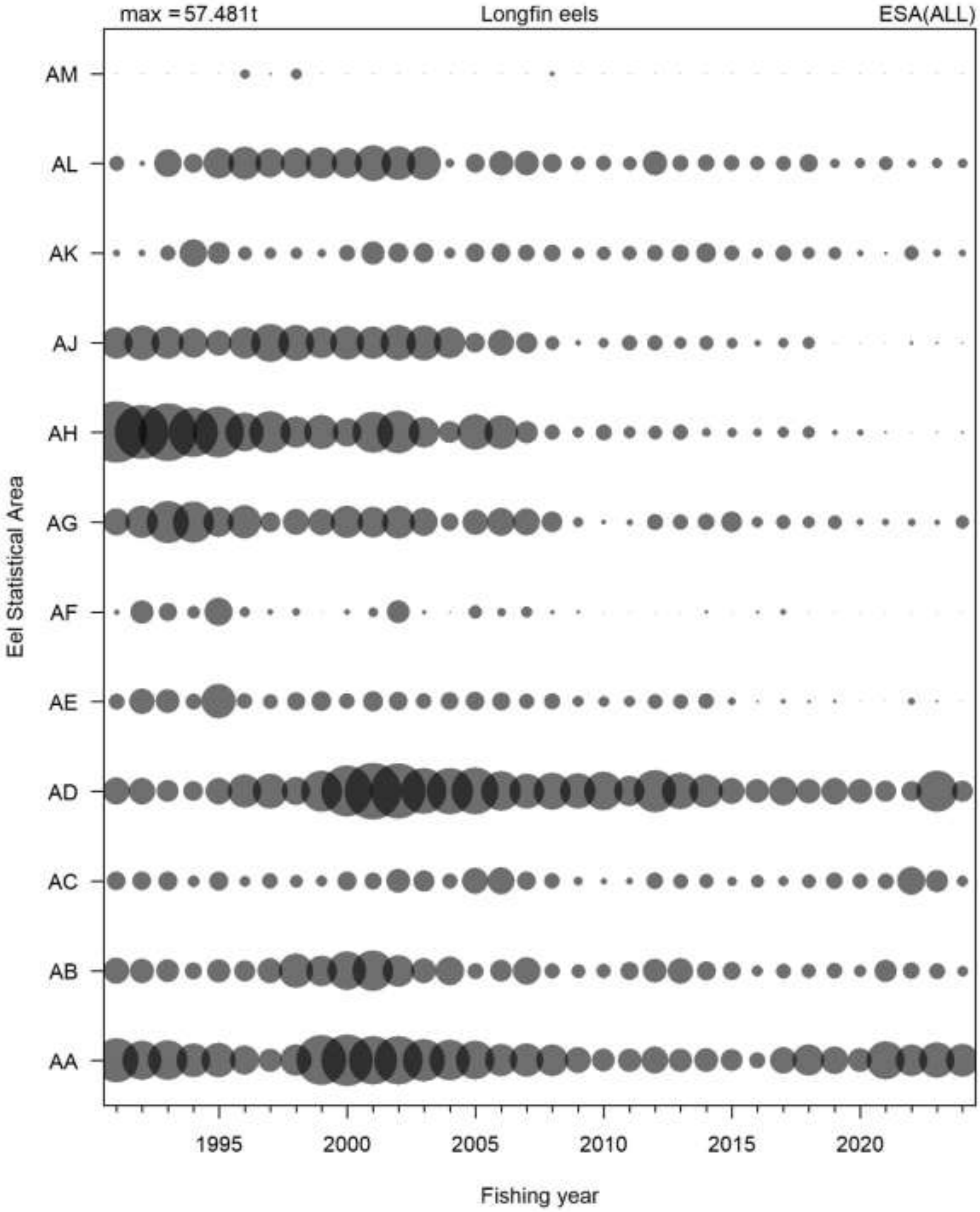


Figure 12: North Island groomed estimated commercial catch of legal sized longfin for the years 1990–91 to 2023–24 for method fyke net. Dates shown represent the end of the fishing year i.e., 1991 = 1990–91 fishing year. See Figure 2 for spatial representation of ESAs.

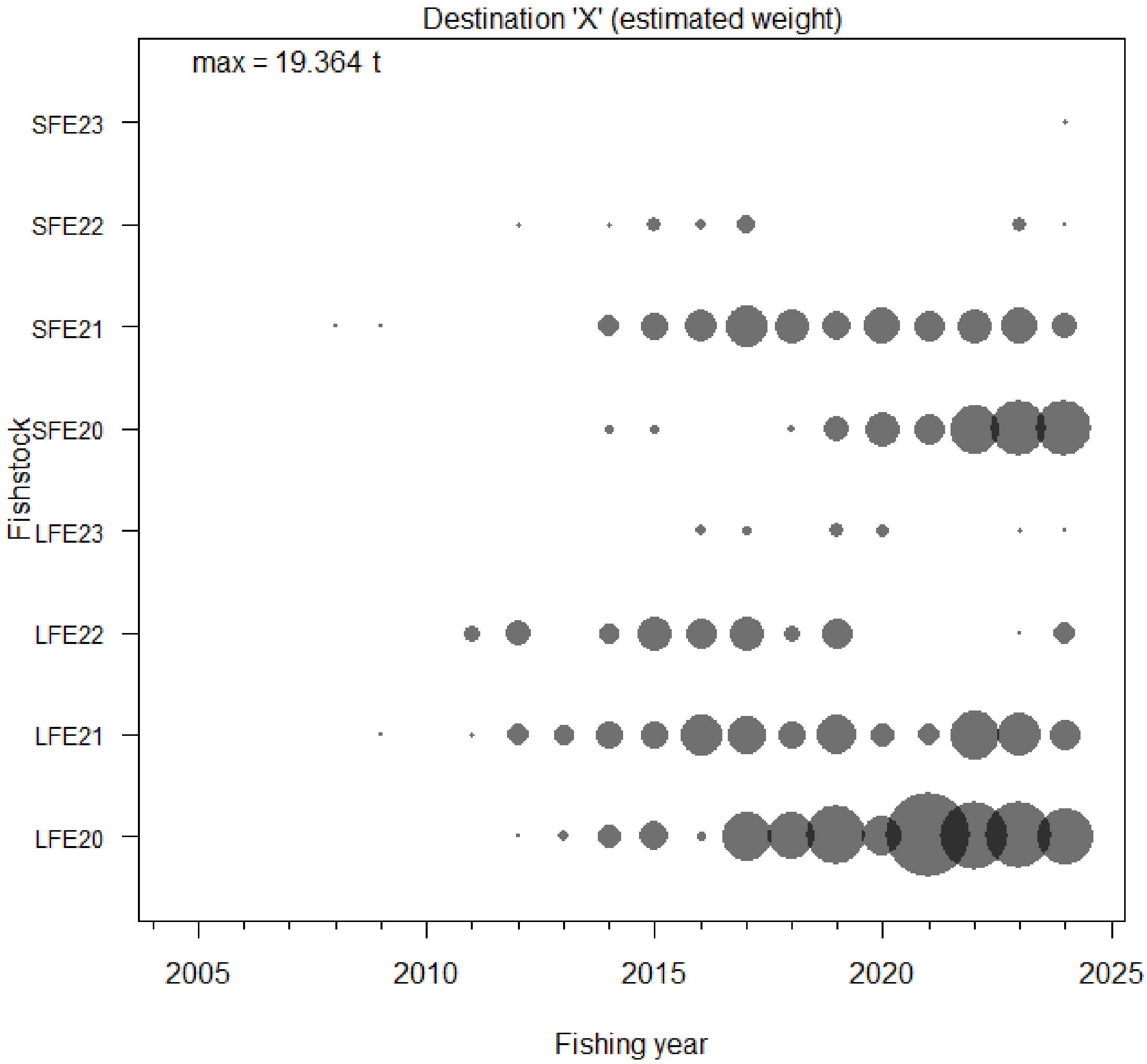
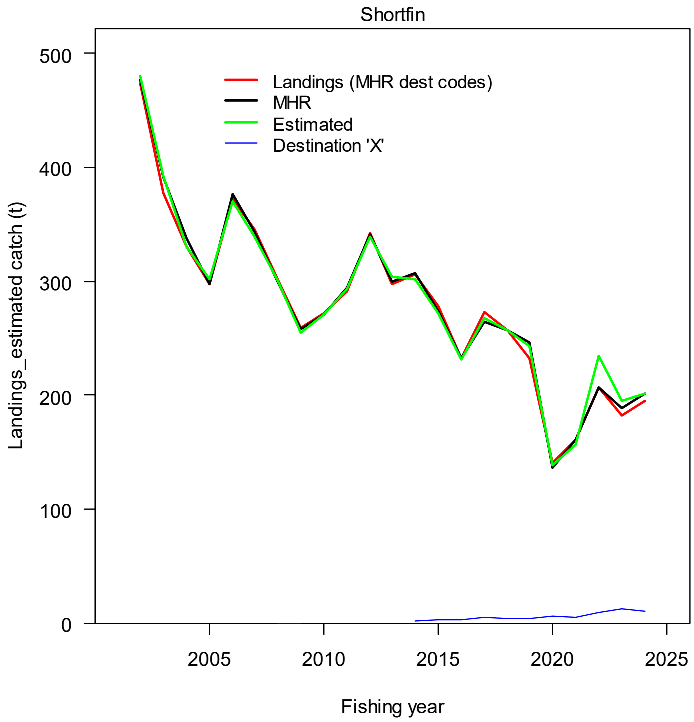


Figure 13: North Island commercial catch of shortfin and longfin by fishstock for the fishing years 2001 to 2024 recorded in ECLRs and the ERS under destination 'X'. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year.

Figure 14: North Island commercial landings and catch reported as destination 'X' for shortfin (top panel) and longfin (bottom panel) for the fishing years 2001 to 2024. Data are from ECLRs and ERS disposal reports. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year.



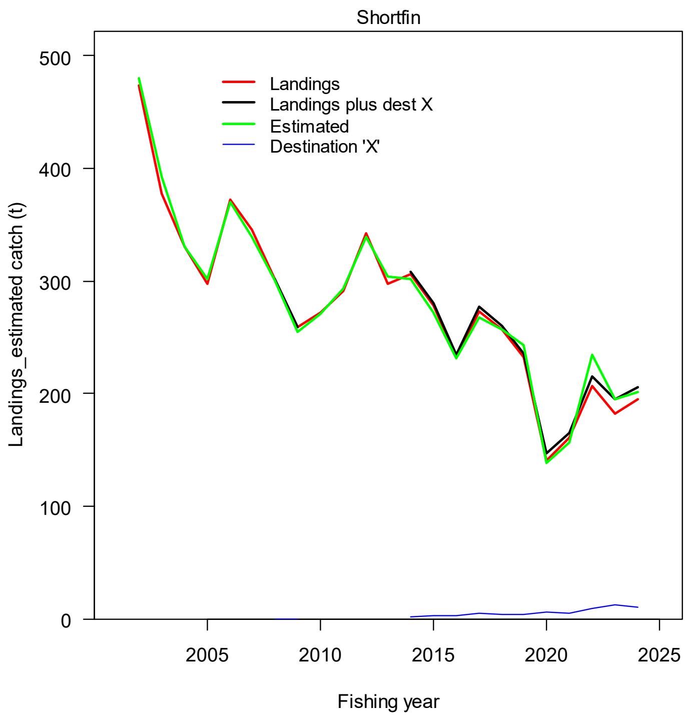
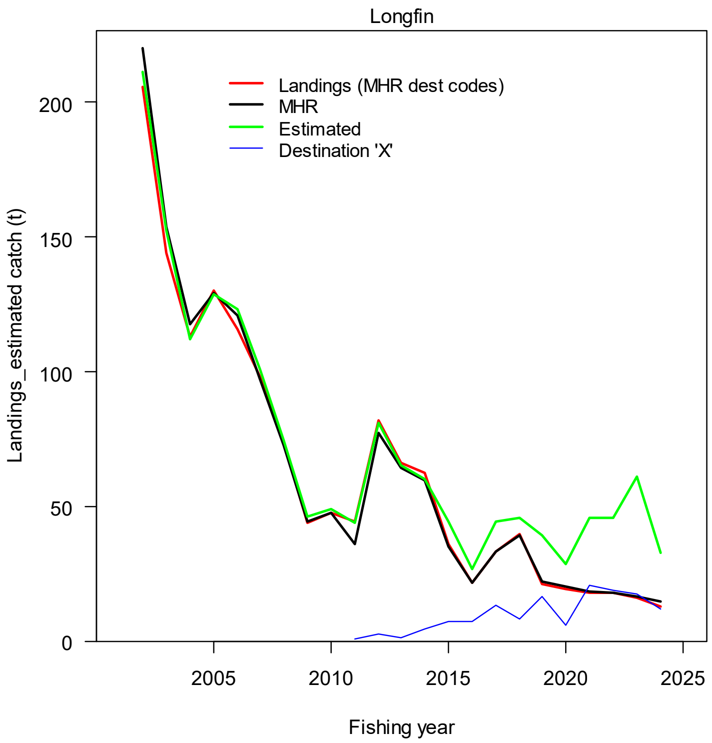


Figure 15: North Island commercial landings, monthly harvest return reported catch (MHR), estimated catch (legal size), and destination 'X' released catch, of shortfin for fishing years 2002 to 2024. (top panel). The bottom panel plots the same data except MHR, and a new plot of landed catch that includes destination 'X' catch. Data are from ECLRs, MHRs, ECERs, and the ERS. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year. MHR dest codes are the disposal codes used by Fisheries New Zealand for which the catches are summed to determine the landings.



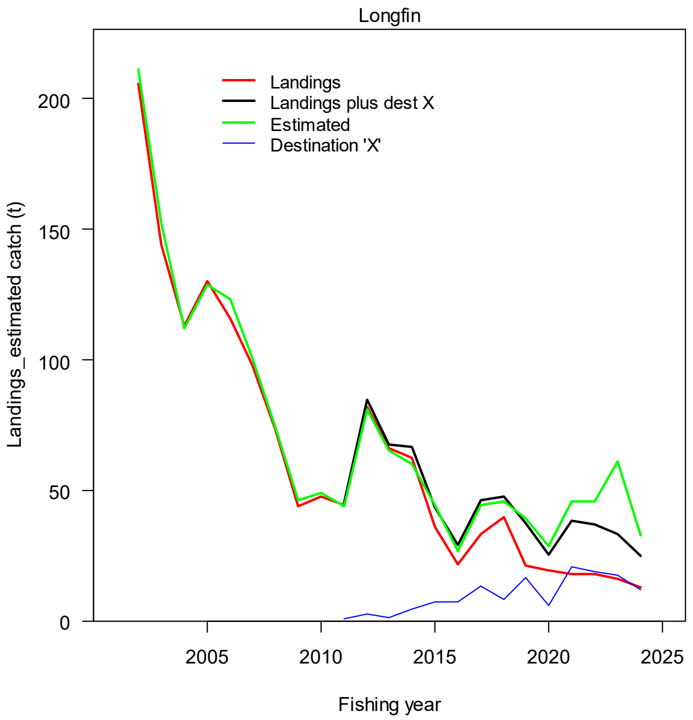


Figure 16: North Island commercial landings, monthly harvest return reported catch (MHR), estimated catch (legal size), and destination 'X' released catch, of longfin for fishing years 2002 to 2024. (top panel). The bottom panel plots the same data except MHR, and a new plot of landed catch that includes destination 'X' catch. Data are from ECLRs, MHRs, ECERs, and the ERS. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year. MHR dest codes are the disposal codes used by Fisheries New Zealand for which the catches are summed to determine the landings.

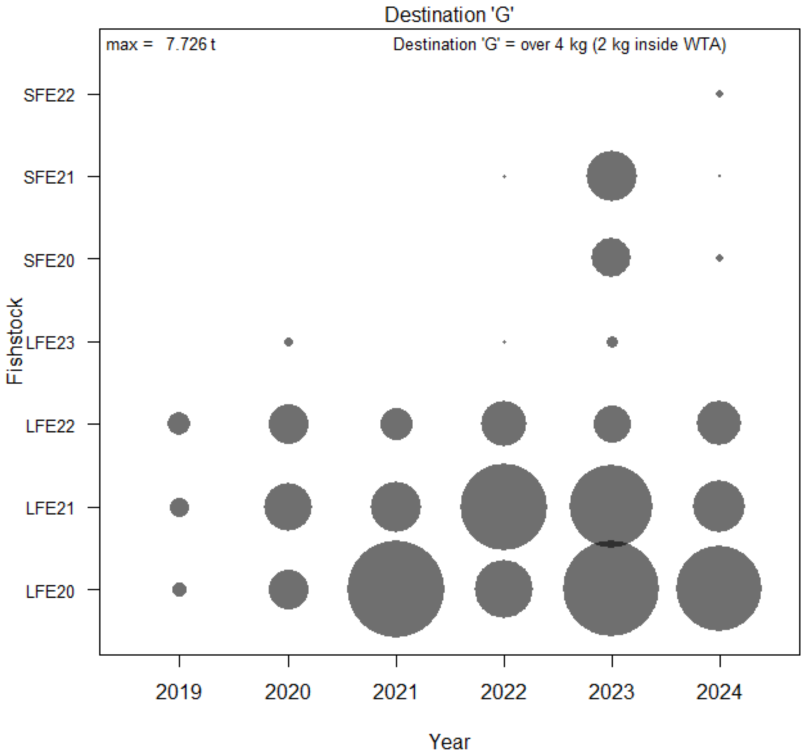


Figure 17: North Island commercial catch of shortfin and longfin by fishstock for the fishing years 2019 to 2024 recorded in the ERS under destination 'G'. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year.

Figure 18: North Island commercial landings of shortfin (top panel) and longfin (bottom panel) for the fishing years 2005 to 2024 and catch reported as destination ‘G’ from mid-2019 to 2024. Data are from ECLRs and ERS disposal reports. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year.

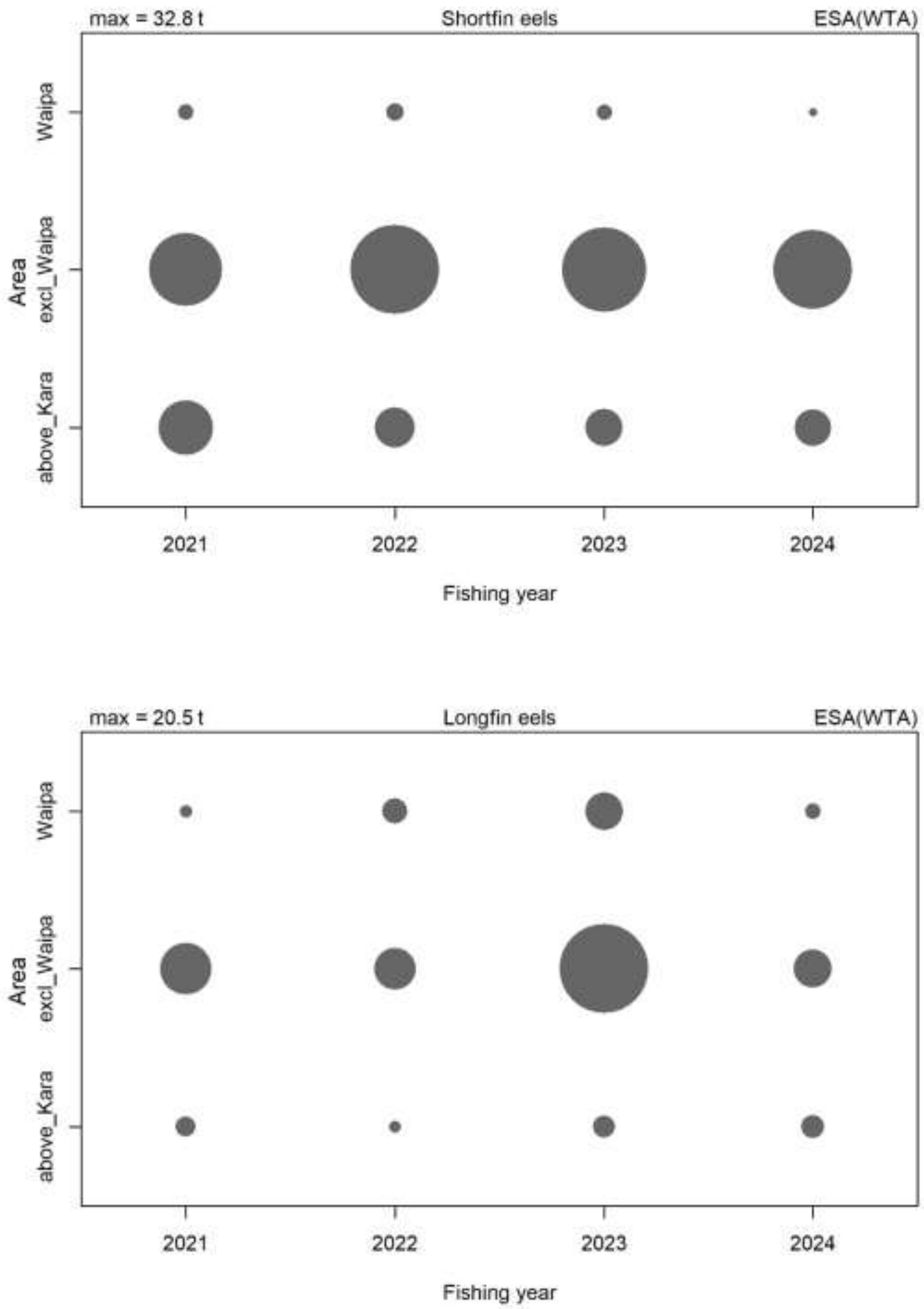


Figure 19: Waikato Tainui Fisheries Area (WTFA) regions, and above Karapiro Dam groomed estimated legal size eel catch for shortfin (top panel), longfin (bottom panel) from 2020 to 2024, for method fyke net. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year. See Figure 2 for spatial representation of regions. Kara, Karapiro Dam; Waipa, Waipa River.

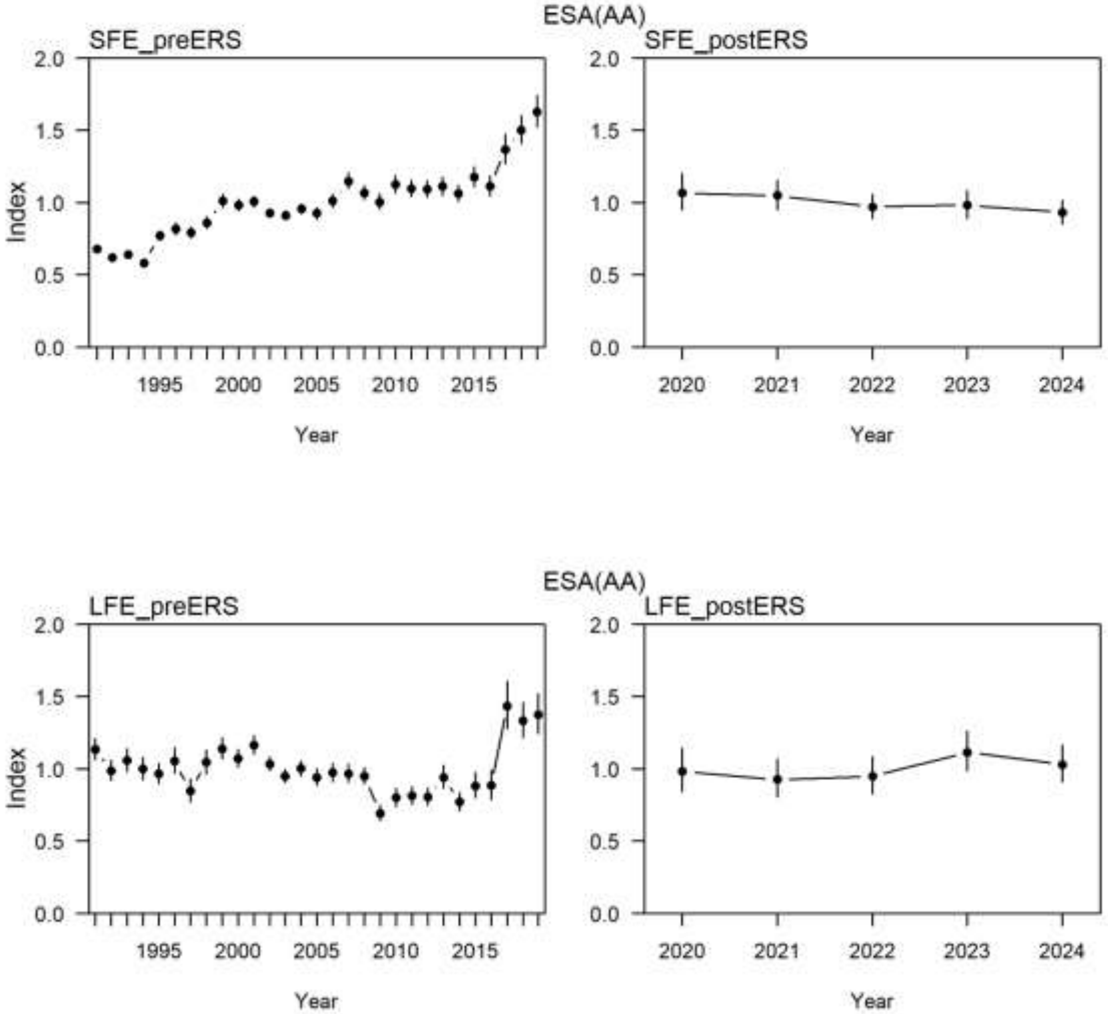


Figure 20: Standardised CPUE indices for shortfin (SFE) and longfin (LFE) eels for the years 1991–2019 (pre-ERS) and 2020–2024 (post-ERS) for North Island ESAs AA to AD. Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year. ERS, electronic reporting system.

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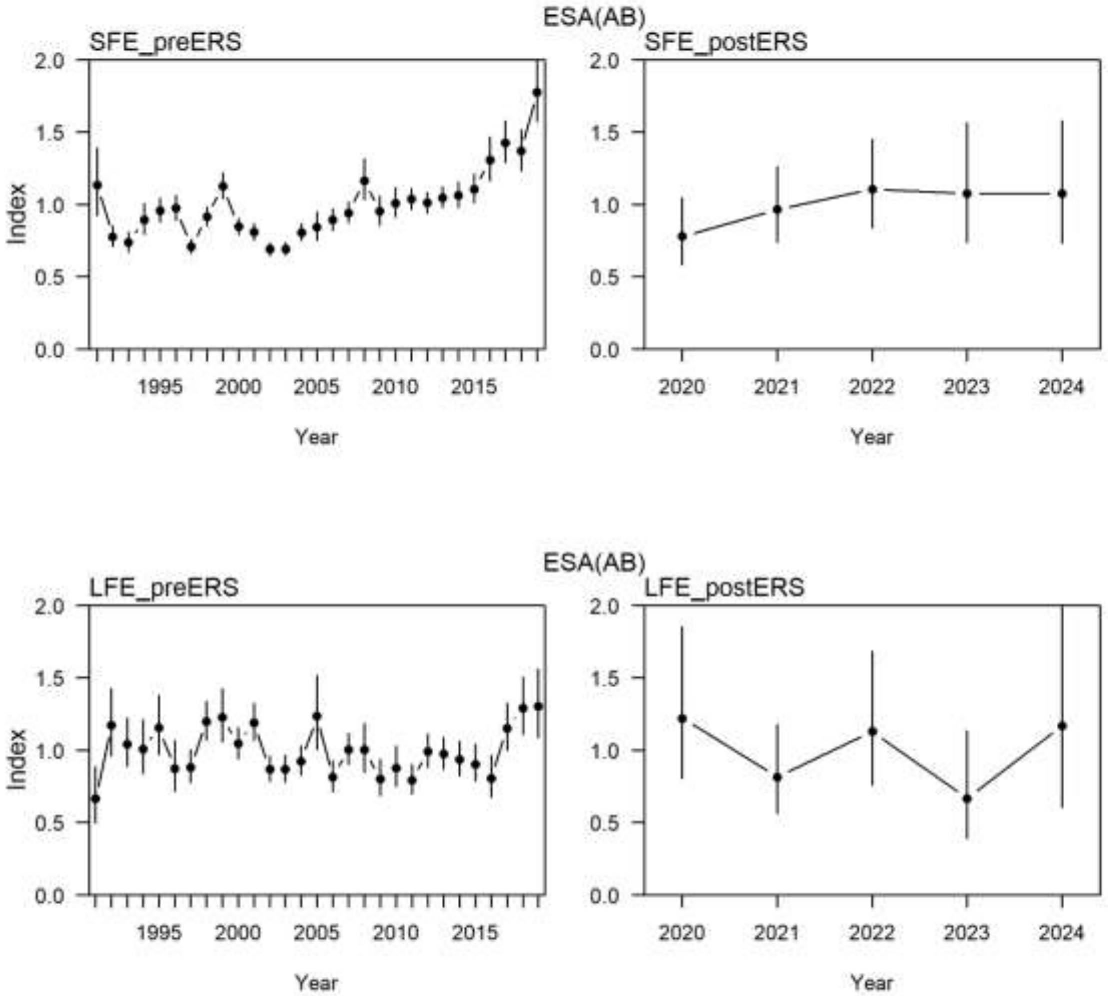

Figure 20 [Continued]

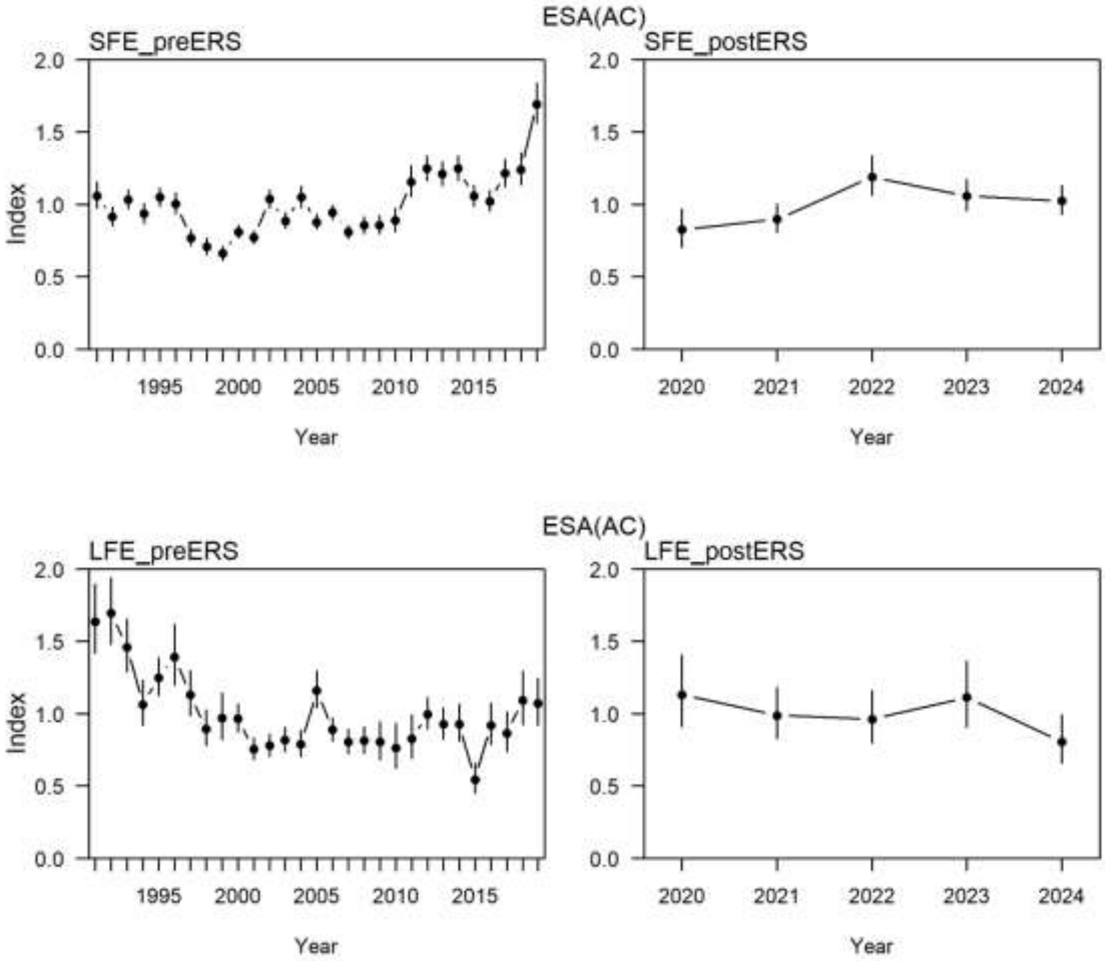

Figure 20 [Continued]

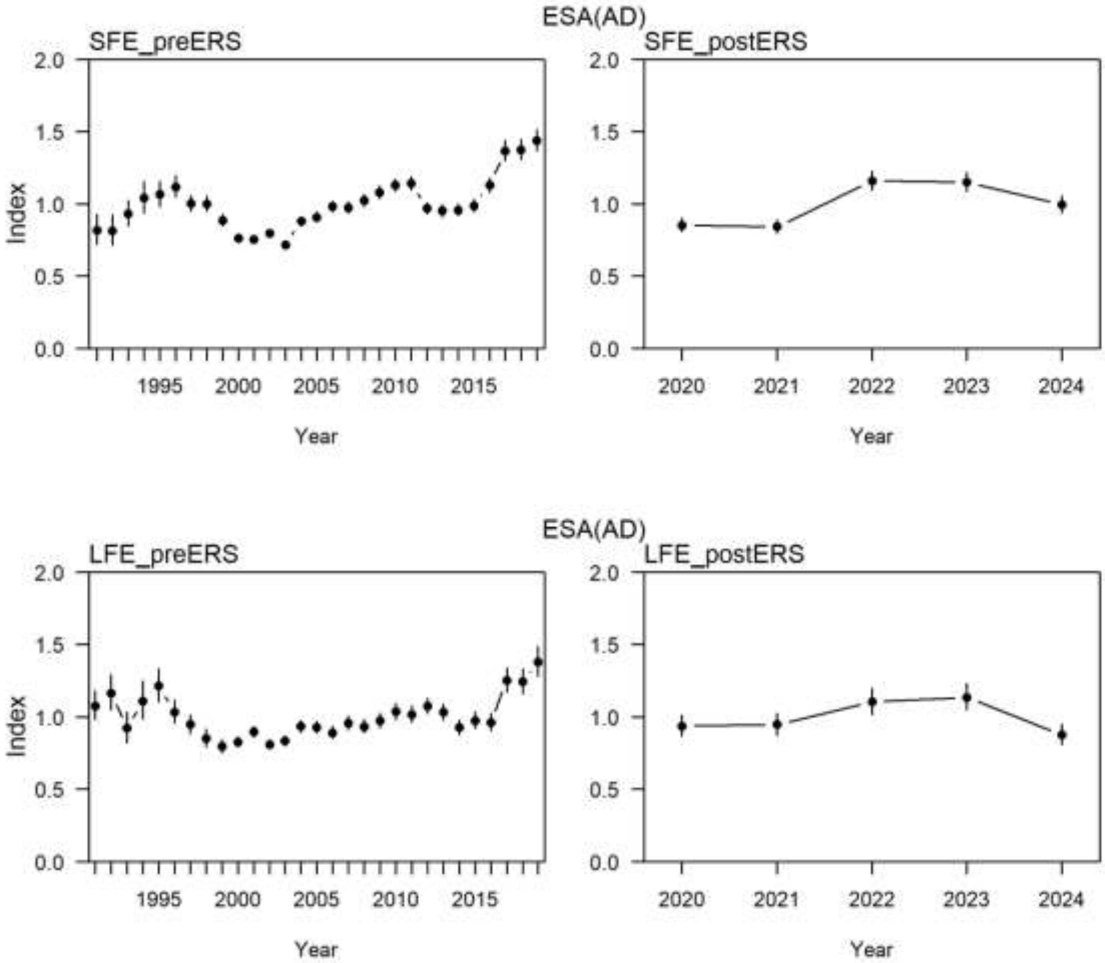

Figure 20 [Continued]

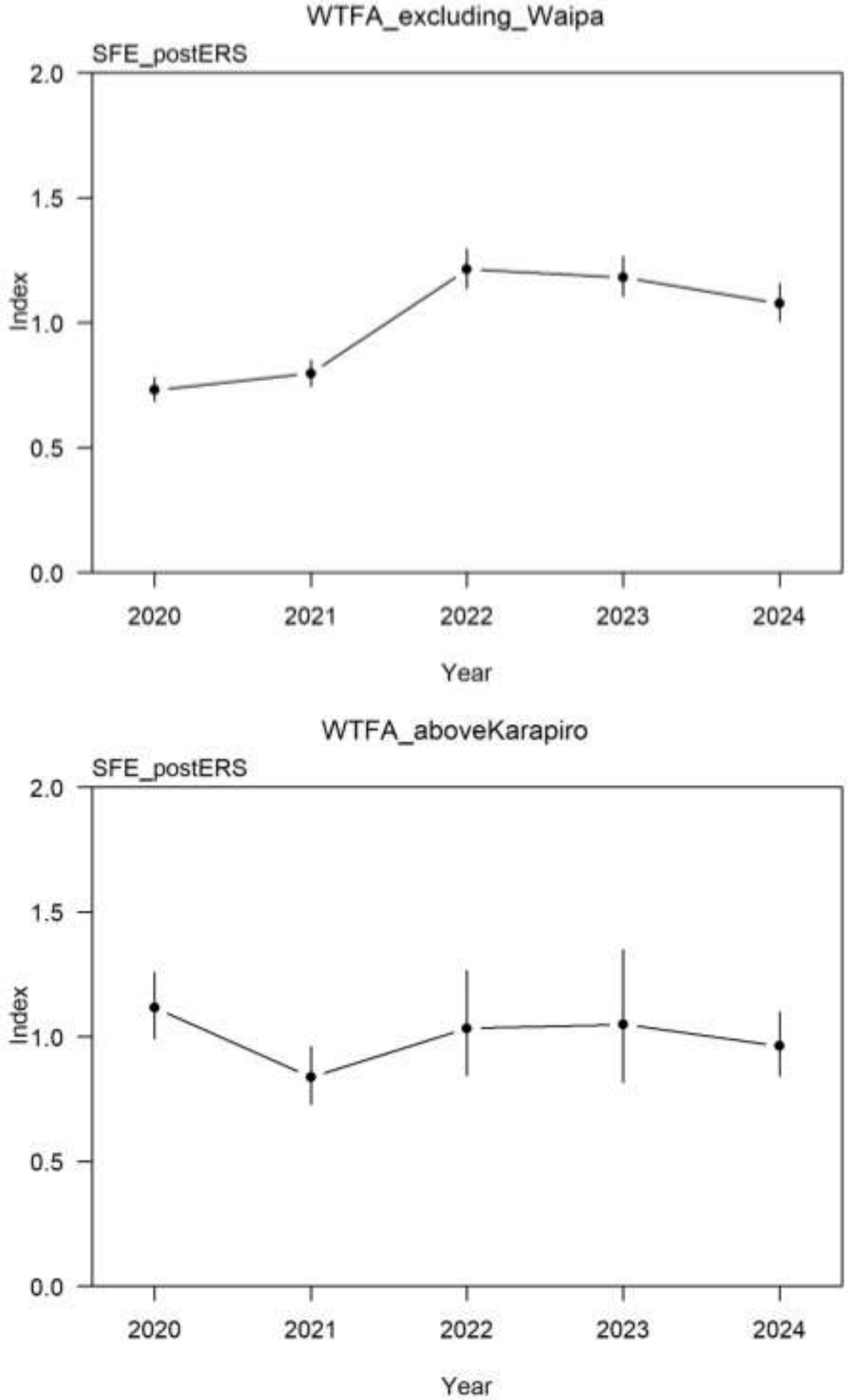

Figure 21: Shortfin standardised CPUE indices for the years 2020–2024 (post-ERS), for WTFA excluding Waipa River, and above Karapiro Dam (outside WTFA). Dates shown represent the end of the fishing year, i.e., 2020 = 2019–20 fishing year. ERS, electronic reporting system; WTFA, Waikato Tainui Fisheries Area.

APPENDIX 1

Daily river flow data used in the standardised CPUE analyses for ESAs AA, AB, AC and AD.

ESA	River	Site/Location	Source
AA	Manganui River	46651, Permanent Station	Northland Regional Council
	Wairoa River	8516 Tourist Rd	Auckland Regional Council
	Wairua River	46647	Northland Regional Council
AB	Hoteo River	45703, Gubbs	Auckland Regional Council
AC	Piako River	9175, Kiwitahi	Environment Waikato
	Waihou River	9205 Te Aroha	Environment Waikato
AD and WTFA	Waikato River	43402, Ngaruawahia C/W	Environment Waikato
	Waipa River	43433 Whatawhata	Environment Waikato

APPENDIX 2

Predictor variables, degrees of freedom, and R^2 values from GLM stepwise regression analysis for CPUE analyses by area for shortfin and longfin eels, for pre-ERS (legal sized eels) and post-ERS (legal size plus destination G) periods. Variables are shown in order of acceptance by the model with associated cumulative R^2 value. Only variables entered into the model are shown. ESA, eel statistical area.

Northland (ESA AA)

Shortfin pre-ERS			Shortfin post-ERS		
Predictors	DF	R^2	Predictors	DF	R^2
fish.year	28	0.05	fish.year	4	0.01
target_est	2	0.28	lifts	3	0.51
permit	25	0.41	propLFE	1	0.54
lifts	3	0.49	permit	4	0.56
			month	11	0.57
			Wairoa flow	3	0.58
			moon.phase	3	0.58

Longfin pre-ERS			Longfin post-ERS		
Predictors	DF	R^2	Predictors	DF	R^2
fish.year	28	0.13	fish.year	4	0.01
target_est	2	0.56	propSFE	1	0.58
permit	19	0.60	lifts	3	0.75
lifts	3	0.63	Wairua flow	3	0.77
			permit	2	0.78

Auckland ESA AB

Shortfin pre-ERS			Shortfin post-ERS		
Predictors	DF	R^2	Predictors	DF	R^2
fish.year	28	0.08	fish.year	4	0.08
permit	15	0.42	lifts	3	0.59
target_est	2	0.55	propLFE	1	0.62
lifts	3	0.63	month	11	0.64
			subarea	2	0.66
			Hoteo flow	3	0.68
			moon.phase	3	0.68

Longfin pre-ERS			Longfin post-ERS		
Predictors	DF	R^2	Predictors	DF	R^2
fish.year	28	0.14	fish.year	4	0.11
target_est	2	0.58	propSFE	1	0.61
permit	14	0.65	lifts	3	0.72
lifts	3	0.68	month	11	0.78
			permit	2	0.81
			subarea	2	0.82
			moon.phase	3	0.83
			Hoteo flow	3	0.84

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Hauraki (ESA AC)

Shortfin pre-ERS		
Predictors	DF	R^2
fish.year	28	0.05
lifts	3	0.18
target_est	2	0.31
permit	14	0.37
month	11	0.38
Waihou_flow	3	0.39

Shortfin post-ERS		
Predictors	DF	R^2
fish.year	4	0.03
lifts	3	0.25
permit	7	0.40
propLFE	1	0.43
month	11	0.45

Longfin pre-ERS		
Predictors	DF	R^2
fish.year	28	0.15
target_est	2	0.48
lifts	3	0.54
permit	10	0.57

Longfin post-ERS		
Predictors	DF	R^2
fish.year	4	0.11
permit	5	0.53
propSFE	1	0.68
lifts	3	0.77
month	11	0.78
Waihou flow	3	0.79

Waikato (ESA AD)

Shortfin pre-ERS		
Predictors	DF	R^2
fish.year	28	0.08
permit	26	0.34
target_est	2	0.47
lifts	3	0.49
month	11	0.50
Waipa flow	3	0.51

Shortfin post-ERS		
Predictors	DF	R^2
fish.year	4	0.05
permit	4	0.32
propLFE	1	0.42
lifts	3	0.44
month	11	0.47
subarea	11	0.48

Longfin pre-ERS		
Predictors	DF	R^2
fish.year	28	0.08
target_est	2	0.45
permit	25	0.63
lifts	3	0.64
month	11	0.65

Longfin post-ERS		
Predictors	DF	R^2
fish.year	4	0.02
propSFE	1	0.58
permit	4	0.64
month	11	0.66
subarea	11	0.68
lifts		

WTFA (exclude Waipa River)

Shortfin post-ERS		
Predictors	Df	R.squared
fish.year	4	0.08
permit	2	0.34
lifts	3	0.36
month	11	0.38
moon.phase	3	0.39

Outside WTFA (above Karapiro Dam)

Shortfin post-ERS		
Predictors	Df	R.squared
fish.year	4	0.06
subarea	6	0.27
lifts	3	0.40
month	11	0.51
moon.phase	3	0.53
permit	3	0.55
Waikato_flow	3	0.56
Waipa_flow	3	0.57

APPENDIX 3

CPUE indices by area for shortfin and longfin for pre-ERS (legal sized eels) and post-ERS (legal size plus destination G) periods for ESAs AA to AD. CI, 95% confidence intervals; s.e., standard error; CV, coefficient of variation; Dates shown represent the end of the fishing year, i.e., 1991 = 1990–91 fishing year. ERS, electronic reporting system.

Northland (ESA AA)

SFE pre-ERS

Year	Index	Lower	Upper	s.e.	CV
1991	0.70	0.67	0.73	0.02	0.02
1992	0.64	0.61	0.66	0.02	0.02
1993	0.66	0.63	0.69	0.02	0.02
1994	0.60	0.57	0.63	0.02	0.02
1995	0.79	0.76	0.83	0.02	0.02
1996	0.84	0.80	0.88	0.02	0.02
1997	0.81	0.78	0.86	0.02	0.02
1998	0.89	0.85	0.93	0.02	0.02
1999	1.04	0.99	1.09	0.02	0.02
2000	1.01	0.97	1.05	0.02	0.02
2001	1.03	1.00	1.07	0.02	0.02
2002	0.95	0.92	0.98	0.02	0.02
2003	0.94	0.91	0.97	0.02	0.02
2004	0.98	0.95	1.02	0.02	0.02
2005	0.95	0.91	0.99	0.02	0.02
2006	1.04	0.99	1.09	0.02	0.02
2007	1.18	1.13	1.24	0.02	0.02
2008	1.10	1.05	1.15	0.02	0.02
2009	1.03	0.98	1.09	0.03	0.03
2010	1.16	1.10	1.22	0.03	0.03
2011	1.13	1.07	1.19	0.03	0.03
2012	1.12	1.07	1.18	0.03	0.03
2013	1.14	1.08	1.21	0.03	0.03
2014	1.09	1.04	1.15	0.03	0.03
2015	1.21	1.14	1.28	0.03	0.03
2016	1.14	1.08	1.22	0.03	0.03
2017	1.41	1.30	1.52	0.04	0.04
2018	1.55	1.45	1.65	0.03	0.03
2019	1.67	1.57	1.79	0.03	0.03

SFE post-ERS

Year	Index	Lower	Upper	s.e.	CV
2020	1.07	0.95	1.20	0.06	0.06
2021	1.05	0.95	1.16	0.05	0.05
2022	0.97	0.89	1.06	0.04	0.04
2023	0.98	0.89	1.09	0.05	0.05
2024	0.93	0.85	1.02	0.04	0.04

Northland (ESA AA)

LFE pre-ERS

Year	Index	Lower	Upper	s.e.	CV
1991	1.15	1.08	1.23	0.03	0.03
1992	1.00	0.93	1.07	0.03	0.03
1993	1.07	1.00	1.15	0.04	0.04
1994	1.01	0.94	1.09	0.04	0.04
1995	0.98	0.91	1.05	0.04	0.04
1996	1.07	0.98	1.16	0.04	0.04
1997	0.86	0.78	0.95	0.05	0.05
1998	1.06	0.98	1.15	0.04	0.04
1999	1.16	1.09	1.23	0.03	0.03
2000	1.09	1.02	1.15	0.03	0.03
2001	1.18	1.12	1.25	0.03	0.03
2002	1.05	1.00	1.10	0.02	0.02
2003	0.96	0.92	1.01	0.02	0.02
2004	1.02	0.96	1.07	0.03	0.03
2005	0.95	0.90	1.01	0.03	0.03
2006	0.99	0.92	1.05	0.03	0.03

LFE post-ERS

Year	Index	Lower	Upper	Year	Index
2020	0.98	0.84	1.15	0.08	0.08
2021	0.93	0.80	1.07	0.07	0.07
2022	0.95	0.83	1.09	0.07	0.07
2023	1.12	0.99	1.26	0.06	0.06
2024	1.03	0.91	1.16	0.06	0.06

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2007	0.98	0.92	1.05	0.03	0.03
2008	0.96	0.91	1.02	0.03	0.03
2009	0.70	0.65	0.76	0.04	0.04
2010	0.81	0.75	0.88	0.04	0.04
2011	0.82	0.76	0.89	0.04	0.04
2012	0.81	0.76	0.88	0.04	0.04
2013	0.95	0.88	1.04	0.04	0.04
2014	0.78	0.72	0.85	0.04	0.04
2015	0.90	0.81	0.99	0.05	0.05
2016	0.90	0.80	1.01	0.06	0.06
2017	1.45	1.29	1.63	0.06	0.06
2018	1.35	1.23	1.48	0.05	0.05
2019	1.39	1.26	1.54	0.05	0.05

Auckland (ESA AB)

SFE pre-ERS						SFE post-ERS					
Year	Index	Lower	Upper	s.e.	CV	Year	Index	Lower	Upper	s.e.	CV
1991	1.16	0.95	1.43	0.10	0.10	2020	0.79	0.59	1.05	0.15	0.15
1992	0.80	0.73	0.87	0.05	0.05	2021	0.97	0.74	1.27	0.13	0.13
1993	0.75	0.69	0.83	0.05	0.05	2022	1.11	0.85	1.46	0.14	0.14
1994	0.92	0.81	1.03	0.06	0.06	2023	1.08	0.75	1.58	0.19	0.19
1995	0.98	0.90	1.07	0.04	0.04	2024	1.09	0.74	1.59	0.19	0.19
1996	1.00	0.91	1.09	0.04	0.04						
1997	0.73	0.68	0.78	0.03	0.03						
1998	0.94	0.87	1.01	0.04	0.04						
1999	1.16	1.07	1.25	0.04	0.04						
2000	0.87	0.81	0.93	0.03	0.03						
2001	0.83	0.77	0.89	0.04	0.04						
2002	0.71	0.66	0.75	0.03	0.03						
2003	0.71	0.66	0.76	0.03	0.03						
2004	0.83	0.77	0.89	0.04	0.04						
2005	0.86	0.77	0.97	0.06	0.06						
2006	0.91	0.84	1.00	0.04	0.04						
2007	0.97	0.89	1.04	0.04	0.04						
2008	1.20	1.06	1.35	0.06	0.06						
2009	0.98	0.88	1.09	0.05	0.05						
2010	1.03	0.93	1.15	0.05	0.05						
2011	1.06	0.99	1.14	0.03	0.03						
2012	1.04	0.97	1.11	0.03	0.03						
2013	1.07	1.00	1.15	0.03	0.03						
2014	1.09	1.00	1.18	0.04	0.04						
2015	1.13	1.04	1.24	0.05	0.05						
2016	1.34	1.19	1.50	0.06	0.06						
2017	1.46	1.32	1.62	0.05	0.05						
2018	1.40	1.26	1.56	0.05	0.05						
2019	1.82	1.61	2.06	0.06	0.06						

Auckland (ESA AB)

LFE pre-ERS						LFE post-ERS					
Year	Index	Lower	Upper	s.e.	CV	Year	Index	Lower	Upper	s.e.	CV
1991	0.67	0.50	0.90	0.14	0.14	2020	1.25	0.83	1.90	0.21	0.21
1992	1.19	0.98	1.44	0.10	0.10	2021	0.84	0.58	1.21	0.18	0.19
1993	1.06	0.90	1.24	0.08	0.08	2022	1.16	0.78	1.73	0.20	0.20
1994	1.02	0.85	1.23	0.09	0.09	2023	0.69	0.40	1.16	0.26	0.27
1995	1.17	0.98	1.40	0.09	0.09	2024	1.20	0.62	2.32	0.33	0.34
1996	0.89	0.72	1.08	0.10	0.10						
1997	0.89	0.79	1.02	0.06	0.06						
1998	1.21	1.09	1.36	0.05	0.05						
1999	1.25	1.07	1.45	0.07	0.07						

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2000	1.06	0.96	1.17	0.05	0.05
2001	1.21	1.08	1.34	0.05	0.05
2002	0.88	0.80	0.98	0.05	0.05
2003	0.88	0.79	0.98	0.05	0.05
2004	0.94	0.84	1.04	0.05	0.05
2005	1.25	1.02	1.54	0.10	0.10
2006	0.83	0.72	0.94	0.07	0.07
2007	1.02	0.92	1.13	0.05	0.05
2008	1.02	0.86	1.20	0.08	0.08
2009	0.81	0.70	0.95	0.08	0.08
2010	0.89	0.76	1.04	0.08	0.08
2011	0.81	0.71	0.92	0.07	0.07
2012	1.00	0.89	1.13	0.06	0.06
2013	0.99	0.88	1.10	0.06	0.06
2014	0.95	0.83	1.08	0.07	0.07
2015	0.92	0.80	1.05	0.07	0.07
2016	0.82	0.68	0.98	0.09	0.09
2017	1.17	1.01	1.34	0.07	0.07
2018	1.31	1.12	1.53	0.08	0.08
2019	1.32	1.10	1.58	0.09	0.09

Hauraki (ESA AC)

				SFE pre-ERS							SFE post-ERS
Year	Index	Lower	Upper	s.e.	CV	Year	Index	Lower	Upper	s.e.	CV
1991	1.08	0.99	1.18	0.04	0.04	2020	0.83	0.71	0.98	0.08	0.08
1992	0.93	0.87	1.00	0.04	0.04	2021	0.91	0.81	1.01	0.06	0.06
1993	1.05	0.99	1.12	0.03	0.03	2022	1.20	1.07	1.35	0.06	0.06
1994	0.95	0.89	1.03	0.04	0.04	2023	1.07	0.96	1.18	0.05	0.05
1995	1.07	1.01	1.13	0.03	0.03	2024	1.04	0.94	1.14	0.05	0.05
1996	1.02	0.95	1.10	0.04	0.04						
1997	0.78	0.73	0.84	0.04	0.04						
1998	0.72	0.67	0.78	0.04	0.04						
1999	0.67	0.63	0.73	0.04	0.04						
2000	0.83	0.78	0.87	0.03	0.03						
2001	0.79	0.74	0.83	0.03	0.03						
2002	1.06	1.00	1.12	0.03	0.03						
2003	0.90	0.85	0.96	0.03	0.03						
2004	1.07	1.00	1.15	0.03	0.03						
2005	0.90	0.85	0.95	0.03	0.03						
2006	0.96	0.91	1.01	0.03	0.03						
2007	0.82	0.78	0.87	0.03	0.03						
2008	0.87	0.81	0.93	0.03	0.03						
2009	0.88	0.81	0.94	0.04	0.04						
2010	0.91	0.83	0.99	0.05	0.05						
2011	1.18	1.07	1.29	0.05	0.05						
2012	1.27	1.19	1.36	0.03	0.03						
2013	1.24	1.15	1.32	0.03	0.03						
2014	1.27	1.19	1.36	0.03	0.03						
2015	1.08	1.01	1.16	0.04	0.04						
2016	1.04	0.97	1.12	0.03	0.03						
2017	1.24	1.15	1.34	0.04	0.04						
2018	1.27	1.16	1.39	0.05	0.05						
2019	1.73	1.59	1.88	0.04	0.04						
1991	1.08	0.99	1.18	0.04	0.04						

[Continued on next pages]

Hauraki (ESA AC)

					LFE pre-ERS
Year	Index	Lower	Upper	s.e.	CV
1991	1.69	1.46	1.96	0.07	0.07
1992	1.75	1.53	2.00	0.07	0.07
1993	1.51	1.33	1.71	0.06	0.06
1994	1.10	0.95	1.27	0.07	0.07
1995	1.29	1.16	1.43	0.05	0.05
1996	1.44	1.24	1.67	0.07	0.08
1997	1.17	1.02	1.34	0.07	0.07
1998	0.92	0.81	1.06	0.07	0.07
1999	1.00	0.85	1.18	0.08	0.08
2000	1.00	0.90	1.10	0.05	0.05
2001	0.78	0.71	0.86	0.05	0.05
2002	0.80	0.73	0.89	0.05	0.05
2003	0.84	0.76	0.94	0.05	0.05
2004	0.82	0.73	0.91	0.06	0.06
2005	1.20	1.07	1.33	0.05	0.05
2006	0.92	0.84	1.00	0.05	0.05
2007	0.83	0.75	0.92	0.05	0.05
2008	0.84	0.75	0.94	0.06	0.06
2009	0.83	0.70	0.98	0.08	0.08
2010	0.79	0.65	0.96	0.10	0.10
2011	0.85	0.71	1.02	0.09	0.09
2012	1.03	0.92	1.15	0.05	0.05
2013	0.96	0.85	1.08	0.06	0.06
2014	0.96	0.84	1.10	0.07	0.07
2015	0.56	0.46	0.68	0.09	0.10
2016	0.95	0.82	1.11	0.08	0.08
2017	0.89	0.76	1.05	0.08	0.08
2018	1.13	0.95	1.34	0.09	0.09
2019	1.10	0.95	1.29	0.08	0.08

					LFE post-ERS
Year	Index	Lower	Upper	s.e.	CV
2020	1.14	0.92	1.41	0.11	0.11
2021	1.00	0.83	1.19	0.09	0.09
2022	0.97	0.80	1.17	0.09	0.09
2023	1.12	0.91	1.37	0.10	0.10
2024	0.81	0.66	1.00	0.10	0.10

Waikato (ESA AD)

					SFE pre-ERS
Year	Index	Lower	Upper	s.e.	CV
1991	0.83	0.73	0.94	0.06	0.06
1992	0.83	0.73	0.94	0.06	0.06
1993	0.95	0.86	1.04	0.05	0.05
1994	1.06	0.95	1.17	0.05	0.05
1995	1.08	1.00	1.17	0.04	0.04
1996	1.14	1.07	1.21	0.03	0.03
1997	1.02	0.96	1.07	0.03	0.03
1998	1.02	0.96	1.07	0.03	0.03
1999	0.90	0.86	0.94	0.02	0.02
2000	0.77	0.74	0.80	0.02	0.02
2001	0.76	0.74	0.79	0.02	0.02
2002	0.81	0.78	0.83	0.02	0.02
2003	0.73	0.70	0.75	0.02	0.02
2004	0.89	0.86	0.93	0.02	0.02
2005	0.92	0.89	0.96	0.02	0.02
2006	1.00	0.96	1.04	0.02	0.02
2007	0.99	0.95	1.03	0.02	0.02
2008	1.04	1.00	1.08	0.02	0.02
2009	1.10	1.05	1.14	0.02	0.02
2010	1.15	1.10	1.19	0.02	0.02
2011	1.16	1.11	1.21	0.02	0.02
2012	0.98	0.95	1.02	0.02	0.02
2013	0.97	0.93	1.01	0.02	0.02

					SFE post-ERS
Year	Index	Lower	Upper	s.e.	CV
2020	0.86	0.82	0.91	0.03	0.03
2021	0.85	0.80	0.90	0.03	0.03
2022	1.17	1.11	1.24	0.03	0.03
2023	1.16	1.10	1.23	0.03	0.03
2024	1.00	0.95	1.06	0.03	0.03

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2014	0.97	0.93	1.01	0.02	0.02
2015	1.00	0.96	1.05	0.02	0.02
2016	1.15	1.10	1.20	0.02	0.02
2017	1.39	1.32	1.46	0.03	0.03
2018	1.39	1.33	1.47	0.03	0.03
2019	1.46	1.38	1.54	0.03	0.03

Waikato (ESA AD)

LFE pre-ERS					
Year	Index	Lower	Upper	s.e.	CV
1991	1.09	0.99	1.19	0.05	0.05
1992	1.17	1.06	1.30	0.05	0.05
1993	0.93	0.83	1.04	0.06	0.06
1994	1.12	0.99	1.26	0.06	0.06
1995	1.23	1.12	1.35	0.05	0.05
1996	1.04	0.96	1.13	0.04	0.04
1997	0.96	0.89	1.02	0.03	0.03
1998	0.86	0.80	0.92	0.04	0.04
1999	0.80	0.76	0.85	0.03	0.03
2000	0.83	0.80	0.87	0.02	0.02
2001	0.91	0.87	0.94	0.02	0.02
2002	0.82	0.79	0.85	0.02	0.02
2003	0.84	0.81	0.88	0.02	0.02
2004	0.94	0.90	0.98	0.02	0.02
2005	0.94	0.90	0.98	0.02	0.02
2006	0.90	0.86	0.94	0.02	0.02
2007	0.97	0.92	1.02	0.03	0.03
2008	0.94	0.90	0.99	0.02	0.02
2009	0.98	0.93	1.04	0.03	0.03
2010	1.05	0.99	1.10	0.03	0.03
2011	1.03	0.97	1.09	0.03	0.03
2012	1.09	1.04	1.14	0.02	0.02
2013	1.04	0.99	1.10	0.03	0.03
2014	0.94	0.89	0.99	0.03	0.03
2015	0.99	0.93	1.04	0.03	0.03
2016	0.97	0.91	1.03	0.03	0.03
2017	1.26	1.18	1.35	0.03	0.03
2018	1.25	1.17	1.35	0.03	0.04
2019	1.39	1.30	1.50	0.04	0.04

LFE post-ERS					
Year	Index	Lower	Upper	s.e.	CV
year	index	lower.CI	upper.CI	se	cv
2020	0.94	0.87	1.02	0.04	0.04
2021	0.95	0.88	1.03	0.04	0.04
2022	1.11	1.02	1.20	0.04	0.04
2023	1.14	1.05	1.24	0.04	0.04
2024	0.88	0.81	0.95	0.04	0.04

WTFA (exclude Waipa River)

SFE post-ERS					
Year	Index	Lower	Upper	s.e.	CV
2020	0.75	0.70	0.80	0.03	0.03
2021	0.81	0.76	0.87	0.03	0.03
2022	1.24	1.16	1.32	0.03	0.03
2023	1.21	1.13	1.29	0.03	0.03
2024	1.10	1.03	1.18	0.03	0.03

Outside WTFA (above Karapiro Dam)

SFE post-ERS					
2020	1.12	0.99	1.26	0.06	0.06
2021	0.84	0.73	0.97	0.07	0.07
2022	1.04	0.85	1.27	0.10	0.10
2023	1.05	0.82	1.35	0.13	0.13
2024	0.97	0.85	1.11	0.07	0.07

Appendices A to Z

Plots of North Island eel fishery characterisation by Eel Statistical Area (AA, AB, AC, AD, AE, AF, AG, AH, AJ, AK, AL, AM, and Waikato Tainui Fisheries Area), and CPUE analyses (AA, AB, AC, AD, and Waikato Tainui Fisheries Area) from 1991 to 2024. The plots are shown by ESA, with shortfin first followed by longfin for CPUE plots.

ESA AA (Northland)

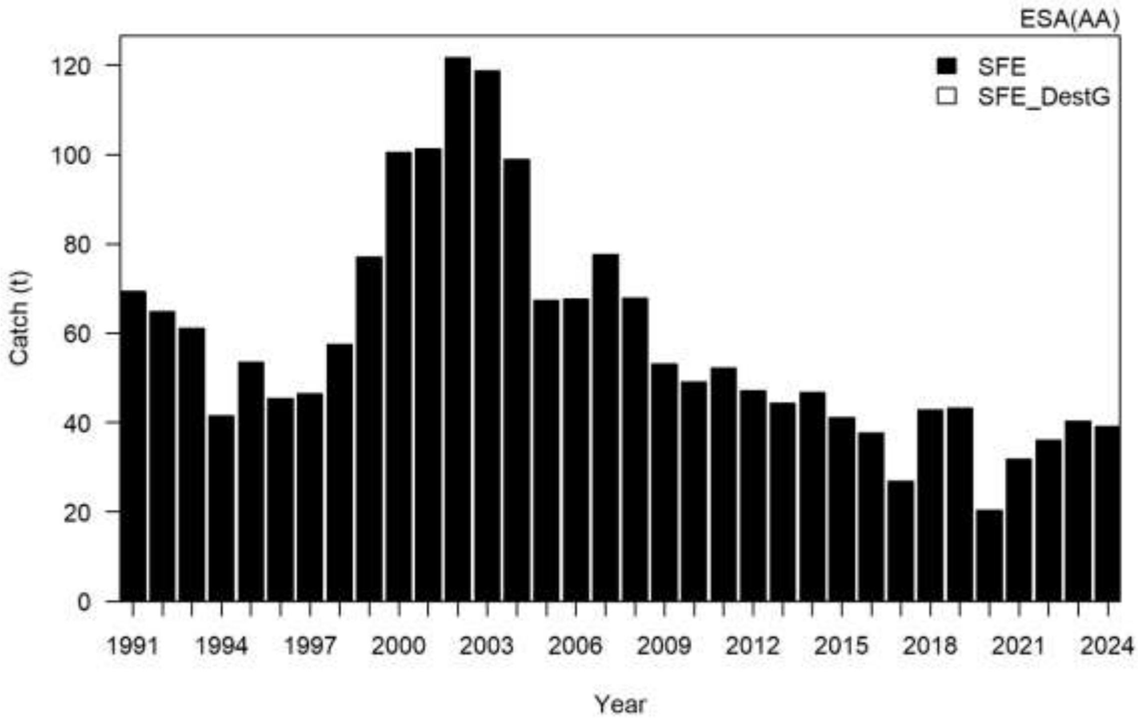

Figure A1: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AA).

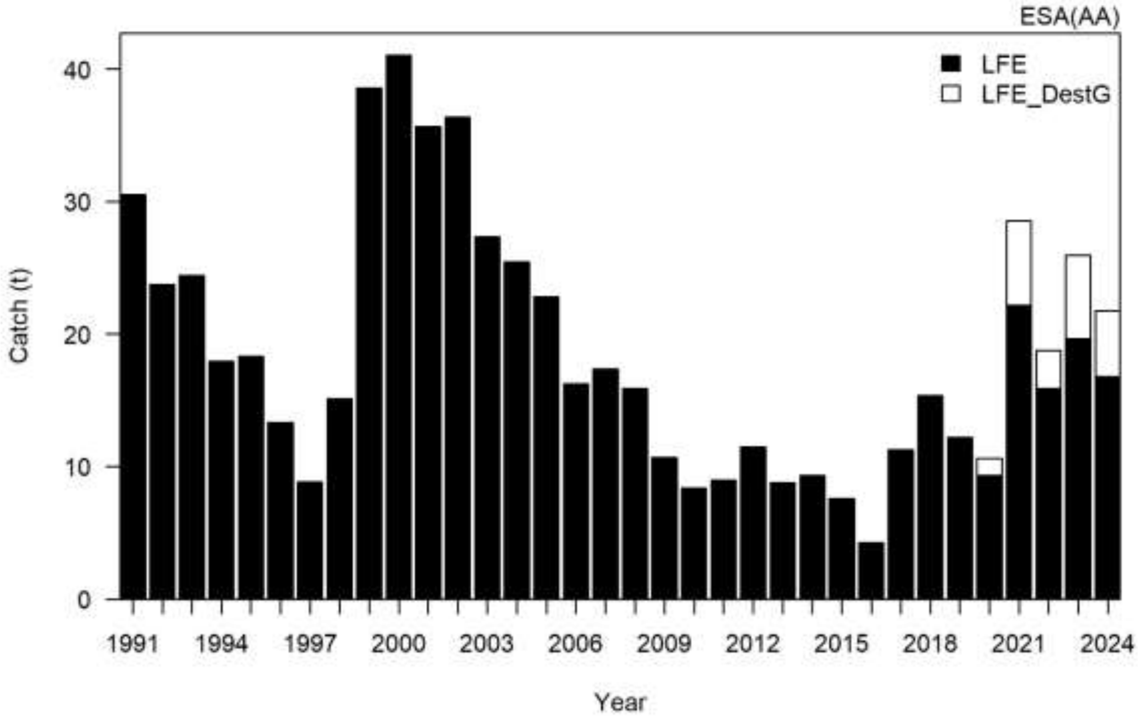

Figure A2: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AA).

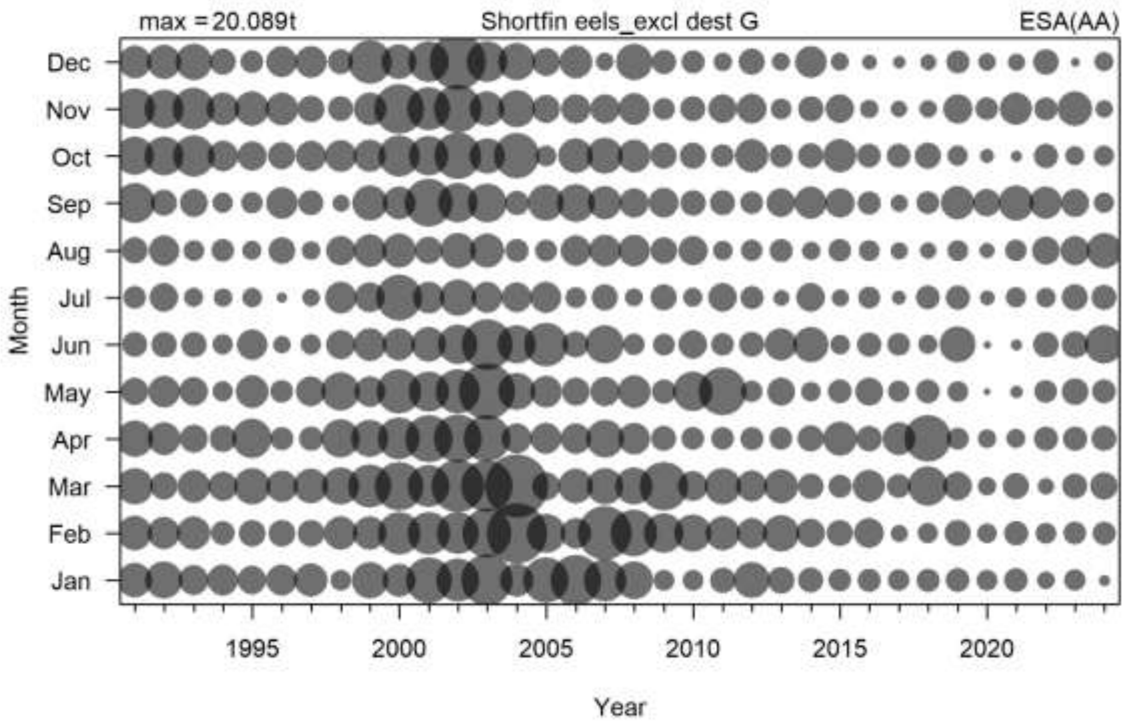

Figure A3: Shortfin legal size eel catch by month for the years 1990–91 to 2023–24 (ESA AA).

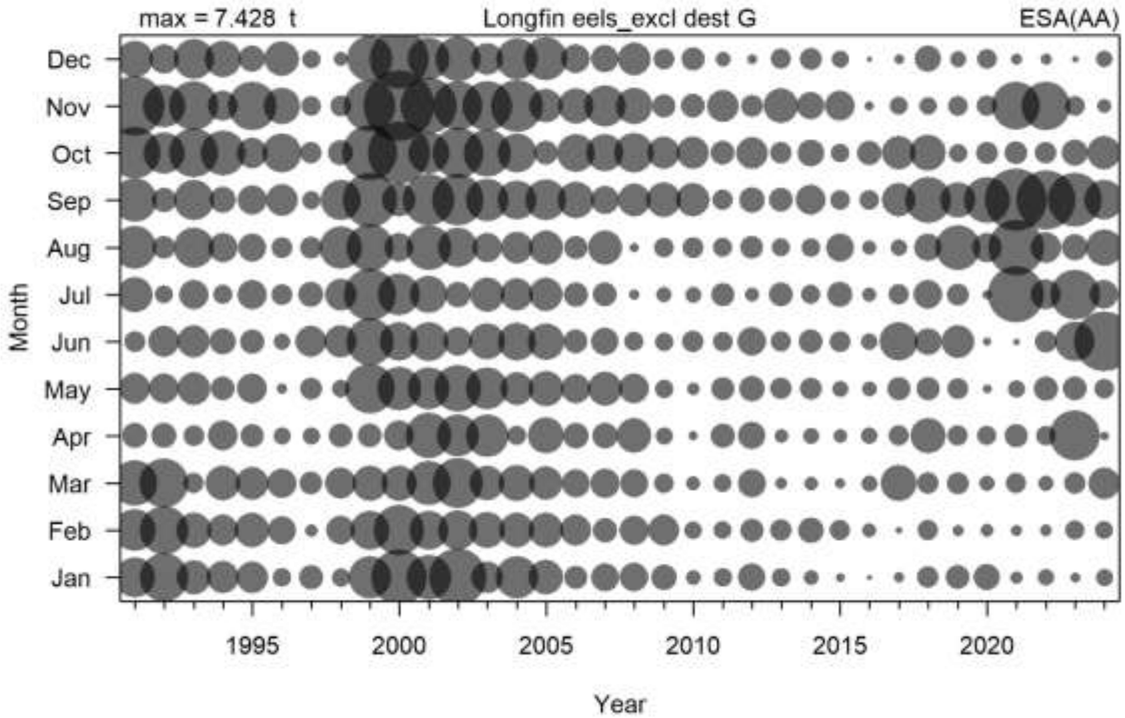

Figure A4: Longfin legal size eel catch by month for the years 1990–91 to 2023–24 (ESA AA).

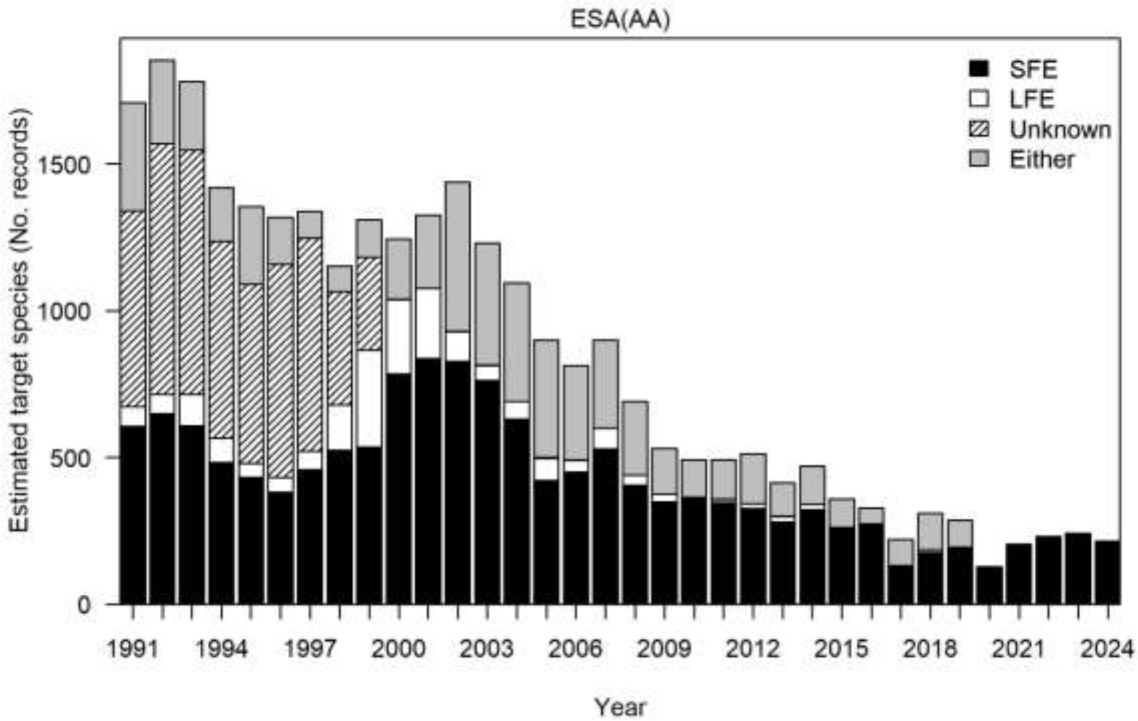

Figure A5: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AA).

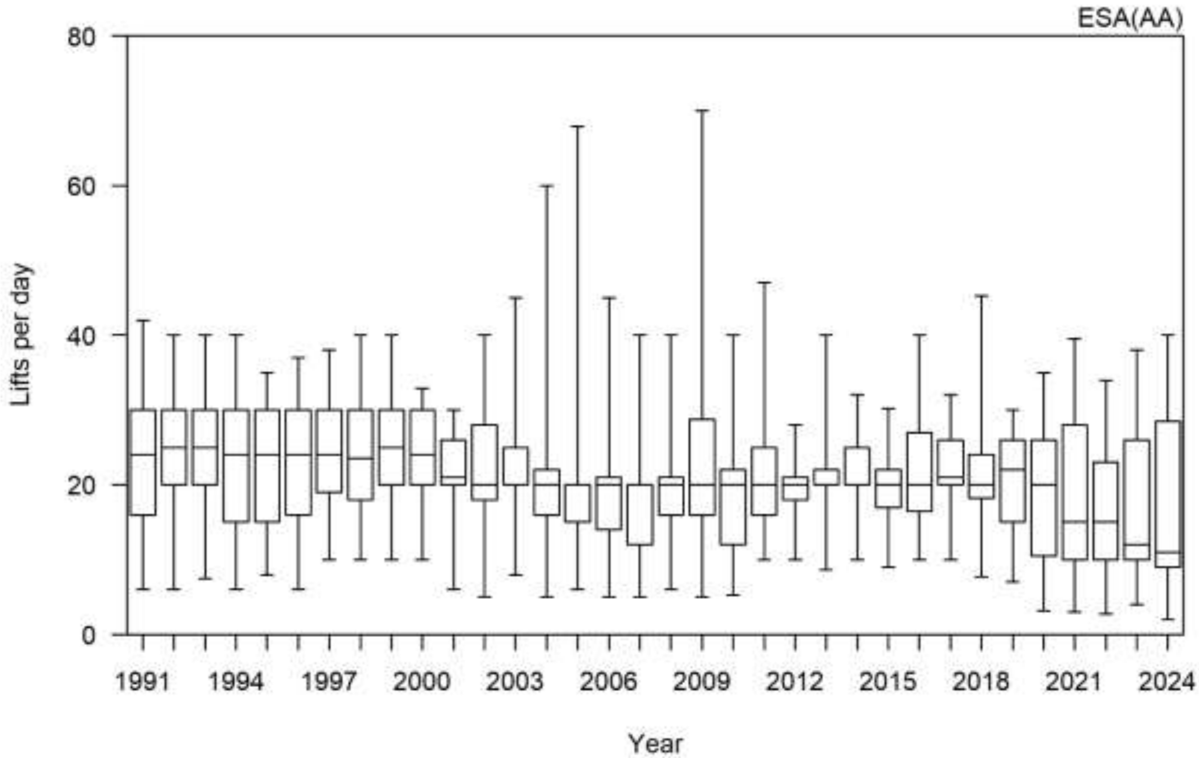

Figure A6: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AA).

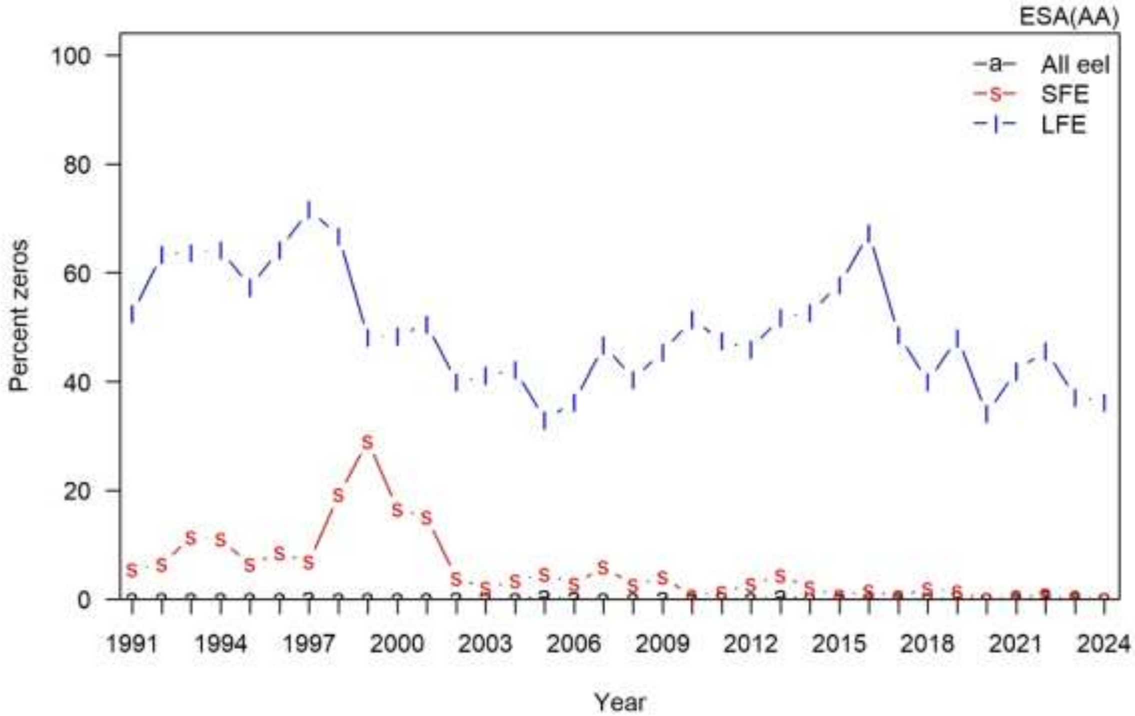

Figure A7: Proportion of valid zero records for legal size all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AA).

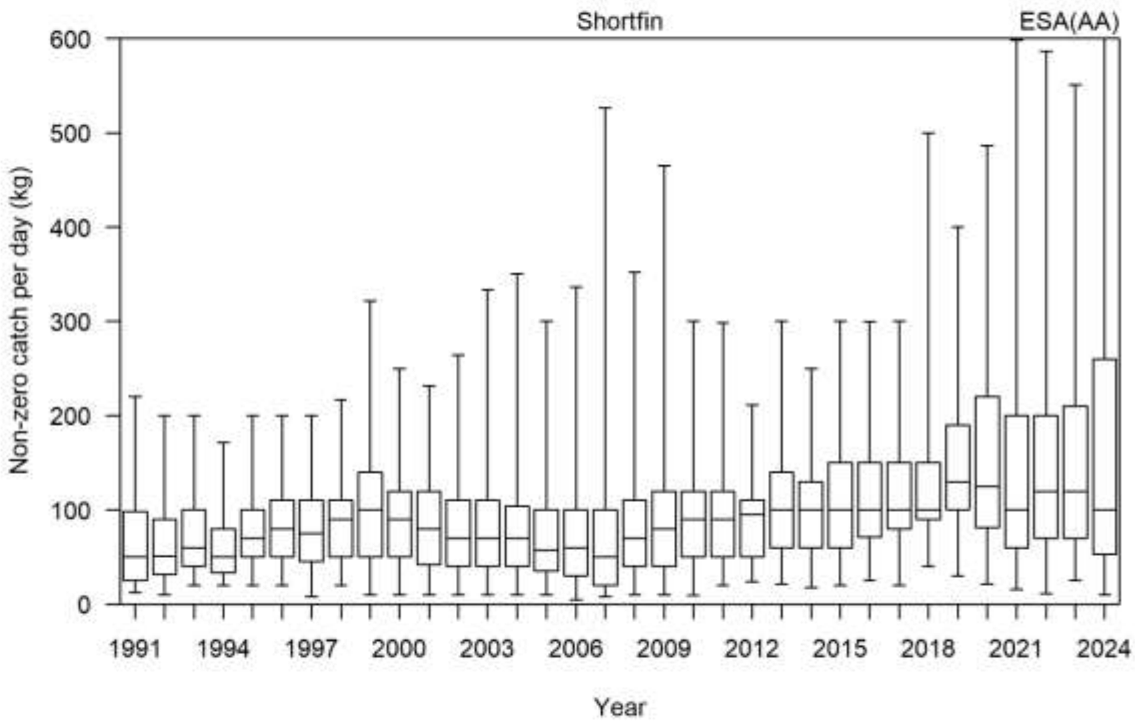

Figure A8: Shortfin non-zero catch per day for legal size eels for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AA).

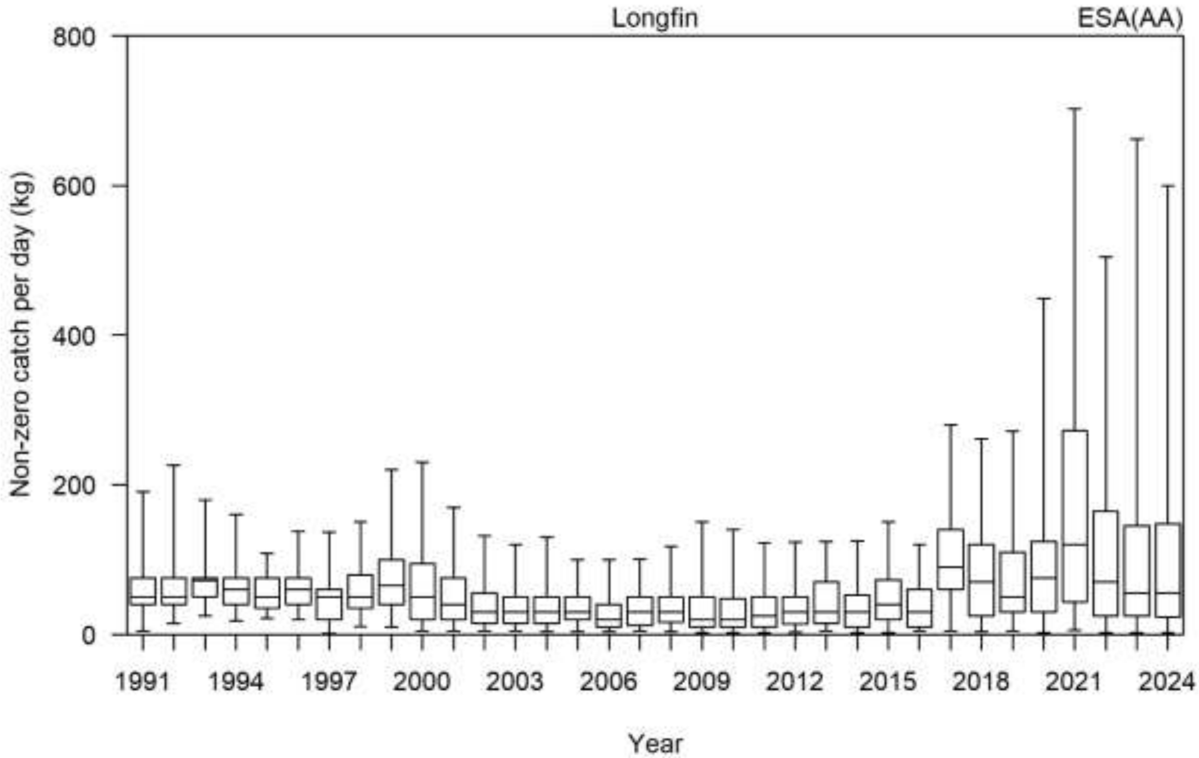

Figure A9: Longfin non-zero catch per day for legal size eels for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AA).

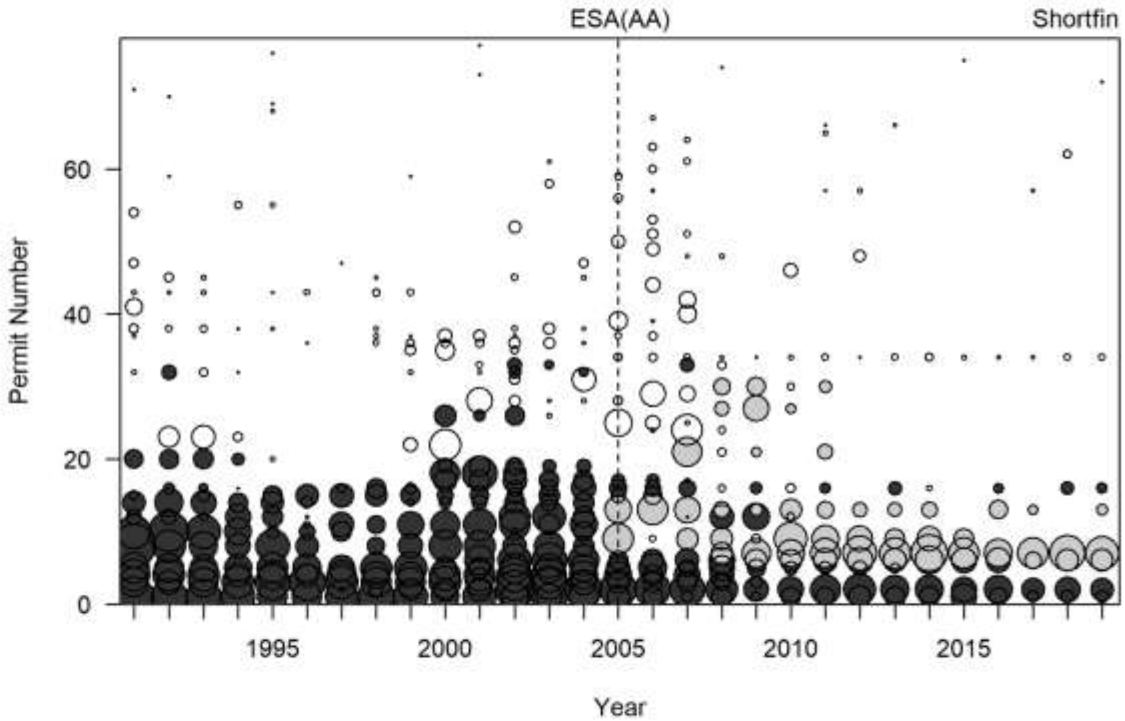

Figure A10: Relative shortfin legal size eel catch, from all fishers (all circles) for the years 1990–91 to 2018–19 (pre-ERS), and for core fishers (dark and grey shaded circles) included in the catch per unit effort analyses. The vertical dotted line indicates introduction into the QMS in 2004–05. The dark shaded circles post-QMS are existing fishers and the grey, new entrants (ESA AA).

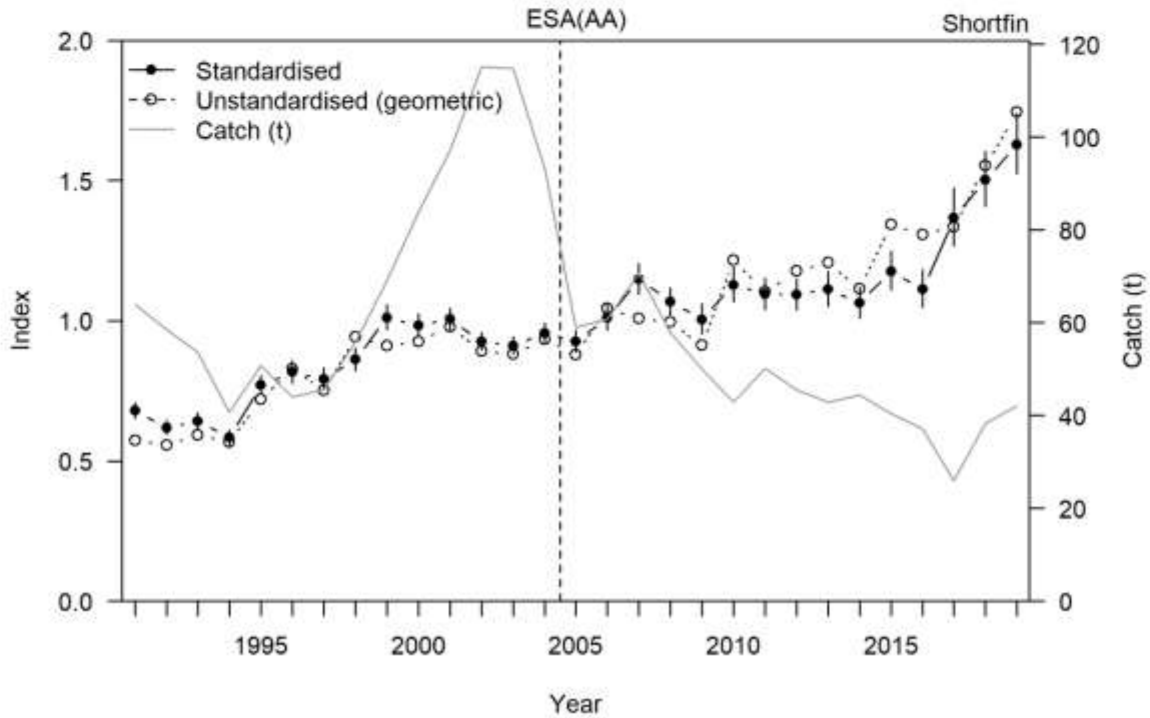

Figure A11: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for shortfin (core fishers) for the years 1990–91 to 2018–19 (pre-ERS). The shortfin catch by core fishers is also plotted. The vertical dotted line indicates introduction into the QMS in 2004–05. Catch includes legal size eels (ESA AA).

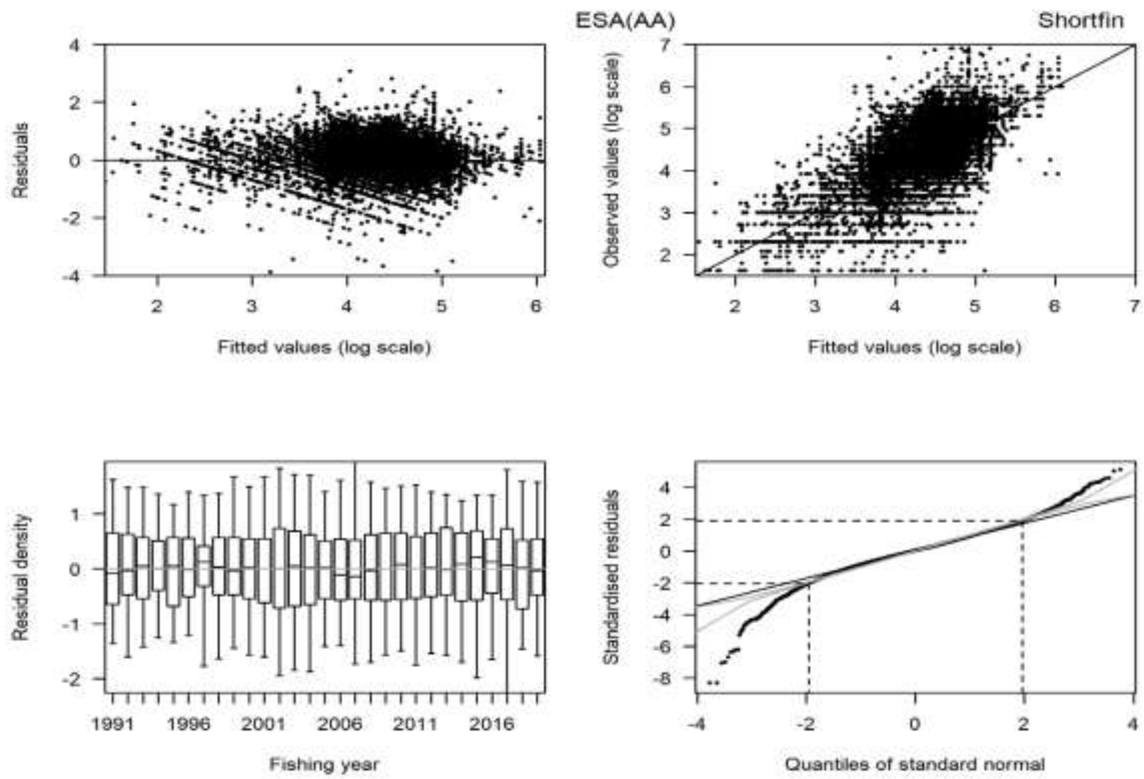

Figure A12: Residual diagnostic plots for the shortfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AA).

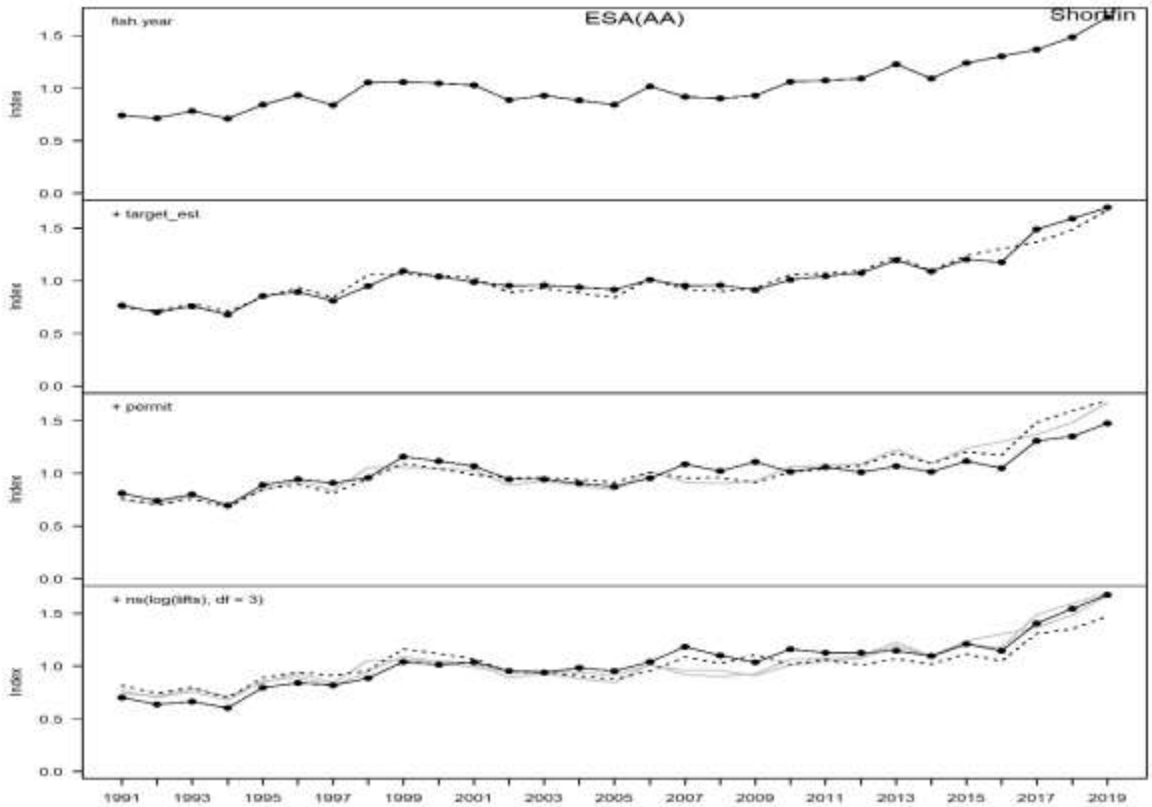

Figure A13: Step plot for the shortfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AA).

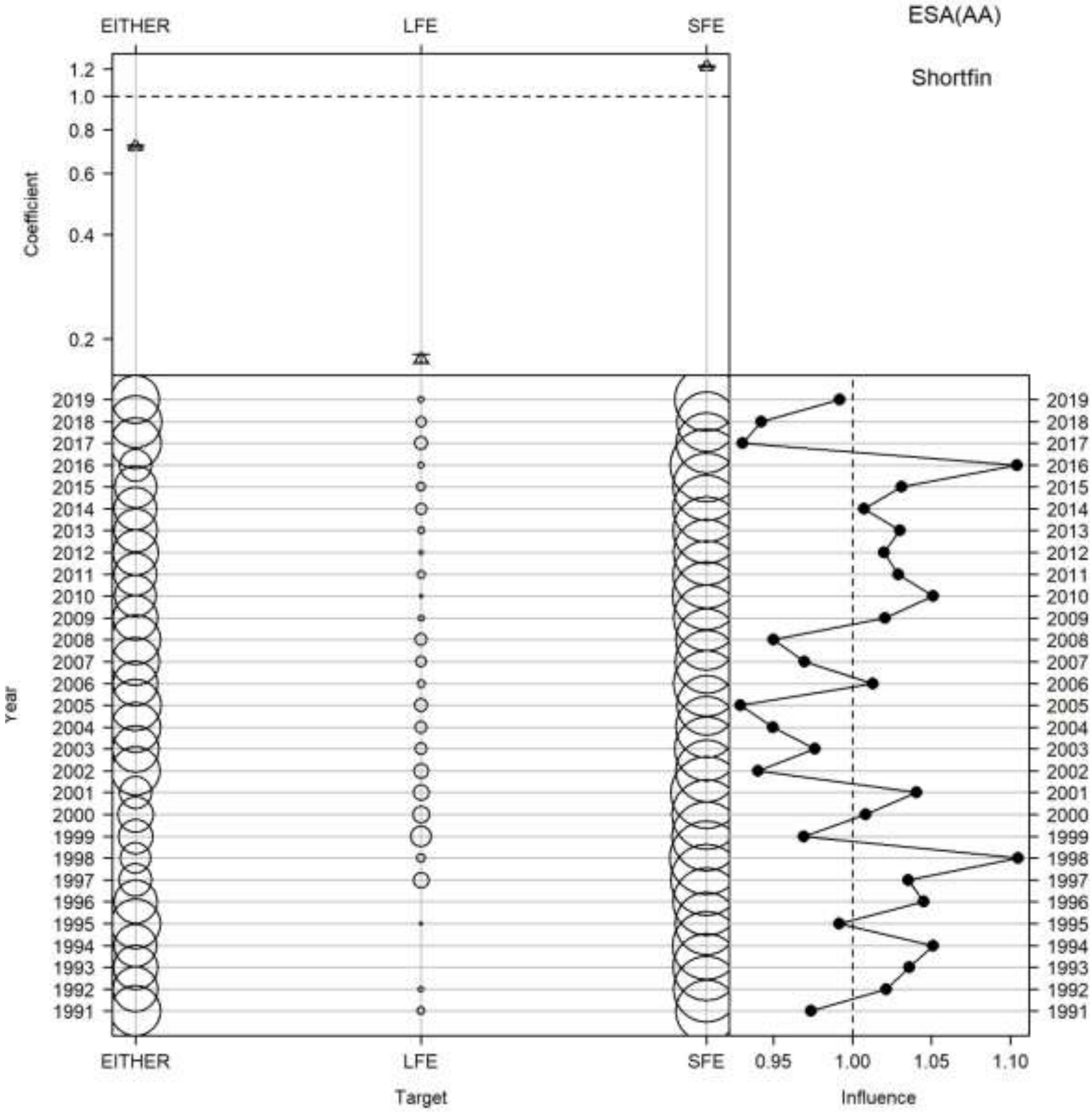

Figure A14: Influence of reconstructed target for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AA).

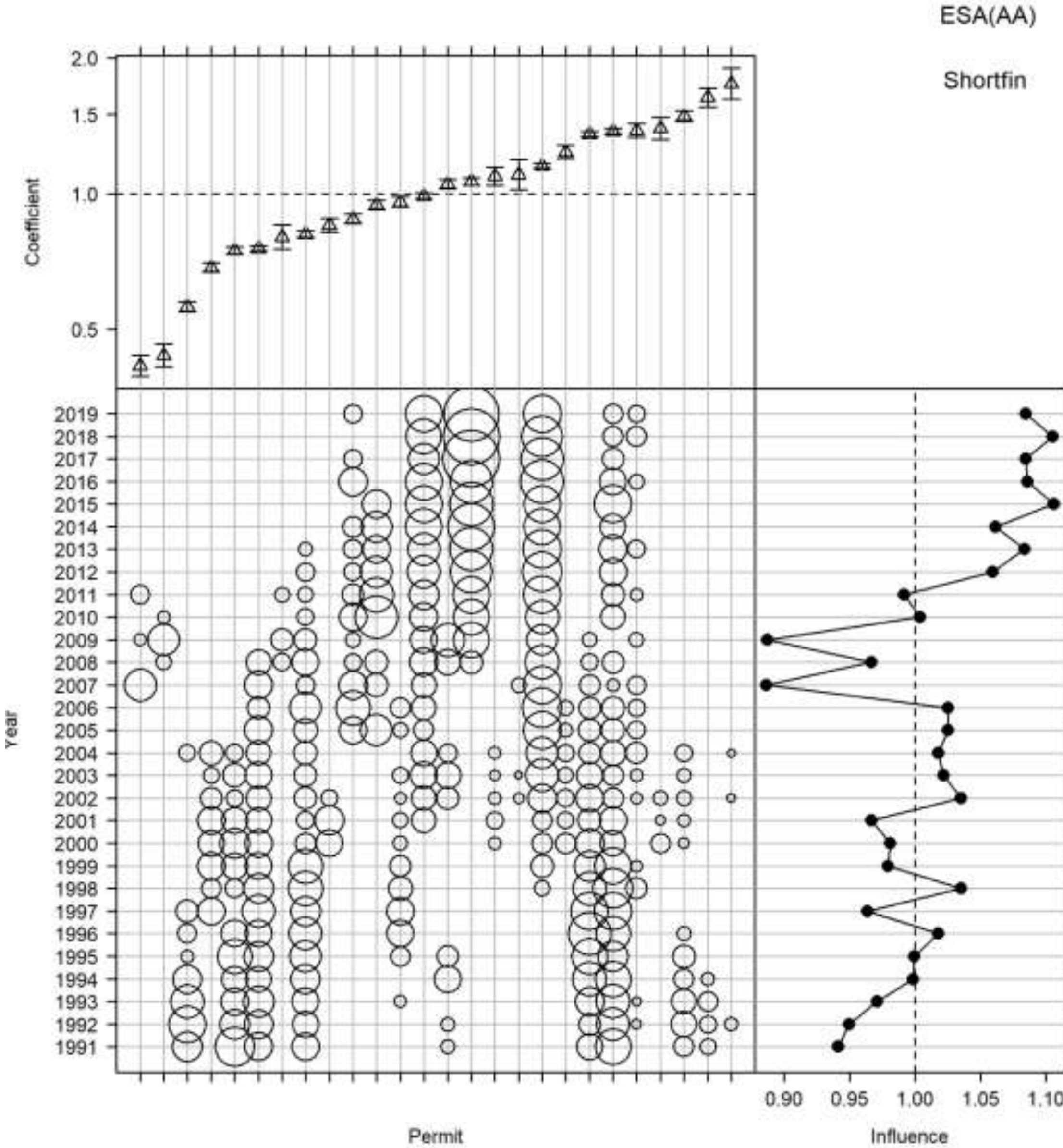

Figure A15: Influence of permit for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AA).

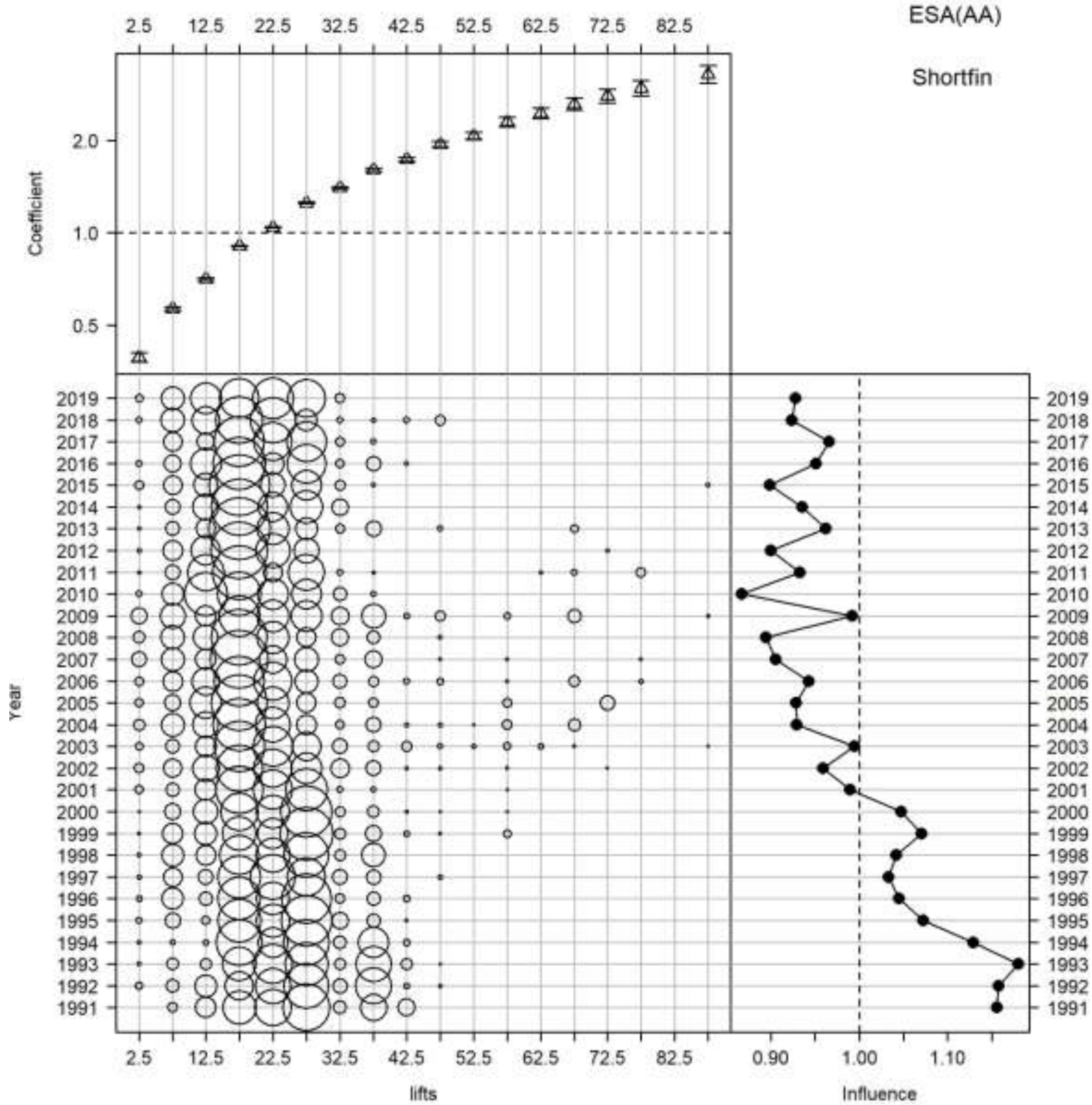

Figure A16: Influence of lifts for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AA).

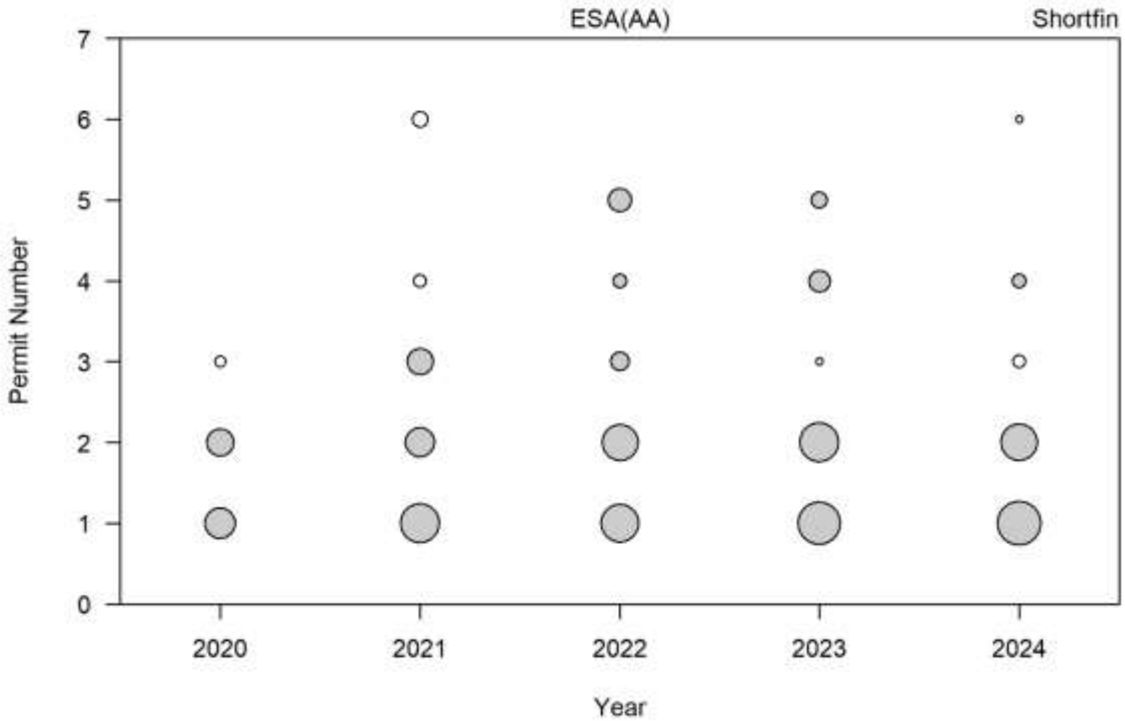

Figure A17: Relative shortfin legal size eel catch and destination G, from all fishers (all circles) for the years 2019–20 to 2023–24 (post-ERS), and for core fishers (grey shaded circles) included in the catch per unit effort analyses (ESA AA).

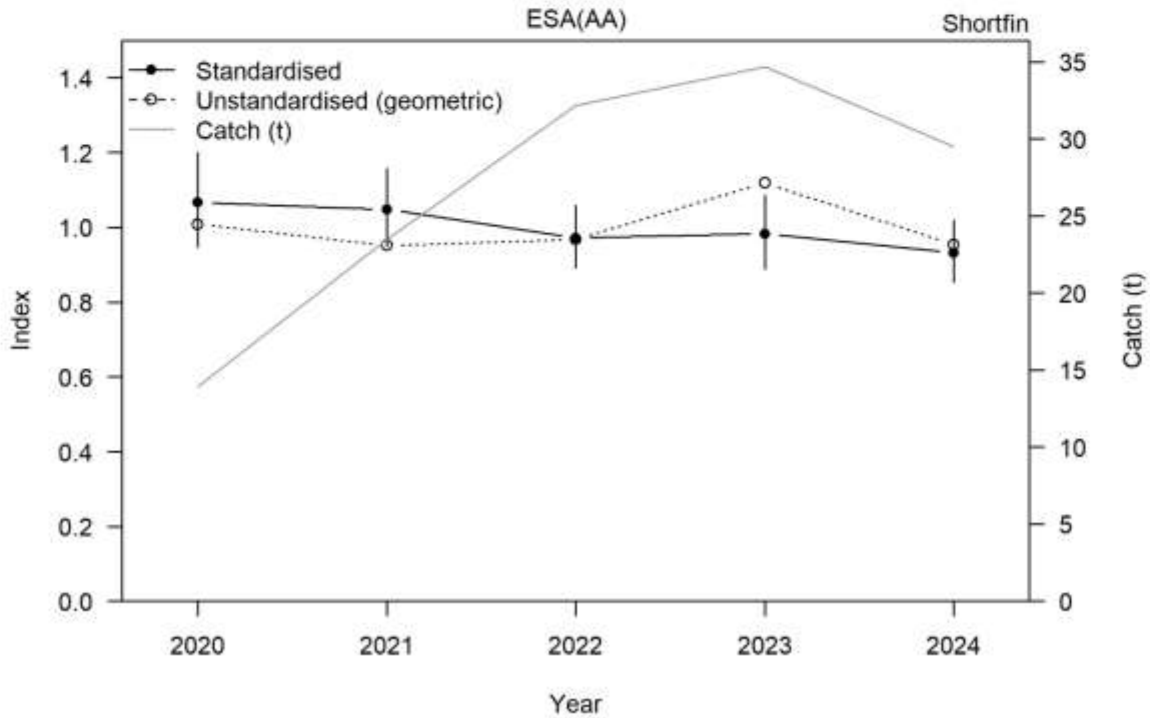

Figure A18: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for shortfin (core fishers) for the years 2019–20 to 2023–24 (post-ERS). The shortfin catch by core fishers is also plotted. Catch includes legal size eels and destination G (ESA AA).

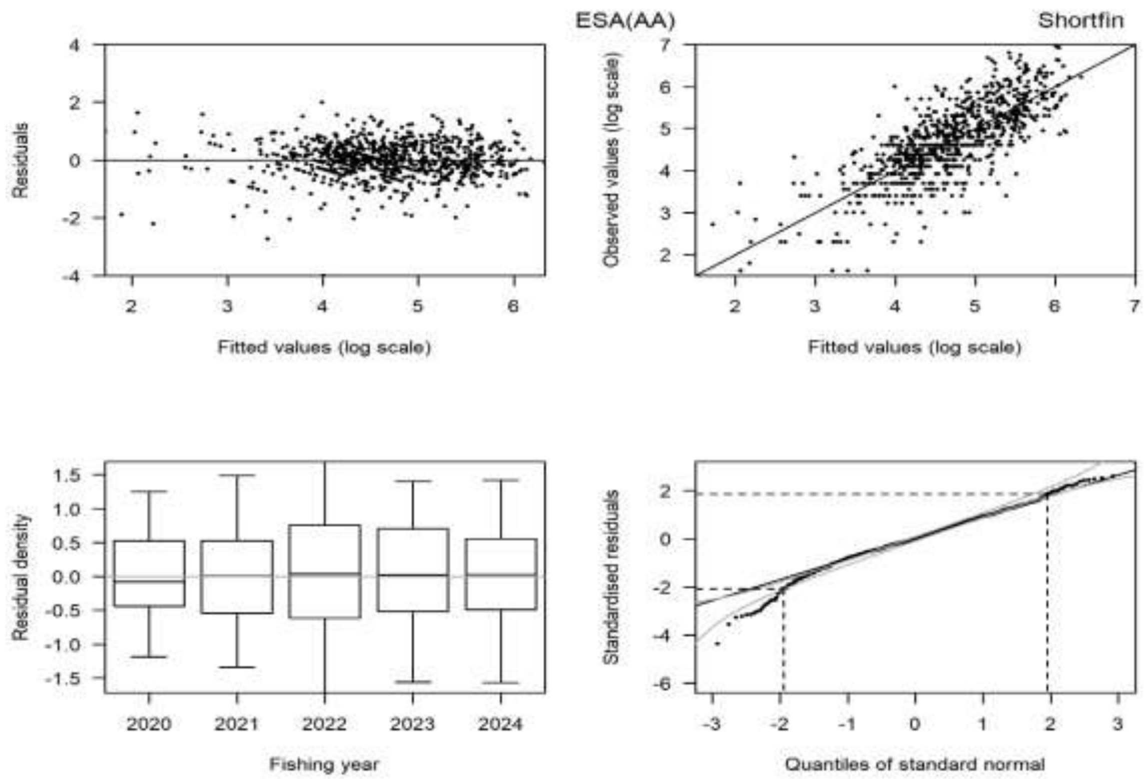

Figure A19: Residual diagnostic plots for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AA).

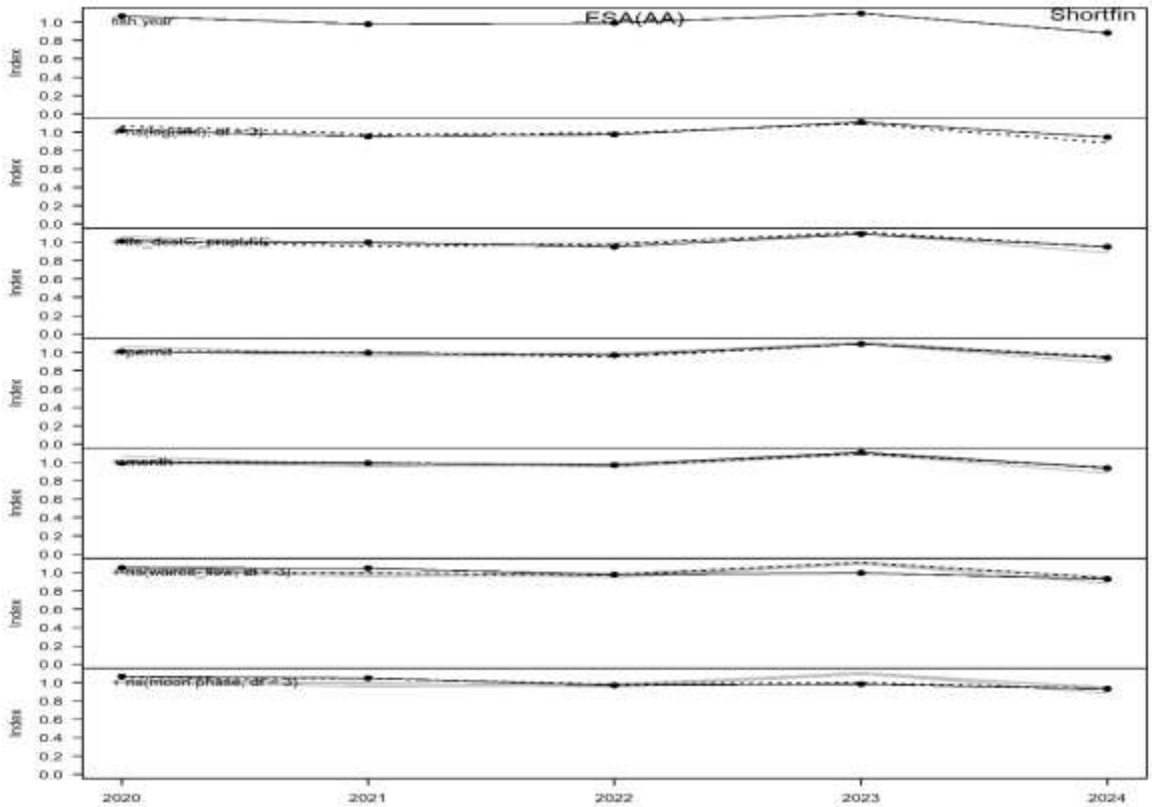

Figure A20: Step plot for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AA).

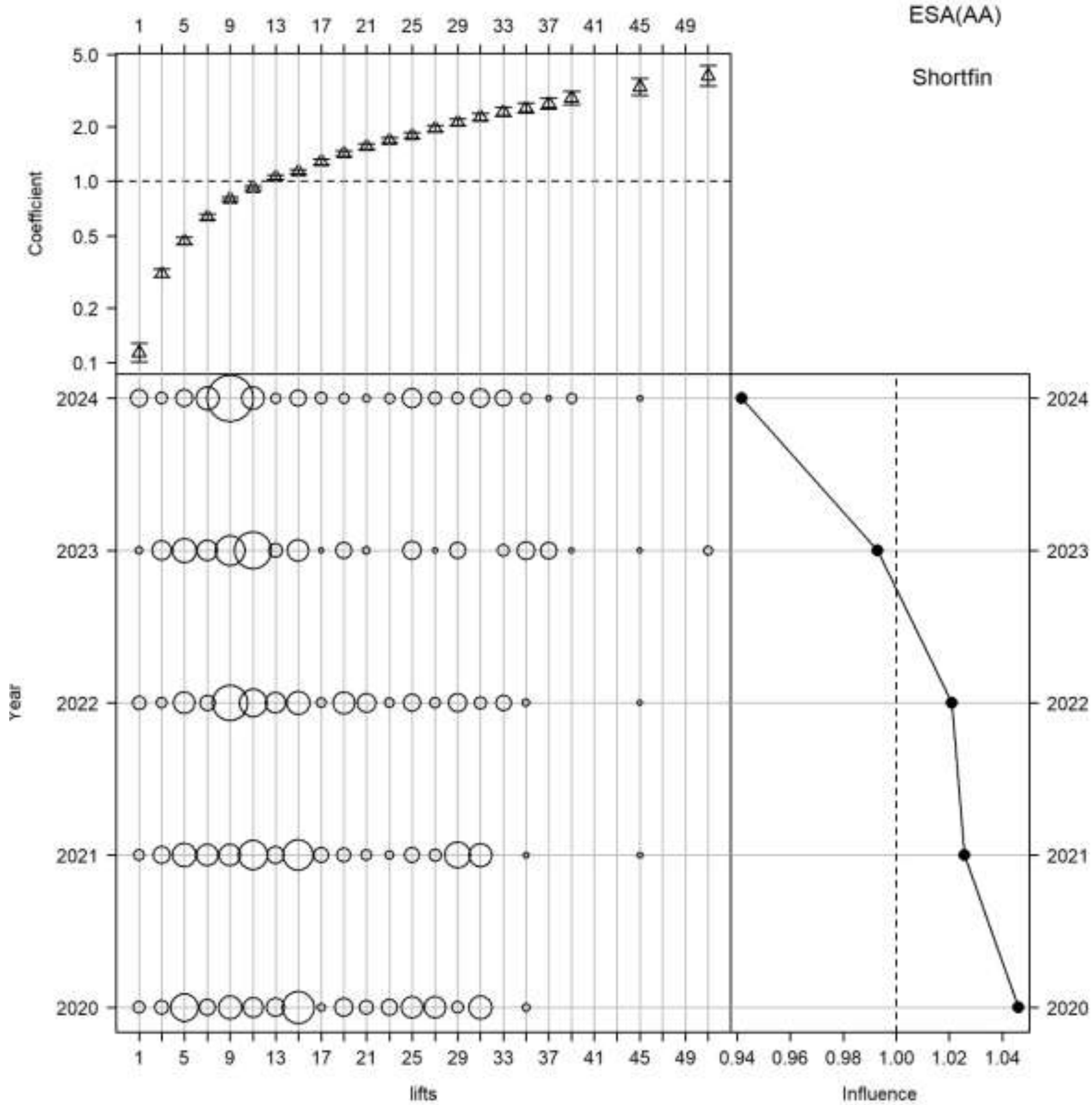

Figure A21: Influence of lifts for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

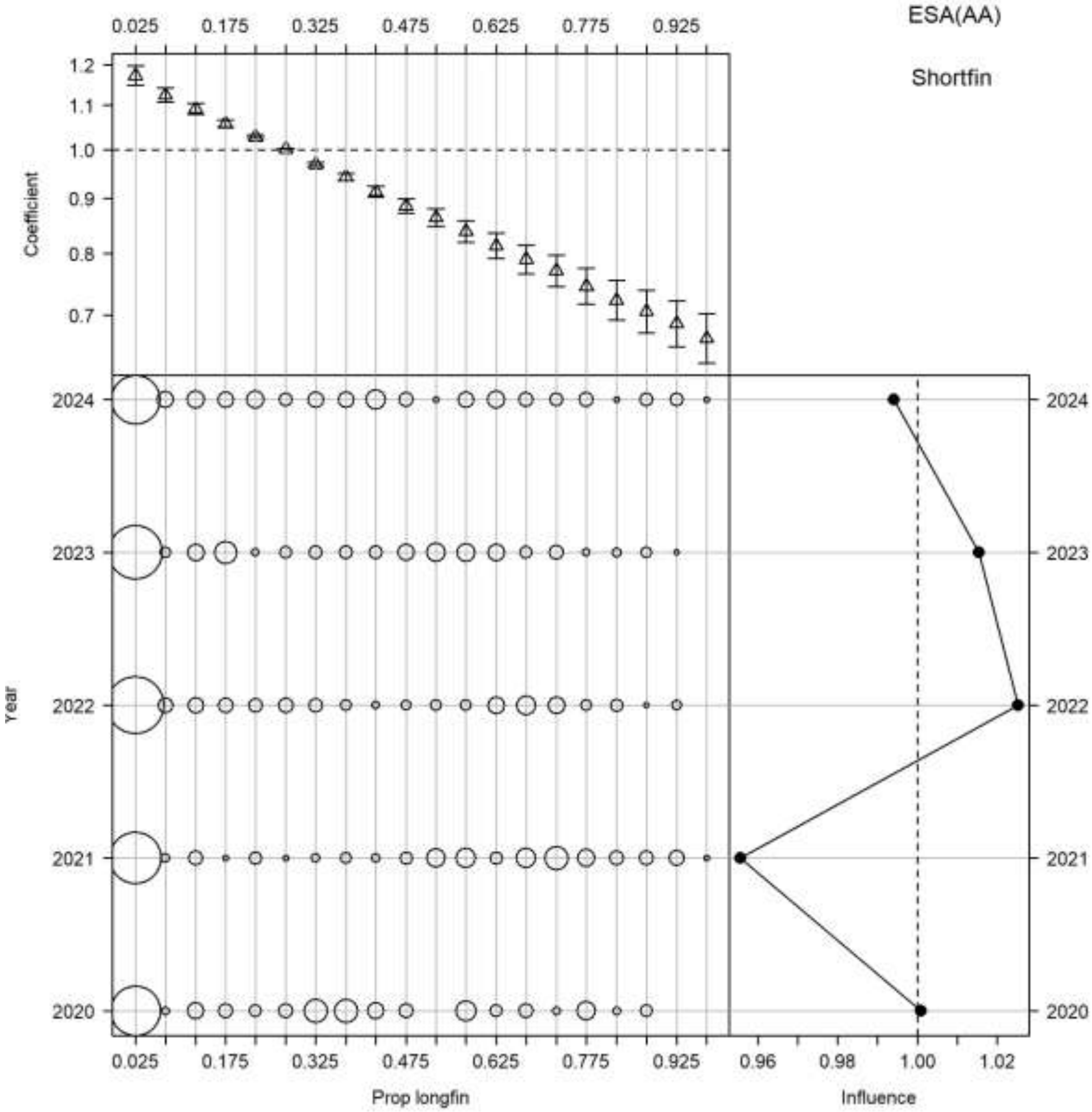

Figure A22: Influence of proportion longfin in the catch for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

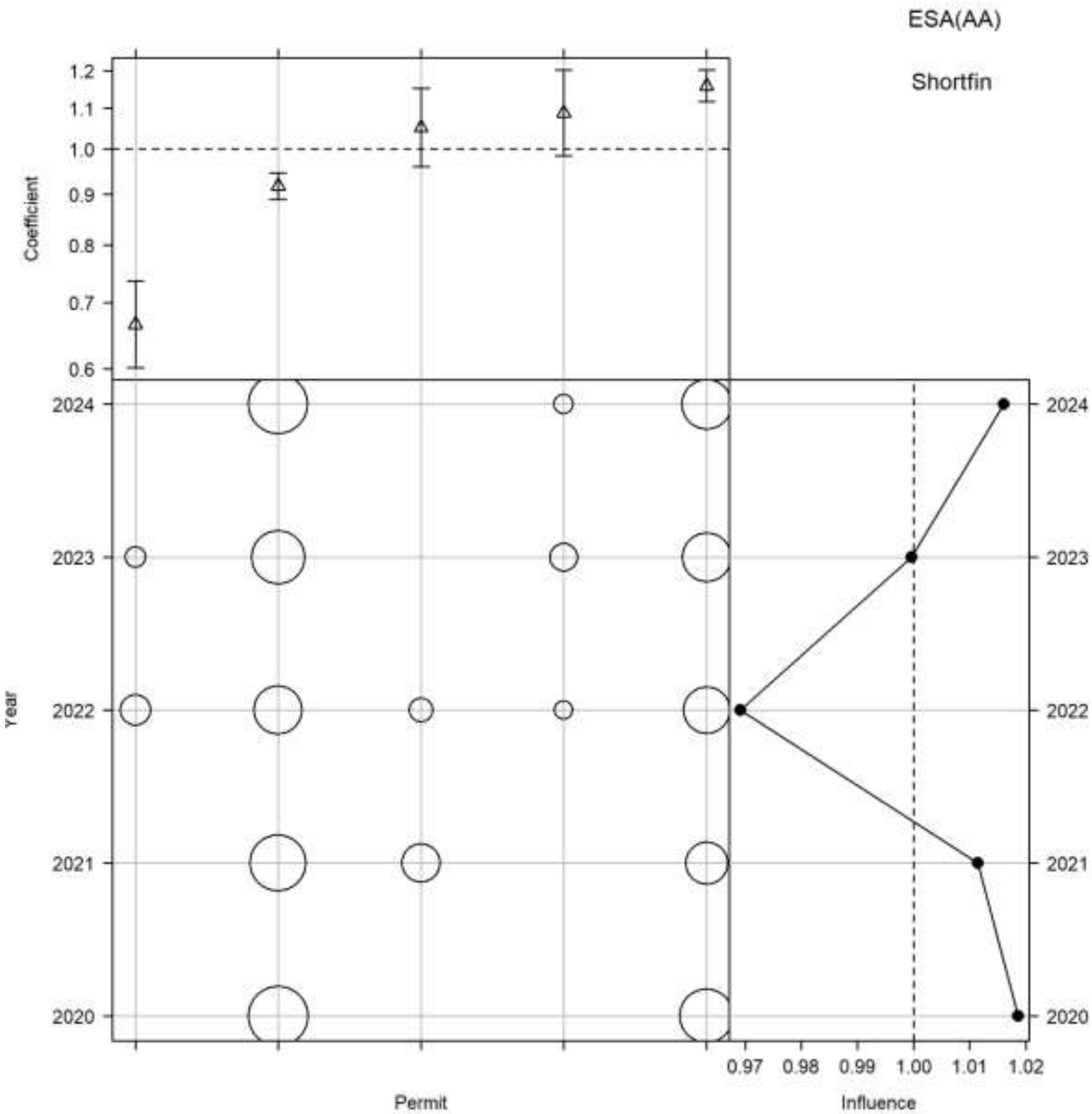

Figure A23: Influence of permit for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

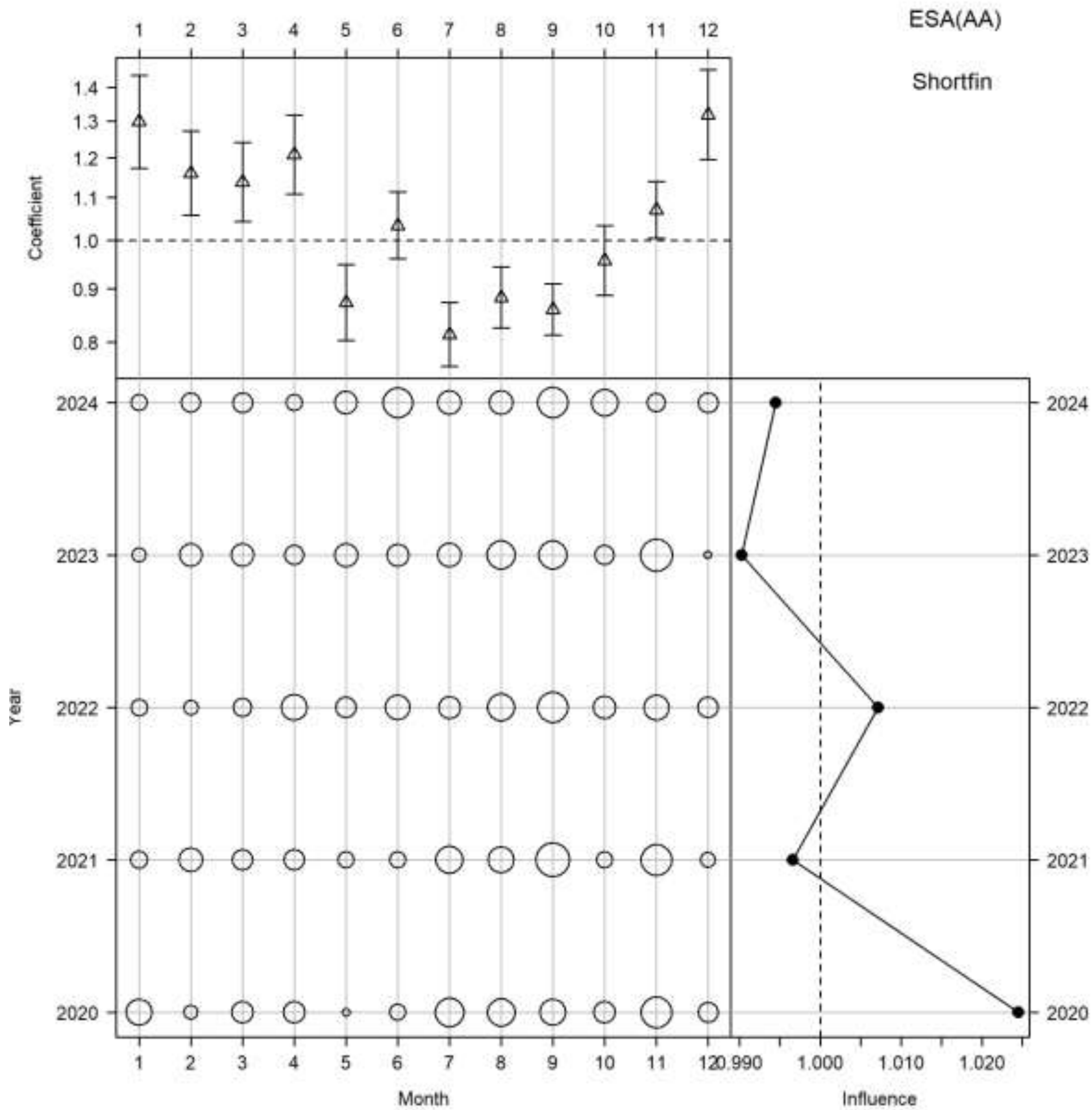

Figure A24: Influence of month for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

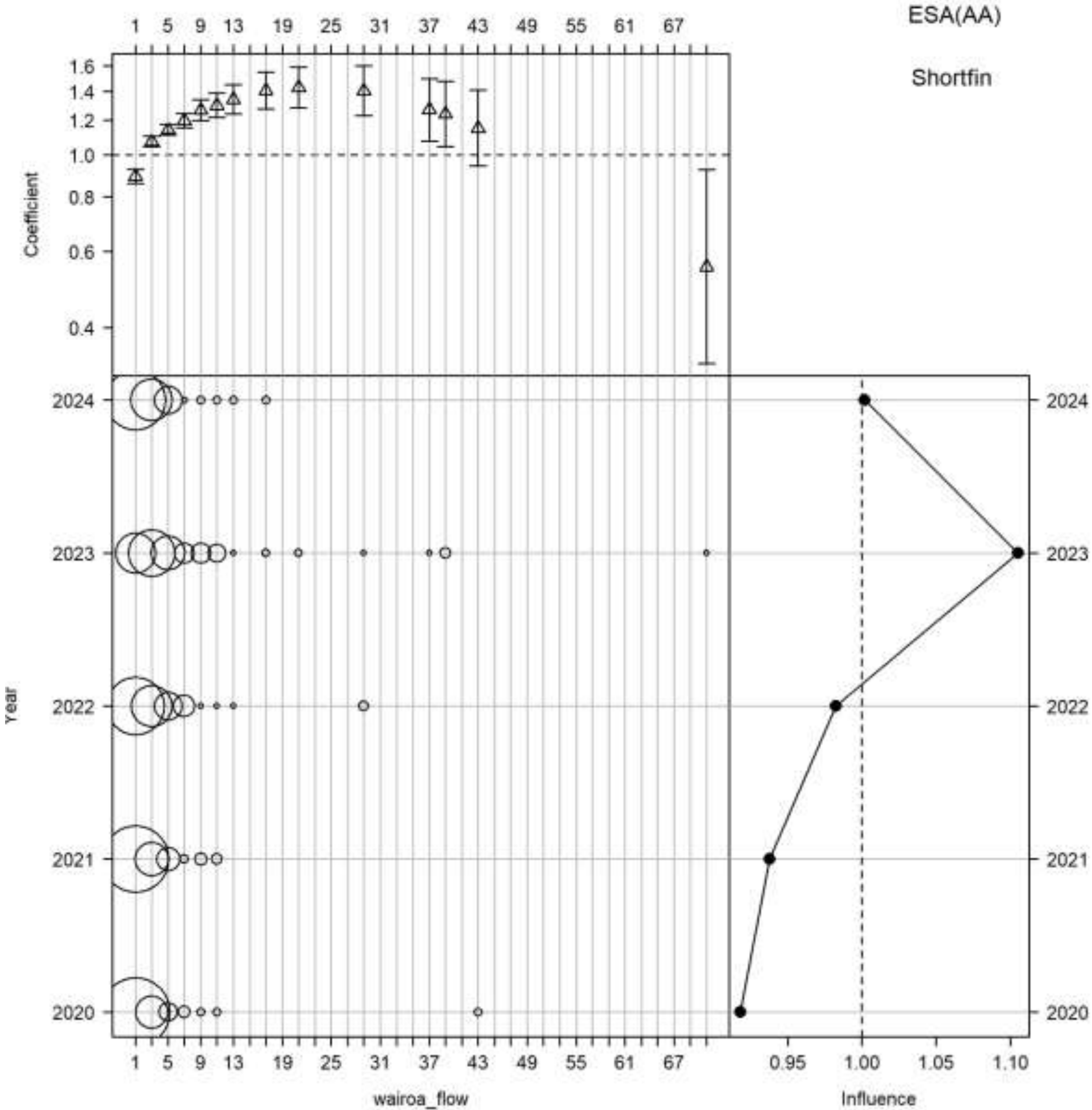

Figure A25: Influence of Wairoa River flow for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

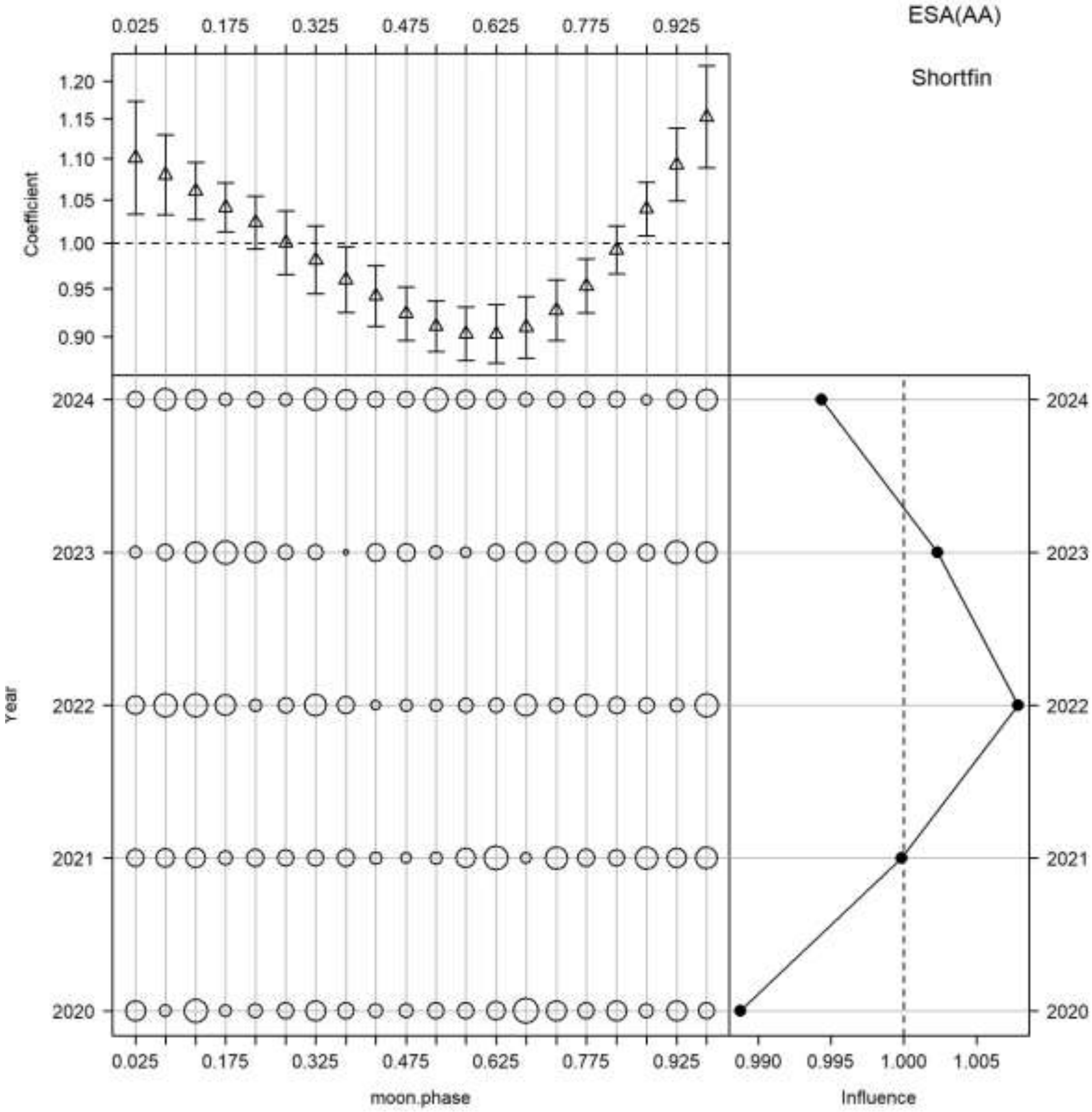

Figure A26: Influence of moon-phase for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

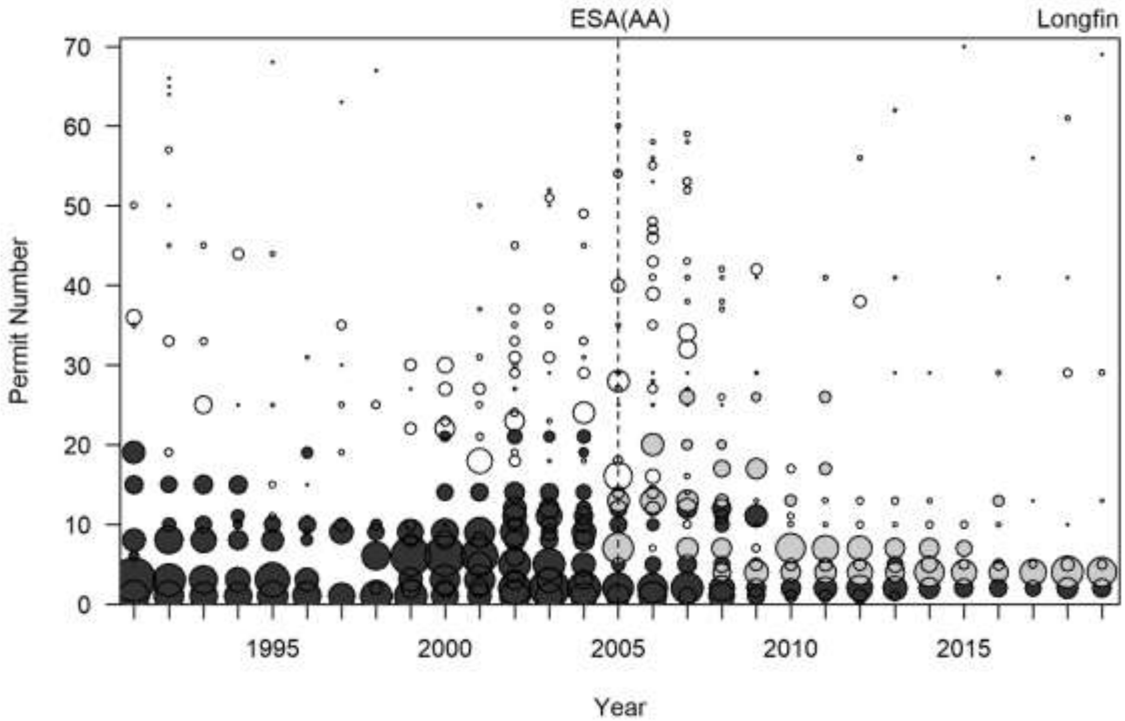

Figure A27: Relative longfin legal size eel catch, from all fishers (all circles) for the years 1990–91 to 2018–19 (pre-ERS), and for core fishers (dark and grey shaded circles) included in the catch per unit effort analyses. The vertical dotted line indicates introduction into the QMS in 2004–05. The dark shaded circles post-QMS are existing fishers and the grey, new entrants (ESA AA).

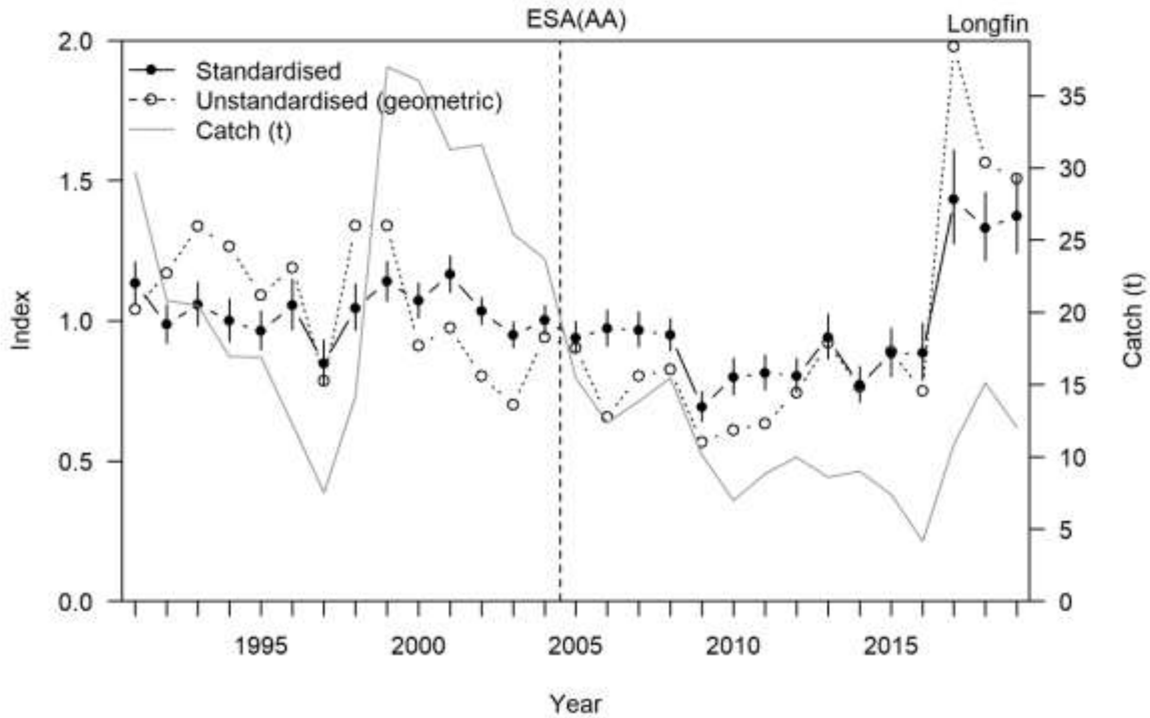

Figure A28: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for longfin (core fishers) for the years 1990–91 to 2018–19 (pre-ERS). The longfin catch by core fishers is also plotted. The vertical dotted line indicates introduction into the QMS in 2004–05. Catch includes legal size eels (ESA AA).

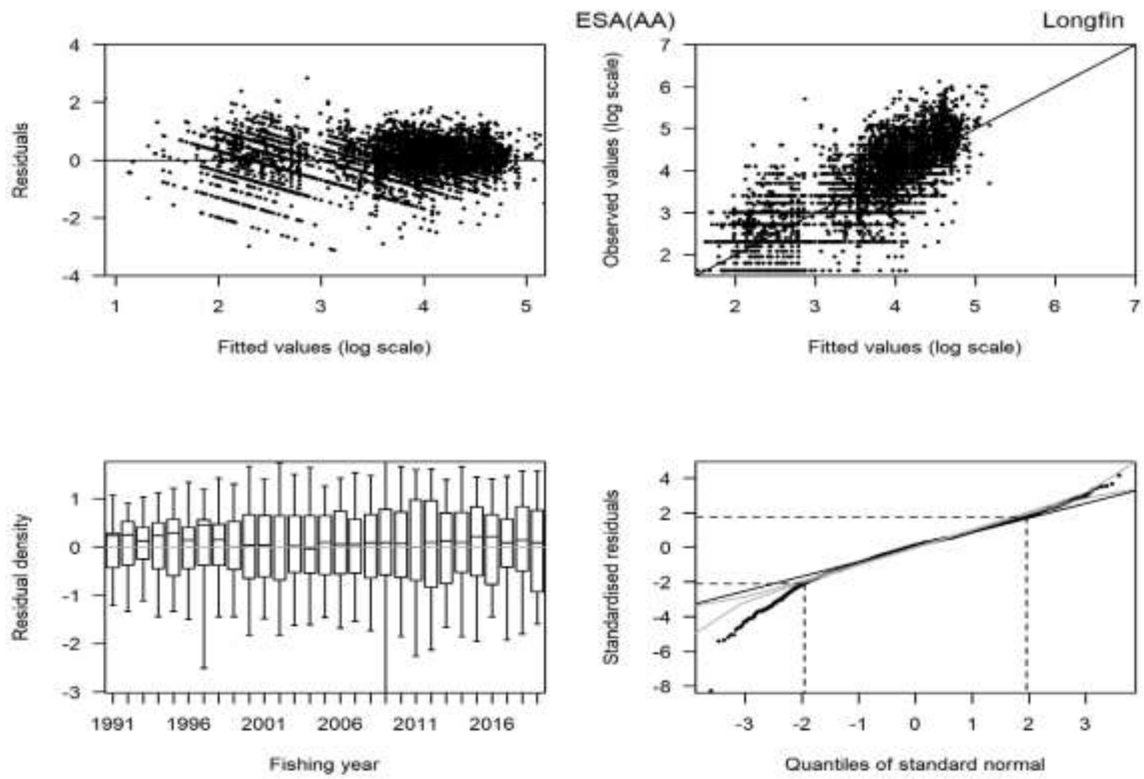

Figure A29: Residual diagnostic plots for the longfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AA).

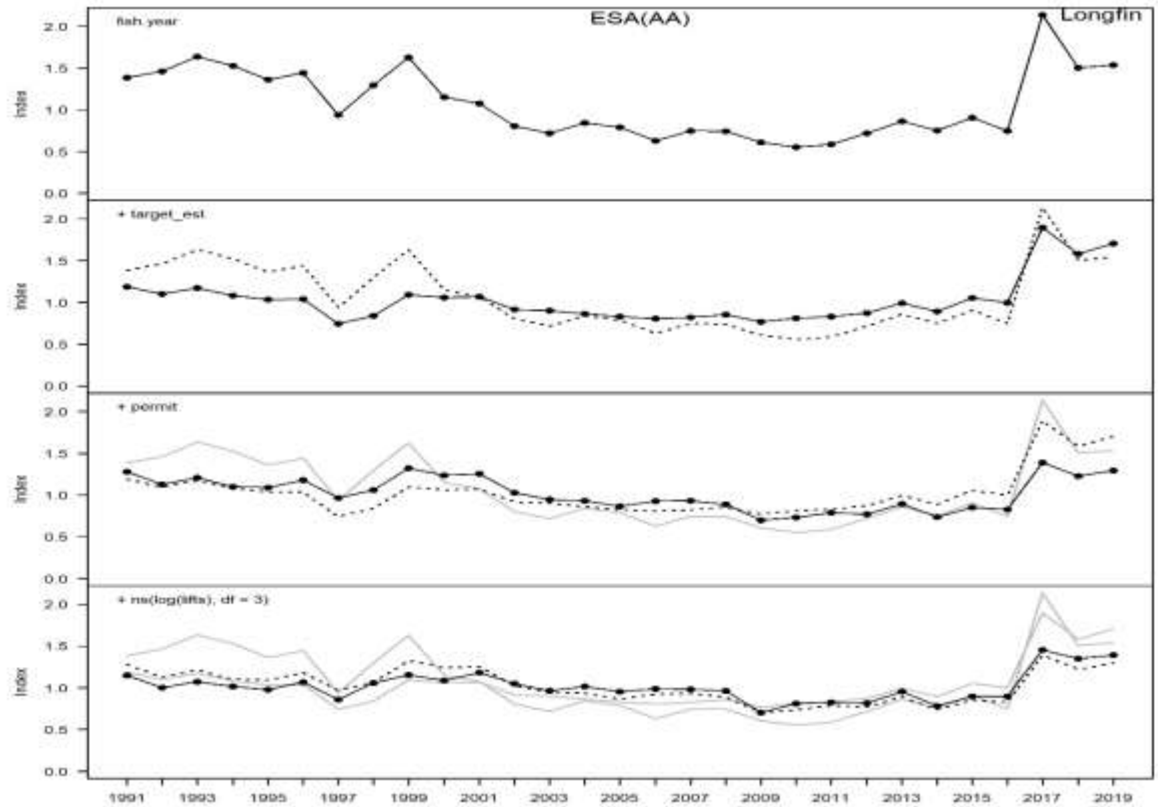

Figure A30: Step plot for the longfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AA).

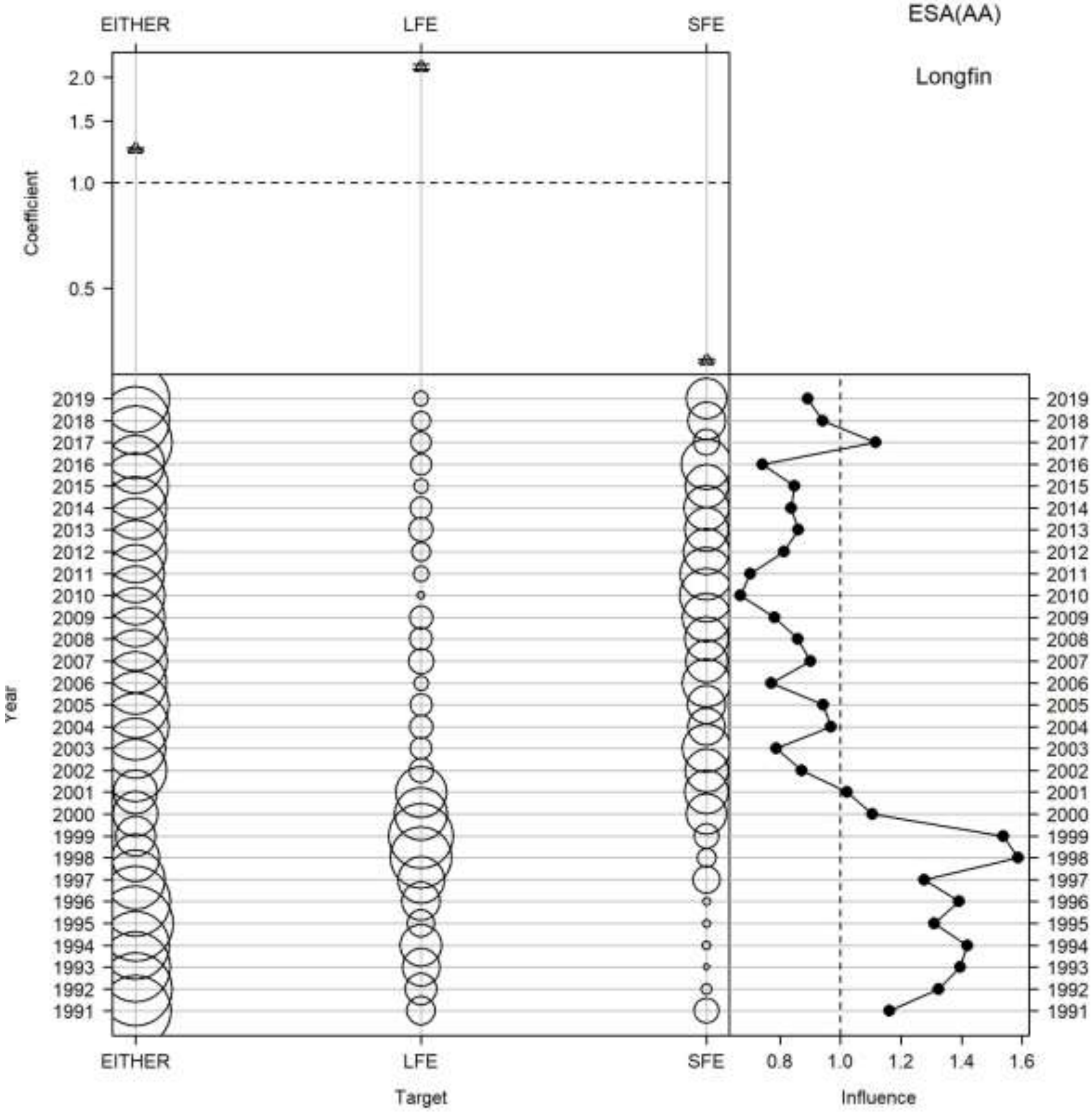

Figure A31: Influence of reconstructed target for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AA).

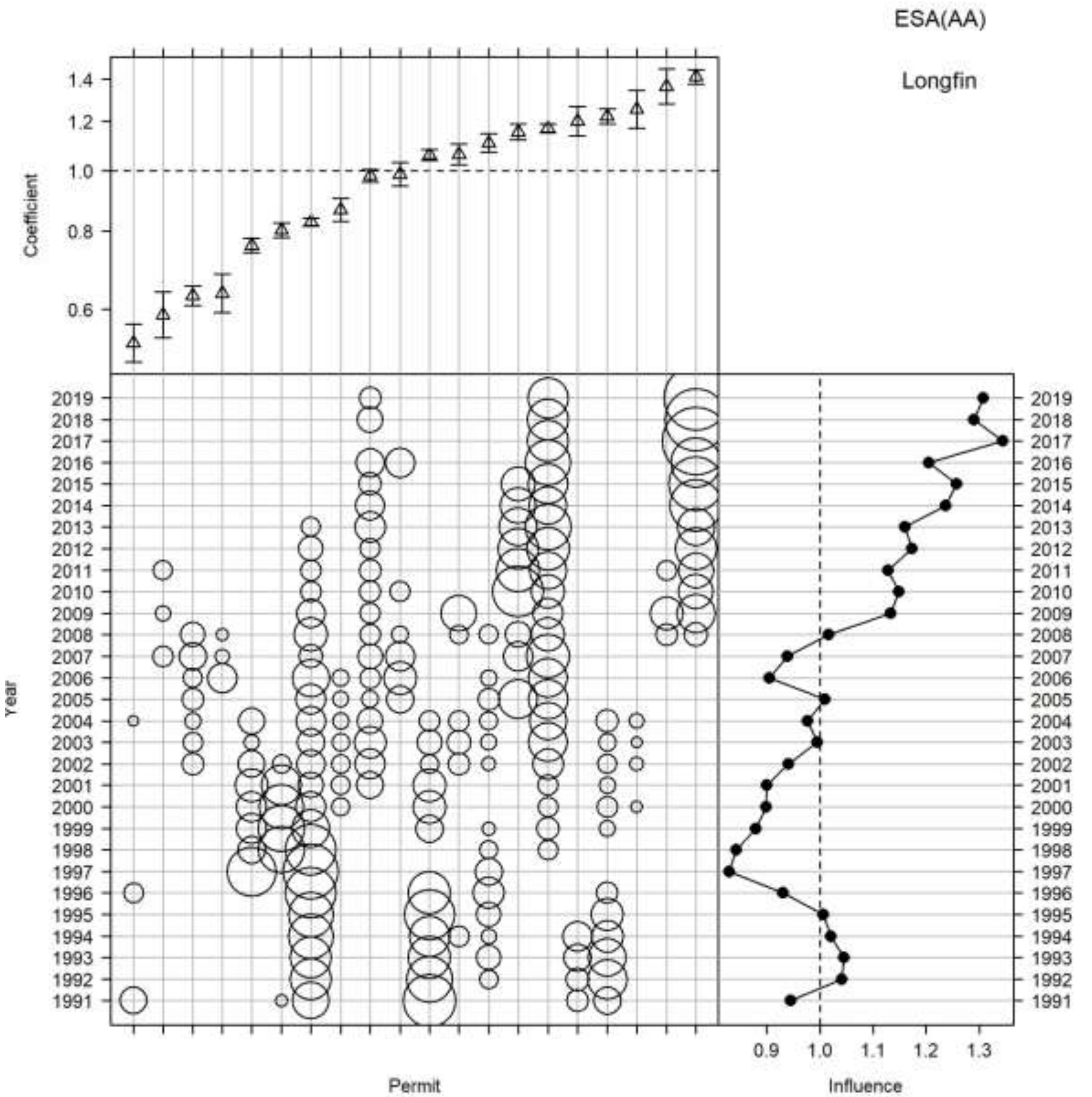

Figure A32: Influence of permit for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AA).

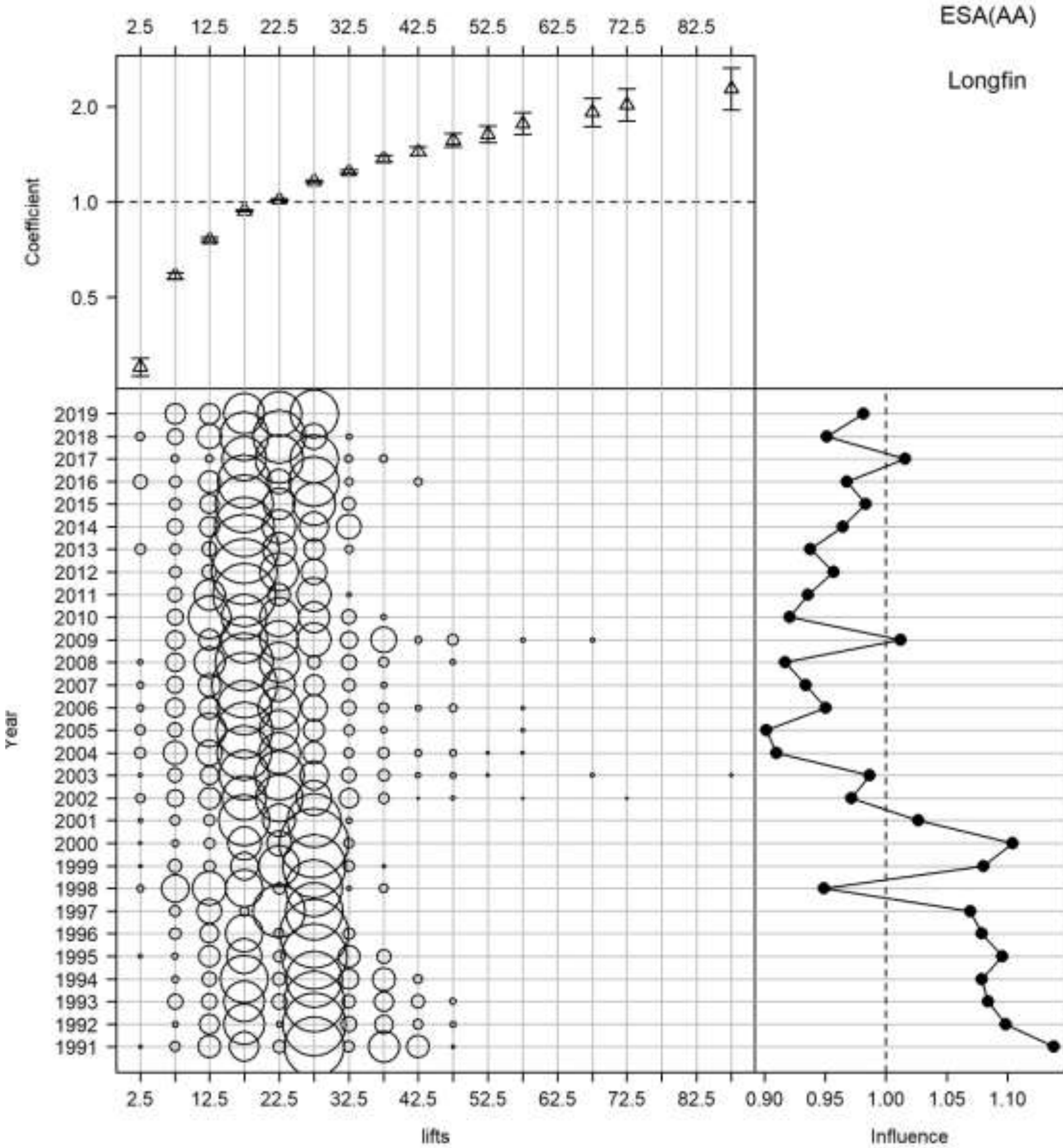

Figure A33: Influence of lifts for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AA).

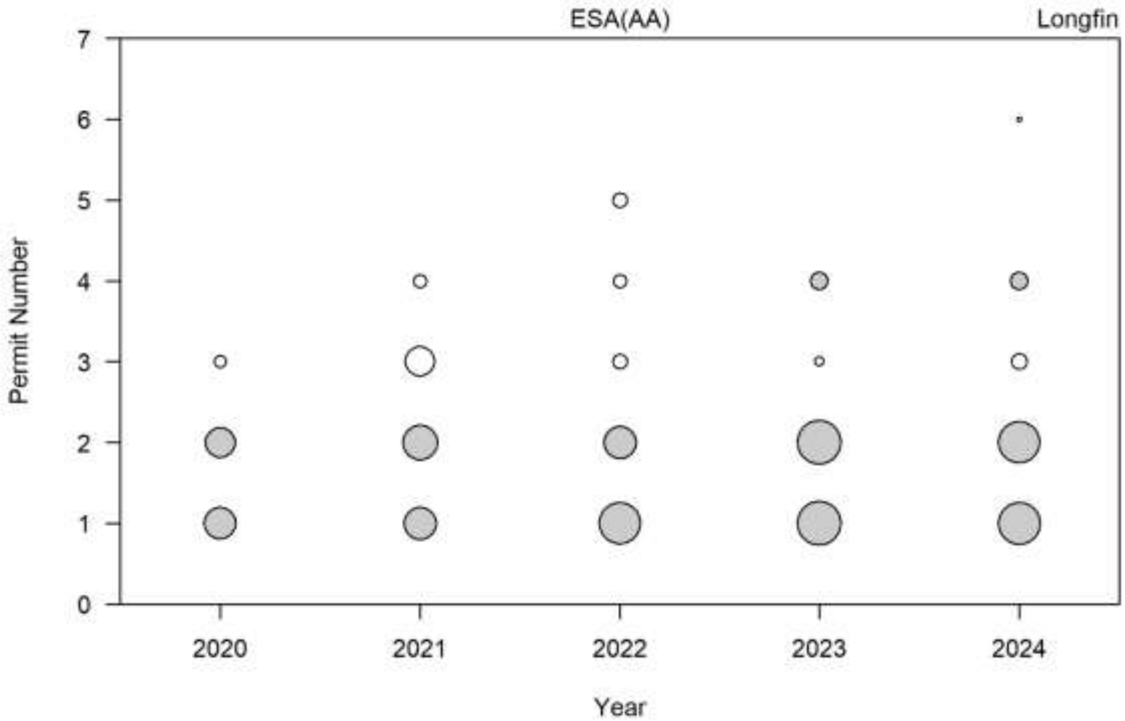

Figure A34: Relative longfin legal size eel catch and destination G, from all fishers (all circles) for the years 2019–20 to 2023–24 (post-ERS), and for core fishers (grey shaded circles) included in the catch per unit effort analyses (ESA AA).

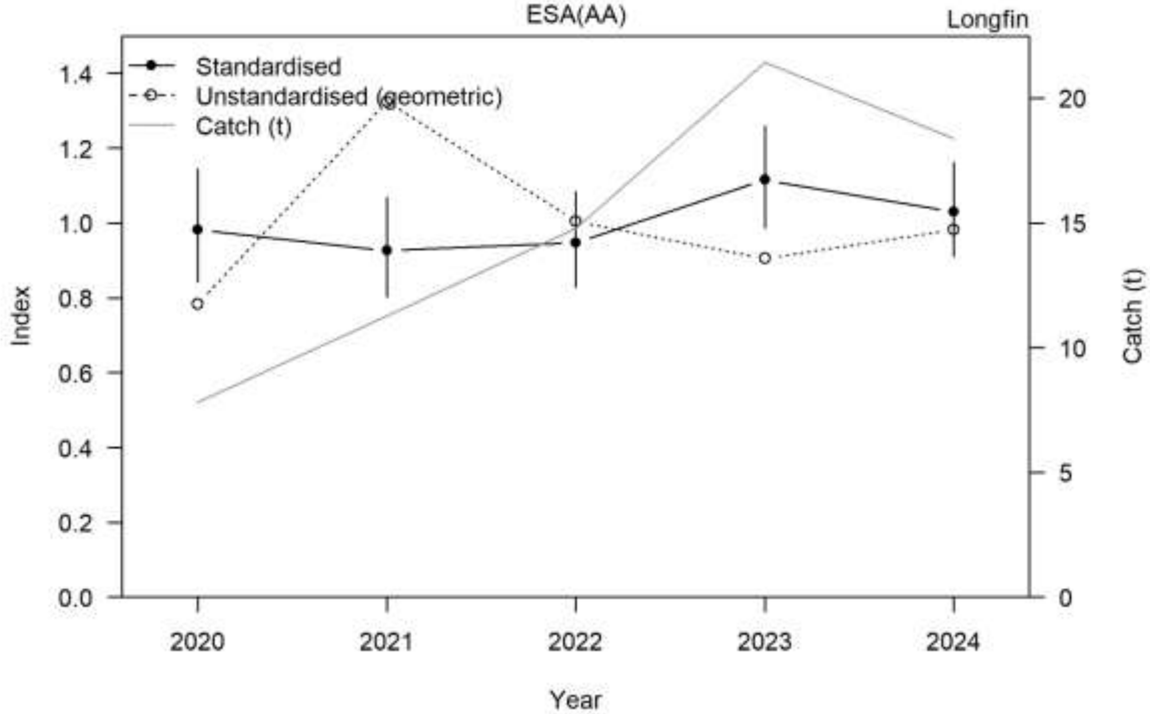

Figure A35: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for longfin (core fishers) for the years 2019–20 to 2023–24 (post-ERS). The longfin catch by core fishers is also plotted. Catch includes legal size eels and destination G (ESA AA).

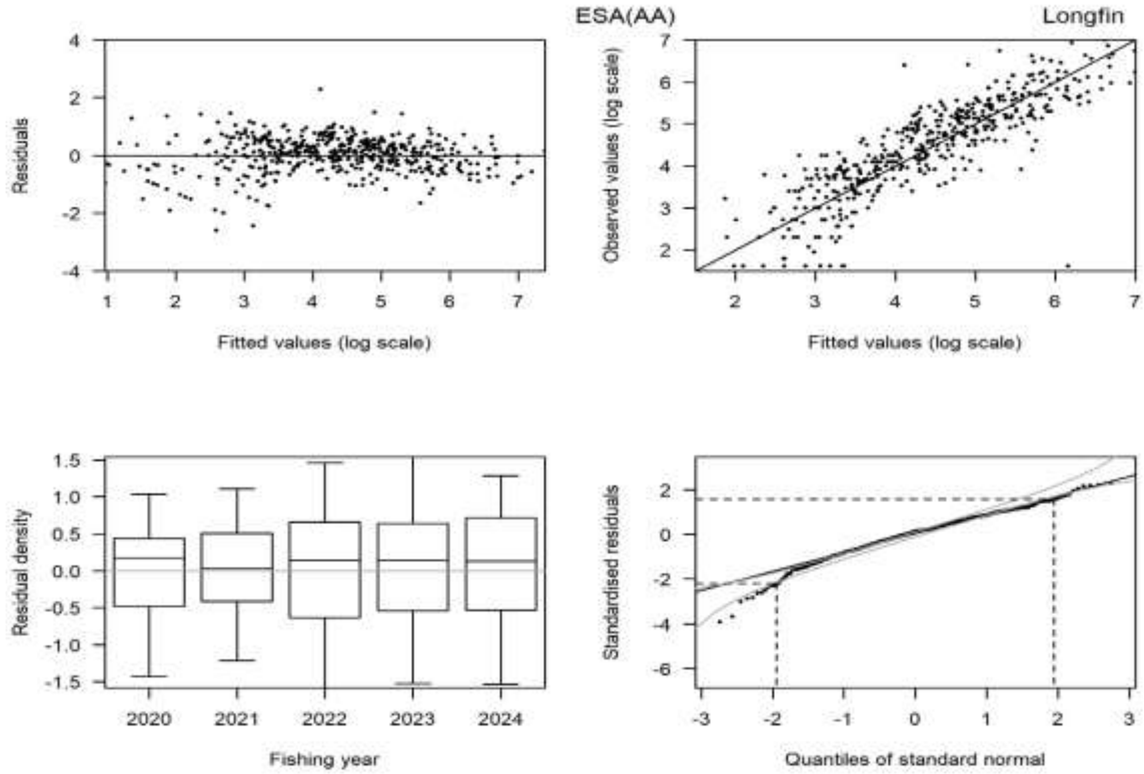

Figure A36: Residual diagnostic plots for the longfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AA).

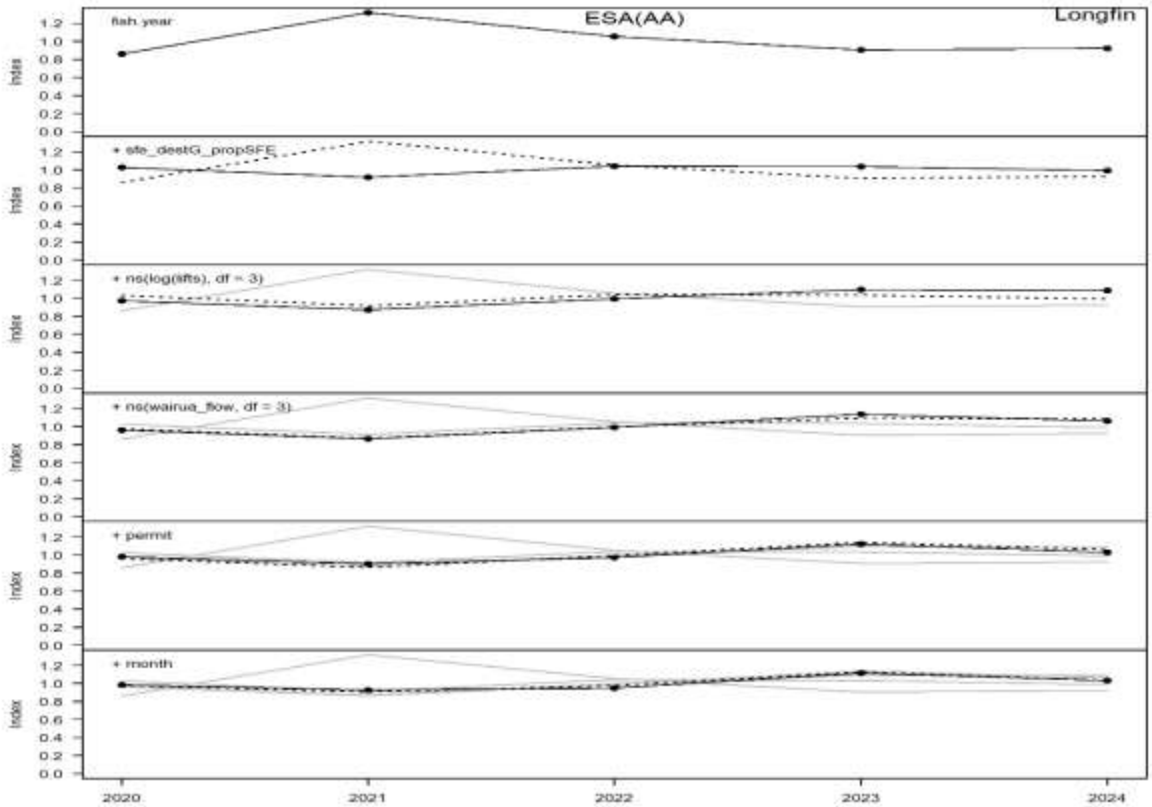

Figure A37: Step plot for the longfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AA).

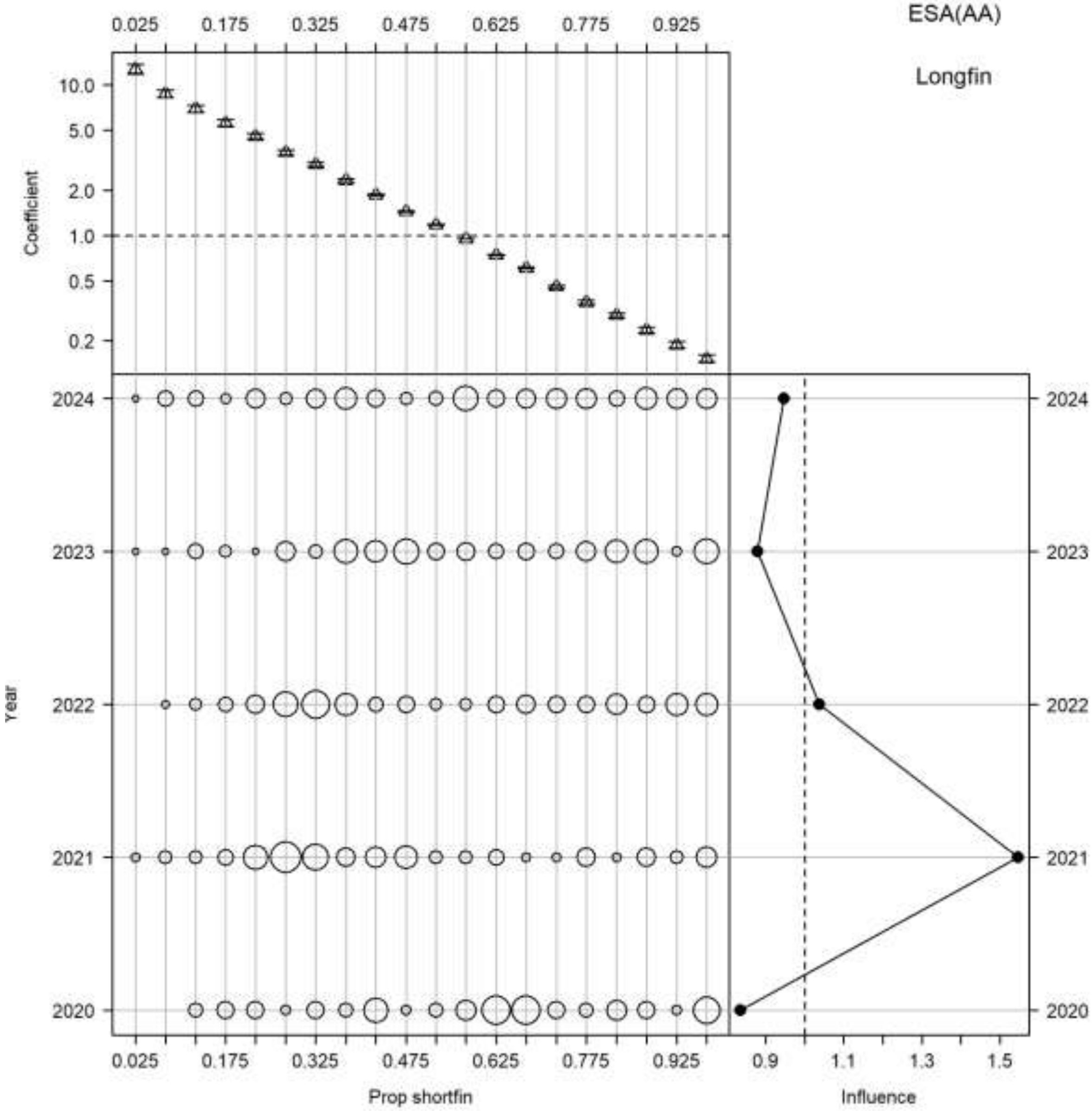

Figure A38: Influence of proportion shortfin for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

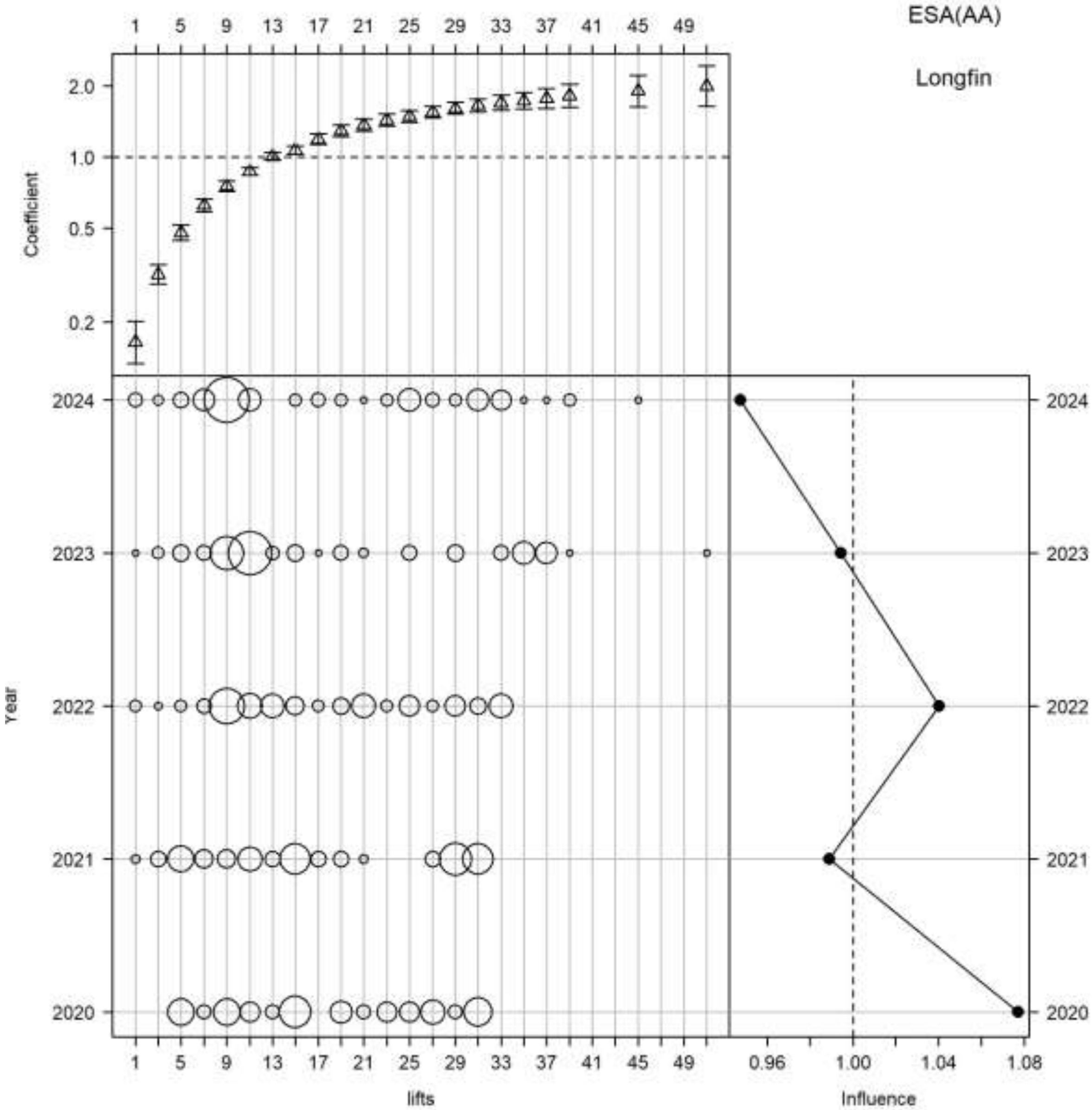

Figure A39: Influence of lifts in the catch for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

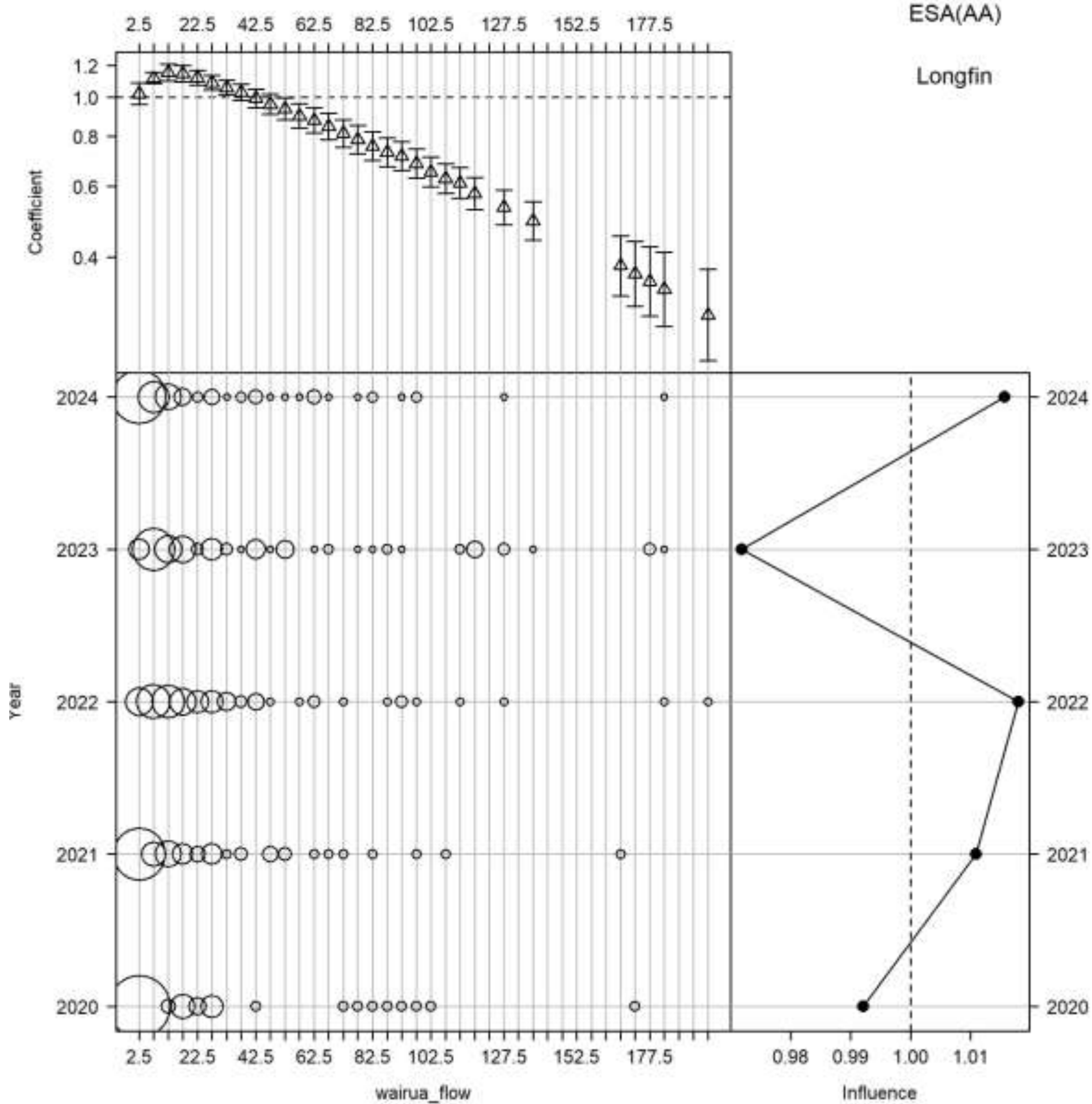

Figure A40: Influence of Wairua River flow for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

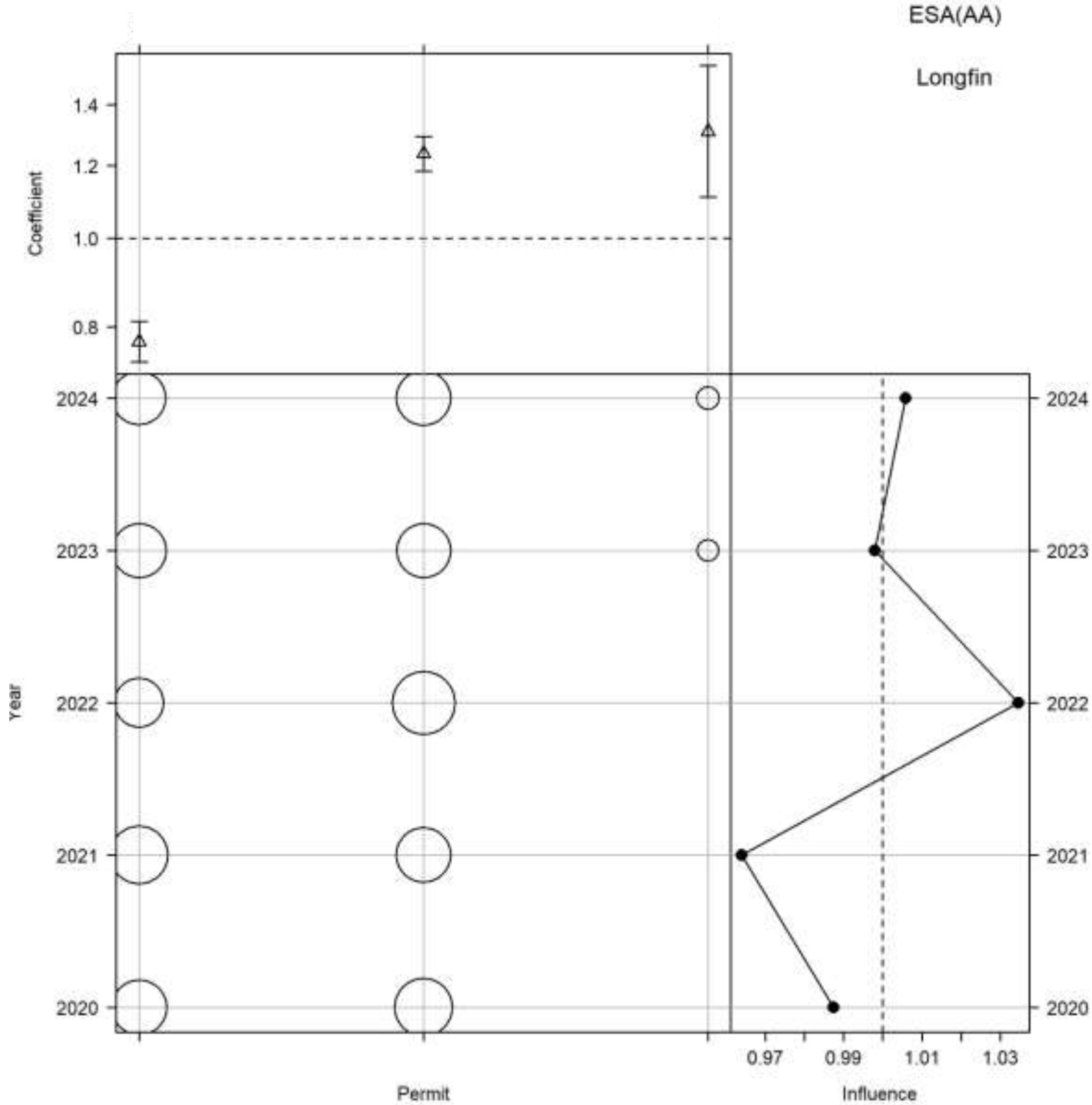

Figure A41: Influence of permit for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

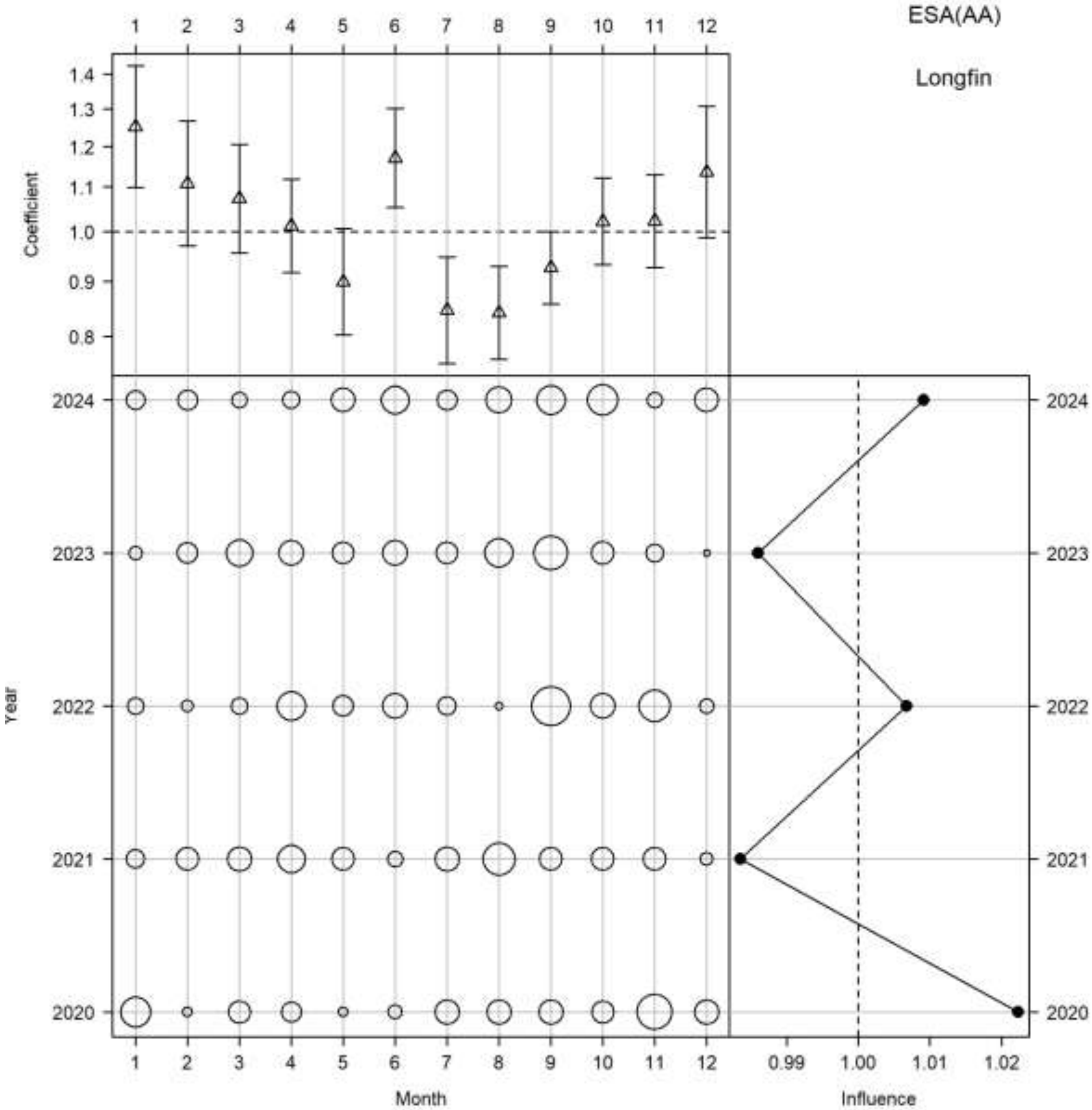

Figure A42: Influence of month for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AA).

ESA AB (Auckland)

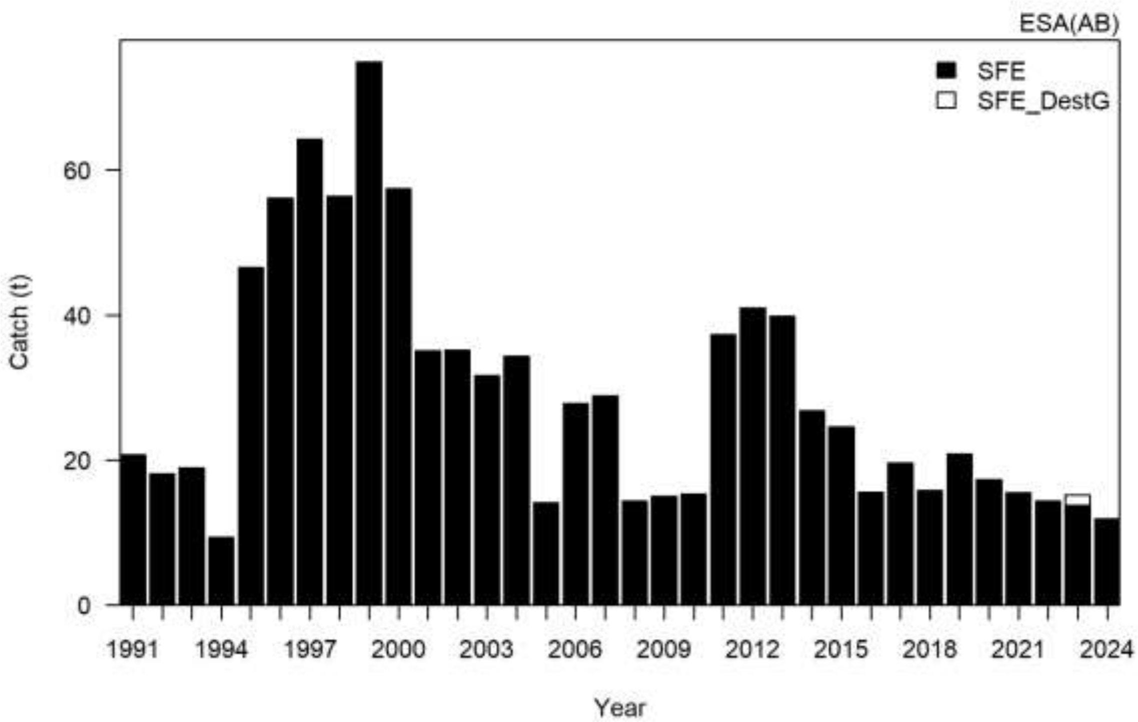

Figure B1: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AB).

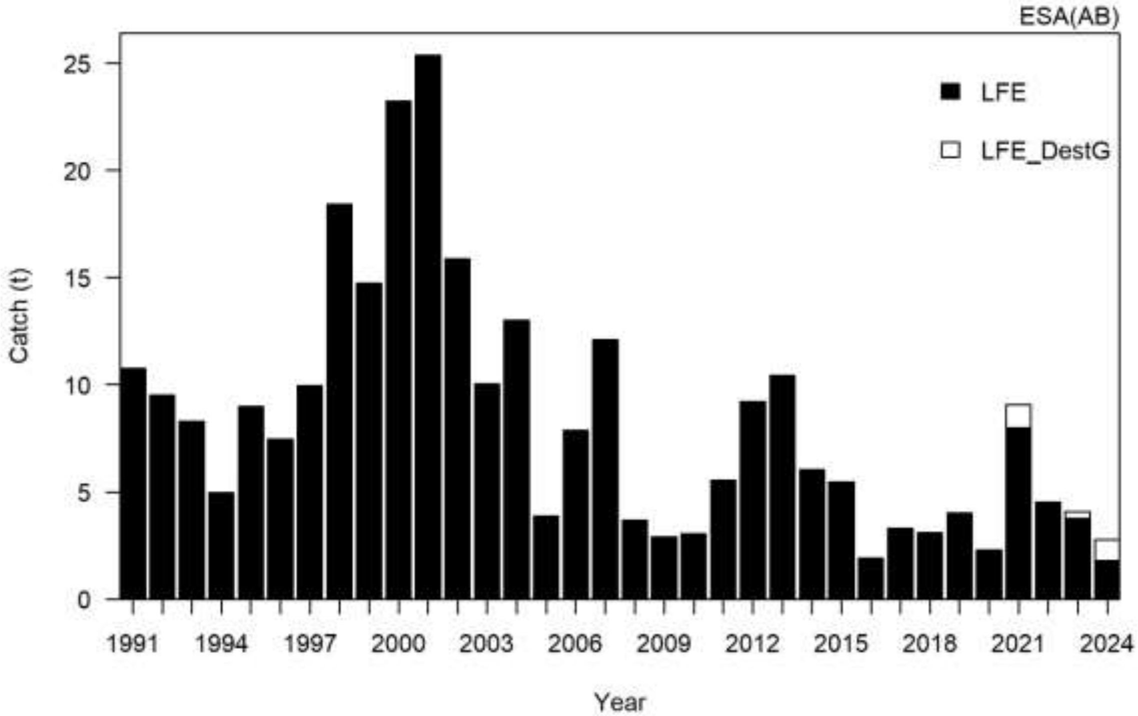

Figure B2: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AB).

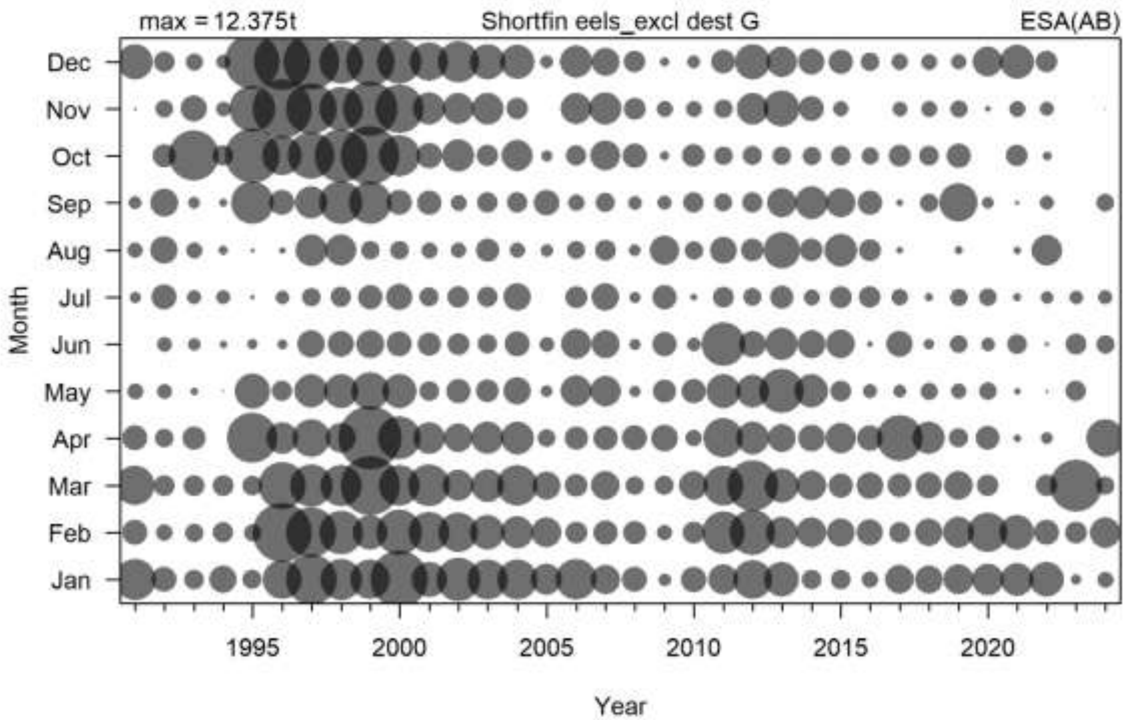

Figure B3: Shortfin legal size eel catch by month for the years 1990–91 to 2023–24 (ESA AB).

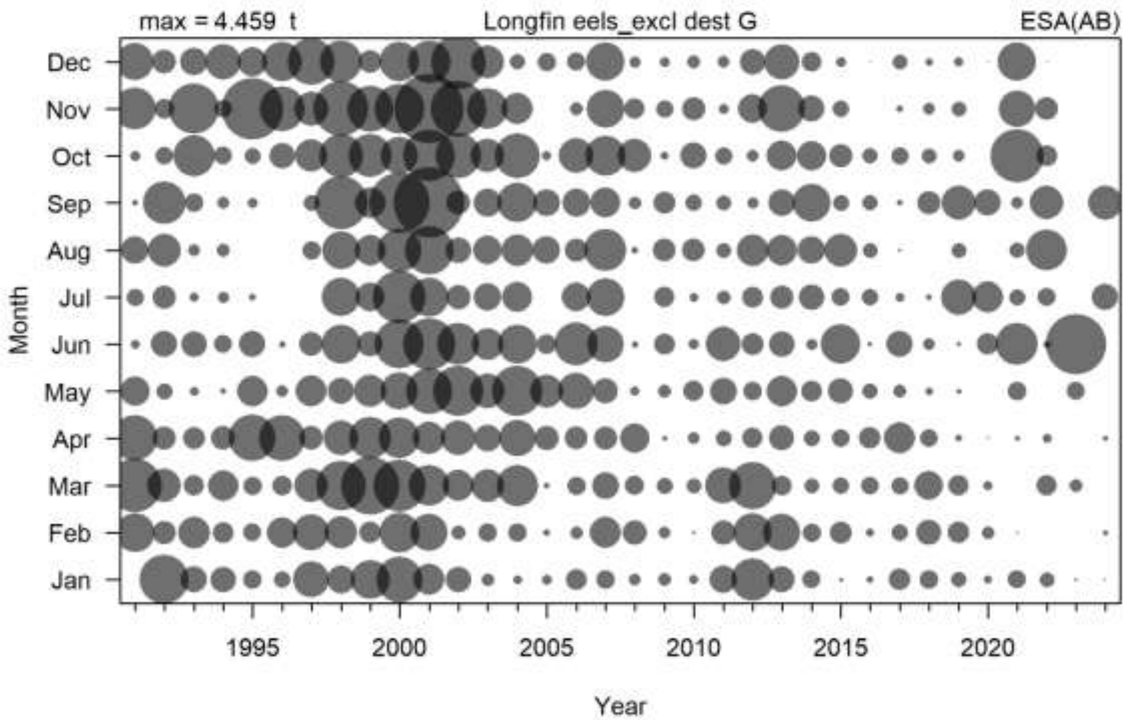

Figure B4: Longfin legal size eel catch by month for the years 1990–91 to 2023–24 (ESA AB).

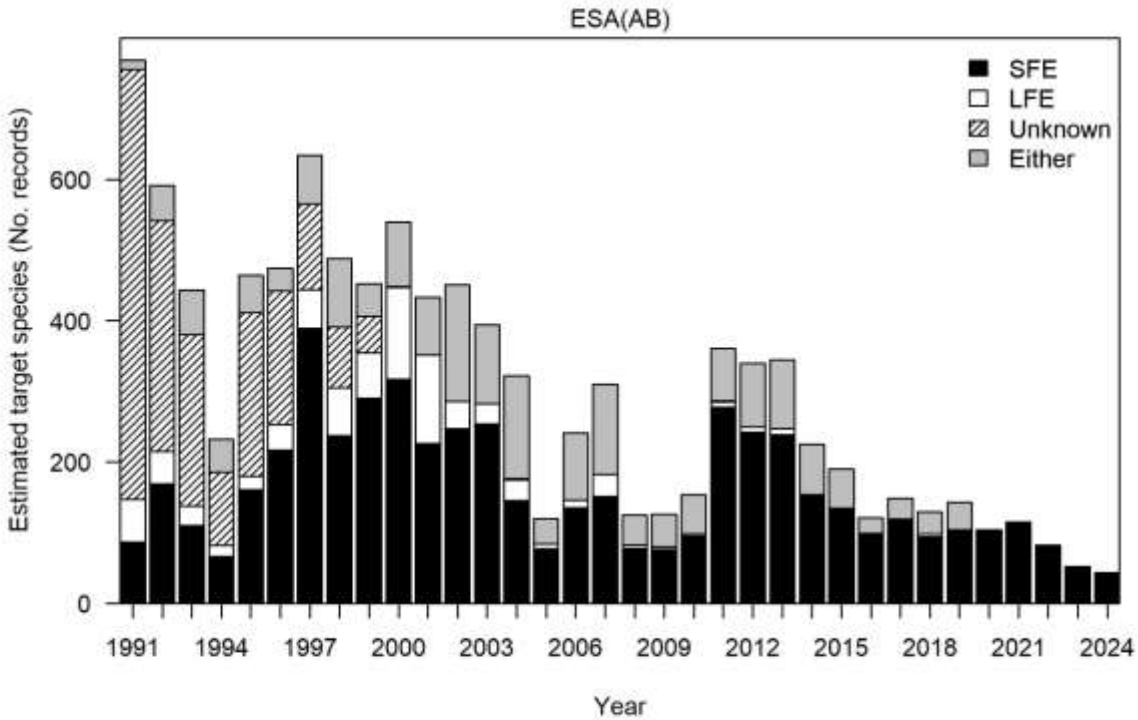

Figure B5: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AB).

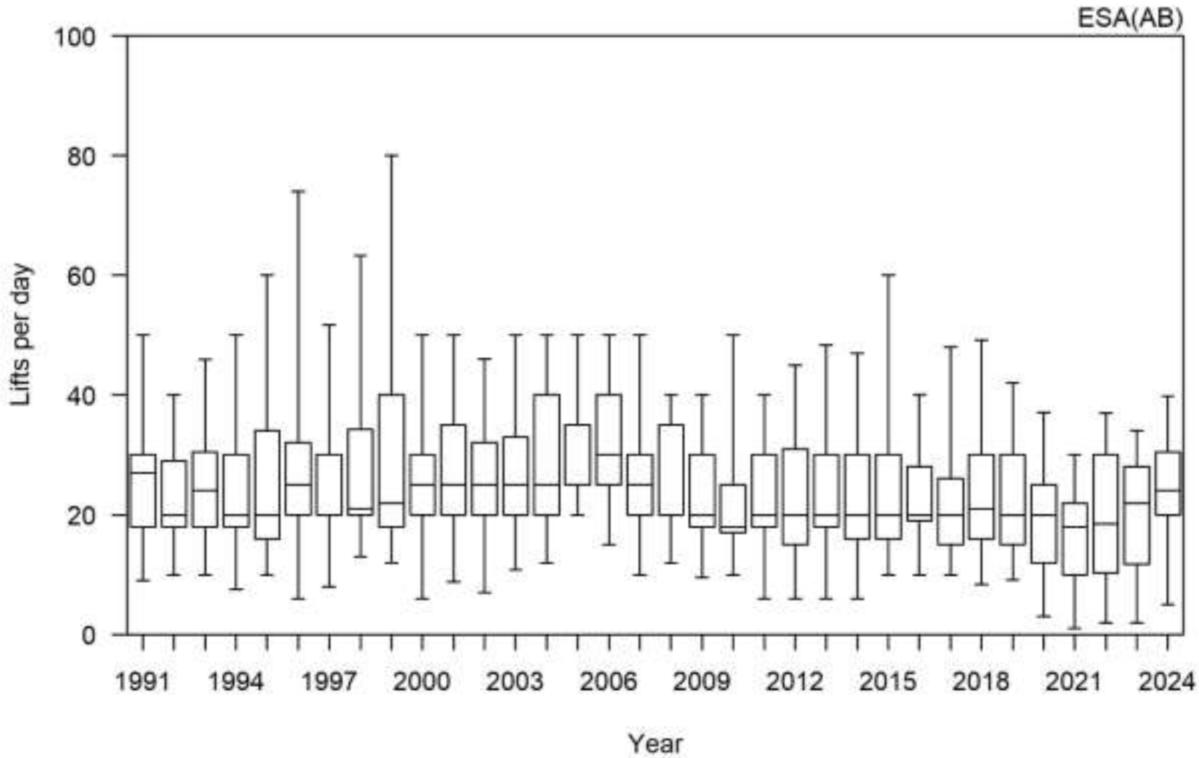

Figure B6: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AB).

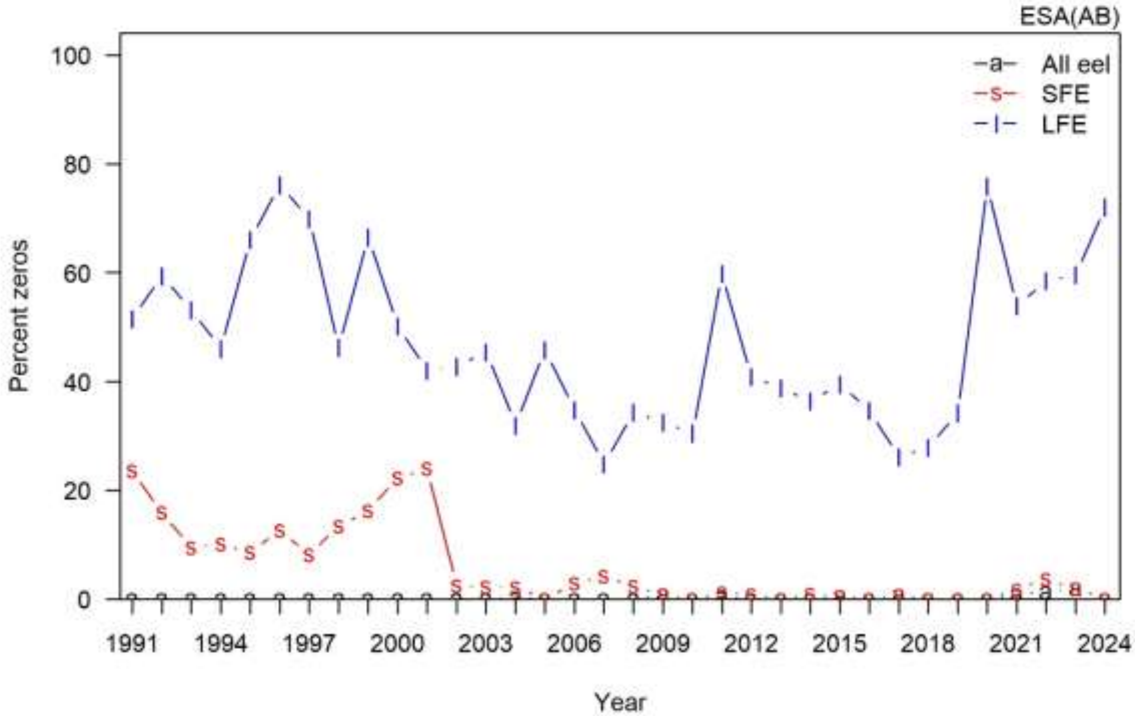

Figure B7: Proportion of valid zero records for legal size all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AB).

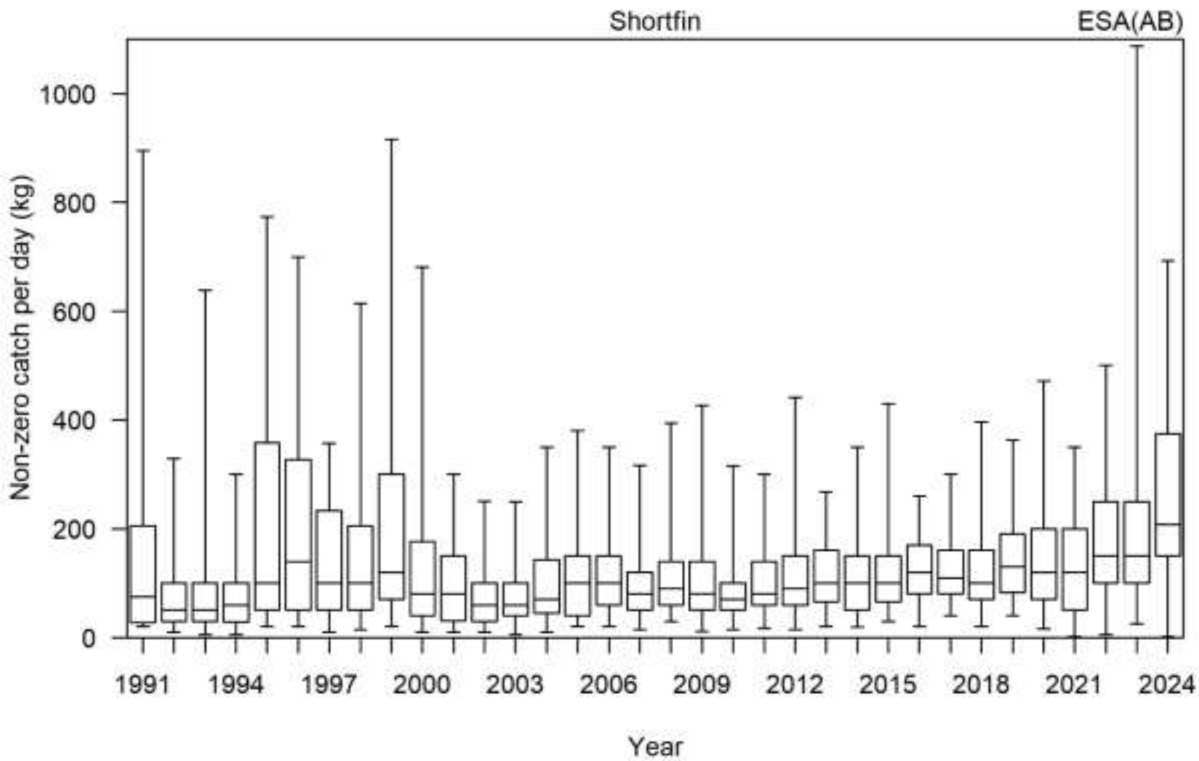

Figure B8: Shortfin non-zero catch per day for legal size eels for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AB).

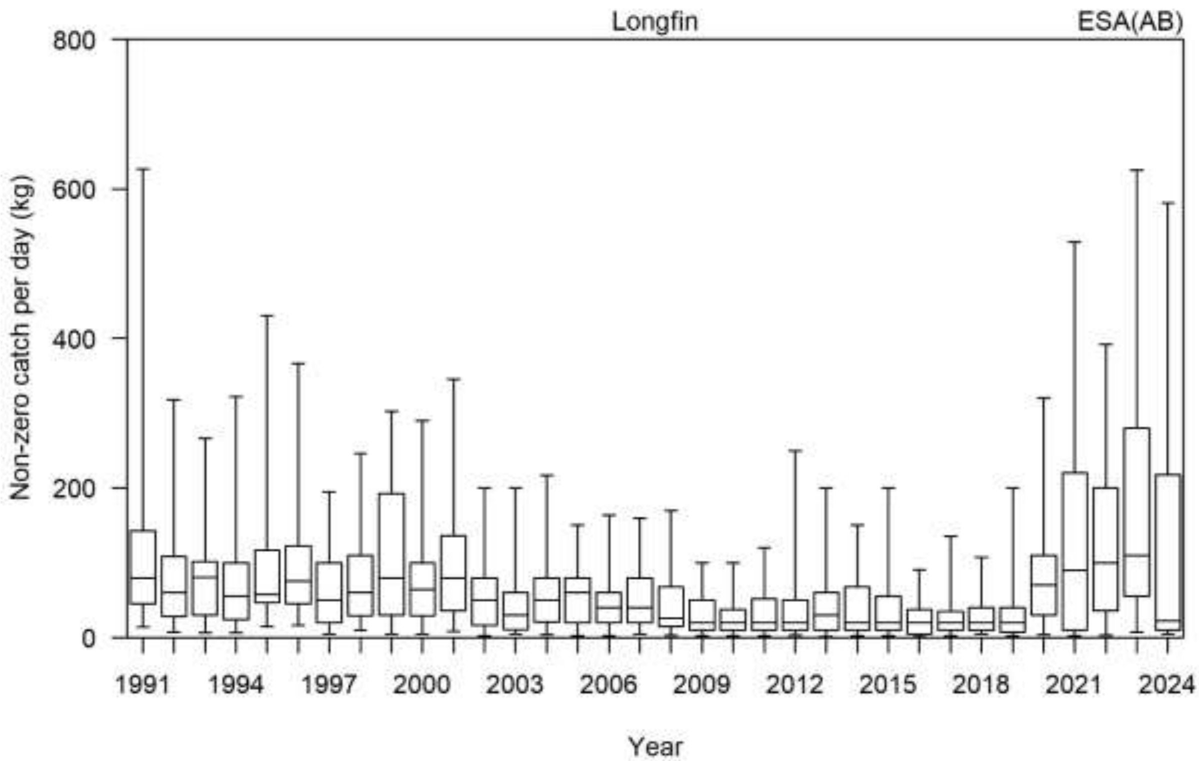

Figure B9: Longfin non-zero catch per day for legal size eels for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AB).

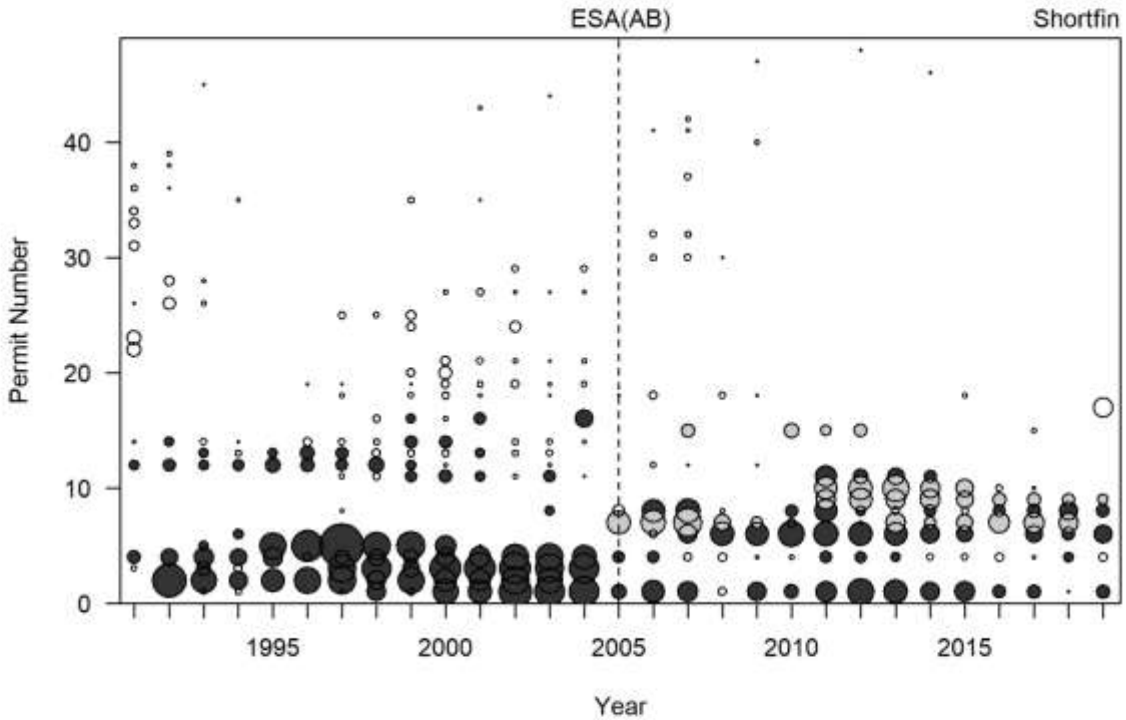

Figure B10: Relative shortfin legal size eel catch, from all fishers (all circles) for the years 1990–91 to 2018–19 (pre-ERS), and for core fishers (dark and grey shaded circles) included in the catch per unit effort analyses. The vertical dotted line indicates introduction into the QMS in 2004–05. The dark shaded circles post-QMS are existing fishers and the grey, new entrants (ESA AB).

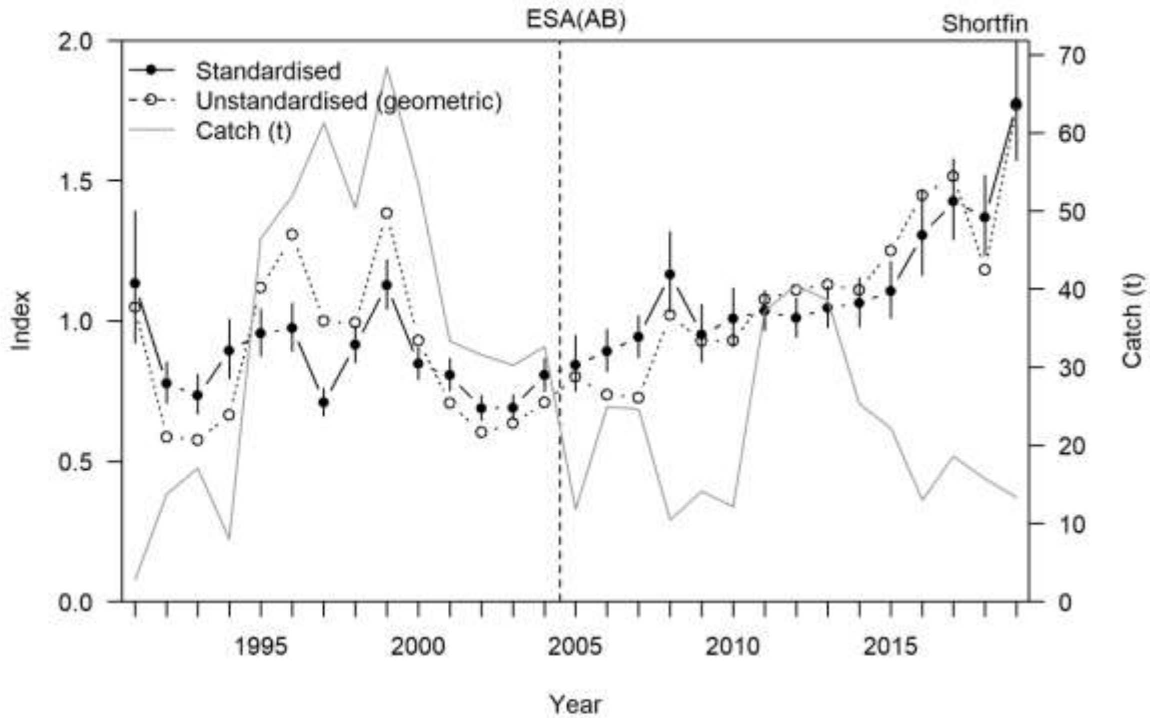

Figure B11: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for shortfin (core fishers) for the years 1990–91 to 2018–19 (pre-ERS). The shortfin catch by core fishers is also plotted. The vertical dotted line indicates introduction into the QMS in 2004–05. Catch includes legal size eels (ESA AB).

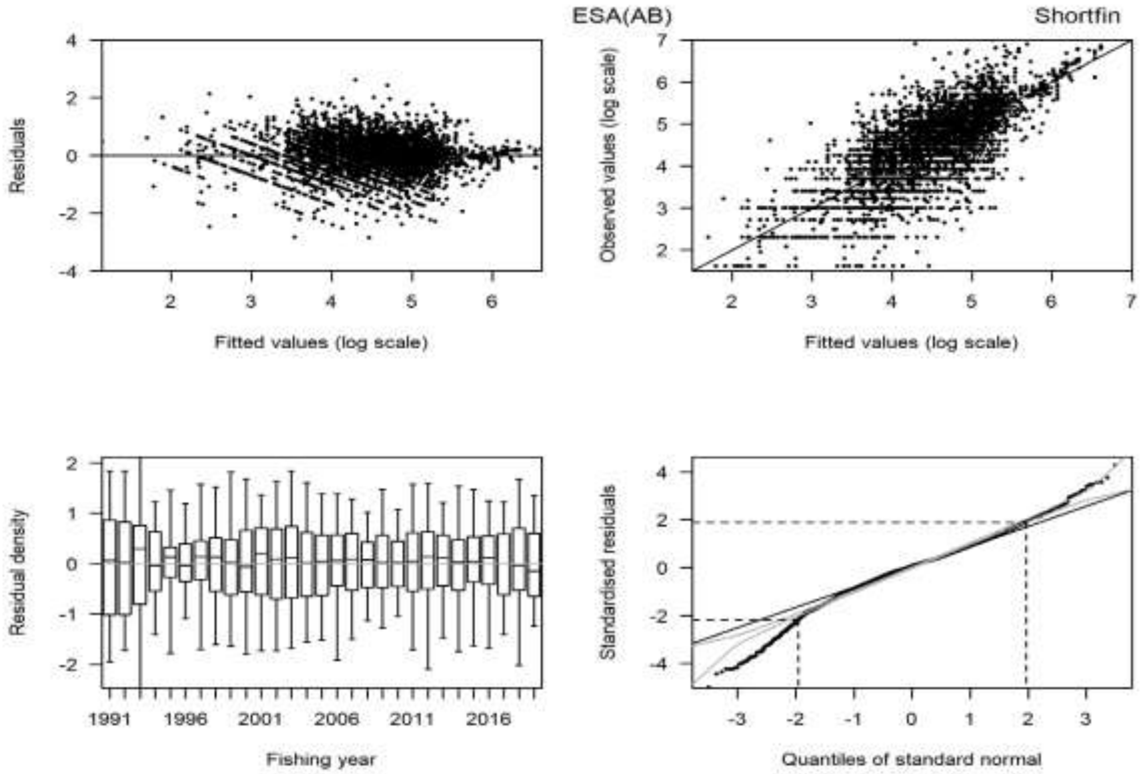

Figure B12: Residual diagnostic plots for the shortfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AB).

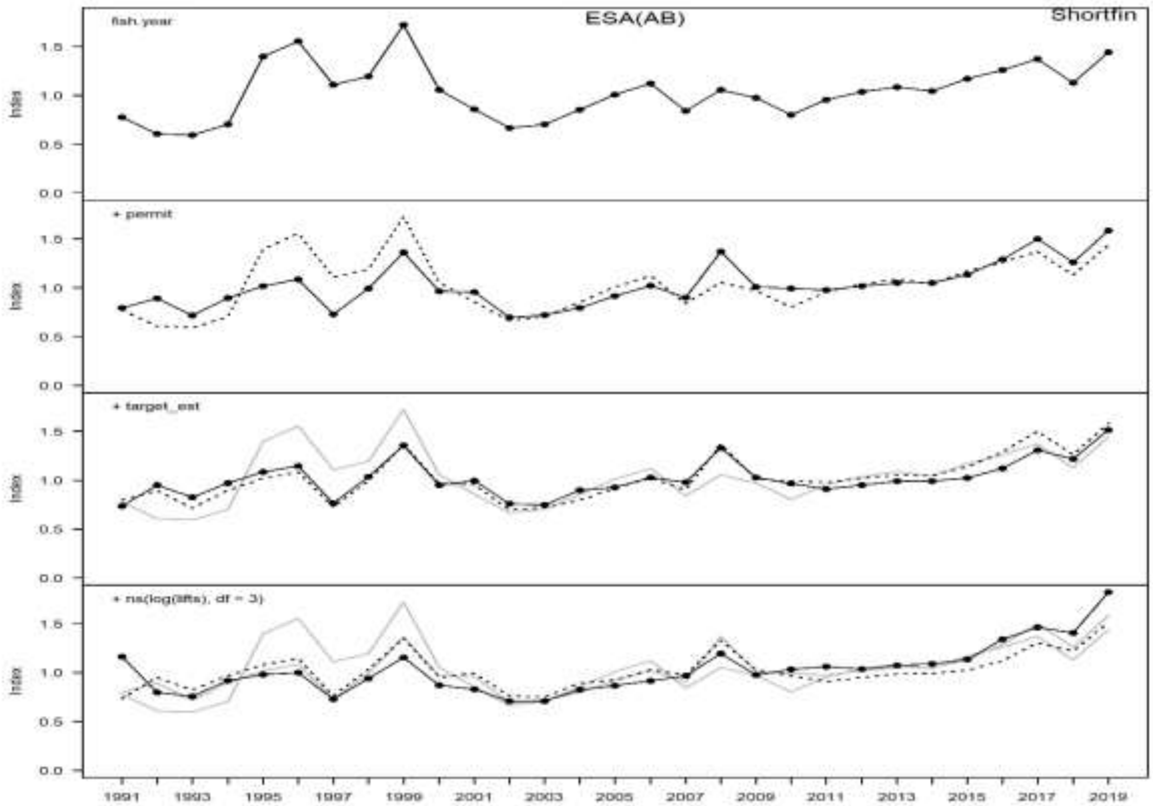

Figure B13: Step plot for the shortfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AB).

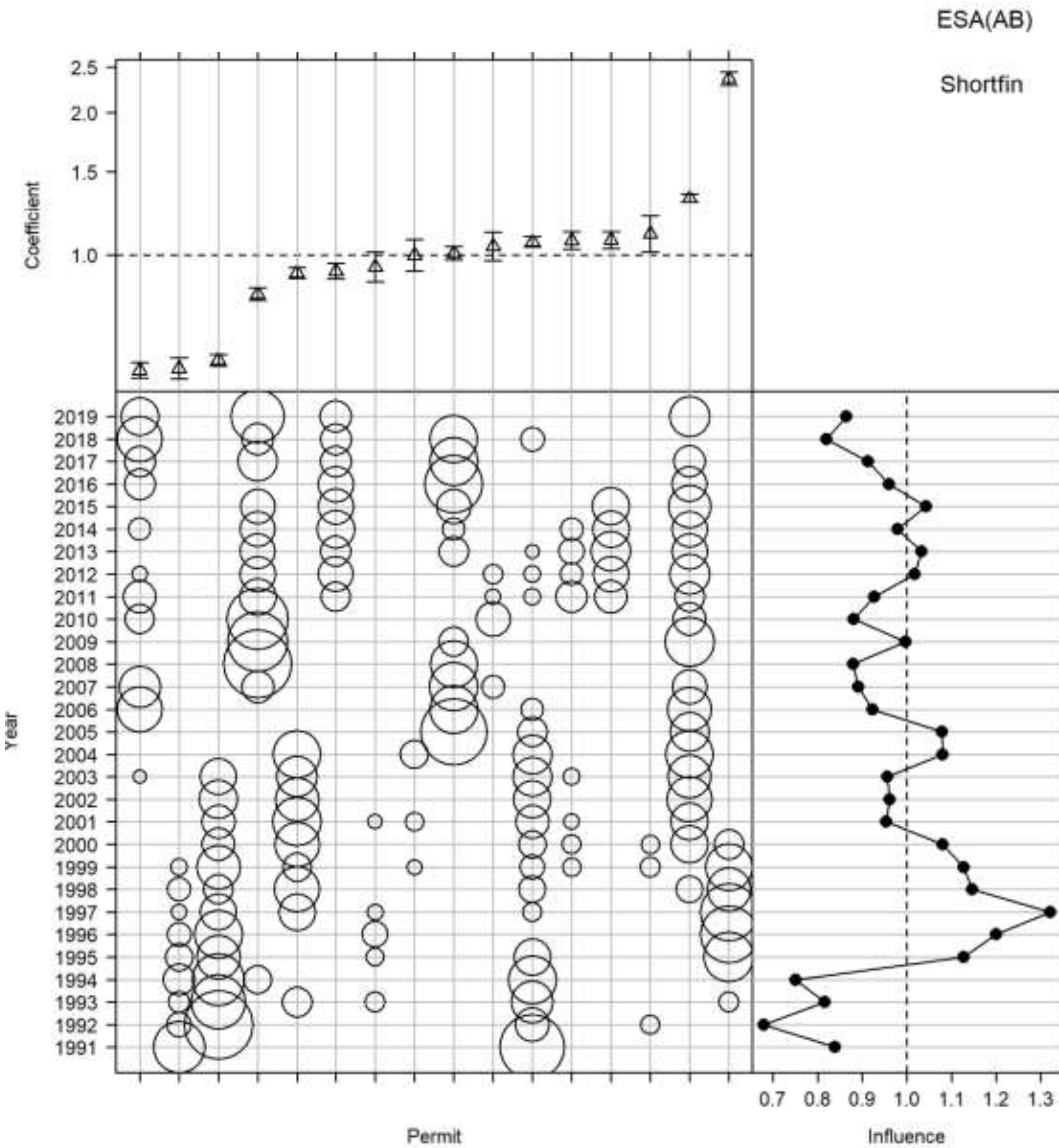

Figure B14: Influence of permit for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AB).

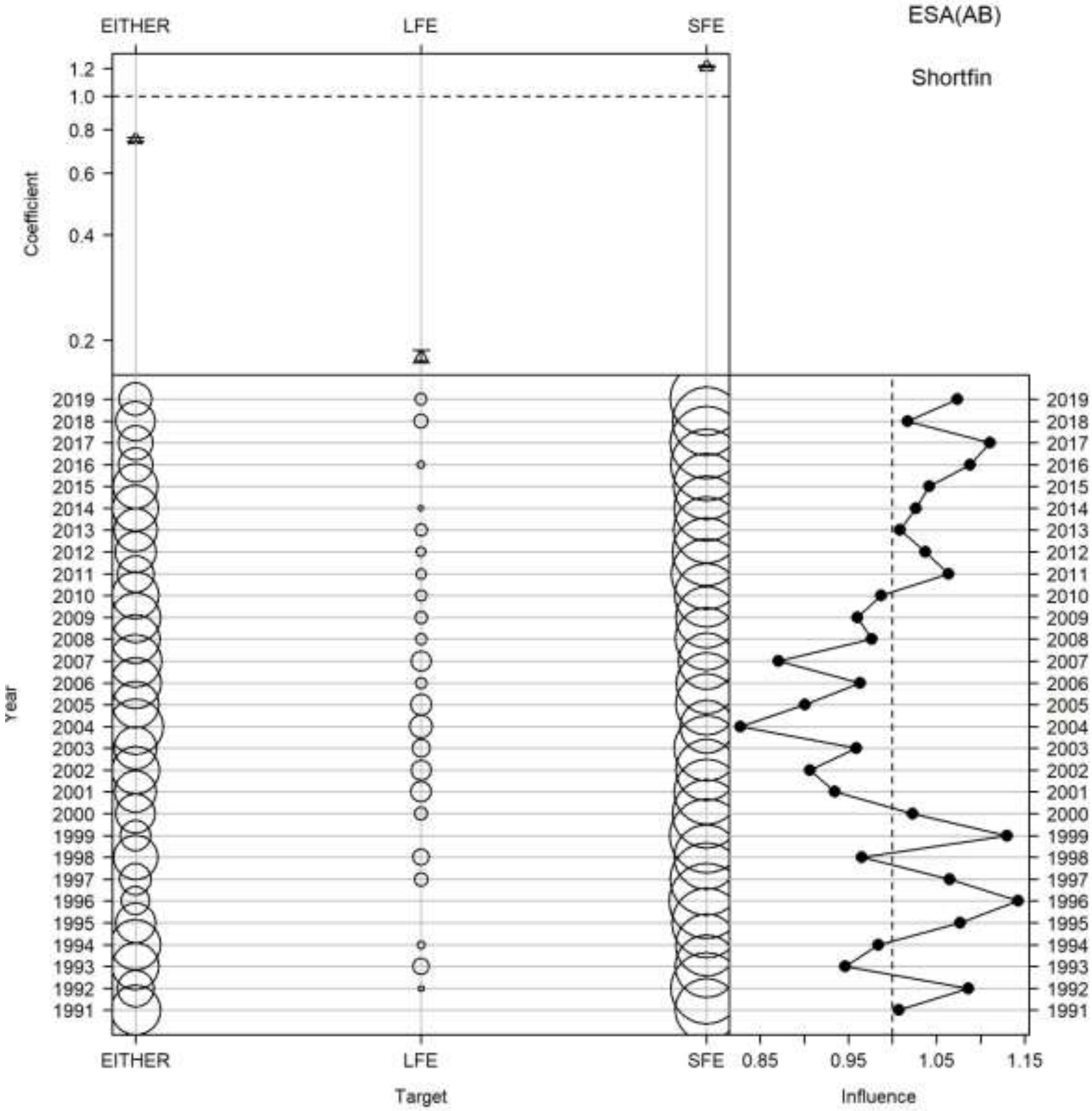

Figure B15: Influence of reconstructed target for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AB).

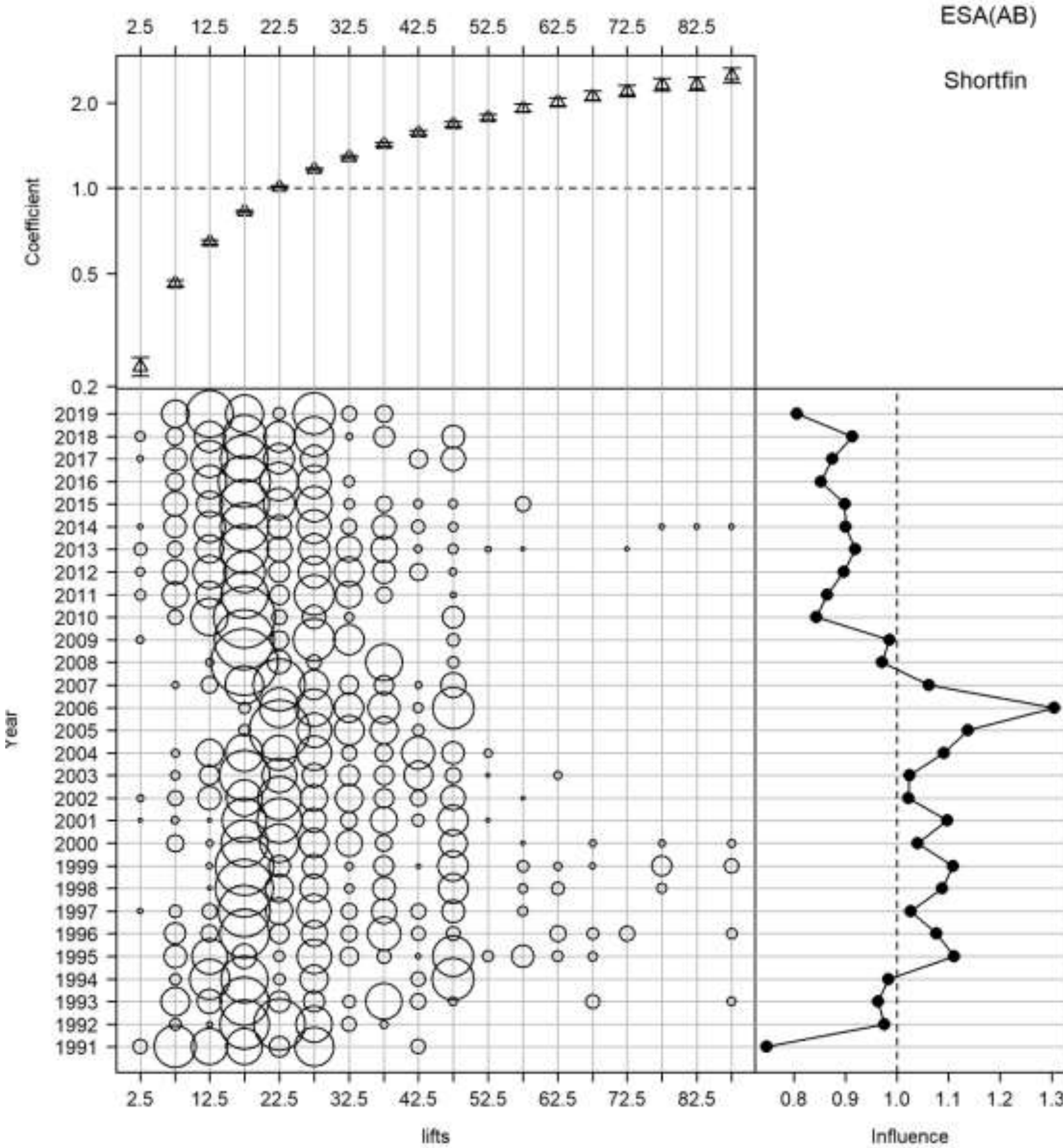

Figure B16: Influence of lifts for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AB).

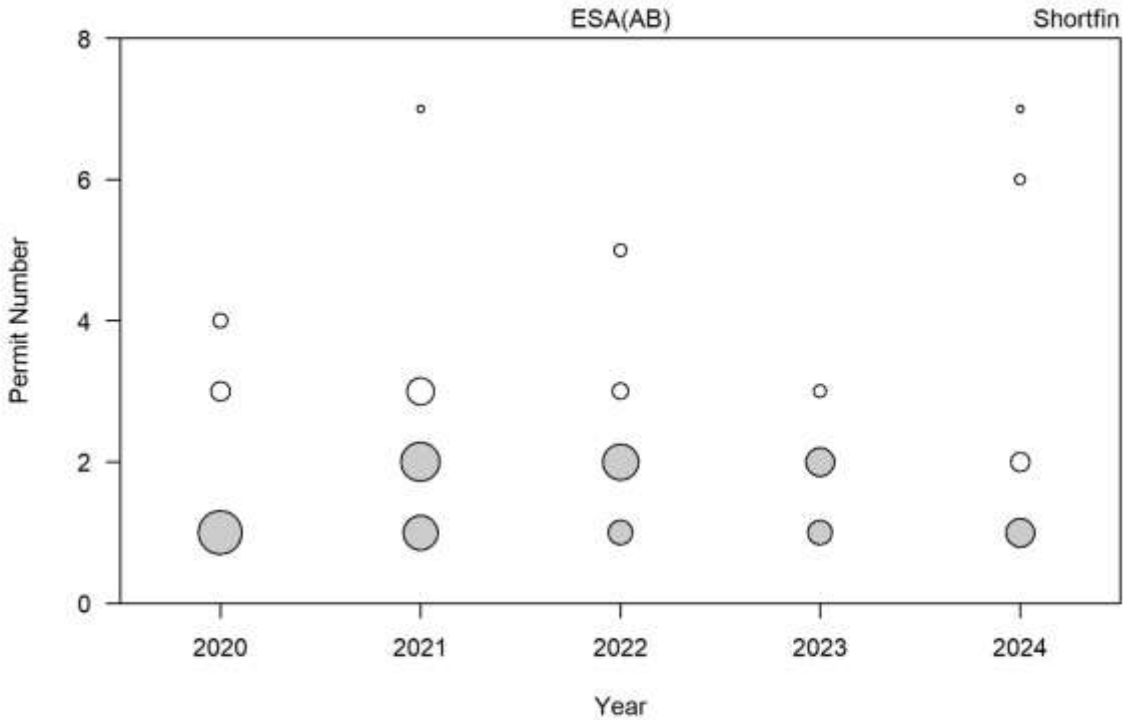

Figure B17: Relative shortfin legal size eel catch and destination G, from all fishers (all circles) for the years 2019–20 to 2023–24 (post-ERS), and for core fishers (grey shaded circles) included in the catch per unit effort analyses (ESA AB).

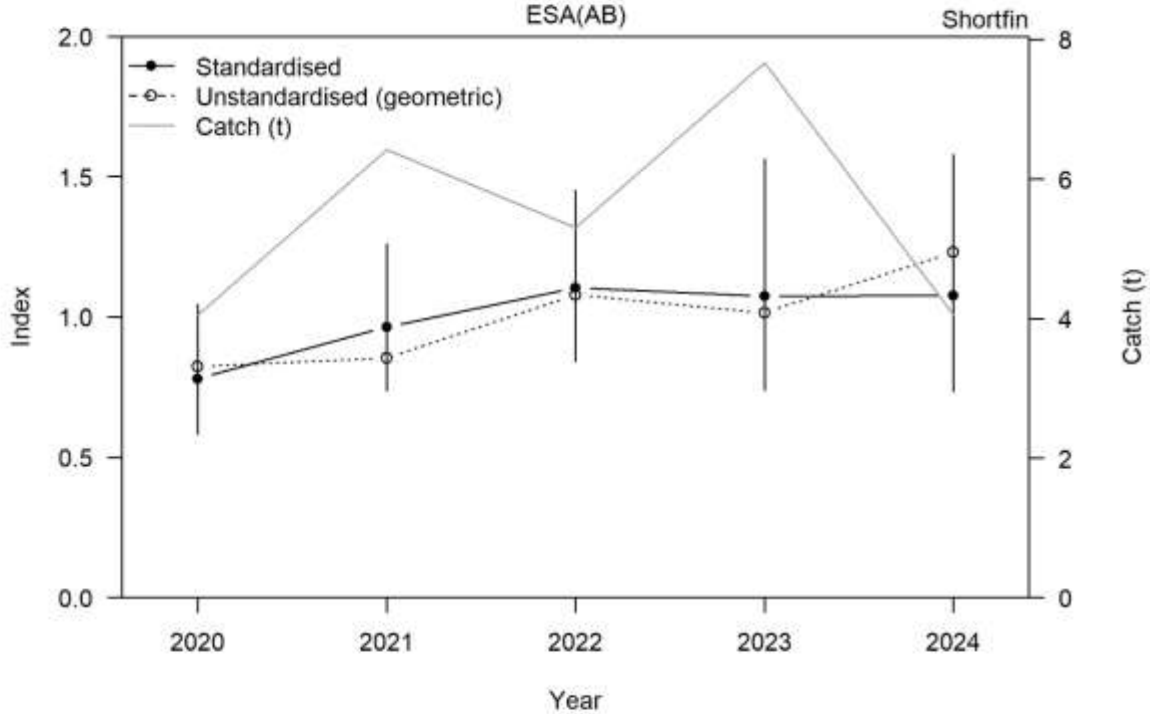

Figure B18: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for shortfin (core fishers) for the years 2019–20 to 2023–24 (post-ERS). The shortfin catch by core fishers is also plotted. Catch includes legal size eels and destination G (ESA AB).

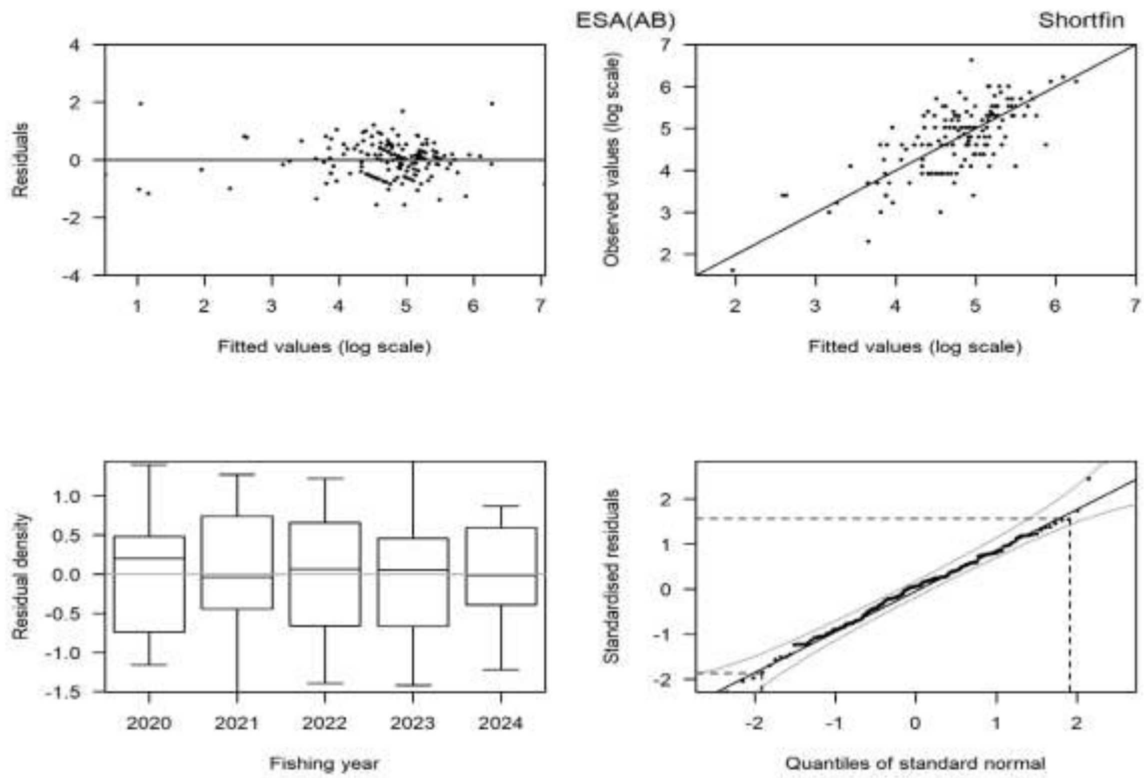

Figure B19: Residual diagnostic plots for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AB).

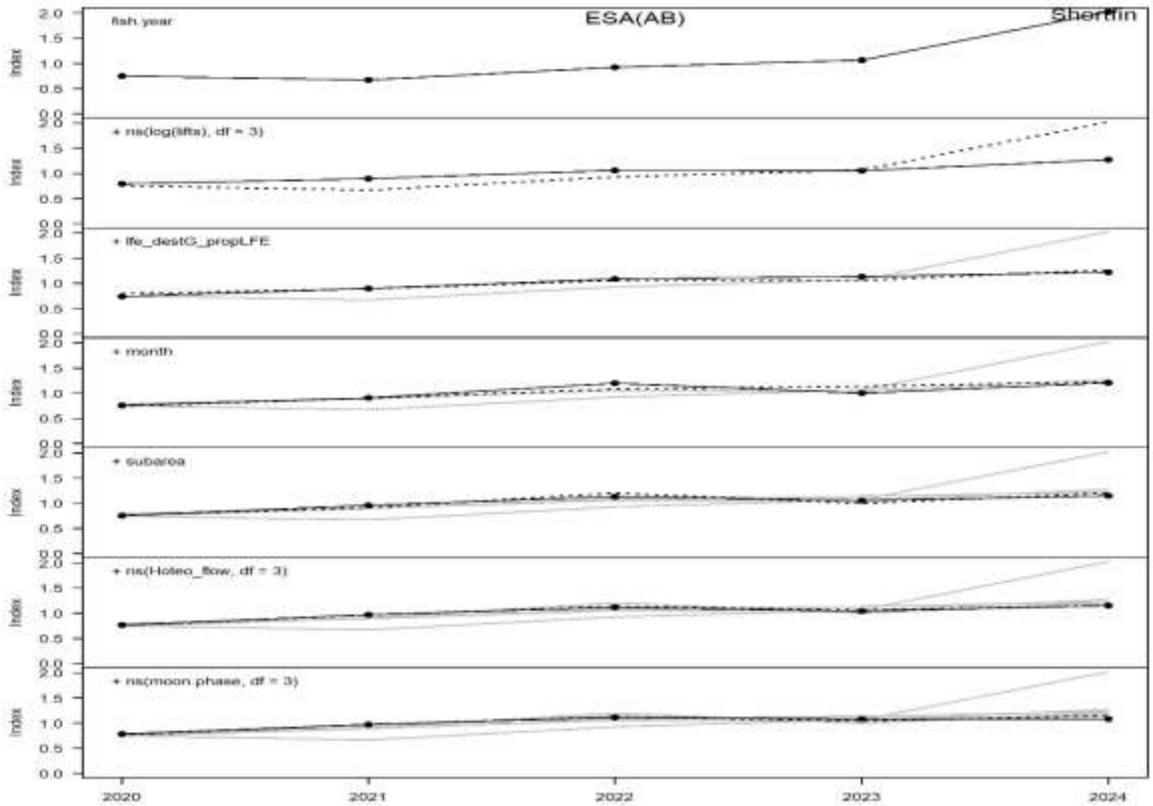

Figure B20: Step plot for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AB).

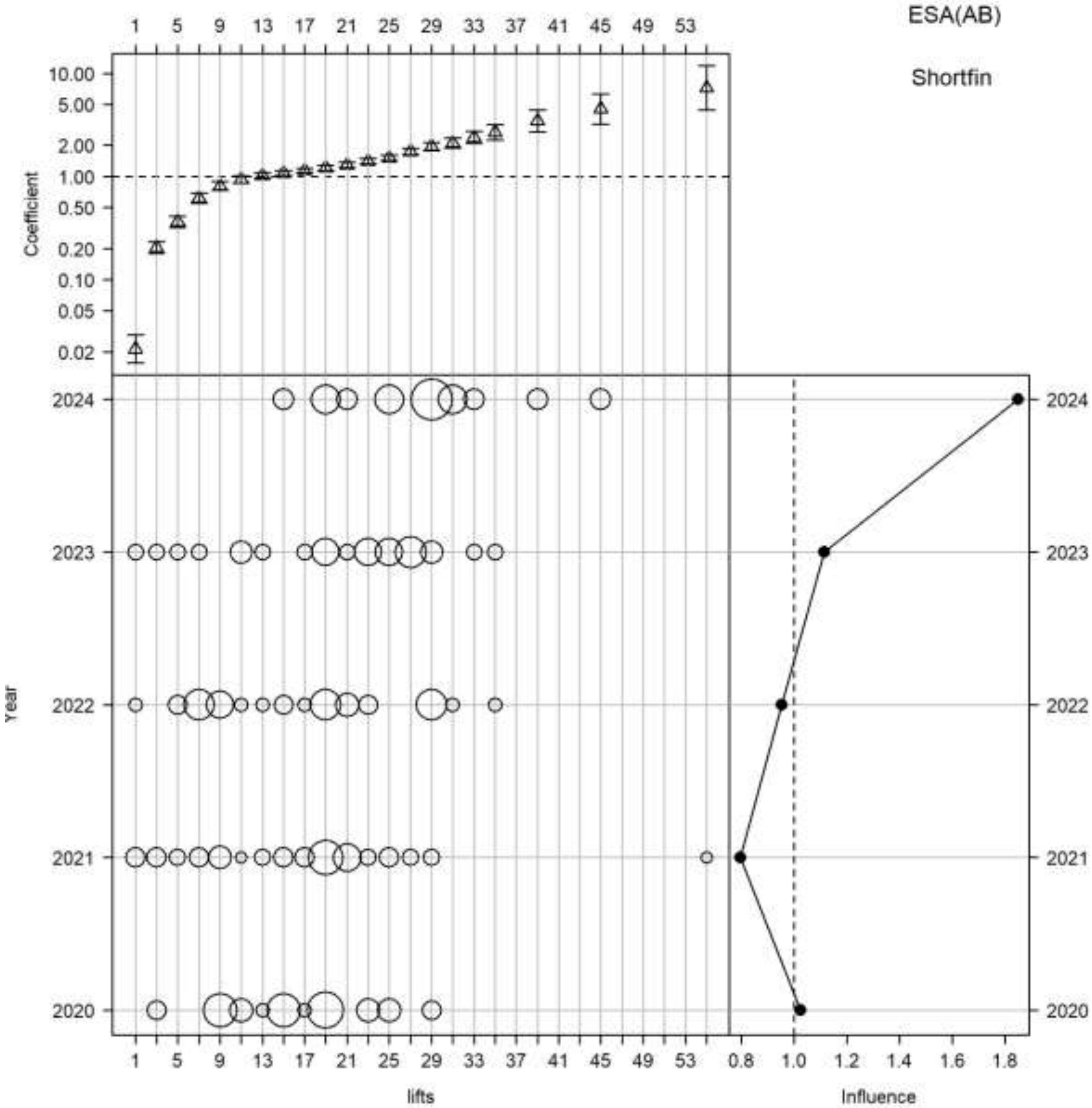

Figure B21: Influence of lifts for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

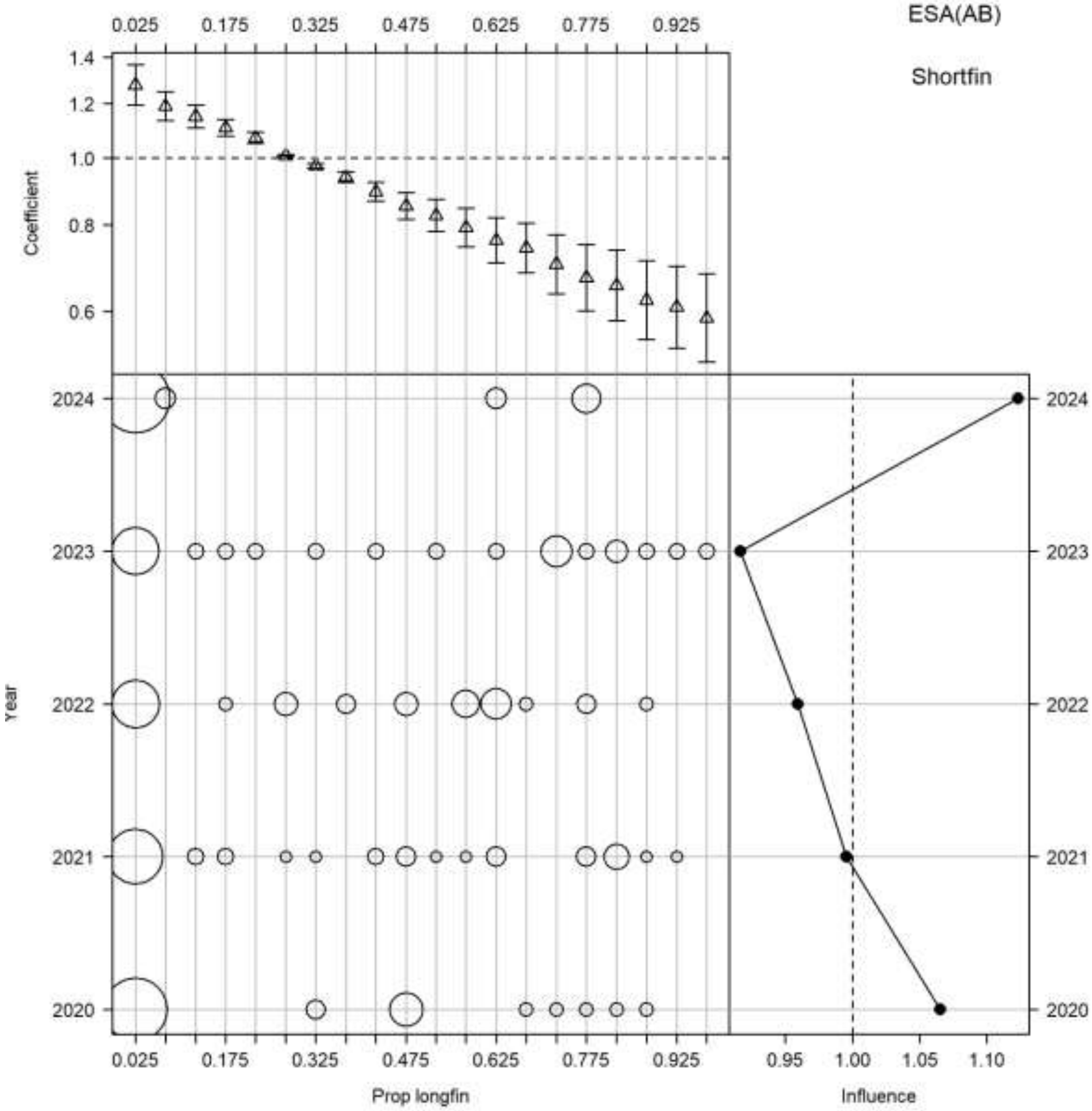

Figure B22: Influence of proportion longfin in the catch for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

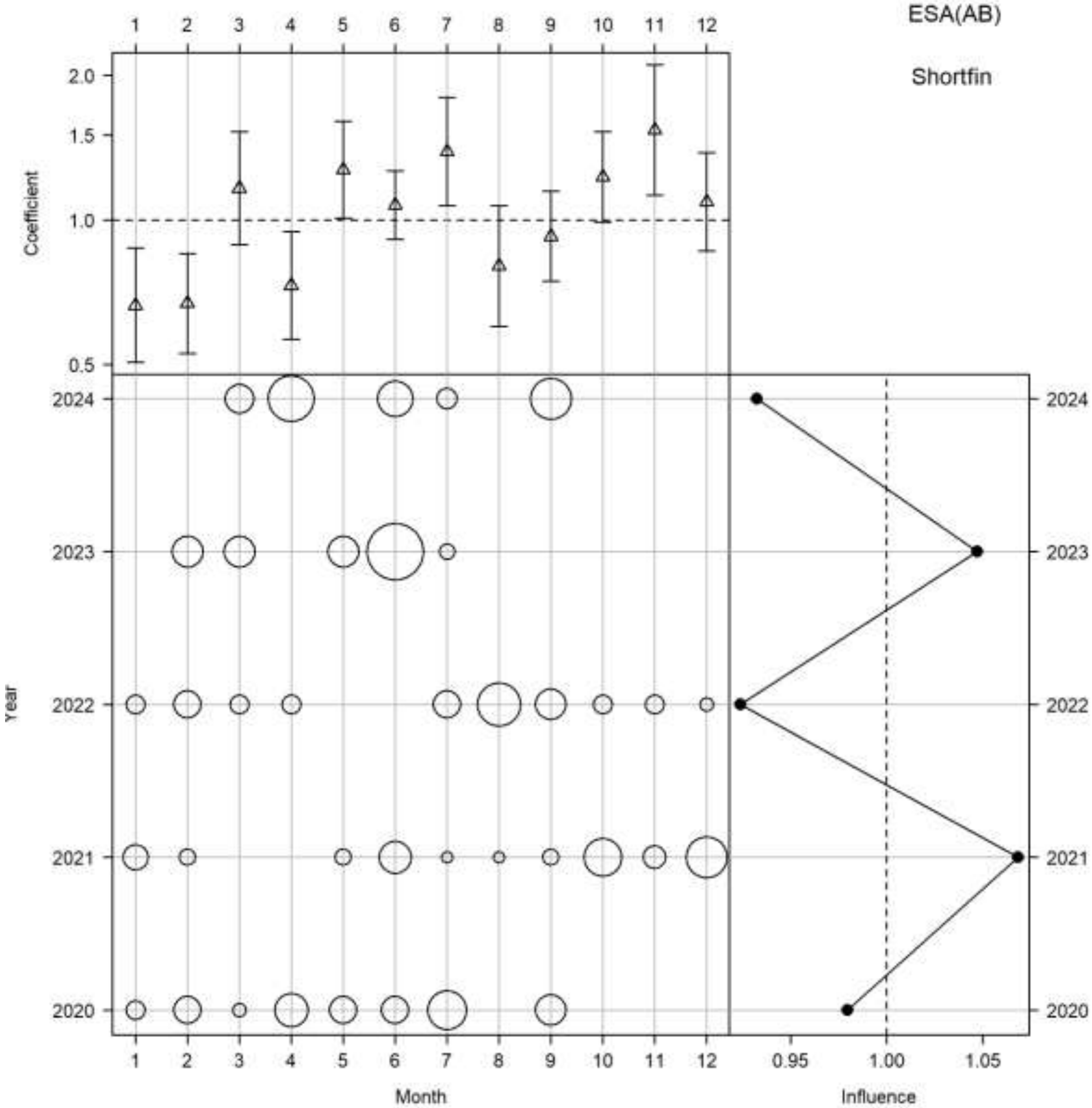

Figure B23: Influence of month for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

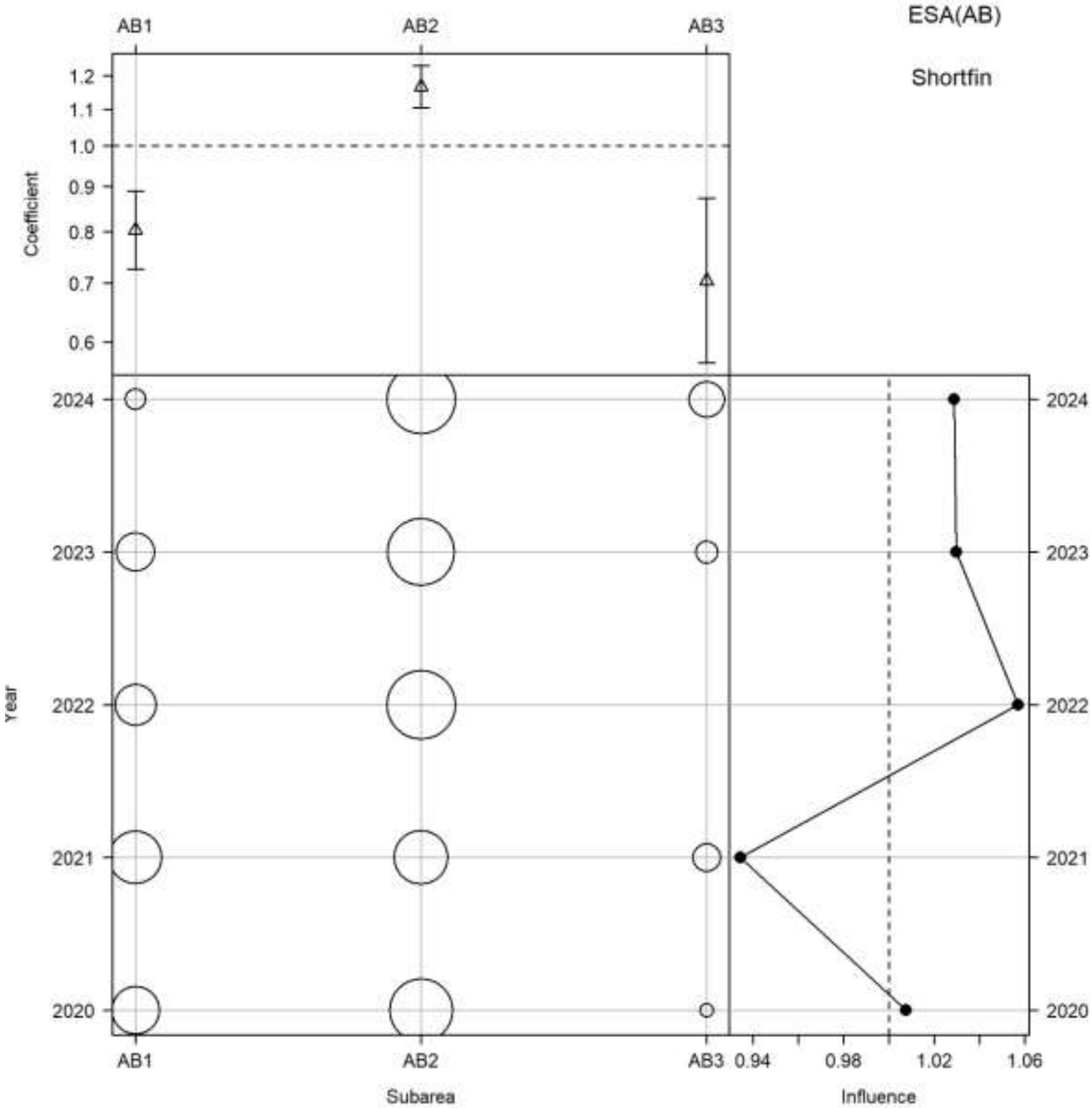

Figure B24: Influence of subarea for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

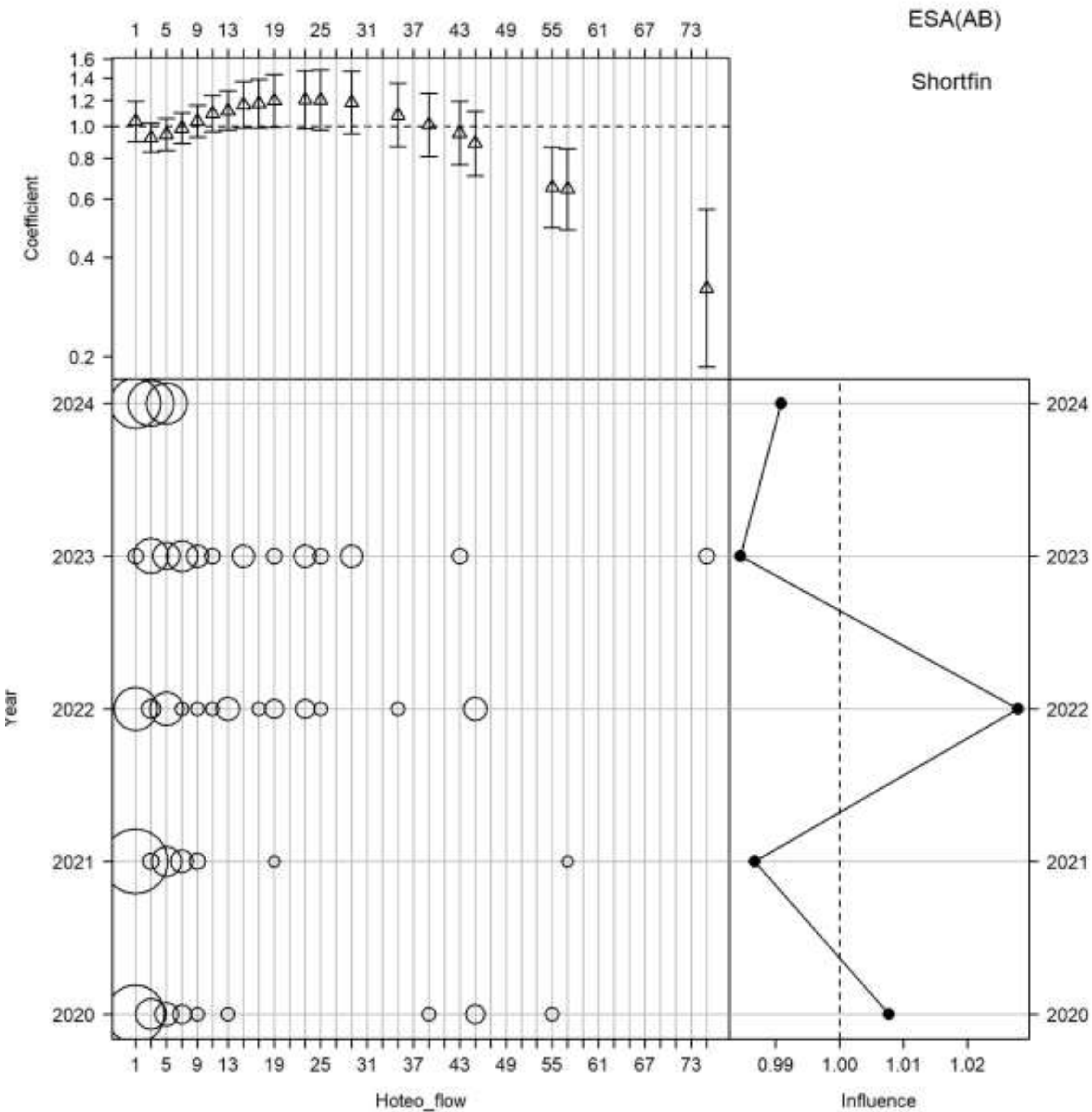

Figure B25: Influence of Hoteo River flow for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

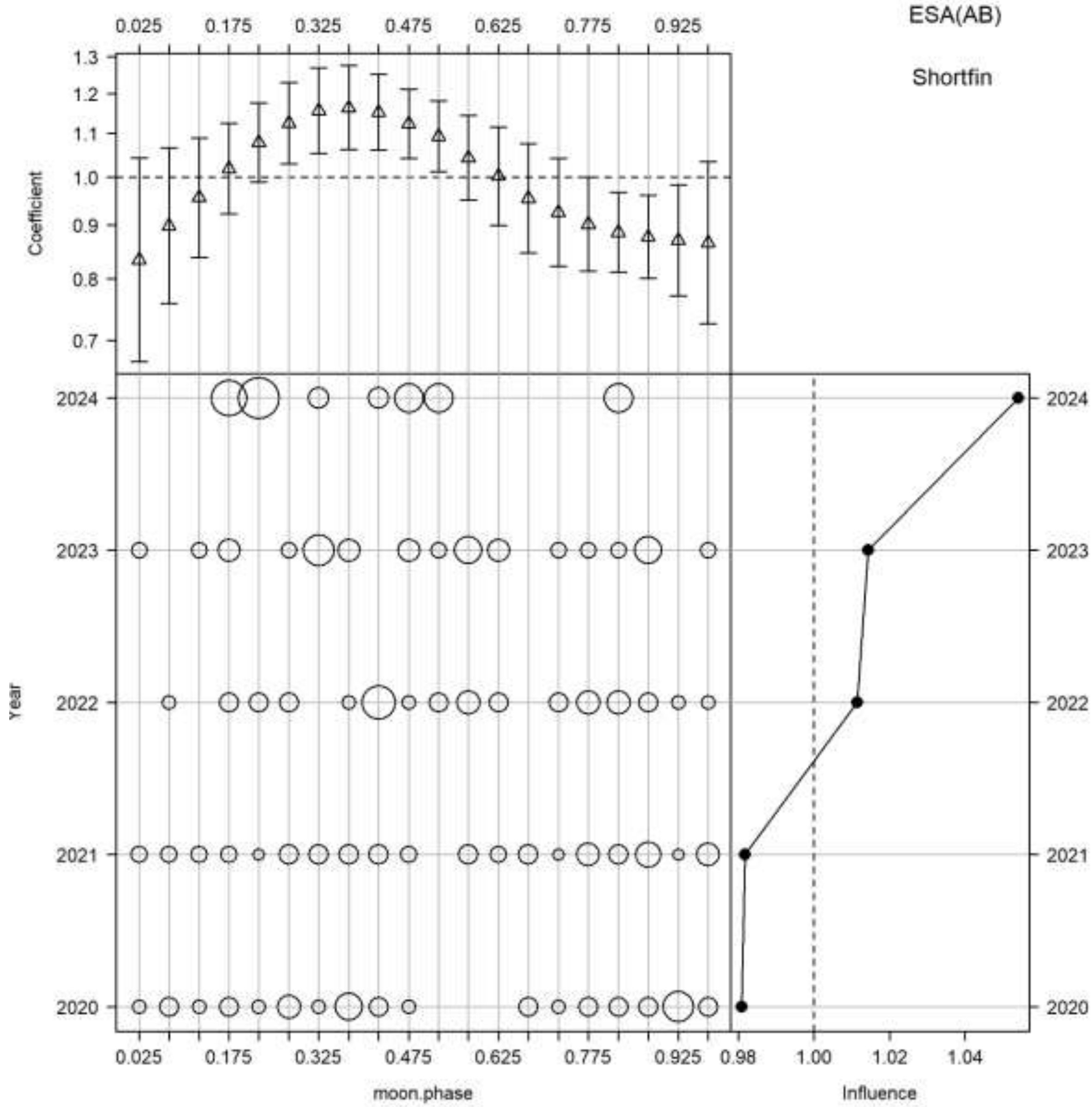

Figure B26: Influence of moon-phase for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

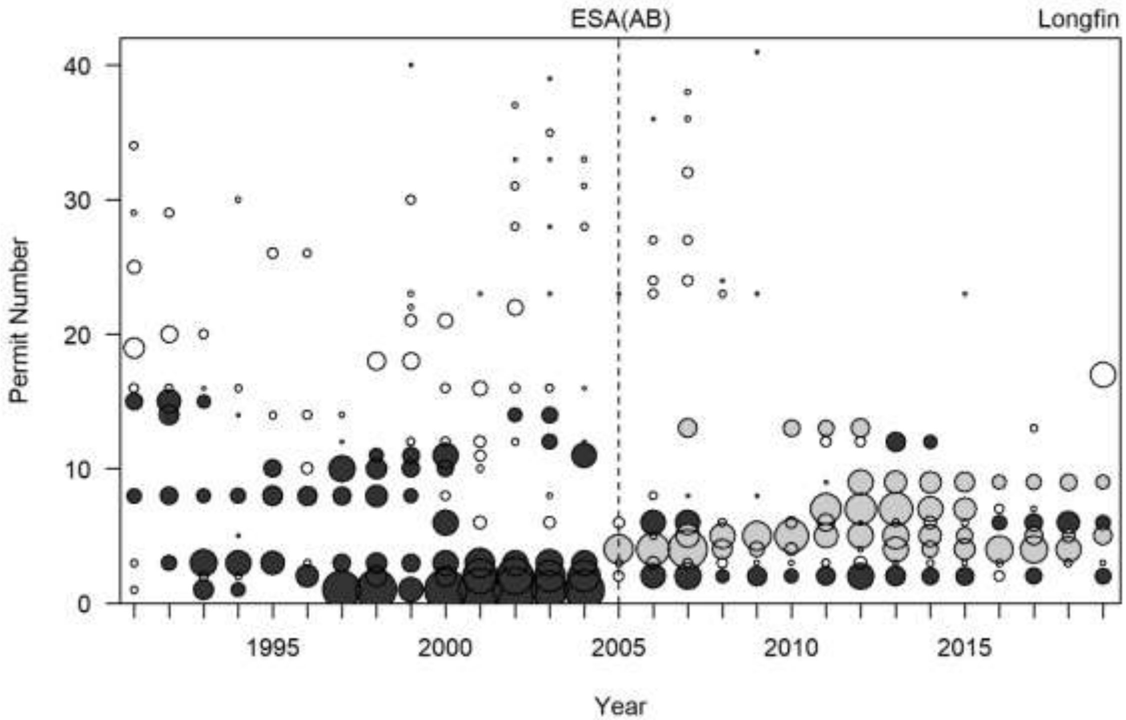

Figure B27: Relative longfin legal size eel catch, from all fishers (all circles) for the years 1990–91 to 2018–19 (pre-ERS), and for core fishers (dark and grey shaded circles) included in the catch per unit effort analyses. The vertical dotted line indicates introduction into the QMS in 2004–05. The dark shaded circles post-QMS are existing fishers and the grey, new entrants (ESA AB).

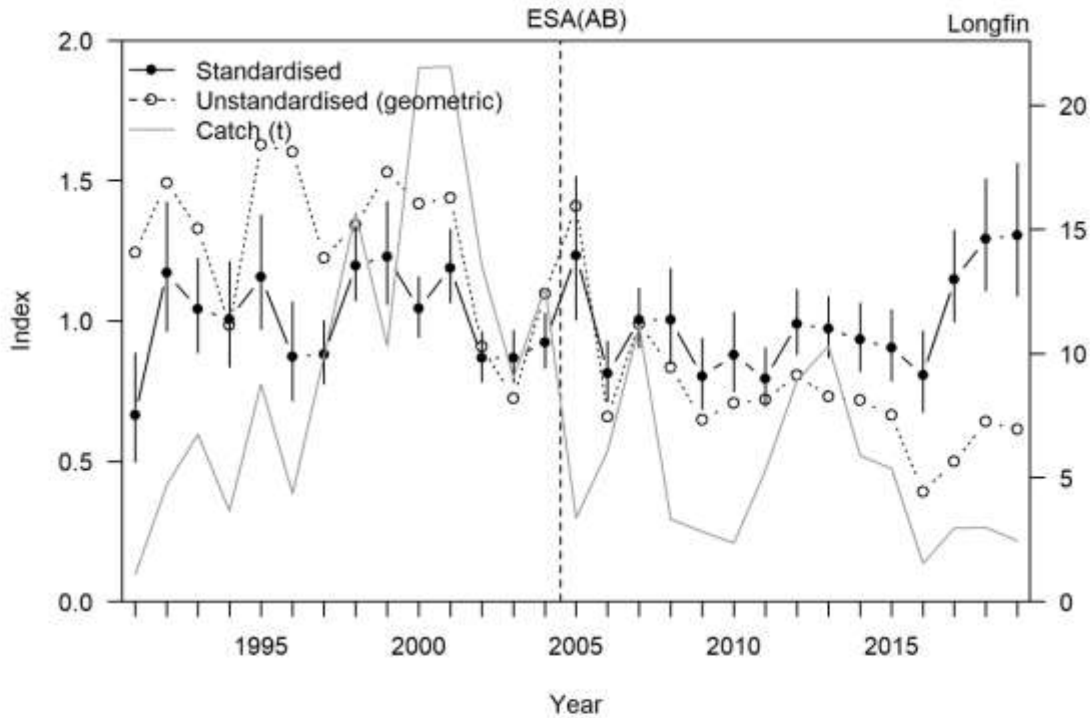

Figure B28: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for longfin (core fishers) for the years 1990–91 to 2018–19 (pre-ERS). The longfin catch by core fishers is also plotted. The vertical dotted line indicates introduction into the QMS in 2004–05. Catch includes legal size eels (ESA AB).

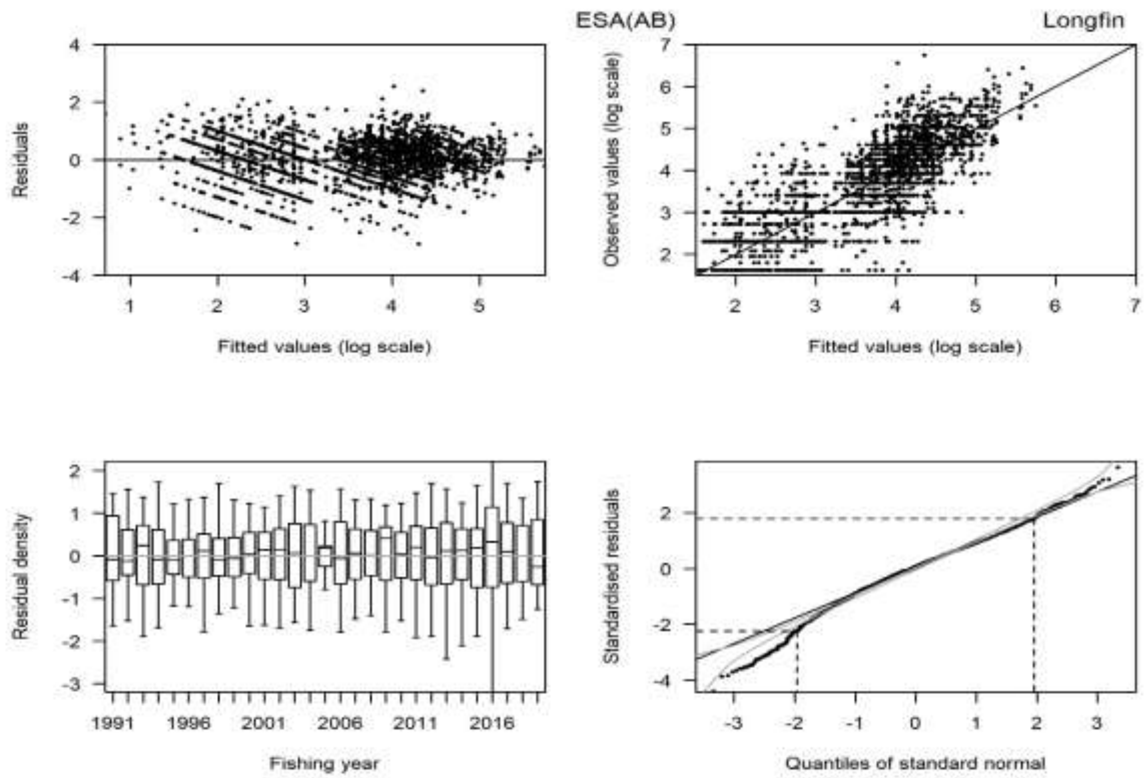

Figure B29: Residual diagnostic plots for the longfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AB).

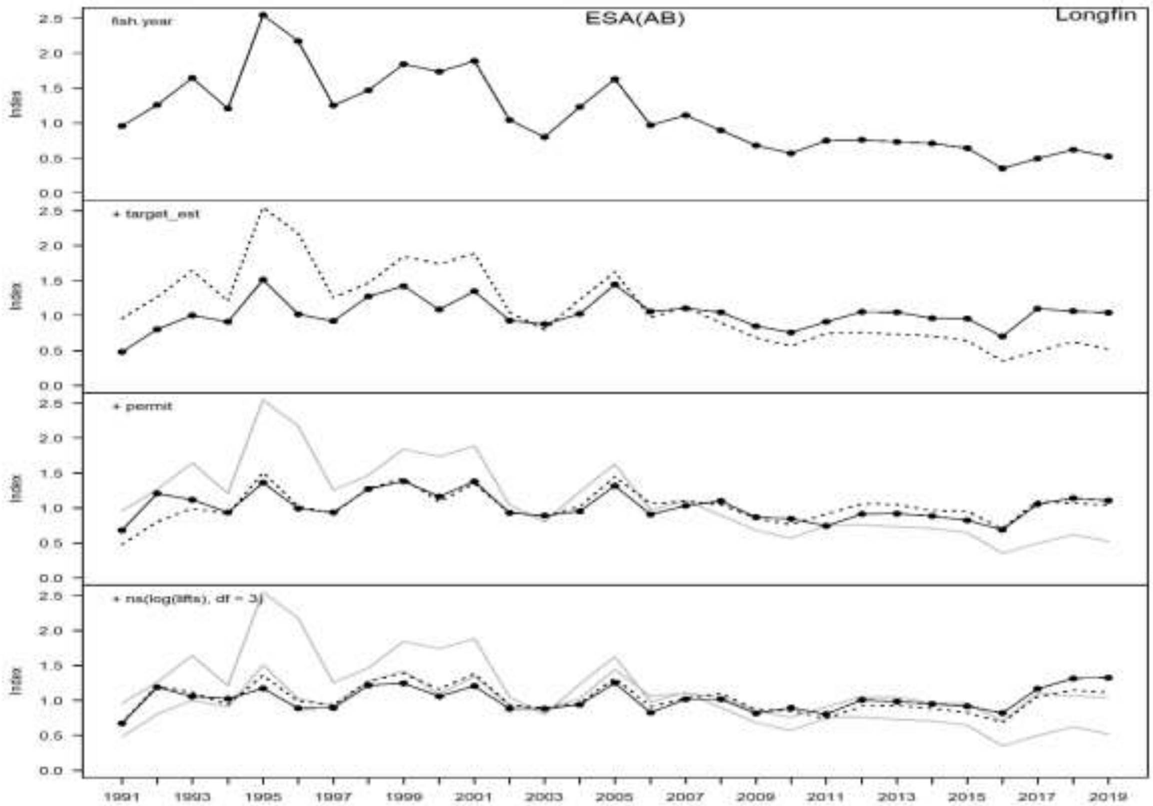

Figure B30: Step plot for the longfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AB).

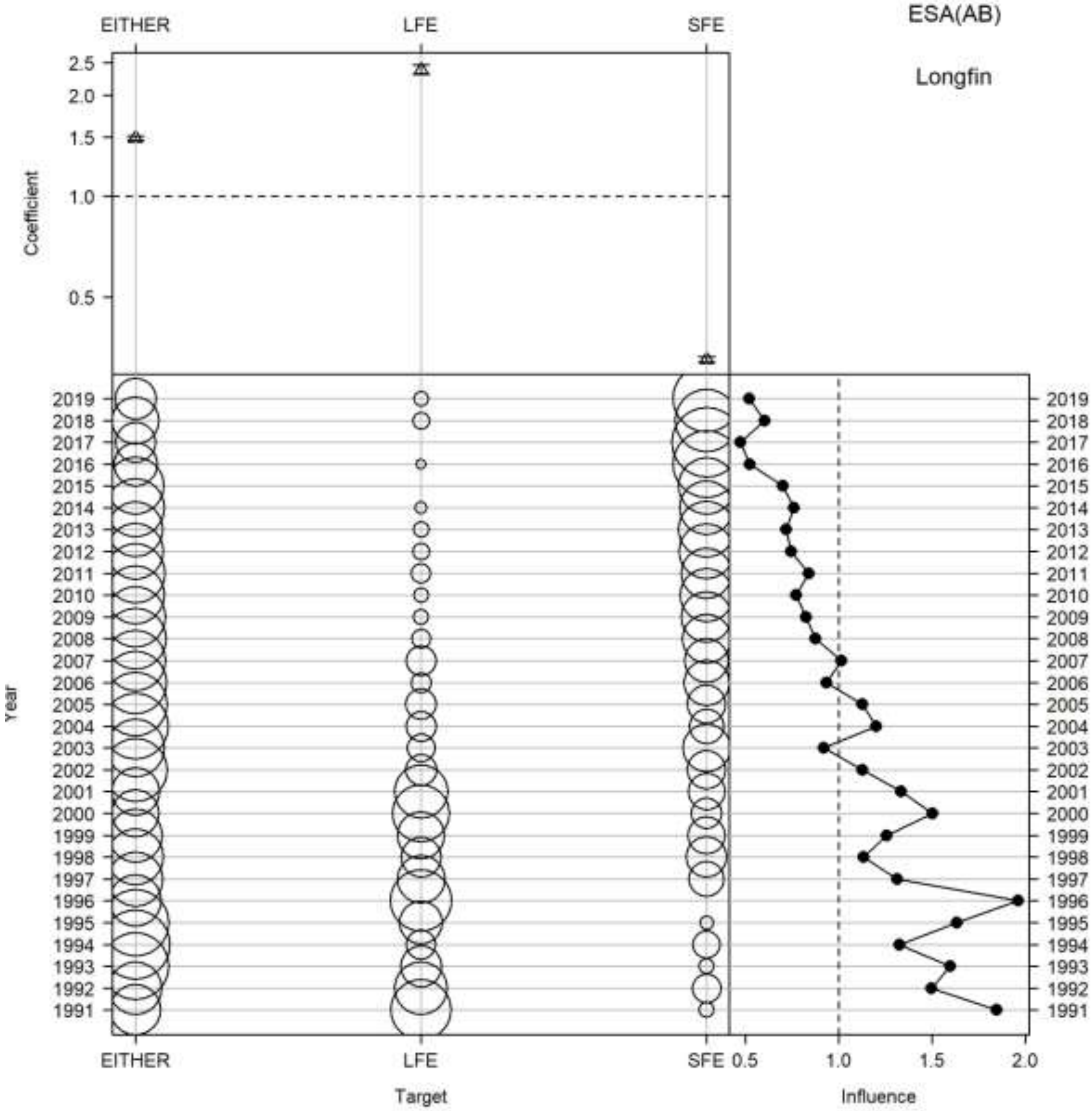

Figure B31: Influence of reconstructed target for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AB).

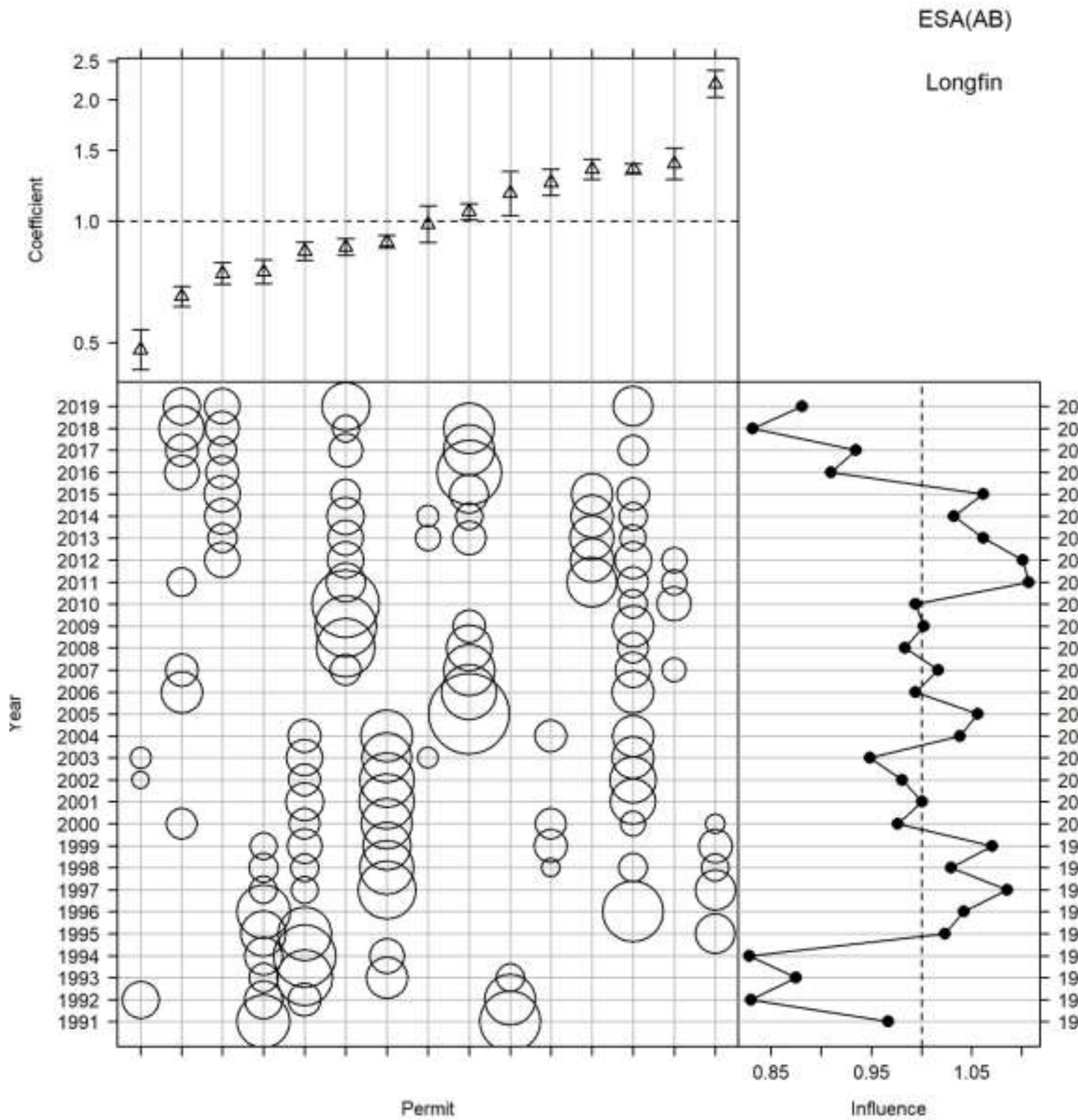

Figure B32: Influence of permit for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS).

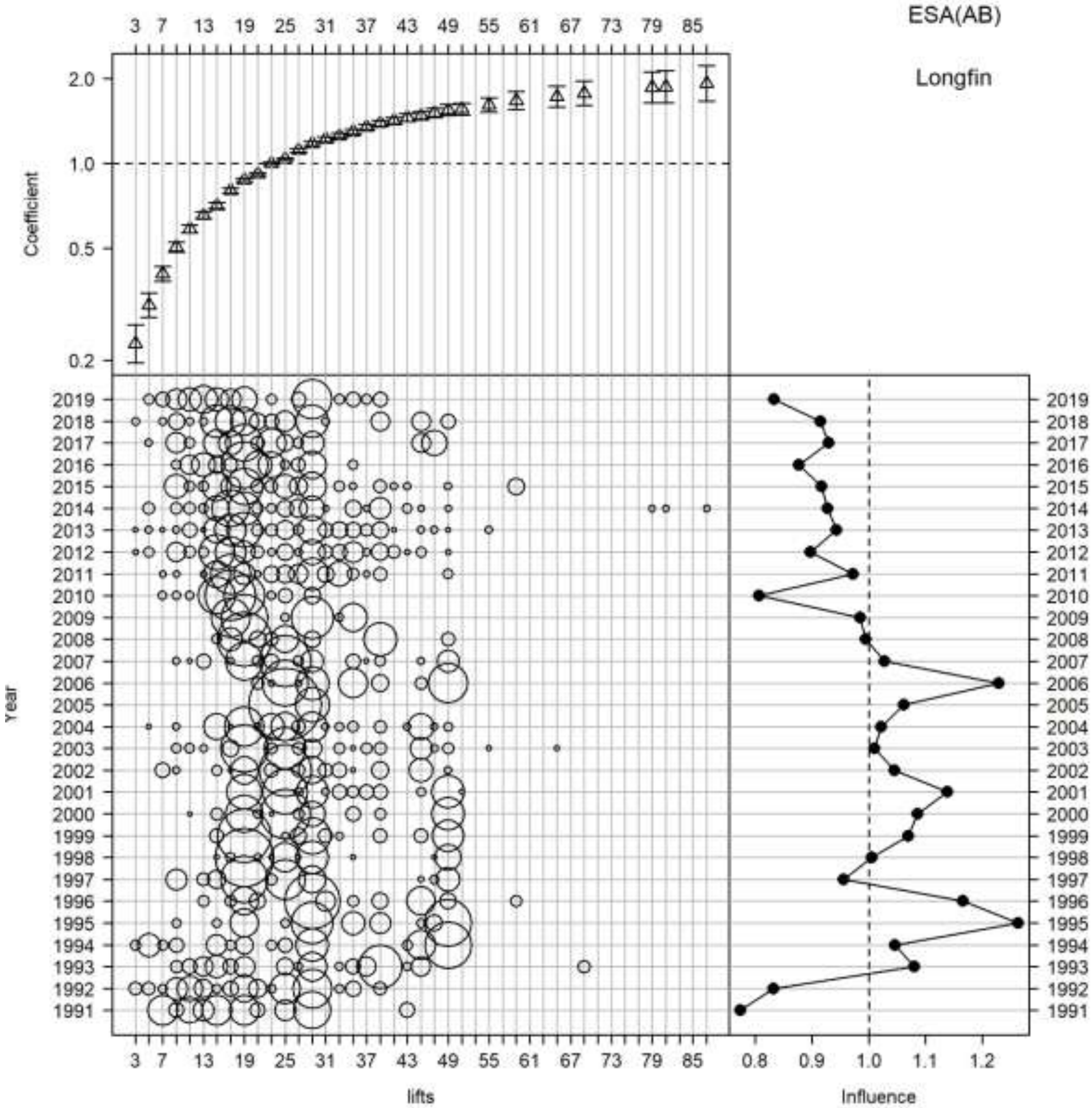

Figure B33: Influence of lifts for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AB).

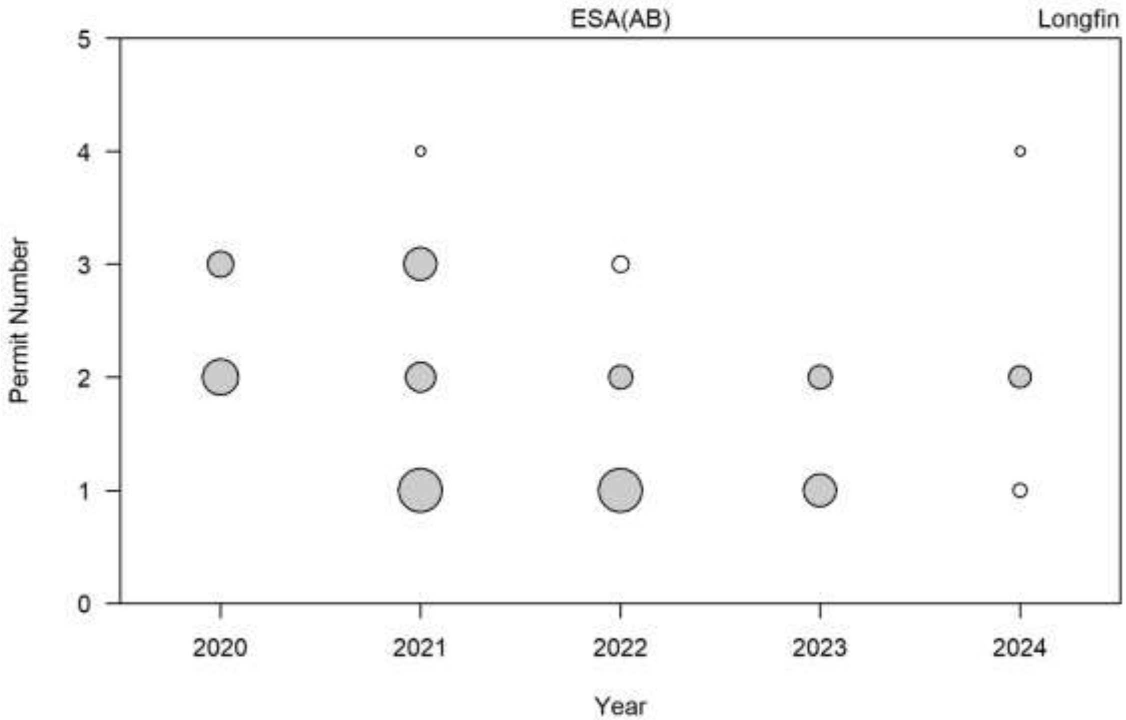

Figure B34: Relative longfin legal size eel catch and destination G, from all fishers (all circles) for the years 2019–20 to 2023–24 (post-ERS), and for core fishers (grey shaded circles) included in the catch per unit effort analyses (ESA AB).

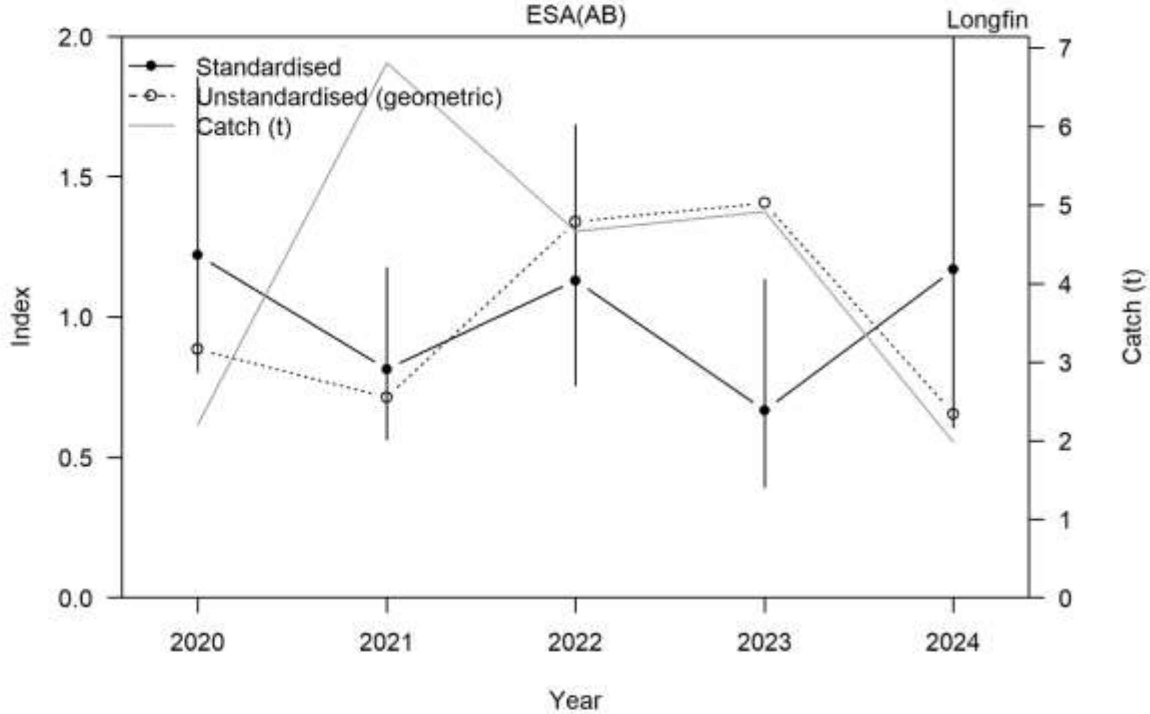

Figure B35: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for longfin (core fishers) for the years 2019–20 to 2023–24 (post-ERS). The longfin catch by core fishers is also plotted. Catch includes legal size eels and destination G (ESA AB).

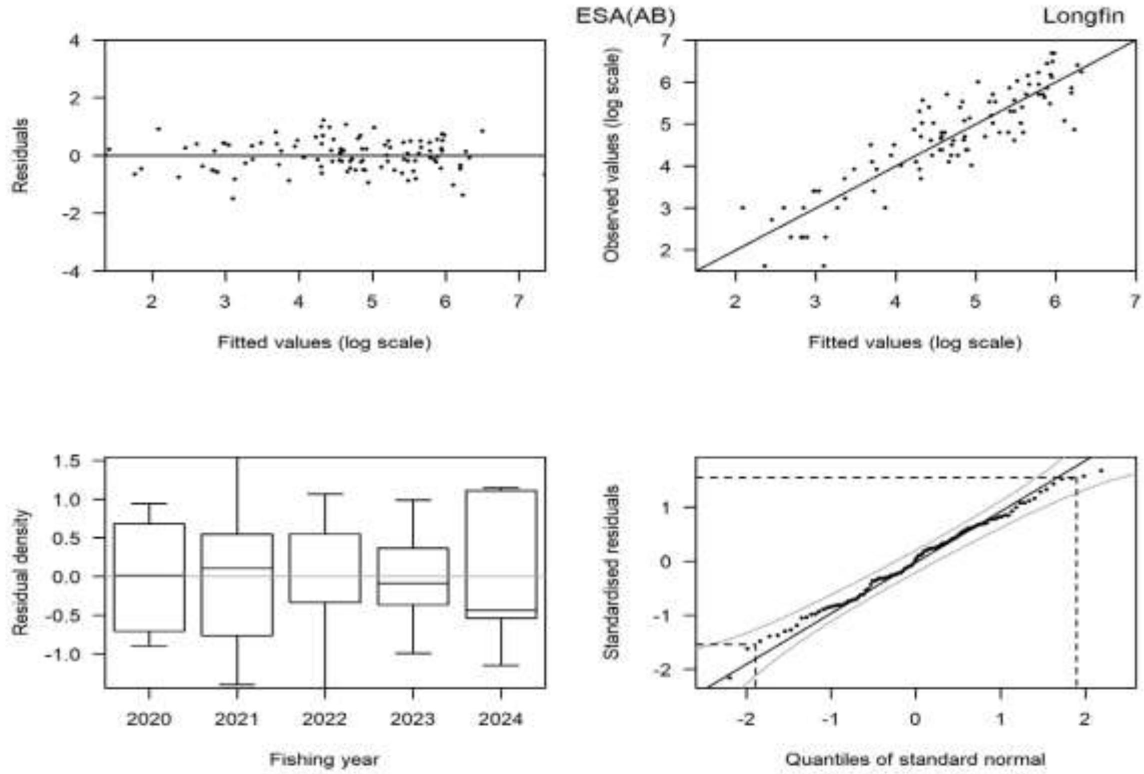

Figure B36: Residual diagnostic plots for the longfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AB).

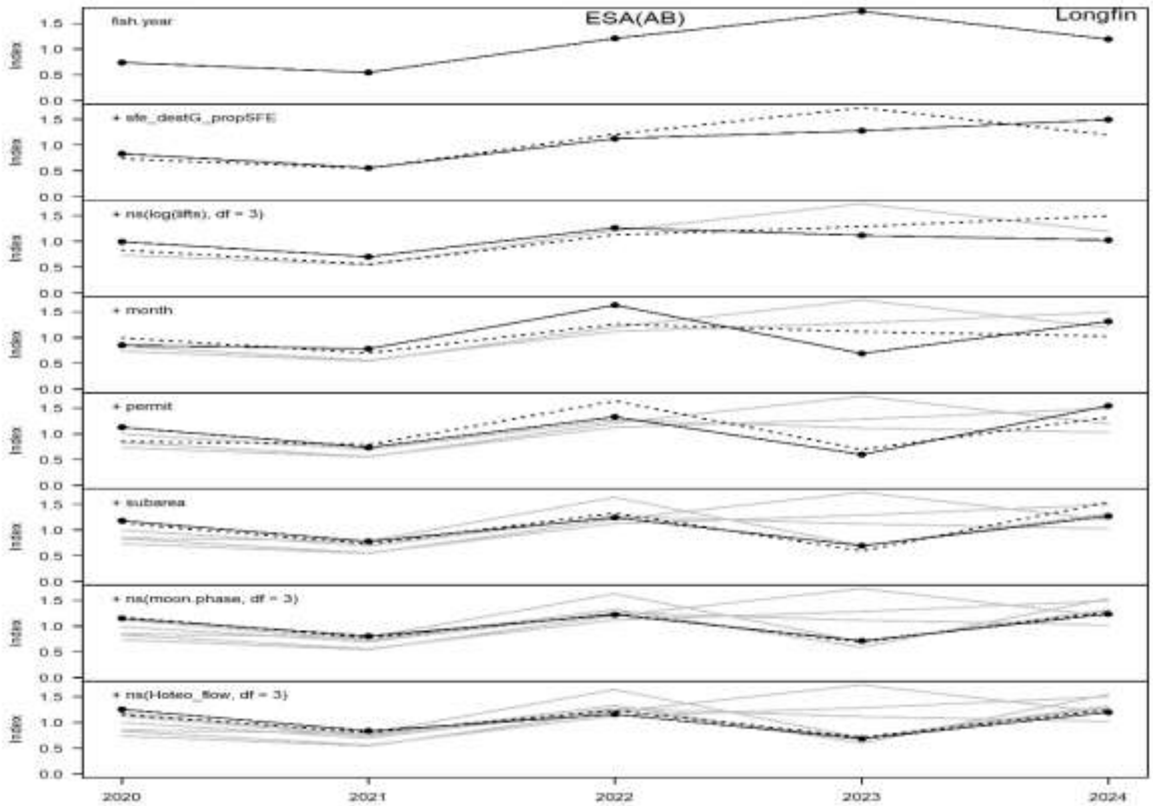

Figure B37: Step plot for the longfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AB).

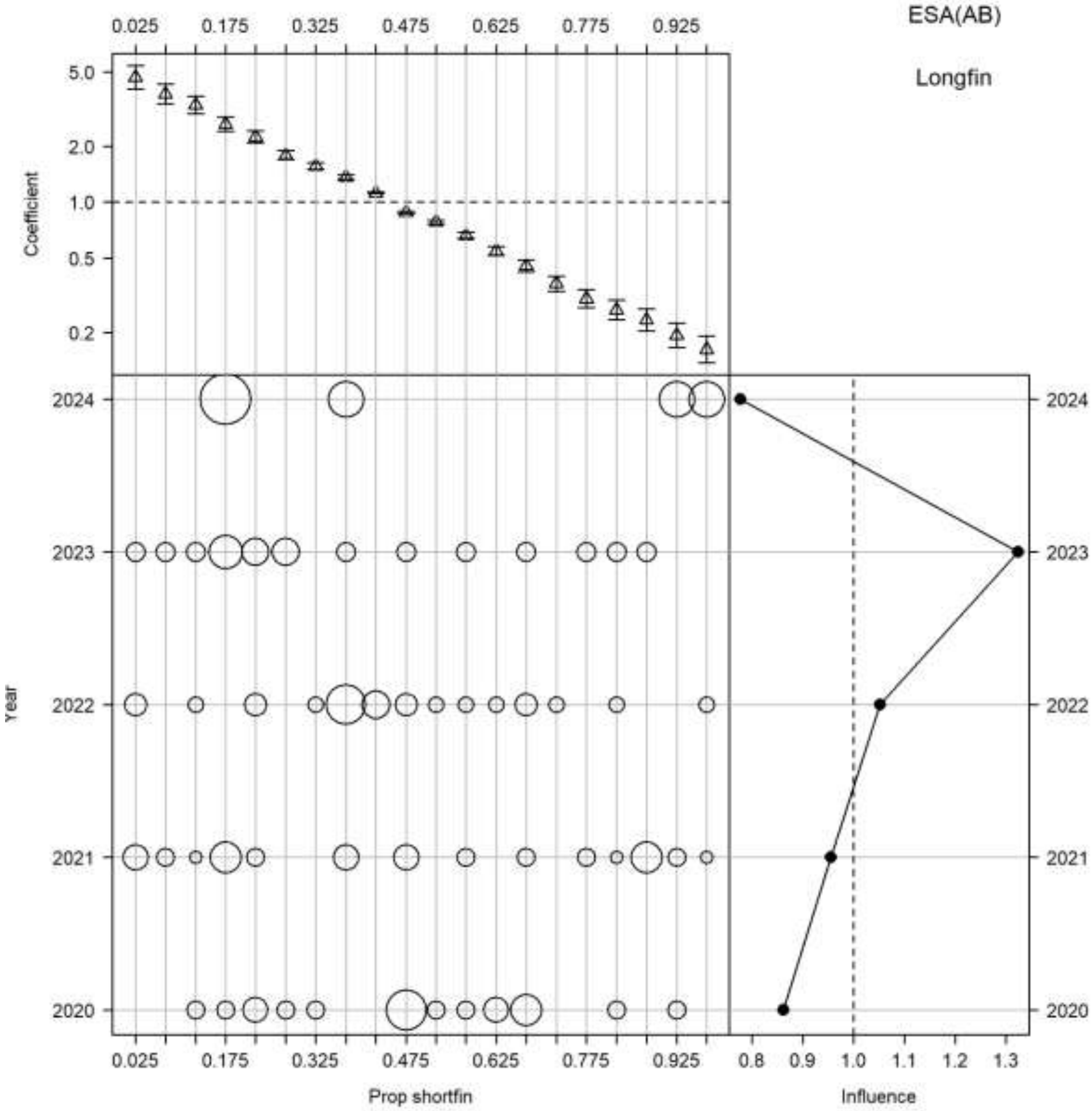

Figure B38: Influence of proportion shortfin for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

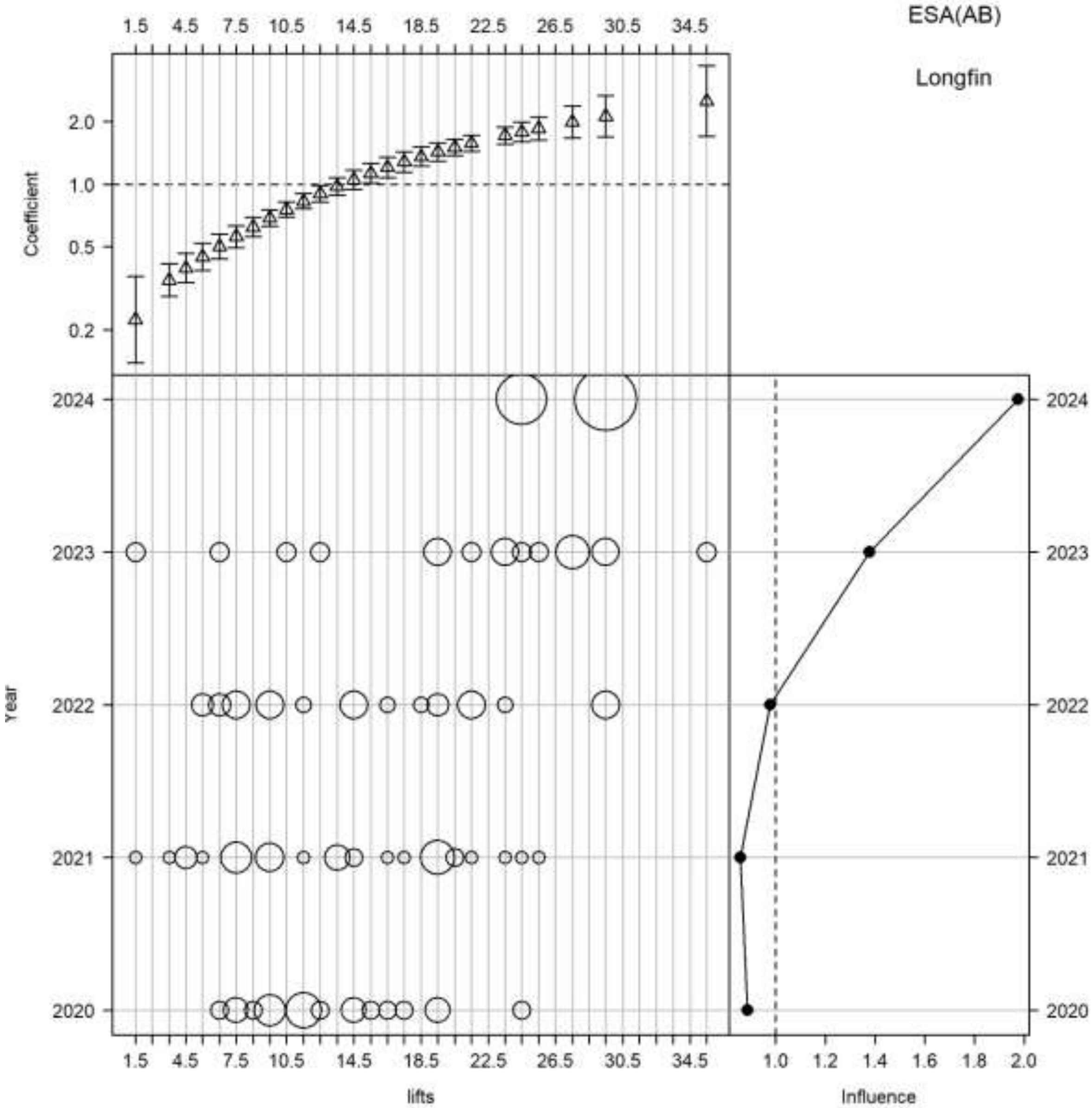

Figure B39: Influence of lifts in the catch for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

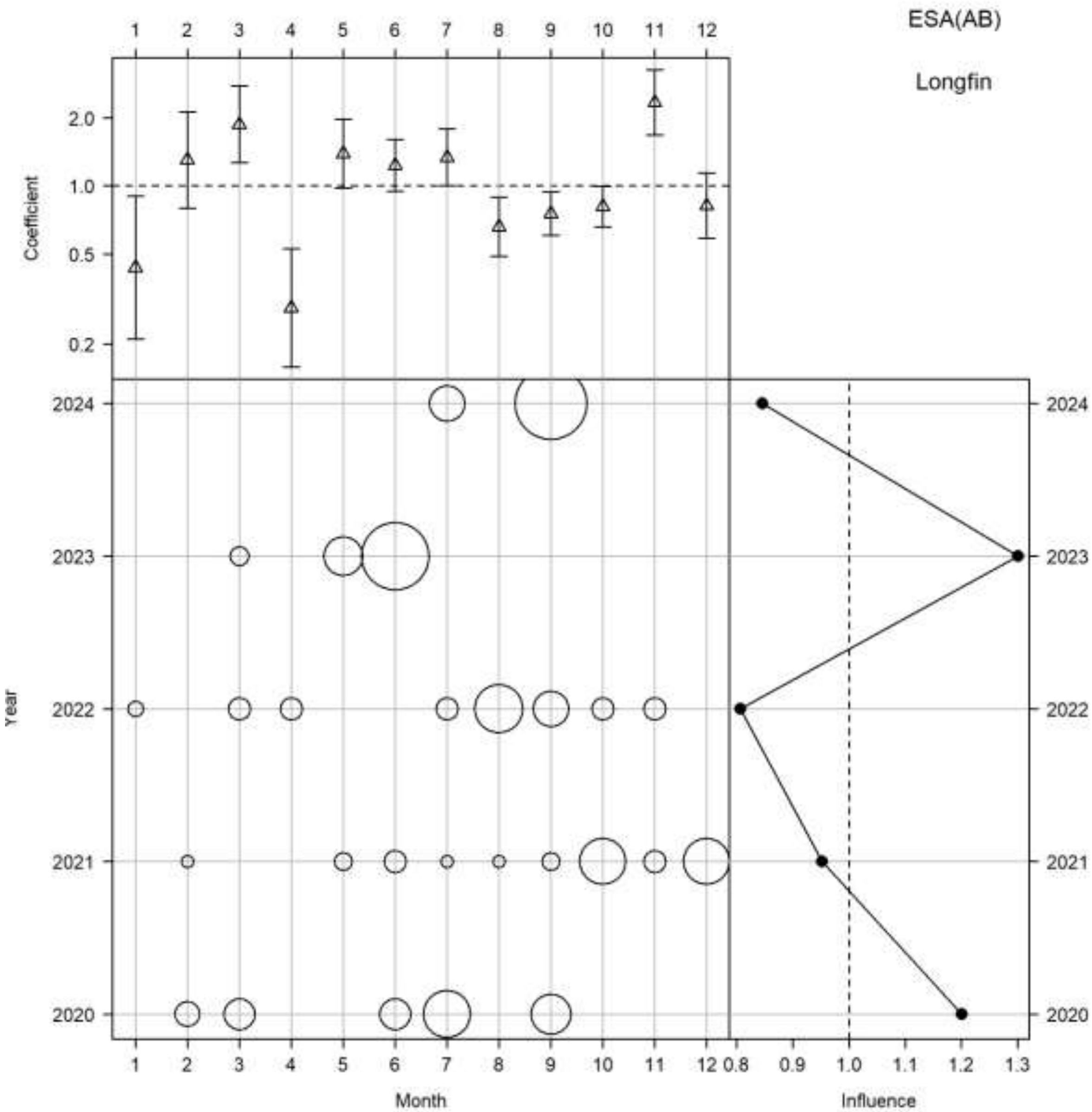

Figure B40: Influence of month for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

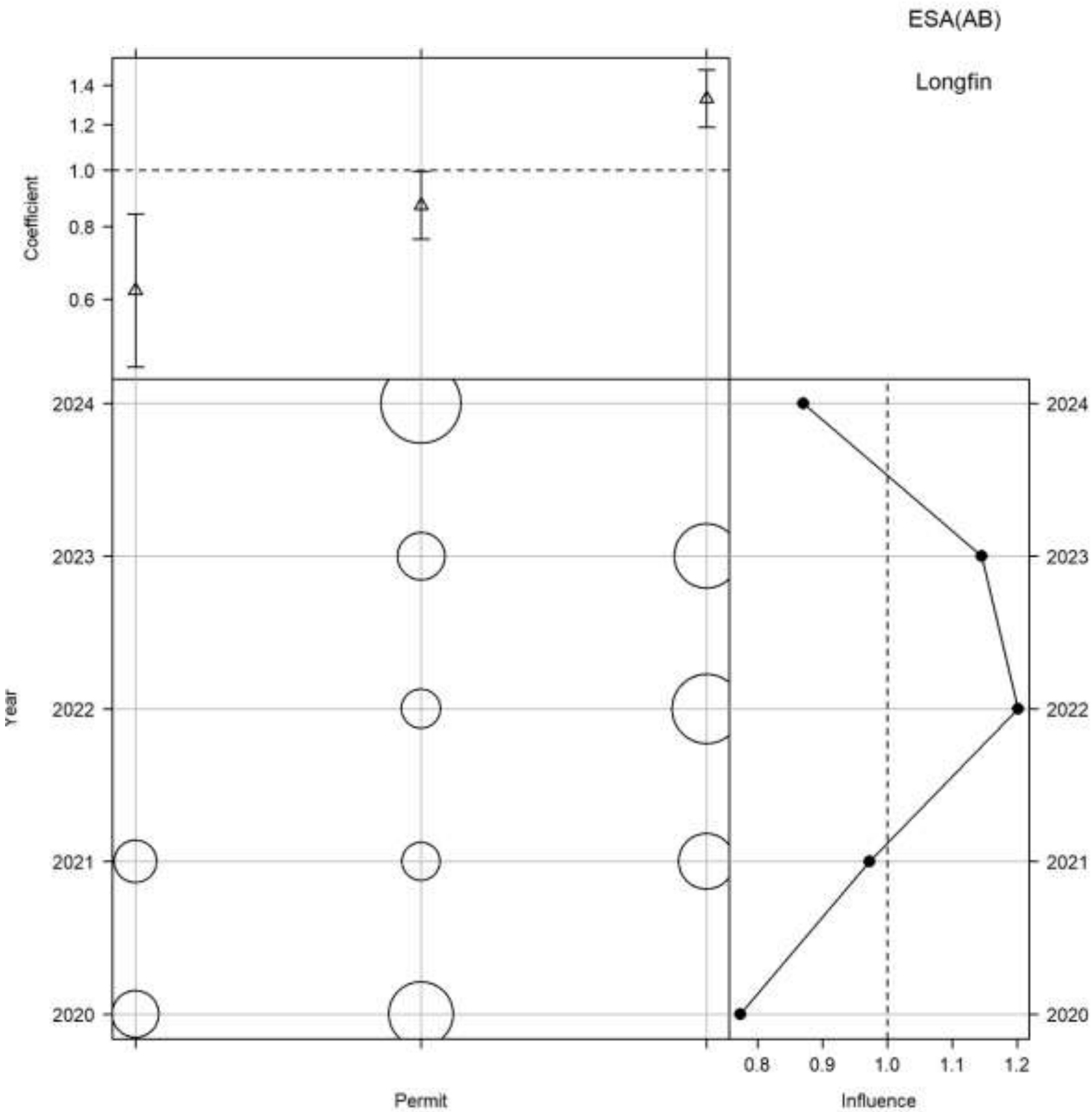

Figure B41: Influence of permit for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

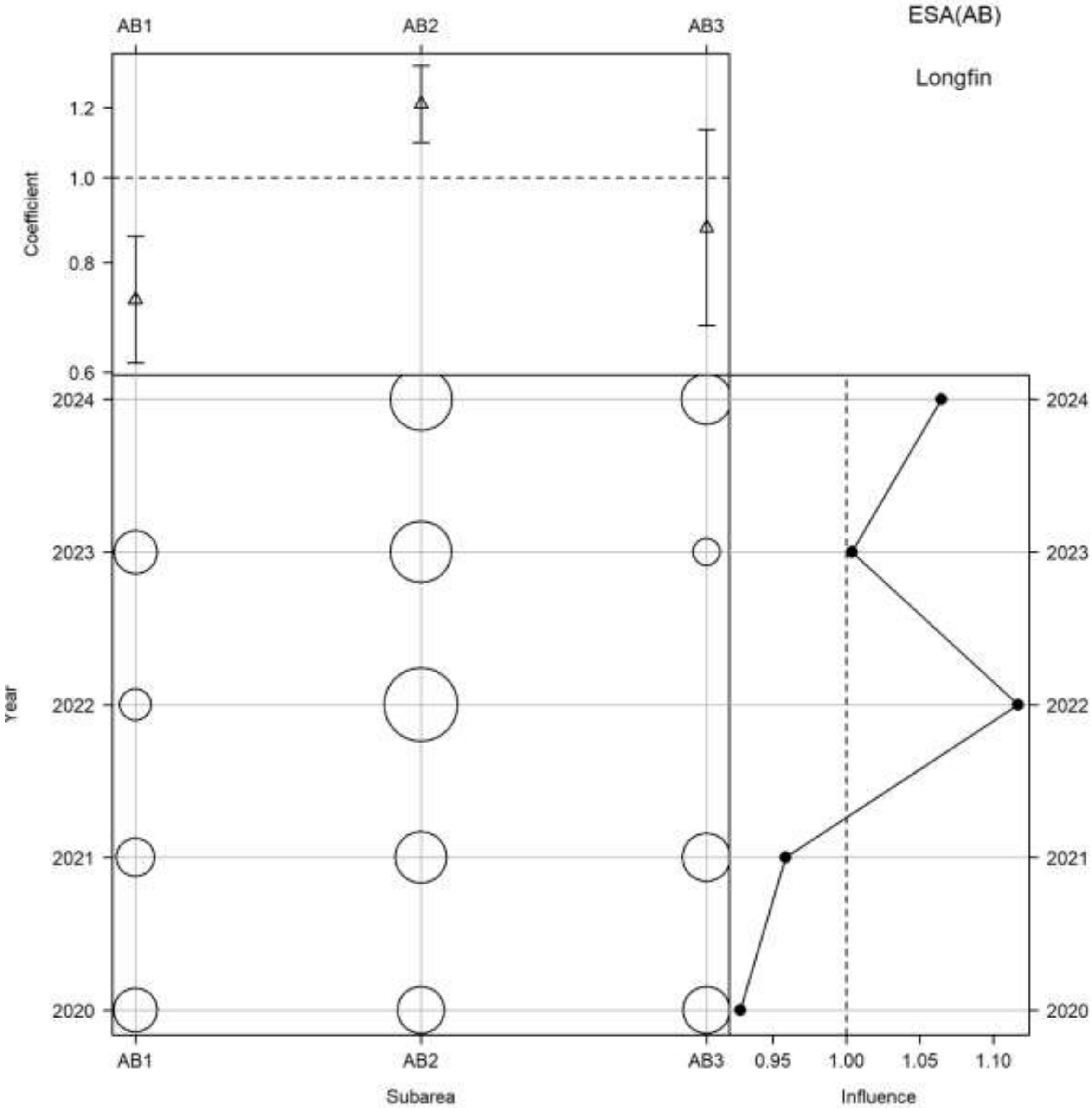

Figure B42: Influence of subarea for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

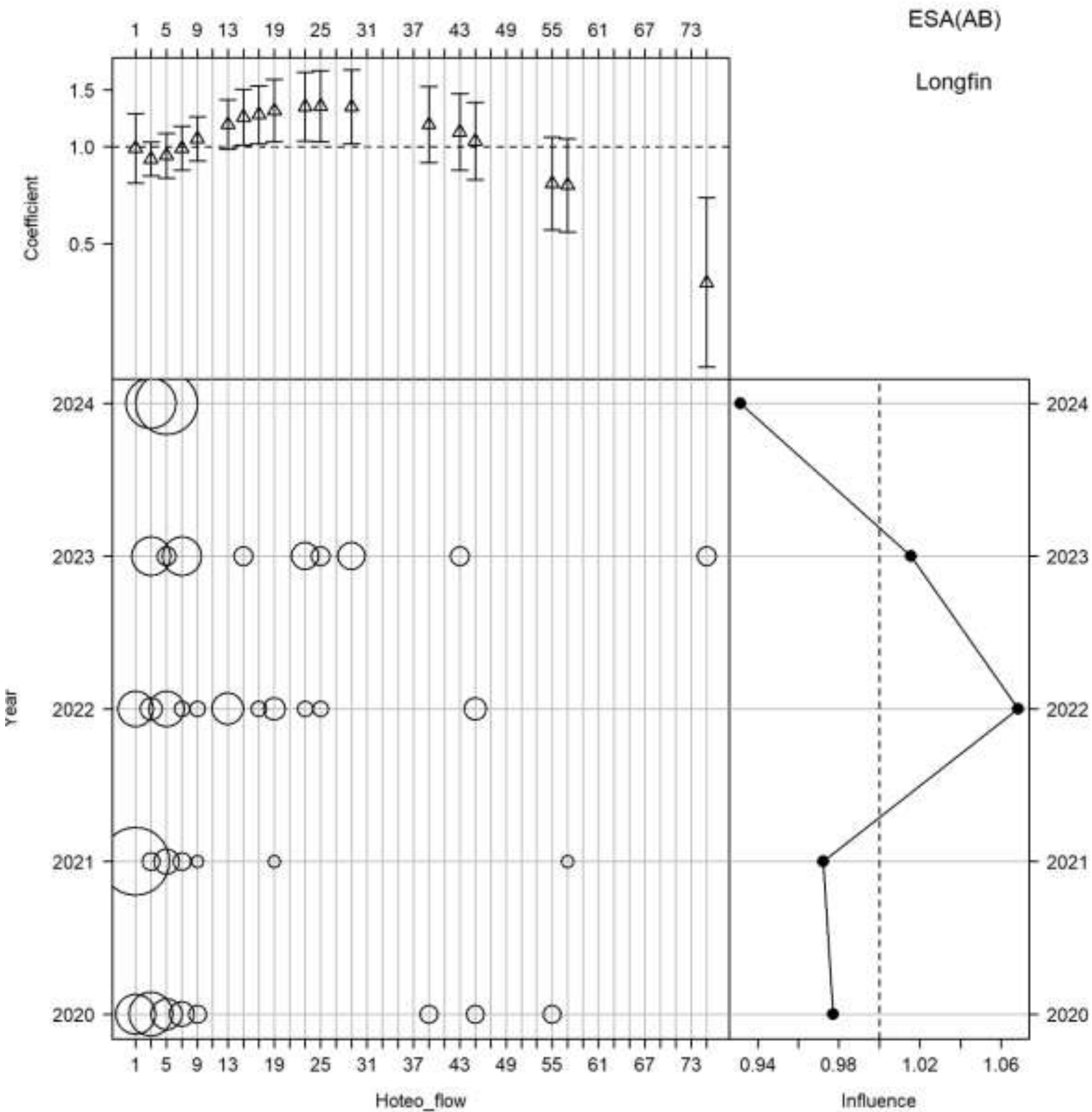

Figure B43: Influence of Hoteo River flow for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AB).

ESA AC (Hauraki)

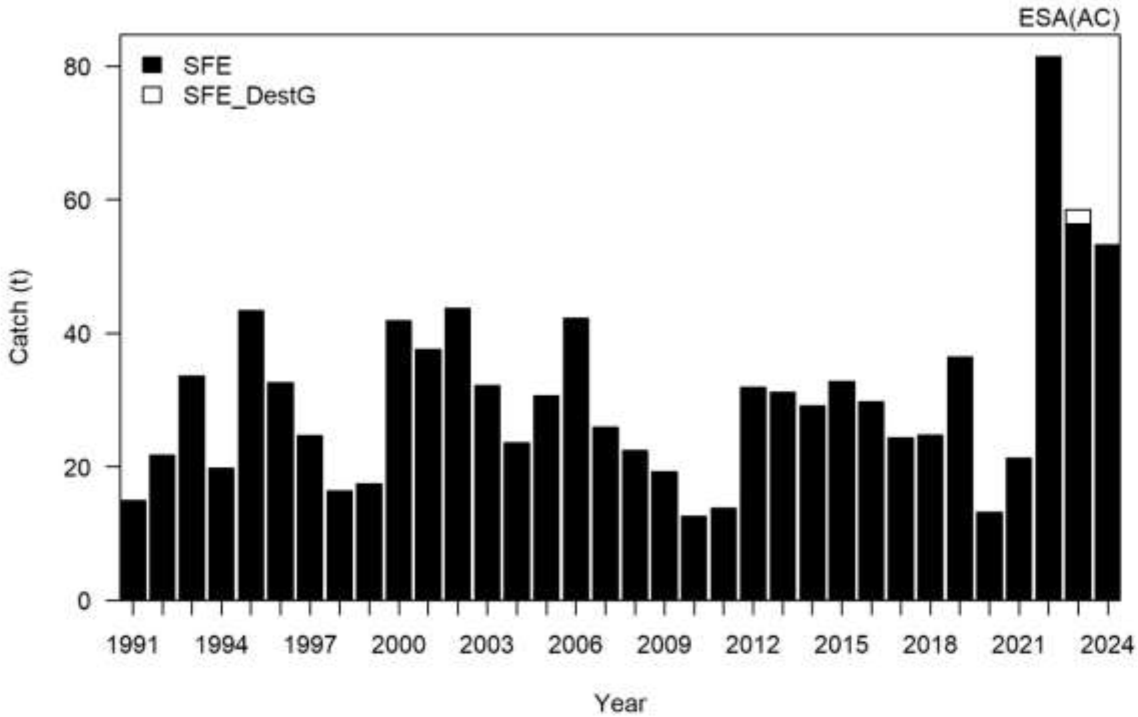

Figure C1: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AC).

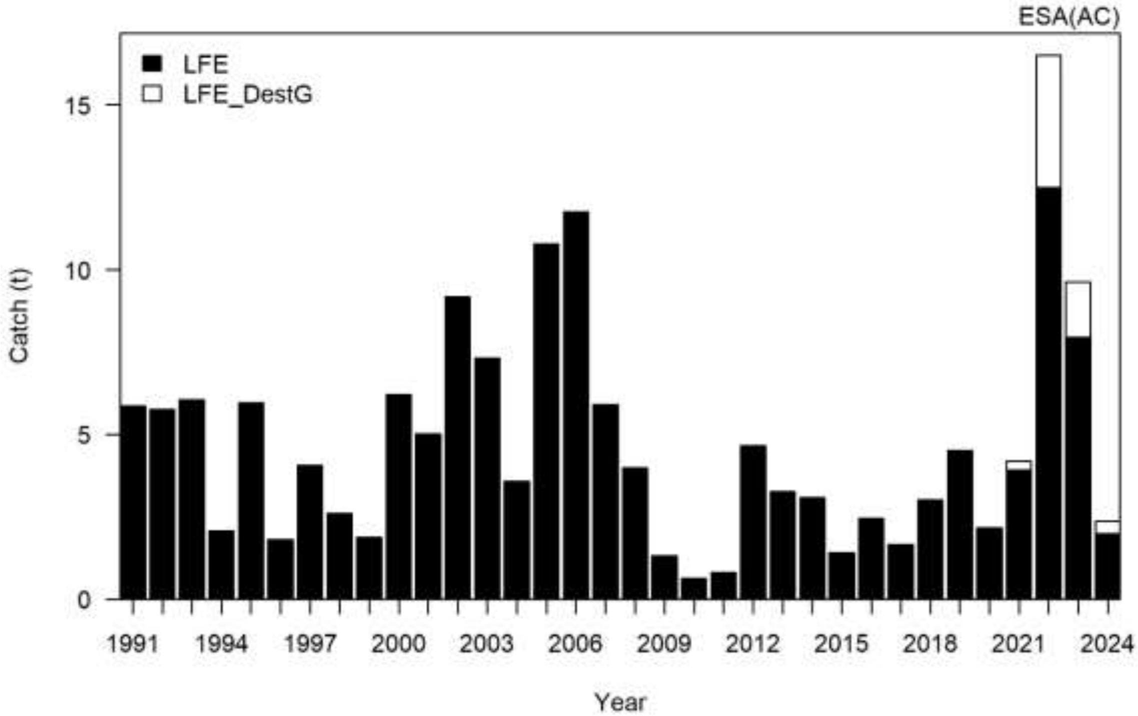

Figure C2: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AC).

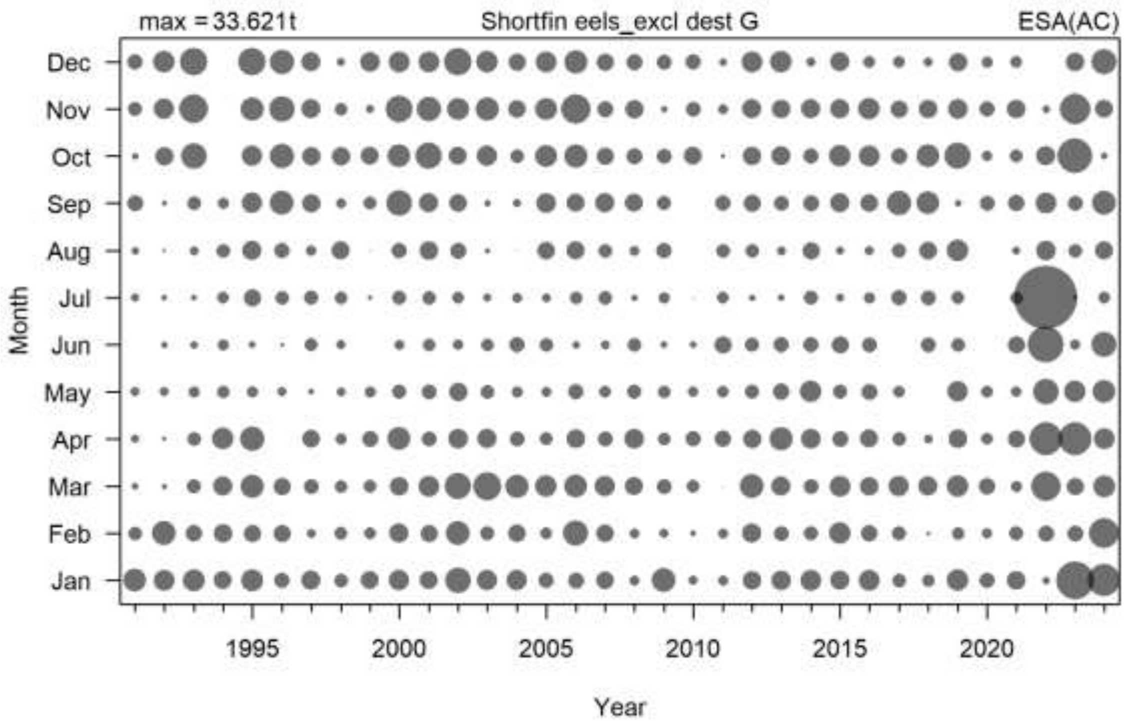

Figure C3: Shortfin legal size eel catch by month for the years 1990–91 to 2023–24 (ESA AC).

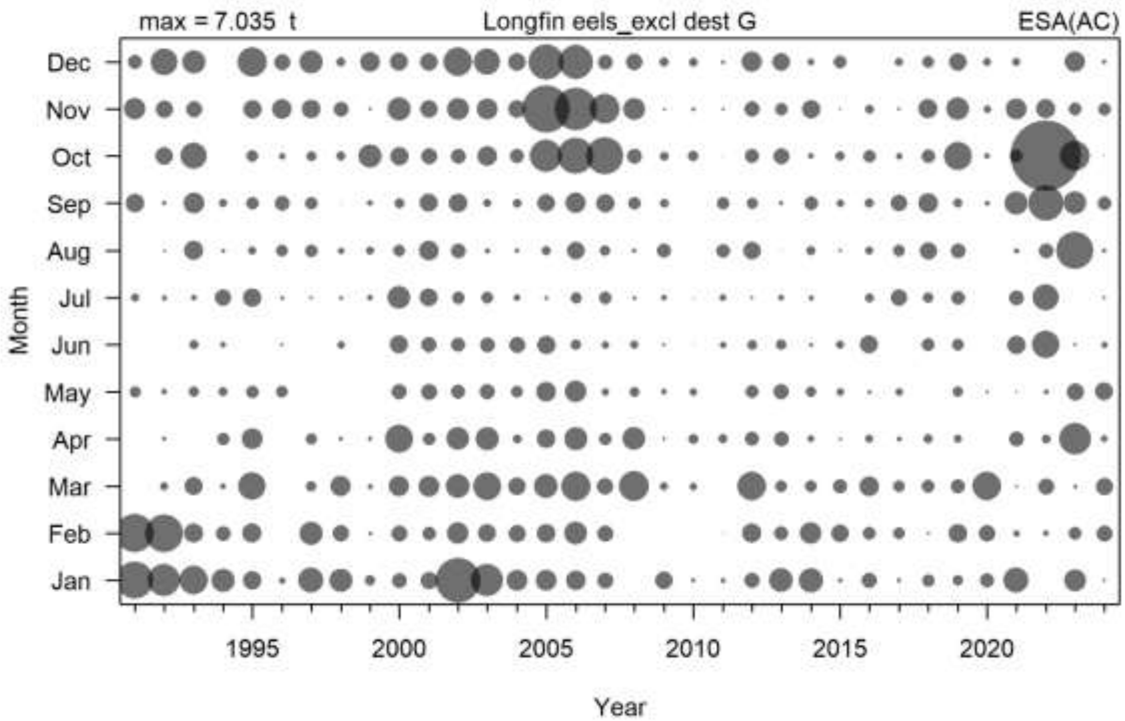

Figure C4: Longfin legal size eel catch by month for the years 1990–91 to 2023–24 (ESA AC).

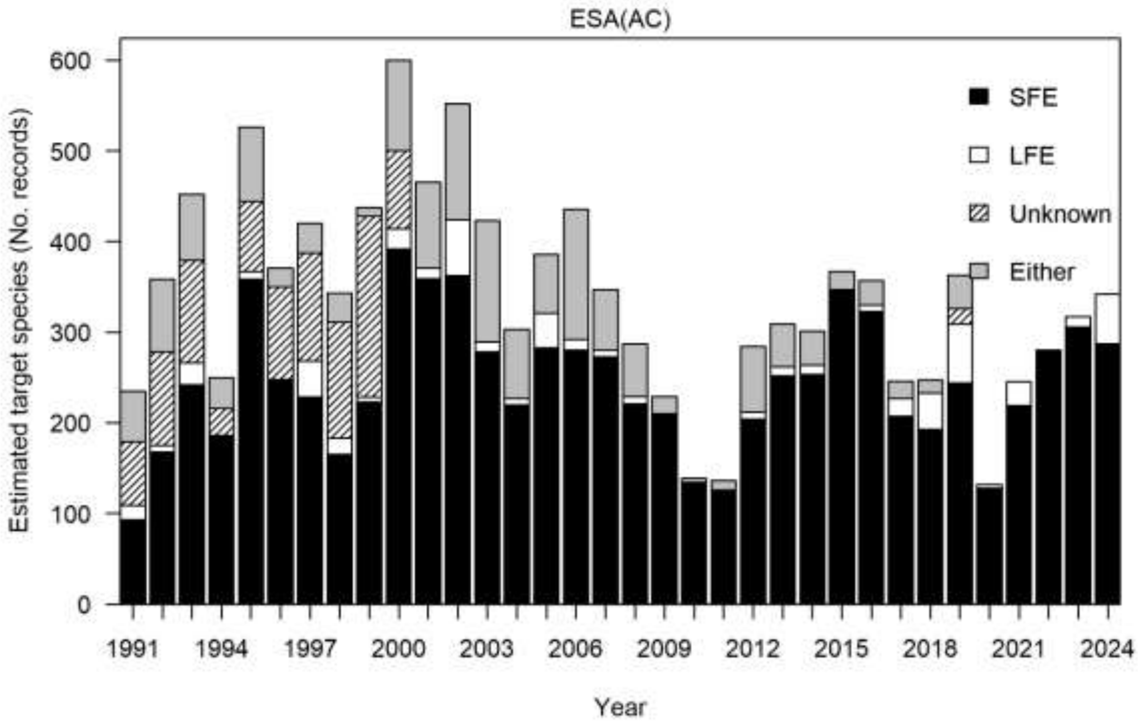

Figure C5: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AC).

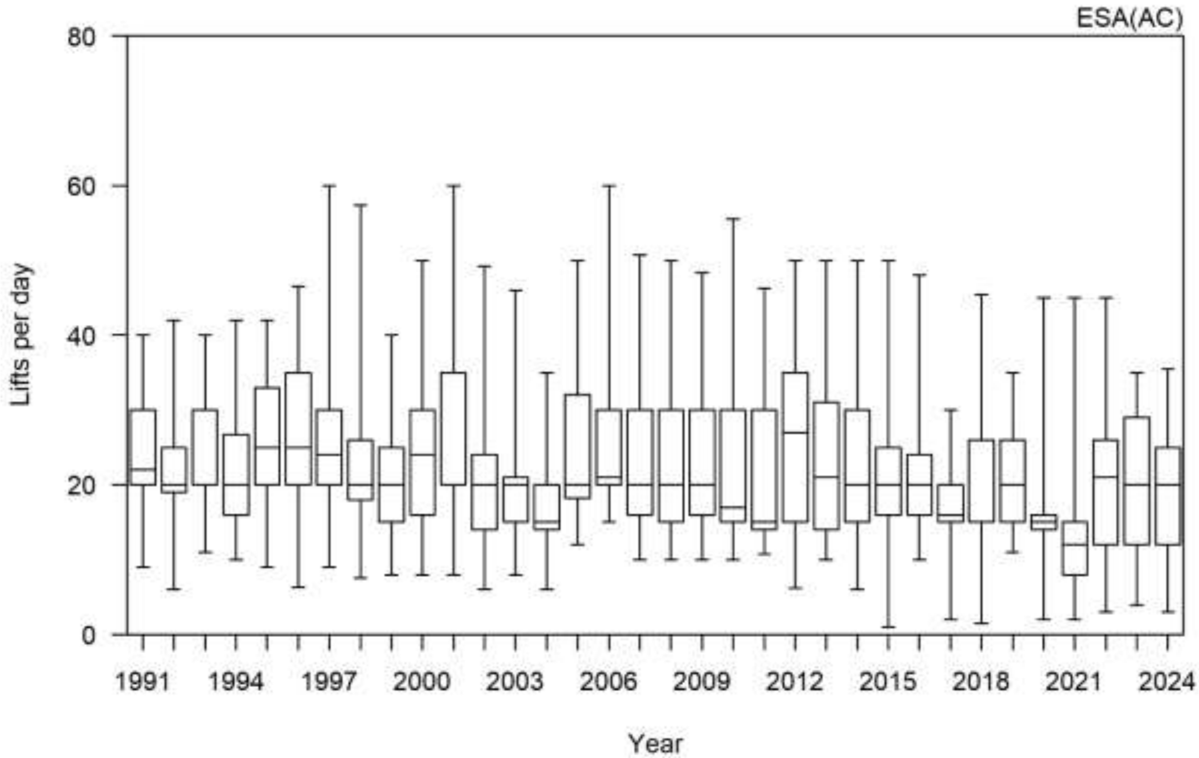

Figure C6: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AC).

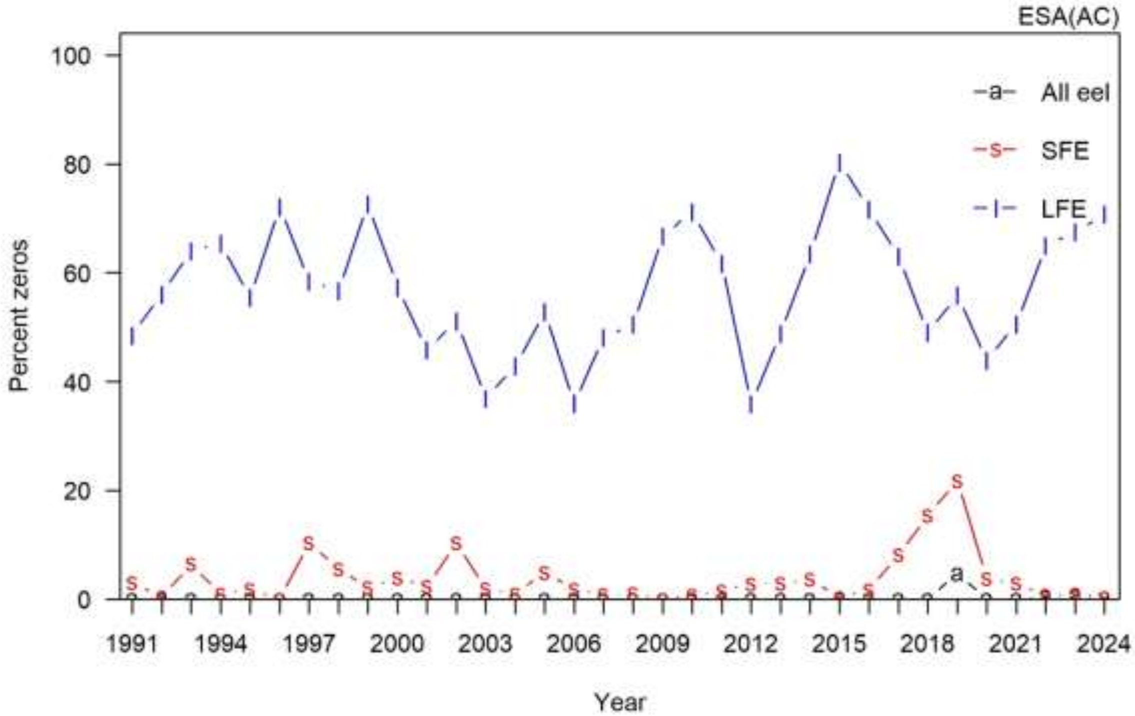

Figure C7: Proportion of valid zero records for legal size all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AC).

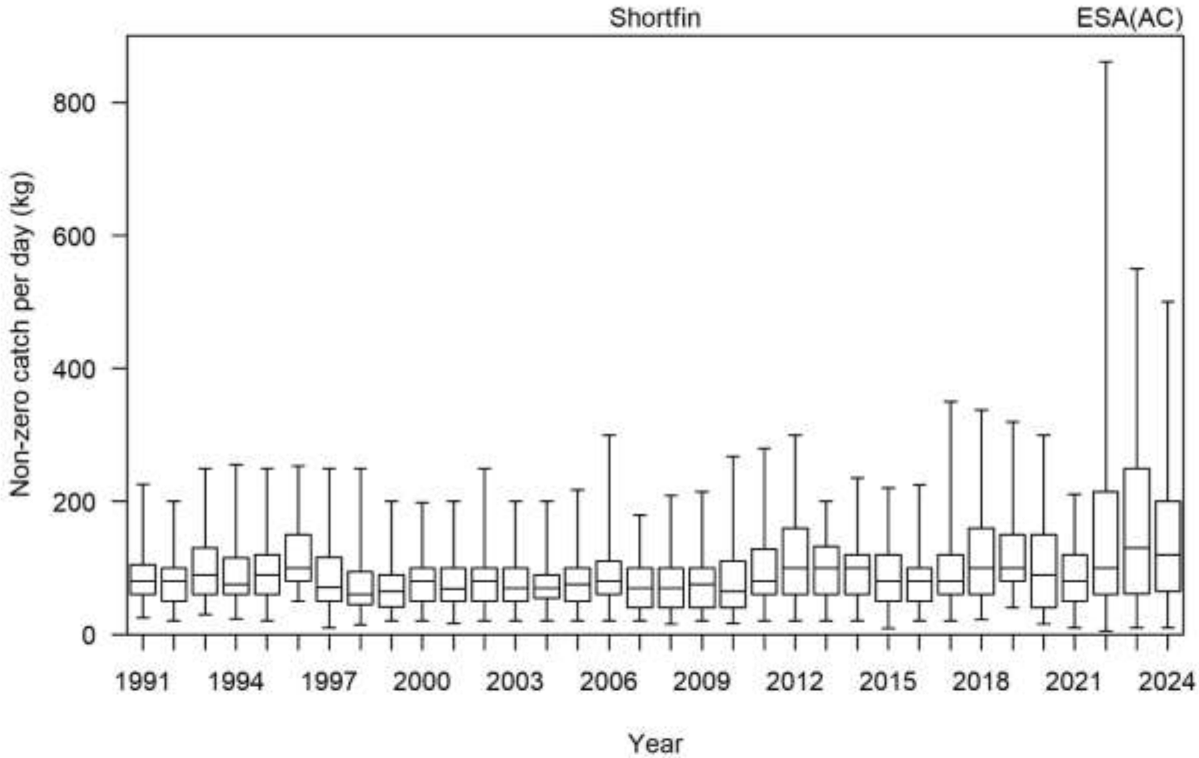

Figure C8: Shortfin non-zero catch per day for legal size eels for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AC).

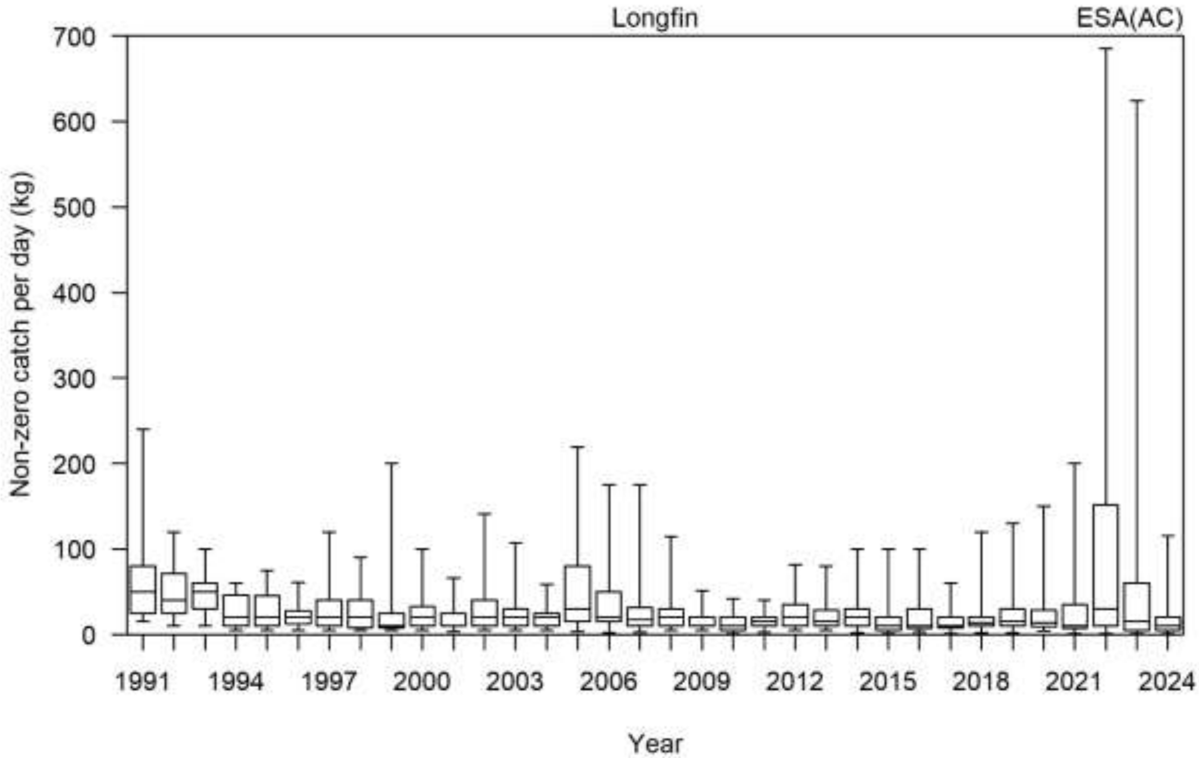

Figure C9: Longfin non-zero catch per day for legal size eels for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AC).

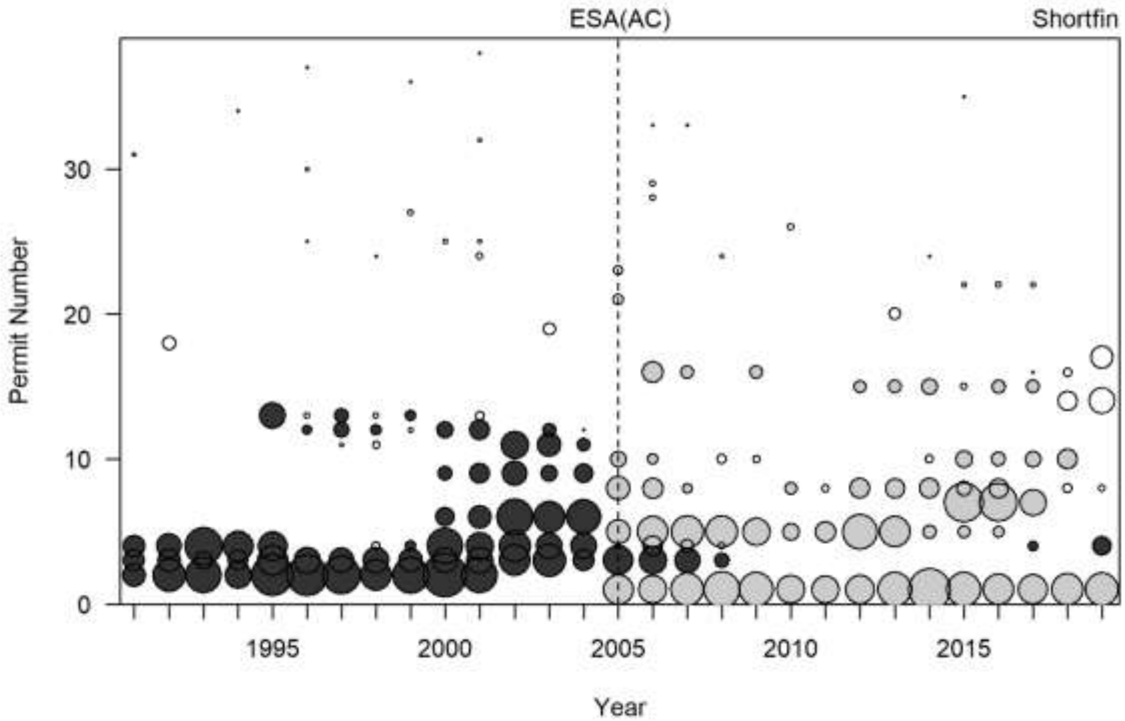

Figure C10: Relative shortfin legal size eel catch, from all fishers (all circles) for the years 1990–91 to 2018–19 (pre-ERS), and for core fishers (dark and grey shaded circles) included in the catch per unit effort analyses. The vertical dotted line indicates introduction into the QMS in 2004–05. The dark shaded circles post-QMS are existing fishers and the grey, new entrants (ESA AC).

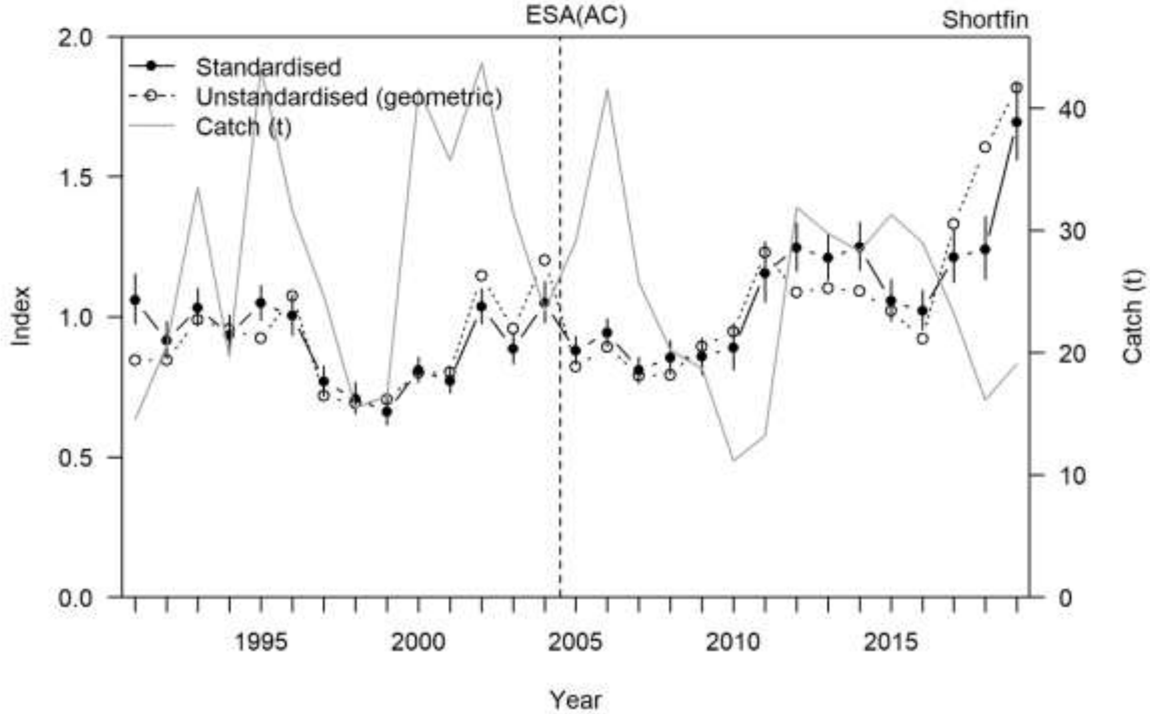

Figure C11: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for shortfin (core fishers) for the years 1990–91 to 2018–19 (pre-ERS). The shortfin catch by core fishers is also plotted. The vertical dotted line indicates introduction into the QMS in 2004–05. Catch includes legal size eels (ESA AC).

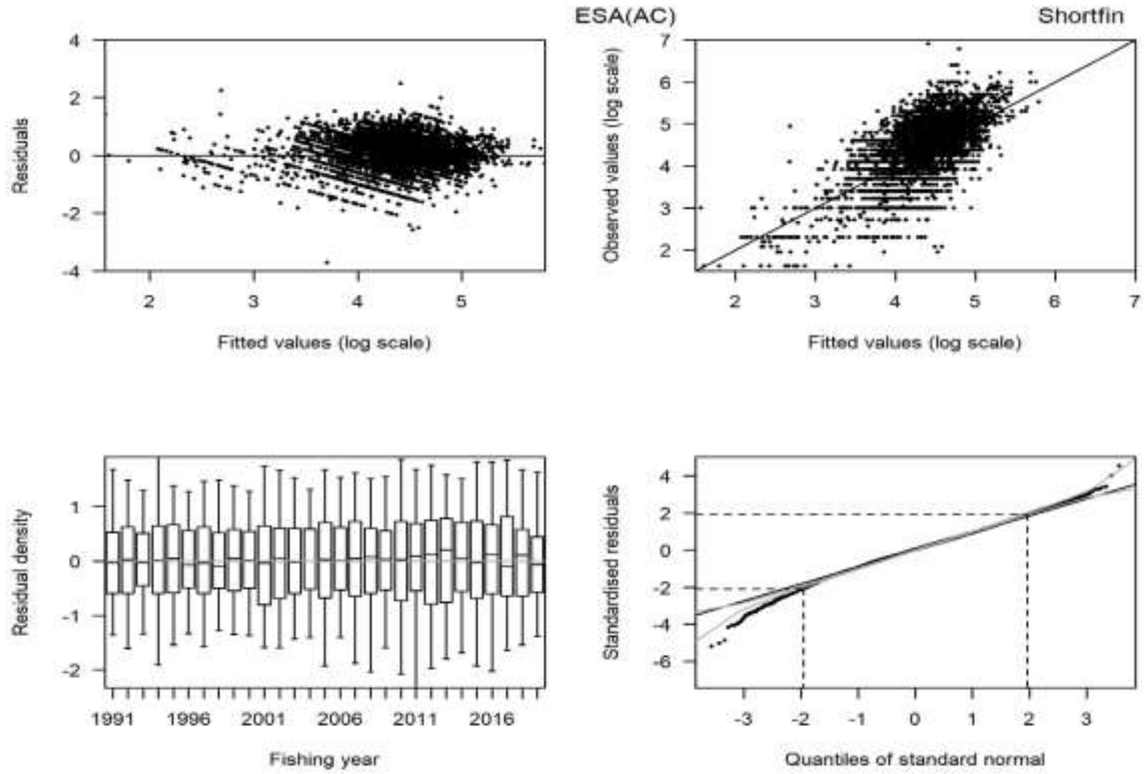

Figure C12: Residual diagnostic plots for the shortfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AC).

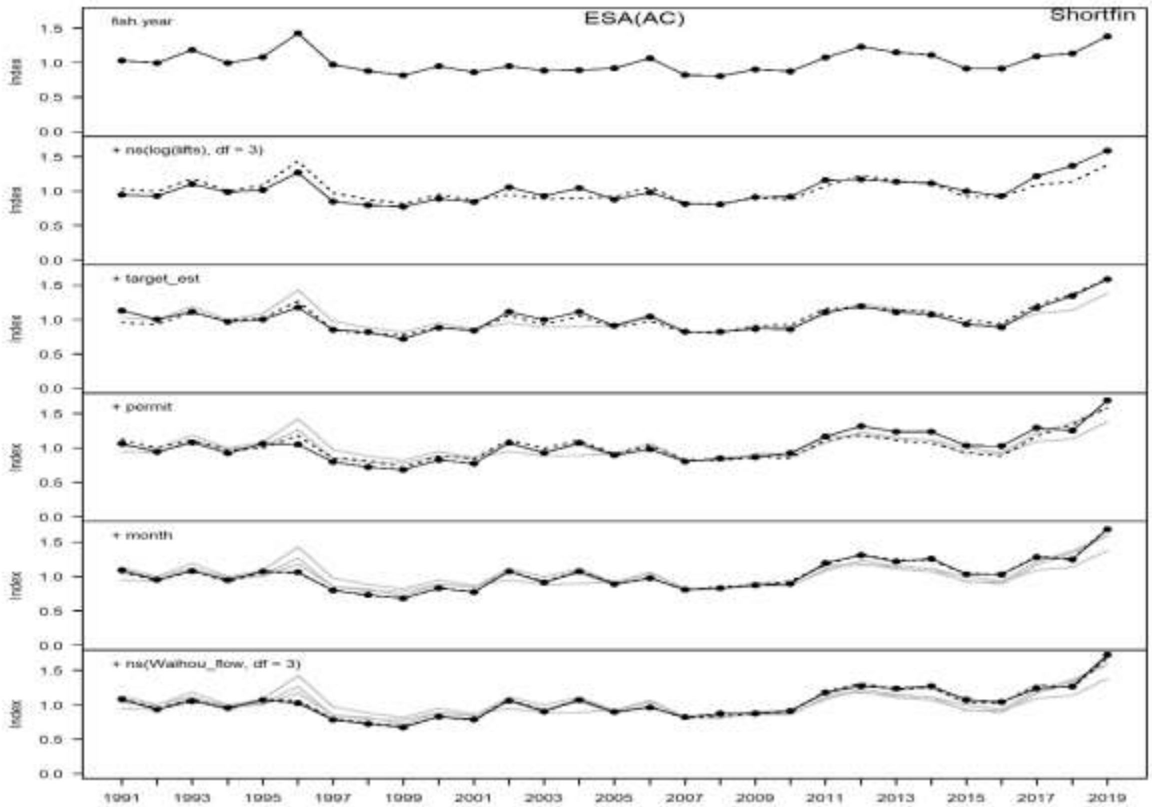

Figure C13: Step plot for the shortfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AC).

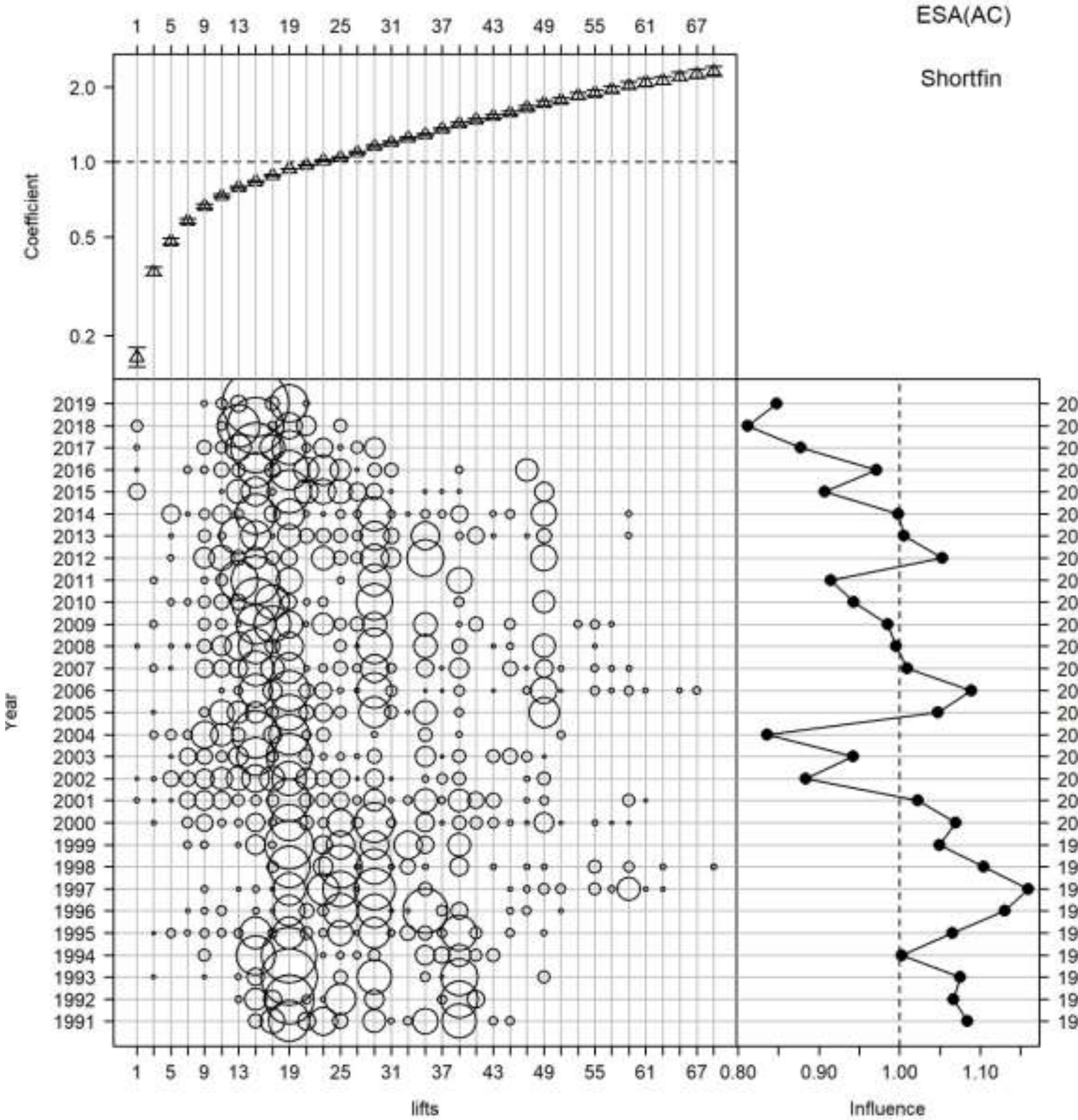

Figure C14: Influence of lifts for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AC).

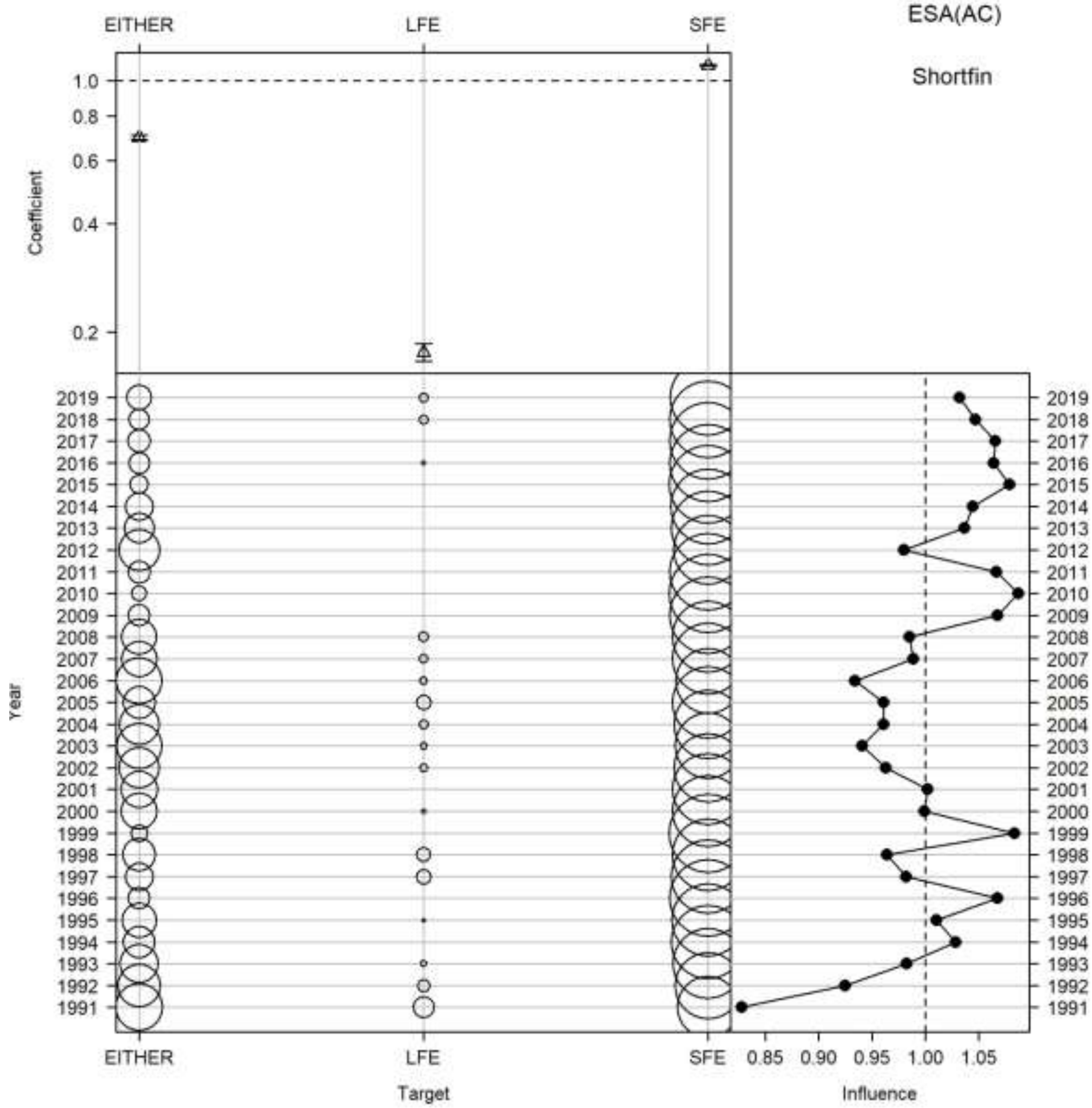

Figure C15: Influence of reconstructed target for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AC).

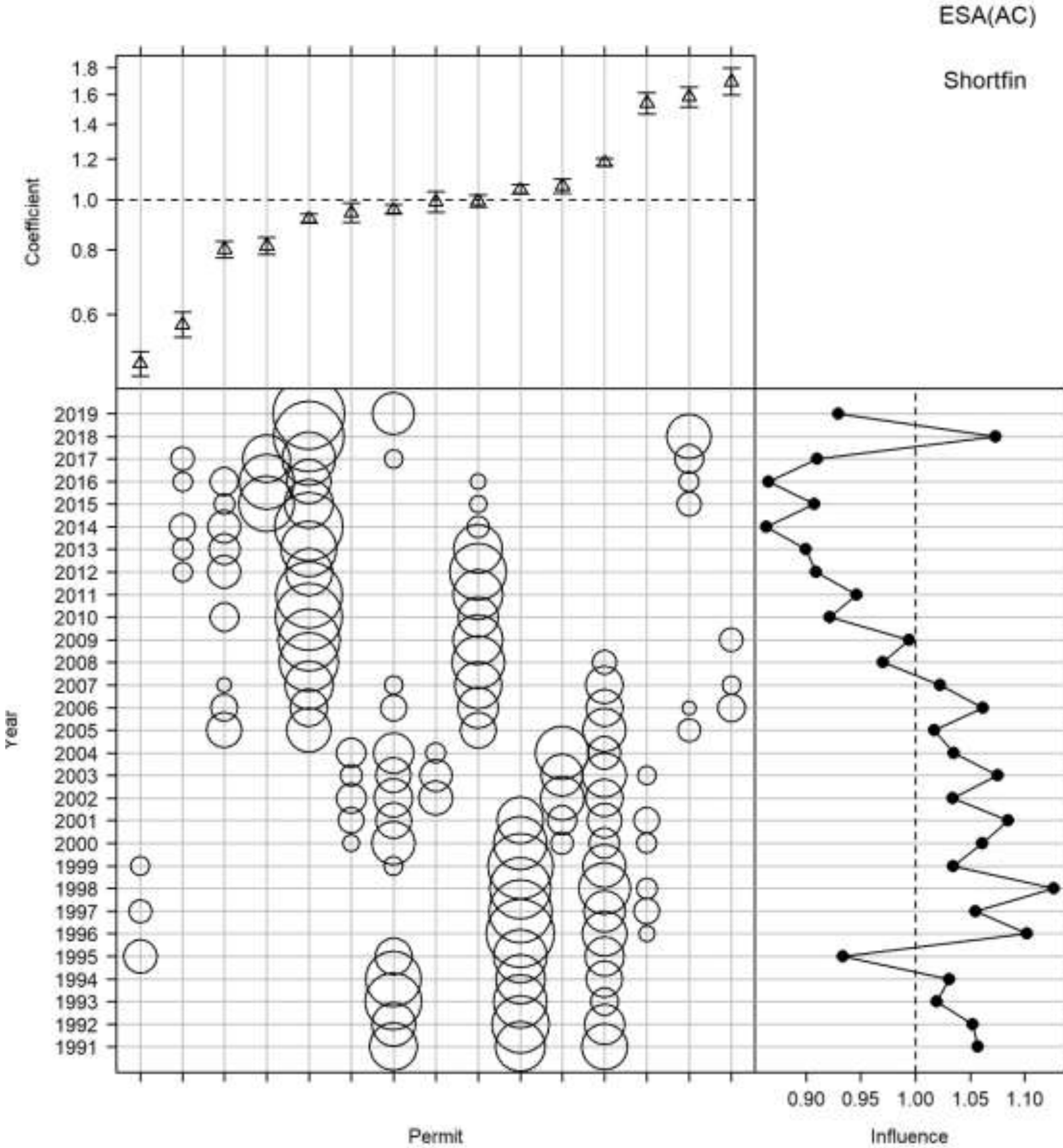

Figure C16: Influence of permit for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AC).

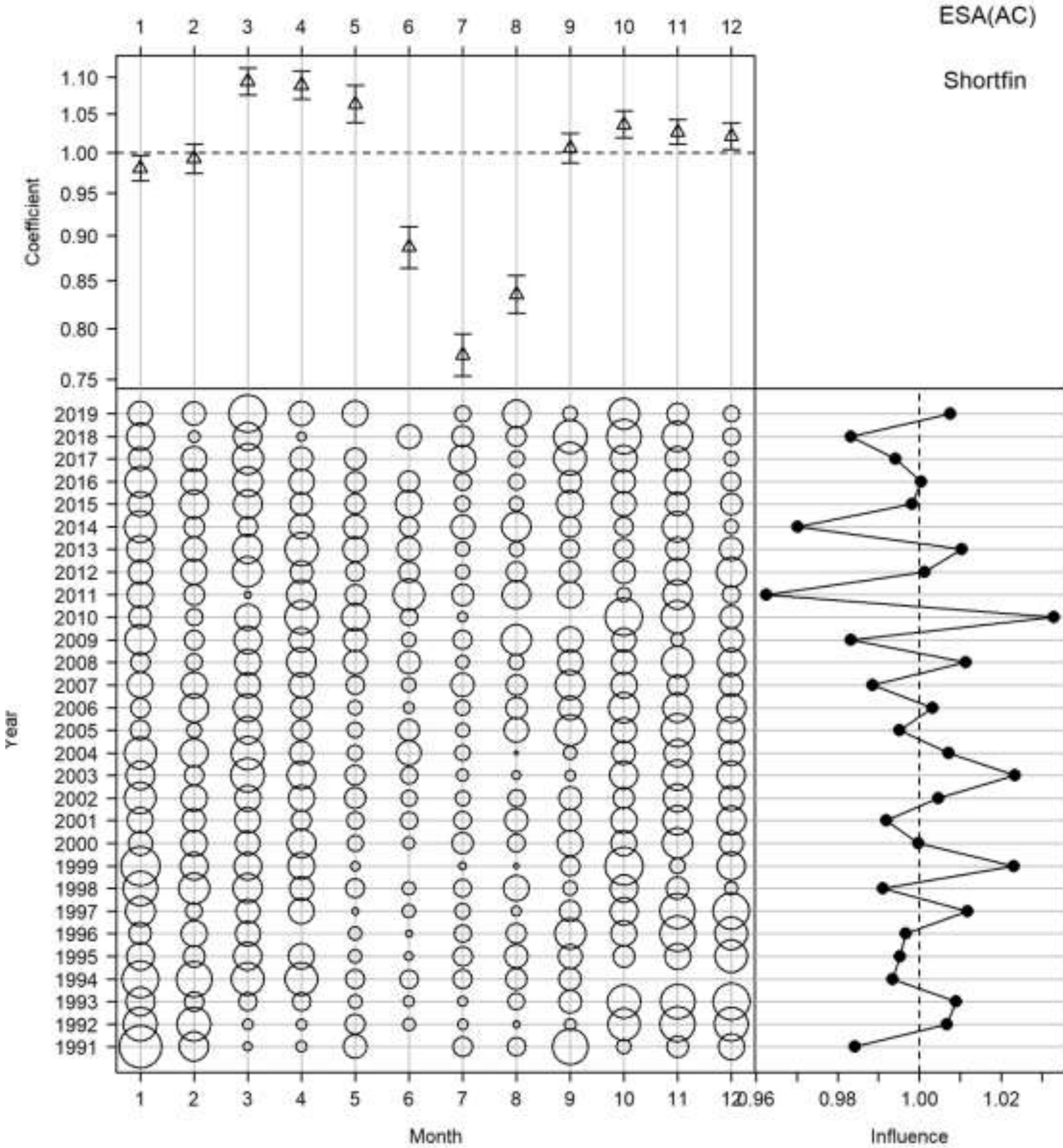

Figure C17: Influence of month for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AC).

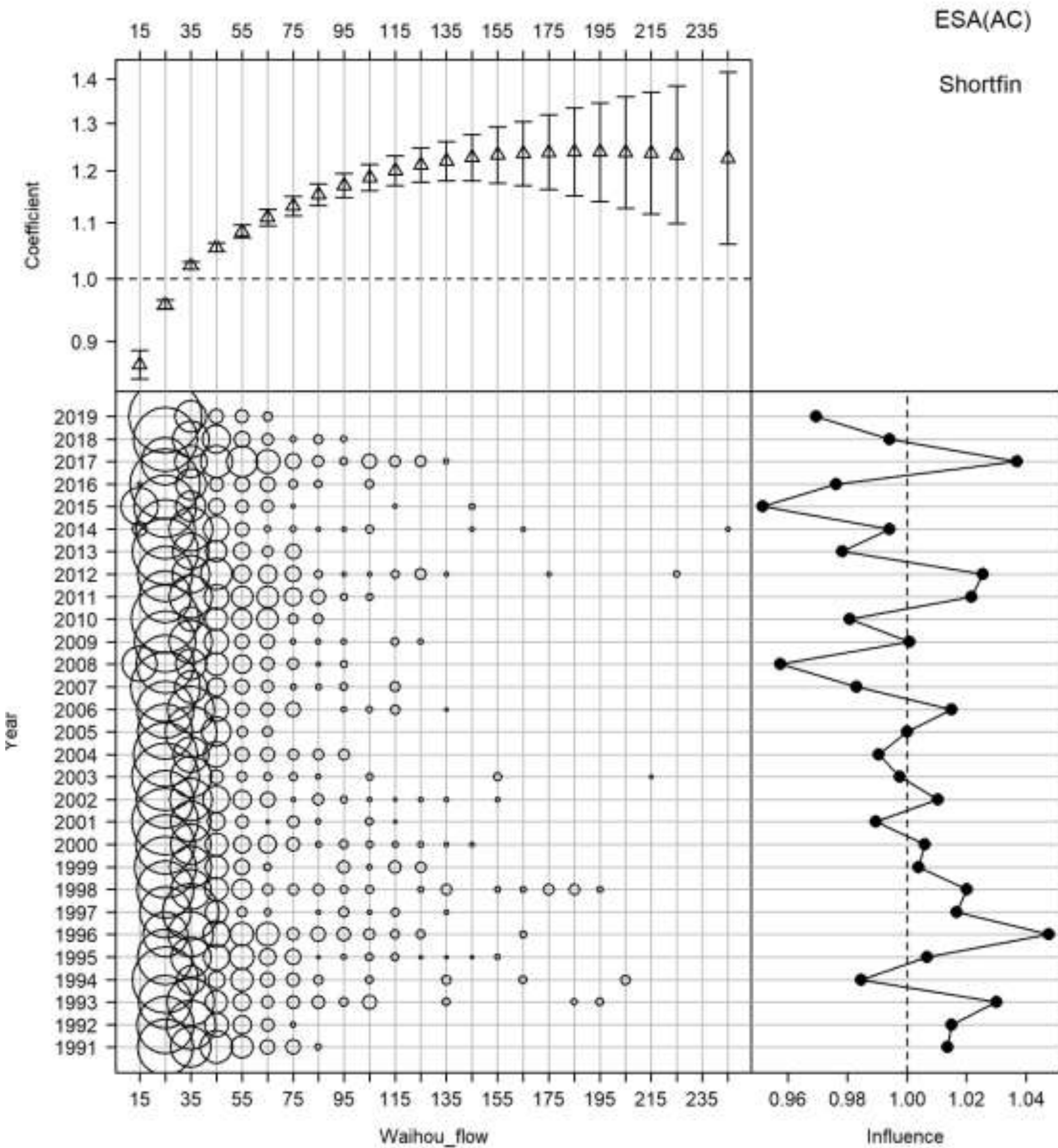

Figure C18: Influence of Waihou River flow for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AC).

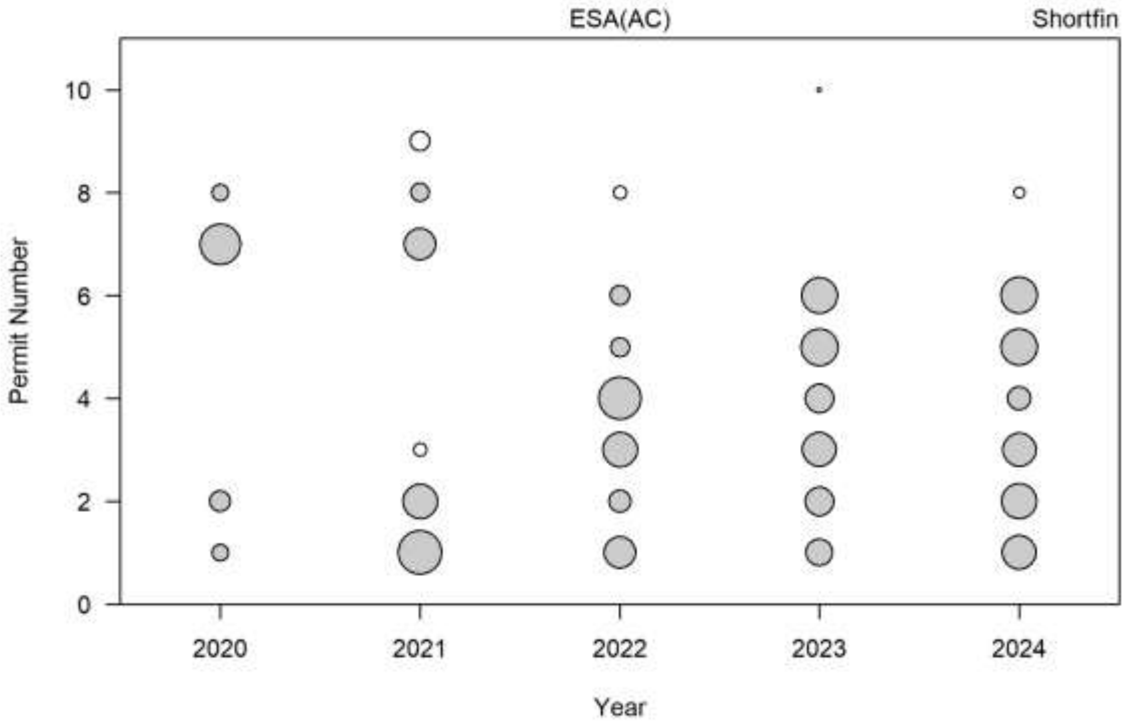

Figure C19: Relative shortfin legal size eel catch and destination G, from all fishers (all circles) for the years 2019–20 to 2023–24 (post-ERS), and for core fishers (grey shaded circles) included in the catch per unit effort analyses (ESA AC).

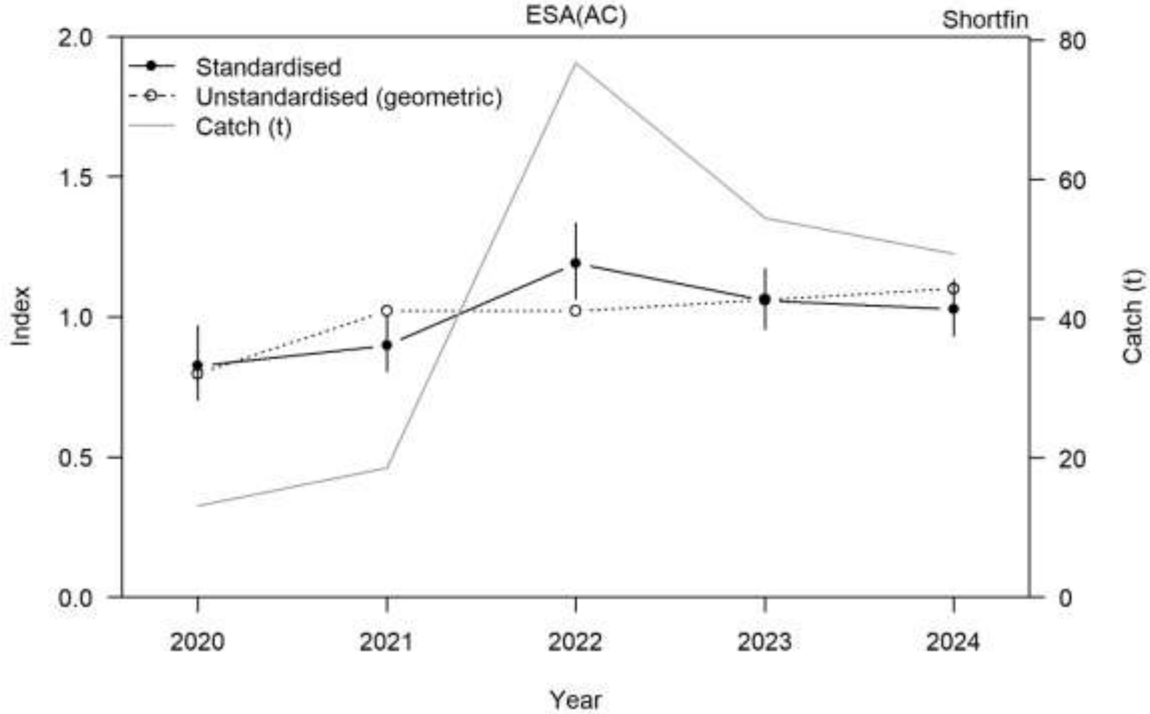

Figure C20: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for shortfin (core fishers) for the years 2019–20 to 2023–24 (post-ERS). The shortfin catch by core fishers is also plotted. Catch includes legal size eels and destination G (ESA AC).

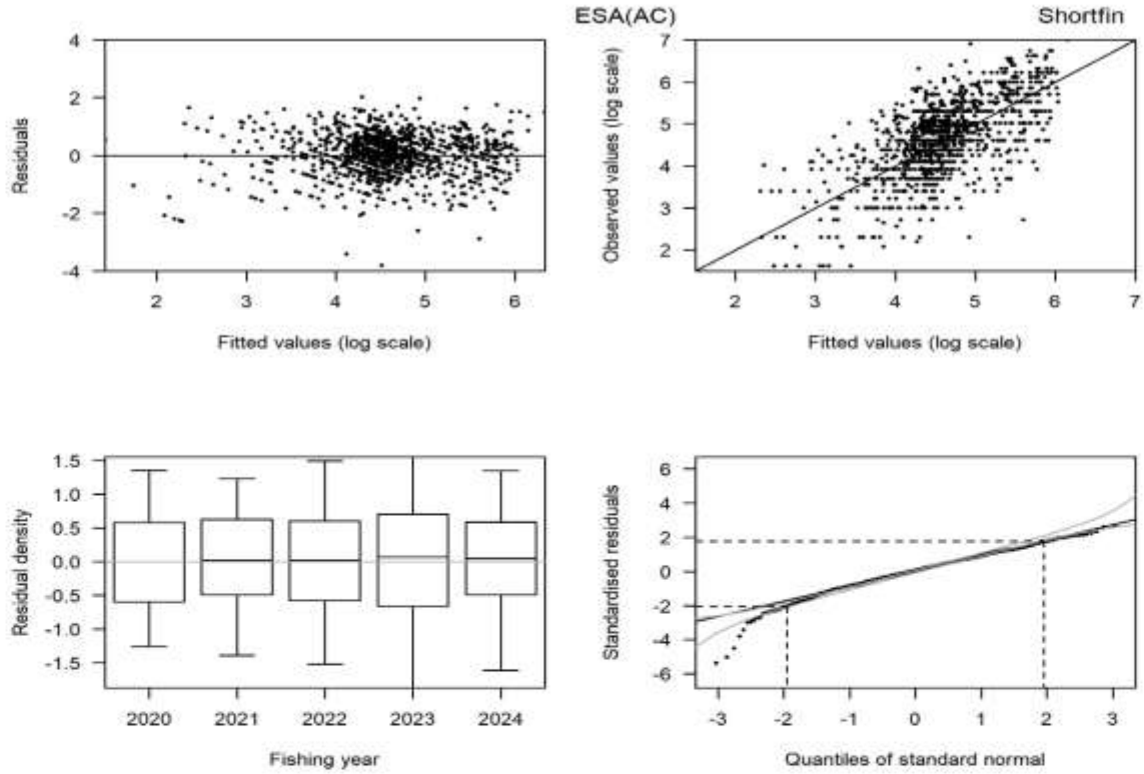

Figure C21: Residual diagnostic plots for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AC).

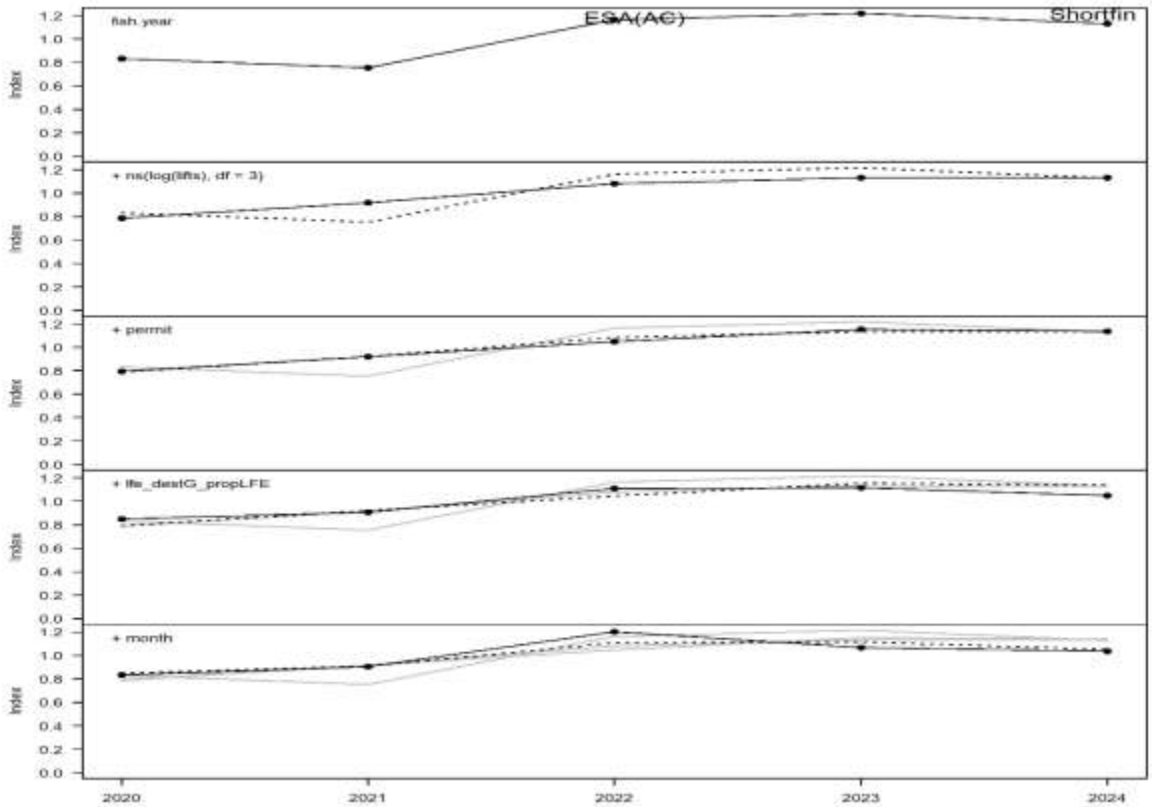

Figure C22: Step plot for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AC).

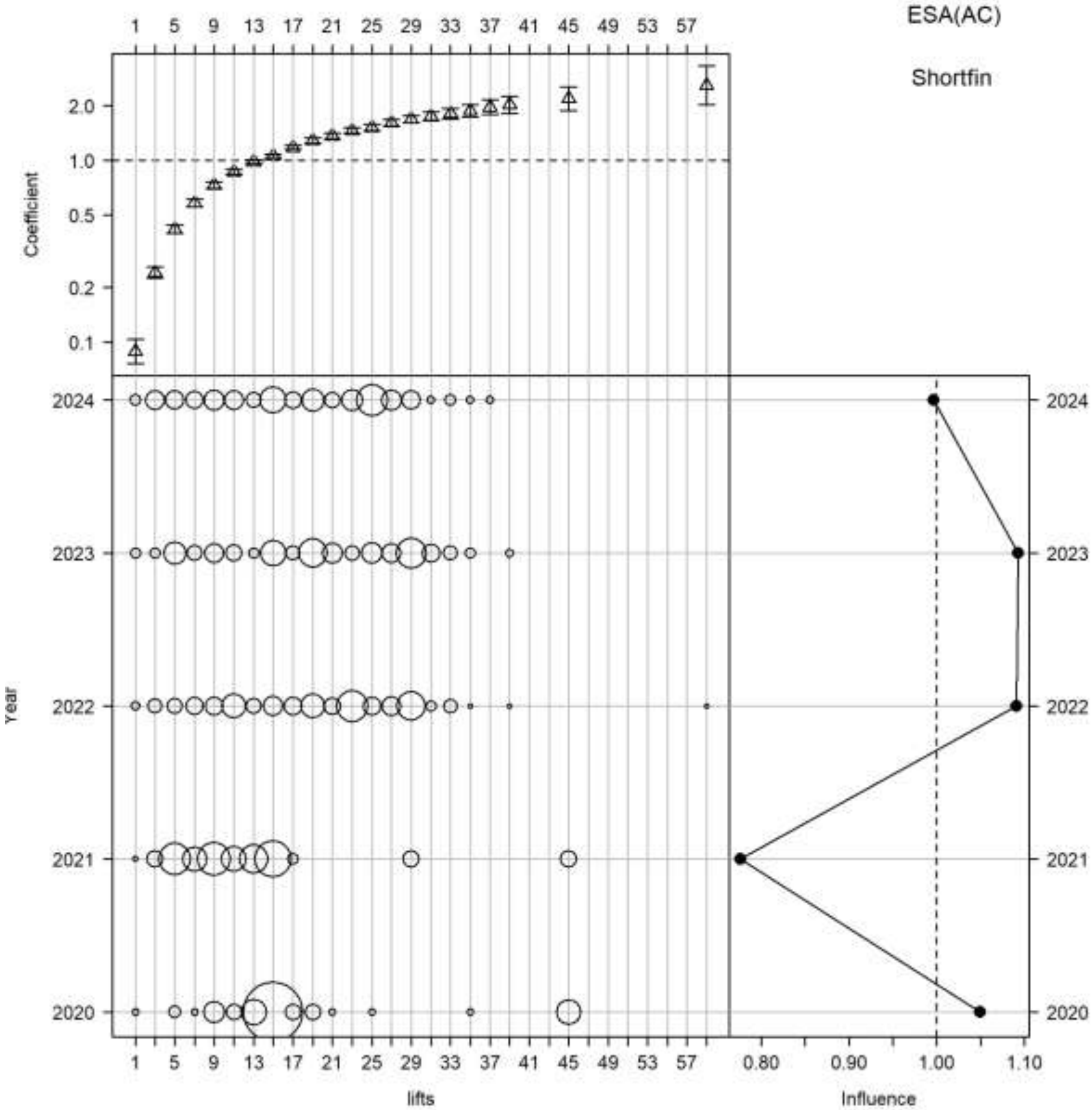

Figure C23: Influence of lifts for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AC).

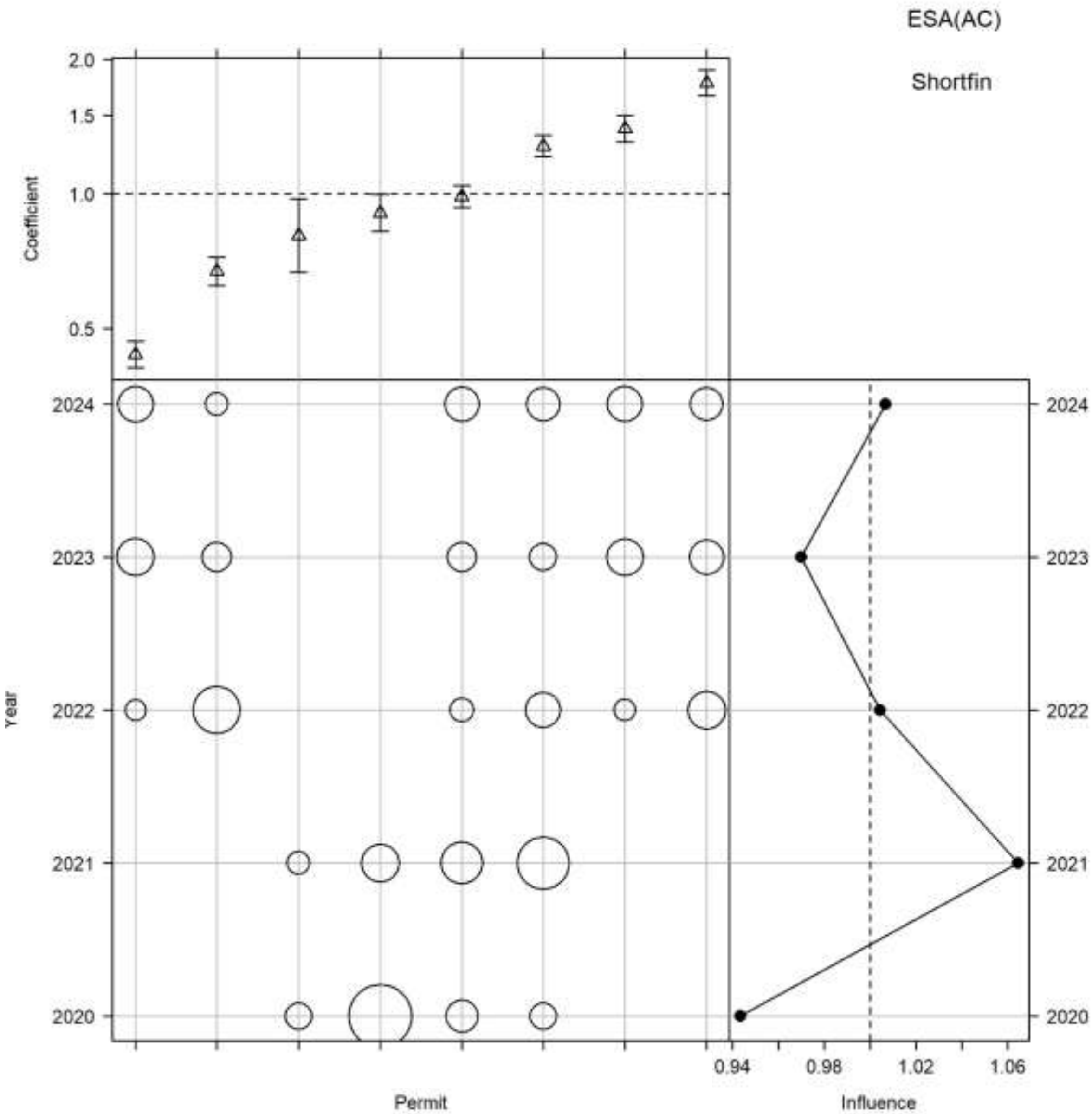

Figure C24: Influence of permit for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AC).

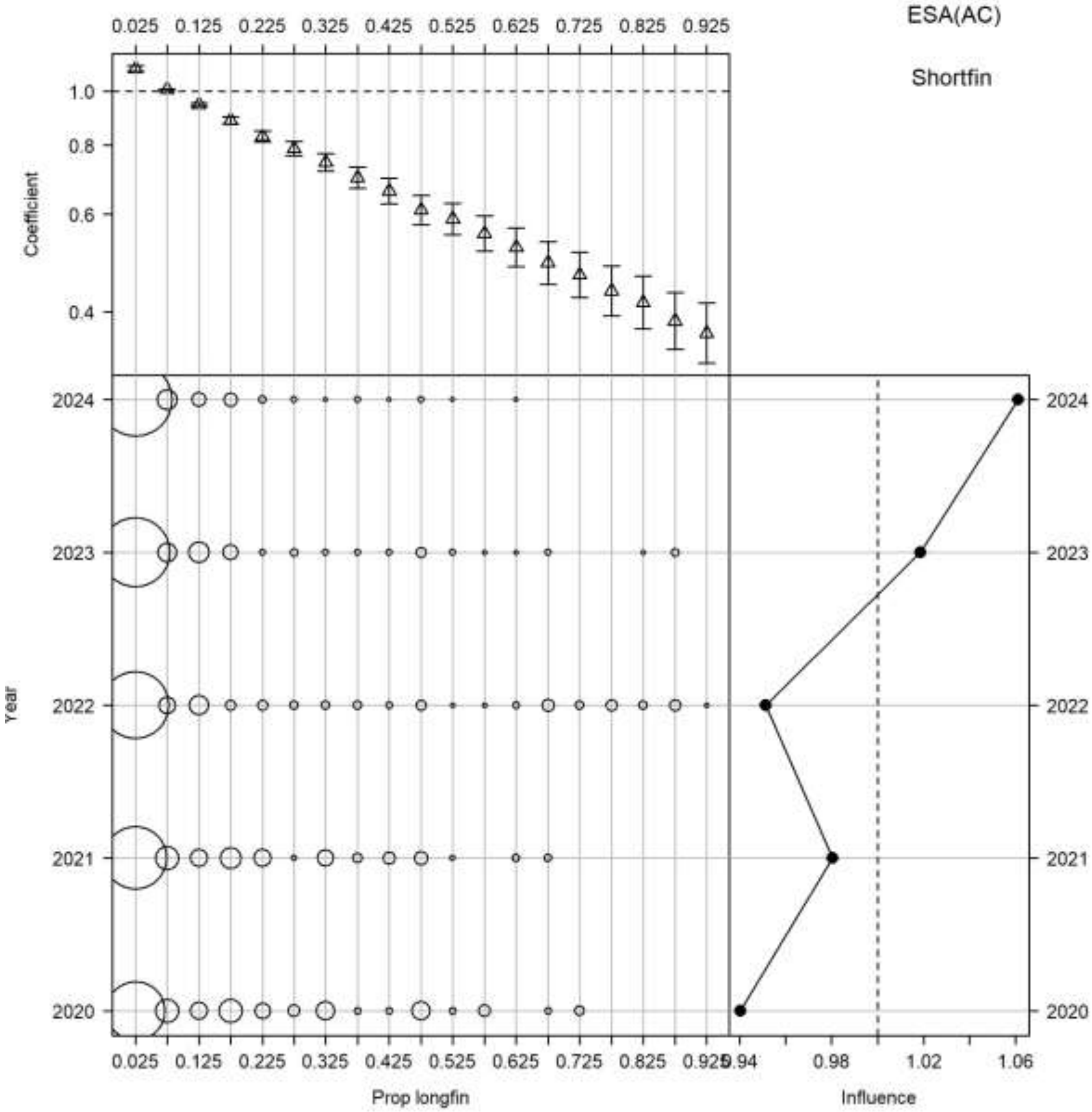

Figure C25: Influence of proportion longfin in the catch for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AC).

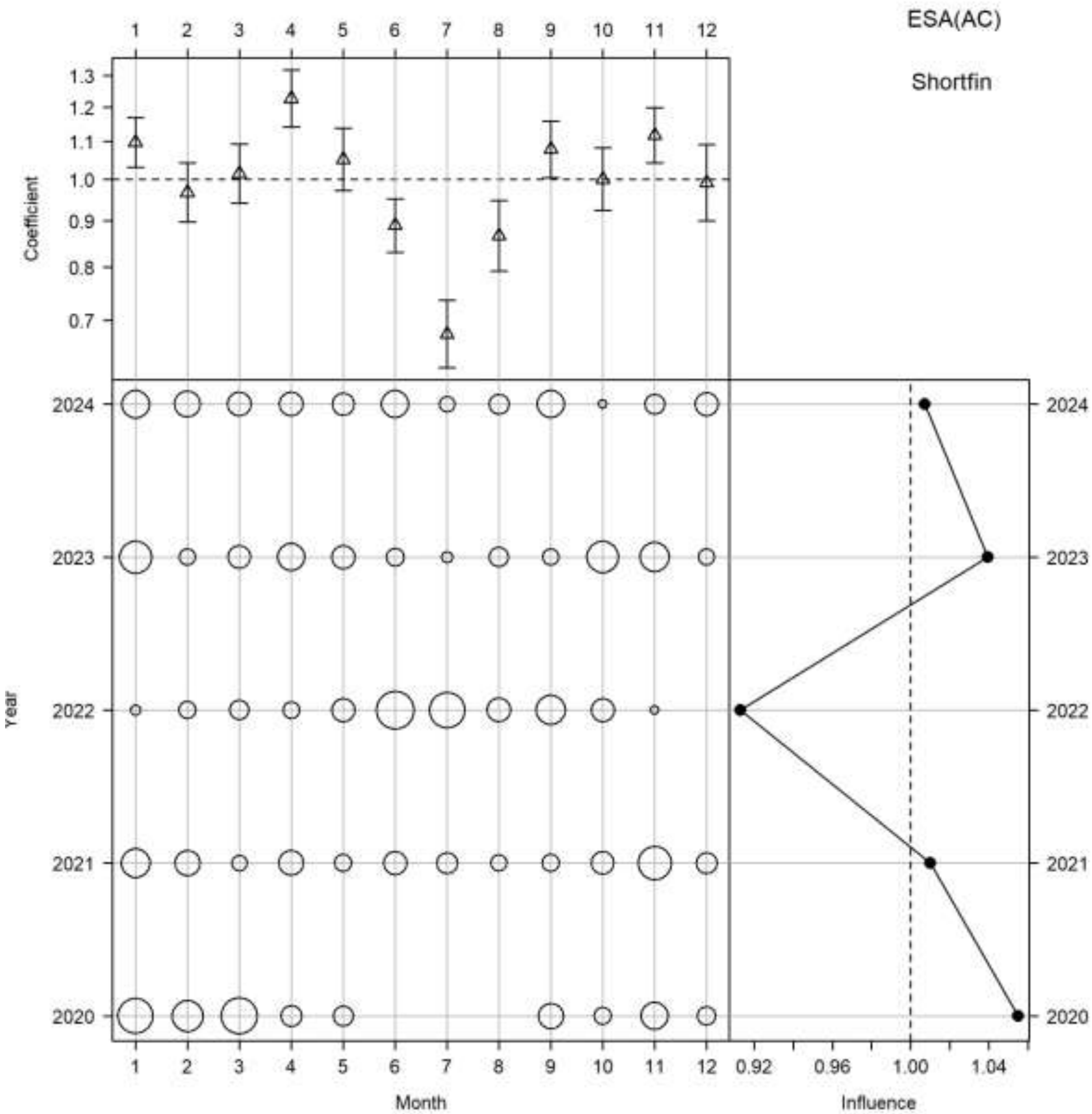

Figure C26: Influence of month for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AC).

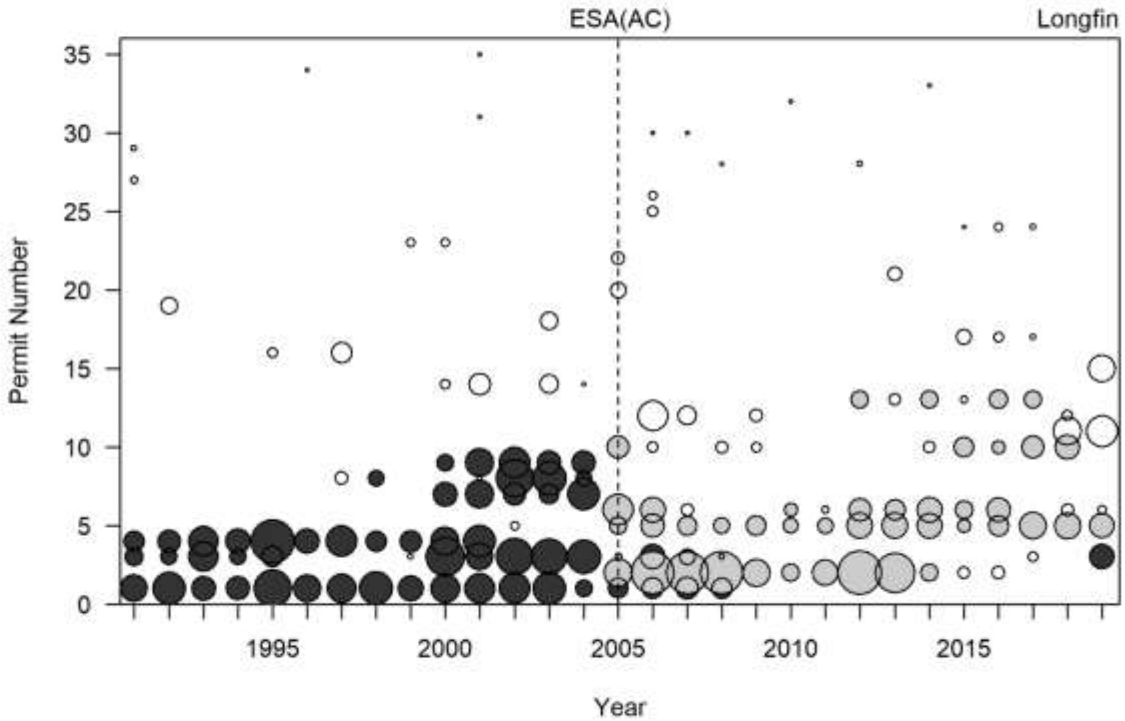

Figure C27: Relative longfin legal size eel catch, from all fishers (all circles) for the years 1990–91 to 2018–19 (pre-ERS), and for core fishers (dark and grey shaded circles) included in the catch per unit effort analyses. The vertical dotted line indicates introduction into the QMS in 2004–05. The dark shaded circles post-QMS are existing fishers and the grey, new entrants (ESA AC).

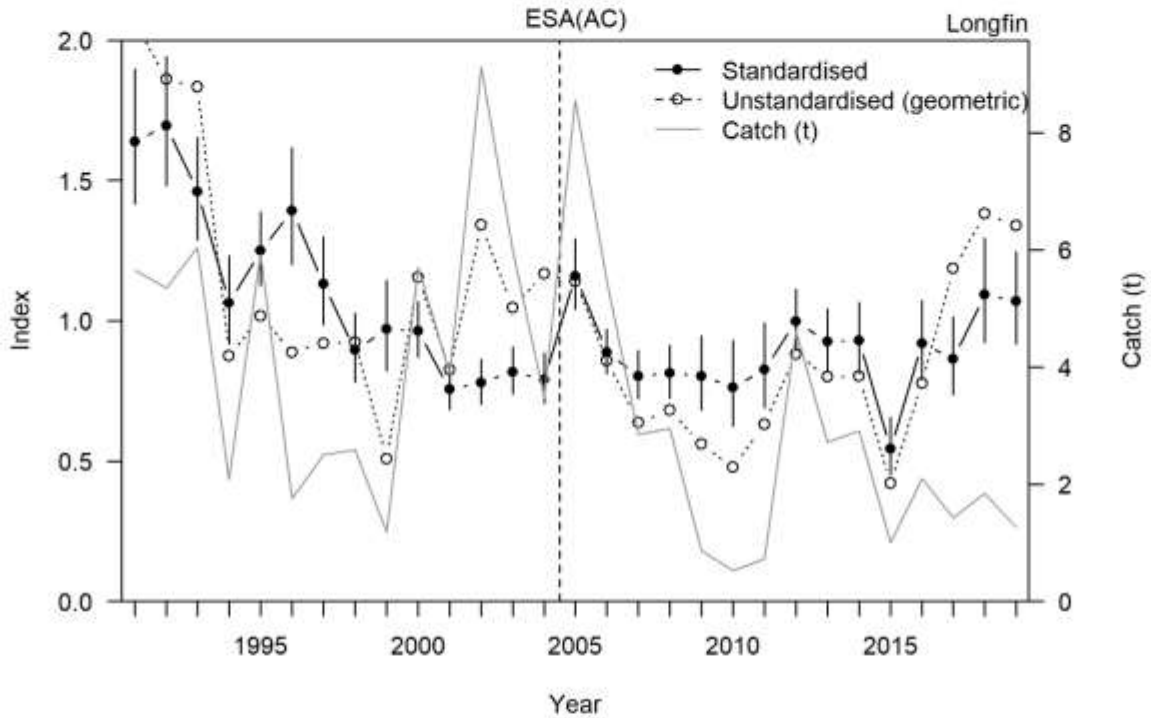

Figure C28: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for longfin (core fishers) for the years 1990–91 to 2018–19 (pre-ERS). The longfin catch by core fishers is also plotted. The vertical dotted line indicates introduction into the QMS in 2004–05. Catch includes legal size eels (ESA AC).

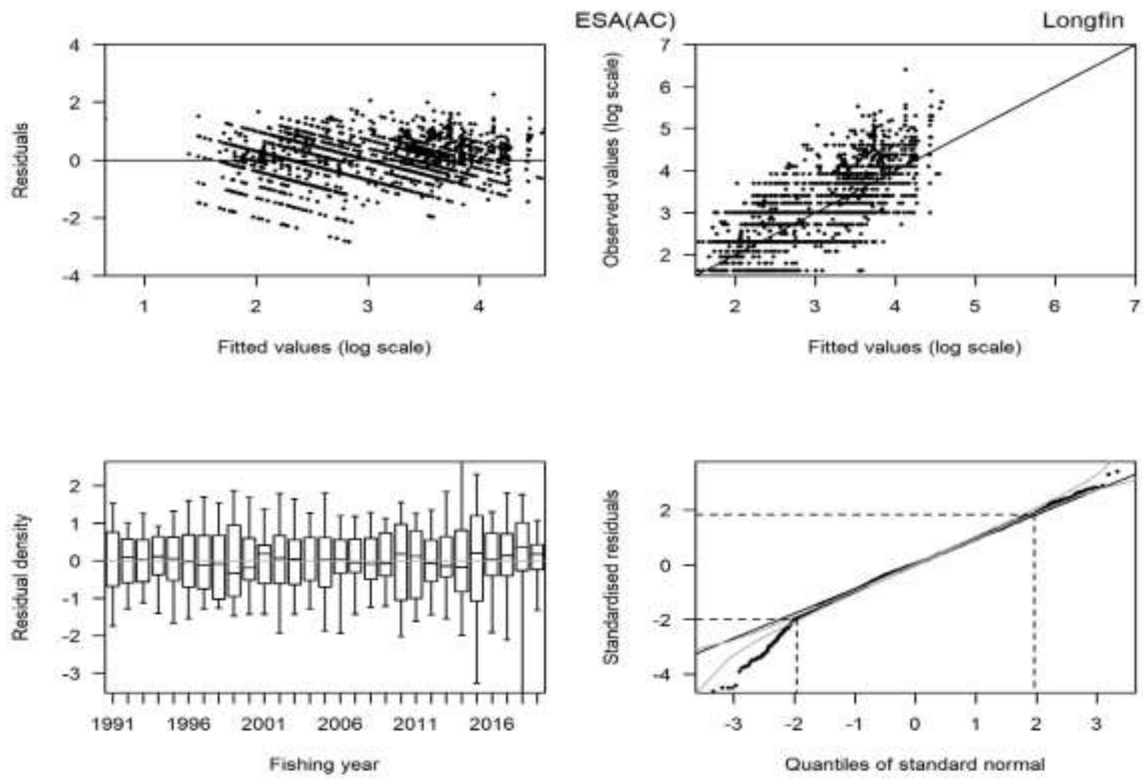

Figure C29: Residual diagnostic plots for the longfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AC).

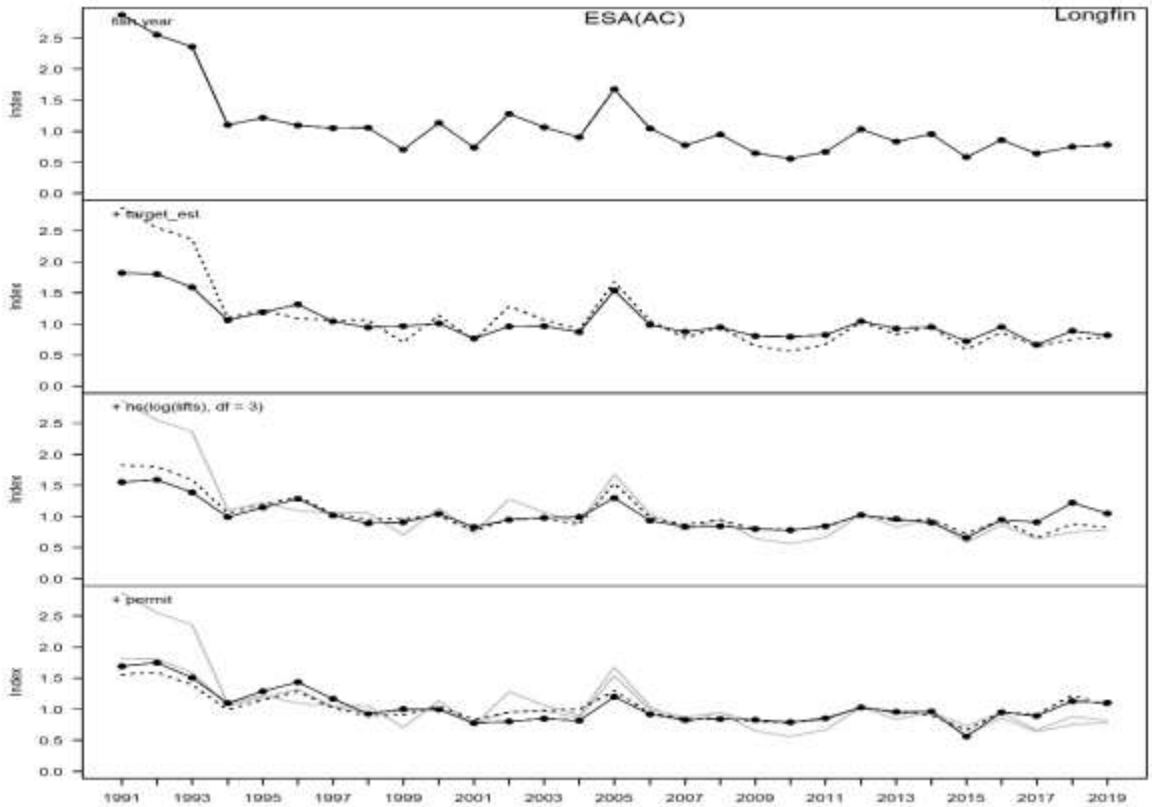

Figure C30: Step plot for the longfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AC).

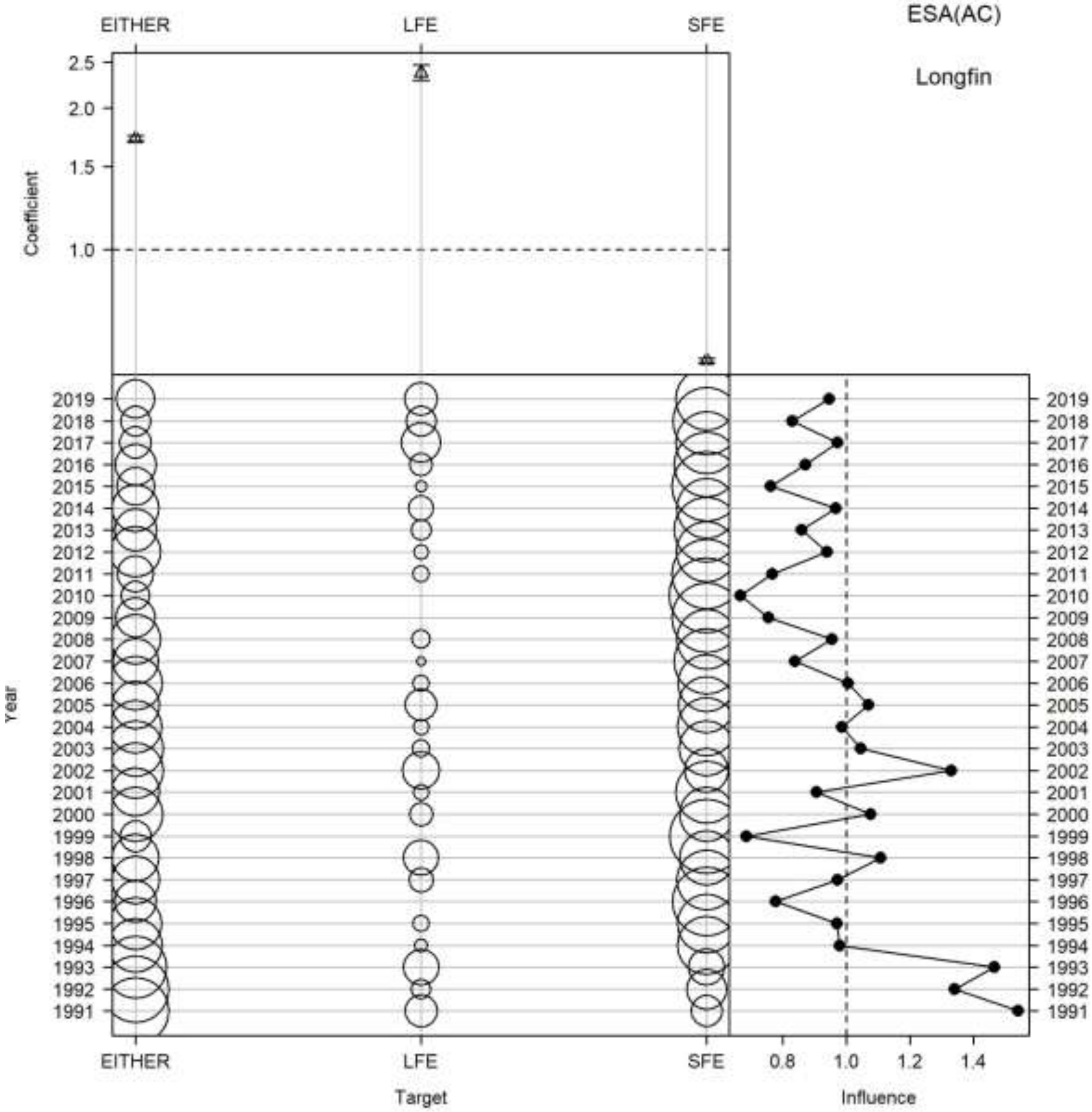

Figure C31: Influence of reconstructed target for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AC).

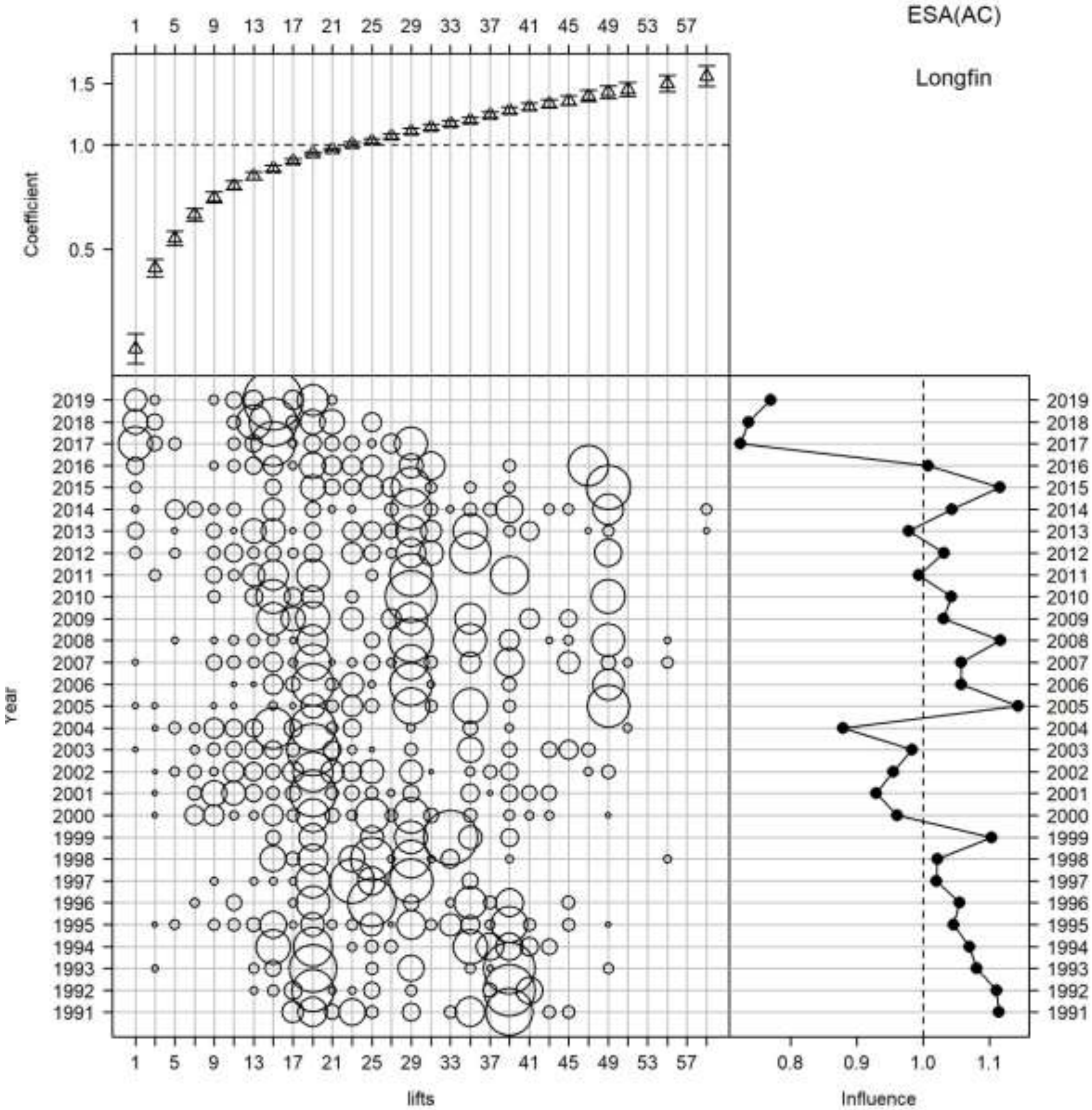

Figure C32: Influence of lifts for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AC).

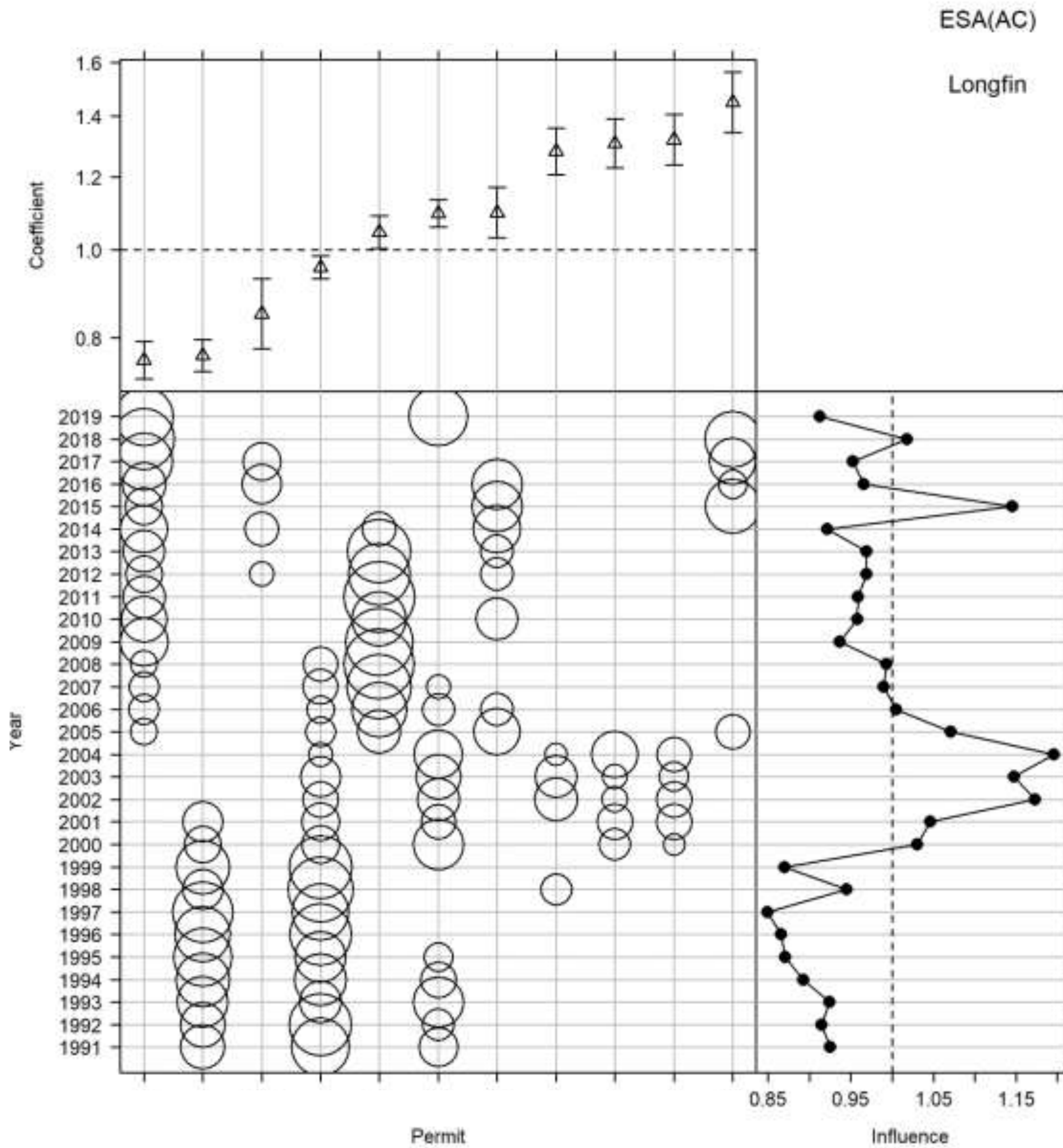

Figure C33: Influence of permit for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AC).

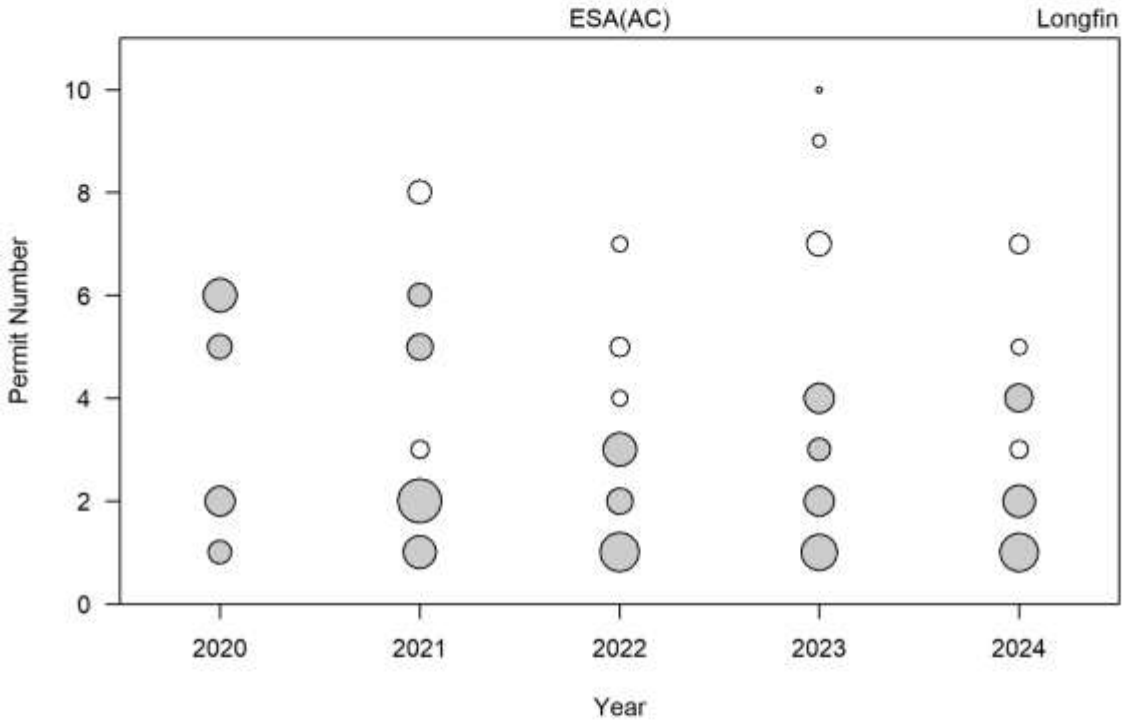

Figure C34: Relative longfin legal size eel catch and destination G, from all fishers (all circles) for the years 2019–20 to 2023–24 (post-ERS), and for core fishers (grey shaded circles) included in the catch per unit effort analyses (ESA AC).

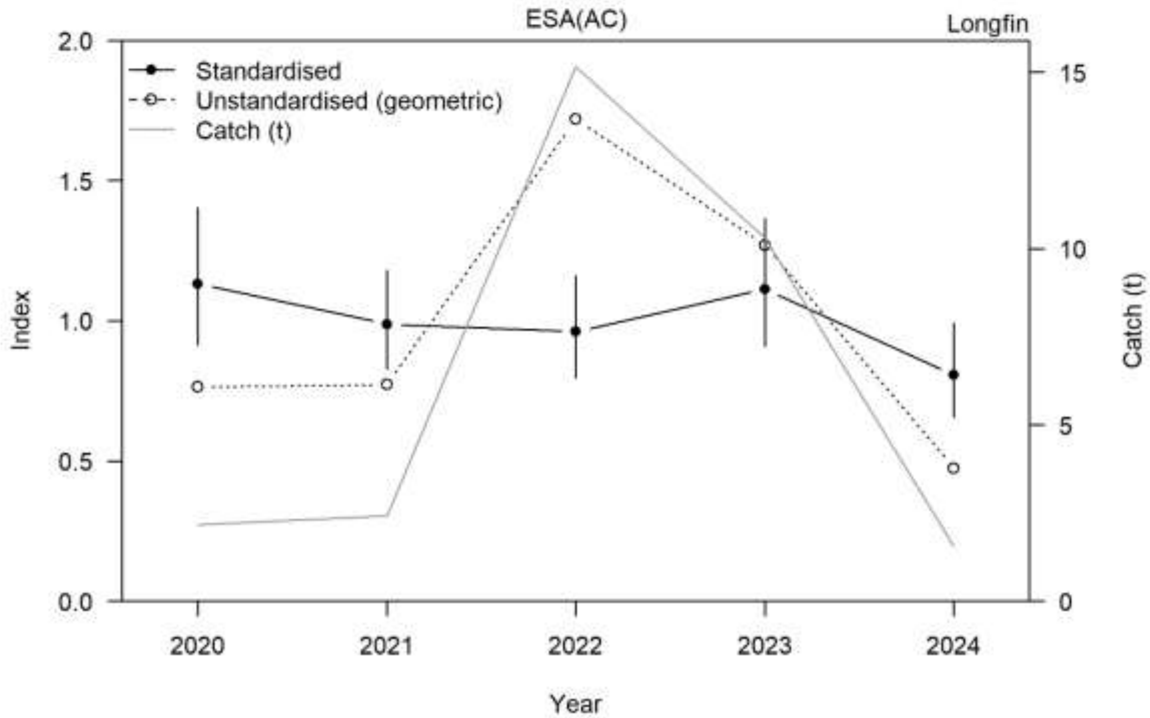

Figure C35: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for longfin (core fishers) for the years 2019–20 to 2023–24 (post-ERS). The longfin catch by core fishers is also plotted. Catch includes legal size eels and destination G (ESA AC).

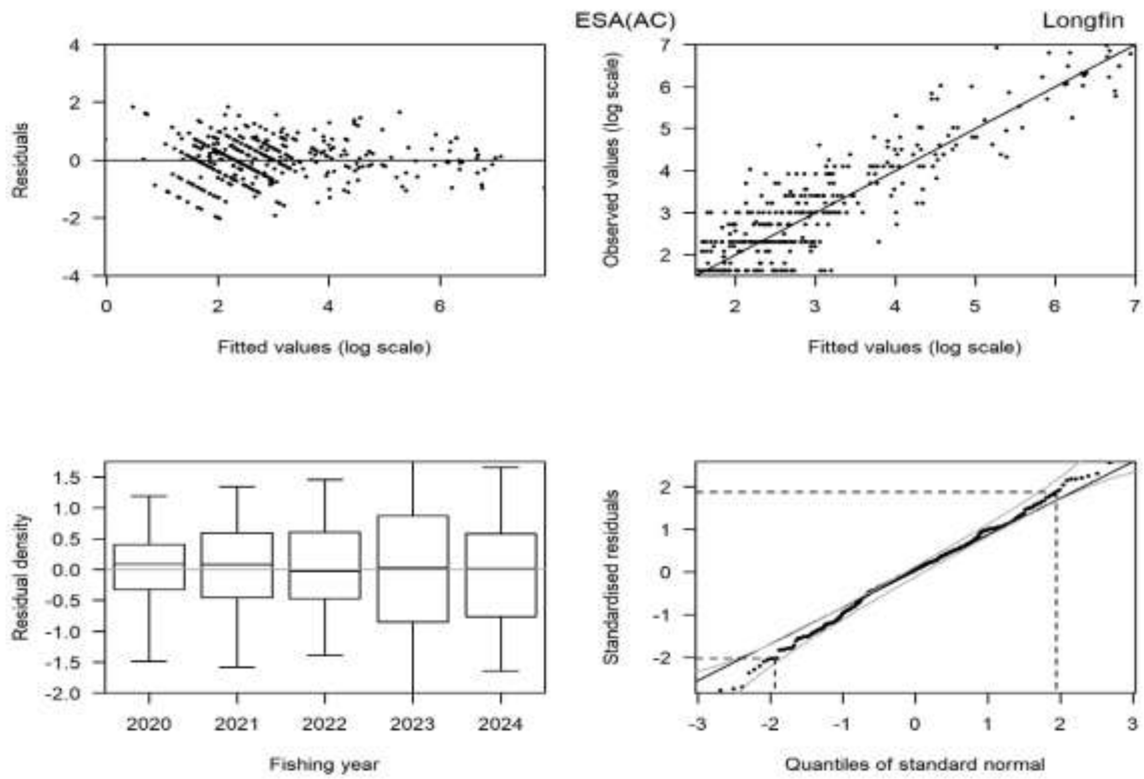

Figure C36: Residual diagnostic plots for the longfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AC).

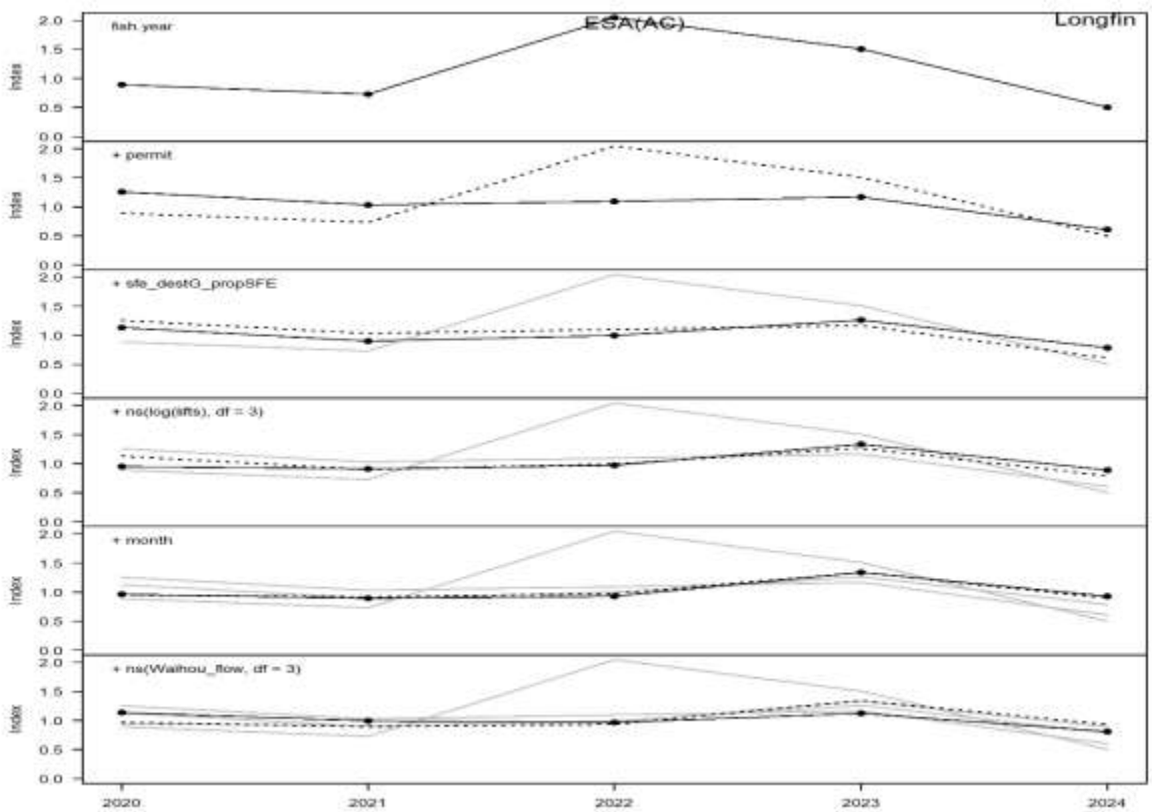

Figure C37: Step plot for the longfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AC).

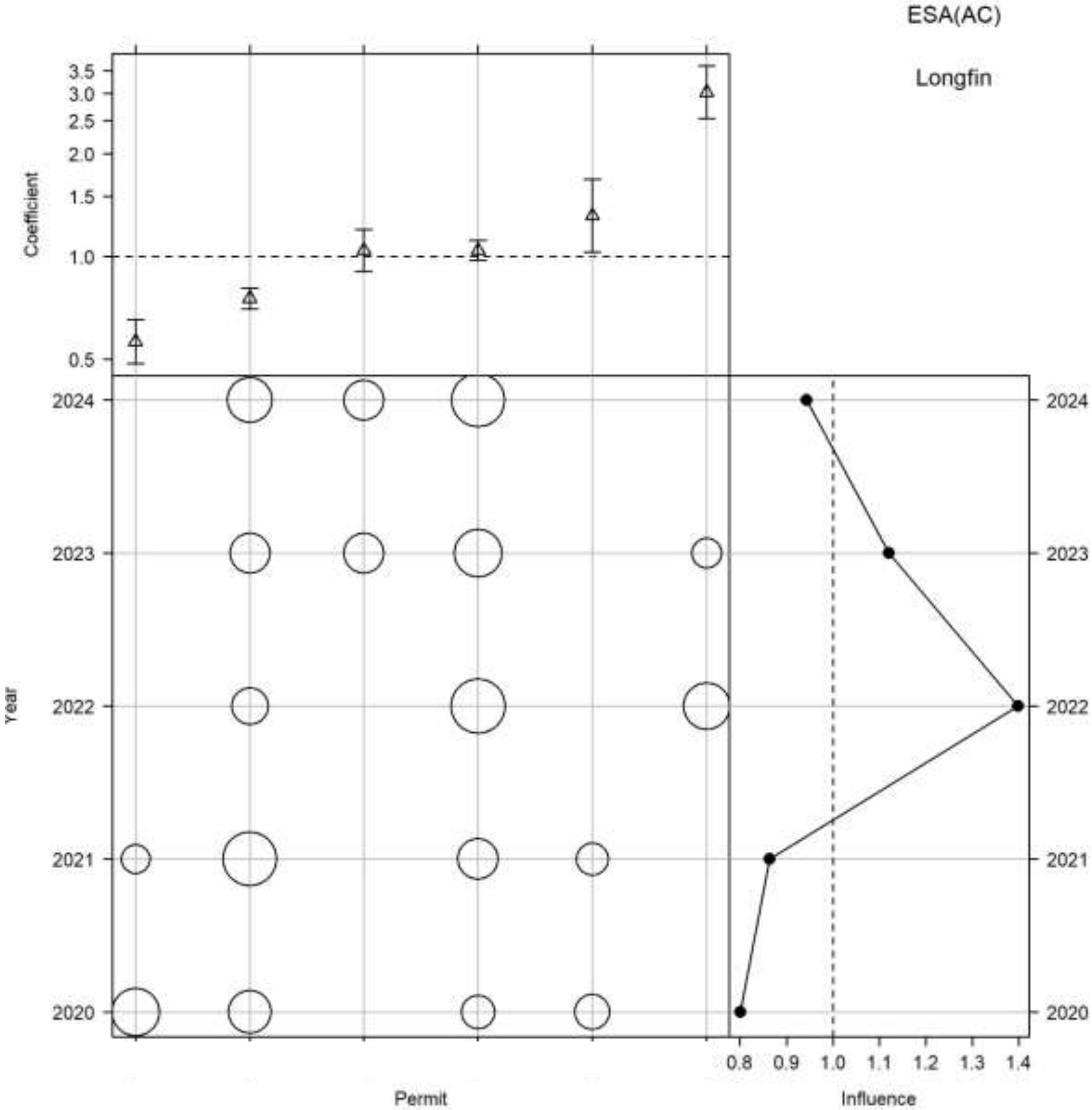

Figure C38: Influence of permit for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AC).

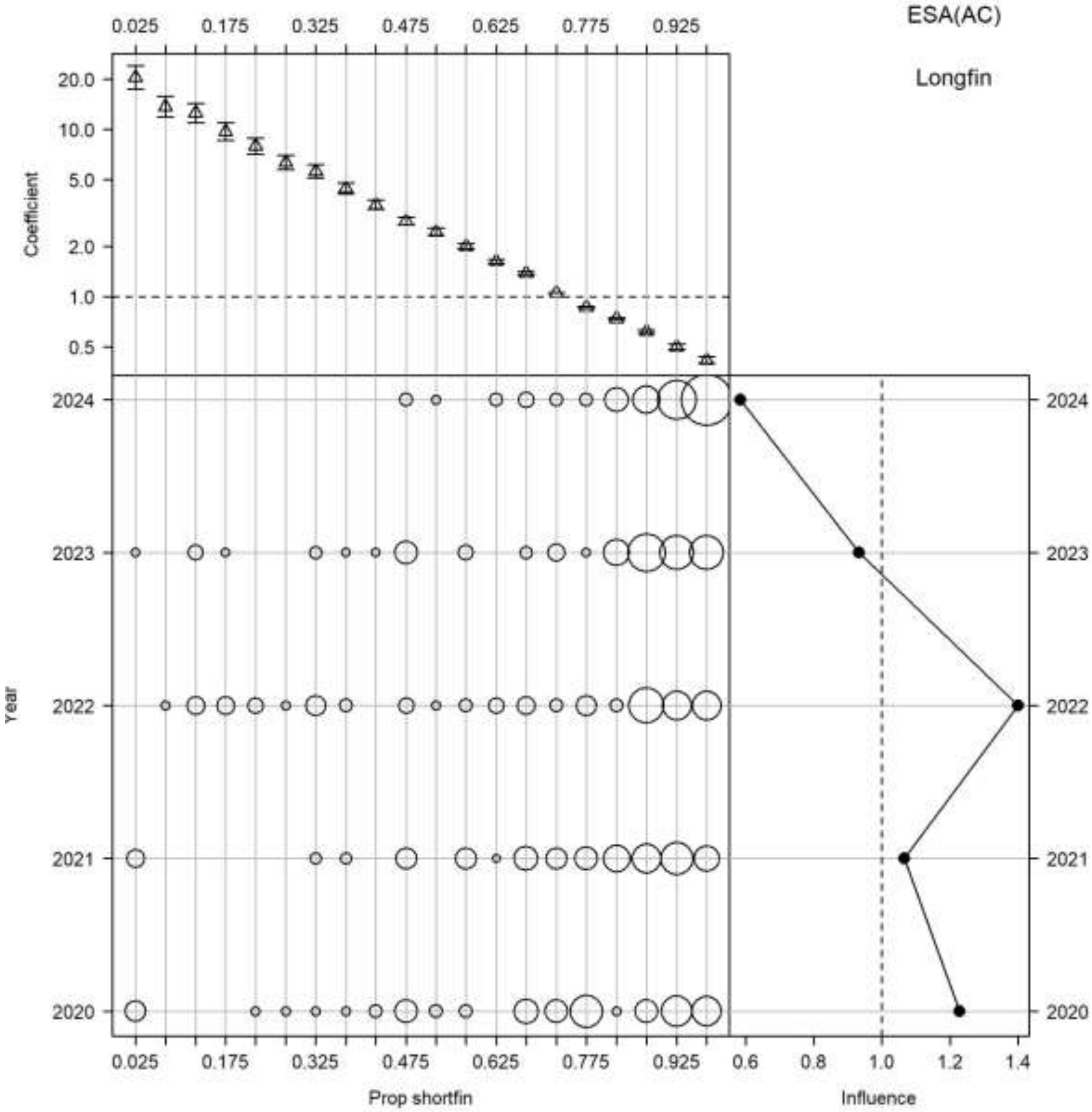

Figure C39: Influence of proportion shortfin for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AC).

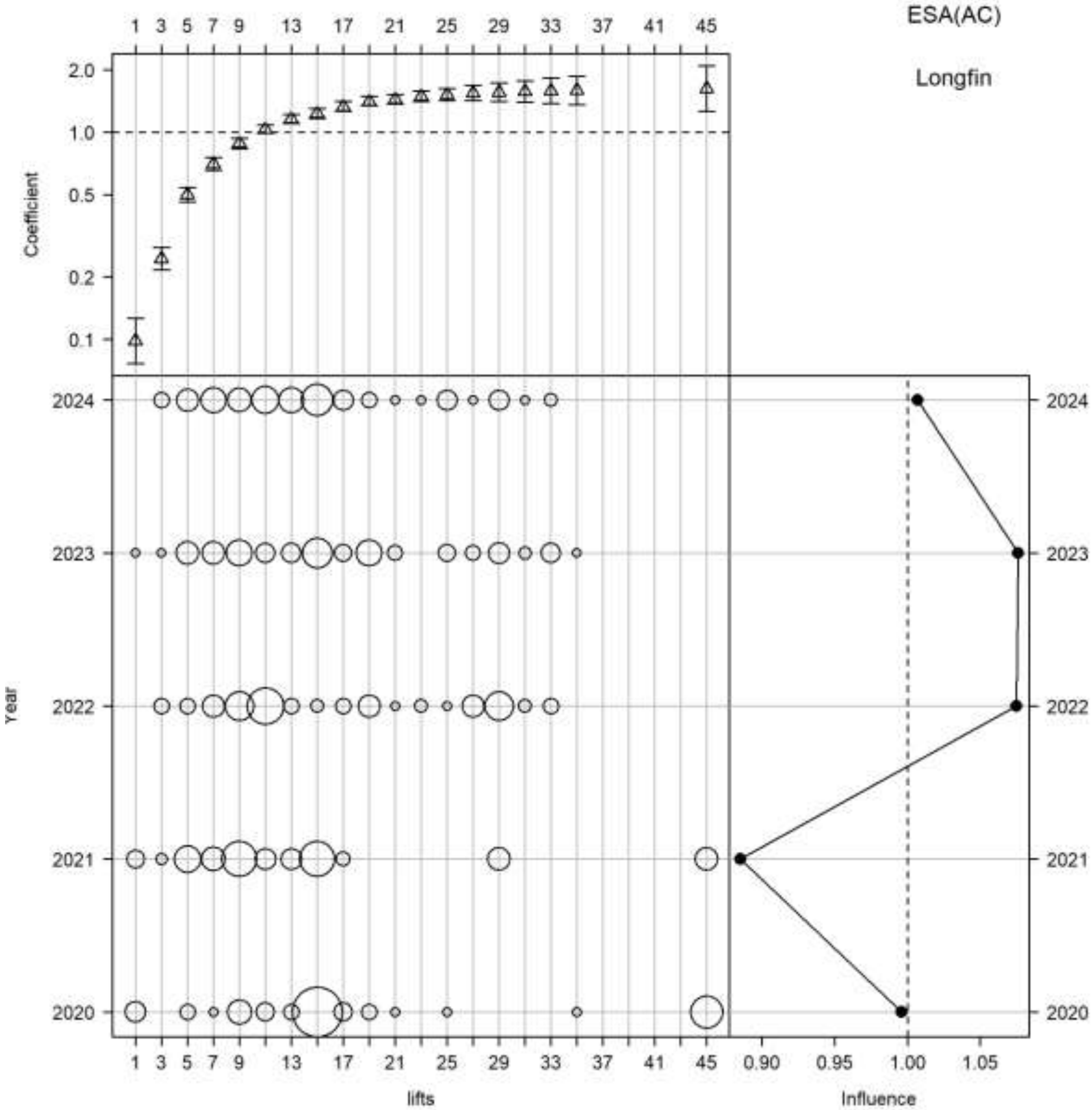

Figure C40: Influence of lifts in the catch for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AC).

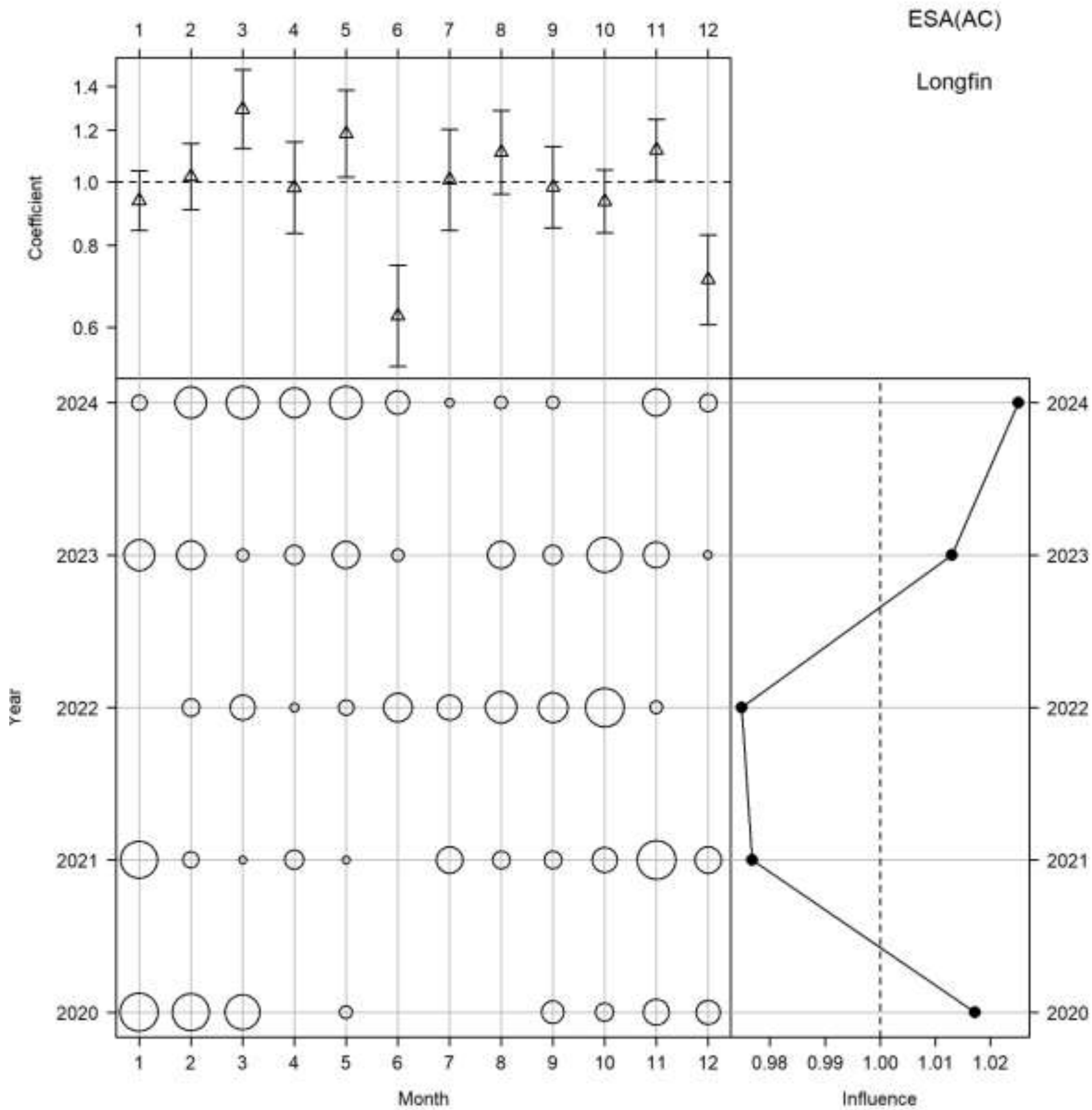

Figure C41: Influence of month for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AC).

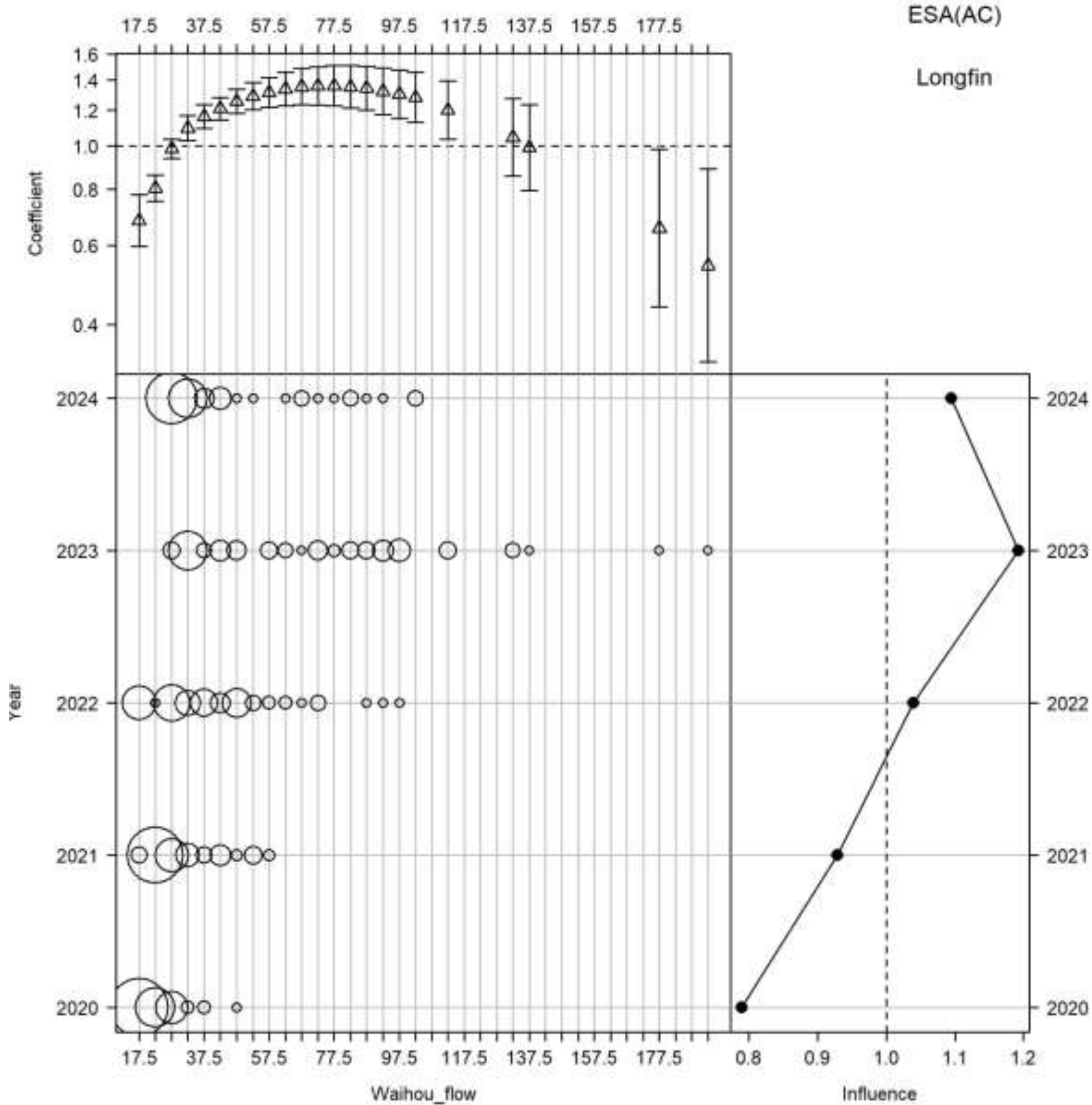

Figure C42: Influence of Waihou River flow for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AC).

ESA AD (Waikato)

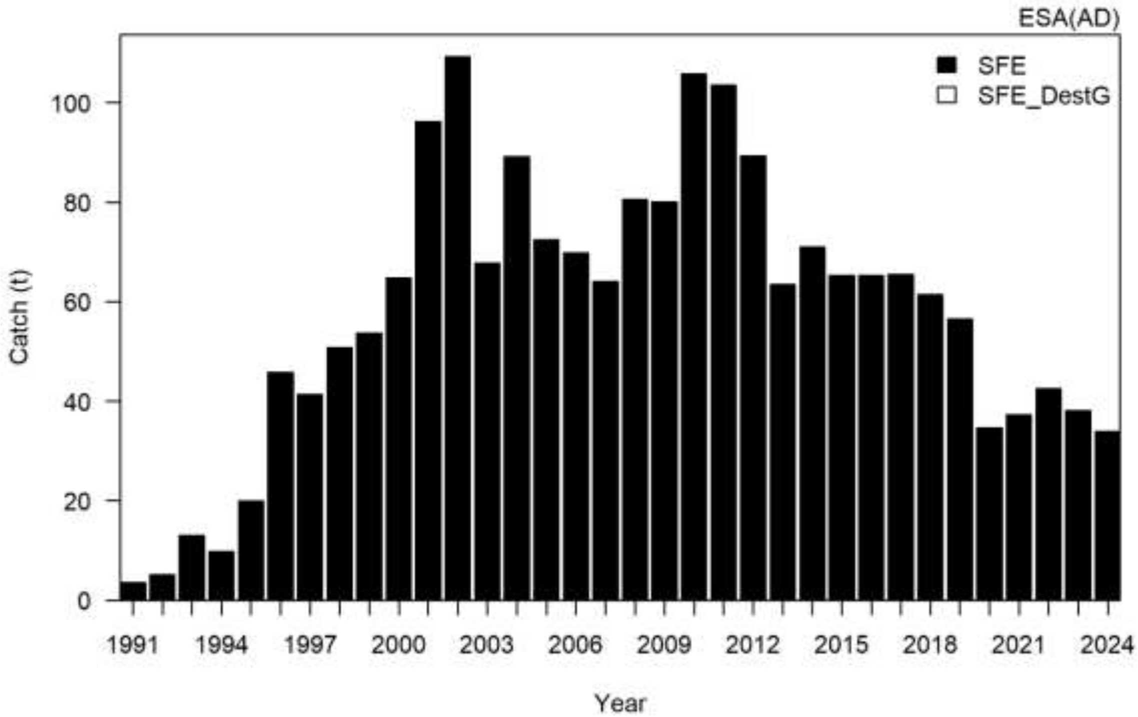

Figure D1: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AD).

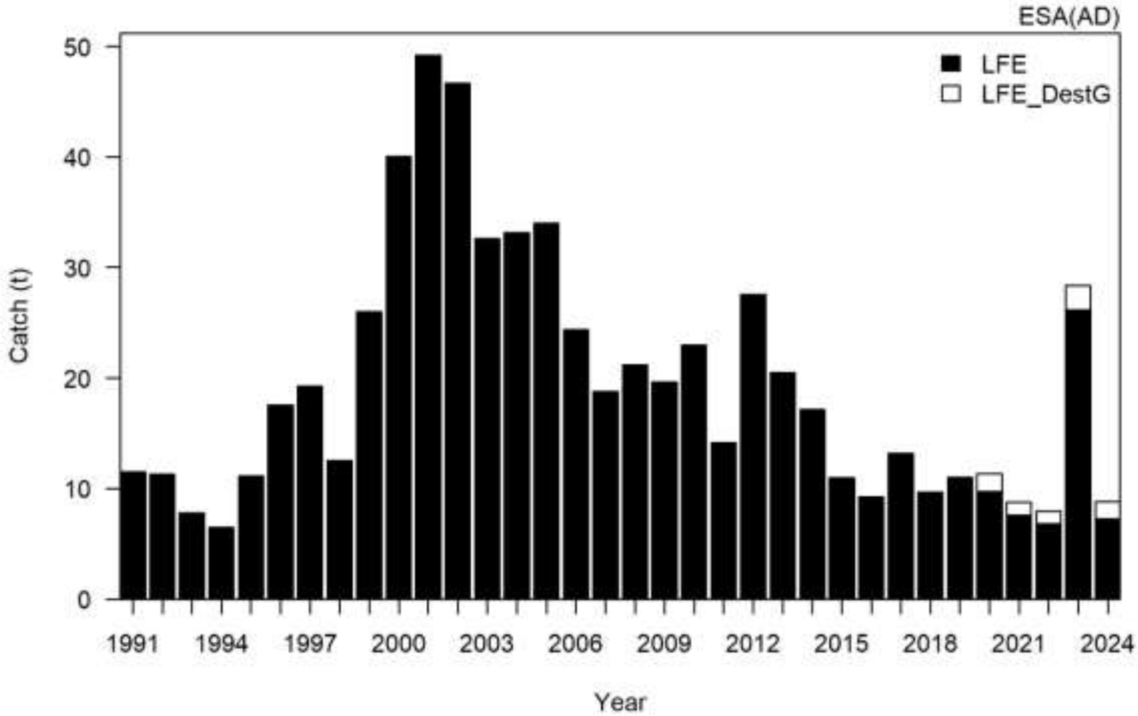

Figure D2: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AD).

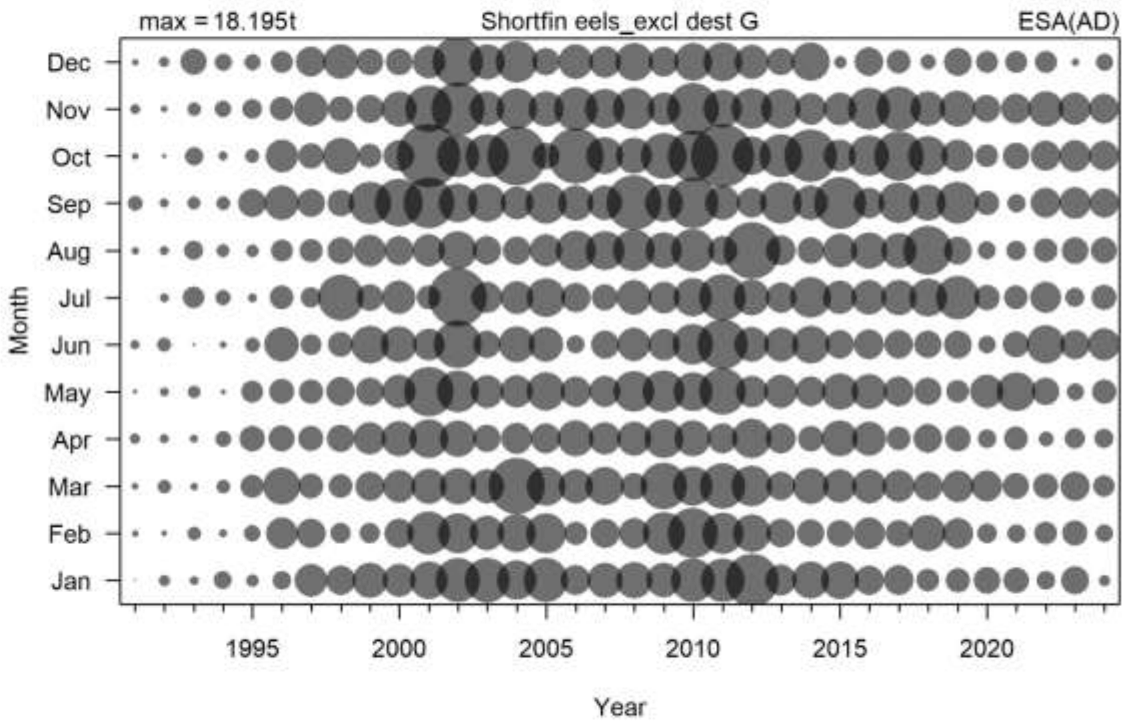

Figure D3: Shortfin legal size eel catch by month for the years 1990–91 to 2023–24 (ESA AD).

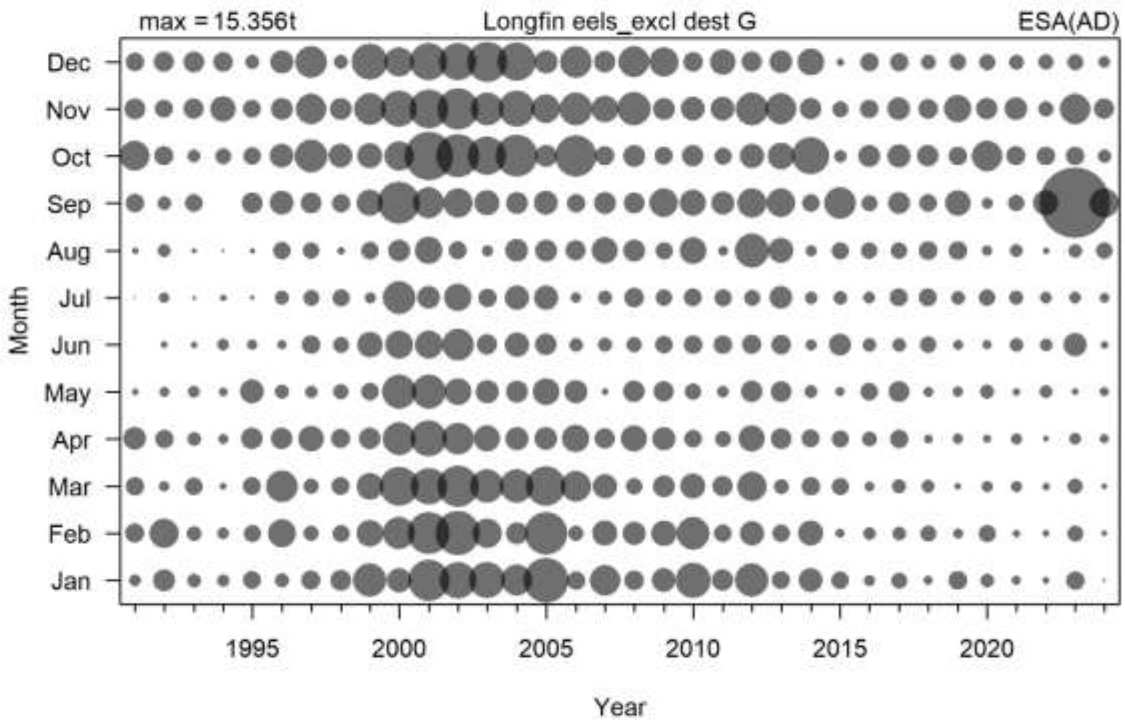

Figure D4: Longfin legal size eel catch by month for the years 1990–91 to 2023–24 (ESA AD).

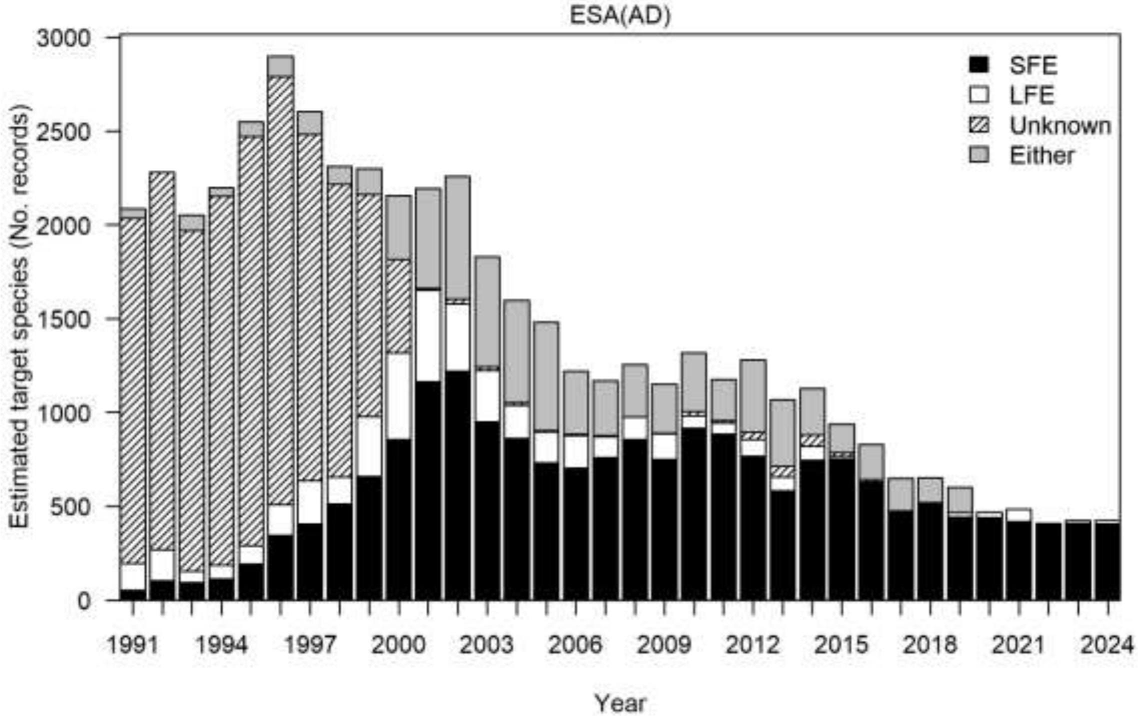

Figure D5: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AD).

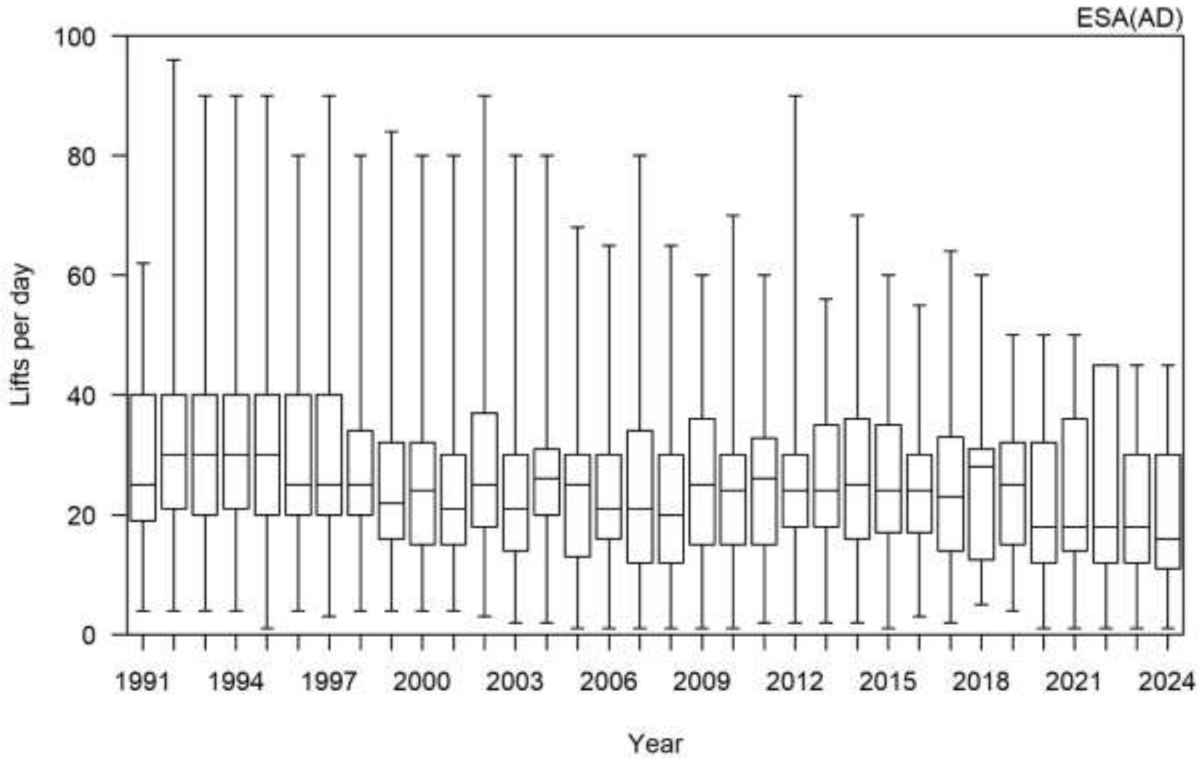

Figure D6: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AD).

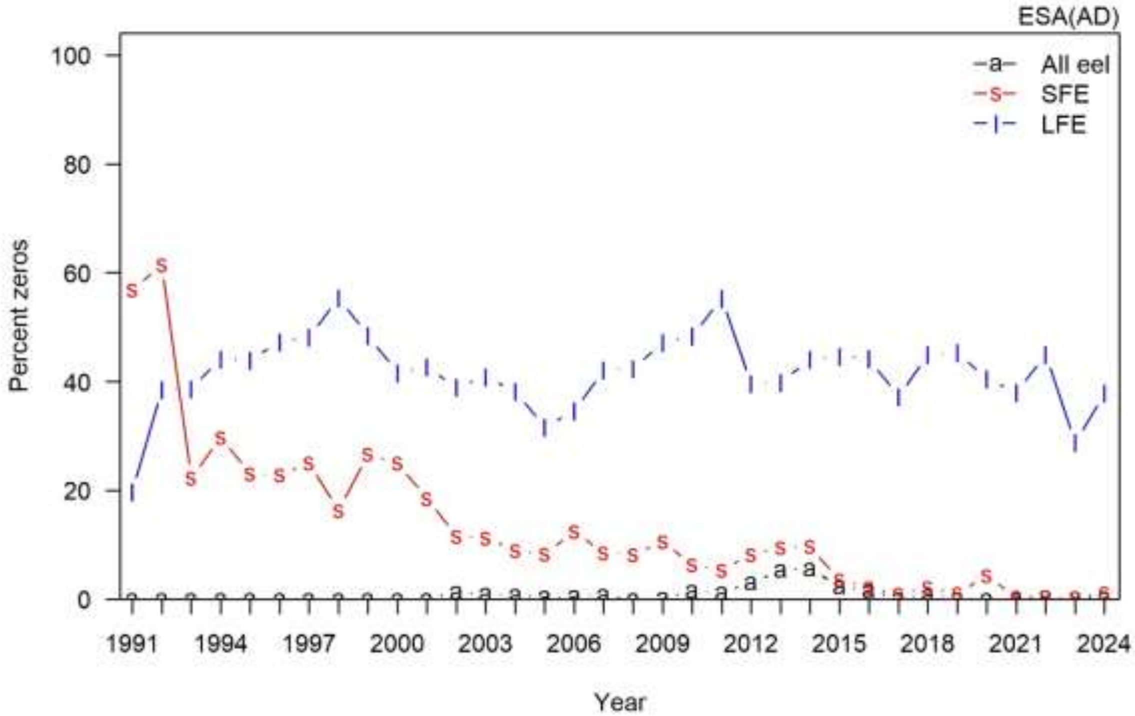

Figure D7: Proportion of valid zero records for legal size all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AD).

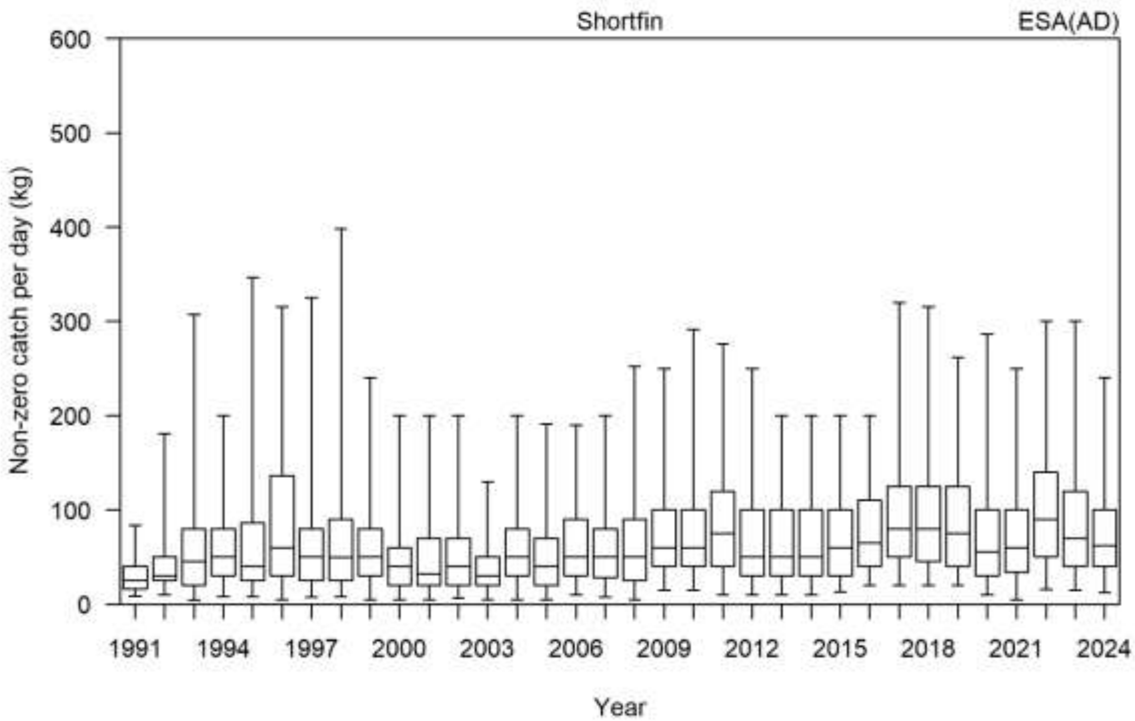

Figure D8: Shortfin non-zero catch per day for legal size eels for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AD).

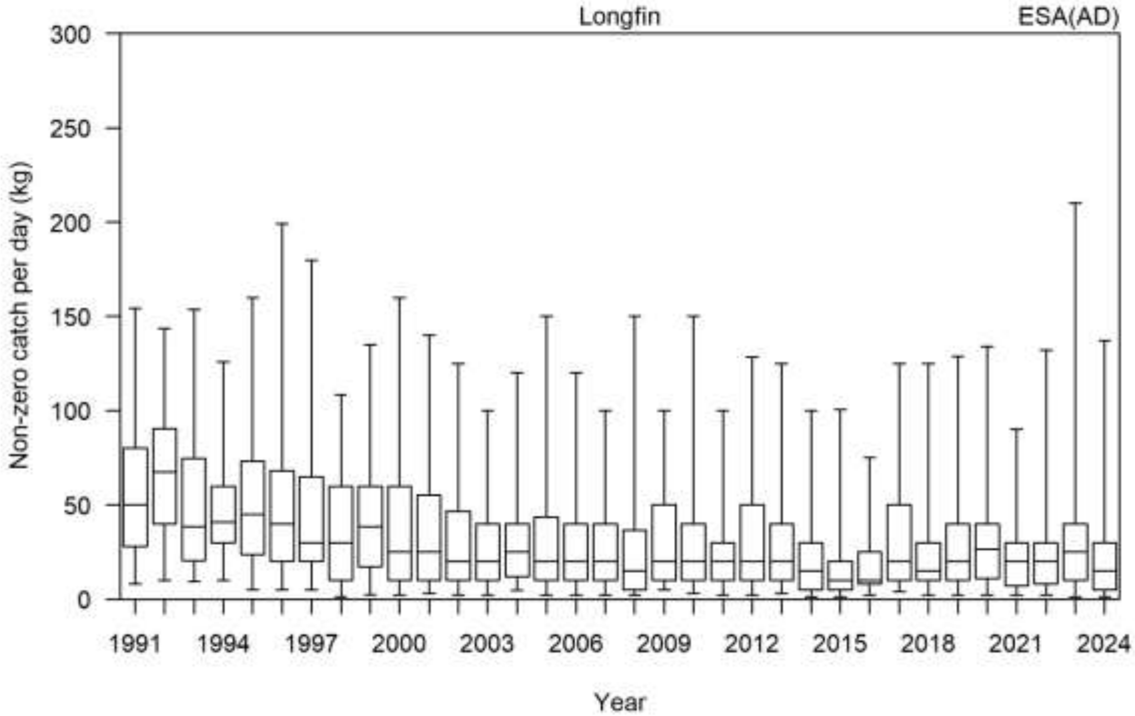

Figure D9: Longfin non-zero catch per day for legal size eels for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AD).

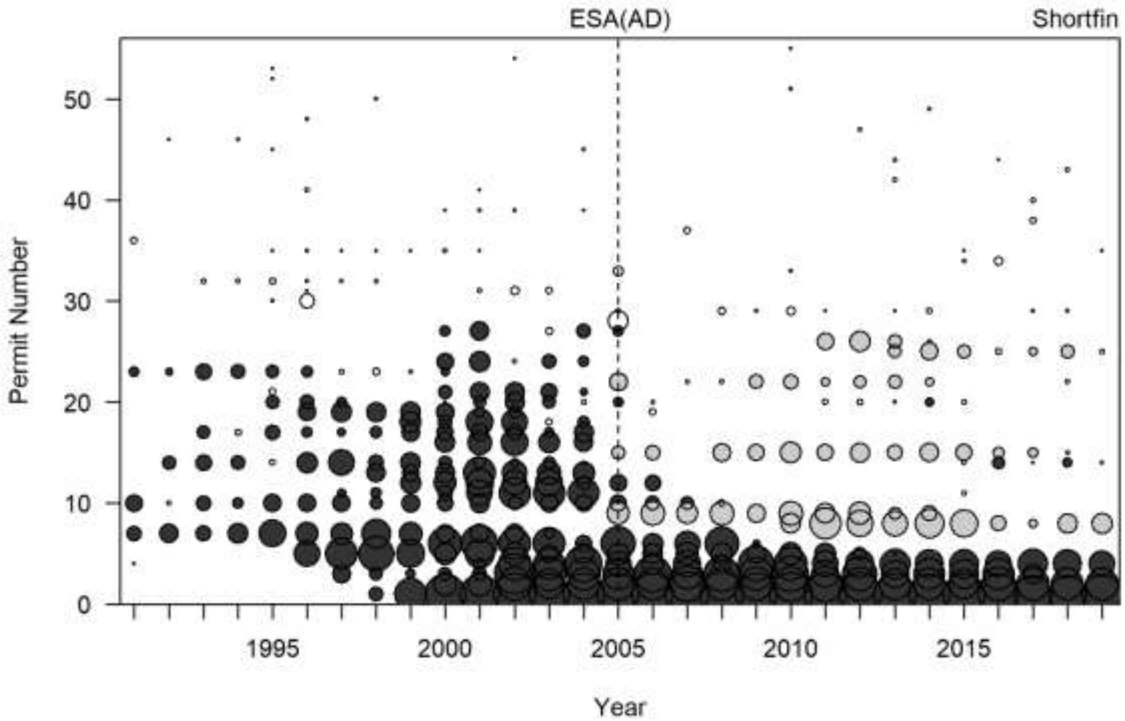

Figure D10: Relative shortfin legal size eel catch, from all fishers (all circles) for the years 1990–91 to 2018–19 (pre-ERS), and for core fishers (dark and grey shaded circles) included in the catch per unit effort analyses. The vertical dotted line indicates introduction into the QMS in 2004–05. The dark shaded circles post-QMS are existing fishers and the grey, new entrants (ESA AD).

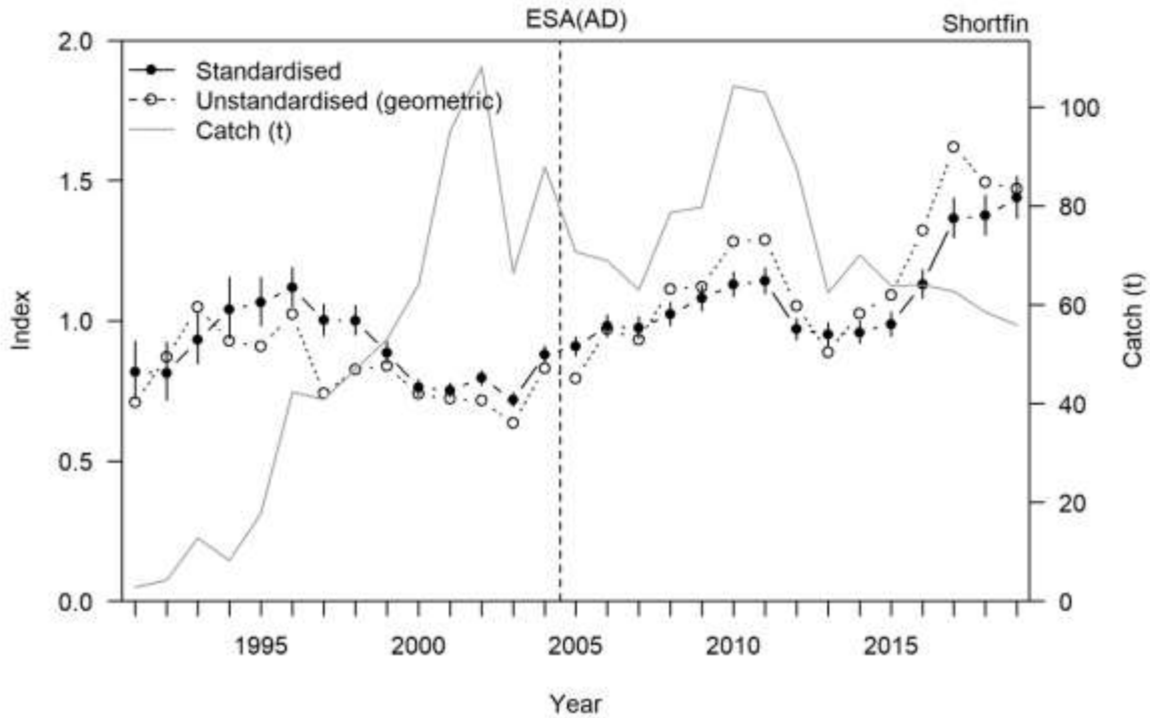

Figure D11: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for shortfin (core fishers) for the years 1990–91 to 2018–19 (pre-ERS). The shortfin catch by core fishers is also plotted. The vertical dotted line indicates introduction into the QMS in 2004–05. Catch includes legal size eels (ESA AD).

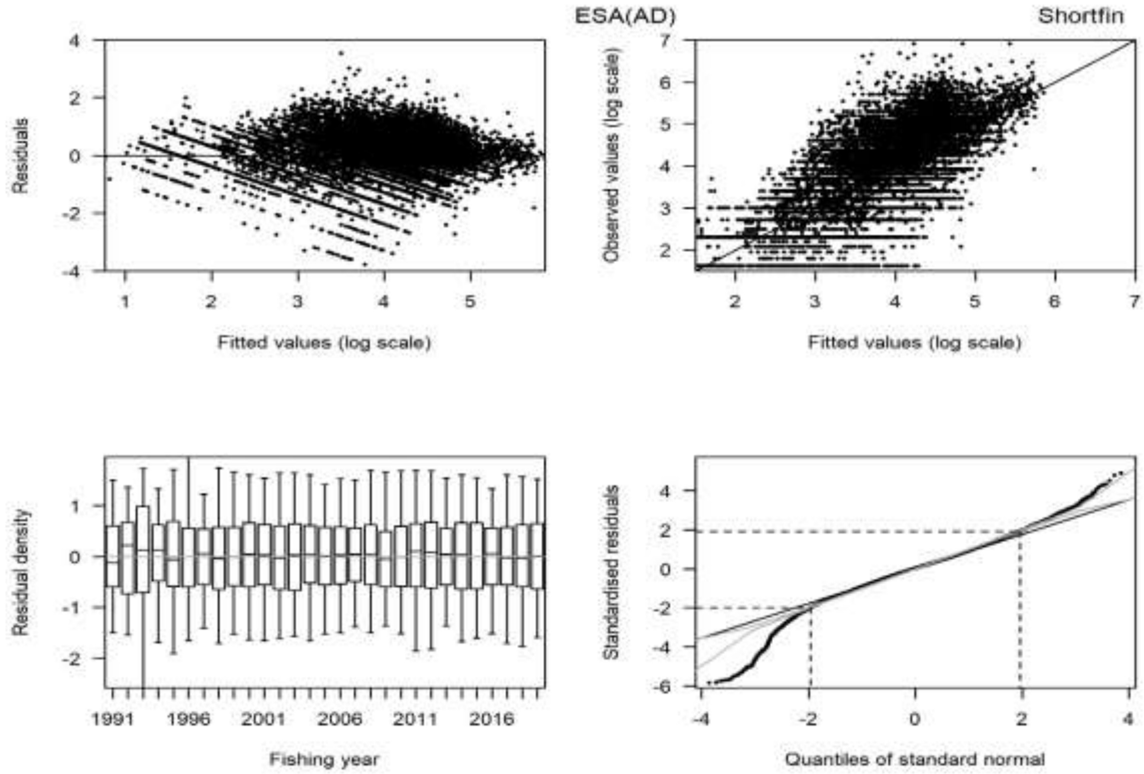

Figure D12: Residual diagnostic plots for the shortfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AD).

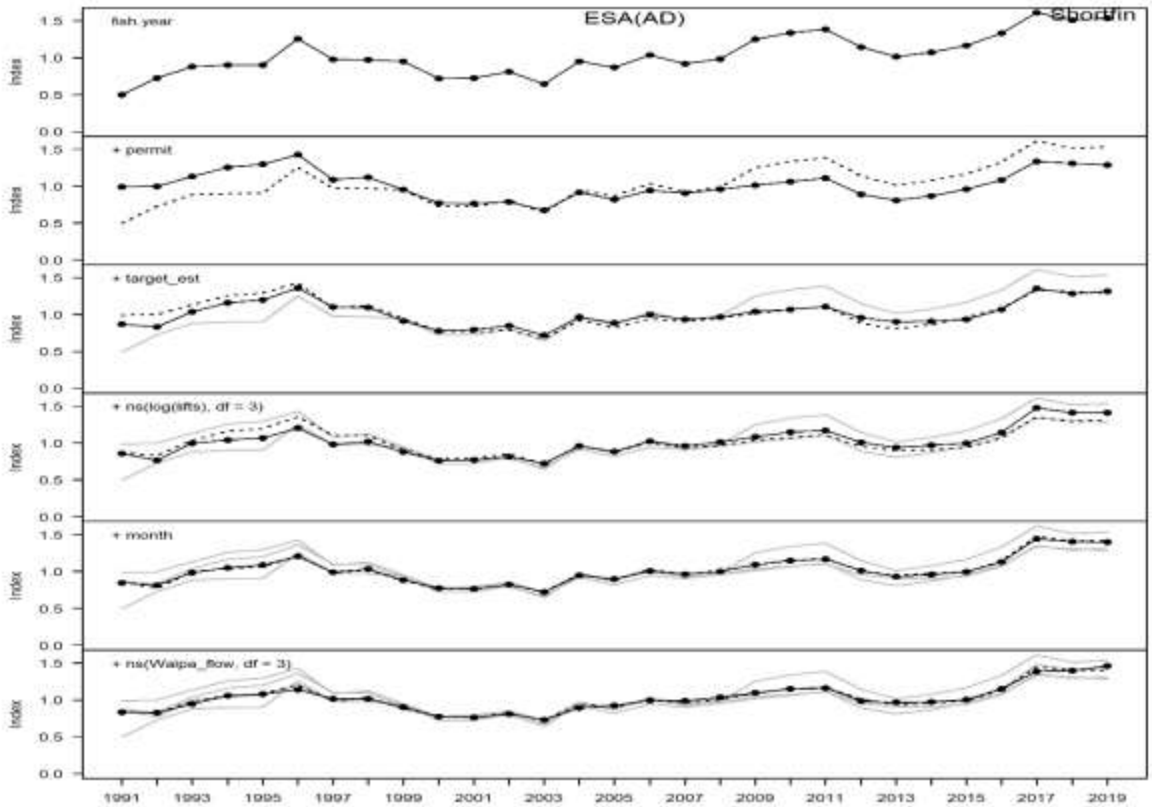

Figure D13: Step plot for the shortfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AD).

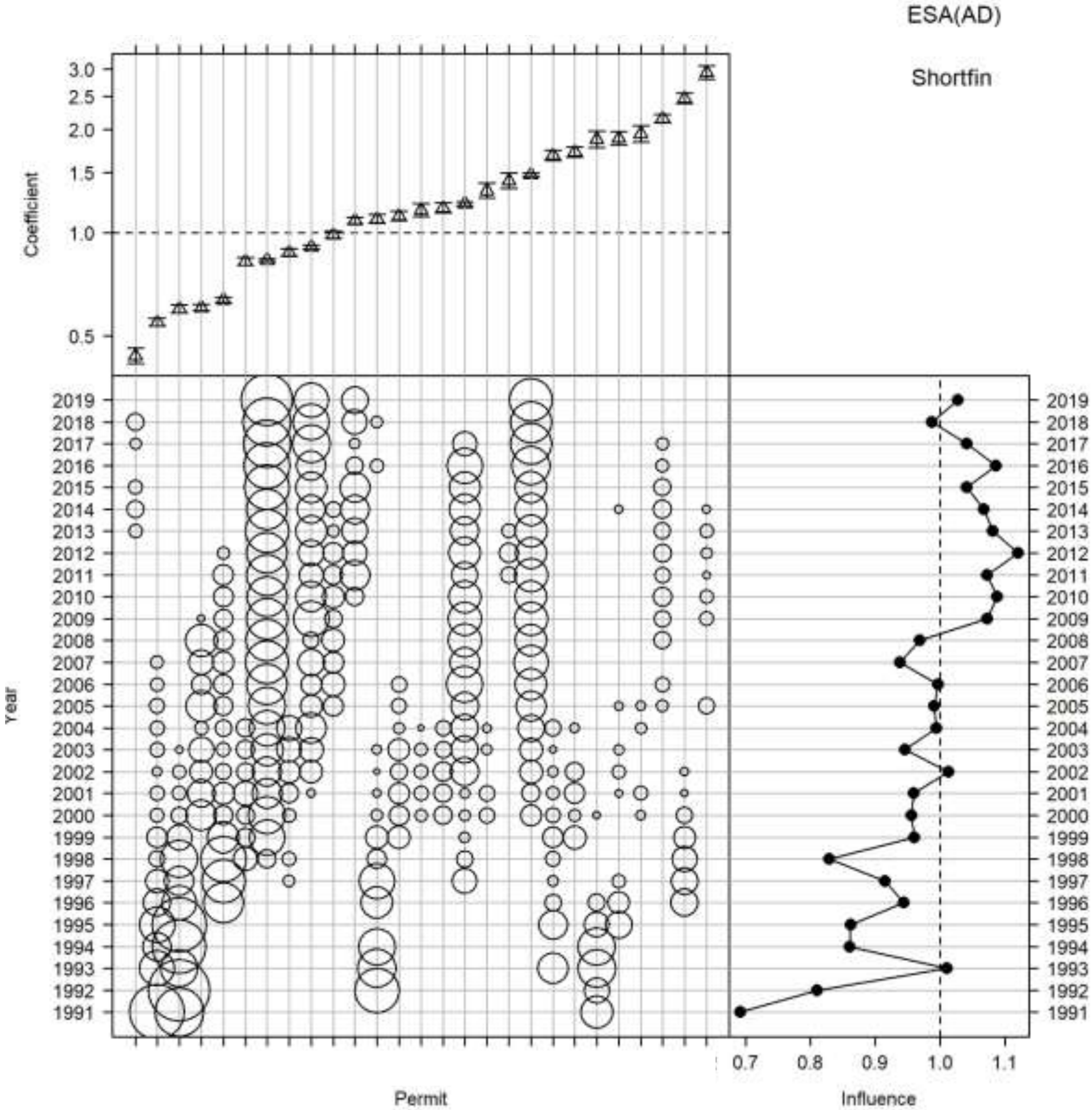

Figure D14: Influence of permit for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AD).

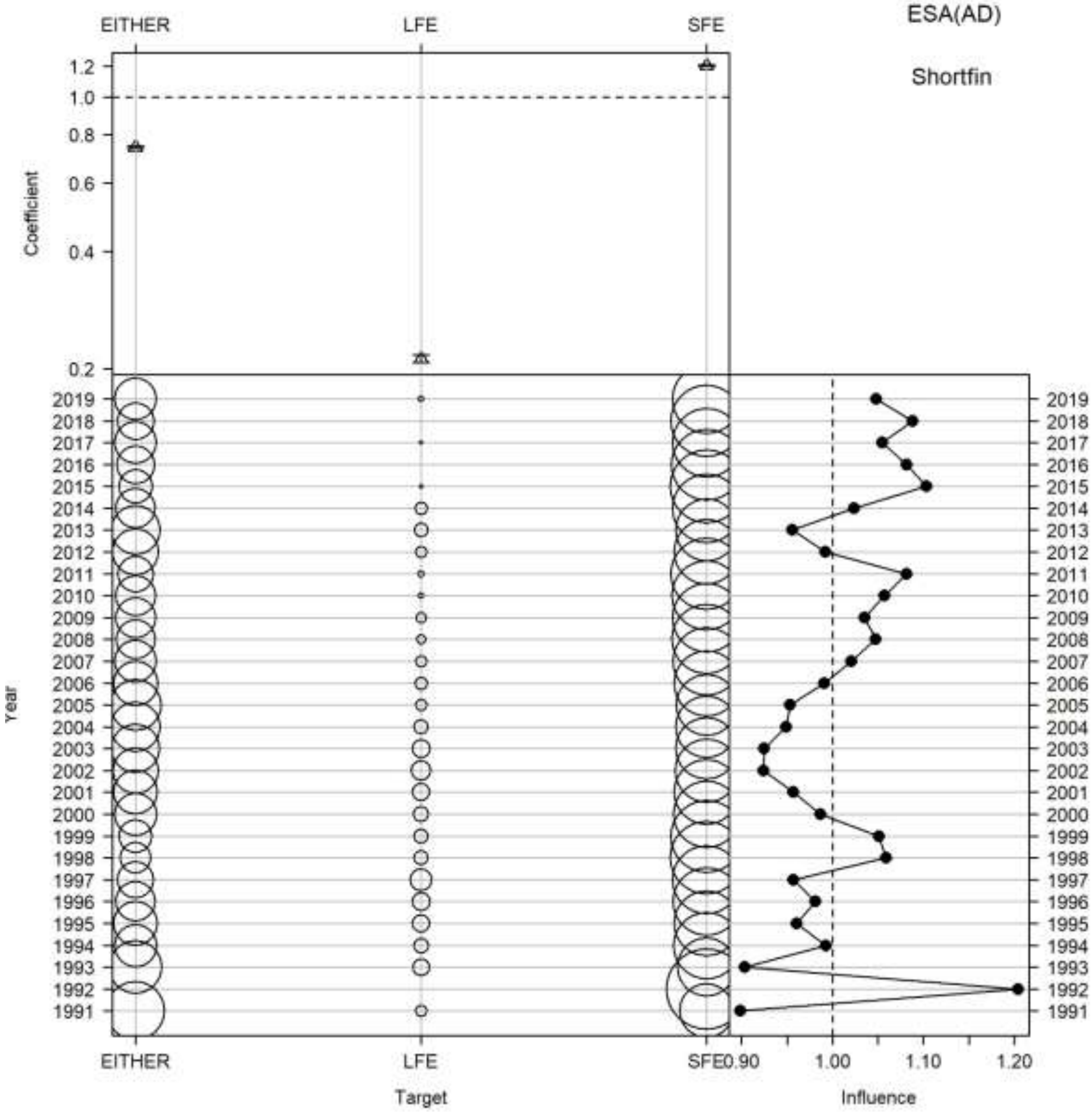

Figure D15: Influence of reconstructed target for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AD).

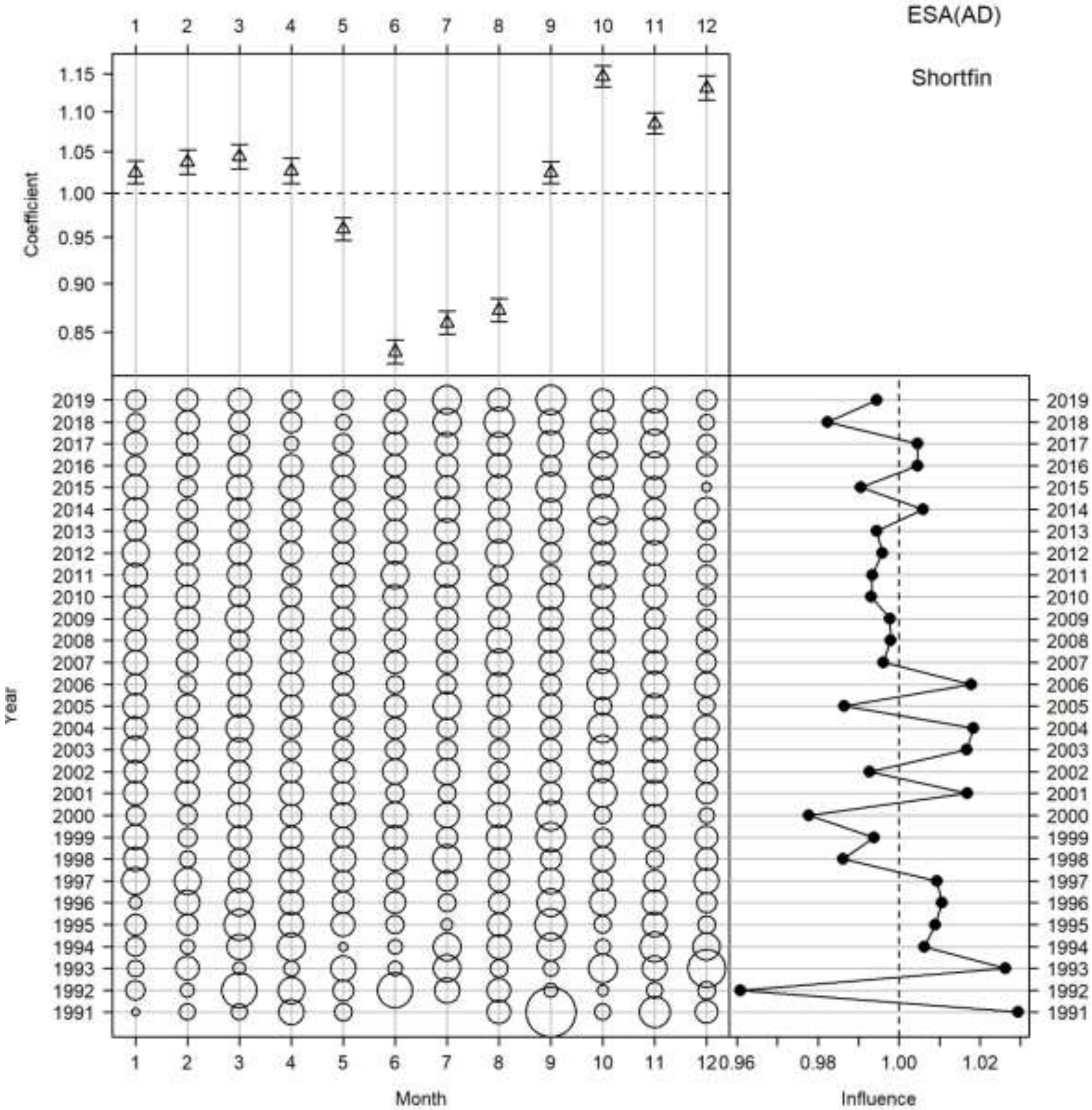

Figure D16: Influence of month for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AD).

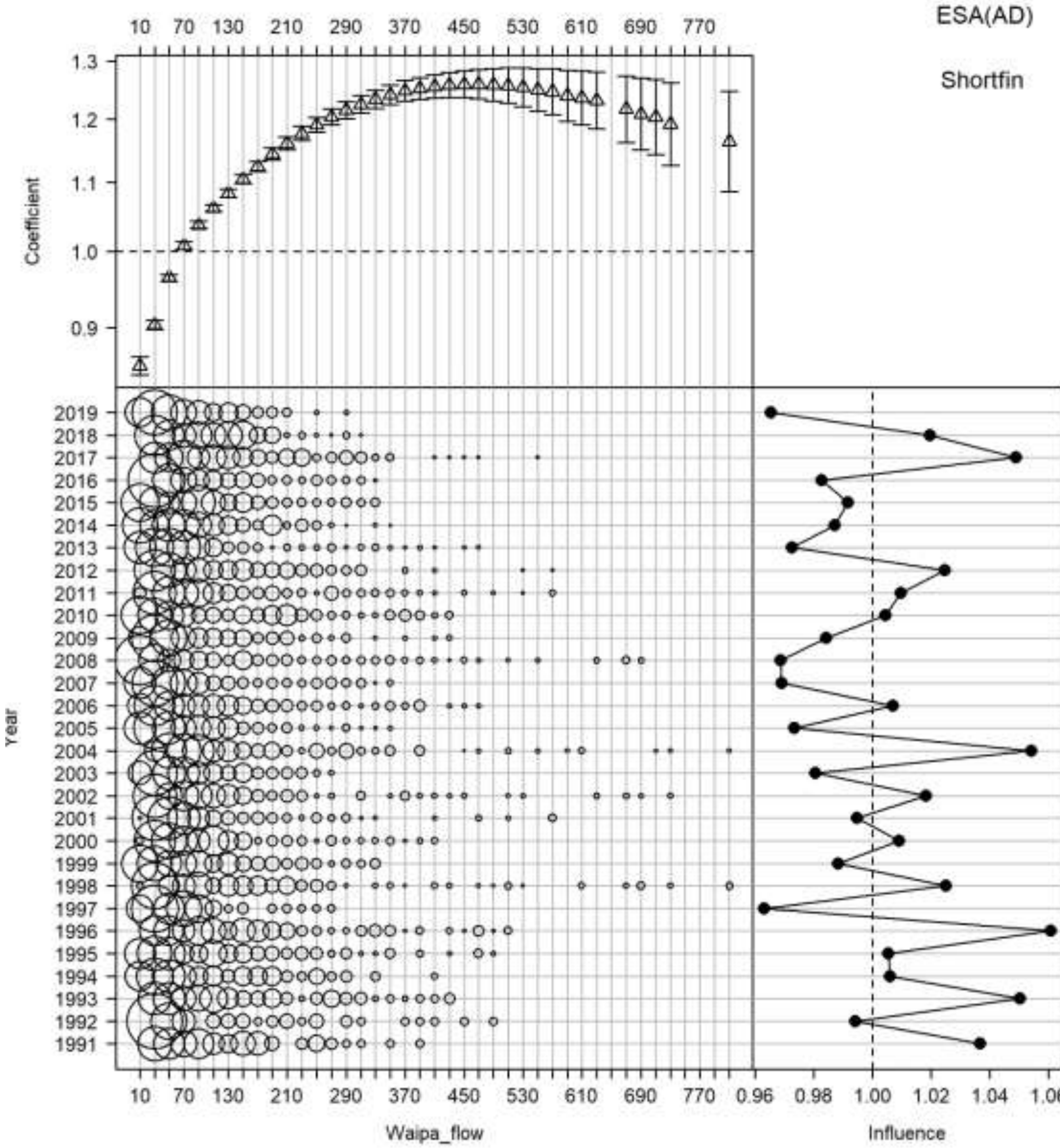

Figure D17: Influence of Waipa River flow for the shortfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AD).

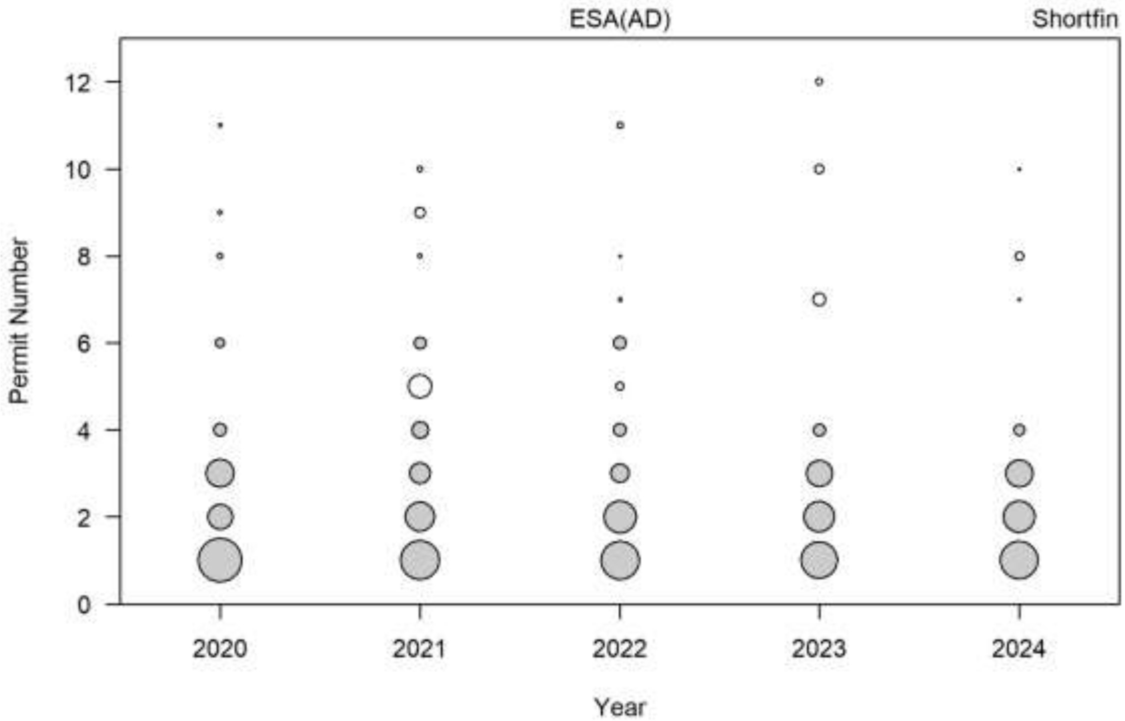

Figure D18: Relative shortfin legal size eel catch and destination G, from all fishers (all circles) for the years 2019–20 to 2023–24 (post-ERS), and for core fishers (grey shaded circles) included in the catch per unit effort analyses (ESA AD).

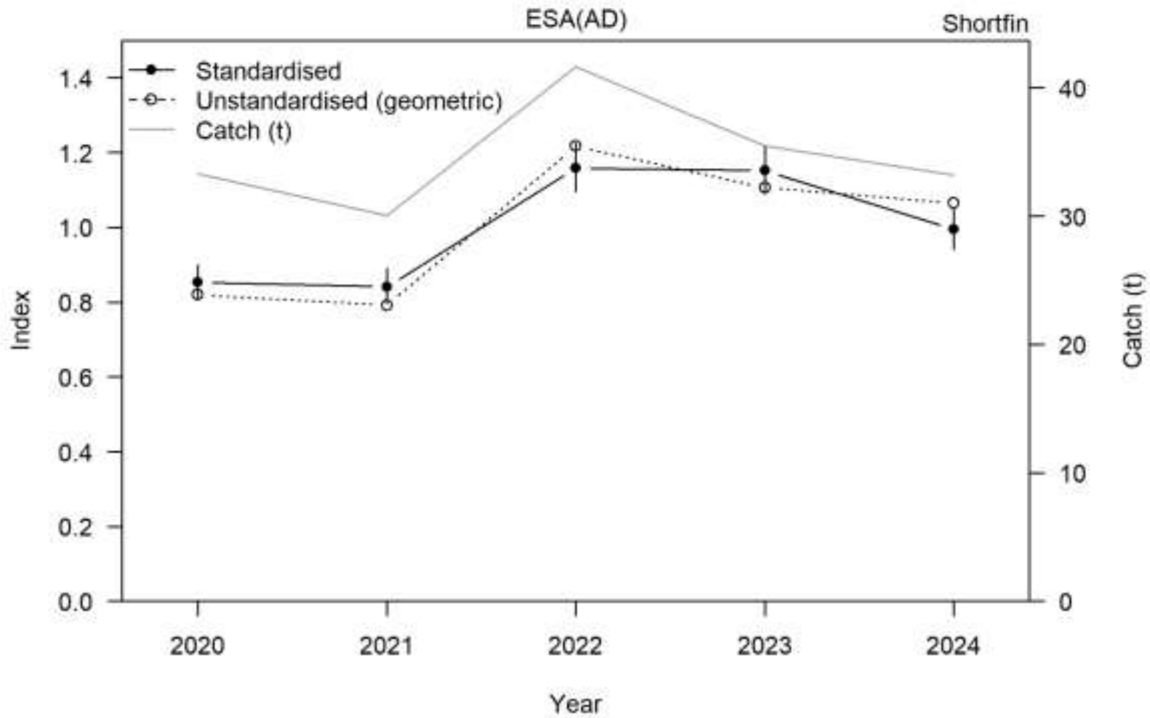

Figure D19: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for shortfin (core fishers) for the years 2019–20 to 2023–24 (post-ERS). The shortfin catch by core fishers is also plotted. Catch includes legal size eels and destination G (ESA AD).

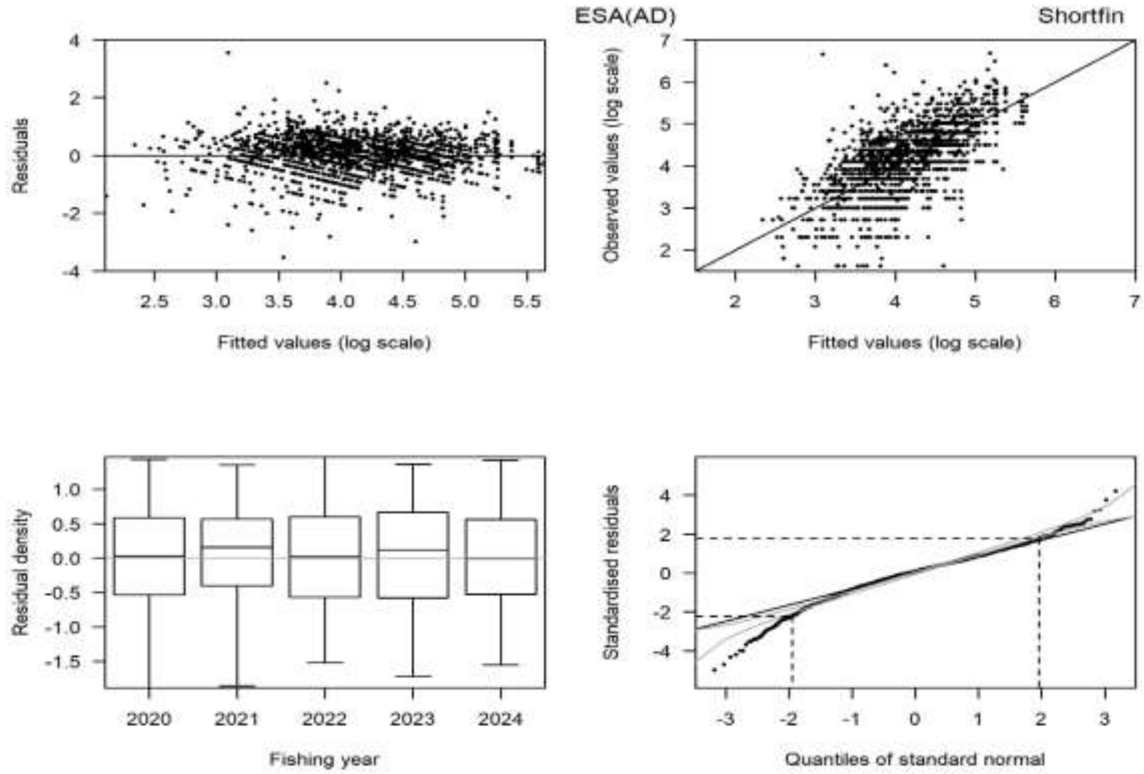

Figure D20: Residual diagnostic plots for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AD).

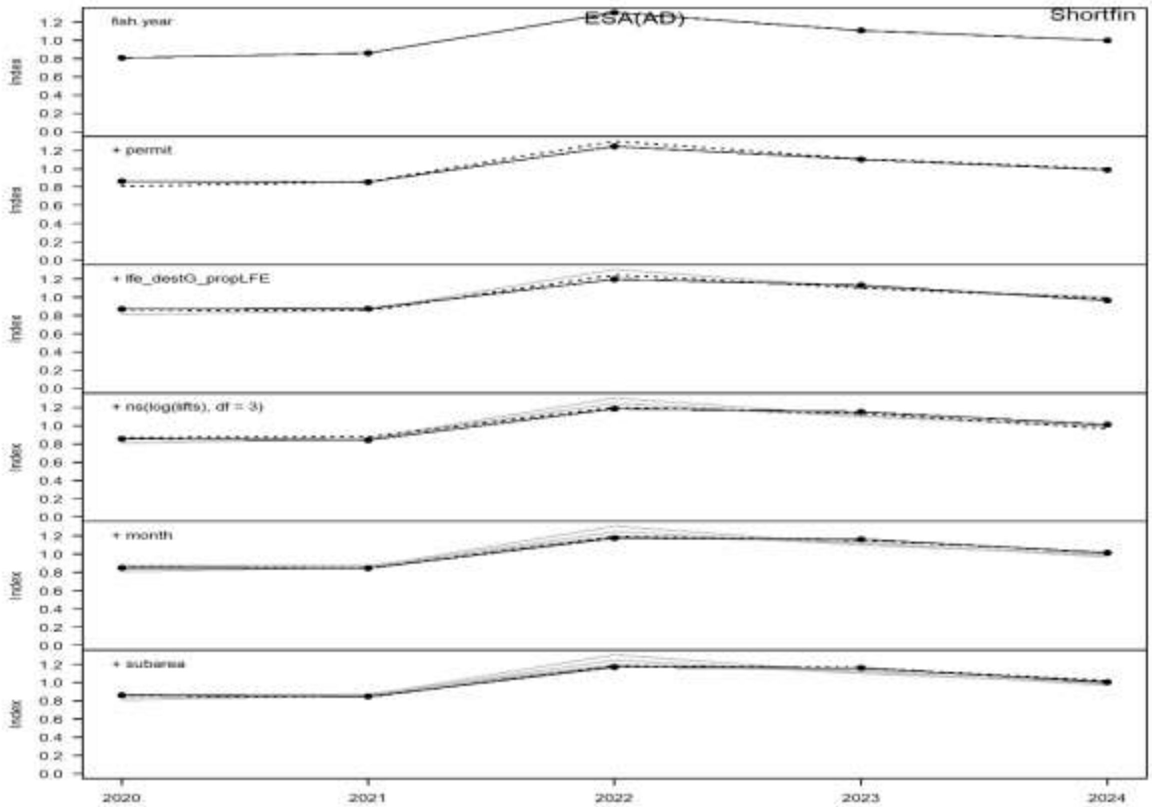

Figure D21: Step plot for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AD).

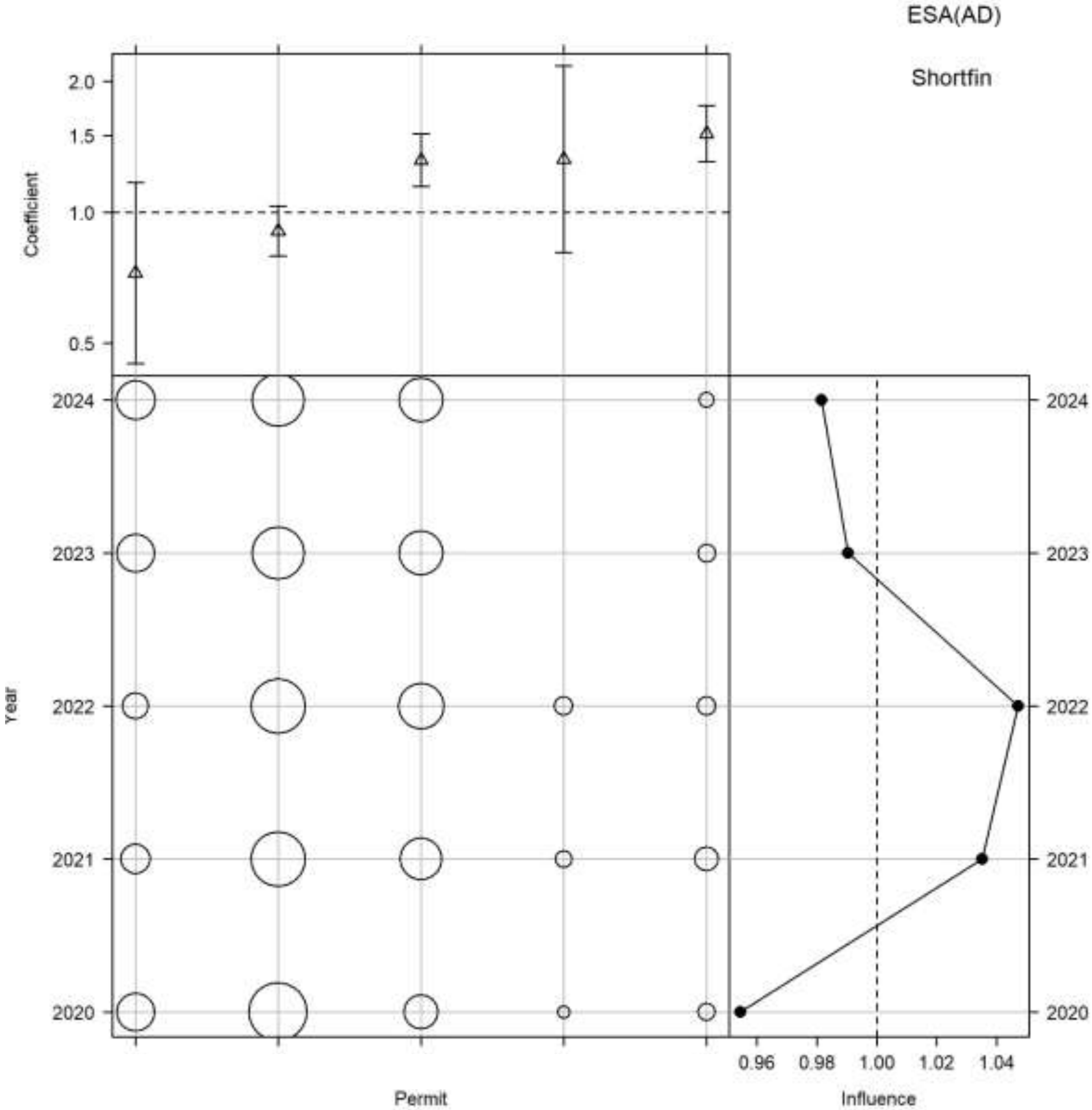

Figure D22: Influence of permit for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AD).

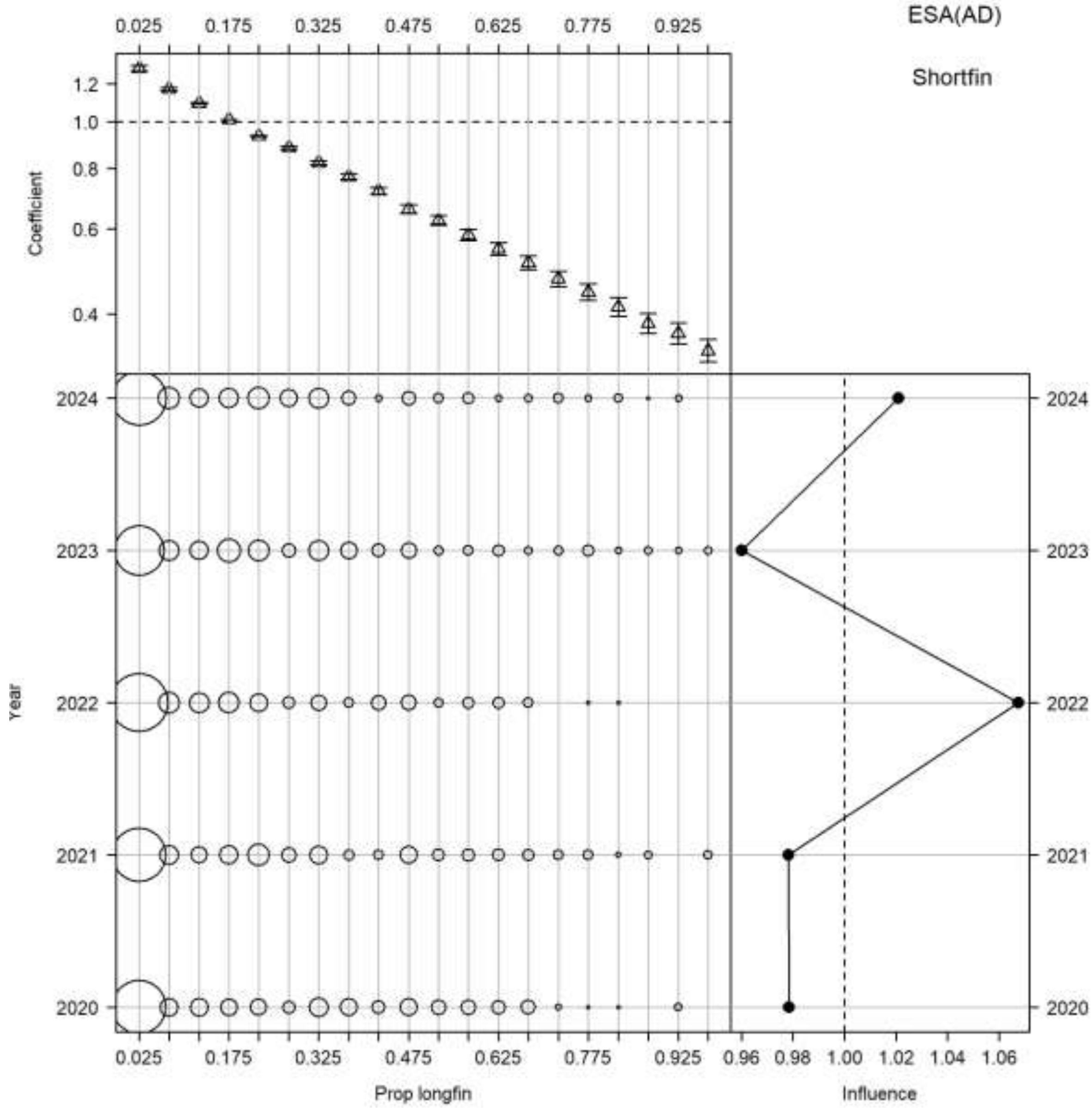

Figure D23: Influence of proportion longfin in the catch for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AD).

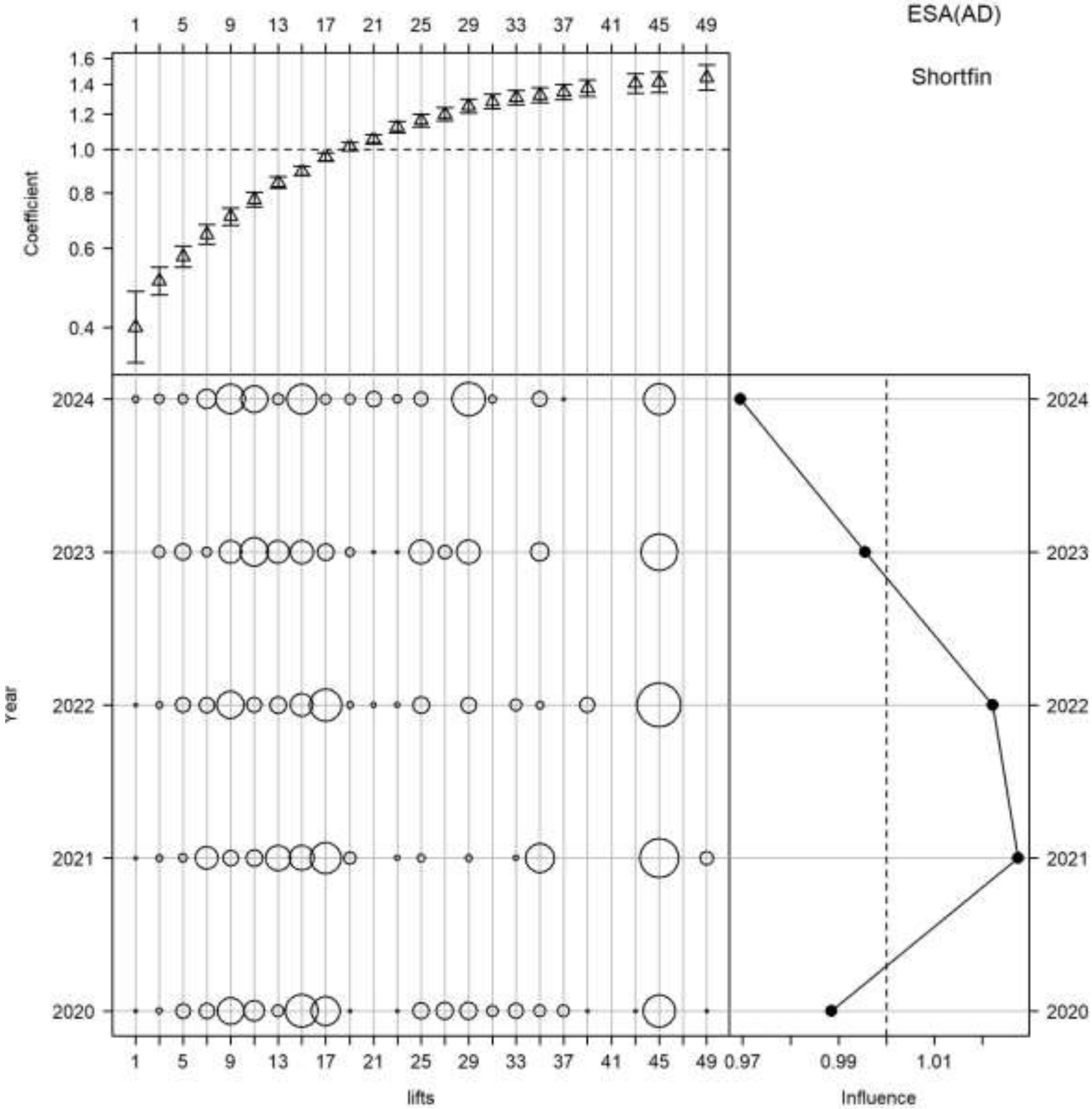

Figure D24: Influence of lifts for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AD).

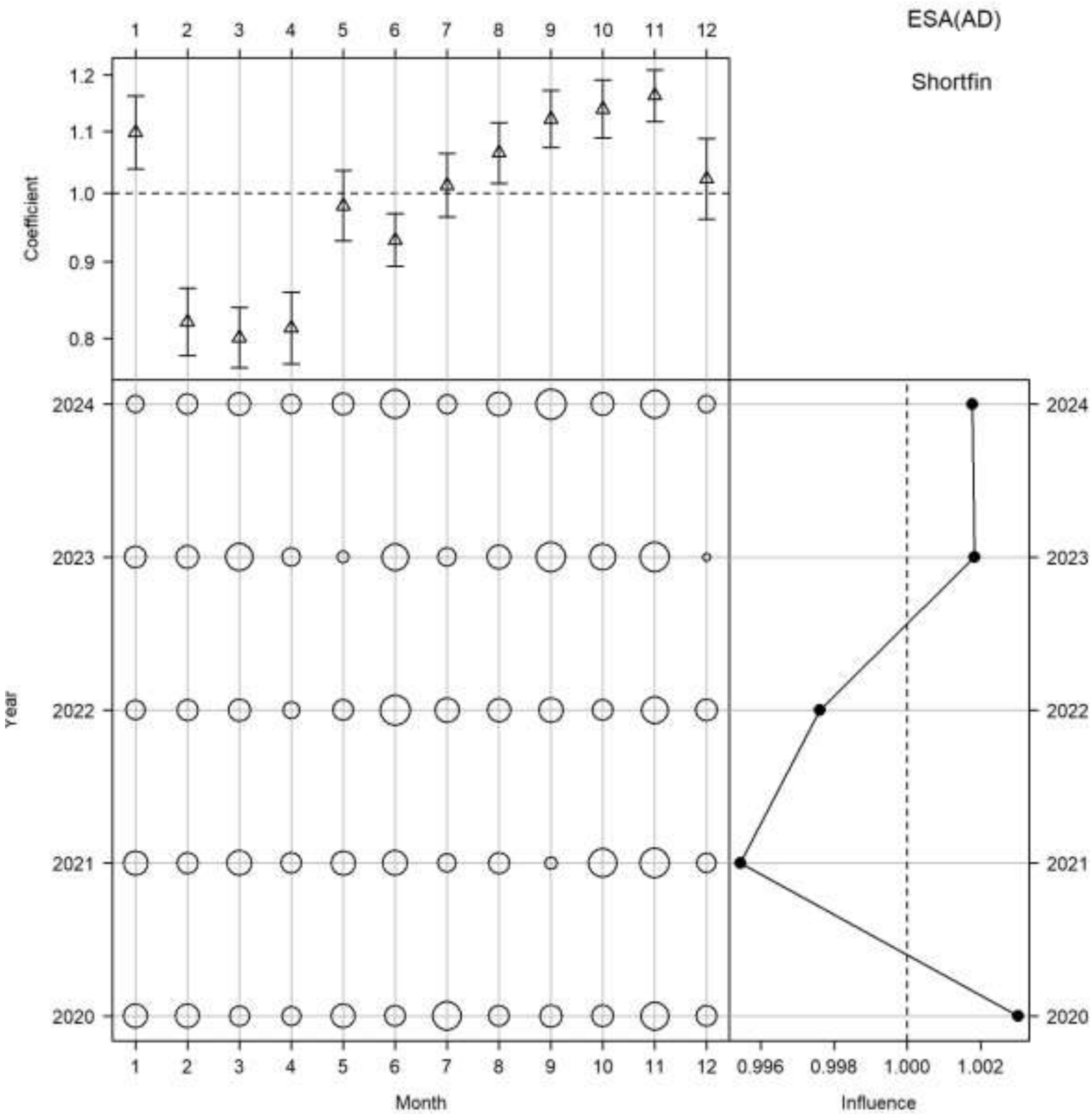

Figure D25: Influence of month for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AD).

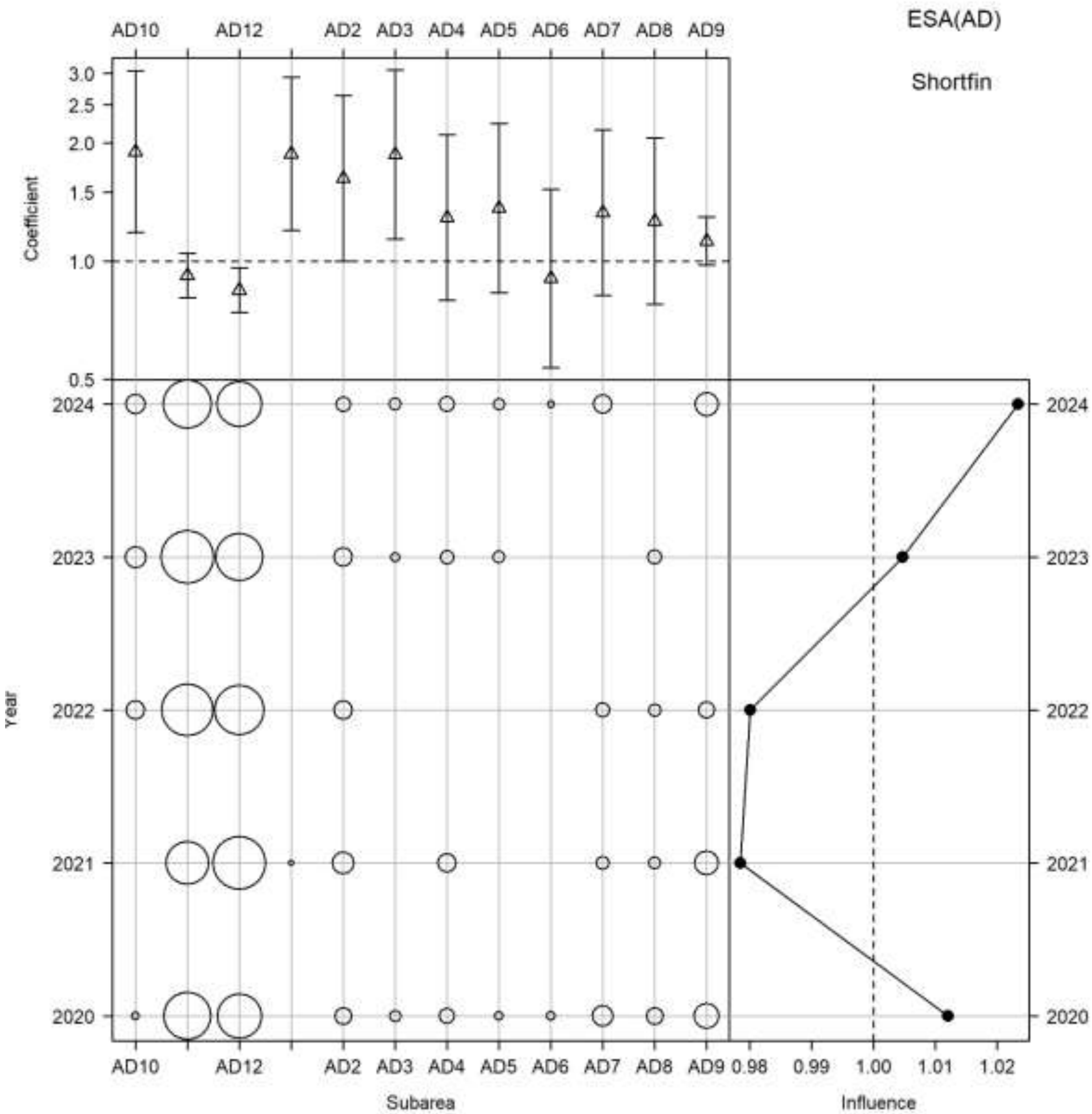

Figure D26: Influence of subarea for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AD).

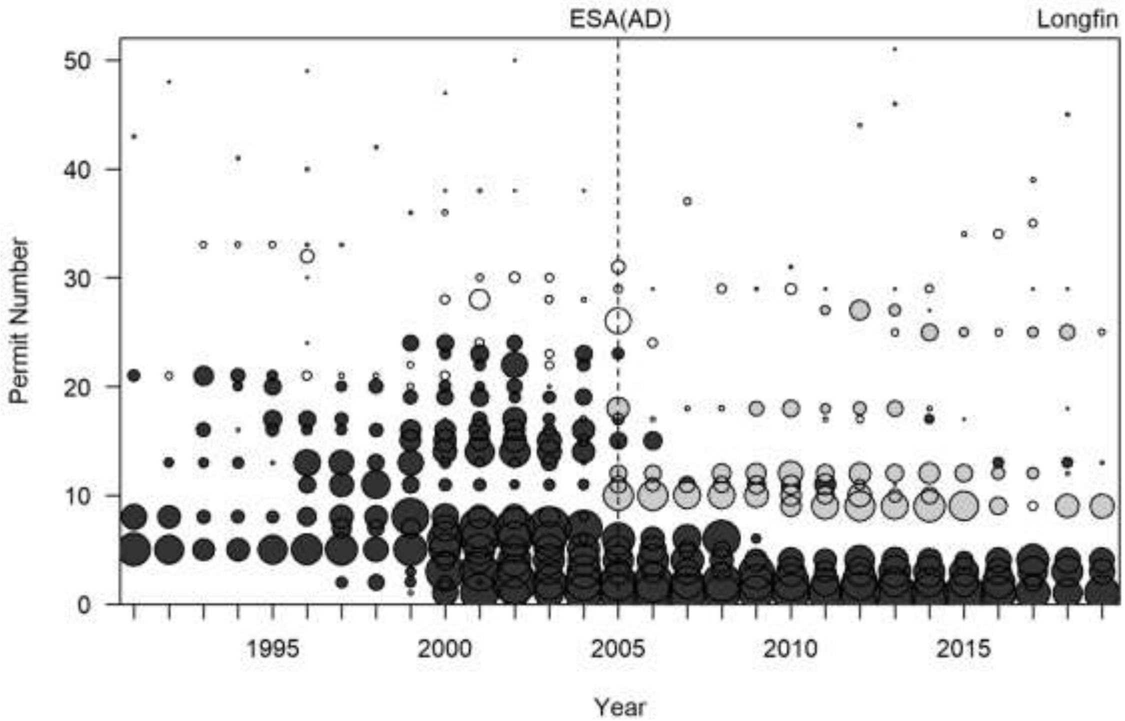

Figure D27: Relative longfin legal size eel catch, from all fishers (all circles) for the years 1990–91 to 2018–19 (pre-ERS), and for core fishers (dark and grey shaded circles) included in the catch per unit effort analyses. The vertical dotted line indicates introduction into the QMS in 2004–05. The dark shaded circles post-QMS are existing fishers and the grey, new entrants (ESA AD).

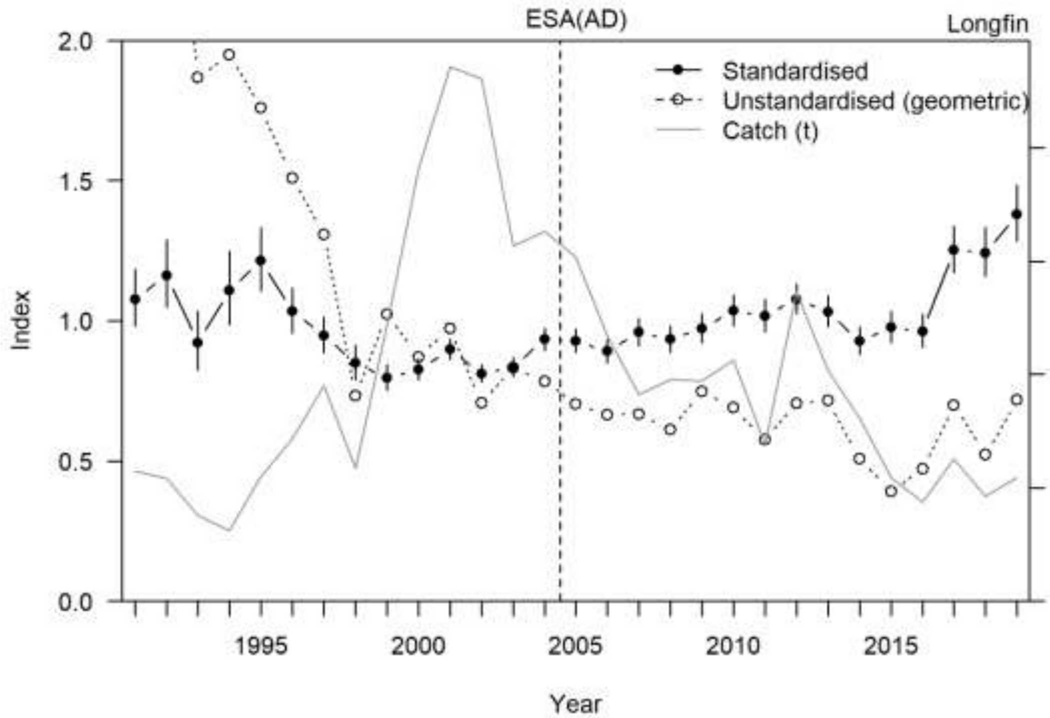

Figure D28: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for longfin (core fishers) for the years 1990–91 to 2018–19 (pre-ERS). The longfin catch by core fishers is also plotted. The vertical dotted line indicates introduction into the QMS in 2004–05. Catch includes legal size eels (ESA AD).

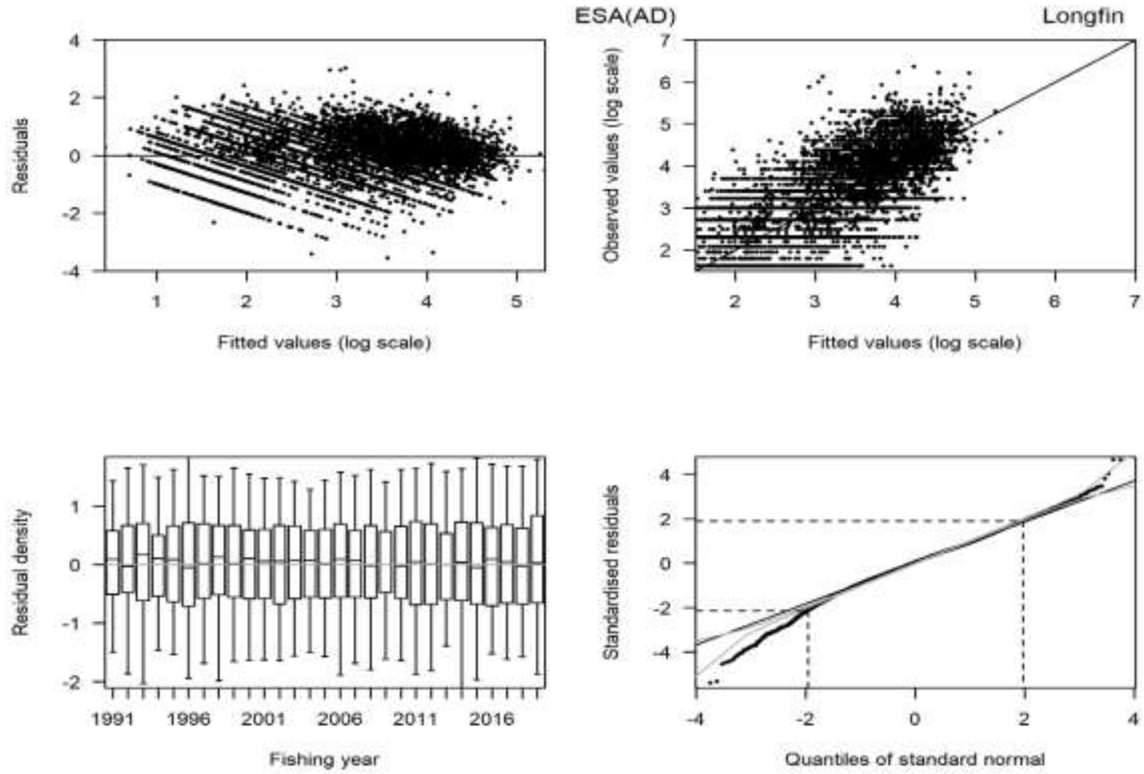

Figure D29: Residual diagnostic plots for the longfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AD).

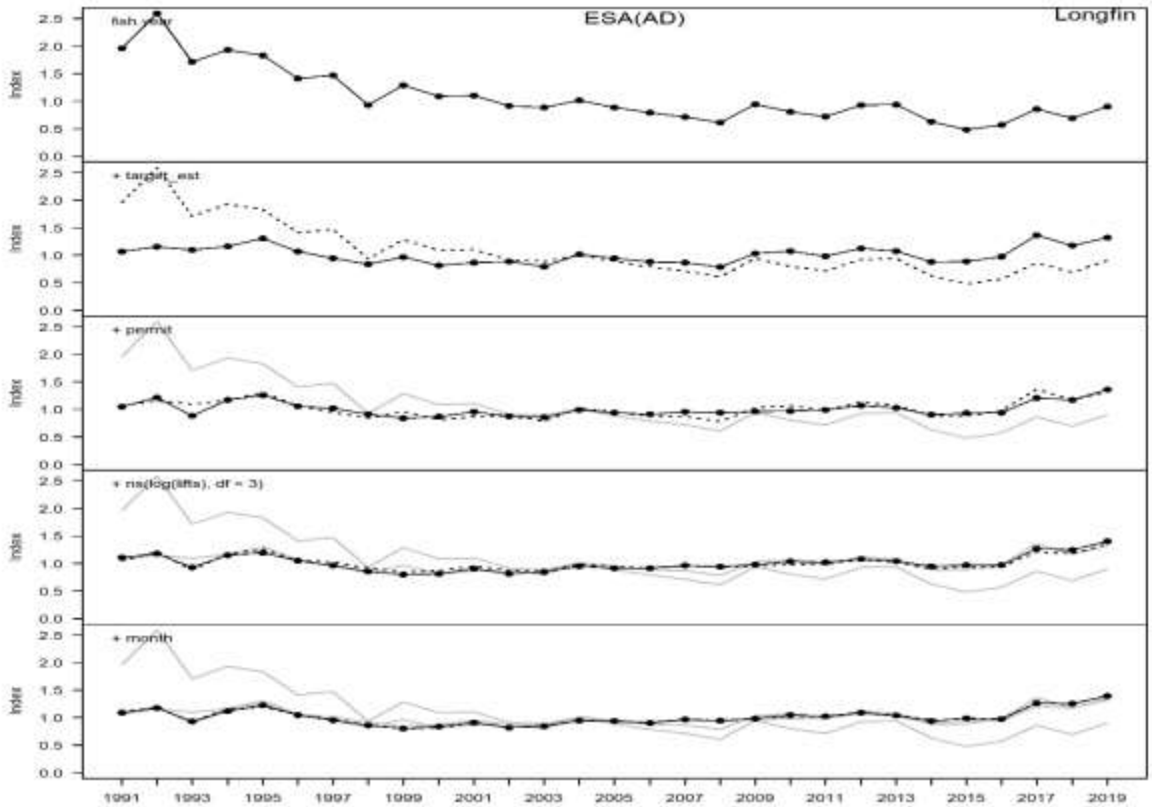

Figure D30: Step plot for the longfin eel CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AD).

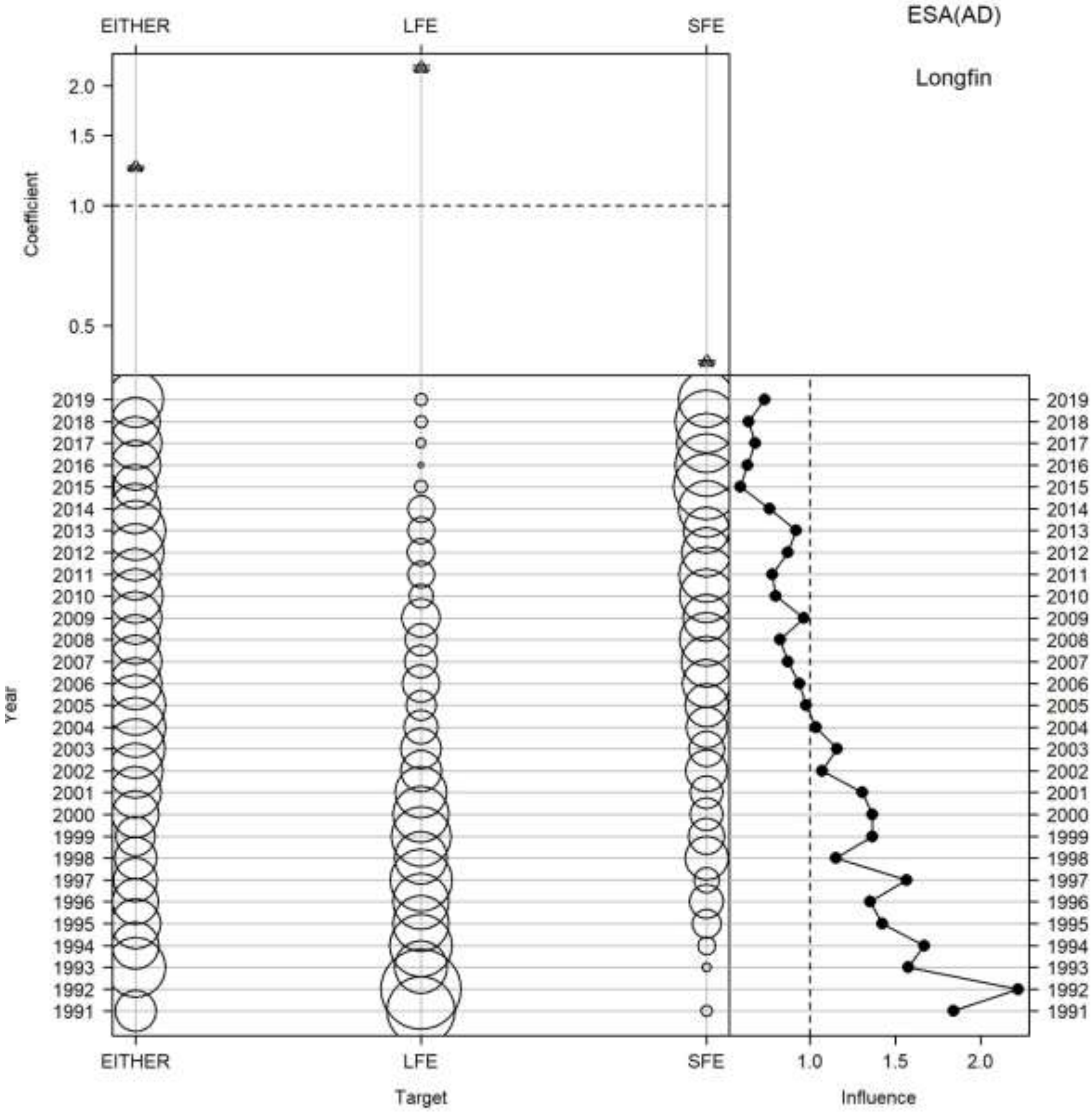

Figure D31: Influence of reconstructed target for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AD).

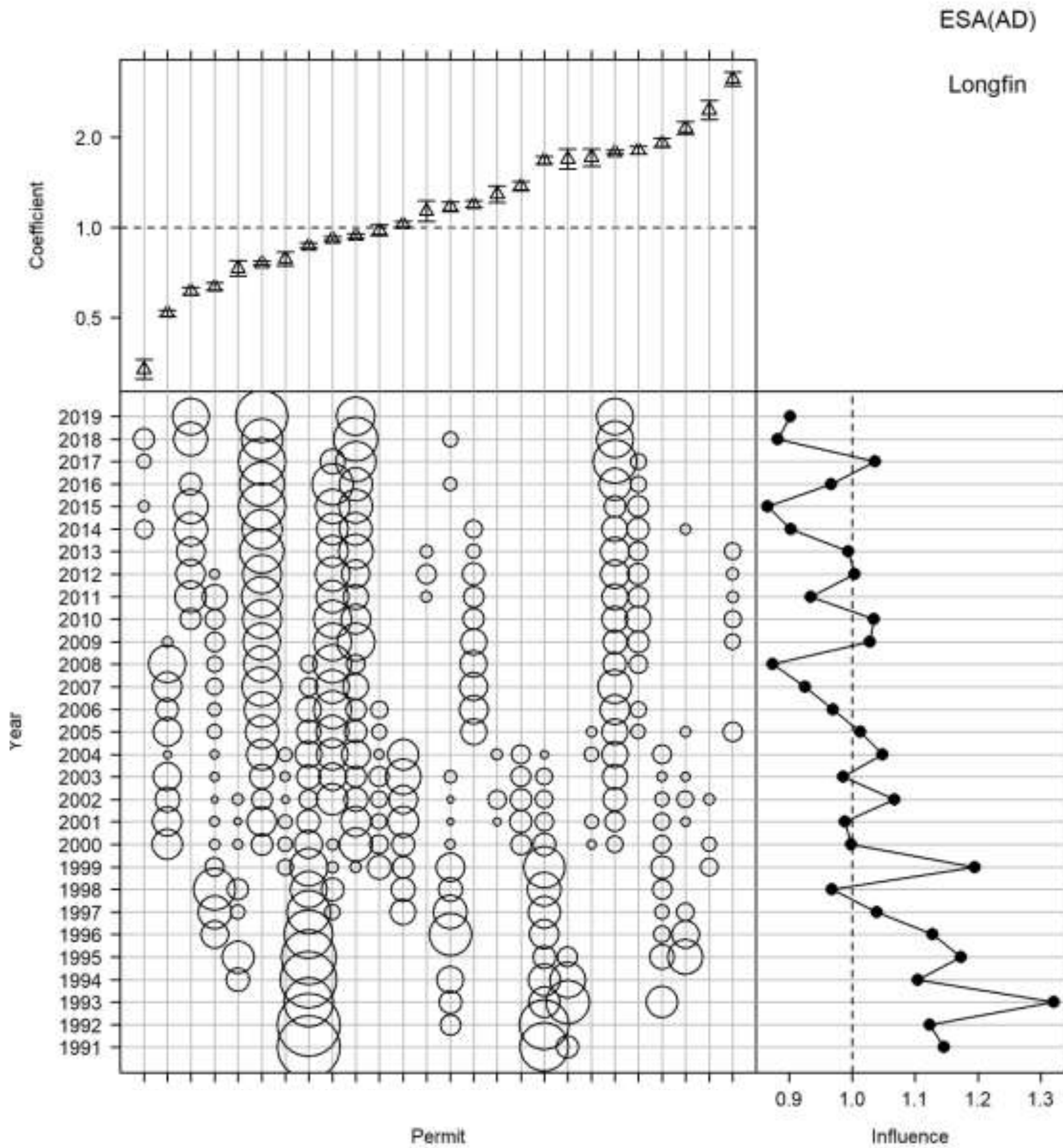

Figure D32: Influence of permit for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AD).

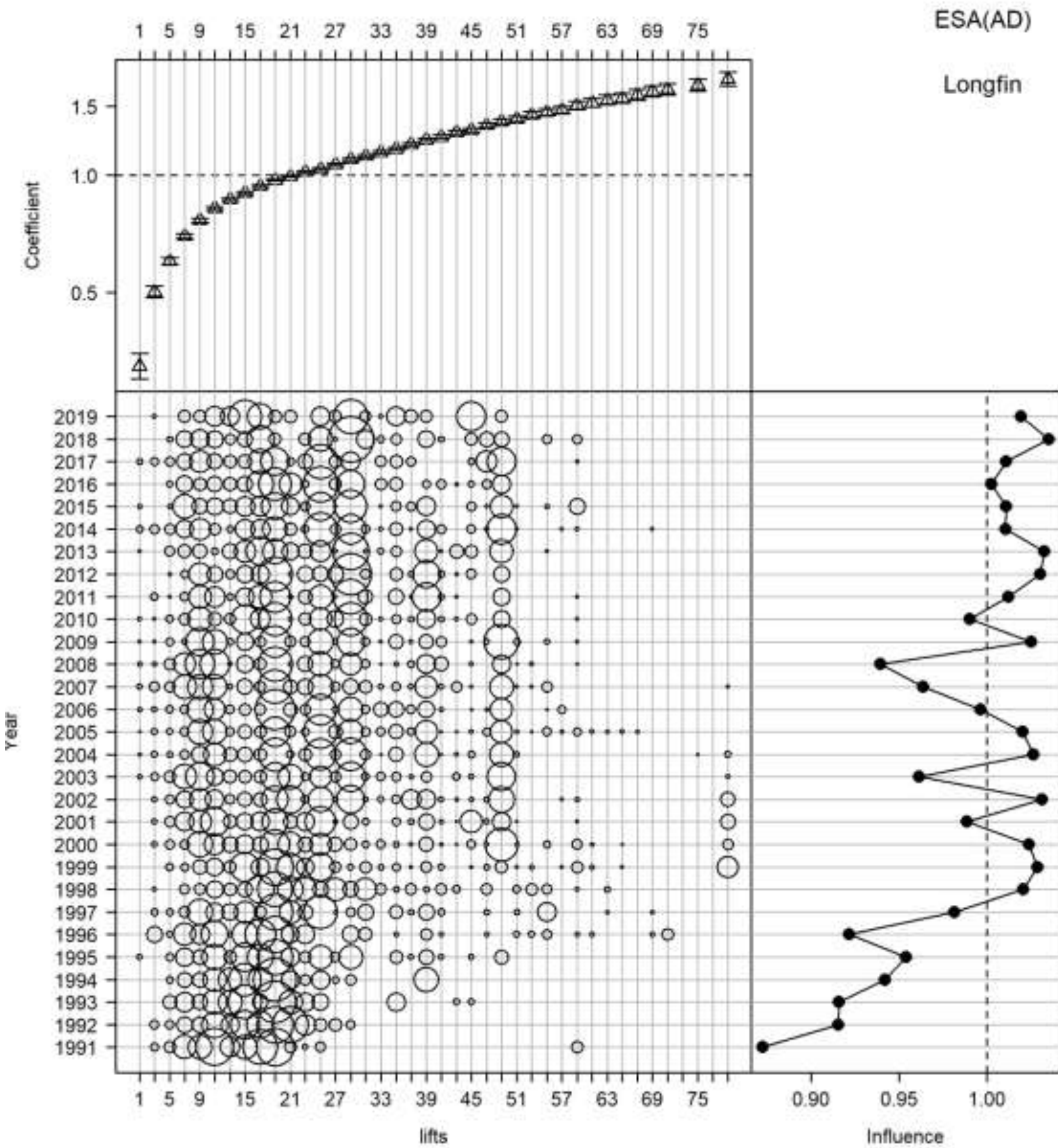

Figure D33: Influence of lifts for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AD).

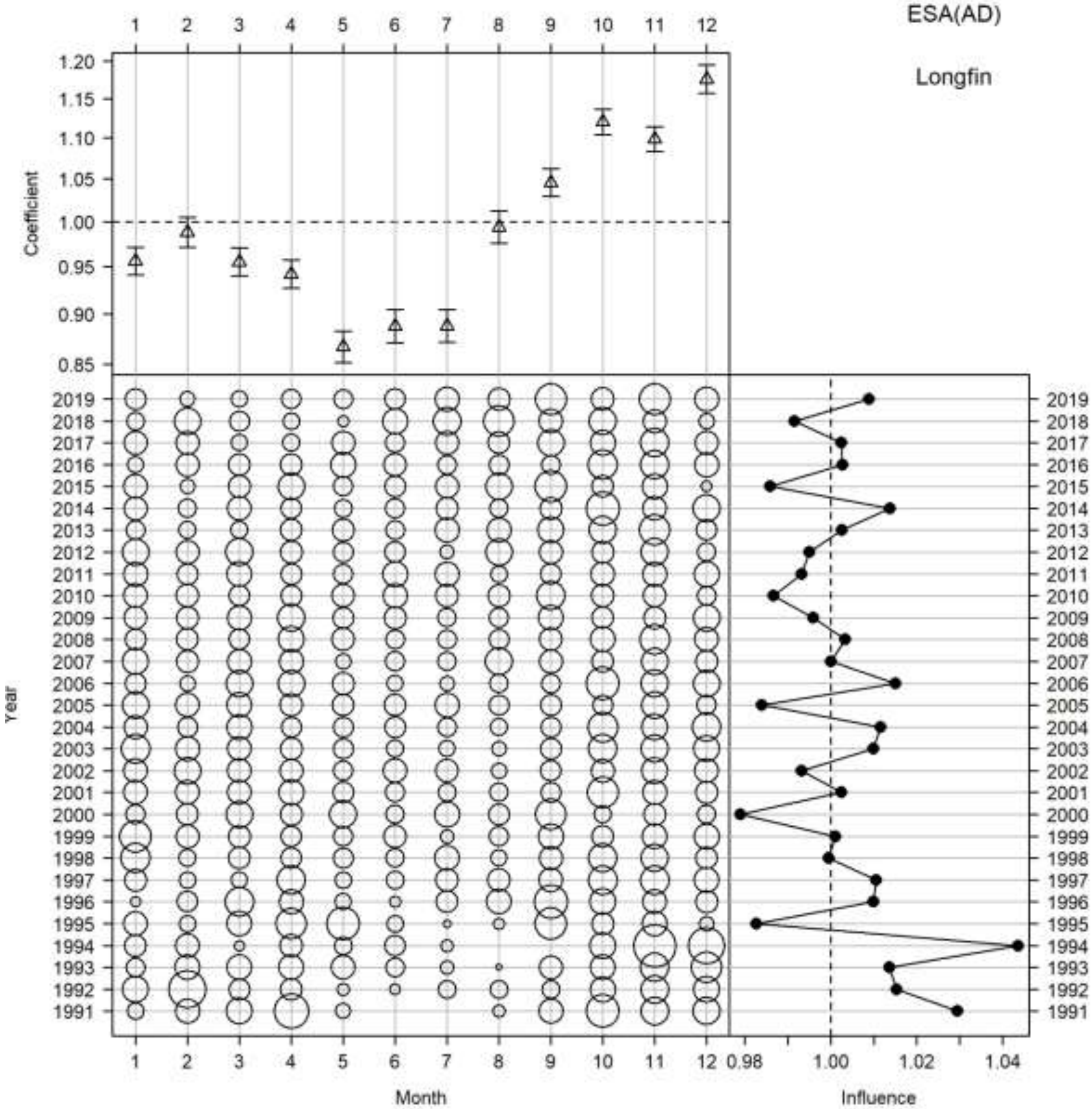

Figure D34: Influence of month for the longfin CPUE model for the years 1990–91 to 2018–19 (pre-ERS). Catch includes legal size eels (ESA AD).

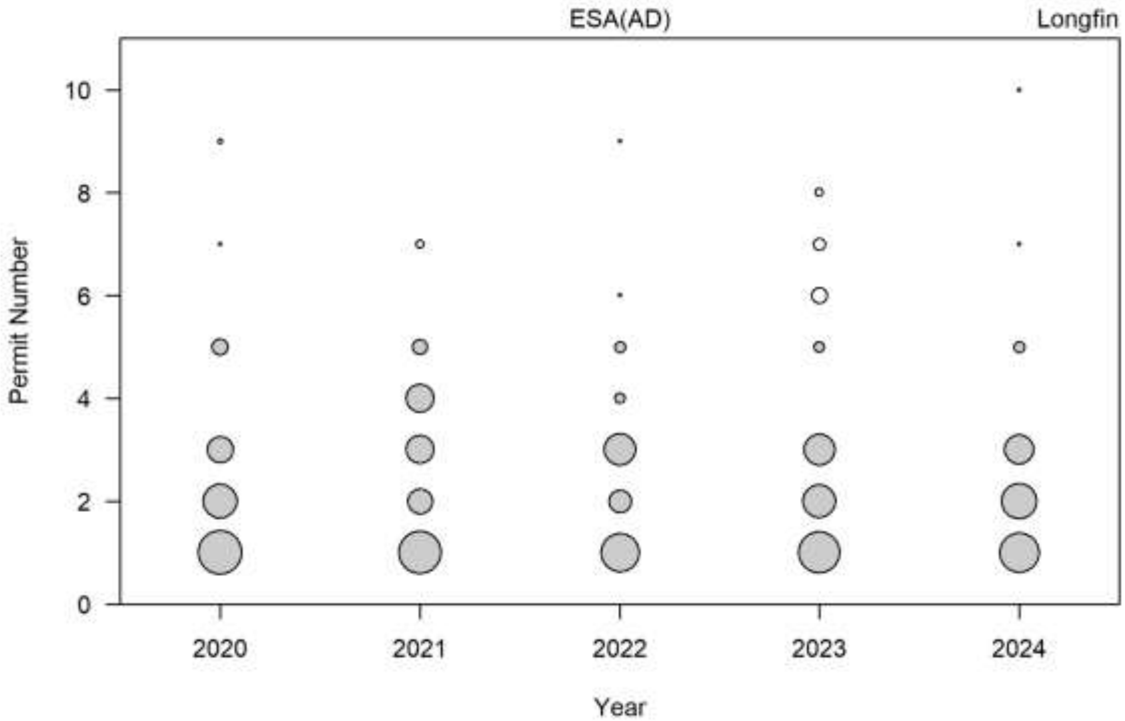

Figure D35: Relative longfin legal size eel catch and destination G, from all fishers (all circles) for the years 2019–20 to 2023–24 (post-ERS), and for core fishers (grey shaded circles) included in the catch per unit effort analyses (ESA AD).

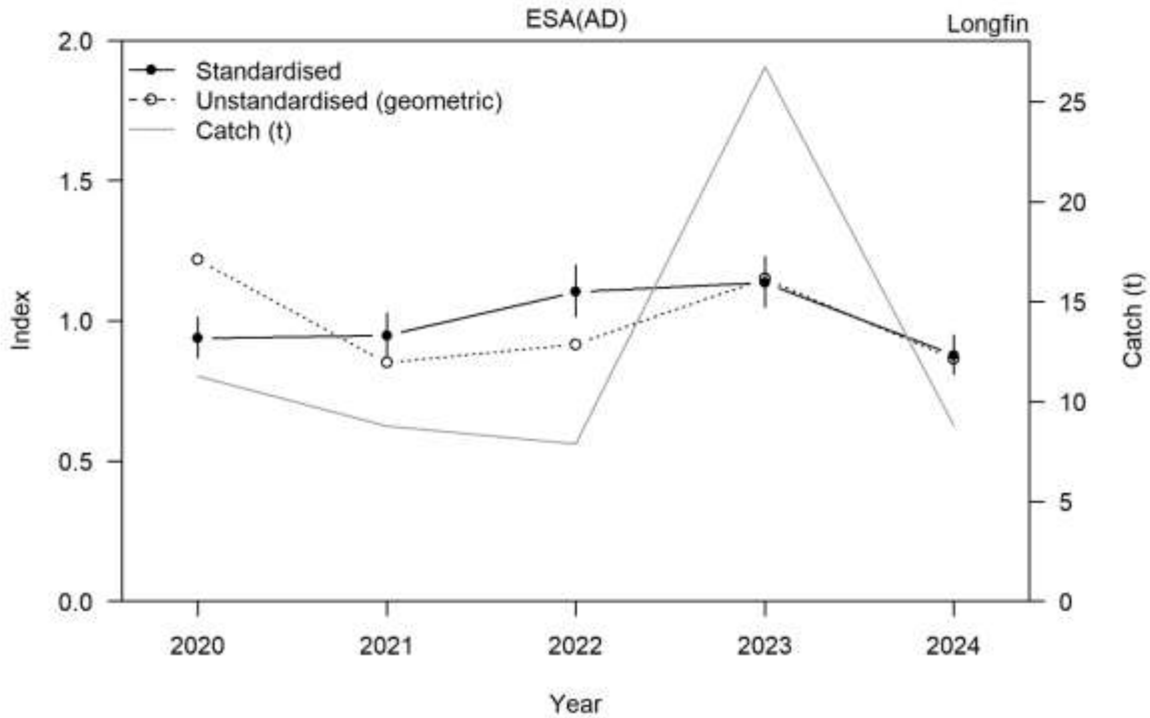

Figure D36: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for longfin (core fishers) for the years 2019–20 to 2023–24 (post-ERS). The longfin catch by core fishers is also plotted. Catch includes legal size eels and destination G (ESA AD).

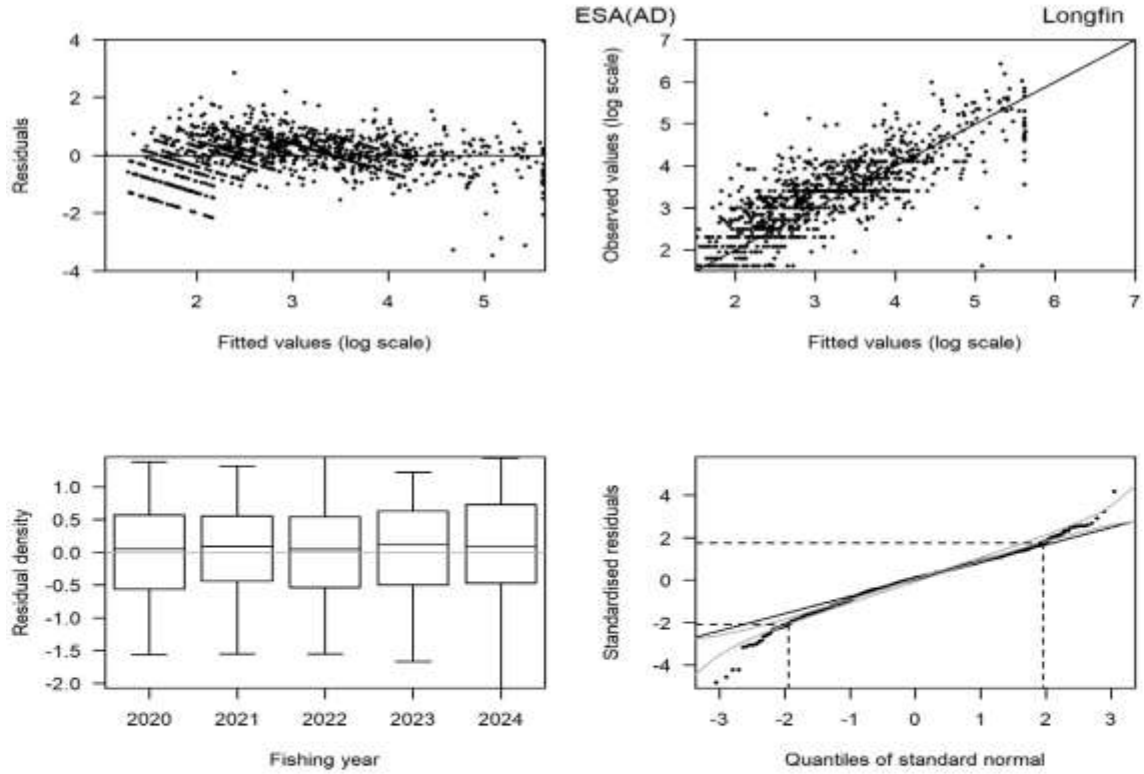

Figure D37: Residual diagnostic plots for the longfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution (ESA AD).

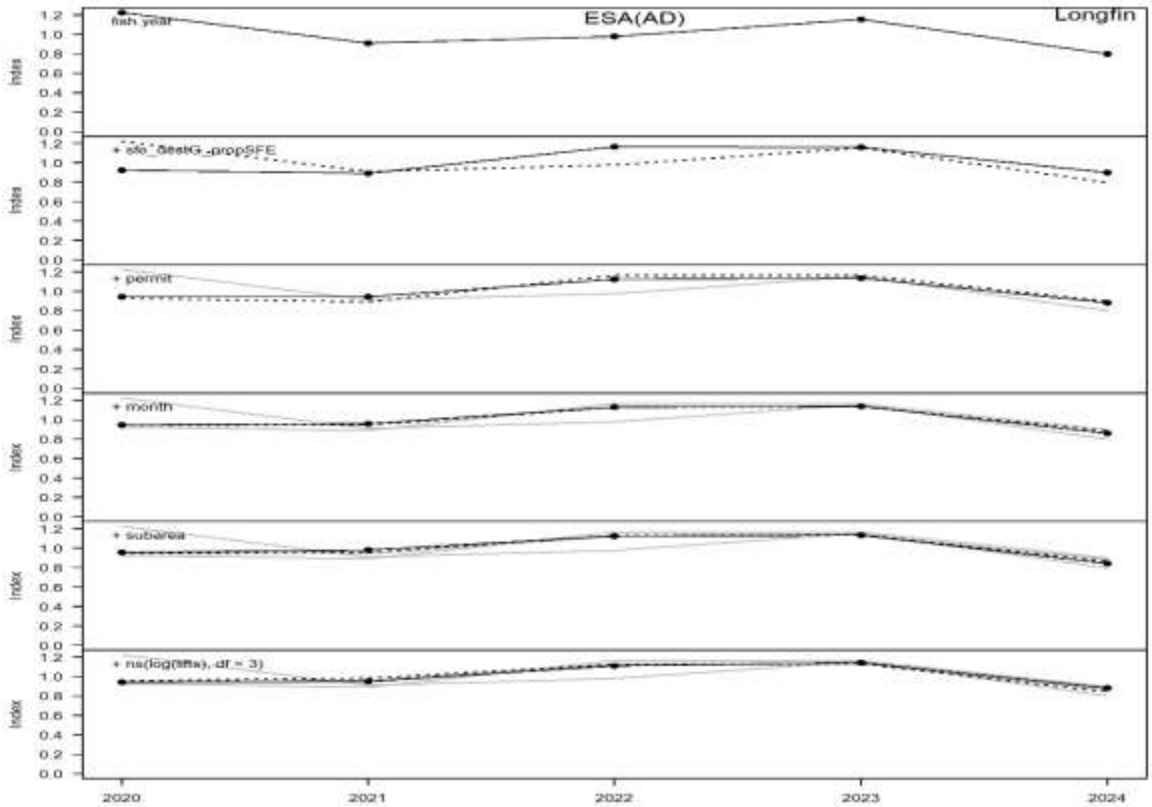

Figure D38: Step plot for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that (ESA AD).

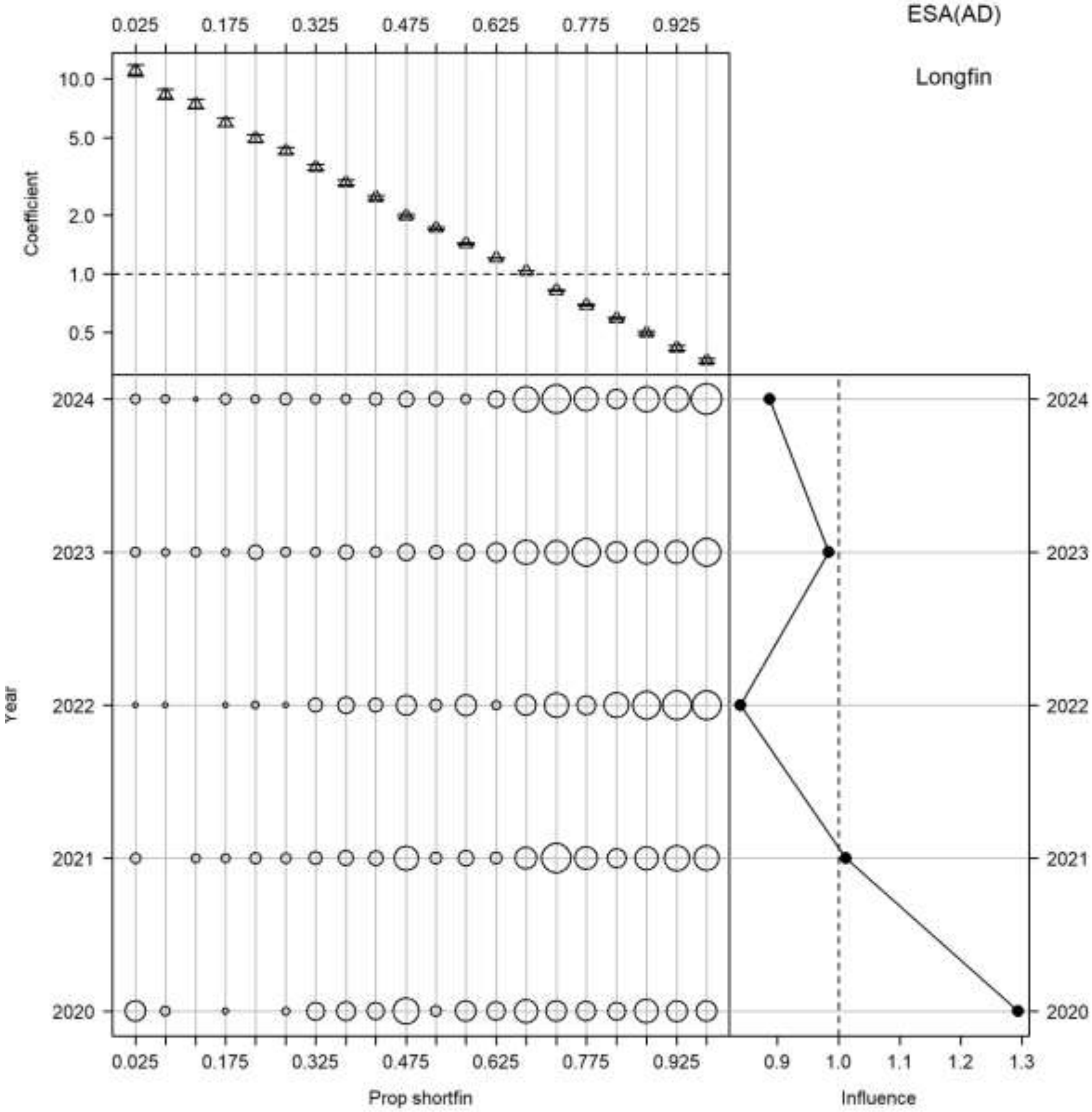

Figure D39: Influence of proportion shortfin for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AD).

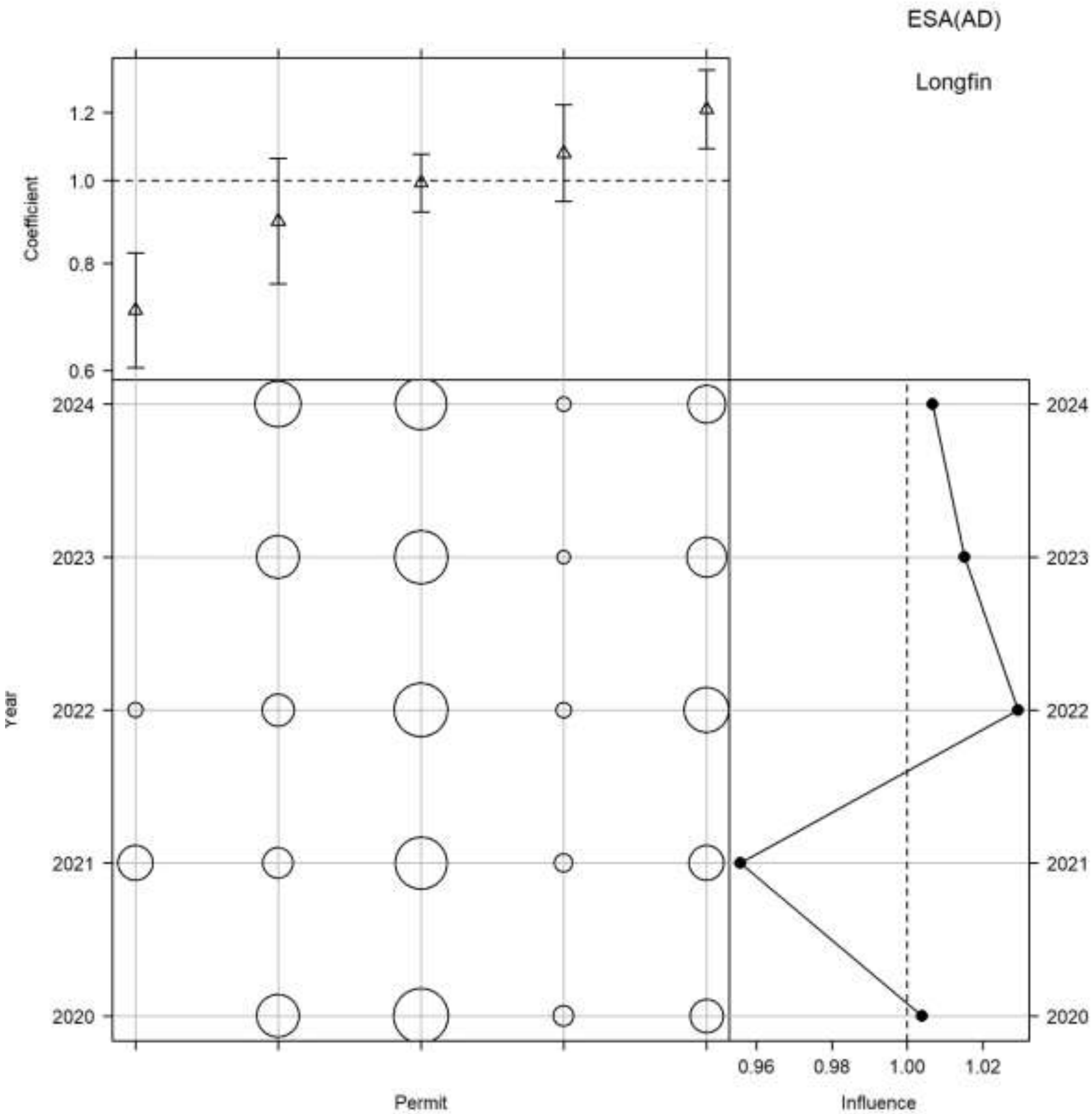

Figure D40: Influence of permit for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AD).

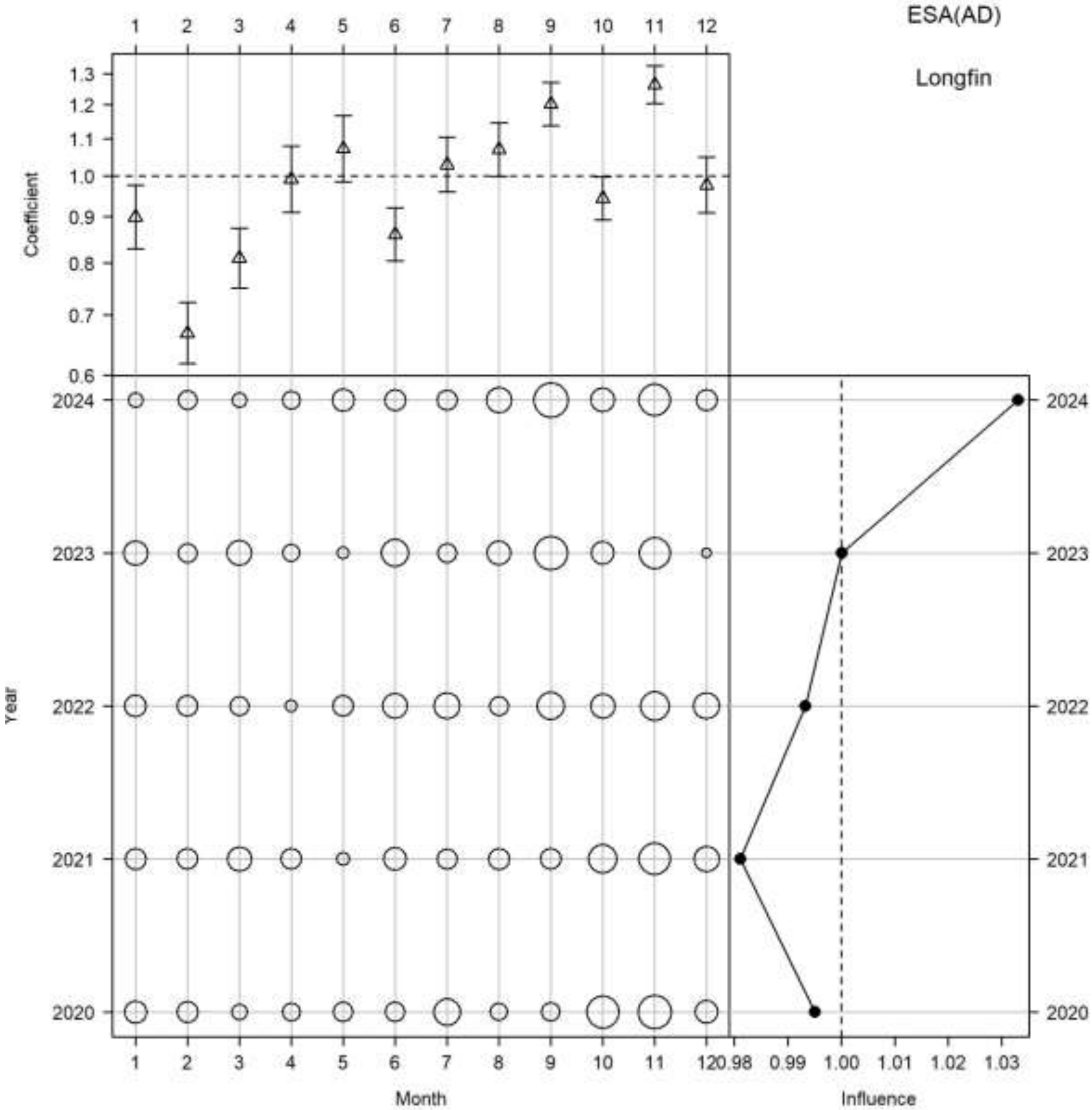

Figure D41: Influence of month for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AD).

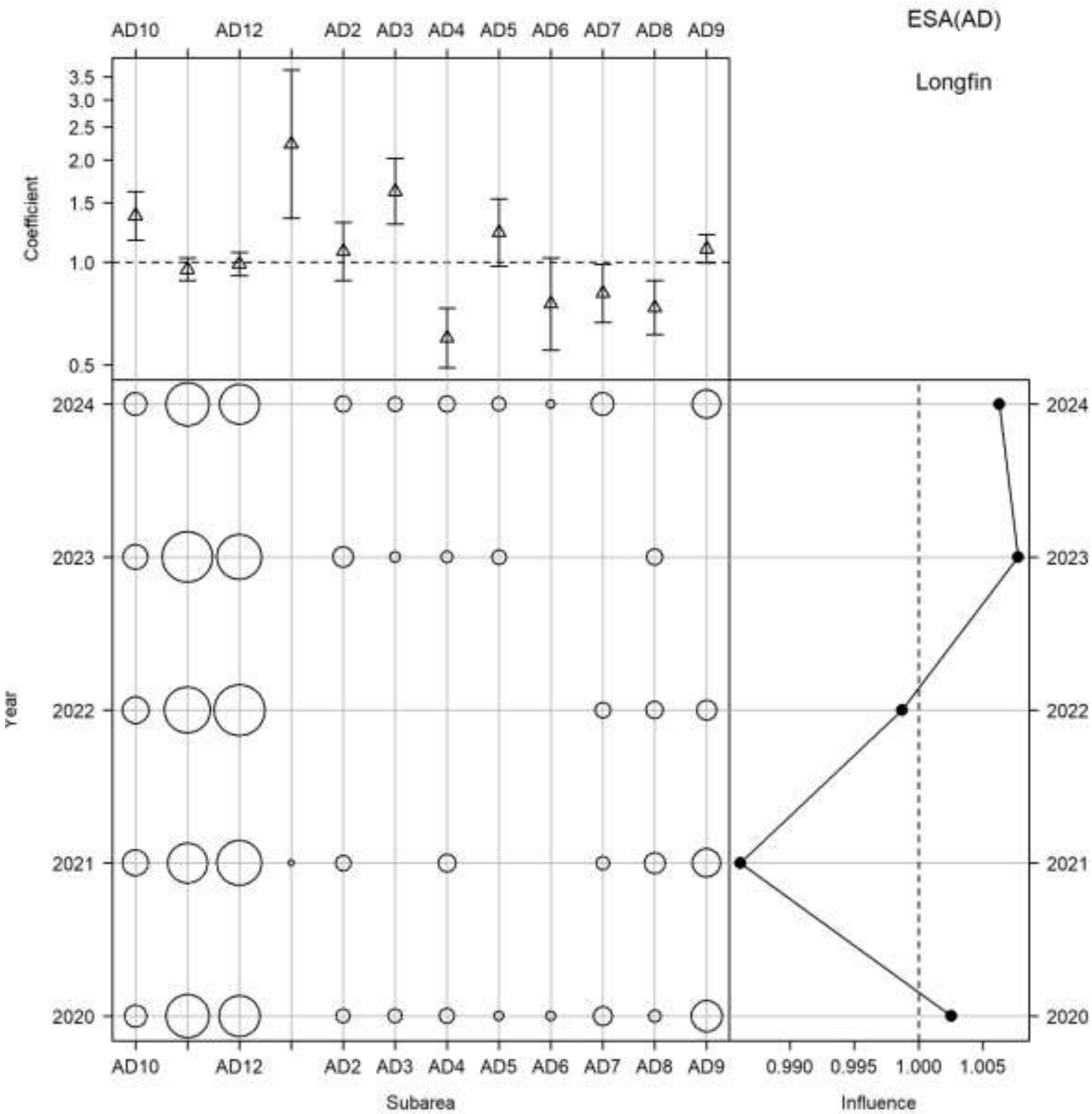

Figure D42: Influence of subarea for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AD).

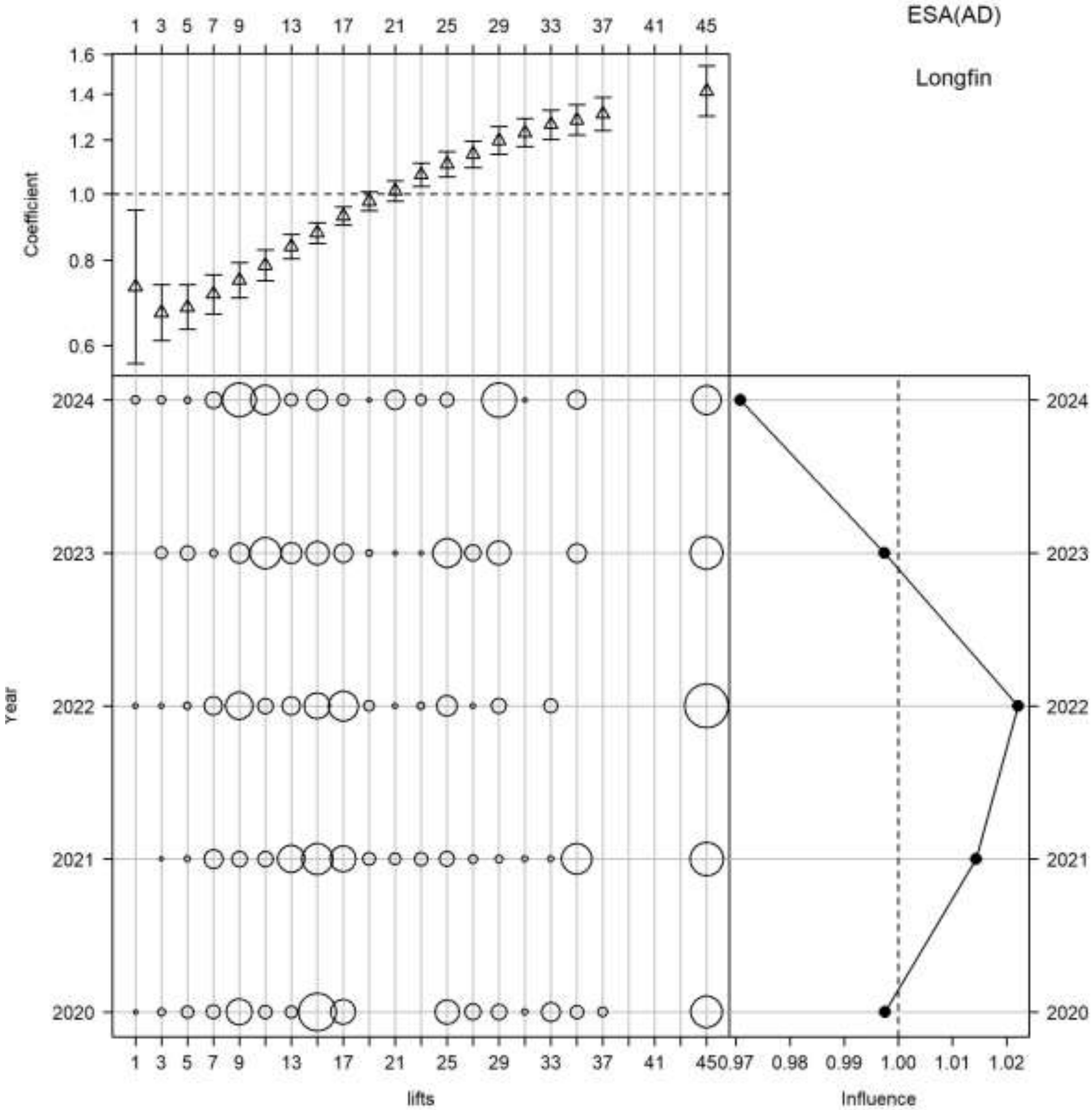

Figure D43: Influence of lifts in the catch for the longfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G (ESA AD).

ESA AE (Bay of Plenty)

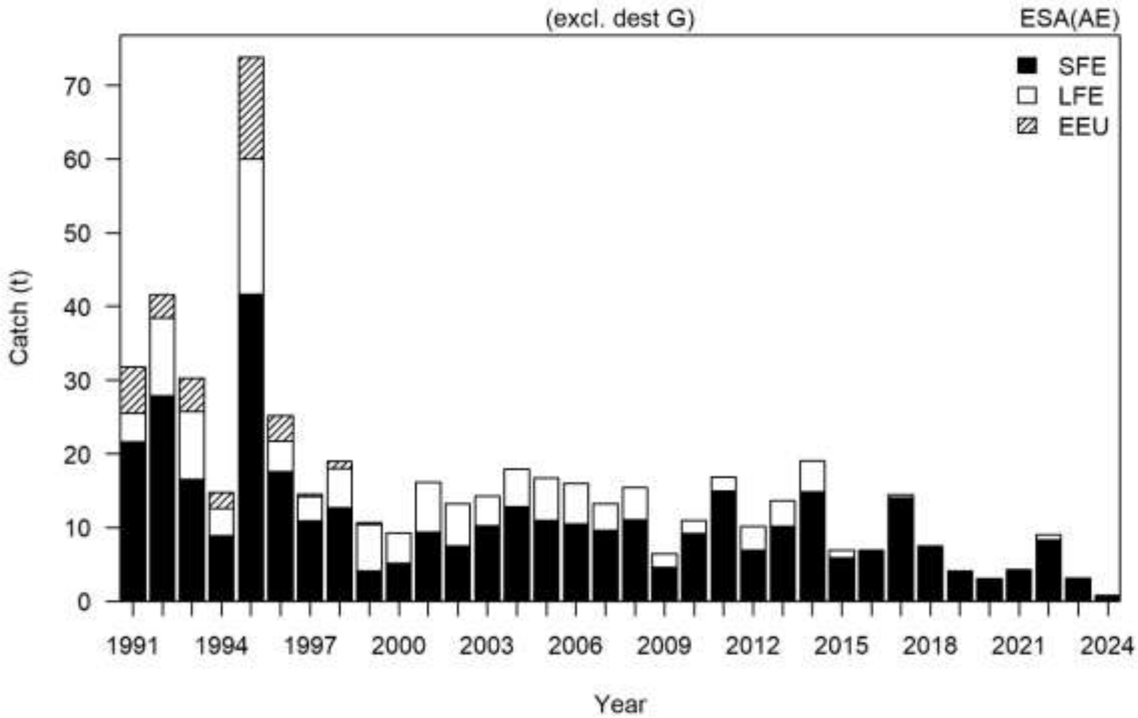

Figure E1: Total estimated commercial catch of shortfin (SFE), longfin (LFE), and unclassified eel catch (EEU) for the years 1990–91 to 2023–24 (ESA AE).

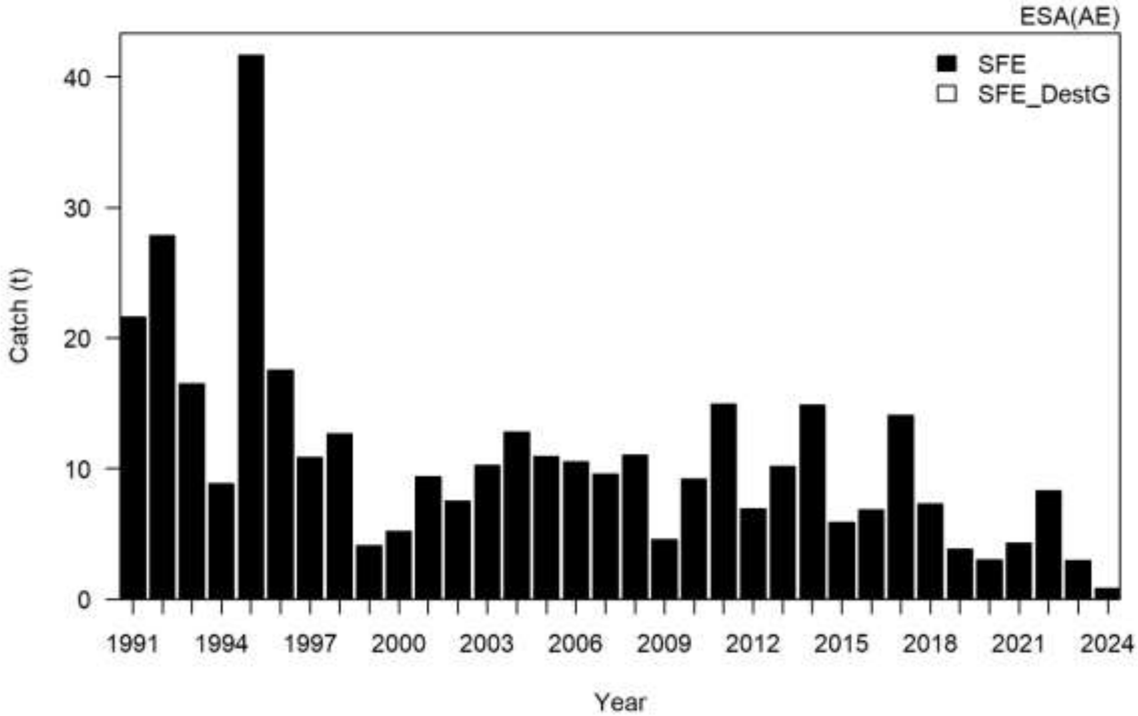

Figure E2: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AE).

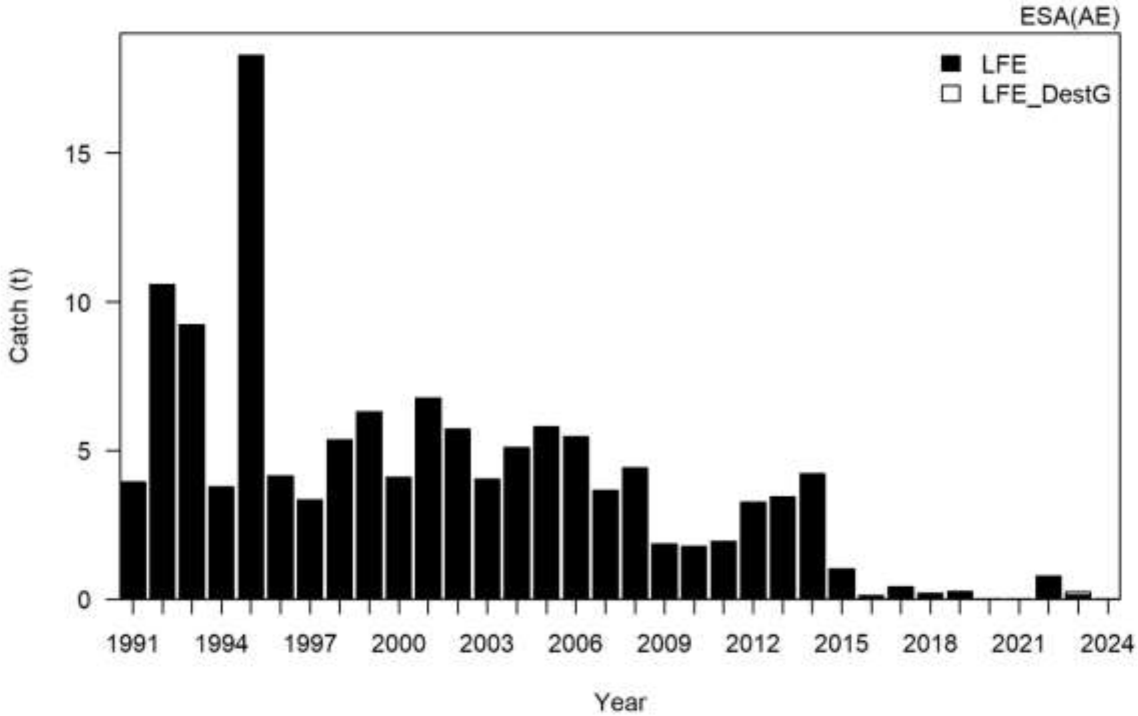

Figure E3: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AE).

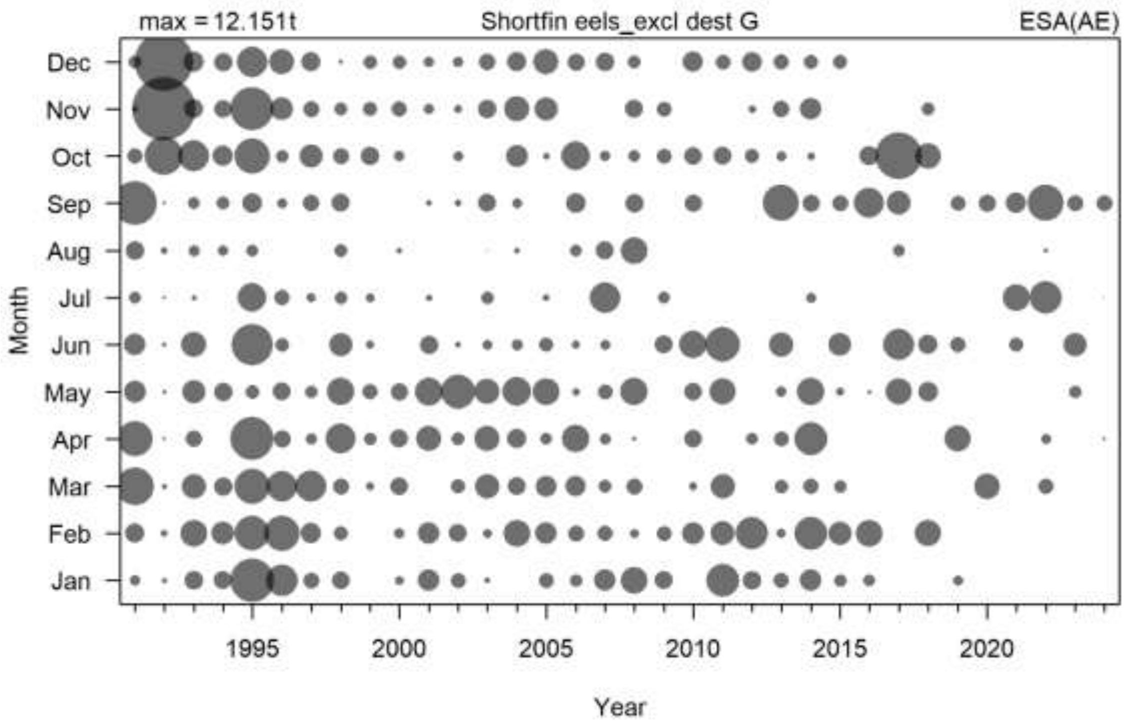

Figure E4: Shortfin eel catch by month for the years 1990–91 to 2023–24 (ESA AE).

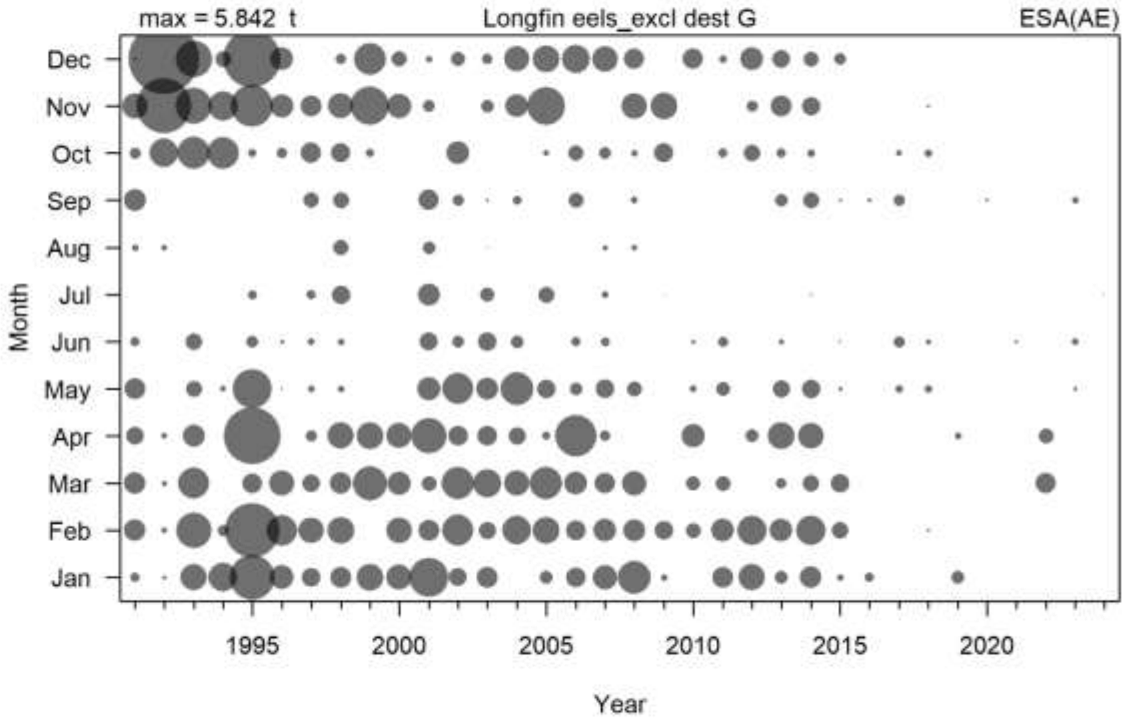

Figure E5: Longfin eel catch by month for the years 1990–91 to 2023–24 (ESA AE).

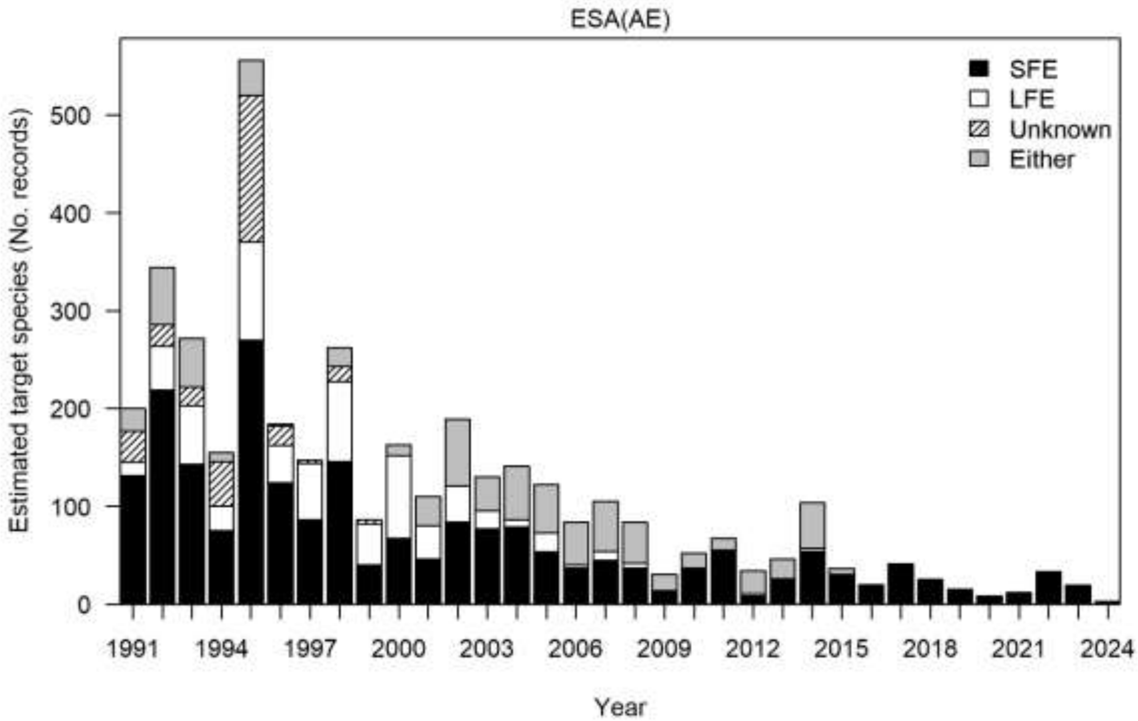

Figure E6: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AE).

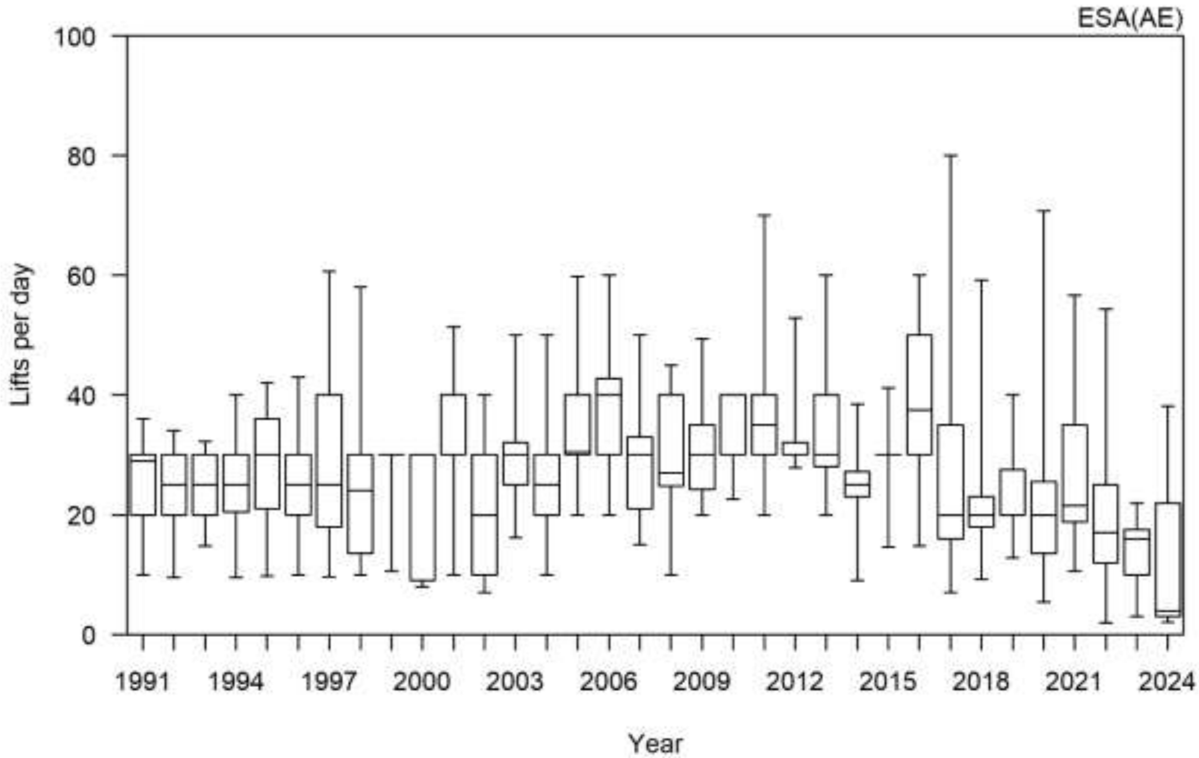

Figure E7: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AE).

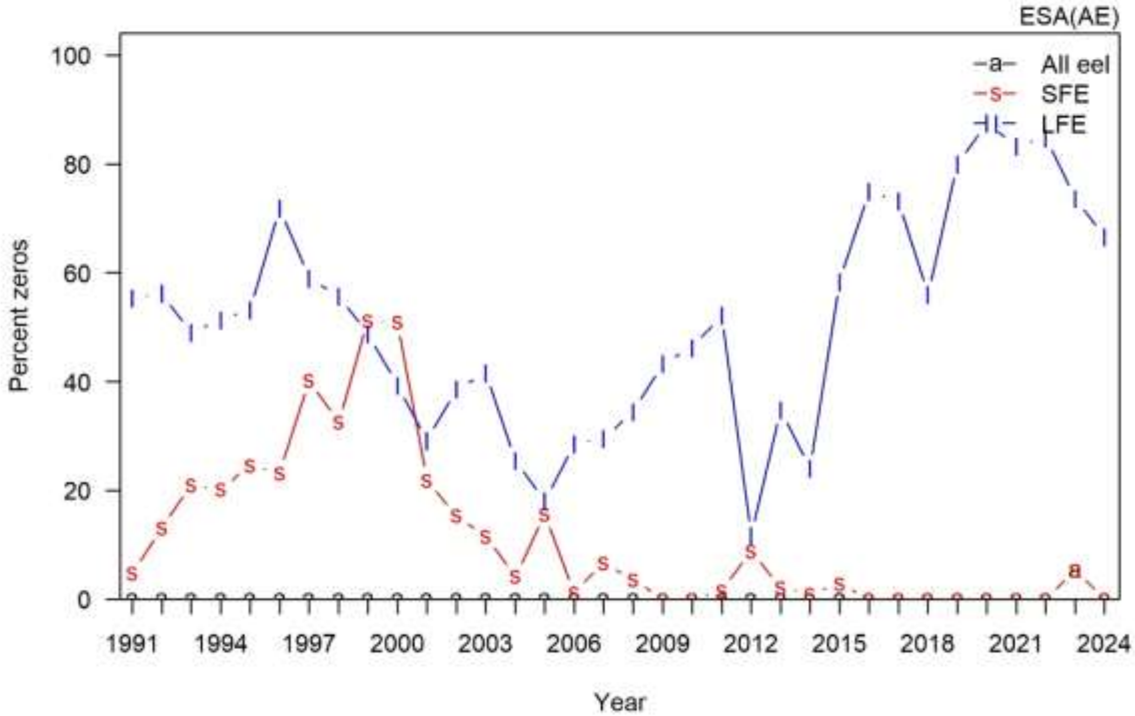

Figure E8: Proportion of valid zero records for all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AE).

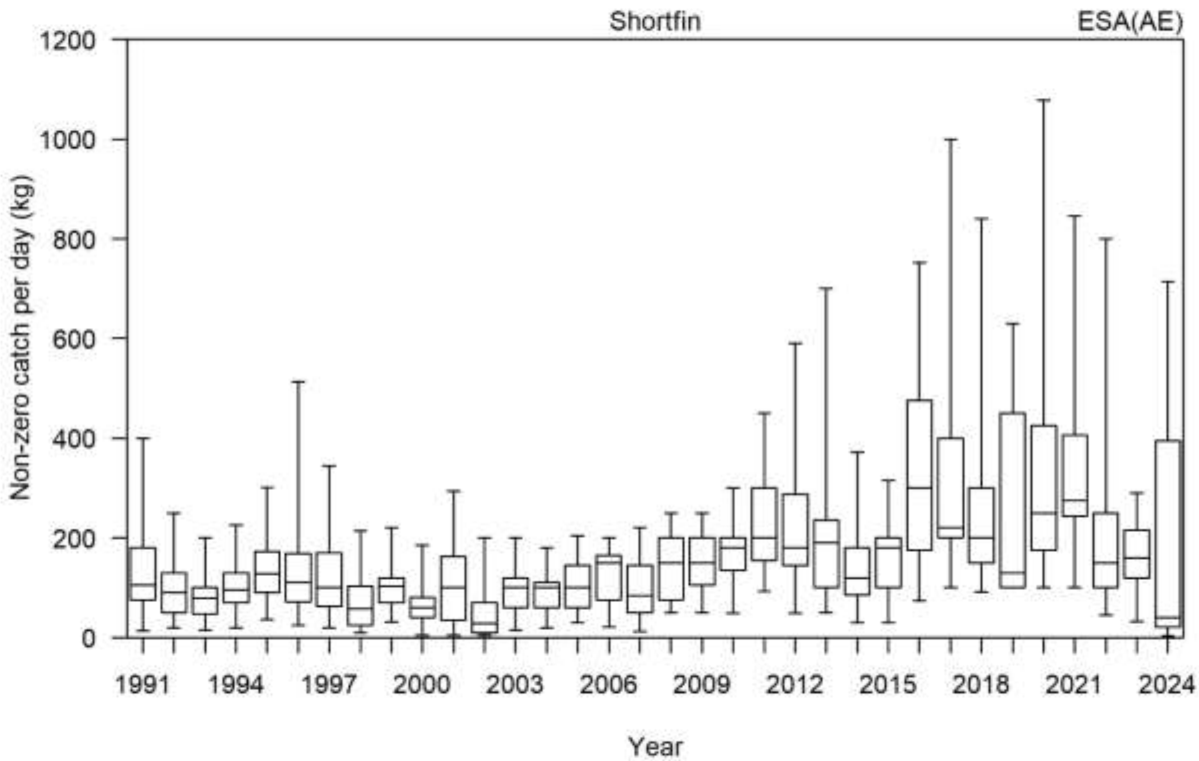

Figure E9: Shortfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AE).

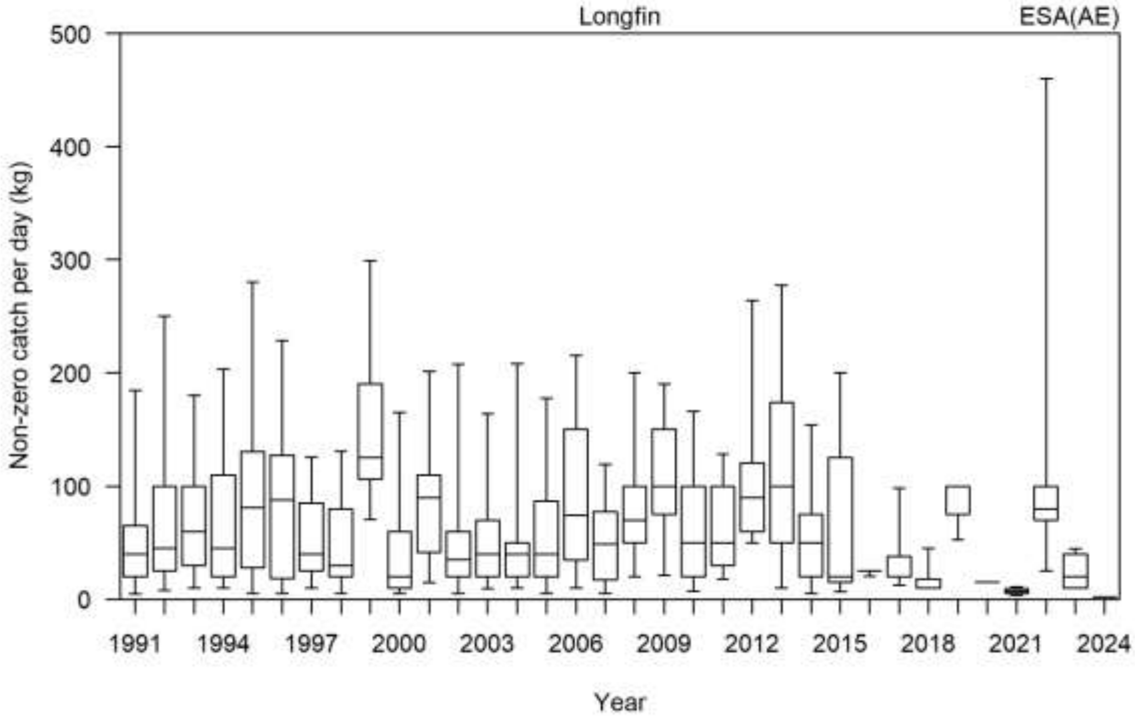

Figure E10: Longfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AE).

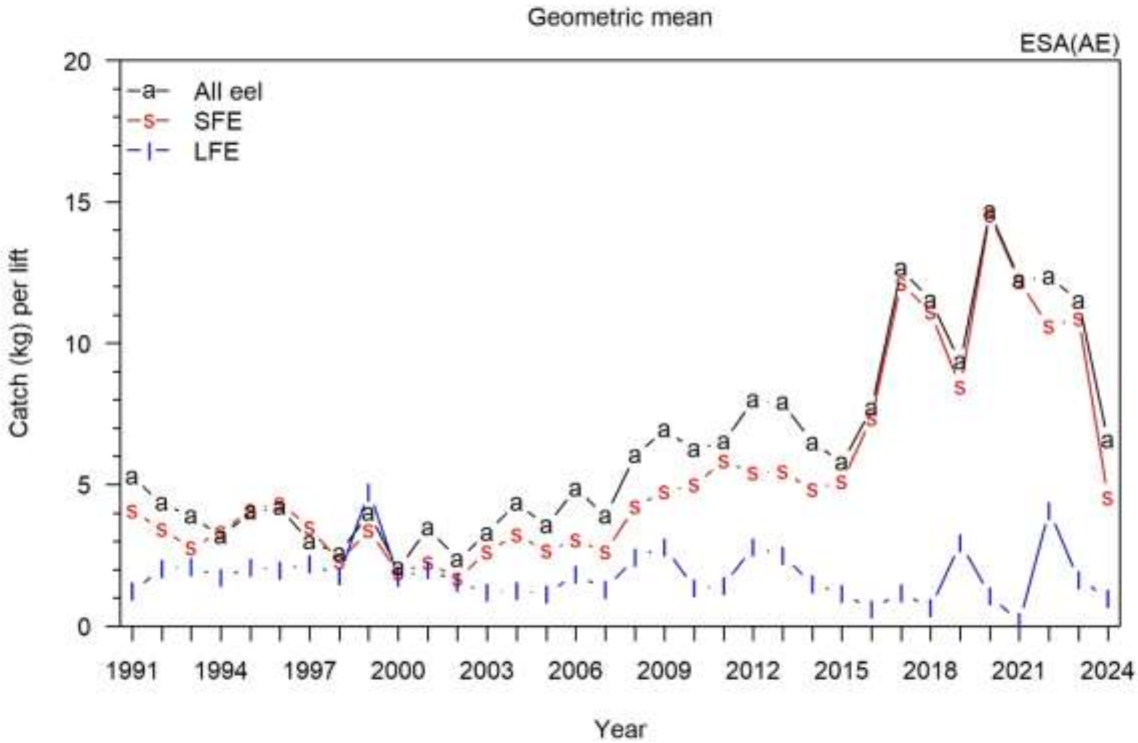

Figure E11: Unstandardised catch per lift (geometric mean of catch per lift) for all eels, shortfin (SFE), and longfin (LFE) for the years 1990–91 to 2023–24 (ESA AE).

ESA AF (Poverty Bay)

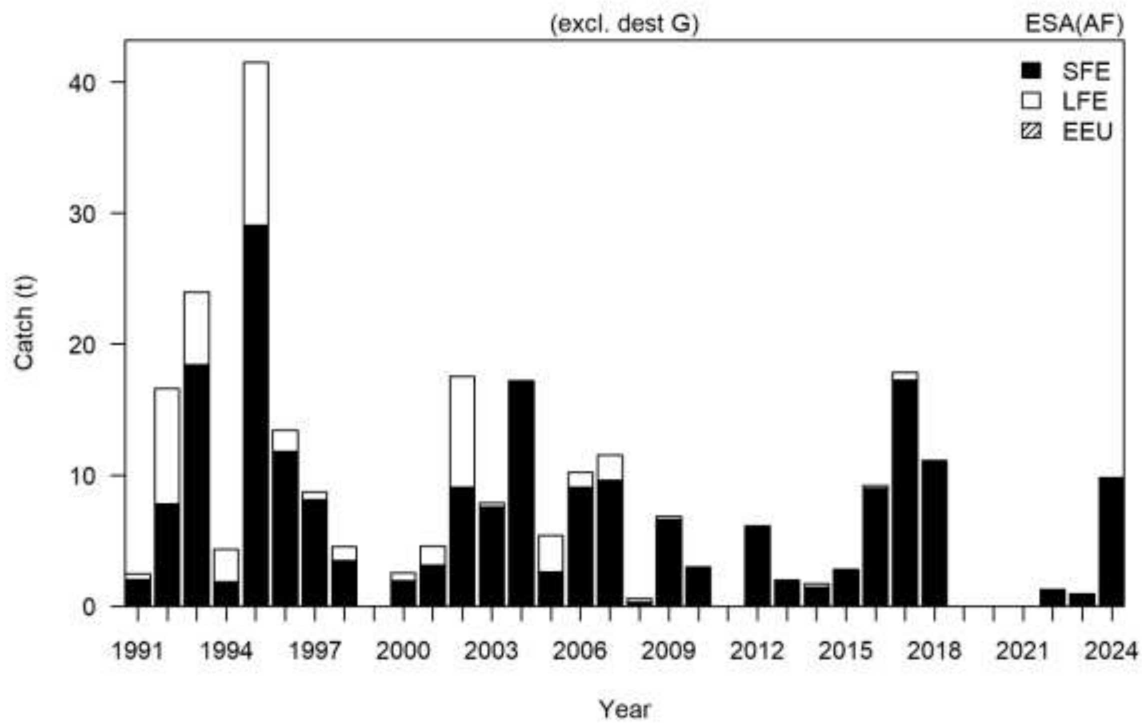

Figure F1: Total estimated commercial catch of shortfin (SFE), longfin (LFE), and unclassified eel catch (EEU) for the years 1990–91 to 2023–24 (ESA AF).

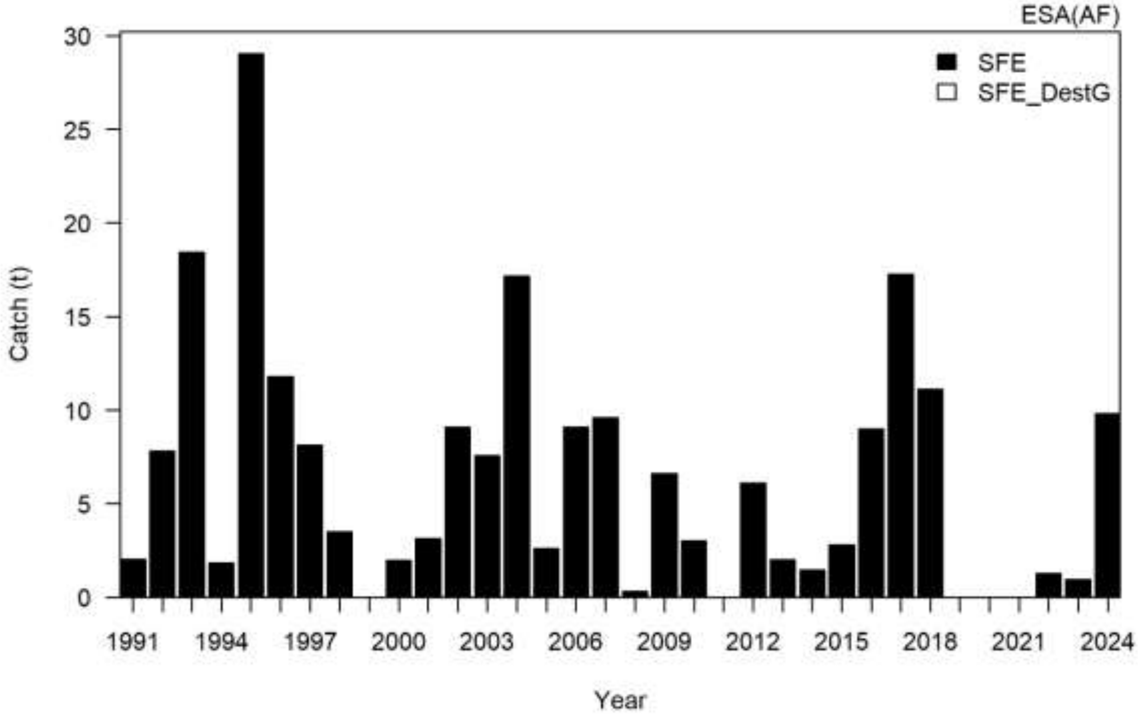

Figure F2: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AF).

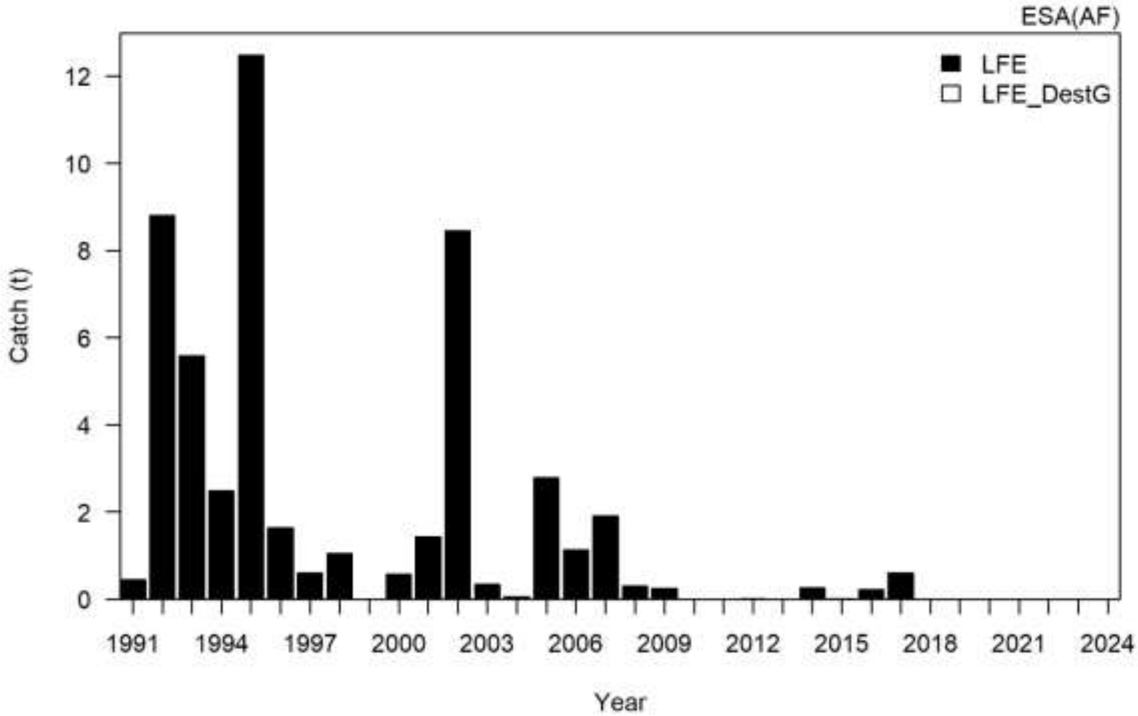

Figure F3: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AF).

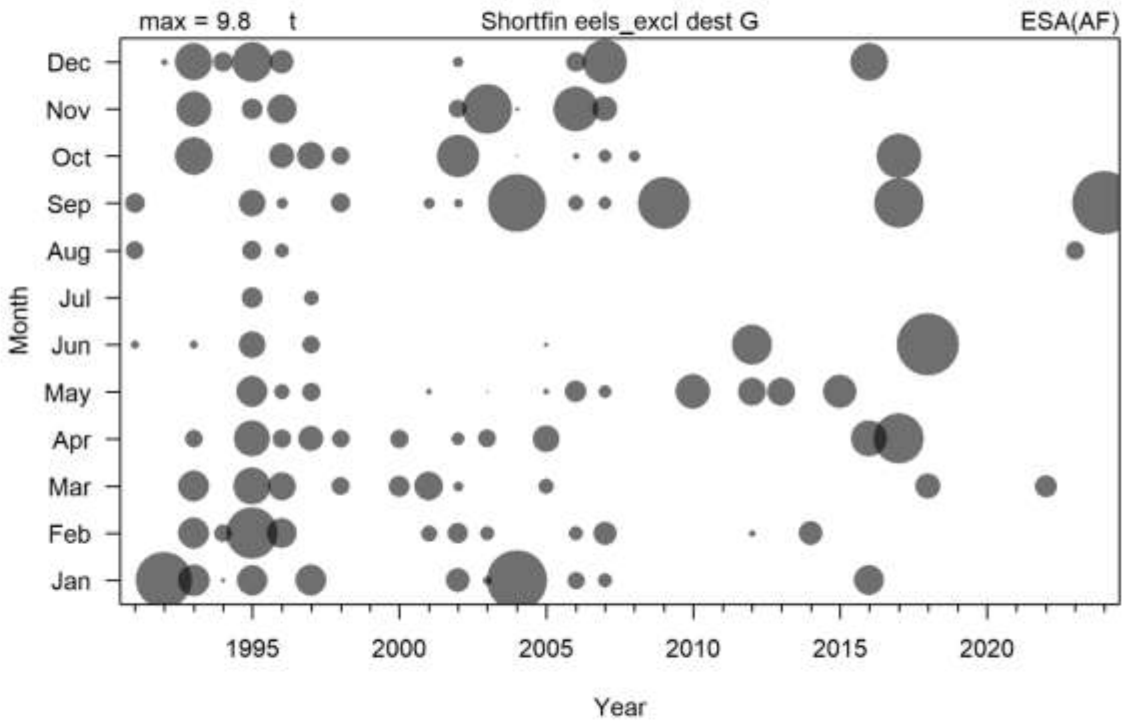

Figure F4: Shortfin eel catch by month for the years 1990–91 to 2023–24 (ESA AF).

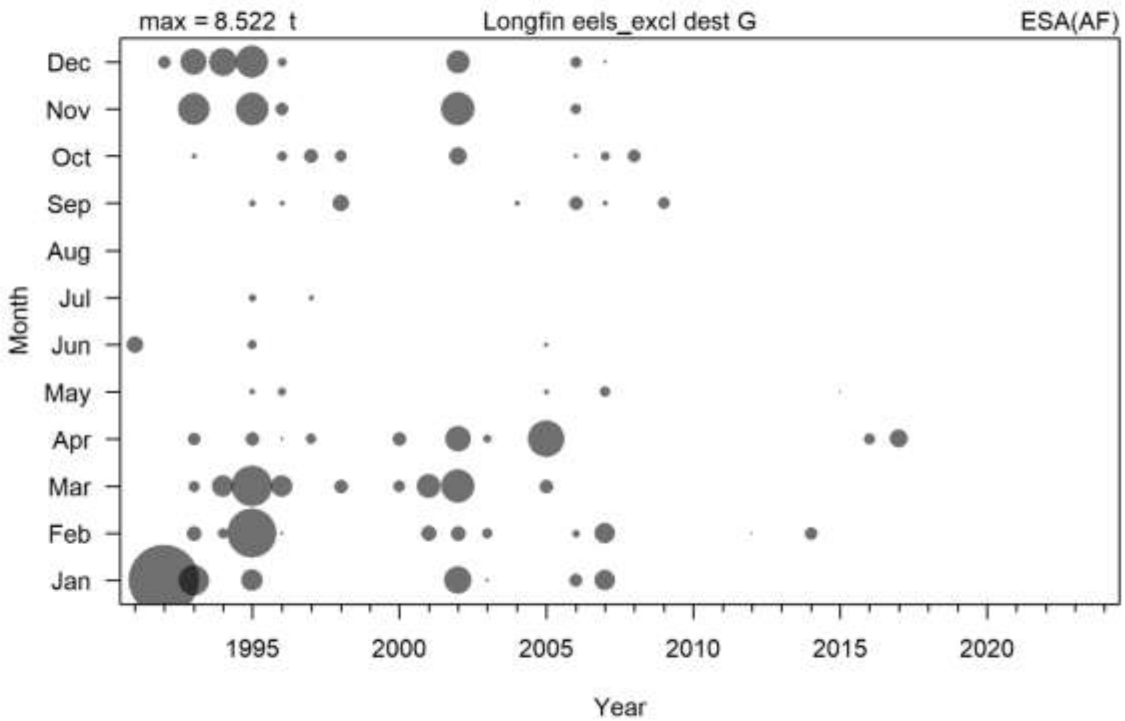

Figure F5: Longfin eel catch by month for the years 1990–91 to 2023–24 (ESA AF).

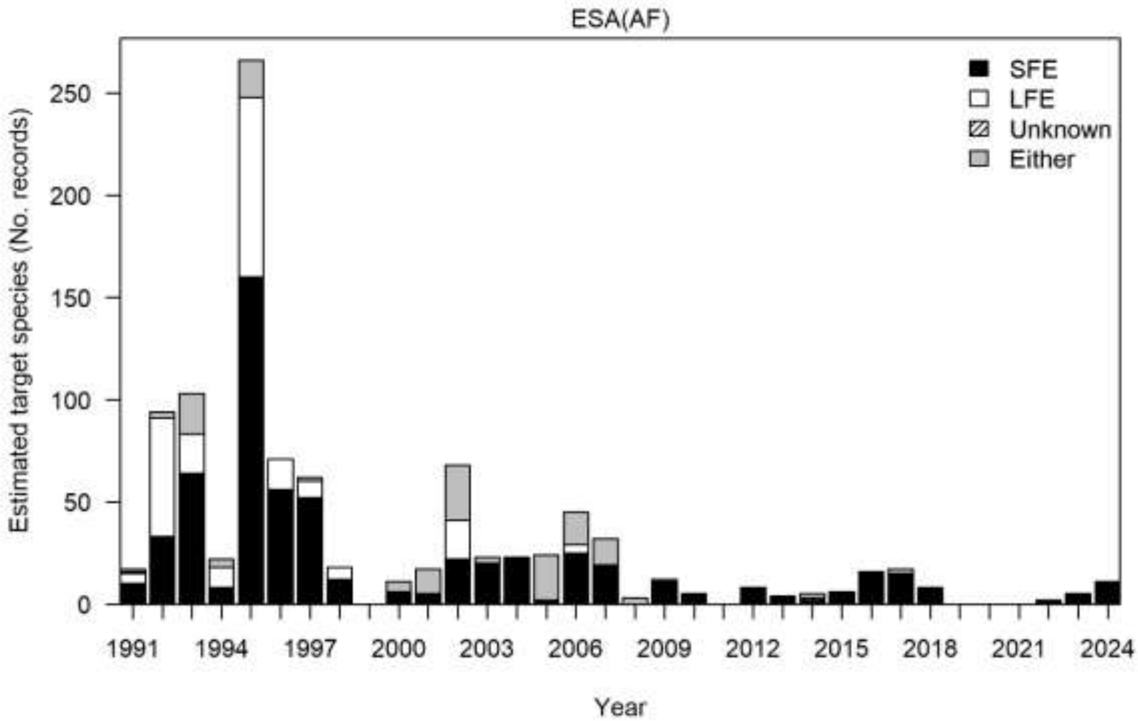

Figure F6: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AF).

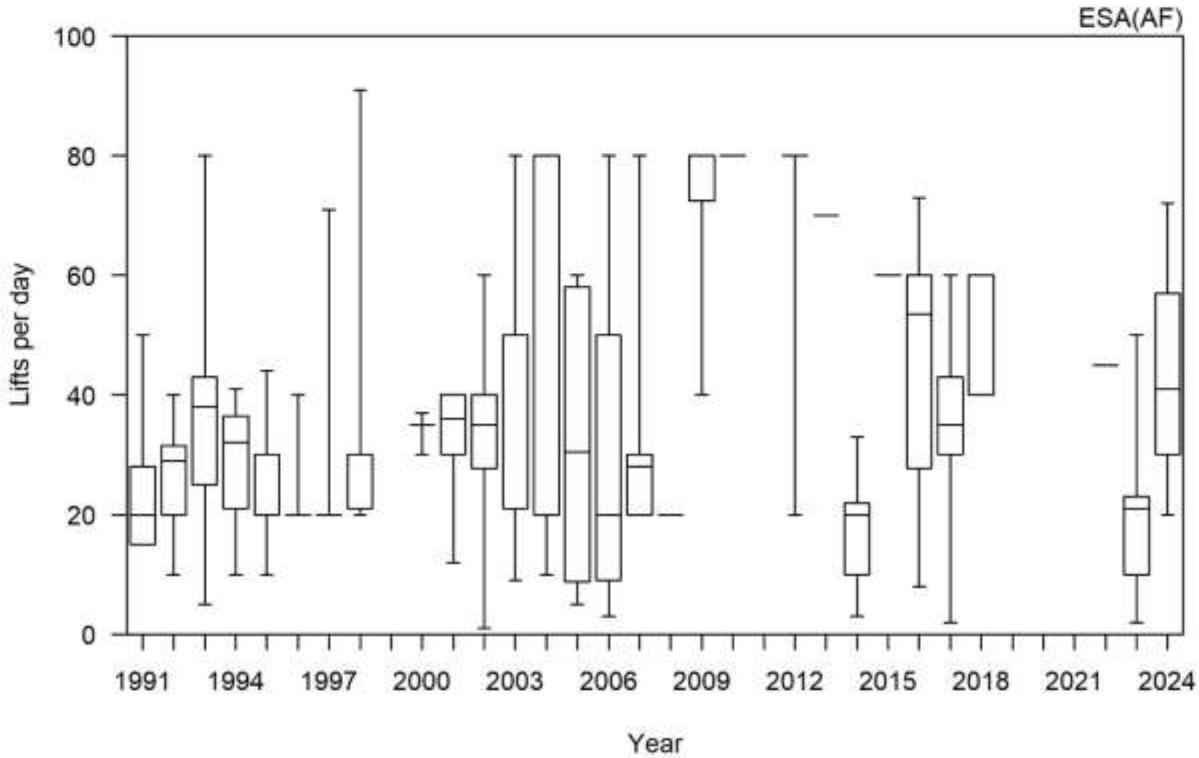

Figure F7: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AF).

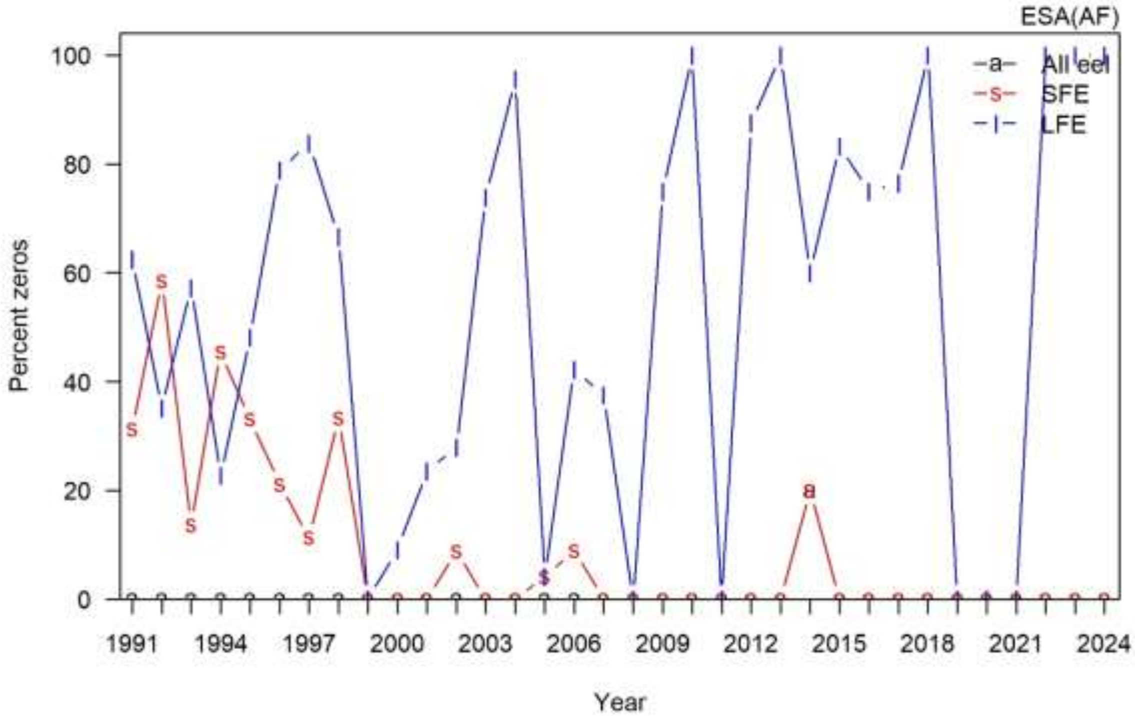

Figure F8: Proportion of valid zero records for all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AF).

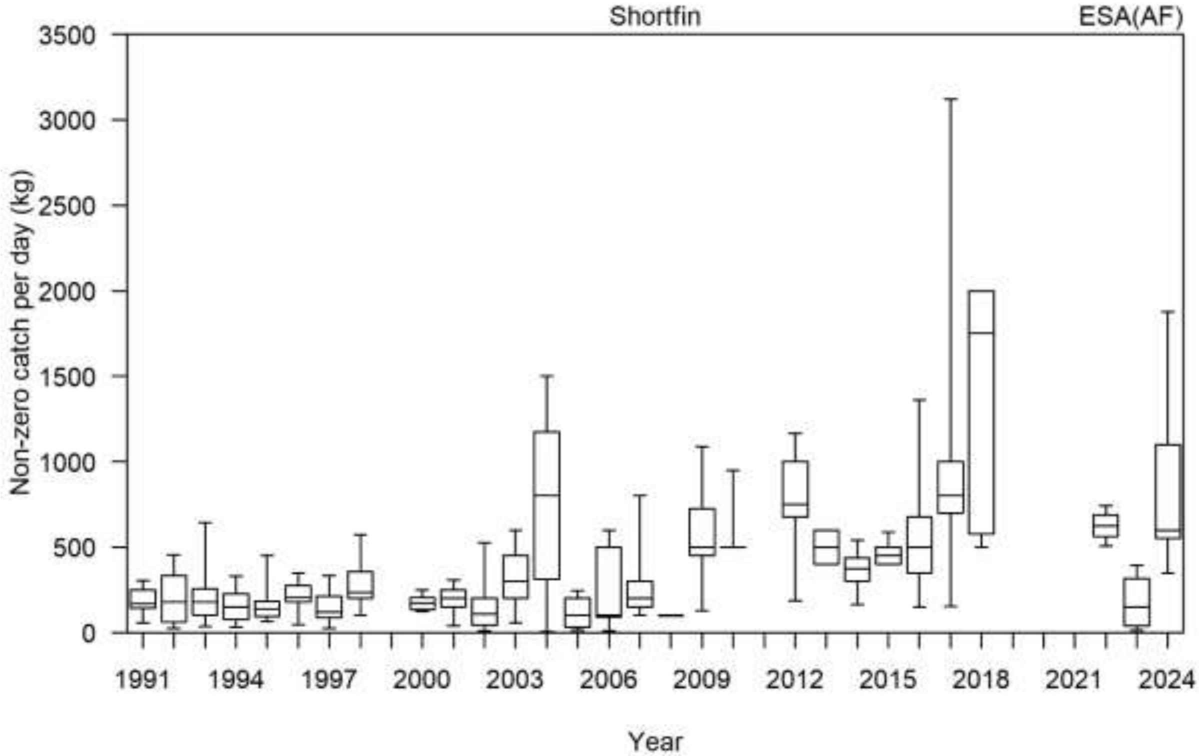

Figure F9: Shortfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AF).

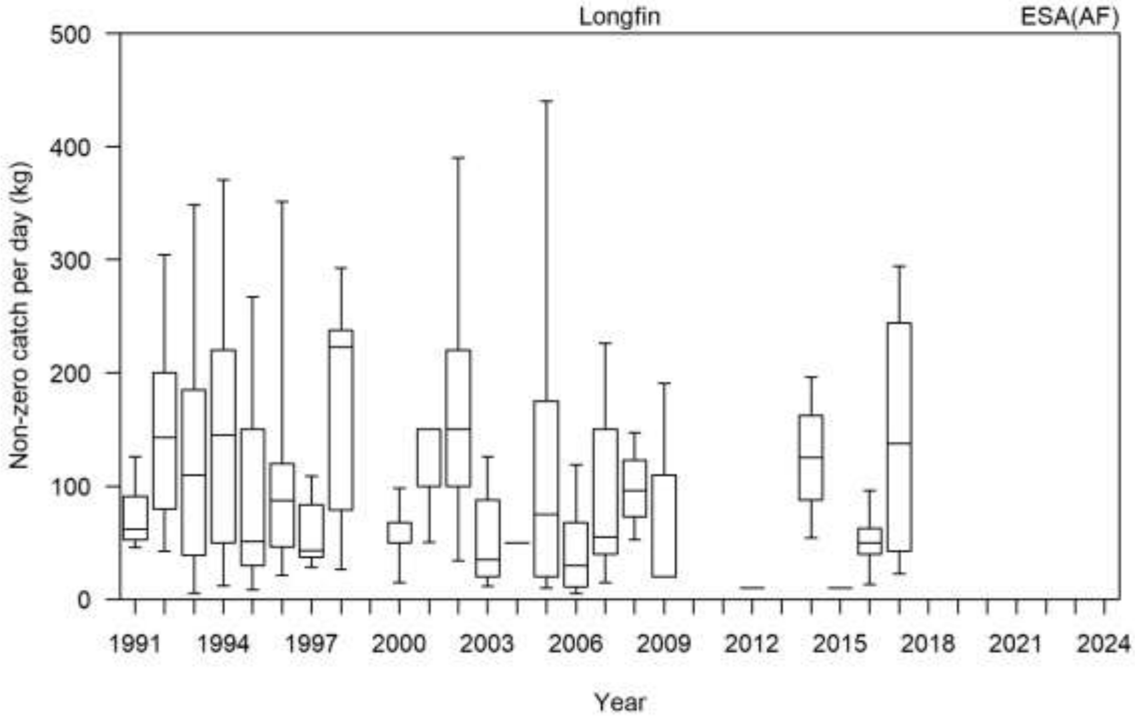

Figure F10: Longfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AF).

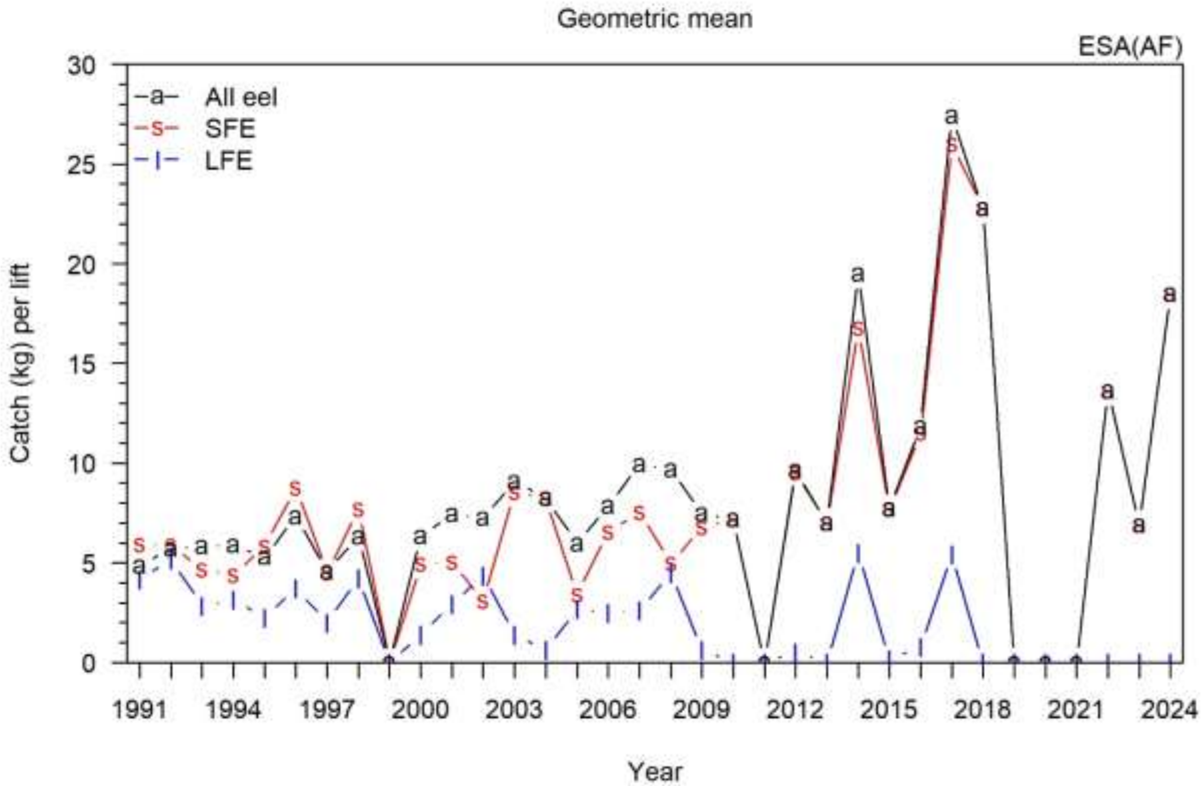

Figure F11: Unstandardised catch per lift (geometric mean of catch per lift) for all eels, shortfin (SFE), and longfin (LFE) for the years 1990–91 to 2023–24 (ESA AF).

ESA AG (Hawke's Bay)

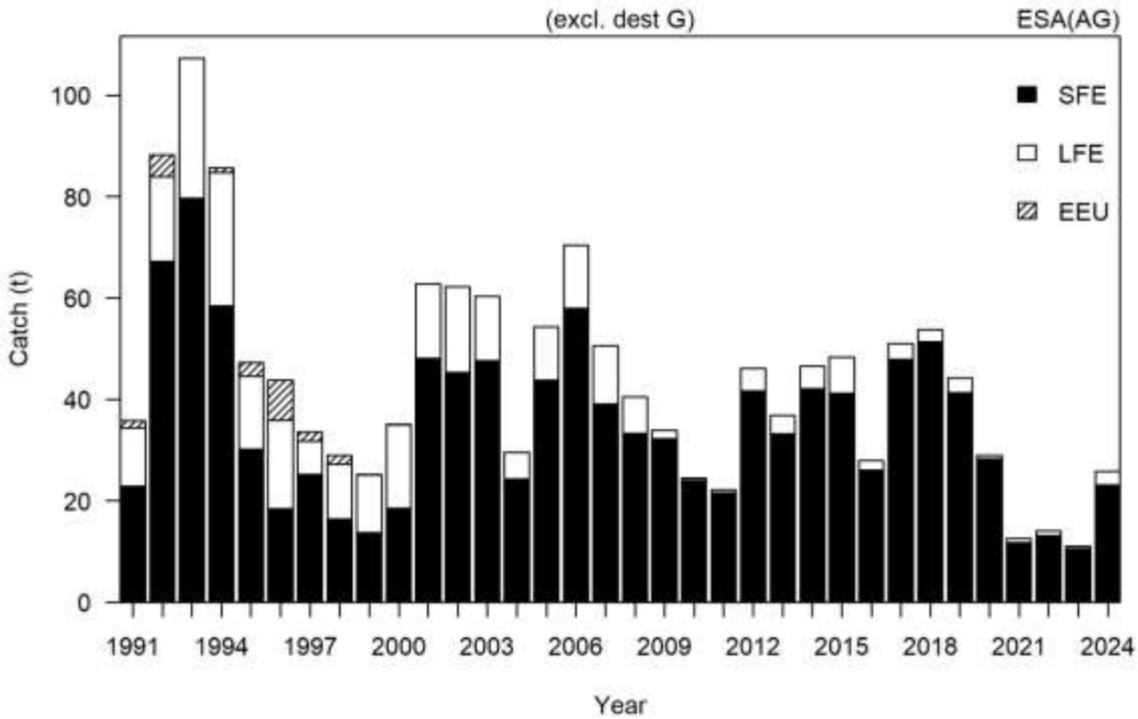

Figure G1: Total estimated commercial catch of shortfin (SFE), longfin (LFE), and unclassified eel catch (EEU) for the years 1990–91 to 2023–24 (ESA AG).

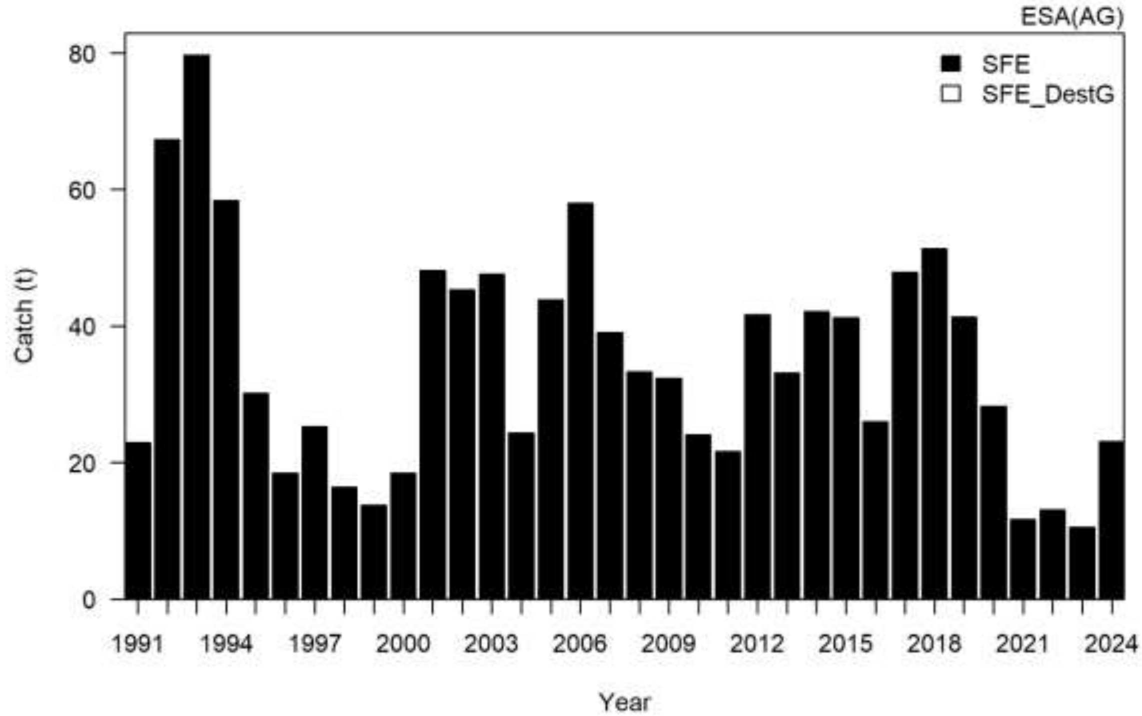

Figure G2: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AG).

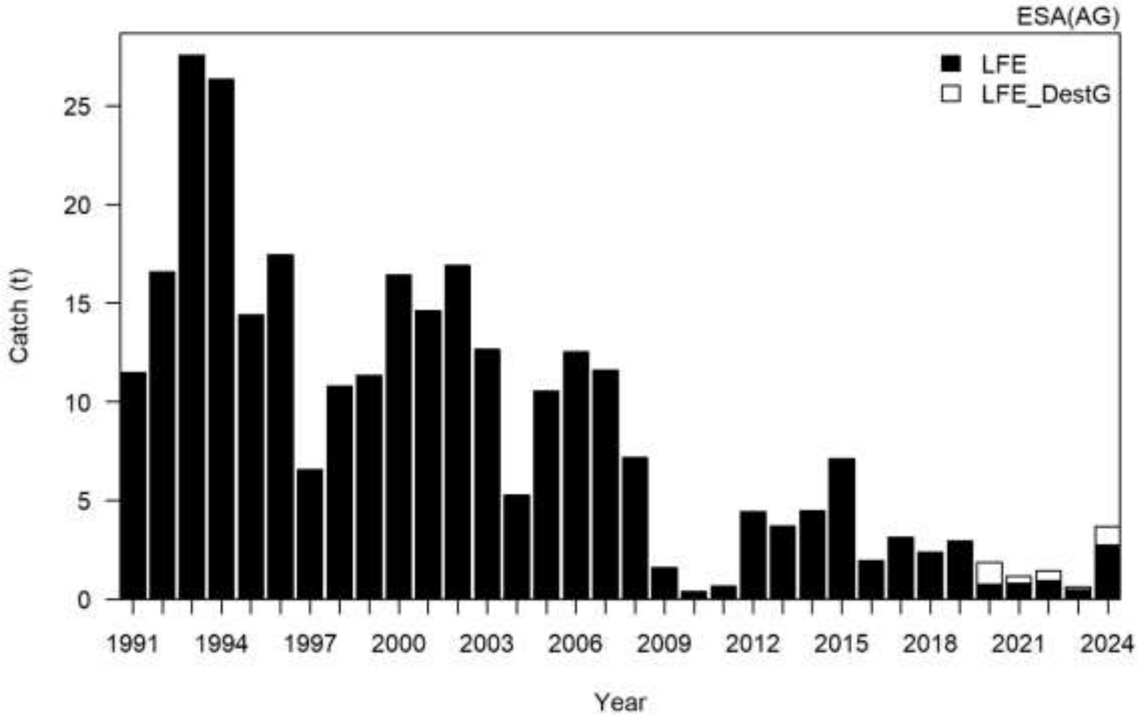

Figure G3: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AG).

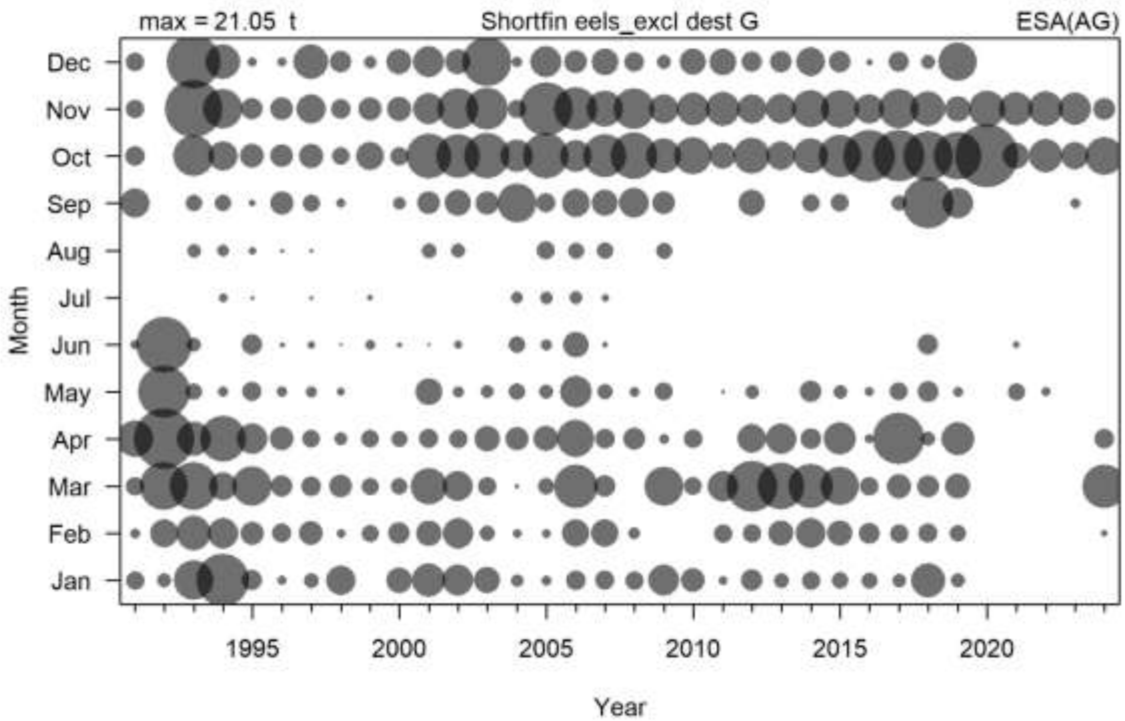

Figure G4: Shortfin eel catch by month for the years 1990–91 to 2023–24 (ESA AG).

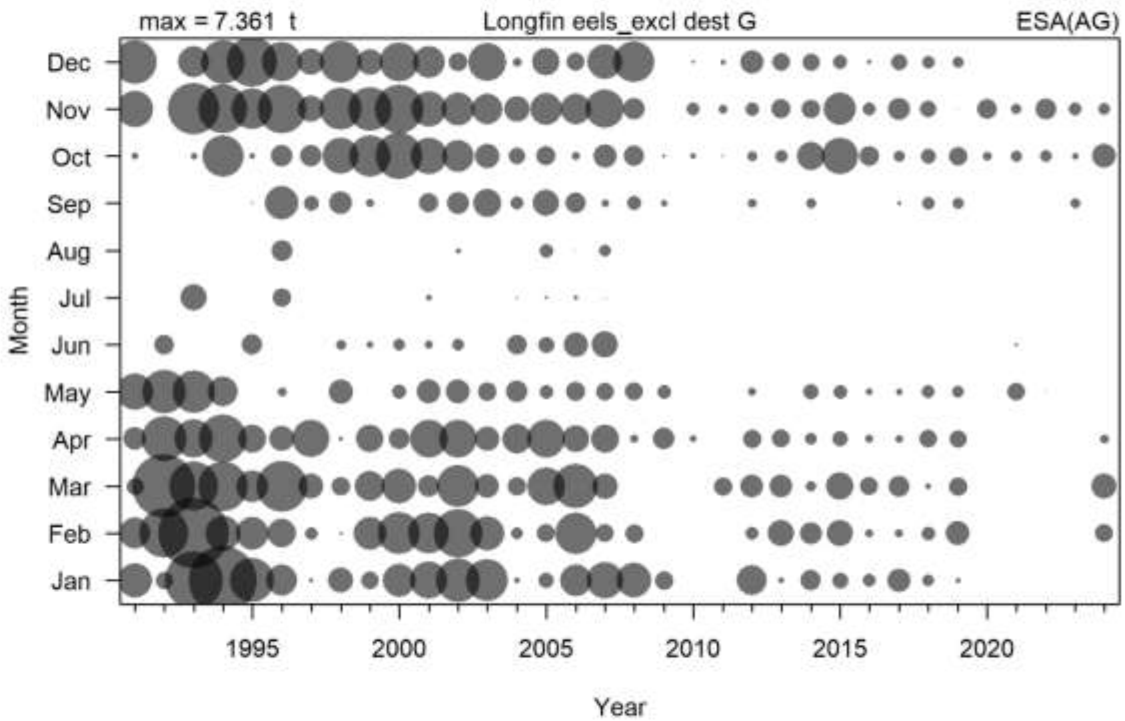

Figure G5: Longfin eel catch by month for the years 1990–91 to 2023–24 (ESA AG).

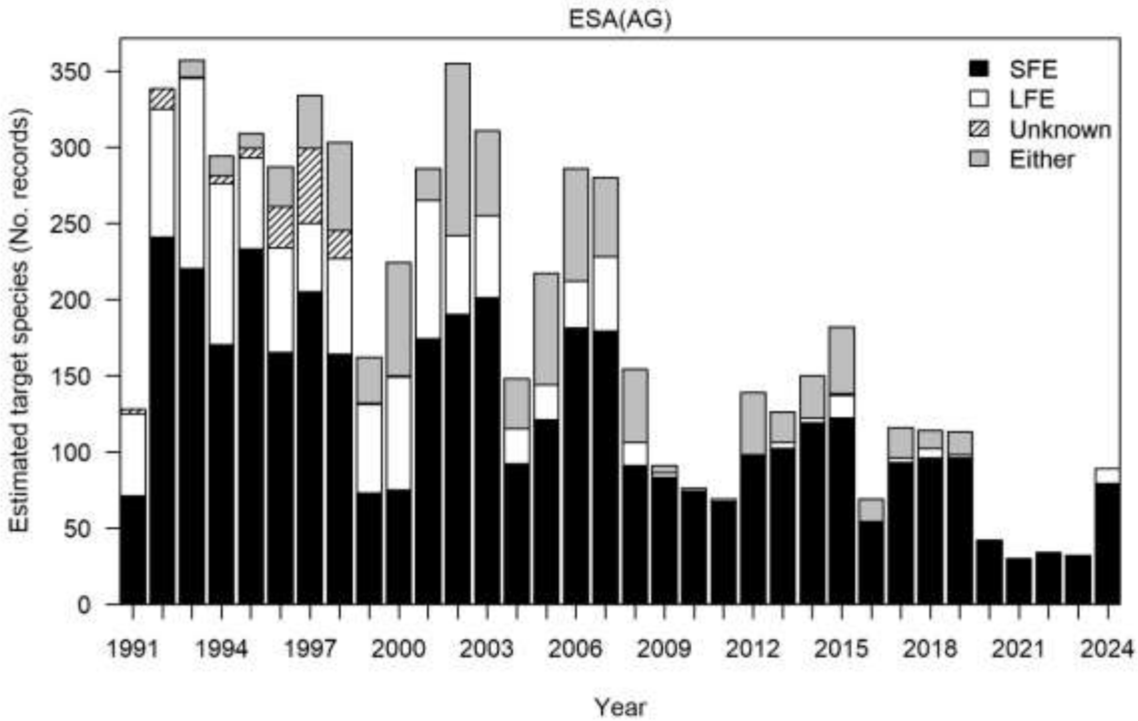

Figure G6: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AG).

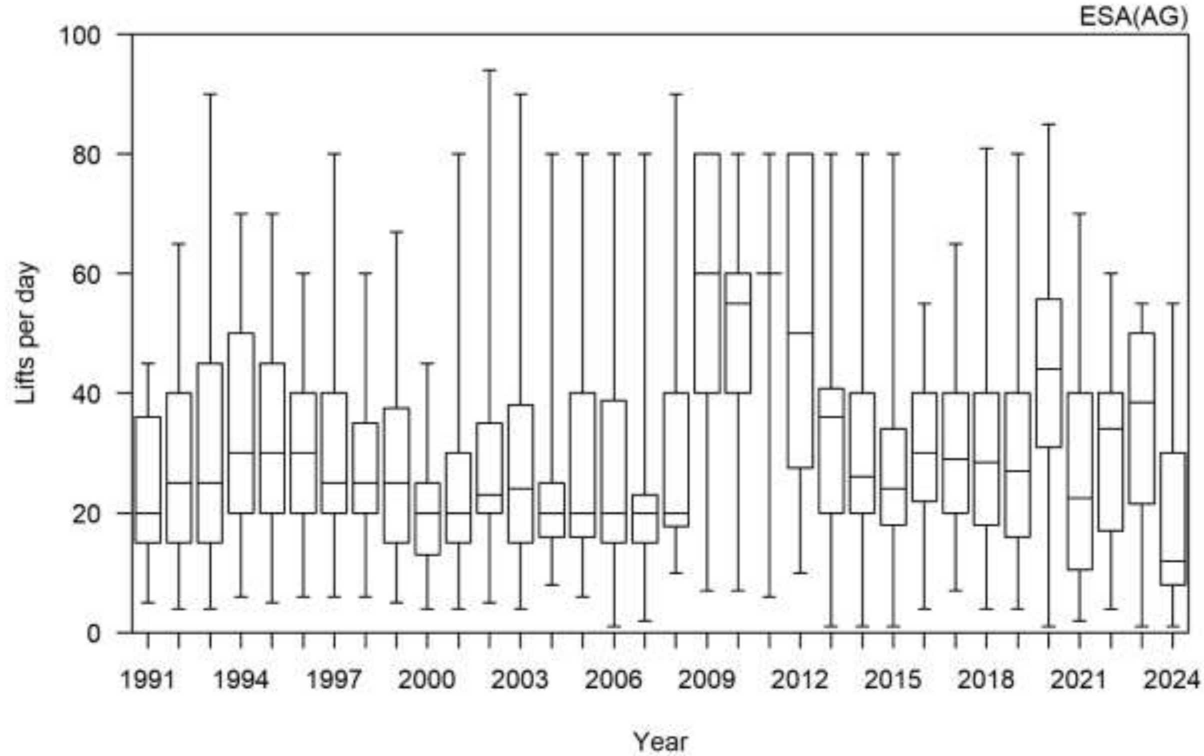

Figure G7: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AG).

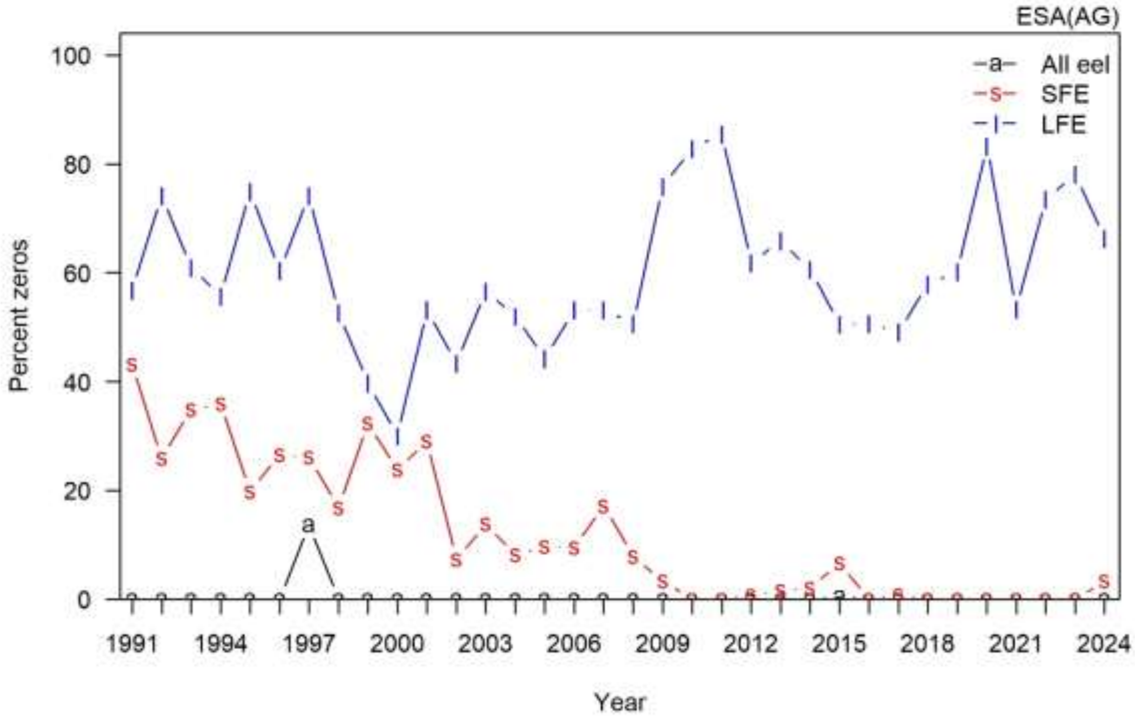

Figure G8: Proportion of valid zero records for all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AG).

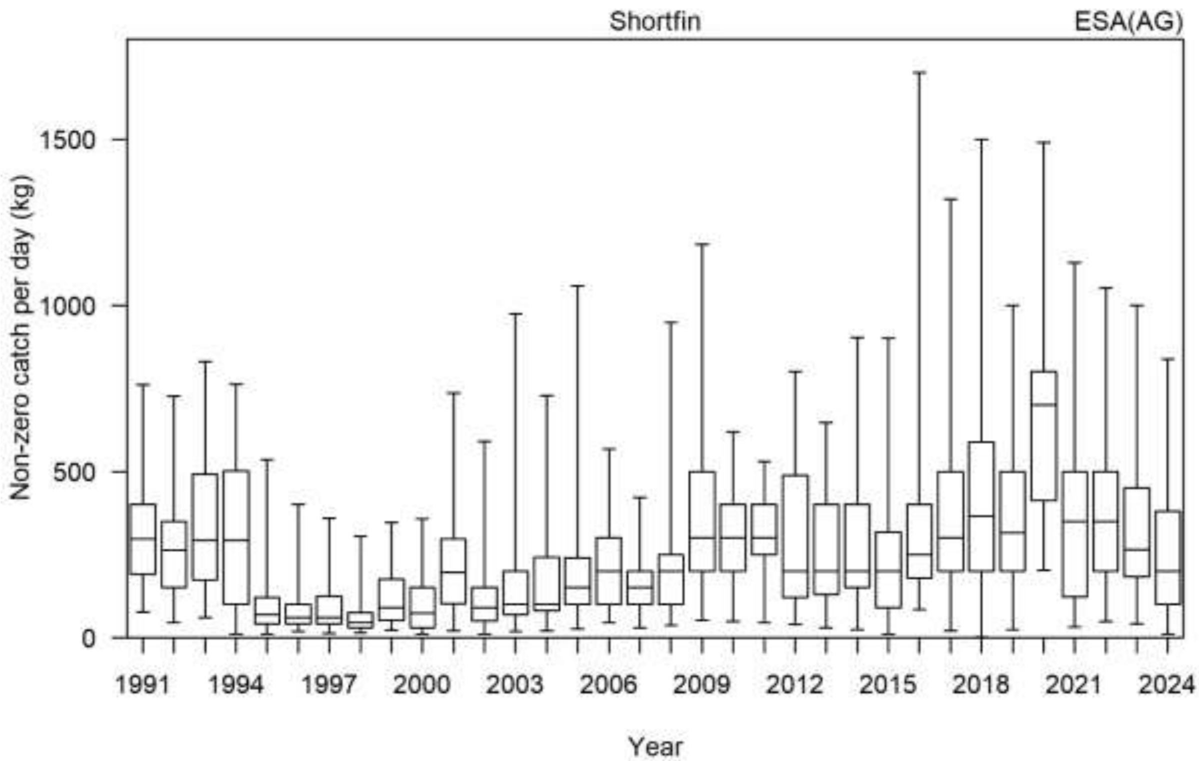

Figure G9: Shortfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AG).

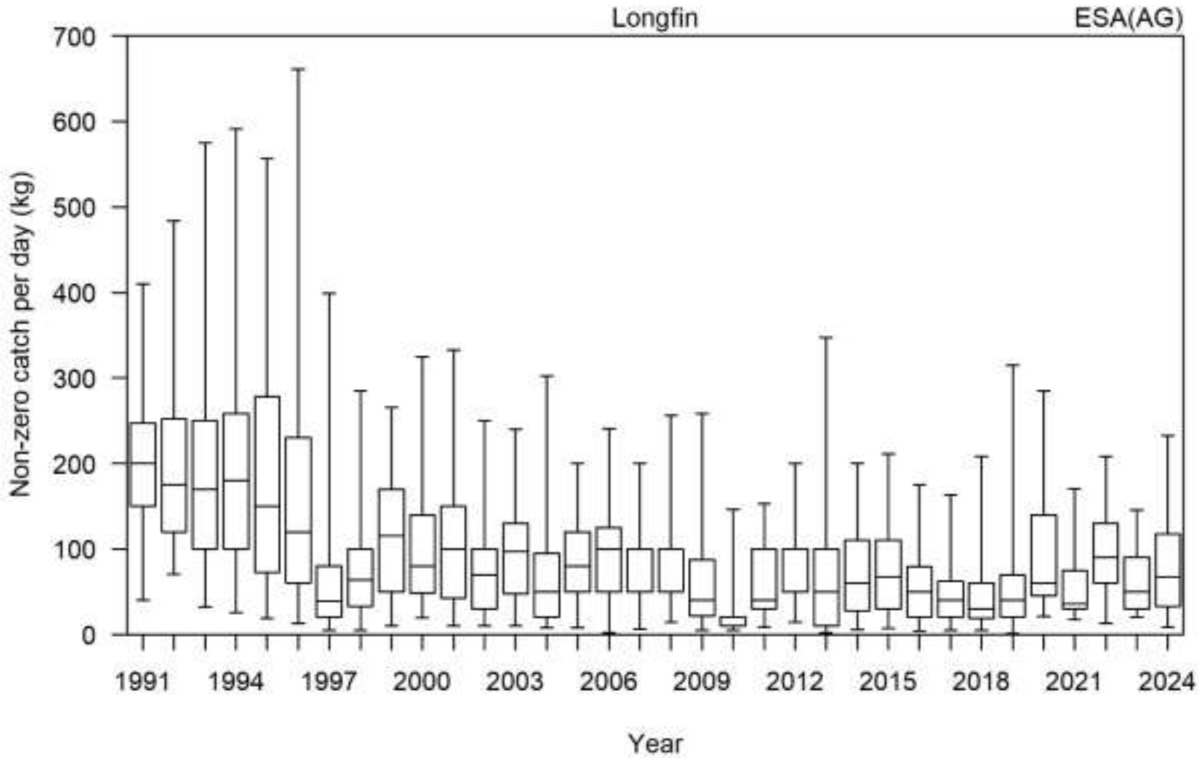

Figure G10: Longfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AG).

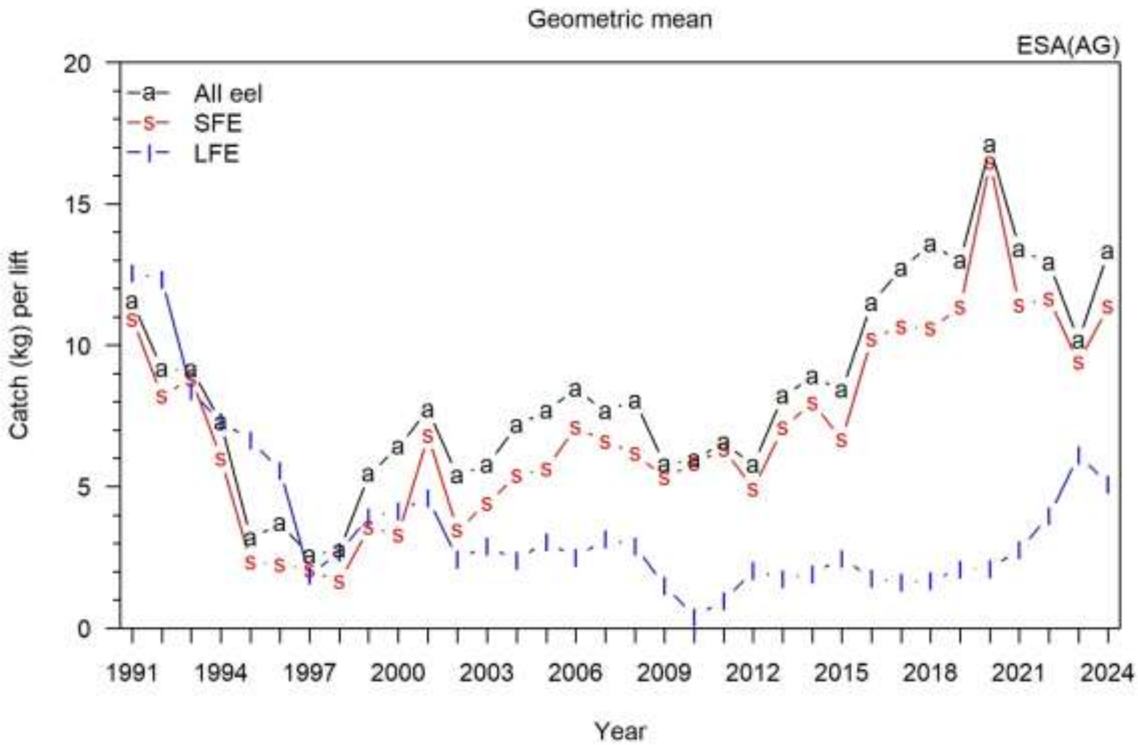

Figure G11: Unstandardised catch per lift (geometric mean of catch per lift) for all eels, shortfin (SFE), and longfin (LFE) for the years 1990–91 to 2023–24 (ESA AG).

ESA AH (Rangitikei-Whanganui)

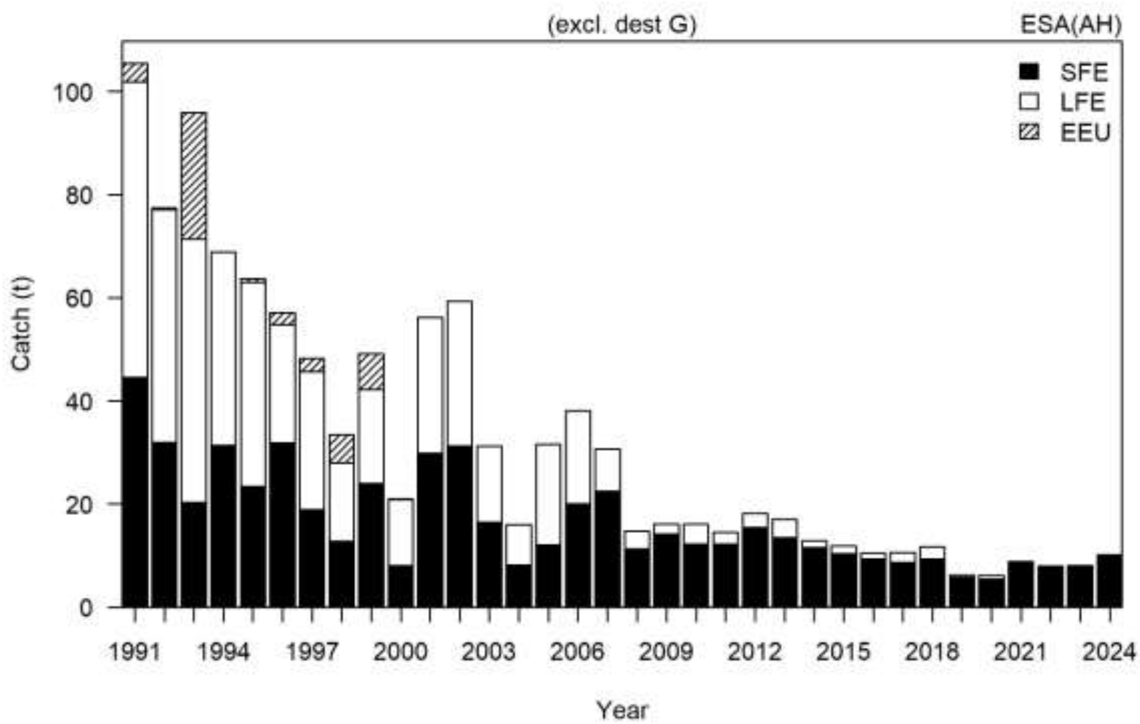

Figure H1: Total estimated commercial catch of shortfin (SFE), longfin (LFE), and unclassified eel catch (EEU) for the years 1990–91 to 2023–24 (ESA AH).

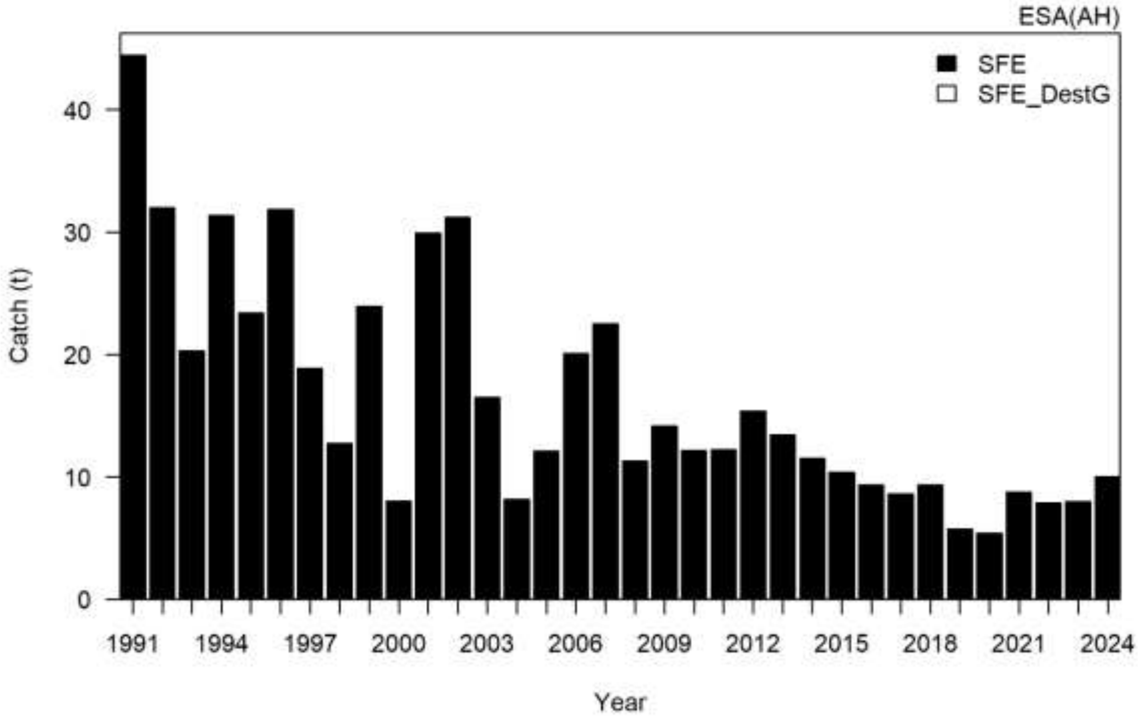

Figure H2: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AH).

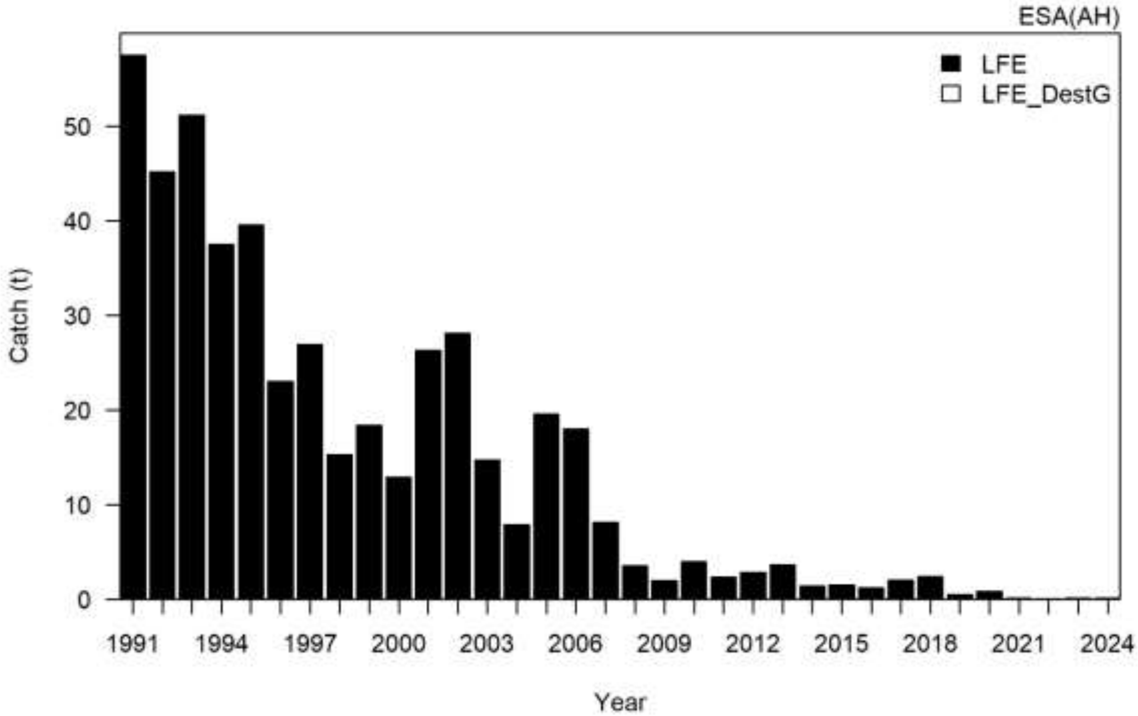

Figure H3: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AH).

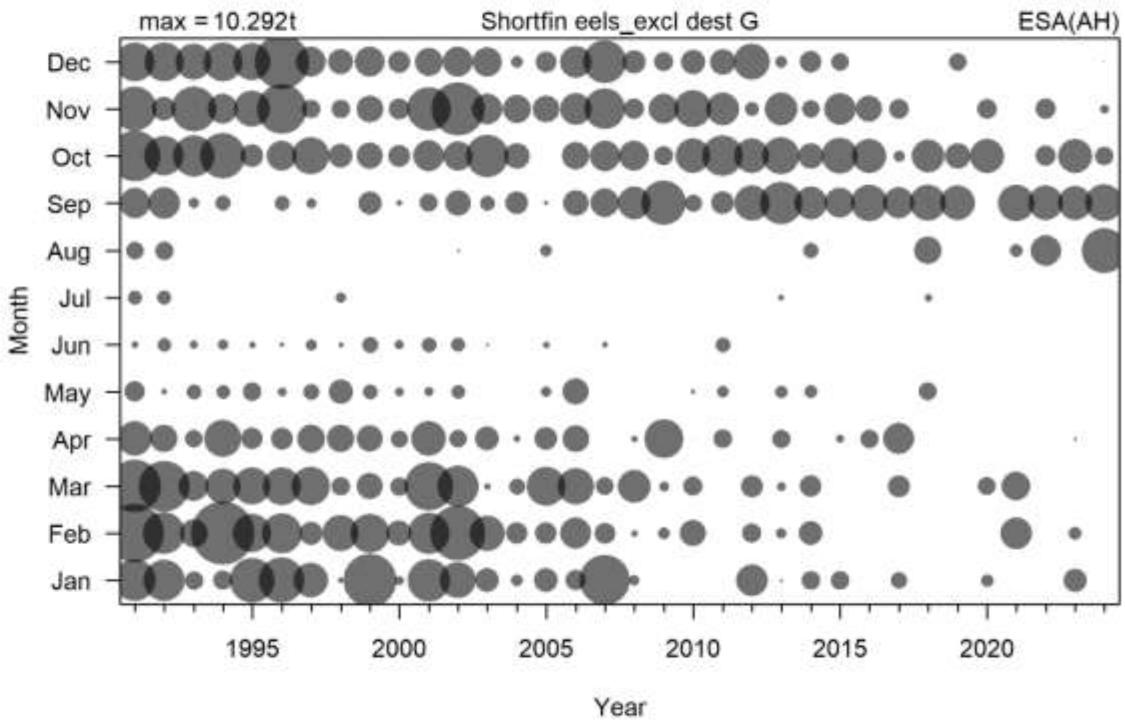

Figure H4: Shortfin eel catch by month for the years 1990–91 to 2023–24 (ESA AH).

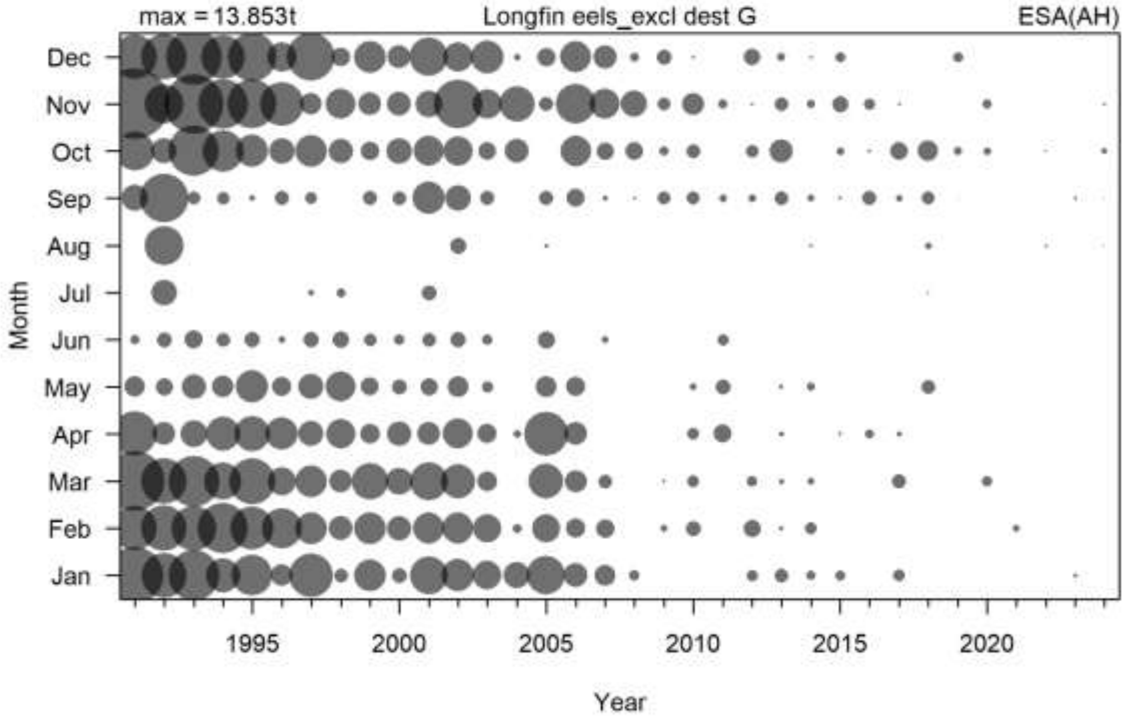

Figure H5: Longfin eel catch by month for the years 1990–91 to 2023–24 (ESA AH).

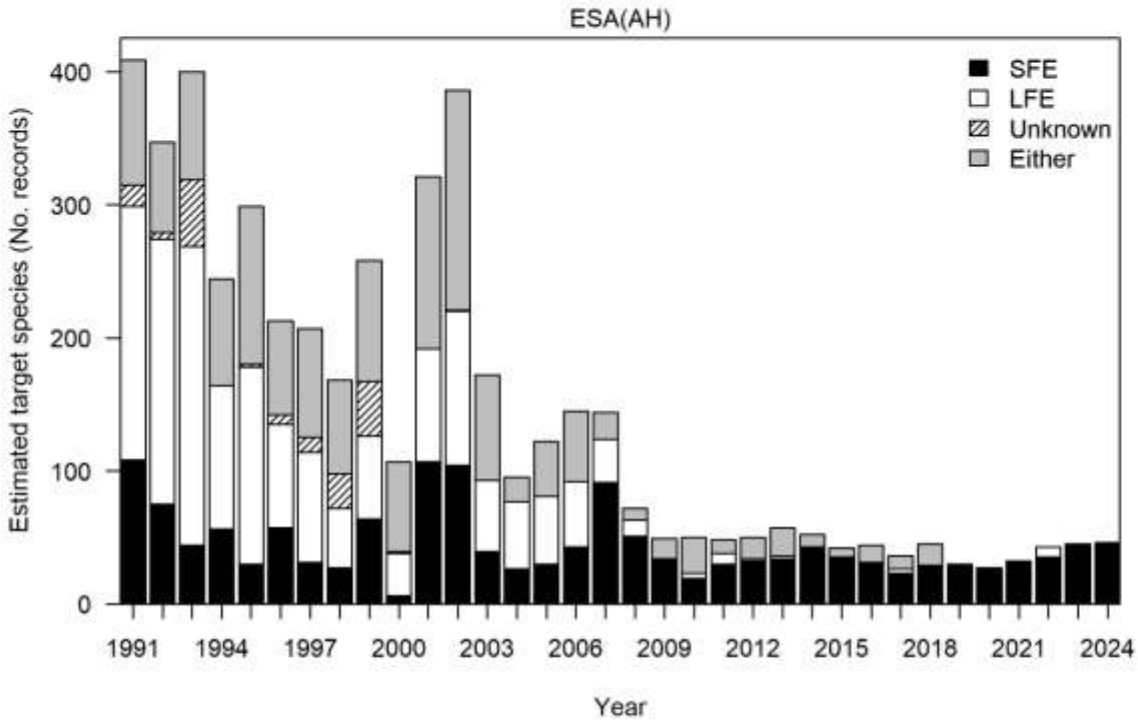

Figure H6: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AH).

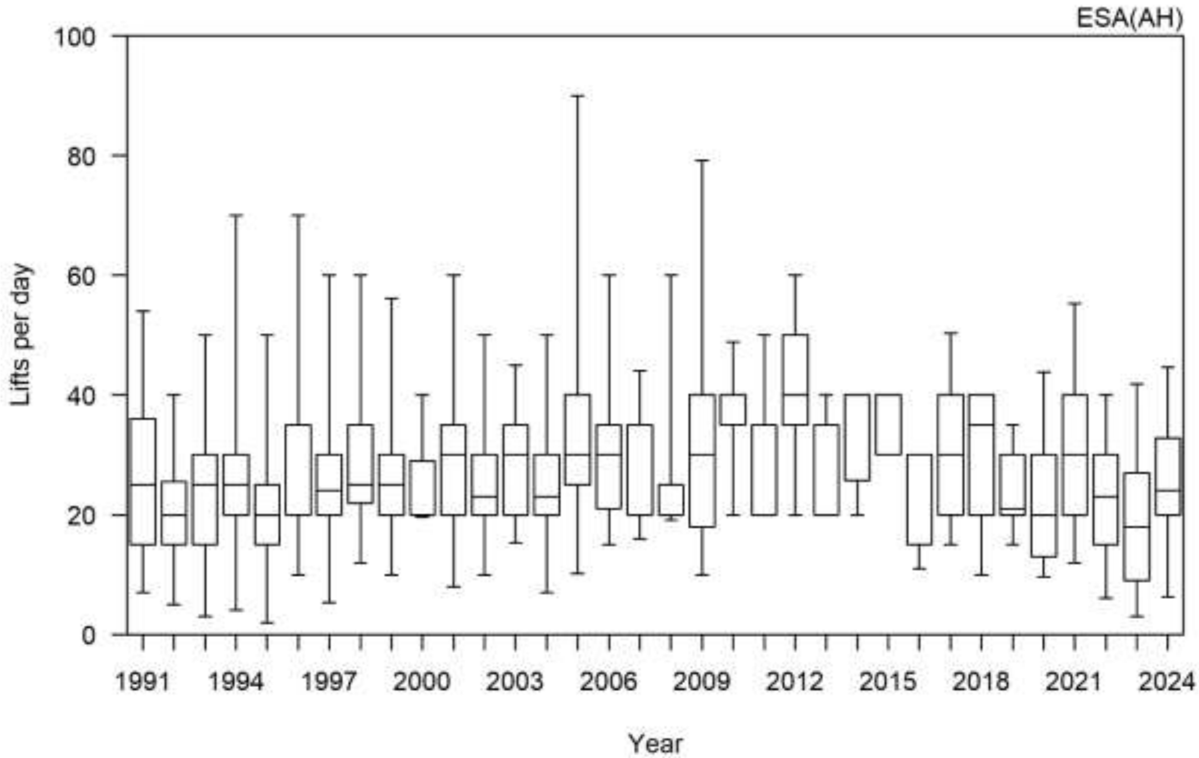

Figure H7: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AH).

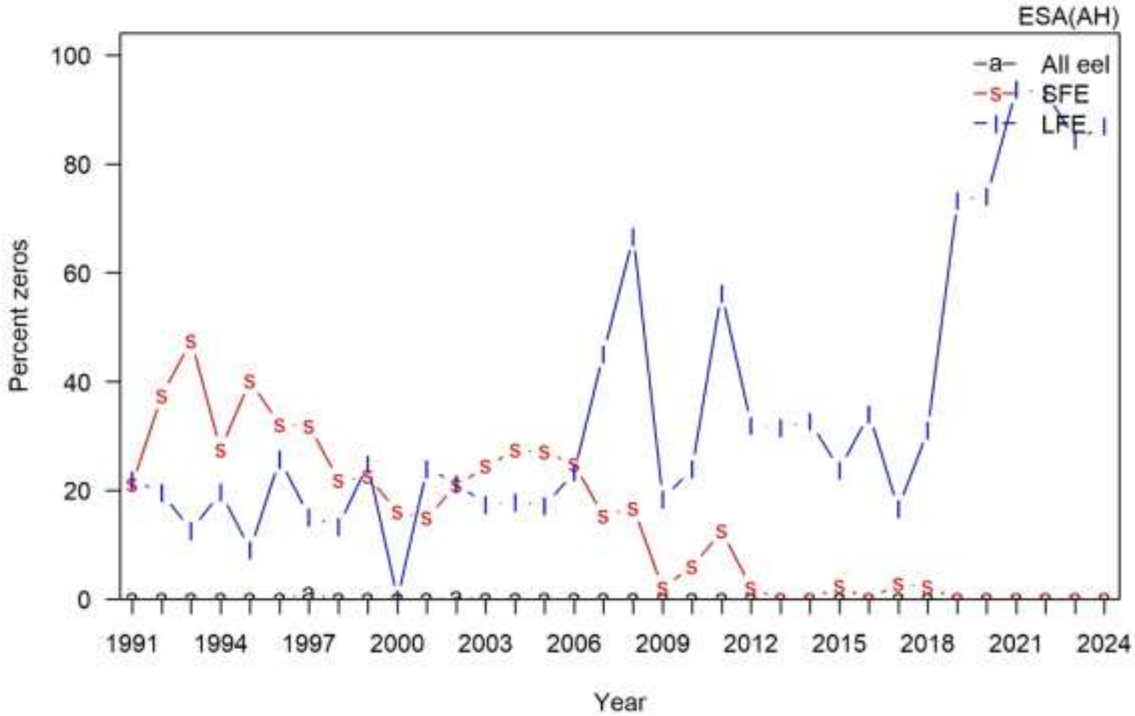

Figure H8: Proportion of valid zero records for all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AH).

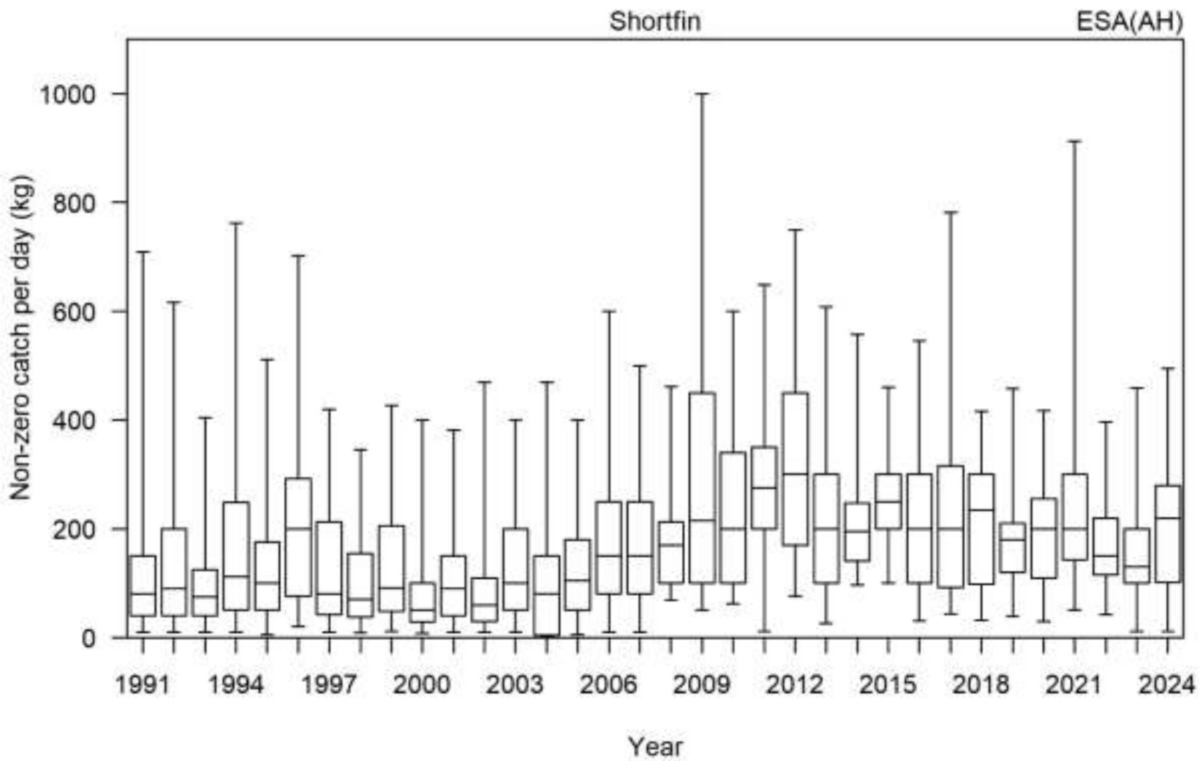

Figure H9: Shortfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AH).

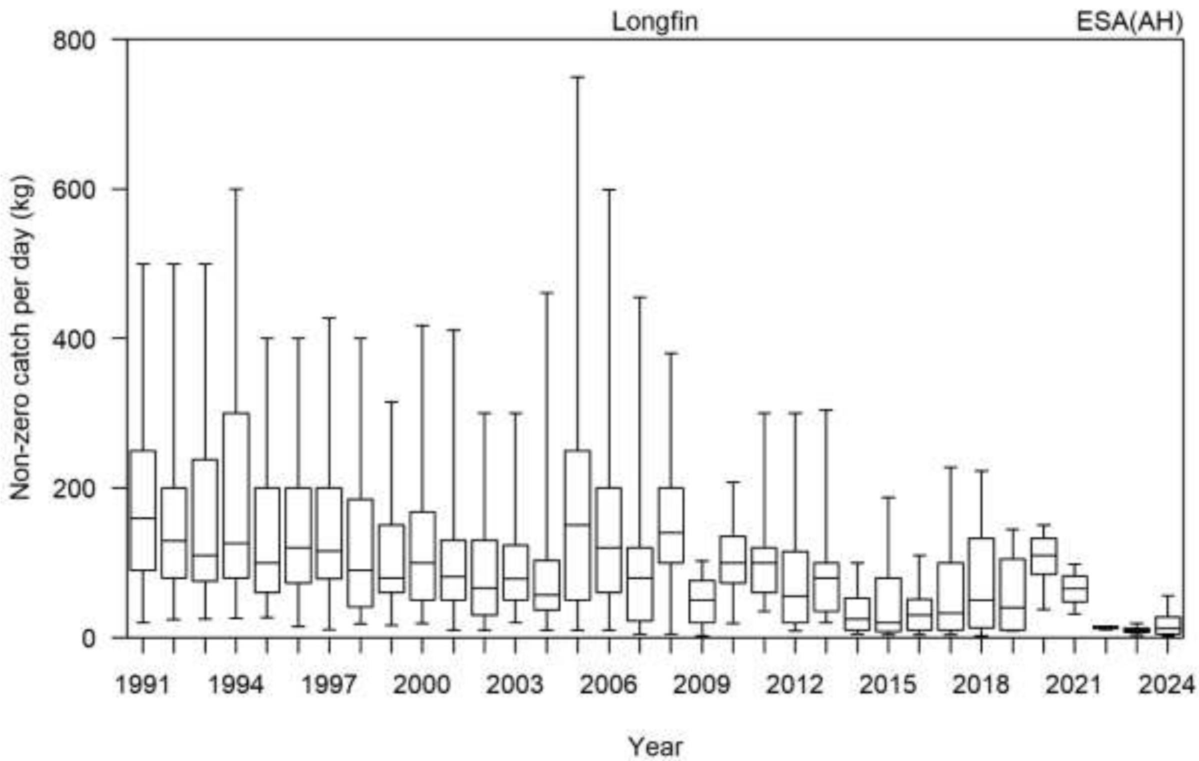

Figure H10: Longfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AH).

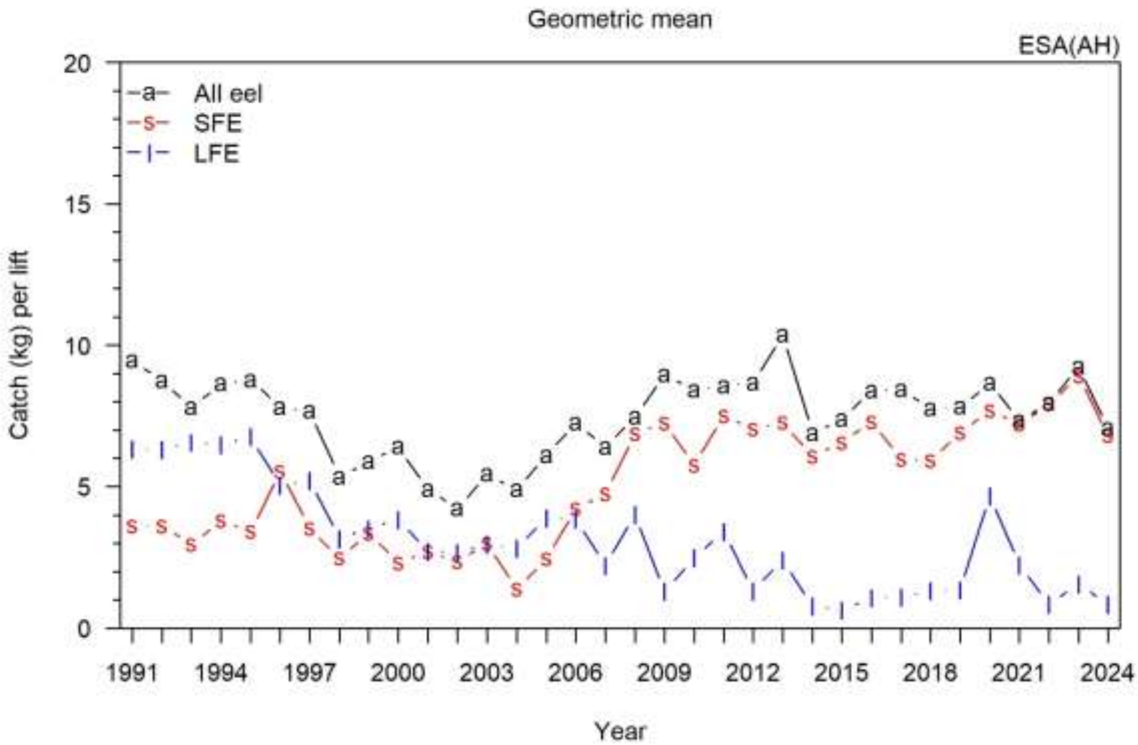

Figure H11: Unstandardised catch per lift (geometric mean of catch per lift) for all eels, shortfin (SFE), and longfin (LFE) for the years 1990–91 to 2023–24 (ESA AH).

ESA AJ (Taranaki)

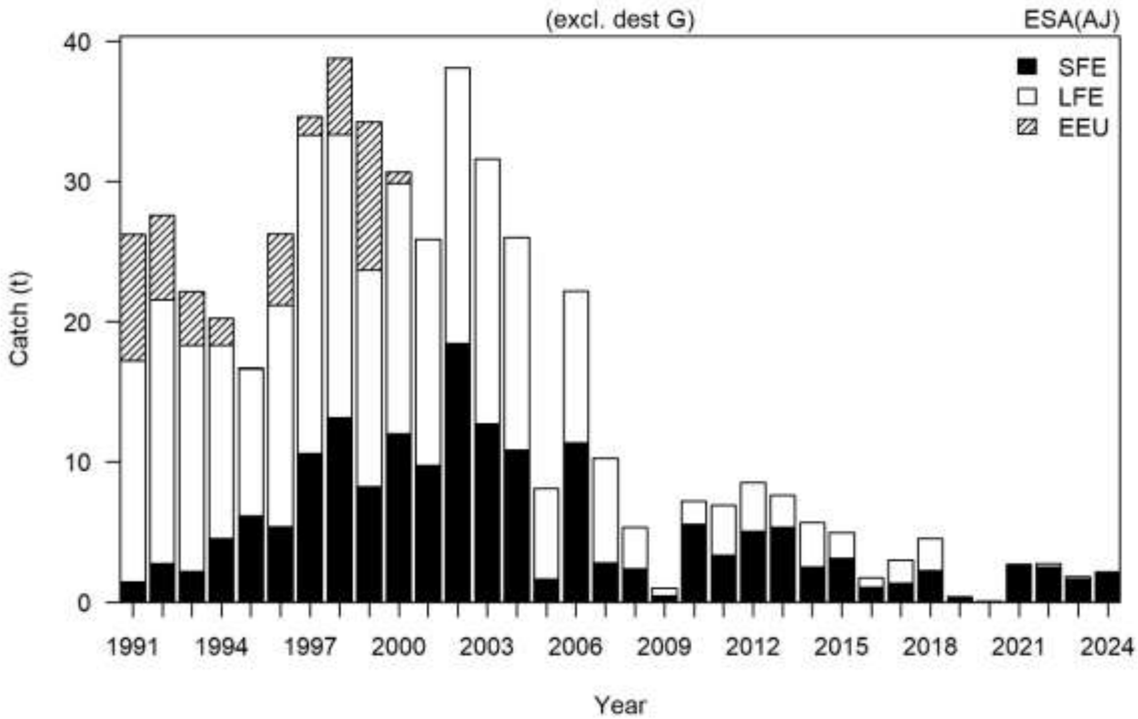

Figure J1: Total estimated commercial catch of shortfin (SFE), longfin (LFE), and unclassified eel catch (EEU) for the years 1990–91 to 2023–24 (ESA AJ).

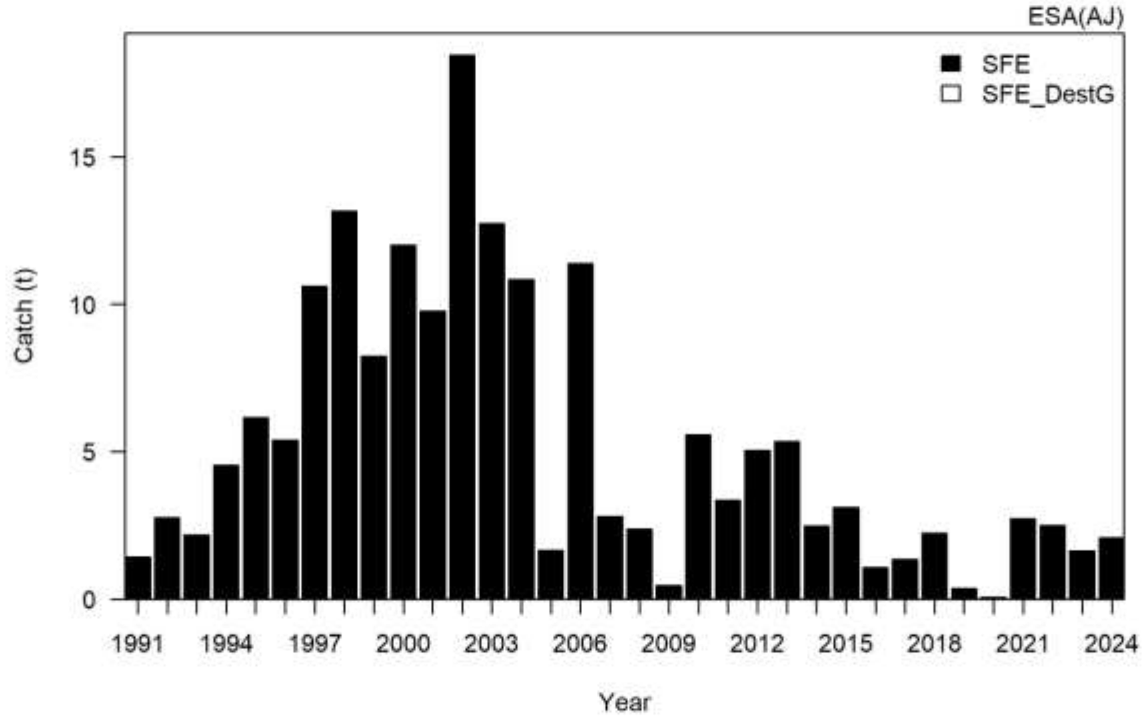

Figure J2: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AJ).

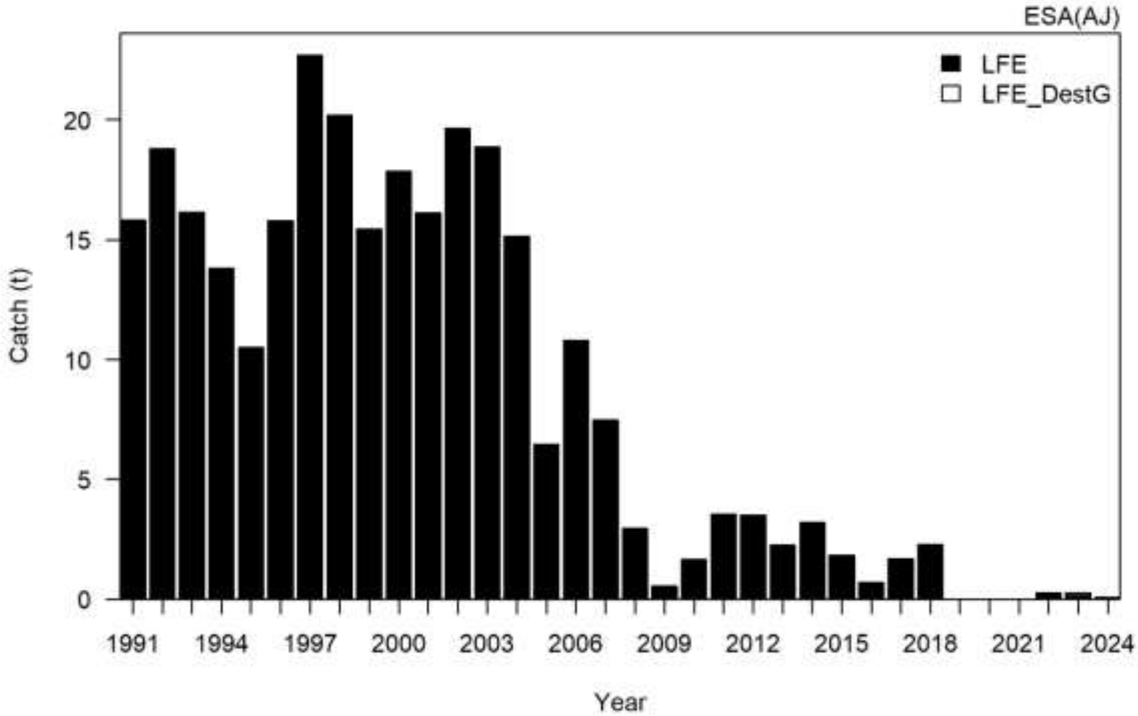

Figure J3: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AJ).

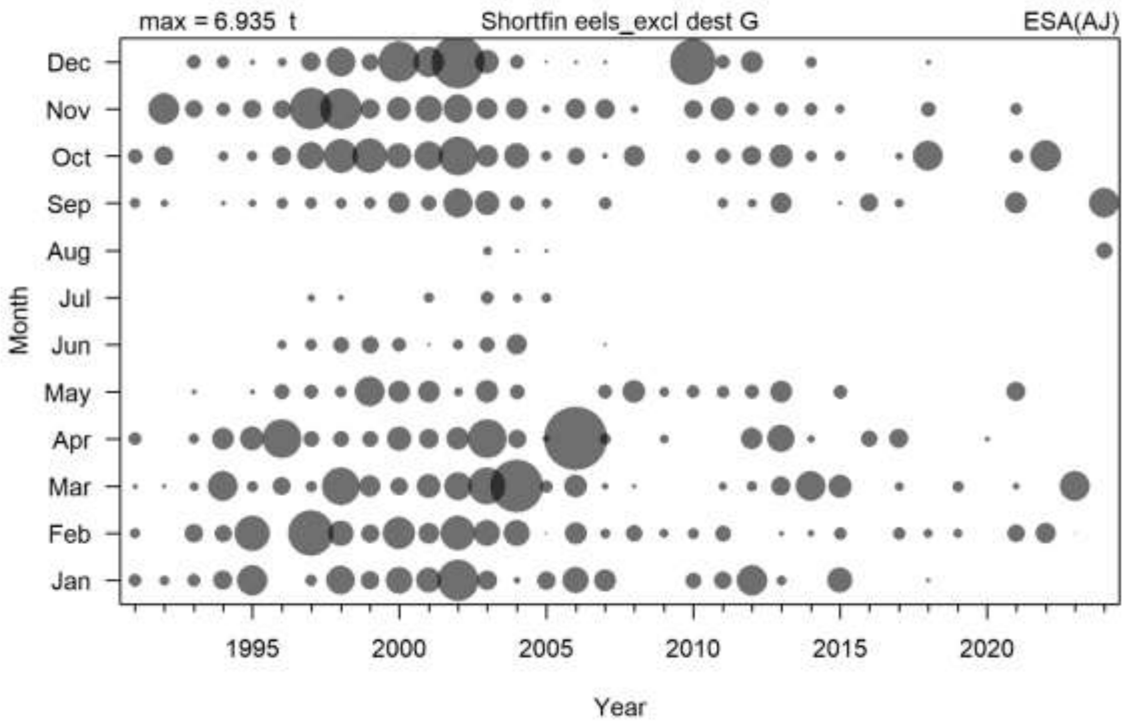

Figure J4: Shortfin eel catch by month for the years 1990–91 to 2023–24 (ESA AJ).

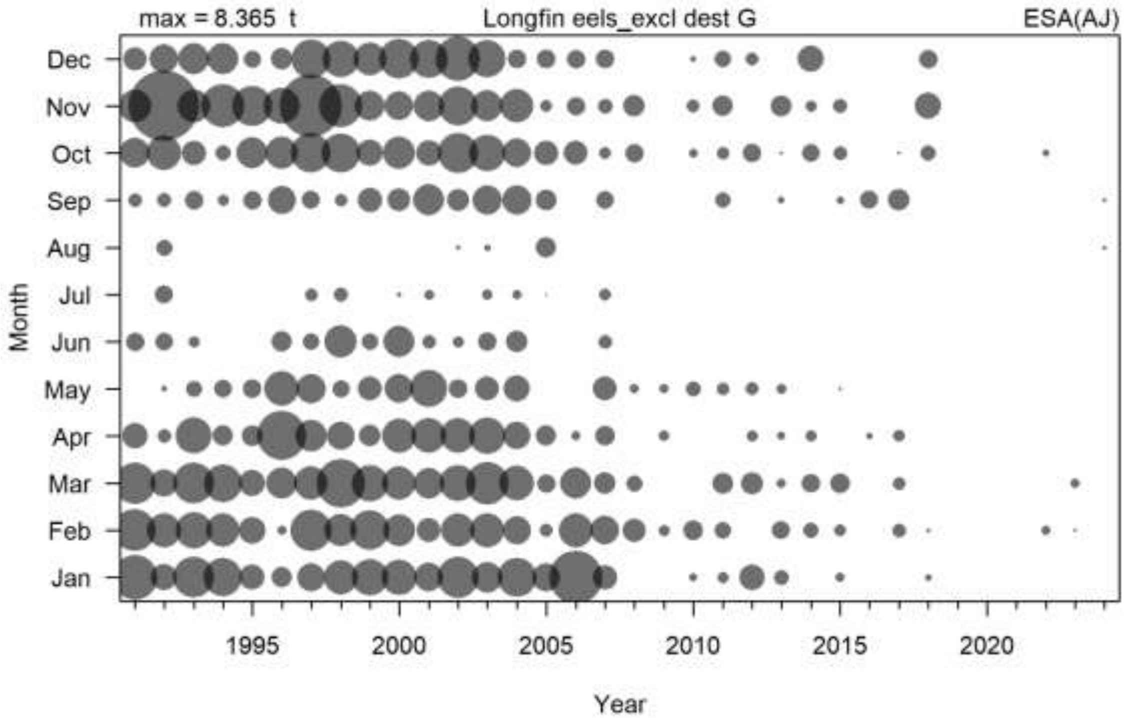

Figure J5: Longfin eel catch by month for the years 1990–91 to 2023–24 (ESA AJ).

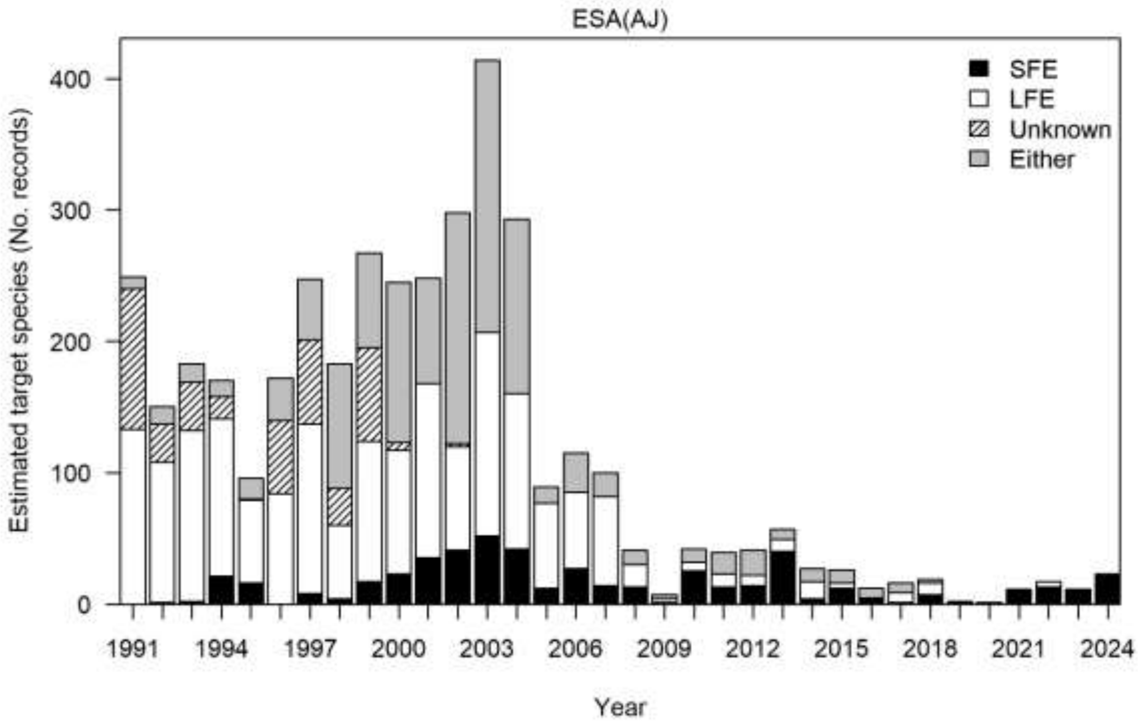

Figure J6: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AJ).

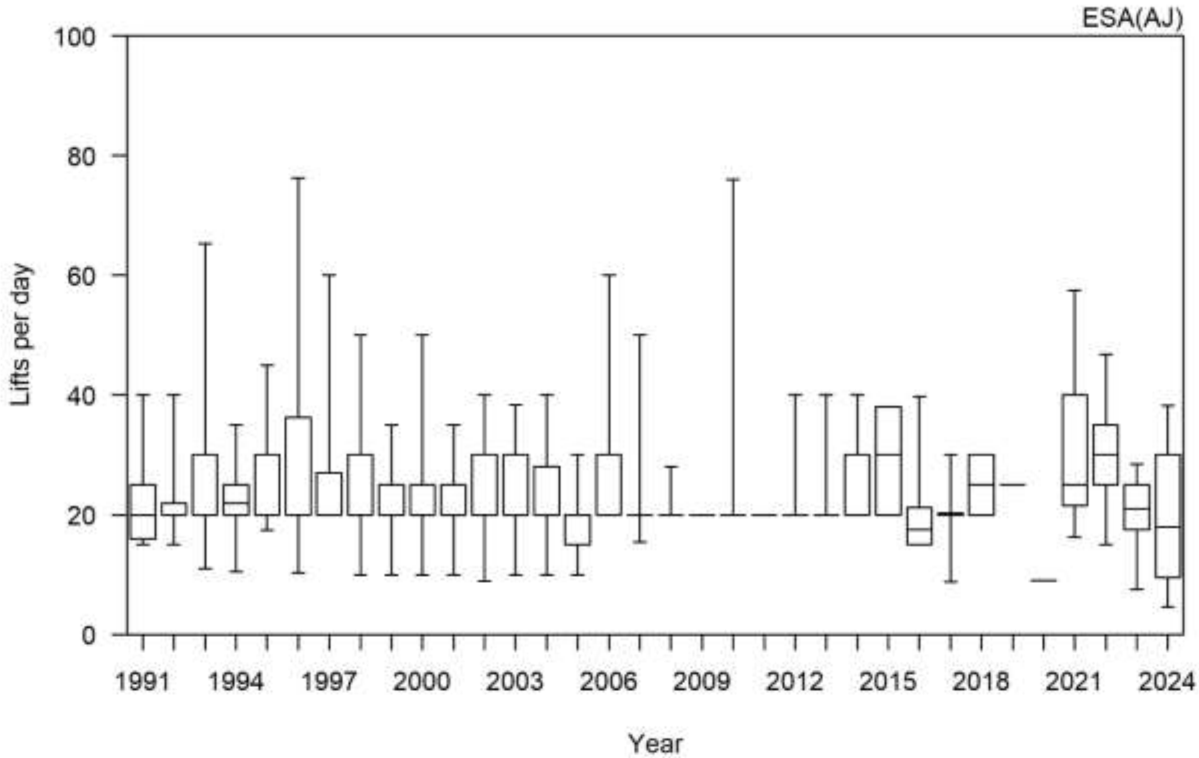

Figure J7: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AJ).

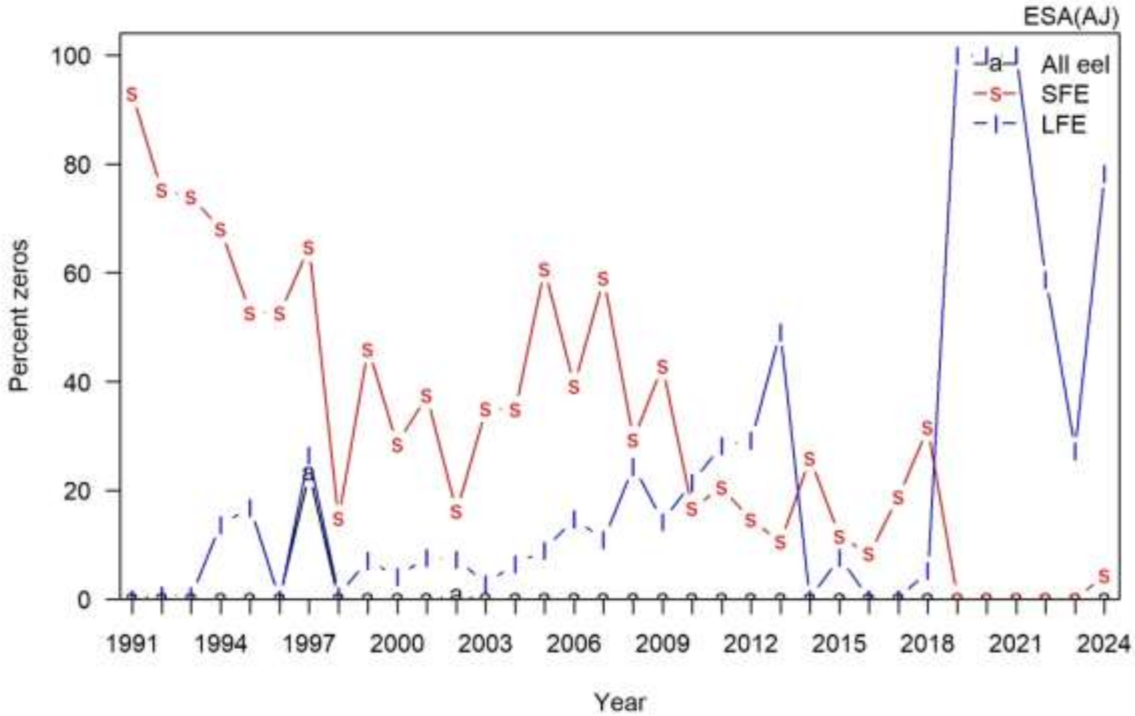

Figure J8: Proportion of valid zero records for all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AJ).

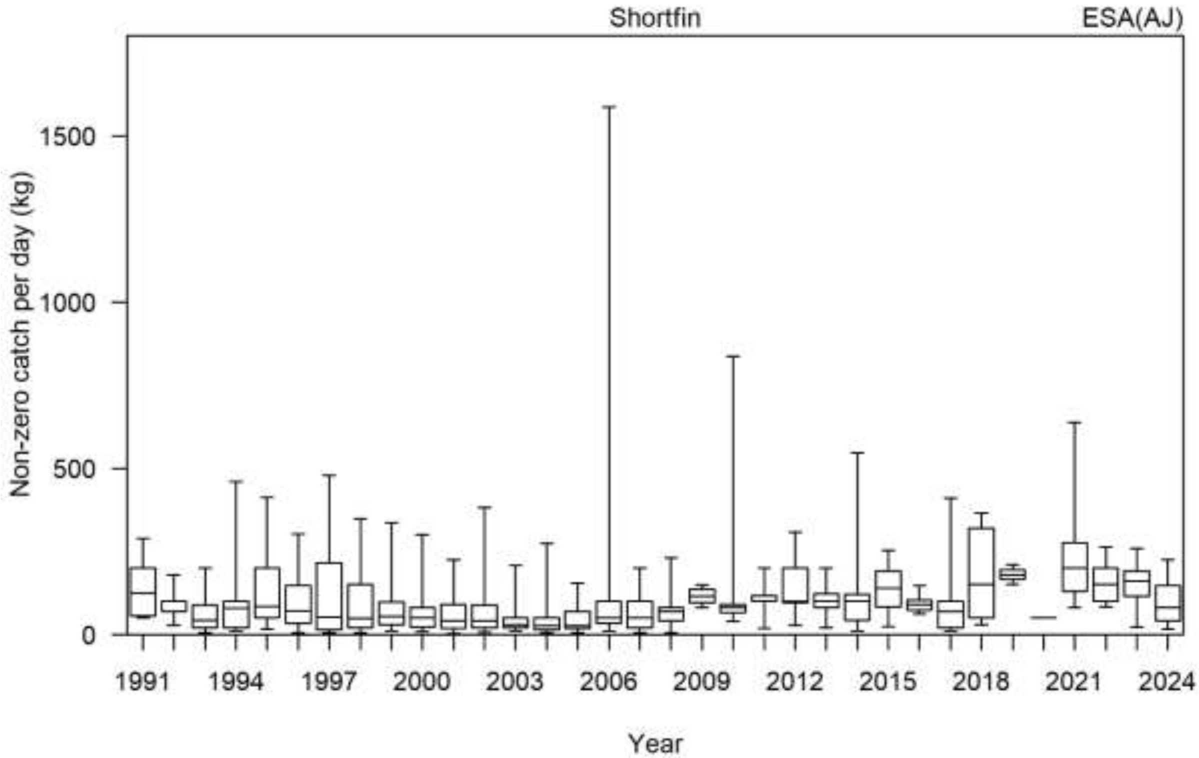

Figure J9: Shortfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AJ).

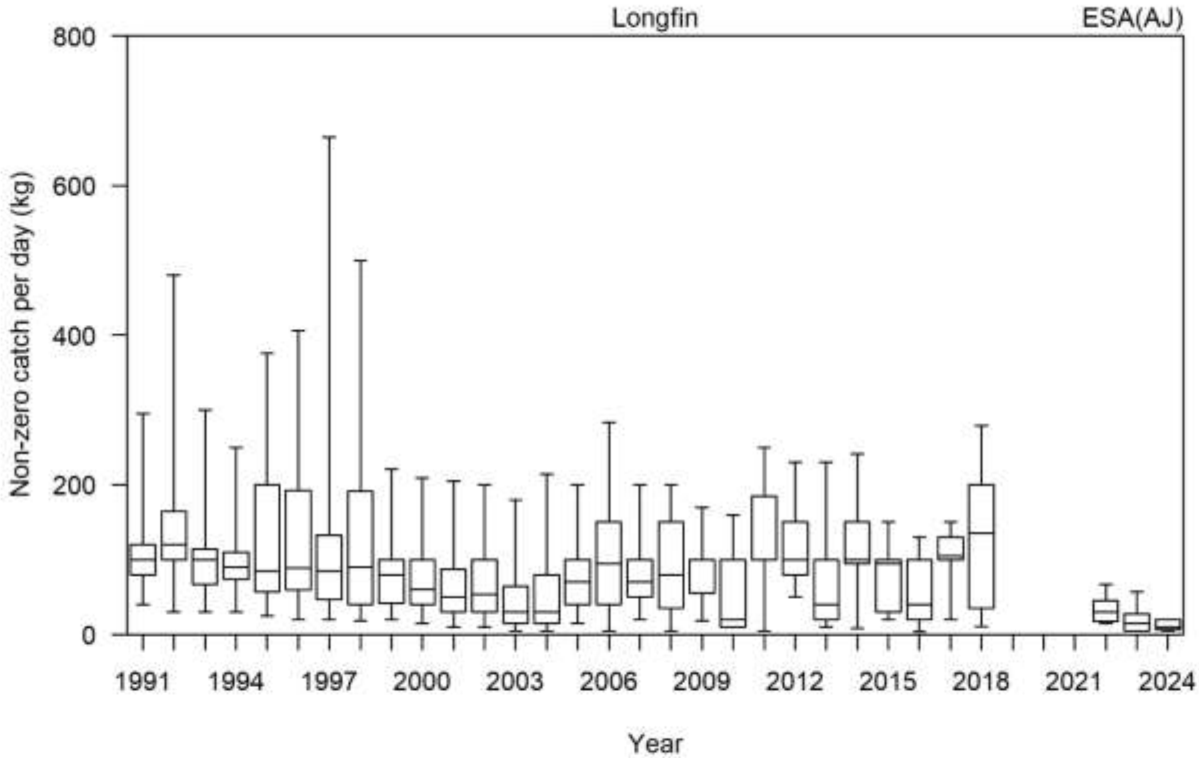

Figure J10: Longfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AJ).

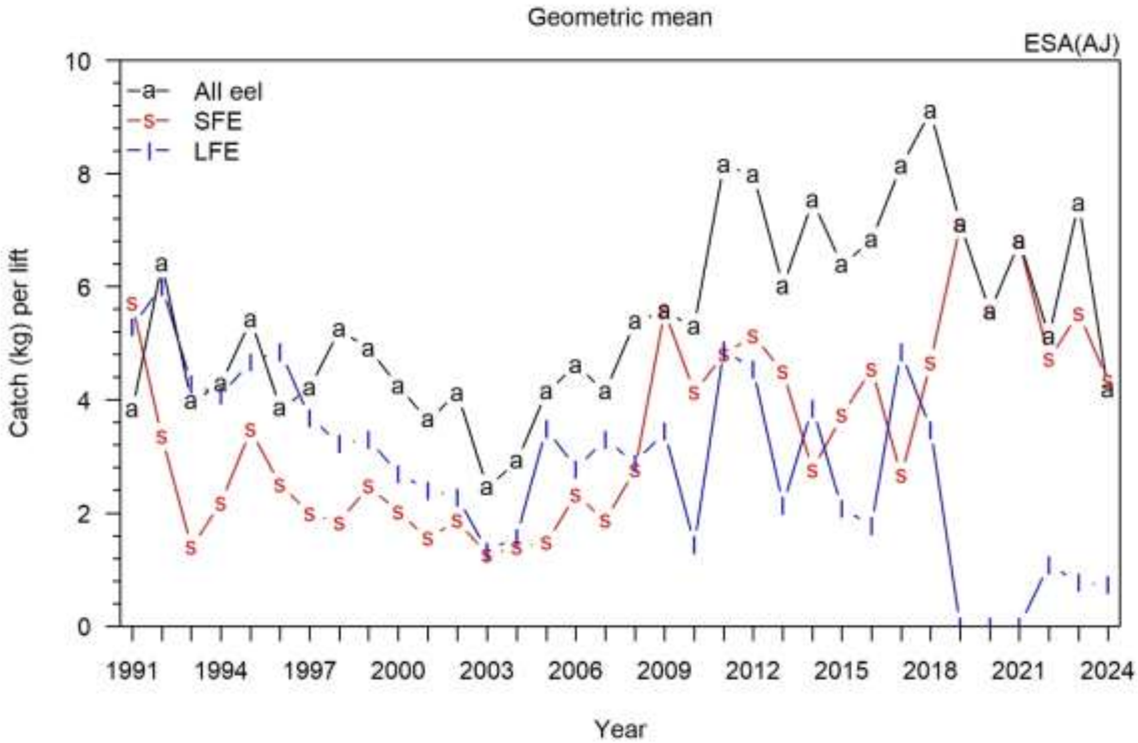

Figure J11: Unstandardised catch per lift (geometric mean of catch per lift) for all eels, shortfin (SFE), and longfin (LFE) for the years 1990–91 to 2023–24 (ESA AJ).

ESA AK (Manawatu)

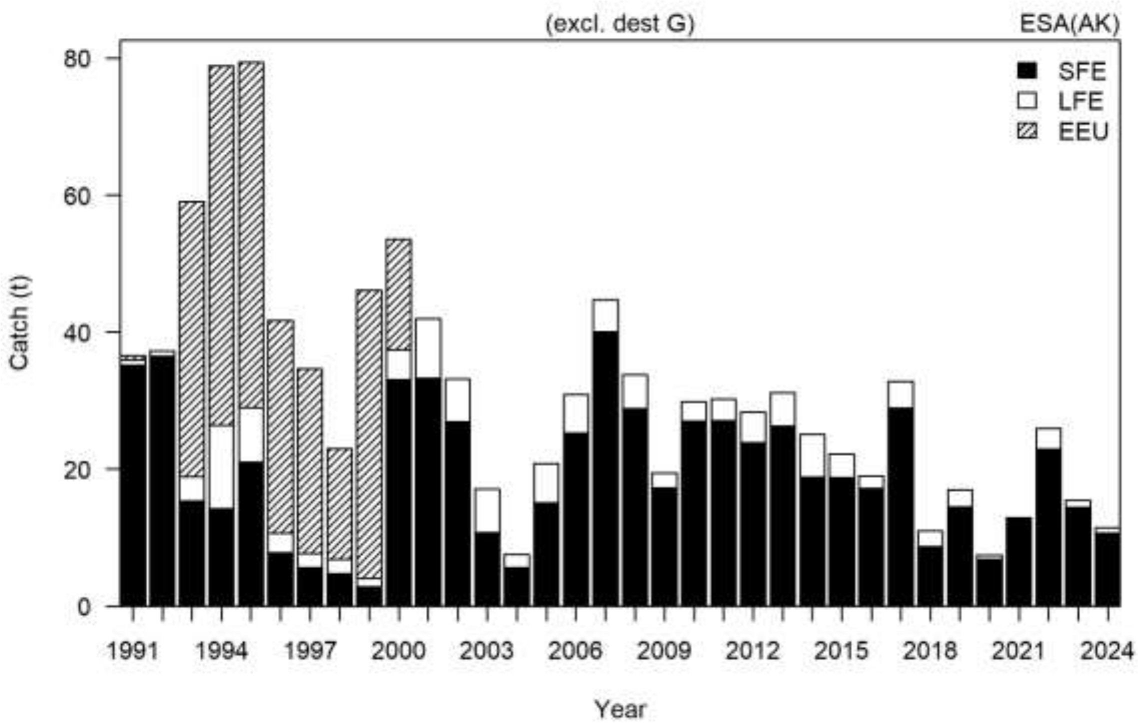

Figure K1: Total estimated commercial catch of shortfin (SFE), longfin (LFE), and unclassified eel catch (EEU) for the years 1990–91 to 2023–24 (ESA AK).

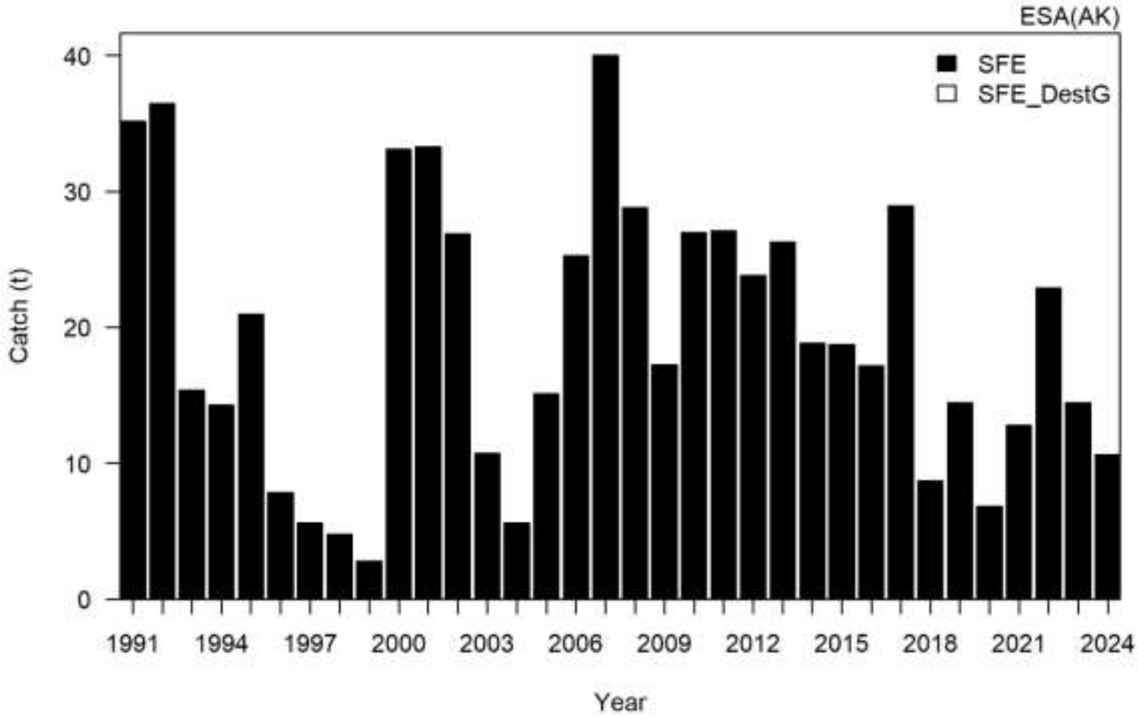

Figure K2: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AK).

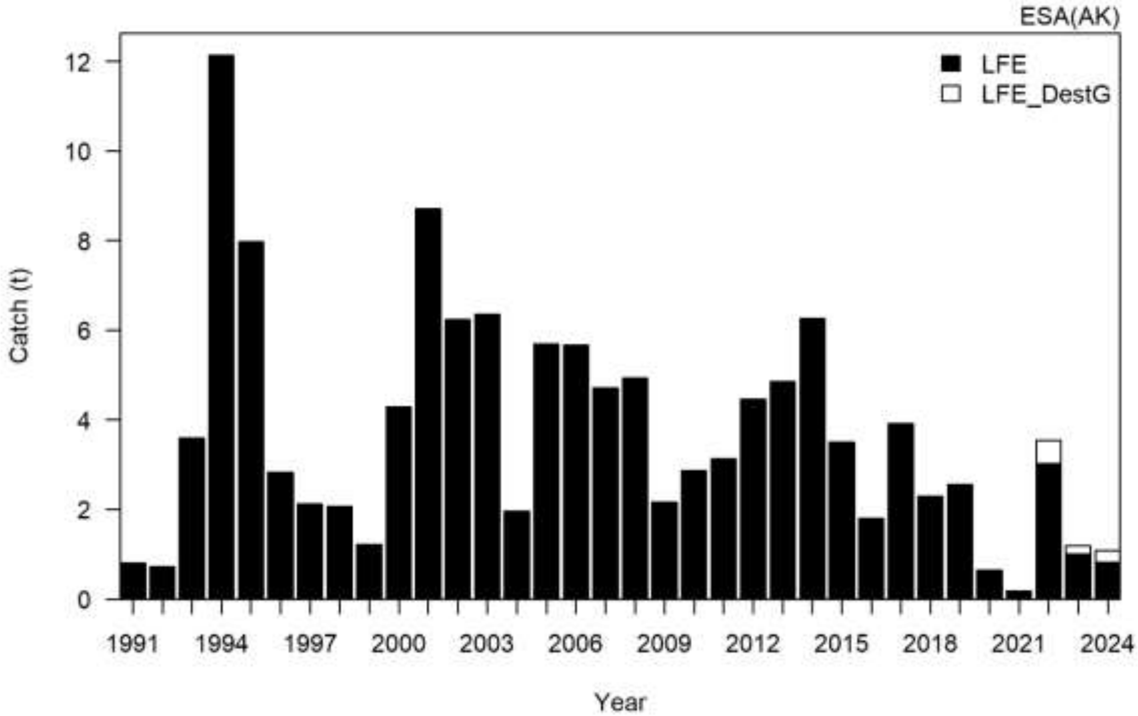

Figure K3: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AK).

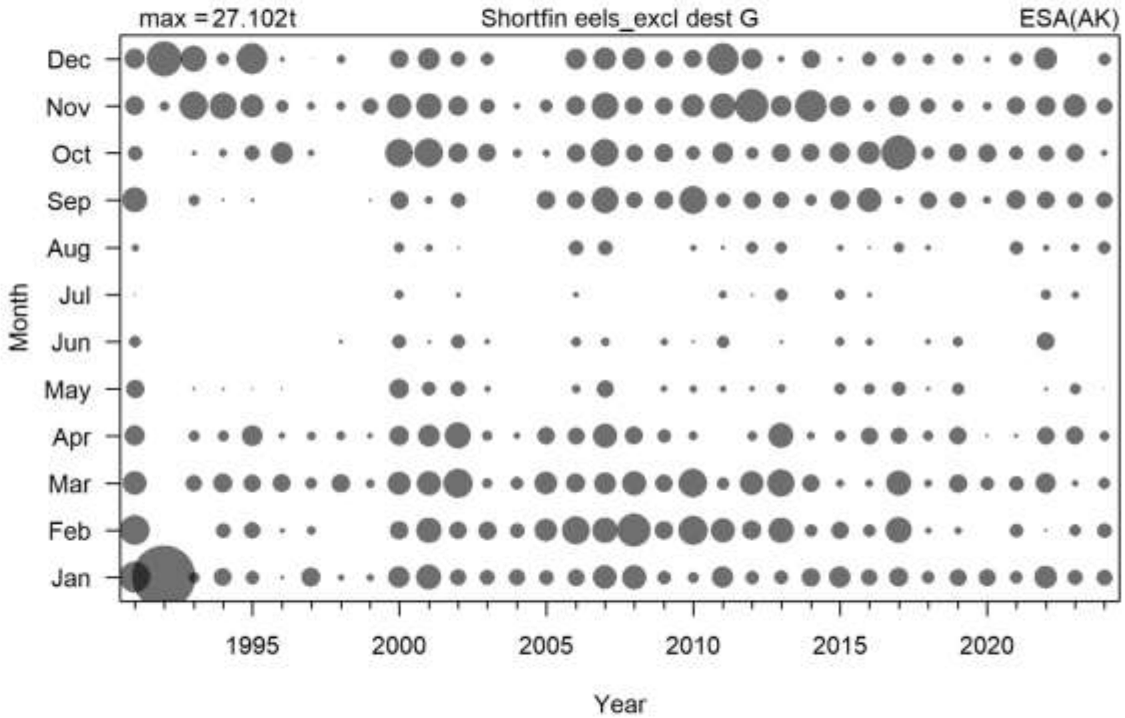

Figure K4: Shortfin eel catch by month for the years 1990–91 to 2023–24 (ESA AK).

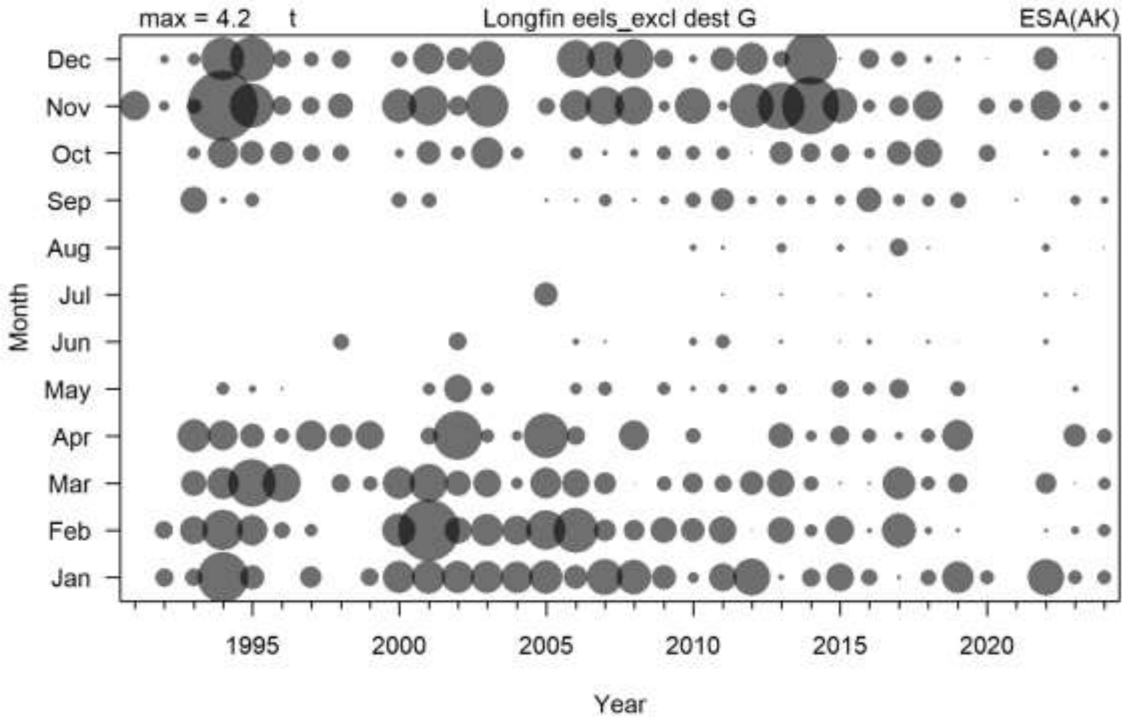

Figure K5: Longfin eel catch by month for the years 1990–91 to 2023–24 (ESA AK).

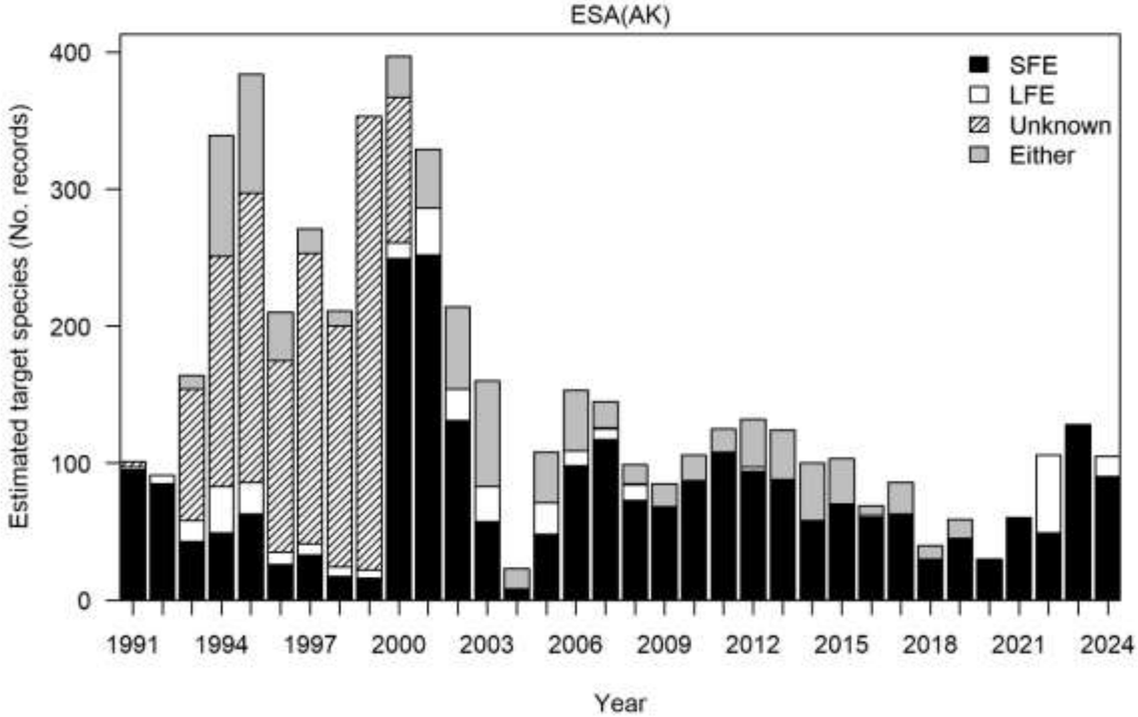

Figure K6: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AK).

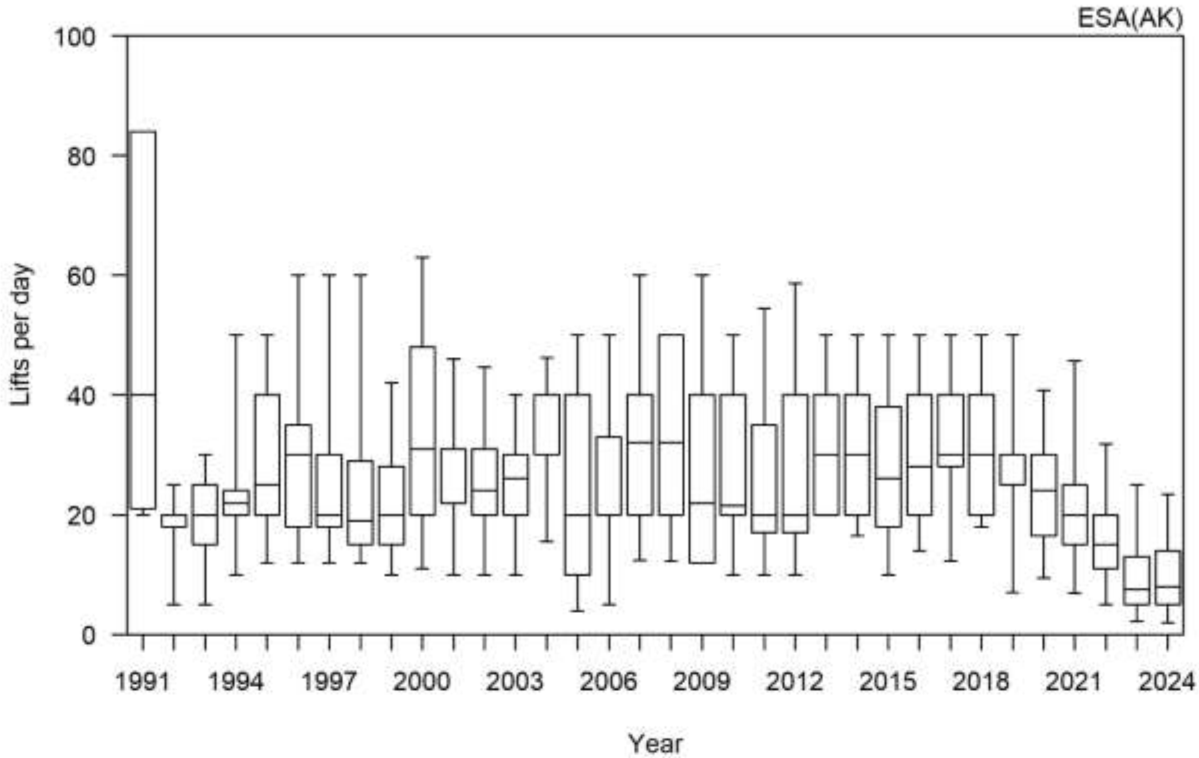

Figure K7: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AK).

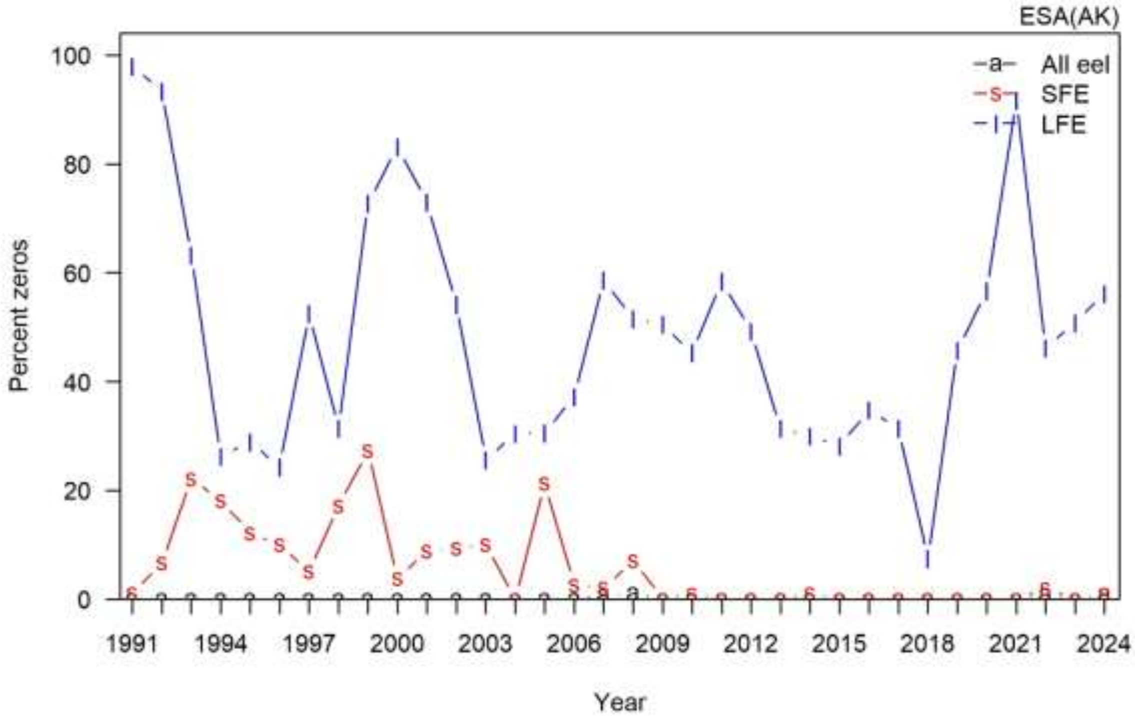

Figure K8: Proportion of valid zero records for all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AK).

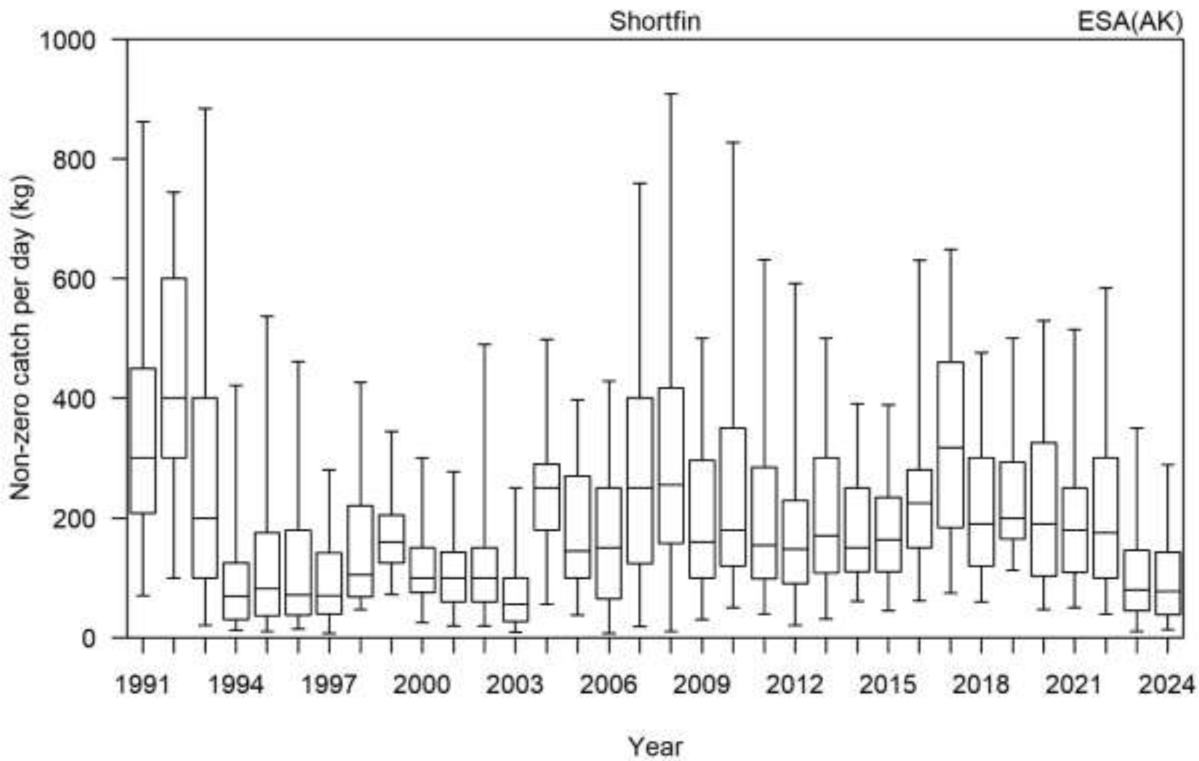

Figure K9: Shortfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AK).

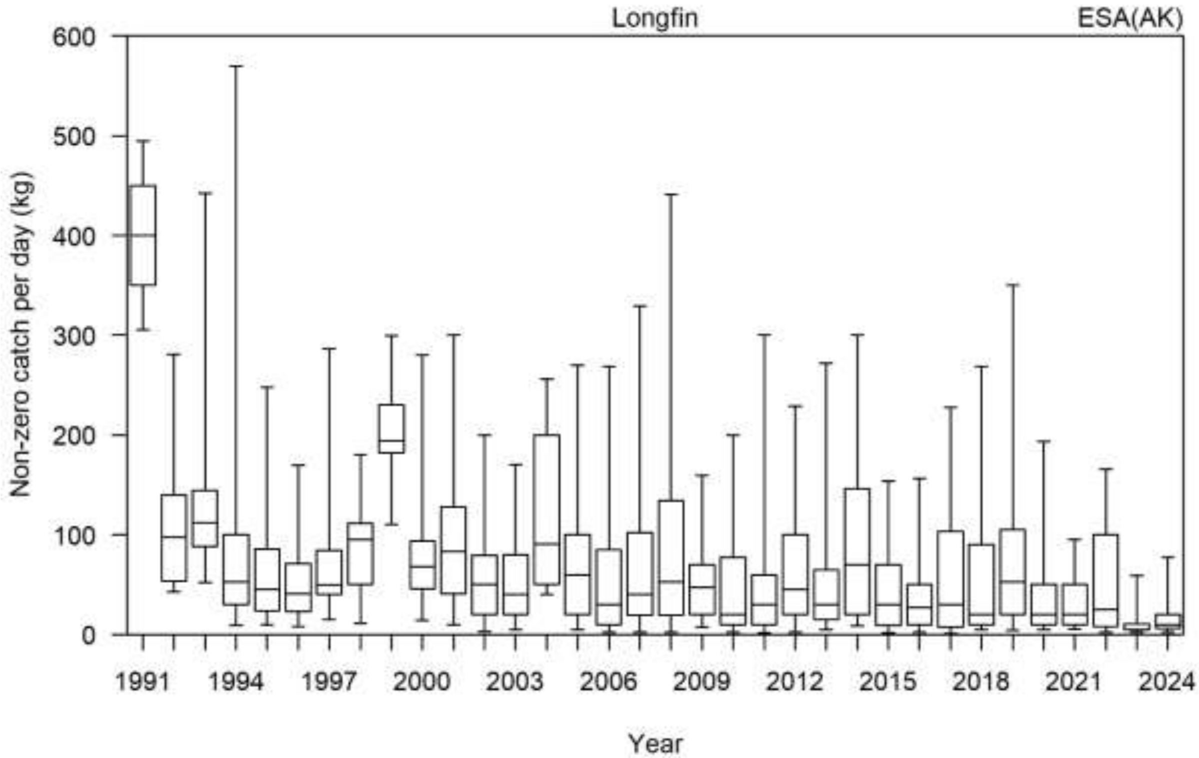

Figure K10: Longfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AK).

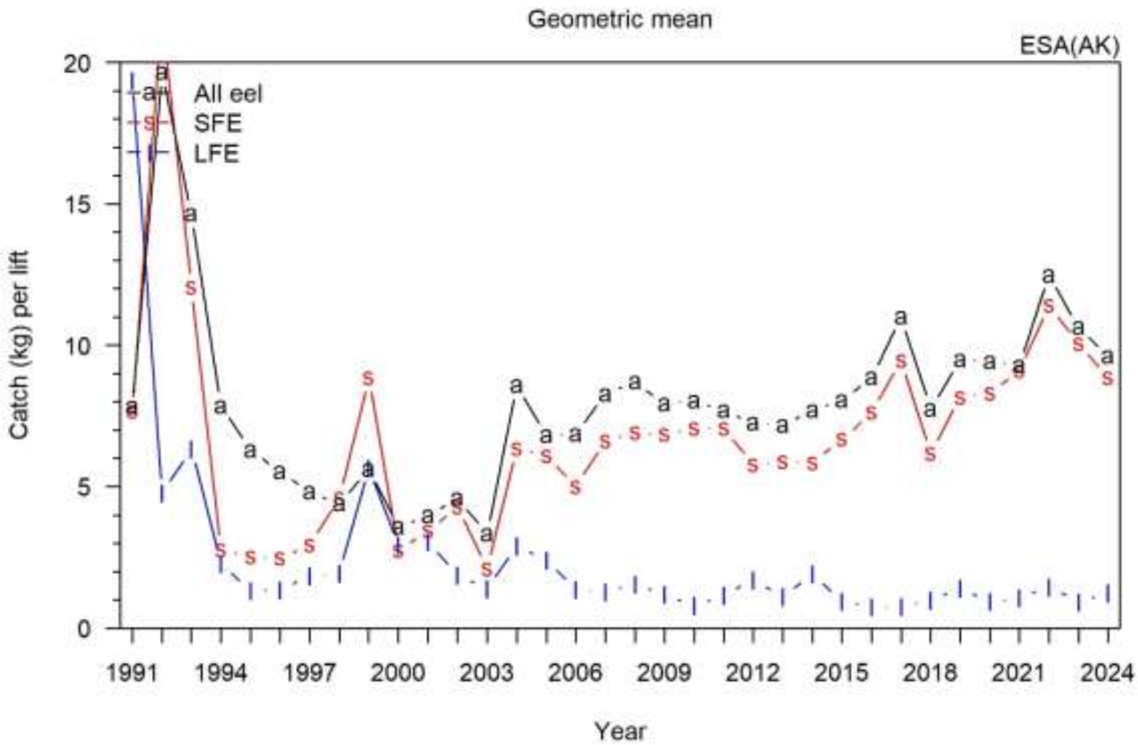

Figure K11: Unstandardised catch per lift (geometric mean of catch per lift) for all eels, shortfin (SFE), and longfin (LFE) for the years 1990–91 to 2023–24 (ESA AK).

ESA AL (Wairarapa)

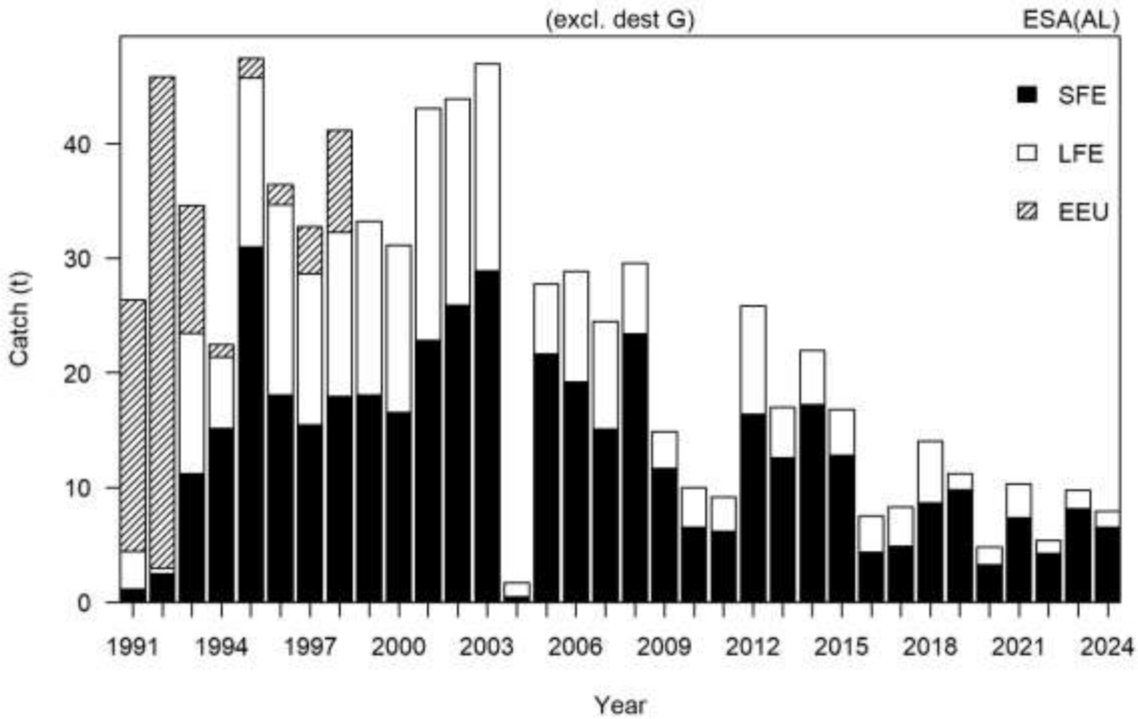

Figure L1: Total estimated commercial catch of shortfin (SFE), longfin (LFE), and unclassified eel catch (EEU) for the years 1990–91 to 2023–24 (ESA AL).

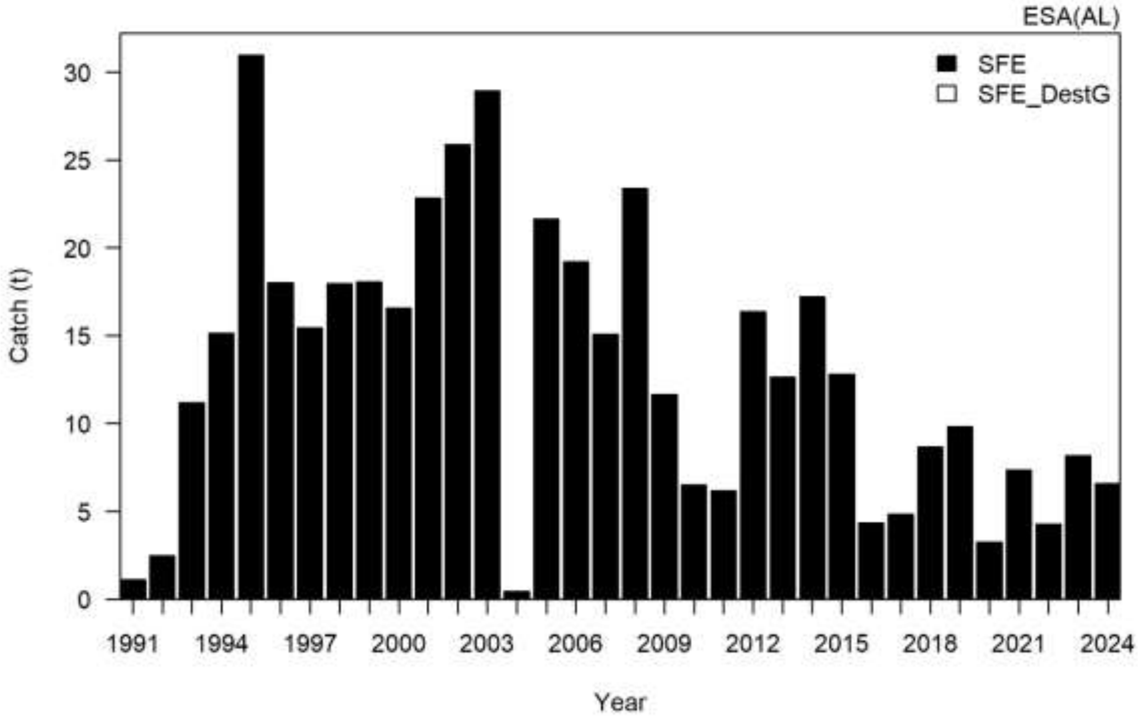

Figure L2: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AL).

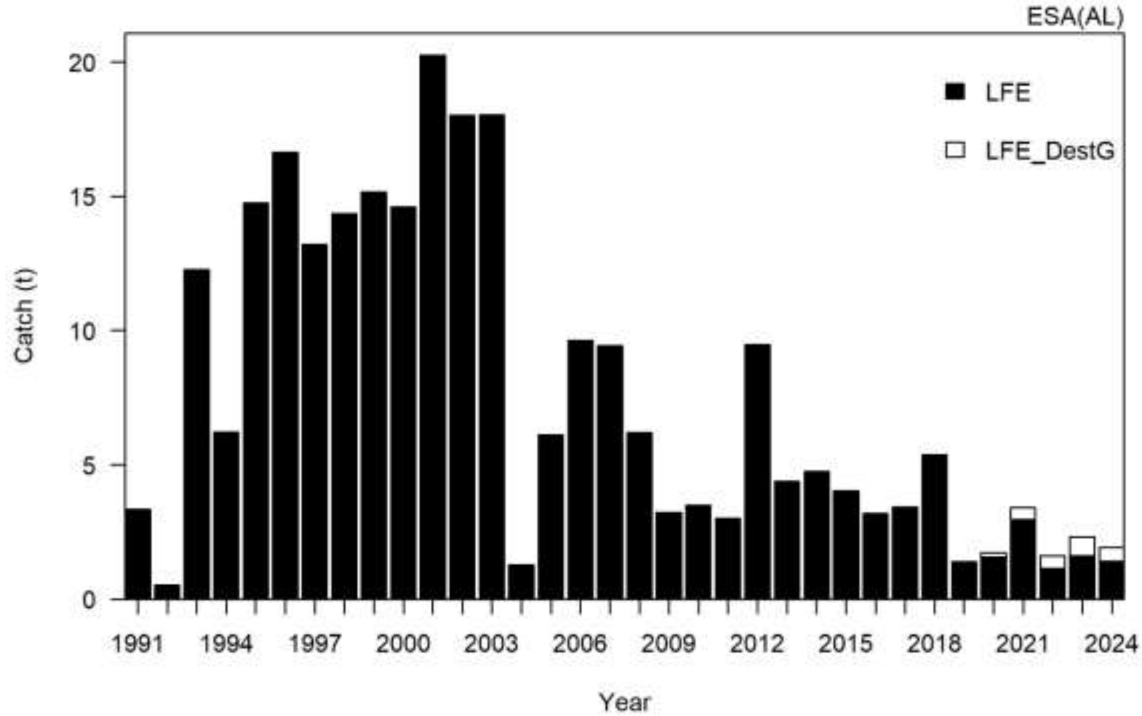

Figure L3: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 1990–91 to 2023–24 (ESA AL).

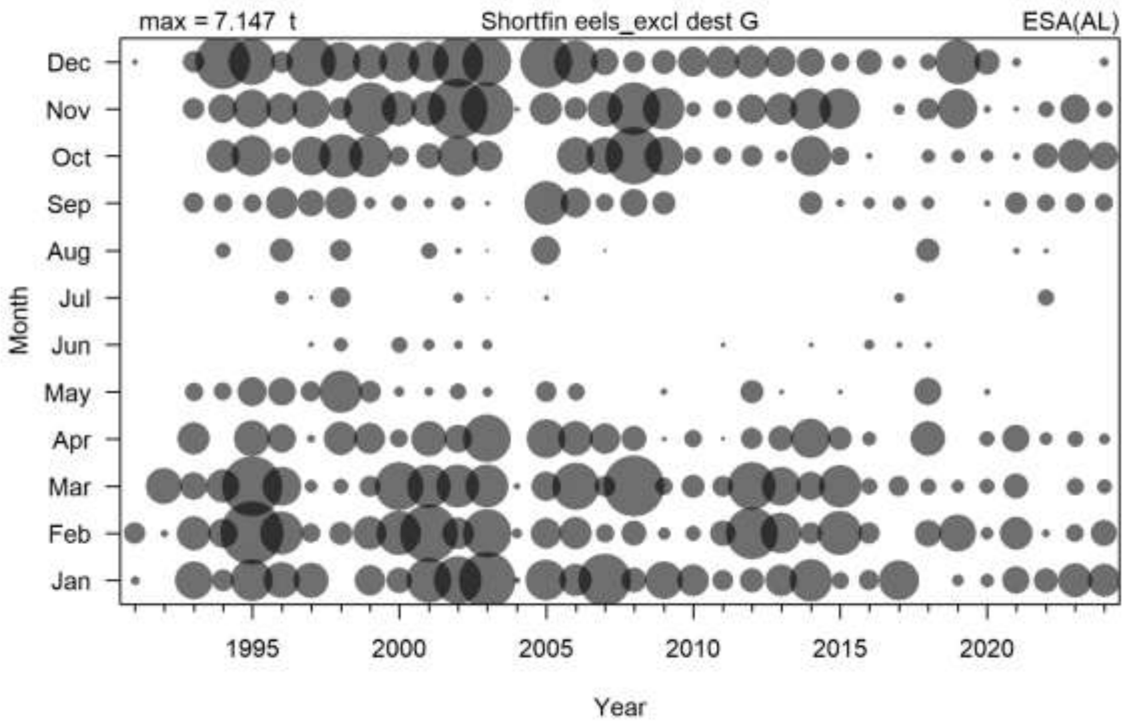

Figure L4: Shortfin eel catch by month for the years 1990–91 to 2023–24 (ESA AL).

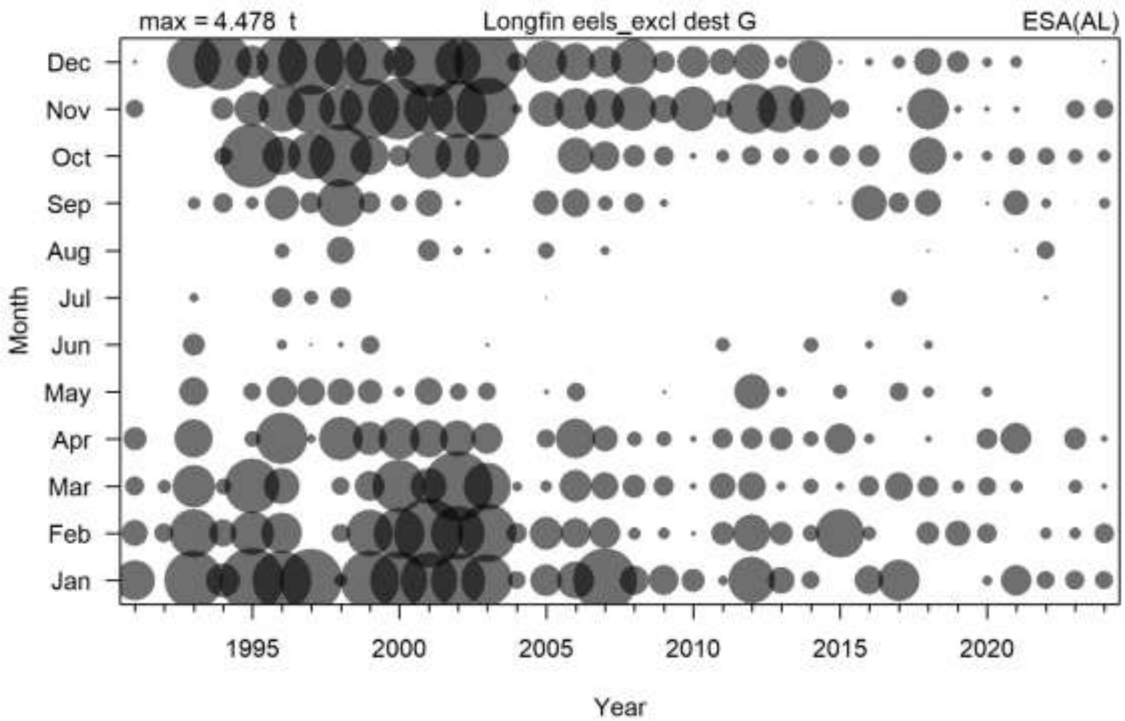

Figure L5: Longfin eel catch by month for the years 1990–91 to 2023–24 (ESA AL).

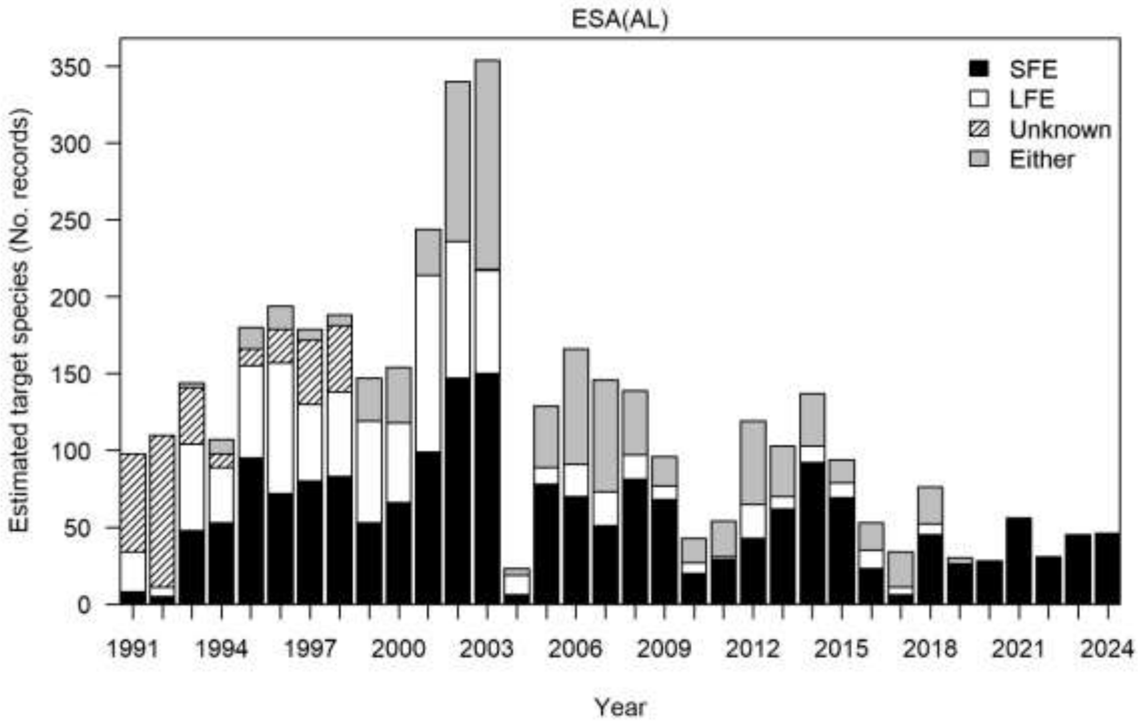

Figure L6: Reconstructed target species for the years 1990–91 to 2018–19 and declared target from 2019–20 to 2023–24 (ESA AL).

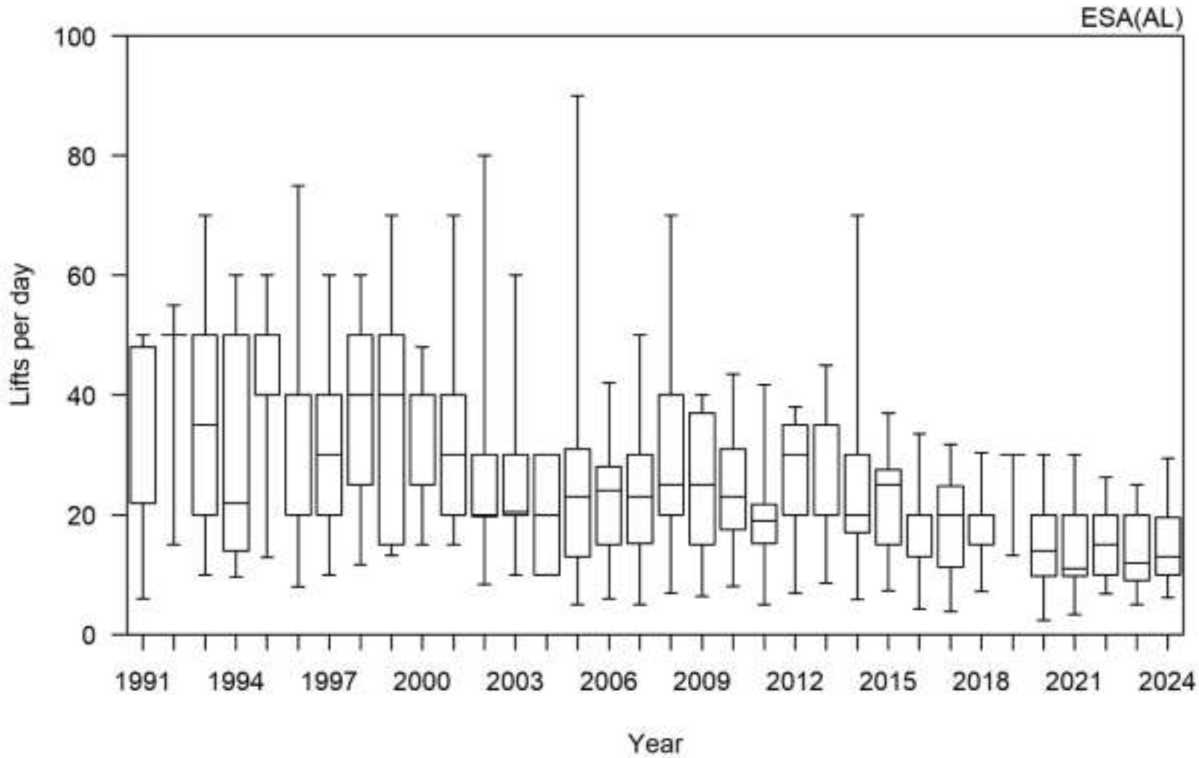

Figure L7: Total lifts per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AL).

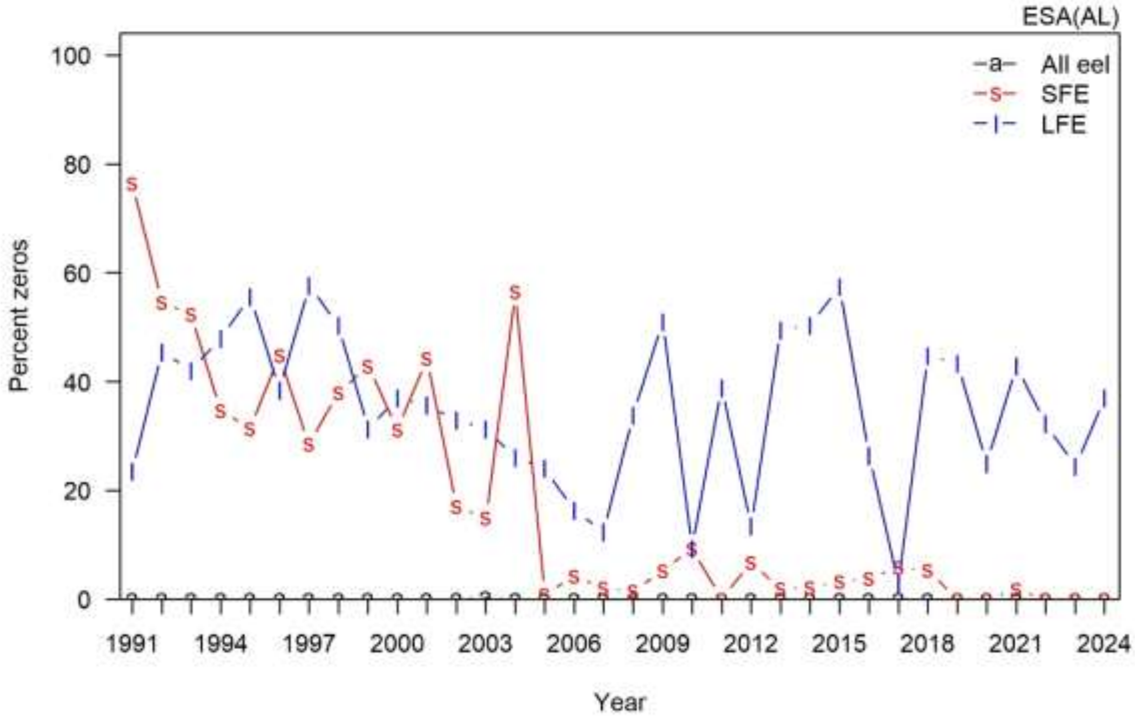

Figure L8: Proportion of valid zero records for all eels, shortfin (SFE), and longfin (LFE) catch for the years 1990–91 to 2023–24. Excludes zeros associated with reporting EEU (unclassified) (ESA AL).

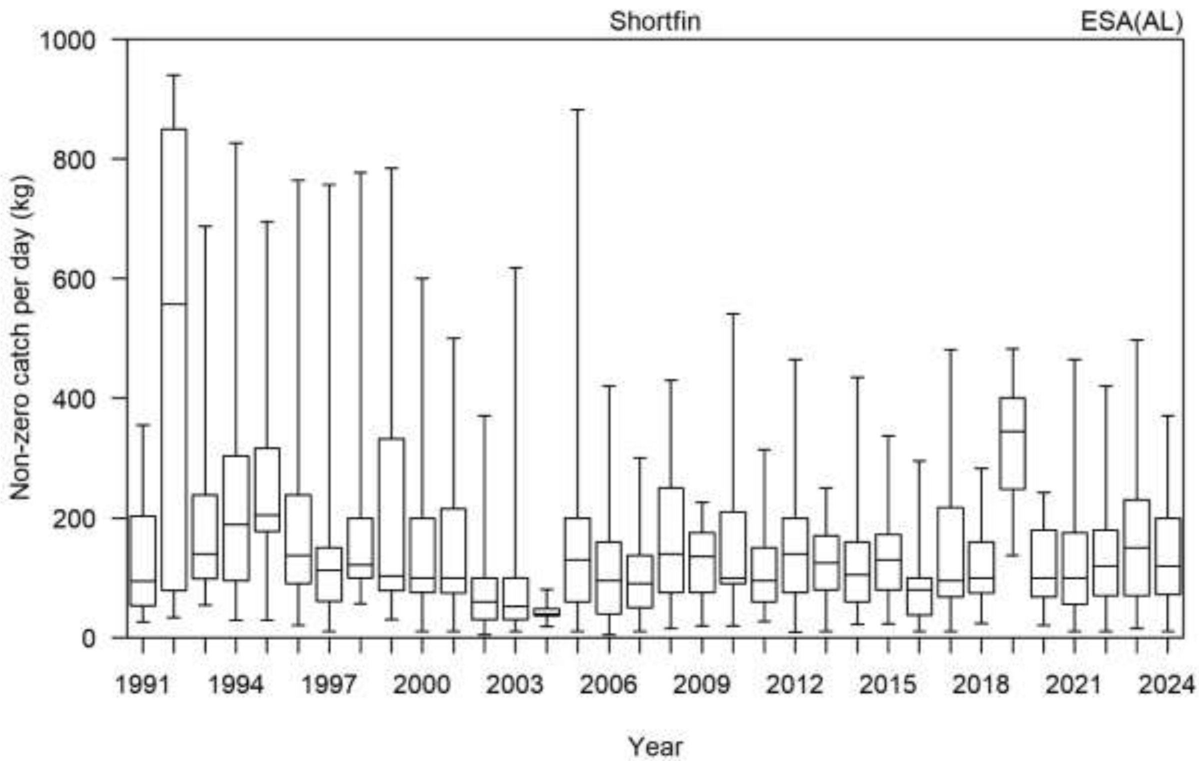

Figure L9: Shortfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AL).

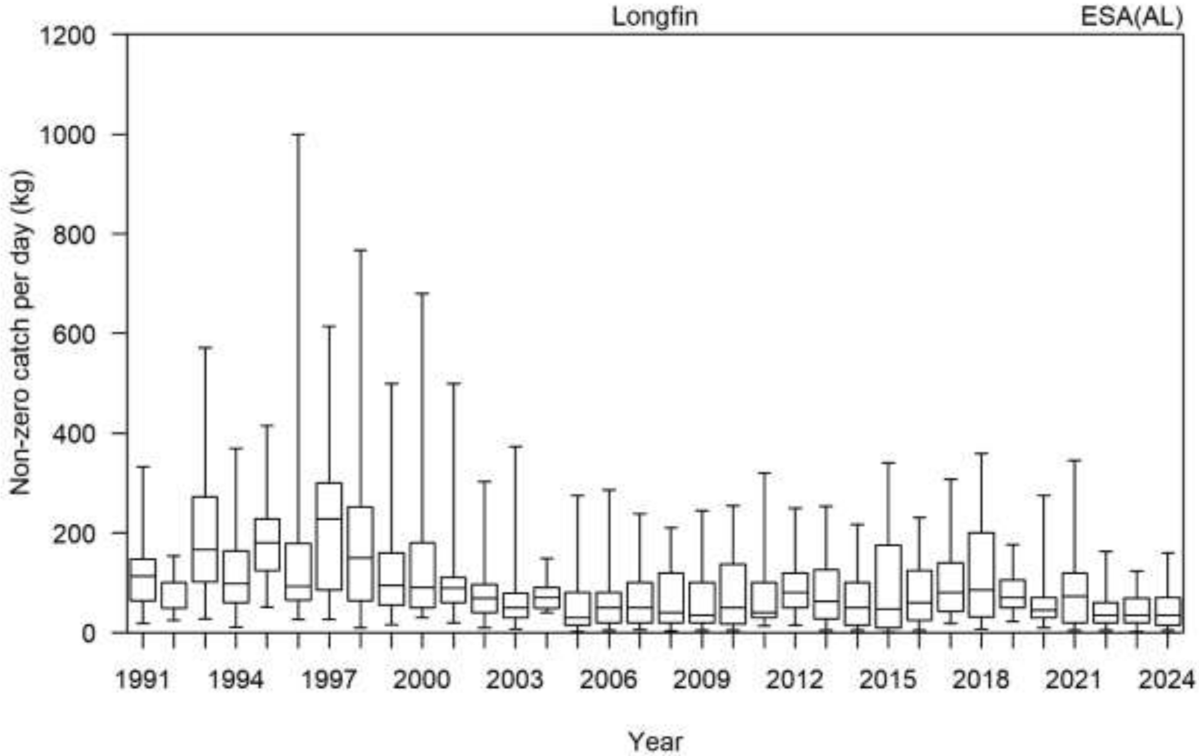

Figure L10: Longfin non-zero catch per day for the years 1990–91 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range (ESA AL).

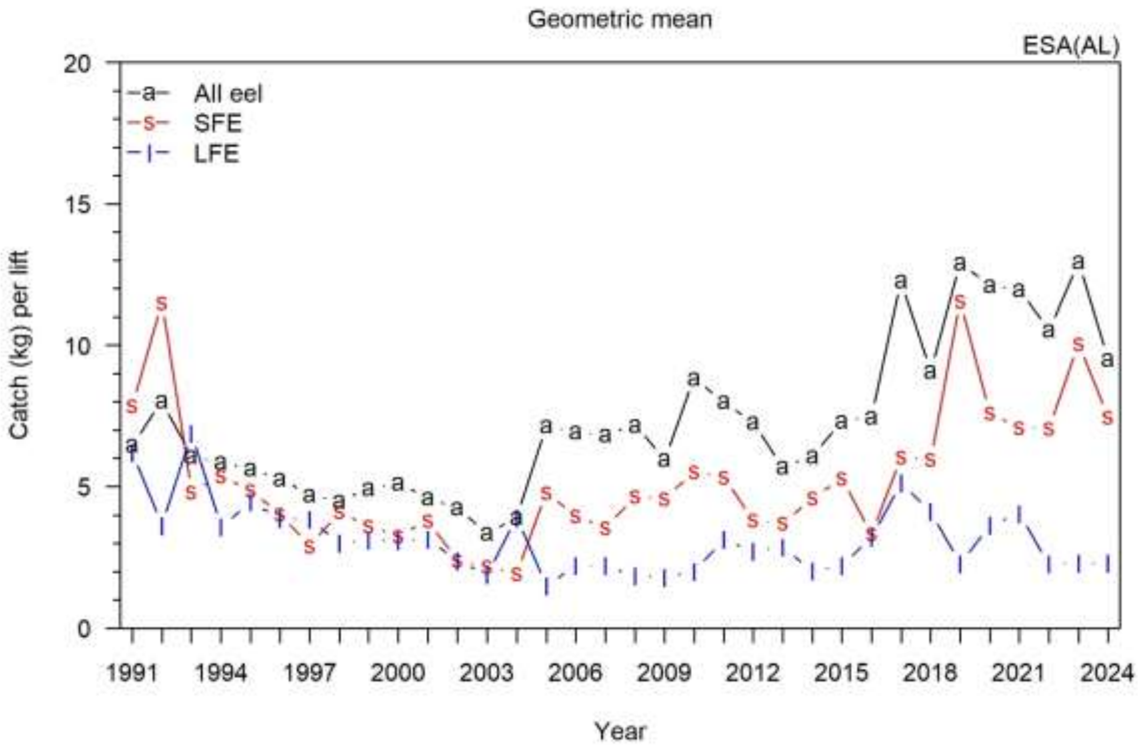

Figure L11: Unstandardised catch per lift (geometric mean of catch per lift) for all eels, shortfin (SFE), and longfin (LFE) for the years 1990–91 to 2023–24 (ESA AL).

ESA AM (Wellington)

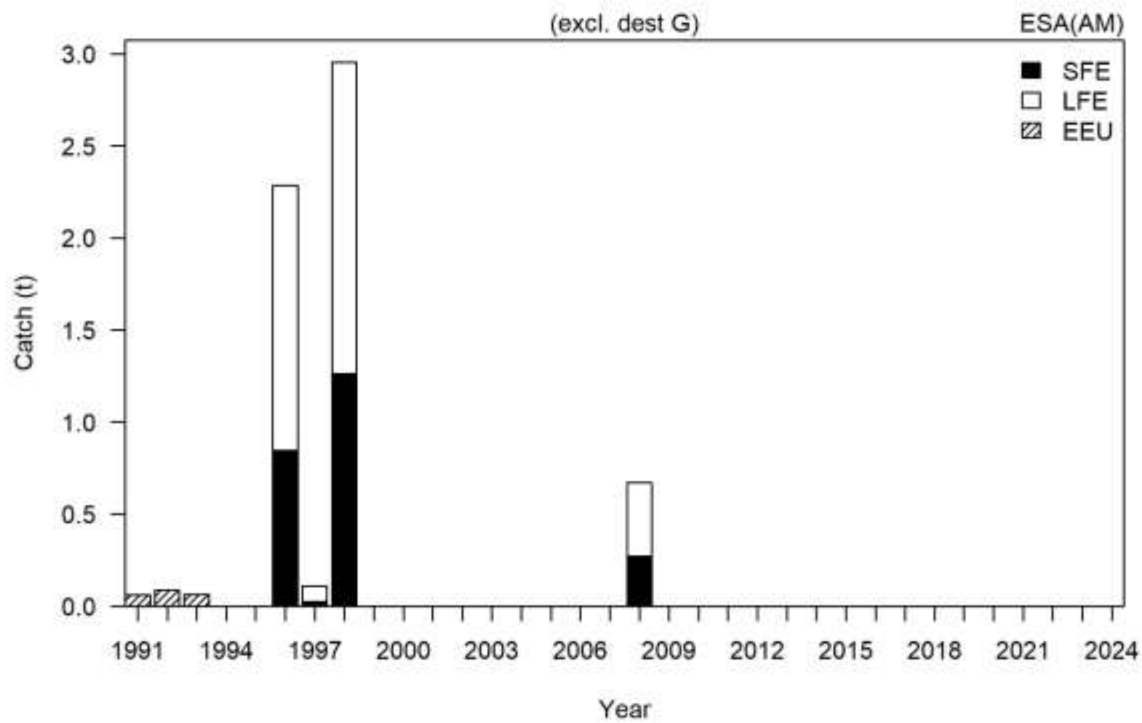

Figure M1: Total estimated commercial catch of shortfin (SFE), longfin (LFE), and unclassified eel catch (EEU) for the years 1990–91 to 2023–24 (ESA AM).

ESA AD (Waikato Tainui Fisheries Area – excluding Waipa River)

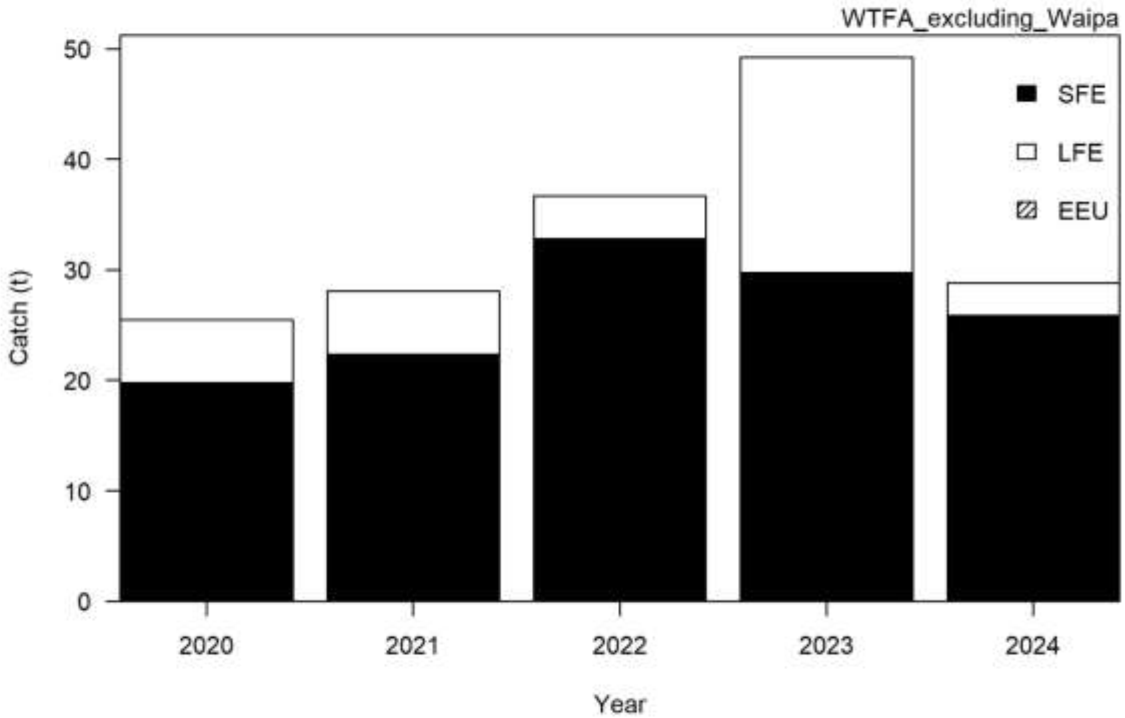

Figure X1: Total estimated commercial catch of legal size shortfin (SFE-300 to 2000 g), longfin (LFE-400 to 2000 g), and unclassified eel catch (EEU) for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

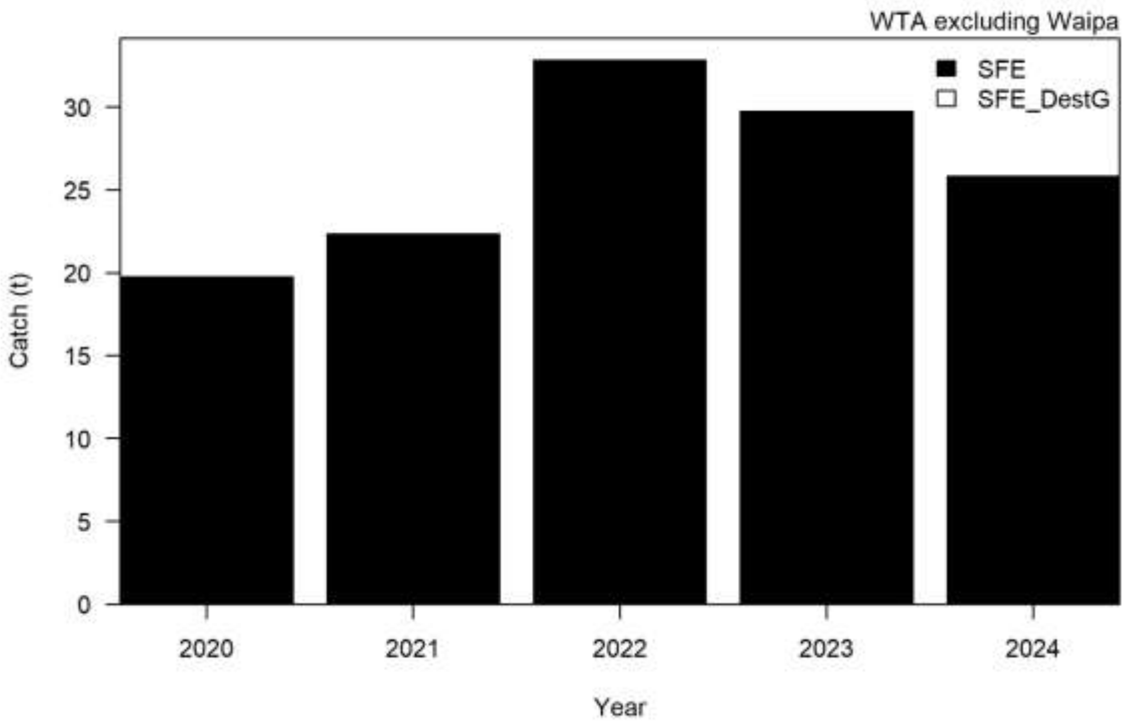

Figure X2: Total estimated commercial catch of legal sized (300 to 2000 g) shortfin (SFE) eels, and catch of destination G eels (over 2000 g) for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

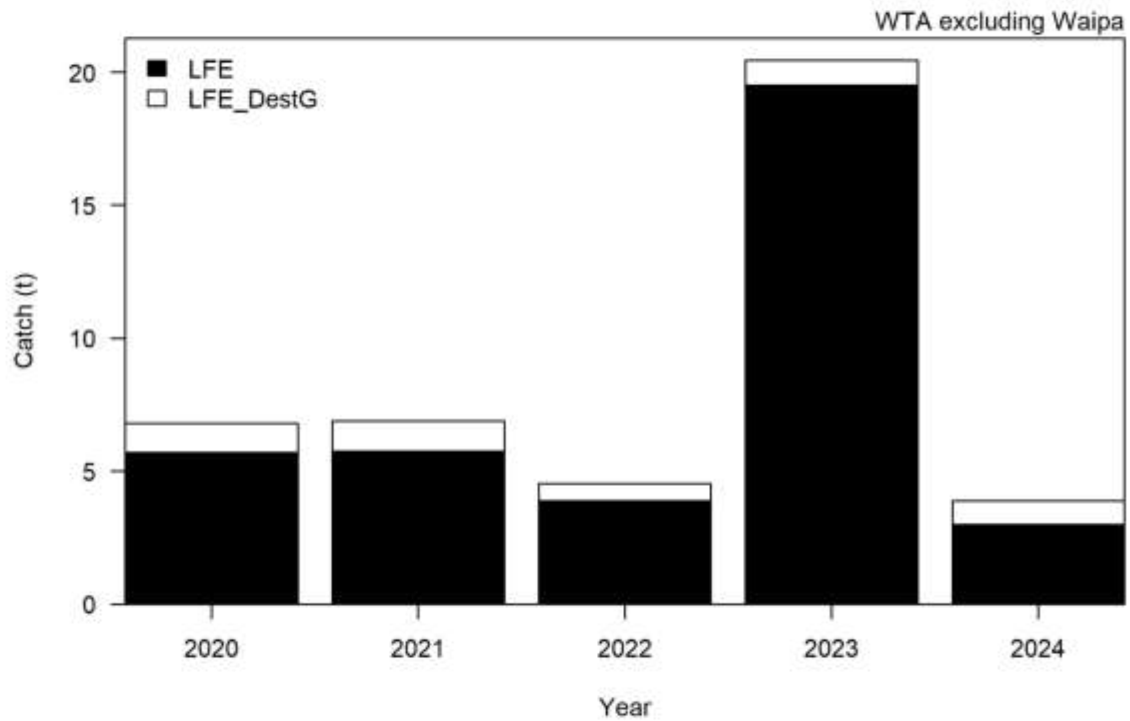

Figure X3: Total estimated commercial catch of legal sized longfin (LFE-400 to 2000 g) eels, and catch of destination G eels (over 2000 g) for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

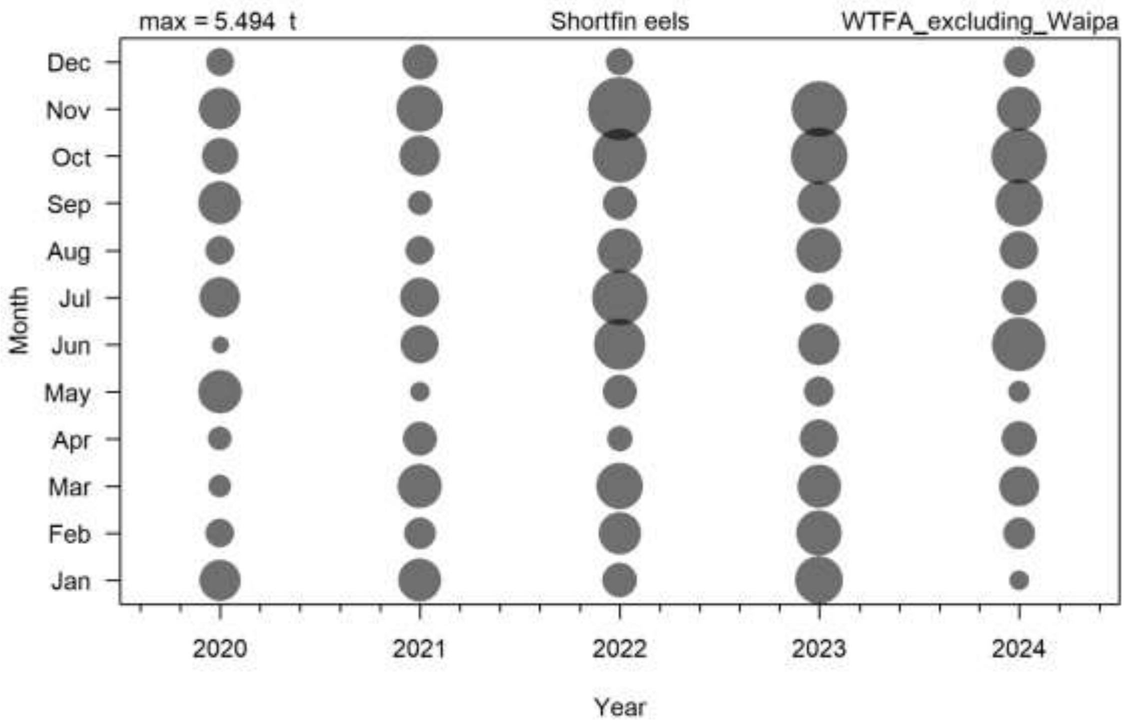

Figure X4: Shortfin legal size eel catch by month for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

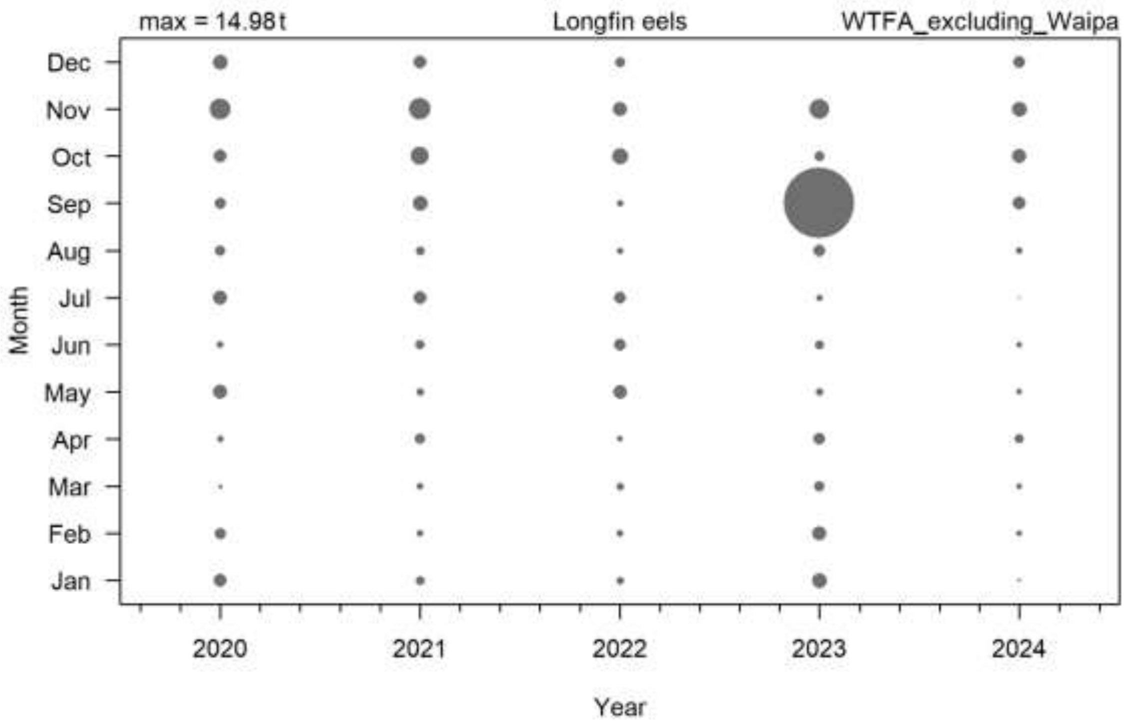

Figure X5: Longfin legal size eel catch by month for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

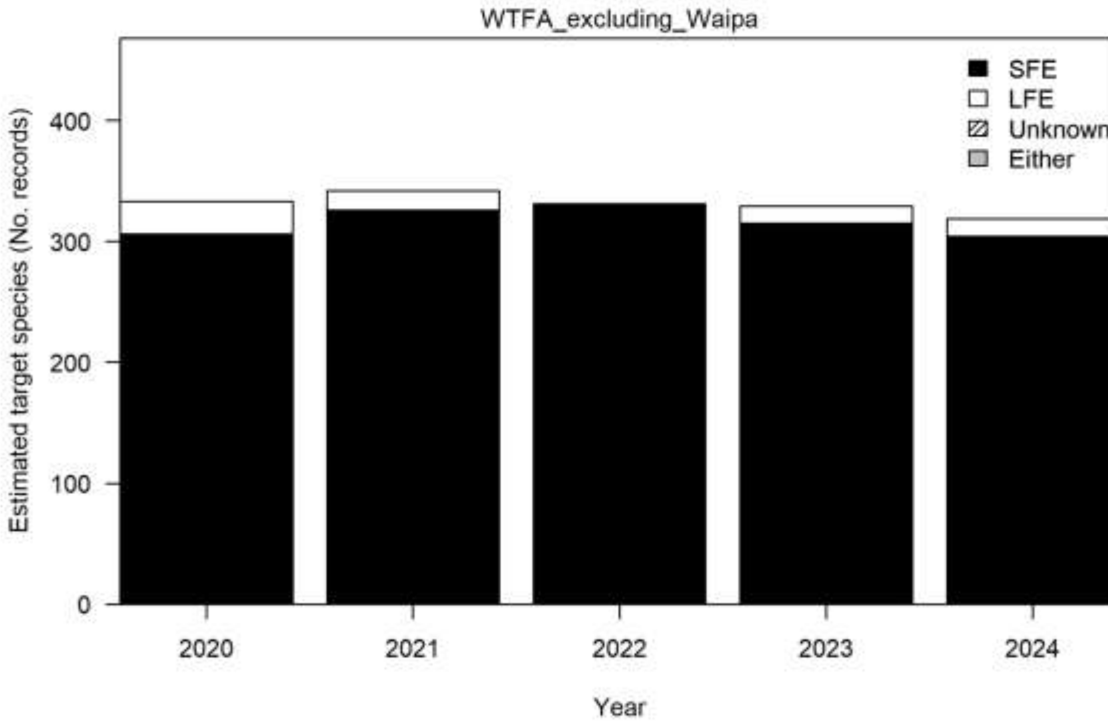

Figure X6: Declared target species from 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

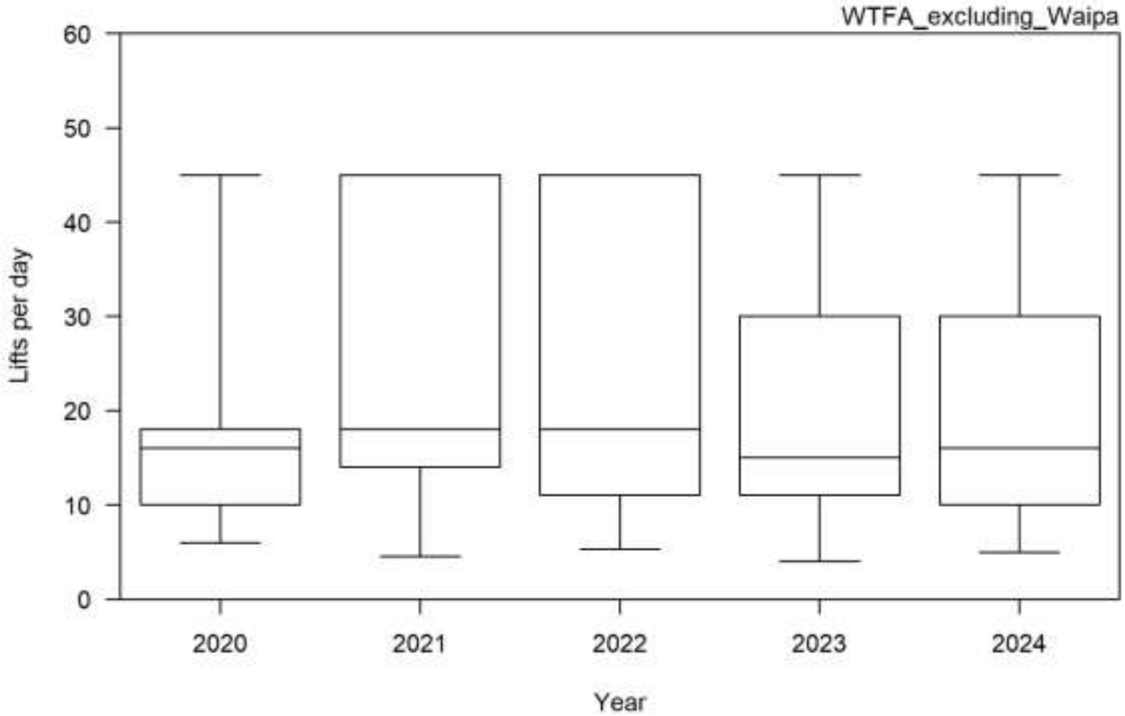

Figure X7: Total lifts per day for the years 2019–20 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range. (WTFA, Waikato Tainui Fisheries Area).

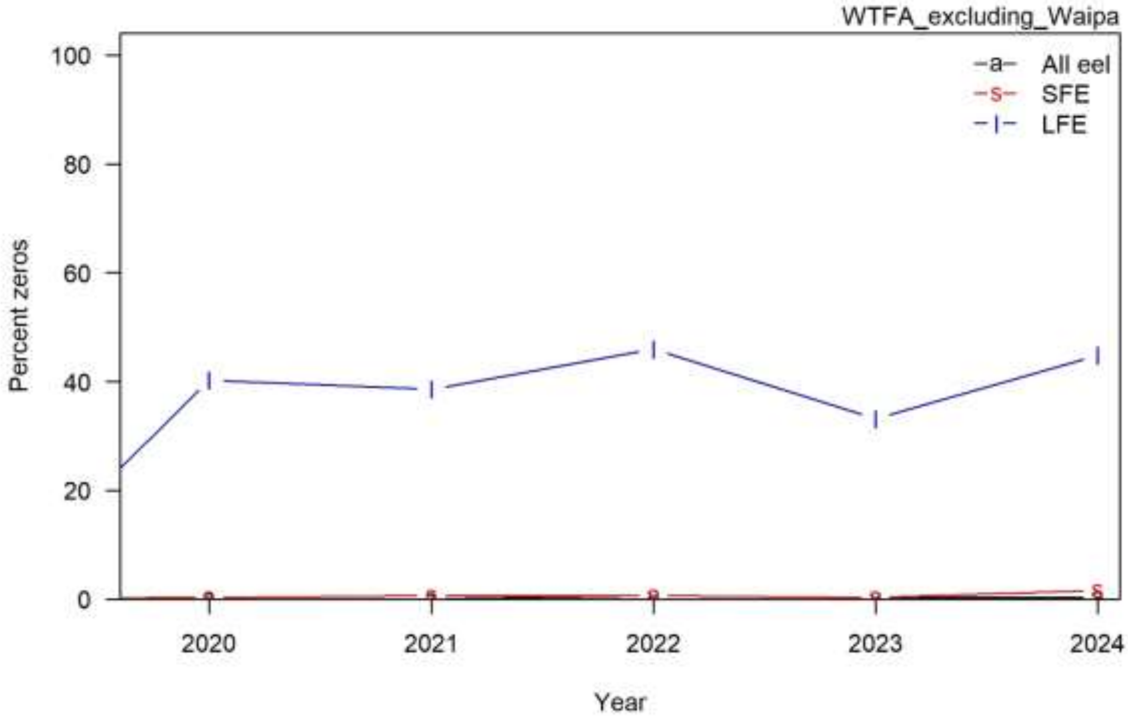

Figure X8: Proportion of valid zero records for legal size all eels, shortfin (SFE), and longfin (LFE) catch for the years 2019–20 to 2023–24. Excludes zeros associated with reporting EEU (unclassified). (WTFA, Waikato Tainui Fisheries Area).

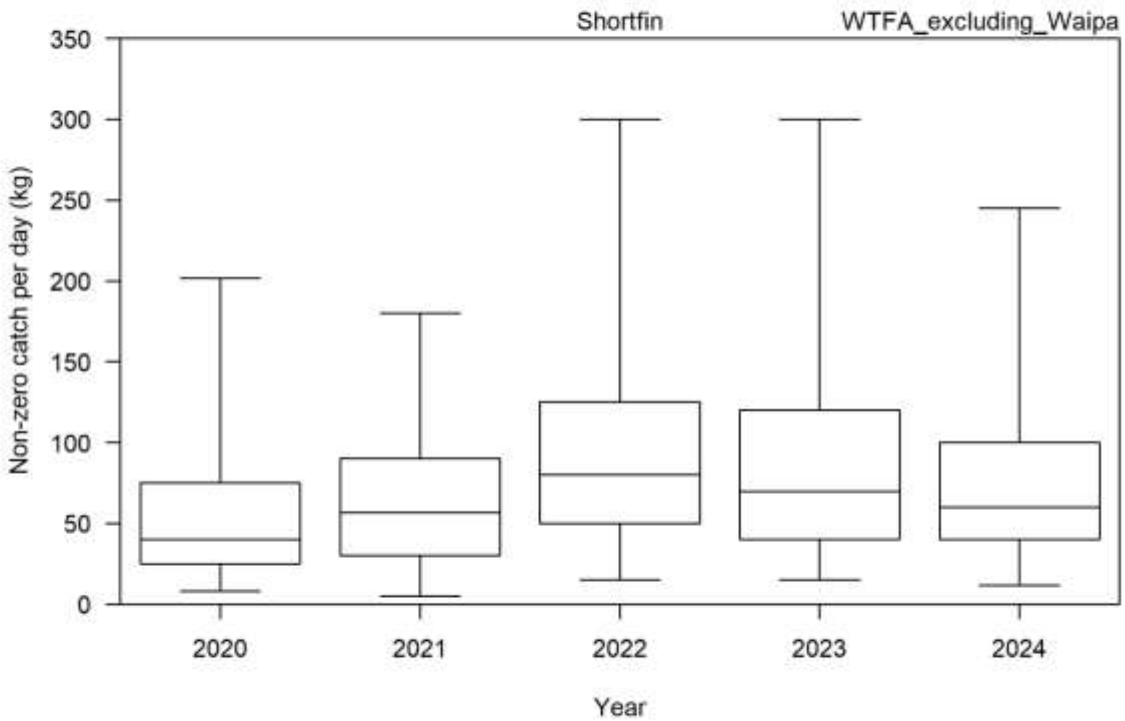

Figure X9: Shortfin non-zero catch per day for legal size eels for the years 2019–20 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range. (WTFA, Waikato Tainui Fisheries Area).

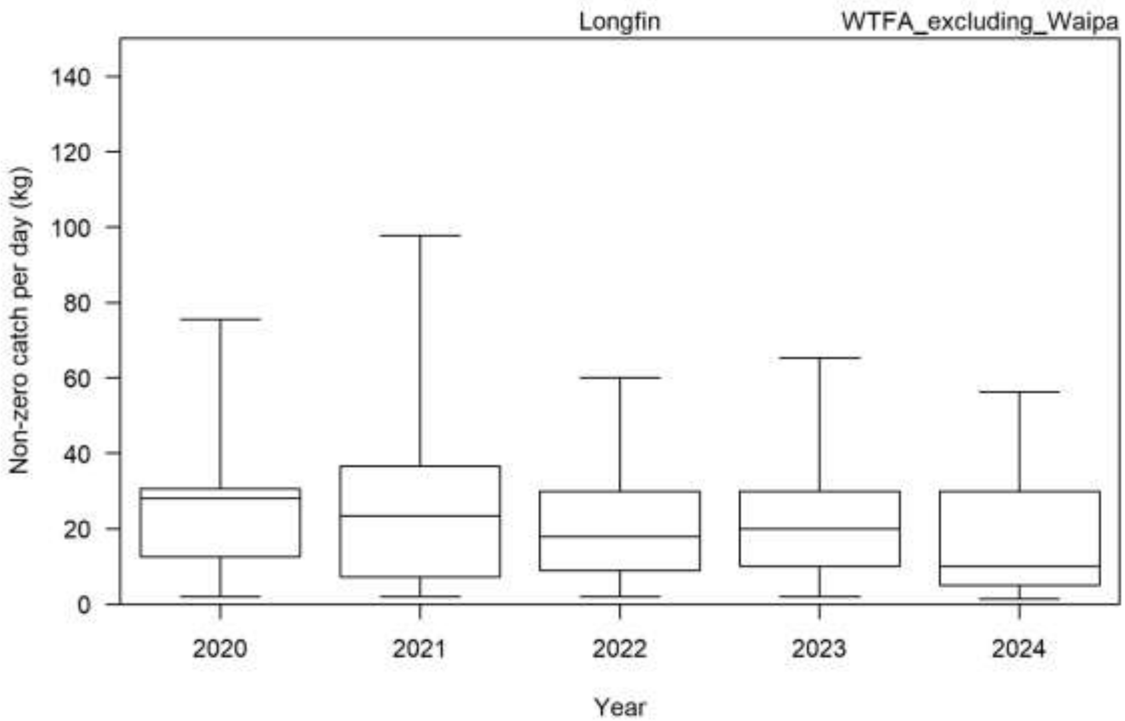

Figure X10: Longfin non-zero catch per day for legal size eels for the years 2019–20 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range. (WTFA, Waikato Tainui Fisheries Area).

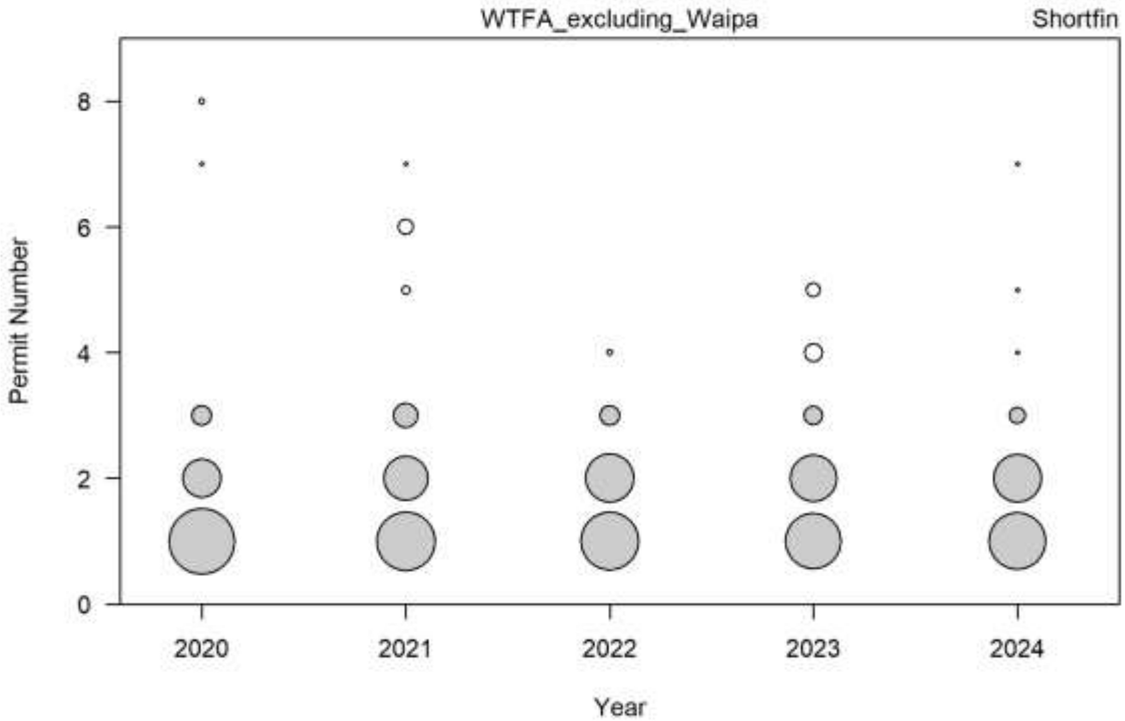

Figure X11: Relative shortfin legal size eel catch and destination G, from all fishers (all circles) for the years 2019–20 to 2023–24 (post-ERS), and for core fishers (grey shaded circles) included in the catch per unit effort analyses. (WTFA, Waikato Tainui Fisheries Area).

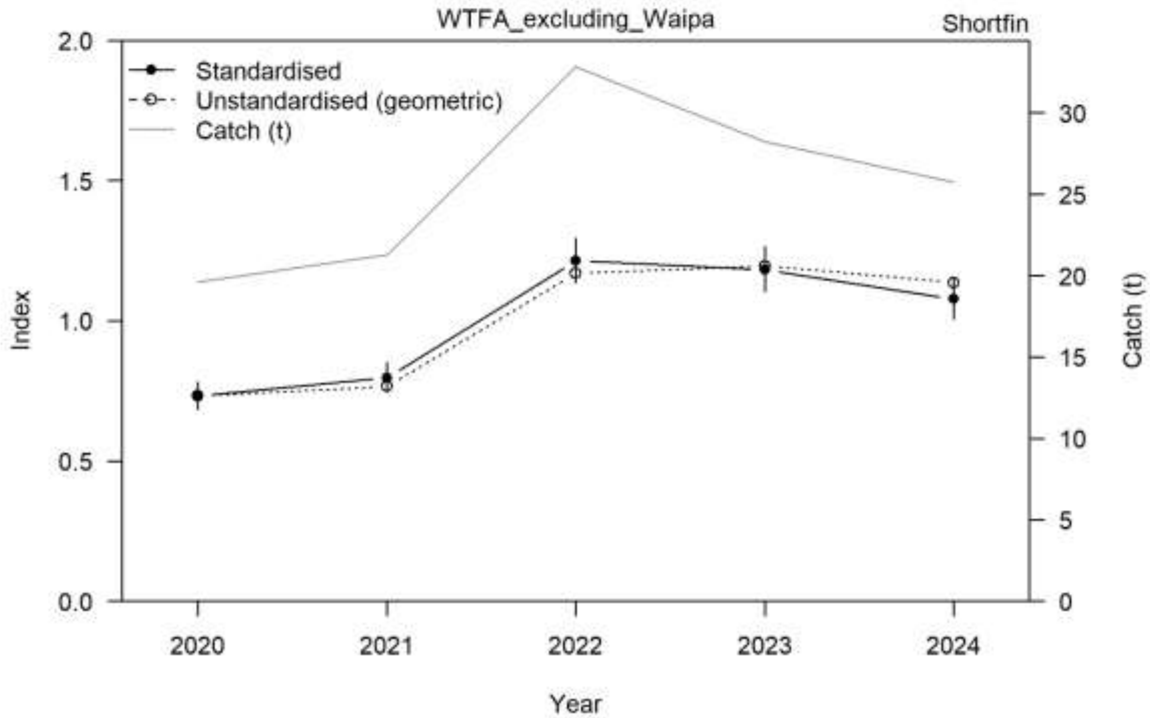

Figure X12: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for shortfin (core fishers) for the years 2019–20 to 2023–24 (post-ERS). The shortfin catch by core fishers is also plotted. Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

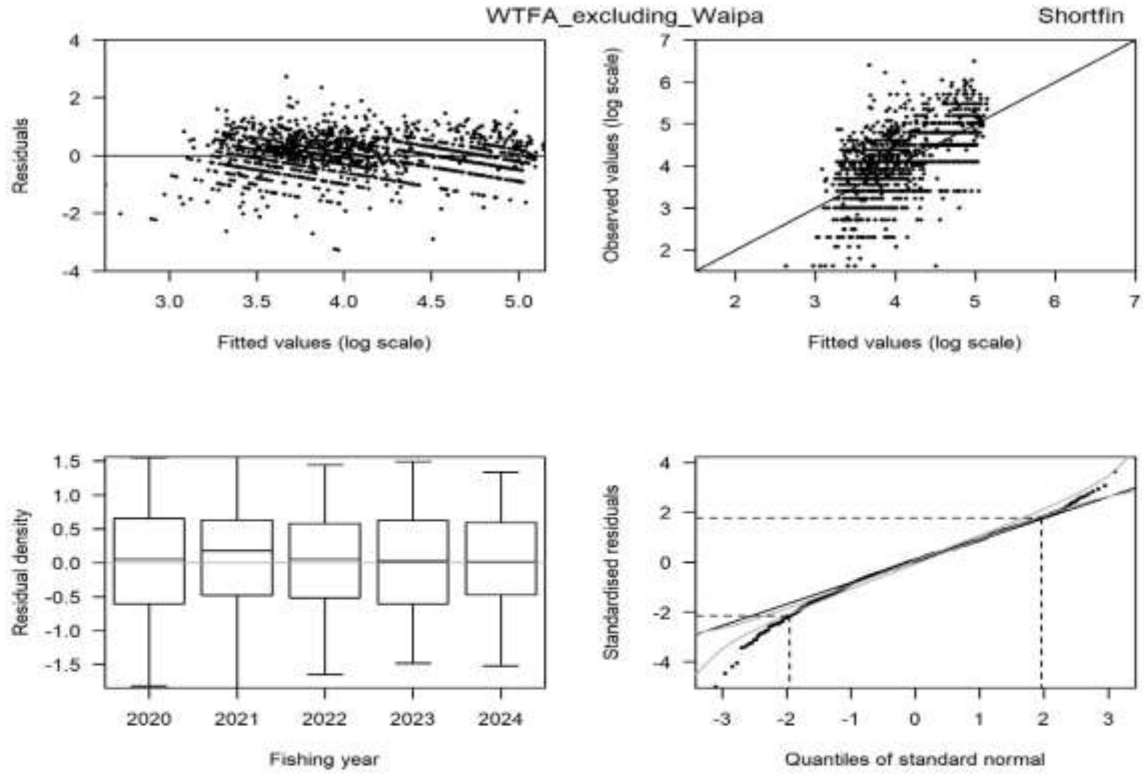

Figure X13: Residual diagnostic plots for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution. (WTFA, Waikato Tainui Fisheries Area).

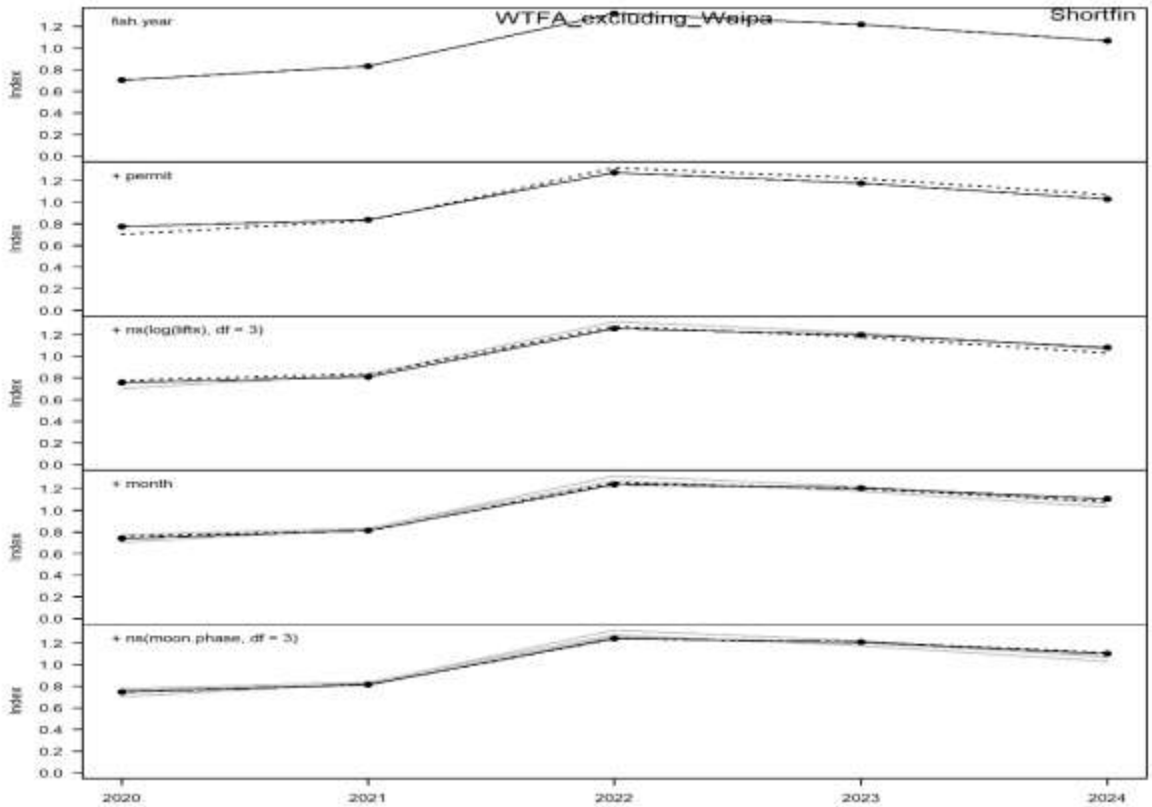

Figure X14: Step plot for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that. (WTFA, Waikato Tainui Fisheries Area).

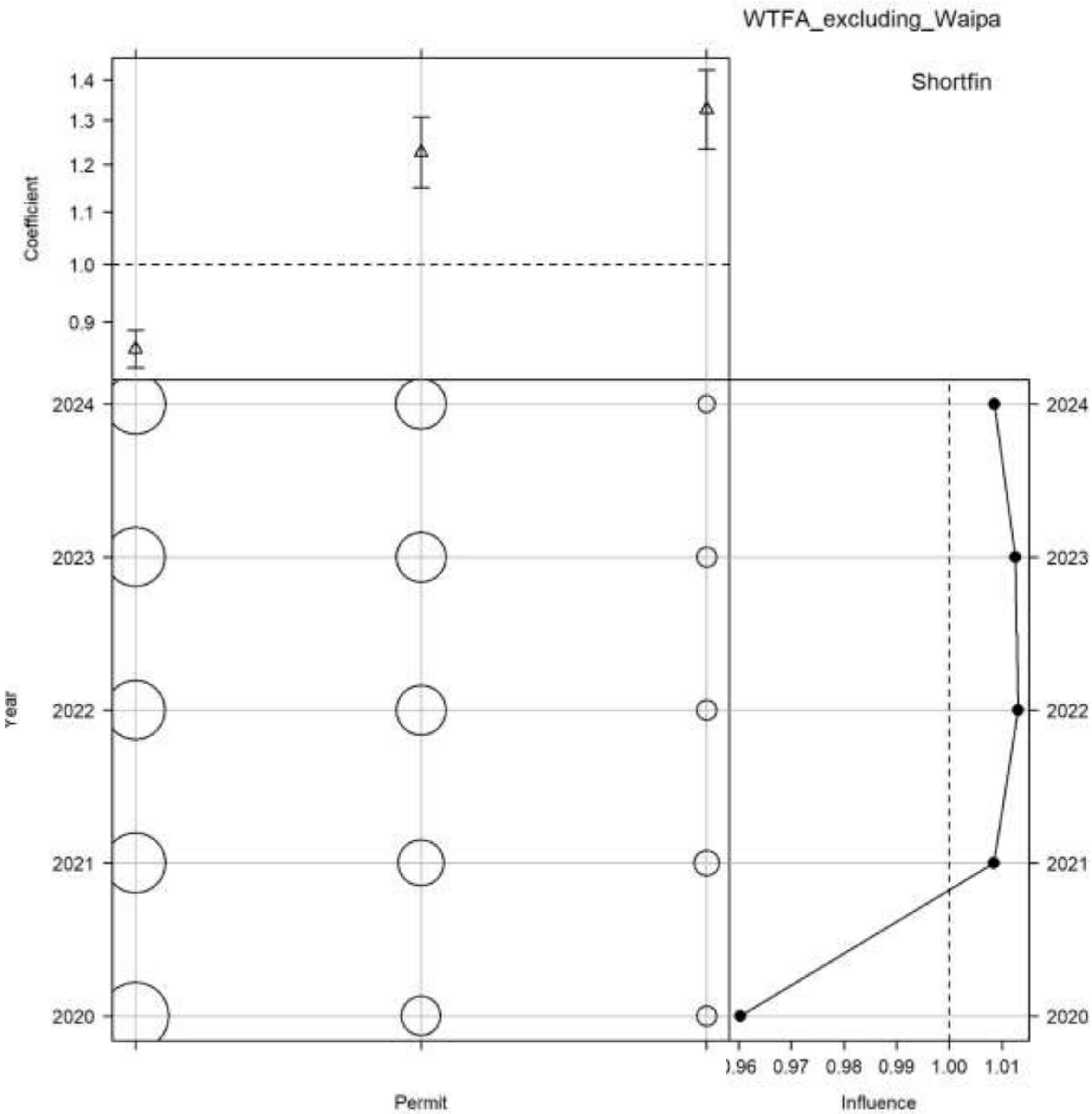

Figure X15: Influence of permit for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

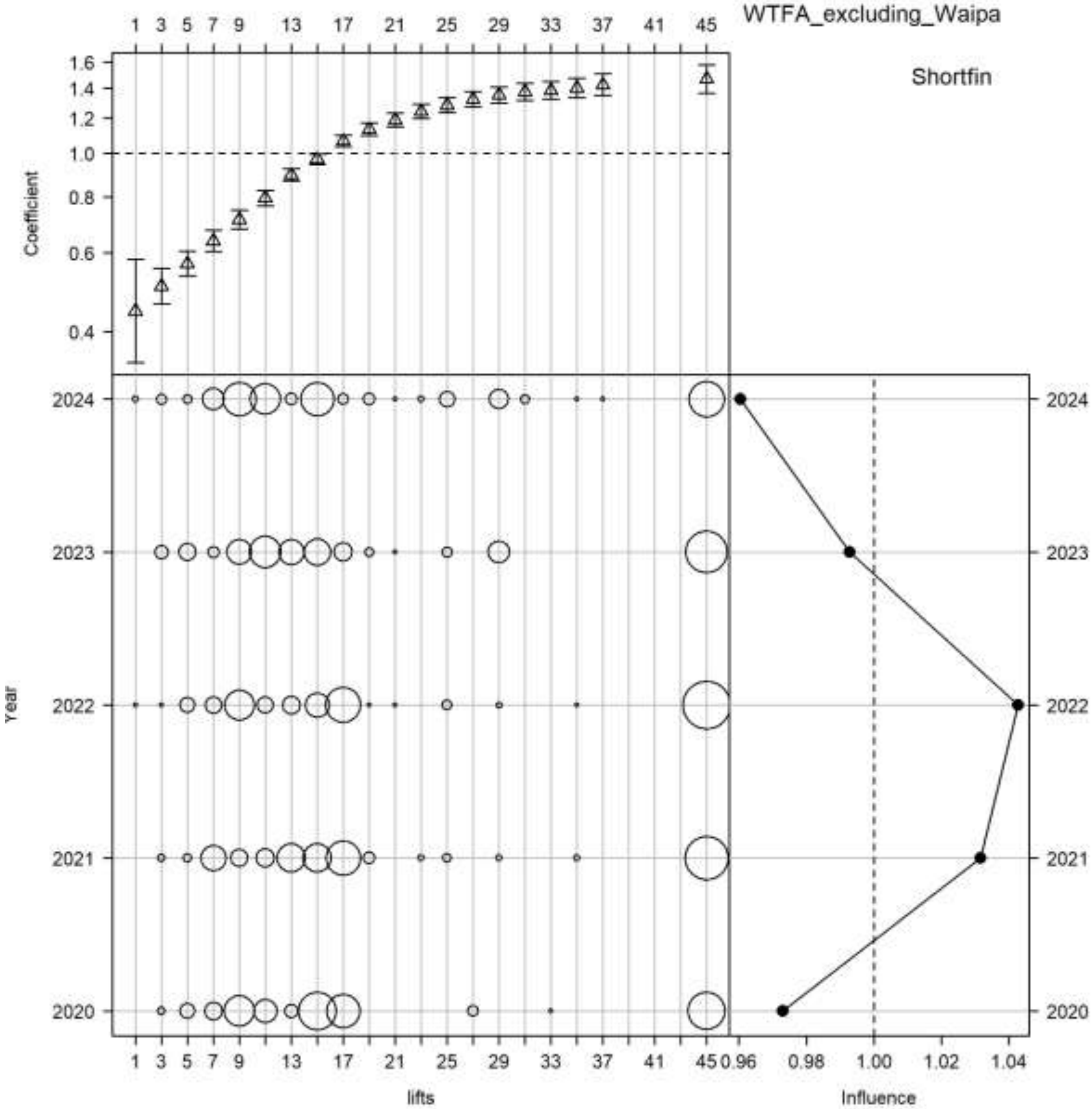

Figure X16: Influence of lifts for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

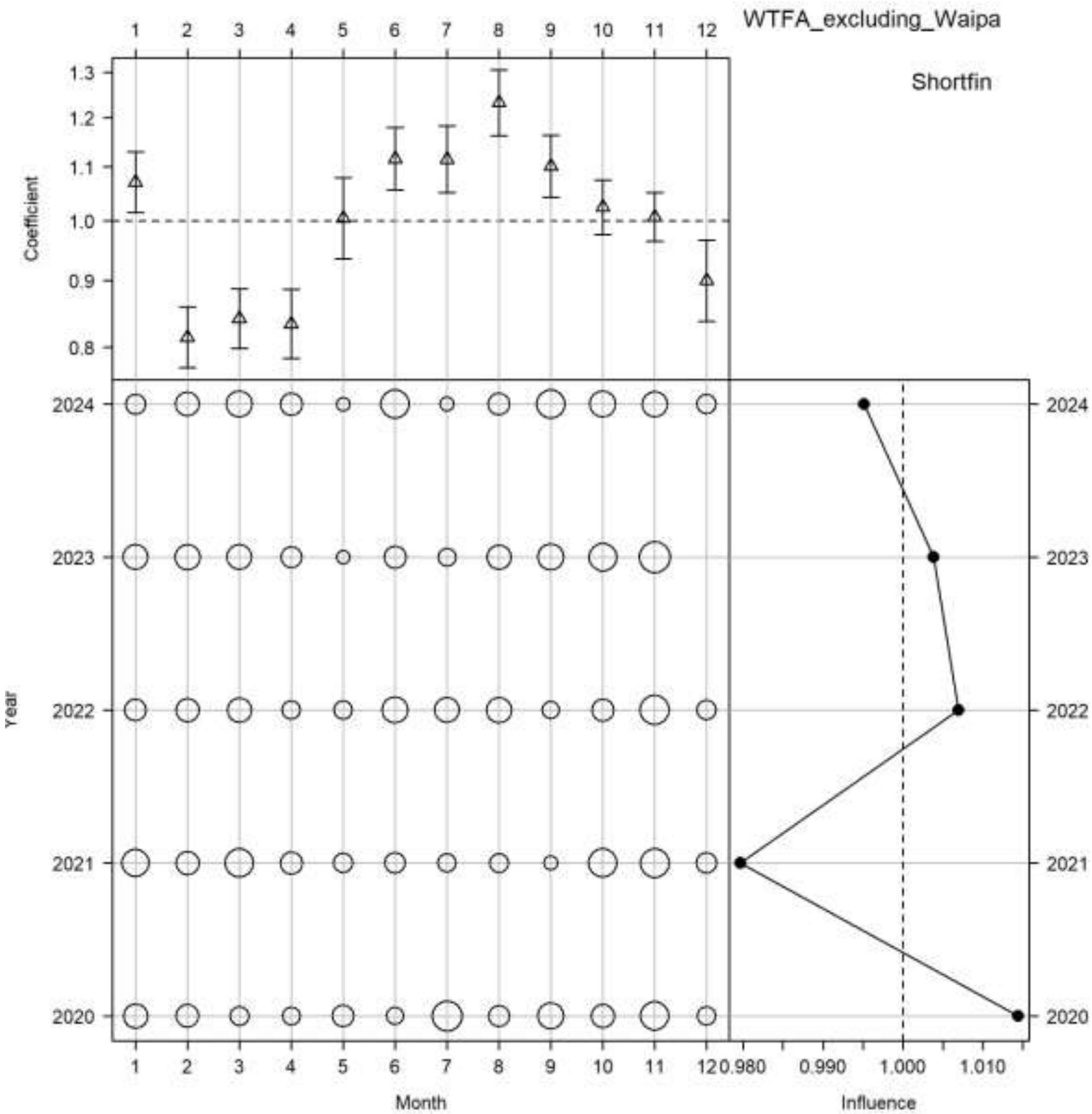

Figure X17: Influence of month for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

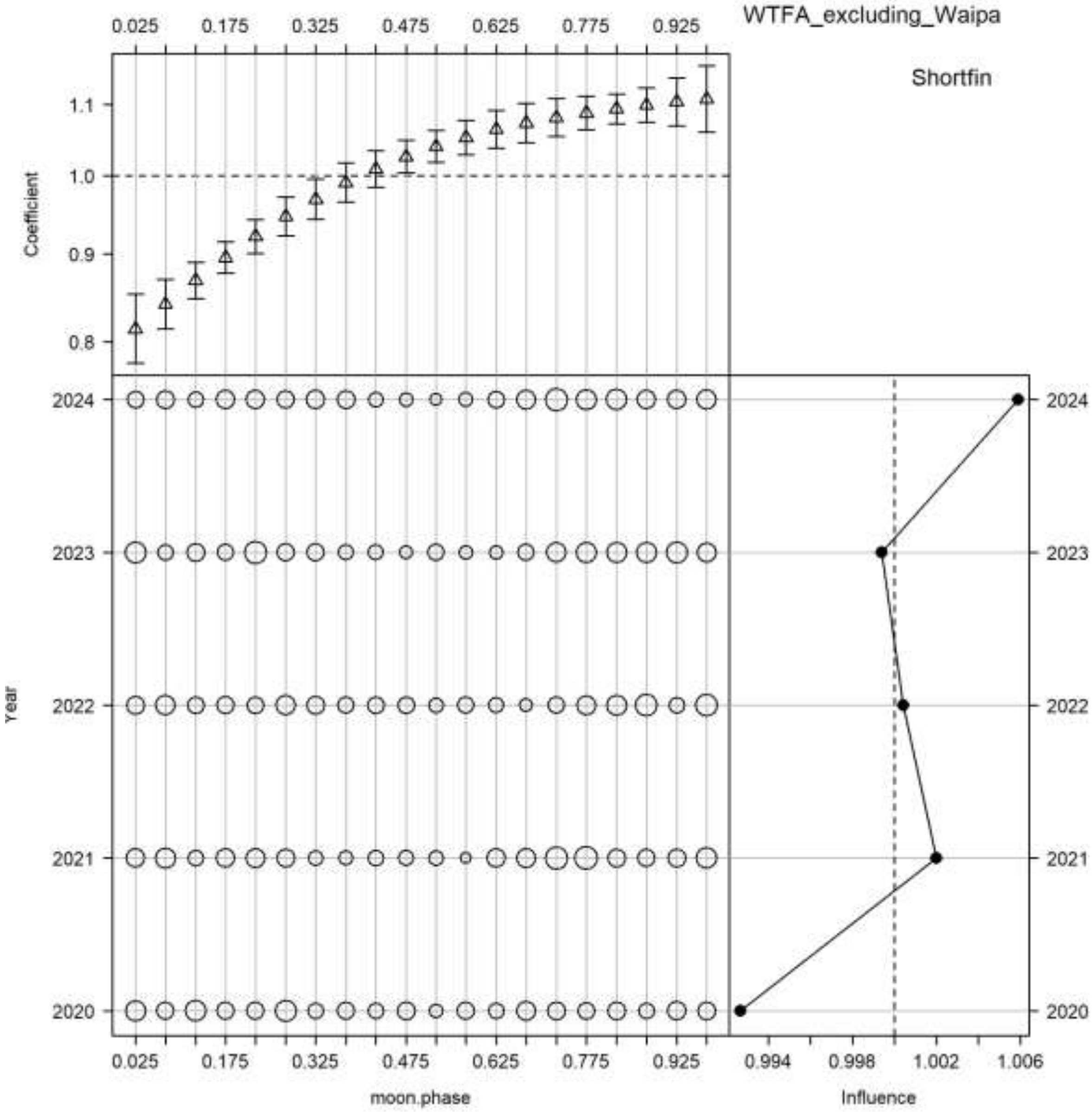

Figure X18: Influence of moon-phase for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

ESA AD (Waikato Tainui Fisheries Area – Waipa River)

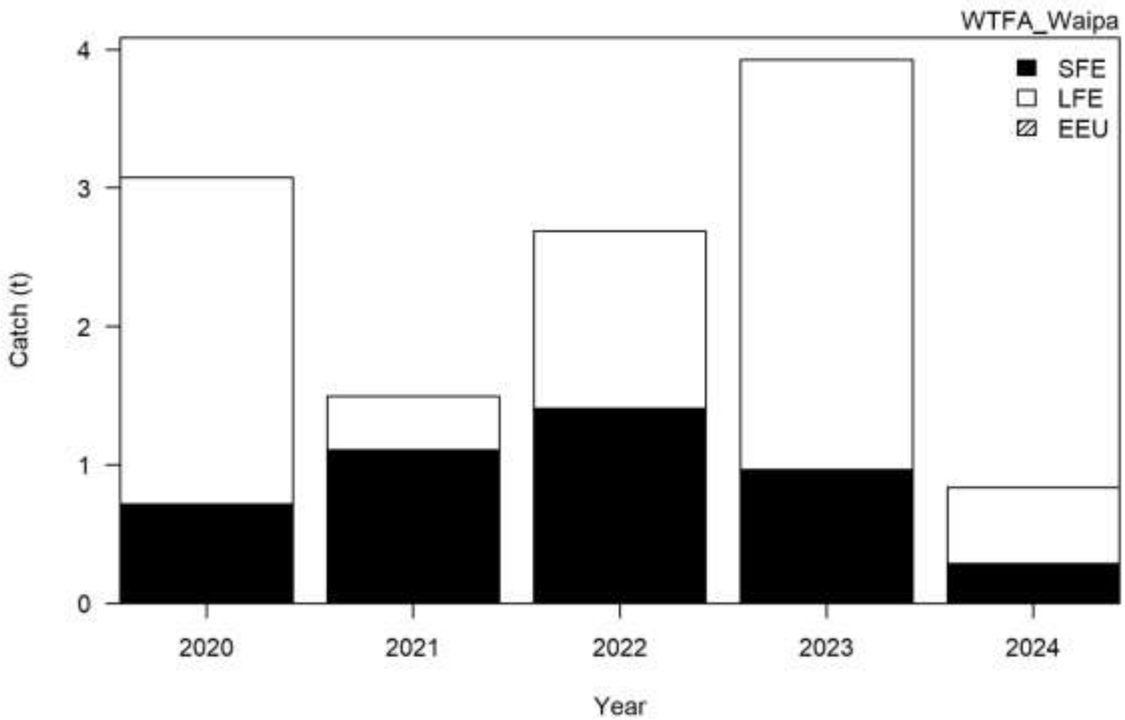

Figure Y1: Total estimated commercial catch of legal size shortfin (SFE-300 to 2000 g), longfin (LFE-400 to 2000 g), and unclassified eel catch (EEU) for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

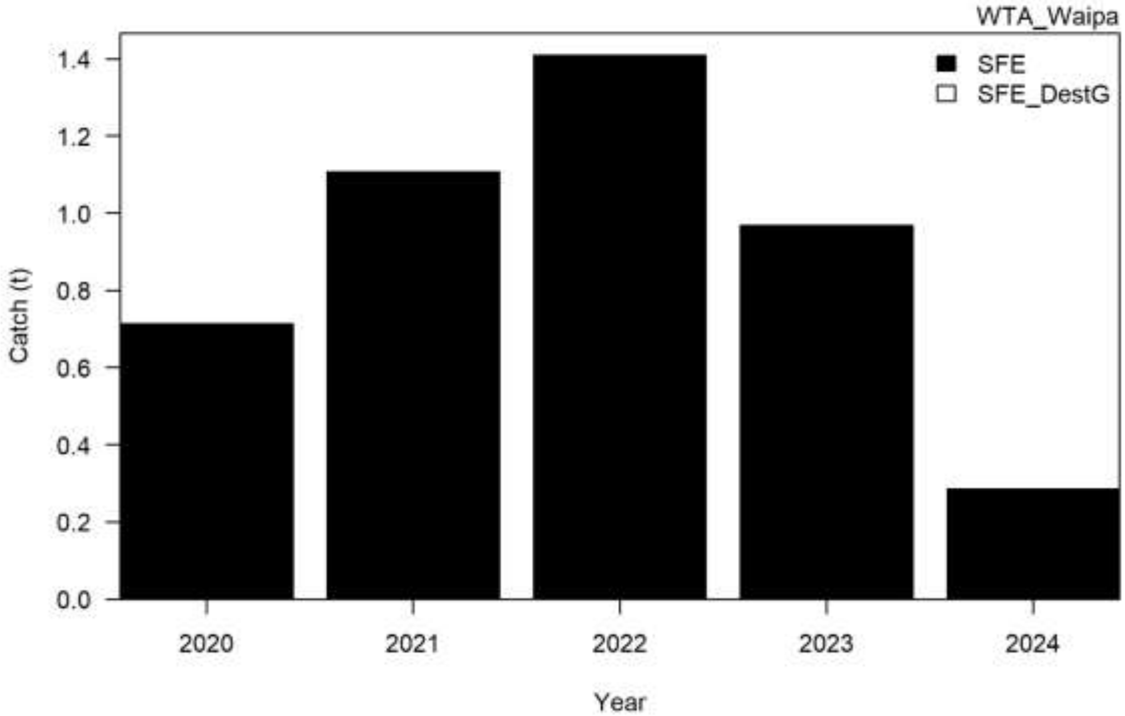

Figure Y2: Total estimated commercial catch of legal sized (300 to 2000 g) shortfin (SFE) eels, and catch of destination G eels (over 2000 g) for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

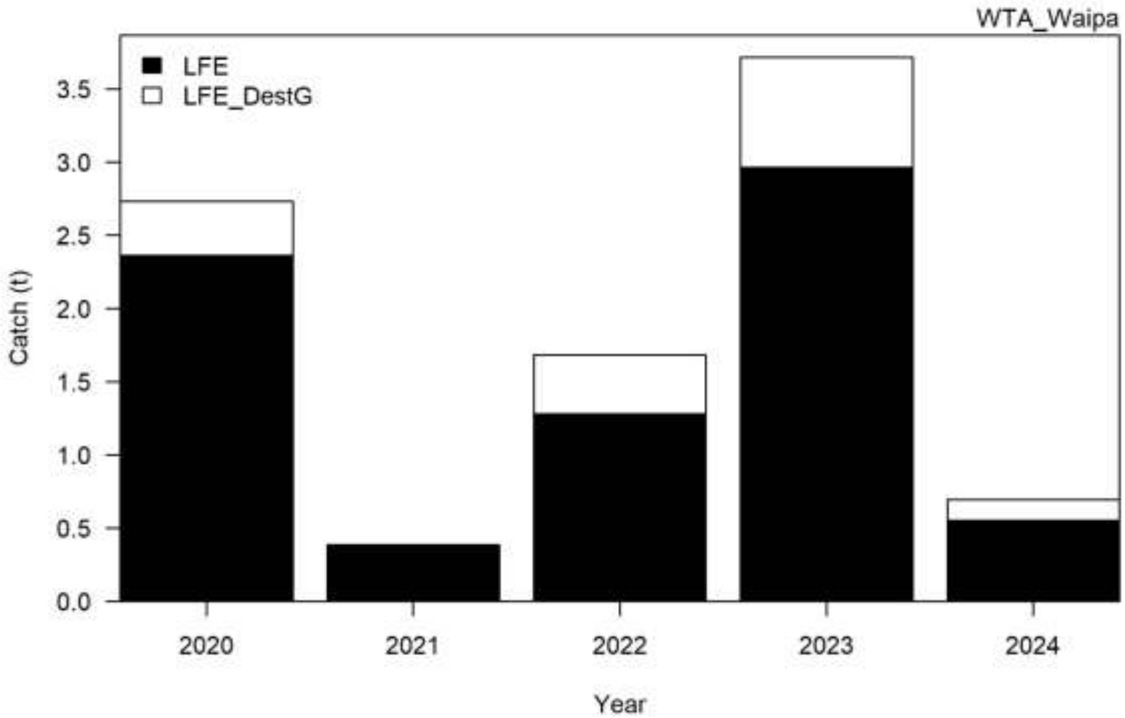

Figure Y3: Total estimated commercial catch of legal sized longfin (LFE-400 to 2000 g) eels, and catch of destination G eels (over 2000 g) for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

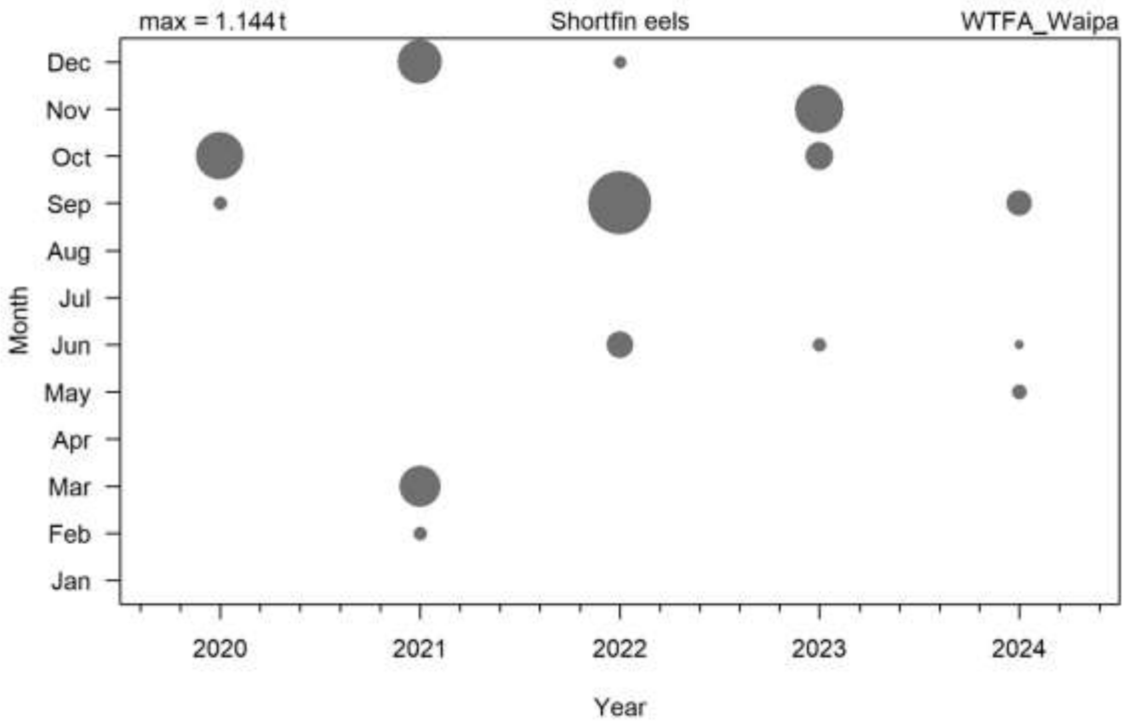

Figure Y4: Shortfin legal size eel catch by month for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

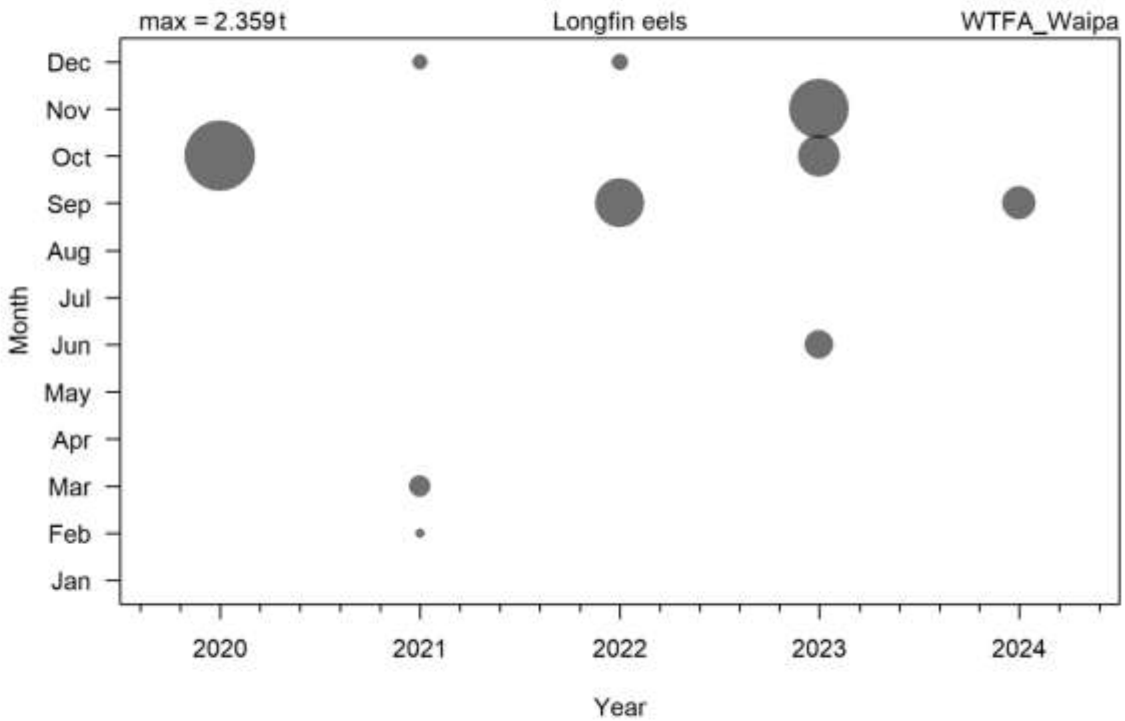

Figure Y5: Longfin legal size eel catch by month for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

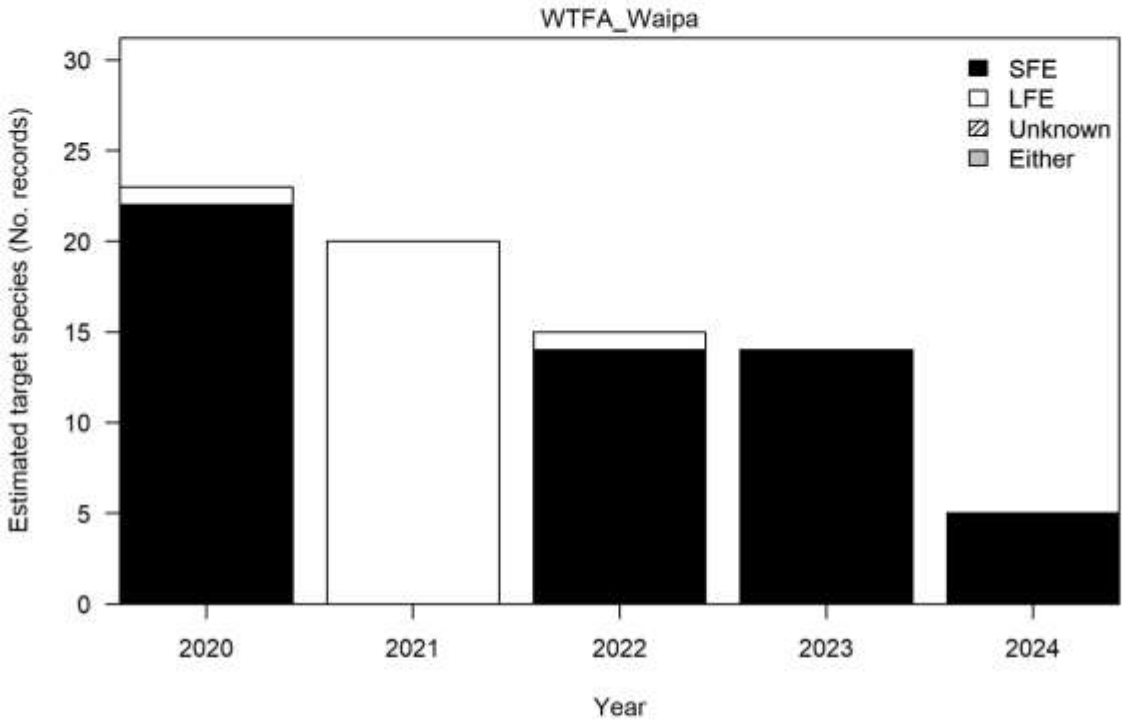

Figure Y6: Declared target species from 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

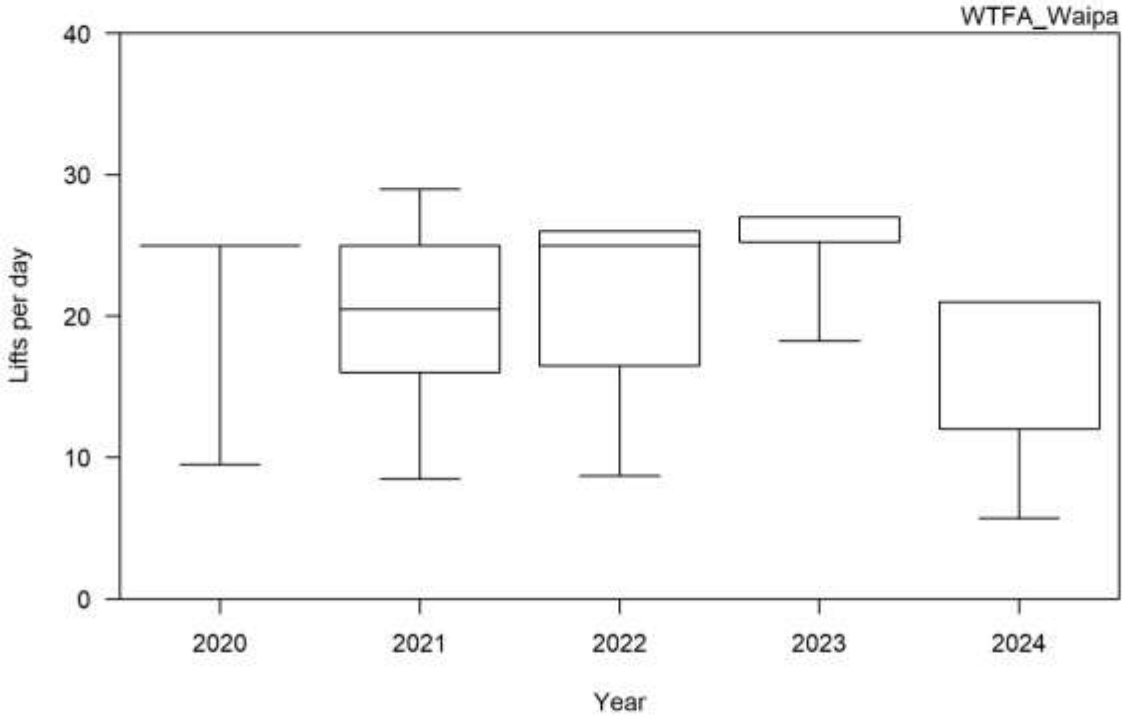

Figure Y7: Total lifts per day for the years 2019–20 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range. (WTFA, Waikato Tainui Fisheries Area).

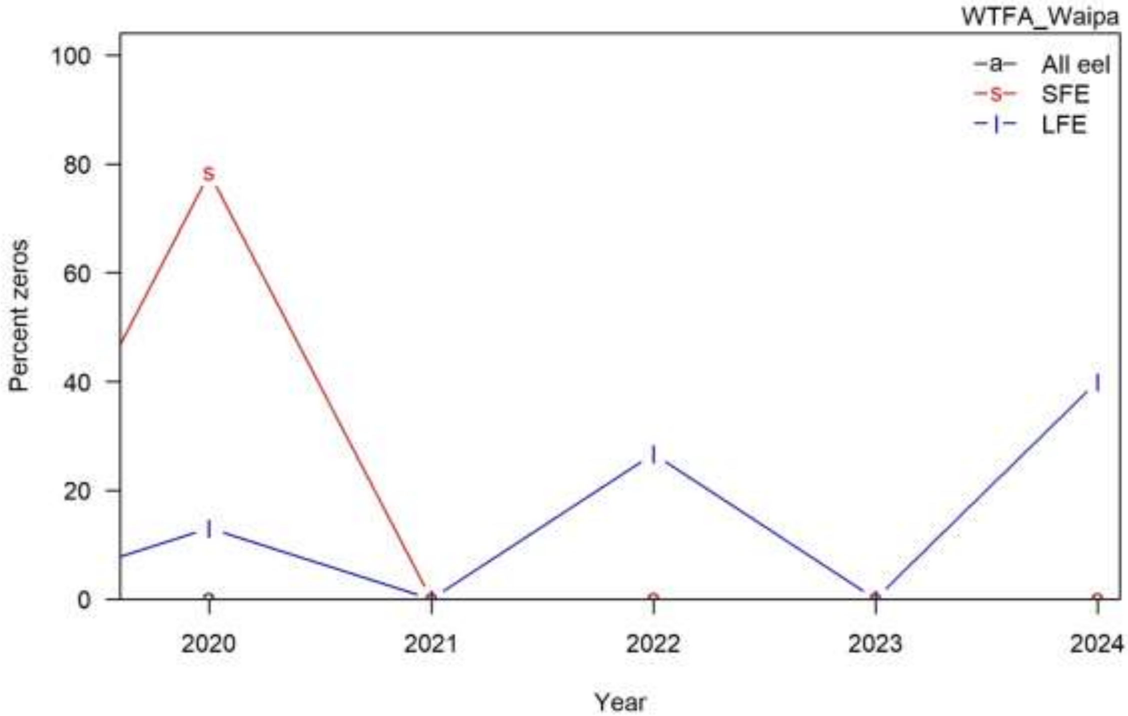

Figure Y8: Proportion of valid zero records for legal size all eels, shortfin (SFE), and longfin (LFE) catch for the years 2019–20 to 2023–24. Excludes zeros associated with reporting EEU (unclassified). (WTFA, Waikato Tainui Fisheries Area).

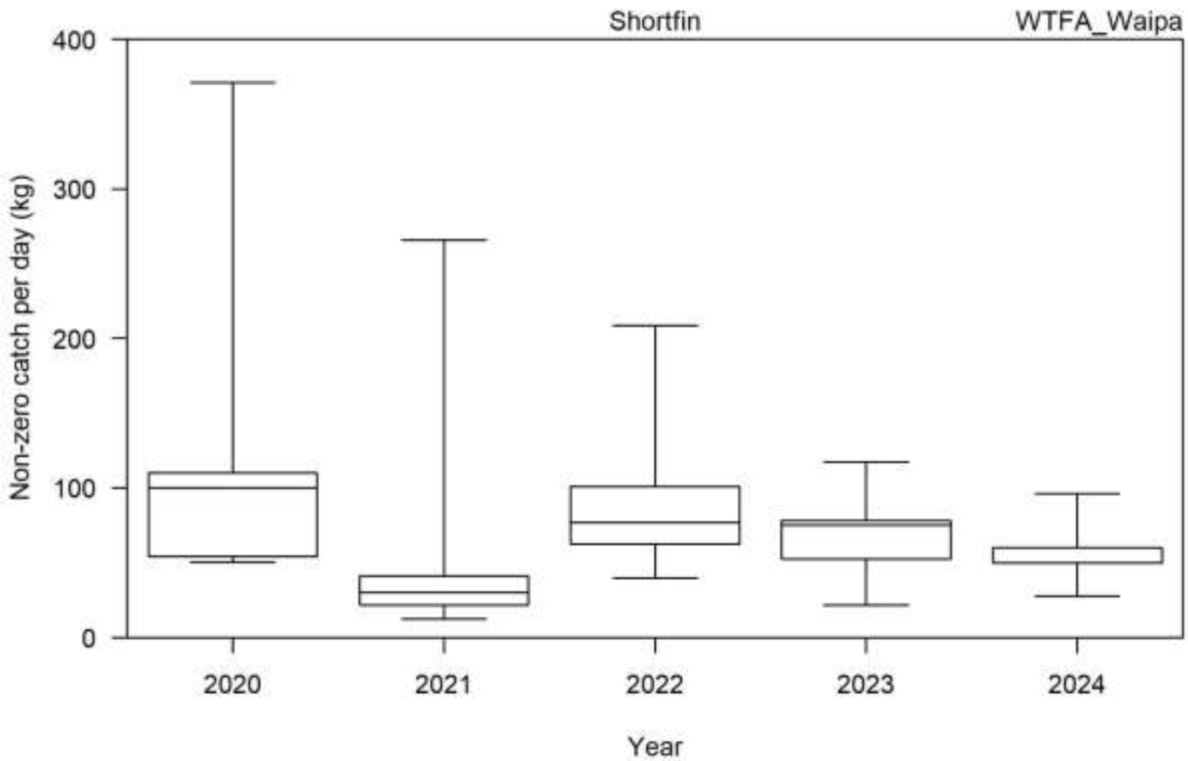

Figure Y9: Shortfin non-zero catch per day for legal size eels for the years 2019–20 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range. (WTFA, Waikato Tainui Fisheries Area).

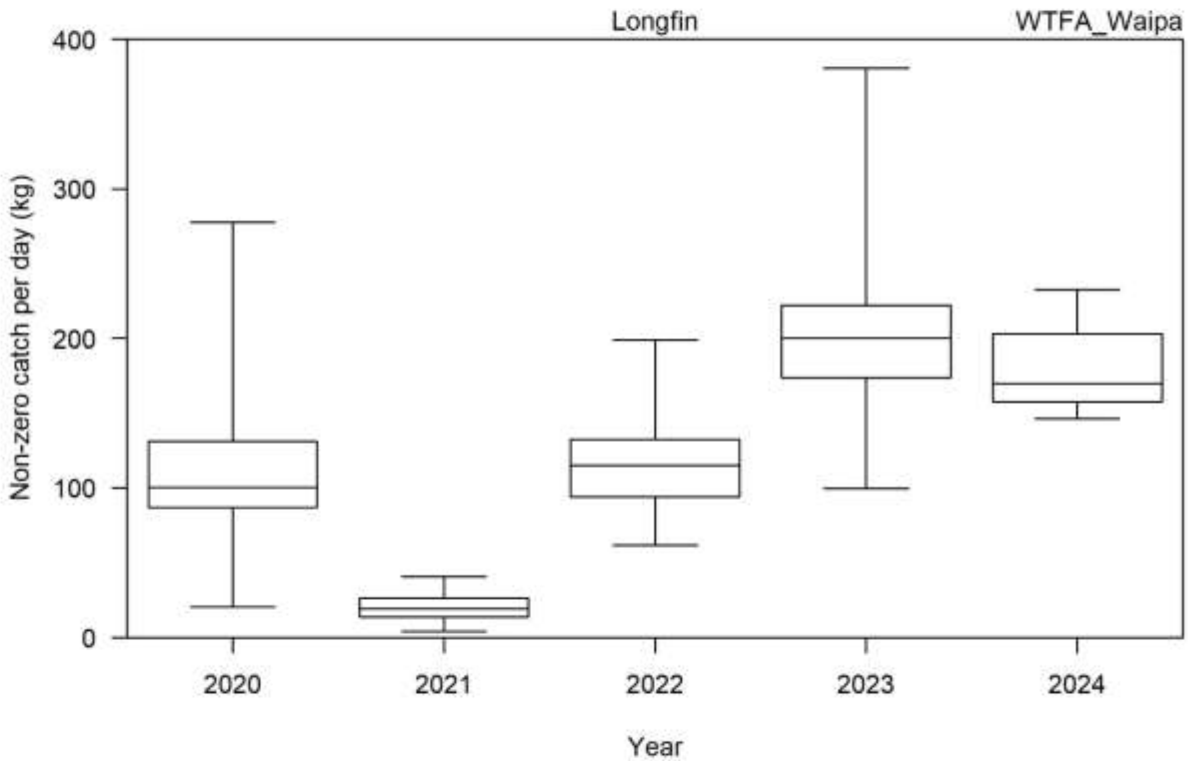

Figure Y10: Longfin non-zero catch per day for legal size eels for the years 2019–20 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range. (WTFA, Waikato Tainui Fisheries Area).

ESA AD (outside Waikato Tainui Fisheries Area – above Karapiro Dam)

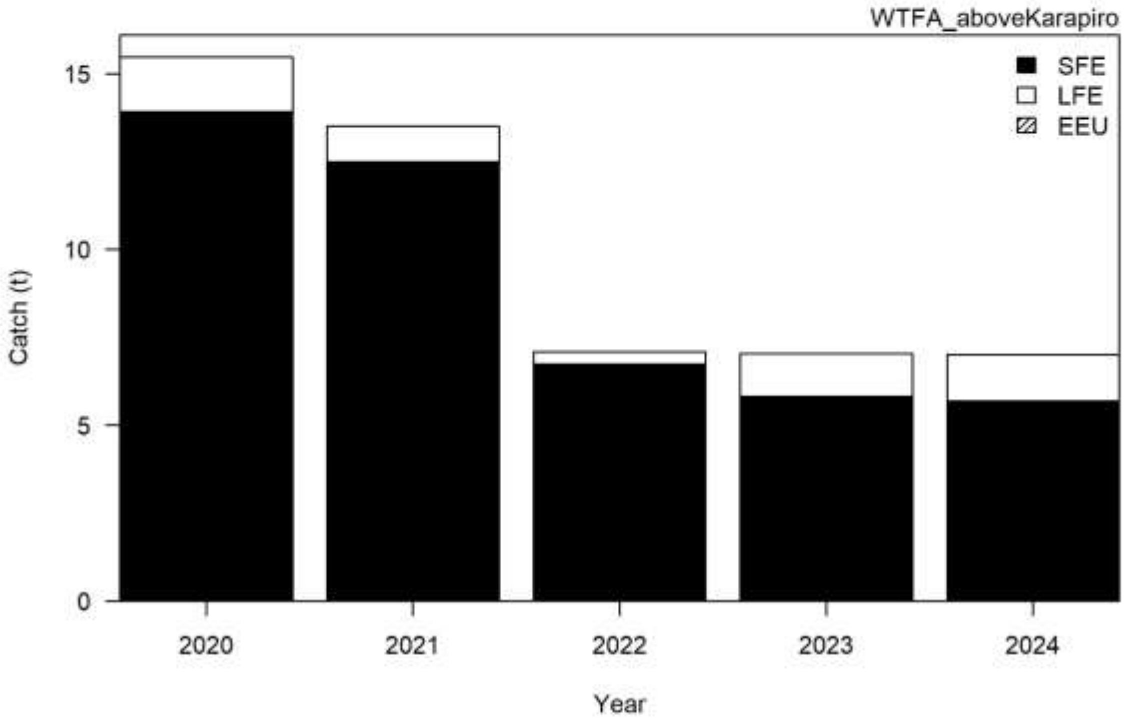

Figure Z1: Total estimated commercial catch of legal size (220 to 4000 g) shortfin (SFE), longfin (LFE), and unclassified eel catch (EEU) for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

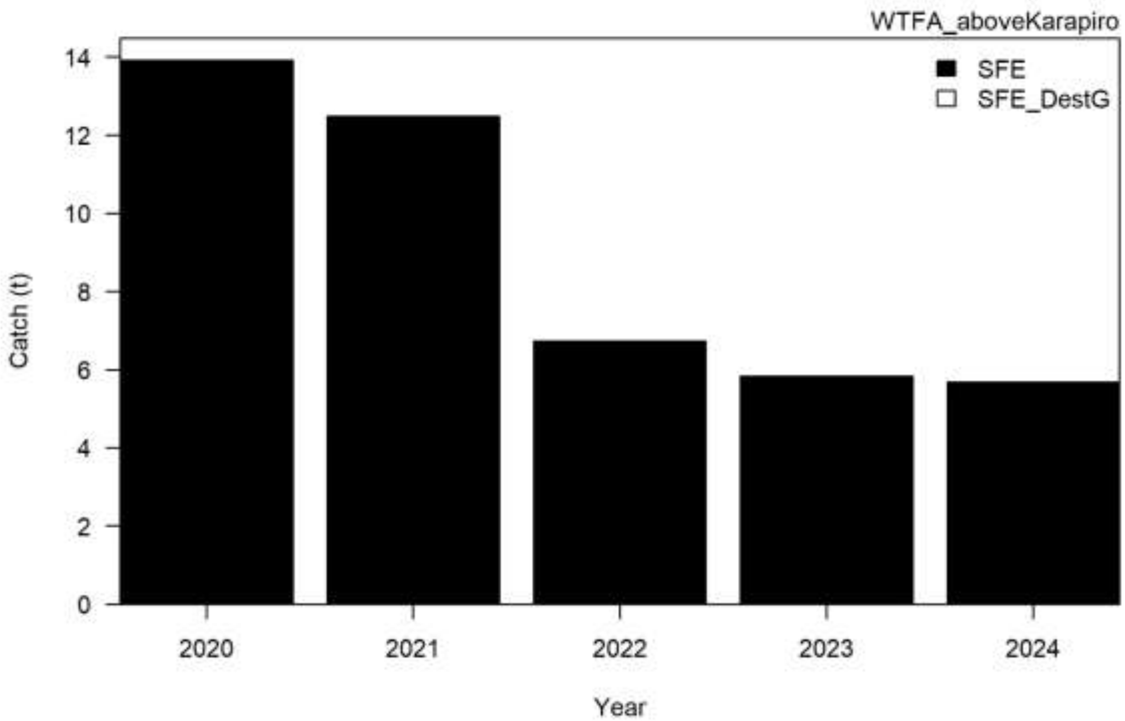

Figure Z2: Total estimated commercial catch of legal sized (220 to 4000 g) shortfin (SFE) eels, and catch of destination G eels (over 4000 g) for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

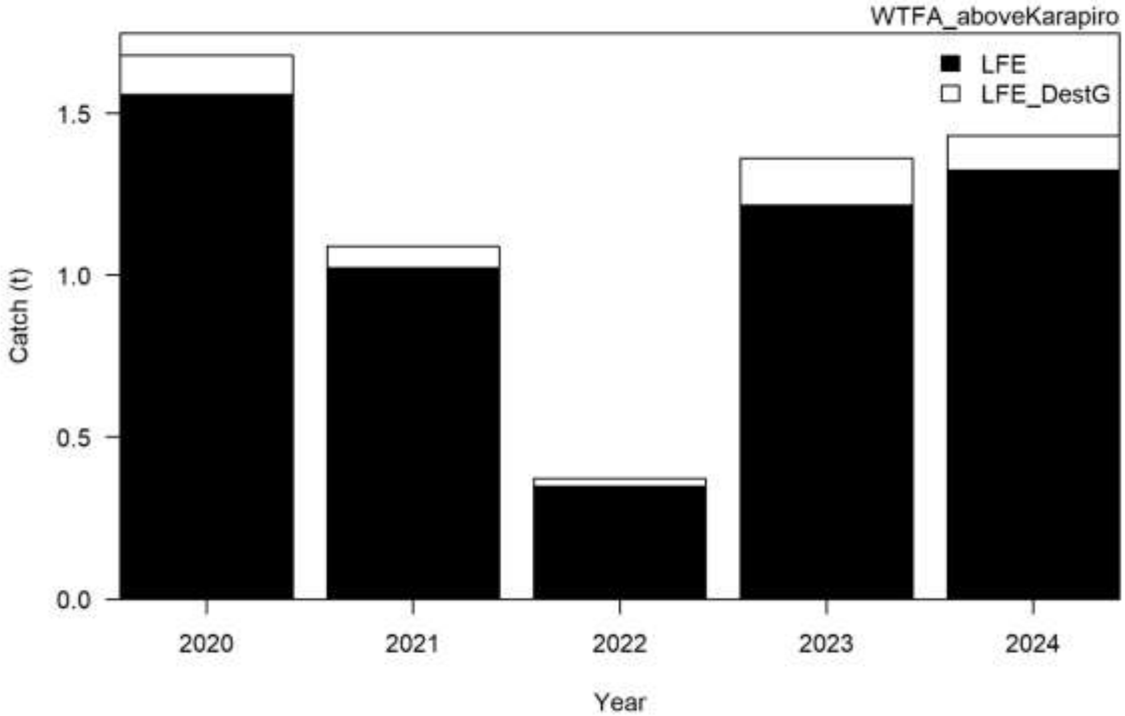

Figure Z3: Total estimated commercial catch of legal sized (220 to 4000 g) longfin (LFE) eels, and catch of destination G eels (over 4000 g) for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

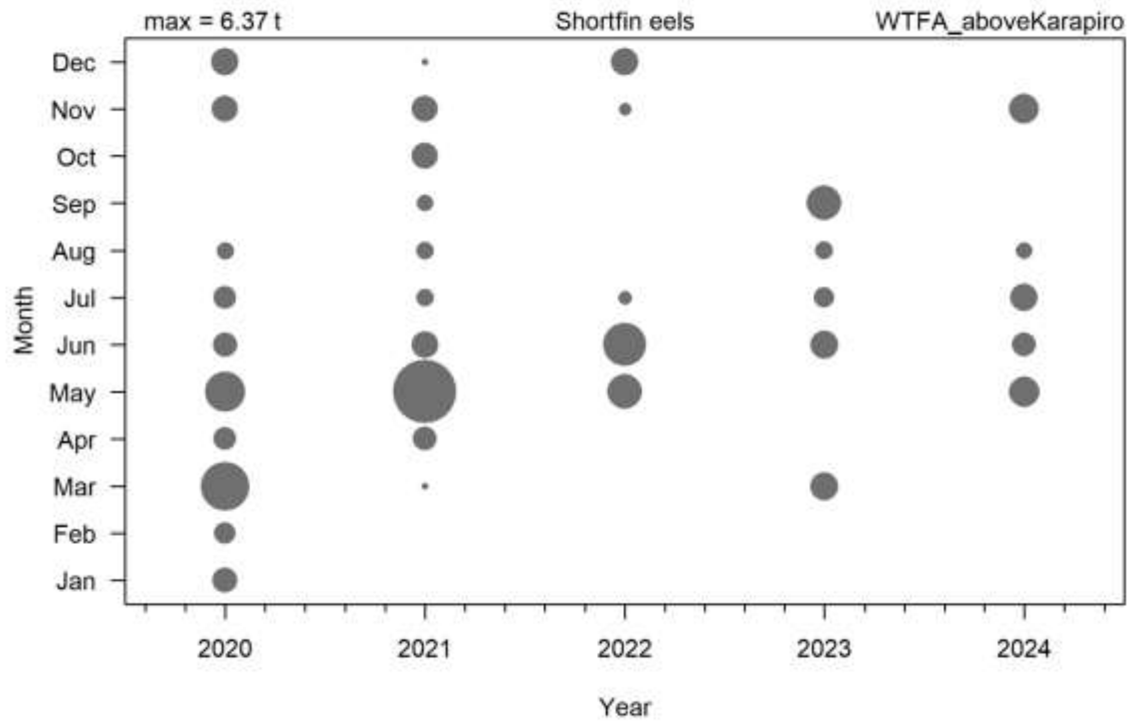

Figure Z4: Shortfin legal size eel catch by month for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

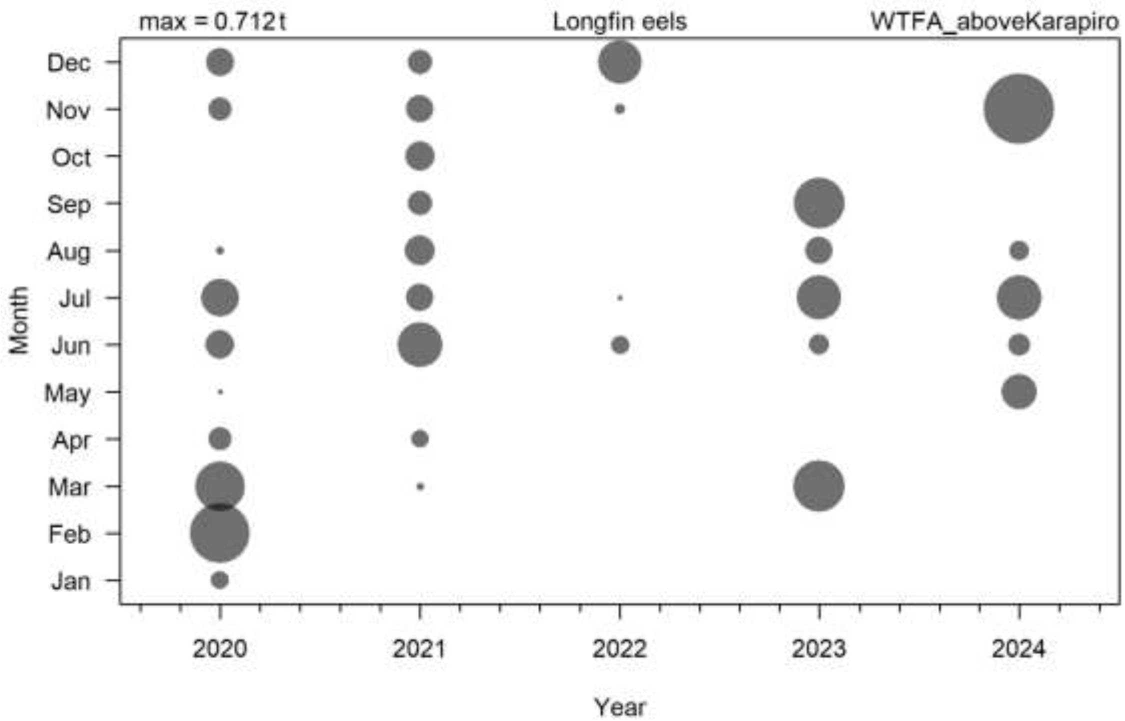

Figure Z5: Longfin legal size eel catch by month for the years 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

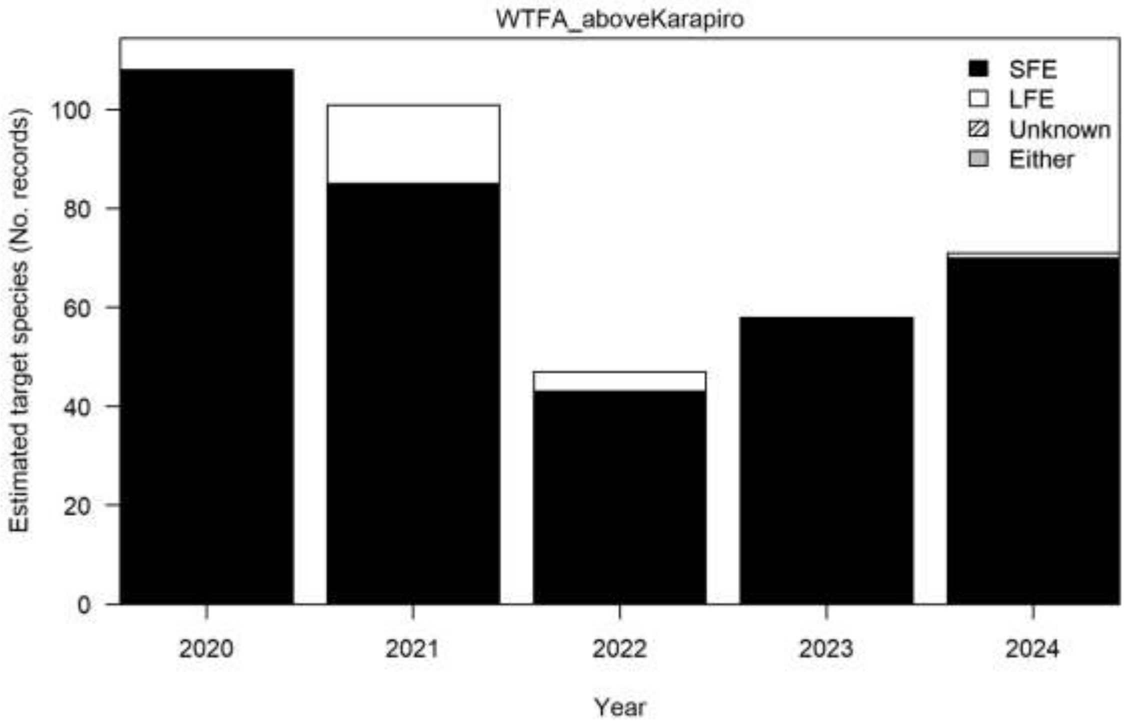

Figure Z6: Declared target species from 2019–20 to 2023–24. (WTFA, Waikato Tainui Fisheries Area).

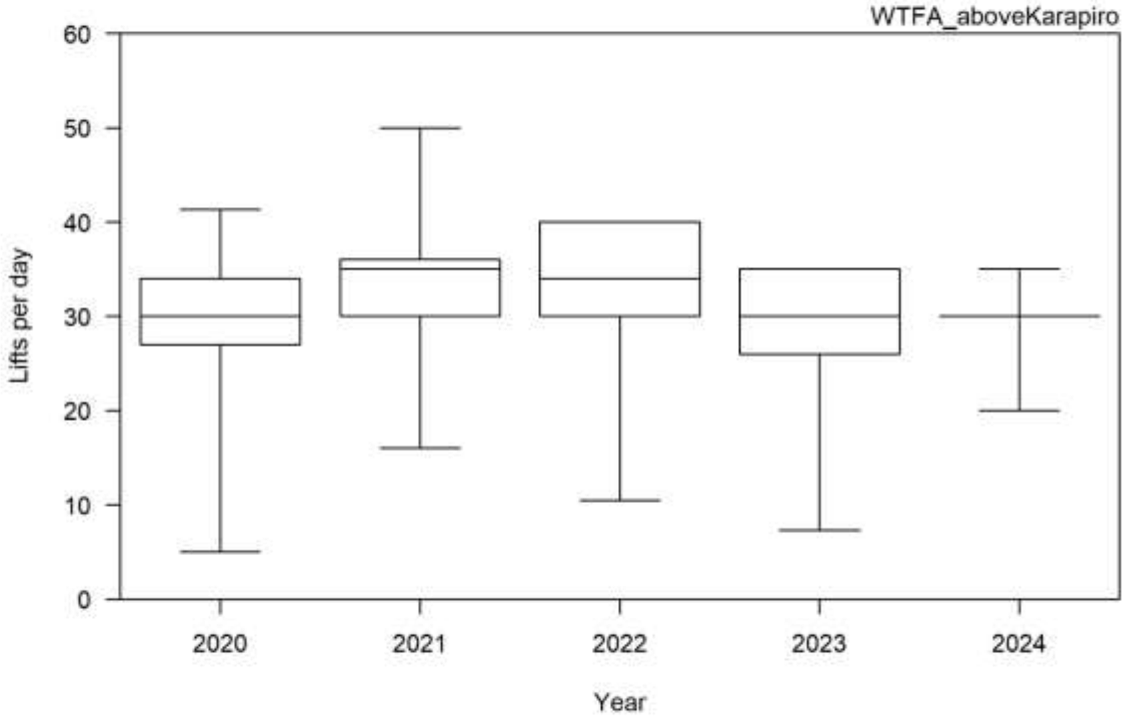

Figure Z7: Total lifts per day for the years 2019–20 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range. (WTFA, Waikato Tainui Fisheries Area).

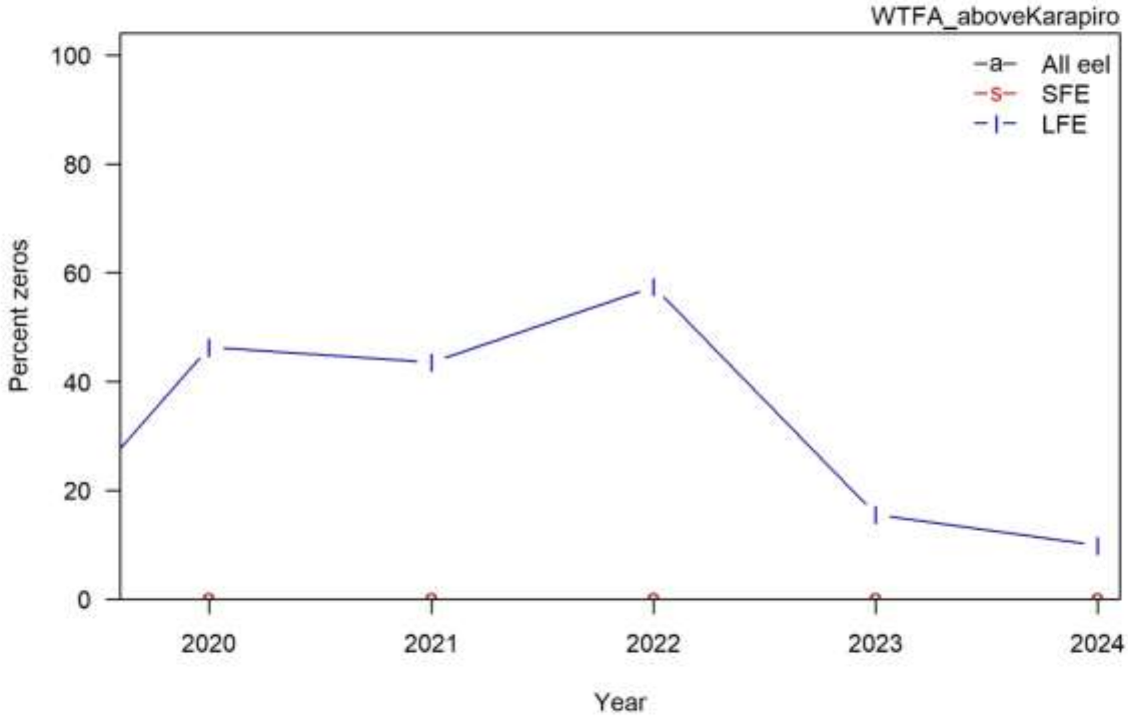

Figure Z8: Proportion of valid zero records for legal size all eels, shortfin (SFE), and longfin (LFE) catch for the years 2019–20 to 2023–24. Excludes zeros associated with reporting EEU (unclassified). (WTFA, Waikato Tainui Fisheries Area).

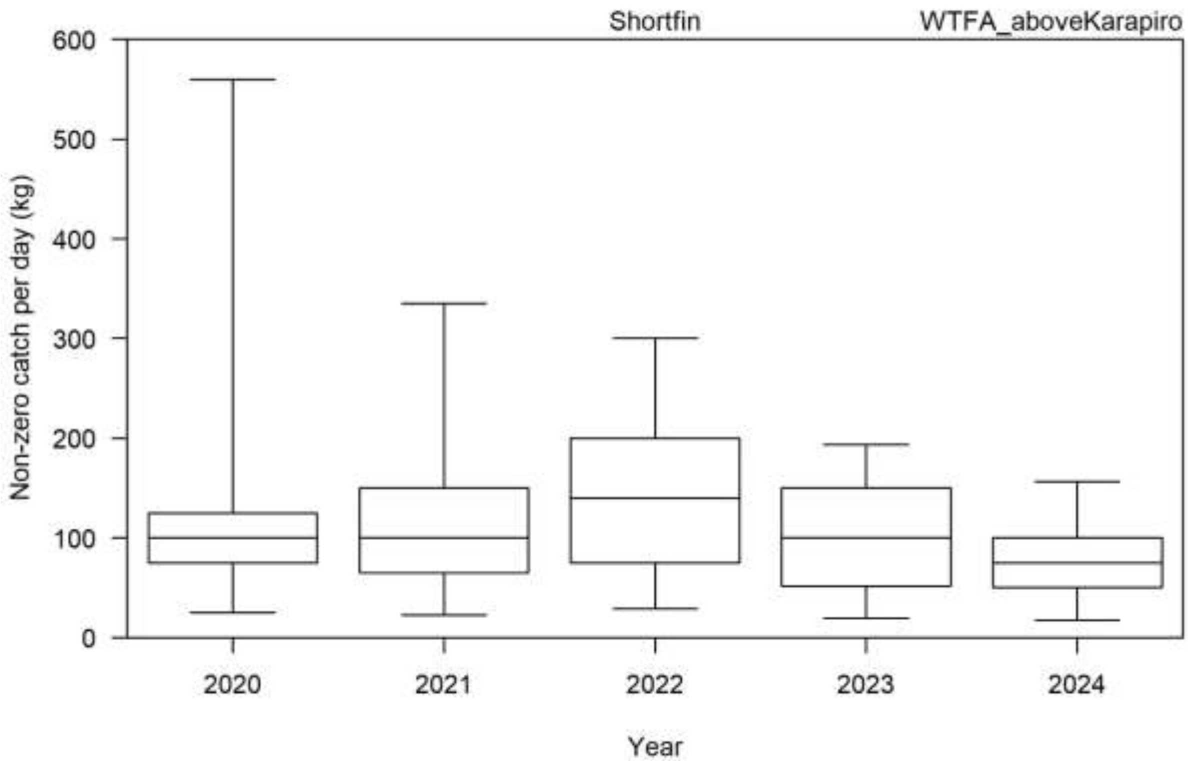

Figure Z9: Shortfin non-zero catch per day for legal size eels for the years 2019–20 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range. (WTFA, Waikato Tainui Fisheries Area).

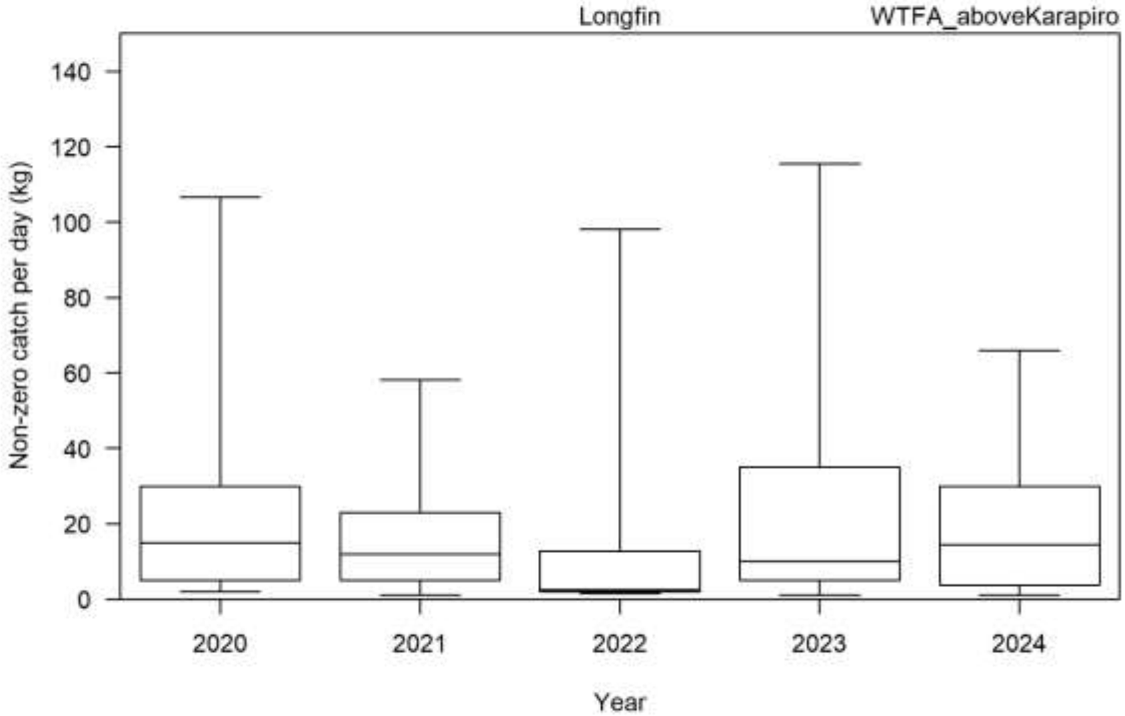

Figure Z10: Longfin non-zero catch per day for legal size eels for the years 2019–20 to 2023–24. The horizontal line is the median, the top and bottom of the box are the interquartiles (25th and 75th), and error bars are the 95th percentile range. (WTFA, Waikato Tainui Fisheries Area).

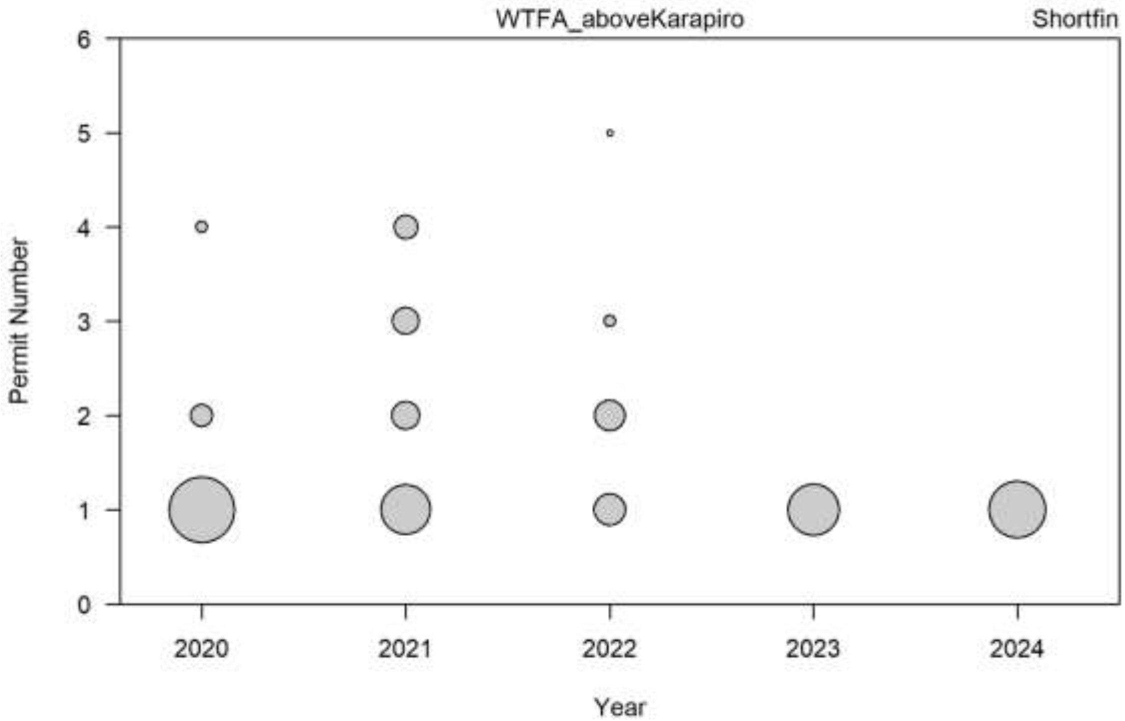

Figure Z11: Relative shortfin legal size eel catch and destination G, from all fishers (all circles) for the years 2019–20 to 2023–24 (post-ERS), and for core fishers (grey shaded circles) included in the catch per unit effort analyses. (WTFA, Waikato Tainui Fisheries Area).

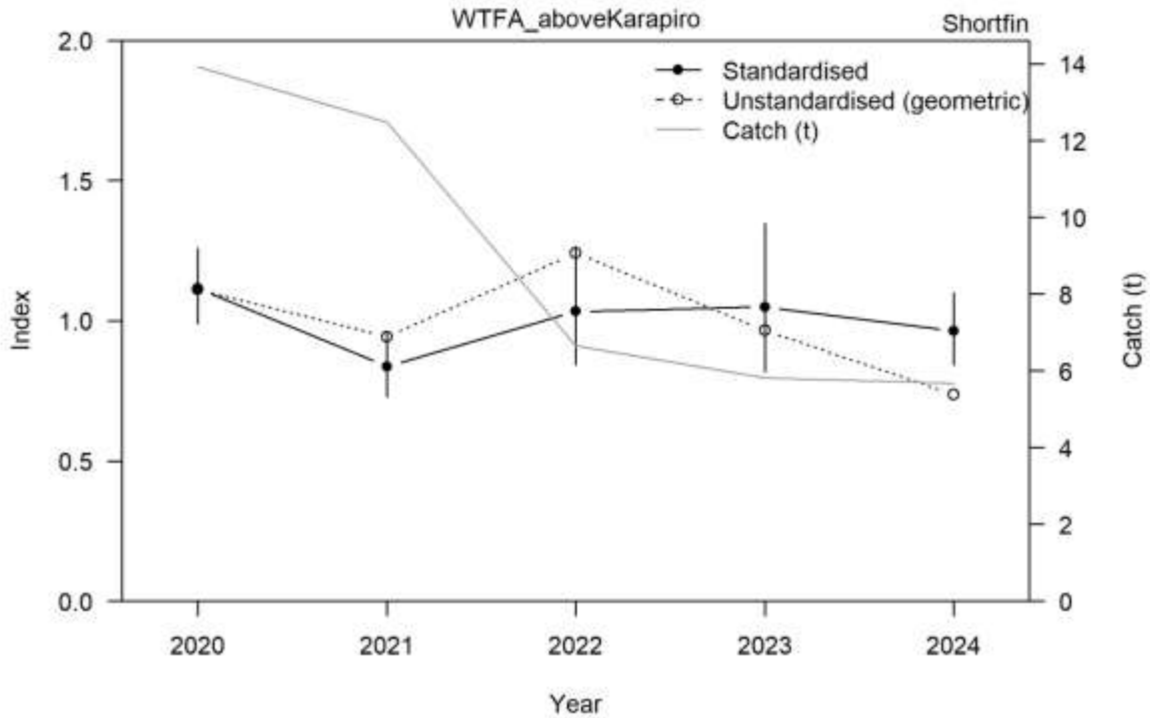

Figure Z12: Indices of unstandardised (geometric mean of catch per lift) and standardised CPUE for shortfin (core fishers) for the years 2019–20 to 2023–24 (post-ERS). The shortfin catch by core fishers is also plotted. Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

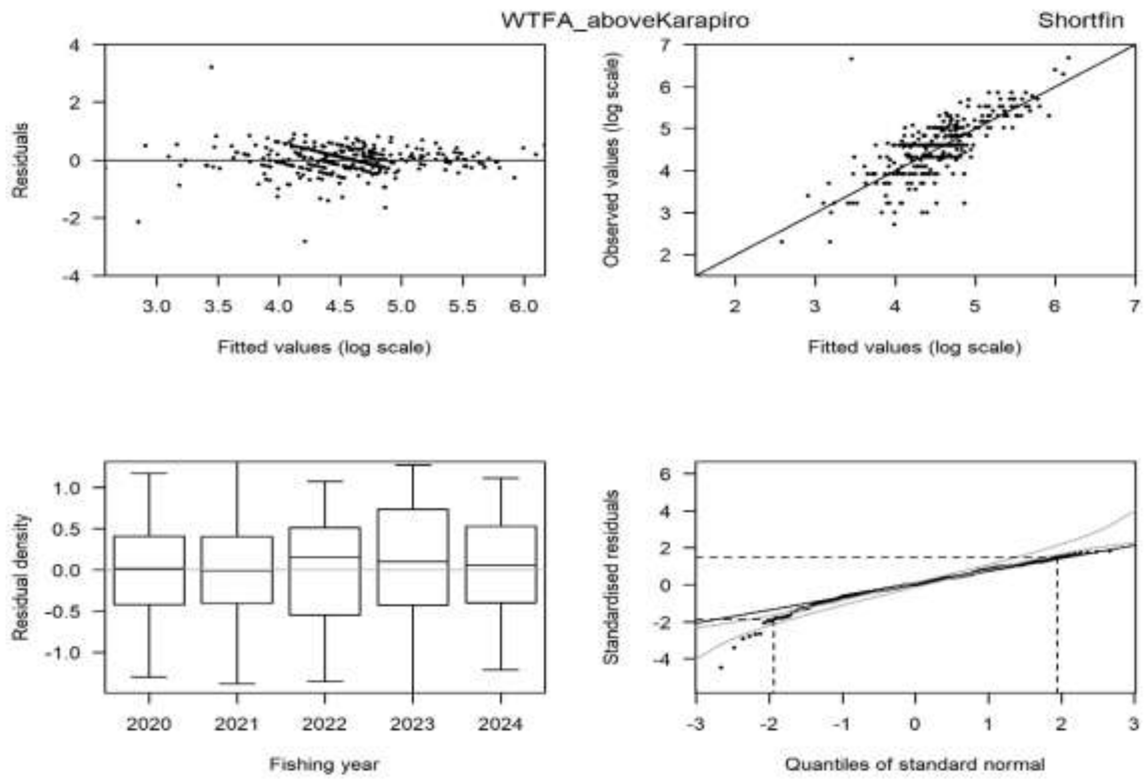

Figure Z13: Residual diagnostic plots for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. The grey lines on the quantile-quantile plot represent the 95% confidence envelopes of a standard normal distribution. (WTFA, Waikato Tainui Fisheries Area).

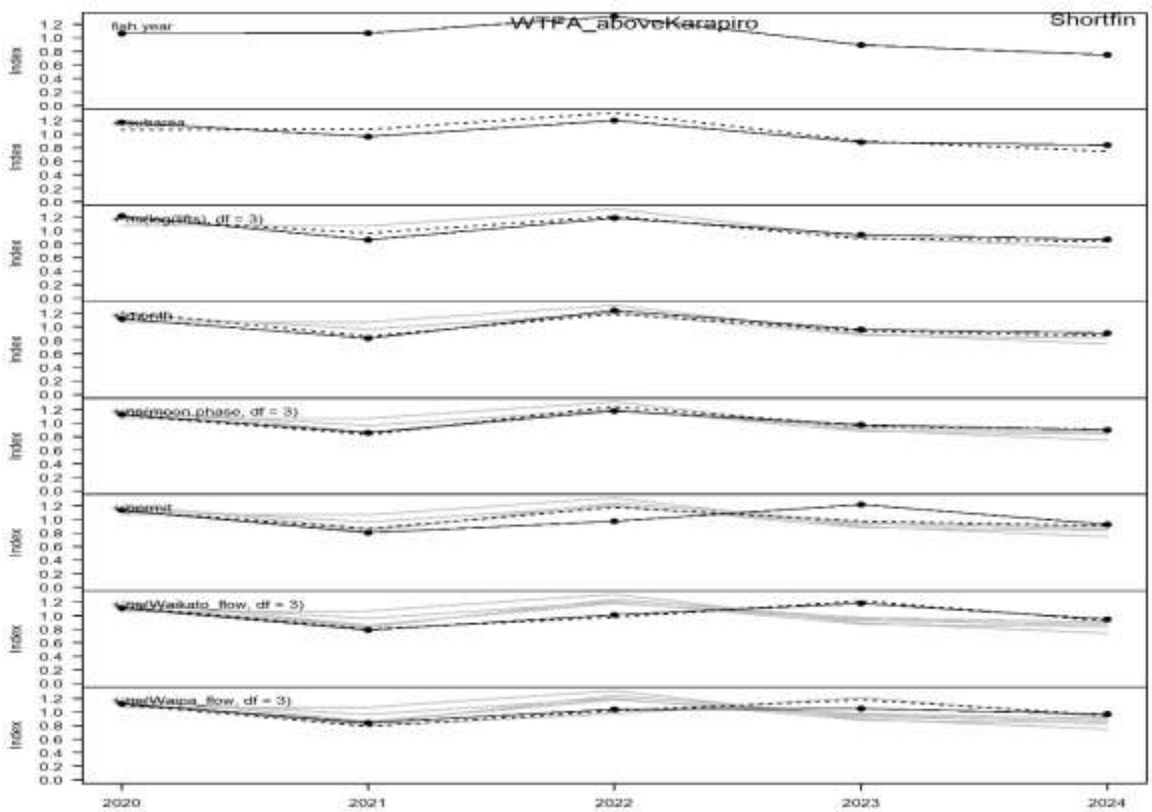

Figure Z14: Step plot for the shortfin eel CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. Each panel shows the standardised CPUE index as each explanatory variable is added to the model with the previous index shown by the dotted line and the grey lines for steps before that. (WTFA, Waikato Tainui Fisheries Area).

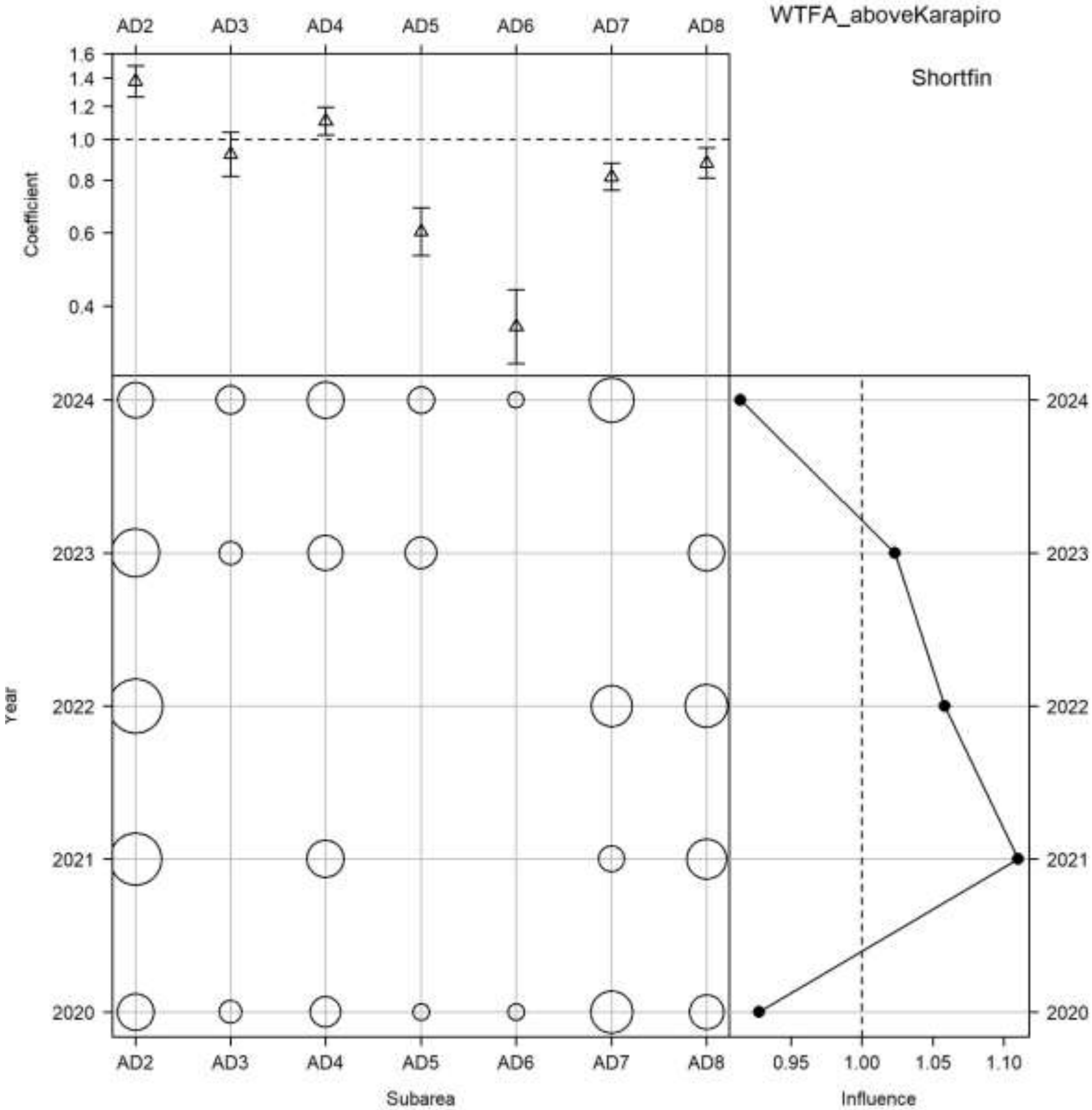

Figure Z15: Influence of subarea for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

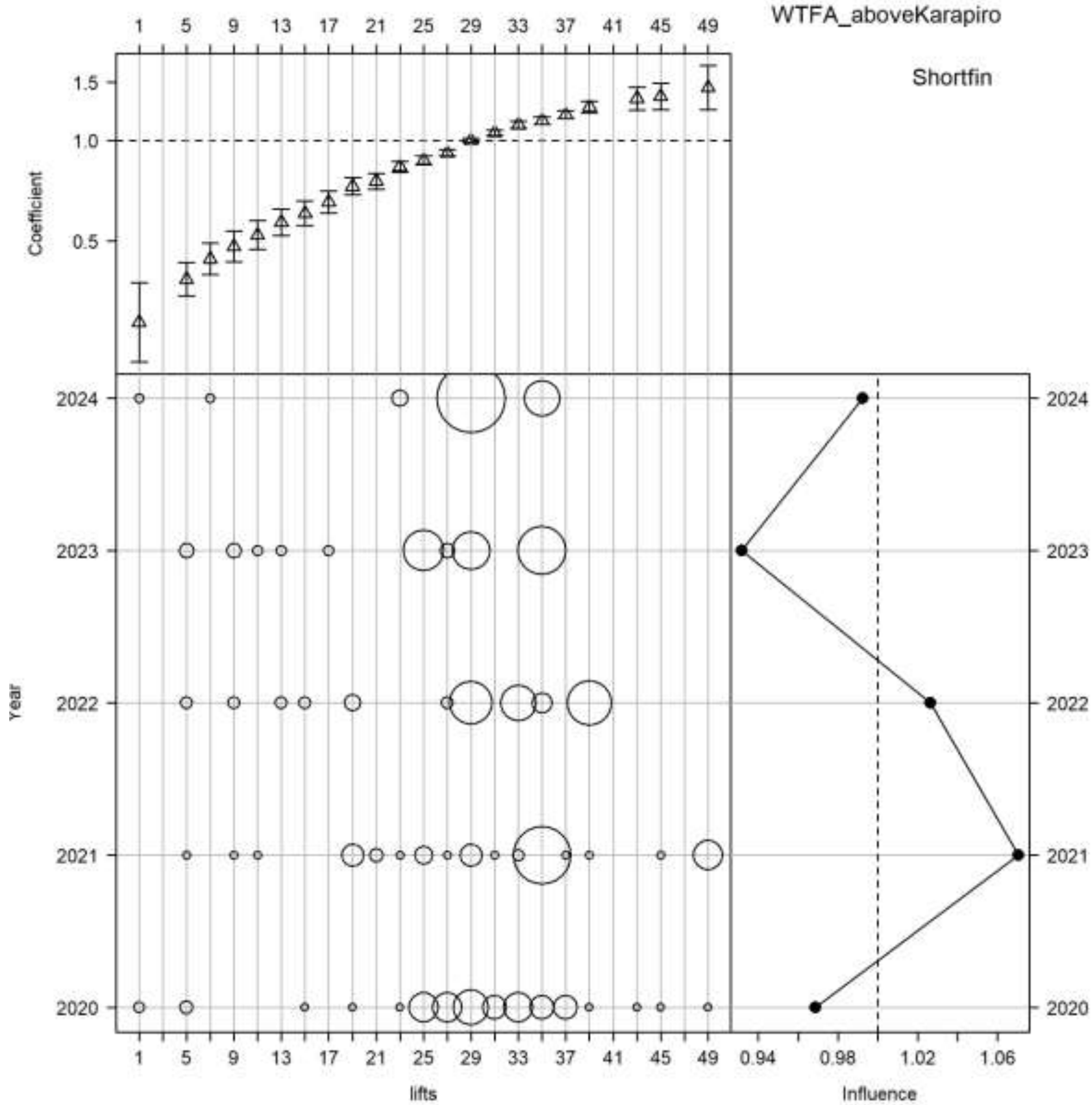

Figure Z16: Influence of lifts for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

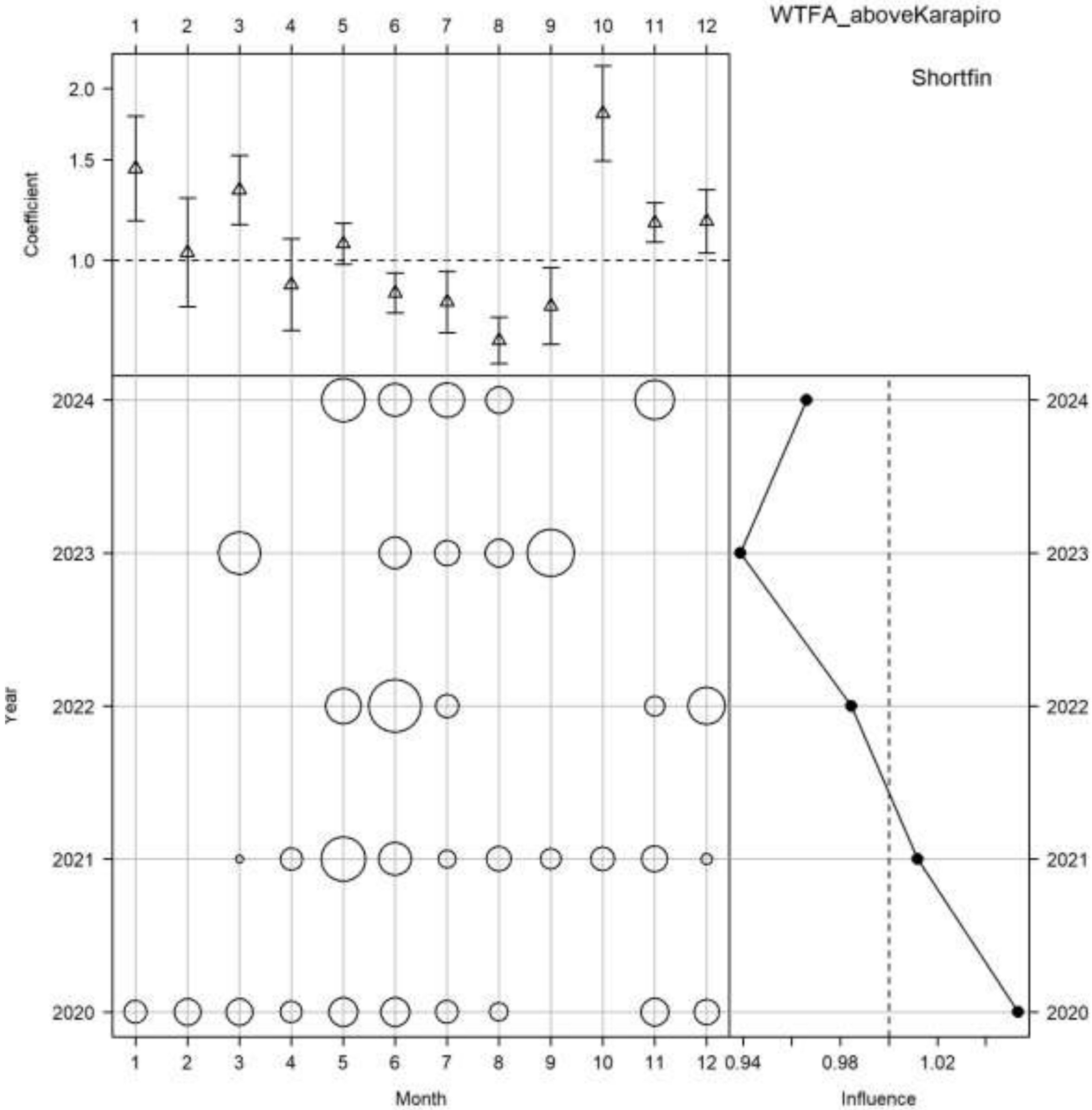

Figure Z17: Influence of month for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

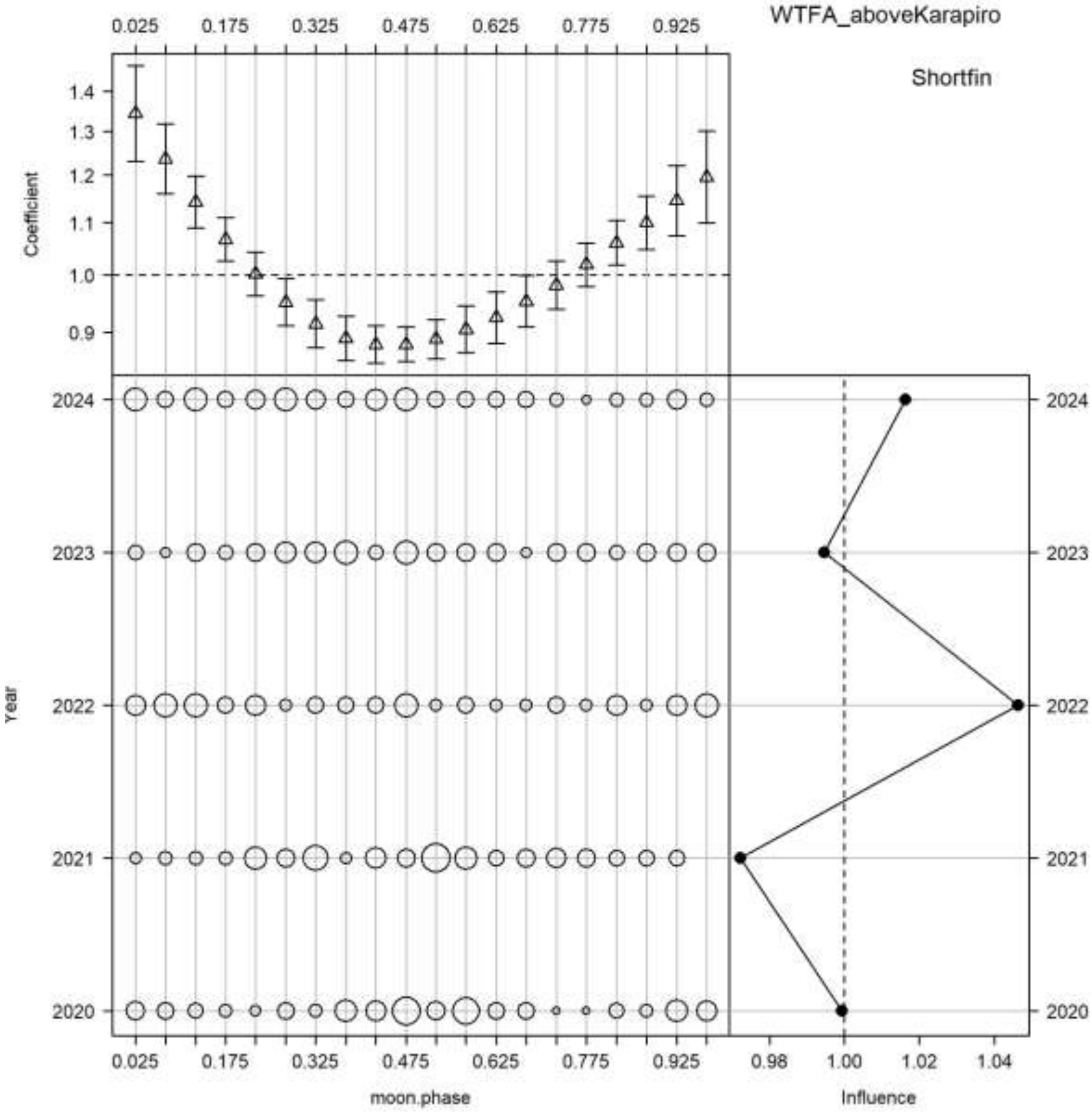

Figure Z18: Influence of moon-phase for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

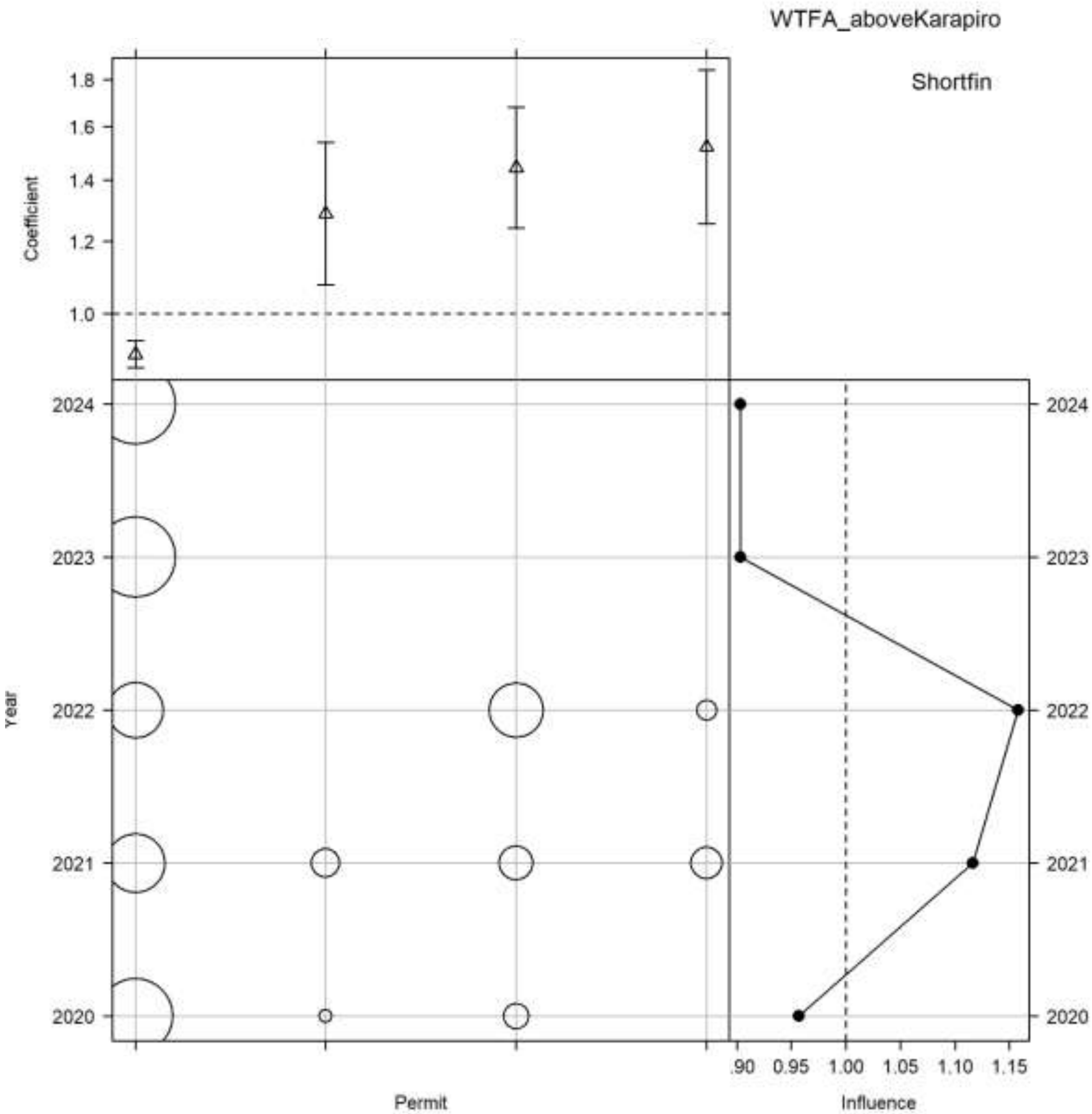

Figure Z19: Influence of permit for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

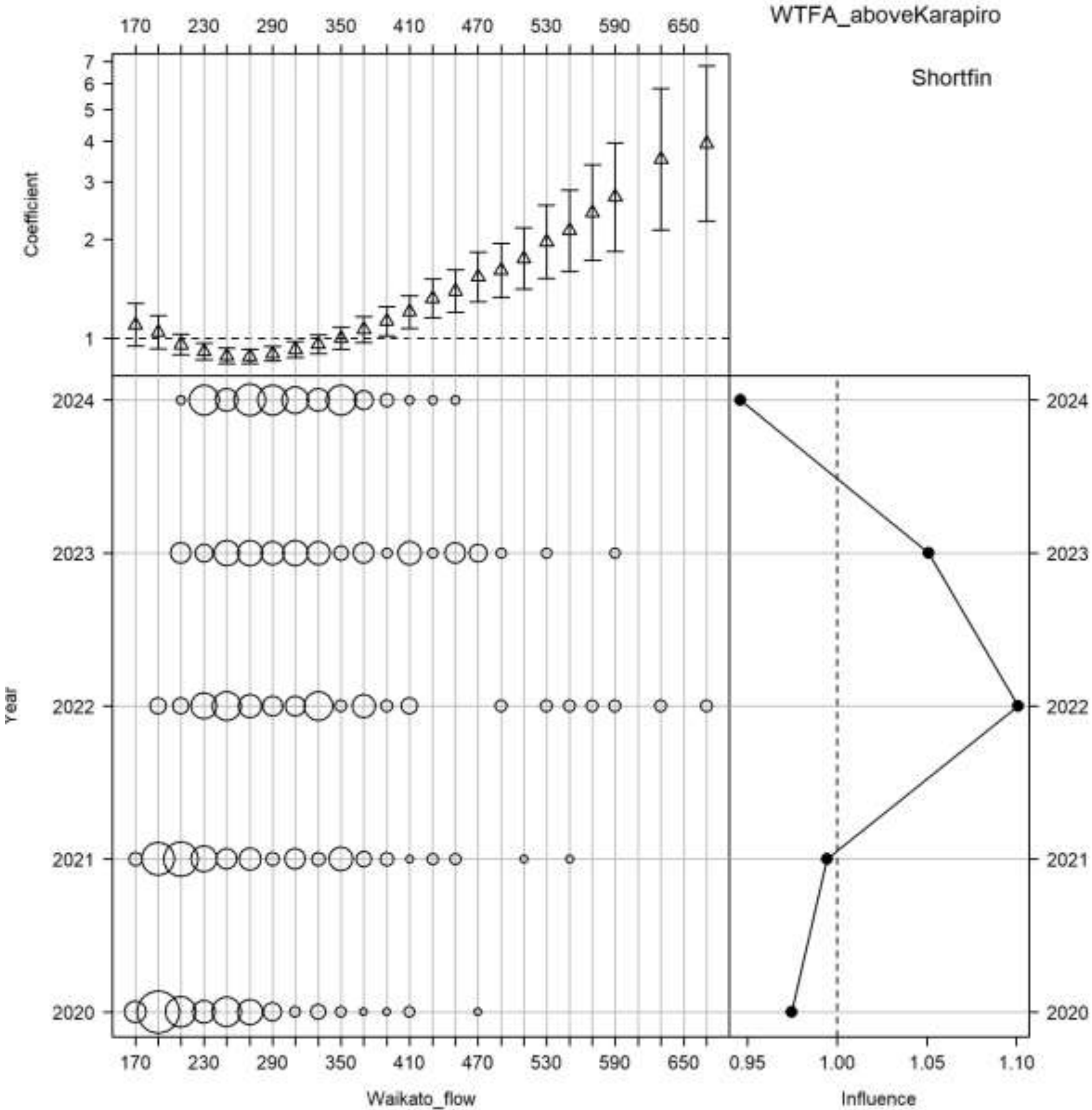

Figure Z20: Influence of Waikato River flow for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).

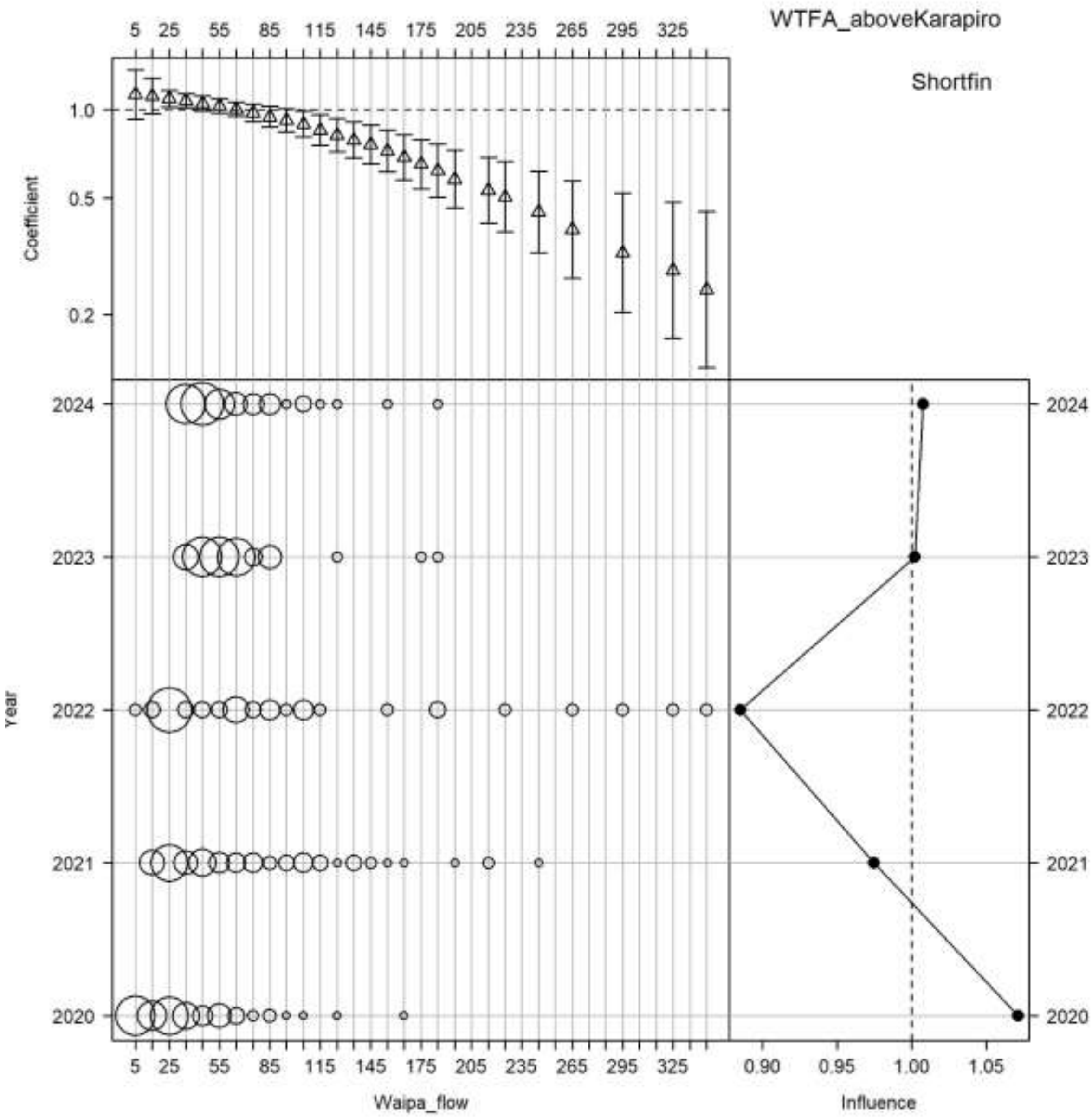

Figure Z21: Influence of Waipa River flow for the shortfin CPUE model for the years 2019–20 to 2023–24 (post-ERS). Catch includes legal size eels and destination G. (WTFA, Waikato Tainui Fisheries Area).