



Monitoring commercial eel fisheries: 2009–10 to 2011–12

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EXECUTIVE SUMMARY

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The commercial eel monitoring programme began in the North Island in 2003–04 with the aim of eventually capturing processor recorded data on size grades, species composition, and catch location from individual landings throughout New Zealand. In the North Island virtually all freshwater eel (longfin, *Anguilla dieffenbachii*; shortfin, *A. australis*) landings data in the 2009–10 to 2011–12 fishing years were provided, together with detailed capture location data. In the South Island data were provided for the first time in 2006–07 for ANG 15 only, with no details of catch location other than that all landings were from ANG 15 (Southland/Otago). Data came onstream for all South Island landings in 2010–11. This report provides results from the 2009–10 to 2011–12 fishing years and examines trends in the North and South Island time series.

North Island

For 2009–10, 2010–11 and 2011–12, the shortfin and longfin total catch and catch by size grades are presented at three geographical levels of scale (4 Quota Management Areas (QMA), 12 Eel Statistical Areas (ESAs), and 65 ESA subareas).

In 2009–10, data from 46 t (14.9% of total eel catch weight) of longfin and 264 t (85.1%) of shortfin from 776 landings were provided by North Island processors (98% of North Island total reported catch for 2009–10). The number of captured eels was estimated at 72 000 longfins (11.7% of the total number of captured eels) and 542 000 (88.3%) shortfins. Mean weight estimates of individual eels were 0.488 kg for shortfin and 0.644 kg for longfin. Half of the shortfin and longfin catch was from four to five subareas, the most important being Lake Waikare/Port Waikato (4L), and Dargaville (1D).

In 2010–11, data from 41 t (11.1% of the total eel catch weight) of longfin and 328 t (88.9%) of shortfin from 873 landings were provided by processors (110% of North Island total reported catch for 2010–11). The number of captured eels was estimated at 49 000 longfins (7% of the total number of captured eels) and 656 000 (93%) shortfins. Mean weight estimates of individual eels were 0.500 kg for shortfin and 0.838 kg for longfin. Half of the shortfin and longfin catch was from four to five subareas, the most important being Lake Waikare/Port Waikato (4L) and Dargaville (1D) for shortfin, and Dargaville (1D) and Pirongia Forest (4J) for longfin.

In 2011–12, data from 77 t (18.5% of the total eel catch weight) of longfin and 339 t (81.5%) of shortfin from 1002 landings were provided by processors (99% of North Island total reported catch for 2011–12). The number of eels captured was estimated at 106 000 longfins (13.5% of the total number of captured eels) and 676 000 (86.5%) shortfins. Mean weight estimates of individual eels were 0.501 kg for shortfin and 0.725 kg for longfin. Half of the shortfin and longfin catch was from five to six subareas, the most important being Napier (7D) and Dargaville (1D) for shortfin, and Dargaville (1D) and Pirongia Forest (4J) for longfin.

North Island trends

The North Island commercial shortfin catch from 2003–04 to 2011–12 shows no trend in total catch or in the proportion of the catch by the size grades (small, medium, and large). Of the 63 subareas, 1D (Dargaville), and 4L (Lake Waikare, Port Waikato) were consistently the main contributors to the North Island shortfin annual landings making up one quarter (24%) of the catch. The North Island commercial longfin catch from 2003–04 to 2011–12 shows a trend of generally declining catch, with markedly lower catches recorded between 2008–09 and 2010–11. The medium longfin size grade was also poorly represented in these three fishing seasons. This variability is largely driven by the TACC reduction in 2007–08, a fall in demand for medium size longfin eels during the three low catch years, and unavailability of quota in 2010–11. Of the 63 subareas where longfin was caught, 1D (Dargaville),

4J (Pirongia Forest), and 4L (Lake Waikare, Port Waikato) are consistently the main contributors to the North Island longfin annual landings making up nearly one third (29%) of the catch.

South Island (ANG 15)

In 2009–10, data from 39 t (57.5% of the total eel catch weight) of longfin and 28 t (42.5%) of shortfin from 315 landings were provided by processors from ANG 15 (97% of ANG 15 total reported eel catch for 2009–10). The number of captured eels was estimated at 52 000 longfins (54.2% of the total number of eels captured) and 44 000 (45.8%) shortfins. Mean weight estimates of individual eels were 0.740 kg for shortfin and 0.646 kg for longfin.

In 2010–11, data from 72 t (77% of the total eel catch weight) of longfin and 21 t (23%) of shortfin from 276 landings were provided by processors from ANG 15 (99.8% of ANG 15 total reported catch for 2010–11). The numbers of eels captured was estimated at 121 000 longfins (77.6% of the total number of eels captured) and 35 000 (22.4%) shortfins. Mean weight estimates of individual eels were 0.593 kg for shortfin and 0.615 kg for longfin.

In 2011–12, data from 82 t (79% of the total eel catch weight) of longfin and 21 t (21%) of shortfin from 384 landings were provided by processors (99% of ANG 15 total reported catch for 2011–12). The numbers of eels captured was estimated at 127 000 longfins (80% of the total number of eels captured) and 32 000 (20%) shortfins. Mean weight estimates of individual eels were 0.645 kg for shortfin and 0.666 kg for longfin.

South Island (All areas)

For 2010–11 and 2011–12, the shortfin and longfin total catch and catch by size grades are presented at three geographical levels of scale (58 ESA subareas, 6 QMAAs, and 10 ESAs).

In 2010–11, data from 109 t (36% of the total eel catch weight) of longfin and 193 t (64%) of shortfin from 476 landings were provided by processors from all South Island (102% of South Island total reported catch for 2010–11). The number of eels captured was estimated at 178 000 longfins (33% of the total number of eels captured) and 356 000 (67%) shortfins. Mean weight estimates of individual eels were 0.542 kg for shortfin and 0.612 kg for longfin.

In 2011–12, data from 148 t (46% of the total eel catch weight) of longfin and 177 t (54%) of shortfin from 648 landings were provided by processors (97% of South Island total reported catch for 2011–12). The numbers of eels captured was estimated at 209 000 longfins (40% of the total number of eels captured) and 309 000 (60%) shortfins. Mean weight estimates of individual eels were 0.572 kg for shortfin and 0.705 kg for longfin.

South Island Trends

Although shortfin is the dominant catch species in the South Island and was landed from most subareas where eels were caught, three quarters of the shortfin catch was from only three subareas (Te Waihora AS1 and AS2, Lake Brunner AX4, and Lake Waihora/Waipori River AV9), highlighting the concentrated nature of the shortfin eel stocks in the South Island and the importance of these few areas to the commercial shortfin fishery. Longfin were caught from nearly all subareas where eel catch was landed. Although longfin catch is more widespread than shortfin about half of the South Island longfin catch in 2010–11 and 2011–12 was from four to seven subareas, the key areas being Maitai River coast (AW11), Clutha River coast, (AV10), the Wairau River (AP2), and Oreti River inland (AW3).

There are no apparent trends in shortfin catch or catch by size grade in ANG 15, whereas longfin catches in ANG 15 have varied more than shortfin with 2008–09 and 2009–10 having relatively low catch, possibly resulting from unfavourable environmental conditions for targeting longfin in these years. There are currently only two years of detailed subarea data for the South Island.

1. INTRODUCTION

The commercial eel monitoring programme began in 2003–04 in the North Island with the collation of processor data on all freshwater eel (longfin, *Anguilla dieffenbachii*; shortfin, *A. australis*) size grades, species composition, and fine scale catch location from individual eel landings (Appendix 1). In the South Island, data were provided for the first time in 2006–07 for ANG 15 only, with no details of catch location other than that all landings were from ANG 15 (Southland/Otago). Data came onstream for all South Island landings in 2010–11. In this report results of the programme for the fishing years 2009–10, 2010–11 and 2011–12 are presented, as well as trends over the time series.

1.1 The fishery

The commercial freshwater eel fishery in New Zealand developed in the late 1960s. Landings consist of both the endemic longfin eel (*Anguilla dieffenbachii*), and the shortfin eel (*A. australis*) which is also found in southeast Australia. Landings from the north of the North Island can include the occasional Australian longfin eel (*A. reinhardtii*) (Jellyman et al. 1996). Total New Zealand eel catches peaked in 1972 at about 2100 t (Figure 1) and from 1972 to 1999 the catch fluctuated somewhat, but there was no clear trend with an annual average catch of about 1300 t. From 1999, catches progressively declined to a low of about 520 t in 2008–09 and have since gradually increased to 750 t in 2011–12.

Breakdown of the catch by island and species since 1984 indicates that before 2004–05 North Island contributed about 70%, on average, of the total New Zealand eel catch but this has dropped to 60% over the last seven years (Figure 1). In the North Island, shortfin has consistently been the dominant species, representing, on average, about 67% of the catch — this proportion has been increasing over the last seven years and in 2010–11, 87% of the landed catch was shortfin. North Island catches of shortfin steadily declined after 1995–96 to a low of 258 t in 2008–09 after which the catch has been increasing and in 2011–12 it was 341 t (Figure 1). Similarly, North Island longfin catch declined from about 1990–91 and has stabilised at about 45 to 70 t over the last five years (Figure 1). In the South Island there was little difference between the reported longfin and shortfin catches until about 2001–02 when shortfin landings have exceeded those of longfin and have comprised about 60% of the South Island landed catch. South Island catches of both species gradually declined since the mid-1990s, but stabilised with the introduction of the Quota Management System (QMS).

The onset of the shortfin and longfin declines in catches preceded the introduction of eels into the QMS in both the North and South Islands. These declines may, in part, have been the result of effort restrictions imposed on the fishery in the early 1990s. In the South Island the decline may also be related to a voluntary incremental increase in the fyke net escape tube openings which increased from 25 to 26 mm in 1990–91, to 27 mm in 1993–94, to 28.5 mm in 1994–95, and finally to 31 mm in 1997–98 (Vic Thompson, Mossburn Enterprises, Pers. Comm.).

The South Island eel fishery was introduced into the QMS on 1 October 2000 and Total Allowable Commercial Catches (TACCs) were set in six Quota Management Areas (QMA) (ANG 11 to ANG 16) for both species combined (Table 1, Figure 2). TACCs have been consistently under-caught in all South Island QMAs, with the exception of ANG 13 (Te Waihora) in some years (Ministry for Primary Industries 2012). On average the South Island TACC is about 64% caught (range 51 to 79%) with the highest catches recorded in 2011–12 (2011–12 data from MPI web site). The North Island eel fishery was introduced into the QMS on 1 Oct 2004 with four separate QMAs for shortfin and longfin (SFE 20–23 and LFE 20–23). The total North Island TACC for both species was set at 650 t, and has consistently been under-caught for both species with the average shortfin TACC 79% caught, and longfin TACC 62% caught. The North Island TACC was reduced to 418 t on 1 October 2007 (TACC reductions of 58% for longfin and 26% for shortfin), but catches were still substantially under-caught in every QMA for both species up to and including 2010–11 (Ministry for Primary Industries 2012) (Figure 1). In 2011–12 the TACC for the North Island for both species was caught (MPI web site). The under catch of the TACCs is

likely to be due to a number of factors including factory closures, retirement of long term fishers, market demands for various sizes, and significant unfished quota.

1.2 Stock assessment Information

Until the mid-1990s, knowledge of the sustainability of the eel fishery was based mainly on the interpretation of annual commercial catch data recorded on fisher and processor reporting forms (i.e. catch effort landing returns, CELR; eel catch effort landings returns, ECER; eel catch landing returns, ECLR; and monthly harvest returns, MHR), and knowledge of the biology of the two species. In more recent years, our understanding has been enhanced by commercial catch sampling (Beentjes & Chisnall 1997, 1998, Beentjes 1999, Speed et al. 2001, Beentjes 2005), monitoring recruitment of elvers and glass eels (Jellyman et al. 2000, Boubée et al. 2002, Martin et al. 2009), and the ongoing collection of size-grade, species composition and catch location from commercial landings (monitoring commercial eel fisheries programme, i.e., the subject of this report) (Beentjes 2005, 2008a, 2008b, 2011). Studies have also provided a method of estimating longfin eel biomass in New Zealand rivers based on physical variables such as river gradient and flow (Graynoth & Niven 2004). Analyses to assess the New Zealand eel stocks include ongoing catch-per-unit-effort (CPUE) analyses (Beentjes & Bull 2002, Beentjes & Dunn 2003a, 2003b, 2008, 2010, 2013), and most recently, modelling the longfin fishery in Southland and subsequently New Zealand wide (Dunn et al. 2009, Fu et al. 2012).

1.3 Objectives

Overall objective

1. To monitor size and species composition of commercially processed eels.

Specific objective

1. To monitor size and species of eels by recording quantities of eels in the different commercial size grades and link this to catch location in 2010/11 and 2011/12.*

*data collected in 2009–10 (MPI project IPA2009-07) was also included in the analyses and documented in this report.

2. METHODS

2.1 North Island

The database and analyses are updated with North Island landings from 2009–10 (MPI project IPA2009-07), and 2010–11 and 2011–12 (MPI project EEL201002) from two processors, New Zealand Eel Processing Co. Limited based in Te Kauwhata (NZ Eel), and Levin Eel Trading Company Ltd. (AFL- Levin)¹ (Appendix 1). Together, these two companies process virtually all North Island eel landings. In the factory the catch from each landing is sorted into species (shortfin and longfin) and visually graded by size before weighing, i.e., eels are sorted into weight grades by eye and a total weight of each species in each grade is recorded. The size grades are processor specific, and are usually determined by market demands and hence have changed slightly over time (Table 2).

The species weight grade information for each landing, including catch location, is recorded on customised landing record forms by the processor. Catch location is recorded at the sub catchment

¹ In 2008–09 the AFL owned Whenuapai factory closed and the operation was moved to Levin where catches were processed by Levin Eel Trading Ltd. For the purposes of reporting we refer to these data in this report as AFL-Levin.

level, e.g., the Waikato River catchment has twelve subareas, several of which are the hydro lakes. This was achieved by subdividing the 12 North Island ESAs (Table 1, Figure 3) into 65 ESA subareas. ESAs were divided into one to seven subareas except ESA AD, which has 17 subareas (Table 3). Maps showing the marked subareas were provided to each processor. Landings with catch taken from more than one subarea were prorated across the respective areas (e.g., Area 9A, 60%; 9B, 30%; 9E, 10%). The need to prorate combined subarea catches occurred occasionally when the programme was first implemented, and not at all in recent years. Data were provided to NIWA on a monthly basis for checking, collation, and entry onto a customised database.

For each fishing year (2009–10, 2010–11, and 2011–12) the catch of longfin and shortfin, from both processors combined, was plotted by subarea, ESA, and Quota Management Area. Unlike previous analyses where size grade data were analysed separately for each processor to account for the slightly different size grades used, in the present report the processors' data have been pooled by combining various size grades and assigning them into one of three categories; small, medium, or large (Table 2). This is necessary to develop a continuous time series comparison (the alternative was to present a fragmented series of data that started and finished whenever minor changes to the size grades were made by the processors).

Numbers of eels landed in each weight grade are not recorded, but were estimated as follows:

1. Length frequency data for each species collected during the North Island catch sampling programme undertaken in 1995–96, 1996–97, and 1997–98 (Beentjes & Chisnall 1997, 1998, Beentjes 1999) were extracted from the MPI *market* database and scaled to landed weight using the catch-at-age program (Bull & Dunn 2002). It is considered that this analysis gives a reasonable representation of the overall size distribution of the North Island longfin and shortfin eel populations captured at that time.
2. The scaled length frequency data were then plotted as cumulative distributions and the weight grades converted to the equivalent length grades using the length weight relationship taken from the South Island catch sampling programme where length-weight sampling was comprehensive.
3. The length corresponding to the mid-point (cumulative percent) of each length grade range was determined and then converted back to a weight (mid-point weight). The total landed weight in each size grade was then divided by the mid-point weight to provide an estimate of the numbers of eels in each weight grade (see Beentjes 2011 for more detail).

Mid-point lengths and weights for size grades are shown in Table 4. These midpoints differ from those used by Beentjes (2011) in that they are derived from the three generic grades of small, medium, and large, rather than the exact grades for each year. A 4 kg maximum limit was also used in the present analysis, even though this did not come into effect in the North Island until March 2007.

General trends in size and species composition throughout the North Island are explored using histogram plots comparing size grade data from 2003–04 to 2011–12. To further examine both temporal and spatial (subarea, ESA, QMA) trends in catch and weights grades in the North Island, these data are presented as bubble plots.

In this report North Island eel statistical areas (ESAs) are referred to in the text by alpha codes (see Table 1 for equivalent numeric codes), but numeric codes were used in previous reports and are used in figures in this report because the subareas codes are based on the numeric ESA codes. i.e., subarea 1A falls within ESA 1, 4A within ESA 4, 5A within ESA 5 etc. Hence when plotted together using ESA numeric codes, the geographic relationship between ESAs and subareas is evident.

2.2 South Island

For the South Island, the existing database and analyses are updated with landings from 2009–10 (MPI project IPA2009-07), 2010–11, and 2011–12 (MPI project EEL201002) (Appendix 1). Collection of

species size grade data in the South Island began in 2006–07 by Mossburn Enterprises Limited (Invercargill), but these data include landings only from ANG 15 (Otago–Southland, see Figure 2), and unlike the North Island, detailed catch location for subarea or ESA were not provided. In 2010–11 and 2011–12, data were provided for the entire South Island, including location of the catch. Three eel processors operate in the South Island: Mossburn Enterprises, Independent Fisheries (Christchurch), and Levin Eel Trading Ltd (Levin). Hence there are two time series for the South Island, ANG15 from 2006–07 to 2011–12 which does not have catch location before 2010–11, and all South Island from 2010–11 to 2011–12 which has complete catch location data. The expectation is that data for the entire South Island will be routinely provided in future.

As undertaken in the North Island, processors in the South Island sort the catch from each landing into species (shortfin and longfin) and then visually grade it by size before weighing. The size grades used by the three South Island processors are shown in Table 5. Although processors use more than two size grades, the data have been assigned to two generic size grades in the South Island, small and large, because of the difficulty in combining North and South Island size grades in a meaningful way.

Numbers of eels were estimated from the North Island scaled length frequency data using the methods described above. Scaled length frequency data from ANG 15 collected during the South Island catch sampling programmes were not used in the estimate of numbers because landings were sampled predominantly from heavily fished mainstem rivers, and tended to contain smaller eels on average than that of all landings. In addition, eels landed from AS2 (shortfin male migration area), exclusively by Independent Fisheries in the South Island, are smaller than the estimated midpoint weight for the small grade category (Table 4). Numbers of small South Island shortfin are therefore underestimated.

The ANG 15 catch is tabulated and plotted by species and year, and for each species the catch and numbers of eels in each size grade are plotted against year (2006–07 to 2011–12). South Island data are plotted as for ANG15 for 2010–11 and 2011–12 and in addition the catch data are tabulated and plotted by location (subarea, ESA, and QMA).

2.3 Digitising eel statistical area subareas

Although not documented in the specific objectives, a project milestone was to convert the eel statistical area subareas into digital geographical information system (GIS) shape files. Before this project these areas have existed only as hand drawn lines annotated on LINZ topographic maps (see figures in Beentjes 2011).

Because the ESA subareas are catchment based, we used the River Environment Classification (REC) database which contains digitised boundaries of New Zealand catchments at a range of spatial scales from small streams to main stems of river systems (Snelder et al. 2004). The annotated ESA sub areas were in effect overlaid on the REC and the matching boundaries were identified and formed the framework of the new digitised sub areas. For smaller catchments this was straight forward and the entire subarea was closely matched with the REC catchment digital outline, requiring only the coastal boundary to be manually joined. For larger catchments such as the Waikato and Maitai Rivers, the catchments were subdivided into major tributaries. In a few cases, inland, middle, and coastal reaches of a catchment and major lakes were artificially split by joining segments of the digitised REC boundaries. The digitised subareas were converted to shape files and are available for plotting in GIS mapping packages.

The ESA boundaries (legal definitions provided by MPI) are also catchment based and were overlaid on the subareas so inconsistencies could be detected. The expectation was that the subareas should fall precisely within the ESAs and have common boundaries.

3. RESULTS

3.1 Digitised eel statistical area subareas

The North Island digitised eel statistical area subareas are shown in Figure 4 and detailed descriptions are provided in Appendix 2. The numeric ESA codes were used as the basis for labelling North Island subareas because they were being used before the change to alpha codes, and recoding them may result in reporting errors in future. Regardless, the alpha codes are included in the shape files as an alternative subarea label and can be used if required when plotting the map or for management purposes. Other shape file labels include ESA (alpha codes only), QMA, island, and subarea area location (Appendix 2).

The South Island digitised ESA subareas are shown in Figure 5 and detailed descriptions are provided in Appendix 2. Unlike the North Island, the alpha ESA codes were used as the basis for labelling South Island subareas because reporting began more than ten years after alpha codes were in place. Alpha code labels are included in the shape files, as are ESA (alpha codes only), QMA, island, and subarea area location (Appendix 2).

For both North and South Islands the annotated subareas were found to correspond closely to the REC boundaries with few exceptions. Where there was divergence, the REC boundaries were used rather than the hand drawn boundary. The subarea boundaries were then compared with the ESA boundaries from the shape files provided by MPI (Figures 6 and 7). Again there was a good match between bordering subareas and the ESAs. Where there was divergence, this tended to be where the boundaries met the coastline (for example, see subareas 12B and 10D in Figure 6 and AT1 and AR5 in Figure 7). The subarea boundaries are based strictly on REC catchment boundaries and are therefore more accurate than those of ESAs. Consequently, the subarea boundaries have been retained rather than forcing the borders to match those of the ESAs. Overall, however, the mismatch is insignificant.

Changes made to the original hand drawn subareas were as follows: North Island: 12A was re-coded to 10D because it falls predominantly within ESA 10. South Island: AW1 was split into two (AW1 and AW12), and AS1 was split between Selwyn catchment (AS1A) and the lake excluding the migration area (AS1), with AS2 including only catches from the migration area (Appendix 2).

3.2 North Island

3.2.1 Landings and catch

A summary of landings, species tonnages, sampling proportions, and species composition from North Island processors between 2003–04 and 2011–12 is shown in Table 6, and the catch by species plotted in Figure 8. Catches of shortfin have remained reasonably stable at around 300 t over the nine years. Longfin catch was between 100 and 120 t at the start of the monitored period, but declined after 2006–07 and was lowest between 2008–09 and 2010–11 when it dropped to about 40 t. The proportion of shortfin overall is 79% and the continued decline in longfin and stabilisation of shortfin has caused the shortfin component of the catch to rise in recent years. Comparison of catches reported to MPI from ECERs and/or MHRs (Ministry for Primary Industries 2012) and those provided to NIWA in the programme show a close match from 2006–07 onward. The value of 110% in 2010–11 is anomalous (Table 6).

Estimated numbers of eels, and species composition from North Island landings between 2003–04 and 2011–12 are shown in Table 7, and the species catch by numbers are plotted in Figure 9. The estimated commercial landings of shortfin has varied from about 550 000 to 700 000 eels per year and longfin from about 50 000 to 200 000 eels per year. The proportions of shortfin in the total eel landings are slightly higher when estimated by number than by weight because longfins have a larger mean size than shortfins (compare Figures 8 and 9). The mean size for shortfin has been stable at

about 500 g throughout the monitoring period, but longfins have been markedly larger in the last two seasons (Table 7).

Individual landing weights (both species combined) were mostly between 50 and 400 kg with the largest over 2000 kg (Figure 10). The largest landings are likely to be from multiple days fishing that were combined and trucked to the factory as a single landing.

3.2.2 2009–10 fishing year

Catch location

The catches of each species by subarea for 2009–10 are shown in Figure 11. Landings are from 39 of the 65 North Island subareas (60%), but about half (49%) of the catch was from just four subareas. These are, in decreasing order of catch: 4L (Lake Waikare/Port Waikato), 1D (Dargaville), 7D (Napier) and 10A (Manawatu River coast). (Figure 11).

The catches of each species by ESA for 2009–10 are shown in Figure 12. Catch was landed from all twelve ESAs. The major contributors by statistical area, in descending catch order, were AD (Waikato), AA (Northland), AK (Manawatu), and AG (Hawkes's Bay) which together accounted for 71% of the catch.

The catches of each species by QMA for 2009–10 are shown in Figure 13. Of the total eel catch, 47% was landed from QMA 21, 25% from QMA 22, 21% from QMA 20, and 7% from QMA 23.

Species composition

The species composition of the North Island catch in 2009–10 was 85.1% shortfin (see Table 6). Shortfin was also the dominant species in all subareas except four (10B, 4P, 4Q, and 9A) (Figure 11). Catches in these four subareas, however, were relatively small. Shortfin was the dominant species in all ESAs in 2009–10 (Figure 12) and in all QMAs (Figure 13).

Size composition

North Island shortfin eels in 2009–10 were present in all 39 subareas where eel catch was landed, although fifty percent of the shortfin catch was from just four subareas. In declining order of catch these are: 4L (Lake Waikare/Port Waikato), 1D (Dargaville), 7D (Napier), and 10A (Manawatu River coast) (Figure 14). The overall proportions by weight of shortfin in the three size grades were 54%, 31%, and 14% for small, medium, and large, respectively (Table 8). The equivalent proportions by eel numbers were 71%, 23%, and 6%, respectively (Table 8). Shortfin was landed from all ESAs and QMAs (Figures 15 and 16).

North Island longfin eels in 2009–10 were present in all 39 subareas where eel catch was landed, although fifty five percent of the longfin catch was from just five subareas. In descending order of catch: 1D (Dargaville), 4L (Lake Waikare/Port Waikato), 10B (Manawatu River inland), 4J (Pirongia Forest), and 10A (Manawatu River coast) (Figure 17). The overall proportions by weight of longfin in the three size grades were 44%, 6%, and 50% for the small, medium, and large, respectively (Table 9). The equivalent proportions by eel numbers were 73%, 3%, and 22%, respectively (Table 9). Longfin were landed from all ESAs and QMAs (Figures 18 and 19).

3.2.3 2010–11 fishing year

Catch location

The catches of each species by subarea for 2010–11 are shown in Figure 11. Eels were landed from 43 of the 65 North Island subareas (66%), but about half (48%) of the catch was contributed by just five subareas. In descending order of catch these are: 1D (Dargaville), 4L (Lake Waikare/Port Waikato),

4K (Lakes Whangape, Waahi, Rotorongaro), 3A (Hauraki Plains west), and 2C (Manukau Harbour) (Figure 11).

The catches of each species by ESA for 2010–11 are shown in Figure 12. Catch was landed from all ESAs, except ESA 6. The major contributors by eel statistical area, in descending order, were AD (Waikato), AA (Northland), AC (Hauraki), and AB (Auckland) which together accounted for 73% of the catch.

The catches of each species by QMA for 2010–11 are shown in Figure 13. Of the total eel catch, 46% was landed from QMA 21, 29% from QMA 20, 18% from QMA 22, and 6% from QMA 23.

Species composition

The species composition of the North Island catch in 2010–11 was 88.9% shortfin (Table 6) and shortfin was the dominant species in all subareas except 4P (Awakino River), 9A (North Taranaki Bight), and 9D (Patea River inland) (Figure 11), although the catch from this subarea was relatively small. Shortfin was the dominant species in all ESAs in 2010–11 (Figure 12) and in all QMAs (Figure 13).

Size composition

North Island shortfin eels in 2010–11 were present in all 43 subareas where eel catch was landed, although nearly half (48%) of the shortfin catch was from just five subareas; in order of catch: 1D (Dargaville), 4L (Lake Waikare/Port Waikato), 4K (Lakes Whangape, Waahi, Rotorongaro), 3A (Hauraki Plains west), and 2C (Manukau Harbour) (Figure 14). The overall proportions by weight of shortfin in the three size grades were 50%, 36%, and 14% for the small, medium, and large, respectively (Table 8). The equivalent proportions by eel numbers were 67%, 27%, and 6%, respectively (Table 8). Shortfin was landed from all ESAs except ESA 6, and from all QMAs (Figures 15 and 16).

North Island longfin eels in 2010–11 were present in 40 of the 43 subareas where eel catch was landed, although just under half (46%) of the longfin catch was from just four subareas; in order of catch: 1D (Dargaville), 4J (Pirongia Forest), 2C (Manukau Harbour), and 4L (Lake Waikare/Port Waikato) (Figure 17). The overall proportions by weight of longfin in the three size grades were 26%, 4%, and 70% for the small, medium, and large, respectively (Table 9). The equivalent proportions by eel numbers were 56%, 4%, and 40%, respectively (Table 9). Longfin were landed from all ESAs except ESA 6, and from all QMAs (Figures 18 and 19).

3.2.4 2011–12 fishing year

Catch location

The catches of each species by subarea for 2011–12 are shown in Figure 11. Eel catch was landed from 44 of the 65 North Island subareas (68%), but about half (47%) of the catch was contributed by just five subareas; in order of catch: 1D (Dargaville), 7D (Napier), 4L (Lake Waikare/Port Waikato), 3A (Hauraki Plains west), and 4J (Pirongia Forest) (Figure 11).

The catches of each species by ESA for 2011–12 are shown in Figure 12. Catch was landed from all twelve ESAs. The major contributors by eel statistical area, in descending order, were AD (Waikato), AA (Northland), AC (Hauraki), and AG (Hawke's Bay) which together accounted for 68% of the catch.

The catches of each species by QMA for 2011–12 are shown in Figure 13. Of the total eel catch, 42% was landed from QMA 21, 28% from QMA 22, 25% from QMA 20, and 6% from QMA 23.

Species composition

The species composition of the North Island catch in 2011–12 was 81.5% shortfin (see Table 6) and shortfin was the dominant species in all subareas except 5A (Tauranga), 5D (Whakatane River), 9A (North Taranaki Bight), 9B (Waitara River), 9C (Mount Taranaki coast), and 12B (Wellington) (Figure 11), although the catches from these subareas were relatively small. Shortfin was the dominant species in all ESAs in 2010–11 (Figure 12) and in all QMAs (Figure 13).

Size composition

North Island shortfin eels in 2011–12 were present in all 44 subareas where eel catch was landed, although nearly half (49%) of the shortfin catch was from just six subareas; in order of catch: 7D (Napier), 1D (Dargaville), 3A (Hauraki Plains west), 4L (Lake Waikare/Port Waikato), 3B (Hauraki Plains east), and 2C (Manukau Harbour) (Figure 14). The overall proportions by weight of shortfin in the three size grades were 49%, 37%, and 14% for the small, medium, and large, respectively (Table 8). The equivalent proportions by eel numbers were 65%, 29%, and 6%, respectively (Table 8). Shortfin was landed from all ESAs and all QMAs (Figures 15 and 16).

In 2011–12 longfin eels were landed from 43 of the 44 North Island subareas, although just under half (46%) of the longfin catch was from just five subareas. In descending order of catch these were: 1D (Dargaville), 4J (Pirongia Forest), and 4L (Lake Waikare/Port Waikato), 11A (Lake Wairarapa), and 7D (Napier) (Figure 17). The overall proportions by weight of longfin in the three size grades were 30%, 21%, and 50% for small, medium, and large, respectively (Table 9). The equivalent proportions by eel numbers were 55%, 21%, and 24%, respectively (Table 9). Longfin were landed from all ESAs and from all QMAs (Figures 18 and 19).

3.2.5 Time series trends in the North Island

Shortfin catch and size

The North Island commercial shortfin catch over the nine year period from 2003–04 to 2011–12 that was examined shows no consistent trend in annual catch weight or in the distribution of these catches in the three size grades used (Figure 20). The catch by estimated numbers of eels landed mirrors catch by weight, although the relative proportions of the three size grades differs because for a given catch there are fewer eels in the large than the small size grades (Figure 20).

Shortfin spatial trends in catch

Spatial and temporal trends in the North Island catch of shortfin by subarea from 2003–04 to 2011–12 are shown in Figure 21. Shortfin was landed from 63 of the possible 65 subareas (no landings from 6C (Cape Runaway) and 6D (Waiapu River)). The bubble plots indicate that of these 63 subareas, 1D (Dargaville), and 4L (Lake Waikare, Port Waikato) are consistently the main contributors to the North Island shortfin annual landings making up one quarter (24%) of the catch (Figure 21, Appendix 3). For other subareas, catches are more variable among years, but the most important subareas, in descending order of percent contribution of catch, include: 3A (Hauraki Plains west), 10A (Manawatu River coast), 7D (Napier), 3B (Hauraki Plains east), 2C (Manukau Harbour), 4K (Lakes, Whangape, Waahi, and Rotongaro), 7E (Tukitiki River), 11A (Lake Wairarapa), 4J (Pirongia Forest), and 1B (Hokianga Harbour). Together these 12 subareas have contributed over two thirds (69%) of the shortfin catch from 2003–04 to 2011–12 (Appendix 3). The pattern of catches by subareas is similar in all nine years. Spatial and temporal trends of the North Island catch of shortfin by eel statistical area from 2003–04 to 2011–12 are shown in Figure 22. ESAs 4 and 1 consistently contribute the largest proportion of the shortfin catch and the pattern of catches by ESA is similar among all nine years with no clear trends.

Spatial and temporal trends of the North Island catch of shortfin by Quota Management Area from 2003–04 to 2011–12 are shown in Figure 23. QMA 21 consistently contributes the largest proportion of the shortfin catch, with smaller but roughly equal proportions by QMAs 20 and 22, whereas QMA 23 contributes the least. The pattern of catches by QMA is similar among all nine years with no clear trends.

Longfin catch and size

The North Island commercial longfin catch over the nine year period from 2003–04 to 2011–12 shows a trend of generally declining catch, with lowest catches recorded between 2008–09 and 2010–11, with a substantial increase in 2011–12 (Figure 24). The medium longfin size grade is poorly represented in these three years of low catches. These changes are largely driven by the TACC reduction in 2007–08, followed by a fall in demand for medium size longfin eels during the three low catch years. Finally, AFL quota was not made available to fishers in 2010–11 resulting in further reductions to landed catch. The increase in total longfin catch and of the medium size grade in 2011–12, reflects both an improved market for this grade, and restoration of AFL quota for lease. The catch of large longfin in 2011–12 is of the same magnitude as pre 2008–09 years. The catch by eel numbers mirror this, but as expected the relative proportions of the size grades differs when expressed by number rather than weight (Figure 24).

Longfin spatial trends in catch

Spatial and temporal trends in the North Island catch of longfin by subarea from 2003–04 to 2011–12 are shown in Figure 25. Longfin have been landed from 63 of the possible 65 subareas (no landings from 6C (Cape Runaway) and 6D (Waiapu River)). The bubble plots indicate that of these 63 subareas, 1D (Dargaville), 4J (Pirongia Forest), and 4L (Lake Waikare, Port Waikato) are consistently the main contributors to the North Island longfin annual landings, making up nearly one third (29%) of the catch (Figure 25, Appendix 4). For other subareas, catches are more variable among years, but the most important subareas, in order of contribution are: 11A (Lake Wairarapa), 2C (Manukau Harbour), 10A (Manawatu River coast), 7E (Tukitiki River), 9D (Patea River inland), 3A (Hauraki Plains west), 3B (Hauraki Plains east), 4K (Lakes, Whangape, Waahi, and Rotongaro), 10B (Manawatu River inland), 1C (Bay of Islands), 7D (Napier), 1B (Hokianga Harbour), and 2A (Warkworth). Together these 16 subareas have contributed over two thirds (68%) of the longfin catch from 2003–04 to 2011–12 (Appendix 3). The pattern of catches for the main subareas is similar among all nine years with no strong trends, although the unavailability of AFL quota in 2010–11 and the poor market demand for medium sized longfins in 2008–09 to 2010–11 is evident. For the minor subareas there is more variation among years as catch is not always landed from these subareas every year.

The plots for ESAs indicate that ESAs AA and AD consistently provide the largest proportion of the longfin catch each year, and ESAs AE, AF, and AM the least (Figure 26). Similarly, QMA 21 consistently provides the largest proportion of the catch each year, with similar but smaller proportions from QMAs 20 and 22, whereas QMA 23 provides the least (Figure 27). There are no clear trends apparent in the ESA plots or QMA plots, notwithstanding the issues of quota availability and market demands described above for the subarea bubble plots.

3.3 South Island

3.3.1 Landings and catch

ANG 15

A summary of landings, species tonnages, sampling proportions, and species composition from eel processors between 2006–07 and 2011–12 for ANG 15 catches are shown in Table 6, and the species catch plotted in Figure 28. Catches of shortfin have ranged from about 15 t to 28 t with no consistent trend. Longfin catch was between 35 t and 82 t, with low catches in 2008–09 and 2009–10. The proportion of shortfin in the total eel catch over this six year period is 26%, but has varied annually between 21% and 42%. Comparison of catches reported to MPI from ECERs and/or MHRs (Ministry for Primary Industries 2012) and those provided to NIWA in the programme show a close match for all years (Table 6).

Estimated numbers of eels, and species composition by number from South Island ANG 15 landings between 2006–07 and 2011–12 are shown in Table 7 and Figure 29. The annual commercial catch

from ANG 15 is estimated to have varied between 23 000 and 44 000 shortfin and 52 000 to 127 000 longfin over the six years. The proportions of shortfin in the estimated total number of eels captured are similar to that derived from actual catch weights (compare Figures 28 and 29). The mean size for shortfin has been stable at just over 600 g and for longfins it has varied between 530 to 740 g with largest average weight recorded in the last three years (Table 7).

All South Island

A summary of landings, tonnages by species, proportion of landings examined, and species composition from eel processors in 2010–11 and 2011–12 for all South Island catches are shown in Table 6. Catch by species from the same records are plotted in Figure 30. Catches in the two reporting seasons were 193 t and 177 t for shortfin, and 109 t and 148 t for longfin. The proportion of shortfin overall is 59%, with values of 64% and 54% for each year. Comparison of catches reported to MPI from ECERs and/or MHRs (Ministry for Primary Industries 2012) and those provided to NIWA in the programme show a close match for both years (Table 6).

Estimated numbers of eels, and species composition from all South Island landings in 2010–11 and 2011–12 are shown in Table 7, and the species catch by numbers are plotted in Figure 31. The commercial catch of shortfin was about 356 000 and 309 000 eels respectively for the two reporting seasons and 178 000 and 209 000 for longfin eels. The proportions of shortfin in the total eel catch derived from estimated numbers of eels captured are similar to that derived from actual catch weights (compare Figures 30 and 31). The mean size for shortfin is about 550 g and longfin 600 g to 700 g.

Individual landing weight (both species combined) was most commonly between 50 and 300 kg with largest landings over 2400 kg (Figure 32). Largest landings are likely to be from extended fishing periods with the combined catch trucked to the processors.

3.3.2 2009–10 fishing year (ANG 15 only)

There was no breakdown of catch in ANG 15 by ESA or subarea in 2009–10. The overall proportions by weight of shortfin in the two size grades were 48% and 52% for the small and large, respectively (Table 8). The equivalent proportions by estimated eel numbers were 72% and 28%, respectively (Table 8).

The overall proportions by weight of longfin in the two size grades were 42% and 57% for the small and large, respectively (Table 9). The equivalent proportions by estimated eel numbers were 71% and 29%, respectively (Table 9).

3.3.3 2010–11 fishing year

ANG 15

Although there is a breakdown of catch location by ESA and subarea from ANG 15 in 2010–11, this is covered in the all South Island results (below). The overall proportion of shortfin in ANG 15 in 2010–11 is 23% and the overall proportions of shortfin in the two size grades were 54% and 45% for the small and large, respectively (Tables 6 and 8). The equivalent proportions derived from estimated eel numbers were 77% and 23%, respectively (Table 8).

The overall proportions of longfin in the two size grades were 64% and 36% for small and large, respectively (Table 9). The equivalent proportions by estimated eel numbers were 86% and 14%, respectively (Table 9).

All South Island catch location

The catches of each species by subarea for 2010–11 are shown in Figure 33. Eel catch was landed from 38 of the 58 South Island subareas (65%), but nearly three quarters (72%) of the catch was contributed by just eight subareas; in descending order of catch: AS2 (Te Waihora migration area), AS1 (Te Waihora, excluding migration area), AW11 (Mataura River coast), AV10 (Clutha River coast), AX4 (Lake Brunner), AP2 (Wairau River), AW3 (Oreti River inland down to Bog Burn), and AP1 (Pelorus River/Pelorus Sounds) (Figure 33).

The catches of each species by ESA for 2010–11 are shown in Figure 34. Catch was landed from all eleven South Island ESAs. The major contributors by statistical area, in descending order, were AS2, (Te Waihora migration area), AW (Southland), AS1 (Te Waihora, excluding migration area), AV (Otago), and AX (Westland), which together accounted for 85% of the catch.

The catches of each species by QMA for 2010–11 are shown in Figure 35. Of the total eel catch, 43% was landed from ANG 13, 31% from ANG 15, 11% from ANG 16, 6% from ANG 12, 5% from ANG 11, and 3% from ANG 14.

All South Island species composition

The species composition of the South Island catch in 2010–11 was 63.9% shortfin (see Table 6) although shortfin was the dominant species in only eleven subareas (Figure 33), in descending order of shortfin proportion: AS2 (Te Waihora, excluding migration area), AS1 (Te Waihora migration area), AR1 (Waiau River, north), AX4 (Lake Brunner), AV9 (Lake Waihora and Waipori River), AP1 (Pelorus River/Pelorus Sounds), AQ1 (Awatere River), AR3 (Waimakariri River), AT4 (Wainono Lagoon/Pareora River), AT3 (Opihi and Orari Rivers), and AX1 (Karamea and Mokihinui Rivers). Shortfin was the dominant species in six of the eleven ESAs in 2010–11 (Figure 34) and in three of the six QMAs (Figure 35).

All South Island size composition

South Island shortfin eels in 2010–11 were present in 30 of the 38 subareas where eel catch was landed, although over three quarters (76%) of the shortfin catch was from Te Waihora (AS1 and AS2) and Lake Brunner (AX4) (Figure 36). The overall proportions of shortfin in the two size grades were 68.5% and 31.5% for the small and large, respectively (Table 8). The equivalent proportions by eel numbers were 86% and 14%, respectively (Table 8). Shortfin was landed from all eleven ESAs, but 68% of the catch was from Te Waihora (AS1 and AS2). Similarly, shortfin was landed from all six QMAs, but 68% of the catch was also from ANG 13 (Figures 37 and 38).

South Island longfin eels in 2010–11 were present in 36 of the 38 subareas where eel catch was landed and was absent only in Te Waihora (AS1 and AS2) (Figure 39). Nearly half the longfin catch was from just four subareas, in descending order of catch: AW11 (Mataura River coast), AV10 (Clutha River coast), AP2 (Wairau River), and AW3 (Oreti River inland down to Bog Burn) (Figure 39). The overall proportions of longfin by weight in the two size grades were 60.5% and 39.5% for the small and large size grades, respectively (Table 9). The equivalent proportions by estimated eel numbers were 84% and 16%, respectively (Table 9). Longfin were landed from all ESAs except AS1 and AS2 (Te Waihora) and from all QMAs except ANG 13 (Figures 40 and 41).

3.3.4 2011–12 fishing year

ANG 15

As in 2010–11, there is a breakdown of catch records by ESA and subarea from ANG 15 in 2011–12, however, this is covered in the all South Island results (below). The ANG 15 time series, that started in 2006–07 is retained here for continuity.

The proportion shortfin in ANG 15 in 2011–12 is 21% and the overall proportions by weight of shortfin in the two size grades were 45% and 55% for the small and large, respectively (Tables 6 and 8). The equivalent proportions by estimated numbers were 69.5% and 30.5%, respectively (Table 8).

The overall proportions by weight of longfin in the two size grades were 57.5% and 42.5% for small and large, respectively (Table 9). The equivalent proportions by estimated numbers were 82% and 18%, respectively (Table 9).

All South Island catch location

The catches of each species by subarea for 2011–12 are shown in Figure 33. Eel catch was landed from 45 of the 58 South Island subareas (77%), but nearly three quarters (74%) of the catch was contributed by just thirteen subareas. These were (in descending order of catch): AS2 (Te Waihora migration area), AS1 (Te Waihora, excluding migration area), AW11 (Mataura River coast), AW3 (Oreti River inland down to Bog Burn), AP2 (Wairau River), AV10 (Clutha River coast), AU5 (Waitaki River), AV9 (Lake Waihora and Waipori River), AR3 (Waimakariri River), AX4 (Lake Brunner), AX3 (Grey River Arnold River), AW9 (Oreti River coast), and AT3 (Opihi and Orari Rivers) (Figure 33).

The catches of each species by ESA for 2011–12 are shown in Figure 34. Catch was landed from all eleven South Island ESAs. The major contributors by statistical area, in descending order, were AS2, (Te Waihora migration area), AW (Southland), AX (Westland), AV (Otago), and AS1 (Te Waihora, excluding migration area) which together accounted for 81% of the catch.

The catches of each species by QMA for 2011–12 are shown in Figure 35. Of the total eel catch, 36% was landed from ANG 13, 32% from ANG 15, 13% from ANG 16, 7% from ANG 14, 6% from ANG 11, and 5% from ANG 12.

All South Island species composition

The species composition of the South Island catch in 2011–12 was 54.5% shortfin (see Table 6), although shortfin was the dominant species in only thirteen of the 45 subareas with reported catches (Figure 33). These were in, in descending order of shortfin proportion: AS2 (Te Waihora, excluding migration area), AS1 (Te Waihora migration area), AT4 (Wainono Lagoon/Pareora River), AX4 (Lake Brunner), AT3 (Opihi and Orari Rivers), AV9 (Lake Waihora and Waipori River), AN2 (Motueka River/Tasman Bay), AP1 (Pelorus River/Pelorus Sounds), AQ1 (Awatere River), AR3 (Waimakariri River), AR1 (Waiau River, north), AW8 (Aparima River coast), and AX1 (Karamea and Mokihinui Rivers). Shortfin was the dominant species in four of the eleven ESAs in 2011–12 (Figure 34) and of the six QMAs, it was dominant only in ANG 15 (Figure 35).

All South Island size composition

South Island shortfin eels in 2011–12 were present in 32 of the 45 subareas where eel catch was landed, although over three quarters (76%) of the shortfin catch was from Te Waihora (AS1 and AS2), Lake Brunner (AX4), and AV 9 (Lake Waihora and Waipori River) (Figure 36). The overall proportions of shortfin in the two size grades were 62% and 38% for small and large, respectively (Table 8). The equivalent proportions by estimated eel numbers were 82% and 18%, respectively (Table 8). Shortfin was landed from all eleven ESAs, but 66% of the catch was from Te Waihora (AS1 and AS2). Similarly, shortfin was landed from all six QMAs, but 66% of the catch was also from ANG 13 (Figures 37 and 38).

South Island longfin eels in 2011–12 were present in 42 of the 45 subareas where eel catch was landed and was absent only in Te Waihora (AS1 and AS2) and Wainono Lagoon/Pareora River (AT4) (Figure 39). Over half the longfin catch (51%) is from just seven subareas. Those were (in descending order of catch): AW11 (Mataura River coast), and AW3 (Oreti River inland down to Bog Burn), AU5 (Waitaki River), AV10 (Clutha River coast), AP2 (Wairau River), AX3 (Grey River Arnold River), and AW2 (Waiau and Mararoa Rivers down to Monawai) (Figure 39). The overall proportions by weight of longfin in the two size grades were 49.5% and 50.5% for the small and large, respectively (Table 9).

The equivalent proportions by estimated numbers were 77% and 23%, respectively (Table 9). Longfin were landed from all ESAs except AS1 and AS2 (Te Waihora) and from all QMAs except ANG 13 (Figures 40 and 41).

3.3.5 Time series trends in the South Island

There are six years of data (2006–07 to 2011–12) for the South Island ANG 15, probably too few to draw any firm conclusions on trends (Figure 42). Shortfin catches have varied between about 15 t and 28 t but there is no consistent trend in either catch or proportions in the two size grades (Figure 42). Longfin catches have varied more than shortfin between about 35 t and 82 t with 2008–09 and 2009–10 having relatively low catch (Figure 43).

With only two years data for all South Island landings, it is not valid to speculate on any trends in the data.

4. DISCUSSION

4.1 General comments on the eel monitoring programme

Data are analysed and presented for years seven to nine (2009–10 and 2010–11) of the commercial eel fishery monitoring programme. The North Island has had full participation since the inception of the monitoring programme in 2003–04, whereas the South Island provided limited data from ANG 15 (Otago and Southland) since 2006–07, and from the entire South Island from 2010–11. The expectation is that complete data, including location from all landings, will be provided from the South Island henceforth.

Landings data examined include processed size grades, species composition, and catch location from individual commercial eel catch landings. Although these records provide less information on size and sex distribution from individual landings than the historical catch sampling programmes (Beentjes & Chisnall 1997, 1998, Beentjes 1999, Chisnall & Kemp 2000, Beentjes 2005), they have the distinct advantage of capturing data from nearly all North and South Island eel landings, rather than a select few, thus providing a more accurate representation of the spatial stock structure.

Because virtually the entire annual catch is sampled (see Table 6), this programme provides an accurate estimate of the proportion of large eels landed by the commercial eel fishery. For longfin eels, this provides an index of potential spawning females in the harvested population. Eels over 1000 g or about 70 cm (large size grade) are almost certainly females as males migrate at a mean length of about 62 cm, equivalent to about 680 g (Todd 1980). Longfin females can mature and migrate from about 90 cm or 2 kg depending on condition (see review in Fu et al. 2012). The maximum size limit for commercial harvest is 4 kg (108 cm), and hence where commercial fishing takes place, many of the maturing and potentially migrating females are vulnerable to the commercial fishery. Common practice, however, is to release eels that display morphological signs of migration, even if they are below 4 kg.

Because the location of the catch is recorded at the time of landing, species catch and size can be examined at three geographic spatial scales, i.e., QMA, ESA, and most importantly, the catchment based subarea. The latter two spatial area data are unique to this programme, although catch is estimated (not weighed) by species and recorded by ESA as part of the mandatory monthly reporting by individual commercial fishers using ECERs. The shortcomings of this monitoring approach are that size grade data are coarse with only two to three size grades recorded. Grades may also differ among the processors and/or species, and grades have also been slowly changing in response to market demands or regulation changes affecting size limits (e.g., 4 kg maximum size limit, escape tube size). Furthermore, the data offer limited information on the sex structure of the populations, except where

the sex of eels may be assumed from size, i.e., all shortfin caught outside of Te Waihora migration area (AS2), and all longfin in the large size grade are female.

Numbers of eels in the size grades are not provided by the processors in the monitoring programme, but instead were estimated, allowing the overall mean size of each species in the fishery to be calculated. Estimates of eel numbers are particularly important for the largest size grades where, until March 2007, there was no upper limit on the North Island large size grade (e.g., over 1000 g) and the catch could contain a few very large eels, or many smaller eels. The estimated eel numbers that are presented in this report are based on a number of assumptions about the population length frequency, and involve the amalgamation of different processor size grades. They are, therefore, only crude estimates and more accurate estimates of numbers, would require collection of detailed length and weight records at regular intervals.

In this report we have modified the analyses undertaken in previous reports in that the size grade catch data have now been combined for all processors (i.e., those processing North Island caught eels, or those processing South Island caught eels) despite some differences in the grades used. The rationale for this is that size grades will inevitably change over time, grading is done by eye, and our goal is to provide an overall picture of the size of eels that are being commercially landed. Hence minor changes to the ranges of a size grade are not likely to mask any gross changes in size that might be occurring. This has simplified the analyses and the outputs and allows a continuous time series to be constructed for each island.

The previously annotated subareas have been digitised and are now available as shape files that can be plotted in any GIS software such as Mapinfo, R, or Arcview. Because the subareas boundaries are based on the REC database it is theoretically possible to view catchment attributes such as extent of river/lake systems, river flow, land use, and sediment loads within subareas, parts of sub areas, or subarea combinations. Some REC boundary sections do not match exactly those of the MPI ESA boundaries (See Figures 6 and 7), particularly near the coast, because the latter were implemented primarily for fisheries management purposes. In this report, the catchment based boundaries have been retained for subareas to preserve the integrity of the REC.

4.2 Factors affecting eel landings

There are a number of factors that may have affected the size of catches (overall and within size ranges) and the species composition of this time series. These include the following:

1. 1 October 2004: North Island eels introduced into the Quota Management System.
2. March 2007: 4 kg maximum size limit for longfin introduced in the North Island.
3. 1 October 2007: TACC reductions for North Island stocks (58% reduction for longfin and 26% for shortfin).
4. Fishing years 2008–09 to 2010–11: Limited market for longfin eels in the medium size grade (500–1000 g) and fishers actively discouraged from landing eels in this grade (both AFL-Levin and NZ Eel).
5. 1 October 2009: Escape tubes voluntarily increased from 25 mm to 31 mm in the North Island. The purpose was to reduce landings of eels below 300 g for both shortfin and longfin.
6. Fishing year 2010–11: Aotearoa Fisheries Ltd did not lease longfin quota to North Island fishers which resulted in most fishers having insufficient quota to cover their catch. As a result some fishers sorted their catch at or near the capture point and released longfin.
7. Fishing year 2011–12: Access to Aotearoa Fisheries Ltd quota restored to North Island fishers. Also all size grades of both species were in high demand and hence there were no restrictions imposed on fishers not to land medium sized longfin.
8. The South Island is less affected by longfin market demands as the condition of longfins is better in the South Island than the North Island and there are different markets for South Island longfins.

9. South Island has a single eel catch quota for each QMA (ANG 13 to ANG 16) and hence the annual catch could conceivably be made up of a single species. The proportion of the catch that is shortfin or longfin in a year depends on environmental conditions with shortfin targeted more often when rivers are high and longfin during dry conditions.

4.3 North Island

In the North Island, data on eel catch weight, size, and capture location by species from commercial landings have now been collected continuously for nine years (2003–04 to 2011–12). The eel catches included in our analyses for the last three years represent 98%, 110%, and 99%, respectively, of the landed catch for the North Island (catch data from Ministry for Primary Industries 2012) (see Table 6). The additional 10% sampled in 2010–11 is inexplicable. Despite this anomalous year, overall the programme is capturing virtually all of the landed North Island catch.

Shortfin catches in the last three years have been stable and are consistent with those recorded in the previous period (see Figure 8). Longfin catch, however, shows a marked drop from 2008–09 to 2010–11. This is likely to be a result of the limited market for medium sized longfins and also the non-availability of quota for lease to fishers (see section 4.2). The rebound of the longfin catch in 2011–12 is consistent with an improved market for longfins of all sizes and less restricted access to longfin quota.

The proportion of shortfin in the last few years is around 81% to 90% of the landed catch (see Table 6) which is higher than the aggregate over all nine years (79.4%). The higher than average proportion of shortfin in the total catch reflects the sharp decline in longfin landings resulting from a number of factors that may include larger TACC cuts for longfin than shortfin, decreased market demand for medium sized longfin, and unavailability of quota.

A major concern regarding the sustainability of the longfin eel fishery relates to spawning escapement and the decline in numbers of large females from mainstem rivers (Dunn et al. 2009, Fu et al. 2012). In 2011–12, when there were no restrictions on quota or marketable sizes, about half of the longfin catch (by weight) consisted of eels over 1000 g. Because longfins above about 700 g are predominantly, if not exclusively, female, it follows that more than half the longfin catch caught in 2011–12 was female, with the remainder being either male or female (see Table 9). If we use the estimates of eel numbers, about a quarter (24%) of longfins were female and the remainder either male or female. The proportion of large eels in 2011–12 is considerably higher than pre 2008–09 when there were also no restrictions on quota or size taken by processors (see Table 9) which suggests that there has been no reduction in the number of large eels in the fished stock in the last nine years. The MPI Eel Working Group (EELWG 2013-08B, 11 April 2013) after reviewing this report, recommended the following: “As a monitoring tool the largest size category is expected to be the most sensitive to changes in fishing mortality. Given that proportions may be influenced by variable market forces – e.g. low market value of longfin eels in the medium size category – the CPUE of the largest size category could provide a better indication of the abundance of larger eels over time. Project EEL2012-02 should investigate the options for linking form types to obtain information on effort related to catches in each sub-area”. This may be investigated for EEL201202 which is in progress and will collate data from 2012–13 to 2014–15.

4.3.1 North Island time series trends

Shortfin show no trend in catch or size of eels captured over the nine year time series. The pattern of catches by subareas is also similar among all nine years with no clear trends. Of the 63 subareas where shortfin has been caught (out of 65), 1D (Dargaville), and 4L (Lake Waikare, Port Waikato) are consistently the main contributors to the North Island shortfin annual landings making up one-quarter (24%) of the catch (see Figure 21).

For longfin, there was no strong evidence of a decrease in the catch or the size of large eels when the drop in demand for medium sized eels in 2008–09 to 2010–11, the non-availability of quota in 2010–11, and the decrease in the TACC in 2007–08 is taken into account. Indeed in 2011–12 the North Island longfin TACC was reached and the proportion of eels in the large size grade (over 1000 g) was the highest of the time series (disregarding 2008–09 to 2010–11 period when medium size eels could not be marketed).

Longfin have been landed from 63 of the possible 65 subareas yet nearly one third of the catch comes from just three subareas (1D Dargaville, 4J Pirongia Forest, and 4L Lake Waikare/ Port Waikato) (see Figure 25). The pattern of catches for the main subareas is similar among all nine years with no strong trends, although the unavailability of AFL quota in 2010–11 and the poor market demand for medium sized longfins in 2008–09 to 2010–11 is evident. For the lesser areas there is more variation among years as catch is not always landed from these subareas every year.

4.4 South Island

The South Island commercial eel monitoring programme began in 2006–07 with the provision of species catch and size grade data for ANG 15, but there was no breakdown by subarea or eel statistical area until 2010–11. The ANG 15 time series should be continued in its current format without reference to catch location as it gives information on size and species catch from Otago and Southland that precedes the all South Island time series by four years. The ANG 15 time series will assume less importance as more years are added to the South Island time series.

With the provision of eel landings from throughout the South Island, beginning in 2010–11, virtually all commercial eel catch from throughout New Zealand are accounted for within this monitoring programme. In the South Island there are currently three processors (Mossburn, AFL-Levin, and Independent Fisheries) and because of the difference in size grades used between Mossburn and AFL-Levin it was necessary to amalgamate shortfin and longfin, each into two size grades, not three as for the North Island. This makes comparison between the South and North Island difficult, however, the results indicate that the proportion of shortfins in the large size grade is higher in the South Island than the North Island, even with the inclusion of eels landed from Te Waihora Migration area, which are under 220 g (see Table 8). However, the longfin proportions of large eels in 2011–12 (no restrictions on quota or size processed in this year) are similar between North and South Islands at about 50% (see Table 9).

Although shortfin is the dominant catch species in South Island landings (65% in 2010–11 and 54% in 2011–12), and is landed from most subareas where eels were caught, three quarters of the shortfin catch was from only three subareas (Te Waihora AS1 and AS2, Lake Brunner AX4, and Lake Waihora/Waipori River AV9), highlighting the concentrated nature of the shortfin eel stocks in the South Island and importance of these three subareas to the commercial shortfin fishery.

In 2010–11 and 2011–12 longfin were caught from nearly all subareas where eel catch was landed (36 and 42 respectively of the 58 possible subareas) with the notable exception of Te Waihora where fishers actively return any longfin caught to the water. Regardless, longfin historically constitute only about 1% of the Te Waihora eel catch (Beentjes & Dunn 2013). Although longfin catch is more widespread than shortfin in the South Island, there are nevertheless key areas that provide most of the catch. Indeed about half of the South Island longfin catch in 2010–11 and 2011–12 was from four to seven subareas, the key areas being Maitai River coast (AW11), Clutha River coast, (AV10), the Wairau River (AP2), and Oreti River inland (AW3).

There are six years of data for the South Island ANG 15, probably too few to draw any firm conclusions on temporal trends (see Figure 42), although there are no apparent trends in shortfin catch or size of the eels harvested (Figure 42). Longfin catches in ANG 15 have varied more than shortfin

with 2008–09 and 2009–10 having relatively low catch. Given that the target species is very much dependent on the environmental conditions in the South Island, these low catch years may well have been less suitable for longfin harvest (see Figure 43).

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Table 1: Quota Management Areas (QMA) for longfin (LFE) and shortfin (SFE) eels, and both species combined (ANG) in the South Island, and eel statistical areas (ESA).

Area	QMA		ESA (alpha)	ESA (numeric)
	LFE	SFE	(after 1 Oct 2001)	(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-Wanganui	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	ANG 11	ANG 11	AN	13
Marlborough	ANG 11	ANG 11	AP }	14
South Marlborough	ANG 12	ANG 12	AQ }	14
Westland	ANG 16	ANG 16	AX	15
North Canterbury	ANG 12	ANG 12	AR	16
South Canterbury	ANG 14	ANG 14	AT	17
Waitaki	ANG 14	ANG 14	AU	18
Otago	ANG 15	ANG 15	AV	19
Southland	ANG 15	ANG 15	AW	20
Te Waihora (outside Migration Area)	ANG 13	ANG 13	AS1 }	21
Te Waihora Migration Area	ANG 13	ANG 13	AS2 }	21
Chatham Islands	LFE 17	SFE 17	AZ	22
Stewart Island	ANG 15	ANG 15	AY	23

Table 2: Summary of chronology of weight grades used by the two main North Island eel processors. NZ Eel, New Zealand Eel Processors; AFL-Levin, Aotearoa Fisheries and Levin Eel Trading.

Year	Processor	Species	Size grade (g)		
			Small	Medium	Large
2003–04	NZ Eel	LFE	220–500	500–1200	over 1200
2006–07			300–500	500–1200	over 1200
2008–09			300–500	500–1000	over 1000
2003–04	NZ Eel	SFE	220–500	500–1000	over 1000
2009–10			300–500	500–1000	over 1000
2003–04	AFL-Levin	LFE	220–500	500–1000	over 1000
2009–10			300–500	500–1000	over 1000
2003–04	AFL-Levin	SFE	220–500	500–1000	over 1000
2008–09			220–650	650–1000	over 1000
2009–10			300–650	650–1000	over 1000

Table 3: Subareas, eel statistical areas (ESA alpha and numeric codes), and Quota Management Areas (QMA). Eel statistical area alpha codes replaced numeric codes on 1 October 2001.

Island	Subarea		Eel Statistical Area		QMA
	Code	Number	Numeric	Alpha	
North	1A–1E	5	1	AA	20
	2A–2C	3	2	AB	20
	3A–3C	3	3	AC	21
	4A–4Q	17	4	AD	21
	5A–5D	4	5	AE	21
	6A–6G	7	6	AF	21
	7A–7F	6	7	AG	22
	8A–8F	6	8	AH	23
	9A–9F	6	9	AJ	23
	10A–10D	4	10	AK	22
	11A–11C	3	11	AL	22
	12B	1	12	AM	22
	Sub total	65	12	12	4
South	AN1–AN3	3	13	AN	ANG11
	AP1–AP2	2	14	AP	ANG11
	AQ1–AQ2	2	14	AQ	ANG12
	AR1–AR5	5	16	AR	ANG12
	AS1	1	21	AS1	ANG13
	AS2	1	21	AS2	ANG13
	AS1A	1	21	AS1	ANG13
	AT1–AT4	4	17	AT	ANG14
	AU1–AU5	5	18	AU	ANG14
	AV1–AV12	12	19	AV	ANG15
	AW1–AW12	12	20	AW	ANG15
	AX1–AX10	10	15	AX	ANG16
	Sub total	58	9	11	6
	Total	123	21	23	10

Table 4: Size grades and equivalent length ranges, with mid-point length and weight derived from the cumulative length frequency distribution. Mid-point weight was used to estimate total numbers of eels in each size grade. See methods for weight grades that correspond to small, medium, and large categories. 100 cm was close to the maximum size of shortfin, and 125 close to the maximum size of longfin recorded in the catch sampling data.

	Size grade	Length range (cm)	Mid-point	
			Length (cm)	Weight (g)
North Island SFE	Small	50–59	54	375
	Medium	59–75	64.5	699
	Large	75–100	78.5	1197
North Island LFE	Small	48–59	52	391
	Medium	59–70	63	721
	Large	70–108	79	1484
South Island SFE	Small	**50–77	56.5	432
	Large	75–100	78.8	1197
South Island LFE	Small	48–70	54	441
	Medium	70–108	79	1484

** eels landed from AS2 (Te Waihora migration area) are smaller than this grade.

Table 5: Summary of chronology of weight grades used in the South Island. Mossburn, Mossburn Enterprises; AFL-Levin, Aotearoa Fisheries and Levin Eel Trading; Independent, Independent Fisheries.

Year	Processor	Species	Size grade (g)	
			Small	Large
2006–07	Mossburn	LFE	300–1000	1000–1500 and over 1500
2010–11	AFL-Levin	LFE	300–500 and 500–1000	over 1000
2006–07	Mossburn	SFE	300–800	over 800
2010–11	AFL-Levin	SFE	300–650 and 650 to 1000	over 1000
2010–11	Independent	SFE	Migrating males (below 300 g)	–

Table 6: Summary of landings (Lndg) and species landed weights from North Island processors from 2003–04 to 2011–12, South Island ANG15 from 2006–07 to 2011–12, and the entire South Island from 2010–11 to 2011–12. % samp. = percent of total reported landed weight sampled where the reported landings are from the 2012 plenary summary document and are based on ECLR data (Ministry for Primary Industries 2012).

North Island

Year	Vanderdrift			New Zealand Eel			AFL-Levin			All processors combined				
	No. Lndg	Weight (kg)		No. Lndg	Weight (kg)		No. Lndg	Weight (kg)		No. Lndg	Weight (kg)		% samp.	% SFE
		SFE	LFE		SFE	LFE		SFE	LFE		SFE	LFE		
2003–04	175	18 072	21 878	511	151 947	28 007	729	129 367	55 396	1415	299 386	105 281	89	74.0
2004–05	–	–	–	549	124 980	42 351	590	140 903	77 889	1139	265 883	120 240	90	68.9
2005–06	–	–	–	563	160 725	38 654	697	173 853	63 997	1260	334 578	102 651	90	76.5
2006–07	–	–	–	532	152 902	29 572	772	185 868	70 216	1304	338 770	99 788	99	77.2
2007–08	–	–	–	525	148 891	26 488	460	148 652	46 572	985	297 543	73 060	99	80.3
2008–09	–	–	–	306	130 366	15 711	406	122 352	26 586	712	252 718	42 297	98	85.7
2009–10	–	–	–	417	140 544	15 702	359	123 879	30 592	776	264 423	46 294	98	85.1
2010–11	–	–	–	474	202 940	23 883	399	125 155	17 248	873	328 095	41 131	110	88.9
2011–12	–	–	–	537	193 235	36 862	465	145 830	39 944	1002	339 065	76 806	99	81.5
Totals	175	18 072	21 878	4 414	1 406 530	257 230	4 877	1 295 859	4 28 440	9 466	27 20 461	707 548		79.4

South Island (ANG 15)

Year	Mossburn			AFL-Levin			All processors combined				
	No. Lndg	Weight (kg)		No. Lndg	Weight (kg)		No. Lndg	Weight (kg)		% samp.	% SFE
		SFE	LFE		SFE	LFE		SFE	LFE		
2006–07	300	17 520	63 941	0	–	–	300	17 520	63 941	101.3	21.5
2007–08	367	21 033	69 132	0	–	–	367	21 033	69 132	95.7	23.3
2008–09	204	14 879	34 882	0	–	–	204	14 879	34 882	98.9	29.9
2009–10	315	28 427	38 515	0	–	–	315	28 427	38 515	96.9	42.5
2010–11	276	21 442	71 657	0	–	–	276	21 442	71 657	99.8	23.0
2011–12	381	19 883	78 829	1354	3054	1354	384	21 237	81 883	98.8	20.6
Totals	871	53 432	167 955				1846	124 538	360 009		25.7

Table 6 – continued

All South Island

Year	Mossburn			AFL-Levin			Independent		All processors combined				
	No. Lndg	Weight (kg)		No. Lndg	Weight (kg)		No. Lndg	Weight (kg)	Lndg	Weight (kg)		% samp.	% SFE
		SFE	LFE		SFE	LFE				SFE	LFE		
2010–11	363	101 232	94 631	33	30 547	14 463	100	61 115	496	192 894	109 094	102.0	63.9
2011–12	513	85 466	133 669	39	34 050	13 905	96	57 275	648	176 791	147 574	96.8	54.5
Totals	876	186 698	228 300	72	64 597	28 368	196	118 390	1 144	369 685	256 668		59.0

Table 7: Estimated total number of shortfins (SFE) and longfins (LFE) landed for North Island processors from 2003–04 to 2011–12, for the South Island ANG 15 region from 2006–07 to 2011–12, and the entire South Island from 2010–11 to 2011–12. The proportion (%) of shortfin in the catch and the estimated mean weight of individual eels (i.e., total weight divided by the number of eels) are also shown.

North Island

Fishing year	Numbers		% SFE	Mean eel weight (g)	
	SFE	LFE		SFE	LFE
2003–04	628 027	184 360	77.3	0.477	0.571
2004–05	546 491	200 716	73.1	0.487	0.599
2005–06	680 971	167 177	80.3	0.491	0.614
2006–07	710 267	162 416	81.4	0.477	0.614
2007–08	610 114	124 396	83.1	0.488	0.587
2008–09	545 231	70 963	88.5	0.464	0.596
2009–10	542 389	71 838	88.3	0.488	0.644
2010–11	655 583	49 082	93.0	0.500	0.838
2011–12	676 403	105 935	86.5	0.501	0.725
Total	5 595 477	1 136 884	83.1	0.486	0.622

Table 7 – continued

South Island (ANG 15)

Fishing year	Numbers		% SFE	Mean eel weight (g)	
	SFE	LFE		SFE	LFE
2006–07	28 451	116 466	19.6	0.616	0.549
2007–08	33 749	127 363	20.9	0.623	0.543
2008–09	22 662	65 368	25.7	0.657	0.534
2009–10	43 998	52 056	45.8	0.646	0.740
2010–11	34 846	120 758	22.4	0.615	0.593
2011–12	31 907	126 853	20.1	0.666	0.645
Total	195 612	608 864	24.3	0.637	0.591

All South Island

Fishing year	Numbers		% SFE	Mean eel weight (g)	
	SFE	LFE		SFE	LFE
2010–11	356 152	178 283	66.6	0.542	0.612
2011–12	308 829	209 182	59.6	0.572	0.705
Total	664 981	387 465	63.2	0.556	0.662

Table 8: Distribution (%) of landed shortfin catch by weight and estimated number for each size grade for the North Island (2003–04 to 2011–12), South Island ANG 15 (2006–07 to 2011–12), and for the entire South Island (2010–11 and 2011–12). See methods for weight grades that correspond to small, medium, and large categories.

North Island (shortfin)

Fishing year	Percent of landed shortfin catch			Percent of landed shortfin numbers		
	Size grade			Size grade		
	Small	Medium	Large	Small	Medium	Large
2003–04	56.4	31.1	12.5	72.1	22.9	5.0
2004–05	54.5	31.8	13.8	70.7	23.7	5.6
2005–06	53.7	30.9	15.4	70.4	23.3	6.3
2006–07	57.4	29.9	12.7	73	21.9	5.1
2007–08	53.6	33.2	13.1	69.8	24.9	5.4
2008–09	62.7	24.9	12.4	77.5	17.7	4.8
2009–10	54.5	31	14.4	70.9	23.2	5.9
2010–11	49.9	35.6	14.5	66.5	27.4	6.1
2011–12	49.0	37.4	13.6	65.5	28.8	5.7

Table 8 – continued**South Island (ANG 15 shortfin)**

Fishing year	Percent of landed shortfin catch		Percent of landed shortfin numbers	
	Size grade		Size grade	
	Small	Large	Small	Large
2006–07	53.3	46.7	76.0	24.0
2007–08	52.0	48.0	75.0	25.0
2008–09	46.5	53.5	70.6	29.4
2009–10	48.1	51.9	72.0	28.0
2010–11	54.5	45.5	76.9	23.1
2011–12	45.1	54.9	69.5	30.5

All South Island (shortfin)

Fishing year	Percent of landed shortfin catch		Percent of landed shortfin numbers	
	Size grade		Size grade	
	Small	Large	Small	Large
2010–11	68.5	31.5	85.8	14.2
2011–12	61.9	38.1	81.8	18.2

Table 9: Distribution (%) of landed longfin catch by weight and estimated number for each size grade for the North Island (2003–04 to 2011–12), South Island ANG 15 (2006–07 to 2011–12), and for the entire South Island (2010–11 and 2011–12). See methods for weight grades that correspond to small, medium, and large categories.

North Island (longfin)

Fishing year	Percent of landed longfin catch			Percent of landed longfin numbers		
	Size grade			Size grade		
	Small	Medium	Large	Small	Medium	Large
2003–04	47.5	14.6	37.9	72.6	12.1	15.3
2004–05	46.2	17.6	36.2	70.8	14.6	14.6
2005–06	43.8	18.2	38.0	68.8	15.5	15.7
2006–07	44.6	15.9	39.5	70.1	13.6	16.4
2007–08	47.8	17.9	34.3	71.9	14.6	13.6
2008–09	49.8	9.3	40.9	75.9	7.7	16.4
2009–10	44.4	5.9	49.7	73.1	5.3	21.6
2010–11	26.2	3.6	70.2	56.2	4.2	39.6
2011–12	29.6	20.6	49.7	55.0	20.7	24.3

South Island (ANG 15 longfin)

Fishing year	Percent of landed longfin catch		Percent of landed longfin numbers	
	Size grade		Size grade	
	Small	Large	Small	Large
2006–07	72.0	28.0	89.6	10.4
2007–08	73.3	26.7	90.2	9.8
2008–09	75.3	24.7	91.1	8.9
2009–10	42.5	57.5	71.3	28.7
2010–11	63.8	36.2	85.6	14.4
2011–12	57.5	42.5	82.0	18.0

All South Island (longfin)

Fishing year	Percent of landed longfin catch		Percent of landed longfin numbers	
	Size grade		Size grade	
	Small	Large	Small	Large
2010–11	60.5	39.5	83.7	16.3
2011–12	49.5	50.5	76.7	23.3

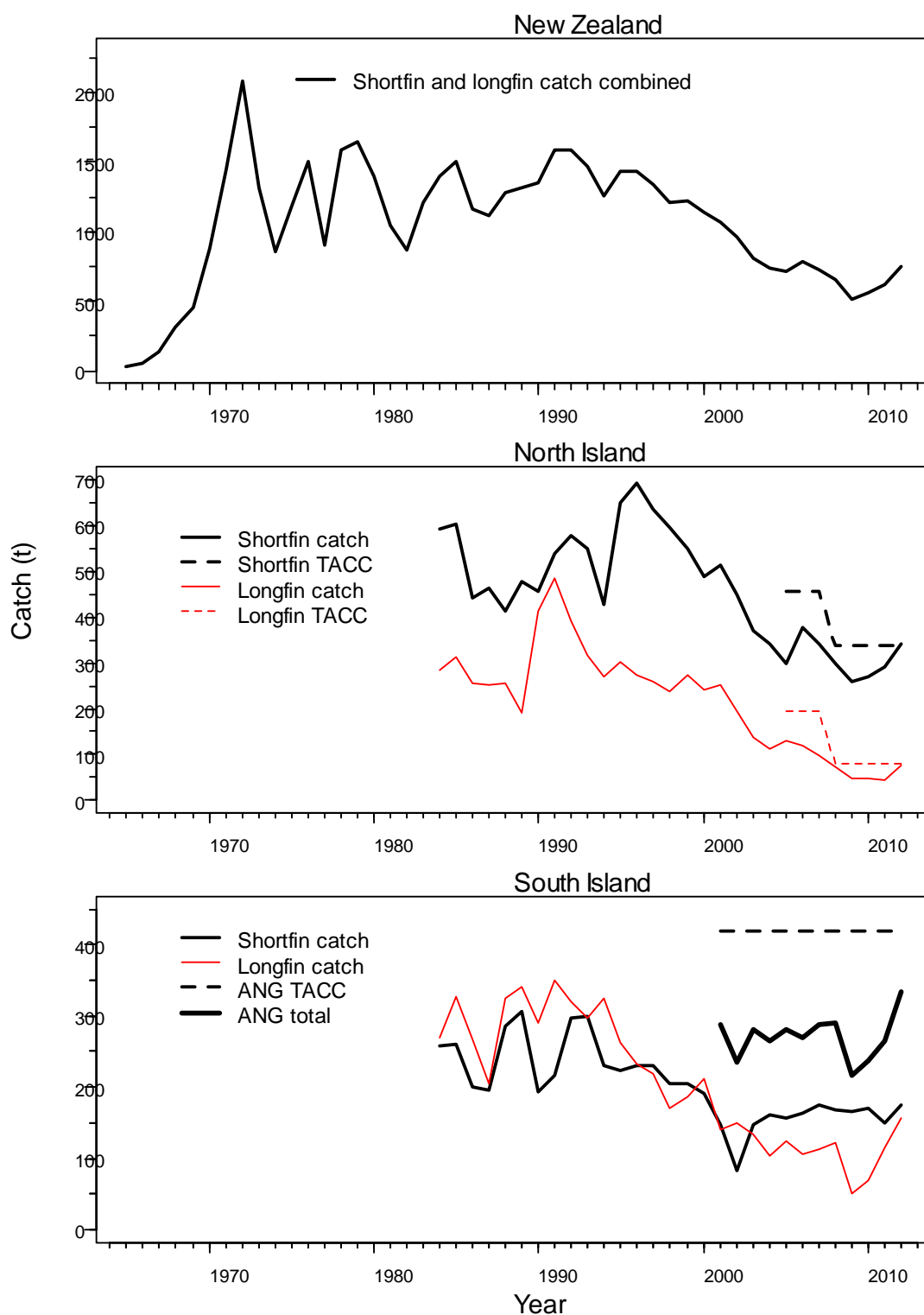


Figure 1: New Zealand eel catch from 1965 to 2011–12 (top), and North Island (centre) and South Island (bottom) catch by species from 1984 to 2011–12, and TACCs. Species catch was estimated from species proportions in catch effort data (FSU, CELR, ECER) in the South Island before 2001, and in the North Island before 2005. Subsequent species data are from landings reported on ECLRs (Ministry for Primary Industries 2012 and draft report for 2013). In the South Island there is no separation of species under the QMS and ANG is used for both species. Catches are expressed by calendar year until 1988, and thereafter by fishing year. 2010 = 2009–10.

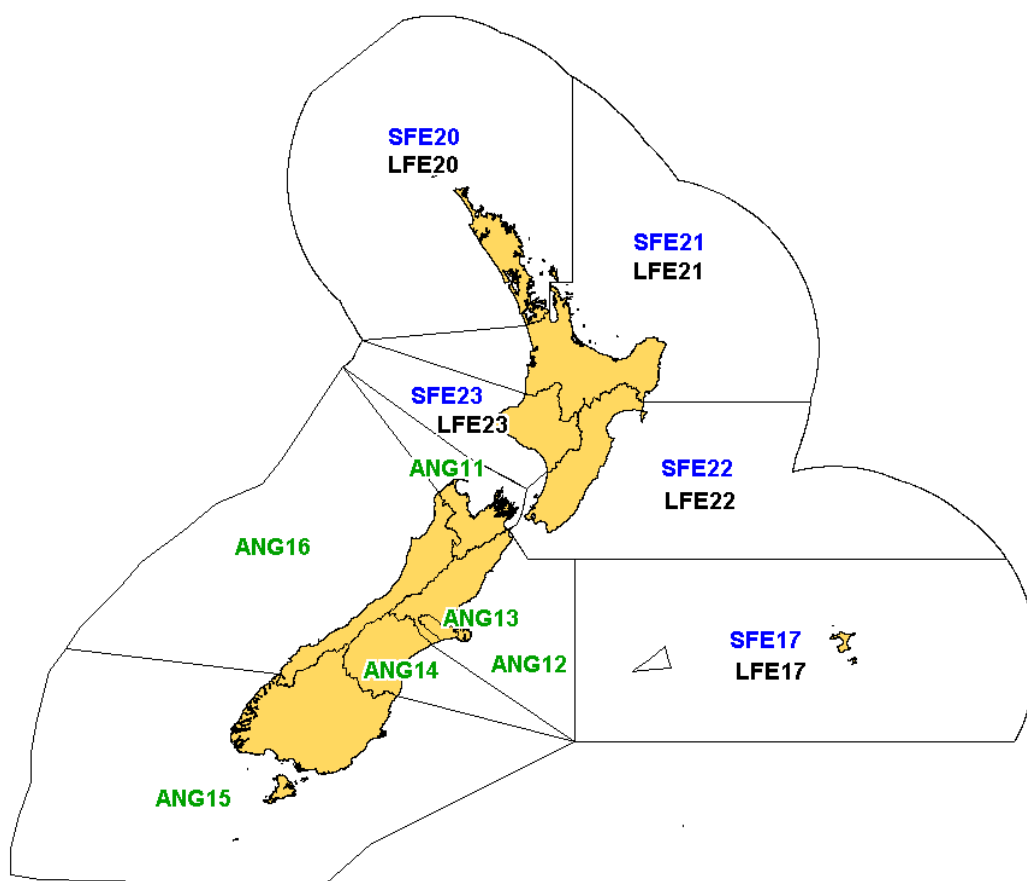


Figure 2: Quota Management Areas for the New Zealand eel fishery (see Table 1 for breakdown by eel statistical areas). Shortfin stocks are denoted by the prefix SFE, and longfin by LFE. ANG comprises both shortfin and longfin combined (Ministry for Primary Industries 2012).

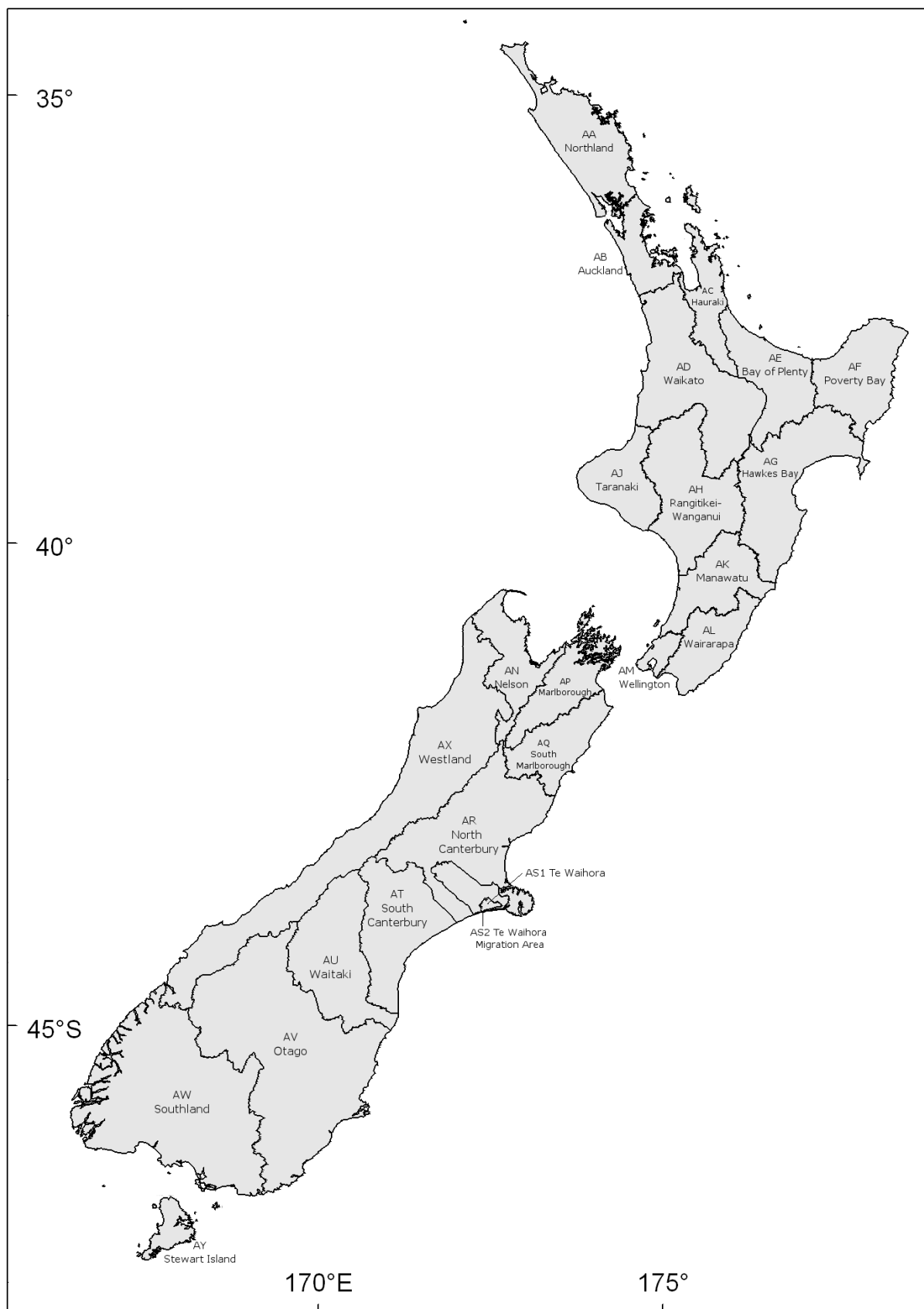


Figure 3: Eel statistical areas (ESAs). (See Table 1 for numeric codes).

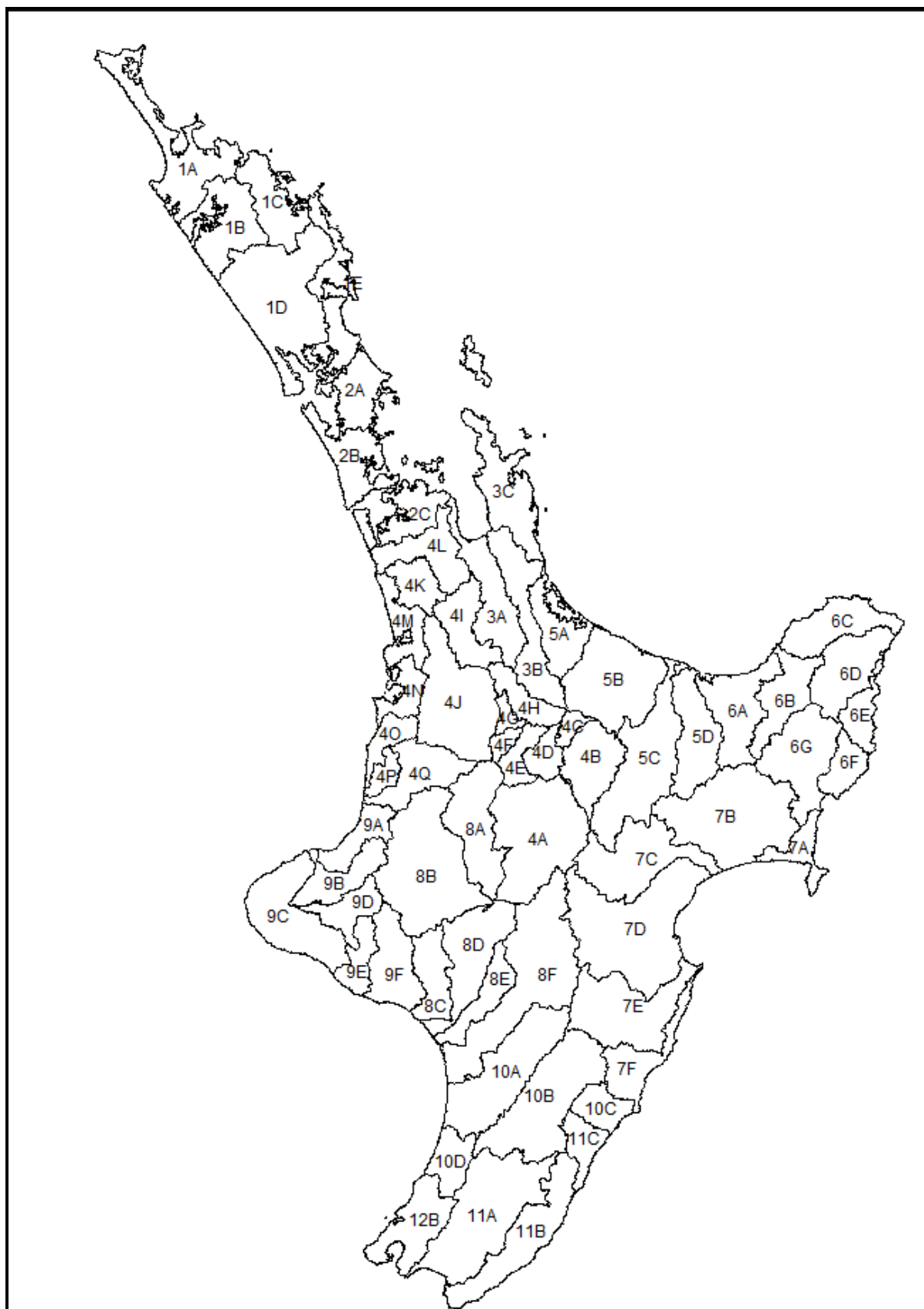


Figure 4: North Island eel statistical area subareas. Locations are defined in Appendix 2.

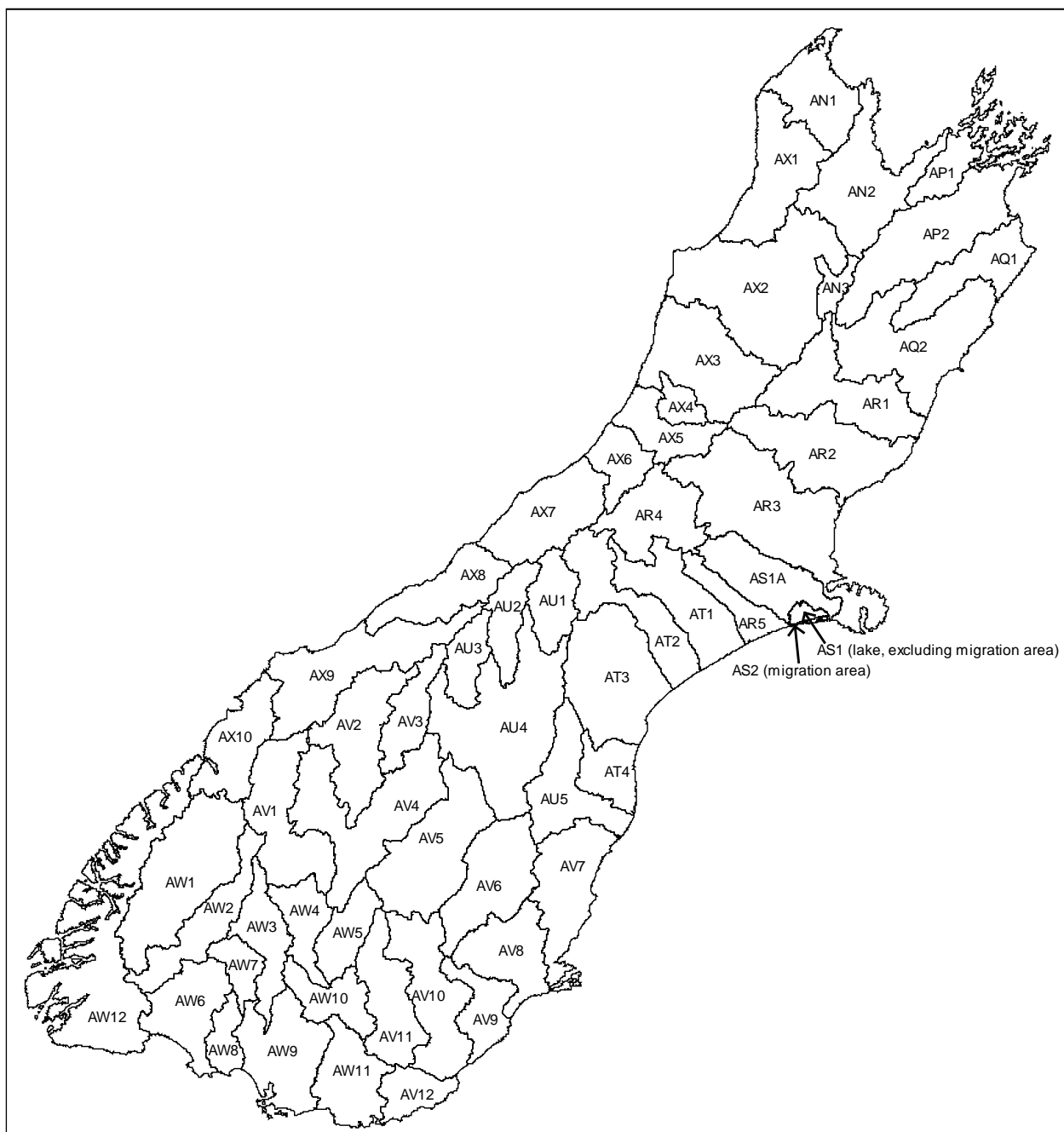


Figure 5: South Island eel statistical area subareas. Locations are defined in Appendix 2.

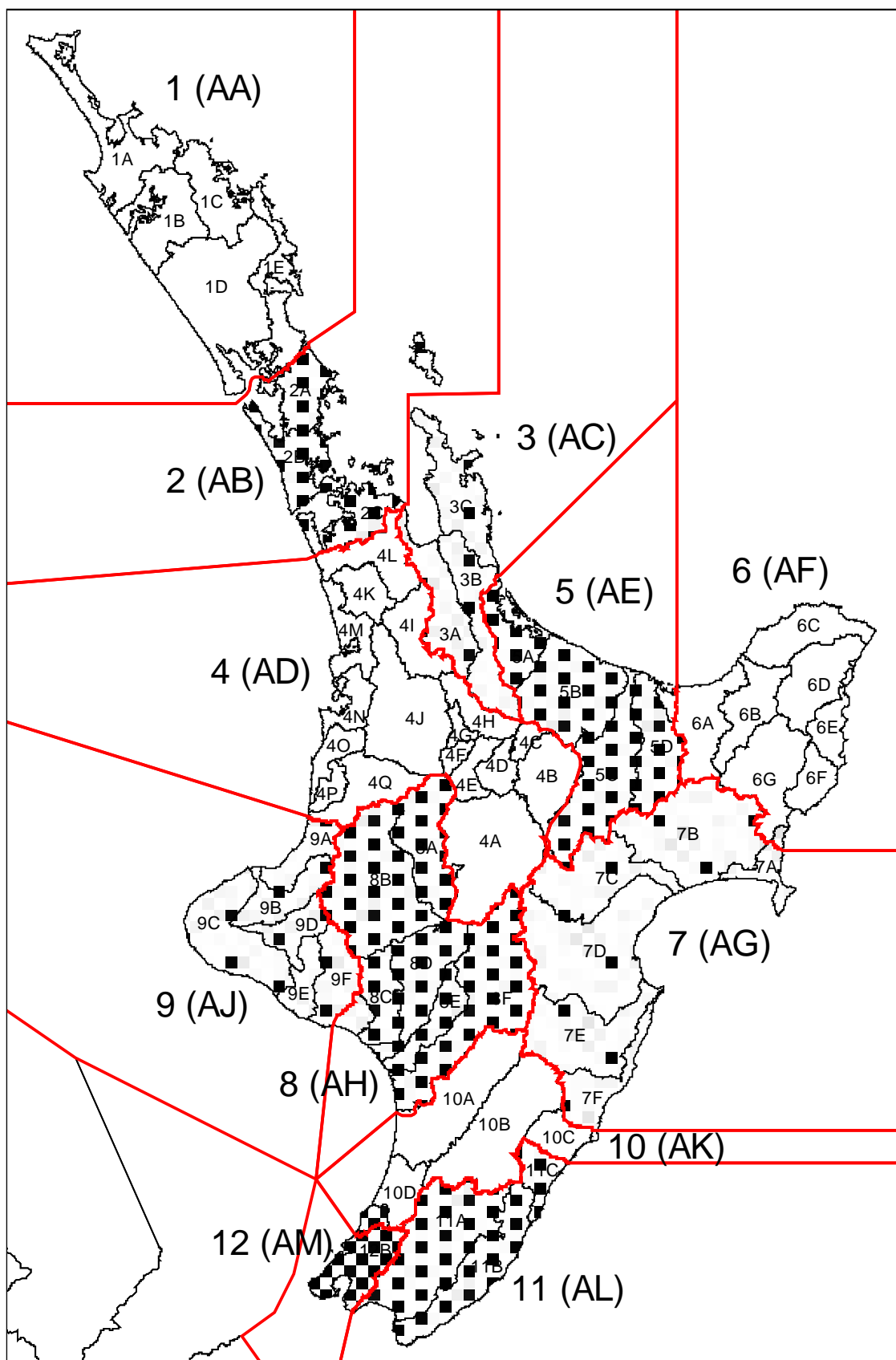


Figure 6: North Island eel statistical area subareas and eel statistical areas (ESAs 1 to 12 equivalent to AA to AM) overlaid, showing the shared boundaries (red). Subarea locations are defined in Appendix 2 and ESA areas defined in Table 1. The shading and fill patterns delineate individual ESAs.

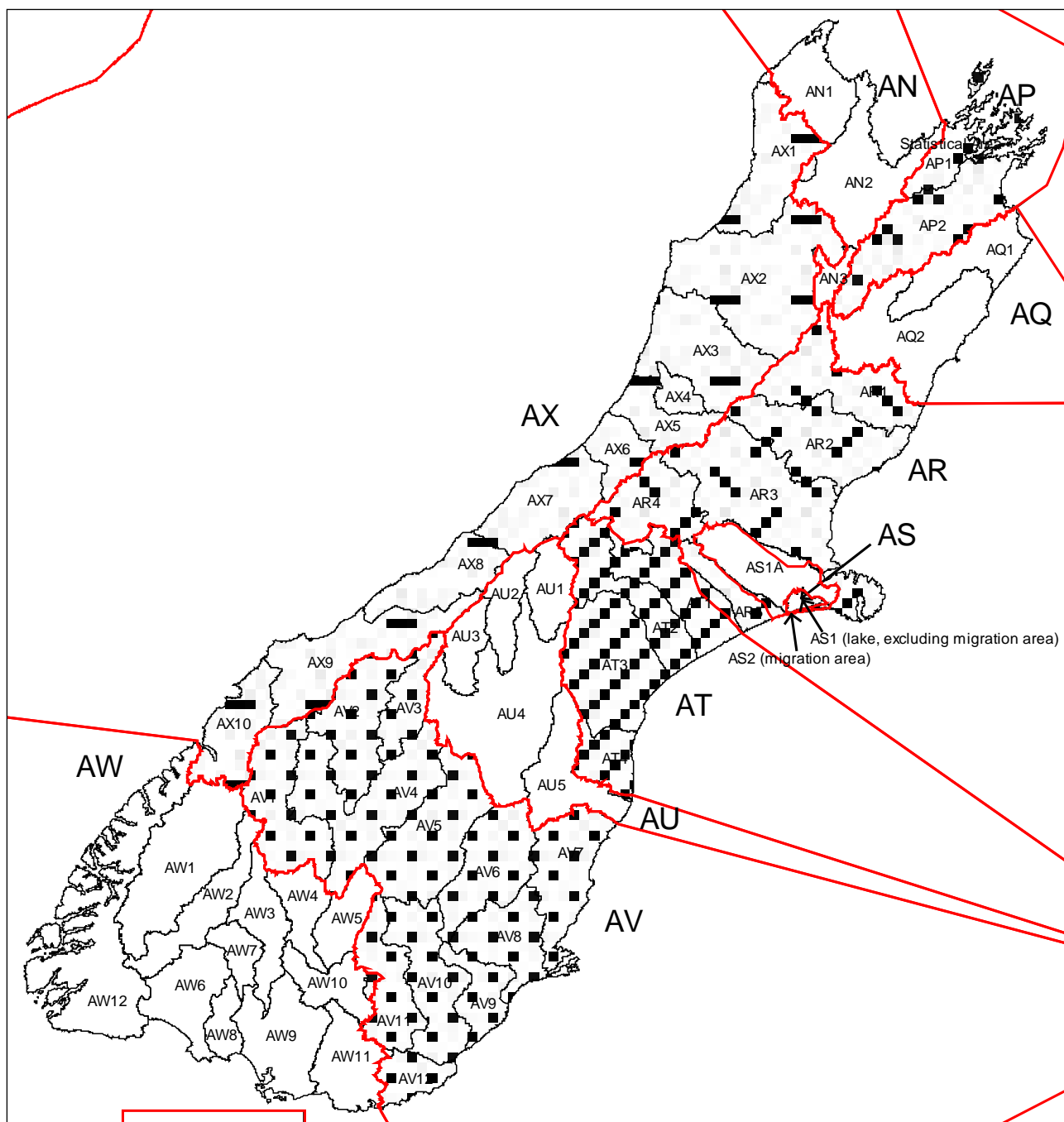


Figure 7: South Island eel statistical area subareas and eel statistical areas (ESAs AN to AX) overlaid, showing the shared boundaries (red). Subarea locations are defined in Appendix 2 and ESA areas defined in Table 1. The shading and fill patterns delineate individual ESAs.

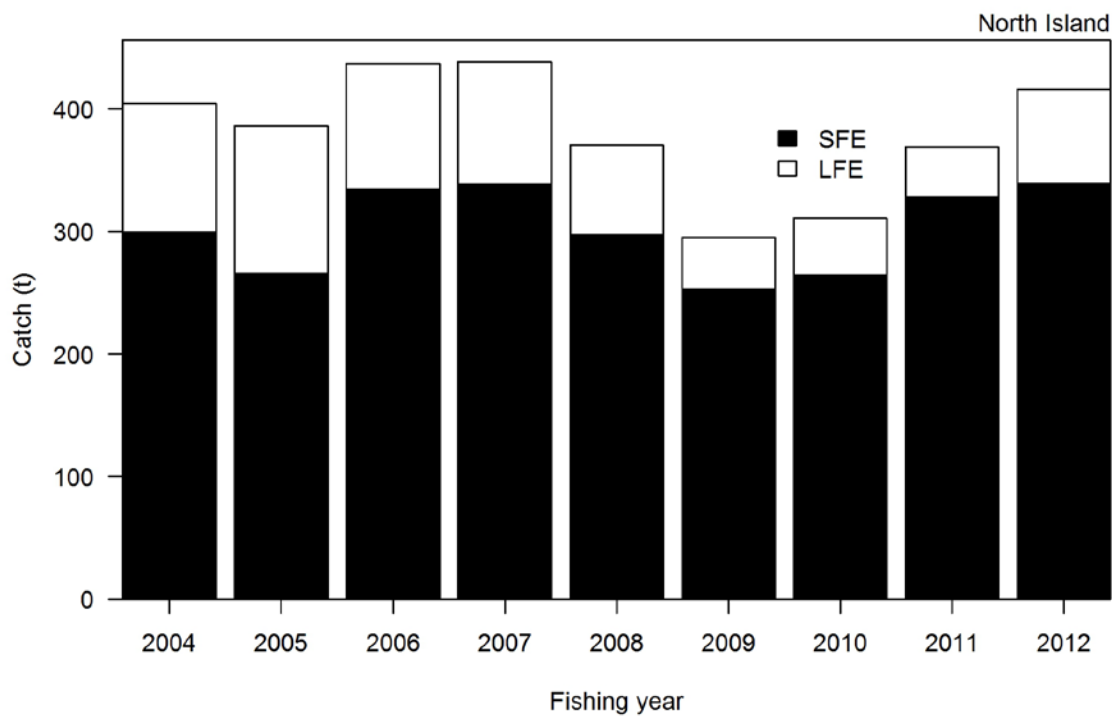


Figure 8: North Island total commercial catch (t) of shortfin (SFE) and longfin (LFE) eels for the years 2003–04 to 2011–12.

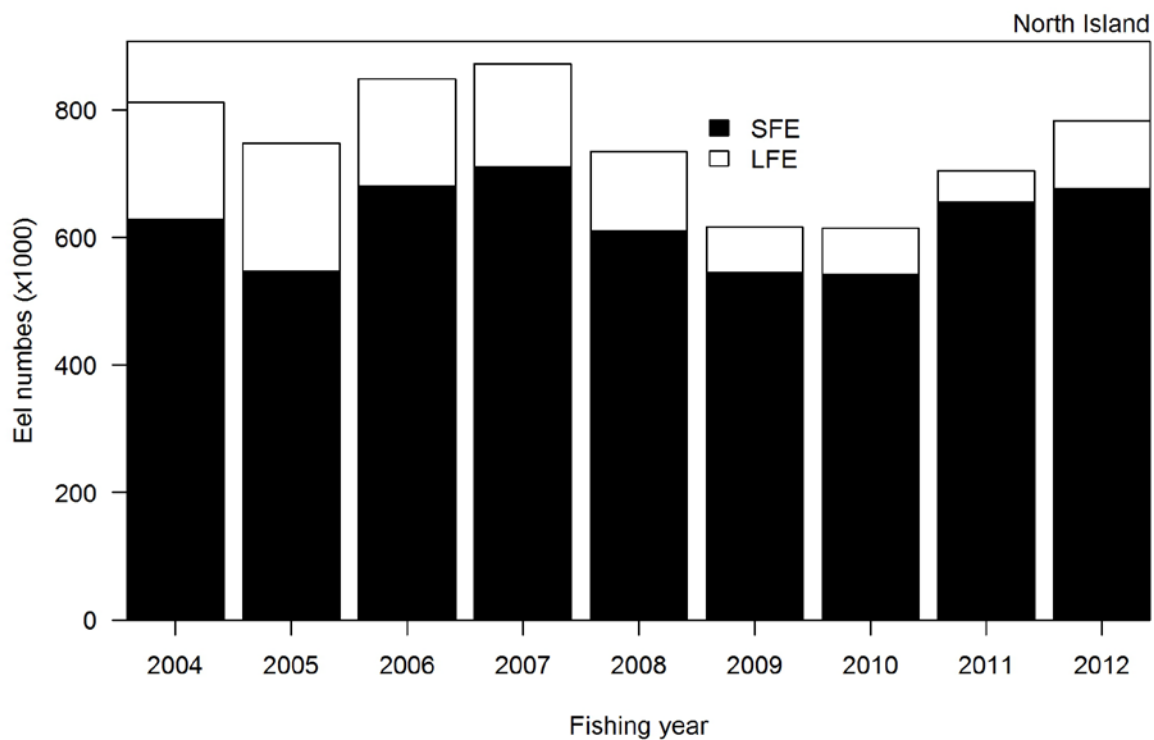


Figure 9: Estimated numbers of shortfin (SFE) and longfin (LFE) eels in the North Island total commercial catch for the years 2003–04 to 2011–12.

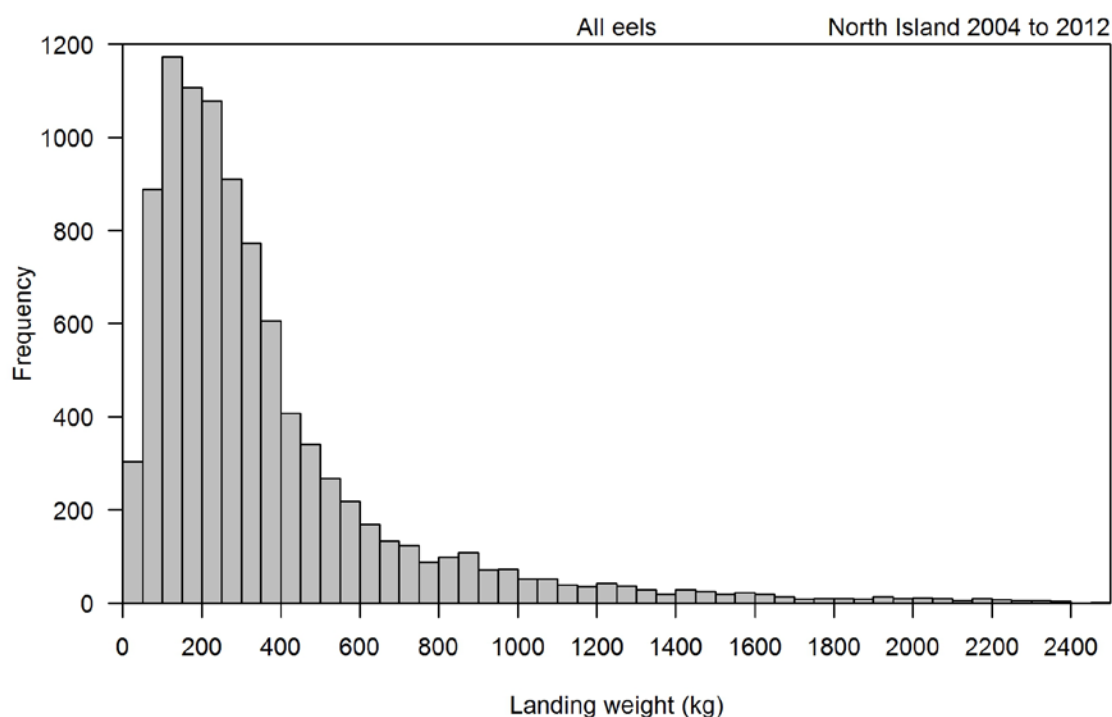


Figure 10: Distribution of individual eel landing weights in the North Island from 2003–04 to 2011–12. Landings include both shortfin and longfin eels.

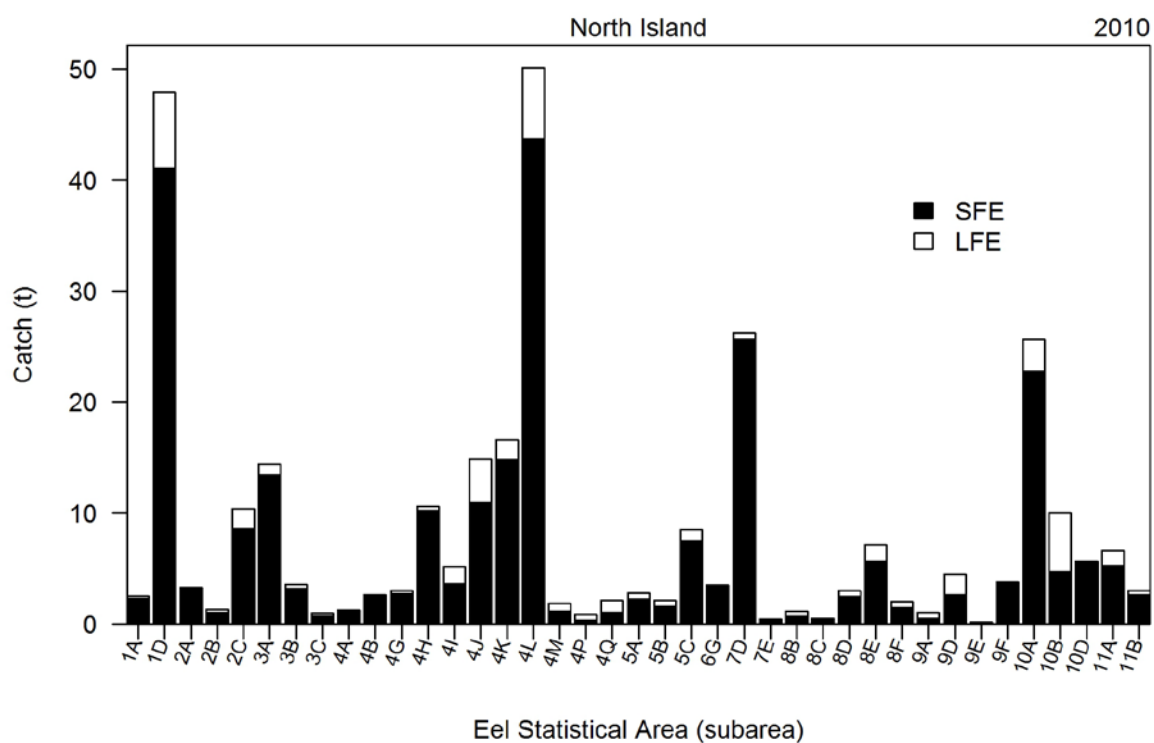


Figure 11: Catch of North Island shortfin (SFE) and longfin (LFE) eels by eel statistical area subarea for fishing years 2009–10 (2010), 2010–11 (2011), and 2011–12 (2012).

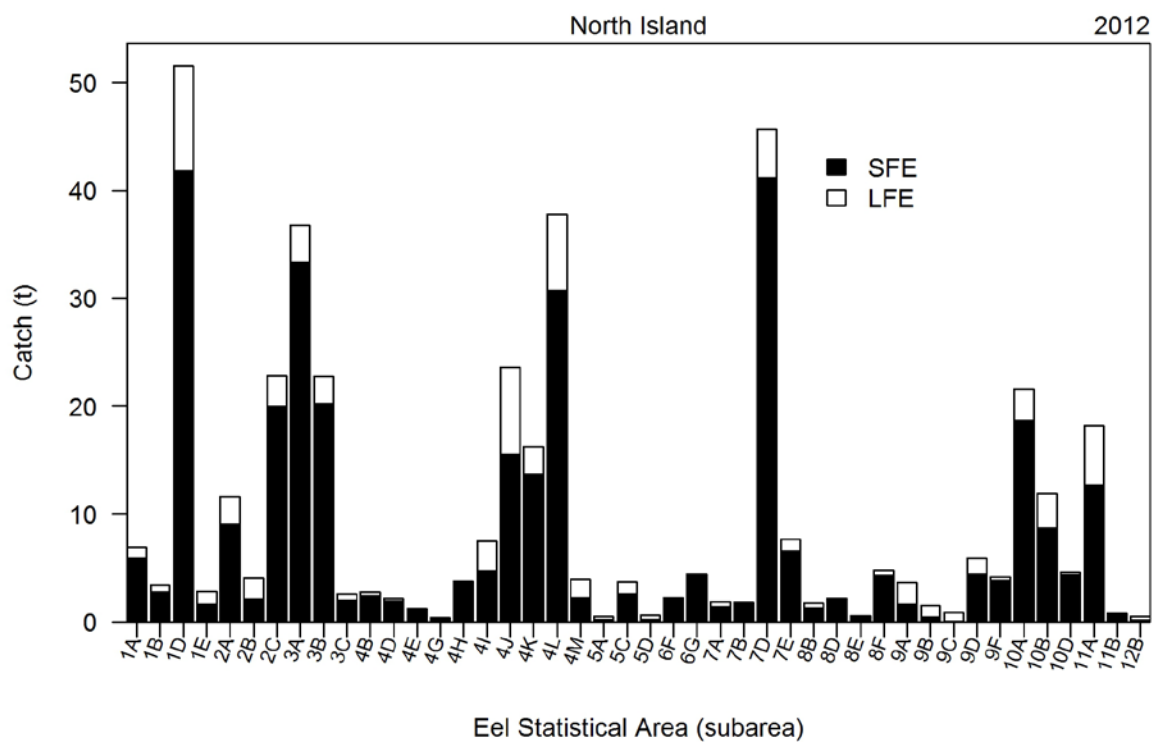
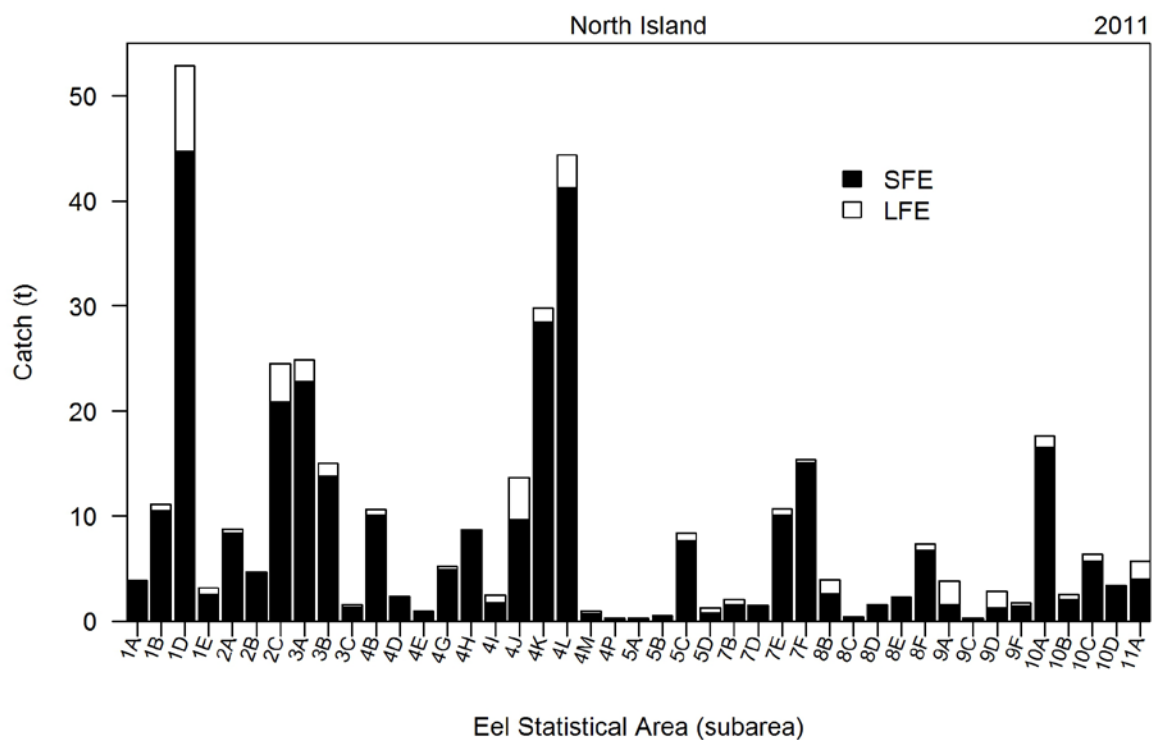


Figure 11 – continued

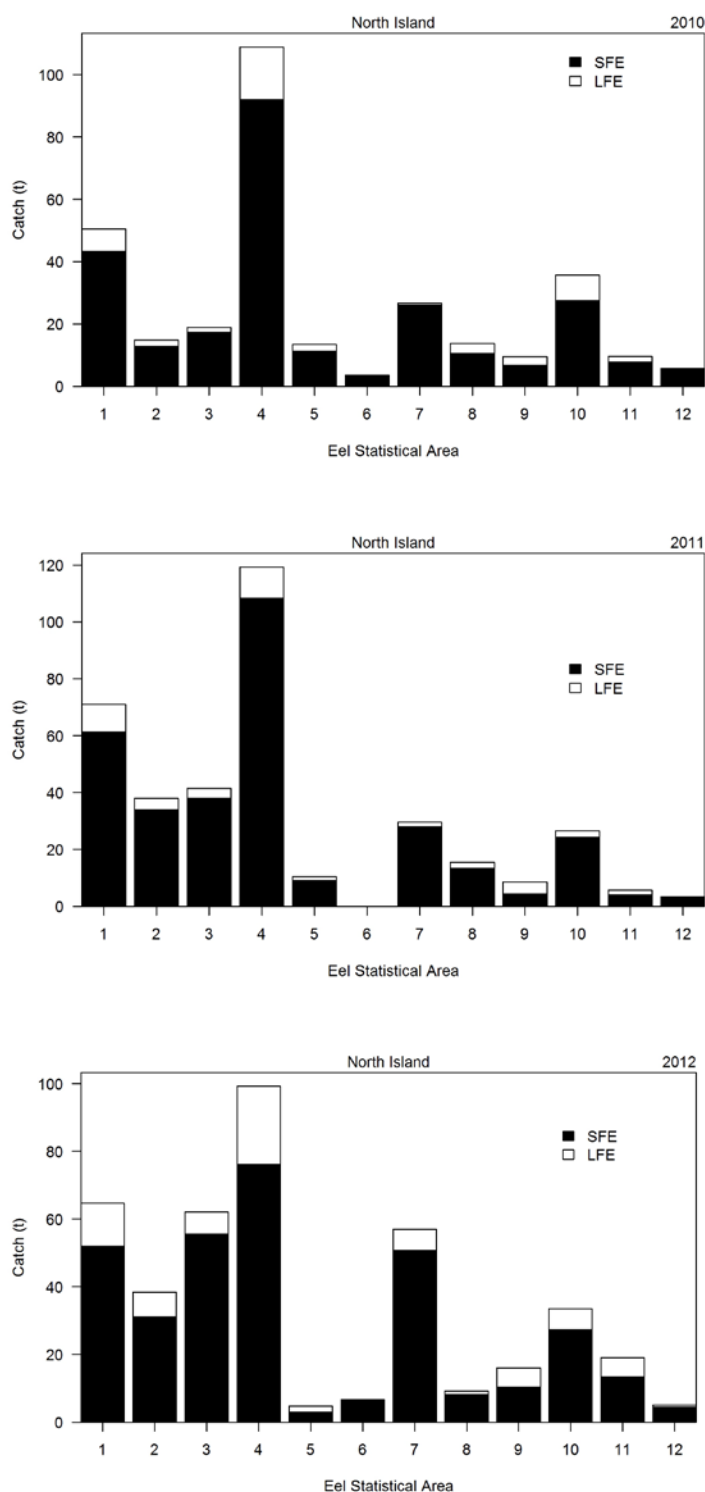


Figure 12: Catch of North Island shortfin (SFE) and longfin (LFE) eels by eel statistical area for fishing years 2009–10 (2010), 2010–11 (2011) and 2011–12 (2012).

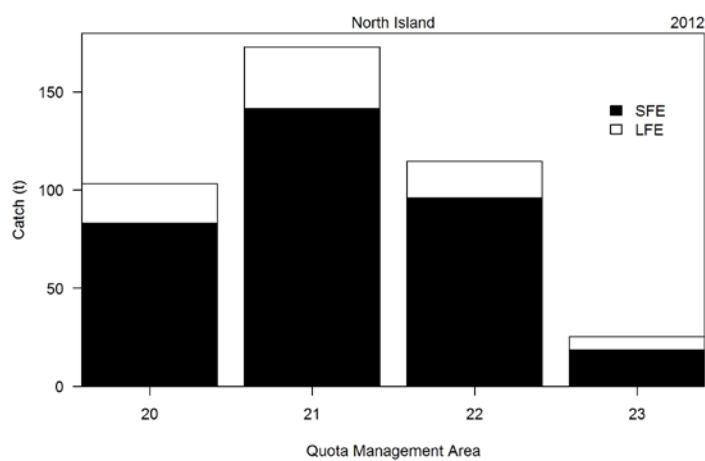
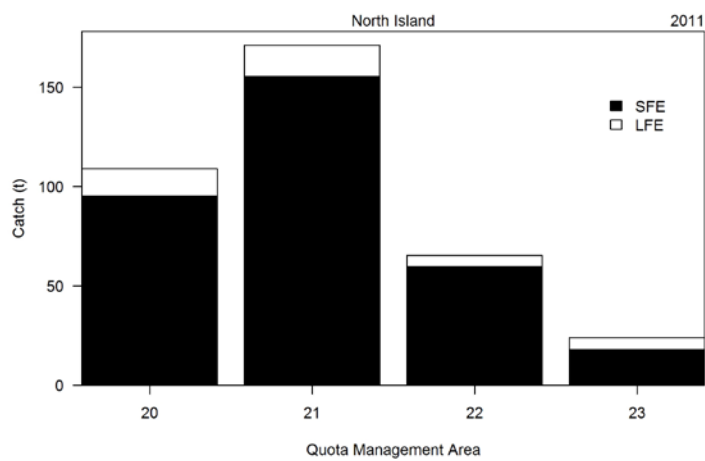
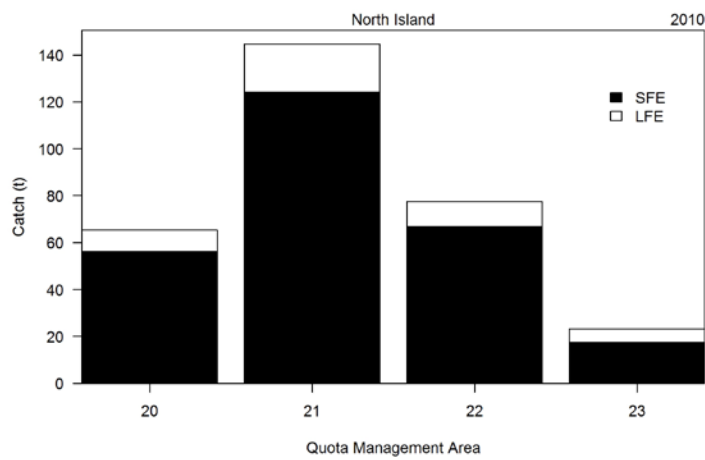


Figure 13: Catch of North Island shortfin (SFE) and longfin (LFE) eels by Quota Management Area for fishing years 2009–10 (2010), 2010–11 (2011) and 2011–12 (2012).

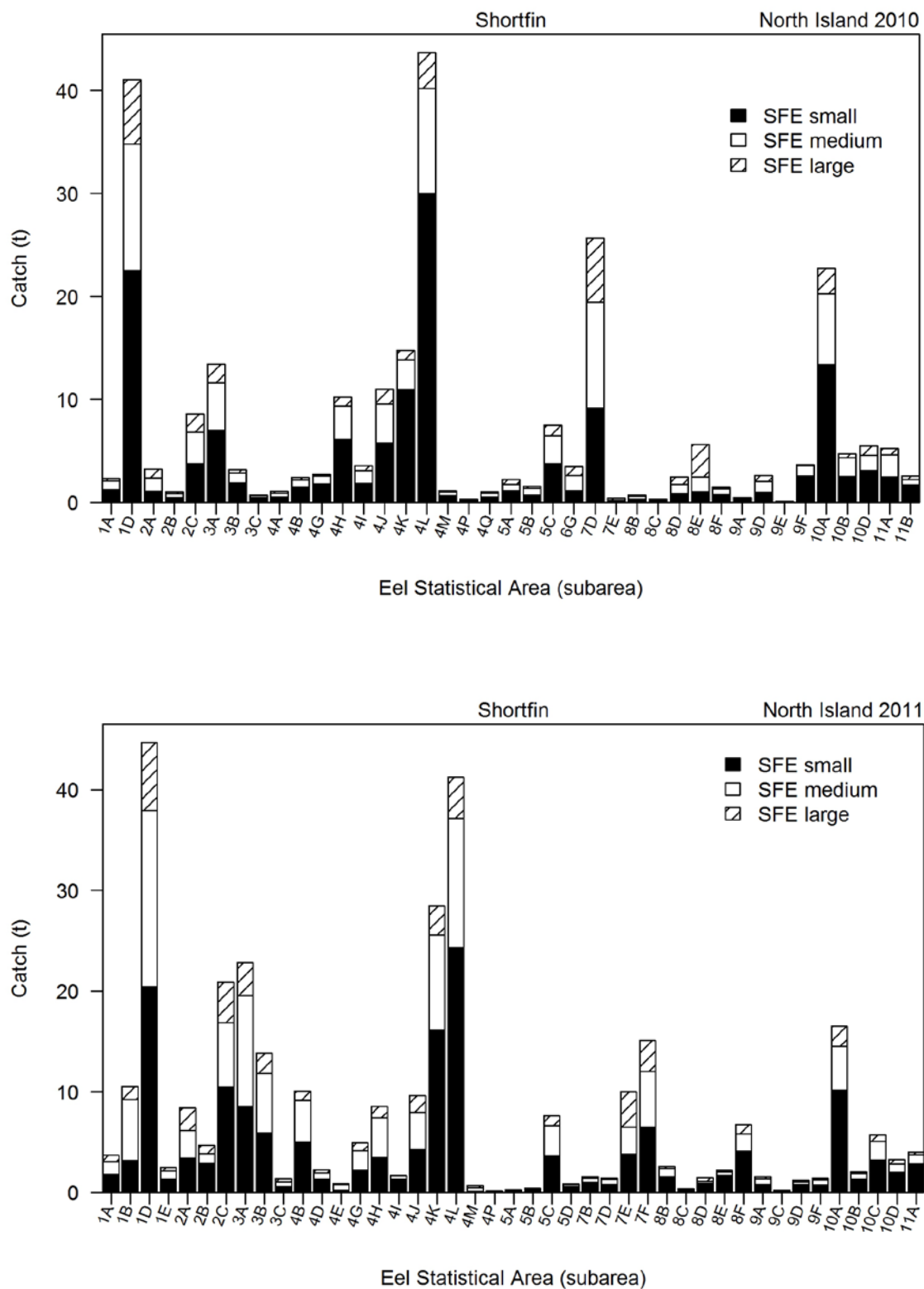


Figure 14: Catch of shortfin (SFE) eels by size grade for North Island eel statistical area subareas for fishing years 2009–10 (2010), 2010–11 (2011) and 2011–12 (2012).

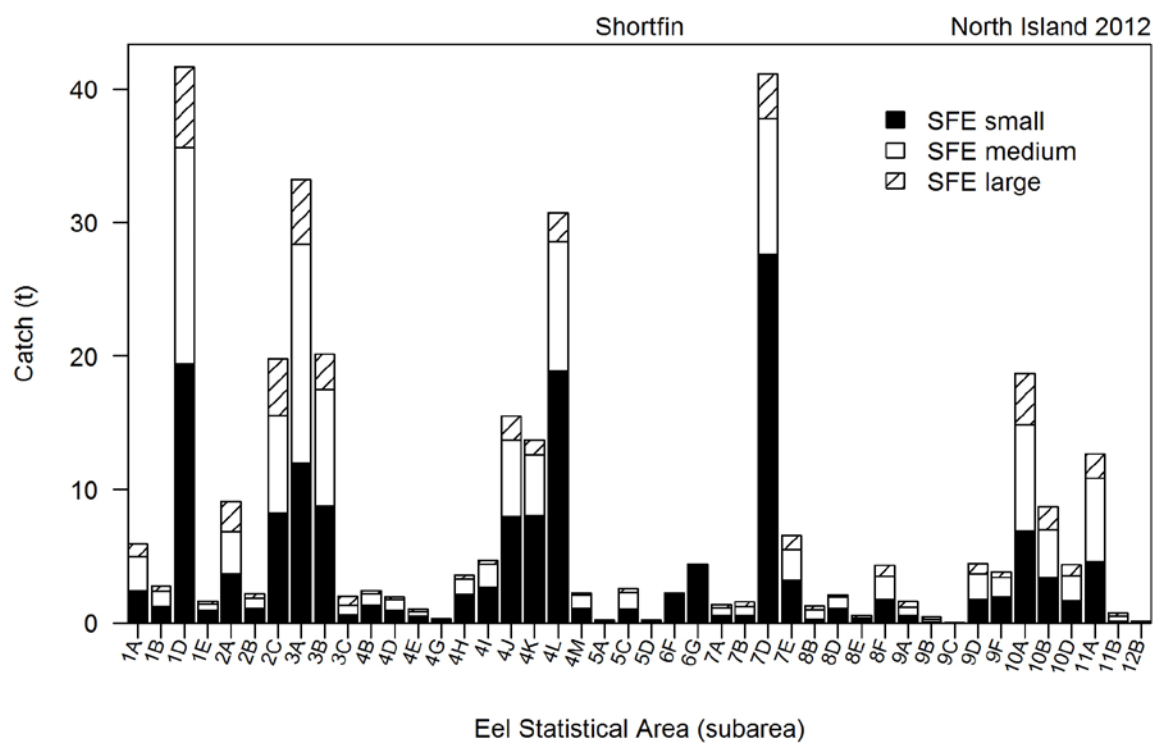


Figure 14 – continued

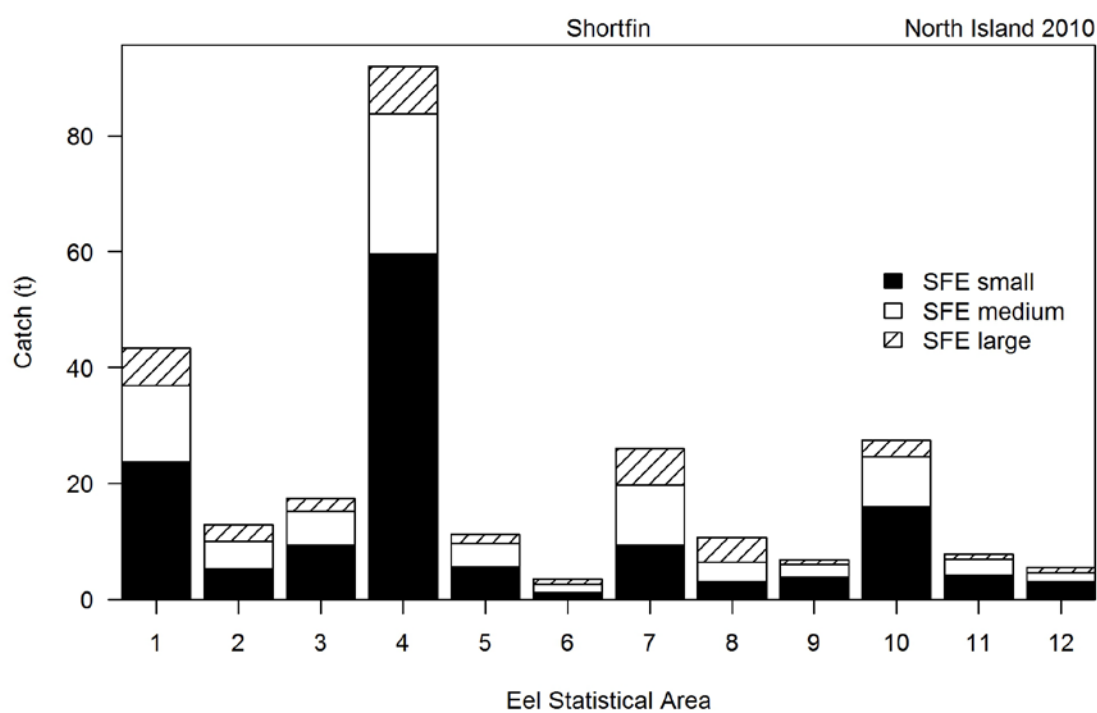


Figure 15: Catch of shortfin (SFE) eels by size grade for North Island eel statistical area for fishing years 2009–10 (2010), 2010–11 (2011) and 2011–12 (2012). See Table 1 for alpha ESA codes.

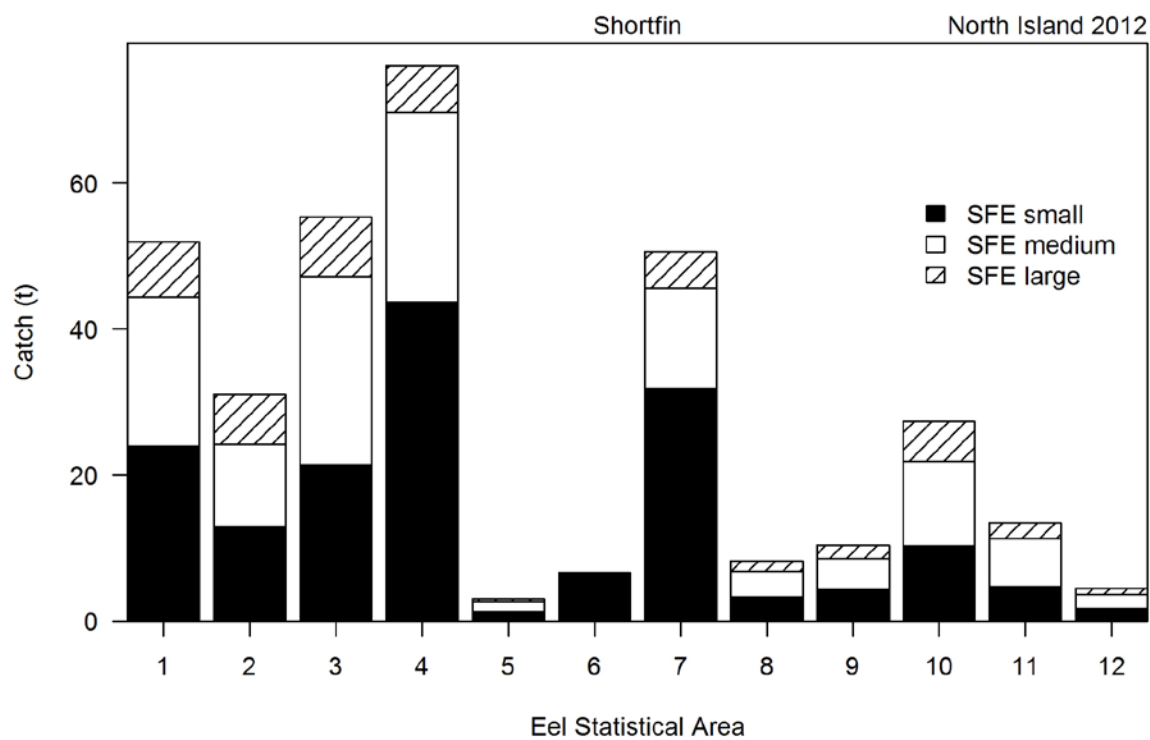
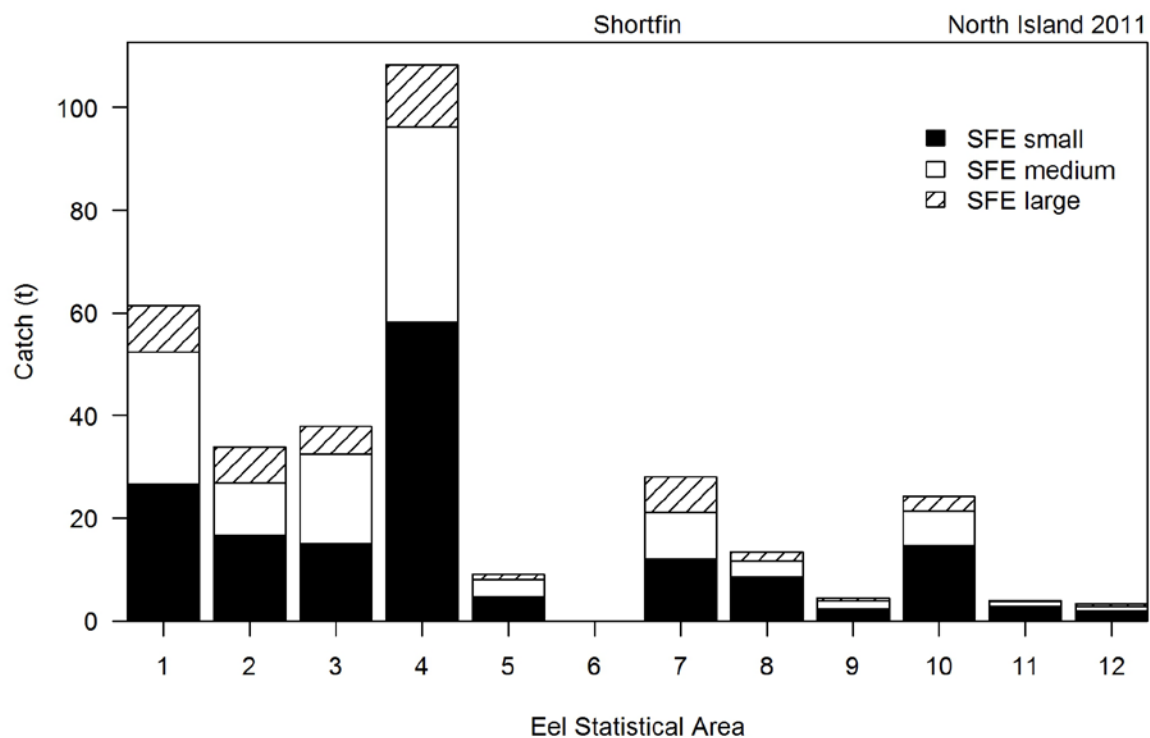


Figure 15 – continued

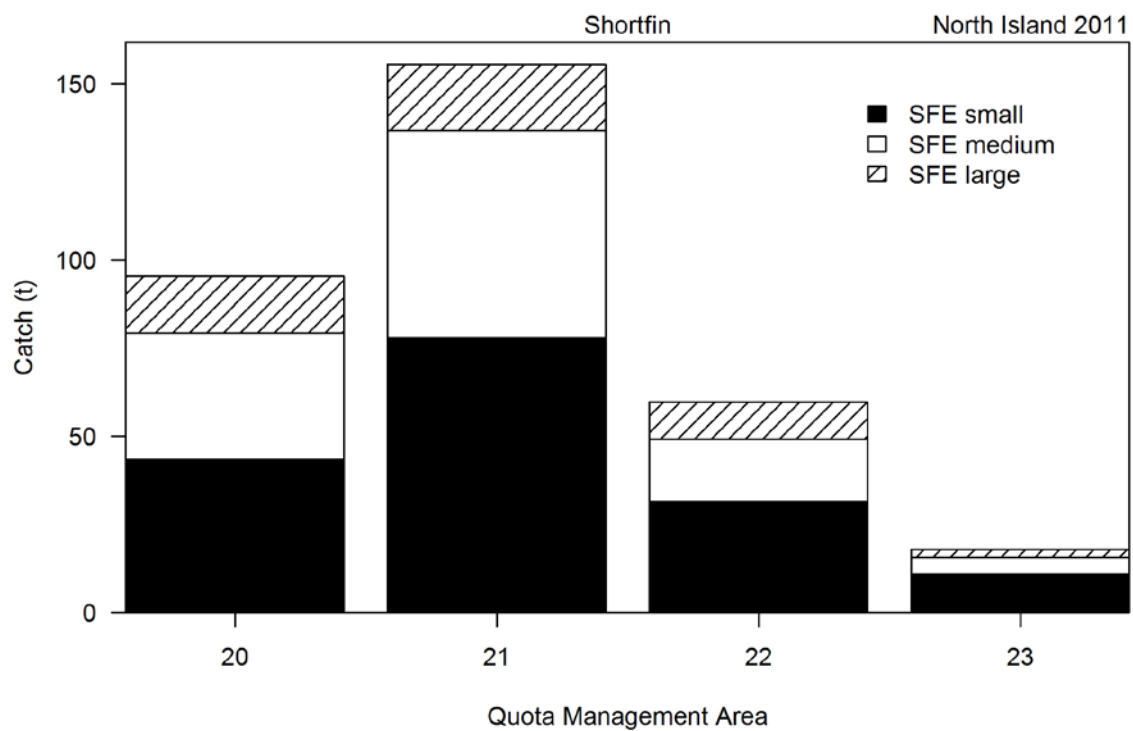
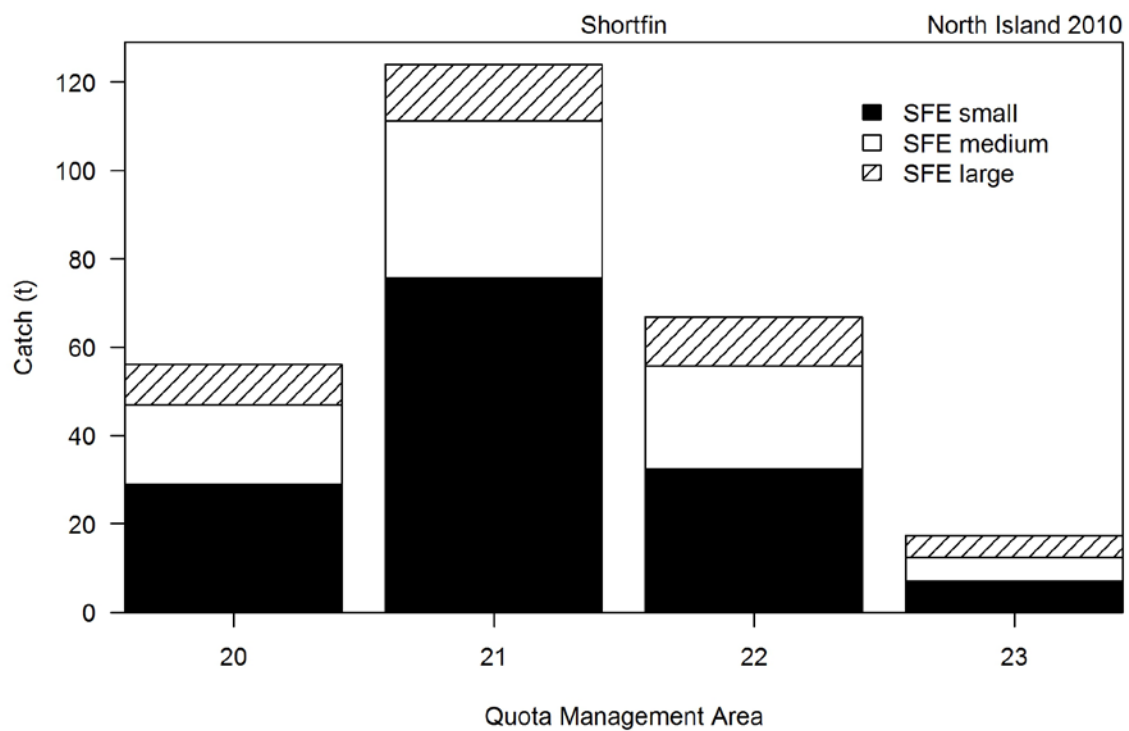


Figure 16: Catch of shortfin (SFE) eels by size grade and North Island Quota Management Area (QMA) for fishing years 2009–10 (2010), 2010–11 (2011) and 2011–12 (2012).

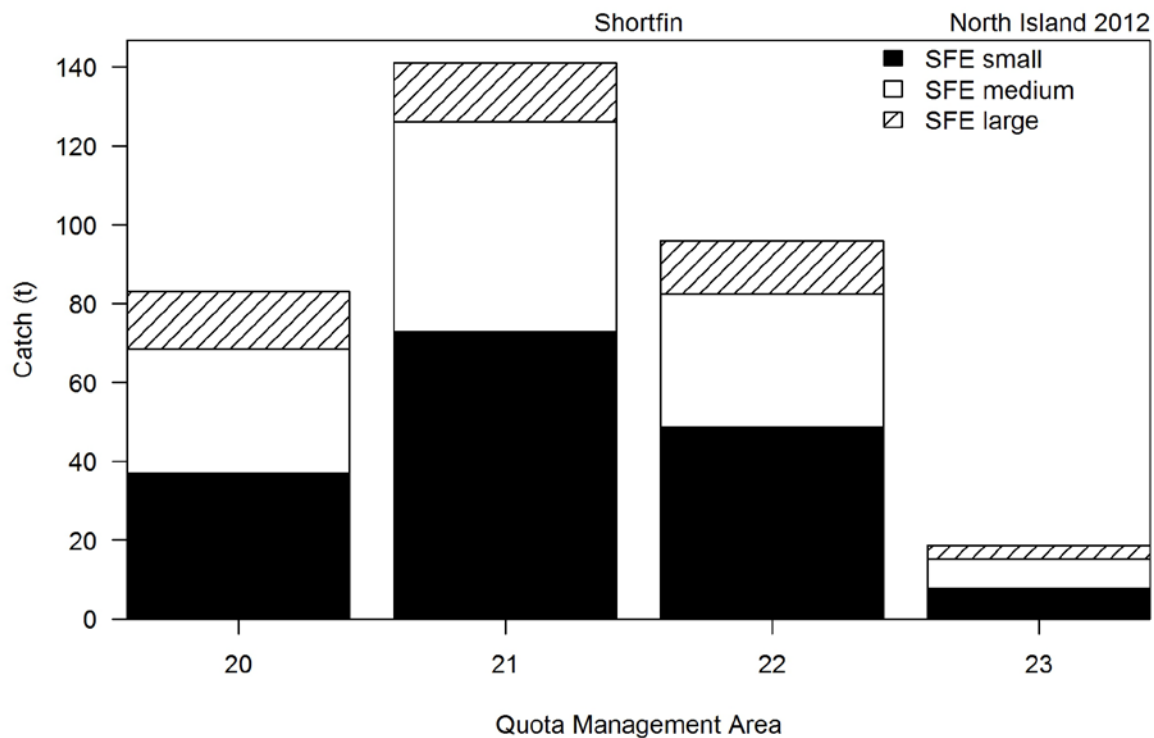


Figure 16 – continued

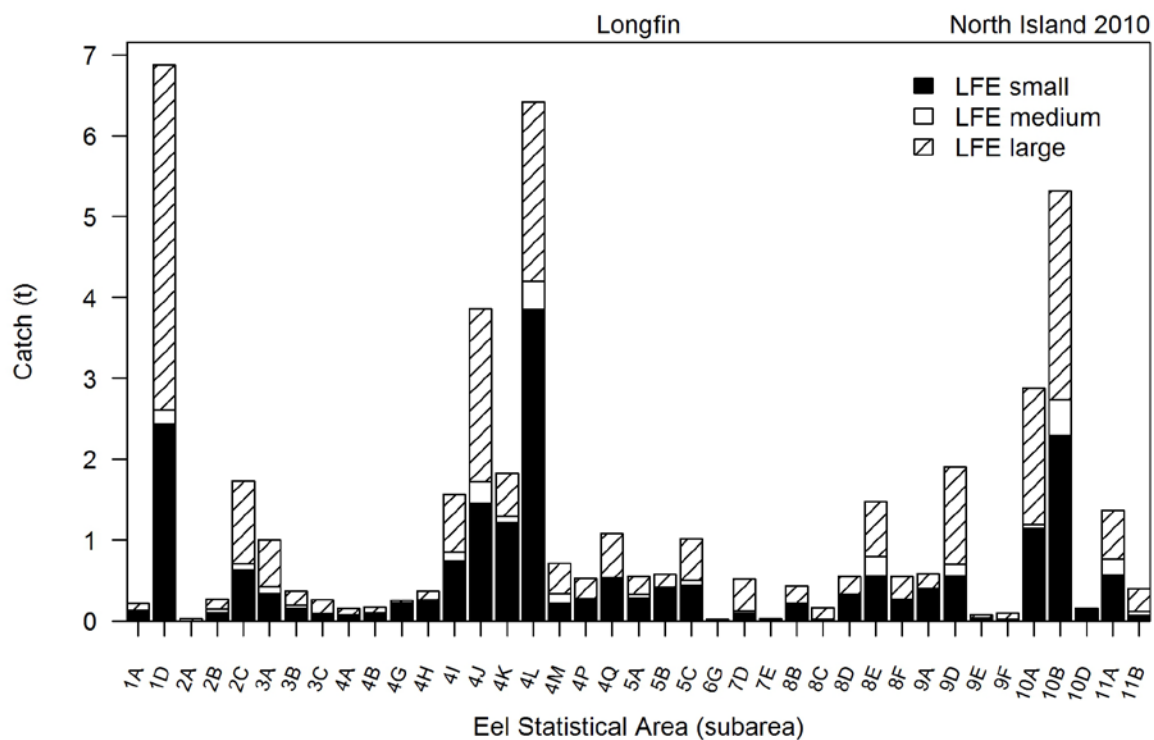


Figure 17: Catch of longfin (LFE) eels by size grade and North Island eel statistical area subarea for fishing years 2009–10 (2010), 2010–11 (2011) and 2011–12 (2012).

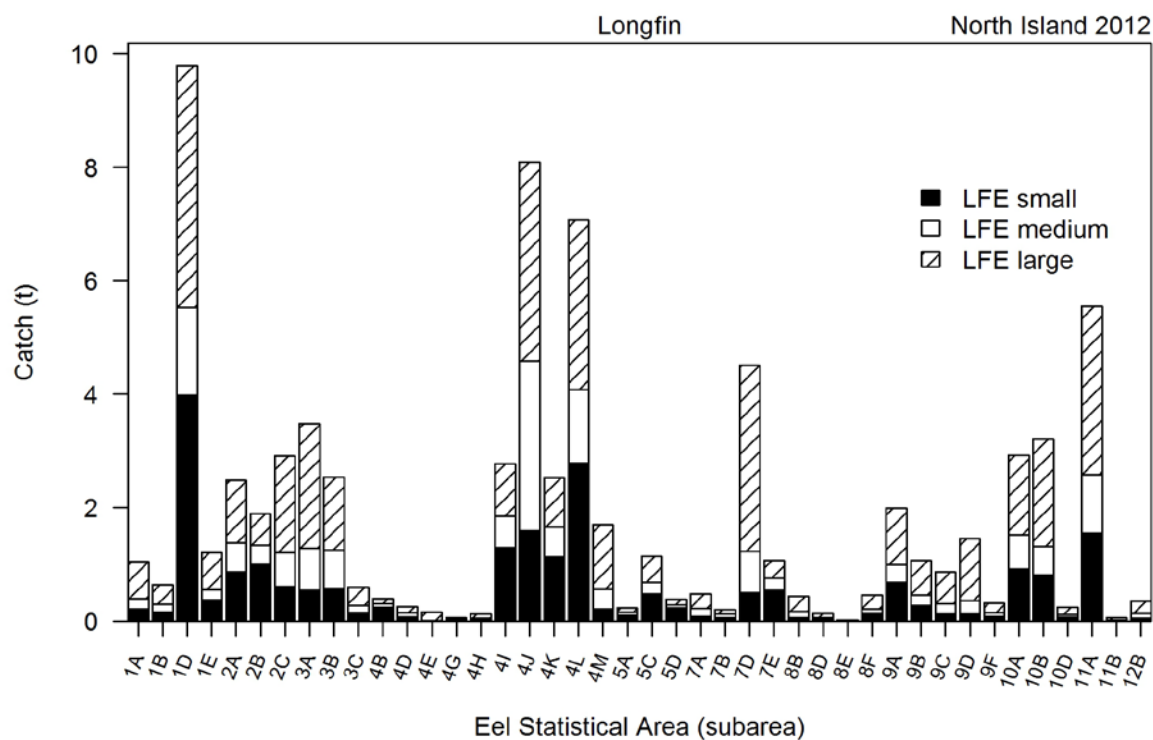
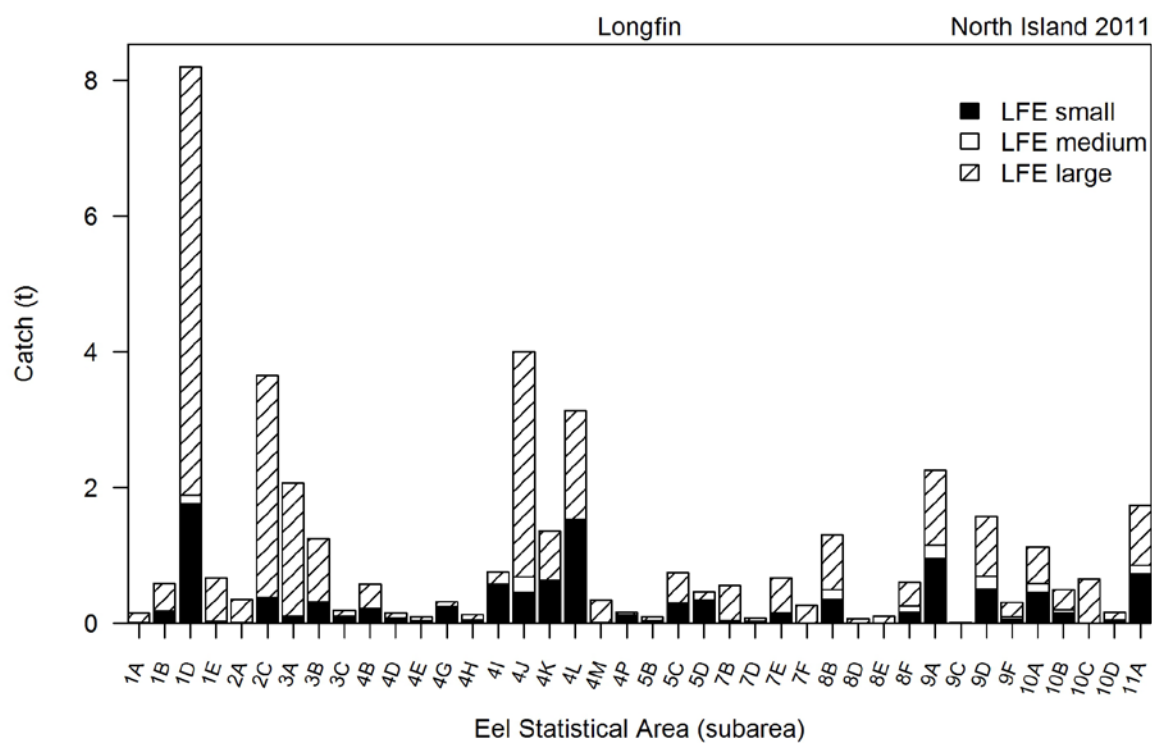


Figure 17 – continued

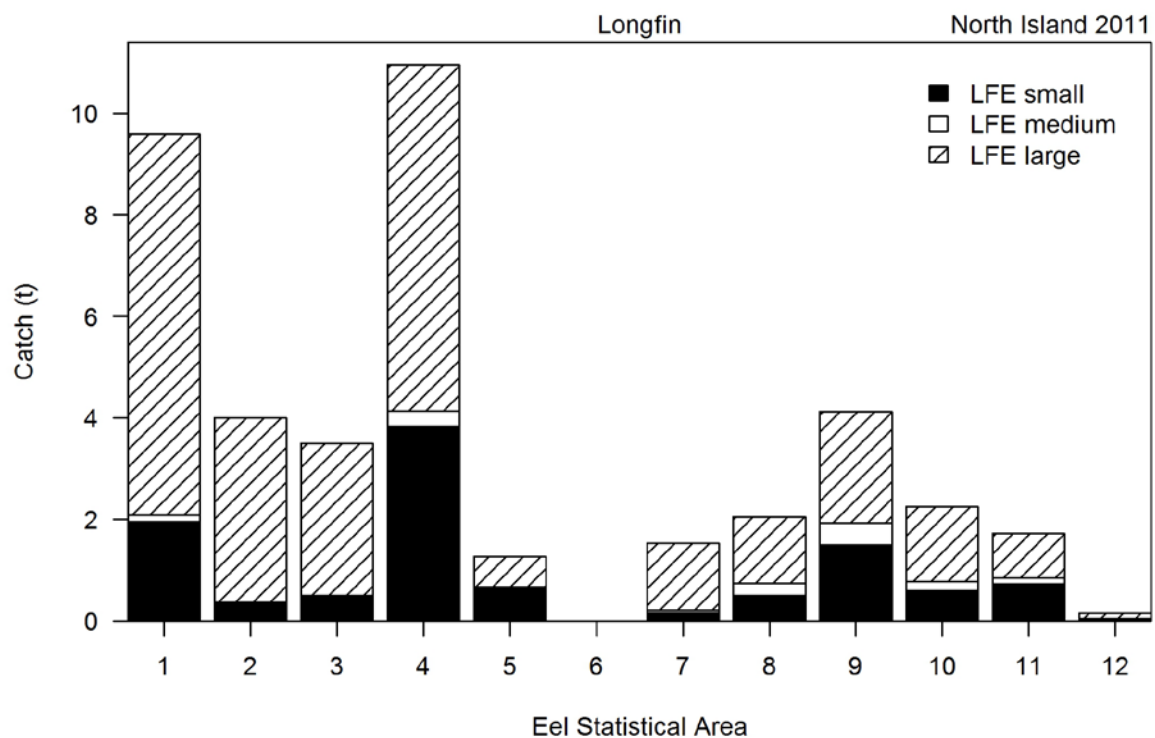
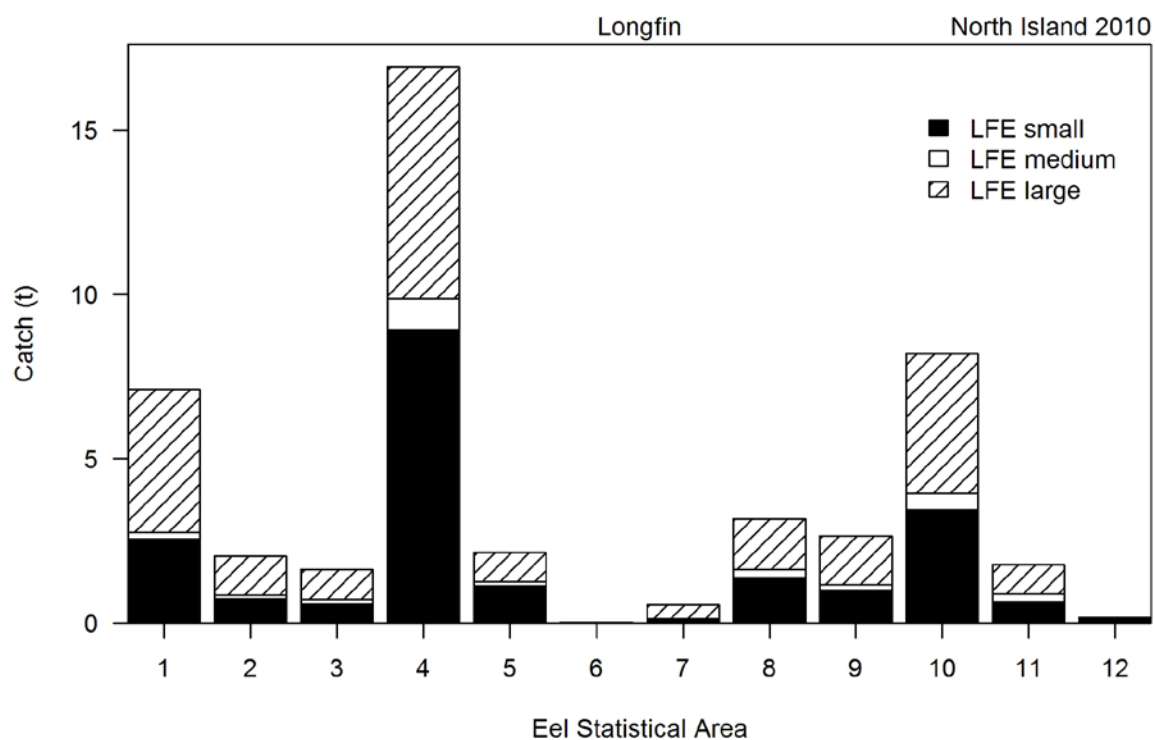


Figure 18: Catch of longfin (LFE) eels by size grade and North Island eel statistical area for fishing years 2009–10 (2010), 2010–11 (2011) and 2011–12 (2012). See Appendix 2 for alpha ESA codes.

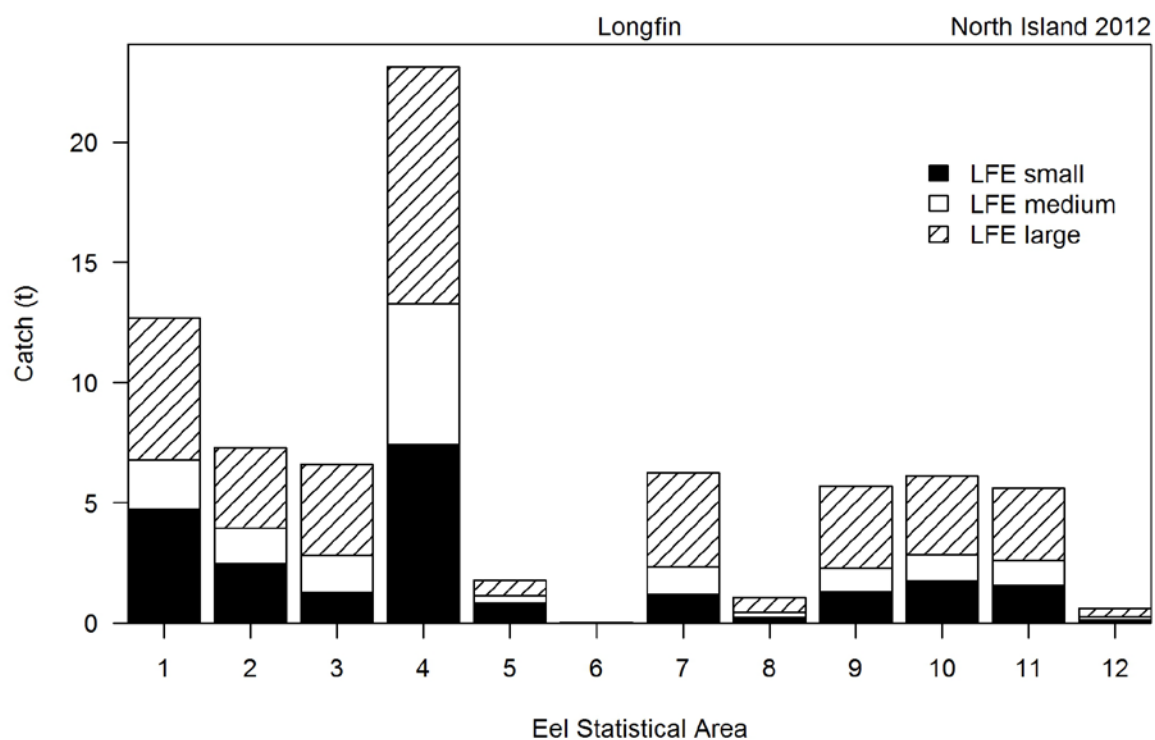


Figure 18 – continued

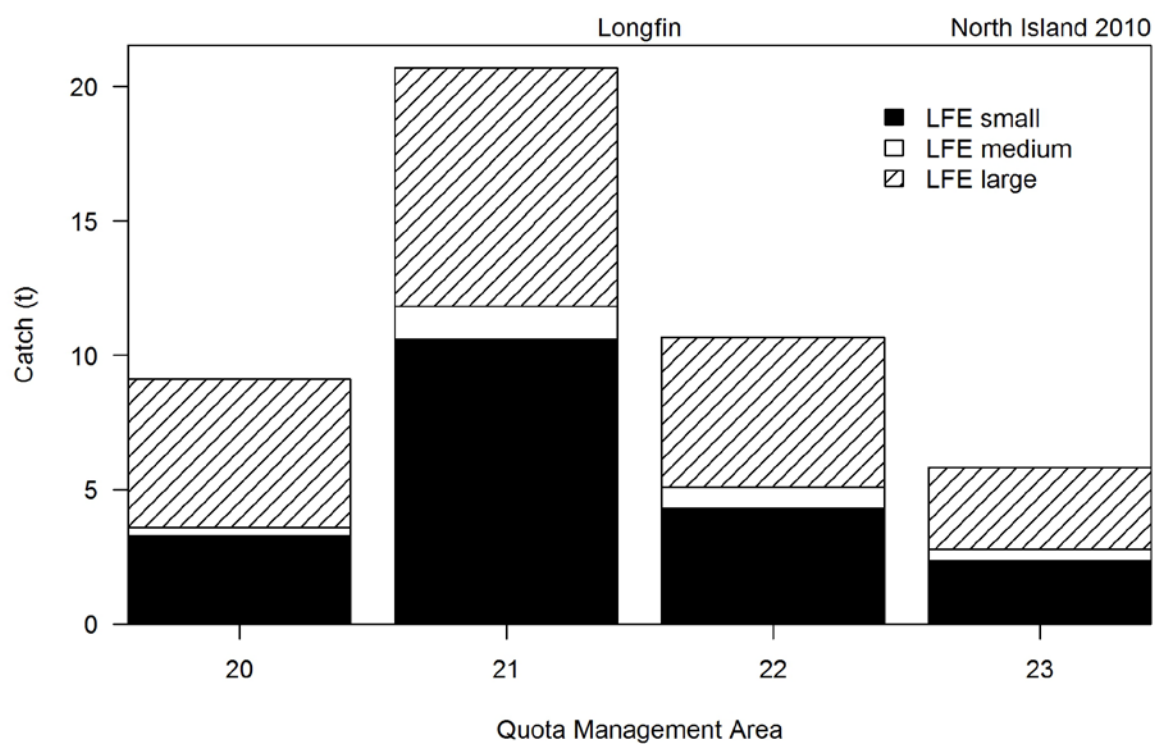


Figure 19: Catch of longfin (LFE) eels by size grade and North Island Quota Management Area for fishing years 2009–10 (2010), 2010–11 (2011) and 2011–12 (2012).

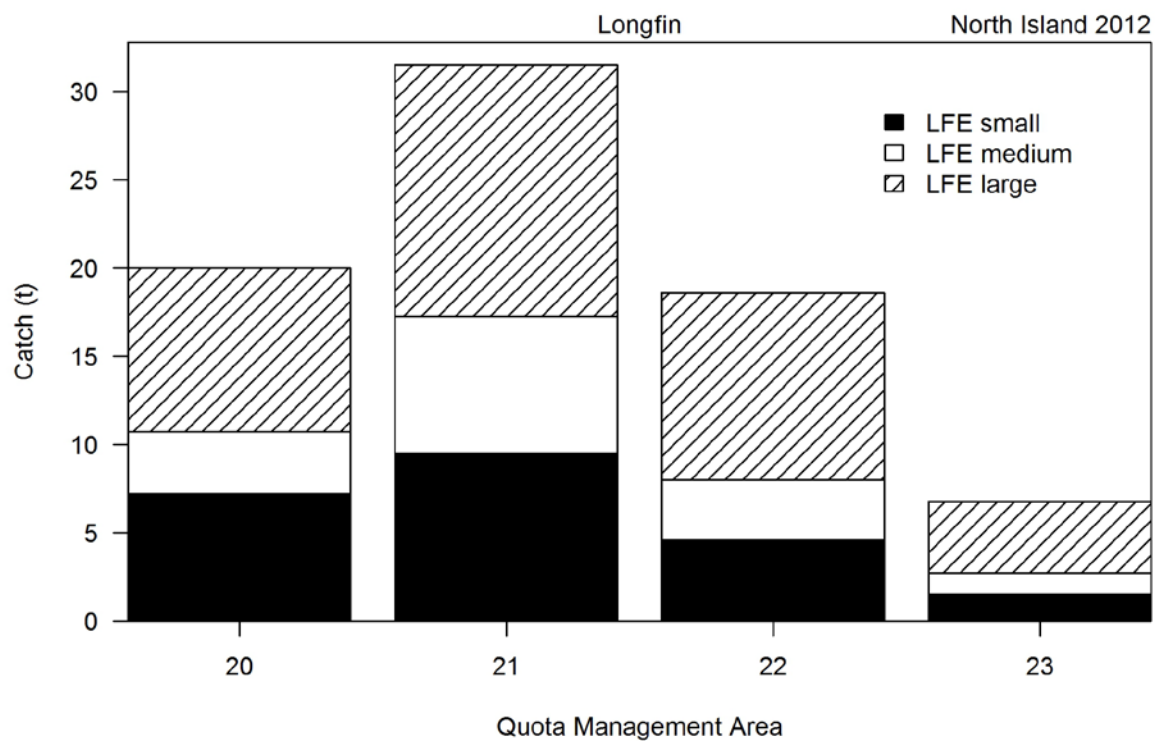
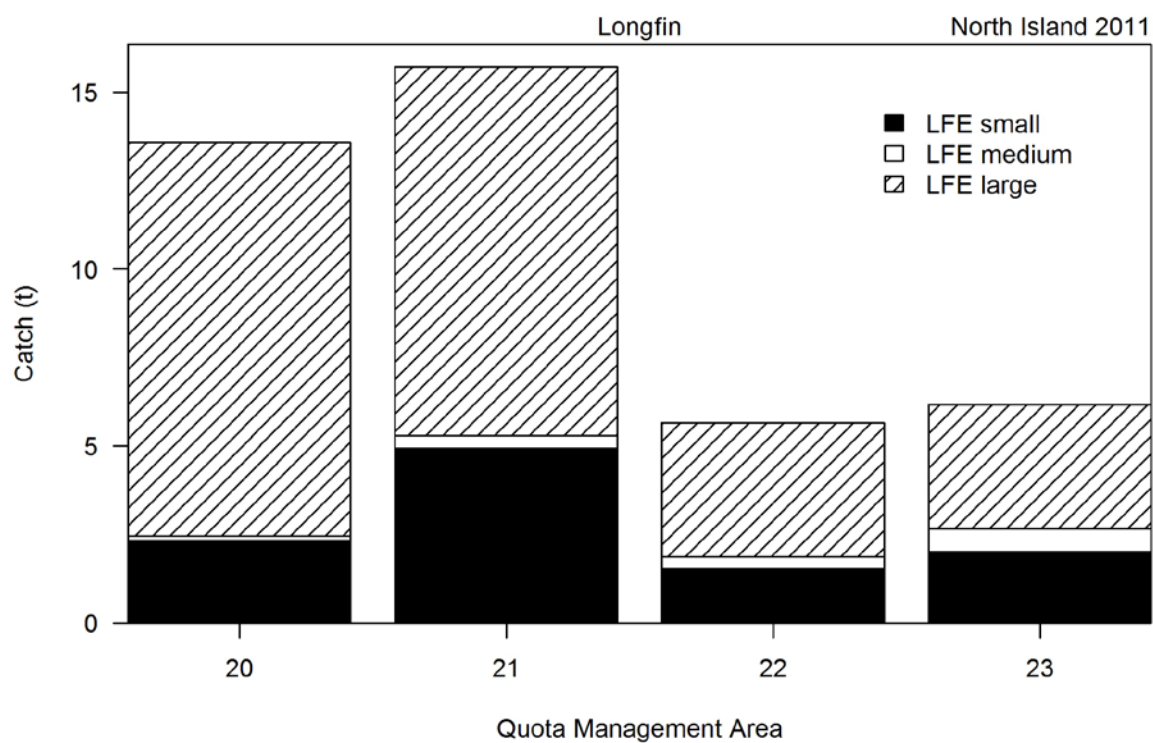


Figure 19 – continued

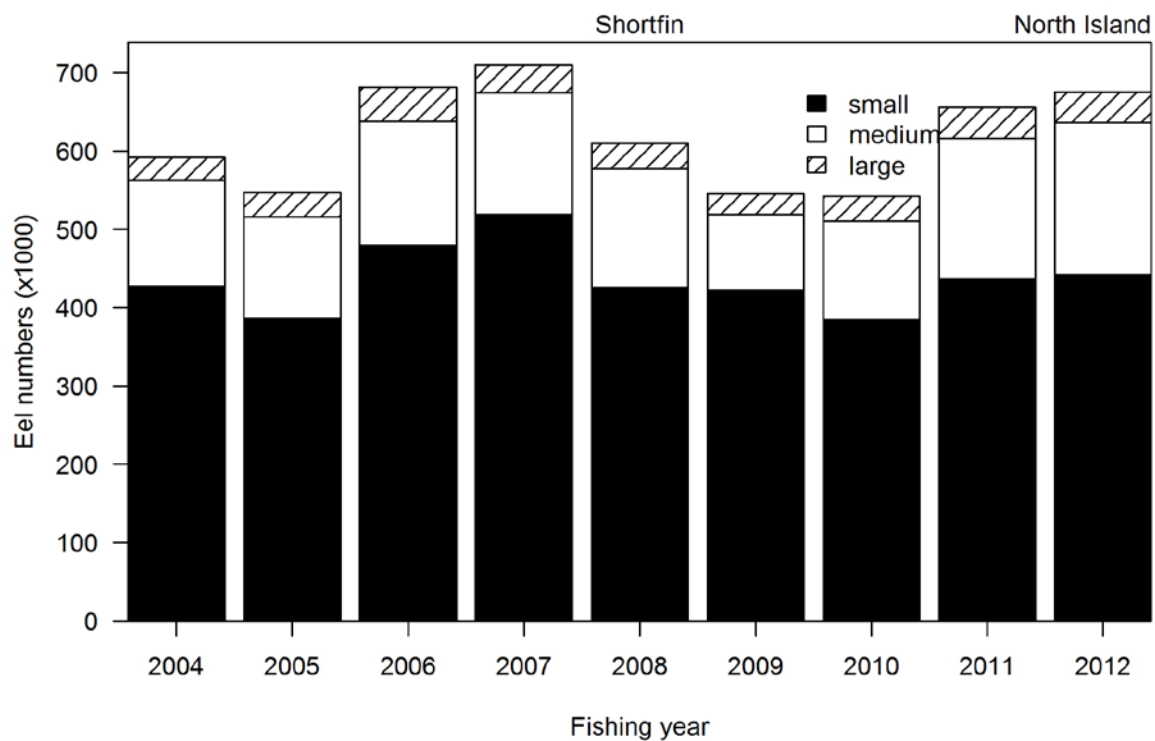
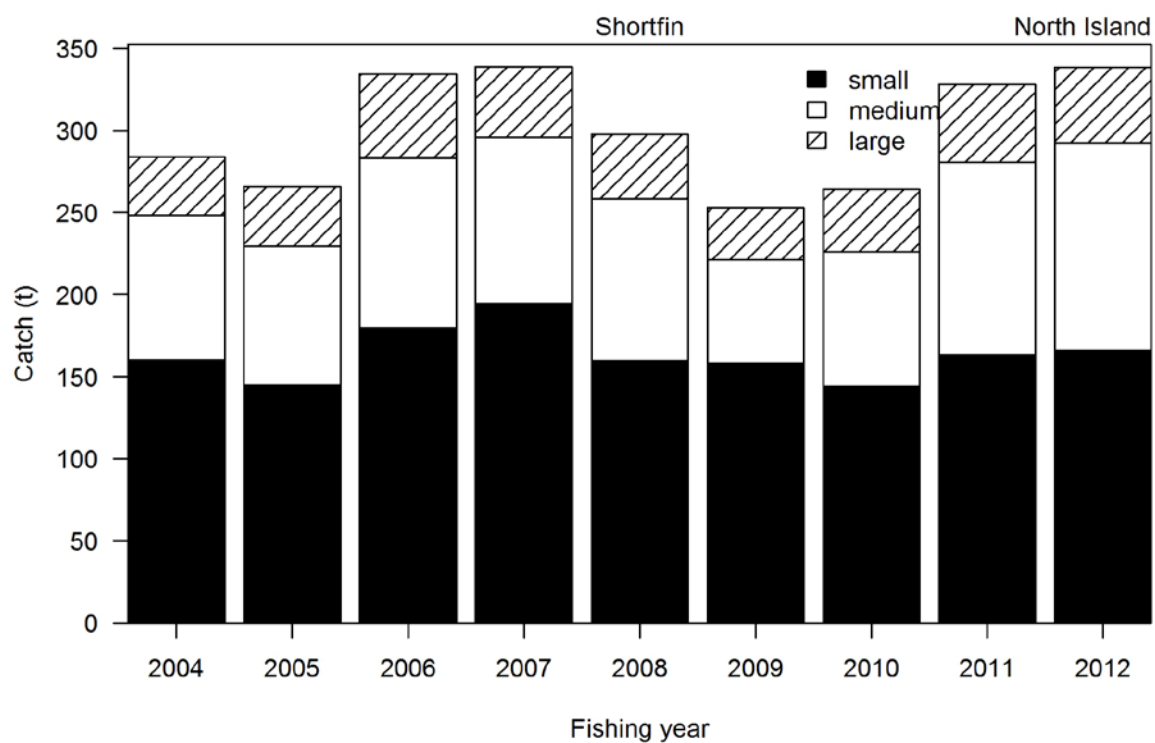


Figure 20: North Island shortfin eel catch by weight (t) and by estimated numbers for each size grade from 2003–04 to 2011–12.

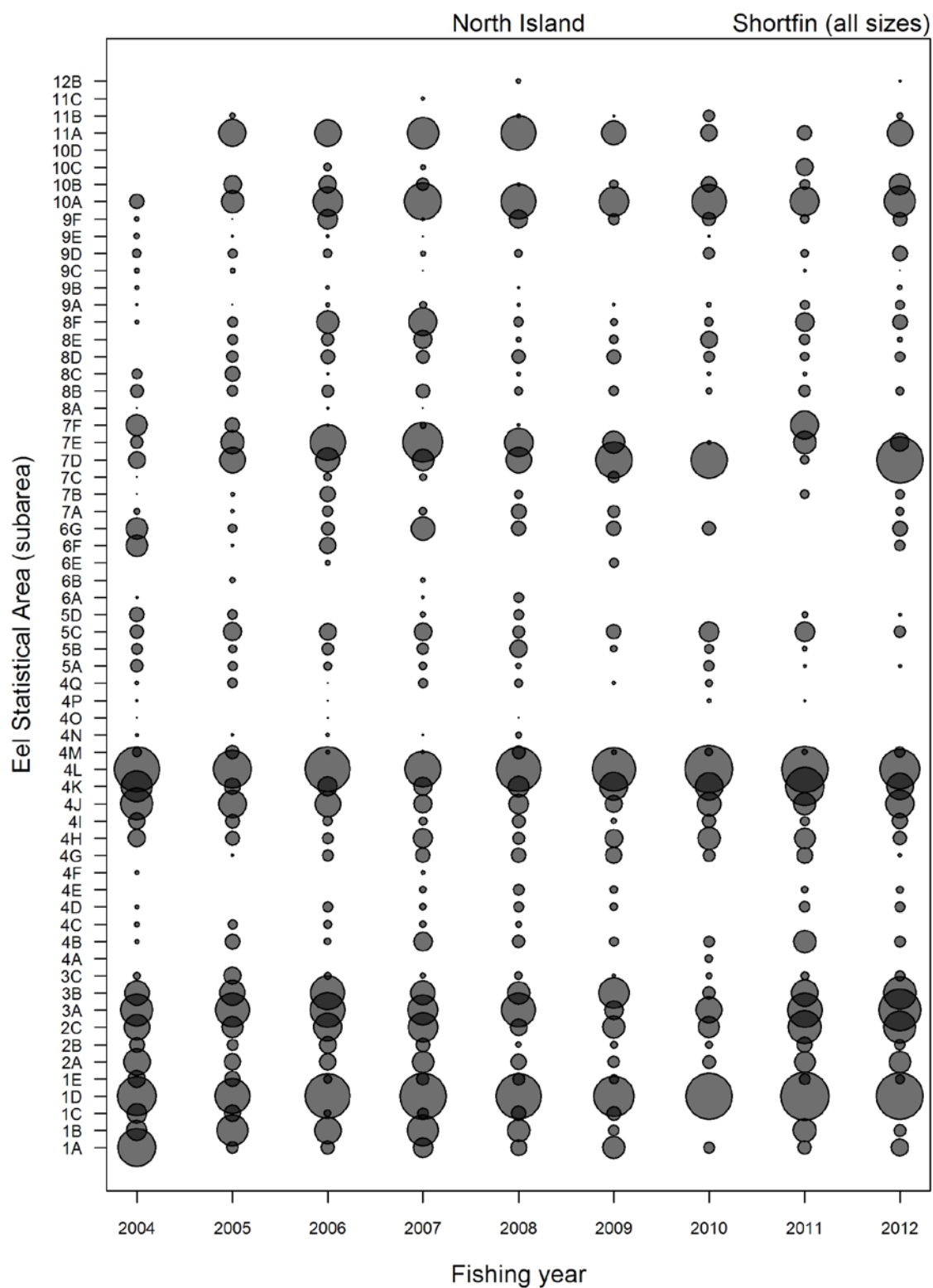


Figure 21: North Island shortfin catch by eel statistical area subarea from 2003–04 to 2011–12. Maximum = 45t.

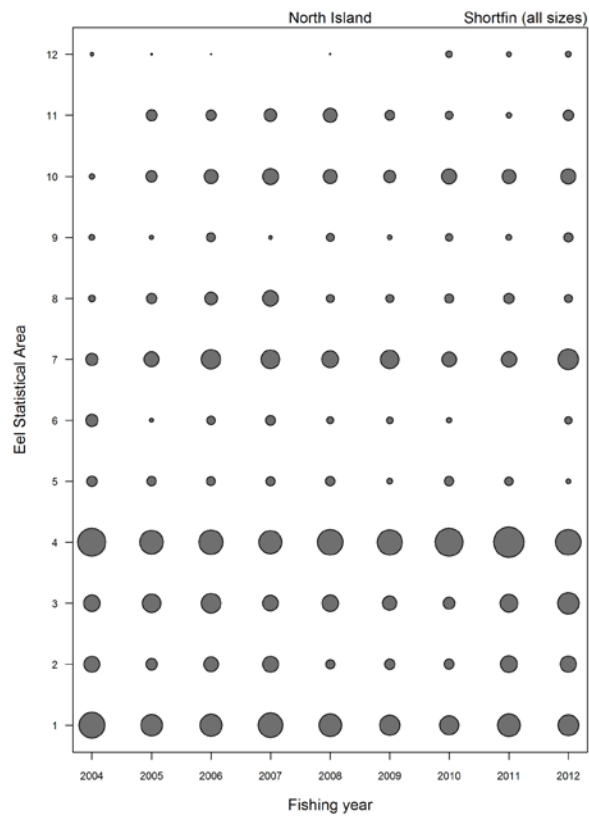


Figure 22: North Island shortfin catch by eel statistical area from 2003–04 to 2011–12. Maximum = 108 t.

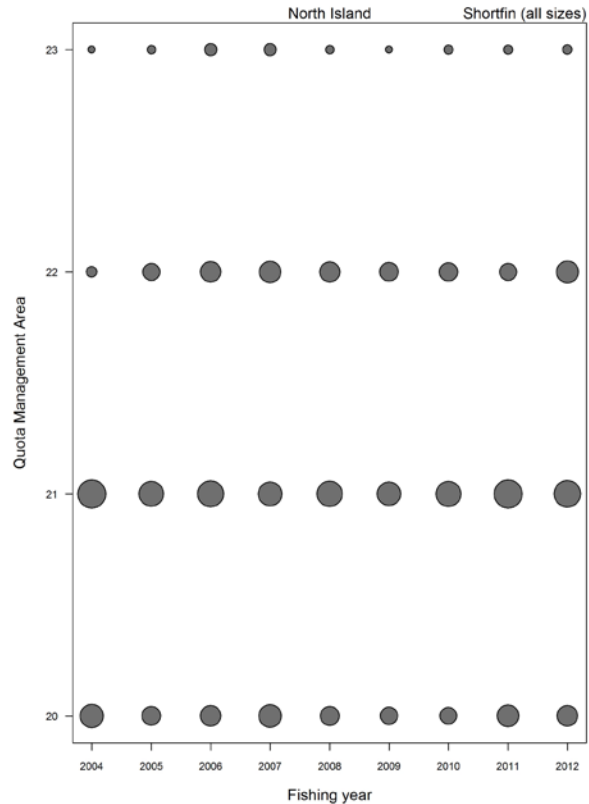


Figure 23: North Island shortfin catch by Quota Management Area from 2003–04 to 2011–12. Maximum = 156 t.

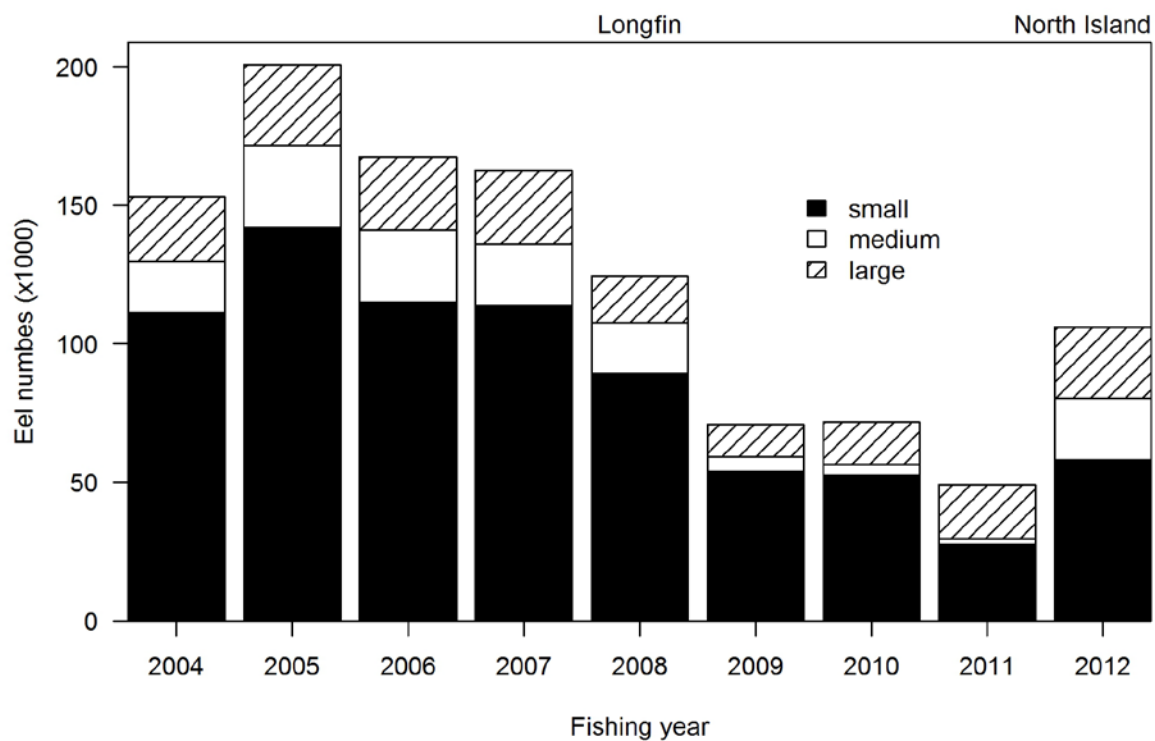
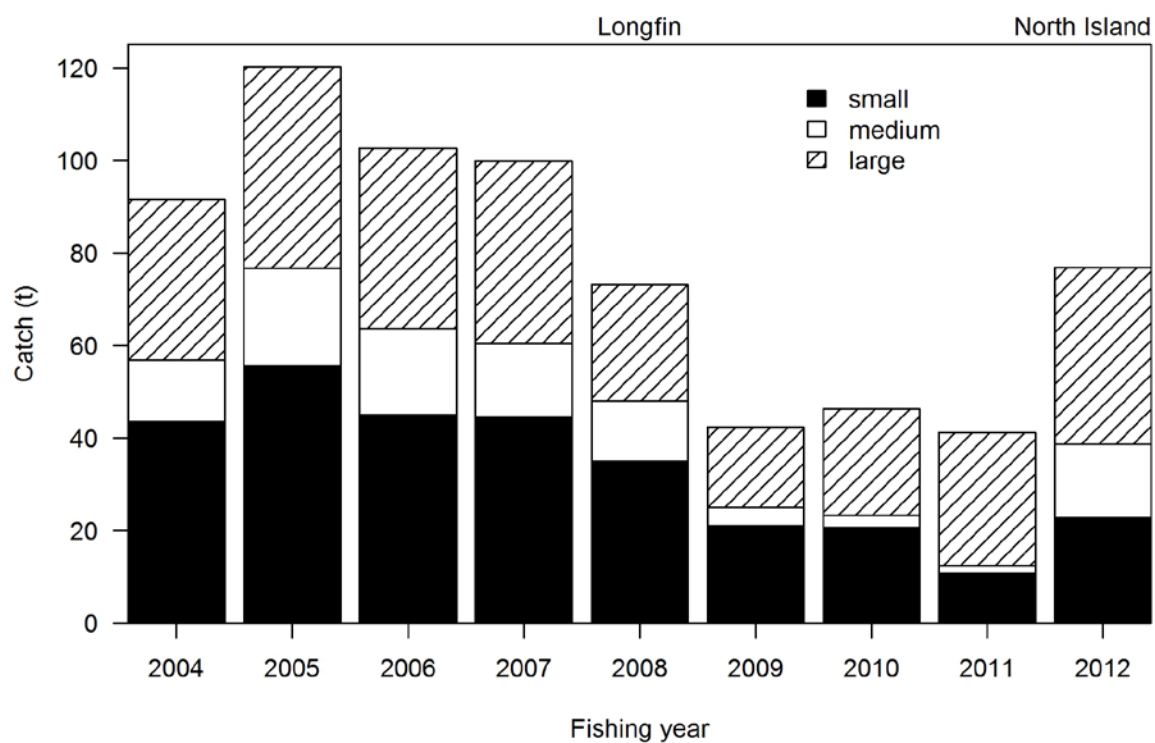


Figure 24: North Island longfin eel catch by weight (t) and estimated numbers for the three size grades from 2003–04 to 2011–12.

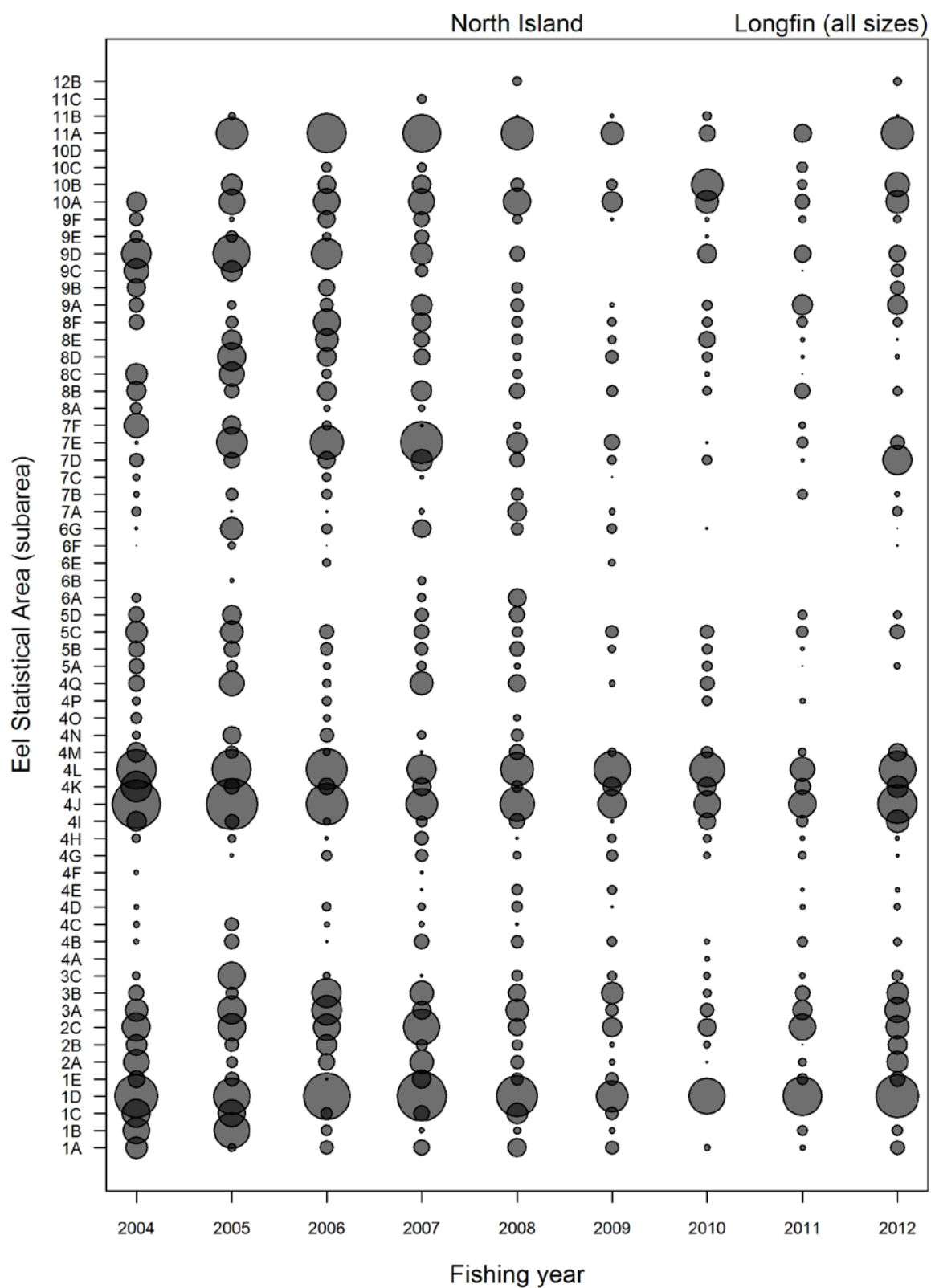


Figure 25: North Island longfin catch by eel statistical area subarea from 2003–04 to 2011–12.
Maximum = 14 t.

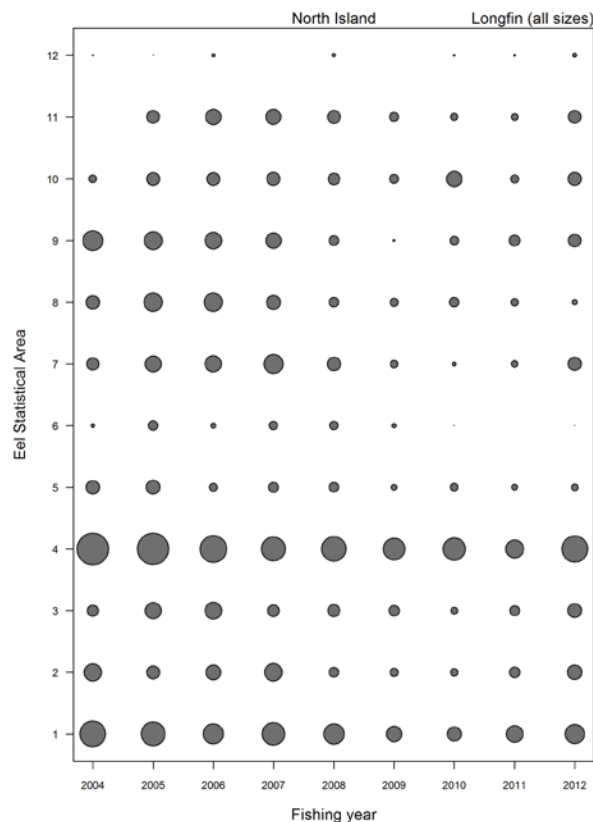


Figure 26: North Island longfin catch by eel statistical area from 2003–04 to 2011–12. Maximum = 34 t.

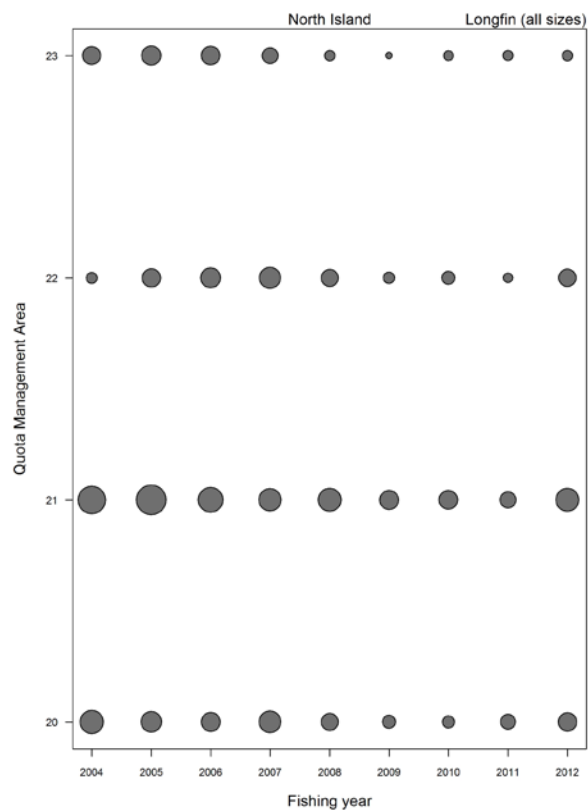


Figure 27: North Island longfin catch by Quota Management Area from 2003–04 to 2011–12. Maximum = 52 t.

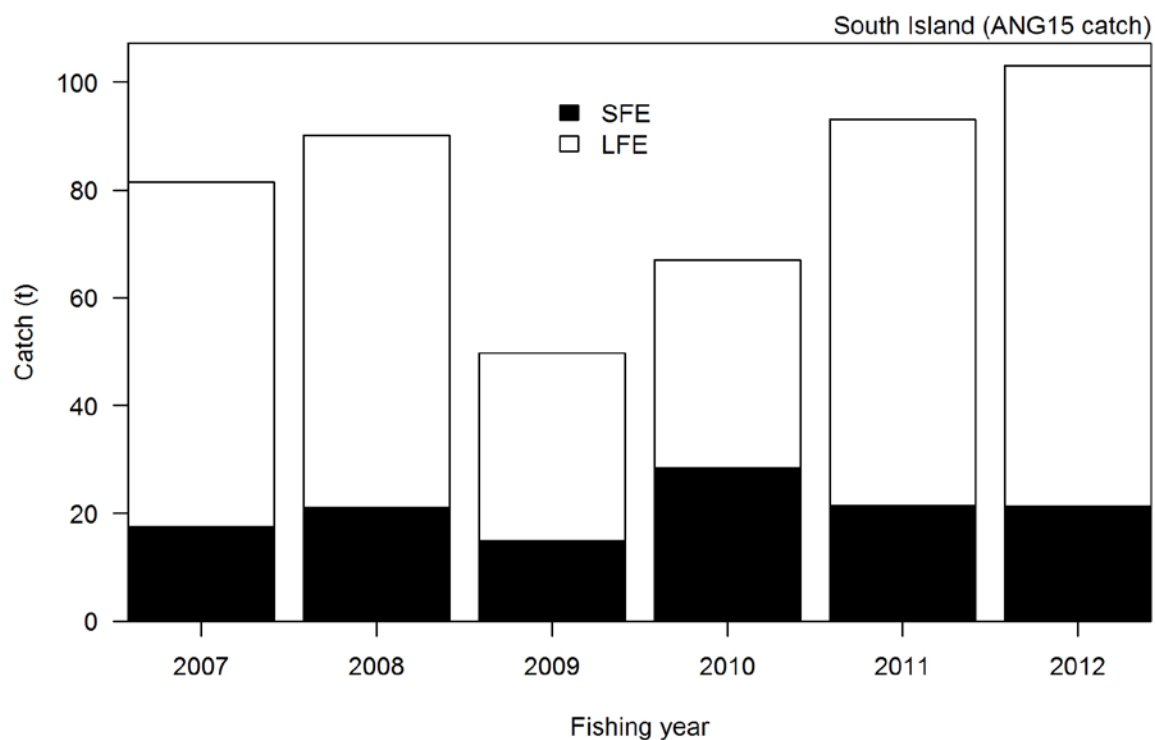


Figure 28: ANG 15 total commercial catch (t) of shortfin (SFE), longfin (LFE) for the years 2006–07 to 2011–12.

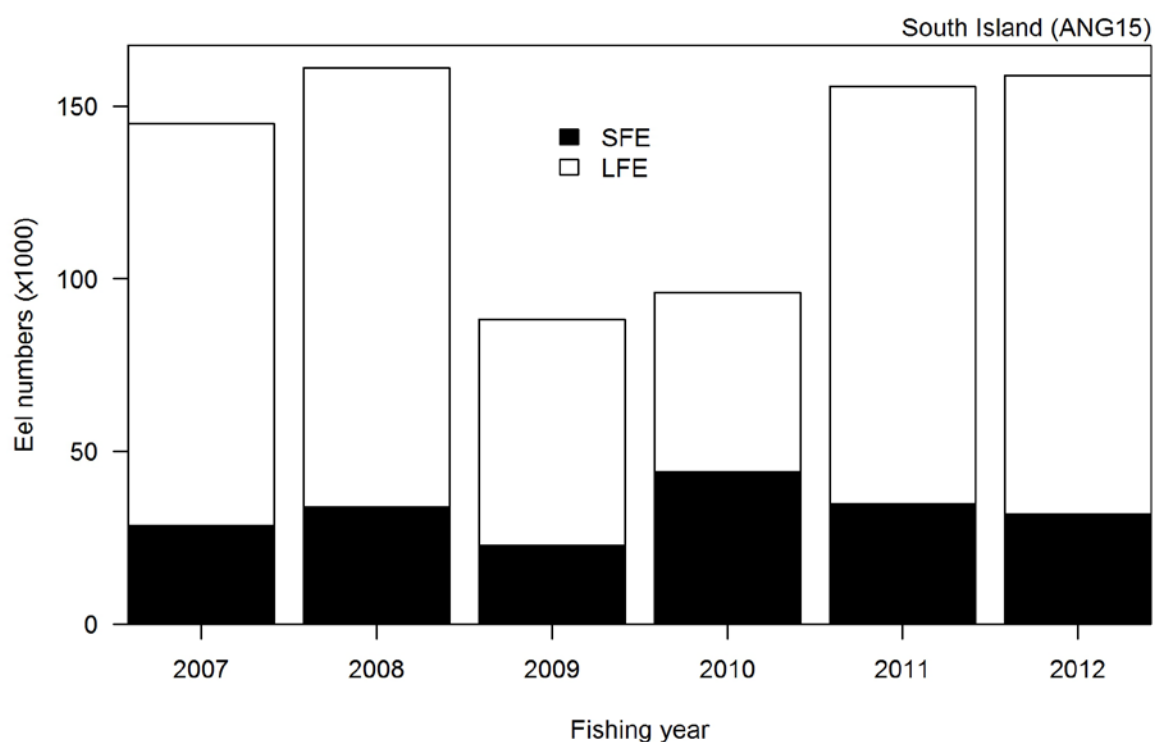


Figure 29: ANG 15 total commercial catch of shortfin (SFE), longfin (LFE) by estimated eel numbers for the years 2006–07 to 2011–12.

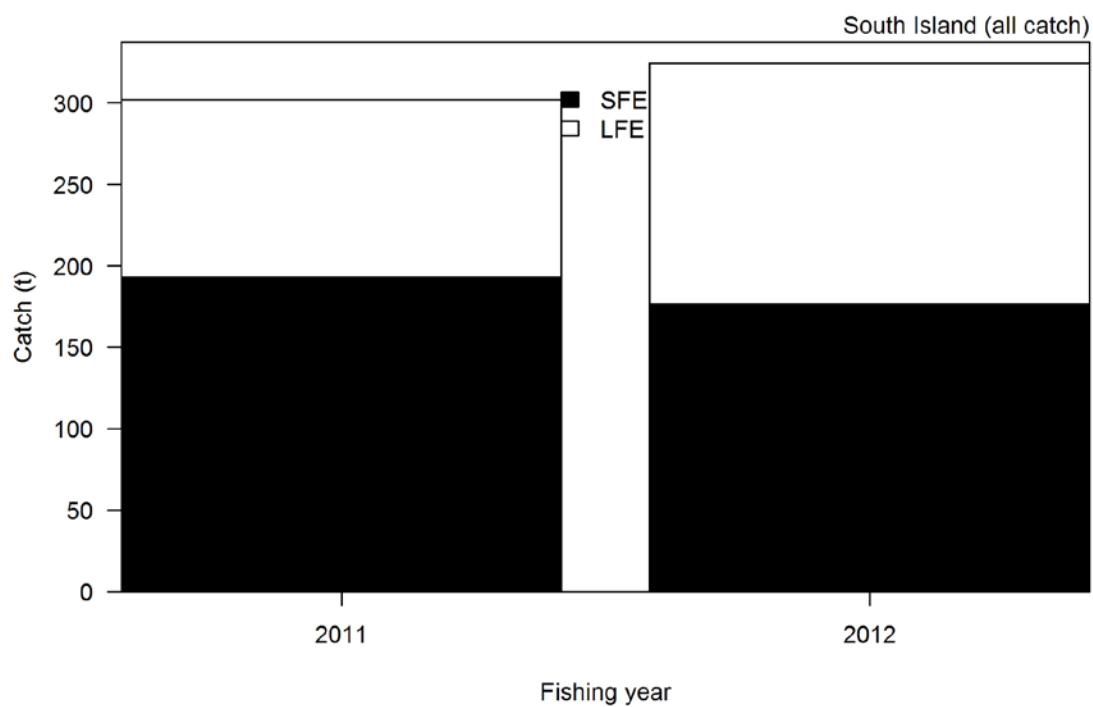


Figure 30: South Island commercial catch (t) of shortfin (SFE) and longfin (LFE) eels for the years 2010–11 and 2011–12.

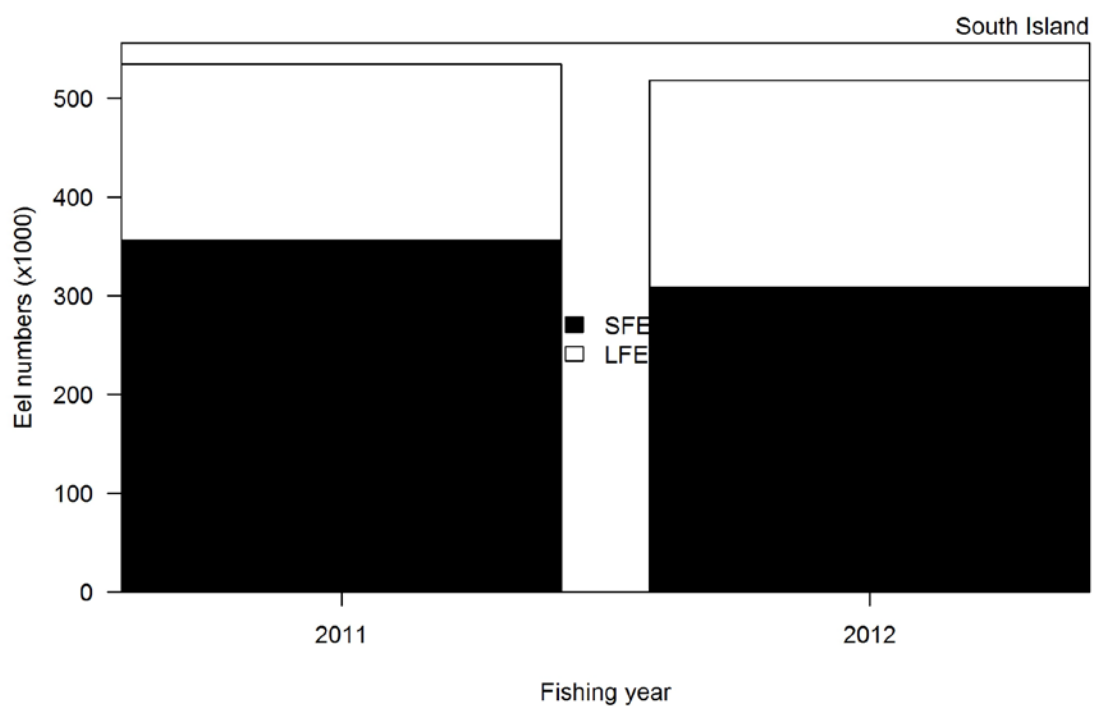


Figure 31: South Island commercial catch of shortfin (SFE) and longfin (LFE) eels by estimated numbers for the years 2010–11 and 2011–12.

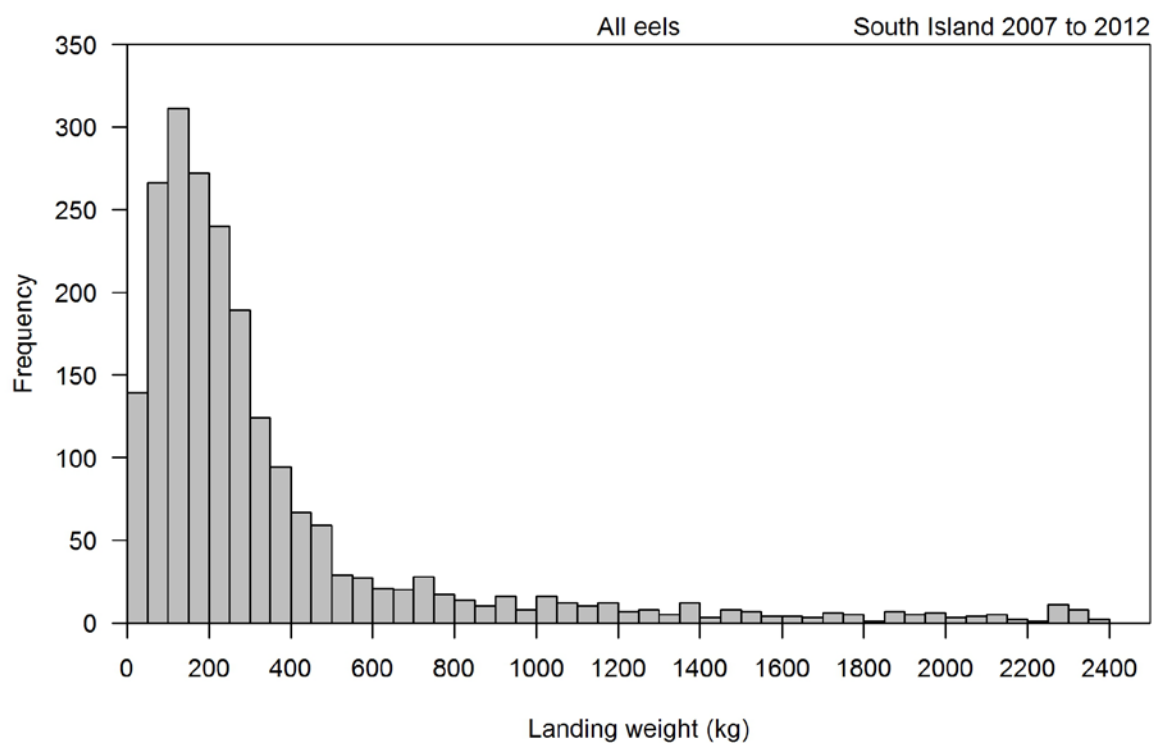


Figure 32: Distribution of individual eel landing weights in the South Island for 2006–07 to 2011–12. Landings include both shortfin and longfin eels, and the period 2006–07 to 2009–10 is for ANG 15 only.

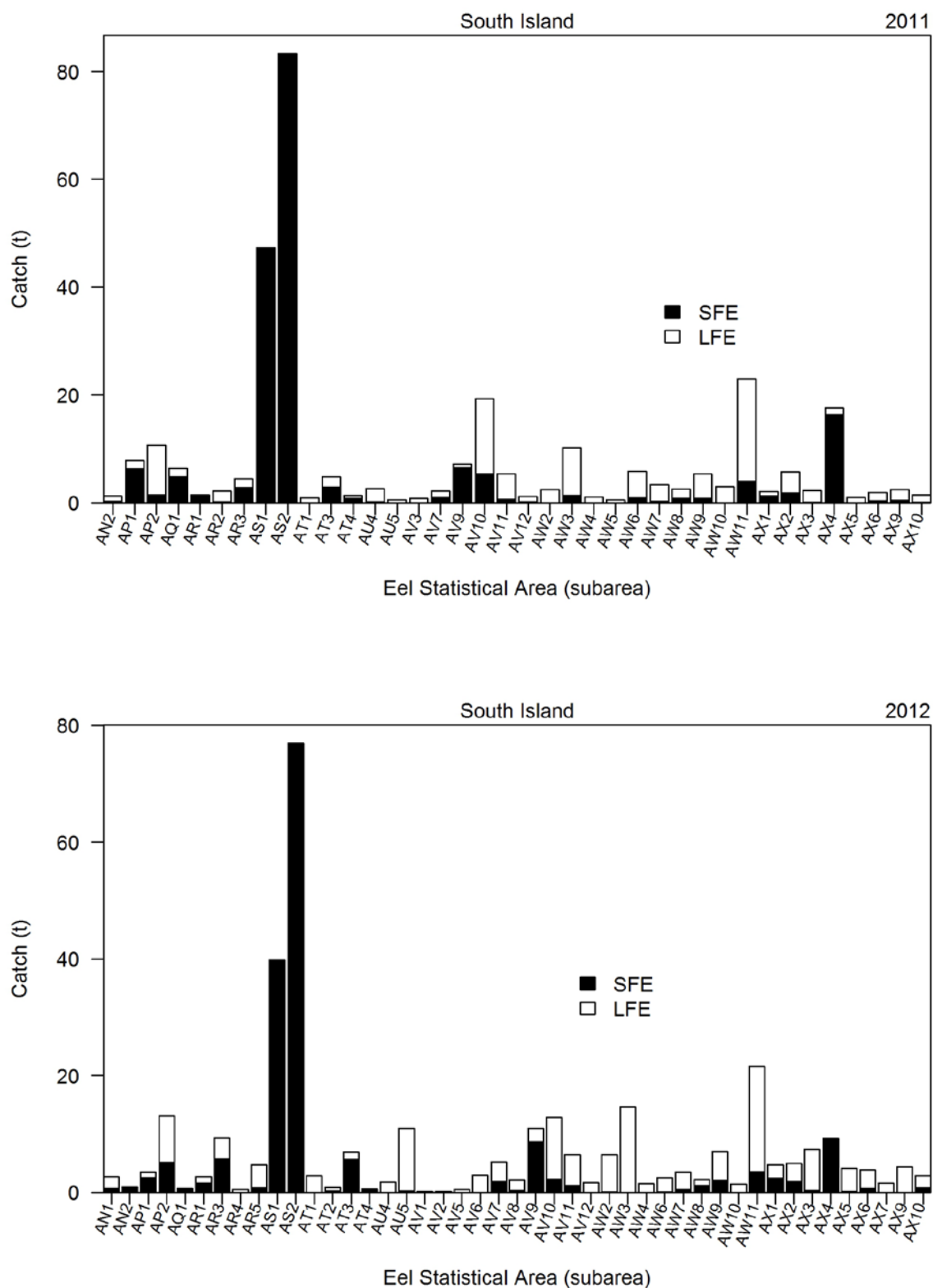


Figure 33: Catch of South Island shortfin (SFE) and longfin (LFE) eels by eel statistical area subarea for 2010–11 (2011) and 2011–12 (2012).

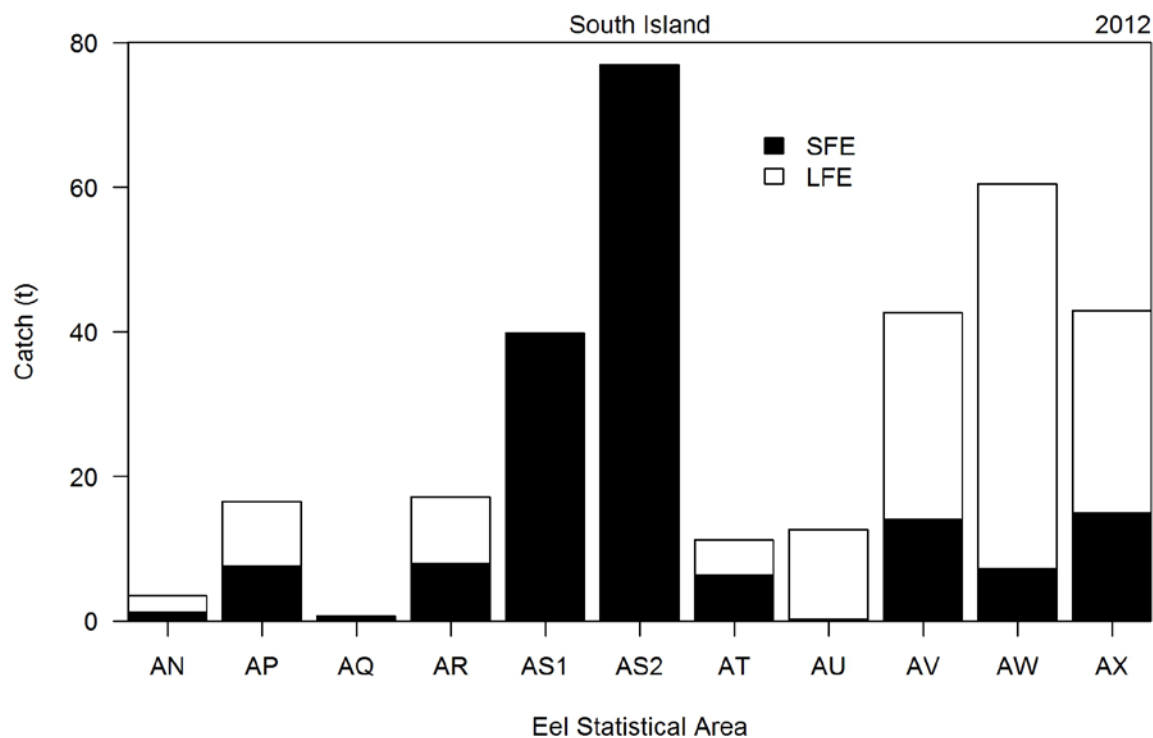
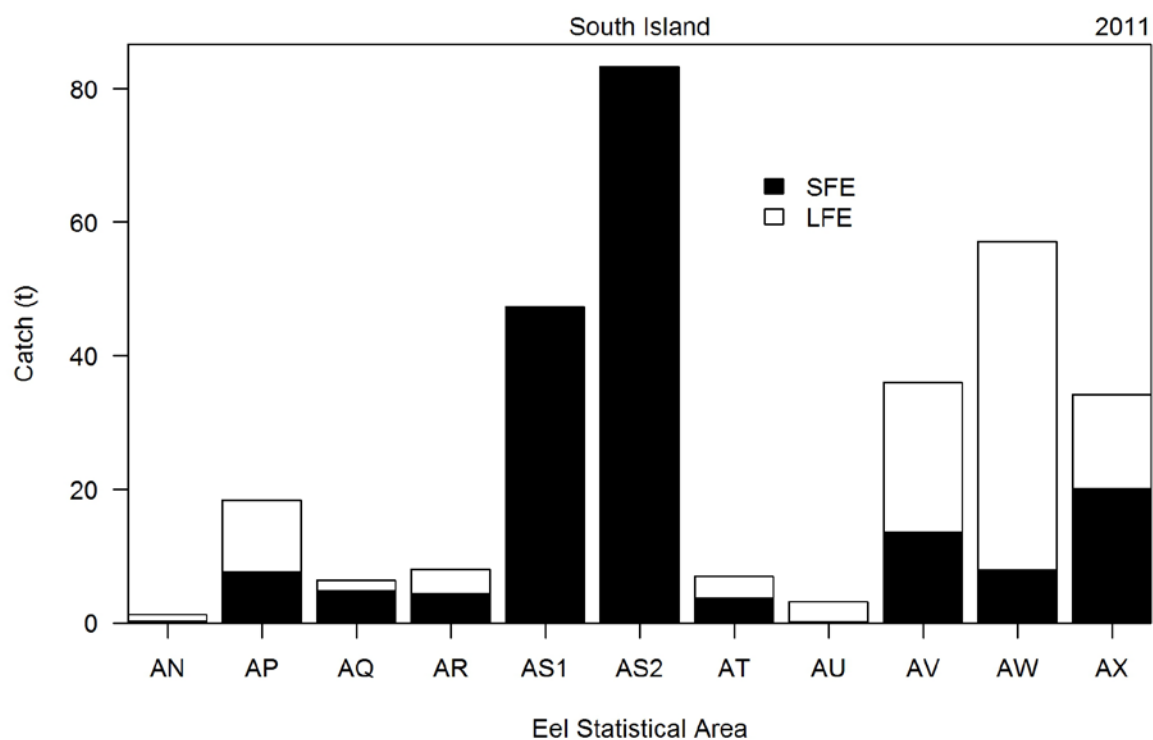


Figure 34: Catch of South Island shortfin (SFE) and longfin (LFE) eels by eel statistical area for 2010–11 (2011) and 2011–12 (2012).

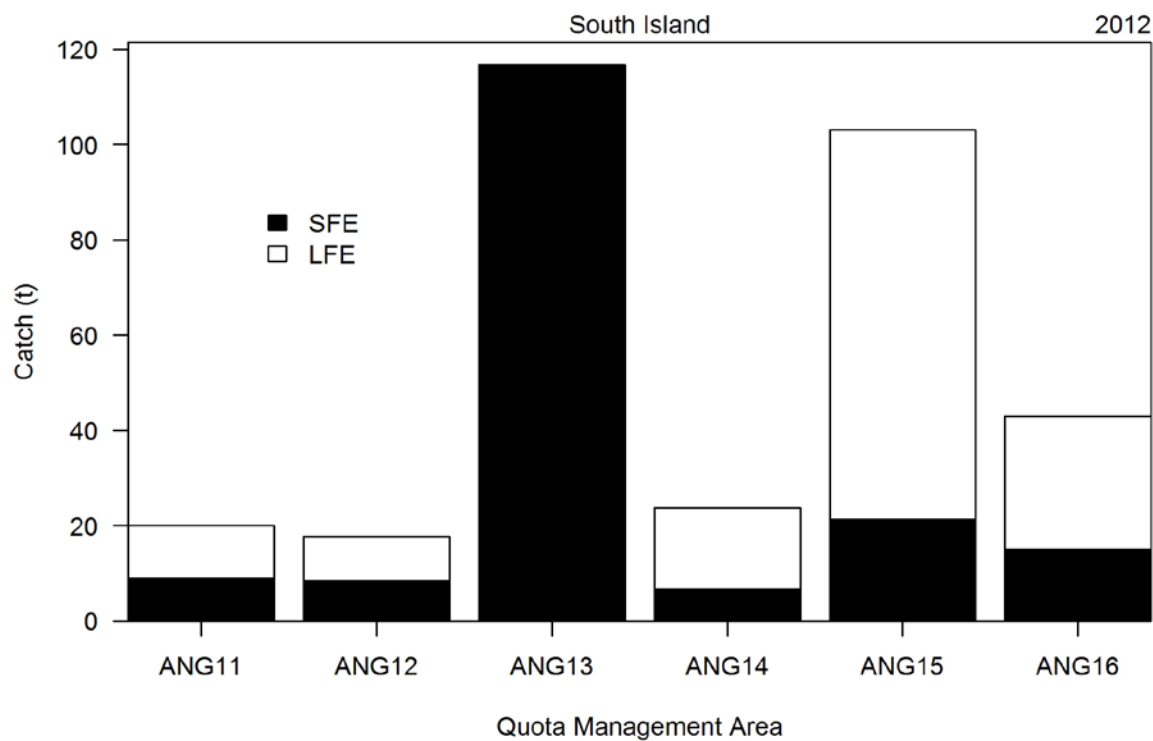
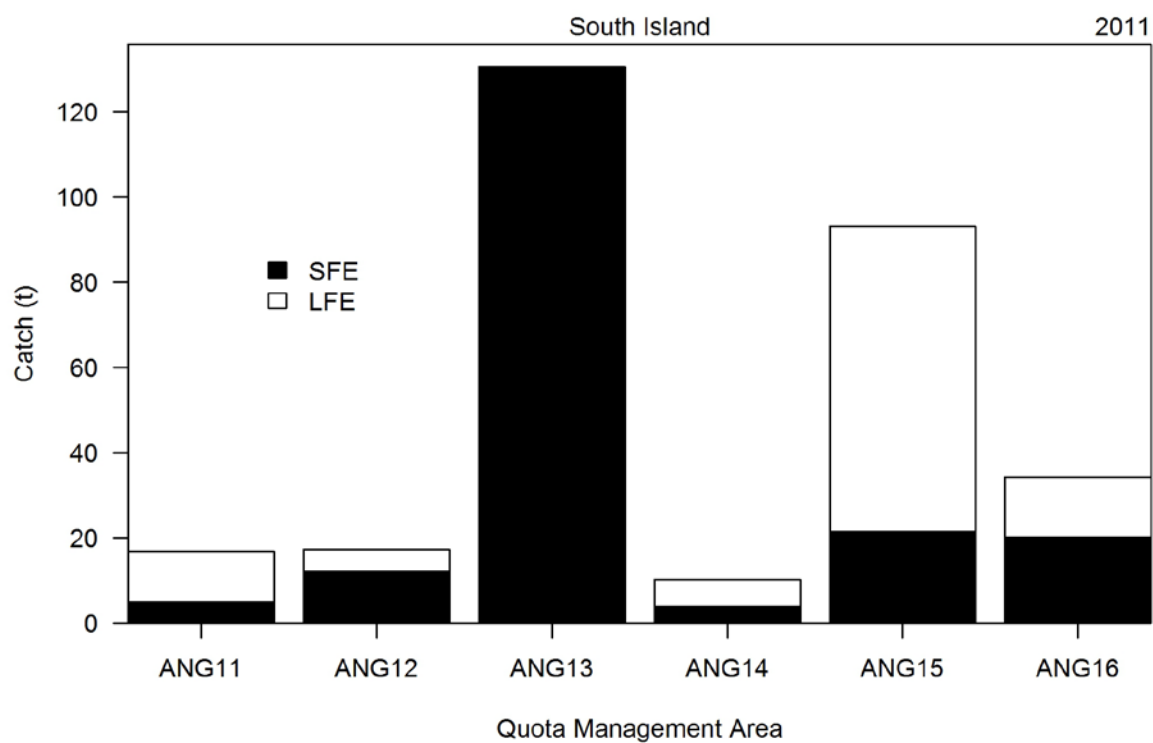


Figure 35: Catch of South Island shortfin (SFE) and longfin (LFE) eels by Quota Management Area for 2010–11 (2011) and 2011–12 (2012).

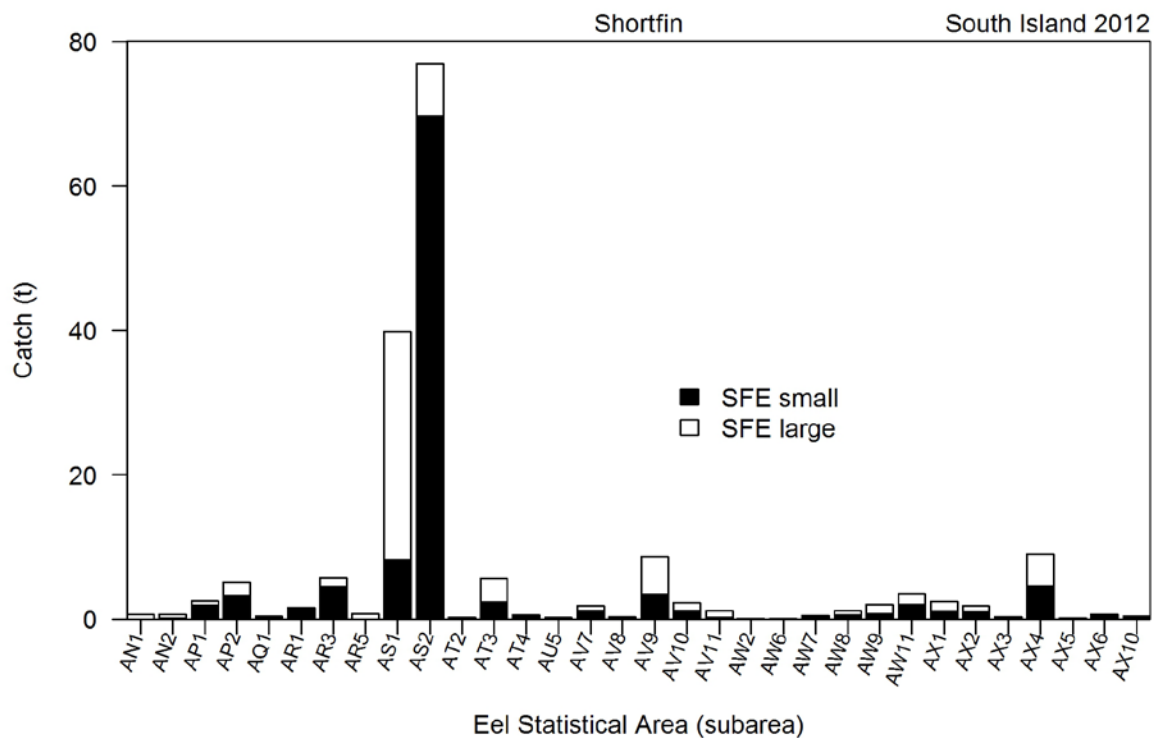
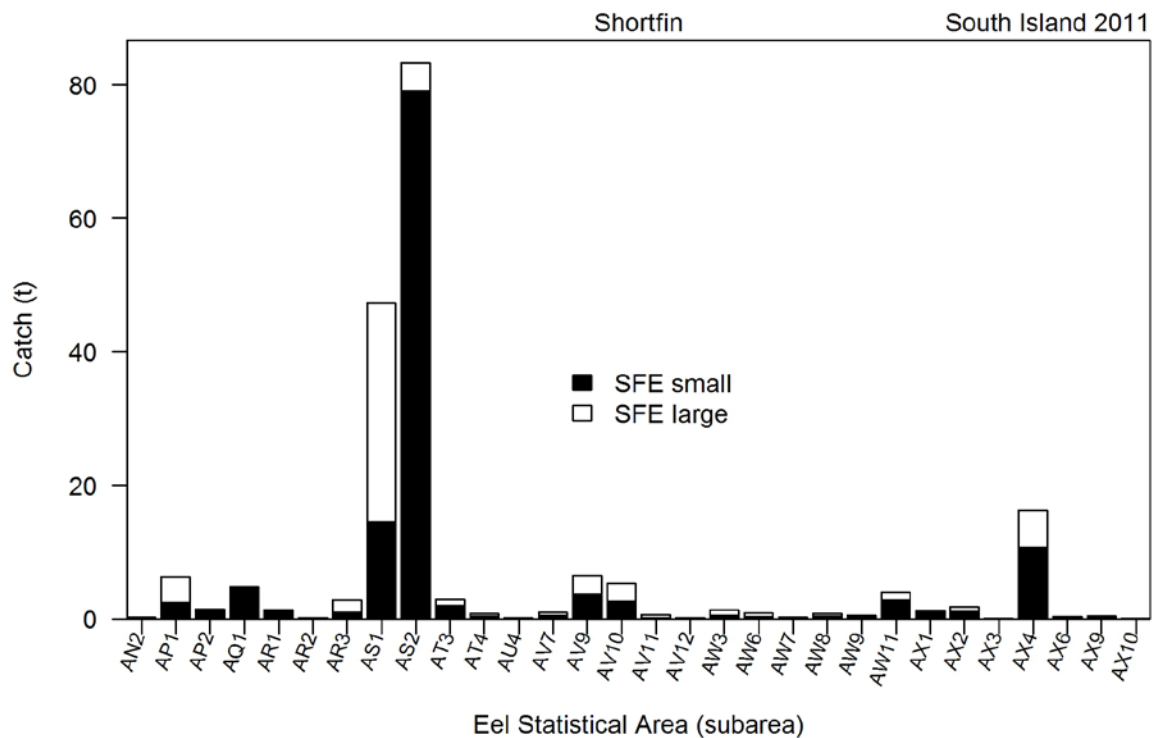


Figure 36: Catch of South Island shortfin (SFE) eels by size grade and by eel statistical area subarea for fishing years 2010–11 (2011) and 2011–12 (2012).

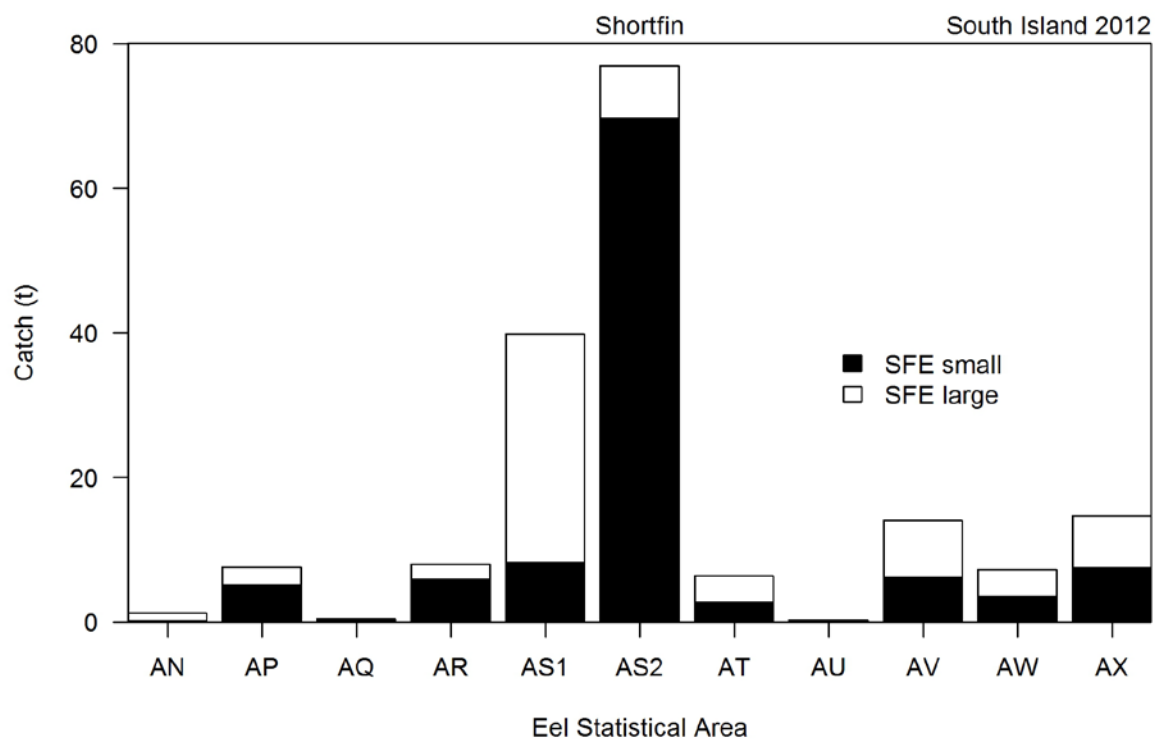
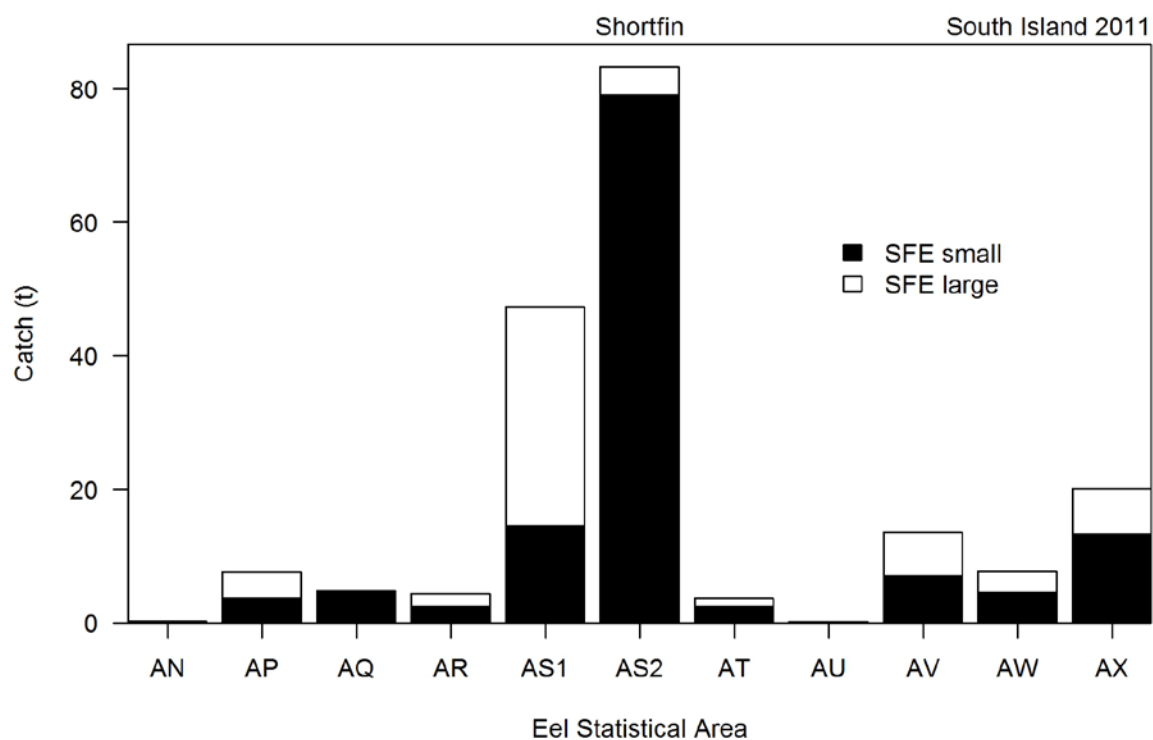


Figure 37: Catch of South Island shortfin (SFE) eels by size grade and eel statistical area for fishing years 2010–11 (2011) and 2011–12 (2012).

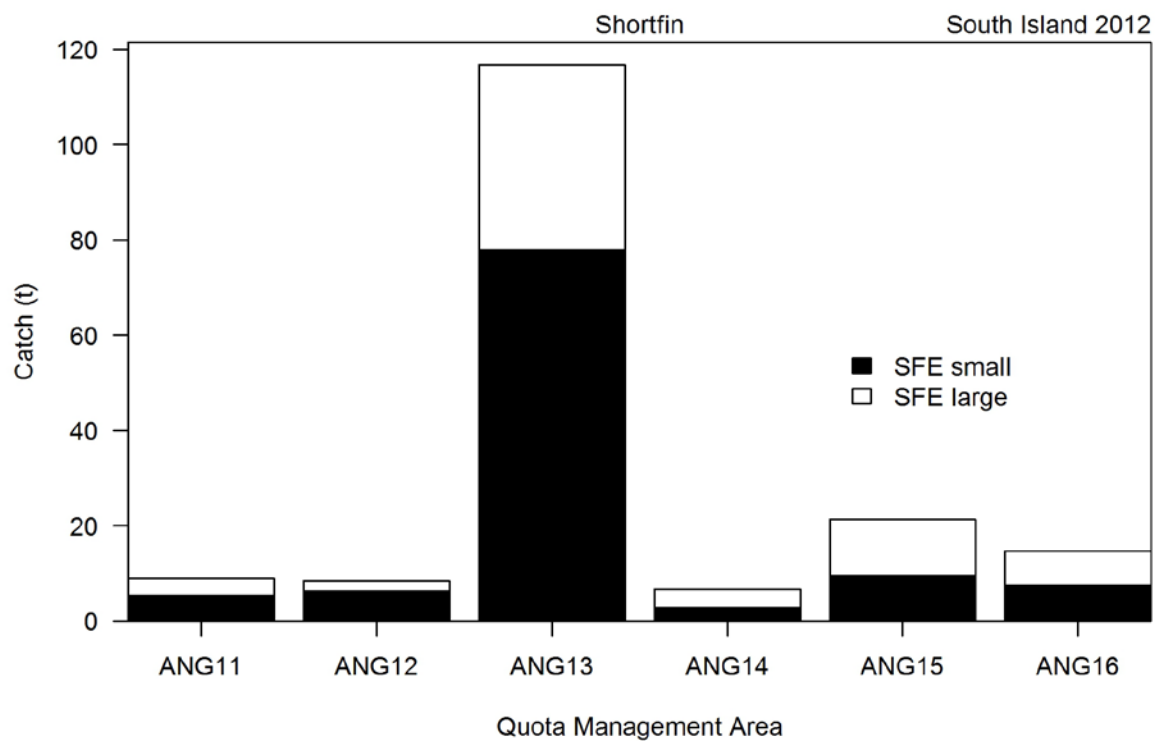
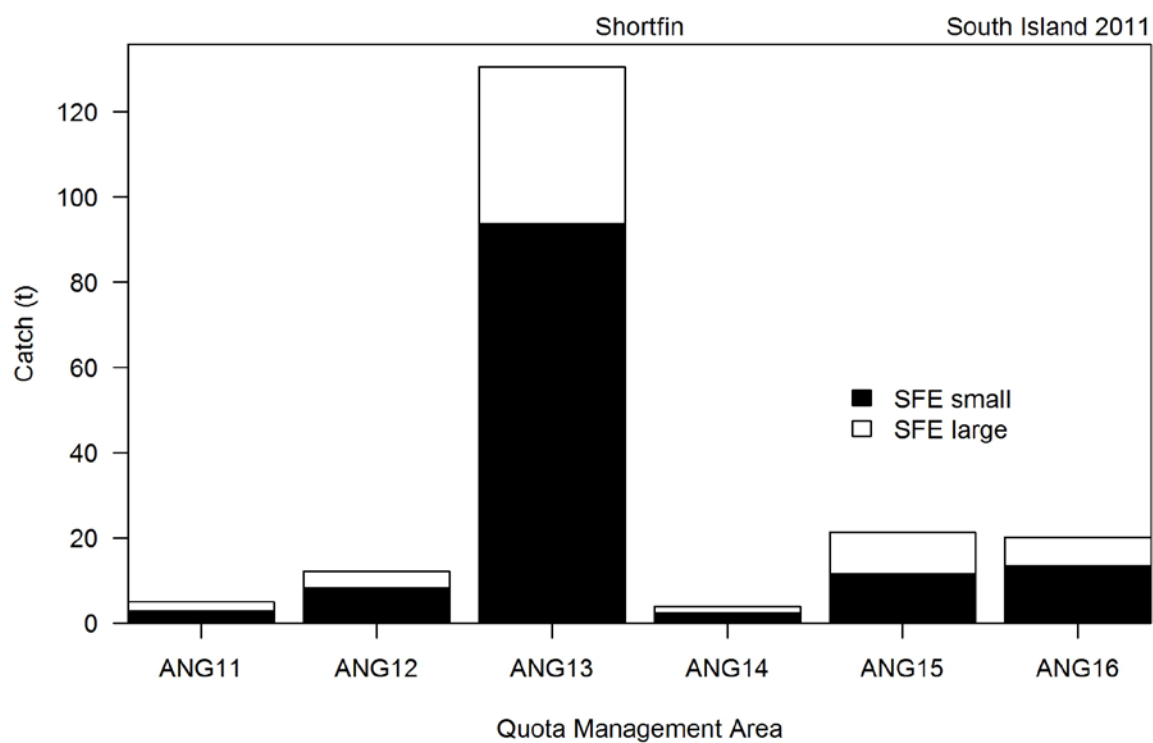


Figure 38: Catch of South Island shortfin (SFE) eels by size grade and Quota Management Area for fishing years 2010–11 (2011) and 2011–12 (2012).

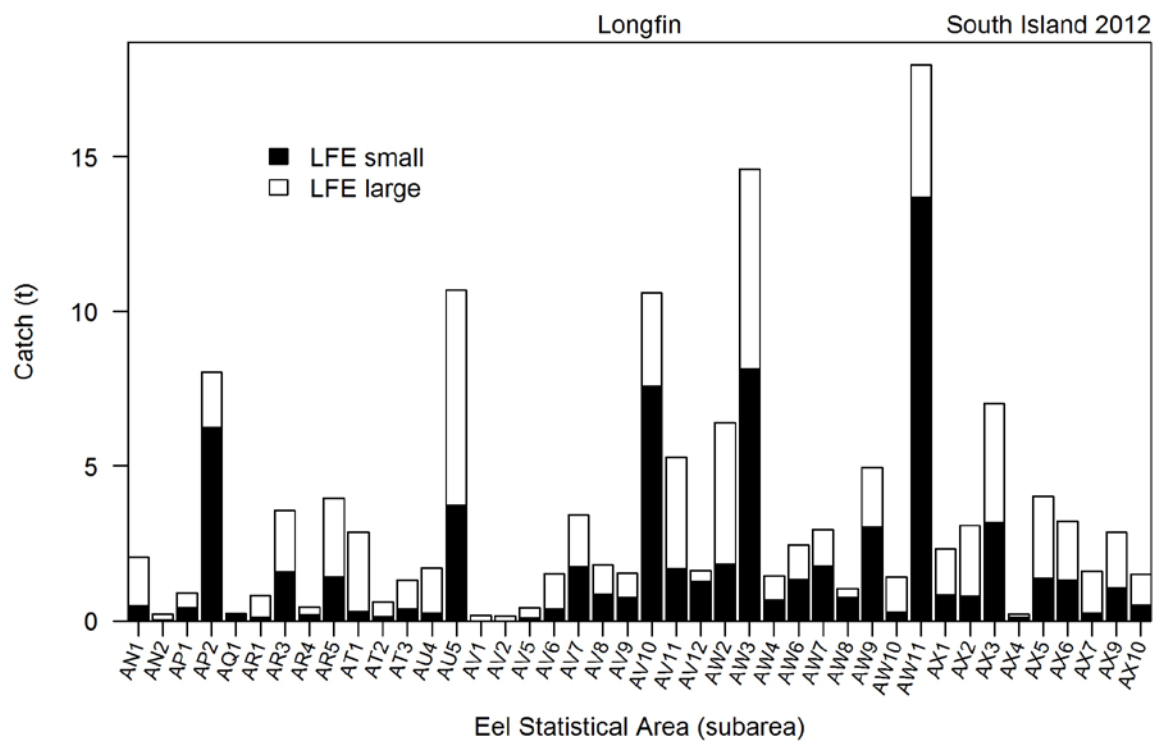
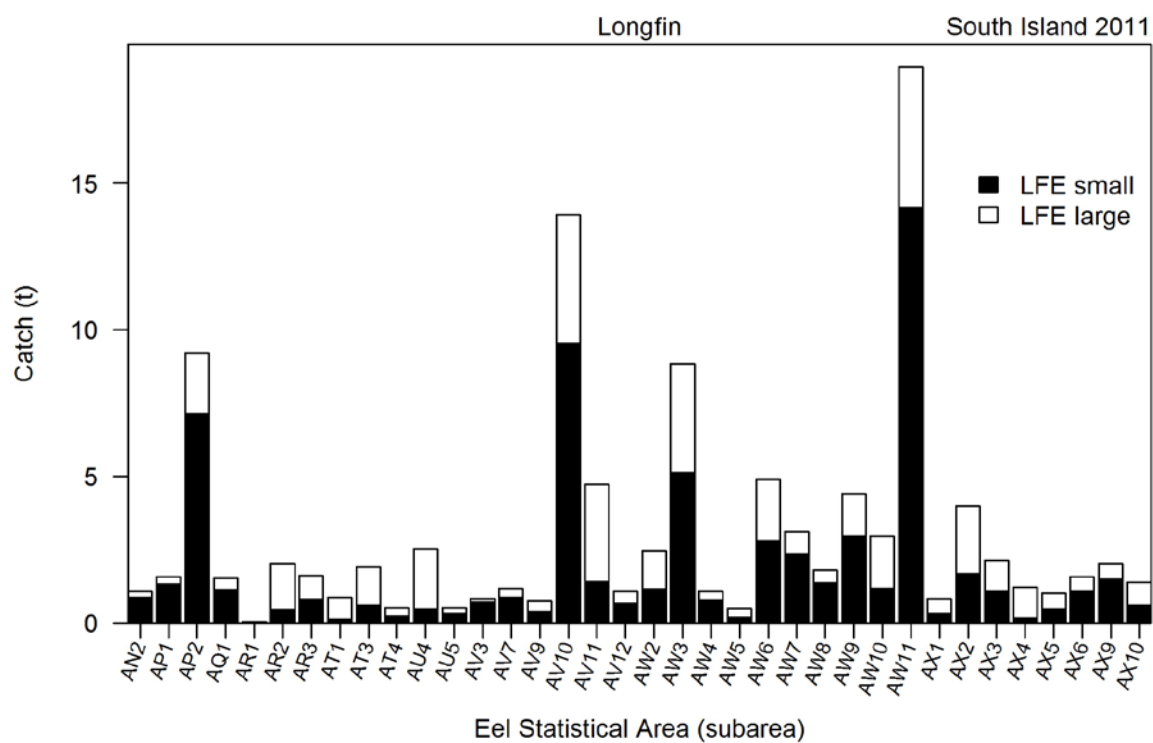


Figure 39: Catch of South Island longfin (LFE) eels by size grade and eel statistical area subarea for fishing years 2010–11 (2011) and 2011–12 (2012).

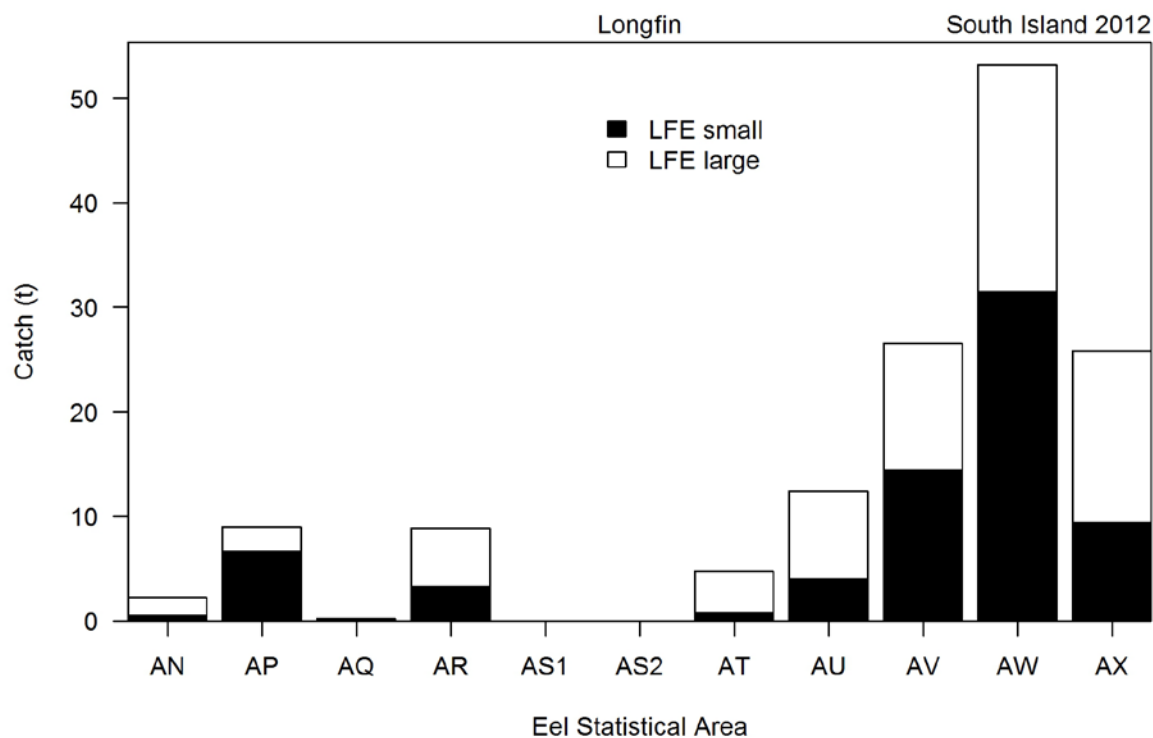
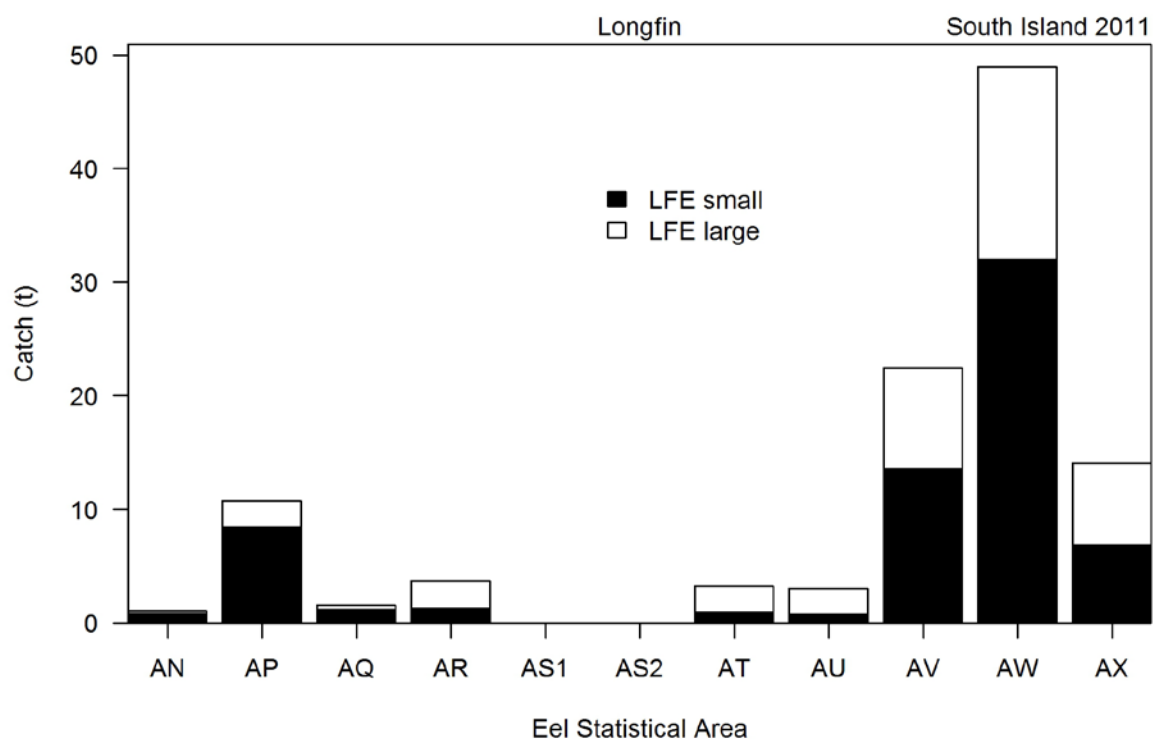


Figure 40: Catch of South Island longfin (LFE) eels by size grade and eel statistical area for fishing years 2010–11 (2011) and 2011–12 (2012).

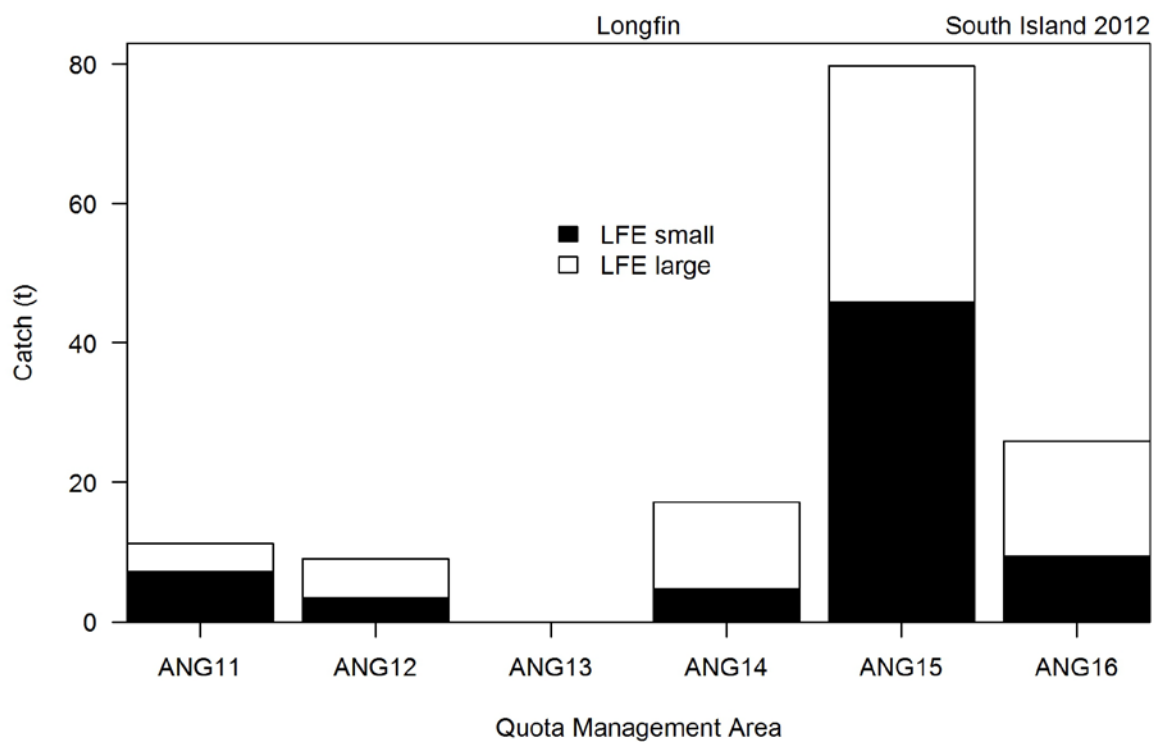
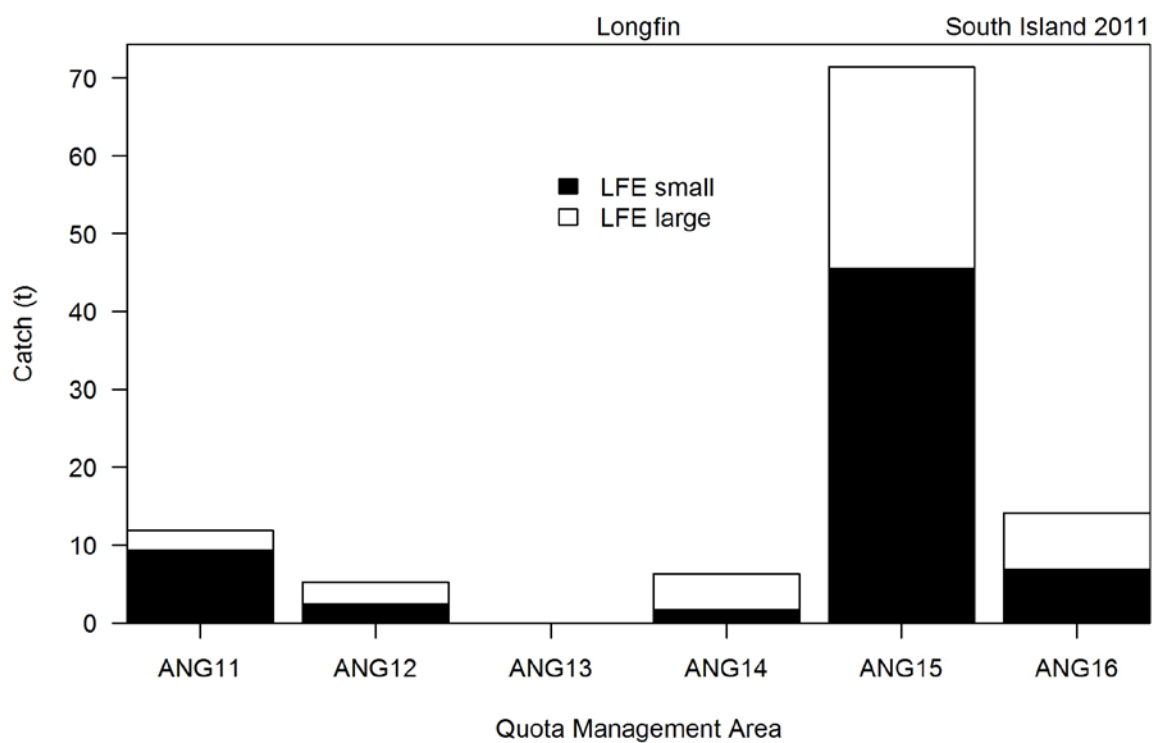


Figure 41: Catch of South Island longfin (LFE) eels by size grade and Quota Management Area for fishing years 2010–11 (2011) and 2011–12 (2012).

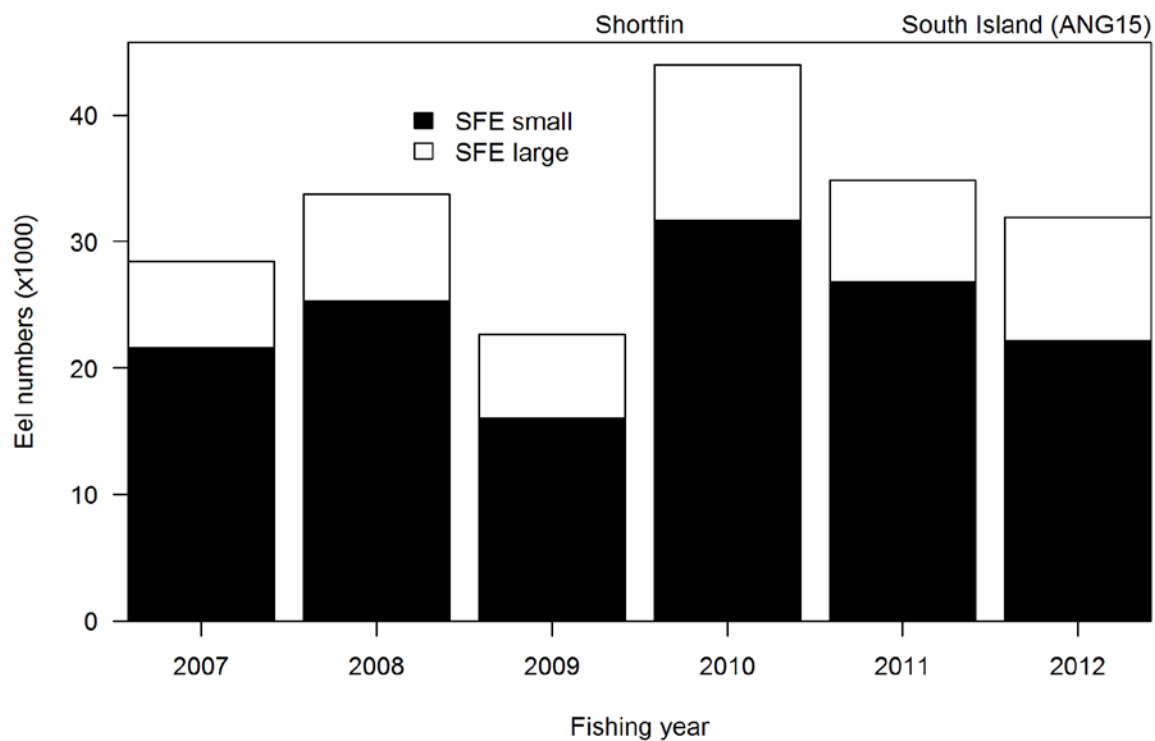
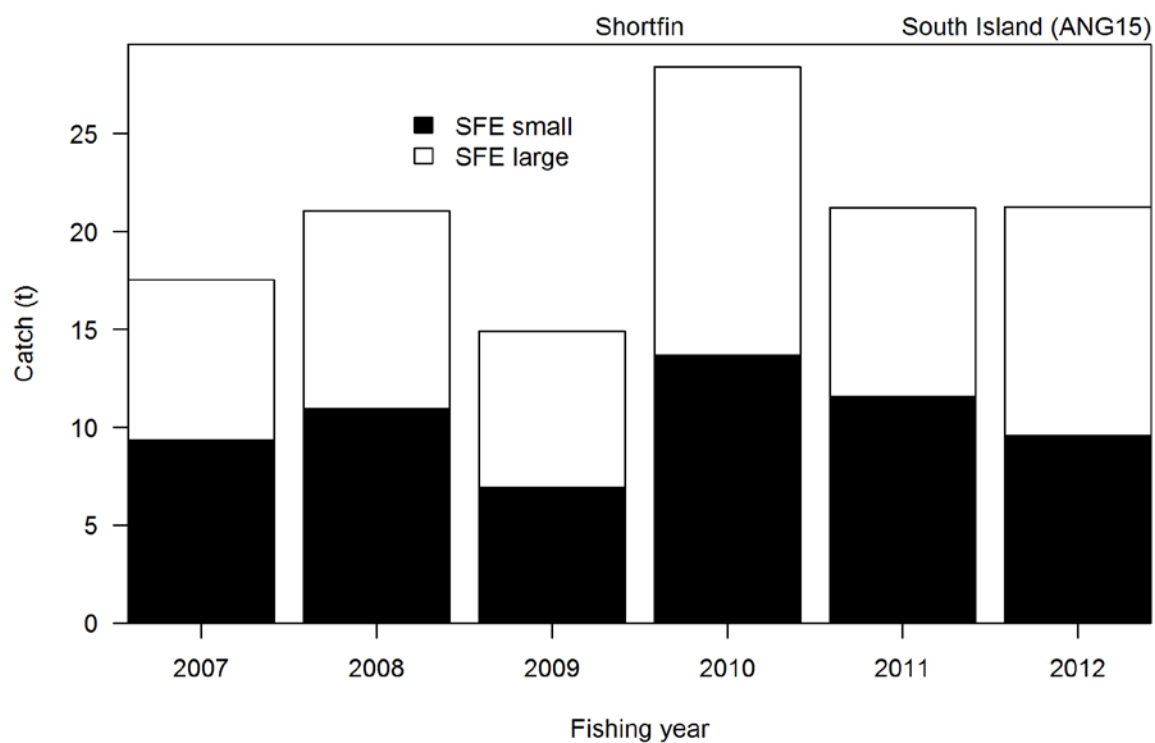


Figure 42: ANG 15 shortfin eel (SFE) catch by weight (t) and estimated numbers by size grade from 2006–07 to 2011–12.

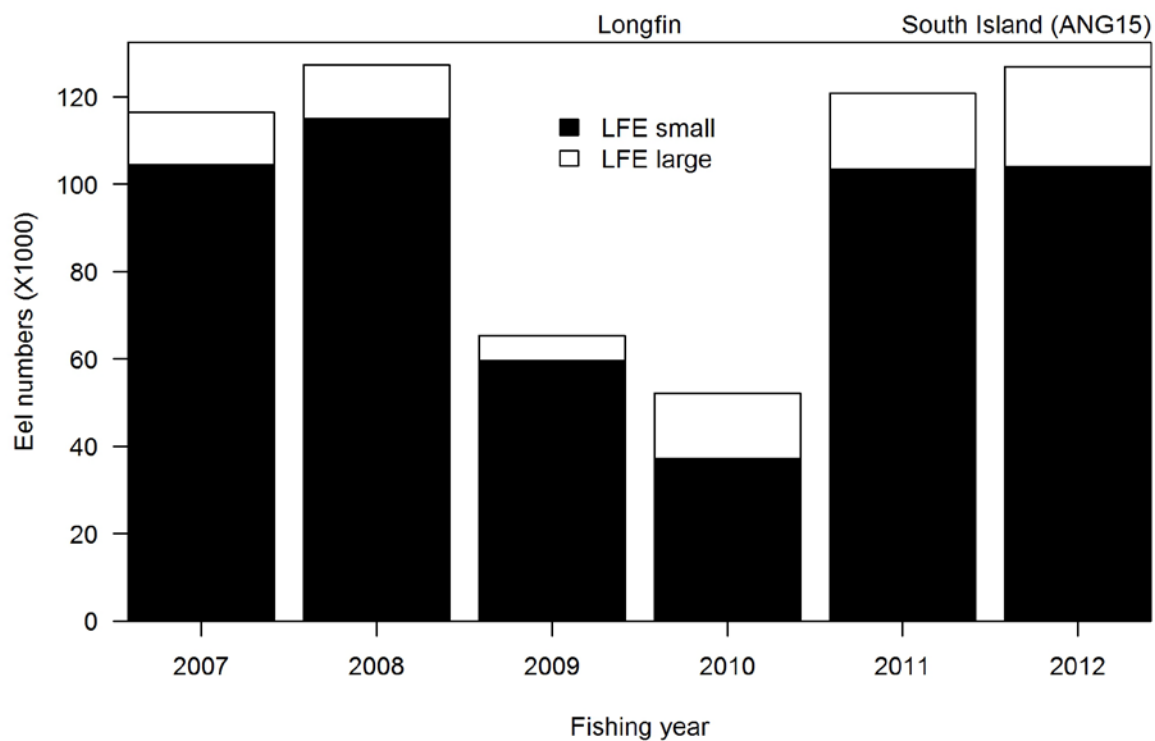
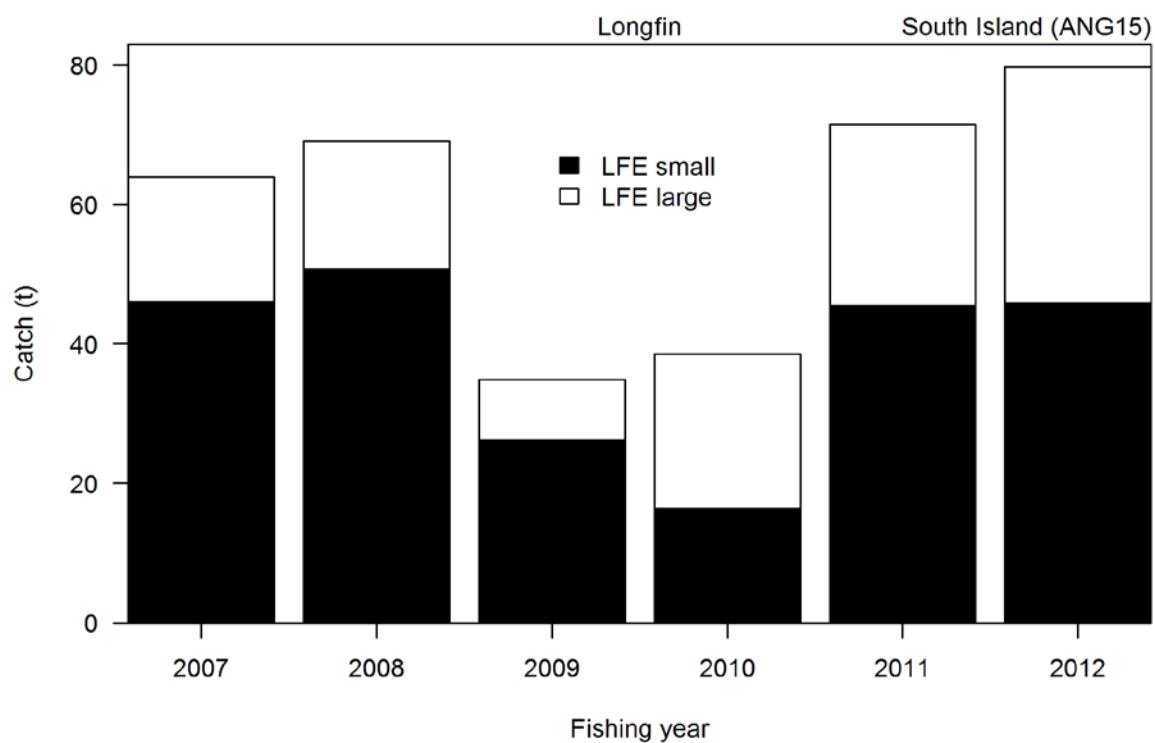


Figure 43: ANG 15 longfin eel (LFE) catch by weight (t) and estimated numbers by size grade from 2006–07 to 2011–12.

Appendix 1: Summary of the commercial eel monitoring programme. *ANG 15 only from 2006–07.

Fishing year	North Island	South Island	Data collected	Project code
2003–04 (pilot)	All landings	No data	Species size, landing weight, location	EEL200204
2004–05	All landings	No data	Species size, landing weight, location	EEL200402
2005–06 and 2006–07*	All landings	ANG 15	Species size, landing weight, location	EEL200501
2007–08 and 2008–09	All landings	ANG 15	Species size, landing weight, location	EEL200708
2009–10	All landings	ANG 15	Species size, landing weight, location	IPA200907
2010–11 and 2011–12	All landings	All landings	Species size, landing weight, location	EEL201002
2012–13 to 2014–15	All landings	All landings	pending	EEL201202

Appendix 2: North Island and South Island subarea codes (n = 65, n = 58) with general locations and the matching eel statistical area (ESA) and Quota Management area (QMA). The number of the alphanumeric “subarea” code refers to the historical numeric ESA within which the subarea is located, and subarea2 the letters refer to the current alpha code of the ESA. In our reporting we have used the variable “Subarea” codes. These labels are included in the digitised shape files.

Subarea	Subarea2	Subarea location	Island	ESA	QMA (LFE)	QMS (SFE)
1A	AA1	Kaitaia	North	AA	LFE 20	SFE 20
1B	AA2	Hokianga Harbour	North	AA	LFE 20	SFE 20
1C	AA3	Bay of Islands	North	AA	LFE 20	SFE 20
1D	AA4	Dargaville	North	AA	LFE 20	SFE 20
1E	AA5	Bream Bay	North	AA	LFE 20	SFE 20
2A	AB1	Warkworth	North	AB	LFE 20	SFE 20
2B	AB2	Auckland	North	AB	LFE 20	SFE 20
2C	AB3	Manukau Harbour	North	AB	LFE 20	SFE 20
3A	AC1	Hauraki Plains west	North	AC	LFE 21	SFE 21
3B	AC2	Hauraki Plains east	North	AC	LFE 21	SFE 21
3C	AC3	Coromandel Peninsula	North	AC	LFE 21	SFE 21
4A	AD1	Lake Taupo	North	AD	LFE 21	SFE 21
4B	AD2	Lake Ohakuri	North	AD	LFE 21	SFE 21
4C	AD3	Lake Atiamuri	North	AD	LFE 21	SFE 21
4D	AD4	Lake Whakamaru	North	AD	LFE 21	SFE 21
4E	AD5	Lake Maraetai	North	AD	LFE 21	SFE 21
4F	AD6	Lake Waipapa	North	AD	LFE 21	SFE 21
4G	AD7	Lake Arapuni	North	AD	LFE 21	SFE 21
4H	AD8	Lake Karapiro	North	AD	LFE 21	SFE 21
4I	AD9	Hamilton	North	AD	LFE 21	SFE 21
4J	AD10	Pirongia Forest Park	North	AD	LFE 21	SFE 21
4K	AD11	Lakes Whangape, Waahi and Rotongaro	North	AD	LFE 21	SFE 21
4L	AD12	Lake Waikare/Port Waikato	North	AD	LFE 21	SFE 21
4M	AD13	Raglan Harbour	North	AD	LFE 21	SFE 21
4N	AD14	Kawhia Harbour	North	AD	LFE 21	SFE 21
4O	AD15	Marakopa River	North	AD	LFE 21	SFE 21
4P	AD16	Awakino River	North	AD	LFE 21	SFE 21
4Q	AD17	Mokau River	North	AD	LFE 21	SFE 21
5A	AE1	Tauranga	North	AE	LFE 21	SFE 21
5B	AE2	Rotorua Lakes	North	AE	LFE 21	SFE 21
5C	AE3	Rangitaiki River	North	AE	LFE 21	SFE 21
5D	AE4	Whakatane River	North	AE	LFE 21	SFE 21
6A	AF1	Ohiwa Harbour	North	AF	LFE 21	SFE 21
6B	AF2	Motu River	North	AF	LFE 21	SFE 21
6C	AF3	Cape Runaway	North	AF	LFE 21	SFE 21
6D	AF4	Waiapu River	North	AF	LFE 21	SFE 21
6E	AF5	Tolaga Bay	North	AF	LFE 21	SFE 21
6F	AF6	Gisborne	North	AF	LFE 21	SFE 21
6G	AF7	Waipaoa River	North	AF	LFE 21	SFE 21

7A	AG1	Mahia Peninsula	North	AG	LFE 22	SFE 22
7B	AG2	Lake Waikaremoana	North	AG	LFE 22	SFE 22
7C	AG3	Mohaka River	North	AG	LFE 22	SFE 22
7D	AG4	Napier	North	AG	LFE 22	SFE 22
7E	AG5	Tukituki River	North	AG	LFE 22	SFE 22
7F	AG6	Waimarama/Porangahau	North	AG	LFE 22	SFE 22
8A	AH1	Taumarunui	North	AH	LFE 23	SFE 23
8B	AH2	Whanganui River inland	North	AH	LFE 23	SFE 23
8C	AH3	Whanganui River coast	North	AH	LFE 23	SFE 23
8D	AH4	Whangaehu River	North	AH	LFE 23	SFE 23
8E	AH5	Turakina River	North	AH	LFE 23	SFE 23
8F	AH6	Rangitikei River	North	AH	LFE 23	SFE 23
9A	AJ1	North Taranaki Bight	North	AJ	LFE 23	SFE 23
9B	AJ2	Waitara River	North	AJ	LFE 23	SFE 23
9C	AJ3	Mount Taranaki coast	North	AJ	LFE 23	SFE 23
9D	AJ4	Patea River inland	North	AJ	LFE 23	SFE 23
9E	AJ5	Patea River coast	North	AJ	LFE 23	SFE 23
9F	AJ6	Waitotara River	North	AJ	LFE 23	SFE 23
10A	AK1	Manawatu River coast	North	AK	LFE 22	SFE 22
10B	AK2	Manawatu River Inland	North	AK	LFE 22	SFE 22
10C	AK3	Akitio River	North	AK	LFE 22	SFE 22
10D	AK4	Otaki	North	AM	LFE 22	SFE 22
11A	AL1	Lake Wairarapa	North	AL	LFE 22	SFE 22
11B	AL2	Wairarapa coast	North	AL	LFE 22	SFE 22
11C	AL3	Castle point	North	AL	LFE 22	SFE 22
12B	AM2	Wellington	North	AM	LFE 22	SFE 22
AN1	AN1	Kahurangi National Park/Takaka	South	AN	ANG 11	ANG 11
AN2	AN2	Motueka River/Tasman Bay	South	AN	ANG 11	ANG 11
AN3	AN3	Lakes Rotoroa and Rotoiti	South	AN	ANG 11	ANG 11
AP1	AP1	Pelorus River/Pelorus Sounds	South	AP	ANG 11	ANG 11
AP2	AP2	Wairau River	South	AP	ANG 11	ANG 11
AQ1	AQ1	Awatere River	South	AQ	ANG 12	ANG 12
AQ2	AQ2	Clarence and Conway Rivers	South	AQ	ANG 12	ANG 12
AR1	AR1	Waiau River (north)	South	AR	ANG 12	ANG 12
AR2	AR2	Hurunui River	South	AR	ANG 12	ANG 12
AR3	AR3	Waimakariri River	South	AR	ANG 12	ANG 12
AR4	AR4	Upper Rakaia River/Lake Coleridge	South	AR	ANG 12	ANG 12
AR5	AR5	Rakaia River coast	South	AR	ANG 12	ANG 12
AS1	AS1	Te Waihora (lake only)	South	AS1	ANG13	ANG13
AS2	AS2	Te Waihora Concession Area	South	AS2	ANG 13	ANG 13
AS1A	ASA	Selwyn catchment (excluding the lake)	South	AS1	ANG 13	ANG 13
AT1	AT1	Ashburton River	South	AT	ANG 14	ANG 14
AT2	AT2	Rangitata River	South	AT	ANG 14	ANG 14
AT3	AT3	Opihi and Orari Rivers	South	AT	ANG 14	ANG 14
AT4	AT4	Wainono Lagoon/Pareora River	South	AT	ANG 14	ANG 14
AU1	AU1	Lake Tekapo	South	AU	ANG 14	ANG 14
AU2	AU2	Lake Pukaki	South	AU	ANG 14	ANG 14
AU3	AU3	Lake Ohau	South	AU	ANG 14	ANG 14
AU4	AU4	Lakes Benmore, Aviemore and Waitaki	South	AU	ANG 14	ANG 14
AU5	AU5	Waitaki River	South	AU	ANG 14	ANG 14
AV1	AV1	Lake Wakatipu	South	AV	ANG 15	ANG 15
AV2	AV2	Lake Wanaka	South	AV	ANG 15	ANG 15
AV3	AV3	Lake Hawea	South	AV	ANG 15	ANG 15
AV4	AV4	Kawarau and upper Clutha Rivers down to Cromwell	South	AV	ANG 15	ANG 15
AV5	AV5	Clutha River from Cromwell to Roxburgh Dam	South	AV	ANG 15	ANG 15
AV6	AV6	Taieri River above Middlemarch	South	AV	ANG 15	ANG 15
AV7	AV7	Kakanui, Shag and Waikouaiti Rivers	South	AV	ANG 15	ANG 15
AV8	AV8	Taieri River coast	South	AV	ANG 15	ANG 15
AV9	AV9	Lake Waihora and Waipori River	South	AV	ANG 15	ANG 15
AV10	AV10	Clutha River coast	South	AV	ANG 15	ANG 15

AV11	AV11	Pomahaka River	South	AV	ANG 15	ANG 15
AV12	AV12	Catlins and Tahakopa River	South	AV	ANG 15	ANG 15
AW1	AW1	Lakes Te Anau and Manapouri	South	AW	ANG15	ANG15
AW2	AW2	Waiau and Mararoa Rivers down to Monawai	South	AW	ANG 15	ANG 15
AW3	AW3	Oreti River inland down to Bog Burn	South	AW	ANG 15	ANG 15
AW4	AW4	Mataura River inland down to Riversdale	South	AW	ANG 15	ANG 15
AW5	AW5	Waikaka River	South	AW	ANG 15	ANG 15
AW6	AW6	Waiau River coast	South	AW	ANG 15	ANG 15
AW7	AW7	Aparima River inland down to Wreys Bush	South	AW	ANG 15	ANG 15
AW8	AW8	Aparima River coast	South	AW	ANG 15	ANG 15
AW9	AW9	Oreti River coast	South	AW	ANG 15	ANG 15
AW10	AW10	Mataura River from Riversdale to Gore	South	AW	ANG 15	ANG 15
AW11	AW11	Mataura River coast	South	AW	ANG 15	ANG 15
AW12	AW12	Fiordland National Park	South	AW	ANG 15	ANG 15
AX1	AX1	Karamea and Mokihinui Rivers	South	AX	ANG 16	ANG 16
AX2	AX2	Buller River	South	AX	ANG 16	ANG 16
AX3	AX3	Grey River Arnold River	South	AX	ANG 16	ANG 16
AX4	AX4	Lake Brunner	South	AX	ANG 16	ANG 16
AX5	AX5	Taramakau River	South	AX	ANG 16	ANG 16
AX6	AX6	Hokitika River	South	AX	ANG 16	ANG 16
AX7	AX7	Mikonui River to Waikukupa River	South	AX	ANG 16	ANG 16
AX8	AX8	Cook River to Waita River	South	AX	ANG 16	ANG 16
AX9	AX9	Arawata and Haast Rivers	South	AX	ANG 16	ANG 16
AX10	AX10	Sutherland Sound to George River	South	AX	ANG 16	ANG 16

Appendix 3: Shortfin catch by North Island subareas for the combined years 2003–04 to 2011–12. Data are sorted by percent contribution from highest to lowest. See Appendix 2 for subarea locations.

Subarea	Shortfin catch (kg)	% by subarea
1D	329 226	12.10
4L	319 732	11.75
3A	181 750	6.68
10A	155 848	5.73
7D	145 321	5.34
3B	122 402	4.50
2C	118 103	4.34
4K	117 528	4.32
7E	109 901	4.04
11A	103 976	3.82
4J	103 463	3.80
1B	84 069	3.09
1A	67 763	2.49
2A	61 141	2.25
4H	50 728	1.86
5C	46 452	1.71
8F	43 302	1.59
6G	40 837	1.50
10B	32 356	1.19
4B	32 276	1.19
7F	28 818	1.06
9F	26 287	0.97
4I	26 218	0.96
2B	25 756	0.95
1C	23 933	0.88
4G	23 849	0.88
1E	23 402	0.86
8D	23 054	0.85
8E	21 882	0.80
8B	19 778	0.73
5B	17 687	0.65
6F	16 753	0.62
10D	15 624	0.57
9D	14 595	0.54
3C	14 092	0.52
4M	13 495	0.50
7A	12 913	0.47
4D	10 660	0.39
5A	10 448	0.38
7B	9 582	0.35
5D	9 526	0.35

Appendix 3 – continued

Subarea	Shortfin catch (kg)	% by subarea
8C	7 461	0.27
10C	7 457	0.27
4E	6 336	0.23
4Q	6 329	0.23
9A	5 448	0.20
4C	5 167	0.19
7C	4 781	0.18
11B	4 495	0.17
6A	2 291	0.08
Unknown	2 238	0.08
6E	2 170	0.08
4N	1 512	0.06
9C	1 410	0.05
7?	1 307	0.05
9B	1 244	0.05
6B	1 123	0.04
4A	1 096	0.04
9E	1 043	0.04
4F	692	0.03
12B	556	0.02
4P	547	0.02
9?	444	0.02
4?	284	0.01
11C	282	0.01
8A	100	0.00
12?	71	0.00
4O	54	0.00
Total	2 720 461	

Appendix 4: Longfin catch by North Island subareas for the combined years 2003–04 to 2011–12. Data are sorted by percent contribution from highest to lowest. See Appendix 2 for subarea locations.

Subarea	Longfin catch (kg)	% by subarea
1D	80 627	11.40
4J	67 310	9.51
4L	59 573	8.42
11A	38 225	5.40
2C	31 188	4.41
10A	26 249	3.71
7E	25 861	3.66
9D	25 730	3.64
3A	23 814	3.37
3B	18 061	2.55
4K	17 890	2.53
10B	16 383	2.32
1C	13 475	1.90
7D	13 299	1.88
1B	13 094	1.85
2A	12 741	1.80
5C	11 927	1.69
8B	11 581	1.64
4Q	10 868	1.54
9A	10 765	1.52
4I	10 569	1.49
8F	10 396	1.47
1A	9 506	1.34
8D	9 467	1.34
2B	9 174	1.30
8E	8 814	1.25
1E	8 004	1.13
4M	7 722	1.09
9C	7 355	1.04
8C	6 910	0.98
3C	6 653	0.94
5B	6 619	0.94
6G	6 511	0.92
5D	6 285	0.89
7F	6 157	0.87
9F	5 338	0.75
4B	4 982	0.70
9B	4 979	0.70
4N	4 383	0.62
5A	3 670	0.52
7A	3 285	0.46

Appendix 4 – continued

Subarea	Longfin catch (kg)	% by subarea
7B	3 073	0.43
9E	3 061	0.43
4G	3 027	0.43
4H	3 013	0.43
6A	2 562	0.36
4D	1 890	0.27
4C	1 608	0.23
10C	1 595	0.23
4P	1 492	0.21
4E	1 353	0.19
8A	1 185	0.17
4O	1 166	0.16
10D	1 066	0.15
11B	865	0.12
7C	773	0.11
12B	772	0.11
unknown	750	0.11
6E	562	0.08
11C	457	0.06
6B	441	0.06
9?	369	0.05
4?	330	0.05
6F	327	0.05
4F	174	0.02
4A	158	0.02
7?	43	0.01
12?	0	0.00
Total	707 548	100.00