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EXECUTIVE SUMMARY

Walsh, C.; Buckthought, D.; Armiger, H.; Spong, K.; Vaughan, M.; Smith, M.; Kohn, Y. (2009). Age composition of commercial snapper landings in SNA 1, 2007–08.

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This report presents the results of Objective 1 of the Ministry of Fisheries project "Estimation of snapper year class strength in SNA 1" (SNA2007/01A). The general objective was to determine by market sampling the age structure of commercial landings from the three snapper stocks that constitute SNA 1 for use in stock assessment models.

The random age frequency sampling approach was employed over four seasons from spring 2007 to winter 2008 to estimate catch-at-age for snapper from the three bottom longline fisheries in SNA 1; Bay of Plenty, Hauraki Gulf, and East Northland. The target sample sizes (landings and otoliths) were achieved for all sampled fisheries.

Year class strengths inferred from the age distributions sampled from the SNA 1 longline fisheries in 2007–08 were generally consistent with trends previously observed. The 1999 year class, although not as dominant as in recent years, still makes up almost one in every five snapper landed in SNA 1. The 1999 year class continues to remain the singularly most dominant year class in the fishery for the fifth consecutive year in the Bay of Plenty and East Northland stocks, and the fourth for the Hauraki Gulf stock, and will continue to be of considerable importance in sustaining the SNA 1 fishery for the remaining decade and almost certainly into the next. The recent recruitment of the 2000–2003 year classes of similar average strength, especially in the Bay of Plenty and East Northland fisheries, has helped boost the numbers of young fish, and these too should be of importance in the SNA 1 fishery over the next few years.

The Bay of Plenty longline fishery continues to be based predominantly on fish 10 years of age and younger with those age classes 13 years and greater making up only 5% of the total annual catch by number, indicating as it has over recent years, that few older fish exist in this fishery. Although the catch-at-age distribution appears to broadening by the recent strong recruitment, should the high level of fishing pressure exerted on the Bay of Plenty stock continue, it would seem unlikely that any appreciable growth in the right hand limb of the age distribution will occur in this fishery for some years to come. The Hauraki Gulf stock continues to be the broadest of the SNA 1 age distributions, and accordingly has the highest estimate of mean age at 10 years, the highest seen this decade. Although numbers in the Hauraki Gulf aggregate (over 19 years) age group continue to be reasonably low, they are expected to increase two-fold this coming year when fish from the previously dominant 1989 year class become 20 years of age. Although the age composition for the Hauraki Gulf is perceived to be broadening and, hence, potentially rebuilding, the average size of the fish landed there is still comparatively small at around 35 cm (about 900 g), resulting in a yield-per-recruit (by weight) to the fishery that is relatively low compared to that seen in other New Zealand snapper stocks. The East Northland stock comprises a reasonably broad range of fish of various ages. Although two-thirds of the East Northland longline catch is 9 years of age or less, an appreciable number of fish still occur in the right hand limb including the aggregate age group, reflected in a high mean age of 9 years in the age distribution.

The seasonal variability in the age structure of longline landings from SNA 1 was mostly consistent with and similar to, trends observed in previous year-round sampling events. The highest proportions of older fish in the catch were found in spring in the Bay of Plenty, summer in East Northland, and as always, during winter in the Hauraki Gulf. Although only marginally different, the highest proportions of young fish were caught in spring in the Hauraki Gulf, autumn in East Northland, and during winter in the Bay of Plenty.

Because collections were made across all four seasons, comparisons with spring-summer estimates collected in previous years should be treated with some caution because of the effects of growth and recruitment during autumn and winter. However, seasonal catch-at-age estimates for 2007–08 were more similar than those seen in previous year-round collections, especially for newly recruited age classes, where the high catch of these age classes over autumn and winter in past years had influenced their relative weight in terms of numbers of fish, mainly in the Bay of Plenty and East Northland fisheries. Low winter catches and slower growth rates exhibited in snapper from the Hauraki Gulf have resulted in only minor differences in proportion-at-age estimates for spring-summer compared to those sampled year-round, similar to that seen in previous years.

Mean weight-at-age estimates determined for each season were generally more similar within a stock than between stocks, except for a proportion of old fish from the East Northland spring sample which may have comprised a high number of slow growing resident fish. Estimates from the Bay of Plenty more closely approximate values predicted from published parameters than those from other areas, while those estimates for the Hauraki Gulf and East Northland stocks were not overly dissimilar to each other but fell well below the predicted values.

Some variability was evident in the relative year class strengths inferred from catch-at-age estimates for the SNA 1 stocks and most likely reflects between-stock differences in recruitment, growth rates, and fishing mortality, as well as sampling error. Mean weighted coefficients of variation (for analytical estimates) of below 20% across all age classes in the SNA 1 catch-at-age compositions were achieved. Bootstrap mean weighted coefficients of variation were higher and ranged from 19% to 22%.

1. INTRODUCTION

Staff of the National Institute of Water and Atmospheric Research (NIWA) and, formerly, MAF Fisheries have sampled the length and age compositions of snapper from commercial landings in port (market sampling) intermittently since 1963 (Davies et al. 1993). In the 1988–89 fishing year, a structured sampling programme was designed to establish a time series of length and age composition data for the main snapper fisheries in the east and west coast North Island stocks, SNA 1 and SNA 8 respectively. Because of heterogeneity in snapper biology and fishing patterns, SNA 1 is often further subdivided into three substocks (referred to herein as stocks): Bay of Plenty, Hauraki Gulf, and East Northland. The time series of length and age information has been summarised in previous reports (Davies & Walsh 1995, Walsh et al. 1995, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2006a, 2006b, 2007, 2008). This report presents the results of market sampling between October 2007 and August 2008, thus continuing the time series. Funding for this project, SNA2007/01A, was provided by the Ministry of Fisheries.

The specific objective of this project for 2007–08 was:

1. To carry out sampling and estimate the relative proportion at age and length of recruited snapper sampled from the commercial longline catch in SNA 1 throughout the fishing year 2007–08. The target coefficient of variation (c.v.) for the catch-at-age will be 20% (mean weighted c.v. across all age classes).

The approach for sampling SNA 1 commercial longline landings for length and age data in 2003–04 was modified from a spring and summer sampling programme to one that encompassed the entire year (see Walsh et al. 2006b). This change was largely brought about so that sampling reflected the seasonal characteristics of the longline fleet and its fishing operations, whereby more of the snapper catch in recent years was landed year-round, rather than just over spring and summer. The sampling undertaken in 2007–08 continued with the year-round approach as implemented in 2003–04, 2004–05, and 2006–07, but landings were sampled randomly for age only. Davies et al. (1993) investigated the relative benefit of catch-at-age precision associated with particular length frequency and otolith sample sizes in snapper landings so as to optimise sampling resources. It was evident that no great benefit was gained from collecting large length frequency samples. The aim of this study in 2007–08 was to estimate the annual catch-at-age of snapper from the SNA 1 stocks for its use in a population model.

2. METHODS

Landings from the snapper fishery were stratified by stock, fishing method, and quarter, e.g., Bay of Plenty – longline – spring. The stocks correspond to the three areas that make up the Quota Management Area SNA 1 on the northeast coast of New Zealand: Bay of Plenty, Hauraki Gulf, and East Northland (Figure 1). The fishing method sampled was longline (BLL) and the samples were collected over four seasons that make up the fishing year; spring (October–November), summer (December–February), autumn (March–May), and winter (June–August), unlike that before 2003–04 when spring and summer sampling was the norm. September, normally clustered with spring, was not included in the seasonal stratification as it lies outside the bounds of the fishing year (October to September) that the sampling relates to. As limited fishing occurs in September (the last month of the fishing year), its absence from the spring sampling strata was deemed to have minimal effect on the final results. The percentages of the snapper catch taken by method in each of the stocks for the sampling period in 2007–08 are given in Table 1 to indicate the dominant methods.

Age frequency samples were collected from the SNA 1 longline fisheries using a two-stage sampling procedure similar to that described for length sampling (West 1978). The random selection of landings and a random sample of bins within landings represent the first and second stages respectively. The sampling procedure was modified to account for the grading of fish according to length and quality (within-landing strata) by taking a stratified random sample of bins within a landing (Davies et al. 1993).

The random age frequency sampling method for collecting otoliths was used for each stratum. Age-frequency samples were collected by taking random otolith samples from each within-landing stratum using a systematic selection interval. This involved taking a random sample of bins from each stratum that was roughly proportional to the total number of bins in a landing, hence large samples were taken from large landings and small samples from small landings. A systematic selection of every n^{th} fish was taken from the sampled bins by counting in a continuous sequence. The optimum selection interval, *n*, was determined from simulations using data from historical length and age samples that achieved a desired level of precision. This range took account of the expected mean number of fish in a bin and the total number of bins in landings. Sample sizes typically ranged from 15 fish being collected from landings having a total of 10 bins, to 45 fish from landings of over 100 bins. A total sample size of 800 otoliths was targeted from the Bay of Plenty and East Northland longline fisheries over the entire year, with about 200 otoliths collected per season. Similarly, 1000 otoliths were targeted from the Hauraki Gulf longline fishery with about 250 otoliths collected per season.

All fish making up the sample were measured to the nearest centimetre below the fork length. As snapper show no differential growth between sexes (Paul 1976), sex was not determined.

In 2001–02, the random age frequency design for the East Northland stock was substratified by the statistical areas 002 and 003 (Figure 1) to improve the precision on catch-at-age estimates (Davies & Walsh 2003). In previous years, the allocation of sample collections from each statistical area was generally dependent on the availability of landings from those areas during the season. It was anticipated that the expected number of samples collected from each statistical area would be proportional to the landings from each area during the period of sampling. However, Walsh et al. (2006b) reported that year-round sampling can result in sub-optimal numbers of landings being sampled in a sub-stratum-quarter that may increase observation error and create possible bias in the sample estimates. Therefore, for each season in 2007–08 the sample allocation over statistical areas was targeted at about five landings (half the stock seasonal target of ten) to ensure adequate sample sizes were obtained.

Proportion at age and variance (analytical and bootstrap) estimates for the SNA 1 longline fisheries were calculated from the random age frequency samples collected from each landing. Proportions at age across all landings within a season were estimated from sample proportions, weighted by the estimated number of fish in each landing. The weighted mean proportion at age and variance across temporal (seasons) and spatial (East Northland only) strata for each fishery was calculated following Blackwell et al. (1999).

Calculation of mean weight-at-age was based on w (g) = $0.04467 l^{2.793}$(cm) (Paul 1976). Mean weight-at-age estimates were calculated as a weighted mean with respect to the total number of fish estimated in each within-landing stratum sampled (Walsh et al. 2006b) and is directly analogous to estimating proportion catch-at-age (Davies et al. 2003). Landing-specific weight-at-age was scaled up to the season-fishery stratum and combined over all seasons (and spatial strata in East Northland).

Proportions at age and mean weight-at-age (bootstrap variances) were calculated for the range of age classes recruited, with the maximum age being an aggregate of all age classes over 19 years.

Random age frequency data were collected primarily to derive catch-at-age estimates. However, it can be assumed that fish sampled randomly for age were also random observations from within each length interval. Consequently, age-length keys could be derived from the random age frequency otolith samples. However, fish in the larger length classes, collected by the random age frequency method, were infrequently sampled and are likely to be poorly described in the age-length key. Age-length keys are assumed to be representative of the seasonal strata of the samples, that being the entire year, and may not be directly comparable to collections in years when only spring and summer were usually sampled. The main assumption that must be satisfied for an age-length key is that the sample was taken randomly with respect to age from within each length interval (Southward 1976). Age-length keys are included to give the reader an appreciation of the age-at-length differences between the stocks.

A standardised procedure for reading otoliths was followed (Davies & Walsh 1995). Age was defined as the rounded whole year from a nominal birth date of 1 January, e.g., in 2007–08, the 1999 year class was 9 years old, whether sampled in December 2007 or February 2008.

Snapper age data were stored on the Ministry of Fisheries *age* database, administered by NIWA.

3. RESULTS

3.1 Sample collections

Summaries of the sample sizes for stock-method-season strata are given in Tables 2–4, and summaries of the otolith sample collections in Table 5. Catch data from spring 2007 to winter 2008 are provided in Tables 2–4, displaying seasonal patterns in the fisheries. Although longline catches from the SNA 1 fishery were spread over the entire year, the greatest proportion of annual catch was taken from spring-autumn in the Hauraki Gulf and summer-winter in East Northland and the Bay of Plenty (Tables 2–4). Single trawl and longline were the dominant methods in the Hauraki Gulf accounting for 38% and 34% of the annual catch respectively (see Table 1). In East Northland, longline continues to dominate the fishery (52%), while in the Bay of Plenty, single trawl accounts for just under half the annual catch (49%), with Danish seine taking 31% and longline 18%.

In 2007–08 it was possible to sample from all sectors of the fishing industry. Forty landings (about 10 per season) were targeted from each longline fishery in SNA 1 with sample sizes achieved in all fisheries; Bay of Plenty (40), Hauraki Gulf (42), and East Northland (44). The cumulative proportion of the number of snapper longline landings and those sampled in the respective SNA 1 stocks from October 2007 to August 2008 is given in Appendix 1a illustrating the sampling performance to that of the fishery operation. A temporal comparison of the seasonal distribution of landings in the fishery (for catch weight and numbers of landings) to those sampled for the stock–season strata of SNA 1 is given in Appendix 1b. A spatial comparison using the proportional distribution of the estimated fishery catch with that sampled by statistical area is given for the respective SNA 1 stocks in Appendix 1c.

3.2 Age distributions

For all fisheries sampled in 2007–08, catch-at-age compositions (sampled using the random age frequency sampling approach) were derived for each stock, season, and combined over all seasons (spring to winter) to produce annual compositions. These are presented in Figures 2–5 and used to compare differences in the age structure of each stock and season stratum and to identify year class strengths. Combined seasonal catch-at-age distributions are presented with analytical and bootstrap variance estimates (Figures 2–4). A comparison of the relative proportions at age for the spring-summer combined season with that from the year-round sampling using cumulative plots is presented in Figure 6. Mean weight-at-age estimates for each stock–season stratum are presented in Figure 7. The estimated proportions at age and mean weight-at-age are tabled in Appendices 2 and 3. The age-length keys are tabled in Appendix 4 and age-at-length scatterplots for the full range of age classes present in the fisheries are given in Appendix 5. A time series comparison of the catch-at-age compositions for each stock where year-round sampling was undertaken is presented in Appendix 6.

3.3 Bay of Plenty

The Bay of Plenty longline age distribution consisted mainly of fish between 4 and 10 years old with very low numbers of fish in age classes 15 years and older (Figure 2). The mean age was 7.6 years and the analytical and bootstrap mean weighted coefficients of variation (MWCVs) were 0.16 and 0.20 respectively. The previously strong 1999 year class (9 year olds) continues to dominate the age composition and along with the 2003 (5 year olds) make up over one-third by number of the Bay of

Plenty longline catch. The 2002 to 2000 year classes (6–8 year olds), equally the second most dominant group of age classes in the fishery, combined make up 42% of the annual catch, and appear to be of about average strength. For age classes more than 10 years of age, only the 1996 year class (12 year olds) continues to show any apparent strength in the right hand limb of the distribution, the combined total making up only 9% of the landed catch. The 2001 year class (7 year olds) appears fully recruited to the fishery, while the 2002 to 2004 year classes are not because they are still well represented in the 25–27 cm length intervals (see age-length key, Appendix 4).

The seasonal catch-at-age samples for the Bay of Plenty longline fishery were generally similar over all seasons and showed a high level of consistency in the relative strengths of common age classes. The seasonal differences seen in the relative year class strengths for the 2004 and 2003 year classes (4 & 5 year olds), especially between spring and the three other seasons, is likely to be due to the recruitment of these small young fish into the fishery throughout the year. Spring samples contained only marginally more old fish than summer, autumn, and winter samples (Figure 5).

3.4 Hauraki Gulf

The Hauraki Gulf longline age distribution was dominated by the 2001 and 1999 year classes (7 & 9 year olds) and combined make up almost one-third of the annual landed catch by number (Figure 3). The distribution in 2007–08 was comparatively broad, with most year classes, including those in the right hand limb, comprising appreciable numbers of fish, most noticeably 1996, 1995, 1991, and 1989. Only those age classes over 10 years of age are considered fully recruited to the fishery because they no longer contain a proportion of fish in the 25–27 cm length intervals (see age-length key, Appendix 4). The mean age of snapper in the fishery was 10.0 years, the highest estimate for the past decade. The analytical and bootstrap MWCVs for the random age frequency approach were 0.17 and 0.22 respectively.

The seasonal catch-at-age samples for the Hauraki Gulf longline fishery were generally similar over all seasons and showed a high level of consistency in the relative strengths of common age classes, a pattern similar to that seen in previous year-round sampling. Winter samples contained proportionally more old fish than summer, autumn, and spring samples (Figure 5).

3.5 East Northland

The East Northland longline age distribution continues to be dominated by the strong 1999 year class (9 year olds) making up almost 20% of the annual landed catch (Figure 4). The 2003 to 2000 year classes (5–8 year olds) appear to be of similar average strengths, and along with the 1999 year class dominate the left hand limb of the age distribution, making up about two-thirds by number of snapper landed by longline. The age distribution is comparatively broad with appreciable numbers of fish in all age classes in the right hand limb, the most noticeable being the 1996 year class (12 year olds). The aggregate (over 19 years) age group now makes up about 3% of the landed catch, considerably lower than estimates from the fishery in the late 1990s. Only those age classes over 9 years of age are considered fully recruited because they no longer contain a noticeable proportion of fish in the 25–27 cm length intervals (see age-length key, Appendix 4). The mean age of the East Northland distribution was 9.1 years and the analytical and bootstrap MWCVs were 0.14 and 0.19 respectively.

The seasonal catch-at-age samples for the East Northland longline fishery were largely similar over all seasons and generally showed a high level of consistency in the relative strengths of common age classes. Summer samples contained proportionally more old fish than winter, spring, and autumn samples (Figure 5).

3.6 Mean weight-at-age

Seasonal mean weight-at-age estimates for the Bay of Plenty, Hauraki Gulf, and East Northland stocks in 2007–08 are generally similar to those estimates previously observed in year-round sampling in 2003–04, 2004–05, and 2006–07 being more different between stocks than within stocks for the most common age classes (Figure 7, Appendix 3). As previously seen, mean weight-at-age estimates were generally highest from samples collected in the Bay of Plenty longline fishery. As in 2006–07, Bay of Plenty mean weight-at-age estimates in 2007–08 were found to be 6–14% greater on average for the most common age classes (i.e., 5–13 year olds) than those determined for the Hauraki Gulf and East Northland stocks. Similarly, Bay of Plenty longline estimates of mean weight-at-age more closely reflected the predicted values for the SNA 1 stock for the common age classes, while those for the Hauraki Gulf and East Northland were on average lower than the predicted SNA 1 values. The mean weight-at-age estimates for some of the young age classes (3–5 year olds) lie on or above the predicted weight-at-age curve because commercial catches do not contain the full length distribution because of the minimum legal size (MLS) of 25 cm.

The most noticeable seasonal difference in mean weight-at-age estimates within stocks in 2007–08 was for spring samples from the East Northland fishery where age class estimates for 13–17 year olds were considerably lower than in other seasons. Also apparent were the higher than expected mean weight-at-age estimates for the 1997 year class (11 year olds) in the Hauraki Gulf fishery for all seasons except summer in comparison to adjacent year classes.

4. DISCUSSION

The relative year class strengths inferred from the age distributions sampled from the SNA 1 fisheries in the 2007–08 fishing year are generally consistent with trends observed in previous years (Walsh et al. 1995, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2006a, 2006b, 2007, 2008). The collection of otolith samples in 2007–08 followed the same design as that first implemented in 2003–04 (Walsh et al. 2006a) spanning the entire year, whereas collections before 2003–04 (and in 2005–06) were made only in the spring and summer seasons. The change was made largely so that sampling better reflected the seasonal characteristics of the longline fleet and its fishing operations, as more of the snapper catch in recent years was landed year-round. However, compared to spring and summer sampling, year-round sampling was found to influence annual length and age compositions by two main factors: a higher rate of recruitment of small and young fish in autumn and winter, and the high catch in these seasons relative to spring and summer both influence the relative weight (in terms of the total numbers of fish) used in combining season strata, especially in the East Northland and the Bay of Plenty stocks (Walsh et al. 2006a, 2006b). In 2007–08 however, the differences in the annual age composition estimates between year-round samples and those taken in spring and summer were less obvious. Nevertheless, any direct comparisons made with the annual age composition estimates to those sampled only in spring and summer in previous years should be treated with some caution. The Snapper Fishery Assessment Working Group in March 2006 concluded that future market sampling of the SNA 1 fisheries should take place throughout the year.

Walsh et al. (2008) reported considerable developments within the fishing industry in recent years, with a number of veteran skippers retiring and a gradual downsizing and rationalisation of the commercial fishing fleet taking place. As a result some companies moved away from longlining in SNA 1 and increased their fishing effort using trawl and Danish seine to allow for a higher bycatch of other important species. Most longline fishers now catch much higher tonnages of snapper than they have in the past, the vast majority destined for export. In 2007–08, samples were collected from 37 of a total of 38 longline vessels operating in SNA 1, estimated to be about half the fleet size that operated five or more years ago, with many part-time fishers leaving the fishery in this last year. Although the number of longline vessels within the fishery may have decreased in recent years, the catch of snapper by longline continues to remain substantial at about one-third of the Total Allowable Commercial Catch (TACC), only marginally less than that of single trawl. Unlike other methods, longlining operates extensively in most spatial strata of SNA 1, across a wide range of habitats (soft and hard substrates), and has few fine-scale management (area and effort) restrictions imposed on its use. Importantly, catch-at-age data from the longline fishery provide a particularly useful tool for stock monitoring. Longline is believed to be the most uniform of all the fishing methods in its selection of fish across both size and age. Thus, method-specific mortality at age may be calculated using the longline catch-at-age estimates that also reflect the population age structure, and reveal the relative strength of newly recruiting year classes entering the fishery. These are important estimates that are derived from fitting a population model to longline catch-at-age estimates and are significant for the long-term monitoring of the fishery.

The Bay of Plenty combined age distribution for 2007–08 was relatively similar to that seen in the previous year allowing for the progression of year classes from one year to the next. The left hand limb has continued to broaden, with the fishery now dominated by 4 to 10 year olds, reflected by an increase in mean age to 7.6 years, the highest estimate in the past five years. The 1999 year class (9-year-olds), the most dominant in the fishery for the past four consecutive years, and now of equal dominance with the 2003 year class (5-year-olds), makes up 17% by number of snapper landed by longline. The average size of fish from the 1999 year class was about 35 cm (about 900 g), and the year class is fully recruited to the commercial fishery with the smallest fish sampled being 29 cm. In 2006–07, Walsh et al. (2008) estimated the relative recruitment strength of the 2003–2000 year classes (now 5–8-year-olds) to be of about average strength, and combined with the 1999 year class are likely to be of considerable importance for the sustainability of the Bay of Plenty fishery over the following decade. Currently most of the other age classes in the Bay of Plenty catch-at-age distribution appear to be of low relative strength, except the 1996 year class (12 year olds). Those age classes over 12 years, including the aggregate (over 19 years) age group, make up only 5% of the total annual catch by number indicating, as it has over recent years, that few older fish exist in this fishery (see Appendix 5).

Since sampling first began in 1989–90, the Bay of Plenty fishery has always had the youngest and narrowest age distribution of any of the SNA 1 stocks. More recently, Walsh et al. (2004, 2006a, 2006b) reported that the Bay of Plenty has continued to have the youngest age distribution, largely as a result of the increased commercial fishing pressure there, where the level of exploitation was considerably higher than on other stocks relative to its size. In 2007–08, an estimated 30% of the SNA 1 TACC of 4500 t was caught in the Bay of Plenty (MFish data), similar to the previous year and down from a peak of 40% in 2004–05. Because of the past and present high fishing pressure imposed on the Bay of Plenty stock, the age structure of snapper from the longline fishery is unlikely to broaden to any extent in the near future, especially if high fishing pressure is to continue.

As in most recent years, the Hauraki Gulf longline age distribution in 2007–08 continues to have the broadest age distribution of any of the SNA 1 fisheries, being well represented by a range of young, moderate, and old aged fish. The once strong 1999 year class (9-year-olds), although now decreased in its relative dominance compared to previous years, still remains the most dominant year class in the Hauraki Gulf fishery accounting for 17% of fish landed by longline. With an average size centred around 34 cm (about 850 g), the year class is probably close to being fully recruited to the commercial fishery with only a low proportion of fish being 26–27 cm. Similar to the previous year, those year classes less than 11 years of age make up about two-thirds of snapper landed by longline in the Hauraki Gulf. It is expected that the recent recruitment of the 2003–2000 year classes (5–8-year-olds) should continue to boost the left hand limb of the age distribution, although these year classes are estimated to be of only average strength, and none are yet fully recruited. Hauraki Gulf snapper exhibit some of the slowest growth rates of any New Zealand snapper stock (Davies et al. 2003), this being reflected in the rate of cohort recruitment above the MLS, where the left hand limb for cohorts up to about 8–10 years of age (largely since sampling first began in 1989–90) still contains some snapper at about, and probably below, the MLS of 25 cm (see Appendix 4). Walsh et al. (2007) reported that although the age composition for the Hauraki Gulf is perceived to be broadening and, hence, potentially rebuilding, the average size of the fish landed there is still comparatively small at about 35 cm (about 900 g). This alone is probably one of the most important factors for fisheries scientists, managers, and commercial and recreational fishers and those involved in the industry to fully comprehend. The Hauraki Gulf fishery now lands comparatively more fish now than it did 15–20 years ago to achieve the same catch weight. The yield-per-recruit (by weight) to the fishery in this past decade has been relatively low compared to that seen in other stocks with higher growth rates, like SNA 8. Although there has been no noticeable accumulation of older fish into the Hauraki Gulf aggregate age group in recent years (currently comprising less than 2% of the longline catch), the previously dominant 1989 year class (19-year-olds), estimated to be the second strongest year class (to the 1999 year class) in the fishery for the past 25 years, is expected to increase the relative strength of the aggregate age group two-fold this coming year.

Walsh et al. (2008) determined that an increase in mean age in the Hauraki Gulf fishery in 2006–07 was almost certainly attributable to the following: the dominance of the 1999 year class and other relatively dominant older age classes still present in the fishery, and the progression of these by one year into the next; the slower rate of recruitment of younger age classes into the fishery because of the slow growth exhibited by Hauraki Gulf snapper; and an apparently lower exploitation rate (compared to the other SNA 1 stocks) that allows snapper to attain a greater average age (albeit at a relatively small average size because of the slower growth rate). Consequently, the mean age of snapper from the Hauraki Gulf fishery in 2007–08 has continued to increase, and now at 10.0 years is the highest estimate seen this decade, second equal only to that from 1989–90, the year in which catch-at-age sampling from this fishery first began. The analytical (0.17) and bootstrap (0.22) MWCV estimates for the random age frequency collection have also increased from the past year and remain relatively high, most likely reflecting higher catch-at-age variability between landings in the fishery and the broadening of the age distribution.

The East Northland age distribution in 2007–08 was very similar to that seen in the previous year, allowing for the progression of year classes by one year, and the recent recruitment of young age classes into the fishery. Similar to the Hauraki Gulf, the East Northland stock comprises a reasonably broad range of fish of various ages, although two-thirds of these are less than 10 years of age, a similar pattern to that seen in most recent years. Similar to the Bay of Plenty, the East Northland age distribution continues to be dominated by the strong recruiting 1999 year class (9-year-olds), currently for the fifth consecutive year, and made up about one in every five fish landed annually by longline in 2007–08. Walsh et al. (2006a) predicted in 2003–04 that the 1999 year class will be of considerable importance for the sustainability of the SNA 1 fishery for that decade, and it appears very likely now that it will continue to be of significance in the fishery into the next decade as well. With a relatively small average size centred around 34 cm (about 850 g), the 1999 year class is probably close to being fully recruited to the commercial fishery with only a low proportion of fish being 26–27 cm. The 1996 year class (12-year-olds) has continued to remain the most dominant year class in the right hand limb contributing to about 8% of the longline catch by number, and with an average size of about 38 cm (1100 g), substantial in terms of biomass. Analogous to the Bay of Plenty stock is the relative recruitment strength of the 2003–2000 year classes (5–8 year olds) in East Northland, also estimated to be about average strength and also expected to be significant to this fishery for a number of years. The East Northland age distribution in 2007–08, although considerably less broad as it was in the 1990s, still contains an obvious number of fish across most of the older age classes, reflected in a relatively high mean age of 9.1 years, the highest estimate for six years. Although only 3% of fish by number make up the aggregate (over 19 years) age group, the highest for SNA 1, this is most likely to increase in 2008–09 when fish from the 1989 year class become 20 years of age.

Since 1989–90, broad similarities in relative year class strengths and recruitment patterns have been evident between the SNA 1 stocks, particularly for extremely strong and weak year classes (Davies & Walsh 1995, Walsh et al. 1995, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2006b, 2006a, 2007, 2008). The current catch-at-age compositions from all the SNA 1 longline fisheries continue to be dominated by the strong 1999 year class, which, now fully recruited, accounts for just below one in every five snapper landed. In almost 20 years of catch sampling in SNA 1, no year class has singularly dominated the SNA 1 longline fishery to such an extent as the 1999 year class, and such dominance could probably be categorised as a 1 in 10 year or more event. This and previously dominant year classes such as 1974, 1981, and 1989, have all had enormous significance in the long-term sustainability of the SNA 1 fishery. As in past years, the previously dominant 1996 year class continues to be of similar relative strength in all the SNA 1 stocks, as does the weak 1997 year class (11-year-olds). More recently, the recruitment of the 2000–2003 year classes across all the SNA 1 fisheries appear likely to be of similar relative strength between the stocks and will be important in the short term. Most of the older age classes (i.e., 1989 and 1991 year classes), especially those that were once very dominant, are now becoming less apparent in stocks as they are fished down, most noticeably in the Bay of Plenty, but will still be of some importance in supplementing the aggregate (over 19 years) age group in the next few years. Although broad similarities in year class strength exist between the SNA 1 stocks, there have always been some anomalies present, especially in East Northland (i.e., 1998 and 1995 year classes). Any variability in relative year class proportions between the SNA 1 stocks is most likely due to the variable recruitment specific to a stock (a reflection of unique environmental conditions), growth differences, and fishing mortality differences (Walsh et al. 2003).

Previous year’s catch-at-age distributions from within a stock have generally shown a high level of consistency between seasons in the relative strengths of the most common age classes (Walsh et al. 2006a, 2006b, 2008), a trend that has continued in 2007–08. It is generally expected that older and larger fish are found to be more common in summer, and younger and smaller fish more common in winter, a result determined from year-round sampling of SNA 2 landings (Blackwell et al. 2000, Blackwell & Gilbert 2001). Seasonal catch-at-age estimates from the Bay of Plenty in 2007–08 consisted of catches with a marginally higher proportion of older fish from spring compared to other seasons, although few old fish now exist within the stock, which may make any differences less apparent. Summer landings from East Northland contained slightly more old fish than the other seasons, while in the Hauraki Gulf old fish were much more apparent during winter, consistent with previous year-round sample collections. Walsh et al. (2006b) thought the most likely reason for this difference in winter samples may relate to the low abundance of school fish compared to resident fish in the population, the latter of which may not be fished to the same intensity as the school fish, hence, having similar year strengths but of different relative proportions. Resident fish, typically smaller, of lower abundance, and generally more dispersed, continue to occupy shallow inshore areas at least over the winter, and perhaps the entire year (Walsh et al. 2006b).

Differences were apparent between the analytical and bootstrap variances of proportion-at-age estimates with the bootstrap variances being higher, particularly in the less abundant young and old age classes. Given the sizes of the random age frequency samples collected from these fisheries, the bootstrap solutions probably provide more accurate variance estimates (Davies et al. 2003).

The results from this report (for 2007–08) relative to the previous years indicate a high level of consistency in catch-at-age sample estimates from the SNA 1 fisheries. This consistency, indicative of relatively low sampling error, has generally meant the proportions of every year class in the age distributions are similar to those from the previous year, given the potential changes resulting from strong and weak year classes recruiting into the fishery, and the heterogeneity present in the East Northland substock strata. The level of precision for the age distributions is high (MWCVs below 20% for analytical estimates), especially given that sampling events were conducted year-round, and as such reflects the rigorous sampling methodology and accurate ageing currently in place. Low between-year variability in the distribution of fishing effort relative to the recruited population would also contribute to this result. The analytical MWCV estimates for the age distributions sampled from the SNA 1 fisheries in 2007–08 ranged between 0.14 and 0.17 and bootstrap MWCV estimates for the same age distributions ranged between 0.19 and 0.22.

4.1 Mean weight-at-age

As in 2003–04, 2004–05, and 2006–07 mean weight-at-age estimates derived for each stock of SNA 1 in 2007–08 were similar to those recorded for the same fisheries for 1993–94 to 1997–98 (Davies et al. 2003), with only those estimates from the Bay of Plenty more closely approximating those predicted values based on published parameters. Overall there appeared to be little variation in seasonal mean weight-at-age estimates (for the most common age classes) within a stock, or between those for the Hauraki Gulf and East Northland stocks in 2007–08, although estimates for East Northland in spring were consistently the lowest for a range of old age classes. As a reasonably high proportion of the East Northland spring sample collection was made in early October, only a few days after the winter season, it was postulated that the samples may have contained a high number of resident fish, similar to that encountered in Hauraki Gulf winter samples in 2003–04 (Walsh et al. 2006a). As mentioned in the previous section, resident fish occupy shallow inshore strata year-round, and are thought to experience lower water temperatures for a longer period, especially over winter, than those experienced by school fish, resulting in reduced growth rates and hence lower estimates of mean weight-at-age. Mean weight-at-age estimates were higher than expected for the very weak 1997 year class (11 year olds) in the Hauraki Gulf fishery for all seasons except summer in comparison to adjacent year classes. Occasionally seen in the Bay of Plenty mean weight-at-age estimates as well, this year class has shown consistently higher estimates of mean weight-at-age for seasonal summaries in recent years from the Hauraki Gulf fishery, and may be an effect of density-dependent growth for the 1997 year class from an early life stage, or alternatively a coincidence of the low sample size in collections typical of such a weak year class.

Bootstrap variance estimates determined from the random age frequency mean weight-at-age data in this report are higher than those given in catch sampling reports before 2003–04. This difference is attributable to the methods used to calculate mean weight-at-age from random age frequency samples (i.e., length frequency and age-length keys with analytical variance estimates were used previously).

5. CONCLUSIONS

1. In 2007–08, the age distributions of the SNA 1 longline fisheries were generally similar to those observed in previous years using the same year-round sampling design, and are consistent with observed trends. However, unlike most other years, combined spring and summer catch-at-age estimates for the Bay of Plenty and East Northland stocks in 2007–08 more closely resembled those estimates from year-round sampling. The lack of difference is thought to be attributable to the general consistency in relative year class strength across most seasons, especially for young newly recruited age classes (largely 4 and 5 years olds), where the high catch of these year classes over autumn and winter in previous years was thought to influence their relative weight in terms of numbers of fish.

2. Although not as apparent as in previous years, all SNA 1 longline fisheries in 2007–08 continue to be dominated by the 1999 year class, which currently makes up almost one in five snapper landed. The 1999 year class has been the dominant year class in the Bay of Plenty and East Northland stocks for the fifth consecutive year, and in the Hauraki Gulf for the fourth consecutive year, making it the most dominant year class seen in 20 years of sampling, and of considerable importance in sustaining the SNA 1 fishery this decade and well into the next.

3. Although catch-at-age distributions in 2007–08 have broadened slightly from the previous year, there continues to be a relatively high proportion of young fish (10 years or younger) present in all SNA 1 stocks. The Hauraki Gulf stock has the broadest age distribution of all SNA 1 stocks, marginally broader than East Northland, and the highest estimate of mean age, although relatively low numbers of fish exist in the aggregate (over 19 years) age group. East Northland

has a marginally higher proportion of fish in the aggregate age group than the Hauraki Gulf, and, at about 3% in 2007–08, is the highest estimate for the SNA 1 fisheries. The Bay of Plenty age distribution continues to have the lowest numbers of old fish in SNA 1, with only 9% of the total annual catch based on fish 11 years and older, a third of these apportioned to the 1996 year class. Because of the continued high level of fishing pressure exerted on the Bay of Plenty stock, it is unlikely that any appreciable growth in the right hand limb of the age distribution will occur in this fishery for some years to come.

4. Seasonal variability in snapper catch-at-age for the stocks of SNA 1 was mostly consistent and similar to trends observed in previous year-round sampling events. The highest proportions of old fish in the catch were found in spring in the Bay of Plenty, summer in East Northland, and as always, during winter in the Hauraki Gulf. Although only marginally different, the highest proportions of young fish were caught in spring in the Hauraki Gulf, autumn in East Northland, and during winter in the Bay of Plenty.

5. Similarities in relative year class proportions exist between the SNA 1 stocks for most year classes, with differences mainly due to variable recruitment specific to a stock, growth differences, and fishing mortality differences.

6. There appears to be little variation in seasonal mean weight-at-age estimates for the most common age classes within a stock, or between those for the Hauraki Gulf and East Northland stocks in 2007–08, although estimates for East Northland in spring were consistently low for a range of old age classes. Only those estimates from the Bay of Plenty more closely approximate predicted values from published parameters.

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Table 1: Percentage of snapper catch by fishing method* in SNA 1 for the 2007–08 sampling period.†

	BPT	BT	BLL	DS	Other
Bay of Plenty	1	49	18	31	1
Hauraki Gulf	0	38	34	24	4
East Northland	14	21	52	11	2

* BPT, pair trawl; BT, single trawl; BLL, longline; DS, Danish seine.

† 2007–08 represents 01/10/07 to 31/08/08 only.

Table 2: Summary of the catch (total number and weight of landings) and samples (number of landings and weight sampled, and number of fish sampled for otoliths) in method–season strata for the Bay of Plenty snapper fisheries from spring 2007 to winter 2008.*

		Number of landings			No. of fish	Weight of landings (t)		
Method	Season	Total	Sampled	% of total	sampled	Total	Sampled	% of total
BLL	Spring	133	10	7.5	197	34	3	8.8
	Summer	218	10	4.6	215	54	4	7.4
	Autumn	179	10	5.6	215	57	3	5.3
	Winter	214	10	4.7	212	81	4	4.9
BT	Spring	53	0	0	0	88	0	0
	Summer	97	0	0	0	177	0	0
	Autumn	115	0	0	0	198	0	0
	Winter	92	0	0	0	148	0	0
DS	Spring	36	0	0	0	76	0	0
	Summer	39	0	0	0	71	0	0
	Autumn	49	0	0	0	99	0	0
	Winter	59	0	0	0	138	0	0

* BLL, longline; BT, single trawl; DS, Danish seine.

Table 3: Summary of the catch (total number and weight of landings) and samples (number of landings and weight sampled, and number of fish sampled for otoliths) in method–season strata for the Hauraki Gulf snapper fisheries from spring 2007 to winter 2008.*

		Number of landings			No. of fish	Weight of landings (t)		
Method	Season	Total	Sampled	% of total	sampled	Total	Sampled	% of total
BLL	Spring	307	11	3.6	271	180	9	5.0
	Summer	329	10	3.0	269	191	10	5.2
	Autumn	294	11	3.7	257	156	7	4.5
	Winter	197	10	5.1	235	90	7	7.8
BT	Spring	85	0	0	0	191	0	0
	Summer	93	0	0	0	227	0	0
	Autumn	68	0	0	0	149	0	0
	Winter	51	0	0	0	113	0	0
DS	Spring	63	0	0	0	117	0	0
	Summer	91	0	0	0	166	0	0
	Autumn	73	0	0	0	65	0	0
	Winter	79	0	0	0	85	0	0

* BLL, longline; BT, single trawl; DS, Danish seine.

Table 4: Summary of the catch (total number and weight of landings) and samples (number of landings and weight sampled, and number of fish sampled for otoliths) in method–season strata for the East Northland snapper fisheries from spring 2007 to winter 2008.* Data presented for statistical areas 002, 003, and both combined.

		Number of landings			No. of fish	Weight of landings (t)		
Method	Season	Total	Sampled	% of total	sampled	Total	Sampled	% of total
BLL (002)	Spring	173	6	3.5	130	73	3	4.1
	Summer	262	7	2.7	176	110	5	4.5
	Autumn	234	7	3.0	145	76	3	3.9
	Winter	153	5	3.3	101	57	3	5.3
BLL (003)	Spring	91	5	5.5	120	33	3	9.1
	Summer	87	4	4.6	94	38	2	5.3
	Autumn	126	4	3.2	76	63	2	3.2
	Winter	130	6	4.6	153	74	6	8.1
BLL (comb.)	Spring	262	11	4.2	250	106	6	5.7
	Summer	352	11	3.1	270	148	7	4.7
	Autumn	360	11	3.1	221	140	5	3.6
	Winter	287	11	3.8	254	133	10	7.5

* BLL, longline.

Table 5: Details of snapper otolith samples collected in 2007–08 from the stocks in SNA 1.* ENLD data presented for statistical areas 002, 003, and both combined.

Area	Fishing method †	Sampling period	Sample method ††	Length range (cm)	No. aged
BPLE	BLL	Spring-winter	R	23–65	839
HAGU	BLL	Spring-winter	R	24–79	1 032
ENLD (002)	BLL	Spring-winter	R	25–66	552
ENLD (003)	BLL	Spring-winter	R	25–64	443
ENLD (comb.)	BLL	Spring-winter	R	25–66	995

* BPLE, Bay of Plenty; HAGU, Hauraki Gulf; ENLD, East Northland.
† BLL, longline.
†† R, random sample.

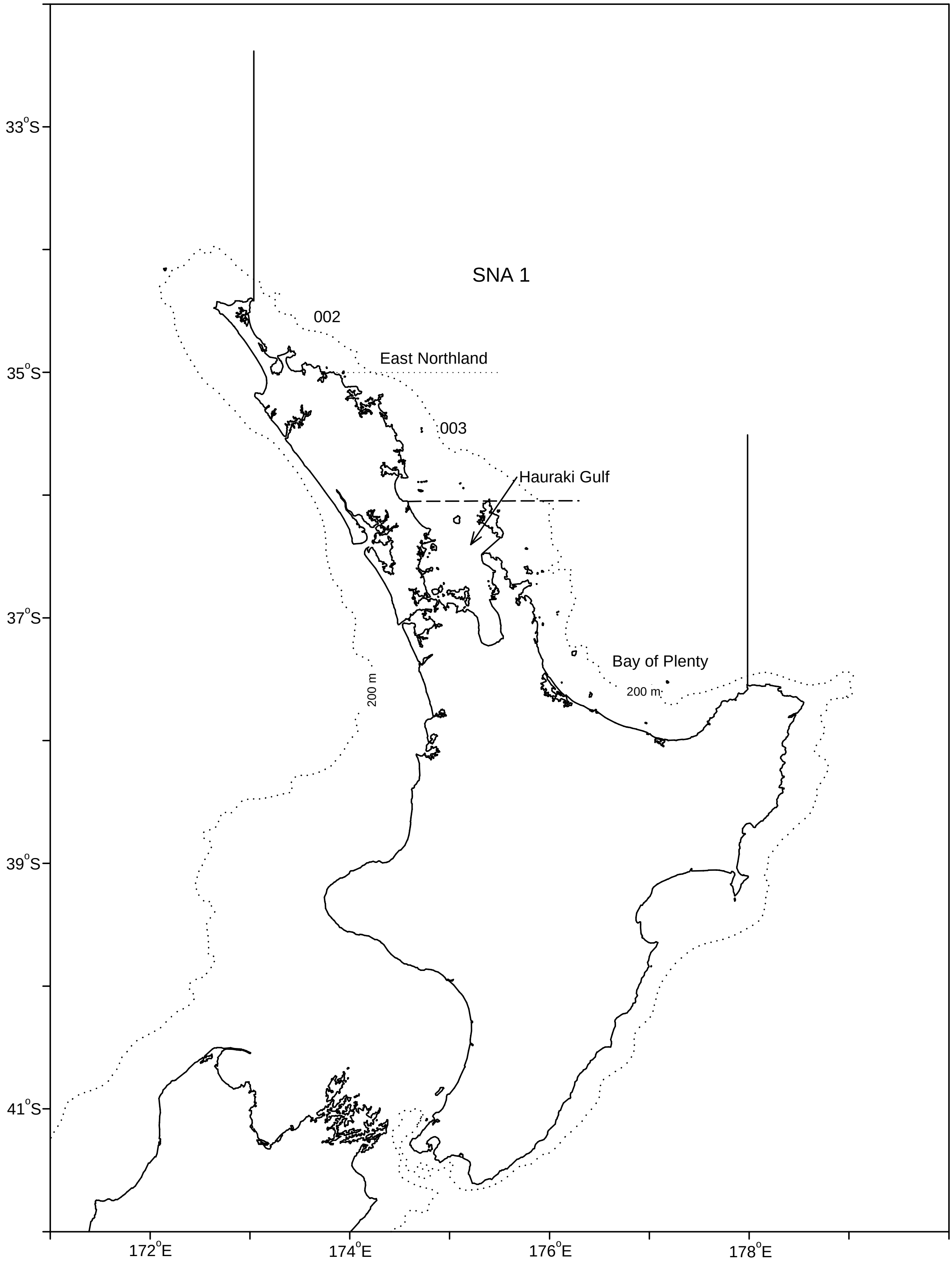


Figure 1: Quota management area for the east coast North Island snapper stock, SNA 1, and the range of the three SNA 1 substocks; East Northland, Hauraki Gulf, and Bay of Plenty.

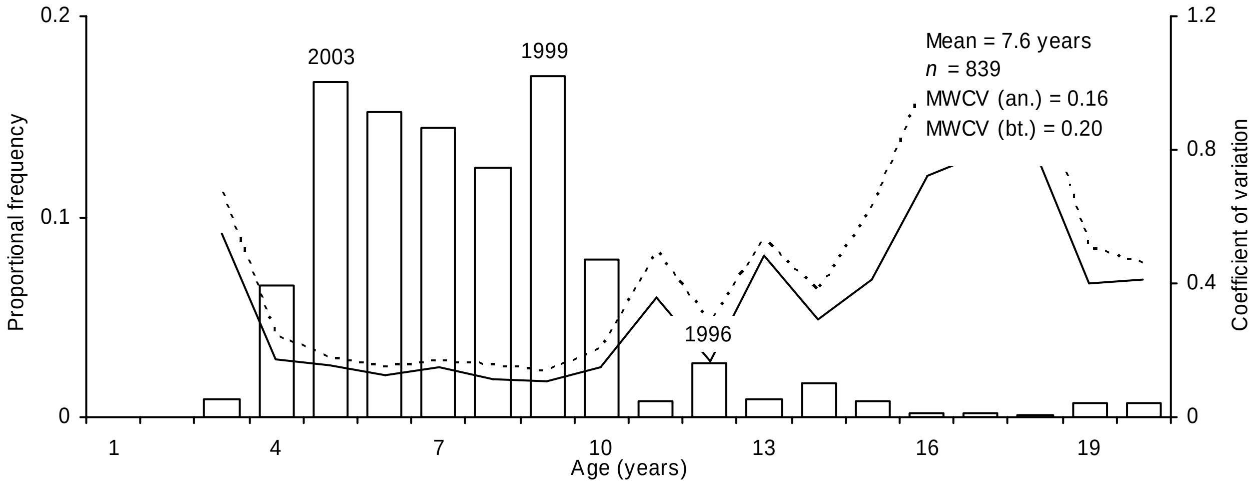


Figure 2: Proportion at age distribution (histogram) and analytical (solid line) and bootstrap (dashed line) c.v.s determined from snapper landings sampled from the Bay of Plenty longline fishery in 2007–08 using the random age frequency approach (*n*, otolith sample size; MWCV, mean weighted c.v.).

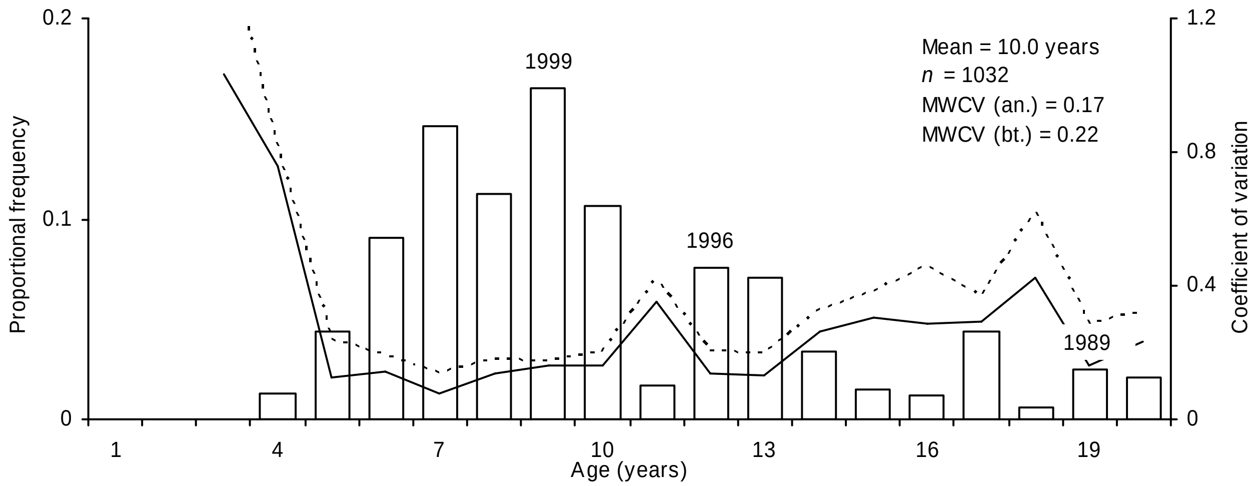


Figure 3: Proportion at age distribution (histogram) and analytical (solid line) and bootstrap (dashed line) c.v.s determined from snapper landings sampled from the Hauraki Gulf longline fishery in 2007–08 using the random age frequency approach (*n*, otolith sample size; MWCV, mean weighted c.v.).

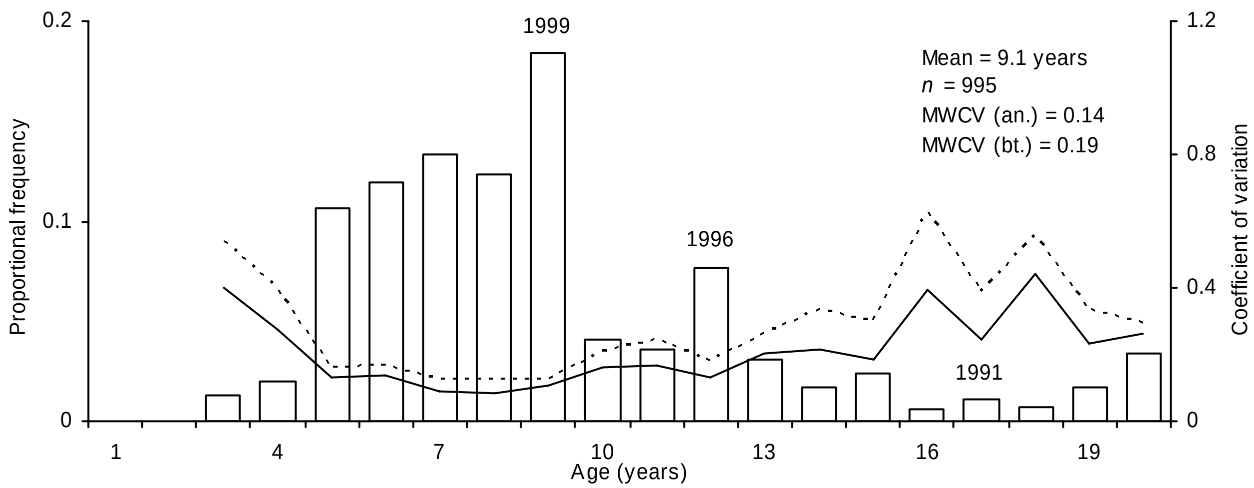


Figure 4: Proportion at age distribution (histogram) and analytical (solid line) and bootstrap (dashed line) c.v.s determined from snapper landings sampled from the East Northland longline fishery in 2007–08 using the random age frequency approach (*n*, otolith sample size; MWCV, mean weighted c.v.).

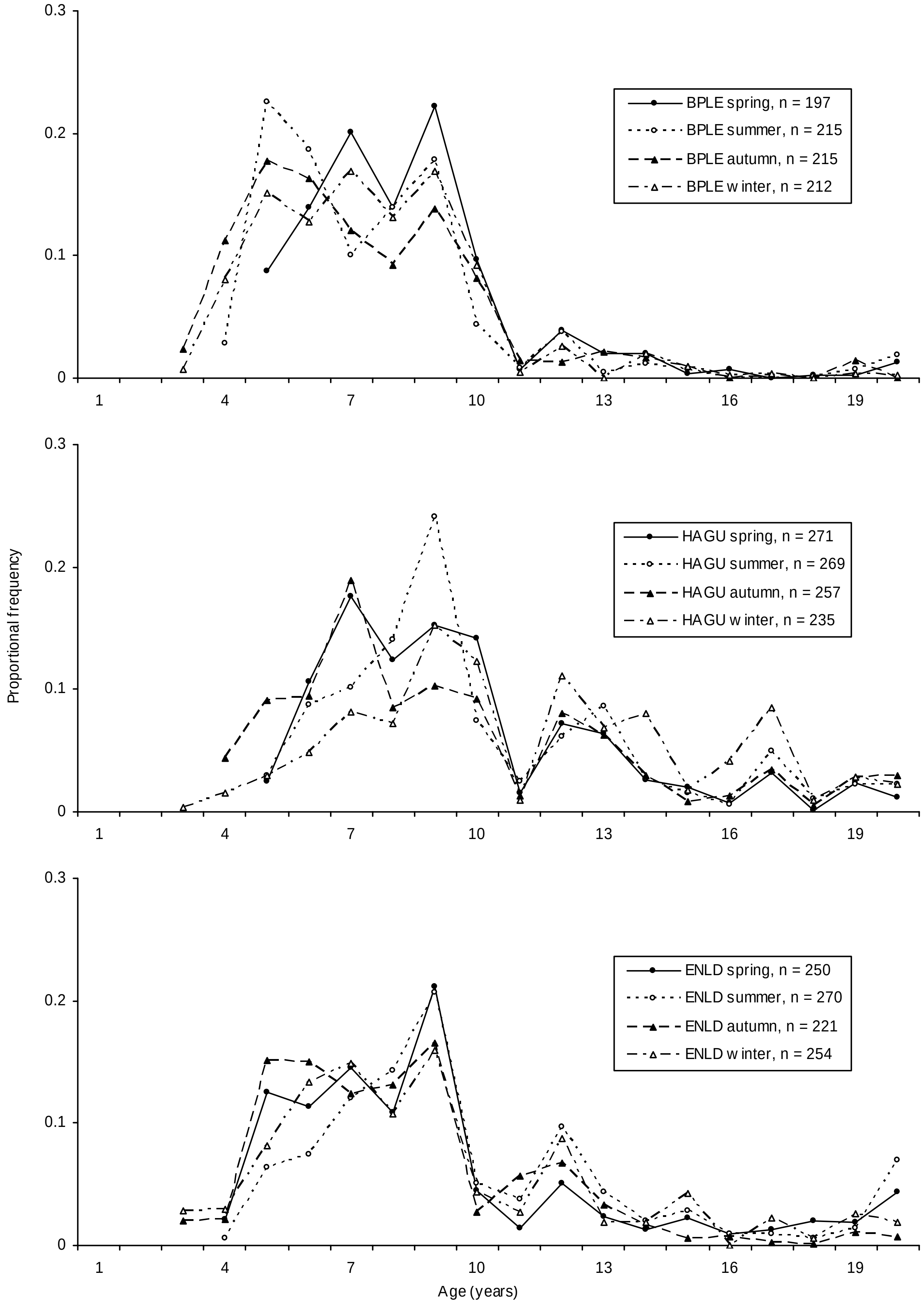


Figure 5: Proportion at age distributions determined from snapper landings sampled over four seasons from the Bay of Plenty (BPLE), Hauraki Gulf (HAGU), and East Northland (ENLD) longline fisheries in 2007–08 (*n*, sample size).

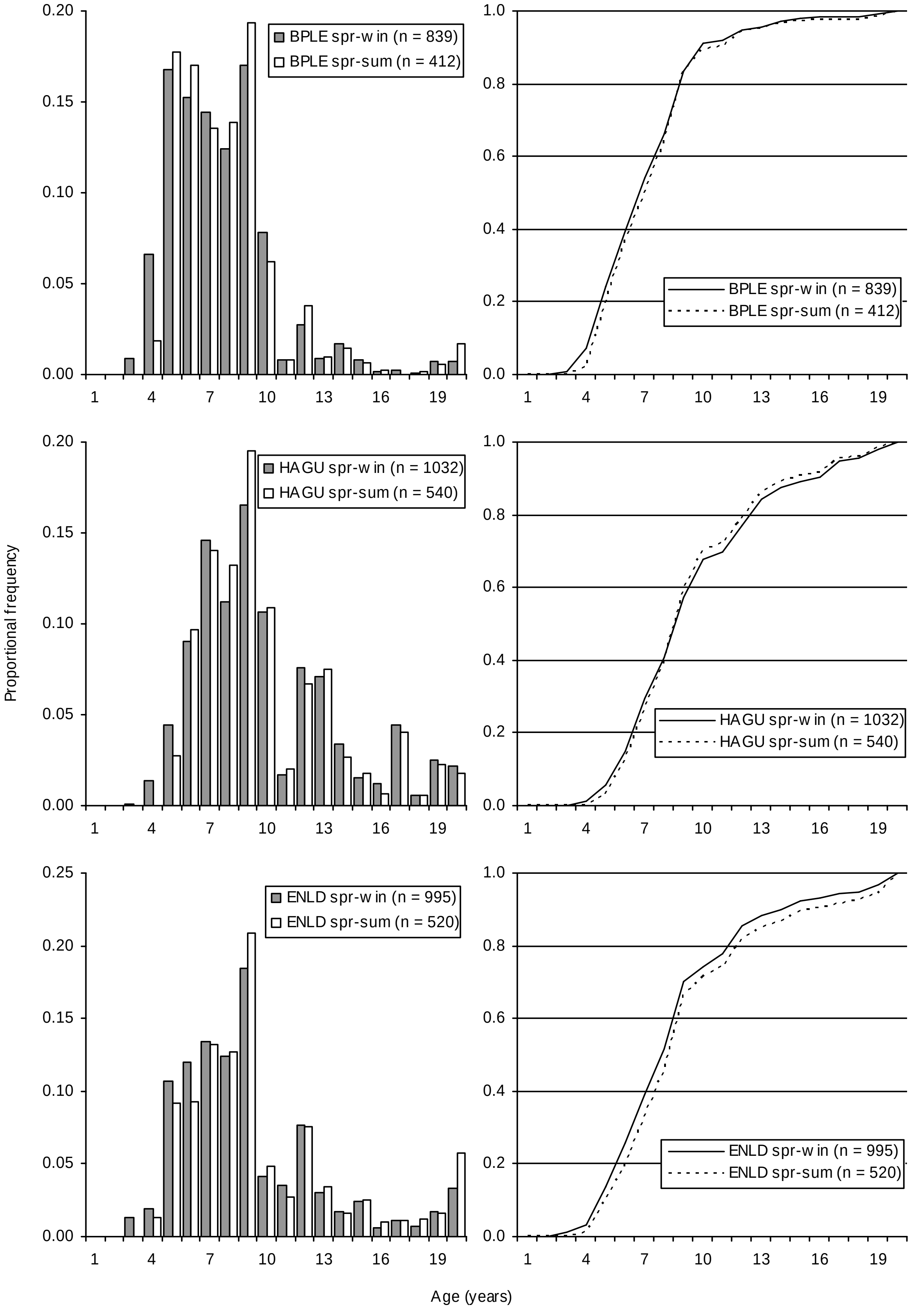


Figure 6: Comparison of the proportion and cumulative proportion at age distributions determined from snapper landings sampled over the spring and summer combined, and year-round seasons from the Bay of Plenty (BPLE), Hauraki Gulf (HAGU), and East Northland (ENLD) longline fisheries in 2007–08 (*n*, sample size).
Note: y-axis scales on proportion at age distributions are not equivalent.

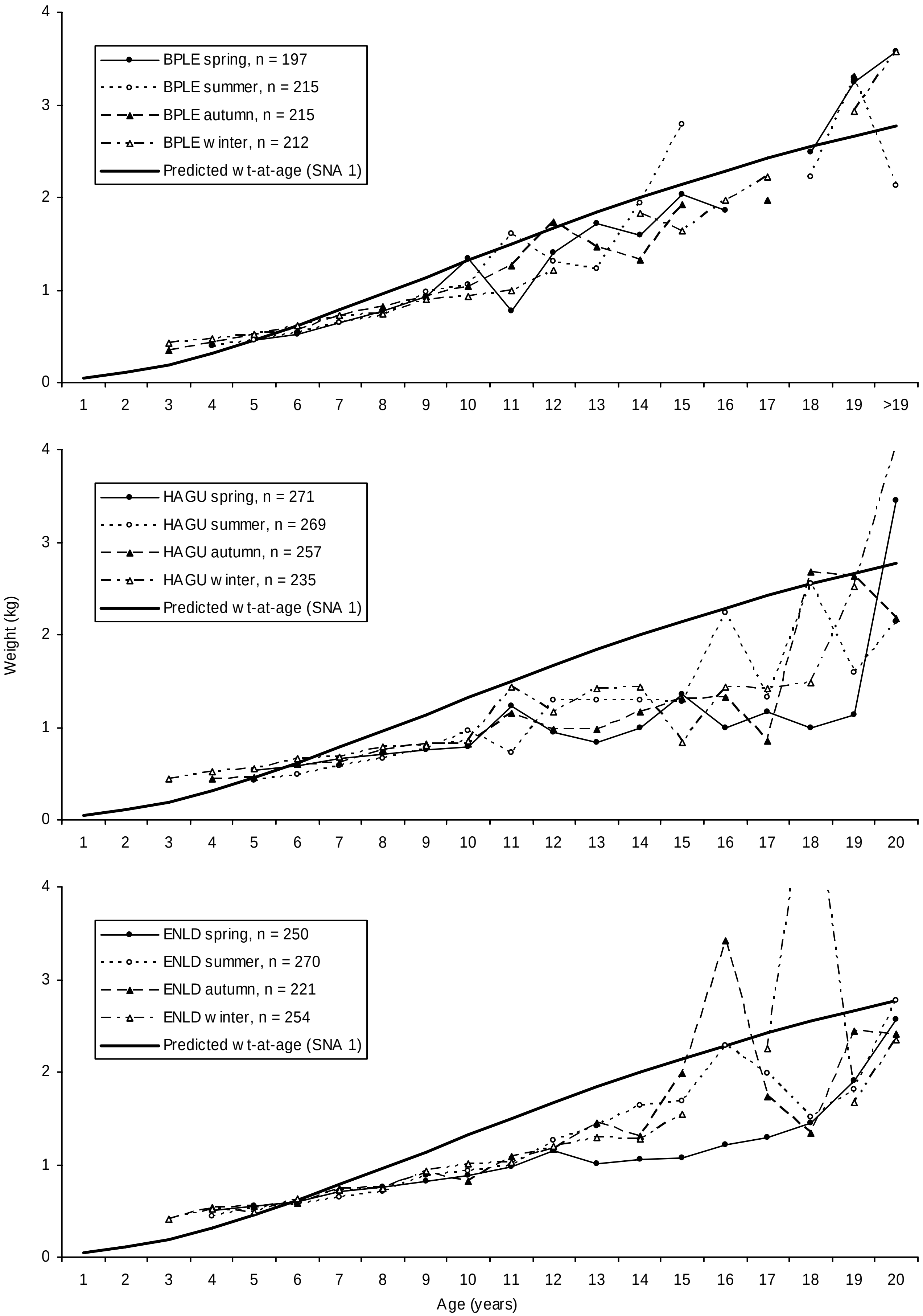
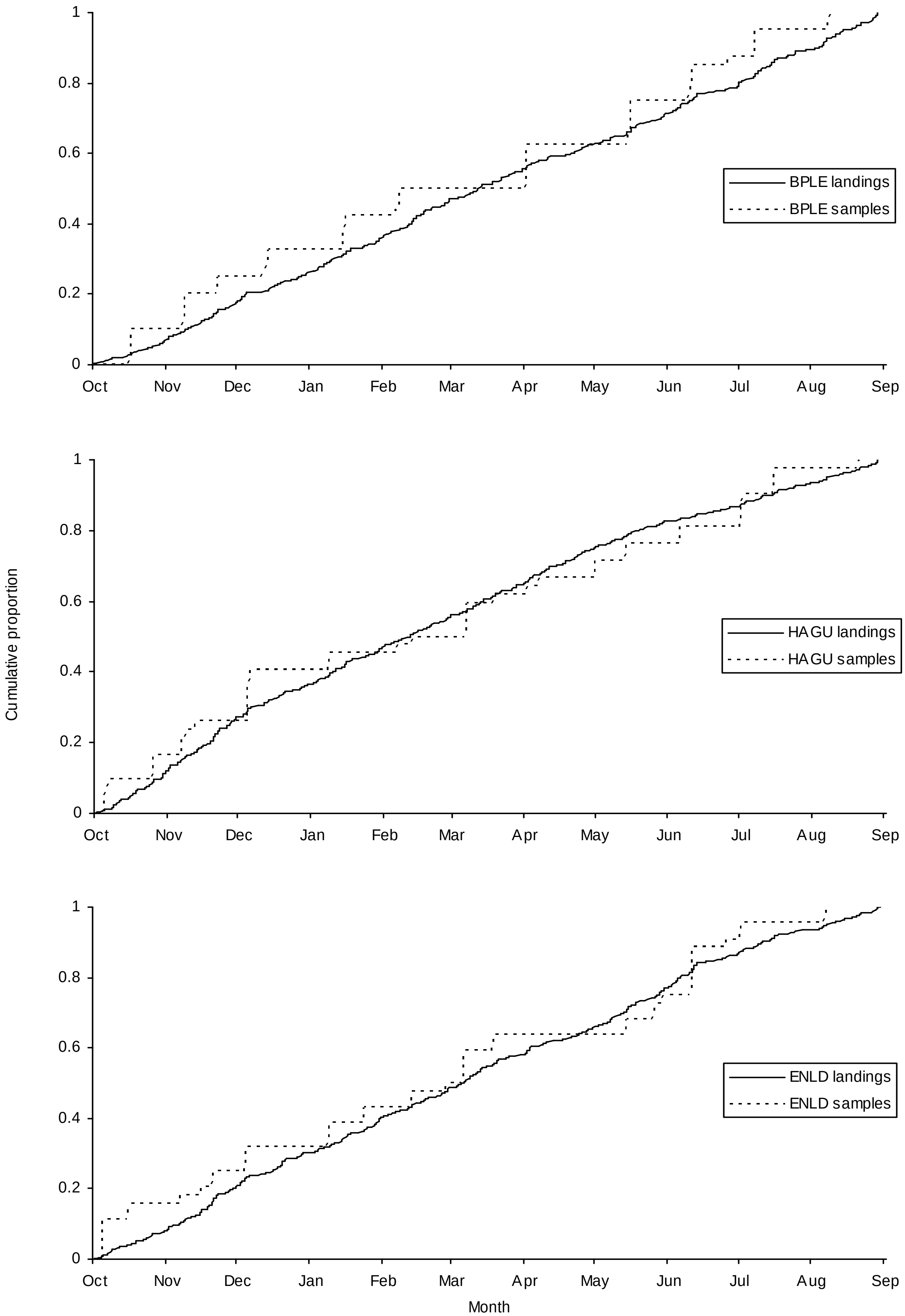
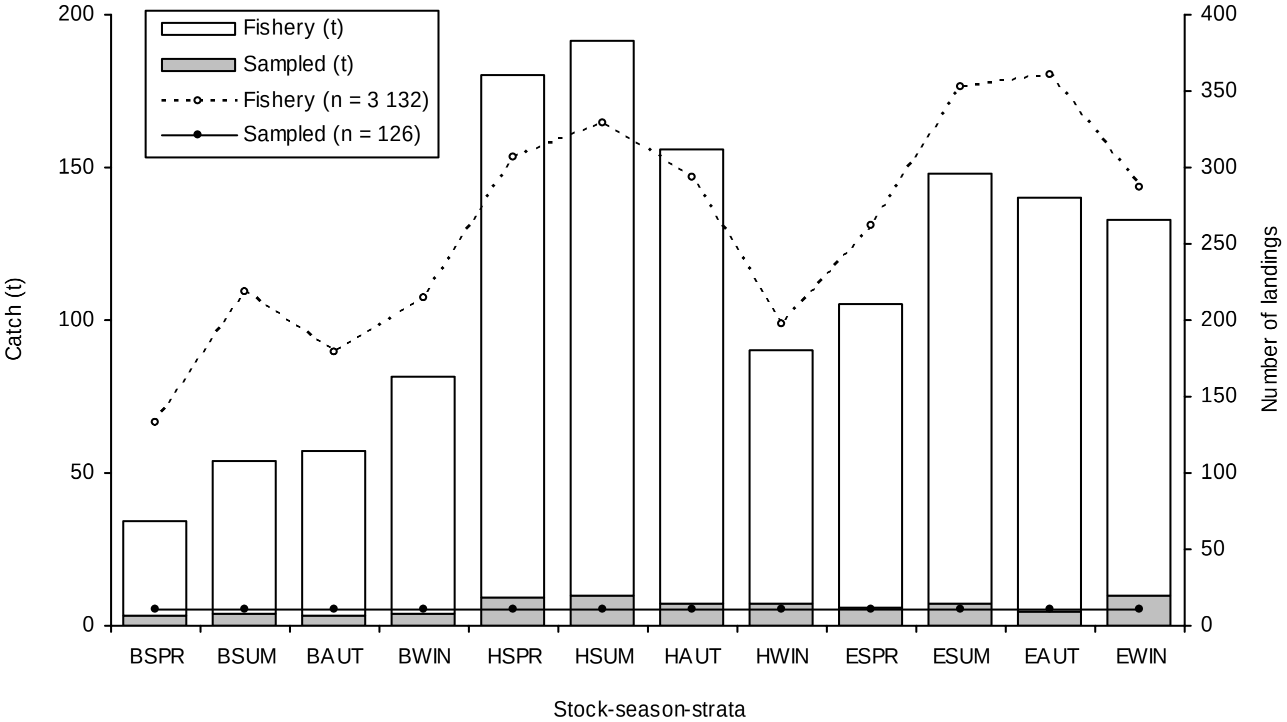


Figure 7: Observed and predicted mean weight-at-age estimates from snapper landings sampled over four seasons from the Bay of Plenty (BPLE), Hauraki Gulf (HAGU), and East Northland (ENLD) longline fisheries in 2007–08 (*n*, sample size). Note: Predicted estimates are based on published growth (Gilbert & Sullivan 1994) and length-weight (Paul 1976) parameters.

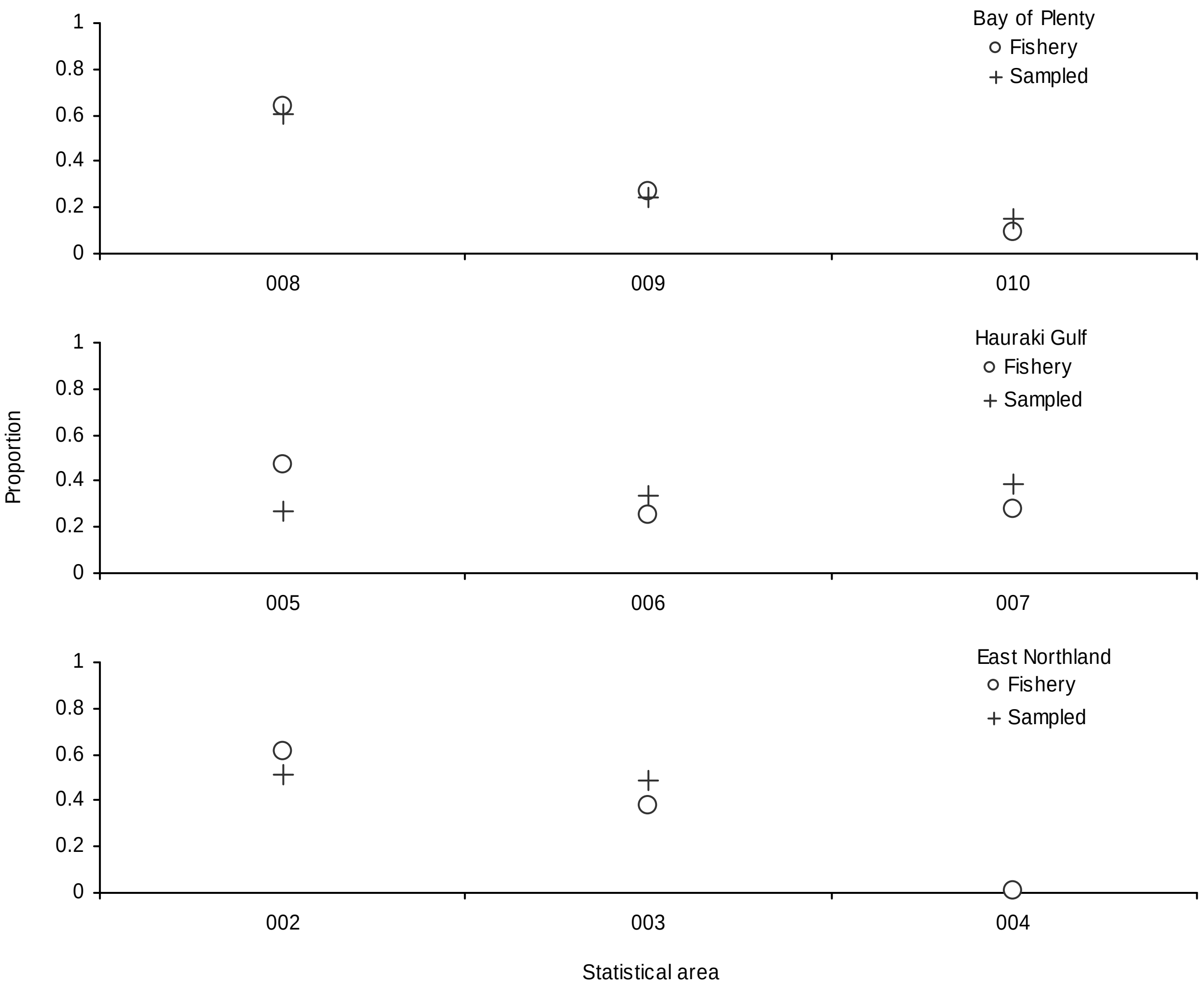
Appendix 1a: The cumulative proportion of the number of landings and samples taken from the Bay of Plenty (BPLE), Hauraki Gulf (HAGU), and East Northland (ENLD) longline fisheries in 2007–08.



Appendix 1b: Comparison of the seasonal distribution of landed weight (histograms) and numbers of landings (lines) of snapper in the SNA 1 longline fisheries over the sampling period in 2007–08 (Note: BSPR = Bay of Plenty spring; HSPR = Hauraki Gulf spring; ESPR = East Northland spring etc).



Appendix 1c: Comparison of the proportional distribution of the estimated longline catch and the sampled component by statistical area over the sampling period for the SNA 1 stocks in 2007–08.



Appendix 2: Estimated seasonal proportion at age and c.v.s for snapper fisheries in SNA 1 in 2007–08.
P.j., proportion of fish in age class; c.v., coefficient of variation; *n*, total number of fish aged.

Estimates of proportion at age with coefficients of variation (analytical and bootstrap estimates) for snapper from the Bay of Plenty longline fishery in 2007–08.

									Random age frequency Longline		
Age	Spring		Summer		Autumn		Winter		Spr-win		
(years)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	c.v. (bt)
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
2	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
3	0.0000	0.00	0.0000	0.00	0.0234	0.63	0.0072	1.08	0.0087	0.55	0.67
4	0.0000	0.00	0.0287	0.46	0.1125	0.28	0.0807	0.23	0.0658	0.17	0.24
5	0.0877	0.46	0.2260	0.30	0.1772	0.16	0.1507	0.31	0.1676	0.15	0.18
6	0.1394	0.18	0.1864	0.17	0.1634	0.19	0.1273	0.33	0.1526	0.13	0.15
7	0.2003	0.18	0.1005	0.18	0.1209	0.19	0.1694	0.32	0.1441	0.15	0.17
8	0.1389	0.28	0.1389	0.17	0.0924	0.21	0.1314	0.22	0.1242	0.11	0.16
9	0.2216	0.26	0.1789	0.21	0.1376	0.20	0.1695	0.20	0.1703	0.11	0.14
10	0.0969	0.12	0.0438	0.35	0.0815	0.25	0.0918	0.28	0.0782	0.15	0.20
11	0.0075	0.93	0.0080	0.67	0.0145	0.49	0.0042	1.07	0.0082	0.36	0.50
12	0.0390	0.24	0.0377	0.38	0.0131	0.51	0.0260	0.20	0.0272	0.17	0.28
13	0.0198	0.46	0.0042	0.81	0.0214	0.76	0.0000	0.00	0.0091	0.49	0.53
14	0.0201	0.37	0.0112	0.67	0.0160	0.61	0.0205	0.50	0.0170	0.29	0.37
15	0.0039	1.11	0.0075	0.75	0.0092	0.73	0.0092	0.71	0.0081	0.41	0.62
16	0.0075	0.93	0.0000	0.00	0.0000	0.00	0.0028	1.10	0.0020	0.72	1.01
17	0.0000	0.00	0.0000	0.00	0.0028	1.06	0.0036	1.08	0.0021	0.79	1.04
18	0.0020	1.11	0.0016	1.10	0.0000	0.00	0.0000	0.00	0.0006	0.79	1.02
19	0.0020	1.11	0.0074	0.82	0.0140	0.51	0.0040	1.06	0.0072	0.40	0.50
>19	0.0133	0.58	0.0191	0.56	0.0000	0.00	0.0018	1.12	0.0070	0.41	0.46
n	197		215		215		212		839		

Estimates of proportion at age with coefficients of variation (analytical and bootstrap estimates) for snapper from the Hauraki Gulf longline fishery in 2007–08.

									Random age frequency Longline		
Age	Spring		Summer		Autumn		Winter		Spr-win		
(years)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	c.v. (bt)
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
2	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
3	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0041	1.03	0.0005	1.03	1.46
4	0.0000	0.00	0.0000	0.00	0.0433	0.87	0.0156	0.83	0.0133	0.76	0.81
5	0.0252	0.21	0.0291	0.34	0.0904	0.17	0.0300	0.54	0.0443	0.13	0.24
6	0.1066	0.10	0.0871	0.28	0.0939	0.40	0.0484	0.49	0.0906	0.14	0.19
7	0.1766	0.15	0.1018	0.06	0.1886	0.14	0.0813	0.38	0.1463	0.08	0.13
8	0.1237	0.20	0.1410	0.27	0.0846	0.21	0.0720	0.50	0.1124	0.14	0.18
9	0.1523	0.15	0.2411	0.31	0.1024	0.45	0.1521	0.18	0.1655	0.16	0.17
10	0.1419	0.28	0.0745	0.31	0.0925	0.22	0.1227	0.46	0.1064	0.16	0.20
11	0.0159	0.64	0.0245	0.53	0.0133	0.86	0.0093	0.70	0.0170	0.35	0.42
12	0.0719	0.21	0.0619	0.29	0.0806	0.31	0.1116	0.28	0.0759	0.14	0.20
13	0.0638	0.15	0.0867	0.22	0.0623	0.37	0.0683	0.37	0.0708	0.13	0.20
14	0.0262	0.78	0.0273	0.47	0.0291	0.40	0.0802	0.38	0.0337	0.26	0.33
15	0.0206	0.56	0.0149	0.32	0.0085	0.91	0.0181	0.74	0.0154	0.31	0.38
16	0.0069	1.07	0.0056	0.83	0.0124	0.53	0.0414	0.23	0.0120	0.29	0.46
17	0.0315	0.30	0.0493	0.74	0.0348	0.59	0.0848	0.34	0.0440	0.29	0.37
18	0.0013	1.13	0.0102	0.66	0.0050	0.88	0.0089	0.72	0.0058	0.43	0.62
19	0.0234	0.19	0.0219	0.48	0.0283	0.24	0.0289	0.36	0.0249	0.16	0.29
>19	0.0124	0.64	0.0230	0.50	0.0299	0.32	0.0224	0.32	0.0214	0.24	0.32
n	271		269		257		235		1032		

Appendix 2 – continued:
Estimates of proportion at age with coefficients of variation (analytical and bootstrap estimates) for snapper from the East Northland longline fishery in 2007–08.

Random age frequency
Longline

Age	Spring		Summer		Autumn		Winter		Spr-win		
(years)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	c.v. (bt)
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
2	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
3	0.0000	0.00	0.0000	0.00	0.0197	0.77	0.0285	0.37	0.0128	0.40	0.53
4	0.0218	0.46	0.0065	0.78	0.0212	0.59	0.0295	0.43	0.0196	0.27	0.39
5	0.1258	0.21	0.0633	0.30	0.1514	0.22	0.0815	0.33	0.1066	0.13	0.16
6	0.1134	0.26	0.0749	0.29	0.1503	0.30	0.1338	0.18	0.1195	0.14	0.16
7	0.1454	0.21	0.1204	0.14	0.1237	0.20	0.1487	0.14	0.1336	0.09	0.12
8	0.1081	0.20	0.1433	0.16	0.1317	0.10	0.1072	0.22	0.1237	0.08	0.13
9	0.2120	0.16	0.2062	0.28	0.1657	0.22	0.1593	0.12	0.1841	0.11	0.12
10	0.0450	0.21	0.0510	0.24	0.0277	0.55	0.0441	0.29	0.0412	0.16	0.21
11	0.0137	0.24	0.0381	0.20	0.0565	0.32	0.0272	0.31	0.0357	0.17	0.24
12	0.0506	0.20	0.0969	0.15	0.0673	0.32	0.0879	0.31	0.0763	0.13	0.18
13	0.0235	0.33	0.0439	0.41	0.0336	0.36	0.0190	0.35	0.0305	0.20	0.27
14	0.0127	0.57	0.0199	0.38	0.0161	0.47	0.0187	0.36	0.0169	0.22	0.34
15	0.0228	0.31	0.0280	0.34	0.0060	0.74	0.0426	0.31	0.0241	0.19	0.30
16	0.0099	0.71	0.0097	0.59	0.0066	0.77	0.0000	0.00	0.0064	0.39	0.63
17	0.0134	0.54	0.0090	0.69	0.0029	0.89	0.0221	0.28	0.0114	0.24	0.39
18	0.0197	0.69	0.0054	0.58	0.0014	1.17	0.0057	0.83	0.0073	0.44	0.55
19	0.0186	0.41	0.0140	0.60	0.0110	0.69	0.0256	0.30	0.0170	0.23	0.33
>19	0.0435	0.35	0.0696	0.45	0.0074	0.71	0.0187	0.40	0.0334	0.26	0.29
n	250		270		221		254		995		

Estimates of proportion at age with coefficients of variation (analytical and bootstrap estimates) for snapper from the East Northland longline fishery (statistical area 002) in 2007–08.

Random age frequency
Longline

Age	Spring		Summer		Autumn		Winter		Spr-win		
(years)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	c.v. (bt)
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
2	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
3	0.0000	0.00	0.0000	0.00	0.0374	0.77	0.0479	0.48	0.0177	0.48	0.65
4	0.0303	0.46	0.0087	0.78	0.0249	0.77	0.0291	1.03	0.0219	0.38	0.49
5	0.1744	0.21	0.0856	0.30	0.1902	0.26	0.0884	0.63	0.1362	0.15	0.18
6	0.1202	0.33	0.0728	0.27	0.0863	0.39	0.1172	0.47	0.0958	0.18	0.22
7	0.1496	0.28	0.1228	0.10	0.1085	0.43	0.1219	0.26	0.1258	0.14	0.18
8	0.1055	0.22	0.1707	0.18	0.1573	0.07	0.0939	0.47	0.1377	0.10	0.16
9	0.2163	0.20	0.2173	0.35	0.1749	0.37	0.1899	0.10	0.2015	0.16	0.17
10	0.0103	0.90	0.0138	0.84	0.0192	0.65	0.0181	0.70	0.0150	0.39	0.50
11	0.0000	0.00	0.0280	0.17	0.0381	0.35	0.0468	0.37	0.0266	0.18	0.35
12	0.0413	0.31	0.0929	0.19	0.0861	0.41	0.0821	0.68	0.0761	0.19	0.25
13	0.0103	0.90	0.0454	0.49	0.0267	0.61	0.0240	0.48	0.0279	0.31	0.39
14	0.0155	0.63	0.0163	0.48	0.0054	0.89	0.0084	1.07	0.0119	0.34	0.51
15	0.0267	0.33	0.0263	0.47	0.0060	0.88	0.0582	0.44	0.0264	0.24	0.37
16	0.0103	0.90	0.0131	0.59	0.0125	0.77	0.0000	0.00	0.0100	0.42	0.66
17	0.0103	0.90	0.0083	0.90	0.0054	0.89	0.0142	0.83	0.0090	0.45	0.60
18	0.0205	0.90	0.0000	0.00	0.0026	1.17	0.0142	0.83	0.0083	0.62	0.79
19	0.0165	0.60	0.0190	0.60	0.0098	0.93	0.0315	0.40	0.0180	0.30	0.42
>19	0.0421	0.42	0.0591	0.64	0.0088	0.88	0.0142	0.83	0.0341	0.38	0.42
n	130		176		145		101		552		

Appendix 2 – continued:
Estimates of proportion at age with coefficients of variation (analytical and bootstrap estimates) for snapper from the East Northland longline fishery (statistical area 003) in 2007–08.

									Random age frequency		
									Longline		
Age	Spring		Summer		Autumn		Winter		Spr-win		
(years)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	c.v. (bt)
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
2	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
3	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0156	0.51	0.0056	0.51	0.94
4	0.0000	0.00	0.0000	0.00	0.0170	0.90	0.0297	0.21	0.0164	0.34	0.61
5	0.0000	0.00	0.0000	0.00	0.1082	0.40	0.0768	0.31	0.0642	0.26	0.35
6	0.0958	0.26	0.0810	0.79	0.2216	0.39	0.1449	0.12	0.1536	0.21	0.24
7	0.1343	0.23	0.1136	0.46	0.1407	0.06	0.1666	0.16	0.1448	0.10	0.17
8	0.1149	0.42	0.0655	0.39	0.1031	0.25	0.1161	0.22	0.1034	0.14	0.21
9	0.2006	0.25	0.1747	0.24	0.1554	0.16	0.1390	0.21	0.1591	0.11	0.15
10	0.1350	0.17	0.1566	0.21	0.0370	0.79	0.0615	0.32	0.0790	0.17	0.21
11	0.0493	0.24	0.0668	0.39	0.0771	0.46	0.0141	0.57	0.0488	0.27	0.34
12	0.0747	0.22	0.1083	0.20	0.0463	0.51	0.0917	0.29	0.0766	0.17	0.25
13	0.0578	0.26	0.0396	0.70	0.0413	0.44	0.0156	0.51	0.0341	0.24	0.37
14	0.0053	1.15	0.0300	0.63	0.0279	0.54	0.0255	0.37	0.0242	0.28	0.43
15	0.0128	0.79	0.0329	0.32	0.0060	1.22	0.0322	0.44	0.0207	0.29	0.44
16	0.0088	0.87	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0013	0.87	1.05
17	0.0216	0.47	0.0110	0.98	0.0000	0.00	0.0273	0.24	0.0147	0.22	0.48
18	0.0176	0.65	0.0205	0.58	0.0000	0.00	0.0000	0.00	0.0058	0.43	0.64
19	0.0242	0.41	0.0000	0.00	0.0124	1.01	0.0216	0.45	0.0154	0.37	0.54
>19	0.0473	0.60	0.0994	0.52	0.0060	1.22	0.0216	0.45	0.0325	0.31	0.36
n	120		94		76		153		443		

Appendix 3: Estimated mean weight-at-age (kg) and c.v.s for snapper fisheries in SNA 1 in 2007–08.
c.v., coefficient of variation.

Estimates of mean weight-at-age (kg) with coefficients of variation (bootstrap estimates) for snapper from the Bay of Plenty longline fishery in 2007–08.

Age	Spring		Summer		Autumn		Winter		Spr-win	
(years)	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.
1	–	–	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–	–	–
3	–	–	–	–	0.35	0.44	0.42	0.82	0.39	0.48
4	–	–	0.40	0.33	0.43	0.06	0.48	0.07	0.44	0.08
5	0.46	0.13	0.45	0.04	0.52	0.05	0.52	0.04	0.50	0.03
6	0.53	0.04	0.54	0.05	0.57	0.05	0.62	0.06	0.57	0.03
7	0.65	0.07	0.64	0.04	0.72	0.07	0.72	0.08	0.69	0.04
8	0.78	0.09	0.72	0.05	0.82	0.07	0.73	0.07	0.76	0.03
9	0.93	0.10	0.98	0.07	0.93	0.08	0.90	0.06	0.93	0.04
10	1.33	0.08	1.06	0.20	1.04	0.08	0.92	0.07	1.04	0.06
11	0.78	1.04	1.60	0.52	1.26	0.28	0.99	1.01	1.18	0.31
12	1.40	0.27	1.30	0.13	1.73	0.33	1.22	0.18	1.39	0.13
13	1.71	0.32	1.22	0.68	1.46	0.31	–	–	1.42	0.26
14	1.60	0.25	1.94	0.36	1.32	0.34	1.83	0.26	1.69	0.16
15	2.03	0.81	2.79	0.63	1.92	0.59	1.63	1.06	2.04	0.39
16	1.85	1.06	–	–	–	–	1.97	1.05	1.94	0.84
17	–	–	–	–	1.97	1.06	2.22	1.08	2.11	0.76
18	2.48	1.03	2.22	0.99	–	–	–	–	2.31	0.74
19	3.24	1.02	3.30	0.61	3.31	0.39	2.92	1.00	3.16	0.37
>19	3.58	0.59	2.13	0.31	–	–	3.58	1.07	3.11	0.48

Estimates of mean weight-at-age (kg) with coefficients of variation (bootstrap estimates) for snapper from the Hauraki Gulf longline fishery in 2007–08.

Age	Spring		Summer		Autumn		Winter		Spr-win	
(years)	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.
1	–	–	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–	–	–
3	–	–	–	–	–	–	0.44	1.03	0.44	1.04
4	–	–	–	–	0.45	0.15	0.51	0.47	0.47	0.18
5	0.54	0.18	0.43	0.32	0.46	0.08	0.55	0.15	0.49	0.10
6	0.58	0.05	0.49	0.09	0.59	0.03	0.66	0.13	0.57	0.04
7	0.66	0.10	0.59	0.07	0.62	0.05	0.67	0.05	0.63	0.04
8	0.71	0.08	0.67	0.10	0.76	0.10	0.79	0.07	0.72	0.05
9	0.75	0.12	0.77	0.11	0.82	0.05	0.80	0.10	0.78	0.05
10	0.78	0.11	0.96	0.12	0.81	0.09	0.85	0.15	0.85	0.06
11	1.23	0.40	0.72	0.40	1.15	0.52	1.44	0.39	1.08	0.22
12	0.94	0.17	1.29	0.15	0.98	0.10	1.17	0.22	1.08	0.08
13	0.84	0.22	1.30	0.19	0.97	0.26	1.42	0.26	1.08	0.11
14	0.99	0.23	1.29	0.32	1.16	0.25	1.43	0.18	1.18	0.14
15	1.36	0.25	1.28	0.40	1.31	0.44	0.83	0.67	1.26	0.19
16	0.99	0.92	2.23	0.59	1.33	0.78	1.44	0.21	1.50	0.36
17	1.17	0.26	1.32	0.36	0.85	0.51	1.41	0.25	1.16	0.17
18	0.99	1.03	2.55	0.64	2.68	0.68	1.48	0.78	1.96	0.38
19	1.14	0.52	1.59	0.31	2.64	0.30	2.52	0.58	1.83	0.20
>19	3.46	0.37	2.13	0.43	2.17	0.28	4.05	0.25	2.79	0.19

Appendix 3 – continued:

Estimates of mean weight-at-age (kg) with coefficients of variation (bootstrap estimates) for snapper from the East Northland longline fishery in 2007–08.

Age	Spring		Summer		Autumn		Winter		Spr-win	
(years)	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.
1	–	–	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–	–	–
3	–	–	–	–	0.42	0.74	0.41	0.35	0.41	0.34
4	0.50	0.28	0.44	0.55	0.53	0.61	0.52	0.27	0.51	0.22
5	0.54	0.07	0.53	0.10	0.55	0.08	0.49	0.09	0.53	0.04
6	0.60	0.05	0.57	0.10	0.59	0.09	0.63	0.07	0.60	0.04
7	0.71	0.09	0.64	0.05	0.74	0.09	0.72	0.08	0.70	0.04
8	0.76	0.08	0.72	0.08	0.76	0.06	0.75	0.09	0.74	0.04
9	0.82	0.06	0.89	0.06	0.92	0.07	0.94	0.09	0.89	0.04
10	0.89	0.54	0.93	0.34	0.82	0.33	1.00	0.28	0.90	0.17
11	0.98	0.22	1.00	0.12	1.08	0.17	1.03	0.32	1.03	0.12
12	1.16	0.20	1.26	0.07	1.16	0.17	1.20	0.15	1.19	0.07
13	1.00	0.45	1.42	0.27	1.45	0.26	1.30	0.47	1.31	0.17
14	1.06	0.53	1.64	0.30	1.30	0.43	1.28	0.36	1.33	0.19
15	1.07	0.33	1.69	0.24	1.98	0.61	1.55	0.28	1.61	0.20
16	1.21	0.57	2.28	0.56	3.41	1.03	–	–	2.19	0.47
17	1.30	0.61	1.99	0.44	1.73	0.73	2.25	0.44	1.85	0.27
18	1.45	0.51	1.51	0.62	1.33	1.00	5.40	1.00	2.15	0.48
19	1.90	0.44	1.81	0.37	2.45	0.44	1.66	0.33	1.99	0.20
>19	2.56	0.19	2.77	0.22	2.40	0.46	2.35	0.45	2.52	0.18

Estimates of mean weight-at-age (kg) with coefficients of variation (bootstrap estimates) for snapper from the East Northland (statistical area 002) longline fishery in 2007–08.

Age	Spring		Summer		Autumn		Winter		Spr-win	
(years)	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.
1	–	–	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–	–	–
3	–	–	–	–	0.42	0.74	0.42	0.38	0.42	0.44
4	0.50	0.29	0.44	0.57	0.52	0.78	0.50	0.77	0.49	0.27
5	0.54	0.07	0.53	0.08	0.54	0.08	0.54	0.16	0.54	0.04
6	0.60	0.06	0.59	0.08	0.61	0.11	0.64	0.12	0.61	0.05
7	0.73	0.12	0.66	0.06	0.79	0.12	0.67	0.11	0.71	0.05
8	0.78	0.09	0.71	0.07	0.89	0.09	0.77	0.17	0.79	0.05
9	0.86	0.07	0.92	0.07	0.98	0.10	0.91	0.11	0.92	0.05
10	0.85	1.08	0.97	0.44	0.75	0.21	1.07	0.62	0.90	0.27
11	–	–	1.05	0.14	0.98	0.33	1.41	0.27	1.11	0.14
12	1.12	0.27	1.30	0.08	1.20	0.25	1.26	0.21	1.22	0.10
13	0.85	1.07	1.54	0.29	1.71	0.38	1.25	0.64	1.36	0.23
14	0.99	0.66	1.73	0.39	0.91	0.62	0.92	1.01	1.19	0.29
15	1.00	0.33	1.73	0.29	1.40	0.58	1.62	0.34	1.44	0.20
16	0.99	1.04	2.28	0.55	3.41	1.03	–	–	2.24	0.51
17	1.33	1.00	1.95	0.48	1.73	0.74	2.77	1.01	1.87	0.37
18	1.20	0.82	–	–	1.33	1.00	5.40	1.00	2.27	0.63
19	1.75	0.65	1.81	0.37	2.65	0.51	2.16	0.34	2.08	0.24
>19	2.59	0.21	2.96	0.26	2.57	0.55	2.09	1.04	2.62	0.20

Appendix 3 – continued:
Estimates of mean weight-at-age (kg) with coefficients of variation (bootstrap estimates) for snapper from the East Northland (statistical area 003) longline fishery in 2007–08.

Age	Spring		Summer		Autumn		Winter		Spr-win	
(years)	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.
1	–	–	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–	–	–
3	–	–	–	–	–	–	0.40	0.55	0.40	0.56
4	–	–	–	–	0.54	0.96	0.54	0.23	0.54	0.36
5	–	–	–	–	0.56	0.15	0.45	0.13	0.50	0.10
6	0.62	0.12	0.51	0.37	0.56	0.16	0.62	0.09	0.58	0.07
7	0.65	0.11	0.59	0.09	0.67	0.11	0.75	0.11	0.69	0.06
8	0.71	0.16	0.72	0.23	0.61	0.07	0.73	0.09	0.69	0.06
9	0.72	0.09	0.78	0.13	0.85	0.10	0.95	0.14	0.86	0.06
10	0.99	0.14	0.81	0.09	0.90	0.57	0.95	0.28	0.92	0.21
11	0.98	0.19	0.84	0.17	1.19	0.16	0.78	0.60	0.96	0.19
12	1.24	0.16	1.14	0.18	1.13	0.27	1.16	0.16	1.16	0.11
13	1.40	0.25	1.07	0.57	1.16	0.28	1.33	0.62	1.24	0.27
14	1.24	0.96	1.38	0.50	1.74	0.57	1.51	0.32	1.53	0.27
15	1.24	1.01	1.58	0.35	2.63	0.98	1.50	0.37	1.86	0.38
16	1.77	0.50	–	–	–	–	–	–	1.77	0.51
17	1.21	0.43	2.09	0.97	–	–	1.90	0.39	1.80	0.31
18	2.09	0.56	1.51	0.66	–	–	–	–	1.79	0.43
19	2.27	0.39	–	–	2.22	1.00	1.33	0.53	1.85	0.41
>19	2.48	0.43	2.25	0.24	2.22	1.02	2.52	0.44	2.37	0.30

Appendix 4: Age-length keys derived from otolith samples collected from snapper fisheries in SNA 1 in 2007–08.

Estimates of proportion of length at age for snapper sampled from the Bay of Plenty, spring-winter 2007–08. (Note: Aged to 01/01/08)

Length	Age (years)																				No.
(cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	>19	aged
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
24	0	0	0	0.50	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
25	0	0	0.14	0.50	0.29	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
26	0	0	0.07	0.30	0.57	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
27	0	0	0.02	0.16	0.43	0.33	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	58
28	0	0	0	0.11	0.34	0.38	0.15	0.01	0	0.01	0	0	0	0	0	0	0	0	0	0	80
29	0	0	0	0	0.22	0.43	0.22	0.12	0.01	0	0	0	0	0	0	0	0	0	0	0	69
30	0	0	0	0.03	0.13	0.28	0.31	0.23	0.03	0	0	0	0	0	0	0	0	0	0	0	75
31	0	0	0	0	0.07	0.13	0.34	0.21	0.20	0.03	0.01	0	0	0	0	0	0	0	0	0	70
32	0	0	0	0	0	0.15	0.21	0.24	0.30	0.09	0	0	0	0	0	0	0	0	0	0	66
33	0	0	0	0	0.02	0.04	0.29	0.30	0.30	0.04	0.02	0	0	0	0	0	0	0	0	0	56
34	0	0	0	0	0.02	0.02	0.14	0.29	0.35	0.18	0	0	0	0	0	0	0	0	0	0	49
35	0	0	0	0	0	0.03	0.13	0.20	0.43	0.18	0	0.03	0.03	0	0	0	0	0	0	0	40
36	0	0	0	0	0.03	0.06	0.06	0.08	0.50	0.17	0.03	0.06	0	0.03	0	0	0	0	0	0	36
37	0	0	0	0	0	0	0.03	0.06	0.35	0.26	0.06	0.13	0.06	0	0.03	0	0	0	0	0	31
38	0	0	0	0	0	0.04	0.04	0.18	0.46	0.11	0.04	0.11	0	0.04	0	0	0	0	0	0	28
39	0	0	0	0	0	0	0	0.09	0.27	0.27	0.05	0.09	0.09	0.14	0	0	0	0	0	0	22
40	0	0	0	0	0	0	0.13	0.06	0.44	0.06	0	0.13	0.06	0.06	0	0	0	0	0	0.06	16
41	0	0	0	0	0	0	0	0	0.42	0.17	0.08	0.17	0.08	0	0.08	0	0	0	0	0	12
42	0	0	0	0	0	0	0	0.07	0.29	0.36	0	0.07	0.07	0.14	0	0	0	0	0	0	14
43	0	0	0	0	0	0	0.07	0.07	0	0.21	0	0.21	0.07	0.29	0.07	0	0	0	0	0	14
44	0	0	0	0	0	0	0	0	0.25	0.13	0.13	0.13	0.25	0.13	0	0	0	0	0	0	8
45	0	0	0	0	0	0	0.08	0	0.17	0.08	0	0	0.08	0.17	0.08	0.08	0	0	0.25	0	12
46	0	0	0	0	0	0	0	0	0	0.13	0	0	0	0.13	0.13	0.13	0.13	0	0.13	0.25	8
47	0	0	0	0	0	0	0	0	0.25	0	0	0	0.25	0	0.25	0	0	0	0	0.25	4
48	0	0	0	0	0	0	0	0	0.13	0	0	0.13	0.13	0.13	0.13	0	0.13	0.13	0	0.13	8
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	1
51	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	0	0	1
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0.50	2
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.50	2
54	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	0	1
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0.50	0	2
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.67	0.33	3
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	1
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total																					839

Appendix 4 – continued:
Estimates of proportion of length at age for snapper sampled from the Hauraki Gulf, spring-winter 2007–08.
(Note: Aged to 01/01/08)

Length (cm)	Age (years) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	>19	No. aged
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	1
25	0	0	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
26	0	0	0	0.25	0.25	0.20	0.10	0.05	0.05	0	0	0.05	0.05	0	0	0	0	0	0	0	20
27	0	0	0.03	0.08	0.28	0.23	0.13	0.03	0.10	0.08	0	0.03	0.03	0	0	0	0	0	0	0	39
28	0	0	0	0.05	0.15	0.29	0.26	0.09	0.03	0.05	0	0.03	0.03	0.03	0	0	0	0	0	0	66
29	0	0	0	0.03	0.03	0.22	0.23	0.12	0.18	0.12	0.01	0.02	0	0.01	0	0.01	0	0	0	0	90
30	0	0	0	0	0.03	0.21	0.29	0.15	0.13	0.09	0.03	0	0.03	0	0	0	0.02	0	0	0	86
31	0	0	0	0.01	0.01	0.13	0.27	0.19	0.23	0.04	0	0.01	0.05	0	0.02	0.01	0.02	0	0	0	84
32	0	0	0	0	0	0.06	0.24	0.16	0.25	0.09	0	0.02	0.05	0.06	0.01	0	0.05	0	0.01	0	87
33	0	0	0	0	0.01	0.01	0.14	0.24	0.29	0.09	0	0.07	0.06	0.03	0.03	0	0	0	0.02	0	87
34	0	0	0	0	0	0.02	0.07	0.21	0.30	0.07	0.02	0.14	0.02	0.05	0.04	0	0.04	0	0	0.02	56
35	0	0	0	0	0.01	0	0.07	0.16	0.29	0.15	0.04	0.09	0.06	0.03	0.01	0	0.04	0	0.03	0	68
36	0	0	0	0	0.02	0.05	0.02	0.09	0.37	0.07	0	0.12	0.09	0.02	0	0	0.09	0.02	0	0.02	43
37	0	0	0	0	0	0	0.02	0.07	0.35	0.22	0.04	0.11	0.09	0.07	0.04	0	0	0	0	0	46
38	0	0	0	0	0	0	0.05	0	0.15	0.20	0	0.15	0.17	0.05	0	0	0.12	0.02	0.07	0.02	41
39	0	0	0	0	0	0.04	0	0.04	0.13	0.13	0.04	0.26	0.13	0.09	0	0.04	0.04	0	0	0.04	23
40	0	0	0	0	0	0.05	0	0	0.05	0.14	0.05	0.41	0	0.05	0.05	0.09	0.05	0	0.09	0	22
41	0	0	0	0	0	0	0.08	0.04	0.19	0.15	0	0.19	0.12	0	0.08	0.08	0.04	0.04	0	0	26
42	0	0	0	0	0	0	0.06	0	0.06	0.06	0.12	0.18	0.12	0.06	0.12	0.06	0.12	0	0.06	0	17
43	0	0	0	0	0	0	0	0	0.10	0	0.20	0.20	0.10	0.20	0	0	0	0	0.10	0.10	10
44	0	0	0	0	0	0	0	0	0.06	0.13	0	0.13	0.38	0.19	0	0	0	0.06	0	0.06	16
45	0	0	0	0	0	0	0	0	0	0	0	0.09	0.18	0.18	0.09	0	0.27	0	0.09	0.09	11
46	0	0	0	0	0	0	0	0	0	0.17	0	0.17	0.17	0.33	0	0.17	0	0	0	0	6
47	0	0	0	0	0	0	0	0	0	0.07	0.07	0.13	0.20	0.07	0.07	0.07	0.07	0	0.07	0.20	15
48	0	0	0	0	0	0	0	0	0.07	0	0.14	0	0.29	0	0.14	0.07	0	0	0.07	0.21	14
49	0	0	0	0	0	0	0	0	0.10	0	0.10	0.20	0	0.10	0	0.10	0.30	0	0	0.10	10
50	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0.20	0	0	0.20	0	0.40	0	5
51	0	0	0	0	0	0	0	0	0	0	0	0.20	0.40	0	0.20	0	0	0.20	0	0	5
52	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0.13	0.13	0	0.25	0	0.25	0.13	8
53	0	0	0	0	0	0	0	0	0	0	0	0	0.17	0	0	0.17	0.17	0.33	0.17	0	6
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0.67	3
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0.33	0.33	3
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	4
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	1
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	1
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	1
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.67	3
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total																					1032

Appendix 4 – continued:
Estimates of proportion of length at age for snapper sampled from East Northland (statistical areas 002 and 003 combined), spring-winter 2007–08. (Note: Aged to 01/01/08)

Length (cm)	Age (years) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	>19	No. aged
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0.67	0	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
26	0	0	0.22	0.11	0.44	0.11	0	0.06	0.06	0	0	0	0	0	0	0	0	0	0	0	18
27	0	0	0.04	0.07	0.31	0.28	0.17	0.06	0.07	0	0	0	0	0	0	0	0	0	0	0	54
28	0	0	0.02	0.05	0.32	0.23	0.21	0.11	0.05	0	0	0	0	0	0	0	0	0	0	0	56
29	0	0	0	0.02	0.20	0.25	0.22	0.13	0.11	0.04	0.01	0.01	0	0	0	0	0	0	0	0	83
30	0	0	0	0.04	0.11	0.23	0.20	0.17	0.13	0.03	0	0.05	0.01	0.01	0	0	0	0	0	0	98
31	0	0	0	0.01	0.09	0.18	0.26	0.18	0.19	0.09	0	0	0	0	0	0	0	0	0	0	78
32	0	0	0	0	0.07	0.09	0.22	0.18	0.30	0.07	0.02	0.02	0	0.01	0	0	0	0	0	0	82
33	0	0	0	0	0.03	0.13	0.20	0.17	0.30	0.06	0	0.09	0.02	0	0	0	0	0	0	0	64
34	0	0	0	0	0.01	0.07	0.15	0.15	0.38	0.07	0.03	0.06	0.06	0.01	0	0	0	0	0	0	68
35	0	0	0	0	0.03	0.03	0.08	0.15	0.33	0.13	0.07	0.08	0.03	0.02	0.03	0	0.02	0	0	0	61
36	0	0	0	0	0	0	0.06	0.15	0.38	0.11	0.09	0.08	0.02	0	0.04	0.02	0.02	0.02	0	0.02	53
37	0	0	0	0	0.02	0.07	0.02	0.12	0.27	0.07	0.10	0.22	0.02	0	0.02	0	0	0	0.02	0.02	41
38	0	0	0	0	0	0	0.03	0.03	0.24	0.08	0.18	0.21	0.13	0.08	0	0	0	0.03	0	0	38
39	0	0	0	0	0	0.03	0	0.10	0.21	0.03	0.07	0.28	0.03	0.10	0.10	0	0	0.03	0	0	29
40	0	0	0	0	0	0	0.05	0	0.14	0.09	0.09	0.23	0.09	0.09	0.05	0	0.05	0.05	0.09	0	22
41	0	0	0	0	0	0	0	0.05	0.10	0.10	0.05	0.35	0.05	0.05	0.10	0	0.10	0	0.05	0	20
42	0	0	0	0	0	0	0.13	0	0.07	0.07	0.07	0.13	0.13	0	0.20	0	0.07	0	0.07	0.07	15
43	0	0	0	0	0	0	0	0	0.10	0.20	0	0.10	0.10	0	0.10	0.10	0	0	0.20	0.10	10
44	0	0	0	0	0	0	0	0	0.09	0.09	0.09	0.27	0	0.09	0.18	0	0	0	0.09	0.09	11
45	0	0	0	0	0	0	0	0	0	0	0	0.13	0.13	0.13	0.25	0	0	0.13	0	0.25	8
46	0	0	0	0	0	0	0	0	0.10	0	0	0	0.20	0	0.10	0.20	0	0	0.20	0.20	10
47	0	0	0	0	0	0	0	0	0	0.06	0	0.06	0.13	0.06	0.06	0	0.19	0.06	0.13	0.25	16
48	0	0	0	0	0	0	0	0	0	0	0	0.09	0.09	0.09	0	0	0.18	0.09	0.09	0.36	11
49	0	0	0	0	0	0	0	0	0	0	0	0	0.29	0.14	0.14	0.14	0	0	0.14	0.14	7
50	0	0	0	0	0	0	0	0	0	0	0	0.17	0.50	0	0	0	0	0	0	0.33	6
51	0	0	0	0	0	0	0	0	0	0	0	0.11	0	0	0.22	0	0.11	0	0.22	0.33	9
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.40	0	0	0.60	5
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75	0.25	4
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.67	3
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0.67	3
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.50	4
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	1
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total																					995

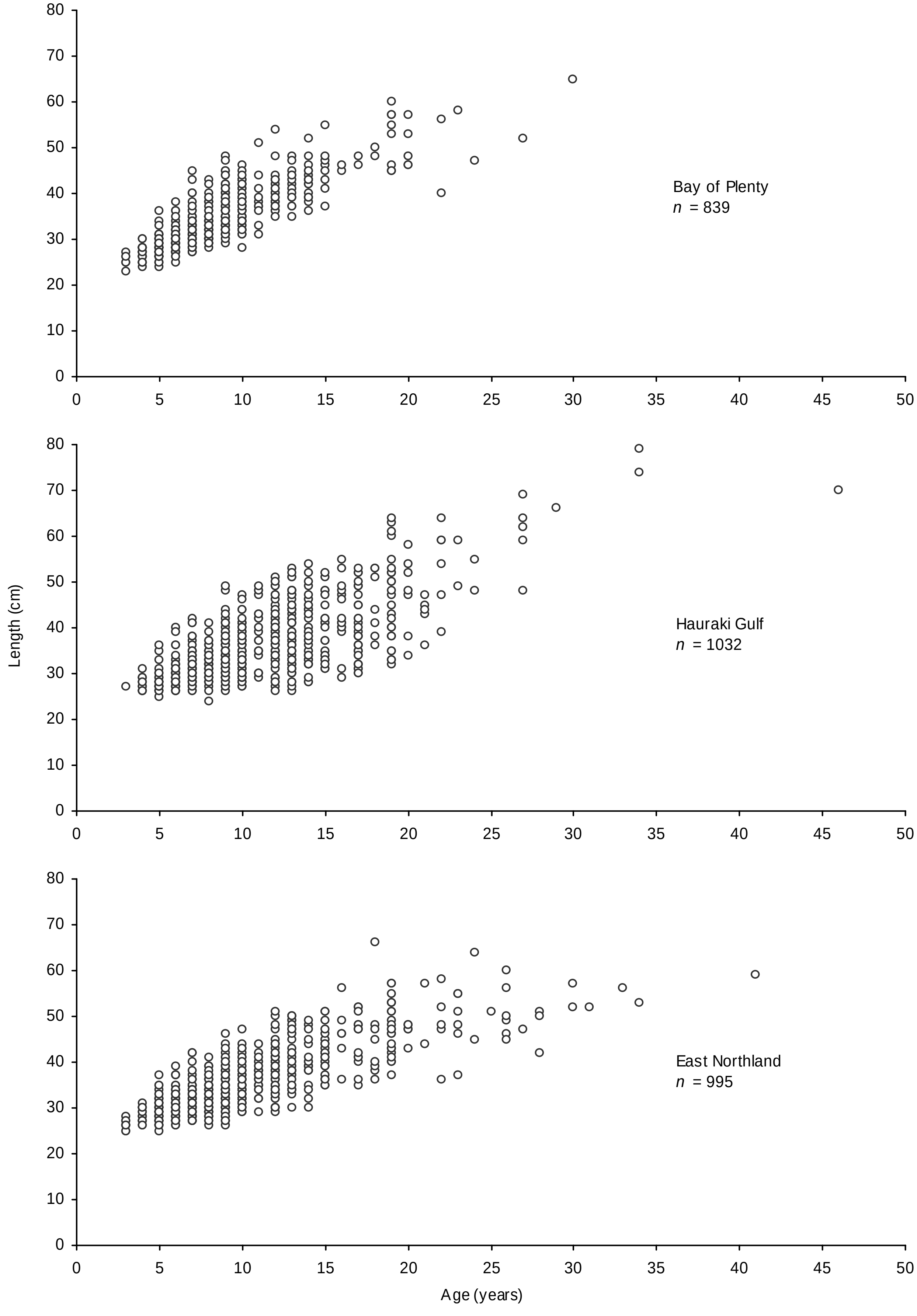
Appendix 4 – continued:
Estimates of proportion of length at age for snapper sampled from East Northland (statistical area 002), spring-winter 2007–08. (Note: Aged to 01/01/08)

Length (cm)	Age (years) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	>19	No. aged
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
26	0	0	0.20	0.10	0.60	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
27	0	0	0.08	0.15	0.50	0.15	0.12	0	0	0	0	0	0	0	0	0	0	0	0	0	26
28	0	0	0.03	0.08	0.42	0.17	0.25	0.06	0	0	0	0	0	0	0	0	0	0	0	0	36
29	0	0	0	0	0.27	0.23	0.21	0.19	0.10	0	0	0	0	0	0	0	0	0	0	0	48
30	0	0	0	0.04	0.21	0.21	0.13	0.17	0.17	0	0	0.04	0	0.02	0	0	0	0	0	0	52
31	0	0	0	0.03	0.13	0.24	0.18	0.18	0.18	0.05	0	0	0	0	0	0	0	0	0	0	38
32	0	0	0	0	0.09	0.09	0.28	0.19	0.28	0.04	0	0.02	0	0.02	0	0	0	0	0	0	54
33	0	0	0	0	0.03	0.09	0.15	0.18	0.39	0.03	0	0.09	0.03	0	0	0	0	0	0	0	33
34	0	0	0	0	0.02	0.10	0.12	0.22	0.39	0.02	0.02	0.05	0.05	0	0	0	0	0	0	0	41
35	0	0	0	0	0.06	0.06	0.10	0.16	0.39	0.03	0.03	0.06	0	0.03	0.03	0	0.03	0	0	0	31
36	0	0	0	0	0	0	0.05	0.16	0.49	0.08	0.08	0.08	0	0	0.03	0.03	0	0	0	0	37
37	0	0	0	0	0.05	0.15	0	0.20	0.25	0	0.05	0.20	0.05	0	0.05	0	0	0	0	0	20
38	0	0	0	0	0	0	0	0	0.35	0	0.10	0.30	0.10	0.10	0	0	0	0.05	0	0	20
39	0	0	0	0	0	0	0	0.12	0.29	0	0.06	0.24	0.06	0.06	0.12	0	0	0.06	0	0	17
40	0	0	0	0	0	0	0	0	0.17	0	0.17	0.17	0.08	0	0.08	0	0.08	0.08	0.17	0	12
41	0	0	0	0	0	0	0	0	0.10	0.10	0	0.50	0	0	0.10	0	0.10	0	0.10	0	10
42	0	0	0	0	0	0	0.25	0	0	0	0.13	0	0.13	0	0.25	0	0	0	0.13	0.13	8
43	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0.25	0	0	0	0.50	0	4
44	0	0	0	0	0	0	0	0	0.14	0	0.14	0.29	0	0.14	0.14	0	0	0	0	0.14	7
45	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0.25	0.5	0	0	0	0	0	4
46	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0.20	0.20	0	0	0.20	0.20	5
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0.75	4
48	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0.67	0	0	0	3
49	0	0	0	0	0	0	0	0	0	0	0	0	0.40	0	0.20	0.20	0	0	0	0.20	5
50	0	0	0	0	0	0	0	0	0	0	0	0.25	0.50	0	0	0	0	0	0	0.25	4
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.50	4
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0.50	4
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75	0.25	4
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.67	3
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	1
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.50	2
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	1
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total																					552

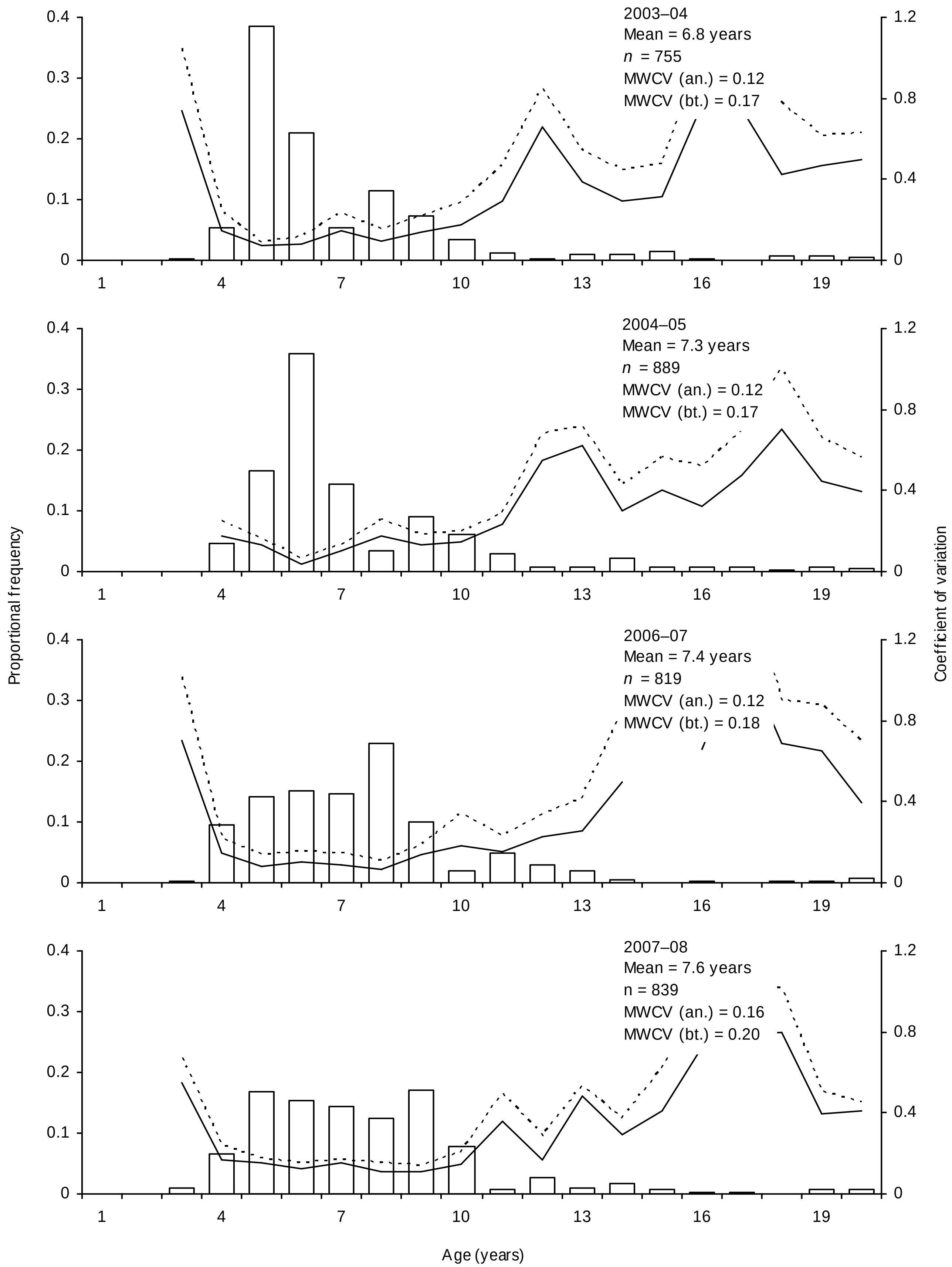
Appendix 4 – continued:
Estimates of proportion of length at age for snapper sampled from East Northland (statistical area 003), spring-winter 2007–08. (Note: Aged to 01/01/08)

Length (cm)	Age (years) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	>19	No. aged
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
26	0	0	0.25	0.13	0.25	0.13	0	0.13	0.13	0	0	0	0	0	0	0	0	0	0	0	8
27	0	0	0	0	0.14	0.39	0.21	0.11	0.14	0	0	0	0	0	0	0	0	0	0	0	28
28	0	0	0	0	0.15	0.35	0.15	0.20	0.15	0	0	0	0	0	0	0	0	0	0	0	20
29	0	0	0	0.06	0.11	0.29	0.23	0.06	0.11	0.09	0.03	0.03	0	0	0	0	0	0	0	0	35
30	0	0	0	0.04	0	0.26	0.28	0.17	0.09	0.07	0	0.07	0.02	0	0	0	0	0	0	0	46
31	0	0	0	0	0.05	0.13	0.33	0.18	0.20	0.13	0	0	0	0	0	0	0	0	0	0	40
32	0	0	0	0	0.04	0.07	0.11	0.18	0.36	0.14	0.07	0.04	0	0	0	0	0	0	0	0	28
33	0	0	0	0	0.03	0.16	0.26	0.16	0.19	0.10	0	0.10	0	0	0	0	0	0	0	0	31
34	0	0	0	0	0	0.04	0.19	0.04	0.37	0.15	0.04	0.07	0.07	0.04	0	0	0	0	0	0	27
35	0	0	0	0	0	0	0.07	0.13	0.27	0.23	0.10	0.10	0.07	0	0.03	0	0	0	0	0	30
36	0	0	0	0	0	0	0.06	0.13	0.13	0.19	0.13	0.06	0.06	0	0.06	0	0.06	0.06	0	0.06	16
37	0	0	0	0	0	0	0.05	0.05	0.29	0.14	0.14	0.24	0	0	0	0	0	0	0.05	0.05	21
38	0	0	0	0	0	0	0.06	0.06	0.11	0.17	0.28	0.11	0.17	0.06	0	0	0	0	0	0	18
39	0	0	0	0	0	0.08	0	0.08	0.08	0.08	0.08	0.33	0	0.17	0.08	0	0	0	0	0	12
40	0	0	0	0	0	0	0.10	0	0.10	0.20	0	0.30	0.10	0.20	0	0	0	0	0	0	10
41	0	0	0	0	0	0	0	0.10	0.10	0.10	0.10	0.20	0.10	0.10	0.10	0	0.10	0	0	0	10
42	0	0	0	0	0	0	0	0	0.14	0.14	0	0.29	0.14	0	0.14	0	0.14	0	0	0	7
43	0	0	0	0	0	0	0	0	0.17	0.33	0	0	0.17	0	0	0.17	0	0	0	0.17	6
44	0	0	0	0	0	0	0	0	0	0.25	0	0.25	0	0	0.25	0	0	0	0.25	0	4
45	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0.25	0	0.50	4
46	0	0	0	0	0	0	0	0	0.20	0	0	0	0.20	0	0	0.20	0	0	0.20	0.20	5
47	0	0	0	0	0	0	0	0	0	0.08	0	0.08	0.17	0.08	0.08	0	0.25	0.08	0.08	0.08	12
48	0	0	0	0	0	0	0	0	0	0	0	0.13	0	0.13	0	0	0	0.13	0.13	0.50	8
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0.50	0	2
50	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0	0.50	2
51	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0	0.40	0	0.20	0	0	0.20	5
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.50	2
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total																					443

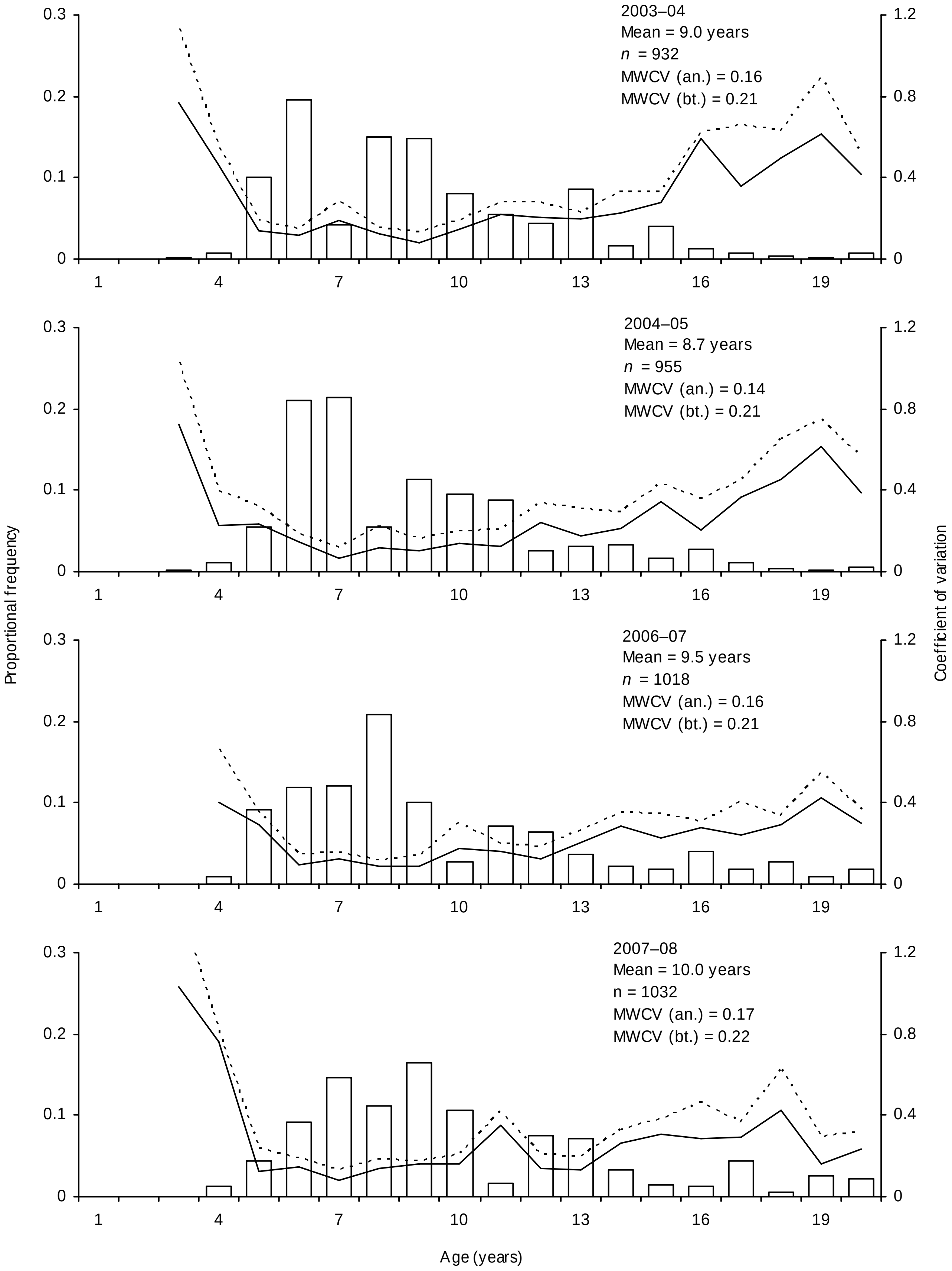
Appendix 5: Scatterplots of age-at-length data for snapper sampled from the SNA 1 longline fisheries year-round in 2007–08 (*n*, sample size).



Appendix 6: Comparison of the proportion at age distributions determined from snapper landings sampled year-round from the Bay of Plenty longline fishery in 2003–04, 2004–05, 2006–07, and 2007–08 (*n*, sample size).



Appendix 6 – continued: Comparison of the proportion at age distributions determined from snapper landings sampled year-round from the Hauraki Gulf longline fishery in 2003–04, 2004–05, 2006–07, and 2007–08 (*n*, sample size).



Appendix 6 – continued: Comparison of the proportion at age distributions determined from snapper landings sampled year-round from the East Northland longline fishery in 2003–04, 2004–05, 2006–07, and 2007–08 (*n*, sample size).