Age composition of commercial snapper landings in SNA 1, 2008–09

C. Walsh[1]
D. Buckthought[2]
H. Armiger[2]
H. Ferguson[2]
M. Smith[2]
N. Rush[2]
K. Spong[2]
A. Miller[2]

[1]Stock Monitoring Services Ltd
P O Box 89234
Torbay
Auckland 0742

[2]NIWA
Private Bag 99940
Auckland 1149

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EXECUTIVE SUMMARY

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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" (SNA2007/01B). 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 2008 to winter 2009 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 except for the Bay of Plenty where the overall collection fell short by only one landing and about 90 otoliths. Spatio-temporal comparisons revealed good sample representativeness.

Year class strengths inferred from the age distributions sampled from the SNA 1 longline fisheries in 2008–09 were generally consistent with trends previously observed. Longline landings are currently dominated by the 2003 to 1999 year classes (6- to 10-year-olds), and although some minor variability in relative strength is evident between the stocks, these year classes accounted for about two in every three snapper landed. The very strong 1999 year class, previously dominant for five consecutive years in the Bay of Plenty and Hauraki Gulf longline fisheries, remains the singularly dominant year class in the East Northland fishery for a sixth consecutive year, and is expected to be of considerable importance in the sustainability of the SNA 1 fishery well into the next decade.

Catch-at-age distributions for the SNA 1 longline fisheries in 2008–09 have continued to broaden from the previous year, resulting in some of the highest estimates of mean age seen for a decade, ranging from 8.2 to 9.7 years for the respective stocks. However, as there continues to be a relatively high proportion of young fish (10 years or younger) present in all SNA 1 stocks, and combined with only moderate growth rates, the mean size in the fisheries is relatively small at about 36 cm (about 1.0 kg), 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 Hauraki Gulf stock has the broadest age distribution of all SNA 1 stocks, marginally broader than East Northland, but considerably more than the Bay of Plenty. The Bay of Plenty age distribution continues to have the lowest numbers of old fish in SNA 1, with only 14% of the total annual catch based on fish 11 years and older, over half of these apportioned to the 1996 and 1998 year classes alone.

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 old fish in the catch were found in summer in the Bay of Plenty and East Northland stocks, and during spring in the Hauraki Gulf, the latter most likely reflecting a high proportion of resident fish, similar to winter landings seen in previous years. This difference for the Hauraki Gulf may be explained by the seasonal partitioning of sample collections, the timing of 'school fish' migrations, as well as the spatial operation of the fishery. Although only marginally different, the highest proportions of young fish were caught in autumn in the Hauraki Gulf and East Northland stocks, and during autumn and 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 caution because of the effects of growth and recruitment during autumn and winter. This was particularly true for estimates from the Bay of Plenty

stock in 2008–09 and to a lesser degree East Northland, where the relative abundance of young fish recruiting into the stock appears to be highest, mainly in autumn and winter when a high proportion of the annual longline catch is landed. These seasonal differences in proportions at age may also be exacerbated by the recruitment of young year classes, especially into the Bay of Plenty and East Northland stocks, and the faster growth rates exhibited there. Low winter catches and slower growth rates exhibited in snapper from the Hauraki Gulf have resulted in the smallest differences in proportion-at-age estimates for spring-summer compared to those sampled year-round.

Overall, 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 2008–09, although estimates for the Hauraki Gulf spring collections were noticeably low for a range of old age classes, likely to be reflective of a proportion of resident fish in landings, and fell well below the predicted values from published parameters. Although those estimates from the Bay of Plenty more closely approximate predicted values, the combined annual mean weight-at-age estimates for the common age classes are some of the lowest recorded, and may reflect a slowing in growth rate as a result increasing stock size and decreased productivity.

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 17% to 19%.

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, 2009). This report presents the results of market sampling between October 2008 and August 2009, thus continuing the time series. Funding for this project, SNA2007/01B, was provided by the Ministry of Fisheries.

The specific objective of this project for 2008–09 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 2008–09. 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 2008–09 continued with the year-round approach as implemented in 2003–04 to 2004–05 and 2006–07 to 2007–08, 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 2008–09 was to estimate the annual catch-at-age of snapper from the SNA 1 stocks for 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). September, usually 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 2008–09 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 sub-stratified 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 2008–09 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 are 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.

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 2008 to winter 2009 are provided in Tables 2–4, displaying seasonal patterns in the fisheries. Although longline and other method catches from the SNA 1 fishery were spread over the entire year, the greatest proportion of annual catch was taken from summer-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 41% and 34% of the annual catch respectively (see Table 1). In East Northland, longline continues to dominate the fishery (51%), while in the Bay of Plenty, single trawl accounts for half the annual catch (50%), with Danish seine taking 34% and longline 15%.

In 2008–09 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 almost fully achieved in all fisheries; Bay of Plenty (39), Hauraki Gulf (41), and East Northland (47). The cumulative proportion of the number of snapper longline landings and those sampled in the respective SNA 1 stocks from October 2008 to August 2009 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 2008–09, 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 from the 2003 to 1999 year classes (6- to 10-year-olds) making up three-quarters (74%) of the landed catch by number for longline in 2008–09 (Figure 2). The 2003 year class (6-year-olds) dominates the distribution and accounts for one in every five fish landed, and there are very low numbers of fish in age classes 15 years and older. For age classes more than 10 years of age, only the 1998 and 1996 year classes (11- and 13-year-olds) continue to show any apparent strength in the right hand limb of the distribution, although the aggregate (over 19 years) age group has increased slightly as a result of the previously strong 1989 year class merging into the group as 20-year-olds. The mean age was 8.2 years and the analytical and bootstrap mean weighted coefficients of variation (MWCVs) were 0.14 and 0.18 respectively. The 2001 year class (8-year-olds) appears fully recruited to the fishery, while the 2002 to 2006 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 generally 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 2005 to 2003 year classes (4- to 6-year-olds), especially between spring and summer, and autumn and winter, is likely to be due to the recruitment of these small young fish into the fishery later in the year. Summer samples contained marginally more old fish than spring, and both seasons contained at least twice the number of old fish to that of autumn and winter samples, which were the lowest estimates for any SNA 1 stock (Figure 5).

3.4 Hauraki Gulf

The Hauraki Gulf longline age distribution was broad with good representation in most young age classes, particularly the 2004 to 1998 year classes (5- to 11-year-olds), which combined make up three-quarters (75%) of the annual landed catch by number (Figure 3). Many year classes in the right hand limb also contained appreciable numbers of fish, most noticeably 1996, 1995, 1994, and 1991 (13- to 15-, and 18-year-olds), and the aggregate (over 19 years) age group has increased slightly as a result of the previously strong 1989 year class merging into the group as 20-year-olds. Only those age classes over 11 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 9.7 years and the analytical and bootstrap MWCVs for the random age frequency approach were 0.14 and 0.19 respectively.

The seasonal catch-at-age samples for the Hauraki Gulf longline fishery were generally similar over the summer to winter seasons and showed a high level of consistency in the relative strengths of common age classes, although spring estimates exhibited some variation in proportions for particular age classes. Spring samples comprised 50% of fish over 10 years of age, and proportionally more old fish than winter, autumn, and summer samples (Figure 5).

3.5 East Northland

For the sixth consecutive year, the strong 1999 year class (10-year-olds) has dominated the East Northland longline age distribution as the singularly most dominant year class, currently making up 17% of the annual landed catch by number in 2008–09 (Figure 4). The 2003 to 2000 year classes (6- to 9-year-olds) have remained of similar average strengths to that seen in the previous year, and along with the 1999 year class, dominate the left hand limb of the age distribution, making up two-thirds (66%) by number of snapper landed by longline. The age distribution is comparatively broad with representation in all age classes in the right hand limb, the most noticeable being the 1996 year class (13-year-olds). The aggregate (over 19 years) age group has increased slightly as a result of the previously strong 1989 year class merging into the group as 20-year-olds, and remains the highest estimate for any of the SNA 1 stocks, comprising 4% of the landed catch, although considerably lower than estimates from the fishery in the late 1990s. Only those age classes over 8 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 9.3 years and the analytical and bootstrap MWCVs were 0.12 and 0.17 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. Although only marginal, summer samples contained proportionally more old fish than spring, winter, 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 2008–09 are generally similar to those estimates previously observed in year-round sampling in 2003–04, 2004–05, 2006–07, and 2007–08, generally 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 and 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 (2- to 6-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.

Similar to the previous year, the most noticeable seasonal difference in mean weight-at-age estimates within stocks in 2008–09 was for spring samples, especially from the Hauraki Gulf fishery where estimates for those fish 10–17 years of age were most often the lowest estimates over all seasons.

4. DISCUSSION

The relative year class strengths inferred from the age distributions sampled from the SNA 1 fisheries in the 2008–09 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, 2009). The collection of otolith samples in 2008–09 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 generally 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). However, in some years the differences in catch-at-age proportions between spring-summer and year-round summaries were less obvious (Walsh et al. 2009) and may also be affected by the seasonal partitioning of sample collections and in relation to the timing of the ‘school fish’ migrations. 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.

Despite considerable developments within the fishing industry in recent years relating to a downsizing and rationalisation of the commercial inshore fishing fleet (Walsh et al. 2008), the SNA 1 longline fleet has remained comparatively stable for the past three years with a core group of about 40 vessels taking about one-third of the Total Allowable Commercial Catch (TACC). Most longline fishers work year-round and catch much higher tonnages of snapper than they have in the past, the vast majority destined for export. 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 (Walsh et al. 2008).

The Bay of Plenty combined age distribution for 2008–09, although not dissimilar to that of the previous year, has broadened considerably from that seen in the fishery 5 years ago, with a number of year classes of average to above average strength recruiting into the fishery over consecutive years. The most prominent of these currently occupy age classes 6 to 10 years, and make up three-quarters of the longline catch by number in 2008–09. As a result, the mean age of snapper in the Bay of Plenty fishery has gradually increased over time, and at 8.2 years, is now one of the highest estimates seen in 20 years of sampling. The 1999 year class (10-year-olds), the most dominant in the fishery for the previous five consecutive years, now makes up 13% by number of snapper landed by longline, and with an average size of about 36 cm (about 1 kg), will undoubtedly be of importance for the sustainability of the Bay of Plenty fishery over the following decade, not only by number, but more importantly in relation to their contribution by weight. Despite this improvement in the fishery, the Bay of Plenty catch-at-age composition continues to have the lowest proportion of fish over 10 years of age (14%) for any of the SNA 1 stocks, largely as a result of the past commercial fishing pressure there, where the level of exploitation was considerably higher than on other stocks relative to its size (Walsh et al. 2004). With the exception of the 1998, 1996, and 1995 year classes (11-, 13-, and 14-year-olds), most older age classes, including the aggregate (over 19 years), are of low relative strength and based only on a few individuals from sample collections, indicating as it has over recent years, that few older fish exist in this fishery (see Appendices 4 & 5). In 2008–09, an estimated one-quarter of the SNA 1 TACC of 4500 t was caught in the Bay of Plenty (MFish data), similar to the East Northland catch and half that from the Hauraki Gulf, but considerably lower than the peak of 40% in 2004–05. Should fishing pressure in the Bay of Plenty continue to remain stable in the near future, then the opportunity for the rebuilding of the stock and broadening the age composition, especially the right hand limb, may be achievable.

As in most recent years, the Hauraki Gulf longline age distribution in 2008–09 has the broadest age composition and the highest mean age (9.7 years) of any of the SNA 1 longline fisheries, being reasonably well represented by a range of young, moderate, and old aged fish. The once strong 1999 year class (10-year-olds), although now decreased in its relative dominance compared to previous years, remains the most dominant year class (equal with the 2002 year class) in the Hauraki Gulf fishery for a fifth consecutive year, and now accounts for 13% of the number of fish landed by longline. With an average size centred around 35 cm (about 900 g), the 1999 year class is probably close to being fully recruited to the commercial fishery with only a low proportion of fish being 27 cm, and immensely important in the medium-term sustainability of this fishery. Similar to the previous two years, those year classes less than 11 years of age make up about two-thirds of snapper landed by longline in the Hauraki Gulf most of which are not 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). Despite a proportion of small slow growing snapper, overall, the Hauraki Gulf fishery appears to be in reasonable shape. The age composition is as broad as that seen 20 years ago when catch sampling in the fishery was first initiated, notwithstanding the recent increase in fishing pressure by single trawl, Danish seine, and longline in the Hauraki Gulf. More recently, commercial fishers from SNA 1 report some of the best catches in years (author's discussions with industry managers and fishers), supported by an overall increasing trend in CPUE for the SNA 1 longline fisheries between 1989 and 2005 (McKenzie 2008). Although recreational catch rates are known to fluctuate markedly, these may in part be driven by environmental effects influencing snapper spatial abundance and accessibility, anecdotal evidence from this sector suggests that fishing in SNA 1 has improved considerably over the past 10 years (B. Hartill, pers. comm.). However, as the average size of snapper landed in the Hauraki Gulf fishery remains comparatively small at about 35 cm (about 0.9 kg), and with the yield-per-recruit (by weight) relatively low, the fishery now lands more fish now than it did 15–20 years ago to achieve a similar catch weight (Walsh et al. 2007). The slower rate of recruitment of younger age classes into the fishery because of the slow growth, and an apparent lower exploitation rate in past years compared to the other SNA 1 stocks, has likely enabled Hauraki Gulf snapper to attain a greater average age, albeit at a relatively small average size (Walsh et al. 2008). In spite of this, there has been minimal accumulation of older fish into the aggregate age group in recent years (currently containing about 2% of the longline catch), and few fish now survive past 20 years of age, although the previously dominant 1989 year class (20-year-olds), estimated to be the second strongest year class (to the 1999 year class) in the fishery for the past 25 years, has, this year, merged into the aggregate age group, and should help retain some stability within this group for some years to come (see Appendices 4 & 5).

In the past 6 years, the East Northland longline combined catch-at-age composition has largely mirrored those changes seen in catch-at-age estimates for both the Bay of Plenty and Hauraki Gulf longline fisheries. The East Northland age distribution in 2008–09 is the broadest seen since year-round sampling was instigated in 2003–04 reflected by the high estimate of mean age (9.3 years), similar estimates only seen in the fishery a decade or more ago. Largely dominated by 6- to 10-year-olds, these cohorts appear at present to all be of similar relative strength, and combined account for two of every three snapper landed by longline in East Northland. In 2008–09, East Northland was the only SNA 1 fishery to be singularly dominated by the strong 1999 year class (10-year-olds), currently the sixth year in succession. Walsh et al. (2006a) predicted in 2003–04 that the 1999 year class would 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 well into the next decade. Despite slow growth rates and a relatively small average size centred around 35 cm (about 0.9 kg), 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. Analogous to the Bay of Plenty stock is the relative recruitment strength of the 2003–2000 year classes (6- to 9-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. Although the right hand limb does not appear as broad as that seen in the Hauraki Gulf fishery, the East Northland stock still comprises a reasonable number of fish across most of the older age classes, including the aggregate (over 19 years) age group, which at 4% of the catch is the highest estimate in SNA 1, slightly increased as a result of the previously dominant 1989 year class becoming 20-year-olds.

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, 2009). Most noticeable in the current catch-at-age compositions from all the longline fisheries are the dominance of the 2003 to 1999 year classes (6- to 10-year-olds); likely to be of significant importance for the short term sustainability of SNA 1. The 2004 year class (5-year-olds) appears to be below average strength in 2008–09 in contrast to previous 5-year-olds recruiting into the SNA 1 fisheries, and a comparison to other year classes over the subsequent years should further confirm this. Although broad similarities in year class strength exist between the SNA 1 stocks, there have always been some anomalies present, such as the noticeably low numbers of older fish in the Bay of Plenty, and the higher proportions of fish occupying the 1998 and 1991 year classes in the Hauraki Gulf compared to the other two stocks. 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), and differences in growth and fishing mortality (Walsh et al. 2003).

Previous stock specific catch-at-age distributions have shown a high level of consistency between seasons in the relative strengths of the most common age classes (Walsh et al. 2006a, 2006b, 2008, 2009), a trend that has generally continued in 2008–09. It is generally expected that older and larger fish are 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), and also evident in almost all year-round sample collections from the Bay of Plenty and East Northland fisheries (Walsh et al. 2006a, 2006b, 2008, 2009), including 2008–09. The degree to which ‘school’ and ‘resident’ fish influence such results is not fully determined, but what is apparent, at least in the Hauraki Gulf fishery (Walsh et al. 2006a, 2006b, 2008, 2009), is that those snapper sampled over winter will most often comprise the highest proportions of old fish compared to all other seasons, with most fish being of a smaller average size, reflecting a high proportion of ‘resident’ fish in catches. Resident fish, typically smaller, of lower abundance, and generally more dispersed, may continue to occupy shallow inshore areas at least over the winter, and perhaps the entire year (Walsh et al. 2006b). Walsh et al. (2006a) suggested that resident fish may not be fished to the same intensity as the school fish, hence, having similar year strengths but of different relative proportions. However, in 2008–09, spring catch-at-age estimates from the Hauraki Gulf unexpectedly comprised the highest numbers of old fish, most of which were of a small average size, comparable to findings in previous winter samples for this stock, obviously reflecting a high proportion of ‘resident’ fish in the early spring fishery. Such variations are likely to be dependent upon the temporal spread of sample collections within seasons, which as described previously may also be affected by the seasonal partitioning of sample collections, and in relation to the timing of the ‘school fish’ migrations, and possibly influenced by the spatial operation of the fishery.

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 2008–09) indicate a high level of consistency over time in estimates of 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 stock strata. The level of precision for the age distributions is high (MWCVs below 20% for analytical and bootstrap 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. In addition, comparisons of temporal and spatial fishing and sampling effort also suggest a good level of representivity in the sample collections. The analytical MWCV estimates for the age distributions sampled from the SNA 1 fisheries in 2008–09 ranged between 0.12 and 0.14 and bootstrap MWCV estimates for the same age distributions ranged between 0.17 and 0.19.

4.1 Mean weight-at-age

Overall, mean weight-at-age estimates derived for each SNA 1 stock in 2008–09 were generally similar to those recorded in 1993–94 to 1997–98 (Davies et al. 2003). Although estimates from the Bay of Plenty have always more closely approximated the predicted values based on published parameters, more recently, mean weight estimates for the more common age classes have been some of the lowest ever recorded. The gradual reduction in annual mean weight-at-age for the Bay of Plenty stock appears to correlate with a perceived gradual increase in stock size. The increase in biomass is supported by a broadening of the age composition, due to above average recent recruitment, combined with a reduction in fishing pressure, and may have resulted in a slowing down of the Bay of Plenty stock productivity.

Despite low mean weight-at-age estimates for some age classes in the Hauraki Gulf (and to a lesser degree East Northland) spring fishery, overall there appeared to be little variation in seasonal mean weight-at-age estimates (for the most common age classes) in 2008–09. As mentioned in the previous section, such variation most likely reflects resident fish that occupy shallow inshore strata year-round, and are thought to experience lower water temperatures for a longer period, especially over winter (early spring in this instance), than those experienced by school fish, resulting in reduced growth rates and hence lower estimates of mean weight-at-age (Walsh et al. 2006a).

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 2008–09, 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. Estimates differ slightly from collections made only in spring and summer, evident in the Bay of Plenty and East Northland stocks, and may be attributable to the higher proportion of catch, and hence the higher proportion of young fish, landed over the autumn and winter seasons. Comparisons of temporal and spatial fishing and sampling effort suggest a good level of representivity in the sample collections.

2. All SNA 1 longline fisheries in 2008–09 are currently dominated by the 2003 to 1999 year classes (6- to 10-year-olds), and although some minor variability in relative strength is evident between the stocks, combined they account for about two in every three snapper landed. The very strong 1999 year class, previously dominant for five consecutive years in the Bay of Plenty and Hauraki Gulf longline fisheries, remains the singularly dominant year class in the East Northland fishery for a sixth consecutive year, and is expected to be important in the sustainability the SNA 1 fishery well into the next decade.

3. Catch-at-age distributions in 2008–09 have continued to broaden from the previous year, resulting in some of the highest estimates of mean age seen for a decade, ranging between 8.2 and 9.7 years for the SNA 1 stocks. However, as there continues to be a relatively high proportion of young fish (10 years or younger) present in all SNA 1 stocks, the mean size in the fisheries is low, ranging between 35 and 36 cm, with mean weight just under 1.0 kg. The Hauraki Gulf stock has the broadest age distribution of all SNA 1 stocks, marginally broader than East Northland, but considerably more than the Bay of Plenty. The Bay of Plenty age distribution continues to have the lowest numbers of old fish in SNA 1, with only 14% of the total annual catch based on fish 11 years and older, over half of these apportioned to the 1996 and 1998 year classes. Should the level of fishing pressure exerted on the Bay of Plenty stock be similar to recent years, it would be unlikely that any appreciable growth in the right hand limb of the age distribution will occur in this fishery in the near future. The previously dominant 1989 year class (20-year-olds), estimated to be the second strongest year class (to the 1999 year class) in the fishery for the past 25 years, has this year merged into the aggregate (over 19 years) age group and should retain some stability within this group (currently making up about 2–4% of the longline catch by number), despite few fish surviving past 20 years of age.

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 summer in the Bay of Plenty and East Northland stocks, and during spring in the Hauraki Gulf, the latter most likely reflecting a high proportion of resident fish, similar to winter landings seen in previous years. This difference for the Hauraki Gulf may be explained by the seasonal partitioning of sample collections, the timing of ‘school fish’ migrations, as well as the spatial operation of the fishery. Although only marginally different, the highest proportions of young fish were caught in autumn in the Hauraki Gulf and East Northland stocks, and during autumn and 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, and differences in growth and fishing mortality.

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 2008–09, although estimates for the Hauraki Gulf in spring were consistently low for a range of old age classes, likely to be reflective of a proportion of resident fish in landings. Although those estimates from the Bay of Plenty more closely approximate predicted values from published parameters, the combined annual mean weight-at-age estimates for the more common age classes are some of the lowest recorded, and may reflect a recent slowing in growth rate for this fishery.

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Table 1: Percentage of snapper catch by fishing method[*] in SNA 1 for the 2008–09 sampling period.[†]

	BPT	BT	BLL	DS	Other
Bay of Plenty	1	50	15	34	0
Hauraki Gulf	1	41	34	21	3
East Northland	12	25	51	10	2

[*] BPT, pair trawl; BT, single trawl; BLL, longline; DS, Danish seine.
[†] 2008–09 represents 01/10/08 to 31/08/09 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 2008 to winter 2009.[*]

		Number of landings			No. of fish	Weight of landings (t)		
Method	Season	Total	Sampled	% of total	sampled	Total	Sampled	% of total
BLL	Spring	142	10	7.0	211	32	4	12.5
	Summer	188	10	5.3	174	31	2	6.5
	Autumn	176	9	5.1	161	40	2	5.0
	Winter	201	10	5.0	221	54	4	7.4
BT	Spring	57	0	0	0	68	0	0
	Summer	83	0	0	0	118	0	0
	Autumn	110	0	0	0	205	0	0
	Winter	107	0	0	0	144	0	0
DS	Spring	34	0	0	0	58	0	0
	Summer	64	0	0	0	122	0	0
	Autumn	56	0	0	0	101	0	0
	Winter	51	0	0	0	85	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 2008 to winter 2009.[*]

		Number of landings			No. of fish	Weight of landings (t)		
Method	Season	Total	Sampled	% of total	sampled	Total	Sampled	% of total
BLL	Spring	289	10	3.5	262	204	9	4.4
	Summer	396	12	3.0	318	244	14	5.7
	Autumn	323	11	3.4	296	156	8	5.1
	Winter	243	8	3.3	202	102	6	5.9
BT	Spring	58	0	0	0	151	0	0
	Summer	89	0	0	0	249	0	0
	Autumn	83	0	0	0	224	0	0
	Winter	67	0	0	0	219	0	0
DS	Spring	46	0	0	0	75	0	0
	Summer	92	0	0	0	158	0	0
	Autumn	91	0	0	0	136	0	0
	Winter	47	0	0	0	65	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 2008 to winter 2009.* 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	154	6	3.9	120	53	2	3.8
	Summer	245	5	2.0	119	98	2	2.0
	Autumn	173	7	4.0	148	61	3	4.9
	Winter	191	6	3.1	135	89	3	3.4
BLL (003)	Spring	81	5	6.2	108	35	2	5.7
	Summer	90	5	5.6	104	37	3	8.1
	Autumn	107	6	5.6	132	44	3	6.8
	Winter	107	7	6.5	196	60	7	11.7
BLL (comb.)	Spring	241	11	4.6	228	89	4	4.5
	Summer	333	10	3.0	223	136	5	3.7
	Autumn	293	13	4.4	280	108	6	5.6
	Winter	304	13	4.3	331	150	10	6.7

* BLL, longline.

**Table 5: Details of snapper otolith samples collected in 2008–09 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	24–63	767
HAGU	BLL	Spring-winter	R	26–69	1 078
ENLD (002)	BLL	Spring-winter	R	26–67	522
ENLD (003)	BLL	Spring-winter	R	25–58	540
ENLD (comb.)	BLL	Spring-winter	R	25–67	1 062

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

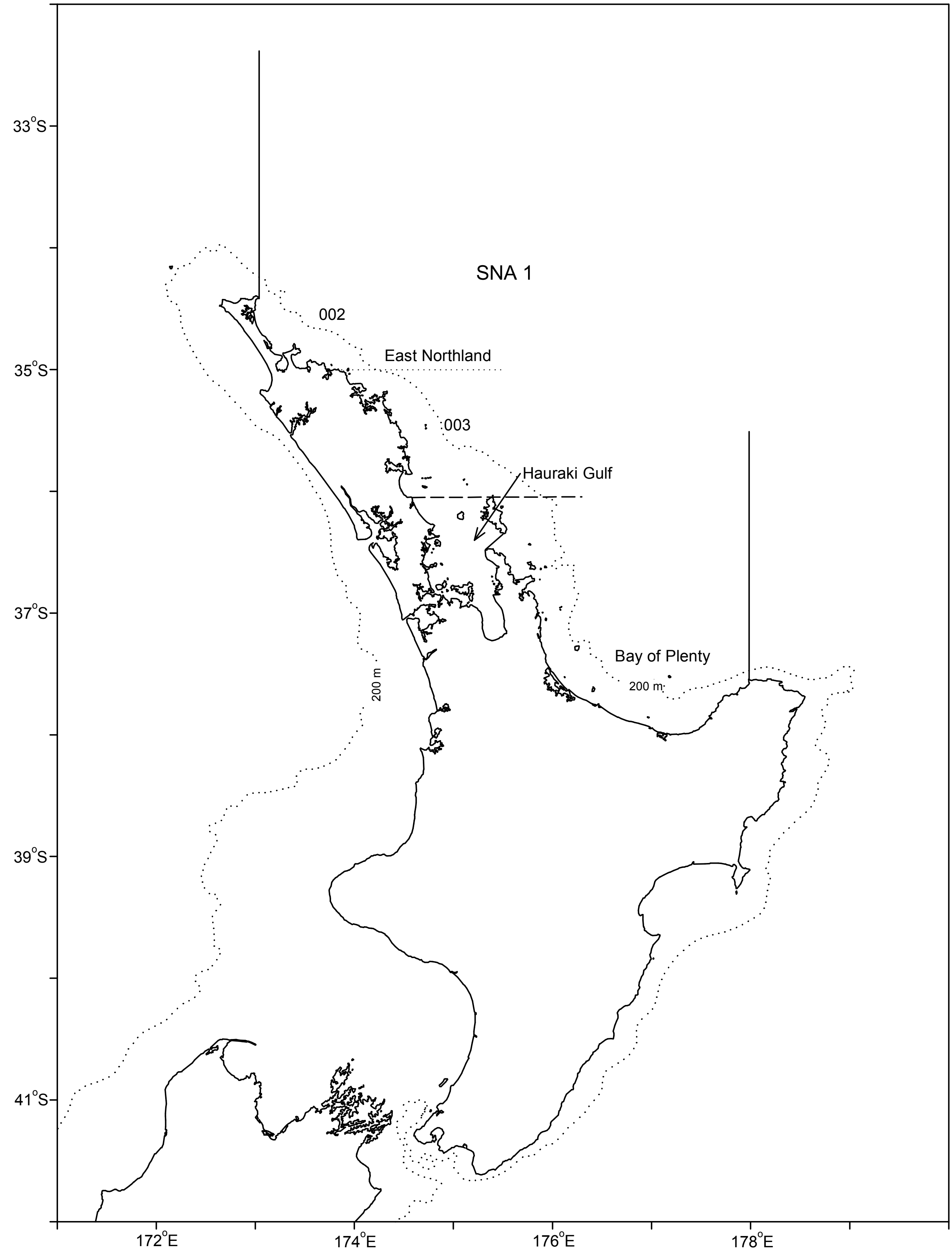


Figure 1: Quota management area for the east coast North Island snapper stock, SNA 1, and the range of the three SNA 1 substocks; East Northland, Hauraki Gulf, and Bay of Plenty.

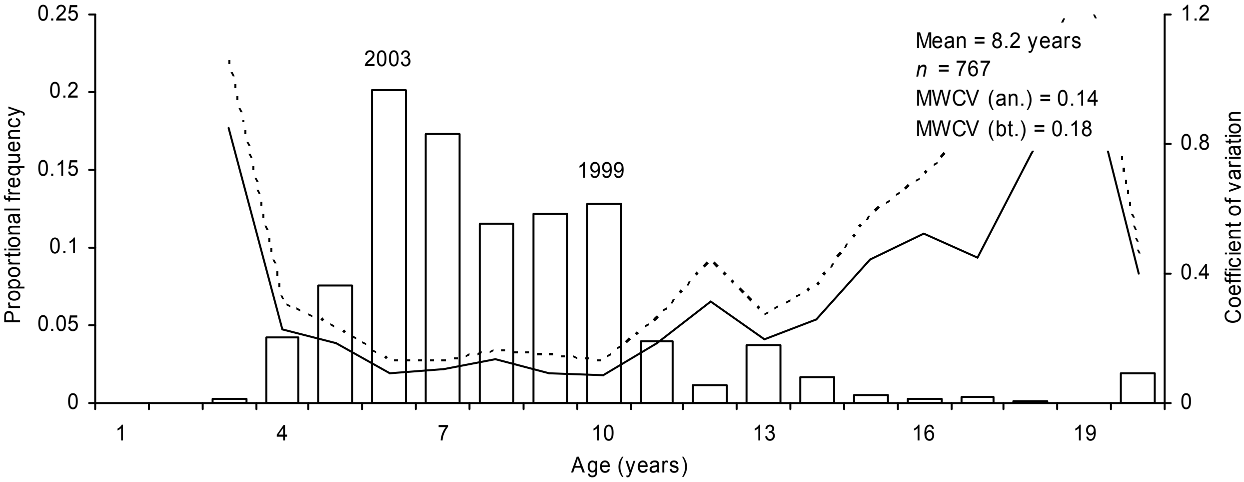


Figure 2: Proportion at age distribution (histogram) and analytical (solid line) and bootstrap (dashed line) c.v.s determined from snapper landings sampled from the Bay of Plenty longline fishery in 2008–09 using the random age frequency approach (*n*, otolith sample size; MWCV, mean weighted c.v.).

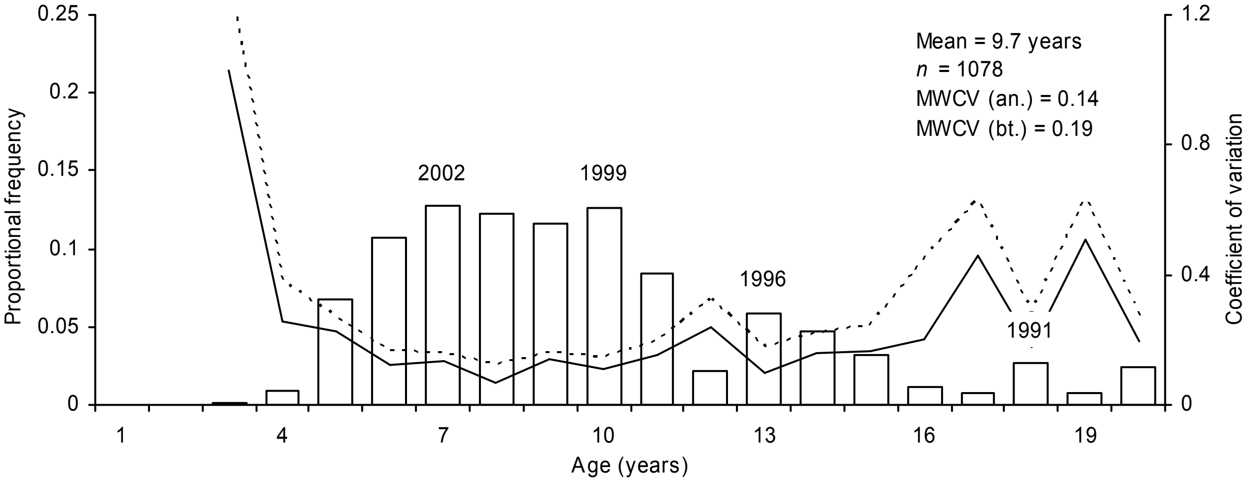


Figure 3: Proportion at age distribution (histogram) and analytical (solid line) and bootstrap (dashed line) c.v.s determined from snapper landings sampled from the Hauraki Gulf longline fishery in 2008–09 using the random age frequency approach (*n*, otolith sample size; MWCV, mean weighted c.v.).

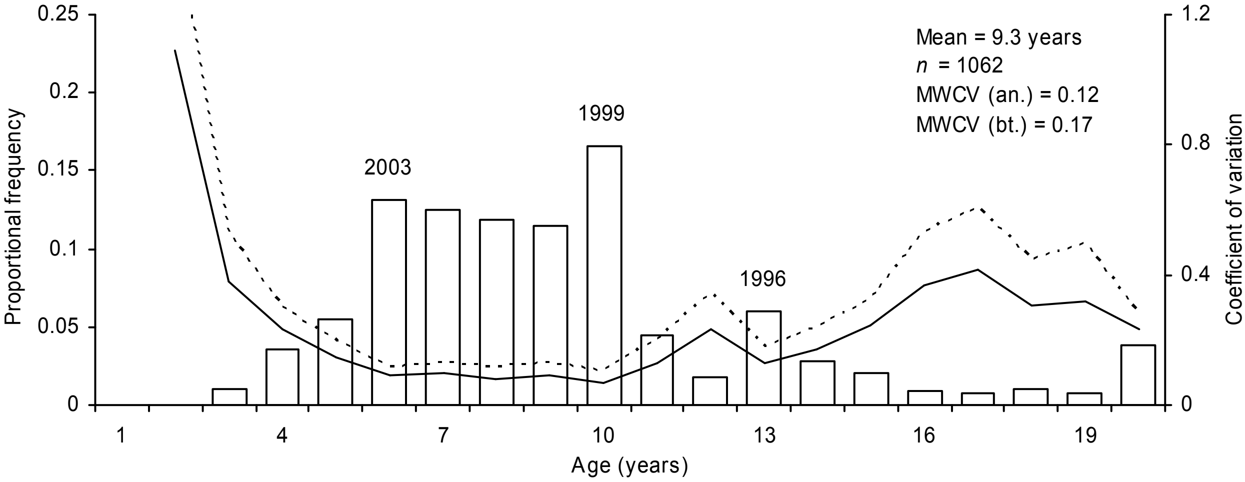


Figure 4: Proportion at age distribution (histogram) and analytical (solid line) and bootstrap (dashed line) c.v.s determined from snapper landings sampled from the East Northland longline fishery in 2008–09 using the random age frequency approach (*n*, otolith sample size; MWCV, mean weighted c.v.).

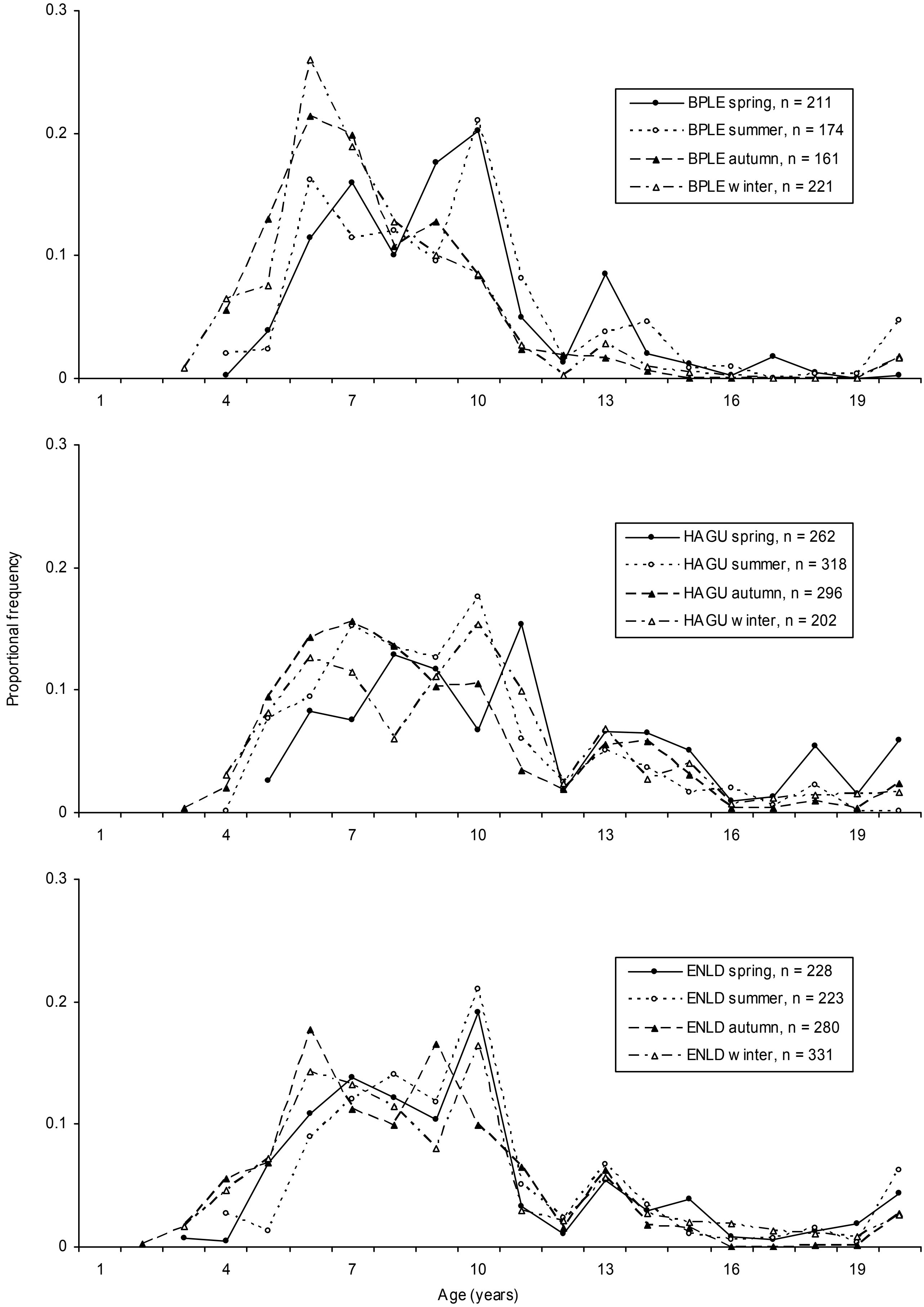


Figure 5: Proportion at age distributions determined from snapper landings sampled over four seasons from the Bay of Plenty (BPLE), Hauraki Gulf (HAGU), and East Northland (ENLD) longline fisheries in 2008–09 (*n*, sample size).

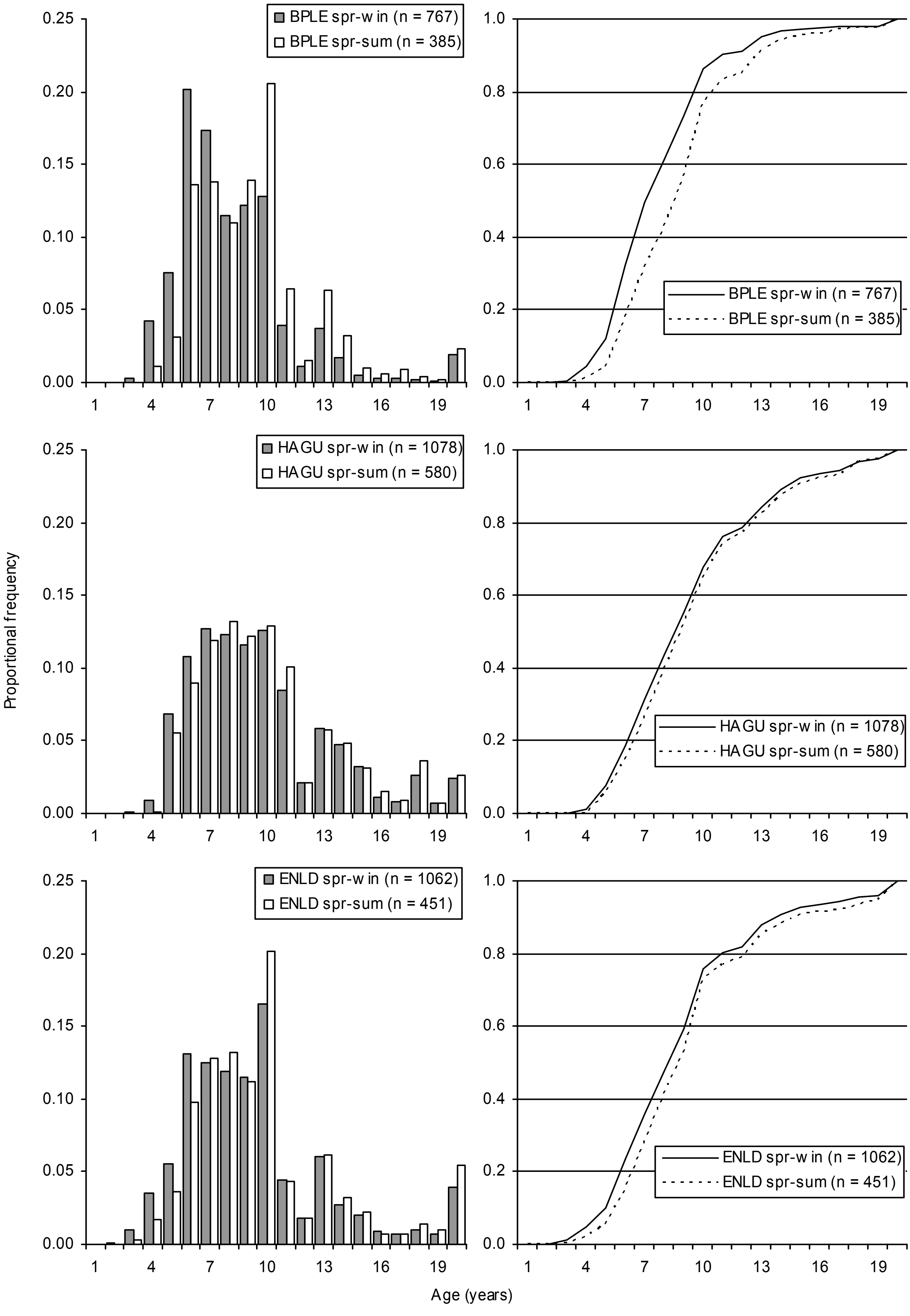


Figure 6: Comparison of the proportion and cumulative proportion at age distributions determined from snapper landings sampled over the spring and summer combined, and year-round seasons from the Bay of Plenty (BPLE), Hauraki Gulf (HAGU), and East Northland (ENLD) longline fisheries in 2008–09 (*n*, sample size).

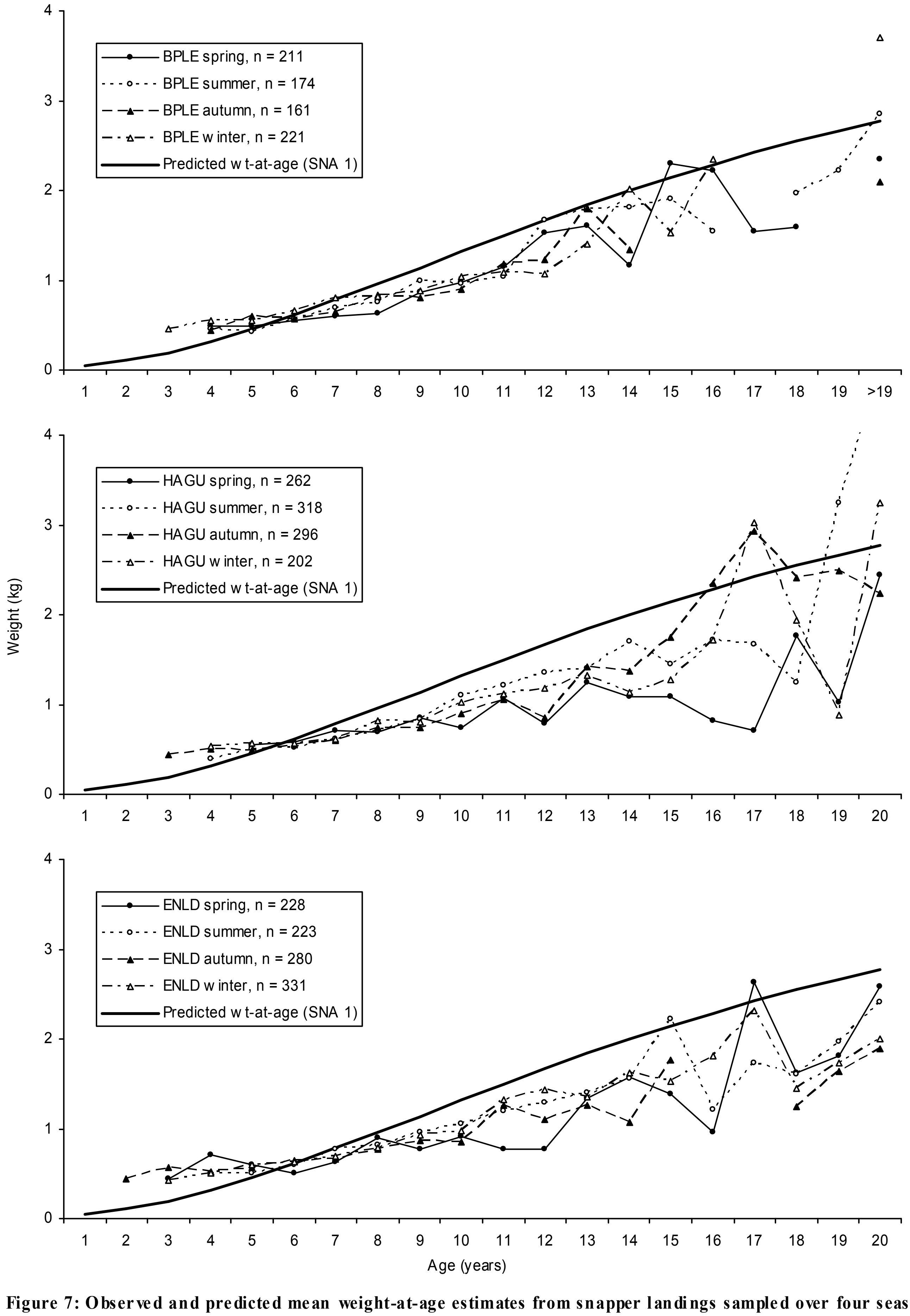
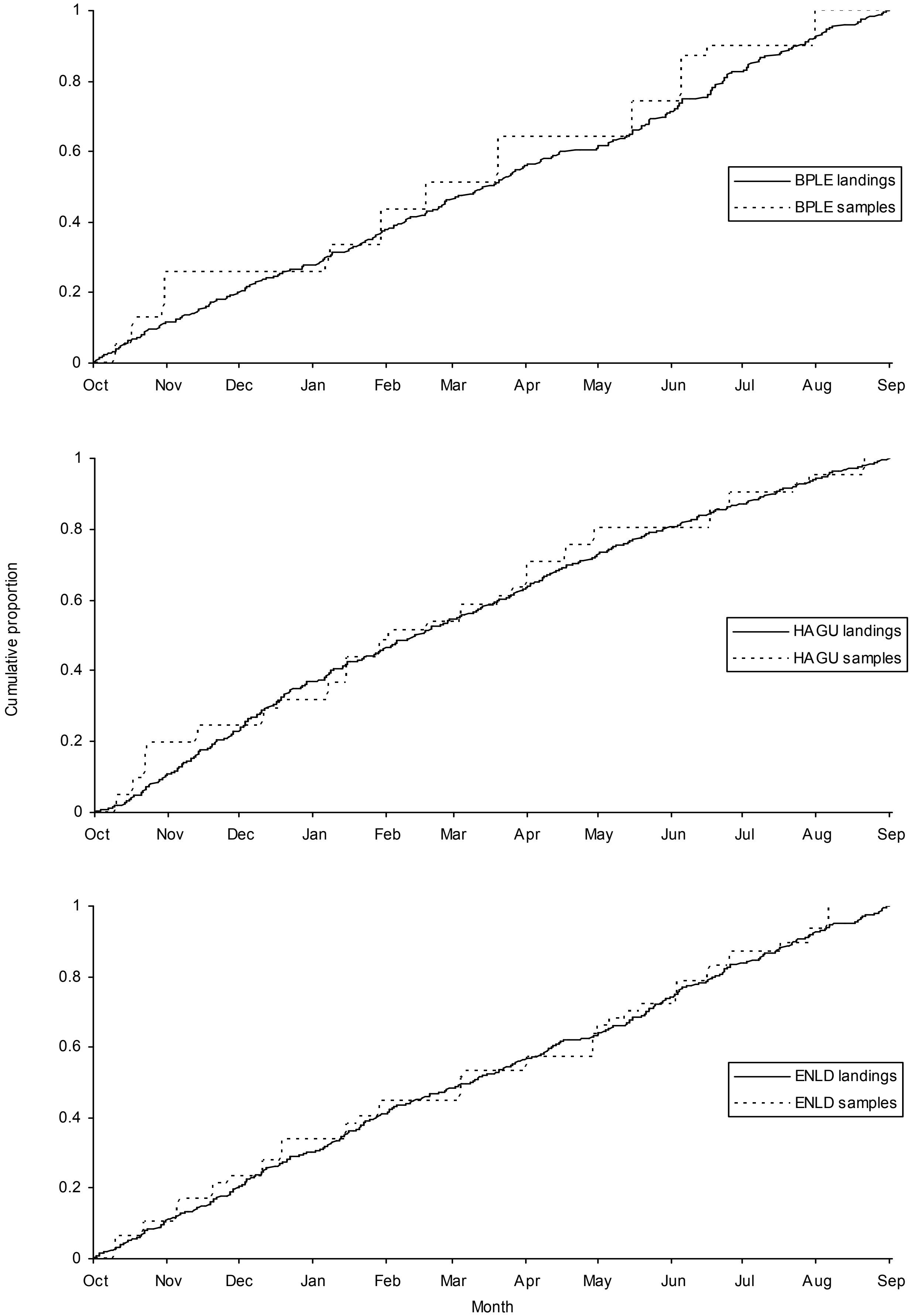
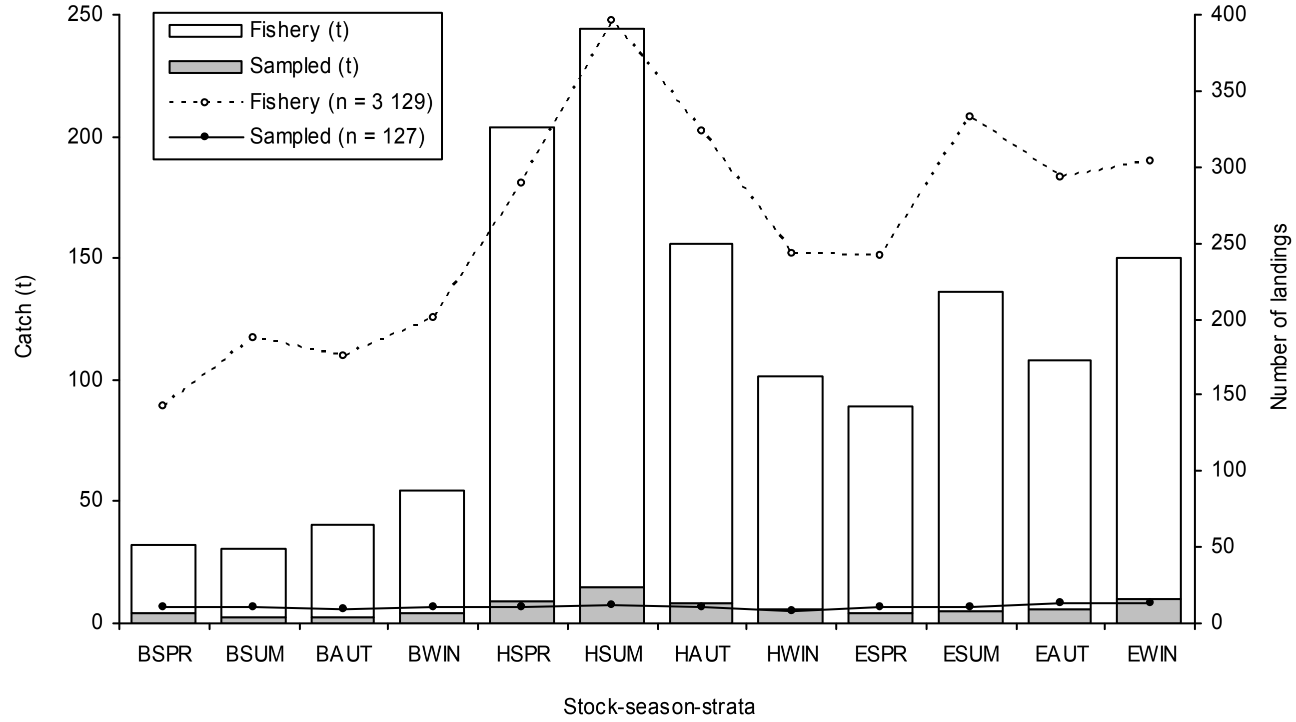


Figure 7: Observed and predicted mean weight-at-age estimates from snapper landings sampled over four seasons from the Bay of Plenty (BPLE), Hauraki Gulf (HAGU), and East Northland (ENLD) longline fisheries in 2008–09 (*n*, sample size). Note: Predicted estimates are based on published growth (Gilbert & Sullivan 1994) and length-weight (Paul 1976) parameters.

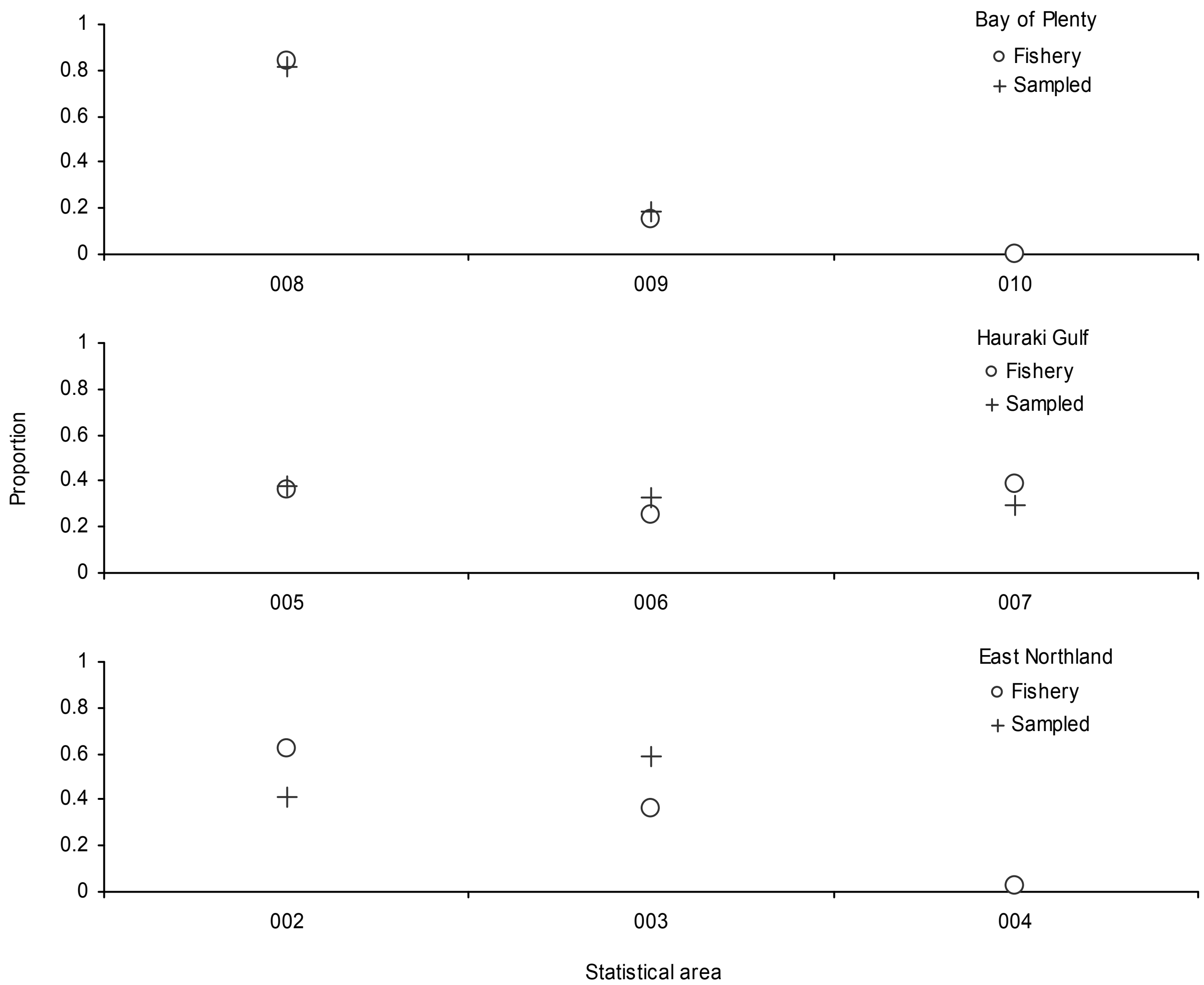
Appendix 1a: The cumulative proportion of the number of landings and samples taken from the Bay of Plenty (BPLE), Hauraki Gulf (HAGU), and East Northland (ENLD) longline fisheries in 2008–09.



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 2008–09 (Note: histograms and lines overlaid; 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 2008–09.



Appendix 2: Estimated seasonal proportion at age and c.v.s for snapper fisheries in SNA 1 in 2008–09.
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 2008–09.

									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	0.0078	0.85	0.0027	0.85	1.06
4	0.0026	1.09	0.0198	0.48	0.0552	0.43	0.0644	0.28	0.0423	0.22	0.31
5	0.0387	0.38	0.0232	0.49	0.1294	0.30	0.0752	0.28	0.0753	0.18	0.23
6	0.1141	0.17	0.1616	0.19	0.2143	0.18	0.2599	0.15	0.2019	0.09	0.13
7	0.1590	0.28	0.1150	0.20	0.1984	0.22	0.1886	0.13	0.1734	0.10	0.13
8	0.1000	0.24	0.1206	0.21	0.1076	0.41	0.1278	0.16	0.1153	0.14	0.16
9	0.1763	0.11	0.0958	0.15	0.1275	0.23	0.1008	0.18	0.1224	0.09	0.15
10	0.2024	0.09	0.2099	0.19	0.0840	0.24	0.0856	0.17	0.1285	0.08	0.13
11	0.0492	0.43	0.0818	0.20	0.0236	0.42	0.0266	0.48	0.0394	0.18	0.26
12	0.0134	0.62	0.0163	0.53	0.0186	0.51	0.0021	1.09	0.0115	0.31	0.43
13	0.0849	0.30	0.0382	0.20	0.0167	0.53	0.0280	0.48	0.0374	0.20	0.27
14	0.0201	0.50	0.0455	0.35	0.0064	0.99	0.0099	0.63	0.0168	0.26	0.36
15	0.0118	0.60	0.0077	1.03	0.0000	0.00	0.0047	0.79	0.0052	0.44	0.58
16	0.0025	1.08	0.0097	0.70	0.0000	0.00	0.0021	1.09	0.0028	0.52	0.70
17	0.0176	0.45	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0034	0.45	0.86
18	0.0049	1.08	0.0038	1.03	0.0000	0.00	0.0000	0.00	0.0016	0.77	0.92
19	0.0000	0.00	0.0036	1.06	0.0000	0.00	0.0000	0.00	0.0006	1.06	1.35
>19	0.0025	1.08	0.0473	0.35	0.0183	1.00	0.0164	0.85	0.0194	0.40	0.46
n	211		174		161		221		767		

Estimates of proportion at age with coefficients of variation (analytical and bootstrap estimates) for snapper from the Hauraki Gulf longline fishery in 2008–09.

									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	0.0030	1.03	0.0000	0.00	0.0007	1.03	1.34
4	0.0000	0.00	0.0014	1.12	0.0197	0.36	0.0310	0.40	0.0095	0.26	0.38
5	0.0265	0.38	0.0766	0.44	0.0949	0.40	0.0810	0.21	0.0682	0.23	0.27
6	0.0832	0.29	0.0946	0.26	0.1424	0.19	0.1266	0.28	0.1075	0.13	0.17
7	0.0752	0.26	0.1525	0.29	0.1558	0.13	0.1146	0.17	0.1274	0.13	0.16
8	0.1284	0.11	0.1344	0.10	0.1360	0.16	0.0597	0.33	0.1229	0.07	0.12
9	0.1171	0.14	0.1258	0.27	0.1032	0.36	0.1113	0.27	0.1160	0.14	0.16
10	0.0674	0.38	0.1755	0.14	0.1047	0.32	0.1536	0.13	0.1265	0.11	0.15
11	0.1530	0.19	0.0605	0.45	0.0348	0.28	0.0994	0.23	0.0845	0.16	0.19
12	0.0178	0.56	0.0244	0.21	0.0194	0.79	0.0233	0.47	0.0213	0.24	0.32
13	0.0662	0.13	0.0511	0.20	0.0554	0.20	0.0679	0.29	0.0585	0.10	0.18
14	0.0645	0.23	0.0362	0.36	0.0573	0.30	0.0270	0.52	0.0476	0.16	0.22
15	0.0510	0.20	0.0161	0.37	0.0303	0.43	0.0398	0.47	0.0321	0.17	0.25
16	0.0091	0.64	0.0205	0.17	0.0038	1.01	0.0069	0.76	0.0115	0.20	0.44
17	0.0126	0.91	0.0060	0.74	0.0038	1.01	0.0115	0.61	0.0080	0.46	0.63
18	0.0543	0.12	0.0219	0.50	0.0093	0.77	0.0146	0.49	0.0265	0.18	0.28
19	0.0153	0.75	0.0010	1.12	0.0030	1.03	0.0156	0.86	0.0073	0.51	0.64
>19	0.0585	0.23	0.0015	0.88	0.0233	0.50	0.0164	0.44	0.0241	0.20	0.27
n	262		318		296		202		1 078		

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 2008–09.

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	0.0025	1.09	0.0000	0.00	0.0006	1.09	1.49
3	0.0072	0.91	0.0000	0.00	0.0164	0.64	0.0164	0.54	0.0105	0.38	0.53
4	0.0047	1.02	0.0269	0.35	0.0553	0.38	0.0461	0.42	0.0356	0.23	0.30
5	0.0680	0.32	0.0128	0.59	0.0689	0.30	0.0722	0.20	0.0555	0.15	0.19
6	0.1082	0.30	0.0893	0.22	0.1771	0.15	0.1429	0.15	0.1310	0.09	0.12
7	0.1385	0.23	0.1202	0.27	0.1118	0.12	0.1326	0.15	0.1255	0.10	0.13
8	0.1214	0.23	0.1404	0.13	0.0988	0.14	0.1145	0.13	0.1186	0.08	0.11
9	0.1037	0.26	0.1179	0.16	0.1655	0.15	0.0802	0.23	0.1150	0.09	0.13
10	0.1912	0.11	0.2101	0.13	0.0994	0.21	0.1648	0.10	0.1654	0.06	0.10
11	0.0329	0.50	0.0508	0.15	0.0652	0.19	0.0293	0.33	0.0442	0.13	0.20
12	0.0107	0.63	0.0236	0.46	0.0148	0.68	0.0218	0.28	0.0184	0.23	0.34
13	0.0545	0.21	0.0674	0.28	0.0631	0.27	0.0561	0.19	0.0604	0.13	0.18
14	0.0298	0.39	0.0348	0.22	0.0174	0.48	0.0278	0.34	0.0274	0.17	0.24
15	0.0389	0.45	0.0103	0.56	0.0149	0.69	0.0198	0.33	0.0198	0.25	0.33
16	0.0089	0.75	0.0064	0.81	0.0000	0.00	0.0185	0.48	0.0091	0.37	0.53
17	0.0062	0.95	0.0074	0.93	0.0000	0.00	0.0129	0.52	0.0071	0.42	0.60
18	0.0134	0.56	0.0155	0.47	0.0009	1.18	0.0102	0.59	0.0099	0.30	0.45
19	0.0188	0.44	0.0039	0.79	0.0009	1.18	0.0078	0.61	0.0072	0.32	0.50
>19	0.0432	0.59	0.0627	0.37	0.0271	0.48	0.0262	0.46	0.0389	0.23	0.28
n	228		223		280		331		1 062		

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 2008–09.

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	0.0046	1.09	0.0000	0.00	0.0010	1.09	1.48
3	0.0121	0.91	0.0000	0.00	0.0297	0.64	0.0125	0.84	0.0126	0.45	0.62
4	0.0079	1.02	0.0277	0.31	0.0801	0.46	0.0555	0.58	0.0439	0.30	0.34
5	0.0567	0.48	0.0157	0.66	0.0561	0.48	0.0707	0.32	0.0488	0.22	0.29
6	0.1107	0.41	0.1017	0.19	0.1747	0.24	0.1147	0.20	0.1234	0.13	0.17
7	0.1267	0.38	0.1196	0.36	0.0927	0.18	0.1231	0.27	0.1161	0.16	0.20
8	0.1059	0.44	0.1702	0.13	0.0844	0.25	0.0900	0.24	0.1153	0.12	0.17
9	0.0739	0.46	0.0933	0.28	0.2019	0.19	0.0685	0.38	0.1062	0.14	0.20
10	0.1983	0.16	0.2006	0.17	0.0794	0.42	0.2074	0.11	0.1755	0.09	0.14
11	0.0118	0.73	0.0521	0.18	0.0391	0.38	0.0370	0.38	0.0372	0.17	0.31
12	0.0180	0.63	0.0238	0.60	0.0252	0.72	0.0220	0.43	0.0225	0.30	0.44
13	0.0761	0.19	0.0459	0.35	0.0612	0.24	0.0560	0.25	0.0579	0.13	0.23
14	0.0300	0.49	0.0326	0.24	0.0201	0.61	0.0227	0.66	0.0264	0.24	0.36
15	0.0569	0.50	0.0067	1.03	0.0074	0.83	0.0228	0.44	0.0210	0.31	0.39
16	0.0105	0.95	0.0067	1.03	0.0000	0.00	0.0315	0.48	0.0134	0.40	0.60
17	0.0105	0.95	0.0106	0.93	0.0000	0.00	0.0173	0.59	0.0103	0.45	0.67
18	0.0059	1.06	0.0220	0.47	0.0000	0.00	0.0173	0.59	0.0128	0.35	0.51
19	0.0184	0.61	0.0000	0.00	0.0000	0.00	0.0055	1.09	0.0051	0.54	0.74
>19	0.0695	0.61	0.0709	0.45	0.0434	0.52	0.0255	0.61	0.0509	0.27	0.31
n	120		119		148		135		522		

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 2008–09.

	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	0.0221	0.70	0.0073	0.70	1.10
4	0.0000	0.00	0.0249	0.97	0.0249	0.49	0.0327	0.35	0.0225	0.31	0.45
5	0.0844	0.42	0.0057	1.13	0.0845	0.38	0.0743	0.19	0.0659	0.19	0.25
6	0.1045	0.42	0.0599	0.82	0.1800	0.17	0.1831	0.21	0.1428	0.14	0.18
7	0.1556	0.24	0.1214	0.26	0.1353	0.17	0.1461	0.11	0.1402	0.09	0.15
8	0.1438	0.14	0.0699	0.48	0.1164	0.14	0.1494	0.12	0.1238	0.09	0.15
9	0.1468	0.30	0.1760	0.09	0.1207	0.23	0.0969	0.24	0.1287	0.11	0.17
10	0.1809	0.14	0.2326	0.18	0.1241	0.17	0.1041	0.20	0.1498	0.09	0.14
11	0.0633	0.61	0.0477	0.24	0.0973	0.20	0.0182	0.65	0.0549	0.19	0.26
12	0.0000	0.00	0.0230	0.59	0.0020	1.18	0.0215	0.27	0.0121	0.27	0.48
13	0.0232	0.80	0.1181	0.44	0.0655	0.52	0.0563	0.30	0.0642	0.24	0.30
14	0.0296	0.63	0.0402	0.44	0.0141	0.77	0.0349	0.24	0.0291	0.22	0.33
15	0.0128	0.88	0.0187	0.55	0.0241	0.90	0.0156	0.43	0.0180	0.39	0.54
16	0.0064	1.11	0.0057	1.13	0.0000	0.00	0.0000	0.00	0.0024	0.80	1.03
17	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0067	1.15	0.0022	1.15	1.22
18	0.0242	0.65	0.0000	0.00	0.0020	1.18	0.0000	0.00	0.0054	0.60	0.69
19	0.0192	0.61	0.0130	0.79	0.0020	1.18	0.0110	0.70	0.0105	0.38	0.61
>19	0.0052	1.13	0.0431	0.54	0.0070	1.00	0.0270	0.69	0.0202	0.39	0.42
n	108		104		132		196		540		

Appendix 3: Estimated mean weight-at-age (kg) and c.v.s for snapper fisheries in SNA 1 in 2008–09.
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 2008–09.

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	–	–	–	–	–	–	0.46	0.51	0.46	0.51
4	0.49	1.06	0.46	0.40	0.44	0.12	0.55	0.08	0.49	0.14
5	0.49	0.11	0.42	0.33	0.59	0.13	0.55	0.04	0.53	0.06
6	0.54	0.08	0.56	0.04	0.57	0.06	0.66	0.05	0.60	0.03
7	0.60	0.04	0.69	0.11	0.65	0.07	0.81	0.12	0.70	0.05
8	0.64	0.07	0.75	0.11	0.83	0.11	0.82	0.07	0.77	0.05
9	0.87	0.07	1.00	0.15	0.81	0.06	0.88	0.13	0.88	0.06
10	0.98	0.07	0.96	0.05	0.89	0.08	1.04	0.09	0.97	0.04
11	1.14	0.10	1.04	0.13	1.17	0.29	1.09	0.20	1.12	0.12
12	1.52	0.53	1.68	0.37	1.23	0.42	1.07	1.02	1.31	0.29
13	1.60	0.08	1.79	0.16	1.79	0.38	1.41	0.44	1.62	0.19
14	1.17	0.29	1.81	0.18	1.33	1.01	2.01	0.43	1.62	0.25
15	2.30	0.50	1.91	0.81	–	–	1.53	0.57	1.83	0.35
16	2.22	0.94	1.55	0.57	–	–	2.35	1.05	2.12	0.59
17	1.55	0.62	–	–	–	–	–	–	1.55	0.64
18	1.58	0.74	1.97	1.05	–	–	–	–	1.76	0.63
19	–	–	2.22	1.02	–	–	–	–	2.22	1.02
>19	2.35	0.95	2.84	0.10	2.10	0.79	3.70	0.85	2.83	0.42

Estimates of mean weight-at-age (kg) with coefficients of variation (bootstrap estimates) for snapper from the Hauraki Gulf longline fishery in 2008–09.

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	0.97	–	–	0.44	0.97
4	–	–	0.40	0.99	0.51	0.13	0.54	0.20	0.46	0.28
5	0.56	0.16	0.50	0.08	0.49	0.07	0.57	0.13	0.52	0.06
6	0.59	0.11	0.52	0.05	0.56	0.06	0.57	0.09	0.55	0.04
7	0.71	0.09	0.61	0.03	0.60	0.03	0.61	0.08	0.64	0.03
8	0.69	0.09	0.72	0.04	0.73	0.06	0.82	0.09	0.73	0.03
9	0.86	0.08	0.83	0.08	0.74	0.09	0.80	0.14	0.81	0.05
10	0.75	0.10	1.10	0.10	0.90	0.11	1.02	0.16	0.94	0.06
11	1.07	0.12	1.21	0.16	1.05	0.14	1.12	0.26	1.12	0.09
12	0.78	0.28	1.35	0.15	0.84	0.48	1.18	0.56	1.05	0.15
13	1.24	0.24	1.40	0.19	1.41	0.11	1.33	0.20	1.35	0.10
14	1.09	0.22	1.70	0.14	1.37	0.06	1.13	0.45	1.38	0.09
15	1.08	0.19	1.44	0.16	1.74	0.21	1.27	0.37	1.39	0.11
16	0.83	0.64	1.72	0.30	2.35	1.09	1.72	0.64	1.63	0.31
17	0.72	0.87	1.67	0.46	2.92	1.06	3.03	0.68	1.90	0.40
18	1.77	0.40	1.25	0.27	2.40	0.51	1.93	0.55	1.76	0.22
19	1.02	0.53	3.24	1.07	2.48	1.02	0.89	0.84	2.14	0.57
>19	2.43	0.30	4.72	0.63	2.24	0.24	3.24	0.40	3.30	0.30

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 2008–09.

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	–	–	–	–	0.44	1.01	–	–	0.44	1.05
3	0.44	0.98	–	–	0.56	0.43	0.42	0.71	0.46	0.35
4	0.71	1.06	0.51	0.34	0.52	0.14	0.50	0.08	0.54	0.14
5	0.60	0.13	0.51	0.51	0.57	0.12	0.59	0.12	0.57	0.11
6	0.51	0.11	0.59	0.09	0.64	0.06	0.63	0.06	0.60	0.04
7	0.62	0.09	0.78	0.08	0.66	0.07	0.69	0.07	0.69	0.04
8	0.90	0.13	0.81	0.07	0.78	0.06	0.78	0.07	0.81	0.04
9	0.78	0.13	0.96	0.10	0.86	0.11	0.93	0.10	0.89	0.05
10	0.91	0.05	1.06	0.06	0.85	0.07	0.97	0.04	0.95	0.03
11	0.77	0.31	1.20	0.19	1.25	0.17	1.32	0.22	1.17	0.11
12	0.76	0.59	1.29	0.44	1.11	0.43	1.43	0.32	1.23	0.22
13	1.33	0.19	1.40	0.22	1.26	0.18	1.35	0.11	1.34	0.09
14	1.57	0.37	1.55	0.21	1.08	0.31	1.63	0.29	1.46	0.15
15	1.38	0.37	2.22	0.75	1.77	0.48	1.52	0.31	1.73	0.25
16	0.97	0.70	1.21	0.79	–	–	1.81	0.45	1.31	0.35
17	2.63	1.01	1.74	1.02	–	–	2.32	0.52	2.21	0.42
18	1.63	0.47	1.61	0.34	1.24	0.99	1.44	0.61	1.51	0.26
19	1.81	0.42	1.97	0.98	1.63	1.02	1.74	0.73	1.77	0.37
>19	2.59	0.47	2.41	0.19	1.89	0.41	2.00	0.27	2.19	0.15

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 2008–09.

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	–	–	–	–	0.44	1.02	–	–	0.44	1.03
3	0.44	0.97			0.56	0.43	0.44	0.94	0.48	0.42
4	0.71	0.96	0.57	0.36	0.54	0.17	0.55	0.10	0.58	0.18
5	0.70	0.15	0.50	0.57	0.59	0.17	0.60	0.20	0.59	0.14
6	0.51	0.15	0.61	0.06	0.64	0.04	0.64	0.08	0.61	0.04
7	0.61	0.14	0.81	0.10	0.68	0.10	0.72	0.10	0.72	0.05
8	0.95	0.19	0.85	0.08	0.85	0.09	0.79	0.10	0.85	0.05
9	0.68	0.11	1.03	0.14	0.90	0.08	0.91	0.15	0.90	0.07
10	0.88	0.07	1.09	0.08	0.89	0.09	0.96	0.06	0.97	0.04
11	0.72	0.56	1.31	0.22	1.43	0.27	1.16	0.35	1.18	0.15
12	0.76	0.56	1.42	0.55	1.48	0.47	1.20	0.56	1.25	0.29
13	1.56	0.20	1.46	0.28	1.06	0.15	1.17	0.12	1.31	0.11
14	1.78	0.48	1.71	0.22	1.05	0.31	1.52	0.55	1.52	0.20
15	1.21	0.23	2.48	0.97	1.82	0.55	1.76	0.39	1.89	0.34
16	0.78	1.00	1.15	1.03	–	–	1.81	0.47	1.32	0.40
17	2.63	1.06	1.74	1.01	–	–	2.61	0.65	2.28	0.48
18	1.07	0.99	1.61	0.33	–	–	1.44	0.58	1.42	0.32
19	1.61	0.64	–	–	–	–	1.74	1.01	1.69	0.62
>19	1.90	0.30	2.47	0.17	2.34	0.48	1.75	0.44	2.12	0.19

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 2008–09.

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	–	–	–	–	–	–	0.38	0.81	0.38	0.81
4	–	–	0.38	0.79	0.51	0.29	0.43	0.19	0.44	0.18
5	0.47	0.17	0.54	1.01	0.55	0.16	0.58	0.06	0.54	0.13
6	0.52	0.17	0.55	0.36	0.64	0.12	0.61	0.09	0.59	0.08
7	0.64	0.11	0.70	0.11	0.63	0.11	0.66	0.08	0.65	0.05
8	0.84	0.19	0.73	0.14	0.70	0.10	0.77	0.08	0.76	0.06
9	0.92	0.20	0.80	0.09	0.81	0.21	0.97	0.15	0.88	0.09
10	0.95	0.09	1.00	0.06	0.81	0.08	0.99	0.05	0.93	0.03
11	0.84	0.25	0.95	0.31	1.04	0.15	1.53	0.28	1.14	0.15
12	–	–	0.99	0.43	0.65	1.01	1.75	0.36	1.19	0.28
13	1.00	0.41	1.23	0.14	1.50	0.28	1.61	0.21	1.39	0.13
14	1.26	0.47	1.17	0.26	1.12	0.57	1.78	0.28	1.37	0.19
15	1.63	1.03	1.61	0.53	1.71	0.79	1.18	0.57	1.50	0.37
16	1.24	1.03	1.33	1.06	–	–	–	–	1.29	0.74
17	–	–	–	–	–	–	1.91	0.89	1.91	0.89
18	2.43	0.49	–	–	1.24	1.01	–	–	1.74	0.46
19	2.11	0.53	1.97	0.95	1.63	0.99	1.74	1.04	1.83	0.45
>19	3.58	1.01	2.27	0.42	1.33	1.04	2.36	0.30	2.30	0.29

Appendix 4: Age-length keys derived from otolith samples collected from snapper fisheries in SNA 1 in 2008–09.

Estimates of proportion of length at age for snapper sampled from the Bay of Plenty, spring-winter 2008–09. (Note: Aged to 01/01/09)

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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
25	0	0	0	0.30	0.50	0.10	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	10
26	0	0	0.12	0.29	0.24	0.29	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	17
27	0	0	0	0.11	0.25	0.43	0.18	0.04	0	0	0	0	0	0	0	0	0	0	0	0	28
28	0	0	0	0.07	0.24	0.27	0.38	0.02	0.02	0	0	0	0	0	0	0	0	0	0	0	45
29	0	0	0.01	0.06	0.12	0.41	0.27	0.08	0.05	0	0	0	0	0	0	0	0	0	0	0	78
30	0	0	0	0.03	0.08	0.38	0.25	0.16	0.08	0.01	0.01	0	0	0	0	0	0	0	0	0	79
31	0	0	0	0.03	0.03	0.29	0.22	0.22	0.12	0.06	0.01	0.01	0	0	0	0	0	0	0	0	68
32	0	0	0	0.02	0.03	0.16	0.24	0.16	0.22	0.16	0.02	0	0	0	0	0	0	0	0	0	63
33	0	0	0	0	0.02	0.04	0.28	0.30	0.15	0.19	0.02	0	0	0	0	0	0	0	0	0	53
34	0	0	0	0	0	0.07	0.12	0.14	0.28	0.26	0.11	0.02	0	0	0	0	0	0	0	0	57
35	0	0	0	0	0	0.02	0.07	0.14	0.23	0.42	0.09	0	0	0.02	0	0	0	0	0	0	43
36	0	0	0	0	0	0.06	0	0.09	0.32	0.32	0.13	0.04	0.04	0	0	0	0	0	0	0	47
37	0	0	0	0	0.04	0	0.12	0.15	0.15	0.31	0.08	0.04	0.08	0	0.04	0	0	0	0	0	26
38	0	0	0	0	0	0.04	0.07	0.07	0.30	0.15	0.19	0	0.11	0.07	0	0	0	0	0	0	27
39	0	0	0	0	0	0.06	0.11	0.06	0.06	0.44	0.06	0	0.11	0.06	0	0	0.06	0	0	0	18
40	0	0	0	0	0	0	0.06	0.11	0.11	0.22	0.17	0	0.17	0.17	0	0	0	0	0	0	18
41	0	0	0	0	0	0.07	0	0.07	0.07	0.47	0	0.07	0.13	0	0	0.07	0	0.07	0	0	15
42	0	0	0	0	0	0	0	0.09	0.09	0.09	0	0.09	0.27	0.18	0.18	0	0	0	0	0	11
43	0	0	0	0	0	0	0	0	0.17	0	0.25	0.08	0.25	0.08	0.08	0.08	0	0	0	0	12
44	0	0	0	0	0	0	0	0	0	0.20	0.10	0.10	0.30	0.10	0	0	0	0.10	0	0.10	10
45	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0.33	0	0.33	0	0	0	3
46	0	0	0	0	0	0	0.20	0	0	0	0	0	0.20	0.20	0.20	0	0	0.20	0	0	5
47	0	0	0	0	0	0	0	0	0	0.20	0	0.20	0.20	0.20	0	0	0	0	0	0.20	5
48	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0.38	0	0.13	0	0	0.13	0.25	8
49	0	0	0	0	0	0	0	0	0	0	0.17	0	0	0.17	0	0.17	0	0	0	0.50	6
50	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	3
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0.67	3
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	1.00	1
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
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	0	0
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	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
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	1.00	0	0	0	0	0	0	0	1
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	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																					767

Appendix 4 – continued:
Estimates of proportion of length at age for snapper sampled from the Hauraki Gulf, spring-winter 2008–09.
(Note: Aged to 01/01/09)

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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0.10	0.38	0.24	0.05	0.14	0.05	0	0	0	0	0	0	0	0	0.05	0	0	21
27	0	0	0.02	0.09	0.35	0.23	0.14	0.05	0.02	0.02	0.05	0	0	0	0.02	0	0	0	0	0	43
28	0	0	0	0.04	0.23	0.29	0.17	0.06	0.09	0.03	0.08	0	0.01	0	0	0	0	0	0	0	77
29	0	0	0	0.03	0.09	0.26	0.27	0.10	0.07	0.11	0.03	0	0.01	0	0.02	0	0	0	0	0	99
30	0	0	0	0	0.04	0.21	0.27	0.13	0.16	0.04	0.09	0.04	0.01	0.01	0	0	0	0.01	0	0	104
31	0	0	0	0.01	0.04	0.10	0.26	0.26	0.08	0.08	0.06	0.01	0.02	0.02	0.03	0.01	0.01	0.01	0	0	102
32	0	0	0	0.01	0.02	0.10	0.18	0.24	0.20	0.12	0.05	0.01	0.04	0	0	0	0	0.01	0	0.01	94
33	0	0	0	0	0	0.06	0.13	0.16	0.25	0.16	0.08	0	0.06	0.01	0.05	0	0.01	0.01	0.01	0.01	87
34	0	0	0	0	0	0	0.01	0.27	0.18	0.17	0.10	0.04	0.07	0.03	0.01	0.03	0	0.04	0.01	0.03	71
35	0	0	0	0	0	0	0.08	0.06	0.17	0.33	0.10	0.06	0.02	0.06	0.08	0	0.02	0.02	0	0.02	52
36	0	0	0	0	0	0.05	0	0.20	0.25	0.20	0.08	0.03	0.05	0.05	0	0.03	0	0.03	0.05	0	40
37	0	0	0	0	0	0	0	0.08	0.14	0.39	0.06	0.08	0.06	0.11	0	0	0	0.03	0	0.06	36
38	0	0	0	0	0.04	0.04	0.04	0.08	0.25	0.25	0.08	0	0.04	0.08	0.04	0.04	0	0	0	0	24
39	0	0	0	0	0	0.04	0	0.04	0.18	0.14	0.21	0.04	0.11	0.11	0.07	0	0	0.04	0	0.04	28
40	0	0	0	0	0	0	0	0	0.12	0.12	0.15	0	0.18	0.27	0.09	0	0.03	0	0	0.03	33
41	0	0	0	0	0	0	0	0	0	0.24	0.05	0.05	0.38	0.10	0.05	0.05	0	0.05	0.05	0	21
42	0	0	0	0	0	0	0	0	0.08	0.08	0.23	0	0.08	0.23	0.27	0	0	0.04	0	0	26
43	0	0	0	0	0	0	0	0.05	0	0.23	0.23	0.14	0.14	0.23	0	0	0	0	0	0	22
44	0	0	0	0	0	0	0	0	0	0.23	0.08	0	0.15	0.08	0.15	0	0.08	0.15	0	0.08	13
45	0	0	0	0	0	0	0	0	0	0.08	0	0.17	0.08	0.25	0	0.08	0.08	0.17	0	0.08	12
46	0	0	0	0	0	0	0	0	0.07	0	0.29	0	0.43	0	0	0	0	0	0	0.21	14
47	0	0	0	0	0	0	0	0	0.13	0	0.25	0	0.13	0.13	0.13	0	0	0.13	0	0.13	8
48	0	0	0	0	0	0	0	0	0	0	0	0	0.43	0.29	0	0	0	0.29	0	0	7
49	0	0	0	0	0	0	0	0	0	0.14	0	0	0	0.14	0.29	0.29	0	0.14	0	0	7
50	0	0	0	0	0	0	0	0	0	0.11	0.22	0	0	0.11	0.22	0	0	0	0.11	0.22	9
51	0	0	0	0	0	0	0	0	0	0	0.25	0.25	0	0	0	0.25	0	0.25	0	0	4
52	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0.33	0	0.33	0	0	3
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0.50	0	0	0	2
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.57	0.14	0.29	7
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.50	0	0	2
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
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	0.33	0	0	0	0	0	0	0.67	3
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	1.00	0	0	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	1.00	1
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
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	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																					1078

Appendix 4 – continued:
Estimates of proportion of length at age for snapper sampled from East Northland (statistical areas 002 and 003 combined), spring-winter 2008–09. (Note: Aged to 01/01/09)

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	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	0.25	0.25	0	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
26	0	0	0.05	0.20	0.20	0.40	0.10	0.05	0	0	0	0	0	0	0	0	0	0	0	0	20
27	0	0.02	0.07	0.09	0.11	0.48	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	46
28	0	0	0.01	0.13	0.14	0.32	0.18	0.08	0.07	0.06	0	0	0	0	0	0	0	0	0	0	71
29	0	0	0	0.07	0.17	0.29	0.22	0.10	0.07	0.06	0.01	0	0	0	0	0	0	0	0	0	82
30	0	0	0.01	0.07	0.10	0.20	0.22	0.12	0.15	0.06	0.06	0.01	0	0	0.01	0	0	0	0	0	104
31	0	0	0	0	0.08	0.20	0.17	0.20	0.11	0.19	0.01	0.01	0.01	0.01	0	0	0	0	0	0	75
32	0	0	0	0.02	0.01	0.19	0.23	0.24	0.11	0.18	0	0	0.01	0	0	0	0	0	0	0	88
33	0	0	0	0.01	0.07	0.09	0.22	0.13	0.14	0.22	0.04	0.01	0	0.01	0.01	0.01	0	0	0	0.01	76
34	0	0	0.01	0	0.01	0.08	0.10	0.14	0.18	0.24	0.07	0.03	0.07	0.03	0.01	0	0	0	0	0.03	72
35	0	0	0	0	0.02	0.02	0.05	0.11	0.20	0.38	0.08	0.02	0.10	0	0	0	0.02	0	0	0.02	61
36	0	0	0	0	0.03	0.03	0.06	0.16	0.12	0.28	0.04	0.04	0.12	0.07	0	0	0	0	0	0.03	67
37	0	0	0	0	0	0.04	0.04	0.13	0.15	0.31	0.09	0	0.11	0.07	0.02	0	0	0.02	0	0.02	54
38	0	0	0	0	0	0.02	0.05	0.10	0.14	0.24	0.07	0.05	0.17	0.07	0.05	0.02	0	0	0	0.02	42
39	0	0	0	0	0	0	0.07	0.11	0.11	0.30	0.04	0.04	0.04	0.07	0.04	0.04	0.04	0.07	0.04	0	27
40	0	0	0	0	0	0.03	0	0.16	0.05	0.24	0.13	0	0.21	0	0.05	0.03	0	0.03	0	0.08	38
41	0	0	0	0	0	0.05	0.05	0.18	0.05	0.14	0.14	0	0.23	0.05	0.05	0	0	0.05	0	0.05	22
42	0	0	0	0	0	0	0	0.06	0.17	0.11	0.06	0.11	0.11	0.17	0.06	0.06	0	0	0	0.11	18
43	0	0	0	0	0	0	0	0	0.15	0.15	0.08	0	0	0.08	0.15	0	0	0	0.08	0.31	13
44	0	0	0	0	0	0	0	0	0	0	0.09	0	0.27	0	0.18	0	0.09	0	0.18	0.18	11
45	0	0	0	0	0	0	0	0	0.18	0	0	0.18	0	0.18	0.18	0.09	0	0.09	0	0.09	11
46	0	0	0	0	0	0	0	0	0.22	0.11	0	0	0.11	0.11	0	0.11	0.00	0.11	0.22	0	9
47	0	0	0	0	0	0	0	0	0	0	0.15	0	0.23	0	0.15	0	0.08	0.08	0.08	0.23	13
48	0	0	0	0	0	0	0	0	0	0	0.17	0	0.33	0.17	0	0	0	0.17	0	0.17	6
49	0	0	0	0	0	0	0	0	0	0	0	0.20	0.40	0	0	0	0	0	0	0.40	5
50	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0.25	0	0	0	0.25	0.25	4
51	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0.25	0	0	0.50	4
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0.67	3
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	0.50	0	0	0	0	0	0.50	4
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	0.25	0	0	0.75	4
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0.50	2
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	1
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	1.00	1
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	1.00	1
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																					1062

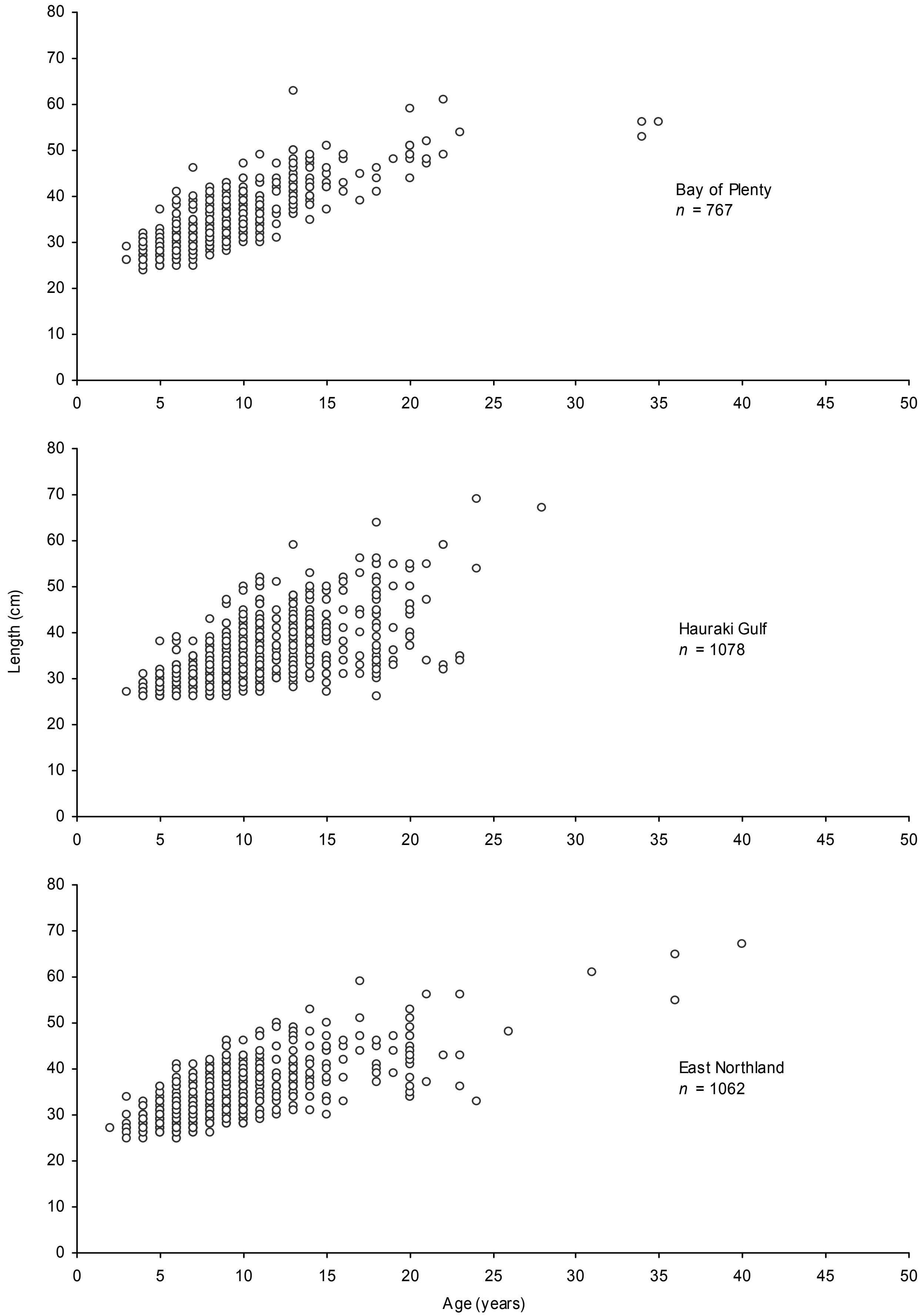
Appendix 4 – continued:
Estimates of proportion of length at age for snapper sampled from East Northland (statistical area 002), spring-winter 2008–09. (Note: Aged to 01/01/09)

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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0.11	0.22	0.56	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	9
27	0	0.04	0.13	0.08	0.08	0.50	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	24
28	0	0	0.03	0.20	0.14	0.29	0.23	0.03	0.06	0.03	0	0	0	0	0	0	0	0	0	0	35
29	0	0	0	0.16	0.09	0.34	0.19	0.06	0.06	0.09	0	0	0	0	0	0	0	0	0	0	32
30	0	0	0.02	0.11	0.09	0.27	0.24	0.07	0.09	0.02	0.04	0.02	0	0	0.02	0	0	0	0	0	45
31	0	0	0	0	0.10	0.29	0.19	0.19	0.03	0.16	0	0	0	0.03	0	0	0	0	0	0	31
32	0	0	0	0.05	0	0.16	0.23	0.23	0.09	0.25	0	0	0	0	0	0	0	0	0	0	44
33	0	0	0	0.03	0.08	0.10	0.23	0.15	0.13	0.23	0	0	0	0	0.03	0.03	0	0	0	0.03	40
34	0	0	0.03	0	0.03	0.05	0.08	0.13	0.18	0.23	0.05	0.03	0.08	0.05	0.03	0	0	0	0	0.05	39
35	0	0	0	0	0.02	0.02	0.05	0.12	0.21	0.37	0.07	0	0.12	0	0	0	0	0	0	0.02	43
36	0	0	0	0	0.06	0.03	0	0.23	0.16	0.23	0.06	0.03	0.06	0.06	0	0	0	0	0	0.06	31
37	0	0	0	0	0	0	0.04	0.20	0.16	0.32	0	0	0.12	0.04	0.04	0	0	0.04	0	0.04	25
38	0	0	0	0	0	0	0.06	0.06	0.11	0.22	0.06	0.11	0.17	0.06	0.06	0.06	0	0	0	0.06	18
39	0	0	0	0	0	0	0.08	0.15	0.15	0.23	0	0.08	0.08	0.08	0	0	0	0.08	0.08	0	13
40	0	0	0	0	0	0	0	0.12	0.06	0.35	0.06	0	0.29	0	0.06	0	0	0.06	0	0	17
41	0	0	0	0	0	0	0	0.19	0.06	0.13	0.19	0	0.19	0.06	0.06	0	0	0.06	0	0.06	16
42	0	0	0	0	0	0	0	0	0.10	0.20	0.10	0.20	0.10	0.10	0	0.10	0	0	0	0.10	10
43	0	0	0	0	0	0	0	0	0.20	0.20	0	0	0	0	0	0	0	0	0	0.60	5
44	0	0	0	0	0	0	0	0	0	0	0	0	0.14	0	0.29	0	0.14	0	0.14	0.29	7
45	0	0	0	0	0	0	0	0	0	0	0	0.13	0	0.25	0.25	0.13	0	0.13	0	0.13	8
46	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0.33	0	0.33	0	0	3
47	0	0	0	0	0	0	0	0	0	0	0.14	0	0.14	0	0.14	0	0.14	0	0.14	0.29	7
48	0	0	0	0	0	0	0	0	0	0	0.20	0	0.40	0.20	0	0	0	0	0	0.20	5
49	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0	0.50	2
50	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0.50	0	0	0	0	0	2
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0.50	2
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0.50	2
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	1.00	1
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	0	0
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	1.00	0	0	0	1
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	1.00	1
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	1.00	1
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																					522

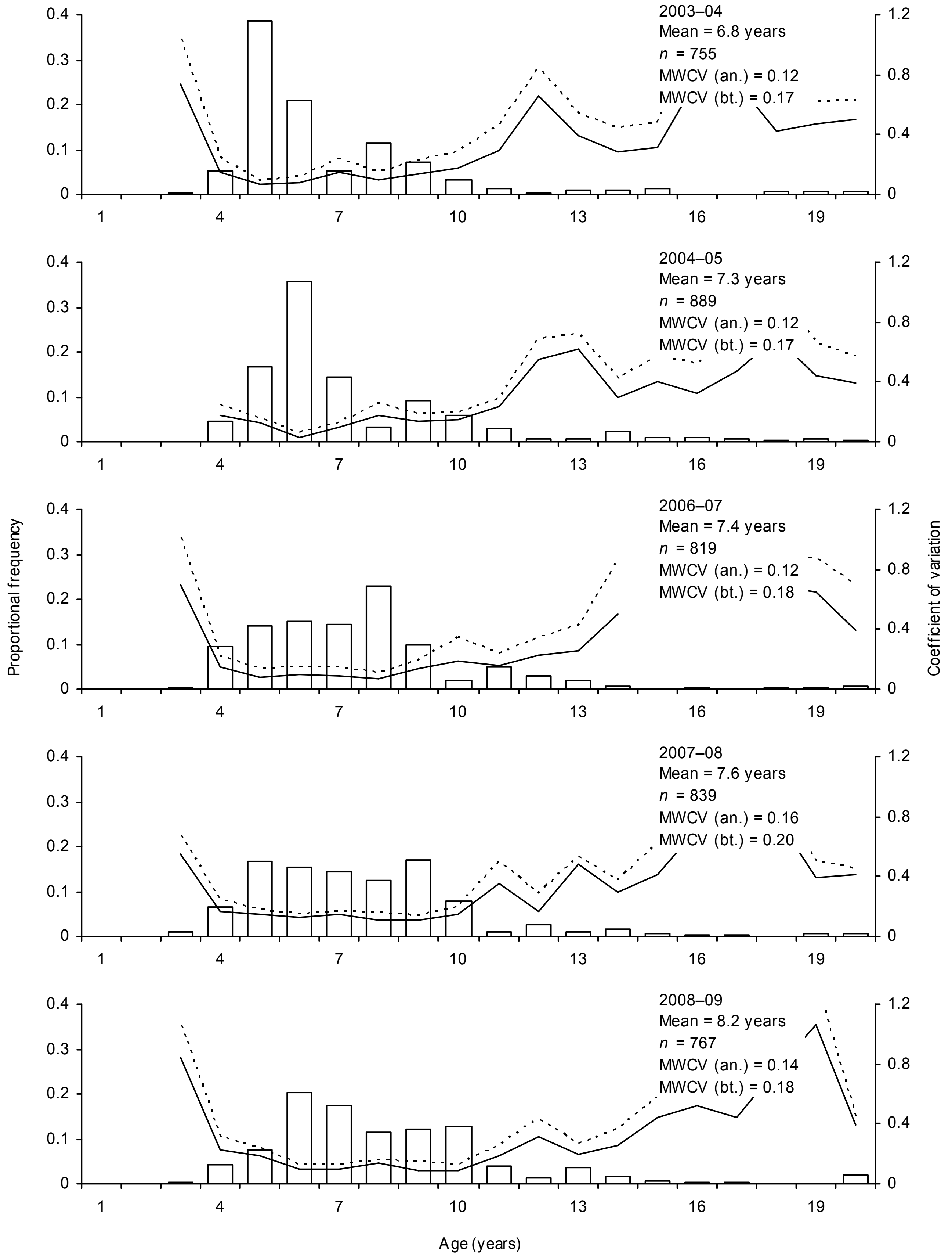
Appendix 4 – continued:
Estimates of proportion of length at age for snapper sampled from East Northland (statistical area 003), spring-winter 2008–09. (Note: Aged to 01/01/09)

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	0.25	0.25	0	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
26	0	0	0.09	0.27	0.18	0.27	0.09	0.09	0	0	0	0	0	0	0	0	0	0	0	0	11
27	0	0	0	0.09	0.14	0.45	0.32	0.00	0	0	0	0	0	0	0	0	0	0	0	0	22
28	0	0	0	0.06	0.14	0.36	0.14	0.14	0.08	0.08	0	0	0	0	0	0	0	0	0	0	36
29	0	0	0	0.02	0.22	0.26	0.24	0.12	0.08	0.04	0.02	0	0	0	0	0	0	0	0	0	50
30	0	0	0	0.03	0.10	0.15	0.20	0.15	0.20	0.08	0.07	0	0	0	0	0	0	0	0	0	59
31	0	0	0	0	0.07	0.14	0.16	0.20	0.16	0.20	0.02	0.02	0.02	0	0	0	0	0	0	0	44
32	0	0	0	0	0.02	0.23	0.23	0.25	0.14	0.11	0	0	0.02	0	0	0	0	0	0	0	44
33	0	0	0	0	0.06	0.08	0.22	0.11	0.17	0.22	0.08	0.03	0	0.03	0	0	0	0	0	0	36
34	0	0	0	0	0	0.12	0.12	0.15	0.18	0.24	0.09	0.03	0.06	0	0	0	0	0	0	0	33
35	0	0	0	0	0	0	0.06	0.11	0.17	0.39	0.11	0.06	0.06	0	0	0	0.06	0	0	0	18
36	0	0	0	0	0	0.03	0.11	0.11	0.08	0.33	0.03	0.06	0.17	0.08	0	0	0	0	0	0	36
37	0	0	0	0	0	0.07	0.03	0.07	0.14	0.31	0.17	0	0.10	0.10	0	0	0	0	0	0	29
38	0	0	0	0	0	0.04	0.04	0.13	0.17	0.25	0.08	0	0.17	0.08	0.04	0	0	0	0	0	24
39	0	0	0	0	0	0	0.07	0.07	0.07	0.36	0.07	0	0	0.07	0.07	0.07	0.07	0.07	0	0	14
40	0	0	0	0	0	0.05	0	0.19	0.05	0.14	0.19	0	0.14	0	0.05	0.05	0	0	0	0.14	21
41	0	0	0	0	0	0.17	0.17	0.17	0	0.17	0	0	0.33	0	0	0	0	0	0	0	6
42	0	0	0	0	0	0	0	0.13	0.25	0	0	0	0.13	0.25	0.13	0	0	0	0	0.13	8
43	0	0	0	0	0	0	0	0	0.13	0.13	0.13	0	0	0.13	0.25	0	0	0	0.13	0.13	8
44	0	0	0	0	0	0	0	0	0	0	0.25	0	0.50	0	0	0	0	0	0.25	0	4
45	0	0	0	0	0	0	0	0	0.67	0	0	0.33	0	0	0	0	0	0	0	0	3
46	0	0	0	0	0	0	0	0	0.33	0	0	0	0.17	0.17	0	0	0	0	0.33	0	6
47	0	0	0	0	0	0	0	0	0	0	0.17	0	0.33	0	0.17	0	0	0.17	0	0.17	6
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	1
49	0	0	0	0	0	0	0	0	0	0	0	0.33	0.33	0	0	0	0	0	0	0.33	3
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.50	2
51	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0	0.50	2
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
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	0.67	0	0	0	0	0	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	0.25	0	0	0.75	4
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0.50	2
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	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	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																					540

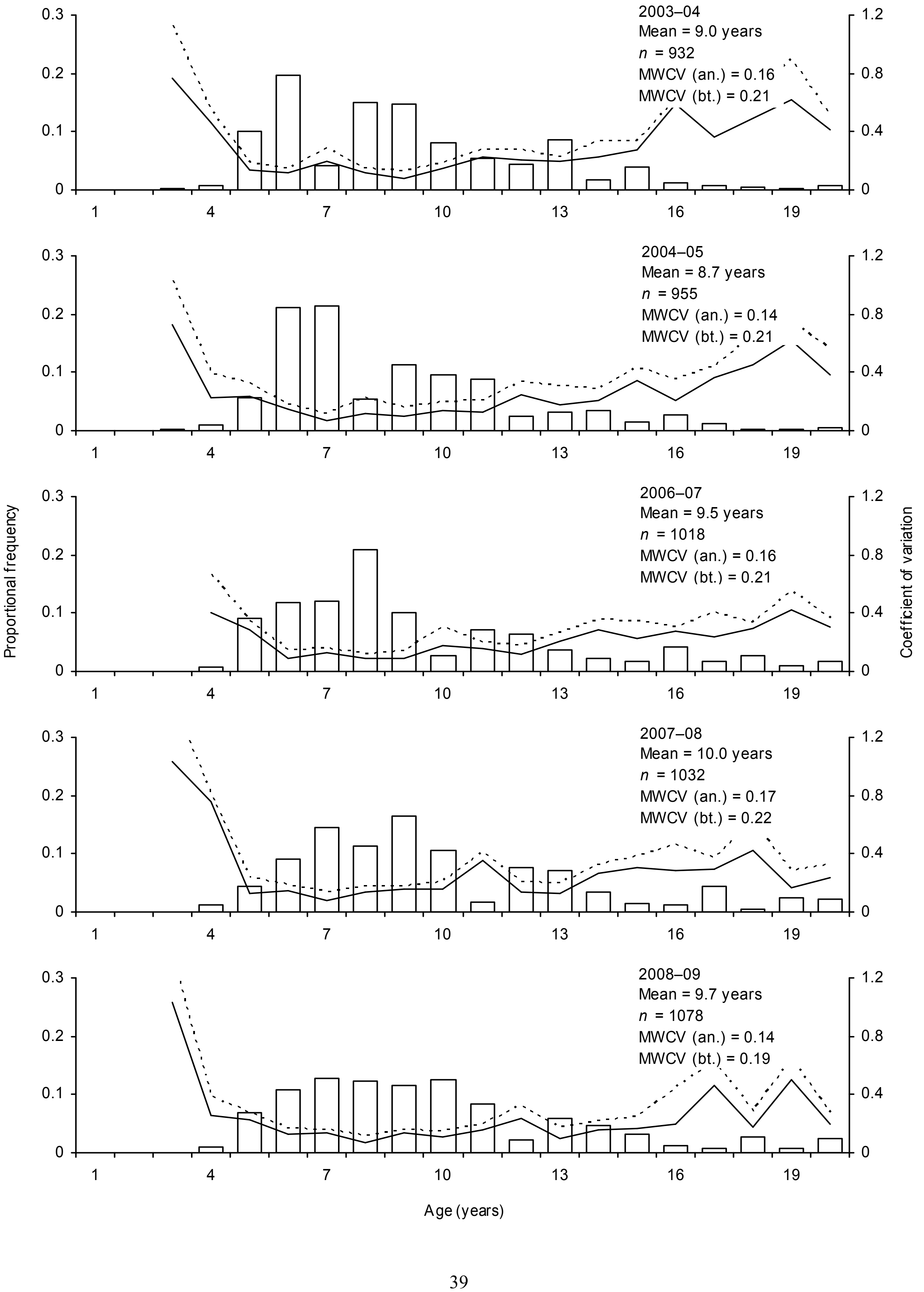
Appendix 5: Scatterplots of age-at-length data for snapper sampled from the SNA 1 longline fisheries year-round in 2008–09 (*n*, sample size).



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, 2007–08, and 2008–09 (*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, 2007–08, and 2008–09 (*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, 2007–08, and 2008–09 (*n*, sample size).