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Age composition of commercial snapper landings in SNA 1, 2012–13

New Zealand Fisheries Assessment Report 2014/55

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This report presents the results of Objective 1 of the Ministry for Primary Industries project "Estimation of snapper year class strength in SNA 1, 2012–13" (SNA2012/01). 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 2012 to winter 2013 to estimate catch-at-age for snapper from the three bottom longline fisheries in SNA 1: East Northland, Hauraki Gulf, and Bay of Plenty. Target sample sizes (landings and otoliths) were achieved for the East Northland (Statistical Area 003) and Bay of Plenty fisheries. However, targets for the Hauraki Gulf fishery fell short by three landings and for East Northland (Statistical Area 002) by four landings. Overall, spatio-temporal comparisons revealed good sample representativeness.

Year class strengths inferred from the age distributions sampled from the SNA 1 bottom longline fisheries in 2012–13 were mostly consistent with trends previously observed, although a two year hiatus from sampling resulted in a marked change in the relative strengths of some year classes, particularly in East Northland and the Bay of Plenty, probably due to the effect of either recruitment and/or fishing mortality over the three year period. Hauraki Gulf landings were largely dominated by the 2007 to 1998 year classes (6- to 15-year-olds), whereas East Northland and Bay of Plenty landings were dominated by the 2009 to 1999 year classes (4- to 14-year-olds). Although some minor variability in relative strengths was evident between the stocks, these year classes accounted for about three in every four snapper landed in 2012–13. The 2007 year class (6-year-olds) was singularly the most dominant year class in East Northland and Bay of Plenty bottom longline fisheries. This year class accounted for 15–20% of the catch, and although likely to be delayed by slow growth, should recruit at above average strength into the Hauraki Gulf over the next few years. The very strong 1999 year class (14-year-olds), quite possibly the strongest to recruit in SNA 1 over three decades, still comprises almost 10% of the landed catch by number in the Hauraki Gulf bottom longline fishery, and about 5% in East Northland and the Bay of Plenty. With an average size of about 40 cm (about 1.3 kg), the 1999 year class will undoubtedly continue to be important for the SNA 1 fishery for the remainder of this decade.

Catch-at-age distributions for the SNA 1 bottom longline fisheries in 2012–13 have continued to broaden from the previous sampling year in 2009–10, resulting in the highest estimates of mean age seen in both the Hauraki Gulf (11.3 years) and Bay of Plenty (8.5 years) over the past two decades. About 5% of the landed catch by number in the Hauraki Gulf and East Northland are 20 years or older, while that from the Bay of Plenty remains less than 1%. A good proportion of partially recruited young fish are present in both the East Northland and Bay of Plenty stocks, and although delayed by slower growth in the Hauraki Gulf, this suggests that recruitment will be reasonable over the following few years. With current SNA 1 growth rates low, mean size in the bottom longline fisheries has continued to decline, and now ranges between 32 and 34 cm, with mean weight about 0.75 kg. A gradual reduction in annual mean weight-at-age for the common age classes over the past two successive decades is obvious for the Bay of Plenty and Hauraki Gulf stocks and likely to be a compensatory density dependence effect, with estimates in 2012–13 being close to, or the lowest recorded for this period. Alternatively, trends in mean weight-at-age for East Northland appear to have largely stabilised. The resulting net weight loss to the fishery in terms of yield per recruit compared to that of the 1990s, will undoubtedly mean a decrease in productivity in the SNA 1 stock.

With a gradual increase in stock size, the fishery is likely to land more snapper now than it did 10–20 years ago to achieve the same unit weight.

The seasonal variability in the age structure of bottom 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 during spring and/or summer, and young fish during autumn and/or winter in all stocks.

Because samples were collected 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 East Northland and Bay of Plenty stocks in 2012–13, where the relative abundance of young fish recruiting into the stock appears to be highest in autumn and winter, when a high proportion of the annual bottom 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 initial growth rates exhibited there. Low winter catches and slower growth rates exhibited by 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.

Although only marginal, differences in annual mean weight-at-age and mean length-at-age estimates for most of the common age classes existed between stocks. Specifically, East Northland often had the highest estimates of mean weight-at-age and mean length-at-age in SNA 1, while the Hauraki Gulf most often had the lowest, being reflective of slow growth. Seasonal mean weight-at-age differences are less apparent within a stock, although Hauraki Gulf autumn estimates were often the lowest, possibly due to a higher proportion of slow growing resident fish in landings, due to a shortfall in sampling.

Comparatively minor variability was evident in the relative year class strengths inferred from catch-at-age estimates for the SNA 1 stocks in 2012–13, and most likely reflects between-stock differences in recruitment, growth rates, and fishing mortality, as well as sampling error. Mean weighted coefficients of variation (bootstrap estimates) for the age compositions of SNA 1 ranged between 0.21 and 0.22, increasing slightly over recent years as the age structure in the respective fisheries has broadened. Although marginally falling short of the target MWCV of 20%, estimates in 2012–13 are likely to be acceptable.

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 dominant fishing methods in SNA 1 and SNA 8. Because of heterogeneity in snapper biology and fishing patterns, SNA 1 is often further subdivided into three substocks (referred to herein as stocks): East Northland, Hauraki Gulf, and Bay of Plenty. The time series of length and age information from the SNA 1 fishery continued uninterrupted for a period of 21 years up until 2009–10 and 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, 2011a, 2011b). Triennial sampling was adopted after 2009–10 based on research investigating the optimum frequency for market sampling (Bian et al. 2009).

In 2003–04 the approach for sampling SNA 1 commercial bottom longline landings for length and age data 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 introduced so that sampling reflected the seasonal characteristics of the longline fleet and its fishing operations in recent years, in which the snapper catch is landed year-round, rather than just over spring and summer. The sampling undertaken in 2012–13 continued with the year-round approach as implemented in 2003–04 to 2004–05 and 2006–07 to 2009–10, 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 the present study in 2012–13 was to estimate the annual catch-at-age of snapper from the SNA 1 stocks for use in a population model.

This report presents the results of market sampling between October 2012 and August 2013, thus continuing the time series. Funding for this project, SNA2012/01, was provided by the Ministry for Primary Industries.

The specific objective of this project for 2012–13 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 2012–13. The target coefficient of variation (c.v.) for the catch-at-age will be 20% (mean weighted c.v. across all age classes).

2. METHODS

Stratification of the SNA 1 fishery

Landings from the snapper fishery were stratified by stock, fishing method, and quarter, e.g., Bay of Plenty – bottom longline – spring. The stocks correspond to the three areas that make up Quota Management Area SNA 1 on the northeast coast of New Zealand: East Northland, Hauraki Gulf, and Bay of Plenty (Figure 1). The fishing method sampled was bottom 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) sampled. As limited fishing occurs in September (the last month of the fishing year), its absence from the spring sampling stratum was deemed to have a minimal effect on the final results.

Sampling SNA 1 bottom longline landings

Age frequency samples were collected from the SNA 1 bottom 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. In previous years the sampling procedure needed 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), but was not required in 2012–13.

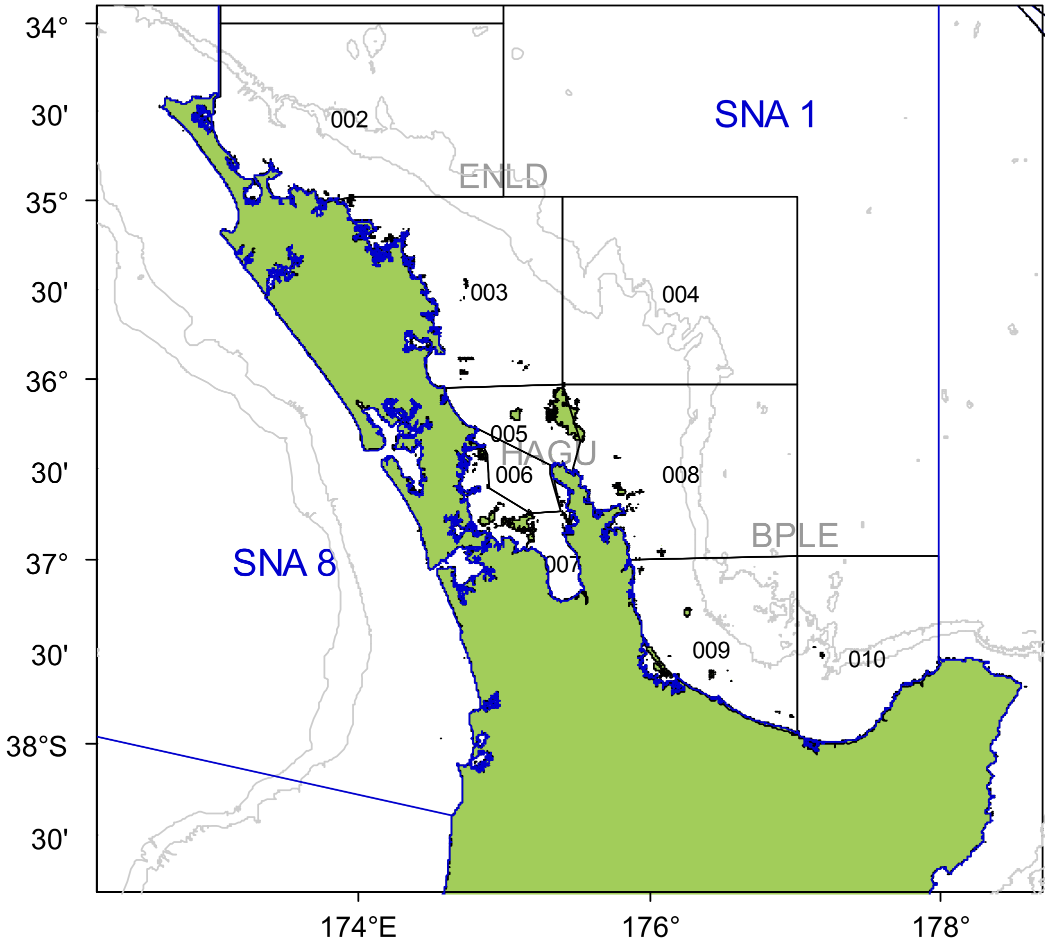

Figure 1: Quota management area for the east coast North Island snapper stock, SNA 1, and the spatial dimensions of the three SNA 1 substocks: East Northland (Statistical Areas 002 and 003), Hauraki Gulf (Statistical Areas 005 to 007), and Bay of Plenty (Statistical Areas 008 to 010).

The random age frequency sampling method was used for collecting otoliths from each landing by taking random otolith samples using a systematic selection interval. This involved taking a random sample of bins from each landing 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 10^{th} fish was taken from the sampled bins by counting in a continuous sequence. The optimum selection interval 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 20 fish being collected from landings having a total of 15 bins, to 40 fish from landings of over 100 bins. A total sample size of 800 otoliths was targeted from each of the East Northland and Bay of Plenty bottom longline fisheries over the entire year, with about 200 otoliths collected per season. Similarly, 1000 otoliths were targeted from the Hauraki Gulf bottom 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. (2006a) 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 2012–13 the sample allocation over statistical areas was targeted at five landings (half the stock seasonal target of ten) to ensure that adequate sample sizes were obtained.

Ageing snapper

A standardised procedure for reading otoliths was followed, outlined in the age determination protocol for snapper (Walsh et al. 2014). A total of four readers were used in ageing SNA 1 otolith samples in 2012–13, with reader 1 ageing all three fishery collections and readers 2 to 4 each ageing one. Each reader had no prior knowledge of each other's zone count obtained or of the fish length. For otoliths from each fishery where both readers agreed on the zone count, the age was determined from this count. When readers disagreed, the otolith was re-read together to determine the likely source of error and the count agreed upon. The forced margin method was implemented to anticipate the otolith margin type (wide, line, narrow) *a priori* in the month in which the fish was sampled to provide guidance in determining age. The forced margin method was found to be essential for ageing snapper sampled throughout the fishing year (October to September), as some otolith readers had difficulty correctly interpreting otolith margins in year-round collections compared to samples from spring-summer. To determine the "fishing year age class" of fish using the forced margin, 'wide' readings are increased by 1 year (e.g., 3W is aged as a 4 year old) and 'line' and 'narrow' readings remain the same as the zone count (e.g., 4L or 4N are aged as a 4 year old), meaning that regardless of whether the fish was caught before or after the nominal birth date of 1 January, age remains the same throughout, unlike that which would be used for age groups/age classes or in growth rate estimation (see Walsh et al. 2014).

Otolith reading precision was quantified by carrying out between-reader comparison tests after Campana et al. (1995), including those between each reader and the agreed age. The Index of Average Percentage Error, IAPE (Beamish & Fournier 1981), and mean coefficient of variation (CV) (Chang 1982), were calculated for each test.

Catch-at-age analysis

NIWA's catch-at-length and -age analysis software tool CALA (catch-at-length and -age, Francis & Bian 2011) was used in the calculation of proportion-at-age and variance (bootstrap) estimates for the SNA 1 bottom longline fisheries 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 were based on the following length-weight relationship: w (g) = $0.04467l^{2.793}$(cm) (Paul 1976). Mean weight-at-age estimates were calculated as a weighted mean with respect to the total number of fish estimated within each landing 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). The calculation of estimates of mean length-at-age followed those procedures for estimating weight-at-age outlined in Davies et al. (2003).

Proportions-at-age, mean weight-at-age, and mean length-at-age were calculated for the range of fishing year age classes (herein referred to as "age classes" encompassing October 2012 to August 2013) recruited, with the maximum age being an aggregate of all age classes over 29 years. Estimates of mean age determined from annual catch-at-age estimates in each stock were calculated such that all fish comprising the aggregate (over 29 years) age group were assigned an age of 30.

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.

Snapper age data were stored on the Ministry for Primary Industries *age* database, and landing details on the *market* database, administered by NIWA.

3. RESULTS

3.1 Relative SNA 1 catch by area and method in 2012–13

The catch of snapper from SNA 1 in 2012–13 was disproportionate between stocks with the Hauraki Gulf (Statistical Areas 005–007) contributing 45% of the overall SNA 1 take, the Bay of Plenty contributing 33% (Statistical Areas 008–010) and East Northland 22% (Statistical Areas 002–004) (Figure 2). Similar to recent years, the three main fishing methods that have operated in the SNA 1 fishery for over three decades continue to take the greater proportion (98%) of the snapper catch. In 2012–13, bottom longline was the dominant method and accounted for 39% of all snapper landed, with bottom trawl and Danish seine making up 32% and 27%, respectively (Figure 2). Spatially, all three methods operate together within particular statistical areas (i.e., 003, 005 and 006) but some dominate in others (i.e., bottom longline in 002 and 007; bottom trawl and Danish seine in 009 and 010).

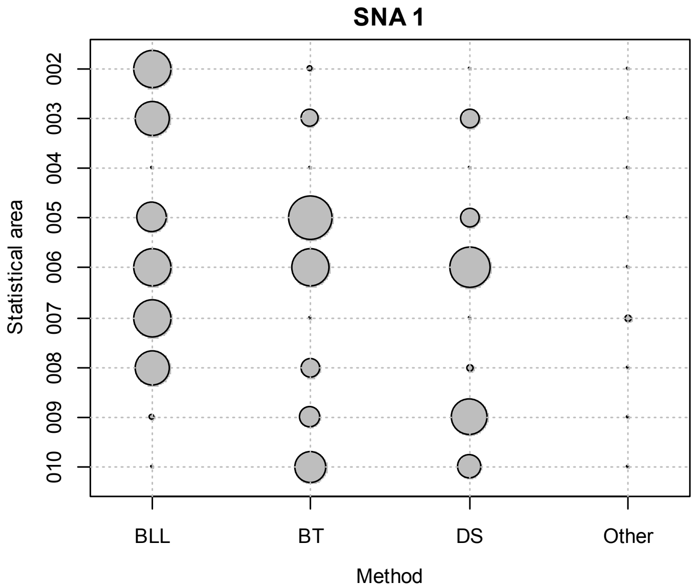

Figure 2: Relative catch by method and statistical area in SNA 1 in 2012–13 (BLL, bottom longline, BT, bottom trawl; DS, Danish seine).

3.2 Sampling the SNA 1 bottom longline fishery in 2012–13

Sample collections

Summaries of the sample sizes for stock-method-season strata are given in Tables 1–3, and summaries of the otolith sample collections are given in Table 4. Catch data from spring 2012 to winter 2013 are provided in Tables 1–3, displaying seasonal patterns in the fisheries. A total of 120 bottom longline landings were sampled from the SNA 1 fisheries in 2012–13, with 2916 snapper selected randomly for age information. Target sample sizes were achieved for the East Northland (42 landings, 1015 otoliths) and Bay of Plenty (40 landings, 892 otoliths) stocks, but fell marginally short of the target for the Hauraki Gulf (37 landings, 979 otoliths) (Tables 1–4). Although the overall East Northland stock target was met, the substratified Statistical Area 002 target was not, and fell short by four landings (see Table 3).One landing (30 otoliths) was rejected from the East Northland stock as the vessel had fished in both East Northland Statistical Areas 002 and 003. A further six landings had been assigned to the incorrect stock (three each from the East Northland 002 (86 otoliths) and Hauraki Gulf (65 otoliths)) and were moved into the East Northland 003 collection.

Table 1: 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 2012 to winter 2013.*

		Number of landings			No. of fish	Weight of landings (t)		
Method	Season	Total	Sampled	% of total	sampled	Total	Sampled	% of total
BLL	Spring	217	5	2.3	131	80	4	5.0
(002)	Summer	179	3	1.7	70	57	1	1.8
	Autumn	252	3	1.2	71	86	2	2.3
	Winter	164	5	3.0	128	65	4	6.2
BLL	Spring	81	5	6.2	103	29	2	6.9
(003)	Summer	131	7	5.3	171	64	4	6.3
	Autumn	166	9	5.4	215	76	5	6.6
	Winter	149	5	3.4	126	81	3	3.7
BLL	Spring	296	10	3.4	234	110	6	5.5
(comb.)	Summer	307	10	3.3	241	121	5	4.1
	Autumn	412	12	2.9	286	162	7	4.3
	Winter	311	10	3.2	254	147	8	5.4

* BLL, bottom longline.

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 Hauraki Gulf snapper fisheries from spring 2012 to winter 2013.*

		Number of landings			No. of fish	Weight of landings (t)		
Method	Season	Total	Sampled	% of total	sampled	Total	Sampled	% of total
BLL	Spring	242	10	4.1	298	221	11	5.0
	Summer	393	10	2.5	295	295	13	4.4
	Autumn	261	7	2.7	160	120	4	3.3
	Winter	213	10	4.7	226	125	5	4.0
BT	Spring	55	0	0	0	137	0	0
	Summer	67	0	0	0	142	0	0
	Autumn	51	0	0	0	134	0	0
	Winter	66	0	0	0	166	0	0
DS	Spring	44	0	0	0	67	0	0
	Summer	55	0	0	0	120	0	0
	Autumn	60	0	0	0	119	0	0
	Winter	46	0	0	0	115	0	0

* BLL, bottom longline; BT, bottom 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 Bay of Plenty snapper fisheries from spring 2012 to winter 2013.*

		Number of landings			No. of fish	Weight of landings (t)		
Method	Season	Total	Sampled	% of total	sampled	Total	Sampled	% of total
BLL	Spring	137	10	7.3	214	41	3	7.3
	Summer	171	10	5.8	238	61	5	8.2
	Autumn	233	10	4.3	224	101	5	5.0
	Winter	208	10	4.8	216	92	5	5.4
BT	Spring	47	0	0	0	56	0	0
	Summer	85	0	0	0	140	0	0
	Autumn	84	0	0	0	143	0	0
	Winter	93	0	0	0	155	0	0
DS	Spring	42	0	0	0	115	0	0
	Summer	58	0	0	0	129	0	0
	Autumn	55	0	0	0	124	0	0
	Winter	45	0	0	0	103	0	0

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

Table 4: Details of snapper otolith samples collected in 2012–13 from the stocks in SNA 1*
(Note: ENLD data presented for Statistical Areas 002, 003, and both combined).

Stock	Method†	Sampling period	Sampling method††	Length range (cm)	No. aged
ENLD (002)	BLL	Spring-winter	R	25–69	400
ENLD (003)	BLL	Spring-winter	R	24–64	615
ENLD (comb.)	BLL	Spring-winter	R	24–69	1 015
HAGU	BLL	Spring-winter	R	24–70	979
BPLE	BLL	Spring-winter	R	24–67	892

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

Representativeness

A temporal comparison of the seasonal distribution of landings in the bottom longline fisheries of SNA 1 (for catch weight and numbers of landings) to those sampled demonstrates the representativeness of the sample collections in 2012–13 (Figure 3).

The East Northland bottom longline catch of snapper was relatively stable over the sampling period with slightly more fish caught over the months of spring, autumn and winter (Figure 3). East Northland landings accounted for 34% of the total SNA 1 bottom longline catch. The temporal spread of sampled landings was reasonably evenly distributed and proportional to the fishery over all months. The sampled catch accounted for 5% by weight and 3% by number of landings of the total bottom longline catch in East Northland and the average landing size in the fishery was smaller (407 kg) compared to that selected for sampling (612 kg) (Figure 3, Table 1).

The bottom longline catch in the Hauraki Gulf over spring and summer was more than twice that landed during autumn and winter, and exceeded 100 t in each of the first four months of the fishing year (Figure 3). In total, the bottom longline catch from the Hauraki Gulf accounted for almost half that (48%) from SNA 1 in 2012–13. The temporal spread of sampled landings in the fishery was disproportionate to the fishery, with a high number sampled during some months (i.e., October, December), and only one sample in some other months (i.e., April, May). Nevertheless, samples were collected over all months of the sampling period (Figure 3). The sampled catch accounted for 4% by weight and 3% by number of landings of the total bottom longline catch in the Hauraki Gulf as the average landing size in the fishery was smaller (686 kg) compared to that selected for sampling (899 kg) (Figure 3, Table 2).

The catch of snapper in the Bay of Plenty never exceeded 50 tonnes in any month during the sampling period, with the lowest volumes taken during October to January and highest during February to August (Figure 3). Bay of Plenty landings accounted for 19% of the total SNA 1 bottom longline catch. The temporal spread of sampled landings in the fishery was disproportionate to the fishery, with a high number sampled during some months (i.e., February, April, June), and only one sample (i.e., January, May) or no sample (i.e., December) taken in some other months (Figure 3). The sampled catch accounted for 6% by weight and 5% by number of landings of the total bottom longline catch in the Bay of Plenty and the average landing size in the fishery was marginally smaller (394 kg) compared to that selected for sampling (435 kg) (Figure 3, Table 3).

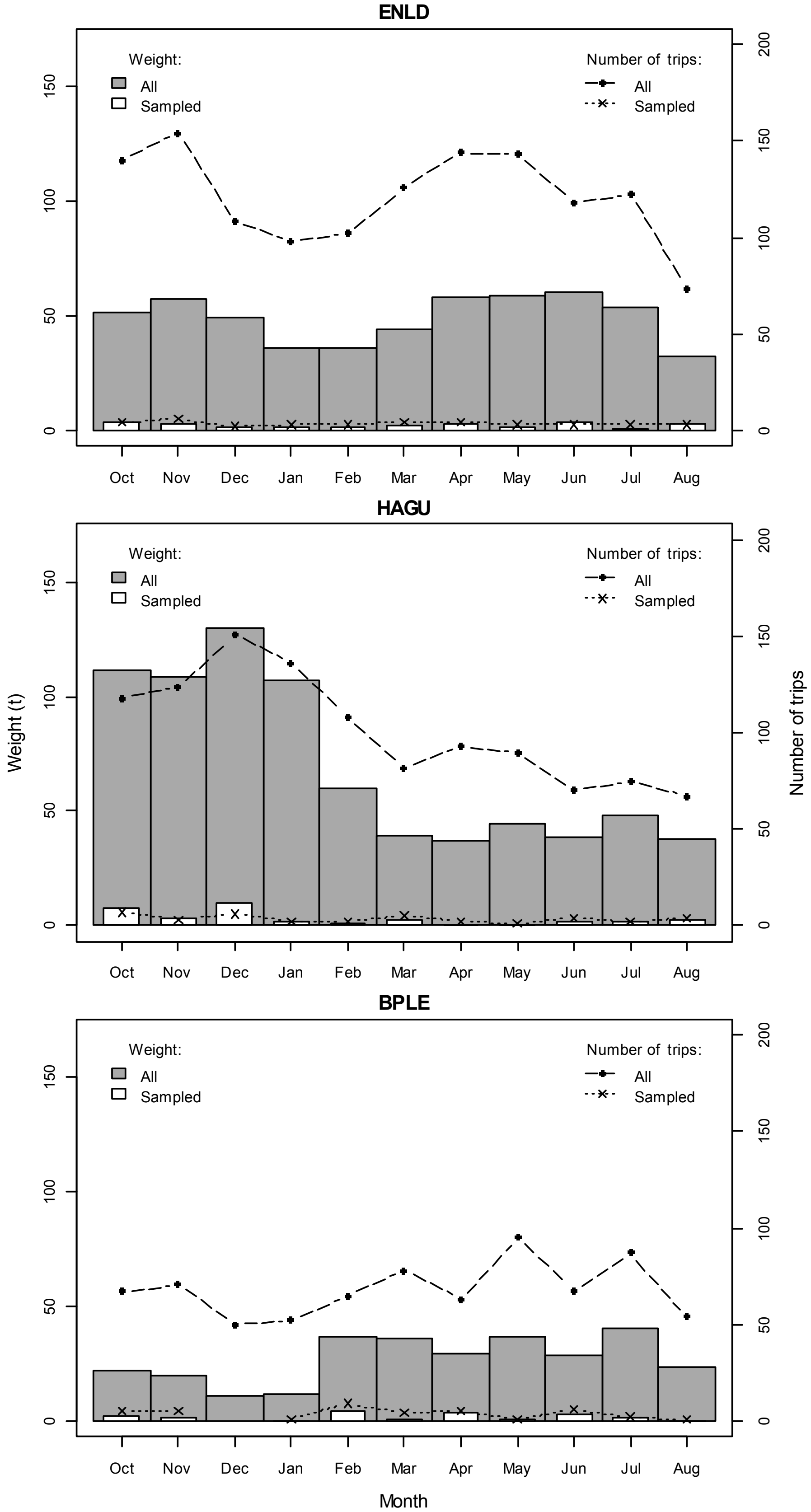

Figure 3: Comparison of the monthly distribution of landed weight (grey bars) and numbers of landings (dashed line) of snapper in the SNA 1 stock bottom longline fisheries for all landings where snapper was caught for the period October to August 2012–13. Included are corresponding estimates for all sampled landings (white bars and dotted line) to show representativeness of collections. ENLD, East Northland; HAGU, Hauraki Gulf; BPLE, Bay of Plenty.

The sampling performance relative to the cumulative proportion of the total number and catch weight of landings throughout the sampling period is illustrated in Figure 4. Sampling was distributed in proportion to, and representative of, the bottom longline fishery in East Northland, but less so for the Hauraki Gulf and Bay of Plenty stocks.

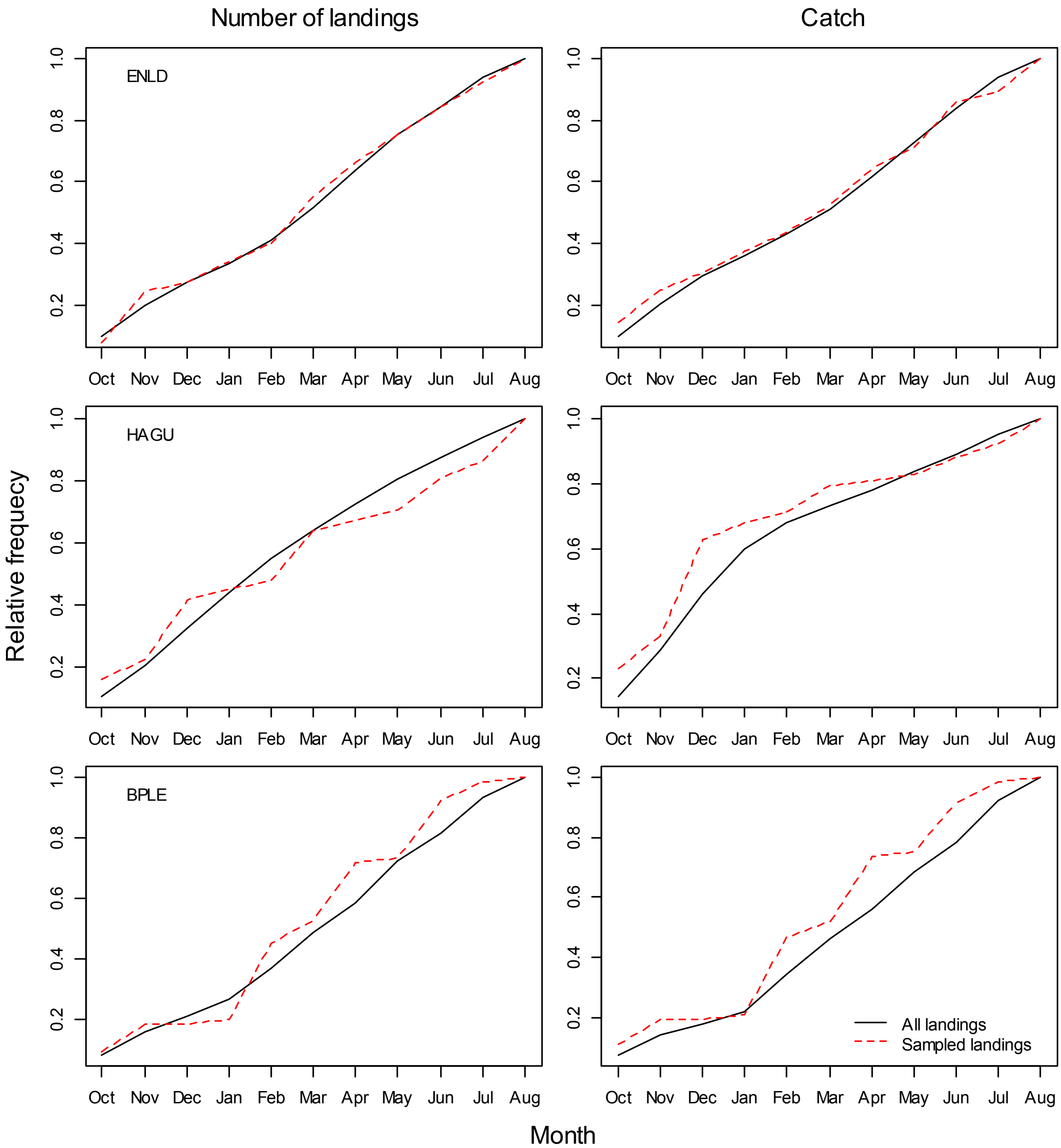

Figure 4: Comparison of the cumulative proportion of the number of landings (left column) and catch weight of landings (right column) with cumulative proportions of samples taken from the SNA 1 stock bottom longline fisheries in 2012–13. ENLD, East Northland; HAGU, Hauraki Gulf; BPLE, Bay of Plenty.

Fine scale spatial comparisons (0.1 degree blocks) of the proportional distribution of the estimated SNA 1 bottom longline fishery catch and sampled catch for 2012–13 is presented in Figure 5 and by statistical area in Figure 6.

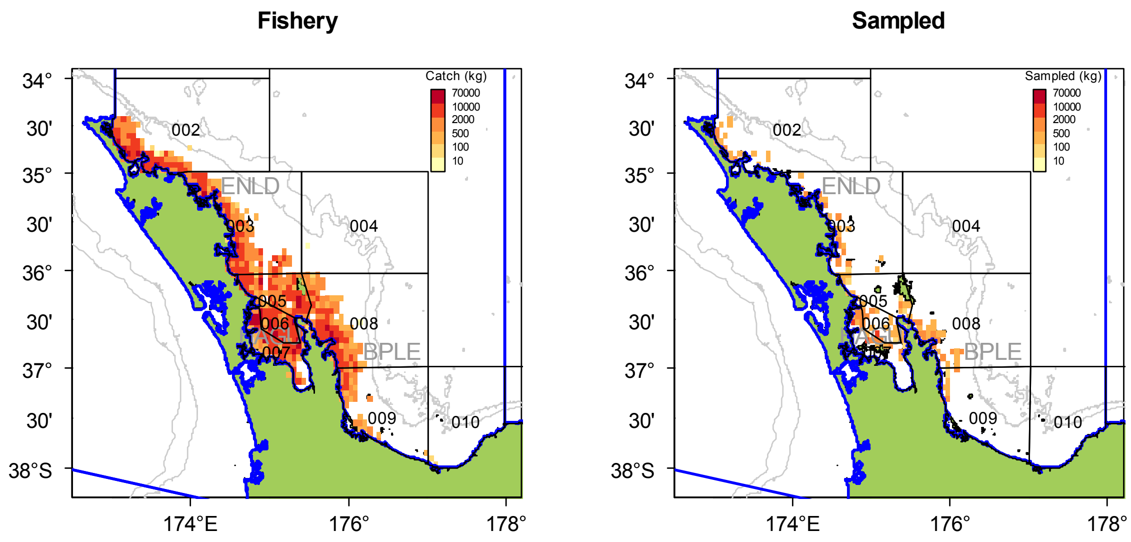

Figure 5: Comparison of the spatial distribution of the bottom longline catch and the sampled component for the SNA 1 stocks in 2012–13.

The vast majority (97%) of the bottom longline catch in 2012–13 was taken from coastal regions between North Cape and Tairua Harbour (principally Statistical Areas 002–003, 005–008) with the sampled component generally consistent with the same spatial distribution. Negligible catch and samples were taken from the central and eastern Bay of Plenty (Statistical Areas 009–010). Approximately 90% of the landed bottom longline catch over the sampling period was taken by 26 vessels out of a total of 43 that fished in SNA 1 in 2012–13, most of which mainly targeted snapper.

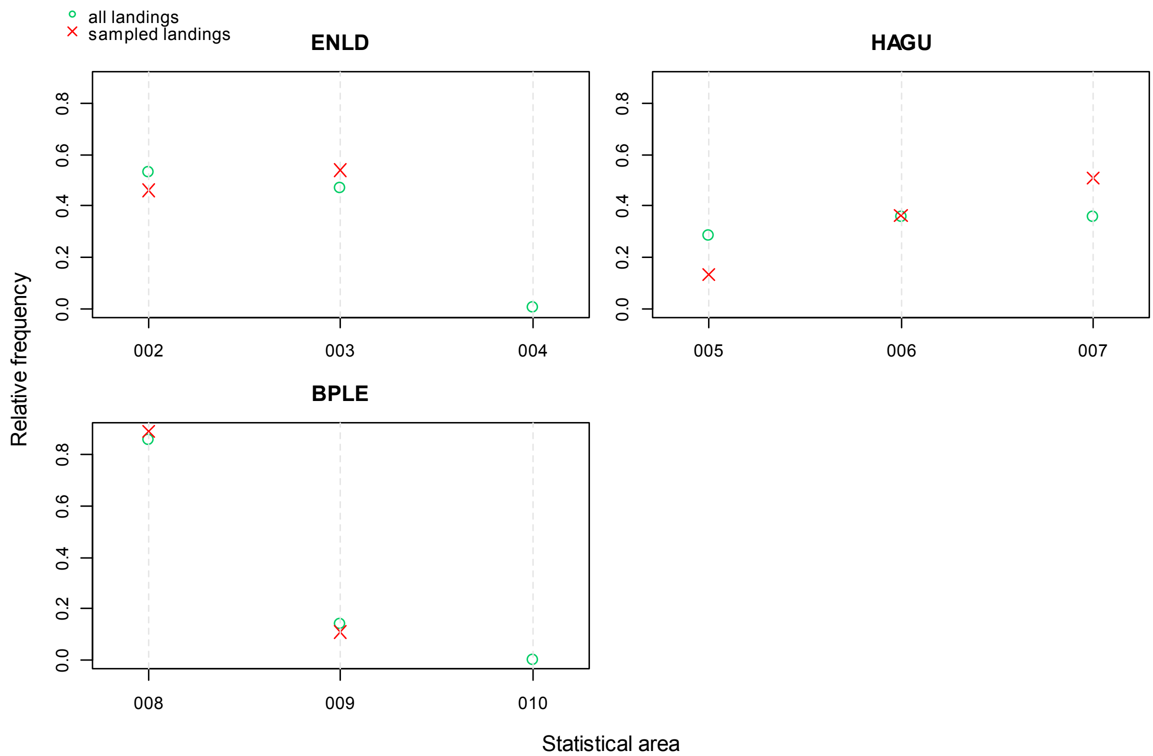

Figure 6: Comparison of the proportional distribution of the estimated bottom longline catch and the sampled component by statistical area over the sampling period for the SNA 1 stocks in 2012–13.

A similar comparison depicting the SNA 1 bottom longline catch by target species shows that although 11 species were targetted in total, snapper was overwhelmingly the main target species, accounting for 97% of the catch in 2012–13 (Figure 7). The two target species that registered any other significant catch of snapper were tarakihi (*Nemadactylus macropterus*) (2%) and red gurnard (*Chelidonichthys kumu*) (1%), and were reported by only a handful of vessels in East Northland and the Bay of Plenty. Although four other species were reported as the target species in sampled landings from either East Northland or the Bay of Plenty in 2012–13, only snapper was used as the target species in the Hauraki Gulf.

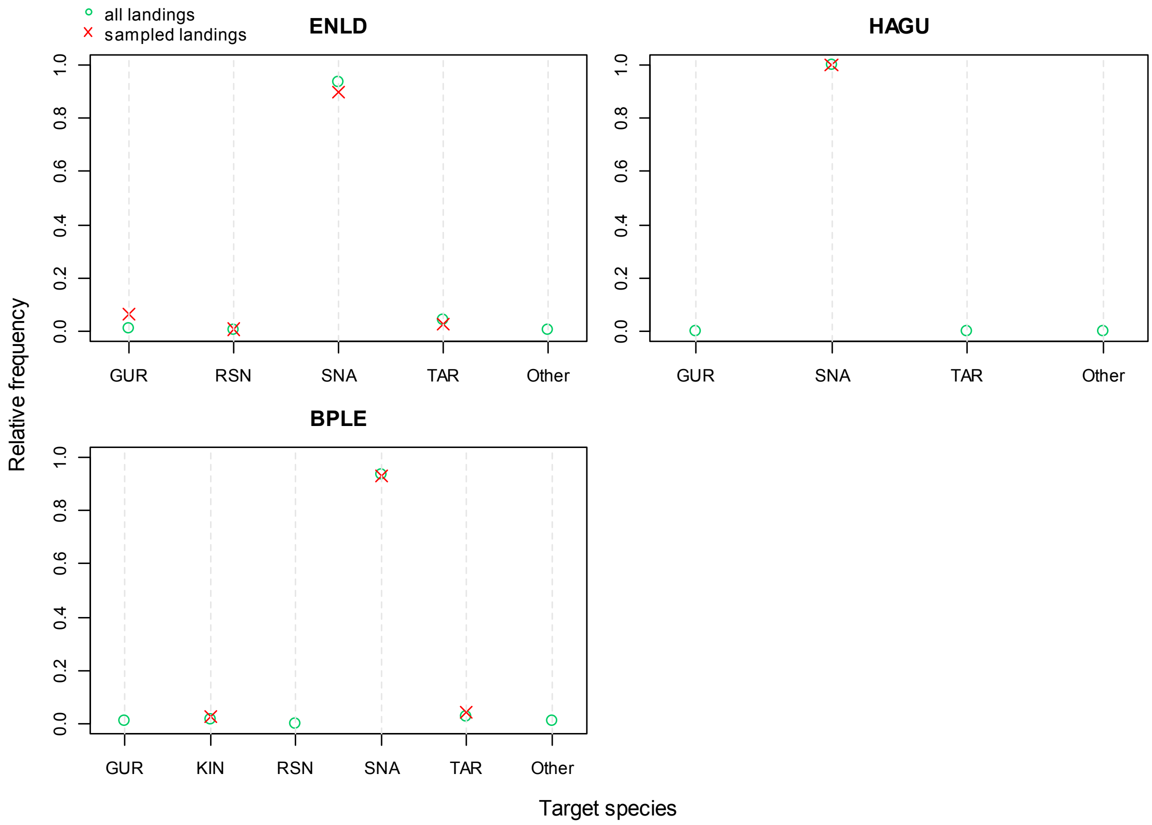

Figure 7: Comparison of the proportional distribution of the estimated bottom longline catch and the sampled component by target species over the sampling period for SNA 1 stocks in 2012–13.

The proportionality of the sampled component to that of the fishery suggests that the sampled landings, by and large, are representative of the operation of the SNA 1 bottom longline fleet as a whole.

3.3 Otolith readings

All SNA 1 stock otolith samples selected for ageing from the 2012–13 collections were successfully aged by four readers, reader 1 reading all stock samples and readers 2 to 4, each reading a single stock sample. Between-reader tests, based on graphical comparisons, are given in Figures 8–10, and shows some inconsistency between readers. The overall percentage agreement between readers was 67% for East Northland, 73% for Hauraki Gulf and 68% for the Bay of Plenty. There appeared to be some systematic differences (bias) in first counts of snapper otoliths between the readers. The slight positive weighting of the histogram, the relative clustering of plotted points about the zero line, and the slight deviation from the one-to-one line on the age-bias plots (Figures 8 and 10(a–c)) indicate that readers 2 and 4 underestimated age, particularly for older and younger fish respectively. For reader 3, the slight negative weighting of the histogram, the relative clustering of plotted points about the zero line, and the slight deviation from the one-to-one line on the age-bias plot, indicates an overestimation of age, particularly for old fish (Figure 9a–c). The between reader CVs ranged from 1.76 to 3.09% and IAPE ranged from 1.25 to 2.18% (Figure 8–10(c)) and the profiles show that precision varied across age classes in all stock collections, being lowest for East Northland and highest for the Hauraki Gulf (Figure 8–10(d)). Comparisons of the age-bias plots for all four readers with the agreed age indicate that reader 1 showed a high level of precision and consistency in estimating age with CV and IAPE estimates less than 0.03% (Figures 8–10(e)). For readers 2 to 4, precision was slightly lower, with CVs and IAPEs almost identical to the between reader estimates (8–10(c)), and ranging from 1.75 to 3.09% (CV) and 1.23 to 2.18% (IAPE) (Figures 8–10(e) and (f)).

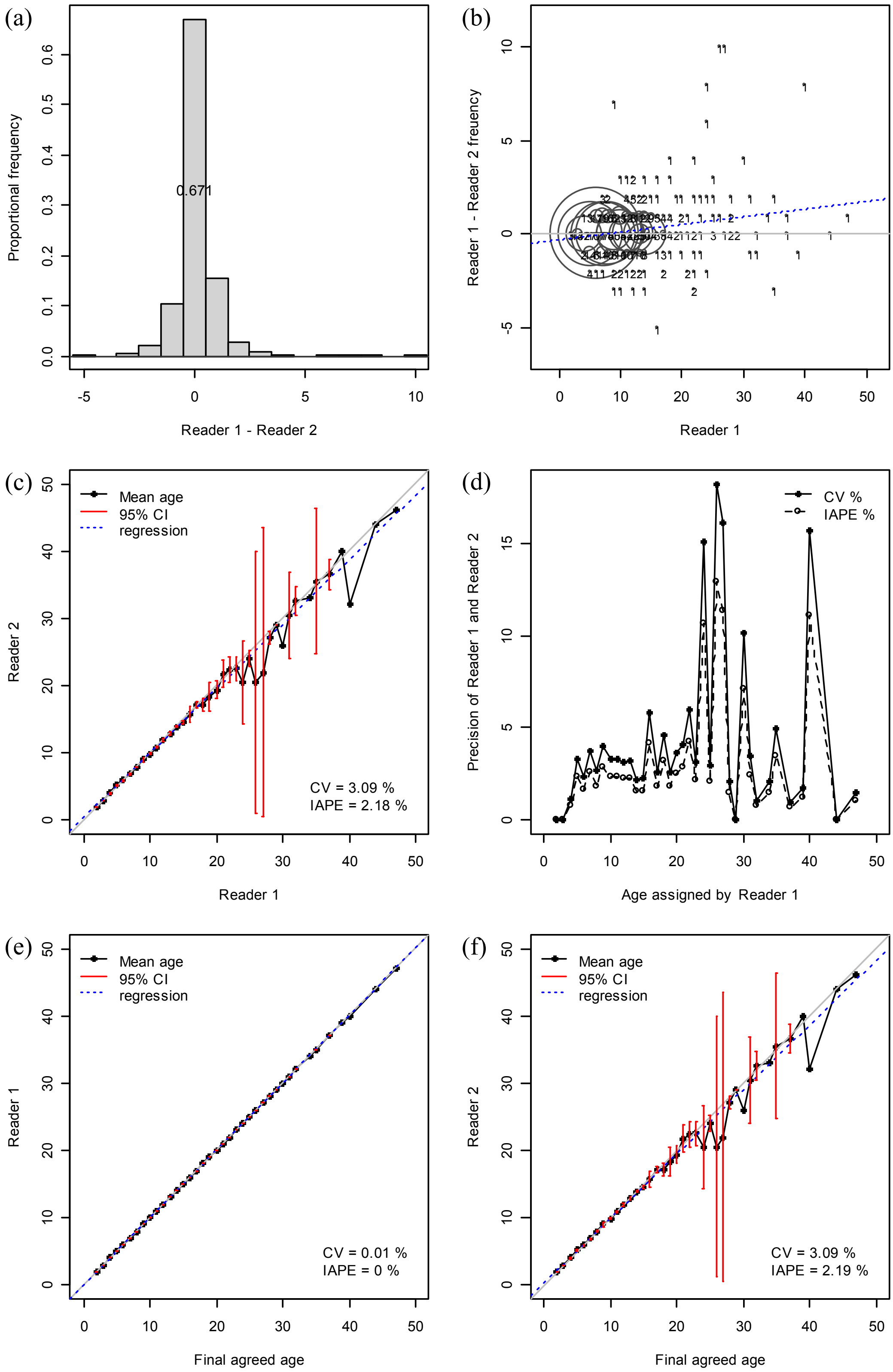

Figure 8: Results of between-reader comparison test (reader 1 and 2) for East Northland otoliths collected in 2012–13 (*n* = 1015): (a) histogram of differences between readings for the same otolith; (b) differences between readers for a given age assigned by reader 1; (c) bias plot between readers; (d) CV and IAPE profiles (precision) relative to the age assigned by reader 1; (e) bias plot between reader 1 ((f) reader 2) and agreed age. The expected one-to-one (solid line) and actual relationship (dashed line) between readers are overlaid on (b) and (c), and between reader 1 and 2 and the agreed age on (e) and (f).

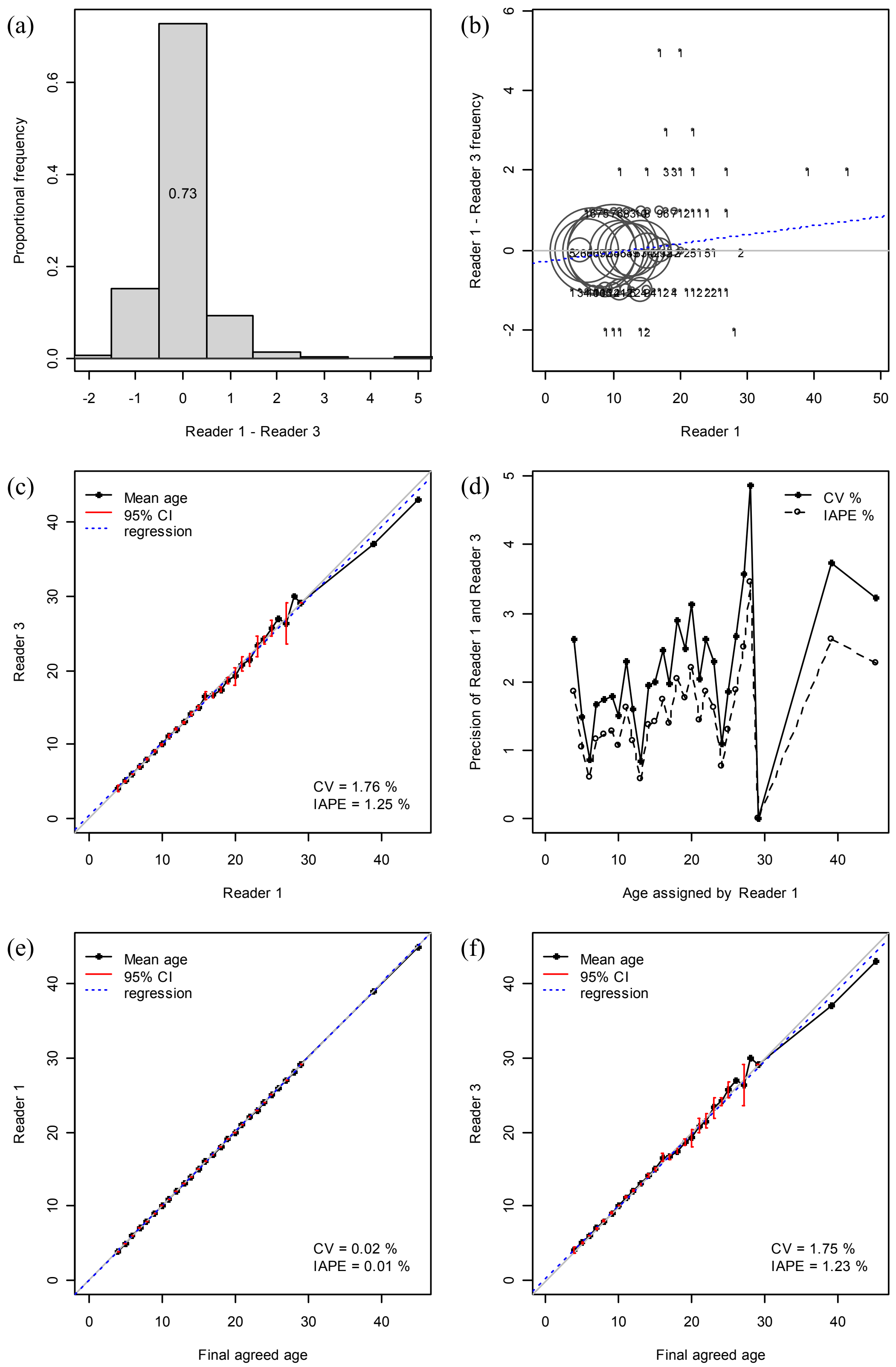

Figure 9: Results of between-reader comparison test (reader 1 and 2) for Hauraki Gulf otoliths collected in 2012–13 (*n* = 979): (a) histogram of differences between readings for the same otolith; (b) differences between readers for a given age assigned by reader 1; (c) bias plot between readers; (d) CV and IAPE profiles (precision) relative to the age assigned by reader 1; (e) bias plot between reader 1 ((f) reader 2) and agreed age. The expected one-to-one (solid line) and actual relationship (dashed line) between readers are overlaid on (b) and (c), and between reader 1 and 2 and the agreed age on (e) and (f).

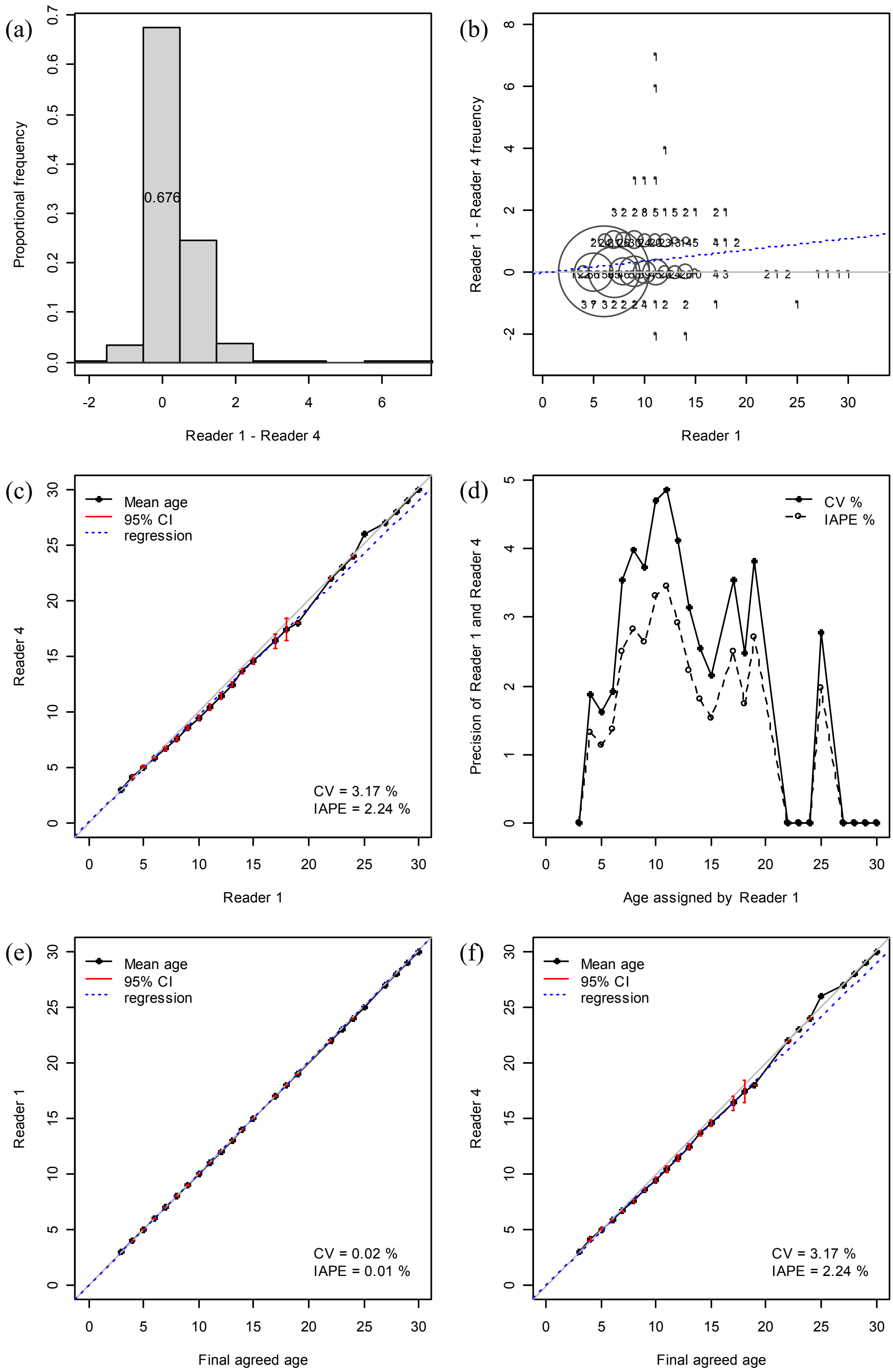

Figure 10: Results of between-reader comparison test (reader 1 and 2) for Bay of Plenty otoliths collected in 2012–13 (*n* = 892): (a) histogram of differences between readings for the same otolith; (b) differences between readers for a given age assigned by reader 1; (c) bias plot between readers; (d) CV and IAPE profiles (precision) relative to the age assigned by reader 1; (e) bias plot between reader 1 ((f) reader 2) and agreed age. The expected one-to-one (solid line) and actual relationship (dashed line) between readers are overlaid on (b) and (c), and between reader 1 and 2 and the agreed age on (e) and (f).

3.4 Catch-at-age

Catch-at-age compositions (sampled using the random age frequency sampling approach) with bootstrap variance estimates were derived for each stock and season, and then combined over all seasons (spring to winter) to produce annual compositions (Figure 11). Age distributions are used to compare differences in the age structure of each stock and season stratum and to gauge relative year class strengths (Figures 11 and 12, Appendix 1).

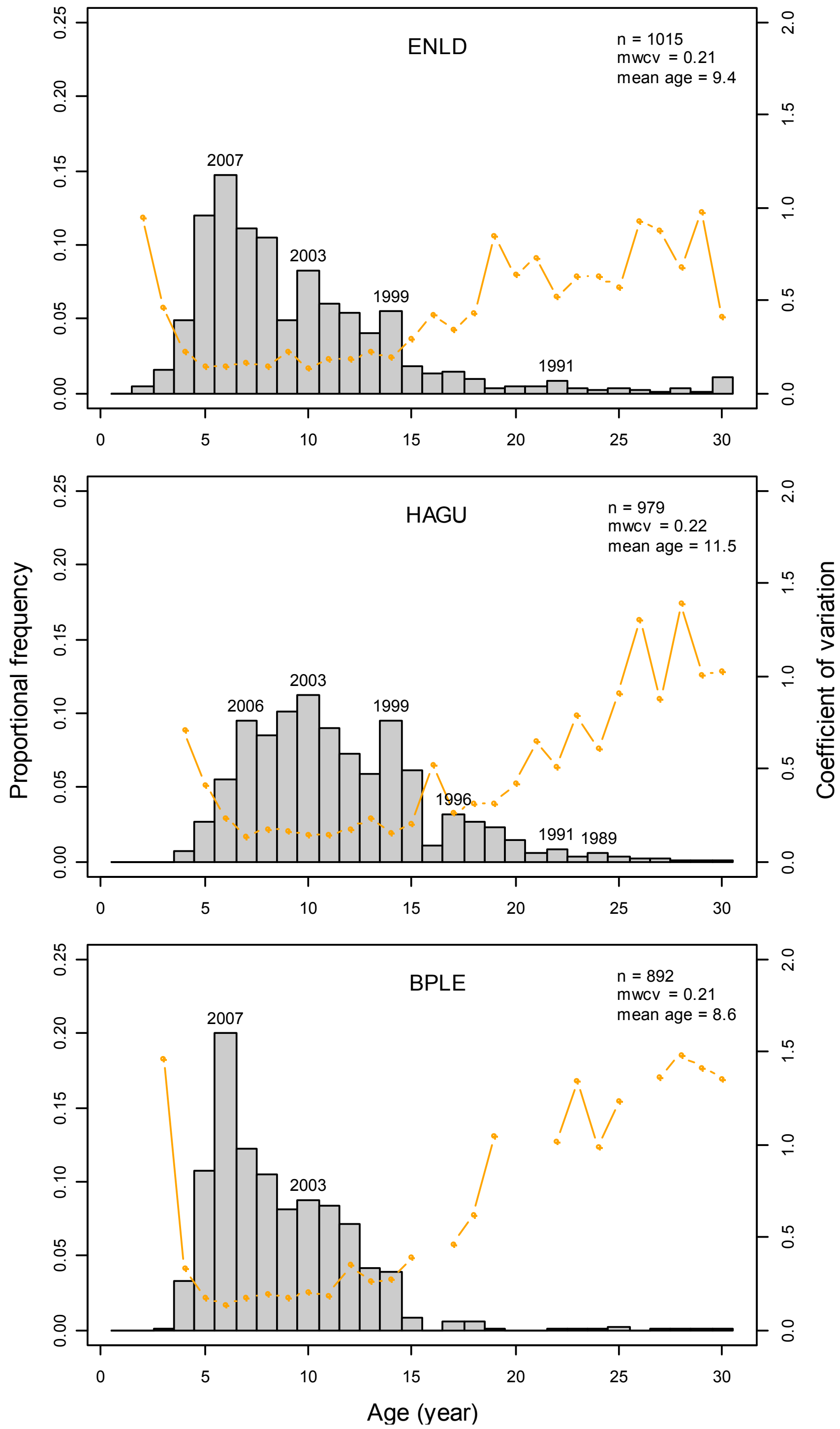

Figure 11: Proportion at age distributions (histograms) and CVs (lines) determined from snapper landings sampled from the three SNA 1 stock bottom longline fisheries in 2012–13 (ENLD, East Northland; HAGU, Hauraki Gulf; BPLE, Bay of Plenty; *n*, sample size; mwcv, mean weighted CV).

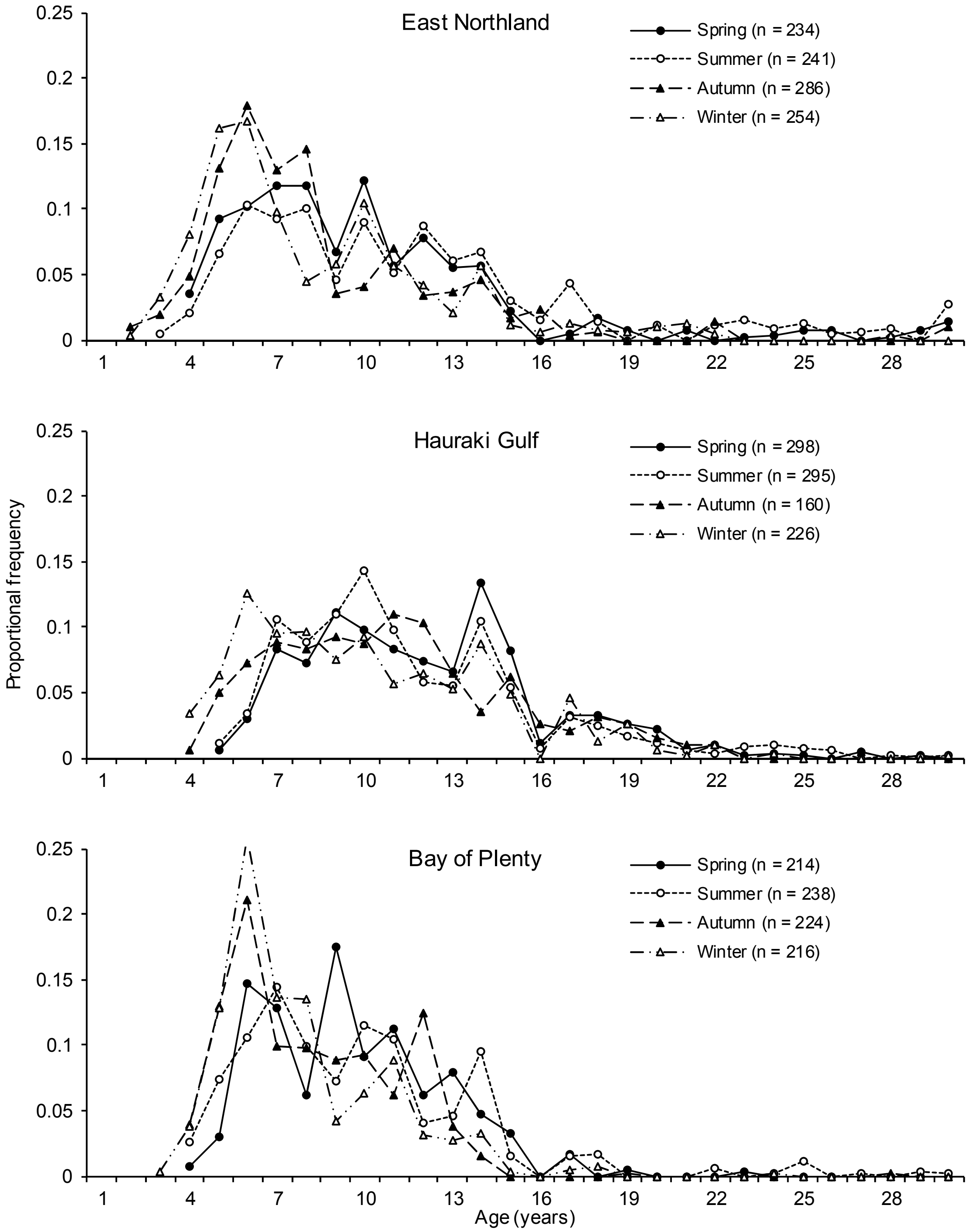

Figure 12: Proportion-at-age by season for SNA 1 bottom longline landings in 2012–13 (*n*, sample size).

Relative proportions-at-age for the spring-summer combined season are compared with those from the year-round sampling in Figure 13. Results of the catch-at-age for each stock are described below (Sections 3.5 to 3.7).

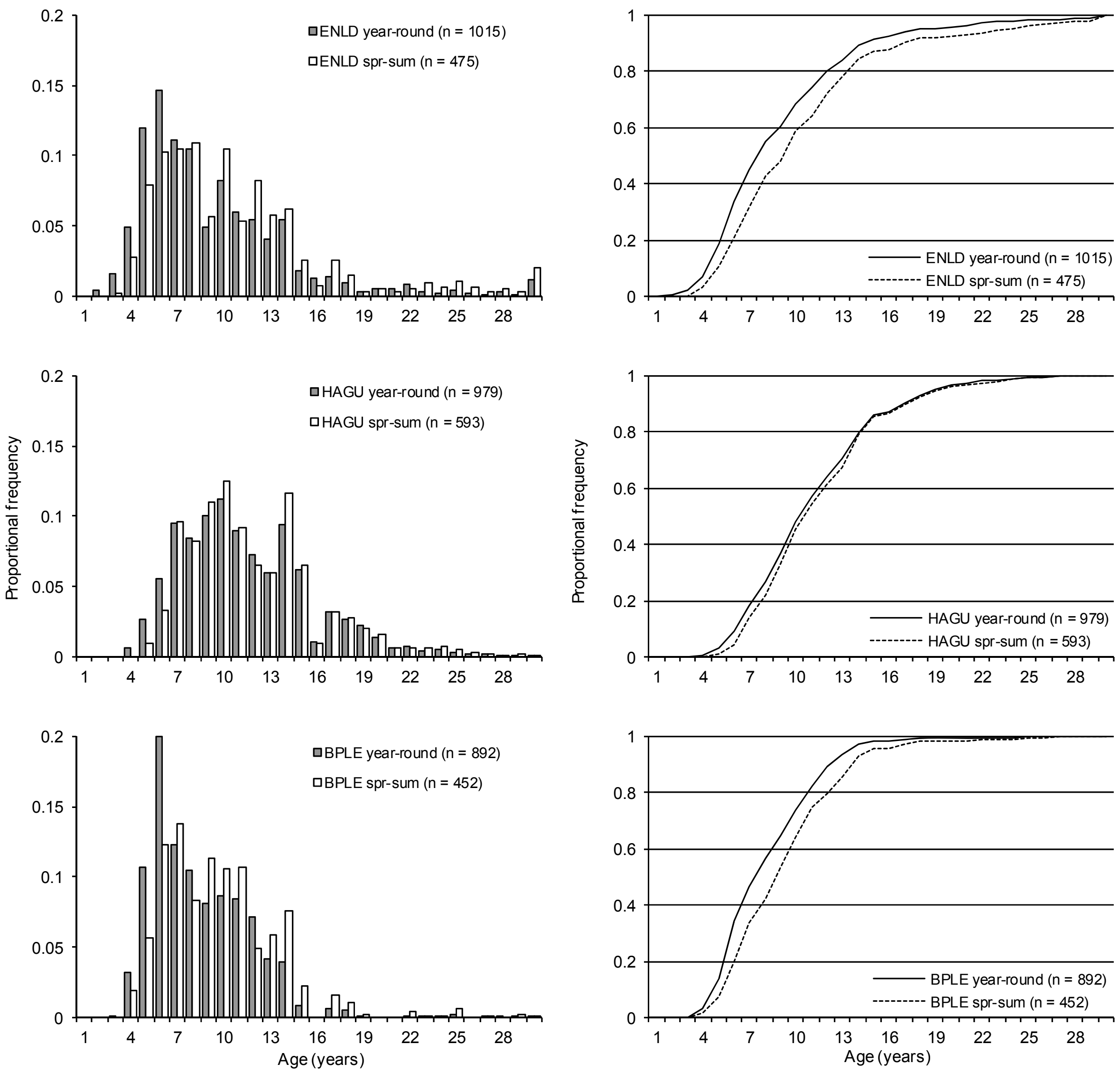

Figure 13: Comparison of the proportion and cumulative proportion at age distributions determined from snapper landings sampled over the spring and summer combined, and year-round seasons from the three SNA 1 stock bottom longline fisheries in 2012–13 (ENLD, East Northland; HAGU, Hauraki Gulf; BPLE, Bay of Plenty; *n*, sample size).

3.5 East Northland

The East Northland bottom longline age distribution in 2012–13 consisted mainly of young to moderate aged fish, where those 4 to14 years of age collectively made up approximately 90% of the landed catch by number (Figure 11, see Appendix 1). Nevertheless, there was representation across all recruited age classes up to 30 years, those fish 20 years and older accounting for 5% of the landed catch. The 2007 year class (6-year-olds), currently the most dominant in the fishery, accounted for 15% of fish in landings in 2012–13. Other prominent year classes were 2003, 1999, and 1991 (10-, 14- and 22-year-olds). 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 2). The mean age of the East Northland distribution was 9.4 years and the MWCV was 0.21. The oldest fish sampled from the fishery during 2012–13 was 47 years (Appendix 3).

Seasonal catch-at-age samples for the East Northland bottom longline fishery showed some consistency over seasons in the relative strengths of some common older age classes, while variations in proportions were evident for others i.e., 10-, 12-, 13-, 17-year-olds (Figures 12 and 13). The proportions for spring and summer samples contained considerably more old fish than autumn and winter samples, which were dominated by small young fish. The seasonal differences seen in the relative year class strengths for the 2010 to 2007 year classes (3- to 6-year-olds) 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 (Figures 12 and 13).

3.6 Hauraki Gulf

The Hauraki Gulf age distribution was broad with good representation in most young age classes up to 20 years, particularly for fish between 6 and 15 years of age which made up 83% of the landed catch by number in 2012–13 (Figure 11, see Appendix 1). The 2003 year class (10-year-olds) was marginally the most prominent of a number of closely adjacent year classes (i.e., 1999, 2002, 2004–2006) that collectively make up almost 60% of landed bottom longline catch of snapper in the Hauraki Gulf. The 1996–1994 year classes (17- to 19-year-olds) dominate the right hand limb of the distribution and in total account for 8% of the catch, and those 20 years and older 5%. The 1997 year class (16-year-olds) was weak. Only those age classes over 10 years of age are considered fully recruited to the fishery as they no longer contain a noticeable proportion of fish in the 25–27 cm length intervals (see age-length key, Appendix 2). The mean age of snapper in the Hauraki Gulf fishery was 11.5 years, the highest ever recorded estimate for the stock, and the MWCV was 0.22. The oldest fish sampled during 2012–13 was 45 years (Appendix 3).

For Hauraki Gulf seasonal catch-at-age samples, a reasonable level of consistency in the relative strengths of common older age classes was evident, although occasional variation in proportions occurred for particular age classes i.e., 14-year-olds (Figures 12 and 13). Spring samples contained proportionally more old fish than all other seasons, and autumn and winter were the only seasons to include 4-year-olds. The seasonal differences seen in the relative year class strengths for the 2008 to 2007 year classes (5- to 6-year-olds) 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 (Figures 12 and 13).

3.7 Bay of Plenty

The Bay of Plenty bottom longline age distribution in 2012–13 consisted mainly of fish between 5 and 12 years of age, collectively making up 86% of the number of snapper landed, with over 50% based on young fish, principally 5- to 8-year-olds (Figure 11, see Appendix 1). The 2007 year class (6-year-olds), was singularly the most dominant year class in the fishery, and accounted for about one in every five fish in the longline catch, almost twice that of any other year class. Most of the older age classes in the Bay of Plenty fishery contain very low numbers, with 16-, 20-, 21-, and 26-year-old snapper (year classes 1997, 1993, 1994, 1987) absent from sample collections. The combined total for fish over 15 years made up less than 3% of the catch, and those 20 years and older, less than 1%. The 2010 to 2005 year classes (3- to 8-year-olds) do not appear fully recruited to the fishery, as they still contain a proportion of fish in the 25–27 cm length intervals (see age-length key, Appendix 2). The mean age of snapper in the Bay of Plenty fishery was 8.6 years, the highest ever recorded estimate for the stock, and the MWCV was 0.21. The oldest fish sampled during 2012–13 was 30 years (Appendix 3).

Although seasonal catch-at-age samples for the Bay of Plenty bottom longline fishery often showed a reasonable level of consistency in the relative strengths of common older age classes, some disparities were evident for particular age classes i.e., 9-, 12-, and 14-year-olds (Figures 12 and 13). Spring and summer samples contained proportionally more old fish than autumn and winter. The seasonal differences seen in the relative year class strengths for the 2009 to 2007 year classes (4- to 6-year-olds) 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 (Figures 12 and 13).

3.8 Mean weight-at-age and mean length-at-age estimates

A trend of increasing mean weight-at-age and mean length-at-age over successive age classes up to around 20 years of age was generally evident in year-round data collected from the SNA 1 bottom longline fisheries in 2012–13 (Figure 14, Appendices 4 and 5). Although not greatly different between stocks, observed annual mean weight-at-age and mean length-at-age estimates for most of the common age classes from East Northland were often the highest estimates in SNA 1, on average 25% and 13% heavier than Hauraki Gulf and Bay of Plenty snapper, respectively (and 8% and 4% longer) for age classes 4–14 years of age. For age classes 15 years and above, sample estimates from the Bay of Plenty, although sporadic, were most often highest, while estimates from the Hauraki Gulf were consistently the lowest in SNA 1 for age classes 4–14 years of age (Figure 14, Appendices 4 and 5).

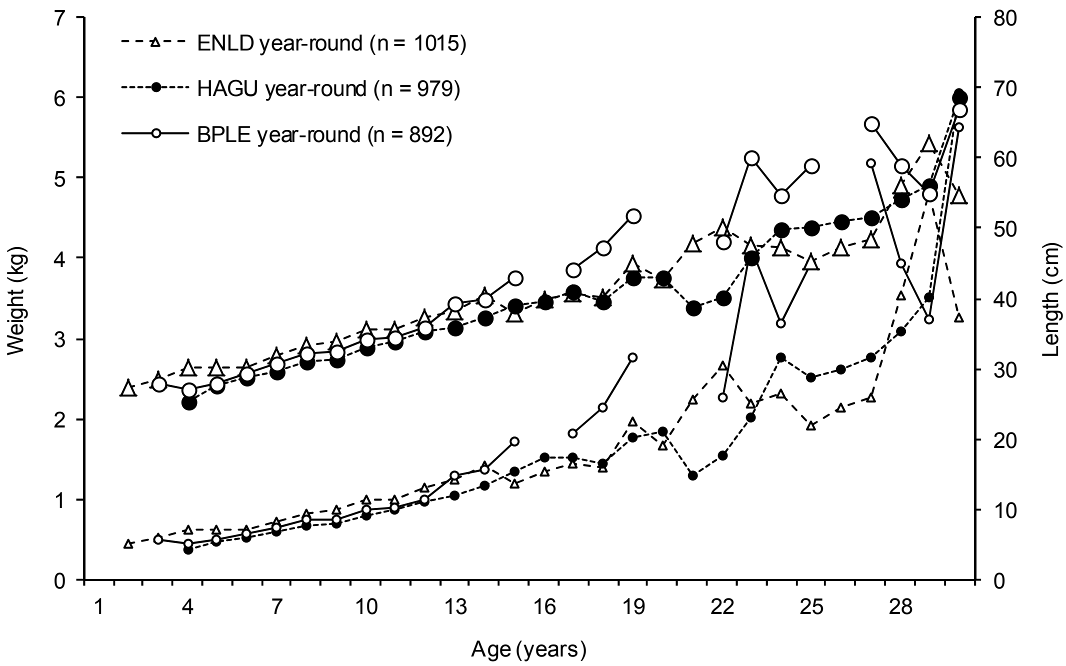

Figure 14: Observed mean weight-at-age (small symbols) and mean length-at-age (large symbols) estimates from snapper landings sampled from the three SNA 1 stock bottom longline fisheries in 2012–13 (ENLD, East Northland; HAGU, Hauraki Gulf; BPLE, Bay of Plenty; *n*, sample size).

3.9 Mean weight-at-age time series comparisons

Time series comparisons of spring-summer mean weight-at-age estimates derived from sampling the SNA 1 bottom longline fisheries over the previous two decades show a gradual long-term decrease in the mean weight-at-age for snapper for most of the common age classes, particularly in the Hauraki Gulf and Bay of Plenty stocks, and is indicative of a temporal decline in growth rate (Figures 15–17). As a result, the youngest age at which snapper now recruit into the fishery has increased over time, from three to five years in the Hauraki Gulf, and three to four years in the Bay of Plenty. Annual mean weight-at-age estimates for many of the older age classes (i.e., over 13 years of age) appear highly variable from year to year and unlikely to provide realistic estimates due to the low number of individuals present.

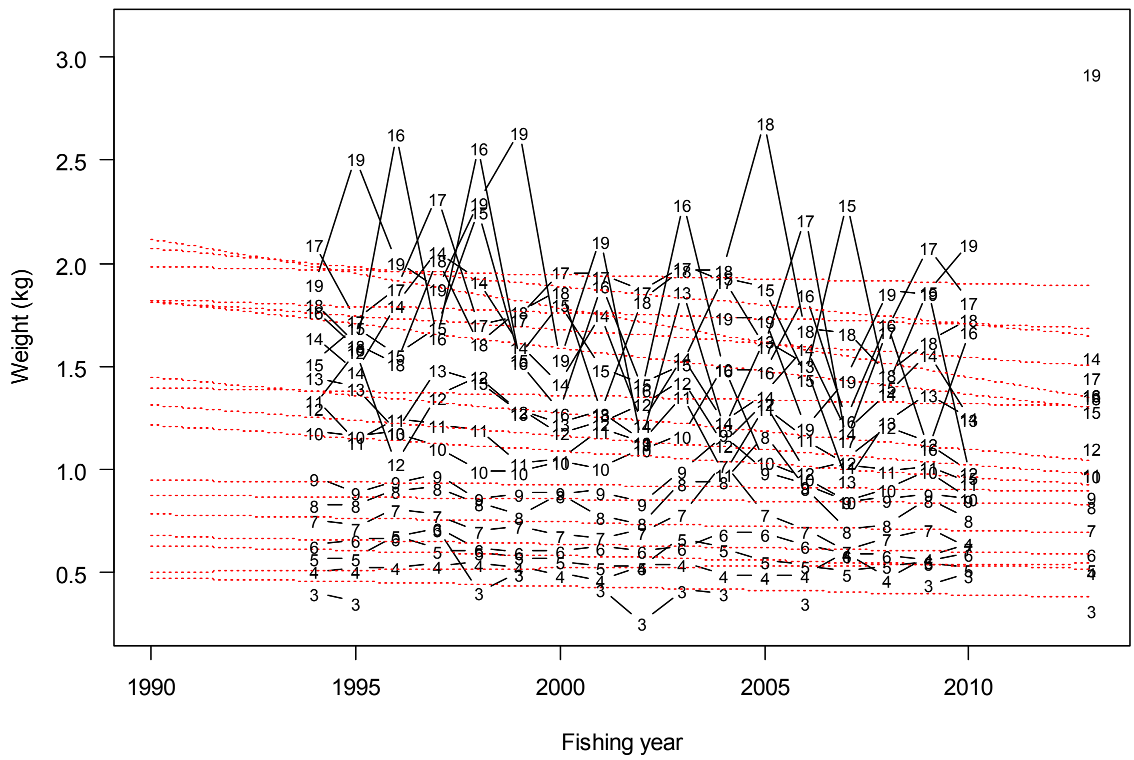

Figure 15: Mean weight-at-age estimates for 3- to >19-year-old snapper sampled from the East Northland bottom longline fishery between 1993–94 and 2012–13 with fitted trend lines (dotted) for each age class depicting long-term changes in growth rates over the 20 year period.

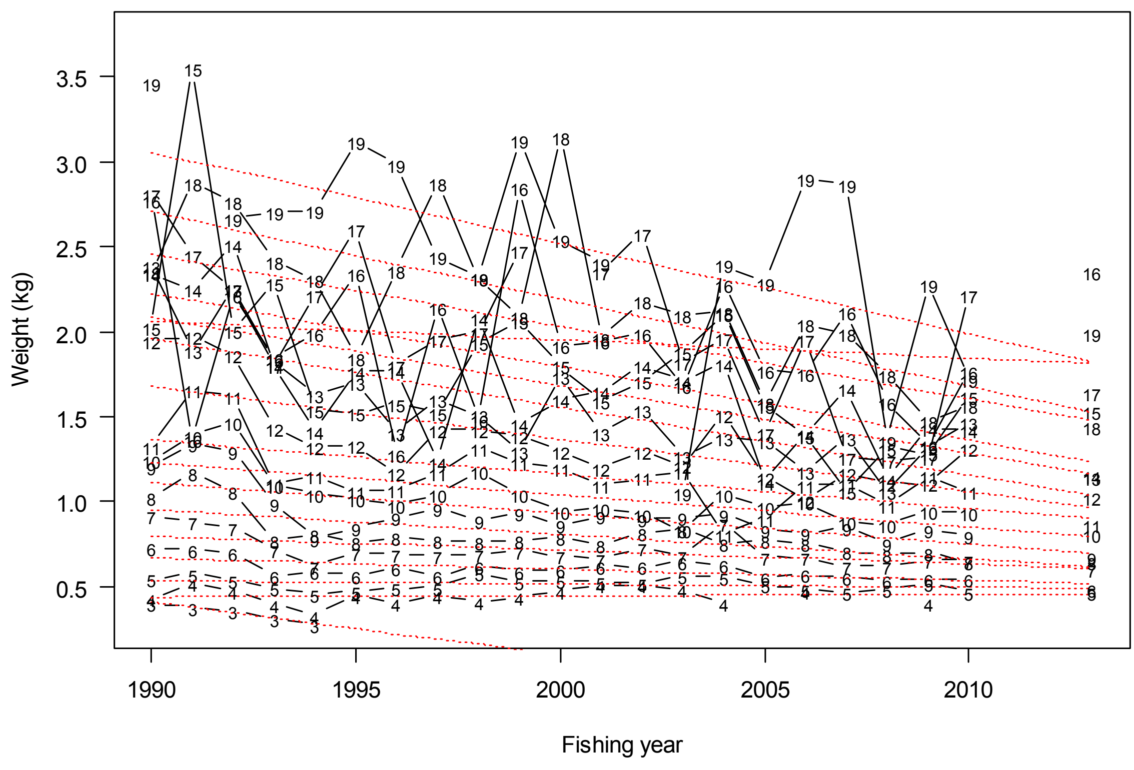

Figure 16: Mean weight-at-age estimates for 3- to >19-year-old snapper sampled from the Hauraki Gulf bottom longline fishery between 1989–90 and 2012–13 with fitted trend lines (dotted) for each age class depicting long-term changes in growth rates over the 24 year period.

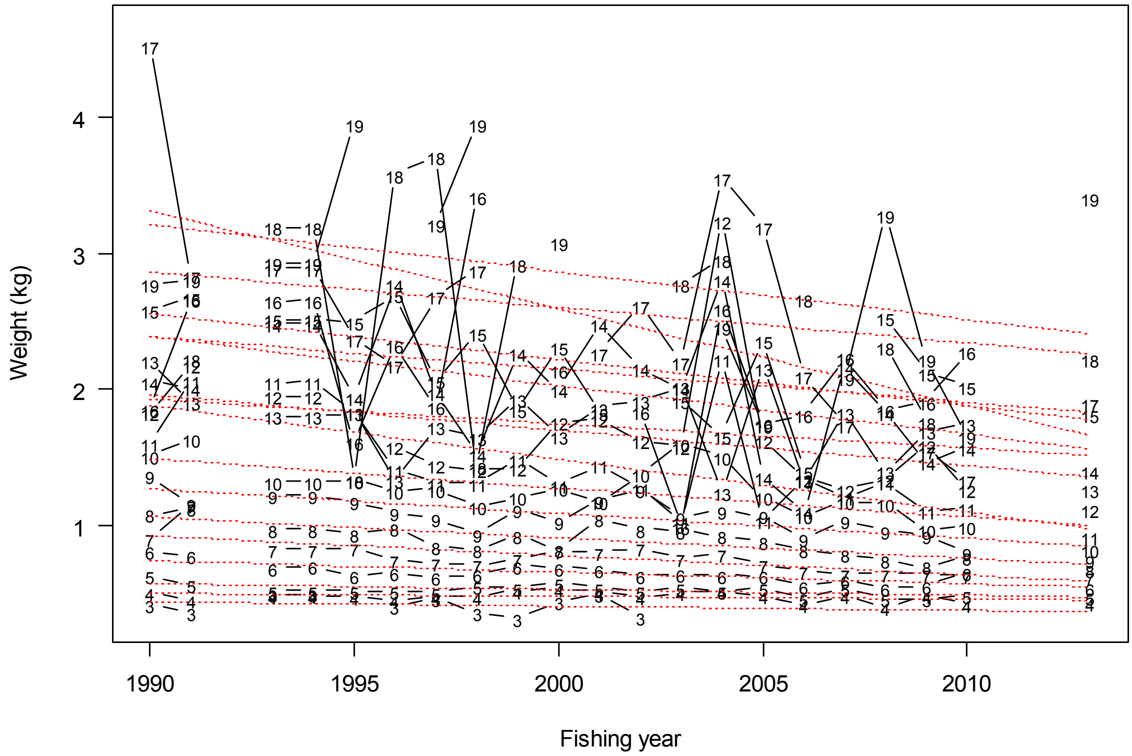

Figure 17: Mean weight-at-age estimates for 3- to >19-year-old snapper sampled from the Bay of Plenty bottom longline fishery between 1989–90 and 2012–13 with fitted trend lines (dotted) for each age class depicting long-term changes in growth rates over the 24 year period.

Comparisons of stock mean weight-at-age estimates from 2012–13 samples to a time series comprising the average of two decadal collections (1990s and 2000s) of mean weight-at-age from the East Northland, Hauraki Gulf, and Bay of Plenty bottom longline fisheries indicates mean weight-at-age (over spring-summer) has continued to decrease in both the Hauraki Gulf and Bay of Plenty, but has largely stabilised in East Northland (Figure 18). The difference in mean weight-at-age between the first decade (1990s) and 2012–13 indicates the overall net weight loss/gain to the respective fisheries, estimated conservatively at around -30% for most of the common age classes (i.e., 6- to 15-year-olds) in the Hauraki Gulf and Bay of Plenty fisheries, and -8% for East Northland. Only a handful of age classes demonstrated positive gains across all three stocks and were often related to a year class of poor strength in 2012–13 comprising a low sample size such as the 1994 year class (19-year-olds) in East Northland and the Bay of Plenty and the 1997 year class (16-year-olds) in the Hauraki Gulf (Figure 18).

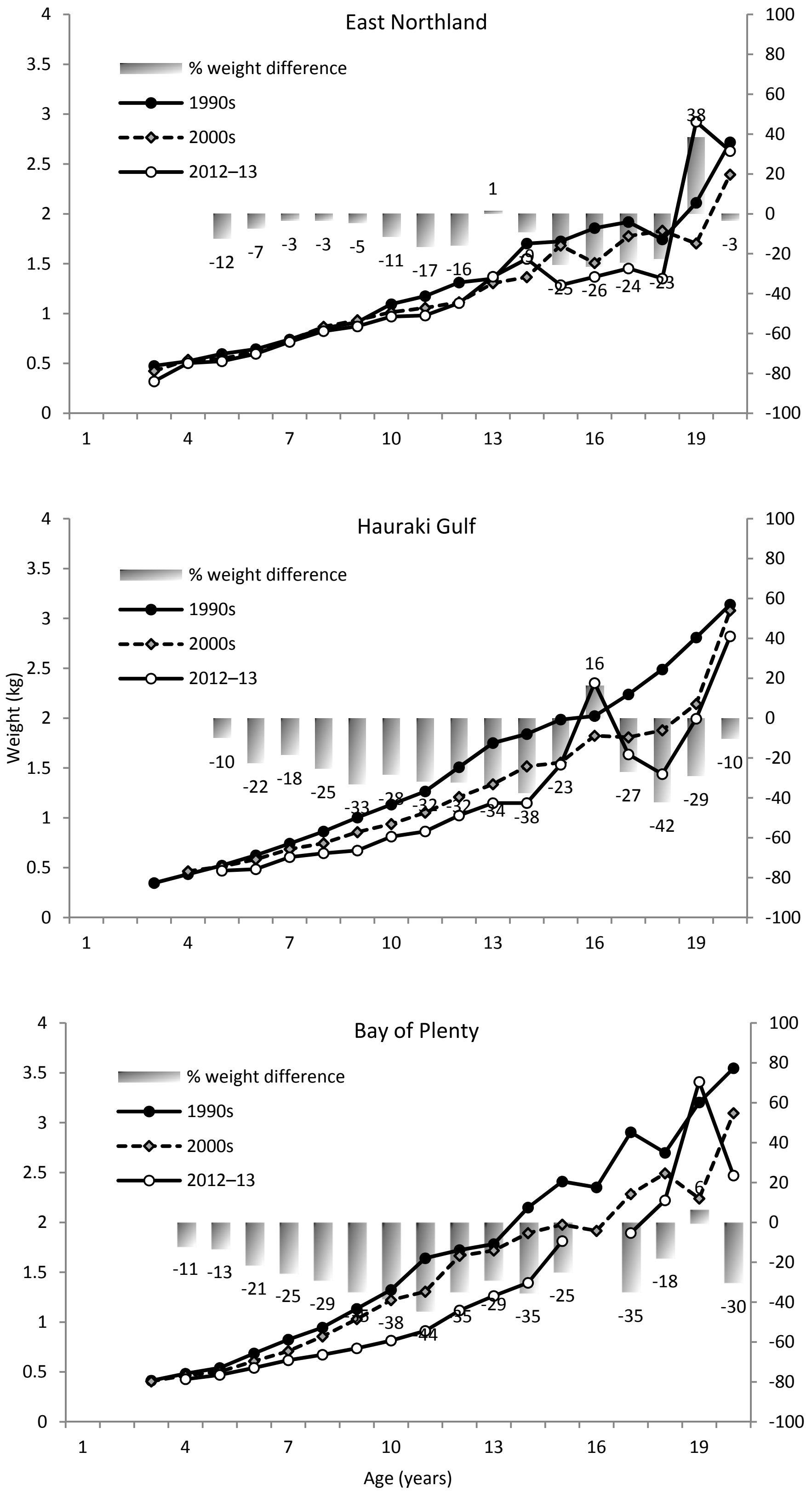

Figure 18: Mean weight-at-age estimates for snapper sampled from the three SNA 1 stock bottom longline fisheries from two distinct decadal time periods and from the current sampling year 2012–13, and where each period reflects the average mean weight-at-age for those years. The percentage weight difference for each age class (positive or negative) is the difference between the first decade (1990s) and 2012–13, and indicative of a net weight gain or loss in mean weight-at-age through time. Note: For comparative purposes over time, only spring-summer samples have been presented.

The most consistent difference in seasonal mean weight-at-age estimates between stocks in 2012–13 was for young fish, 5–14 years of age, where East Northland snapper were on average 21% heavier than those from the Hauraki Gulf and 11% heavier than those from the Bay of Plenty, which corresponds to a 7% and 3% difference in mean length-at-age (Figures 19 and 20, Appendices 4 and 5). For seasonal mean weight-at-age comparisons within stocks, and mainly in relation to young fish, estimates were most often higher for samples collected during winter compared to other seasons. Mean weight-at-age estimates determined from Hauraki Gulf autumn samples were noticeably the lowest in SNA 1 for most age classes 10 years and older (Figure 19).

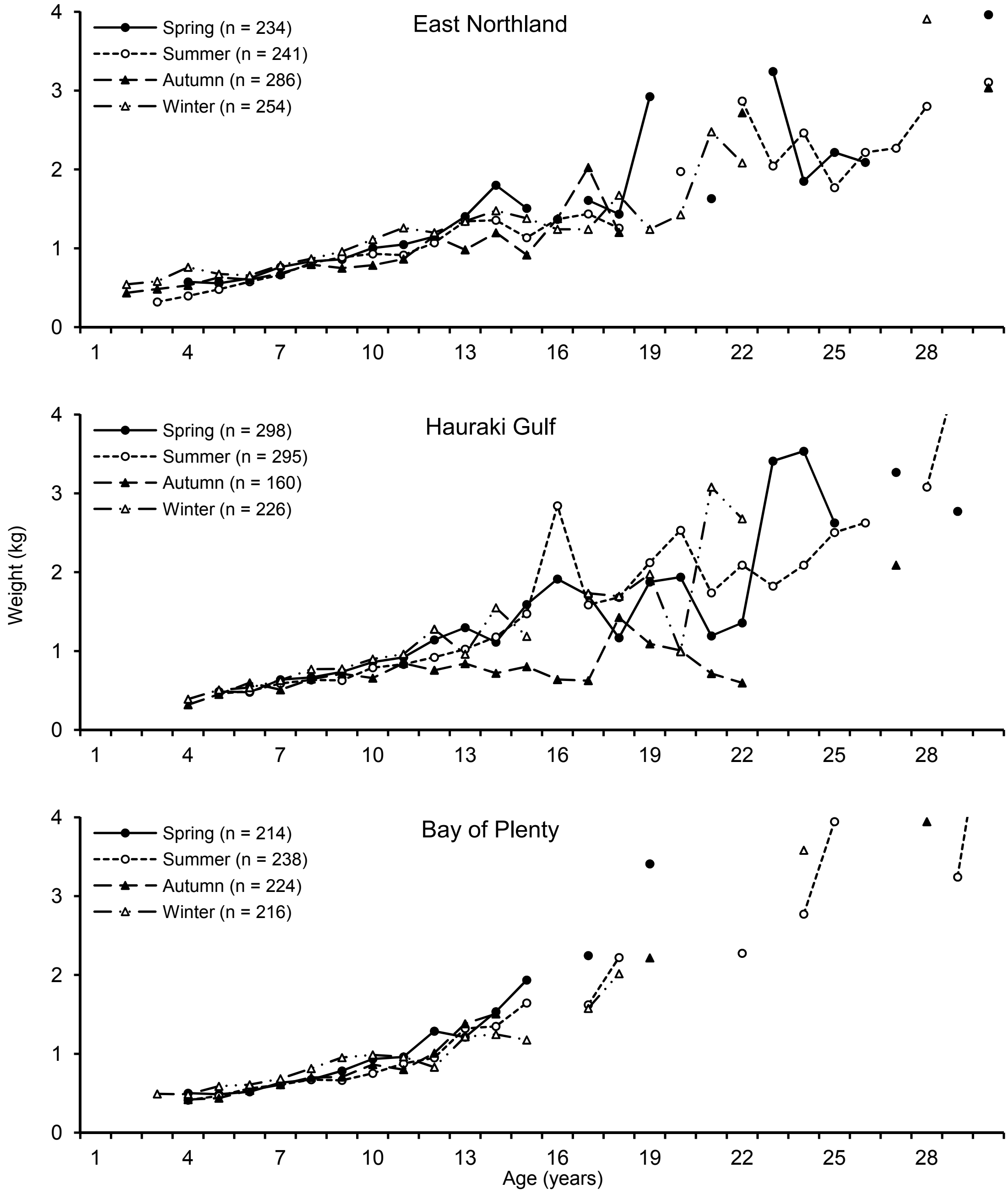

Figure 19: Observed mean weight-at-age estimates from snapper landings sampled over four seasons from the three SNA 1 stock bottom longline fisheries in 2012–13 (ENLD, East Northland; HAGU, Hauraki Gulf; BPLE, Bay of Plenty; *n*, sample size).

Observed seasonal mean length-at-age estimates for the SNA 1 stock fisheries closely resemble those patterns seen in mean weight-at-age estimates (Figure 20, Appendix 5).

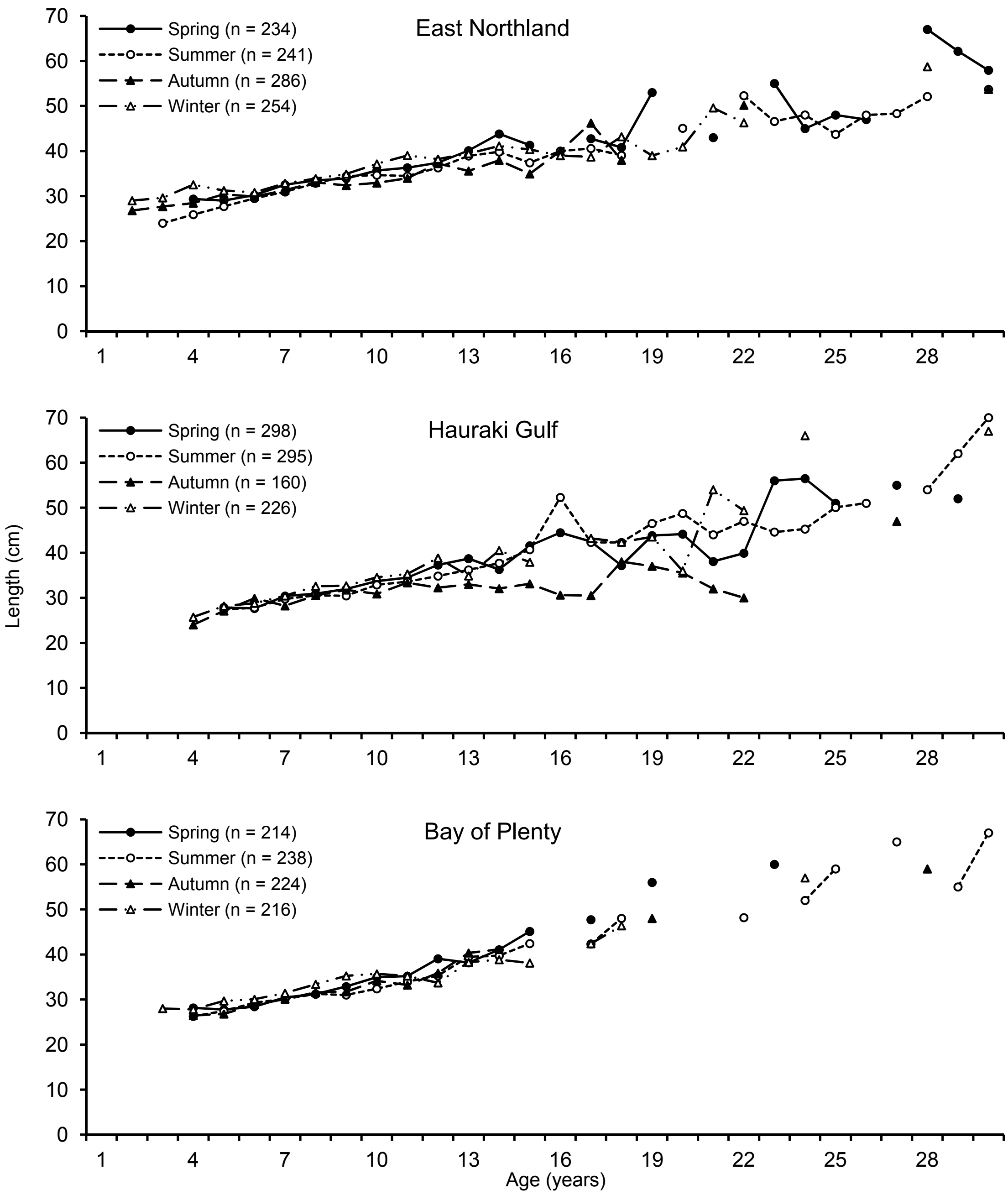

Figure 20: Observed mean length-at-age estimates from snapper landings sampled over four seasons from the three SNA 1 stock bottom longline fisheries in 2012–13 (ENLD, East Northland; HAGU, Hauraki Gulf; BPLE, Bay of Plenty; *n*, sample size).

4. DISCUSSION

The relative year class strengths inferred from the age distributions sampled from the SNA 1 fisheries in the 2012–13 fishing year are generally consistent with trends observed over the previous decade (Walsh et al. 2006a, 2006b, 2007, 2008, 2009, 2011a, 2011b). The collection of otolith samples in 2012–13 followed the same design as that first implemented in 2003–04 (Walsh et al. 2006b), 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 bottom longline fleet and its fishing operations, as more of the snapper catch in recent years has been landed year-round. 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 influencing 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, 2008, 2011a, 2011b). 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 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.

Most bottom longline fishers work year-round and individually catch much higher tonnages of snapper than they have in the past, the vast majority destined for export. In 2012–13, a core group of about 30 vessels caught over one-third of the Total Allowable Commercial Catch (TACC) of 4500 t, with individual annual landings ranging from 15 t to over 100 t, the average in excess of 50 t. Bottom longline has remained the dominant method in the fishery since 2009–10, catching marginally more snapper than bottom trawl. Unlike other methods, longlining operates extensively in most spatial strata of SNA 1 (with the exception of the central and eastern Bay of Plenty), 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. Bottom 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 bottom longline catch-at-age estimates, which also reflect the population age structure, and reveal the relative strength of newly recruiting year classes entering the fishery, as well as variations in annual growth rates, which influence stock productivity. These are important estimates that are derived from fitting a population model to bottom longline catch-at-age estimates and are significant for the long-term monitoring of the fishery (Walsh et al. 2008). Nonetheless, as proportional catch-at-age data are not a direct index of absolute abundance, inferences from these data in respect to changes in stock size may not be totally reliable and should be interpreted with caution.

East Northland

The East Northland year-round catch-at-age distribution in 2012–13 appears to have broadened from that seen in 2009–10, the previous fishing year in which catch-at-age estimates were determined, with a good representation in all recruited age classes up to 14 years (see Appendices 6 and 7). However, the relative proportion of the 1999 year class (now 14 years of age) that dominated East Northland landings from 2003–04 in an unprecedented manner for seven consecutive years, now accounts for about one-third what it did three years ago, similar to the handful of year classes that precede it (2000–2003). Nevertheless, these teenage cohorts have average individual sizes ranging from about 36 cm (about 1.0 kg) to about 40 cm (about 1.3 kg), and collectively should be important to the East Northland fishery for some years to come, not just by number, but significantly in their contribution by weight.

A good proportion of young age classes now dominate the East Northland fishery, with more than half the current bottom longline landed catch based on fish eight years of age or less, the 2007 year class (6-year-olds) the most dominant, making up 15% by number, although the average size is small at 30 cm (about 0.6 kg). As some of these young age classes are not yet fully recruited to the fishery, they still include a proportion of fish in the small length class intervals in the age-length key (see Appendix 2), which are probably below the the minimum legal size (MLS) of 25 cm, so their relative proportions may continue to increase in the age distribution in the following years.

Although not as large as the Hauraki Gulf, the East Northland stock has remained in a healthy state comprising a reasonable number of fish between 20 and 30 years of age and older, proportionally more than that present in any other New Zealand snapper stock (Walsh et al. 2011b). Unfortunately, due to the inherently slow growth rates for snapper in SNA 1, the average size of fish in East Northland remains comparatively small at about 34 cm (about 0.8 kg), and this is likely to impact on the productivity of the stock.

Hauraki Gulf

The age distribution of Hauraki Gulf bottom longline catch in 2012–13 is likely to be close to, if not the broadest composition seen in the fishery in well over two decades (see Appendices 6 and 7), and has the highest ever recorded mean age (11.5 years) for any SNA 1 stock (Appendix 8). It is well represented by a range of young to moderate age fish; those 6–15 years of age being of similar relative strengths, collectively making up four in every five snapper landed, and will be important for the sustainability of the fishery well into the next decade. The 1999 year class (14-year-olds) which dominated longline landings for five consecutive years (2004–05 to 2008–09), still makes up around 10% of the catch in 2012–13, the same as it did three years ago in 2009–10 (Walsh et al. 2011b, see Appendix 6). It has an average individual size of about 39 cm (about 1.2 kg) and will undoubtedly be important to the Hauraki Gulf fishery for at least this decade. In 2000, Morrison et al. (2002) reported that the 1999 year class (age 1+) was predicted be the strongest to recruit into the Hauraki Gulf since 1983, using a modelled relationship between sea surface temperature and snapper recruitment (Francis 1993). In 2012–13 it appears to have remained more dominant in the right hand limb of the Hauraki Gulf bottom longline catch than that seen in either East Northland or the Bay of Plenty, although recent recruitment to both these areas has been strong, and is likely to have influenced the relative proportions.

Although a perception may exist that the Hauraki Gulf age distribution appears less broad than East Northland in having proportionally fewer old fish, particularly those around 30 years, the actual proportion of fish 20 years and greater stands at 5% in 2012–13, equal to that of East Northland (see Figure 11). With a considerable proportion of fish occupying the 1996–1993 year classes (17-to 20-year-olds), and the good number of strong year classes that precede them, the right hand limb of the Hauraki Gulf age distribution will undoubtedly continue to broaden over the following few years, and most likely demonstrate further improvement on that seen a decade ago. However, as recruitment into the fishery is delayed by slow growth, as it has been for many years (Walsh et al. 2008), the average size of fish landed by bottom longline in the Hauraki Gulf has remained comparatively small, currently at about 34 cm (about 0.8 kg), similar to East Northland.

The Hauraki Gulf has most often been the mainstay of the SNA 1 fishery, comprising the largest biomass and producing the largest commercial and recreational harvest. Commercial fishers regularly state that they often try to avoid snapper, but with little success, and have difficulty catching the range of other species they require to meet their ACE (Annual Catch Entitlement) holdings and market demands. Unstandardized recreational and standardised commercial bottom longline catch per unit effort (CPUE) indices both suggest a considerable improvement in the fishery in recent years (Hartill 2012, McKenzie & Parsons 2012). The most recent aerial-access survey conducted in 2011–12 estimated the recreational snapper harvest to be 2490 t for the Hauraki Gulf and 3754 t for the whole of SNA 1 (Hartill et al. 2013).

Bay of Plenty

The Bay of Plenty age distribution for 2012–13 has continued to broaden (see Appendices 6 and 7) from the last sampling collection in 2009–10 (Walsh et al. 2011b), and like the Hauraki Gulf, has the highest ever recorded mean age (8.6 years) from catch sampling research undertaken over a period of 24 years (Appendix 7). Although 90% of the current landed catch was based on snapper 14 years and younger, there has been, and remains, a paucity of older fish in the Bay of Plenty compared to the East Northland and Hauraki Gulf fisheries (see Figure 11, Appendices 6 and 7). Those fish 20 years and older in the Bay of Plenty currently make up less than 1% of the total catch by number, similar to recent catch-at-age estimates determined for SNA 2 and SNA 8 (Walsh et al. 2012, 2014 in press), stocks that have also experienced high commercial fishing pressure over previous decades (Langley 2010, Davies et al. 2013). Nevertheless, with a noticeable and consistent broadening in the age distribution since 2007–08, coupled with an increasing trend of CPUE for bottom longline (McKenzie & Parsons 2012), it is quite possible that the biomass of snapper in the Bay of Plenty may be rebuilding to a size not seen for over three decades, should fishing pressure remain stable, and recruitment, average or better. Only a tagging programme to estimate stock biomass would ultimately clarify this uncertainty.

Like East Northland, a good proportion of young age classes now dominate the Bay of Plenty fishery, with more than half the current bottom longline landed catch based on fish eight years of age or less, many of which are not yet fully recruited. The 2007 year class (6-year-olds), by far the most dominant, make up one in five fish by number, although the average size is small at 29 cm (about 0.5 kg). The 1999 year class (14-year-olds) which previously dominated longline landings for five consecutive years (2003–04 to 2007–08), makes up just 4% of the catch in 2012–13. In 2008–09, Walsh et al. (2011a) reported the 1999 year class to be important for the sustainability of the Bay of Plenty fishery in the following decade, not only by number, but more importantly in relation to their contribution by weight. However, the rapid decline of this very strong year class, quite possibly the strongest to recruit in over three decades, is a direct reflection of the high level of exploitation the Bay of Plenty receives relative to the larger East Northland and Hauraki Gulf stocks (Walsh et al. 2004).

Similar to the Hauraki Gulf, recruitment into the Bay of Plenty snapper fishery in recent years has been delayed by a slowing growth rate (Walsh et al. 2011b), and with an average size of about 32 cm (about 0.7 kg) landed by bottom longline in 2012–13, it has now become the lowest recorded estimate for more than two decades.

Variability in catch-at-age between stocks

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, 2006a, 2006b, 2007, 2008, 2009, 2011a, 2011b). Most noticeable in bottom longline catch-at-age compositions from 2012–13 is the similarities in relative strengths of the 2008 to 1999 year classes (5- to 14-year-olds) that exists between the SNA 1 stocks, particularly East Northland and the Bay of Plenty. The minor differences for these year classes in the Hauraki Gulf fishery are likely to be due to slow growth and delayed recruitment.

Nevertheless, there have always been anomalies present within SNA 1 (Walsh et al. 1998, 2000, 2002, 2003, 2006a, 2008, 2011a, 2011b) such as consistently low numbers of old fish in the Bay of Plenty, and the higher proportions of fish from the 1998 year class in the Hauraki Gulf compared to the other two stocks in 2012–13. Any variability in relative year class proportions between the SNA 1 stocks is most likely to be 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).

Seasonal differences in catch-at-age

A number of factors have been proposed as influencing the seasonal variability associated with catch-at-age estimates for snapper. These include the seasonal partitioning of sample collections and the temporal and spatial spread of samples within these seasons, particularly in relation to the timing of school fish migrations and the proportion with which resident fish make up the fishery (Walsh et al. 2011a, 2011b). Other seasonal influences may relate to the adequacy of sample size collections in terms of the number of landings and otoliths sampled within seasonal strata (i.e., shortfalls in Hauraki Gulf in autumn, East Northland Statistical Area 002 in summer and autumn in 2012–13, see Tables 1 and 2), heterogeneity in age structure that exists within the fishery or subareas (i.e., East Northland Statistical Areas 002 and 003, Davies & Walsh 2003) and differences in growth rate and its effect on the rate of recruitment (Walsh et al. 2006a, 2006b, 2008, 2009, 2011a, 2011b).

While some variations in the relative strengths of a few common age classes over seasons were evident in 2012–13, particularly in East Northland, a reasonable level of consistency was apparent in others, as has been seen in previous years (Walsh et al. 2006a, 2006b, 2008, 2009, 2011a, 2011b). Most often, older and larger fish have been found to be common in summer, and younger and smaller fish common in winter, a result also observed in year-round sampling of SNA 2 landings (Blackwell et al. 2000, Blackwell & Gilbert 2001), and also evident in most year-round sample collections from the Bay of Plenty and East Northland fisheries (Walsh et al. 2006a, 2006b, 2008, 2009, 2011a, 2011b), including those in 2012–13.

In most year-round sampling of the Hauraki Gulf fishery, the highest proportion of old fish has been found during winter, and thought to be representative of resident fish (Walsh et al. 2006a, 2006b, 2008, 2009). In 2012–13, the highest proportion of old fish occurred during spring, the same as in 2008–09 (Walsh et al. 2011a) and is thought to be affected by the seasonal partitioning of the sample collections in relation to the timing of the school fish migrations. This appears to occur when school fish migrations into the Hauraki Gulf during spring are delayed, so that initial sampling of spring landings, the first season of the fishing year, capture a larger proportion of slow growing resident fish. Walsh et al. (2006b) 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 in the fishery.

Precision in catch-at-age

In previous years, when annual sampling of the SNA 1 stock fisheries was the standard practise, comparisons between inter-annual catch-at-age estimates in the time series indicated a high level of consistency in proportion-at-age sample estimates (Appendices 6 and 7). In 2012–13, following a two year hiatus from sampling, the same level of consistency is not as apparent, whereby relative year class strengths have often markedly changed, due to either recruitment and/or fishing mortality over time. Examples of these are the 2007 and 1999 year classes in the East Northland and Bay of Plenty fisheries. The 2007 year class (6-year-olds) currently dominates the respective fisheries as the strongest year class, but in 2009–10 was barely recruited (see Appendices 6 and 7). Similarly, but in the reverse sense, the previously strong 1999 year class, which dominated both stocks for seven and five years respectively over the previous decade, is now largely insignificant compared to most other year classes that precede it. Such changes in the relative proportions of catch-at-age data for the Hauraki Gulf seem less obvious, which may be due to the slower growth rates, delayed recruitment and lower level of exploitation compared to the Bay of Plenty.

The bootstrap MWCV estimates for the age distributions sampled from the SNA 1 fisheries in 2012–13 ranged between 0.21 and 0.22, and have increased slightly over recent years as the age structure in the respective fisheries has broadened. Although marginally falling short of the targeted MWCVs of 20%, estimates in 2012–13 still remain acceptable, given that sampling was conducted year-round, and reflects the rigorous sampling methodology and accurate ageing currently in place for snapper. 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 representativeness in the sample collections, albeit with some shortfalls (see previous section). Furthermore, although significant area closures to commercial fishing activity have occurred as a result the of container vessel *Rena* grounding on Astrolabe reef in the central Bay of Plenty in October 2011, it is unlikely that spatio-temporal representativeness of catch-at-age samples for the Bay of Plenty in 2012–13 were affected as few bottom longline vessels historically fished within the area.

Mean weight-at-age

In recent years, a gradual reduction in annual mean weight-at-age estimates for the common age classes has been evident in year-round and spring-summer sample collections in SNA 1, most apparent in the Bay of Plenty and Hauraki Gulf stocks (Walsh et al. 2011a, 2011b). It was considered that a decrease in growth rates may have been correlated with an increase in stock size, as all SNA 1 age distributions appear to have broadened from around the time in which the dominant 1999 year class first recruited to the fishery (around 2004–05 as 6-year-olds), and was further supported by a succession of four year classes (2000–2003) of above average strength over subsequent years (see Appendices 6 and 7). In 2012–13, estimates of mean weight-at-age for the common age classes in year-round and spring-summer samples are now close to, if not the, lowest estimates recorded for the Bay of Plenty and Hauraki Gulf stocks, indicative of a continuing trend, while that for East Northland appears to have largely stabilised (see Figures 15–18). Furthermore, the age at which snapper recruit over spring and summer has increased from that seen two decades ago, from three to four years of age in the Bay of Plenty, and now to five years of age in the Hauraki Gulf (Walsh et al. 2011b, see Figures 15–17).

Aside from any possible bias associated with the sampling design or selectivity of the fishing method, temporal growth trends for snapper, like those observed in this study and documented in the past (Davies et al. 2003, 2013, Walsh et al. 2011a, 2011b), are more likely to be attributable to compensatory density dependence (Rose et al. 2001) as the stock biomass changes, rather than temperature related effects. Although water temperature has been found to be an important determinant for juvenile snapper growth, (growth being positively correlated with mean sea surface temperature (SST) (Francis 1994)), its influence on temporal growth in adults is unclear here, given that mean SST estimates for the Hauraki Gulf have been on average above the 47-year long-term mean for the last two decades. The reduced growth rate observed in the Hauraki Gulf and Bay of Plenty fisheries in recent years and the resulting net weight loss in terms of yield-per-recruit compared to the 1990s and the impact on productivity of the stocks has been reported a number of times (Walsh et al 2007, 2010, 2011a, 2011b) and simply means that the fishery will now land considerably more snapper than it did 10–20 years ago to achieve the same harvest weight.

Overall there appears to be little variation in seasonal mean weight-at-age estimates for the most common age classes in SNA 1 in 2012–13, with the exception of the low estimates for some age classes in the Hauraki Gulf autumn fishery, likely to be an artefact due to the shortfall in sampling (see Table 2). Such variation most likely reflects a disproportionately higher number of resident fish in autumn landings associated with samples from Statistical Area 007 (inner Hauraki Gulf), due to the removal of other landings incorrectly presumed to be fishing in the northern Hauraki Gulf. Resident fish have been found to occupy shallow inshore strata year-round, and are thought to experience lower water temperatures for a longer period, especially over winter (sometimes in early spring), than those experienced by school fish, resulting in reduced growth rates and hence lower estimates of mean weight-at-age (Walsh et al. 2006b).

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7. APPENDICES

Appendix 1: Estimated seasonal proportion at age and coefficients of variation (CVs) for snapper bottom longline fisheries in SNA 1 in 2012–13.

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 for snapper from the East Northland bottom longline fishery in 2012–13.

Random age frequency

									Longline	
Age	Spring		Summer		Autumn		Winter		Spr-win	
(years)	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
2	0.0000	0.00	0.0000	0.00	0.0096	1.13	0.0032	1.39	0.0042	0.95
3	0.0000	0.00	0.0042	1.38	0.0192	0.95	0.0327	0.46	0.0164	0.47
4	0.0351	0.51	0.0212	0.66	0.0489	0.42	0.0801	0.37	0.0495	0.23
5	0.0920	0.33	0.0665	0.44	0.1312	0.23	0.1618	0.26	0.1197	0.15
6	0.1015	0.42	0.1033	0.35	0.1795	0.21	0.1664	0.28	0.1468	0.14
7	0.1177	0.35	0.0931	0.33	0.1292	0.31	0.0976	0.28	0.1114	0.16
8	0.1183	0.28	0.1008	0.28	0.1457	0.21	0.0451	0.53	0.1044	0.15
9	0.0667	0.32	0.0465	0.50	0.0350	0.54	0.0579	0.41	0.0492	0.23
10	0.1219	0.25	0.0900	0.25	0.0410	0.38	0.1050	0.25	0.0827	0.14
11	0.0561	0.47	0.0518	0.36	0.0703	0.30	0.0563	0.39	0.0603	0.19
12	0.0775	0.27	0.0870	0.27	0.0344	0.46	0.0414	0.48	0.0545	0.18
13	0.0546	0.38	0.0611	0.29	0.0364	0.48	0.0202	0.69	0.0401	0.22
14	0.0564	0.37	0.0672	0.36	0.0455	0.38	0.0569	0.42	0.0549	0.20
15	0.0219	0.47	0.0295	0.52	0.0167	0.58	0.0111	0.80	0.0186	0.30
16	0.0000	0.00	0.0150	0.70	0.0233	0.56	0.0063	1.28	0.0128	0.42
17	0.0051	0.87	0.0437	0.45	0.0032	1.04	0.0133	0.73	0.0143	0.34
18	0.0170	0.92	0.0135	0.79	0.0062	0.79	0.0076	1.09	0.0100	0.44
19	0.0073	1.00	0.0000	0.00	0.0000	0.00	0.0063	1.31	0.0030	0.85
20	0.0000	0.00	0.0110	0.86	0.0000	0.00	0.0098	0.96	0.0048	0.64
21	0.0074	1.32	0.0000	0.00	0.0000	0.00	0.0129	0.90	0.0049	0.74
22	0.0000	0.00	0.0112	0.79	0.0143	0.79	0.0050	1.04	0.0086	0.52
23	0.0025	1.38	0.0157	0.72	0.0000	0.00	0.0000	0.00	0.0036	0.63
24	0.0029	1.27	0.0087	0.75	0.0000	0.00	0.0000	0.00	0.0022	0.63
25	0.0073	1.03	0.0129	0.71	0.0000	0.00	0.0000	0.00	0.0039	0.57
26	0.0074	1.30	0.0046	1.27	0.0000	0.00	0.0000	0.00	0.0022	0.93
27	0.0000	0.00	0.0057	0.91	0.0000	0.00	0.0000	0.00	0.0011	0.88
28	0.0025	1.49	0.0085	1.01	0.0000	0.00	0.0030	1.08	0.0029	0.68
29	0.0072	1.02	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0013	0.98
>29	0.0136	0.84	0.0273	0.54	0.0105	0.95	0.0000	0.00	0.0115	0.42
n	234		241		286		254		1 015	

Appendix 1 – continued:
Estimates of proportion at age with coefficients of variation for snapper from the East Northland bottom longline fishery (statistical area 002) in 2012–13.

Random age frequency

Longline

Age	Spring		Summer		Autumn		Winter		Spr-win	
(years)	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
2	0.0000	0.00	0.0000	0.00	0.0181	1.16	0.0082	1.41	0.0081	0.96
3	0.0000	0.00	0.0000	0.00	0.0362	1.01	0.0716	0.45	0.0286	0.53
4	0.0397	0.61	0.0155	1.29	0.0338	0.76	0.1595	0.35	0.0605	0.29
5	0.1025	0.40	0.0735	0.78	0.1828	0.27	0.1578	0.36	0.1378	0.19
6	0.1197	0.49	0.0897	0.61	0.1623	0.32	0.0762	0.43	0.1197	0.22
7	0.1310	0.44	0.0946	0.60	0.1579	0.44	0.0712	0.58	0.1208	0.26
8	0.1098	0.34	0.1194	0.48	0.1912	0.26	0.0429	0.62	0.1246	0.19
9	0.0682	0.39	0.0763	0.74	0.0315	1.09	0.0108	1.03	0.0440	0.38
10	0.1383	0.27	0.0982	0.42	0.0181	1.21	0.1049	0.37	0.0825	0.21
11	0.0399	0.76	0.0276	0.81	0.0496	0.65	0.0484	0.59	0.0431	0.36
12	0.0397	0.62	0.0707	0.45	0.0254	0.87	0.0801	0.58	0.0490	0.31
13	0.0559	0.45	0.0544	0.50	0.0181	1.15	0.0207	1.09	0.0347	0.37
14	0.0597	0.41	0.0771	0.54	0.0254	0.89	0.0590	0.53	0.0506	0.27
15	0.0047	1.46	0.0227	1.05	0.0000	0.00	0.0082	1.40	0.0069	0.73
16	0.0000	0.00	0.0000	0.00	0.0181	1.21	0.0161	1.32	0.0099	0.90
17	0.0000	0.00	0.0438	0.74	0.0000	0.00	0.0082	1.40	0.0092	0.64
18	0.0213	1.07	0.0113	1.18	0.0000	0.00	0.0026	1.82	0.0081	0.76
19	0.0073	1.32	0.0000	0.00	0.0000	0.00	0.0161	1.32	0.0055	0.94
20	0.0000	0.00	0.0155	1.26	0.0000	0.00	0.0161	1.35	0.0062	0.93
21	0.0106	1.26	0.0000	0.00	0.0000	0.00	0.0161	1.26	0.0064	0.88
22	0.0000	0.00	0.0276	0.79	0.0157	1.24	0.0029	1.58	0.0107	0.67
23	0.0035	1.51	0.0389	0.73	0.0000	0.00	0.0000	0.00	0.0074	0.63
24	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
25	0.0073	1.33	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0019	1.30
26	0.0106	1.28	0.0113	1.31	0.0000	0.00	0.0000	0.00	0.0047	0.93
27	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
28	0.0035	1.44	0.0162	1.28	0.0000	0.00	0.0026	1.80	0.0042	0.87
29	0.0073	1.27	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0019	1.23
>29	0.0194	0.85	0.0155	1.27	0.0157	1.24	0.0000	0.00	0.0131	0.64
n	131		70		71		128		400	

Appendix 1 – continued:
Estimates of proportion at age with coefficients of variation for snapper from the East Northland bottom longline fishery (statistical area 003) in 2012–13.

Random age frequency

Age	Longline									
	Spring		Summer		Autumn		Winter		Spr-win	
(years)	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
2	0.0000	0.00	0.0000	0.00	0.0020	1.45	0.0000	0.00	0.0007	1.44
3	0.0000	0.00	0.0070	1.33	0.0038	1.44	0.0073	1.40	0.0053	0.83
4	0.0243	0.87	0.0251	0.81	0.0625	0.51	0.0284	0.90	0.0393	0.38
5	0.0677	0.63	0.0618	0.41	0.0847	0.52	0.1645	0.35	0.1031	0.24
6	0.0591	0.54	0.1126	0.39	0.1950	0.26	0.2251	0.32	0.1718	0.18
7	0.0867	0.47	0.0921	0.33	0.1032	0.30	0.1148	0.31	0.1027	0.17
8	0.1381	0.46	0.0882	0.31	0.1046	0.29	0.0464	0.84	0.0859	0.22
9	0.0631	0.52	0.0263	0.59	0.0381	0.54	0.0885	0.44	0.0540	0.28
10	0.0835	0.45	0.0845	0.33	0.0616	0.38	0.1050	0.33	0.0828	0.19
11	0.0940	0.41	0.0683	0.40	0.0890	0.28	0.0615	0.54	0.0761	0.20
12	0.1658	0.31	0.0980	0.34	0.0425	0.51	0.0162	0.82	0.0595	0.22
13	0.0515	0.70	0.0656	0.32	0.0529	0.53	0.0198	0.76	0.0451	0.27
14	0.0486	0.67	0.0604	0.46	0.0636	0.41	0.0556	0.61	0.0588	0.27
15	0.0621	0.46	0.0341	0.56	0.0317	0.58	0.0130	0.97	0.0295	0.32
16	0.0000	0.00	0.0252	0.73	0.0280	0.50	0.0000	0.00	0.0156	0.40
17	0.0169	0.97	0.0437	0.49	0.0061	1.04	0.0166	0.93	0.0191	0.40
18	0.0072	1.44	0.0150	0.94	0.0118	0.82	0.0109	1.28	0.0118	0.54
19	0.0072	1.37	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0008	1.33
20	0.0000	0.00	0.0079	1.23	0.0000	0.00	0.0057	1.46	0.0036	0.95
21	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0109	1.28	0.0035	1.27
22	0.0000	0.00	0.0000	0.00	0.0130	0.98	0.0064	1.25	0.0066	0.76
23	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
24	0.0098	1.28	0.0146	0.77	0.0000	0.00	0.0000	0.00	0.0043	0.63
25	0.0072	1.37	0.0217	0.71	0.0000	0.00	0.0000	0.00	0.0057	0.64
26	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
27	0.0000	0.00	0.0096	0.99	0.0000	0.00	0.0000	0.00	0.0022	0.95
28	0.0000	0.00	0.0032	1.46	0.0000	0.00	0.0032	1.43	0.0017	1.04
29	0.0070	1.36	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0007	1.34
>29	0.0000	0.00	0.0353	0.62	0.0057	1.31	0.0000	0.00	0.0100	0.52
n	103		171		215		126		615	

Appendix 1 – continued:
Estimates of proportion at age with coefficients of variation for snapper from the Hauraki Gulf bottom longline fishery in 2012–13.

Random age frequency
Longline

Age	Spring		Summer		Autumn		Winter		Spr-win	
(years)	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
2	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
3	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
4	0.0000	0.00	0.0000	0.00	0.0060	1.48	0.0336	0.79	0.0066	0.71
5	0.0061	1.00	0.0115	0.76	0.0499	0.89	0.0627	0.56	0.0263	0.42
6	0.0303	0.52	0.0343	0.53	0.0722	0.55	0.1262	0.29	0.0559	0.24
7	0.0838	0.27	0.1055	0.23	0.0884	0.36	0.0947	0.28	0.0946	0.14
8	0.0724	0.42	0.0889	0.30	0.0836	0.41	0.0971	0.36	0.0849	0.18
9	0.1113	0.23	0.1093	0.32	0.0923	0.35	0.0747	0.30	0.1007	0.16
10	0.0979	0.28	0.1432	0.21	0.0875	0.46	0.0925	0.29	0.1118	0.15
11	0.0832	0.26	0.0980	0.25	0.1099	0.29	0.0560	0.45	0.0899	0.14
12	0.0742	0.29	0.0586	0.38	0.1033	0.33	0.0645	0.32	0.0728	0.18
13	0.0665	0.40	0.0551	0.49	0.0646	0.38	0.0527	0.46	0.0596	0.23
14	0.1331	0.27	0.1044	0.24	0.0351	0.83	0.0869	0.31	0.0945	0.16
15	0.0818	0.26	0.0537	0.35	0.0622	0.69	0.0485	0.53	0.0619	0.20
16	0.0119	0.87	0.0073	1.03	0.0261	0.82	0.0000	0.00	0.0112	0.52
17	0.0331	0.50	0.0316	0.40	0.0208	1.06	0.0460	0.46	0.0321	0.26
18	0.0327	0.41	0.0251	0.54	0.0312	0.95	0.0132	0.80	0.0264	0.32
19	0.0266	0.48	0.0168	0.63	0.0261	0.83	0.0258	0.59	0.0227	0.32
20	0.0219	0.63	0.0112	0.87	0.0153	0.88	0.0062	1.27	0.0140	0.42
21	0.0067	0.91	0.0057	1.37	0.0104	1.29	0.0020	1.39	0.0064	0.65
22	0.0106	0.75	0.0033	1.50	0.0104	1.27	0.0101	0.89	0.0077	0.51
23	0.0018	1.51	0.0093	0.88	0.0000	0.00	0.0000	0.00	0.0039	0.79
24	0.0041	0.97	0.0099	0.83	0.0000	0.00	0.0039	1.24	0.0054	0.61
25	0.0022	1.45	0.0073	1.07	0.0000	0.00	0.0000	0.00	0.0033	0.91
26	0.0000	0.00	0.0057	1.31	0.0000	0.00	0.0000	0.00	0.0021	1.31
27	0.0053	1.23	0.0000	0.00	0.0049	1.36	0.0000	0.00	0.0024	0.88
28	0.0000	0.00	0.0016	1.41	0.0000	0.00	0.0000	0.00	0.0006	1.39
29	0.0027	1.38	0.0013	1.44	0.0000	0.00	0.0000	0.00	0.0012	1.00
>29	0.0000	0.00	0.0016	1.47	0.0000	0.00	0.0027	1.40	0.0010	1.03
n	298		295		160		226		979	

Appendix 1 – continued:
Estimates of proportion at age with coefficients of variation for snapper from the Bay of Plenty bottom longline fishery in 2012–13.

Random age frequency
Longline

Age	Spring		Summer		Autumn		Winter		Spr-win	
(years)	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.	*P.j.*	c.v.
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
2	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
3	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0030	1.47	0.0010	1.46
4	0.0080	0.92	0.0261	0.82	0.0393	0.57	0.0373	0.44	0.0325	0.33
5	0.0306	0.57	0.0745	0.58	0.1292	0.26	0.1279	0.26	0.1071	0.18
6	0.1470	0.32	0.1063	0.45	0.2114	0.23	0.2585	0.18	0.1998	0.13
7	0.1286	0.31	0.1446	0.24	0.0985	0.38	0.1360	0.33	0.1225	0.18
8	0.0615	0.39	0.0985	0.36	0.0973	0.36	0.1344	0.29	0.1051	0.19
9	0.1750	0.24	0.0722	0.39	0.0881	0.32	0.0423	0.42	0.0809	0.18
10	0.0910	0.31	0.1157	0.28	0.0921	0.41	0.0629	0.38	0.0869	0.20
11	0.1123	0.26	0.1040	0.34	0.0623	0.36	0.0884	0.37	0.0842	0.19
12	0.0618	0.45	0.0413	0.44	0.1240	0.55	0.0312	0.58	0.0718	0.35
13	0.0788	0.29	0.0454	0.41	0.0384	0.57	0.0280	0.61	0.0412	0.26
14	0.0472	0.39	0.0955	0.39	0.0159	0.78	0.0327	0.55	0.0394	0.27
15	0.0329	0.48	0.0159	0.78	0.0000	0.00	0.0038	1.04	0.0081	0.39
16	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
17	0.0172	0.64	0.0147	0.77	0.0000	0.00	0.0046	1.06	0.0062	0.47
18	0.0000	0.00	0.0174	0.75	0.0000	0.00	0.0072	1.06	0.0055	0.62
19	0.0051	1.35	0.0000	0.00	0.0019	1.48	0.0000	0.00	0.0013	1.04
20	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
21	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
22	0.0000	0.00	0.0063	1.02	0.0000	0.00	0.0000	0.00	0.0011	1.02
23	0.0030	1.36	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0004	1.35
24	0.0000	0.00	0.0027	1.42	0.0000	0.00	0.0016	1.33	0.0010	0.99
25	0.0000	0.00	0.0111	1.26	0.0000	0.00	0.0000	0.00	0.0020	1.23
26	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.0000	0.00
27	0.0000	0.00	0.0019	1.37	0.0000	0.00	0.0000	0.00	0.0003	1.37
28	0.0000	0.00	0.0000	0.00	0.0017	1.51	0.0000	0.00	0.0006	1.49
29	0.0000	0.00	0.0033	1.41	0.0000	0.00	0.0000	0.00	0.0006	1.41
>29	0.0000	0.00	0.0027	1.38	0.0000	0.00	0.0000	0.00	0.0005	1.36
n	214		238		224		216		892	

Appendix 2: Age-length keys derived from otolith samples collected from snapper fisheries in SNA 1 in 2012–13.

Estimates of proportion of length at age for snapper sampled from East Northland (statistical areas 002 and 003 combined), spring-winter 2012–13. (Note: Aged to 01/01/13)

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	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
25	0	0.07	0.07	0.33	0.27	0.20	0	0	0	0.07	0	0	0	0	0	0	0	0	0	0	15
26	0	0	0.06	0.29	0.24	0.24	0.06	0.12	0	0	0	0	0	0	0	0	0	0	0	0	17
27	0	0.02	0.02	0.12	0.38	0.31	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	42
28	0	0	0.07	0.03	0.14	0.40	0.12	0.10	0.03	0.02	0.05	0.02	0.02	0	0	0	0	0	0	0	58
29	0	0.02	0.03	0.06	0.18	0.25	0.23	0.14	0.03	0.03	0.02	0.02	0	0	0	0	0	0	0	0	65
30	0	0	0.01	0.04	0.18	0.32	0.10	0.12	0.03	0.06	0.07	0.04	0.01	0	0	0	0	0	0	0	68
31	0	0	0	0.05	0.12	0.21	0.15	0.22	0.07	0.09	0.05	0.01	0.02	0.01	0	0	0	0	0	0	86
32	0	0	0.01	0.08	0.17	0.11	0.19	0.08	0.11	0.04	0.07	0.10	0	0.02	0.01	0.01	0	0	0	0	84
33	0	0	0.01	0.08	0.09	0.07	0.17	0.11	0.11	0.11	0.05	0.09	0.04	0.04	0.03	0	0	0.01	0	0	76
34	0	0	0	0.01	0.06	0.11	0.14	0.16	0.09	0.14	0.07	0.07	0.03	0.07	0.04	0	0	0	0	0	70
35	0	0	0	0	0.02	0.07	0.14	0.18	0.11	0.18	0.07	0.02	0.13	0.05	0.02	0	0.02	0	0	0	56
36	0	0	0	0	0.02	0.02	0.09	0.07	0.07	0.15	0.13	0.13	0.06	0.11	0.04	0.04	0.06	0	0	0.02	54
37	0	0	0	0.05	0	0.02	0.12	0.09	0.07	0.23	0.07	0.14	0.07	0.07	0	0	0.05	0.02	0	0	43
38	0	0	0	0.03	0.03	0	0.03	0.03	0	0.08	0.15	0.13	0.10	0.18	0.15	0.03	0	0.05	0	0.03	39
39	0	0	0	0	0	0	0	0.10	0.03	0.07	0.20	0.23	0.10	0.07	0	0.03	0.03	0	0.03	0.10	30
40	0	0	0	0	0	0.03	0.03	0.12	0.03	0.30	0.03	0	0.09	0.24	0.06	0.03	0.03	0	0	0	33
41	0	0	0	0	0	0	0.06	0	0	0.06	0.17	0.22	0.11	0	0	0.17	0.06	0.06	0	0.11	18
42	0	0	0	0	0	0	0	0.04	0	0.11	0.14	0.25	0.11	0.14	0.04	0.04	0.04	0.04	0	0.07	28
43	0	0	0	0	0	0	0	0	0.04	0.11	0.07	0.11	0.11	0.37	0.04	0	0.04	0.04	0	0.07	27
44	0	0	0	0	0	0	0	0	0	0	0.08	0.17	0	0.17	0.08	0	0.08	0.25	0	0.17	12
45	0	0	0	0	0	0	0	0	0	0	0	0.07	0.07	0.29	0.14	0.07	0.14	0	0	0.21	14
46	0	0	0	0	0	0	0	0.08	0	0.08	0.08	0	0.08	0.46	0	0	0	0	0	0.23	13
47	0	0	0	0	0	0	0	0	0	0.25	0	0.13	0.25	0	0	0	0	0	0	0.38	8
48	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0.11	0	0.11	0	0	0.44	9
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0.75	4
50	0	0	0	0	0	0	0	0	0	0	0	0.29	0.14	0	0	0	0.14	0	0	0.43	7
51	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0.33	0	0.33	3
52	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0.20	0	0	0.20	0	0	0.40	5
53	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0.20	0	0	0	0	0.4	0.20	5
54	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0.75	4
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0	0	0.67	3
56	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0.25	0	0	0	0	0	0.50	4
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0	0.75	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	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
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	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	1.00	1
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
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																					1014

No length measurement was recorded for one fish and therefore does not appear in the age-length key.

Appendix 2 – continued:
Estimates of proportion of length at age for snapper sampled from East Northland (statistical area 002), spring-winter 2012–13. (Note: Aged to 01/01/13)

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	0.50	0	0	0	0	0	0.50	0	0	0	0	0	0	0	0	0	0	2
26	0	0	0.50	0	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
27	0	0.07	0.07	0.07	0.50	0.07	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0	14
28	0	0	0.25	0	0.17	0.25	0.25	0.08	0	0	0	0	0	0	0	0	0	0	0	0	12
29	0	0.07	0.13	0.13	0.27	0.20	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	15
30	0	0	0.05	0.10	0.33	0.43	0	0.05	0.05	0	0	0	0	0	0	0	0	0	0	0	21
31	0	0	0	0.11	0.17	0.28	0.22	0.17	0.06	0	0	0	0	0	0	0	0	0	0	0	18
32	0	0	0.03	0.21	0.33	0.18	0.12	0.09	0.03	0	0	0	0	0	0	0	0	0	0	0	33
33	0	0	0.03	0.19	0.16	0.13	0.22	0.13	0.06	0.06	0.03	0	0	0	0	0	0	0	0	0	32
34	0	0	0	0	0.15	0.19	0.22	0.22	0.07	0.15	0	0	0	0	0	0	0	0	0	0	27
35	0	0	0	0	0.03	0.13	0.20	0.27	0.10	0.10	0.03	0	0.13	0	0	0	0	0	0	0	30
36	0	0	0	0	0.04	0.04	0.17	0.13	0.13	0.21	0.04	0.21	0.04	0	0	0	0	0	0	0	24
37	0	0	0	0.09	0	0.05	0.14	0.14	0.09	0.27	0	0.09	0.05	0.05	0	0	0	0.05	0	0	22
38	0	0	0	0.06	0.06	0	0.06	0.06	0	0.11	0.22	0.11	0.06	0.17	0.06	0	0	0.06	0	0	18
39	0	0	0	0	0	0	0	0.18	0.06	0.06	0.29	0.12	0.06	0.12	0	0.06	0	0	0.06	0	17
40	0	0	0	0	0	0.05	0.05	0.21	0.05	0.26	0	0	0.11	0.16	0.05	0	0.05	0	0	0	19
41	0	0	0	0	0	0	0.13	0	0	0.13	0.25	0.25	0.13	0	0	0.13	0	0	0	0	8
42	0	0	0	0	0	0	0	0.07	0	0.14	0.14	0.29	0	0.21	0	0	0.07	0	0	0.07	14
43	0	0	0	0	0	0	0	0	0.07	0.14	0.14	0.07	0.21	0.29	0	0	0	0	0	0.07	14
44	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0.20	0.20	0	0	0.20	0	0.20	5
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.17	0	0.17	0	0	0.33	6
46	0	0	0	0	0	0	0	0.11	0	0.11	0.11	0	0.11	0.44	0	0	0	0	0	0.11	9
47	0	0	0	0	0	0	0	0	0	0.33	0	0.17	0.17	0	0	0	0	0	0	0.33	6
48	0	0	0	0	0	0	0	0	0	0	0	0	0.40	0	0	0	0.20	0	0	0.40	5
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
50	0	0	0	0	0	0	0	0	0	0	0	0.33	0.33	0	0	0	0	0	0	0.33	3
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0.50	2
52	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.33	0	0	0	0	0	0.33	3
53	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.33	0	0	0	0	0.33	0	3
54	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0	0	0	0	0	0.50	2
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
56	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.33	0	0	0	0	0	0.33	3
57	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	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	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	0	0
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	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	1.00	1
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
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																					399

No length measurement was recorded for one fish and therefore does not appear in the age-length key.

Appendix 2 – continued:

Estimates of proportion of length at age for snapper sampled from East Northland (statistical area 003), spring-winter 2012–13. (Note: Aged to 01/01/13)

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	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
25	0	0.08	0.08	0.31	0.31	0.23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
26	0	0	0	0.33	0.20	0.27	0.07	0.13	0	0	0	0	0	0	0	0	0	0	0	0	15
27	0	0	0	0.14	0.32	0.43	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	28
28	0	0	0.02	0.04	0.13	0.43	0.09	0.11	0.04	0.02	0.07	0.02	0.02	0	0	0	0	0	0	0	46
29	0	0	0	0.04	0.16	0.26	0.24	0.18	0.04	0.04	0.02	0.02	0	0	0	0	0	0	0	0	50
30	0	0	0	0.02	0.11	0.28	0.15	0.15	0.02	0.09	0.11	0.06	0.02	0	0	0	0	0	0	0	47
31	0	0	0	0.03	0.10	0.19	0.13	0.24	0.07	0.12	0.06	0.01	0.03	0.01	0	0	0	0	0	0	68
32	0	0	0	0	0.06	0.06	0.24	0.08	0.16	0.06	0.12	0.16	0	0.04	0.02	0.02	0	0	0	0	51
33	0	0	0	0	0.05	0.02	0.14	0.09	0.14	0.14	0.07	0.16	0.07	0.07	0.05	0	0	0.02	0	0	44
34	0	0	0	0.02	0	0.07	0.09	0.12	0.09	0.14	0.12	0.12	0.05	0.12	0.07	0	0	0	0	0	43
35	0	0	0	0	0	0	0.08	0.08	0.12	0.27	0.12	0.04	0.12	0.12	0.04	0	0.04	0	0	0	26
36	0	0	0	0	0	0	0.03	0.03	0.03	0.10	0.20	0.07	0.07	0.20	0.07	0.07	0.10	0	0	0.03	30
37	0	0	0	0	0	0	0.10	0.05	0.05	0.19	0.14	0.19	0.10	0.10	0	0	0.10	0	0	0	21
38	0	0	0	0	0	0	0	0	0	0.05	0.10	0.14	0.14	0.19	0.24	0.05	0	0.05	0	0.05	21
39	0	0	0	0	0	0	0	0	0	0.08	0.08	0.38	0.15	0	0	0	0.08	0	0	0.23	13
40	0	0	0	0	0	0	0	0	0	0.36	0.07	0	0.07	0.36	0.07	0.07	0	0	0	0	14
41	0	0	0	0	0	0	0	0	0	0	0.10	0.20	0.10	0	0	0.20	0.10	0.10	0	0.20	10
42	0	0	0	0	0	0	0	0	0	0.07	0.14	0.21	0.21	0.07	0.07	0.07	0	0.07	0	0.07	14
43	0	0	0	0	0	0	0	0	0	0.08	0.00	0.15	0	0.46	0.08	0	0.08	0.08	0	0.08	13
44	0	0	0	0	0	0	0	0	0	0	0.14	0.14	0	0.14	0	0	0.14	0.29	0	0.14	7
45	0	0	0	0	0	0	0	0	0	0	0	0.13	0.13	0.25	0.13	0.13	0.13	0	0	0.13	8
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0.50	4
47	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0	0.50	2
48	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0.25	0	0	0	0	0.50	4
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0.50	2
50	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0.25	0	0	0.50	4
51	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	0	1
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	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	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	1.00	0	0	0	0	1
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	1.00	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	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	2
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																					615

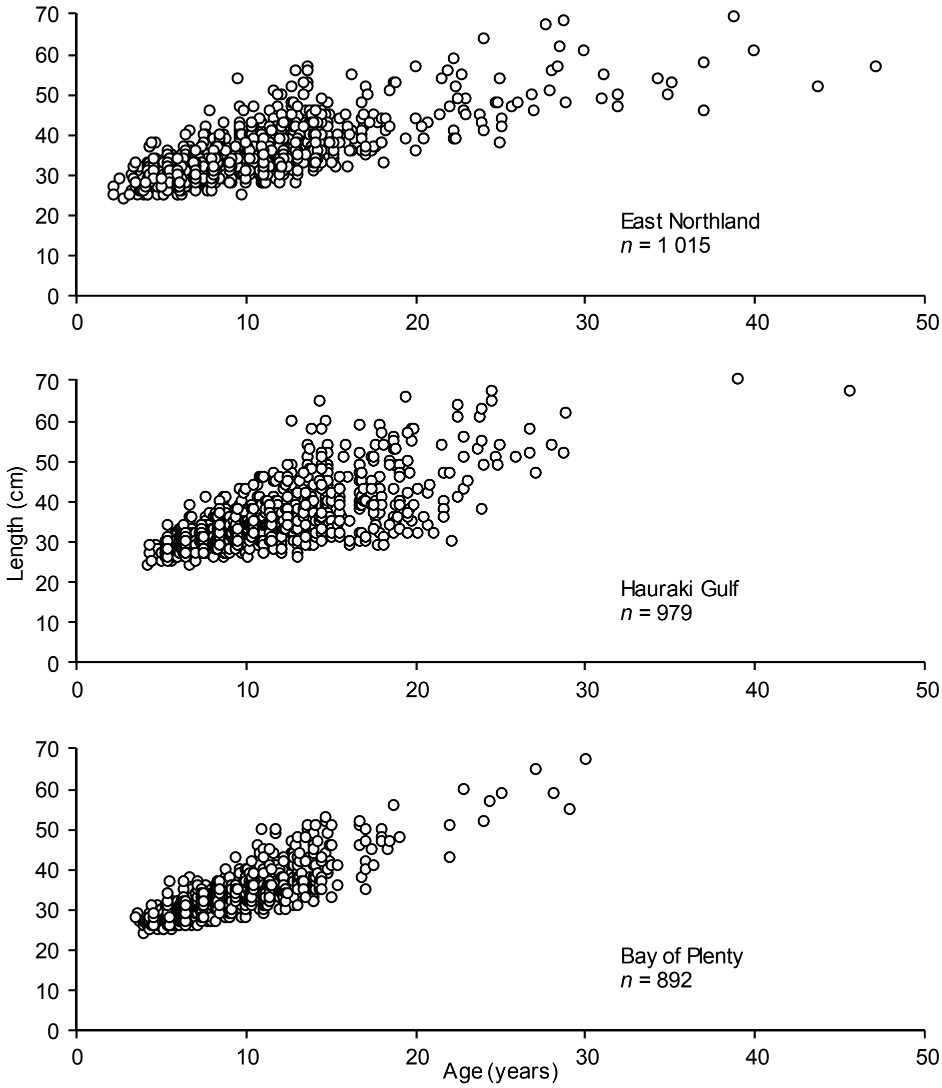
Appendix 2 – continued:
Estimates of proportion of length at age for snapper sampled from the Hauraki Gulf, spring-winter 2012–13.
(Note: Aged to 01/01/13)

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	0.50	0	0	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	2
25	0	0	0	0.43	0.29	0.14	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	7
26	0	0	0	0	0.17	0.30	0.30	0.04	0.04	0.09	0	0	0.04	0	0	0	0	0	0	0	23
27	0	0	0	0.02	0.19	0.29	0.17	0.13	0.06	0.06	0.04	0.02	0.02	0	0	0	0	0	0	0	48
28	0	0	0	0	0.07	0.16	0.29	0.09	0.20	0.09	0	0.11	0	0	0	0	0	0	0	0	45
29	0	0	0	0.02	0.03	0.17	0.23	0.20	0.11	0.06	0.05	0.02	0.03	0.03	0	0.02	0	0.03	0	0	64
30	0	0	0	0	0.05	0.10	0.17	0.14	0.16	0.12	0.12	0.01	0.02	0.06	0	0.01	0.02	0	0	0.01	86
31	0	0	0	0	0.01	0.09	0.14	0.16	0.10	0.16	0.08	0.06	0.05	0.06	0.05	0	0.01	0.01	0	0	77
32	0	0	0	0	0	0.07	0.11	0.14	0.19	0.13	0.08	0.02	0.04	0.08	0.04	0	0.02	0.01	0.02	0.02	83
33	0	0	0	0	0	0.03	0.08	0.16	0.13	0.16	0.05	0.07	0.05	0.18	0.05	0	0.02	0	0.02	0	61
34	0	0	0	0	0.01	0.01	0.07	0.07	0.07	0.24	0.22	0.12	0.03	0.04	0.03	0	0	0.04	0	0.01	67
35	0	0	0	0	0	0	0.06	0.02	0.08	0.23	0.15	0.13	0.08	0.11	0.09	0.02	0	0	0.02	0.02	53
36	0	0	0	0	0	0	0.03	0.07	0.10	0.12	0.10	0.18	0.17	0.08	0.03	0.02	0	0.02	0.05	0.03	60
37	0	0	0	0	0	0	0	0.08	0.10	0.10	0.13	0.18	0.10	0.15	0.08	0	0.03	0.03	0.03	0	39
38	0	0	0	0	0	0	0	0.04	0.18	0.07	0.14	0.11	0.14	0.14	0.04	0	0.04	0	0	0.11	28
39	0	0	0	0	0	0	0.03	0	0	0.10	0.18	0.05	0.13	0.15	0.10	0	0.13	0.05	0.05	0.03	39
40	0	0	0	0	0	0	0	0.04	0.04	0.04	0.08	0.12	0.04	0.12	0.20	0	0.12	0.08	0.08	0.04	25
41	0	0	0	0	0	0	0	0.06	0.11	0	0.11	0.17	0.11	0.06	0.17	0	0.11	0.06	0	0.06	18
42	0	0	0	0	0	0	0	0	0	0.10	0	0	0.20	0.10	0.30	0	0.10	0	0.10	0.10	10
43	0	0	0	0	0	0	0	0	0	0.19	0	0.06	0	0.13	0.19	0	0.13	0.13	0.06	0.13	16
44	0	0	0	0	0	0	0	0	0	0.10	0.10	0.10	0.10	0.30	0.20	0	0	0	0	0.10	10
45	0	0	0	0	0	0	0	0	0	0	0	0.24	0.12	0.18	0.18	0	0.18	0.06	0	0.06	17
46	0	0	0	0	0	0	0	0	0	0	0.25	0.25	0	0.17	0.08	0.08	0	0.08	0.08	0	12
47	0	0	0	0	0	0	0	0	0	0	0	0.08	0.17	0	0.08	0	0.25	0	0.08	0.33	12
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0.57	0.43	0	0	0	0	0	7
49	0	0	0	0	0	0	0	0	0	0	0	0.07	0.07	0.21	0.07	0	0.14	0.07	0.21	0.14	14
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.33	0.33	0	3
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0.11	0.22	0	0	0.33	9
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0.20	0	0.20	0	0	0.40	5
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0.50	0.25	4
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0.13	0.13	0	0.25	0	0.38	8
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	0	0	0.50	0.50	2
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.50	0	2
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0.40	0	0	0	0	0	0.60	5
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0.50	0	0	2
60	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0.50	0	0	0	0	0	2
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
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	0	1.00	1
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	0.50	0	0	0	0	0	0.50	2
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	1
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
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	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	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																					979

Appendix 2 – continued:
Estimates of proportion of length at age for snapper sampled from the Bay of Plenty, spring-winter 2012–13.
(Note: Aged to 01/01/13)

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	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
25	0	0	0	0.20	0.60	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
26	0	0	0	0.26	0.37	0.30	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	27
27	0	0	0	0.14	0.33	0.42	0.05	0.05	0	0	0	0	0	0	0	0	0	0	0	0	57
28	0	0	0.01	0.06	0.24	0.40	0.16	0.03	0.06	0.03	0	0	0	0	0	0	0	0	0	0	67
29	0	0	0	0.03	0.12	0.48	0.23	0.03	0.09	0.02	0.01	0	0	0	0	0	0	0	0	0	104
30	0	0	0	0	0.07	0.36	0.32	0.11	0.05	0.04	0.03	0.03	0	0	0	0	0	0	0	0	75
31	0	0	0	0.01	0.06	0.24	0.22	0.18	0.14	0.07	0.06	0	0.02	0	0	0	0	0	0	0	85
32	0	0	0	0	0.02	0.17	0.18	0.19	0.13	0.08	0.17	0.02	0.01	0.02	0	0	0	0	0	0	88
33	0	0	0	0	0	0.05	0.11	0.13	0.21	0.16	0.15	0.08	0.06	0.03	0.02	0	0	0	0	0	62
34	0	0	0	0	0.03	0	0.12	0.14	0.17	0.20	0.20	0.11	0.02	0.03	0	0	0	0	0	0	66
35	0	0	0	0	0	0.02	0.06	0.08	0.25	0.17	0.13	0.13	0.06	0.09	0	0	0.02	0	0	0	53
36	0	0	0	0	0	0	0.03	0.08	0.16	0.19	0.22	0.11	0.08	0.11	0.03	0	0	0	0	0	37
37	0	0	0	0	0.03	0.03	0.03	0.13	0.07	0.17	0.03	0.20	0.13	0.17	0	0	0	0	0	0	30
38	0	0	0	0	0	0	0.05	0	0.10	0.14	0.05	0.14	0.19	0.29	0	0	0.05	0	0	0	21
39	0	0	0	0	0	0	0	0	0	0.29	0.21	0.14	0.21	0.07	0.07	0	0	0	0	0	14
40	0	0	0	0	0	0	0	0	0.08	0.33	0.17	0.17	0	0	0.17	0	0.08	0	0	0	12
41	0	0	0	0	0	0	0	0	0	0	0.14	0.14	0.29	0.14	0.21	0	0.07	0	0	0	14
42	0	0	0	0	0	0	0	0	0	0.11	0	0.11	0.33	0.22	0.11	0	0.11	0	0	0	9
43	0	0	0	0	0	0	0	0	0.10	0	0.10	0.10	0.30	0.30	0	0	0	0	0	0.10	10
44	0	0	0	0	0	0	0	0	0	0	0.14	0.14	0.43	0.14	0.14	0	0	0	0	0	7
45	0	0	0	0	0	0	0	0	0	0	0.40	0	0	0.20	0	0	0.20	0.20	0	0	5
46	0	0	0	0	0	0	0	0	0	0	0.14	0	0.14	0.29	0.29	0	0.14	0	0	0	7
47	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0.20	0	0	0.20	0.40	0	0	5
48	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0.33	0	0	0	0.17	0.17	0	6
49	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0.33	0.33	0	0	0	0	0	3
50	0	0	0	0	0	0	0	0	0	0	0.20	0.20	0	0.20	0	0	0.20	0.20	0	0	5
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0.40	0.20	0	0.20	0	0	0.20	5
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0.33	0	0	0.33	3
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	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	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	1.00	0	1
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	0	0	0	0	0	0	1.00	2
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	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																					892

Appendix 3: Scatterplot of age-at-length data for snapper sampled from the SNA 1 bottom longline fisheries in 2012–13 (*n*, sample size). Age is decimalised as of the month of collection relative to an assumed January 1 "birthdate".



Appendix 4: Estimated mean weight-at-age (kg) and coefficents of variation (CVs) for snapper bottom longline fisheries in SNA 1 in 2012–13.

Estimates of mean weight-at-age (kg) with coefficients of variation for snapper from the East Northland bottom longline fishery in 2012–13.

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	0.61	0.54	1.01	0.46	0.41
3	–	–	0.32	0.98	0.48	0.54	0.58	0.16	0.53	0.10
4	0.57	0.18	0.40	0.29	0.53	0.15	0.76	0.08	0.63	0.08
5	0.56	0.10	0.48	0.05	0.63	0.08	0.67	0.05	0.62	0.04
6	0.62	0.09	0.58	0.07	0.60	0.06	0.66	0.07	0.62	0.04
7	0.76	0.09	0.66	0.12	0.68	0.05	0.79	0.08	0.72	0.04
8	0.83	0.09	0.81	0.16	0.79	0.05	0.87	0.13	0.81	0.05
9	0.86	0.11	0.89	0.11	0.75	0.10	0.96	0.23	0.87	0.07
10	1.00	0.11	0.93	0.11	0.79	0.09	1.11	0.09	0.99	0.05
11	1.05	0.13	0.91	0.13	0.86	0.10	1.26	0.08	1.00	0.06
12	1.15	0.12	1.07	0.14	1.15	0.22	1.20	0.12	1.14	0.08
13	1.40	0.17	1.34	0.21	0.98	0.13	1.34	0.23	1.24	0.10
14	1.80	0.17	1.36	0.12	1.20	0.16	1.48	0.10	1.43	0.07
15	1.51	0.15	1.14	0.19	0.92	0.15	1.38	0.38	1.19	0.09
16	–	–	1.37	0.32	1.38	0.26	1.24	1.01	1.36	0.14
17	1.61	0.50	1.44	0.17	2.02	0.64	1.24	0.42	1.44	0.11
18	1.43	0.54	1.26	0.43	1.20	0.46	1.67	0.63	1.39	0.13
19	2.92	0.58	–	–	–	–	1.24	1.02	1.97	0.51
20	–	–	1.97	0.56	–	–	1.43	0.61	1.67	0.33
21	1.63	1.04	–	–	–	–	2.48	0.65	2.25	0.47
22	–	–	2.87	0.56	2.72	0.59	2.08	0.55	2.66	0.25
23	3.24	1.00	2.04	0.39	–	–	–	–	2.19	0.30
24	1.85	0.98	2.46	0.60	–	–	–	–	2.32	0.47
25	2.22	0.59	1.77	0.37	–	–	–	–	1.92	0.21
26	2.09	1.03	2.22	0.97	–	–	–	–	2.14	0.58
27	–	–	2.27	0.53	–	–	–	–	2.27	0.53
28	5.63	1.04	2.80	0.63	–	–	3.91	0.57	3.53	0.28
29	4.80	0.73	–	–	–	–	–	–	4.80	0.73
>29	3.96	0.56	3.11	0.18	3.04	0.57	–	–	3.27	0.12

Appendix 4 – continued:
Estimates of mean weight-at-age (kg) with coefficients of variation for snapper from the East Northland (statistical area 002) bottom longline fishery in 2012–13.

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	0.89	0.54	1.02	0.47	0.56
3	–	–	–	–	0.50	0.71	0.60	0.16	0.55	0.12
4	0.62	0.28	0.36	0.97	0.74	0.48	0.79	0.09	0.73	0.07
5	0.59	0.13	0.48	0.34	0.69	0.08	0.76	0.05	0.67	0.05
6	0.64	0.11	0.64	0.15	0.72	0.09	0.92	0.10	0.72	0.06
7	0.80	0.12	0.64	0.37	0.74	0.04	0.97	0.13	0.77	0.06
8	0.94	0.10	1.04	0.24	0.87	0.05	1.02	0.13	0.93	0.06
9	0.93	0.15	0.95	0.34	0.85	0.77	2.58	0.72	1.01	0.15
10	1.01	0.14	1.17	0.15	0.92	0.93	1.27	0.11	1.11	0.08
11	1.19	0.34	1.40	0.50	1.13	0.36	1.29	0.18	1.22	0.06
12	1.14	0.29	1.39	0.20	1.42	0.64	1.28	0.13	1.30	0.11
13	1.43	0.24	1.80	0.36	0.92	0.89	1.74	0.27	1.48	0.16
14	1.93	0.21	1.57	0.20	1.71	0.56	1.46	0.08	1.68	0.10
15	1.33	1.03	1.50	0.73	–	–	1.74	1.02	1.54	0.34
16	–	–	–	–	1.43	0.92	1.24	1.07	1.36	0.56
17	–	–	1.71	0.40	–	–	1.85	1.03	1.74	0.28
18	1.41	0.81	1.15	0.89	–	–	2.63	1.00	1.43	0.42
19	2.92	0.99	–	–	–	–	1.24	1.07	1.83	0.72
20	–	–	1.74	0.95	–	–	1.53	1.05	1.62	0.59
21	1.63	0.98	–	–	–	–	1.85	0.99	1.75	0.60
22	–	–	2.87	0.50	3.94	0.98	2.35	0.97	3.38	0.28
23	3.24	1.04	2.04	0.39	–	–	–	–	2.19	0.31
24	–	–	–	–	–	–	–	–	–	–
25	2.22	1.00	–	–	–	–	–	–	2.22	1.00
26	2.09	0.99	2.22	0.96	–	–	–	–	2.14	0.56
27	–	–	–	–	–	–	–	–	–	–
28	5.63	1.00	2.63	1.01	–	–	4.53	1.03	3.55	0.48
29	5.86	1.02	–	–	–	–	–	–	5.86	1.02
>29	3.96	0.56	3.24	0.99	3.08	0.97	–	–	3.45	0.27

Appendix 4 – continued:
Estimates of mean weight-at-age (kg) with coefficients of variation for snapper from the East Northland (statistical area 003) bottom longline fishery in 2012–13.

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	–	–	–	–	0.36	1.00	–	–	0.36	1.00
3	–	–	0.32	1.01	0.36	1.01	0.49	1.00	0.41	0.42
4	0.38	0.55	0.41	0.48	0.43	0.15	0.65	0.39	0.47	0.11
5	0.43	0.24	0.48	0.05	0.50	0.12	0.62	0.09	0.55	0.06
6	0.52	0.08	0.54	0.08	0.51	0.05	0.60	0.07	0.55	0.04
7	0.63	0.11	0.68	0.07	0.60	0.09	0.71	0.10	0.66	0.05
8	0.64	0.07	0.60	0.07	0.66	0.07	0.78	0.49	0.66	0.05
9	0.69	0.13	0.77	0.25	0.67	0.07	0.83	0.07	0.77	0.05
10	0.97	0.14	0.74	0.10	0.75	0.10	1.01	0.11	0.87	0.06
11	0.90	0.19	0.78	0.12	0.73	0.08	1.24	0.16	0.89	0.08
12	1.15	0.18	0.91	0.17	1.01	0.14	0.94	0.43	1.01	0.09
13	1.34	0.37	1.09	0.23	1.00	0.17	1.07	0.39	1.08	0.10
14	1.42	0.25	1.17	0.13	1.01	0.11	1.49	0.19	1.23	0.08
15	1.54	0.17	0.97	0.22	0.92	0.15	1.23	0.55	1.11	0.09
16	–	–	1.37	0.30	1.35	0.37	–	–	1.36	0.19
17	1.61	0.57	1.25	0.24	2.02	0.64	1.04	0.52	1.31	0.14
18	1.63	1.05	1.31	0.61	1.20	0.44	1.53	1.02	1.36	0.17
19	2.92	1.02	–	–	–	–	–	–	2.92	1.02
20	–	–	2.29	0.96	–	–	1.24	1.02	1.76	0.68
21	–	–	–	–	–	–	3.08	1.02	3.08	1.02
22	–	–	–	–	1.38	0.60	2.01	0.84	1.57	0.40
23	–	–	–	–	–	–	–	–	–	–
24	1.85	0.99	2.46	0.60	–	–	–	–	2.32	0.50
25	2.22	1.02	1.77	0.36	–	–	–	–	1.83	0.26
26	–	–	–	–	–	–	–	–	–	–
27	–	–	2.27	0.60	–	–	–	–	2.27	0.60
28	–	–	3.41	1.04	–	–	3.58	0.98	3.51	0.58
29	2.22	1.00	–	–	–	–	–	–	2.22	1.00
>29	–	–	3.07	0.23	2.92	1.03	–	–	3.04	0.18

Appendix 4 – continued:
Estimates of mean weight-at-age (kg) with coefficients of variation for snapper from the Hauraki Gulf bottom longline fishery in 2012–13.

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	–	–	–	–	–	–	–	–	–	–
4	–	–	–	–	0.32	1.09	0.39	0.31	0.38	0.23
5	0.49	0.58	0.46	0.30	0.45	0.38	0.51	0.14	0.48	0.06
6	0.48	0.11	0.49	0.10	0.60	0.11	0.54	0.07	0.53	0.05
7	0.64	0.11	0.59	0.05	0.51	0.10	0.63	0.07	0.59	0.04
8	0.66	0.11	0.63	0.06	0.65	0.15	0.77	0.10	0.67	0.05
9	0.74	0.11	0.63	0.05	0.71	0.09	0.78	0.10	0.69	0.04
10	0.86	0.13	0.79	0.08	0.66	0.11	0.90	0.08	0.80	0.05
11	0.92	0.12	0.83	0.08	0.85	0.17	0.96	0.10	0.87	0.07
12	1.14	0.10	0.92	0.08	0.76	0.17	1.28	0.16	0.98	0.07
13	1.30	0.16	1.02	0.06	0.84	0.27	0.96	0.24	1.05	0.09
14	1.11	0.22	1.18	0.12	0.72	0.47	1.55	0.25	1.17	0.11
15	1.59	0.16	1.47	0.17	0.80	0.40	1.19	0.19	1.34	0.11
16	1.91	0.75	2.84	0.62	0.64	0.56	–	–	1.52	0.42
17	1.71	0.24	1.59	0.12	0.63	0.81	1.73	0.18	1.52	0.12
18	1.17	0.27	1.68	0.24	1.43	0.95	1.70	0.50	1.46	0.16
19	1.88	0.26	2.12	0.26	1.09	0.51	1.98	0.48	1.78	0.16
20	1.94	0.40	2.53	0.77	1.01	0.67	0.99	1.00	1.84	0.30
21	1.19	0.61	1.74	1.07	0.71	1.05	3.08	1.03	1.31	0.39
22	1.36	0.36	2.09	1.06	0.60	1.05	2.68	0.70	1.54	0.37
23	3.41	1.07	1.82	0.41	–	–	–	–	2.01	0.35
24	3.53	0.60	2.09	0.50	–	–	5.40	0.81	2.76	0.31
25	2.63	1.07	2.50	0.62	–	–	–	–	2.52	0.42
26	–	–	2.63	1.04	–	–	–	–	2.63	1.04
27	3.27	0.83	–	–	2.09	0.96	–	–	2.77	0.53
28	–	–	3.08	1.01	–	–	–	–	3.08	1.01
29	2.77	1.00	4.53	1.01	–	–	–	–	3.51	0.65
>29	–	–	6.36	1.02	–	–	5.63	1.05	6.05	0.60

Appendix 4 – continued:
Estimates of mean weight-at-age (kg) with coefficients of variation for snapper from the Bay of Plenty bottom longline fishery in 2012–13.

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	–	–	–	–	–	–	0.49	1.04	0.49	1.04
4	0.50	0.58	0.41	0.29	0.42	0.16	0.49	0.09	0.45	0.05
5	0.49	0.19	0.47	0.08	0.44	0.07	0.59	0.07	0.50	0.05
6	0.52	0.05	0.56	0.03	0.54	0.03	0.61	0.05	0.57	0.03
7	0.63	0.07	0.61	0.04	0.61	0.06	0.68	0.04	0.64	0.03
8	0.67	0.08	0.67	0.05	0.70	0.08	0.81	0.06	0.74	0.04
9	0.78	0.06	0.66	0.09	0.71	0.10	0.95	0.15	0.76	0.05
10	0.93	0.09	0.75	0.10	0.86	0.07	0.99	0.10	0.87	0.05
11	0.96	0.10	0.88	0.15	0.80	0.07	0.96	0.09	0.90	0.05
12	1.29	0.17	0.95	0.10	1.01	0.10	0.83	0.17	1.01	0.06
13	1.21	0.13	1.32	0.14	1.38	0.22	1.22	0.25	1.29	0.07
14	1.53	0.20	1.35	0.14	1.51	0.21	1.25	0.15	1.37	0.08
15	1.94	0.19	1.65	0.31	–	–	1.18	0.59	1.72	0.14
16	–	–	–	–	–	–	–	–	–	–
17	2.25	0.31	1.62	0.30	–	–	1.58	0.61	1.82	0.14
18	–	–	2.22	0.37	–	–	2.02	0.62	2.13	0.19
19	3.41	1.05	–	–	2.22	0.98	–	–	2.77	0.65
20	–	–	–	–	–	–	–	–	–	–
21	–	–	–	–	–	–	–	–	–	–
22	–	–	2.28	0.61	–	–	–	–	2.28	0.61
23	4.13	1.04	–	–	–	–	–	–	4.13	1.04
24	–	–	2.77	1.01	–	–	3.58	1.02	3.19	0.61
25	–	–	3.94	1.03	–	–	–	–	3.94	1.03
26	–	–	–	–	–	–	–	–	–	–
27	–	–	5.17	0.98	–	–	–	–	5.17	0.98
28	–	–	–	–	3.94	1.04	–	–	3.94	1.04
29	–	–	3.24	1.06	–	–	–	–	3.24	1.06
>29	–	–	5.63	1.04	–	–	–	–	5.63	1.04

Appendix 5: Estimated mean length-at-age (cm) and coefficents of variation (CVs) for snapper bottom longline fisheries in SNA 1 in 2012–13.

Estimates of mean length-at-age (cm) with coefficients of variation for snapper from the East Northland bottom longline fishery in 2012–13.

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	–	–	–	–	26.78	0.60	29.00	1.01	27.25	0.40
3	–	–	24.00	0.98	27.69	0.51	29.63	0.13	28.55	0.05
4	29.36	0.14	25.90	0.29	28.45	0.05	32.53	0.03	30.15	0.03
5	29.00	0.03	27.70	0.03	30.38	0.03	31.22	0.02	30.21	0.02
6	30.23	0.03	29.47	0.02	29.89	0.02	30.82	0.03	30.16	0.01
7	32.53	0.03	30.93	0.04	31.30	0.02	32.84	0.03	31.84	0.02
8	33.47	0.03	32.87	0.05	33.06	0.02	33.90	0.05	33.21	0.02
9	33.91	0.04	34.42	0.07	32.38	0.04	34.89	0.06	33.94	0.02
10	35.67	0.04	34.67	0.03	32.91	0.03	37.17	0.03	35.49	0.02
11	36.30	0.05	34.44	0.05	33.97	0.03	39.03	0.03	35.73	0.02
12	37.41	0.04	36.29	0.05	37.25	0.07	38.23	0.04	37.19	0.03
13	40.11	0.06	38.92	0.07	35.59	0.07	39.43	0.10	38.23	0.03
14	43.81	0.06	39.82	0.04	37.95	0.05	41.13	0.04	40.39	0.02
15	41.30	0.06	37.41	0.12	34.93	0.13	40.36	0.35	37.94	0.03
16	–	–	40.00	0.26	40.00	0.11	39.00	1.01	39.87	0.04
17	42.75	0.50	40.58	0.08	46.23	0.60	38.69	0.36	40.69	0.04
18	40.82	0.52	39.05	0.40	37.99	0.38	43.20	0.58	40.22	0.05
19	53.00	0.58	–	–	–	–	39.00	1.02	45.04	0.41
20	–	–	45.07	0.46	–	–	40.94	0.60	42.80	0.24
21	43.00	1.04	–	–	–	–	49.59	0.61	47.78	0.41
22	–	–	52.30	0.51	50.16	0.42	46.29	0.50	50.09	0.11
23	55.00	1.00	46.58	0.38	–	–	–	–	47.63	0.26
24	45.00	0.98	48.02	0.38	–	–	–	–	47.31	0.25
25	48.00	0.59	43.72	0.30	–	–	–	–	45.17	0.16
26	47.00	1.03	48.00	0.97	–	–	–	–	47.40	0.57
27	–	–	48.34	0.52	–	–	–	–	48.34	0.52
28	67.00	1.04	52.12	0.62	–	–	58.72	0.56	56.19	0.21
29	62.16	0.61	–	–	–	–	–	–	62.16	0.61
>29	57.94	0.47	53.69	0.11	53.71	0.57	–	–	54.60	0.04

Appendix 5 – continued:
Estimates of mean length-at-age (cm) with coefficients of variation for snapper from the East Northland (statistical area 002) bottom longline fishery in 2012–13.

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	–	–	–	–	27.00	0.89	29.00	1.02	27.45	0.55
3	–	–	–	–	28.00	0.69	29.89	0.12	29.06	0.07
4	30.36	0.26	25.00	0.97	32.47	0.48	33.01	0.03	32.10	0.03
5	29.70	0.04	27.63	0.34	31.61	0.03	32.56	0.02	31.13	0.02
6	30.59	0.04	30.64	0.11	31.96	0.03	34.91	0.05	31.85	0.02
7	33.13	0.05	30.41	0.25	32.32	0.01	35.53	0.11	32.72	0.02
8	35.05	0.04	36.05	0.09	34.28	0.02	35.85	0.06	34.86	0.02
9	34.85	0.05	35.28	0.33	34.00	0.76	49.69	0.56	35.58	0.04
10	35.73	0.05	37.84	0.06	35.00	0.93	39.14	0.04	37.07	0.03
11	38.16	0.31	40.64	0.49	37.73	0.35	39.49	0.16	38.59	0.02
12	37.73	0.27	40.24	0.11	40.04	0.49	39.27	0.09	39.31	0.04
13	40.22	0.08	43.42	0.20	35.00	0.89	43.46	0.15	40.55	0.06
14	44.90	0.07	42.17	0.14	43.40	0.50	41.20	0.03	42.97	0.03
15	40.00	1.03	41.50	0.71	–	–	44.00	1.02	41.90	0.32
16	–	–	–	–	41.00	0.92	39.00	1.07	40.27	0.55
17	–	–	43.48	0.37	–	–	45.00	1.03	43.79	0.26
18	40.50	0.79	38.00	0.89	–	–	51.00	1.00	40.67	0.32
19	53.00	0.99	–	–	–	–	39.00	1.07	43.87	0.62
20	–	–	44.00	0.95	–	–	42.00	1.05	42.84	0.59
21	43.00	0.98	–	–	–	–	45.00	0.99	44.13	0.59
22	–	–	52.30	0.45	59.00	0.98	49.00	0.97	55.51	0.21
23	55.00	1.04	46.58	0.39	–	–	–	–	47.63	0.27
24	–	–	–	–	–	–	–	–	–	–
25	48.00	1.00	–	–	–	–	–	–	48.00	1.00
26	47.00	0.99	48.00	0.96	–	–	–	–	47.40	0.56
27	–	–	–	–	–	–	–	–	–	–
28	67.00	1.00	51.00	1.01	–	–	62.00	1.03	56.02	0.40
29	68.00	1.02	–	–	–	–	–	–	68.00	1.02
>29	57.94	0.46	55.00	0.99	54.00	0.97	–	–	55.72	0.19

Appendix 5 – continued:
Estimates of mean length-at-age (cm) with coefficients of variation for snapper from the East Northland (statistical area 003) bottom longline fishery in 2012–13.

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	–	–	–	–	25.00	1.00	–	–	25.00	1.00
3	–	–	24.00	1.01	25.00	1.01	28.00	1.00	26.02	0.39
4	25.56	0.55	26.28	0.48	26.49	0.11	30.81	0.37	27.39	0.04
5	26.54	0.22	27.76	0.02	27.99	0.09	30.38	0.04	29.07	0.02
6	28.49	0.04	28.84	0.03	28.33	0.02	29.92	0.02	29.07	0.01
7	30.44	0.10	31.30	0.02	29.90	0.03	31.75	0.03	30.89	0.02
8	30.54	0.03	29.95	0.02	31.04	0.02	32.73	0.46	30.99	0.02
9	31.52	0.09	32.72	0.22	31.17	0.03	33.72	0.06	32.71	0.02
10	35.45	0.09	32.16	0.03	32.36	0.04	35.89	0.04	34.05	0.02
11	34.47	0.08	32.74	0.04	32.08	0.03	38.80	0.10	34.24	0.03
12	37.23	0.06	34.35	0.05	35.73	0.05	34.88	0.32	35.57	0.03
13	39.83	0.35	36.38	0.08	35.77	0.09	36.68	0.32	36.58	0.03
14	40.69	0.23	37.78	0.06	35.99	0.04	41.09	0.10	38.34	0.03
15	41.53	0.08	35.56	0.19	34.93	0.12	38.87	0.54	37.09	0.03
16	–	–	40.00	0.24	39.42	0.17	–	–	39.63	0.07
17	42.75	0.57	38.61	0.12	46.23	0.61	36.66	0.52	39.31	0.05
18	43.00	1.05	39.59	0.57	37.99	0.37	42.00	1.02	39.95	0.10
19	53.00	1.02	–	–	–	–	–	–	53.00	1.02
20	–	–	46.50	0.84	–	–	39.00	1.02	42.75	0.53
21	–	–	–	–	–	–	54.00	1.02	54.00	1.02
22	–	–	–	–	40.49	0.59	45.50	0.79	42.03	0.33
23	–	–	–	–	–	–	–	–	–	–
24	45.00	0.99	48.02	0.37	–	–	–	–	47.31	0.27
25	48.00	1.02	43.72	0.29	–	–	–	–	44.28	0.19
26	–	–	–	–	–	–	–	–	–	–
27	–	–	48.34	0.59	–	–	–	–	48.34	0.59
28	–	–	56.00	1.04	–	–	57.00	0.98	56.59	0.58
29	48.00	1.00	–	–	–	–	–	–	48.00	1.00
>29	–	–	53.30	0.14	53.00	1.03	–	–	53.24	0.10

Appendix 5 – continued:
Estimates of mean length-at-age (cm) with coefficients of variation for snapper from the Hauraki Gulf bottom longline fishery in 2012–13.

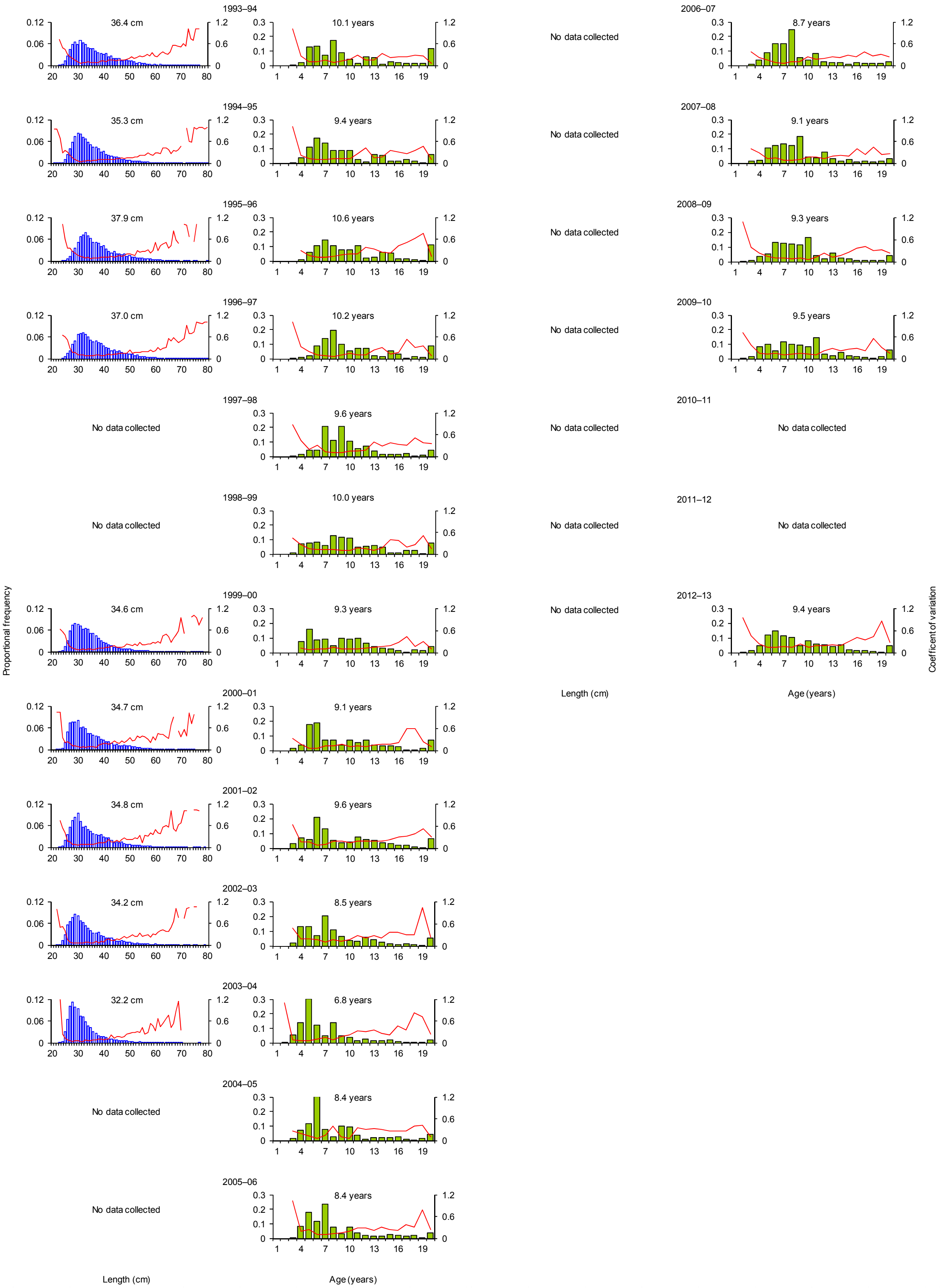
Age	Spring		Summer		Autumn		Winter		Spr-win	
(years)	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.
1	–	–	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–	–	–
3	–	–	–	–	–	–	–	–	–	–
4	–	–	–	–	24.00	1.09	25.71	0.28	25.39	0.20
5	27.88	0.58	27.39	0.30	27.09	0.38	28.16	0.07	27.59	0.02
6	27.64	0.08	27.80	0.05	29.90	0.08	28.80	0.03	28.70	0.02
7	30.39	0.04	29.75	0.02	28.21	0.04	30.43	0.03	29.70	0.01
8	30.91	0.04	30.52	0.02	30.53	0.05	32.58	0.03	30.99	0.02
9	31.95	0.04	30.45	0.02	31.74	0.03	32.67	0.04	31.39	0.01
10	33.72	0.05	32.88	0.03	30.87	0.05	34.56	0.03	32.96	0.02
11	34.47	0.04	33.57	0.03	33.34	0.06	35.31	0.04	33.90	0.02
12	37.29	0.04	34.84	0.03	32.23	0.06	38.85	0.05	35.28	0.02
13	38.70	0.05	36.21	0.02	33.00	0.09	34.86	0.08	36.01	0.03
14	36.30	0.08	37.70	0.04	32.03	0.46	40.52	0.09	37.17	0.04
15	41.56	0.05	40.70	0.07	33.12	0.30	37.91	0.14	39.06	0.04
16	44.46	0.62	52.29	0.59	30.61	0.52	–	–	39.66	0.21
17	42.50	0.10	42.31	0.05	30.50	0.81	43.22	0.11	40.97	0.04
18	37.16	0.10	42.29	0.09	38.00	0.77	42.34	0.38	39.60	0.06
19	43.82	0.10	46.51	0.16	37.00	0.49	43.52	0.19	42.88	0.06
20	44.14	0.23	48.73	0.62	35.51	0.56	36.00	1.00	42.98	0.11
21	38.07	0.55	44.00	1.07	32.00	1.05	54.00	1.03	38.79	0.22
22	39.91	0.30	47.00	1.06	30.00	1.05	49.37	0.54	40.24	0.15
23	56.00	1.07	44.61	0.37	–	–	–	–	45.94	0.27
24	56.47	0.57	45.26	0.30	–	–	66.00	0.81	49.89	0.15
25	51.00	1.07	50.07	0.60	–	–	–	–	50.23	0.41
26	–	–	51.00	1.04	–	–	–	–	51.00	1.04
27	55.00	0.83	–	–	47.00	0.96	–	–	51.59	0.49
28	–	–	54.00	1.01	–	–	–	–	54.00	1.01
29	52.00	1.00	62.00	1.01	–	–	–	–	56.17	0.61
>29	–	–	70.00	1.02	–	–	67.00	1.05	68.72	0.60

Appendix 5 – continued:
Estimates of mean length-at-age (cm) with coefficients of variation for snapper from the Bay of Plenty bottom longline fishery in 2012–13.

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	–	–	–	–	–	–	28.00	1.04	28.00	1.04
4	28.15	0.57	26.27	0.28	26.46	0.16	27.81	0.03	26.98	0.02
5	27.77	0.15	27.44	0.08	26.79	0.03	29.69	0.02	28.02	0.02
6	28.43	0.02	29.30	0.01	28.83	0.01	30.06	0.02	29.35	0.01
7	30.47	0.03	30.11	0.02	30.11	0.02	31.42	0.02	30.62	0.01
8	31.19	0.03	31.25	0.02	31.58	0.03	33.39	0.02	32.24	0.02
9	32.88	0.02	31.01	0.03	31.73	0.04	35.25	0.06	32.50	0.02
10	34.98	0.03	32.40	0.03	34.16	0.03	35.71	0.05	34.20	0.02
11	35.19	0.03	33.96	0.05	33.21	0.02	35.24	0.03	34.38	0.02
12	39.05	0.06	35.28	0.04	35.85	0.05	33.71	0.14	35.82	0.02
13	38.17	0.05	39.47	0.06	40.35	0.19	38.26	0.19	39.22	0.03
14	41.05	0.07	39.73	0.05	41.13	0.12	38.85	0.10	39.90	0.03
15	45.13	0.07	42.42	0.25	–	–	38.11	0.57	43.09	0.05
16	–	–	–	–	–	–	–	–	–	–
17	47.72	0.24	42.34	0.23	–	–	42.41	0.59	44.14	0.05
18	–	–	48.02	0.37	–	–	46.39	0.62	47.33	0.18
19	56.00	1.05	–	–	48.00	0.98	–	–	51.71	0.61
20	–	–	–	–	–	–	–	–	–	–
21	–	–	–	–	–	–	–	–	–	–
22	–	–	48.18	0.57	–	–	–	–	48.18	0.57
23	60.00	1.04	–	–	–	–	–	–	60.00	1.04
24	–	–	52.00	1.01	–	–	57.00	1.02	54.59	0.60
25	–	–	59.00	1.03	–	–	–	–	59.00	1.03
26	–	–	–	–	–	–	–	–	–	–
27	–	–	65.00	0.98	–	–	–	–	65.00	0.98
28	–	–	–	–	59.00	1.04	–	–	59.00	1.04
29	–	–	55.00	1.06	–	–	–	–	55.00	1.06
>29	–	–	67.00	1.04	–	–	–	–	67.00	1.04

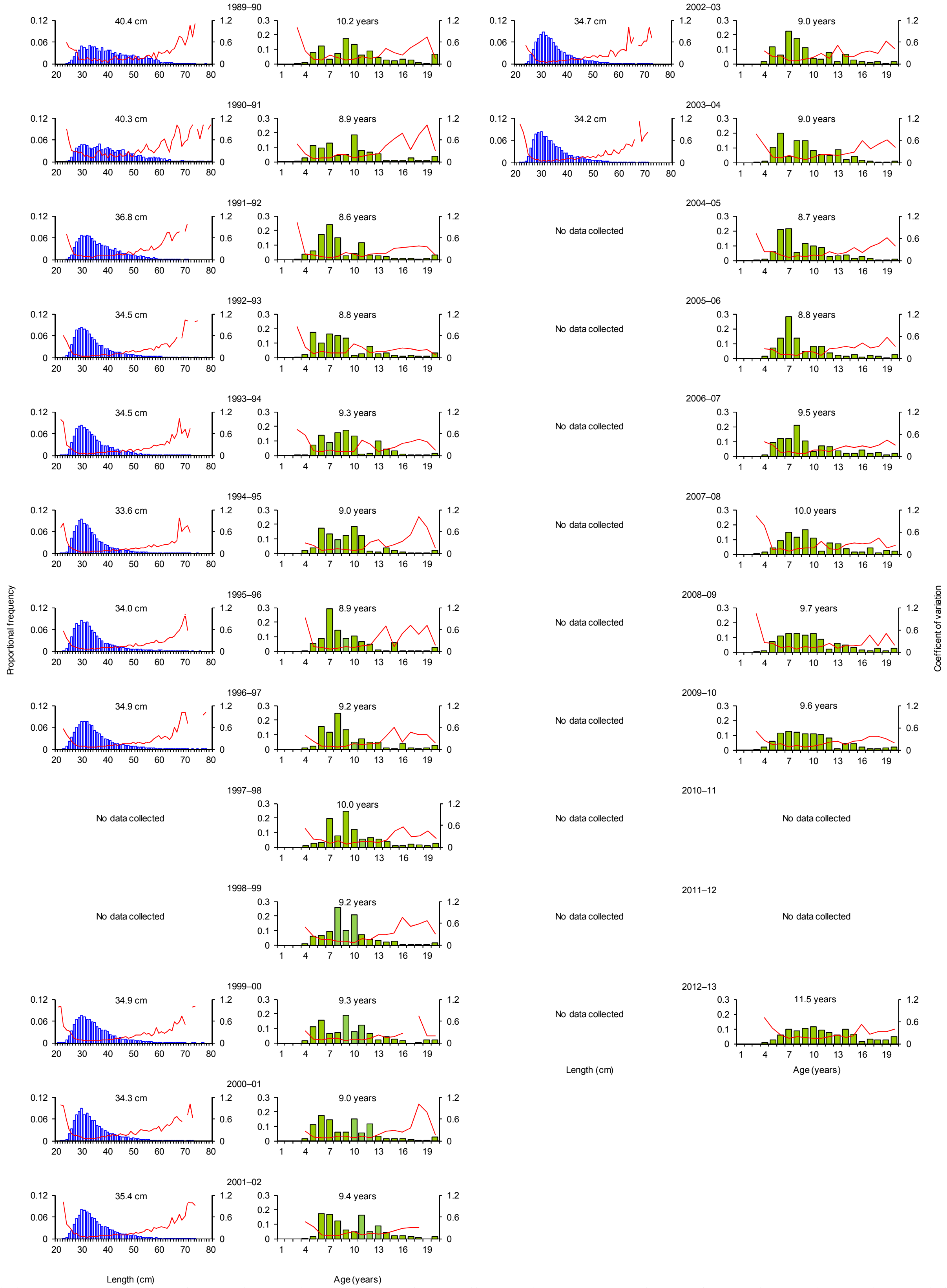
Appendix 6: Time series of proportion at length and age distributions for the snapper bottom longline fisheries in SNA 1.

Proportion at length and age distributions and CVs for snapper from the East Northland bottom longline fishery from 1993–94 to 2012–13. Data are from spring-summer, except 2003–04 to 2004–05, 2006–07 to 2009–10, 2012–13 which are year-round, and plots are annotated with estimates of mean length or age.



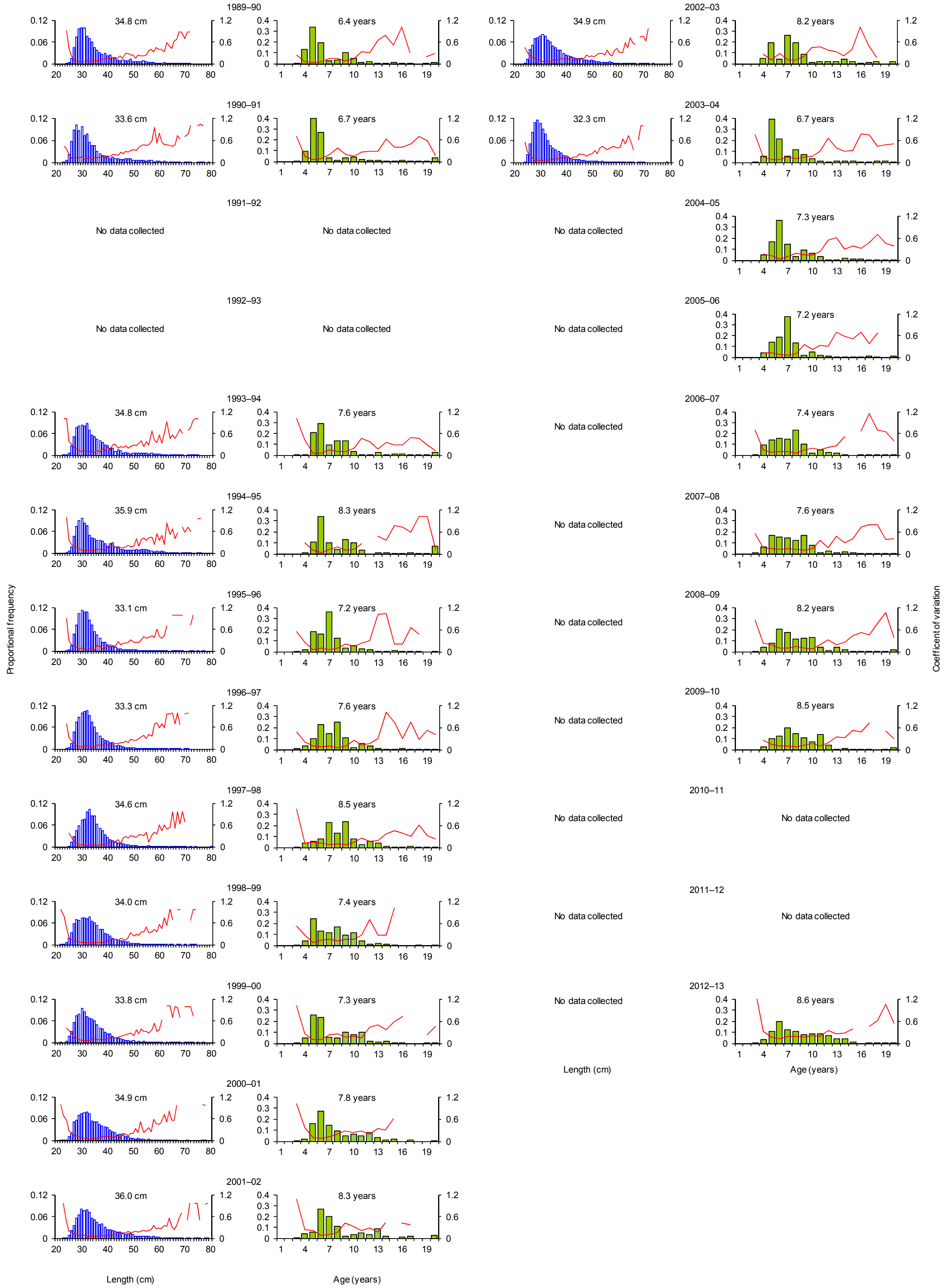
Appendix 6 – continued:

Proportion at length and age distributions and CVs for snapper from the Hauraki Gulf bottom longline fishery from 1989–90 to 2012–13. Data are from spring-summer, except 2003–04 to 2004–05, 2006–07 to 2009–10, 2012–13 which are year-round, and plots are annotated with estimates of mean length or age.



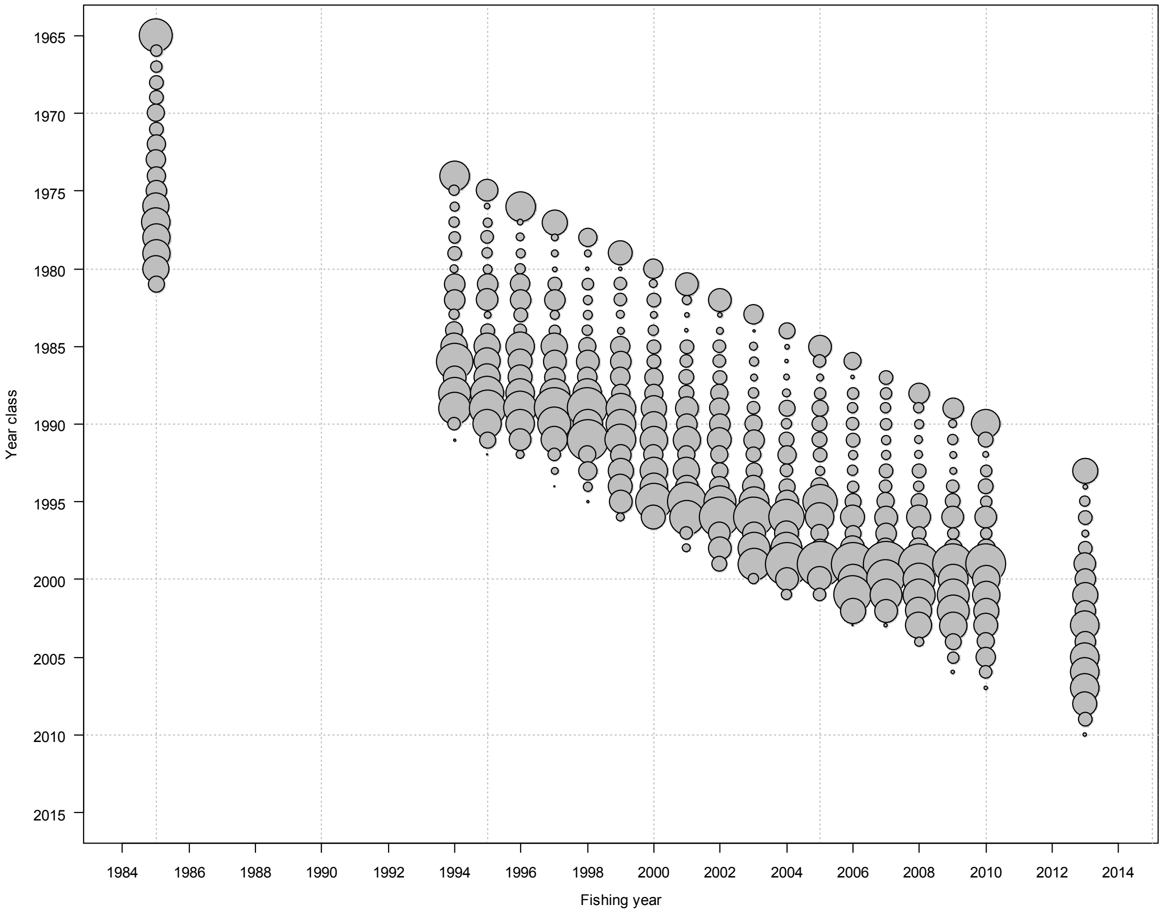
Appendix 6 – continued:

Proportion at length and age distributions and CVs for snapper from the Bay of Plenty bottom longline fishery from 1989–90 to 2012–13. Data are from spring-summer, except 2003–04 to 2004–05, 2006–07 to 2009–10, 2012–13 which are year-round, and plots are annotated with estimates of mean length or age.



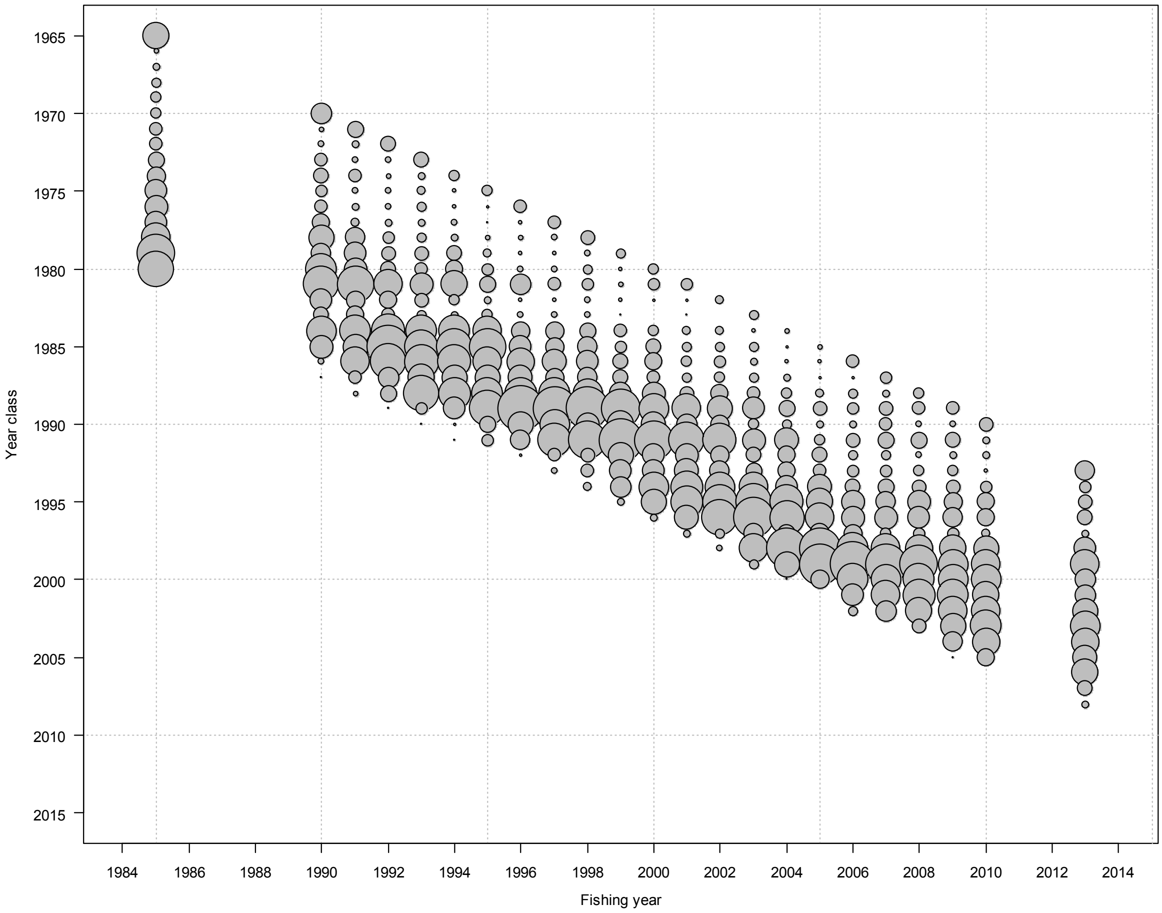
Appendix 7: Time series of age frequency distributions by year class and year from the SNA 1 bottom longline fisheries.

Time series of age frequency distributions by year class and year from the East Northland bottom longline spring-summer fishery from 1984–85 to 2009–10. Symbol area is proportional to the proportion at age. The proportion of the oldest year class in each year is represented by an aggregate (over 19 years) age group.

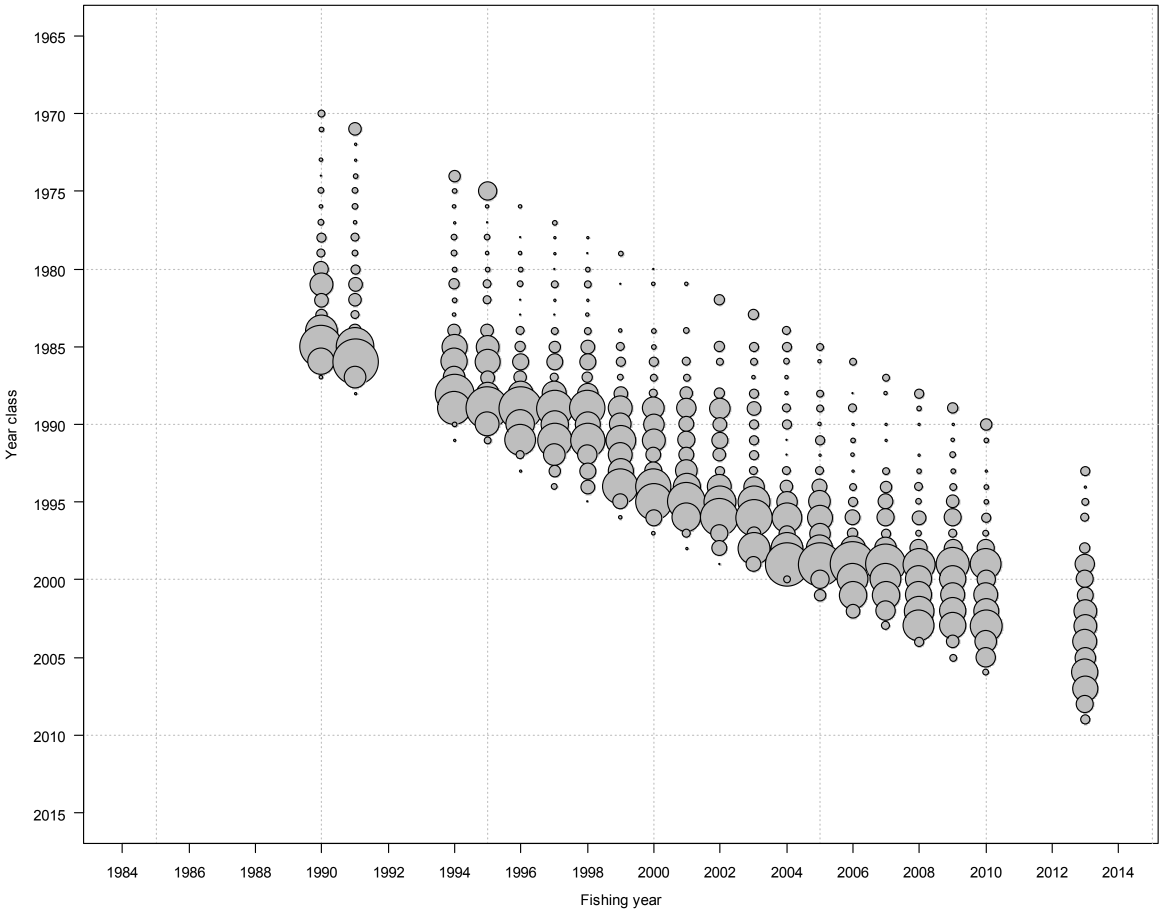


Appendix 7 – continued:

Time series of age frequency distributions by year class and year from the Hauraki Gulf bottom longline spring-summer fishery from 1984–85 to 2009–10. Symbol area is proportional to the proportion at age. The proportion of the oldest year class in each year is represented by an aggregate (over 19 years) age group.



Appendix 7 – continued:
Time series of age frequency distributions by year class and year from the Bay of Plenty bottom longline spring-summer fishery from 1989–90 to 2009–10. Symbol area is proportional to the proportion at age. The proportion of the oldest year class in each year is represented by an aggregate (over 19 years) age group.



Appendix 8: Time series of mean age estimates from the SNA 1 bottom longline (BLL) and Danish seine (DS) fisheries between 1974–75 and 2012–13, using data from spring-summer collections only. For comparative purposes, data collected from the SNA 8 bottom trawl (BT) fishery are also included.