New Zealand Fisheries
Assessment Report
2009/13
March 2009
ISSN 1175-1584

Length and age composition of commercial snapper landings in SNA 8, 2007–08

C. Walsh
N. M. Davies
D. Buckthought

Length and age composition of commercial snapper landings in SNA 8, 2007–08

C. Walsh[1]
N. M. Davies[2]
D. Buckthought[2]

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

[2]NIWA
Private Bag 99940
Newmarket
Auckland 1149

New Zealand Fisheries Assessment Report 2009/13
March 2009

Published by Ministry of Fisheries
Wellington
2009

ISSN 1175-1584

Walsh, C.; Davies, N.M.; Buckthought, D. (2009).
Length and age composition of commercial snapper landings in SNA 8, 2007–08.
New Zealand Fisheries Assessment Report 2009/13. 23 p.

This series continues the informal
New Zealand Fisheries Assessment Research Document series
which ceased at the end of 1999.

EXECUTIVE SUMMARY

Walsh, C.; Davies, N.M.; Buckthought, D. (2009). Length and age composition of commercial snapper landings in SNA 8, 2007–08.

***New Zealand Fisheries Assessment Report 2009/13.* 23 p.**

This report presents the results of Objective 1 of the Ministry of Fisheries project "Estimation of snapper year class strength in SNA 8" (SNA2007/04, Objective 1). The general objective was to determine the length frequency and age structure of commercial landings from SNA 8 for use in stock assessment models by market sampling.

The length frequency and age-length key sampling approach was employed during spring and summer 2007–08 to estimate catch-at-age for snapper for the main fishing methods in SNA 8. Length frequency samples were collected from the SNA 8 single trawl fishery, and age data were collected randomly in the form of a semi-fixed allocation age-length key, mainly to ensure fish in the large length intervals were well accounted for. A total sample size of 15 landings was sampled for length frequency from the single trawl fishery, with an age-length key collection of 522 otoliths. Unlike previous years, no length frequency samples were obtained from the pair trawl fishery in 2007–08, largely due to a rationalisation of the Auckland based inshore trawl fleet, which resulted in fewer trawlers operating, and a reduction in pair trawl landings in SNA 8.

Year class strengths inferred in 2007–08 from the SNA 8 stock were generally similar to those from the previous year but contained a slightly higher proportion of small young fish 3 to 6 years of age from the 2002–2005 year classes, making up over three-quarters (77%) of the number of snapper landed. This resulted in an overall reduction in the relative abundance of older fish present in single trawl landings, with the combined total of fish over 10 years of age making up less than 4% of the landed catch with no appreciable growth apparent in the right hand limb of the distribution. For the last two decades, the aggregate (over 19) age group has accounted for less than 1% of the overall single trawl catch in SNA 8, the lowest proportion of any New Zealand snapper stock. Previously dominant 1998, 1996, and 1995 year classes, although contributing a not unsubstantial portion by weight to the TACC, are probably not be as well represented in catch-at-age estimates because a high proportion of fish in these cohorts now exceed the optimum selectivity of the single trawl method or because their relative abundance is low because of past fishing mortality. The newly recruited 2005 year class, although not yet fully recruited to the fishery, contains an appreciable proportion of fish in the smaller size classes, and appears to be of above average strength, making up about 14% of the single trawl catch by number in 2007–08.

A mean weighted coefficient of variation (for analytical estimates) of below 20% across all age classes in the SNA 8 single trawl catch-at-age composition was achieved.

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 (*Pagrus auratus*) from commercial landings in port (market sampling) intermittently since 1963 (Davies et al. 1993). In the 1988–89 fishing year, a structured sampling programme was designed to establish a time series of length and age composition data for the main snapper fisheries in the east and west coast North Island stocks, SNA 1 and SNA 8 respectively. The time series of length and age information has been summarised in previous reports (Davies & Walsh 1995, Walsh et al. 1995, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2006a, 2006b, 2009, Walsh & Davies 2004). This report presents the results of market sampling from the SNA 8 stock between October 2007 and February 2008, thus continuing the time series. Funding for this project, SNA2007/04 (Objective 1), was provided by the Ministry of Fisheries.

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

1. To carry out sampling and estimate the relative proportion at age and length of recruited snapper sampled from the commercial trawl catch in SNA 8 during spring and summer 2007–08. The target coefficient of variation (c.v.) for the catch-at-age will be 20% (mean weighted c.v. across all age classes).

2. METHODS

The SNA 8 stock encompasses almost all the west coast of New Zealand's North Island (Figure 1). Landings from the SNA 8 fishery were stratified by fishing method and quarter, e.g., single trawl – spring. The fishing method sampled was single trawl (BT) over the spring (September–November) and summer (December–February) quarters only. In most recent years the pair trawl (BPT) method was also sampled. However, a rationalisation of the SNA 8 trawl fleet in 2006–07 resulted in a reduction in the number of vessels operating in the fishery, with the relative pair trawl effort being insufficient to be considered useful for sampling (Walsh et al. 2009).

Details of the sampling design were described by Davies & Walsh (1995). Length frequency samples were collected from the SNA 8 single trawl fishery using a two-stage sampling procedure (West 1978). The random selection of landings and a random sample of bins within landings represent the first and second stages respectively. The sampling procedure was modified to account for the grading of fish according to length and quality by taking a stratified random sample of bins within a landing (Davies et al. 1993). All fish in bins 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.

The age-length key method was used for collecting otoliths as described by Davies & Walsh (1995). In previous years the sample allocation for each length class interval for the age-length key was made according to the broadest proportion-at-length distribution of either the single trawl or pair trawl collection from the year before. However, as large snapper (i.e., those over 65 cm) were often poorly represented or absent in proportion-at-length distributions from SNA 8 collections in recent years, it was felt a proportional allocation age-length key design may under-represent fish in the large length class intervals and over-represent those in the mid-range. To determine whether a broadening of the age-length key collection had any real effect on resulting catch-at-age estimates, the sample collection in 2007–08 was altered to a semi-fixed allocation design (see Appendix 1). This would ensure the right hand tail of the distribution, comprising the large and old snapper, was adequately accounted for. A step-wise sample size of around five fish for length intervals greater than 54 cm, four fish over 57 cm, three fish over 61 cm, two fish over 65 cm, and one fish for all length classes over 70 cm was specified for collection. To allow for annual variability in the abundance of fish in the 25–28 cm size range, a fixed sample size of about 10 otoliths was targeted for collection from each of these length intervals. It was thought that a broad, but slightly less dominant, mode (capped at 25 samples for the most common length intervals) based on the length distribution of the single trawl sample from 2006–07 that covered the mid-length class intervals of the age-length key collection would suitably describe the mid-range of cohorts currently present in the fishery. As in more recent years, otolith samples for fish over 70 cm were difficult to obtain because of their rarity in landings. The otolith sample size for the west coast collection (n = 522) was based on previous SNA 8 catch-at-age simulations using past length and age data that produce mean weighted coefficients of variation (MWCV) of below 20% for catch-at-age estimates.

A standardised procedure for reading otoliths was followed (Davies & Walsh 1995). Age was defined as the rounded whole year from a nominal birth date of 1 January, e.g., in 2007–08, the 1998 year class was 10 years old, whether sampled in December 2007 or February 2008.

The age-length key derived from the age data is assumed to be representative of the spring-summer period. The main assumption to 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).

Calculation of proportions at length and age, and variances from length frequency samples and age-length keys, followed that of Davies & Walsh (1995). Bootstrap variances have been determined for the combined spring and summer proportion-at-length and age estimates. The calculation of mean weight-at-age and variances followed Quinn II et al. (1983), with a length-weight relationship: w (g) = $0.04467\, l^{2.793}$(cm) (Paul 1976). Proportions at age and mean weight-at-age (with analytical estimates of coefficient of variation, c.v.) were calculated for the range of age classes recruited, with the maximum age being an aggregate of all age classes over 19 years.

Snapper length and age data were stored on the Ministry of Fisheries *market* and *age* databases respectively, administered by NIWA.

3. RESULTS

3.1 Sample collections

Summaries of the length frequency sample sizes for method-season strata are given in Table 1, and summaries of the otolith sample collection in Table 2. Catch data from autumn 2007 to summer 2007–08 are provided in Table 1, displaying seasonal patterns in the fisheries. Single trawl was the dominant method, operating mainly over spring and summer, although the landed catch was considerably less than that seen in recent years, indicative of a broadening of the fishing season in SNA 8. Although the landed catch from the pair trawl fishery had increased slightly from 2006–07, it was considerably less than that seen in most other years, with current landings generally of a smaller average size, especially over spring and summer. Although considerably less catch was taken over the sampling period (October 2007–February 2008) compared to most other years in the SNA 8 stock, the relative catch by method was not considerably different, with the exception of that taken in 2006–07. Single trawl continues to dominate and made up 72% of the catch, and pair trawl 18%, while the Danish seine catch increased to account for 7%, and other methods 4%. Considerable differences are still apparent between the percentage of number of landings sampled and the percentage of weight of landings sampled in the west coast single trawl fishery (Table 1). For sample collections made in spring 2007–08, there has been a moderate shift in the target species sought compared to that of previous years when snapper was almost exclusively the target. Catches sampled from the single trawl spring fishery listed snapper and trevally (*Pseudocaranx dentex*) as the main target species for three landings each respectively and red gurnard (*Chelidonichthys kumu*) in one other, although snapper still made up a reasonable proportion of the overall catch in all but the latter. Catch samples from summer were exclusively from landings where trevally was the target species, with moderate catches of snapper ranging from 5 to 9 tonnes. The summarised information in Table 1 is for all single trawl and pair trawl landings containing snapper (target and bycatch) caught from SNA 8. The average sampled landing weight of snapper from single trawl catches in spring was about 11 t, while that for summer was 6 t.

A total of 15 landings was sampled for length frequency from the single trawl fishery in 2007–08, meeting the required target. Because of a rationalisation of the fishing fleet in recent years, only limited pair trawl fishing was undertaken in 2007–08 and as such no catch sampling of this fishery was able to be undertaken. The cumulative proportion of the total number of landings and those sampled from the SNA 8 single trawl fishery from October 2007 to February 2008 is given in Appendix 2, showing the sampling effort was distributed reasonably uniformly in respect of landings over the sampling period. The monthly catch of snapper and of that sampled (weight and number of landings) for the single trawl method (for all landings and for those over 3 tonnes) from October 2007 to February 2008 is presented in Appendices 3 and 4 to display patterns in the fishery and the representativeness of the sample collections.

Sampled landings from the single trawl fishery were largely from the northern half of the SNA 8 stock, between Ninety Mile Beach and North Taranaki Bight, with the greater proportion of samples coming from those areas adjacent to the Kaipara and Manukau Harbours. This fishing pattern is similar to that seen in past years over the ‘school season’ in SNA 8.

3.2 Length and age distributions

For the SNA 8 single trawl fishery in 2007–08, a catch-at-age composition (using the length frequency and age-length key approach) was derived from the combined spring and summer length distributions, and used to identify year class strengths. Although otolith samples were collected from each sampled landing, they were not collected consistently across the entire spring or summer period. In combining the seasonal data, it is assumed that an age-length key collected from spring and/or summer can be applied to the combined spring and summer length data. Because the growth of snapper over 25 cm long is not great between spring and summer, this assumption is reasonable. This assumption has been accepted for other species with growth rates comparable to those of snapper (Westrheim & Ricker 1978).

Sample length and age distributions for the SNA 8 single trawl fishery in 2007–08 are presented as histograms and line graphs (Figures 2–5). The estimated proportions at length, age, and mean weight-at-age, are tabulated in Appendices 5–7. The age-length key is presented in Appendix 8. For comparison, a time series of proportional catch-at-length and -age distributions from the SNA 8 single trawl and pair trawl fisheries is presented in Appendices 9 and 10.

The estimated total number of fish caught in each season stratum was calculated from the reported total weight landed and the mean fish weight derived from stratum length compositions (Appendix 5). The estimated total number of fish caught for the spring-summer combined stratum may not correspond exactly to the sum of the individual season estimates because of differences in mean fish weight when spring and summer are treated separately.

3.3 Catch-at-length and catch-at-age

The length distribution of the single trawl catch in 2007–08 was characterised by one main mode at 32 cm and two smaller modes at about 45 and 49 cm respectively (Figure 2). The tail of the distribution extended to over 65 cm. The mean length of snapper sampled from the fishery was 35.2 cm, and the proportion-at-length analytical and bootstrap MWCVs were 0.10 and 0.12.

The age distribution for the SNA 8 single trawl fishery in 2007–08 was dominated by the 2004 and 2003 year classes (4- and 5-year-olds) making up almost half (47%) the number of snapper landed (Figure 3). Together with the two other most dominant year classes in the fishery, 2005 and 2002 (3- and 6-year-olds), these four year classes account for a combined total of over three-quarters (77%) of the landed catch. With the exception of the 1998 and 1996 year classes (10- and 12-year-olds), the proportion of most other age classes, especially those more than 10 years of age is low, now comprising less than 4% of fish. The aggregate (over 19) age group makes up less than 0.5% of the overall catch reflecting the low number of fish of this age range available in the fishery. Of the 41 fish over 19 years old, two-thirds (66%) were from either the 1986, 1985, or 1984 year classes (22-, 23-, and 24-year-olds) that dominated landings in the early 1990s. One fish in the collection was aged at 60 years old (71 cm, est. 6.6 kg), the oldest recorded age for snapper from SNA 8.

The 2003 and 2004 year classes appear to be of about average strength and are now fully recruited as they contain few fish under 27 cm (see Appendix 8). The 2005 year class (3-year-olds) appears to be of above average strength and is not yet fully recruited as it contains a considerable proportion of fish under 27 cm. The mean age of snapper from the single trawl fishery was 5.6 years, and the catch-at-age analytical and bootstrap MWCVs were 0.11 and 0.14.

The spring and summer catch-at-length and catch-at-age samples for the single trawl fishery were reasonably similar over both seasons, although spring samples contained a higher proportion of fish in the large length and old age ranges compared to summer samples which contained a higher proportion of small young fish (Figures 4 & 5).

4. DISCUSSION

The relative year class strengths inferred in the length and age distributions sampled from the SNA 8 single trawl fishery in the 2007–08 are generally consistent with trends observed in recent years (Walsh et al. 2002, 2003, 2004, 2006a, 2006b, 2008, Walsh & Davies 2004).

Single trawl landings from the SNA 8 fishery in 2007–08 were largely dominated by young fish, 3 to 6 years of age from the 2002–2005 year classes, and made up over three-quarters (77%) of the number of snapper landed. Consequently, the combined total proportion of fish from the 1998–2001 year classes (7 to 10 year olds) is now less than half that of the year before comprising about 20% of the catch. As indicated in most recent years, with the exception of the 1996 year class, there continues to be a low to very low relative abundance of older fish in the fishery. The combined total of fish over 10 years of age made up less than 4% of the single trawl catch-at-age distribution in 2007–08, similar to most estimates from the fishery over the last 19 years. For the last two decades, the aggregate (over 19) age group has accounted for less than 1% of the overall single trawl catch in SNA 8, the lowest proportion of any New Zealand snapper stock. In 2004–05, Walsh et al. (2006b) reported that the aggregate age group in SNA 8 was unlikely to increase substantially for at least another 10 years, and based on catch-at-age estimates from 2007–08, may conceivably take even longer. As the length frequency of the single trawl catch in recent years contained a relatively high proportion of smaller fish, for the age-length key collection in 2007–08 a concerted sampling effort was undertaken to ensure the right hand limb, comprising large fish, was adequately represented (see Appendix 1). The semi-fixed allocation otolith design increased the total number of fish for many of the larger length intervals, especially those that were likely to make up the aggregate (over 19 years) age group, compared to that for a proportional allocation otolith sample, as collected in most previous years. However, otoliths for most of the large length intervals were generally difficult to obtain from sampled landings, and none were able to be collected for length intervals over 73 cm. Although a total of 41 fish (8%) in the age-length key collection in 2007–08 could be allocated to the aggregate age group, there was no obvious effect on the resulting proportion at age estimate (0.4%) after scaling with the proportion at length distribution compared to estimates derived in previous years. Snapper making up the aggregate age group were generally large and ranged in size from 60 to 73 cm, (see Appendix 8), and two-thirds (66%) of these were from the previously dominant 1986, 1985, or 1984 year classes (22- to 24-year-olds). Interestingly, one fish in the collection was aged at 60 years old, the oldest recorded age for a snapper from SNA 8.

In 2005–06, Walsh et al. (2006a) reported an apparent broadening of the age distribution in SNA 8, compared to that seen a decade ago when the population model estimated a decreasing population size (Davies et al. 2006). Walsh et al. (2009) stated that the broadening of the age distribution appeared to be continuing in 2006–07, although the relative strengths of some previously dominant year classes (i.e., 1998, 1996, and 1995) that occupied the mid age range, seemed less apparent, and may be a reflection of the selectivity of the single trawl method. Although there was a reduction in the SNA 8 TACC from 1500 t to 1300 t in October 2005 to ensure a faster rebuild of the stock (Ministry of Fisheries 2008), proportion at length and age estimates for 2007–08 are now the narrowest seen in the fishery for the last five years, with mean length and age estimates of 35.2 cm and 5.6 years respectively. Either historically high fishing mortality has reduced the relative abundance of the large and old fish, as has been observed in previous years (Davies & Walsh 1995), or recent year classes have recruited into the fishery with above average strength to dominate age distributions, as reported by Walsh et al. (2001, 2002).

The newly recruited 2005 year class, although not yet fully recruited to the fishery, contains an appreciable proportion of fish in the smaller size classes, and appears to be of above average strength, making up about 14% of the single trawl catch by number in 2007–08. Those year classes that recruit at well above average strength as three year olds (i.e., more than 10%) into the fishery (e.g. 1996 and 1998 year classes in 1998–99 and 2000–01 respectively) most often appear in the length frequency distribution, either by broadening the distribution below 30 cm or appearing independently as a strong length mode dominating the 25–30 cm size classes (see Walsh et al. 2000, 2002). This was also apparent for the 2005 year class in 2007–08 and may be the main reason for the narrowing in proportion at length and age distributions from that in 2006–07. A comparison of a fully recruited 2005 year class (as 4 year olds) relative to other year classes in 2008–09 will further confirm this.

West coast snapper are known to have some of the fastest growth rates of any New Zealand snapper stock (Davies et al. 2003), and the size range at age for mid-range age classes that previously dominated catches is now such that a considerable proportion of fish from these cohorts are now not caught. Davies et al. (2006) derived fishing method-specific selectivity estimates using the results of a SNA 8 tag-recapture programme undertaken in 2002–03 and predicted fish averaging about 50 cm in length or about 2.5 kg have about a 50% selection probability by the single trawl method. For this reason, and because of past annual fishing mortalities impacting on cohorts over time, previously dominant year classes (i.e. 1995, 1996, and 1998) may now not be as well represented in the catch-at-age of this trawl based fishery as they used to. Therefore, 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 are not totally reliable and should be treated with some care.

However, two absolute stock biomass estimates derived from tagging programmes over the last 18 years and comprehensive catch-at-age based models (Davies 1997, Davies et al. 2006) have all pointed to the SNA 8 stock being of a size well below a biomass that would achieve the maximum sustainable yield. It is generally inferred that a long time series of catch-at-age data may also reveal consistent trends in the age composition of a stock, where a lightly fished population would likely contain a high proportion of older age classes and a heavily exploited population mainly young fish, for a moderately to long lived species. The latter scenario is indicative of catch-at-age data collections made from the SNA 8 stock over the last 20 years, where proportion at age estimates are often narrow, recruitment driven, based on only a few age classes, often where one or two dominate exclusively, and have a distinct lack of accumulation of fish in the older age classes. Although proportional catch-at-age data may not be a direct index of absolute abundance as mentioned above, the consistency seen in the long-term catch-at-age time series from SNA 8 implies that the biomass is low and has remained that way for the past two decades, consistent with the tagging programme absolute abundance estimates.

Although similarities in year class strengths are generally apparent in catch-at-age collections over a term of a few consecutive years, the level of fishing mortality in SNA 8 along with a generally low number of cohorts present and the effect of selectivity in trawl caught fish, has meant that catch-at-age compositions can change dramatically in only a few years. The relative strength of the 1998 year class, being a good example of this, dominated SNA 8 landings for four consecutive years and was estimated to be second strongest behind the 1985 year class (in over 25 years), with a relative strength almost twice that of the mean (Davies et al. 2006), but now making up 6% of the single trawl catch in 2007–08. The 1998 year class and other previously dominant year classes (i.e., 1995 and 1996) were predicted by Walsh et al. (2006b) to contribute substantially in terms of their combined biomass, and be important in the future rebuilding of the SNA 8 stock. The average fish size for the two remaining most dominant older year classes in the 2007–08 single trawl age distribution, 1998 and 1996, is currently about 47 and 52 cm respectively with average weights about 2.0 and 2.2 kg (see Appendixes 7 and 8). Scaled up, the combined estimated overall contribution by weight in terms of the TACC (accounting for the relative method catch) is about equal to that of the 2002 year class made up of fish of an average size and weight about 37 cm and 1.1 kg, therefore obviously still important for sustainability of the fishery, at least in the short term. However, the decay of these once dominant year classes from one year to the next is alarming and suggests that the level of exploitation is such that a relatively low proportion of fish from these year classes now survive, and that even fewer will contribute to the accumulation of older fish in the fishery as they eventually merge into the aggregate (over 19 years) age group. Walsh et al. (2009) reported that overall few fish are able to be caught in the larger size and older age classes in SNA 8, unlike that seen in the late 1990s, or in other snapper fisheries (e.g., SNA 7) where similar fishing methods are used, primarily because few fish of ages 10–20 years now exist in SNA 8. Although SNA 8 has a high rate of stock productivity, the sustained high fishing mortality and a past TACC over-run of 6% on average each year for a decade have not allowed the stock to grow significantly and have contributed to the lack of appreciable growth currently seen in the right hand limb of the age distribution.

As always, length and age collections were made over the spring and summer seasons, a period when the greatest proportion of snapper is usually caught. However, the relative proportion of fish landed in the spring and summer of 2007–08 was considerably less than that of recent years, indicative of a further broadening of the fishing season in SNA 8 from that first seen in 2006–07. Walsh et al. (2009) reported the main reasons for this change was a rationalisation (and subsequent decline in the number of vessels) of the Auckland-based inshore trawl fleet in response to a number of factors. These included the SNA 8 TACC reduction in October 2005, an economic downturn in fishing relating to export markets and the high valued New Zealand dollar, the increasing cost of diesel, the availability of ACE (Annual Catch Entitlement), and the high relative lease price for sought after species. This has resulted in the targeting of other species, e.g., trevally (*Pseudocaranx dentex*) and red gurnard (*Chelidonichthys kumu*) over a longer period to provide better financial returns, where snapper is more regularly now taken as a bycatch (authors' discussions with industry managers and fishers) or secondary catch to another species.

Although the 15 sampled single trawl landings in 2007–08 came from only four vessels, the temporal and spatial spread of the catches were such that the derived proportional length and age estimates were expected to be representative of the fishery over spring and summer, and therefore directly comparable to those collections in past years. Sample collections generally reflected the temporal fishing activity of the sampling period, with seven and eight samples made over spring and summer seasons respectively. However, there has been a considerable decrease in the size of landings, especially over spring, with the average landing sampled being about 11 t, less than half the size of that in 2006–07, while those from summer were the same at about 6 t. Similarly, because of the reduced fishing effort for snapper, especially over summer, and the small number of vessels fishing in SNA 8, it has generally become increasingly more difficult to attain representative samples that contain a sufficient catch of snapper (i.e., over 3 t) and yet encompass the temporal spread of the spring-summer season as well. Although pair trawling made up about 18% of the landed catch of snapper over the spring and summer of 2007–08, the catches were often small, mixed with landings from SNA 1 or alternated with single trawling on the same trip, and were therefore deemed insufficient to be considered useful for sampling.

Similar to previous years, most of the spring sampled landings in 2007–08 were from vessels operating in an area off the Kaipara and Manukau Harbours (source: TCEPR reports) and contained a slightly higher proportion of fish in the mid length and age ranges compared to summer samples. Length summaries from single trawl vessels operating over summer contained a greater proportion of catches from other areas, especially North Taranaki Bight, where a high proportion of smaller fish are known to be more frequent (Reid 1950, Walsh et al. 2006c), although the greatest effort was still from around the greater Kaipara and Manukau Harbour area. Although spring landings contained some catches where snapper was the primary target, summer landings, as seen in past years, were exclusively the bycatch of a trevally target fishery. Walsh et al. (2006c) found that the similarity in the length distributions within a season is almost certainly related to the area that the vessels fished rather than a reflection of any seasonal or bycatch aspect of the fishery. However, as the areas fished were generally similar between the seasons, the minor differences seen in the length samples for spring and summer in 2007–08 may in part reflect a combination of all these factors.

The MWCV (analytical and bootstrap estimates) for the length and age distributions sampled from the SNA 8 single trawl fishery in 2007–08 ranged between 0.10 and 0.14, with all analytical estimates being well below 0.20. Differences were apparent between the analytical and bootstrap variances of proportion-at-length and proportion-at-age estimates with the bootstrap variances being higher, particularly in the less abundant length and age classes respectively, i.e., small and large, young and old. The bootstrap solutions probably provide more accurate variance estimates (Davies et al. 2003). The level of precision in the catch-at-age estimates has been similar in recent years and reflects the rigorous sampling methodology and precise and accurate ageing currently in place.

5. CONCLUSIONS

1. The length and age distributions sampled from the SNA 8 single trawl fishery in 2007–08 were generally consistent with trends observed in recent years.

2. The 2003 and 2004 year classes dominate the age distribution in the single trawl fishery in SNA 8 in 2007–08, and combined with the 2002 and 2005 year classes account for three-quarters (77%) of the number of snapper landed.

3. The previously dominant 1998, 1996, and 1995 year classes, may now not be as well represented in catch-at-age estimates for two main reasons: because a high proportion of fish in these cohorts now exceed the optimum selectivity of the single trawl method, and their lower relative abundance in the fishery because of past fishing mortality impacting on these cohorts over time.

4. Relative to most other age classes (with the exception of the 1996 year class), those year classes over 10 years of age are of low to very low abundance, including the aggregate (over 19) age group, and make up a combined total of less than 4% of snapper landed.

5. The newly recruited 2005 year class, although not yet fully recruited to the fishery, contains an appreciable proportion of fish in the smaller size classes, and appears to be of above average strength, making up about 14% of the single trawl catch by number in 2007–08.

6. ACKNOWLEDGMENTS

We thank Dave Fisher, Christopher Dick, Colin Sutton, and the stock monitoring team for their prompt and efficient handling and storage of data and Rebekah Cole and Chantal Percy (Ministry of Fisheries) for the provision of data from the catch effort return system. Funding for this project, SNA2007/04 (Objective 1), was provided by the Ministry of Fisheries.

Thanks to Eddie Dodd and Rob Essex (Moana Pacific Ltd) and Gypsy Rameka and Boo Rowley (Seafood Processors Ltd) for their cooperation in enabling NIWA staff to sample catches, and to Matthew Smith, Melanie Vaughan, and Oliver Hannaford (NIWA) for helping out at short notice, and Yair Kohn and Mark Fitzpatrick for their help in preparing the SNA 8 otolith collection. Thanks also to Andrew Bond and Pouha Lotoahea (Sanford Ltd) for collecting length and age information from the west coast single trawl fishery.

7. REFERENCES

Davies, N.M. (1997). Assessment of the west coast snapper (*Pagrus auratus*) stock (SNA 8) for the 1996–97 fishing year. New Zealand Fisheries Assessment Research Document 97/12. 47 p. (Unpublished report held in NIWA library, Wellington.)

Davies, N.M.; Hartill, B.; Walsh, C. (2003). A review of methods used to estimate snapper catch-at-age and growth in SNA 1 and SNA 8. *New Zealand Fisheries Assessment Report 2003/10*. 63 p.

Davies, N.M.; McKenzie, J.R.; Gilbert, D.J. (2006). Assessment of the SNA 8 stock for the 2003–2004 fishing year. *New Zealand Fisheries Assessment Report 2006/9.* 58 p.

Davies, N.M.; Walsh, C. (1995). Length and age composition of commercial snapper landings in the Auckland Fishery Management Area 1988–94. *New Zealand Fisheries Data Report No. 58.* 85 p.

Davies, N.M.; Walsh, C.; Hartill, B. (1993). Estimating catch at age of snapper from west coast and Hauraki Gulf fisheries, 1992–93. Northern Fisheries Region Internal Report No. 17. 58 p. (Draft report held by NIWA, Auckland.)

Ministry of Fisheries (2008). Report from the Fisheries Assessment Plenary, May 2008: stock assessments and yield estimates. (Unpublished report held in NIWA library, Wellington.) 990 p.

Paul, L.J. (1976). A study on age, growth, and population structure of the snapper, *Chrysophrys auratus* (Forster), in the Hauraki Gulf, New Zealand. *Fisheries Research Bulletin No. 13.* 62 p.

Quinn II, T.J.; Best, E.A.; Bijsterveld, L.; McGregor, I.R. (1983). Sampling Pacific halibut (*Hippoglossus stenolepis*) landings for age composition: history, evaluation and estimation. *Scientific Report 68, International Pacific Halibut Commission.* 56 p.

Reid, B. (1969). The Auckland west coast trawl fishery 1953–1958. *Fisheries Technical Report No. 38.* 48 p.

Southward, G.M. (1976). Sampling landings of halibut for age composition. *Scientific Report 58, International Pacific Halibut Commission.* 31 p.

Walsh, C.; Cadenhead, H.; Smith, M.; Davies, N.M. (2002). Length and age composition of commercial snapper landings in SNA 1 and SNA 8, 2000–01. *New Zealand Fisheries Assessment Report 2002/57*. 32 p.

Walsh, C.; Davies, N.M. (2004). Length and age composition of commercial snapper landings in SNA 8, 2003–04. *New Zealand Fisheries Assessment Report 2004/56*. 18 p.

Walsh, C.; Davies, N.M.; Buckthought, D. (2006a). Length and age composition of commercial snapper landings in SNA 8, 2005–06. *New Zealand Fisheries Assessment Report 2006/54*. 21 p.

Walsh, C.; Davies, N.M.; Buckthought, D. (2009). Length and age composition of commercial snapper landings in SNA 8, 2006–07. *New Zealand Fisheries Assessment Report 2009/3* 19 p.

Walsh, C.; Davies, N.M.; Rush, N.; Buckthought, D.; Smith, M. (2006b). Length and age composition of commercial snapper landings in SNA 8, 2004–05. *New Zealand Fisheries Assessment Report 2006/5*. 19 p.

Walsh, C.; Hartill, B.; Davies, N.M. (1995). Length and age composition of commercial snapper landings in the Auckland Fishery Management Area, 1994–95. *New Zealand Fisheries Data Report No. 62.* 36 p.
Walsh, C.; Hartill, B.; Davies, N.M. (1997). Length and age composition of commercial snapper landings in the Auckland Fishery Management Area, 1995–96. *NIWA Technical Report 3.* 29 p.
Walsh, C.; Hartill, B.; Davies, N.M. (1998). Length and age composition of commercial snapper landings in SNA 1 and SNA 8, 1996–97. *NIWA Technical Report 24.* 30 p.
Walsh, C.; Hartill, B.; Davies, N.M. (1999). Length and age composition of commercial snapper landings in SNA 1 and SNA 8, 1997–98. *NIWA Technical Report 54.* 28 p.
Walsh, C.; Hartill, B.; Davies, N.M. (2000). Length and age composition of commercial snapper landings in SNA 1 and SNA 8, 1998–99. *NIWA Technical Report 78.* 30 p.
Walsh, C.; McKenzie, J.; Armiger, H. (2006c). Spatial and temporal patterns in snapper length and age composition and movement; west coast North Island, New Zealand. *New Zealand Fisheries Assessment Report 2006/6.* 57 p.
Walsh, C.; Middleton, C.; Davies, N.M. (2003). Length and age composition of commercial snapper landings in SNA 1 and SNA 8, 2001–02. *New Zealand Fisheries Assessment Report 2002/12*. 40 p.
Walsh, C.; Middleton, C.; Davies, N.M. (2004). Length and age composition of commercial snapper landings in SNA 1 and SNA 8, 2002–03. *New Zealand Fisheries Assessment Report 2004/18*. 42 p.
Walsh, C.; Smith, M.; Davies, N.M. (2001). Length and age composition of commercial snapper landings in SNA 1 and SNA 8, 1999–2000. *New Zealand Fisheries Assessment Report 2001/52.* 32 p.
West, I.F. (1978). The use in New Zealand of multilevel clustered sampling designs for the sampling of fish at market for year-class. *C.M. 1978/D:5, Statistics Committee, Conseil International pour 1'Exploration de la Mer.*
Westrheim, S.J.; Ricker, W.E. (1978). Bias in using an age-length key to estimate age-frequency distributions. *Journal of the Fisheries Research Board of Canada 35*: 184–189.

Table 1: Summary of the catch (total number and weight of landings) and samples (number of landings and weight sampled, and number of fish measured) in method–season strata for the SNA 8 snapper fisheries from autumn 2007 to summer 2007–08.*

		Number of landings			No. of fish	Weight of landings (t)		
Method	Season	Total	Sampled	% of total	measured	Total	Sampled	% of total
BPT	Autumn	9	0	0	0	20	0	0
	Winter	10	0	0	0	20	0	0
	Spring	21	0	0	0	81	0	0
	Summer	22	0	0	0	73	0	0
BT	Autumn	113	0	0	0	117	0	0
	Winter	74	0	0	0	46	0	0
	Spring	82	7	8.5	5 174	238	77	32.4
	Summer	112	8	7.1	6 231	240	50	20.8

[*] BPT, pair trawl; BT, single trawl.

Table 2: Details of snapper otolith samples collected in 2007–08 from SNA 8.

Area	Fishing method [†]	Sampling period	Sample method [††]	Length range (cm)	No. aged
SNA 8	BT	Spring, summer	SR	23–73	522

[†] BT, single trawl.
[††] SR, stratified random sample.

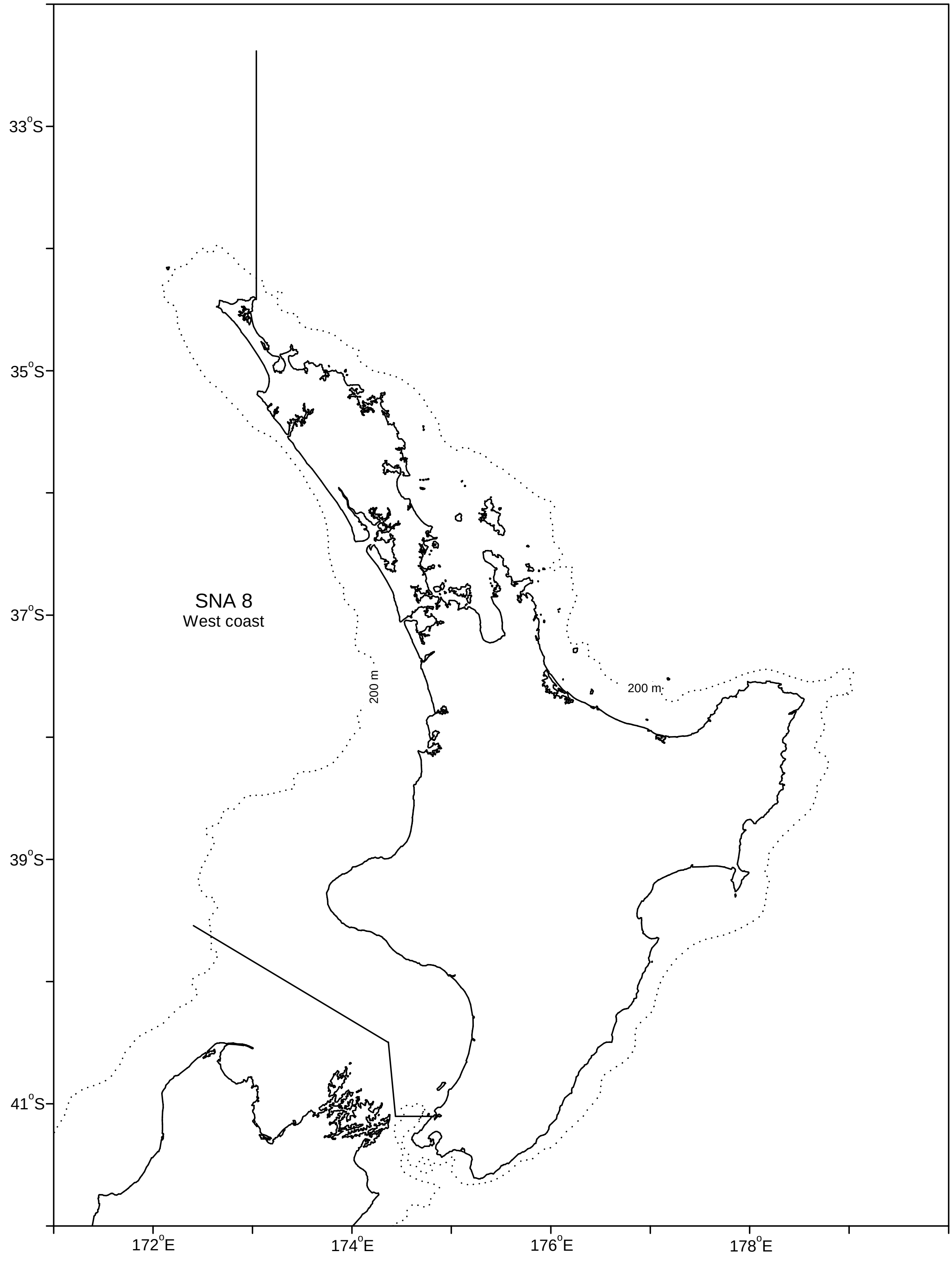


Figure 1: Quota management area for the west coast North Island snapper stock, SNA 8.

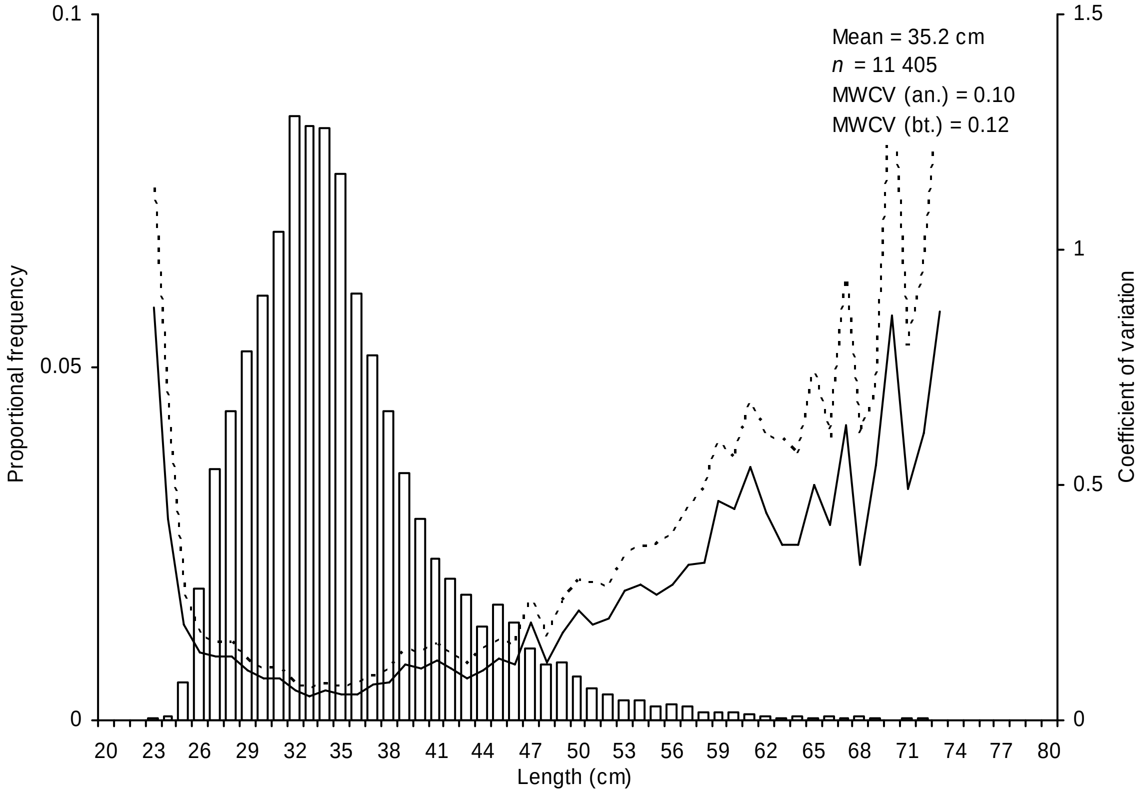


Figure 2: Proportion at length distribution (histogram) and analytical (solid line) and bootstrap (dashed line) c.v.s determined from snapper landings sampled from the SNA 8 single trawl fishery in 2007–08 (n, length sample size; MWCV, mean weighted c.v.).

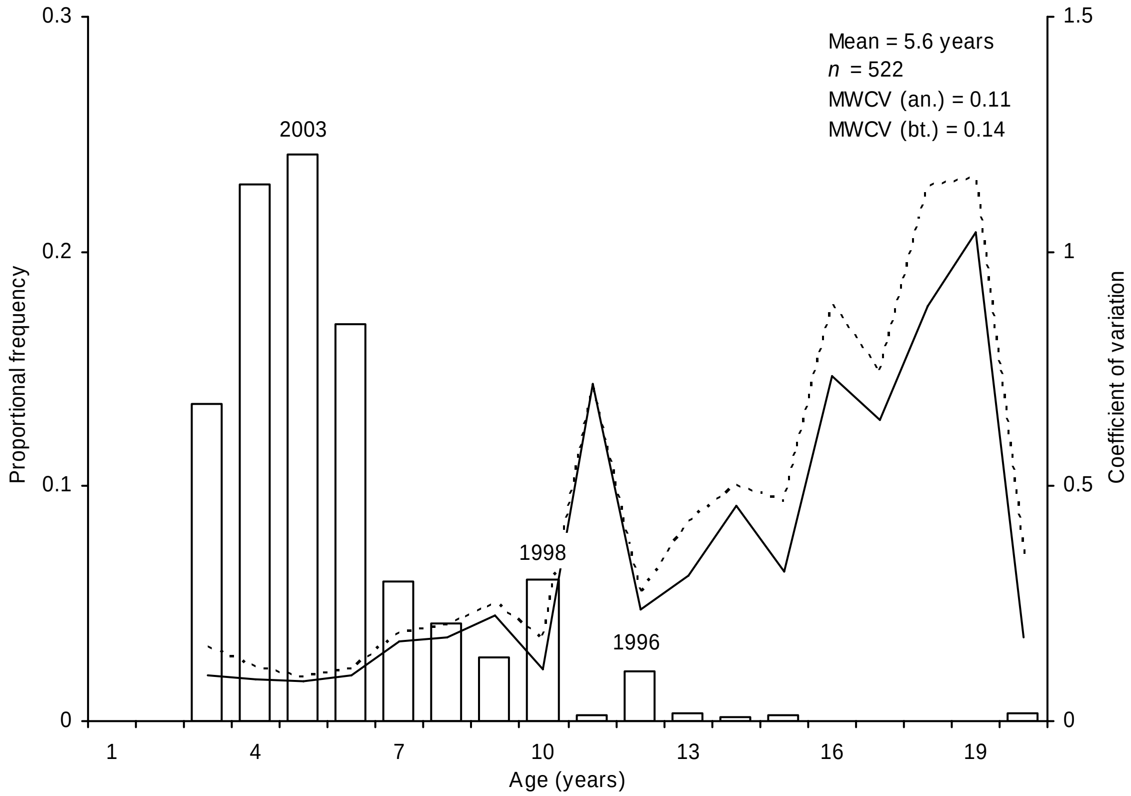


Figure 3: Proportion at age distribution (histogram) and analytical (solid line) and bootstrap (dashed line) c.v.s determined from snapper landings sampled from the SNA 8 single trawl fishery in 2007–08 using the age-length key approach (*n*, otolith sample size; MWCV, mean weighted c.v.).

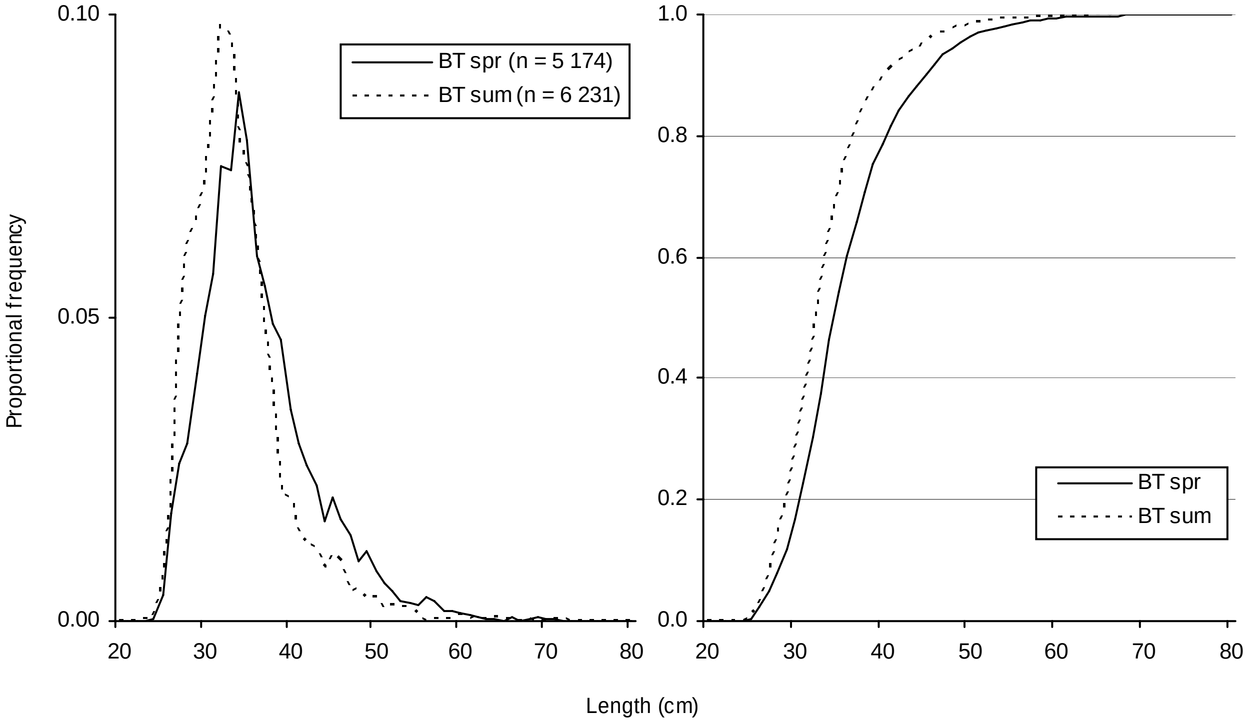


Figure 4: Comparison of the proportion and cumulative proportion at length distributions determined from snapper landings sampled over the spring and summer seasons from the SNA 8 single trawl fishery in 2007–08 (*n*, sample size).

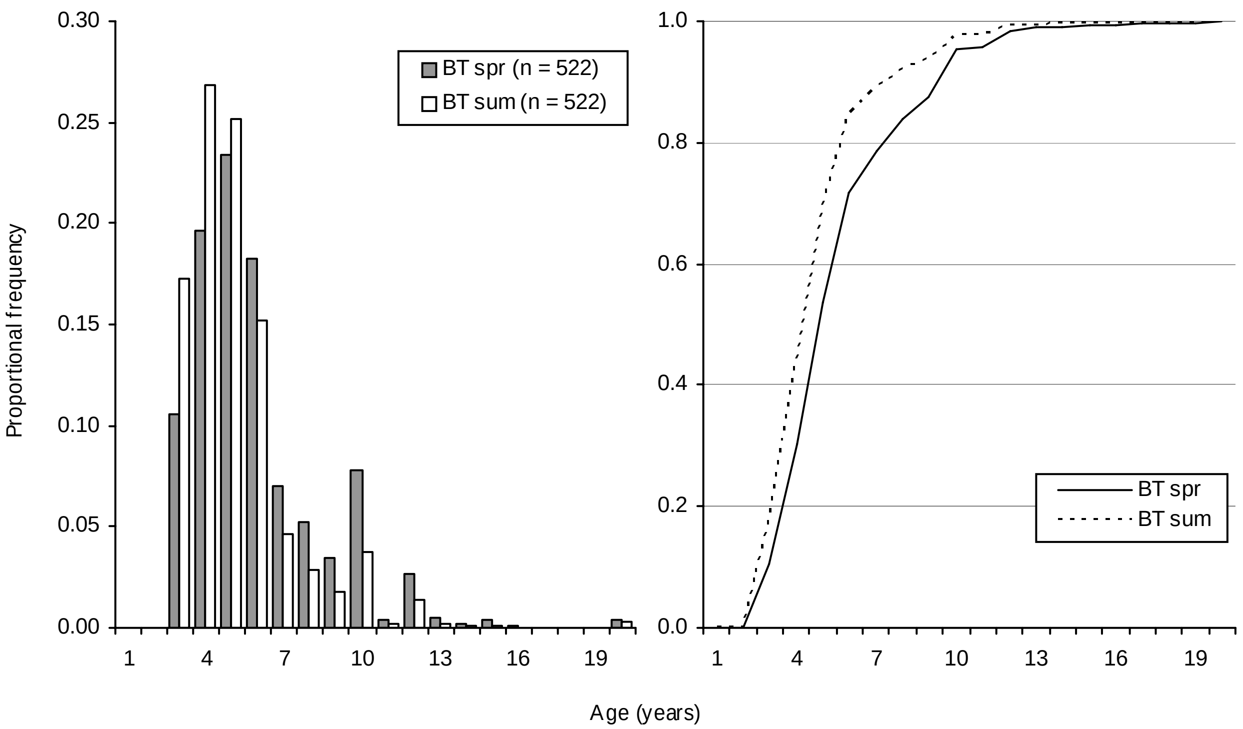
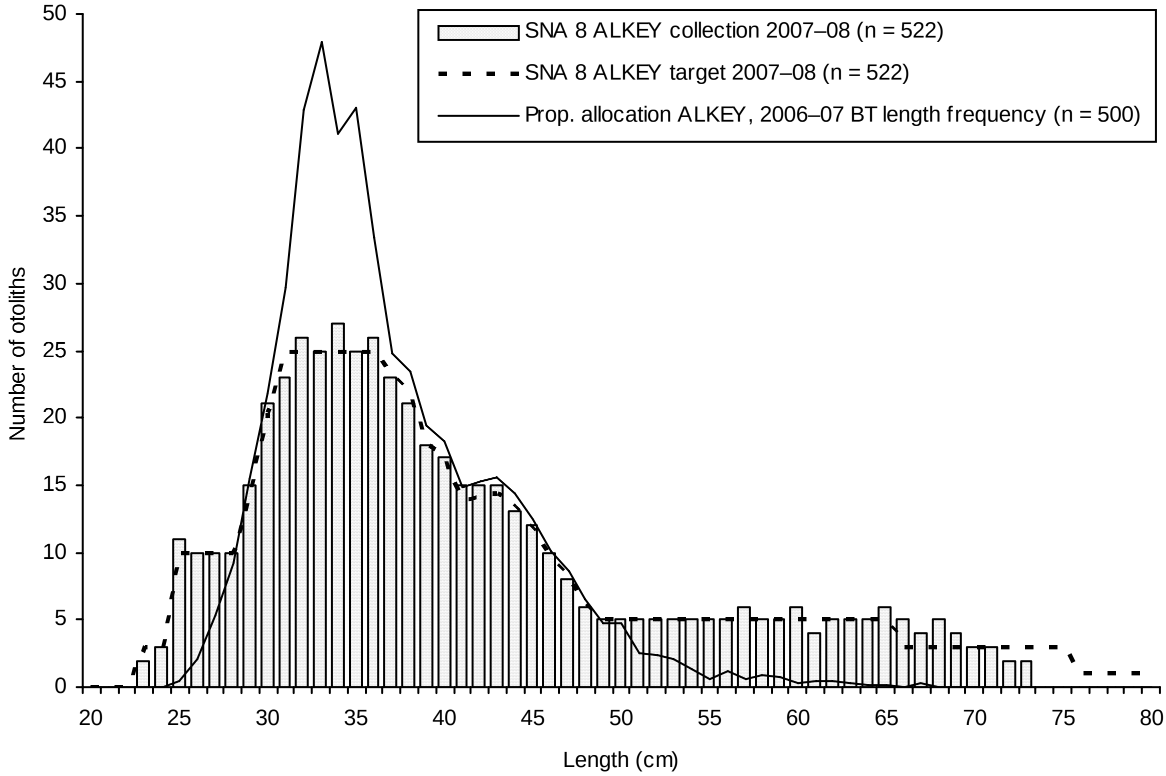
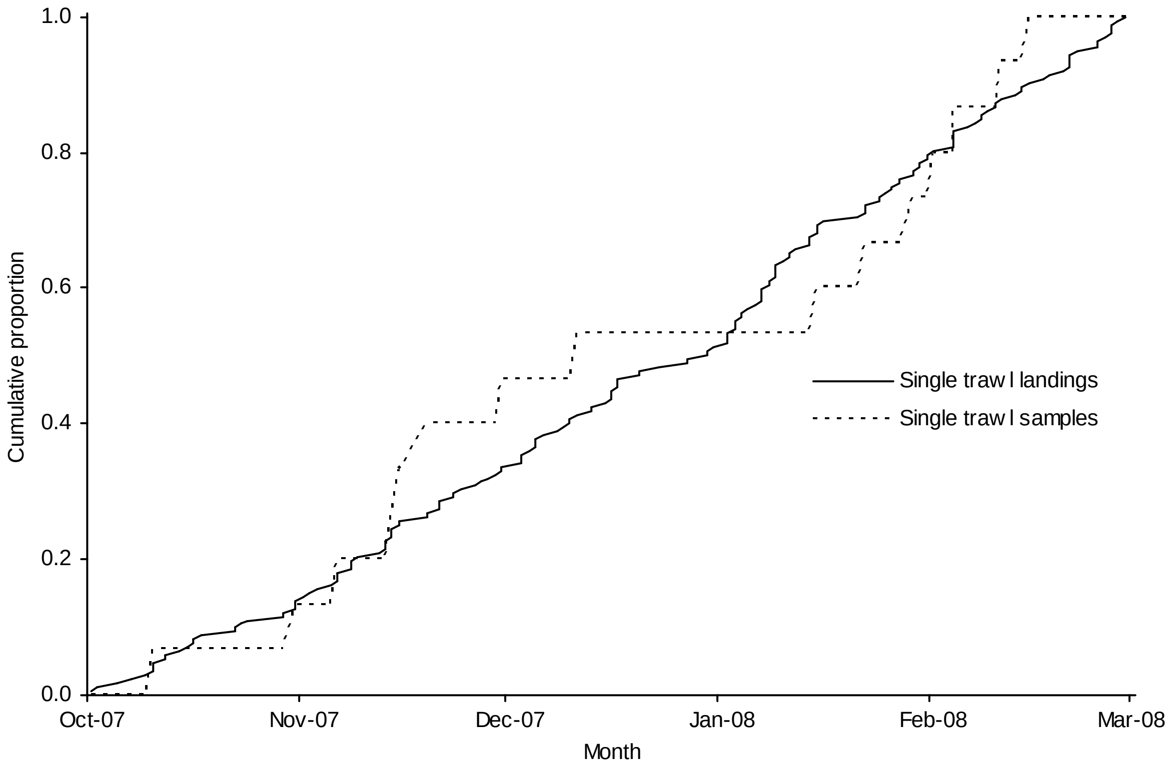


Figure 5: Comparison of the proportion and cumulative proportion at age distributions determined from snapper landings sampled over the spring and summer seasons from the SNA 8 single trawl fishery in 2007–08 (*n*, age-length key sample size).

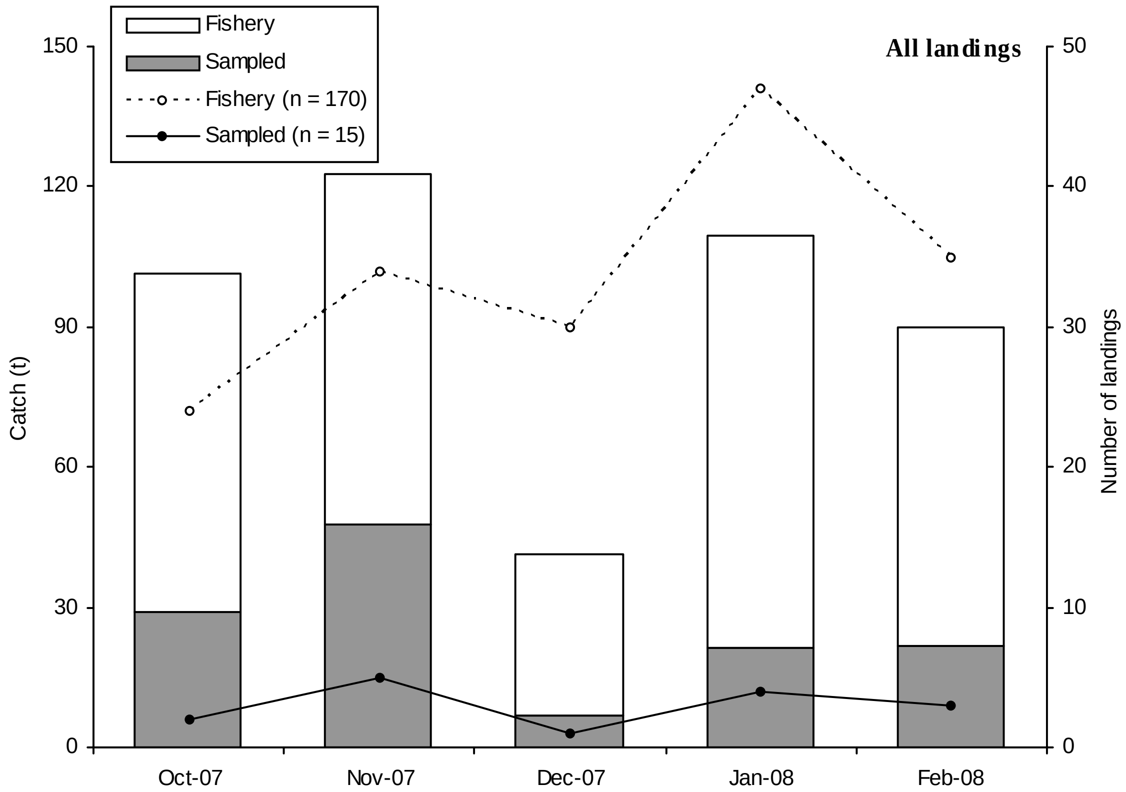
Appendix 1: Length distributions of the target semi-fixed allocation otolith sample (dashed line) and the achieved otolith collection (histogram) from SNA 8 in 2007–08. For comparison, the proportional allocation otolith sample of 500 fish based on the single trawl length distribution from 2006–07 is also given (solid line).



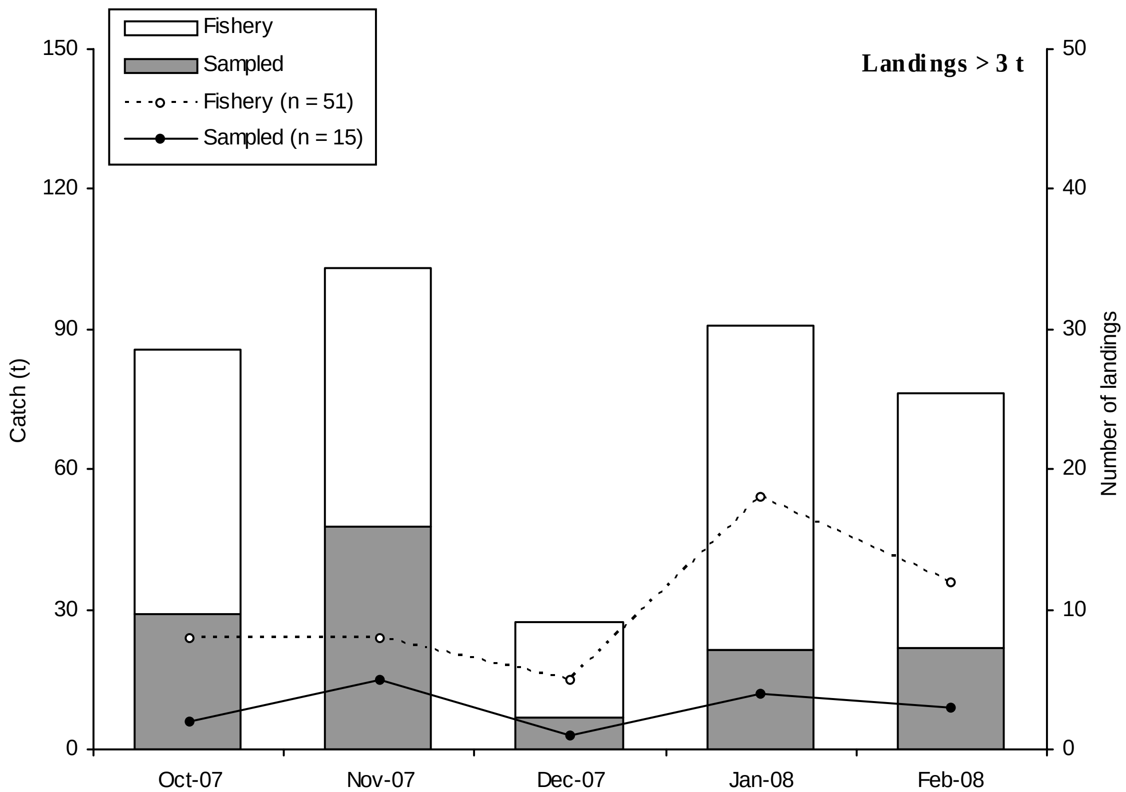
Appendix 2: The cumulative proportion of the number of landings and samples taken from the SNA 8 single trawl fishery in 2007–08.



Appendix 3: Comparison of the monthly distribution of landed weight (histograms) and numbers of landings (lines) of snapper in the SNA 8 single trawl fishery from October 2007 to February 2008 for all landings where snapper was caught. Included are corresponding estimates for all sampled landings to show representivity of collections.



Appendix 4: Comparison of the monthly distribution of landed weight (histograms) and numbers of landings (lines) of snapper in the SNA 8 single trawl fishery from October 2007 to February 2008 for all landings > 3 tonnes. Included are corresponding estimates for all sampled landings to show representivity of collections.



Appendix 5: Estimates of proportion at length with c.v.s (analytical and bootstrap estimates) for snapper from the SNA 8 single trawl fishery in 2007–08.
Spr-sum estimates are based on a combined stratum, not the sum of spring and summer values.

P.i. = proportion of fish in length class.
c.v. = coefficient of variation.
Nt = total number of fish caught.
n = total number of fish sampled.

					Single trawl		
Length	Spring		Summer		Spr-sum		
(cm)	*P.i.*	c.v. (an)	*P.i.*	c.v. (an)	*P.i.*	c.v. (an)	c.v. (bt)
20	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
21	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
22	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
23	0.0000	0.00	0.0004	0.90	0.0002	0.88	1.13
24	0.0005	0.59	0.0006	0.66	0.0005	0.43	0.66
25	0.0044	0.20	0.0066	0.34	0.0054	0.20	0.27
26	0.0177	0.19	0.0201	0.23	0.0188	0.14	0.18
27	0.0261	0.12	0.0474	0.18	0.0355	0.14	0.17
28	0.0292	0.13	0.0620	0.16	0.0438	0.14	0.17
29	0.0408	0.08	0.0664	0.15	0.0522	0.10	0.13
30	0.0503	0.08	0.0722	0.14	0.0600	0.09	0.11
31	0.0573	0.07	0.0843	0.13	0.0693	0.09	0.11
32	0.0751	0.08	0.0984	0.08	0.0855	0.06	0.08
33	0.0743	0.04	0.0964	0.07	0.0841	0.05	0.07
34	0.0873	0.07	0.0794	0.11	0.0838	0.06	0.08
35	0.0793	0.06	0.0751	0.11	0.0774	0.05	0.07
36	0.0601	0.06	0.0612	0.11	0.0606	0.06	0.07
37	0.0551	0.09	0.0475	0.12	0.0517	0.08	0.09
38	0.0489	0.08	0.0373	0.16	0.0438	0.08	0.11
39	0.0464	0.07	0.0211	0.21	0.0352	0.12	0.15
40	0.0349	0.10	0.0204	0.18	0.0284	0.11	0.14
41	0.0294	0.12	0.0146	0.22	0.0228	0.13	0.16
42	0.0258	0.06	0.0127	0.20	0.0199	0.11	0.14
43	0.0222	0.07	0.0120	0.12	0.0177	0.09	0.12
44	0.0165	0.07	0.0090	0.20	0.0132	0.10	0.15
45	0.0205	0.14	0.0112	0.20	0.0164	0.13	0.17
46	0.0169	0.14	0.0099	0.18	0.0138	0.12	0.16
47	0.0142	0.24	0.0049	0.17	0.0100	0.21	0.26
48	0.0097	0.12	0.0053	0.22	0.0078	0.12	0.18
49	0.0116	0.18	0.0038	0.27	0.0081	0.19	0.25
50	0.0081	0.32	0.0040	0.20	0.0063	0.23	0.29
51	0.0064	0.18	0.0021	0.46	0.0045	0.20	0.29
52	0.0048	0.24	0.0025	0.47	0.0038	0.22	0.28
53	0.0032	0.39	0.0022	0.36	0.0027	0.28	0.35
54	0.0031	0.42	0.0023	0.36	0.0027	0.29	0.37
55	0.0026	0.28	0.0009	0.64	0.0019	0.27	0.37
56	0.0039	0.23	0.0001	0.88	0.0022	0.29	0.39
57	0.0034	0.30	0.0003	0.63	0.0020	0.33	0.45
58	0.0015	0.35	0.0005	0.64	0.0011	0.33	0.49
59	0.0017	0.50	0.0003	0.87	0.0011	0.46	0.59
60	0.0014	0.67	0.0010	0.46	0.0012	0.45	0.56
61	0.0011	0.64	0.0003	0.53	0.0008	0.54	0.68
62	0.0008	0.57	0.0005	0.70	0.0007	0.44	0.60
63	0.0005	0.50	0.0003	0.59	0.0004	0.37	0.60
64	0.0005	0.58	0.0006	0.49	0.0005	0.37	0.56
65	0.0001	0.86	0.0004	0.61	0.0003	0.50	0.74
66	0.0005	0.66	0.0005	0.41	0.0005	0.41	0.60
67	0.0001	0.92	0.0001	0.87	0.0001	0.63	0.94
68	0.0004	0.50	0.0005	0.45	0.0005	0.33	0.61
69	0.0008	0.54	0.0000	0.00	0.0004	0.54	0.70
70	0.0002	0.85	0.0000	0.00	0.0001	0.86	1.35
71	0.0003	0.60	0.0002	0.90	0.0002	0.49	0.80
72	0.0001	0.86	0.0002	0.93	0.0002	0.61	0.96
73	0.0001	0.86	0.0000	0.00	0.0001	0.87	1.35
74	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
75	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
76	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
77	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
78	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
79	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
80	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
Nt	215 092		267 528		471 719		
n	5 174		6 231		11 405		

Appendix 6: Estimates of proportion at age with c. v.s (analytical and bootstrap estimates) for snapper from the SNA 8 single trawl fishery in 2007–08.

P.j., proportion of fish in age class; c.v., coefficient of variation; otolith sample size = 522

	Single trawl						
Age	Spring		Summer		Spr-sum		
(years)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	*P.j.*	c.v. (an)	c.v. (bt)
1	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
2	0.0000	0.00	0.0000	0.00	0.0000	0.00	0.00
3	0.1051	0.10	0.1731	0.10	0.1354	0.10	0.16
4	0.1964	0.09	0.2683	0.09	0.2284	0.09	0.11
5	0.2335	0.08	0.2519	0.09	0.2417	0.08	0.09
6	0.1821	0.10	0.1522	0.10	0.1688	0.10	0.11
7	0.0701	0.16	0.0465	0.18	0.0596	0.17	0.19
8	0.0528	0.18	0.0287	0.19	0.0420	0.18	0.20
9	0.0346	0.22	0.0181	0.23	0.0273	0.23	0.25
10	0.0781	0.11	0.0378	0.12	0.0602	0.11	0.18
11	0.0039	0.72	0.0015	0.72	0.0029	0.72	0.71
12	0.0269	0.22	0.0139	0.32	0.0211	0.24	0.27
13	0.0050	0.32	0.0019	0.39	0.0036	0.31	0.42
14	0.0023	0.48	0.0012	0.51	0.0018	0.46	0.50
15	0.0037	0.33	0.0014	0.41	0.0027	0.32	0.47
16	0.0006	0.77	0.0002	0.86	0.0004	0.73	0.89
17	0.0003	0.69	0.0003	0.69	0.0003	0.64	0.75
18	0.0002	0.92	0.0001	1.16	0.0001	0.88	1.14
19	0.0003	1.05	0.0001	1.24	0.0002	1.04	1.16
>19	0.0041	0.22	0.0028	0.23	0.0035	0.18	0.35

Appendix 7: Estimated mean weight-at-age (kg) and c.v.s for snapper from the SNA 8 single trawl fishery in 2007–08.

c.v., coefficient of variation; otolith sample size = 522

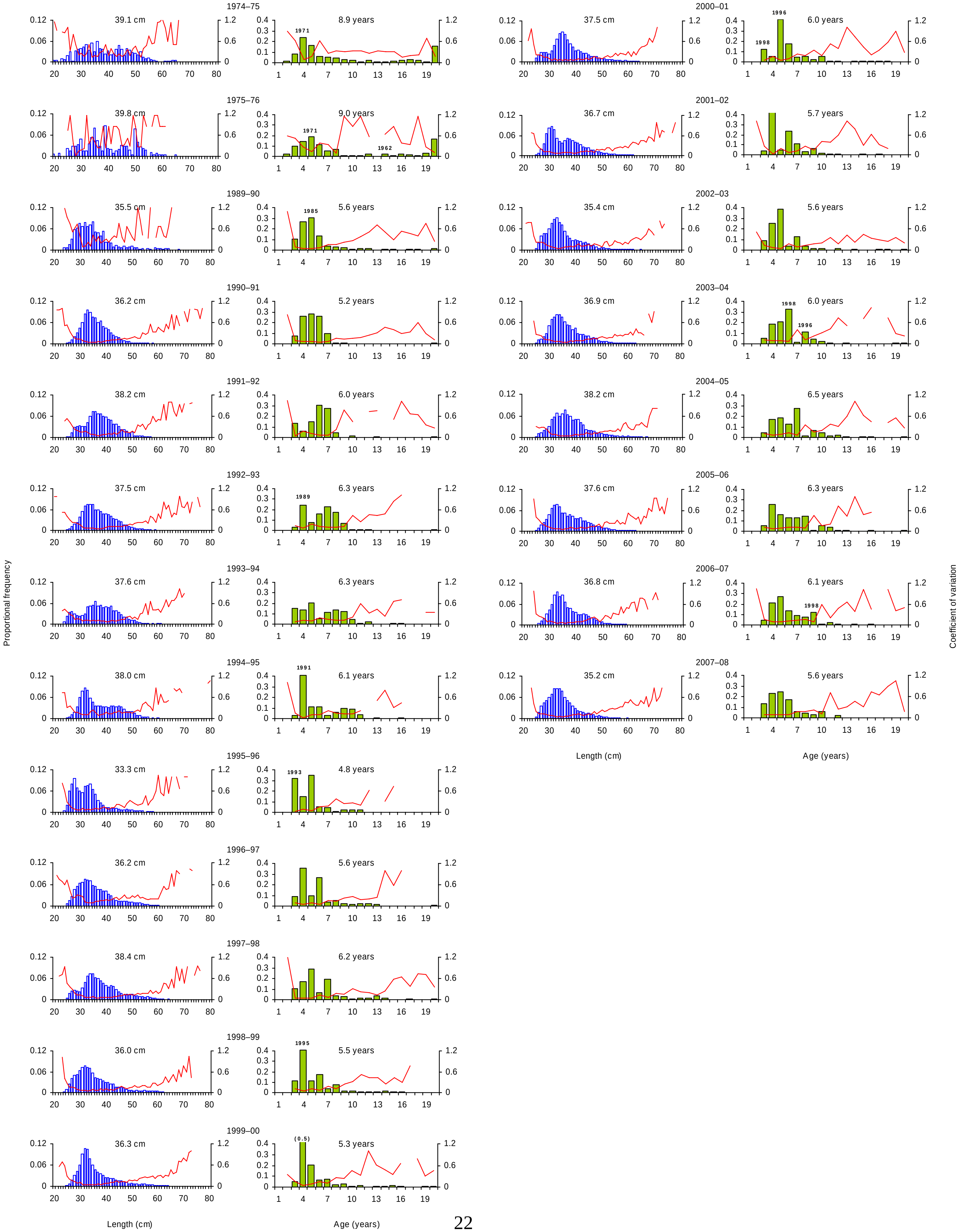
	Single trawl						
Age	Spring		Summer		Spr-sum		
(years)	Mean	c.v.	Mean	c.v.	Mean	c.v.	*n*
1	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–
3	0.50	0.02	0.50	0.02	0.50	0.02	56
4	0.70	0.02	0.67	0.02	0.68	0.02	74
5	0.86	0.01	0.83	0.02	0.85	0.01	82
6	1.07	0.02	1.02	0.02	1.05	0.02	74
7	1.27	0.03	1.21	0.04	1.25	0.04	33
8	1.56	0.05	1.52	0.06	1.55	0.05	29
9	1.59	0.05	1.56	0.05	1.58	0.05	19
10	2.02	0.02	1.97	0.02	2.01	0.02	51
11	2.40	0.02	2.42	0.02	2.41	0.02	2
12	2.32	0.09	1.94	0.18	2.21	0.11	24
13	3.48	0.03	3.39	0.04	3.46	0.03	11
14	3.34	0.06	3.40	0.10	3.36	0.07	6
15	3.87	0.05	3.86	0.09	3.87	0.06	12
16	4.02	0.02	4.08	0.01	4.03	0.02	2
17	4.92	0.07	5.08	0.08	4.98	0.07	3
18	5.75	0.07	5.40	–	5.64	0.06	2
19	3.94	–	3.94	–	3.94	–	1
>19	5.35	0.04	5.21	0.04	5.30	0.03	41

Appendix 8: Age-length key derived from otolith samples collected from snapper fisheries in SNA 8 in 2007–08.

Estimates of proportion of age at length for snapper sampled from SNA 8, spring and summer 2007–08. (Note: Aged to 01/01/2008)

Length	Age (years)																				No.
(cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	>19	aged
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
24	0	0	0.67	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
25	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
26	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
27	0	0	0.80	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
28	0	0	0.80	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
29	0	0	0.40	0.53	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
30	0	0	0.33	0.57	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
31	0	0	0.04	0.74	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23
32	0	0	0.04	0.46	0.38	0.08	0	0	0	0	0	0.04	0	0	0	0	0	0	0	0	26
33	0	0	0	0.32	0.52	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25
34	0	0	0	0.19	0.56	0.19	0.04	0.04	0	0	0	0	0	0	0	0	0	0	0	0	27
35	0	0	0	0.08	0.64	0.20	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	25
36	0	0	0	0.12	0.38	0.42	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	26
37	0	0	0	0.04	0.30	0.61	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	23
38	0	0	0	0	0.05	0.62	0.29	0	0.05	0	0	0	0	0	0	0	0	0	0	0	21
39	0	0	0	0	0.06	0.44	0.17	0.22	0.11	0	0	0	0	0	0	0	0	0	0	0	18
40	0	0	0	0.06	0.06	0.29	0.18	0.29	0.12	0	0	0	0	0	0	0	0	0	0	0	17
41	0	0	0	0	0	0.27	0.40	0	0.13	0.20	0	0	0	0	0	0	0	0	0	0	15
42	0	0	0	0	0	0.07	0.27	0.27	0.20	0.20	0	0	0	0	0	0	0	0	0	0	15
43	0	0	0	0	0	0.07	0.07	0.20	0.27	0.40	0	0	0	0	0	0	0	0	0	0	15
44	0	0	0	0	0	0.08	0.23	0.15	0	0.38	0	0.15	0	0	0	0	0	0	0	0	13
45	0	0	0	0	0	0	0.08	0.42	0	0.33	0	0.17	0	0	0	0	0	0	0	0	12
46	0	0	0	0	0	0	0	0.10	0.20	0.60	0	0.10	0	0	0	0	0	0	0	0	10
47	0	0	0	0	0	0	0	0.13	0.13	0.75	0	0	0	0	0	0	0	0	0	0	8
48	0	0	0	0	0	0	0	0.17	0.17	0.67	0	0	0	0	0	0	0	0	0	0	6
49	0	0	0	0	0	0	0	0	0	0.20	0.20	0.60	0	0	0	0	0	0	0	0	5
50	0	0	0	0	0	0	0	0	0	0.80	0.20	0	0	0	0	0	0	0	0	0	5
51	0	0	0	0	0	0	0	0	0.20	0.60	0	0.20	0	0	0	0	0	0	0	0	5
52	0	0	0	0	0	0	0	0.20	0	0.60	0	0.20	0	0	0	0	0	0	0	0	5
53	0	0	0	0	0	0	0	0	0	0.20	0	0.20	0	0.40	0.20	0	0	0	0	0	5
54	0	0	0	0	0	0	0	0	0	0	0	0.60	0.40	0	0	0	0	0	0	0	5
55	0	0	0	0	0	0	0	0.20	0	0	0	0.40	0.40	0	0	0	0	0	0	0	5
56	0	0	0	0	0	0	0	0	0	0.40	0	0.40	0.20	0	0	0	0	0	0	0	5
57	0	0	0	0	0	0	0	0	0	0	0	0.50	0.17	0.17	0.17	0	0	0	0	0	6
58	0	0	0	0	0	0	0	0	0	0	0	0.20	0.20	0.20	0.40	0	0	0	0	0	5
59	0	0	0	0	0	0	0	0	0	0	0	0	0.40	0	0.20	0.20	0	0	0.20	0	5
60	0	0	0	0	0	0	0	0	0	0	0	0	0.17	0	0.17	0.17	0	0	0	0.50	6
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75	0	0	0	0	0.25	4
62	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0.40	0	0.20	0	0	0.20	5
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0	0.80	5
64	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0	0	0	0	0	0	0.80	5
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0.17	0	0	0	0	0	0.83	6
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0	0.20	0	0.60	5
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	4
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0.20	0	0	0.20	0	0	0.60	5
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	4
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.33	0	0.67	3
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	3
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total																					522

Appendix 9: Time series of proportion at length and age distributions and c.v.s for snapper from the SNA 8 single trawl fishery from 1974–75 to 1975–76 and 1989–90 to 2007–08. Note: Data are from spring-summer with estimates of mean length and age.



Appendix 10: Time series of proportion at length and age distributions and c.v.s for snapper from the SNA 8 pair trawl fishery from 1974–75 to 1979–80, 1985–86 to 1986–87, 1988–89 to 1991–92, and 2000–01 to 2005–06. Note: Data are from spring-summer with estimates of mean length and age.