Ministry for Primary Industries
Manatū Ahu Matua

# Length and age composition of commercial trevally landings in TRE 7, 2012–13

New Zealand Fisheries Assessment Report 2014/66

C. Walsh
J.R. McKenzie
R. Bian
D. Buckthought
H. Armiger
C. Ó Maolagáin

ISSN 1179-5352 (online)
ISBN 978-0-477-10503-3 (online)

November 2014

New Zealand Government

Growing and Protecting New Zealand

Requests for further copies should be directed to:

Publications Logistics Officer
Ministry for Primary Industries
PO Box 2526
WELLINGTON 6140

Email: brand@mpi.govt.nz
Telephone: 0800 00 83 33
Facsimile: 04-894 0300

This publication is also available on the Ministry for Primary Industries websites at:
http://www.mpi.govt.nz/news-resources/publications.aspx
http://fs.fish.govt.nz go to Document library/Research reports

**TABLE OF CONTENTS**

## EXECUTIVE SUMMARY

**Walsh, C.; McKenzie, J.M.; Bian, R.; Buckthought, D.; Armiger, H.; Ó Maolagáin, C. (2014). Length and age composition of commercial trevally landings in TRE 7, 2012–13.**

***New Zealand Fisheries Assessment Report 2014/66.* 51 p.**

This report presents the results of Objective 1 of the Ministry for Primary Industries project "Estimation of year class strength in TRE 7" (TRE201202). The general objective was to determine the length frequency and age structure of commercial landings of trevally from TRE 7 in 2012–13 (by market sampling), for use in stock assessment models.

The length frequency and age-length key sampling approach was employed during the 2012–13 fishing year to estimate catch-at-age for trevally for the main fishing method in TRE 7. Length frequency samples were collected from the TRE 7 bottom trawl fishery identified as coming from one of four spatial subarea strata: Ninety Mile Beach, Kaipara and Manukau coastline, North Taranaki Bight and South Taranaki Bight. Two different sampling strategies were employed and involved samples being collected only from clean subarea whole "landings" or subsamples "at-sea". Otoliths were randomly subsampled from "landing" or "at-sea" length frequency samples to form a fixed allocation age-length key, to ensure that fish in all length intervals were well accounted for. No seasonal stratification was imposed on the sampling design other than that it be conducted over the "peak" period, spring and summer, when most trevally is landed.

A total of 28 bottom trawl "landing" or "at-sea" length frequency samples were successfully sampled from the TRE 7 subarea fisheries, with 9728 trevally measured for length and 949 otoliths aged to construct age-length keys. A further 19 "landing" or "at-sea" samples were omitted from the collection, largely due to the inadequate size of the sample, most of these collected "at-sea". Estimates of proportion at length and age for the TRE 7 fishery were calculated according to stratified subarea specific collections, using identifiable subarea data to weight proportions of length and age for each stratum according to the estimated number of fish landed in each stratum.

The stratified length and age distributions sampled from the TRE 7 bottom trawl fishery in 2012–13 contained a broad range of fish lengths and ages, resulting in high estimates of mean length (40.8 cm, about 1.4 kg) and mean age (10.6 years). Young trevally between 5 and 7 years of age (2006 to 2008 year classes) dominated the fishery and collectively made up one in every three fish landed. There was a reasonable level of representation across most recruited age classes up to and over 20 years, with the exception of three and four year old trevally which appear to be below average strength. The proportion of fish occupying the aggregate (over 19 years) age group was significant, making up around 12% of the catch by number.

For a fourth year, spatial differences in length and age structure of bottom trawl landings were examined in TRE 7, with independent sample collections made from four distinct latitudinal subareas of the west coast of New Zealand. The Ninety Mile Beach and North Taranaki Bight subareas comprised trevally of mainly small to moderate size and age, with three-quarters of the commercial catch from these areas consisting of fish 10 years of age or less. Although not dissimilar to estimates for South Taranaki Bight, landings from the Kaipara-Manukau subarea comprised the broadest size and age range of trevally in 2012–13, with those occupying the aggregate (over 19 years) age group being the most dominant, almost twice that of all other year classes. Such differences further confirm what is already known: that persistent spatial patterns of heterogeneity in age structure exist within the TRE 7 stock, as shown in 2012–13 by a trend of decreasing proportions of very small and young trevally down a latitudinal cline.

Despite some anomalies, similarities in relative year class strength between TRE 7 and SNA 8 catch-at-age estimates for 2012–13 were also obvious, with the similarity evident mainly for young fish. This is consistent with findings in previous years, and is likely to be due to temperature related recruitment effects. The most noticeable of these was the dominance of the 2004 to 2006 year classes (5- to 7-year-olds) in both fisheries, despite selectivity differences between the species and the relative exploitation status of the respective populations.

It is expected that the derived proportional length and age estimates presented here provide representative descriptions of the temporal and spatial spread of bottom trawl catches from the TRE 7 fishery for 2012–13. Although precision on the combined TRE 7 length and age distributions can be considered moderate, with mean weighted coefficient of variation (MWCV) estimates of 0.24 and 0.26 respectively, estimates still fell below the target goal of the project of 0.30. Precision on subarea length and age distributions was highly variable, with MWCVs ranging from 0.18 to 0.45, reflective of lower sample sizes and between sample variance.

In 2012–13 slight differences in mean weight-at-age estimates were evident between the subareas of TRE 7, the lowest estimates for the common age classes most often from North Taranaki Bight and Ninety Mile Beach, and the highest most often from South Taranaki Bight and Kaipara-Manukau.

Combined subarea catch samples for TRE 7 in 2012–13 were broad and comprised proportionally fewer small young trevally compared to samples from the late 1990s. Furthermore, the aggregate age group, and estimates of mean length and mean age were the highest recorded since sampling began in 1997–98. It is more than likely that the current TRE 7 fishery is in a relatively healthy state and that exploitation is unlikely to have significantly reduced stock biomass. However, as proportional catch-at-age data are not a direct index of absolute abundance, inferences to changes in stock size or state are not totally reliable and should be treated with some care.

# 1. INTRODUCTION

Trevally (*Pseudocaranx dentex*) is one of New Zealand's most important commercial inshore fish species. Over 50% of the national Total Allowable Commercial Catch (TACC) of 3933 t is allocated to TRE 7 (2153 t), the largest of the trevally Quota Management Areas (QMAs), encompassing the entire west coast of the North Island and most of the north and west coasts of the South Island (Figure 1). In recent years the greatest proportion of the TRE 7 catch has been taken by bottom trawl, mainly from the northern half of the North Island's west coast. Furthermore, most trevally is caught as the target species over the spring and summer months (almost 70% in 2012–13), but it is also taken as a bycatch when targeting other species, usually snapper (*Pagrus auratus*) and red gurnard (*Chelidonichthys kumu*). The annual TRE 7 catch has been below the Total Allowable Commercial Catch (TACC) for the last six fishing years (2007–08 to 2012–13), remaining relatively constant at an average of around 1900 t, equivalent to 89% of the TACC (Figure 2, Ministry for Primary Industries 2014).

The first trevally length and age sample collections from the west coast fishery were from a series of bimonthly research cruises undertaken between Tasman Bay and North Cape during 1971 and 1972, with some additional intermittent samples taken up until 1979 (James 1984). Sampling of commercial landings for length and age compositions from the bottom pair trawl fishery first took place around the late 1970s (unpublished data) and was resumed in the 1997–98 fishing year (Walsh et al. 1999) as part of a new stock monitoring programme instigated by the Ministry of Fisheries. Annual sampling from the bottom trawl and bottom pair trawl fishing methods continued in the TRE 7 fishery until 2000–01 and the data were summarised in a series of subsequent reports (Walsh et al. 2000, Langley 2001, 2002) and in reviews by Langley (unpublished) and Walsh & McKenzie (2009). The programme was reinstated in 2005–06 (Langley 2009) with sampling concentrating on the bottom trawl fishery and continued until 2009–10 (Walsh et al. 2010a, 2010b, 2012a), with a secondary aim of investigating patterns of spatial heterogeneity within the TRE 7 stock. A summary of the various methods and subarea strata that have been sampled from TRE 7 since 1997–98 is presented in Appendix 1.

This report presents the results of market sampling from the TRE 7 bottom trawl fishery for length and age data between October 2012 and September 2013, and thus continues the time series. The size and age composition of TRE 7 bottom trawl catches is currently sampled every third year. Funding for this project, TRE2012/02, was provided by the Ministry for Primary Industries (MPI).

The specific objectives of this project for 2012–13 were:

1. To characterise the TRE 7 fishery by analysing existing commercial catch and effort data to the end of 2012/13 fishing year.

2. To conduct representative sampling to determine the length, sex and age composition of the commercial catch of trevally in TRE 7 during the 2012/13 fishing year.

3. To explore the time series of catch sampling data, in particular, for any significant changes in the length and age composition of commercial catches.

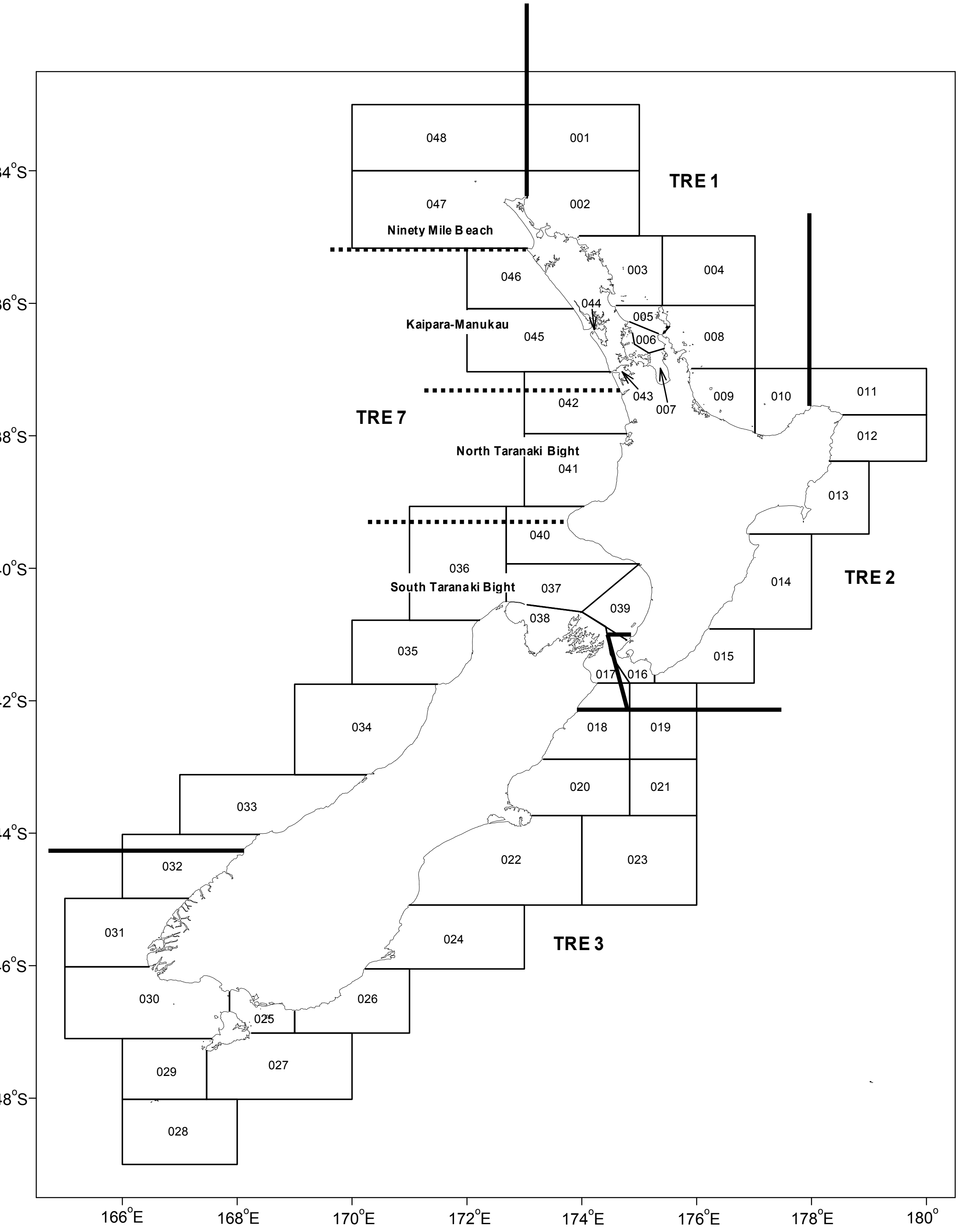



**Figure 1: Trevally Quota Management Areas, statistical areas, and locations referred to in the text. Dashed lines represent the boundaries separating the subareas that make up the TRE 7 stock.**

## 2. METHODS

### 2.1 Characterisation of recent fishery profile data for TRE 7, 2007–08 to 2012–13

A characterisation of patterns in the TRE 7 fishery over the period October 2007 through to September 2013 (excluding 2011–12) was undertaken using data extracted from the MPI commercial catch reporting system. Data from 2011–12 was not included in the analysis as it lay between the initial characterisation and sampling year stages of the project. All effort details and associated catch weights (all species including trevally) from all trips landing TRE 7 were requested.

Data obtained from MPI was groomed and checked for typical reporting errors. Information to perform the characterisation was compiled in two tables:

1. Landed catch weight: A file containing the verified green (unprocessed) landed weight of all TRE 7 trips.
2. Trip specific data: A file containing demographic information (location, method, target species, estimated catch etc).

Although the trip effort data table has information on catch, these are only fisher estimates. The process followed was to prorate the actual trip landed weight totals across the effort information (location, method, target species) on the basis of the estimated catch ratios. The link between the two data tables was the common trip number field (trip_key).

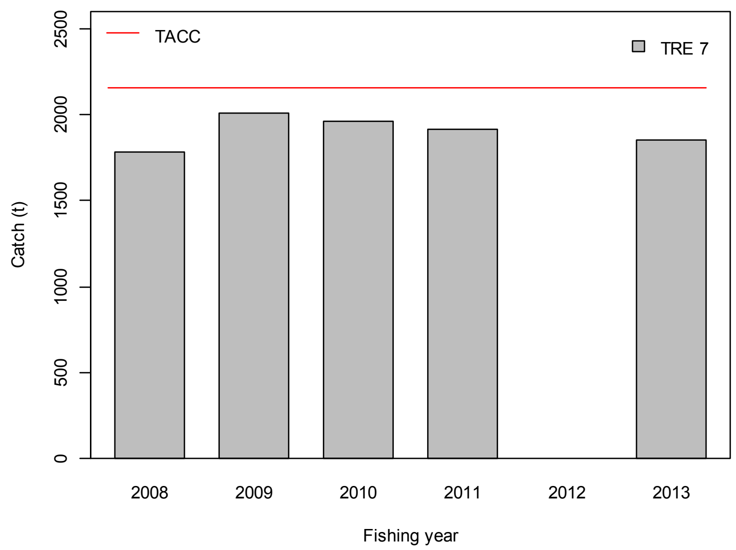



**Figure 2: Reported landings of trevally in TRE 7 and TACCs for 2007–08 to 2012–13 excluding 2011–12.**

## 2.2 Design of TRE 7 sampling in 2012–13

### Stratification of the TRE 7 fishery

Landings were stratified by subarea and sample collections made from the only significant commercial method that currently operates in TRE 7, bottom trawl. Although the bottom pair trawl (BPT) method had been sampled in previous years, in 2012–13, the relative effort was deemed insufficient to be considered useful for sampling purposes. There was no seasonal stratification imposed on the sampling, other than it be conducted over the "peak" period when most trevally is landed by bottom trawl, usually spring and summer.

Subarea stratification of the TRE 7 fishery was based on findings by James (1984). To fully investigate the patterns of spatial heterogeneity in 2012–13, a concerted effort was made to ensure only clean subarea samples were collected from landings identified as coming from one of four subarea strata: Ninety Mile Beach, Kaipara and Manukau coastline, North Taranaki Bight and South Taranaki Bight (see Figure 1). This was a slight modification from the spatial stratification used in most recent years (2006–07, 2007–08 and 2009–10) where the Kaipara and Manukau coastline, and North Taranaki Bight subareas were combined, as few differences were apparent in the length distributions from these subareas (Walsh et al. 2010a). The subareas that catches were associated with were determined through communication with the skipper during the fishing trip and before sampling.

The 2012–13 programme marks the first time that comprehensive "at-sea" sampling in conjunction with "landing" catch sampling has been employed in TRE 7. "At-sea" sampling enabled data to be collected when multiple subareas were fished during a trip, which would normally have invalidated the trip from being sampled once landed. At sea sampling required vessel skippers to mark bins collected at the time a tow was being stowed away "at-sea" (as stratification of ponds within the hold was not viable) to indicate the sample component of the catch relating to a particular subarea stratum. The process required a high degree of coordination and cooperation between vessel skippers, unloading crews, and on-shore samplers and would not have been possible to implement without company level industry support. This support was forthcoming because of the involvement of the industry owned stock monitoring company, Trident Systems Ltd, who were contracted to conduct and oversee all the TRE 7 "at-sea" and "landing" based sampling. Final confirmation of the subarea catch of trevally for both "landing" and "at-sea" samples was not fully determined until some months after sampling, based on data received from the MPI catch and effort returns. Unlike previous years where all landings were utilised in the analysis, including those from mixed subarea strata, in 2012–13 such samples were removed from the collection, unless they were verified as being specific "at-sea" subarea samples.

### Sampling TRE 7 bottom trawl landings

The length frequency and age-length key sampling approach was implemented in TRE 7 in 2012–13 to estimate catch-at-age, and has been the preferred sampling method since 1997–98. As part of a trevally catch sampling review, Walsh & McKenzie (2009) undertook an optimisation analysis for various catch sampling designs. The optimisation results for the length frequency and age-length key approach indicated that a mean weighted coefficient of variation (MWCV) of 0.20 for TRE 7 bottom trawl catch-at-age estimates could be achieved by sampling about 20 landings and through the application of a 900 otolith age-length key. This design was implemented in 2006–07, 2007–08 and 2009–10, but with a target of 10 landings and about 300 otoliths from each of the three subarea strata (Walsh et al. 2010a, 2010b, 2012a). In 2012–13, the goal of the programme was slightly modified to achieve a MWCV of below 0.30 in the TRE 7 stock catch-at-age after subarea stratum amalgamation using the subarea target sample sizes outlined in Table 1, the combined total sample sizes being about 50 landings and 1200 otoliths. There was no proposed MWCV target in each subarea stratum. The sampling design for TRE 7 specified that all bottom trawl landings were to have a minimum catch weight of trevally of at least 2 t (later adjusted to 1 t for subareas where large landings were difficult to source i.e., North Taranaki Bight) for the northern three subareas and 0.5 t for the South Taranaki Bight subarea.

**Table 1: Level of sampling proposed to describe the TRE 7 subarea bottom trawl fisheries in 2012–13.**

| Stock | Subarea | Method | Minimum landing size | Number of landings* | Number of otoliths in age-length-key |
|---|---|---|---|---|---|
| TRE 7 | Ninety Mile Beach | Bottom trawl | 1 t | 10 | ~300 |
| | Kaipara-Manukau | Bottom trawl | 1 t | 10 | ~300 |
| | North Taranaki Bight | Bottom trawl | 1 t | 10 | ~300 |
| | South Taranaki Bight | Bottom trawl | 0.5 t | 15–20 | ~300 |

*number of landings signifies whole the combined total of "landing" and "at-sea" subarea samples

A two-stage sampling procedure was used to obtain length frequencies (West 1978). The first stage is represented by a random selection of subarea samples (from either "landings" or samples "at-sea" as described in the second paragraph of Section 2.2) chosen at regular intervals across the fishing year. For whole "landings", a random subsample of about 15–30 bins (dependent on bin capacity) within landings represented the second stage, with sample sizes typically ranging from about 300 (for small landings with less than 100 bins) to 600 fish (for large landings with over 1000 bins).

Sampling of an "at-sea" subarea stratum was dependent on the size of the qualifying tow, estimated to be 400 kg of trevally or greater, and the number of bins selected for sampling based on tow size (Table 2). To ensure randomness and minimize bias in sampling from "landings", it was a requirement that the whole "landing" was available to choose the sample from, while for "at-sea" samples, it was imperative that total sample bins matched the sum of the expected number of qualifying bins collected from each tow (see Table 2). If neither sampling strategy was adhered to appropriately (i.e., too few bins selected for sampling or bin totals not matching catch and effort estimates), the sample was deemed invalid and omitted from the collection. The "at-sea" sample, like the "landing" sample, was measured by trained fishing industry samplers either on the day of the landing, or soon after, on licenced fish receiver premises. All fish in the sampled bins were measured to the nearest centimetre below the fork length. As trevally show no differential growth between sexes (James 1984), sex was not determined.

**Table 2: Proposed number of bins of trevally sampled from "at-sea" tows based on estimated trevally catch (kg).**

| Estimated catch (kg) of trevally in tow | Number of bins of trevally to be collected |
|---|---|
| <400 | 0 |
| 400–1000 | 2 |
| 1000–1500 | 3 |
| 1500–2000 | 4 |
| 2000–3000 | 5 |
| 3000–4000 | 6 |
| 4000–5000 | 7 |
| 5000–6000 | 8 |
| 6000–7000 | 9 |
| 7000+ | 10 |

### Otolith collections and ageing of TRE 7 samples in 2012–13

Otoliths were collected as a subsample of all "landing" or "at-sea" samples sampled for length frequency to create age-length keys (refer Davies & Walsh 1995). Samples taken from the TRE 7 bottom trawl fishery encompassed the period November–August. The purpose of the keys was to convert catch length frequency information to age frequency. It was assumed that age was distributed randomly within each sampled centimetre length class (Southward 1976). A fixed allocation sample for each length class was determined from the proportion of fish in each length class in bottom trawl length frequency samples in TRE 7 from 2000–01, but was broadened to ensure that fish in all length intervals were well accounted for (Appendix 2). Otolith sample sizes were capped at 12 for the common length class intervals (31–40 cm), and a step-wise sample size of about ten fish for length intervals greater than 40 cm, eight fish over 45 cm, five fish over 50 cm, three fish over 55 cm, two fish over 60 cm, and one fish for all length classes 66 cm and above was specified for collection. This resulted in about 300 otolith samples being targeted for collection from each of the four subareas: Ninety Mile Beach, Kaipara-Manukau, North Taranaki Bight, South Taranaki Bight and the overall target otolith allocation for TRE 7 would therefore sum to about 1200 (Table 1). To ensure spatial and temporal representativeness in the sample collections, a target of about 30 otoliths was collected from all "landing" or "at-sea" samples sampled for length frequency within a subarea until the target sample sizes for each length class within the age-length key were achieved. This also included otoliths from "landing" or "at-sea" length frequency samples that were omitted from the collection, as the otolith sample was still regarded as a random sample from the subarea fishery, and therefore useful for the age-length key. Those size classes that were uncommon in landings (i.e., very small or large fish) were often targeted for otoliths when available to samplers in order to fulfil the age-length key requirements as best as possible.

All trevally otoliths were prepared using the thin section technique as described by Stevens & Kalish (1998) and Tracey & Horn (1999) and a standardised procedure for reading otoliths was documented in an age determination protocol for trevally (Walsh et al. 2014a). In a review on trevally catch sampling, Walsh & McKenzie (2009) determined that inconsistencies observed in the relative year class strengths of trevally catch-at-age data from collections prior to 2006–07 were most likely a result of ageing error caused by two main factors: the misinterpretation of growth zones in difficult otolith sections, and the inaccurate determination of the margin relative to the sample collection and birth dates. A more rigorous approach to ageing trevally was adopted in 2006–07 to improve reader accuracy and increase the level of between-reader agreement (now documented in the trevally age determination protocol by Walsh et al. (2014a)), and this was followed for 2012–13. In summary, this approach focused on a few main facets: the interpretation and location of the first annulus; forcing an expected margin on the reader relative to the otolith collection date; and allowing the readers access to a variety of otolith images from previous collections. As a result, there has been considerable improvement in reader accuracy and precision in ageing trevally in recent years (Walsh et al. 2010a, 2010b, 2012a, 2012b).

As part of the development of the age determination protocol for trevally, a reference collection numbering approximately 500 prepared otoliths has been compiled and documented from previously collected samples (Walsh et al. 2014a). Reference collections are used to ensure consistent ageing between readers and across time. To assess reader competency in ageing trevally otoliths in 2012–13, each of the two selected readers aged a subsample of 50 reference otolith preparations with an aim of achieving a pass mark score for Index of Average Percentage Error, IAPE (Beamish & Fournier 1981), and mean coefficient of variation (CV) (Chang 1982), set at 2.50% and 3.54% respectively (see Walsh et al. 2014a).

Once reader competency was established, both readers read the entire 2012–13 TRE 7 otolith collection independently to determine an unbiased reading estimate. Where agreement was reached, it was deemed to be the final agreed reading. If counts disagreed, then the otolith was reviewed again by both readers with an experienced third reader present to reach agreement, or discarded from the set as unreadable; but only if it was of an age less than 20 years, as samples over 19 years were combined into an aggregate age group for the analysis. It was envisaged that discarding a few unreadable otoliths from the age-length key should have minimal effect on the sample collections and was likely to improve the precision in estimates of catch-at-age. Reading precision for the TRE 7 otolith collections from 2012–13 was quantified by carrying out between-reader comparison tests after Campana et al. (1995), including those between each reader and the agreed age, with IAPE and CV calculated for each test. The nominal birth date of trevally was set as 1 January.

### Catch-at-age analysis
The National Institute of Water and Atmospheric Research (NIWA) catch-at-length and -age analysis software tool CALA (catch-at-length and –age, Francis & Bian 2011) was used in the calculation of

proportions at length and age, and variances from length frequency samples and the age-length keys. For sample collections from the TRE 7 bottom trawl fishery in 2012–13, estimates of proportion at length and age (and coefficient of variation) were calculated for each stratum, and then combined to calculate weighted mean estimates. CALA scales up the numbers of fish in the samples to numbers of fish in landings and finally the numbers of fish in each subarea stratum, based on the weights of both samples and landings. Bootstrap variances were determined for the combined subarea proportion at length and proportion at age estimates for TRE 7.

The calculation of mean weight-at-age and variances followed Quinn II et al. (1983), using the length-weight relationship: w (g) = 0.016 $l^{3.064}$ (cm) established by James (1984). Proportions at age, mean length-at-age and mean weight-at-age (with estimates of coefficient of variation, CV) were calculated for the range of fishing year age classes (herein referred to as "age classes" encompassing October 2012 to September 2013) recruited, with the maximum age being an aggregate of all age classes over 19 years. Estimates of mean age determined from year-round catch-at-age estimates were calculated such that all fish comprising the aggregate (over 19 years) age group were assigned an age of 20.

Trevally length and age data are stored on the MPI *market* and *age* databases respectively, administered by NIWA.

# 3. RESULTS

## 3.1 Characterisation of TRE 7, 2007–08 to 2012–13, excluding 2011–12

Fishery data collated from the MPI covers all TRE 7 catches from 2007–08 to 2012–13 with the exception of 2011–12. Data from this fishing year was not included in the characterisation analysis. To reflect this but still retain plot readability, Figures 2 and 3 have a straight line drawn between the 2010–11 and 2012–13 fishing years, while Figures 4 to 7 have no data for 2011–12.

### Annual TRE 7 catch by subarea

Between 2007–08 and 2012–13 the annual TRE 7 catch has been disproportionate between subareas, the largest proportion consistently taken from the Kaipara-Manukau subarea (Figure 3). The Ninety Mile Beach and North Taranaki Bight subareas also recorded significant catches over most years, while South Taranaki Bight usually had the lowest proportion of the catch in TRE 7 (Figure 3).

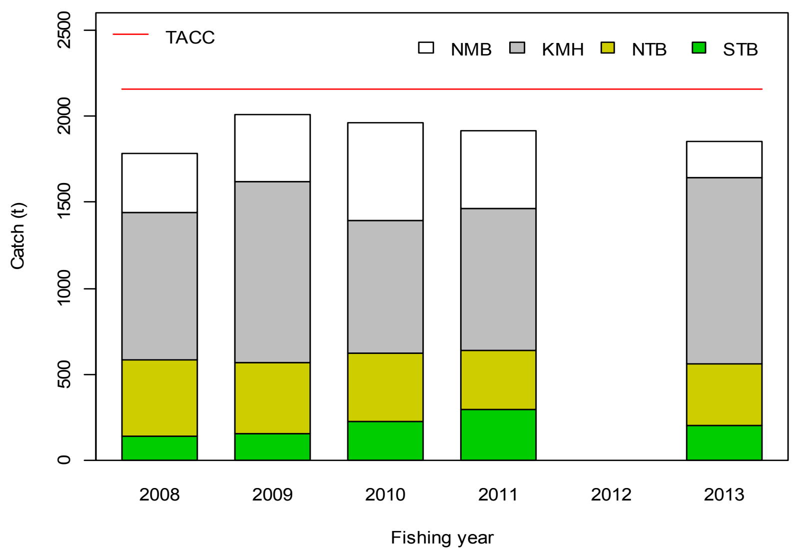



**Figure 3: Annual TRE 7 catch by subarea for 2007–08 to 2012–13 excluding 2011–12.**

## Relative catch by method for the subareas of TRE 7

Overall, bottom trawl was the dominant fishing method in all subareas of TRE 7, although significant catches of trevally have been made by bottom pair trawlers operating in the Ninety Mile Beach and Kaipara-Manukau subareas in earlier years (Figure 4, Appendix 3). A shift in bottom trawl effort for trevally away from the Kaipara-Manukau subarea occurred in 2009–10 and 2010–11, with more emphasis toward the Ninety Mile Beach and North Taranaki Bight subareas, but this trend reversed in 2012–13. In 2012–13 bottom trawl accounted for 96% of the total TRE 7 catch.

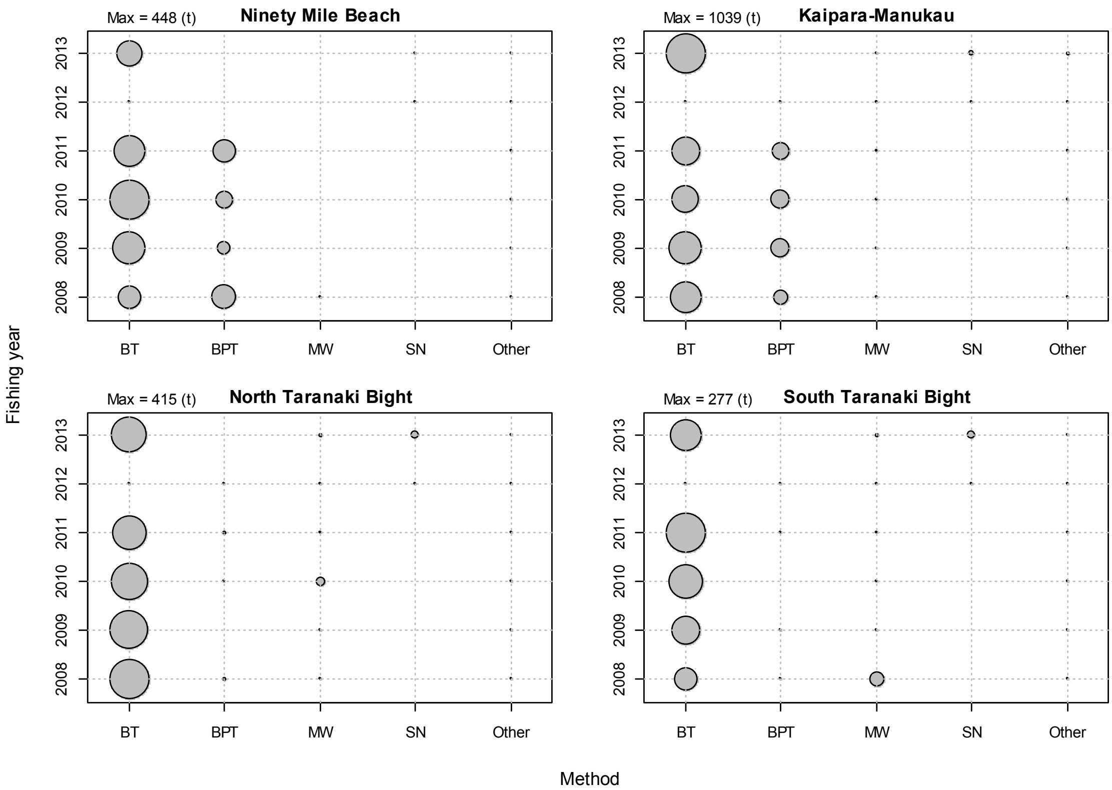



**Figure 4: Relative annual catch by method for the TRE 7 subareas from 2007–08 to 2012–13 excluding 2011–12 (BT, bottom trawl; BPT, bottom pair trawl; MW, midwater trawl; SN, set net).**

## Spatio-temporal distribution and target species of the bottom trawl commercial catch

The TRE 7 bottom trawl catch by statistical area for the period 2007–08 to 2012–13 shows that the majority of trevally catch is consistently taken from the northern half of North Island's west coast, principally statistical areas 041, 042, and 045–047 (Figure 5, Appendix 4). As bottom trawl is the dominant method in the TRE 7 fishery, the overall trend evident in subarea fishing patterns (Section 3.1.2) is similar to those for just the bottom trawl catch by statistical area, as subarea and statistical area are closely aligned. Most obvious is the significant increase in the catch from statistical area 045 (coastal Kaipara Harbour) in 2012–13 and the steady decline in recent years in statistical area 047 (Ninety Mile Beach). Conversely, catches in statistical areas 041, 042 and 046 have remained relatively constant (North Taranaki Bight and Northern Kaipara-Manukau). Bottom trawl catches for the statistical areas south of New Plymouth, 017 to 040, are consistently low although statistical area 040 has shown a slight increase in recent years (Figure 5, Appendix 4).

In terms of seasonality, the majority of the TRE 7 bottom trawl catch is taken over the spring and summer months (Figure 6). There appears to be a general trend in the temporal pattern of fishing activity especially in the northern three subareas with fishing first taking place in the Kaipara-Manukau subarea from November to January, followed by the North Taranaki Bight subarea over January to February, and the Ninety Mile Beach subarea from February to March. Although trevally is encountered in the South Taranaki Bight subarea year-round, the largest catches appear more common in October to November and February to March (Figure 6).

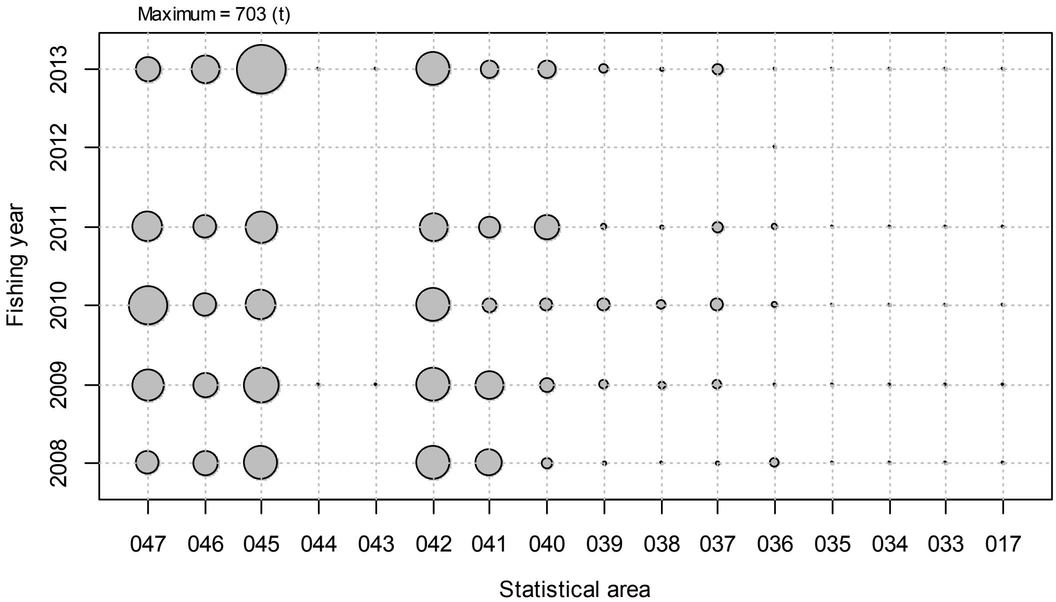



**Figure 5: Relative annual bottom trawl catch by the statistical reporting areas within the TRE 7 stock, 2007–08 to 2012–13 excluding 2011–12.**

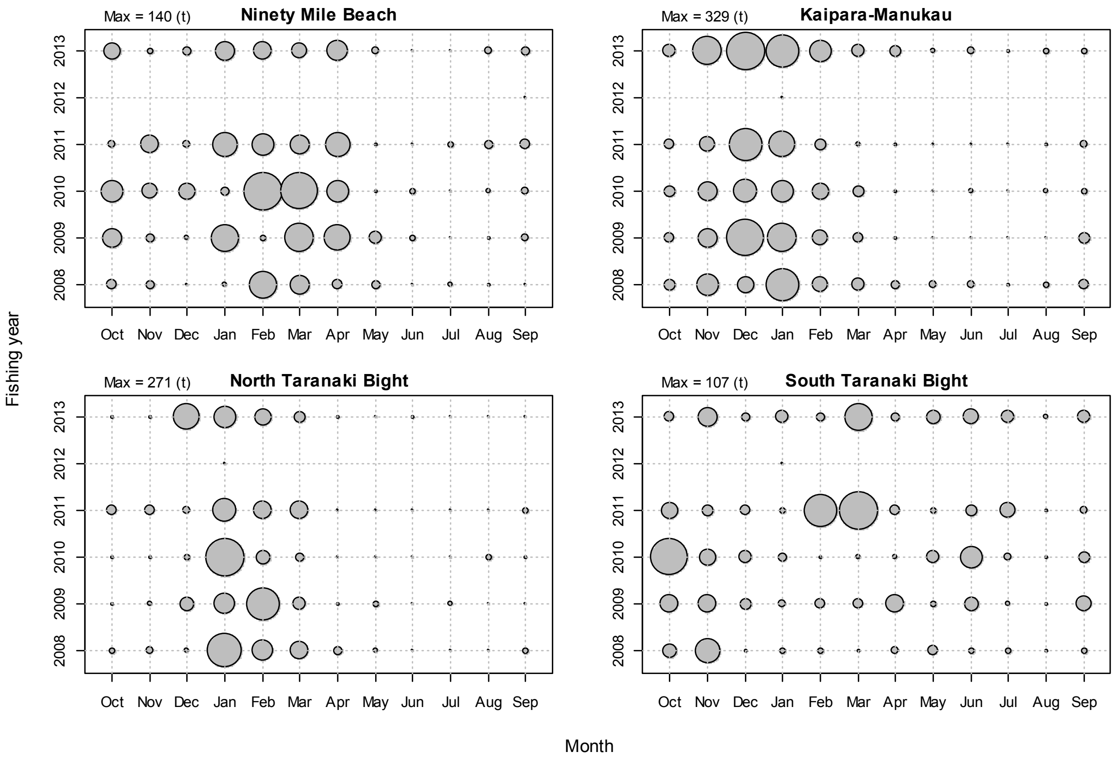



**Figure 6: Relative annual bottom trawl catch by month for the subareas of TRE 7, 2007–08 to 2012–13 excluding 2011–12. Scales differ between subareas.**

For the three northern subareas of TRE 7 the bottom trawl catch is almost exclusively a trevally target fishery with comparatively minor amounts of trevally landed when snapper or red gurnard are the target species (Figure 7, Appendix 5). For the South Taranaki Bight subarea there has been a considerable increase in catch in recent years where trevally is the target species, particularly from statistical area 040 in the north. Nevertheless, a number of other target species are also commonly reported when trevally is caught which include red gurnard, snapper, leatherjacket (*Parika scaber*), barracouta (*Thyrsites atun*), tarakihi (*Cheilodactylus macropterus*), blue warehou (*Seriolella brama*), and flatfish species (Figure 7, Appendix 5).

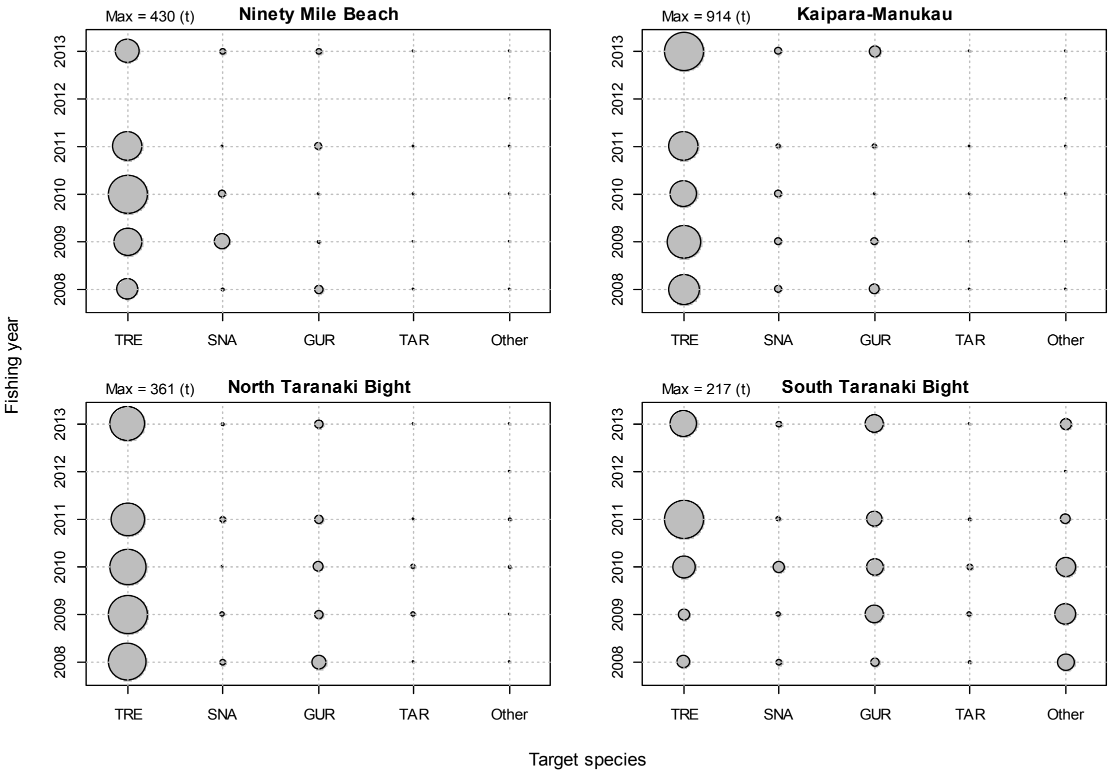



**Figure 7: Relative annual bottom trawl catch by target species for the subareas of TRE 7, 2007–08 to 2012–13 excluding 2011–12 (TRE, trevally; SNA, snapper; GUR, red gurnard; TAR, tarakihi). Scales differ between subareas.**

## 3.2 Sampling of the TRE 7 bottom trawl fishery in 2012–13

### Sample collections

Summaries of the length frequency sample sizes for bottom trawl taken from each subarea stratum within TRE 7 in 2012–13 are given in Table 3. Twenty-eight clean subarea “landing” or “at-sea” samples of a total target of 50 (see Tables 1 and 3) that met the sampling criteria (outlined in Section 2.2) were successfully sampled: seven each from Ninety Mile Beach and Kaipara-Manukau, four from North Taranaki Bight and ten from South Taranaki Bight. A total of 9728 fish were measured for length. A further 19 “landing” or “at-sea” samples were omitted from the collection, largely due to the inadequate size of the sample, most of these collected “at-sea”.

**Table 3: 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–subarea strata for the TRE 7 bottom trawl fishery in 2012–13.**

| | | Number of landings | | | No. of fish | Weight of landings (t) | | |
|---|---|---|---|---|---|---|---|---|
| Method | Subarea* | Total | Sampled | % of total | measured | Total | Sampled | % of total |
| Bottom trawl | NMB | 78 | 7 | 9.0 | 1 704 | 201 | 38 | 18.9 |
| | KMH | 186 | 7 | 3.8 | 2 954 | 1039 | 161 | 15.5 |
| | NTB | 261 | 4 | 1.5 | 2 172 | 334 | 17 | 5.1 |
| | STB | 402 | 10 | 2.5 | 2 898 | 184 | 87 | 47.3 |
| | TRE 7† | 764 | 28 | 3.0 | 9 728 | 1758 | 303 | 17.2 |

* NMB, Ninety Mile Beach; KMH, Coastal Kaipara-Manukau; NTB, North Taranaki Bight; STB, South Taranaki Bight.

† The TRE 7 bottom trawl total number of landings does not equal the combined subareas total as a vessel may fish over more than one subarea per trip

The average weight of the sampled landings from the TRE 7 bottom trawl fishery in 2012–13 was 10.796 t, with a broad range spanning 0.924 to 89.300 t. The sampled component accounted for 17% by weight and 3% by number of the total bottom trawl catch in TRE 7 in 2012–13. The number and weight of landings summarised in Table 3 is for all bottom trawl landings containing trevally (target and bycatch) caught from TRE 7.

A total of 980 otolith pairs were subsampled from TRE 7 subarea "landings" or "at-sea" length frequency samples in 2012–13, with 949 (97%) of these successfully aged (Table 4). Length distributions of otolith sample collections as a comparison to that targeted for TRE 7 subarea strata are presented in Appendix 2.

**Table 4: Details of trevally otolith samples collected in 2012–13 from TRE 7.**

| Method | Subarea* | Sampling period | Sampling method | Length range | Number collected | Number aged |
|---|---|---|---|---|---|---|
| Bottom | NMB | Jan–May 2013 | Stratified random | 27–61 | 282 | 276 |
| Trawl | KMH | Nov 2012–Apr 2013 | Stratified random | 25–60 | 267 | 260 |
| | NTB | Jan–Aug 2013 | Stratified random | 25–55 | 222 | 209 |
| | STB | Nov 2012–Jul 2013 | Stratified random | 30–59 | 209 | 204 |
| | TRE 7 | Nov 2012–Aug 2013 | Stratified random | 25–61 | 980 | 949 |

* NMB, Ninety Mile Beach; KMH, Coastal Kaipara-Manukau; NTB, North Taranaki Bight; STB, South Taranaki Bight.

## 3.3 Sampling representativeness

### Monthly catch comparisons

A temporal comparison of the monthly catch of trevally and of that sampled (weight and number of landings) for the bottom trawl method (all landings and those greater than 1 t for the three northern subareas, and greater than 500 kg for South Taranaki Bight) are presented in Figure 8 to display the seasonal patterns in the subarea fisheries and the representativeness of the sample collections. Although trevally may be caught year-round, the greatest proportion of the TRE 7 bottom trawl catch in 2012–13 was over the spring and summer months in the three northern subareas with low level catches generally spread throughout the year in South Taranaki Bight. The Kaipara-Manukau subarea stratum accounted for almost two-thirds (59%) of the TRE 7 bottom trawl catch, followed by North Taranaki Bight (19%), Ninety Mile Beach (11%), and South Taranaki Bight (10%) (see Table 3, Figure 8). Overall, the temporal sampling coverage was restricted by the availability of candidate "landings" (i.e., only where a whole "landings", and not "at-sea" samples, were available for sampling), and best represented by sampling in the Kaipara-Manukau and South Taranaki Bight subareas (Figure 8). Few candidate landings were available for sampling in the Ninety Mile Beach and North Taranaki Bight subarea strata.

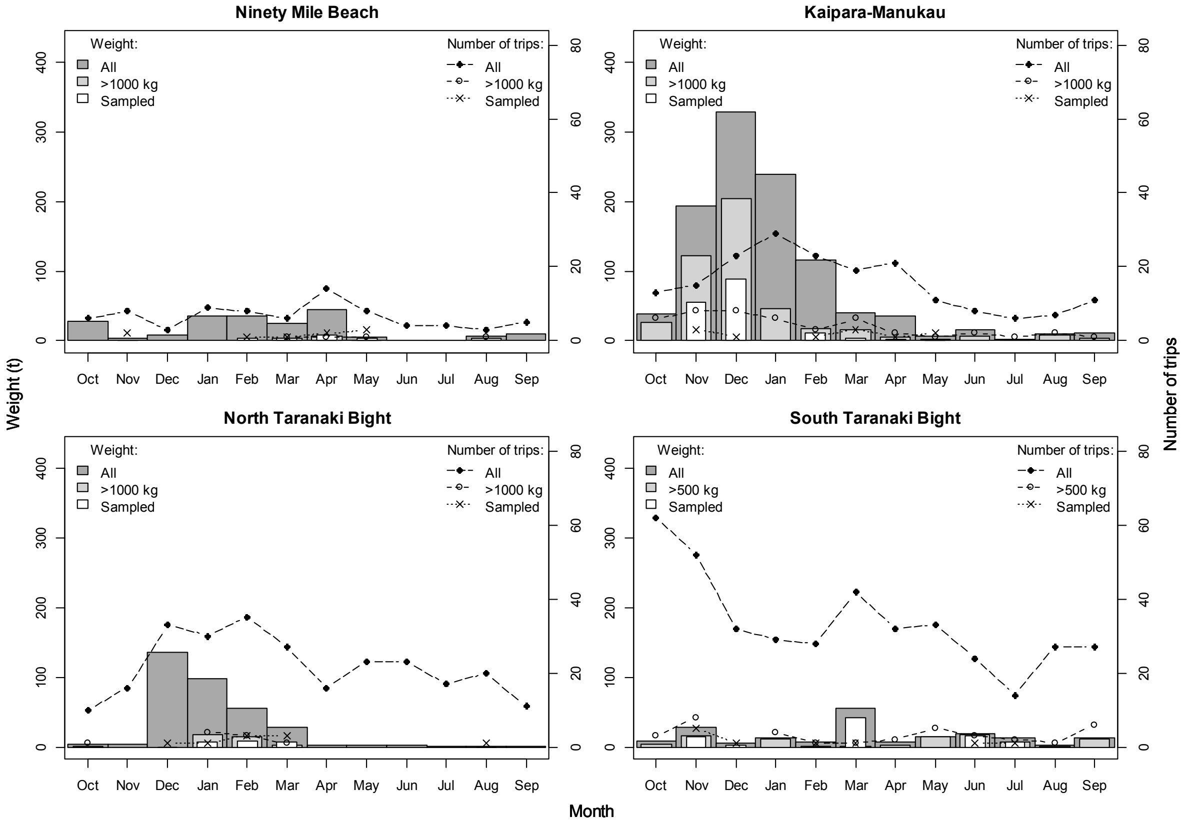



**Figure 8: Comparison of the monthly distributions of landed weight and number of landings of trevally in the TRE 7 bottom trawl subarea fisheries for all landings where trevally was caught in 2012–13. Included are corresponding estimates for all sampled landings to show representativeness of collections. Note: bars and lines are overlaid.**

The sampling performance relative to the cumulative proportion of the total number and catch weight of landings throughout the sampling period illustrates that sampling was more temporally consistent with the fishery operation for the Kaipara-Manukau, North Taranaki Bight and South Taranaki Bight subareas relative to the availability of candidate "landings", than the Ninety Mile Beach subarea (Figures 9 and 10).

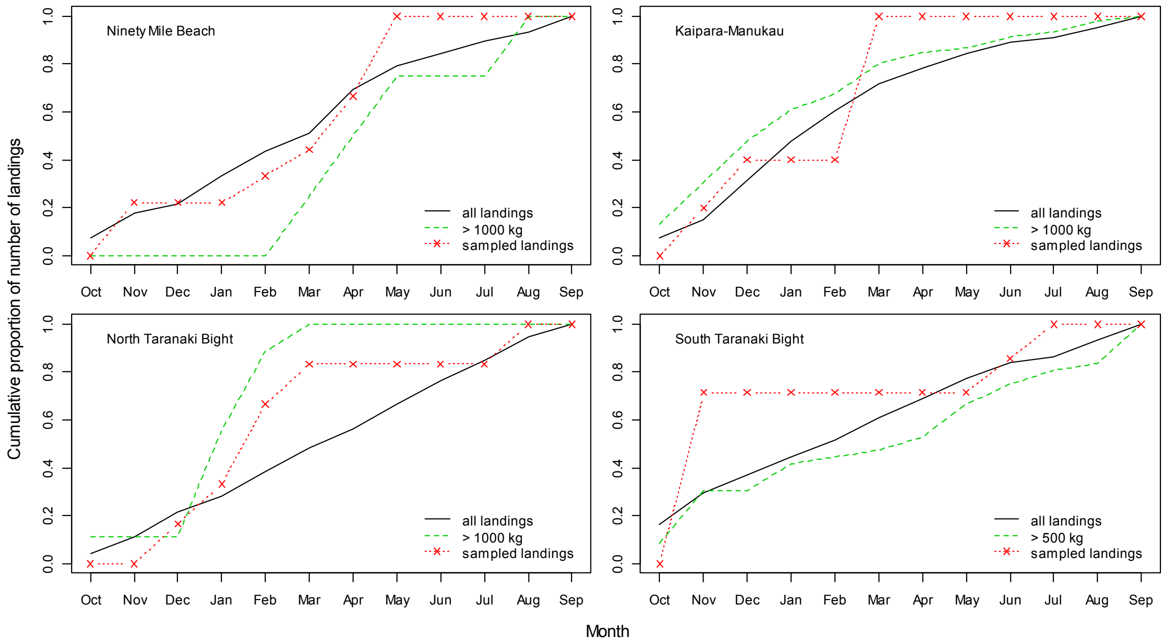



**Figure 9: Comparison of the cumulative proportion of the number of landings with samples taken from the TRE 7 bottom trawl subarea fisheries in 2012–13.**

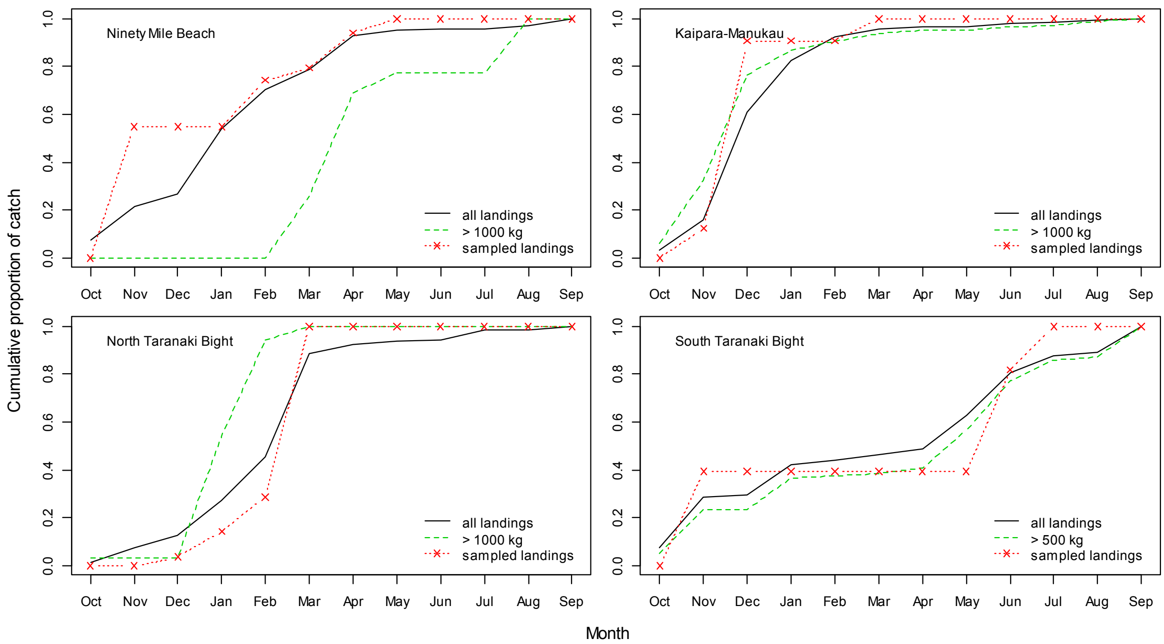



**Figure 10: Comparison of the cumulative proportion of the catch weight of landings with samples taken from the TRE 7 bottom trawl subarea fisheries in 2012–13.**

## Spatial catch, statistical area, and target species comparisons

Fine scale spatial comparisons (0.1 degree blocks) of the proportional distribution of the estimated TRE 7 bottom trawl commercial catch and sampled catch for 2012–13 shows that although a few large catches were made just south of Cape Egmont, the majority (90%) of the catch, as well as the sampled component, was taken from coastal regions between Cape Maria van Diemen and Kawhia Harbour (Figure 11). Negligible catch and samples was taken from the southern part of the South Taranaki Bight subarea (i.e. the South Island) in 2012–13. Furthermore, trevally was rarely encountered south of statistical area 036 (Figure 11). With the exception of the northern North Taranaki Bight and southern Kaipara-Manukau subareas (principally statistical area 042), the sampled component was generally spread throughout areas where the commercial bottom trawl fishery operated in 2012–13, suggesting that sampled landings, by and large, are likely to be spatially representative of the TRE 7 fishery.

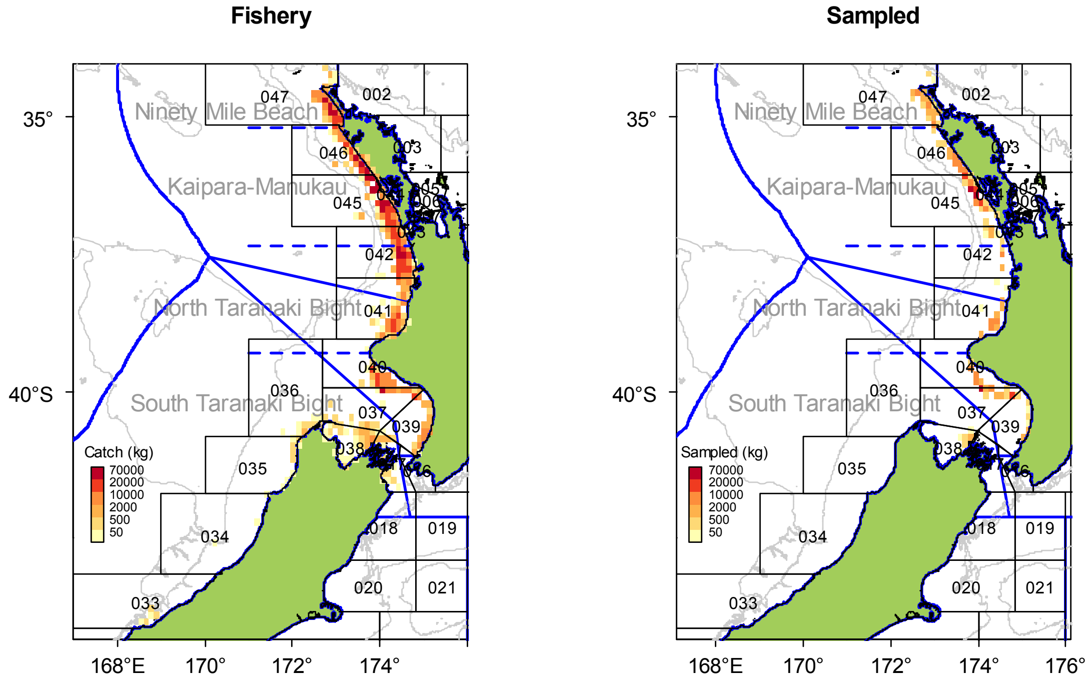



**Figure 11: Comparison of the spatial distribution of the bottom trawl catch and the sampled component for the TRE 7 stock in 2012–13.**

A comparison of the proportional distribution of the estimated bottom trawl catch of trevally with that sampled in 2012–13 for the statistical areas that make up TRE 7 is given in Figure 12. By far the greatest proportion of trevally caught by bottom trawl (approximately 40%) was from vessels fishing in statistical area 045 (coastal Kaipara Harbour region), with considerable catch also coming from the adjacent statistical areas to the north (046–047) and south (042) (see Figures 11 and 12).

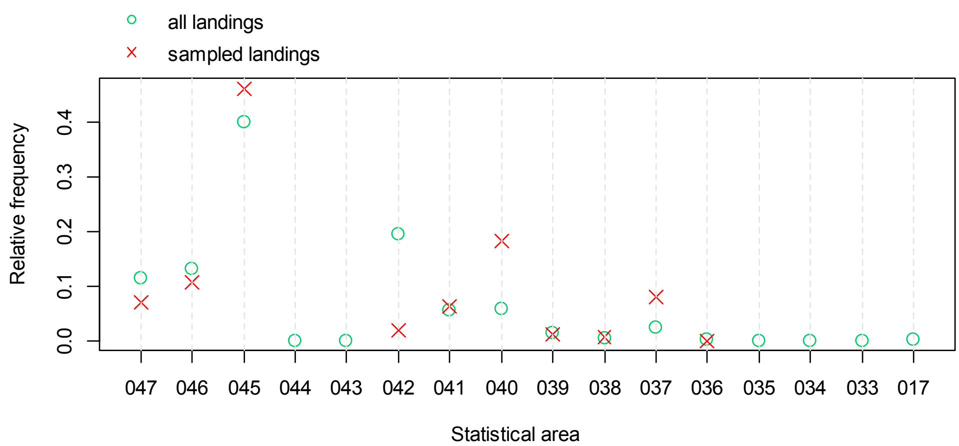



**Figure 12: Comparison of the proportional distribution of the estimated bottom trawl catch and the sampled component by statistical area over the sampling period for the TRE 7 stock in 2012–13.**

A similar comparison depicting the bottom trawl catch by target species is given in Figure 13 and shows that approximately 90% of the landed catch of trevally for the three northern subareas of TRE 7 in 2012–13, was taken by trevally targeted tows, with snapper and red gurnard the only other significant target species reported. For the South Taranaki Bight subarea, trevally targeted tows accounted for around 60% of the catch, far outweighing the catch for a dozen or so other target species regularly reported within this subarea. Despite some spatial shortfalls and low sample sizes, particularly in sampling the North Taranaki Bight stratum, the proportionality of the sampled component compared to that of the fishery suggests that sampled landings were generally representative of the operation of the TRE 7 bottom trawl fleet as a whole.

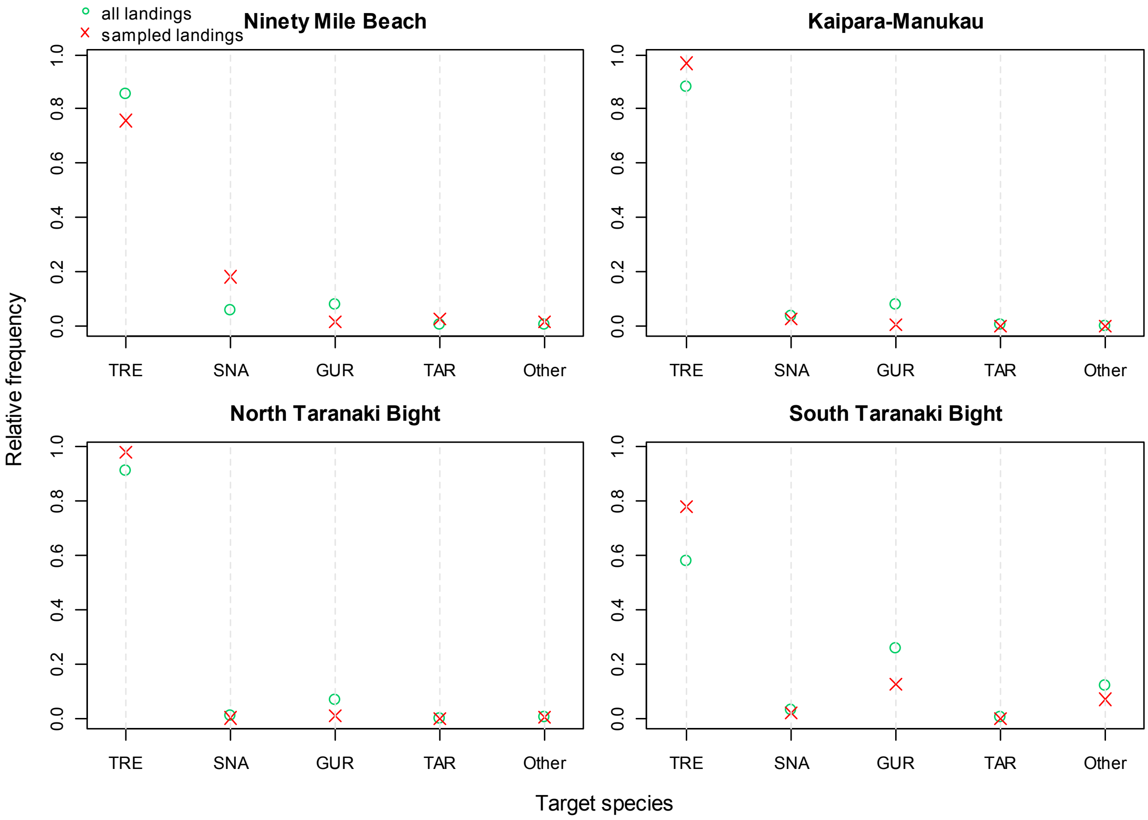



**Figure 13: Comparison of the proportional distribution of the estimated bottom trawl catch and the sampled component by target species over the sampling period for the TRE 7 bottom trawl subarea fisheries in 2012–13.**

## 3.4 Otolith readings

### Reader comparison tests for reference readings

For the 50 reference otoliths used to assess reader competency, both readers 1 and 2 achieved CV and IAPE pass mark scores below the targets set at 3.54% (CV) and 2.50% (IAPE) respectively, meaning that both readers could go on with ageing the TRE 7 otolith collection from 2012–13 to independently determine an unbiased reading estimate (Table 5).

**Table 5: Reader comparison scores determined from ageing 50 randomly selected trevally reference otolith samples ranging in age from 3 to 42 years.**

| | CV | IAPE | Agreed age | Pass/Fail |
|---|---|---|---|---|
| Target | 3.54% | 2.50% | – | – |
| Reader 1 | 2.41% | 1.71% | 76% | Pass |
| Reader 2 | 2.82% | 2.00% | 61% | Pass |

### Reader comparison tests for TRE 7 2012–13 readings

Between-reader tests with graphical comparisons for the 949 otoliths successfully aged from TRE 7 in 2012–13 are given in Figure 14 and show a reasonable level of consistency between readers. There appeared to be relatively minor systematic differences (bias) in first counts of trevally otoliths between the readers. The slight negative weighting of the histogram in Figure 14(a), the relative clustering of plotted points about the zero line in Figure 14(b), and the slight deviation from the one-to-one line on the age-bias plot for some of the older age classes (Figures 14(c)) indicate that the second reader slightly over-counted zones relative to the first reader. The overall percentage agreement between readers was 62.9%, with 70 of the 949 readings (7.4%) resulting in reader disagreement of more than 1 year. The between reader CV and IAPE were 3.49% and 2.47% respectively (Figure 14(c)) and the profiles show that precision was lowest for very young age classes and moderate across most other age classes (Figure 14(d)). Comparisons of the age-bias plots for reader 1 and 2 with the agreed age show that overall agreement was reasonable (74.9 and 90.0%) and precision highest for reader 2 with CV and IAPE estimates less than 1% (Figures 14(e) and (f)).

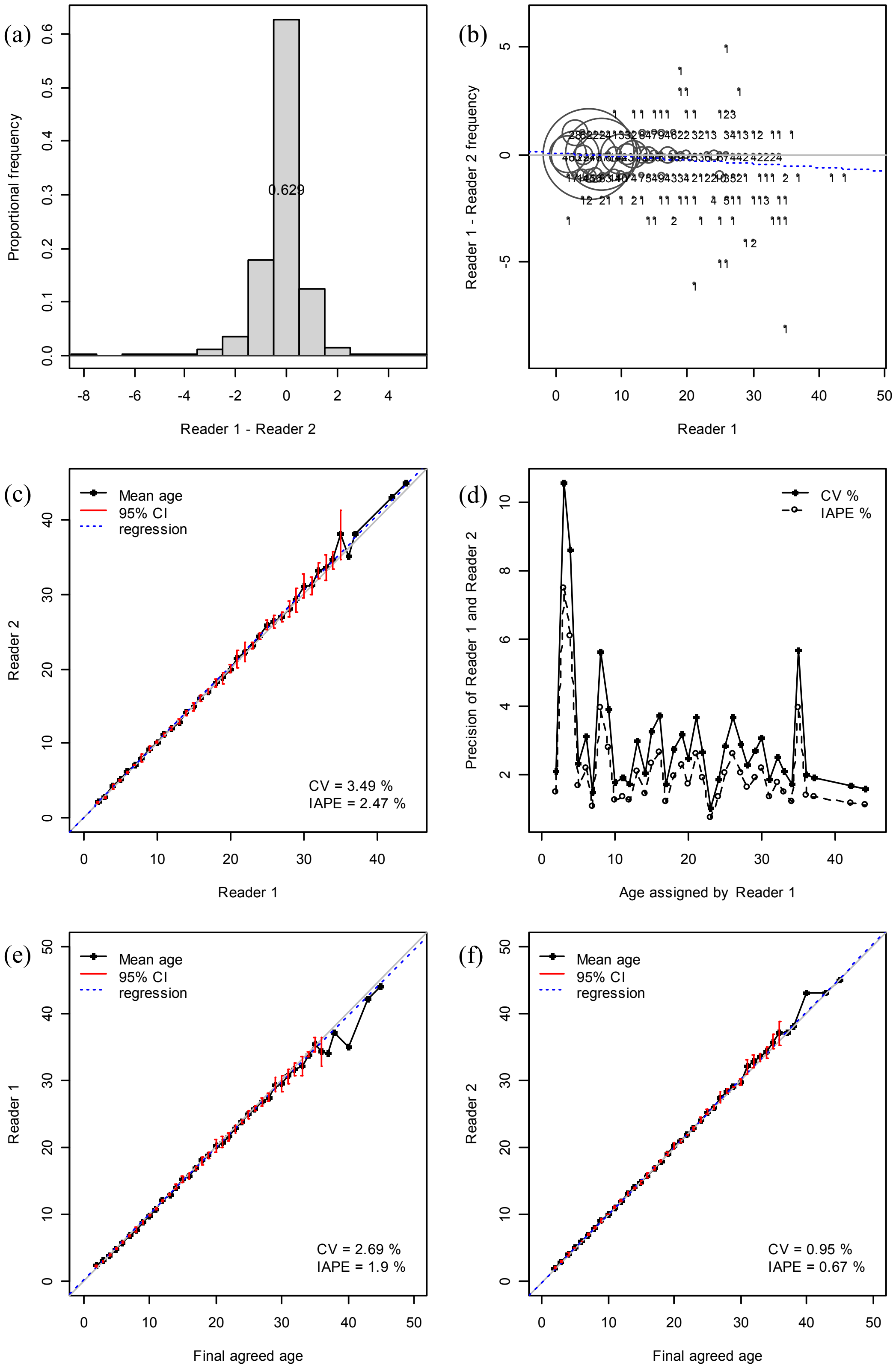



**Figure 14: Results of between-reader comparison test (reader 1 and 2) for TRE 7 otoliths collected in 2012–13 (*n* = 949): (a) histogram of differences between readings for the same otolith; (b) differences between readers for a given age assigned by reader 1; (c) bias plot between readers; (d) CV 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).**

## 3.5 Length and age distributions

For the TRE 7 fisheries in 2012–13, catch-at-age compositions (using the length frequency and age-length key approach) were derived from the combined length distributions of subarea strata, and used to identify year class strengths. Otolith collections may not have been consistent across the entire sampling period, especially from landings sampled toward the end of the season when the age-length key collection was nearly complete or when specific subarea collections were difficult to obtain. This is unlikely to bias the age characterisations because the growth of recruited trevally (i.e., those over 25 cm long) would have been relatively low over the period when length frequency collections were made. This assumption has been accepted for other species with growth rates comparable to those of trevally (Westrheim & Ricker 1978, Davies & Walsh 1995).

The TRE 7 and subarea age-length keys are presented in Appendix 6 and age-at-length scatterplots (using decimalised ages and not fishing year ages) are given in Appendix 7.

## 3.6 TRE 7 and subarea catch-at-length and catch-at-age estimates

Length and age distributions and coefficients of variation for the TRE 7 stock and subarea bottom trawl fisheries in 2012–13 are presented in Figure 15 (Appendices 8 and 9), and cumulative proportions of length and age for the subarea bottom trawl fisheries in Figure 16. Considerable variation in the length and age distributions is apparent between the subareas, with the Ninety Mile Beach and North Taranaki Bight comprising a high proportion of small and young trevally relative to the Kaipara-Manukau and South Taranaki Bight subareas where a higher proportion of larger and older fish were present. A trend of decreasing proportions of very small and young trevally down a latitudinal cline was evident in the respective subareas of TRE 7 in 2012–13 (Figure 15).

### TRE 7

The stratified length distribution for the TRE 7 bottom trawl fishery contained a broad range of fish of various sizes, with a tail extending out to over 50 cm (Figure 15, see Appendix 8). The mean length sampled from the fishery was relatively high at 40.8 cm (about 1.4 kg) and the proportion at length MWCV was 0.24. The stratified age distribution for the TRE 7 bottom trawl fishery was also broad with a reasonable level of representation across most recruited age classes up to and over 20 years, although recent recruitment for three and four year old trevally appears below average (Figure 15, see Appendices 7 and 9). Young trevally between 5 and 7 years of age (2006 to 2008 year classes) currently dominate the fishery and collectively make up one in every three fish landed in 2012–13. The 2003 year class was also prominent (10-year-olds) making up 9% of the catch and those fish 20 years and older contribute significantly (12% of the catch). The mean age of the TRE 7 distribution in 2012–13 was high at 10.6 years and the proportion at age MWCV was 0.26 (Figure 15). The oldest trevally sampled from the TRE 7 fishery in 2012–13 was 45 years old.

### Ninety Mile Beach

Landings from the Ninety Mile Beach subarea comprised a high proportion of small to moderate sized trevally between 34 and 42 cm, characterised by one main mode centred around 38 cm, with a narrow tail extending out to over 50 cm (Figure 15, see Appendix 8). The mean length sampled from the fishery was the lowest of the TRE 7 subareas at 38.3 cm, and the proportion at length MWCV was 0.30, indicative of moderate between-landing variability. Ninety Mile Beach catches were largely comprised of young trevally, those seven years and younger dominating the left hand limb, making up almost two of every three (63%) fish landed in 2012–13 (Figure 15, see Appendix 9). The 2006 year class (7-year-olds) was by far the most dominant of these, making up just under one-fifth (19%) of the annual catch. There were very low proportions of fish occupying the older age classes, the combined total over 12 years of age amounting to only 13%, inclusive of the aggregate (over 19 years) age group, which at 2% is the lowest estimate of the four subarea fisheries (Figure 15, Appendix 7). The mean age of trevally sampled from Ninety Mile Beach was 7.8 years and also the lowest subarea estimate in 2012–13, and the proportion at age MWCV was 0.33. Cumulative plots of length and age proportions indicate that the Ninety Mile Beach subarea marginally comprised the highest proportions of small and young trevally caught from TRE 7 in 2012–13 (Figure 16).

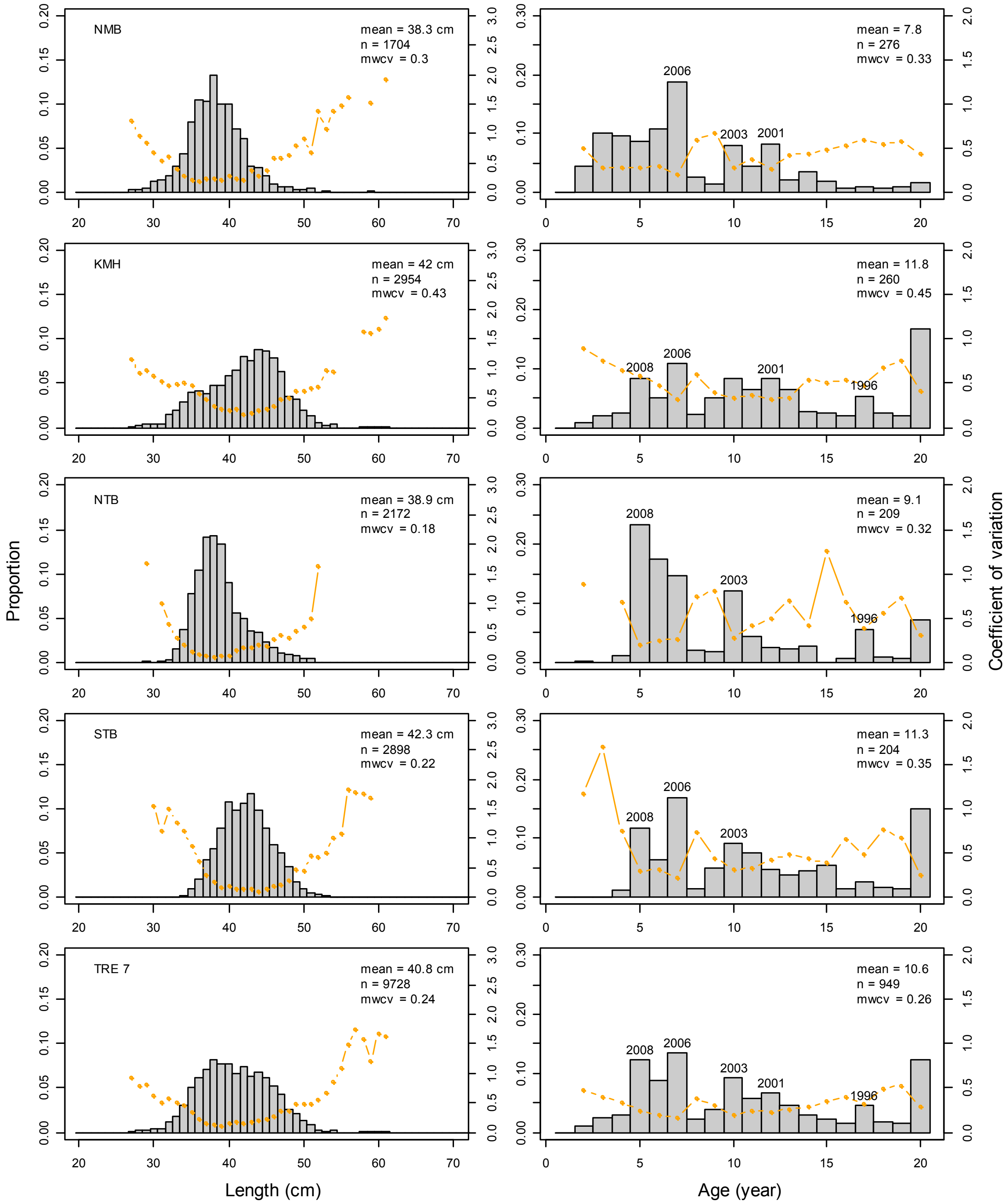



**Figure 15: Proportion at length and age distributions (histograms) and bootstrap CVs (lines) determined from trevally landings sampled from the TRE 7 and subarea bottom trawl fisheries in 2012–13 using the length frequency and age-length key approach (n, sample size; MWCV, mean weighted CV). NMB, Ninety Mile Beach; KMH, Coastal Kaipara-Manukau; NTB, North Taranaki Bight; STB, South Taranaki Bight.**

## Kaipara-Manukau

The length distribution from the Kaipara-Manukau was the broadest subarea distribution in 2012–13, comprising a good representation of small, moderate and large trevally, and characterised by one main mode centred around 44 cm, and a small poorly defined mode centred at 36 cm (Figure 15, see Appendix 8). The mean length of trevally sampled from the fishery was 42.0 cm, the second highest subarea estimate, and the proportion at length MWCV was high at 0.43, indicative of high between-landing variability. The age distribution from the Kaipara-Manukau subarea was also the broadest in TRE 7 with a good level of representation across all recruited age classes up to and over 20 years (Figure 15, see Appendices 7 and 9). The aggregate (over 19 years) age group dominated the distribution making up 17% of the landed catch by number, twice that of all other year classes in the Kaipara-Manukau subarea with the exception of 2006 (7-year-olds) which made up 11% of the catch. The mean age of trevally sampled from the fishery was 11.8 years, and the proportion at age MWCV was high at 0.45, which most likely reflects a combination of the lower sample size of age samples collected and the broadness of the age distribution. Cumulative plots of length and age proportions indicate that the Kaipara-Manukau subarea marginally comprised the highest proportions of large and old trevally caught from TRE 7 in 2012–13 (Figure 16).

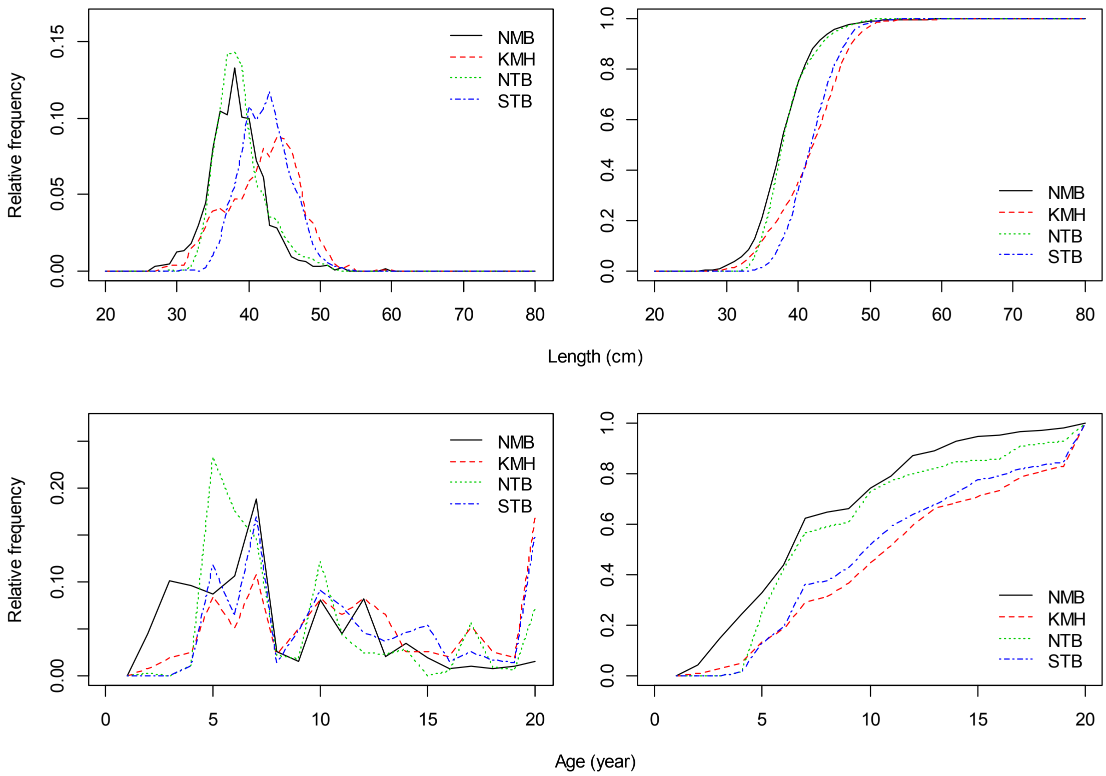



**Figure 16: Comparison of the proportion and cumulative proportion at length (top) and age (bottom) distributions determined from trevally landings sampled from the TRE 7 subarea bottom trawl fisheries in 2012–13. NMB, Ninety Mile Beach; KMH, Coastal Kaipara-Manukau; NTB, North Taranaki Bight; STB, South Taranaki Bight.**

## North Taranaki Bight

Landings from the North Taranaki Bight subarea comprised a high proportion of small to moderate sized trevally between 34 and 44 cm, characterised by one main mode centred around 38 cm, with a narrow tail extending out to 51 cm (Figure 15, see Appendix 8). The mean length sampled from the fishery was 38.9 cm and the proportion at length MWCV was 0.18, indicative of low between-landing variability. North Taranaki Bight catches were dominated by young trevally, the 2006 to 2008 year classes (5- to 7-years-olds), making up more than half the landed catch (56%) by number in 2012–13. The 2008 year class (5-year-olds) was singularly the most dominant in the fishery, making up just under one-quarter (23%) of the catch (Figure 15, see Appendix 9). With the exception of the 2003 and 1996 year classes (10- and 17-year-olds) and the aggregate (over 19 years) age group, most other age classes in the North Taranaki Bight fishery in 2012–13 comprised very low proportions of fish (Figure 15, see Appendices 7 and 9). The mean age of trevally sampled from North Taranaki Bight was 9.1 years and the proportion at age MWCV was 0.32.

### South Taranaki Bight

The South Taranaki Bight length distribution was mainly comprised of moderate to large sized trevally between 37 and 48 cm, and had a tail extending to over 55 cm (Figure 15, see Appendix 8). The mean length was marginally the highest of the TRE 7 subareas at 42.3 cm, and the proportion at length MWCV was 0.22, indicative of low between-landing variability. The South Taranaki Bight age distribution was also one of the broadest in TRE 7 with a good level of representation across all recruited age classes up to and over 20 years (Figure 15, see Appendices 7 and 9). Virtually devoid of very young fish below 5 years of age, the age distribution still comprised a high proportion of young age classes, 5- to 7-year-olds (2006 to 2008 year classes) making up over one-third (35%) of the landed catch by number in 2012–13, the 2006 and 2008 year classes individually the first and second most dominant in the fishery. The aggregate (over 19 years) age group collectively made up 15% of the catch, the second highest estimate for all TRE 7 subareas. The mean age of trevally sampled from the South Taranaki Bight subarea was also the second highest in TRE 7 at 11.3 years, and the proportion at age MWCV was high at 0.35, which most likely reflects a combination of the lower sample size of age samples collected and the broadness of the age distribution.

## 3.7 Mean length-at-age and mean weight-at-age

A trend of increasing mean weight-at-age and mean length-at-age over successive age classes up to 20 years of age was generally evident in data collected from the TRE 7 bottom trawl fishery in 2012–13 (Figure 17, Appendices 10 and 11), with slight variability occurring between subareas (Figure 18, Appendices 10 and 11). The lowest mean weight-at-age estimates for the common age classes was most often from North Taranaki Bight and Ninety Mile Beach and the highest most often from South Taranaki Bight and Kaipara-Manukau (Figure 18, Appendix 10). Mean weight-at-age for some of the young age classes (2- to 3-year-olds) may be positively biased because of the minimum legal size (MLS) restriction of 25 cm in commercial catches, and also because fish of this age range may not yet be fully recruited to the fishery (Davies et al. 2003).

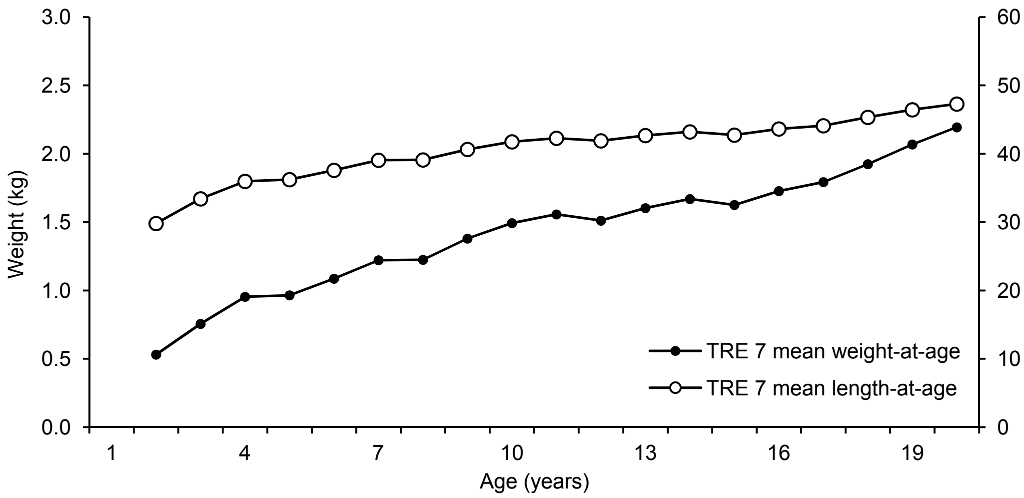



**Figure 17: Observed mean weight-at-age (small symbols) and mean length-at-age (large symbols) estimates from trevally landings sampled from the TRE 7 subarea bottom trawl fisheries in 2012–13.**

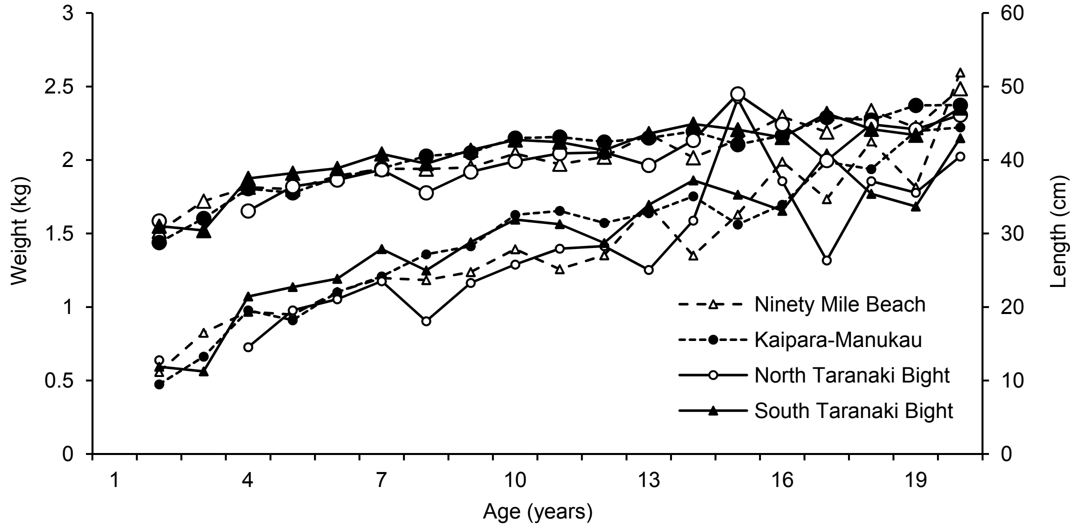



**Figure 18: Observed mean weight-at-age (small symbols) and mean length-at-age (large symbols) estimates from trevally landings sampled from the TRE 7 subarea bottom trawl fisheries in 2012–13.**

## 3.8 TRE 7 and subarea length and age distribution time series comparisons (2006–07, 2007–08, 2009–10, 2012–13)

Although a time series of length and age information from catch sampling the TRE 7 fishery spans the period 1997–98 to 2012–13 (see Appendix 1), investigation into patterns of spatial heterogeneity within the stock for three subareas (Ninety Mile Beach, Kaipara-Manukau and North Taranaki Bight combined, and South Taranaki Bight) only began in 2006–07, the same time that a rigorous approach to ageing trevally was adopted (see Section 2.2). A four year non-sequential time series (2006–07, 2007–08, 2009–10 and 2012–13) of these distributions is presented in Figures 19–22. Independent subarea collections made from the Kaipara-Manukau and North Taranaki Bight in 2012–13 were combined here for the purpose of time series comparisons described above. As the years are non-sequential, specific age classes within each time series age distribution have been annotated white for easier interpretation of cohort progression between sampling years.

### TRE 7

Length and age distributions sampled from TRE 7 bottom trawl landings have broadened considerably between 2006–07 and 2012–13 (Figure 19) with estimates of mean length and age increasing from 38.0 to 40.8 cm and 7.9 to 10.6 years respectively, over the seven year period. Despite some variability in length and age structure between years, there is good continuity in year class strength evident in the progression of most year classes over successive years, particularly those occupying the common age classes.

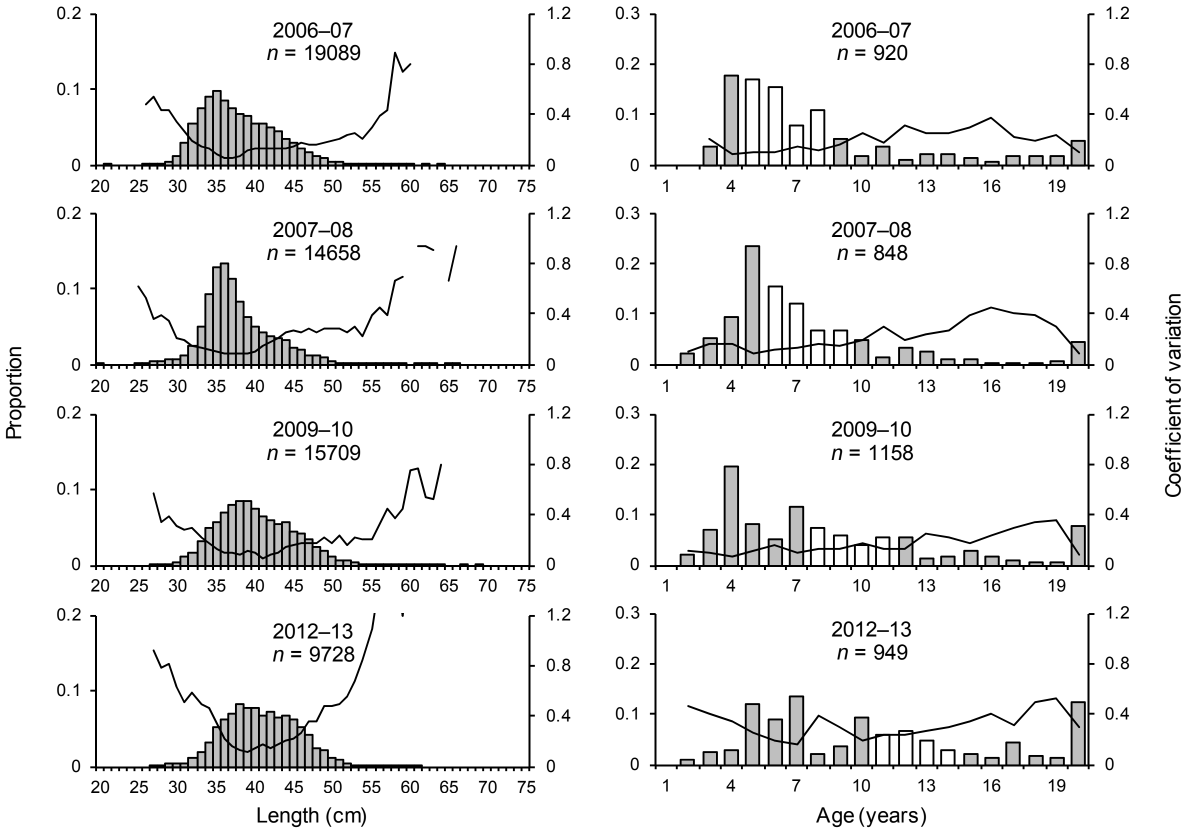



**Figure 19: Recent time series of proportion at length and age distributions (histograms) and CVs (lines) determined from trevally landings sampled from the TRE 7 bottom trawl fishery in 2006–07, 2007–08, 2009–10 and 2012–13 (*n*, sample size). White bars in the age distribution represent the 1999 to 2002 year classes.**

## Ninety Mile Beach

The length and age distributions sampled from bottom trawl landings from the Ninety Mile Beach subarea between 2006–07 and 2012–13 consistently comprised a high proportion of small and young trevally, those fish 10 years and younger accounting for 75–90% of the catch (Figure 20). Estimates of mean length ranged from 37.2 to 40.6 cm and mean age from 6.0 to 8.2 years, consistently representing the lowest age estimates sampled from the TRE 7 subarea fisheries in each respective sampling year. Some continuity of year class progression over successive years was evident, most noticeably the strong 2003 year class, 4-year-olds in 2006–07 (Figure 20). Sample sizes for both length and age collections in the 2006–07 and 2007–08 fishing years were well below targets and most likely explain some of the variability apparent in length and age structure between years.

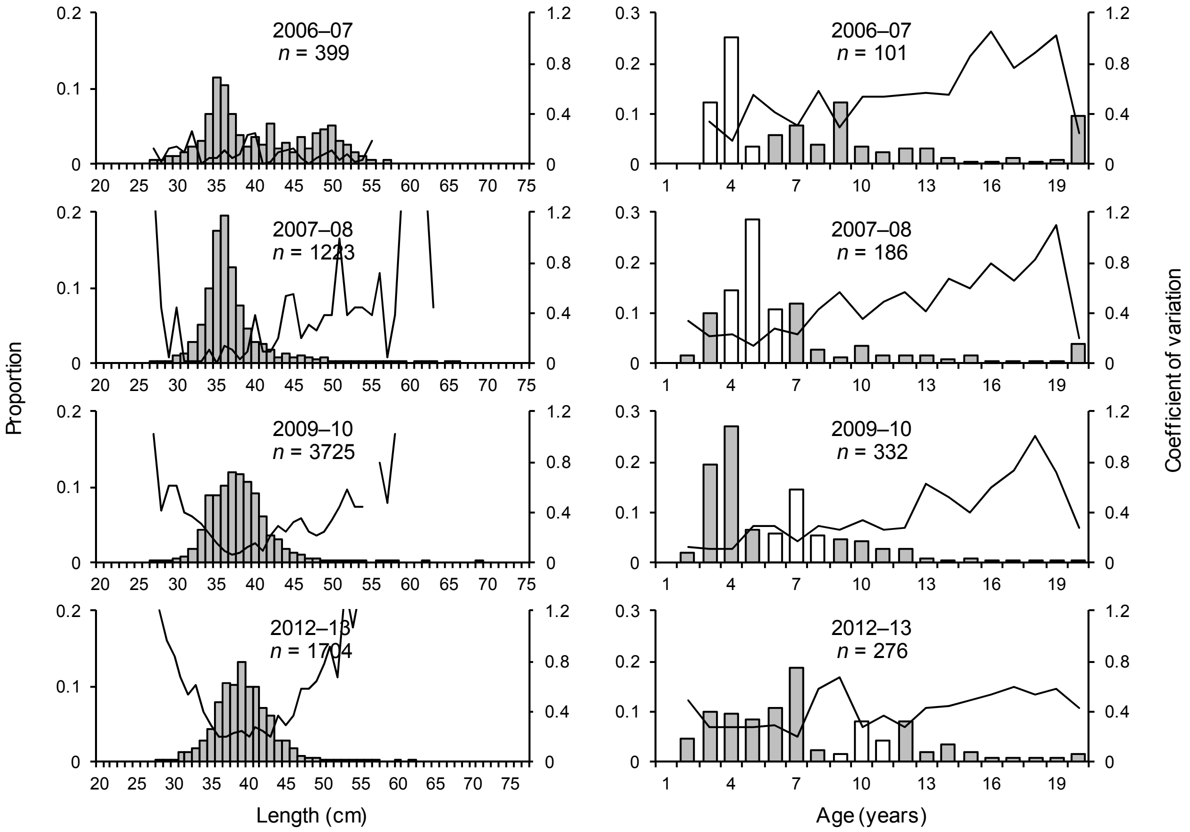



**Figure 20: Recent time series of proportion at length and age distributions (histograms) and CVs (lines) determined from trevally landings sampled from the Ninety Mile Beach subarea bottom trawl fishery in 2006–07, 2007–08, 2009–10 and 2012–13 (*n*, sample size). White bars in the age distribution represent the 2002 to 2004 year classes.**

## Kaipara-Manukau/North Taranaki Bight

Sampled bottom trawl length and age distributions from the combined Kaipara-Manukau and North Taranaki Bight subareas between 2006–07 and 2012–13 illustrate that variability in length and age is more obvious within this part of the fishery (Figure 21). As a result, continuity in year class strength progression in the Kaipara-Manukau and North Taranaki Bight time series age distributions is less evident than other subarea summaries. With the exception of samples from 2009–10, all other samples were based on comprehensive collections, although the proportion of samples associated with either the Kaipara-Manukau or North Taranaki Bight subarea is unknown. Recent reduced levels of precision in age distributions (MWCV 0.30 or greater) in 2009–10 and 2012–13 may be indicative of high between-landing variability, a broadening age composition, and increased proportion of the aggregate (over 19 years) age group (Figure 21). Estimates of mean length ranged from 38.2 to 42.8 cm and mean age from 7.9 to 11.9 years, most often second highest in TRE 7, behind those determined for South Taranaki Bight.

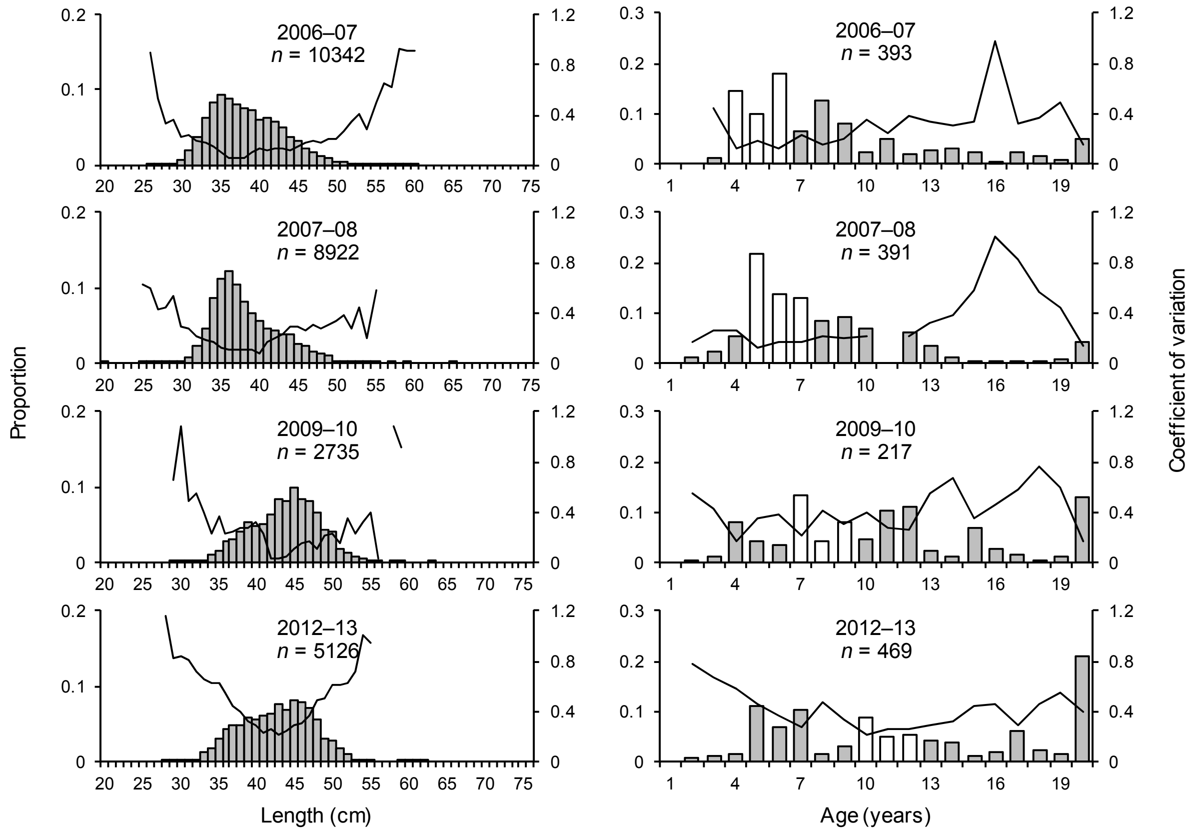



**Figure 21: Recent time series of proportion at length and age distributions (histograms) and CVs (lines) determined from trevally landings sampled from the Kaipara-Manukau/North Taranaki Bight subarea bottom trawl fishery in 2006–07, 2007–08, 2009–10 and 2012–13 (*n*, sample size). White bars in the age distribution represent the 2001 to 2003 year classes.**

## South Taranaki Bight

The length and age distributions sampled from bottom trawl landings from the South Taranaki Bight from 2006–07 and 2012–13 often comprised a relatively high proportion of moderate to large sized and old trevally (Figure 22). Estimates of mean length ranged from 42.2 to 44.6 cm and mean age from 9.4 to 14.1 years, and were most often the highest estimates sampled from the TRE 7 subarea fisheries in each respective year. Despite some variability in length and age structure between years, continuity in year class strength progression over most sampled years was generally evident. Sample sizes for both length and age collections for the 2007–08 fishing year were poor, resulting in the age distribution having low precision (MWCV 0.30).

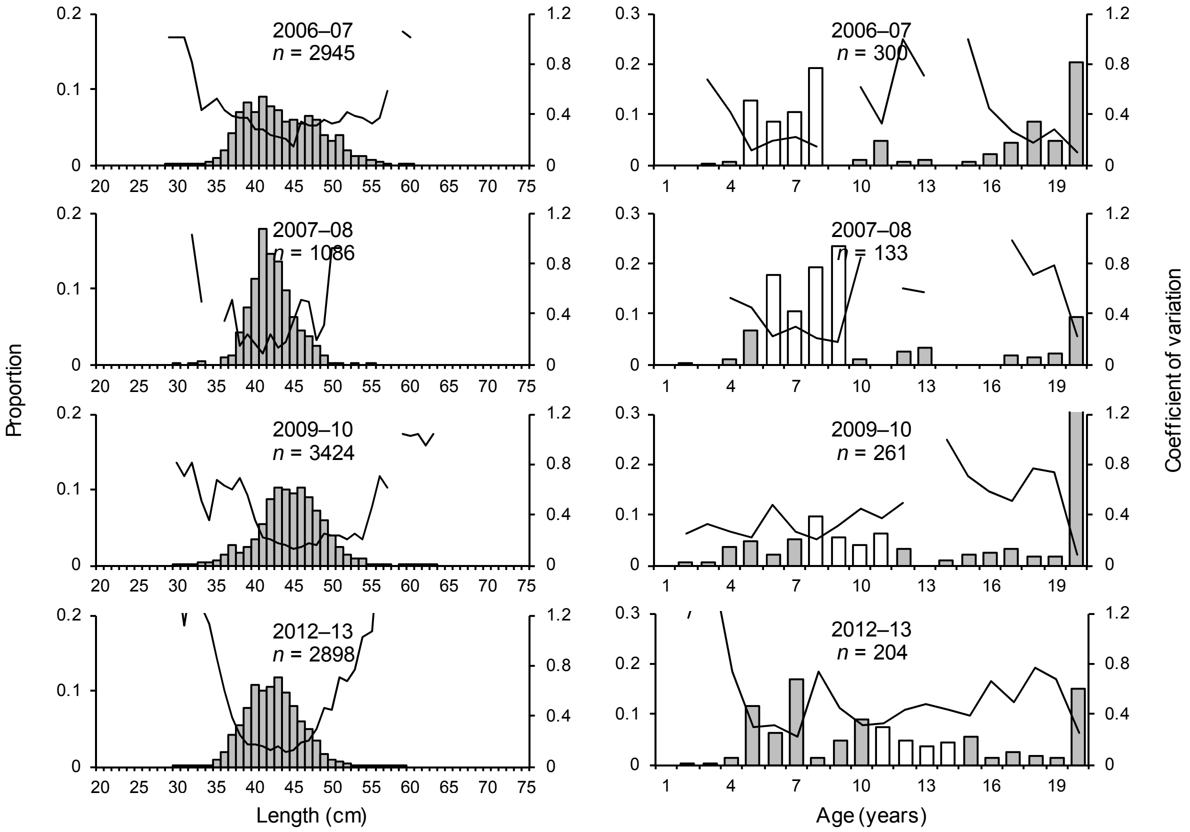



**Figure 22: Recent time series of proportion at length and age distributions (histograms) and CVs (lines) determined from trevally landings sampled from the South Taranaki Bight subarea bottom trawl fishery in 2006–07, 2007–08, 2009–10 and 2012–13 (*n*, sample size). White bars in the age distribution represent the 1999 to 2002 year classes.**

# 4. DISCUSSION

This is the eighth report to summarise the length and age compositions of trevally landings from the main fishing methods operating in TRE 7 since 1997–98, and the fourth report since 2006–07 where patterns of spatial heterogeneity within the stock have been investigated. The implementation of a revised ageing protocol to improve reader accuracy and precision in age estimation was also undertaken in 2006–07 (documented in a trevally age determination protocol by Walsh et al. (2014a)), and now means that relative year class strengths inferred from the age distributions sampled from the TRE 7 subarea fisheries since this time can be treated with a considerable level of confidence. Nevertheless, trevally otoliths can be difficult to age, and as such, some level of ageing error is always likely to be present in catch-at-age results, particularly in ageing older fish.

## Sampling landings

Walsh et al. (2010a) suggested that inadequate sample sizes from trevally catch sampling in 2006–07, may have adversely affected results, warning that in order to fully determine whether spatial variability in length and age composition exists for trevally, future sampling would require full industry (company managers and fishers) cooperation to improve on previous results, and to minimise bias in sample estimates (spatial, temporal, and size/age selective). In 2012–13, a concerted effort in fulfilling sample requirements was undertaken to ensure that only subarea samples were collected, either from "landings" or "at-sea", identified as coming from one of four subareas (Ninety Mile Beach, Kaipara and Manukau coastline, North Taranaki Bight and South Taranaki Bight). Although 28 clean subarea samples were successfully collected in 2012–13, a total of 19 other samples were omitted from the collection, mainly due to inadequate sample size, the vast majority of these from collections made "at-sea". As a result, the total number of "landing" and "at-sea" samples for all subareas from the TRE 7 fishery in 2012–13 fell short of the proposed targets, some considerably (i.e., North Taranaki Bight). However, otolith subsamples from almost all "landings" or "at-sea" length frequency samples remained useful and were utilised for subarea age-length keys.

In the previous three years of sampling the TRE 7 subarea fisheries, at least one or more subarea collections fell short of the required targets to adequately describe the length or age composition of the commercial bottom trawl catch to a satisfactory level of precision (Walsh et al. 2010a, 2010b, 2012a). Despite a high level of industry cooperation and the implementation of "at-sea" sampling, it again proved difficult to achieve sampling targets in 2012–13. Only a few industry vessels proved capable of collecting the requisite number of bins by subarea "at-sea". In all, 19 samples were excluded from the final analysis, most were from collections "at-sea", and were removed principally because sample bin totals were well short of the requisite number based on the sum of the estimated tow weight of the trevally catch. The main problem was the lack of lead-in time to adequately train and brief vessel crews on sampling requirements. This was compounded by a two–three month time lag in obtaining trip data to determine whether qualifying tows matched sample bin totals for subarea locations. There were confidentiality issues in accessing the data directly from the companies and vessels, making it difficult to get these data in a shorter time frame. Many lessons have been learned from the "at-sea" sampling process that, given continued industry support, should improve "at-sea" sampling success in future programmes. The fact that TRE 7 sampling frequency occurs one in every three years means that vessel crews, unloaders and samplers will need to receive lead-in training prior to the commencement of sampling "at-sea" if the problems experienced in the 2012–13 programme are to be avoided.

Although not yet tested for sampling TRE 7, it was recommended in May 2014 by the MPI Northern Inshore Working Group (NINSWG) that a random age sampling design replace the current length frequency and age-length key approach with the intention of increasing spatial resolution, and that simulations be undertaken to optimise sample sizes for subarea strata, and to reduce the current high MWCVs. Nevertheless, both sampling approaches have their limitations. The non-random otolith sampling design (length frequency and age-length key) can introduce bias in growth estimates from the sample length-at-age data if otoliths are not collected proportionally by length bin throughout the sampling period, particularly over extended periods. But if robust collections are maintained, an age-length key approach can ensure that every possible length bin is accounted for, the age composition therefore being well described with representation across most age classes in the fishery. In a random age sampling design for "landing" or "at-sea" samples, selection of the otolith sample can introduce bias if undertaken in a non-rigorous manner (i.e., non-random selection, all tows not sampled), nor does it account for uncommon size classes well (i.e., very small and large fish) which may be infrequently sampled, particularly if the total collection is small. Furthermore, random age frequency collections normally require twice the number of otolith samples than for an age-length key, and therefore incur twice the expense to age. The relative benefit of the two sampling approaches should be compared, in terms of resources required and the information needed to address the objectives of the sampling programme, before implementing either approach (Davies et al. 2003). Nevertheless, the continuation of a spatially specific trawl-based sampling programme with some regularity should continue to provide better information on the mortality and recruitment variation of the TRE 7 stock required for stock assessments as long as adequate sampling strategies and robust collections can be maintained to meet the target requirements, and if industry participation and cooperation is forthcoming.

### Length and age distributions

As only subarea specific data were collected from the TRE 7 bottom trawl fishery in 2012–13, a stratified design was used in analysing the length and age distributions, as opposed to an unstratified design, in which data are pooled across spatial strata (as used in analyses prior to 2009–10). The stratified design weights proportions of length and age for each stratum according to the estimated number of fish landed in that stratum, when calculating TRE 7 proportions at length and age. The total tonnage (and the estimated number of trevally) landed by bottom trawl from the Kaipara-Manukau subarea in 2012–13 was approximately half as large again as the combined total of all three other subarea fisheries together (i.e., Ninety Mile Beach, North Taranaki Bight, South Taranaki Bight), resulting in the results for the stratified age composition for the TRE 7 bottom trawl fishery in 2012–13 closely resembling the Kaipara-Manukau subarea stratum (see Figure 15). Because of spatial heterogeneity in length and age within TRE 7 and the fact that the relative fishing effort for each subarea may change between years, estimates of proportion at length and age (and the means) are also likely to vary due to the weighting process of the stratified design used. Although negligible differences were found between stratified and unstratified TRE 7 proportion at length and age estimates in 2012–13, some caution should be taken when making comparisons between combined TRE 7 yearly estimates in respect to the status of the fishery i.e., the high estimate for the aggregate (over 19 years) age group in 2012–13 (Appendix 12).

The TRE 7 length composition in 2012–13 was broad with good representation of small, medium and large sized trevally and had a high mean of 40.8 cm. The estimate of mean age of 10.6 years also reflects a broad age distribution with good representation across most age classes, including a high proportion of young fish (5- to 7-years-old) collectively making up more than one-third of the catch by number, as well as a significant proportion (12%) of fish 20 or more years of age, the highest estimate determined for TRE 7 since sampling began in 1997–98.

### Spatial patterns in length and age

Similar to findings since 2006–07 (Walsh et al. 2010a, 2010b, 2012a), the length and age distributions for the TRE 7 subarea fisheries in 2012–13 further confirm that heterogeneous patterns exist within TRE 7 on a moderate spatial scale along a latitudinal cline from the north to the south. Like previous years, this fourth year addition to the time series of proportion at age data for the three subarea fisheries (Ninety Mile Beach, Kaipara-Manukau and North Taranaki Bight combined, and South Taranaki Bight) has further reinforced the evidence that relative year class strengths vary among subareas, and that continuity from one year to the next within each subarea is indicative of spatial heterogeneity in age within TRE 7. This persistent feature also suggests that more than one biological stock may be present, and is consistent with what is known from tagging studies in that trevally movement between areas is limited with most fish (88%) captured within 30 nautical miles of release sites (James 1980). Given the consistency of heterogeneous patterns in age structure in TRE 7, it is highly likely that the vast majority of fish probably reside within the same spatial strata from year to year, indicative of low levels of stock and subarea mixing, similar to that determined from tagging studies of west coast snapper (Walsh et al. 2006c).

Even though persistent spatial differences in proportion at age exist across time in TRE 7, there has always been some level of consistency in relative year class strengths between some subareas, particularly those to the north (Ninety Mile Beach, Kaipara-Manukau and North Taranaki Bight), and mostly for young trevally i.e., such as the 2003 to 2006 year classes, while such similarities were often far less apparent for South Taranaki Bight. The positioning of subarea boundaries and internal spatial patterns of fishing effort, which may occur within any subarea (i.e., combined Kaipara-Manukau/NorthTaranaki Bight, South Taranaki Bight) are likely to contribute to the apparent inter-annual proportion at age variability and are being investigated in a current project on the stock assessment of TRE 7 (TRE2013-02). Even so, any variability in relative year class proportions between the TRE 7 subareas may also be due to the variable recruitment specific to a stock (a reflection of unique environmental conditions), growth differences, and fishing mortality differences. Only a tagging programme would clarify the level of connectivity between the subareas of TRE 7, as has been done for SNA 8 (Gilbert et al. 2005).

### Ninety Mile Beach

Sample collections from the Ninety Mile Beach subarea have consistently been dominated by a high proportion of small young trevally (Walsh et al. 2010a, 2010b, 2012a), with generally few large and old fish present. This remains largely unchanged in 2012–13 when two in every three fish landed by bottom trawl were 7 years and younger, and low proportions occupy the right hand limb of the age distribution. Nevertheless, there is good continuity in year class strength progression between recent years, particularly 2009–10 and 2012–13 where both years have robust otolith collections and precision is moderate. However, inconsistencies in sample collections occur, particularly in 2006–07 when sample sizes were poor, and hinder the time series results.

### Kaipara-Manukau and North Taranaki Bight

The combined Kaipara-Manukau and North Taranaki Bight subareas catch-at-age distribution in 2012–13 has continued to broaden from that seen in previous years, and although a lack of continuity is present for a few year classes over some years in the time series, by and large, some progression of year classes is evident, particularly between 2009–10 and 2012–13. Where early samples in the four year time series mainly comprised trevally of small to moderate size and age, recent samples now comprise a higher proportion of moderate to large size and older age. Although sample sizes for 2012–13 were high, considerable heterogeneity remains present within the combined Kaipara-Manukau and North Taranaki Bight subarea, with MWCVs for length and age distributions of 39% and 36% respectively, indicative of high between-landing variability. Such variation is almost certainly related to the positioning of subarea boundaries and internal spatial patterns of fishing effort as described above, as independent length and age compositions derived for these two subareas in 2012–13 appear quite diverse. The Kaipara-Manukau subarea comprises a much broader range of fish for size and age, and was determined with low precision, whereas the North Taranaki Bight subarea is dominated by a high proportion of small young fish and was determined with high precision. Such year to year variation in fishing patterns may provide an explanation for the escalation of the aggregate (over 19 years) age group to over 20% of the catch in the combined Kaipara-Manukau and North Taranaki Bight subarea estimate in 2012–13. Similar to previous years, the Kaipara-Manukau subarea was the mainstay of the TRE 7 fishery in 2012–13, and received by far the greatest fishing pressure, landing around 60% of the total bottom trawl catch, while North Taranaki Bight accounted for around 20%.

### South Taranaki Bight

Previous sampling of the South Taranaki Bight subarea has demonstrated length and age samples to be the most different to all other subareas in TRE 7 (James 1984, Walsh et al. 1999, Langley 2001, Walsh & McKenzie 2009, Walsh et al. 2010a, Walsh et al. 2010b). In 2012–13 however, such differences were less apparent, particularly with age. In previous years of sampling South Taranaki Bight, there had been a paucity of age data for specific age ranges and an overwhelming dominance of old fish in the aggregate (over 19 years) age group. However, increased fishing effort in 2012–13 concentrated in the northern region of the South Taranaki Bight stratum, principally statistical areas 037 and 040, has meant that a high proportion of the sample collection also came from there (see Figure 11), rather than the northern South Island (i.e., Tasman and Golden Bays), as occurred in some years. As a result, relative year class strengths for South Taranaki Bight in 2012–13 appear more aligned with those subareas in the north of TRE 7 and there appears to be more representation across all age classes than ever before, which is likely to be an effect of the positioning of subarea boundaries and internal spatial patterns of fishing effort as previously described above. With the exception of 2007–08 where sample sizes were poor, most other year collections from South Taranaki Bight can be considered adequate descriptions of the length and age composition of the catch.

### Comparison of relative year class strengths in TRE 7 and TRE 1

In the early 1990s, only minor similarities in relative year class strengths in bottom trawl catches from the TRE 1 and TRE 7 stocks were apparent when sampling was conducted concurrently in both fisheries (Walsh et al. 1999, 2000). However, following the implementation of a revised ageing protocol to improve reader accuracy and precision in age estimation in 2006–07, some similarities in year class strength between East Northland and Ninety Mile Beach during concurrent (Walsh et al. 2010a, 2010b) and non-concurrent sampling (Walsh et al. 2012a) of both trevally stocks were apparent. During 2012–13, sampling was undertaken concurrently in both TRE 1 and TRE 7, and similarities in year class strengths between the stocks were again evident, more so between the TRE 7 subareas and East Northland, than the Bay of Plenty (Walsh et al. 2014c). Although trevally movement is known to be limited (James 1980), the similarities in year class strengths between the northern boundaries of TRE 1 and the subareas of TRE 7 are likely to be related to an environmental driver such as water temperature (outlined in the paragraph below), although the presence, at times, of very large fast growing fish in East Northland and Ninety Mile Beach (James 1984, Walsh et al. 1999, 2000, 2010b), may indicate some linkage between these adjacent subareas.

### Comparison of relative year class strengths in TRE 7 and SNA 8

Similarities in relative year class strengths for trevally from the combined Kaipara-Manukau and North Taranaki Bight subareas in 2007–08 (Walsh et al. 2010b) and TRE 7 in 2009–10 (Walsh et al. 2012a) were found to correlate well with those for snapper from SNA 8 for the same fishing years, particularly for young fish (Walsh et al. 2009, 2011). Despite some anomalies, comparisons made between TRE 7 and SNA 8 catch-at-age estimates for 2012–13 (Walsh et al. 2014d) were also obvious, with consistency evident also for young fish, particularly the 2004 to 2008 year classes (5- to 9-year-olds) (Appendix 13), given selectivity differences between the species and the relative exploitation status of the respective populations. Walsh et al. (2012a) reported that recruitment strength variability in TRE 7 and SNA 8 is likely to be driven by water temperature, similar to the relationship modelled for snapper in the Hauraki Gulf (Francis 1993), although this is likely to vary over the geographic range of the stocks due to the different hydrodynamic and recruitment processes between the two species.

### Precision and representativeness in catch-at-age

Despite shortfalls in sampling with 19 samples omitted from the TRE 7 bottom trawl collections in 2012–13, reasonably comprehensive length (9728 measurements) and age (949 otoliths) samples were still achieved, and temporal and spatial fishing and sampling effort generally suggested an adequate level of representativeness. The combined TRE 7 length and age distributions had moderate levels of precision, with MWCVs of 0.24 and 0.26 respectively, reflective of some variability between subarea fisheries, but still fell below the target goal of the project of 0.30. Precision on subarea bottom trawl length and age distributions in 2012–13 was highly variable, with MWCVs ranging from 0.18 to 0.45, reflective of lower sample sizes and heterogeneity between sample collections. The highest MWCV estimate for catch-at-age was determined for the Kaipara-Manukau subarea (0.45) and may be indicative of the high between-landing variance, a broad age distribution and the high proportions of old fish present in 2012–13. However, as very small and large trevally were largely absent from subarea length and age collections in 2012–13, the full size range of the age-length key target (about 300 otoliths) was not achieved, but the age-length key did meet the size ranges of trevally available in the respective fisheries (see Appendix 2). The decision by the NINSWG that a random age sampling design will replace the current length frequency and age-length key approach with the intention of increasing spatial resolution, should alleviate shortfalls in otolith sample sizes and therefore precision for future collections from TRE 7, as long as subarea sample targets are met and industry participation and cooperation is forthcoming.

The potential for differences in the subarea length and age compositions highlights the importance of ensuring that the sampling coverage is representative of the areal distribution of the entire fishery to ensure the collection of an unbiased sample of the length (Langley 2002) and age (Walsh et al. 2010b) composition of the catch. This may be dependent on changes in spatial fishing pattern and if the relative catch by subarea varies from year to year, as has occurred in 2012–13, with considerably more effort directed toward the Kaipara-Manukau subarea and northern region of South Taranaki Bight. As comprehensive length and age samples from the South Taranaki Bight subarea were only included in TRE 7 collections in recent years (2006–07, 2007–08, 2009–10, 2012–13), previous collections may not be entirely comparable because of the level of spatial heterogeneity that is present within the stock, and because of recent improvements in reader accuracy and precision in age estimation.

It is fundamental that future sampling in TRE 7 should ensure that all length and age data are representative of the areal distribution of the entire fishery, and that the optimised targets of numbers of landings and otolith samples in the catch sampling design are firmly adhered to.

### Mean weight-at-age

Length stratification of otolith samples, such as was used in the fixed allocation for TRE 7 subarea otolith collections in 2012–13, has been known to introduce bias in estimates of mean weight- and length-at-age, and consequently in growth parameters (Goodyear 1995). To estimate catch-at-age, the otolith samples presented here have been adjusted to reflect the length composition of the fishery and are therefore unbiased. Consequently, the estimates of mean weight- and length-at-age may be suitable for gross comparisons in growth variability between the subareas of TRE 7 in 2012–13; differences possibly related to spatial and genetic factors within the TRE 7 stock.

Similar to previous years, mean weight-at-age estimates in 2012–13 were generally highest from the South Taranaki Bight (younger age classes) and Kaipara-Manukau (older age classes) subareas, while estimates for the North Taranaki Bight and Ninety Mile Beach were regularly the lowest in TRE 7. Spatial and temporal variability in mean weight-at-age estimates have also been found in snapper and are thought to be due to differences in regional exploitation levels, recruitment rates, and different rates of somatic growth (Davies et al. 2003, Walsh et al. 2006a, 2006b, 2006c, 2011, 2014b). If spatial and/or temporal variation in growth exist within the TRE 7 stock or subarea strata, then it is likely that the predicted estimates presented here will not be suitable descriptions of the stock. Observed mean length-at-age estimates for the TRE 7 subarea fisheries follow the same patterns seen in mean weight-at-age estimates.

The oldest trevally sampled from the TRE 7 fishery in 2012–13 was 45 years old, and samples aged by James (1984) from collections undertaken in the 1970s determined maximum age estimates of 47 years.

## 5. ACKNOWLEDGMENTS

We thank Dave Fisher and Colin Sutton, and the stock monitoring team for their prompt and efficient handling and storage of data; Christopher Dick (MPI) for the provision of data from the catch effort return system; Darren Parsons for reviewing this report and providing some helpful comments. Funding for this project, TRE201202, was provided by the Ministry for Primary Industries. Trident Systems coordinated and arranged the catch sampling events and managed sample collections.

## 6. REFERENCES

Beamish, R.J.; Fournier, D.A. (1981). A method for comparing the precision of a set of age determinations. *Canadian Journal of Fisheries and Aquatic Sciences 38*: 982–983.

Campana, S.E.; Annand, M.C.; McMillan, J.I. (1995). Graphical and statistical methods for determining the consistency of age determinations. *Transactions of the American Fisheries Society 124*: 131–138.

Chang, W.Y.B. (1982). A statistical method for evaluating the reproducibility of age determination. *Canadian Journal of Fisheries and Aquatic Sciences 39*: 1208–1210.

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.; 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.

Francis, M.P. (1993). Does water temperature determine year class strength in New Zealand snapper (*Pagrus auratus*, Sparidae)? *Fisheries Oceanography 2(2)*: 65–72.

Francis, R.I.C.C; Bian, R. (2011). Catch-at-length and -age User Manual, National Institute of Water & Atmospheric Research Ltd. Unpublished report. 83 p.

Gilbert, D.J.; McKenzie, J.R.; Watson, T.G.; Davies, N.M. (2005). Etag-est, a tag-recapture abundance estimator, applied to west coast North Island New Zealand snapper (*Pagrus auratus*). Final Research Report for Ministry of Fisheries Research Project SNA2000/03, Objective 10.3. (Unpublished report held by Ministry for Primary Industries, Wellington.)

Goodyear, C.P. (1995). Mean size at age: An evaluation of sampling strategies with simulated red grouper data. *Transactions of the American Fisheries Society 124*: (5) 746–755.

James, G.D. (1980). Tagging experiments on trawl-caught trevally, *Caranx georgianus*, off north-east New Zealand, 1973–79. *New Zealand Journal of Marine and Freshwater Research 14 (3)*: 249–254.

James, G.D. (1984). Trevally, *Caranx georgianus* Cuvier: age determination, population biology, and the fishery. *Fisheries Research Bulletin 25.* 52 p.

Langley, A.D. (2001). Length and age composition of trevally in commercial landings from TRE 1 and TRE 7, 1999–2000. *New Zealand Fisheries Assessment Report 2001/42.* 32 p.

Langley, A.D. (2002). Length and age composition of trevally in commercial landings from TRE 1 and TRE 7, 2000–01. *New Zealand Fisheries Assessment Report 2002/19.* 34 p.

Langley, A.D. (2009). Length and age composition of trevally in commercial landings from TRE 1 and TRE 7, 2005–06. *New Zealand Fisheries Assessment Report 2009/31.* 23 p.

Ministry for Primary Industries (2014). Fisheries Assessment Plenary, May 2014: stock assessments and stock status. Compiled by the Fisheries Science Group, Ministry for Primary Industries, Wellington, New Zealand.1381 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.

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

Stevens, D.W.; Kalish, J.M. (1998). Validated age and growth of kahawai (*Arripis trutta*) in the Bay of Plenty and Tasman Bay. *NIWA Technical Report 11.* 33 p.

Tracey, D.M.; Horn, P.L. (1999). Background and review of ageing orange roughy (*Hoplostethus atlanticus*, Trachichthyidae) from New Zealand and elsewhere. *New Zealand Journal of Marine and Freshwater Research 33*: 67–86.

Walsh, C.; Buckthought D.; McKenzie, J. (2011). Length and age composition of commercial snapper landings in SNA 8, 2009–10. *New Zealand Fisheries Assessment Report 2011/16.*

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.

Walsh, C.; Davies, N.M.; Rush, N.; Buckthought, D.; Smith, M. (2006a). Age composition of commercial snapper landings in SNA 1, 2004–05. *New Zealand Fisheries Assessment Report 2006/39.* 34 p.

Walsh, C.; Davies, N.M.; Rush, N.; Middleton, C.; Smith, M.; Newmarch, G. (2006b). Length and age composition of commercial snapper landings in SNA 1, 2003–04. *New Zealand Fisheries Assessment Report 2006/7.* 46 p.

Walsh, C.; Horn, P.; McKenzie, J.; Ó Maolagáin, C.; Buckthought, D.; Sutton, C. (2014a). Age determination protocol for trevally (*Pseudocaranx dentex*). *New Zealand Fisheries Assessment Report 2014/52.*

Walsh, C.; McKenzie, J. (2009). Review of length and age sampling for trevally in TRE 1 and TRE 7 from 1997–98 to 2002–03. *New Zealand Fisheries Assessment Report 2009/14.* 56 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.; McKenzie, J.; Bian, R.; Armiger, H.; Rush, N.; Smith, M.; Spong, K.; Buckthought, D. (2014b). Age composition of commercial snapper landings in SNA 1, 2012–13. *New Zealand Fisheries Assessment Report 2014/55.*

Walsh, C.; McKenzie, J.; Bian, R.; Buckthought, D.; Armiger, H.; Ó Maolagáin, C.; Spong, K. (2014c). Length and age composition of commercial trevally landings in TRE 1, 2012–13. *New Zealand Fisheries Assessment Report 2014/65.*

Walsh, C.; McKenzie, J.; Buckthought, D.; Armiger, H.; Ferguson, H.; Smith, M.; Spong, K.; Miller, A. (2011). Age composition of commercial snapper landings in SNA 1, 2009–10. *New Zealand Fisheries Assessment Report 2011/54.*

Walsh, C.; McKenzie, J.; Buckthought, D.; Bian, R.; Armiger, H. (2014d). Length and age composition of commercial snapper landings in SNA 8, 2012–13. *New Zealand Fisheries Assessment Report 2014/63.*

Walsh, C.; McKenzie, J.M.; Buckthought, D.; Ó Maolagáin, C.; Bian, R. (2012a). Length and age composition of commercial trevally landings in TRE 7, 2009–10. *New Zealand Fisheries Assessment Report 2012/41.* 51 p.

Walsh, C.; McKenzie, J.; Ó Maolagáin, C.; Buckthought, D.; Blackwell, R.; James, G.D.; Rush, N. (2010a). Length and age composition of commercial trevally landings in TRE 1 and TRE 7, 2006–07. *New Zealand Fisheries Assessment Report 2010/9.* 62 p.

Walsh, C.; McKenzie, J.; Ó Maolagáin, C.; Buckthought, D.; Blackwell, R.; James, G.D. (2010b). Length and age composition of commercial trevally landings in TRE 1 and TRE 7, 2007–08. *New Zealand Fisheries Assessment Report 2010/22.* 57 p.

Walsh, C.; McKenzie, J.; Ó Maolagáin, C.; Buckthought, D.; James, G.D. (2012b). Length and age composition of commercial trevally landings in TRE 1, 2008–09. *New Zealand Fisheries Assessment Report 2012/04.* 42 p.

Walsh, C.; McKenzie, J.; O Maolagain, C.; Stevens, D. (2000). Length and age composition of commercial trevally landings in TRE 1 and TRE 7, 1998–99. Final Research Report for MFish Research Project TRE9801 Objective 1. 24 p. (Unpublished report held by Ministry for Primary Industries, Wellington).

Walsh, C.; McKenzie, J.; Ó Maolagáin, C.; Stevens, D.; Tracey, D. (1999). Length and age composition of trevally in commercial landings from TRE 1 and TRE 7, 1997–98. *NIWA Technical Report 66*. 39 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*. 9 p.

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.

## 7. APPENDICES

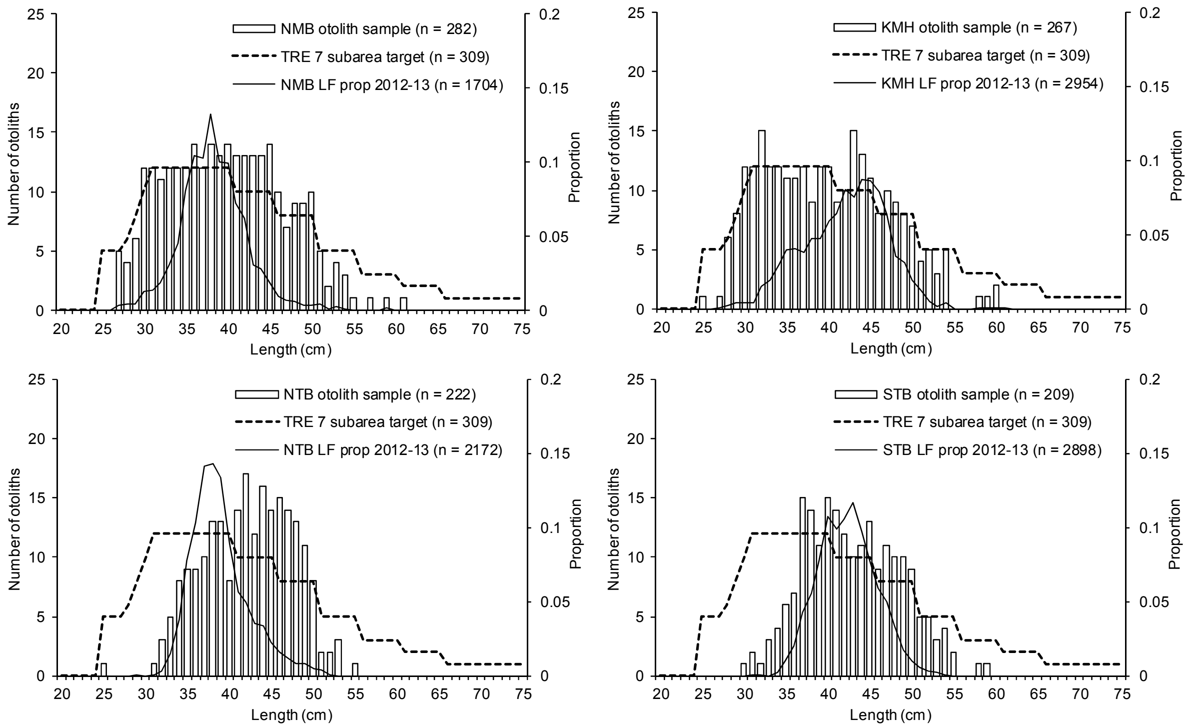
**Appendix 1: TRE 7 catch sampling summary from 1997–98 to 2012–13. (Note: all collections made using the length frequency and age-length key sampling approach, and all ageing undertaken by NIWA).**

**TRE 7**

| Catch sampling report | Research Provider | Fishing year | Fishing method | No. of landings sampled for LF | Season[††] | Comments* | Otolith sample size | Otolith prep[n†] | Season[††] |
|---|---|---|---|---|---|---|---|---|---|
| Walsh et al. (1999) | NIWA | 1997–98 | Bottom trawl | 55 | Spr–Aut, Win | 9 NMB, 15 KMH, 10 NTB, 1 STB, 20 Mixed (47 Peak, 8 Off-peak) | 375 | B&E | Sum |
| | | | Bottom pair trawl | 7 | Spr–Sum | Unknown | | | |
| Walsh et al. (2000) | NIWA | 1998–99 | Bottom trawl | 26 | Spr–Aut | 3 NMB, 10 KMH, 2 NTB, 11 Mixed | 225 | TS | Sum–Aut |
| | | | Bottom pair trawl | 14 | Sum–Aut | 6 NMB, 2 KMH, 2 NTB, 4 Mixed | 156 | TS | Sum–Aut |
| Langley (2001) | Sanford Ltd | 1999–2000 | Bottom trawl | 39 | Sum–Aut | 6 NMB, 7 KMH, 5 NTB, 2 STB, 19 Mixed | 505 | TS | Sum–Aut |
| Langley (2002) | Sanford Ltd | 2000–01 | Bottom trawl | 49 | Spr–Aut | 5 NMB, 16 KMH, 3 NTB, 25 Mixed | 496 | TS | Spr–Sum |
| | | | Bottom pair trawl | 13 | Spr–Sum | 2 NMB, 7 KMH, 4 Mixed | | | |
| Langley (2009) | GANZL | 2005–06 | Bottom trawl | 11 | Spr–Aut | 3 KMH, 2 NTB, 3 STB, 3 Mixed | 328 | TS | Spr–Sum |
| Walsh et al. (2010a) | NIWA | 2006–07 | Bottom trawl | 33 | Spr–Win | 2 NMB, 14 KMH/NTB, 11 STB, 6 Mixed | 920 | TS | Spr–Win |
| Walsh et al. (2010b) | NIWA | 2007–08 | Bottom trawl | 21 | Spr–Aut | 2 NMB, 12 KMH/NTB, 3 STB, 4 Mixed | 848 | TS | Spr–Aut |
| Walsh et al. (2012a) | NIWA | 2009–10 | Bottom trawl | 37 | Spr–Win | 6 NMB, 6 KMH/NTB, 17 STB, 8 Mixed | 1158 | TS | Spr–Win |
| This report | NIWA | 2012–13 | Bottom trawl | 28 | Spr–Win | 7 NMB, 7 KMH, 4 NTB, 10 STB | 949 | TS | Spr–Win |

* NMB = Ninety Mile Beach; KMH = Coastal Kaipara-Manukau; NTB = North Taranaki Bight; STB = South Taranaki Bight.
[†] B&E = Bake and embed; TS = Thin section.
[††] Spr (Oct–Nov), Sum (Dec–Feb), Aut (Mar–May), Win (Jun–Sep).
NIWA, National Institute of Water and Atmospheric Research; GANZL, Golder Associates (NZ) Ltd.

**Appendix 2: Length distributions of the target fixed allocation otolith samples (dashed lines) and the achieved otolith collections (histograms) for the subarea strata of TRE 7 in 2012–13. For comparison, the proportional subarea length distributions from 2012–13, from which the otolith subsamples were collected is also given (solid lines). NMB, Ninety Mile Beach; KMH, Kaipara-Manukau; NTB, North Taranaki Bight; STB, South Taranaki Bight.**



**Appendix 3: Annual commercial catch (t) by method for the subareas of TRE 7, 2007–08 to 2012–13 (excluding 2011–12).**

| | Ninety Mile Beach | | | | | Kaipara-Manukau | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Fishing year | BT | BPT | MW | SN | Other | BT | BPT | MW | SN | Other |
| 2007–08 | 156 | 170 | 0 | 2 | 3 | 734 | 159 | 0 | 21 | 10 |
| 2008–09 | 308 | 55 | 0 | 1 | 4 | 803 | 254 | 0 | 13 | 12 |
| 2009–10 | 448 | 94 | 0 | 2 | 2 | 535 | 234 | 0 | 20 | 10 |
| 2010–11 | 274 | 147 | 0 | 0 | 1 | 554 | 215 | 0 | 0 | 1 |
| 2011–12 | | | | | | | | | | |
| 2012–13 | 201 | 0 | 0 | 3 | 3 | 1039 | 0 | 0 | 19 | 13 |

| | North Taranaki Bight | | | | | South Taranaki Bight | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Fishing year | BT | BPT | MW | SN | Other | BT | BPT | MW | SN | Other |
| 2007–08 | 350 | 4 | 0 | 15 | 0 | 92 | 0 | 43 | 8 | 1 |
| 2008–09 | 347 | 0 | 0 | 16 | 0 | 152 | 0 | 0 | 11 | 1 |
| 2009–10 | 317 | 1 | 24 | 30 | 0 | 209 | 0 | 0 | 13 | 0 |
| 2010–11 | 309 | 6 | 0 | 0 | 0 | 277 | 0 | 0 | 0 | 1 |
| 2011–12 | | | | | | | | | | |
| 2012–13 | 334 | 0 | 3 | 15 | 0 | 184 | 0 | 3 | 11 | 0 |

BT = bottom trawl; BPT = bottom pair trawl; MW = mid water trawl; SN = set net

**Appendix 4: Annual bottom trawl catch (t) by statistical reporting areas within the TRE 7 stock, 2007–08 to 2012–13 (excluding 2011–12).**

| | Statistical area | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fishing year | 048 | 047 | 046 | 045 | 044 | 043 | 042 | 041 | 040 | 039 | 038 | 037 | 036 | 035 | 034 | 033 | 017 |
| 2007–08 | 0 | 156 | 190 | 338 | 0 | 0 | 335 | 214 | 36 | 6 | 4 | 7 | 35 | 3 | 1 | 0 | 1 |
| 2008–09 | 0 | 308 | 180 | 371 | 0 | 0 | 338 | 251 | 67 | 31 | 18 | 31 | 5 | 2 | 0 | 4 | 0 |
| 2009–10 | 0 | 448 | 173 | 280 | 0 | 0 | 333 | 64 | 51 | 52 | 28 | 59 | 16 | 3 | 0 | 0 | 2 |
| 2010–11 | 0 | 274 | 162 | 309 | 0 | 0 | 240 | 152 | 195 | 15 | 9 | 41 | 12 | 2 | 0 | 1 | 3 |
| 2011–12 | | | | | | | | | | | | | | | | | |
| 2012–13 | 0 | 201 | 231 | 703 | 0 | 0 | 342 | 97 | 101 | 26 | 7 | 43 | 2 | 0 | 0 | 0 | 4 |

**Appendix 5: Annual bottom trawl catch (t) by target species for the subareas of TRE 7, 2007–08 to 2012–13 (excluding 2011–12).**

| | Ninety Mile Beach | | | | Kaipara-Manukau | | | |
|---|---|---|---|---|---|---|---|---|
| Fishing year | TRE | SNA | GUR | Other | TRE | SNA | GUR | Other |
| 2007–08 | 127 | 6 | 22 | 2 | 627 | 35 | 63 | 9 |
| 2008–09 | 231 | 71 | 4 | 2 | 713 | 39 | 43 | 9 |
| 2009–10 | 431 | 16 | 0 | 1 | 487 | 35 | 8 | 5 |
| 2010–11 | 252 | 3 | 17 | 2 | 521 | 144 | 15 | 3 |
| 2011–12 | | | | | | | | |
| 2012–13 | 172 | 11 | 16 | 2 | 914 | 38 | 82 | 5 |

| | North Taranaki Bight | | | | South Taranaki Bight | | | |
|---|---|---|---|---|---|---|---|---|
| Fishing year | TRE | SNA | GUR | Other | TRE | SNA | GUR | Other |
| 2007–08 | 289 | 12 | 48 | 1 | 25 | 7 | 14 | 46 |
| 2008–09 | 316 | 4 | 21 | 6 | 21 | 4 | 57 | 69 |
| 2009–10 | 276 | 1 | 28 | 12 | 74 | 23 | 43 | 68 |
| 2010–11 | 271 | 12 | 22 | 4 | 217 | 5 | 35 | 21 |
| 2011–12 | | | | | | | | |
| 2012–13 | 305 | 3 | 23 | 2 | 107 | 6 | 48 | 24 |

TRE, trevally; SNA, snapper; GUR, red gurnard

**Appendix 6: Age-length keys derived from otolith samples collected from trevally fisheries in TRE 7, 2012–13.**

**Estimates of proportion of age at length for trevally sampled from all TRE 7 subareas combined, 2012–13.**

**(Note: Aged to 01/01/2013)**

| 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 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 28 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 29 | 0 | 0.93 | 0.07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 30 | 0 | 0.62 | 0.38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| 31 | 0 | 0.41 | 0.45 | 0.07 | 0.03 | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 |
| 32 | 0 | 0.22 | 0.44 | 0.09 | 0.19 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| 33 | 0 | 0.03 | 0.26 | 0.15 | 0.38 | 0.09 | 0.03 | 0 | 0 | 0 | 0.03 | 0 | 0 | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| 34 | 0 | 0 | 0.23 | 0.21 | 0.44 | 0.10 | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 |
| 35 | 0 | 0 | 0.10 | 0.10 | 0.40 | 0.20 | 0.18 | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| 36 | 0 | 0 | 0 | 0.07 | 0.41 | 0.16 | 0.18 | 0.05 | 0.05 | 0.02 | 0.02 | 0.02 | 0 | 0 | 0.02 | 0 | 0 | 0 | 0 | 0 | 44 |
| 37 | 0 | 0 | 0.02 | 0.08 | 0.27 | 0.18 | 0.25 | 0 | 0.02 | 0.06 | 0 | 0.04 | 0.04 | 0 | 0 | 0 | 0.04 | 0 | 0 | 0 | 51 |
| 38 | 0 | 0 | 0.02 | 0.04 | 0.29 | 0.20 | 0.18 | 0.06 | 0.04 | 0.04 | 0 | 0.06 | 0.02 | 0.04 | 0 | 0 | 0 | 0 | 0 | 0.02 | 51 |
| 39 | 0 | 0 | 0 | 0.02 | 0.12 | 0.17 | 0.29 | 0.06 | 0.06 | 0.08 | 0.12 | 0.04 | 0 | 0 | 0.02 | 0.02 | 0.02 | 0 | 0 | 0 | 52 |
| 40 | 0 | 0 | 0 | 0 | 0.06 | 0.12 | 0.43 | 0.04 | 0.02 | 0.16 | 0.04 | 0.04 | 0 | 0 | 0.04 | 0.04 | 0 | 0.02 | 0 | 0 | 51 |
| 41 | 0 | 0 | 0 | 0.02 | 0.04 | 0.02 | 0.17 | 0.02 | 0.06 | 0.21 | 0.09 | 0.17 | 0.06 | 0.06 | 0 | 0 | 0.02 | 0 | 0.02 | 0.02 | 47 |
| 42 | 0 | 0 | 0 | 0 | 0 | 0.04 | 0.08 | 0 | 0.10 | 0.25 | 0.12 | 0.18 | 0.04 | 0.04 | 0.02 | 0.02 | 0.08 | 0 | 0.04 | 0 | 51 |
| 43 | 0 | 0 | 0 | 0 | 0 | 0.02 | 0.10 | 0.02 | 0.02 | 0.14 | 0.10 | 0.14 | 0.14 | 0.10 | 0.04 | 0.02 | 0.04 | 0.04 | 0 | 0.06 | 49 |
| 44 | 0 | 0 | 0 | 0 | 0 | 0.02 | 0.04 | 0 | 0 | 0.21 | 0.13 | 0.06 | 0.04 | 0.15 | 0.08 | 0.02 | 0.06 | 0.04 | 0.02 | 0.13 | 52 |
| 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.02 | 0.08 | 0.02 | 0.08 | 0.14 | 0.02 | 0.06 | 0.08 | 0.14 | 0.06 | 0.04 | 0.27 | 51 |
| 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0.03 | 0 | 0 | 0.05 | 0.05 | 0.00 | 0.05 | 0.03 | 0.05 | 0.05 | 0.08 | 0.03 | 0.05 | 0.55 | 40 |
| 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0.02 | 0 | 0.02 | 0 | 0.05 | 0.02 | 0.10 | 0.12 | 0 | 0.05 | 0.10 | 0.07 | 0.05 | 0.39 | 41 |
| 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0.03 | 0.03 | 0.08 | 0 | 0.03 | 0.05 | 0.03 | 0.70 | 37 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0.03 | 0 | 0 | 0 | 0 | 0 | 0.03 | 0 | 0.03 | 0.05 | 0.08 | 0.03 | 0.03 | 0.08 | 0.66 | 38 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0.06 | 0.03 | 0.03 | 0 | 0 | 0 | 0 | 0.06 | 0 | 0 | 0.09 | 0.06 | 0.06 | 0.61 | 33 |
| 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.07 | 0.07 | 0.13 | 0 | 0 | 0.73 | 15 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0.08 | 0 | 0.17 | 0.08 | 0.08 | 0.50 | 12 |
| 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.08 | 0 | 0 | 0.08 | 0.08 | 0.75 | 12 |
| 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.09 | 0 | 0 | 0.91 | 11 |
| 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.25 | 0 | 0.75 | 4 |
| 56 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 1 |
| 58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 2 |
| 59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 3 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 2 |
| 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 1 |
| 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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 |
| Total | | | | | | | | | | | | | | | | | | | | | 984 |

**Appendix 6 – continued:**

**Estimates of proportion of age at length for trevally sampled from the Ninety Mile Beach subarea of TRE 7, 2012–13. (Note: Aged to 01/01/2013)**

| Length | Age (years) | | | | | | | | | | | | | | | | | | | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (cm) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | >19 | Aged |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 28 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 29 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 30 | 0 | 0.92 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 31 | 0 | 0.83 | 0.17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 32 | 0 | 0.45 | 0.55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 33 | 0 | 0.08 | 0.58 | 0.08 | 0.17 | 0 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 34 | 0 | 0 | 0.58 | 0.25 | 0.17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 35 | 0 | 0 | 0.33 | 0.17 | 0.42 | 0 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 36 | 0 | 0 | 0 | 0.15 | 0.15 | 0.23 | 0.23 | 0 | 0.08 | 0 | 0.08 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 37 | 0 | 0 | 0.08 | 0.33 | 0 | 0.33 | 0.17 | 0 | 0 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 38 | 0 | 0 | 0.07 | 0.14 | 0.07 | 0.14 | 0.21 | 0.07 | 0 | 0 | 0 | 0.14 | 0 | 0.14 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 39 | 0 | 0 | 0 | 0 | 0.15 | 0.15 | 0.23 | 0.15 | 0 | 0 | 0.23 | 0 | 0 | 0 | 0.08 | 0 | 0 | 0 | 0 | 0 | 13 |
| 40 | 0 | 0 | 0 | 0 | 0 | 0.07 | 0.64 | 0 | 0 | 0.21 | 0.07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0.08 | 0 | 0.08 | 0.38 | 0 | 0.38 | 0 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 42 | 0 | 0 | 0 | 0 | 0 | 0.08 | 0.15 | 0 | 0 | 0.23 | 0 | 0.23 | 0.15 | 0 | 0 | 0 | 0.08 | 0 | 0.08 | 0 | 13 |
| 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0.15 | 0 | 0 | 0 | 0.08 | 0.31 | 0.15 | 0.08 | 0.15 | 0 | 0.08 | 0 | 0 | 0 | 13 |
| 44 | 0 | 0 | 0 | 0 | 0 | 0.08 | 0 | 0 | 0 | 0.23 | 0.08 | 0.08 | 0 | 0.23 | 0 | 0.08 | 0 | 0.08 | 0.08 | 0.08 | 13 |
| 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.08 | 0.08 | 0.08 | 0.15 | 0 | 0.15 | 0.15 | 0.08 | 0.15 | 0.08 | 0 | 13 |
| 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0 | 0 | 0.11 | 0 | 0 | 0.11 | 0 | 0.11 | 0.11 | 0.11 | 0 | 0 | 0.33 | 9 |
| 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.14 | 0 | 0.14 | 0 | 0.29 | 0.14 | 0 | 0.14 | 0 | 0 | 0.14 | 0 | 7 |
| 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0.22 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0 | 0.22 | 0 | 0 | 0.11 | 0 | 0.33 | 9 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0 | 0 | 0.11 | 0 | 0 | 0 | 0.11 | 0.56 | 9 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0.11 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0 | 0 | 0.22 | 0.11 | 0.11 | 0.22 | 9 |
| 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.25 | 0.25 | 0 | 0 | 0 | 0.50 | 4 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.50 | 0 | 0 | 2 |
| 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.25 | 0.25 | 0.50 | 4 |
| 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.50 | 0 | 0 | 0.50 | 2 |
| 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 0 | 0 | 1 |
| 56 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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 | 1 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 1 |
| 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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 |
| Total | | | | | | | | | | | | | | | | | | | | | 276 |

**Appendix 6 – continued:**

**Estimates of proportion of age at length for trevally sampled from the Kaipara-Manukau subarea of TRE 7, 2012–13. (Note: Aged to 01/01/2013)**

| Length (cm) | Age (years) 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | >19 | No. Aged |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 28 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 29 | 0 | 0.88 | 0.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 30 | 0 | 0.33 | 0.67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 31 | 0 | 0 | 0.75 | 0.08 | 0.08 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 32 | 0 | 0 | 0.40 | 0.20 | 0.27 | 0.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 33 | 0 | 0 | 0.09 | 0.09 | 0.55 | 0.09 | 0 | 0 | 0 | 0 | 0.09 | 0 | 0 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 34 | 0 | 0 | 0.17 | 0.25 | 0.33 | 0.17 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 35 | 0 | 0 | 0 | 0.09 | 0.27 | 0.36 | 0.27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 36 | 0 | 0 | 0 | 0 | 0.55 | 0 | 0.27 | 0 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0.09 | 0 | 0 | 0 | 0 | 0 | 11 |
| 37 | 0 | 0 | 0 | 0 | 0.27 | 0 | 0.36 | 0 | 0 | 0.09 | 0 | 0.18 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 38 | 0 | 0 | 0 | 0 | 0.33 | 0.11 | 0.11 | 0.11 | 0.11 | 0 | 0 | 0 | 0.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0.11 | 9 |
| 39 | 0 | 0 | 0 | 0 | 0 | 0.18 | 0.36 | 0 | 0.09 | 0 | 0.09 | 0.09 | 0 | 0 | 0 | 0.09 | 0.09 | 0 | 0 | 0 | 11 |
| 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0.42 | 0.08 | 0.08 | 0.08 | 0 | 0.08 | 0 | 0 | 0.08 | 0.08 | 0 | 0.08 | 0 | 0 | 12 |
| 41 | 0 | 0 | 0 | 0.13 | 0 | 0 | 0.25 | 0.13 | 0.13 | 0.13 | 0 | 0.13 | 0.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 42 | 0 | 0 | 0 | 0 | 0 | 0.10 | 0 | 0 | 0.20 | 0.10 | 0.30 | 0.20 | 0 | 0 | 0.10 | 0 | 0 | 0 | 0 | 0 | 10 |
| 43 | 0 | 0 | 0 | 0 | 0 | 0.07 | 0 | 0.07 | 0 | 0.20 | 0.07 | 0.07 | 0.27 | 0.13 | 0 | 0 | 0 | 0 | 0 | 0.13 | 15 |
| 44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.31 | 0.15 | 0.15 | 0.08 | 0 | 0.08 | 0 | 0.15 | 0 | 0 | 0.08 | 13 |
| 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.09 | 0.18 | 0 | 0.27 | 0.18 | 0.09 | 0 | 0.09 | 0.09 | 0 | 0 | 0 | 11 |
| 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0.13 | 0.13 | 0.63 | 8 |
| 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0.10 | 0 | 0 | 0 | 0.10 | 0 | 0.10 | 0.10 | 0 | 0 | 0.30 | 0.10 | 0 | 0.20 | 10 |
| 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.13 | 0.13 | 0.75 | 8 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.13 | 0.13 | 0 | 0.13 | 0.63 | 8 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 7 |
| 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.25 | 0 | 0 | 0.75 | 4 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.25 | 0 | 0.25 | 0 | 0.25 | 0.25 | 4 |
| 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.50 | 0 | 0 | 0 | 0 | 0.50 | 2 |
| 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 5 |
| 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 1 |
| 59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 1 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 2 |
| 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 74 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | | | | | | | | | | | | | | | | | | | | | 260 |

**Appendix 6 – continued:**

**Estimates of proportion of age at length for trevally sampled from the North Taranaki Bight subarea of TRE 7, 2012–13. (Note: Aged to 01/01/2013)**

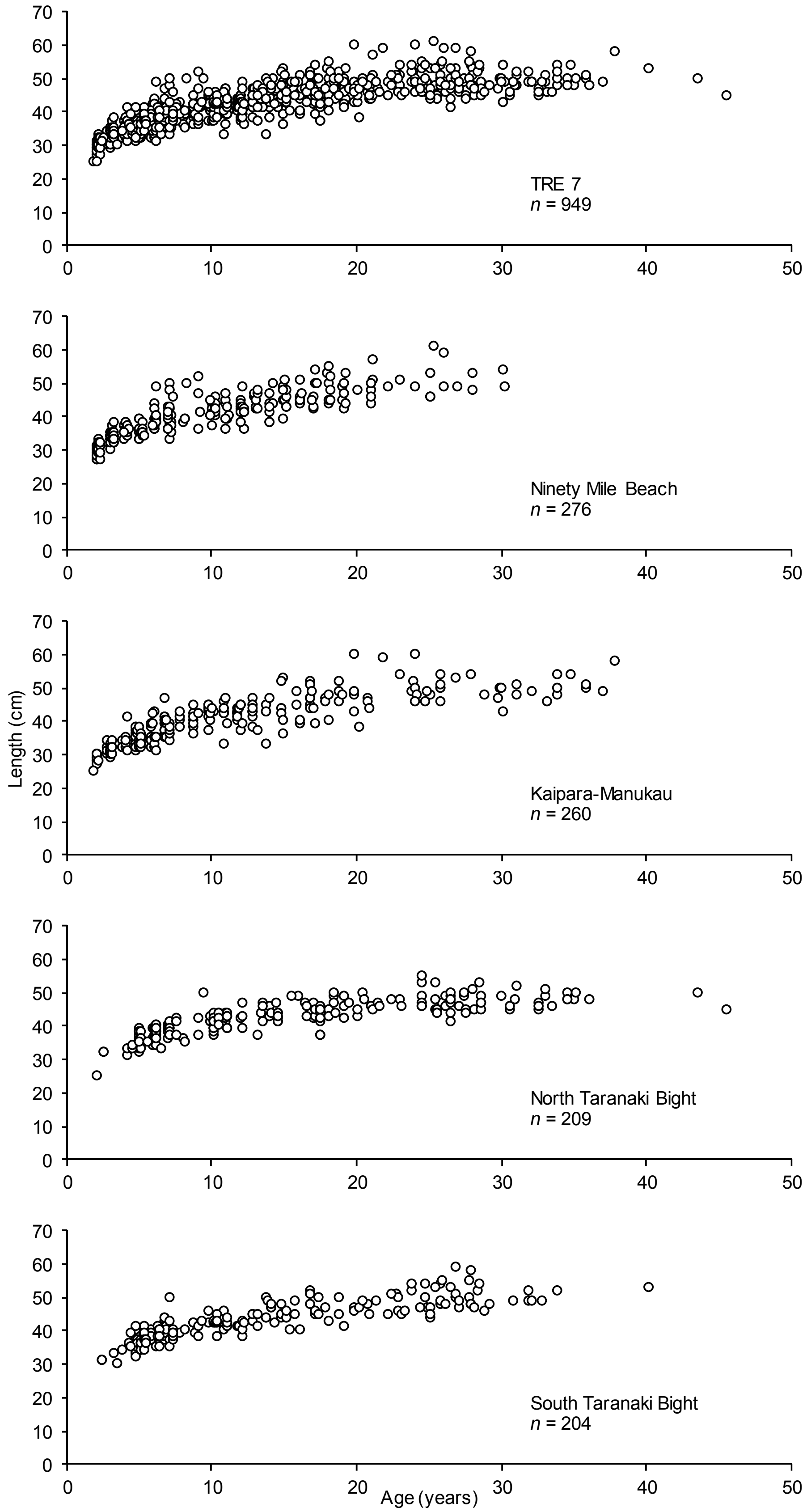
| Length | Age (years) | | | | | | | | | | | | | | | | | | | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (cm) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | >19 | Aged |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 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 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 0 | 0 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 32 | 0 | 0.67 | 0 | 0 | 0.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 33 | 0 | 0 | 0 | 0.40 | 0.40 | 0.20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 34 | 0 | 0 | 0 | 0.13 | 0.63 | 0.25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 35 | 0 | 0 | 0 | 0 | 0.63 | 0.25 | 0 | 0.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 36 | 0 | 0 | 0 | 0 | 0.44 | 0.33 | 0.11 | 0.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 37 | 0 | 0 | 0 | 0 | 0.10 | 0.20 | 0.20 | 0 | 0.10 | 0.10 | 0 | 0 | 0.10 | 0 | 0 | 0 | 0.20 | 0 | 0 | 0 | 10 |
| 38 | 0 | 0 | 0 | 0 | 0.58 | 0.17 | 0.17 | 0 | 0 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 39 | 0 | 0 | 0 | 0 | 0.08 | 0.23 | 0.23 | 0 | 0 | 0.23 | 0.15 | 0.08 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 40 | 0 | 0 | 0 | 0 | 0 | 0.29 | 0.43 | 0 | 0 | 0.29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 41 | 0 | 0 | 0 | 0 | 0 | 0 | 0.17 | 0 | 0 | 0.33 | 0.08 | 0 | 0.08 | 0.17 | 0 | 0 | 0.08 | 0 | 0 | 0.08 | 12 |
| 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0.07 | 0 | 0.07 | 0.21 | 0.07 | 0.21 | 0 | 0.07 | 0 | 0 | 0.21 | 0 | 0.07 | 0 | 14 |
| 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.09 | 0.27 | 0.09 | 0 | 0.18 | 0 | 0.09 | 0.09 | 0.09 | 0 | 0.09 | 11 |
| 44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.20 | 0.13 | 0 | 0.07 | 0.20 | 0 | 0 | 0.07 | 0.07 | 0 | 0.27 | 15 |
| 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.21 | 0.07 | 0 | 0.71 | 14 |
| 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.07 | 0.07 | 0 | 0.07 | 0.07 | 0 | 0.07 | 0.67 | 15 |
| 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.07 | 0.07 | 0.07 | 0 | 0.07 | 0.07 | 0.07 | 0.07 | 0.50 | 14 |
| 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 11 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.09 | 0.09 | 0 | 0.09 | 0.09 | 0.64 | 11 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.13 | 0 | 0.75 | 8 |
| 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 2 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 1 |
| 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 3 |
| 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 1 |
| 56 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 74 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | | | | | | | | | | | | | | | | | | | | | 209 |

**Appendix 6 – continued:**

**Estimates of proportion of age at length for trevally sampled from the South Taranaki Bight subarea of TRE 7, 2012–13. (Note: Aged to 01/01/2013)**

| Length | Age (years) | | | | | | | | | | | | | | | | | | | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (cm) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | >19 | Aged |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 31 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 32 | 0 | 0 | 0 | 0 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 33 | 0 | 0 | 0.33 | 0 | 0.67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 34 | 0 | 0 | 0 | 0.25 | 0.75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 35 | 0 | 0 | 0 | 0.17 | 0.33 | 0.33 | 0.17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 36 | 0 | 0 | 0 | 0.14 | 0.86 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 37 | 0 | 0 | 0 | 0 | 0.60 | 0.13 | 0.27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 38 | 0 | 0 | 0 | 0 | 0.21 | 0.36 | 0.21 | 0 | 0.07 | 0.07 | 0 | 0.07 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 39 | 0 | 0 | 0 | 0.09 | 0.27 | 0.09 | 0.36 | 0.09 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 40 | 0 | 0 | 0 | 0 | 0.20 | 0.20 | 0.27 | 0.07 | 0 | 0 | 0.07 | 0.07 | 0 | 0 | 0.07 | 0.07 | 0 | 0 | 0 | 0 | 15 |
| 41 | 0 | 0 | 0 | 0 | 0.14 | 0.07 | 0.21 | 0 | 0.07 | 0 | 0.21 | 0.14 | 0.07 | 0 | 0 | 0 | 0 | 0 | 0.07 | 0 | 14 |
| 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0.09 | 0 | 0.18 | 0.36 | 0.18 | 0.09 | 0 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 43 | 0 | 0 | 0 | 0 | 0 | 0 | 0.30 | 0 | 0.10 | 0.30 | 0 | 0.10 | 0.10 | 0 | 0 | 0 | 0 | 0.10 | 0 | 0 | 10 |
| 44 | 0 | 0 | 0 | 0 | 0 | 0 | 0.20 | 0 | 0 | 0 | 0.20 | 0 | 0 | 0.20 | 0.30 | 0 | 0 | 0 | 0 | 0.10 | 10 |
| 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.08 | 0 | 0 | 0.23 | 0 | 0.08 | 0.08 | 0.15 | 0 | 0.08 | 0.31 | 13 |
| 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.13 | 0.13 | 0 | 0 | 0 | 0.13 | 0 | 0.13 | 0 | 0 | 0.50 | 8 |
| 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.20 | 0 | 0 | 0 | 0.10 | 0 | 0.70 | 10 |
| 48 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0.11 | 0 | 0.11 | 0 | 0 | 0.67 | 9 |
| 49 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.10 | 0 | 0.1 | 0 | 0 | 0 | 0.80 | 10 |
| 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0 | 0 | 0 | 0 | 0 | 0 | 0.11 | 0 | 0 | 0.11 | 0 | 0.11 | 0.56 | 9 |
| 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.20 | 0 | 0 | 0.80 | 5 |
| 52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.20 | 0 | 0 | 0.80 | 5 |
| 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 3 |
| 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 4 |
| 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 1 |
| 59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.00 | 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 | 0 | 0 |
| 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 64 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 65 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 69 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 74 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | | | | | | | | | | | | | | | | | | | | | 204 |

**Appendix 7: Scatterplot of age-at-length data for trevally sampled from the TRE 7 and subarea bottom trawl fisheries in 2012–13 (*n*, sample size). Age is decimalised as of the month of collection relative to an assumed January 1 "birthdate".**



**Appendix 8: Estimates of proportion at length with CVs (bootstrap estimates) for trevally from the TRE 7 and subarea bottom trawl fisheries in 2012–13 (Area codes: NMB, Ninety Mile Beach; KMH, Kaipara-Manukau; NTB, North Taranaki Bight; STB, South Taranaki Bight).**

*P.i.* = proportion of fish in length class. *Nt* = scaled total number of fish caught.
CV = coefficient of variation. *n* = total number of fish sampled.

| Length | TRE 7 | | NMB | | KMH | | NTB | | STB | |
|---|---|---|---|---|---|---|---|---|---|---|
| (cm) | *P.i.* | CV | *P.i.* | CV | *P.i.* | CV | *P.i.* | CV | *P.i.* | CV |
| 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 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 23 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 24 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 25 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 26 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 27 | 0.0007 | 0.91 | 0.0031 | 1.21 | 0.0004 | 1.16 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 28 | 0.0018 | 0.78 | 0.0041 | 0.96 | 0.0023 | 0.92 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 29 | 0.0030 | 0.81 | 0.0045 | 0.84 | 0.0041 | 0.96 | 0.0007 | 1.68 | 0.0000 | 0.00 |
| 30 | 0.0041 | 0.62 | 0.0127 | 0.67 | 0.0043 | 0.88 | 0.0000 | 0.00 | 0.0002 | 1.56 |
| 31 | 0.0045 | 0.50 | 0.0138 | 0.54 | 0.0043 | 0.79 | 0.0010 | 1.01 | 0.0008 | 1.12 |
| 32 | 0.0114 | 0.58 | 0.0182 | 0.61 | 0.0150 | 0.71 | 0.0033 | 0.65 | 0.0005 | 1.49 |
| 33 | 0.0181 | 0.49 | 0.0300 | 0.40 | 0.0196 | 0.73 | 0.0150 | 0.41 | 0.0001 | 1.27 |
| 34 | 0.0308 | 0.46 | 0.0445 | 0.29 | 0.0295 | 0.76 | 0.0377 | 0.29 | 0.0023 | 1.13 |
| 35 | 0.0512 | 0.34 | 0.0804 | 0.21 | 0.0397 | 0.71 | 0.0783 | 0.19 | 0.0103 | 0.87 |
| 36 | 0.0620 | 0.23 | 0.1045 | 0.20 | 0.0409 | 0.57 | 0.1037 | 0.14 | 0.0204 | 0.61 |
| 37 | 0.0709 | 0.16 | 0.1024 | 0.23 | 0.0378 | 0.48 | 0.1417 | 0.12 | 0.0428 | 0.39 |
| 38 | 0.0816 | 0.12 | 0.1323 | 0.24 | 0.0473 | 0.36 | 0.1431 | 0.09 | 0.0554 | 0.26 |
| 39 | 0.0775 | 0.12 | 0.1001 | 0.21 | 0.0475 | 0.32 | 0.1341 | 0.10 | 0.0779 | 0.17 |
| 40 | 0.0765 | 0.15 | 0.0993 | 0.28 | 0.0592 | 0.30 | 0.0897 | 0.12 | 0.1076 | 0.18 |
| 41 | 0.0669 | 0.18 | 0.0721 | 0.24 | 0.0641 | 0.32 | 0.0563 | 0.20 | 0.0992 | 0.16 |
| 42 | 0.0734 | 0.15 | 0.0615 | 0.20 | 0.0803 | 0.22 | 0.0501 | 0.25 | 0.1062 | 0.14 |
| 43 | 0.0639 | 0.18 | 0.0301 | 0.38 | 0.0749 | 0.26 | 0.0353 | 0.26 | 0.1170 | 0.16 |
| 44 | 0.0682 | 0.21 | 0.0281 | 0.29 | 0.0876 | 0.30 | 0.0339 | 0.31 | 0.0977 | 0.11 |
| 45 | 0.0618 | 0.22 | 0.0188 | 0.37 | 0.0862 | 0.31 | 0.0230 | 0.29 | 0.0789 | 0.14 |
| 46 | 0.0530 | 0.27 | 0.0095 | 0.58 | 0.0787 | 0.36 | 0.0162 | 0.41 | 0.0595 | 0.18 |
| 47 | 0.0423 | 0.36 | 0.0071 | 0.58 | 0.0632 | 0.48 | 0.0113 | 0.47 | 0.0500 | 0.21 |
| 48 | 0.0253 | 0.37 | 0.0060 | 0.64 | 0.0358 | 0.50 | 0.0084 | 0.43 | 0.0340 | 0.29 |
| 49 | 0.0208 | 0.48 | 0.0035 | 0.79 | 0.0314 | 0.63 | 0.0080 | 0.54 | 0.0174 | 0.46 |
| 50 | 0.0128 | 0.49 | 0.0030 | 0.92 | 0.0195 | 0.62 | 0.0046 | 0.60 | 0.0097 | 0.45 |
| 51 | 0.0089 | 0.49 | 0.0042 | 0.67 | 0.0128 | 0.66 | 0.0042 | 0.75 | 0.0054 | 0.70 |
| 52 | 0.0031 | 0.55 | 0.0007 | 1.39 | 0.0048 | 0.69 | 0.0005 | 1.64 | 0.0031 | 0.67 |
| 53 | 0.0015 | 0.68 | 0.0024 | 1.08 | 0.0017 | 0.96 | 0.0000 | 0.00 | 0.0022 | 0.76 |
| 54 | 0.0023 | 0.85 | 0.0004 | 1.38 | 0.0039 | 0.95 | 0.0000 | 0.00 | 0.0009 | 1.02 |
| 55 | 0.0001 | 1.09 | 0.0003 | 1.47 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0002 | 1.08 |
| 56 | 0.0000 | 1.47 | 0.0001 | 1.63 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 1.83 |
| 57 | 0.0000 | 1.75 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 1.77 |
| 58 | 0.0005 | 1.59 | 0.0000 | 0.00 | 0.0009 | 1.62 | 0.0000 | 0.00 | 0.0001 | 1.76 |
| 59 | 0.0008 | 1.20 | 0.0019 | 1.53 | 0.0009 | 1.59 | 0.0000 | 0.00 | 0.0000 | 1.68 |
| 60 | 0.0005 | 1.68 | 0.0000 | 0.00 | 0.0009 | 1.67 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 61 | 0.0002 | 1.62 | 0.0003 | 1.92 | 0.0004 | 1.86 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 62 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 63 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 64 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 65 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 66 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 67 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 68 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 69 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 70 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 71 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 72 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 73 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 74 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 75 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| *Nt* | 1 220 242 | | 170 116 | | 661 625 | | 273 576 | | 116 390 | |
| *n* | 9 728 | | 1 704 | | 2 954 | | 2 172 | | 2 898 | |

**Appendix 9: Estimates of proportion at age with CVs (bootstrap estimates) for trevally from the TRE 7 and subarea bottom trawl fisheries in 2012–13 (Area codes: NMB, Ninety Mile Beach; KMH, Kaipara-Manukau; NTB, North Taranaki Bight; STB, South Taranaki Bight).**

*P.j.* = proportion of fish in age class; CV = coefficient of variation; *n* = number of fish aged.

| Age | TRE 7 | | NMB | | KMH | | NTB | | STB | |
|---|---|---|---|---|---|---|---|---|---|---|
| (years) | *P.j.* | CV | *P.j.* | CV | *P.j.* | CV | *P.j.* | CV | *P.j.* | CV |
| 1 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 | 0.0000 | 0.00 |
| 2 | 0.0111 | 0.47 | 0.0455 | 0.50 | 0.0078 | 0.90 | 0.0025 | 0.88 | 0.0008 | 1.17 |
| 3 | 0.0244 | 0.40 | 0.1015 | 0.28 | 0.0193 | 0.76 | 0.0000 | 0.00 | 0.0003 | 1.70 |
| 4 | 0.0302 | 0.34 | 0.0961 | 0.29 | 0.0241 | 0.65 | 0.0121 | 0.68 | 0.0123 | 0.74 |
| 5 | 0.1218 | 0.25 | 0.0869 | 0.28 | 0.0841 | 0.58 | 0.2336 | 0.19 | 0.1177 | 0.30 |
| 6 | 0.0881 | 0.19 | 0.1069 | 0.30 | 0.0504 | 0.48 | 0.1753 | 0.25 | 0.0646 | 0.31 |
| 7 | 0.1336 | 0.17 | 0.1881 | 0.21 | 0.1077 | 0.32 | 0.1461 | 0.27 | 0.1687 | 0.22 |
| 8 | 0.0222 | 0.39 | 0.0252 | 0.59 | 0.0232 | 0.59 | 0.0213 | 0.74 | 0.0143 | 0.74 |
| 9 | 0.0379 | 0.30 | 0.0150 | 0.68 | 0.0501 | 0.39 | 0.0183 | 0.81 | 0.0491 | 0.44 |
| 10 | 0.0919 | 0.19 | 0.0807 | 0.28 | 0.0820 | 0.33 | 0.1222 | 0.27 | 0.0912 | 0.31 |
| 11 | 0.0581 | 0.24 | 0.0452 | 0.37 | 0.0648 | 0.37 | 0.0431 | 0.41 | 0.0747 | 0.33 |
| 12 | 0.0657 | 0.23 | 0.0821 | 0.27 | 0.0822 | 0.32 | 0.0251 | 0.49 | 0.0467 | 0.43 |
| 13 | 0.0468 | 0.26 | 0.0207 | 0.43 | 0.0654 | 0.34 | 0.0230 | 0.71 | 0.0370 | 0.48 |
| 14 | 0.0296 | 0.29 | 0.0346 | 0.44 | 0.0259 | 0.54 | 0.0280 | 0.42 | 0.0458 | 0.43 |
| 15 | 0.0217 | 0.35 | 0.0191 | 0.49 | 0.0255 | 0.51 | 0.0007 | 1.26 | 0.0538 | 0.39 |
| 16 | 0.0152 | 0.41 | 0.0082 | 0.54 | 0.0210 | 0.54 | 0.0058 | 0.69 | 0.0150 | 0.66 |
| 17 | 0.0451 | 0.31 | 0.0104 | 0.59 | 0.0529 | 0.48 | 0.0561 | 0.39 | 0.0261 | 0.49 |
| 18 | 0.0185 | 0.50 | 0.0074 | 0.54 | 0.0256 | 0.68 | 0.0092 | 0.56 | 0.0167 | 0.77 |
| 19 | 0.0147 | 0.53 | 0.0107 | 0.58 | 0.0194 | 0.76 | 0.0062 | 0.73 | 0.0142 | 0.68 |
| >19 | 0.1233 | 0.29 | 0.0157 | 0.43 | 0.1681 | 0.42 | 0.0714 | 0.30 | 0.1511 | 0.24 |
| *n* | 949 | | 276 | | 260 | | 209 | | 204 | |

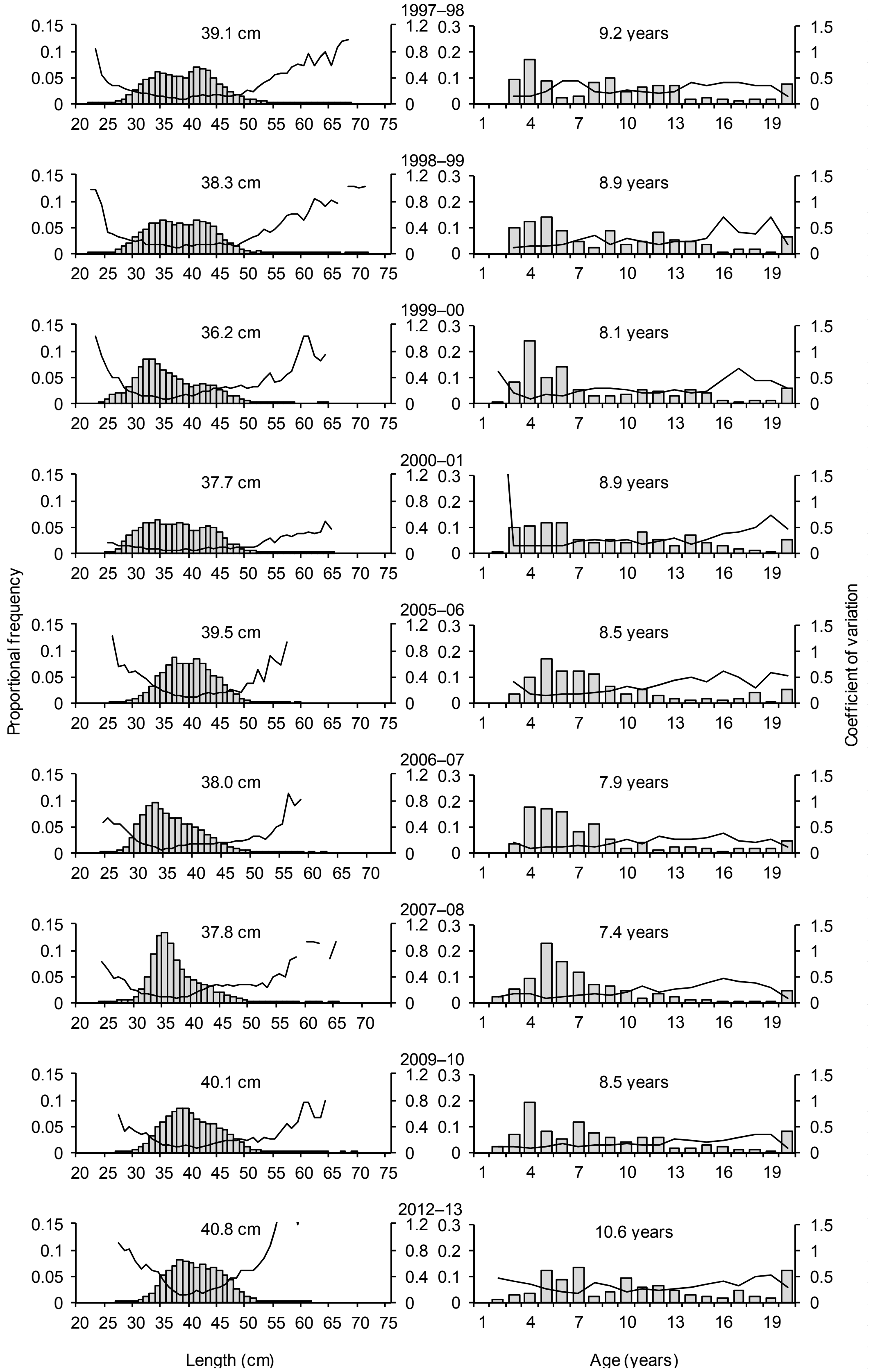
**Appendix 10: Estimates of mean weight-at-age (kg) with CVs for trevally from the TRE 7 and subarea bottom trawl fisheries in 2012–13 (Area codes: NMB, Ninety Mile Beach; KMH, Kaipara-Manukau; NTB, North Taranaki Bight; STB, South Taranaki Bight).**

| Age | TRE 7 | | NMB | | KMH | | NTB | | STB | |
|---|---|---|---|---|---|---|---|---|---|---|
| (years) | Mean | CV | Mean | CV | Mean | CV | Mean | CV | Mean | CV |
| 1 | – | – | – | – | – | – | – | – | – | – |
| 2 | 0.53 | 0.04 | 0.56 | 0.04 | 0.47 | 0.10 | 0.64 | 0.36 | 0.59 | 0.65 |
| 3 | 0.76 | 0.05 | 0.82 | 0.05 | 0.66 | 0.05 | – | – | 0.56 | 0.71 |
| 4 | 0.95 | 0.09 | 0.97 | 0.03 | 0.98 | 0.19 | 0.73 | 0.18 | 1.07 | 0.19 |
| 5 | 0.96 | 0.03 | 0.95 | 0.05 | 0.91 | 0.04 | 0.98 | 0.02 | 1.14 | 0.05 |
| 6 | 1.09 | 0.05 | 1.10 | 0.04 | 1.10 | 0.13 | 1.05 | 0.04 | 1.19 | 0.04 |
| 7 | 1.22 | 0.04 | 1.20 | 0.04 | 1.21 | 0.08 | 1.18 | 0.03 | 1.39 | 0.04 |
| 8 | 1.22 | 0.07 | 1.18 | 0.21 | 1.36 | 0.14 | 0.90 | 0.38 | 1.25 | 0.42 |
| 9 | 1.38 | 0.07 | 1.24 | 0.35 | 1.41 | 0.08 | 1.16 | 0.39 | 1.44 | 0.08 |
| 10 | 1.49 | 0.03 | 1.39 | 0.04 | 1.63 | 0.05 | 1.29 | 0.04 | 1.59 | 0.03 |
| 11 | 1.56 | 0.06 | 1.26 | 0.08 | 1.65 | 0.08 | 1.40 | 0.07 | 1.56 | 0.05 |
| 12 | 1.51 | 0.05 | 1.35 | 0.05 | 1.57 | 0.07 | 1.41 | 0.10 | 1.44 | 0.09 |
| 13 | 1.60 | 0.06 | 1.69 | 0.06 | 1.64 | 0.08 | 1.25 | 0.21 | 1.70 | 0.08 |
| 14 | 1.67 | 0.06 | 1.35 | 0.11 | 1.75 | 0.15 | 1.59 | 0.04 | 1.86 | 0.07 |
| 15 | 1.63 | 0.09 | 1.63 | 0.12 | 1.56 | 0.19 | 2.41 | 0.75 | 1.76 | 0.06 |
| 16 | 1.73 | 0.11 | 1.99 | 0.08 | 1.70 | 0.21 | 1.86 | 0.17 | 1.65 | 0.30 |
| 17 | 1.79 | 0.08 | 1.73 | 0.14 | 1.99 | 0.09 | 1.32 | 0.11 | 2.05 | 0.07 |
| 18 | 1.92 | 0.07 | 2.13 | 0.13 | 1.94 | 0.21 | 1.86 | 0.10 | 1.77 | 0.40 |
| 19 | 2.07 | 0.06 | 1.82 | 0.14 | 2.20 | 0.15 | 1.78 | 0.19 | 1.68 | 0.27 |
| >19 | 2.19 | 0.05 | 2.60 | 0.12 | 2.22 | 0.07 | 2.02 | 0.03 | 2.15 | 0.03 |

**Appendix 11: Estimates of mean length-at-age (cm) with CVs for trevally from the TRE 7 and subarea bottom trawl fisheries in 2012–13 (Area codes: NMB, Ninety Mile Beach; KMH, Kaipara-Manukau; NTB, North Taranaki Bight; STB, South Taranaki Bight).**

| Age | TRE 7 | | NMB | | KMH | | NTB | | STB | |
|---|---|---|---|---|---|---|---|---|---|---|
| (years) | Mean | CV | Mean | CV | Mean | CV | Mean | CV | Mean | CV |
| 1 | – | – | – | – | – | – | – | – | – | – |
| 2 | 29.8 | 0.014 | 30.3 | 0.013 | 28.8 | 0.096 | 31.7 | 0.358 | 31.0 | 0.650 |
| 3 | 33.4 | 0.017 | 34.4 | 0.015 | 32.1 | 0.015 | – | – | 30.4 | 0.691 |
| 4 | 36.0 | 0.027 | 36.3 | 0.011 | 36.1 | 0.060 | 33.1 | 0.174 | 37.5 | 0.158 |
| 5 | 36.2 | 0.009 | 36.0 | 0.016 | 35.5 | 0.013 | 36.4 | 0.008 | 38.2 | 0.015 |
| 6 | 37.6 | 0.016 | 37.8 | 0.013 | 37.6 | 0.041 | 37.3 | 0.012 | 38.9 | 0.013 |
| 7 | 39.1 | 0.013 | 38.8 | 0.012 | 38.9 | 0.025 | 38.7 | 0.011 | 40.8 | 0.013 |
| 8 | 39.1 | 0.023 | 38.8 | 0.135 | 40.5 | 0.113 | 35.5 | 0.377 | 39.5 | 0.422 |
| 9 | 40.6 | 0.022 | 39.0 | 0.201 | 41.0 | 0.028 | 38.4 | 0.233 | 41.3 | 0.058 |
| 10 | 41.8 | 0.011 | 40.9 | 0.013 | 43.0 | 0.017 | 39.8 | 0.013 | 42.7 | 0.011 |
| 11 | 42.3 | 0.019 | 39.4 | 0.026 | 43.1 | 0.028 | 40.9 | 0.022 | 42.4 | 0.015 |
| 12 | 41.9 | 0.016 | 40.4 | 0.018 | 42.5 | 0.022 | 41.1 | 0.061 | 41.3 | 0.079 |
| 13 | 42.7 | 0.022 | 43.5 | 0.018 | 43.0 | 0.027 | 39.3 | 0.073 | 43.6 | 0.066 |
| 14 | 43.2 | 0.024 | 40.3 | 0.035 | 43.9 | 0.072 | 42.7 | 0.012 | 44.9 | 0.023 |
| 15 | 42.7 | 0.030 | 42.8 | 0.041 | 42.1 | 0.084 | 49.0 | 0.750 | 44.1 | 0.037 |
| 16 | 43.6 | 0.036 | 45.9 | 0.024 | 43.3 | 0.146 | 44.9 | 0.140 | 43.1 | 0.244 |
| 17 | 44.1 | 0.027 | 43.8 | 0.051 | 45.8 | 0.044 | 39.9 | 0.035 | 46.3 | 0.021 |
| 18 | 45.3 | 0.026 | 46.7 | 0.038 | 45.4 | 0.172 | 44.9 | 0.053 | 44.2 | 0.383 |
| 19 | 46.4 | 0.021 | 44.4 | 0.052 | 47.4 | 0.130 | 44.2 | 0.139 | 43.4 | 0.204 |
| >19 | 47.3 | 0.017 | 49.7 | 0.037 | 47.5 | 0.026 | 46.1 | 0.011 | 47.1 | 0.008 |

**Appendix 12: A discontinuous time series of proportion at length and age distributions and CVs for trevally from the TRE 7 bottom trawl fishery from 1997–98 to 2012–13. Plots are annotated with estimates of mean length or age.**



**Appendix 13: Comparison of the proportion at age distributions for TRE 7 (histogram) and SNA 8 (line) sampled from the bottom trawl fisheries in 2012–13.**