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Length and age composition of trevally in commercial landings from TRE 1 and TRE 7, 1999–2000

Adam J. Langley

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Adam J. Langley

Fisheries Information Systems Ltd.
43B Anglesea Street
Freemans Bay
Auckland 1

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EXECUTIVE SUMMARY

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During 1999–2000, the trevally catch from the target TRE 7 single trawl fishery and the TRE 1 trawl and purse-seine fisheries was sampled. The length and age composition of the catch was determined for each fishery.

The TRE 1 trawl catch was sampled solely from the Bay of Plenty. The length composition of the catch had a dominant mode occupying the 33–41 cm F.L. length range and a broad distribution of larger fish extending to a maximum of 58 cm F.L.. The TRE 1 purse-seine catch was characterised by a strong unimodal distribution, occupying the 30–55cm F.L. length range with a modal peak at 40 cm F.L..

The age composition of the catch from the TRE 1 single trawl and purse-seine fisheries was similar, largely due to the influence of the single age-length key collected from the trawl fishery. The TRE 1 catch was dominated by fish in the 3–7 year age classes, although the catch also contained a large number of older age classes and a high proportion of fish in the accumulated 20+ year age group. The estimated age composition of the purse-seine catch included a higher proportion of fish in the over 7 year age classes. Both age compositions revealed a strong 1995 year class and a weak 1991 year class

The TRE 7 trawl catch was dominated by fish in the 30–45 cm F.L. length range representing the 3–6 year age classes and accumulated older age classes (7–15 years). A significant proportion of the catch comprised fish aged 20 years and older. The age composition reveals strong recent recruitment of the 1994 and 1996 year classes.

Trends in length and age composition from the sampled catch are generally consistent with the results of sampling from 1997–98 and 1998–99. The time series of age compositions derived from the TRE 7 fishery will be incorporated in an updated stock assessment scheduled for 2001–02.

The report summarises recommendations for future sampling of the catch from the TRE 1 and TRE 7 fisheries.

1. INTRODUCTION

The TRE 1 and TRE 7 fishstocks support an important inshore fishery for trevally around the northern North Island (Figure 1). The current TACCs for TRE 1 and TRE 7 are 1506 t and 2153 t, respectively. Most of the catch from TRE 7 is taken by trawl, either targeting trevally or as a bycatch of the target snapper fishery (Annala et al. 2000). Similarly, a large proportion of the TRE 1 catch is taken as a bycatch of the snapper trawl fishery, although an important target purse-seine fishery also operates in TRE 1 (Walsh et al. 1999).

In 1997–98, the Ministry of Fisheries instigated a catch sampling programme to monitor the length and age composition of the main commercial trevally fisheries in TRE 1 and TRE 7. The programme initially included the single trawl and purse-seine fisheries in TRE 1 and the single trawl (peak season and off-peak) and pair trawl fisheries in TRE 7 (Walsh et al. 1999). The four method fisheries were resampled during the 1998–99 fishing year, though sampling of the off-peak TRE 7 fishery was discontinued (Walsh et al. 2000). For the 1999–2000 fishing year, catch sampling was maintained in the single trawl and purse-seine fisheries in TRE 1 and the peak-season single trawl fishery in TRE 7.

The age composition of the TRE 7 catch from the 1997–98 single trawl fishery was incorporated in a preliminary stock assessment of TRE 7 (Hanchet 1999). It is intended to update the stock assessment to include the age compositions from the additional years of sampling, once these data are available.

This report provides a summary of the catch sampling data collected from the main TRE 1 and TRE 7 fisheries during the 1999–2000 fishing year under the Ministry of Fisheries contract TRE1999/01. The specific objective of the project was to conduct the sampling and determine the length and age composition of commercial catches in TRE 1 and TRE 7 during the 1999–2000 fishing year. The target coefficient of variation (c.v.) for the catch at age will be 20% (mean weighted c.v. across all age classes).

2. METHODS

2.1 Sample collection

During the 1999–2000 fishing year, the landed catch of the single trawl and purse-seine fisheries in TRE 1 and the peak-season (December 1999 to March 2000) single trawl fishery in TRE 7 was sampled. A two-stage sampling procedure was used to determine the length composition of the catch, where the first stage in the sampling selection was the unbiased selection of the landed catches of trevally from vessels operating exclusively within a given fishery. All sampling was conducted from the trevally catch discharged to Sanford Limited processing plants in either Auckland or Tauranga.

The sampling regime specified a target sample size of 20 landings and 40 landings from the TRE 1 and TRE 7 single trawl fisheries, respectively. Initially, only landings exceeding a minimum catch weight were considered for sampling; a minimum landed weight of 500 kg for TRE 1 and 1 t for TRE 7. However, some smaller landings were also sampled from the TRE 1 single trawl fishery. The sampling regime for the TRE 1 purse-seine fishery required the sampling of all trevally landings exceeding 10 t.

Where possible, individual purse-seine landings were assigned to one of the two sub-areas of the TRE 1 fishery (East Northland and Bay of Plenty) and TRE 7 landings were assigned to four sub-areas within TRE 7 (Ninety Mile Beach, Kaipara/Manukau, North Taranaki Bight, and South Taranaki Bight) (Figure 1). Landings were assigned to each of these areas based on

the location of the trevally catch recorded on the Ministry of Fisheries catch and effort returns. Landings from the TRE 7 fishery often comprised catches from more than one sub-area.

The second stage of the sampling procedure was the random selection of a sub-sample of the catch from the individual landing. For the single trawl fisheries, this involved the random selection of 20–30 bins containing 400–600 fish. All fish in the selected bins were measured to the nearest centimetre below the fork length F.L. The growth rate of trevally is comparable between sexes (James 1984) and, consequently, it was not necessary to determine the sex of the fish sampled. The sampling strategy was slightly modified for sampling purse-seine landings, with each of the four fish holds (wells) treated as a separate stratum. A random sample of two bins of trevally was selected from the top, middle, and bottom of each hold during discharge.

For each landing, the total weight of the landed catch of trevally and the sampled fraction were recorded.

2.2 Otolith collections and ageing

Otoliths were collected from the TRE 1 and TRE 7 single trawl fisheries. The TRE 1 otoliths were collected between April and June 2000 and the TRE 7 otoliths in January to March. Otoliths were collected in accordance with a fixed allocation per length interval, with the allocation skewed towards the dominant length classes in the length composition.

A target of 552 pairs of otoliths was required from the TRE 1 fishery and 508 otoliths from TRE 7. For the TRE 7 fishery, otoliths were assigned to one of the four sub-areas of the fishery when the sampled catch was taken exclusively from one area. This was to determine the potential to investigate possible differences in growth rates (and age composition) between sub-areas.

Ageing of the two otolith collections was conducted by NIWA Ltd, in accordance to the procedures documented by Walsh et al. (1999).

2.3 Data analysis

For each fishery-method, the sampling coverage was determined by comparing the monthly and, where available, the areal distribution of the sampled component of the catch with the total fishery. The latter was determined from an extract of catch and effort data provided by the Information Group of the Ministry of Fisheries (Report No. 2875). Catch and effort data from each fishery-method were summarised to determine the total number of landings and cumulative weight of landings in the sampled population by month and statistical area.

Combined length compositions were determined for each fishery-method by scaling the individual samples by the weight of the landing. The c.v. of the estimate of the proportion at length for each length interval was determined following the statistical approach described by Davies & Walsh (1995). Separate amalgamated length compositions were also determined for the individual sub-areas sampled from the TRE 7 fishery and the TRE 1 purse-seine fishery.

Separate age-length keys were derived from the age readings of the otolith collections from the TRE 1 and TRE 7 fisheries. The age-length keys determine the proportion of fish at each age in each length interval (Gavaris & Gavaris 1983). The age-length key was applied to the amalgamated length frequency distribution to determine the estimate of the age composition for the individual method fishery. All fish older than 19 years were amalgamated in a single

age class ("plus group"). The c.v. of the individual age classes was determined following the approach of Southward (1976). The overall precision of the age composition was calculated as the average coefficient of variation for each age class, weighted by the proportion of the fish in the interval (MWCV).

The age-length key for the TRE 1 fishery was derived from otoliths collected from the single trawl fishery only. In the absence of a specific otolith collection from the purse-seine fishery, the single trawl age-length key was applied to determine the age composition of the purse-seine catch. This approach assumes the distribution of age at length is the same for the two fisheries.

For the TRE 1 and TRE 7 otolith collections, Von Bertalanffy growth parameter estimates were determined by least squares minimisation of the age-length dataset.

3. RESULTS

3.1 TRE 1 single trawl

3.1.1 Sampling coverage

A total of 22 samples was collected from the TRE 1 single trawl fishery during 1999–2000, representing a total landed weight of 53 t (Table 1). Most of the sampled catches were small, generally less than 2 t, and eight of the sampled landings were less than the 500 kg threshold initially determined as the minimum weight of landed catch to be sampled (Appendix 1). The weight of the landings sampled represented about 9% of the total weight of the 1999–2000 TRE 1 single trawl catch.

The TRE 1 single trawl fishery was sampled between October and June, with limited sampling in October–December and April (Table 2). Most (80%) of the total TRE 1 single trawl catch was taken between October and February, although only 10 landings were sampled during this period.

Most of the samples were taken from catches landed at the Tauranga branch of Sanford Limited with few landings sampled from catches discharged in Auckland (Appendix 1). The high proportion of samples taken in Tauranga is consistent with the high proportion of the TRE 1 single trawl catch taken from within the Bay of Plenty sub-area (statistical areas 008–010) (Figure 2). However, no samples were taken from catch landed from the East Northland single trawl fishery (statistical areas 002 and 003) despite this area accounting for about 25% of the total catch from the fishery (Figure 2).

A total of 572 otoliths was collected from the catch sampled from the TRE 1 single trawl fishery (see Table 1). Otoliths were collected using a fixed allocation sample of 20 otoliths for each of the 1 cm length classes (33–50 cm F.L.) and eight otoliths from the length classes at the extremes of the length range sampled.

The few fish sampled in the peripheral length classes prevented the collection of a full complement of otoliths from length classes less than 28 cm F.L. and greater than 53 cm F.L. (Figure 3). The target of 20 otoliths was collected from each of the 33–50 cm length classes, while additional otoliths were collected from the 40–48 cm length range.

3.1.2 Length and age composition

The length composition of the TRE 1 single trawl catch comprised a dominant mode occupying the 33–41 cm F.L. length range and a broad distribution of larger fish extending to

a maximum of 58 cm F.L. (Figure 4). The length composition was determined with moderate precision over the 33–45 cm F.L. length range, with c.v.s of 10–20%. The upper length range of the distribution is poorly determined due to the high variation in the proportion of larger fish between individual landings (Figure 4).

The age-length key derived from the TRE 1 otolith collection (see Appendix 7) shows that most of the fish sampled in the 27–32 cm F.L. length range are age 3 years and the 33–35 cm length range is dominated by 4 year old fish. The oldest fish recorded in the TRE 1 otolith collection was a 50 cm fish of age 42 years.

The Von Bertalanffy growth parameters derived from the TRE 1 otolith collection were: L_{inf}, 49.16 (standard error 0.364); k, 0.137 (s.e. 0.009); t_0, -4.38 (s.e. 0.467). The growth function is poorly defined at the younger age classes due to the absence of data from the 1 and 2 year age classes. The growth parameters are also strongly influenced by the relative weighting of the number of otoliths collected from each length class as determined by the fixed otolith sample allocation. Consequently, the resulting growth parameters should not be interpreted as defining the underlying growth function of the TRE 1 stock, but rather the best fit to the data from the otolith collection (Figure 5).

The age composition of the TRE 1 single trawl catch shows that fish recruit to the fishery at age 3 and 4 years (Figure 6). A high proportion (33%) of the catch was comprised of fish in the 3–8 year age classes, with a broad range of fish in the older year classes and a large proportion of fish in the aggregated age class of older fish (over 19 years) (Figure 6). Strong year classes were evident in the age composition at age 5 years (1995) and age 10–12 years, but the 1991 year class at age 9 years is weak. The c.v. of the estimates of proportion at age is 10–20% for the younger age classes that make up a high proportion of the catch and about 30% for the older age classes (Figure 6). The MWCV of the age composition is 20.7%.

3.2 TRE 1 purse-seine

3.2.1 Sampling coverage

Seven landings were sampled from the TRE 1 purse-seine fishery during 1999–2000. The sampled landings represented all the significant landings (over 10 t) of trevally from the TRE 1 purse-seine fishery and accounted for 96% of the total TRE 1 catch taken by the purse-seine method. A total of 4415 fish were measured from the sampled catch of 322 t.

The sampled catch was all taken by a single vessel operating from the Tauranga branch of Sanford Limited (Appendix 2). All landings were taken during the October 1999–January 2000 period. The first three landings sampled were from catches taken exclusively from along the East Northland coast, while the remainder of the sampled catches were taken in the Bay of Plenty (Appendix 2).

3.2.2 Length and age composition

The length composition of the 1999–2000 TRE 1 purse-seine catch was characterised by a strong unimodal distribution, occupying the 30–55 cm F.L. length range with a modal peak at 40 cm F.L. (Figure 7). The length composition was determined with moderate precision, with a c.v.of about 10% for the main length classes (38–42 cm) and a MWCV of 17.5%.

There was a slight difference in the length composition of the trevally catch between the two sub-areas fished within TRE 1, East Northland and Bay of Plenty. The modal peak of the length composition was the same for the two areas, although the length composition from the

East Northland fishery occupied a broader range than that of the Bay of Plenty sub-area (Figure 8).

The estimated age composition of the 1999–2000 TRE 1 purse-seine catch comprised a wide range of age classes, dominated by 5–7 year age classes and a relatively high proportion of older fish (20+ years) (Figure 9). The age composition reveals the presence of a strong 1994 year class (age 6 years) and a weak 1991 year class, at age 9 years. The c.v. associated with the estimate of proportion at age is about 15% for the dominant 5–7 year age classes and increases to 30–35% with increasing age (Figure 9). The MWCV for the entire age composition is 24%.

3.3 TRE 7 single trawl

3.3.1 Sampling coverage

During 1999–2000, 39 landings were sampled from the TRE 7 single trawl fishery between December 1999 and March 2000 (Appendix 3). The sampled landings represented 19% by weight and 14% by number of the TRE 7 landings exceeding 1 t. The level of sampling resulted in the measurement of 20 490 fish from a sampled catch of 240.2 t.

Sampling of the 1999–2000 TRE 7 fishery was restricted to the December–March, the period that generally accounts for most of the annual catch from the fishery (Francis et al. 1999). During 1999–2000, this period accounted for 48% of the single trawl TRE 7 catch from landings exceeding 1 t, although the fishing season was protracted with a significant proportion of the catch also taken in November 1999 and April–May 2000 (Table 3).

In 1999–2000, most of the TRE 7 single trawl catch was taken from north of Cape Egmont (Statistical areas 041 to 047), although a significant proportion of the catch was also taken south of Cape Egmont, including the "Rolling Ground" (Statistical areas 037, 039, and 040) (Figure 10). The proportion of catch taken south of Cape Egmont in 1999–2000 was considerably higher than during the three previous fishing years (Langley 2000).

The landings sampled were dominated by catches from north of Cape Egmont, including North Taranaki Bight, the stretch of coast adjacent to the entrance to the Kaipara and Manukau harbours, and Ninety Mile Beach. A limited number of landings were also sampled from catches south of Cape Egmont (Table 4). In general, the areal distribution of the sampled component of the catch was comparable to the total catch from the fishery, except that catches from statistical areas 037 and 040 were under-represented in the sampled fraction (Figure 10).

The fixed allocation otolith sample from the TRE 7 fishery required the collection of 18 otoliths per centimetre length class from the 31–48 cm F.L. length range, with an additional 8 otoliths collected from each length class beyond the extremes of this range. The target otholith sample was achieved for each length class within the 25–53 cm length range, although only a few otoliths were collected from the larger length classes (Figure 11). To supplement the otolith collection, additional otoliths were sampled from fish in the 31–38 cm F.L. length range.

A minor objective of the TRE1999–01 project was to determine whether the growth rate of trevally varied between the main sub-areas of the TRE 7 fishery. For this purpose, it was attempted to collect sub-samples of otoliths from each of the defined areas. This was reliant on identifying fishing trips that operated exclusively within a single sub-area and collecting otoliths solely from these landings. However, opportunities to collect otoliths from a distinct area were limited and often in conflict with the other requirements of the sampling programme, principally the requirement to collect all otoliths during a relatively short time

period. As a result, only a few otoliths were collected from the Ninety Mile Beach and Kaipara/Manukau sub-areas, with a larger sample taken from North Taranaki Bight (Table 5 and Figure 12). The remainder of the otoliths were collected from landings that combined catches from more than one of the sub-areas. Consequently, insufficient otoliths were available from the individual sub-areas to investigate potential differences in growth rate within TRE 7.

3.3.2 Length and age composition

The length composition of the 1999–2000 TRE 7 single trawl catch was dominated by a strong mode of fish in the 30–37 cm F.L. length range and a smaller mode at about 40–45 cm F.L. (Figure 13). The length composition was determined with a high level of precision, with c.v.s of 7–20% for the estimates of proportion at length for the main length classes (30–45 cm F.L.) and a MWCV of 15.1% (Figure 13).

Separate length compositions were derived for each of the sub-areas of the fishery. Although the number of samples available for each sub-area was limited (see Table 4), the results generally indicate that the length composition was comparable between the Ninety Mile Beach, Kaipara/Manukau, and North Taranaki Bight sub-areas (Figure 14). In contrast, the two landings sampled from the Southern Taranaki Bight area consisted of fish in the 40–50 cm F.L. length range. These samples, and the two other samples from catches taken in both North and South Taranaki Bight, account for most of the fish in the secondary length mode (40–45 cm F.L.) of the combined length frequency distribution (see Figure 13).

The age length key from the TRE 7 fishery shows that fish in the 25–28 cm F.L. length range are predominantly 3 years old, while the 29–33 cm length range is dominated by the 4 year age class (Appendix 8). Von Bertalanffy growth parameters were determined from the TRE 7 otolith data were: L_{inf}, 53.57 (standard error 0.825); k, 0.092 (s.e. 0.007); t_0, -5.41 (s.e. 0.576). However, as with the TRE 1 data, the dataset does not include records for the 1 and 2 year age classes and the collection of the data set was non-random with respect to either the single trawl length composition or the length structure of the TRE 7 population. Consequently, although the resulting Von Bertalanffy parameters represent the best fit to the available data, they do not represent the true growth function of the TRE 7 stock (Figure 15).

Trevally recruit to the TRE 7 single trawl fishery from age 3 years and the 1999–2000 catch was dominated by fish in the 3–15 year age classes (Figure 16). There was a high proportion of younger fish in the catch, dominated by 4 and 6 year old fish, representing the 1996 and 1994 year classes, respectively. The age composition also reveals the presence of the weak 1991 and 1992 year classes, at age 8 and 9 years, and a relatively high proportion of old fish (20+ years). The c.v.s of the estimates of proportion at age are about 10–20% for most of the main age classes and the MWCV is 18.3% (Figure 16).

3.4 DISCUSSION

This report summarises the results of the third year of length and age sampling of the three main fisheries within TRE 1 and TRE 7; the peak-season single trawl fishery in TRE 7 and the single trawl and purse-seine fishery in TRE 1. For each of the three fisheries, the sampling programme achieved the target level of sampling and yielded length and age compositions of the specified level of precision.

The level of sampling coverage varied considerably between the three fisheries. All the significant landings from the TRE 1 purse-seine fishery in 1999–2000 were sampled and about 20% of the catch landed from the entire TRE 7 single trawl fishery was sampled. In

general, the distribution of sampling effort in TRE 7 was broadly consistent with the seasonal and areal distribution of the entire TRE 7 single trawl fishery, although the sampling programme did not encompass the whole of the main fishing season. Given the intensity of sampling of the TRE 1 purse-seine and TRE 7 single trawl fisheries, and the high level of precision associated with the amalgamated length compositions, it appears that the level of coverage was adequate to reliably determine the length frequency distribution of the catch from these two fisheries.

The TRE 1 single trawl fishery is characterised by a large number of small landings, mainly taken as a bycatch of the target snapper fishery. There is also considerable variation in the length composition of the trevally catch between landings. The level of sampling achieved in 1999–2000 yielded estimates of length and age composition with a reasonable level of precision. However, given the relatively small number of landings sampled and the small proportion of the total landed catch sampled, it is difficult to determine how representative the sampled fraction is of the entire TRE 1 single trawl catch. Nevertheless, it is apparent that the sampling is strongly biased to the proportion of the catch taken in the Bay of Plenty sub-area and does not encompass catches taken within East Northland.

The three years of catch sampling data from the TRE 1 single trawl fishery reveal considerable annual variation in the length and age composition of the catch (Walsh et al. 1999, 2000). For the 1997–98 fishing year, there was a higher proportion of larger (older) fish in the catch compared to the two subsequent years. Over the three-year study period, there has been a decline in the proportion of older fish (10–15 years) in the sampled catch and a corresponding increase in the proportion of younger fish (age 3–7 years) in the estimated age composition (Appendix 9a). This trend in the age composition of the catch may be partly attributable to the apparent recruitment of recent strong year classes to the fishery (1994 and 1995 year classes) and the progression of the weak 1991 year class into the older age classes. However, the differences in length and age composition may also be influenced by differences in the annual distribution of sampling effort between years. The sampling data should be examined in more detail to determine the comparability of the sampled component of the catch between fishing years.

Comparison of the time series of the age composition data from the TRE 1 single trawl fishery reveals some differences in the relative strength of individual year classes. For example, the three years of sampling data indicate the presence of the strong 1994 year class, at ages 4, 5, and 6 years in the 1997–98, 1998–99, and 1999–2000 age compositions, respectively. However, although the 1990 year class is weak in 1997–98 and 1998–99, this year class is of average strength in the 1999–2000 age composition and the adjacent 1991 age class is weak. This is consistent with the level of ageing error associated with older fish (+/- 1 year for 8–12 year age classes) reported by Walsh et al. (1999, 2000).

The annual length frequency distributions of the catch sampled from the TRE 1 purse-seine fishery from the three-year period were very similar, with a strong unimodal distribution occupying the 30–50 cm F.L. length range and a modal peak at around 40 cm F.L. (Walsh et al. 1999, 2000). Walsh et al. (2000) identified differences in the length composition of the catch between the Bay of Plenty and East Northland sub-areas of TRE 1 which were not apparent in the present study.

Although there was no apparent trend in the amalgamated length composition of the purse-seine catch between years, there was a considerable shift in the estimated age composition during the same period. Over the three years, the proportion of fish in the 5–7 year age classes increased with a corresponding decline in the proportion of fish in the 10–13 year age classes (Appendix 9b). These differences are attributable to trends in the proportion at age by length class as determined from the annual TRE 1 age-length keys. The TRE 1 age-length keys were derived from otoliths collected from the TRE 1 single trawl fishery and the application of

these data to the purse-seine fishery assumes a comparable distribution of age at length for fish vulnerable to each method. The validity of this assumption is unknown and given the differences in operation and, therefore, selectivity between the two methods this assumption should be investigated.

Length compositions of the peak-season TRE 7 catch were comparable between 1997–98 and 1998–99 (Walsh et al. 1999, 2000), although sampling data from the current study reveal a substantial increase in the proportion of smaller (less than 35 cm F.L.) fish in the catch taken in 1999–2000. The increase in the proportion of smaller fish in the catch is apparent as a high proportion of the 4 year old age class in the age composition, indicating the recruitment of a strong 1996 year class to the fishery. The time-series of age composition data also reveals the progression of the strong 1994 year class previously identified by Walsh et al. (1999, 2000) and the weak 1981 year class, aged 9 years in the 1999–2000 age composition (Appendix 9c).

In general, there is a high level of consistency between the three successive age compositions derived from the TRE 7 single trawl catch during the 1997–98 to 1999–2000 period. These data will contribute significantly to improving the current stock assessment for TRE 7 (Hanchet 1999) which is scheduled to be updated during the 2001–2002 fishing year.

Catch sampling data collected from the TRE 7 single trawl fishery in 1997–98 and 1998–99 revealed differences in length composition between the Ninety Mile Beach, Kaipara/Manukau, and North Taranaki Bight sub-areas of TRE 7 (Walsh et al. 1999, 2000). However, these differences were not consistent between fishing years and no significant differences in the length composition were apparent between these sub-areas for 1999–2000, although recent sampling revealed catches from the South Taranaki Bight were comprised of large trevally.

The potential for differences in the length composition between sub-areas highlights the importance of ensuring the sampling coverage is representative of the areal distribution of the entire fishery to ensure the collection of an unbiased sample of the length composition of the catch. Significant differences in relationship between age and length between areas would also require the random distribution of otolith samples from the fishery with respect to area. The collection of additional otoliths from discrete sub-areas of the fishery during 2000–2001 may provide the opportunity to compare growth rates of trevally between areas.

In September 2000, the results of the first three years of catch sampling from the TRE 1 and TRE 7 fisheries were considered in a review by the Pelagic Fishery Assessment Working Group (Langley 2000). This review included the length compositions from 1997–98 to 1999–2000 and age frequency data from the first two years of sampling. The review was primarily conducted to make recommendations for the continuation of catch sampling during the 2000–01 fishing year. The recommendations are summarised as follows.

1. To continue to sample the peak-season TRE 7 single trawl fishery. This will extend the time-series of length and age composition data from the fishery to four years. The collection of data from 2000–2001 will also enable the recent recruitment of strong year classes (1994 and 1995) to be monitored.
2. To defer sampling of the TRE 1 single trawl fishery, pending a further review of the data from the 1999–2000 fishing year. The fishery has been difficult to sample, primarily due to the large number of small landings, and it was considered that differences in length and age composition between years were likely to be influenced by changes in the operation of the sampled fleet (selectivity), rather than changes in the TRE 1 population age composition.
3. Sampling of the TRE 1 purse-seine fishery would be continued in 2000–01, including the collection of a TRE 1 otolith sample from the sampled landings. The collection of a specific otolith sample from the purse-seine catch will enable a comparison with the age-

length keys determined from single trawl catches and, thereby, determine whether there is a significant difference in the distribution of the proportion of age at length between the two methods.

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Table 1: Sampling coverage of the 1999–2000 TRE 1 single trawl fishery.

	No. of samples	Percent of landings		Sampled weight (t)	No. of otoliths	No. of fish
		By number	By weight			
> 0.5 tonne	14	5.8	9.1	50		7 697
All landings	22	3.7	8.6	53	572	10 385

Table 2: Comparison of the number of length frequency samples collected from the TRE 1 single trawl fishery and the monthly distribution of the total TRE 1 single trawl fishery, expressed as a percentage of the total annual number of landings and the total annual weight (tonnes) of the catch for the 1999–2000 fishing year.

	Month												Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	(t)
Number landings	11	10	8	9	10	9	10	11	6	4	7	5	590
Landed weight	12	14	10	27	16	3	4	4	2	1	3	3	613
Samples	2	1	1	4	2	3	0	5	4	0	0	0	22

Table 3: Comparison of the number of length frequency samples collected from the TRE 7 single trawl fishery and the monthly distribution of the total 1999–2000 TRE 7 single trawl fishery, expressed as a percentage of the total annual number of landings and the total annual weight of the catch for landings exceeding 1 t of trevally. The box encompasses the sampling period.

	Month												Total
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	(t)
Number landings	9	13	15	13	12	10	7	8	4	5	2	3	289
Landed weight	6	13	15	14	10	9	15	10	3	3	1	2	1 282
Samples	0	0	6	5	14	14	0	0	0	0	0	0	39

Table 4: Areal distribution of catch from sampled landings from the TRE 7 BT fishery from 1999–2000.

Fishery sub-area	Number of samples
Ninety Mile Beach	6
Kaipara/Manukau and Ninety Mile Beach	13
Kaipara/Manukau	7
Kaipara/Manukau and North Taranaki Bight	4
North Taranaki Bight	5
North and South Taranaki Bight	2
South Taranaki Bight	2
Total	39

Table 5: Summary of 1999–2000 TRE 7 otolith collection by fishery sub-area.

Fishery sub-area	No. of otoliths	Length range (cm)	
		Min	Max
Ninety Mile Beach	39	36	59
Kaipara/Manukau	22	29	58
North Taranaki Bight	172	25	51
South Taranaki Bight	4	46	56
Other	268	25	64
Total	505	25	64

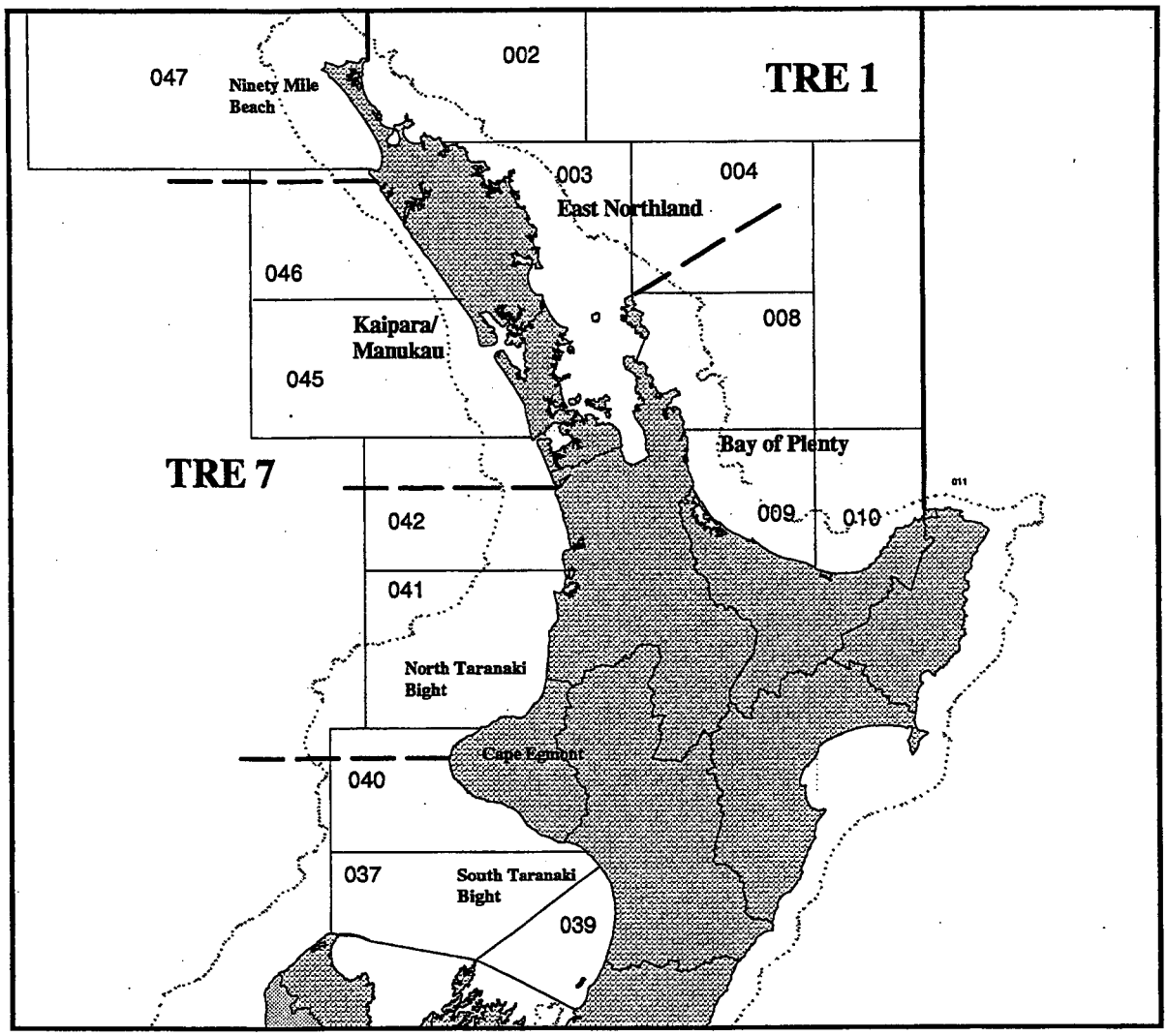


Figure 1: Map of the TRE 1 and TRE 7 fishstock areas including the sub-areas of each fishery and the Ministry of Fisheries statistical areas. The grey dotted line represents the 200 m depth contour.

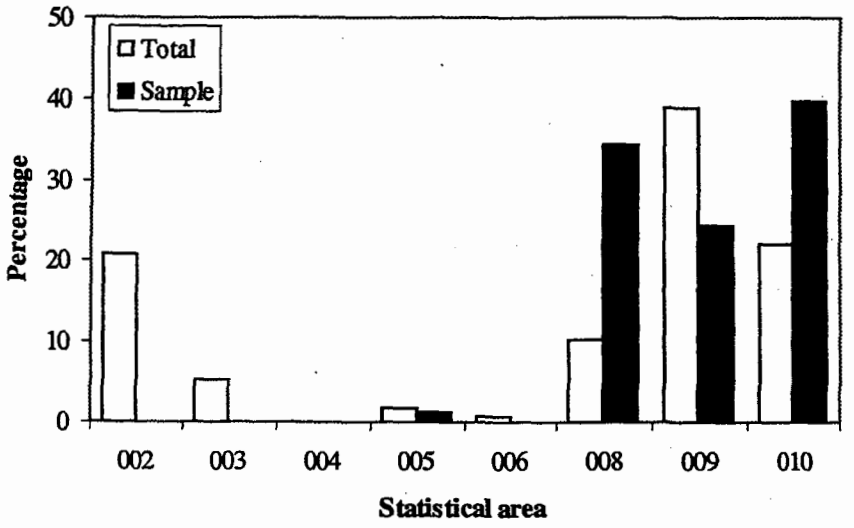


Figure 2: Comparison of the percentage distribution of the total TRE 1 bottom trawl catch and the sampled component by statistical area for the 1999–2000 fishing year.

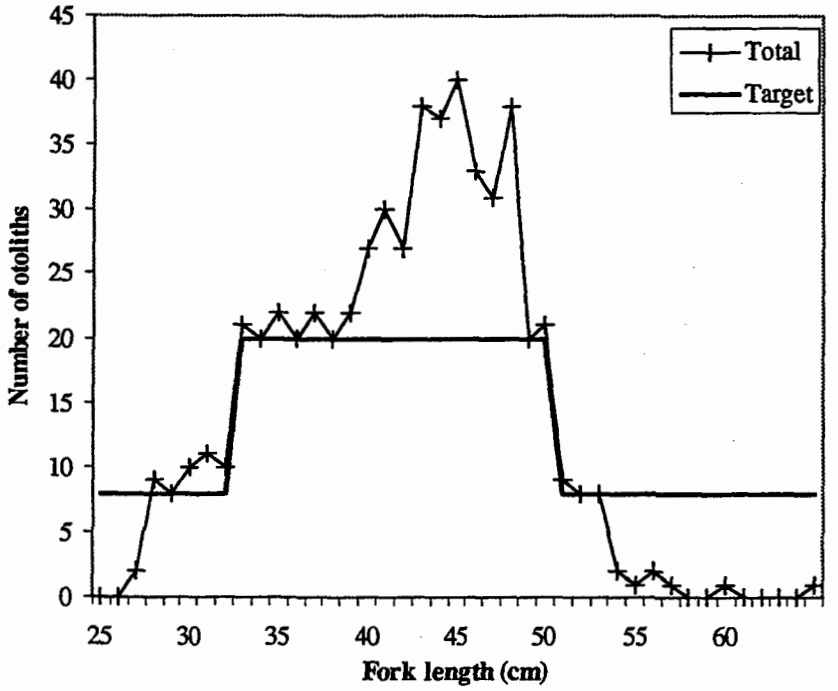


Figure 3: Length distribution of the target fixed allocation otolith sample (solid line) and the achieved otolith collection (crosses) for the 1999–2000 TRE 1 single trawl fishery.

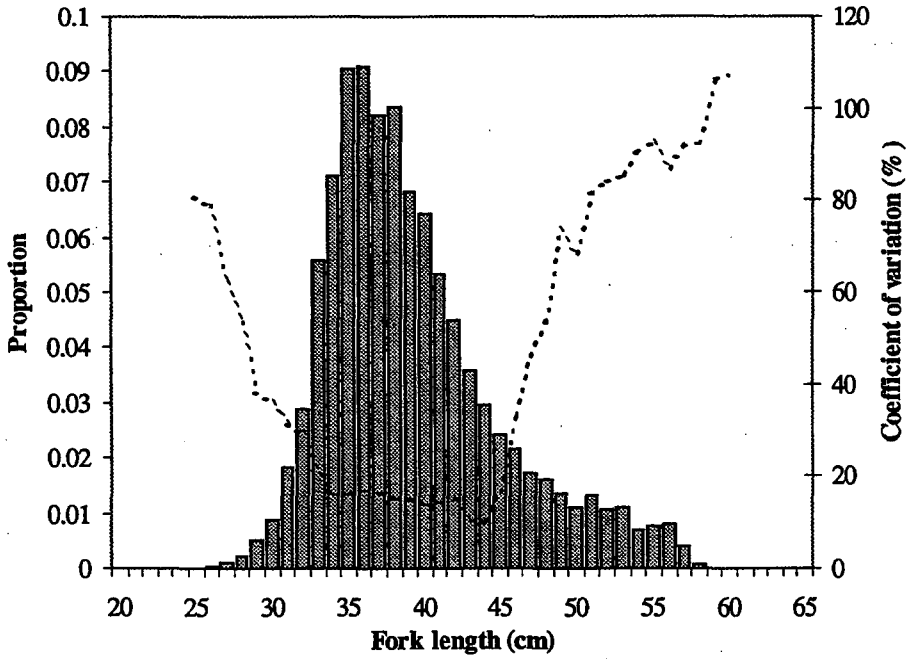


Figure 4: Length composition of the TRE 1 single trawl catch from the 1999–2000 fishing year. The dashed line represents the coefficient of variation associated with the estimates of proportion at length. Number of samples, 22; number of fish measured, 10 385; MWCV, 24.0%.

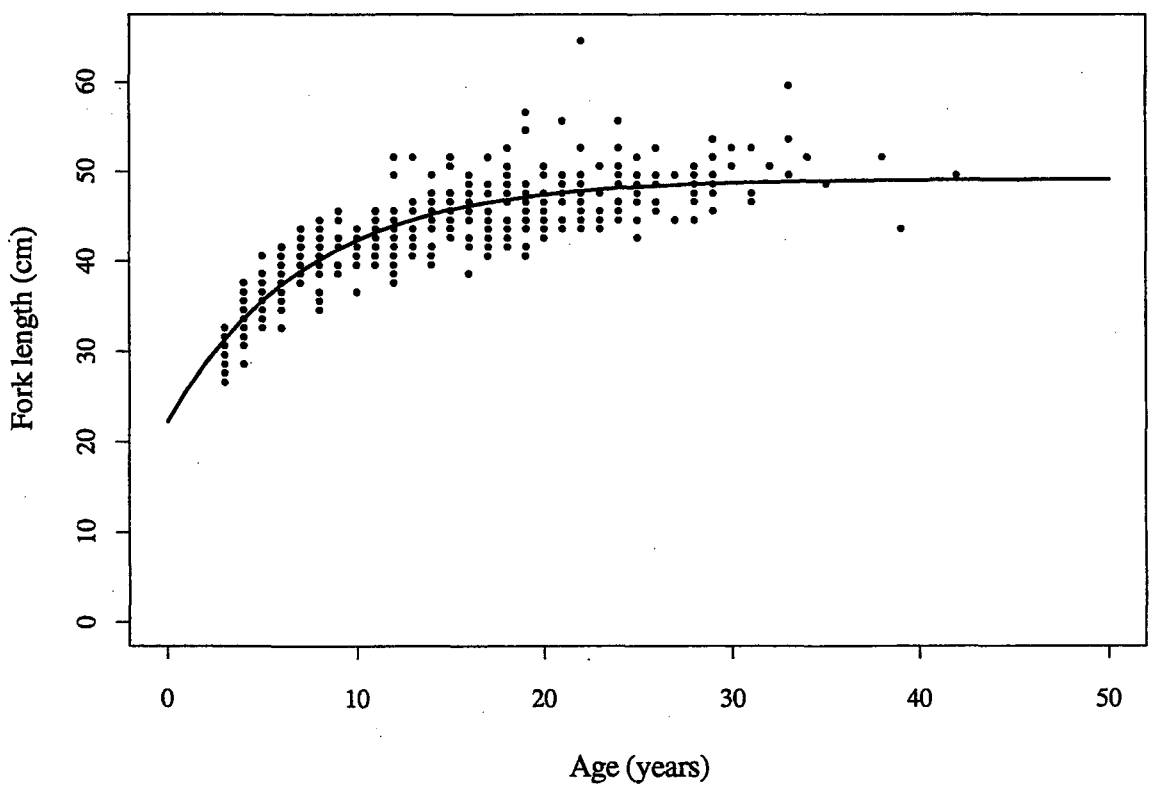


Figure 5: Relationship between age and length for trevally sampled from the 1999–2000 TRE 1 single trawl fishery. The line represents the Von Bertalanffy growth function fitted to the data.

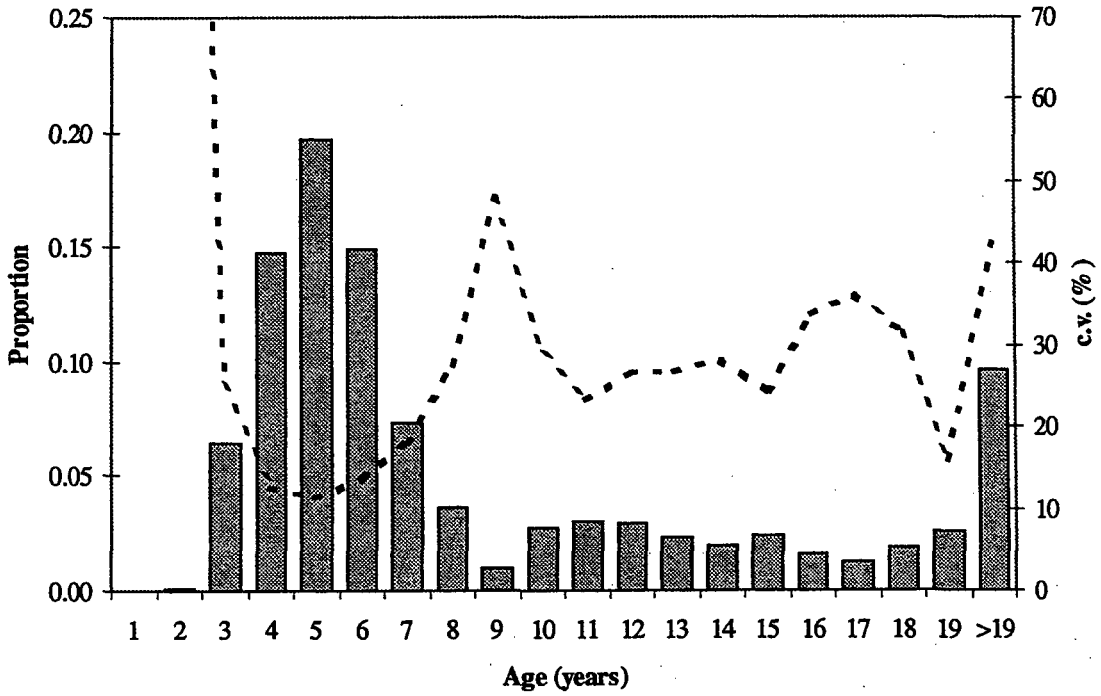


Figure 6: Age composition of the TRE 1 single trawl catch for 1999–2000. The dashed line represents the coefficient of variation associated with the estimates of proportion at age. Number of otoliths in the sample, 572; MWCV, 20.7%.

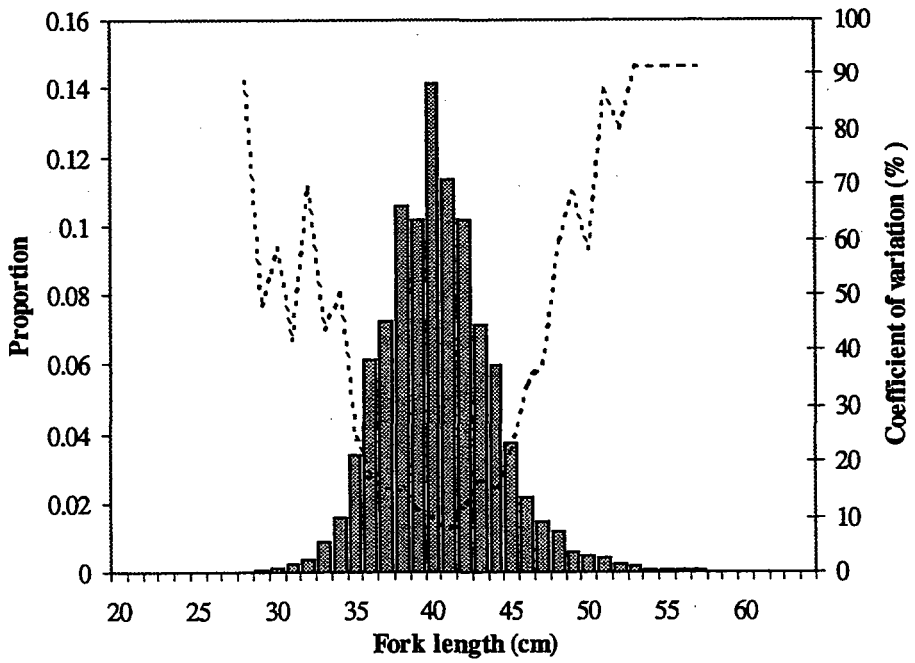


Figure 7: Length composition of the TRE 1 purse-seine catch from the 1999–2000 fishing year. The dashed line represents the coefficient of variation associated with the estimates of proportion at length. Number of samples, 7; number of fish measured, 4415; MWCV, 17.5%.

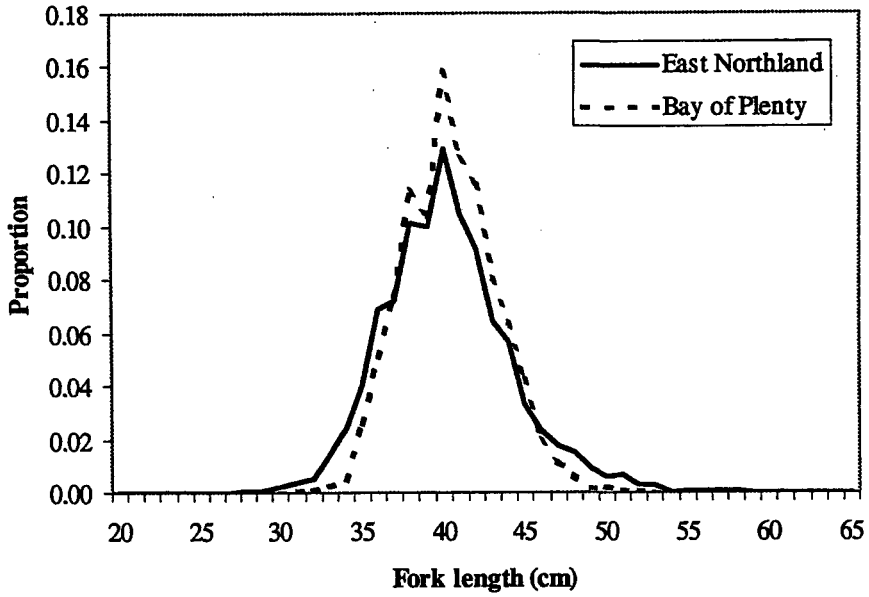


Figure 8: Comparison of the length compositions of trevally from the purse-seine catch from the East Northland and Bay of Plenty regions of TRE 1 for the 1999–2000 fishing year.

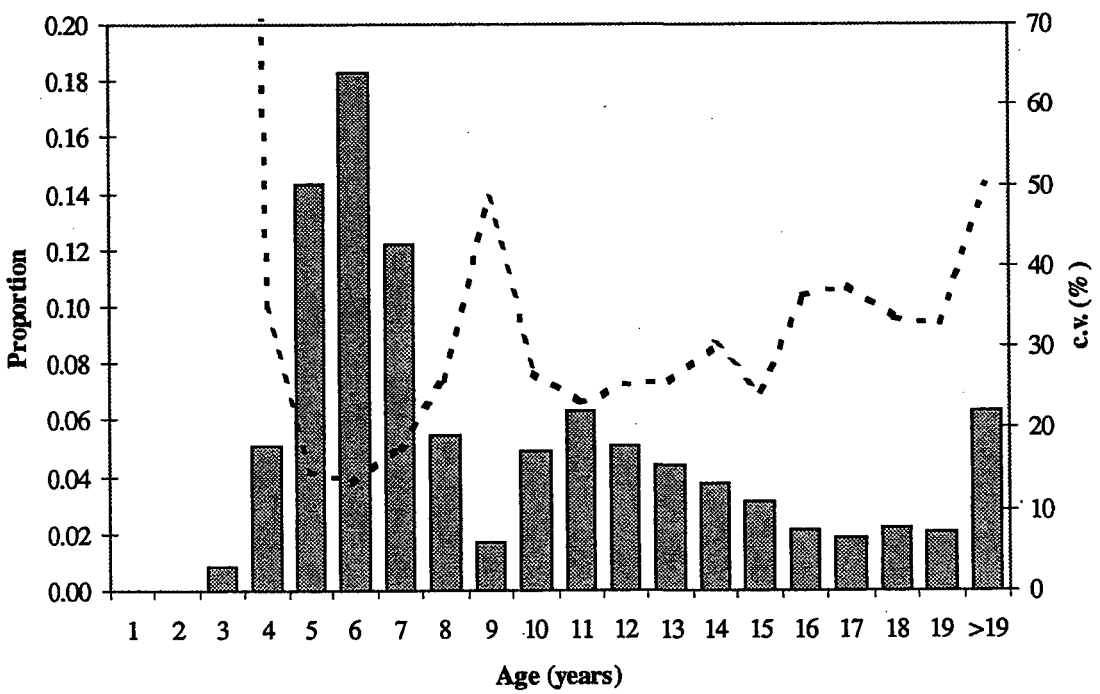


Figure 9: Age composition of the TRE 1 purse-seine catch for 1999–2000. The dashed line represents the coefficient of variation associated with the estimates of proportion at age. The age composition was determined using an otolith collection from the TRE 1 single trawl fishery. Number of otoliths in the sample, 572; MWCV, 24.0%.

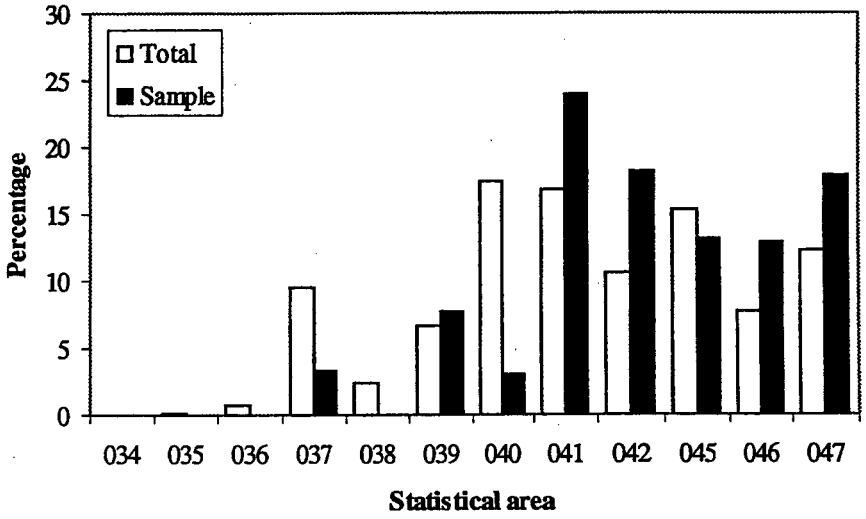


Figure 10: Comparison of the percentage distribution of the total TRE 7 bottom trawl catch and the sampled component by statistical area for the 1999–2000 fishing year.

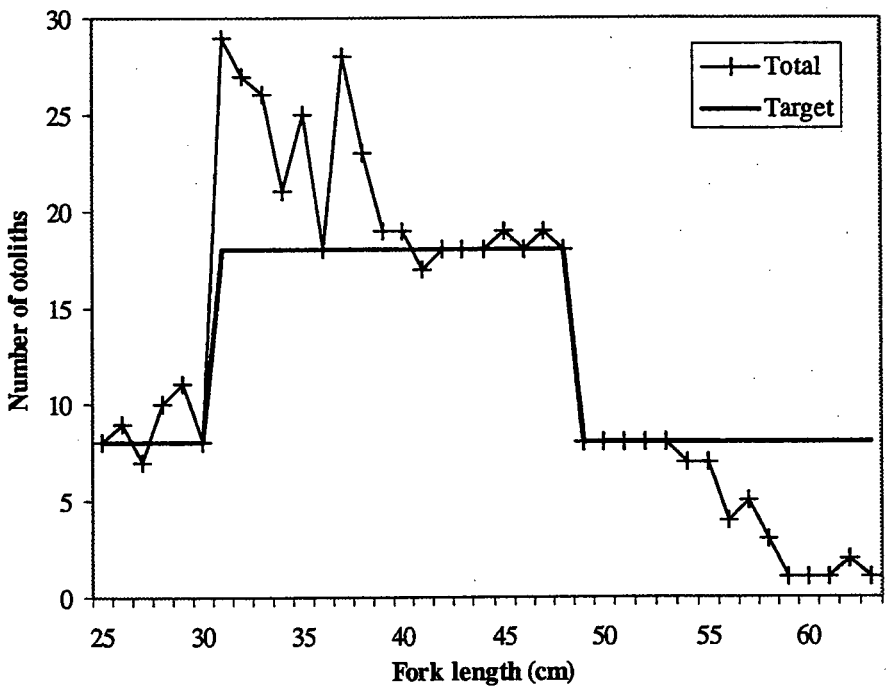


Figure 11: Length distribution of the target fixed allocation otolith sample (solid line) and the achieved otolith collection (crosses) for the 1999–2000 TRE 7 single trawl fishery.

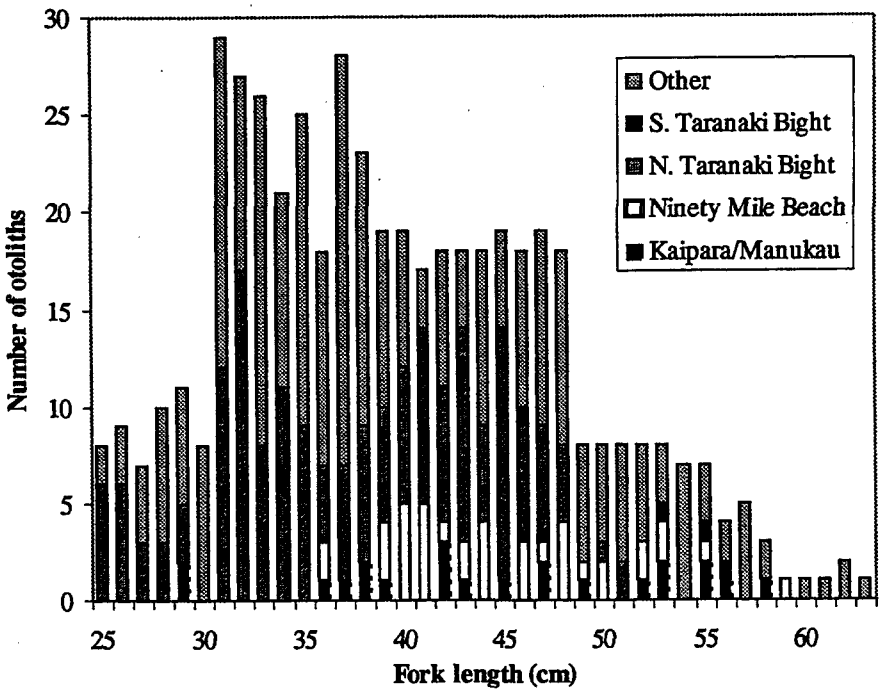


Figure 12: Number of otoliths collected from TRE 7 by fish length for each of the sub areas of the fishery.

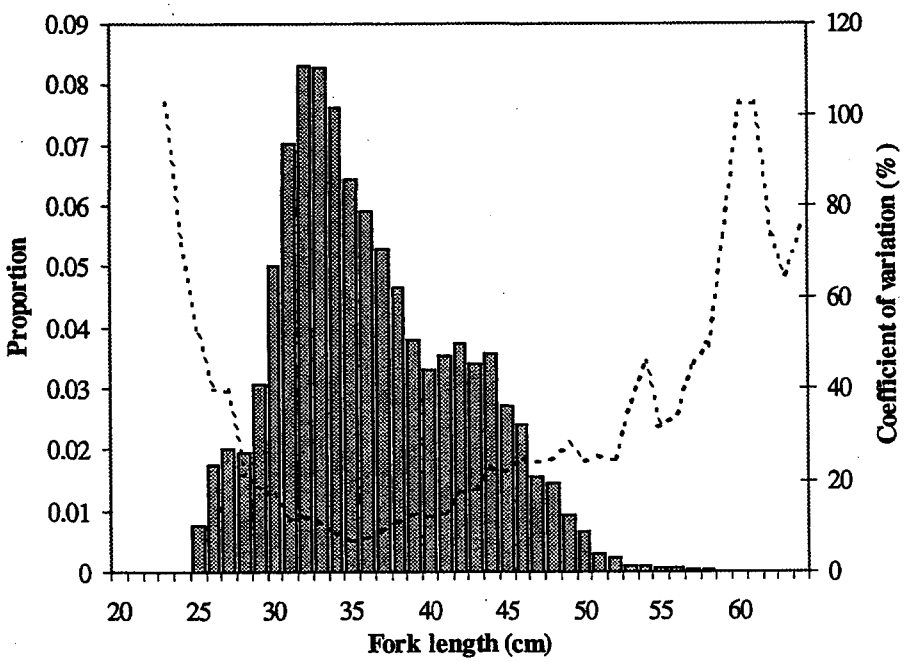


Figure 13: Length composition of the catch from the TRE 7 single trawl peak season fishery for 1999–2000. Number of samples, 39; number of fish measured, 20 003; MWCV, 15.1%.

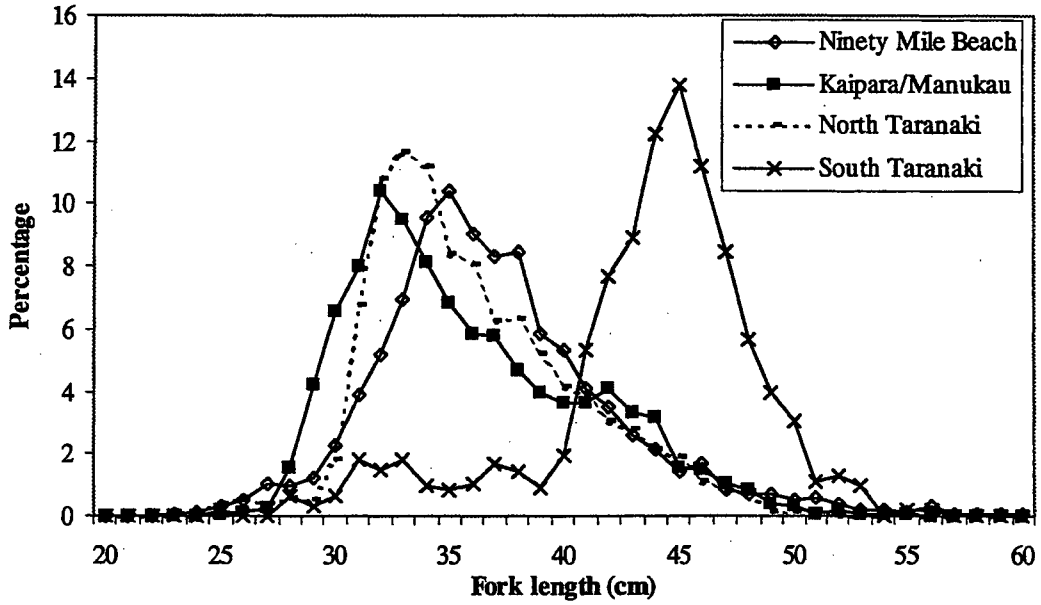


Figure 14: Comparison between length compositions from sub-areas of TRE 7 sampled in 1999–2000.

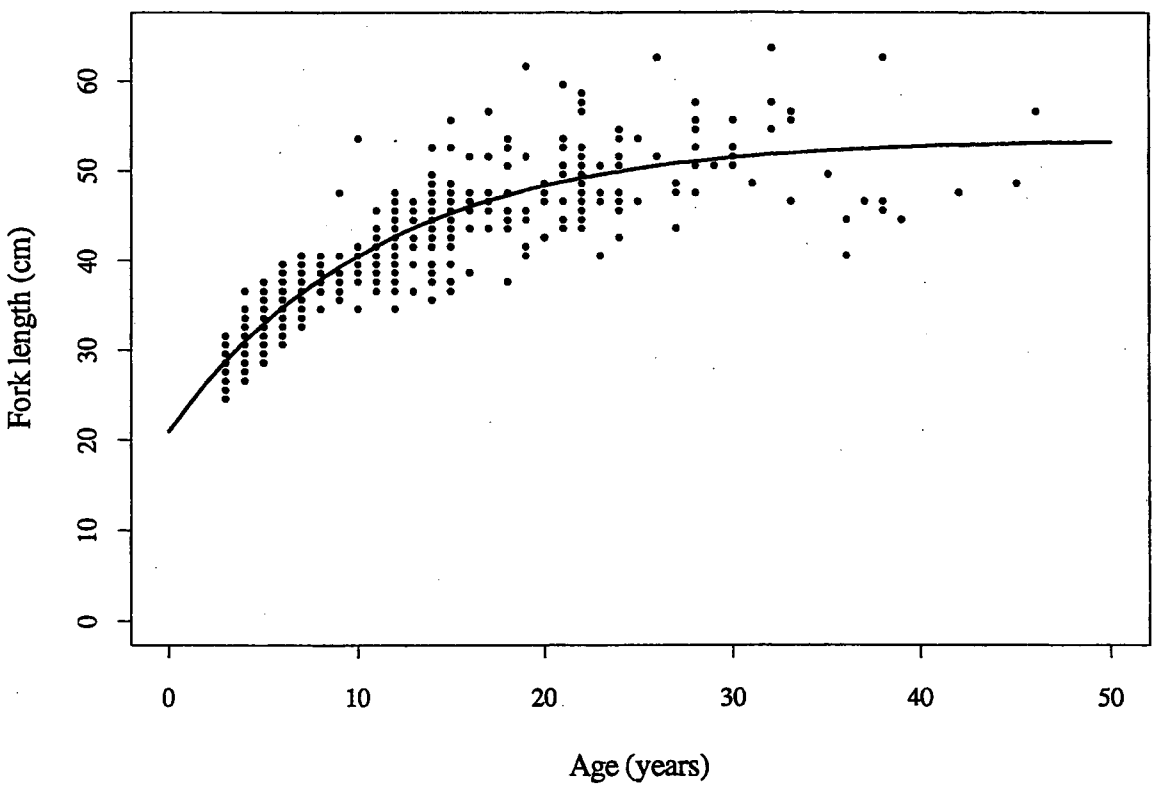


Figure 15: Relationship between age and length for trevally sampled from the 1999–2000 TRE 7 single trawl fishery. The line represents the Von Bertalanffy growth function fitted to the data.

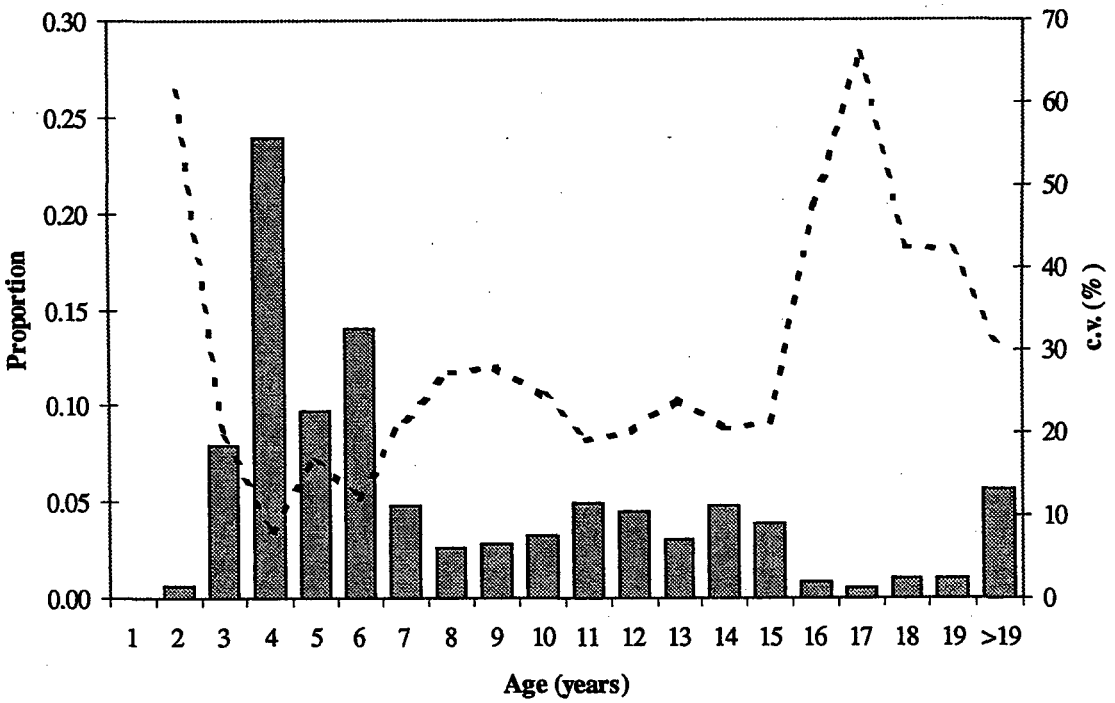


Figure 16: Age composition of the peak-season TRE 7 single trawl catch for 1999–2000. The dashed line represents the coefficient of variation associated with the estimates of proportion at age. Number of otoliths in the sample, 504; MWCV, 18.3%.

Appendix 1. Summary of individual landings sampled from the TRE 1 single trawl fishery during 1999–2000 fishing year.

Landing number	Vessel name	Landing date	Sampling date	Landed weight (t)	No. fish measured	Port of Landing
20101	*San Hauraki*	22-Oct-99	22-Oct-99	11.7	207	Auckland
20102	*San Rakino*	26-Oct-99	26-Oct-99	1.6	319	Auckland
20103	*Albert Sanford*	15-Nov-99	15-Nov-99	9.1	693	Auckland
20107	*Albert Sanford*	1-Jun-00	1-Jun-00	0.2	112	Auckland
20501	*San Cuvier*	15-Dec-99	15-Dec-99	2.2	499	Tauranga
20502	*San Cuvier*	12-Jan-00	12-Jan-00	3.4	600	Tauranga
20503	*San Colville*	17-Jan-00	17-Jan-00	6.4	482	Tauranga
20504	*San Colville*	24-Jan-00	24-Jan-00	4.6	516	Tauranga
20505	*San Cuvier*	26-Jan-00	26-Jan-00	2.0	567	Tauranga
20506	*San Cuvier*	2-Feb-00	2-Feb-00	2.6	556	Tauranga
20507	*San Cuvier*	17-Feb-00	17-Feb-00	1.6	647	Tauranga
20508	*San Colville*	5-Mar-00	6-Mar-00	0.5	440	Tauranga
20509	*San Colville*	13-Mar-00	13-Mar-00	0.5	425	Tauranga
20510	*San Cuvier*	13-Mar-00	15-Mar-00	0.3	292	Tauranga
20511	*San Cuvier*	1-May-00	1-May-00	0.4	326	Tauranga
20512	*San Cuvier*	5-May-00	5-May-00	0.7	637	Tauranga
20513	*San Colville*	8-May-00	8-May-00	0.5	638	Tauranga
20514	*San Colville*	24-May-00	24-May-00	0.5	348	Tauranga
20515	*San Colville*	31-May-00	31-May-00	2.3	757	Tauranga
20516	*San Cuvier*	12-Jun-00	12-Jun-00	0.3	173	Tauranga
20517	*San Colville*	15-Jun-00	15-Jun-00	0.4	374	Tauranga
20518	*San Colville*	26-Jun-00	26-Jun-00	1.0	777	Tauranga
Total				52.8	10 385	

Appendix 2. Summary of individual landings sampled from F.V. *Lindberg* from the TRE 1 purse-seine fishery during 1999–2000 fishing year.

Landing number	Landing date	Sampling date	Landed weight (t)	No. fish measured	Area(s) fished
20151	13-Oct-99	13-Oct-99	85.2	742	East Northland
20152	26-Oct-99	26-Oct-99	23.5	612	East Northland
20153	8-Nov-99	8-Nov-99	72.9	903	East Northland
20154	18-Nov-99	20-Nov-99	24.2	201	Bay of Plenty
20155	30-Nov-99	30-Nov-99	11.6	461	Bay of Plenty
20156	2-Dec-99	2-Dec-99	57.0	725	Bay of Plenty
20157	10-Jan-00	10-Jan-00	47.3	771	Bay of Plenty
Total			321.7	4 415	

Appendix 4. Estimates of the proportion at length of trevally from the TRE 1 purse-seine and single trawl fishery in 1999–2000.

Length	Purse-seine		Single trawl	
(cm)	Prop.	c.v	Prop.	c.v
20	0.0000	0.00	0.0000	0.00
21	0.0000	0.00	0.0000	0.00
22	0.0000	0.00	0.0000	0.00
23	0.0000	0.00	0.0000	1.06
24	0.0000	0.00	0.0000	0.00
25	0.0000	0.00	0.0001	0.81
26	0.0000	0.00	0.0002	0.79
27	0.0000	0.00	0.0011	0.62
28	0.0003	0.89	0.0020	0.53
29	0.0006	0.48	0.0051	0.38
30	0.0012	0.58	0.0088	0.36
31	0.0026	0.42	0.0184	0.32
32	0.0033	0.69	0.0287	0.29
33	0.0091	0.44	0.0560	0.20
34	0.0158	0.50	0.0713	0.16
35	0.0340	0.24	0.0905	0.16
36	0.0612	0.17	0.0908	0.17
37	0.0727	0.15	0.0822	0.16
38	0.1060	0.15	0.0835	0.15
39	0.1014	0.12	0.0681	0.15
40	0.1414	0.10	0.0642	0.14
41	0.1131	0.08	0.0532	0.14
42	0.1016	0.13	0.0449	0.15
43	0.0711	0.17	0.0359	0.11
44	0.0594	0.15	0.0294	0.10
45	0.0372	0.22	0.0242	0.16
46	0.0215	0.34	0.0216	0.33
47	0.0147	0.38	0.0171	0.46
48	0.0116	0.60	0.0162	0.54
49	0.0060	0.68	0.0134	0.74
50	0.0045	0.58	0.0108	0.68
51	0.0040	0.87	0.0131	0.82
52	0.0021	0.80	0.0104	0.84
53	0.0019	0.91	0.0111	0.85
54	0.0000	0.00	0.0070	0.91
55	0.0006	0.91	0.0076	0.92
56	0.0003	0.91	0.0080	0.87
57	0.0006	0.91	0.0042	0.92
58	0.0003	0.91	0.0007	0.93
59	0.0000	0.00	0.0000	1.07
60	0.0000	0.00	0.0000	1.07
61	0.0000	0.00	0.0000	0.00
62	0.0000	0.00	0.0000	0.00
63	0.0000	0.00	0.0000	0.00
64	0.0000	0.00	0.0000	0.00
65	0.0000	0.00	0.0000	1.07

Appendix 5. Estimates of the proportion at length of trevally from the TRE 7 single trawl fishery in 1999–2000. The proportion at length for each sub-area is also presented (Area codes: NMB, Ninety Mile Beach; KMH, Kaipara/Manukau; NTB, Northern Taranaki Bight; STB, Southern Taranaki Bight).

Length	Total		Sub Areas			
(cm)	Prop.	c.v	NMB	KMH	NTB	STB
20	0.0000	0.00	0.0000	0.0000	0.0000	0.0000
21	0.0000	0.00	0.0000	0.0000	0.0000	0.0000
22	0.0000	0.00	0.0000	0.0000	0.0000	0.0000
23	0.0000	1.02	0.0007	0.0000	0.0000	0.0000
24	0.0001	0.72	0.0011	0.0002	0.0000	0.0000
25	0.0075	0.52	0.0035	0.0005	0.0039	0.0017
26	0.0175	0.40	0.0049	0.0015	0.0061	0.0000
27	0.0200	0.40	0.0107	0.0023	0.0037	0.0000
28	0.0196	0.22	0.0099	0.0154	0.0057	0.0067
29	0.0307	0.19	0.0121	0.0423	0.0049	0.0034
30	0.0502	0.17	0.0231	0.0659	0.0182	0.0067
31	0.0701	0.11	0.0390	0.0801	0.0678	0.0185
32	0.0832	0.12	0.0521	0.1042	0.1082	0.0151
33	0.0829	0.11	0.0695	0.0950	0.1166	0.0185
34	0.0762	0.09	0.0954	0.0812	0.1117	0.0101
35	0.0644	0.07	0.1040	0.0680	0.0838	0.0084
36	0.0590	0.08	0.0901	0.0585	0.0809	0.0104
37	0.0526	0.09	0.0834	0.0577	0.0622	0.0168
38	0.0466	0.11	0.0843	0.0470	0.0629	0.0143
39	0.0380	0.13	0.0589	0.0398	0.0520	0.0092
40	0.0329	0.12	0.0532	0.0364	0.0419	0.0196
41	0.0352	0.13	0.0412	0.0363	0.0389	0.0536
42	0.0372	0.18	0.0354	0.0407	0.0305	0.0771
43	0.0341	0.18	0.0263	0.0334	0.0279	0.0890
44	0.0356	0.23	0.0218	0.0319	0.0216	0.1223
45	0.0271	0.22	0.0141	0.0158	0.0186	0.1376
46	0.0242	0.25	0.0172	0.0150	0.0111	0.1119
47	0.0156	0.24	0.0082	0.0105	0.0079	0.0849
48	0.0144	0.25	0.0071	0.0085	0.0078	0.0564
49	0.0093	0.28	0.0071	0.0041	0.0010	0.0399
50	0.0065	0.24	0.0052	0.0034	0.0012	0.0304
51	0.0031	0.25	0.0056	0.0004	0.0021	0.0112
52	0.0024	0.25	0.0037	0.0018	0.0000	0.0131
53	0.0010	0.37	0.0023	0.0006	0.0001	0.0095
54	0.0009	0.46	0.0019	0.0004	0.0000	0.0000
55	0.0006	0.32	0.0011	0.0005	0.0007	0.0020
56	0.0006	0.34	0.0032	0.0003	0.0000	0.0020
57	0.0002	0.45	0.0008	0.0002	0.0000	0.0000
58	0.0002	0.49	0.0005	0.0001	0.0000	0.0000
59	0.0000	0.74	0.0004	0.0000	0.0000	0.0000
60	0.0000	1.02	0.0007	0.0000	0.0000	0.0000
61	0.0000	1.02	0.0004	0.0000	0.0000	0.0000
62	0.0000	0.73	0.0000	0.0000	0.0000	0.0000
63	0.0001	0.65	0.0002	0.0000	0.0000	0.0000
64	0.0001	0.75	0.0000	0.0000	0.0000	0.0000
65	0.0000	0.00	0.0000	0.0000	0.0000	0.0000

Appendix 6. Estimates of proportion at age.

Estimates of proportion at age of trevally from the TRE 1 single trawl and purse-seine fisheries in 1999–2000 and the associated coefficient of variations.

Age (years)	Single trawl		Purse-seine	
	Prop.	c.v	Prop.	c.v
1	0.000	0.000	0.000	0.000
2	0.001	1.761	0.000	0.000
3	0.064	0.253	0.008	3.840
4	0.147	0.126	0.051	0.350
5	0.197	0.114	0.143	0.147
6	0.149	0.136	0.183	0.135
7	0.073	0.184	0.122	0.177
8	0.036	0.275	0.055	0.257
9	0.009	0.479	0.017	0.484
10	0.027	0.287	0.049	0.267
11	0.030	0.233	0.063	0.231
12	0.029	0.268	0.051	0.252
13	0.023	0.268	0.044	0.259
14	0.020	0.281	0.037	0.301
15	0.024	0.244	0.031	0.242
16	0.016	0.337	0.022	0.361
17	0.012	0.360	0.018	0.376
18	0.019	0.315	0.022	0.334
19	0.025	0.159	0.021	0.328
>19	0.096	0.423	0.063	0.500

Estimates of proportion at age of trevally from the TRE 7 single trawl fishery in 1999–2000 and the associated coefficient of variations.

Age (years)	Prop.	c.v
1	0.000	0.000
2	0.006	0.615
3	0.079	0.196
4	0.240	0.082
5	0.097	0.169
6	0.140	0.123
7	0.048	0.218
8	0.026	0.273
9	0.028	0.281
10	0.032	0.245
11	0.049	0.191
12	0.045	0.202
13	0.030	0.241
14	0.048	0.204
15	0.039	0.211
16	0.008	0.477
17	0.005	0.659
18	0.011	0.425
19	0.010	0.422
>19	0.057	0.298

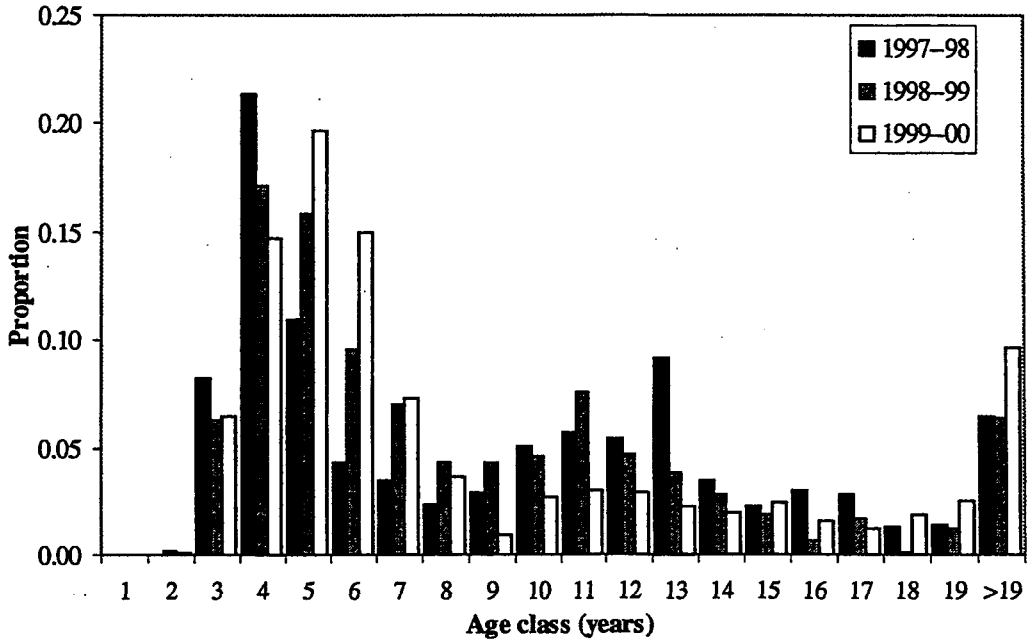
Appendix 7. TRE 1 age-length key for the 1999–2000 fishing year.

Length (cm)	Age (years) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	>19	No. Aged
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
28	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
29	0	0.13	0.75	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
30	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
31	0	0	0.82	0.18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
32	0	0	0.70	0.30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
33	0	0	0.24	0.43	0.29	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
34	0	0	0	0.75	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
35	0	0	0	0.36	0.36	0.23	0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	22
36	0	0	0	0.10	0.55	0.30	0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	20
37	0	0	0	0.14	0.50	0.23	0	0.05	0	0.09	0	0	0	0	0	0	0	0	0	0	22
38	0	0	0	0.05	0.30	0.30	0.30	0	0	0	0	0.05	0	0	0	0	0	0	0	0	20
39	0	0	0	0	0.18	0.27	0.32	0.09	0.05	0	0	0.05	0	0	0	0.05	0	0	0	0	22
40	0	0	0	0	0	0.41	0.19	0.07	0.04	0.07	0.15	0.04	0	0.04	0	0	0	0	0	0	27
41	0	0	0	0	0.03	0.17	0.13	0.13	0	0.07	0.07	0.03	0.17	0.13	0	0	0.03	0	0.03	0	30
42	0	0	0	0	0	0.04	0.11	0.04	0.04	0.15	0.15	0.11	0.11	0.11	0	0.04	0.04	0.04	0.04	0	27
43	0	0	0	0	0	0	0.05	0.08	0.03	0.11	0.16	0.05	0.11	0	0.16	0.08	0.03	0.08	0	0.08	38
44	0	0	0	0	0	0	0.03	0.03	0	0.03	0.11	0.24	0.08	0.03	0.11	0.00	0.03	0.08	0.05	0.19	37
45	0	0	0	0	0	0	0	0.03	0.03	0	0.03	0.05	0	0.03	0.13	0.10	0.13	0.08	0.13	0.30	40
46	0	0	0	0	0	0	0	0	0.03	0	0.03	0.03	0.03	0.06	0.18	0.03	0.06	0	0.03	0.52	33
47	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0.10	0.16	0.10	0	0.10	0.10	0.42	31
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0.13	0.05	0.05	0.16	0.16	0.42	38
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	0.05	0.20	0.05	0.60	20
50	0	0	0	0	0	0	0	0	0	0	0	0.05	0	0.05	0	0.19	0	0.05	0	0.67	21
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11	0	0	0.11	0	0.78	9
52	0	0	0	0	0	0	0	0	0	0	0	0.13	0.13	0	0.13	0	0.13	0	0	0.50	8
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0	0.88	8
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	1
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	1
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
Total																					572

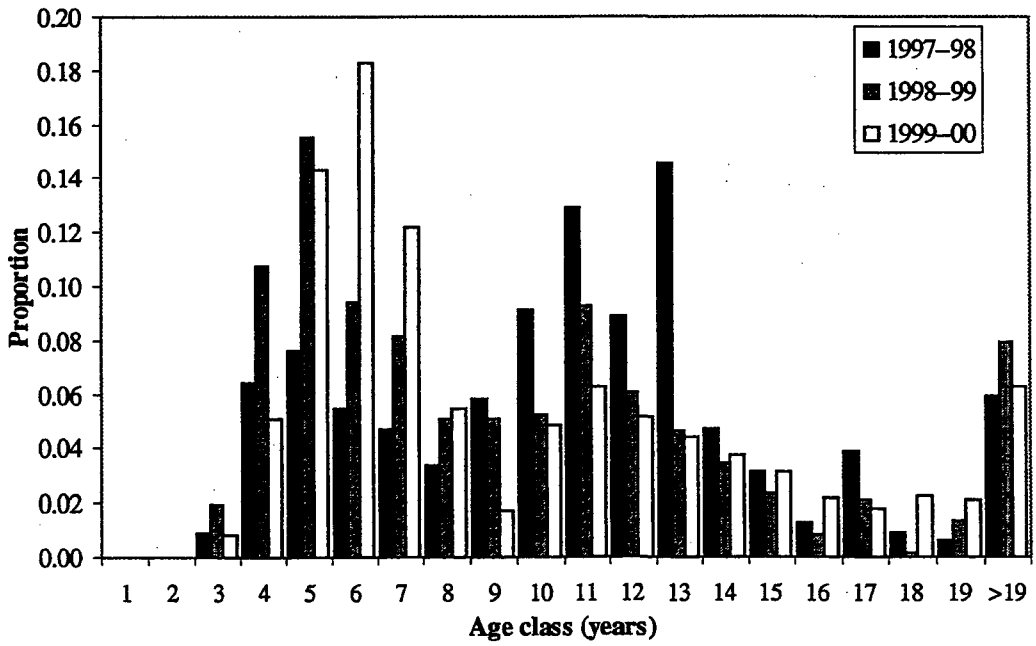
Appendix 8. TRE 7 age-length key for the 1999–2000 fishing year.

Length (cm)	Age (years) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	>19	No. Aged
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
26	0	0.11	0.89	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
27	0	0	0.86	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
28	0	0.20	0.70	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
29	0	0	0.36	0.55	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
30	0	0	0.13	0.75	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
31	0	0	0.07	0.83	0.07	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29
32	0	0	0.04	0.63	0.26	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27
33	0	0	0	0.42	0.23	0.31	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	26
34	0	0	0	0.33	0.14	0.48	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	21
35	0	0	0	0.12	0.20	0.40	0.12	0.08	0	0.04	0	0.04	0	0	0	0	0	0	0	0	25
36	0	0	0	0	0.22	0.39	0.11	0	0.17	0	0	0	0	0.11	0	0	0	0	0	0	18
37	0	0	0	0.04	0.04	0.14	0.21	0.18	0.14	0	0.07	0.04	0.07	0	0.07	0	0	0	0	0	28
38	0	0	0	0	0.09	0.13	0.17	0.04	0.04	0.04	0.13	0.13	0	0.13	0.04	0	0	0.04	0	0	23
39	0	0	0	0	0	0.16	0.05	0.16	0.05	0.16	0.16	0.16	0	0.05	0	0.05	0	0	0	0	19
40	0	0	0	0	0	0.05	0.11	0.05	0.00	0.21	0.26	0.05	0.16	0.05	0.05	0	0	0	0	0	19
41	0	0	0	0	0	0	0.06	0.06	0.18	0.29	0.18	0.06	0.00	0	0.00	0	0	0	0.06	0.12	17
42	0	0	0	0	0	0	0	0	0	0.11	0.22	0.17	0.22	0.11	0.11	0	0	0	0.06	0	18
43	0	0	0	0	0	0	0	0	0	0	0.06	0.22	0.28	0.22	0.11	0	0	0	0	0.11	18
44	0	0	0	0	0	0	0	0	0	0	0.17	0.11	0.00	0.17	0.22	0.06	0.06	0.06	0	0.17	18
45	0	0	0	0	0	0	0	0	0	0	0.00	0.11	0.05	0.16	0.21	0	0	0.11	0.11	0.26	19
46	0	0	0	0	0	0	0	0	0	0	0.11	0.06	0.06	0.17	0.17	0.06	0.06	0.06	0.11	0.17	18
47	0	0	0	0	0	0	0	0	0	0	0	0.05	0.05	0.05	0.11	0.11	0.05	0	0	0.58	19
48	0	0	0	0	0	0	0	0	0.06	0	0	0.11	0	0.06	0.11	0.06	0.06	0.11	0	0.44	18
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0.25	0	0	0	0	0.63	8
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0.38	0	0	0	0	0	0.63	8
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0	0.88	8
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0.13	0	0.13	0.50	8
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0.13	0	0	0.13	0	0.50	8
54	0	0	0	0	0	0	0	0	0	0.14	0	0	0	0	0	0	0	0.29	0	0.57	7
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	7
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0	0	0.75	4
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.40	0	0	0.60	5
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	3
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	1
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	2
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total																					505

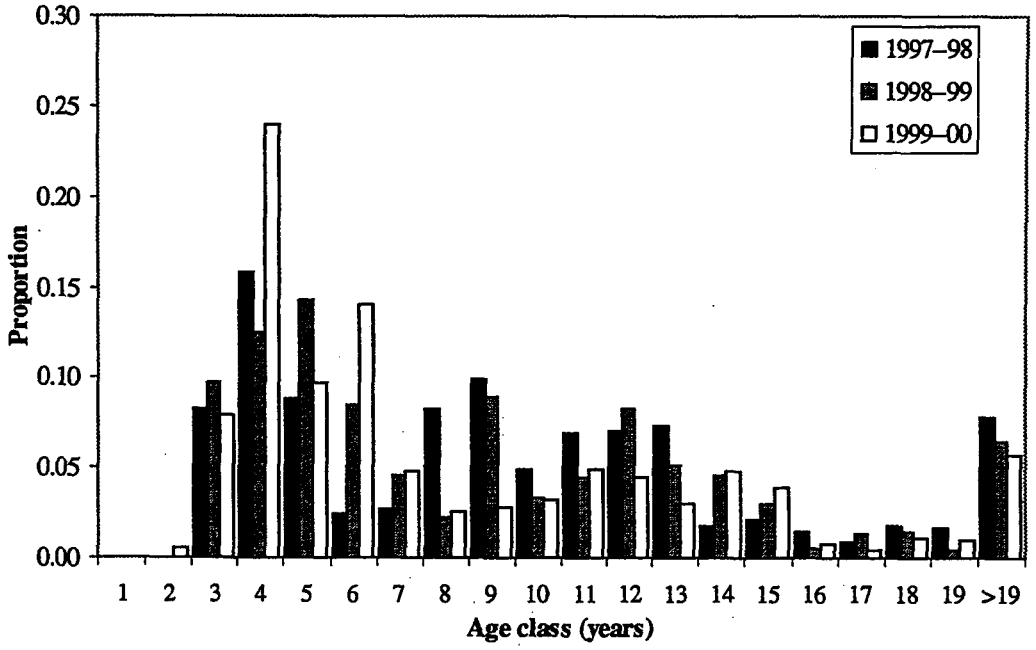
Appendix 9. Comparison of age compositions by method fishery for the 1997–98, 1998–99, and 1999–2000 fishing years. Data from 1997–98 and 1998–99 were sourced from Walsh et al. (1999, 2000).



Appendix 9a. Estimates of age composition of the catch from the TRE 1 single trawl fishery for the 1997–98, 1998–99, and 1999–2000 fishing years.



Appendix 9b. Estimates of age composition of the catch from the TRE 1 purse-seine fishery for the 1997–98, 1998–99, and 1999–2000 fishing years.



Appendix 9c. Estimates of age composition of the catch from the peak-season TRE 7 single trawl fishery for the 1997–98, 1998–99, and 1999–2000 fishing years.