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Tini a Tangaroa

Length and age compositions of recreational landings of kahawai in KAH 1 from January to April in 2015–16, 2016–17 and 2017–18

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This report documents the eleventh, twelfth and thirteenth years of recreational catch sampling in KAH 1; conducted during the first four months of 2015–16, 2016–17 and 2017–18. Recreational landings of kahawai were sampled to monitor trends in regional length and age compositions for the KAH 1 stock. Amateur fishers land a wider size range of kahawai, from a far greater number of geographically dispersed schools, than any commercial fishery, providing a means for more representative sampling of the KAH 1 fish stock.

The numbers of kahawai encountered and measured in East Northland, Hauraki Gulf and the Bay of Plenty in 2015–16 and 2017–18 were higher than in 2016–17, but target sample sizes were achieved in all three regions in all three years. The progressions of year class strengths across areas were broadly consistent with those seen in previous years. In East Northland, there was evidence of strong year classes following through from those observed in 2010–11 and 2011–12. The Hauraki Gulf and Bay of Plenty length and age distributions in 2015–16 to 2017–18 were broad, and similar to those in 2010–11 and 2011–12. In the Hauraki Gulf, the larger, older fish between 45 and 60 cm long have persisted. All of the age distributions described had levels of precision that achieved the target (a mean weighted coefficient of variation of (0.30).

Two alternative analytical methods were used to estimate a time series of total mortality estimates (Z) for East Northland and the Bay of Plenty. Both estimation methods showed a declining trend in kahawai total mortality in the East Northland and Bay of Plenty regions, which suggests that current levels of fishing pressure are unlikely to see the KAH 1 stock falling below the current management target of 52% B_0, or the Fisheries New Zealand Harvest Strategy Standard B_{MSY} proxy for medium productivity stocks of 35% B_0 over the next five years. The decline in estimates of total mortality seen in both regions since 2001 are likely to be due, in part, to reduced commercial landings following the imposition of a Total Allowable Commercial Catch Limit for the KAH 1 stock in 2004–05.

1 INTRODUCTION

Kahawai (*Arripis trutta*) are a schooling pelagic species, mainly found around inshore coastal areas, harbours, estuaries and even river mouths of the North Island, the South Island, the Kermadec and Chatham Islands. Often referred to as ‘the people’s fish’, kahawai are highly significant to the recreational and customary sectors as well as the commercial sector. In particular it is the second most important recreational species in FMA1 after snapper and a highly desirable catch for recreational fishers. They employ a range of methods to target this species from surfcasting from land to trolling and bait fishing from boats. Kahawai are also a traditional food source and highly prized culturally for Maori. Commercially most kahawai are caught by purse seining with a TACC of 1075 for FMA1.

Many fisheries are monitored using catch-at-age and catch-at-length data collected from commercial landings. Kahawai school by size, however, and commercial landings, comprised of fish from a small number of schools, may not reliably represent the age and size structure of the population. For example, amalgamated length frequencies collected from commercial purse seine landings in 1990–91 and 1991–92 were multimodal, (McKenzie & Trusewich (NIWA, Auckland, pers. comm.)) which were thought to be an artefact of the way the purse seine fleet operates, rather than an intrinsic feature of the Bay of

Plenty population. While comprehensive sampling of commercial catches can be used to characterise commercial extraction, these samples cannot be considered indicative of the underlying population length and age structure, as the fishery operates non-randomly in space and time.

Recreational fishers were interviewed at boat ramps in FMA 1 during the 1990s, to monitor aspects of the recreational fishery (Sylvester, 1993, Hartill et al. 1998). An incidental outcome of these surveys was the realisation that recreational fisheries could provide a more representative description of the local kahawai population, as a wider range of schools is sampled at a far lower intensity, thus lessening the influence of any single school. Further, recreational fishers catch, and tend to land, a wider size range of fish than their commercial counterparts (Bradford 1999).

Although recreational kahawai length frequency data were collected during the 1990s, underlying survey designs differed both spatially and temporally, and there was no concurrent collection of age data from this fishery. In a review of data collected from these surveys, Bradford (2000) suggested that sufficient kahawai were landed by recreational fishers to support a length and age catch sampling programme in KAH 1.

Dedicated sampling of recreational landings of kahawai was initiated in the summer of 2000–01 (January to April 2001), and continued for a further ten years as part of the Ministry of Fisheries' programmes KAH2002/02 (Hartill et al. 2007a), KAH2003/01 (Armiger et al. 2006), KAH2005/02 (Hartill et al. 2007b), KAH2006/02 (Hartill et al. 2008), KAH2007/01 (Armiger et al. 2009) and MAF2010/03 (Armiger et al. 2014). Recreational landings recorded lengths from East Northland, Hauraki Gulf, and the Bay of Plenty and age from East Northland and the Bay of Plenty in 2010–11 and 2011–12.

Recreational fishers were interviewed in the first four months of each year during these surveys, when fishing effort was expected to peak. Kahawai were measured where possible, and otoliths were collected from a sizeable proportion of these fish. These data were then used to derive length and age distributions for each substock of KAH 1.

Based on a recommendation from the Northern Inshore Working Group (NIWG), Hauraki Gulf recreational kahawai landings were only sampled for length in 2010–11 and 2011–12. The NINSWG recommendation not to collect HG kahawai age data was based on the observed lack of kahawai older than 5 years in the data collection time series. The decision was made to reinstate HG kahawai age collection in future years due to the appearance of larger fish in the 2010–11 and 2011–12 recreational length data.

This report summaries recreational catch-at-age data from KAH 1 collected in 2015–16, 2016–17 and 2017–18, following a three-year hiatus in sampling. These surveys closely followed methods used by previous KAH 1 catch sampling programmes, as discussed below.

Objectives

1. To conduct representative sampling and determine the length, sex, and age composition of the amateur landings of kahawai in KAH 1 for the 2015–16 fishing year to monitor the KAH 1 stock. The target coefficient of variation (CV) for the catch at age will be 30% (mean weighted CV across all age classes).

2. To conduct representative sampling and determine the length, sex, and age composition of the amateur landings of kahawai in KAH 1 for the 2016–17 fishing year to monitor the KAH 1 stock.

The target coefficient of variation (CV) for the catch at age will be 30% (mean weighted CV across all age classes).

3. To conduct representative sampling and determine the length, sex, and age composition of the amateur landings of kahawai in KAH 1 for the 2017–18 fishing year to monitor the KAH 1 stock. The target coefficient of variation (CV) for the catch at age will be 30% (mean weighted CV across all age classes).

4. Estimate fishing mortality F for each of the fishing year sampled, relative to reference fishing mortality reference point.

2 METHODS

2.1 Sample design

The sample design used in this survey was based on data collected from boat ramp surveys conducted between 2001–2008 and in 2010–11 and 2011–12. Kahawai length and age distributions from these surveys (and length data from previous surveys in 1991, 1994, and 1996) strongly suggest ongoing differences between the length frequency compositions of kahawai caught by recreational fishers in East Northland, the Hauraki Gulf, and Bay of Plenty (Bradford 1999, Hartill et al. 1998). Separate boat ramp surveys were therefore conducted concurrently in each region (Figure 1) to measure landed kahawai, with the additional collection of fish heads, from which otoliths were extracted at a later date. There has been very little change in the selection of boat ramps where interviewing has taken place since 2001.

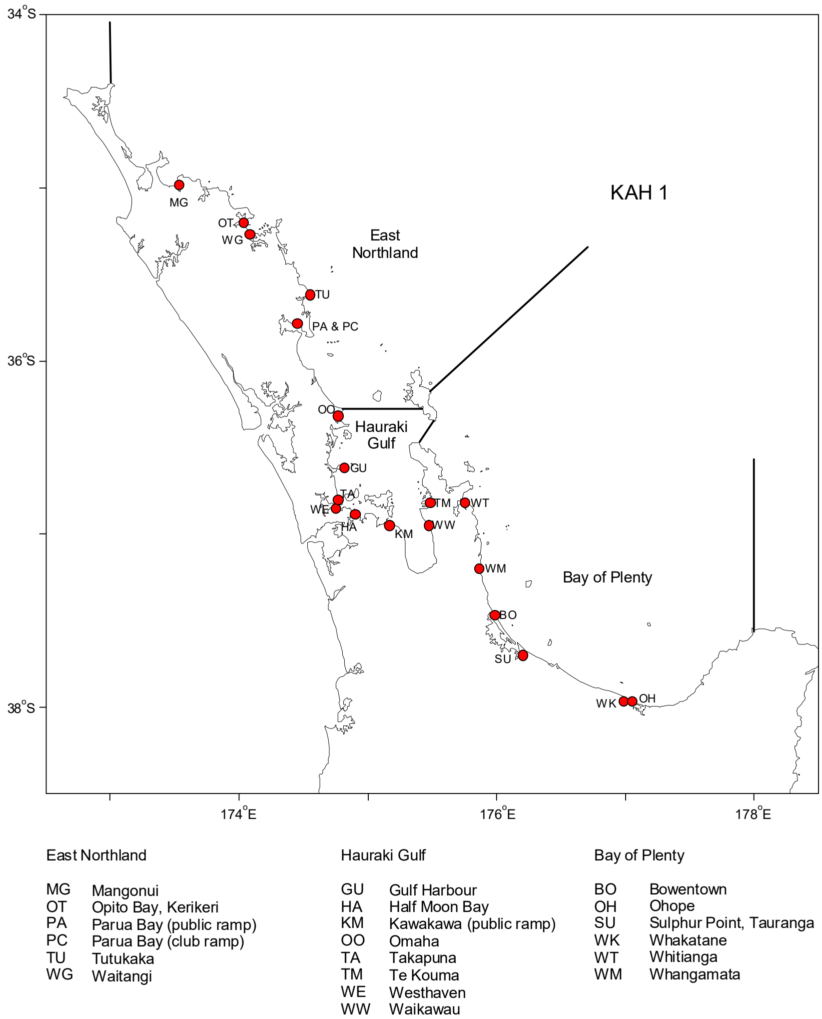

Figure 1: KAH 1 substock boundaries and location of boat ramp interview sites.

Sampling of recreational catches was restricted to a four-month season (1 January to 30 April) which roughly corresponded to the expected peak of the recreational fishing season, when kahawai landings were expected to be most common. Restriction of sampling to a four-month season was desirable, as a longer collection period would have increased the likelihood of growth distorting the age-length-keys. Further, as otolith ring deposition occurs during the onset of winter (Stevens & Kalish 1998), collection of otoliths in early winter should be avoided, as ambiguous structures on the edge of an otolith may result in ageing error.

Target levels of sampling effort were based on levels of sampling effort required in each region in previous years, to achieve a target mean weighted coefficient of variation (MWCV) of 0.30 for each regional age distribution (Table 1). The basis for these targets was a recommendation by Bradford (2000), that 400–500 kahawai should be aged to give a reasonable approximation of the relationship between length and age, and hence, potentially, a population's age structure. A further recommendation from this study was that as many fish as possible (E. Bradford, pers comm.) should be measured to provide a reliable length frequency distribution; preferably at least 1500. The timing and intensity of recreational landings of kahawai is, however, difficult to predict given interannual variability in fishing effort and the spatially dynamic nature of kahawai schooling behaviour. A reasonable intensity of sampling effort is therefore required in space and time so that appreciable landings of kahawai can be sampled, if and when they occur.

The levels of precision associated with the age distributions described by catch sampling between 2001 and 2011–12 were well within the target MWCV (0.30), with most being less than 0.20. Simulations were, therefore, conducted using the NIWA R software package CALA (Catch At Length and Age) to determine the likely MWCV that would be expected given differing: numbers of landings sampled; numbers of fish sampled from each landing; and the size of the age-length key collected across all landings within a region (Appendix 1). These simulations were based on data collected during the two survey years with the greatest contrasting length and age distributions (2006 and 2011–12). No age data were available from the Hauraki Gulf in 2010–11 and 2011–12, however, upon which simulations could be based. The CALA simulations suggested that an age-length key comprising as few as 300 fish would still be sufficient to achieve the 0.30 MWCV target. The number of hours surveyed in 2015–16, 2016–17 and 2017–18, was therefore reduced from that sampled in previous years, to achieve a target otolith pair collection sample of 300 fish.

Table 1: Number of hours that interviewers were present at surveyed ramps and the number of kahawai aged relative to regional sampling targets.

2016	Number of hours		Number of kahawai aged	
Region	Target	Actual	Target	Actual
East Northland	720	813	300	317
Hauraki Gulf	864	946	300	291
Bay of Plenty	432	455	300	303

2017	Number of hours		Number of kahawai aged	
Region	Target	Actual	Target	Actual
East Northland	720	763	300	323
Hauraki Gulf	864	921	300	302
Bay of Plenty	432	417	300	276

2018	Number of hours		Number of kahawai aged	
Region	Target	Actual	Target	Actual
East Northland	720+	750	300	315
Hauraki Gulf	864+	897	300	320
Bay of Plenty	432+	631	300	303

For the 2015–16 and 2016–17 sampling season, sessions at each ramp were randomly assigned to weekend and public holiday days between 1 January and 30 April in both fishing years. If strong onshore winds or local fishing competitions occurred on any of the randomly preassigned dates, sampling took place on the next available weekend/holiday day instead.

In 2017–18, interviews were also conducted on midweek days as well, to take advantage of a synergy with a concurrent large-scale aerial-access survey of the FMA 1 recreational boat fishery (MAF201602). As part of this larger survey, interviews with fishers were conducted throughout the day, on randomly preassigned surveys days regardless of prevailing weather conditions. Results from a 1996 boat ramp survey found no substantive differences between weekend and weekday length compositions of commonly caught species (Hartill et al. 1998). It was therefore assumed that the introduction of midweek sampling in all three areas in 2017–18 was unlikely to bias the size and age composition of sampled landings.

All interviews conducted in KAH 1 followed the format of those undertaken in all previous surveys to ensure that the data were collected in a consistent manner. When more than one vessel approached a ramp simultaneously, a vessel was chosen randomly for interviewing. All landed fish, including kahawai, were measured when permission was given by the fisher. Cooperation rates were generally very high, with approximately 95% of fishers completing an interview. For ageing purposes, up to four kahawai were selected at random from each vessel's catch, although most landings are of only one or two kahawai. Age samples were collected at random from each catch, to ensure that the length distribution of the age sample broadly reflected the length distribution of the landed catch

Kahawai otoliths are fragile and time consuming to extract, and interviewers therefore asked permission to cut the head off at the gills, which most fishers agreed to. These heads were retained by the interviewer together with a record of the fish's length, and a code linking the head to other data collected during the interview. Kahawai were not sexed, as there is no apparent sexual dimorphism in growth rates (Bradford 1998). Otoliths were extracted from these heads at a later date.

2.2 Ageing of kahawai otoliths

Kahawai otoliths were prepared using the thin section method described by the age determination protocol for kahawai (Walsh et al. 2014). Each otolith was marked across an intended sectioning plane passing through the nucleus. Each otolith was then embedded in a disposable epoxy mould with three other otoliths so that their nuclei were at the same level. Once the resin hardened, a thin transverse section was cut out of each epoxy block with a Struers Accutom-2 low speed saw. One side of this section was then ground, polished, and mounted polished side down on a slide using 5-minute epoxy resin. After at least 1 hour, the material attached to each slide was sectioned again (to a thickness of approximately 250 to 350 µm) and briefly polished with 400 grit carborundum paper.

To improve clarity, a thin layer of immersion oil was brushed over each slide and reading took place under transmitted light. Two readers were initially used to interpret the thin sectioned otoliths and any disagreements in interpretation were ultimately resolved in conjunction with a third reader when necessary. All three otolith readers were very experienced, and the two main readers have been involved in the reading of kahawai otoliths collected by this and similar programmes since 2001.

- Each reader is required to read and pass a reference set of otoliths before reading commences;
- Each reader independently read all otoliths collected from each region;
- Disagreements in initial age estimates resulted in the otoliths being re-read with no knowledge of any prior age estimates;
- Remaining disagreements were resolved by discussing images of otoliths projected onto a video screen with a third experienced reader until a consensus was reached;
- If no consensus could be reached, the otolith was discarded from the dataset.

It is only very rarely necessary to discard an otolith, and when this occurs it is usually because both otoliths are deformed and unreadable.

Otolith reading precision was quantified by carrying out between-reader comparison tests and comparisons between initial reads and final agreed ages for each reader as recommended by Campana et al. (1995). An Index of Average Percentage Error (IAPE, Beamish & Fournier 1981) statistic, and mean coefficient of variation (CV, Chang 1982), was calculated for each comparative test.

Interannual variability in a reader's interpretation of an otolith (known as "drift") can lead to spurious changes of age compositions over time. The consistency of an experienced kahawai otolith reader was examined in 2006–07. The reader was asked to re-read a random sample of otoliths collected between 2000–01 and 2004–05, which had previously been assigned ages across seven age groups; ages 2 to 8 (Hartill et al. 2008). These results suggested a very high level of agreement despite the fact that the reader had no information about their previous interpretation, nor the size of the fish that were being aged. This reader is one of the two key readers used to interpret otoliths collected in 2015–16, 2016–17 and in 2017–18.

A forced margin was implemented to anticipate *a priori* the otolith margin type (wide, line, narrow) for the month in which the fish was sampled to provide guidance in determining age (Walsh et al. 2014). The forced margin method reduces the chance of any misinterpretation of a fish's age that may arise when otoliths are collected over a four month period, given variable rates of otolith material deposition between fish. The nominal birth date of kahawai is taken as 1 January.

2.3 Data analysis

Proportional catch-at-length and catch-at-age distributions and bootstrap variance estimates were calculated using the CALA R software developed by NIWA (Francis & Bian 2011). Vessels landing kahawai were treated as individual sampling events, which were weighted together on the basis of the number of kahawai landed by each vessel. The distribution of fish-at-age within length classes (an age-length key) was derived for each region and used to translate the regional length distributions into estimates of recreational catch-at-age. Proportional catch-at-age estimates were calculated for the range of recruited age classes. No kahawai older than 20 years have been encountered to date, and there is therefore no need to combine fish older than 20 into a plus-group. Recreational catch-at-age and length frequency distributions and their associated variances were derived and presented in the form of histograms and tables.

Two methods were used to estimate annual total instantaneous mortality (Z), which can be used to monitor trends in fishing pressure over time, given the assumption of constant natural mortality (M).

Dunn et al. (2002) used simulation modelling to compare the performance of alternative catch curve based estimators of Z and found that the most accurate estimates were provided by the method proposed by Chapman & Robson (1960). The Chapman-Robson estimator assumes that the descending limb of an age distribution declines exponentially, but unlike other methods that are regression based, the estimate is based on the mean number of years above an assumed age at recruitment (ā).

$$Z = \log_e\left(\frac{1 + \bar{a} - 1/n}{\bar{a}}\right)$$

where *n* is the sample size.

The Chapman Robson estimator is sensitive to the assumed age at recruitment, which we assume to be at 4 years of age. A logistic selectivity ogive was fitted to recreational catch-at-age data as part of the 2015 stock assessment for KAH 1 (Hartill & Bian 2016), with an L_{50} at 4 years of age. Estimates associated with recruitment of a range of years (3 to 6 years) are given for comparison, but an age at recruitment of 4 years is considered to be the most appropriate.

A second regression based method was also used to estimate total mortality, which does not assume that the dynamics of the underlying population are in a steady state, explicitly allowing for annual variability in recruitment into the fishery. Recent simulations by Miller (2015) suggest that a random-intercept Poisson log-linear mixed model (Z_{MM}) is more robust to error associated with: partial recruitment; autocorrelated annual recruitment; variability in annual survival; ageing error and sampling randomness.

Annual estimates of total mortality (Z) have therefore been calculated using both the Chapman Robson (ZCR) and the mixed model (Z_{MM}), to provide alternative measures of change in fishing mortality over time. The estimates have been plotted against reference estimates of $F_{B35\%B0}$[1] + M(0.20), $F_{B52\%B0}$[2] + M(0.20) and a time series of Equivalent Annual Z (F + M(0.20)) estimates for the period 2000–01 to 2011–12, as estimated by the 2014–15 KAH 1 stock assessment (Hartill & Bian 2015).

[1] The Fisheries New Zealand Harvest Strategy Standard recommends F35%B_0 as a proxy for Fmsy for medium productivity stocks, such as kahawai, which was estimated during the most recent Tier 1 fully quantitative stock assessment (Hartill & Bian 2016).
[2] The management target for KAH 1 is 52% B_0, which was set by the Minister in 2010.

Estimates of Z were calculated for all annual East Northland and Bay of Plenty age distributions generated since 2000–01. Total mortality rates were not estimated for the Hauraki Gulf, because, prior to 2005–06, fully recruited fish comprised a small proportion of the fish landed (Hartill et al. 2007b) and a pulse of larger fish appear to have since immigrated into the Gulf from elsewhere. Recruitment and emigration appear to have largely determined the age composition of landings in the Hauraki Gulf, violating two key assumptions associated with catch-curve mortality estimators: constant recruitment and a closed population.

3 RESULTS

Results for each region of KAH 1 are given and discussed in separate sections, but overall sampling summary statistics are given in Table 2.

Table 2: Summary statistics by region of the number of interview sessions, hours surveyed, vessels interviewed, vessels with measurable kahawai, kahawai measured, and kahawai aged in 2015–16, 2016–17 and 2017–18. Regional summary statistics from previous survey years are given for comparison.

Year	Number of ramps surveyed	Number of sessions	Number of hours	Boats interviewed (fishing)	Boats with measured kahawai	Measurable kahawai landed*	Kahawai measured	Kahawai aged
East Northland								
2017–18	6	214	1 341	1 865	699	1 392	1 048	315
2016–17	6	143	763	1 508	405	853	621	323
2015–16	6	146	813	1 600	594	1 531	1 006	317
2011–12	6	217	1 452	1 446	345	1 139	770	485
2010–11	6	144	1 105	1 980	552	1 713	1 462	497
2007–08	8	172	1 015	2 068	416	1 137	874	539
2006–07	8	178	1 049	1 836	331	769	726	471
2005–06	8	183	1 083	1 714	274	619	537	321
2004–05	8	344	2 407	2 752	459	1 134	993	514
2003–04	8	190	1 096	2 427	439	1 119	1 015	517
2002–03	8	186	1 049	2 089	436	1 316	1 171	504
2001–02	8	199	1 110	1 878	491	1 437	1 318	526
2000–01	9	196	1 129	2 233	474	1 377	1 236	517
Hauraki Gulf								
2017–18	8	287	1 859	2 619	1 112	2 439	1 673	320
2016–17	8	164	921	1 998	378	682	497	302
2015–16	8	167	946	2 723	1 163	2 759	2 007	291
2011–12	9	362	2 347	4 883	1 061	4 370	2 732	–
2010–11	9	176	1 059	3 255	1 139	5 586	3 784	–
2007–08	10	230	1 464	2 787	216	694	477	227
2006–07	10	223	1 391	3 543	332	1 216	632	398
2005–06	10	229	1 317	4 034	530	1 556	1 170	526
2004–05	11	557	3 529	6 402	293	899	606	289
2003–04	11	408	2 475	6 222	345	1 015	764	350
2002–03	10	231	1 301	3 432	395	1 035	880	527
2001–02	10	204	1 138	3 348	339	924	786	500
2000–01	11	212	1 174	2 706	435	1 081	892	500
Bay of Plenty								
2017–18	6	233	1 460	2 464	1209	2 700	2209	303
2016–17	6	108	417	1 255	269	608	419	276
2015–16	7	107	455	1 318	650	1 404	987	303
2011–12	6	246	1 607	2 701	763	2 590	1 891	492
2010–11	6	145	555	1 703	547	2 329	1 300	499
2007–08	7	134	535	1 405	462	1 272	1 156	552
2006–07	8	121	485	1 226	397	1 473	1 072	472
2005–06	8	106	497	678	232	982	656	497
2004–05	9	406	2 636	3 611	565	2 703	1 483	393
2003–04	9	108	429	952	306	1 256	995	412
2002–03	9	120	462	1 246	357	1 260	1 133	477
2001–02	9	141	474	1 197	457	1 746	1 476	495
2000–01	9	100	319	934	294	1 277	1 104	457

* Excludes kahawai which were released, used for bait, or landed filleted.

Interviewers were present at East Northland, Hauraki Gulf and Bay of Plenty ramps for fewer hours in 2015–16 and 2016–17 compared to previous survey years (Table 2), following a revised sampling design based on simulations given in Appendix 1. The inclusion of mid-week sampling, as required by the broader 2017–18 FMA 1 survey, resulted in a higher number of survey hours in 2017–18 (Table 2). Fewer kahawai were measured in 2016–17, because fewer boats landing kahawai were encountered.

3.1 East Northland

High levels of initial otolith age agreement were achieved between the two readers in all three years: 67 % in 2015–16 (Appendix 4); 85% in 2016–17 (Appendix 5); and 83% in 2017–18 (Appendix 6). Most of the remaining interpretations from the two readers were within one year of each other, with no apparent trend in over or under reading by either reader. Comparisons of initial readings with final agreed ages resulted in IAPE (Index of Average Percentage Error) scores across both readers for all three years ranging from 0.25% to 1.33% (values of 5% or less suggest high levels of agreement in interpretation).

The length and age distributions for the three survey years were described with reasonable precision, with the MWCVs for length ranging from 0.19 to 0.29 (Appendix 2) and for age ranging from 0.20 to 0.23 (Appendix 3) respectively, which were well within target levels.

Over recent years the length compositions of recreational landings of kahawai from East Northland have become increasingly dominated by fish larger than 50 cm in length, with a far lower proportion of immature fish (less than 40 cm) landed than in any year surveyed since 2001 (Figure 2). The age distribution has also become increasingly broad, with the clear progression of some strong and weak year classes. The stronger 6, and 9 year old age classes seen in the 2011–12 age distribution are still clearly evident as stronger 11 and 13 year old age classes in 2015–16, after which their dominance gradually decreases over time. Similarly, the progression of the weak 5 year old age class in 2015–16 is also clearly evident in the following two years. The strength of the most recently recruited year classes (ages 2–4) is weak relative to older age classes in 2017–18 and ages 2–4 in most previous fishing years.

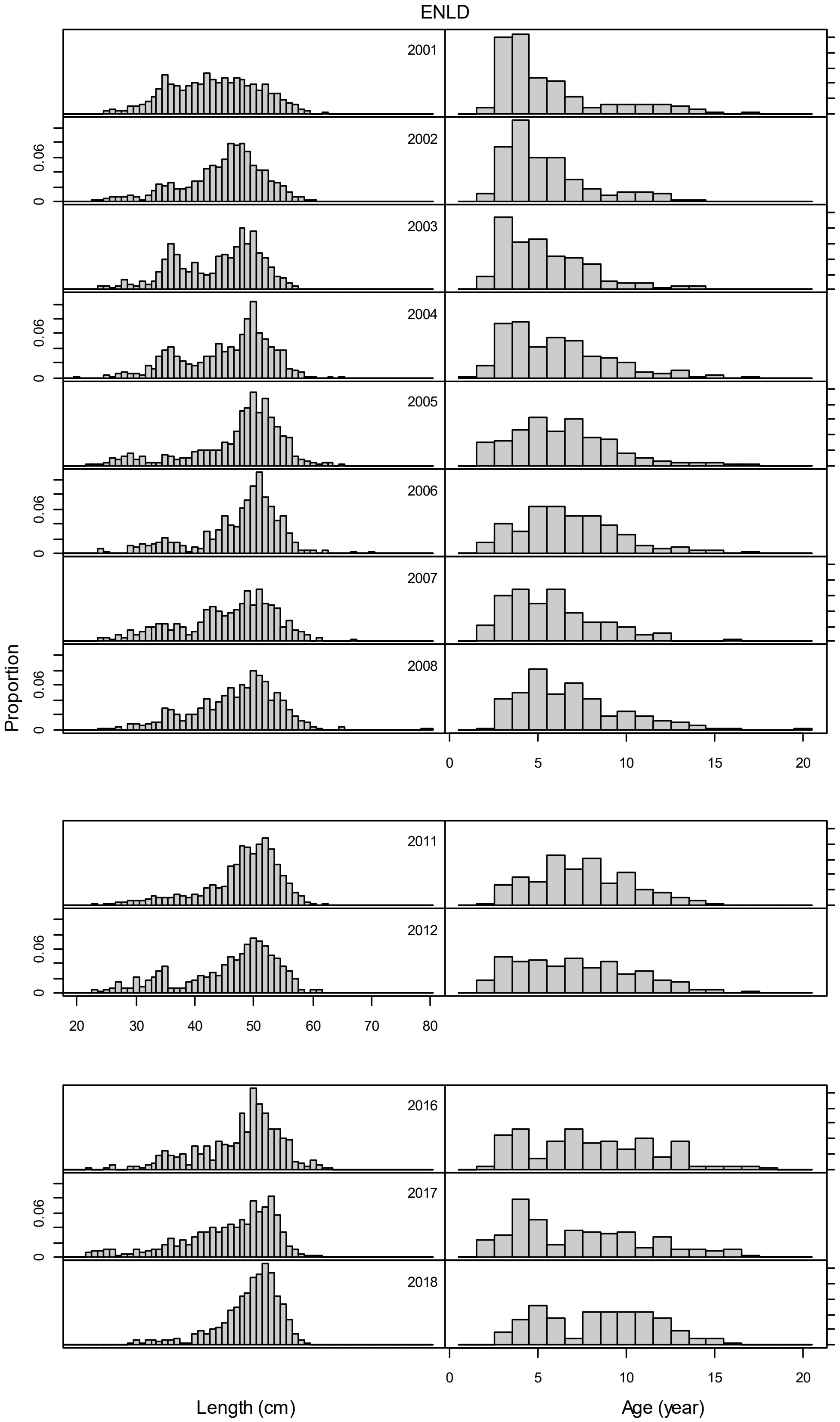

Figure 2: Length and age distributions (histograms) and CVs (solid lines) of recreational landings of kahawai in East Northland annually since 2001. (Years denoted 2001 = fishing year 2001–02).

3.2 Hauraki Gulf

High levels of otolith reader agreement were achieved in all three years, ranging from 83% to 85% (Appendices 4, 5 and 6). High levels of initial reader agreement with final agreed ages were therefore achieved, with IAPE scores ranging from 0.17 to 0.85%, which were well within the 5% threshold for acceptable agreement. The length and age distributions for the three survey years were described with reasonable precision, with the MWCVs for length ranging from 0.14 to 0.33 (Appendix 2) and for age ranging from 0.19 to 0.28 (Appendix 3), which were well within the target 0.30 threshold.

The length distributions of kahawai landings sampled from the Hauraki Gulf in 2015–16, 2016–17 and 2017–18 were dominated by fish in the 50–60 cm length classes, as also seen in 2010–11 and 2010–11–12 (Figure 3). Age distributions in recent years are dominated by two modes, with a progression of younger fish (evident as 3 to 5 year olds in 2017–18), and a much stronger representation of older fish (11 to 15 year olds) than at any time since catch sampling started in 2001. The progression of relatively weak year classes, evident as 6 to 10 year olds in 2017–18, may lead to fewer older fish in future years, as seen in the early 2000s. Most kahawai in this region recruit into the fishery at about 3 years of age, which corresponds to a length mode of about 30 to 40 cm (Appendix 4).

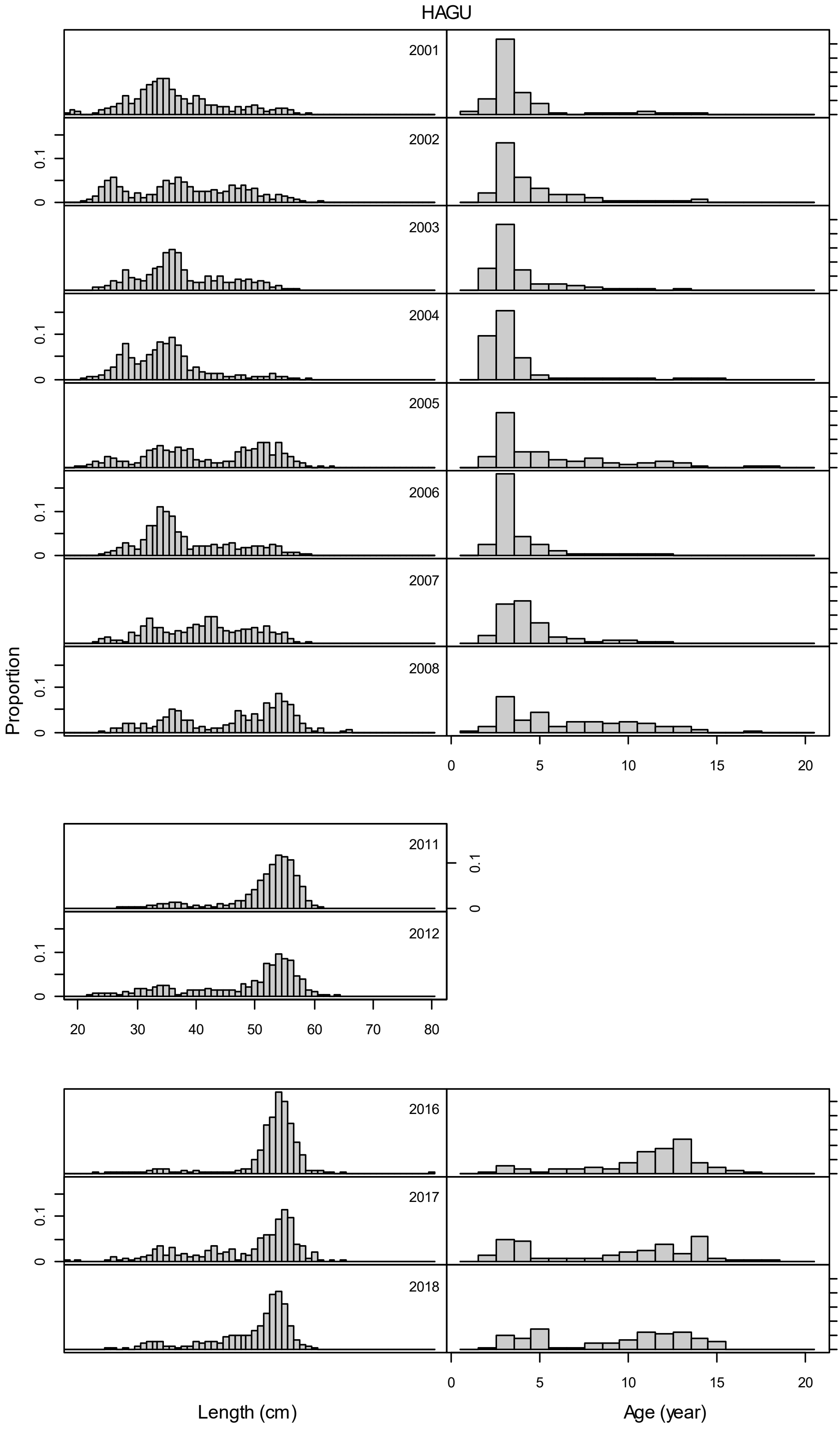

Figure 3: Length and age distributions (histograms) and CVs (solid lines) of recreational landings of kahawai in the Hauraki Gulf since 2001. (Years denoted 2001 = fishing year 2001–02).

3.3 Bay of Plenty

The length and age distributions for the three survey years were described with reasonable precision with MWCVs for length ranging between 0.15 to 0.36 (Appendix 2) and for age ranging between 0.20 and 0.25 (Appendix 3). The MWCVs for age fell within the target 0.30 threshold of Objectives 1 to 3.

As in previous survey years, a mode of 45–55 cm fish consistently dominates the Bay of Plenty length distribution from 2015–16 to 2017–18 (Figure 4). Similar to East Northland, there was a lower proportion of immature fish (less than 40 cm) landed over this three-year period. The age distributions are also characteristically broad, as in earlier years. There is progression of both strong and weak year classes that can be followed through successive years. The 4 and 7 year old cohorts in 2010–11 can be followed through to 2015–16, when they appear at ages 9 and 13 respectively. Their dominance decreases over the follow two survey years. The 4 to 6 year old cohorts in 2015–16 can be followed through to 2017–18, showing similar patterns of two strong year classes surrounding a weaker one. Most kahawai in this region recruit into the fishery at about 3 years of age, which corresponds to a length mode of about 30 to 40 cm (Appendix 4). The strength of the most recently recruited year classes is weak relative to older age classes, similar to the pattern found in the other two regions.

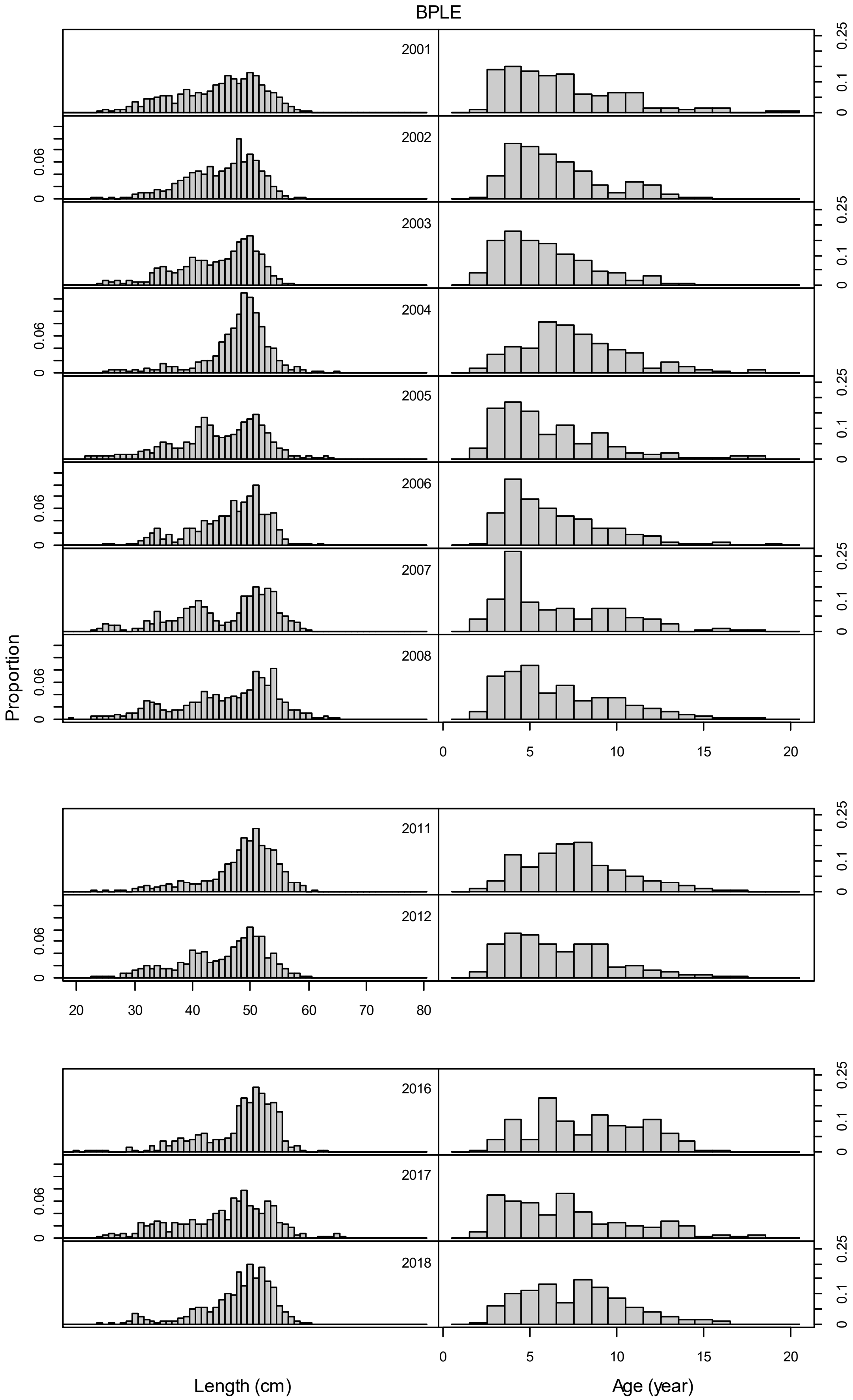

Figure 4: Length and age distributions (histograms) and CVs (solid lines) of recreational landings of kahawai in the Bay of Plenty since 2001. (Years denoted 2001 = fishing year 2001-02).

3.4 Monitoring fishing pressure

Total mortality rates were generally higher in East Northland than in the Bay of Plenty (Figure 5, Table 3), particularly prior to 2010. There is some evidence of declining mortality rates in both regions over time, although the degree of change has been less in the Bay of Plenty. This could be partially attributable to reduced fishing pressure, as commercial landings from KAH 1 have almost halved since the early 2000s. Size-dependent movement between the areas could, however, influence respective age structures, and consequently this could result in misleading estimates of total mortality, the total mortality estimates should therefore be regarded with some caution. Total mortality estimates were calculated for the Hauraki Gulf, but these were considered to be misleadingly low as they were an artefact of the progression of an influx of larger fish around 2008 which must have recruited from elsewhere, reflecting movement dynamics rather than the cumulative effect of fishing pressure over time on a distinct population.

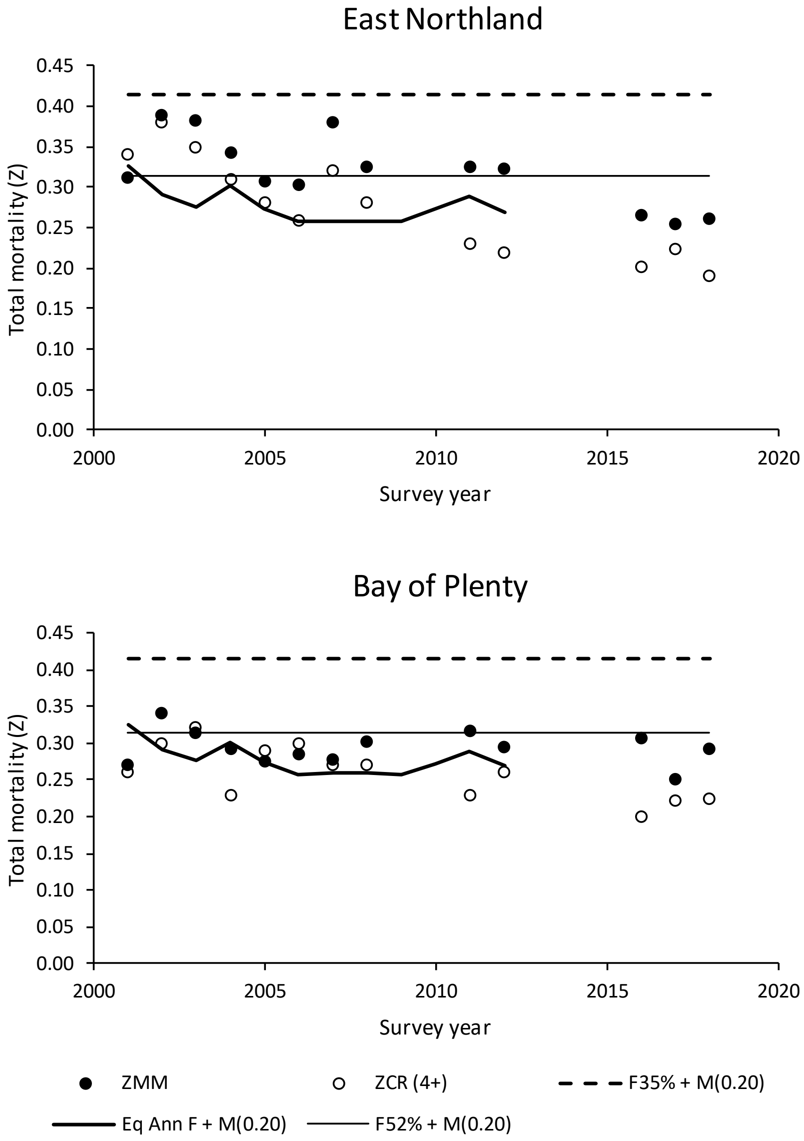

Figure 5: Annual Chapman-Robson (Z_{CR} 4+) and random-intercept Poisson log-linear Mixed Model (Z_{MM}) estimates of total instantaneous mortality plotted relative to the Harvest Strategy Standard target fishing mortality rate for medium productivity stocks of F35% + M(0.20), the estimated fishing mortality rate required to maintain the stock at B52% as set by the Minister in 2010 of F52% + M(0.20), and a time series of Equivalent Annual F + M(0.20) estimates for the period 2001 to 2010–11–12, as estimated by the 2015 KAH 1 stock assessment (Hartill & Bian 2016).

Fishing pressure could increase in KAH 1 in the immediate future if current catches are maintained at current or higher levels, given the recent progression of a series of weak younger age classes seen in all three regions (Figures 2, 3, 4). While a period of lower than average recruitment may reduce the availability of kahawai to recreational fishers, and hence levels of non-commercial harvesting, the catch landed by the commercial fishery is constrained by the TACC, with similar catch tonnages landed every year.

Table 3: Chapman -Robson estimates of Z derived from recreational catch sampling in East Northland and the Bay of Plenty by survey year and assumed age at recruitment.

Age at																		East Northland
recruitment	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
3	0.33	0.33	0.32	0.28	0.24	0.23	0.28	0.24	–	–	0.20	0.21	–	–	–	0.19	0.20	0.17
4	0.34	0.38	0.35	0.31	0.28	0.26	0.32	0.28	–	–	0.23	0.22	–	–	–	0.20	0.22	0.19
5	0.30	0.37	0.39	0.33	0.33	0.32	0.35	0.33	–	–	0.27	0.25	–	–	–	0.21	0.22	0.21
6	0.30	0.40	0.41	0.38	0.36	0.36	0.41	0.34	–	–	0.32	0.28	–	–	–	0.25	0.22	0.23

Age at																		Bay of Plenty
recruitment	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
3	0.23	0.25	0.28	0.20	0.27	0.25	0.24	0.24	–	–	0.20	0.23	–	–	–	0.17	0.21	0.19
4	0.26	0.30	0.32	0.23	0.29	0.30	0.27	0.27	–	–	0.23	0.26	–	–	–	0.20	0.22	0.22
5	0.28	0.33	0.34	0.26	0.30	0.30	0.24	0.29	–	–	0.26	0.29	–	–	–	0.22	0.24	0.25
6	0.30	0.36	0.38	0.32	0.30	0.32	0.26	0.29	–	–	0.31	0.31	–	–	–	0.27	0.26	0.29

The time series of Chapman-Robson (Z_{CR}) and Mixed Model (Z_{MM}) estimates of total instantaneous mortality for both East Northland and the Bay of Plenty all suggest that current levels of fishing pressure are unlikely to see the stock fall below the management target of 52% B_0 set by the Minister in 2010, or the Fisheries New Zealand Harvest Strategy Standard B_{MSY} proxy for medium productivity stocks of 35% B_0, over the next five years. Both sets of catch curve based total mortality estimates are mostly higher than the annual estimates of Equivalent Annual Fishing Mortality generated by the fully quantitative 2015 stock assessment for the combined KAH 1 stock (Hartill & Bian 2016), but the trend over time is broadly similar, suggesting a gradual decline in fishing pressure. The Mixed Model (Z_{MM}) estimates are more consistent with the of Equivalent Annual Fishing Mortality estimates produced by the most recent stock assessment, which would be expected given the results of the simulations described in Miller (2015), which suggested that this approach was more robust to stochasticity than the Chapman-Robson approach.

4 CONCLUSIONS

- The 2016–17 fishing year saw a reduction in the numbers of kahawai encountered in the creel surveys across all three regions. Conversely, the numbers of kahawai measured across all three regions in 2015–16 and 2017–18 was significantly higher than previous years, which was partially due to increased sampling effort in 2017–18. This variability in the number of kahawai encountered during creel surveys over time is characteristic of summary statistics collected for kahawai.

- Regional length and age compositions derived from recreational landings sampled in 2015–16, 2016–17 and 2017–18 are broadly consistent with patterns and trends seen in previous years for KAH 1 in East Northland and Bay of Plenty, but there has been a marked increase in the proportion of larger/older kahawai landed in the Hauraki Gulf since 2010–11.

- In each of the three regions there appears to be weaker year class representation in the fish recruiting to the fishery. This could potentially be due to a change in selectivity by recreational fishers as larger fish are more likely to be landed than smaller 30 – 40 cm sized fish, which are being released or used for bait. It could, on the other hand, be an indication of weakened recruitment in all three regions.

- The East Northland age distribution is dominated by five age classes (9 to 12 year olds in 2017–18) followed by a series of weaker year classes. The length composition of recreational landings from this region is therefore dominated by a peak of 49 to 55 cm fish.

- There has been a much greater proportion of larger fish present in landings from the Hauraki Gulf in 2015–16, 2016–17 and in 2017–18, following an apparent influx of older age classes (≥11) in 2007–08. The strength of the 50 to 60 cm cohort has significantly increased accordingly. Recent year classes appear to be relatively weak.

- The age distribution of the kahawai population in the Bay of Plenty remains typically broad, as in previous years, but recruitment in recent years appears to be weaker than average. The length distributions from this region continue to be dominated by a strong cohort of 50 to 55 cm fish.

- The levels of precision associated with all age distributions described over the three survey years were well within the target MWCV threshold of 0.30, despite the adoption of a reduced sampling design based on simulations of catch-at-age data collected in 2005–06 and 2011–12.

- Two alternative analytical methods were used to estimate a time series of total mortality estimates (Z) for East Northland and the Bay of Plenty. Both methods estimate current levels of fishing pressure that are unlikely to result in the KAH 1 stock falling below either the current management target of 52% B_0 or the Fisheries New Zealand Harvest Standard proxy B_{MSY} level of 35% B_0 over the next five years, given an assumed natural mortality rate of 0.20.

- Ongoing monitoring of the age structure of this stock is required, however, as the strength of recent year classes caught in all three regions of KAH 1 appears to be lower than average, which may lead to increased fishing pressure if current levels of harvesting by the recreational and or commercial sector are maintained.

5 ACKNOWLEDGMENTS

We thank the numerous boat ramp interviewers, who collected the data for this survey. We are also grateful to Cameron Walsh for his help as a third expert otolith reader and to Richard Bian for his assistance with CALA. The methods used in this project have also benefitted from numerous suggestions made by working group members over many years. Funding for this project, KAH201501, was provided by the Ministry for Primary Industries. We thank Jeremy McKenzie and Richard O'Driscoll for reviewing this report.

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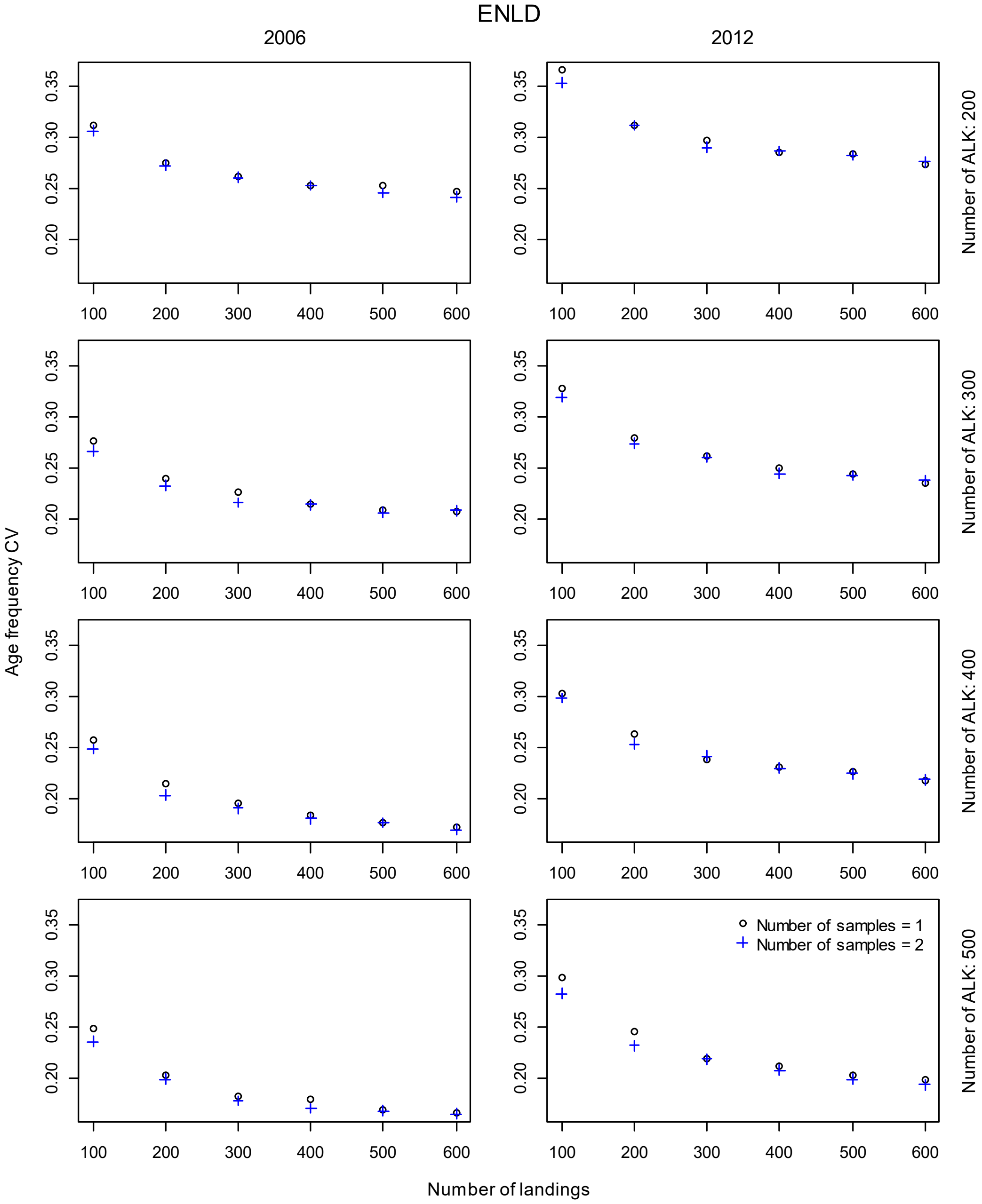
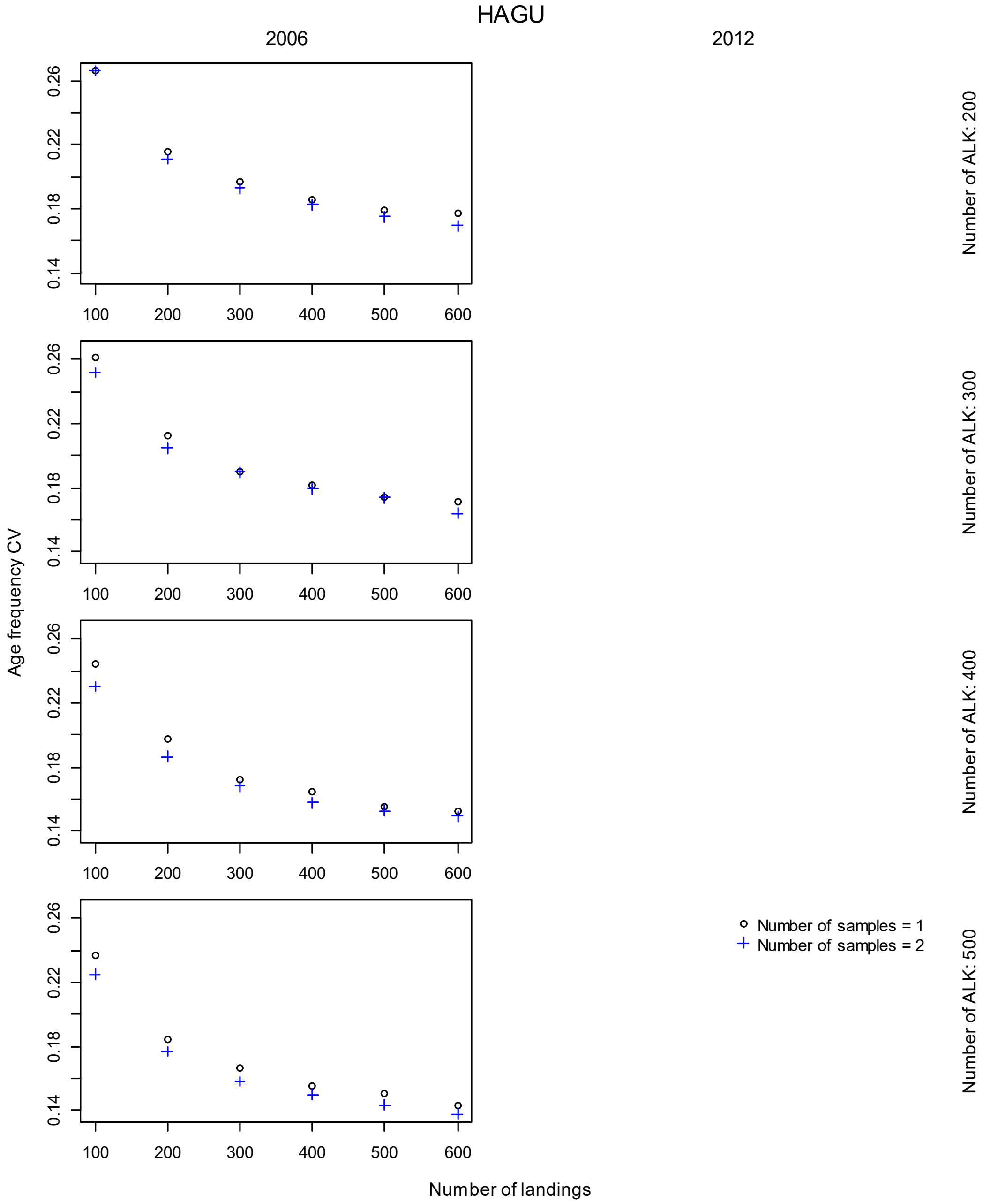
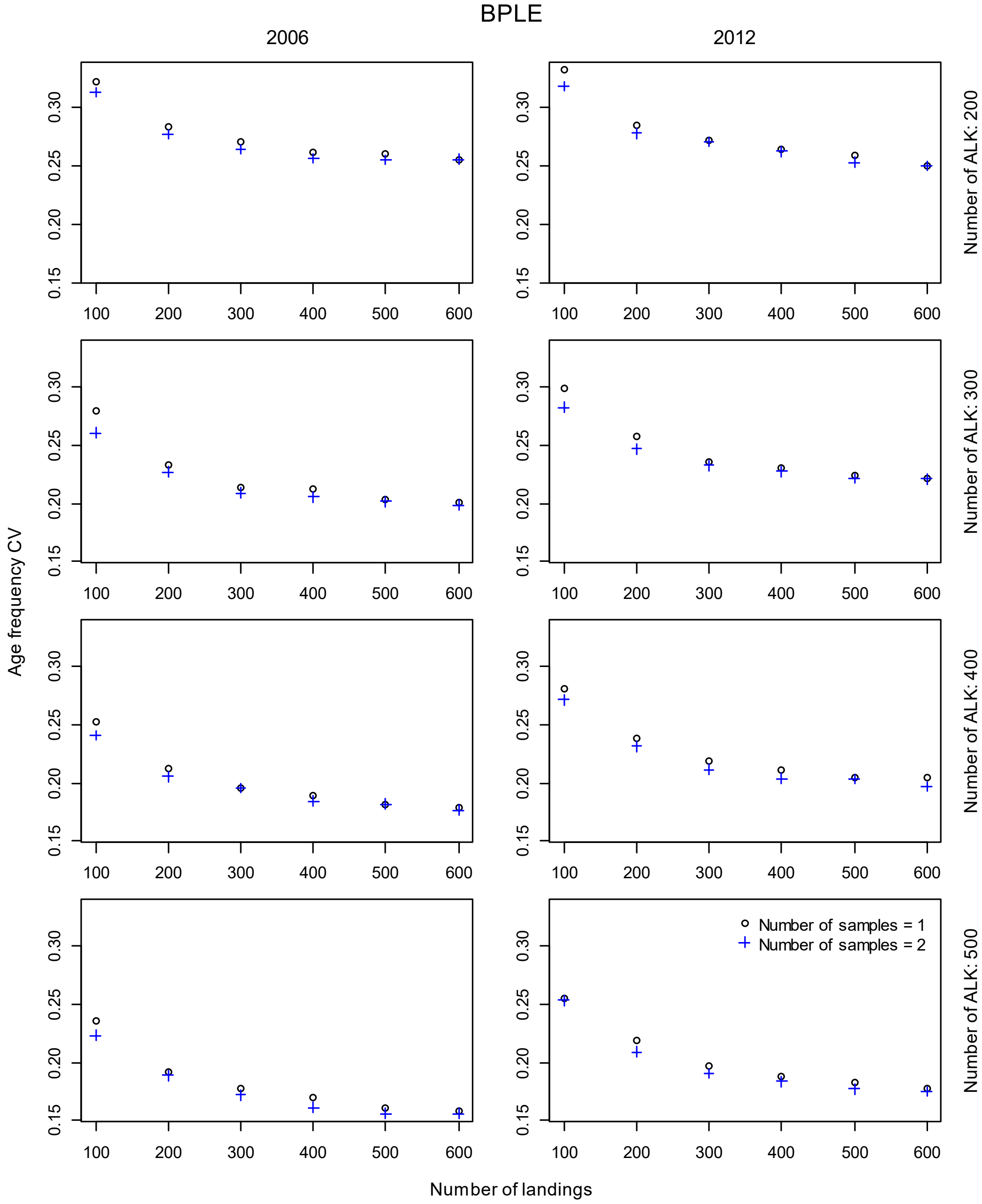
APPENDIX 1: Simulations conducted in CALA to determine the expected level of precision that might be expected for East Northland age distributions given the number of kahawai landings intercepted and the size of the age-length sample collected, based on data collected in 2006 and 2010–11–12. MWCVs were calculated for each scenario when a maximum of one fish was sampled from each landing, and when up to two fish were sampled from each landing.



Appendix 1 continued: Age distribution precision simulations for the Hauraki Gulf. No simulations were undertaken based on data collected in 2010–11–12 in this region, as no kahawai otoliths were collected from the Hauraki Gulf fishery in this year.



Appendix 1 continued: Age distribution precision simulations for the Bay of Plenty.



Appendix 2: Estimated proportions at length and CVs of kahawai sampled from recreational fishers in East Northland, Hauraki Gulf and the Bay of Plenty in 2015–16, 2016–17 and 2017–18

P.i. = proportion of fish in length class. *n* = total number of fish sampled.
CV = coefficient of variation. *MWCV = mean weighted c.v.*

Estimates of the proportion at length of kahawai from East Northland in 2015–16, 2016–17 and 2017–18

Length	CALA 2015–16		2016–17		2017–18	
(cm)	*P.i.*	CV	*P.i.*	CV	*P.i.*	CV
10	0.0000	0.00	0.0000	0.00	0.0000	0.00
11	0.0000	0.00	0.0000	0.00	0.0000	0.00
12	0.0000	0.00	0.0000	0.00	0.0000	0.00
13	0.0000	0.00	0.0000	0.00	0.0000	0.00
14	0.0000	0.00	0.0000	0.00	0.0000	0.00
15	0.0000	0.00	0.0000	0.00	0.0000	0.00
16	0.0000	0.00	0.0000	0.00	0.0000	0.00
17	0.0000	0.00	0.0000	0.00	0.0000	0.00
18	0.0000	0.00	0.0000	0.00	0.0000	0.00
19	0.0000	0.00	0.0000	0.00	0.0000	0.00
20	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
22	0.0010	1.28	0.0064	0.89	0.0010	1.24
23	0.0010	0.98	0.0081	0.74	0.0010	1.19
24	0.0000	0.00	0.0081	0.56	0.0010	1.19
25	0.0020	0.87	0.0097	0.57	0.0000	0.00
26	0.0040	0.64	0.0097	0.53	0.0000	0.00
27	0.0010	1.34	0.0016	1.30	0.0000	0.00
28	0.0000	0.00	0.0032	0.82	0.0010	1.26
29	0.0030	0.88	0.0048	0.77	0.0019	0.82
30	0.0060	0.54	0.0097	0.57	0.0076	0.37
31	0.0060	0.57	0.0064	0.66	0.0029	0.59
32	0.0060	0.55	0.0081	0.55	0.0057	0.50
33	0.0080	0.47	0.0113	0.43	0.0057	0.48
34	0.0149	0.34	0.0113	0.44	0.0048	0.64
35	0.0179	0.37	0.0177	0.43	0.0076	0.46
36	0.0149	0.35	0.0258	0.37	0.0067	0.48
37	0.0129	0.36	0.0145	0.43	0.0095	0.43
38	0.0189	0.32	0.0242	0.33	0.0029	0.61
39	0.0100	0.41	0.0161	0.40	0.0019	0.91
40	0.0239	0.26	0.0274	0.31	0.0162	0.30
41	0.0219	0.27	0.0338	0.28	0.0191	0.30
42	0.0309	0.23	0.0338	0.27	0.0143	0.41
43	0.0179	0.29	0.0403	0.26	0.0210	0.28
44	0.0309	0.23	0.0338	0.27	0.0239	0.26
45	0.0259	0.28	0.0403	0.24	0.0296	0.22
46	0.0249	0.27	0.0435	0.23	0.0468	0.18
47	0.0378	0.21	0.0403	0.25	0.0515	0.16
48	0.0697	0.15	0.0499	0.23	0.0668	0.15
49	0.0518	0.16	0.0451	0.24	0.0706	0.15
50	0.0996	0.13	0.0757	0.17	0.0916	0.13
51	0.0807	0.14	0.0612	0.20	0.0964	0.13
52	0.0886	0.13	0.0676	0.18	0.1107	0.12
53	0.0737	0.15	0.0837	0.16	0.0983	0.13
54	0.0667	0.15	0.0580	0.20	0.0658	0.15
55	0.0508	0.18	0.0338	0.26	0.0553	0.17
56	0.0339	0.21	0.0145	0.40	0.0353	0.20
57	0.0139	0.32	0.0113	0.51	0.0143	0.31
58	0.0090	0.42	0.0048	0.72	0.0067	0.45
59	0.0030	0.81	0.0016	1.32	0.0029	0.66
60	0.0120	0.39	0.0016	1.26	0.0010	1.03
61	0.0030	0.81	0.0016	1.22	0.0000	0.00
62	0.0010	1.42	0.0000	0.00	0.0010	1.01
63	0.0010	1.32	0.0000	0.00	0.0000	0.00
64	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
66	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
68	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
70	0.0000	0.00	0.0000	0.00	0.0000	0.00
n	1 004		621		1 048	
MWCV		0.22		0.29		0.19

Appendix 2 – continued:
Estimates of the proportion at length of kahawai from the Hauraki Gulf in 2015–16, 2016–17 and 2017–18

Length	CALA 2015–16		2016–17		2017–18	
(cm)	*P.i.*	CV	*P.i.*	CV	*P.i.*	CV
10	0.0000	0.00	0.0000	0.00	0.0000	0.00
11	0.0000	0.00	0.0000	0.00	0.0000	0.00
12	0.0000	0.00	0.0000	0.00	0.0000	0.00
13	0.0000	0.00	0.0000	0.00	0.0000	0.00
14	0.0000	0.00	0.0000	0.00	0.0000	0.00
15	0.0000	0.00	0.0000	0.00	0.0000	0.00
16	0.0000	0.00	0.0000	0.00	0.0000	0.00
17	0.0000	0.00	0.0000	0.00	0.0000	0.00
18	0.0000	0.00	0.0020	1.48	0.0000	0.00
19	0.0000	0.00	0.0000	0.00	0.0006	1.34
20	0.0000	0.00	0.0040	0.86	0.0000	0.00
21	0.0000	0.00	0.0000	0.00	0.0000	0.00
22	0.0005	1.03	0.0000	0.00	0.0006	1.35
23	0.0010	1.02	0.0000	0.00	0.0006	1.38
24	0.0005	0.98	0.0000	0.00	0.0006	1.41
25	0.0025	0.60	0.0040	0.82	0.0024	0.59
26	0.0035	0.51	0.0101	0.65	0.0030	0.53
27	0.0015	0.72	0.0040	0.93	0.0012	0.82
28	0.0015	0.83	0.0080	0.57	0.0030	0.54
29	0.0010	0.85	0.0020	0.99	0.0018	0.91
30	0.0035	0.46	0.0060	0.68	0.0090	0.37
31	0.0045	0.41	0.0101	0.71	0.0137	0.27
32	0.0075	0.31	0.0121	0.68	0.0185	0.26
33	0.0095	0.35	0.0262	0.59	0.0179	0.24
34	0.0080	0.41	0.0342	0.47	0.0173	0.24
35	0.0110	0.33	0.0141	0.51	0.0072	0.41
36	0.0030	0.55	0.0302	0.32	0.0072	0.35
37	0.0025	0.53	0.0141	0.43	0.0042	0.47
38	0.0055	0.64	0.0181	0.37	0.0060	0.40
39	0.0020	0.62	0.0101	0.54	0.0090	0.34
40	0.0055	0.50	0.0141	0.42	0.0179	0.22
41	0.0015	0.89	0.0101	0.57	0.0161	0.26
42	0.0075	0.35	0.0241	0.34	0.0191	0.26
43	0.0015	0.75	0.0342	0.30	0.0179	0.25
44	0.0040	0.46	0.0181	0.41	0.0132	0.26
45	0.0025	0.57	0.0221	0.46	0.0275	0.18
46	0.0040	0.45	0.0262	0.33	0.0335	0.18
47	0.0050	0.40	0.0040	0.79	0.0335	0.16
48	0.0115	0.26	0.0161	0.46	0.0329	0.17
49	0.0120	0.25	0.0121	0.49	0.0317	0.17
50	0.0304	0.17	0.0262	0.34	0.0436	0.14
51	0.0508	0.13	0.0523	0.26	0.0526	0.14
52	0.1076	0.08	0.0584	0.23	0.0801	0.10
53	0.1216	0.07	0.0604	0.22	0.1231	0.09
54	0.1744	0.07	0.0926	0.19	0.1291	0.08
55	0.1565	0.07	0.1167	0.17	0.1010	0.09
56	0.1091	0.08	0.0966	0.17	0.0538	0.14
57	0.0628	0.12	0.0382	0.28	0.0227	0.21
58	0.0379	0.15	0.0342	0.29	0.0114	0.30
59	0.0105	0.30	0.0060	0.71	0.0078	0.35
60	0.0060	0.52	0.0221	0.36	0.0042	0.50
61	0.0055	0.41	0.0020	1.31	0.0018	0.85
62	0.0010	0.94	0.0000	0.00	0.0006	1.34
63	0.0005	1.38	0.0020	1.40	0.0000	0.00
64	0.0000	0.00	0.0000	0.00	0.0000	0.00
65	0.0015	0.64	0.0020	1.37	0.0012	0.88
66	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
68	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
70	0.0000	0.00	0.0000	0.00	0.0000	0.00
n	2 007		497		1 673	
MWCV		0.14		0.33		0.17

Appendix 2 – continued:
Estimates of the proportion at length of kahawai from the Bay of Plenty in 2015–16, 2016–17 and 2017–18

Length	CALA 2015–16		2016–17		2017–18	
(cm)	*P.i.*	CV	*P.i.*	CV	*P.i.*	CV
10	0.0000	0.00	0.0000	0.00	0.0000	0.00
11	0.0000	0.00	0.0000	0.00	0.0000	0.00
12	0.0000	0.00	0.0000	0.00	0.0000	0.00
13	0.0000	0.00	0.0000	0.00	0.0000	0.00
14	0.0000	0.00	0.0000	0.00	0.0000	0.00
15	0.0000	0.00	0.0000	0.00	0.0000	0.00
16	0.0000	0.00	0.0000	0.00	0.0000	0.00
17	0.0000	0.00	0.0000	0.00	0.0000	0.00
18	0.0000	0.00	0.0000	0.00	0.0000	0.00
19	0.0000	0.00	0.0000	0.00	0.0005	1.17
20	0.0010	1.34	0.0000	0.00	0.0000	0.00
21	0.0000	0.00	0.0000	0.00	0.0005	1.25
22	0.0010	1.35	0.0000	0.00	0.0005	1.01
23	0.0010	1.34	0.0000	0.00	0.0009	0.90
24	0.0010	1.35	0.0024	1.29	0.0023	0.58
25	0.0031	0.88	0.0048	0.81	0.0005	1.31
26	0.0000	0.00	0.0072	0.74	0.0023	0.54
27	0.0031	0.68	0.0048	0.91	0.0014	0.89
28	0.0010	1.29	0.0072	0.76	0.0027	0.57
29	0.0051	0.59	0.0024	1.34	0.0063	0.42
30	0.0041	0.55	0.0072	0.76	0.0172	0.23
31	0.0010	1.03	0.0239	0.40	0.0122	0.25
32	0.0020	0.90	0.0191	0.42	0.0086	0.29
33	0.0112	0.39	0.0215	0.56	0.0045	0.42
34	0.0041	0.61	0.0287	0.42	0.0041	0.42
35	0.0122	0.42	0.0239	0.37	0.0050	0.35
36	0.0082	0.51	0.0096	0.76	0.0045	0.40
37	0.0173	0.30	0.0239	0.41	0.0054	0.37
38	0.0194	0.30	0.0215	0.43	0.0100	0.29
39	0.0153	0.34	0.0215	0.43	0.0122	0.25
40	0.0143	0.34	0.0311	0.33	0.0258	0.18
41	0.0265	0.25	0.0215	0.43	0.0272	0.17
42	0.0316	0.22	0.0215	0.39	0.0276	0.17
43	0.0163	0.30	0.0311	0.33	0.0208	0.20
44	0.0194	0.29	0.0407	0.43	0.0294	0.16
45	0.0224	0.25	0.0455	0.30	0.0403	0.14
46	0.0275	0.25	0.0311	0.35	0.0512	0.12
47	0.0296	0.25	0.0646	0.23	0.0484	0.13
48	0.0673	0.16	0.0598	0.25	0.0865	0.09
49	0.0877	0.12	0.0789	0.22	0.0643	0.10
50	0.0734	0.14	0.0526	0.25	0.0982	0.09
51	0.0928	0.13	0.0478	0.28	0.0765	0.10
52	0.0999	0.12	0.0407	0.28	0.0937	0.09
53	0.0856	0.13	0.0598	0.24	0.0702	0.10
54	0.0897	0.13	0.0526	0.26	0.0602	0.11
55	0.0612	0.15	0.0239	0.38	0.0303	0.16
56	0.0183	0.30	0.0215	0.44	0.0199	0.19
57	0.0133	0.35	0.0167	0.43	0.0127	0.24
58	0.0071	0.44	0.0048	0.88	0.0059	0.36
59	0.0010	0.95	0.0072	0.79	0.0036	0.44
60	0.0010	1.28	0.0000	0.00	0.0027	0.52
61	0.0000	0.00	0.0000	0.00	0.0005	1.34
62	0.0010	1.34	0.0024	1.02	0.0009	0.86
63	0.0020	0.80	0.0024	1.26	0.0009	0.89
64	0.0000	0.00	0.0024	1.36	0.0000	0.00
65	0.0000	0.00	0.0072	0.82	0.0000	0.00
66	0.0000	0.00	0.0024	0.96	0.0000	0.00
67	0.0000	0.00	0.0000	0.00	0.0005	1.26
68	0.0000	0.00	0.0000	0.00	0.0005	1.03
69	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
n	981		418		2 209	
MWCV		0.21		0.36		0.15

Appendix 3: Estimated proportions at age and CVs of kahawai sampled from recreational fishers in East Northland, Hauraki Gulf and the Bay of Plenty in 2015–16, 2016–17 and 2017–18.

P.i. = proportion of fish in length class. *n* = total number of fish sampled.
CV = coefficient of variation. *MWCV = mean weighted c.v.*

Estimates of the proportion at age of kahawai from East Northland in 2015–16, 2016–17 and 2017–18

Age	CALA 2015–16		2016–17		2017–18	
(years)	*P.j.*	CV	*P.j.*	CV	*P.j.*	CV
1	0.0000	0.0000	0.0000	0.00	0.0000	0.00
2	0.0070	0.5651	0.0556	0.33	0.0000	0.00
3	0.0997	0.1887	0.0688	0.23	0.0432	0.22
4	0.1256	0.1439	0.1911	0.14	0.0850	0.18
5	0.0309	0.3962	0.1238	0.17	0.1285	0.14
6	0.0823	0.2187	0.0389	0.31	0.0899	0.20
7	0.1279	0.1697	0.0851	0.21	0.0234	0.40
8	0.0863	0.2005	0.0836	0.20	0.1103	0.17
9	0.0966	0.1769	0.0752	0.22	0.1063	0.16
10	0.0678	0.2084	0.0802	0.21	0.1102	0.15
11	0.1018	0.1868	0.0288	0.33	0.1097	0.17
12	0.0457	0.2359	0.0658	0.23	0.0897	0.18
13	0.0906	0.1926	0.0234	0.42	0.0457	0.27
14	0.0099	0.5575	0.0230	0.36	0.0228	0.35
15	0.0088	0.5309	0.0223	0.38	0.0230	0.38
16	0.0083	0.6796	0.0257	0.35	0.0049	0.73
17	0.0084	0.6087	0.0066	0.78	0.0017	1.23
18	0.0023	1.0585	0.0021	1.13	0.0030	1.02
19	0.0000	0.0000	0.0000	0.00	0.0025	1.01
>19	0.0000	0.0000	0.0000	0.00	0.0000	0.00
n	317		323		315	
MWCV		0.21		0.23		0.20

Appendix 3 – continued:
Estimates of the proportion at age of kahawai from Hauraki Gulf in 2015–16, 2016–17 and 2017–18.

Age	CALA 2015–16		2016–17		2017–18	
(years)	*P.j.*	CV	*P.j.*	CV	*P.j.*	CV
1	0.0000	0.0000	0.0000	0.00	0.0000	0.00
2	0.0088	0.3618	0.0248	0.39	0.0072	0.44
3	0.0530	0.1926	0.1201	0.32	0.0998	0.13
4	0.0241	0.3740	0.1124	0.15	0.0741	0.21
5	0.0033	0.7758	0.0608	0.19	0.1460	0.14
6	0.0347	0.3020	0.0273	0.25	0.0079	0.70
7	0.0317	0.3097	0.0579	0.21	0.0137	0.52
8	0.0393	0.3181	0.0605	0.25	0.0407	0.29
9	0.0289	0.3361	0.0592	0.27	0.0496	0.34
10	0.0788	0.2153	0.0777	0.22	0.0717	0.23
11	0.1499	0.1473	0.0437	0.29	0.1254	0.17
12	0.1715	0.1399	0.0735	0.23	0.1107	0.15
13	0.2365	0.1125	0.0711	0.28	0.1200	0.14
14	0.0721	0.2343	0.0567	0.28	0.0734	0.20
15	0.0378	0.3201	0.0452	0.42	0.0547	0.21
16	0.0185	0.5138	0.0485	0.34	0.0052	0.74
17	0.0111	0.5973	0.0413	0.52	0.0000	0.00
18	0.0000	0.0000	0.0194	0.66	0.0000	0.00
19	0.0000	0.0000	0.0000	0.00	0.0000	0.00
>19	0.0000	0.0000	0.0000	0.00	0.0000	0.00
n	291		306		320	
MWCV		0.20		0.28		0.19

Appendix 3 – continued:
Estimates of the proportion at age of kahawai from the Bay of Plenty in 2015–16, 2016–17 and 2017–18.

Age	CALA 2015–16		2016–17		2017–18	
(years)	*P.j.*	CV	*P.j.*	CV	*P.j.*	CV
1	0.0000	0.0000	0.0000	0.00	0.0000	0.00
2	0.0041	0.9782	0.0195	0.54	0.0061	0.46
3	0.0431	0.2720	0.1429	0.19	0.0599	0.16
4	0.1032	0.1539	0.1202	0.19	0.1036	0.14
5	0.0359	0.3389	0.1144	0.21	0.1101	0.17
6	0.1677	0.1372	0.0771	0.25	0.1298	0.17
7	0.0993	0.1757	0.1478	0.17	0.0704	0.23
8	0.0541	0.2476	0.0856	0.22	0.1481	0.16
9	0.1222	0.1525	0.0461	0.29	0.1195	0.17
10	0.0827	0.2011	0.0507	0.27	0.0843	0.24
11	0.0834	0.1890	0.0380	0.32	0.0558	0.28
12	0.1028	0.1872	0.0335	0.36	0.0421	0.35
13	0.0621	0.2255	0.0530	0.29	0.0268	0.41
14	0.0318	0.3549	0.0419	0.33	0.0178	0.46
15	0.0026	1.0967	0.0035	1.17	0.0173	0.42
16	0.0050	0.7789	0.0106	0.69	0.0086	0.69
17	0.0000	0.0000	0.0055	1.13	0.0000	0.00
18	0.0000	0.0000	0.0098	0.82	0.0000	0.00
19	0.0000	0.0000	0.0000	0.00	0.0000	0.00
>19	0.0000	0.0000	0.0000	0.00	0.0000	0.00
n	303		276		303	
MWCV		0.20		0.25		0.21

Appendix 4: Age–length keys derived from otolith samples collected from recreational fishers from Hauraki Gulf in 2015–16.

Estimates of proportion of length at age for kahawai sampled from the Hauraki Gulf recreational fishery, January to April 2016. (Note: Aged to 01/01/16)

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
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
22	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
23	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
24	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
26	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
28	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
29	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
30	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
31	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
32	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
33	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
34	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
35	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
36	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
37	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
38	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
40	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
41	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
42	0.00	0.00	0.00	0.60	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
44	0.00	0.00	0.00	0.75	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
46	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
47	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
48	0.00	0.00	0.00	0.00	0.00	0.50	0.33	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
49	0.00	0.00	0.00	0.00	0.00	0.25	0.38	0.00	0.00	0.13	0.00	0.00	0.13	0.00	0.13	0.00	0.00	0.00	0.00	0.00	8
50	0.00	0.00	0.00	0.00	0.00	0.08	0.25	0.17	0.00	0.08	0.17	0.08	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12
51	0.00	0.00	0.00	0.00	0.00	0.09	0.18	0.09	0.00	0.18	0.09	0.27	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
52	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.03	0.10	0.21	0.17	0.21	0.10	0.07	0.03	0.00	0.00	0.00	0.00	0.00	29
53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.07	0.20	0.13	0.30	0.00	0.03	0.00	0.07	0.00	0.00	0.00	30
54	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.08	0.00	0.13	0.13	0.26	0.31	0.05	0.03	0.00	0.00	0.00	0.00	0.00	39
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.22	0.16	0.32	0.16	0.05	0.03	0.00	0.00	0.00	0.00	37
56	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03	0.27	0.27	0.17	0.13	0.03	0.03	0.00	0.00	0.00	0.00	30
57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.42	0.17	0.08	0.17	0.00	0.00	0.00	0.00	12
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.08	0.54	0.08	0.08	0.00	0.08	0.00	0.00	0.00	13
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.33	0.17	0.33	0.00	0.00	0.00	0.00	0.00	6
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Total																					291

Appendix 4: Age–length keys derived from otolith samples collected from recreational fishers from East Northland in 2015–16.

Estimates of proportion of length at age for kahawai sampled from the East Northland recreational fishery, January to April 2016. (Note: Aged to 01/01/16)

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
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
23	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
25	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
26	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
27	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
29	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
30	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
31	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
32	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
33	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
34	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
35	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
36	0.00	0.00	0.80	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
37	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
38	0.00	0.00	0.20	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
39	0.00	0.00	0.14	0.71	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
40	0.00	0.00	0.14	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
41	0.00	0.00	0.00	0.89	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
42	0.00	0.00	0.09	0.82	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
43	0.00	0.00	0.00	0.75	0.13	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
44	0.00	0.00	0.00	0.43	0.29	0.00	0.14	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
45	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
46	0.00	0.00	0.00	0.00	0.00	0.40	0.40	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
47	0.00	0.00	0.00	0.00	0.22	0.11	0.44	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
48	0.00	0.00	0.00	0.11	0.00	0.39	0.22	0.06	0.11	0.06	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18
49	0.00	0.00	0.00	0.00	0.00	0.31	0.13	0.13	0.19	0.13	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16
50	0.00	0.00	0.00	0.00	0.05	0.14	0.29	0.10	0.10	0.05	0.14	0.05	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21
51	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.14	0.27	0.14	0.18	0.05	0.05	0.00	0.00	0.00	0.05	0.00	0.00	0.00	22
52	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.27	0.17	0.13	0.10	0.13	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	30
53	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.23	0.16	0.16	0.06	0.13	0.03	0.00	0.00	0.03	0.00	0.00	0.00	31
54	0.00	0.00	0.00	0.00	0.00	0.03	0.10	0.07	0.20	0.07	0.17	0.13	0.17	0.00	0.07	0.00	0.00	0.00	0.00	0.00	30
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.14	0.18	0.23	0.18	0.05	0.05	0.05	0.05	0.05	0.00	0.00	22
56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.43	0.00	0.14	0.00	0.14	0.14	0.00	0.00	0.00	0.00	7
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	4
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.33	0.00	0.00	0.33	0.00	0.00	0.00	0.00	3
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Total																					317

Appendix 4: Age–length keys derived from otolith samples collected from recreational fishers from Hauraki Gulf in 2015–16.

Estimates of proportion of length at age for kahawai sampled from the Hauraki Gulf recreational fishery, January to April 2016. (Note: Aged to 01/01/16)

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
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
22	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
23	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
24	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
26	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
28	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
29	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
30	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
31	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
32	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
33	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
34	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
35	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
36	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
37	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
38	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
40	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
41	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
42	0.00	0.00	0.00	0.60	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
44	0.00	0.00	0.00	0.75	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
46	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
47	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
48	0.00	0.00	0.00	0.00	0.00	0.50	0.33	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
49	0.00	0.00	0.00	0.00	0.00	0.25	0.38	0.00	0.00	0.13	0.00	0.00	0.13	0.00	0.13	0.00	0.00	0.00	0.00	0.00	8
50	0.00	0.00	0.00	0.00	0.00	0.08	0.25	0.17	0.00	0.08	0.17	0.08	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12
51	0.00	0.00	0.00	0.00	0.00	0.09	0.18	0.09	0.00	0.18	0.09	0.27	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
52	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.03	0.10	0.21	0.17	0.21	0.10	0.07	0.03	0.00	0.00	0.00	0.00	0.00	29
53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.07	0.20	0.13	0.30	0.00	0.03	0.00	0.07	0.00	0.00	0.00	30
54	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.08	0.00	0.13	0.13	0.26	0.31	0.05	0.03	0.00	0.00	0.00	0.00	0.00	39
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.22	0.16	0.32	0.16	0.05	0.03	0.00	0.00	0.00	0.00	37
56	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03	0.27	0.27	0.17	0.13	0.03	0.03	0.00	0.00	0.00	0.00	30
57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.42	0.17	0.08	0.17	0.00	0.00	0.00	0.00	12
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.08	0.54	0.08	0.08	0.00	0.08	0.00	0.00	0.00	13
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.33	0.17	0.33	0.00	0.00	0.00	0.00	0.00	6
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Total																					291

Appendix 4: Age–length keys derived from otolith samples collected from recreational fishers from Bay of Plenty in 2015–16.

Estimates of proportion of length at age for kahawai sampled from the Bay of Plenty recreational fishery, January to April 2016. (Note: Aged to 01/01/16)

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
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
25	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
27	0.00	0.33	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
28	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
29	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
30	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
31	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
33	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
34	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
35	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
36	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
37	0.00	0.00	0.00	0.50	0.33	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
38	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
39	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
40	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
41	0.00	0.00	0.00	0.88	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
42	0.00	0.00	0.00	0.90	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10
43	0.00	0.00	0.00	0.33	0.17	0.33	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
44	0.00	0.00	0.00	0.00	0.00	0.67	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
45	0.00	0.00	0.00	0.00	0.38	0.50	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
46	0.00	0.00	0.00	0.00	0.00	0.50	0.40	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10
47	0.00	0.00	0.00	0.00	0.11	0.67	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
48	0.00	0.00	0.00	0.00	0.00	0.44	0.31	0.00	0.06	0.06	0.00	0.06	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	16
49	0.00	0.00	0.00	0.00	0.07	0.31	0.14	0.07	0.21	0.07	0.07	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	29
50	0.00	0.00	0.00	0.00	0.00	0.21	0.37	0.11	0.21	0.00	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19
51	0.00	0.00	0.00	0.00	0.00	0.09	0.05	0.09	0.18	0.18	0.14	0.18	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22
52	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.09	0.21	0.21	0.18	0.18	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	33
53	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.28	0.09	0.22	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32
54	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.15	0.18	0.12	0.18	0.09	0.21	0.00	0.00	0.03	0.00	0.00	0.00	0.00	34
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.45	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	11
56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.29	0.14	0.14	0.14	0.00	0.00	0.00	0.00	0.00	7
57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.25	0.25	0.25	0.00	0.13	0.00	0.00	0.00	0.00	8
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Total																					303

Appendix 4: Age–length keys derived from otolith samples collected from recreational fishers from East Northland in 2016–17.

Estimates of proportion of length at age for kahawai sampled from the East Northland recreational fishery, January to April 2017. (Note: Aged to 01/01/17)

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
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
22	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
23	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
24	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
25	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
26	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
27	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
28	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
29	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
30	0.00	0.67	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
31	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
32	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
33	0.00	0.00	0.83	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
34	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
35	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
36	0.00	0.00	0.73	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
37	0.00	0.00	0.25	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
38	0.00	0.00	0.20	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10
39	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
40	0.00	0.00	0.14	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
41	0.00	0.00	0.00	0.86	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14
42	0.00	0.00	0.00	0.80	0.10	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10
43	0.00	0.00	0.00	0.31	0.56	0.06	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16
44	0.00	0.00	0.00	0.38	0.50	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
45	0.00	0.00	0.00	0.18	0.36	0.09	0.00	0.09	0.18	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
46	0.00	0.00	0.00	0.06	0.53	0.12	0.06	0.12	0.06	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17
47	0.00	0.00	0.00	0.00	0.36	0.27	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
48	0.00	0.00	0.00	0.00	0.42	0.00	0.50	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12
49	0.00	0.00	0.00	0.00	0.05	0.16	0.26	0.26	0.05	0.11	0.05	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	19
50	0.00	0.00	0.00	0.00	0.04	0.04	0.11	0.33	0.15	0.22	0.07	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27
51	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.17	0.33	0.08	0.00	0.17	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12
52	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.13	0.08	0.21	0.13	0.17	0.04	0.00	0.08	0.08	0.00	0.00	0.00	0.00	24
53	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.04	0.17	0.26	0.04	0.17	0.09	0.00	0.09	0.04	0.00	0.00	0.00	0.00	23
54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.10	0.05	0.33	0.05	0.24	0.05	0.14	0.00	0.00	0.00	0.00	21
55	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.20	0.00	0.00	0.10	0.00	0.00	0.00	10
56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.14	0.14	0.00	0.00	0.14	0.00	0.29	0.00	0.00	0.14	0.00	0.00	7
57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	4
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	2
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Total																					323

Appendix 4: Age–length keys derived from otolith samples collected from recreational fishers from Hauraki Gulf in 2016–17.

Estimates of proportion of length at age for kahawai sampled from the Hauraki Gulf recreational fishery, January to April 2017. (Note: Aged to 01/01/17)

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
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
20	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
25	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
26	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
27	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
28	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
29	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
32	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
33	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
34	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
35	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
36	0.00	0.00	0.82	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
37	0.00	0.00	0.75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
38	0.00	0.00	0.57	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
39	0.00	0.00	0.33	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
40	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
41	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
42	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
43	0.00	0.00	0.00	0.82	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
44	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
45	0.00	0.00	0.00	0.80	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
46	0.00	0.00	0.00	0.50	0.38	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
47	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
48	0.00	0.00	0.00	0.00	0.33	0.17	0.17	0.00	0.17	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	6
49	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.00	0.00	0.00	0.00	0.25	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	4
50	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.14	0.14	0.14	0.00	0.14	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	7
51	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.06	0.06	0.18	0.29	0.12	0.00	0.06	0.00	0.06	0.00	0.00	0.00	0.00	17
52	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.13	0.07	0.20	0.13	0.27	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	15
53	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.17	0.22	0.17	0.22	0.00	0.11	0.00	0.06	0.00	0.00	0.00	0.00	18
54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.06	0.09	0.22	0.13	0.31	0.03	0.00	0.00	0.00	0.00	0.00	32
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.14	0.06	0.25	0.11	0.28	0.08	0.00	0.06	0.00	0.00	0.00	36
56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.11	0.14	0.11	0.46	0.03	0.05	0.03	0.03	0.00	0.00	37
57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.08	0.00	0.08	0.50	0.08	0.00	0.00	0.08	0.00	0.00	12
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.25	0.17	0.42	0.00	0.00	0.08	0.00	0.00	0.00	12
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	2
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.13	0.13	0.38	0.13	0.00	0.00	0.00	0.00	0.00	8
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Total																					302

Appendix 4: Age–length keys derived from otolith samples collected from recreational fishers from Bay of Plenty in 2016–17.

Estimates of proportion of length at age for kahawai sampled from the Bay of Plenty recreational fishery, January to April 2017. (Note: Aged to 01/01/17)

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
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
24	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
25	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
26	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
27	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
28	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
30	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
31	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
32	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
33	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
34	0.00	0.00	0.67	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
35	0.00	0.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
36	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
37	0.00	0.00	0.29	0.43	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
38	0.00	0.00	0.44	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
39	0.00	0.00	0.14	0.43	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
40	0.00	0.00	0.00	0.88	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
41	0.00	0.00	0.00	0.29	0.43	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
42	0.00	0.00	0.00	0.43	0.29	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
43	0.00	0.00	0.00	0.38	0.25	0.13	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
44	0.00	0.00	0.00	0.00	0.33	0.17	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
45	0.00	0.00	0.00	0.13	0.27	0.20	0.27	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15
46	0.00	0.00	0.00	0.13	0.25	0.13	0.13	0.25	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
47	0.00	0.00	0.00	0.00	0.50	0.11	0.17	0.11	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18
48	0.00	0.00	0.00	0.00	0.08	0.23	0.31	0.23	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13
49	0.00	0.00	0.00	0.00	0.04	0.11	0.37	0.22	0.11	0.07	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	27
50	0.00	0.00	0.00	0.00	0.00	0.06	0.41	0.29	0.00	0.06	0.06	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17
51	0.00	0.00	0.00	0.00	0.00	0.15	0.23	0.08	0.23	0.23	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13
52	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.14	0.14	0.21	0.21	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	14
53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.21	0.14	0.43	0.07	0.00	0.00	0.00	0.07	0.00	0.00	14
54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.19	0.06	0.13	0.19	0.19	0.00	0.06	0.00	0.00	0.00	0.00	16
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.14	0.29	0.14	0.14	0.14	0.00	0.00	0.00	0.00	0.00	7
56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.25	0.25	0.00	0.00	4
57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.29	0.14	0.29	0.00	0.14	0.00	0.00	0.00	0.00	7
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Total																					276

Appendix 4: Age–length keys derived from otolith samples collected from recreational fishers from East Northland in 2017–18.

Estimates of proportion of length at age for kahawai sampled from the East Northland recreational fishery, January to April 2018. (Note: Aged to 01/01/18)

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
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
29	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
30	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
31	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
32	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
35	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
36	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
37	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
38	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
39	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
40	0.00	0.00	0.00	0.60	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
41	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
42	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
43	0.00	0.00	0.00	0.60	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
44	0.00	0.00	0.00	0.33	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
45	0.00	0.00	0.00	0.00	0.38	0.25	0.00	0.13	0.13	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
46	0.00	0.00	0.00	0.07	0.79	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14
47	0.00	0.00	0.00	0.00	0.50	0.25	0.00	0.06	0.00	0.06	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16
48	0.00	0.00	0.00	0.05	0.24	0.19	0.05	0.19	0.10	0.05	0.10	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	21
49	0.00	0.00	0.00	0.00	0.07	0.21	0.07	0.29	0.07	0.00	0.21	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	14
50	0.00	0.00	0.00	0.00	0.00	0.20	0.04	0.24	0.12	0.28	0.04	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25
51	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.19	0.31	0.22	0.03	0.06	0.03	0.00	0.00	0.00	0.00	0.03	0.00	0.00	32
52	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.17	0.17	0.15	0.10	0.24	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	41
53	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.07	0.20	0.12	0.20	0.17	0.07	0.05	0.07	0.00	0.00	0.00	0.00	0.00	41
54	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.15	0.11	0.19	0.22	0.07	0.11	0.04	0.07	0.00	0.00	0.00	0.00	27
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.33	0.27	0.13	0.13	0.07	0.00	0.00	0.00	0.00	0.00	0.00	15
56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.14	0.29	0.21	0.07	0.14	0.00	0.00	0.00	0.07	0.00	14
57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25	0.00	0.00	0.25	0.00	0.00	0.25	0.00	0.00	0.00	4
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Total																					315

Appendix 4: Age–length keys derived from otolith samples collected from recreational fishers from Hauraki Gulf in 2017–18.

Estimates of proportion of length at age for kahawai sampled from the Hauraki Gulf recreational fishery, January to April 2018. (Note: Aged to 01/01/18)

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
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
25	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
28	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
29	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
30	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
31	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
32	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
33	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
34	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
35	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
36	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
37	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
38	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
39	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
40	0.00	0.00	0.00	0.67	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
41	0.00	0.00	0.00	0.75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
42	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
43	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
44	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
45	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
46	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
47	0.00	0.00	0.00	0.00	0.71	0.14	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
48	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	5
49	0.00	0.00	0.00	0.00	0.38	0.00	0.25	0.25	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
51	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.13	0.07	0.00	0.33	0.13	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	15
52	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.00	0.19	0.23	0.12	0.15	0.15	0.04	0.04	0.00	0.00	0.00	0.00	0.00	26
53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.05	0.13	0.20	0.23	0.10	0.08	0.08	0.00	0.00	0.00	0.00	0.00	40
54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.12	0.12	0.21	0.28	0.14	0.09	0.00	0.00	0.00	0.00	0.00	58
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.09	0.16	0.20	0.23	0.16	0.11	0.02	0.00	0.00	0.00	0.00	44
56	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.16	0.16	0.28	0.16	0.20	0.00	0.00	0.00	0.00	0.00	25
57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.31	0.31	0.08	0.15	0.00	0.00	0.00	0.00	0.00	13
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.25	0.25	0.00	0.25	0.00	0.00	0.00	0.00	4
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	3
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Total																					320

Appendix 4: Age–length keys derived from otolith samples collected from recreational fishers from Bay of Plenty in 2017–18.

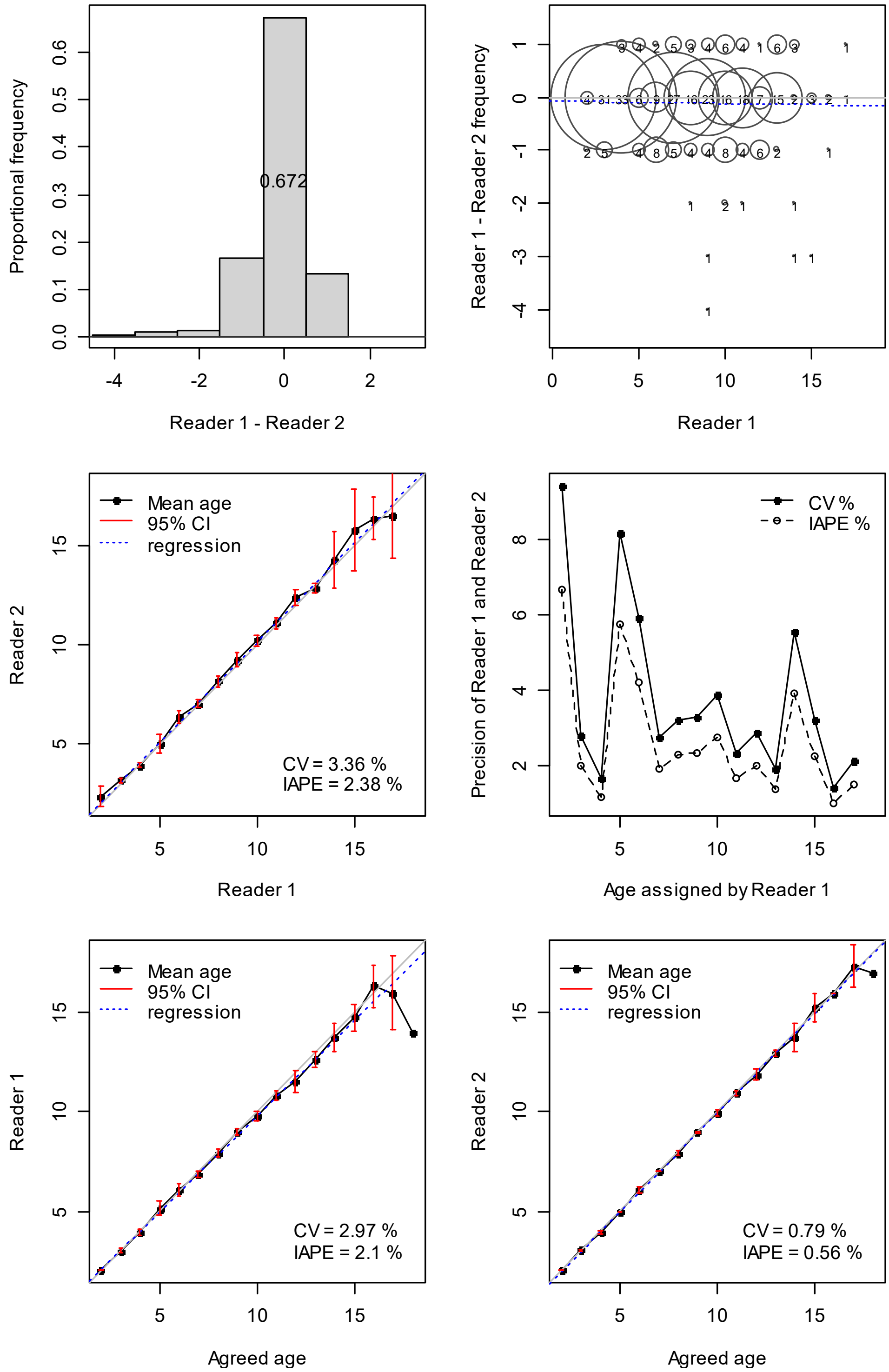
Estimates of proportion of length at age for kahawai sampled from the Bay of Plenty recreational fishery, January to April 2018. (Note: Aged to 01/01/18)

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
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
24	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
26	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
27	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
28	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
29	0.00	0.17	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6
30	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10
31	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
32	0.00	0.00	0.75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
33	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
34	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
35	0.00	0.00	0.33	0.33	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
36	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
37	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
38	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
39	0.00	0.00	0.33	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
40	0.00	0.00	0.00	0.75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8
41	0.00	0.00	0.00	0.80	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
42	0.00	0.00	0.00	0.53	0.33	0.07	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15
43	0.00	0.00	0.00	0.56	0.33	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
44	0.00	0.00	0.00	0.20	0.53	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15
45	0.00	0.00	0.00	0.00	0.44	0.44	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9
46	0.00	0.00	0.00	0.00	0.33	0.27	0.13	0.13	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15
47	0.00	0.00	0.00	0.06	0.12	0.29	0.18	0.18	0.12	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17
48	0.00	0.00	0.00	0.00	0.17	0.23	0.17	0.27	0.13	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30
49	0.00	0.00	0.00	0.00	0.00	0.29	0.14	0.29	0.00	0.14	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7
50	0.00	0.00	0.00	0.00	0.04	0.17	0.25	0.25	0.17	0.08	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24
51	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.41	0.06	0.29	0.12	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17
52	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.15	0.30	0.20	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	20
53	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.14	0.21	0.11	0.18	0.11	0.07	0.04	0.07	0.00	0.00	0.00	0.00	0.00	28
54	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.40	0.00	0.07	0.13	0.07	0.13	0.00	0.07	0.00	0.00	0.00	0.00	15
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.25	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4
56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.25	0.00	0.13	0.13	0.38	0.00	0.00	0.00	0.00	0.00	8
57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2
59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1
61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Total																					303

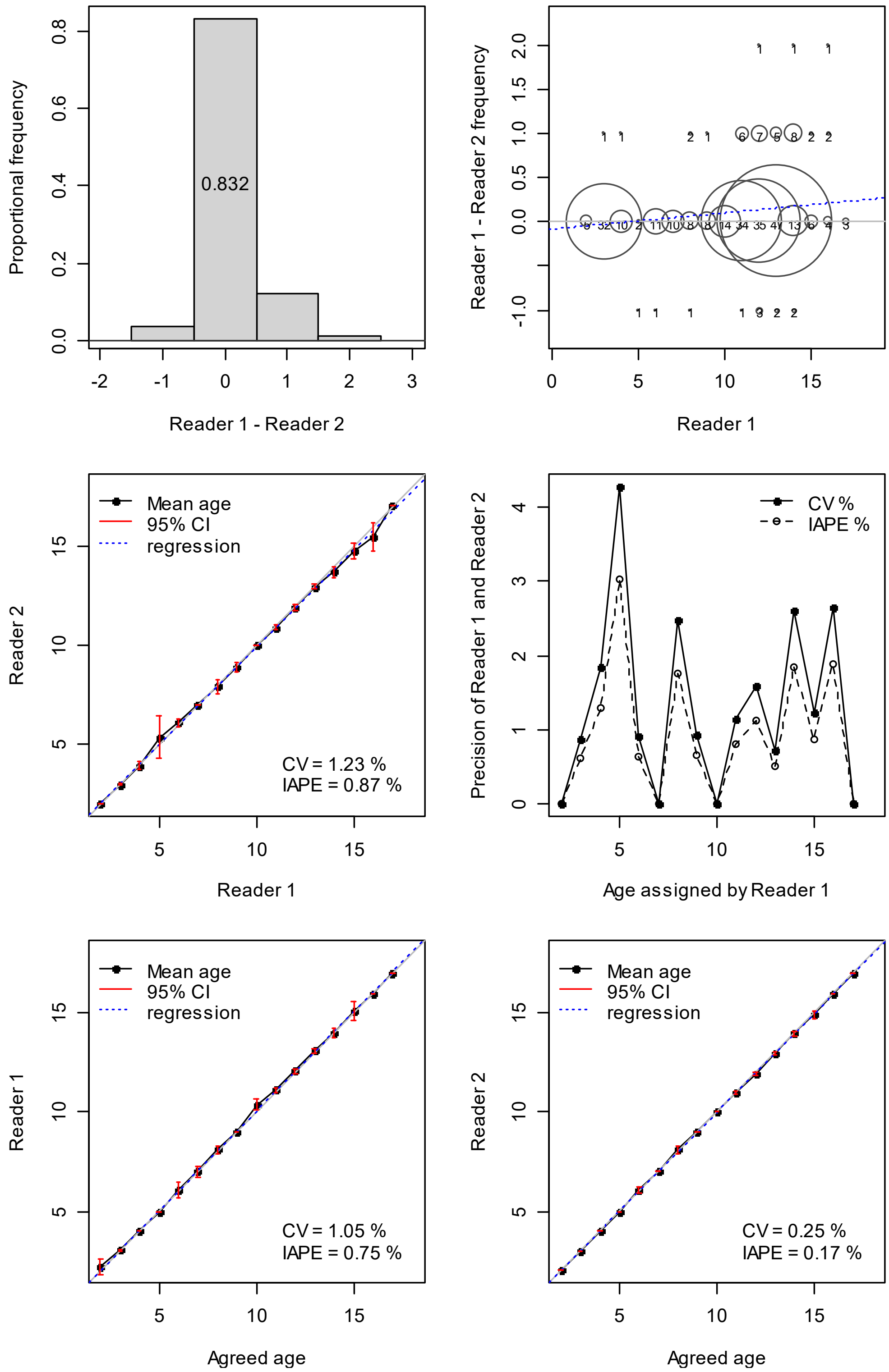
Appendix 5

Age bias diagnostic plots of kahawai aged from recreational catches in East Northland, Hauraki Gulf and the Bay of Plenty in 2015–16.

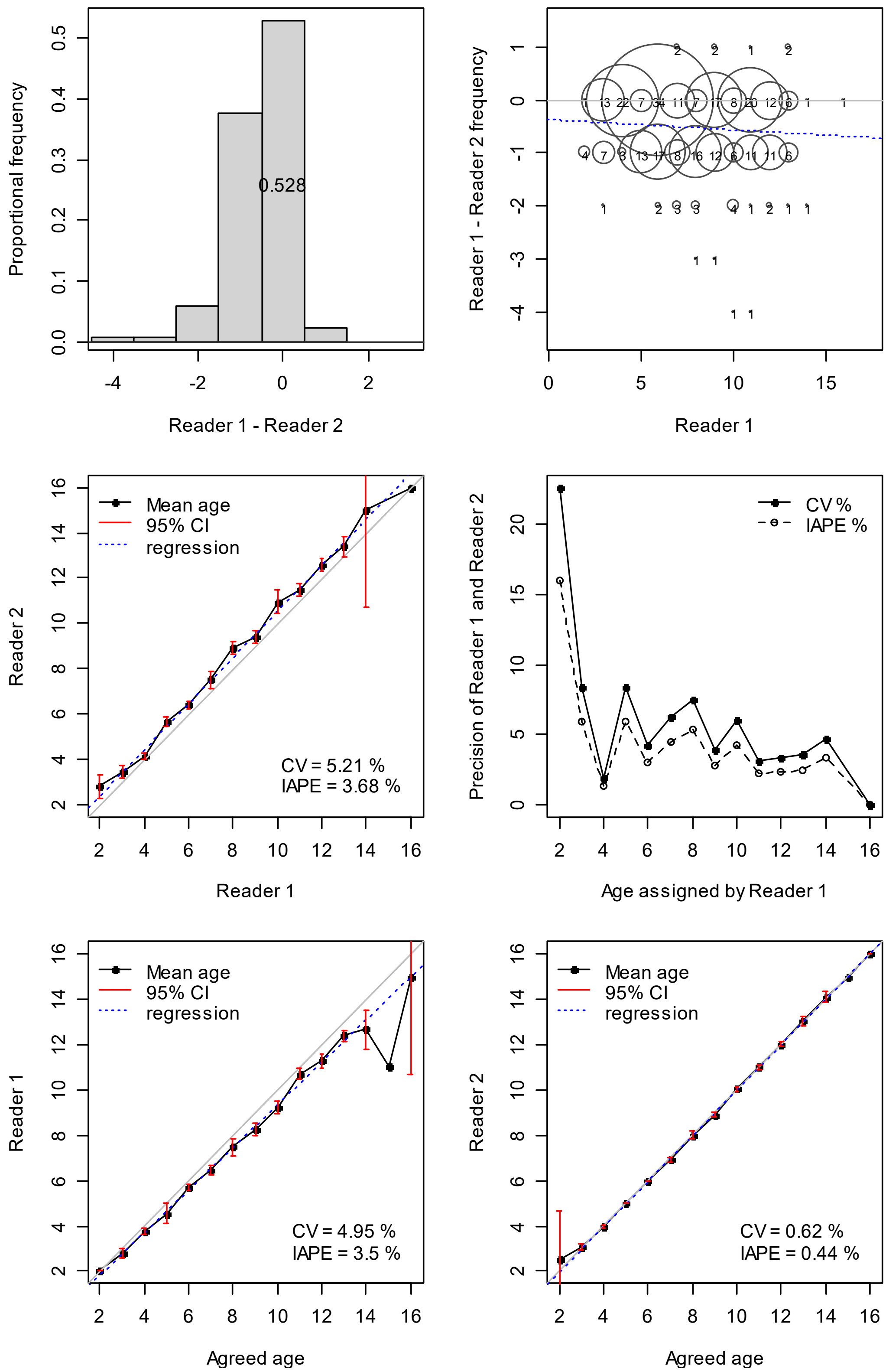
Age bias diagnostic plot of kahawai aged from recreational catch from East Northland in 2015–16.



Appendix 5 – continued:
Age bias diagnostic plot of kahawai aged from recreational catch from Hauraki Gulf in 2015–16.

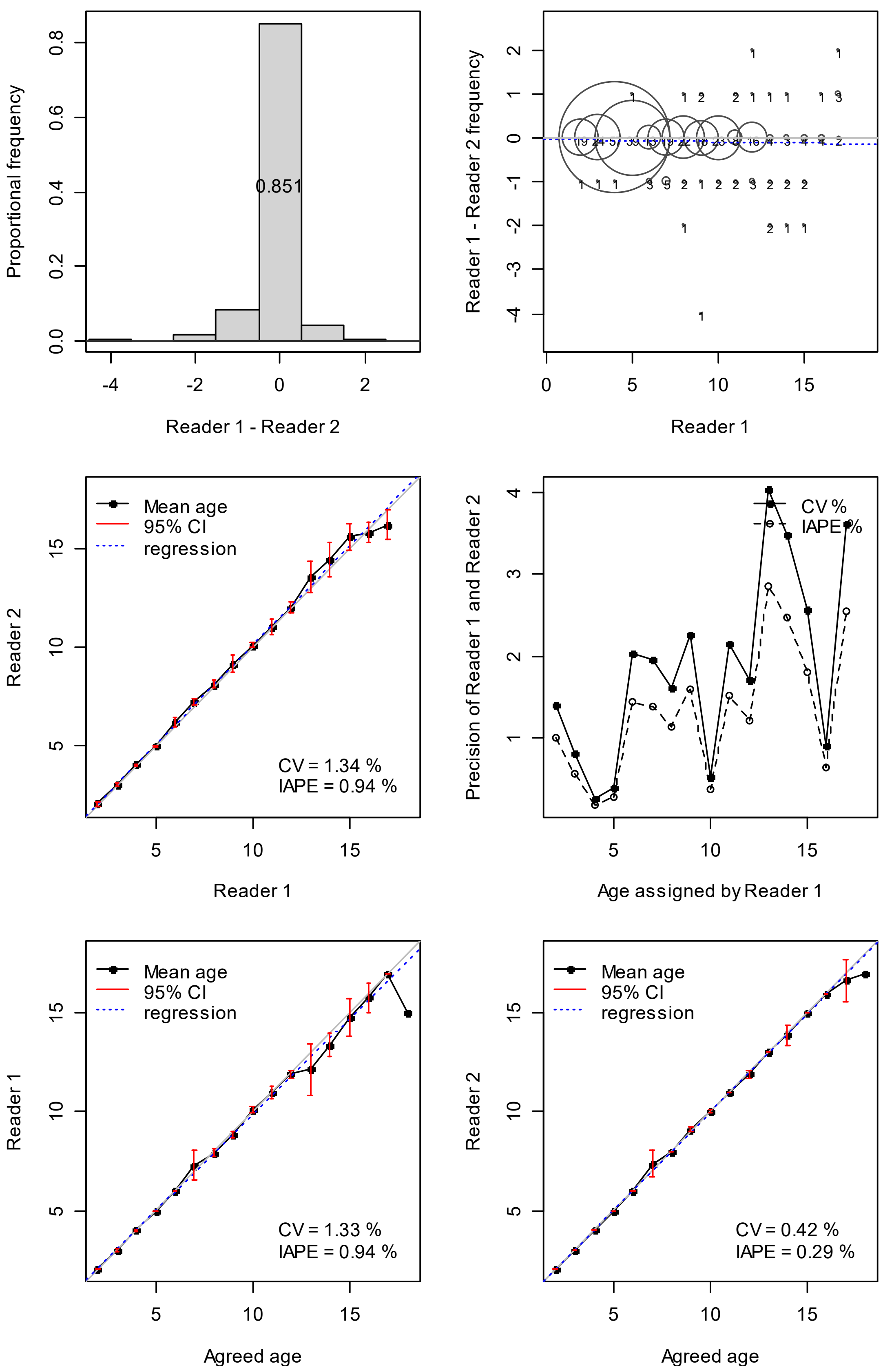


Appendix 5 – continued:
Age bias diagnostic plot of kahawai aged from recreational catch from Bay of Plenty in 2015–16.

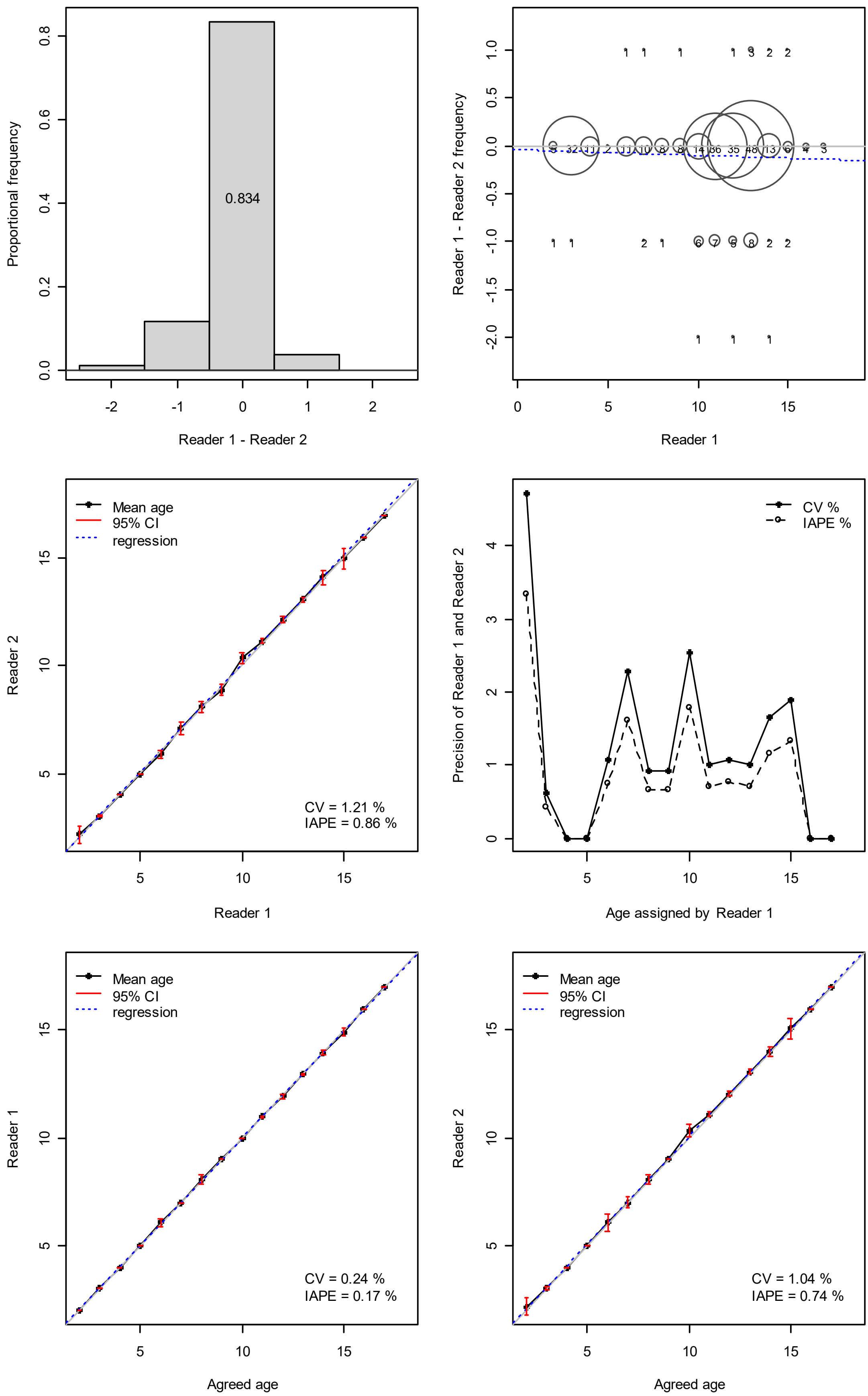


Appendix 6: Age bias diagnostic plots of kahawai aged from recreational catches in East Northland, Hauraki Gulf and the Bay of Plenty in 2016–17.

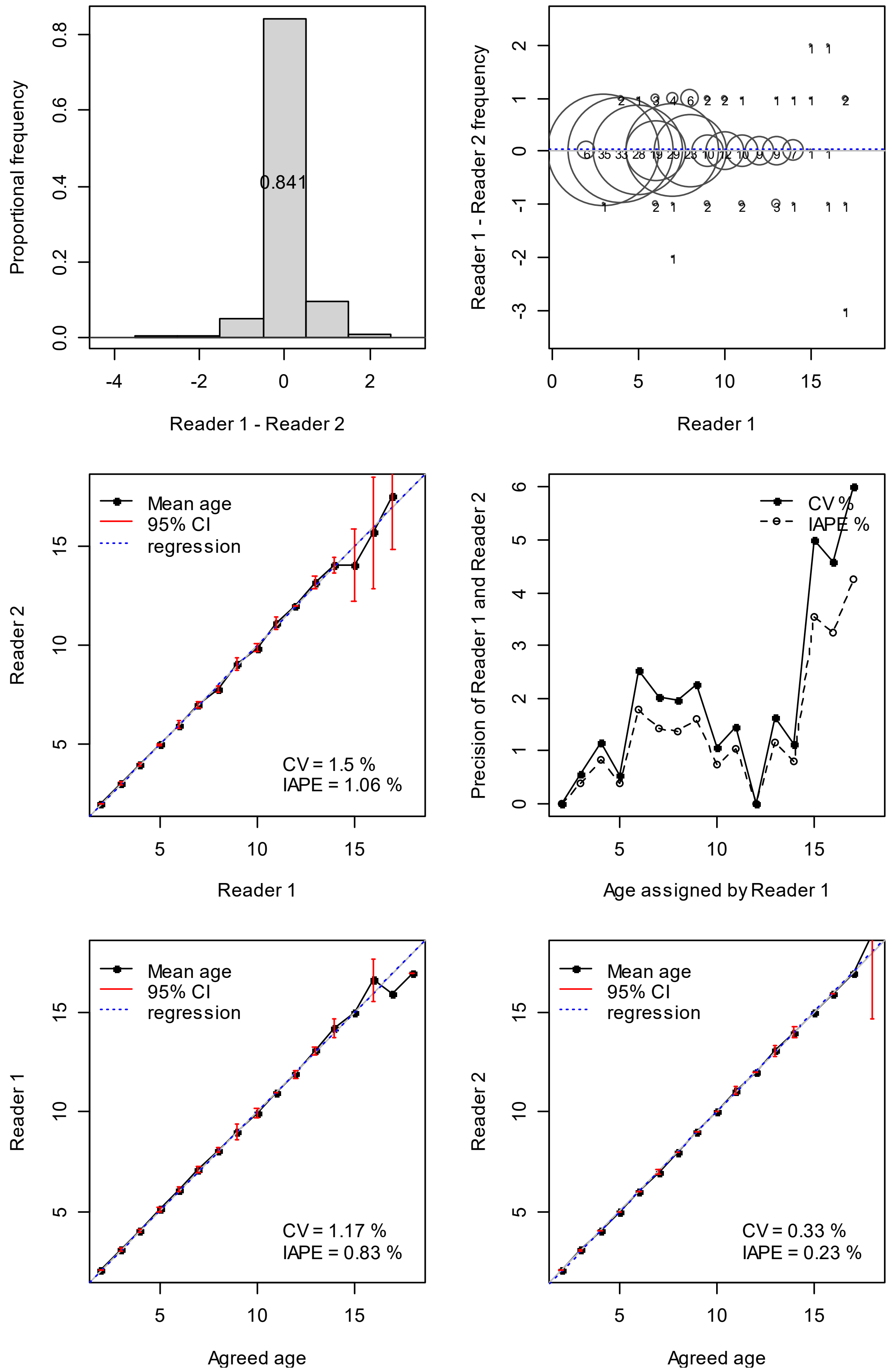
Age bias diagnostic plot of kahawai aged from recreational catch from East Northland in 2016–17.



Appendix 6 – continued:
Age bias diagnostic plot of kahawai aged from recreational catch from Hauraki Gulf in 2016–17.

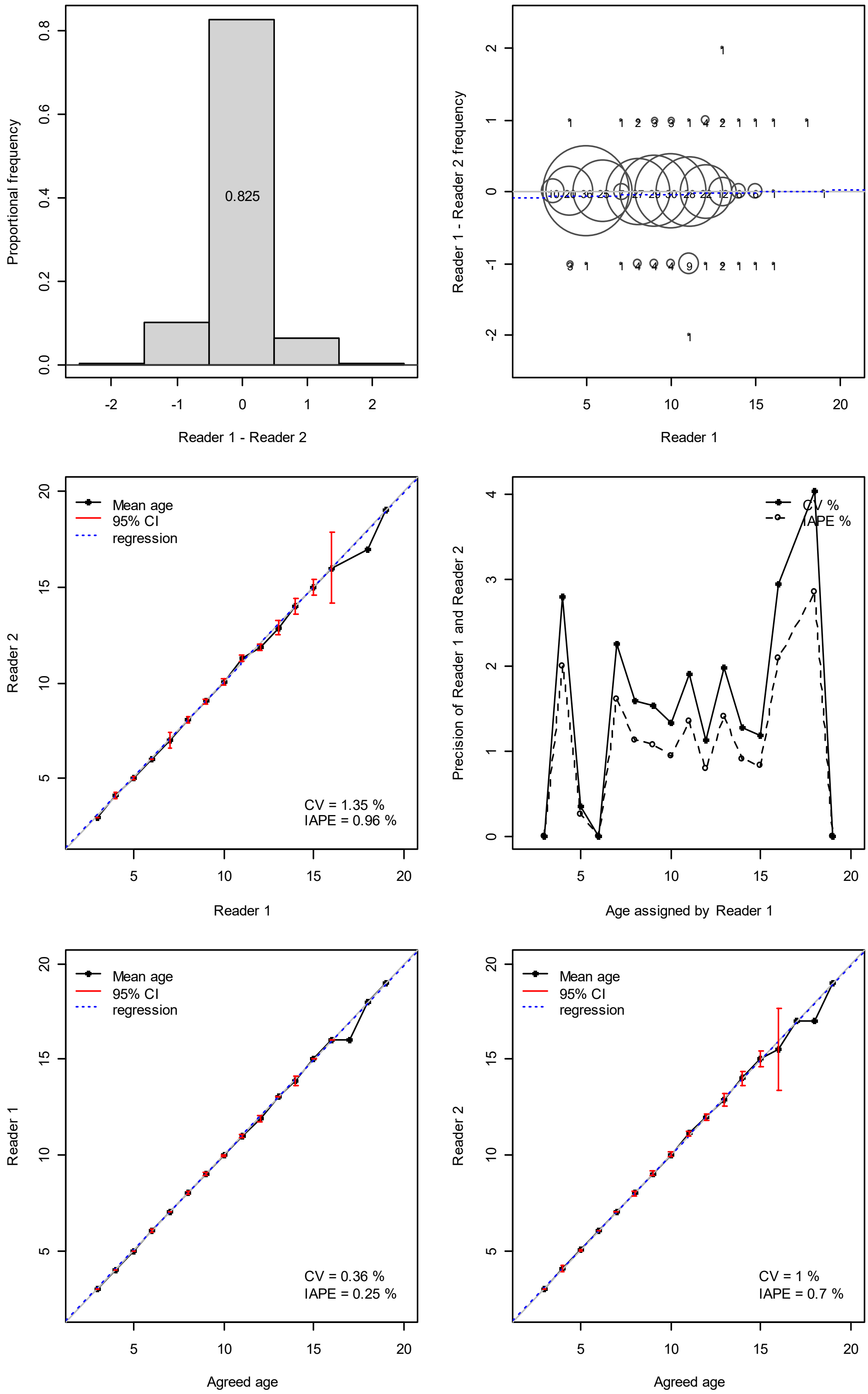


Appendix 6 – continued:
Age bias diagnostic plot of kahawai aged from recreational catch from Bay of Plenty in 2016–17.

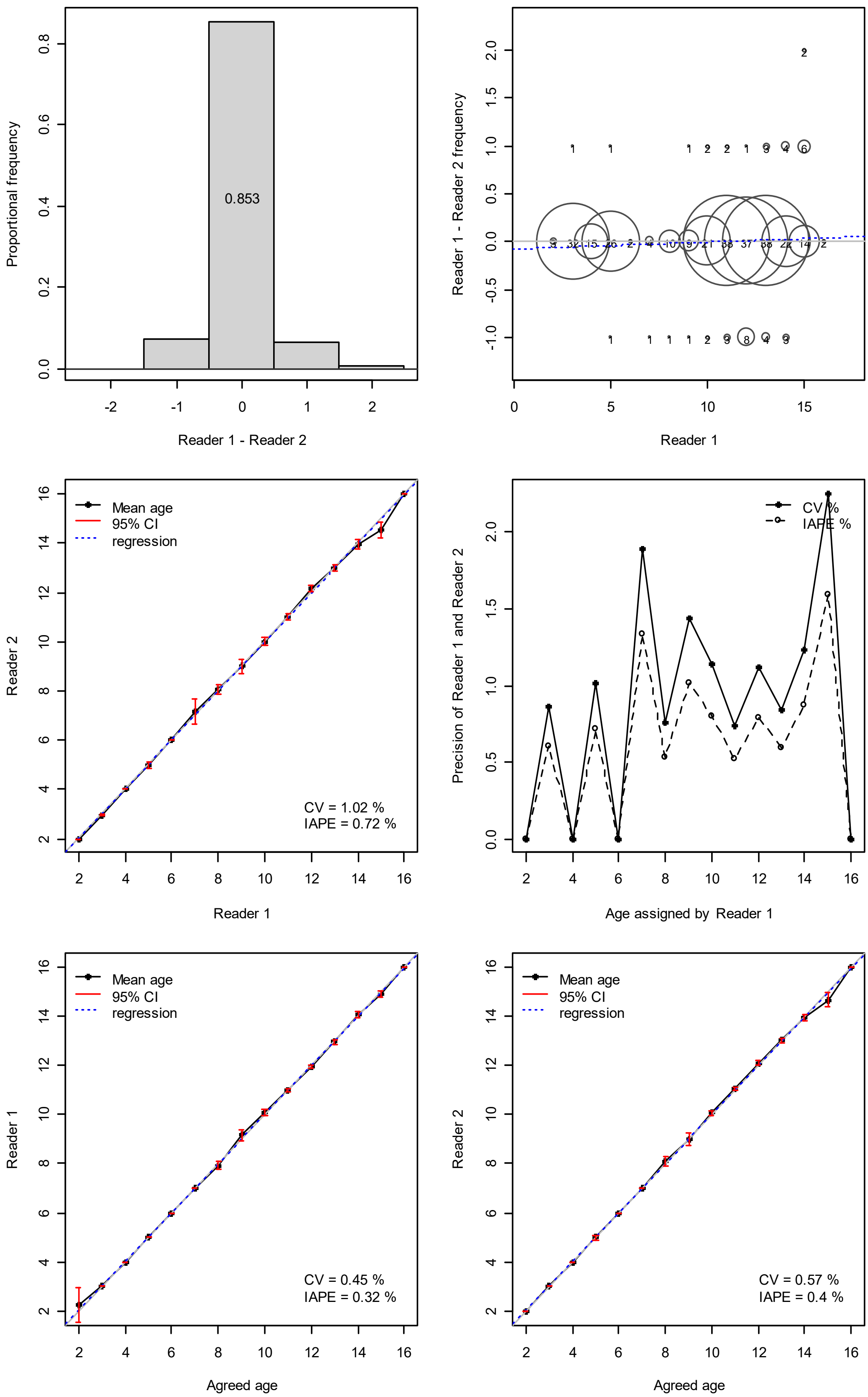


Appendix 7: Age bias diagnostic plots of kahawai aged from recreational catches in East Northland, Hauraki Gulf and the Bay of Plenty in 2017–18.

Age bias diagnostic plot of kahawai aged from recreational catch from East Northland in 2017–18.



Appendix 7 – continued:
Age bias diagnostic plot of kahawai aged from recreational catch from Hauraki Gulf in 2017–18.



Appendix 7 – continued:
Age bias diagnostic plot of kahawai aged from recreational catch from Bay of Plenty in 2017–18.