



NIWA

Taihoru Nukurangi

**Monitoring the length and age composition of
recreational landings of kahawai
in KAH 1 in 2000–2001**

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**Final Research Report for
Ministry of Fisheries Research Project KAH2000/01
Objective 1
(Revised)**

National Institute of Water and Atmospheric Research

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Final Research Report

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3. **Project Title:** Monitoring the length and age composition of recreational landings of kahawai
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7. **Executive Summary:**

Recreational landings of schooling species such as kahawai are considered to provide a better description of the underlying population structure than commercial landings due to the widespread and comparatively random nature of recreational fishing effort. This report summarises the results of the first of three years of sampling of recreational catches of kahawai from three regions in KAH 1: East Northland, Hauraki Gulf and the Bay of Plenty.

Bradford (2000) recommended that 400–500 kahawai be aged to provide a reasonable approximation of a population's age structure. Recreational fishers were generally willing to let NIWA staff remove the heads of their landed kahawai and adequate age sample sizes were obtained in all three regions. Bradford (2001) also recommended that approximately 1500 kahawai length measurements were required to provide a description of the less common length classes in a regional length frequency distribution. This target was not achieved in any of the three regions, as levels of sampling effort were based on historical boatramp data, and there appears to have been a subsequent decrease the number of kahawai landed per hour of interviewing. It is not clear whether this is due to a reduction in overall fishing effort and/or reduced kahawai catch rates by recreational fishers. Anecdotal evidence suggests that kahawai catch rates have fallen in recent years. The low numbers of kahawai encountered by interviewers may however be partially attributable to a higher than normal incidence of easterly onshore winds north of the Bay of Plenty during much of the survey period. There were many incidences of interviewers postponing or canceling pre-assigned interview sessions due to unfishable weather conditions. While fewer kahawai have consequently been measured, analytically derived mean weighted *c.v.s* suggest that the length and age compositions of the regional populations have been described with reasonable precision.

There are clear regional differences in the length and age compositions of recreational catches of kahawai sampled in 2001. The Hauraki Gulf population was largely comprised of relatively small, younger fish, with the East Northland region having the broadest kahawai length distribution which was dominated by fish of less than 6 years of age, while the Bay of Plenty distribution was mainly comprised of larger fish reflecting a broader underlying age distribution. Length distributions from the Hauraki Gulf and the Bay of Plenty were very similar to those derived from boatramp survey data from the early 1990s.

Either spatial or temporal trends were evident in regional age distributions but no consistent trend is evident across the whole of KAH 1. In East Northland the mean age of kahawai landed by recreational fishers increased throughout the four months sampled and this may be indicative of onshore movement by schools of older fish. In the Hauraki Gulf, the incidence of 1 and 2 year old kahawai increased in recreational landings as autumn progressed. In the Bay of Plenty there was a marked longitudinal trend in the age distributions of kahawai landed at boat ramps, with the older age classes becoming increasingly prevalent in the east. The boundaries between these regions are arbitrary however, with the age distributions of the northern ramps in the Hauraki Gulf and Bay of Plenty showing some similarity to those in southern East Northland. Recreational fishers are also more likely to sample from inshore schools than those found in deeper offshore waters.

8. Objective:

To conduct the sampling and determine the length and age composition of the recreational landings of kahawai in KAH 1.

9. Methods:

Sample design

The sample design for the 2001 survey of recreational catches in KAH 1 was based on data collected from boat ramp surveys conducted in 1991, 1994, and 1996. Although similar questions were asked in all three surveys, and there was little change in the ramps used, the objectives and sample designs were different. The 1991 survey was designed to collect baseline information on harvest rates by recreational fishers interviewed at boat ramps throughout the AFMA. Most interviewing occurred at weekends and the survey went from Boxing Day 1990 to June 1991 (Sylvester 1993). The main objective of the 1994 survey was to verify aspects of a concurrent diary survey. Catches observed from boat ramp interviews were compared with those reported by diarists. Boat ramp data were also used in conjunction with an aerial survey to estimate harvest from the Hauraki Gulf. This estimate was compared with that from the diary programme (Sylvester 1994). In 1996 a nation wide boat ramp survey was carried out to estimate the mean weights of fish caught by recreational fishers (Hartill et al. 1998). These mean weights were used in conjunction with estimates of the numbers of fish caught (derived from a national diary survey, Bradford et al. (1998)), to provide estimates of the national recreational harvest of key species (Bradford 1998). In 1998, a further boat ramp survey was conducted to gather information on catch rates and fishing effort in three key harbours in the AFMA, but these data was not used as due to the survey's limited spatial extent

The 1991, 1994, and 1996 surveys indicated that there were substantive regional differences in the length frequency compositions of kahawai caught by recreational fishers in East Northland, Hauraki Gulf and the Bay of Plenty (Bradford 1999, Hartill *et al.* 1998). Separate recreational boat ramp surveys were therefore conducted in each of these three regions (Figure 1) from which concurrent length and age samples were collected from landed catches of kahawai.

To avoid complications with growth, sampling of recreation catches was restricted to a four month season, 1 January to 30 April 2001. This period avoided the otolith ring deposition in winter, which may lead to misinterpretation of a fish's age (Stevens & Kalish 1998), and coincides with the peak season for recreational kahawai catch rates in KAH 1. Surveying took place on weekends and holidays when most recreational fishing usually occurs. The 1996 boatramp survey indicated that for the most commonly caught species, there were no substantive differences between length frequencies of fish caught during weekdays and weekends (Hartill *et al.* 1998).

Bradford (2000) recommended that 400–500 kahawai should be aged to give a reasonable approximation of a population's age structure and age-length relationship. She suggested that as many fish as possible should be measured to provide a reliable length frequency distribution. The recommended number of kahawai required to describe a regional length frequency is thought to be approximately 1500 (E. Bradford *pers comm.*), although there is no analytical basis for this estimate. A sample design based on the number of kahawai landed and measured per hour at selected key ramps, during weekends and holidays during the 1991, 1994 and 1996 boatramp surveys is given in Table 1.

Table 1: Sample design required to obtain measurements of 1500 kahawai per region based on the average number of kahawai landed by recreational fishers per hour during weekends and holidays during the 1991, 1994 and 1996 boatramp surveys

Region	Average no. of fish landed/interview hr	Number of ramps	Session length (hrs)	Sessions per ramp	Estimated number of kahawai measured
East Northland	1.3	7	6	27	1 558
Hauraki Gulf	1.1	11	6	20	1 553
Bay of Plenty	3.5	9	4	12	1 498

The regional averages of the number of fish landed per hour of interviewing are weighted averages across survey years, where the weighting is based on the number of weekend or holiday hours of interviewing which took place in each survey year.

The number of sampling sessions per ramp specified by the sample design were randomly pre-assigned to weekend/holiday days between 1 January and 30 April before sampling began. Interviews followed the format of those undertaken in 1991, 1994, 1996, and 1998 to ensure that the data were consistent with those from previous surveys. During interview sessions, recreational fishers who had not caught kahawai were also interviewed when this did not interfere with interviewing of other fishers landing kahawai. All data not involving catches of kahawai were stored but not checked for errors or entered into the database as this was not an objective of this study. These data may be useful for other purposes in the future and there was no additional cost in their collection. When more than one boat approached a ramp, the vessel was chosen randomly prior to landing.

Kahawai otoliths are fragile and time consuming to extract and interviewers therefore asked permission to cut the head off at the gills. These heads are retained by the interviewer together with a record of the fish's length and a code linking the head to other data collected as a result of the interview. Otoliths were extracted from these heads by NIWA staff at a later

date. Generally, in excess of 90% of recreation fishers permitted the interviewer to remove heads from their kahawai. Kahawai were selected at random from each available boat's catch, from which no more than four fish are taken. As age samples were collected randomly, the length distribution of the age sample should reflect the length distribution of the landed catch.

Ageing of kahawai otoliths

Kahawai otoliths were prepared using the thin section method described by Stevens & Kalish (1998). Each otolith was marked across an intended sectioning plane passing through the nucleus. Each otolith was then imbedded in a disposable epoxy mould with three other otoliths such that their nuclei were at the same level. Once 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, each slide was ground with a series of progressively finer carborundum papers (400, 1200, and 4000 grit) to a thickness of 250 to 350 μm depending on ring increment clarity. A suspension of 1.0 μm alumina powder (Linde A) was used for the final polish.

To improve clarity, a thin layer of immersion oil was brushed over each slide before reading. Thin sections were read under reflected light and or transmitted light, depending on the readers preference. Three readers were used to interpret the thin sectioned otoliths and disagreements in interpretation were resolved using a method similar to that used for snapper (SNA2000/02) which was as follows:

- Each reader independently read all otoliths collected from a region.
- Disagreements between the three reader's initial age estimates were identified and where one or more readers failed to agree in their initial interpretation of an otolith, those readers reread the otolith with no knowledge of any prior age estimates.
- Remaining disagreements were resolved by discussing images of otoliths projected onto a video screen, until a consensus was reached.
- If no consensus could be reached, the otolith was discarded from the dataset.

Data Analysis

Regional, proportions and analytical variances at length and age were calculated using a FORTAN programme developed for snapper market samples (Davies & Walsh 1995). Two weighting approaches were used to combine individual fisher's catches of kahawai into regional proportional length and age frequencies. In the first approach, boats landing kahawai were regarded as strata, which were weighted together on the basis of the number of kahawai landed by each boat. In the second approach, each boatramp was considered as a stratum with each boat landing kahawai at that boatramp being considered as a substratum. The boat specific substrata were weighted together on the basis of the number of fish landed by each boat and ramp strata were combined on the basis of the number of reported kahawai caught by boats interviewed, per hour of interviewing, at each ramp.

The distribution at age within length classes, (age-length keys) was used to translate the regional length distributions into estimates of recreational catch-at-age. Proportions at age were calculated for the range of age classes recruited to each stratum with the maximum age

being an aggregate of all age classes greater than 19 years. Recreational catch-at-age and length frequency estimates and their associated variances were produced in the form of histograms and tables. Von Bertalanffy growth curves were fitted to regional age data by least squares regression.

For each region, age distributions were derived both for each ramp, and for each of the four months sampled. Spatial and temporal differences in the underlying age composition of the regional kahawai populations fished by recreational fishers were then inferred from these histograms. Coefficients of variation were not calculated for these distributions due to the low sample sizes of the strata involved (Table 2). Kahawai were assigned to the ramp at which they were sampled rather than the location at which they were caught, as outside of Auckland there is little overlap the areas fished from two or more ramps.

10. Results:

Sample design

A network of interviewers was established at 28 key boatramps in East Northland, the Hauraki Gulf and the Bay of Plenty (Figure 1). Sampling was initiated at each ramp as appropriate interviewers were found and trained, with the last interviewer recruited on the 19th of January. Sampling ceased at Houhora in early February due to consistently low numbers of recreational vessels using the ramp and resultant low numbers of kahawai measured. Interviewing activity was transferred to a second, club ramp at Parua Bay, in Whangarei Harbour, where fishing activity was much higher. Interviewing generally took place on weekend/holiday days which were pre-specified and randomly chosen. If an interviewer found that there were strong onshore winds or local competitions on any of these dates, sampling took place on the next available weekend/holiday day.

In East Northland and the Hauraki Gulf, the number of kahawai landed per hour in 2001 (Table 2) was less than predicted from data collected from comparable surveys in 1991, 1994 and 1996 (see Table 1). It is not clear whether this is due to a reduction in overall fishing effort and/or reduced kahawai catch rates by recreational fishers. Anecdotal evidence suggests that kahawai catch rates have fallen in recent years. The low numbers of kahawai encountered by interviewers may however be partially attributable to a higher than normal incidence of easterly onshore winds north of the Bay of Plenty during much of the survey period (Georgina Daw, NIWA climate scientist, pers comm.). At Whakatane, two of the sessions took place during a competition. Prior to the competition starting, fishers were advised that a spot prize was offered for kahawai and that all kahawai should therefore be landed. Proportional length frequencies created with and without length data from this competition were very similar. No other competitions were sampled in 2001.

Table 2: Summary statistics by region, by ramp of the number of interview sessions, hours surveyed, boats with measurable kahawai, kahawai measured, kahawai measured per hour and kahawai aged.

Region	Ramp	Number of sessions	Number of hours	Boats with measurable kahawai	Kahawai measured	Kahawai measured per hour	Kahawai aged
East Northland	Houhora	11	66	5	10	0.2	10
	Mangonui	26	150	92	302	2.0	79
	Opito Bay	24	145	62	226	1.6	73
	Waitangi	26	144	78	201	1.4	79
	Tutukaka	24	144	42	95	0.7	88
	Parua Bay (public)	27	163	62	121	0.7	71
	Parura Bay (club)	20	118	86	169	1.4	49
	One Tree Point	13	73	11	30	0.4	25
	Mangawai	25	126	36	82	0.7	43
	Total	196	1 129	474	1 236	1.1	517
Hauraki Gulf	Omaha	18	109	18	26	0.2	23
	Gulf Harbour	22	121	47	81	0.7	71
	Browns Bay	12	72	10	16	0.2	14
	Takapuna	20	114	40	93	0.8	49
	Westhaven	15	103	15	23	0.2	22
	Hobson Bay	20	114	17	30	0.3	30
	Okahu Bay	10	47	7	10	0.2	0
	Half Moon Bay	29	173	132	260	1.5	98
	Maretai	19	97	60	170	1.8	103
	Kawakawa Bay	26	120	63	139	1.2	52
	Te Kouma	21	103	26	44	0.4	38
	Total	212	1 174	435	892	0.8	500
Bay of Plenty	Whitianga	10	40	8	24	0.6	16
	Bowentown	12	48	30	86	1.8	60
	Sulphur Point	13	52	49	107	2.1	94
	Toll Bridge	4	16	0	0	0.0	0
	Maketu	10	13	18	50	3.8	38
	Whakatane	3	11	68	315	28.6	54
	Ohope	17	69	43	164	2.4	81
	Motu River	11	28	29	185	6.6	0
	Waihau Bay	20	42	49	173	4.1	114
	Total	100	319	294	1 104	3.5	457

Analysis

The two stratification approaches used calculate proportions at length and age and their associated *c.v.s* (ratios of standard deviations to the mean) give broadly similar but not identical results in all three regions. Stratification by trip alone tends to result in lower length

based *c.v.s* than those derived from the other stratification approach. Age based *c.v.s* calculated by stratifying by trip alone tend to be lower than those otherwise derived in the younger age classes but higher in the older age classes suggesting high between ramp variance in the older less common age classes. In the following descriptions of regional demographics, the statistics used will be those derived from stratifying the data by fishing trip alone although it should be noted that those derived by stratifying by ramp and fishing trip give generally similar results (Appendices 1 & 2).

East Northland

The East Northland length distribution is broad with evidence of recruiting modes peaking at 26 and 35 cm (Figure 2). These modes are largely comprised of 2 and 3 year old fish (Appendix 3). The mean weighted *c.v.* of the length distribution is 0.17 with a mean length of 43.2 cm (Appendix 1).

Over half of the East Northland age distribution is comprised of 3 and 4 year old fish (Figure 3, Appendix 2). The mean age of kahawai landed by recreational fishers is 5.5 years old with a mean weighted *c.v.* of 0.13. The age distributions of kahawai landed at East Northland ramps were generally similar with no clear latitudinal trend in relative year class strengths (Figure 8). The mean age of kahawai landed in East Northland increased throughout the four months sampled and this may be indicative of onshore movement by schools of older fish (Figure 11).

Hauraki Gulf

The Hauraki Gulf length composition peaks at around 35 cm with a small separate mode peaking at 19 cm which correspond to 3 and 2 year old age classes respectively (Figure 4, Appendix 3). The mean length of the distribution is 36.4 cm with a mean weighted *c.v.* of 0.22 (Appendix 1).

The age distribution is comparatively narrow and is dominated by a very strong 3 year old age class (Figure 5). Kahawai age classes 6 years or older barely comprise 10% of age distribution. (Appendix 2). The predominance of the younger age classes results in a comparatively low mean weighted *c.v.* of 0.14 although consequently, the older less common age classes are poorly described. The Hauraki Gulf is the only region in which 1 year old fish were found in the age distribution. With the exception of fish landed at Omaha, which neighbours East Northland, the age distributions of kahawai landed at Hauraki Gulf ramps were typical of that region, with a predominance of younger age classes (Figure 9). Monthly age distributions for this region are also broadly similar with 1 and 2 year olds becoming increasing common towards the end of the sampling period (Figure 12).

Bay of Plenty

The Bay of Plenty length distribution is comprised mainly of fish in the larger length classes with a peak at 50 cm and mean length of 44.4 cm (Figure 6). The mean weighted *c.v.* of the distribution is 0.18 (Appendix 1).

The age distribution is broader than observed in the other two regions with 32% of the age distribution comprised of fish at least 8 years old (Figure 7, Appendix 3). The mean age is 6.7 years with a mean weighted *c.v.* of 0.16. There is a marked longitudinal trend in the age distributions of kahawai landed at boat ramps, with the older age classes becoming increasing prevalent in the eastern Bay of Plenty (Figure 10). No clear trend is evident in the monthly distributions of kahawai ages however (Figure 13).

Growth rates

Growth rates in all three regions appear to be very similar (Figure 14, Table 3) as might be expected from a pelagic schooling species.

Table 3: Von Bertalanffy growth parameters derived from kahawai sampled from recreational catches in East Northland, Hauraki Gulf and the Bay of Plenty.

Region	T_0	K	L_{inf}	n
East Northland	-0.08	0.34	54.5	517
Hauraki Gulf	-0.14	0.30	55.7	500
Bay of Plenty	-0.23	0.28	55.1	457

11. Conclusions:

Due to the widespread and comparatively random nature of recreational fishing effort with respect to schools of kahawai, the length and age distributions described in this report are more likely to be representative of the underlying population than those observed from commercial catches in the past (Bradford 1999, McKenzie and Trusewich 1996). As kahawai school by size, a commercial catch tends to be comprised of fish from only one or two schools. Distributions derived from amalgamating these commercial catches are therefore usually multi modal as there are generally insufficient catches sampled to describe more than a few schools of kahawai. In contrast, a recreational fishery is comprised of hundreds of trips which sample a greater number of schools at a much lower level of intensity, and therefore probably samples fish from a population of schools in a more random and representative manner. Resultant length frequency distributions tend to be more unimodal with any secondary peaks probably reflecting strong year classes rather than the influence of individual schools. There is no minimum legal size for kahawai and recreational fishers therefore also tend to land a greater size range of kahawai thus providing a broader description of the population being fished.

Obtaining sufficient length at age samples from a region's recreational fishery is an uncertain process however. Unlike commercial fisheries, where annual catch levels are largely determined by TACCs, recreational landings vary depending on prevailing weather patterns and local catch rates. In East Northland and the Hauraki Gulf, the number of kahawai landed per hour of interviewing was lower than experienced on average during the 1991, 1994 and 1996 boatramp surveys. It is not clear whether this is due to a reduction in overall fishing effort and/or reduced kahawai catch rates by recreational fishers. Anecdotal evidence suggests that kahawai catch rates have fallen in recent years. The low number of kahawai encountered by interviewers may however be partially attributable to a higher than normal

incidence of easterly onshore winds north of the Bay of Plenty during much of the survey period (Georgina Daw, NIWA climate scientist, pers comm.). There were many incidences of interviewers postponing or canceling pre-assigned interview sessions due to unfishable weather conditions. While fewer kahawai have consequently been measured, analytically derived mean weighted *c.v.s* suggest that the length and age compositions of the regional populations have been described with reasonable precision.

There are clear regional differences in the length and age compositions of recreational catches of kahawai. The Hauraki Gulf population was largely comprised of relatively small younger fish, with the East Northland region having the broadest kahawai length distribution which was dominated by fish of less than 6 years of age, while the Bay of Plenty distribution was mainly comprised of larger fish reflecting a broader underlying age distribution. When these distributions are compared to those sampled from recreational fishers in the early 1990s, there is a marked similarity for those derived from the Hauraki Gulf and the Bay of Plenty (see Figure 1 of Bradford 2001).

Either spatial or temporal trends were evident in regional age distributions but no consistent trend is evident across the whole of KAH 1. In East Northland the mean age of kahawai landed by recreational fishers increased throughout the four months sampled and this may be indicative of onshore movement by schools of older fish. In the Hauraki Gulf, the incidence of 1 and 2 year old kahawai increased in recreational landings as autumn progressed. In the Bay of Plenty there was a marked longitudinal trend in the age distributions of kahawai landed at boat ramps, with the older age classes becoming increasingly prevalent in the east. The boundaries between these regions are arbitrary however, with the age distributions of the northern ramps in the Hauraki Gulf and Bay of Plenty showing some similarity to those in southern East Northland. Recreational fishers are also more likely to sample from inshore schools than those found in deeper offshore waters.

Two approaches have been used when combining regional recreational landing of kahawai which give broadly similar but not identical results. As there is no information available on the spatial intensity of recreational fishing effort and little is known about the spatial distribution of the kahawai population being sampled it is difficult to speculate about which stratification method is more applicable. Where between ramp variability is marked as in the Bay of Plenty, stratification by ramp should take place, but the weighting used should reflect the relative size of the kahawai population in that area and this is currently unknown and likely to vary due to kahawai movement. Results from both stratification procedures are therefore given.

When regional growth rates are compared they appear to be similar which suggests that age data from all three regions could potentially be combined to provide a more comprehensive age-length key. However, if kahawai movements between areas are size related as suggested by the differences between regional length and age distributions, the use of a combined age-length key may result in distorted age distributions and this should be avoided.

12. Publications

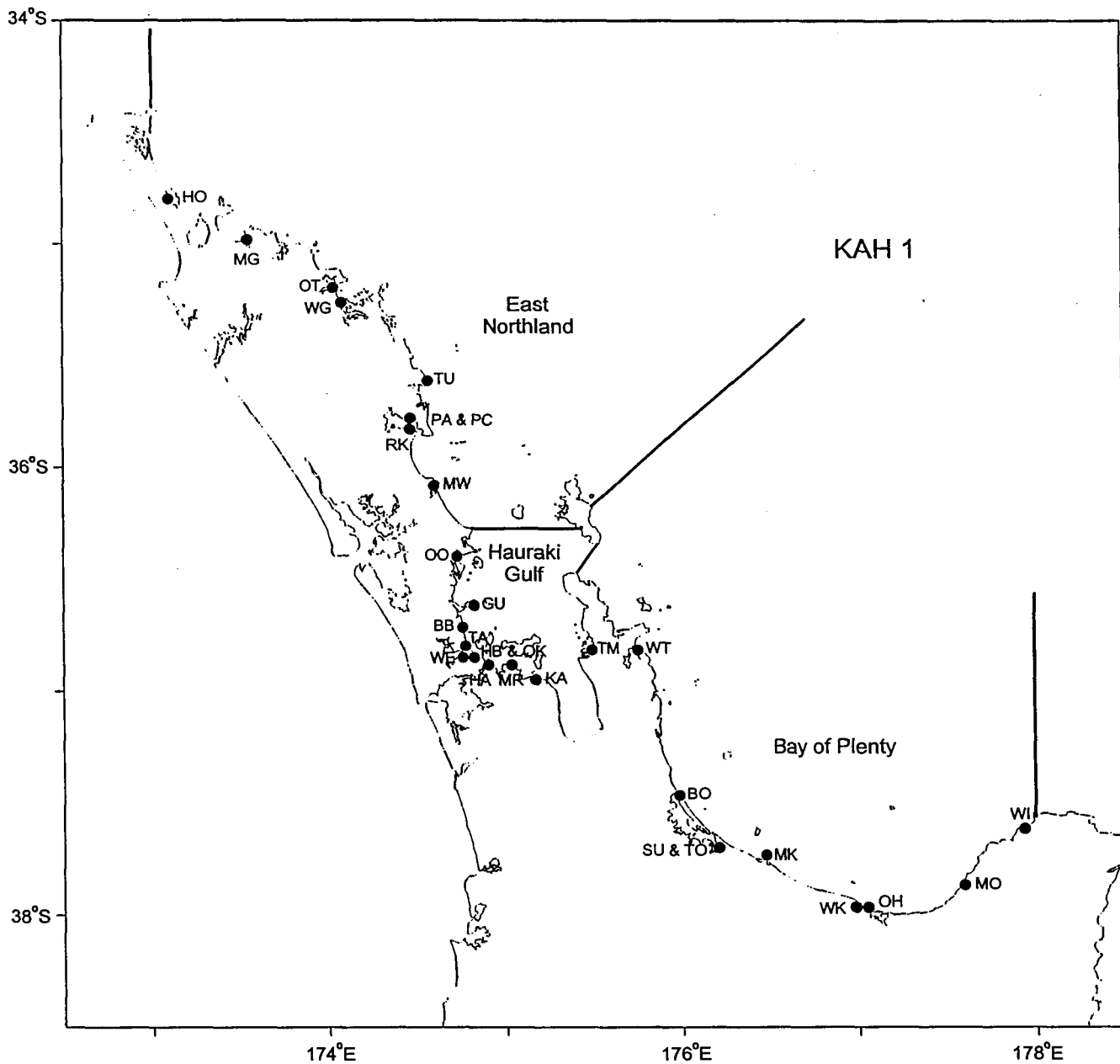
Hartill, B. 2001: Research Progress Report. 19 February 2001, Monitoring the length and age composition of recreational landings of kahawai. (Unpublished report held at NIWA Auckland) 8 pp.

13. Data Storage

All interview, length frequency and ageing data relating to recreational landings of kahawai have been entered onto the MFish relational *rec_data* and *age* databases with adherence to its quality assurance standards administered by NIWA. Data from catches which do not include kahawai were stored but not checked or entered onto the database. The collection and databasing of non-kahawai related data was not covered under the contract for KAH2000/01, but has been collected incidentally and may prove useful in the future.

14. References

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East Northland

- HO Houhora
- MG Mangonui
- MW Mangawai
- OT Opito Bay, Kerikeri
- PA Parua Bay (public ramp)
- PC Parua Bay (club ramp)
- RK One Tree Point, Ruakaka
- TU Tutukaka
- WG Waitangi

Hauraki Gulf

- BB Browns Bay
- GU Gulf Harbour
- HA Half Moon Bay
- HB Hobson Bay
- KA Kawakawa
- MR Maretai
- TM Te Kouma
- OK Okahu Bay
- OO Omaha
- TA Takapuna
- WE Westhaven

Bay of Plenty

- BO Bowentown
- MK Maketu
- MO Motu River
- OH Ohope
- SU Sulphur Point, Tauranga
- TO Toli Bridge, Tauranga
- WI Waihou Bay
- WK Whakatane
- WT Whitianga

Figure 1: Location of boatramp interview sites.

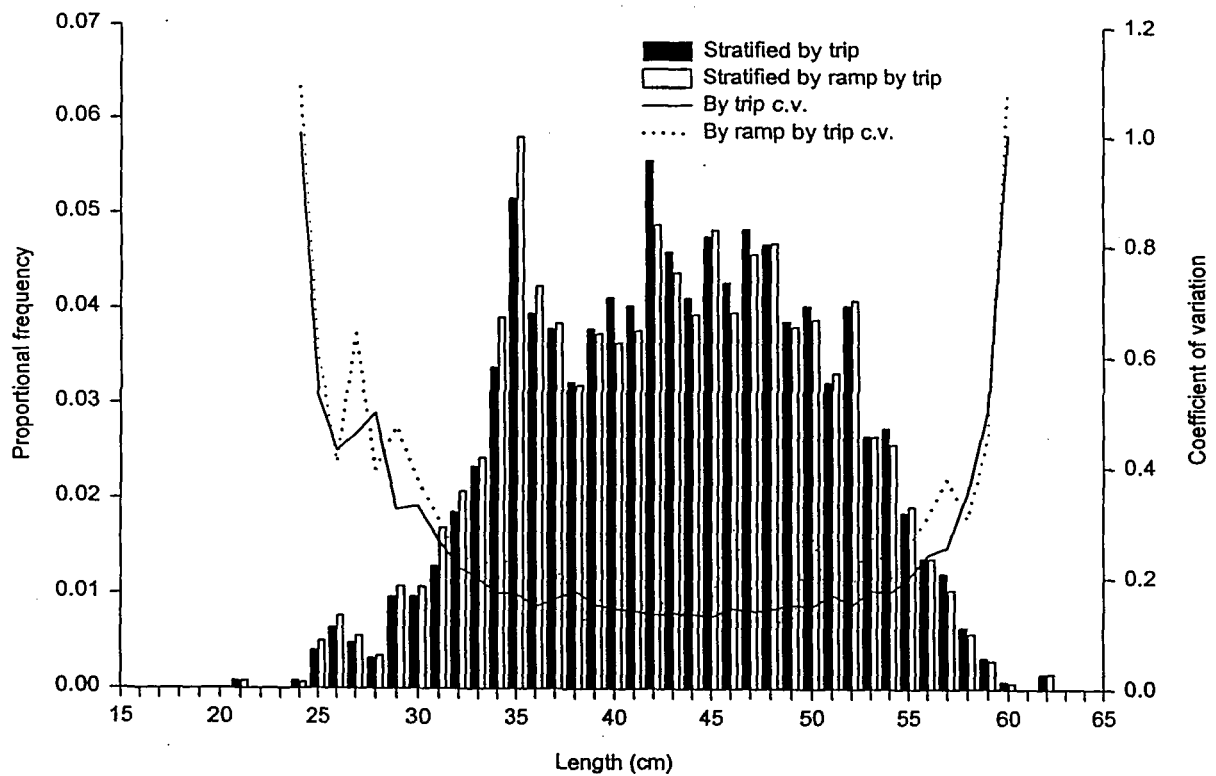


Figure 2: Proportion at length estimates and c.v.s based on stratification by trips only and by trips by ramp in east Northland in 2000–2001.

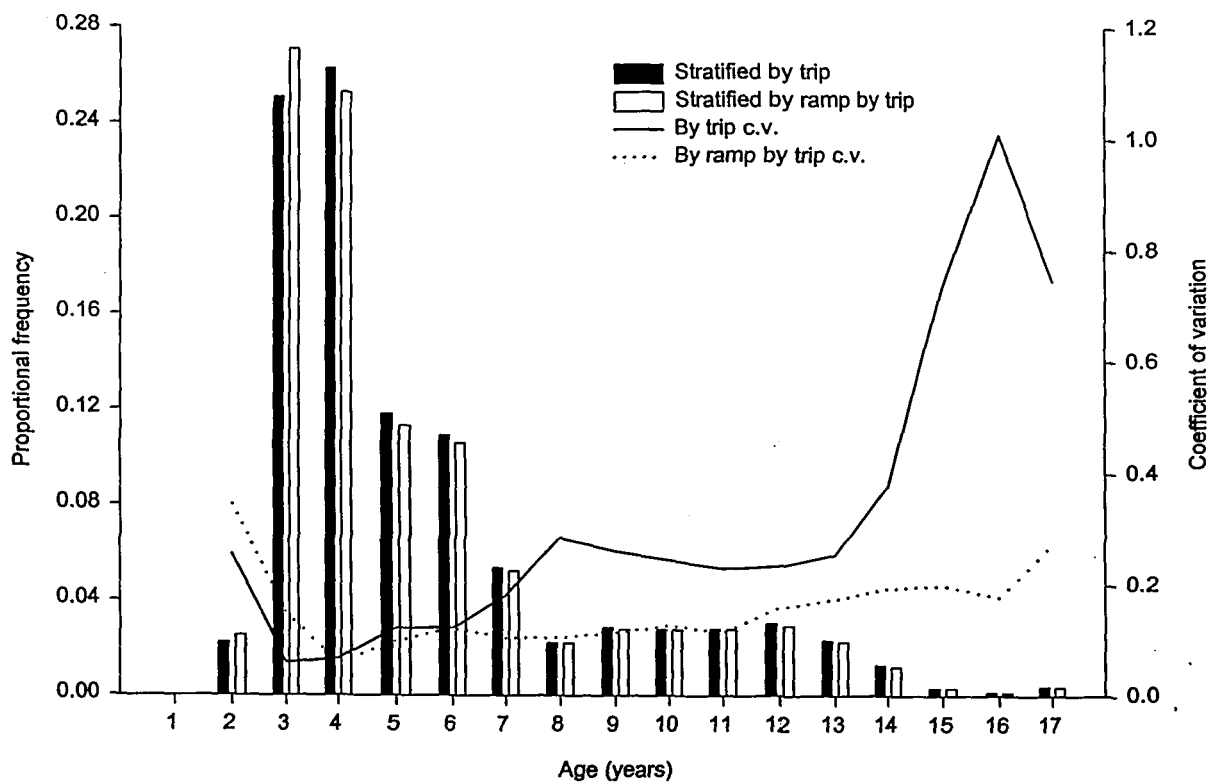


Figure 3: Proportion at age estimates and c.v.s based on stratification by trips only and by trips by ramp in East Northland in 2000–2001.

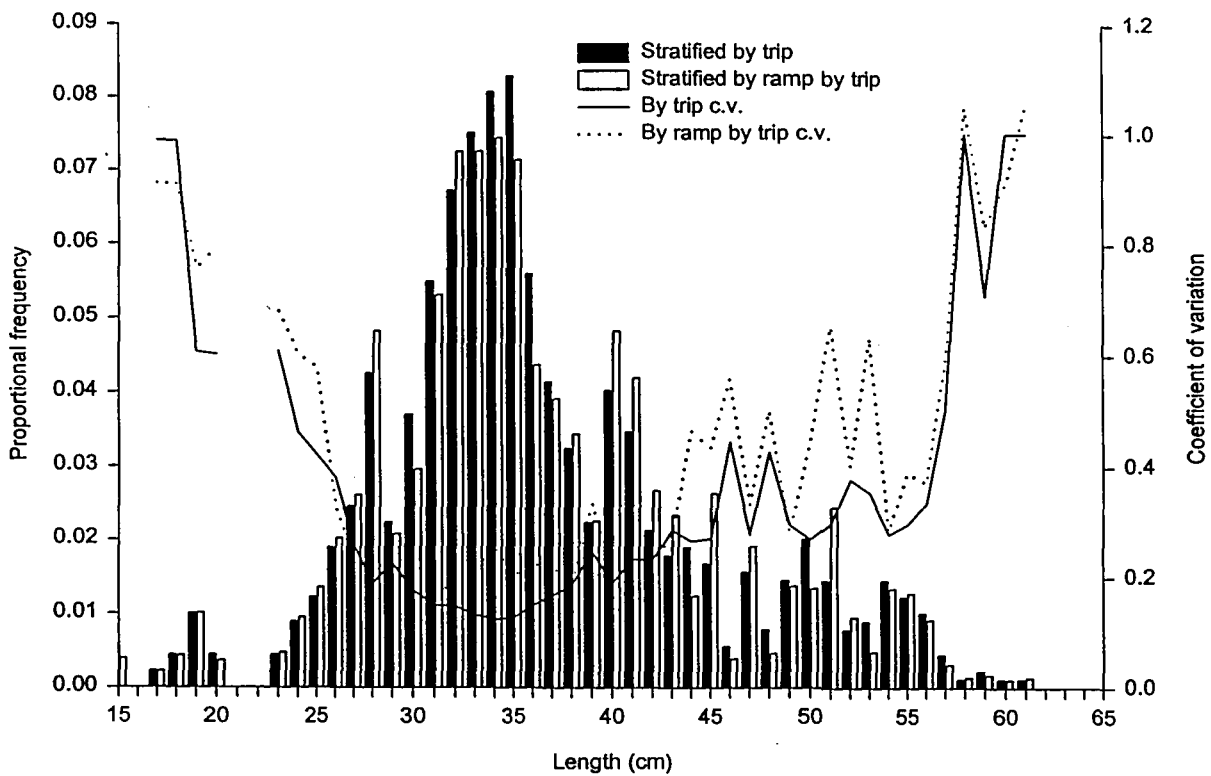


Figure 4: Proportion at length estimates and c.v.s based on stratification by trips only and by trips by ramp in the Hauraki Gulf in 2000–2001.

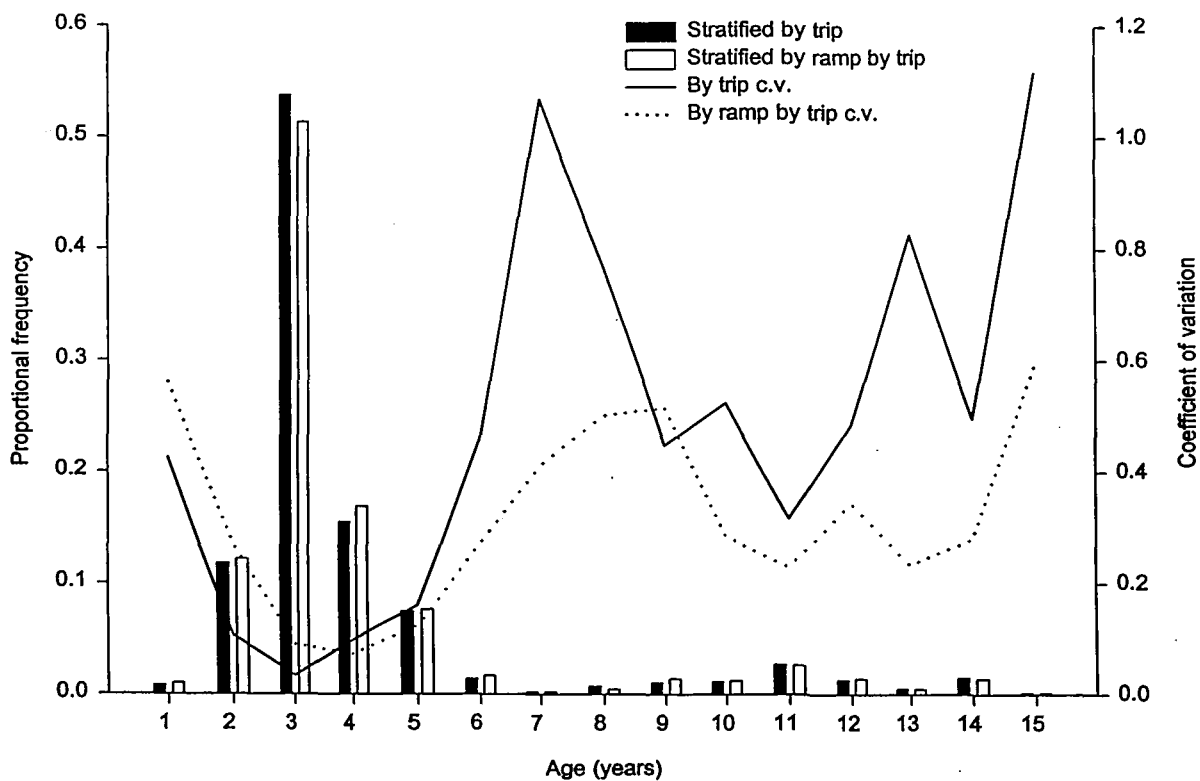


Figure 5: Proportion at age estimates and c.v.s based on stratification by trips only and by trips by ramp in the Hauraki Gulf in 2000–2001.

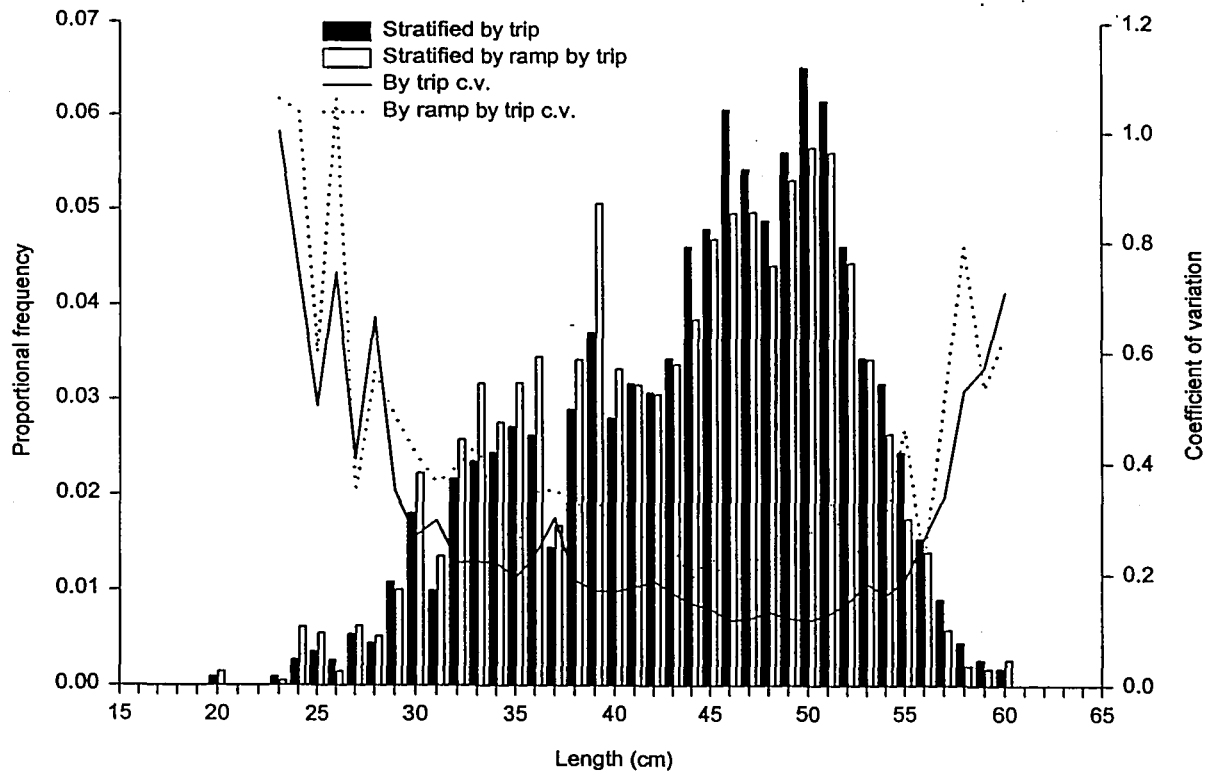


Figure 6: Proportion at length estimates and c.v.s based on stratification by trips only and by trips by ramp in the Bay of Plenty in 2000–2001.

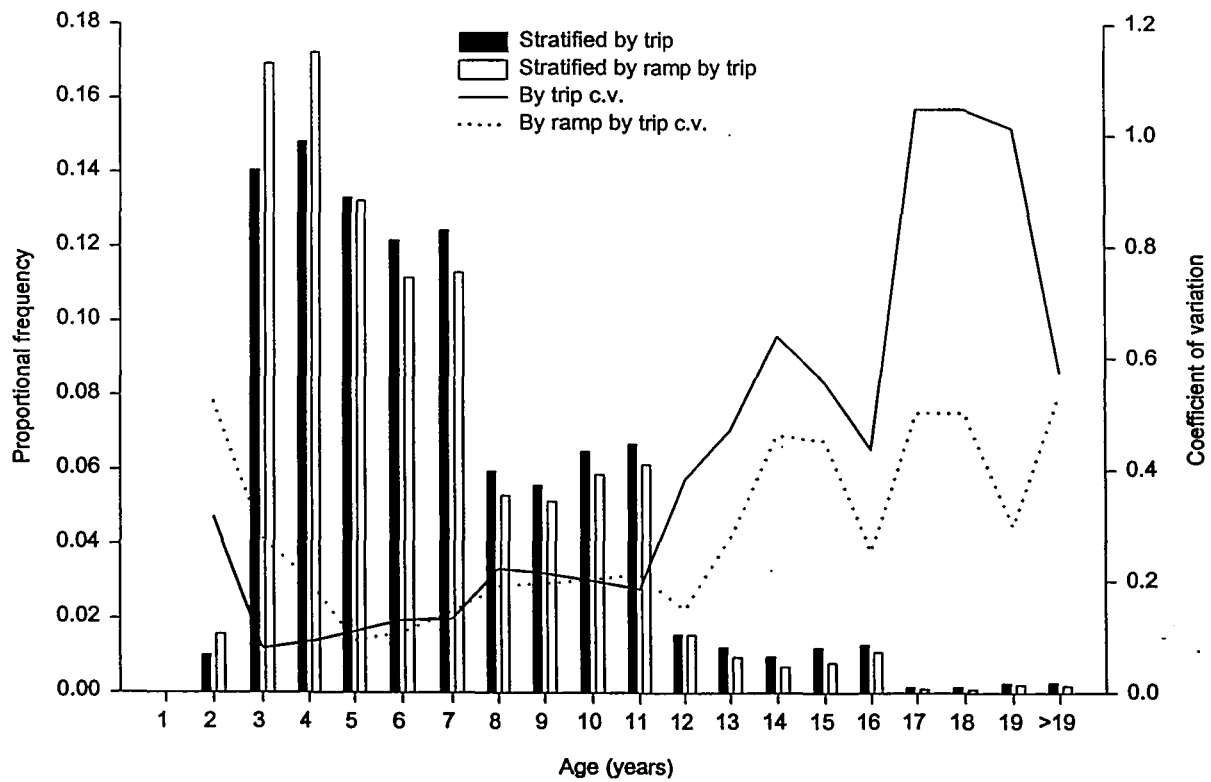


Figure 7: Proportion at age estimates and c.v.s based on stratification by trips only and by trips by ramp in the Bay of Plenty in 2000–2001.

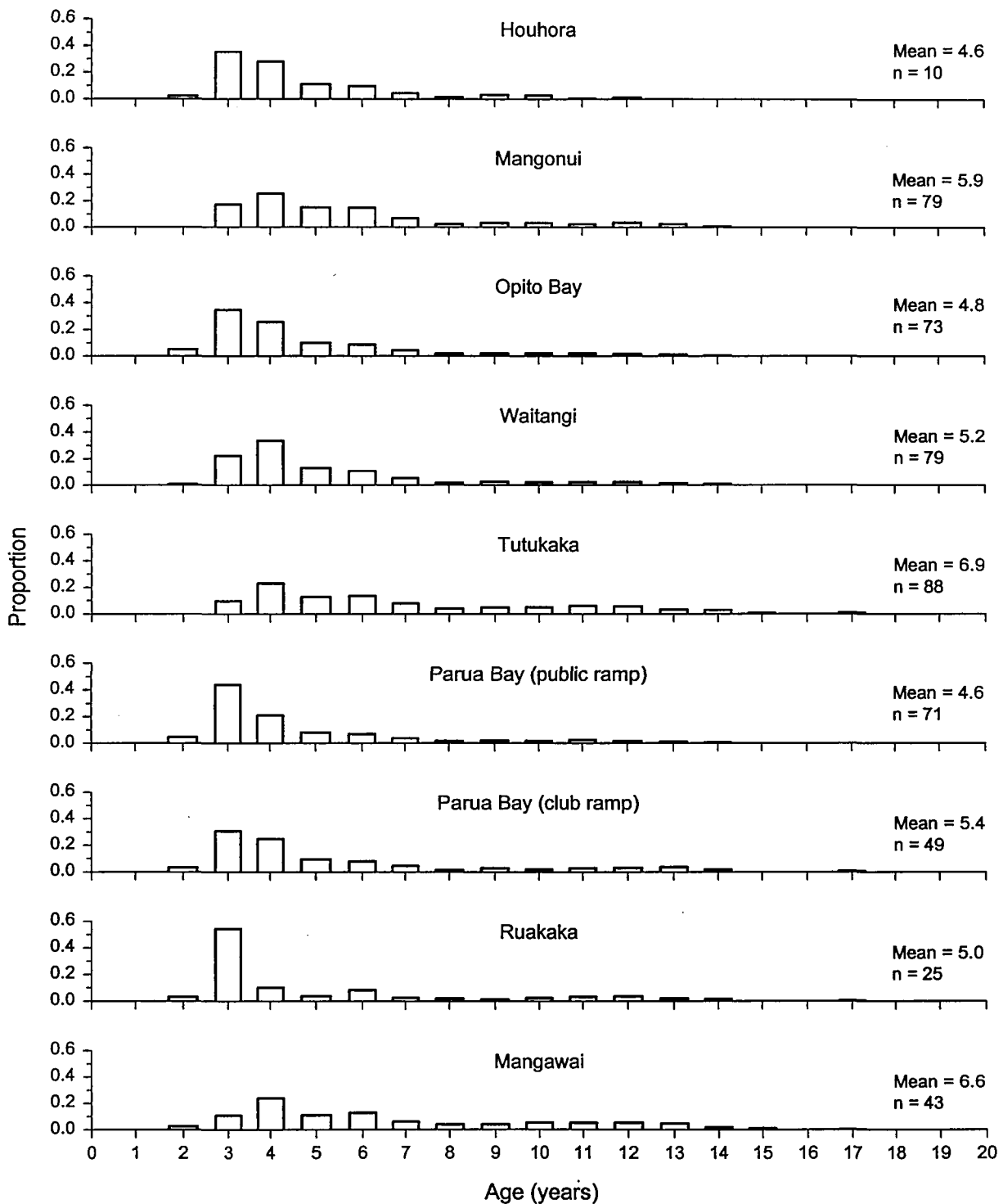


Figure 8: Proportions at age by ramp in East Northland in 2000–2001.

NB: n refers to the number of kahawai aged which contributed to the age length key.

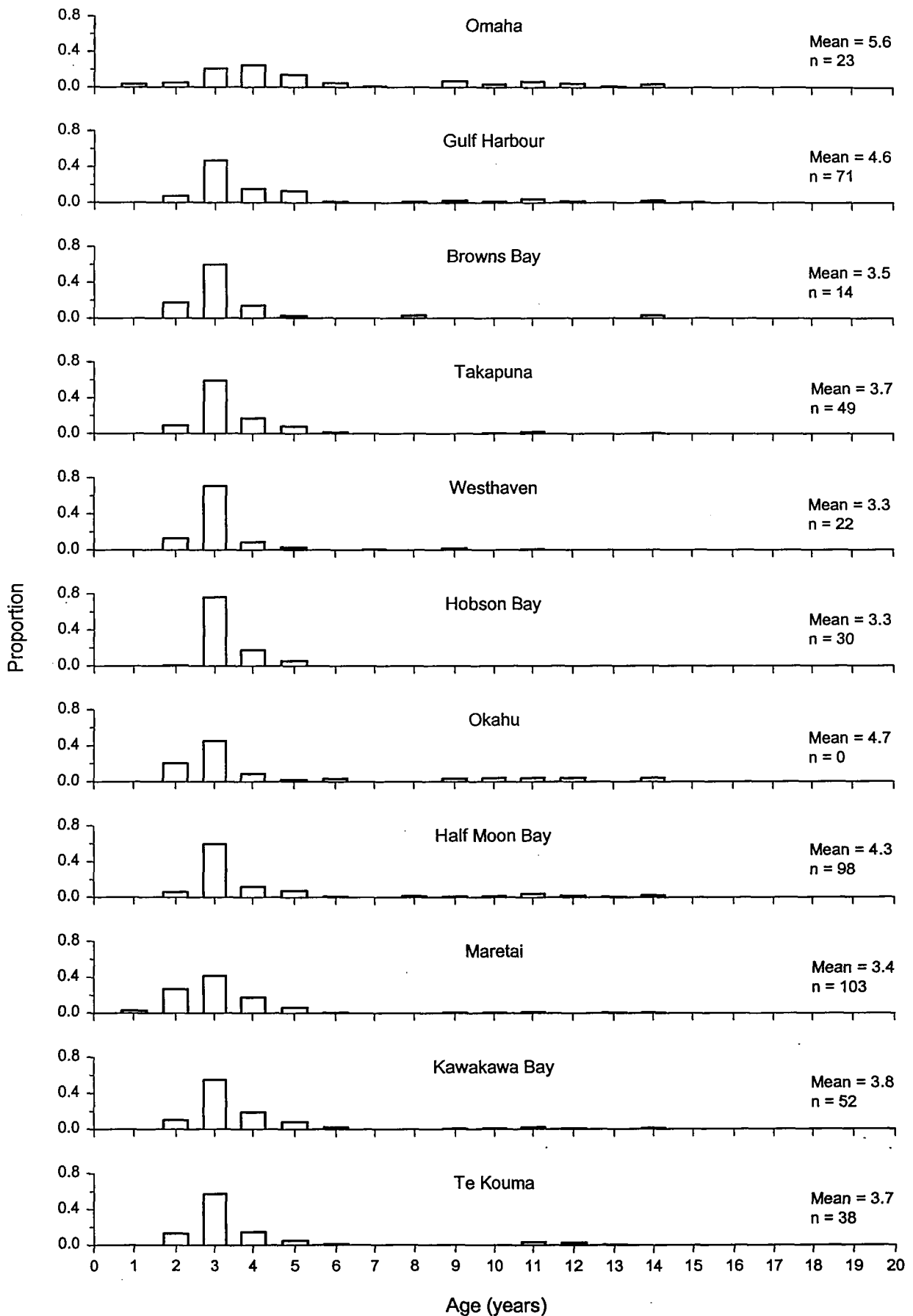


Figure 9: Proportions at age by ramp in the Hauraki Gulf in 2000–2001.

NB: n refers to the number of kahawai aged which contributed to the age length key.

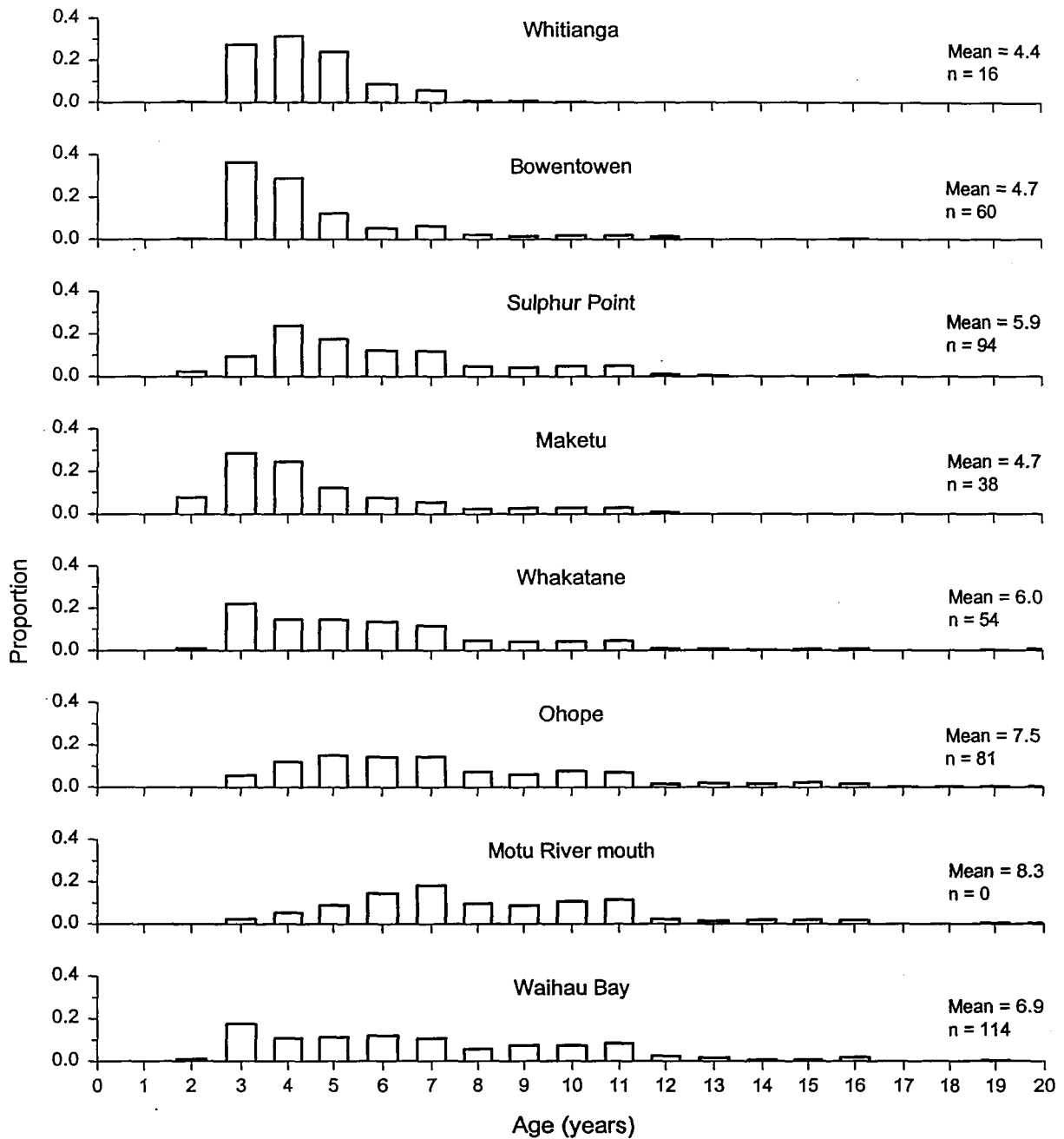


Figure 10: Proportions at age by ramp in the Bay of Plenty in 2000–2001.

NB: n refers to the number of kahawai aged which contributed to the age length key.

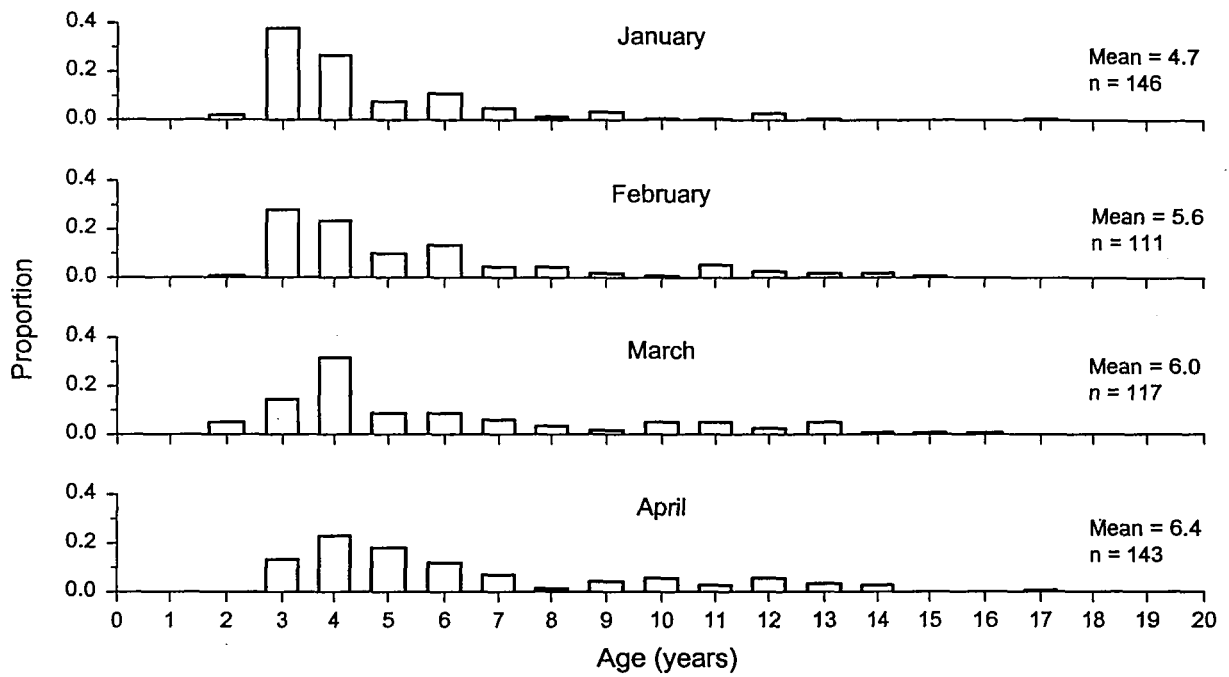


Figure 11: Proportions at age by month of kahawai from East Northland in 2000–2001.

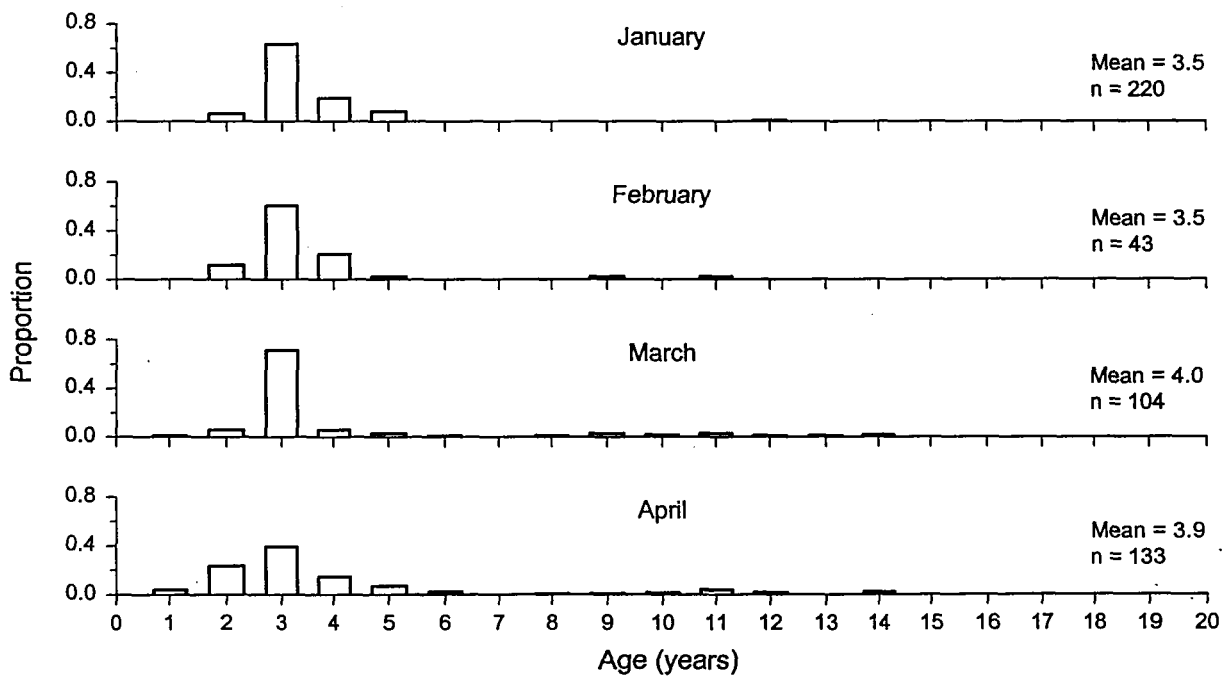


Figure 12: Proportions at age by month of kahawai from the Hauraki Gulf in 2000–2001.

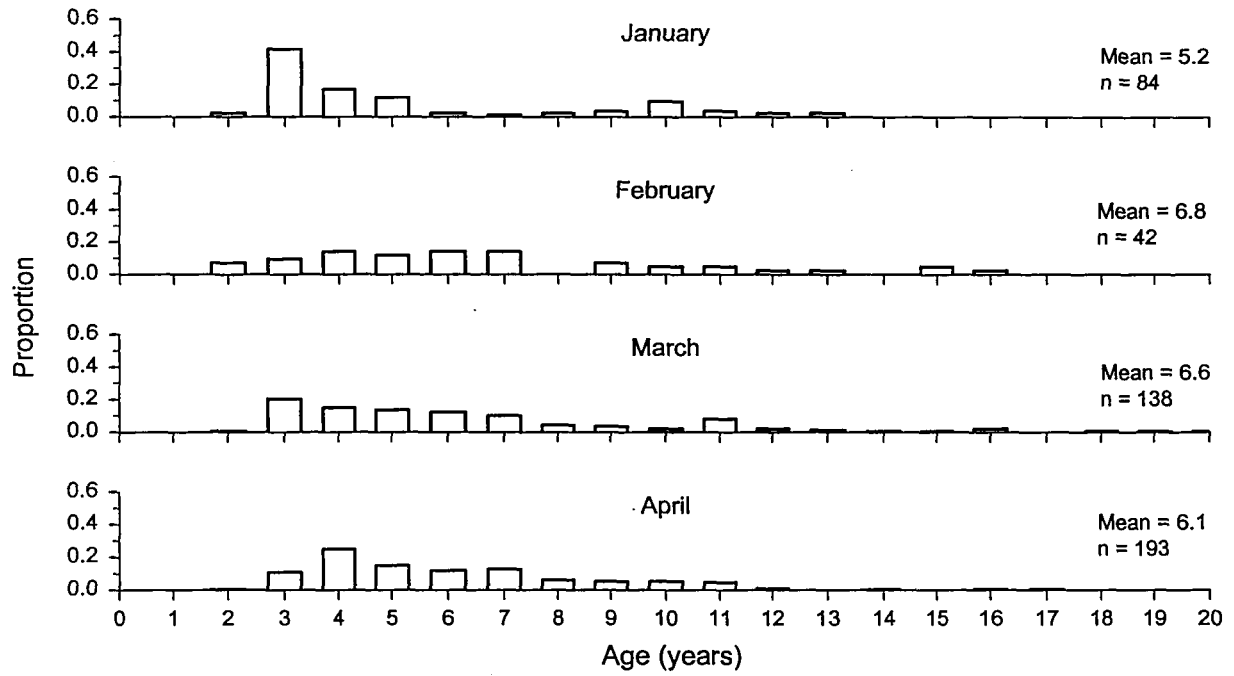


Figure 13: Proportions at age by month of kahawai from the Bay of Plenty in 2000–2001.

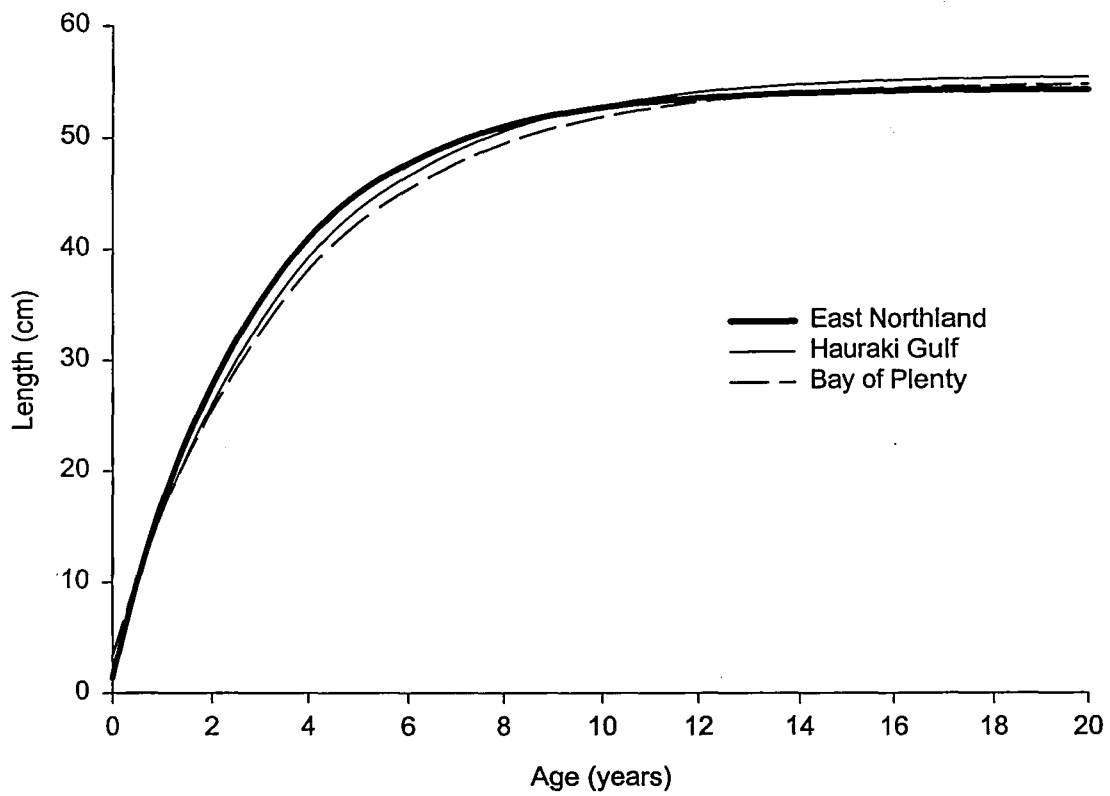


Figure 14: Von Bertalanffy growth curves derived from kahawai sampled from the recreational catch in East Northland, Hauraki Gulf and the Bay of Plenty.

Appendix 1: Estimated proportions at length and c.v.s of kahawai sampled from recreational fishers in East Northland, Hauraki Gulf and the Bay of Plenty in 2000–01

P.i. = proportion of fish in length class.

n = total number of fish sampled.

c.v. = coefficient of variation.

m.w.c.v. = mean weighted c.v.

Estimates of the proportion at length of kahawai from East Northland in 2000–01

Length (cm)	Stratified by trip		Stratified by ramp by trip	
	<i>P.i.</i>	<i>c.v.</i>	<i>P.i.</i>	<i>c.v.</i>
10	0.0000	0.00	0.0000	0.00
11	0.0000	0.00	0.0000	0.00
12	0.0000	0.00	0.0000	0.00
13	0.0000	0.00	0.0000	0.00
14	0.0000	0.00	0.0000	0.00
15	0.0000	0.00	0.0000	0.00
16	0.0000	0.00	0.0000	0.00
17	0.0000	0.00	0.0000	0.00
18	0.0000	0.00	0.0000	0.00
19	0.0000	0.00	0.0000	0.00
20	0.0000	0.00	0.0000	0.00
21	0.0008	1.00	0.0008	0.99
22	0.0000	0.00	0.0000	0.00
23	0.0000	0.00	0.0000	0.00
24	0.0008	1.00	0.0007	1.09
25	0.0040	0.53	0.0050	0.60
26	0.0065	0.43	0.0076	0.41
27	0.0048	0.46	0.0056	0.64
28	0.0032	0.50	0.0035	0.40
29	0.0097	0.32	0.0108	0.47
30	0.0097	0.33	0.0107	0.37
31	0.0129	0.27	0.0169	0.31
32	0.0186	0.22	0.0208	0.23
33	0.0234	0.20	0.0244	0.23
34	0.0339	0.17	0.0391	0.22
35	0.0517	0.17	0.0581	0.24
36	0.0395	0.15	0.0424	0.19
37	0.0379	0.16	0.0385	0.23
38	0.0323	0.18	0.0320	0.10
39	0.0379	0.15	0.0375	0.15
40	0.0412	0.15	0.0365	0.20
41	0.0404	0.14	0.0378	0.14
42	0.0557	0.13	0.0489	0.16
43	0.0460	0.14	0.0439	0.15
44	0.0412	0.14	0.0395	0.12
45	0.0476	0.13	0.0484	0.15
46	0.0428	0.15	0.0397	0.31
47	0.0484	0.14	0.0457	0.19
48	0.0468	0.14	0.0469	0.13
49	0.0387	0.15	0.0382	0.11
50	0.0404	0.15	0.0390	0.29
51	0.0323	0.17	0.0333	0.13
52	0.0404	0.15	0.0409	0.18
53	0.0266	0.18	0.0266	0.29
54	0.0274	0.17	0.0258	0.19
55	0.0186	0.20	0.0192	0.26
56	0.0137	0.24	0.0137	0.31
57	0.0121	0.26	0.0104	0.38
58	0.0065	0.35	0.0058	0.31
59	0.0032	0.50	0.0030	0.46
60	0.0008	1.00	0.0007	1.09
61	0.0000	0.00	0.0000	0.00
62	0.0016	0.71	0.0017	0.99
63	0.0000	0.00	0.0000	0.00
64	0.0000	0.00	0.0000	0.00
65	0.0000	0.00	0.0000	0.00
66	0.0000	0.00	0.0000	0.00
67	0.0000	0.00	0.0000	0.00
68	0.0000	0.00	0.0000	0.00
69	0.0000	0.00	0.0000	0.00
70	0.0000	0.00	0.0000	0.00
<i>n</i>	1 239		1 239	
<i>m.w.c.v.</i>		0.17		0.21

Appendix 1 – continued:

Estimates of the proportion at length of kahawai from the Hauraki Gulf in 2000–01

Length (cm)	Stratified by trip		Stratified by ramp by trip	
	<i>P.i.</i>	<i>c.v.</i>	<i>P.i.</i>	<i>c.v.</i>
10	0.0000	0.00	0.0000	0.00
11	0.0000	0.00	0.0000	0.00
12	0.0000	0.00	0.0000	0.00
13	0.0000	0.00	0.0000	0.00
14	0.0000	0.00	0.0000	0.00
15	0.0011	1.00	0.0040	1.00
16	0.0000	0.00	0.0000	0.00
17	0.0022	0.99	0.0022	0.91
18	0.0045	0.99	0.0044	0.91
19	0.0101	0.61	0.0101	0.76
20	0.0045	0.60	0.0037	0.79
21	0.0000	0.00	0.0000	0.00
22	0.0000	0.00	0.0000	0.00
23	0.0045	0.61	0.0048	0.68
24	0.0090	0.46	0.0095	0.60
25	0.0123	0.42	0.0136	0.58
26	0.0191	0.38	0.0203	0.33
27	0.0247	0.26	0.0261	0.23
28	0.0426	0.19	0.0483	0.22
29	0.0224	0.23	0.0209	0.22
30	0.0370	0.18	0.0296	0.25
31	0.0549	0.15	0.0531	0.20
32	0.0673	0.15	0.0726	0.16
33	0.0751	0.13	0.0726	0.21
34	0.0807	0.12	0.0745	0.26
35	0.0830	0.13	0.0716	0.20
36	0.0561	0.15	0.0438	0.22
37	0.0415	0.17	0.0392	0.22
38	0.0325	0.19	0.0344	0.19
39	0.0224	0.25	0.0226	0.33
40	0.0404	0.19	0.0484	0.21
41	0.0348	0.23	0.0420	0.16
42	0.0213	0.23	0.0268	0.23
43	0.0179	0.29	0.0235	0.27
44	0.0191	0.27	0.0125	0.47
45	0.0168	0.27	0.0264	0.43
46	0.0056	0.45	0.0040	0.56
47	0.0157	0.28	0.0192	0.33
48	0.0078	0.43	0.0047	0.50
49	0.0146	0.30	0.0138	0.28
50	0.0202	0.27	0.0134	0.44
51	0.0146	0.30	0.0245	0.65
52	0.0078	0.38	0.0096	0.40
53	0.0090	0.35	0.0049	0.63
54	0.0146	0.28	0.0135	0.28
55	0.0123	0.30	0.0128	0.39
56	0.0101	0.33	0.0093	0.37
57	0.0045	0.50	0.0032	0.58
58	0.0011	1.00	0.0014	1.05
59	0.0022	0.71	0.0018	0.83
60	0.0011	1.00	0.0011	0.91
61	0.0011	1.00	0.0014	1.05
62	0.0000	0.00	0.0000	0.00
63	0.0000	0.00	0.0000	0.00
64	0.0000	0.00	0.0000	0.00
65	0.0000	0.00	0.0000	0.00
66	0.0000	0.00	0.0000	0.00
67	0.0000	0.00	0.0000	0.00
68	0.0000	0.00	0.0000	0.00
69	0.0000	0.00	0.0000	0.00
70	0.0000	0.00	0.0000	0.00
<i>n</i>	892		892	
<i>m.w.c.v.</i>		0.22		0.29

Appendix 1 – continued:

Estimates of the proportion at length of kahawai from the Bay of Plenty in 2000–01

Length (cm)	Stratified by trip		Stratified by ramp by trip	
	<i>P.i.</i>	<i>c.v.</i>	<i>P.i.</i>	<i>c.v.</i>
10	0.0000	0.00	0.0000	0.00
11	0.0000	0.00	0.0000	0.00
12	0.0000	0.00	0.0000	0.00
13	0.0000	0.00	0.0000	0.00
14	0.0000	0.00	0.0000	0.00
15	0.0000	0.00	0.0000	0.00
16	0.0000	0.00	0.0000	0.00
17	0.0000	0.00	0.0000	0.00
18	0.0000	0.00	0.0000	0.00
19	0.0000	0.00	0.0000	0.00
20	0.0009	1.00	0.0015	0.97
21	0.0000	0.00	0.0000	0.00
22	0.0000	0.00	0.0000	0.00
23	0.0009	1.00	0.0005	1.06
24	0.0027	0.75	0.0062	1.04
25	0.0036	0.50	0.0056	0.60
26	0.0027	0.74	0.0015	1.06
27	0.0054	0.41	0.0063	0.35
28	0.0045	0.66	0.0052	0.56
29	0.0109	0.35	0.0101	0.48
30	0.0181	0.27	0.0223	0.42
31	0.0100	0.30	0.0136	0.36
32	0.0217	0.22	0.0259	0.40
33	0.0236	0.22	0.0318	0.44
34	0.0245	0.22	0.0276	0.31
35	0.0272	0.19	0.0318	0.24
36	0.0263	0.23	0.0346	0.35
37	0.0145	0.30	0.0168	0.35
38	0.0290	0.19	0.0343	0.32
39	0.0371	0.17	0.0507	0.35
40	0.0281	0.17	0.0333	0.25
41	0.0317	0.18	0.0316	0.26
42	0.0308	0.19	0.0306	0.29
43	0.0344	0.17	0.0338	0.25
44	0.0462	0.15	0.0385	0.19
45	0.0480	0.14	0.0470	0.24
46	0.0607	0.12	0.0497	0.18
47	0.0543	0.12	0.0498	0.21
48	0.0489	0.13	0.0442	0.25
49	0.0562	0.12	0.0532	0.25
50	0.0652	0.12	0.0567	0.26
51	0.0616	0.13	0.0562	0.35
52	0.0462	0.15	0.0445	0.24
53	0.0344	0.18	0.0343	0.25
54	0.0317	0.16	0.0264	0.30
55	0.0245	0.19	0.0175	0.46
56	0.0154	0.26	0.0140	0.22
57	0.0091	0.34	0.0059	0.50
58	0.0045	0.53	0.0021	0.79
59	0.0027	0.57	0.0018	0.54
60	0.0018	0.71	0.0027	0.63
61	0.0000	0.00	0.0000	0.00
62	0.0000	0.00	0.0000	0.00
63	0.0000	0.00	0.0000	0.00
64	0.0000	0.00	0.0000	0.00
65	0.0000	0.00	0.0000	0.00
66	0.0000	0.00	0.0000	0.00
67	0.0000	0.00	0.0000	0.00
68	0.0000	0.00	0.0000	0.00
69	0.0000	0.00	0.0000	0.00
70	0.0000	0.00	0.0000	0.00
<i>n</i>	1 104		1 104	
<i>m.w.c.v.</i>		0.18		0.30

Appendix 2: Estimated proportions at age and c.v.s of kahawai sampled from recreational fishers in East Northland, Hauraki Gulf and the Bay of Plenty in 2000–01

P_j = proportion of fish in age class.
c.v. = coefficient of variation.

n = total number of fish sampled.
m.w.c.v. = mean weighted c.v.

Estimates of the proportion at age of kahawai from East Northland in 2000–01

Age (years)	Stratified by trip		Stratified by ramp by trip	
	<i>P_j</i>	<i>c.v.</i>	<i>P_j</i>	<i>c.v.</i>
1	0.0000	0.00	0.0000	0.00
2	0.0223	0.26	0.0254	0.34
3	0.2511	0.06	0.2709	0.15
4	0.2629	0.07	0.2528	0.06
5	0.1182	0.12	0.1133	0.10
6	0.1091	0.12	0.1062	0.12
7	0.0537	0.18	0.0524	0.10
8	0.0221	0.29	0.0221	0.10
9	0.0287	0.26	0.0279	0.11
10	0.0279	0.25	0.0277	0.13
11	0.0281	0.23	0.0279	0.11
12	0.0304	0.23	0.0294	0.16
13	0.0230	0.25	0.0224	0.17
14	0.0127	0.38	0.0121	0.19
15	0.0032	0.74	0.0031	0.20
16	0.0013	1.01	0.0013	0.18
17	0.0039	0.75	0.0036	0.27
18	0.0000	0.00	0.0000	0.00
19	0.0000	0.00	0.0000	0.00
>19	0.0000	0.00	0.0000	0.00
<i>n</i>	517		517	
<i>m.w.c.v.</i>		0.13		0.12

Estimates of the proportion at age of kahawai from the Hauraki Gulf in 2000–01

Age (years)	Stratified by trip		Stratified by ramp by trip	
	<i>P_j</i>	<i>c.v.</i>	<i>P_j</i>	<i>c.v.</i>
1	0.0101	0.56	0.0078	0.43
2	0.1216	0.27	0.1176	0.11
3	0.5133	0.09	0.5377	0.03
4	0.1687	0.07	0.1548	0.10
5	0.0761	0.12	0.0748	0.16
6	0.0167	0.27	0.0137	0.46
7	0.0024	0.41	0.0020	1.07
8	0.0041	0.50	0.0070	0.77
9	0.0140	0.52	0.0103	0.45
10	0.0121	0.28	0.0114	0.52
11	0.0259	0.23	0.0268	0.32
12	0.0137	0.34	0.0128	0.49
13	0.0045	0.23	0.0048	0.83
14	0.0139	0.28	0.0149	0.50
15	0.0011	0.60	0.0015	1.12
16	0.0000	0.00	0.0000	0.00
17	0.0000	0.00	0.0000	0.00
18	0.0000	0.00	0.0000	0.00
19	0.0000	0.00	0.0000	0.00
>19	0.0000	0.00	0.0000	0.00
<i>n</i>	500		500	
<i>m.w.c.v.</i>		0.14		0.11

Appendix 2 – continued:

Estimates of the proportion at age of kahawai from the Bay of Plenty in 2000–01

Age (years)	Stratified by trip		Stratified by ramp by trip	
	<i>P.j.</i>	<i>c.v.</i>	<i>P.j.</i>	<i>c.v.</i>
1	0.0000	0.00	0.0000	0.00
2	0.0101	0.32	0.0159	0.52
3	0.1405	0.08	0.1694	0.28
4	0.1482	0.09	0.1725	0.20
5	0.1331	0.11	0.1322	0.09
6	0.1217	0.13	0.1118	0.11
7	0.1244	0.13	0.1131	0.15
8	0.0596	0.22	0.0530	0.19
9	0.0558	0.21	0.0515	0.20
10	0.0650	0.20	0.0588	0.20
11	0.0669	0.19	0.0615	0.21
12	0.0158	0.38	0.0156	0.15
13	0.0123	0.47	0.0097	0.28
14	0.0098	0.64	0.0070	0.46
15	0.0120	0.56	0.0081	0.45
16	0.0130	0.44	0.0110	0.25
17	0.0015	1.05	0.0010	0.50
18	0.0015	1.05	0.0010	0.50
19	0.0026	1.01	0.0022	0.30
>19	0.0027	0.58	0.0018	0.54
<i>n</i>	457		457	
<i>m.w.c.v.</i>		0.16		0.19

Appendix 3: Age-length keys derived from otolith samples collected from recreational fishers from East Northland, Hauraki Gulf and the Bay of Plenty.

Estimates of proportion of length at age for kahawai sampled from the East Northland recreational fishery, January to April 2000–01.
(Note: Aged to 01/01/01)

Length (cm)	Age (years)																			No. aged	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		>19
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
25	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
26	0	0.25	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
27	0	0.50	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
28	0	0.50	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
29	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
30	0	0.33	0.50	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
31	0	0.14	0.86	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
32	0	0.10	0.70	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
33	0	0	0.91	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
34	0	0	0.76	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
35	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
36	0	0	0.86	0.09	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
37	0	0	0.65	0.29	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
38	0	0	0.65	0.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
39	0	0	0.10	0.75	0.10	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
40	0	0	0.11	0.68	0.16	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
41	0	0	0.12	0.88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25
42	0	0	0.09	0.50	0.23	0.14	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	22
43	0	0	0.05	0.62	0.24	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
44	0	0	0.16	0.53	0.21	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
45	0	0	0.07	0.45	0.21	0.21	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	29
46	0	0	0	0.22	0.30	0.39	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	23
47	0	0	0	0.18	0.27	0.18	0.27	0.05	0.05	0	0	0	0	0	0	0	0	0	0	0	22
48	0	0	0	0	0.34	0.34	0.17	0.03	0.07	0.03	0	0	0	0	0	0	0	0	0	0	29
49	0	0	0	0.07	0.27	0.13	0.20	0.07	0.20	0	0.07	0	0	0	0	0	0	0	0	0	15
50	0	0	0	0.12	0.18	0.24	0	0.06	0.06	0.24	0	0.12	0	0	0	0	0	0	0	0	17
51	0	0	0	0.06	0.06	0.41	0.06	0.12	0	0.06	0.12	0	0.06	0.06	0	0	0	0	0	0	17
52	0	0	0	0.06	0	0.16	0.13	0.16	0.06	0.09	0.22	0.06	0	0.03	0	0.03	0	0	0	0	32
53	0	0	0	0	0	0.11	0.06	0	0.06	0.06	0.11	0.28	0.17	0.11	0	0	0.06	0	0	0	18
54	0	0	0	0	0	0	0.06	0.06	0.13	0.13	0.13	0.25	0.25	0	0	0	0	0	0	0	16
55	0	0	0	0	0	0	0.08	0.08	0.08	0.33	0.08	0.17	0.08	0	0.08	0	0	0	0	0	12
56	0	0	0	0	0	0	0.25	0	0.13	0	0.13	0.13	0.25	0.13	0	0	0	0	0	0	8
57	0	0	0	0	0	0	0	0	0.20	0	0	0.20	0	0.40	0	0	0.20	0	0	0	5
58	0	0	0	0	0	0	0	0	0	0	0	0.25	0.50	0	0.25	0	0	0	0	0	4
59	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	0	1
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total

Appendix 3 – continued:

Estimates of proportion of length at age for kahawai sampled from the Hauraki Gulf recreational fishery, January to April 2000–01.
 (Note: Aged to 01/01/01)

Length (cm)	Age (years)																			No. aged	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		>19
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
17	0.50	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
19	0.25	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
20	0.67	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
24	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
25	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
26	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
27	0	0.63	0.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
28	0	0.44	0.56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
29	0	0.55	0.45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
30	0	0.19	0.81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
31	0	0.09	0.88	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
32	0	0	0.90	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41
33	0	0	0.88	0.10	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
34	0	0	0.93	0.07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
35	0	0	0.98	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44
36	0	0	0.87	0.10	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
37	0	0	0.70	0.20	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
38	0	0	0.38	0.44	0.19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
39	0	0	0.42	0.42	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
40	0	0	0.35	0.35	0.25	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
41	0	0	0.13	0.81	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
42	0	0	0.10	0.70	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
43	0	0	0.30	0.50	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
44	0	0	0.25	0.63	0.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
45	0	0	0.17	0.33	0.33	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
46	0	0	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
47	0	0	0	0.50	0.17	0.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
48	0	0	0	0.33	0.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
49	0	0	0	0	0.75	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
50	0	0	0	0	0.25	0	0	0.13	0	0.13	0.38	0.13	0	0	0	0	0	0	0	0	8
51	0	0	0	0	0	0	0	0	0.33	0.17	0.17	0.17	0	0.17	0	0	0	0	0	0	6
52	0	0	0	0	0	0	0.25	0	0.50	0	0.25	0	0	0	0	0	0	0	0	0	4
53	0	0	0	0	0	0	0	0.50	0	0	0	0	0	0.50	0	0	0	0	0	0	2
54	0	0	0	0	0	0	0	0	0	0	0.50	0.25	0.25	0	0	0	0	0	0	0	4
55	0	0	0	0	0	0	0	0	0	0.25	0.25	0.25	0	0.25	0	0	0	0	0	0	4
56	0	0	0	0	0	0	0	0	0	0.33	0.33	0	0	0.33	0	0	0	0	0	0	3
57	0	0	0	0	0	0	0	0	0.33	0	0	0	0	0.33	0.33	0	0	0	0	0	3
58	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	0	1
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	1
61	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	0	1
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total

Appendix 3 – continued:

Estimates of proportion of length at age for kahawai sampled from the Bay of Plenty recreational fishery, January to April 2000–01.
(Note: Aged to 01/01/01)

Length (cm)	Age (years)																		No. aged		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		19	>19
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0.50	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
24	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
25	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0.20	0.60	0.20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
28	0	0.25	0.25	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
29	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
30	0	0.06	0.88	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
31	0	0	0.86	0.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
32	0	0	0.90	0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
33	0	0	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
34	0	0	0.75	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
35	0	0	0.63	0.31	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
36	0	0	0.35	0.59	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
37	0	0	0.25	0.67	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
38	0	0	0.06	0.71	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
39	0	0	0.08	0.68	0.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25
40	0	0	0.06	0.61	0.22	0.11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18
41	0	0	0.08	0.42	0.33	0.08	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	12
42	0	0	0	0.17	0.58	0.17	0.08	0	0	0	0	0	0	0	0	0	0	0	0	0	12
43	0	0	0	0.15	0.54	0.15	0.08	0.08	0	0	0	0	0	0	0	0	0	0	0	0	13
44	0	0	0	0.20	0.52	0.12	0.12	0	0.04	0	0	0	0	0	0	0	0	0	0	0	25
45	0	0	0	0.04	0.35	0.35	0.13	0.04	0.04	0.04	0	0	0	0	0	0	0	0	0	0	23
46	0	0	0	0.04	0.17	0.39	0.22	0.09	0.04	0.04	0	0	0	0	0	0	0	0	0	0	23
47	0	0	0	0	0.05	0.47	0.32	0.05	0.05	0.05	0	0	0	0	0	0	0	0	0	0	19
48	0	0	0	0	0.11	0.11	0.50	0.11	0.06	0.06	0.06	0	0	0	0	0	0	0	0	0	18
49	0	0	0	0	0	0.23	0.36	0.09	0.05	0.05	0.18	0.05	0	0	0	0	0	0	0	0	22
50	0	0	0	0	0	0.12	0.24	0.24	0.06	0.29	0.06	0	0	0	0	0	0	0	0	0	17
51	0	0	0	0	0	0.06	0.11	0.11	0.22	0.11	0.28	0.06	0.06	0	0	0	0	0	0	0	18
52	0	0	0	0	0	0.05	0.16	0.05	0.21	0.21	0.21	0.05	0.05	0	0	0	0	0	0	0	19
53	0	0	0	0	0	0.06	0	0.12	0.24	0.18	0.29	0.12	0	0	0	0	0	0	0	0	17
54	0	0	0	0	0	0	0	0.08	0.08	0.08	0.42	0	0.08	0	0	0.17	0	0	0.08	0	12
55	0	0	0	0	0	0	0	0.20	0	0	0	0	0	0.40	0.40	0	0	0	0	0	5
56	0	0	0	0	0	0	0	0	0.20	0.40	0	0	0	0	0	0.40	0	0	0	0	5
57	0	0	0	0	0	0	0	0	0	0.17	0	0.17	0.17	0	0	0.17	0.17	0.17	0	0	6
58	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0.50	0	0	0	0	0	2
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	1
60	0	0	0	0	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0	0	2
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total