

**Monitoring the length structure of commercial landings of albacore  
(*Thunnus alalunga*) during the 2007–08 fishing year**

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## EXECUTIVE SUMMARY

**Griggs, L.H.; Doonan, I.J. (2010). Monitoring the length structure of commercial landings of albacore (*Thunnus alalunga*) during the 2007–08 fishing year.**

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Albacore tuna caught by trolling in New Zealand waters during the 2007–08 fishing season were sampled in fish sheds to determine the length frequency composition and length-weight relationship. Albacore were sampled from two ports, Auckland and Greymouth.

Albacore sampled in the 2007–08 fishing year showed a multimodal distribution with three modes visible in most samples each month and port. The median fork length was 61 cm, the overall mean fork length was 61.6 cm, and the size range was 42–92 cm, with nearly all fish (99%) in the 49–77 cm range. Length-weight relationships were determined. Log of fork length plotted against log of green weight produced a significant linear relationship ( $R^2=0.96$ ).

Nearly all (99%) of the albacore sampled in the troll fishery over a 12 year period from 1996–97 to 2007–08 were in the 47–81 cm size range, with a median fork length of 63 cm and mean fork length of 63.4 cm. There is considerable variability in the size composition from year to year. Length composition scaled to the total catch is presented.

Size frequency of the troll catch is compared with the New Zealand observed longline catch of albacore. Longline caught albacore are larger, with an median fork length of 79 cm, average fork length of 80.6 cm, and most fish (99%) in the 56–106 cm size range.

Albacore caught by trolling around the New Zealand coast tend to be smaller than those caught by troll vessels from the U.S. fishing in the subtropical convergence zone in the eastern Pacific, the only other surface fishery for the South Pacific albacore stock. Fish caught by longline throughout the South Pacific are all larger sub-adult and adult fish.

Continued monitoring of the catch composition of juvenile albacore in the New Zealand troll fishery is a critical input to the length-based regional stock assessment of the South Pacific albacore stock. The New Zealand fishery catches up to half of the total removals of juveniles from this stock and is one of only a few target fisheries for this stock. Failure to monitor size composition in this stock would appreciably increase the uncertainty of stock assessments.

## 1. INTRODUCTION

Albacore tuna (*Thunnus alalunga*) caught in the New Zealand EEZ are part of a single South Pacific Ocean stock that ranges from the equator to about 45° S. Female albacore mature at about 85 cm fork length and spawn in the austral summer from November to February in tropical and subtropical waters, between about 10° S and 20° S, west of 140° W (Murray 1994, Ramon & Bailey 1996, Murray et al. 1999).

Juvenile albacore recruit to surface fisheries in New Zealand coastal waters and in the vicinity of the subtropical convergence zone (STCZ) at about 2 years of age, at 45–50 cm fork length. They then appear to gradually disperse north (Hampton & Fournier 2000) where they are caught by longline fleets. Longline fleets from Japan, Korea, and Taiwan, and domestic fleets of several Pacific Island countries, catch adult albacore throughout their range. Fish caught by longline in the southern part of the region are smaller than those caught further north (Hampton & Fournier 2000). The New Zealand longline fishery catches adult and sub-adult albacore (Murray et al. 1999).

There has been a troll fishery for juvenile albacore in New Zealand coastal waters since the 1960s, and in the central region of the STCZ since the mid 1980s (Murray 1994, Hampton & Fournier 2000). The New Zealand troll fishery, operated by domestic vessels mostly in New Zealand coastal waters, catches up to 6000 t of albacore annually, over half of the total South Pacific surface fishery catch (Murray et al. 2000). Trolling for albacore occurs primarily off the west coasts of the North Island and South Island with Onehunga (Auckland), New Plymouth, Westport, and Greymouth being major landing ports.

Troll vessels from the United States have fished for albacore in the South Pacific since 1986, in the STCZ, approximately 39–41° S, 1000 n. miles east of New Zealand east to waters off South America. Landings from these vessels have fluctuated between 603 t and 2916 t from 1986–87 to 1994–95, with no real trend (Childers & Coan 1996). Over the 5 years from 1999–2002 to 2003–04, American catches were highest in 1999–2000 (2562 t) and lowest in the 2003–04 season (955 t) (Ito et al. 2005). Canadian landings in this fishery from its inception in 1987–88 to 2000–04 are estimated to have ranged from 134 to 351 mt per season (Stocker & Shaw 2005).

The albacore troll catch was 2093 mt in 2007, the lowest for nearly 20 years, and mainly because of a reduction in active vessel numbers due to economic conditions and hence a reduction in overall effort. In 2007 the New Zealand troll fleet caught 1734 mt and USA vessels caught 218 mt, with minor contributions from the Canadian, Cook Islands and French Polynesian fleets (Williams & Terawasi 2008).

Labelle (1993) noted that STCZ albacore tend to be larger than those around New Zealand. Albacore sampled in the STCZ by the American fleet in 2003–04 had an average fork length of 66 cm, 5 cm less than in the previous year (Ito et al. 2005).

The size composition, sex ratio, and length-weight relationship of albacore caught by troll in New Zealand have previously been investigated by NIWA (Griggs & Murray 2000, 2001a, 2001b, Griggs 2002a, 2002b, 2003a, 2003b, 2004a, 2004b, 2005a, 2005b, 2008a, 2008b). Fish sampled in the 2005–06 season, mostly juveniles, ranged from 45 to 92 cm fork length, with nearly all fish (99%) in the 50–83 cm range (Griggs 2008a), and fish sampled in the 2006–07 season ranged from 43–92 cm fork length, with nearly all fish (99%) in the 49–80 cm range (Griggs 2008b). A significant linear relationship was found between the logs of albacore fork length and greenweight. Griggs & Murray (2000) found that the sex ratio was not statistically different from 1:1.

The present study updates and extends those previous analyses for one more year which will be the twelfth year in the time series. It addresses the following objectives.

### **1.1 Overall objective**

To determine the length composition of the commercial catch of albacore (*Thunnus alalunga*) in the New Zealand EEZ to support the stock assessment of the wider South Pacific stock.

### **1.2 Specific objectives**

Objective 3: To conduct sampling in fish sheds and determine and report the length composition and length-weight relationships of albacore tuna during the 2007/2008 fishing year from samples collected in fish sheds. The target coefficient of variation (c.v.) for the length composition is 20% (mean weighted c.v. across all length classes).

Objective 4: To collect 50 pairs of otoliths from fish of 50 cm fork length or less per fishing year.

ALB2005/01 is a three year project with objectives 1, 2, and 3 for the 2005–06, 2006–07, and 2007–08 fishing years respectively. This work is an extension to the sampling funded in 1996–97 and 1997–98 by the SPC, and 1998–99 to 2005–06 by the Ministry of Fisheries.

Note that objective 4 has subsequently been revised and replaced by project IFA200707, in which otoliths are sampled from albacore, along with tissue samples, dorsal fin spines, gonads, and stomachs.

## **2. METHODS**

### **2.1 Catch sampling**

Characterisation of the size composition of the fishery requires regular sampling through the season (December–May) and should take account of any differences in size composition between areas and between boats. Fish were sampled from at least five vessel unloadings and were selected at random from each unloading. At least 1000 fork lengths were measured in each port, each month, and at least 100 of these fish were subsampled for length and weight.

Two ports, Auckland (Port Onehunga, on the west coast) and Greymouth, were sampled during the 2007–08 troll fishing season from December–January to April–May.

At each port, sampling was carried out when the troll vessel unloaded its catch. The fish were kept on ice while on the vessel and frozen once they were discharged into the fish receivers. Fish were sampled before freezing. Fork length was measured to the nearest whole centimetre, rounded down, and weight was recorded to the nearest 0.1 kg. Otoliths were collected from fish of fork length 50 cm or less.

## 2.2 Size composition and length-weight relationships

Size composition and length-weight relationships for fish sampled during the 2007–08 troll season are summarised and presented, and are compared with those from the previous 10 years of troll sampling, and with albacore caught by longline. The longline data (extracted from the *l\_line* database) were collected by Ministry of Fisheries Observer Programme observers on New Zealand domestic and Japanese longliners from 1987 to April 2008.

## 2.3 Target coefficient of variation

Mean weighted c.v.s were calculated using the ‘catch.at.age’ software developed by NIWA for the analysis of mean weighted c.v.s across length classes.

Mean weighted c.v.s of length frequency estimates were calculated with the original port sampling data analysed in 1 cm length classes. The mean weighted c.v. was calculated as the average of the c.v.s for the individual length classes weighted by the proportion of fish in each class. Coefficients of variation were calculated by bootstrapping with fish resampled within each landing and landings resampled within each month. Although the resulting c.v.s would be smaller if the size classes were aggregated, the finer resolution of the original data has been maintained because the purpose of the data is for inferring growth rate within a length-based age-structured model, MULTIFAN-CL (Fournier et al. 1998).

## 2.4 Scaled catches

The total catch of albacore by year and month was obtained from data recorded by fishers on Catch Effort Landing Return (CELR) forms, and this was accessed from the *tuna* database (Wei 2007). Sampled landings were matched to records on CELR forms. This provided the total catch of albacore in each landing.

Catch.at.age was used to estimate scaled catches and c.v.s. for 2005–06 to 2007–08, the three years assessed in the project ALB200501. The ‘year’ used is the ‘albacore year’ from 1 July to 30 June each year.

There was one sampled landing in 2007–08 that not did link with the CELR troll data. This landing was excluded because it came from a set net trip where the vessel appeared to have fished by trolling as well, and it was thought to be atypical of the troll fleet. We also excluded seven samples with less than 50 fish since these were fish collected for biological sampling and these fish were not necessarily selected at random.

Samples were stratified by month and North-South area. The North area was defined by FMA areas 1, 2, 8, 9, and 10. The other samples were assigned to the South area. Samples were assigned to the FMA area used in the CELR data that they were linked to. Where fishing occurred in more than one FMA area, the sample was assigned to FMA with the most catch (by fish number).

There were only two landings (with 400 fish) sampled in January 2008, so the 2008 data were stratified by month only with North and South data combined. Inspection of the overall scaled-up LFs by area and month, compared to those stratified only by month, showed minor differences, in all three years.

Samples were first scaled up by the total albacore catch in each landing. These were then scaled up by the total catch in the month to give an overall scaled-up LF. Some months were not sampled and so the catch from these months were assigned to the nearest month that was sampled.

Some sampled landings had zero catches of albacore recorded in the corresponding CELR data and so these were assigned a landing catch equal to the median of the other sampled landings in that year. This affected three sampled landings, one in 2006–07 and two in 2007–08.

### **3. RESULTS**

During the 2007–08 fishing season, 4564 fish were sampled, 400 landed in Auckland and 4164 in Greymouth. The season was very short in Auckland, with fish sampled from only two boats in January. Fishers reported that prices paid for albacore were low in Auckland and higher in the South Island, so boats headed south to fish earlier than usual. In Greymouth, fish were sampled from eight boats in January when the season started, five boats in February, nine boats in March, and seven boats in April. The season ended in April. The target of 1000 fish was met in all months in Greymouth, but not in Auckland in January, due to the short fishing season there.

The two boats sampled that landed their catch into Auckland fished off the northern part of the west coast of the North Island (from latitude 35°13' S to 37°01' S), while the area fished out of Greymouth extended from Charleston (40°54' S, 171°25' E) to Milford (44°33' S, 167°46' E) on the west coast of the South Island (Figure 1).

Weights were recorded for 574 fish, 100 from Auckland and 474 from Greymouth. Otoliths, dorsal fin spines, tissue samples, gonads, and stomachs were collected from 160 (40 each month) of the fish sampled from Greymouth for project IFA200707.

#### **3.1 Size composition**

The length frequency distributions of fork length, by month, for albacore sampled from troll vessels during the 2007–08 fishing season in Auckland and Greymouth is shown by month and port in Figure 2. Fish sampled ranged in size from 42 to 92 cm, with nearly all fish (99%) in the 49–77 cm range. The median fork length was 61 cm and the overall mean fork length was 61.6 cm. The distributions of the fish sampled in the two ports and their median lengths were difficult to compare with few fish sampled in Auckland, but the medians are the same. Three modes are seen in all months (Figure 2). Modes are seen in the Greymouth caught fish at 48 cm, 60 cm, and about 70 cm in January, 48–49 cm, 60–61 cm, and about 70 cm in February, 49 cm, 61 cm, and about 71 cm in March, and 50 cm, 62 cm, and about 73 cm in April (Figure 2). There were only five fish longer than 85 cm, all from Greymouth.

The mean length, standard deviation, median, minimum and maximum lengths, and percentiles for each month for each port sampled in the 2007–08 season are shown in Table 1, and summaries for each port combined, and for all 2007–08 samples combined, are shown in Table 2.

The length frequency statistics for the fishing years sampled from 1996–97 to 2007–08 are summarised in Table 3, and the length frequency distributions for each of these years are shown in Figure 3. During this 12 year period, fork length of troll-caught albacore ranged from 38 to 99 cm, with nearly all of the fish (99%) in the 47–81 cm range; the mean was 63.4 cm, and the median 63 cm (Table 3). Three modes are

visible in most months of the years sampled. These modes tended to increase by about 1 cm each month during the sampling period.

There is considerable variability in the distributions from year to year. In 1998–99 there was a large proportion of small fish (46–56 cm). There was one dominant mode centred around 60 cm in the fish sampled in the 1999–2000 season. The greatest proportion of large fish (68–78 cm) was seen in the 2000–01 sample. In 2001–02, there were more small fish with the peak of the largest mode at 62 cm, and there were also a significant number of large fish (over 75 cm). The peak of the largest mode was at 61 cm in 2002–03, and there were few fish over 75 cm, more smaller fish (less than 55 cm), and the lowest mean (60.9 cm) in the nine years sampled. In 2003–04 there were two prominent modes with peaks at 62 cm and 70 cm, few small fish (less than 55 cm) and a large proportion of bigger fish, but few over 75 cm. A larger proportion of both smaller and bigger fish was seen in 2004–05. The 2005–06 distribution showed two distinct modes, and a good representation of both small fish (less than 55 cm) and large fish (over 75 cm). There were three prominent modes in the 2006–07 distribution. Small and large fish were well represented, and there were more fish longer than 85 cm fork length than seen in any of the previous years. Three modes are again seen in 2007–08, with good representation of small and large fish, although there were fewer fish longer than 85 cm fork length than the previous year (Figure 3).

Length distributions of troll- and longline-caught albacore are shown in Figure 4. This shows troll-caught albacore from 12 years of sampling combined (1996–97 to 2007–08) and longline-caught albacore measured by observers from 1987 to 2007. Albacore caught in New Zealand by longline are larger (mean fork length 80.6 cm) than troll-caught fish, are caught over a wider geographic area, and are caught all year round. Albacore are usually taken as bycatch in longline operations targeting southern bluefin tuna and bigeye tuna. Mean length, standard deviation, median, minimum and maximum lengths, and percentiles are compared for troll- and longline-caught fish in Table 3.

### **3.2 Length-weight relationship**

The length-weight relationship for albacore sampled from January to April 2008 is shown in Figure 5. Data are plotted as  $\ln(\text{greenweight})$  vs.  $\ln(\text{fork length})$ .

The length-weight relationship for albacore sampled over 10 fishing years, 1998–99 to 2007–08, is shown in Figure 6. Length-weight relationships for albacore caught by troll and longline are shown in Figure 7. Note that longline-caught fish are measured by observers to the nearest kilogram, which is less precise than the troll-caught fish (measured to the nearest 0.1 kg).

A summary of the linear regression parameters and their standard errors is shown in Table 4, for the following equation:

$$\ln(\text{greenweight}) = b_0 + b_1 * \ln(\text{fork length})$$

### **3.3 Representativeness of sampling**

Most vessels fished in FMA 7, with 70% of days fished from this FMA over the last three fishing years covered by this project, 2005–06 to 2007–08 (Table 5). Sampling over this period was in FMA7, 8, and 9 with similar proportions to those fished (Table 6). Fishing in FMA7, 8, and 9 accounted for 96% of the commercial catch.



Positions fished, where available, and positions sampled in 2007–08 are shown in Figure 8, and positions fished and sampled for the three years 2005–06 to 2007–08 are shown in Figure 9. Where fishers have only recorded statistical area, the ‘centroid’ (centre of statistical area) is shown.

### 3.4 Total troll catch

The total albacore troll catch, shown as fish numbers and fish weights, for 1999–00 to 2007–08 is shown in Table 7. CELR catch numbers were converted to catch weights using the average fish weight for each year determined by the albacore troll sampling programme, and these were added to weights where fishers recorded weight instead of fish number, and similarly catch weights were divided by average weights to derive full catch numbers. Over this period, the troll fishery peaked in 2003–04 and has declined to 2006–07 but showed an increase in 2007–08.

The number of landings per month and the number of fish caught per month, with the percentages of landings and fish numbers that were sampled are shown in Table 8 for 2005–6 to 2007–08.

### 3.5 Scaled catches

The length frequencies scaled to the total catch numbers are shown in Figure 10 for 2005–06 to 2007–08.

### 3.6 Target coefficient of variation

This project specified that “The target coefficient of variation (c.v.) for the length composition is 20% (mean weighted c.v. across all length classes).”

The following mean weighted c.v.s were calculated using NIWA’s ‘catch.at.age’ software:

#### 1. MWCVs by area and month

Year	Area	Month	MWCV
2005-06	North	January	29
2005-06	North	February	32
2005-06	North	March	36
2005-06	South	January	24
2005-06	South	February	29
2005-06	South	March	29
2006-07	North	January	35
2006-07	North	February	34
2006-07	North	March	31
2006-07	South	February	31
2006-07	South	March	27
2006-07	South	April	27
2007-08	North	January	30
2007-08	South	January	20
2007-08	South	February	28
2007-08	South	March	27
2007-08	South	April	27

## 2. Pooled MWCVs by year

Year	MWCV
2005-06	18.0
2006-07	18.7
2007-08	15.6

The target c.v. for this port sampling project of 20% as a mean weighted c.v. across all length classes was realised in the pooled samples.

## 4. DISCUSSION

Troll caught albacore sampled in the 2007–08 fishing year from the landings of New Zealand troll vessels ranged from 42 to 92 cm fork length, with nearly all of the fish in the 49–77 cm range; the median fork length was 61 cm and the mean length was 61.6 cm. As albacore reach sexual maturity at about 85 cm (Bailey 1991), almost all of these fish were juveniles.

Albacore sampled over an 12 year period from 1996–97 to 2007–08 were mostly in the 47 to 81 cm size range, with median fork length of 63 cm, and an average fork length of 63.4 cm. The size distribution varied over the 12 year period.

There was a large proportion of small fish (46–56 cm) in 1998–99, one dominant mode centred around 60 cm in 1999–2000, the greatest proportion of large fish (68–78 cm) in 2000–01, and more smaller fish (less than 55 cm) in the 2002–03 season than in any of the other years. Few small fish and more larger fish are seen in the 2003–04 sample, while in 2004–05 there was a big proportion of large fish and more small fish than seen the previous year. Small fish (under 55 cm) and large fish (over 75 cm) were both quite well represented in the 2005–06 distribution and there were two distinct modes, with peaks at 50 cm and 61cm. The distribution was trimodal in 2006–07 with peaks at 51 cm, 61 cm, and 72 cm, and a good representation of small and large fish. The distribution was again trimodal in 2007–08 with a dominant peak at 61 cm and smaller peaks at 49 cm and 122 cm, but with fewer large fish (over 85 cm) than the previous year.

Size classes tended to increase by about 1 cm each month during the sampling period, which is similar to the growth rate seen in length-frequency analysis of South Pacific albacore (Labelle et al. 1993).

New Zealand longline fisheries caught adult and sub-adult albacore, with a median fork length of 79 cm, mean of 80.6 cm, and mostly in the 56–106 cm size range, as shown by data in this report, and reported by Murray et al. (1999), Griggs & Murray (2000, 2001a, 2001b), and Griggs (2005a, 2005b, 2008a, 2008b).

A significant linear relationship was found between the logs of albacore fork length and greenweight for troll-caught fish sampled in 2004–05 ( $R^2=0.96$ ). The length-weight relationships showed similar slopes and intercepts for fish sampled over a 10 year period, and for troll- and longline-caught fish.

Display of accurate fishing positional information is limited by the data recorded on CELR forms, where less than 5% of forms have latitude and longitude recorded.

Data from this albacore troll sampling programme are provided to the Secretariat of the Pacific Community (SPC) for incorporation into the stock assessment of South Pacific albacore. This was most recently described by Hoyle et al. (2008).

Continued monitoring of the catch composition of juvenile albacore in the New Zealand troll fishery is a critical input to the length-based regional stock assessment of the South Pacific albacore stock. The New Zealand fishery accounts for up to half of the total removals of juveniles from this stock and is one of only a few target fisheries for this stock. Failure to monitor size composition in this stock would appreciably increase uncertainty of stock assessments.

## 5. ACKNOWLEDGMENTS

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**Table 1: Summary of mean fork length, standard deviation, median, and percentiles for albacore sampled each month during the 2007–08 season.**

	Auckland Jan 2007	Greymouth Jan 2007	Greymouth Feb 2007	Greymouth Mar 2007	Greymouth Apr 2007
n	400	1040	1042	1042	1040
mean	61.9	61.0	63.6	59.6	62.1
stdev	6.5	4.9	6.5	6.7	6.5
min	42	46	44	45	43
1%	47	50	51	48	49
5%	57	58	58	49	51
median	61	60	62	61	62
95%	72	70	74	71	74
99%	75	73	81	75	77
max	90	80	92	91	85

**Table 2: Summary of mean fork length, standard deviation, median, and percentiles for albacore sampled during the 2007–08 season, by area.**

	Auckland data combined	Greymouth data combined	All 2007- 08 data combined
n	400	4164	4564
mean	61.9	61.6	61.6
stdev	6.5	6.4	6.4
min	42	43	42
1%	47	49	49
5%	57	51	51
median	61	61	61
95%	72	73	73
99%	75	77	77
max	90	92	92

**Table 3: Summary of length frequency statistics for albacore sampled during 12 years of troll sampling, and albacore caught by longline.**

	1996 -97	1997 -98	1998 -99	1999 -00	2000 -01	2001 -02	2002 -03	2003 -04	2004 -05	2005 -06	2006 -07	2007 -08	Troll data 1997- 2008	Longline data 1987- 2007
n	4217	3978	3431	3962	5192	5170	7606	5485	5502	4670	4200	4564	57977	76698
mean	65.0	66.0	61.4	61.1	65.2	63.6	60.9	64.3	66.5	63.3	61.4	61.6	63.4	80.6
std.dev	6.9	6.7	8.7	5.6	8.5	8.6	6.4	5.1	7.1	7.5	8.1	6.4	7.4	11.7
min	40	45	38	39	40	42	42	40	45	45	43	42	38	37
1%	49	51	47	49	46	47	47	52	52	50	49	49	47	56
5%	51	59	48	55	49	51	50	58	55	52	50	51	50	63
median	66	64	62	60	68	62	61	63	68	63	61	61	63	79
95%	76	78	74	74	75	80	71	73	76	78	74	73	75	100
99%	81	81	81	81	78	83	76	76	80	83	80	77	81	106
max	92	91	91	94	99	89	92	94	94	92	92	92	99	135

**Table 4: Linear regression parameters for troll and longline length-weight relationships.**

		n	$b_0$	$SE_{b_0}$	$b_1$	$SE_{b_1}$	$R^2$
troll	1998-99	317	-10.61	0.13	2.95	0.03	0.97
troll	1999-2000	397	-9.46	0.16	2.67	0.04	0.93
troll	2000-01	599	-9.86	0.12	2.77	0.03	0.94
troll	2000-02	606	-9.69	0.10	2.73	0.02	0.95
troll	2002-03	709	-9.82	0.16	2.76	0.04	0.87
troll	2003-04	598	-10.33	0.14	2.89	0.03	0.92
troll	2004-05	400	-10.36	0.13	2.90	0.03	0.96
troll	2005-06	600	-10.47	0.10	2.92	0.02	0.96
troll	2006-07	598	-10.63	0.06	2.97	0.02	0.98
troll	2007-08	574	-10.33	0.11	2.89	0.03	0.96
troll	1999-2008	5 398	-10.15	0.04	2.84	0.01	0.95
longline	1999-2007	37 975	-10.26	0.02	2.86	0.00	0.92

**Table 5: Number of days fished by FMA and fishing year.**

FMA	2005-06	2006-07	2007-08	Total	%
1	27	31	13	71	0.6
2	21	36	103	160	1.3
3	1			1	0.0
4		3		3	0.0
5	65	35	149	249	2.0
7	2 770	2 309	3 618	8 697	70.7
8	566	449	343	1358	11.0
9	980	525	252	1757	14.3
Unknown	4	1	1	6	0.0
Total	4 434	3 389	4 479	12 302	

**Table 6: Number of samples by FMA and fishing year, using FMA at start of fishing.**

FMA	2005-06	2006-07	2007-08	Total	%
7	16	13	28	57	76.0
8	2	4		6	8.0
9	6	4	2	12	16.0
Total	24	21	30	75	

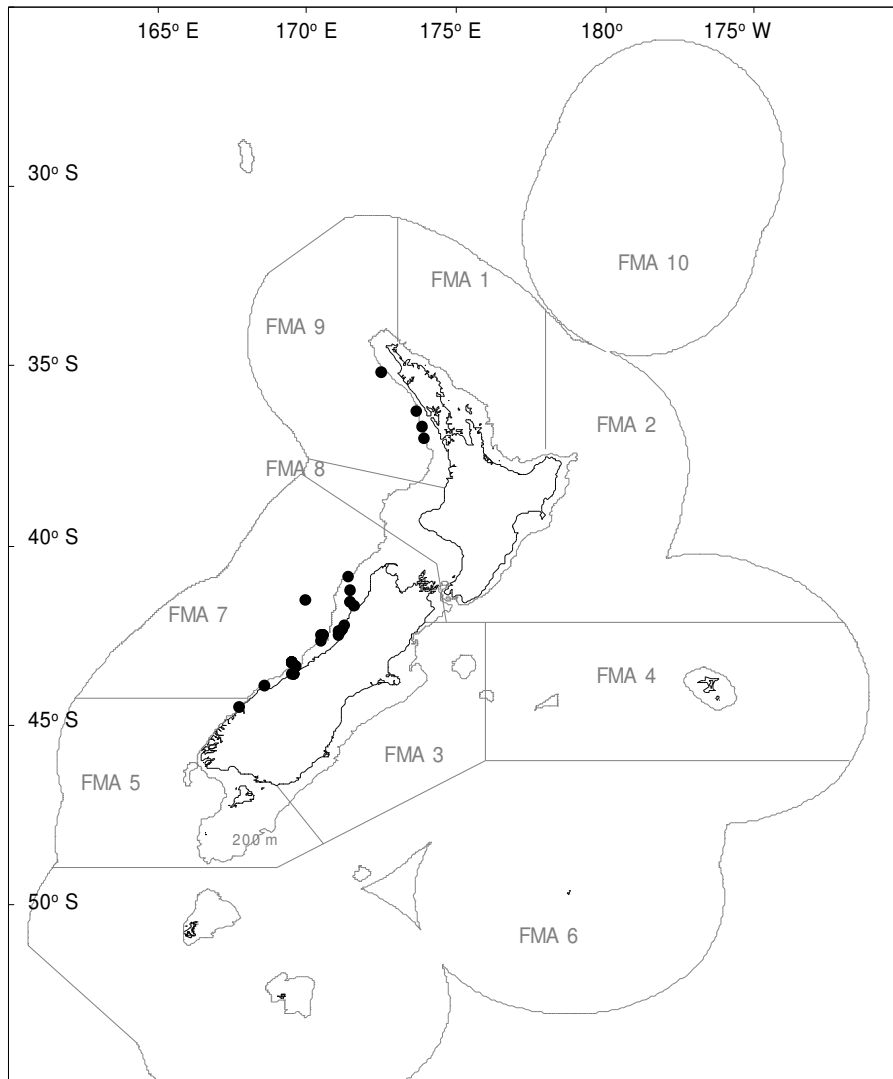
**Table 7: Total troll catch recorded on CELR forms.**

Year	No. of fish	Weight (kg)
1999-00	566 247	2 672 202
2000-01	550 467	2 986 363
2001-02	555 510	2 826 972
2002-03	674 283	3 130 960
2003-04	568 179	3 167 817
2004-05	476 717	2 928 249
2005-06	393 427	2 183 331
2006-07	329 775	1 716 409
2007-08	436 442	2 018 381

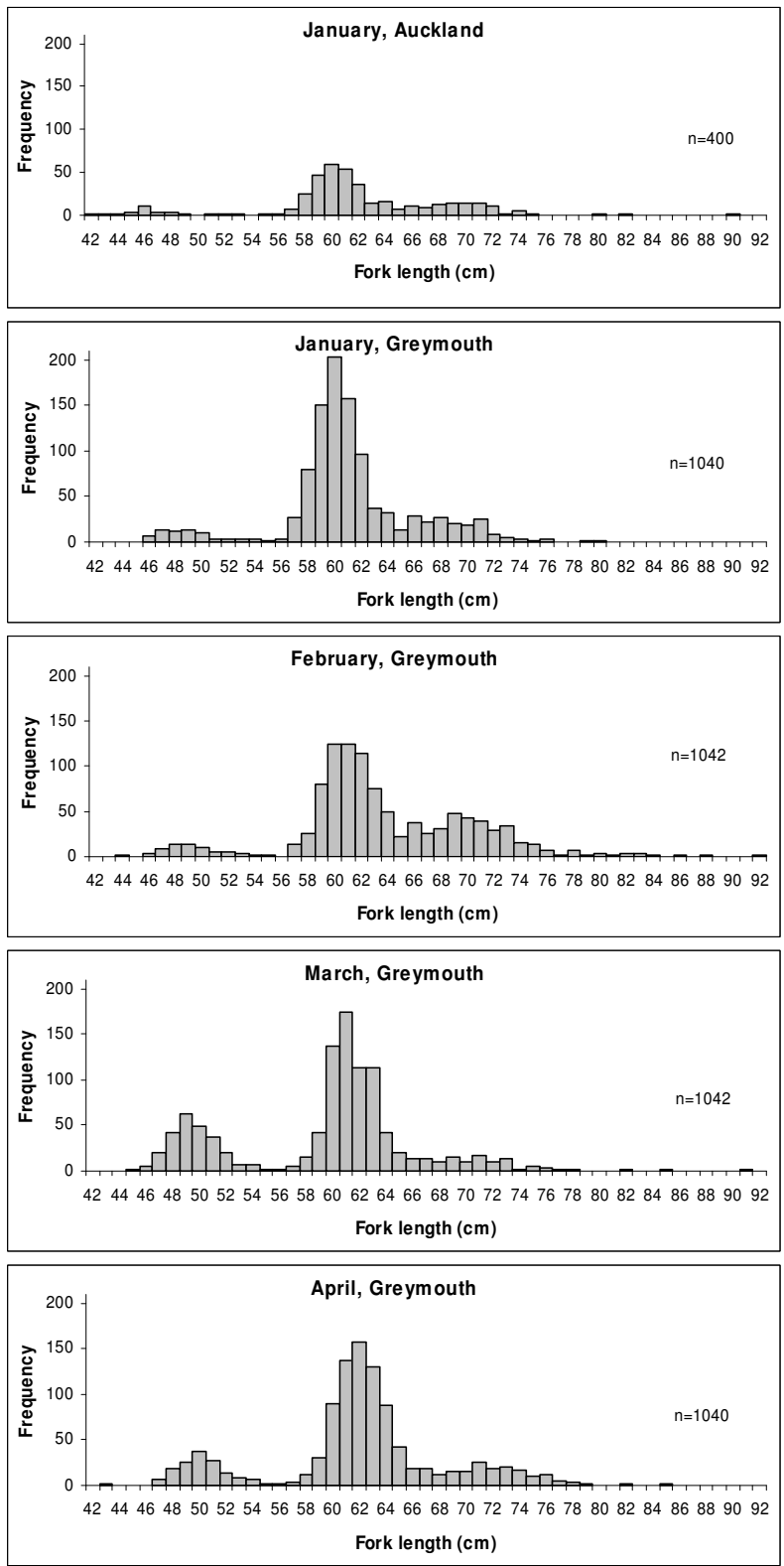
**Table 8: Number of landings and number fish caught per month, and the percentages sampled.**

Year	Month	Landings		Number of fish	
		No. of landings	% Sampled	No. of fish caught	% Sampled
2005	10	2	0.0	22	0.0
	11	6	0.0	457	0.0
	12	63	0.0	30 828	0.0
2006	1	322	3.1	135 769	1.5
	2	486	1.4	150 561	0.9
	3	286	2.4	66 226	1.9
	4	51	0.0	6 944	0.0
	5	13	0.0	2 620	0.0
2005-06 Total		1 229	2.0	393 427	1.2
2006	12	26	0.0	8 592	0.0
2007	1	145	3.4	39 480	2.5
	2	346	2.0	148 885	0.9
	3	258	2.3	90 998	1.3
	4	104	2.9	37 214	1.6
	5	32	0.0	4 575	0.0
	6	3	0.0	32	0.0
2006-07 Total		914	2.3	329 775	1.3
2007	11	1	0.0	25	0.0
	12	27	0.0	10 384	0.0
2008	1	387	2.6	130 410	1.1
	2	491	1.0	147 876	0.7
	3	344	2.6	117 585	0.9
	4	113	6.2	28 608	3.6
	5	20	0.0	1 555	0.0
2007-08 Total		1 383	2.2	436 443	1.0

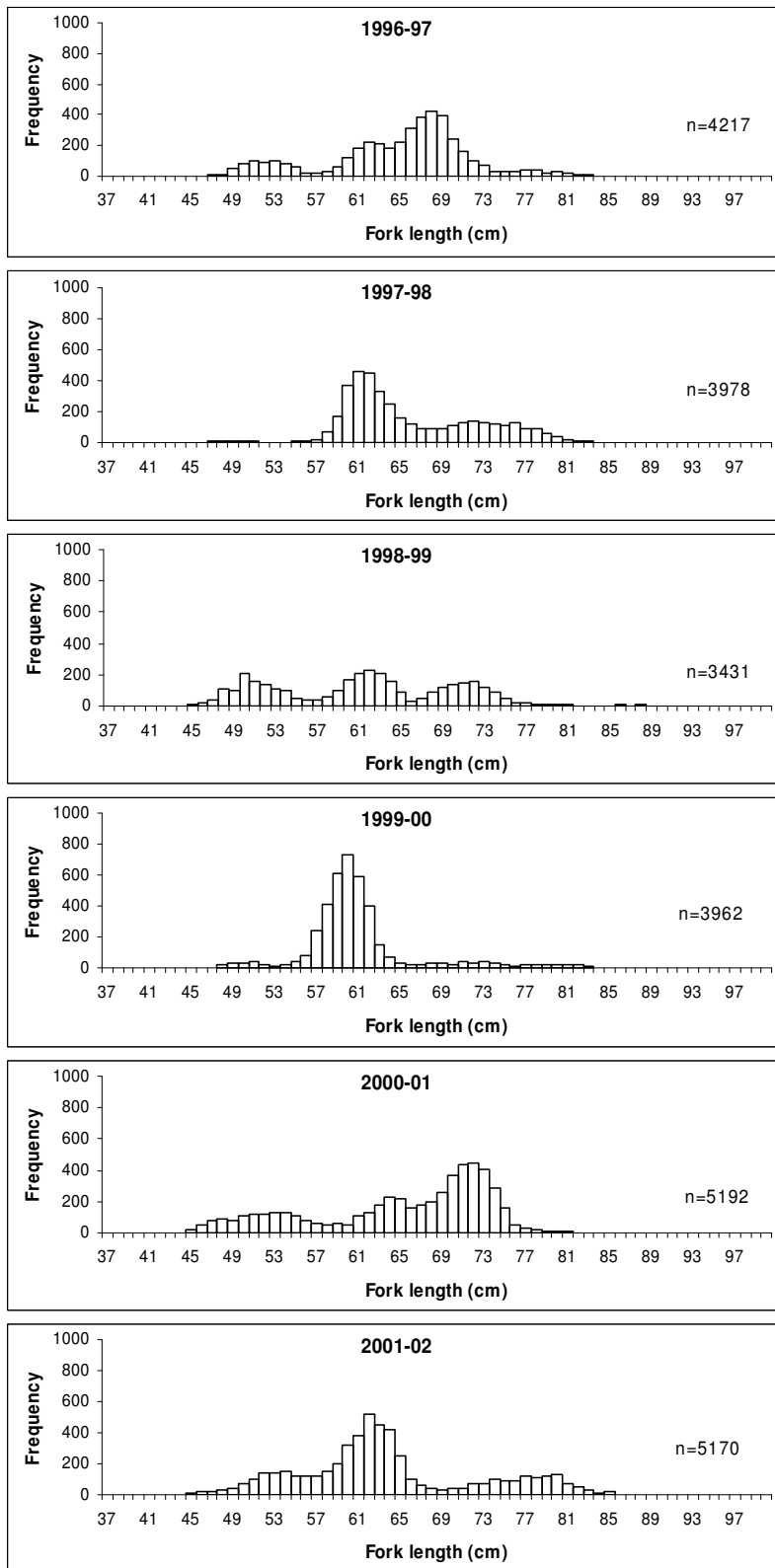




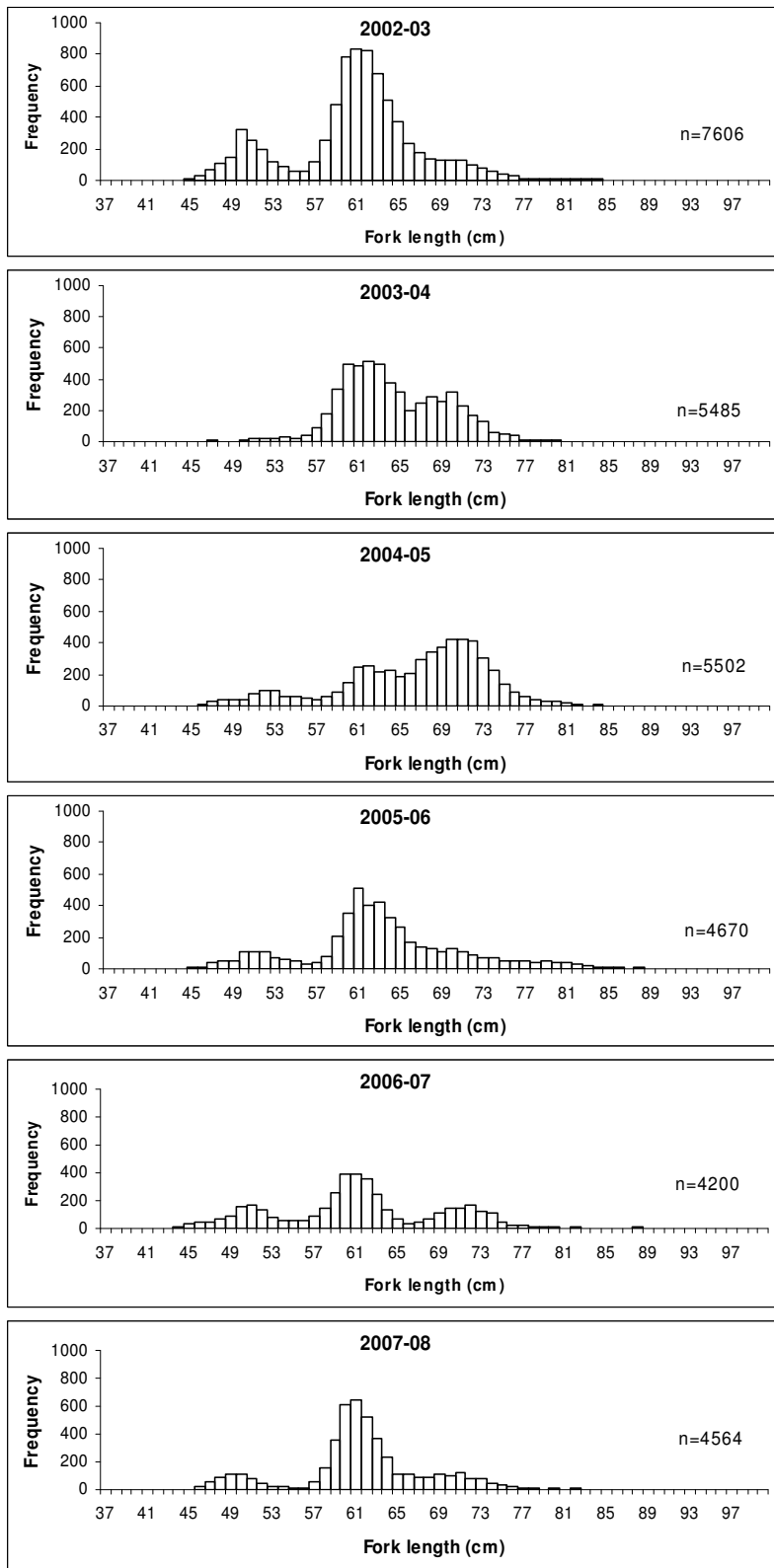
**Figure 1: Fishing positions of troll vessels sampled during the 2007–08 fishing season.**



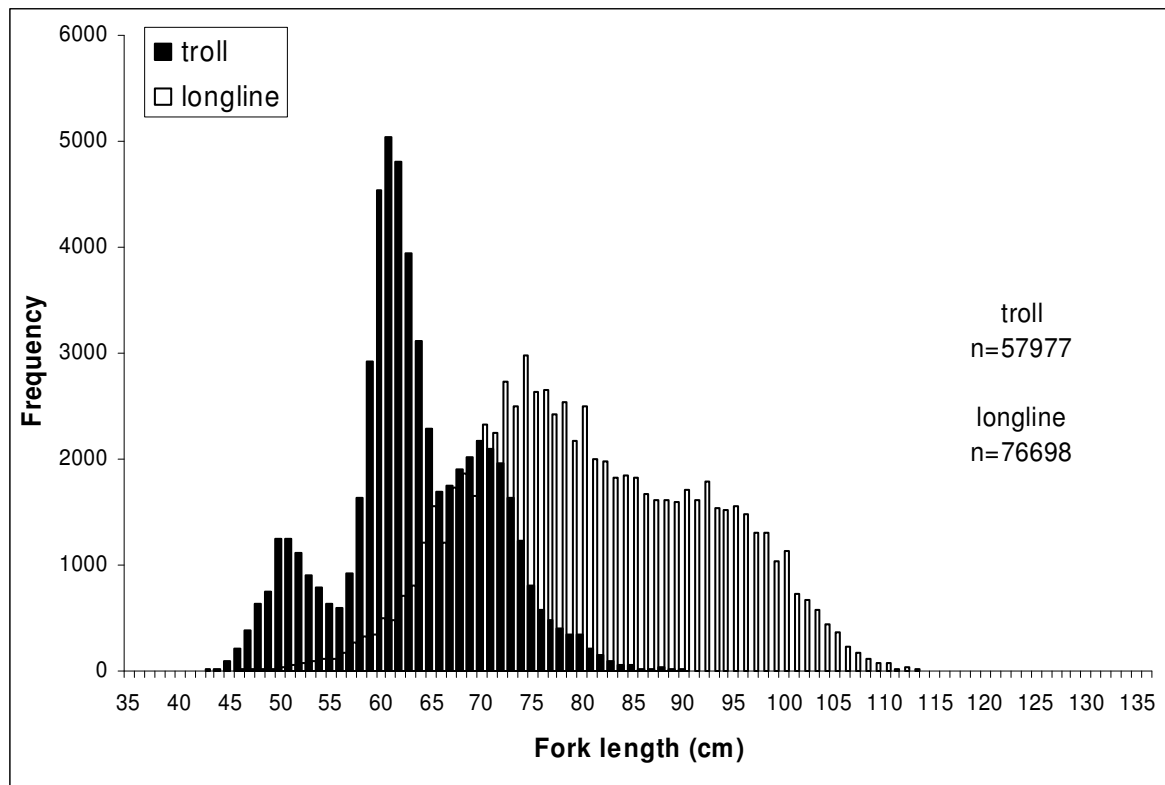
**Figure 2: Albacore length frequency distributions, sampled from landings by troll vessels, Auckland and Greymouth, 2007–08.**



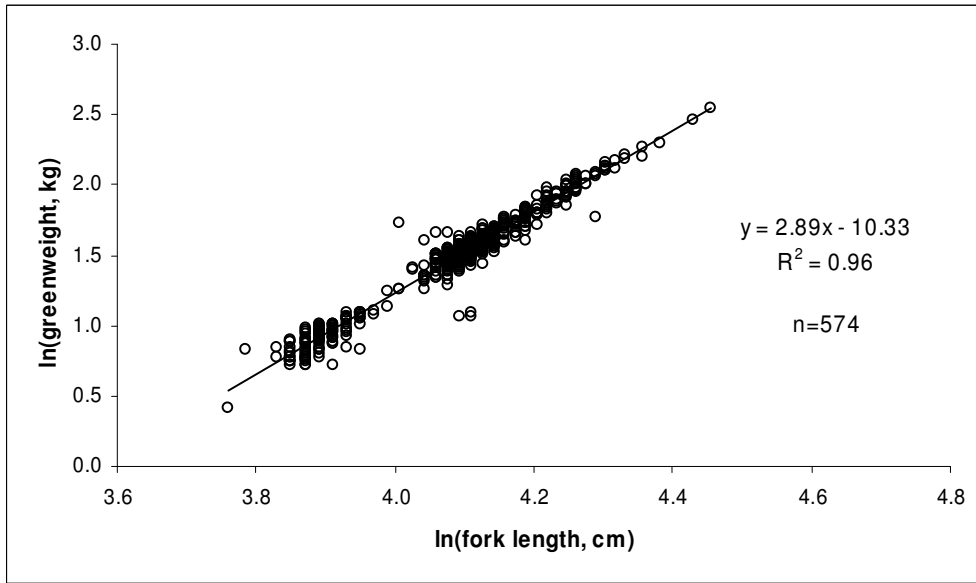
**Figure 3: Albacore length frequency distributions for 12 years of sampling landings from troll vessels, 1996–97 to 2007–08.**



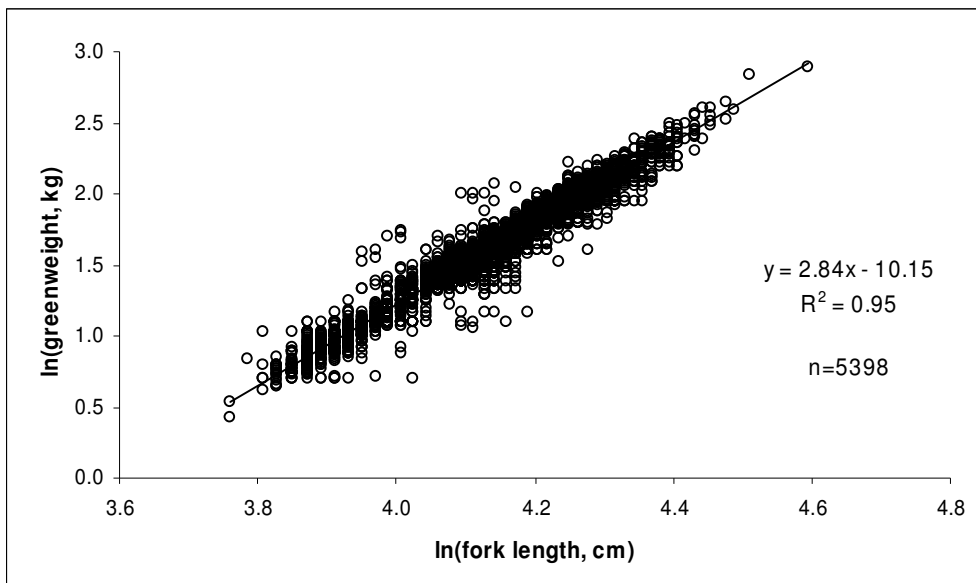
**Figure 3 (continued):** Albacore length frequency distributions for 12 years of sampling landings from troll vessels, 1996–97 to 2007–08.



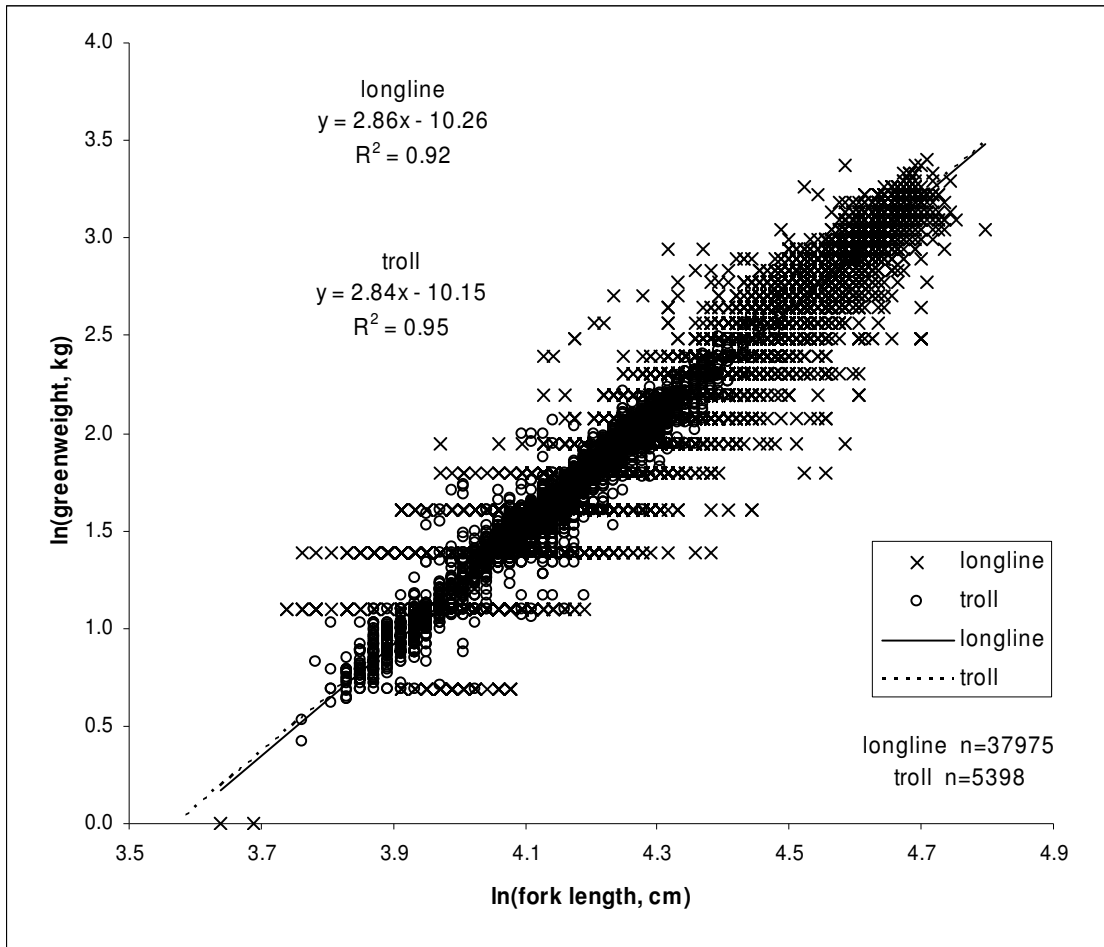
**Figure 4: Length frequency distribution for troll- and longline-caught albacore. Troll data are from 12 years of sampling landings from troll vessels, 1996–97 to 2007–08. Longline data were recorded by observers from 1987 to 2007.**



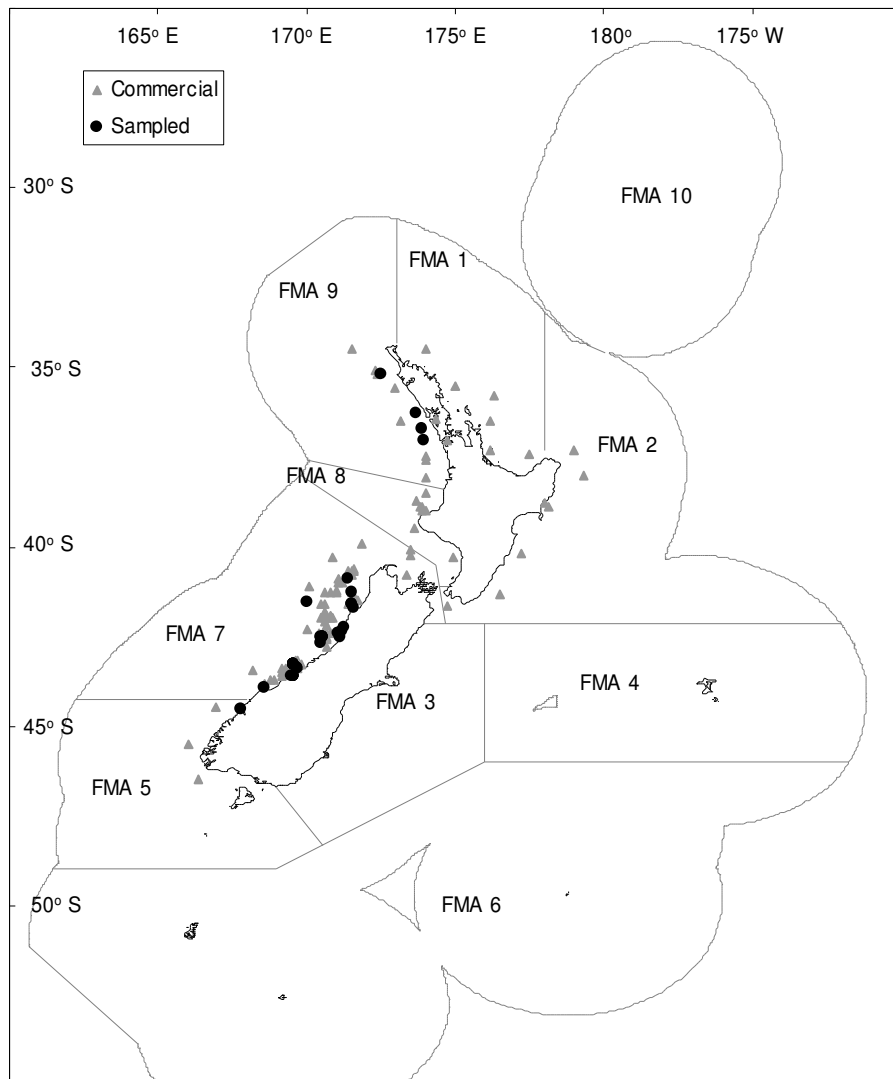
**Figure 5: Length-weight relationship for troll caught albacore sampled from troll vessel landings during 2007–08.**



**Figure 6: Length-weight relationship for troll caught albacore sampled from troll vessel landings from 1998–99 to 2007–08.**

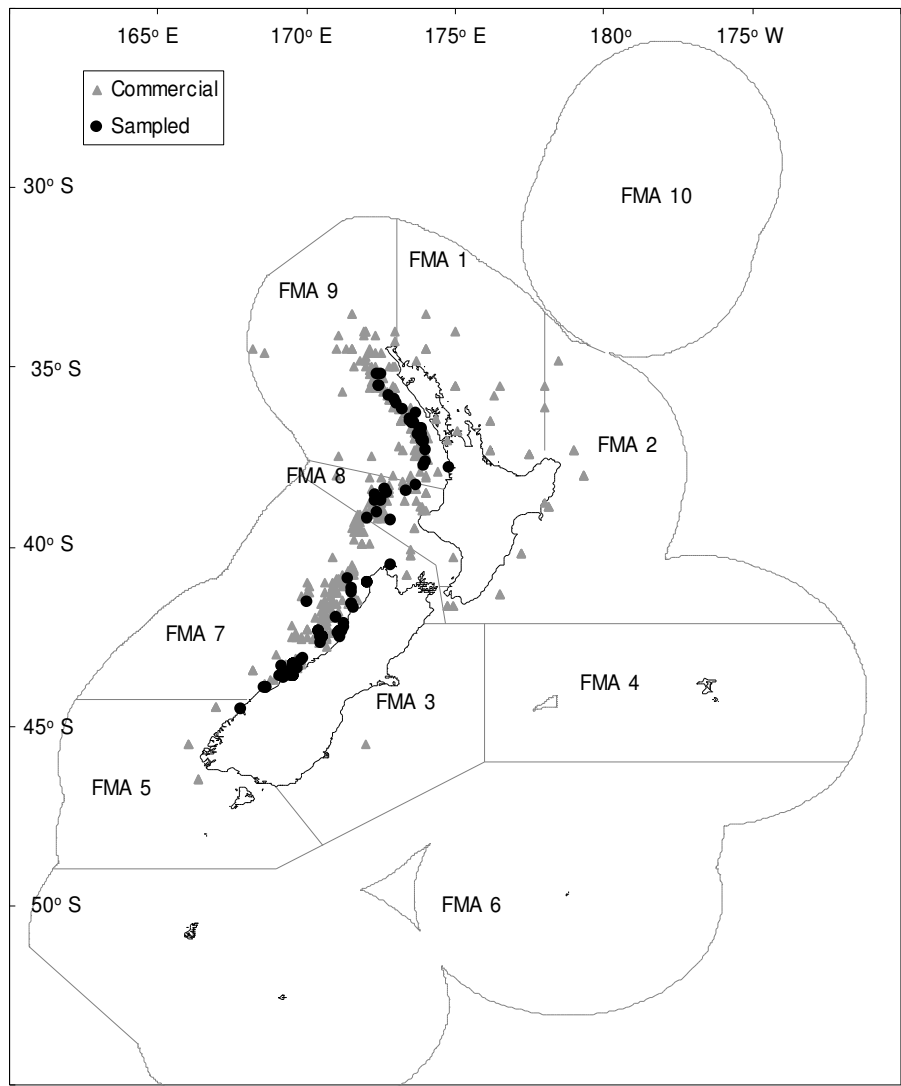


**Figure 7: Length-weight relationship for troll and longline caught albacore. The troll data were from sampled vessels, 1998–99 to 2007–08. The longline data were recorded by observers, 1999– 2007.**

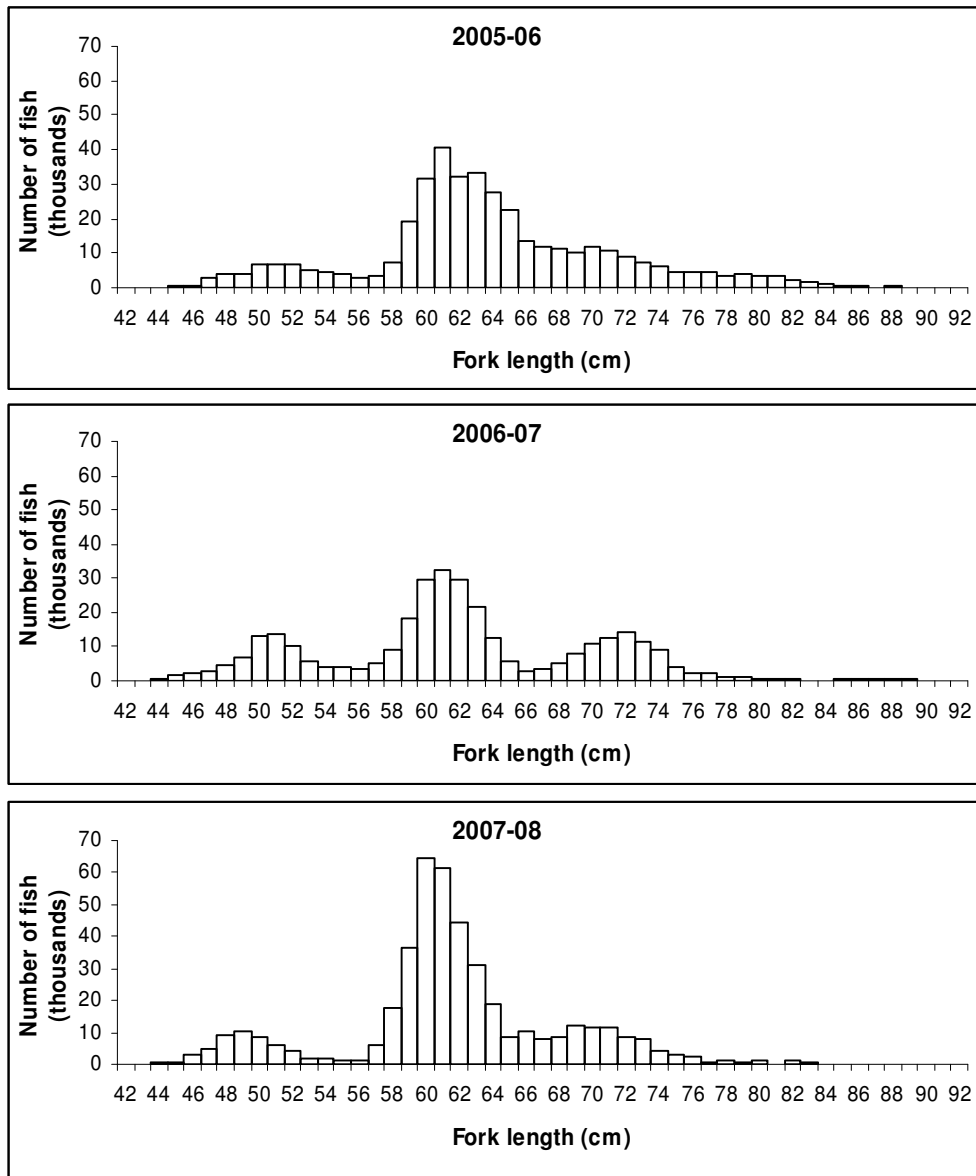


**Figure 8: Fishing positions recorded on CELR forms and positions sampled during 2007–08.**





**Figure 9: Fishing positions recorded on CELR forms and positions sampled for 2005-06 to 2007-08.**



**Figure 10: Albacore length frequency distributions, scaled to the total catch, 2005–06 to 2007–08.**