National marine recreational fishing survey 1996: snapper, kahawai, and blue cod length distributions from boat ramp and diary surveys

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NIWA Technical Report 19
ISSN 1174-2631
1998

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Published by NIWA
Wellington
1998

Inquiries to:
Publication Services, NIWA,
PO Box 14-901, Wellington, New Zealand

ISSN 1174-2631
ISBN 0-478-08432-3

Citation: Bradford, E., Fisher, D., & Bell, J. 1998: National marine recreational fishing survey 1996: snapper, kahawai, and blue cod length distributions from boat ramp and diary surveys.
NIWA Technical Report 19. 49 p.

Cover photograph by Neil Bagley

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Abstract

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In the three regional diary surveys run for the New Zealand Ministry of Fisheries, diarists were asked to record the combined weight of all fish of a species that they caught. The Fishstock mean weights estimated from these diary weights appeared to be overestimates, sometimes gross overestimates. In the 1996 national survey, diarists who had caught more than 10 snapper, kahawai, or blue cod in the previous year were asked if they were willing to measure the snapper, kahawai, and blue cod they caught. Boat ramp surveys were also conducted in several key areas to measure fish lengths. A mean weight of recreationally caught fish is needed for each Fishstock so that the numbers estimates from the diary survey can be converted into tonnage estimates.

This report compares the size distributions of snapper, kahawai, and blue cod as measured by diarists and at boat ramps by Fishstock, or by sub-divisions of a Fishstock where the amount of data warranted.

The size distributions obtained from the diarists were generally similar to those measured at boat ramps, though there was a tendency for the mean lengths (and mean weights) measured by the diarists to be somewhat greater than those measured at boat ramps. Some positive bias was introduced by asking diarists to measure to the nearest centimetre rather than to the nearest centimetre below. The selection procedure meant that the diarists measuring fish were experienced fishers and might be expected to be able to catch bigger fish on average.

The size distributions from diarists are likely to lead to acceptable mean weights (possibly scaled) in Fishstocks where the recreational catch is of moderate importance. The technique is unlikely to prove acceptable in Fishstocks like SNA 1 where the recreational catch is large.

Introduction

The lack of quantitative information on marine recreational fishing catch and effort in New Zealand has been a serious shortcoming for stock assessment and for those involved in making fisheries management decisions. In 1991, the then MAF Fisheries initiated marine recreational fishing catch and effort telephone and diary surveys and boat ramp surveys. The purpose of the surveys is to collect quantitative and representative information on the distribution of fishing effort, methods used, species caught, and total harvest. The first diary survey, in 1991–92, was of fishers living in the South region (Bell *et al.* 1993, L. Teirney & A. Kilner, Ministry of Fisheries, Dunedin, unpubl. results), the second, in 1992–93, was of fishers living in the Central region (A. Kilner & E. Coddington, Ministry of Fisheries, Dunedin, unpubl. results), and the third, from December 1993 to November 1994, was of fishers in the North region (Bradford 1996a). A national telephone and diary survey and a boat ramp survey were run in 1996. This report is one of a series on the 1996 surveys.

The diary surveys give estimates of the numbers of fish caught by marine recreational fishers per Fishstock (or smaller area). Estimates of the mean weight of species caught by recreational fishers are required to derive tonnage estimates of the recreational harvest from these estimates of numbers. In the three regional diary surveys, the diarists were asked to record the total weight of their landed catch of each species. Previous comparisons of estimated mean fish weights recorded by the diarists with those from length measurements at boat ramps suggested that, for some species, the mean fish weights obtained from the diarists were often overestimates. The weight estimate for snapper in SNA 1 obtained from the North region diary survey was rejected by the Snapper Fisheries Assessment Working Group as being implausibly large. Bradford (1997) gave mean weights and tonnage estimates for other key species caught in substantial numbers by recreationalists in the North region using mean fish weights derived both from boat ramp and diary survey fish weight data. Estimates of recreational harvests from all three regional diary surveys were given by Teirney *et al.* (1997). Estimates of the numbers of fish of the main recreational species caught by diarists during the 1996 National diary survey were given by Bradford *et al.* (1998).

For the 1996 national diary survey, diarists who caught more than 10 snapper, kahawai, or blue cod in 1995 were asked if they were willing to measure their landed catch of these species. Many agreed. The lengths of fish landed by recreational fishers were measured during the national boat ramp survey in 1996 (Hartill *et al.* in press). This report compares the length data provided by the diarists with lengths measured at boat ramps.

David Fisher had overall responsibility for coding the data, entering the punched data into the database, and maintaining the database. John Bell, Department of Marketing, University of Otago (operating as J. D. Bell & Associates) was subcontracted by NIWA and ran the diary survey, maintained contact with the diarists, and hence provided the raw data on which this report is based. Elizabeth Bradford was responsible for writing the report, and any errors and opinions expressed therein.

Funding for this work (projects RFNA01 and RFNA02) was provided by the Ministry of Fisheries.

Objective

To evaluate the accuracy of fish size data recorded by diarists by comparisons with data collected from boat ramps.

Methods

The people measuring fish at boat ramps were provided with measuring boards and instruction on how to measure fish. At boat ramps, the measurements should have been of fork length for snapper and kahawai (FL, measured from snout to the fork in the tail) and total length for blue cod (TL, measured from the snout to the end of the tail). Measurements should have been to the nearest centimetre below.

The diarists who agreed to measure the lengths of the snapper, kahawai, and blue cod that they caught were provided with a tape measure and a length recording diary. Diarists were asked to measure the fish they caught and kept. They were provided with a picture showing a tape measure beside a fish and lines indicating that the fish be measured from snout to the fork in the tail. This method of measuring allows some error at each end. Diarists were asked to measure fish to the nearest centimetre, rather than the nearest centimetre below. Some total lengths could have been measured.

The size distributions of the recreational catch of snapper, kahawai, and blue cod measured at boat ramps and by diarists are to be compared. Fishstocks are the basic areas used for the comparisons. Some smaller areas were used as well if the data were sufficient to warrant the subdivision of the Fishstock. Figure 1 defines the coastal Quota Management Areas (QMAs) where marine recreational fishing occurs and Table 1 defines the snapper, kahawai, and blue cod Fishstocks in terms of the coastal QMAs.

The length data for the snapper, kahawai, and blue cod Fishstocks (where both diary and boat ramp data are available) are plotted both as length frequency distributions and cumulative frequency distributions. Figures 2, 6, 8, 11, 14, 16, 19, 21, 23, and 25 show the length distribution comparisons in SNA 1, SNA 7, SNA 8, KAH 1, KAH 3, KAH 9, BCO 3 (north), BCO 3 (south), BCO 7, and BCO 1 respectively. Figures 3, 7, 9, 12, 15, 17, 20, 22, 24, and 26 show the cumulative frequency distributions for the Fishstocks listed above. The cumulative frequency distributions show clearly any discrepancies in the data sets. Length frequency distributions for snapper in SNA 1 (Figures 4 and 5) and kahawai in KAH 1 (Figure 13) are compared in several area/time strata. BCO 3 has been divided into two (BCO 3N — Clarence River to Rakaia River and BCO 3S — Rakaia River to Slope Point) because the large number of lengths measured at the Motunau boat ramp (*see* Figure 1) may not be representative of the whole BCO 3 Fishstock.

Length frequency distributions obtained from the diarists in those Fishstocks where there was no boat ramp sampling in 1996 are plotted separately (Figures 10, 18, 27, and 28).

The mean lengths and mean weights, derived from the lengths using the relations in Table 2, are tabulated by Fishstock together with their standard errors in Tables 3–8. Differences in the length distributions tend to become magnified when the lengths are converted to weights as the lengths are (roughly) cubed in the conversion. Hence a small proportional difference in mean length can translate into a large proportional difference in mean weight. The mean lengths and weights are also given by season (summer – December to April and winter – May to November) and day type (weekends – weekends and holidays and weekdays) where the numbers of fish exceed 100. One hundred is likely to be too small to give a reliable mean length or mean weight as at least 1000 are probably required (Bradford 1996b). For snapper, the mean lengths

and weights are tabulated for east Northland (ENLD), Hauraki Gulf (HAGU), Bay of Plenty (BPLE), and the Hauraki Gulf and Bay of Plenty combined (HGBP).

Snapper (in the Central and South regions), kahawai, and blue cod measured at boat ramps are assigned to the Fishstock where the boat ramp is located rather than to where the fishing took place. This should be adequate on the scale of a Fishstock. One of the southern survey sites was close to Slope Point and some of the blue cod allocated to BCO 3 may have been caught in BCO 5. For snapper in the North region, the locality where the fish was caught was used to assign it to an area. Diarists gave their area of fishing in one of 40 zones which are arranged so that no zone contains a QMA boundary.

For reference, Table 9 contains the minimum legal sizes and maximum daily bag limits applicable to the recreational fishery in the New Zealand coastal Fishstocks for snapper and blue cod in 1996. There are no size restrictions on kahawai and no specific bag limits. The minimum legal size limit means that few small snapper and blue cod were measured. A maximum daily bag limit may lead to fishers keeping the largest fish caught.

The purpose of this project was to see whether the diarist length measurements could be used to derive an adequate mean weight for the recreational harvest in a Fishstock, either as they stand or modified in some way. For this reason, the data were not tested statistically, though it is obvious that often the difference in means would be highly statistically significant.

Results

Although most of the pairs of length distributions show similarities they also show differences. Figures 2, 6, 8, 11, 14, 16, 19, 21, 23, and 25 show the length distribution comparisons in SNA 1, SNA 7, SNA 8, KAH 1, KAH 3, KAH 9, BCO 3 (north), BCO 3 (south), BCO 7, and BCO 1 respectively. Consistent differences are shown more clearly in the plots of the cumulative distribution functions (*see* Figures 3, 7, 9, 12, 15, 17, 20, 22, 24, and 26 for the Fishstocks listed above). Mean length and mean weight and their standard errors are tabulated in Tables 3, 5, and 7 for snapper, kahawai, and blue cod lengths measured by the diarists and in Tables 4, 6, and 8 for lengths measured at boat ramps. The data given in Tables 3–8 are stratified by season and day type as appropriate.

Length distribution comparisons are given for stratified data in SNA 1 and KAH 1. The snapper data are divided by area (east Northland and Hauraki Gulf and Bay of Plenty) and season/day type (summer weekdays and weekends and winter) (Figures 4 and 5). The kahawai data are divided by season/day type (Figure 13).

The mean lengths from the diary data are often higher than those measured at boat ramps and the data from diarists tend to include some abnormally large fish. A few snapper greater than 100 cm recorded in SNA 7 have been omitted as they were improbably large. A few kahawai in KAH 1 were improbably large and have been omitted (fish 10 – 76 cm were included). It is possible that the large fish identified as kahawai were *Arripis xylabion* or another fish species altogether.

Some diarists measured fish other than the three species requested, but told us the species; some may have omitted to tell us.

The most worrying differences occur in SNA 1 where the means of the diarist measurements are higher than the means of the boat ramp measurements and the mean weight of the recreational harvest is the most critical. The diarist mean lengths are higher irrespective of area and season/day type (Tables 3 and 4 and Figures 2–5). The numbers of fish measured by both diarists and at boat ramps were large. Proportionately fewer were measured on weekdays at boat ramps than by the diarists but this seems unlikely to have caused a bias. The diarist measurements in SNA 1 are unlikely to prove acceptable. The same comment may apply to SNA 8 (Figures 8 and 9); here the number of fish measured by diarists (about 1000) is at the lower limit of acceptable sample sizes which might be expected to lead to a reliable mean value (Bradford 1996b). In SNA 7, where the sample sizes are even smaller, the mean length from the diarists is less than that from boat ramp measurements (Figures 6 and 7). Regional differences in mean fish size will become important when the sampling effort in the boat ramp surveys is not roughly proportional to the recreational fishing effort. This could be a problem in widespread stocks with light recreational fishing pressure such as SNA 7.

The mean lengths for kahawai in KAH 1 obtained from diarist measurements and boat ramp measurements are almost the same, perhaps fortuitously (Tables 5 and 6, Figures 11–13). The mean lengths from diarists are larger in KAH 3 and KAH 9 (Figures 14–17). In KAH 3, kahawai vary from mainly juveniles (for example, in Tasman Bay) to mainly large mature fish (for example, off Kaikoura and the rest of the South Island east coast). The sample sizes in KAH 3 are too small to give good results, and too small to stratify by area. The sample size of fish measured by the diarists is about five times larger than that measured at boat ramps and is likely to be more representative. In KAH 9, the sample size of the boat ramp measurements is about three times that of the diarist measurements and is likely to be more representative.

Blue cod mean length and mean weight from diarists are greater than those from the boat ramp survey in the southern part of BCO 3 and somewhat greater in BCO 7 (Tables 7 and 8 and Figures 19–26). The mean length and mean weight from boat ramp measurements were greater in the southern part of BCO 3 than in the northern part. The size distribution from diarists in the southern part of BCO 3 (Figure 21) shows many large fish (about 7% of the fish above 50 cm and 1% above 60 cm) some of which could be red cod.

For kahawai, blue cod (except BCO3 S), and SNA 7 the differences between diarist and boat ramp measurements are not great and the diarist lengths would be adequate to give a mean weight estimate in those Fishstocks where the recreational catch is not a controversial issue. The data from the diarists give valuable length (and hence weight) information in those areas where boat ramp sampling is less cost effective (*see* Figures 10, 18, 27, and 28 for the length frequency distributions from SNA 2, KAH 2, BCO 2 and BCO 8, and BCO 5). The mean weight estimate obtained from the diarists could be reduced by, say, 10% to allow for some of the reasons for overestimation discussed below.

The differences in mean size seem to be consistent across seasons and day types.

Possible reasons for the different mean sizes

The diarists who measured fish may form a biased sample of recreational fishers as they were (self) chosen from those fishers who claimed to have caught 10 or more snapper, kahawai, or blue cod in 1995. They are likely to be experienced fishers.

Hartill *et al.* (in press) noted that snapper caught in winter tend to be larger than those caught in summer. They suggested that this is largely due to the more experienced fishers fishing throughout the year, the less experienced fishers fishing mainly during summer. If more experienced fishers do catch larger fish on average, a higher mean length is to be expected from the diarist measurements.

The diary and length forms were examined to estimate the extent of any confusion between catch and harvest (Bradford 1998a). This examination left the subjective impression that diarists had not, in general, just measured their largest fish (a common criticism of self-recording methods). One circumstance where possibly only the largest fish were measured was when kahawai were caught by a fisher predominantly fishing for snapper: the smaller kahawai may have been returned or used as bait.

Diarists were asked to measure to the nearest centimetre rather than to the nearest centimetre below (though some lengths were given in millimetres). Measuring to the nearest centimetre rather than to the nearest centimetre below the length will increase the mean length by 0.5 cm on average. It is likely that some diarists measured the fish other than by lying it on or beside the tape measure provided. Some may have measured total length (TL). There is some tendency for abnormally high peaks in the size distributions to occur at 20, 30, and 40 cm indicating some guessing of lengths or rounding (possibly up) to the nearest 10 cm. Diarists had not been instructed to place the snout of the fish and one end of the tape measure against a solid object at right angles to the tape and fish, so parallax errors could have been introduced.

There is confusion between red cod and blue cod and both were often recorded as "cod". Although we have generally coded fish caught and called "cod" as COD rather than BCO or RCO, many of these fish were measured and entered under blue cod on the length measuring forms and assumed to be blue cod. Some of the larger blue cod measurements could have come from red cod. This is likely to have been a problem in QMA 3 where both red cod and blue cod are found.

Where the numbers of fish involved are less than 1000, say, any outliers in the size distribution are likely to bias the mean values. Some improbably large lengths have been removed from the KAH 1 and SNA 7 data.

In summary, the differences in mean length are likely to be a result of the fish being caught by a sample of experienced fishers who are likely to catch more and larger fish, and an accumulation of small errors introduced mainly by the measuring technique. There is no evidence that most fishers measured just their largest fish or that fish lengths were inflated.

Discussion

Some of the problems with the diarist length measurements noted above could be reduced by clearer instructions to the diarists (even some of the boat ramp measurements are suspect, despite supervision of these measurements).

The snapper lengths measured by diarists in SNA 1 and perhaps SNA 8 are unlikely to give an acceptable mean snapper weight. The diarist size distribution from the southern part of BCO 3 may contain too many large fish.

The results suggest that if diarists are asked to measure the individual lengths of the fish they harvest, the data so obtained can be used to get a useful estimate of the mean weight of a species as caught by recreational fishers in those Fishstocks where the recreational harvest is of moderate importance.

In the future, diarists could be asked to measure gurnard, tarakihi, and trevally. Diarists will give uncertain length measurements where there is known confusion in identification (as noted for blue cod and red cod). Diarists may not give reliable measurements of fish over about 100 cm long.

Problems can arise when the boat ramp sampling is not representative of the recreational effort. This arose most clearly at Motunau where we have many measurements from a heavily used access point to a local fishery. The size distribution of fish measured at such a ramp may not be representative of size distribution of a species in a wider area such as BCO 3.

Acknowledgments

We thank Laurel Teirney and Allan Kilner (MFish, Dunedin) who wrote the first proposals for the national telephone-diary and boat ramp surveys, and Kevin Sullivan (MFish, Wellington, while still with NIWA) who became responsible for implementing the surveys. We thank all those people who were involved in boat ramp surveys including those who did the measuring, and in particular, Todd Sylvester (MFish, Auckland), who set up the survey in the North region, Bruce Hartill (NIWA, Auckland), who took over from Todd Sylvester, Ron Blackwell (NIWA, Nelson), who organised the Central region survey, and Lindsay Hawke (NIWA, Christchurch) and Glen Carbines (NIWA, Dunedin), who organised the surveying around Christchurch and Dunedin respectively. We thank the many people who assisted in checking the boat ramp data before entry, particularly Dean Stotter and Brian Sanders from NIWA, Wellington, and Cameron Walsh, Jim Drury, and Derrick Parkinson from NIWA, Auckland. Brian Sanders also helped with loading the data to the Empress database. We thank Larry Paul, John Kapa, and Peter Benson (NIWA, Wellington) who were involved in coding the diary data before punching. We thank the NIWA data entry operators who have cheerfully handled the heavy load of data entry from sometimes messy forms. We thank John Cranfield and Mike Beardsell for comments on a draft of this report. Funding for this work (projects RFNA01 and RFNA02) was provided by the Ministry of Fisheries.

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Table 1: Definitions of Fishstocks and non-standard areas used. The National diary zones were defined by Bradford et al. (1998)

Area	Definition
SNA 1	QMA 1 (National diary zones 1–13)
SNA 2	QMA 2 (National diary zones 14–17)
SNA 3	QMAs 3 & 5 (National diary zones 29–38)
SNA 7	QMA 7 (National diary zones 26–28, 39, 40)
SNA 8	QMAs 8 & 9 (National diary zones 18–25)
KAH 1	QMA 1 (National diary zones 1–13)
KAH 2	QMA 2 (National diary zones 14–17)
KAH 3	QMAs 3, 5, 7, & 8 (National diary zones 18, 19, 26–40)
KAH 9	QMA 9 (National diary zones 20–25)
BCO 1	QMAs 1 & 9 (National diary zones 1–13, 20–25)
BCO 2	QMA 2 (National diary zones 14–17)
BCO 3	QMA 3 (National diary zones 29–34)
BCO 5	QMA 5 (National diary zones 35–38)
BCO 7	QMA 7 (National diary zones 26–28, 39, 40)
BCO 8	QMA 8 (National diary zones 18, 19)
ENLD	East Northland (National diary zones 1–5)
HAGU	Hauraki Gulf (National diary zones 6–9)
BPLE	Bay of Plenty (National diary zones 10–13)
HGBP	Hauraki Gulf and Bay of Plenty (National diary zones 6–13)
BCO 3N	Northern BCO 3, Clarence River to Rakaia River (National diary zones 29, 30)
BCO 3S	Southern BCO 3, Rakaia River to Slope Point (National diary zones 31–34)

Table 2: Parameters used to derive weight from length measurements in weight = a(length)^b (weight in grams, length in centimetres)

Species	a	b	Source
BCO	0.0102	3.123	Blackwell (1997)
KAH 1 & 9	0.1024	2.502	Bradford (1998b)
KAH 3	0.0400	2.760	Drummond & Wilson (1993)
SNA	0.0447	2.793	Paul (1976)

Table 3: Number of snapper measured by diarists, N, mean length, L_m, and mean weight, W_m (both with standard errors), by Fishstock and several time strata. (Areas are defined in Table 1)

Fishstock	Stratum	N	L_m	$s.e.(L_m)$	W_m	$s.e.(W_m)$
SNA 1	All	10 179	35.6	0.08	1 109	10.4
	Summer	7 467	35.2	0.09	1 073	11.9
	Summer, Weekends	3 126	35.7	0.15	1 116	19.1
	Summer, Weekdays	4 341	34.9	0.12	1 043	15.0
	Winter	2 712	36.6	0.17	1 206	21.5
	Winter, Weekends	1 242	35.5	0.21	1 062	22.9
	Winter, Weekdays	1 470	37.5	0.26	1 327	34.3
SNA 2	All	147	40.8	0.78	1 604	101.7
	Summer	114	41.1	0.92	1 663	125.7
	Winter	33	39.4	1.37	1 401	125.7
SNA 7	All	371	42.7	0.54	1 848	76.7
	Summer	319	42.8	0.57	1 853	84.4
	Summer, Weekends	133	41.6	0.72	1 640	82.8
	Summer, Weekdays	186	43.6	0.84	2 005	131.5
	Winter	52	42.2	1.53	1 817	180.5
SNA 8	All	1 012	35.5	0.29	1 128	33.0
	Summer	911	35.5	0.29	1 120	34.8
	Summer, Weekends	347	35.7	0.47	1 129	53.3
	Summer, Weekdays	564	35.4	0.37	1 114	45.6
	Winter	101	35.7	1.09	1 203	105.7
BPLE	All	4 889	35.8	0.12	1 132	15.7
	Summer	3 527	35.6	0.15	1 123	19.3
	Summer, Weekends	1 541	36.0	0.22	1 162	31.0
	Summer, Weekdays	1 986	35.3	0.19	1 093	24.5
	Winter	1 362	36.3	0.22	1 153	25.7
	Winter, Weekends	589	35.8	0.31	1 098	36.9
	Winter, Weekdays	773	36.7	0.30	1 195	35.4
HAGU	All	2 971	34.4	0.13	974	14.3
	Summer	2 301	34.0	0.13	924	13.0
	Summer, Weekends	988	34.3	0.20	948	21.4
	Summer, Weekdays	1 313	33.8	0.17	906	16.1
	Winter	670	36.0	0.33	1 146	44.0
	Winter, Weekends	385	34.3	0.28	925	24.4
	Winter, Weekdays	285	38.3	0.64	1 446	95.4

Table 3 — continued

Fishstock	Stratum	N	L_m	$s.e.(L_m)$	W_m	$s.e.(W_m)$
ENLD	All	2 319	36.6	0.20	1 233	25.5
	Summer	1 639	36.1	0.22	1 177	28.7
	Summer, Weekends	597	37.3	0.37	1 278	47.2
	Summer, Weekdays	1 042	35.4	0.28	1 118	36.0
	Winter	680	37.8	0.39	1 369	52.6
	Winter, Weekends	268	36.6	0.50	1 178	57.4
	Winter, Weekdays	412	38.6	0.56	1 493	77.8
HGBP	All	7 860	35.3	0.09	1 072	11.2
	Summer	5 828	35.0	0.10	1 044	12.8
	Summer, Weekends	2 529	35.3	0.16	1 078	20.8
	Summer, Weekdays	3 299	34.7	0.13	1 019	16.1
	Winter	2 032	36.2	0.18	1 151	22.5
	Winter, Weekends	974	35.2	0.22	1 030	24.4
	Winter, Weekdays	1 058	37.1	0.28	1 263	36.6

Table 4: Number of snapper measured in the boat ramp surveys, N, mean length, L_m, and mean weight, W_m (both with standard errors), by Fishstock and several time strata

Fishstock	Stratum	N	L_m	$s.e.(L_m)$	W_m	$s.e.(W_m)$
SNA 1	All	16 357	33.6	0.05	916	5.7
	Summer	11 811	33.2	0.06	880	6.5
	Summer, Weekends	7 516	33.2	0.08	867	7.9
	Summer, Weekdays	4 295	33.4	0.11	902	11.4
	Winter	4 546	34.8	0.11	1 011	11.7
	Winter, Weekends	3 443	34.9	0.12	1 020	13.5
	Winter, Weekdays	1 103	34.5	0.20	980	23.3
SNA 7	All	467	47.3	0.48	2 399	73.6
	Summer	372	45.2	0.47	2 072	69.8
	Summer, Weekends	315	44.9	0.49	2 025	71.7
	Summer, Weekdays	57	46.9	1.36	2 337	222.8
	Winter	95	55.6	1.16	3 679	186.6
SNA 8	All	2 039	32.8	0.16	870	17.3
	Summer	1 996	32.8	0.16	863	16.9
	Summer, Weekends	1 271	32.3	0.19	822	20.0
	Summer, Weekdays	725	33.7	0.28	935	30.6
	Winter	43	35.3	1.62	1 183	230.7
BPLE	All	5 603	33.5	0.08	888	8.6
	Summer	4 084	33.1	0.09	847	9.1
	Summer, Weekends	2 479	33.1	0.11	844	12.0
	Summer, Weekdays	1 605	33.1	0.14	851	13.9
	Winter	1 519	34.7	0.18	998	20.2
	Winter, Weekends	984	34.9	0.23	1 017	25.7
	Winter, Weekdays	535	34.4	0.29	964	32.7
HAGU	All	6 443	33.0	0.08	857	7.4
	Summer	4 397	32.4	0.09	808	8.3
	Summer, Weekends	3 029	32.3	0.11	803	10.0
	Summer, Weekdays	1 368	32.5	0.17	819	14.7
	Winter	2 046	34.3	0.15	962	14.9
	Winter, Weekends	1 579	34.4	0.18	972	17.4
	Winter, Weekdays	467	34.1	0.28	928	28.8

Table 4 — continued

Fishstock	Stratum	N	L_m	$s.e.(L_m)$	W_m	$s.e.(W_m)$
ENLD	All	4 310	34.7	0.13	1 041	14.8
	Summer	3 329	34.3	0.14	1 014	16.8
	Summer, Weekends	2 007	34.2	0.18	991	20.5
	Summer, Weekdays	1 322	34.5	0.24	1 048	28.7
	Winter	981	35.8	0.27	1 132	31.0
	Winter, Weekends	880	35.6	0.28	1 112	31.2
	Winter, Weekdays	101	37.3	0.97	1 307	127.1
HGBP	All	12 046	33.2	0.06	871	5.7
	Summer	8 481	32.7	0.06	826	6.1
	Summer, Weekends	5 508	32.6	0.08	821	7.7
	Summer, Weekdays	2 973	32.8	0.11	836	10.1
	Winter	3 565	34.5	0.12	977	12.2
	Winter, Weekends	2 563	34.6	0.14	989	14.5
	Winter, Weekdays	1 002	34.3	0.20	947	22.0

Table 5: Number of kahawai measured by diarists N, mean length, L_m, and mean weight, W_m (both with standard errors), by Fishstock and several time strata

Fishstock	Stratum	N	L_m	$s.e.(L_m)$	W_m	$s.e.(W_m)$
KAH 1	All	3 078	44.2	0.18	1 467	13.8
	Summer	1 981	44.1	0.22	1 446	16.7
	Summer, Weekends	771	44.4	0.32	1 455	25.2
	Summer, Weekdays	1 210	43.9	0.29	1 441	22.1
	Winter	1 097	44.6	0.31	1 504	24.3
	Winter, Weekends	422	45.3	0.52	1 567	41.0
	Winter, Weekdays	675	44.1	0.39	1 465	30.1
KAH 2	All	553	48.6	0.36	1 938	37.6
	Summer	407	48.3	0.42	1 915	44.9
	Summer, Weekends	176	48.0	0.67	1 894	71.4
	Summer, Weekdays	231	48.6	0.55	1 930	57.5
	Winter	146	49.3	0.69	2 004	68.3
	Winter, Weekends	116	48.8	0.77	1 957	70.8
	Winter, Weekdays	30	51.1	1.58	2 211	186.4
KAH 3	All	953	47.2	0.31	1 822	29.1
	Summer	741	48.1	0.32	1 896	31.8
	Summer, Weekends	321	48.9	0.43	1 943	44.2
	Summer, Weekdays	420	47.5	0.46	1 859	44.7
	Winter	212	43.9	0.74	1 566	66.8
	Winter, Weekends	90	42.3	1.19	1 439	99.4
	Winter, Weekdays	122	45.1	0.94	1 660	89.3
KAH 9	All	628	41.6	0.40	1 273	29.4
	Summer	363	42.3	0.51	1 321	37.2
	Summer, Weekends	174	42.9	0.77	1 371	58.3
	Summer, Weekdays	189	41.9	0.67	1 274	47.1
	Winter	265	40.5	0.64	1 208	47.3
	Winter, Weekends	117	38.3	0.79	1 025	54.8
	Winter, Weekdays	148	42.2	0.94	1 353	70.7

Table 6: Number of kahawai measured in the boat ramp surveys, N, mean length, L_m, and mean weight, W_m (both with standard errors), by Fishstock and several time strata

Fishstock	Stratum	N	L_m	$s.e.(L_m)$	W_m	$s.e.(W_m)$
KAH 1	All	3 658	44.2	0.15	1 442	11.2
	Summer	2 553	44.6	0.18	1 474	13.2
	Summer, Weekends	1 693	44.7	0.21	1 472	15.8
	Summer, Weekdays	860	44.7	0.32	1 479	23.6
	Winter	1 105	43.0	0.29	1 367	20.9
	Winter, Weekends	861	42.4	0.33	1 321	23.6
	Winter, Weekdays	244	45.4	0.55	1 530	43.5
KAH 3	All	168	41.9	0.69	1 335	56.5
	Summer	106	43.9	0.91	1 507	74.3
	Winter	62	38.7	0.89	1 041	72.3
KAH 9	All	1 797	38.0	0.22	1 022	14.3
	Summer	1 084	38.7	0.29	1 070	19.4
	Summer, Weekends	671	37.0	0.36	963	23.5
	Summer, Weekdays	413	41.3	0.46	1 242	32.1
	Winter	713	37.0	0.33	950	20.3
	Winter, Weekends	533	36.7	0.38	932	23,2
	Winter, Weekdays	180	37.8	0.67	1 002	41.9

Table 7: Number of blue cod measured by diarists N, mean length, L_m, and mean weight, W_m (both with standard errors), by Fishstock and several time strata. (Areas are defined in Table 1)

Fishstock	Stratum	N	L_m	$s.e.(L_m)$	W_m	$s.e.(W_m)$
BCO 1	All	144	32.8	0.40	594	22.2
BCO 2	All	717	37.0	0.18	848	13.7
	Summer	509	37.0	0.22	854	17.2
	Summer, Weekends	242	36.7	0.30	828	23.2
	Summer, Weekdays	267	37.2	0.32	877	25.0
	Winter	208	36.9	0.30	835	21.5
	Winter, Weekdays	136	37.2	0.40	864	29.0
	Winter, Weekends	72	36.3	0.39	781	28.3
BCO 3	All	1 794	38.5	0.17	1 026	16.5
BCO 3N	Summer	119	36.6	0.44	819	33.0
BCO 3S	All	1 675	38.6	0.18	1 041	17.4
	Summer	1 285	38.6	0.21	1 047	21.0
	Summer, Weekends	597	40.2	0.33	1 192	33.6
	Summer, Weekdays	688	37.2	0.27	922	25.2
	Winter	390	38.8	0.32	1 018	28.6
	Winter, Weekends	244	38.9	0.45	1 042	39.0
	Winter, Weekdays	146	38.6	0.43	979	39.6
BCO 5	All	874	38.2	0.19	957	16.3
	Summer	702	38.2	0.22	959	19.2
	Summer, Weekends	298	37.9	0.36	952	32.5
	Summer, Weekdays	404	38.4	0.27	964	23.3
	Winter	172	38.4	0.34	948	27.2
	Winter, Weekends	67	39.1	0.46	984	38.4
	Winter, Weekdays	105	38.0	0.47	925	37.1
BCO 7	All	1 703	34.7	0.12	705	9.0
	Summer	1 207	34.8	0.14	709	11.0
	Summer, Weekends	589	35.3	0.20	741	14.9
	Summer, Weekdays	618	34.3	0.19	678	16.1
	Winter	496	34.6	0.22	696	15.0
	Winter, Weekends	203	35.1	0.37	736	26.3
	Winter, Weekdays	293	34.2	0.26	668	17.4
BCO 8	All	464	35.0	0.20	713	13.8
	Summer	345	35.0	0.26	721	17.4
	Summer, Weekends	168	35.8	0.34	764	25.6
	Summer, Weekdays	177	34.3	0.38	680	23.3
	Winter	119	34.9	0.29	690	18.1

Table 8: Number of blue cod measured in the boat ramp surveys, N, mean length, L_m, and mean weight, W_m (both with standard errors), by Fishstock and several time strata

Fishstock	Stratum	N	L_m	$s.e.(L_m)$	W_m	$s.e.(W_m)$
BCO 1	All	125	32.1	0.48	564	23.6
BCO 3N	All	8 813	35.0	0.03	696	2.2
	Summer	5 560	35.0	0.04	693	2.4
	Summer, Weekends	5 427	35.0	0.04	690	2.3
	Summer, Weekdays	133	36.6	0.34	807	26.8
	Winter	3 253	35.0	0.06	701	4.4
BCO 3S	All	827	36.6	0.15	815	11.1
	Summer	734	36.6	0.16	817	12.0
	Winter	93	36.5	0.42	801	27.2
BCO 7	All	1 824	34.3	0.10	670	6.6
	Summer	1 103	34.4	0.12	673	8.4
	Winter	721	34.2	0.16	666	10.6

Table 9: Minimum legal size (MLS in cm) and maximum daily limits (MDL) applicable to the recreational fishery around New Zealand in 1996 for snapper and blue cod stocks. Where separate sub-area restictions are given, the Fishstock limits apply outside the sub-area

Fishstock	MLS	MDL
SNA 1	27	9
SNA 2	27	10
SNA 7	25	10
Marlborough Sounds	25	3
SNA 8	27	15
BCO 1	33	20
BCO 2	33	20
BCO 3	30	30
BCO 5	33	30
Paterson Inlet	33	15
BCO 7	33	20
Marlborough Sounds	28	6
BCO 8	33	20

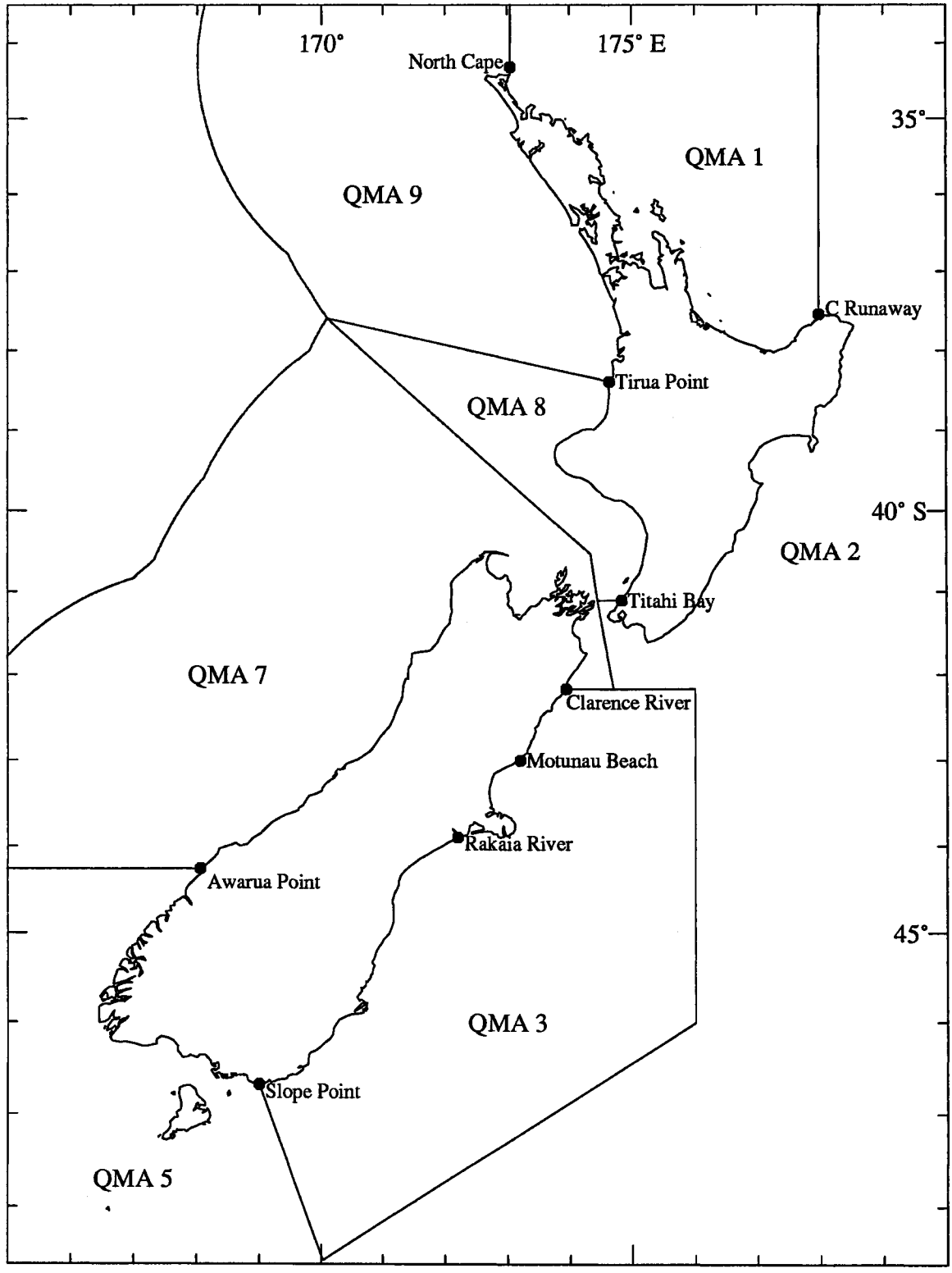
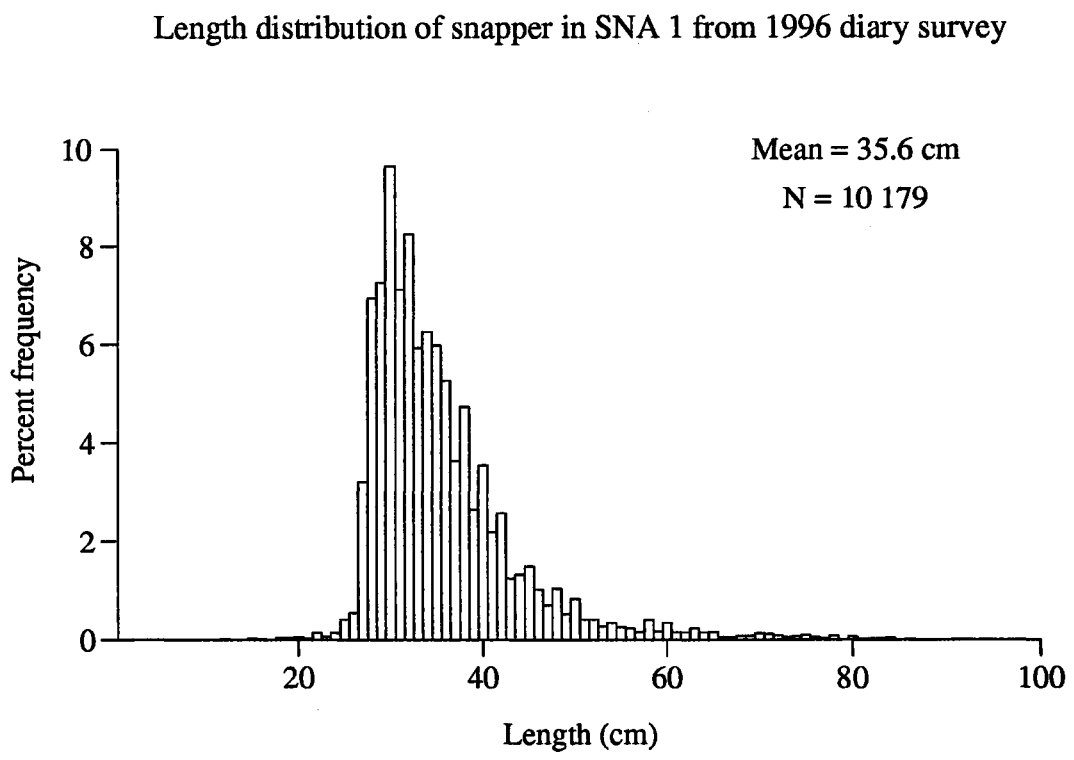


Figure 1: Map of New Zealand showing the QMAs which adjoin the coastline and places mentioned in this report.



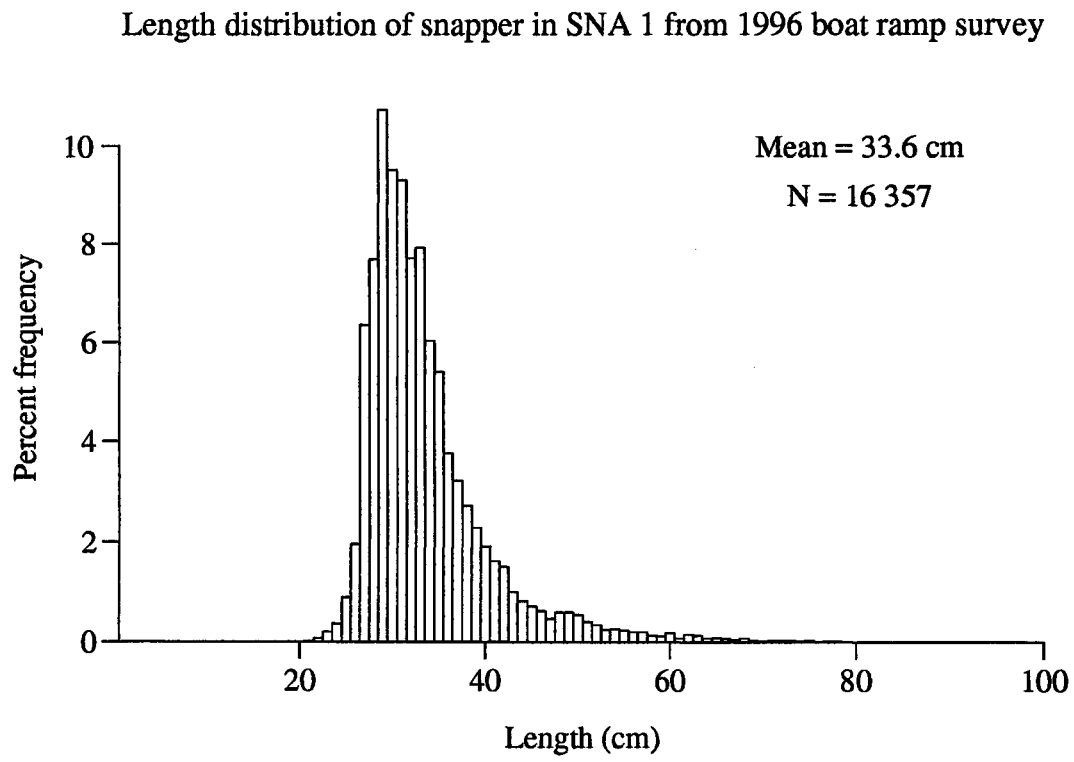


Figure 2: Comparison of length distributions of snapper measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The snapper were caught in SNA 1.

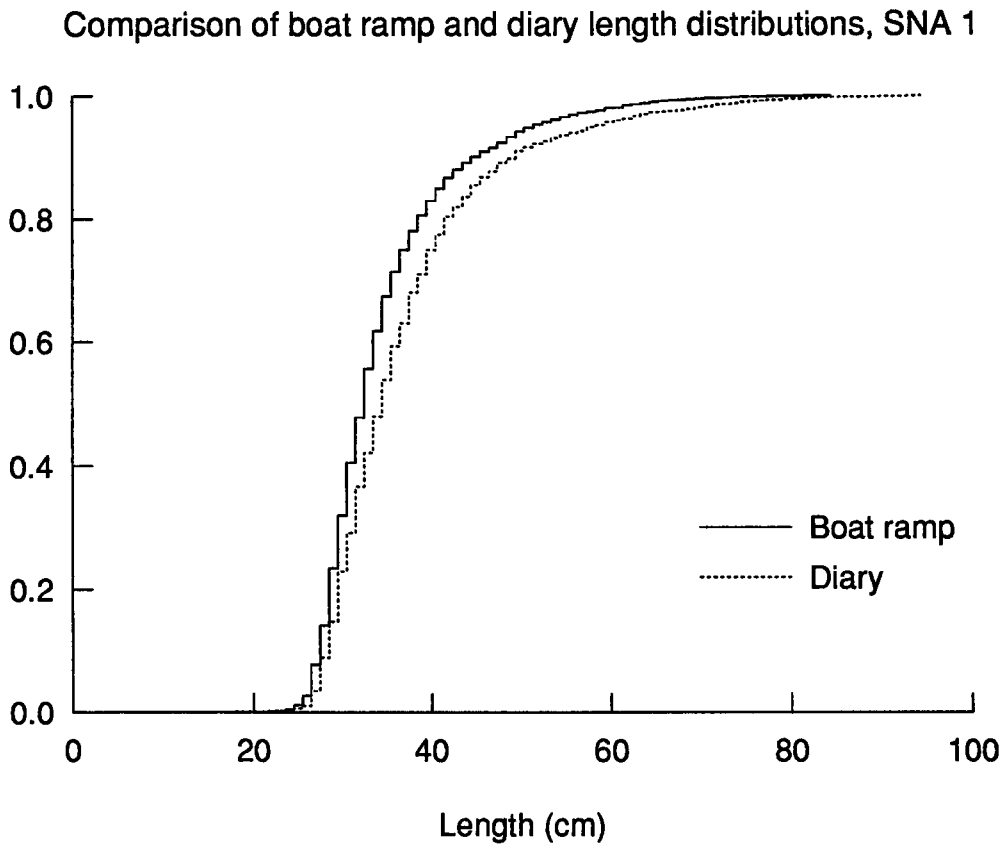


Figure 3: Comparison of cumulative length distributions of snapper measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The snapper were caught in SNA 1.

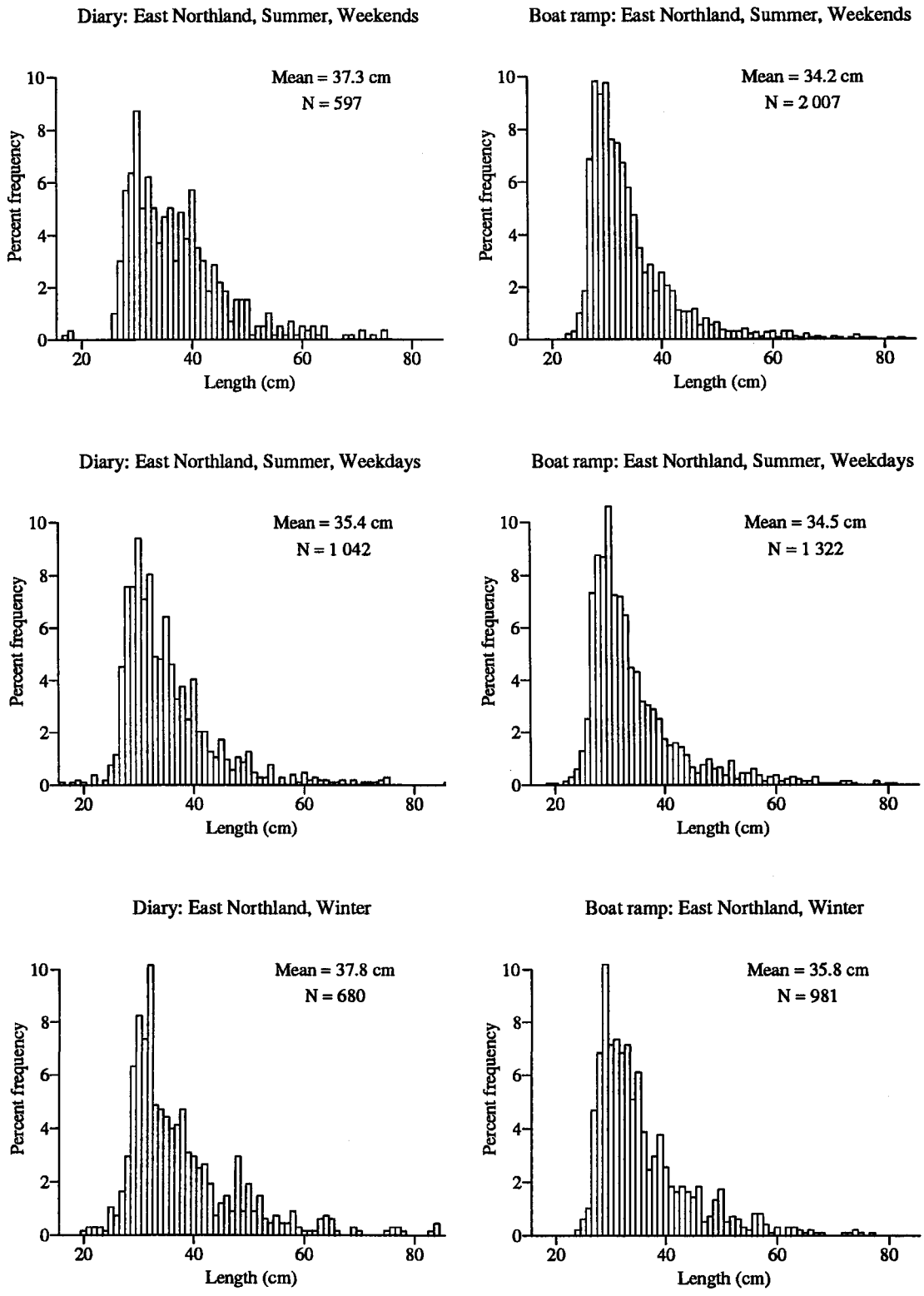


Figure 4: Comparison of length distributions of snapper measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The snapper were caught in east Northland.

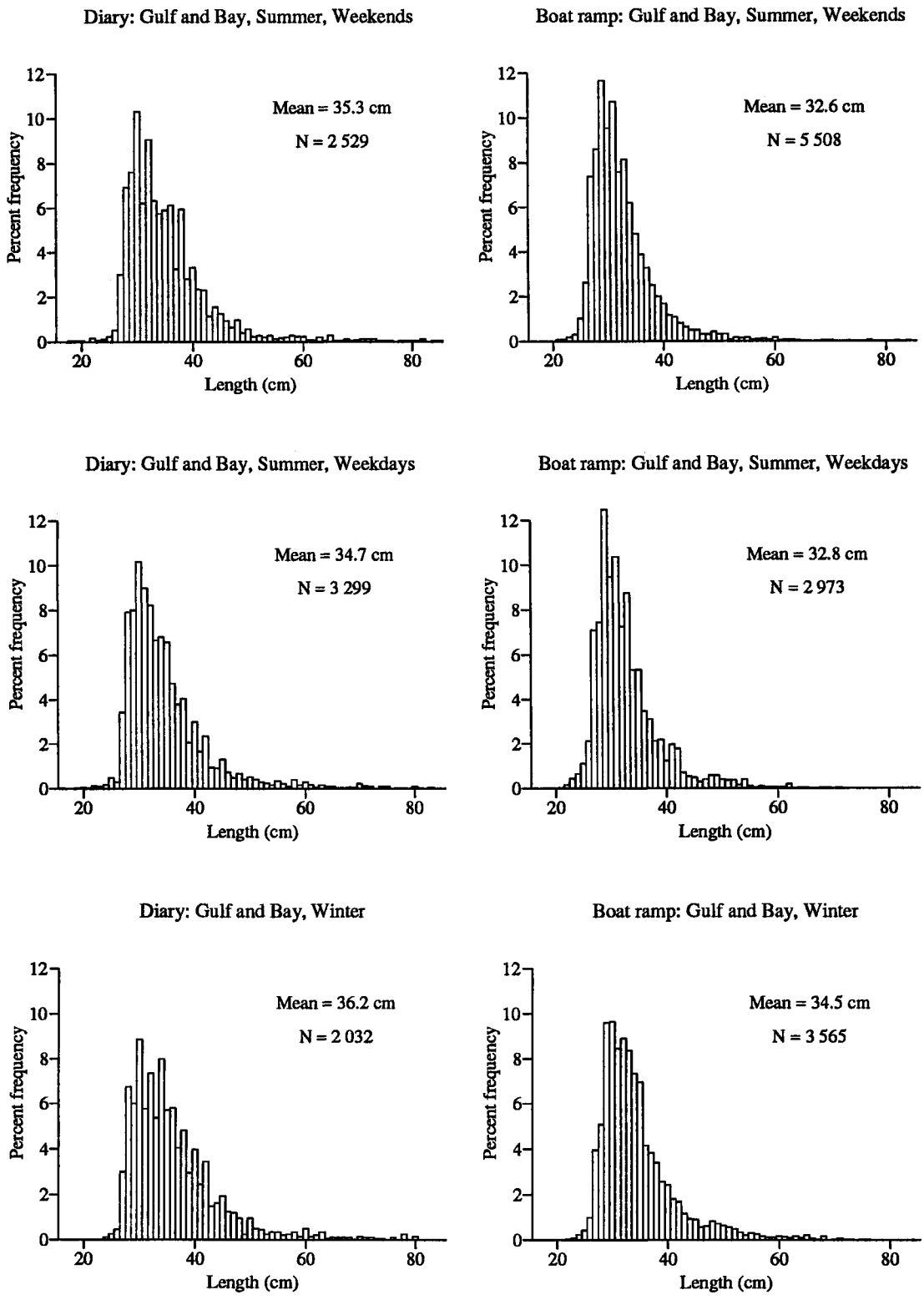


Figure 5: Comparison of length distributions of snapper measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The snapper were caught in the Hauraki Gulf and the Bay of Plenty.

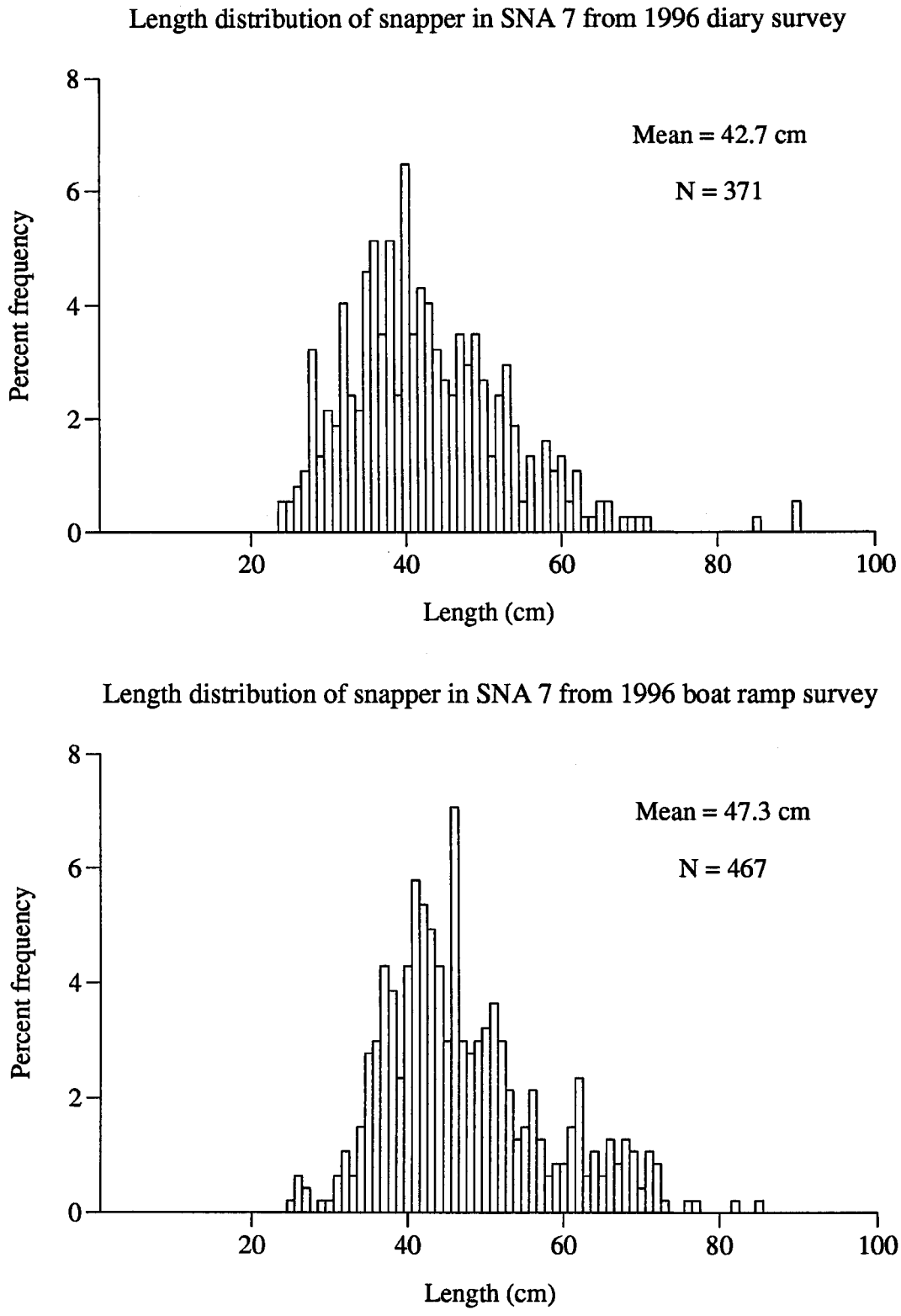


Figure 6: Comparison of length distributions of snapper measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The snapper were caught in SNA 7.

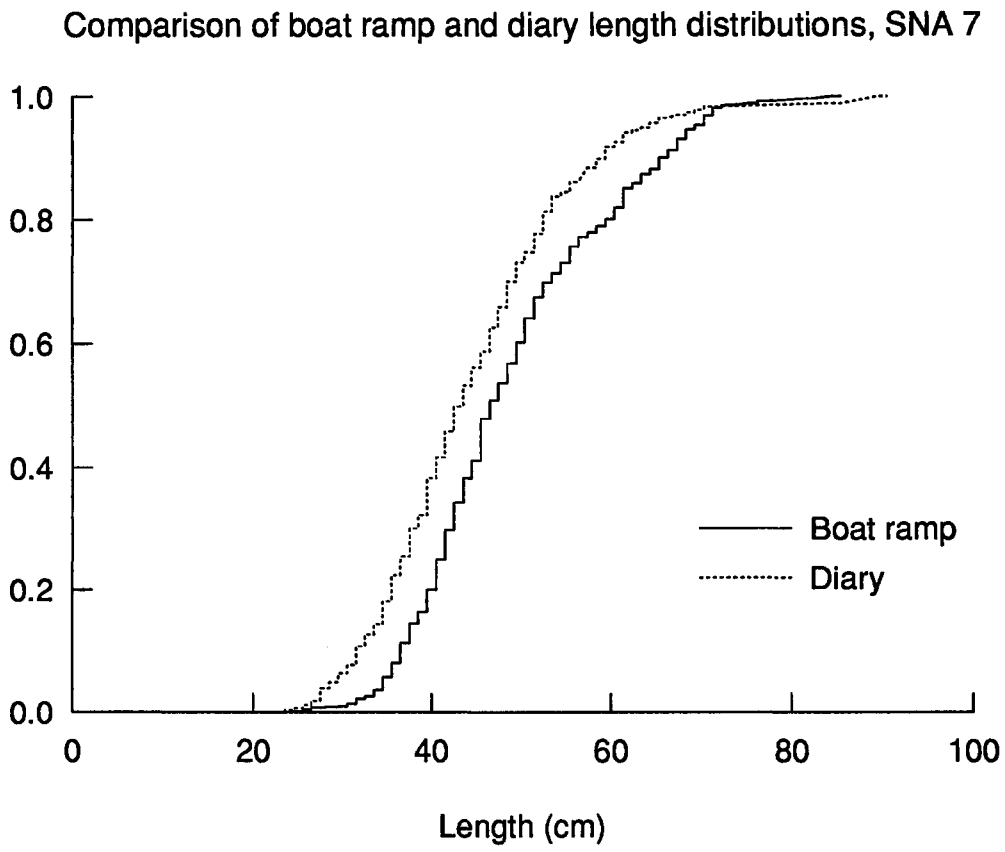


Figure 7: Comparison of cumulative length distributions of snapper measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The snapper were caught in SNA 7.

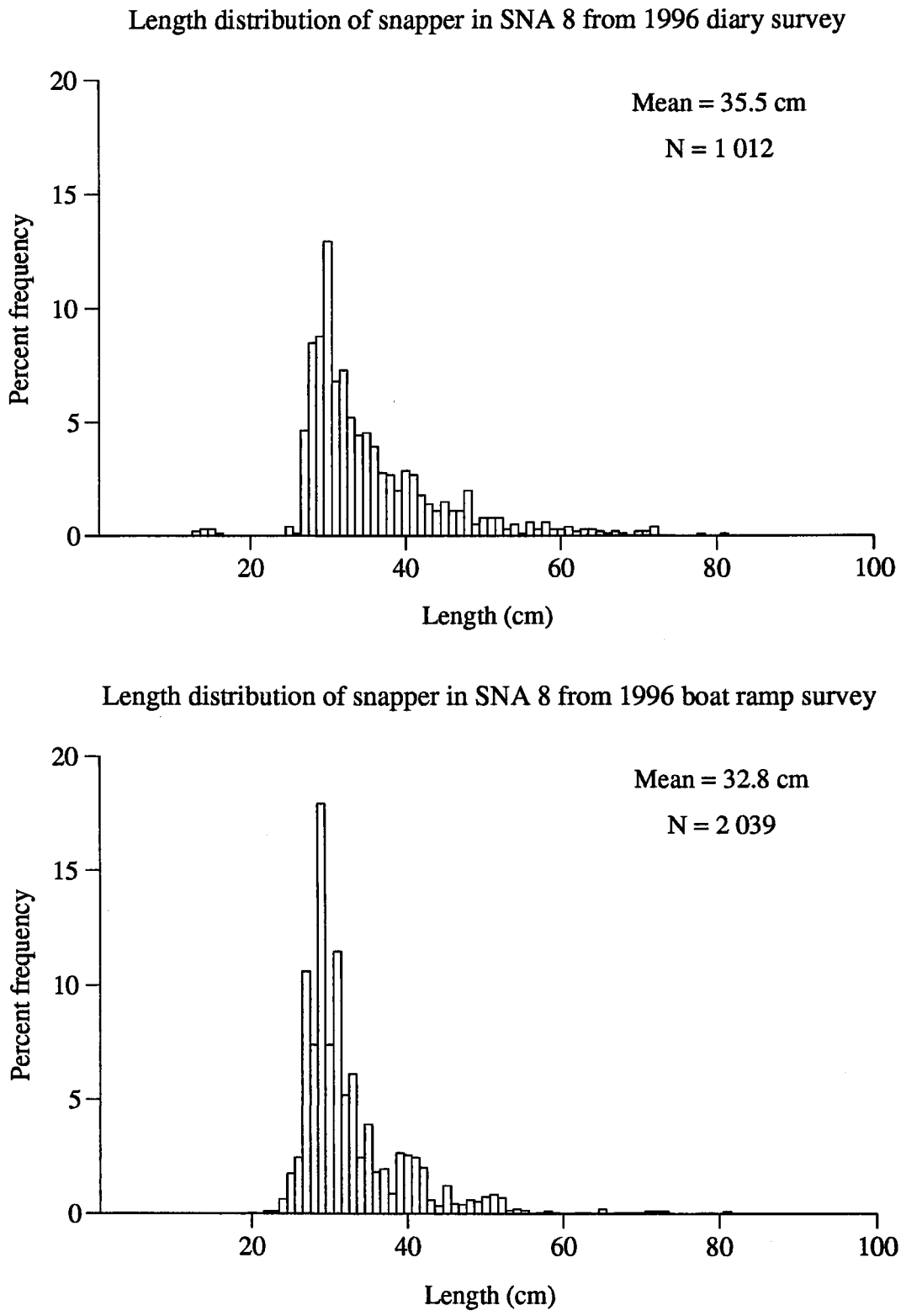


Figure 8: Comparison of length distributions of snapper measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The snapper were caught in SNA 8.

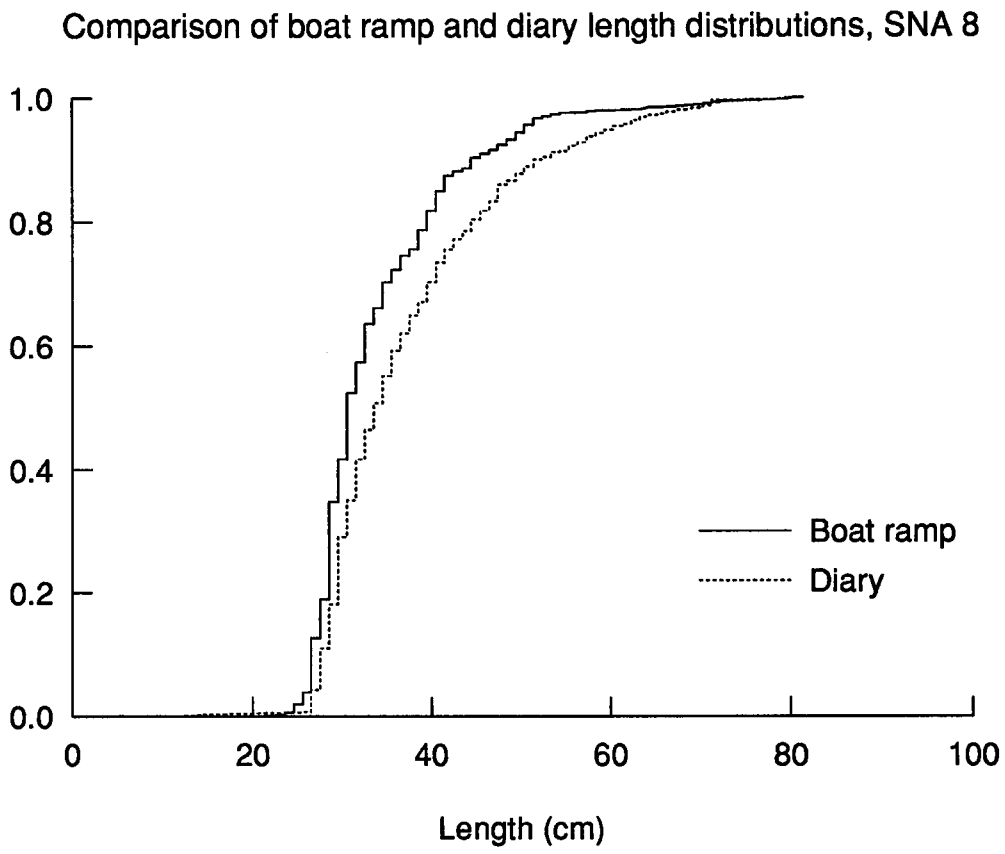


Figure 9: Comparison of cumulative length distributions of snapper measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The snapper were caught in SNA 8.

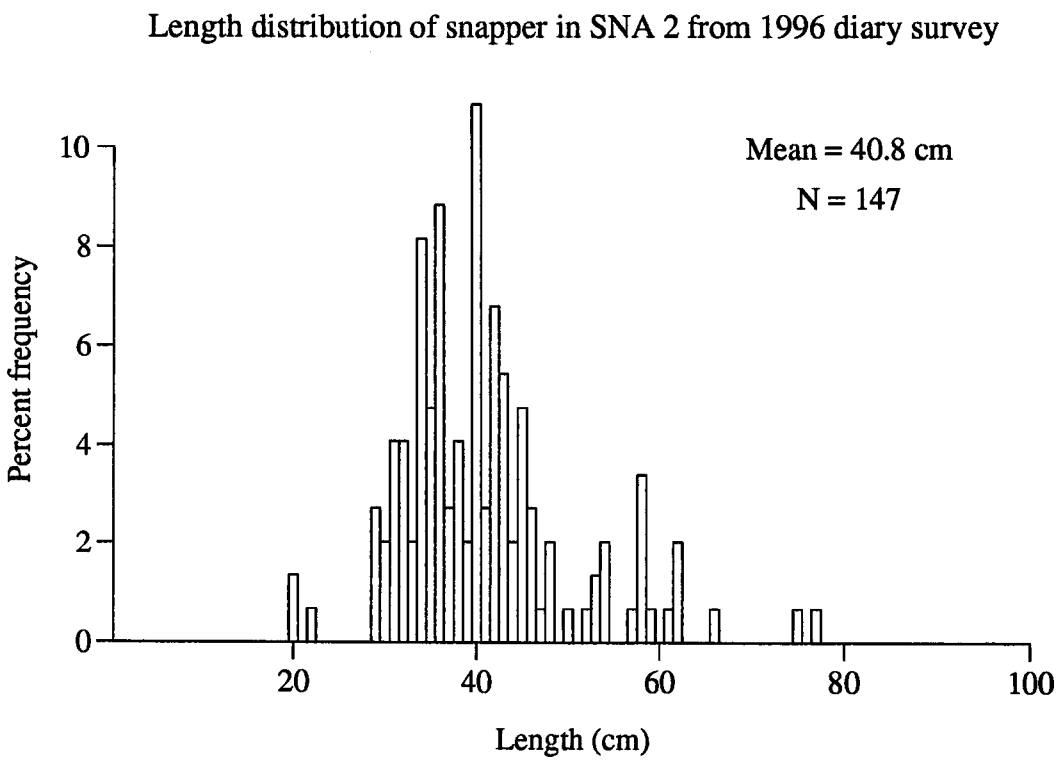


Figure 10: Length distribution of snapper measured by diarists in the 1996 national diary survey. The snapper were caught in SNA 2.

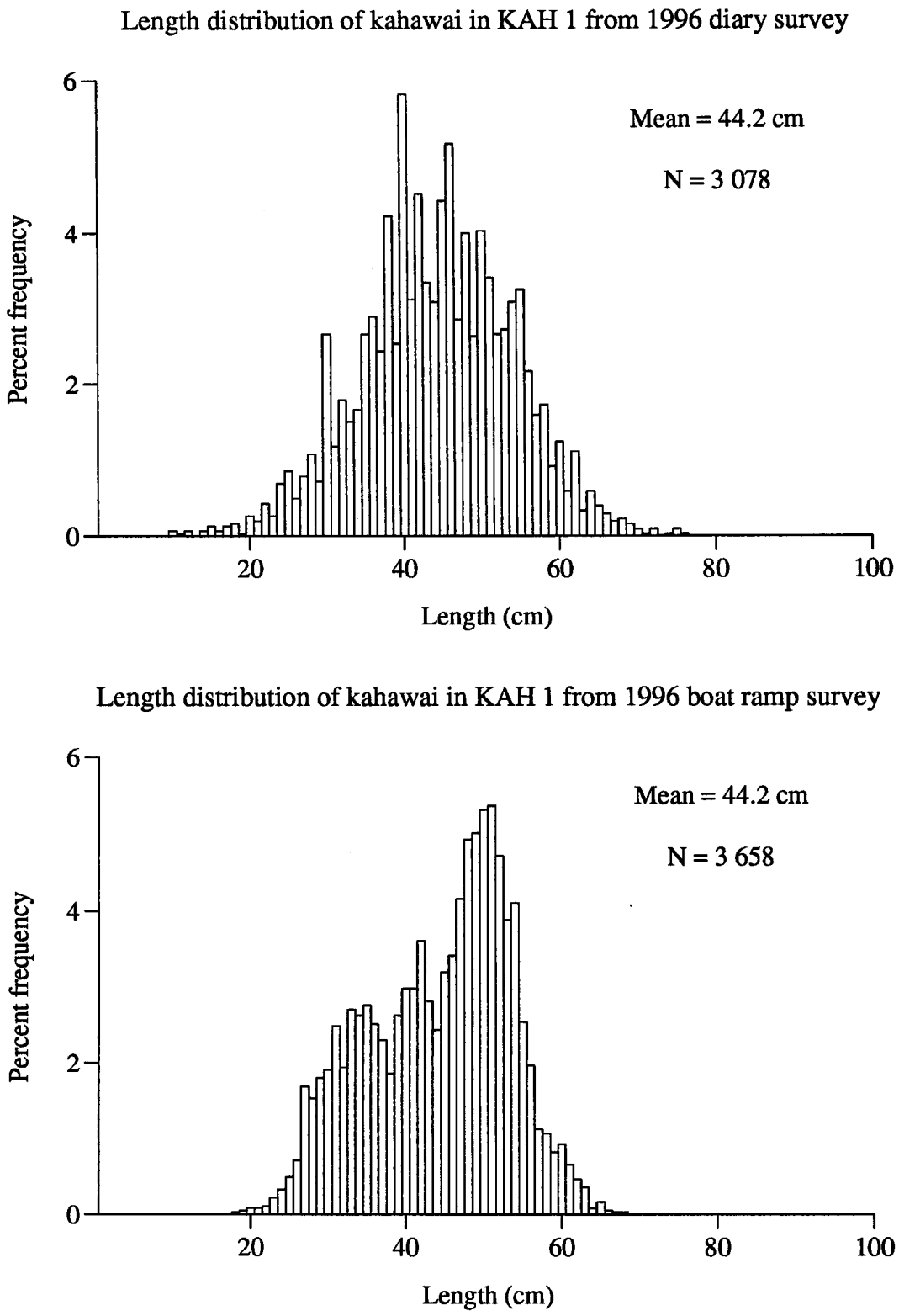


Figure 11: Comparison of length distributions of kahawai measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The kahawai were caught in KAH 1.

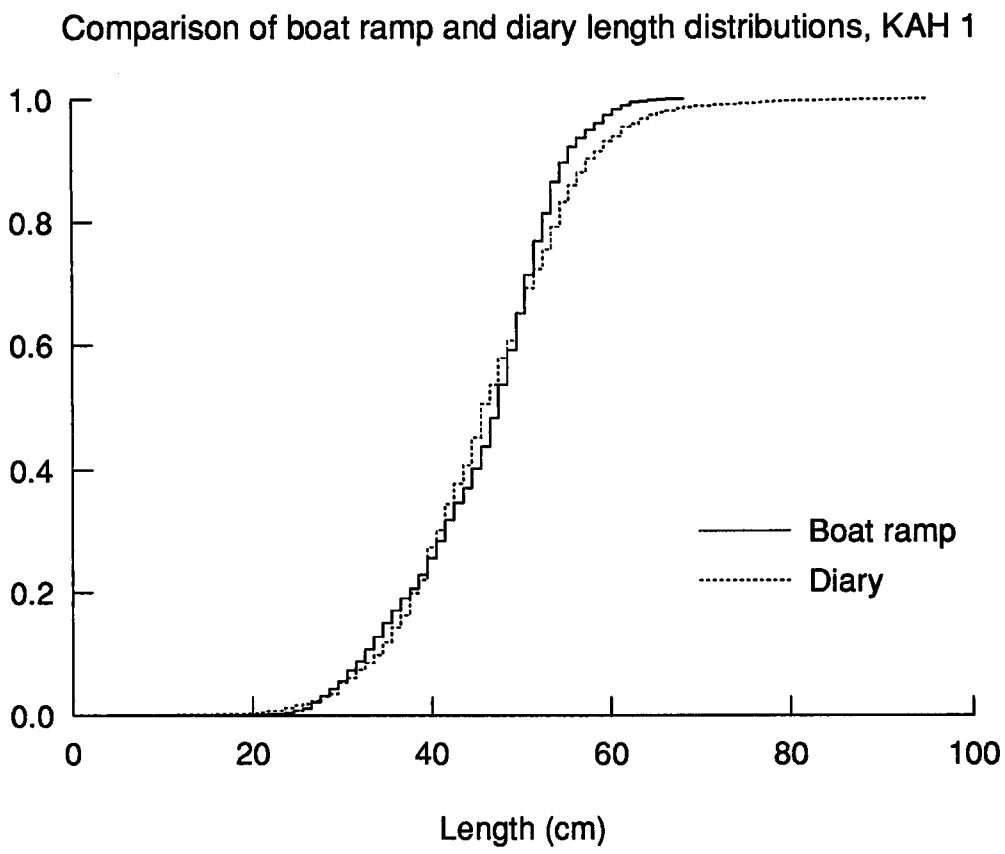


Figure 12: Comparison of cumulative length distributions of kahawai measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The kahawai were caught in KAH 1.

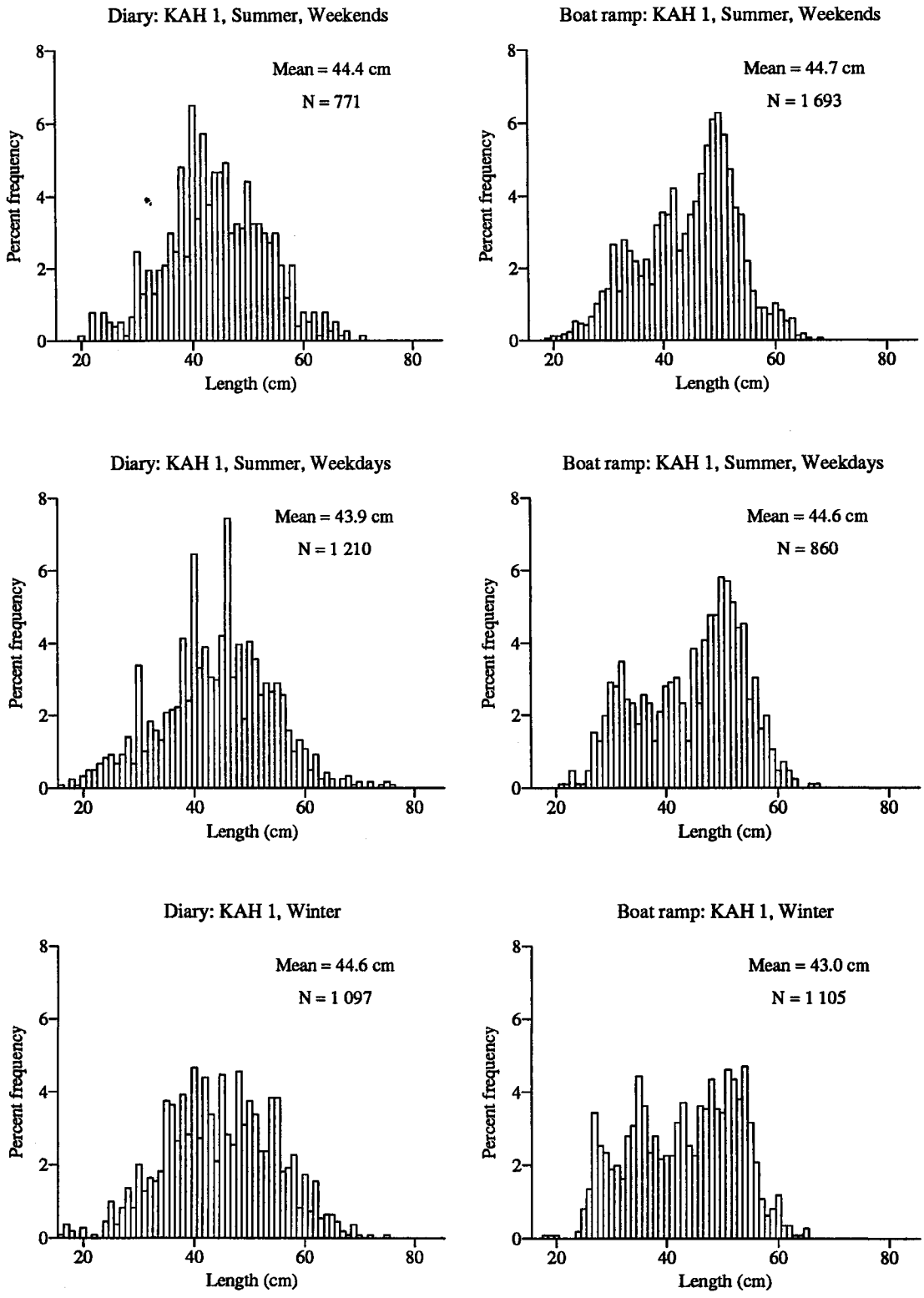


Figure 13: Comparison of length distributions of kahawai measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The kahawai were caught in KAH 1 at the specified times.

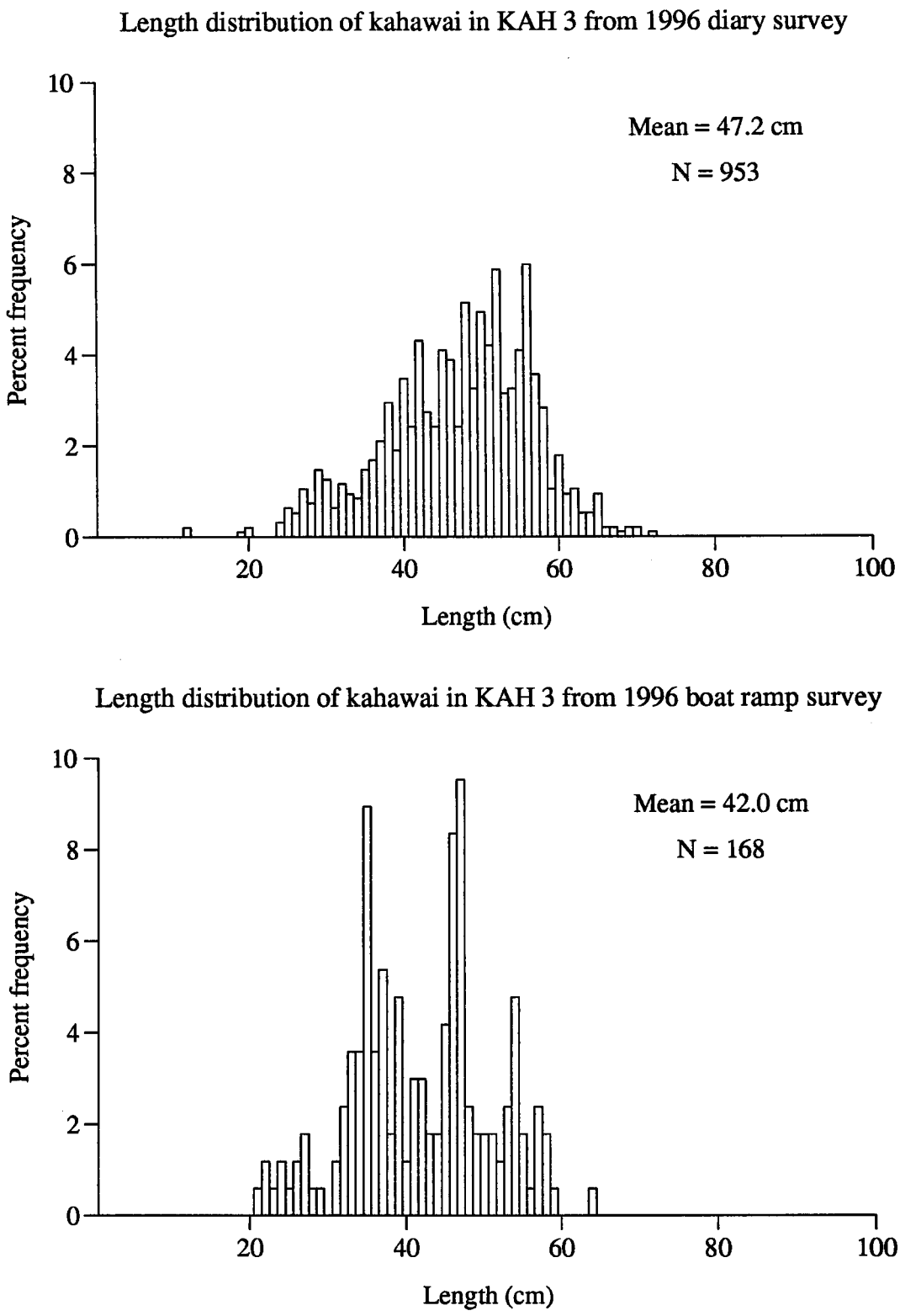


Figure 14: Comparison of length distributions of kahawai measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The kahawai were caught in KAH 3.

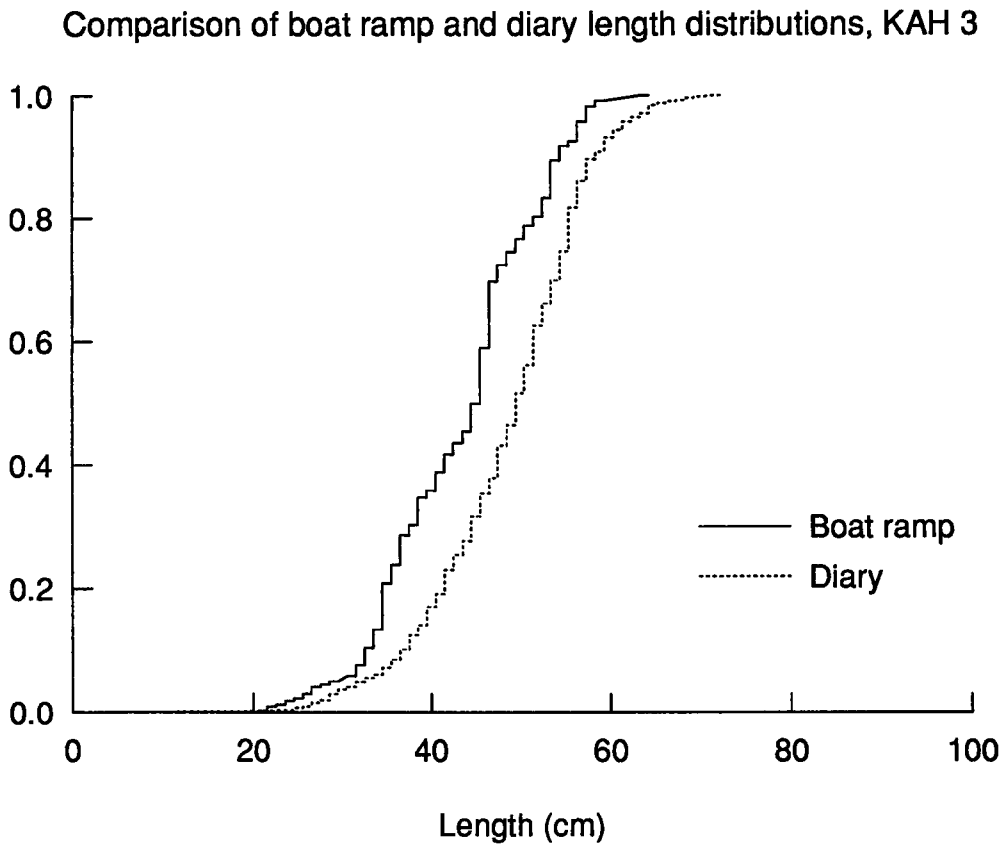
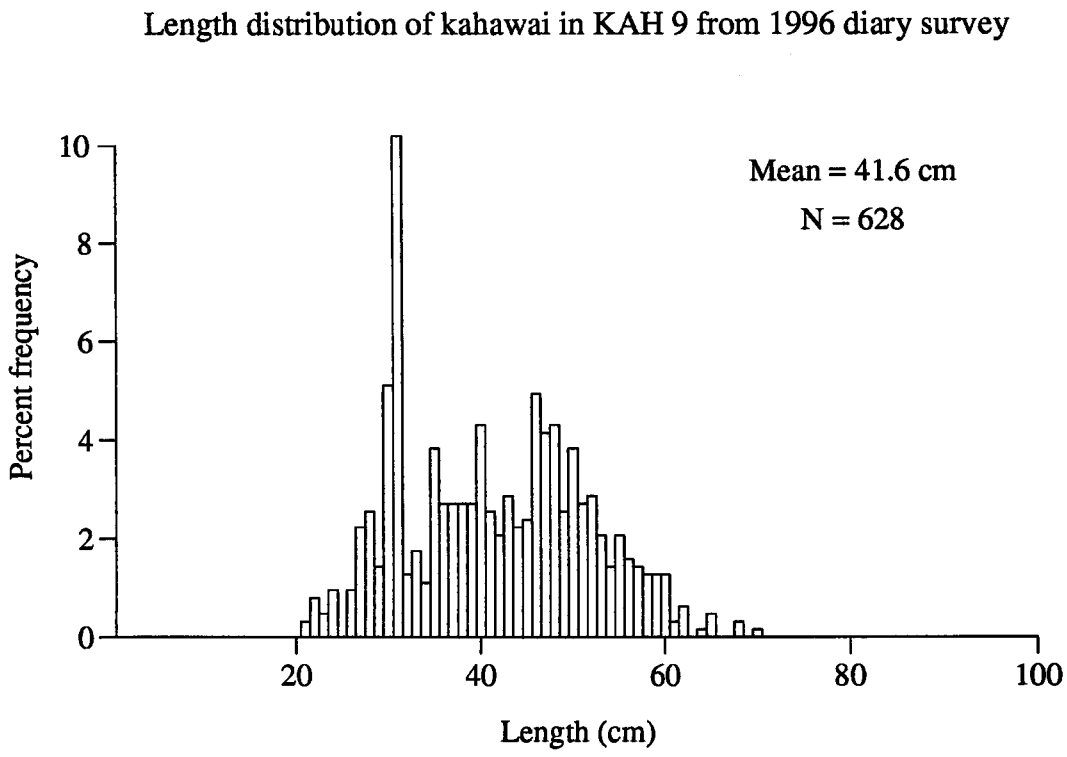


Figure 15: Comparison of cumulative length distributions of kahawai measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The kahawai were caught in KAH 3.



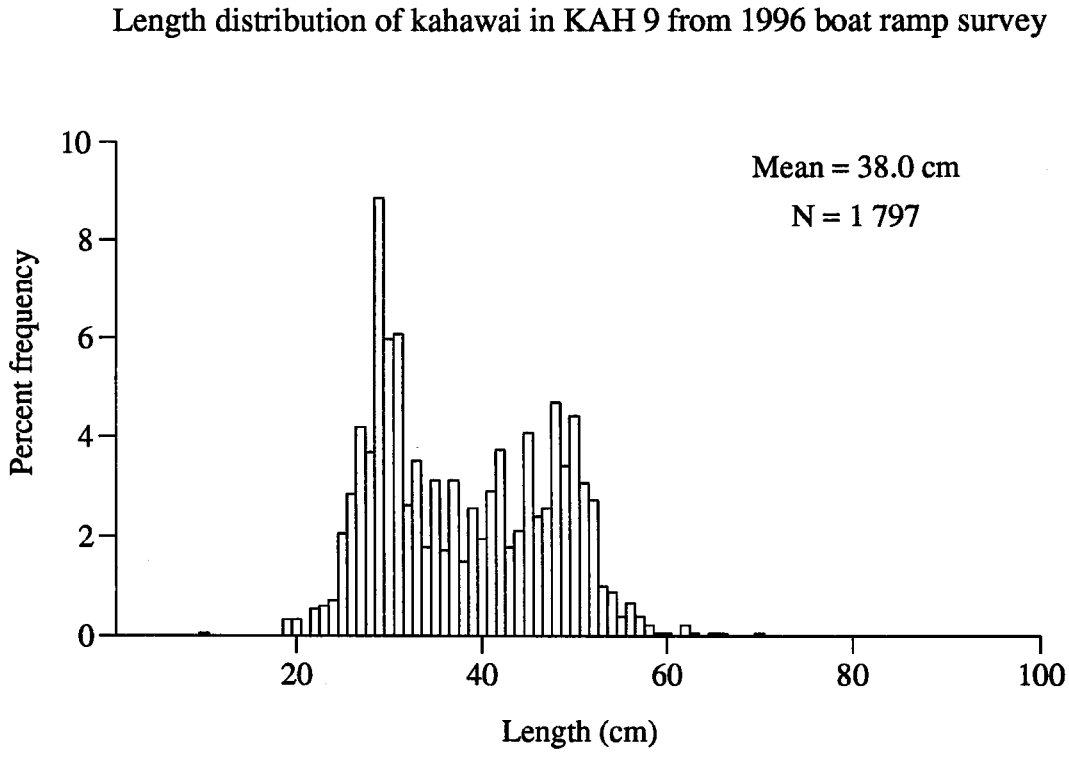


Figure 16: Comparison of length distributions of kahawai measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The kahawai were caught in KAH 9.

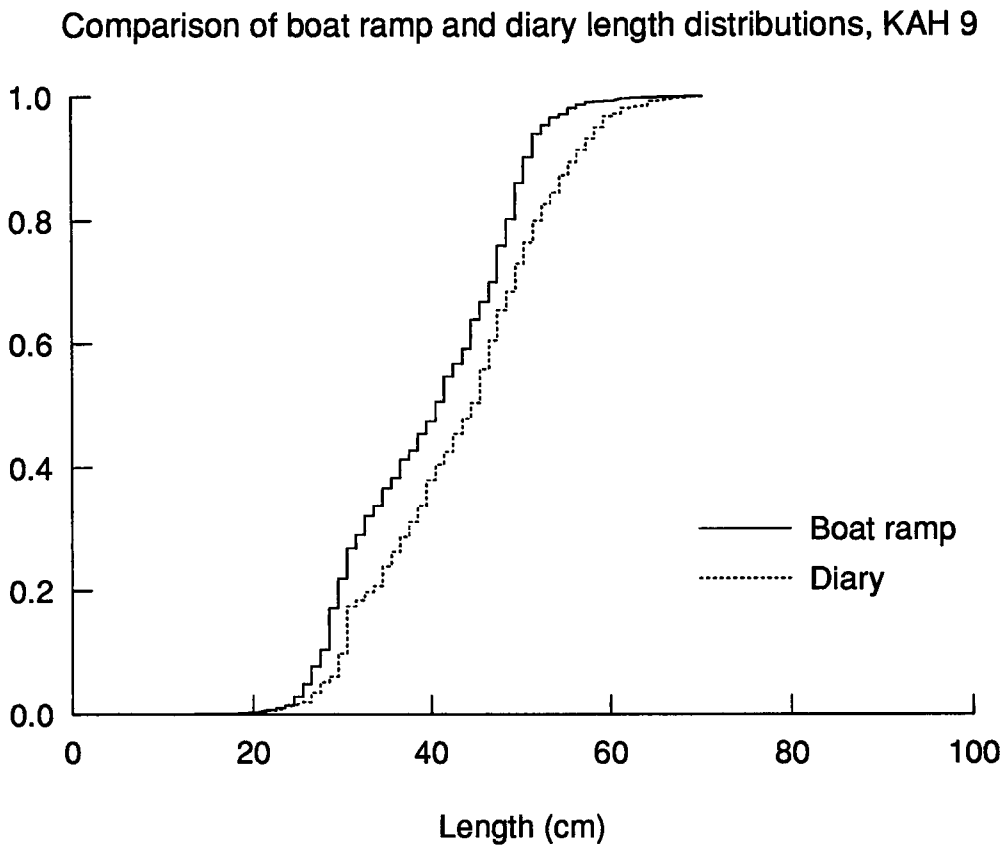


Figure 17: Comparison of cumulative length distributions of kahawai measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The kahawai were caught in KAH 9.

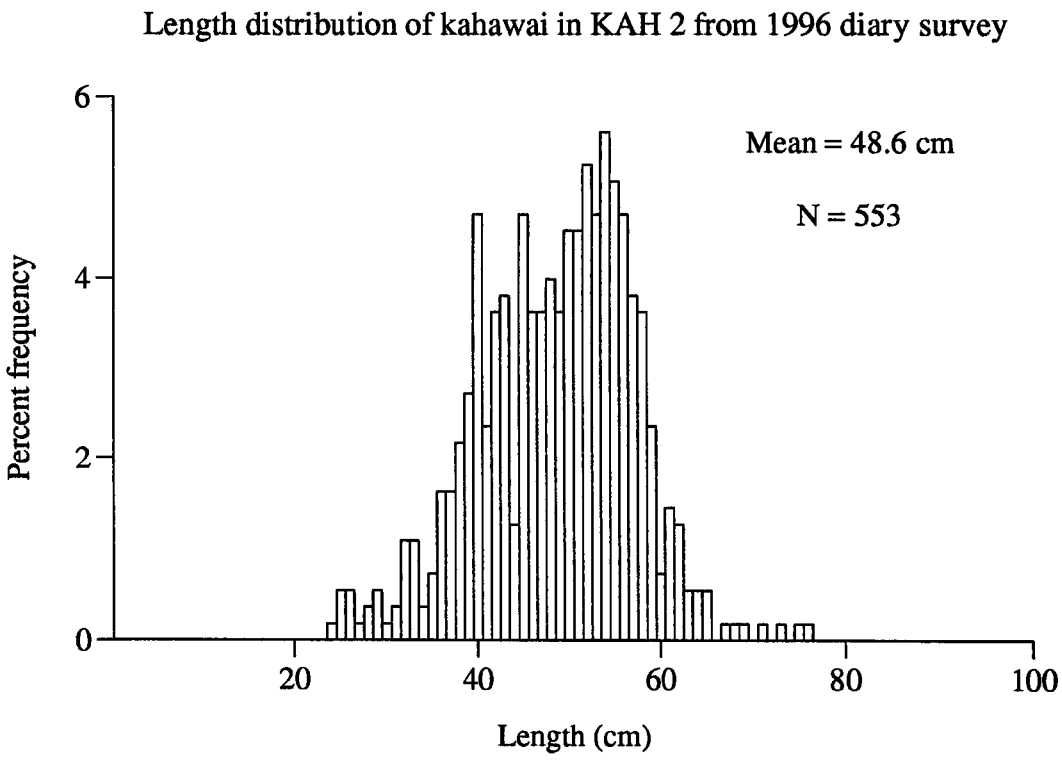


Figure 18: Length distribution of kahawai measured by diarists in the 1996 national diary survey. The kahawai were caught in KAH 2.

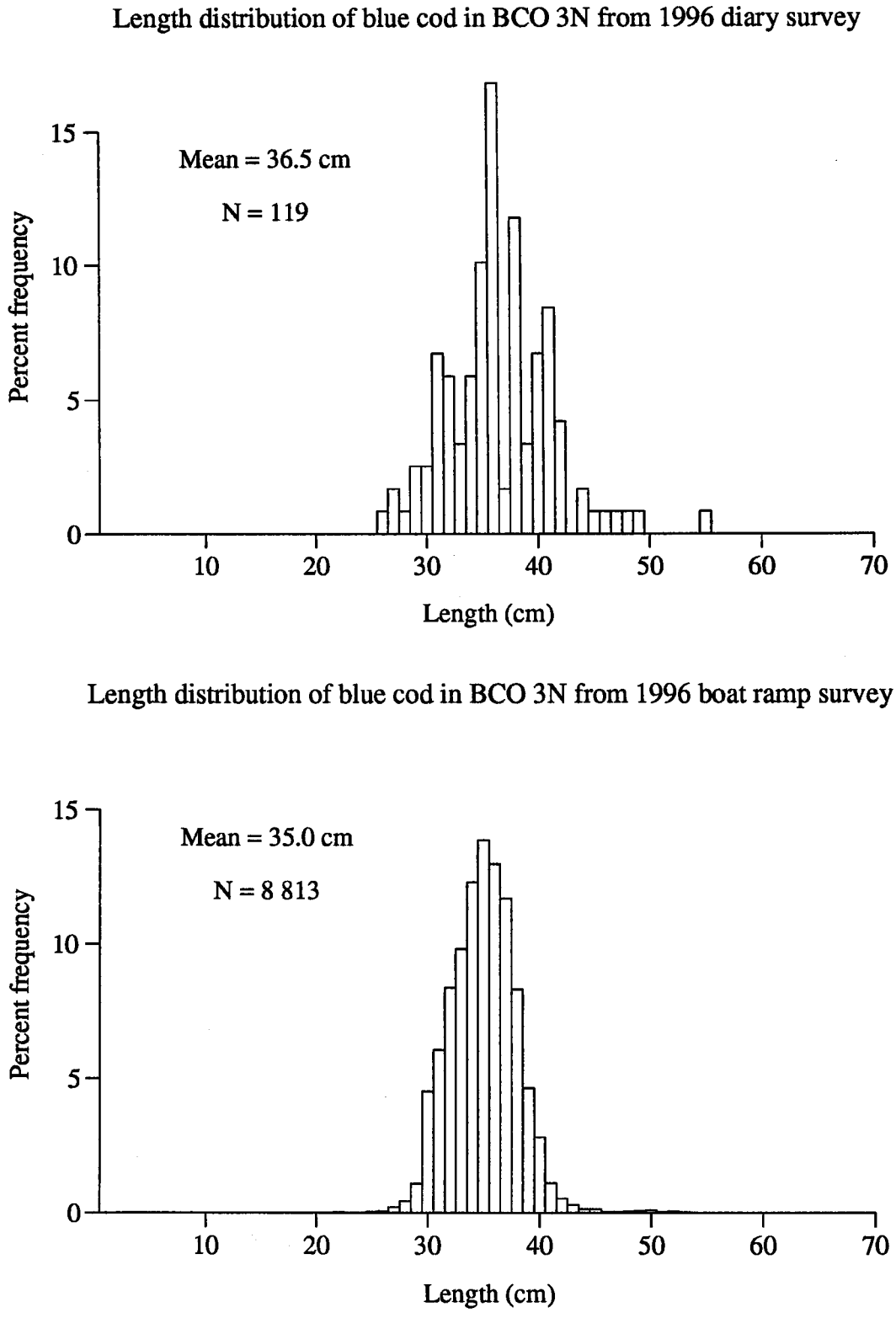


Figure 19: Comparison of length distributions of blue cod measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The blue cod were caught in the northern part of BCO 3.

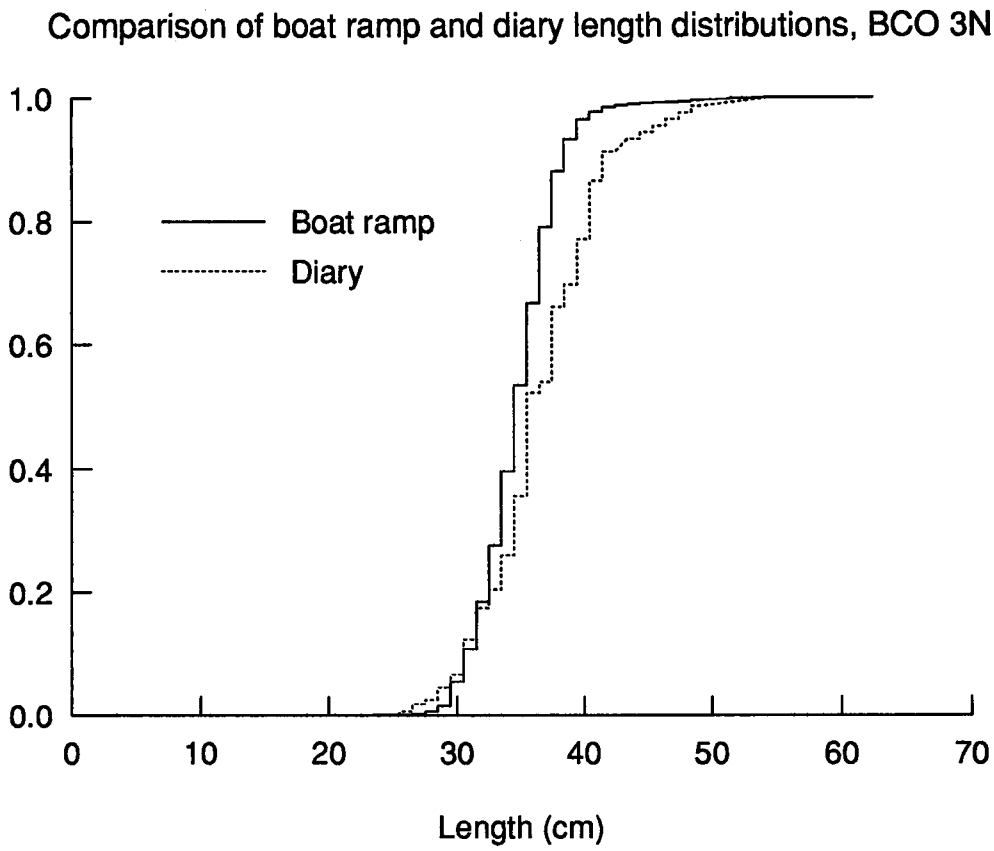
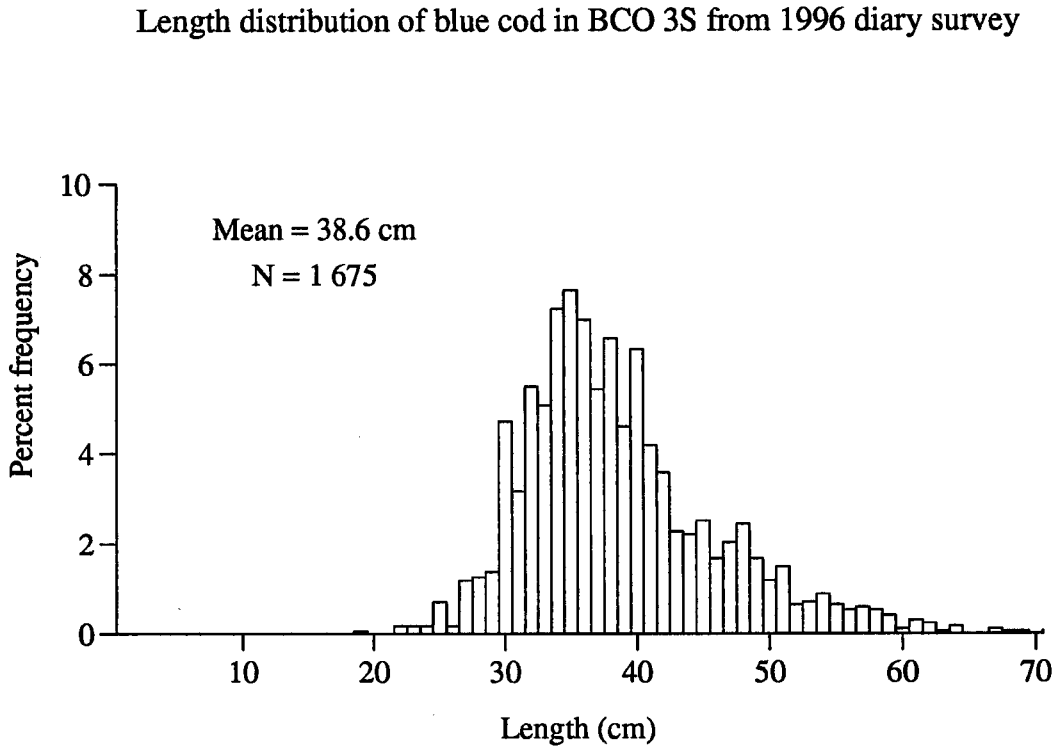


Figure 20: Comparison of cumulative length distributions of blue cod measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The blue cod were caught in the northern part of BCO 3.



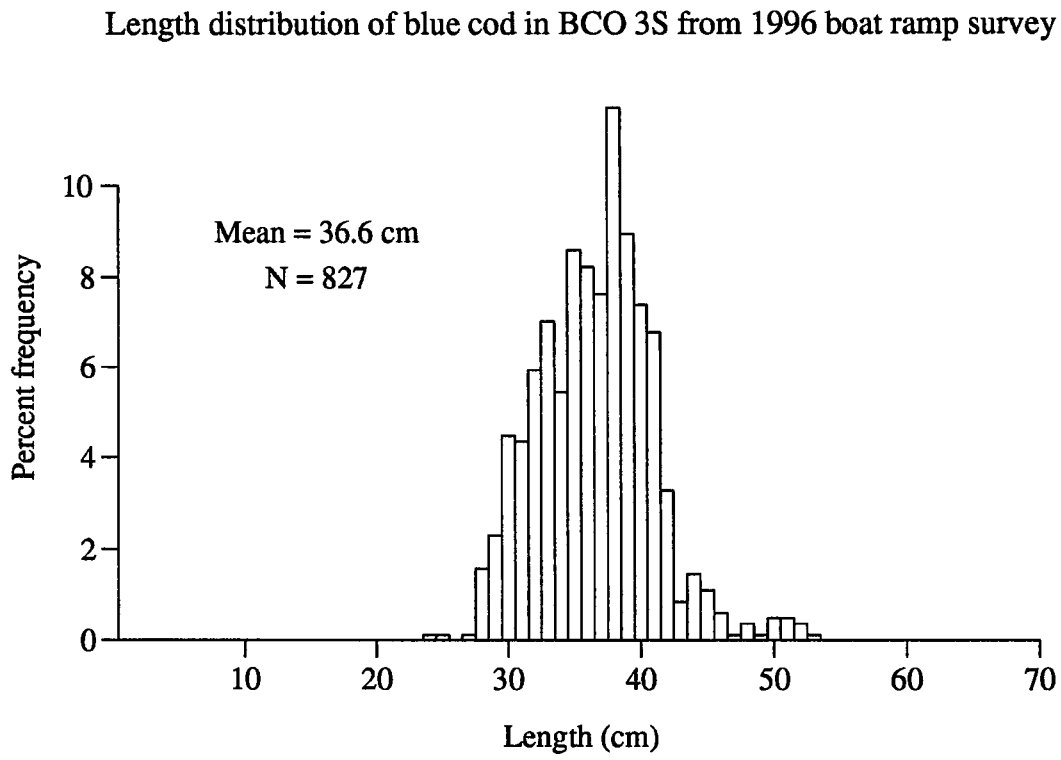


Figure 21: Comparison of length distributions of blue cod measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The blue cod were caught in the southern part of BCO 3.

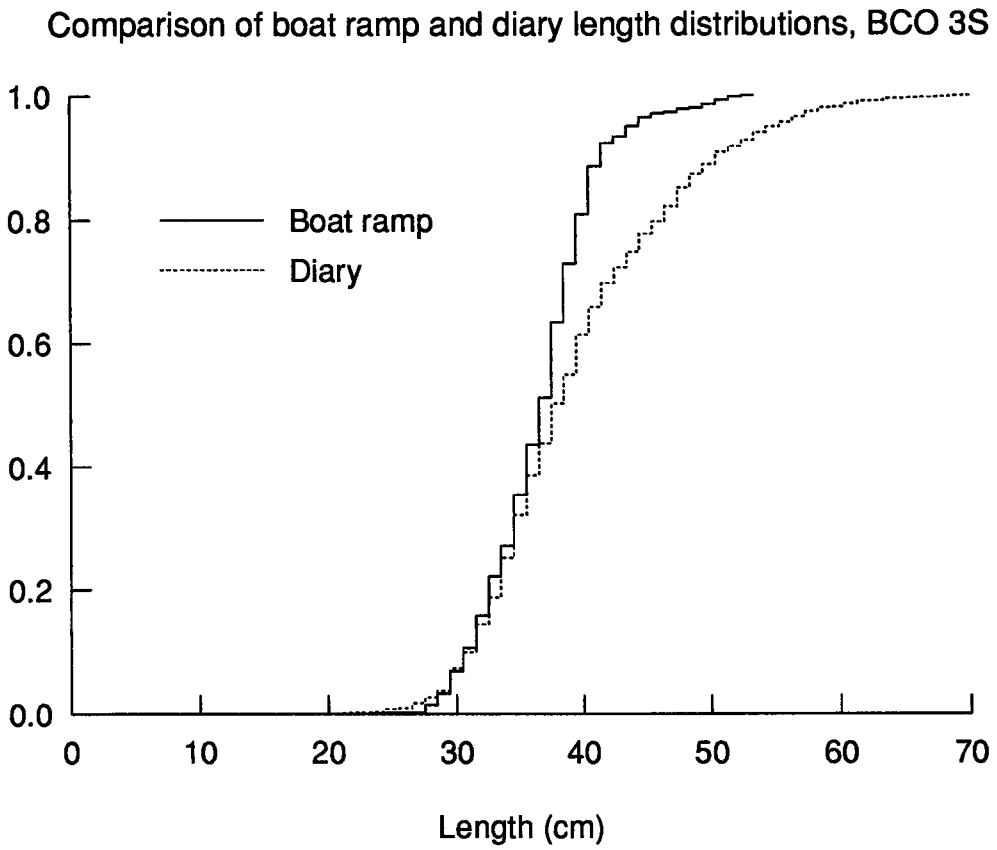


Figure 22: Comparison of cumulative length distributions of blue cod measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The blue cod were caught in the southern part of BCO 3.

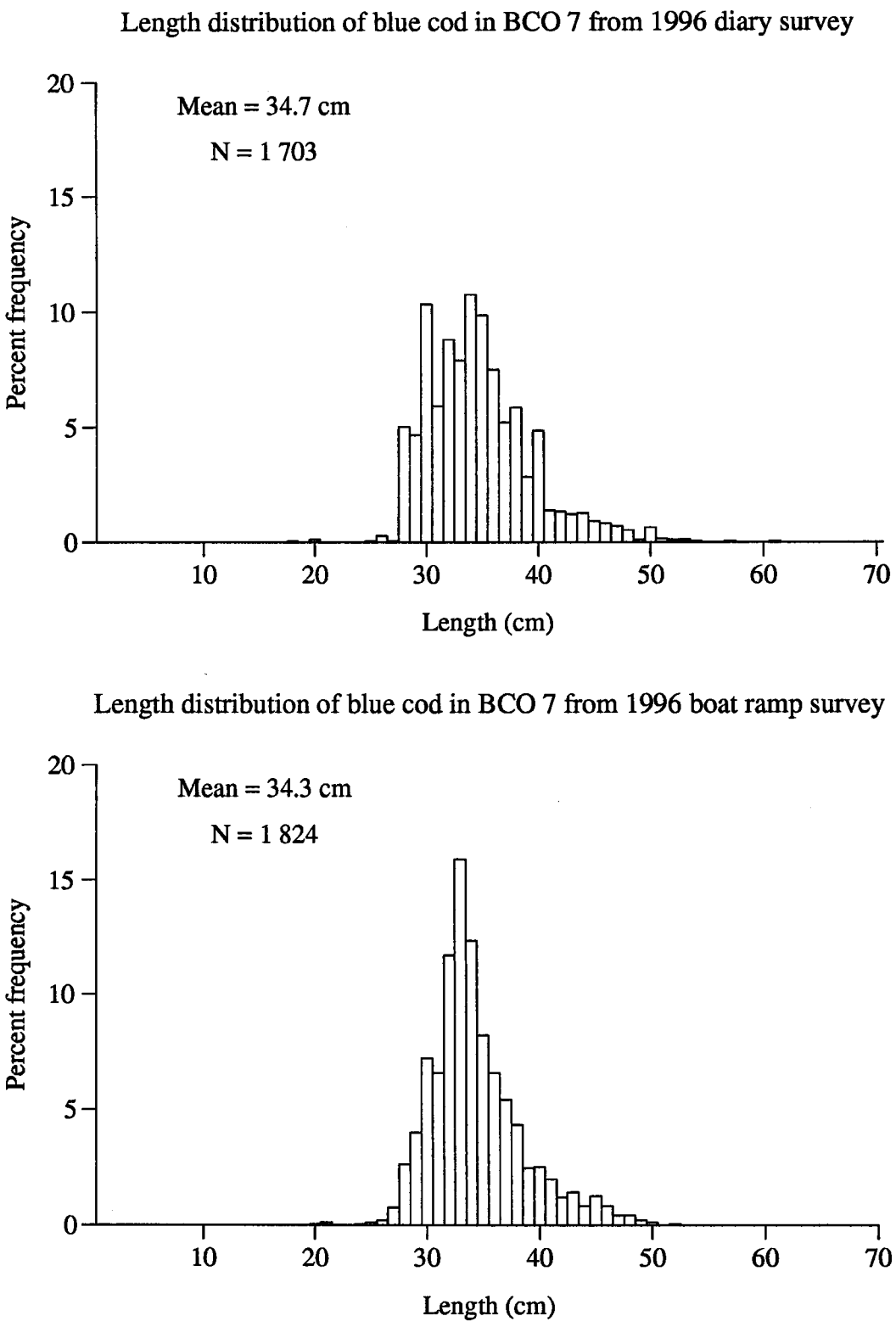


Figure 23: Comparison of length distributions of blue cod measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The blue cod were caught in BCO 7.

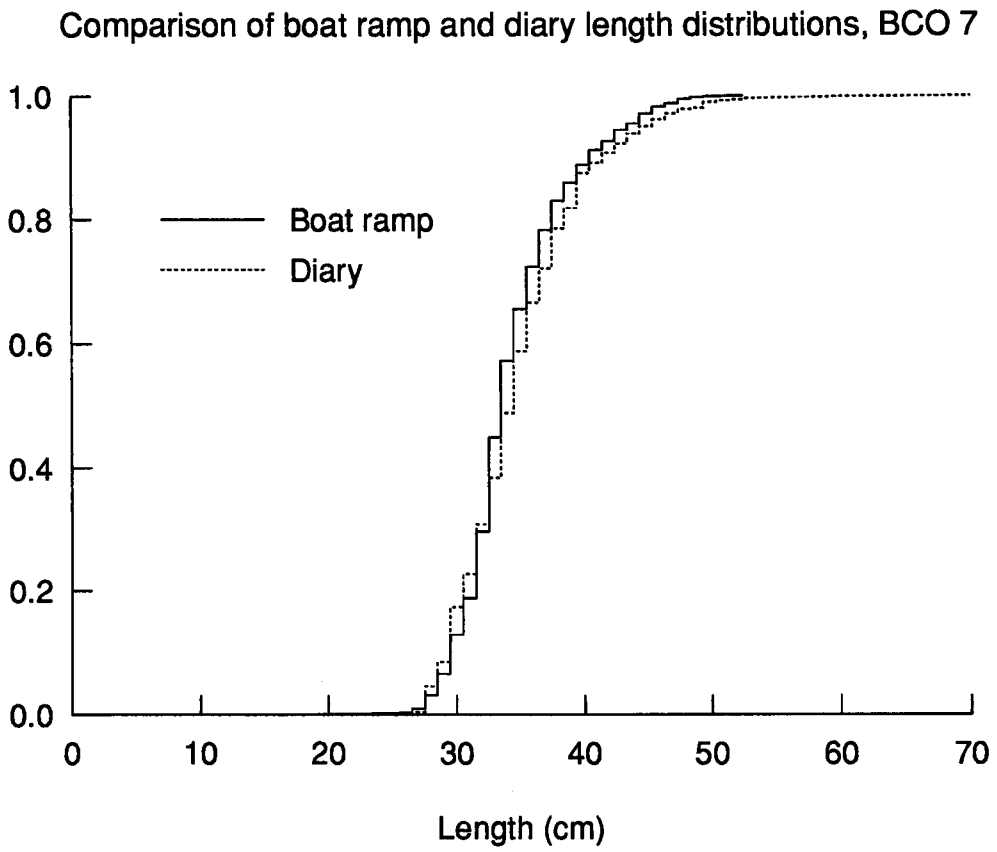


Figure 24: Comparison of cumulative length distributions of blue cod measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The blue cod were caught in BCO 7.

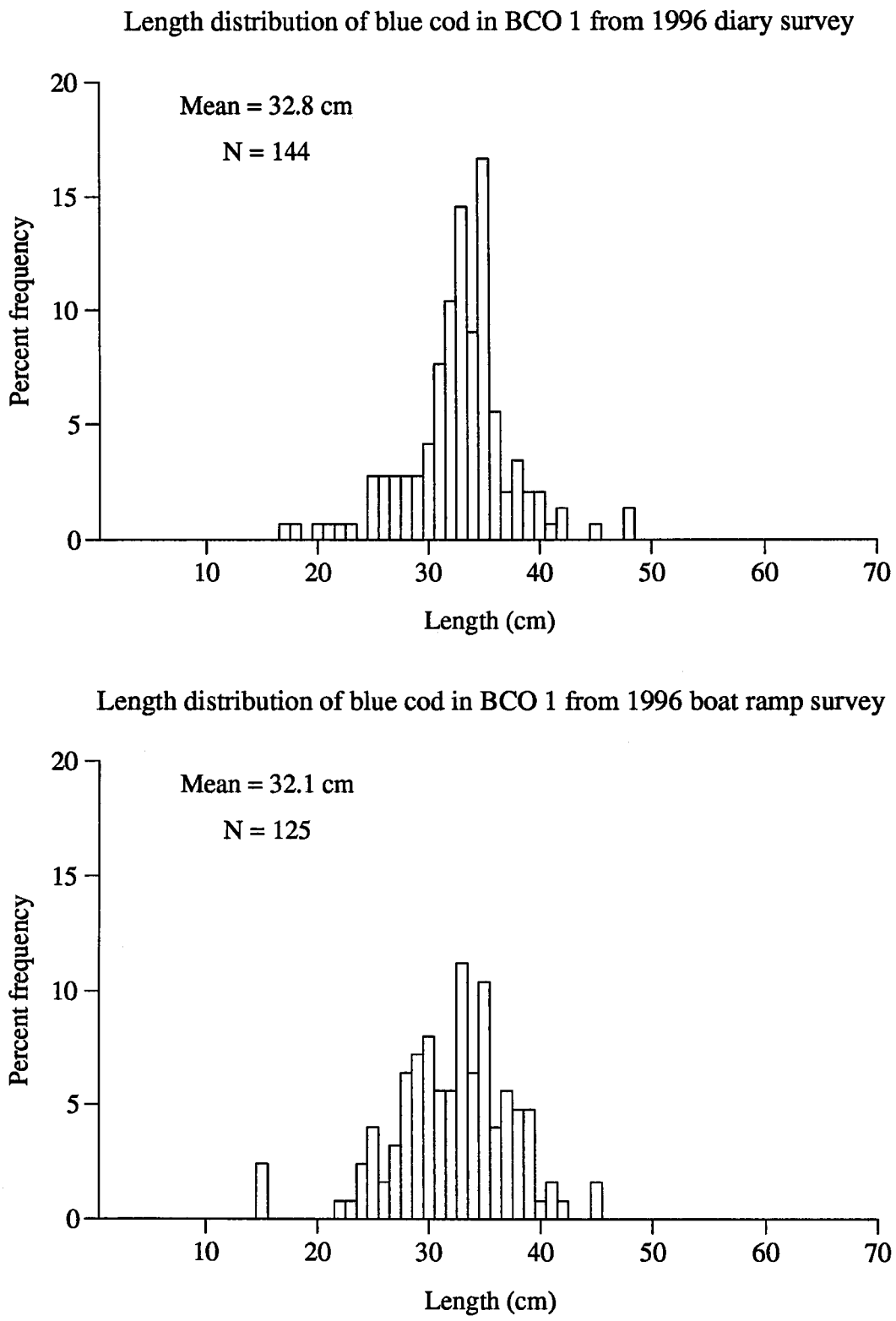


Figure 25: Comparison of length distributions of blue cod measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The blue cod were caught in BCO 1.

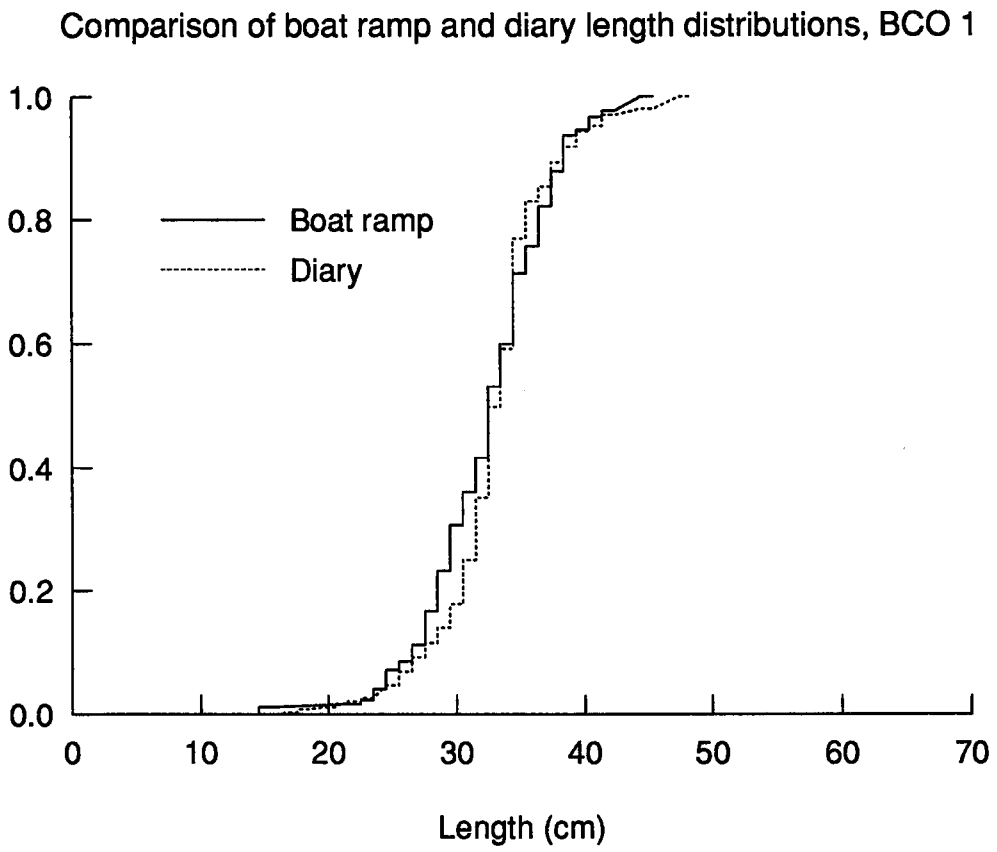


Figure 26: Comparison of cumulative length distributions of blue cod measured in the 1996 boat ramp survey and by diarists in the 1996 national diary survey. The blue cod were caught in BCO 1.

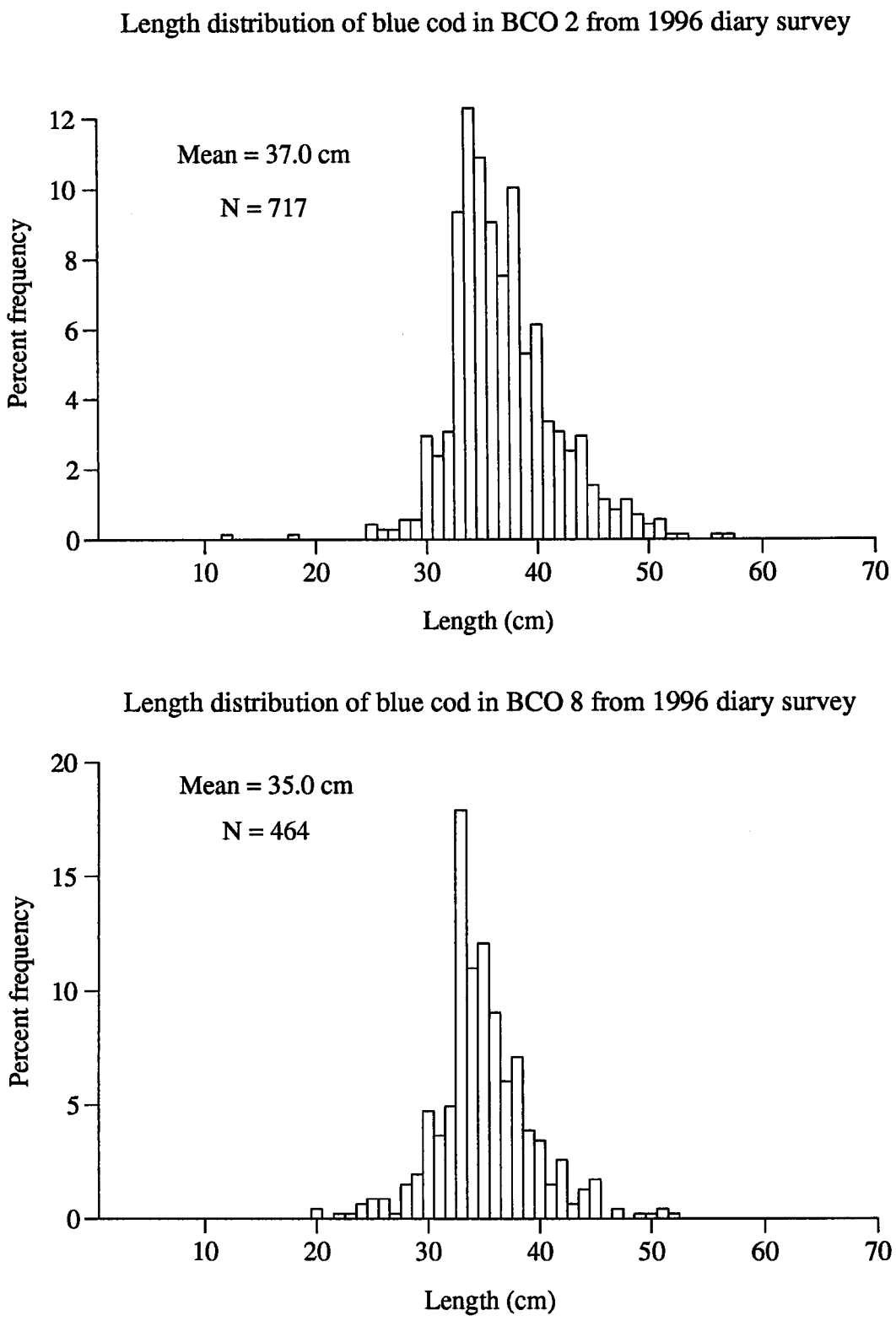


Figure 27: Length distributions of blue cod measured by diarists in the 1996 national diary survey. The blue cod were caught in BCO 2 and BCO 8.

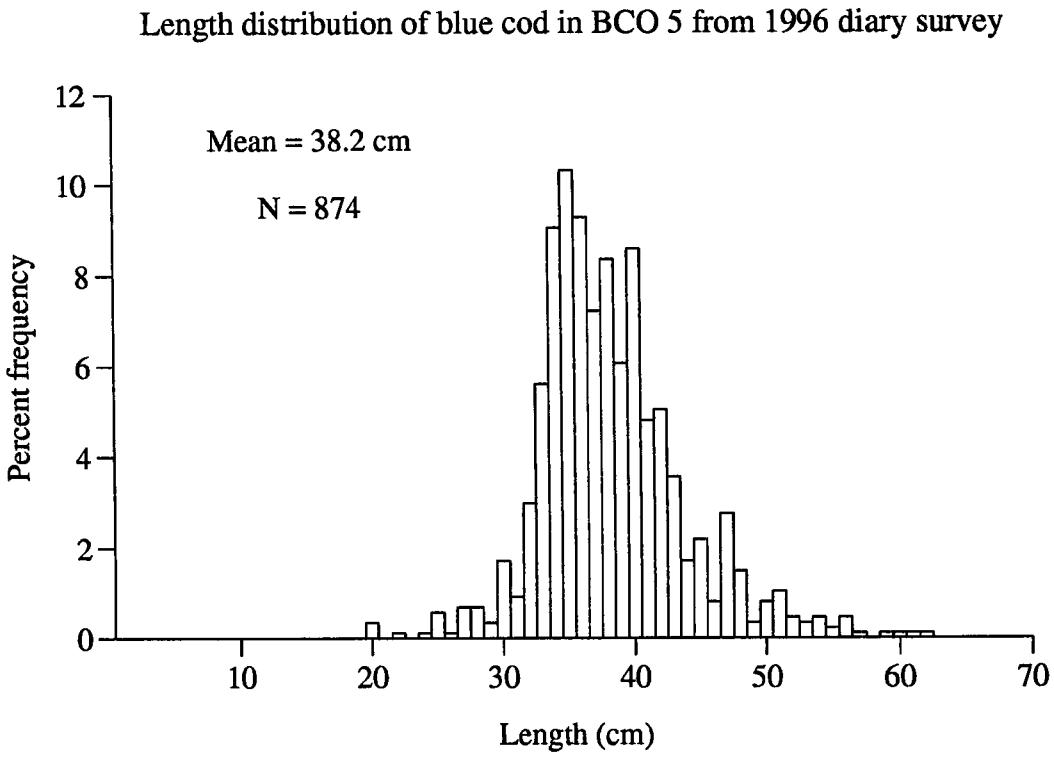


Figure 28: Length distribution of blue cod measured by diarists in the 1996 national diary survey. The blue cod were caught in BCO 5.