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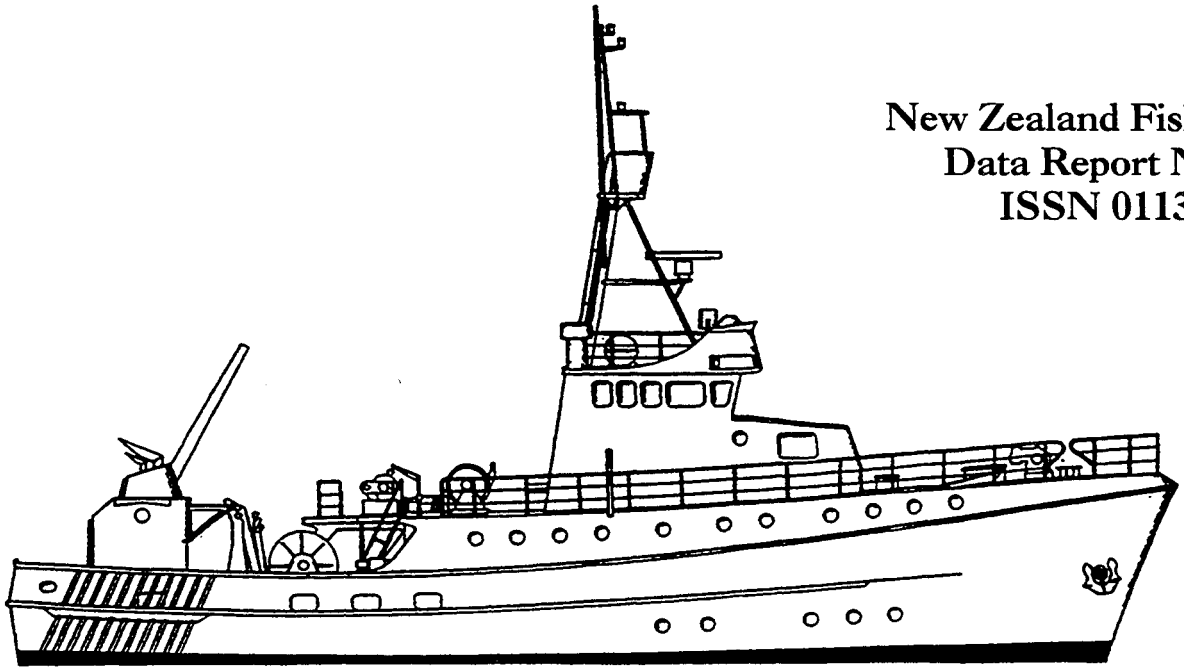
Trawl survey of snapper and associated species off the west coast of the North Island, October 1994 (KAH9410)

Adam D. Langley



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Introduction

RV *Kaharoa* has conducted trawl surveys off the west coast of the North Island since 1986. A major objective of the programme has been to determine the relative year class strength (YCS) of juvenile snapper. Snapper YCS indices derived from the programme have enabled estimates of short-term recruitment to be included in the assessment of SNA 8 biomass and yield (Annala 1995a).

The trawl survey programme also collects data on other commercial finfish species, particularly red gurnard (*Chelidonichthys kumu*), tarakihi (*Nemadactylus macropterus*), and John dory (*Zeus faber*). These species represent an important bycatch of the inshore trawl fisheries on the North Island west coast. The trawl survey programme may monitor trends in the relative abundance and population structure of these species.

The results of the 1989 and 1991 west coast North Island trawl surveys have been reported by Drury & McKenzie (1992) and Drury & Hartill (1993), and data from the four *Kaharoa* surveys conducted between 1986 and 1991 were summarised by Langley (1994b). This report presents the results of the west coast North Island trawl survey conducted in October 1994.

Project objectives

The major objectives of this research programme are as follows.

1. To estimate relative abundance, distributions, age, sex, and length frequencies for snapper, John dory, red gurnard, and tarakihi off the west coast of the North Island.
2. To describe the structure of fish communities vulnerable to trawl gear off the west coast of the North Island.
3. To estimate the relative year class strength of juvenile snapper off the west coast of the North Island.

Survey objectives

The 1994 trawl survey off the west coast of the North Island was designed to contribute to the fulfilment of project objectives 1, 2, and 3. The specific objectives of the trawl survey were as follows.

1. To carry out a single-phase stratified random trawl survey off the west coast of the North Island study area.
2. To collect biological data and samples from snapper and other finfish species caught during the survey.

Timetable and personnel

The survey was scheduled to start from New Plymouth on 29 September, but *Kaharoa* developed mechanical problems en route from Wellington and was forced to divert to Nelson for repairs. *Kaharoa* reached New Plymouth on 2 October, collected scientific staff, and sailed immediately to start the survey. During the first leg, *Kaharoa* trawled between New

Plymouth and Raglan Harbour (Figure 1). However, fishing was further disrupted by mechanical problems, bad weather, and crew illness which necessitated several port calls to New Plymouth. *Kaharoa* returned to New Plymouth to change scientific staff on 10 October.

The second leg of the survey included the area between the Raglan and Manukau Harbours. Further bad weather was encountered, initially delaying sailing and resulting in the loss of several days fishing. The second leg was completed on 17 October at Manukau Harbour with the change of two scientific staff. The third leg began the next day and trawl stations were completed between Manukau Harbour and Ninety Mile Beach. The survey ended on 22 October.

Methods

Survey area and design

The survey area extended along the northern west coast of the North Island from Scott Point (the northern end of Ninety Mile Beach) to Airedale Reef (north of New Plymouth) in the 10–200 m depth range (*see* Figure 1). The survey area was divided into 24 depth and area strata based on the catch rates of pre-recruit (< 25 cm fork length (FL)) snapper from the *Kaharoa* trawl surveys conducted between 1986 and 1991. Boundaries of the 25–50 m depth strata were modified slightly from the 1991 trawl survey to more accurately delineate the distribution of pre-recruit snapper (*see* Figure 1).

The survey was of a single-phase stratified random design (*after* Francis 1984). Trawls were conducted at randomly selected positions, with a minimum of three stations per stratum at least 1 n. mile (1.85 km) apart. A total of 88 stations was allocated to the 19 strata in the 10–100 m depth range based on snapper catch rate data from the time series of west coast North Island trawl surveys (Langley 1993). A further 22 stations were allocated to the five 100–200 m depth strata based on tarakihi catch rate data from the commercial fishery and previous trawl surveys. A summary of the station allocation is given in Table 1.

Vessel and gear specifications

RV *Kaharoa* is a research stern trawler with an overall length of 28 m, a displacement of 302 t, and a power rating of 522 kW. All trawling was carried out using a high opening bottom trawl (HOBT) with cut away lower wings and a 40 mm codend. The specifications of the trawl gear are given in Appendix 1.

Trawling procedure

All trawls were carried out during daylight hours, between 0530 and 1700 hours (NZST). Trawls were conducted from the randomly selected start position unless untrawlable ground was encountered, when a search was made for suitable ground within a 2 n. mile (3.70 km) radius of the station position. If no suitable ground was located, the station was abandoned and another random position substituted.

Towing speed was between 3.0 and 3.5 kn (5.6–6.5 $km.h^{-1}$) and tow direction was

generally towards the nearest random station position. The distance trawled was constant at 1.5 n. miles (2.8 km), measured using Magnavox GPS. Warp to depth ratios ranged from 15 : 1 at the shallowest stations to 4 : 1 for the deepest trawls.

Headline height was recorded from a net sonde and averaged over the length of the tow. Trawl door spread was estimated using the equation given by Langley (1994a), where:

$$Doorspread = 88.8214(1-e^{-0.0096994(warplength + 7.3296)}) \quad \text{Eqn 1}$$

Catch and biological sampling

The catch from each trawl was sorted by species and weighed to the nearest 0.1 kg on Seaway motion-compensating scales. For all commercially important fish and squid, a sample of the catch was taken from each trawl for biological sampling. All specimens were sampled from small catches: for large catches, a random sample of about 200 fish was taken.

The length of fish and squid sampled was measured to the nearest centimetre below the actual length. The first 60 mature snapper (≥ 23 cm FL) in each sample were also sexed and the ovarian condition of female fish categorised using a five stage developmental scale (Appendix 2). Red gurnard, John dory, trevally, rays, and sharks were also sexed. Gonadal development data were collected from rig and school shark and vertebral sections were taken from individual specimens.

Otoliths were collected from measured snapper (up to a target of 20 otoliths per 1 cm length class), John dory, red gurnard, and trevally.

Environmental observations

For each trawl station the following environmental observations were collected: sea surface temperature, bottom temperature (from net monitor), air temperature, wind direction and speed, sea condition and colour, and swell height and direction.

Data analysis

Biomass indices and length frequency distributions of the main commercial species were calculated by the area swept method (Francis 1989) using the Trawlsurvey Analysis Program (Vignaux 1994). In the calculation of biomass, the following assumptions were made.

1. The area swept was the distance between the doors multiplied by the distance towed. Door spread was estimated from Equation 1.
2. The vertical availability was 1.0. This assumes that all fish within the area swept were below the headline height of the net.
3. The vulnerability was 1.0. This assumes that all fish in the volume swept were caught.
4. The areal availability was 1.0. This assumes that all the fish were within the survey area at the time of the survey.

The coefficient of variation (*c.v.*) is a measure of the precision of the biomass estimates, and is calculated from

$$c.v.(B) = \frac{\sqrt{Var(B)}}{B} \times 100$$

where B is the biomass estimate and $Var(B)$ is the variance of the biomass estimate.

Snapper age determination

Snapper otoliths were aged as described by McKenzie *et al.* (1992). Age classes were defined after Paul (1976), whereby 1 January is defined as the theoretical birthday. The otoliths were aged as at the collection date (October 1994).

The resulting age data were applied to the scaled snapper length frequency distribution to estimate the age frequency distribution of the snapper population sampled by the survey.

Results

The loss of 12 of the scheduled 25 days necessitated a considerable rationalisation of the survey. The five 100–200 m depth strata were excluded from the revised survey area, as were the 10–25 m and 50–100 m Ninety Mile Beach strata. In total, 17 of the original 24 strata were completed, including those between Airedale Reef and Tauroa Point, 10–100 m. The revised survey boundaries encompassed the area surveyed during all previous west coast North Island *Kaharoa* trawl surveys, enabling a continuation of the comparable time-series.

A total of 73 stations was successfully completed during the survey. Stations 66 and 73 were abandoned because of gear damage and/or poor performance of the trawl gear and were excluded from the biomass analysis. The areal distribution of trawl stations is shown in Figure 2 and individual station information is given in Appendix 3.

Catch composition

Sixty species were caught during the survey (Table 2). Red gurnard accounted for 33.2% of the total catch by weight, jack mackerel (*Trachurus novaezelandiae*) 15.1%, snapper 10.3%, and trevally 9.6%. Small catches of other commercial species, notably spiny dogfish, rig, school shark, and barracouta, were also taken. John dory, a secondary target species of the survey, accounted for only 1.1% of the total catch. The restriction of the survey to depths less than 100 m resulted in only a small total catch of tarakihi. A summary of catch by station of the most abundant species is given in Appendix 4.

Distribution and catch rates

Snapper were caught at 59 of the 73 successfully completed trawl stations (*see* Appendix 4). Pre-recruit and legal-sized (≥ 25 cm FL) snapper were most abundant at shallow (< 50 m) stations north of the Manukau Harbour and off the entrance to Raglan Harbour (Figures 3 and 4). Few pre-recruit snapper were caught south of Kawhia Harbour, although the distribution of legal-sized of snapper extended further south: small catches of

snapper were taken throughout the North Taranaki Bight.

The distribution of catch rates for jack mackerel (*T. novaezelandiae*), trevally, and red gurnard are given in Figures 5–7.

Biological data

Biological data collected from the catch are summarised in Table 3.

The scaled length frequency distribution of snapper (Figure 8) shows two modes; a strong mode between 16 and 22 cm and a broader mode occupying the 24–34 cm length range. Snapper age data show that the smaller mode represents the 1+ age class and the broader mode is dominated by the 2+ and 3+ age classes (Figure 9, Appendix 5).

The length compositions of snapper from individual strata are presented in Figure 10. Six strata between Raglan Harbour and Hokianga Harbour accounted for 87% of all snapper measured during the survey. Fish of the 1+ age class dominated the snapper length compositions from strata BB50, C25, and RG50.

The female snapper sampled from the catch were predominantly in the immature (47.1%) and resting (45.7%) stages of ovarian development. Female fish with developing ovaries accounted for 7.2% of fish sampled. No ripe, ovulated, or spent fish were recorded.

Scaled length frequency distributions are presented for red gurnard, trevally, jack mackerel (*T. novaezelandiae*), rig, and school shark in Figures 11–13.

Biomass estimates

Biomass estimates for snapper, red gurnard, jack mackerel (*T. novaezelandiae*), trevally, rig, and school shark are given in Table 4. A large proportion (60%) of the total snapper biomass was within the three strata adjacent to the entrance of the Kaipara Harbour (C25, C50, and C100). The biomass of trevally was concentrated in the Ninety Mile Beach (AA50) and Kaipara (C50) 25–50 m depth strata, and these strata accounted for 68% of the total biomass. Most (70%) of the red gurnard biomass was within the four large 50–100 m depth strata (B100, C100, E100, and F100), with stratum E100 alone accounting for 35% of the total biomass. Stratum E100 also included 50% of the total school shark biomass. The biomass of rig was fairly evenly distributed throughout the survey strata. No clear trend in the distribution of jack mackerel (*T. novaezelandiae*) biomass is apparent.

For snapper, red gurnard, and jack mackerel (*T. novaezelandiae*) the coefficients of variation around the total biomass estimates were less than 25%, implying moderate precision. Catches of trevally, rig, and school shark were variable throughout the survey area resulting in a high *c.v.* associated with the total biomass estimates.

Discussion

The trawl survey design was optimised to estimate the relative abundance of pre-recruit snapper. Accordingly, the stratification of the survey area was refined from previous trawl surveys based on the time series of pre-recruit snapper catch rate data collected from the four spring surveys carried out between 1986 and 1991. The 1994 survey yielded estimates of numbers of 2+ and 3+ snapper with moderate precision. However, the current survey design does not appear to adequately sample 1+ age snapper: the 1994 survey achieved a *c.v.* of 44% of the estimated number of 1+ fish. The distribution of 1+ snapper was concentrated in 3 of the 17 strata surveyed, namely BB50, C25, and RG50, and station densities within this area were increased from previous surveys. However, station densities are still substantially lower than the intensity of sampling afforded areas of high pre-recruit snapper abundance in the Hauraki Gulf trawl surveys (M. P. Francis *et al.*, NIWA, unpublished results). It is proposed to further increase the number of stations allocated to these strata in future surveys of the North Island west coast.

The five surveys of the North Island west coast carried out to date have each employed different survey boundaries and, to some extent, different stratification. All surveys have included the area surveyed during the 1987 survey (KAH8715), i.e., from Manganui Bluff to Tirua Point, 10–100 m. However, the incongruous survey boundaries and areal stratification present problems in deriving comparable biomass estimates. The biomass estimates and scaled length frequency distributions presented in this report were calculated for the entire 1994 survey area. To derive biomass estimates comparable to the 1987 survey it is necessary to exclude strata AA50, B25, F50, F100, and G25 from the analysis. In addition, stratum B100 overlaps the northern boundary of the 1987 survey and it is therefore necessary to prorate the stratum biomass by the proportion included within the 1987 survey area (about 0.5). Details of comparable survey stratification for the time series of North Island west coast surveys were presented by Langley (1994b). The time series of biomass estimates derived for John dory and red gurnard have been included in the annual assessment of these species (Annala 1995b).

Snapper relative YCS indices derived from the 1987, 1989, and 1991 trawl survey estimates of 2+ and 3+ fish are correlated with the recruitment indices estimated from the SNA 8 age-structure population model (Annala 1995a). The consistency between the two sets of data to some extent validates the results of the trawl survey programme and provides support for a continuation of the time series to estimate short term recruitment to the SNA 8 fishery. It is currently proposed to maintain biennial trawl surveys of the North Island west coast: the next survey is scheduled for October 1996.

The 1994 trawl survey of the North Island west coast sampled the 1991 and 1992 snapper year classes at ages 2+ and 3+, respectively. The survey estimated the 1991 and 1992 year classes to be of moderate strength compared to the time series of relative YCS indices (Annala 1995a).

Acknowledgments

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References

Annala, J. H. (Comp.) 1995a: Report from the Special Fishery Assessment Plenary, 29 May 1995: stock assessments and yield estimates for snapper. 36 p. (Unpublished report held in NIWA library, Wellington.)

Annala, J. H. (Comp.) 1995b: Report from the Fishery Assessment Plenary, May 1995: stock assessments and yield estimates. 277 p. (Unpublished report held in NIWA library, Wellington.)

Drury, J. & Hartill, B. 1993: Summary findings from the 1991 R.V. *Kaharoa* trawl survey of the west coast of the North Island (KAH9111). Northern Fisheries Region Internal Report No. 15. 70 p. (Draft report held by NIWA, Auckland).

Drury, J. & McKenzie, J. R. 1992: Summary findings from the 1989 R.V. *Kaharoa* trawl survey of the west coast of the Auckland Fisheries Management Area (KAH8918). Northern Fisheries Region Internal Report No. 4. 62 p. (Draft report held by NIWA, Auckland).

Francis, R. I. C. C. 1984: An adaptive strategy for stratified random trawl surveys. *N.Z. Journal of Marine and Freshwater Research 18*: 59–71.

Francis, R. I. C. C. 1989: A standard approach to biomass estimation from trawlsurveys. N.Z. Fisheries Assessment Research Document 89/3 p. (Draft report held in NIWA library, Wellington.)

Langley, A. D. 1993: The distribution of juvenile snapper within the Auckland Fishery Management Area. Northern Fisheries Region Internal Report No. 13. 33 p. (Draft report held by NIWA, Auckland).

Langley, A. D. 1994a: Trawl survey of snapper and associated species in the Hauraki Gulf, November 1993 (KAH9311). Northern Fisheries Region Internal Report No. 21. 39 p. (Draft report held by NIWA, Auckland).

Langley, A. D. 1994b: Summary results from the Auckland Fishery Management Area R.V. *Kaharoa* trawl survey programme for the main commercial finfish species (excluding snapper), 1982–93. Northern Fisheries Region Internal Report No. 18. 98 p. (Draft report held by NIWA, Auckland).

McKenzie, J., Haddon, M., Walsh, C., Carter, S., & Davies, N. 1992: Summary findings of commercial snapper (*Pagrus auratus*) market sampling from SNA1 & SNA8 (1989–1992). Northern Fisheries Region Internal Report No. 8. 63 p. (Draft report held by NIWA, Auckland).

Pankhurst, N. W., McMillan P. J., & Tracey, D. M. 1987: Seasonal reproductive cycles in three commercially exploited fishes from the slope waters off New Zealand. *Journal of Fish Biology 30*: 193–211.

Paul, L. J. 1976: A study on age, growth, and population structure of the snapper, *Chrysophrys auratus* (Forster), in the Hauraki Gulf, New Zealand. *Fisheries Research Bulletin No. 13.* 62 p.

Vignaux, M. 1994: Documentation of Trawlsurvey Analysis Program. MAF Fisheries Greta Point Internal Report No. 225. 44 p. (Draft report held in NIWA library, Wellington.)

Table 1: Stratum description, areas, station allocation, and station densities

Stratum	Description	Depth range (m)	Area (km^2)	Number of stations Planned	Number of stations Completed	Density (per km^2)
A25	Ninety Mile Beach	10–25	254	6	0	–
AA50	Scott Pt. to Sth Hokianga	25–50	942	4	4	1 : 236
A100	Scott Pt. to Tauroa Pt.	50–100	624	4	0	–
A200	Scott Pt. to Tauroa Pt.	100–200	1 998	5	0	–
B25	Tauroa Pt. to Sth Hokianga	10–25	104	5	3	1 : 35
BB50	Sth Hokianga to Nth Kaipara	25–50	203	5	4	1 : 51
B100	Tauroa Pt. to Nth Kaipara	50–100	1 332	4	4	1 : 333
B200	Tauroa Pt. to Nth Kaipara	100–200	970	4	0	–
C25	Sth Hokianga to Sth Manukau	10–25	562	7	5	1 : 112
C50	Baylys Beach to Sth Manukau	25–50	612	5	5	1 : 122
C100	Nth Kaipara to Waikato	50–100	1 736	5	5	1 : 347
C200	Nth Kaipara to Waikato	100–200	1 045	4	0	–
D25	Muriwai to Sth Manukau	10–25	191	4	4	1 : 48
DD50	Sth Manukau to Otehe Pt	25–50	462	4	4	1 : 116
RG50	Otehe Pt. to Raglan	25–50	441	5	5	1 : 88
E25	Sth Manukau to Otehe Pt.	10–25	312	4	4	1 : 78
E50	Raglan to Tirua Pt.	25–50	487	4	4	1 : 122
E100	Waikato to Tirua Pt.	50–100	3 635	5	5	1 : 727
E200	Waikato to Tirua Pt.	100–200	1 424	4	0	–
F25	Otehe Pt. to Tirua Pt.	10–25	329	4	4	1 : 82
F50	Tirua Pt. to Airedale Reef	25–50	741	4	4	1 : 185
F100	Tirua Pt. to Airedale Reef	50–100	2 490	5	5	1 : 498
F200	Tirua Pt. to Airedale Reef	100–200	2 722	5	0	–
G25	Tirua Pt. to Airedale Reef	10–25	492	4	4	1 : 123
		Total	24 108	110	73	
		Surveyed	15 071			

Table 2: Species caught, total catch, and percentage of stations at which each species occurred

Common name	Species code	Scientific name	Total weight (kg)	Percentage of catch by weight	Percentage occurrence
Red gurnard	GUR	*Chelidonichthys kumu*	3 242.3	33.2	100.0
Jack mackerel	JMN	*Trachurus novaezelandiae*	1 473.0	15.1	77.3
Snapper	SNA	*Pagrus auratus*	1 009.0	10.3	81.3
Trevally	TRE	*Pseudocaranx dentex*	936.2	9.6	58.7
Spiny dogfish	SPD	*Squalus acanthias*	513.7	5.3	36.0
Rig	SPO	*Mustelus lenticulatus*	390.3	4.0	73.3
School shark	SCH	*Galeorhinus australis*	353.3	3.6	48.0
Barracouta	BAR	*Thyrsites atun*	262.0	2.7	42.7
Sweep	SWE	*Scorpis lineolatus*	204.2	2.1	1.3
Eagle ray	EGR	*Myliobatis tenuicaudatus*	163.4	1.7	32.0
Smooth skate	SSK	*Raja innominata*	161.1	1.6	28.0
Longtailed stingray	WRA	*Dasyatis thetidis*	133.1	1.4	8.0
Blue warehou	WAR	*Seriolella punctata*	132.8	1.4	12.0
John dory	JDO	*Zeus faber*	110.7	1.1	38.7
Rough skate	RSK	*Raja nasuta*	89.6	0.9	13.3
Leatherjacket	LEA	*Parika scaber*	70.4	0.7	38.7
Tarakihi	TAR	*Nemadactylus macropterus*	67.3	0.7	24.0
Sponges	ONG	Porifera	50.0	0.5	1.3
Frostfish	FRO	*Lepidopus caudatus*	33.0	0.3	5.3
Kahawai	KAH	*Arripis trutta*	32.9	0.3	22.7
New Zealand sole	ESO	*Peltorhamphus novaezeelandiae*	32.8	0.3	53.3
Anchovy	ANC	*Engraulis australis*	26.9	0.3	13.3
Arrow squid	SQU	*Nototodarus sloanii*	26.1	0.3	18.7
Red cod	RCO	*Pseudophycis bachus*	24.9	0.3	16.0
Hammerhead shark	HHS	*Sphyrna zygaena*	23.7	0.2	9.3
Shorttailed stingray	BRA	*Dasyatis brevicaudatus*	23.6	0.2	4.0
Turbot	TUR	*Colistium nudipinnis*	23.0	0.2	28.0
Electric ray	ERA	*Torpedo fairchildi*	22.3	0.2	10.7
Scaly gurnard	SCG	*Lepidotrigla brachyoptera*	21.6	0.2	10.7
Jack mackerel	JMD	*Trachurus declivis*	20.1	0.2	10.7
Carpet shark	CAR	*Cephaloscyllium isabella*	18.1	0.2	8.0
Spotted stargazer	SPZ	*Genyagnus monopterygius*	10.1	0.1	17.3
Thresher shark	THR	*Alopias vulpinus*	8.8	0.1	32.0
Lemon sole	LSO	*Pelotretis flavilatus*	8.8	0.1	1.3
Northern spiny dogfish	NSD	*Squalus blainvillei*	7.8	0.1	4.0
Sprat	SPR	*Sprattus antipodum*	4.8	< 0.1	10.7
Japanese gurnard	JGU	*Pterygotrigla picta*	4.6	< 0.1	2.7
Blue cod	BCO	*Parapercis colias*	4.5	< 0.1	2.7
Sand flounder	SFL	*Rhombosolea plebeia*	3.6	< 0.1	12.0
Witch	WIT	*Arnoglossus scapha*	3.4	< 0.1	13.3
Blue mackerel	EMA	*Scomber australasicus*	3.3	< 0.1	20.0
Hoki	HOK	*Macruronus novaezelandiae*	3.0	< 0.1	1.3
Brill	BRI	*Colistium guntheri*	1.7	< 0.1	4.0
Broad squid	BSQ	*Sepioteuthis bilineata*	1.3	< 0.1	6.7
Red moki	RMO	*Cheilodactylus spectabilis*	1.2	< 0.1	1.3
Ahuru	PCO	*Auchenoceros punctatus*	1.0	< 0.1	9.3
Estuarine stargazer	ESZ	*Leptoscopus macropygus*	1.0	< 0.1	6.7
Sea perch	SPE	*Helicolenus percoides*	0.8	< 0.1	1.3
Red mullet	RMU	*Upeneichthys lineatus*	0.8	< 0.1	1.3
Ling	LIN	*Genypterus blacodes*	0.7	< 0.1	1.3

Yelloweyed mullet	YEM	*Aldrichetta forsteri*	0.5	< 0.1	4.0
Yellowbelly flounder	YBF	*Rhombosolea leporina*	0.4	< 0.1	1.3
Pilchard	PIL	*Sardinops neopilchardus*	0.4	< 0.1	5.3
Cucumberfish	CUC	*Chlorophthalmus nigripinnis*	0.3	< 0.1	2.7
Northern bastard cod	BRC	*Pseudophycis breviuscula*	0.3	< 0.1	1.3
Pufferfish	PUF	*Contusus richei*	0.2	< 0.1	6.7
Hake	HAK	*Merluccius australis*	0.2	< 0.1	1.3
Butterfly perch	BPE	*Caesioperca lepidoptera*	0.2	< 0.1	1.3
Boarfish	BOA	*Paristiopterus labiosus*	0.2	< 0.1	1.3
Snipefish	SNI	*Macrorhamphosus scolopax*	0.1	< 0.1	1.3
	Total		9 765.4		

Table 3: Species and numbers of fish and squid measured

Commom name	No. of tows sampled	No. of fish	No. of males	No. of females
Red gurnard	75	5 593	1 763	3 506
Snapper	61	1 777	979	618
Jack mackerel *(Trachurus novaezelandiae)*	55	5 424	15	–
Rig	53	216	88	126
Trevally	44	729	327	301
New Zealand sole	38	147	–	–
School shark	36	95	43	50
Barracouta	31	231	57	35
John dory	28	156	62	73
Leatherjacket	25	189	9	–
Lemon sole	21	41	3	–
Turbot	20	28	–	–
Smooth skate	18	58	25	26
Kahawai	17	45	16	13
Tarakihi	17	68	13	46
Eagle ray	16	46	23	18
Blue mackerel	15	69	13	–
Spiny dogfish	14	100	24	76
Spotted stargazer	13	24	–	–
Red cod	11	46	6	21
Sand flounder	9	16	–	–
Blue warehou	9	58	15	27
Arrow squid	8	140	–	–
Witch	7	15	–	–
Electric ray	6	14	6	8
Hammerhead shark	6	7	4	3
Jack mackerel *(T. declivis)*	6	161	–	–
Estuarine stargazer	5	5	–	–
Frostfish	4	61	–	–
Longtailed stingray	4	3	–	1
Brill	3	4	–	–
Northern spiny dogfish	3	7	3	4
Yelloweyed mullet	3	3	–	–
Blue cod	2	6	3	2
Shorttailed stingray	2	2	–	–
Northern bastard cod	2	3	–	–
Japanese gurnard	2	18	17	–
Pilchard	2	5	–	–
Scaly gurnard	2	25	–	–
Boarfish	1	1	–	–
Butterfly perch	1	1	–	1
Carpet shark	1	1	1	–
Hake	1	1	1	–
Hoki	1	2	2	–
Ling	1	1	–	1
Ahuru	1	2	–	–
Red moki	1	1	1	–
Red mullet	1	1	–	–
Thresher shark	1	1	–	1
Yellowbelly flounder	1	1	–	–

– No data or fish not sexed.

Table 4: Estimated biomass (t) and coefficient of variation (in parentheses) by stratum of snapper (SNA), red gurnard (GUR), trevally (TRE), jack mackerel (*Trachurus novaezelandiae*, JMN), rig (SPO), and school shark

								Species code
			SNA	GUR	TRE	JMN	SPO	SCH
Stratum	< 25 cm	≥ 25 cm	Total					
AA50	3.1	23.9	26.9	248.8	164.0	348.6	31.8	4.7
	(34)	(35)	(34)	(18)	(53)	(24)	(34)	(100)
B25	5.4	14.0	19.4	24.5	34.6	4.8	2.9	13.5
	(97)	(94)	(95)	(16)	(99)	(63)	(80)	(31)
BB50	8.9	14.8	23.7	66.0	2.2	30.4	5.3	1.8
	(74)	(33)	(25)	(31)	(64)	(25)	(61)	(100)
B100	0.9	14.6	15.5	268.8	48.2	44.2	18.1	6.8
	(100)	(65)	(66)	(31)	(100)	(97)	(65)	(100)
C25	53.0	89.9	142.9	84.7	35.9	134.6	33.8	0.3
	(72)	(22)	(32)	(37)	(47)	(51)	(39)	(100)
C50	7.1	90.4	97.4	176.1	188.3	77.0	18.0	67.0
	(32)	(25)	(25)	(19)	(80)	(54)	(44)	(78)
C100	10.0	97.7	107.7	505.9	3.4	44.8	13.8	30.7
	(60)	(52)	(47)	(10)	(100)	(75)	(64)	(41)
D25	0.2	0.1	0.3	4.9	5.2	2.7	3.0	0.3
	(71)	(100)	(43)	(18)	(62)	(27)	(42)	(100)
DD50	0.3	3.1	3.4	28.8	8.1	0.0	15.7	4.4
	(34)	(43)	(41)	(26)	(89)		(43)	(62)
RG50	11.0	12.6	23.7	93.1	2.2	4.2	4.1	5.9
	(56)	(39)	(44)	(14)	(24)	(71)	(48)	(80)
E25	0.3	4.7	5.0	4.8	9.7	11.4	13.4	1.8
	(5)	(48)	(45)	(29)	(33)	(11)	(23)	(61)
E50	0.1	1.3	1.4	92.7	0.0	1.5	4.5	0.8
	(100)	(100)	(100)	(74)		(100)	(78)	(100)
E100	0.0	22.7	22.7	1 244.0	0.0	139.1	42.1	157.3
		(48)	(48)	(59)		(73)	(44)	(74)
F25	0.2	16.4	16.6	23.2	6.0	6.2	1.9	0.0
	(65)	(76)	(75)	(22)	(69)	(32)	(58)	
F50	0	25.3	25.3	210.3	2.6	20.1	6.7	9.1
		(28)	(28)	(20)	(63)	(58)	(32)	(31)
F100	1.6	34.5	36.1	457.5	1.7	280.9	95.9	7.9
	(100)	(85)	(86)	(31)	(100)	(78)	(100)	(100)
G25	0.7	7.3	8.0	16.8	4.3	62.7	3.5	0.4
	(49)	(62)	(61)	(27)	(98)	(46)	(69)	(100)
Total	102.6	473.3	575.9	3 550.8	516.3	1 213.1	314.2	312.3
	(39)	(15)	(15)	(21)	(36)	(23)	(32)	(41)

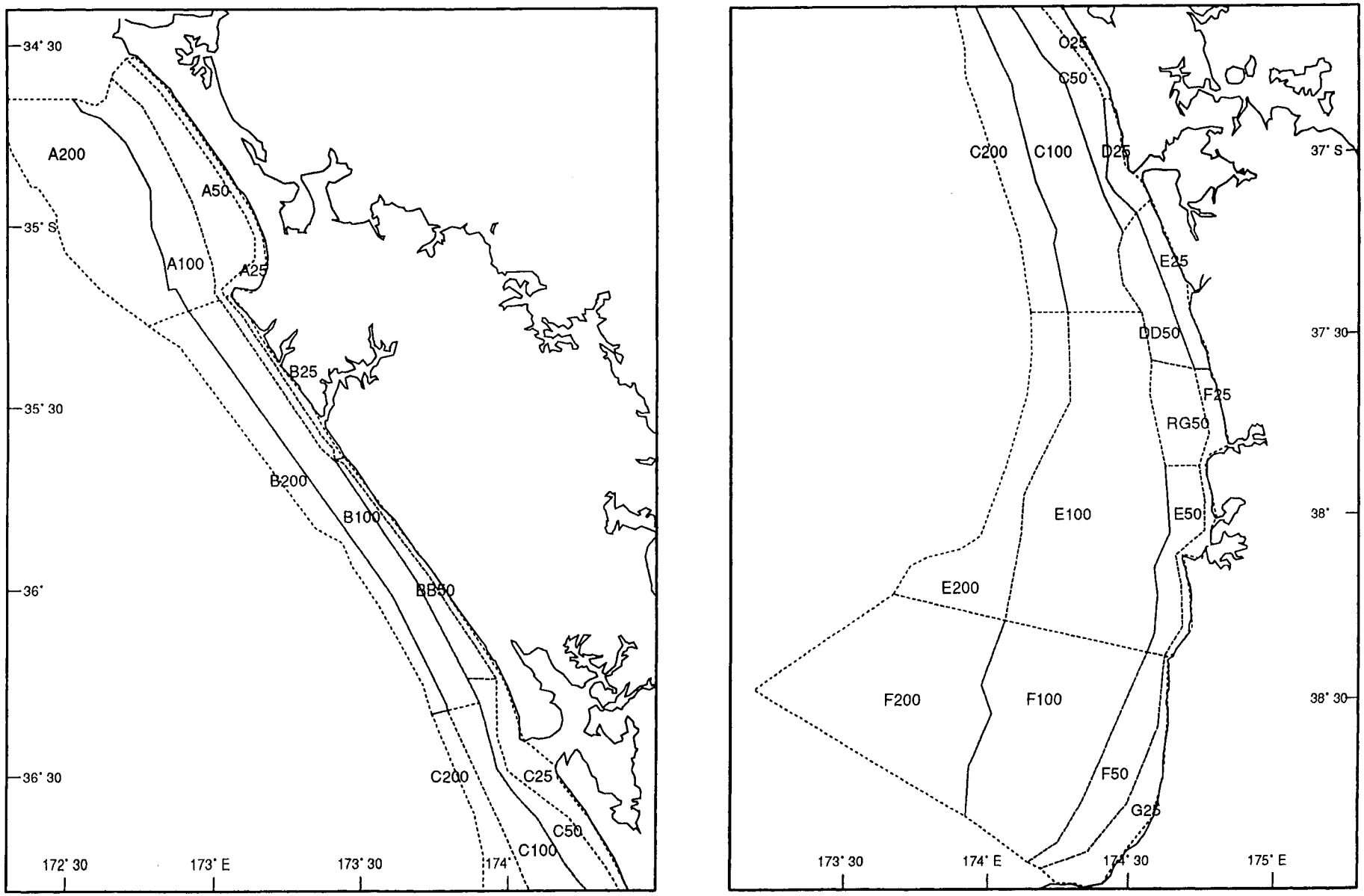


Figure 1: Survey area and stratum boundaries.

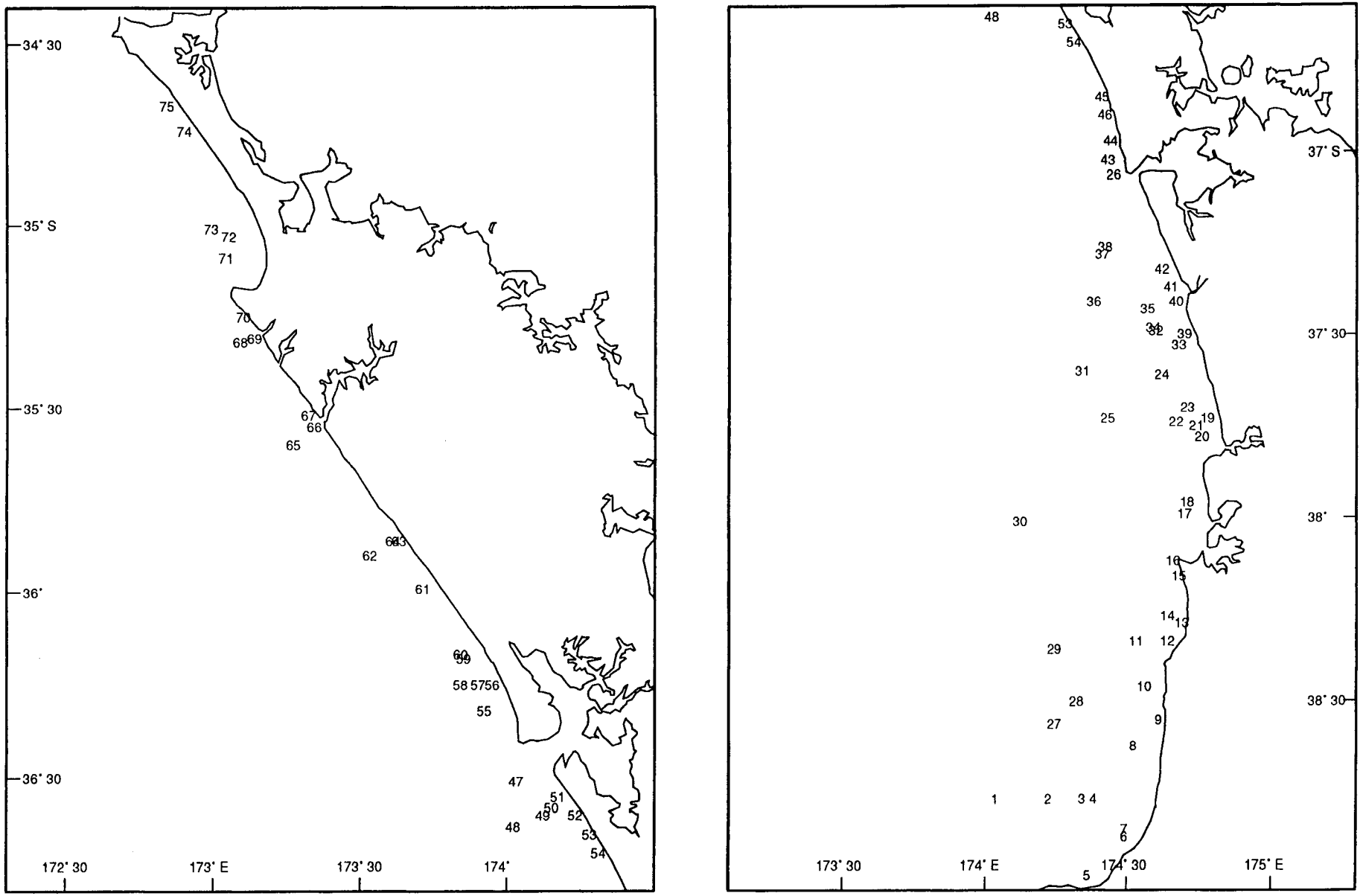


Figure 2: Station positions and numbers.

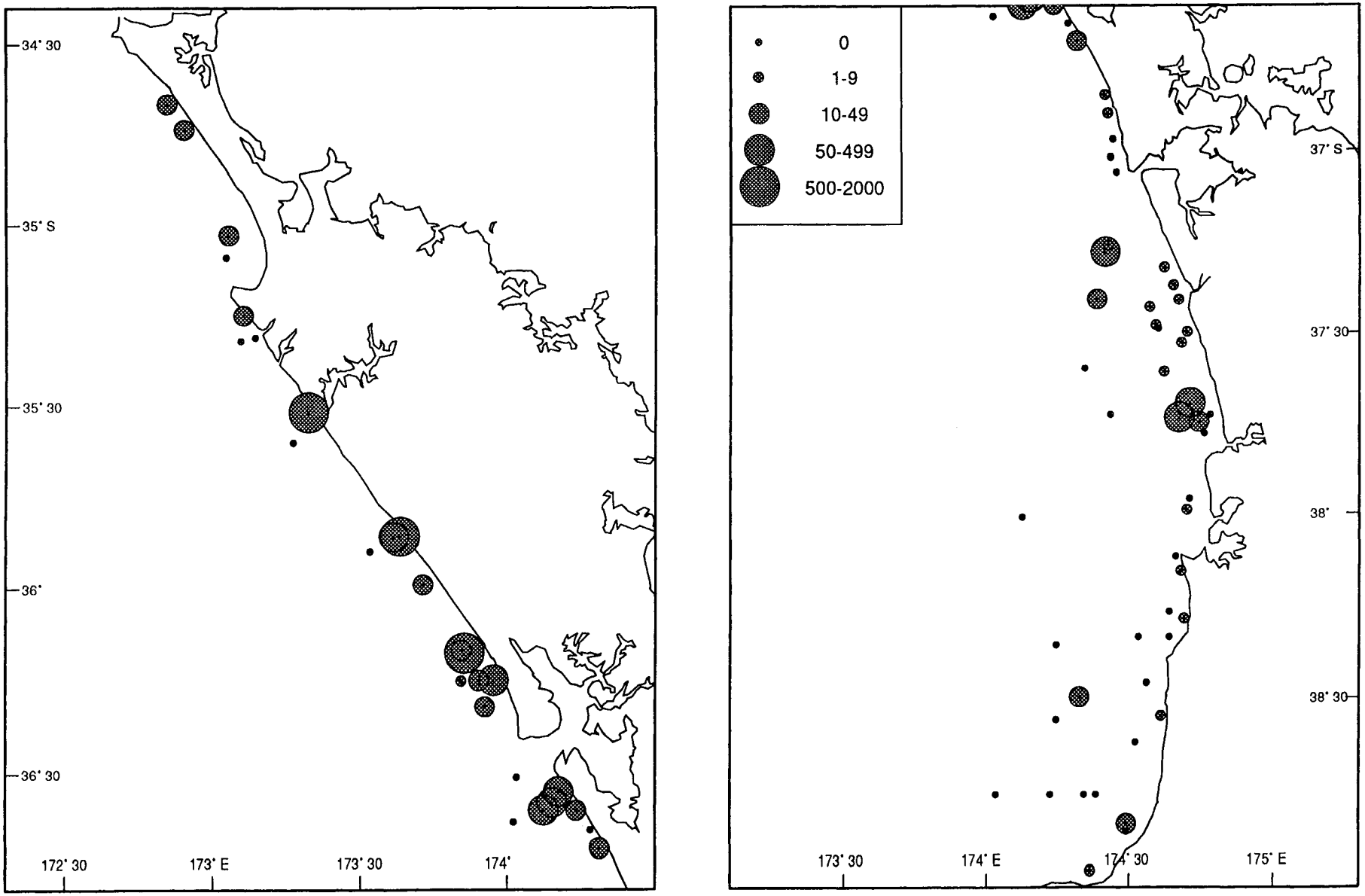


Figure 3: Catch rates (no. per km^2) of pre-recruit (< 25 cm F.L.) snapper.

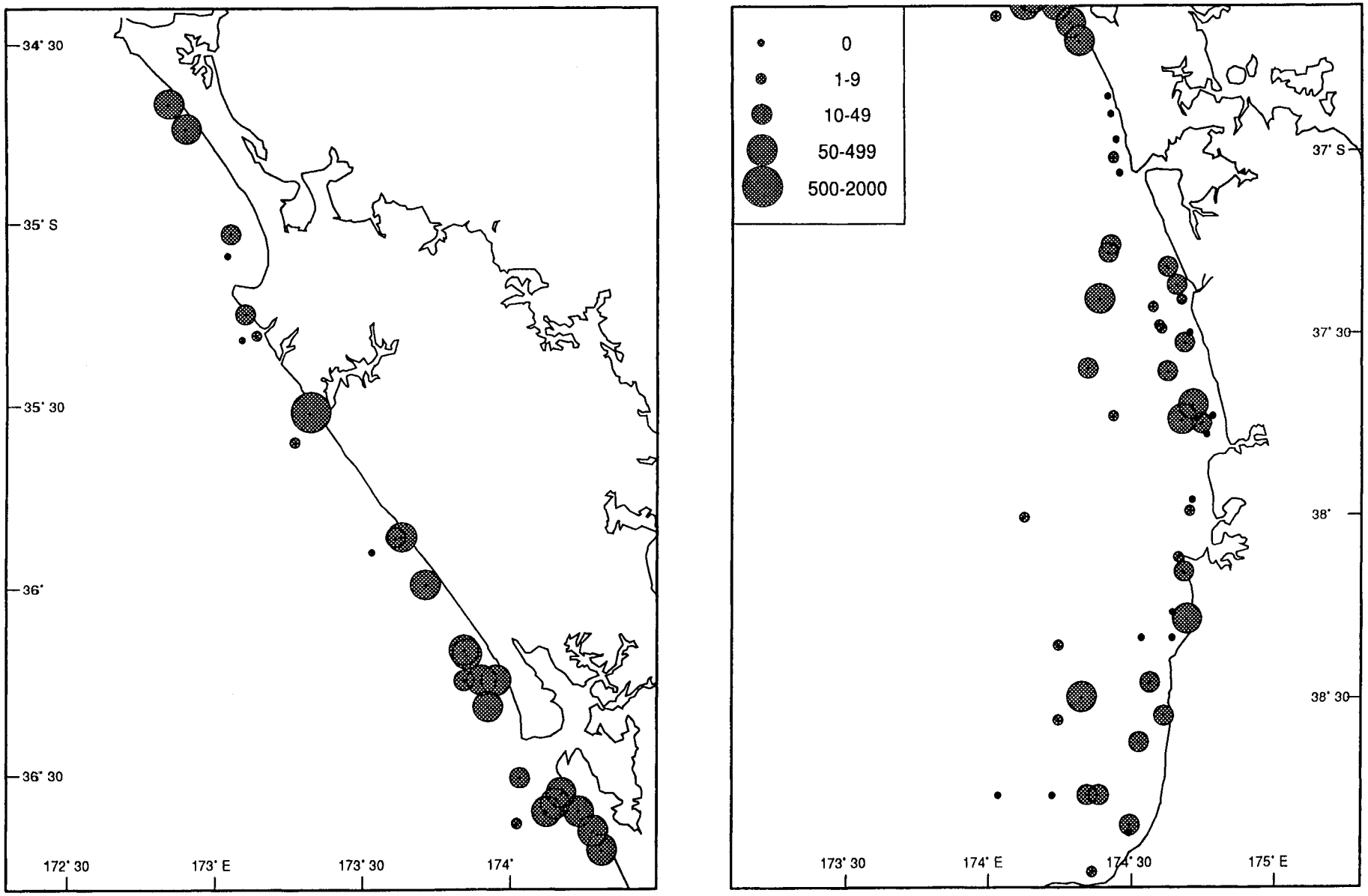


Figure 4: Catch rates (no. per km^2) of legal-size (≥ 25 cm F.L.) snapper.

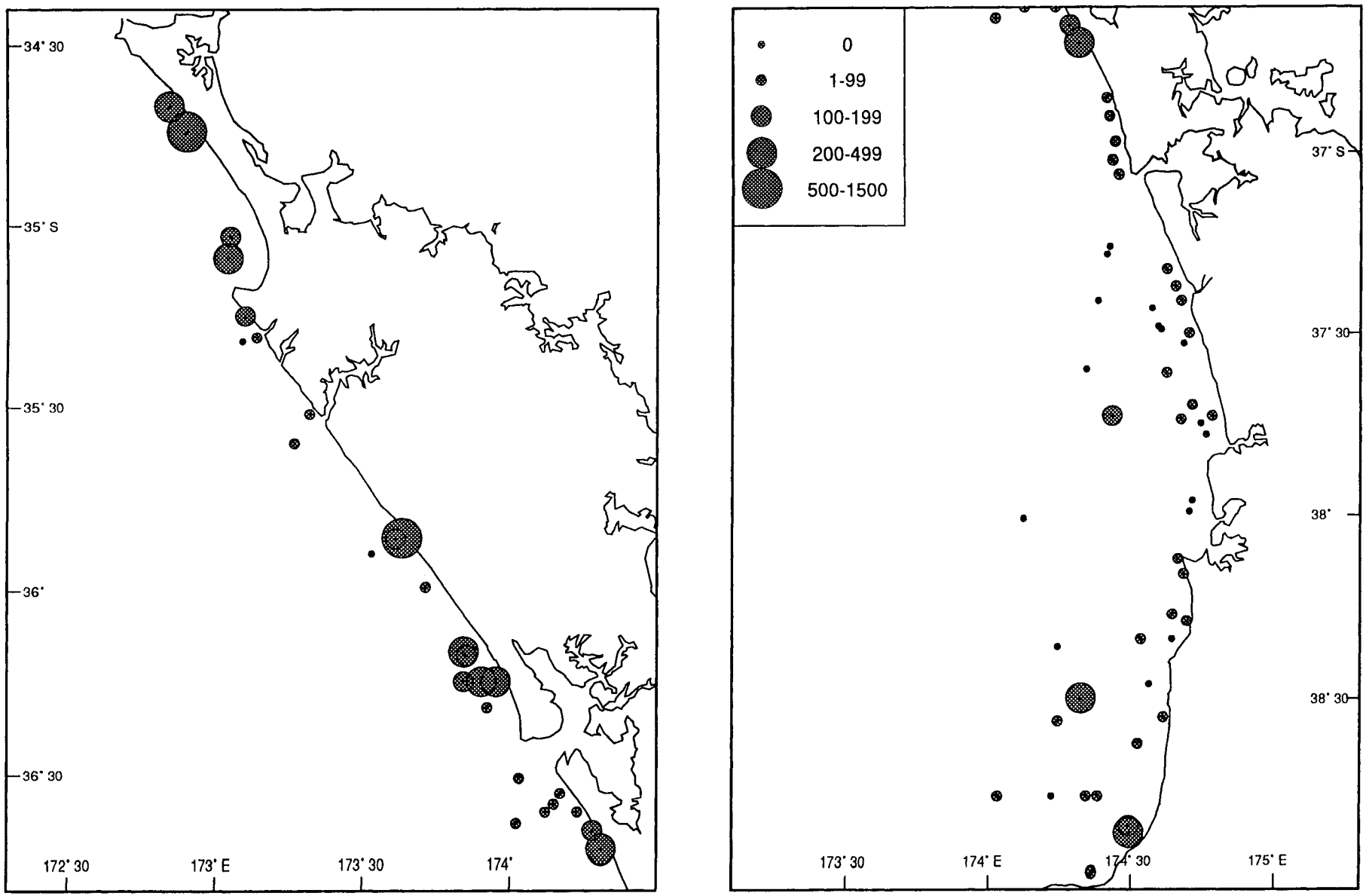


Figure 5: Catch rates (kg.km^{-2}) of jack mackerel (*Trachurus novaezelandiae*).

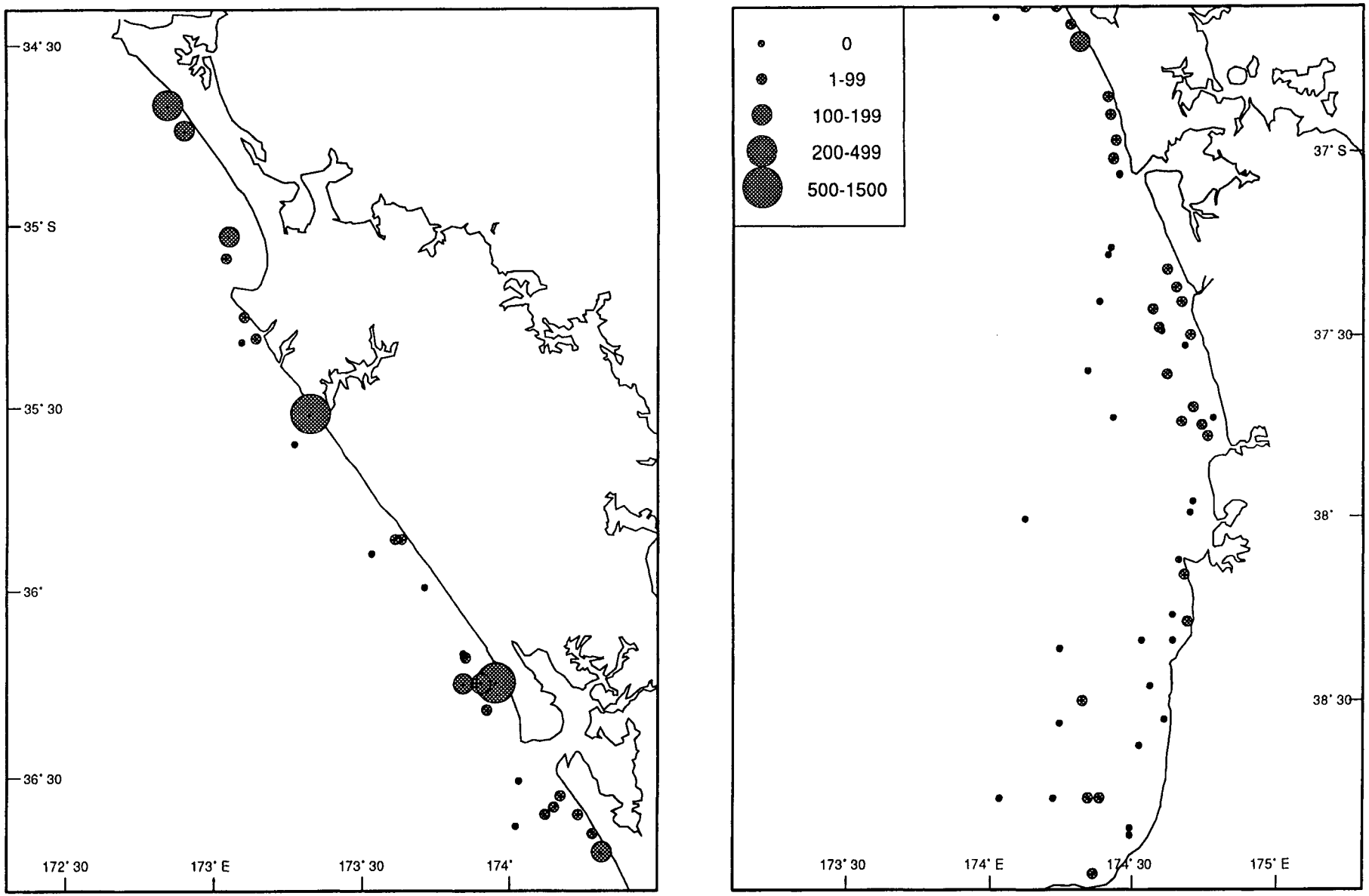


Figure 6: Catch rates (kg.km^{-2}) of trevally.

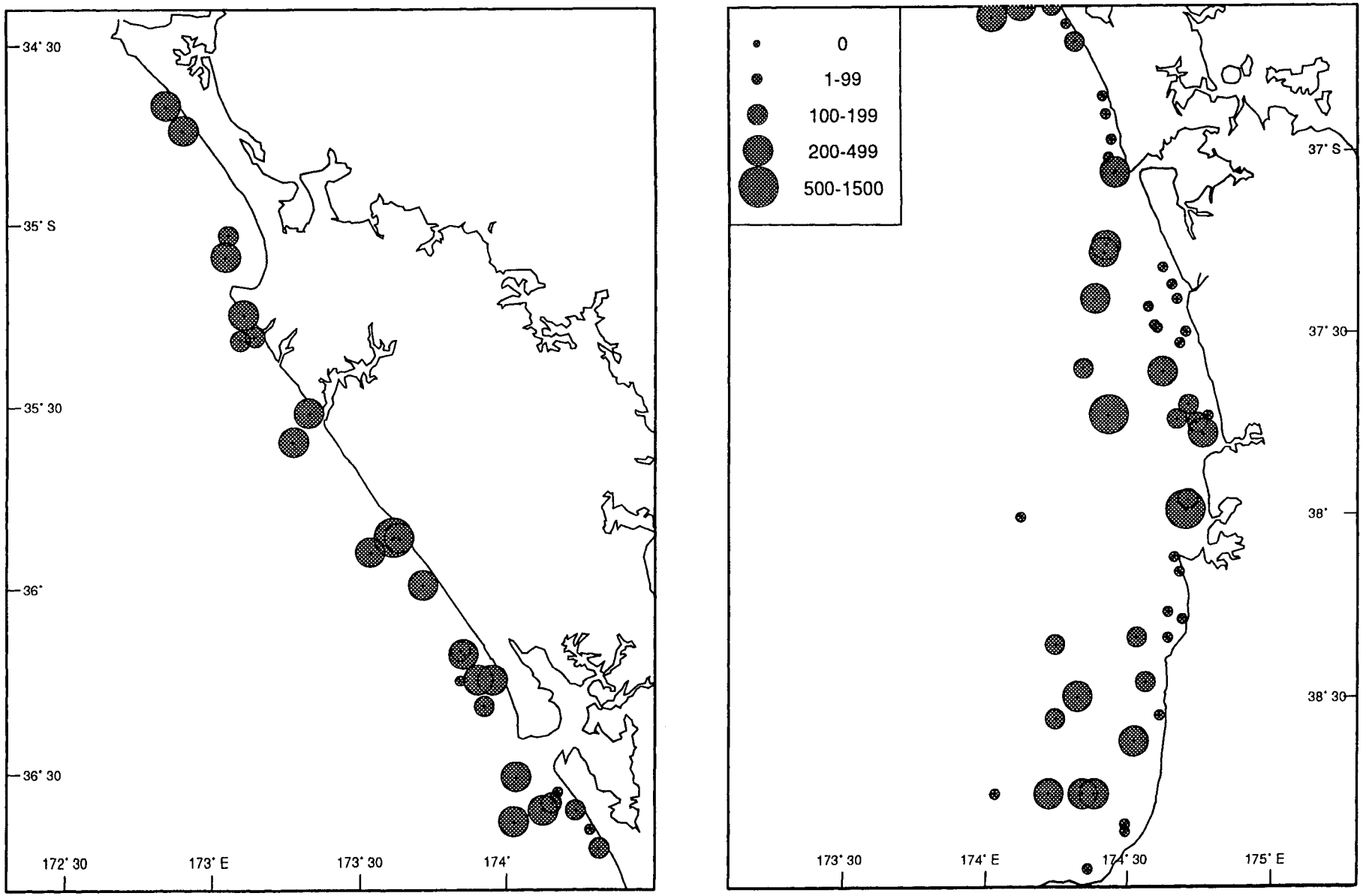


Figure 7: Catch rates (kg.km^{-2}) of red gurnard.

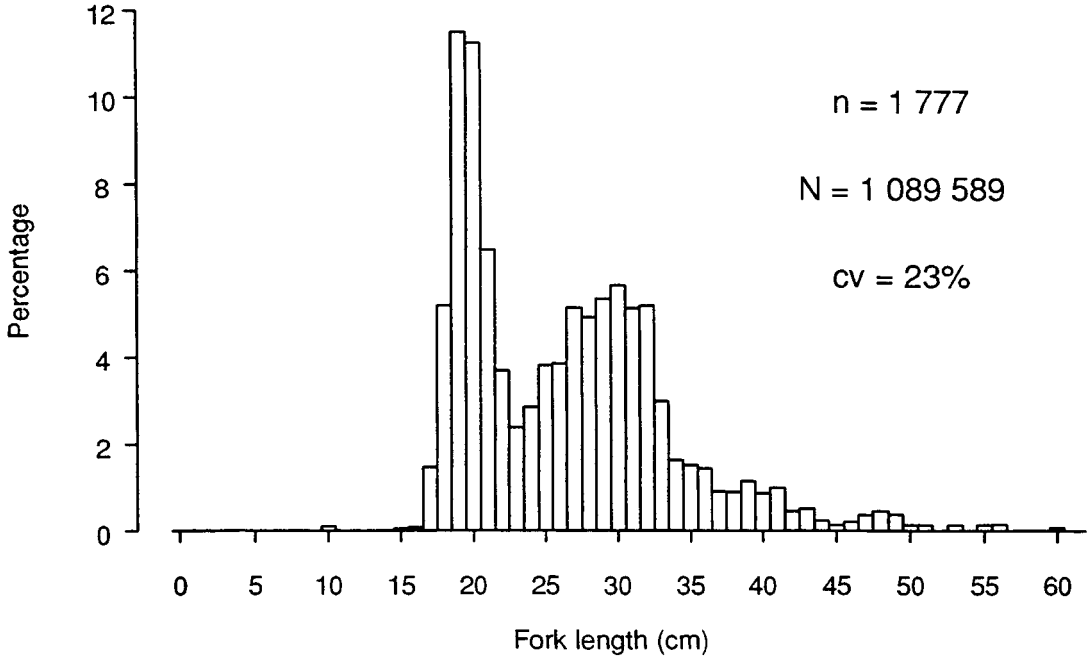


Figure 8: Length frequency distribution of snapper. n = number of fish measured, N = estimated number of snapper in the survey area, cv = coefficient of variation of the survey estimate.

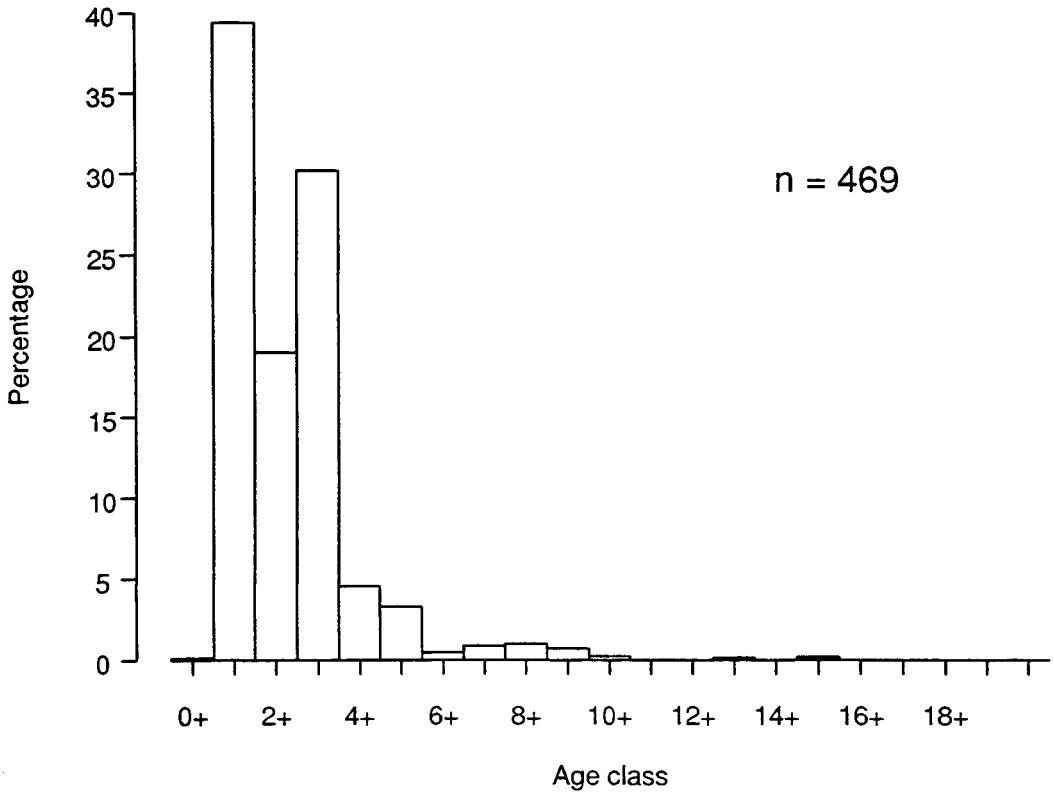


Figure 9: Age composition of snapper. n = number of otolith readings used to construct the snapper age-length key.

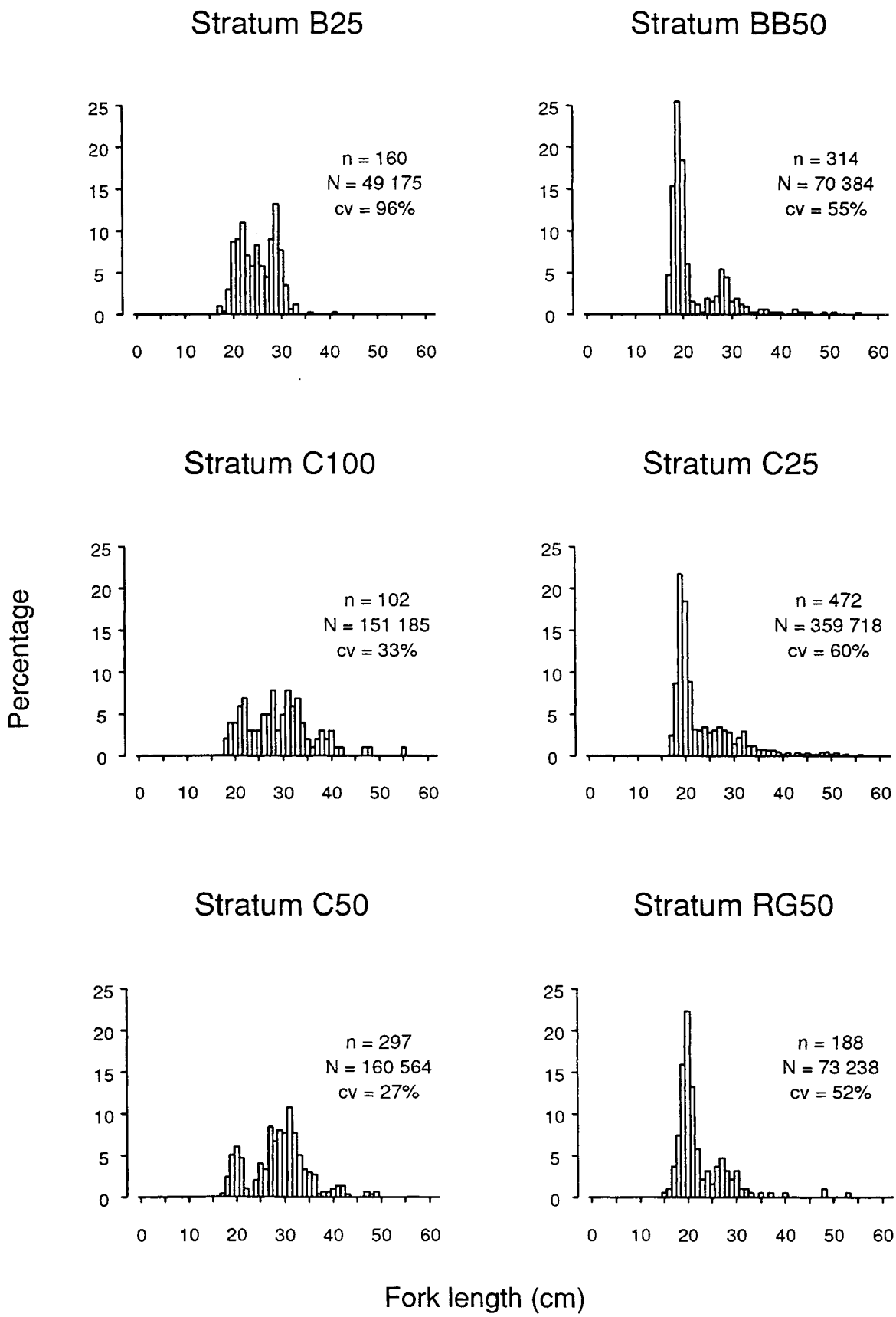


Figure 10: Stratum length compositions of snapper (for strata where greater than 100 fish were measured). n = number of fish measured, N = estimated number of snapper within the stratum, cv = coefficient of variation of the stratum estimate.

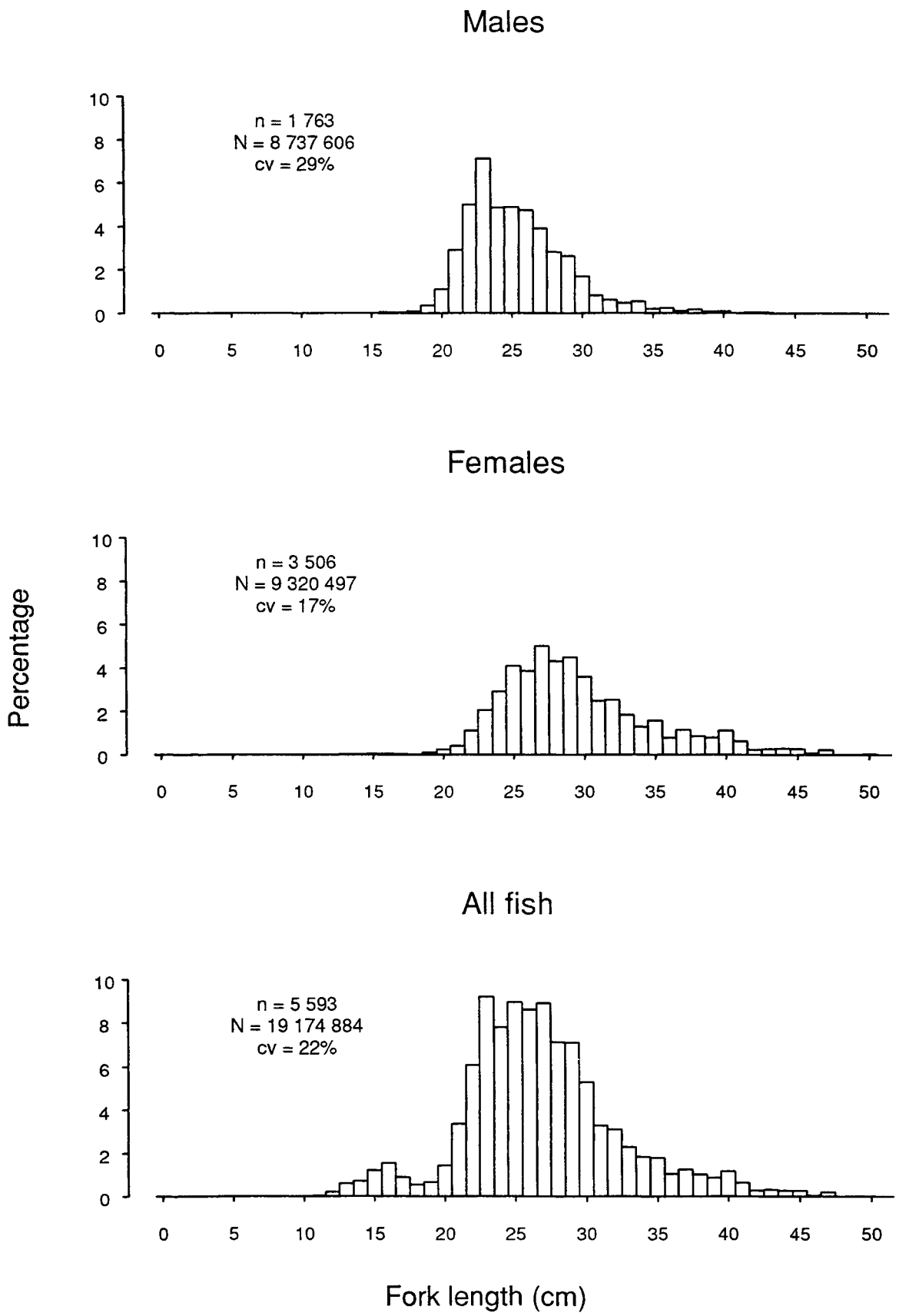
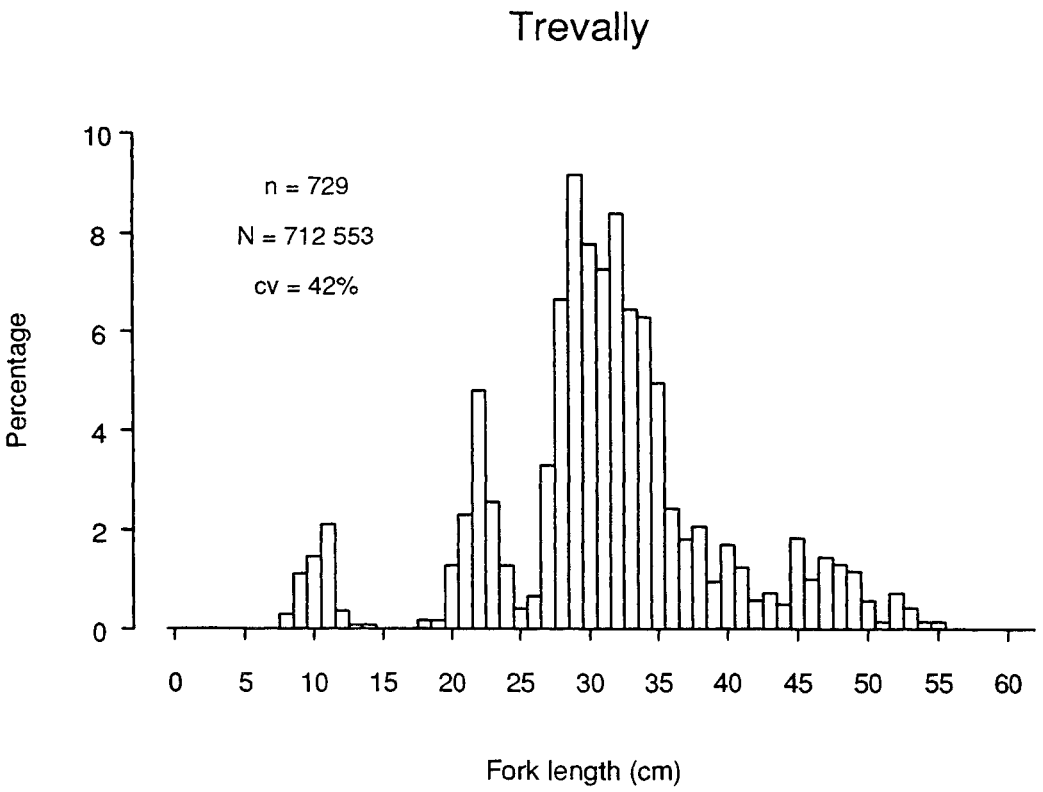


Figure 11: Length frequency distributions of male, female, and all red gurnard. n = number of fish measured, N = estimated number of fish in the survey area, and cv = coefficient of variation of the survey estimate.



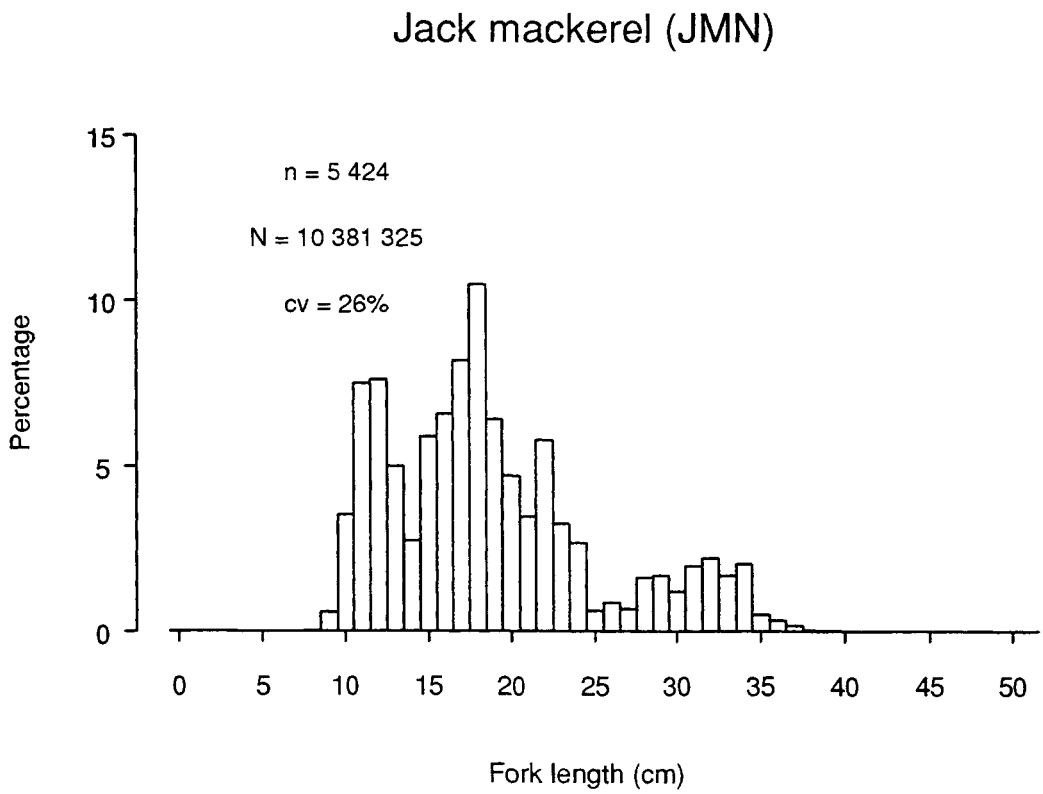


Figure 12: Length compositions of trevally and jack mackerel (*Trachurus novaezelandiae*).

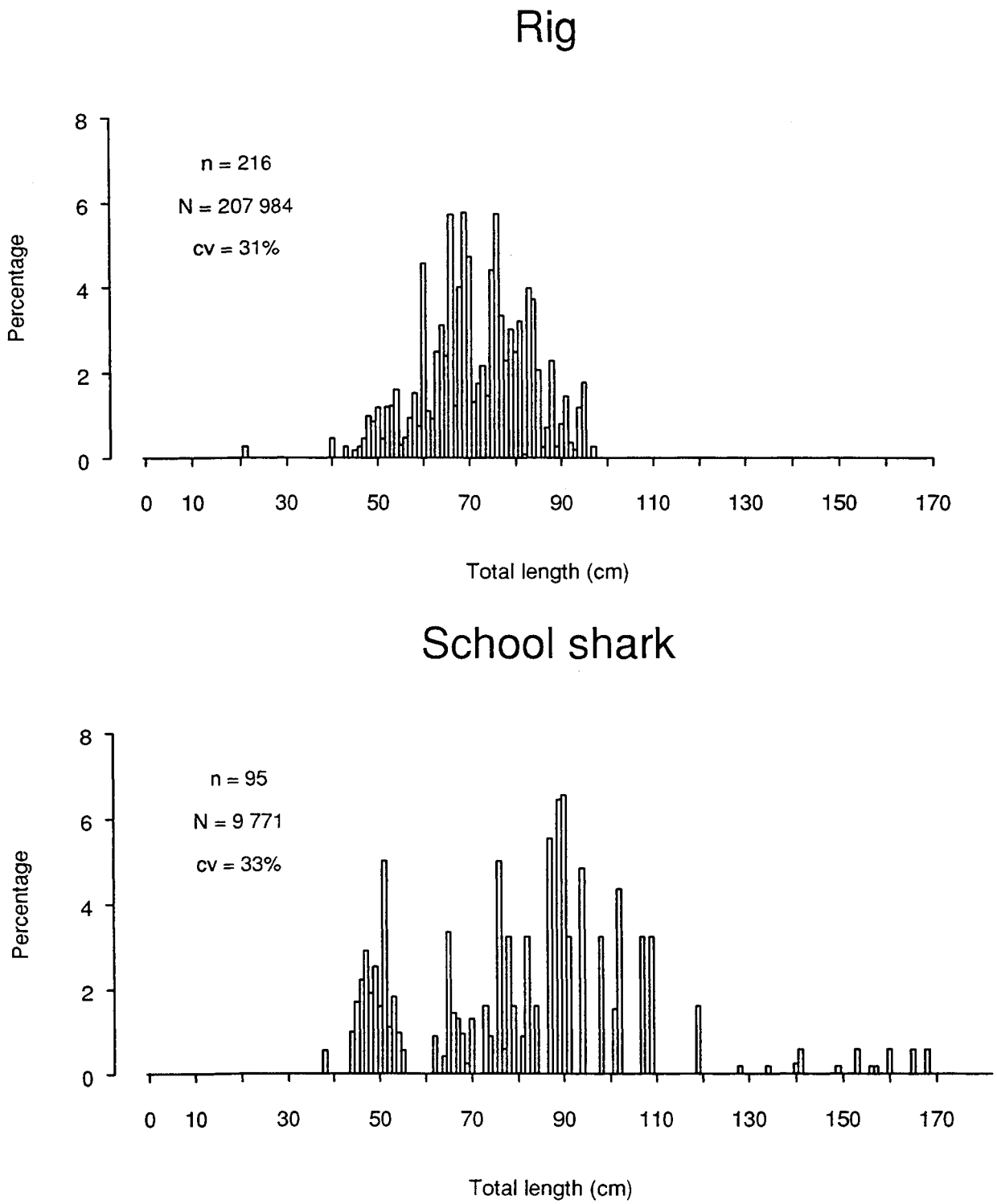


Figure 13: Length compositions of rig and school shark.

Appendix 1: Trawl gear specifications.

Type:	High opening bottom trawl (HOBT) without lower wings.
Doors:	
Type	Rectangular Vee
Area	3.4 m^2
Weight	480 kg
Backstrop:	6.6 m
Sweeps:	55 m x 16 mm diam.
Bridles:	
Top	55 m x 12 mm diam.
Bottom	55 m x 16 mm diam.
Headline:	34.5 m
Ground rope:	18.66 m
Ground chains:	2 x 14.5 m x 13 mm diam.
Ground rope weight:	120 kg plus 40 kg
Floats:	62 x 20 cm
Total flotation:	217 kgf
Vertical opening of trawl:	5.5–6.0 m
Codend mesh:	40 mm

Appendix 2: Macroscopic condition stages of gonads of female snapper (after Pankhurst *et al.* 1987).

Stage	Macroscopic condition
1	Immature or regressed; ovary clear, no oocytes visible.
2	Resting; ovary pink or clear. Small clear oocytes visible against the light.
3	Developing; opaque orange ovary; oocytes present.
4	Ripe; hyaline oocytes present.
5	Ovulated; eggs flow freely when light pressure applied to abdomen.
6	Spent; ovary flaccid and 'bloody'; residual eggs sometimes present in oviduct.

Appendix 3: Individual station data

Station	Stratum	Date	Start of tow Time	Latitude ° 'S	Longitude ° 'E	Depth (m)	Tow distance (n. mile)	Warp length (m)	Headline height (m)	Sea surface temp. (°C)
1	F100	06 Oct 94	0641	38 45.62	174 01.86	92	1.50	300	5.7	13.6
2	F100	06 Oct 94	0824	38 45.35	174 13.30	73	1.50	300	6.0	13.7
3	F50	06 Oct 94	0955	38 45.52	174 20.42	56	1.50	250	6.0	13.7
4	F50	06 Oct 94	1131	38 45.46	174 23.02	49	1.50	250	6.0	14.0
5	G25	06 Oct 94	1442	38 57.56	174 21.41	19	1.50	200	5.8	14.5
6	G25	06 Oct 94	1628	38 51.86	174 29.44	20	1.50	200	5.6	14.0
7	G25	07 Oct 94	1506	38 50.32	174 29.56	23	1.50	200	6.0	14.3
8	F50	07 Oct 94	1659	38 37.45	174 31.29	42	1.50	250	6.2	14.2
9	G25	08 Oct 94	0522	38 32.97	174 36.59	19	1.50	200	6.3	14.0
10	F50	08 Oct 94	0646	38 27.71	174 33.48	45	1.50	250	6.0	14.0
11	E100	08 Oct 94	0818	38 20.16	174 31.67	57	1.50	300	6.1	13.9
12	E50	08 Oct 94	0937	38 20.10	174 38.55	38	1.50	250	6.0	14.1
13	F25	08 Oct 94	1036	38 17.17	174 41.66	23	1.50	200	6.2	14.3
14	E50	08 Oct 94	1148	38 15.91	174 38.57	45	1.50	250	6.0	16.1
15	F25	08 Oct 94	1315	38 09.76	174 41.00	21	1.50	200	6.0	15.0
16	F25	08 Oct 94	1422	38 06.90	174 39.80	21	1.50	200	6.0	15.1
17	E50	08 Oct 94	1605	37 59.27	174 42.26	39	1.50	250	6.0	15.0
18	E50	08 Oct 94	1710	37 57.85	174 42.87	45	1.50	250	6.0	15.0
19	F25	09 Oct 94	0528	37 43.84	174 47.00	23	1.50	200	6.0	14.7
20	RG50	09 Oct 94	0632	37 46.52	174 45.32	29	1.50	250	6.0	14.7
21	RG50	09 Oct 94	0742	37 44.98	174 44.65	33	1.50	250	6.1	14.5
22	RG50	09 Oct 94	0859	37 44.13	174 39.98	45	1.50	250	6.2	14.6
23	RG50	09 Oct 94	0953	37 41.77	174 42.43	37	1.50	250	6.2	14.6
24	RG50	09 Oct 94	1142	37 36.89	174 37.47	46	1.50	250	5.5	14.5
25	E100	09 Oct 94	1342	37 44.04	174 26.03	76	1.53	300	6.0	14.2
26	E100	09 Oct 94	1625	37 03.58	174 26.83	74	1.50	300	5.4	14.2
27	F100	11 Oct 94	1325	38 33.45	174 14.41	78	1.50	300	5.9	13.8
28	F100	11 Oct 94	1436	38 29.82	174 19.35	74	1.50	300	6.0	13.8
29	F100	11 Oct 94	1651	38 21.38	174 14.60	89	1.50	350	6.0	13.8
30	E100	13 Oct 94	1246	38 00.39	174 07.48	98	1.50	400	6.0	13.9
31	E100	13 Oct 94	1604	37 36.11	174 20.21	93	1.52	400	6.0	14.0
32	DD50	14 Oct 94	0730	37 29.31	174 35.89	42	1.50	250	5.8	14.2
33	DD50	14 Oct 94	1103	37 32.05	174 40.78	29	1.50	250	6.0	14.3
34	DD50	15 Oct 94	0924	37 28.52	174 35.11	43	1.50	250	6.0	14.1
35	DD50	15 Oct 94	1044	37 25.80	174 33.93	43	1.50	250	6.0	14.2
36	C100	15 Oct 94	1239	37 24.35	174 22.51	79	1.50	300	6.0	14.0
37	C100	15 Oct 94	1433	37 16.98	174 24.65	62	1.50	300	6.0	14.3
38	C100	15 Oct 94	1556	37 15.61	174 25.05	61	1.50	300	6.0	14.2
39	E25	16 Oct 94	0828	37 30.13	174 42.29	22	1.53	200	6.0	13.9
40	E25	16 Oct 94	0935	37 24.88	174 40.00	18	1.50	200	6.0	14.1
41	E25	16 Oct 94	1028	37 22.13	174 38.74	20	1.50	200	6.0	14.2
42	E25	16 Oct 94	1121	37 19.32	174 37.34	20	1.50	200	6.2	14.2
43	D25	16 Oct 94	1407	37 01.07	174 25.67	24	1.50	200	6.0	14.4
44	D25	16 Oct 94	1547	36 57.98	174 26.47	23	1.50	200	6.2	14.4
45	D25	17 Oct 94	0529	36 51.08	174 24.39	22	1.50	200	6.0	14.0
46	D25	17 Oct 94	0628	36 53.78	174 25.39	22	1.50	200	6.2	14.0
47	C50	19 Oct 94	0525	36 30.75	174 02.01	27	1.50	250	6.0	14.2
48	C100	19 Oct 94	0655	36 38.04	174 01.31	87	1.54	300	6.0	14.2
49	C50	19 Oct 94	0824	36 35.98	174 06.91	41	1.50	250	6.0	14.3

	50	C50	19 Oct 94	0946	36 35.07	174 09.03	29	1.50	250	6.0	14.3
	51	C25	19 Oct 94	1111	36 32.73	174 10.03	19	1.50	200	6.0	14.3
	52	C25	19 Oct 94	1225	36 36.06	174 13.66	20	1.50	200	6.0	14.4
	53	C25	19 Oct 94	1325	36 38.88	174 16.58	18	1.50	200	6.0	14.6
	54	C25	19 Oct 94	1424	36 41.87	174 18.38	24	1.50	200	6.0	14.5
	55	C100	20 Oct 94	0543	36 19.23	173 55.25	50	1.50	300	6.0	14.3
	56	C50	20 Oct 94	0729	36 15.07	173 57.09	32	1.50	250	6.0	14.2
	57	C50	20 Oct 94	0914	36 15.10	173 54.10	46	1.50	250	6.0	14.3
	58	B100	20 Oct 94	1032	36 14.80	173 50.64	61	1.50	300	6.0	14.2
	59	BB50	20 Oct 94	1207	36 10.79	173 51.03	46	1.50	250	6.0	14.5
	60	BB50	20 Oct 94	1328	36 09.97	173 50.36	46	1.50	250	6.0	14.5
	61	BB50	20 Oct 94	1600	35 59.20	173 42.32	45	1.50	250	6.0	14.7
	62	B100	21 Oct 94	0529	35 53.77	173 31.61	83	1.50	300	6.0	14.4
	63	C25	21 Oct 94	0646	35 51.35	173 37.99	23	1.50	200	6.0	14.7
	64	BB50	21 Oct 94	0757	35 51.45	173 36.37	46	1.50	250	5.5	14.6
	65	B100	21 Oct 94	1140	35 35.87	173 16.19	90	1.50	300	6.0	14.8
F	66	B25	21 Oct 94	1309	35 32.76	173 20.48	25	1.49	200	6.0	14.7
	67	B25	21 Oct 94	1510	35 30.96	173 19.02	24	1.50	200	6.0	14.6
	68	B100	22 Oct 94	0541	35 18.91	173 05.52	60	1.50	300	6.0	14.4
	69	B25	22 Oct 94	0710	35 18.31	173 08.67	24	1.50	200	6.0	14.2
	70	B25	22 Oct 94	0807	35 15.00	173 06.08	21	1.50	200	6.0	14.2
	71	AA50	22 Oct 94	0953	35 05.39	173 02.31	48	1.50	250	6.0	14.5
	72	AA50	22 Oct 94	1050	35 02.04	173 03.00	44	1.50	250	6.0	14.5
F	73	AA50	22 Oct 94	1158	35 00.31	172 59.34	50	1.50	250	6.0	14.6
	74	AA50	22 Oct 94	1431	34 44.21	172 54.10	36	1.50	250	6.3	14.8
	75	AA50	22 Oct 94	1536	34 40.05	172 50.39	36	1.50	250	6.1	14.7

F, Fouled trawl shots

Appendix 4: Catch (kg) at each station for the 6 most abundant commercial species: snapper (SNA), jack mackerel (JMN, Trachurus novaezelandiae), red gurnard (GUR), trevally (TRE), rig (SPO) and school shark (SCH).

Station	SNA	JMN	GUR	TRE	SPO	SCH
1	0.0	20.2	17.2	0.0	0.0	0.0
2	0.0	0.0	90.0	0.0	0.0	0.0
3	4.2	14.9	81.5	1.1	1.7	1.5
4	3.9	8.8	77.6	2.1	0.7	2.7
5	0.7	13.7	9.7	7.3	0.0	0.0
6	0.0	60.1	11.0	0.0	1.6	0.0
7	9.3	31.6	2.1	0.1	4.4	0.6
8	12.1	0.8	72.7	0.0	3.8	5.2
9	3.9	3.5	6.4	0.0	0.0	0.0
10	10.7	0.0	25.2	0.0	2.0	1.7
11	0.0	2.0	32.0	0.0	2.9	0.5
12	0.0	0.0	7.1	0.0	6.8	0.0
13	34.3	3.9	21.1	11.5	2.6	0.0
14	0.0	2.7	4.1	0.0	0.0	0.0
15	8.5	7.5	12.9	4.2	0.0	0.0
16	0.2	3.2	19.5	0.0	2.2	0.0
17	2.5	0.0	138.1	0.0	0.0	0.0
18	0.0	0.0	23.1	0.0	1.5	1.4
19	0.0	1.4	6.8	0.0	0.0	0.0
20	0.0	0.0	45.4	0.7	2.2	0.0
21	7.4	0.1	35.2	2.2	0.0	0.8
22	29.4	8.1	45.0	1.1	5.8	1.2
23	19.4	1.7	40.6	0.9	1.8	0.4
24	4.6	0.8	72.7	0.8	0.7	12.7
25	1.3	35.0	266.1	0.0	0.0	0.0
26	0.0	8.5	82.7	0.0	5.6	4.2
27	1.0	4.0	23.5	0.0	0.0	3.7
28	15.0	107.9	55.5	0.8	45.1	0.0
29	1.0	0.0	29.5	0.0	0.0	0.0
30	2.5	0.0	1.7	0.0	0.0	40.9
31	3.8	0.0	24.6	0.0	5.3	6.7
32	1.1	0.0	6.1	0.0	1.9	0.0
33	3.6	0.0	18.6	0.0	4.9	0.0
34	1.4	0.0	21.7	14.5	17.1	3.1
35	0.5	0.0	10.0	1.3	6.8	5.5
36	40.0	0.0	60.6	0.0	0.0	10.1
37	7.8	0.0	79.9	0.0	0.0	3.7
38	4.6	0.0	80.3	0.0	3.5	4.6
39	0.2	8.8	2.8	3.6	5.1	3.4
40	1.5	8.9	3.3	4.3	6.8	0.9
41	5.2	8.3	5.8	5.7	14.4	0.6
42	6.8	5.3	1.2	13.0	10.4	0.0
43	0.6	0.9	7.9	3.3	5.0	0.0
44	0.0	4.9	5.2	16.5	0.2	1.3
45	0.6	2.8	6.0	2.3	6.5	0.0
46	0.2	3.6	3.0	1.2	1.9	0.0
47	4.6	6.8	64.7	0.0	9.4	100.8
48	3.5	7.1	76.4	0.0	0.0	0.0
49	30.9	4.1	45.4	4.3	2.4	0.0

	50	57.6	0.8	35.3	9.1	0.8	1.8
	51	41.6	4.2	13.5	2.3	0.5	0.0
	52	62.7	11.4	27.4	3.8	2.9	0.0
	53	20.9	40.8	14.5	10.2	14.4	0.0
	54	29.6	49.7	27.8	38.1	19.7	0.5
	55	16.8	23.3	46.0	2.3	5.8	2.3
	56	48.7	57.6	74.4	290.4	16.8	21.3
	57	38.4	73.2	105.9	44.5	3.8	0.0
	58	7.6	30.5	22.6	33.9	4.1	0.0
	59	42.1	25.7	50.5	6.4	0.0	0.0
	60	21.5	52.8	29.8	0.0	4.8	0.0
	61	30.9	15.3	79.0	0.0	2.5	7.8
	62	0.0	0.0	61.6	0.0	0.0	0.0
	63	116.8	149.8	77.7	13.8	26.8	0.0
	64	11.2	41.6	135.3	3.2	16.2	0.0
	65	3.3	0.5	81.5	0.0	0.0	0.0
F	66	14.4	20.1	27.5	3.1	14.4	0.0
	67	115.5	2.1	53.4	211.0	15.2	39.2
	68	0.0	0.1	23.5	0.0	8.6	4.8
	69	0.9	5.3	35.1	0.2	0.7	11.1
	70	3.2	22.0	62.2	1.8	1.7	32.8
	71	0.0	76.4	86.9	2.3	11.5	4.5
	72	10.1	35.3	34.7	33.4	0.0	0.0
F	73	10.6	22.3	39.1	1.6	7.0	9.0
	74	7.3	131.1	57.5	23.6	8.8	0.0
	75	8.5	92.4	60.1	98.4	10.3	0.0
	Total	1 009.0	1 386.2	3 242.3	936.2	390.3	353.3

F, Fouled trawl shots

Appendix 5. Snapper age-length key.

Length (cm)	Age class 0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+	14+	15+	>15+	No. aged
10	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
11	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
12	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
13	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
14	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
17	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
18	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	15
19	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19
20	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20
21	–	0.94	0.06	–	–	–	–	–	–	–	–	–	–	–	–	–	–	18
22	–	0.74	0.26	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19
23	–	0.24	0.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17
24	–	0.13	0.75	0.13	–	–	–	–	–	–	–	–	–	–	–	–	–	16
25	–	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20
26	–	0.05	0.85	0.10	–	–	–	–	–	–	–	–	–	–	–	–	–	20
27	–	–	0.60	0.40	–	–	–	–	–	–	–	–	–	–	–	–	–	20
28	–	–	0.45	0.55	–	–	–	–	–	–	–	–	–	–	–	–	–	20
29	–	–	0.25	0.75	–	–	–	–	–	–	–	–	–	–	–	–	–	20
30	–	–	–	0.95	0.05	–	–	–	–	–	–	–	–	–	–	–	–	21
31	–	–	–	0.91	0.09	–	–	–	–	–	–	–	–	–	–	–	–	22
32	–	–	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	19
33	–	–	–	0.90	0.10	–	–	–	–	–	–	–	–	–	–	–	–	21
34	–	–	–	0.67	0.33	–	–	–	–	–	–	–	–	–	–	–	–	21
35	–	–	–	0.63	0.38	–	–	–	–	–	–	–	–	–	–	–	–	16
36	–	–	–	0.33	0.40	0.27	–	–	–	–	–	–	–	–	–	–	–	15
37	–	–	–	0.13	0.63	0.25	–	–	–	–	–	–	–	–	–	–	–	8
38	–	–	–	–	0.45	0.55	–	–	–	–	–	–	–	–	–	–	–	11
39	–	–	–	–	0.56	0.33	0.11	–	–	–	–	–	–	–	–	–	–	9
40	–	–	–	0.10	0.10	0.40	–	0.30	0.10	–	–	–	–	–	–	–	–	10
41	–	–	–	–	0.13	0.75	–	0.13	–	–	–	–	–	–	–	–	–	8
42	–	–	–	–	–	0.63	0.25	0.13	–	–	–	–	–	–	–	–	–	8
43	–	–	–	–	–	0.33	0.11	0.22	0.22	0.11	–	–	–	–	–	–	–	9
44	–	–	–	–	–	0.50	–	0.50	–	–	–	–	–	–	–	–	–	4
45	–	–	–	–	–	0.50	0.50	–	–	–	–	–	–	–	–	–	–	2
46	–	–	–	–	–	0.33		0.33	0.33	–	–	–	–	–	–	–	–	3
47	–	–	–	–	–	–	–	–	0.25	0.50	0.25	–	–	–	–	–	–	4
48	–	–	–	–	–	–	–	0.14	0.43	0.43	–	–	–	–	–	–	–	7
49	–	–	–	–	–	–	0.25	0.13	0.25	0.25	0.13	–	–	–	–	–	–	8
50	–	–	–	–	–	–	–	–	0.50	0.50	–	–	–	–	–	–	–	2
51	–	–	–	–	–	–	–	–	–	0.50	0.50	–	–	–	–	–	–	2
52	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
53	–	–	–	–	–	–	–	–	0.67	0.33	–	–	–	–	–	–	–	3
54	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
55	–	–	–	–	–	–	–	–	1.00	–	–	–	–	–	–	–	–	1
56	–	–	–	–	–	–	–	–	0.33	–	–	–	–	–	–	0.67	–	3
57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1.00	–	1
61	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
62	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
63	–	–	–	–	–	–	–	–	–	–	–	–	–	1.00	–	–	–	1
64	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
65	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
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