Trawl survey of snapper and associated species off the west coast of the North Island, November 1996 (KAH9615)

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Introduction

Since 1986, trawl surveys have been conducted from R.V. *Kaharoa* off the west coast of the North Island, with a primary objective being the determination of the relative year class strength (YCS) of juvenile snapper. Derived snapper YCS indices from this ongoing programme have allowed for estimates of short-term recruitment to be included in the assessment of SNA 8 biomass and yield (Annala & Sullivan 1997).

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

Previous trawl surveys of this area have been documented as follows: four surveys between 1986 and 1991 (Langley 1994); 1989 (Drury & McKenzie 1992); 1991 (Drury & Hartill 1992); 1994 (Langley 1995). This report presents the results of the west coast North Island trawl survey conducted in November 1996. This research was funded by the Ministry of Fisheries through contract AKSN711.

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 objectives of the trawl survey for 1996 were as follows.

1. To estimate the relative year class strength and distribution of juvenile snapper off the west coast North Island.
2. To estimate relative abundance, distributions, age, sex, and length-frequencies of John dory, red gurnard, and tarakihi off the west coast of the North Island.

Timetable and personnel

The science staff joined *Kaharoa* at Auckland on 14 October and fishing began on 15 October at the northern limits of Ninety Mile Beach. All allocated stations south to the Manukau Harbour entrance were completed, and the science crew disembarked on 22 October at Onehunga. The second science crew boarded the vessel on 24 October, and

worked on the stations remaining from Manukau south to New Plymouth. The weather remained fine, and no days of fishing were lost. The initial 110 stations were completed before the end of the second leg, and an additional 14 stations were completed as an adaptive second phase of sampling. The survey ended on 3 November 1996.

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. The stratification remained the same as that of the 1994 survey, with the area being divided into 24 depth and area strata based on the catch rates of pre-recruit (under 25 cm fork length (FL)) snapper.

The original survey was of a single phase, stratified random design (*after* Francis 1984). Trawls were conducted at randomly selected positions, with a minimum of four stations per stratum at least 2 n. miles (3.7 km) apart. Additional stations were allocated to optimise the snapper coefficient of variation (*c.v.*), based on catch rates from previous surveys and their variability, scaled by stratum areas. All 110 stations were completed in advance of the timetable allocated, so an additional 14 stations were added to the survey as a second phase to maximise reduction in the *c.v.*s of snapper and tarakihi. This was achieved by adding an additional station iteratively to each of the strata, and using the existing density and variance information to predict the likely improvement in the overall *c.v.* for each possible stratum allocation. The station was then assigned to the stratum giving the greatest improvement, and the process repeated until all stations available had been allocated. Strata off Ninety Mile Beach (A25–A200) were excluded from this process because of the time that would have been lost steaming to that area. 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. Specifications of the trawl gear are given in Appendix 1.

Trawling procedure

All trawls were carried out during daylight between 0500 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 with a 2 n. mile (3.7 km) radius of the start position. If no suitable ground was located, the station was abandoned and another random position substituted. Towing speed was between 3.0 and 3.2 knots, and tow direction was generally in a direction that maintained the same water depth throughout the tow. Distance towed was constant at 1.5 n. miles, measured using Magnavox GPS. Warp to depth ratios ranged from 16.7:1 at the shallowest stations to 2.3:1 for the deepest trawls. Trawl door

spread was estimated using Scanmar gear. Where the Scanmar gear was not attached to the doors for a particular tow, trawl doorspread was estimated using the average from other tows for which doorspread was available. Scanmar gear was available only for the second leg of the voyage. A summary of gear parameters is given in Appendix 2.

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, but for large catches a random sample was taken, equal to at least 25% of total fish weight (apart from jack mackerel species, for which a smaller percentage was measured).

The length of fish and squid sampled was measured to the nearest centimetre below the actual length. The first 50 mature snapper greater than 23 cm FL in each sample were sexed and the ovarian condition of female fish categorised using a six stage developmental scale after Pankhurst *et al.* (1987) (Appendix 3). Red gurnard, John dory, and tarakihi were also sexed.

Otoliths were collected from measured snapper, red gurnard, John dory, and tarakihi, with sampling spread throughout the survey area. Fish were randomly selected within 1 cm length increments, up to a maximum of 20 individuals for snapper (both sexes combined) and 5 of each sex for the other species.

Environmental observations

The following environmental conditions were recorded for each trawl station: sea surface temperature, air temperature, bottom temperature, wind direction and speed, cloud cover, bottom type and contour, barometric pressure, sea condition and colour, and swell height and direction.

Data analysis

Biomass indices and scaled 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.
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 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.

Age determination

Snapper otoliths were aged as described by Davies & Walsh (1995). Age classes followed Paul (1976), whereby 1 January is defined as the theoretical birthday. Ages were inferred given the collection date of November 1996.

Age data were then applied to the scaled snapper length frequency distribution using an age-length key to estimate the age frequency distribution of the snapper population sampled by the survey.

Otoliths from tarakihi and red gurnard were processed and aged using the methods described by Sutton (1997), and the results used to construct age length keys. Problems were encountered with reliably ageing whole John dory otoliths, as described by Hore (1982), and new techniques may be needed to produce reliable age estimations for this species. No results are presented here on the age composition of the John dory sampled.

Estimation of snapper year class strength

To generate indices of relative snapper YCS, the number of individuals per year class was estimated in the following manner. For each shot, catch rates were scaled to numbers per square kilometre using the age-length key and corrections for tow length, doorspread, and percentage sampled. Total numbers per strata were then calculated. To ensure that the indices were calculated over the same spatial extent as had been used historically (1987 survey extent), it was necessary to exclude strata A25, A50, A100, A200, B25, B200, C200, E200, F50, F100, F200, and G25. In addition, stratum B100 had to be prorated to allow for the original northern extent of sampling ending at Manganui Bluff (Langley 1995).

Results

A total of 121 stations was successfully completed during the survey. Stations 11, 54, and 55 were excluded from the biomass analysis because of poor gear performance. The areal distribution of trawl stations is shown in Figure 2, and individual station information is given in Appendix 4.

Exceptionally good weather allowed completion of the initial allocated 110 stations well in advance of the time expected. Therefore, a further 14 stations were allocated using a two phase strategy based on their predicted contribution to a reduction in the overall snapper and

tarakihi *c.v.*s, and also to collect additional John dory and tarakihi otoliths. At this stage the *c.v.* on snapper less than 25 cm FL was 25.5%, and it was predicted to be further improved by the addition of the second phase stations. The overall *c.v.* for all snapper was 13.1%. After the 14 additional stations had been completed, *c.v.*s had increased to 40.7 and 27.7% respectively. Size frequency and density information indicated that snapper in shallower waters (e.g., stratum C25) may have moved out into deeper waters (e.g., stratum C100). This may have been due to the moderate sea conditions that had built up by this time. As stratum C100 occupies a substantial proportion of the total surveyed area (7%), the effects on the *c.v.*s were extreme. Assuming that movement between strata was the cause of the inflated *c.v.*s, one of the fundamental assumptions of stratified surveys was violated, that is, that the organisms being surveyed do not alter their spatial distribution between strata during the survey. Results and biomass estimates with their associated *c.v.*s have been presented as those calculated from all useable trawl shots, but the issue of which estimate (110 vs 124 stations) is more appropriate to use remains unclear.

Biomass estimates for other shallow water species, such as red gurnard and John dory, were unaffected by the 14 additional stations.

Catch composition

Eighty-eight species were caught during the survey (Table 2). Jack mackerel (*Trachurus* spp., excluding *T. murphyi*) accounted for 29.4% of the total catch by weight, red gurnard 21.8%, snapper 10.4%, barracouta 7%, and trevally 5.2%. Tarakihi and John dory, both secondary target species of the survey, accounted for 2.2% and 2.1% respectively of total weight. Catches of other commercial species, including school sharks, rig, and rough skates, were small. Catches of reef associated species (butterfly perch, red mullet, blue cod, pink maomao, red pigfish, spotty, and sweep) indicated that limited patches of foul may have been encountered by the trawl. A summary of catch by station of the more abundant species is given in Appendix 5.

Distribution and catch rates

Snapper were caught at 95 of the 121 successful stations (*see* Appendix 4). Both pre-recruit and larger snapper (greater than 24 cm FL) were most abundant in the shallower strata (less than 50 m water depth, Figures 3 and 4). Catch rates in the north Taranaki Bight were very low for larger snapper, and no pre-recruits were sampled.

Red gurnard were common throughout the survey area, though catches from the north Taranaki Bight were low (Figure 5). John dory displayed no clear spatial patterns, though they were absent at some inshore stations south of Manukau Harbour (Figure 6). Tarakihi were not taken in large numbers (Figure 7), most of the catch being taken in the deeper strata. Jack mackerel (all species combined) were widespread throughout the survey area (Figure 8). Trevally were distributed through the survey area in the shallower stations (Figure 9).

Biological data

Biological data collected from the catch are summarised in Table 3. The scaled length frequencies of snapper (Figure 10) showed two well defined modes at 10–14 cm and 17–24 cm length. The age-length key derived from the otolith readings indicates that these

modes represent the 0+ and 1+ age classes (Figure 11, Appendix 6). A broader size mode was also present from 25 to 38 cm, which was composed of 2+ to 5+ individuals.

The length compositions from six strata where more than 200 individuals were measured are presented in Figure 12. These strata accounted for 79% of all snapper measured during the survey. Fish of the 0+ age class were abundant in strata A25, C100, and RG50, 1+ fish were common in all except G25, and 2+ fish were common in A25, G25, and B25.

Female snapper were predominantly in the resting (54%) or developing (31%) phases of ovarian development. Females in immature or regressed phase accounted for 13% of fish sampled. Two percent of fish sampled were in the ripe phase.

Female red gurnard were generally larger than males (Figure 13). The male component was dominated by age classes 2–4, while the female component had a broader distribution across the 2–8 year classes (Figure 14, Appendix 7).

Most tarakihi were between 30 and 45 cm FL (Figure 15). Few fish under 25 cm were taken. For males the 3–8 age classes dominated, while for females the 4–10 age classes contained most individuals (Figure 16, Appendix 8). However, for both sexes combined, 17% of the population was composed of fish older than 10 years.

John dory length frequency distributions for males and females were similar (Figure 17), though adult females tended to be slightly larger. Moderate numbers of juveniles in the 15–22 cm range were encountered. Trevally displayed three size modes, of 10–15, 20–25, and 25–35 cm (Figure 18a), and for jack mackerel (*T. novaezealandiae*) a juvenile size mode of 13–19 cm was present (Figure 18b). Southern dogfish ranged from 40 to 90 cm, with no clear size modes (Figure 19a), and school shark ranged from 45 to 151 cm (Figure 19b).

Biomass estimates

Biomass estimates for snapper, jack mackerel (*T. novaezealandiae* and *T. declivis* combined), gurnard, trevally, tarakihi, John dory, school shark, and rig are given in Table 4. As with the previous west coast trawl survey (Langley 1995), much of the total snapper biomass (53.5%) was concentrated in the three strata adjacent to the entrance of Kaipara Harbour (C25, C50, and C100). Stratum C100 in particular stood out, accounting for 40% of total snapper biomass. Much of the red gurnard biomass (52%) was within three of the four large 50–100 m depth strata (B100, C100, E100), although F100 had a low biomass (18.8 t) compared to 1994 survey results (457.5 t). G25 and AA50 accounted for a further 16% of red gurnard biomass. In G25, the biomass of red gurnard was greatly increased from the 1994 survey (from 16.8 to 257.9 t).

Tarakihi were aggregated in strata B100, E200, and F200, which accounted for 70% of total biomass. Thirty-six percent of trevally biomass was located in stratum A25. School shark were relatively abundant in only three strata (A200, B200, E100), which accounted for 67% of total biomass. Strata C200, E100, E200, and F200 accounted for 75% of jack mackerel biomass (*T. novaezealandiae* and *T. declivis* combined). John dory and rig showed no clear patterns of biomass distribution.

For snapper, trevally, rig, and school shark, *c.v.*s around the total biomass estimates were between 15 and 25%, implying moderate precision. Tarakihi had a *c.v.* of 26.7%. Red gurnard and John dory had *c.v.*s of less than 10%, indicating a high level of precision. The

c.v. for jack mackerel was poorly estimated at 36%. Vertical availability in this species is likely to make biomass estimates very conservative (i.e., a significant proportion of the population is likely to occur at greater distances above the bottom than the net headline height).

Estimation of snapper year class strength

The total number of juveniles per year class is given in Table 5, as estimated from this and previous trawl surveys of the west coast of the North Island. Indices have been generated by expressing the number of fish in any particular year class as a ratio of the number of fish in that year class, divided by the mean of all year classes combined. Indices for the 1993 and 1994 year classes are slightly below the historical average.

Discussion

The trawl survey design was optimised to estimate the relative abundance of pre-recruit snapper. Strata were the same as those adopted by Langley (1995), but direct comparison between the two surveys is complicated by a number of strata (A25, A100, A200, B200, C200, E200, F200) not being sampled during the 1994 survey. However, most of these deeper strata would have contributed little to juvenile snapper biomass or numbers. The five surveys before 1994 have all had different survey boundaries and require modifications to be comparable (Langley 1994).

The apparent changes in the spatial distribution of snapper between the first and second phases of this survey are of concern, and resulted in substantial increases in the *c.v.* of snapper after completion of the second phase of sampling. Whether to use the full survey dataset or only those of the first phase remains open to debate. Results presented here incorporate all 121 successful station shots completed.

This survey yielded estimates of 2+ and 3+ snapper numbers with modest to poor precision (20 and 31% respectively). Biomasses of red gurnard and John dory were more accurately estimated, with *c.v.*s of 9.6 and 9.9% respectively, indicating that the present stratification is well suited to these species. Tarakihi biomass was poorly estimated, with a *c.v.* of 26.7%, and if this is a target species in future surveys, station allocation may need to be directed towards achieving improvements in the *c.v.* of this species as well as that of juvenile snapper.

Red gurnard and tarakihi were aged during this programme, but John dory proved to be a difficult species to age using historically accepted methods. New approaches to ageing this species are currently being examined within the MFish funded programme INS801.

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

Stratum	Description	Depth range (m)	Area (km^2)	No. of stations phase 1	No. of stations phase 2	Density (per km^2)
A25	Ninety Mile Beach	10–25	254	5		1 : 50
AA50	Scott Pt. to Sth Hokianga	25–50	942	4		1 : 235
A100	Scott Pt. to Tauroa Pt.	50–100	624	4		1 : 156
A200	Scott Pt. to Tauroa Pt.	100–200	1 998	4		1 : 499
B25	Tauroa Pt. to Sth Hokianga	10–25	104	5		1 : 20
BB50	Sth Hokianga to Nth Kaipara	25–50	323	5		1 : 65
B100	Tauroa Pt. to Nth Kaipara	50–100	1 332	4		1 : 333
B200	Tauroa Pt. to Nth Kaipara	100–200	970	4	1	1 : 194
C25	Sth Hokianga to Sth Manukau	10–25	562	7	5	1 : 47
C50	Baylys Beach to Sth Manukau	25–50	612	6		1 : 102
C100	Nth Kaipara to Waikato	50–100	1 736	4	4	1 : 217
C200	Nth Kaipara to Waikato	100–200	1 045	4		1 : 261
D25	Muriwai to Sth Manukau	10–25	191	4		1 : 47
DD50	Sth Manukau to Otehe Pt.	25–50	462	4		1 : 115
RG50	Otehe Pt. to Raglan	25–50	441	5		1 : 88
E25	Sth Manukau to Otehe Pt.	10–25	312	4		1 : 78
E50	Raglan to Tirua Pt.	25–50	487	4		1 : 121
E100	Waikato to Tirua Pt.	50–100	3 635	5		1 : 727
E200	Waikato to Tirua Pt.	100–200	1 424	4		1 : 356
F25	Otehe Pt. to Tirua Pt.	10–25	329	4		1 : 82
F50	Tirua Pt. to Airedale Reef	25–50	741	4		1 : 185
F100	Tirua Pt. to Airedale Reef	50–100	2 490	5	1	1 : 415
F200	Tirua Pt. to Airedale Reef	100–200	2 722	6	3	1 : 302
G25	Tirua Pt. to Airedale Reef	10–25	492	5		1 : 98
		Total	24 108	107	14	

Table 2 : **Species caught, total catch, percentage of 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*	5 115.1	21.8	96.0
Jack mackerel	JMN	*Trachurus novaezealandiae*	3 068.2	13.1	47.6
Jack mackerel	JMA	*Trachurus* sp.	2 525.9	10.8	37.1
Snapper	SNA	*Pagrus auratus*	2 443.3	10.4	77.4
Barracouta	BAR	*Thyrsites atun*	1 646.6	7.0	58.9
Jack mackerel	JMD	*Trachurus declivis*	1 311.2	5.6	17.7
Trevally	TRE	*Pseudocaranx dentex*	1 231.2	5.2	46.0
School shark	SCH	*Galeorhinus australis*	769.7	3.3	50.8
Spiny dogfish	SPD	*Squalus acanthias*	725.7	3.1	25.0
Rig	SPO	*Mustelus lenticulatus*	675.6	2.9	62.9
Tarakihi	TAR	*Nemadactylus macropterus*	506.5	2.2	36.3
John dory	JDO	*Zeus faber*	490.8	2.1	71.8
Rough skate	RSK	*Raja nasuta*	312.9	1.3	31.5
Cucumberfish	CUC	*Chlorophthalmus nigripinnis*	185.0	0.8	20.2
Arrow squid	SQU	*Nototodarus sloanii*	183.0	0.8	33.9
Smooth skate	SSK	*Raja innominata*	170.4	0.7	16.1
Northern spiny dogfish	NSD	*Squalus blainvillei*	163.7	0.7	14.5
Longtailed stingray	WRA	*Dasyatis thetidis*	152.8	0.7	8.1
Jack mackerel	JMM	*Trachurus murphyi*	141.0	0.6	8.1
Red cod	RCO	*Pseudophycis bachus*	127.5	0.5	28.2
Leatherjacket	LEA	*Parika scaber*	125.3	0.5	25.8
Eagle ray	EGR	*Myliobatus tenuicaudatus*	119.5	0.5	12.1
Silver dory	SDO	*Cyttus novaezealandiae*	118.6	0.5	10.5
Snipefish	SNI	*Macrorhamphosus scolopax*	104.0	0.4	4.8
Kahawai	KAH	*Arripis trutta*	98.6	0.4	28.2
Shorttailed stingray	BRA	*Dasyatis brevicaudatus*	80.0	0.3	4.8
Kingfish	KIN	*Seriola lalandi*	75.2	0.3	2.4
Anchovy	ANC	*Engraulis australis*	71.7	0.3	21.8
Japanese gurnard	JGU	*Pterygotrigla picta*	68.7	0.3	11.3
Ghost shark	GSH	*Hydrolagus novaezealandiae*	55.9	0.2	8.9
Sea perch	SPE	*Helicolenus* spp.	52.7	0.2	21.0
English sole	ESO	*Peltorhamphus novaezeelandiae*	49.4	0.2	44.4
Frostfish	FRO	*Lepidopus caudatus*	45.2	0.2	8.1
Thresher shark	THR	*Alopias vulpinus*	44.4	0.2	1.6
Giant stargazer	STA	*Kathetostoma giganteum*	39.2	0.2	7.3
Turbot	TUR	*Colistium nudipinnis*	34.5	0.1	19.4
Spotted stargazer	SPZ	*Genyagnus monopterygius*	29.9	0.1	25.0
Scaly gurnard	SCG	*Lepidotrigla brachyoptera*	26.3	0.1	25.0
Stingray	STR	*Allothunnus fallai*	23.0	0.1	1.6
Ruby fish	RBY	*Plagiogeneion rubiginosus*	21.7	0.1	1.6
Carpet shark	CAR	*Cephaloscyllium isabella*	20.6	0.1	13.7
Blue warehou	WAR	*Seriolella brama*	19.4	0.1	14.5
Hammerhead shark	HHS	*Sphyrna zygaena*	16.0	0.1	3.2
Electric ray	ERA	*Torpedo fairchildi*	14.8	0.1	5.6
Lemon sole	LSO	*Pelotretis flavilatus*	14.7	0.1	29.8
Orange perch	OPE	*Lepidoperca aurantia*	14.2	0.1	2.4
Brill	BRI	*Colistium guntheri*	12.3	0.1	8.9
Redbait	RBT	*Emmelichthys nitidus*	10.8	< 0.1	5.6

English mackerel	EMA	*Scomber australasicus*	10.7	< 0.1	21.0
Common roughy	RHY	*Paratrachichthys trailli*	9.0	< 0.1	0.8
Longfinned boarfish	LFB	*Zanclistius elevatus*	8.7	< 0.1	6.5
Sand flounder	SFL	*Rhombosolea plebia*	7.1	< 0.1	22.6
Witch	WIT	*Arnoglossus scapha*	7.1	< 0.1	21.0
Gemfish	SKI	*Rexea solandri*	6.5	< 0.1	0.8
Brown stargazer	BRZ	*Xenocephalus armatus*	6.2	< 0.1	1.6
Pilchard	PIL	*Sardinops neopilchardus*	6.2	< 0.1	10.5
Hapuku	HAP	*Polyprion oxyceneios*	5.6	< 0.1	1.6
Yellow eyed mullet	YEM	*Aldrichetta forsteri*	4.9	< 0.1	8.1
Estuarine stargazer	ESZ	*Leptoscopus macropygus*	4.8	< 0.1	9.7
Paddle crab	PAD	*Ovalipes catharus*	4.3	< 0.1	3.2
Butterfly perch	BPE	*Caesioperca lepidoptera*	4.2	< 0.1	2.4
Blue cod	BCO	*Parapercis colias*	3.4	< 0.1	1.6
Pink maomao	PMA	*Caprodon longimanus*	3.0	< 0.1	0.8
Rock cod	ROC	*Lotella rhacinus*	3.0	< 0.1	0.8
Octopus	OCT	*Octopus* sp.	2.6	< 0.1	0.8
Red mullet	RMU	*Upeneichthys lineatus*	2.6	< 0.1	0.8
Broad squid	BSQ	*Sepioteuthis bilineata*	2.2	< 0.1	4.0
Conger eel	CON	*Conger* spp.	1.8	< 0.1	0.8
Ahuru	PCO	*Auchenoceros punctatus*	1.8	< 0.1	13.7
Red snapper	RSN	*Centroberyx affinis*	1.8	< 0.1	0.8
Lookdown dory	LDO	*Cyttus traversi*	1.7	< 0.1	0.8
Northern bastard red cod	BRC	*Pseudophycis breviuscula*	1.3	< 0.1	2.4
Ling	LIN	*Genypterus blacodes*	1.3	< 0.1	1.6
Stargazer	STG		1.3	< 0.1	1.6
Unidentified	UNI		1.3	< 0.1	2.4
Red pigfish	RPI	*Bodianus vulpinus*	1.1	< 0.1	0.8
Sprat	SPM	*Sprattus muelleri*	1.1	< 0.1	7.3
Flatfish	FLA		1.0	< 0.1	0.8
Mirror dory	MDO	*Zenopsis nebulosus*	1.0	< 0.1	0.8
Rock lobster	CRA	*Jasus edwardsii*	0.8	< 0.1	0.8
Spotty	STY	*Notolabrus celidotus*	0.8	< 0.1	2.4
Sweep	SWE	*Scorpis lineolatus*	0.7	< 0.1	0.8
Hoki	HOK	*Macruronus novaezealandiae*	0.6	< 0.1	4.0
Wrasse spp.	WSE	Labridae (Family)	0.6	< 0.1	0.8
Yellow-belly flounder	YBF	*Rhombosolea leporina*	0.5	< 0.1	1.6
Yellow cod	YCO	*Parapercis gilliesi*	0.3	< 0.1	1.6
Silver warehou	SWA	*Seriolella punctata*	0.2	< 0.1	0.8
Crested flounder	CFL	*Lophonectes gallus*	0.1	< 0.1	0.8
Silver conger	SEE	*Gnathophis habenatus*	0.1	< 0.1	0.8
Spiny seadragon	SDR	*Solegnathus spinosissimus*	0.1	< 0.1	0.8
Porcupine fish *(not weighed, water inflation)*	POP	*Allomycterus jaculiferus*	–	–	19.4
	Total		23 476.1		

Table 3 : **Species and number of fish and squid measured**

Common Name	No. of tows in which species occurred	No. of fish	No. of males	No. of females
Red gurnard	119	10 270	2 919	5 703
Snapper	89	3 611	710	591
Jack mackerel *(Trachurus* spp.*)*	39	3 227	11	–
Trevally	56	1 418	15	7
Jack mackerel *(T. novaezelandiae)*	13	937	–	–
Tarakihi	45	587	182	301
Barracouta	68	567	267	280
Rig	74	514	208	301
John dory	89	477	219	204
Kahawai	34	372	12	1
Cucumberfish	8	362	–	–
Red cod	32	329	1	–
Arrow squid	18	314	–	–
Leatherjacket	14	306	–	–
Anchovy	9	274	–	–
English sole	52	261	22	–
Japanese gurnard	11	160	7	7
School shark	49	148	71	77
Rough skate	26	117	58	59
Silver dory	4	100	–	–
Spiny dogfish	8	98	33	64
Blue warehou	15	92	12	1
Jack mackerel *(T. murphii)*	6	86	–	–
Northern spiny dogfish	10	72	49	23
Lemon sole	33	70	–	–
Pilchard	5	63	9	–
Jack mackerel *(T. declivis)*	3	54	–	–
Spotted stargazer	24	53	5	–
Sand flounder	27	50	–	–
Common roughy	1	49	–	–
Ruby fish	2	47	–	–
Turbot	24	47	–	–
Witch	21	47	1	–
Orange perch	3	44	–	–
Yellow-eyed mullet	7	44	–	1
Ghost shark	11	41	9	26
English mackerel	16	39	–	–
Ahuru	6	27	–	–
Sea perch	4	26	–	–
Smooth skate	12	22	7	14
Frostfish	9	21	–	–
Giant stargazer	8	21	–	–
Brill	10	20	7	–
Butterfly perch	3	17	–	–

Longfinned boarfish	4	17	–	–
Estuarine stargazer	10	15	–	–
Sprat	2	14	–	–
Blue cod	1	8	–	–
Broad squid	3	7	–	–
Hoki	1	7	–	–
Pink maomao	1	7	–	–
Rock cod	1	6	–	–
Sweep	1	6	–	–
Kingfish	3	5	1	–
Eagle ray	4	4	2	1
Northern bastard red cod	3	3	–	–
Redbait	1	3	–	–
Brown stargazer	2	2	–	–
Hapuku	2	2	1	–
Ling	2	2	–	–
Stargazer	2	2	1	–
Yellow-belly flounder	2	2	–	–
Carpet shark	1	1	–	–
Hammerhead shark	1	1	–	1
Mirror dory	1	1	–	1
Red pigfish	1	1	–	–
Red snapper	1	1	–	–
Gemfish	1	1	–	1
Spotty	1	1	–	–
Silver warehou	1	1	–	–
Thresher shark	1	1	–	1
Longtailed stingray	1	1	–	1
Yellow cod	1	1	–	–

– no data or fish not sexed

Table 4 : **Estimated biomass (t) and coefficient of variation (cv, in parentheses) by stratum of snapper (SNA), jack mackerel species (JMA, *Trachurus* spp.), red gurnard (GUR), trevally (TRE), tarakihi (TAR), John dory (JDO), rig (SPO), and school shark (SCH)**

				Species code						
			SNA	JMA	GUR	TRE	TAR	JDO	SPO	SCH
Stratum	< 25 cm	≥ 25 cm	Total							
A25	10.6	94.5	105.2		110.1	120.1	0.3	8.0	18.3	0.0
	(79)	(39)	(35)		(23)	(53)	(100)	(50)	(58)	
AA50	0.2	18.5	18.7		243.1	10.4	4.0	19.4	11.3	10.1
	(55)	(73)	(72)		(17)	(68)	(58)	(43)	(76)	(100)
A100	0.0	7.9	7.9		157.6	0.0	20.9	46.5	14.0	0.0
		(67)	(67)		(39)		(55)	(43)	(38)	
A200	0.0	0.0	0.0		14.7	0.0	38.7	18.7	12.6	249.9
					(72)		(46)	(87)	(65)	(58)
B25	7.3	18.8	26.1		45.9	7.6	0.0	3.7	4.3	0.0
	(88)	(58)	(65)		(18)	(46)		(41)	(29)	
BB50	1.4	17.6	18.9		117.3	27.7	1.0	3.9	2.1	17.1
	(71)	(35)	(34)		(26)	(89)	(79)	(29)	(84)	(61)
B100	8.0	39.2	47.2		501.1	0.0	166.5	64.0	32.4	26.8
	(100)	(32)	(43)		(12)		(93)	(29)	(43)	(100)
B200	0.0	11.4	11.4		19.3	0.1	67.1	17.4	8.7	137.8
		(73)	(73)		(36)	(100)	(53)	(30)	(62)	(31)
C25	56.7	61.5	118.2		144.5	32.2	0.0	2.9	44.1	28.7
	(36)	(36)	(32)		(24)	(54)		(45)	(47)	(52)
C50	7.2	35.8	43.0		133.3	0.5	0.0	1.0	5.7	1.7
	(42)	(49)	(48)		(20)	(100)		(63)	(51)	(100)
C100	83.6	393.9	477.5		353.0	3.3	5.3	54.1	1.9	34.4
	(97)	(65)	(51)		(42)	(100)	(39)	(31)	(100)	(60)
C200	0.0	41.1	41.1		27.8	0.0	30.6	17.1	2.1	21.1
		(64)	(64)		(36)		(30)	(22)	(100)	(42)
D25	1.7	5.9	7.6		38.0	34.6	0.0	0.0	19.3	0.3
	(63)	(54)	(56)		(12)	(87)			(48)	(64)
DD50	6.7	7.7	14.3		100.4	8.3	0.0	0.0	16.4	4.1
	(32)	(14)	(20)		(35)	(64)			(60)	(25)
RG50	0.9	3.1	4.0		24.7	13.5	0.0	3.8	13.9	3.8
	(33)	(42)	(37)		(23)	(29)		(54)	(23)	(43)
E25	0.0	3.2	3.2		33.0	0.2	0.0	0.0	8.0	0.6
		(73)	(73)		(41)	(100)			(96)	(100)
E50	0.1	65.6	65.7		374.8	9.0	19.0	41.8	47.6	145.8
	(100)	(51)	(51)		(16)	(100)	(87)	(29)	(61)	(49)
E100	0.0	17.7	17.7		8.0	0.0	137.8	39.5	1.6	78.4
		(59)	(59)		(60)		(18)	(32)	(100)	(63)
E200	0.5	15.4	15.9		34.3	7.3	0.0	0.5	2.9	0.7
	(96)	(64)	(65)		(55)	(64)		(100)	(74)	(75)
F25	7.4	27.7	35.1		93.2	13.7	0.0	5.1	3.8	3.3
	(100)	(98)	(98)		(35)	(68)		(71)	(71)	(20)
F50	0.0	2.3	2.3		15.5	0.2	0.9	8.5	0.1	3.8
		(100)	(100)		(41)	(100)	(77)	(31)	(100)	(84)
F100	0.0	8.9	8.9		20.8	4.0	138.9	78.5	3.1	41.9
		(45)	(45)		(61)	(100)	(29)	(18)	(67)	(51)
F200	4.4	77.7	82.1		257.9	30.2	0.0	6.2	4.0	4.2
	(43)	(37)	(36)		(52)	(47)		(99)	(60)	(63)
G25	12.9	7.6	20.6		55.8	4.5	0.0	1.7	2.3	3.4
	(73)	(48)	(58)		(20)	(73)		(63)	(48)	(38)
Total	209.6	982.8	1192.4		2923.9	327.3	630.8	442.2	280.4	817.8
	(41)	(27)	(22)		(33)	(25)	(1)	(10)	(16)	(22)

Table 5 : **Snapper year class strength (YCS) estimates**

Year class	Number (000s)	Index	*c.v.(%)*
1984	166.4	0.82	27
1985	557.3	2.73	28
1986	158.9	0.78	10
1987	135.7	0.67	20
1988	35.9	0.18	37
1989	195.5	0.96	32
1991	258.5	1.27	15
1992	160.6	0.79	26
1993	190.1	0.93	31
1994	181.6	0.89	20

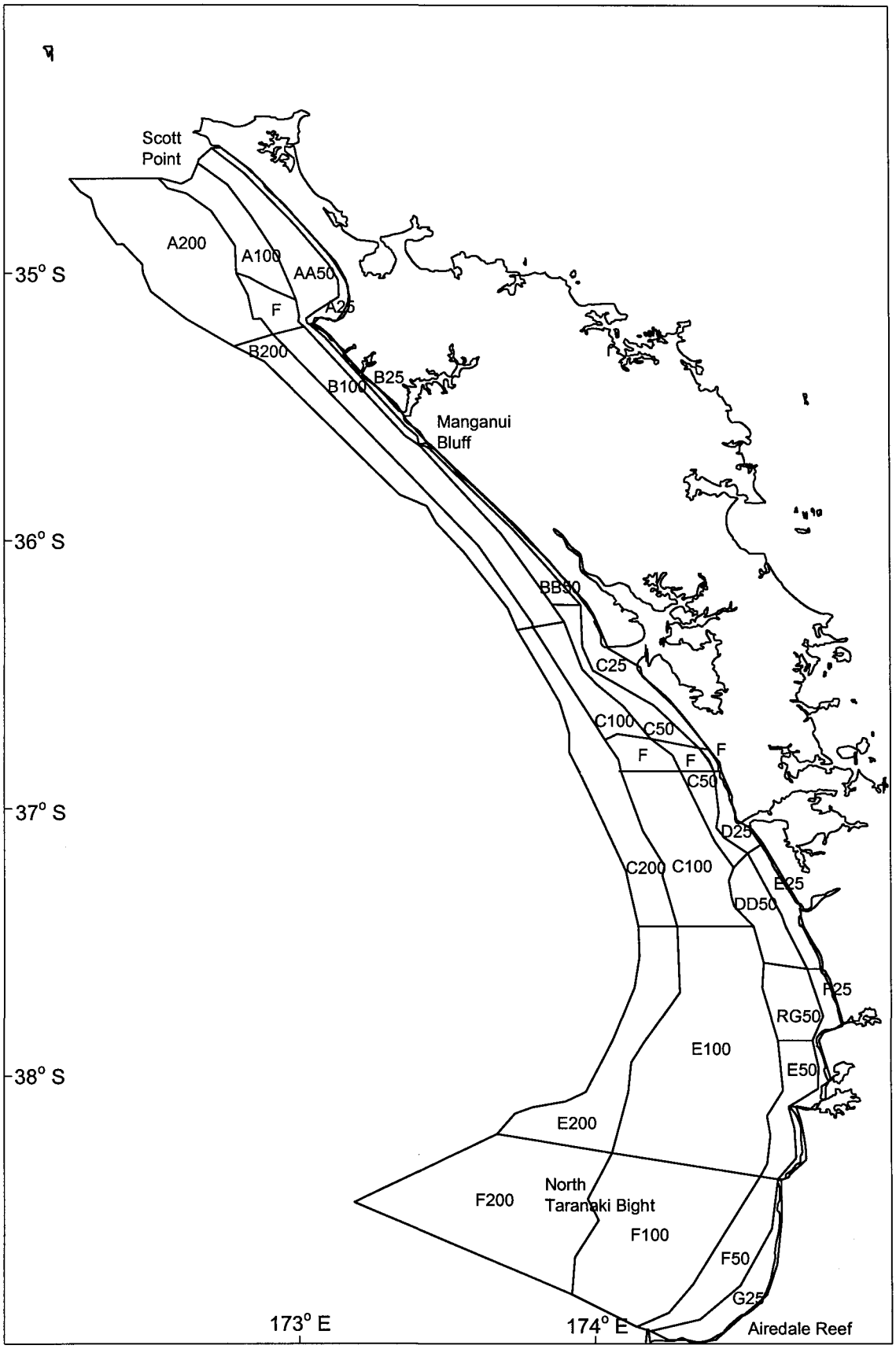


Figure 1: **Survey area and stratum boundaries (F, foul ground area).**

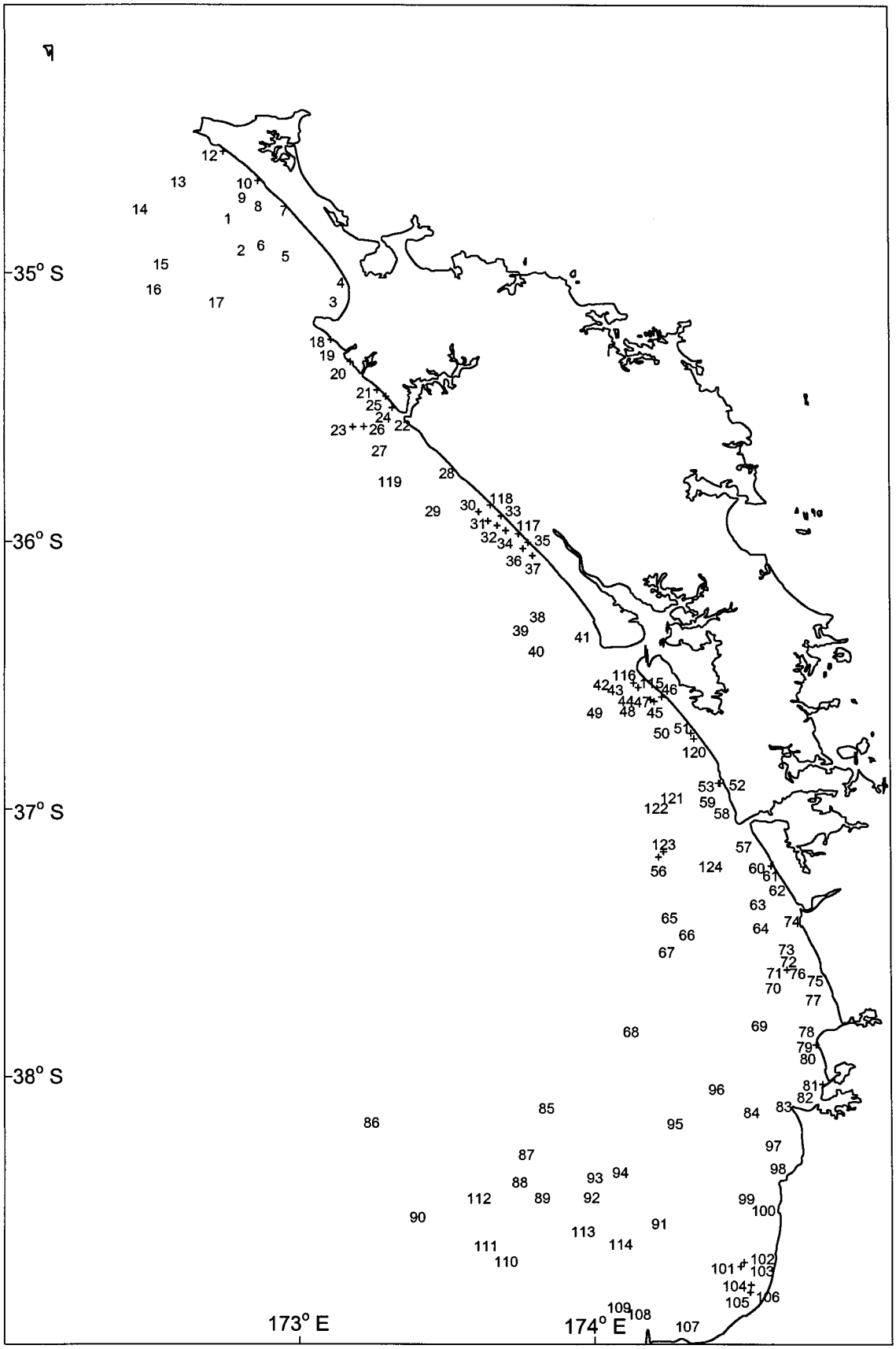


Figure 2: **Station positions and numbers (+ denotes actual station position for overlapping labels).**

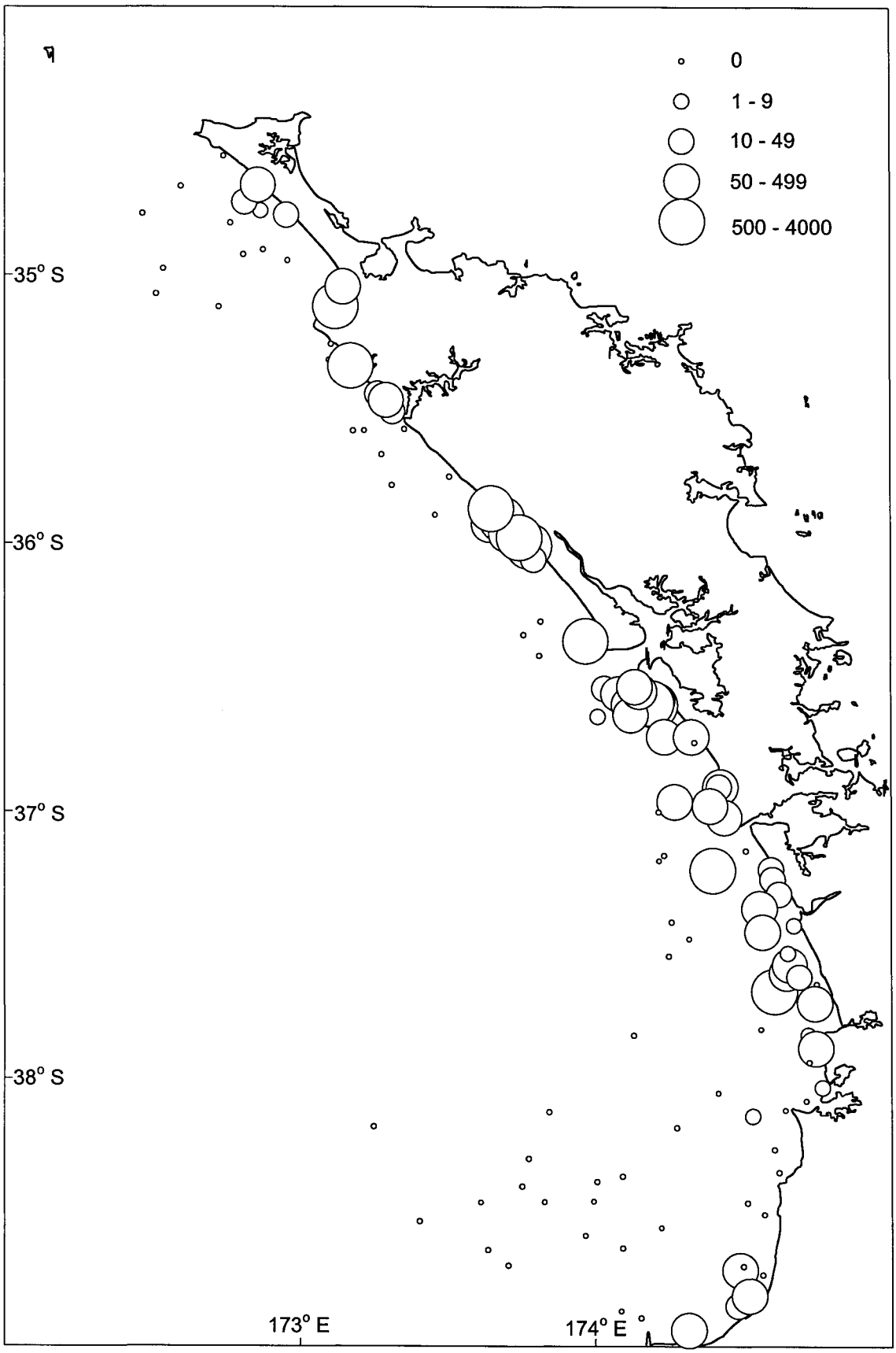


Figure 3: **Catch rates (individuals per km^2) of juvenile (< 25 cm) snapper**

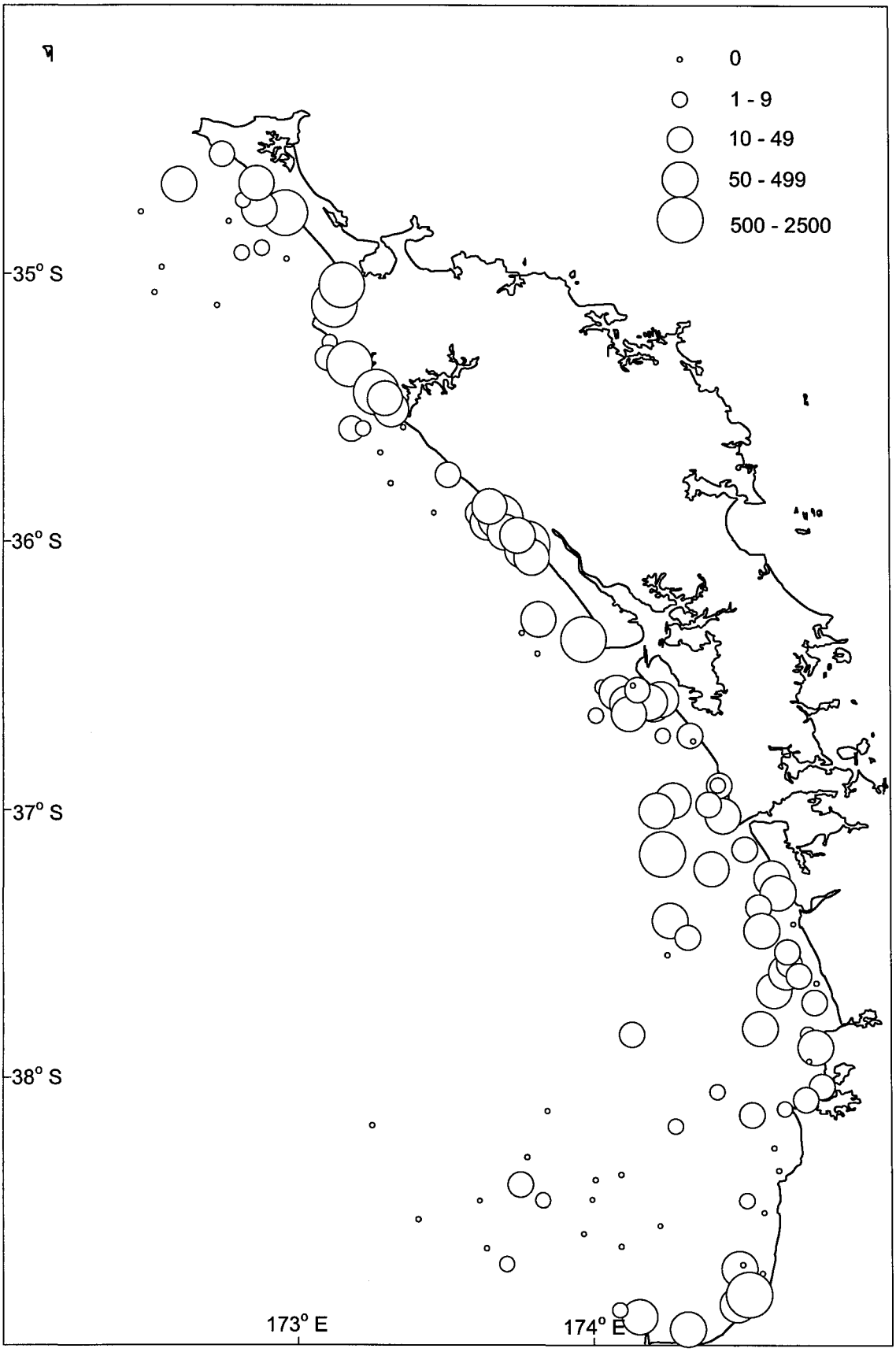


Figure 4: **Catch rates (individuals per km^2) of adult (> 24 cm F.L.) snapper.**

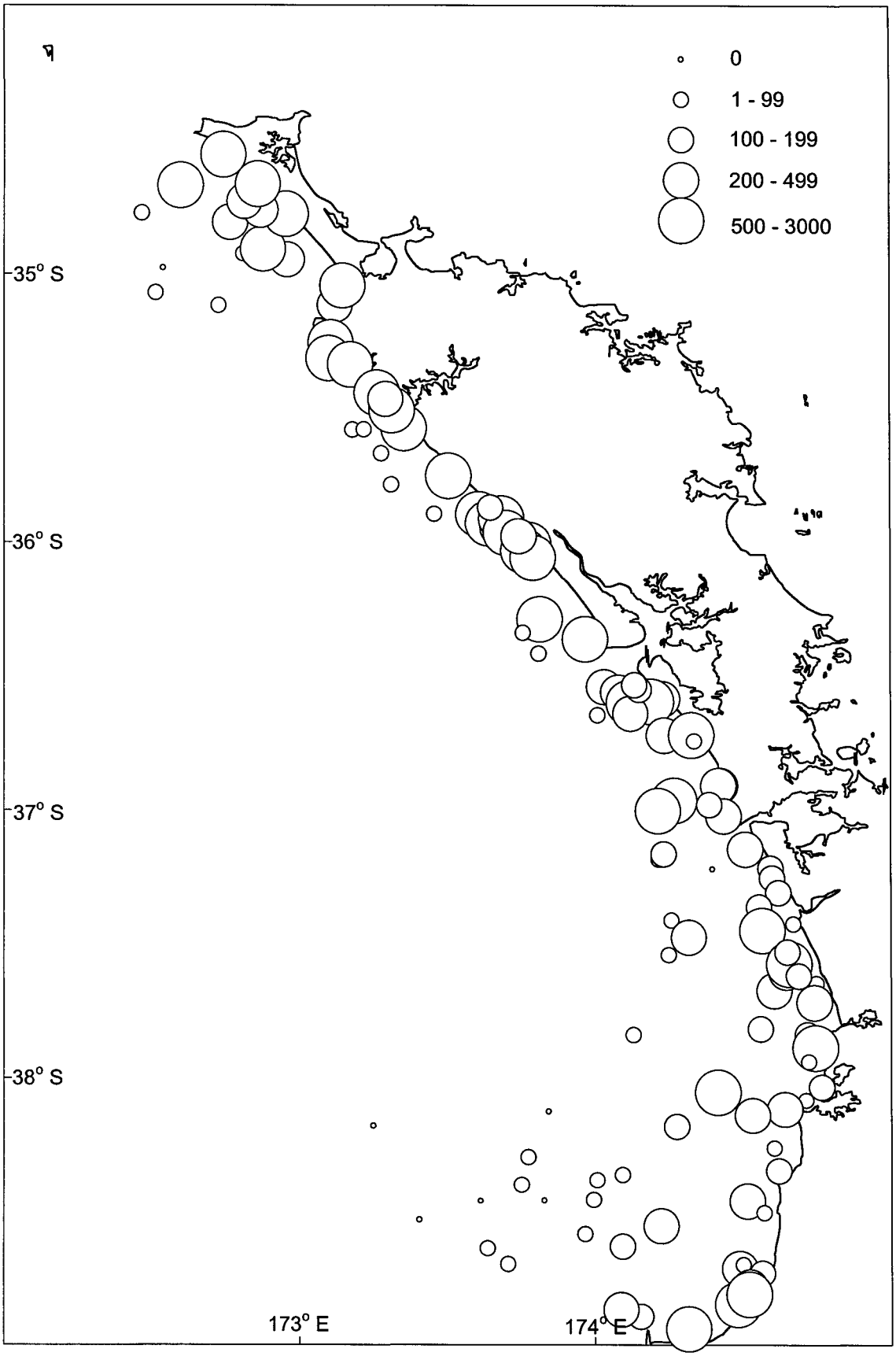


Figure 5: **Catch rates (kg.km^{-2}) of red gurnard (GUR).**

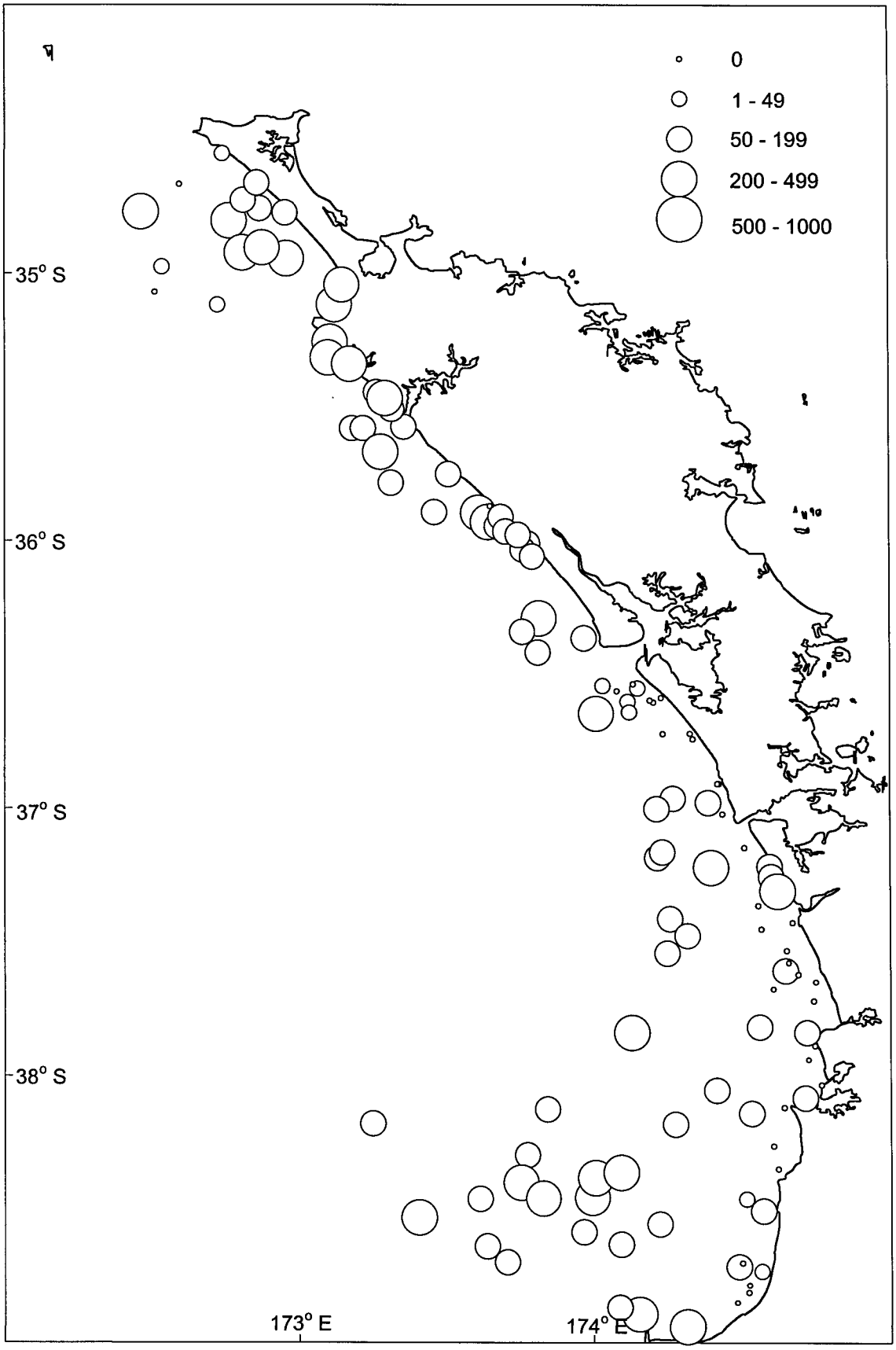


Figure 6: **Catch rates (kg.km^{-2}) of John dory (JDO).**

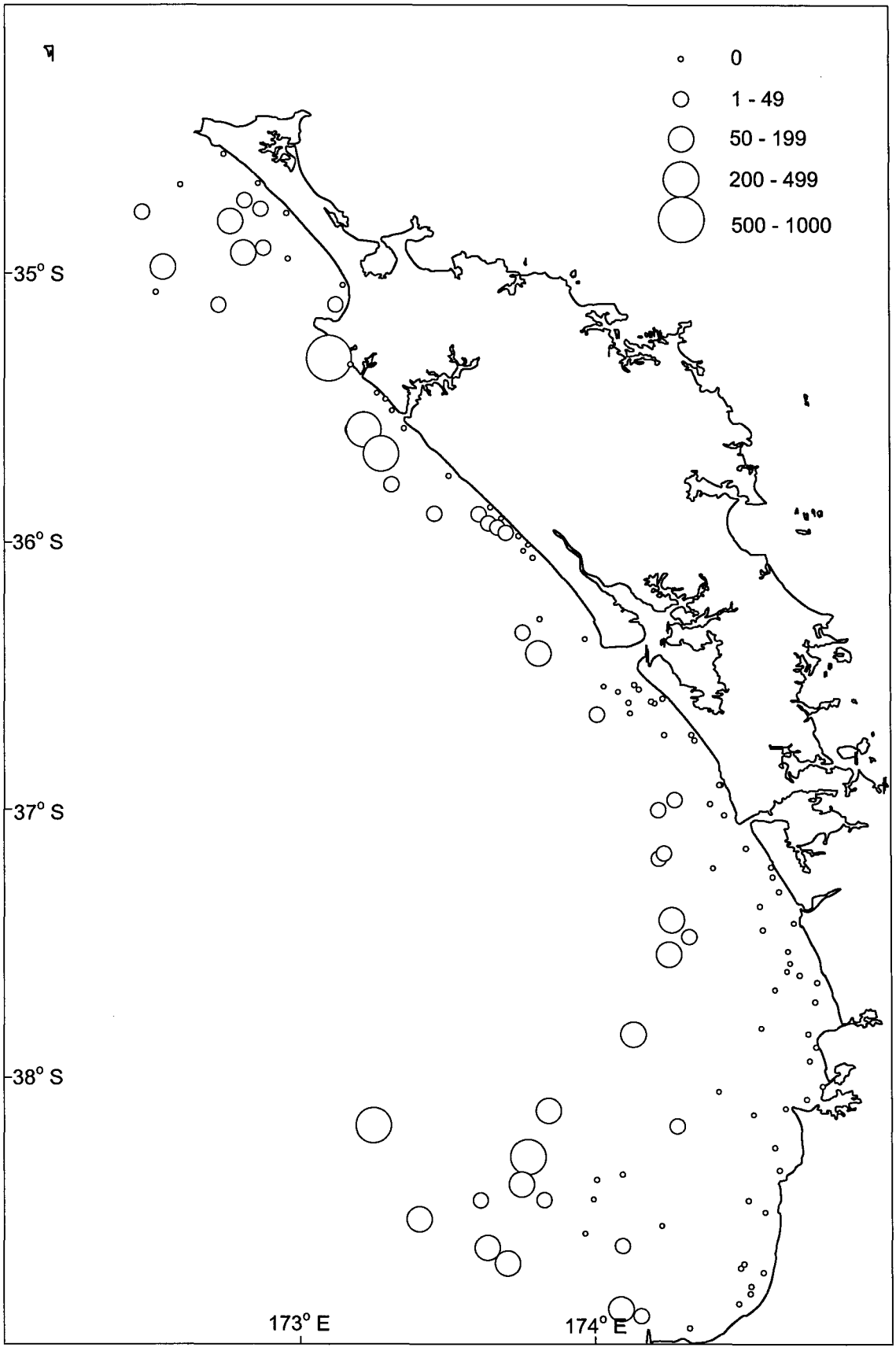


Figure 7: **Catch rates (kg.km^{-2}) of tarakihi (TAR).**

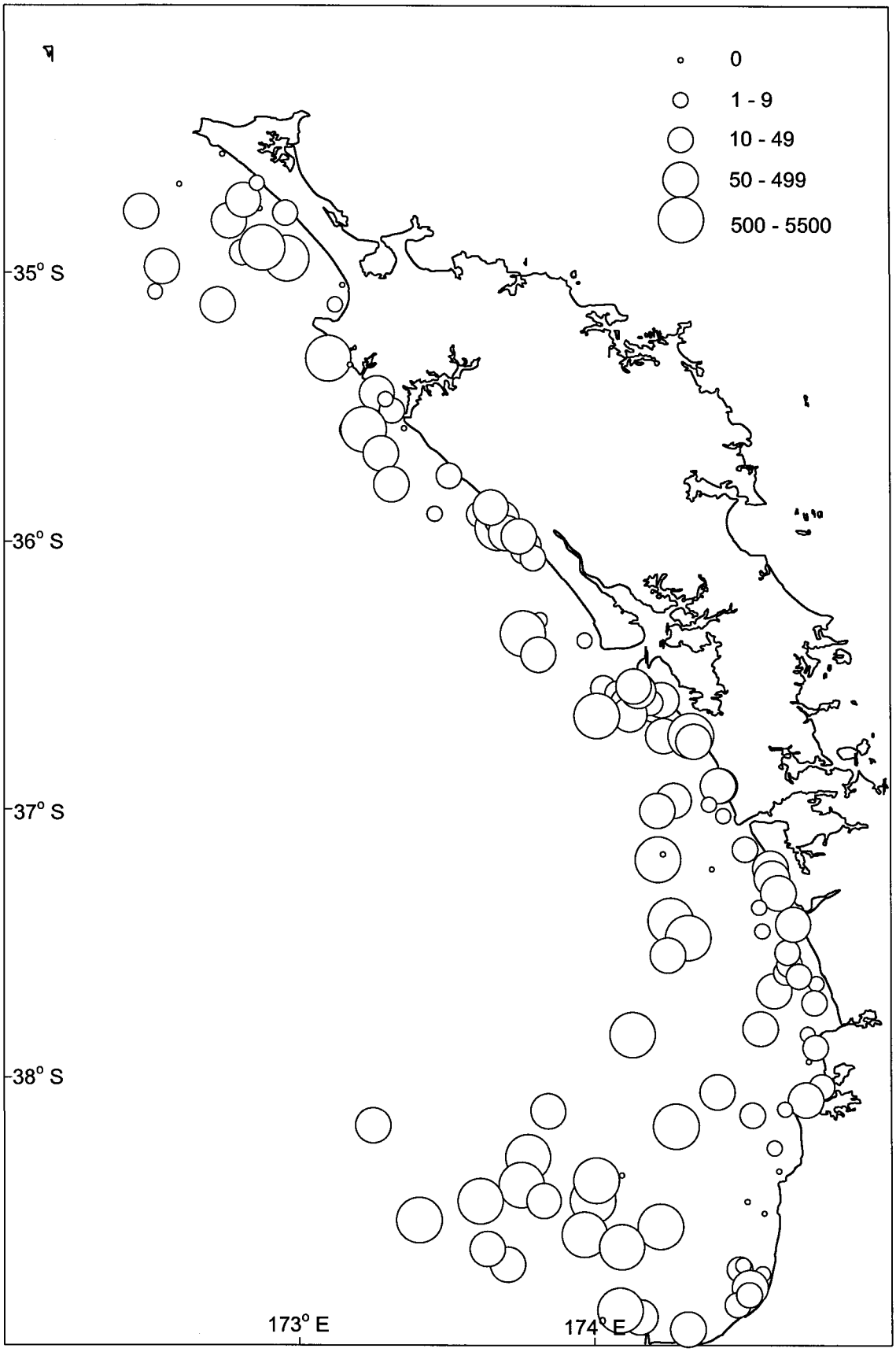


Figure 8: **Catch rates (kg.km^{-2}) of all jack mackerel species combined (JMA).**

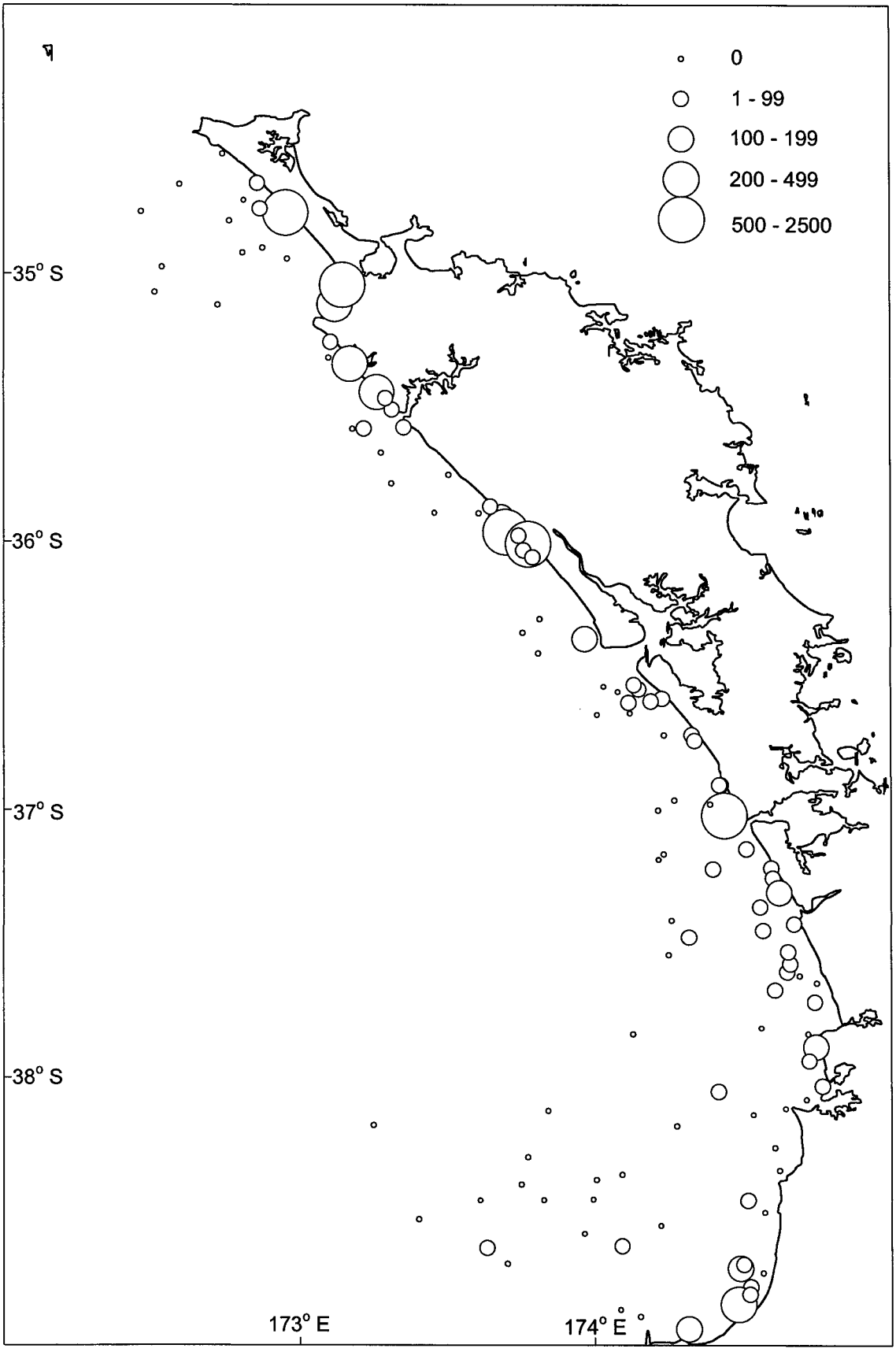


Figure 9: **Catch rates (kg.km^{-2}) of trevally (TRE).**

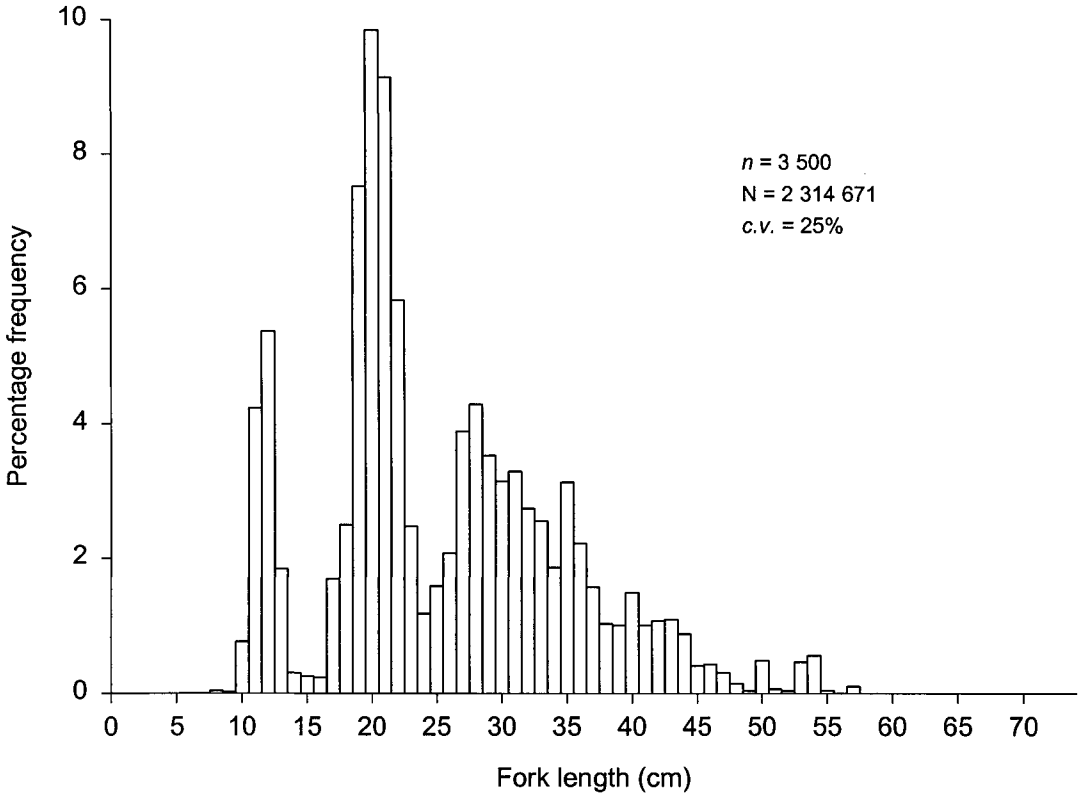


Figure 10 **: Length frequency distribution of snapper. *n*, number of fish measured; N, estimated number of fish in the survey area; *c.v.*, coefficient of variation.**

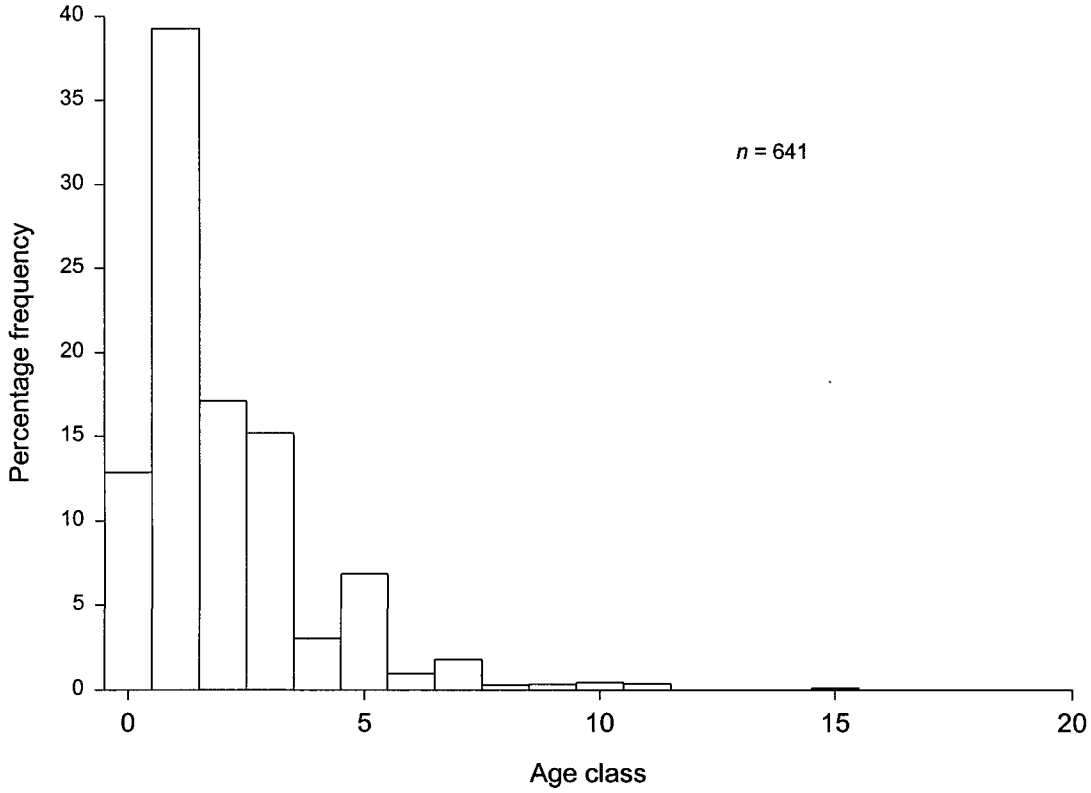


Figure 11**: Age composition of snapper. *n*, number of otolith readings used to construct the snapper age-length key**

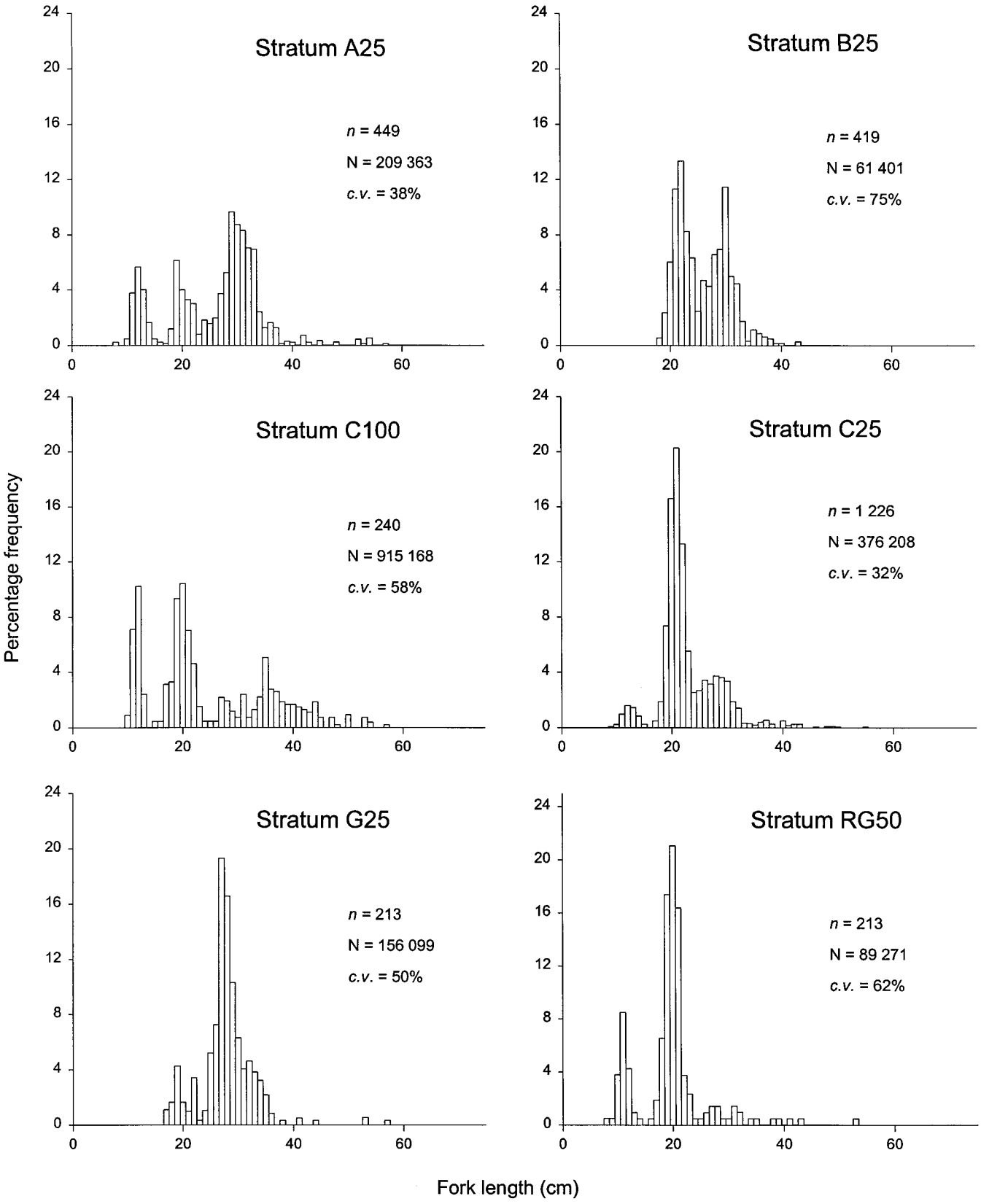


***Figure 12*: Stratum length compositions of snapper (for strata where more than 200 fish were measured). *n*, number of fish measured; N, estimated number of snapper within the stratum; *c.v.*, coefficient of variation.**

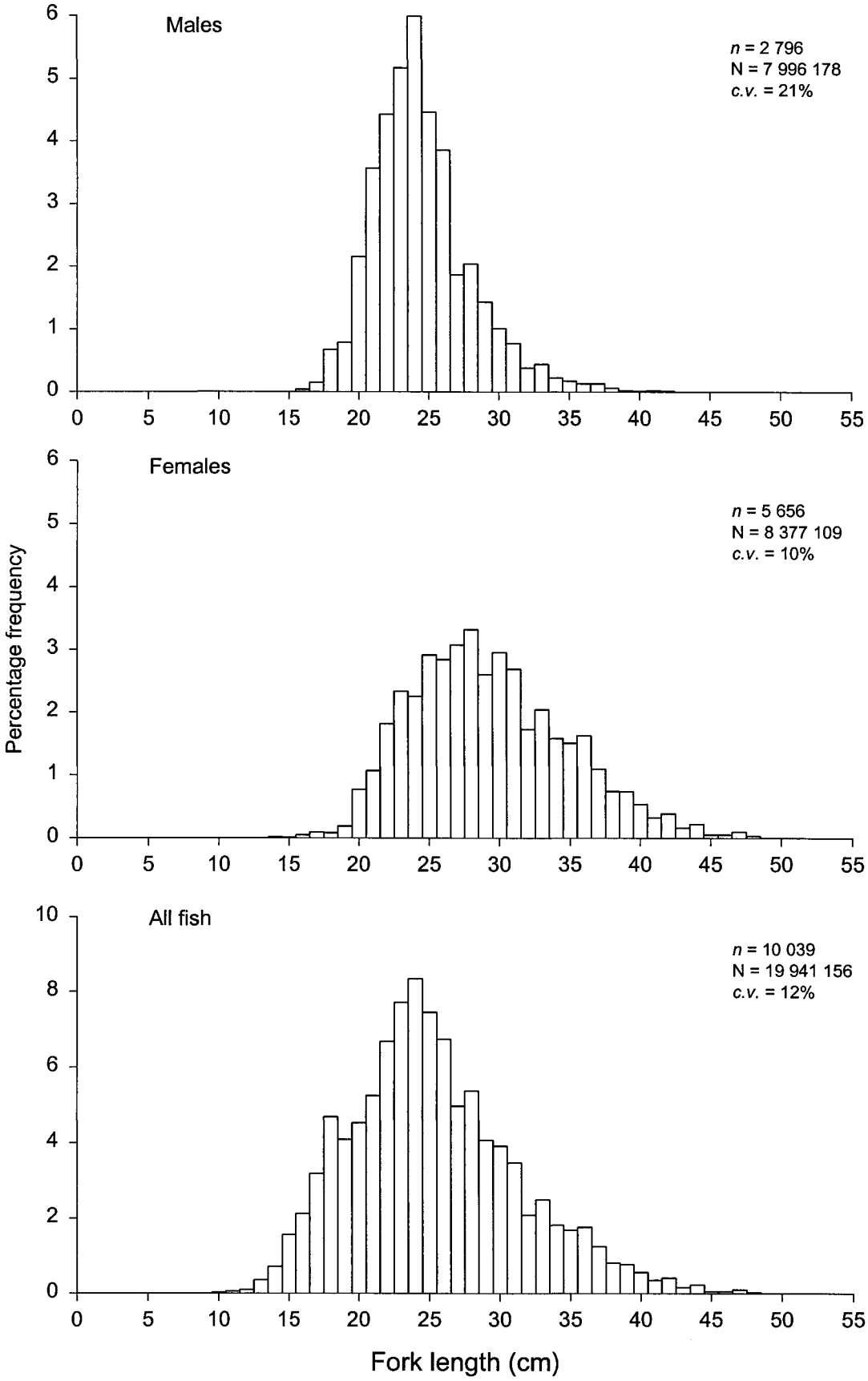


***Figure 13*: Length frequency distributions of male, female and all red gurnard. *n*, number of fish measured, N, estimated number of red gurnard in the survey area, *c.v.*, coefficient of variation of the survey estimate.**

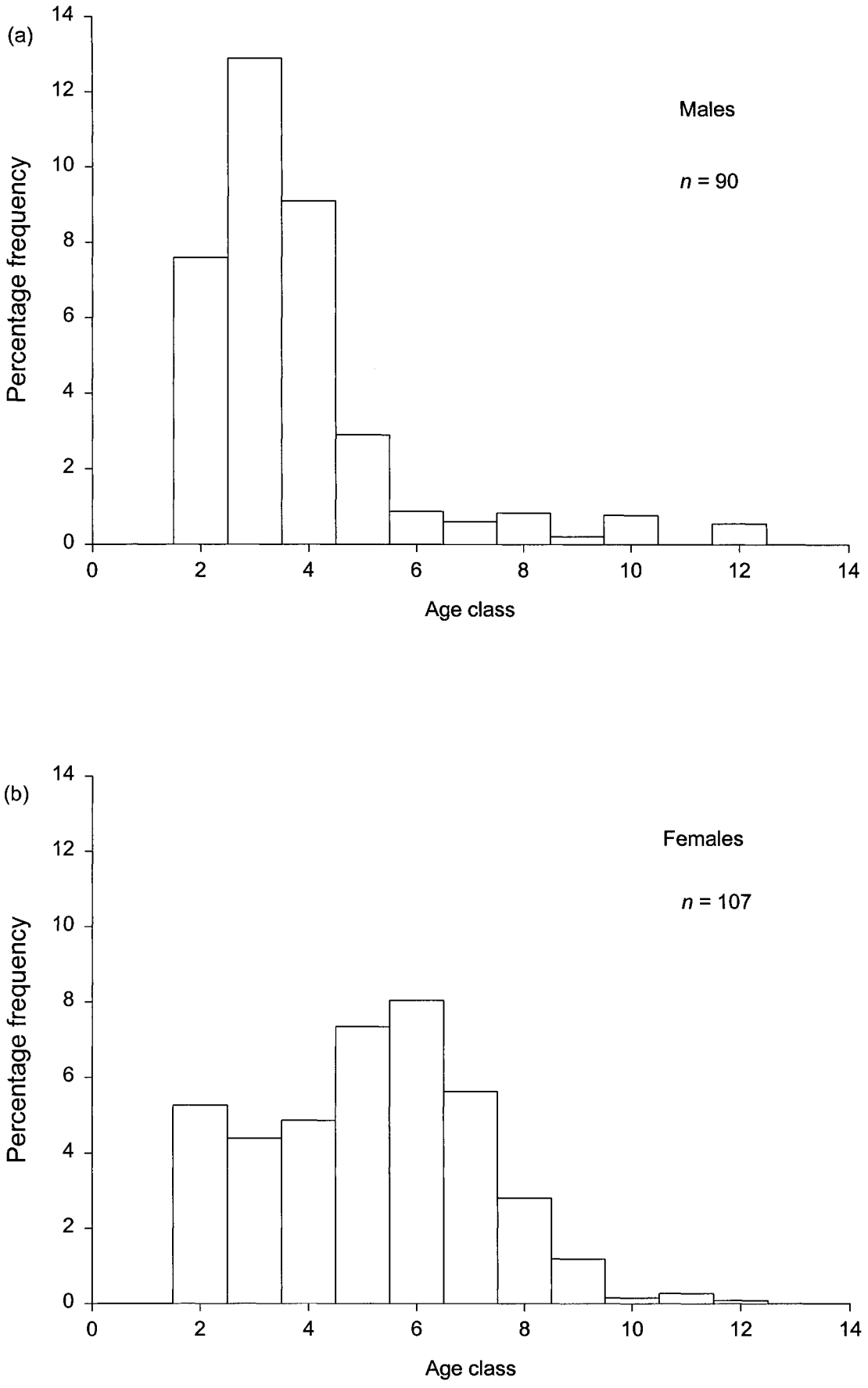


***Figure 14*: Age composition of red gurnard (GUR) for (a) males and (b) females. *n*, number of otolith readings used to construct the age-length key**

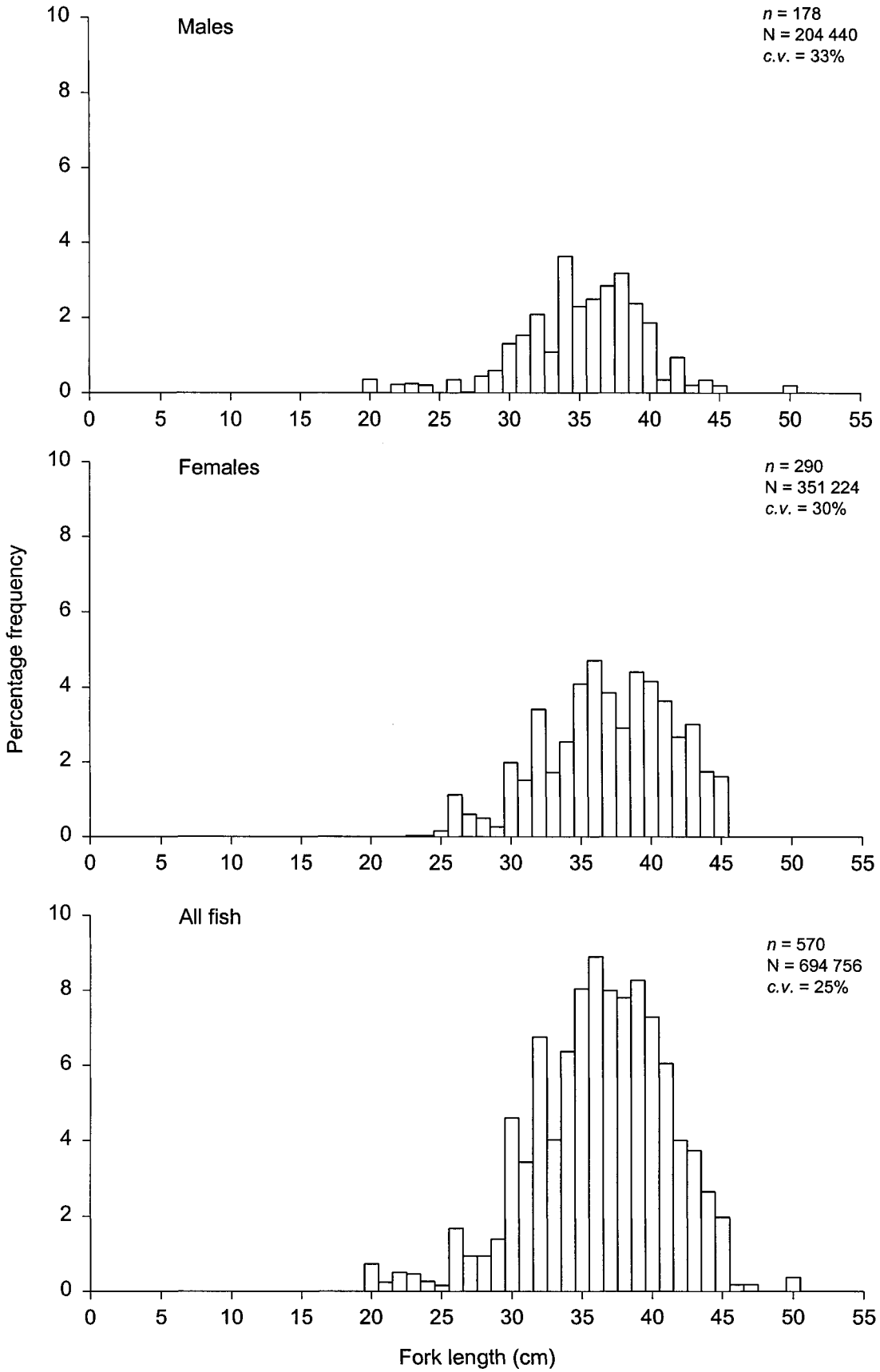


Figure 15: **Length frequency distributions of tarakihi. *n*, number of fish measured; N, estimated number of fish within the stratum; *c.v.*, coefficient of variation.**

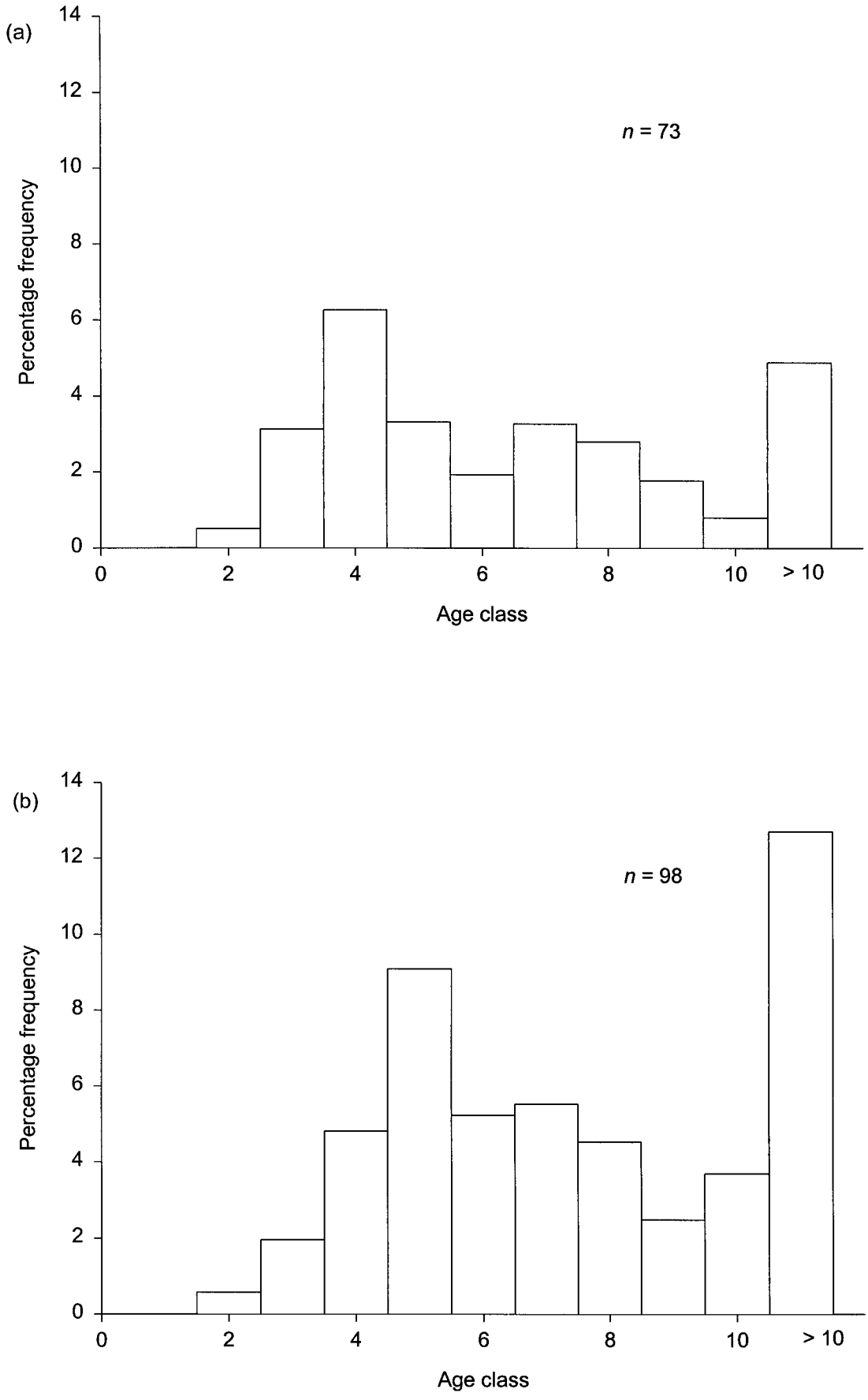


***Figure 16*: Age composition of tarakihi (TAR) for (a) males and (b) females. *n*, number of otolith readings used to construct the age-length key.**

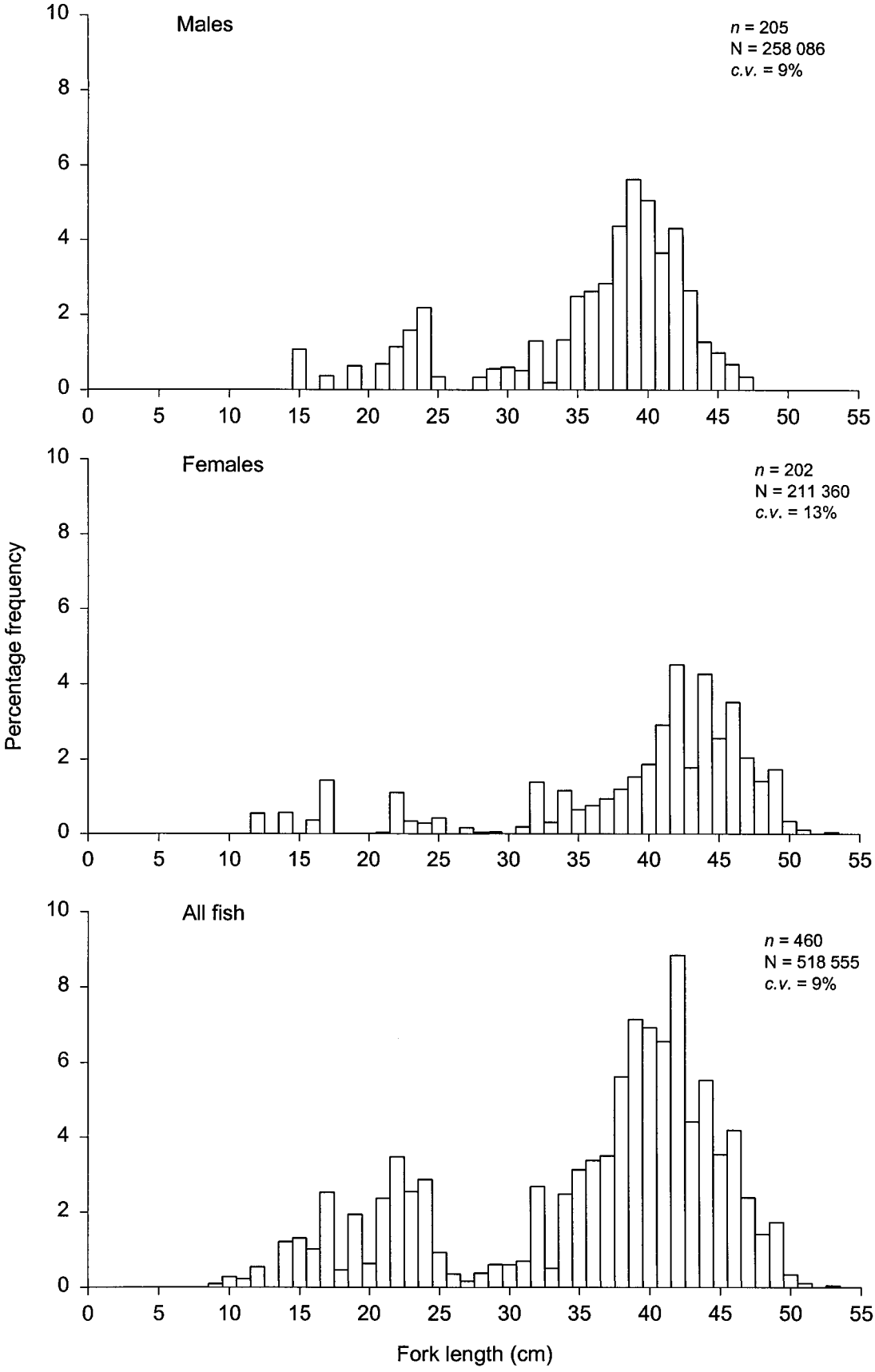


***Figure 17*: Length frequency distributions of John dory. *n*, number of fish measured; N, estimated number of fish; *c.v.*, coefficient of variation.**

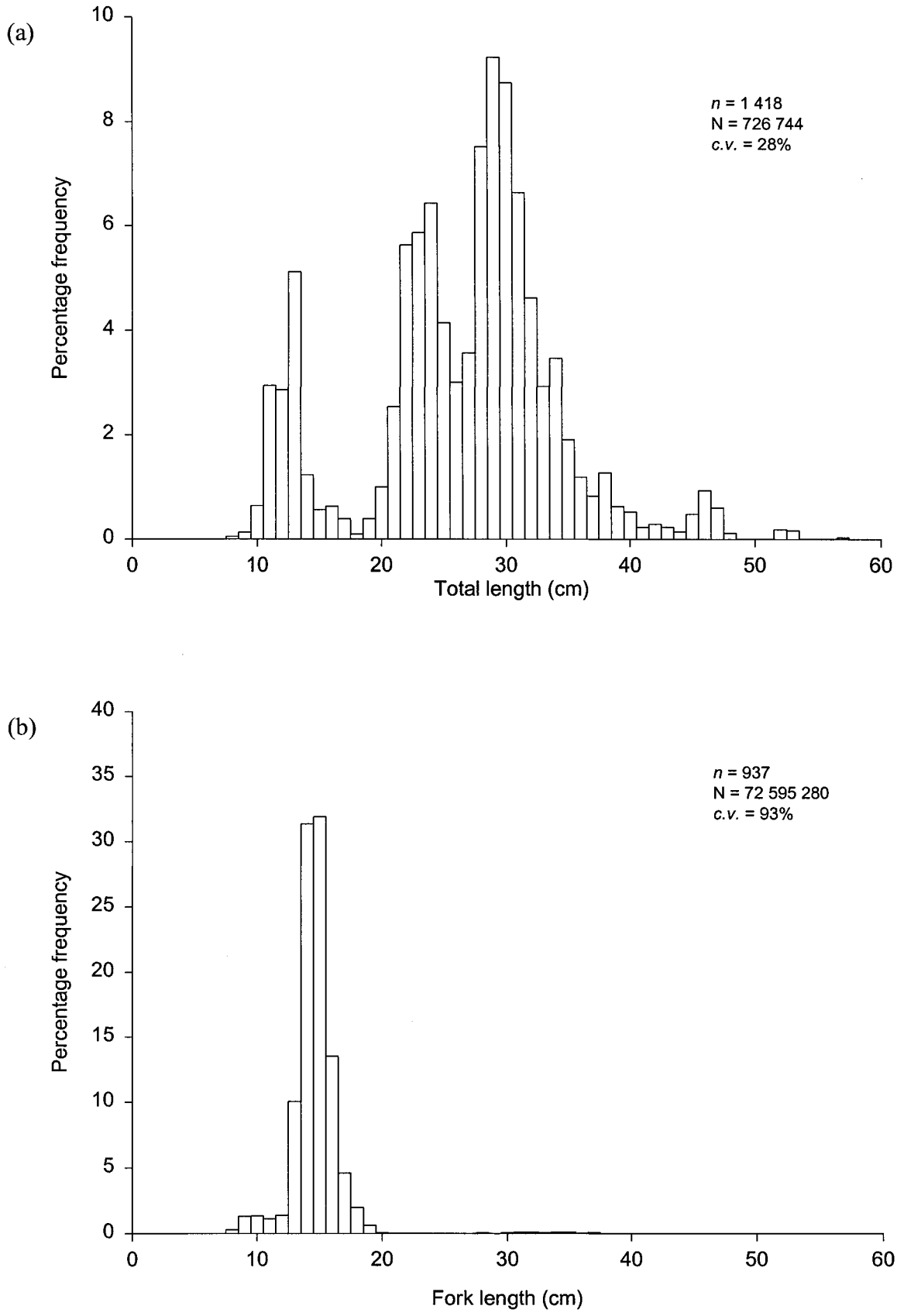
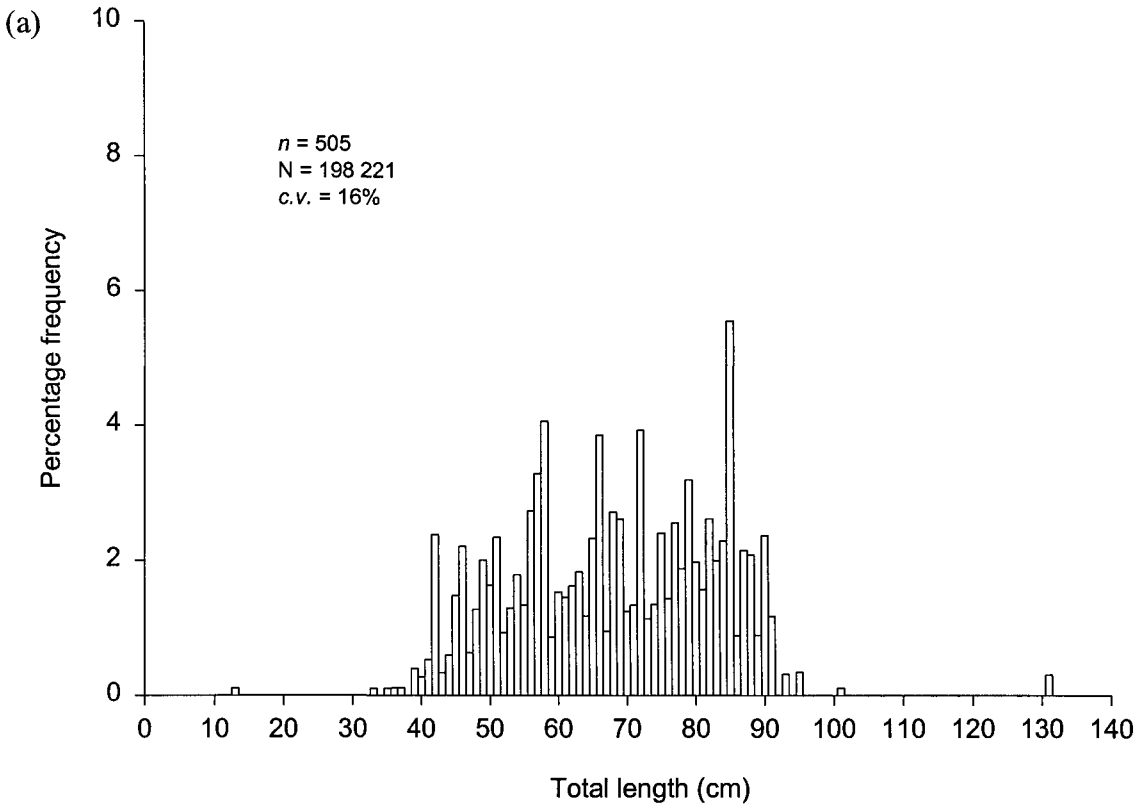


Figure 18: **Length compositions of (a) trevally and (b) jack mackerel (*T. novaezealandiae*)**



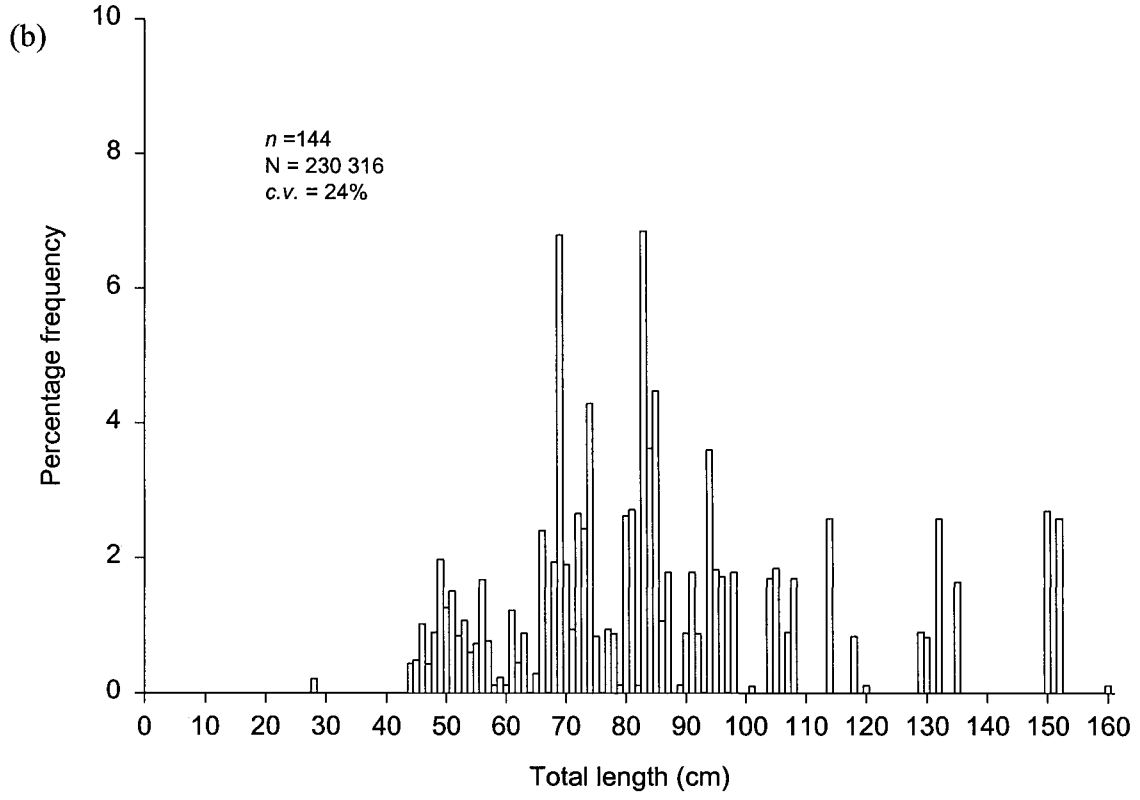


***Figure 19*: Length compositions of (a) southern dogfish and (b) school shark**

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 :	60 x 20 cm
Total floatation :	217 kgf
Vertical opening of trawl :	5.2–7.3 m
Codend mesh :	40 mm
Doorspread	72.1–90.3

Appendix 2: **Gear and tow parameters (recorded values only) by depth range (*n* = number of tows)**

	Depth range (m)												
	0–50			50–100			100–150			150–200			Total
	n	Mean	*s.d.*	*n*	Mean	*s.d.*	*n*	Mean	*s.d.*	*n*	Mean	*s.d.*	*n*
Headline Height (m)	67	6.2	0.3	27	6.1	0.1	21	6.1	0.3	6	6.3	0.3	148
Tow speed (knots)	67	3.0	0.0	27	3	0	21	3.0	0.0	6	3	0.0	148
Doorspread (DS) (m)	36	82.4	2.8	16	80.1	2.7	14	82.9	4.5	2	86.8	4.6	84

Appendix 3: **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 4: **Individual station data**

Station	Stratum	Date	Start time	Start of tow Latitude ° 'S	Start of tow Longitude ° 'E	Start of tow Depth (m)	Tow distance (n. mile)	Warp length (m)	Headline height (m)	Door spread (m)
1	A100	15 Oct 96	1310	34 48.37	172 45.69	88	1.50	250	6.0	80.0
2	A100	15 Oct 96	1447	34 55.49	172 48.35	93	1.50	250	6.0	80.0
3	A25	16 Oct 96	0550	35 07.08	173 07.26	26	1.50	200	6.0	80.0
4	A25	16 Oct 96	0654	35 02.71	173 08.78	22	1.50	200	7.0	80.0
5	AA50	16 Oct 96	0845	34 56.81	172 57.45	49	1.50	200	6.0	80.0
6	A100	16 Oct 96	1002	34 54.38	172 52.45	65	1.50	200	6.3	80.0
7	A25	16 Oct 96	1135	34 46.63	172 57.16	25	1.50	200	6.4	80.0
8	AA50	16 Oct 96	1249	34 45.66	172 51.93	43	1.50	200	6.0	80.0
9	AA50	16 Oct 96	1351	34 43.77	172 48.62	50	1.50	200	6.2	80.0
10	A25	16 Oct 96	1508	34 39.94	172 51.36	24	1.50	200	6.4	80.0
* 11	A25	16 Oct 96	1610	34 37.64	172 49.59	15	1.08	200	6.6	80.0
12	A25	17 Oct 96	0601	34 33.37	172 44.32	20	1.50	200	6.0	80.0
13	A100	17 Oct 96	0752	34 40.21	172 35.56	56	1.50	200	6.2	80.0
14	A200	17 Oct 96	0937	34 46.31	172 27.76	161	1.50		6.5	80.0
15	A200	17 Oct 96	1130	34 58.63	172 31.99	164	1.50	400	6.3	80.0
16	A200	17 Oct 96	1252	35 04.26	172 30.56	199	1.50	500	6.0	80.0
17	A200	17 Oct 96	1448	35 07.17	172 43.33	160	1.50	600	6.0	80.0
18	B25	18 Oct 96	0542	35 15.51	173 06.36	22	1.50	200	6.6	80.0
19	B100	18 Oct 96	0648	35 19.06	173 05.96	59	1.50	200	6.0	80.0
20	B25	18 Oct 96	0748	35 20.43	173 10.34	20	1.50	200	6.3	80.0
21	B25	18 Oct 96	0927	35 26.78	173 15.82	24	1.50	200	6.4	80.0
22	AA50	18 Oct 96	1054	35 34.64	173 21.35	38	1.50	200	6.0	80.0
23	B200	18 Oct 96	1240	35 34.99	173 10.82	144	1.50	375	6.0	80.0
24	B25	18 Oct 96	1418	35 30.67	173 18.89	24	1.50	200	5.6	80.0
25	B25	18 Oct 96	1519	35 28.16	173 17.58	13	1.50		6.0	80.0
26	B200	19 Oct 96	0552	35 34.96	173 13.11	115	1.50	300	6.2	80.0
27	B200	19 Oct 96	0708	35 40.28	173 16.69	130	1.50	325	6.2	80.0
28	B50	19 Oct 96	0859	35 45.26	173 30.46	46	1.50	200	6.0	80.0
29	B200	19 Oct 96	1007	35 53.77	173 27.56	138	1.50	350	6.2	80.0
30	B100	19 Oct 96	1206	35 53.91	173 36.62	56	1.50	200	6.1	80.0
31	B100	19 Oct 96	1323	35 55.94	173 38.57	55	1.50	200	6.3	80.0
32	B50	19 Oct 96	1423	35 56.92	173 40.41	49	1.50	200	6.2	80.0
33	C25	19 Oct 96	1520	35 54.82	173 41.23	22	1.50	200	6.1	80.0
34	B50	20 Oct 96	0543	35 58.07	173 42.15	43	1.50	200	6.1	80.0
35	C25	20 Oct 96	0646	36 00.76	173 46.69	17	1.50	200	6.0	80.0
36	B50	20 Oct 96	0758	36 02.13	173 45.66	41	1.50	200	6.4	80.0
37	B50	20 Oct 96	0906	36 03.69	173 47.58	37	1.50	200	6.0	80.0
38	B100	20 Oct 96	1104	36 17.51	173 48.98	78	1.50	200	6.0	80.0
39	C200	20 Oct 96	1221	36 20.51	173 45.54	149	1.50	375	6.2	80.0
40	C200	20 Oct 96	1332	36 25.17	173 48.74	140	1.50	350	6.2	80.0
41	C25	20 Oct 96	1508	36 21.97	173 58.23	25	1.50	200	6.0	80.0
42	C50	21 Oct 96	0543	36 32.67	174 02.02	39	1.50		6.1	80.0
43	C50	21 Oct 96	0639	36 33.86	174 04.93	30	1.50		6.1	80.0
44	C50	21 Oct 96	0736	36 36.31	174 07.09	39	1.50		6.0	80.0
45	C25	21 Oct 96	0848	36 36.44	174 12.35	25	1.50		6.2	80.0
46	C25	21 Oct 96	0946	36 35.39	174 13.87	13	1.50	200	6.5	80.0
47	C25	21 Oct 96	1047	36 36.02	174 11.60	23	1.50		6.0	80.0
48	C50	21 Oct 96	1216	36 38.65	174 07.41	57	1.50	200	6.0	80.0
49	C100	21 Oct 96	1337	36 39.00	174 00.68	95	1.50	250	6.0	80.0

50	C50	21 Oct 96	1520	36 43.52	174 14.23	46	1.50	200	6.0	80.0
51	C25	22 Oct 96	0540	36 43.50	174 19.78	21	1.50	200	6.6	80.0
52	D25	22 Oct 96	0720	36 54.68	174 25.62	22	1.50	200	6.2	80.0
53	D25	22 Oct 96	0826	36 54.69	174 25.31	25	1.52		6.2	80.0
* 54	C100	22 Oct 96	1029	36 56.22	174 12.56	72	1.50	200	6.1	80.0
* 55	C100	22 Oct 96	1205	37 04.95	174 11.59	100	1.50	250	6.1	80.0
56	C200	22 Oct 96	1323	37 11.25	174 13.10	106	1.50	250	6.0	80.0
57	D25	24 Oct 96	1155	37 08.95	174 30.73	22	1.51	200	6.8	82.5
58	D25	24 Oct 96	1324	37 01.47	174 26.36	17	1.69	200	6.0	82.9
59	C50	24 Oct 96	1442	36 58.93	174 23.44	38	1.50	200	6.0	82.5
60	E25	25 Oct 96	0542	37 13.21	174 35.81	12	1.50	200	6.5	75.9
61	E25	25 Oct 96	0639	37 15.43	174 36.13	16	1.50	200	6.5	76.0
62	E25	25 Oct 96	0735	37 18.69	174 37.41	18	1.50	200	6.5	78.5
63	DD50	25 Oct 96	0846	37 21.94	174 33.52	41	1.50	200	5.2	82.5
64	DD50	25 Oct 96	0955	37 27.19	174 34.13	44	1.50	200	5.8	79.5
65	C200	25 Oct 96	1220	37 24.93	174 15.69	106	1.50	275	5.8	79.5
66	E100	25 Oct 96	1329	37 28.73	174 19.22	90	1.50	250	6.1	80.3
67	E200	25 Oct 96	1442	37 32.64	174 15.12	112	1.50	275	5.8	80.0
68	E200	26 Oct 96	0549	37 50.46	174 07.89	135	1.50	350	6.0	87.5
69	E100	26 Oct 96	0840	37 49.12	174 33.77	63	1.60	200	6.1	81.0
70	RG50	26 Oct 96	1006	37 40.61	174 36.51	51	1.50	200	6.2	83.8
71	RG50	26 Oct 96	1123	37 36.50	174 39.01	39	1.50	200	6.1	82.3
72	DD50	26 Oct 96	1222	37 34.71	174 39.60	35	1.50	200	6.1	82.6
73	DD50	26 Oct 96	1324	37 31.99	174 39.20	32	1.50	200	6.1	81.9
74	E25	26 Oct 96	1438	37 25.71	174 40.41	17	1.50	200	6.2	81.6
75	F25	27 Oct 96	0531	37 38.97	174 45.08	24	1.51	200	6.5	83.2
76	RG50	27 Oct 96	0631	37 37.32	174 41.54	33	1.50	200	6.1	82.8
77	RG50	27 Oct 96	0745	37 43.25	174 44.68	33	1.50	200	6.4	81.0
78	RG50	27 Oct 96	0902	37 50.40	174 43.28	37	1.50	200	6.1	82.8
79	F25	27 Oct 96	1000	37 53.33	174 44.91	21	1.50	200	6.1	83.0
80	E50	27 Oct 96	1057	37 56.47	174 43.54	39	1.50	200	6.2	80.0
81	F25	27 Oct 96	1211	38 02.10	174 46.19	14	1.50	200	6.0	82.5
82	F25	27 Oct 96	1306	38 05.07	174 42.96	21	1.50	200	6.0	84.4
83	E50	27 Oct 96	1404	38 07.12	174 38.67	34	1.50	200	6.3	74.7
84	E100	27 Oct 96	1523	38 08.48	174 32.10	62	1.50	200	6.0	79.5
85	E200	28 Oct 96	0545	38 07.57	173 50.64	147	1.51	370	6.5	80.0
86	E200	28 Oct 96	0657	38 10.78	173 14.99	145	1.50	375	7	85.6
87	F200	28 Oct 96	0828	38 17.89	173 46.48	140	1.50	375	6.1	90.3
88	F200	28 Oct 96	0955	38 24.07	173 45.12	141	1.50	375	6.3	87.5
89	F200	28 Oct 96	1130	38 27.61	173 49.70	122	1.57	300	6.1	84.5
90	F200	28 Oct 96	1414	38 31.90	173 24.27	155	1.50	400	6.9	83.5
91	F100	29 Oct 96	0528	38 33.40	174 13.48	77	1.51	200	6	72.1
92	F100	29 Oct 96	0722	38 27.47	173 59.74	100	1.50	250	6	78.3
93	F200	29 Oct 96	0843	38 23.08	174 00.45	102	1.51	250	6.1	75.0
94	F100	29 Oct 96	0959	38 21.89	174 05.64	99	1.50	250	6	79.7
95	E100	29 Oct 96	1217	38 11.00	174 16.70	87	1.52	250	6.2	85.4
96	E100	29 Oct 96	1355	38 03.33	174 25.07	76	1.54	250	6.1	80.0
97	E50	30 Oct 96	0541	38 15.86	174 36.49	47	1.50	200	6	84.0
98	E50	30 Oct 96	0652	38 21.00	174 37.42	38	1.50	200	6.1	83.7
99	F50	30 Oct 96	0822	38 27.74	174 31.02	51	1.50	200	6	81.1
100	F50	30 Oct 96	0930	38 30.39	174 34.42	42	1.50	200	6	85.9
101	F50	30 Oct 96	1133	38 42.94	174 29.49	41	1.50	200	6	83.1
102	F50	30 Oct 96	1302	38 42.04	174 30.16	41	1.50	200	5.9	84.6
103	G25	30 Oct 96	1416	38 43.95	174 34.09	22	1.50	200	5.5	86.8
104	G25	30 Oct 96	1545	38 47.09	174 31.56	26	1.50	200	6	84.6
105	G25	31 Oct 96	0528	38 50.97	174 29.07	22	1.59	200	7.3	83.7

106	G25	31 Oct 96	0623	38 48.71	174 31.39	21	1.51	200	5.9	85.1
107	G25	31 Oct 96	0830	38 56.48	174 19.08	25	1.02	200	5.9	80.0
108	F100	31 Oct 96	1010	38 53.70	174 09.36	71	1.50	200	6.2	79.8
109	F100	31 Oct 96	1133	38 52.16	174 05.30	85	1.60	225	6.2	80.0
110	F200	01 Nov 96	0741	38 41.89	173 42.29	133	1.50	350	6.5	85.1
111	F200	01 Nov 96	0916	38 38.34	173 38.17	135	1.50	350	5.9	80.0
112	F200	01 Nov 96	1100	38 27.69	173 36.73	146	1.50	375	5.9	87.4
113	F200	01 Nov 96	1350	38 35.17	173 58.02	102	1.50	250	6	80.0
114	F100	01 Nov 96	1526	38 37.93	174 05.65	85	1.52	225	6.2	80.0
115	C25	02 Nov 96	0526	36 33.27	174 09.12	21	1.53	200	6.4	84.0
116	C25	02 Nov 96	0636	36 32.28	174 08.21	18	1.50	200	7.3	84.0
117	C25	02 Nov 96	1125	35 58.83	173 44.70	22	1.50	200	6.4	87.6
118	C25	02 Nov 96	1243	35 52.37	173 38.98	20	1.50	200	6.2	84.8
119	B200	02 Nov 96	1506	35 47.20	173 18.78	191	1.50	500	6.2	90.0
120	C25	03 Nov 96	0518	36 44.73	174 20.36	24	1.50	200	6.1	82.5
121	C100	03 Nov 96	0724	36 58.07	174 16.31	63	1.50	200	6.1	79.0
122	C100	03 Nov 96	0832	37 00.32	174 12.99	80	1.50	220	6.1	79.5
123	C100	03 Nov 96	1006	37 10.05	174 14.15	94	1.50	250	6	80.0
124	C100	03 Nov 96	1157	37 13.39	174 24.00	59	1.50	200	6.1	80.0

*, fouled or poor performance shot

Appendix 5: **Catch (kg) at each station for the more important commercial species; snapper (SNA), gurnard (GUR), John dory (JDO), tarakihi (TAR), jack mackerel (JMA, *Trachurus* spp.), and trevally (TRE)**

Station	SNA	GUR	JDO	TAR	JMA	TRE
1	0.9	29.6	26.5	9.6	10.5	0.0
2	1.0	11.6	9.3	17.9	4.4	0.0
3	102.7	44.1	6.2	1.2	0.3	40.6
4	130.4	67.6	20.3	0.0	0.0	225.7
5	2.5	44.9	9.9	0.0	337.7	0.0
6	0.9	74.2	30.5	2.2	136.6	0.0
7	183.5	88.3	5.7	0.0	4.1	255.1
8	13.8	57.5	1.5	2.1	0.0	7.0
9	1.3	41.9	5.2	1.7	23.8	0.0
10	36.5	176.1	1.8	0.0	0.1	4.0
* 11	59.8	9.2	0.0	0.0	0.0	0.0
12	6.9	105.4	0.8	0.0	0.0	0.0
13	8.5	109.1	0.0	0.0	0.0	0.0
14	0.0	0.5	7.5	2.5	47.8	0.0
15	0.0	0.0	0.1	9.2	7.8	0.0
16	0.0	0.4	0.0	0.0	0.1	0.0
17	0.0	4.0	0.7	5.5	9.5	0.0
18	0.7	152.2	19.1	0.0	0.0	6.3
19	3.1	109.4	7.7	105.3	66.1	0.0
20	197.5	114.2	10.3	0.0	0.0	30.3
21	47.6	79.3	1.4	0.0	23.0	38.0
22	0.0	85.1	1.7	0.0	0.0	2.8
23	9.8	1.8	1.1	4.1	2.2	0.0
24	6.7	99.4	1.7	0.0	3.3	0.7
25	26.3	44.9	7.1	0.0	0.9	5.6
26	3.2	9.1	2.7	39.4	92.1	0.1
27	0.0	6.5	8.3	30.7	5.9	0.0
28	1.6	155.8	1.6	0.0	1.1	0.0
29	0.0	4.4	4.3	1.5	0.8	0.0
30	4.2	83.4	8.0	2.5	2.2	0.0
31	17.7	79.2	19.9	3.3	5.4	0.0
32	4.3	26.0	5.3	2.7	75.1	0.0
33	130.4	75.4	1.5	0.0	38.8	15.7
34	19.2	68.9	1.6	0.6	25.8	87.0
35	135.5	78.0	4.6	0.0	1.5	85.5
36	15.5	86.2	3.8	0.0	3.8	6.5
37	24.5	66.5	1.2	0.0	5.7	1.9
38	6.5	62.4	7.1	0.0	0.4	0.0
39	0.0	11.1	4.7	3.9	139.4	0.0
40	0.0	5.9	1.2	10.3	43.0	0.0
41	120.8	161.0	3.1	0.0	0.5	21.3
42	1.4	37.7	0.2	0.0	2.4	0.0
43	11.6	43.5	0.0	0.0	1.7	0.0
44	49.8	92.2	0.2	0.0	27.2	1.1
45	23.1	42.8	0.0	0.0	8.0	0.0
46	7.0	34.9	0.0	0.0	6.4	0.7
47	37.6	92.3	0.0	0.0	3.6	1.2

48	21.1	53.2	0.3	0.0	18.9	0.0
49	1.3	5.4	13.4	1.3	196.5	0.0
50	2.3	40.0	0.0	0.0	38.6	0.0
51	12.6	110.0	0.0	0.0	64.0	8.7
52	7.6	48.0	0.0	0.0	14.2	8.8
53	1.5	31.4	0.0	0.0	10.9	6.7
* 54	31.2	64.8	3.0	4.4	264.6	0.0
* 55	11.8	8.1	1.4	4.7	474.3	0.0
56	11.7	6.0	4.3	2.5	277.2	0.0
57	3.4	57.7	0.0	0.0	1.5	0.4
58	27.1	49.6	0.0	0.0	0.3	169.6
59	7.8	24.5	1.5	0.0	0.2	0.0
60	2.2	18.7	1.3	0.0	16.7	4.5
61	4.5	21.6	2.6	0.0	17.5	11.2
62	4.1	21.7	6.6	0.0	34.4	16.2
63	6.5	20.3	0.0	0.0	0.3	0.1
64	8.4	86.6	0.0	0.0	0.9	2.1
65	23.1	0.6	4.3	9.3	97.2	0.0
66	3.2	24.9	3.1	4.2	68.0	2.2
67	4.8	3.0	5.5	13.4	44.4	0.0
68	6.8	2.2	13.0	20.1	453.9	0.0
69	10.8	19.1	1.4	0.0	7.6	0.0
70	33.2	25.2	0.0	0.0	32.7	2.4
71	16.1	50.1	1.8	0.0	3.5	8.9
72	9.8	68.4	0.0	0.0	2.5	11.9
73	3.4	20.6	0.0	0.0	1.7	2.3
74	0.1	6.0	0.0	0.0	10.4	5.4
75	0.0	6.3	0.0	0.0	0.8	0.0
76	2.7	21.5	0.0	0.0	1.6	0.0
77	1.4	31.6	0.0	0.0	1.7	0.4
78	0.5	16.4	2.6	0.0	0.3	0.0
79	32.3	62.9	0.0	0.0	1.2	13.7
80	1.3	7.4	0.0	0.0	0.0	0.4
81	7.8	16.7	0.0	0.0	5.1	6.7
82	4.5	10.5	1.3	0.0	34.1	0.0
83	4.2	30.4	0.0	0.0	0.2	0.0
84	1.3	32.5	1.4	0.0	2.5	0.0
85	0.0	0.0	4.6	23.3	8.1	0.0
86	0.0	0.0	2.9	33.3	40.0	0.0
87	0.0	0.9	6.4	30.3	679.1	0.0
88	2.6	1.4	12.6	12.9	165.6	0.0
89	0.7	0.0	10.3	4.9	14.3	0.0
90	1.7	0.0	8.3	20.2	322.1	0.0
91	0.0	27.0	3.4	0.0	402.1	0.0
92	0.0	1.4	12.0	0.0	344.0	0.0
93	0.0	9.3	9.8	0.0	514.6	0.0
94	0.0	0.8	6.7	0.0	0.0	0.0
95	1.7	17.8	4.8	0.5	262.5	0.0
96	0.8	88.6	4.2	0.0	11.5	1.9
97	0.0	5.7	0.0	0.0	0.3	0.0
98	0.0	15.5	0.0	0.0	0.0	0.0
99	0.6	46.1	0.2	0.0	0.0	1.7
100	0.0	11.1	1.3	0.0	0.0	0.0

101		43.1	45.9	4.9	0.0	4.7	12.9
102		0.0	12.5	0.0	0.0	0.4	2.5
103		0.0	17.7	0.1	0.0	0.7	0.0
104		40.2	60.5	0.0	0.0	10.2	2.6
105		36.9	77.6	0.0	0.0	1.3	38.2
106		89.1	90.5	0.0	0.0	1.7	9.7
107		21.1	241.0	9.4	0.0	4.5	15.1
108		10.0	20.6	13.7	3.0	10.2	0.0
109		1.4	33.9	6.2	17.0	92.0	0.0
110		2.0	2.0	1.5	13.0	23.5	0.0
111		0.0	1.1	3.8	23.0	25.1	2.9
112		0.0	0.0	4.8	4.8	160.0	0.0
113		0.0	0.4	3.2	0.0	63.0	0.0
114		0.0	16.5	1.4	0.8	300.8	1.0
115		10.3	18.2	0.4	0.0	24.9	8.1
116		2.5	16.0	0.0	0.0	24.3	8.0
117		40.7	27.6	4.5	0.0	28.9	0.9
118		47.5	24.0	0.0	0.0	38.4	3.2
119		0.0	0.4	4.0	1.3	57.7	0.0
120		0.0	11.4	0.0	0.0	8.2	0.7
121		42.6	81.8	3.1	0.3	20.7	0.0
122		19.7	70.8	2.3	0.5	11.5	0.0
123		179.4	21.3	5.5	1.3	0.0	0.0
124		62.0	0.0	10.3	0.0	0.0	2.1
	Total	2 443.3	5 115.1	490.8	506.5	7 046.3	1 231.2

*, fouled or poor performance shot

Appendix 6. Snapper age-length key

Length (cm)	Age class																	No. aged
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+	14+	15+	>15+	
5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
8	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
9	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
10	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
11	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	18
12	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22
13	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17
14	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9
15	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
17	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
18	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19
19	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20
20	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20
21	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	21
22	–	0.95	0.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19
23	–	0.95	0.05	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19
24	–	0.22	0.78	–	–	–	–	–	–	–	–	–	–	–	–	–	–	18
25	–	0.13	0.87	–	–	–	–	–	–	–	–	–	–	–	–	–	–	23
26	–	–	0.95	0.05	–	–	–	–	–	–	–	–	–	–	–	–	–	20
27	–	0.05	0.86	0.10	–	–	–	–	–	–	–	–	–	–	–	–	–	21
28	–	–	1.00	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19
29	–	–	0.68	0.32	–	–	–	–	–	–	–	–	–	–	–	–	–	19
30	–	–	0.55	0.45	–	–	–	–	–	–	–	–	–	–	–	–	–	20
31	–	–	0.11	0.84	0.05	–	–	–	–	–	–	–	–	–	–	–	–	19
32	–	–	0.05	0.90	–	0.05	–	–	–	–	–	–	–	–	–	–	–	21
33	–	–	0.05	0.70	0.05	0.20	–	–	–	–	–	–	–	–	–	–	–	20
34	–	–	–	0.89	0.11	–	–	–	–	–	–	–	–	–	–	–	–	18
35	–	–	–	0.60	0.15	0.15	–	0.05	0.05	–	–	–	–	–	–	–	–	20
36	–	–	–	0.50	0.40	–	–	0.10	–	–	–	–	–	–	–	–	–	20
37	–	–	–	0.20	0.25	0.50	–	–	–	0.05	–	–	–	–	–	–	–	20
38	–	–	–	0.06	0.28	0.67	–	–	–	–	–	–	–	–	–	–	–	18
39	–	–	–	–	0.08	0.83	–	0.08	–	–	–	–	–	–	–	–	–	12
40	–	–	–	0.06	0.11	0.72	0.06	0.06	–	–	–	–	–	–	–	–	–	18
41	–	–	–	–	0.14	0.64	0.07	0.14	–	–	–	–	–	–	–	–	–	14
42	–	–	–	–	0.06	0.47	0.18	0.29	–	–	–	–	–	–	–	–	–	17
43	–	–	–	–	–	0.55	0.27	0.09	–	–	–	–	–	–	–	0.09	–	11
44	–	–	–	–	–	0.43	0.14	0.43	–	–	–	–	–	–	–	–	–	7
45	–	–	–	–	–	0.20	0.20	–	0.20	–	–	0.40	–	–	–	–	–	5
46	–	–	–	–	–	–	0.25	0.13	–	0.38	0.25	–	–	–	–	–	–	8
47	–	–	–	–	–	0.25	–	0.25	–	–	0.50	–	–	–	–	–	–	4
48	–	–	–	–	–	0.29	–	–	0.14	–	0.57	–	–	–	–	–	–	7
49	–	–	–	–	–	–	–	0.25	0.25	–	–	0.50	–	–	–	–	–	4
50	–	–	–	–	–	–	–	0.33	–	0.17	0.17	0.33	–	–	–	–	–	6
51	–	–	–	–	–	–	–	–	0.25	0.75	–	–	–	–	–	–	–	4
52	–	–	–	–	–	–	–	–	–	0.33	–	0.67	–	–	–	–	–	3
53	–	–	–	–	–	–	–	–	–	0.14	0.57	0.14	0.14	–	–	–	–	7
54	–	–	–	–	–	–	–	0.11	0.11	0.11	0.11	0.33	0.11	–	–	0.11	–	9
55	–	–	–	–	–	–	–	–	–	0.50	–	–	0.50	–	–	–	–	2
56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
57	–	–	–	–	–	–	–	–	–	0.33	–	0.33	–	–	0.33	–	–	3
58	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
59	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0
Total																		641

Appendix 7: Gurnard age-length key

(a) Males

Length (cm)	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	>11+	No. Aged.
20	–	0.25	0.75	–	–	–	–	–	–	–	–	–	–	4
21	–	–	0.67	0.17	–	0.17	–	–	–	–	–	–	–	6
22	–	–	0.50	0.50	–	–	–	–	–	–	–	–	–	4
23	–	–	0.40	0.40	0.20	–	–	–	–	–	–	–	–	5
24	–	–	–	0.50	0.50	–	–	–	–	–	–	–	–	2
25	–	–	–	0.75	0.25	–	–	–	–	–	–	–	–	4
26	–	–	0.20	0.20	0.40	–	–	–	–	–	0.20	–	–	5
27	–	–	–	0.20	0.20	0.60	–	–	–	–	–	–	–	5
28	–	–	–	0.25	0.50	–	–	–	–	–	–	0.25	–	4
29	–	–	–	–	0.25	0.25	0.25	–	0.25	–	–	–	–	4
30	–	–	–	–	0.40	0.20	–	0.20	–	0.20	–	–	–	5
31	–	–	0.20	–	–	0.40	0.20	–	0.20	–	–	–	–	5
32	–	–	–	–	0.40	0.20	0.20	0.20	–	–	–	–	–	5
33	–	–	–	–	0.20	–	0.40	0.40	–	–	–	–	–	5
34	–	–	–	–	–	0.80	0.00	0.20	–	–	–	–	–	5
35	–	–	–	–	–	0.25	0.25	0.25	0.25	–	–	–	–	4
36	–	–	–	–	–	–	0.40	–	0.60	–	–	–	–	5
37	–	–	–	–	–	–	–	0.25	0.75	–	–	–	–	4
38	–	–	–	–	–	–	–	–	0.50	–	–	0.50	–	2
39	–	–	–	–	–	–	–	–	1.00	–	–	–	–	1
40	–	–	–	–	–	–	–	–	1.00	–	–	–	–	1
41	–	–	–	–	–	–	–	0.50	0.50	–	–	–	–	2
42	–	–	–	–	–	–	–	–	–	–	–	–	–	0
43	–	–	–	–	–	–	–	–	–	–	–	–	–	0
44	–	–	–	–	–	–	–	–	–	–	–		1	1
Total														88

(b) Females

Length (cm)	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	>10+	>11+	No. Aged.
20	–	–	1.00	–	–	–	–	–	–	–	–	–	–	1
21	–	–	0.50	0.50	–	–	–	–	–	–	–	–	–	2
22	–	–	0.25	0.25	–	0.25	–	–	–	–	–	–	–	4
23	–	–	0.67	0.33	–	–	–	–	–	–	–	–	–	3
24	–	–	0.75	0.25	–	–	–	–	–	–	–	–	–	4
25	–	–	0.17	0.33	0.50	–	–	–	–	–	–	–	–	6
26	–	–	0.25	–	0.25	0.25	–	0.25	–	–	–	–	–	4
27	–	–	–	0.25	0.25	0.25	–	0.25	–	–	–	–	–	4
28	–	–	–	–	0.20	–	0.80	–	–	–	–	–	–	5
29	–	–	–	–	–	0.33	0.33	0.33	–	–	–	–	–	3
30	–	–	–	–	0.13	0.38	0.38	–	0.13	–	–	–	–	9
31	–	–	–	–	0.25	–	0.25	–	0.50	–	–	–	–	4
32	–	–	–	–	–	–	–	1.00	–	–	–	–	–	3
33	–	–	–	–	–	0.50	0.50	–	–	–	–	–	–	2
34	–	–	–	–	–	0.33	0.50	0.17	–	–	–	–	–	6
35	–	–	–	–	–	0.75	–	0.25	–	–	–	–	–	4
36	–	–	–	0.17	–	0.33	0.17	0.17	–	–	–	0.17	–	6
37	–	–	–	0.20	0.20	–	–	–	0.40	0.20	–	–	–	5
38	–	–	–	–	–	–	0.50	–	0.25	0.25	–	–	–	4
39	–	–	–	–	–	0.20	–	0.20	0.20	0.20	0.20	–	–	5
40	–	–	–	–	–	–	0.40	0.40	0.20	–	–	–	–	5
41	–	–	–	–	–	0.20	0.20	0.60	–	–	–	–	–	5
42	–	–	–	–	–	–	–	–	–	1.00	–	–	–	1
43	–	–	–	–	–	–	–	–	0.50	–	–	–	0.50	2
44	–	–	–	–	–	–	–	0.33	–	0.67	–	–	–	3
45	–	–	–	–	–	–	–	–	1.00	–	–	–	–	1
46	–	–	–	–	–	–	–	–	–	1.00	–	–	–	2
47	–	–	–	–	–	–	–	–	0.50	0.50	–	–	–	2
48	–	–	–	–	–	–	–	–	1.00	–	–	–	–	1
Total														106

Appendix 8: Tarakihi age-length key

(a) Males

Length (cm)	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	>10+	No. aged
20	–	–	–	–	–	–	–	–	–	–	–	–	0
21	–	–	–	–	–	–	–	–	–	–	–	–	0
22	–	–	–	–	1.00	–	–	–	–	–	–	–	1
23	–	–	1.00	–	–	–	–	–	–	–	–	–	1
24	–	–	0.50	–	0.50	–	–	–	–	–	–	–	2
25	–	–	–	–	–	–	–	–	–	–	–	–	0
26	–	–	–	0.50	0.25	0.25	–	–	–	–	–	–	4
27	–	–	–	1.00	–	–	–	–	–	–	–	–	1
28	–	–	0.33	0.67	–	–	–	–	–	–	–	–	3
29	–	–	–	0.43	0.29	0.29	–	–	–	–	–	–	7
30	–	–	–	0.67	0.33	–	–	–	–	–	–	–	3
31	–	–	–	0.71	0.29	–	–	–	–	–	–	–	7
32	–	–	–	–	0.57	0.29	0.14	–	–	–	–	–	7
33	–	–	–	–	1.00	–	–	–	–	–	–	–	2
34	–	–	–	0.11	0.22	0.33	0.11	0.22	–	–	–	–	9
35	–	–	–	–	0.20	–	0.20	0.40	0.20	–	–	–	5
36	–	–	–	–	0.50	0.50	–	–	–	–	–	–	2
37	–	–	–	–	–	–	–	0.33	0.33	–	–	0.33	3
38	–	–	–	–	–	–	–	–	0.25	0.50	0.25	–	4
39	–	–	–	–	–	–	0.25	0.25	0.25	–	–	0.25	4
40	–	–	–	–	–	–	–	–	–	–	–	1.00	1
41	–	–	–	–	–	–	0.50	–	–	0.50	–	–	2
42	–	–	–	–	–	–	–	–	–	–	–	1.00	2
43	–	–	–	–	–	–	–	–	–	–	–	1.00	1
44	–	–	–	–	–	–	–	–	–	–	–	1.00	1
45	–	–	–	–	–	–	–	–	–	–	–	–	0
46	–	–	–	–	–	–	–	–	–	–	–	–	0
47	–	–	–	–	–	–	–	–	–	–	–	–	0
48	–	–	–	–	–	–	–	–	–	–	–	–	0
49	–	–	–	–	–	–	–	–	–	–	–	–	0
Total													72

(b) Females

Length (cm)	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	>10+	No. aged
20	–	–	–	–	–	–	–	–	–	–	–	–	0
21	–	–	–	–	–	–	–	–	–	–	–	–	0
22	–	–	–	1.00	–	–	–	–	–	–	–	–	1
23	–	–	1.00	–	–	–	–	–	–	–	–	–	1
24	–	–	0.25	0.50	0.25	–	–	–	–	–	–	–	4
25	–	–	–	0.50	0.50	–	–	–	–	–	–	–	3
26	–	–	–	–	1.00	–	–	–	–	–	–	–	2
27	–	–	–	0.50	0.50	–	–	–	–	–	–	–	2
28	–	–	–	0.50	0.50	–	–	–	–	–	–	–	4
29	–	–	–	0.33	0.33	0.33	–	–	–	–	–	–	3
30	–	–	–	0.33	0.33	0.33	–	–	–	–	–	–	4
31	–	–	–	–	0.20	0.40	–	–	0.20	0.20	–	–	5
32	–	–	–	–	0.25	0.50	0.25	–	–	–	–	–	4
33	–	–	–	–	0.00	0.67	0.00	0.17	0.17	–	–	–	6
34	–	–	–	–	0.00	0.50	0.50	–	–	–	–	–	2
35	–	–	–	–	0.33	0.33	–	0.17	0.17	–	–	–	6
36	–	–	–	–	–	0.17	0.33	0.33	0.17	–	–		6
37	–	–	–	–	–	0.20	0.40	–	0.20	–	–	–	5
38	–	–	–	–	–	–	–	0.33	0.17	0.33	–	0.17	6
39	–	–	–	–	–	–	–	0.67	–	–	–	0.33	5
40	–	–	–	–	–	–	–	–	–	–	0.50	0.50	3
41	–	–	–	–	–	–	–	–	0.33	0.33	–	0.33	6
42	–	–	–	–	–	–	–	–	–	–	0.25	0.75	4
43	–	–	–	–	–	–	–	–	–	–	–	1.00	3
44	–	–	–	–	–	–	–	0.14	–	–	0.14	0.71	7
45	–	–	–	–	–	–	–	–	–	–	–	1.00	3
46	–	–	–	–	–	–	–	–	–	–	–	–	0
47	–	–	–	–	–	–	–	–	–	–	–	1.00	2
48	–	–	–	–	–	–	–	–	–	–	–	–	0
49	–	–	–	–	–	–	–	–	–	–	–	–	0
50	–	–	–	–	–	–	–	–	–	–	–	1.00	1
Total													98