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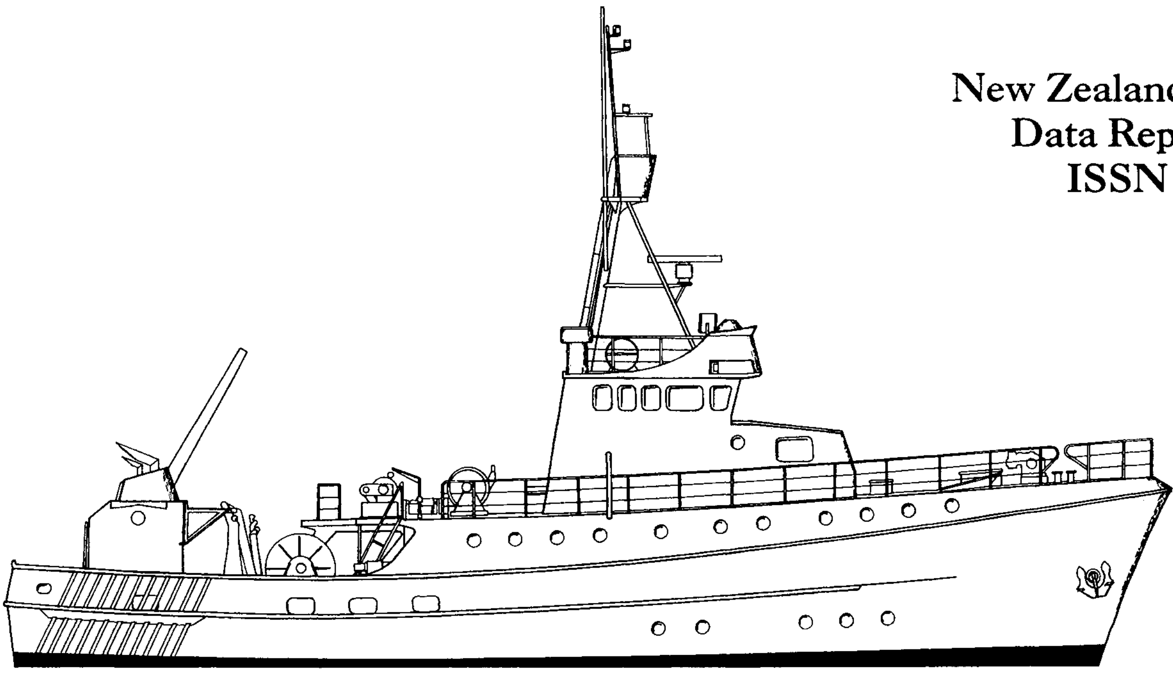
Taihoro Nukurangi

Trawl survey of juvenile snapper in Tasman and Golden Bays, July 1996 (KAH9608)

Ron G. Blackwell
Michael L. Stevenson



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Introduction

This report is part of the requirements of the Ministry of Fisheries Contract CESN03: "Estimation of juvenile snapper year class strength in Tasman Bay/Golden Bay using trawl surveys". The report describes the second in a planned time-series of stratified random trawl surveys (KAH9603) which reviews the distribution and relative abundance of juvenile snapper (*Pagurus auratus)* in Tasman and Golden Bays. The first trawl survey (KAH9507) in this series was described by Stevenson (1996). These surveys will provide data for the development of an index of year class strength. Knowledge of cohort strength is considered important for the development of a model of this fishery.

The inshore areas of Tasman and Golden Bays are a nursery area for a number of important inshore fishes, including tarakihi (*Nemadactylus macropterus*) and snapper.

The SNA 7 fishery is highly valued by the non-commercial sector. Up to the early 1980s, it sustained an important commercial fishery, with recorded catches in excess of 500 t over a 29 year period from 1955 to 1983. Following overfishing in the late 1970s and early 1980s (Drummond 1994), the TACC was set at a historically low level (372 t) in 1986. It was further reduced to 160 t in 1989 as a result of a biomass assessment (Drummond 1994). Recent modelling of the fishery suggests that it has been rebuilding since the mid 1980s. This view is supported by the commercial sector who advocate an increase in the TACC (Annala & Sullivan 1996).

The 1986–87 tagging programme showed that the population consisted mainly of old fish (Kirk *et al.* 1988), which suggests that any increase in biomass would most likely have come from new recruits to the fishery rather than growth within the fishery. From previous survey data, juvenile snapper are concentrated in shallow waters (inside 15 m) during summer and move out to the deeper waters of Tasman and Golden Bays during winter (Drummond & Kirk 1986, Drummond 1994, Drummond & Stevenson 1996). Winter sampling should therefore provide better estimates of relative year class strength than summer sampling, when juvenile snapper are concentrated inshore.

The previous (1995) winter juvenile snapper survey (Stevenson 1996) recorded low numbers of juvenile snapper, thought to be related to poor recruitment. Recent modelling of relative year class strengths for this fishstock (M. Francis, NIWA Greta Point, unpublished data) utilised available climate data and determined that recruitment success may be related to spring/summer air temperatures.

Project objectives

The major objectives of the research programme are as follows.

1. To determine the distribution of juvenile snapper in Tasman and Golden Bays and develop a time-series of relative abundance indices.
2. To estimate the age distribution of juvenile snapper in Tasman and Golden Bays.

Survey objectives

The specific objectives of the 1996 trawl survey are as follows.

1. To obtain relative abundance data for juvenile snapper and other commercially important species sampled by bottom trawl in Tasman and Golden Bays.
2. To collect data on length and age of juvenile snapper.

3. To collect otoliths from snapper.
4. To collect data on length and sex of Individual Transferable Quota (ITQ) and selected non-ITQ species taken during the survey.
5. To collect tissue samples (where possible) of juvenile hoki for biochemical analysis by the New Zealand Institute for Crop and Food Research Ltd.
6. To measure individual lengths and weights of lemon sole to calculate length-weight coefficients.

Project and voyage personnel

The project and voyage leader was Ron Blackwell and the skipper was Roy Brown.

Methods

Survey area and design

The survey was designed to cover depths of 10–70 m in Tasman and Golden Bays inside a line from Farewell Spit to Stephens Island (Figure 1). The total survey area was 4317 km^2, 90% of which was trawlable ground.

The six strata used for the 1995 survey (Stevenson 1996) were based on information from previous winter surveys of juvenile snapper in Tasman and Golden Bays. Stratification was modified as recommended by the Inshore Research Planning Group by dividing Stratum 4 (Tasman Bay 20–40 m) into two smaller strata: 4A (20–30 m), and 4B (30–40 m). Time permitted the establishment of an additional stratum (Stratum 7, Tasman Bay 5–10 m) to examine the occurrence of juvenile snapper in depths of 5–10 m in Tasman Bay (*see* Figure 1).

The survey was of a two-phase stratified random design (*after* Francis 1984). Before the survey began, sufficient trawl stations to cover both first and second phase stations within each stratum were randomly generated by the computer programme 'Rand_stn v2.1' (*see* Vignaux 1994). The stations were required to be a minimum of 3 km (1.6 n. miles) apart. Non-trawlable ground was identified before the voyage. The distribution of non-trawlable ground is shown in Table 1 and Figure 1.

For the two-phase methodology, juvenile snapper (less than 25 cm fork length) was designated as the target species. For strata 1–6, a total of 35 phase 1 stations were allocated. Each stratum was originally assigned three stations and the remaining phase 1 stations were allocated to strata to minimise the variance of the expected catch rates of the target species and on stratum area. Catch rates were assumed to be similar to the catch rates from the 1995 survey and previous winter surveys.

For stratum 7, the stratum area was divided into 35 1-minute squares of latitude and longitude on the relevant hydrographic chart (N.Z. 61). This method was chosen because the latitude and longitude points necessary to run the 'Rand_stn' programme were not available, and there was not enough time to complete that process. The squares were numbered 1–35 and five squares were randomly selected (without replacement). Stations were placed in the centre of each selected square.

Stations reserved for phase 2 were aimed at improving the precision of the biomass estimate for juvenile snapper and were allocated after phase 1 sampling was completed.

Vessel and gear

RV *Kaharoa*, a 28 m stern trawler with a beam of 8.2 m, a displacement of 302 t, and engine power of 522 kW, is capable of towing at depths of 500 m. The net used was a high opening bottom trawl (without lower wings) and was fitted with a 40 mm knotless codend. Gear specifications and net plans were given by Drury & McKenzie (1992).

Doorspread estimates from the 1996 survey were based upon recorded headline height and warp length and measurement of warp angles, using the method of Koyama (1974), as the Scanmar doorspread monitoring equipment used for the 1995 survey was not available. From the 1995 survey, doorspread varied between 67.5 and 89.4 m (Stevenson 1996).

For the 1996 survey, at the stations where 200 m or more of warp were used, a doorspread of 78 m was assumed. This was reduced to 68 m where bogging occurred in deep soft mud. For the shallow water stations, warp length was reduced and a doorspread estimate of 65 m was assumed.

Headline height was read off a Scanmar net monitor and varied between 4.5 and 6.0 m.

Trawling procedure

All tows were undertaken in daylight. For each tow the vessel steamed to the station position and, if necessary, the bottom was checked with the depth sounder. Once the tow was considered safe, the gear was set away so that the midpoint of the tow would coincide as nearly as possible with the station position. The direction of the tow was influenced firstly by a combination of weather conditions and bottom contours, and secondly by the location of the next tow (to minimise steaming between stations).

All stations were on trawlable ground. Standard tows were of 15 min at a speed over the ground of 3.25 kn: the distance covered was measured by GPS. The tow was deemed to have started when the netsonde showed that the net was on the bottom, and was completed when hauling began.

A minimum of 100 m and a maximum of 250 m of warp was used during towing. Because no tows were in depths greater than 60 m, variations in the length of warp were determined firstly by depth and secondly by bottom conditions.

Water temperatures

To determine the surface temperature at each station, a water sample was collected from off the starboard side of the vessel (away from the engine outlet) immediately after retrieval of the fishing gear. The temperature was measured using a calibrated digital thermometer. Bottom temperatures were recorded from the Scanmar netsonde, on average three times during each tow.

Catch and biological sampling

The catch was sorted into species on deck and weighed on 100 kg electronic motion-compensating Seaway scales to the nearest 0.1 kg. Where large catches of small baitfish species (sprats, pilchards, anchovies) and small (less than 15 cm fork length) jack mackerel were taken, the weights of individual species were estimated from a subsample.

Lengths, to the nearest whole centimetre below actual length, and sex were recorded for all ITQ species (except arrow squid), either for the whole catch or for a randomly selected subsample of 100–200 fish per tow. Biological data were collected from all snapper and consisted of individual fish length and weight, and gonad stages for fish longer than 25 cm. The gonad stages used were: 1, immature or resting; 2, maturing (oocytes visible in females); 3, mature (hyaline oocytes in females, milt expressible in males); 4, running ripe (eggs or milt free flowing); 5, spent.

Data analysis

Relative biomass was estimated by the area-swept method of Francis (1981, 1989) using the Trawlsurvey Analysis Program (Vignaux 1994). The catchability coefficient (an estimate of the proportion of fish in the survey area available to be caught in the net) is the product of the vulnerability (v), vertical availability (u_v), and areal availability (u_a) as defined by Francis (1989). The following assumptions were made.

1. The area swept during each tow equalled the distance between the doors multiplied by the distance towed.
2. Vulnerability was 1.0. This assumes that all fish in the volume swept were caught and there was no escapement.
3. Vertical availability was 1.0. This assumes that all fish in the water column were below the headline height and available to the net.
4. Areal availability was 1.0. This assumes that the fishstock being sampled was entirely within the area sampled at the time of the survey.
5. Within the survey area, fish density was the same over both trawlable and non-trawlable ground.

Although these assumptions are unlikely to be correct, they are consistent with the previous survey and their adoption provides the basis for a time series of relative biomass estimates.

Biomass estimates were calculated using data from all stations where gear performance was judged to be satisfactory, i.e., the gear performance code was 1 or 2. A combined biomass and length frequency analysis was used for species for which biomass above a specific length was required and for deriving the weighted length frequency distributions. Length-weight coefficients used in the scaling are given in Appendix 1. All length frequencies were scaled by the percentage of catch sampled, area swept (a function of doorspread and distance towed), and stratum area using the Trawlsurvey Analysis Program. The coefficient of variation (*c.v.*) associated with estimates of biomass was calculated using the method of Vignaux (1994).

The geometric mean functional relationship was used to calculate the length-weight coefficient for lemon sole.

Results

Trawl stations

A total of 46 phase 1 and 15 phase 2 stations was successfully completed (Table 1, Figure 1, Appendix 2). No days were lost to bad weather, and at least four stations were completed in each stratum. An overall station density of one station per 70.7 km^2 was achieved (*see* Table 1).

Trawl stations 1–6 had insufficient warp length for the depths fished, which resulted in a low doorspread, estimated at 48 m. These stations were repeated and data from the initial stations have not been used for biomass estimation.

Catch composition

A total of 9873 kg of fish was caught, at an average of 162 kg per tow (range 14.1–737.6 kg). Amongst the wetfish catch, 8 elasmobranchs and 46 teleosts were recorded, together with 3 cephalopods and 6 bivalves. Southern spiny dogfish made up 24% and red cod 23% of the catch by weight (Table 2).

Barracouta, red cod, and red gurnard were each caught in over 90% of the tows. Catches of the 10 most abundant commercial fish species by station and by stratum are given in Tables 3 and 4, respectively.

The absence of hoki from this survey was a major contrast to the 1995 survey (Stevenson 1996) when the hoki catch of 1096 kg represented 14% of the total catch and hoki was the third most abundant species by weight. Total landings of jack mackerel *(Trachurus novaezelandiae, T. declivis,* and *T. murphyi*) were also lower during this survey (353.4 kg vs 1153 kg in 1995).

Landings of hake were significantly greater for this survey (216 kg) than in 1995 (2.3 kg) (Stevenson 1996).

Catch rates and species distribution

Distributions and catch rates for all species combined and for the 10 most abundant commercial finfish species are shown in Figure 2. (N.B., catch rates are given in terms of $kg.km^{-2}$, hence a catch rate of 1000 $kg.km^{-2}$ equates to a catch of 117 kg in a standard tow as it covers 0.117 km^{-2} on average.) The catch rates for the 10 most abundant commercial species by stratum are given in Table 5.

Biomass estimation

Relative biomass estimates for the 15 most abundant finfish species and 7 other commercially important ITQ species are given in Table 6. For species subject to a regulatory or processing limit, estimates above a given size are provided. For red cod, the processing size has varied among years (38 cm in 1992, 45 cm in 1994, and 40 cm in 1995): 40 cm is used as the minimum size of recruited red cod in this report. This is consistent with the WCSI trawl survey reports (Drummond & Stevenson 1996).

Water temperatures

Isotherms estimated from station data for surface and bottom water temperatures are shown in Figures 3a and 3b. Surface and bottom temperatures are included in Appendix 2.

Length frequency and biological data

The numbers of length frequency and biological samples taken during the survey are given in Table 7. Scaled length frequency distributions for the 10 most abundant commercial finfish species and other selected ITQ species are given in Figure 4.

Species of which a significant proportion of juveniles was caught in both 1995 and 1996 include barracouta, tarakihi, red cod, red gurnard, and jack mackerel (*Trachurus declivis* and *T. novaezelandiae*).

The length frequency distributions for red cod and red gurnard were bimodal. For red cod, these modes were around 13–19 cm (0+ cohort) and 29–42 cm (1+ cohort). For red gurnard modes were around 13–15 cm (1+ cohort) and 24–31 cm (2+ cohort). Three modes can be seen in the length frequency data for juvenile barracouta, at around 4–6 cm, 11–19 cm, and 21–30 cm.

The length frequencies for sand flounder and common warehou were unimodal. Strong peaks representing 0+ cohort fish occurred at around 9–13 cm for sand flounder, and around 10–13 cm for common warehou.

Snapper

A total of 19 snapper (13 juveniles) was caught during the survey. The lengths and ages (estimated from otolith readings) of all snapper caught are given in Table 8.

No juvenile snapper were caught in Golden Bay, although adult snapper were taken in both Tasman and Golden Bays. The low catch of adult snapper was expected because most adults move out of the bays after spawning in summer (Drummond 1994).

The distribution of juvenile snapper appears to be related to depth and/or bottom temperature. The 0+ snapper were caught in inner Tasman Bay between 10–30 m and the single 2+ snapper was caught in 36 m (Figure 5). All but one 0+ snapper were caught within a bottom temperature range of 10–12 °C (Figure 6).

No biomass estimate or length frequency analysis was completed for snapper because of the low numbers of fish caught.

Discussion

This survey is the second in a time series to estimate the relative year class strengths of juvenile snapper in Tasman and Golden Bays. The low snapper catch rates raise concern about whether the trawl gear was working properly, but the catches of juvenile red cod, anchovy, and other small fish indicates that the gear was working well. The same vessel and net have been used to successfully sample juvenile snapper in the Auckland Fishery Management Area (AFMA) for many years.

The low catch of juvenile snapper (13 fish less than or equal to 20 cm) indicates that the 1996 (0+) recruitment was poor. The lack of 1995 year class (1+) snapper (10–20 cm) from this survey is consistent with poor recruitment during 1995 as demonstrated by the previous survey when no 0+ and two 1+ snapper were reported (Stevenson 1996).

These data indicate that there may have been a recruitment failure for as many as 4 years. This may be due to the effects of the El Niño Southern Oscillation producing lower than average sea temperatures for the years 1991—94. A similar recruitment failure in Tasman and Golden Bays occurred in the strong El Niño of 1982–83 (Drummond 1994).

As the Tasman Bays fishstock represents the most southerly spawning location for snapper, strong recruitment may be related to a positive SOI (La Niña). Negative SOIs (such as in 1991–1994) or zero SOIs (such as in 1995 and 1996) may thus result in zero or poor recruitment. Research in the AFMA has shown a strong relationship between the number of 1+ snapper and sea surface temperature in the summer-autumn after spawning (Francis 1993). Studies in Tasman and Golden Bays will be needed to establish whether a similar relationship exists in this area.

Data collected on other species, especially red cod and red gurnard, may be used to complement those gathered from other sources for input to the stock assessment process.

Acknowledgments

We thank R. Brown, master of *Kaharoa*, and his crew for their active cooperation and assistance during the survey, the NIWA staff, and Rachel Law and Simon Davies (New Zealand Institute for Crop and Food Research Ltd) who assisted with data collection. We also thank Malcom Francis for useful comments on an earlier draft of this manuscript.

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Table 1: Stratum depth ranges, survey area, non-trawlable area, number of successful* stations and station density.
* excludes stations where gear performance < 2.

	Stratum Description	Depth (m)	Area (Km^2)	Non-trawlable area (Km^2)	Number of stations			Station density (km^2 per station)
					Phase 1	Phase 2	Total	
1	Inner Golden Bay	10–20 m	215	49	6	0	6	35.8
2	Outer Golden Bay	20–30 m	294	14	4	0	4	73.5
3	Inner Tasman Bay	10–20 m	257	44	10	5	15	17.1
4A	Inner Tasman Bay	20–30 m	326	63	8	7	15	21.7
4B	Inner Tasman Bay	30–40 m	618	8	5	3	8	77.3
5	Western Outer Tasman Bay	40–70 m	1 025	144	4	0	4	256.0
6	Eastern Outer Tasman Bay	40–70 m	1 473	104	4	0	4	368.0
7	Inshore Tasman Bay	6–10 m	109	0	5	0	5	21.8
Total (average)			4 317	426	46	15	61	(70.7)

Table 2: Species caught, total weight, and number of stations out of 61 at which species occurred (Occ)

Common name	Scientific name	Code	Catch (kg)	% of total catch	Occ
Spiny dogfish	*Squalus acanthias*	SPD	2 356.9	23.9	38
Red cod	*Pseudophycis bachus*	RCO	2 234.1	22.6	61
Barracouta	*Thyrsites atun*	BAR	1 295.4	13.1	57
Spotty	*Notolabrus celidotus*	STY	678.5	6.9	53
Red gurnard	*Chelidonichthys kumu*	GUR	431.8	4.4	58
Sprat	*Sprattus* spp.	SPR	432.4	4.4	35
Jack mackerel	*Trachurus novaezelandiae*	JMN	232.5	2.4	38
Hake	*Merluccius australis*	HAK	216.5	2.2	46
Blue warehou	*Seriolella brama*	WAR	210.4	2.1	53
Sponges	Porifera	ONG	206.9	2.1	10
Tarakihi	*Nemadactylus macropterus*	TAR	176.5	1.8	10
Anchovy	*Engraulis australis*	ANC	128.6	1.3	30
Carpet shark	*Cephaloscyllium isabella*	CAR	127.5	1.3	35
Jack mackerel	*Trachurus declivis*	JMD	119.2	1.2	17
Pilchard	*Sardinops neopilchardus*	PIL	102.2	1.0	26
Sand flounder	*Rhombosolea plebeia*	SFL	101.4	1.0	53
Leatherjacket	*Parika scaber*	LEA	90.1	0.9	29
Thresher shark	*Alopias vulpinus*	THR	85.7	0.9	4
Scaly gurnard	*Lepidotrigla brachyoptera*	SCG	75.5	0.8	25
School shark	*Galeorhinus galeus*	SCH	66.5	0.7	22
Smooth skate	*Raja innominata*	SSK	57.7	0.6	5
Sea perch	*Helicolenus percoides*	SPE	56.1	0.6	11
Rough skate	*Raja nasuta*	RSK	51.4	0.5	16
Pufferfish	*Contusus richei*	PUF	49.4	0.5	17
Greenlipped mussel	*Perna canaliculus*	MSG	42.5	0.4	15
Blue cod	*Parapercis colias*	BCO	29.8	0.3	14
Blue mackerel	*Scomber australasicus*	EMA	22.1	0.2	21
Yellowbelly flounder	*Rhombosolea leporina*	YBF	21.5	0.2	26
Octopus	*Octopus maorum*	OCT	20.3	0.2	10
Lemon sole	*Pelotretis flavilatus*	LSO	18.2	0.2	31
Arrow squid	*Nototodarus sloanii, N. gouldi*	SQU	18	0.2	37
Snapper	*Pagrus auratus*	SNA	16.1	0.2	12
N.Z. sole	*Peltorhamphus novaezeelandiae*	ESO	14.1	0.1	21
Rig	*Mustelus lenticulatus*	SPO	12.2	0.1	2
Yelloweyed mullet	*Aldrichetta forsteri*	YEM	12.2	0.1	7
Two saddle rattail	*Caelorinchus biclinozonalis*	CBI	10.2	0.1	11
Giant stargazer	*Kathetostoma giganteum*	STA	6.8	0.1	4
Eagle ray	*Myliobatis tenuicaudatus*	EGR	6.5	0.1	5
Frostfish	*Lepidopus caudatus*	FRO	5.1	0.1	4
Spotted stargazer	*Genyagnus monopterygius*	SPZ	4.9	< 0.1	5
Witch	*Arnoglossus scapha*	WIT	4.4	< 0.1	19
Broad squid	*Sepioteuthis australis*	BSQ	3.3	< 0.1	12
John dory	*Zeus faber*	JDO	2.6	< 0.1	2
Nesting mussel	*Modiolarca impacta*	MIM	2.5	< 0.1	2
Speckled sole	*Peltorhamphus latus*	SPS	2.2	< 0.1	22
Murphy's mackerel	*Trachurus murphyi*	JMM	1.7	< 0.1	1
Trevally	*Pseudocaranx dentex*	TRE	1.6	< 0.1	15
Red mullet	*Upeneichthys lineatus*	RMU	1.3	< 0.1	3
Opalfish	*Hemerocoetes monopterygius*	OPA	1.2	< 0.1	12
Shag	Phalacrocoracidae	XSL	1.2	< 0.1	1
Conger eel	*Conger verreauxi*	CON	0.9	< 0.1	2

Table 2—*continued*

Common name	Scientific name	Code	Catch (kg)	% of total catch	Occ
Pigfish	*Congiopodus leucopaecilus*	PIG	0.9	< 0.1	4
Silver warehou	*Seriolella punctata*	SWA	0.8	< 0.1	2
Ling	*Genypterus blacodes*	LIN	0.7	< 0.1	1
Horse mussel	*Atrina zelandica*	HOR	0.6	< 0.1	2
Kahawai	*Arripis trutta*	KAH	0.6	< 0.1	2
Dredge oyster	*Tiostrea chilensis*	OYS	0.5	< 0.1	4
Scallop	*Pecten novaezelandiae*	SCA	0.5	< 0.1	2
Sea squirt	Ascidiacea	–	0.5	< 0.1	1
Butterfly perch	*Caesioperca lepidoptera*	BPE	0.4	< 0.1	1
Silver dory	*Cyttus novaezelandiae*	SDO	0.4	< 0.1	1
Redbait	*Emmelichthys nitidus*	RBT	0.2	< 0.1	2
Unidentified crab	Decapoda	CRB	0.1	< 0.1	1
Sandfish	*Gonorynchus gonorynchus*	GON	0.1	< 0.1	1
Porcupinefish	*Allomycterus jaculiferus*	POP	0.0*		1
			9 872.9		

* Counted but not weighed
– No code

Table 3: Catch (kg) of the 10 most abundant commercial fish species by station*

Station	SPD	RCO	BAR	GUR	JMN	HAK	WAR	TAR	JMD	SFL	Total	All species
1	0.0	14.9	0.0	0.4	0.0	4.4	0.2	0.0	0.0	0.2	20.1	21.9
2	8.0	62.1	0.0	0.8	0.0	9.5	0.4	0.0	0.0	0.1	80.9	88.8
3	0.0	24.7	8.9	4.3	0.0	6.6	0.3	0.0	0.0	0.4	45.2	60.5
4	0.0	86.2	6.9	3.5	0.0	7.8	0.4	0.0	0.0	0.7	105.5	116.9
5	8.1	36.9	3.6	3.3	0.0	3.7	2.8	0.0	0.0	0.8	59.2	72.9
6	23.6	11.8	9.8	1.6	0.1	0.7	0.1	0.0	0.0	0.0	47.7	63.9
7	39.9	84.1	5.8	13.8	0.1	14.8	2.3	0.0	0.0	0.8	161.6	173.8
8	5.9	64.6	19.6	3.2	0.0	1.8	1.5	0.0	0.0	1.5	98.1	139.0
9	2.6	79.1	23.8	7.9	0.0	2.8	0.1	0.0	0.0	0.5	116.8	145.2
10	0.0	145.9	25.2	7.0	0.0	9.2	2.1	0.0	0.0	0.2	189.6	228.8
11	0.0	61.9	5.4	2.0	0.3	0.0	0.0	0.0	0.0	0.3	69.9	81.5
12	0.0	79.9	10.1	3.5	0.6	3.1	0.4	0.0	0.0	2.6	100.2	113.7
13	388.7	49.3	10.8	18.3	0.1	0.9	2.0	0.0	0.0	0.1	470.2	478.6
14	332.5	50.2	12.9	10.7	4.4	0.0	1.5	0.0	0.0	0.9	413.1	420.9
15	2.2	18.1	2.9	5.1	0.1	0.7	0.1	0.0	0.0	2.4	31.6	40.4
16	5.6	106.3	20.8	33.0	0.5	1.5	0.6	9.5	0.0	3.2	181.0	229.3
17	11.4	48.8	8.4	8.6	0.4	10.4	1.4	0.1	0.0	0.4	89.9	106.7
18	39.0	25.5	10.4	10.0	0.2	4.0	16.9	0.0	0.0	0.0	106.0	173.8
19	22.5	30.9	9.1	13.1	2.2	2.5	1.8	0.0	0.0	1.4	83.5	238.1
20	11.6	33.0	21.7	11.7	0.1	0.0	0.0	0.0	0.0	1.6	79.7	105.1
21	163.4	7.3	11.6	12.5	0.9	1.6	69.3	10.0	0.0	1.6	278.2	314.3
22	29.6	36.4	4.8	27.5	2.7	1.1	0.1	0.0	1.9	1.1	105.2	141.6
23	20.6	41.7	5.3	18.7	17.0	2.8	1.0	0.7	3.0	1.0	111.8	210.2
24	0.0	63.1	4.1	2.0	0.2	4.4	2.0	55.2	0.1	0.0	131.1	382.3
25	0.0	26.9	6.2	2.1	0.0	3.0	0.1	0.0	0.0	6.0	44.3	48.5
26	0.0	40.4	14.0	1.4	0.0	1.7	0.2	0.0	0.1	8.0	65.8	137.8
27	41.1	23.6	40.2	2.8	0.0	0.0	0.1	0.0	0.0	3.4	111.2	122.9
28	87.6	8.1	27.1	10.9	0.1	0.0	0.1	0.0	0.0	1.3	135.2	164.8
29	85.9	12.3	10.1	4.4	0.1	0.0	0.1	0.0	0.0	0.5	113.4	209.5
30	63.4	7.7	9.9	1.5	0.1	0.0	0.2	0.0	0.0	0.0	82.8	86.5
31	3.0	29.3	52.1	0.2	0.0	0.0	0.0	0.0	0.0	1.3	85.9	96.4
32	76.4	10.3	38.2	7.0	2.9	0.5	0.6	0.3	0.1	1.0	137.3	147.8
33	302.2	58.6	209.5	14.0	0.6	3.6	1.3	38.4	0.0	0.5	628.7	737.6
34	130.6	105.7	68.0	5.4	2.1	0.0	0.3	0.0	0.4	0.0	312.5	342.7
35	80.0	10.8	211.4	0.8	8.0	0.0	0.0	0.0	1.5	0.0	312.5	326.8
36	47.7	8.2	74.2	3.2	3.5	0.0	24.6	0.0	1.6	0.0	163.0	199.7
37	44.2	4.3	40.6	0.7	8.7	0.0	0.0	0.0	23.2	0.0	121.7	155.3
38	59.9	14.4	13.1	3.0	10.3	0.2	0.1	0.0	1.6	0.4	103.0	148.3
39	11.8	6.2	23.5	4.6	9.6	0.0	0.0	0.0	0.0	0.3	56.0	202.7
40	6.7	13.2	10.9	2.9	0.2	0.5	0.0	0.0	0.2	11.1	45.7	71.9
41	13.3	9.0	46.8	16.9	0.0	0.5	0.0	0.0	10.9	3.8	101.2	164.5
42	88.0	12.8	0.0	9.6	0.4	0.0	3.0	49.9	0.7	2.2	166.6	215.4
43	0.0	48.1	19.0	8.9	6.0	1.8	0.2	0.0	0.0	1.7	85.7	144.3
44	12.6	44.1	3.1	14.4	0.1	3.4	1.5	0.0	0.0	1.0	80.2	87.3
45	0.0	30.3	2.3	3.7	0.5	2.2	0.9	0.0	0.0	2.4	42.3	50.9
46	0.0	16.8	24.5	13.8	0.3	0.5	3.6	0.0	0.0	1.8	61.3	79.8
47	0.0	26.9	2.4	2.8	0.6	1.6	0.1	0.0	0.0	5.2	39.6	88.1
48	38.1	50.2	14.8	10.6	0.0	68.0	0.9	0.0	0.0	1.6	184.2	214.1
49	4.6	12.2	10.4	11.8	1.1	1.7	15.0	11.7	0.1	0.6	69.2	109.7
50	28.5	70.0	3.3	25.9	145.0	5.5	1.2	0.7	72.5	5.9	358.5	458.8
51	16.1	28.1	8.1	11.0	2.0	1.3	8.0	0.0	1.2	3.4	79.2	112.4
52	0.0	20.2	13.0	2.5	0.0	0.0	0.2	0.0	0.0	1.3	37.2	44.3
53	0.0	5.7	4.3	1.8	0.0	0.9	0.3	0.0	0.0	1.5	14.5	24.0
54	0.0	30.5	11.1	1.3	0.4	5.7	4.7	0.0	0.1	1.1	54.9	76.0
55	0.0	37.7	20.0	4.8	0.0	3.7	0.2	0.0	0.0	2.8	69.2	86.4
56	0.0	12.9	4.4	0.4	0.0	1.4	34.2	0.0	0.0	1.0	54.3	349.8
57	0.0	7.4	0.0	0.0	0.0	0.4	0.5	0.0	0.0	2.4	10.7	14.1
58	0.0	18.2	2.2	0.0	0.0	8.4	0.1	0.0	0.0	1.2	30.1	31.8
59	0.0	31.8	3.8	0.8	0.0	0.4	0.6	0.0	0.0	0.5	37.9	59.0
60	0.0	51.7	8.6	3.4	0.0	4.1	0.1	0.0	0.0	3.2	71.1	77.0
61	0.0	26.8	2.4	0.0	0.0	1.2	0.1	0.0	0.0	1.2	31.7	37.8
Total	2 356.9	2 234.1	1 295.4	431.8	232.5	216.5	210.4	176.5	119.2	101.4	7 374.7	9 872.9

* Species codes are given in Table 2

Table 4: Catch (kg) of the 10 most abundant commercial fish species by stratum*

Stratum	Depth (m)	Species code SPD	RCO	BAR	GUR	JMN	HAK	WAR	TAR	JMD	SFL	Total	All species
1	10–20	195.1	136.0	149.5	18.9	0.2	4.7	0.7	0.0	0.1	20.0	525.2	656.9
2	20–33	464.5	144.3	261.9	27.4	3.8	8.5	4.0	93.9	0.2	2.0	1 010.5	1 477.2
3	10–20	62.1	850.3	153.7	65.2	1.5	73.3	11.9	0.0	0.1	16.2	1 234.3	1 472.4
4A	20–30	1 115.9	487.7	144.6	134.9	9.1	100.5	120.5	71.7	0.8	20.1	2 205.8	2 615.4
4B	30–42	125.1	379.6	73.3	143.2	175.5	17.2	13.0	10.9	78.6	20.1	1 036.5	1 575.1
5	20–70	318.2	139.1	366.7	12.4	23.9	0.2	25.0	0.0	5.1	0.4	891.0	1 017.5
6	20–70	76.0	32.7	121.8	25.1	18.5	1.0	0.0	0.0	34.3	15.2	324.6	594.4
7	5–10	0.0	64.4	23.9	4.7	0.0	11.1	35.3	0.0	0.0	7.4	146.8	464.0
	Total	2 356.9	2 234.1	1 295.4	431.8	232.5	216.5	210.4	176.5	119.2	101.4	7 374.7	9 872.9

* Species codes are given in Table 2

Table 5: Mean catch rates (kg.km^{-2}) of the 10 most abundant commercial fish species by stratum*

Stratum	Depth (m)	Species code SPD	RCO	BAR	GUR	JMN	HAK	WAR	TAR	JMD	SFL
1	10–20	272.8	200.1	209.4	25.7	0.3	7.3	1.0	0.0	0.2	29.6
2	20–33	839.2	270.4	461.5	50.7	7.5	15.9	7.6	175.6	0.4	3.9
3	10–20	29.5	416.3	86.2	33.4	0.9	32.0	6.4	0.0	0.1	9.9
4A	20–30	632.9	259.3	77.6	75.3	5.3	56.6	66.1	38.9	0.4	11.1
4B	30–42	116.7	354.9	68.9	133.3	166.0	16.2	12.2	10.0	74.5	18.9
5	20–70	613.2	265.9	711.8	24.0	46.1	0.4	50.8	0.0	9.9	0.8
6	20–70	142.3	59.0	223.3	44.7	35.1	1.8	0.0	0.0	64.0	26.8
7	5–10	0.0	93.1	42.9	9.0	0.0	5.6	80.8	0.0	0.0	12.1

* Species codes are given in Table 2

Table 6: Relative doorspread biomass estimates (t) of the 15 most abundant fish species and other selected ITQ species* (species are listed in the same order as in Table 2)

Common name	Lower 95% confidence interval	Biomass	Upper 95% confidence interval	*c.v.* (%)
Spiny dogfish	962.1	1 430.2	1 898.3	16.4
Red cod (all)	513.3	903.2	1 293.1	21.6
Red cod (< 40 cm)	208.4	288.0	367.5	13.8
Red cod (40 + cm)	247.8	615.2	982.7	29.9
Barracouta	620.1	1 334.1	2 048.1	26.8
Spotty	36.8	188.4	340.0	40.2
Red gurnard (all)	144.1	227.4	310.7	18.3
Red gurnard (< 30 cm)	44.0	77.0	110.0	21.4
Red gurnard (30 + cm)	95.0	150.5	205.9	18.4
Sprats	0.0	493.0	1 151.3	66.8
Jack mackerel (T. nz)	27.0	205.8	384.7	43.5
Hake	19.3	46.6	73.8	29.3
Blue warehou	0.0	94.2	200.9	56.7
Tarakihi (all)	4.3	70.6	136.9	47.0
Tarakihi (< 25 cm)	4.8	69.6	134.5	46.6
Tarakihi (25 + cm)	0.0	1.0	2.9	95.1
Anchovy	5.1	28.6	52.0	41.1
Carpet shark	93.3	148.7	204.1	18.6
Jack mackerel (T. dec.)	0.8	150.9	300.9	49.7
Pilchard	0.0	52.5	147.7	90.8
Sand flounder (all)	12.7	67.0	121.3	40.5
Sand flounder (< 25 cm)	4.0	33.8	63.6	44.1
Sand flounder (25 + cm)	8.1	33.2	58.3	37.8
Leatherjacket	25.1	143.4	261.7	41.3
School shark	55.2	125.0	194.8	27.9
Sea perch	8.6	37.4	66.1	38.5
Blue cod	9.1	24.3	39.6	31.3
Blue mackerel	0.0	12.6	55.0	56.5
Yellowbelly flounder	2.2	3.9	5.6	22.2
Lemon sole	4.2	18.6	33.1	38.8

* Species codes are given in Table 2

Table 7: Numbers of length frequency and biological samples collected

Species	Length frequency		Biological data	
	No. of samples	No. of fish	No. of samples	No. of fish
Barracouta	58	1 566	0	0
Blue cod	15	57	0	0
Blue mackerel	21	325	0	0
Blue warehou	53	1 374	0	0
Giant stargazer	4	4	0	0
Hake	47	402	0	0
Horse mackerel	38	1 850	0	0
Jack mackerel (T. nz)	18	642	0	0
John dory	2	2	0	0
Kahawai	3	7	0	0
Lemon sole	32	114	27	107
Ling	1	1	0	0
Jack mackerel (T. m.)	1	1	0	0
N.Z. sole	22	51	0	0
Red cod	62	5 778	0	0
Red gurnard	59	1 604	0	0
Rig	3	4	0	0
Rough skate	16	22	16	22
Sand flounder	54	504	0	0
School shark	22	84	0	0
Sea perch	12	179	0	0
Silver warehou	3	5	0	0
Smooth skate	5	5	5	5
Snapper	12	19	12	19
Speckled sole	22	30	0	0
Spiny dogfish	38	1 144	0	0
Spotted stargazer	6	6	0	0
Tarakihi	11	498	0	0
Thresher shark	5	5	0	0
Trevally	16	28	0	0
Yellowbelly flounder	27	66	0	0

Table 8: Ages of snapper caught during the survey (I, immature)

Station	Length (cm)	Weight (g)	Sex	Age
1	8	15	I	0+
10	8	18	I	0+
10	8	17	I	0+
12	7	10	I	0+
16	20	250	I	2+
17	7	11	I	0+
17	9	22	I	0+
18	8	25	I	0+
18	9	21	I	0+
18	9	17	I	0+
24	32	740	M	7
24	32	710	F	7
26	36	1020	M	8
42	77	9600	F	43
44	45	1860	F	7
54	7	17	I	0+
54	8	23	I	0+
61	37	1200	M	7
61	7	13	I	0+

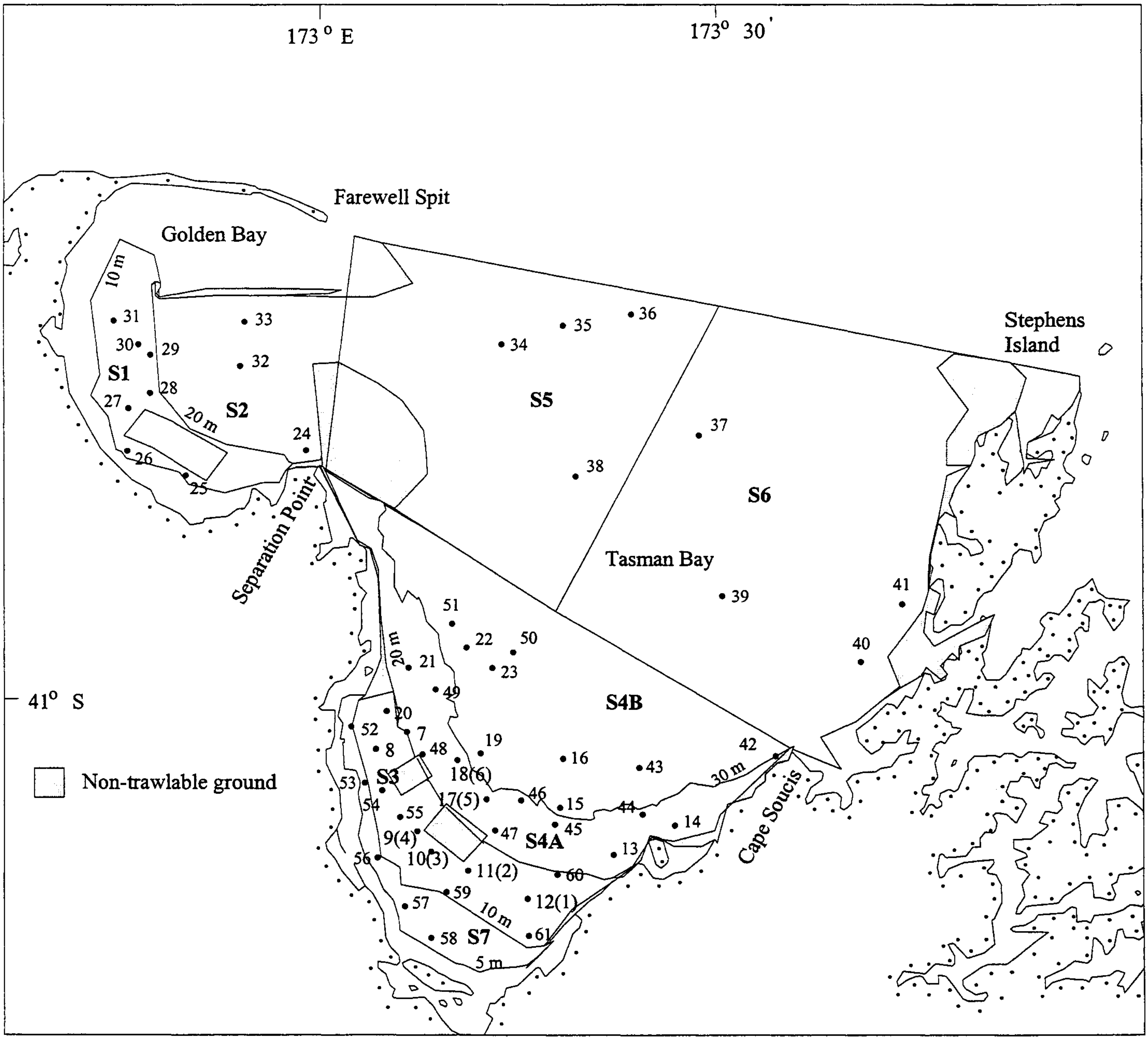

Figure 1: Stratum boundaries with station positions and numbers. Numbers in parentheses are station numbers for stations where insufficient warp length resulted in low doorspread and were subsequently resampled.

All species combined

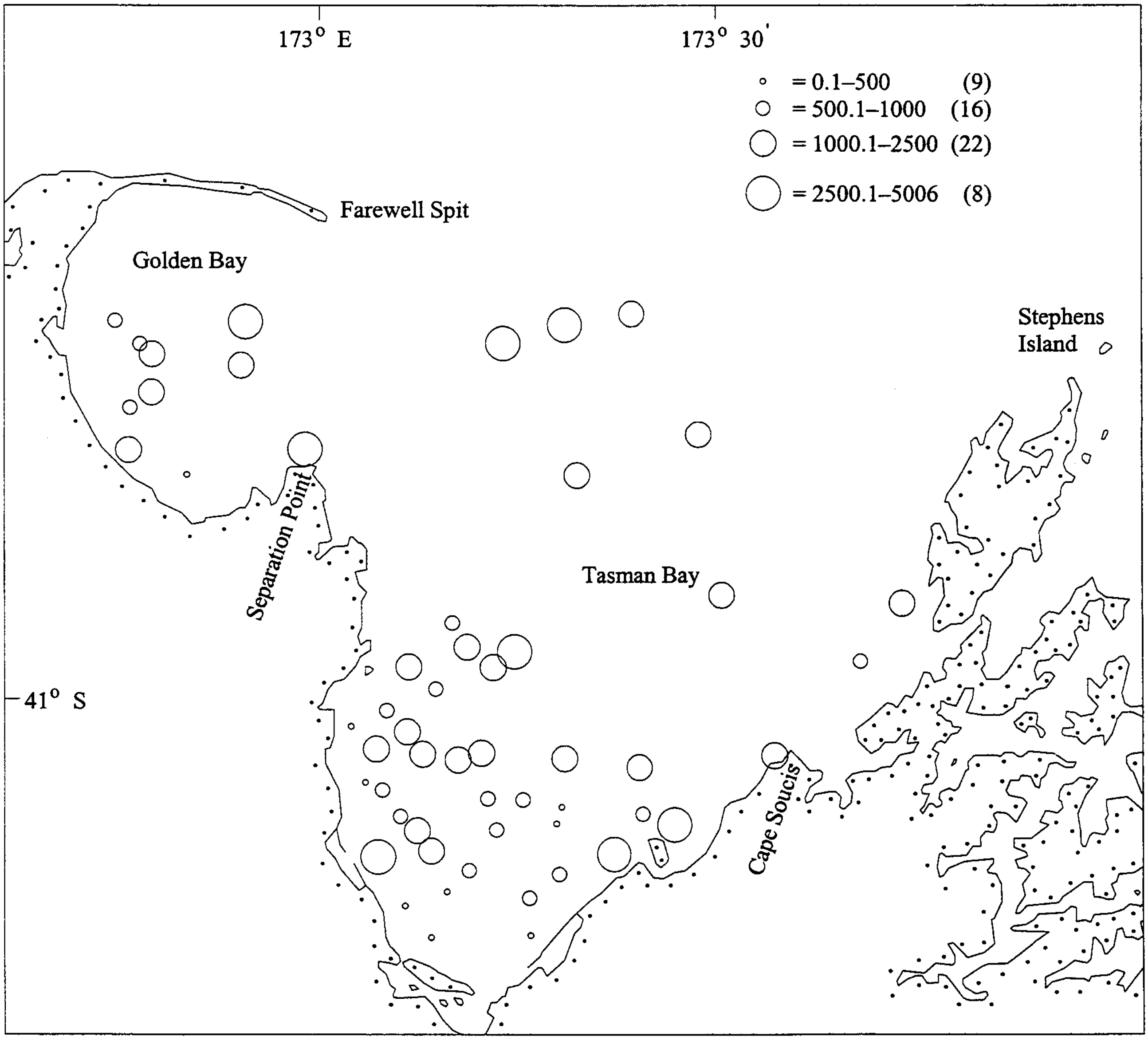

Figure 2: Catch rates (kg.km^{-2}) of all species combined and of the 10 most abundant commercial fish species. Numbers in parentheses are the number of stations at the given catch rates.

Barracouta

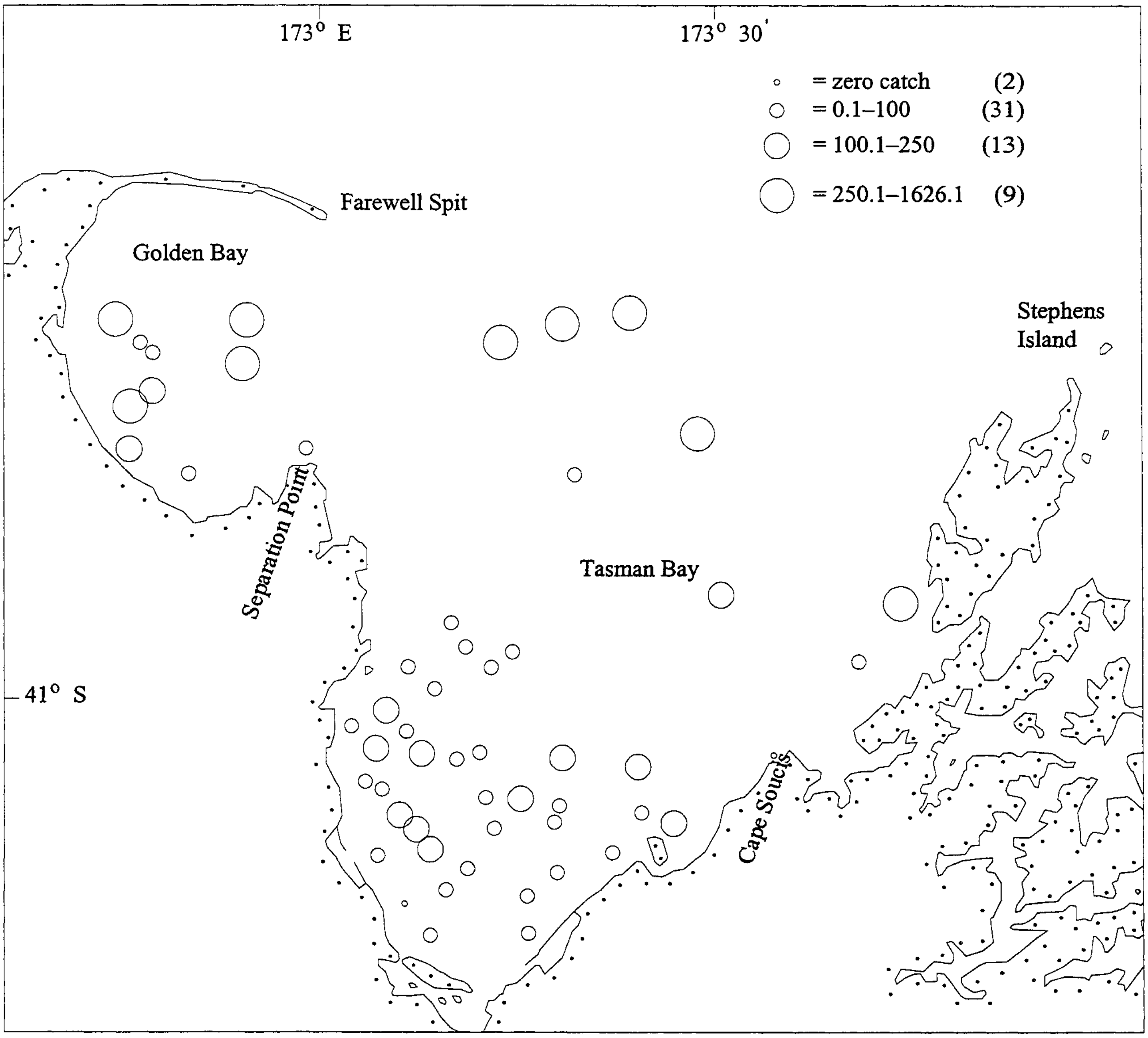

Figure 2*—continued*

Blue warehou

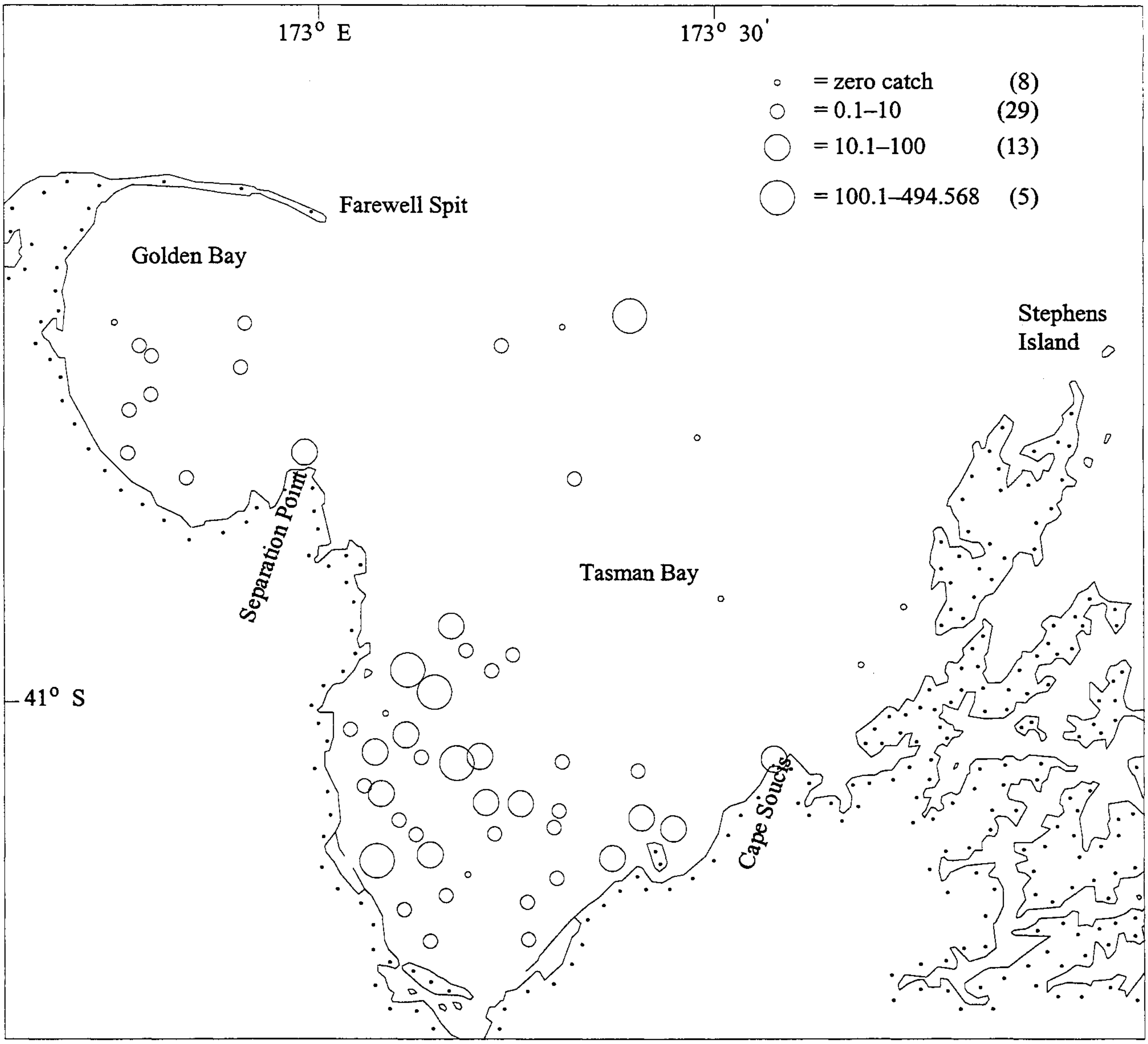

Figure 2—***continued***

Hake

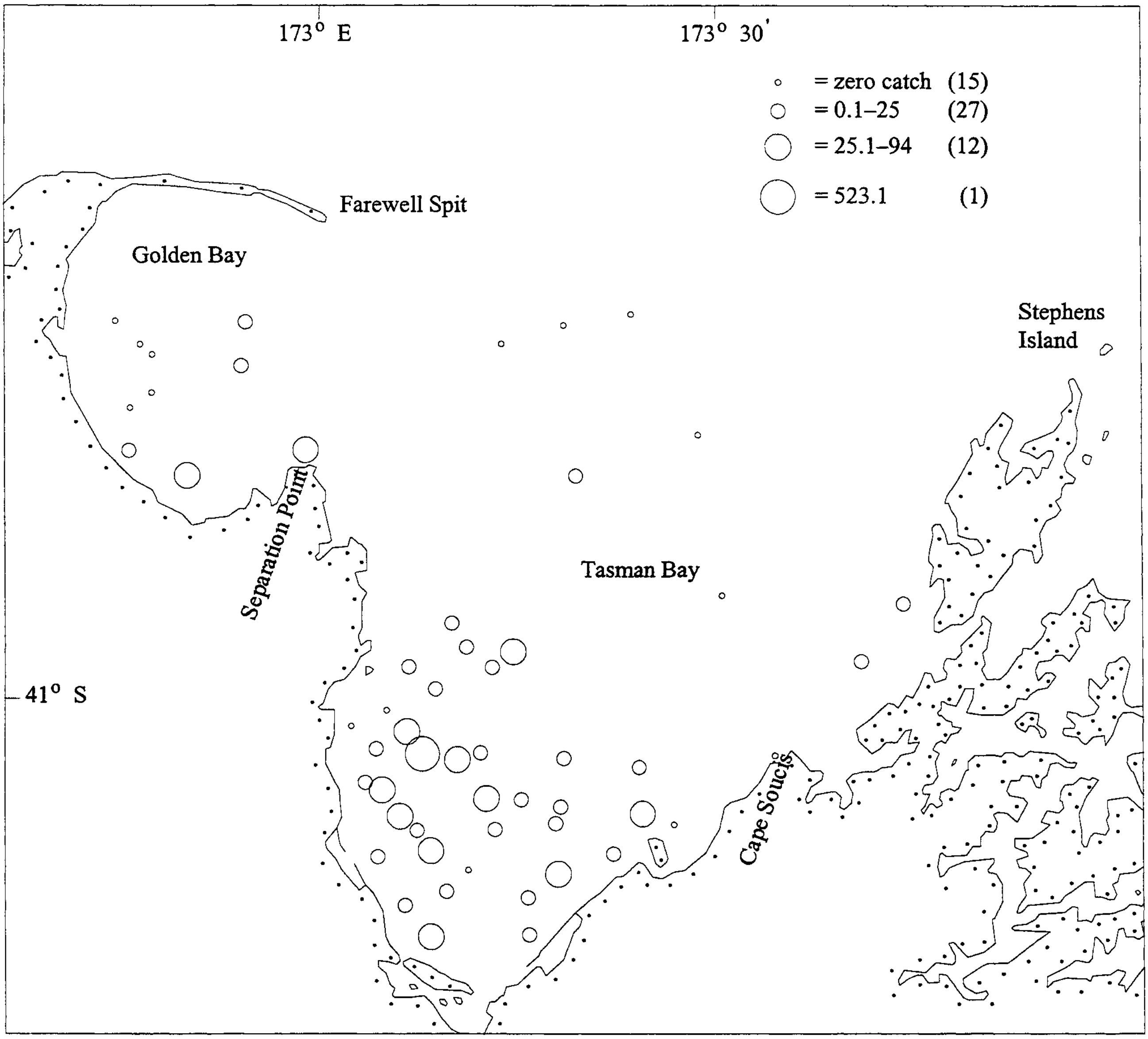

Figure 2—*continued*

Jack mackerel

Trachurus declivis

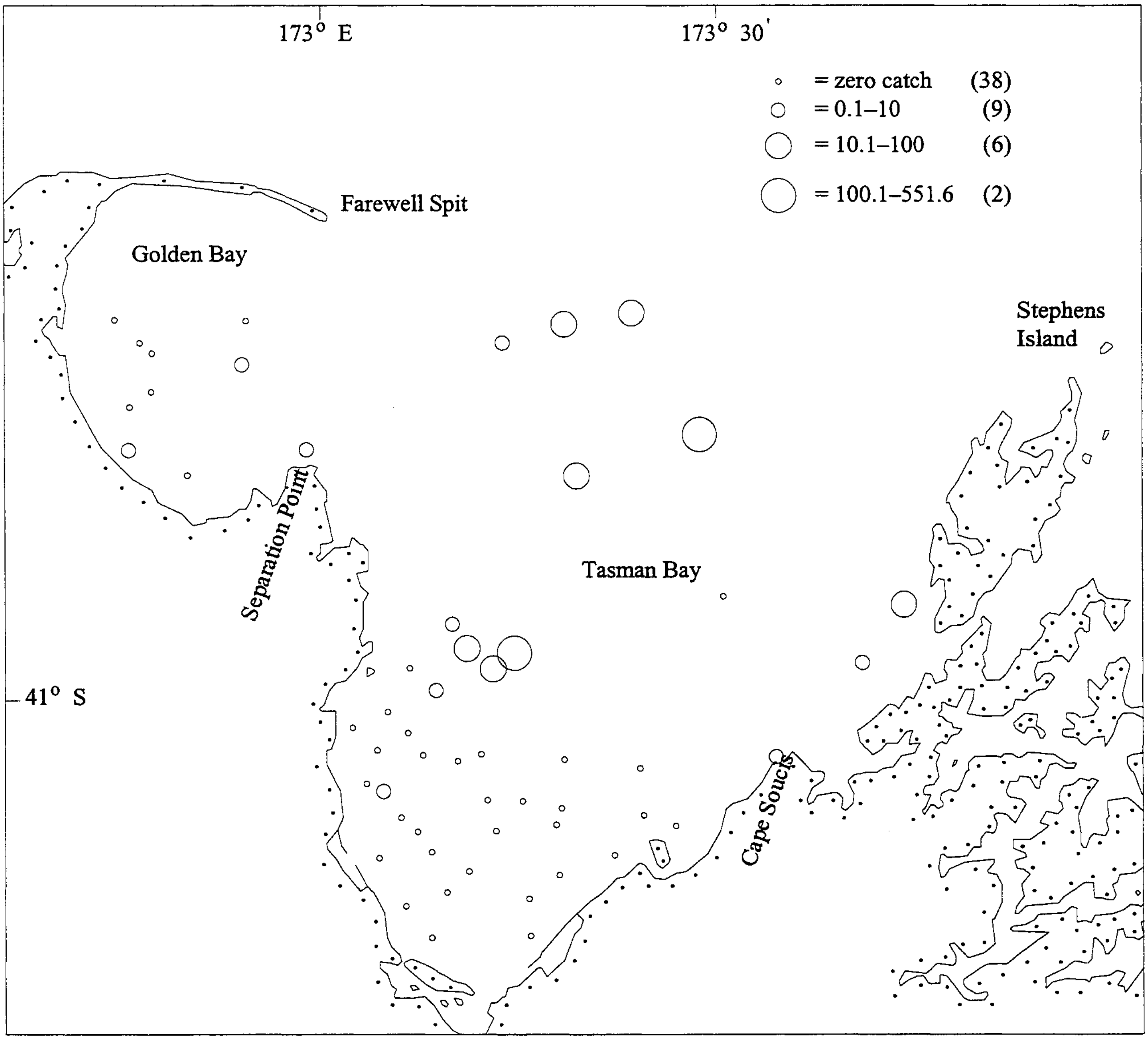

Figure 2—***continued***

Jack mackerel

Trachurus novaezelandiae

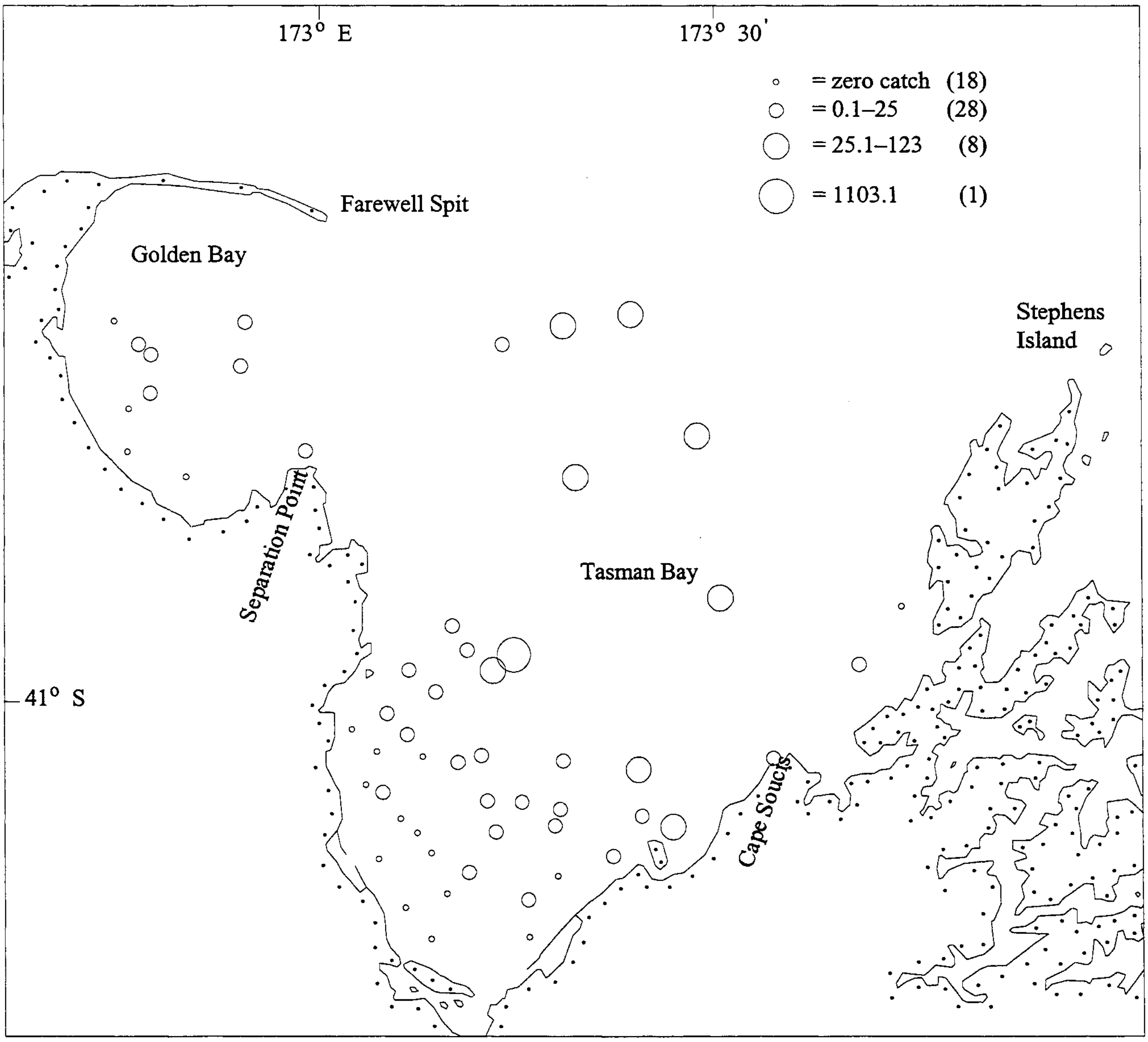

Figure 2—*continued*

Red cod

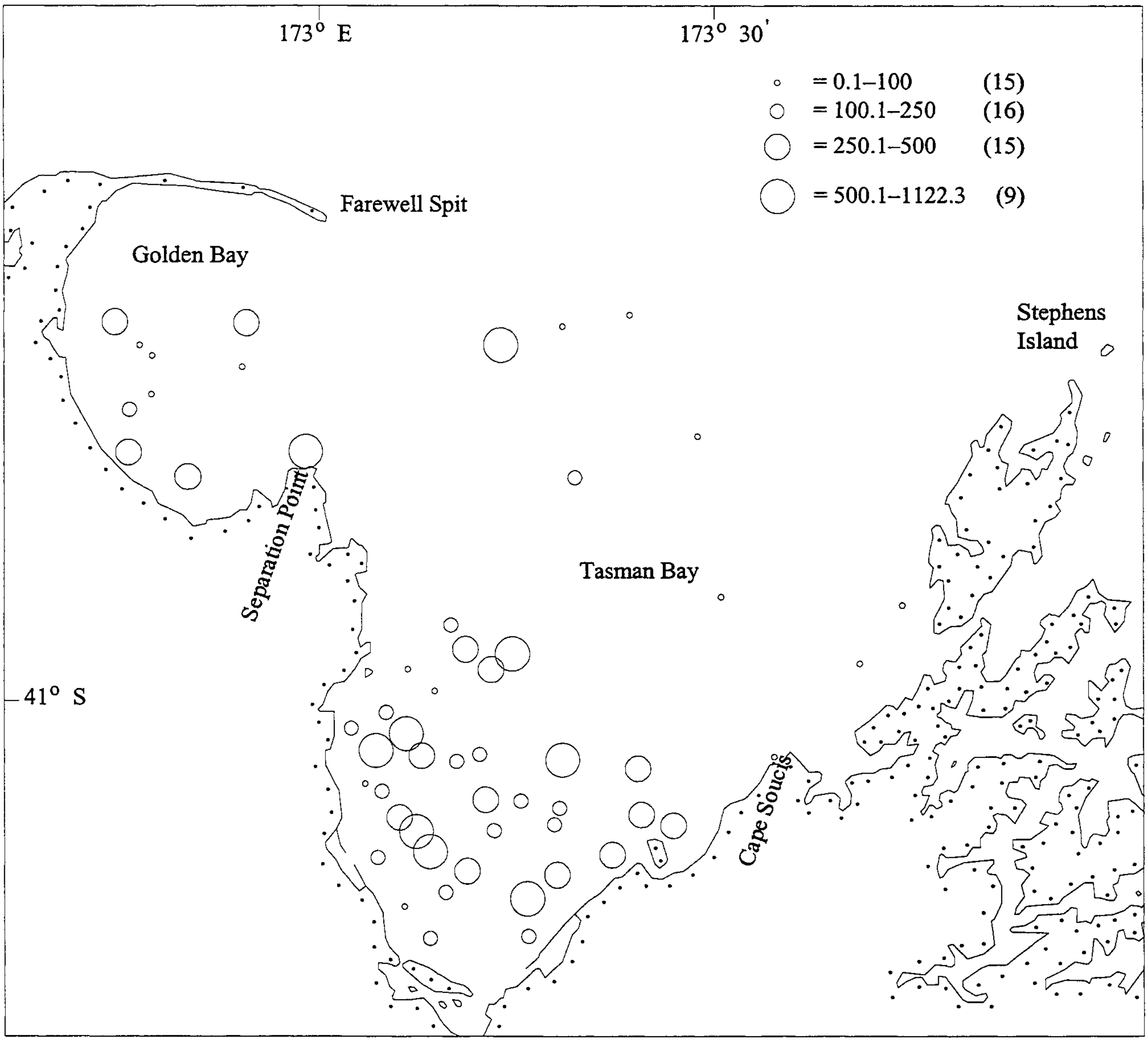

Figure 2—*continued*

Red gurnard

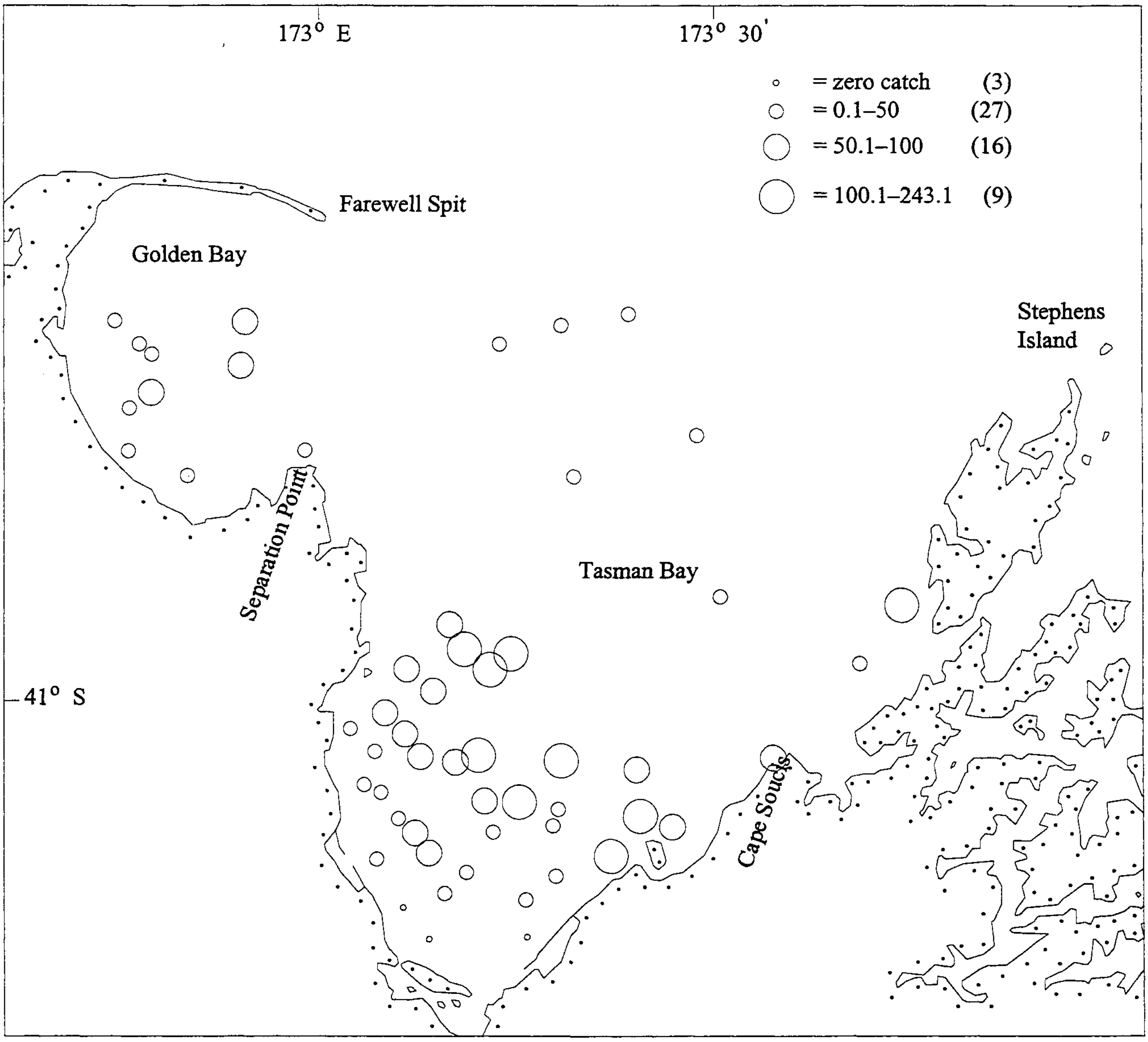

Figure 2—*continued*

Sand flounder

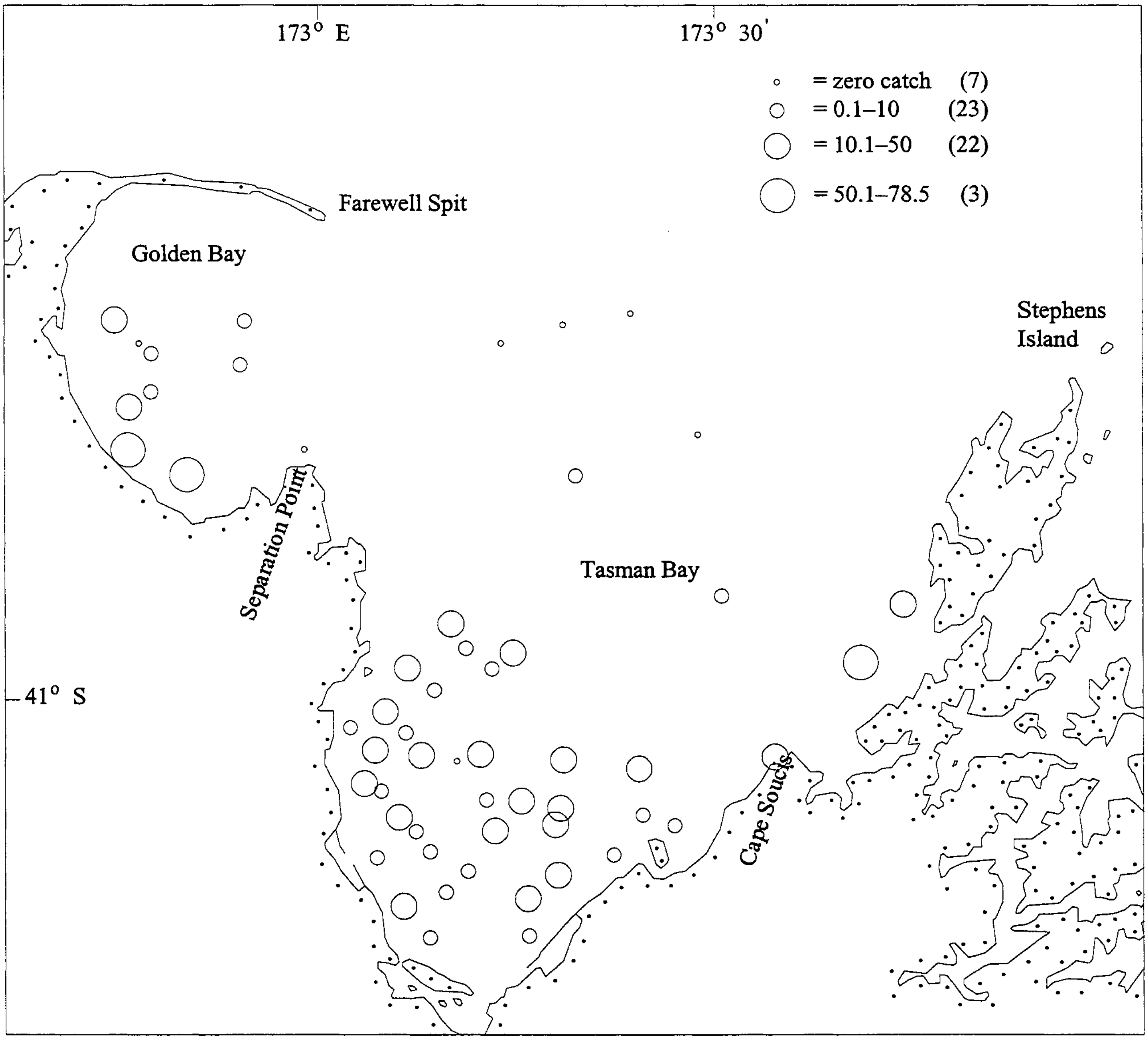

Figure 2—*continued*

Spiny dogfish

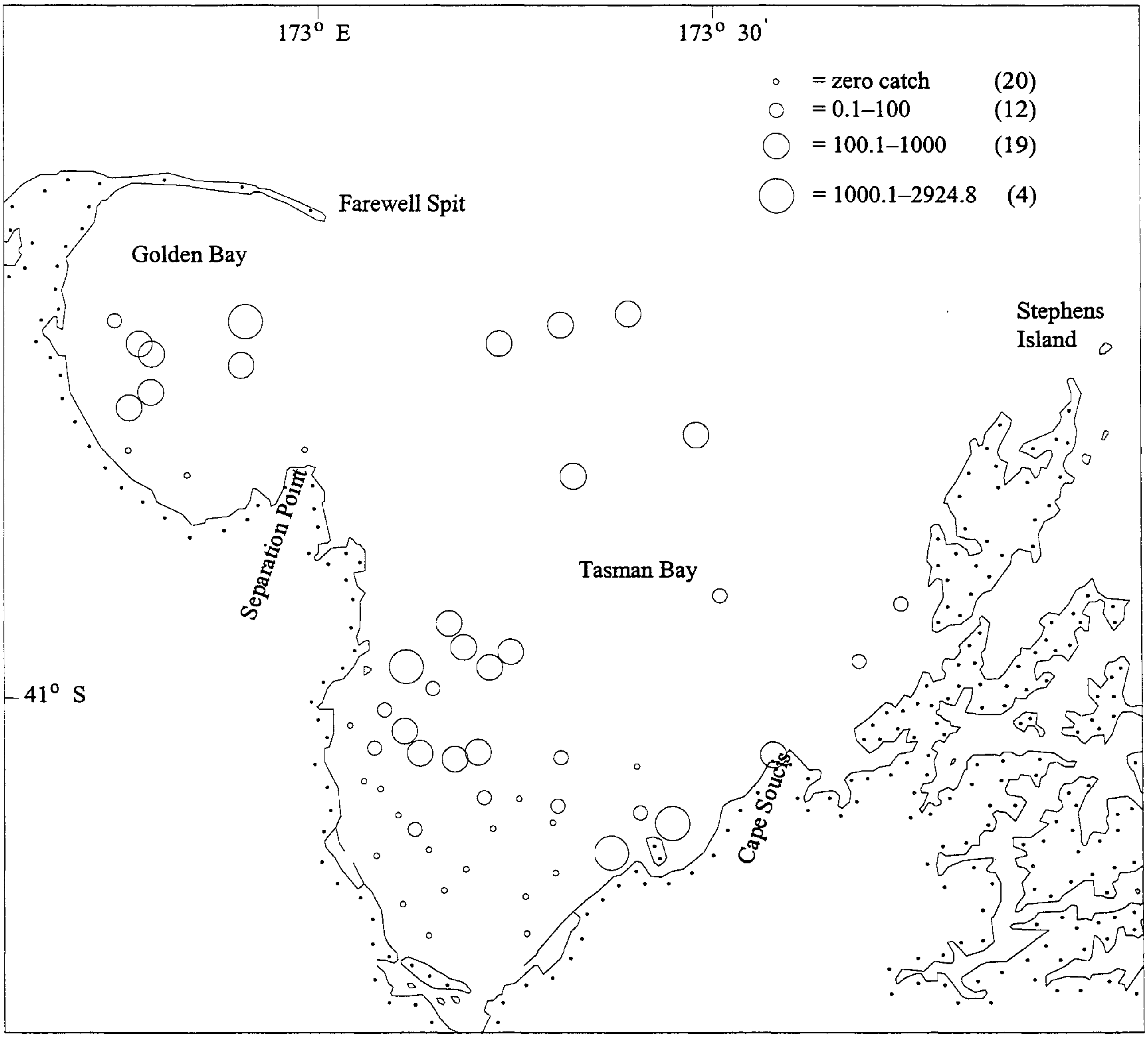

Figure 2—*continued*

Tarakihi

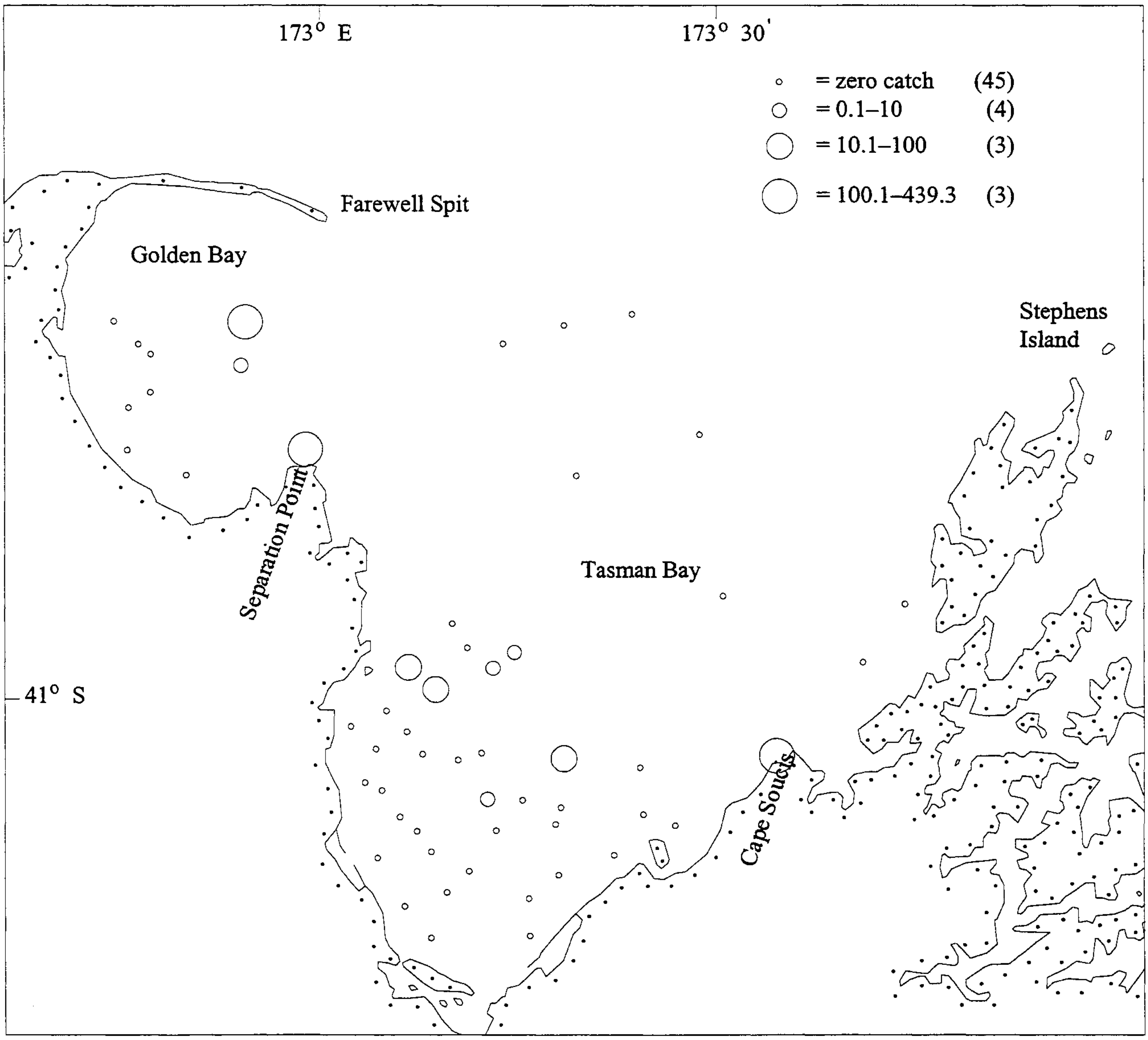

Figure 2—*continued*

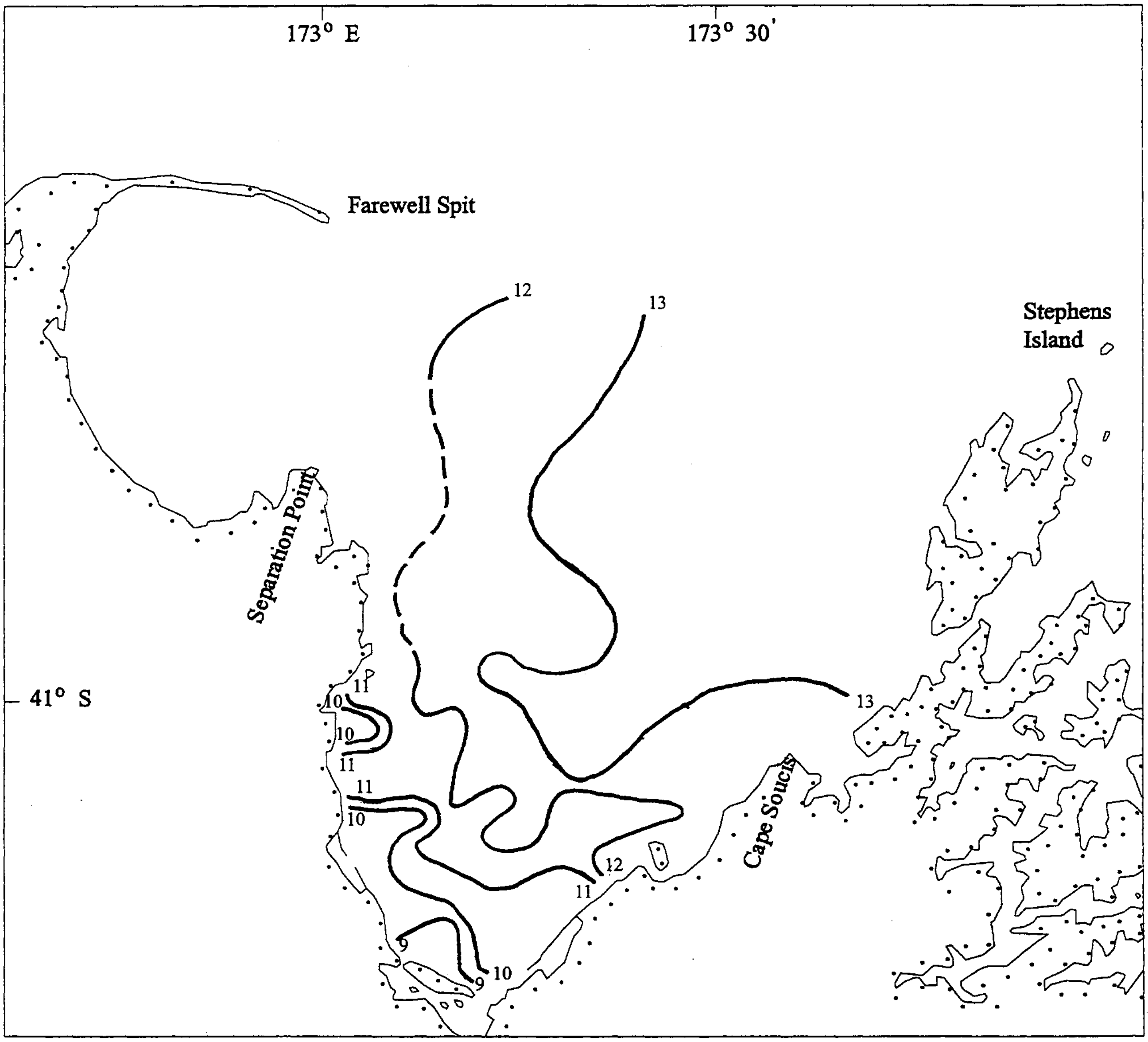

Figure 3a: Sea surface isotherms estimated from station data. Broken line indicates a lack of station data in the immediate area.

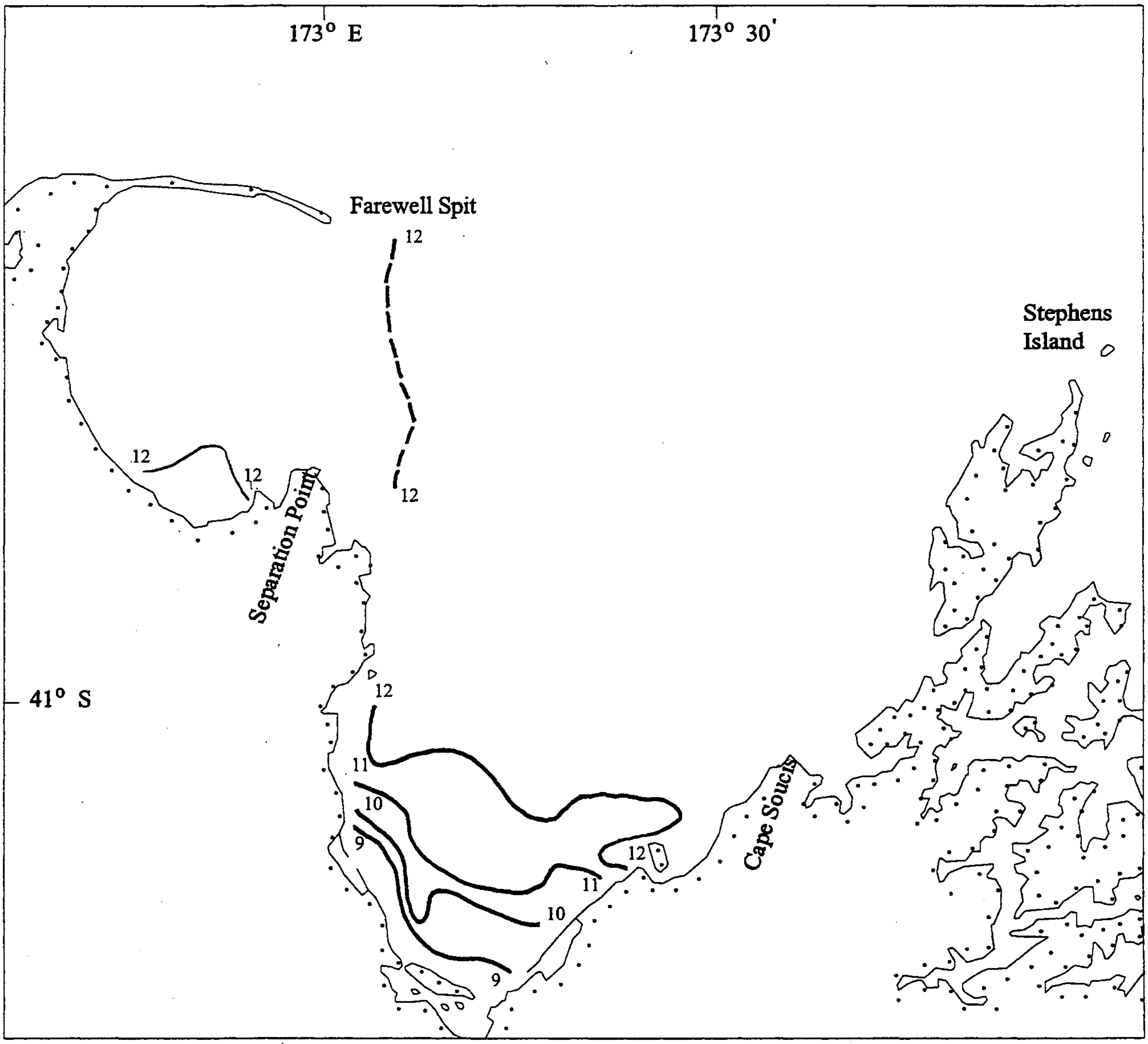

Figure 3b: Bottom isotherms estimated from station data. Broken line indicates a lack of station data in the immediate area

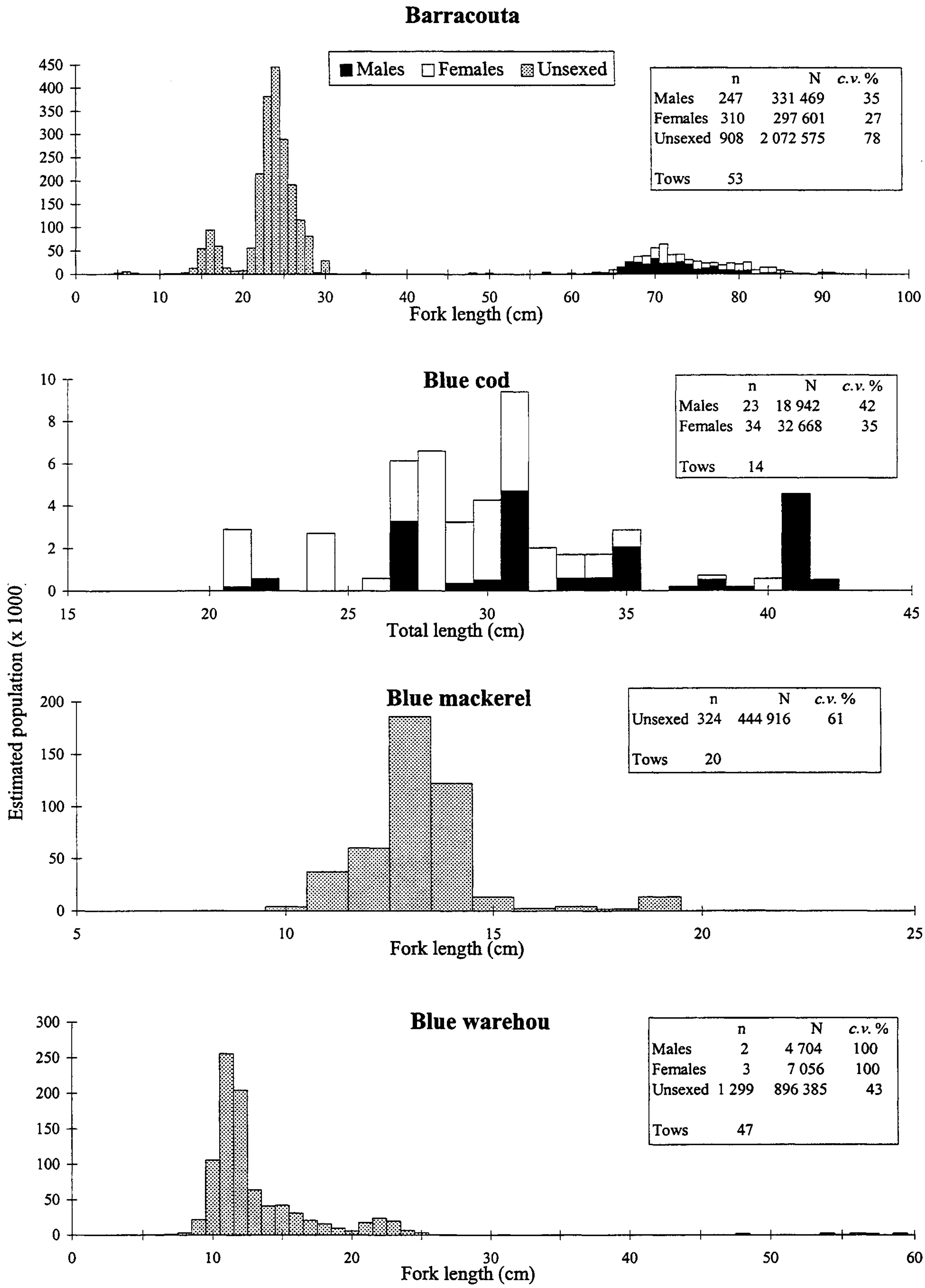

Figure 4: Scaled length frequencies for the 10 most abundant commercial finfish species and other selected ITQ species (n, number of fish measured; N, estimated population; *c.v.*, coefficient of variation; Tows, number of stations where species was caught).

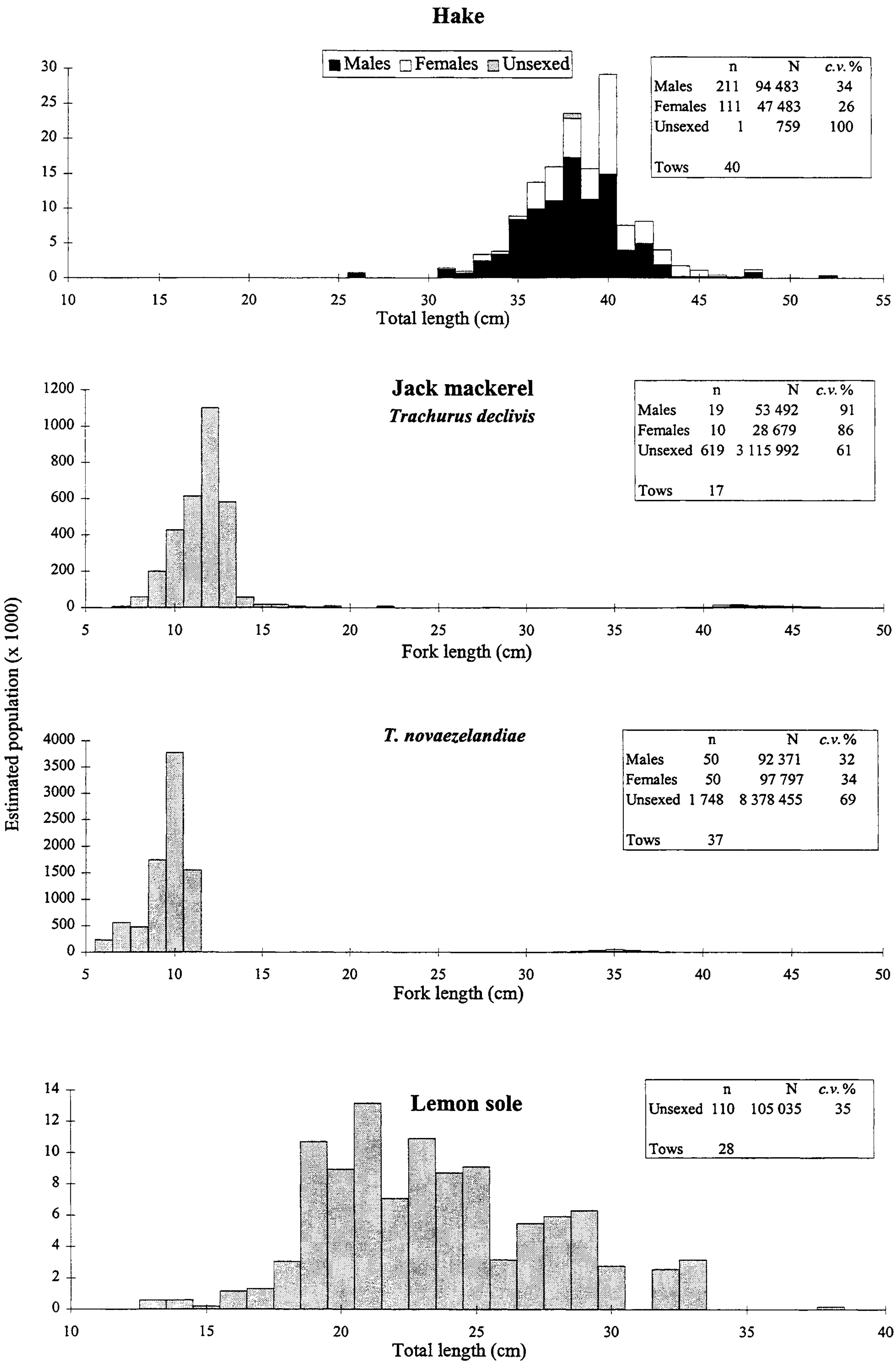

Figure 4—*continued*

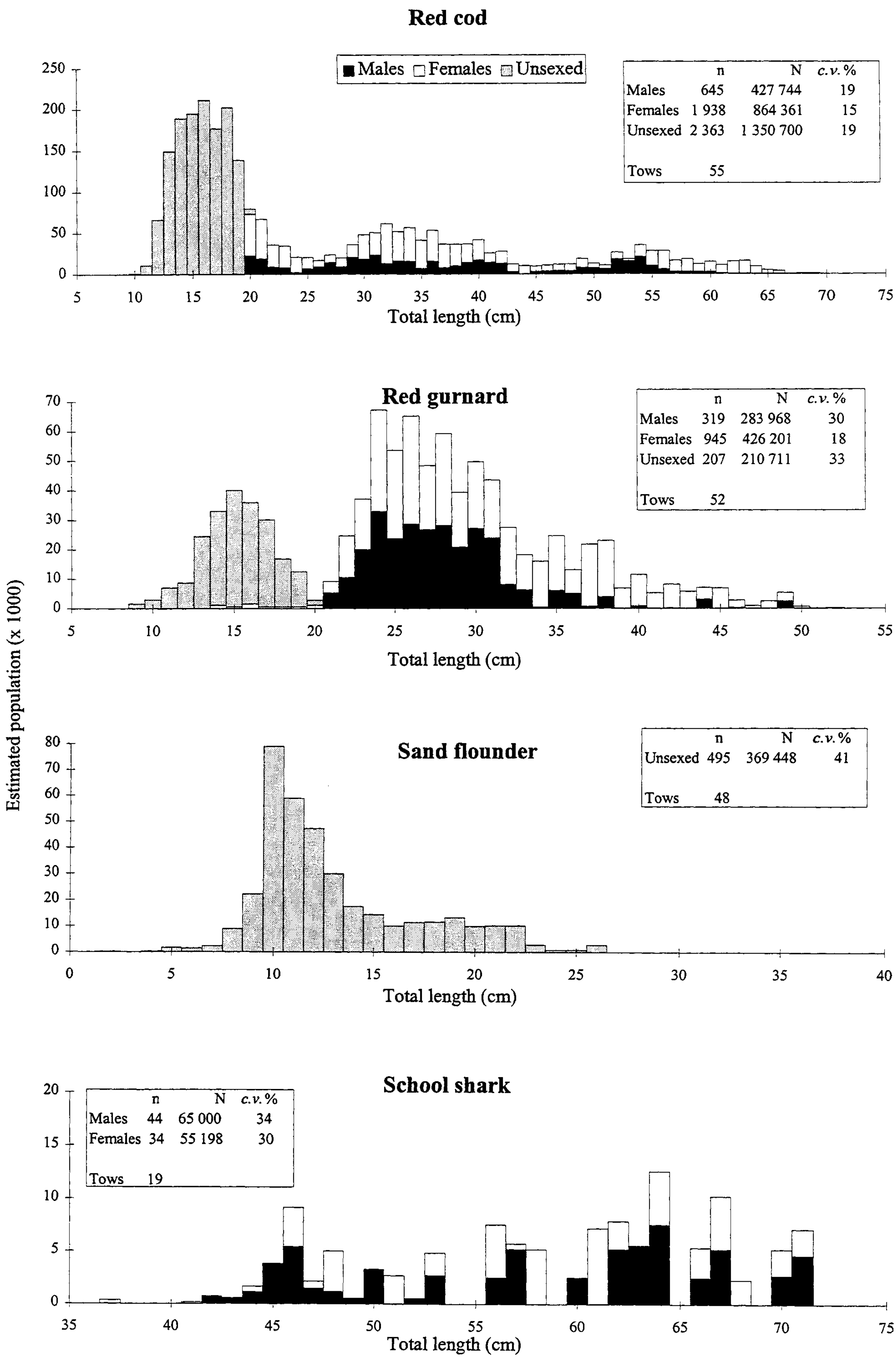

Figure 4—*continued*

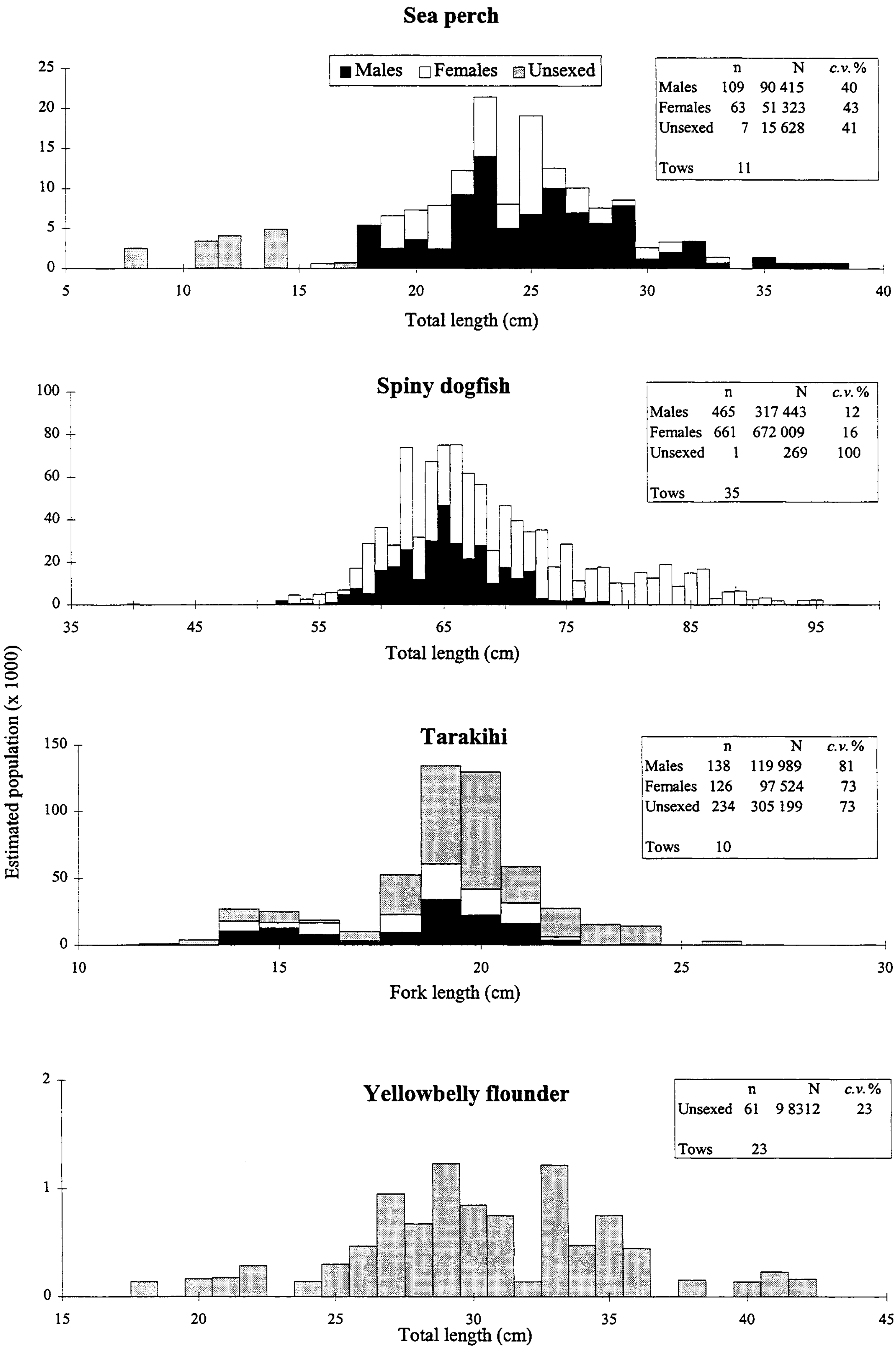

Figure 4—*continued*

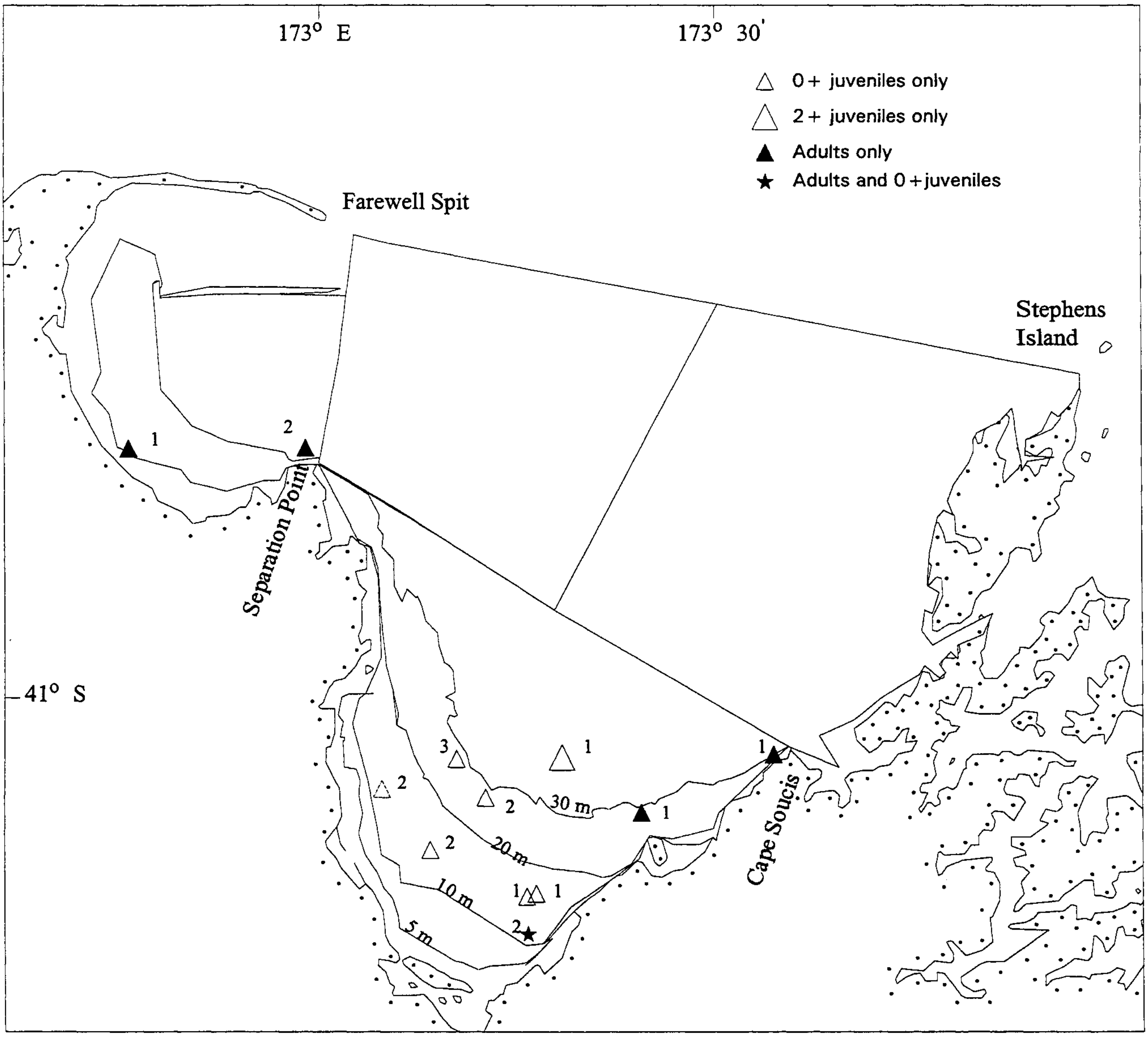

Figure 5: Locations where snapper were caught in relation to stratum boundaries. Numbers indicate the number of snapper caught at that location (includes data from all stations regardless of gear performance).

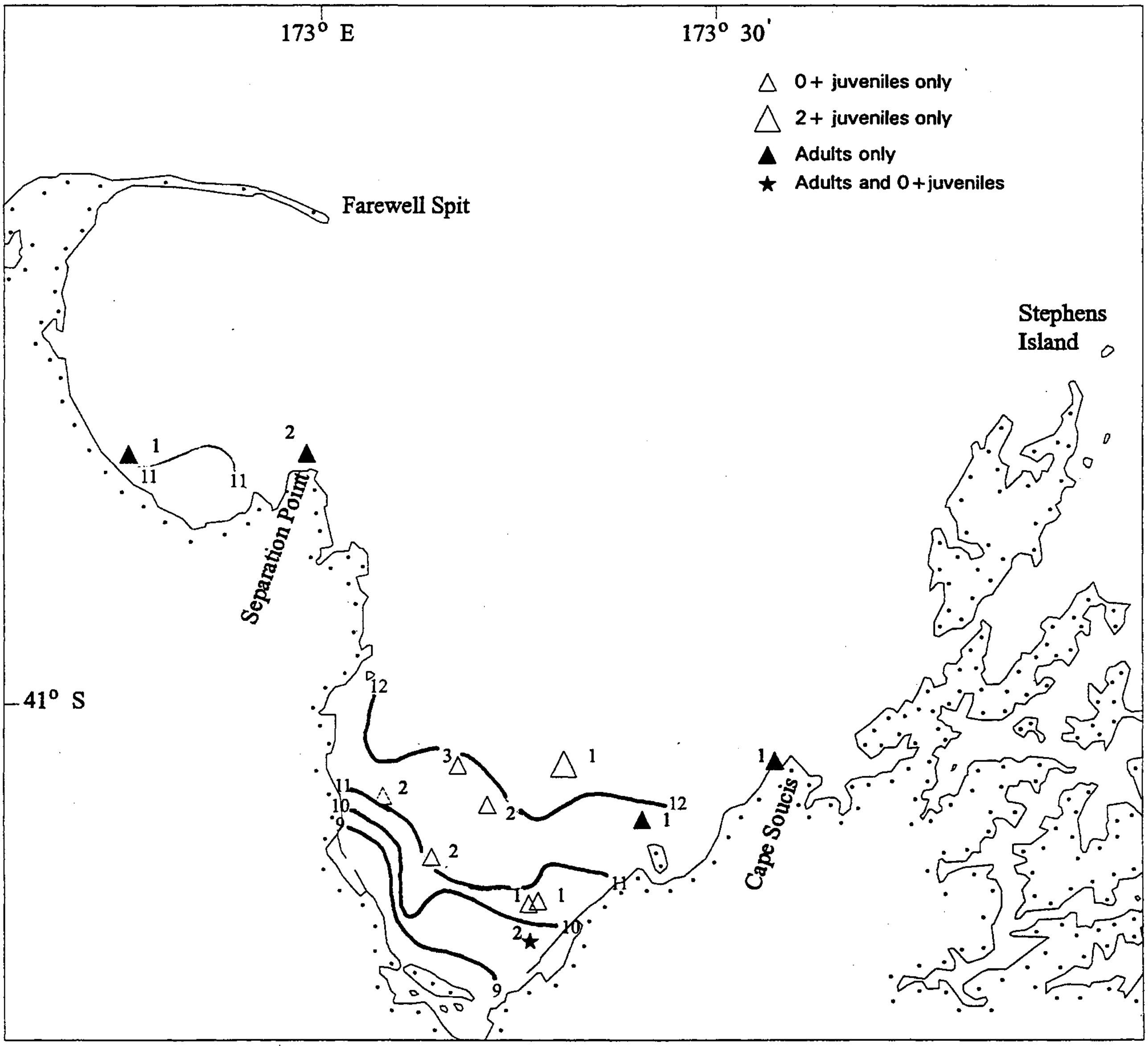

Figure 6: **Locations where snapper were caught in relation to bottom temperature. Numbers indicate the number of snapper caught at that location (includes data from all stations regardless of gear performance).**

Appendix 1: Length-weight coefficients *a* and *b* used to scale length frequencies and calculate biomass above a minimum size*

	a	*b*	Source	*N*	Range (cm)
Barracouta	0.0091	2.88	DB, TAN9301	919	15–96
Blue mackerel	0.0063	3.23	D. Ferrell (Aust. data)	390	15.9–41.9
Blue warehou	0.0191	3.03	DB, TAN9301	281	29–67
Hake	0.0018	3.31	DB, TAN9401	444	39–125
Lemon sole	0.0027	3.47	This survey	107	13–38
Red cod	0.0120	2.93	DB, KAH9504	1 757	8–71
Red gurnard	0.0079	3.22	DB, KAH9504	771	20–56
Sand flounder	0.0125	3.02	DB, IKA8003	–	–
School shark	0.0070	2.91	DB, Seabrook-Davidson (unpub.)	804	65–137
Sea perch	0.0036	3.45	DB, KAH9008, KAH9105, KAH9205,	266	15–40
Southern spiny dogfiish	0.0003	3.62	DB, TAN9301	937	55–102
Tarakihi	0.0159	3.05	DB, KAH9504	1 396	11–54
Trachurus declivis	0.0165	2.93	DB, COR9001	200	15–53
T. novaezelandiae	0.0163	2.92	DB, COR9001	200	15–40
Yellowbelly flounder	0.0092	3.11	Colman, (Hauraki Gulf, pers. comm.)	153	20–45

* Determined from $W = aL^b$, W, weight (g); L, length (cm)
N, sample size.
DB, NIWA (previously MAF Fisheries) trawl database

Appendix 2: Summary of station data

			Start of tow			End of tow		Gear depth (m)				Distance	Surface	Bottom
										Doorspread	Headline	trawled	temp.	temp.
Station	Stratum	Date	Time	° ' S	° ' E	° ' S	° ' E	Min.	Max.	(m)	height (m)	(n. miles)	(°C)	(°C)
1	3	1-Jul-96	1547	41 11.43	173 16.19	41 12.05	173 15.52	13	14	48.6	5.5	0.87	11.0	11.5
2	3	1-Jul-96	1647	41 10.28	173 11.61	41 09.88	173 10.70	12	13	48.6	5.5	0.81	11.0	11.5
3	3	2-Jul-96	739	41 09.07	173 08.10	41 08.57	173 07.26	14	14	48.6	6.7	0.81	11.0	11.5
4	3	2-Jul-96	824	41 07.96	173 07.54	41 07.36	173 08.42	16	18	48.6	6	0.87	11.0	11.8
5	4A	2-Jul-96	916	41 06.35	173 12.34	41 05.78	173 11.42	26	26	48.6	6	0.92	12.0	11.7
6	4A	2-Jul-96	1000	41 03.55	173 10.28	41 02.77	173 09.63	28	28	48.6	6	0.96	12.6	12.1
7	3	2-Jul-96	1046	41 02.10	173 06.33	41 01.14	173 05.56	22	22	78	4.8	1.10	11.7	12.8
8	4A	2-Jul-96	1138	41 03.08	173 04.02	41 03.76	173 03.35	12	15	78	6	0.85	11.5	12.5
9	3	2-Jul-96	1245	41 07.75	173 07.09	41 08.28	173 08.14	15	15	78	5.5	0.95	11.4	12.0
10	3	2-Jul-96	1327	41 08.92	173 08.15	41 09.62	173 09.09	13	14	78	5	0.90	11.1	11.6
11	3	2-Jul-96	1410	41 10.02	173 10.96	41 10.48	173 12.07	13	13	78	5	0.96	11.0	11.6
12	3	2-Jul-96	1501	41 11.60	173 15.48	41 12.13	173 16.45	12	13	78	5	0.92	10.7	10.7
13	4A	2-Jul-96	1556	41 09.09	173 21.93	41 08.53	173 22.89	20	22	78	4.9	0.92	12.7	12.2
14	4A	2-Jul-96	1640	41 07.41	173 26.58	41 07.09	173 27.64	24	24	78	5.2	0.86	12.8	12.3
15	4B	3-Jul-96	746	41 06.40	173 17.93	41 06.27	173 16.75	29	29	78	5.5	0.90	11.5	11.6
16	4B	3-Jul-96	834	41 03.62	173 18.15	41 03.55	173 16.86	36	36	78	5.5	0.94	13.0	12.4
17	4A	3-Jul-96	927	41 05.93	173 12.35	41 06.31	173 11.22	24	26	78	5.2	0.90	11.9	11.5
18	4A	3-Jul-96	1014	41 03.71	173 10.16	41 02.78	173 10.30	27	29	78	5.3	0.92	12.6	11.6
19	4B	3-Jul-96	1103	41 03.31	173 11.89	41 02.47	173 11.44	31	31	78	5.1	0.90	12.4	12.2
20	3	3-Jul-96	1243	41 00.90	173 04.80	40 59.95	173 04.64	19	19	78	5	0.95	11.1	12.9
21	4A	3-Jul-96	1330	40 58.42	173 06.45	40 57.47	173 06.66	25	26	78	4.9	0.97	11.5	12.9
22	4B	3-Jul-96	1425	40 57.28	173 10.85	40 57.55	173 12.06	33	33	78	5.2	0.95	13.2	12.6
23	4B	3-Jul-96	1511	40 58.44	173 12.79	40 59.38	173 13.06	32	33	78	5.3	0.96	13.0	12.6
24	2	4-Jul-96	725	40 45.94	172 58.68	40 45.55	172 57.65	24	24	78	5.5	0.87	11.5	11.3
25	1	4-Jul-96	834	40 47.39	172 49.78	40 46.98	172 48.70	9	10	65	5.3	0.91	11.1	12.5
26	1	4-Jul-96	921	40 45.98	172 45.36	40 45.38	172 44.48	10	10	65	5.7	0.90	10.4	11.1
27	1	4-Jul-96	1020	40 43.53	172 45.44	40 42.65	172 45.09	15	15	78	5.2	0.92	11.6	11.1
28	1	4-Jul-96	1113	40 42.64	172 47.09	40 41.90	172 46.42	19	20	78	6	0.90	11.6	11.2
29	2	4-Jul-96	1152	40 40.46	172 47.12	40 39.59	172 47.03	22	22	78	5.9	0.87	11.8	11.3
30	1	4-Jul-96	1312	40 39.87	172 46.20	40 39.09	172 46.02	18	19	78	5.9	0.70	11.7	11.6
31	1	4-Jul-96	1400	40 38.54	172 44.33	40 39.43	172 44.18	13	13	68	5.9	0.90	11.1	11.6

Appendix 2—*continued*

				Start of tow		End of tow		Gear depth (m)				Distance	Surface	Bottom
										Doorspread	Headline	trawled	temp.	temp.
Station	Stratum	Date	Time	° ' S	° ' E	° ' S	° ' E	Min.	Max.	(m)	height (m)	(n. miles)	(°C)	(°C)
32	2	4-Jul-96	1519	40 41.11	172 53.84	40 40.74	172 52.84	28	28	78	5.8	0.85	11.5	11.3
33	2	4-Jul-96	1608	40 38.61	172 54.15	40 38.16	172 55.36	28	28	78	5.2	1.02	11.8	11.3
34	5	5-Jul-96	759	40 39.87	173 13.53	40 39.76	173 14.73	46	47	78	4.8	0.91	12.7	12.5
35	5	5-Jul-96	849	40 38.81	173 18.19	40 39.00	173 19.35	51	53	78	4.9	0.90	12.9	12.5
36	5	5-Jul-96	943	40 38.17	173 23.34	40 38.48	173 24.42	55	55	78	4.8	0.85	13.0	12.6
37	6	5-Jul-96	1055	40 45.09	173 28.45	40 45.76	173 29.24	52	53	78	4.7	0.90	13.0	12.6
38	5	5-Jul-96	1206	40 47.44	173 19.13	40 47.51	173 17.91	47	48	78	4.7	0.91	13.1	12.6
39	6	5-Jul-96	1343	40 54.32	173 30.20	40 54.80	173 31.23	51	52	78	4.9	0.92	13.3	12.8
40	6	5-Jul-96	1501	40 58.10	173 40.62	40 57.27	173 41.31	42	43	78	5	0.98	13.1	12.6
41	6	5-Jul-96	1550	40 54.80	173 43.79	40 53.82	173 43.56	43	43	78	5	0.99	13.2	12.8
42	4A	6-Jul-96	753	41 03.46	173 34.20	41 04.11	173 33.20	26	27	78	4.8	1.00	12.3	12.7
43	4B	6-Jul-96	857	41 04.13	173 23.90	41 04.18	173 22.71	33	33	78	4.6	0.90	12.9	12.8
44	4A	6-Jul-96	954	41 06.79	173 24.16	41 06.72	173 22.91	27	28	78	4.8	0.93	11.1	11.4
45	4A	6-Jul-96	1044	41 07.35	173 17.54	41 07.21	173 16.34	26	26	78	5	0.91	11.8	11.8
46	4A	6-Jul-96	1122	41 05.99	173 14.98	41 06.24	173 13.84	27	28	78	5	0.90	12.7	12.5
47	4A	6-Jul-96	1231	41 07.70	173 13.01	41 07.62	173 11.75	21	22	78	5	0.95	12.0	11.5
48	4A	6-Jul-96	1327	41 03.37	173 07.49	41 02.55	173 07.02	22	22	78	5	0.90	11.6	11.8
49	4A	6-Jul-96	1422	40 59.67	173 084.9	40 59.02	173 09.39	27	29	78	5	0.92	12.2	12.6
50	4B	6-Jul-96	1514	40 57.55	173 143.7	40 56.77	173 15.10	36	36	78	5.1	0.91	12.5	12.2
51	4B	6-Jul-96	1609	40 55.91	173 097.5	40 55.72	173 08.52	30	33	78	5.1	0.92	12.2	12.2
52	7	7-Jul-96	734	41 01.79	173 02.15	41 02.68	173 02.32	7	7	78	5.5	0.90	9.1	11.3
53	7	7-Jul-96	815	41 05.00	173 03.19	41 05.95	173 03.36	7	7	78	5.5	0.96	11.1	11.3
54	3	7-Jul-96	856	41 05.43	173 04.48	41 06.31	173 04.52	11	11	78	5.5	0.94	11.1	11.4
55	3	7-Jul-96	936	41 06.94	173 05.82	41 07.86	173 05.55	11	12	78	5.5	0.94	9.6	10.9
56	7	7-Jul-96	1018	41 09.25	173 04.15	41 09.99	173 04.82	6	8	65	5.5	0.90	9.6	8.6
57	7	7-Jul-96	1110	41 12.03	173 06.17	41 12.83	173 06.68	6	7	78	5.5	0.90	9.5	10.1
58	7	7-Jul-96	1146	41 13.83	173 08.15	41 14.30	173 09.17	6	6	78	5.5	0.90	8.8	9.2
59	3	7-Jul-96	1245	41 11.23	173 09.33	41 11.60	173 10.45	11	11	78	5.5	0.91	10.9	9.2
60	3	7-Jul-96	1350	41 10.23	173 17.74	41 11.14	173 17.51	18	20	78	5.5	0.92	10.7	10.6
61	3	7-Jul-96	1435	41 13.71	173 15.56	41 13.61	173 14.37	12	12	78	5.5	0.90	10.4	9.6