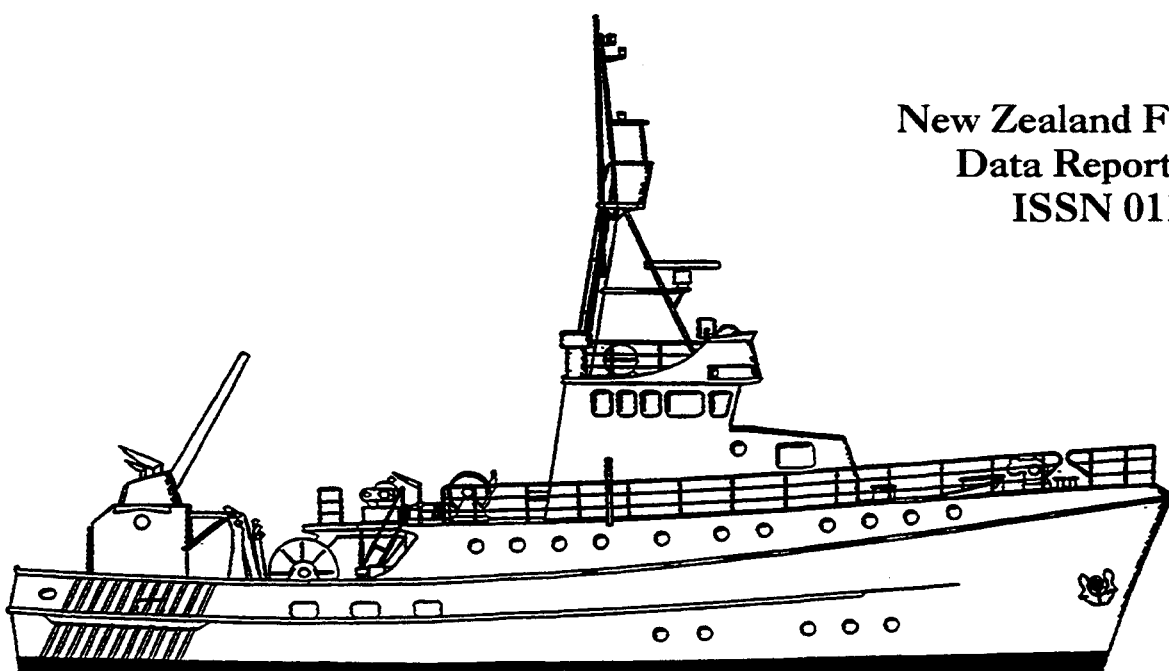




Inshore trawl survey of the  
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March-April 1992  
(KAH9204)

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## Introduction

This report presents results from the first in a time series of stratified random trawl surveys in depths between 20 and 400 m off the west coast of the South Island and within Tasman and Golden Bays. It follows a pilot trawl survey of this area in March–April 1990 (Drummond & Ryan 1992).

The west coast of the South Island and Tasman and Golden Bays fall entirely within the Challenger Fishery Management Area (Challenger FMA), one of seven FMAs declared for New Zealand waters by the Fisheries Act 1986. The survey area supports a number of important inshore fisheries. The aim of the time series is to estimate the relative abundance of the species that are both important to the inshore fishery and are vulnerable to bottom trawling within the survey area. The main species that meet these criteria are giant stargazer (*Kathetostoma giganteum*), red cod (*Pseudophycis bachus*), red gurnard (*Chelidonichthys kumu*), and tarakihi (*Nemadactylus macropterus*). A standardised index of relative abundance estimates for the key species from this time series will help stock assessment and management strategies, particularly for giant stargazer and red gurnard which were introduced into an "adaptive management" programme in 1991 (see Francis & Hurst 1991).

Previous surveys of the west coast of the South Island (Robertson & Grimes 1981, Hurst & Fenaughty 1985, Robertson *et al.* 1989, Horn 1991) are not comparable with the current time series because of vessel, gear, survey area, and seasonal differences. Most of the previous trawl surveys in Tasman Bay and Golden Bay have targeted juvenile snapper (Drummond 1994).

To develop a comparable time series, March–April was chosen as the most relevant time of year as many inshore target fisheries operate then (Drummond & Ryan 1992). This suggests that fish are in higher abundance than at other periods.

This report describes the survey design and methods and provides stock assessment data for commercially important Individual Transferable Quota (ITQ) and non-ITQ species.

## Project objectives

1. To determine the distribution and develop a time series of relative abundance indices for species caught in the inshore waters of the west coast of the South Island and Tasman and Golden Bays.
2. To provide parameter inputs for the stock assessment of the primary species caught by collecting and analysing biological data, i.e., length and age frequency, weight, reproductive condition, and fecundity.

## Survey objectives

1. To obtain relative biomass data for giant stargazer, red cod, red gurnard, tarakihi, and other commercially important species sampled by bottom trawl in the inshore waters of the west coast of the South Island and Tasman and Golden Bays.

2. To collect data on the length, sex, and reproductive condition of giant stargazer, red cod, red gurnard, and tarakihi.
3. To collect otoliths from giant stargazer and red gurnard in support of an adaptive management programme for these species.
4. To collect data on the length and sex of all other Individual Transferable Quota (ITQ) and selected non-ITQ species taken during the survey.
5. To tag lively school shark as part of a national study on the growth and movement of this species.
6. To tag 300 giant stargazer to assess the suitability of tagging as a method for obtaining information on growth, movement, and stock size.

## Project and voyage personnel

The project leader was K. Drummond. The survey was divided into two sections (21 March–12 April, 13–28 April) with a changeover of scientific and vessel staff. A. Muir was the skipper for the first part and A. Aberdein for the second part.

## Methods

### Survey area

The survey area covered depths of 20–400 m off the west coast of the South Island from Farewell Spit to Haast River mouth and within Tasman and Golden Bays. The 1992 survey area totalled 25 600 km<sup>2</sup>, or about 41% of the 62 500 km<sup>2</sup> inside the 400 m depth contour within the Challenger Fishery Management Area (QMA7).

South of Karamea on the west coast of the South Island the minimum depth was increased to 25 m as the 20 m contour was not shown on the bathymetric charts used to determine stratum boundaries. The maximum survey depth of 400 m was determined by the depth range of the primary species and the maximum trawling depth of *Kaharoa*.

### Survey design

The survey used a two-phase stratified random design (*after* Francis 1984). The two-phase methodology was applied separately to the west coast and the Tasman and Golden Bay zones in recognition of the geographic separation of the two areas and the variable weather patterns anticipated on the west coast. The strata used for the 1992 survey followed on from those developed for the 1990 pilot *Kaharoa* survey when the area surveyed was divided into 19 strata.

In 1990, 16 strata had been allocated on the west coast using depth contours of 20 or 25 m, together with 100, 200, 300, and 400 m, separated by lines of latitude corresponding to prominent geographical features, i.e., Cape Farewell (northern boundary), Karamea, Cape Foulwind, Paroa (Greymouth), Kohuamarua Bluff (Okarito), and Awarua Point (southern boundary). On the basis of the results from the 1990 survey these boundaries were modified by dropping areas that

historically had provided low survey catch rates (*see Fenaughty et al.* 1983, Drummond & Ryan 1992), amalgamating strata that had a high proportion of non-trawlable ground, and moving the southern boundary north to Haast River mouth. This reduced the number of strata on the west coast to 13. Strata for Tasman and Golden Bays were defined by the 20 m depth contour and by lines that ran from directly south of Farewell Spit to Separation Point, Separation Point to Cape Soucis, and south of Farewell Spit to Stephens Island. The stratum boundaries are shown in Figure 1.

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 5.6 km (3 n. miles) apart, and each tow was 1 h long. Non-trawlable ground was identified before the voyage, and the results of the 1990 survey were used to further refine areas that were unsuitable for trawling on the west coast of the South Island. The distribution of the non-trawlable ground is given in Table 1.

For the two-phase methodology, giant stargazer, red cod, red gurnard, and tarakihi were designated as the target species. In total, 80 stations were assigned to phase 1, with a minimum of three stations per stratum. The balance of phase 1 stations was allocated to minimise the variance of the expected catch rates of the four target species, where the expected catch rates were assumed to be the combined catch rates obtained during the 1990 survey. Phase 2 stations were aimed at improving the precision of biomass estimates for the target species and were allocated after phase 1 had been 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 trawling to depths of 500 m. The two-panel trawl net used during the survey was designed and constructed in 1991 specifically for South Island inshore trawl surveys. The net is based on an 'Alfredo' design, and is similar to the net used during the 1980s for GRV *W. J. Scott* South Island surveys. The net was fitted with a 74 mm (inside measurement) knotless codend: net details are given in Appendix 1.

Doorspread was estimated from net trials conducted in 10–200 m of water during 1991–94 using the method of Koyama (1974). Estimates of doorspread ranged from 63 to 92 m, with an overall mean of about 79 m. Headline height was recorded from a netsonde for each tow during the survey and varied between 4 and 5 m.

## Trawling procedure

All tows were undertaken in daylight, and three to five tows a day were planned. 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 the combination of weather conditions and bottom contours, and secondly by the location of the next tow (to minimise steaming between stations).

If the station was in an area of foul or the depth was out of the stratum range, an area within 5 km of the station was searched and the station occupied if possible. If the search for clear

ground was unsuccessful, the station was abandoned and the next station on the list was chosen. Standard tows were trawled at a speed over the ground of 3 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 250 m of warp was used during towing. In depths below 60 m a reducing warp to depth ratio was employed, starting at 4 : 1 and dropping to 3 : 1 for depths below 150 m.

## **Surface temperature**

The surface temperature at each station was recorded from a hull-mounted sensor. The calibration of the sensor was uncertain, so surface temperatures are only relative. Bottom temperatures were not recorded as the sensor on the net monitor was not functioning.

## **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. The weight of tagged school shark was estimated from the length weight coefficients given in Appendix 2.

Length, to the nearest whole centimetre below the actual length, and sex were recorded for all ITQ species, either for the whole catch or for a randomly selected subsample of up to 200 fish per tow. Biological data were collected from a sample of up to 20 fish per tow for giant stargazer, red cod, red gurnard, and tarakihi, and consisted of individual fish length, otoliths for ageing (giant stargazer and red gurnard), and gonad stages. 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 and milt free flowing); 5, spent. Individual fish weights were not recorded because of malfunctioning of the small scales.

Lively school shark were measured, sexed, and tagged using a single dart tag, and released within minutes of being removed from the codend. For each tagged school shark a release factor was assigned on a scale of 1–3, with 1 corresponding to the fish swimming away slowly, 2 freely, and 3 vigorously. A handling factor on the same 1–3 scale was also recorded to assess the liveliness of individual sharks before release. A sample of giant stargazer was also tagged, but no handling or release factors were assigned.

## **Data analysis**

Relative biomass was estimated by the area-swept method described by Francis (1981, 1989) using the Trawlsurvey Analysis Program (Vignaux 1994).

The following assumptions were made.

1. The area swept during each tow equalled the distance between the doors multiplied by the distance towed (doorspread was estimated at 79 m from gear trials and distance towed was usually 3 n. miles).

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 were distributed evenly over both trawlable and non-trawlable ground.

Although these assumptions are unlikely to be correct, their adoption provides the basis for a time series of relative biomass estimates.

A combined biomass and length frequency analysis was used for species for which biomass above and below a specific size was required, and for deriving the weighted length frequency distributions. The length weight coefficients used are given in Appendix 2. All length frequencies were scaled by the percentage of catch sampled, area swept (function of doorspread and distance towed), and stratum area using the Trawlsurvey Analysis Program.

## **Results**

### **Trawl stations**

Seventy-nine phase 1 stations and 34 phase 2 stations were successfully completed (Figure 1, Table 1, Appendix 3).

All stations where the gear performance code was 1 or 2 were used for biomass estimation. This excluded stations 22, 71, 75, 83, and 115.

Of the 80 planned phase 1 stations, the gear malfunctioned during 3 and 1 in stratum 12 was occupied during phase 2 instead. Three stations were added to phase 1 in areas of relatively high catch rates of the target species to make best use of the available time. During phase 2, two stations were assigned an unsatisfactory gear performance code. At least three stations were completed in all 16 strata.

### **Catch composition**

A total of 68.4 t was caught during the 118 tows at an average of 579 kg per tow (range 0–5541 kg). Among the catch, 1 agnathan, 22 elasmobranchs, and 70 teleosts were identified, together with 3 cephalopods and 3 crustaceans (other than crabs). Other bivalves and crabs were caught, but not always identified. Red cod and southern spiny dogfish made up 27% of the catch by weight (Table 2, Appendix 4). Giant stargazer, red cod, red gurnard, and tarakihi made up 6.9, 15.7, 2.6, and 6.1% of the catch, respectively. Southern spiny dogfish, barracouta, arrow squid, and witch flounder were all caught in over 80% of the tows.

## Catch rates and species distribution

Catch rates are given in terms of  $\text{kg.km}^{-2}$ , so a catch rate of  $1000 \text{ kg.km}^{-2}$  equates to a catch of 440 kg in a standard 1 h tow (as it covers  $0.44 \text{ km}^2$  on average). Distribution and catch rates for all species combined, the 12 most abundant ITQ species in the catch, and the most abundant non-ITQ species (southern spiny dogfish) are shown in Figure 2. The catch rates for the 20 most abundant species are given in Table 3.

## Biomass estimation

Relative biomass estimates for the 20 most abundant species are given in Table 4. For a species subject to a regulatory or processing size limit, estimates above a given size are provided. The relative biomass estimates for the four target species are broken down by stratum in Table 5.

## Surface temperatures

Surface water temperature isotherms estimated from station data are shown in Figure 3 and included in Appendix 2.

## Tagging

One hundred and ninety-six school shark (112 males and 84 females) were tagged and released. The total length of tagged school shark ranged from 61 to 152 cm. A total of 333 giant stargazer ranging from 18 to 77 cm total length were also tagged and released.

## Length frequency and biological data

The numbers of length frequency and biological samples taken during the survey are given in Table 6. The scaled length frequency distributions for the 12 most abundant ITQ species, blue cod, blue warehou, and jack mackerel, are given in Figure 4.

## Target species

**Giant stargazer.** Virtually all (99%) of the estimated relative biomass of 1543 t (*c.v.* = 12%) was south of Cape Foulwind, and 50% was within the 100–200 m depth range (*see* Table 5). The sex ratios were 0.42 : 1 inside 100 m, 0.85 : 1 in 100–200 m, and 1.67 : 1 in 200–400 m (*see* Figure 4). Virtually all female stargazer below 40 cm were immature or had resting gonads. Above this size most had maturing gonads (*see* Table 7).

**Red cod.** Of the total estimated relative biomass of 3091 t (*c.v.* = 13%), 1972 t (*c.v.* = 15%) was recruited biomass ( $\geq 38$  cm) (*see* Table 4). Most (89%) of the biomass was inside the 200 m contour on the west coast. The length frequency data show that the 1+ cohort was the dominant age class at the time of the survey. The sex ratio in Tasman and Golden Bays favoured females (0.48 : 1): on the west coast it favoured males at depths over 100 m (0.73 : 1 inside 100 m, 1.98 : 1 in 100–200 m and 6.81 : 1 in 200–400 m) (*see* Figure 4). Female red cod sampled from Tasman and Golden Bays were immature or resting, as were most of the females sampled on the west coast. In the latter area some fish over 20 cm showed maturing stages of gonad development, with about half of the females above 50 cm mature (*see* Table 7).

**Red gurnard.** The estimated relative biomass of 605 t (*c.v.* = 16%) was fairly evenly divided between Tasman and Golden Bays (44%) and the west coast (56%) and was virtually all inside 100 m (*see* Table 5). The recruited relative biomass estimate ( $\geq 30$  cm) was 487 t (*c.v.* = 15%). In Tasman and Golden Bays the size distribution of the catch consisted of mainly prerecruits and the sex ratio was 0.73 : 1. On the west coast most red gurnard were recruited fish and the sex ratio was 1.79 : 1 (*see* Figure 4). Most female red gurnard gonads were either resting or developing. A few large red gurnard had spent gonads (*see* Table 7).

**Tarakihi.** The estimated relative biomass of tarakihi (all sizes) was 1673 t (*c.v.* = 13%), with 91% (*c.v.* = 13%) recruited ( $\geq 25$  cm) (*see* Table 4). The length frequency data for Tasman and Golden Bays consisted almost entirely of two cohorts, ages 1–2 years. These year classes were also present on the west coast, but most (98%) of the biomass in this area was of recruited fish. In total, 93% of the tarakihi biomass was on the west coast, and most of this (63%) was in 100–200 m depth. The sex ratios in this area were 0.49 : 1 inside 100 m, 0.73 : 1 in 100–200 m and 1.91 : 1 in 200–400 m (*see* Figure 4). There was little reproductive development in tarakihi below 30 cm, but above this size a full range of gonad stages was recorded (*see* Table 7), including both running ripe and spent fish south of Greymouth.

## Discussion

The refined survey strata enabled the minimum of three survey stations to be completed within each stratum. The allocation of second phase stations by subarea reduced the steaming time that would have otherwise been required allowing an increase in the number of stations occupied.

The recorded catch of 68 t represented more than a threefold increase on the 1990 catch. The main reason for this is probably the use of a more suitable and effective net. This net will be used for inshore trawl surveys around the South Island, and based on the results of this survey it appears to be well suited to both the bottom conditions and the target species.

The *c.v.s* of the relative biomass estimates of the target species (giant stargazer, red cod, red gurnard, and tarakihi) were all below 20%, suggesting that the survey design provides satisfactory indices of abundance for each of these species. A few other inshore commercial species that were vulnerable to the towed gear (arrow squid, barracouta, rig, and southern spiny dogfish) also had low *c.v.s* of the relative biomass estimates.

The results suggest that there may be some potential for using the time series of trawl surveys to monitor the recruitment patterns of barracouta, blue warehou, hake, hoki, red cod,

silver warehou, and tarakihi, though most of the *c.v.s* for each pre-recruit modal group were high in 1992. Future surveys will help to clarify this possibility.

Trials on other vessels have shown that indirect measurements of doorspread underestimate the true value by 15–30% (Hurst & Bagley 1992). The results from this survey will be corrected when direct measurements are available.

The information collected on the location of non-trawlable ground will be incorporated into the design for future surveys in order to further reduce the time spent checking bottom conditions.

## **Acknowledgments**

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**Table 1: Stratum depth ranges, survey area, non-trawlable area, number of successful phase 1 and phase 2 stations, and station density**

Stratum	Depth (m)	Area (km <sup>2</sup> )	Non-trawlable area (km <sup>2</sup> )	Number of stations		Station density ( no. per km <sup>2</sup> )
				Phase 1	Phase 2	
<b>West coast</b>						
1	20–100	1 345	98	3	5	1:168
2	100–200	4 302	303	4	0	1:1 075
5	25–100	1 224	0	3	0	1:408
6	100–200	3 233	238	3	0	1:1 078
7	25–100	927	0	3	7	1:93
8	100–200	2 354	214	8	0	1:294
9	200–400	1 877	1 456	8	0	1:235
11	25–100	1 438	63	5	11	1:90
12	100–200	1 948	338	8	6	1:139
13	200–400	1 206	693	7	1	1:151
14	25–100	851	35	5	0	1:170
15	100–200	905	215	7	1	1:113
16	200–400	295	13	3	0	1:98
<b>Tasman and Golden Bays</b>						
17	20–33	307	27	3	0	1:102
18	20–42	949	9	3	1	1:237
19	20–70	2 431	125	6	2	1:304
<b>Total (average)</b>		<b>25 592</b>	<b>3 827</b>	<b>79</b>	<b>34</b>	<b>1:226</b>

**Table 2: Species caught, total weight, and number of stations out of 113 at which species occurred**

Common name	Scientific name	Code	Catch (kg)	% of total catch	Occurrence
Red cod	<i>Pseudophycis bachus</i>	RCO	10 735.7	16	93
Southern spiny dogfish	<i>Squalus acanthias</i>	SPD	7 919.8	12	96
Barracouta	<i>Thyrstites atun</i>	BAR	6 515.8	10	101
Common roughy	<i>Paratrachichthys trailli</i>	RHY	5 392.3	8	5
Arrow squid	<i>Nototodarus sloanii</i>	SQU	4 766.8	7	111
Giant stargazer	<i>Kathetostoma giganteum</i>	STA	4 696.8	7	75
Tarakihi	<i>Nemadactylus macropterus</i>	TAR	4 197.4	6	92
Rattails	Macrouridae	RAT	3 144.5	5	66
Red gurnard	<i>Chelidonichthys kumu</i>	GUR	1 758.7	3	57
School shark	<i>Galeorhinus galeus</i>	SCH	1 737.2	3	84
Hake	<i>Merluccius australis</i>	HAK	1 626.4	2	58
Hoki	<i>Macruronus novaezelandiae</i>	HOK	1 561.4	2	64
Carpet shark	<i>Cephaloscyllium isabella</i>	CAR	1 503.5	2	93
Ling	<i>Genypterus blacodes</i>	LIN	1 241.9	2	54
Smooth skate	<i>Raja innominata</i>	SSK	1 144.6	2	63
Rig	<i>Mustelus lenticulatus</i>	SPO	827.6	1	80
Sea perch	<i>Helicolenus</i> spp.	SPE	784.8	1	59
Witch	<i>Arnoglossus scapha</i>	WIT	746.5	1	101
Silver dory	<i>Cyttus novaezelandiae</i>	SDO	682.1	1	18
Silver warehou	<i>Seriolella punctata</i>	SWA	602.9	<1	86
Common warehou	<i>S. brama</i>	WAR	538.0	<1	37
Horse mackerel	<i>Trachurus novaezelandiae</i>	JMN	502.8	<1	21
Dark ghost shark	<i>Hydrolagus novaezelandiae</i>	GSH	486.2	<1	30
Rough skate	<i>Raja nasuta</i>	RSK	479.2	<1	47
Gemfish	<i>Rexea solandri</i>	SKI	476.9	<1	28
Leatherjacket	<i>Parika scaber</i>	LEA	355.7	<1	16
Murphy's mackerel	<i>Trachurus murphyi</i>	JMM	307.7	<1	32
Scaly gurnard	<i>Lepidotrigla brachyoptera</i>	SCG	302.4	<1	83
Lemon sole	<i>Pelotretis flavilatus</i>	LSO	296.8	<1	67
Northern spiny dogfish	<i>Squalus blainvillei</i>	NSD	270.9	<1	25
Jack mackerel	<i>Trachurus declivis</i>	JMD	242.7	<1	41
N.Z. sole, common sole	<i>Peltorhamphus novaezelandiae</i>	ESO	237.3	<1	31
Sand flounder	<i>Rhombosolea plebeia</i>	SFL	228.4	<1	20
Electric ray	<i>Torpedo fairchildi</i>	ERA	185.6	<1	17
Snapper	<i>Pagrus auratus</i>	SNA	180.9	<1	12
Conger eel	<i>Conger</i> spp.	CON	154.6	<1	13
Shovelnosed spiny dogfish	<i>Deania calcea</i>	SND	152.7	<1	5
Ruby fish	<i>Plagiogeneion rubiginosus</i>	RBY	130.9	<1	1
John dory	<i>Zeus faber</i>	JDO	120.2	<1	22
Blue cod	<i>Parapercis colias</i>	BCO	117.6	<1	11
Thresher shark	<i>Alopias vulpinus</i>	THR	106.6	<1	3
Elephantfish	<i>Callorhynchus milii</i>	ELE	105.5	<1	11
Slender smooth hound	<i>Gollum attenuatus</i>	SSH	99.5	<1	4
Orange perch	<i>Lepidoperca</i> spp.	OPE	91.8	<1	3
Frostfish	<i>Lepidopus caudatus</i>	FRO	70.2	<1	19
Eagle ray	<i>Myliobatis tenuicaudatus</i>	EGR	66.9	<1	5
Stingray	<i>Dasyatis</i> spp.	STR	56.0	<1	2
Spotty	<i>Notolabrus celidotus</i>	STY	52.8	<1	6
Alfonsino	<i>Beryx splendens</i>	BYS	51.1	<1	2
Cucumber fish	<i>Clorophthalmus nigripinnis</i>	CUC	46.2	<1	23
Broadsnouted sevengill shark	<i>Notorynchus cepedianus</i>	SEV	39.5	<1	1
Hapuku	<i>Polyprion oxygeneios</i>	HAP	40.8	<1	8
Red mullet	<i>Upeneichthys lineatus</i>	RMU	37.2	<1	3

Table 2—continued

Common name	Scientific name	Code	Catch (kg)	% of total catch	Occurrence
Capro dory	<i>Capromimus abbreviatus</i>	CDO	30.1	< 1	23
Turbot	<i>Colistium nudipinnis</i>	TUR	23.0	< 1	7
Longtailed skate	<i>Arhynchobaris asperrimus</i>	LSK	18.8	< 1	7
Scallop	<i>Pecten novaezelandiae</i>	SCA	15.9	< 1	1
Sharpsnouted sevengill shark	<i>Heptranchias perlo</i>	HEP	14.5	< 1	1
Kahawai	<i>Arripis trutta</i>	KAH	12.9	< 1	5
Brill	<i>Colistium guntheri</i>	BRI	12.8	< 1	10
Javelinfinch	<i>Lepidorhynchus denticulatus</i>	JAV	10.0	< 1	11
Trevally	<i>Pseudocaranx dentex</i>	TRE	9.8	< 1	2
Oblique banded rattail	<i>Caelprinchus aspercephalus</i>	CAS	9.6	< 1	2
Lookdown dory	<i>Cyttus traversi</i>	LDO	9.1	< 1	2
Deepsea flathead	<i>Hoplichthys haswelli</i>	FHD	8.4	< 1	4
White warehou	<i>Seriolella caerulea</i>	WWA	7.7	< 1	10
Silverside	<i>Argentina elongata</i>	SSI	6.1	< 1	39
Skate	<i>Rajiformes</i>	SKA	5.6	< 1	2
Yellowbelly flounder	<i>Rhombosolea leporina</i>	YBF	5.5	< 1	2
Pigfish	<i>Congiopodus leucopaecilus</i>	PIG	4.9	< 1	7
Octopus	<i>Octopus maorum</i>	OCT	4.8	< 1	4
Sixgill shark	<i>Hexanchus griseus</i>	HEX	4.3	< 1	1
Hairy conger	<i>Bassanago hirsutus</i>	HCO	4.2	< 1	1
Hagfish	<i>Eptatretus cirrhatus</i>	HAG	3.9	< 1	2
Ahuru	<i>Auchenoceros punctatus</i>	PCO	3.8	< 1	24
Spotted stargazer	<i>Genyagnus monopterygius</i>	SPZ	3.0	< 1	3
Blue mackerel	<i>Scomber australis</i>	EMA	2.9	< 1	2
Stout sprat	<i>Sprattus mulleri</i>	SPM	2.8	< 1	19
Opalfish	<i>Hemerocoetes</i> spp.	OPA	2.4	< 1	6
Blunose	<i>Hyperoglyphe antarctica</i>	BNS	2.3	< 1	1
Redbait	<i>Emmelichthys nitidus</i>	RBT	2.3	< 1	11
Blind electric ray	<i>Typhlonarke</i> spp.	BER	2.1	< 1	1
Yellow boarfish	<i>Pentaceros decacanthus</i>	YBO	1.7	< 1	2
Southern bastard cod	<i>Pseudophycis barbata</i>	SBR	1.4	< 1	1
Brown stargazer	<i>Xenoccephalus armatus</i>	BRZ	1.3	< 1	2
Rock lobster	<i>Jasus edwardsii</i>	CRA	1.2	< 1	3
Broad squid	<i>Sepioteuthis australis</i>	BSQ	0.8	< 1	2
Prawn killer	<i>Ibacus alticrenatus</i>	PRK	0.6	< 1	3
Spiny seadragon	<i>Solegnathus spinosissimus</i>	SDR	0.4	< 1	3
Yellow cod	<i>Parapercis giliesi</i>	YCO	0.4	< 1	1
Skate	<i>Pavoraja</i> spp.	SKA	0.3	< 1	1
Yelloweyed mullet	<i>Aldrichetta forsteri</i>	YEM	0.3	< 1	1
Anchovy	<i>Engralus australis</i>	ANC	0.2	< 1	2
Pufferfish	<i>Sphoeroides</i> spp.	PUF	0.2	< 1	4
Slender sprat	<i>Sprattus antipodum</i>	SPA	0.2	< 1	2
Mantis shrimp	Crustacea	CRU	0.1	< 1	1
Southern boarfish	<i>Pseudopentaceros richardsoni</i>	SBO	0.1	< 1	1
Speckled sole	<i>Peltorhamphus latus</i>	SPS	0.1	< 1	1
Toadfish	<i>Neophrynixthys</i> spp.	TOA	0.1	< 1	2
Porcupine fish	<i>Allomycterus jaculiferus</i>	POP	0.0	< 1	3

**Table 3: Mean catch rates (to the nearest whole kg.km<sup>-2</sup>) for the 20 most abundant species by stratum\***

**ITQ species**

West coast		Species code											
Stratum	Depth (m)	RCO	BAR	SQU	STA	TAR	GUR	SCH	HAK	HOK	LIN	SPO	SWA
1	20-100	159	193	26	2	0	33	3	29	2	1	13	11
5	25-100	114	5	0	0	0	31	8	2	1	1	23	3
7	25-100	597	98	24	1	16	87	28	128	4	28	23	2
11	25-100	524	126	43	73	27	72	7	45	9	27	20	5
14	25-100	105	153	21	288	32	76	6	20	11	25	70	11
2	100-200	38	89	294	0	45	0	122	0	0	1	3	7
6	100-200	1	5	178	2	0	0	21	0	0	1	0	6
8	100-200	82	222	148	72	77	3	24	25	30	14	13	2
12	100-200	246	196	190	186	150	1	71	59	52	10	13	6
15	100-200	186	115	64	252	257	0	25	26	18	19	3	5
9	200-400	0	1	239	6	29	0	0	0	13	0	1	15
13	200-400	131	206	101	325	307	0	137	2	104	51	7	0
16	200-400	112	5	22	28	229	0	32	22	417	413	4	0

**Tasman and Golden Bays**

17	20-33	3	68	13	0	3	64	14	3	0	0	89	73
18	20-42	1	192	50	0	0	173	10	1	0	0	11	1
19	20-70	58	124	58	5	49	34	19	2	5	0	14	73

**Non-ITQ species**

West coast		Species code							
Stratum	Depth (m)	SPD	RHY	RAT	CAR	SSK	SPE	WIT	SDO
1	20-100	80	0	27	49	5	0	12	0
5	25-100	19	0	0	1	14	0	1	0
7	25-100	77	0	180	23	14	0	26	0
11	25-100	248	0	72	23	22	1	29	0
14	25-100	435	0	79	9	47	0	58	0
2	100-200	322	0	0	15	4	2	0	0
6	100-200	105	0	0	56	0	2	0	0
8	100-200	400	0	78	38	19	7	3	0
12	100-200	298	0	112	47	28	46	6	1
15	100-200	60	0	65	33	32	17	13	128
9	200-400	1	0	0	16	12	2	1	3
13	200-400	26	1 837	21	80	58	93	4	42
16	200-400	0	250	30	4	119	34	1	46

**Tasman and Golden Bays**

17	20-33	146	0	1	0	0	1	13	0
18	20-42	87	0	0	1	0	0	9	0
19	20-70	179	0	69	17	6	11	32	0

\* Common names for species codes are given in Table 2.

**Table 4: Relative doorspread biomass estimates of the 20 most abundant species by sub-area\***

Common name	<u>Tasman and Golden Bays</u>		<u>West coast</u>		<u>Total survey area</u>	
	Biomass (t)	c.v. (%)	Biomass (t)	c.v. (%)	Biomass (t)	c.v. (%)
Southern spiny dogfish	563	30	3 887	16	4 449	15
Arrow squid	192	20	3 330	19	3 523	18
Red cod (all)	143	84	2 948	13	3 091	13
Red cod (38+ cm)	99	90	1 873	15	1 972	15
Barracouta	504	28	2 328	16	2 832	14
Common roughy	0		2 290	96	2 290	96
Tarakihi (all)	120	86	1 553	13	1 673	13
Tarakihi (25+ cm)	1	89	1 522	13	1 523	13
Giant stargazer	12	44	1 530	12	1 543	12
School shark	60	26	1 041	23	1 101	22
Rattails	168	95	869	20	1 037	23
Carpet shark	44	31	712	21	755	20
Red gurnard (all)	265	24	340	20	605	16
Red gurnard (30+ cm)	169	23	312	20	480	15
Hoki (all)	11	96	490	18	501	18
Hoki (65+ cm)	0		69	42	69	42
Hake	6	58	447	26	453	25
Smooth skate	15	70	383	19	397	19
Ling	0		350	19	350	19
Silver warehou	201	60	133	25	334	37
Rig	73	24	239	15	312	13
Sea perch	26	42	266	26	293	24
Witch	89	37	169	16	258	16
Silver dory	0		187	44	187	44

\*Estimates above a given size are recruited biomass

**Table 5: Estimates of relative biomass (to the nearest whole tonne) for the four primary species by stratum**

Stratum	Depth (m)	<u>Red cod</u>		<u>Giant stargazer</u>		<u>Red gurnard</u>		<u>Tarakihi</u>		
		Biomass (t)	% of total	Biomass (t)	% of total	Biomass (t)	% of total	Biomass (t)	% of total	
<b>West coast</b>										
1	20–100	214	7	2	0	44	7	0	0	
5	20–100	140	5	0	0	38	6	0	0	
7	20–100	553	18	1	0	80	13	15	1	
11	20–100	753	24	105	7	104	17	39	2	
14	20–100	89	3	245	16	65	11	28	2	
2	100–200	164	5	0	0	0	0	194	12	
6	100–200	2	0	5	0	0	0	81	5	
8	100–200	194	6	169	11	7	1	181	11	
12	100–200	479	15	363	24	1	0	293	18	
15	100–200	168	5	228	15	0	0	232	14	
9	200–400	0	0	12	1	0	0	54	3	
13	200–400	158	5	391	25	0	0	370	22	
16	200–400	33	1	8	1	0	0	68	4	
	<b>Subtotal</b>	<b>2 948</b>	<b>95</b>	<b>1 530</b>	<b>99</b>	<b>340</b>	<b>56</b>	<b>1 553</b>	<b>93</b>	
<b>Tasman and Golden Bays</b>										
17	20–33	1	0	0	0	20	3	1	0	
18	20–42	1	0	0	0	164	27	0	0	
19	20–70	141	5	12	1	82	14	119	7	
	<b>Subtotal</b>	<b>143</b>	<b>5</b>	<b>12</b>	<b>1</b>	<b>265</b>	<b>44</b>	<b>120</b>	<b>7</b>	
	<b>Total</b>	<b>3 091</b>		<b>1 543</b>		<b>605</b>		<b>1 673</b>		

**Table 6: Number of length frequency and biological samples collected**

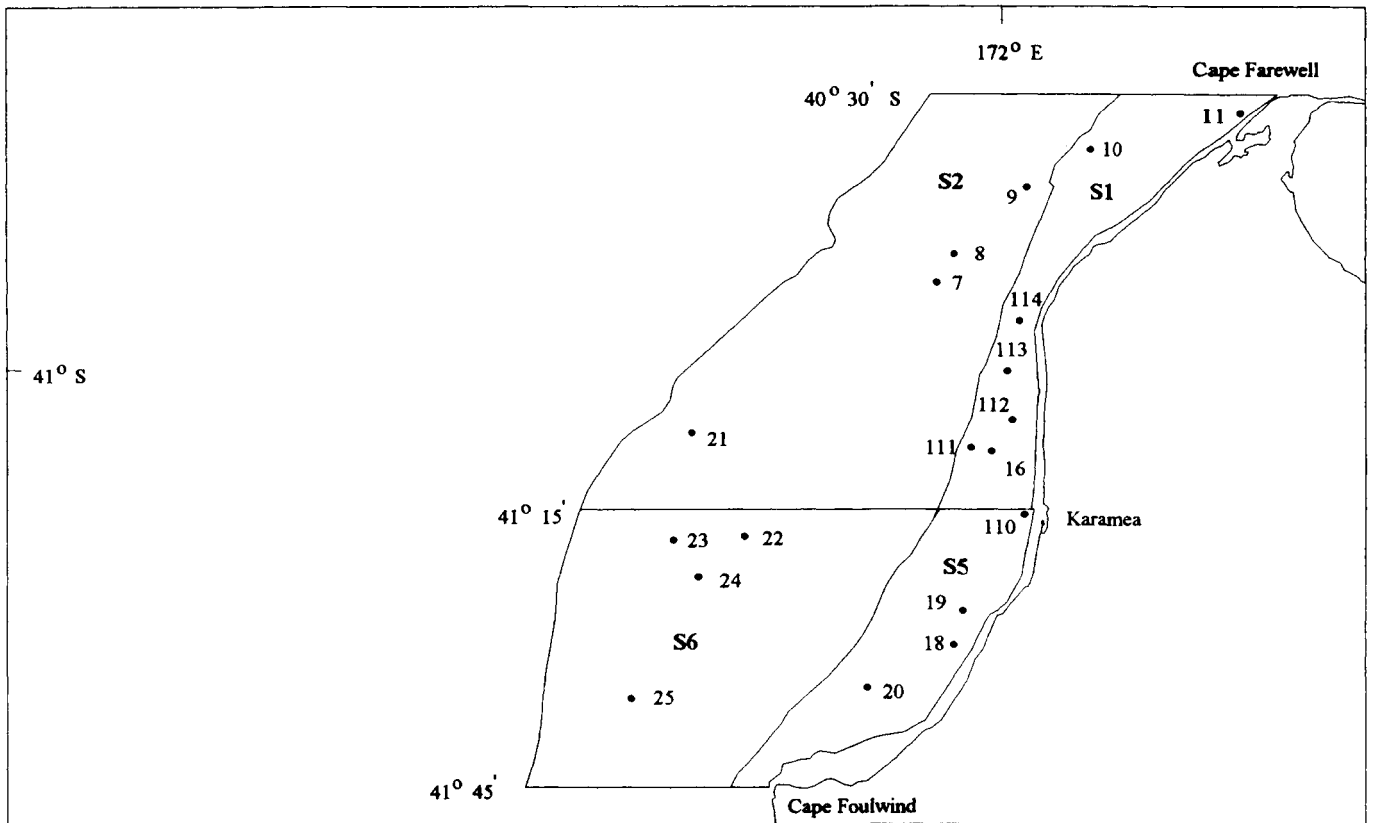
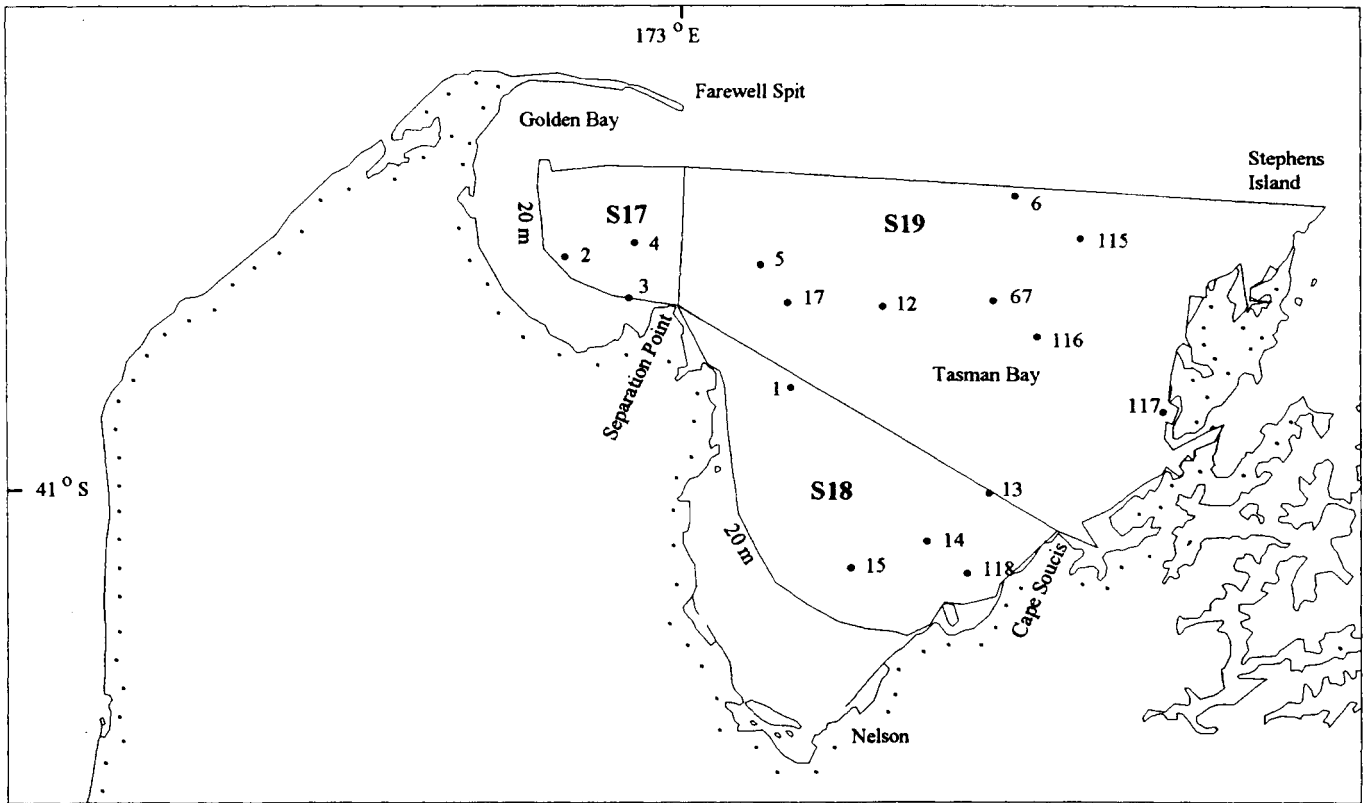
	<u>Length frequency data</u>		<u>Biological data</u>	
	No. of samples	Total	No. of samples	Total
Barracouta	96	6 596	0	0
Blue cod	12	226	0	0
Bluenose	1	1	0	0
Brill	11	21	0	0
Brown stargazer	2	2	0	0
Broad squid	1	1	0	0
Alfonsino	3	173	0	0
Rock lobster	2	2	0	0
Elephantfish	11	51	0	0
Blue mackerel	2	2	0	0
N.Z. sole	31	698	0	0
Frostfish	4	59	0	0
Dark ghost shark	26	439	0	0
Red gurnard	56	2 851	54	1 042
Hake	58	2 186	0	0
Hapuku	8	8	0	0
Hoki	59	5 357	0	0
John dory	23	87	0	0
Jack mackerel	39	287	0	0
Murphy's mackerel	30	203	0	0
Horse mackerel	21	1 352	0	0
Kahawai	6	18	3	3
Lookdown dory	3	7	0	0
Leatherjacket	6	350	0	0
Ling	54	740	0	0
Lemon sole	57	1 304	0	0
Orange perch	2	42	0	0
Ahuru	24	207	0	0
Rattail	1	1	0	0
Rubyfish	2	54	0	0
Red cod	93	7 178	88	1 517
Common roughy	2	166	0	0
Southern bastard cod	1	1	0	0
Scaly gurnard	2	2	0	0
School shark	80	580	0	0
Silver dory	8	597	0	0
Sand flounder	19	948	0	0
Gemfish	29	473	0	0
Snapper	12	61	0	0
Sea perch	6	225	0	0
Rig	76	459	0	0
Speckled sole	1	1	0	0
Spotted stargazer	4	5	0	0
Arrow squid	101	5 191	0	0
Giant stargazer	75	1 362	73	789
Silver warehou	75	2 322	0	0
Tarakihi	92	3 809	77	1 139
Trevally	3	4	0	0
Turbot	8	12	6	11
Blue warehou	37	1 184	0	0
White warehou	8	12	0	0
Yellowbelly flounder	3	15	0	0

**Table 7: Numbers of the target species sampled at each reproductive stage**

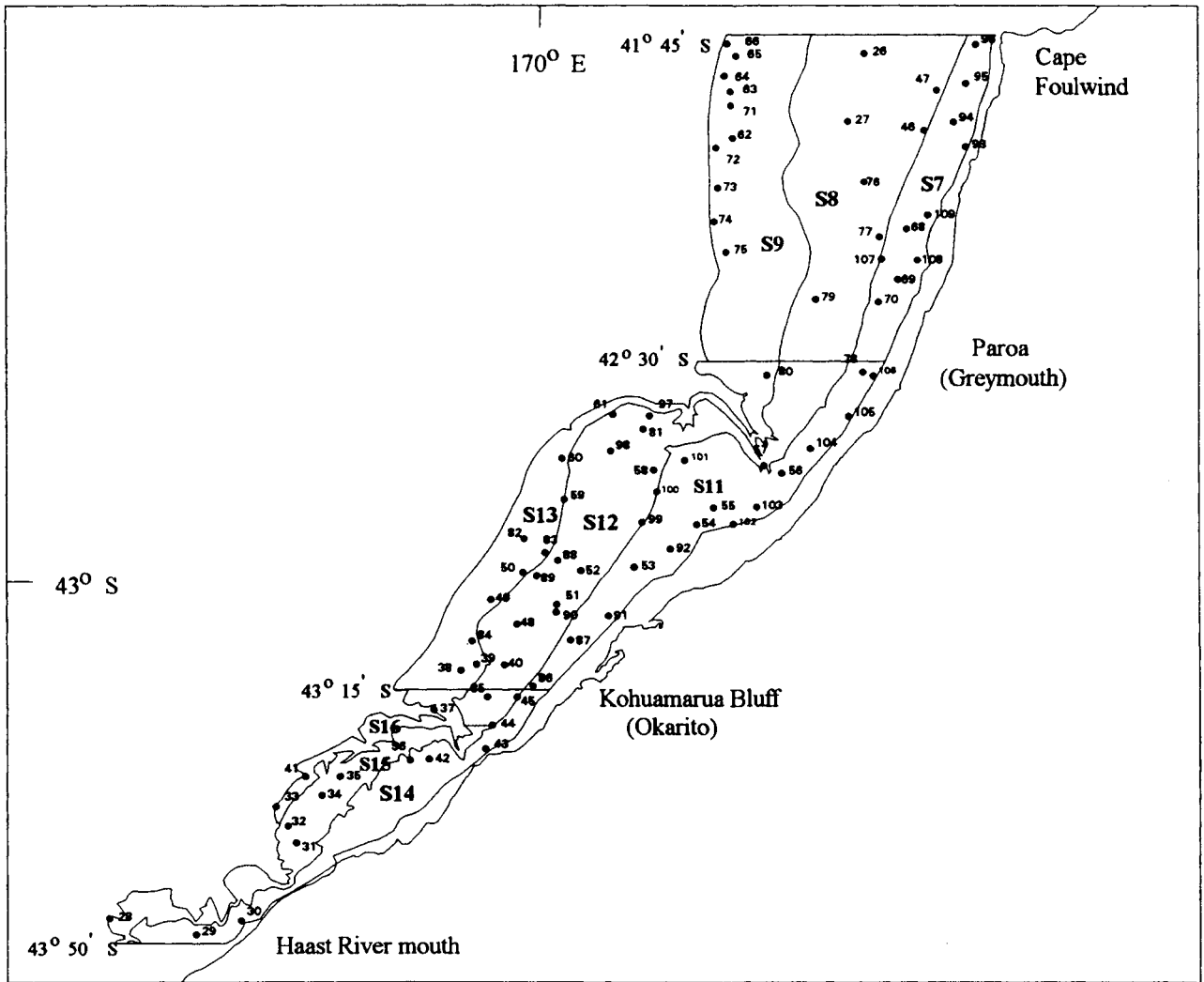
Total length (cm)	Males Gonad stage					Females Gonad stage					
	1	2	3	4	5	1	2	3	4	5	
<b>Giant stargazer</b>											
<b>West coast</b>											
11-20	1	0	0	0	0	2	0	0	0	0	
21-30	1	0	0	0	0	5	0	0	0	0	
31-40	35	8	1	1	0	30	0	0	0	0	
41-50	35	72	30	0	1	25	1	0	0	10	
51-60	14	101	35	0	0	43	48	4	0	17	
61-70	4	15	1	0	4	6	143	14	0	30	
71-80	0	0	0	0	0	0	25	2	0	3	
<b>Total</b>	<b>90</b>	<b>196</b>	<b>67</b>	<b>1</b>	<b>5</b>	<b>111</b>	<b>217</b>	<b>20</b>	<b>0</b>	<b>60</b>	<b>767</b>
<b>Tasman and Golden Bays</b>											
21-30	2	0	0	0	0	5	0	0	0	0	
31-40	3	0	0	0	0	1	0	0	0	0	
41-50	0	0	0	0	0	3	1	0	0	1	
<b>Total</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>16</b>
<b>Red cod</b>											
<b>West coast</b>											
11-20	5	0	0	0	0	18	0	0	0	0	
21-30	204	5	6	0	0	68	0	0	0	0	
31-40	269	22	6	0	0	262	3	0	0	1	
41-50	31	53	24	0	0	131	7	0	0	0	
51-60	11	47	60	1	0	84	34	9	0	1	
61-70	0	0	1	0	0	42	18	11	0	1	
<b>Total</b>	<b>520</b>	<b>127</b>	<b>97</b>	<b>1</b>	<b>0</b>	<b>605</b>	<b>62</b>	<b>20</b>	<b>0</b>	<b>3</b>	<b>1 435</b>
<b>Tasman and Golden Bays</b>											
11-20	4	0	0	0	0	8	0	0	0	0	
21-30	2	0	0	0	0	11	0	0	0	0	
31-40	15	0	0	0	0	25	0	0	0	0	
41-50	3	0	0	0	0	10	1	0	0	0	
<b>Total</b>	<b>24</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>54</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>79</b>

**Table 7—continued**

Fork length (cm)	Males Gonad stage					Females Gonad stage					
	1	2	3	4	5	1	2	3	4	5	
<b>Red gurnard</b>											
<b>West coast</b>											
11-20	0	0	0	0	0	0	0	0	0	0	
21-30	33	46	0	0	0	11	0	0	0	0	
31-40	34	230	7	1	0	56	70	3	1	8	
41-50	2	11	0	0	0	4	44	15	3	5	
<b>Total</b>	<b>69</b>	<b>287</b>	<b>7</b>	<b>1</b>	<b>0</b>	<b>71</b>	<b>114</b>	<b>18</b>	<b>4</b>	<b>13</b>	<b>584</b>
<b>Tasman and Golden Bays</b>											
11-20	3	0	0	0	0	2	0	0	0	0	
21-30	119	16	0	0	0	97	8	1	0	0	
31-40	30	34	1	0	0	66	28	4	0	1	
41-50	2	0	0	0	0	3	24	13	0	5	
51-60	0	0	0	0	0	0	1	0	0	0	
<b>Total</b>	<b>154</b>	<b>50</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>168</b>	<b>61</b>	<b>18</b>	<b>0</b>	<b>6</b>	<b>458</b>
<b>Tarakihi</b>											
<b>West coast</b>											
11-20	73	0	0	0	0	69	0	0	0	0	
21-30	18	0	1	0	0	11	0	0	0	0	
31-40	38	53	96	24	41	137	128	15	6	92	
41-50	4	11	23	14	10	12	117	10	12	99	
51-60	0	0	0	0	0	0	1	0	0	1	
<b>Total</b>	<b>133</b>	<b>64</b>	<b>120</b>	<b>38</b>	<b>51</b>	<b>229</b>	<b>246</b>	<b>25</b>	<b>18</b>	<b>192</b>	<b>1 116</b>
<b>Tasman and Golden Bays</b>											
11-20	1	0	0	0	0	3	0	0	0	0	
21-30	0	0	0	0	0	3	0	0	0	0	
<b>Total</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7</b>

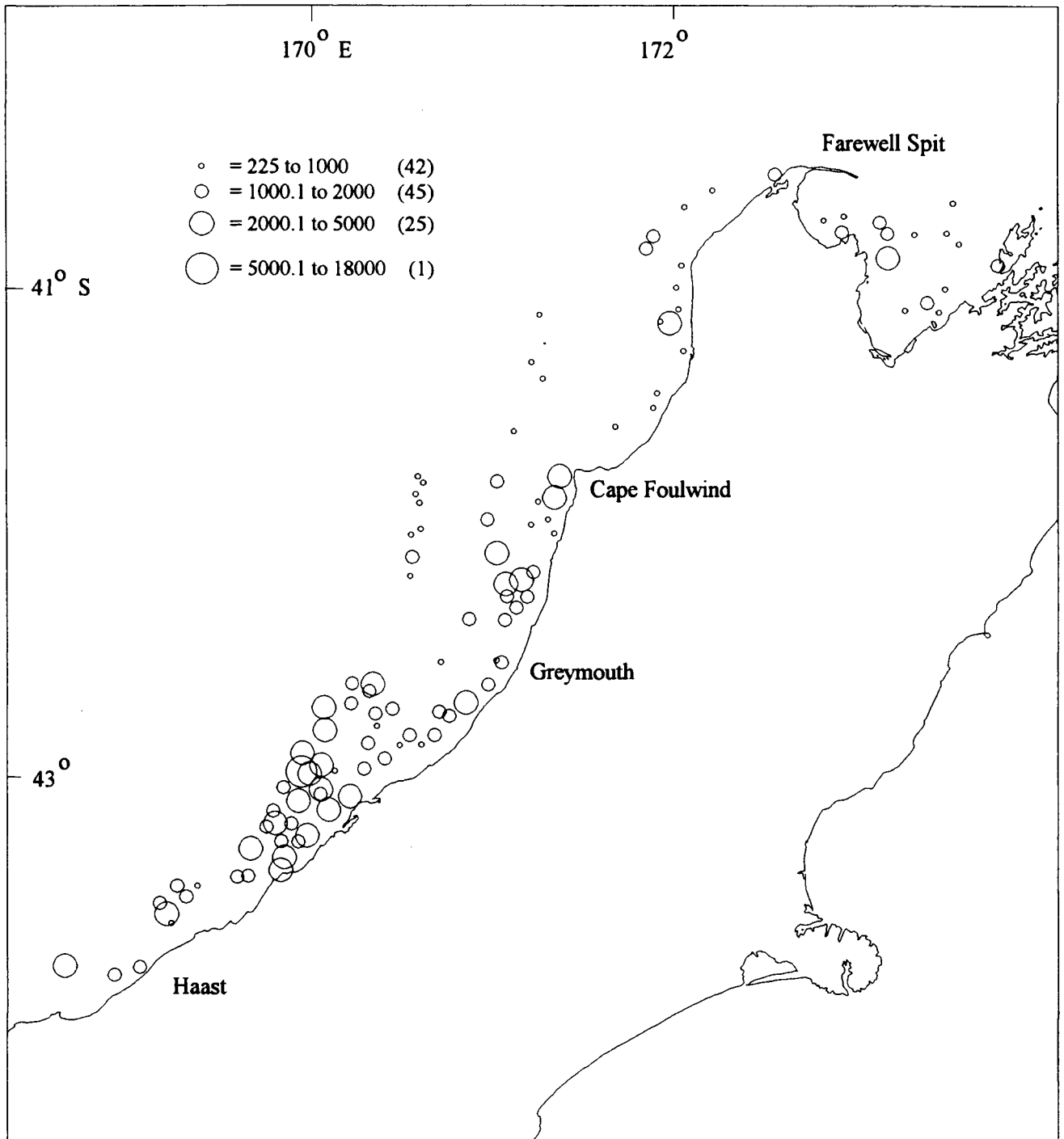


**Figure 1a: Stratum boundaries (west coast north of Cape Foulwind and Tasman and Golden Bays) with station positions and numbers**



**Figure 1b: Stratum boundaries (west coast south of Cape Foulwind) with station positions and numbers**

**All species combined**



**Figure 2: Catch rates (kg.km<sup>-3</sup>) for all species combined and of the major species for stations used for biomass estimates (numbers in parentheses are the number of stations at the given catch rate).**

### Arrow squid

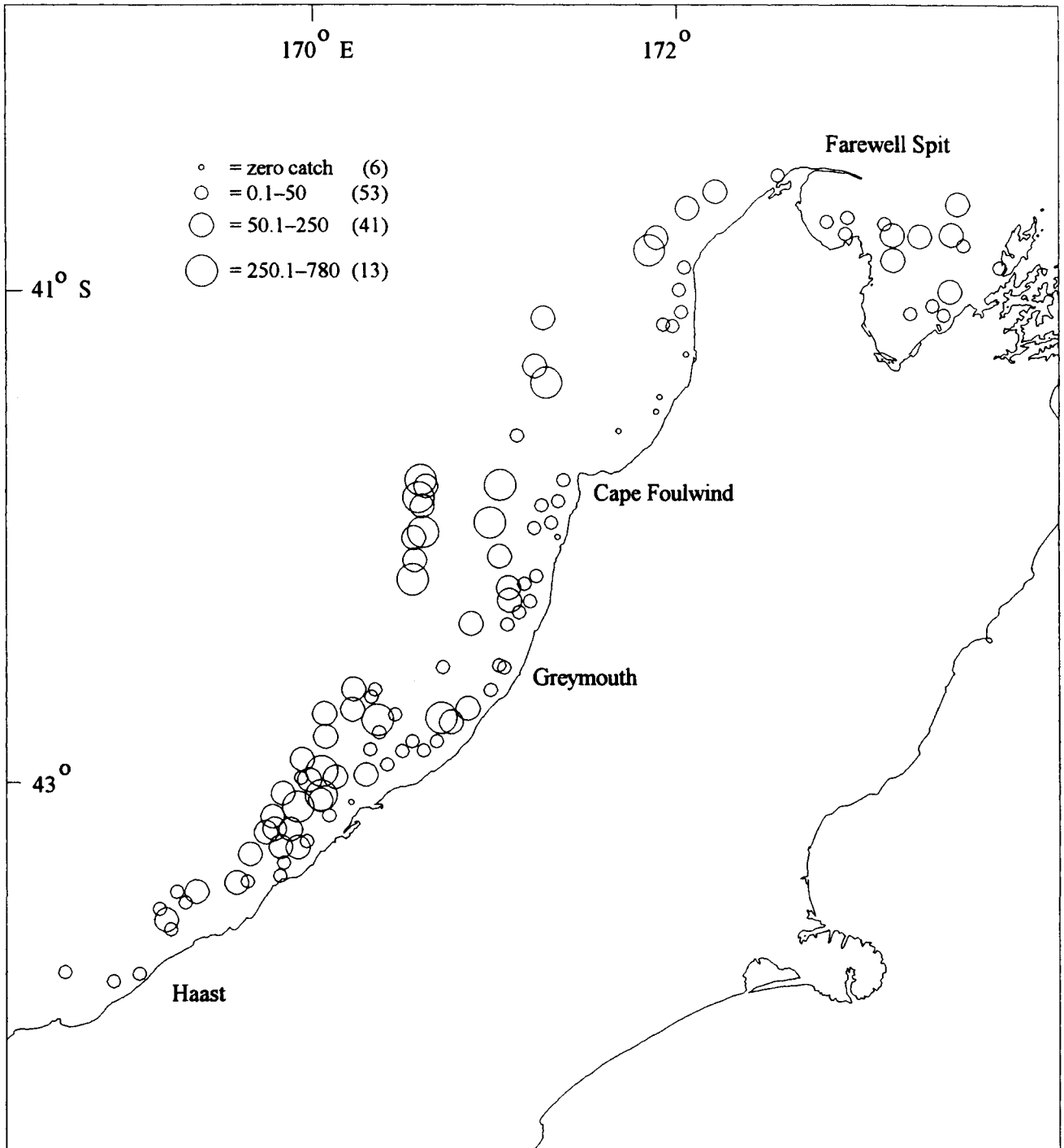


Figure 2—continued

# Barracouta

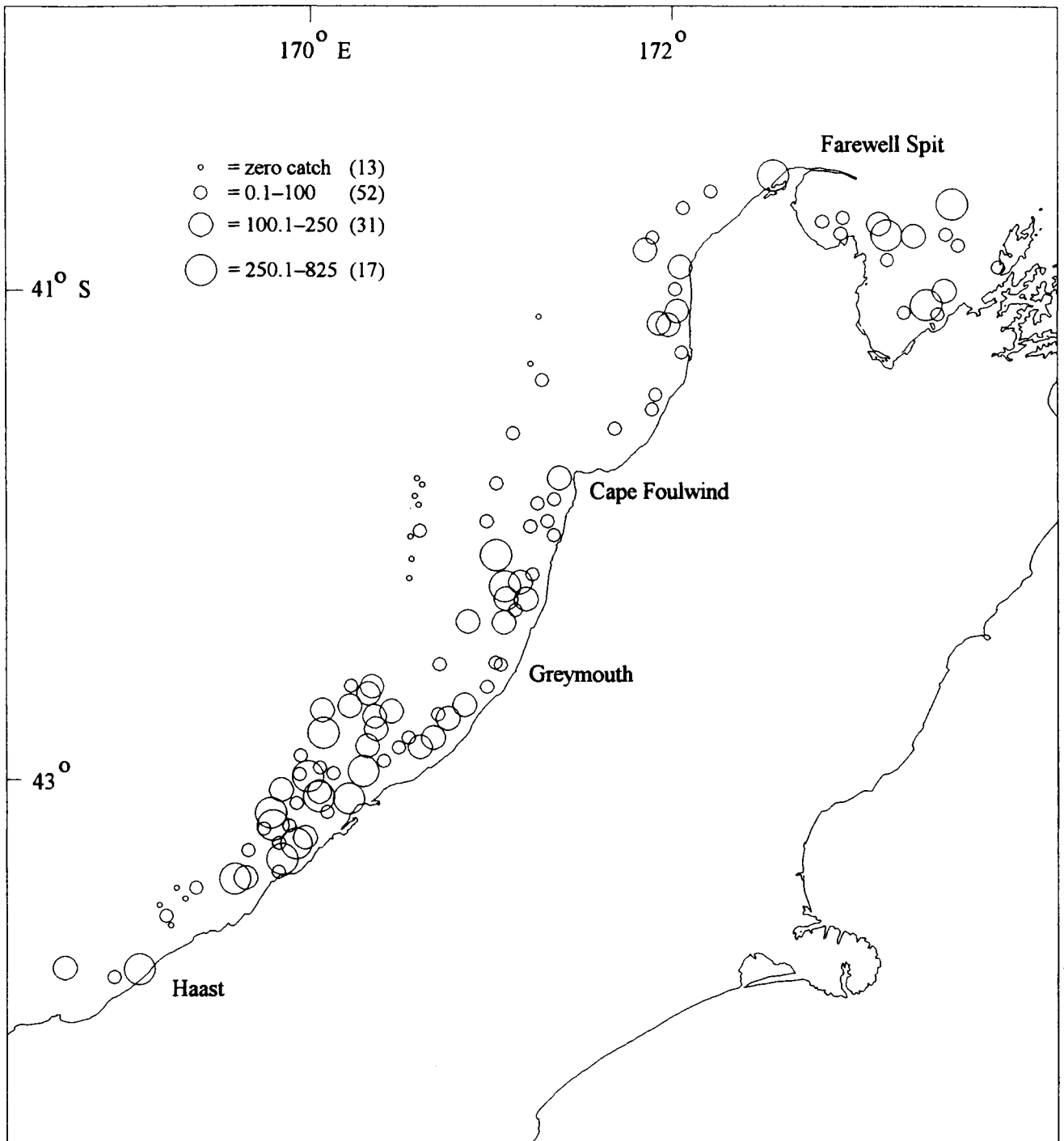


Figure 2—continued

# Giant stargazer

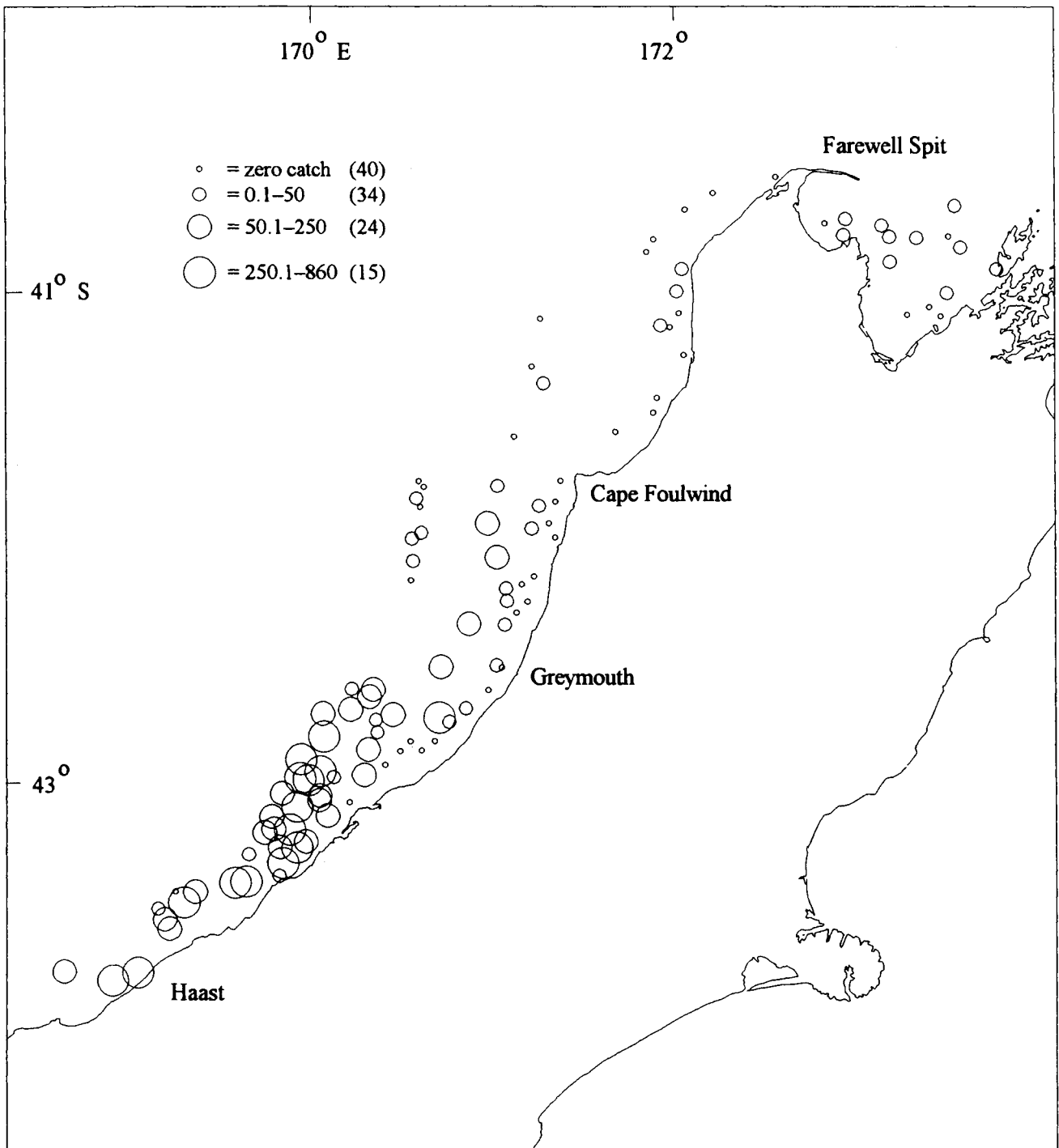


Figure 2—continued

# Hake

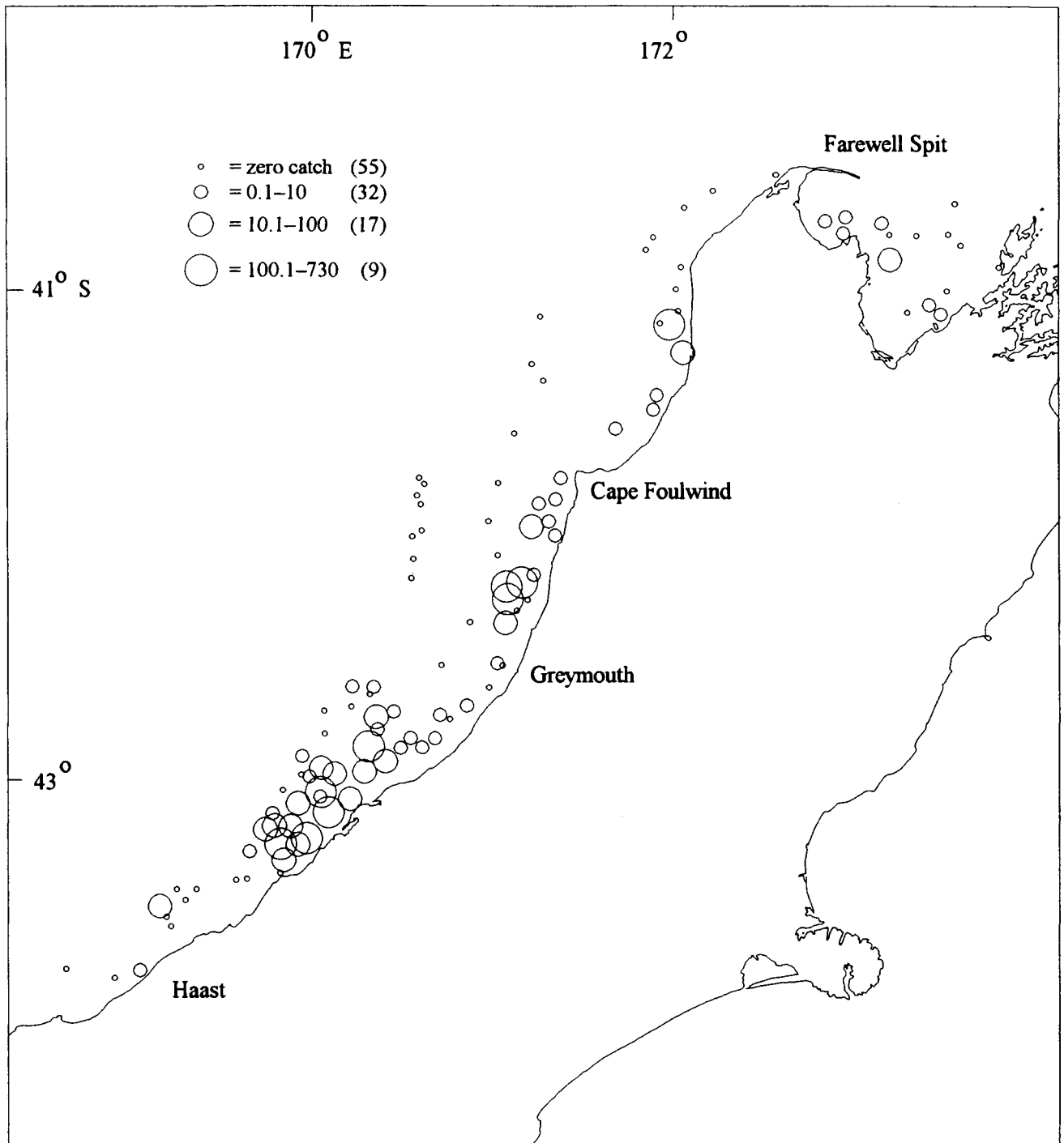


Figure 2—continued

# Hoki

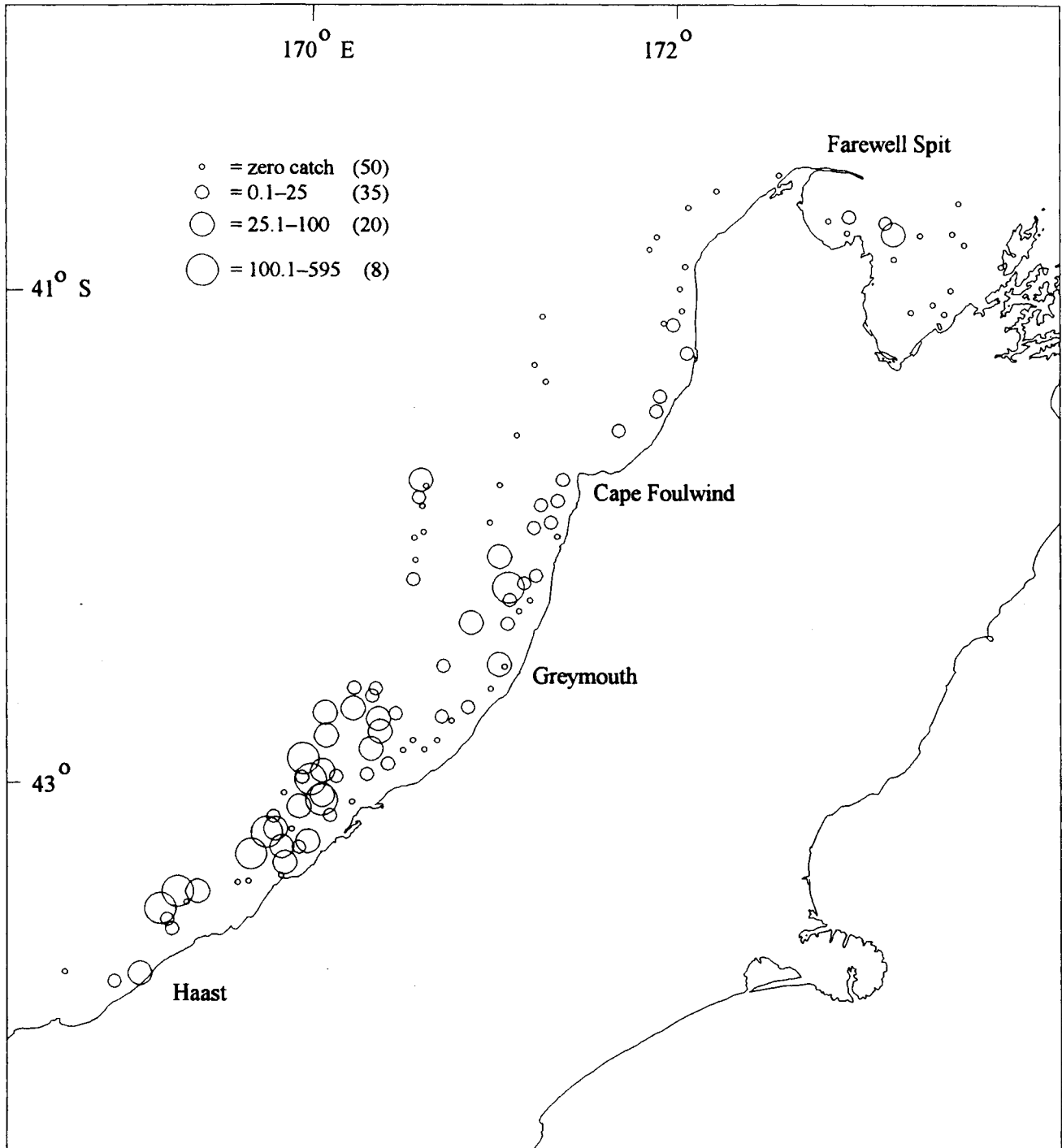


Figure 2—continued

# Ling

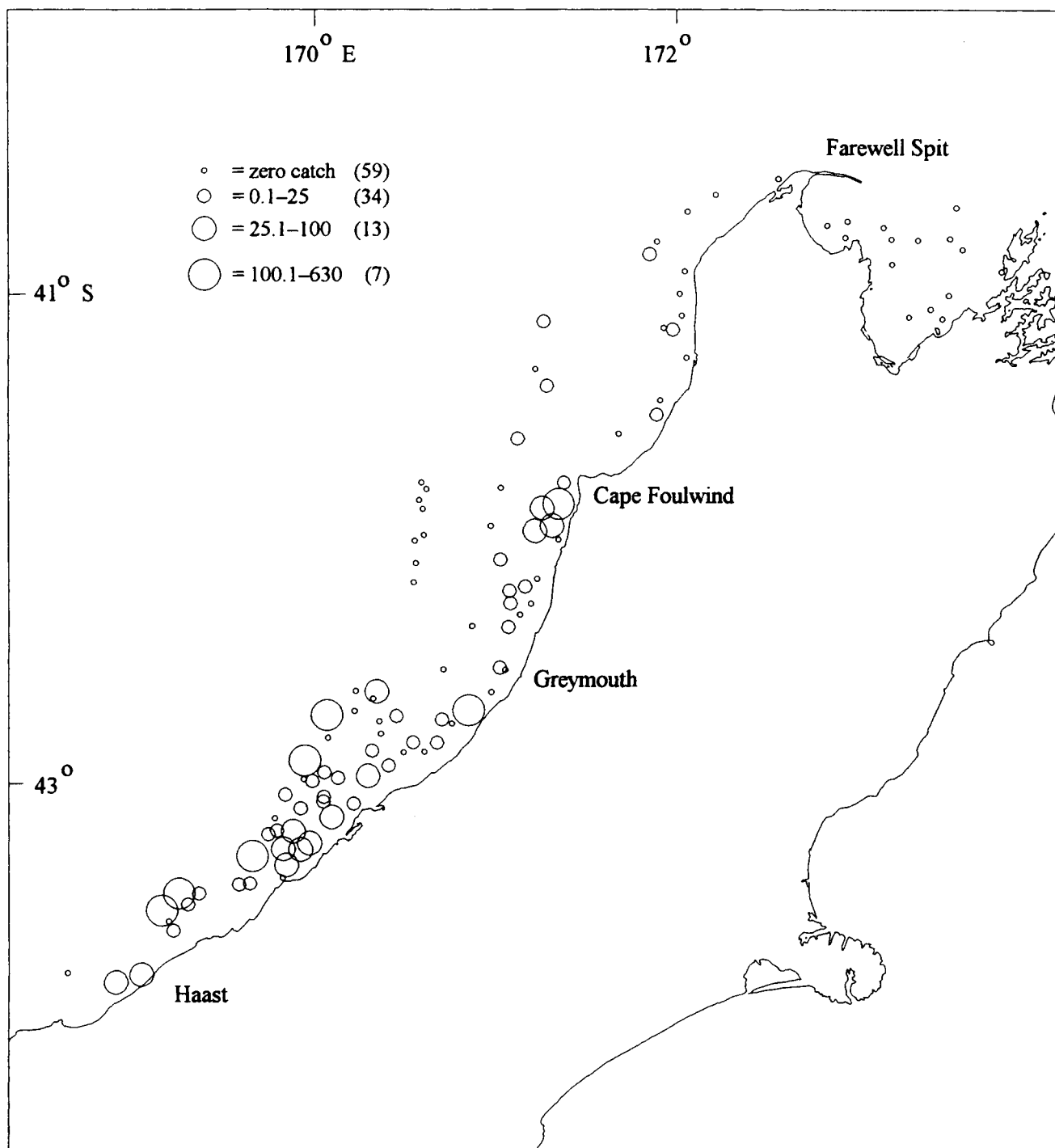


Figure 2—continued

### Red cod

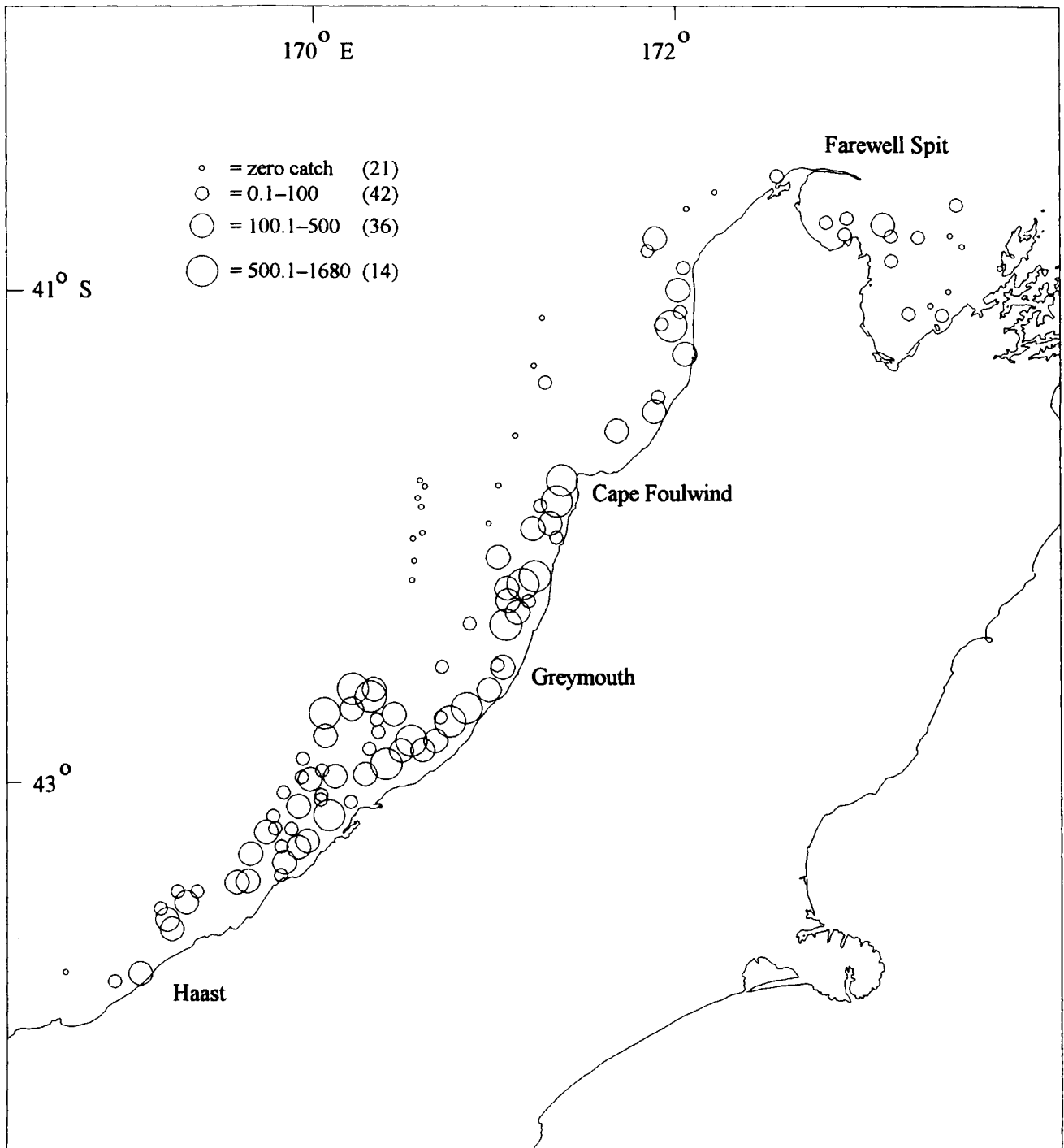


Figure 2—continued

# Red gurnard

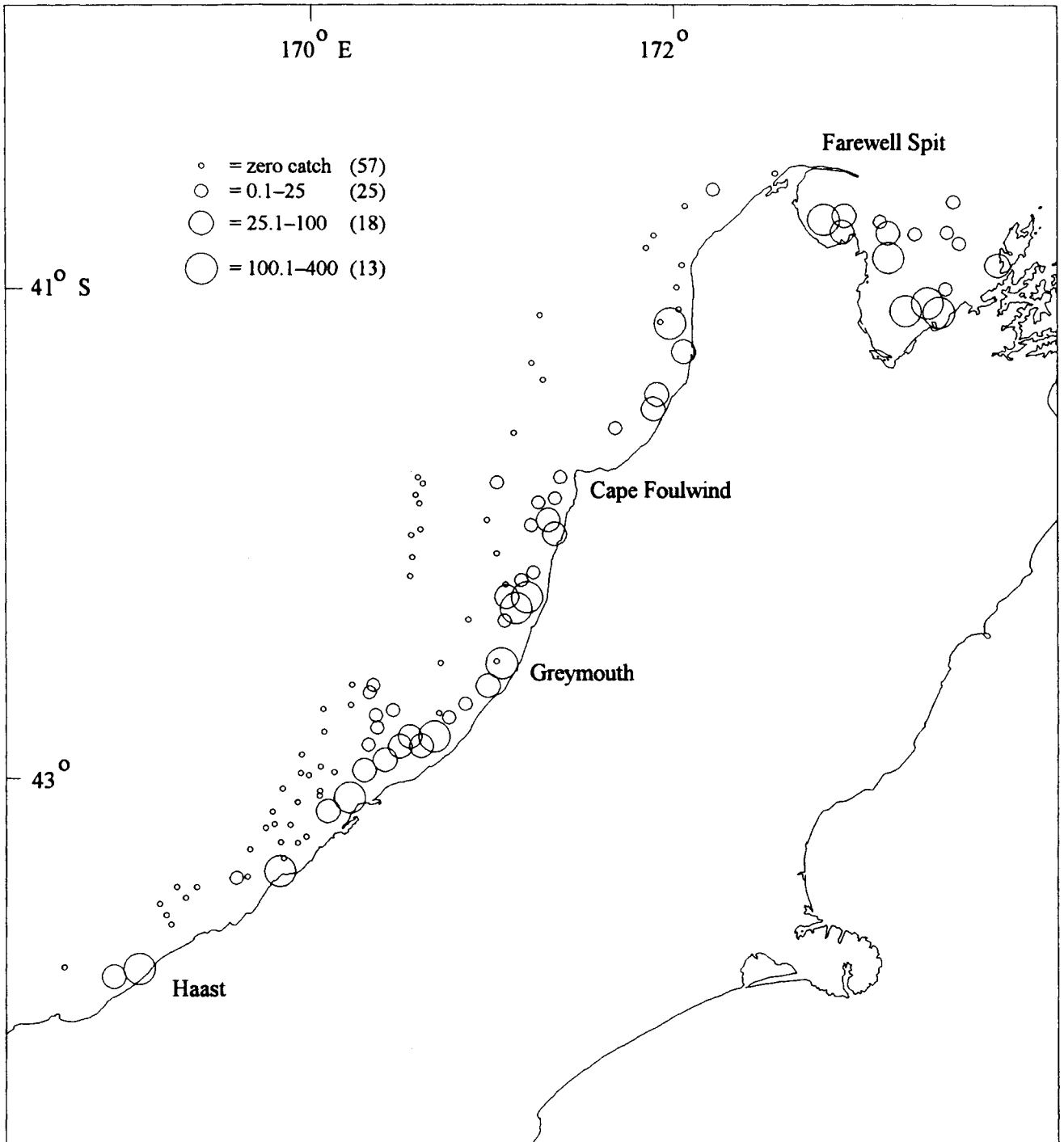
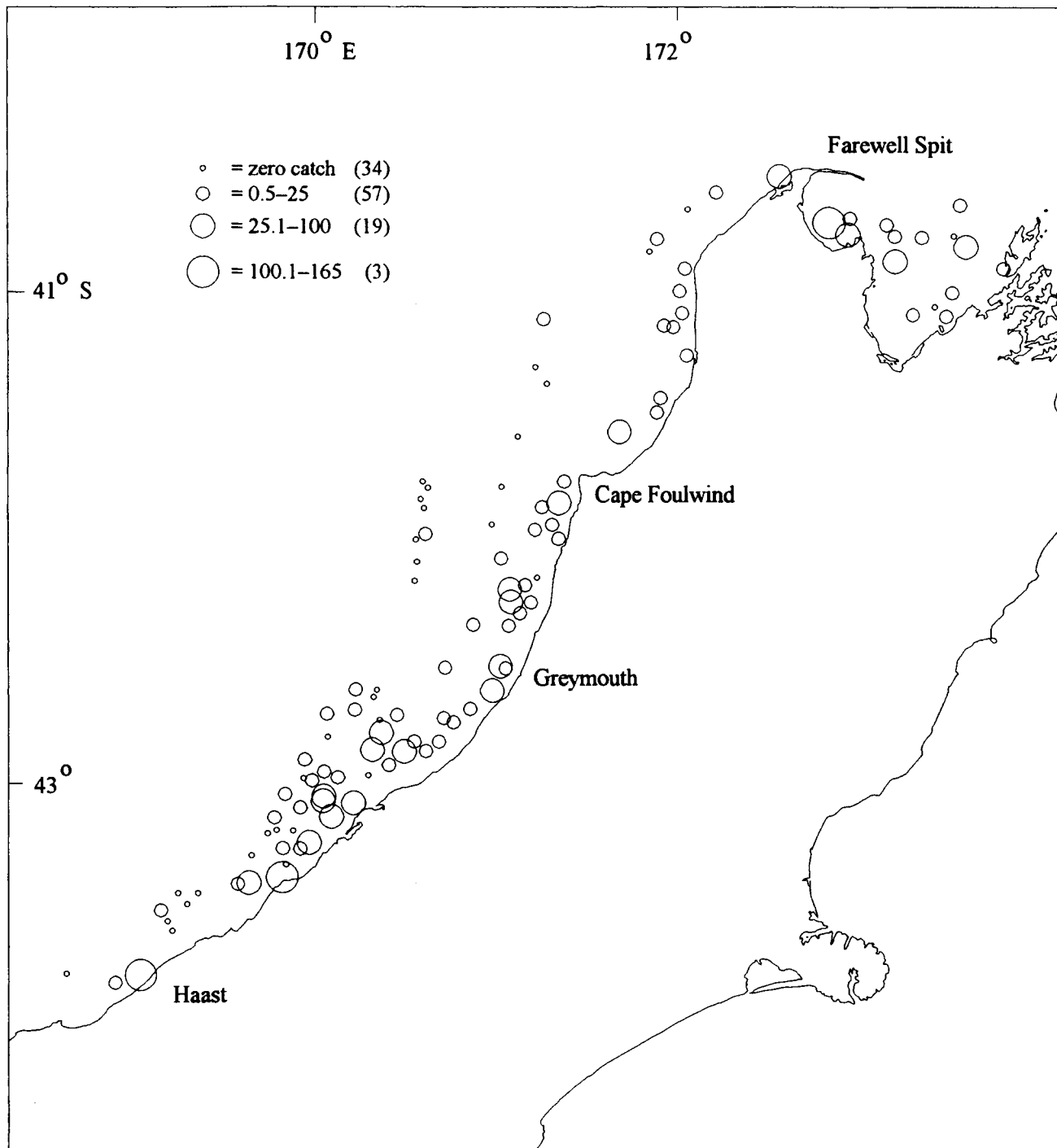


Figure 2—continued

**Rig**



**Figure 2—continued**

### School shark

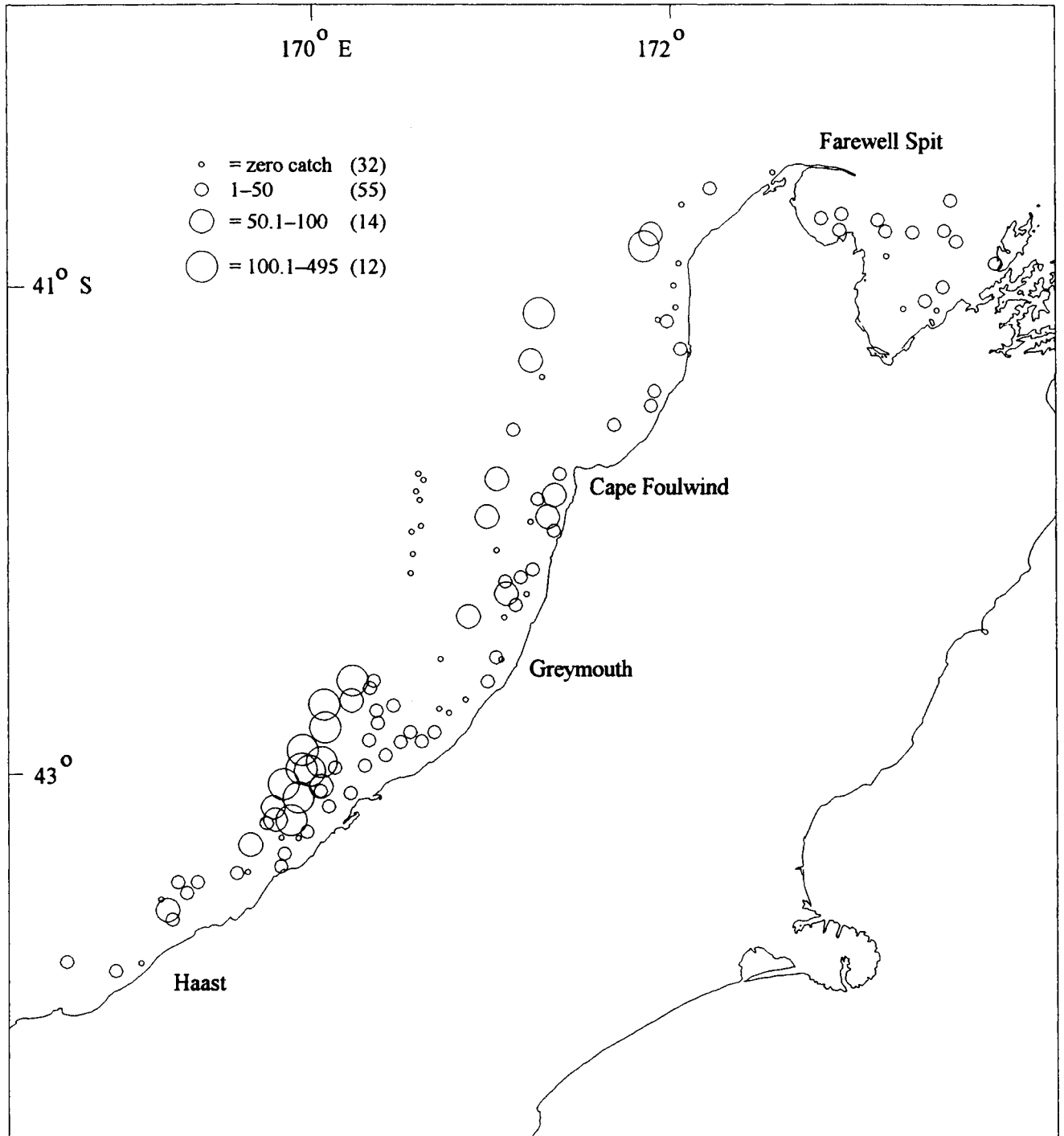


Figure 2—continued

# Silver warehou

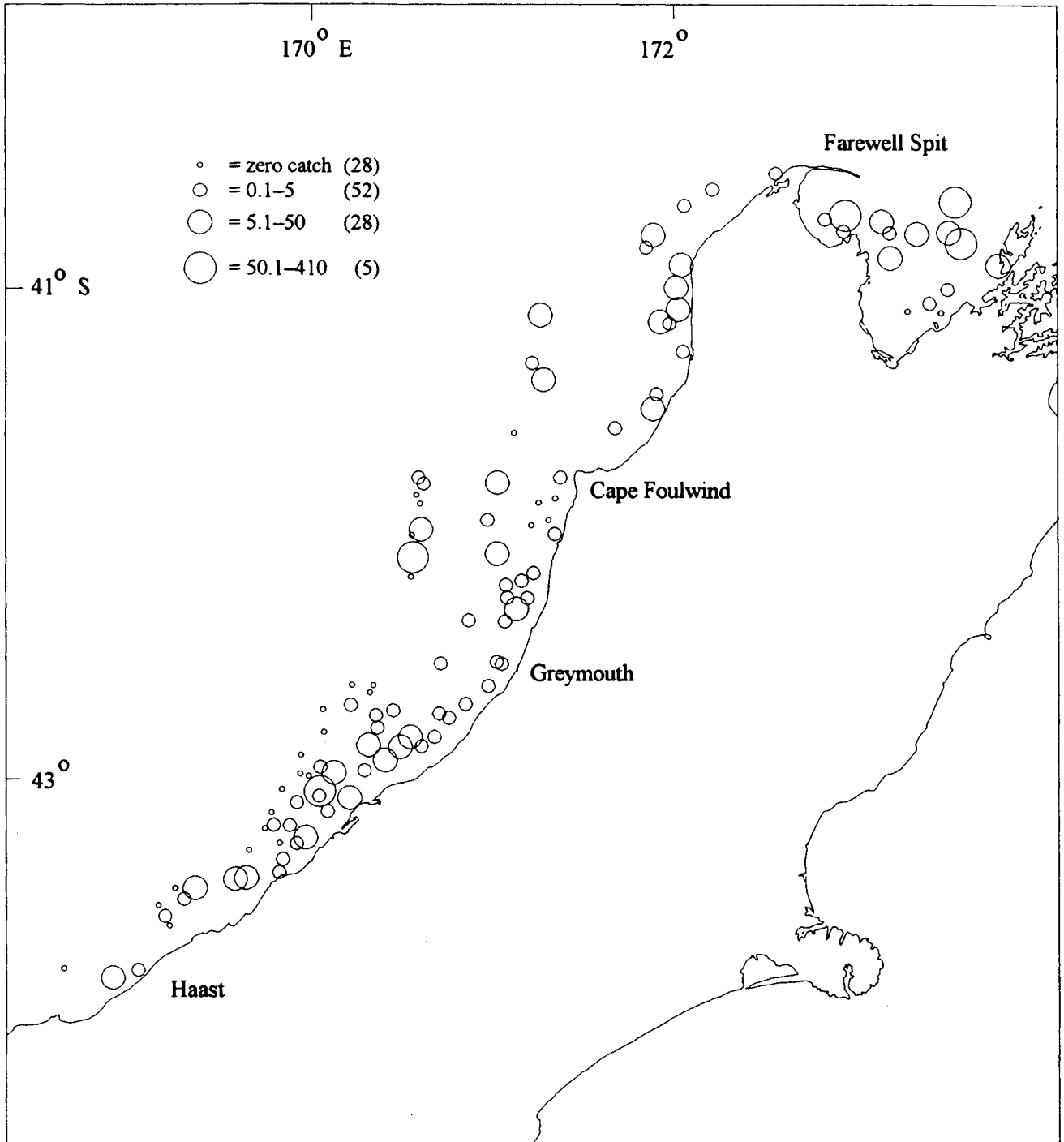


Figure 2—continued

### Southern spiny dogfish

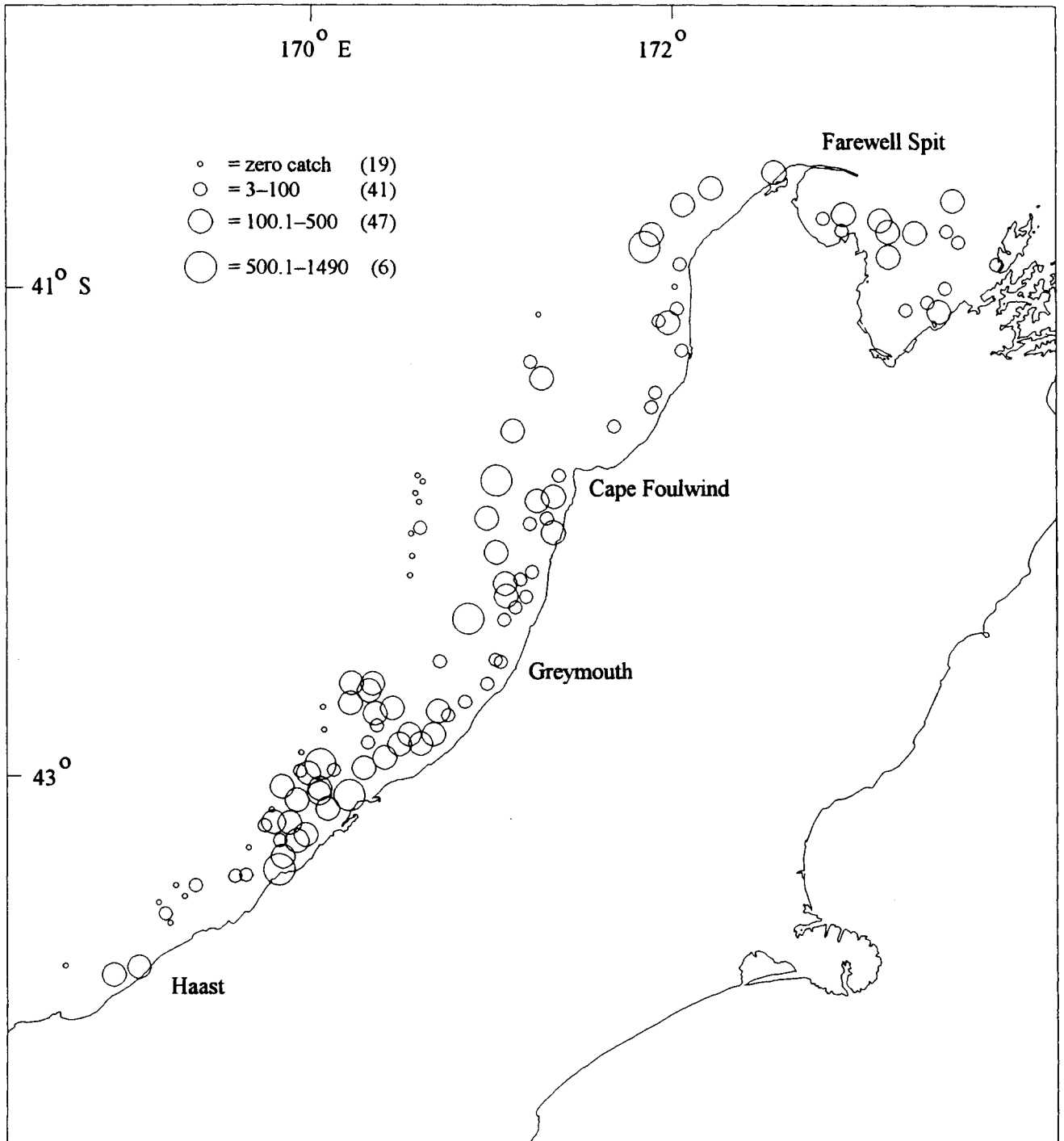


Figure 2—continued

# Tarakihi

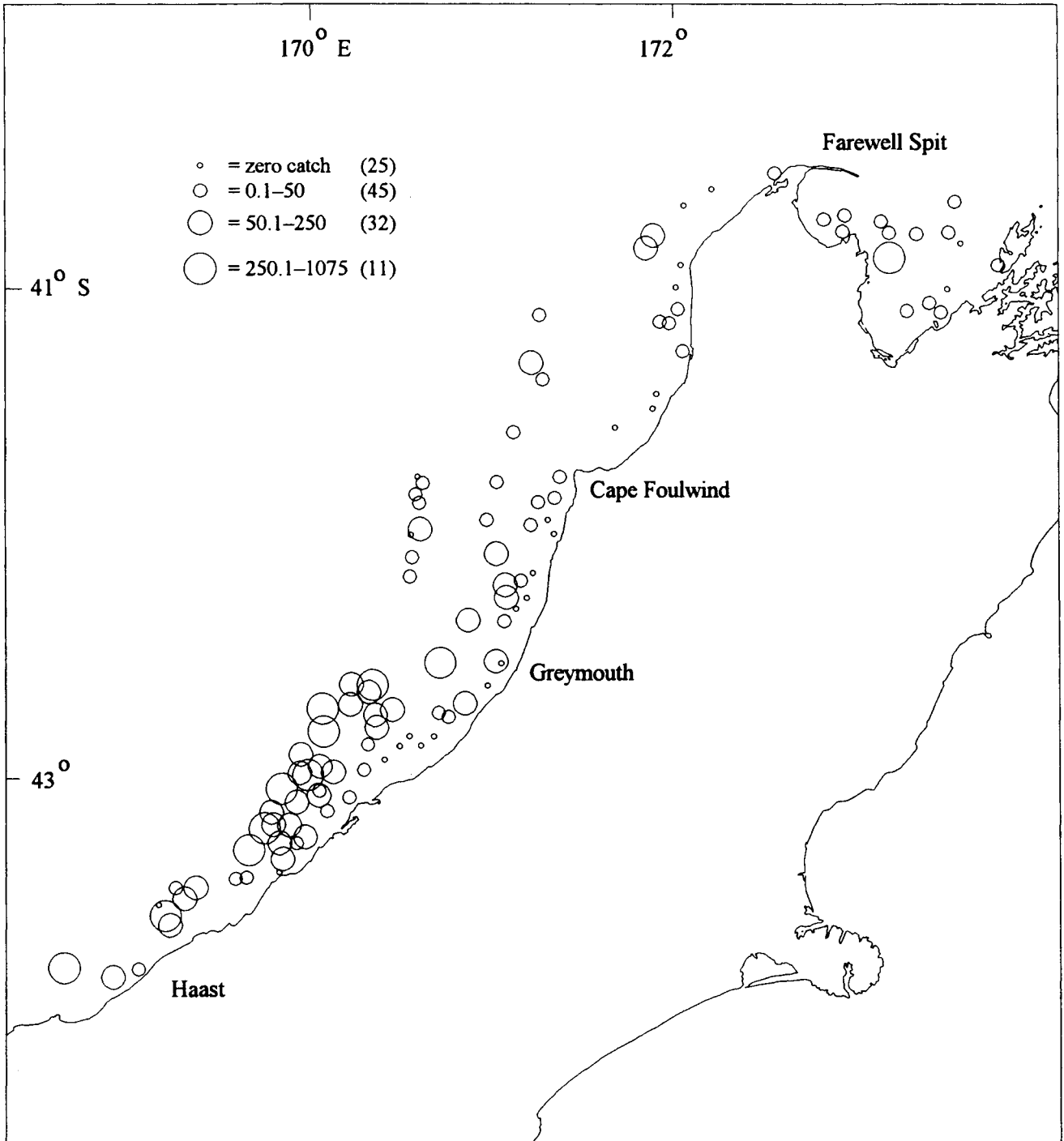
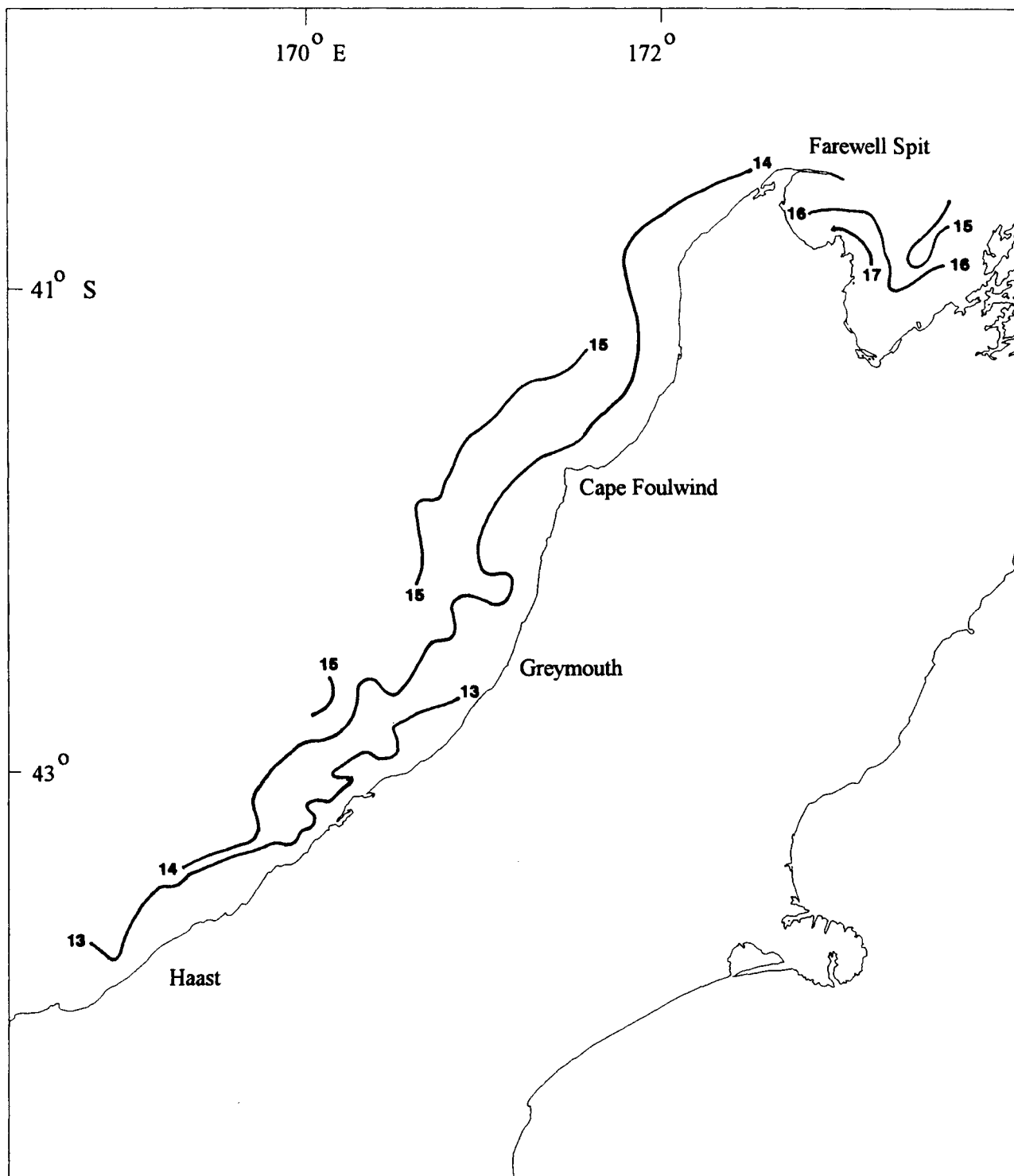
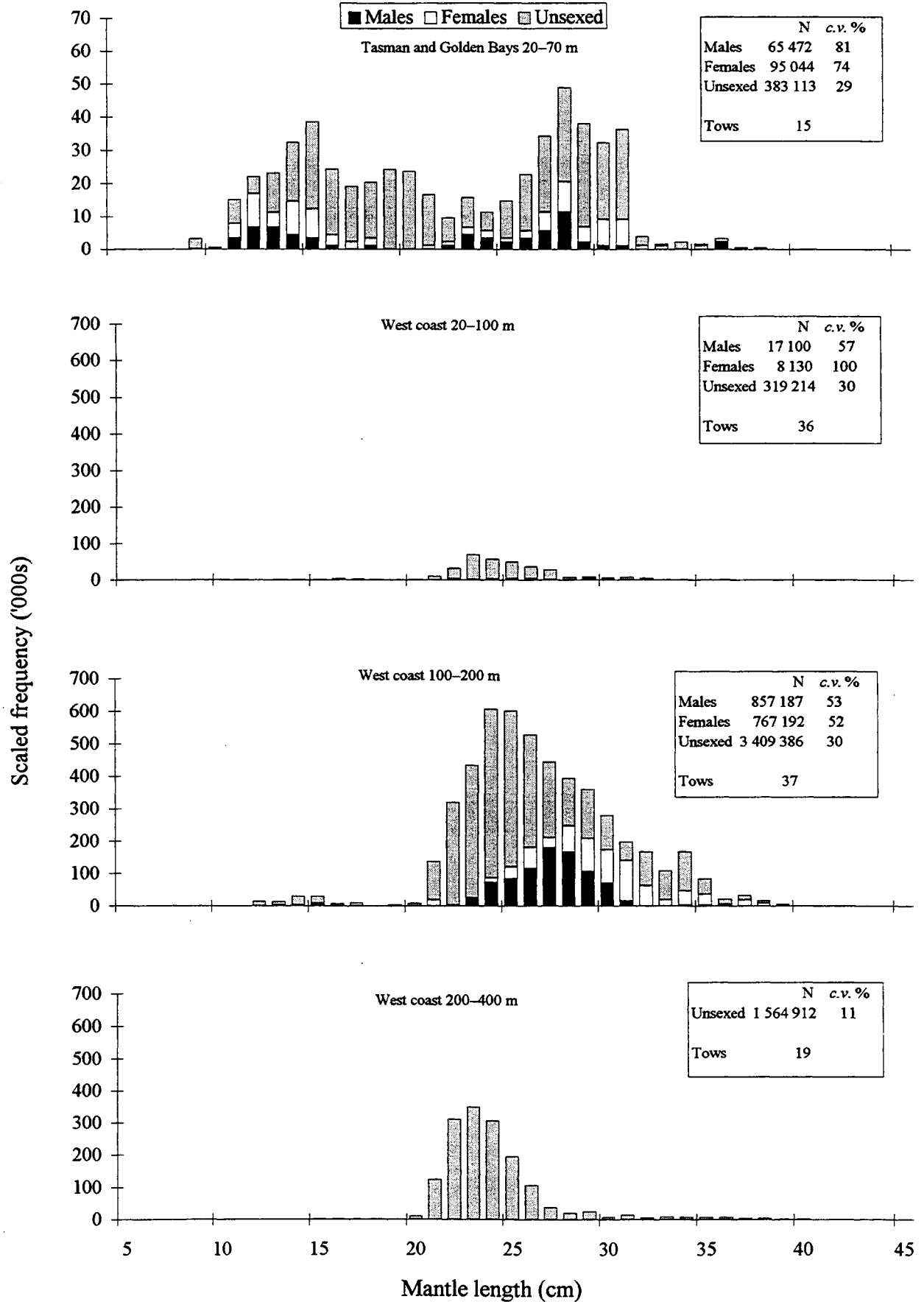


Figure 2—continued



**Figure 3: Sea surface isotherms estimated from station data.**

### Arrow squid



**Figure 4: Scaled length frequency distribution of the 14 most abundant ITQ species and other important species (N = estimated population, Tows = number of stations where species was caught).**

## Barracouta

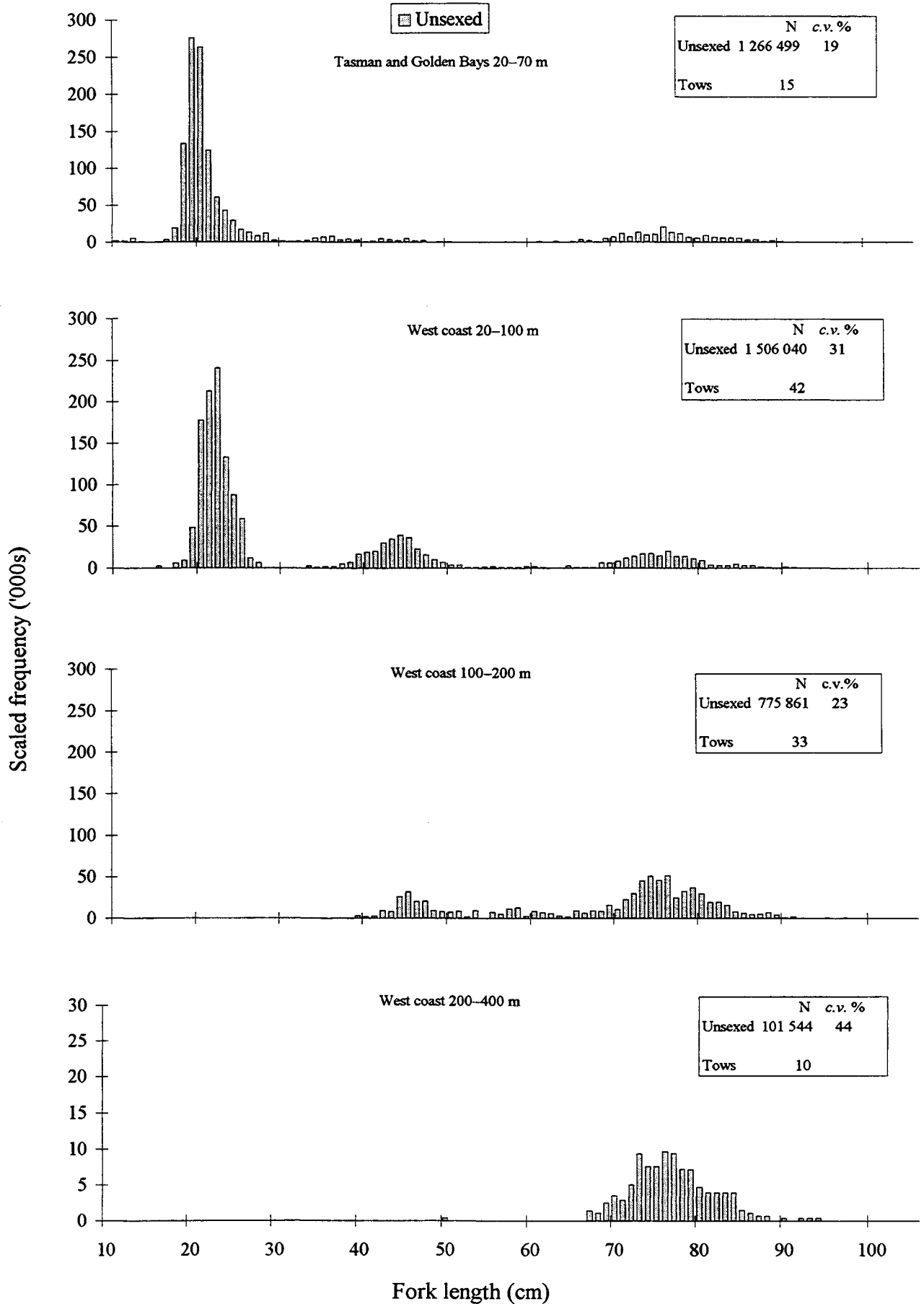
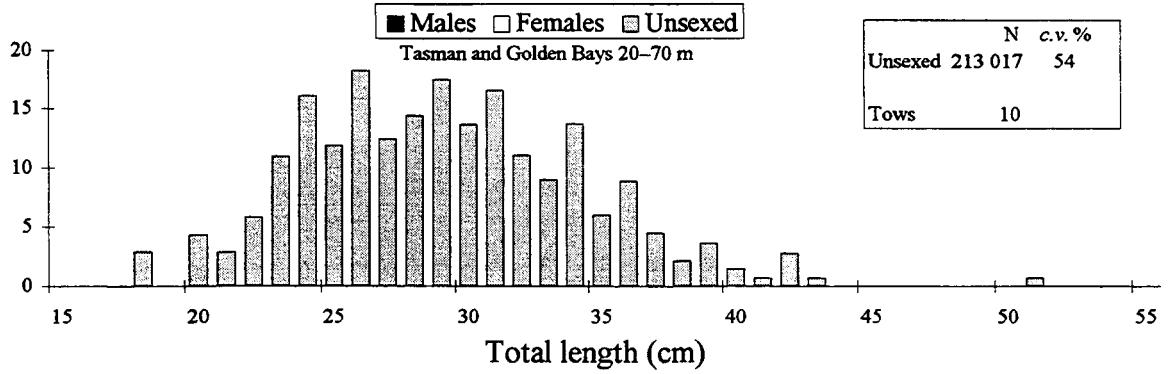


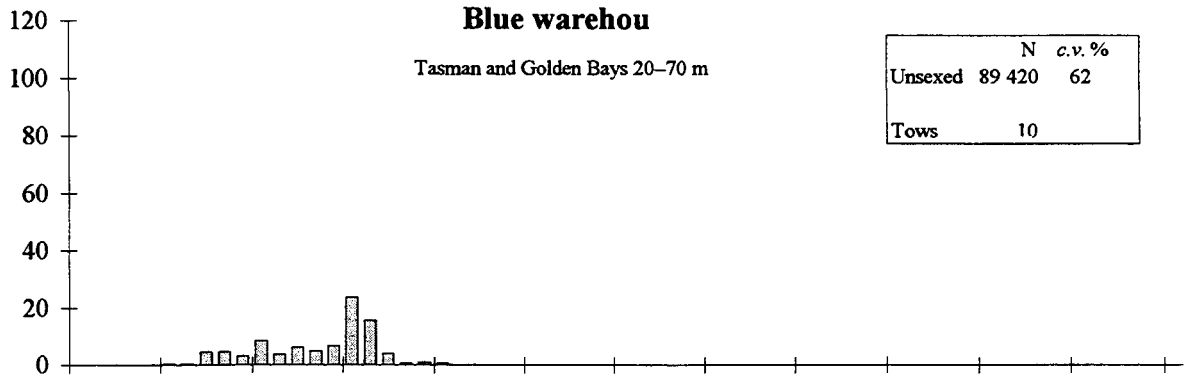
Figure 4— continued

### Blue cod

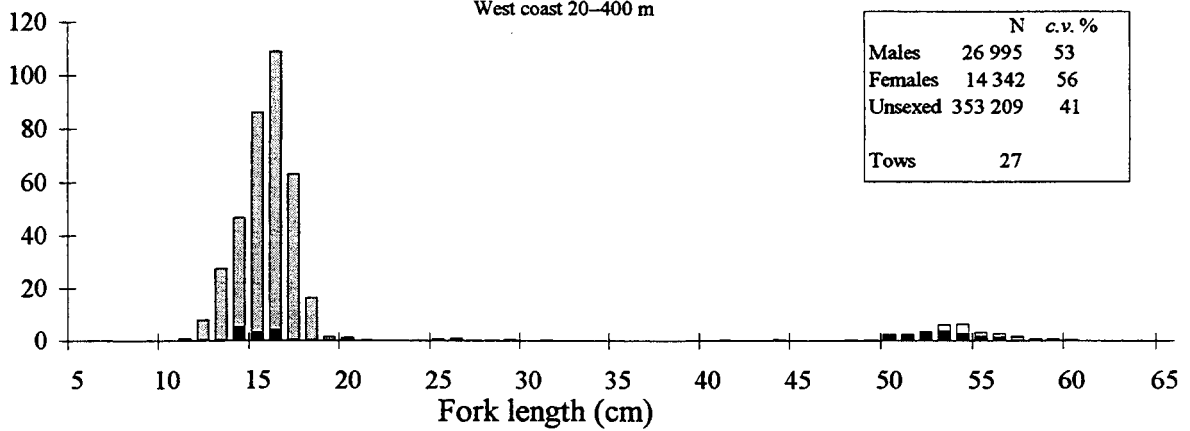


Scaled frequency ('000s)

### Blue warehou

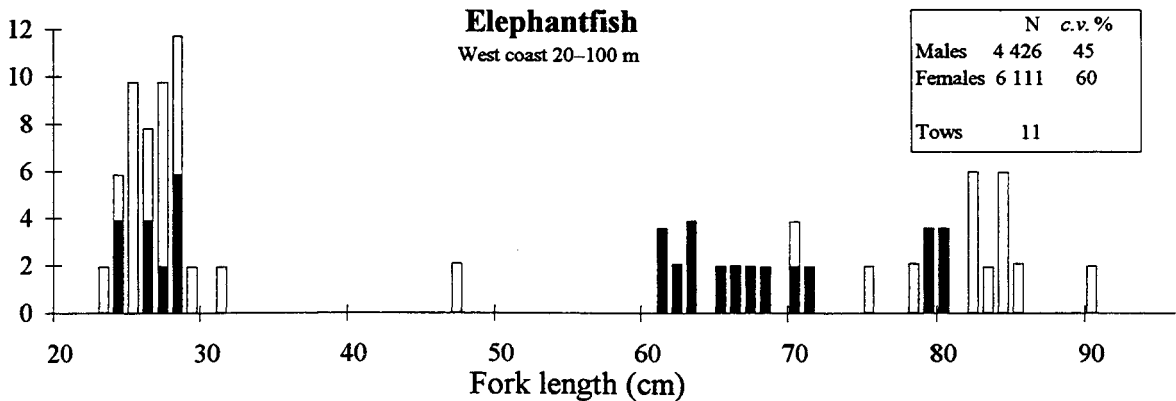


### West coast 20-400 m

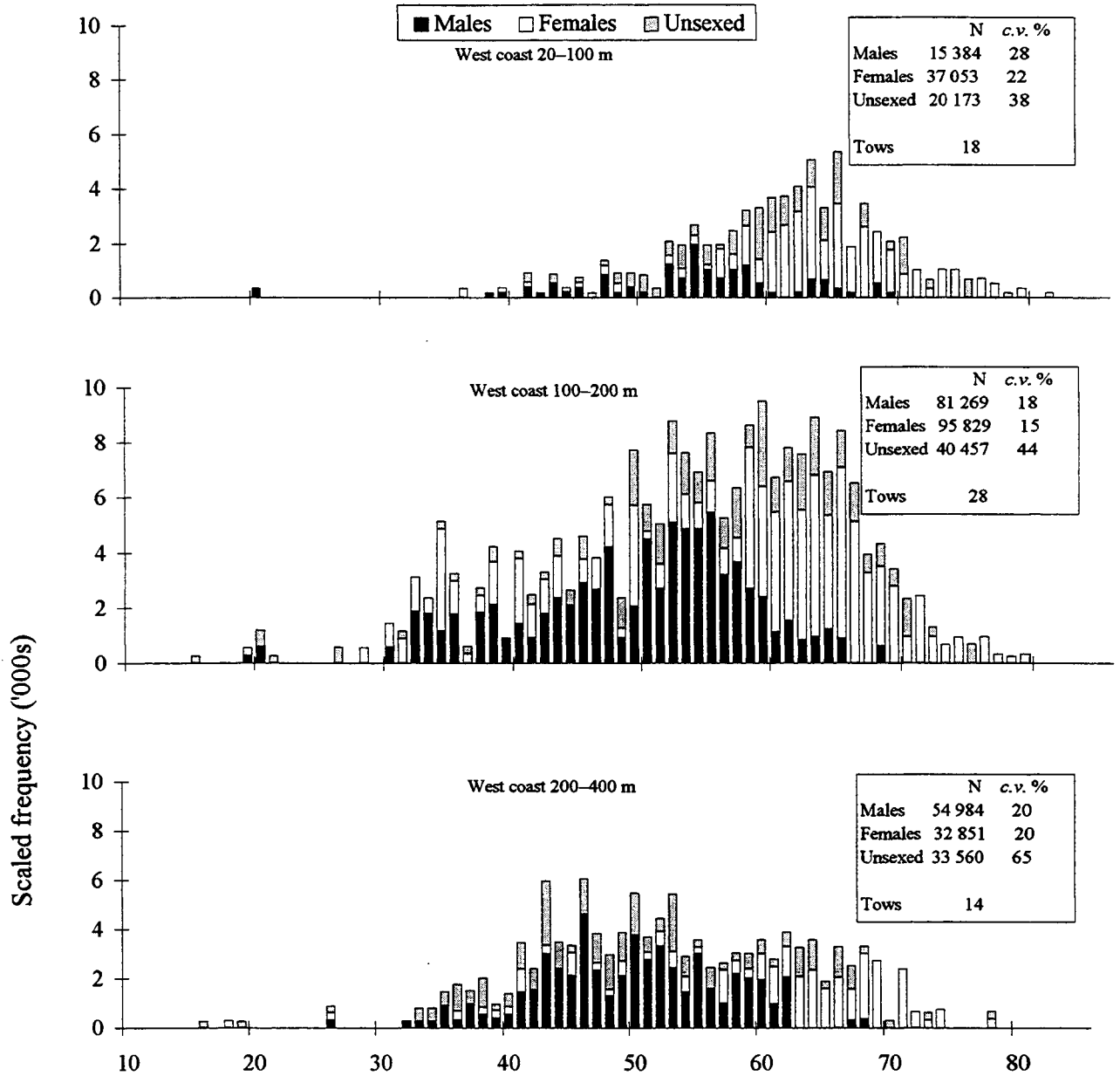


Scaled frequency ('00s)

### Elephantfish



### Giant stargazer



### Hake

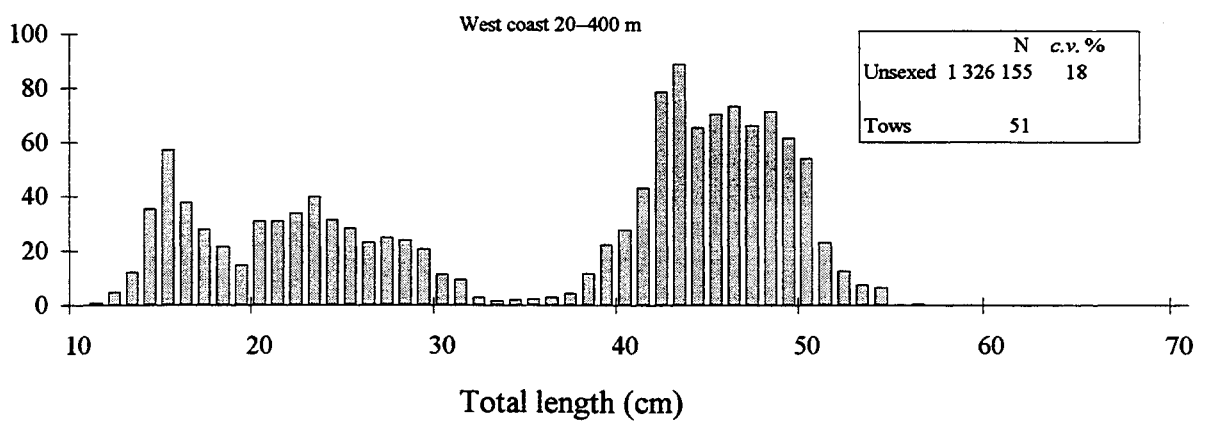
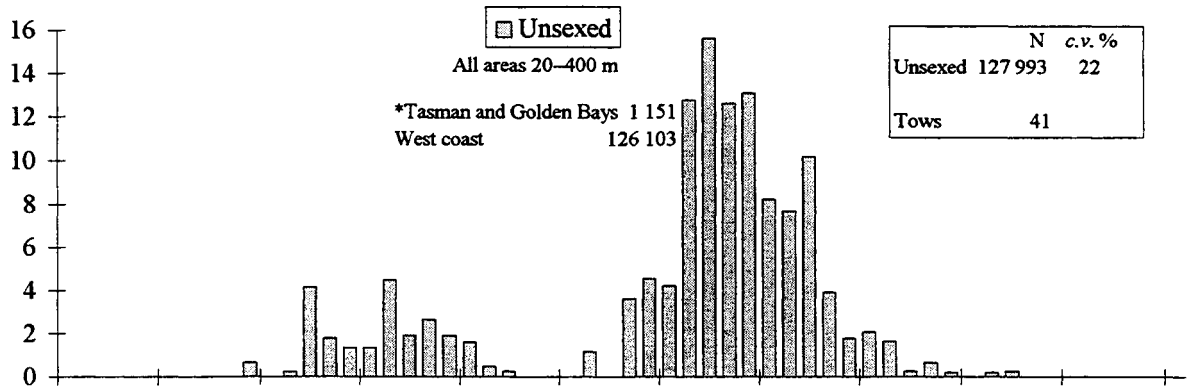


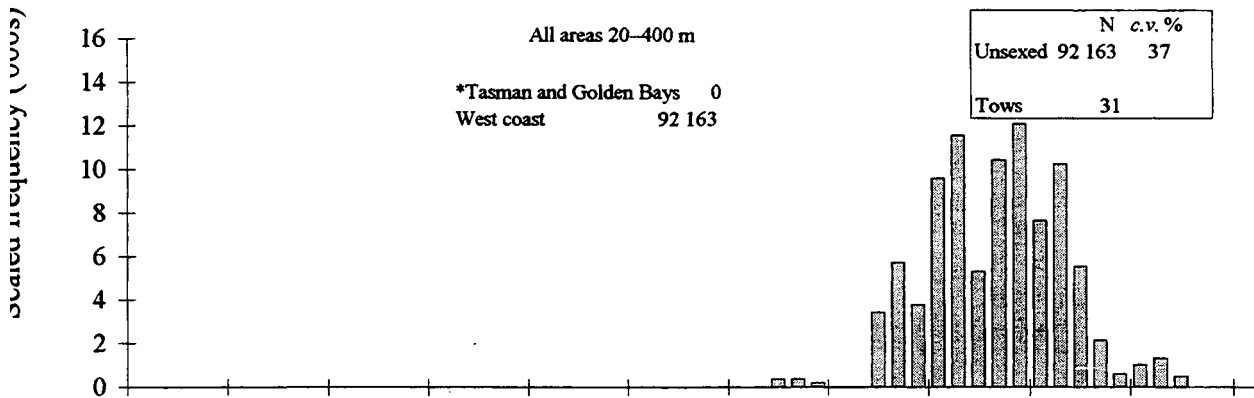
Figure 4— continued

## Jack mackerels

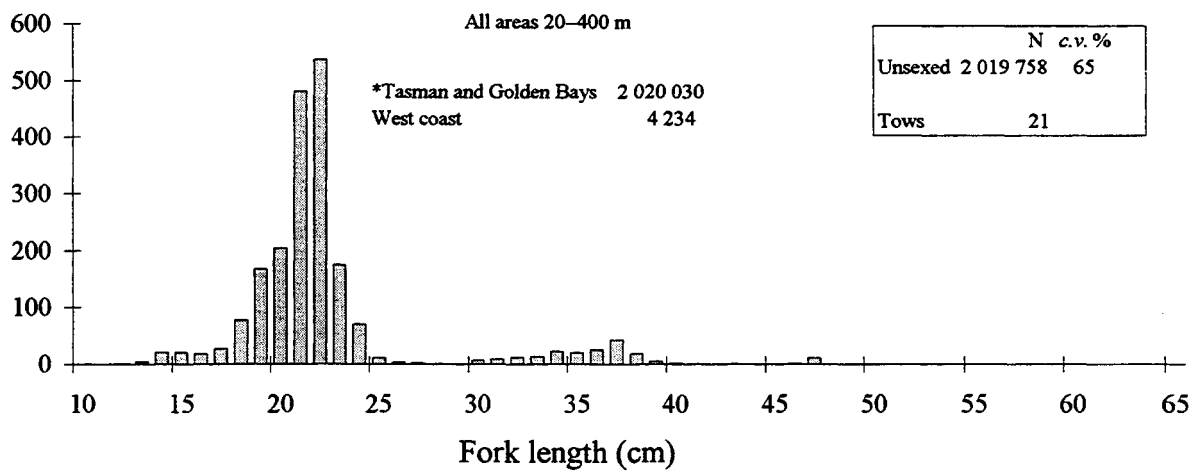
### *Trachurus declivis*



### *T. murphyi*



### *T. novaezelandiae*



\*Estimated population size for each subarea

# Ling

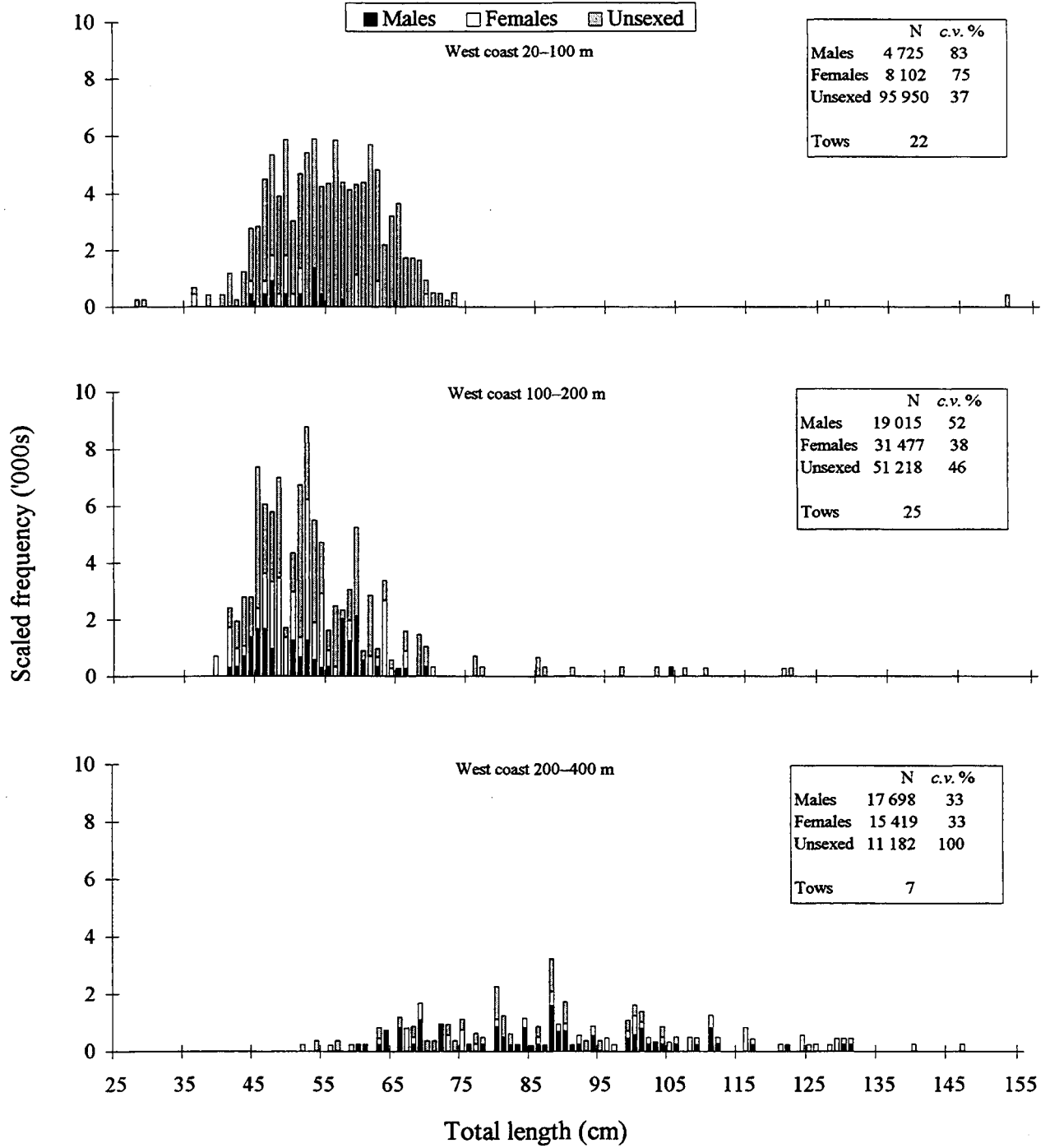


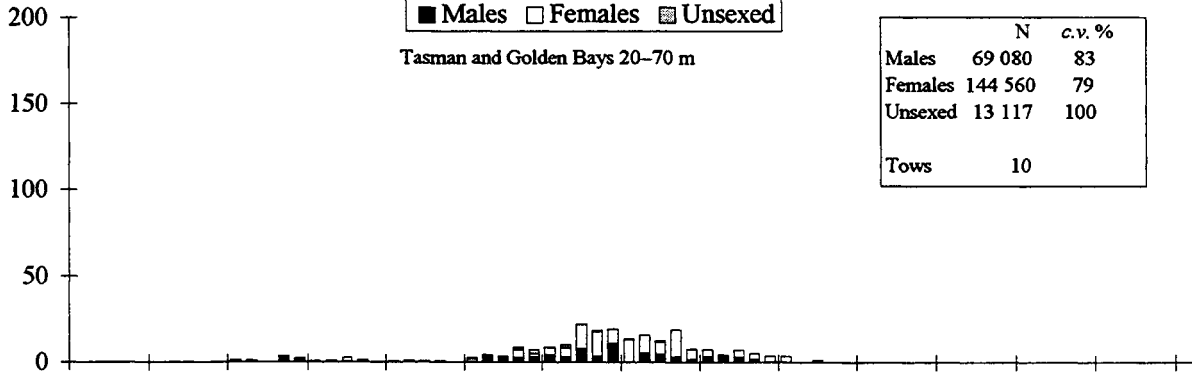
Figure 4— continued

## Red cod

Males
  Females
  Unsexed

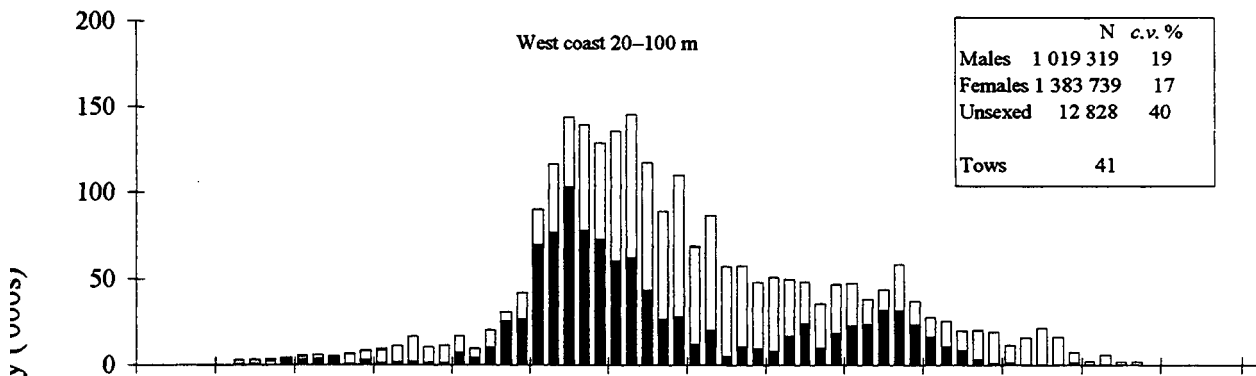
Tasman and Golden Bays 20–70 m

	N	c.v. %
Males	69 080	83
Females	144 560	79
Unsexed	13 117	100
Tows	10	



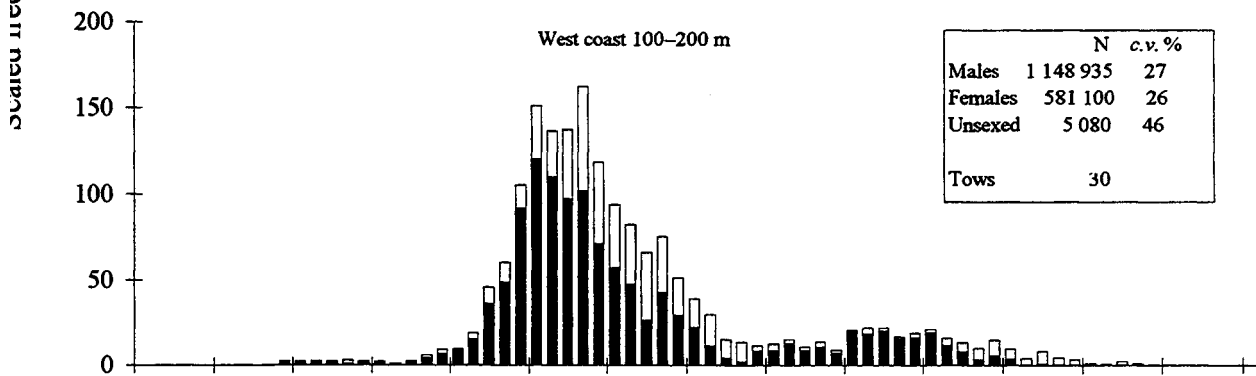
West coast 20–100 m

	N	c.v. %
Males	1 019 319	19
Females	1 383 739	17
Unsexed	12 828	40
Tows	41	



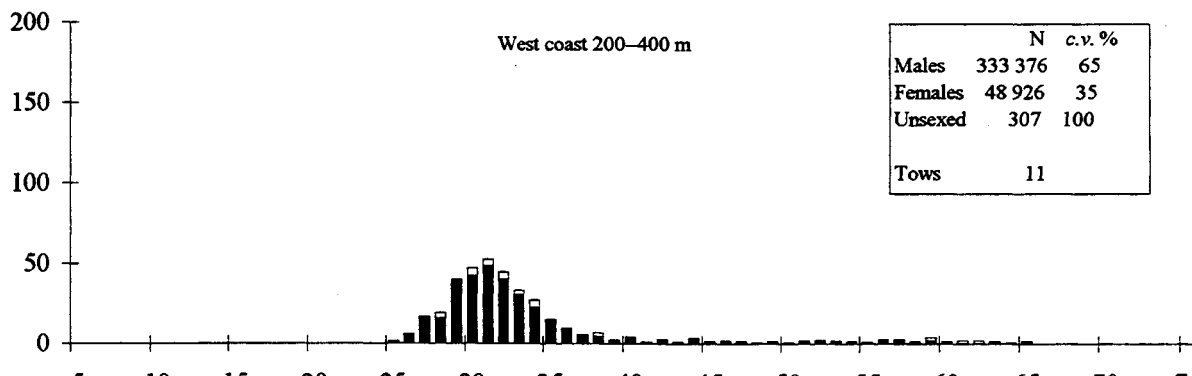
West coast 100–200 m

	N	c.v. %
Males	1 148 935	27
Females	581 100	26
Unsexed	5 080	46
Tows	30	



West coast 200–400 m

	N	c.v. %
Males	333 376	65
Females	48 926	35
Unsexed	307	100
Tows	11	



Total length (cm)

### Red gurnard

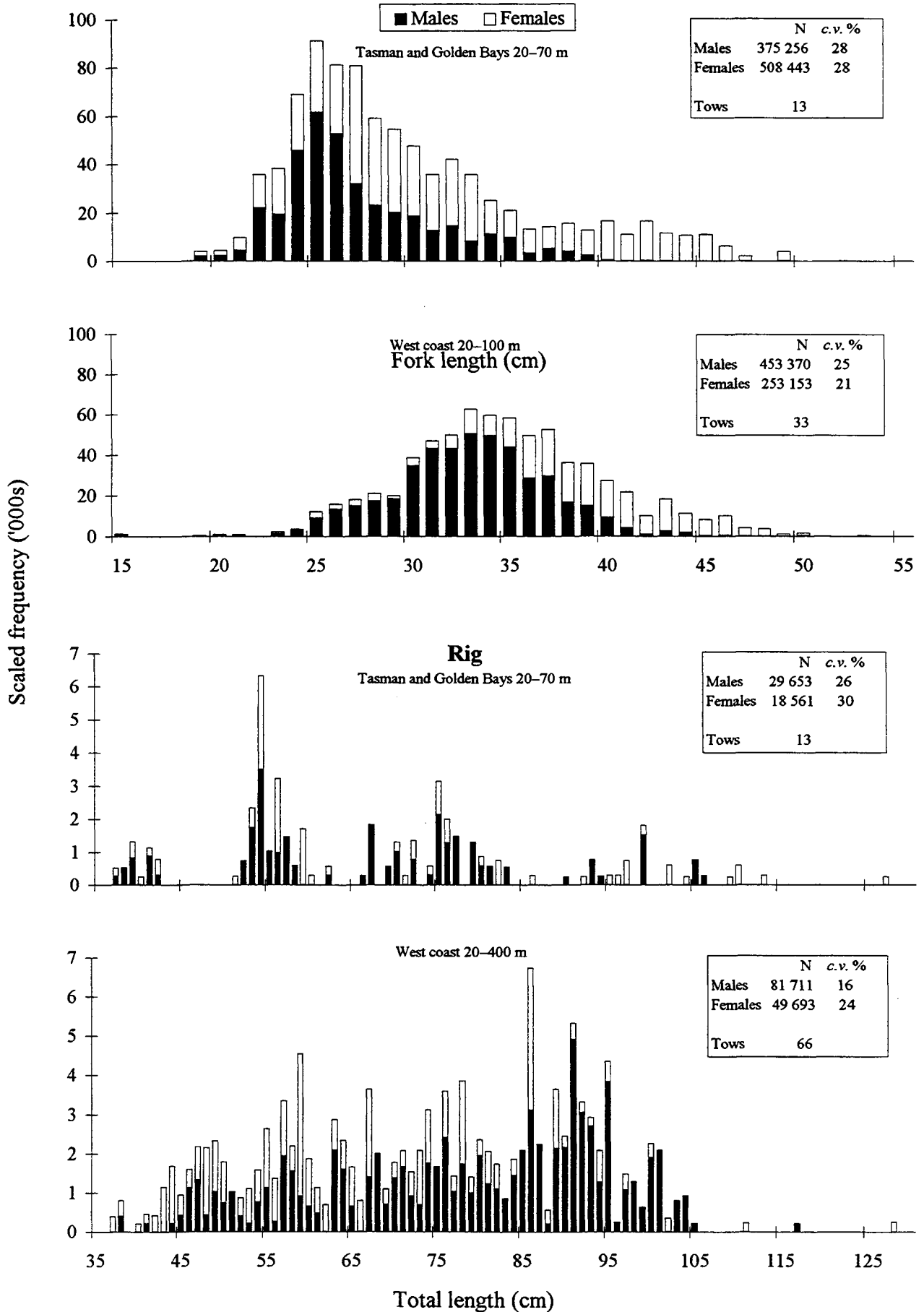


Figure 4— continued

### School shark

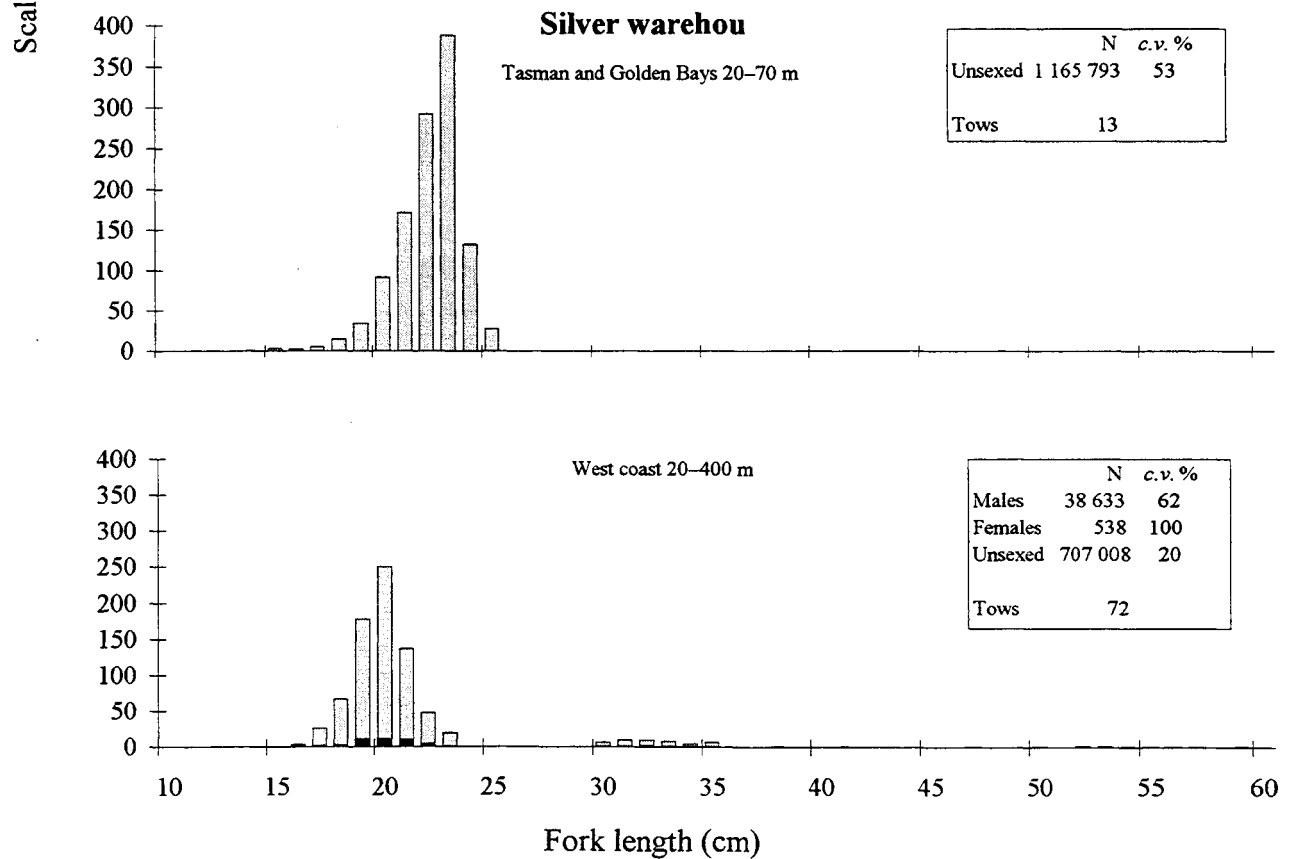
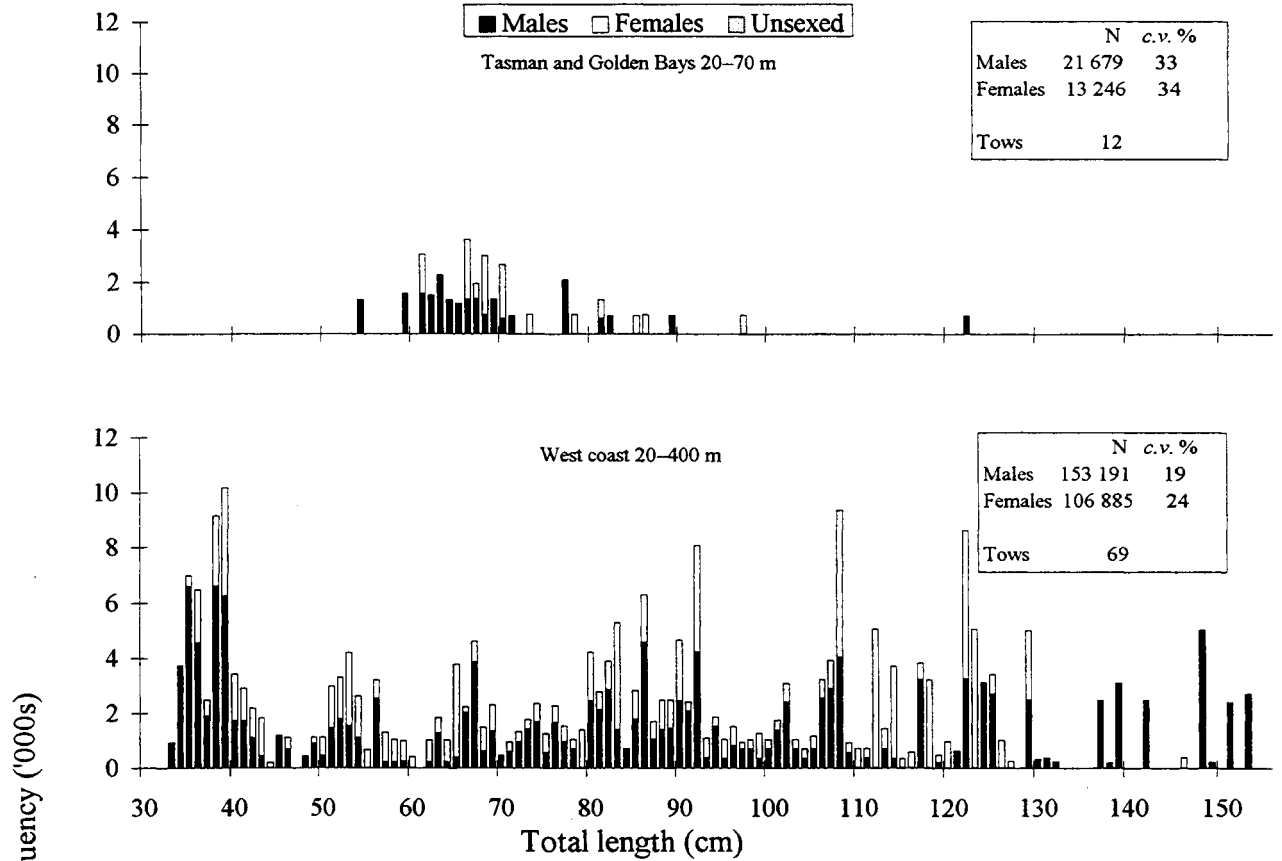


Figure 4: (continued)

### Tarakihi

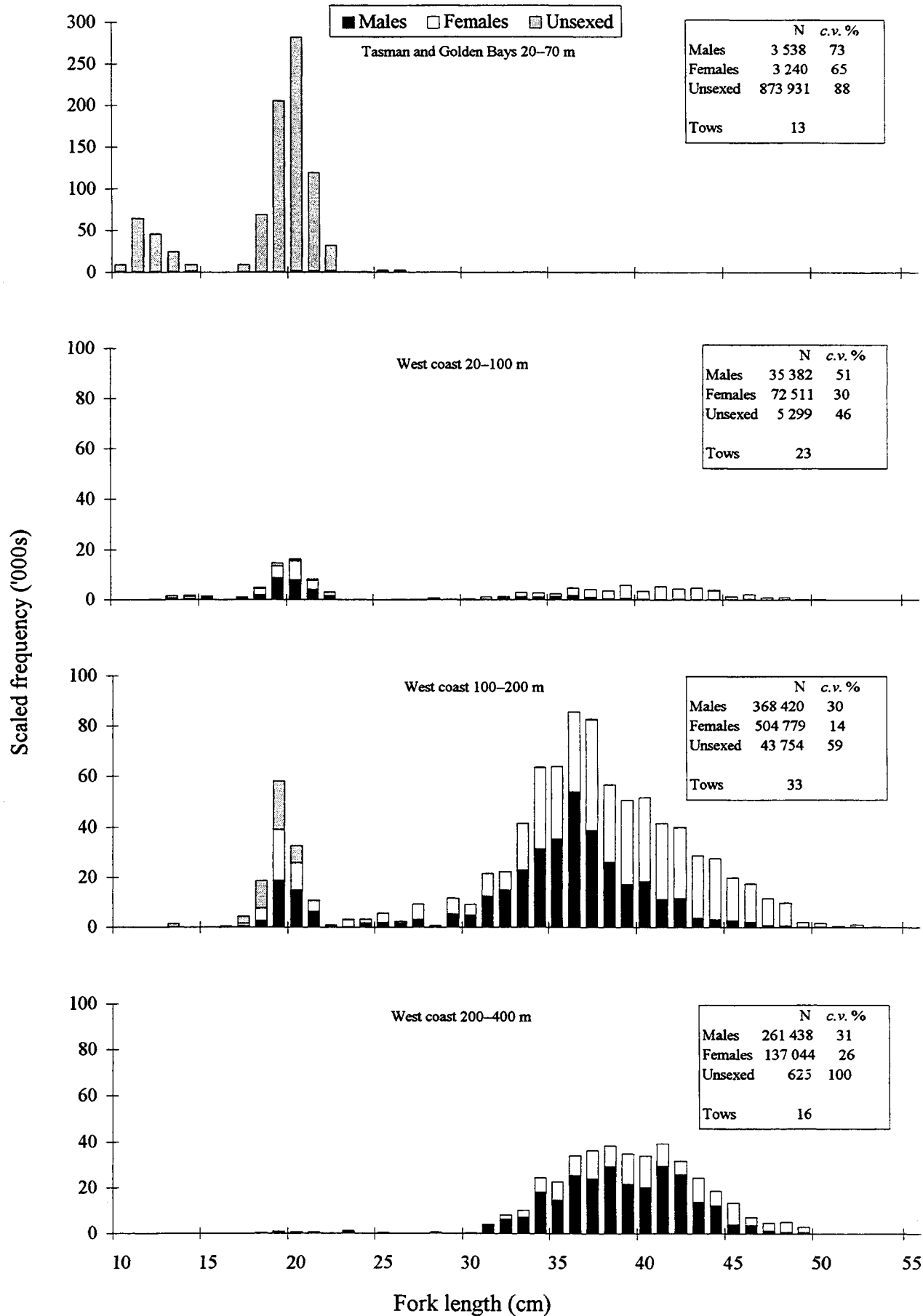


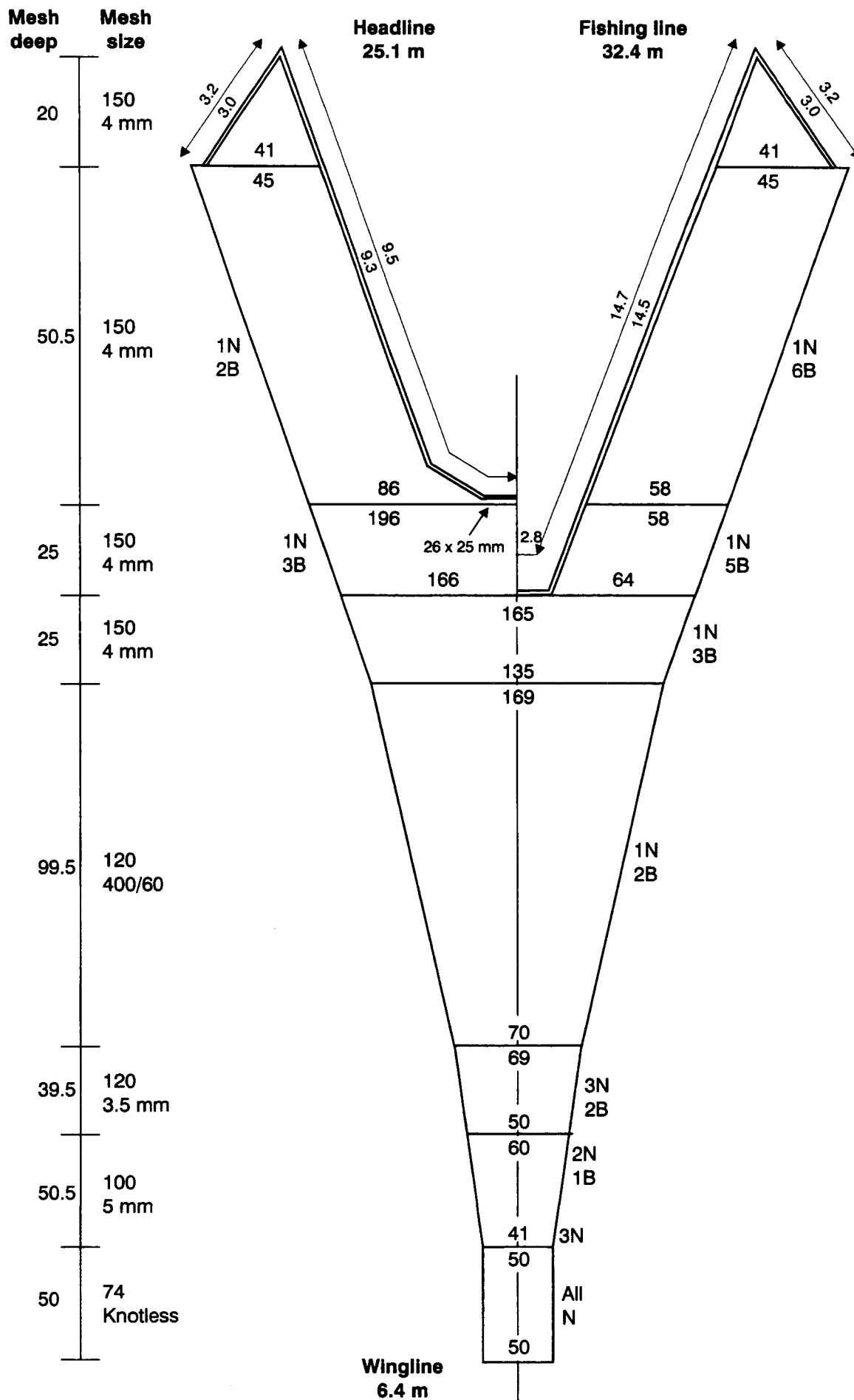
Figure 4— continued

## Appendix 1: Bottom trawl net plan and gear specification

Trawl warp:		16 mm, 6 x 19 PPC
Trawl doors - rectangular vees:		3.4 m <sup>2</sup> , 540 kg (with added weight)
Backstrop length:		7.5 m
Sweep length:		55 m
Bridle length:		55 m
Estimated doorspread (after Koyama, 1974):		79 m *
Estimated wingend spread:		12.5 m *
Estimated angle of attack of sweeps and bridles:		16° *
Flotation	wing:	10 x 300 mm diameter rated to 500 m depth buoyancy 10.8 kg
	centre:	16 x 280 mm diameter rated at 600 m depth buoyancy 8.5 kg
	total:	244 kg
Ground rope specifications	wire rope:	35 m      18 mm    6 x 19
	rubber rollers:	42          100 x 160 mm
	rubber rollers:	4            120 x 200 mm
	rubber disc spacers:	440        40 x 80 mm
	steel balls:	12          12 kg each
	chain droppers:	50
	total weight:	270 kg

\* Estimated during gear trials using the same trawl gear configuration during 1991–94.

Appendix 1 — continued



**Appendix 2a: Length-weight coefficients  $a$  and  $b$  calculated using the geometric mean functional relationship from data collected during the 1994 survey, and used to scale length frequencies and calculate biomass above a minimum size\***

	$a$	$b$	$N$	Range (cm)
Giant stargazer	0.0169	3.06	859	14–78
Red cod	0.0461	2.62	1 712	13–71
Red gurnard	0.0048	3.24	657	17–51
Tarakihi	0.0329	2.89	1 500	10–51

**Appendix 2b: Additional length-weight coefficients  $a$  and  $b$  used to scale length frequencies and calculate biomass above a minimum size\***

	$a$	$b$	Source	$N$	Range (cm)
Arrow squid	0.0290	3.00	Annala (1995)	–	> 11
Blue cod	0.0076	3.20	TAN9301	75	27–59
Blue warehou	0.0191	3.03	TAN9301	281	29–67
Barracouta	0.0052	2.98	TAN9301	919	15–96
Elephantfish	0.0105	2.99	TAN9301	62	58–92
Hoki	0.0046	2.88	SHI8301	525	22–110
Hake	0.0018	3.31	TAN9401	444	39–125
Ling	0.0010	3.36	SHI8302	398	45–135
Rig	0.0005	3.47	Francis (unpub.)	120	65–137
School shark	0.0070	2.91	Seabrook-Davidson (unpub.)	804	30–166
Silver warehou	0.1398	3.08	TAN9401	160	22–56
<i>Trachurus declivis</i>	0.0165	2.93	COR9001	200	15–53
<i>T. murphyi</i>	0.0255	2.77	TAN9301	90	44–62
<i>T. novaezelandiae</i>	0.1630	2.92	COR9001	200	15–40

\* Determined from  $W = aL^b$ , where  $W$  = weight (g),  $L$  = length (cm);  $N$  = sample size.

**Appendix 3: Summary of station data**

Station	Stratum	Date	Time	Start of tow			End of tow			Gear depth (m)		Distance trawled (n. miles)	Surface temp (°C)
				°	'	S	°	'	E	°	'		
1	19	22-Mar-92	1446	40	52.77	173	10.37	40	49.84	173	10.54	42	17.4
2	17	23-Mar-92	0644	40	43.36	172	49.00	40	43.65	172	52.44	26	15.6
3	17	23-Mar-92	0826	40	46.28	172	55.10	40	43.99	172	58.04	32	16.4
4	17	23-Mar-92	1029	40	42.35	172	55.69	40	41.43	172	59.37	37	16.6
5	19	23-Mar-92	1315	40	43.89	173	07.52	40	40.98	173	08.27	45	16.3
6	19	23-Mar-92	1618	40	38.99	173	31.47	40	41.12	173	34.36	62	15.7
7	2	24-Mar-92	0640	40	50.37	171	50.59	40	48.82	171	54.06	131	14.3
8	2	24-Mar-92	0839	40	47.28	171	53.06	40	44.13	171	53.05	143	14.2
9	2	24-Mar-92	1104	40	40.08	172	03.37	40	37.10	172	03.93	129	14.2
10	1	24-Mar-92	1326	40	36.02	172	12.48	40	33.75	172	14.97	93	14.0
11	1	24-Mar-92	1624	40	32.04	172	33.20	40	30.36	172	36.79	53	14.8
12	19	25-Mar-92	0640	40	46.92	173	19.04	40	49.91	173	19.11	46	15.4
13	18	25-Mar-92	0926	41	00.31	173	28.97	41	02.61	173	26.37	42	16.4
14	18	25-Mar-92	1104	41	03.75	173	23.18	41	06.00	173	20.59	34	16.6
15	18	25-Mar-92	1244	41	05.65	173	15.96	41	07.30	173	12.73	31	16.7
16	1	26-Mar-92	0735	41	08.68	171	58.31	41	13.22	171	58.47	75	14.4
17	19	29-Mar-92	1737	40	46.62	173	10.10	40	48.62	173	12.98	46	16.2
18	5	30-Mar-92	1023	41	29.62	171	52.90	41	27.49	171	55.86	37	14.2
19	5	30-Mar-92	1211	41	26.01	171	54.11	41	23.85	171	57.02	39	14.3
20	5	30-Mar-92	1531	41	34.20	171	40.43	41	32.69	171	44.13	49	14.2
21	2	31-Mar-92	0642	41	06.70	171	15.49	41	09.34	171	13.75	182	16.1
22 *	6	31-Mar-92	0934	41	17.91	171	02.30	41	19.10	170	58.77	191	15.7
23	6	31-Mar-92	1341	41	18.33	171	12.84	41	20.17	171	09.70	181	15.4
24	6	31-Mar-92	1551	41	22.39	171	16.46	41	24.36	171	13.42	163	14.9
25	6	1-Apr-92	1205	41	35.43	171	06.90	41	37.66	171	04.05	158	14.4
26	8	1-Apr-92	1429	41	47.53	171	01.41	41	49.89	170	58.93	171	14.2
27	8	1-Apr-92	1641	41	56.80	170	58.28	41	58.85	170	55.21	183	14.4
28	15	3-Apr-92	0829	43	46.51	168	38.70	43	46.06	168	42.67	144	12.8
29	14	3-Apr-92	1230	43	48.73	168	54.98	43	47.91	168	59.09	60	13.4
30	14	3-Apr-92	1410	43	46.88	169	03.38	43	45.37	169	06.90	60	12.3

Appendix 3—continued

Station	Stratum	Date	Time	Start of tow		End of tow		Gear depth (m)		Distance trawled (n. miles)	Surface temp (°C)
				° ' S	° ' E	° ' S	° ' E	Min.	Max.		
31	15	3-Apr-92	1625	43 36.05	169 13.87	43 33.32	169 15.97	130	150	3.05	12.6
32	15	4-Apr-92	0920	43 33.72	169 12.30	43 30.65	169 12.74	147	204	3.07	12.7
33	16	4-Apr-92	1145	43 31.10	169 10.04	43 28.58	169 12.20	337	364	2.97	13.0
34	15	4-Apr-92	1353	43 29.56	169 18.73	43 28.08	169 22.41	124	133	3.05	13.1
35	15	4-Apr-92	1540	43 26.94	169 22.23	43 24.40	169 21.15	137	220	2.66	12.8
36	15	5-Apr-92	0653	43 24.76	169 35.32	43 22.26	169 37.45	69	114	2.94	12.9
37	16	5-Apr-92	0915	43 17.74	169 39.72	43 15.81	169 36.13	311	313	3.24	14.3
38	13	5-Apr-92	1206	43 12.39	169 44.90	43 09.60	169 43.76	225	234	2.91	13.4
39	12	5-Apr-92	1418	43 11.54	169 47.80	43 13.99	169 50.33	169	197	3.07	13.4
40	12	5-Apr-92	1618	43 11.63	169 53.11	43 08.89	169 55.03	163	165	3.07	13.0
41	16	6-Apr-92	0700	43 26.95	169 15.66	43 25.43	169 18.64	261	308	2.65	14.0
42	14	6-Apr-92	0948	43 24.53	169 38.95	43 24.01	169 42.98	52	66	2.98	12.6
43	14	6-Apr-92	1147	43 23.12	169 49.61	43 22.20	169 53.64	22	25	3.07	12.3
44	15	6-Apr-92	1341	43 19.92	169 50.79	43 17.67	169 53.59	100	100	3.03	12.9
45	14	6-Apr-92	1545	43 16.05	169 55.49	43 14.08	169 58.78	80	95	3.10	13.4
46	8	7-Apr-92	0650	41 58.11	171 12.65	41 55.04	171 13.21	104	116	3.09	13.0
47	8	7-Apr-92	1525	41 52.57	171 14.99	41 55.44	171 13.54	111	116	3.05	13.9
48	12	8-Apr-92	0645	43 06.10	169 55.48	43 03.26	169 57.13	167	169	3.08	12.9
49	13	8-Apr-92	2056	43 02.71	169 50.53	43 01.32	169 54.38	183	185	3.13	13.3
50	13	8-Apr-92	1101	42 58.99	169 56.58	42 58.29	169 59.56	191	215	2.31	13.1
51	12	8-Apr-92	1452	43 03.31	170 03.02	43 03.31	170 05.42	123	150	3.00	13.1
52	12	8-Apr-92	1701	42 58.70	170 07.58	42 57.70	170 11.50	121	133	3.00	13.4
53	11	9-Apr-92	0641	42 58.20	170 17.60	42 57.00	170 21.30	48	68	3.00	12.8
54	11	9-Apr-92	0846	42 52.30	170 29.40	42 50.20	170 31.10	33	36	3.00	12.4
55	11	9-Apr-92	1038	42 50.00	170 32.65	42 49.30	170 36.50	34	37	3.00	12.6
56	11	9-Apr-92	1257	42 45.30	170 45.60	42 43.66	170 48.92	61	62	3.06	12.8
57	11	9-Apr-92	1616	42 44.22	170 42.24	42 42.33	170 39.41	124	129	2.80	13.5
58	12	10-Apr-92	0636	42 44.79	170 21.31	42 46.85	170 18.44	112	122	2.96	—
59	13	10-Apr-92	0929	42 48.86	170 04.44	42 45.73	170 04.30	188	202	3.13	15.1
60	13	10-Apr-92	1149	42 43.26	170 03.99	42 40.20	170 04.40	246	324	3.06	15.2

Appendix 3—continued

Station	Stratum	Date	Time	Start of tow		End of tow		Gear depth (m)		Distance trawled (n. miles)	Surface temp (°C)
				° ' S	° ' E	° ' S	° ' E	Min.	Max.		
61	12	10-Apr-92	1426	42 37.29	170 13.54	42 36.29	170 17.31	180	200	2.95	14.6
62	9	11-Apr-92	0652	41 59.14	170 36.33	41 56.62	170 39.14	283	327	3.27	15.6
63	9	11-Apr-92	0914	41 52.78	170 35.94	41 50.08	170 37.68	355	397	2.99	15.6
64	9	11-Apr-92	1144	41 50.62	170 34.77	41 47.72	170 35.70	395	413	2.97	15.4
65	9	11-Apr-92	1342	41 47.89	170 37.05	41 48.04	170 40.96	276	368	2.92	15.5
66	9	11-Apr-92	1606	41 46.26	170 35.33	41 43.56	170 36.90	379	414	2.94	15.4
67	19	12-Apr-92	2249	40 46.48	173 29.42	40 49.59	173 29.19	52	52	3.10	15.1
68	7	15-Apr-92	1124	42 11.70	171 09.30	42 14.08	171 07.44	66	73	2.95	15.7
69	7	15-Apr-92	1324	42 18.63	171 07.59	42 21.33	171 06.66	43	50	2.96	15.4
70	7	15-Apr-92	1523	42 21.67	171 03.89	42 24.52	171 02.92	72	73	3.02	15.4
71*	9	16-Apr-92	1020	41 54.71	170 36.00	41 57.42	170 35.42	370	390	2.79	14.7
72	9	16-Apr-92	1217	42 00.50	170 33.20	42 03.50	170 33.26	391	410	2.90	15.9
73	9	16-Apr-92	1416	42 06.06	170 33.55	42 09.26	170 33.68	380	387	3.20	15.5
74	9	16-Apr-92	1627	42 10.71	170 32.90	42 13.65	170 32.51	378	393	2.95	—
75*	9	17-Apr-92	0713	42 14.90	170 35.00	42 11.93	170 36.38	284	294	3.13	15.3
76	8	17-Apr-92	1040	42 05.18	171 01.30	42 07.66	170 59.31	161	169	2.89	13.7
77	8	17-Apr-92	1242	42 12.77	171 04.22	42 15.53	171 03.30	108	110	3.00	13.5
78	8	17-Apr-92	1448	42 31.47	171 01.03	42 24.28	170 59.99	109	110	2.98	13.7
79	8	17-Apr-92	1656	42 21.36	170 52.09	42 24.04	170 52.06	164	170	2.75	13.7
80	13	18-Apr-92	0705	42 31.90	170 42.79	42 29.62	170 41.08	246	249	2.76	13.7
81	12	18-Apr-92	1100	42 39.21	170 19.34	42 40.22	170 15.56	140	155	3.00	13.7
82	13	18-Apr-92	1420	42 54.34	169 56.81	42 57.07	169 56.56	294	320	2.73	13.7
83*	13	18-Apr-92	1657	42 56.27	170 00.87	42 55.74	170 01.04	210	215	0.65	13.7
84	13	19-Apr-92	0745	43 08.43	169 47.07	43 06.12	169 49.32	193	197	2.92	13.7
85	15	19-Apr-92	1022	43 15.99	169 49.85	43 13.87	169 52.16	160	163	2.78	13.7
86	11	19-Apr-92	1234	43 14.52	169 58.39	43 12.35	170 00.72	79	83	2.87	13.4
87	11	19-Apr-92	1436	43 08.20	170 05.67	43 06.26	170 08.20	60	71	2.91	13.3
88	12	20-Apr-92	0703	42 57.31	170 03.18	42 59.76	170 01.01	165	170	3.00	14.7
89	12	20-Apr-92	0911	42 59.42	169 59.23	43 01.92	169 57.18	174	176	3.00	14.9
90	12	20-Apr-92	1123	43 04.39	170 02.93	43 07.24	170 01.20	133	137	3.19	13.6

Appendix 3—continued

Station	Stratum	Date	Time	Start of tow		End of tow		Gear depth (m)		Distance trawled (n. miles)	Surface temp (°C)
				° ' S	° ' E	° ' S	° ' E	Min.	Max.		
91	11	20-Apr-92	1345	43 04.97	170 12.72	43 02.90	170 15.21	33	38	2.90	13.5
92	11	20-Apr-92	1610	42 55.69	170 24.41	42 53.11	170 26.01	44	49	3.00	13.7
93	7	21-Apr-92	0648	42 00.30	171 20.30	41 57.55	171 21.63	33	34	3.01	13.1
94	7	21-Apr-92	0834	41 56.90	171 18.20	41 53.99	171 19.61	59	61	3.03	13.3
95	7	21-Apr-92	1023	41 51.58	171 20.49	41 49.10	171 22.35	60	61	2.90	13.3
96	7	22-Apr-92	1546	41 46.34	171 22.25	41 48.54	171 19.27	74	93	3.05	13.6
97	12	23-Apr-92	0710	42 37.39	170 20.52	42 39.72	170 18.05	143	151	3.01	15.0
98	12	23-Apr-92	0910	42 42.20	170 13.16	42 44.31	170 11.02	149	154	2.73	14.2
99	12	23-Apr-92	1141	42 51.98	170 19.00	42 49.24	170 19.88	105	108	2.94	13.7
100	11	23-Apr-92	1331	42 47.81	170 21.90	42 45.46	170 23.87	97	100	2.90	13.8
101	11	23-Apr-92	1512	42 43.50	170 27.10	42 42.96	170 30.68	70	85	2.76	14.1
102	11	24-Apr-92	0653	42 52.25	170 36.39	42 51.43	170 40.20	29	30	3.05	13.0
103	11	24-Apr-92	0828	42 49.90	170 40.80	42 47.29	170 42.61	34	49	3.02	13.4
104	11	24-Apr-92	1058	42 41.88	170 51.09	42 40.17	170 54.10	59	61	2.90	13.1
105	11	24-Apr-92	1246	42 37.55	170 58.30	42 35.38	171 00.97	30	36	3.03	13.5
106	11	24-Apr-92	1444	42 31.99	171 02.91	42 29.42	171 04.45	32	33	2.92	13.5
107	7	25-Apr-92	0655	42 15.77	171 04.51	42 13.11	171 05.74	93	96	2.91	13.5
108	7	25-Apr-92	0912	42 15.97	171 11.19	42 13.20	171 12.55	30	33	3.06	13.5
109	7	25-Apr-92	1054	42 09.76	171 13.29	42 06.88	171 14.42	43	47	3.02	13.6
110	1	26-Apr-92	0653	41 15.55	172 02.88	41 12.61	172 02.62	41	49	3.12	14.2
111	1	26-Apr-92	0902	41 08.32	171 55.34	41 05.62	171 56.67	92	96	3.01	14.3
112	1	26-Apr-92	1044	41 05.34	172 01.20	41 02.50	172 01.96	67	68	3.03	14.2
113	1	26-Apr-92	1240	40 59.99	172 00.62	40 57.18	172 01.33	80	83	3.11	14.6
114	1	26-Apr-92	1420	40 54.47	172 02.20	40 51.84	172 03.59	86	87	2.96	14.6
115 *	19	27-Apr-92	0648	40 42.06	173 37.49	40 44.83	173 36.25	58	61	2.97	15.0
116	19	27-Apr-92	0845	40 49.13	173 33.49	40 51.50	173 36.40	54	59	3.02	15.0
117	19	27-Apr-92	1055	40 54.50	173 45.29	40 55.27	173 41.32	45	48	3.15	15.4
118	18	28-Apr-92	0959	41 06.06	173 26.91	41 04.66	173 30.22	32	34	2.96	15.6

\*, Denotes station not used for biomass calculations

—, No data

**Appendix 4: Catch (kg) of the 10 most abundant commercial species at each station (species codes are given in Table 2)**

Station	RCO	SPD	BAR	SQU	STA	TAR	GUR	SCH	HAK	HOK	Total	All species
1	7.1	119.3	21.9	37.2	4.2	148.1	53.3	0.0	5.1	0.0	396.2	793.0
2	0.8	28.2	33.9	3.3	0.0	1.4	41.3	1.0	1.6	0.0	111.5	307.5
3	2.5	26.0	29.4	5.3	0.1	1.0	26.5	0.9	1.3	0.0	93.0	449.3
4	0.5	131.9	21.5	8.2	0.2	0.8	10.8	15.5	1.4	0.1	190.9	347.2
5	174.2	156.5	51.9	21.5	2.0	15.0	7.1	1.0	1.0	0.5	430.7	730.0
6	0.1	73.1	112.7	29.0	0.5	0.1	0.4	15.4	0.0	0.0	231.3	319.7
7	0.6	247.0	95.9	264.1	0.0	33.3	0.0	83.2	0.0	0.0	724.1	770.9
8	69.0	171.5	21.5	87.8	0.0	35.6	0.0	35.8	0.0	0.0	421.2	493.4
9	0.0	107.1	40.2	79.7	0.0	0.0	0.0	0.0	0.0	0.0	227.0	287.5
10	0.0	60.5	4.1	27.7	0.0	0.0	0.7	3.1	0.0	0.0	96.1	128.9
11	4.5	66.1	379.8	22.7	0.0	0.3	0.0	0.0	0.0	0.0	473.4	613.1
12	9.6	51.3	46.3	42.7	0.9	0.8	6.9	14.9	0.0	0.0	173.4	314.0
13	0.0	22.4	70.9	63.4	0.7	0.0	8.7	16.3	0.0	0.0	182.4	262.9
14	0.0	11.4	207.4	15.7	0.0	0.1	99.7	1.5	0.8	0.0	336.6	497.7
15	0.6	1.4	22.8	6.1	0.0	0.4	72.3	0.0	0.0	0.0	103.6	178.9
16	598.5	91.2	83.6	7.9	0.0	0.8	119.5	2.5	117.7	8.6	1 030.3	1 327.7
17	10.3	210.9	163.9	27.8	1.3	2.9	28.8	2.3	0.0	15.3	463.5	545.6
18	49.8	14.0	5.3	0.0	0.0	0.0	18.8	6.5	1.0	1.5	96.9	161.6
19	43.5	6.1	0.4	0.0	0.0	0.0	16.1	3.6	0.8	0.1	70.6	90.3
20	61.2	3.6	0.5	0.0	0.0	0.0	7.2	0.7	0.3	0.3	73.8	139.9
21	0.0	0.0	0.0	90.7	0.0	12.2	0.0	98.6	0.0	0.0	201.5	241.9
22	0.0	0.0	0.0	3.8	4.8	2.0	0.0	15.3	0.0	0.0	25.9	66.2
23	0.0	5.3	0.0	26.9	0.0	25.0	0.0	23.7	0.0	0.0	80.9	121.1
24	1.0	65.9	5.9	198.0	2.0	4.9	0.0	0.0	0.0	0.0	277.7	332.9
25	0.0	56.0	1.2	10.1	0.0	2.9	0.0	3.8	0.0	0.0	74.0	183.0
26	0.0	338.7	20.4	174.4	8.0	11.3	2.0	26.7	0.0	0.0	581.5	613.8
27	0.0	219.1	33.6	163.5	73.9	20.2	0.0	30.6	0.0	0.0	540.9	565.9
28	0.0	0.0	60.1	20.9	38.7	456.8	0.0	17.2	0.0	0.0	593.7	786.6
29	5.7	72.3	14.9	2.2	173.7	49.3	25.9	4.2	0.0	0.2	348.4	412.1
30	56.8	57.1	117.7	2.4	178.5	4.6	64.2	0.0	2.5	15.7	499.5	751.7
31	97.0	0.0	0.0	16.1	95.1	101.9	0.0	4.8	0.0	1.6	316.5	388.9
32	151.9	11.8	27.9	52.0	46.7	163.6	0.0	28.1	0.0	7.4	489.4	939.5
33	7.9	0.0	0.0	1.2	15.4	0.0	0.0	0.0	27.5	256.7	308.7	693.1
34	204.5	0.0	0.0	15.4	136.5	49.6	0.0	6.9	0.0	0.0	412.9	454.5
35	24.7	4.0	24.6	33.2	52.1	31.3	0.0	10.9	0.0	18.8	199.6	292.4
36	104.1	25.9	115.0	37.6	136.8	13.3	0.5	4.0	0.0	0.0	437.2	519.3
37	104.7	0.0	6.5	25.6	23.6	323.2	0.0	32.7	1.5	198.2	716.0	1 362.0
38	49.7	5.0	36.4	46.3	50.5	124.0	0.0	19.3	4.9	69.7	405.8	741.2
39	28.7	156.7	353.0	27.9	97.7	111.3	0.0	36.2	7.1	13.2	831.8	924.5
40	29.7	68.2	44.2	46.2	212.5	50.3	0.0	50.6	19.5	0.0	521.2	670.5
41	38.0	0.0	0.0	3.0	0.0	2.1	0.0	10.3	0.0	93.8	147.2	450.2
42	55.8	19.5	72.4	1.5	122.9	4.4	0.0	0.0	0.0	0.0	276.5	423.7
43	20.4	668.6	3.7	0.9	10.3	0.0	78.6	9.9	0.0	0.0	792.4	943.2
44	59.1	120.9	151.0	19.2	298.6	36.5	0.0	15.6	38.6	14.8	754.3	928.5
45	94.2	71.5	131.1	40.0	153.9	14.2	0.0	0.0	41.8	8.4	555.1	806.4
46	98.9	37.2	4.5	15.8	19.6	18.1	3.9	0.0	12.4	2.1	212.5	288.1
47	33.9	48.9	10.4	11.0	2.7	5.0	5.4	0.8	1.2	1.0	120.3	194.3
48	47.4	213.4	9.8	119.0	264.7	52.5	0.0	57.2	20.9	43.2	828.1	1 034.6
49	1.3	50.1	62.4	110.2	94.4	176.6	0.0	48.6	0.0	0.0	543.6	783.7
50	4.4	5.8	8.2	13.3	289.9	34.6	0.0	37.1	0.0	0.6	393.9	5 541.1
51	22.6	187.8	63.3	172.6	35.0	16.2	0.0	33.7	105.1	12.4	648.7	894.0
52	45.4	19.0	11.8	45.3	12.2	48.8	0.0	2.4	43.4	0.9	229.2	392.4
53	147.7	49.6	144.7	29.3	32.2	17.1	14.0	5.7	25.3	0.6	466.2	558.4
54	116.6	60.7	12.6	2.8	0.0	0.0	26.3	1.3	1.0	0.0	221.3	323.2
55	394.7	104.7	7.0	3.7	0.0	0.0	31.6	4.4	0.3	0.0	546.4	635.3
56	645.4	3.1	85.3	23.5	15.1	6.8	6.8	0.0	0.0	0.0	786.0	811.5
57	29.3	154.7	6.3	135.1	208.6	15.0	0.0	0.0	1.5	1.0	551.5	685.0
58	19.0	46.1	76.4	168.7	20.2	34.4	0.9	6.2	33.3	32.2	437.4	606.7
59	56.7	0.0	356.2	52.6	149.6	225.9	0.0	72.2	0.0	30.5	943.7	1 150.3
60	264.3	0.0	98.8	59.3	56.3	289.2	0.0	220.5	0.0	36.5	1 024.9	1 312.9
61	514.1	48.0	3.2	60.3	15.5	37.3	0.0	78.9	0.6	1.2	759.1	782.0
62	0.0	4.4	2.3	154.2	0.9	53.4	0.0	0.0	0.0	0.0	215.2	343.9
63	0.0	0.0	0.0	66.2	0.0	2.8	0.0	0.0	0.0	0.0	69.0	140.7
64	0.0	0.0	0.0	138.1	9.0	3.8	0.0	0.0	0.0	7.6	158.5	223.4

Appendix 4—continued

Station	RCO	SPD	BAR	SQU	STA	TAR	GUR	SCH	HAK	HOK	Total	All species
65	0.0	0.0	0.0	66.5	0.0	5.4	0.0	0.0	0.0	0.0	71.9	141.9
66	0.0	0.0	0.0	110.8	0.0	0.0	0.0	0.0	0.0	27.1	137.9	241.7
67	0.0	5.8	14.4	24.4	0.0	0.6	0.3	14.8	0.0	0.0	60.3	266.6
68	352.0	29.8	97.0	14.0	0.0	8.4	10.6	3.8	313.7	1.2	830.5	1 012.4
69	126.4	13.4	5.9	0.8	0.0	0.0	173.1	2.0	0.0	0.0	321.6	519.2
70	409.6	19.9	90.6	21.9	4.0	21.2	2.2	0.0	9.7	0.3	579.4	797.9
71	Station abandoned - no catch recorded										0.0	0.0
72	0.0	0.0	0.0	92.9	6.4	0.0	0.0	0.0	0.0	0.0	99.3	155.0
73	0.0	0.0	0.0	82.5	5.9	22.3	0.0	0.0	0.0	0.0	110.7	458.6
74	0.0	0.0	0.0	135.3	0.0	17.9	0.0	0.0	0.0	9.4	162.6	264.5
75	0.0	0.0	0.0	0.6	0.0	3.6	0.0	0.0	0.0	0.0	4.2	11.8
76	63.2	192.0	217.6	43.1	55.1	60.4	0.0	0.0	0.0	18.4	649.8	824.7
77	81.9	111.0	361.5	64.2	20.3	39.7	0.0	3.0	71.4	51.8	804.8	1 097.5
78	3.0	31.9	18.2	11.5	13.2	42.7	0.0	1.5	3.0	20.7	145.7	202.7
79	8.4	273.4	98.2	34.7	54.1	64.9	0.0	20.6	0.0	10.1	564.4	680.8
80	32.3	20.4	8.6	19.4	90.3	103.3	0.0	0.0	0.0	8.3	282.6	365.6
81	365.0	60.8	92.1	20.5	40.0	61.8	1.0	12.9	0.0	6.1	660.2	725.8
82	14.7	0.0	8.3	26.4	212.7	25.9	0.0	49.1	0.6	195.2	532.9	1 004.4
83	0.3	37.7	0.0	4.4	160.6	8.5	0.0	44.5	0.0	13.2	269.2	350.3
84	37.0	0.0	155.0	25.4	87.7	91.3	0.0	24.8	2.2	2.9	426.3	592.6
85	15.0	27.6	19.9	24.3	71.0	33.3	0.0	0.0	49.2	17.3	257.6	393.4
86	74.5	174.8	95.6	11.5	102.6	25.4	0.0	3.1	184.7	20.5	692.7	962.7
87	712.5	50.6	33.2	10.3	80.1	13.8	25.3	3.4	62.0	5.0	996.2	1 338.4
88	34.4	369.0	28.4	341.1	185.3	70.8	0.0	52.9	9.0	38.2	1 129.1	1 306.7
89	52.5	144.3	121.7	27.5	120.1	110.4	0.0	47.1	3.2	52.5	679.3	828.0
90	36.7	69.1	162.2	86.2	33.7	61.3	0.0	22.4	1.5	50.5	523.6	757.3
91	18.8	563.8	117.9	0.0	0.0	0.1	105.1	3.3	4.7	0.0	813.7	907.8
92	393.7	67.7	4.1	0.2	0.0	0.0	19.2	3.5	20.5	1.2	510.1	576.3
93	13.6	47.6	4.7	0.0	0.0	0.0	29.9	11.1	0.5	0.0	107.4	136.2
94	124.0	17.6	13.6	2.5	0.0	0.0	11.6	27.0	3.7	0.8	200.8	319.7
95	481.8	45.6	4.9	2.0	0.0	1.4	7.5	37.7	4.1	2.2	587.2	793.6
96	748.8	21.2	55.2	15.2	0.0	2.9	2.7	1.4	2.4	9.5	859.3	1 352.9
97	181.5	145.8	83.6	15.2	38.3	153.0	1.0	10.4	3.8	1.9	634.5	817.4
98	83.5	133.5	90.1	20.4	44.4	96.2	0.0	21.9	0.0	23.1	513.1	593.5
99	36.5	8.8	73.8	20.4	36.8	18.2	1.6	3.8	111.3	42.3	353.5	512.4
100	19.7	41.9	92.2	14.7	9.9	27.8	1.7	8.1	1.6	27.8	245.4	334.4
101	131.7	51.8	44.4	11.4	29.8	36.6	4.6	6.6	1.5	2.9	321.3	368.4
102	90.8	98.0	53.0	2.6	0.0	0.0	32.3	1.5	1.6	0.0	279.8	311.0
103	140.1	58.9	54.0	1.4	0.0	0.0	64.0	5.9	0.2	0.0	324.5	403.9
104	354.9	13.4	61.9	41.7	11.1	37.8	1.7	0.0	0.7	2.8	526.0	789.2
105	221.5	40.1	30.1	1.0	0.0	0.0	34.6	0.8	0.0	0.0	328.1	481.9
106	148.1	9.4	26.2	1.0	0.0	0.0	131.5	0.0	0.0	0.0	316.2	628.1
107	104.4	62.6	59.2	45.2	1.3	36.8	15.3	35.9	210.5	1.7	572.9	741.0
108	4.3	14.7	81.5	2.0	0.0	0.0	118.6	0.0	0.0	0.0	221.1	414.8
109	244.5	32.8	17.8	2.5	0.0	0.0	8.6	1.6	3.4	1.2	312.4	413.4
110	67.6	33.6	6.3	0.0	0.0	0.1	36.6	5.5	25.6	0.6	175.9	288.5
111	0.1	26.9	65.6	15.3	0.1	0.2	0.0	0.0	0.0	0.0	108.2	212.5
112	44.2	3.1	81.5	2.6	0.0	0.1	0.0	0.0	0.0	0.0	131.5	193.4
113	51.9	0.0	20.5	5.8	3.0	0.0	0.0	0.0	0.0	0.0	81.2	134.4
114	0.1	12.0	89.7	12.7	2.9	0.0	0.0	0.0	0.0	0.0	117.4	175.7
115	0.0	16.2	0.5	16.7	0.0	0.1	0.2	2.5	0.0	0.0	36.2	62.9
116	0.0	2.4	15.5	9.4	8.0	0.0	3.9	11.4	0.0	0.0	50.6	309.0
117	0.0	2.6	8.7	12.0	0.1	0.1	16.7	8.8	0.0	0.0	49.0	441.6
118	1.8	116.8	34.2	2.6	0.0	0.1	119.1	0.0	0.7	0.0	275.3	383.1
Total	10 735.7	7 919.8	6 515.8	4 766.8	4 696.8	4 197.4	1 758.7	1 737.2	1 626.4	1 561.4	45 516.0	68 471.2

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