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Summary of biology and commercial landings, and a stock assessment of ribaldo, *Mora moro* (Risso, 1810), in New Zealand waters

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Summary of biology and commercial landings, and a stock assessment of ribaldo, *Mora moro* (Risso, 1810), in New Zealand waters

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1 EXECUTIVE SUMMARY

Ribaldo (*Mora moro*) is caught on bottom longline and as a bycatch to trawling. Up to 4920 t per year were reported by Japanese and Korean long-line vessels in the 1970s and more recently it has been taken by New Zealand line vessels. Most reported catch since the 1970s has been bycatch during target trawling for hoki (*Macruronus novaezelandiae*), orange roughy (*Hoplostethus atlanticus*), and ling (*Genypterus blacodes*) at 500–1000 m. In 1997 it was not included in the QMS but it is kept and sold by some fishers. Reported catch is likely to be only a small proportion of the actual catch as most ribaldo caught by trawling has probably been discarded in the past.

The species is widespread in New Zealand waters at depths of 200–1200 m but appears to have a relatively low abundance throughout its range. Available data on length/sex, length-weight, and reproductive biology are summarised. No age estimates are known, but the species may have a moderate growth rate like other gadiform fishes.

Numerous trawl surveys have caught ribaldo and the main ones are listed. A detailed analysis would be required to decide on the relevant surveys, areas, and strata and to produce comparable relative abundance estimates. That work is outside the scope of this study and therefore no biomass estimates have been made from trawl surveys. There are no data on stock structure, but four fishstocks are suggested based on the main areas where the species is caught, i.e., the North Island (QMAs 1, 2, 8, & 9), the Chatham Rise and east coast South Island (QMAs 3 & 4), Southland and the Sub-Antarctic (QMAs 5 & 6), and the west coast South Island (QMA 7). Future inclusion of the species in the QMS could produce a conflict between those requiring quota as a bycatch to trawling and those longline fishing.

2 INTRODUCTION

2.1 Overview

Ribaldo is a member of the morid family of fishes (Moridae). Other members of this family include the well known (and QMS species) red cod (*Pseudophycis bachus*), which is caught in substantial quantities in New Zealand waters, the relatively abundant deepwater slender cod (*Halargyreus johnsoni*), and the less abundant deepwater violet cod (*Antimora rostrata*). Some morid species are not caught in sufficient quantity to be considered a fishery, e.g., the northern bastard cod (*Pseudophycis breviuscula*) and the southern bastard cod (*P. barbata*), while others are small, e.g., dwarf cod (*Austrophycis marginata*), or are uncommon, including the large *Lepidion schmidti* and *L. inosimae*.

Ribaldo occurs throughout the New Zealand region from 32 to 53° S at depths of 200–1200 m, with highest occurrence in tows between 500 and 1000 m. It also occurs in other Southern Hemisphere regions at similar latitudes, including Australia, south of Madagascar, and Chile, and in the Northern Hemisphere from Iceland to West Africa, including the western Mediterranean, Cohen *et al.* (1990).

Biological and fishery data for the New Zealand ribaldo fishery are summarised. The biological data were extracted from the Ministry of Fisheries (MFish) research trawl database (TRAWL) and commercial catch data were from the MFish catch and effort database. A preliminary stock assessment is presented.

2.2 Description of the fishery

In New Zealand, ribaldo is caught on bottom longlines and as a bycatch to trawling. Up to 4920 t per year were reported by Japanese and Korean longliners in the 1970s and more recently it has been taken by New Zealand line vessels. Most reported catch between 1978 and 1990 has probably been as a bycatch during target trawling for hoki (*Macruronus novaezelandiae*), orange roughy (*Hoplostethus atlanticus*), and ling (*Genypterus blacodes*) at 500–1000 m. In Australia it is caught as a trawl bycatch (Gomon *et al.* 1994) and it was reportedly caught by line in the Mediterranean in the 1950s (Motais 1960).

2.3 Literature review

There are few sources of information for this species. Some early catch data were provided by King (1985) and Paul & Robertson *in* Elder & Taylor (1979). Information on identification is readily available, e.g., Cohen *et al.* (1990). Biological data are scarce, with a little data on depth range, size, and gonad stage from fish sampled in the North Atlantic by Gordon & Duncan (1985). No information on age structure could be found.

3 REVIEW OF THE FISHERY

3.1 TACCs, catch, landings, and effort data

Ribaldo was not included in the Quota Management System (QMS) and there was no TACC for this species in 1997. It is proposed to include ribaldo in the QMS on 1 October 1998. Regulations for QMAs 3, 4, 5, and 6 include ribaldo in a list of species that are "Totally prohibited as a target species". But target fishing for ribaldo is not prohibited in QMAs 1, 2, 7, 8, and 9. Some of the catch, probably mainly from New Zealand line fishing, is kept and sold (as "deep sea cod" or ribaldo), but it is highly likely that the reported commercial landings are only a proportion of the actual catch as most ribaldo caught by trawling has probably been discarded or mealed in the past. MFish catch data analyses recorded only 223 and 970 kg of ribaldo declared as discarded in 1995 and 1996 respectively. Research catches are small but widespread throughout the EEZ, and this suggests that most of the commercial catch has not been retained.

Reported catch from New Zealand ("domestic") fishers collected by the FSU from 1974 to 1982 shows only small amounts of ribaldo were landed, (Table 1). In the 1970s, substantial

quantities were caught mainly by Japanese but also by Korean longline vessels target fishing for ling, (Table 2). These data are not complete as the Korean vessels fished after 1977 but no subsequent landings data could be found.

Table 1: Reported landings (t) of ribaldo by New Zealand ("domestic") fishers (all fishing methods) by calendar year from 1974 to 1982. Source: King (1985)

Year	1974	1975	1976	1977	1978	1979	1980	1981	1982
Catch	0	0	0	0	0	0	0	3	7

Table 2: Japanese and Korean longline catch (t) of ribaldo ("deep-sea cod") from New Zealand waters, by calendar year from 1975–77. Source: Elder & Taylor (1979)

Year	1975	1976	1977
Japan	2 417	4 920	4 283
Korea	–	–	286[1]

1. Reported as "cods" but considered to be mainly ribaldo. The Korean fleet began fishing in April 1977.

Landings by chartered and foreign licensed trawlers from 1978–79 to 1983–83, collected by the FSU, are summarised in Table 3 (see Figure 1 for Fishery and Quota Management Areas). Most of the catch was from the west coast South Island, Puysegur, and Chatham Rise, presumably as a bycatch to target fishing for mid-depth species such as hoki, hake (*Merluccius australis*), and ling. Reported landings (all fishing methods) by all New Zealand and charter vessels from 1982–83 to 1995–96 (1 October to 30 September), compiled from the sources listed, are presented in Table 4. CELR catches from 1988–89 to 1995–96 that were not reported by area were pro-rated to a QMA by MFish. Data from 1995–96 for TCEPRs and CLRs were not available at the time of writing. A trend of increasing reported landings in recent years from LFRR sources suggests that the species is increasingly being kept. The increase in reported landings may be due to the entry of New Zealand line vessels into the fishery in the early 1990s which caught ribaldo as a bycatch to ling target fishing.

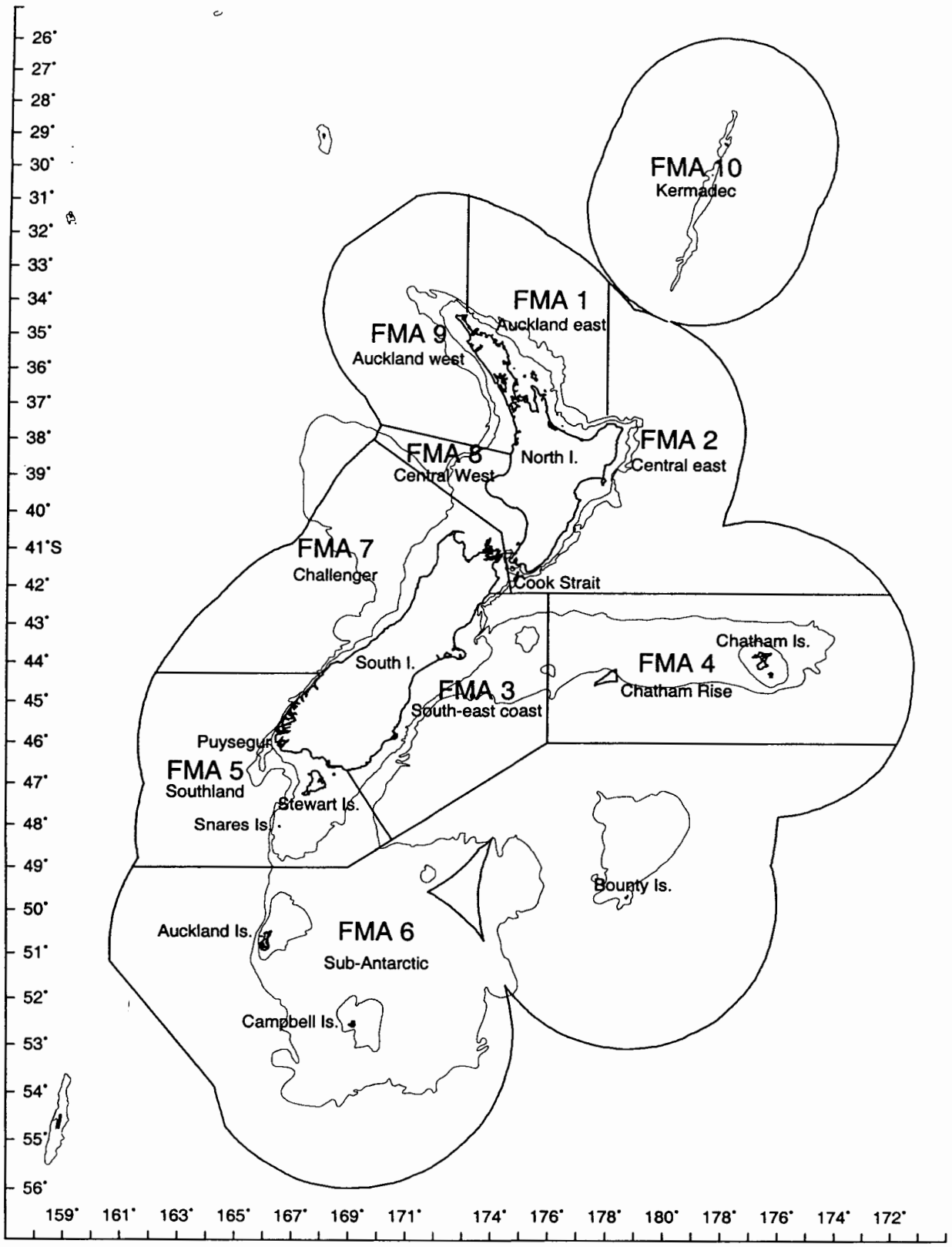

Figure 1: Fishery Management Areas (FMA) of the New Zealand 200 n. mile Exclusive Economic Zone.

Table 3: **Reported trawl landings (t) of ribaldo by fishing year (1 April to 31 March) and by EEZ area by foreign licensed and joint venture vessels from 1978–79 to 1983–83. 1983–83 is from 1 April to 30 September to accommodate the change to a 1 October to 30 September fishing year. The EEZ areas (*see* figure 2 of Baird & McKoy (1988)) correspond approximately to the QMA areas listed. –, no data. Source: hard copies of FSU data summaries held at NIWA, Greta Point**

EEZ area	C(M)	C(-)	D	E(A)	F(E)	F(W)	G	H	Total
QMA		3	4	6		5	7	8 & 9	
1978–79	0	0	0	0	0	0	0	0	0
1979–80	0	0	0	0	0	0	1	0	1
1980–81	–	–	–	–	–	–	–	–	–
1981–82	0	0	10	1	2	2	50	0	65
1982–83	4	0	21	8	1	10	29	0	72
1983–83	11	3	36	3	7	98	60	3	222

Table 4: **Reported landings (t) of ribaldo by fishing year (1 October to 30 September) from 1982–83 to 1995–96. –, no data. From 1988–89 the best estimate was taken as the greater of either the LFRR or the sum of the CLR and $CELR_{landed}$ values. The LFRR data from 1988–89 onwards are probably the most reliable totals. Data sources were: Fisheries Statistics Unit (FSU); catch, effort and landing return (CELR); trawl catch effort and processing return (TCEPR); catch landing return (CLR); licensed fish receivers return (LFRR)**

Year	FSU Inshore	FSU Deepwater	FSU Total	CELR Estimated	CELR Landed	TCEPR Estimated	TCEPR Processed	CLR	LFRR	Best Estimate
1982–83	8	218	226	–	–	–	–	–	–	226
1983–84	14	142	156	–	–	–	–	–	–	156
1984–85	9	125	134	–	–	–	–	–	–	134
1985–86	7	110	117	–	–	–	–	–	–	117
1986–87	11	116	127	–	–	–	–	–	200	200
1987–88	32	229	261	–	–	–	–	–	350	350
1988–89	29	66	95	4	5	164	26	148	312	312
1989–90	–	–	–	32	37	76	83	135	195	195
1990–91	–	–	–	96	152	198	158	363	529	529
1991–92	–	–	–	171	289	149	135	351	609	640
1992–93	–	–	–	232	386	209	169	484	904	904
1993–94	–	–	–	196	338	90	59	200	834	834
1994–95	–	–	–	348	809	100	92	237	1 382	1 382
1995–96	–	–	–	351	632	–	–	–	1 028	1 028

Reported catch by Quota Management Area (QMA) is summarised in Table 5. There are problems with these data (Table 5) because the annual sum of the QMA values is generally much less than the annual total (derived from LFRR sources). Data from 1995–96 for TCEPRs were not available at the time of writing, so the QMA values for that year could not be estimated.

Table 5: **Reported landings (t) of ribaldo by QMA and fishing year (1 October to 30 September) from 1982–83 to 1995–96. Total landings for each fishing year are equal to the best estimate from Table 4. The sum of $FSU_{inshore}$ and $FSU_{deepwater}$ data were used to derive QMA values from 1982–83 to 1987–88 and the sum of $CELR_{estimated}$ and $TCEPR_{estimated}$ were used from 1988–89 to 1994–95. No attempt was made to scale up landings by QMA to the reported total. There was only one reported landing of less than 0.5 t from QMA 10 in 1990–91. Data are rounded, i.e., 0 is less than 0.5 t. –, no data**

Year	QMA											
	1	2	3	4	5	6	7	8	9	10	Unknown	Total
1982–83	0	8	15	33	111	0	58	0	0	0	1	226
1983–84	0	3	24	21	68	1	25	0	0	0	14	156
1984–85	0	4	17	61	21	13	18	0	0	0	0	134
1985–86	1	1	26	13	35	2	37	0	0	0	1	117
1986–87	4	1	44	20	41	10	6	0	0	0	1	200
1987–88	19	4	65	31	56	12	68	0	0	0	6	350
1988–89	1	2	33	41	6	6	69	1	10	0	0	312
1989–90	8	9	23	28	6	13	21	0	0	0	0	195
1990–91	14	11	68	93	7	82	20	0	0	0	0	529
1991–92	84	26	72	68	9	48	11	0	0	0	0	640
1992–93	99	42	100	84	5	50	23	0	36	0	0	904
1993–94	68	58	69	46	2	16	12	0	15	0	0	834
1994–95	92	81	175	64	2	26	7	2	0	0	0	1 382
1995–96	–	–	–	–	–	–	–	–	–	–	–	1 028

3.1.1 CPUE analyses

Ribaldo commercial trawl catch (kg) per tow from 1982 to 1989 from FSU deepwater logbook data are plotted in Figure 2. Catches of over 1000 kg were mainly on the Chatham Rise, Stewart-Snares slope, Puysegur, west coast South Island, and Challenger Plateau. There was no reported target trawling for ribaldo and from 1982 to 1989 most was taken while fishing for hoki, followed by orange roughy, ling, silver warehou (*Seriolella punctata*), smooth oreo (*Pseudocyttus maculatus*), squid (*Nototodarus* spp.), and hake. Because reported ribaldo catch is probably less than the actual catch, it seems that analysis of commercial trawl CPUE would not be useful. It may be worth considering an analysis of longline CPUE because of the more substantial catches using that method. The relatively high longline catch suggests that ribaldo favour rough ground as well as being susceptible to capture by that method.

3.2 Other information

There is likely to have been substantial (relative to the amounts reported landed) discarding from the trawl fishery in the past. It may be possible to collect information on future discarding using observers.

3.3 Recreational and Maori customary fisheries

There are no known Maori, recreational, or other non-commercial fisheries for ribaldo.

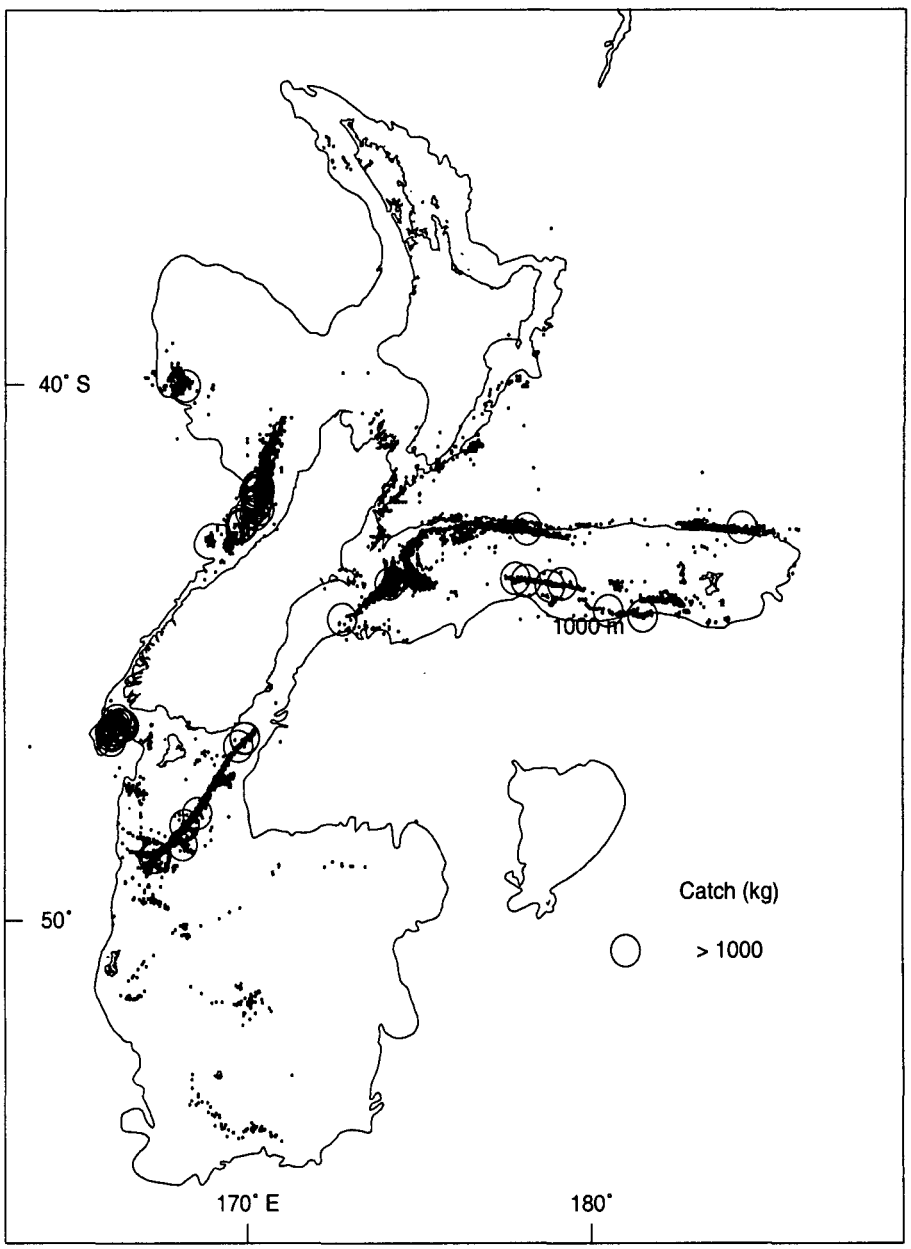

Figure 2: Ribaldo reported commercial trawl catch (kg) for fishing years 1982–83 to 1988–89. Catches less than 1000 kg are black dots and those more than 1000 kg are open circles.

4 RESEARCH

4.1 Stock structure

No information is available. Ribaldo is widespread in New Zealand, but it is possible that there are separate stocks based on natural boundaries such as the New Zealand land mass, i.e., west and east coast stocks. It may be appropriate to manage the species as four fishstocks based on a division into the main fishing areas, i.e., the North Island (QMAs 1, 2, 8, and 9), Chatham Rise and east coast South Island (QMAs 3 and 4), Southland and Sub-Antarctic (QMAs 5 and 6) and the west coast South Island (QMA 7).

4.2 Resource surveys

Catch and catch rate

The location of research catches of ribaldo are plotted in Figure 3. The species has a broad geographical distribution and has been caught on numerous research trawl surveys, though never in large quantities (Appendix 1). Catch rates from research trawl surveys are shown in Figure 4. There are few stations where catch rates exceeded 200 kg.km^{-1}. A plot of depth versus catch rate shows a wide depth range for ribaldo with highest frequencies between about 450 and 1200 m (Figure 5). Best catch rates were between about 700 and 1000 m.

Relative abundance

Numerous abundance trawl surveys have caught ribaldo (Appendix 1). The most appropriate surveys to estimate relative abundance of this species would be those which have a wide geographical and depth coverage: these include wide-area surveys of the Chatham Rise and Campbell Plateau carried out to sample middle-depths species. However, these surveys do not sample the full depth range of ribaldo, and a detailed analysis would be required to provide comparable relative abundance estimates.

Length frequency, length-weight and length at maturity

Research-collected length data for females and males are presented in Figure 6. Maximum sizes of about 80 cm FL seem reasonable and records over this length are probably errors and should be ignored in the length plot. Female ribaldo were generally larger than males. Most fish sampled during mid-depth surveys (200–600 m, where most of the length data were collected) were 40–70 cm FL. Results of analysis of length-weight data are presented in Table 6 and plotted in Figure 7. There are too few gonad stage data (47 females, 27 males) for an analysis of length at maturity.

Table 6: **Length-weight relationships for ribaldo sampled from all areas. The parameters describe the equation in the form $W=a.L^b$, where W is weight (g) and L is fork length (FL) measured to the nearest centimetre below. The values for all fish include fish that were not sexed. n is the number of fish**

	a	b	n	R^2	Length range
All	0.0266	3.257	558	96.4	24.6–78.5
Males	0.0531	3.300	169	95.9	29.9–60.0
Females	0.0357	3.294	386	95.7	24.6–78.5

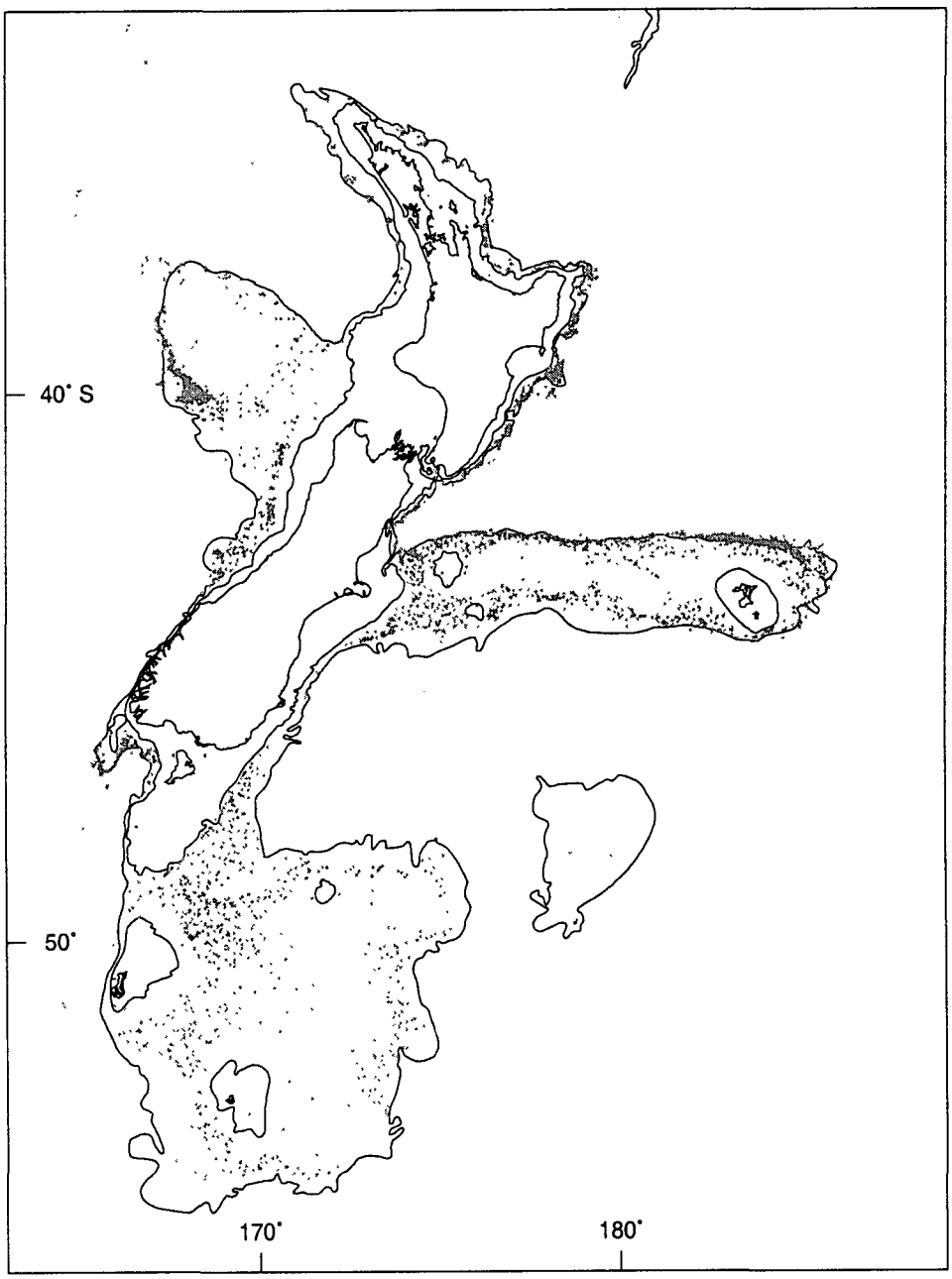

Figure 3: Ribaldo catches from research trawl surveys carried out between 1979 and 1997.

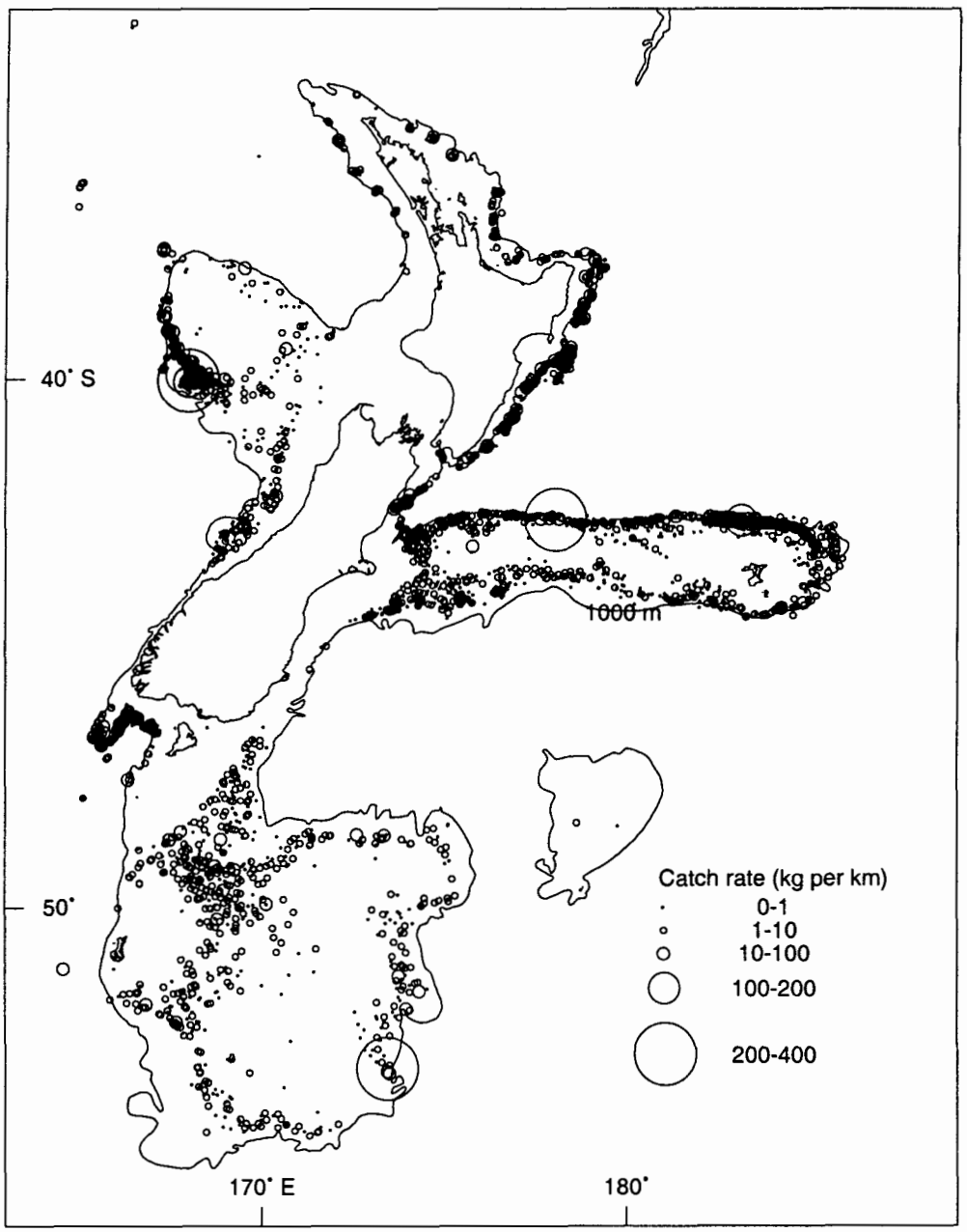

Figure 4: Ribaldo catch rates (kg.km^{-1}) from all research trawl surveys carried out between 1979 and 1997.

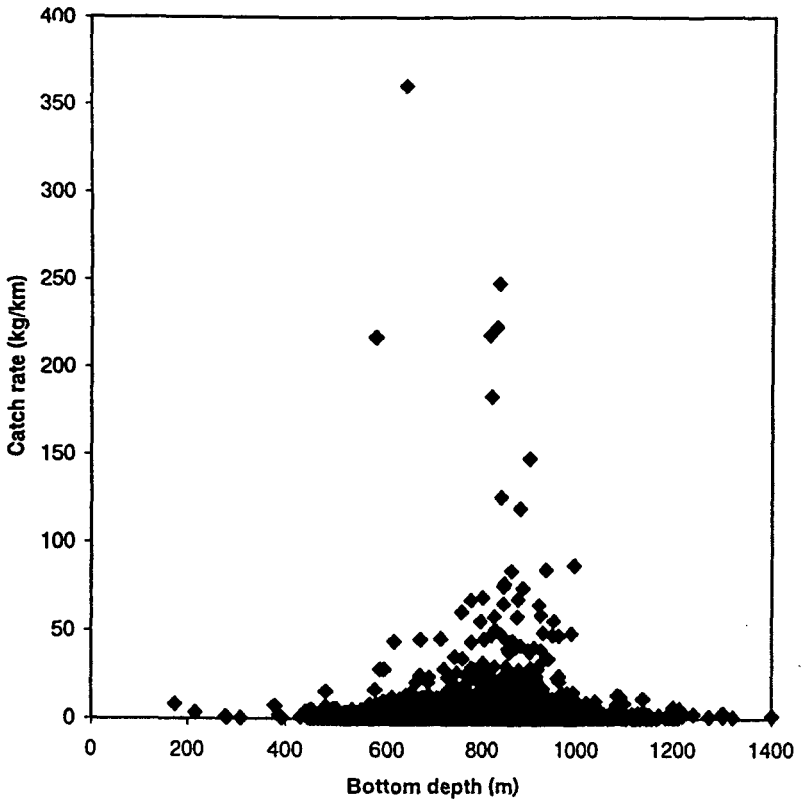

Figure 5: Research catch rate by depth for all data combined.

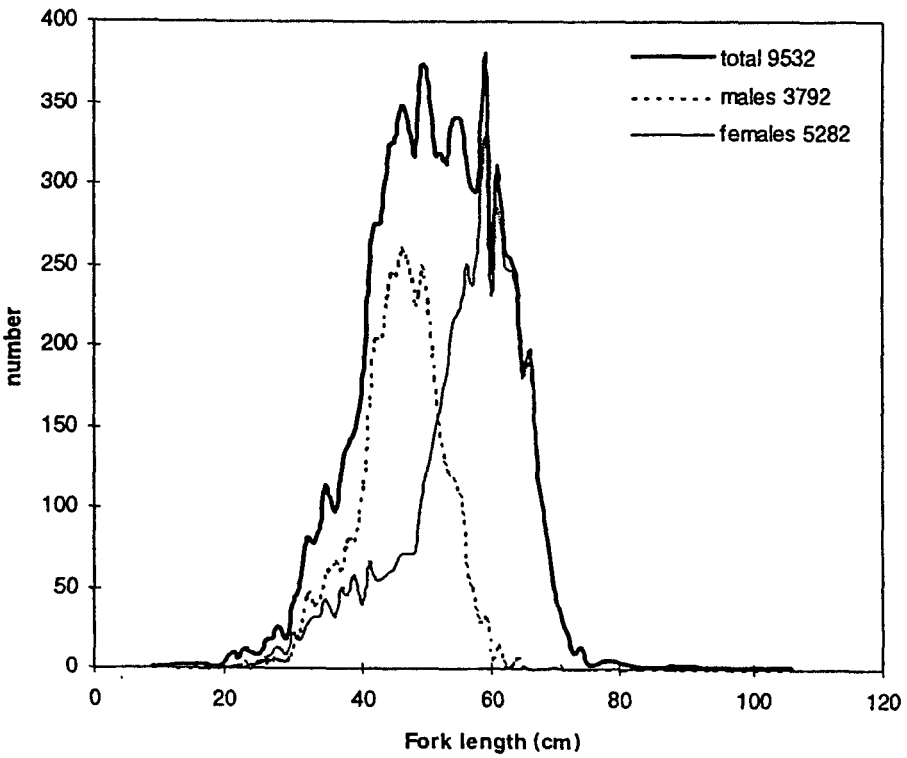

Figure 6: Ribaldo unscaled length frequency from all research data combined.

Age and growth, natural mortality (M)

There are no known estimates of age or M. No modes corresponding to age classes are apparent in the length frequency distribution (all research data from different areas and times combined) (Figure 6). Other gadiform fish and their estimates of M (yr^{-1}) include red cod, 0.76; hoki, 0.25–0.3; and hake, 0.2–0.22 (Annala & Sullivan 1997). It seems reasonable to assume that ribaldo is likely to have a value of M similar to deepwater species like hoki and hake, i.e., 0.2–0.3.

Juveniles

Small ribaldo were caught in the upper 200 m of the water column over the slope occupied by the adults during "bongo" plankton sampling for oreo eggs and larvae at the southwest end of Chatham Rise in 1982 (NIWA unpublished data).

Reproductive condition/spawning

Gonad stages from 47 females and 27 males collected during MFish research trawl surveys were mostly resting or pre-vitellogenic (stage 2). There was only one female with hyaline eggs (stage 4). There is no evidence that ribaldo migrate or aggregate at particular sites to spawn. Small groups of maturing individuals were observed in the orange roughy "spawning box" during survey TAN9609, suggesting a winter (July-August) spawning. Gordon & Duncan (1985) reported the species from 750 to 1000 m, with fish up to 69 cm SL and suggested a midsummer spawning (June or July) based on three developing females in May and one spent female in July.

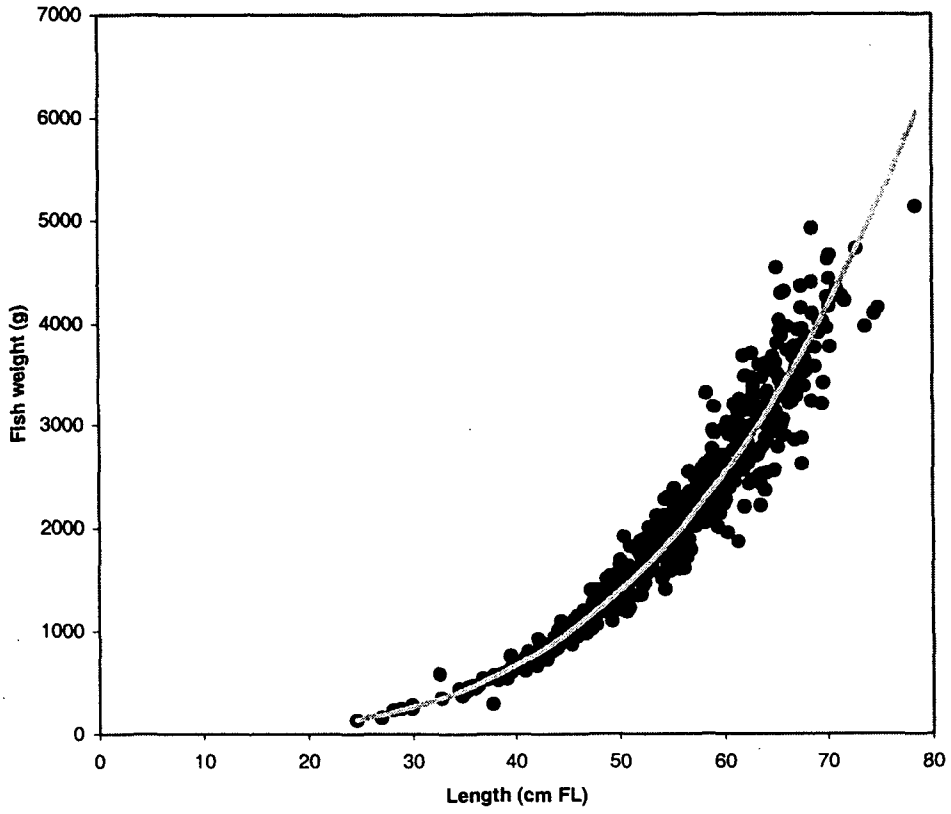

Figure 7: Ribaldo length- weight relationship for all research data combined (1979–97).

4.3 Biomass estimates

No attempt has been made to estimate biomass from research survey relative abundance estimates because a detailed analysis would be required to decide on the relevant surveys, areas, and strata needed to produce comparable estimates. That work is outside the scope of this study. No estimates from standardised CPUE analysis are available and therefore no biomass estimates are available.

4.4 Yield estimates

4.4.1 Estimation of MCY

No estimates of absolute biomass or reference fishing mortalities are available for ribaldo. The most appropriate method to estimate MCY is to use an average catch method (method 4, p. 19, *in* Annala & Sullivan 1997), i.e., MCY = cY_{av}. No estimates of M are available (other than an assumed range of 0.2–0.3), so a conservative natural variability factor (c) of 0.7 is assumed.

Catch history

The catches from 1990–91 to 1994–95 (from Table 5) are suggested as the period for the catch history because the annual reported total catches before then were very low. Reported catch (LFRR data) jumped substantially in 1990–91 (probably due to the entry of New Zealand vessels into the longline fishery) and has continued to increase each year. This may not satisfy the requirement for selecting the period of catches that do not contain systematic changes in fishing mortality or effort. From 1990–91 to 1994–95 annual catch more than doubled, i.e., there is a systematic change which also fails the requirement for using this method of estimating MCY. It is not known if the period chosen (5 years) is equal to or is more than half the exploited life span of the fish, but it also seems unlikely that this criterion is met.

This method is likely to provide a conservative estimate of MCY because:

1. the populations are unlikely to be fully exploited
2. the catch history is not corrected for unreported catch (because of lack of information), i.e., reported catch is less than actual catch
3. the systematic upward trend in catch will result in an underestimate of MCY.

There is a problem with the large discrepancy between the annual total of the reported catch from all QMAs and the annual LFRR total, i.e., the QMA total is much lower. Consequently the value in each QMA has been scaled up by multiplying the reported value in Table 5 by the ratio of the "Total" to the sum of the reported QMA values from Table 5. The "reconstructed" catch history is presented in Table 7.

Table 7: **Catch history for ribaldo reconstructed from table 5. QMA values have been scaled up by multiplying the reported QMA value by the ratio of the "Total" to the sum of the reported QMA values from table 5. See text for an explanation of the period chosen**

Year	QMA									
	1	2	3	4	5	6	7	8	9	Total
1990–91	25	20	122	167	13	147	36	0	0	529
1991–92	169	52	145	137	18	97	22	0	0	640
1992–93	204	86	206	173	10	103	47	0	74	904
1993–94	198	169	201	134	6	47	35	0	44	834
1994–95	283	249	539	197	6	80	22	6	0	1 382

MCY estimates (t) were as follows and have been rounded up(*) to the nearest 100 because of the conservative methods used:

RIB 1	QMAs 1, 2, 8, & 9	MCY =	0.7*316 =	221	*300
RIB 4	QMAs 3& 4	MCY =	0.7*404 =	282	*300
RIB 5	QMAs 5 & 6	MCY =	0.7*105 =	74	*100
RIB 7	QMA 7	MCY =	0.7*32 =	22	*100

These estimates of MCY and proposed fishstock areas are provisional and have not been considered by either the Middle Depths or the Deepwater Stock Assessment Working Groups.

5. MANAGEMENT IMPLICATIONS

This assessment is uncertain because of lack of information on actual (compared to reported) catch, age, growth, natural mortality, and biomass. Therefore it is not known if recent catch levels are sustainable or are at levels that will allow the stocks to move towards a size that will support the MSY.

If this species is introduced into the QMS there is a potential conflict between fishers who would require quota to cover the trawl bycatch and those wanting quota for line fishing catch. A similar issue resulted from the introduction of line-caught species such as hapuku and bass into the QMS in 1986 when quota was allocated to large trawl operators to cover bycatch, sometimes at the expense of small operators who formerly made a living targeting hapuku and bass.

6. ACKNOWLEDGMENTS

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Appendix 1: List of research trawl surveys which caught ribaldo. Catch is in kg and catch rate "Rate" is the mean value for the survey in kg/km. "Min" is the minimum and "Max" is the maximum depth where ribaldo was caught on each survey. "No. of tows" is the number of stations where ribaldo was caught. See footnote for explanation of species codes

Trip code	Main species	Date	Ribaldo		Depth		No. of tows
			Catch	Rate	Min	Max	
Chatham Rise							
Middle depths							
wes7903	MIX	May-Jul 79	4 072	na	330	956	83
shi8301	HOK	Mar 83	710	4.8	300	809	49
shi8304	HOK	Nov-Dec 83	593	na	201	751	52
aex8903	HOK,HAK,LIN	Nov-Dec 89	763	2.4	400	794	59
tan9106	HOK,HAK,LIN,SWA	Dec 91	548	1.2	237	798	80
tan9212	HOK,HAK,LIN,SWA	Dec-Feb 92	295	1.1	448	800	50
tan9401	HOK,LIN,HAK,SWA	Jan-Feb 94	517	1.6	370	796	58
tan9501	HOK,LIN,HAK,SWA	Jan-Feb 95	212	0.9	453	796	40
tan9601	HOK,HAK,LIN,SWA	Dec-Jan 96	170	1.1	437	786	29
tan9701	HOK,LIN,SWA,HAK	Jan 97	174	1.3	465	793	25
Deepwater							
wes7905	HOK,SBW,LIN,HAK	Oct-Dec 79	271	2.4	213	955	76
wes8001	SSO,BOE,ORH	Jul-Aug 80	1 060	9.5	842	978	14
kat8201	ORH	Jul-Sep 82	1 788	8.3	740	1 040	49
ktn8201	ORH	Jul-Sep 82	2 815	8.6	740	1 120	80
buc8401	ORH	Jul-Jul 84	1 430	4.1	758	1 032	63
buc8501	ORH	Jul-Jul 85	2 645	6.2	709	1 184	71
arr8603	SSO,BOE,ORH	Oct-Dec 86	125	1.1	630	1 033	30
buc8601	ORH	Jul-Jul 86	2 738	6.2	765	1 133	76
aex8702	ORH	Nov-Dec 87	76	0.9	603	896	24
buc8701	ORH	Jun-Aug 87	3 771	5.3	725	1 086	128
cor8801	ORH	Jul-Aug 88	2 040	4.8	758	1 209	77
cor8802	ORH	Sep-Oct 88	496	1.9	604	1 100	48
cor8901	ORH,SSO,BOE	Jul-Aug 89	1 443	2.9	730	1 032	89
cor9002	ORH,SSO,BOE,	Jun-Aug 90	834	2.1	744	1 034	72
cor9004	SSO,BOE,ORH	Oct-Nov 90	38	0.7	602	975	14
tan9104	SSO,BOE,ORH	Oct-Nov 91	50	1.0	592	1 000	14
tan9206	ORH,SSO,BOE	Jun-Jul 92	1 401	2.9	741	1 114	87
tan9210	SSO,BOE,ORH	Oct-Nov 92	45	0.8	590	960	15
tan9309	SSO,BOE,ORH	Oct-Nov 93	50	1.1	609	1 240	15
tan9406	ORH,BOE,SSO	May-Jul 94	665	2.1	665	1 020	71
swa9501	ORH	Jul-Aug 95	953	8.2	700	1 135	75
tan9508	ORH,SSO,BOE	Jul-Aug 95	1 143	4.5	795	1 156	101
tan9511	SSO,BOE,ORH	Oct-Nov 95	120	1.5	609	995	23
tan9608	ORH	Jun-Jul 96	46	2.1	735	1 124	8
tan9609	ORH	Jul-Aug 96	356	5.3	648	1 075	31
Challenger							
Deepwater							
arr8301	ORH	Aug-Oct 83	481	1.7	767	1 083	83
arr8401	ORH	Jul 84	637	2.8	789	980	74
arr8501	ORH	Jul 85	359	3.9	760	934	41
arr8601	ORH	Jul 86	382	20.7	680	929	15
aex8701	ORH	Jun 87	1 488	4.7	777	1 069	125
aex8801	ORH	Jul 88	2 824	6.6	766	1 140	136
aex8901	ORH	Jul 89	3 408	12.8	793	1 029	141
wil9001	ORH	Jul 90	1 814	7.9	600	1 124	124

Trip code	Main species	Date	Ribaldo		Depth		No.of tows
			Catch	Rate	Min	Max	
Southern N.Z							
Middle depths							
wes7902	MIX	Mar-May 79	135	na	370	900	29
shi8101	NOS,HOK,SWA,BAR	Jan-Mar 81	252	11.6	440	593	7
shi8201	SBW,HOK,HAK,LIN	Mar-Apr 82	253	3.7	173	750	23
shi8302	NOS,BAR,HOK,MIX	Mar-Apr 83	199	na	485	632	11
shi8303	HOK,LIN,NOS,SBW	Oct-Nov 83	2 105	10.6	512	775	69
aex8902	HOK,HAK,LIN,SBW	Oct-Nov 89	860	3.4	260	786	49
aex9001	HOK,SBW,LIN,HAK	Jul-Aug 90	1 083	3.0	542	792	64
aex9002	HOK,SBW,HAK,LIN	Nov-Dec 90	2 633	4.9	456	966	96
tan9105	HOK,LIN,SBW,HAK	Nov-Dec 91	595	1.5	300	968	71
tan9204	HOK,LIN,HAK,SBW	Apr-May 92	349	1.9	549	788	35
tan9209	HOK,SBW,HAK,LIN	Sep-Oct 92	165	0.9	528	803	32
tan9211	HOK,SBW,LIN,HAK	Nov-Dec 92	412	1.5	342	971	49
tan9304	HOK,LIN,HAK,SBW	May-Jun 93	381	1.6	530	790	42
tan9310	HOK,LIN,SBW,HAK	Nov-Dec 93	706	2.1	450	890	61
tan9402	BAR,WAR,STA,SKI	Feb-Mar 94	74	1.2	417	600	11
tan9502	BAR,SKI,WAR,SWA	Feb-Mar 95	42	0.8	472	575	10
tan9605	LIN,HOK,HAK	Mar-Apr 96	629	2.5	340	983	46
Deepwater							
wil9101	ORH,BOE,SSO	Jun-Jul 91	104	2.3	701	1 217	25
gil9201	ORH,SSO,BOE	Jun-Aug 92	87	1.6	736	1 200	21
tan9208	ORH,BOE,SSO	Aug-Sep 92	261	3.9	600	1 320	39
tan9409	ORH,BOE,SSO	Sep-Oct 94	368	5.0	601	1 190	36
East Coast							
Deepwater							
kva8101	ORH,SSO,BOE	Nov-Dec 81	211	1.1	555	1 175	16
gal8603	ORH	Jun-Jul 86	566	10.6	695	1 100	46
arr8701	ORH	Jun-Jul 87	140	5.8	703	1 100	34
wil8901	ORH	Sep-Oct 89	1 094	3.1	600	1 200	75
tan9203	ORH,SSO,BOE	Mar-Apr 92	488	2.3	570	1 272	64
tan9303	ORH	Mar-Apr 93	780	2.8	582	1 400	78
tan9306	ORH	Jun-Jul 93	229	2.5	674	1 199	31
tan9403	ORH	Mar-Apr 94	754	3.0	600	1 206	70
tan9506	ORH	May-May 95	605	4.3	600	1 300	39
West Coast							
Middle depths							
wes7904	HOK,HAK,LIN,SBW	Jul-Oct 79	1 188	2.6	289	934	71
Deepwater							
arr8602	ORH	Jul-Aug 86	88	0.9	700	1 025	30
North Island							
wnk8501	ORH,HOK	May-Jul 85	686	3.0		1 050	59
wnk8502	ORH,HOK	Aug-Sep 85	790	3.2		1 121	50
wnk8503	ORH,HOK	Nov-Feb 85	640	3.0		1 028	48
wnk8604	ORH,HOK	Mar-Apr 86	721	3.7		1 033	45
wnk8605	ORH,HOK	May-Jun 86	615	3.3		1 078	24

Note: MIX mixed, HOK hoki, HAK hake, LIN ling, SWA silver warehou, SBW southern blue whiting, SSO smooth oreo, BOE black oreo, ORH orange roughy, NOS arrow squid, BAR barracouta, WAR blue warehou, SKI gemfish