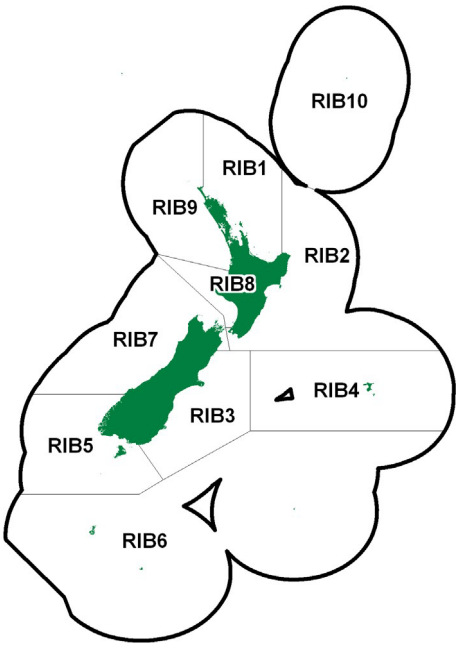
RIBALDO
(RIB)

(*Mora moro*)



1. FISHERY SUMMARY

1.1 Commercial fisheries

In New Zealand ribaldo is caught mainly on bottom longlines and as a bycatch of trawling. About 4500 t catch was reported in 1977 by Japanese and Korean longline vessels target fishing for ling on the Chatham Rise and east coast of the South Island in the 1970s. Since 1982–83, overall reported catch has been mainly from the Chatham Rise, east coast South Island, and the Challenger Plateau (QMAs 3, 4 and 7). RIB 3 landings have fluctuated since entering the QMS, and have remained between about 100 t and 220 t since the early 2000s, except in 2010–11 and 2018–19 when they were around 350 t. RIB 4 landings peaked at just under 850 t in 1996–97, and have fluctuated between 124 tand 492 t since. RIB 7 landings increased from 1994–95 until reaching a maximum at 456 t in 2008–09. Landings subsequently fluctuated between 137 t in 2009–10 and 434 t in 2014–15. The reasons for these changes in catch levels are not well understood as ribaldo is mainly taken as bycatch. Levels of discarding and unreported catch are likely to have changed with the introduction of ribaldo into the QMS. Ribaldo are caught throughout the New Zealand Exclusive Economic Zone by a variety of fishing methods in different target fisheries but mainly as bycatch in bottom trawls targeting hoki (*Macruronus novaezelandiae*), hake (*Merluccius australis*) and ling (*Genypterus blacodes*) and bottom longlines for ling.

There is no seasonality of catch other than on the west coast South Island where catch is related to target fishing of hoki and hake during the winter spawning season. Catches by Japanese and Korean longliners in the mid 1970s are shown in Table 1. Landings from 1982–83 onwards are shown in Table 2, while Figure 1 shows the landings and TACC values for the main RIB stocks since the introduction of the QMS.

Table 1: Japanese and Korean longline catch (t) of ribaldo ("deep-sea cod[1]") from New Zealand waters, probably mostly Chatham Rise and east coast South island, by calendar year from 1975 to 1977.

Year	1975	1976	1977
Japan	2 417	4 920	4 283
Korea	-	-	286

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

Ribaldo was introduced into the QMS from 1 October 1998, no customary, recreational or other mortality allowances have been set. Historical catch limits up to the most recent fishing year are shown in Table 2. TACCs were increased from 1 October 2006 in RIB 6 to 231 t and in RIB 7 to 330 t. In these stocks, landings were above the TACC for a number of years and the TACCs were increased to the average of the previous seven years plus an additional 10%. Current levels of reported landings are below TACCs in most areas, but catches exceeded the TACCs by over a third for RIB 4 in 2013–14, and RIB 7 in 2014–15.

Table 2: Reported landings (t) of ribaldo by QMA for fishing years 1983–84 to present and TACCs (t). QMA 10 has no landings and a TACC of 0. Total includes catches from outside the NZ EEZ. [Continued next page]

	RIB 1		RIB 2		RIB 3		RIB 4		RIB 5	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1982–83	0		8		15		33		111	
1983–84	0		3		24		21		68	
1984–85	0		4		17		61		21	
1985–86	1		1		26		13		35	
1986–87	4		1		44		20		41	
1987–88	19		4		65		31		56	
1988–89	1		2		33		41		6	
1989–90	8		9		23		28		6	
1990–91	15		15		177		119		34	
1991–92	95		40		160		169		73	
1992–93	131		54		217		228		67	
1993–94	87		70		217		186		23	
1994–95	116		136		437		303		68	
1995–96	121		168		286		253		26	
1996–97	114		188		365		843		64	
1997–98	78		122		141		375		80	
1998–99	24	121	55	176	161	394	290	357	71	52
1999–00	22	121	89	176	264	394	347	357	80	52
2000–01	5	121	107	176	269	394	306	357	78	52
2001–02	7	121	53	176	198	394	370	357	62	52
2002–03	12	121	98	176	211	394	183	357	50	52
2003–04	12	121	120	176	175	394	299	357	50	52
2004–05	28	121	127	176	156	394	379	357	44	52
2005–06	49	121	137	176	126	394	202	357	47	52
2006–07	39	121	125	176	149	394	312	357	49	52
2007–08	53	121	135	176	134	394	173	357	43	52
2008–09	45	121	74	176	216	394	216	357	31	52
2009–10	28	121	63	176	213	394	162	357	27	52
2010–11	42	121	67	176	348	394	137	357	30	52
2011–12	29	121	27	176	174	394	304	357	32	52
2012–13	16	121	74	176	182	394	234	357	35	52
2013–14	29	121	80	176	104	394	492	357	41	52
2014–15	35	121	154	176	122	394	341	357	47	52
2015–16	49	121	125	176	163	394	330	357	43	52
2016–17	43	121	160	176	139	394	212	357	46	52
2017–18	36	121	155	176	182	394	182	357	36	52
2018–19	40	121	118	176	358	394	199	357	36	52
2019–20	26	121	115	176	180	394	264	357	38	52
2020–21	30	121	64	176	182	394	205	357	51	52
2021–22	22	121	68	176	92	394	274	357	27	52
2022–23	2	121	27	176	92	394	124	357	25	52

	RIB 6		RIB 7		RIB 8		RIB 9		Total	
	Landing	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1982–83	0		58		0		0		225	
1983–84	1		25		0		0		142	
1984–85	13		18		0		0		134	
1985–86	2		37		0		0		115	
1986–87	10		6		0		0		126	
1987–88	12		68		0		0		255	
1988–89	6		69		1		10		169	
1989–90	13		21		0		0		108	
1990–91	106		55		0		0		521	
1991–92	98		40		0		0		675	
1992–93	96		106		0		0		899	
1993–94	92		42		1		0		718	
1994–95	122		39		2		6		1 231	
1995–96	109		62		0		0		1 025	
1996–97	158		77		1		0		1 824	
1997–98	262		110		1		1		1 214	
1998–99	223	124	243	55	1	1	0	2	1 081	1 282
1999–00	237	124	300	55	< 1	1	< 1	2	1 359	1 282
2000–01	191	124	275	55	< 1	1	< 1	2	1 242	1 282
2001–02	322	124	254	55	0	1	< 1	2	1 311	1 282
2002–03	172	124	338	55	< 1	1	1	2	1 209	1 282
2003–04	205	124	364	55	< 1	1	2	2	1 302	1 282

Table 2 [Continued]:

	RIB 6		RIB 7		RIB 8		RIB 9		Total	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
2004–05	105	124	307	55	< 1	1	2	2	1 240	1 282
2005–06	62	124	336	55	0	1	4	2	1 018	1 282
2006–07	61	231	404	330	0	1	9	2	1 162	1 664
2007–08	80	231	356	330	< 1	1	14	2	992	1 664
2008–09	63	231	456	330	< 1	1	10	2	1 111	1 664
2009–10	104	231	137	330	< 1	1	21	2	755	1 664
2010–11	67	231	198	330	3	1	20	2	913	1 664
2011–12	76	231	177	330	3	1	12	21	835	1 683
2012–13	66	231	180	330	2	1	10	21	799	1 683
2013–14	133	231	291	330	2	1	22	21	1 194	1 683
2014–15	83	231	434	330	1	1	13	21	1 231	1 683
2015–16	67	231	322	330	< 1	1	28	21	1 127	1 683
2016–17	92	231	245	330	1	1	15	21	953	1 683
2017–18	182	231	290	330	< 1	1	14	21	1 094	1 683
2018–19	113	231	151	330	< 1	1	7	21	1 021	1 683
2019–20	110	231	182	330	< 1	1	5	21	921	1 683
2020–21	164	231	223	330	< 1	1	2	21	922	1 683
2021–22	117	231	295	330	< 1	1	6	21	902	1 683
2022–23	238	231	267	330	< 1	1	1	21	776	1 683

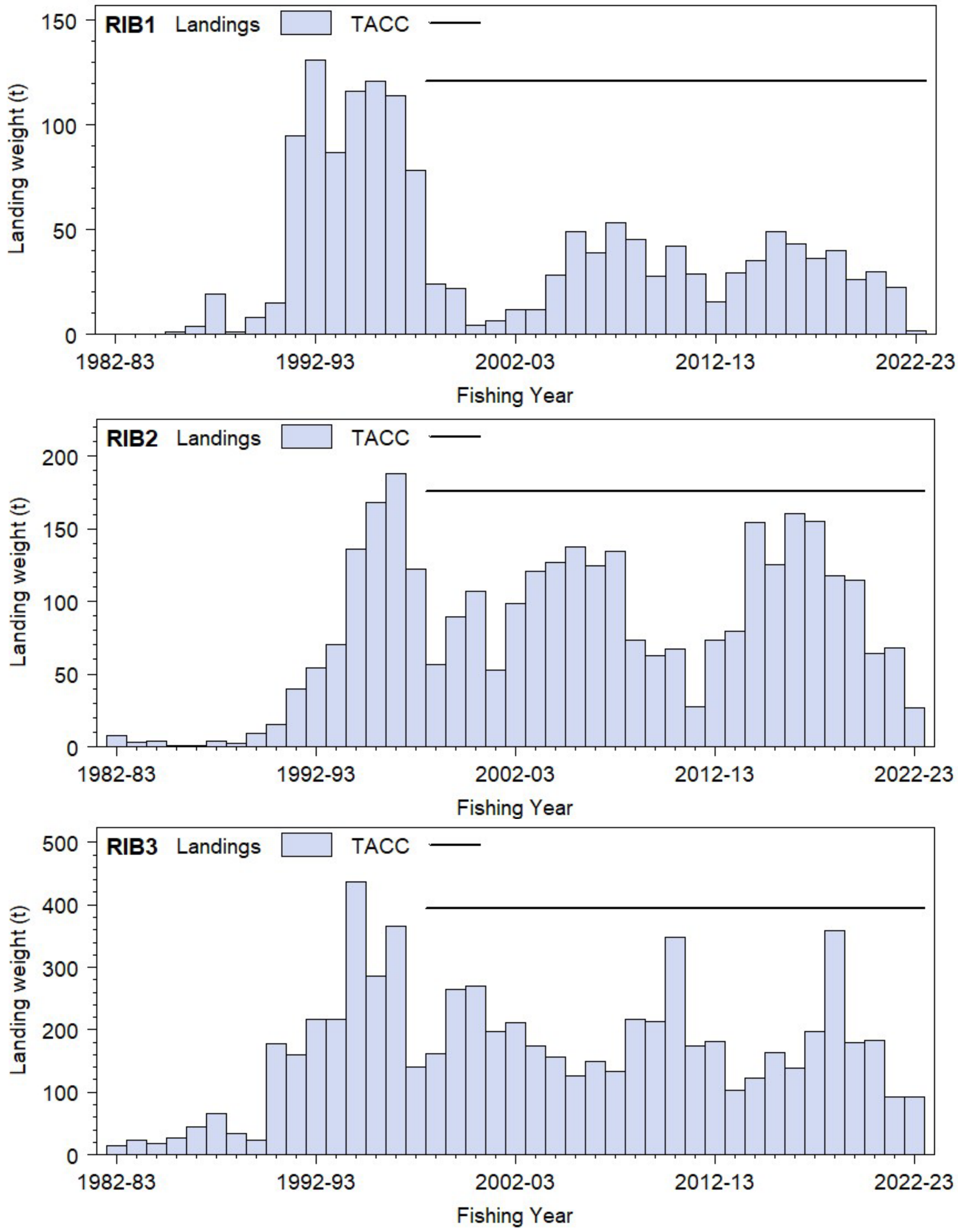


Figure 1: Reported commercial landings and TACC for the seven main RIB stocks. From top to bottom: RIB 1 (Auckland East), RIB 2 (Central East), RIB 3 (South East Coast). [Continued on next page]

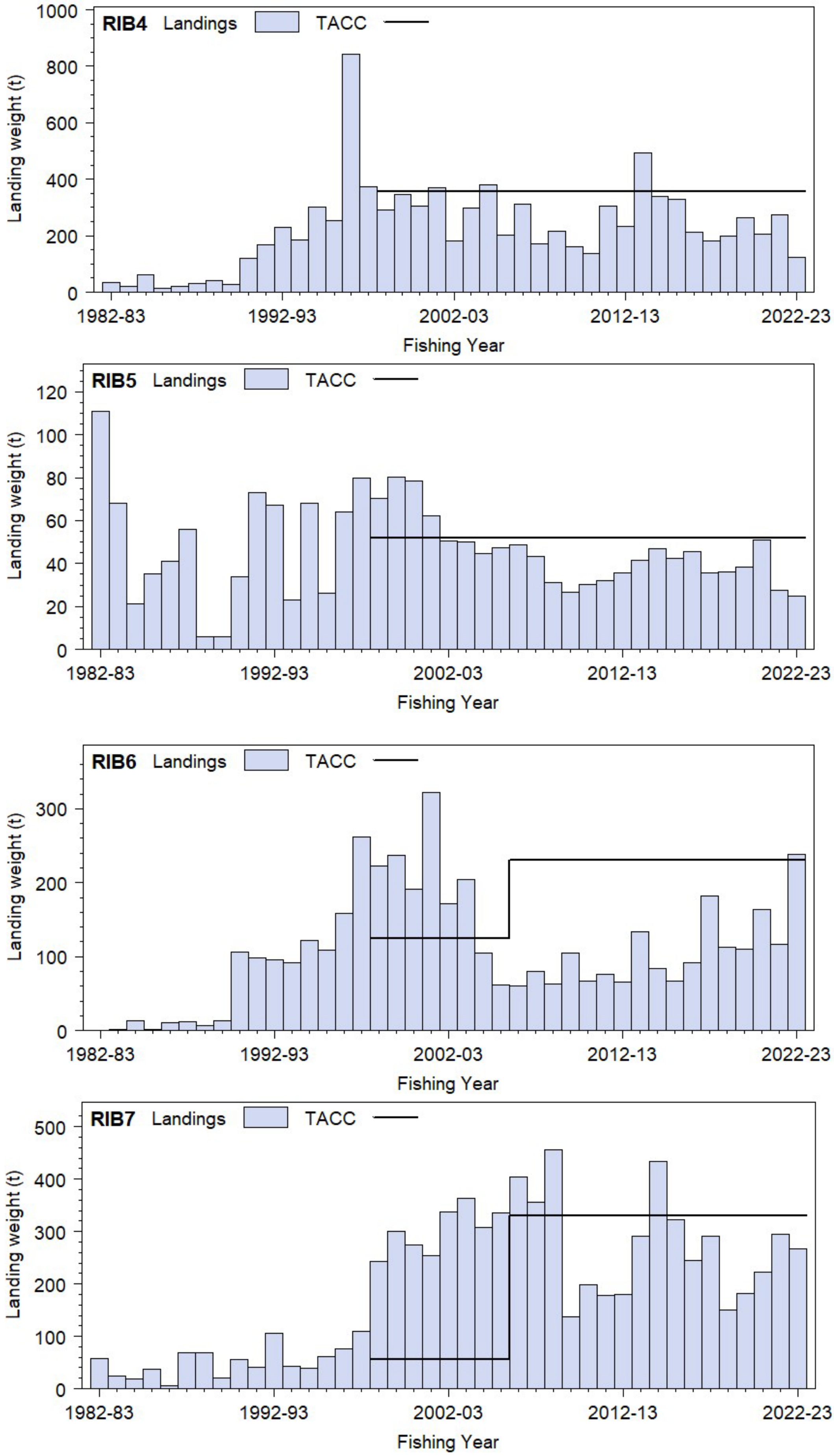


Figure 1 [Continued]: Reported commercial landings and TACC for the seven main RIB stocks. From top to bottom: RIB 4 (South East Chatham Rise), RIB 5 (Southland), RIB 6 (Sub-Antarctic), and RIB 7 (Challenger).

In RIB 1, ribaldo are taken as bycatch primarily in the ling and to a lesser extent bluenose bottom longline fisheries. There is also some direct targeting of ribaldo by bottom longline. In RIB 2, ribaldo are taken as bycatch primarily in the ling and bluenose bottom longline fisheries and to a lesser extent the hoki and orange roughy bottom trawl fisheries. There is also some direct targeting of ribaldo by bottom longline. In RIB 9 very small amounts of ribaldo are taken as bycatch in orange roughy, cardinal and alfonsino target trawl fisheries and in the ling bottom longline fishery. In all areas, a variety of other fishing methods and target fisheries also report catching ribaldo but only in negligible amounts.

1.2 Recreational fisheries

Recreational catches are likely to be negligible given the depth and location of ribaldo.

1.3 Customary non-commercial fisheries

Customary catches are likely to be negligible given the depth and location of ribaldo.

1.4 Illegal catch

Estimates of illegal catch are not available. Given the low value of ribaldo illegal catch is likely to be negligible.

1.5 Other sources of mortality

There is no quantitative information on the level of other sources of mortality.

2. BIOLOGY

Ribaldo is known from the North Atlantic Ocean from Iceland to West Africa, the western Mediterranean Sea, the Indian Ocean south of Madagascar and the Pacific Ocean from Australia, New Zealand, and Chile. In New Zealand, ribaldo is widespread and has been caught by research trawl at depths from 400 to 1300 m. It appears to be most common at 600–700 m, with bottom water temperatures of 6–8°C, and occurrence largely unrelated to surface water temperatures (Dunn, 2022). The spatial distribution of catches has changed little over the last 30 years, which is likely to be a reflection of the target fisheries for which ribaldo is a bycatch. The relatively high catch by bottom longline suggests that it scavenges and may favour rough bottom habitats.

Ribaldo reach maximum fork lengths (FL) of about 75 cm and 65 cm for females and males respectively. Most research trawls have caught fish ranging from 30 to 70 cm FL. The 50% length at sexual maturity has been estimated at about 45 cm total length for New Zealand ribaldo (O'Driscoll et al 2003), with an accompanying change in pattern of weight at length (Finucci et al, 2019). Analysis of data on female gonad development, collected by the Observer Programme, indicated a winter/early spring spawning season. Large spawning aggregations have not been found. Locations at which spawning fish have been observed are the upper North Island (extending outside the EEZ), north-east and west Chatham Rise, the area between the Snares and Auckland Islands shelves, and the west coast of the South Island. Early life history is largely unknown, but a few individuals less than 10 cm FL were captured in plankton nets in the upper 200 m of the water column over bottom depths of about 1000 m at the south west end of Chatham Rise. The distribution of juveniles under 28 cm is similar to that of observed spawning females. Juveniles up to 35 cm have been observed in all fished areas of the EEZ except for the Bounty Islands.

Ageing by zone counts of otoliths has been validated using radiometric techniques (Sutton et al 2010) using ribaldo caught on Chatham Rise trawl surveys by *Tangaroa* from 2001 to 2005. Maximum observed ages were 37 and 39 years for females and males respectively. Ribaldo in the North Atlantic have been aged to 59 years. Von Bertalanffy growth parameters are presented in Table 3, estimates of natural mortality (*M*) are presented in Table 4 and length-weight parameters in Table 5.

Ribaldo are caught in low numbers both in research trawl surveys and in observed commercial fisheries making tracking of cohorts by length frequencies difficult. Analyses of trawl survey and observer data has shown that the biomass of females is usually greater than that of males on the

Chatham Rise although sex ratios by number are about 1:1. In the Sub-Antarctic and west coast South Island the biomass and numbers of females are significantly greater than males, often over 10:1. Sex ratios elsewhere in the EEZ are less clear.

Table 3: Von Bertalanffy growth parameter values for ribaldo. Source: Sutton et al (2010).

Von Bertalanffy growth parameters	K	t_0	L_∞
RIB 3 & 4 females	0.135	0.221	67.526
RIB 3 & 4 males	0.072	-5.246	61.444
RIB 3 & 4 combined sexes	0.14	-0.287	60.47

Table 4: Estimates of natural mortality rate (M) (yr^{-1}). Source: Sutton et al (2010).

	Females	Males
Natural mortality rate (M)	0.106	0.112

Table 5: Length-weight parameter values for ribaldo ($W = aL^b$).

Fishstock		Estimate		Source
Weight = a(length)^b (Weight in g, length in cm total length)				
	Females		Males	
	a	b	a	b	
RIB 3 & 4	0.0037	3.27	0.0053	3.18	Sutton et al (2010)
RIB 5 & 6	-	-	-	-	
			Sexes combined		
			a	b	
RIB 3 & 4			0.004289	3.237753	Sutton et al (2010)
RIB 5 & 6			0.0039	3.15	Bagley et al (unpublished data)

3. STOCKS AND AREAS

It is not known whether different regional stocks of ribaldo occur in New Zealand waters but it is possible that there are separate stocks based on natural bathymetric boundaries. The Working Group had previously agreed on five fishstocks based on the four main fishing areas plus the Kermadec area, i.e., the east coast of the North Island (QMAs 1 and 2), Chatham Rise and east coast South Island (QMAs 3 and 4), Southland and Sub-Antarctic (QMAs 5 and 6), the west coast of New Zealand (QMAs 7, 8 and 9) and QMA 10. Reviews of all available information in 2010 and 2014 indicated that the main fishing areas are still as found previously. The reviews also indicated spawning activity in all areas, except RIB 8 and RIB 10 (for which there was no information). This is not inconsistent with the management of the fishery by the current 10 FMAs. Highly skewed sex ratios in the Sub-Antarctic and west coast South Island have unknown implications for stock structure.

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

East coast North Island (RIB 1 & 2)

There are no stock monitoring indices available for RIB 1 & 2.

Chatham Rise and east coast South Island (RIB 3 & 4)

The Middle Depths Working Group agreed that relative biomass estimates of ribaldo from middle depth trawl surveys on Chatham Rise was suitable for monitoring major changes in ribaldo relative abundance for RIB 3 & 4. Biomass on the Chatham Rise has fluctuated without trend, being at a time series low in 2020, but followed by a relatively high biomass in 2022 (Figure 2; Table 6). Ribaldo were persistently caught mostly on the northern and western Chatham Rise, mostly adults with lengths for males of 40–60 cm and females 40–75 cm, and with a variable but roughly equal sex ratio (Figure 3). There was no obvious change in length frequency compositions over time.

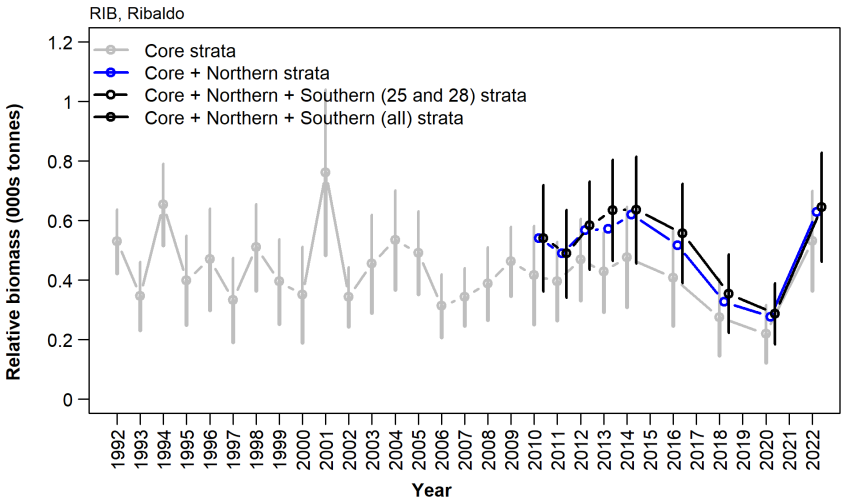


Figure 2: Ribaldo biomass indices from the Chatham Rise *Tangaroa* trawl survey.

Table 6: Biomass indices (t) and coefficients of variation (CV) of ribaldo. Estimates are for the core strata only.

Area	Vessel	Trip code	Date	Biomass (t)	%CV
Chatham Rise	*Tangaroa*	TAN9106	Dec 91–Feb 92	417	12.2
		TAN9212	Dec 92–Feb 93	336	17.2
		TAN9401	Jan 94	602	10.8
		TAN9501	Jan–Feb 95	406	19.7
		TAN9601	Dec 95–Jan 96	470	18.2
		TAN9701	Jan 97	333	21.3
		TAN9801	Jan 98	510	14.3
		TAN9901	Jan 99	395	18.0
		TAN0001	Dec 99–Jan 00	387	20.8
		TAN0101	Dec 00–Jan 01	762	18.3
		TAN0201	Dec 01–Jan 02	417	13.2
		TAN0301	Dec 02–Jan 03	455	18.1
		TAN0401	Dec 03–Jan 04	535	15.6
		TAN0501	Dec 04–Jan 05	491	14.2
		TAN0601	Dec 05–Jan 06	313	16.9
		TAN0701	Dec 06–Jan 07	380	14.1
		TAN0801	Dec 07–Jan 08	479	14.3
		TAN0901	Dec 08–Jan 09	463	12.7
		TAN1001	Jan 10	416	19.9
		TAN1101	Jan 11	396	16.7
		TAN1201	Jan 12	469	14.6
		TAN1301	Jan 13	428	15.7
		TAN1401	Jan 14	477	17.7
		TAN1601	Jan 16	407	19.7
		TAN1801	Jan 18	275	23.2
		TAN2001	Jan 20	220	22.2
		TAN2201	Jan 22	532	15.8
Sub-Antarctic	*Tangaroa*	TAN9105	Nov–Dec 91	1 035	11.2
		TAN9211	Nov–Dec 92	389	18.6
		TAN9310	Nov–Dec 93	996	12.8
		TAN0012	Nov–Dec 00	873	14.0
		TAN0118	Nov–Dec 01	1 017	17.2
		TAN0219	Nov–Dec 02	656	17.5
		TAN0317	Nov–Dec 03	653	18.9
		TAN0414	Nov–Dec 04	951	16.5
		TAN0515	Nov–Dec 05	721	14.6
		TAN0714	Nov–Dec 07	1 062	13.5
		TAN0617	Nov–Dec 06	780	16.4
		TAN0813	Nov–Dec 08	658	18.0
		TAN0911	Nov–Dec 09	1 056	13.4
		TAN1117	Nov–Dec 11	1 017	17.2
		TAN1215	Nov–Dec 12	787	16.7
		TAN1412	Nov–Dec 14	813	16.0
		TAN1614	Nov–Dec 16	276	29.0
		TAN1811	Nov–Dec 18	624	23.7
		TAN2014	Nov–Dec 20	1 128	17.2
West Coast South Island	*Tangaroa*	TAN0007	Jun-Aug 00	104	26.3
		TAN1210	Jul-Aug 12	43	25.3
		TAN1308	Jul-Aug 13	16	30.0
		TAN1609	Jul-Aug 16	15	44.3
		TAN1807	Jul-Aug 18	29	21.1
		TAN2107	Jul-Aug 21	13	50.1

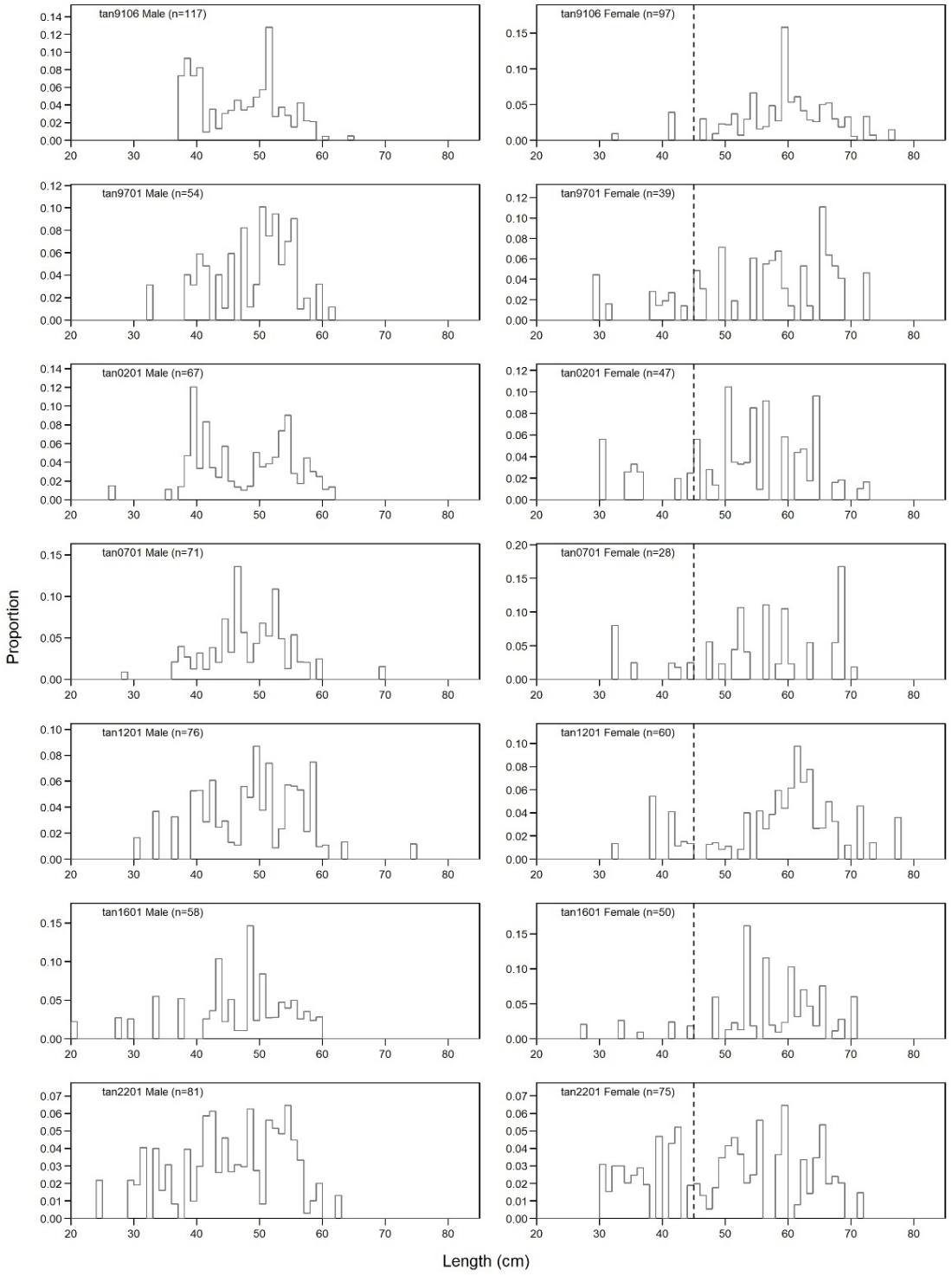


Figure 3: Selected ribaldo length frequency compositions for the Chatham Rise *Tangaroa* trawl survey core strata. n, number of fish measured. Vertical broken lines indicate the approximate size at first maturity (females only).

Southland and Subantarctic (RIB 5 & 6)

The Middle Depths Working Group agreed that biomass estimates of ribaldo from middle depth trawl surveys on the Sub-Antarctic were suitable for monitoring major changes in ribaldo relative abundance for RIB 5 & 6.

Biomass on Chatham Rise has fluctuated without trend, being at a time series low in 2016, but increased to a relatively high biomass in 2020 (Figure 4; Table 6). Ribaldo were persistently caught mostly on the northwest Campbell Plateau and at Puysegur, and catches were dominated by adult females (Figure 5). There was no obvious change in length frequency compositions over time.

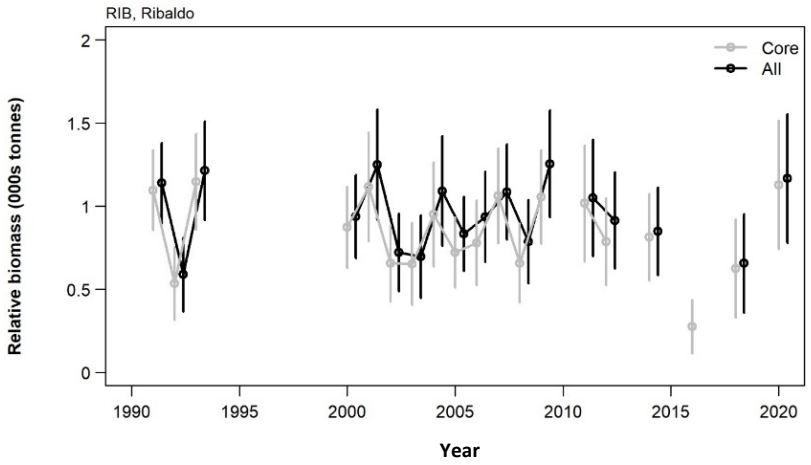


Figure 4: Ribaldo biomass indices from the Subantarctic *Tangaroa* trawl survey.

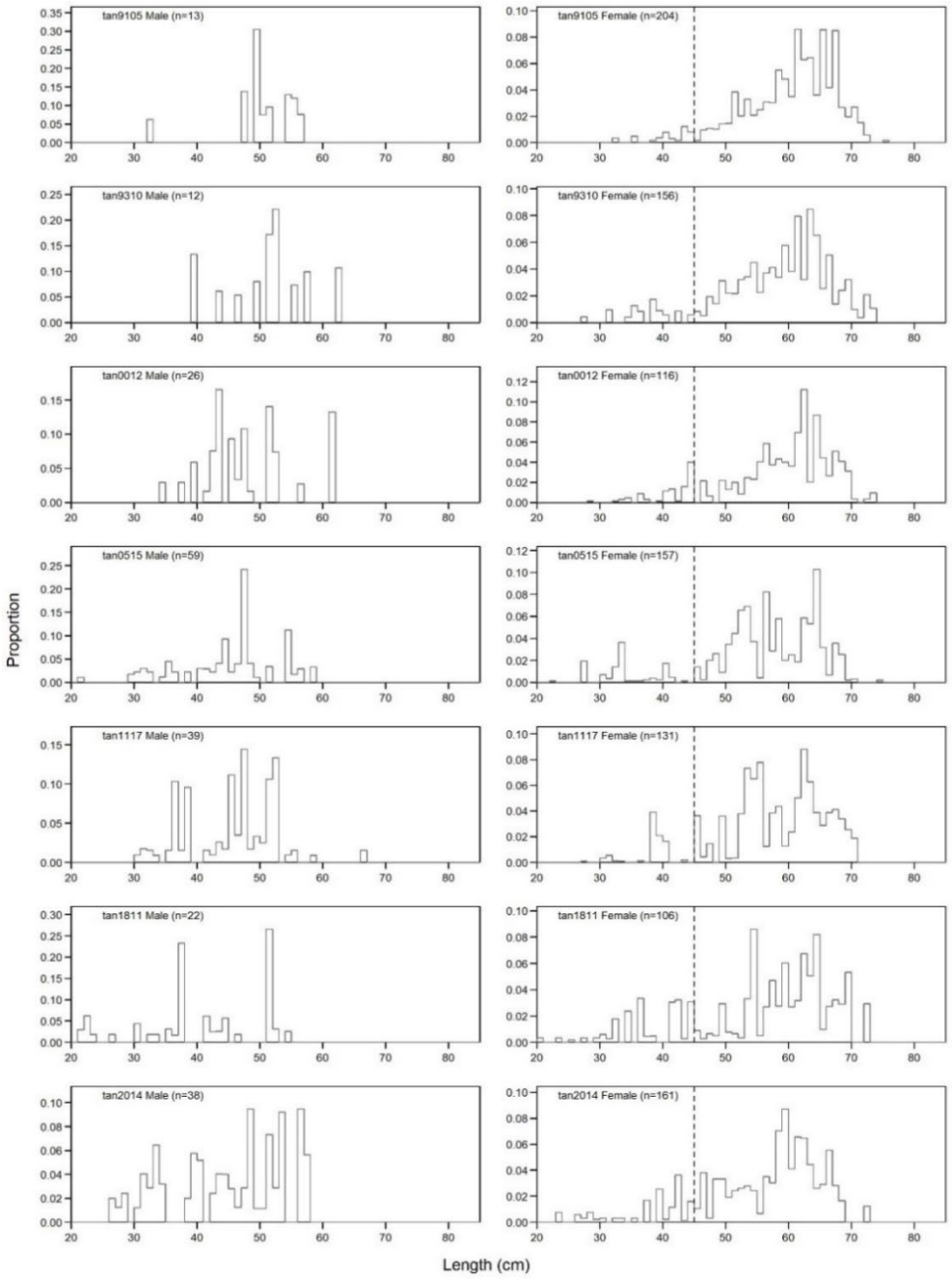


Figure 5: Selected ribaldo length frequency compositions for the Subantarctic *Tangaroa* trawl survey core strata. n, number of fish measured. Vertical broken lines indicate the approximate size at first maturity (females only).

West coast (RIB 7, 8 and 9)

The Middle Depths Working Group agreed that biomass estimates of ribaldo from middle depth trawl surveys on the west coast South Island were suitable for monitoring major changes in ribaldo relative abundance for RIB 7. There are no stock indices available for RIB 8 or 9. Biomass on the west coast South Island has decreased between 2000 and 2013 and then has shown no trend (Figure 6; Table 6). The catch was largely males of 25–50 cm and females of 20–70 cm, with a relatively high proportion of juvenile females, and more females were caught than males (although the sex ratio skew was not as pronounced as for the Subantarctic) (Figure 7). There was no obvious change in the location of catches or length frequency compositions over time.

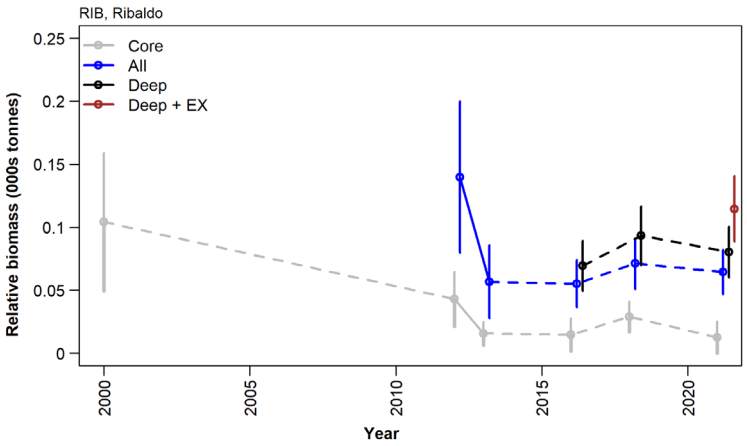


Figure 6: Ribaldo biomass indices from the west coast South Island *Tangaroa* trawl survey.

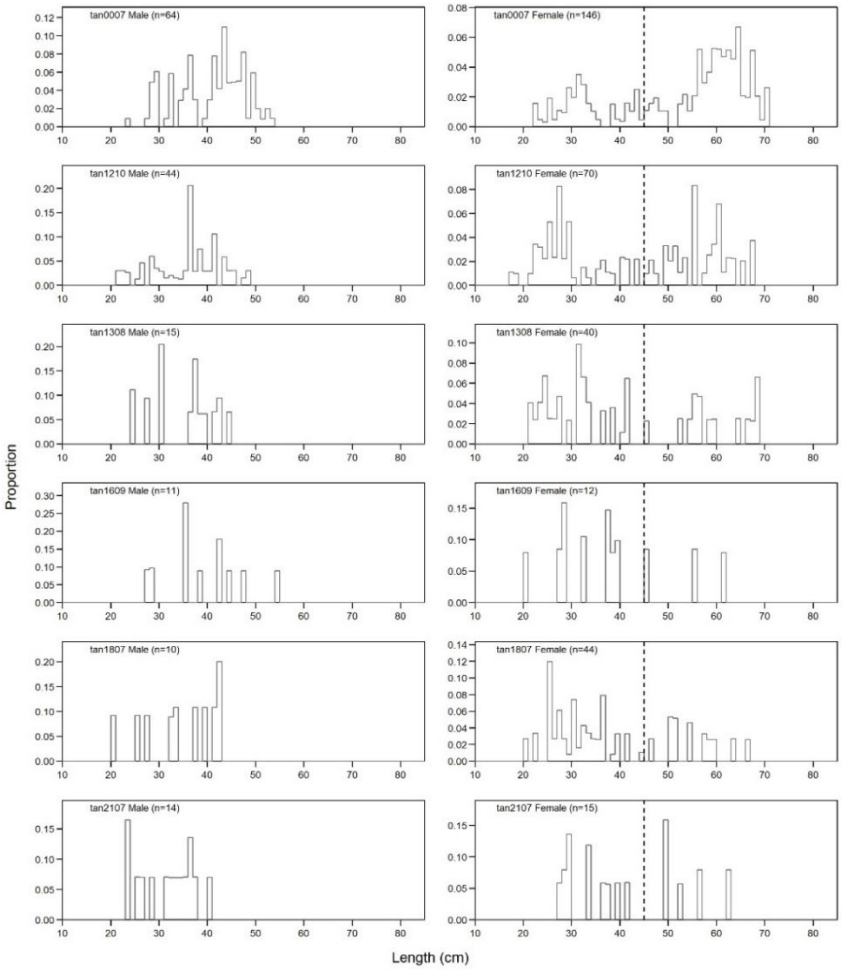


Figure 7: Ribaldo length frequency compositions for the west coast South Island *Tangaroa* trawl survey core strata. n, number of fish measured. Vertical broken lines indicate the approximate size at first maturity (females only).

4.2 Establishing interim B_{MSY}-compatible reference points

Chatham Rise and east coast South Island (RIB 3 & 4)
In 2022, the Working Group accepted biomass estimates from the Chatham Rise research trawl survey as a valid measure of biomass. The period 2004–05 to 2014–15 was adopted to set the interim B_{MSY}-compatible proxy. This period was chosen because abundance fluctuated without trend, whilst including relatively high catches. The Plenary adopted the default Harvest Strategy Standard definitions for the Soft and Hard Limits of one half and one quarter the target, respectively.

Southland and Subantarctic (RIB 5 & 6)
In 2022, the Working Group accepted biomass estimates from the Subantarctic research trawl survey as a valid measure of biomass. The period 1990–91 to 2003–04 was adopted to set the interim B_{MSY}-compatible proxy. This period was chosen because abundance was slightly stable during a period that included relatively high catches. The Plenary adopted the default Harvest Strategy Standard definitions for the Soft and Hard Limits of one half and one quarter the target, respectively.

West coast (RIB 7, 8 & 9)
In 2022, the Working Group accepted biomass estimates from the West Coast South Island research trawl survey as a valid measure of biomass, but only from 2012 after the trawl survey design was optimized and deeper strata were added. The series was considered currently too short to determine a B_{MSY}-compatible proxy period.

5. FUTURE RESEARCH CONSIDERATIONS

- A level 1 stock assessment should be possible for RIB 3&4. Because there is little contrast in the catches or biomass index over time a current assessment would likely have low precision.
- Ageing of ribaldo has been validated, and aged otoliths from surveys and/or fisheries would increase the information available to stock assessments.
- The fishery characterization should be updated. The last characterization covered the period to 2008–09. The characterization should evaluate standardized CPUE as a further biomass index.
- Stock structure should be reviewed for all New Zealand simultaneously using all available data. This should include evaluating hypotheses for the skewed sex ratios.

6. STATUS OF THE STOCKS

- **RIB 1 & 2**

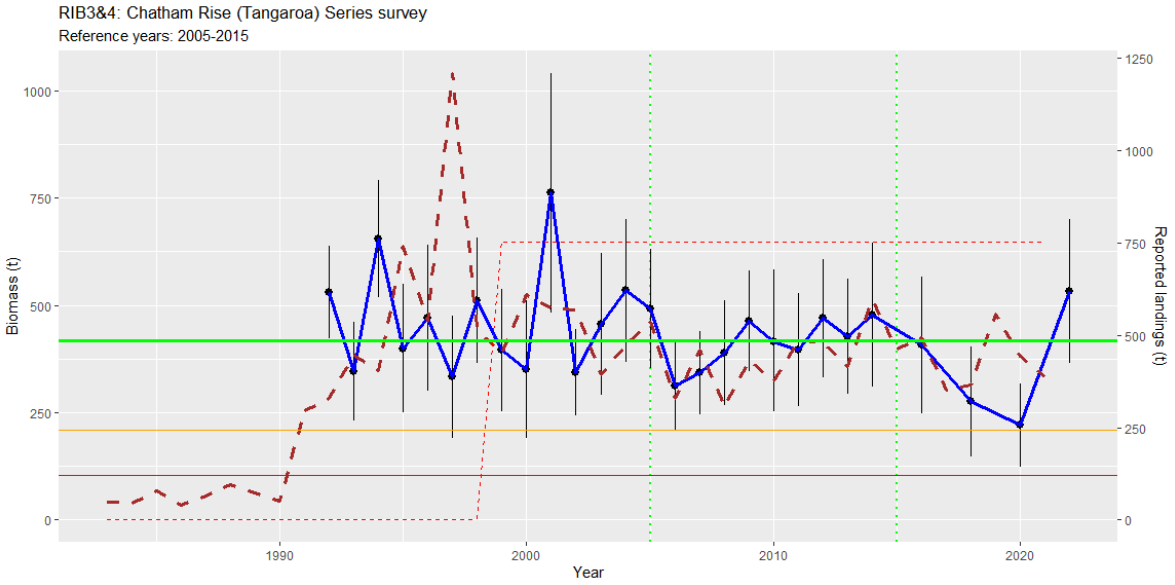
There are no accepted stock monitoring indices available for RIB 1 & 2.

- **RIB 3 & 4**

Stock Status		
Most Recent Assessment Plenary Publication Year	2023	
Catch in most recent year of assessment	Year: 2021–22	Catch: 366 t
Assessment Runs Presented	Abundance index based on Chatham Rise *Tangaroa* research trawl survey	
Reference Points	Interim Target: B_{MSY} proxy based on arithmetic mean survey index for the period 1995 to 2005 Soft Limit: 50% B_{MSY} proxy Hard Limit: 25% B_{MSY} proxy	

	Overfishing threshold: F_{MSY} proxy based on mean relative exploitation rate for the period 2005 to 2015
Status in relation to Target	About as Likely as Not (40–60%) to be at or above the target
Status in relation to Limits	Unlikely (< 40%) to be below soft limit; Unlikely (< 40%) to be below hard limit
Status in relation to Overfishing	Unknown

Historical Stock Status Trajectory and Current Status



RIB 3 & 4: Relative biomass from Chatham Rise *Tangaroa* trawl survey: blue line plus vertical lines showing ± 2 s.d. (left axis); dashed line, reported QMR/MHR landings (right axis); red dotted line, TACC for RIB 3&4 (right axis). Horizontal green line marks the target, horizontal orange line the soft limit, and horizontal red line the hard limit. Vertical broken green lines bound the reference period.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	The relative biomass index declined between 2014 and 2020 and then increased substantially in 2022.
Recent Trend in Fishing Mortality or Proxy	Unknown
Other Abundance Indices	-
Trends in Other Relevant Indicators of Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	Unknown
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft limit: Unknown Hard limit: Unknown
Probability of Current Catch or TACC causing Overfishing to continue or commence	Unknown

Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Survey abundance index	
Assessment Dates	Latest assessment Plenary publication year: 2023	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	Survey abundance index	1 – High Quality

Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	- Low numbers of individuals caught on trawl surveys. - Impact of catches during the 1970s on stock size is unknown	

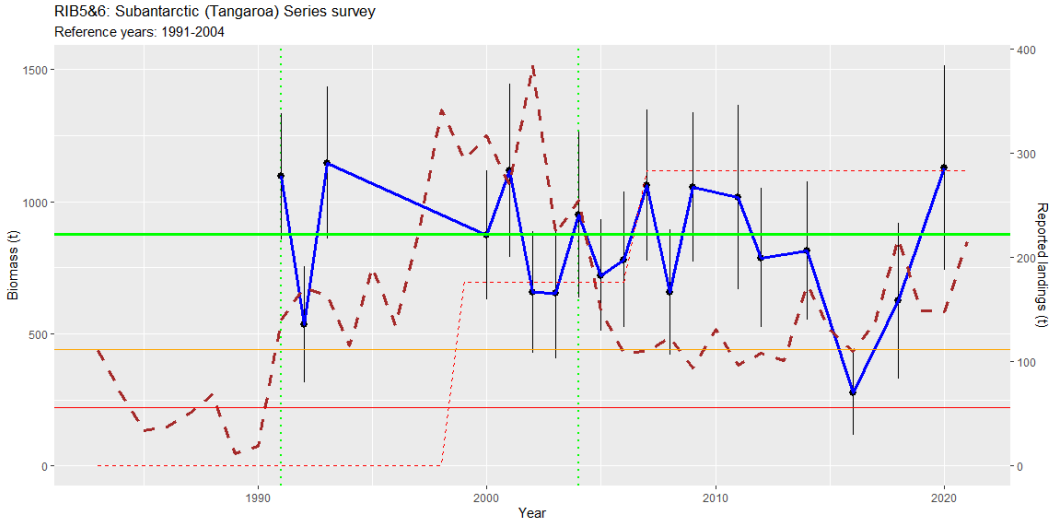
Qualifying Comments
-

Fishery Interactions
In RIB 3 & 4, ribaldo are taken as bycatch primarily in the ling and hoki bottom trawl fisheries and ling bottom longline fishery.

- **RIB 5 & 6**

Stock Status		
Most Recent Assessment Plenary Publication Year	2023	
Catch in most recent year of assessment	Year: 2021–22	Catch: 144 t
Assessment Runs Presented	Abundance index based on Subantarctic *Tangaroa* research trawl survey	
Reference Points	Interim Target: B_{MSY} proxy based on arithmetic mean survey index for the period 1991 to 2004 Soft Limit: 50% B_{MSY} proxy Hard Limit: 25% B_{MSY} proxy Overfishing threshold: F_{MSY} proxy based on mean relative exploitation rate for the period 1991 to 2004	
Status in relation to Target	About as Likely as Not (40–60%) to be at or above the target	
Status in relation to Limits	Unlikely (< 40%) to be below soft limit Unlikely (< 40%) to be below hard limit	
Status in relation to Overfishing	Unknown	

Historical Stock Status Trajectory and Current Status



RIB 5 & 6: Relative biomass from the Subantarctic *Tangaroa* trawl survey: blue line plus vertical lines showing ± 2 s.d. (left axis); dashed line, reported QMR/MHR landings (right axis); red dotted line, TACC for RIB 5&6 (right axis). Horizontal green line marks the target, horizontal orange line the soft limit, and horizontal red line the hard limit. Vertical broken green lines bound the reference period.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	The relative biomass index declined between 2010 and 2016 and then increased to a relatively high level in 2020.
Recent Trend in Fishing Mortality or Proxy	Unknown
Other Abundance Indices	-
Trends in Other Relevant Variables of Indicators	-

Projections and Prognosis	
Stock Projections or Prognosis	Unknown
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft limit: Unknown Hard limit: Unknown
Probability of Current Catch or TACC causing Overfishing to continue or commence	Unknown

Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Survey abundance index	
Assessment Dates	Latest assessment Plenary publication year: 2023	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Survey abundance index	1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	Low numbers of individuals caught on trawl surveys; and unknown implications of highly skewed sex ratios (females usually make up > 90% of biomass) for stock structure. Observer data also shows skewed sex ratio favouring females. Impact of catches during the 1970s is unknown.	

Qualifying Comments
-

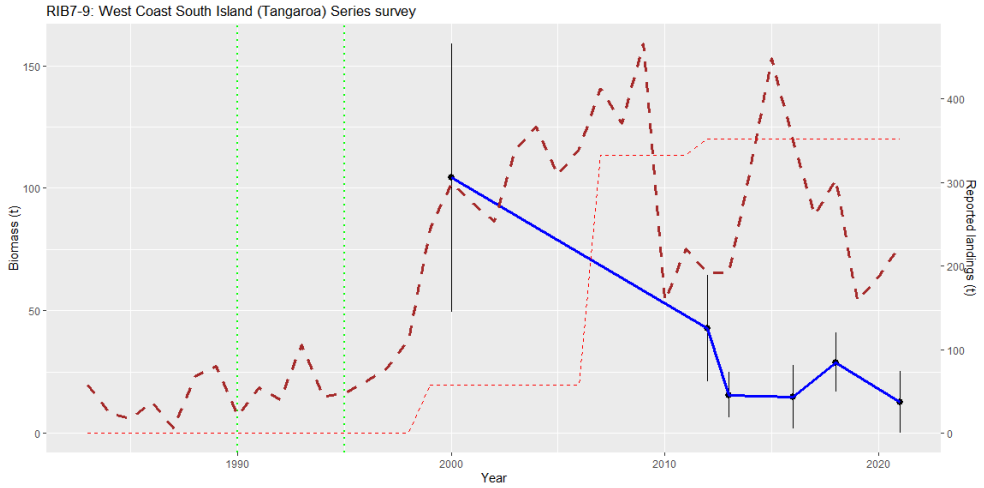
Fishery Interactions
In RIB 5 & 6, ribaldo are mainly caught as bycatch in hoki and ling bottom trawl fisheries and ling bottom longline fisheries.

- **RIB 7, 8 & 9**

Stock Status		
Most Recent Assessment Plenary Publication Year	2023	
Catch in most recent year of assessment	Year: 2021–22	Catch: 301 t
Assessment Runs Presented	Abundance index based on west coast South Island *Tangaroa* research trawl survey	
Reference Points	Management Target: 40% B_0 Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: Not defined	
Status in relation to Target	Unknown	
Status in relation to Limits	Unknown	

Status in relation to Overfishing	Unknown

Historical Stock Status Trajectory and Current Status



RIB 7, 8 & 9: Relative biomass from the west coast South Island *Tangaroa* trawl survey: blue line plus vertical lines showing ± 2 s.d. (left axis); dashed line, reported QMR/MHR landings (right axis); red dotted line, TACC for RIB 7, 8 & 9 (right axis).

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	The relative biomass index has been stable since 2013.
Recent Trend in Fishing Mortality or Proxy	Unknown
Other Abundance Indices	-
Trends in Other Relevant Indicators of Variables	-
Projections and Prognosis	
Stock Projections or Prognosis	Unknown
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft limit: Unknown Hard limit: Unknown
Probability of Current Catch or TACC causing Overfishing to continue or commence	Unknown

Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Survey abundance index	
Assessment Dates	Latest assessment Plenary publication year: 2023	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	Survey abundance index	1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	- Low numbers of individuals caught on trawl surveys.	

Qualifying Comments
-

Fishery Interactions
-

7. FOR FURTHER INFORMATION

Bagley, N W; O'Driscoll, R L (2012) Trawl survey of middle depth species in the Southland and Sub-Antarctic areas, November–December 2009 (TAN0911). *New Zealand Fisheries Assessment Report 2012/05.* 70 p.

Cohen, D M; Inada, T; Iwamoto, T; Scialabba, N (1990) FAO species catalogue. Vol. 10. Gadiform fishes of the world (Order Gadiformes). An annotated and illustrated catalogue of cods, hakes, grenadiers and other gadiform fishes known to date. *Food and Agriculture Orginisation Fisheries Synopsis*. No. 125, Vol. 10. Rome, FAO. 442 p.

Dunn, M R (2006) Descriptive and catch per unit effort analyses for New Zealand ribaldo fisheries for the fishing years 1977–78 to 2002–03. *New Zealand Fisheries Assessment Report 2006/22*. 55 p.

Dunn, M R (2022) Climate change and the distribution of commercially caught marine fish species in New Zealand. Part 1: Spatio-temporal changes since 1989. New Zealand Aquatic Environment and Biodiversity Report No. 286. 405 p.

Elder, R D; Taylor, J L (Comps.) (1979) Prospects and problems for New Zealand's demersal fisheries. Proceedings of the Demersal Fisheries Conference October 1978. *Fisheries Research Division Occasional Publication* No. 19. 123 p.

Finucci, B; Dunn, M R; Arnold, R (2019) Using length-weight relationships to estimate life history: An application to deep-sea sharks. *Canadian Journal of Fisheries and Aquatic Sciences* 76: 723–739.

MacGibbon, D J (2015) Fishery characterisation and standardised CPUE analyses for ribaldo, *Mora moro* (Risso, 1810) (Moridae), 1989–90 to 2012–13 *New Zealand Fisheries Assessment Report 2015/31.* 314 p.

MacGibbon, D J; Hurst, R J (2011) Fishery characterisation and standardised CPUE analyses for ribaldo, *Mora moro*, (Risso, 1810) (Moridae), 1989–90 to 2008–09. *New Zealand Fisheries Assessment Report 2011/25.*

McMillan, P J; Hart, A C (1998) Summary of biology and commercial landings, and a stock assessment of ribaldo *Mora moro* (Risso, 1810), in New Zealand waters. New Zealand Fisheries Assessment Research Document 1998/9. 16 p. (Unpublished report held in NIWA library, Wellington.)

O'Driscoll, R L; Booth, J D; Bagley, N W; Anderson, O F; Griggs, L H; Stevenson, M L; Francis, M P (2003) Areas of importance for spawning, pupping or egg-laying, and juveniles of New Zealand deepwater fish, pelagic fish, and invertebrates. *NIWA Technical Report 119*. 377 p.

Santos, R; Medeiros-Leal, W; Crespo, O; Novoa-Pabon, A; Pinho, M (2021) Contributions to management strategies in the NE Atlantic regarding the life history and population structure of a key deep-sea fish (*Mora moro*). Biology 10, 522.

Sutton, C P; Tracey, D M; Andrews, A H; Hart, A C; MacGibbon, D J (2010) Validated age and growth of ribaldo (*Mora moro*). *New Zealand Fisheries Assessment Report 2010/24.*26 p.