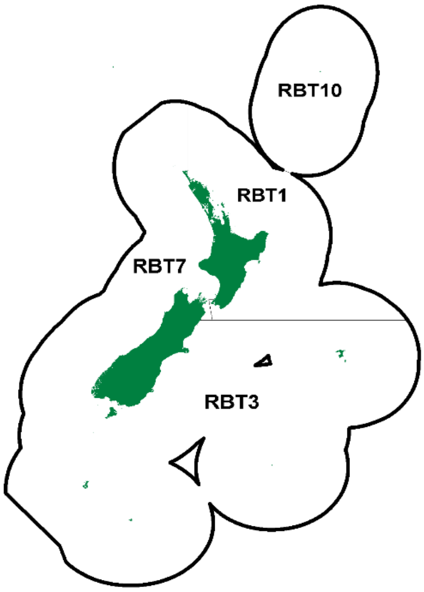
REDBAIT (RBT)

(*Emmelichthys nitidus*)



1. FISHERY SUMMARY

1.1 Commercial fisheries

Redbait (*Emmelichthys nitidus*) was introduced to the Quota Management System on 1 October 2009, with a combined TAC of 5316 t and TACC of 5050 t. Allowances are zero for customary non-commercial or recreational fisheries. Following a period of low catch from RBT 7, the Minister decided to reduce the RBT 7 TAC to 421 t from 1 October 2022.

Redbait is mainly taken as bycatch of the jack mackerel target trawl fishery, but also widely taken as bycatch of barracouta and squid trawl tows, with some taken in the hoki fishery. A target fishery developed in the late-2000s, primarily on the Chatham Rise. Reported total landings ranged from 2184 t to 4307 t during the 2000s, but declined across all QMAs and target fisheries in 2009–10 and 2010–11 landed nearer 1000 t. Since the fishing year 2011–12 total landings have ranged between 1456 t and 2856 t and have primarily been taken in RBT 3.

RBT 3 includes the southern fisheries for squid, and fisheries for jack mackerel on the Mernoo Bank and Chatham Rise, and accounted for most of the redbait landed in each year during the 1990s. From 2002–03 to 2009–10 however, the jack mackerel fishery off the west coast expanded into north and south Taranaki bights, with landings from RBT 7 exceeding those from RBT 3. Since 2010 RBT 7 landings have declined, with RBT 3 catches once again making up the bulk of the landings. Since 2018–19 annual RBT 7 landings have been under 40 t compared with 1700 t to 2700 t in RBT 3. Landings of RBT 1 have been small (less than 5 t) in most years, increasing slightly in the late 2000s with the majority taken as bycatch in rubyfish target midwater trawling.

TACs, allowances and TACCs from 1 October 2009 are reported in Table 1. Table 2 and Figure 1 show historical landings from 2001–02 to the present, reported by QMAs.

Table 1: TACs (t), allowances (t), and TACCs (t) of redbait as at 1 October 2022.

Fishstock	Other mortality	Customary non–commercial and recreational	TACC	TAC
RBT 1	1	0	19	20
RBT 3	115	0	2 190	2 305
RBT 7	21	0	400	421
RBT 10	0	0	0	0

Table 2: Reported landings (t) of redbait by Fishstock and TACCs from 1989–90 to present. Landings from 2001–02 are MHR totals, while landings from 1989–90 to 2000–01 are from CELR/CLR data (Middleton in prep).

	RBT 1		RBT 3		RBT 7		RBT 10			
FMA	**1, 2**		**3, 4, 5, 6**		**7, 8, 9**		**10**		**Total**	
Fishstock	**Landings**	**TACC**	**Landings**	**TACC**	**Landings**	**TACC**	**Landings**	**TACC**	**Landings**	**TACC**
1989–90	< 1	–	53	–	< 1	–	0	–	53	–
1990–91	< 1	–	6	–	9	–	0	–	15	–
1991–92	–	–	557	–	109	–	0	–	666	–
1992–93	< 1	–	1 770	–	46	–	0	–	1816	–
1993–94	< 1	–	1 676	–	235	–	0	–	1912	–
1994–95	< 1	–	1 966	–	550	–	0	–	2517	–
1995–96	< 1	–	1 532	–	460	–	0	–	1993	–
1996–97	< 1	–	1 194	–	608	–	0	–	1802	–
1997–98	3	–	1 485	–	518	–	0	–	2007	–
1998–99	< 1	–	1 820	–	693	–	0	–	2513	–
1999–00	1	–	2 391	–	579	–	0	–	2971	–
2000–01	< 1	–	940	–	739	–	0	–	1679	–
2001–02	< 1	–	1 638	–	1 669	–	0	–	3 308	–
2002–03	< 1	–	1 219	–	2 113	–	0	–	3 333	–
2003–04	1	–	1 535	–	2 771	–	0	–	4 307	–
2004–05	1	–	676	–	1 507	–	0	–	2 184	–
2005–06	2	–	2 016	–	1 936	–	0	–	3 955	–
2006–07	3	–	1 098	–	1 506	–	0	–	2 607	–
2007–08	5	–	560	–	2 376	–	0	–	2 941	–
2008–09	10	–	1 808	–	1 649	–	0	–	3 467	–
2009–10	18	19	886	2 190	170	2 841	0	0	1 066	5 050
2010–11	21	19	284	2 190	713	2 841	0	0	1 017	5 050
2011–12	2	19	1 229	2 190	369	2 841	0	0	1 599	5 050
2012–13	2	19	1 826	2 190	325	2 841	0	0	2 153	5 050
2013–14	4	19	2 774	2 190	78	2 841	0	0	2 856	5 050
2014–15	4	19	2 020	2 190	132	2 841	0	0	2 156	5 050
2015–16	5	19	1 068	2 190	383	2 841	0	0	1 456	5 050
2016–17	5	19	2 435	2 190	160	2 841	0	0	2 600	5 050
2017–18	2	19	1 687	2 190	75	2 841	0	0	1 764	5 050
2018–19	< 1	19	2 648	2 190	26	2 841	0	0	2 674	5 050
2019–20	2	19	2 459	2 190	22	2 841	0	0	2 483	5 050
2020–21	< 1	19	2 171	2 190	38	2 841	0	0	2 210	5 050
2021–22	3	19	1 714	2 190	21	2 841	0	0	1 738	5 050
2022–23	< 1	19	1 890	2 190	6	400	0	0	1 896	2 609

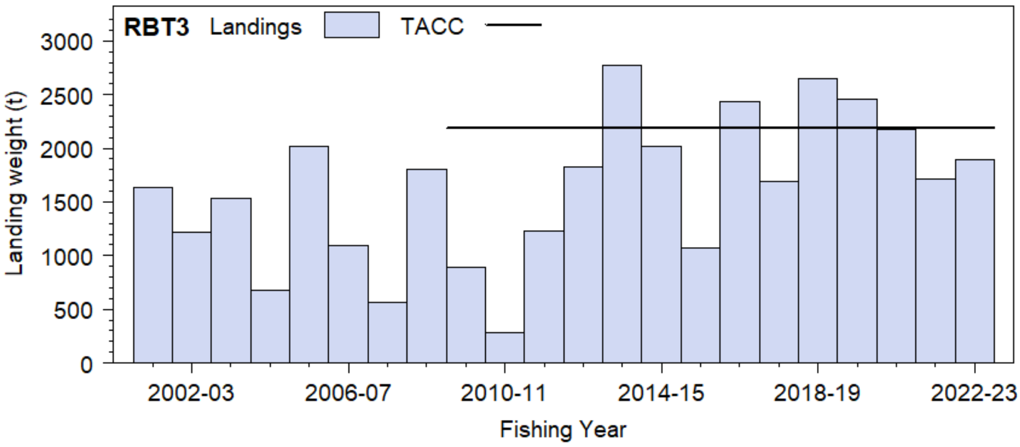


Figure 1: Reported commercial landings and TACC for the two main RBT stocks. RBT 3. [Continued on next page]

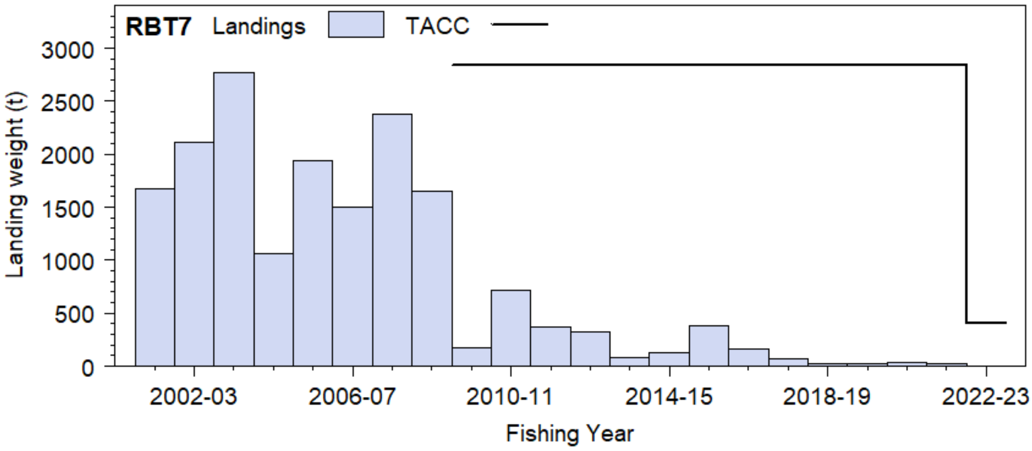


Figure 1 [Continued]: Reported commercial landings and TACC for the two main RBT stocks. RBT 7.

1.2 Recreational fisheries
There is no known non-commercial fishery for redbait.

1.3 Customary non-commercial fisheries
There is no known customary non-commercial fishery for redbait.

1.4 Illegal catch
No quantitative information is available on the level of illegal catch of redbait.

1.5 Other sources of mortality
Taylor (2009) described up to 345 t (but usually less than 200 t) of redbait reported annually as discarded between 1988–89 and 2008–09.

2. BIOLOGY

Emmelichthys nitidus is a schooling, bathypelagic species in the same family (Emmelichthyidae) as rubyfish. It is widely distributed around New Zealand in depths from 85 to 500 m.

There have been no ageing studies of redbait in New Zealand. Australian studies suggest regional differences in maximum size and age with a maximum age of 14 years off New South Wales, 7 years off South Australia (Dennis et al 2021) and 8 years off Tasmania, where the maximum reported size of redbait is 316 mm fork length (Welsford & Lyle 2003). Von Bertalanffy growth parameters of Tasmanian redbait for both sexes combined are given in Table 3.

Research data from New Zealand show that the maximum size of redbait is about 420 mm FL, which is larger than most other regions where length of this species has been recorded, except South Africa. Welsford and Lyle (2003) suggested that the much larger redbait reported from Africa could indicate that the maximum age of redbait may be greater than Australian studies, or that growth is highly variable regionally. They also noted that ageing of rubyfish (subsequently documented by Horn et al 2012) indicated some emmelichthyid species are long lived. However, the relevance of this observation to redbait is questionable: meta-analysis by Thorson et al (2017) indicates that while there is some segregation of life history parameters by family, parameters nevertheless vary by orders of magnitude variation within families and show significant overlap between families. Welsford & Lyle (2003) attempted marginal increment analysis of redbait otoliths but could not identify a clear pattern in otolith growth throughout the year. Most redbait measured by observers from New Zealand fisheries, to the nearest cm below, are over 250 mm; however modes of smaller fish at approximately 120 mm, 200 mm, and 250 mm are consistent with the expected sizes of 1, 2, and 3 year old fish from the Tasmanian growth curve (Middleton in prep).

Spawning in Tasmania extends over 2–3 months during spring, with females producing batches of eggs at three day intervals. Size at maturity varied markedly by region; sizes at 50% maturity in males were 146 mm for eastern and 244 mm for south-western fish, and 157 mm for eastern and 261 mm for south-western females (Ewing & Lyle 2009). There is some evidence that redbait in New Zealand may also spawn in spring, with most stage 4 females recorded by observers in September and October; however, some ripe fish have also been recorded in December and January (Middleton in prep.). Almost all the females sampled off Southland were immature, including fish in the 300–400 mm size range. Size at 50% maturity appears to be around 240 mm on the eastern Chatham Rise, but 270 mm on the western Chatham Rise.

Table 3 shows estimated biological parameters for redbait.

Table 3: Estimates of biological parameters for redbait. Growth is based on Australian studies (Welsford & Lyle 2003).

Fishstock			Estimate	Source
1. Weight = *a* (length)^b (Weight in g, length in cm fork length)				
		Combined sexes		
RBT (All)	*a*		*b*	
	0.004947		3.259168	NIWA (unpub. data)
2. von Bertalanffy growth parameters				
		Combined sexes		
RBT (Tasmania)	L_∞	*k*	t_0	
	28.7	0.56	-0.36	Welsford & Lyle (2003)

3. STOCKS AND AREAS

Because information on redbait stock structure was lacking, management boundaries were established for redbait that mirrored those for jack mackerel. A subsequent analysis of encounter rates (Bentley et al 2014) suggested a north-south seasonal movement of redbait may occur at a spatial scale that is greater than QMAs.

Observer sampling indicates that redbait smaller than 250 mm are only encountered frequently in the Southland fishery, which has been focused in Statistical Area 028. Most redbait sampled in the southern fisheries are immature. Spawning fish have been recorded on the Chatham Rise, particularly on the Mernoo Bank, and, less frequently, off the South Island west coast. It is feasible that there is a single EEZ-wide stock of redbait, with recruiting fish entering the Southland fishery and variable movements of fish to the west coast and Chatham Rise.

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

There are no estimates of spawning stock abundance for any redbait fishstock.

4.2 Biomass estimates

Catch per unit effort analyses were attempted in 2022 for the redbait fisheries in Southland, on the Chatham Rise, and off the west coast South Island/Taranaki Bight fisher-reported and observer data (Middleton in prep). Both the Chatham Rise and the west coast South Island/Taranaki Bight fisheries have variable catches and periods where the absence of any redbait catch precluded the development of CPUE indices.

The Working Group considered that the series using observer catch and effort data were the most promising. For the west coast South Island/Taranaki Bight, the CPUE index (Figure 2) confirmed that redbait abundance was significantly higher in this area in the 2000s than in the 2010s.

For the Southland area, the Working Group considered that the event-resolution observer CPUE series might be regarded as index of the recruiting stock abundance. The index (Figure 3) increased from 1998 to a high point in 2002, then declined to 2008 and fluctuated without trend until 2015 before increasing steadily to 2022. Catch sampling data (Figure 4) suggested that a strong 2016 year class may have been entering the fishery from 2018 to 2020, influenced by increasing selectivity with size.

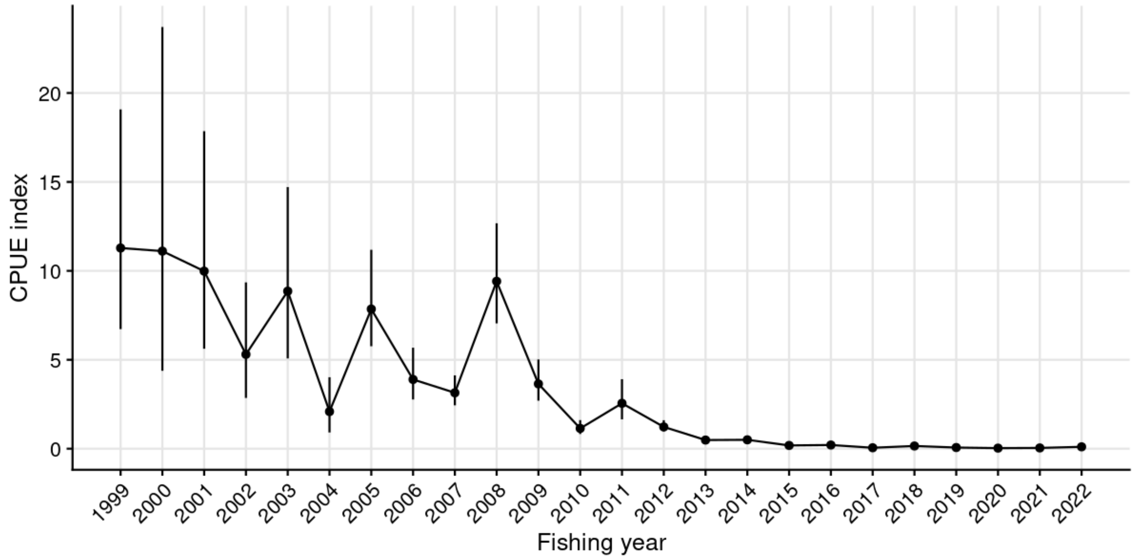


Figure 2: Observer event-resolution combined delta-lognormal CPUE index for the RBT 7 west coast South Island and Taranaki Bight midwater trawl fisheries targeting BAR and JMA showing approximate 95% confidence intervals.

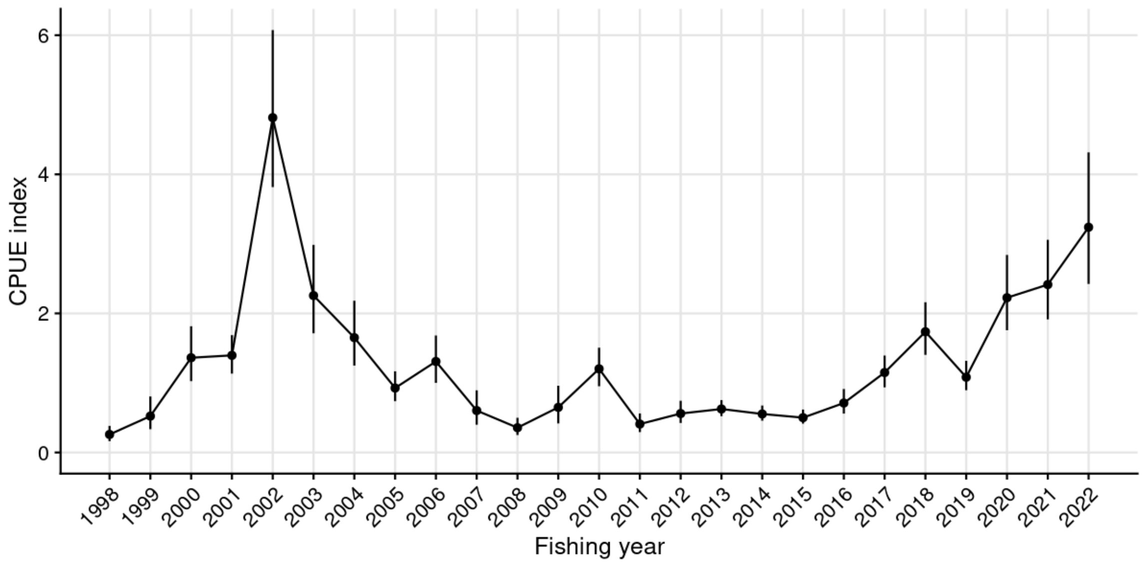


Figure 3: Observer event-resolution combined delta-lognormal CPUE index for the RBT 3 Southland midwater and bottom trawl fisheries targeting SQU, BAR, and JMA showing approximate 95% confidence intervals.

4.3 Future research considerations

- Ageing.
- Directed observer sampling focused on understanding stock structure: regular sampling of the Mernoo Bank fisheries, and verification of maturity stages in the Southland fishery.
- Spatio-temporal modelling of catch and effort data.

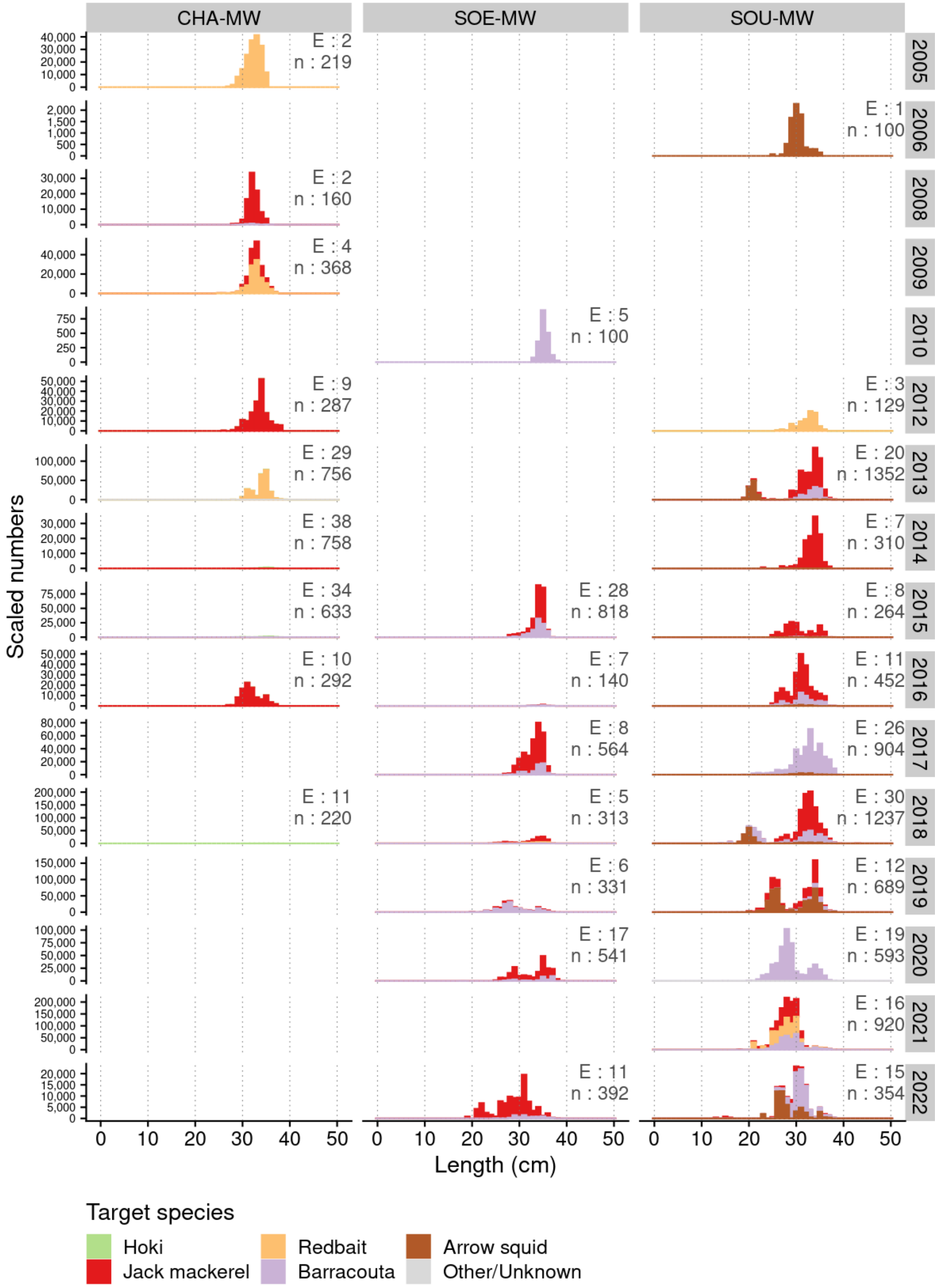


Figure 4: Scaled observer length-frequency distributions for redbait caught in the midwater trawl fishery, by observer region (CHA: Challenger; SOE: eastern Chatham Rise; SOU: Southland), year, and target species (E: Events sampled; n: number of measured fish).

5. STATUS OF THE STOCKS

Redbait may consist of a single New Zealand biological stock. There are no estimates of reference points or current biomass for any redbait fishstock, therefore stock status cannot be determined.

6. FOR FURTHER INFORMATION

Bentley, N; Kendrick, T H; MacGibbon, D J (2014) Fishery characterisation and catch-per-unit-effort analyses for redbait (*Emmelichthys nitidus*), 1989–90 to 2010–11. (Draft New Zealand Fisheries Assessment Report held by Fisheries New Zealand.)

Dennis, J D; Grammer, G; Ward, T; Smart, J; Huveneers, C (2021) Using otolith chronologies to identify extrinsic drivers of growth of 2 commercially targeted small pelagic fish species. *Fishery Bulletin 119*: 135–148.

Ewing, G P; Lyle, J M (2009) Reproductive dynamics of redbait, Emmelichthys nitidus (Emmelichthyidae), from south-eastern Australia. *Fisheries Research 97*: 206–215.

Horn, P L; Neil, H L; Paul, L J; McMillan, P J (2012) Age verification, growth and life history of rubyfish *Plagiogeneion rubiginosum*. *New Zealand Journal of Marine and Freshwater Research 46*: 353–368.

Middleton, D A J (in prep) Characterisation and CPUE analyses for the RBT 1, RBT 3, and RBT 7 fisheries. Draft New Zealand Fisheries Assessment Report.

Taylor, P R (2009) A summary of information on redbait *Emmelichthys nitidus*. Final Research Report for Ministry of Fisheries Project SAP2008-18. (Unpublished report held by Fisheries New Zealand, Wellington.)

Thorson, J T; Munch, S B; Cope, J M.; Gao, J (2017) Predicting life history parameters for all fishes worldwide. *Ecological Applications 27*: 2262–2276.

Welsford, D C; Lyle, J M (2003) Redbait (*Emmelichthys nitidus*): a synopsis of fishery and biological data. *TAFI Technical Report Series 20*. 32 p.