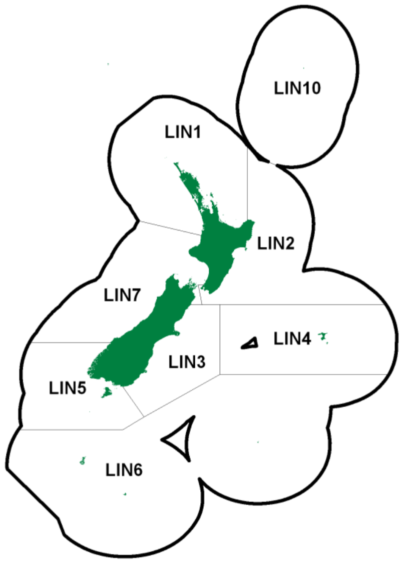
LING

(*Genypterus blacodes*)
Hoka



1. FISHERY SUMMARY

Ling was introduced into the Quota Management System on 1 October 1986. TACs, TACCs, and allowances as of 1 October 2024 are given in Table 1.

Table 1: TACs (t), TACCs (t), and allowances (t) for ling.

Fishstock	Recreational allowance	Customary non-commercial allowance	Other sources of mortality	TACC	TAC
LIN 1	40	20	3	400	463
LIN 2*	–	–	–	982	–
LIN 3	0	0	0	2 060	2 060
LIN 4	0	0	0	4 200	4 200
LIN 5	1	1	104	5 208	5 314
LIN 6	0	0	85	8 505	8 590
LIN 7	1	2	68	3 387	3 458
LIN 10*	–	–	–	10	–

* allowances and TAC not set

1.1 Commercial fisheries

Ling was introduced into the Quota Management System (QMS) on 1 October 1986. Ling are widely distributed throughout the middle depths (200–800 m) of the New Zealand EEZ, particularly south of latitude 40° S. From 1975 to 1980 there was a substantial longline fishery on the Chatham Rise (and to a lesser extent in other areas) carried out by Japanese and Korean longliners. Since 1980 ling have been caught by large trawlers, both domestic and foreign owned, and by small domestic longliners and trawlers. In the early 1990s the domestic fleet was increased by the addition of several larger longliners with autoline equipment, resulting in a large increase in the catches of ling off the east and south of South Island (LIN 3, 4, 5, and 6). Following the 2000–01 fishing year there was a declining trend in catches taken by longline vessels in most areas, offset, to some extent, by increased trawl landings. Potting for ling in LIN 3&4 represented less than 1% of the catch up until 2013; since then, the use of this method has increased, potting represented 10 – 16% of the catch in that area per year between 2018 and 2022 and approximately 30% of total catches in the 2023 and 2024 fishing years. The use of potting has also increased more recently in other ling stocks: in the 2023 fishing year it represented 22% of total catches in LIN 7WC and 12% of total catches in LIN 5&6.

The principal grounds for smaller domestic vessels are off the west coast of South Island (WCSI) and the east coast of both main islands south of East Cape. For the large trawlers the main sources of ling are Puysegur Bank and the slope of the Stewart-Snares shelf and waters in the Auckland Islands area, and the Chatham Rise, primarily as bycatch of target fisheries for hoki. Longliners fish mainly in LIN 3, 4, 5, and 6.

Under the Adaptive Management Programme (AMP), the LIN 1 TACC was increased to 400 t from 1 October 2002; it remained at this level when LIN 1 was removed from the AMP on 30 September 2009. In a proposal for the 1994–95 fishing year, LIN 3 and 4 TACCs were increased to 2810 t and 5720 t, respectively. These stocks were removed from the AMP from 1 October 1998, with TACCs maintained at the increased level. However, from 1 October 2000, the LIN 3 and 4 TACCs were reduced to 2060 t and 4200 t, respectively. From 1 October 2004, LIN 5 and LIN 6 TACCs were increased by about 20% to 3595 t and 8505 t, respectively, and the LIN 5 TACC was increased again by 10% (to 3955 t) from 1 October 2013. From 1 October 2009, the LIN 7 TACC was increased from 2225 t to 2474 t, and to 3080 t from 1 October 2013. From 1 October 2018, the LIN 5 TACC was increased to 4735 t, and further increased to 5208 t from 1 October 2021. From 1 October 2019 a TACC of 3387 t applies for LIN 7. Since 2019–20, landings from Fishstocks LIN 1, LIN 2, LIN 3, LIN 4, and LIN 6 have been substantially lower than their TACCs whilst the LIN 5 and LIN 7 catches were near or slightly above the TACCs. Reported landings for the main QMAs from 1931 to 1982 are given in Table 2.

Table 2: Reported landings (t) for the main QMAs from 1931 to 1982.

Year	LIN 1	LIN 2	LIN 3	LIN 4	LIN 5	LIN 6	LIN 7
1931–32	0	0	11	0	1	0	0
1932–33	0	63	14	0	2	0	35
1933–34	0	146	59	0	1	0	67
1934–35	0	217	70	0	1	0	94
1935–36	0	146	124	0	1	0	66
1936–37	0	133	103	0	1	0	61
1937–38	0	91	320	0	1	0	57
1938–39	0	66	280	0	24	0	37
1939–40	0	40	320	0	16	0	26
1940–41	1	85	286	0	21	0	46
1941–42	0	64	308	0	22	0	40
1942–43	0	54	254	0	24	0	29
1943–44	0	83	264	0	19	0	40
1944	0	103	224	0	13	0	46
1945	1	122	199	0	13	0	80
1946	0	153	348	0	9	0	78
1947	0	203	474	0	24	0	96
1948	0	120	403	0	24	0	66
1949	0	108	402	0	20	0	67
1950	0	84	352	0	29	0	61
1951	0	60	230	0	16	0	34
1952	0	69	235	0	16	0	36
1953	0	62	212	0	19	0	34
1954	0	75	208	0	7	0	44
1955	0	48	160	0	6	0	27
1956	0	27	155	0	4	0	15
1957	0	34	175	0	8	0	19
1958	0	43	178	0	15	0	28
1959	0	39	157	0	13	0	27
1960	0	26	196	0	21	0	19
1961	0	25	230	0	20	0	19
1962	1	27	211	0	13	0	16
1963	1	17	213	0	14	0	11
1964	1	20	223	0	16	0	13
1965	1	21	195	0	24	0	13
1966	5	52	141	0	16	0	17
1967	7	40	106	0	14	0	36
1968	7	55	88	0	11	0	42
1969	5	52	154	0	10	0	23
1970	6	67	167	0	14	0	51
1971	4	49	203	0	20	1	37
1972	6	37	522	6	22	0	33
1973	18	73	1 425	0	23	0	41
1974	9	102	575	42	335	44	82
1975	3	70	1 770	15	1 513	344	224
1976	2	60	1 567	14	2 630	0	1 739
1977	9	100	1 149	466	1 683	0	2 810
1978	24	144	487	0	2 515	391	240
1979	82	228	799	246	4 400	1 431	454
1980	114	205	265	182	4 064	933	928
1981	208	429	427	444	3 576	636	1 020
1982	320	625	924	435	2 109	317	1 208

Reported landings by nation from 1975 to 1987–88 are given in Table 3, and reported landings and TACCs by Fishstock from 1983–84 onwards are given in Table 4. Figure 1 shows the historical landings and TACC values for the main LIN stocks.

Table 3: Reported landings (t) from 1975 to 1987–88. Data from 1975 to 1983 from MAF; data from 1983–84 to 1985–86 from FSU; data from 1986–87 to 1987–88 from QMS. –, no data available.

Fishing year	New Zealand			Foreign Licensed					Grand total
				Longline	Trawl				
	Domestic	Chartered	Total	(Japan + Korea)	Japan	Korea	USSR	Total	
1975*	486	0	486	9 269	2 180	0	0	11 499	11 935
1976*	447	0	447	19 381	5 108	0	1 300	25 789	26 236
1977*	549	0	549	28 633	5 014	200	700	34 547	35 096
1978–79#	657	24	681	8 904	3 151	133	452	12 640	13 321
1979–80#	915	2 598	3 513	3 501	3 856	226	245	7 828	11 341
1980–81#	1 028	–	–	–	–	–	–	–	–
1981–82#	1 581	2 423	4 004	0	2 087	56	247	2 391	6 395
1982–83#	2 135	2 501	4 636	0	1 256	27	40	1 322	5 958
1983†	2 695	1 523	4 218	0	982	33	48	1 063	5 281
1983–84§	2 705	2 500	5 205	0	2 145	173	174	2 491	7 696
1984–85§	2 646	2 166	4 812	0	1 934	77	130	2 141	6 953
1985–86§	2 126	2 948	5 074	0	2 050	48	33	2 131	7 205
1986–87§	2 469	3 177	5 646	0	1 261	13	21	1 294	6 940
1987–88§	2 212	5 030	7 242	0	624	27	8	659	7 901

* Reported by calendar year, # Reported April 1 to March 31(except domestic vessels, which reported by calendar year).
† Reported April 1 to September 30 (except domestic vessels, which reported by calendar year).
§ Reported October 1 to September 30.

Table 4: Reported landings (t) of ling by Fishstock from 1983–84 to present and actual TACCs (t) from 1986–87 to present. Estimated landings for LIN 7 from 1987–88 to 1992–93 include an adjustment for ling bycatch of hoki trawlers, based on records from vessels carrying observers. QMS data from 1986-present. [Continued on next page]

Fishstock	LIN 1		LIN 2		LIN 3		LIN 4		LIN 5	
FMA (s)	1 & 9		2		3		4		5	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1983–84*	141	–	594	–	1 306	–	352	–	2 605	–
1984–85*	94	–	391	–	1 067	–	356	–	1 824	–
1985–86*	88	–	316	–	1 243	–	280	–	2 089	–
1986–87	77	200	254	910	1 311	1 850	465	4 300	1 859	2 500
1987–88	68	237	124	918	1 562	1 909	280	4 400	2 213	2 506
1988–89	216	237	570	955	1 665	1 917	232	4 400	2 375	2 506
1989–90	121	265	736	977	1 876	2 137	587	4 401	2 277	2 706
1990–91	210	265	951	977	2 419	2 160	2 372	4 401	2 285	2 706
1991–92	241	265	818	977	2 430	2 160	4 716	4 401	3 863	2 706
1992–93	253	265	944	980	2 246	2 162	4 100	4 401	2 546	2 706
1993–94	241	265	779	980	2 171	2 167	3 920	4 401	2 460	2 706
1994–95	261	265	848	980	2 679	2 810	5 072	5 720	2 557	3 001
1995–96	245	265	1 042	980	2 956	2 810	4 632	5 720	3 137	3 001
1996–97	313	265	1 187	982	2 963	2 810	4 087	5 720	3 438	3 001
1997–98	303	265	1 032	982	2 916	2 810	5 215	5 720	3 321	3 001
1998–99	208	265	1 070	982	2 706	2 810	4 642	5 720	2 937	3 001
1999–00	313	265	983	982	2 799	2 810	4 402	5 720	3 136	3 001
2000–01	296	265	1 105	982	2 330	2 060	3 861	4 200	3 430	3 001
2001–02	303	265	1 034	982	2 164	2 060	3 602	4 200	3 295	3 001
2002–03	246	400	996	982	2 529	2 060	2 997	4 200	2 939	3 001
2003–04	249	400	1 044	982	1 990	2 060	2 618	4 200	2 899	3 001
2004–05	283	400	936	982	1 597	2 060	2 758	4 200	3 584	3 595
2005–06	364	400	780	982	1 711	2 060	1 769	4 200	3 522	3 595
2006–07	301	400	874	982	2 089	2 060	2 113	4 200	3 731	3 595
2007–08	381	400	792	982	1 778	2 060	2 383	4 200	4 145	3 595
2008–09	320	400	634	982	1 751	2 060	2 000	4 200	3 232	3 595
2009–10	386	400	584	982	1 718	2 060	2 026	4 200	3 034	3 595
2010–11	438	400	670	982	1 665	2 060	1 572	4 200	3 856	3 595
2011–12	384	400	504	982	1 292	2 060	2 305	4 200	3 649	3 595
2012–13	383	400	579	982	1 475	2 060	2 181	4 200	3 610	3 595
2013–14	380	400	673	982	1 442	2 060	2 373	4 200	3 935	3 955
2014–15	374	400	673	982	1 325	2 060	2 246	4 200	3 924	3 955
2015–16	422	400	702	982	1 440	2 060	2 659	4 200	3 868	3 955
2016–17	404	400	1 022	982	1 808	2 060	2 565	4 200	3 356	3 955
2017–18	415	400	1 106	982	2 171	2 060	2 636	4 200	4 034	3 955
2018–19	383	400	939	982	2 016	2 060	2 044	4 200	4 596	4 735
2019–20	371	400	756	982	1 685	2 060	1 778	4 200	4 678	4 735
2020–21	319	400	645	982	1 489	2 060	2 129	4 200	4 949	4 735
2021–22	353	400	532	982	1 175	2 060	2 604	4 200	5 044	5 208
2022–23	270	400	456	982	1 366	2 060	1 892	4 200	4 906	5 208
2023–24	296	400	439	982	1 965	2 060	2 359	4 200	4 763	5 208

Table 4 [Continued]:

Fishstock	LIN 6		LIN 7			LIN 10		Total	
FMA (s)	6		7 & 8			10			
	Landings	TACC	Reported Landings	Estimated Landings	TACC	Landings	TACC	Landings§	TACC
1983–84*	869	–	1 552	–	–	0	–	7 696	–
1984–85*	1 283	–	1 705	–	–	0	–	6 953	–
1985–86*	1 489	–	1 458	–	–	0	–	7 205	–
1986–87	956	7 000	1 851	–	1 960	0	10	6 940	18 730
1987–88	1 710	7 000	1 853	1 777	2 008	0	10	7 901	18 988
1988–89	340	7 000	2 956	2 844	2 150	0	10	8 404	19 175
1989–90	935	7 000	2 452	3 171	2 176	0	10	9 028	19 672
1990–91	2 738	7 000	2 531	3 149	2 192	< 1	10	13 506	19 711
1991–92	3 459	7 000	2 251	2 728	2 192	0	10	17 778	19 711
1992–93	6 501	7 000	2 475	2 817	2 212	< 1	10	19 065	19 737
1993–94	4 249	7 000	2 142	–	2 213	0	10	15 961	19 741
1994–95	5 477	7 100	2 946	–	2 225	0	10	19 841	22 111
1995–96	6 314	7 100	3 102	–	2 225	0	10	21 428	22 111
1996–97	7 510	7 100	3 024	–	2 225	0	10	22 522	22 113
1997–98	7 331	7 100	3 027	–	2 225	0	10	23 145	22 113
1998–99	6 112	7 100	3 345	–	2 225	0	10	21 034	22 113
1999–00	6 707	7 100	3 274	–	2 225	0	10	21 615	22 113
2000–01	6 177	7 100	3 352	–	2 225	0	10	20 552	19 843
2001–02	5 945	7 100	3 219	–	2 225	0	10	19 561	19 843
2002–03	6 283	7 100	2 918	–	2 225	0	10	18 903	19 978
2003–04	7 032	7 100	2 926	–	2 225	0	10	18 760	19 978
2004–05	5 506	8 505	2 522	–	2 225	0	10	17 189	21 977
2005–06	3 553	8 505	2 479	–	2 225	0	10	14 184	21 977
2006–07	4 696	8 505	2 295	–	2 225	0	10	16 102	21 977
2007–08	4 502	8 505	2 282	–	2 225	0	10	16 264	21 977
2008–09	2 977	8 505	2 223	–	2 225	0	10	13 137	21 977
2009–10	2 414	8 505	2 446	–	2 474	0	10	12 609	22 226
2010–11	1 335	8 505	2 800	–	2 474	0	10	12 337	22 226
2011–12	2 047	8 505	2 771	–	2 474	0	10	12 953	22 226
2012–13	3 102	8 505	3 010	–	2 474	0	10	14 339	22 226
2013–14	3 221	8 505	3 200	–	3 080	0	10	15 224	23 192
2014–15	3 115	8 505	3 343	–	3 080	0	10	15 002	23 192
2015–16	2 222	8 505	3 340	–	3 080	0	10	14 654	23 192
2016–17	2 473	8 505	3 428	–	3 080	0	10	15 056	23 192
2017–18	4 846	8 505	3 487	–	3 080	0	10	18 694	23 192
2018–19	3 706	8 505	3 059	–	3 080	0	10	16 743	23 972
2019–20	3 972	8 505	3 216	–	3 387	< 1	10	16 456	24 279
2020–21	3 916	8 505	3 308	–	3 387	0	10	16 754	24 279
2021–22	3 881	8 505	3 325	–	3 387	0	10	16 920	24 752
2022–23	4 780	8 505	3 540	–	3 387	0	10	17 211	24 752
2023–24	4 414	8 505	3 216	–	3 387	0	10	17 451	24 752

* FSU data.
§ Includes landings from unknown areas before 1986–87, and areas outside the EEZ since 1995–96.

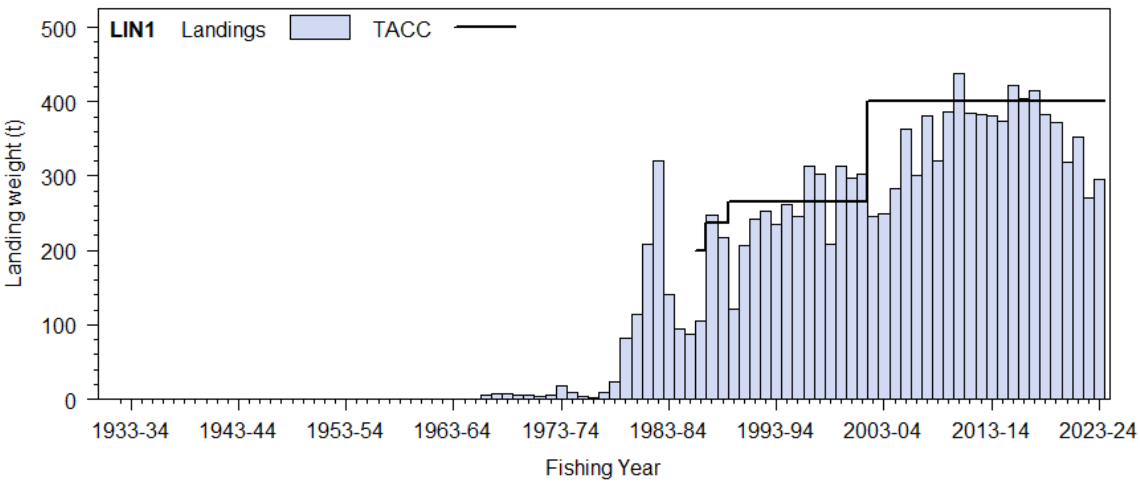
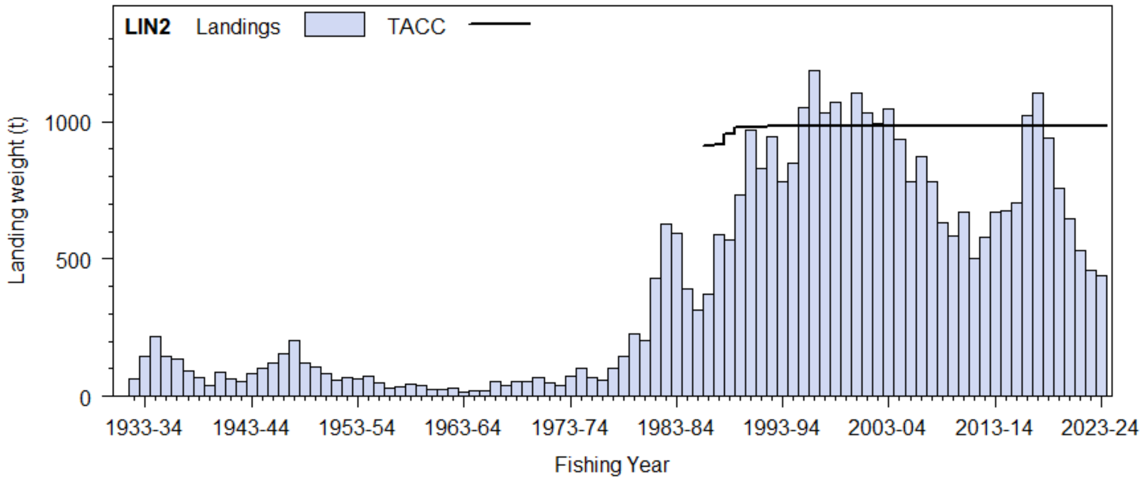
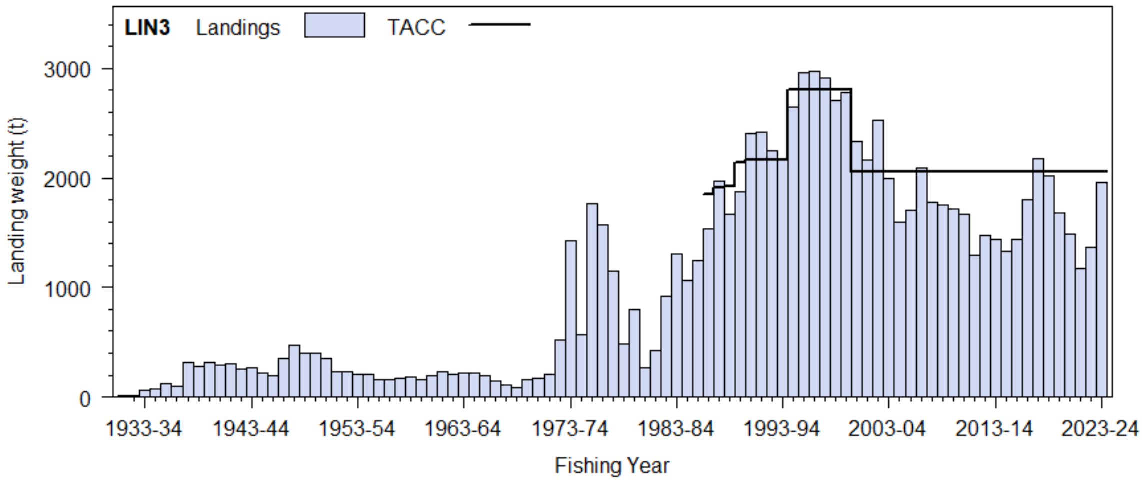


Figure 1: Reported commercial landings and TACC for the seven main LIN stocks. LIN 1 (Auckland East). [Continued on next two pages]





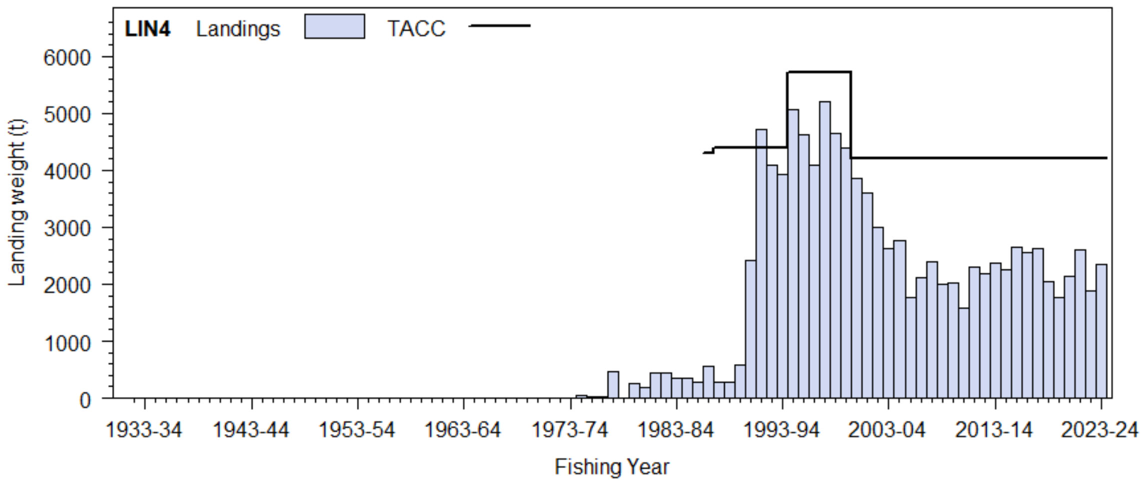


Figure 1 [Continued]: Reported commercial landings and TACC for the seven main LIN stocks. From top to bottom: LIN 2 (Central East), LIN 3 (South East Coast), and LIN 4 (South East Chatham Rise). [Continued on next page]

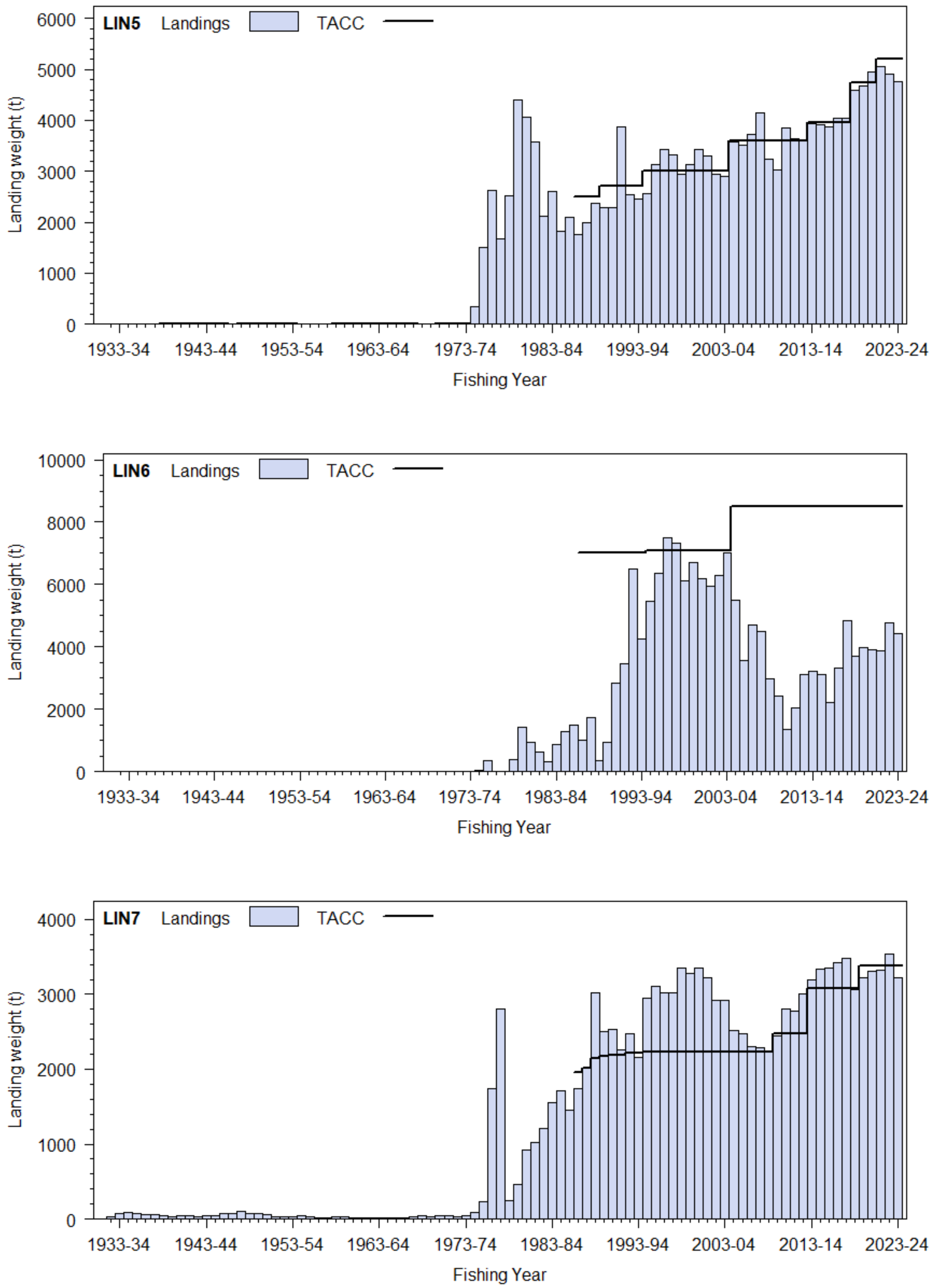


Figure 1 [Continued]: Reported commercial landings and TACC for the seven main LIN stocks. From top to bottom: LIN 5 (Southland), LIN 6 (Sub-Antarctic), and LIN 7 (Challenger).

1.2 Recreational fisheries

Recreational harvest estimates were provided by telephone/diary surveys between 1993 and 2001 but are no longer considered reliable for various reasons. A Recreational Technical Working Group concluded that these harvest estimates should be used only with the following qualifications: a) they may be very inaccurate; b) the 1996 and earlier surveys contain a methodological error; and c) the 2000 and 2001 estimates are implausibly high for many important fisheries. In response to these problems and the cost and scale challenges associated with onsite methods, a national panel survey was conducted for the first time throughout the 2011–12 fishing year. The panel survey used face-to-face interviews of a random sample of 30 390 New Zealand households to recruit a panel of fishers and non-fishers for a full year (Wynne-Jones et al 2014). The panel members were contacted regularly about their fishing activities and harvest information collected in standardised phone interviews. The national panel survey was repeated during the 2017–18 and 2022–23 fishing years using very similar methods to produce directly comparable results (Wynne-Jones et al 2019; Heinemann & Gray 2024). In 2011–12, only three fishers reported catching ling in LIN 1 (4 trips) and only two fishers reported catching ling in LIN 7 (3 trips). In 2017–18, one fisher reported catching ling in LIN 3 (1 trip), and four fishers reported catching ling in LIN 7 (4 trips). In 2022–23, one fisher reported catching ling in LIN 1 (1 trip), Estimates of total nationwide catch were 990, 224 and 84 fish in 2011–12, 2017–18 and 2022–23, respectively, all with wide CVs. Note that national panel survey estimates do not include recreational harvest taken on charter vessel trips or under s111 general approvals.

1.3 Customary non-commercial fisheries

Quantitative information on the level of Māori customary non-commercial take is not available. Ling bones have been recovered from archaic middens throughout the South Island and southern North Island, and on Chatham Island (Leach & Boocock 1993). In the South Island and Chatham Island, ling comprised about 4% (by number) of recovered fish remains.

1.4 Illegal catch

It is believed that up to the mid-1990s some ling bycatch from the west coast hoki fishery was not reported. Estimates of total catch including non-reported catch are given in Table 4 for LIN 7. It is believed that in the early 1990s, some catch from LIN 7 was reported against other ling stocks (probably LIN 3, 5, and 6). The likely levels of misreporting are moderate, being about 250–400 t in each year from 1989–90 to 1991–92 (Dunn 2003).

1.5 Other sources of mortality

There is likely to be some mortality associated with escapement from trawl nets, mostly from small fish that can escape through the trawl mesh. The mortality of ling associated with escapement is not known. In the Sub-Antarctic, the catch and effort records for ling suggest that small ling are uncommon in areas where the hoki/hake/ling fishery occurs with only very low proportions of small ling recorded by observers (Mormede et al 2021a). Hence the level of mortality of ling associated with escapement is likely to be low over the history of the fishery and is assumed to be negligible. The other sources of mortality from the longline fishery are likely to be insignificant.

2. BIOLOGY

The maximum age recorded for New Zealand ling is 46 years, although only 0.5% of successfully aged ling have been older than 30 years. A growth study of ling from five areas (west coast South Island, Chatham Rise, Bounty Platform, Campbell Plateau, and Cook Strait) showed that females grew significantly faster and reached a greater size than males in all areas, and that growth rates were significantly different between areas. Ling growth is fastest in Cook Strait and slowest on the Campbell Plateau (Horn 2005).

M was initially estimated from the equation $M = \log_e 100/\text{maximum age}$, where maximum age is the age to which 1% of the population survives in an unexploited stock. The mean M calculated from five samples of age data was 0.18 (range = 0.17–0.20) (Horn 1993). However, a review of M and results of modelling conducted in 2007 suggested that this parameter may vary between stocks (Horn 2008). The M for Chatham Rise ling was estimated to be lower than 0.18, whereas for Cook Strait and west coast South Island the value was potentially higher than 0.18. M was evaluated again in 2017 (Edwards 2017). In the new study all available life-history data were re-analysed and sex-specific M values derived. For a variety of reasons female M values were estimated with much greater confidence than those for males, the results for females being: west coast South Island 0.15, Cook Strait 0.12, Chatham Rise 0.13, and Sub-Antarctic 0.16. However, all credibility intervals overlapped such that assuming a common value of 0.14 in all areas was also credible. Due to the methodology employed, these values have been treated as a potential minimum value in sensitivity runs rather than the most plausible value for those stocks. M has been estimated in assessment model runs for some stocks (see Section 4).

Ling in spawning condition have been reported in a number of localities throughout the EEZ (Horn 2005, 2015). Time of spawning appears to vary between areas: August to October on the Chatham Rise, September to December on Campbell Plateau and Puysegur Bank, September to February on the Bounty Platform, and July to September off west coast South Island and in Cook Strait. Little is known about the distribution of juveniles until they are about 40 cm total length, when they begin to appear in trawl samples over most of the adult range.

Ling appear to be mainly bottom dwellers, feeding on crustaceans such as *Munida* and scampi and also on fish, with commercial fishing discards being a significant dietary component (Dunn et al 2010). However, they may at times be caught well above the bottom, for example when feeding on hoki during the hoki spawning season.

Biological parameters relevant to the stock assessment are shown in Table 5. The growth model was updated in 2024 for LIN 5&6 and LIN 6B (Mormede et al 2024a), in 2022 for LIN 3&4 (Mormede et al 2022a), and in 2023 for LIN 7WC (Mormede et al 2023a), and showed no indication of change in the length-weight or growth parameters over time. The maturation ogive was re-estimated for LIN 5&6 (Mormede et al 2024a and see Table 6); it showed no indication of change over time. An alternative maturity ogive was evaluated in stock assessment of LIN 3&4 in 2025, where maturity was derived from otolith growth zone measurements (Holmes et al in prep.). This method assumed that a reduction in growth zone width was a result of transition from relatively fast somatic growth, to slow somatic growth plus gamete production. The resulting age at maturity was estimated to be age 7 for both sexes.

Table 5: Estimates of biological parameters. See Section 3 for definitions of Fishstocks.

1. Natural mortality (M)

	Both
FMA	
All stocks	0.18

2. Weight = a (length)^b (Weight in g, length in cm total length)

	Female		Male		Area
FMA	a	b	a	b	
LIN 3&4	0.00138	3.271	0.00128	3.294	Chatham Rise
LIN 5&6	0.00132	3.293	0.00213	3.179	Southern Plateau
LIN 6B	0.00114	3.318	0.001	3.354	Bounty Platform
LIN 7WC	0.00098	3.362	0.00131	3.292	West Coast S.I.
LIN 7CK	0.000934	3.368	0.001146	3.318	Cook Strait

3. von Bertalanffy growth parameters

	Female				Male				Area
FMA	K	t_0	L_{∞}	CV	K	t_0	L_{∞}	CV	
LIN 3&4	0.090	-0.71	153.3	0.09	0.130	-0.65	112.2	0.09	Chatham Rise
LIN 5&6	0.13	-1.53	110.6	0.08	0.19	-1.16	91.2	0.07	Southern Plateau
LIN 6B	0.12	-0.1	138.9	0.08	0.15	-0.1	117.1	0.07	Bounty Platform
LIN 7WC	0.08	-0.86	164.1	0.08	0.08	-1.08	140.0	0.08	West Coast S.I.
LIN 7CK	0.097	-0.54	163.6		0.08	-1.94	158.9		Cook Strait

3. STOCKS AND AREAS

A review of ling stock structure (Horn 2005) examined diverse information from studies of morphometrics, genetics, growth, population age structures, and reproductive biology and behaviour, and indicated that there are at least five ling stocks, i.e., west coast South Island, Chatham Rise, Cook Strait, Bounty Platform, and the Southern Plateau (including the Stewart-Snares shelf and Puysegur Bank). Stock affinities of ling north of Cook Strait are unknown, but spawning is known to occur off Northland, Cape Kidnappers, and in the Bay of Plenty.

In 2023, Statistical Area 032 was reassigned from the LIN 5&6 stock to the LIN 7WC stock based on the continuity of catch locations (Mormede et al 2024a). Before 2024, Sub-Antarctic ling were assessed as two independent stocks (LIN 5&6 and LIN 6B). A spatial analysis of the length and sex structure of ling in 2021 suggested some evidence that LIN 6B could be considered a part of the LIN 5&6 stock (Mormede et al 2021a).

A characterisation of all ling stocks by Horn (2022) suggested that ling in the Sub-Antarctic (LIN 5&6 and LIN 6B) were a single stock, with some between area seasonal movement of adult fish. The stock structure of Sub-Antarctic ling was further investigated in 2024 (Mormede et al 2024b), with differences in growth suggesting that LIN 3&4, LIN 5&6, and LIN 7WC were likely to be different stocks, and that the current boundaries between those stocks were likely to be adequate. Based on available catch rate, age structure, and growth information, LIN 6B was considered unlikely to be part of LIN 3&4, with only weak evidence that it was not part of LIN 5&6. Because of the paucity of data available to assess LIN 6B as a separate stock, and the similarities in the information between LIN 5&6 and LIN 6B, the working group decided to include LIN 6B with LIN 5&6 as a single Sub-Antarctic ling stock (LIN 5&6 and LIN 6B).

4. STOCK ASSESSMENT

LIN 1 was previously managed and assessed under the AMP, and the stocks off the east and west coasts (LIN 1E and LIN 1W) have been assessed separately. An updated CPUE analysis for the eastern part of the stock (LIN 1E) was attempted in 2020 but was not accepted as an index of abundance due to sparse data, the influence of vessels with particularly low catch rates in the early part of the series, and inconsistent trends in different statistical areas. A CPUE analysis for the ling target bottom longline fishery in LIN 2 was conducted in 2014. The characterisation and stock assessments of LIN 3&4 (Chatham Rise) was updated in 2025, LIN 7WC (west coast South Island) in 2023, and that for Sub-Antarctic ling (LIN 5&6 and LIN 6B) was last updated in 2024. Assessments for other stocks were updated in 2007 (LIN 6B when assumed a stand-alone stock, Bounty Platform, with a CPUE update in 2014), 2010 (LIN 7CK, Cook Strait, with an assessment in 2013 rejected). LIN 1 and LIN 2 are assessed using CPUE analysis. All other ling stock assessments have been conducted using a Bayesian age structured model. The 2025 LIN 3&4 assessment used Casal2 (Doonan et al 2016). The stock assessment of ling in LIN 5&6 was run in CASAL and Stan (Webber et al 2021). Other age-structured assessments have used CASAL (Bull et al 2012).

Model input parameters are provided in Table 6, with catch histories by stock and fishery presented in Table 7. Estimates of relative abundance from standardised CPUE analyses (Table 8) and trawl surveys (Table 9) are also presented below. In 2022, the Deepwater Working Group recommended that the model year start for all current and future ling assessments be set at 1st January, matching the calendar year. This matches the biology and fisheries better and allows uniformity in the assessments rather than a different model year for each stock.

Table 6: Input parameters for the assessed stocks.

Parameter	LIN 3&4	LIN 5&6 and LIN 6B	LIN 6B	LIN 7WC	LIN 7CK
Stock-recruitment steepness	0.84	0.84	0.9	0.84	0.9
Recruitment variability CV	0.7	0.7	1.0	0.7	0.7
Ageing error CV	0.05	0.06	0.05	0.05	0.07
Proportion male at birth	0.5	0.5	0.5	0.5	0.5
Proportion of mature that spawn	1.0	1.0	1.0	1.0	1.0
Maximum exploitation rate (U_{max})	0.6	0.6	0.6	0.6	0.6

Maturity ogives (from Horn 2005, and from Mormede et al 2024a for LIN 5&6)

Age	3	4	5	6	7	8	9	10	11	12	13	14	15
LIN 3&4 (and assumed for LIN 6B)													
Male	0.0	0.03	0.063	0.14	0.28	0.48	0.69	0.85	0.93	0.97	0.99	1.00	1.0
Female	0.0	0.00	0.003	0.01	0.014	0.033	0.08	0.16	0.31	0.54	0.76	0.93	1.0
LIN 5&6													
Male	0.0	0.04	0.16	0.41	0.72	0.91	0.98	0.99	1.00	1.00			
Female	0.0	0.01	0.01	0.12	0.28	0.55	0.78	0.91	0.97	0.99	1.00		
LIN 7WC (and assumed for LIN7CK)													
Male	0.0	0.015	0.095	0.39	0.77	0.94	1.00	1.00	1.00	1.00			
Female	0.0	0.004	0.017	0.06	0.18	0.39	0.65	0.85	0.94	1.00			
Combined	0.0	0.010	0.056	0.23	0.48	0.67	0.83	0.93	0.97	1.00			

Table 7: Estimated catch histories (t) for LIN 2 (ECNI), LIN 3&4 (Chatham Rise), LIN 5&6 (Campbell Plateau), LIN 6B (Bounty Platform), LIN 7WC (WCSI section of LIN 7), and LIN 7CK (Cook Strait). Landings have been separated by fishing method (trawl or longline or, where relevant, potting). The catch histories for LIN 2 and LIN 7CK are expressed in fishing years, whereby 1990 is the model year from 1st October 1989 to 31st September 1990. The catch histories for LIN 3&4, LIN 5&6 & LIN 6B and LIN 7WC are expressed in calendar year. '–' denotes no update to the stock assessment and therefore catch histories. [Continued on next page]

	LIN 2		LIN 3&4			LIN 5&6		LIN6B	LIN 7WC		LIN 7CK	
Year	trawl	line	trawl	line	pot	trawl	line	line	trawl	line	trawl	line
1972	–	–	0	0	0	0	0	0	0	0	0	0
1973	–	–	250	0	0	500	0	0	85	20	45	45
1974	–	–	382	0	0	1 120	0	0	144	40	45	45
1975	–	–	953	8 439	0	900	118	0	401	800	48	48
1976	–	–	2 100	17 436	0	3 402	190	0	565	2 100	58	58
1977	–	–	2 055	23 994	0	3 100	301	0	715	4 300	68	68
1978	–	–	1 400	7 577	0	1 945	494	10	300	323	78	78
1979	–	–	2 380	821	0	3 707	1 022	0	539	360	83	83
1980	–	–	1 340	360	0	5 200	0	0	540	305	88	88
1981	–	–	673	160	0	4 427	0	10	492	300	98	98
1982	–	–	1 183	339	0	2 402	0	0	675	400	103	103
1983	–	–	1 210	326	0	2 778	5	10	1 040	710	97	97
1984	–	–	1 366	406	0	3 203	2	6	924	595	119	119
1985	–	–	1 351	401	0	4 480	25	2	1 156	302	116	116
1986	–	–	1 494	375	0	3 182	2	0	1 082	362	126	126
1987	–	–	1 313	306	0	3 962	0	0	1 105	370	97	97
1988	–	–	1 636	290	0	2 065	6	0	1 428	291	107	107
1989	–	–	1 397	488	0	2 923	10	9	1 959	370	255	85
1990	85	134	3 170	243	2	5 004	0	14	2 173	229	362	121
1991	162	185	3 979	1 786	16	3 537	407	139	2 025	425	488	163
1992	110	299	3 851	3 388	37	7 663	1 026	1 244	1 572	873	498	85
1993	97	381	2 836	3 963	13	6 202	1 166	1 260	1 590	699	307	114
1994	96	397	2 374	4 241	11	6 782	1 423	652	1 312	1 003	269	84
1995	97	398	2 680	5 391	7	5 064	2 032	534	1 759	994	344	70
1996	149	350	3 375	4 699	1	6 872	2 101	614	2 019	994	392	35
1997	168	269	3 901	4 182	38	7 468	3 588	312	2 034	1 323	417	89
1998	148	387	5 140	3 299	40	5 771	3 267	493	1 995	1 065	366	88
1999	169	257	4 306	2 994	41	6 013	2 952	707	2 389	916	316	216
2000	166	286	3 826	3 228	23	7 506	2 328	1 175	2 479	947	317	131
2001	216	344	2 941	3 082	2	5 701	1 819	1 061	2 400	1 007	258	80
2002	212	366	3 637	2 330	1	7 720	1 264	859	2 475	762	230	171
2003	124	344	3 563	2 150	1	8 423	668	988	2 094	926	280	180
2004	82	420	2 714	1 731	4	8 016	1 509	422	2 092	764	241	227
2005	54	335	2 250	2 259	10	7 295	892	48	1 595	845	200	282
2006	45	365	1 890	1 489	54	7 118	781	110	1 773	781	129	220
2007	87	425	2 841	1 571	55	8 083	890	218	1 323	1 161	107	189
2008	37	457	2 432	2 034	15	5 345	659	446	1 150	1 021	115	110
2009	49	394	1 459	1 897	12	4 425	550	232	1 216	992	108	39
2010	37	409	1 530	1 973	39	4 391	1 064	2	1 386	1 199	74	14
2011	51	426	1 030	1 658	33	4 445	842	55	1 606	1 143	115	67
2012	57	288	1 470	2 087	11	6 608	1 168	4	1 697	1 285	96	47
2013	44	317	1 125	2 394	24	5 535	259	219	1 959	1 089	104	106
2014	78	337	1 349	2 443	58	6 075	925	75	1 914	1 444	71	71
2015	68	385	1 513	1 685	46	5 735	759	38	2 092	1 350	68	63
2016	69	386	1 551	2 695	164	4 482	618	214	2 159	1 487	52	81
2017	–	–	1 811	2 432	201	7 309	761	970	2 451	1 470	–	–
2018	–	–	1 330	2 870	543	7 355	768	149	2 440	1 239	–	–
2019	–	–	1 347	1 877	674	7 264	1 286	171	1 834	1 408	–	–
2020	–	–	1 060	1 627	402	6 168	2 033	255	1 687	1 752	–	–
2021	–	–	1 050	1 932	369	7 338	1 205	636	1 406	2 057	–	–
2022	–	–	1 090	1 852	479	7 198	1 378	249	1 440	1 464	–	–
2023	–	–	1 343	964	1 186	6 325	3 318	303	–	–	–	–
2024			1 310	1 262	1 208							

Table 8: Standardised CPUE indices (with CVs) for the ling longline and trawl fisheries. Year refers to calendar year. '–' denotes no update to the stock assessment and therefore catch histories. Note that the LIN 5&6, and LIN 7WC CPUE were not standardised to 1 to avoid the minimisation bound constraint in CASAL & Casal2 (Mormede et al 2021b, Webber et al 2021) but instead expressed in standardised catch in kilograms.

	LIN 2 line		LIN 5&6 line		LIN 6B line		LIN 7WC line		LIN 7CK line	
Year	**CPUE**	**CV**	**CPUE**	**CV**	**CPUE**	**CV**	**CPUE**	**CV**	**CPUE**	**CV**
1991	–	–	6 310	0.07	–	–	1 450	0.06	–	–
1992	1.64	0.09	9 030	0.04	1.74	0.15	1 590	0.05	–	–
1993	1.40	0.08	8 610	0.04	1.41	0.13	1 220	0.06	–	–
1994	1.55	0.09	7 620	0.05	0.95	0.16	1 260	0.06	–	–
1995	1.54	0.07	8 870	0.04	1.24	0.13	1 290	0.06	–	–
1996	1.34	0.07	7 150	0.05	1.15	0.12	770	0.10	–	–
1997	1.29	0.07	7 950	0.04	0.92	0.14	1 080	0.07	42 964	0.02
1998	1.27	0.07	6 970	0.04	1.06	0.12	1 170	0.06	39 951	0.03
1999	1.13	0.07	5 330	0.04	1.07	0.11	1 210	0.06	43 587	0.02
2000	0.80	0.07	6 380	0.04	0.95	0.10	1 220	0.06	35 601	0.03
2001	0.60	0.08	7 320	0.04	0.76	0.11	1 500	0.05	33 429	0.03
2002	0.97	0.08	7 160	0.04	0.69	0.11	1 390	0.05	30 237	0.03
2003	0.88	0.07	5 030	0.07	0.78	0.10	1 450	0.05	23 348	0.04
2004	1.07	0.07	4 710	0.07	0.74	0.16	1 510	0.05	27 982	0.04
2005	1.00	0.08	8 510	0.06	–	–	1 090	0.06	24 750	0.04
2006	0.88	0.07	5 810	0.06	–	–	1 060	0.06	26 303	0.04
2007	0.95	0.07	8 260	0.05	–	–	1 540	0.04	26 873	0.04
2008	0.85	0.07	6 310	0.06	–	–	1 440	0.05	25 219	0.05
2009	0.89	0.08	7 400	0.05	–	–	1 490	0.05	33 698	0.04
2010	0.90	0.07	5 840	0.05	–	–	1 760	0.04	28 666	0.04
2011	0.82	0.06	4 570	0.06	–	–	1 620	0.04	30 411	0.03
2012	0.56	0.07	5 570	0.04	–	–	1 650	0.04	27 911	0.04
2013	0.65	0.08	3 080	0.14	–	–	1 830	0.04	33 891	0.03
2014	–	–	4 940	0.06	–	–	1 760	0.04	31 796	0.03
2015	–	–	4 810	0.06	–	–	1 500	0.04	32 743	0.03
2016	–	–	3 880	0.08	–	–	1 490	0.04	34 304	0.03
2017	–	–	4 170	0.07	–	–	1 600	0.04	34 669	0.03
2018	–	–	5 920	0.05	–	–	1 540	0.05	30 621	0.03
2019	–	–	5 180	0.05	–	–	1 650	0.04	30 934	0.04
2020	–	–	5 520	0.04	–	–	1 520	0.04	30 023	0.04
2021	–	–	3 960	0.06	–	–	1 240	0.05	28 896	0.04
2022	–	–	4 140	0.06	–	–	1 080	0.06	25 544	0.05
2023	–	–	4 450	0.06	–	–	–	–	–	–
2024	–	–	–	–	–	–	–	–	–	–

	LIN 7CK line		LIN 7CK trawl	
Year	**CPUE**	**CV**	**CPUE**	**CV**
1990	1.29	0.15	–	–
1991	1.44	0.13	–	–
1992	1.43	0.11	–	–
1993	1.11	0.11	–	–
1994	0.90	0.11	1.25	0.05
1995	0.83	0.12	1.16	0.04
1996	0.97	0.13	1.12	0.04
1997	1.32	0.18	1.00	0.04
1998	0.83	0.15	1.01	0.04
1999	1.54	0.18	1.02	0.03
2000	1.45	0.19	1.27	0.04
2001	1.27	0.18	1.46	0.04
2002	2.04	0.11	1.27	0.05
2003	1.66	0.10	1.27	0.04
2004	1.45	0.09	1.13	0.04
2005	1.16	0.10	1.18	0.04
2006	0.97	0.15	1.10	0.05
2007	0.70	0.12	0.73	0.06
2008	0.82	0.22	0.90	0.06
2009	0.60	0.28	0.44	0.07
2010	0.35	0.30	0.44	0.07
2011	0.22	0.30	0.23	0.09
2012	–	–	–	–

Not updated more recently

Table 9: Trawl survey biomass indices (t) and estimated coefficients of variation (CV). [Continued on next page]

Fishstock	Area	Vessel	Trip code	Date	Biomass	CV (%)
LIN 3	ECSI (winter)	*Kaharoa*	KAH9105*	May–Jun 1991	1 009	35
			KAH9205*	May–Jun 1992	525	17
			KAH9306*	May–Jun 1993	651	27
			KAH9406*	May–Jun 1994	488	19
			KAH9606*	May–Jun 1996	488	21
			KAH0705*	May–Jun 2007	283	17
			KAH0806*	May–Jun 2008	351	22
			KAH0905*	May–Jun 2009	262	19
			KAH1207*	May–Jun 2012	265	21
LIN 3 & 4	Chatham Rise	*Tangaroa*	TAN9106	Jan–Feb 1992	8 930	5.8
			TAN9212	Jan–Feb 1993	9 360	7.9
			TAN9401	Jan 1994	10 130	6.5
			TAN9501	Jan 1995	7 360	7.9
			TAN9601	Jan 1996	8 420	8.2
			TAN9701	Jan 1997	8 540	9.8
			TAN9801	Jan 1998	7 310	8.0
			TAN9901	Jan 1999	10 310	16.1
			TAN0001	Jan 2000	8 350	7.8
			TAN0101	Jan 2001	9 350	7.5
			TAN0201	Jan 2002	9 440	7.8
			TAN0301	Jan 2003	7 260	9.9
			TAN0401	Jan 2004	8 250	6.0
			TAN0501	Jan 2005	8 930	9.4
			TAN0601	Jan 2006	9 300	7.4
			TAN0701	Jan 2007	7 800	7.2
			TAN0801	Jan 2008	7 500	6.8
			TAN0901	Jan 2009	10 620	11.5
			TAN1001	Jan 2010	8 850	10.0
			TAN1101	Jan 2011	7 030	13.8
			TAN1201	Jan 2012	8 098	7.4
			TAN1301	Jan 2013	8 714	10.1
			TAN1401	Jan 2014	7 489	7.2
			TAN1601	Jan 2016	10 201	7.2
			TAN1801	Jan 2018	8 758	11.5
			TAN2001	Jan 2020	7 577	7.9
			TAN2201	Jan 2022	7 293	10.7
			TAN2401	Jan 2024	7 311	8.3
LIN 5 & 6	Southern Plateau	*Amaltal Explorer*	AEX8902*	Oct–Nov 1989	17 490	14.2
			AEX9002*	Nov–Dec 1990	15 850	7.5
LIN 5 & 6	Southern Plateau (summer)	*Tangaroa*	TAN9105	Nov–Dec 1992	24 090	6.8
			TAN9211	Nov–Dec 1992	21 370	6.2
			TAN9310	Nov–Dec 1993	29 750	11.5
			TAN0012	Dec 2000	33 020	6.9
			TAN0118	Dec 2001	25 060	6.5
			TAN0219	Dec 2002	25 630	10.0
			TAN0317	Nov–Dec 2003	22 170	9.7
			TAN0414	Nov–Dec 2004	23 770	12.2
			TAN0515	Nov–Dec 2005	19 700	9.0
			TAN0617	Nov–Dec 2006	19 640	12.0
			TAN0714	Nov–Dec 2007	26 492	8.0
			TAN0813	Nov–Dec 2008	22 840	9.5
			TAN0911	Nov–Dec 2009	22 710	9.6
			TAN1117	Nov–Dec 2011	23 178	11.8
			TAN1215	Nov–Dec 2012	27 010	11.3
			TAN1412	Nov–Dec 2014	30 010	7.7
			TAN1614†	Nov–Dec 2016	26 656	16.0
			TAN1811	Nov–Dec 2018	21 276	10.4
			TAN2014	Nov–Dec 2020	22 343	12.4
			TAN2215	Nov-Dec 2022	24 660	9.2
LIN 5 & 6	Southern Plateau (autumn)	*Tangaroa*	TAN9204	Mar–Apr 1992	42 330	5.8
			TAN9304	Apr–May 1993	37 550	5.4
			TAN9605	Mar–Apr 1996	32 130	7.8
			TAN9805	Apr–May 1998	30 780	8.8
LIN 7WC	WCSI	*Tangaroa*	TAN0007	Aug 2000	1 861	17.3
			TAN1210	Aug 2012	2 169	14.8
			TAN1308	Aug 2013	2 000	18.4
			TAN1608	Aug 2016	1 635	12.7
			TAN1807	Jul–Aug 2018	1 682	18.3
			TAN2107	Jul–Aug 2021	1 231	17.7

Table 9 [Continued]:

Fishstock	Area	Vessel	Trip code	Date	Biomass	CV (%)
LIN 7WC	WCSI	*Kaharoa*	KAH9204*	Mar–Apr 1992	280	19
			KAH9404*	Mar–Apr 1994	261	20
			KAH9504*	Mar–Apr 1995	373	16
			KAH9701*	Mar–Apr 1997	151	30
			KAH0004*	Mar–Apr 2000	95	46
			KAH0304*	Mar–Apr 2003	150	33
			KAH0503*	Mar–Apr 2005	274	37
			KAH0704*	Mar–Apr 2007	180	27
			KAH0904*	Mar–Apr 2009	291	37
			KAH1104*	Mar–Apr 2011	234	43
			KAH1305*	Mar–Apr 2013	405	44
			KAH1503*	Mar–Apr 2015	472	53
			KAH1703*	Mar–Apr 2017	150	18
			KAH1902*	Mar–Apr 2019	316	26
			KAH2101*	Mar–Apr 2021	166	45

* Not used in the reported assessment.
† The core survey strata were unable to be completed and biomass estimates were scaled up using factors based on the proportion of biomass of each species in 'missing strata' in previous surveys from 2000–14 (O'Driscoll et al 2018).

4.1 LIN 1

In October 2002, the TACC for LIN 1 was increased from 265 t to 400 t within an AMP. Reviews of the LIN 1 AMP were carried out in 2007 and 2009. The AMP was discontinued by the Minister of Fisheries in 2009–10. Updates of LIN 1 CPUE analyses were carried out in 2013, 2017, and 2020. The early CPUE analyses were given a reduced data quality ranking; in 2020 the Inshore Working Group concluded that the CPUE analyses did not provide a reliable index of abundance.

4.1.1 Fishery characterisation

- Around two thirds of LIN 1 landings come from the LIN target bottom longline fishery with most of the remainder from a mixed target bottom trawl fishery. The proportion of the catch taken by longline increased in 2005.
- The ling longline fishery has operated consistently in the Bay of Plenty (primarily Statistical Areas 009 and 010). Longline catches increased in East Northland from the mid-1990s, then off the west coast of the North Island from 2008.
- The majority of bottom trawl catches are taken in Statistical Areas 008 to 010, although there have been significant bottom trawl catches of ling off the west coast of the North Island in Statistical Areas 045 to 047. There were substantial ling bycatches made by trawl off the North Island west coast from 1996–97 to 2000–01 in the gemfish fishery (which has since ceased).
- Target bottom trawl catches of LIN 1 have increased since 2005 and represent about a third of trawl catches. Bycatch in the gemfish trawl fishery was important from the mid-1990s to early 2000s. Prior to 1995, bycatch of ling in the scampi fishery represented the majority of ling trawl catches, and, although the volume has reduced, the scampi fishery remains a consistent part of the LIN 1 trawl fishery. Ling catches in the hoki target trawl fishery have increased since 2010.
- The bottom longline landings of LIN 1 are taken mainly in the final two months of the fishing year, probably due to the economics of the vessels switching from tuna longlining to cleaning up available ling quota at the end of the fishing year. Bottom trawl catches of ling tend to be more evenly distributed across the year and reflect the fishing patterns of the diverse trawl targets, such as scampi which is also a consistent fishery over the entire year. Both the major fishing methods which take ling have sporadic seasonal patterns, reflecting the small landings in most years and the bycatch nature of many of the fisheries, although the ling target longline fishery has operated more consistently since 2005.
- The depth distribution of ling catches in the trawl fisheries show two main depths associated with the target species. Most ling are caught in the scampi/hoki/ling fisheries at about 400 m depth, but some are taken in the tarakihi/snapper/barracouta/trevally fisheries around 100 m depth. Bottom longline depth records indicate that target ling fishing (as well as target bluenose fishing) takes place at even deeper depths, with most of the records at between 500 and 600 m.

4.1.2 Abundance indices

A variety of different CPUE analyses have been carried out for LIN 1 (see Starr & Kendrick 2017) but no indices are currently accepted.

4.2 East Coast North Island, (LIN 2, Statistical Areas 011–015)

In 2014 a catch-per-unit-effort (CPUE) analysis was conducted on data from the LIN 2 fishery (Roux 2015). Estimated catch data and effort data from bottom longliners that targeted ling in FMA 2 Statistical Areas 011–015 (ECNI) where there was a positive catch, were used. The estimated catch and effort data were rolled up by vessel/day/statistical area after a filter was applied to individual fishing events to retain estimated catch from the top five species together with all effort.

A GLM model (model 1) was fitted using a core vessel fleet where individual vessels had to have fished for four or more years in the fishery and fished a minimum of 10 days per year. One auto-longlining vessel was excluded because it was an outlier in terms of numbers of hooks set and created patterns in the residuals.

The sensitivity of the CPUE time series was tested for a range of alternative sets of input data: vessels using very large numbers of hooks per day (over 10 000) were either included or excluded; changes in fishing power and fleet were minimised by fitting only the most recent time series (2000–2013); data from Statistical Area 016 (Cook Strait) were either included or excluded; and fitting was carried out with or without the use of interaction terms. An all-target model using bottom longline data that targeted or caught ling was also developed with 'target species' included as an explanatory variable. The GLM trend was robust to all sensitivity runs investigated.

The standardised CPUE index for ling from the ECNI demonstrates an initial decline consistent with the previous assessment (Horn 2004a), followed by a period of stability (2002–2010) with lower CPUE in 2011–12 and 2012–13 (Figure 2). This pattern was consistent across all GLM scenarios examined.

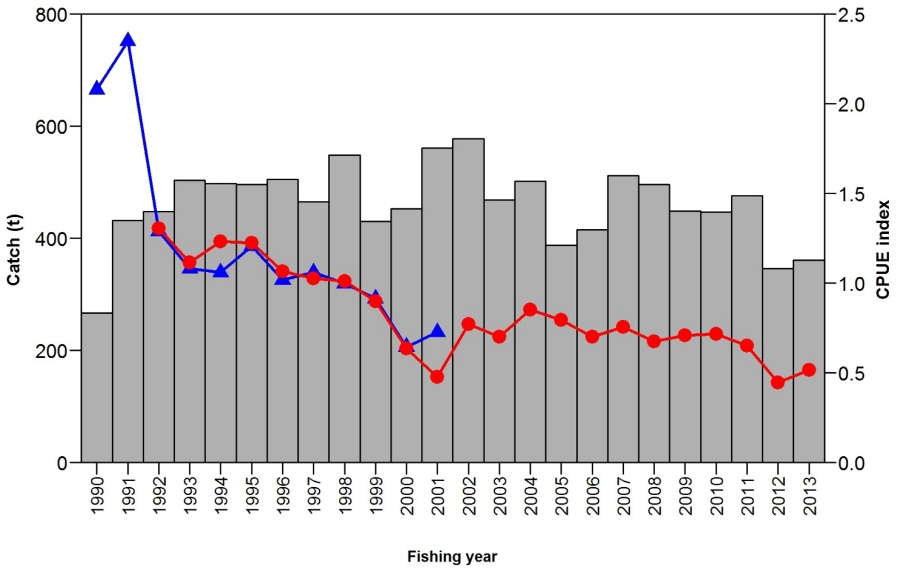


Figure 2: Estimated ling catch (bars) and standardised CPUE indices for LIN 2. Blue line and triangles from Horn (2004a). Red line and circles for ECNI Statistical Areas 011–015 for core bottom longline vessels targeting ling, from Roux (2015). The two CPUE series were normalised to the overlapping fishing years (1992–2001).

4.3 Chatham Rise, LIN 3 & LIN 4

4.3.1 Model structure and inputs

The stock assessment for LIN 3&4 (Chatham Rise) was updated in 2025 (Holmes & Dunn in prep). For final model runs, the full posterior distribution was sampled using Markov chain Monte Carlo (MCMC) methods. Bounded estimates of spawning stock virgin (B_0) and current (B_{2025}) biomass were obtained. Year class strengths and fishing selectivity ogives were estimated in the model. All selectivities were fitted as logistic ogives. Trawl fishery and research survey selectivity ogives used to be fitted as double normal curves (Holmes 2019), but the right-hand limb was highly uncertain and estimated towards logistic, hence the change. Due to the low numbers of young fish aged in the fishery, the age frequency was truncated at age 5 for both commercial fisheries and age 3 for the trawl survey. Because only one potting trip was observed and no age data were available, the potting fishery was assumed to have the same selectivity as the longline fishery based on the trip length frequency (Mormede et al 2022a). Selectivities were assumed constant over all years in each fishery/survey. Instantaneous natural mortality rate (*M*) was estimated as sex-specific and constant at age in the model, parameterised as the average morality value (M_{avg}) and the male-female difference (M_{diff}).

For LIN 3&4, model input data included catch histories for trawl, longline, and pot fisheries separately, biomass and sexed catch-at-age data from a summer trawl survey series, and sexed catch-at-age from the trawl and longline fisheries (Table 10). The longline CPUE series has previously been used in a sensitivity run but was rejected in 2025 because it was not considered a reliable index of the stock abundance. In addition, the longline effort was reducing with vessels transitioning to potting. A scampi target CPUE series was also explored but not accepted. The catch history, biological input parameters, and estimates of relative abundance used in the model are given in Tables 5–9. The stock assessment model partitioned the population into two sexes, and age groups 3 to 25 with age 25 being a plus group. The longline age frequency for the data series started in 2002. Earlier data was not used due to low sample sizes and lack of representativeness of the fishery. The 2019 age frequency was also not included due to low sample size and large uncertainty. To align more closely with the spawning season and seasons of the fishery of the various ling stocks, the model year was set as January to December. The model's annual cycle is described in Table 11.

Table 10: LIN 3&4: Summary of the relative abundance series applied in the models, including source years (Years). Data used in the base case model are shown in bold.

Data series	Years
Trawl survey biomass (*Tangaroa*, Jan)	1992–2014, 2016, 2018, 2020, 2022, 2024
Trawl survey proportion at age (*Tangaroa*, Jan), sexed	1992–2014, 2016, 2018, 2020, 2022, 2024
Commercial longline proportion-at-age (Jun–Oct), sexed	2002–09, 2013–2018, 2020-2022
Commercial trawl proportion-at-age (Oct–May), sexed	1992, 1994–2023

Table 11: LIN 3&4: Annual cycle of the stock model, showing the processes taking place at each time step, their sequence within each time step, and the available observations. Fishing and natural mortality that occur within a time step occur after all other processes, with half of the natural mortality for that time step occurring before and half after the fishing mortality.

					Observations	
Step	**Period**	**Processes**	***M*****	**Age†**	**Description**	**%*Z*‡**
1	Jan-Jun	Recruitment	0.9	0.5	Trawl survey (summer)	0.2
2	Jul-Dec	Spawning	0.1	0	–	
		fisheries (longline & trawl)			Longline CPUE Longline catch-at-age/length Trawl catch-at-age	0.5
		Increment in ages		0.5		

* *M* is the proportion of natural mortality that was assumed to have occurred in that time step.
† Age is the age fraction, used for determining length-at-age, that was assumed to occur by the start of that time step.
‡ %*Z* is the percentage of the total mortality in the step that was assumed to have taken place at the time each observation was made.

The error distributions assumed were multinomial for the age data, and lognormal for the abundance data. The weight assigned to each data set was controlled by the error coefficient of variation (CV). The multinomial observation error CVs for the at-age data were adjusted using the reweighting procedure of Francis (2011). Additional process errors for the trawl survey biomass index were estimated within the model at MPD level only (fixed at MCMC level) after the age frequency datasets were reweighted.

Most priors were intended to be uninformed and were specified with wide bounds. One exception was an informative prior for the trawl survey *q*. The prior on *q* for all the *Tangaroa* trawl surveys was estimated assuming that the catchability constant was a product of areal availability (0.5–1.0), vertical availability (0.5–1.0), and vulnerability between the trawl doors (0.03–0.40). The resulting (approximately lognormal) distribution had mean 0.13 and CV 0.70, with bounds assumed to be 0.02 to 0.30. Penalty functions were used to constrain the model so that any combination of parameters that did not allow the historical catch to be taken was strongly penalised. A penalty was applied to the estimates of year class strengths to encourage estimates that averaged to 1. In all model runs, the catchability coefficients (*q*s) were estimated as free parameters.

4.3.2 Model estimates

The base model used the biomass index and sexed age frequencies from the summer trawl survey but, because of concerns over data quality, used combined sex age frequency information from the commercial trawl and commercial longline fleets. Commercial CPUE series were not used.

The fits to the catch-at-age data and survey biomass series were good. Estimated year class strengths were not widely variable, although were poorly estimated prior to 1980 (Figure 3). Previous analyses fixing year class strengths to 1 prior to 1980 showed that the model results were not sensitive to the different recruitment assumption for this early period (see Mormede et al 2023b). All year class strengths estimated from 2000 have been lower than average, apart from for the 2007 year.

Ling are first caught by the trawl survey (age at full selectivity 5–6 years), then the trawl fishery (age 6–8 years), and then the longline fishery (age 12–15 years).

Base case estimates indicated that it was unlikely that B_0 was lower than 100 000 t for this stock, or that biomass in 2025 was less than 48% of B_0 (Table 12, Figure 4). Annual fishing pressure (catch over vulnerable biomass) were estimated to be lower than 0.15 (often much lower) since 1979 (Figure 5).

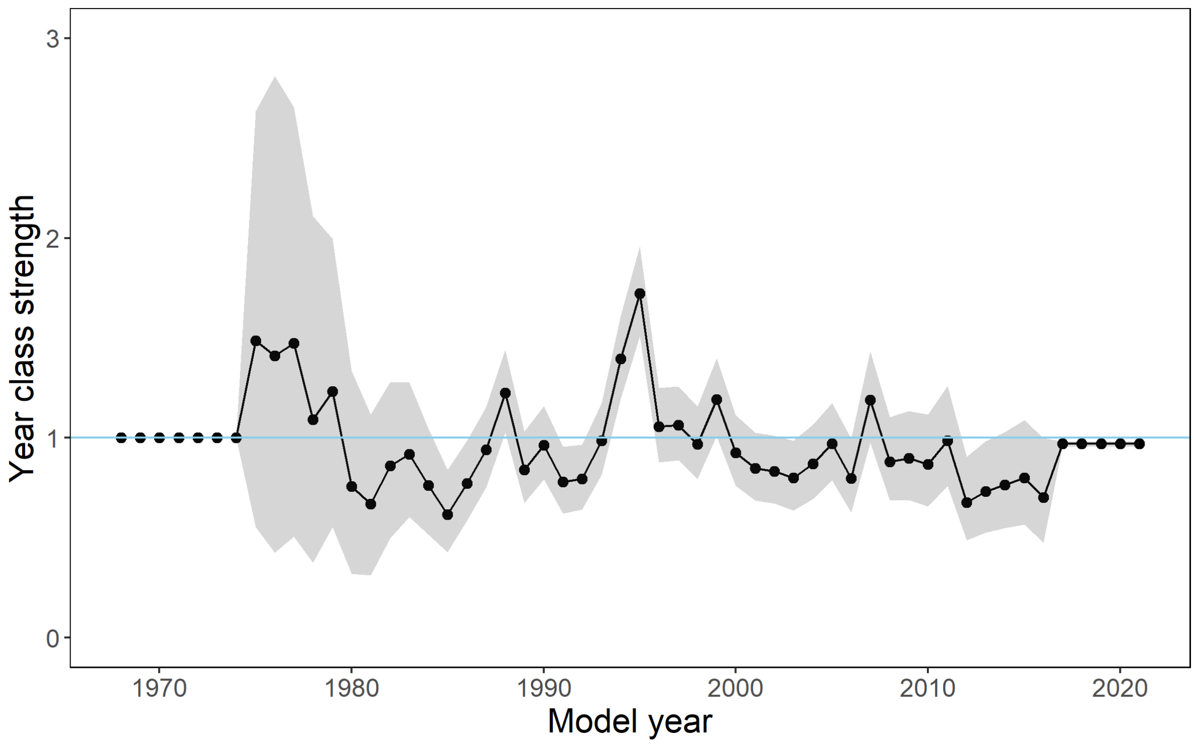


Figure 3: LIN 3&4. Estimated posterior distributions of year class strength from the base case run, with median (line and individual points) and 95% credible interval (grey band). The horizontal line indicates a year class strength of one.

Table 12: LIN 3&4: Bayesian median and 95% credible intervals (in parentheses) of B_0 and B_{2025} (in tonnes, and as a percentage of B_0) for the Base model run and two sensitivities, and the probability that B_{2025} is above 40% of B_0 or below 20% of B_0.

Model run	B_0		B_{2025}		B_{2025} (% B_0)		P(>40% B_0)	P(<20% B_0)
Base model	114 384	(103 473–138 315)	66 638	(50 671–94 693)	58.3	(48.8–68.9)	1.000	0.000

The model indicated a relatively flat biomass trajectory from about 2009 (Figure 4). Annual landings from the LIN 3&4 stock have been less than 4600 t since 2004, markedly lower than the 6000–8000 t taken annually between 1992 and 2003. Biomass projections derived from this assessment are shown below (Section 4.3.3).

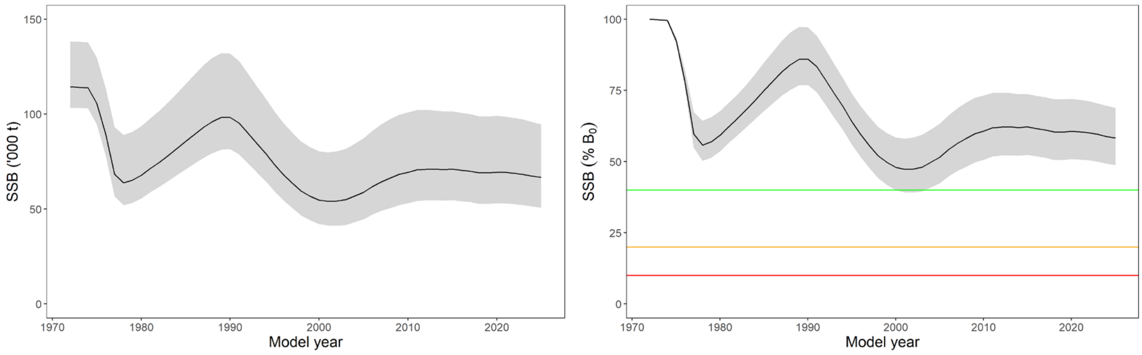


Figure 4: LIN 3&4 base model. Estimated median trajectories (with 95% credible intervals shown as grey band) for absolute biomass and biomass as a percentage of B_0. The red horizontal line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and the green line is the %B_0 target (40% B_0).

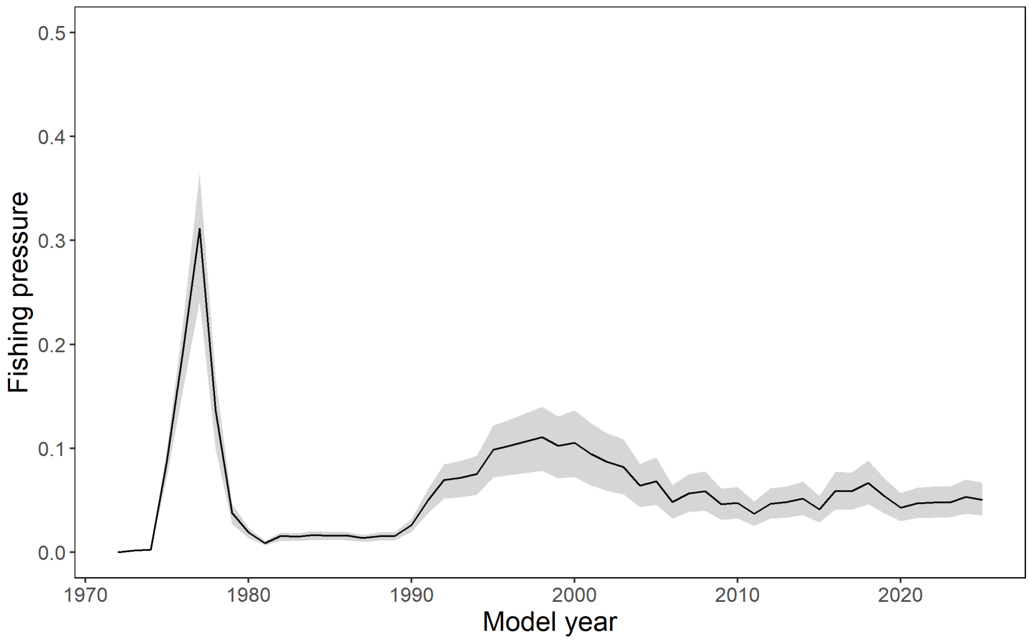


Figure 5: LIN 3&4 base model: Exploitation rates (catch over vulnerable biomass) with 95% credible intervals shown in grey.

Model sensitivity runs included an alternative assumption for maturity at age, derived from otolith zone widths following Morrongiello et al (2020). This indicated an earlier age at 50% maturity of 7 for both sexes. This raised estimated B_0 by approximately 20% and stock status (B_{2025}/B_0) by about 9% compared to the base model. The WG expressed concern about the reliability of the catch-at-age data from the longline fishery. The sex ratio in 2021 and 2022 was reversed compared to most previous years and a large proportion of the females were in the plus group. Sensitivity runs were conducted where i) the 2021–22 years of longline age frequency were removed, ii) selectivity was made double normal for the trawl fleet and survey, iii) selectivity was made double normal only for the survey, iv) sex specific age frequencies were trialled for longline and trawl fisheries. Results from all sensitivities were similar in terms of stock status and, where comparable, in terms of fit to catch-at-age data and survey data.

4.3.3 Projections

Four scenarios were carried out, all using the base case model. Recent catches have been much lower than the TACC so the future catches were assumed to be either the average of the 2022–2024 catches or the TACC, keeping the ratio of catches between the fisheries to that of the 2022–2024 fisheries (38% longline, 35% trawl, and 27% pot). Furthermore, year class strengths have been mostly low since 2000 so the year class strengths for the projections were either resampled from the full 1975–2016 range, or from the 2007–2016 range.

For LIN 3&4, using the base case model and assuming future catches equal recent catch levels, stock size in 2030 is projected to be 55% of B_0 and 95% of biomass in 2025 if year class strengths are consistent with all year class strengths. This reduces to 53% of B_0 and 92% of biomass in 2025 if year class strengths are consistent with recent (2007–2016) year class strengths. If catches reach the TACC, with the same year class strength assumptions biomass in 2030 reduces to 45% and 42% of B_0 and 81% and 77% of B_{2025} respectively (Table 13).

The probability of biomass in 2030 being above 40% B_0 is 0.65–1.0 and the probability of being below 20% B_0 is zero for all projection scenarios.

Table 13: LIN 3&4. Bayesian median and 95% credible intervals (in parentheses) of projected B_{2030}, B_{2030} as a percentage of B_0, and as a percentage of B_{2025} for the base case run and various assumptions of future catches and year class strengths (YCS). The probability of B_{2030} being above 40% B_0 (p_{40}) and of B_{2030} being below 20%B_0 (p_{20}) are also reported.

		Future catch (t)							
YCS range	Catch range	Trawl	Line	Pot	B_{2030} (t)	B_{2030} (%B_0)	B_{2030} (%B_{2025})	p_{40}	p_{20}
All	2022–2024	1 248	1 359	958	63 477 (46 612– 91 951)	55 (44–69)	95 (86–110)	1.00	0
2007–2016	2022–2024	1 248	1 359	958	60 292 (43 818– 87 496)	53 (42–65)	92 (83–101)	0.99	0
All	TACC	2 191	2 387	1 682	51 895 (34 749–80 784)	45 (33–60)	81 (69–96)	0.79	0
2007–2016	TACC	2 191	2 387	1 682	48 663 (31 954– 76 220)	42 (30–56)	77 (65–88)	0.65	0

4.4 Sub-Antarctic, LIN 5 & 6 & LIN 6B

4.4.1 Model structure and inputs

An age-based stock assessment model assuming a Beverton-Holt stock-recruit relationship for LIN 5&6 and LIN 6B (Sub-Antarctic) was carried out in 2024 (Mormede et al 2024c). This was the first time LIN 6B was incorporated in the Sub-Antarctic stock model, and the first time the Sub-Antarctic ling stock was assessed using Casal2 (Casal2 Development Team 2024). LIN 6B was included as a separate fishery in the model, sharing the LIN 5&6 bottom longline selectivity and the LIN 5&6 biological parameters and recruitment. The age composition data and fisheries CPUE from LIN 6B were deemed too poorly determined to be useful in the stock assessment and were omitted. Although potting is becoming an important part of this fishery, there are no age data available for potting in LIN 5&6 and potting was assumed to have the same selectivity as bottom longline, as assumed in the other ling stocks that include potting catches.

For final runs, the posterior distribution was sampled using Markov chain Monte Carlo (MCMC), based on the Metropolis-Hastings algorithm. Estimates of spawning stock virgin (B_0) and current (B_{2024}) biomass were obtained. Year class strengths and fishing selectivity ogives were also estimated in the model. Trawl fishery selectivity ogives were fitted as double normal curves with the right-hand limb fixed at 100 (i.e., a flat-topped selectivity); longline fishery and research survey ogives were fitted as logistic curves. Selectivities were assumed constant over all years in each fishery/survey.

MCMC chains with a total length of 6×10^6 iterations were constructed. A burn-in length of 1×10^6 iterations was used, with every 1000th sample taken from the final 5×10^6 iterations (i.e., a final sample of length 5000 was sampled from the Bayesian posterior). Three individual chains were carried out. Model input data include catch histories for both LIN 5&6 and LIN 6B, biomass and catch-at-age data from summer and autumn trawl survey series (of LIN 5&6), LIN 5&6 longline fishery CPUE series (only as a sensitivity), catch-at-age data from the longline and trawl LIN 5&6 fisheries, and estimates of biological parameters for LIN 5&6. The stock assessment model partitioned the population into two sexes and age groups 3 to 28 with a plus group. The base model's annual cycle is described in Table 14. To align with other ling assessments, the model year was updated to be the calendar year rather than September to August.

A summary of the observations used in this assessment and the associated time series is given in Table 15. Lognormal errors, with known CVs, were assumed for all relative biomass observations. The CVs available for those observations of relative abundance allow for sampling error only. However, additional variance, assumed to arise from differences between model simplifications and real-world variation, was added to the sampling variance. The additional variance, termed process error, was estimated in the models at MPD-level only. Multinomial errors were assumed for all age composition observations. The effective sample sizes for the composition samples were estimated following method TA1.8 as described in appendix A of Francis (2011). Given that making adjustments to correct the Tangaroa Sub-Antarctic trawl survey biomass estimate for 2016 would introduce some undefinable uncertainty, the Deepwater Working Group recommended in 2021 that this survey be excluded in all ling stock assessments. This survey was excluded from the 2024 stock assessment of ling.

Table 14: LIN 5&6 and LIN 6B. Annual cycle of the stock model, showing the processes taking place at each time step, their sequence within each time step, and the available observations. Fishing and natural mortality that occur within a time step occur after all other processes, with half of the natural mortality for that time step occurring before and half after the fishing mortality.

					Observations	
Step	**Period**	**Processes**	***M****	**Age†**	**Description**	**%*Z*‡**
1	Jan–Aug		0.67	0.5	Trawl survey (autumn)	0.5
2	Sep–Dec	Recruitment	0.33	0.0	Longline CPUE	0.5
		Trawl and longline fisheries			Longline catch-at-age	0.5
		Increment ages			Trawl catch-at-age	0.5
					Trawl survey (summer)	0.9

* *M* is the proportion of natural mortality that was assumed to have occurred in that time step.
† Age is the age fraction, used for determining length-at-age, that was assumed to occur in that time step.
‡ %*Z* is the percentage of the total mortality in the step that was assumed to have taken place at the time each observation was made.

Table 15: LIN 5&6 and LIN 6B. Summary of the relative abundance series applied in the models, including source years (Model years). Note that the 2016 trawl survey index and proportions at age were removed based on working group recommendation.

Data series	Model years
Trawl survey biomass (*Tangaroa*, Nov–Dec)	1991–93, 2000–09, 2011–12, 2014, 2018, 2020, 2022
Trawl survey proportion at age (*Tangaroa*, Nov–Dec)	1991–93, 2000–09, 2011–12, 2014, 2018, 2020, 2022
Trawl survey biomass (*Tangaroa*, Mar–May)	1992–93, 1996, 1998
Trawl survey proportion at age (*Tangaroa*, Mar–May)	1992–93, 1996, 1998
LIN 5&6 CPUE (longline) –-sensitivity	1991–2023
LIN 5&6 commercial longline proportion-at-age	1996, 1998–2012, 2014, 2016–2020, 2022
LIN 5&6 commercial trawl proportion-at-age	1993, 1996, 1998–2022

The assumed prior distributions used in the assessment are given in Table 16. Most priors were intended to be relatively uninformed and were specified with wide bounds.

Table 16: LIN 5&6 and LIN 6B. Assumed prior distributions and bounds for estimated parameters in the assessments. The parameters for lognormal priors are mean (in log space) and CV.

Parameter	Shape/ transformation	Starting values			Prior distribution	Parameters		Bounds	
B_0	Log transform	200 000			Uniform			10	13
Year class strengths	Simplex transform	1			Lognormal	1	0.7	-10	10
Survey selectivity	Logistic	5	3		Uniform			0.001–1	5–200*
	Double normal								
Trawl selectivity	Right-hand fixed at 100	10	3	100	Uniform			1	5–200*
Lines selectivity	Logistic	11	3		Uniform			1	5–200*
Survey *q* (free)		0.12			Uniform			0.02	4.0
CPUE *q* (free)		0.01			Uniform			0.0001	10
Survey process error~		0.1			Uniform-log			0.001	2
CPUE process error~		0.2			Uniform-log			0.001	2

* A range of maximum values were used for the upper bound.

Penalty functions were used to constrain the model so that any combination of parameters that did not allow the historical catch to be taken was strongly penalised. A small penalty was applied to the estimates of year class strengths to encourage estimates that averaged to 1. The catch history, biological input parameters, and estimates of relative abundance used in the model are given in Tables 5–9.

The base model for 2024 was quite similar to that of the previous assessment in 2021 (Mormede et al 2021b). The main changes were:

- the addition of LIN 6B as an additional fishery of the Sub-Antarctic stock,
- the removal of the longline CPUE index in the base case model (it was added in 2021),
- the estimation of catchability parameters (*q*) as free parameters, and
- the move from a model year starting in September to starting in January.

4.4.2 Model estimates

Description of the base model run reported is as follows. The base case is considered to be a reference model because it was the most stable model obtained and uses all of the trusted information available. Other model runs which led to this base case are reported elsewhere (Mormede et al 2024c). The incremental addition of the LIN 6B catches to the model increased the initial biomass by about 12 400 t, which is close to the estimated LIN 6B initial biomass when it was assessed as an independent stock (13 570 t, Horn 2007b). The base case model comprised three fisheries (and associated updated annual cycle), a fixed natural mortality of 0.18 y^{-1}, free survey *q* parameters, and fixed right-hand limb trawl selectivity parameters.

A number of sensitivity runs were reported. Further details are below and are also available in Mormede et al (2024c).

- Sensitivity runs on natural mortality with *M* fixed at 0.16 (based on Edwards 2017), at 0.20 (MPD estimated value in 2021) or length-based with a = 0.98, b = -1 and M = 0.18. The length-based natural mortality model was based on Lorenzen (2022) with parameters reported here optimised from a suite of investigations (see Mormede et al 2024c for details).
- A sensitivity run on the effect of CPUE, adding the LIN 5&6 longline CPUE series to the base case model. This resulted in a lower initial biomass estimate and lower status.
- A sensitivity run on the effect of the bottom longline age composition data, whereby the longline selectivity was fixed at the median MCMC value and the model rerun, resulting in little difference compared with the base case.
- A sensitivity run where catches were increased by 5% prior to 1986 and 2% thereafter, resulting in almost identical outcome to the base case.

Stock status estimates for 2024 from three reported models were 52–69% of B_0 (Figure 6, Table 17), with the lowest stock status linked to the lowest value of *M*, followed by the model with the longline CPUE index. Annual exploitation rates (catch divided by vulnerable biomass) were low (less than 0.1) in all years as a consequence of the high estimated stock size relative to the level of catches (Figure 7). Steepness was assumed to be 0.84 (Table 6); sensitivities to this were not done due to the consistently high stock status.

The effect of using a length-based natural mortality was small: the data did not support length-based differential mortality of fish selected in the fishery, and therefore mortality was assumed constant at length by the time fish were selected in the fishery. Length-based mortality did result in slightly different natural mortality rates between males and females because of their different size at age, which resulted in slightly different selectivities but no change in the estimated biomass trajectory.

The inclusion of the LIN 5&6 longline standardised CPUE resulted in both lower initial biomass and lower status compared with the base case model. This change was driven by the trend in this time-series. However, it is unlikely that the fisheries catchability has remained constant over the 1991–2023 period, or that improvements in catchability over time were adequately captured in the CPUE standardisation. Adding an arbitrary 1% annual learning rate to the standardised longline CPUE resulted in model estimates that were close to the base case model.

Posterior distributions of year class strength estimates from the base case model run are shown in Figure 8; the distribution from the base case model differed little from the sensitivity models. Year classes show a trend of alternating periods of strong and weak recruitment. Overall, estimated year class strengths were not widely variable, with all medians being between 0.5 and 1.7. Biomass estimates for the stock declined through the 1990s, were stable between the early 2000s and 2016, and have been declining again since (Figure 6). The biomass trajectory from the sensitivity runs was different for those sensitivity runs with either high or low natural mortality only (see Table 17).

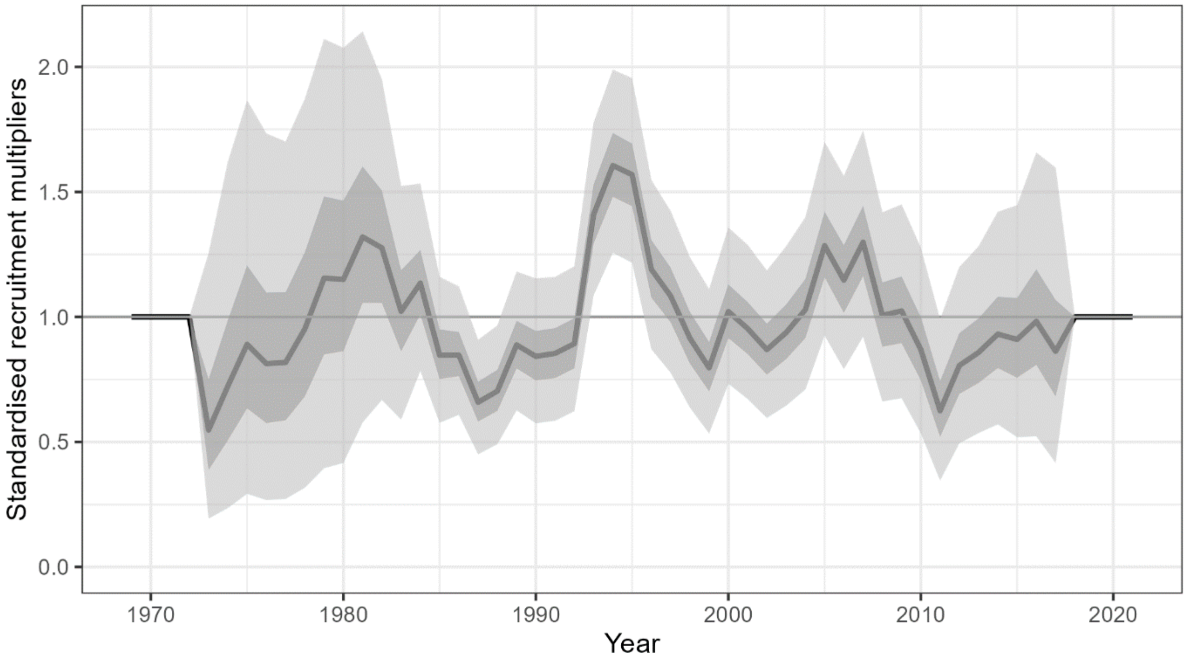


Figure 6: LIN 5&6 and LIN 6B. Estimated posterior distribution of year class strength from the base case run, with median (line and individual points), interquartile range (dark grey band) and 95% credible interval (light grey band). The horizontal line indicates a year class strength of one.

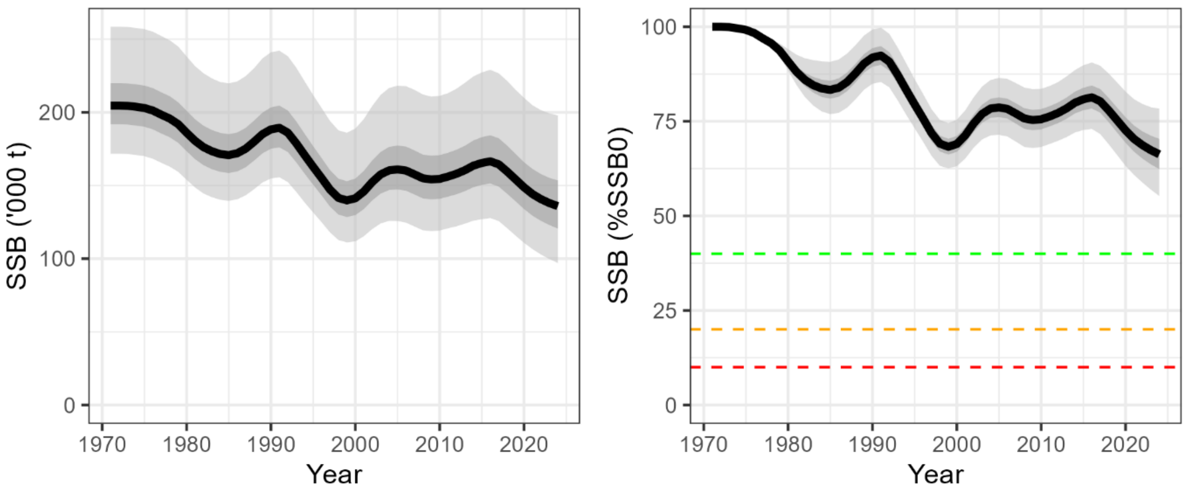


Figure 7: LIN 5&6 and LIN 6B base model. Estimated median trajectories (with interquartile range shown as dark grey bands and 95% credible intervals as light grey bands) for absolute biomass and biomass as a percentage of B_0. The red horizontal line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and the green line is the % B_0 target (40% B_0).

Table 17: LIN 5&6 and LIN 6B. Bayesian median and 95% credible intervals (in parentheses) of B_0 (in tonnes), and B_{2024} as a percentage of B_0, and the probability that B_{2024} is above 40% and below 20% of B_0 from the Base model and sensitivity runs.

Model run		***B_0***		***B_{2024} (%B_0)***	***P(>40% B_0)***	***P(<20% B_0)***
Base model	204 628	171 734 – 258 458	66.3	55.3 – 78.3	1.000	0.000
M=0.16	158 380	142 888 – 179 277	52.1	42.3 - 62.3	0.993	0.000
M=0.20	304 797	226 047 – 419 980	76.7	65.1 – 88.3	1.000	0.000
length-based M	205 664	174 120 – 255 506	64.5	53.9 – 75.7	1.000	0.000
Additional catch	208 772	175 345 – 262 784	66.3	55.3 – 78.4	1.000	0.000
Base + CPUE	180 575	157 476 – 215 386	54.3	45.5 – 64.0	0.999	0.000
Base - BLL AF	212 692	175 995 – 275 733	69.3	57.6 - 82.1	1.000	0.000

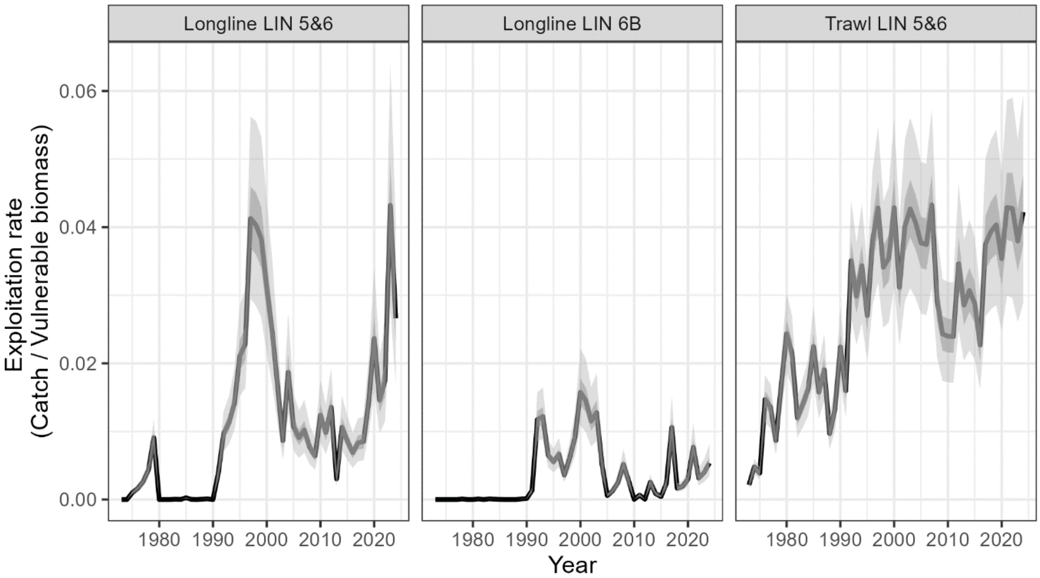


Figure 8: LIN 5&6 and LIN 6B base model exploitation rate (catch divided by vulnerable biomass) by fishery with interquartile range shown in dark grey and 95% credible intervals in light grey.

Research survey and fishery selectivity ogives were relatively tightly defined. The survey ogive suggested that ling were fully selected by the research gear at about age 7–9 years. Estimated fishing selectivities indicated that ling were fully selected by the trawl fishery at about age 9 years, and by the longline fisheries at about age 12–16.

The effect of possible incidental mortality associated with escapement from trawl nets and potential unreported catch from before the introduction of the stock to the QMS was evaluated in a sensitivity model. Discards from the hoki/hake/ling target fishery were likely to be very low (< 0.3%, Anderson et al 2019).

Incidental mortality of small fish associated with escapement is also assumed to be low because the ling fishery occurs in areas away from locations where small ling are found. Unreported catch prior to the introduction of ling into the QMS is not known but assumed to be low due to the high commercial value of ling at that time. A sensitivity model was run that assumed 5% additional fishery mortality for years before the introduction of the QMS (1986) and 2% thereafter. The inclusion of estimates of incidental mortality and pre-QMS unreported catch resulted in a very similar status, and similar estimates of current biomass.

4.4.3 Projections

For LIN 5&6 and LIN 6B, the probability of B_{2029} being below 40% of B_0 is very small when assuming either one of two future annual catch scenarios (the average catch from 2020–2023, or the TACC apportioned to the 2020–2023 catches between the fisheries) and long term (1973 – 2017) or recent (2008 – 2017) recruitment (Table 18).

Table 18: LIN 5&6 and LIN 6B. Bayesian median and 95% credible intervals (range) of projected B_{2029}, B_{2029} as a percentage of B_0, B_{2029}/B_{2024} (%) and probability of B_{2029} being over 40% B_0 in 2029 (pab40) for the base case run and different recruitment and future catch split options. YCS range is range of years where recruitment is resampled for the projections and catch range the basis of future catches (2020–23 or TACC). Future catches are also reported for the LIN 5&6 trawl fishery (trawl), LIN 5&6 longline fishery (line) and LIN 6B fishery (6B).

YCS range	Catch range	Future catch (t)			B_{2029} (t)	B_{2029} (t) range	B_{2029} (%B_{2024})	B_{2029} (%B_{2024}) Range	B_{2029} (%B_0)	B_{2029} (%B_0) Range	pab40
		trawl	line	6B							
1973–2017	2020–23	6 954	1 967	396	133 874	95 594–194 403	98.4	91.9–106.4	65.3	54.3–77.4	1.000
2008–2017	2020–23	6 954	1 967	396	132 208	93 368–194 186	97.2	91.4–104.1	64.5	53.2–77.3	1.000
1973–2017	TACC	10 235	2 895	583	119 754	81 531–180 217	88.0	80.5–96.1	58.4	46.5–71.4	0.999
2008–2017	TACC	10 235	2 895	583	118 044	79 315–179 991	86.8	79.4–94.5	57.6	45.3–71.5	0.998

4.5 Bounty Platform, LIN 6B (Bounty Platform only)

The stock assessment for the Bounty Platform stock (part of LIN 6) was last updated in 2007 (Horn 2007b). In 2024, the working group decided to include LIN 6B with LIN 5&6 as a single Sub-Antarctic ling stock based on the similarities in information between LIN 5&6 and LIN 6B and the paucity of data available to assess LIN 6B as a separate stock (Mormede et al 2024b).

4.6 West coast South Island, LIN 7WC

4.6.1 Model structure and inputs

The stock assessment for LIN 7WC (west coast South Island) was updated in 2023 (Mormede et al 2024d). The assessment model partitioned the population into age groups 1 to 28 with a plus group, and sex in the partition. The previous model had an immature and mature fish partition (Kienzle 2021) but this was removed because the immature selectivity was very poorly estimated and contributed little to the model. The model's annual cycle is described in Table 19. The catch history was updated to include Statistical Area 032 and all fishing methods including potting (Mormede et al 2023a).

The reported model runs were developed following the investigation of numerous previous model runs. These evaluated the sensitivity of the model fit to assumptions about indices of abundance, estimation or fixing of the process errors of the indices of abundance, providing age frequencies observations as sexed or not, the removal of the previously-implemented immature partition, the reduction of the assumed ageing error, alternative values of the natural mortality rate, and alternative catch assumptions, trawl survey and fishery selectivity ogives, and weights assigned to different observational data sets.

Year class strengths and fishing selectivity ogives were estimated in the model. The longline fishery and mature fish research trawl survey selectivity ogives were assumed to be logistic. The selectivity of immature fish by the research trawl survey was estimated as a capped logistic curve. The commercial trawl fishery selectivity ogive was set as a double normal function.

Table 19: LIN 7WC. Annual cycle of the stock model, showing the processes taking place at each time step, their sequence within each time step, and the available observations. Fishing and natural mortality that occur within a time step occur after all other processes, with half of the natural mortality for that time step occurring before and half after the fishing mortality.

					Observations	
Step	**Period**	**Processes**	***M****	**Age†**	**Description**	**%*Z*‡**
1	Jan-Dec	Recruitment	1.0	0.0		
		Spawning				
		fishery (longline)			Longline catch-at-age	0.5
					Longline CPUE	
		fishery (trawl)			Trawl catch-at-age	0.5
					Trawl CPUE	
					Trawl survey biomass and catch-at-age	
1	End of Dec	Increment ages	0.0	1.0		

* *M* is the proportion of natural mortality that was assumed to have occurred in that time step.
† Age is the age fraction, used for determining length-at-age, that was assumed to occur in that time step.
‡ %*Z* is the percentage of the total mortality in the step that was assumed to have taken place at the time each observation was made.

Table 20: LIN 7WC. Settings of the models exploring the sensitivity of the base case stock assessment to the index of abundance (columns) and the value of natural mortalities (rows).

Natural mortality (per year)	Survey + 2 CPUE series	Survey + longline CPUE
0.15	Model 4	
0.18	Base case	Model 2 (h = 0.86) Model 3 (h = 0.6)
0.21	Model 5	

Two analyses were carried out to test the sensitivity of the results of the LIN 7WC stock assessment (base case) to some of the assumptions (Table 20): model 2 was used to investigate the effect of using alternative indices of abundance into the assessment, model 3 was used to investigate the effect of using alternative steepness value based on Horn (2022); and models 4 and 5 assessed the effect of using different values of natural mortality. Natural mortality values of 0.15 y^{-1} (based on Edwards 2017), 0.18 y^{-1} (based on Horn 2005 and value previously used in models), and 0.21 y^{-1} (MPD estimated value) were used as bounding values.

The full posterior distributions of the parameters of the final model runs were sampled using Markov chain Monte Carlo (MCMC) methods, based on the Metropolis-Hastings algorithm. Bounded estimates of spawning stock virgin (B_0) and current (B_{2022}) biomass were obtained. Three MCMC chains were constructed using a burn-in length of 1×10^6 iterations, with every 1000th sample taken from the next 3×10^6 iterations (i.e., three final samples of length 2000 each were taken from the Bayesian posterior totalling 6000 samples to describe the posterior distributions of the model parameters). Visual inspections of the chains were used to determine the acceptability of the MCMC procedure. The final model runs (Section 4.6.2) were considered acceptable for providing management advice.

For LIN 7WC, available data to model the fishery included catch histories, trawl and bottom longline fishery CPUE series, extensive catch-at-age data from the trawl fishery, sparse catch-at-age data from the longline fishery, biomass estimates and catch-at-age data from *Tangaroa* surveys in 2000, 2012, 2013, 2016, 2018, and 2021, and estimates of constant biological parameters (Table 21, Figure 9, and Table 5). Catch-at-age data were used as unsexed, with equal selectivities for males and females. Sensitivity models were run with sexed catch-at-age data, but the resulting selectivities proved highly uncertain and those models were not taken forward.

The trawl CPUE consisted of the standardised commercial tow-by-tow data which targeted hoki, hake, or ling. The longline CPUE consisted of the standardised commercial data aggregated at the vessel, statistical area, and month level. Further investigations highlighted a change in the reporting of longline catch and effort from the TCEPR to ERS forms whereby sets were mostly aggregated daily in the former (because they were within 2 nautical miles of each other) and not the latter, forcing the aggregation of catch and effort data for CPUE analyses (Mormede et al 2024d). The *Kaharoa* inshore trawl survey biomass estimates and proportion-at-length estimates were not considered to be useful (Stevenson 2007).

The error distributions assumed were multinomial for the proportions-at-age and lognormal for all other data. Biomass indices had assumed CVs set equal to the sampling CV plus an arbitrary additional process error of 0.1 for the survey and 0.2 for CPUE indices. The multinomial observation error effective sample sizes for the proportions-at-age data were adjusted using the reweighting procedure of Francis (2011).

The assumed prior distributions used in the assessment are given in Table 22. Most priors were intended to be relatively uninformative and were specified with wide bounds. The prior for the survey q was lognormal with μ of 0.07 and CV of 0.7. A sensitivity run was carried out with an alternative prior with μ of 0.043 and CV of 0.7 and provided identical results to the base case model. The prior distributions for the selectivity parameters were assumed to be uniform.

Penalty functions were used to constrain the model so that any combination of parameters that did not allow the historical catch to be taken was strongly penalised. A small penalty was applied to the estimates of year class strengths to encourage estimates that averaged to 1. This penalty was never triggered in any of the model runs.

The catch history, biological input parameters, and estimates of relative abundance used in the model are given in Tables 5–9.

Table 21: LIN 7WC. Summary of the relative abundance and stock composition series applied in the models, including source years (Years).

Data series	Years
Commercial trawl CPUE	1997–2022
Commercial trawl proportion-at-age (Jun–Sep)	1991, 1994–2008, 2012–2022
Commercial longline CPUE (aggregated)	1991–2022
Commercial longline proportion-at-age (May-Aug, Oct-Dec for 2021)	2003, 2006, 2007, 2012, 2015, 2021
Trawl survey biomass (*Tangaroa*, Jul)	2000, 2012–13, 2016, 2018, 2021
Trawl survey age data	2000, 2012–13, 2016, 2018, 2021

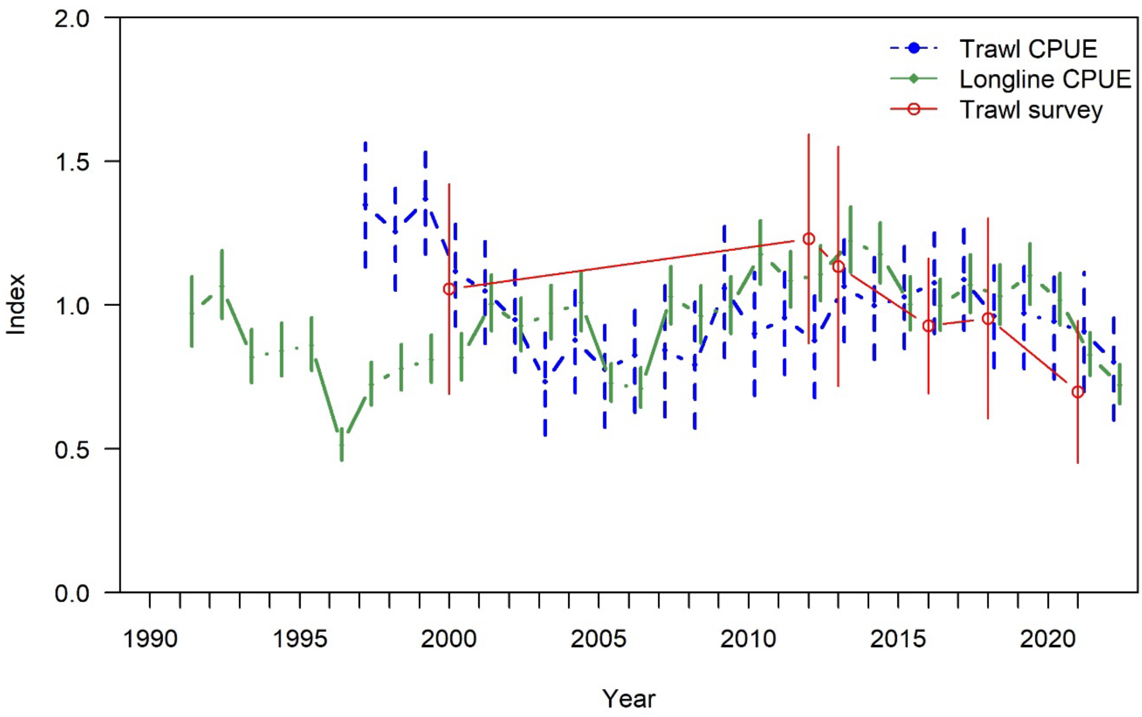


Figure 9: LIN 7WC. Input biomass indices: commercial trawl CPUE, commercial longline CPUE and trawl survey biomass with their associated confidence intervals (prior to the addition of process error).

Table 22: LIN 7WC. Assumed prior distributions and bounds for parameters estimated in the models. For lognormal distributions the figures are the log-space mean and the CV, and for normal distributions the figures are the mean and standard deviation.

Parameter description	Distribution	Initial value	Parameters		Bounds	
B_0	uniform-log	200 000	–	–	10 000	500 000
Year class strengths	lognormal		1.0	0.7	0.01	100
Tangaroa survey *q*	lognormal		0.043	0.70	0.001	1
CPUE *q*	uniform-log		–	–	1e-8	1e-3
Trawl fishery selectivity par 1	Lognormal		10	0.2	1	30
Trawl fishery selectivity par 2	Lognormal		5.5	0.2	1	30
Trawl survey selectivity immature par 1	Lognormal		2.8	0.2	1	30
Trawl survey selectivity immature par 2	Lognormal		0.77	0.2	0.1	30
Trawl survey selectivity immature par 3	Lognormal		0.03	0.2	0.001	0.20
Trawl survey selectivity mature par 1	Lognormal		13.6	0.2	1	30
Trawl survey selectivity mature par 2	Lognormal		7.2	0.2	1	30
Longline fishery selectivity	uniform		–	–	0	30–200*

* A range of maximum values was used for the upper bound.

4.6.2 Model estimates

There was no evidence of lack of convergence of the MCMCs (Mormede et al 2024d). The fits to the catch-at-age data were reasonable considering the variability in the observations from year to year, and the fits were almost indistinguishable between model runs. The fits to the survey biomass series and the CPUE series were reasonable. Estimated recruitment multipliers were estimated with wide confidence intervals throughout the series for all models (Figure 10).

The ling selectivities in LIN 7WC were unusual in that the survey selected older fish than the commercial trawl. The commercial longline selected older fish than both commercial and survey trawl. Fits to the observed data were adequate (Mormede et al 2024d). It resulted in the commercial fisheries selectivities being to the right of the maturity ogive, leading to a small proportion of the spawning stock biomass being not vulnerable to fishing (about 10% at B_0 for the base case). Maturity should be investigated to ensure that the ogive used (from Horn 2005) is still adequate for this stock.

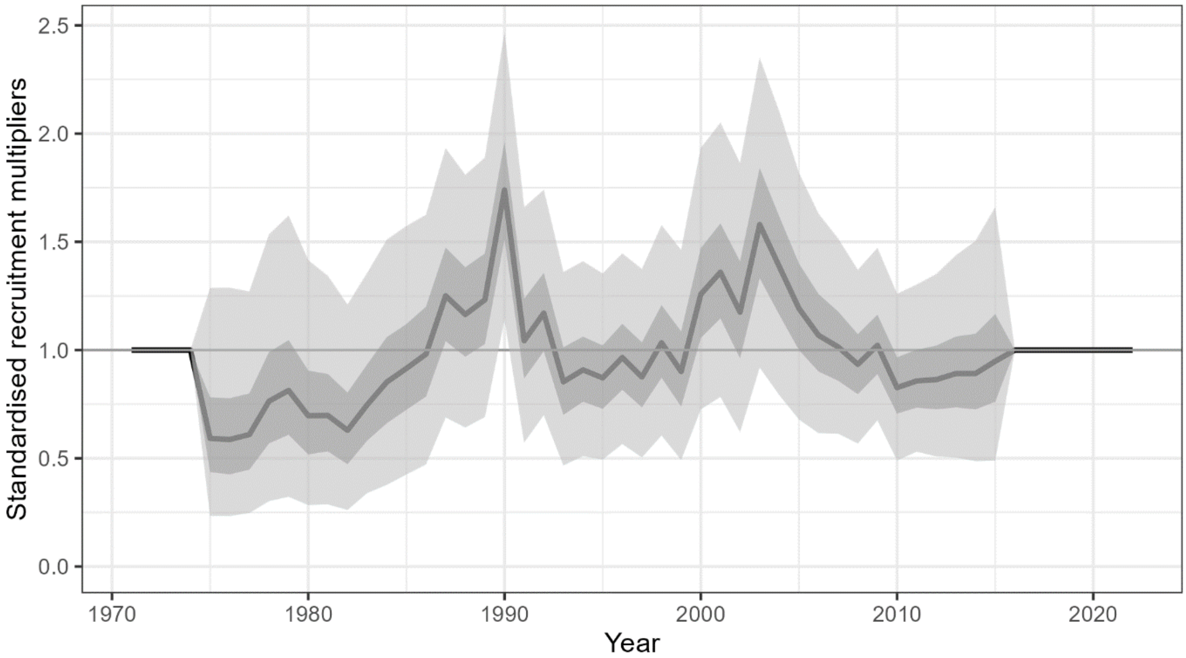


Figure 10: LIN 7WC. Estimated posterior distributions for standardised recruitment multipliers from the base case run, with median (line), the interquartile range (dark grey), and 95% credible interval (light grey). The horizontal line indicates a recruitment multiplier value of one.

Base case estimates indicated that B_0 was about 62 000 t for this stock, and that biomass for 2023 was about 55% of B_0 (Table 23, Figure 11). Annual exploitation rates (catch over vulnerable biomass) were estimated to be lower than 0.1 (Figure 12).

The results of the sensitivity analyses showed that the stock assessment model was moderately sensitive to using alternative indices of abundance. In particular, the CPUE indices diverged in the 1997–2000 time period (see Mormede et al 2023a) and the model excluding the trawl CPUE series led to a slightly lower initial biomass and stock status for 2023. The model with a lower steepness value led to slightly higher initial biomass and lower status for 2023 (Table 23).

The model outcomes were sensitive to alternative values of natural mortality, with a lower value of natural mortality leading to a lower initial biomass and stock status in 2023, and conversely a higher value of natural mortality leading to a higher initial biomass and stock status for 2023.

Prior to the introduction of the QMS and before the establishment of the EEZ, catch reporting was not required and as such catches are uncertain but are assumed to have been low during this period. A sensitivity model was run based on the base case model that assumed 5% additional fishery mortality for years before the introduction of the QMS (1986) and 2% thereafter. The inclusion of estimates of incidental mortality and pre-QMS unreported catch resulted in very similar status and biomass for 2023 as the base model. A further model was carried out to account for reporting issues (Dunn 2003 and see Section 4.1), and also resulted in very similar initial biomass and status for 2023 as the base model.

Table 23: LIN 7WC Bayesian median and 95% credible intervals (in parentheses) of B_0 and B_{2023} (in tonnes and as a percentage of B_0), and the probability that B_{2023} is above 40% of B_0 or below 20% of B_0.

Model run	B_0		B_{2023}		B_{2023} (% B_0)		P(>40% B_0)	P(<20% B_0)
Base case	62 168	(55 007–74 122)	34 265	(25 711–47 751)	55.1	(38.2–63.5)	0.953	0.000
No trawl CPUE (R2)	59 725	(53 183–70 139)	30 970	(23 237–42 440)	51.8	(43.2–61.8)	0.996	0.000
h = 0.6 (R3)	66 716	(59 468–78 689)	34 803	(26 105–48 449)	52.1	(43.5–62.1)	0.998	0.000
M = 0.15 (R4)	58 067	(54 568–62 211)	20 776	(17 255–24 804)	35.8	(31.5–40.0)	0.025	0.000
M = 0.21 (R5)	72 175	(59 611–96 155)	47 907	(34 186–72 670)	66.1	(56.0–77.8)	1.000	0.000

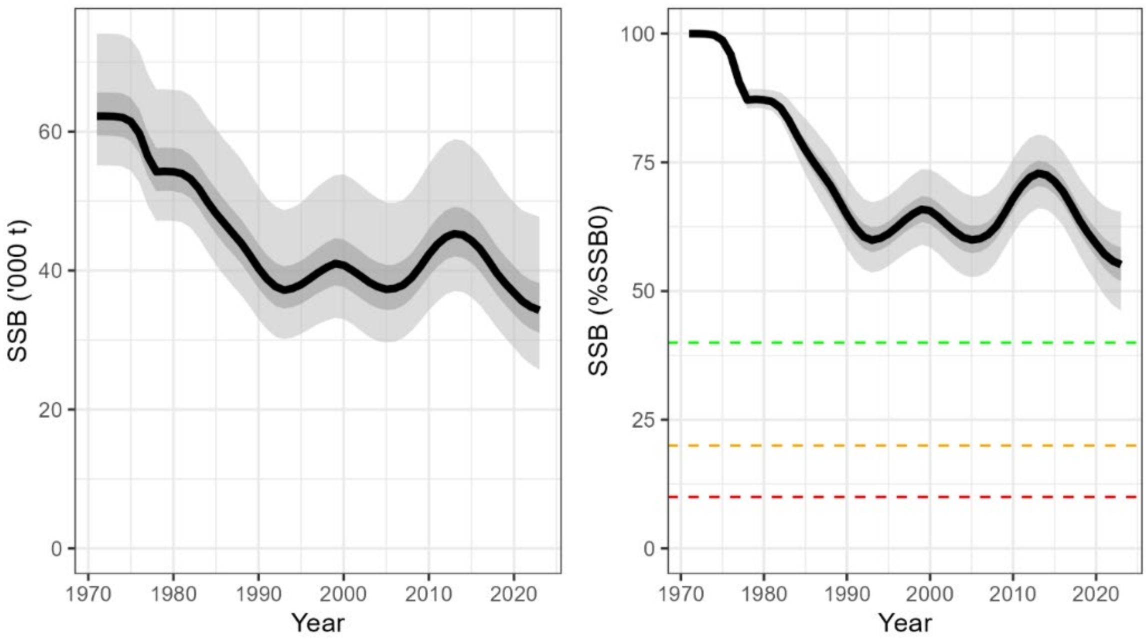


Figure 11: LIN 7WC base case. Estimated posterior distribution of the spawning stock biomass (*SSB* in tonnes, left) and of the proportion of initial spawning biomass (%SSB_0, right) trajectory and estimated virgin spawning stock biomass reference points (40%, 20%, and 10% B_0) for the base case model. The solid black line represents the median values and the dark grey shading interquartile range and light shading 95% credible interval.

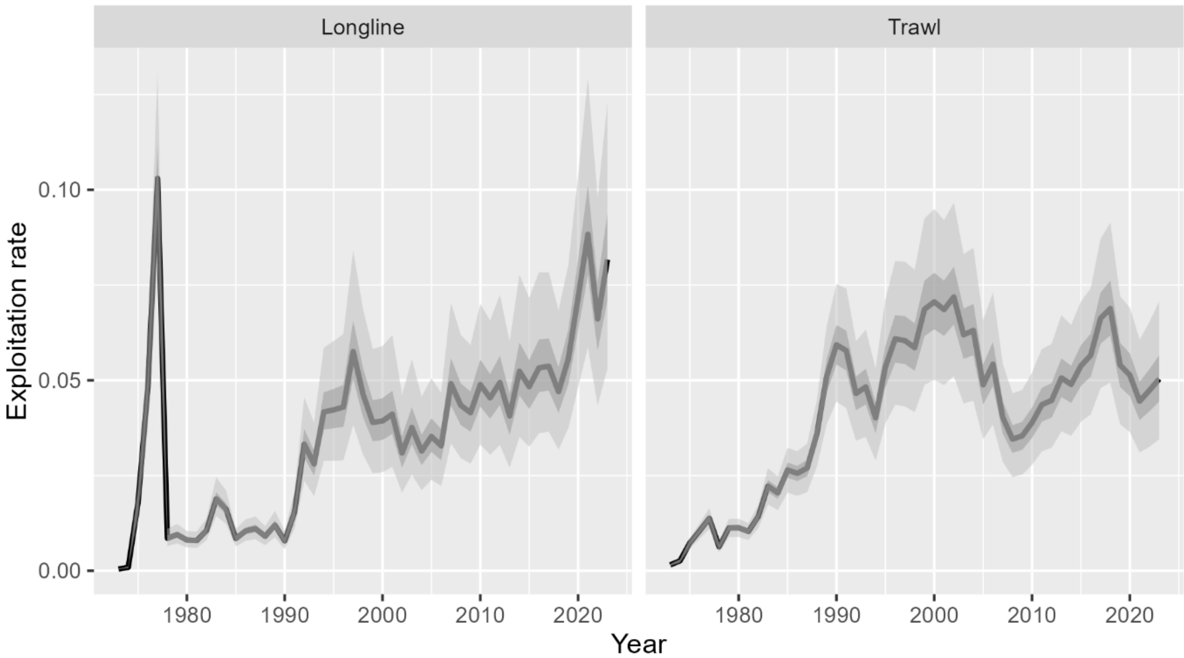


Figure 12: LIN 7WC base model: Exploitation rates for the longline and trawl fisheries with the interquartile range (dark grey) and 95% credible interval (light grey).

4.6.3 Projections

Projections out to 2028 for LIN 7WC using the base case model indicated that biomass was likely to reduce slightly with future catches equal to the average of catch in 2020–2022 (3269 t), which includes Statistical Area 032 and excludes Cook Strait, and YCS resampled over the entire range of the model (Table 24). Under those assumptions, the probability of biomass in 2028 being above 40% B_0 is 0.97 and the probability of being below 20% B_0 is 0.

Table 24: LIN 7WC. Bayesian median and 95% credible intervals (in parentheses) of projected B_{2028}, B_{2028} as a percentage of B_0, and B_{2028}/B_{2023} (%) for the base case model run. The probability of B_{2028} being above 40% B_0 (p_{40}) and of B_{2028} being below 20%B_0 (p_{20}) are also reported.

YCS range	Catch range	Future catch (t) Trawl	Line/Pot	B_{2028} (t)		B_{2028} (%B_0)		B_{2028} (%B_{2023})		p_{40}	p_{20}
All	2020–2022	1 511	1 758	32 550	(22 128–48 238)	52	(39–69)	94	(78–117)	0.97	0.00

4.7 Cook Strait, LIN 7CK

4.7.1 Model structure and inputs

A stock assessment of ling in Cook Strait (LIN 7CK) was completed in 2013 (Dunn et al 2013). Because it is believed that the true *M* for the Cook Strait stock is higher than the 'default' value of 0.18, it was considered desirable to estimate *M* in the model, and so incorporate the effect of this uncertainty in *M* in the assessment. However, the simultaneous estimation of B_0 and *M* was not successful owing to the adoption of a multinomial likelihood (rather than lognormal) for proportions-at-age. Consequently, models with fixed *M* values were run, and, although the age data were reasonably well fitted, the model failed to accurately represent declines in resource abundance that appear evident from CPUE values, which have been declining since 2001. The model was considered unsuitable for the provision of management advice.

The last stock assessment for LIN 7CK (Cook Strait) accepted by the Working Group was completed in 2010 (Horn & Francis 2013), and it is reported here. The stock assessment model partitions the population into two sexes and age groups 3 to 25 with a plus group. The model's annual cycle is described in Table 25. Year class strengths and fishing selectivity ogives were also estimated in the model. Commercial trawl selectivity was fitted as double normal curves; longline fishery ogives were fitted as logistic curves.

Table 25: LIN 7CK. Annual cycle of the stock model, showing the processes taking place at each time step, their sequence within each time step, and the available observations. Fishing and natural mortality that occur within a time step occur after all other processes, with half of the natural mortality for that time step occurring before and half after the fishing mortality.

Step	Period	Processes	*M**	Age†	Observations Description	%*Z*‡
1	Oct–May	Recruitment fishery (line)	0.67	0.5	Longline CPUE Longline catch-at-age	0.5
2	Jun–Sep	increment ages fishery (trawl)	0.33	0	Trawl CPUE Trawl catch-at-age	0.5

* *M* is the proportion of natural mortality that was assumed to have occurred in that time step.
† Age is the age fraction, used for determining length-at-age, that was assumed to occur in that time step.
‡ %*Z* is the percentage of the total mortality in the step that was assumed to have taken place at the time each observation was made.

For final runs, the full posterior distribution was sampled using Markov chain Monte Carlo (MCMC) methods, based on the Metropolis-Hastings algorithm. Bounded estimates of spawning stock virgin (B_0) and current (B_{2008}) biomass were obtained. MCMC chains were constructed using a burn-in length of 4×10^6 iterations, with every 2000th sample taken from the next 20×10^6 iterations (i.e., a final sample of length 1000 was taken from the Bayesian posterior).

For LIN 7CK, model input data include catch histories, trawl and longline fishery CPUE, extensive catch-at-age data from the trawl fishery, sparse catch-at-age data from the longline fishery, and estimates of biological parameters. Initial modelling investigations found that the longline CPUE produced implausible results; this series was rejected as a useful index. The base case used all catch-at-age data from the fisheries, and the trawl CPUE series. Instantaneous natural mortality was estimated in the model.

Lognormal errors, with observation-error CVs, were assumed for all CPUE and proportions-at-age observations. Additional process error, assumed to arise from differences between model simplifications and real world variation, was added to the sampling variance (Table 26).

Table 26: LIN 7CK. Summary of the available data including source years (Years), and the estimated process error (CV) added to the observation error.

Data series	Years	Process error CV
CPUE (hoki trawl, Jun–Sep)	1994–2009	0.2
Commercial trawl proportion-at-age (Jun–Sep)	1999–2009	1.1
Commercial longline proportion-at-age	2006–07	1.1

The assumed prior distributions used in the assessment are given in Table 27. Most priors were intended to be relatively uninformative and were specified with wide bounds.

Table 27: LIN 7CK: Assumed prior distributions and bounds for estimated parameters in the assessments. The parameters are mean (in log space) and CV for lognormal, and mean and standard deviation for normal.

Parameter description	Distribution	Parameters		Bounds	
B_0	uniform-log	–	–	2 000	60 000
Year class strengths	lognormal	1.0	0.9	0.01	100
CPUE *q*	uniform-log	–	–	1e-8	1e-2
Selectivities	uniform	–	–	0	20–200*
M	lognormal	0.18	0.16	0.1	0.3

* A range of maximum values was used for the upper bound.

Penalty functions were used to constrain the model so that any combination of parameters that did not allow the historical catch to be taken was strongly penalised. A small penalty was applied to the estimates of year class strengths to encourage estimates that averaged to 1.

The catch history, biological input parameters, and estimates of relative abundance used in the model are shown in Tables 5–8.

4.7.2 Model estimates

A single model was presented incorporating a catch history, trawl and longline fishery catch-at-age, trawl CPUE series, with double-normal ogives for the trawl fishery and logistic ogives for the longline fishery, and *M* estimated in the model.

Posterior distributions of LIN 7CK year class strength estimates from the base case model run are shown in Figure 13.

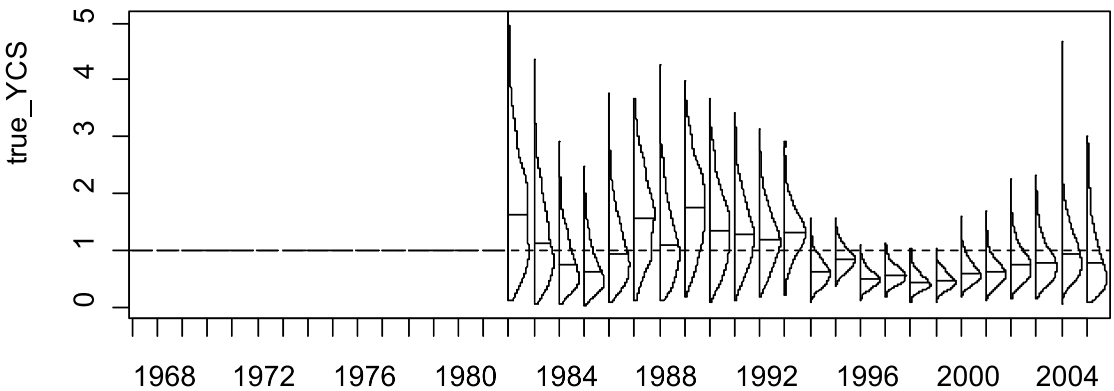


Figure 13: LIN 7CK. Estimated posterior distributions of year class strength. The horizontal line indicates a year class strength of one. Individual distributions show the marginal posterior distribution, with horizontal lines indicating the median.

The assessment is driven by the trawl fishery catch-at-age data and tuned by the trawl CPUE. Both input series contain information indicative of an overall stock decline. The confidence bounds around biomass estimates are wide (Table 28, Figure 14). Probabilities that current and projected biomass will drop below selected management reference points are given in Table 29. Median *M* was estimated to be 0.24 (95% confidence interval 0.16–0.30). Estimates of biomass are very sensitive to small changes in *M*, but clearly there is information in the model encouraging an *M* higher than the 'default' value of 0.18. The model indicated a slight overall biomass decline to about 2000, followed by a much steeper decline from 2000 to 2010. Exploitation rates (catch over vulnerable biomass) were very low up to the late

1980s and have been low to moderate (up to about 0.12 y^{-1}) since then. Since the early 1990s, trawl fishing pressure has generally declined, whereas longline pressure has generally increased.

Table 28: LIN 7CK. Bayesian median and 95% credible intervals (in parentheses) of B_0 and B_{2010} (in tonnes), and B_{2010} as a percentage of B_0 for all model runs.

Model run	B_0		B_{2010}		B_{2010} (% B_0)	
Base case	8 070	(5 290–53 080)	4 370	(1 250–40 490)	54	(23–80)

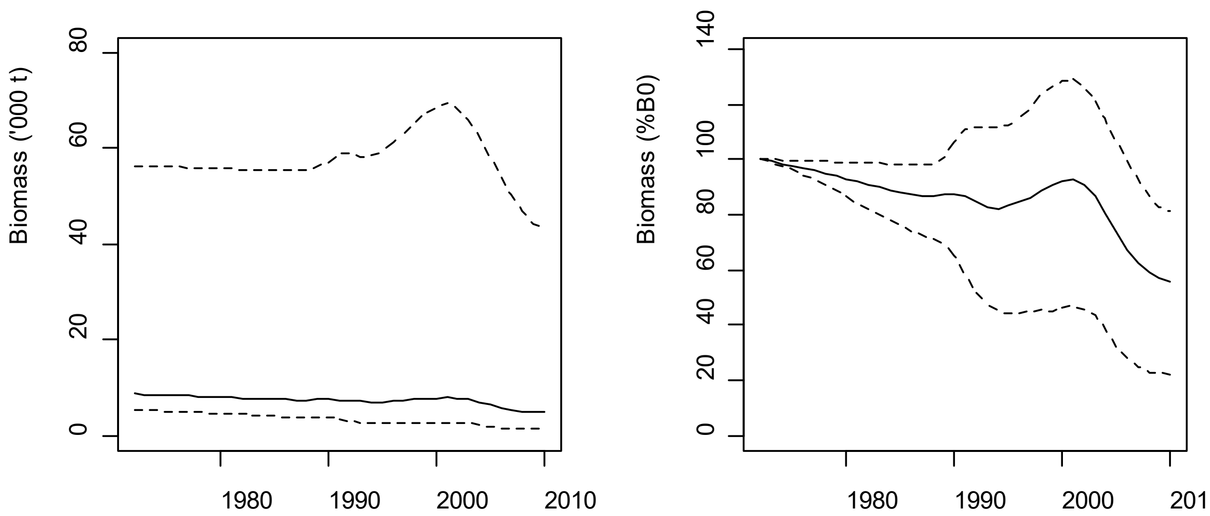


Figure 14: LIN 7CK. Estimated median trajectories (with 95% credible intervals shown as dashed lines) for absolute biomass and biomass as a percentage of B_0.

Table 29: LIN 7CK. Probabilities that current (B_{2010}) and projected (B_{2015}) biomass will be less than 40%, 20%, or 10% of B_0. Projected biomass probabilities are presented for two scenarios of future annual catch (i.e., 220 t and 420 t).

	Management reference points		
Biomass	40% B_0	20% B_0	10% B_0
B_{2010}	0.248	0.006	0.000
B_{2015}, 220 t catch	0.179	0.010	0.000
B_{2015}, 420 t catch	0.328	0.094	0.019

4.7.3 Projections

Projections out to 2015 for LIN 7CK indicated that biomass was likely to increase with future catches equal to recent previous catch levels or decline slightly if catches were equal to the mean since 1990 (Table 30).

Table 30: LIN 7CK. Bayesian median and 95% credible intervals (in parentheses) of projected B_{2015}, B_{2015} as a percentage of B_0, and B_{2015}/B_{2010} (%) for the base case.

Stock and model run		Future catch (t)	B_{2015}		B_{2015} (% B_0)		B_{2015}/B_{2010} (%)	
LIN 7CK	Base	220	5 030	(1 310–43 340)	59	(24–97)	110	(82–158)
		420	4 320	(590–42 910)	52	(11–92)	95	(45–136)

5. FUTURE RESEARCH CONSIDERATIONS

All stocks

- For all stocks, the potential change in growth or spawning over time should be investigated to keep track of potential climate change signals.
- Updates in fishery definitions and fishery seasons need to be applied to the ageing project.

LIN 2

- A review of the ling stock structure for LIN 2 should be completed before further assessments are conducted for this stock.

LIN 3&4

- The potting fishery has been developing since 2018. One trip was observed in 2020 and length data collected. Additional observer collected length data and age readings are required to develop an age frequency and associated selectivity for this fishery.
- Spatial-temporal standardisation of commercial and Chatham Rise survey data provided different indices worthy of further investigation.
- Improve understanding of spatial-temporal spawning cycle.
- Reconsider the most appropriate way to manage the periodic inadequacy in the bottom longline sampling for age and its lack of consistent representativeness.

LIN 5&6 and LIN 6B

- Further work on the most appropriate implementation of *M* should be considered.
- Collect more data to further explore the links between LIN 5&6 and LIN 6B.
- Additional representative longline and potting length frequency and age data are required for all areas.
- Ageing otoliths that were collected in Statistical Area 025 would help delineate the LIN 3&4 and LIN 5&6 stocks.
- The Plenary recommends that the *Tangaroa* Sub-Antarctic trawl survey biomass estimate (but not age compositions) for 2016 be included in future stock assessments.
- Investigate ways to monitor LIN 5 and LIN 6 separately to help inform management, including trawl survey data or spatial CPUE analysis.

LIN 7WC

- The potting fishery has been increasing since 2021. Observer collected length data and age readings are required to develop an age-frequency and associated selectivity for this fishery.
- Longline age frequencies are currently calculated based on data collected between May and August. However, most of the fishery and observer data collection happens at other times of the year. The sampling of length and ages to estimate age frequencies should be reevaluated and sampled at more appropriate times of the year.
- Mean length-at-age has been variable in 2021–22 and should be monitored.

6. STATUS OF THE STOCKS

Stock Structure Assumptions

Ling are assessed as five independent biological stocks, based on the presence of spawning areas and some differences in biological parameters between areas (Horn 2005, Horn 2022). Ling in LIN 6B was considered to be part of the Sub-Antarctic stock in 2024 (Mormede et al 2024b). Statistical Area 032 was reassigned from the LIN 5&6 stock to the LIN 7WC stock in 2023 initially based on the continuity of catches, and confirmed based on differences in growth (Mormede et al 2024b).

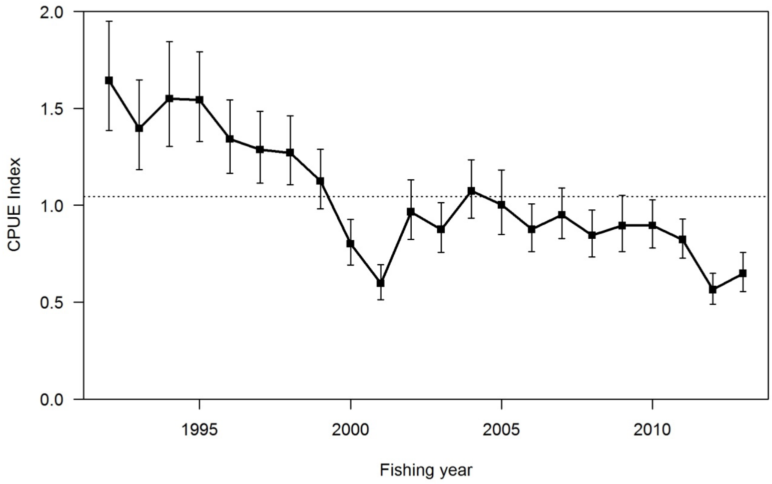
The Chatham Rise biological stock comprises all Fishstock LIN 3 and LIN 4 north of the Otago Peninsula. The Sub-Antarctic biological stock comprises all Fishstock LIN 5 and all Fishstock LIN 6 including the Bounty Platform (LIN 6B starting in 2024), and LIN 3 south of the Otago Peninsula. The WCSI biological stock occurs in Fishstock LIN 7 west of Cape Farewell. The Cook Strait biological stock includes those parts of Fishstocks LIN 7 and LIN 2 between the northern Marlborough Sounds and Cape Palliser. Ling around the northern North Island (Fishstock LIN 1) are assumed to comprise another biological stock, but there is no information to support this assumption. The stock affinity of ling in LIN 2 between Cape Palliser and East Cape is unknown.

East and west coast LIN 1 are regarded as separate stocks, but no assessments are available for either stock.

- **East coast North Island (part of LIN 2, Statistical Areas 011–015)**

Stock Status		
Most Recent Assessment Plenary Publication Year	2014 - now considered out of date	
Intrinsic Productivity Level	Low	
Catch in most recent year of assessment	Year: 2012–13	Catch: 304 t
Assessment Runs Presented	CPUE time series based on bottom longline ling target fishing	
Reference Points	Target: 40% B_0 Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: F corresponding to 40% B_0	
Status in relation to Target	Unknown. CPUE has declined by between about 50–60% since the start of the time series in 1992.	
Status in relation to Limits	B_{2014} is Unlikely (< 40%) to be below the Soft Limit and Very Unlikely (< 10%) to be below the Hard Limit	
Status in relation to Overfishing	Unknown	

Historical Stock Status Trajectory and Current Status



Standardised CPUE index (± 95% CI) for bottom longline vessels targeting ling from the ECNI Statistical Areas 011–015 (1992–2013). The dashed horizontal line is the time series mean.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Biomass is estimated to have declined from 1992 by 50–60%.
Recent Trend in Fishing Intensity or Proxy	Unknown
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis (2014)	
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 to commence	CPUE has declined while catches have been below the TACC. There is some probability that fishing at the TACC or current catch may lead to overfishing.

Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Evaluation of a CPUE time series from 1992–2013 for bottom longliners targeting ling in Statistical Areas 011–015.	
Assessment Dates	Latest assessment Plenary publication year: 2014	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Bottom longline effort & estimated catch	1 – High Quality
Data not used (rank)	N/A	
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	- It is assumed that the longline CPUE time series tracks the entire biomass of ling in this stock. - The boundaries of this biological stock, particularly towards Cook Strait, are uncertain.	

Qualifying Comments
-

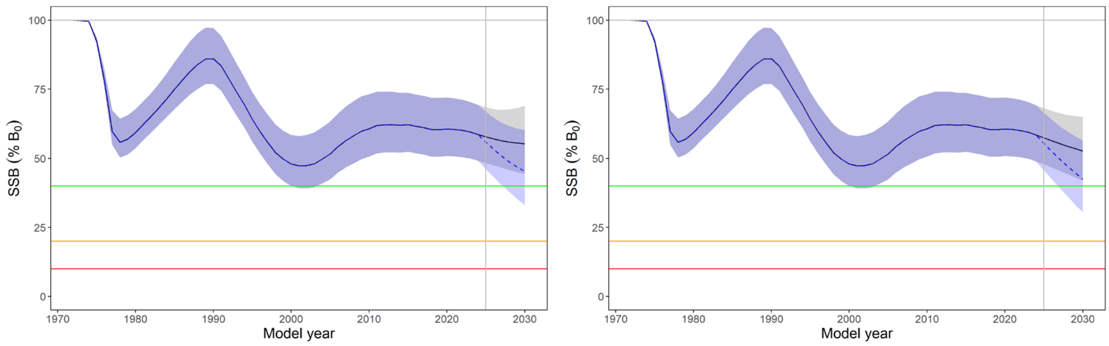
Fishery Interactions
Ling are often taken as bycatch in hoki target trawl fisheries in this region. The main bycatch species of hoki-hake-ling-silver warehou-white warehou target fisheries are rattails, javelinfish, and spiny dogfish. Additional information on trawl bycatch can be found in the Environmental and Ecosystem Considerations section of the hoki chapter of the plenary report. Model-based analysis of observer and effort data shows that, in the target longline fisheries for ling across all stocks, the main bycatch species (those constituting over 1% of the observed catch) are: spiny dogfish, ribaldo, skates (smooth and rough), black cod, sea perch, pale ghost shark, red cod, and shovelnose dogfish. Incidental captures are reported for protected seabirds associated with the longline fishery and seabirds and fur seals associated with the hoki trawl fishery.

- **Chatham Rise (LIN 3 & 4)**

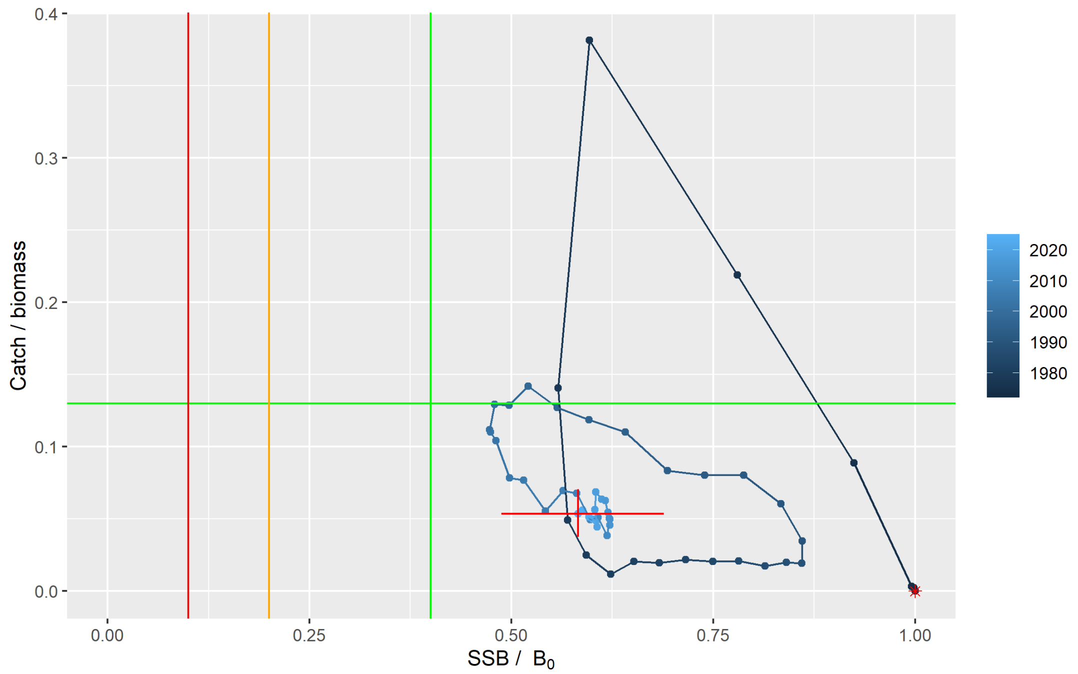
Stock Status		
Most Recent Assessment Plenary Publication Year	2025	
Intrinsic Productivity Level	Low	
Catch in most recent year of assessment	Year: 2024 (model year is calendar year)	Catch: 3780 t
Assessment Runs Presented	Base case	
Reference Points	Management Target: 40% B_0 Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: $U_{40\%}$	
Status in relation to Target	B_{2025} was estimated to be 58% B_0; Very Likely (> 90%) to be at or above the above the target	
Status in relation to Limits	B_{2025} is Exceptionally Unlikely (< 1%) to be below the Soft Limit and Exceptionally Unlikely (< 1%) to be below the Hard Limit	
Status in relation to Overfishing	Overfishing is Very Unlikely (< 10%) to be occurring	

Historical Stock Status Trajectory and Current Status

(a) Resampling all year class strengths (b) Resampling 2007–16 year class strengths



Trajectory over time of relative spawning biomass (with 95% credible intervals in grey or blue) for the base case model for the Chatham Rise ling stock from the start of the assessment period in 1972 to the most recent assessment in 2025 (vertical grey line) and projected to 2030 with future catches as either the average of the catch from 2022–2024 (solid) or TACC (dashed). Biomass estimates are based on MCMC results. The red horizontal line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and the green line is the % B_0 target (40% B_0). Projections were undertaken by resampling all year class strengths (left) or from the 2007 to 2016 year class strengths (right).



Trajectory over time of exploitation rate (U) and spawning biomass (% B_0), for the LIN 3&4 base model from the start of the assessment period in 1972 to 2025. The red vertical line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and green lines are the % B_0 target (40% B_0) and the corresponding exploitation rate (U_{40} = 0.13 calculated using Casal2 MPD projections). Biomass and exploitation rate estimates are medians from MCMC posteriors for the base model. The red cross represents the limits of the 95% confidence intervals of the estimated ratio of the SSB to B_0 and exploitation rate in 2025.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Biomass is estimated to have been increasing or stable since 2003.
Recent Trend in Fishing Mortality or Proxy	Fishing pressure is estimated to have been stable since about 2008.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	Recruitment since about 2000 is estimated to have been lower than the long-term average for this stock.

Projections and Prognosis (2025)	
Stock Projections or Prognosis	Current catch is Very Unlikely (< 10%) and catches at the TACC is Unlikely (< 40%) to cause the stock to decline below the target by 2030.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Very Unlikely (< 10%) at current catch Hard Limit: Exceptionally Unlikely (< 1%) at current catch Soft Limit: Very Unlikely (< 10%) at TACC Hard Limit: Exceptionally Unlikely (< 1%) at TACC
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Very Unlikely (< 10%)

Assessment Methodology and Evaluation		
Assessment Type	Level 1 - Full Quantitative Stock Assessment	
Assessment Method	Age-structured Casal2 model with Bayesian estimation of posterior distributions	
Assessment Dates	Latest assessment Plenary publication year: 2025	Next assessment: 2028
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Summer research trawl survey series, 1992–2014, 2016, 2018, 2020, 2022, 2024	1 – High Quality
	- Proportions-at-age data from the commercial fisheries and trawl survey	1 – High Quality
	- Estimates of biological parameters (note that *M* was estimated in the models)	1 – High Quality
Data not used (rank)	- Longline fishery CPUE series (annual indices since 1991): series not used in the base assessment model	2 – Medium or Mixed Quality: likely unreliable in the early 1990s.
	- Scampi target trawl CPUE series (ling bycatch)	2 – Medium or Mixed Quality: series runs from 1992-2003 only.
	-*Kaharoa* ECSI trawl survey abundance index	3 – Low Quality: inadequate spatial coverage of the stock distribution
	-Pot fishery length and age frequency data	3 – Low Quality: only one fishing trip has been observed
Changes to Model Structure and Assumptions	- Change from CASAL to Casal2 model platform - Combined sexes from longline and trawl	
Major Sources of Uncertainty	- Lack of contrast in survey indices - Reliability of the age frequency data from the longline fishery - Spatial spawning cycle	

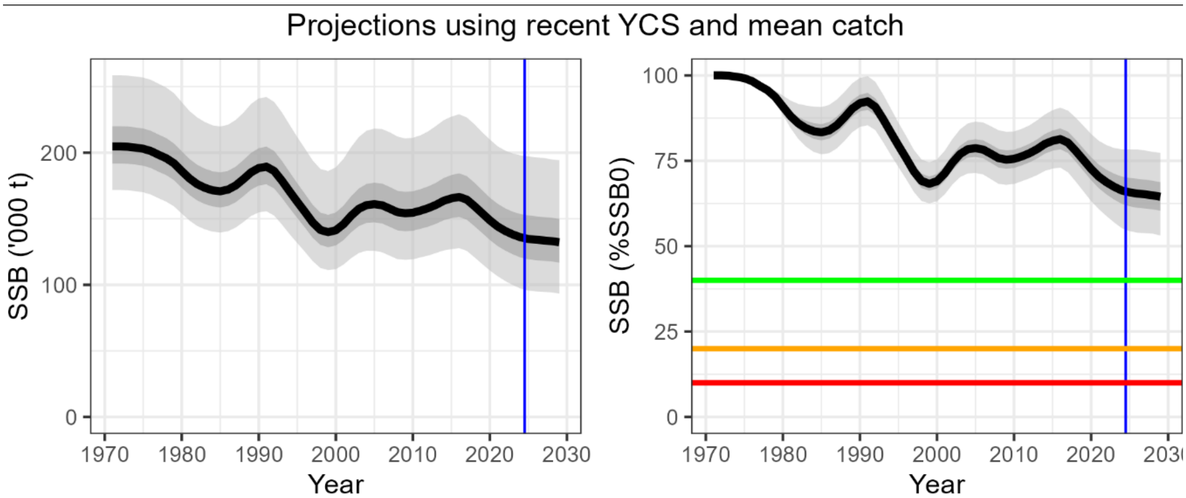
Qualifying Comments
-

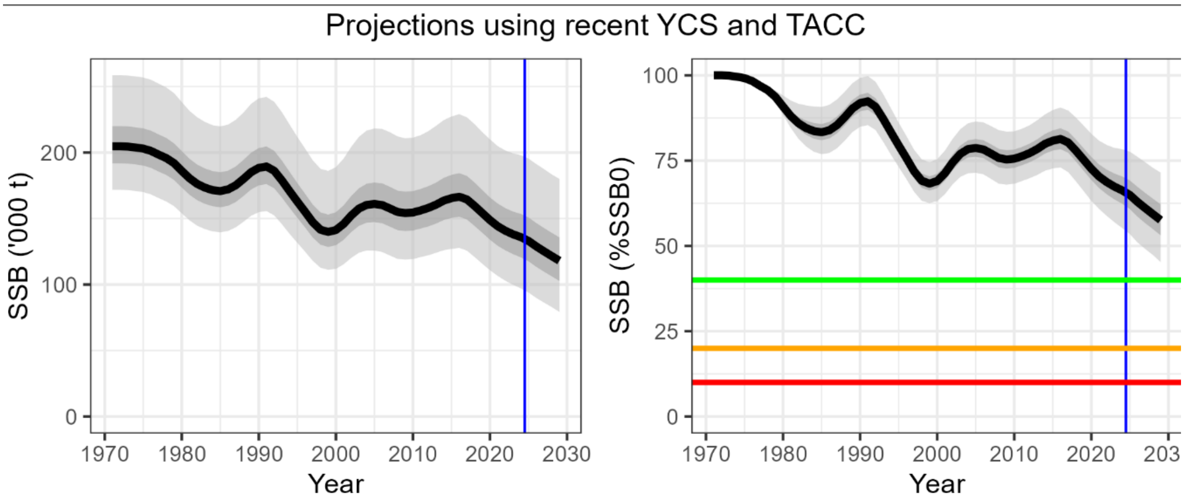
Fishery Interactions
Ling are often taken as bycatch in hoki target trawl fisheries in this region. The main bycatch species of hoki-hake-ling-silver warehou-white warehou target fisheries are rattails, javelinfish, and spiny dogfish. Additional information can be found in the Environmental and Ecosystem Considerations section of the hoki chapter of the plenary report. Model-based analysis of observer and effort data shows that, in the target longline fisheries for ling across all stocks, the main bycatch species (those making up over 1% of the observed catch) are: spiny dogfish, ribaldo, skates (smooth and rough), black cod, sea perch, pale ghost shark, red cod, and shovelnose dogfish. All these species are a significant part of the longline fishery bycatch on the Chatham Rise. Spiny dogfish is particularly represented in the longline bycatch (14.8% of catch across all LIN QMAs), with an estimated average annual catch of 1238 t (minimum 281 t, maximum 2405 t) between 2002–03 and 2017–18 in LIN 3 & 4. Incidental captures are reported for protected seabirds associated with the longline fishery and seabirds and fur seals associated with the hoki trawl fishery. In the 2019–20 fishing year, protected species captures for the longline fishery consisted of 4 seabirds and no marine mammals.

- **Sub-Antarctic (LIN 5 & 6 and LIN 6B)**

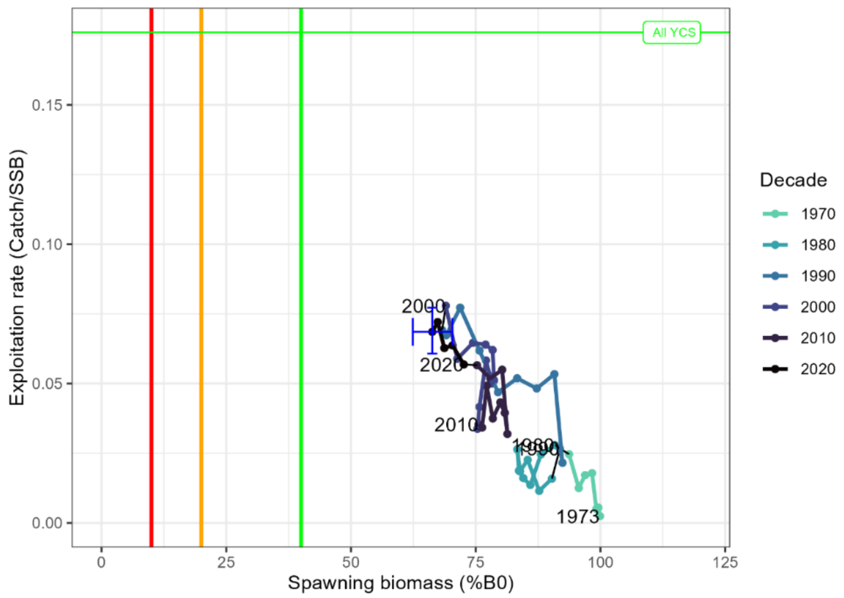
Stock Status		
Most Recent Assessment Plenary Publication Year	2024	
Intrinsic Productivity Level	Low	
Catch in most recent year of assessment	Year: 2023 (model year is calendar year)	Catch: 9946 t
Assessment Runs Presented	Age based Casal2 assessment	
Reference Points	Management Target: 40% B_0 Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: $U_{40\%B0}$	
Status in relation to Target	B_{2024} was estimated to be 66% B_0; Virtually Certain (> 99%) to be at or above the target	
Status in relation to Limits	B_{2024} is Exceptionally Unlikely (< 1%) to be below the Soft Limit and Exceptionally Unlikely (< 1%) to be below the Hard Limit	
Status in relation to Overfishing	Overfishing is Exceptionally Unlikely (< 1%) to be occurring	

Historical Stock Status Trajectory and Current Status



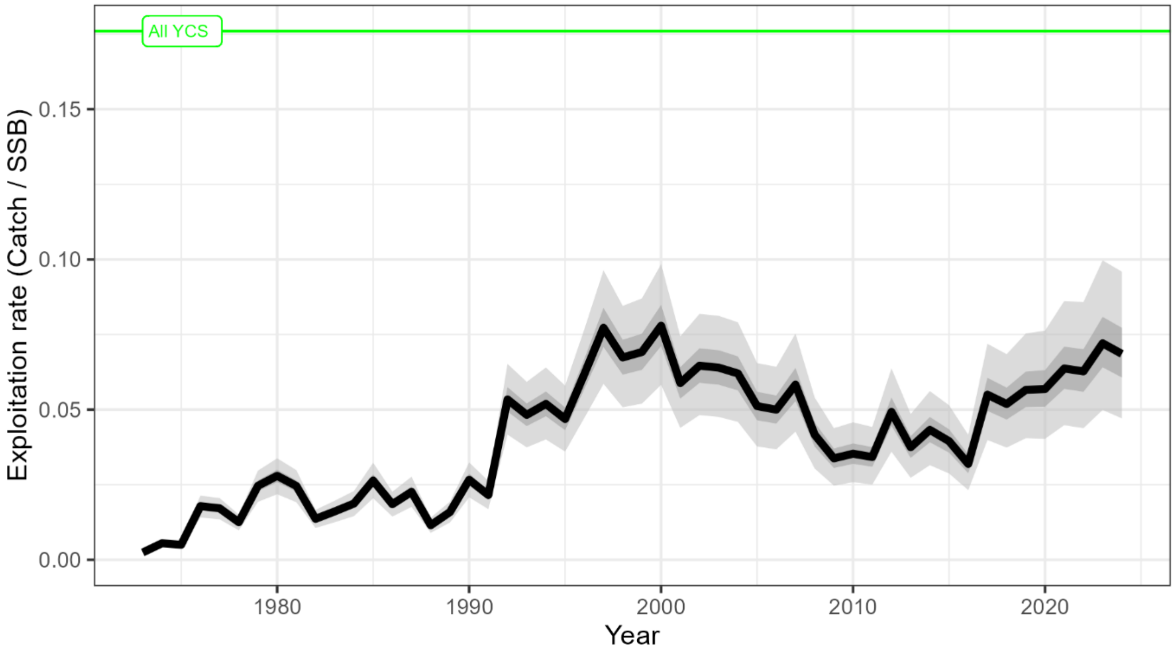


Trajectory over time of relative spawning biomass (with interquartile range in dark grey and 95% credible intervals in light grey) for the LIN 5&6 and LIN 6B base model from the start of the assessment period in 1973 to the most recent assessment in 2024 (vertical blue line) and projected to 2029 with future catches as either the average of the catch from 2020–2023 (9317 t) (top row) or TACC (13 713 t) (bottom row). Years on the x-axis are calendar year. Biomass estimates are based on MCMC results. The red horizontal line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and green line is the %B_0 target (40% B_0). Projections were undertaken by resampling recent year class strengths (2008–2017).



Trajectory over time of exploitation rate (*catch / SSB*) and spawning biomass (% B_0), for the LIN 5&6 and LIN 6B base model from the start of the assessment period in 1973 to 2024. The red vertical line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and green lines are the % B_0 target (40% B_0) and the corresponding exploitation rate (catch divided by SSB U_{40} = 0.176 under average recruitment assumptions). Biomass and exploitation rate estimates are medians from MCMC results. The blue cross represents the limits of the 95% credible intervals of the estimated ratio of the *SSB* to B_0 and exploitation rate in 2024.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Biomass has declined in recent years but remains high.
Recent Trend in Fishing Mortality or Proxy	Exploitation rate is estimated to have been low, but increasing in recent years and remains below the overfishing threshold.



LIN 5&6 and LIN 6B base model: Exploitation rate (Catch / SSB) with interquartile range shown as dark grey and 95% credible interval as light grey. The green horizontal line is the exploitation rate U_{40} (catch divided by SSB U_{40} = 0.176 under average recruitment assumptions)

Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	Stock status is unlikely to change over the next 5 years at recent catch levels (9317 t) and reduce at the level of the TACC (13 713 t), but remain well above the target.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Exceptionally Unlikely (< 1%) at current catch or catches at the level of the TACC Hard Limit: Exceptionally Unlikely (< 1%) at current catch or TACC
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Exceptionally Unlikely (< 1%) at current catch or TACC

Assessment Methodology and Evaluation		
Assessment Type	Level 1 - Full Quantitative Stock Assessment	
Assessment Method	Age-structured Casal2 model with Bayesian estimation of posterior distributions	
Assessment Dates	Latest assessment Plenary publication year: 2024	Next assessment: 2027
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Summer and autumn *Tangaroa* trawl survey series - Proportions-at-age data from the commercial fisheries and trawl surveys - Estimates of biological parameters	1 – High Quality 1 – High Quality 1 – High Quality
Data not used (rank)	- LIN 6B proportions-at-age from the commercial longline fishery - LIN 6B longline fishery CPUE series	3 – Low Quality: sparse data 3 – Low Quality: sparse data

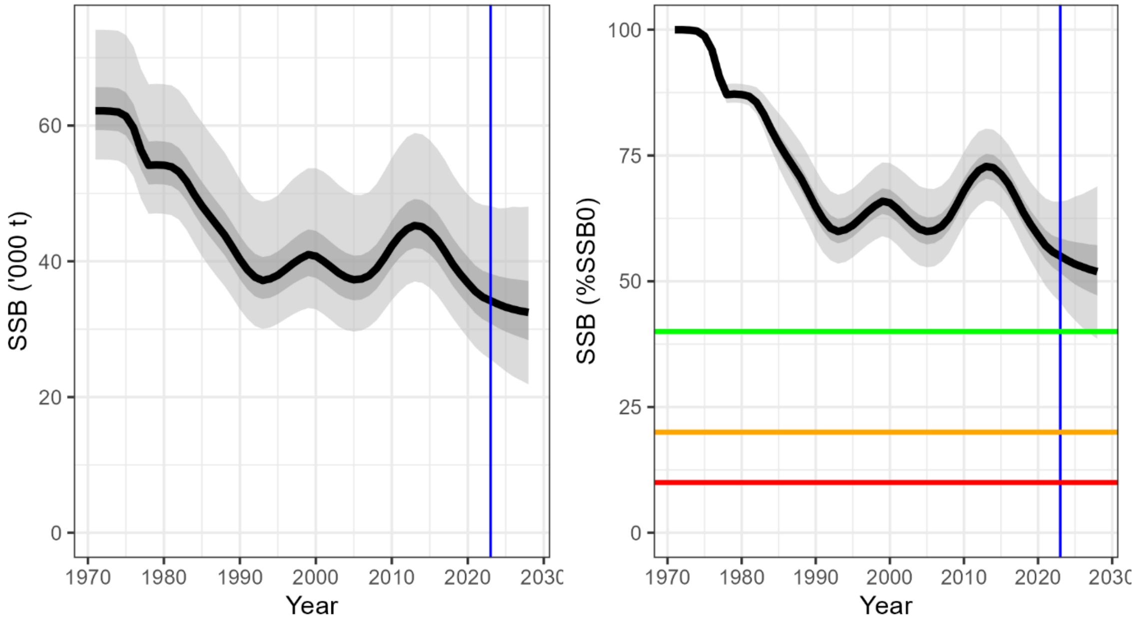
	- LIN 5&6 longline fishery CPUE series (annual indices since 1991)	2 – Medium or mixed Quality: does not have a constant q
Changes to Model Structure and Assumptions	- LIN 6B catch was included in the stock assessment - Data from Statistical Area 032 were removed - Free survey qs were used instead of nuisance qs, and some changes to catchability priors were made - The longline CPUE series was not used in the base case - Model year started 1 January rather than 1 September	
Major Sources of Uncertainty	- B_0 is uncertain due to a lack of contrast in abundance indices. - The degree of mixing between LIN 6B and LIN 5&6.	
Qualifying Comments		
The current assessment assumes that LIN 5 and LIN 6 (including the Bounty Platform LIN 6B) are a single biological stock.		

Fishery Interactions
Ling are often taken as bycatch in hoki target trawl fisheries in this region. The main bycatch species of hoki-hake-ling-silver warehou-white warehou target trawl fisheries are rattails, javelin fish, and spiny dogfish. Additional information can be found in the Environmental and Ecosystem Considerations section of the hoki chapter of the plenary report. Model-based analysis of observer and effort data shows that, in the target longline fisheries for ling across all stocks, the main bycatch species (those comprising over 1% of the observed catch) are: spiny dogfish, ribaldo, skates (smooth and rough), black cod, sea perch, pale ghost shark, red cod, and shovelnose dogfish. Incidental captures are reported for protected seabirds associated with the longline fishery and seabirds and fur seals associated with the hoki trawl fishery. A single basking shark capture was reported for LIN 5 in 2019–20.

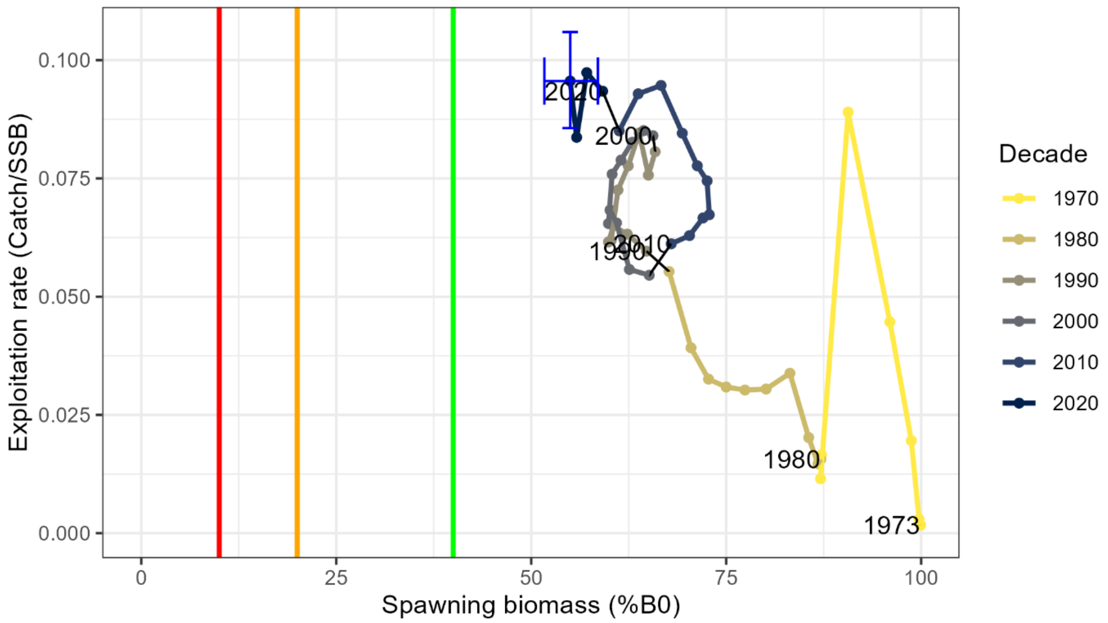
- **West coast South Island (LIN 7WC)**

Stock Status		
Most Recent Assessment Plenary Publication Year	2023	
Intrinsic Productivity Level	Low	
Catch in most recent year of assessment	Year: 2022 (model year is calendar year)	Catch: 2904 t
Assessment Runs Presented	Base case	
Reference Points	Target: 40% B_0 Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: $U_{40\%B0}$	
Status in relation to Target	B_{2023} was estimated to be about 55% B_0. Very Likely (> 90%) to be at or above the target	
Status in relation to Limits	B_{2023} is Very Unlikely (< 10%) to be below the Soft Limit and Exceptionally Unlikely (< 1%) to be below the Hard Limit	
Status in relation to Overfishing	Overfishing is Unlikely (< 40%) to be occurring	

Historical Stock Status Trajectory and Current Status



Trajectory over time of relative spawning biomass (with interquartile range in dark grey and 95% credible intervals in light grey) for the base case model for the WCSI ling stock from the start of the assessment period in 1972 to the most recent assessment in 2023 (vertical blue line) and projected to 2028 with future catches as the average of the catch from 2020–2023 (3269 t) and resampling all year class strengths. Years on the x-axis are calendar year. Biomass estimates are based on MCMC results. The red horizontal line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and green line is the %B_0 target (40% B_0).



Trajectory over time of exploitation rate (*U*) and spawning biomass (% B_0), for the LIN 7 base model from the start of the assessment period in 1972 to 2023 (in blue). The red vertical line at 10% B_0 represents the hard limit, the orange line at 20% B_0 is the soft limit, and the green line is the % B_0 target (40% B_0). Biomass and exploitation rate estimates are medians from MCMC results. The blue cross represents the limits of the 95% confidence intervals of estimated the ratio of the *SSB* to B_0 and exploitation rate in 2023.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Biomass is estimated to have slowly declined since 2012.
Recent Trend in Fishing Intensity or Proxy	Exploitation rates have shown no trend since the mid-1990s for trawl and have increased for bottom longline from 2020.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	Stock status is declining but Very Likely (> 90%) to remain above the target over the next 5 years at the current catch levels.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	At current catch levels: Soft Limit: Very Unlikely (< 10%) Hard Limit: Exceptionally Unlikely (< 1%)
Probability of Current Catch or TACC causing Overfishing to continue or to commence	At current catch levels: Unlikely (<40%)

Assessment Methodology and Evaluation		
Assessment Type	Level 1 - Full Quantitative Stock Assessment	
Assessment Method	Age-structured CASAL model with Bayesian estimation of posterior distributions	
Assessment Dates	Latest assessment Plenary publication year: 2023	Next assessment: 2026
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Catch history - Abundance index from WCSI trawl surveys - Proportions at age data from the commercial fisheries and trawl surveys - Commercial trawl hoki-hake-ling target fishery CPUE - Commercial longline fishery CPUE - Estimates of fixed biological parameters	1 – High Quality 1 – High Quality 1 – High Quality 1 – High Quality 1 – High Quality 1 – High Quality
Data not used (rank)	- *Kaharoa* trawl survey abundance index	3– Low Quality: inadequate spatial coverage of the stock distribution
Changes to Model Structure and Assumptions	-The annual cycle was revised to have a single fishery time step and an age increment time step -Model structure changed to be a sexed model with unsexed age frequency observations and plus group implemented -Immature partition removed -Selectivities assumed with uniform priors instead of informed priors -Catches from Statistical Area 032 now included in the model -Catch history revised	
Major Sources of Uncertainty	- Age data do not track cohorts well due to variable age frequencies between years.	

Qualifying Comments
-

Fishery Interactions
Ling are often taken as a bycatch in hoki target trawl fisheries in this region. The main bycatch species of hoki-hake-ling-silver warehou-white warehou target trawl fisheries are rattails, javelinfish, and spiny dogfish. Additional information can be found in the Environmental and Ecosystem Considerations section of the hoki chapter of the plenary report.

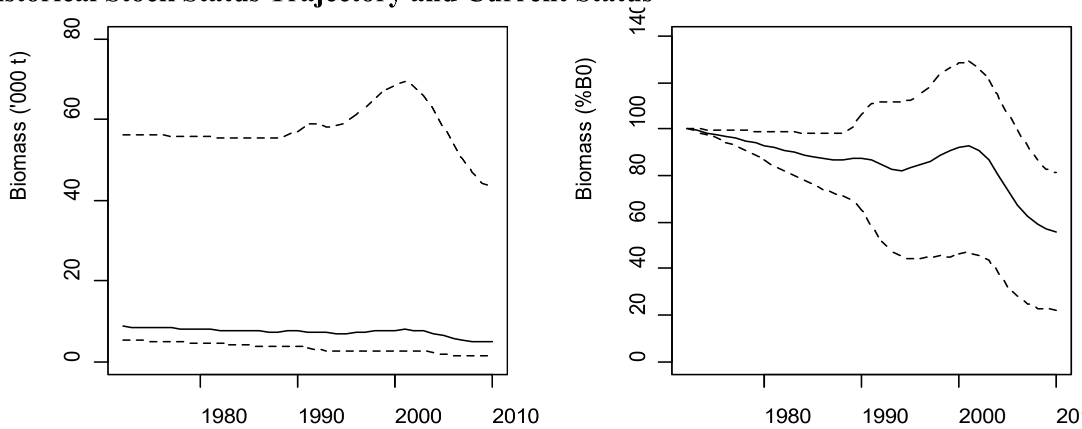
Model-based analysis of observer and effort data shows that, in the target longline fisheries for ling across all stocks, the main bycatch species (those comprising over 1% of the observed catch) are: spiny dogfish, ribaldo, skates (smooth and rough), black cod, sea perch, pale ghost shark, red cod, and shovelnose dogfish.

Incidental captures are reported for protected seabirds associated with the longline fishery and seabirds and fur seals associated with the hoki trawl fishery.

- **Cook Strait (LIN 7CK) (LIN 2 [Statistical Area 016] & part of LIN 7)**

Stock Status		
Most Recent Assessment Plenary Publication Year	2010 (an assessment in 2013 was rejected) - now considered out of date	
Intrinsic Productivity Level	Low	
Catch in most recent year of assessment	Year: 2008–09	Catch: 147 t
Assessment Runs Presented	Base case	
Reference Points	Target: 40% B_0 Soft Limit: 20% B_0 Hard Limit: 10% B_0 Overfishing threshold: F corresponding to 40% B_0	
Status in relation to Target	B_{2010} was estimated to be 54% B_0; Likely (> 60%) to be at or above the target	
Status in relation to Limits	B_{2010} is Exceptionally Unlikely (< 1%) to be below the Soft Limit and Exceptionally Unlikely (< 1%) to be below the Hard Limit	
Status in relation to Overfishing	Overfishing is Very Unlikely (< 10%) to be occurring	

Historical Stock Status Trajectory and Current Status



Trajectory over time of spawning biomass (absolute, and % B_0, with 95% credible intervals shown as broken lines) for the Cook Strait ling stock from the start of the assessment period in 1972 to the most recent assessment in 2010. Years on the x-axis are fishing year with '1990' representing the 1989–90 fishing year. Biomass estimates are based on MCMC results.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	Biomass is estimated to have been declining since 1999, but is unlikely to have dropped below 30% B_0.
Recent Trend in Fishing Intensity or Proxy	Overall fishing pressure is estimated to have been relatively constant since the mid-1990s, but has trended down for trawl and up for longline.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	Recruitment from 1995 to 2006 was low relative to the long-term average for this stock. There are no estimates for the more recent year classes.

Projections and Prognosis	
Stock Projections or Prognosis	Stock status is predicted to improve slightly over the next 5 years at a catch level equivalent to that since 2006 (i.e., 220 t per year), or remain relatively constant at a catch equivalent to the mean since 1990 (i.e., 420 t per year).
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Note that there is no specific TACC for the Cook Strait stock. Soft Limit: Catch 220 t, Very Unlikely (< 10%); Catch 420 t, Very Unlikely (< 10%) Hard Limit: Catch 220 t, Exceptionally Unlikely (< 1%); Catch 420 t, Very Unlikely (< 10%)
Probability of Current Catch or TACC causing Overfishing to continue or to commence	Very Unlikely (< 10%)

Assessment Methodology and Evaluation		
Assessment Type	Level 1 - Full Quantitative Stock Assessment	
Assessment Method	Age-structured CASAL model with Bayesian estimation of posterior distributions	
Assessment Dates	Latest assessment Plenary publication year: 2010	Next assessment: Unknown
Overall assessment quality rank	3 – Low Quality: The only accepted relative abundance series (trawl fishery CPUE) was not well fitted. A subsequent assessment in 2013 was rejected by the Working Group.	
Main data inputs (rank)	- Proportions-at-age data from the commercial trawl fishery	1 – High Quality
	- Proportions-at-age data from the commercial longline fishery	3 – Low Quality: not representative of entire fishery
	- Trawl fishery CPUE series (annual indices since 1994)	2 – Medium or Mixed Quality: not well-fitted by model
	- Estimates of biological parameters	1 – High Quality
Data not used (rank)	- Longline fishery CPUE	3 – Low quality: does not track stock biomass
Changes to Model Structure and Assumptions	- No significant changes since the previous assessment	
Major Sources of Uncertainty	- There are no fishery-independent indices of relative abundance. It is not known if the trawl CPUE series is a reliable abundance index. - The stock structure of Cook Strait ling is uncertain. While ling in this area are almost certainly biologically distinct from the WCSI and Chatham Rise stocks, their association with ling off the lower east coast of the North Island is unknown. - It is possible that trawl selectivity has varied over time, resulting in poor fits to some age classes in some years. - Longline fishery selectivity is based on only two years of catch-at-age data from the auto longline fishery. No information is available from the 'hand-baiting' longline fishery. - The model is moderately sensitive to small changes in *M*, and *M* is poorly estimated.	

Qualifying Comments
There is no separate TACC for this stock; it comprises parts of Fishstocks LIN 7 and LIN 2.

Fishery Interactions
Ling are often taken as a bycatch in hoki target trawl fisheries in this region. The main bycatch species of hoki-hake-ling-silver warehou-white warehou target trawl fisheries are rattails, javelinfish, and spiny dogfish. Additional information can be found in the Environmental and Ecosystem Considerations section of the hoki chapter of the plenary report. Model-based analysis of observer and effort data shows that, in the target longline fisheries for ling across all stocks, the main bycatch species (those comprising over 1% of the observed catch) are: spiny dogfish, ribaldo, skates (smooth and rough), black cod, sea perch, pale ghost shark, red cod, and shovelnose dogfish. Incidental captures are reported for protected seabirds associated with the longline fishery and seabirds and fur seals associated with the hoki trawl fishery.

7. FOR FURTHER INFORMATION

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