BLUE COD (BCO 4)

(Parapercis colias)
Rāwaru

1. FISHERY SUMMARY

Allowances, TACC, and TAC for BCO 4 are shown in Table 1.

Table 1: **Recreational and Customary non-commercial allowances, other mortality, TACCs, and TACs (t) for BCO 3.**

Fishstock	Recreational allowance	Customary non-commercial allowance	Other sources of mortality	TACC	TAC
BCO 4	20	10	40	759	829

1.1 Commercial fisheries

Table 2 and Table 3 provide a summary of the reported commercial catches, TACCs, and TACs for BCO 4. Landings and TACCs are plotted in Figure 1.

Table 2: Reported landings (t) of blue cod from BCO 4 from 1931 to 1982.

Year	BCO 4	Year	BCO 4	Year	BCO 4	Year	BCO 4
1931–32	148	1944	216	1957	1185	1970	39
1932–33	111	1945	102	1958	892	1971	36
1933–34	1 055	1946	175	1959	1158	1972	3
1934–35	1 306	1947	278	1960	903	1973	4
1935–36	1 197	1948	623	1961	871	1974	1
1936–37	755	1949	390	1962	550	1975	2
1937–38	793	1950	485	1963	633	1976	17
1938–39	686	1951	494	1964	495	1977	46
1939–40	715	1952	543	1965	742	1978	14
1940–41	320	1953	682	1966	13	1979	13
1941–42	189	1954	603	1967	0	1980	1
1942–43	204	1955	355	1968	0	1981	40
1943–44	212	1956	636	1969	8	1982	13

The TACC for BCO 4 increased from 600 t to 659 t in a number of steps between 1986 and 2001 and has been maintained at that level since this time (Table 3).

1.2 Recreational fisheries

Blue cod are the most important recreational finfish in Marlborough, Otago, Canterbury, Southland, and the Chatham Islands. Blue cod are taken predominantly by line fishing, but also by longlining, set netting, potting, and spearfishing. The current allowances within the TAC for BCO 3 are shown in Table 1.

1.2.1 Management controls

The main methods used to manage recreational harvests of blue cod are minimum legal size (MLS) limits, method restrictions, and daily bag limits. Daily bag limits are specified as either blue cod specific (DL) or a combined species limit (CDL). The main management controls have changed over time (Table 5).

Table 3: Reported landings (t) of blue cod from BCO 4 from 1983 to present and actual TACCs (t) from 1986–87 to present. QMS data from 1986 to present. FSU data cover 1983–1986.

Fishstock FMA (s)	BCO 4 4		Fishstock FMA (s)	BCO 4 4	
	Landings	TACC		Landings	TACC
1983	192	–	2004–05	731	759
1984	273	–	2005–06	580	759
1985	274	–	2006–07	747	759
1986	337	–	2007–08	779	759
1986–87	417	600	2008–09	787	759
1987–88	204	647	2009–10	691	759
1988–89	279	647	2010–11	781	759
1989–90	358	749	2011–12	753	759
1990–91	409	757	2012–13	739	759
1991–92	378	757	2013–14	720	759
1992–93	445	757	2014–15	796	759
1993–94	474	757	2015–16	758	759
1994–95	565	757	2016–17	741	759
1995–96	464	757	2017–18	752	759
1996–97	423	757	2018–19	744	759
1997–98	575	757	2019–20	732	759
1998–99	499	757	2020–21	703	759
1999–00	490	757	2021–22	720	759
2000–01	627	757	2022–23	783	759
2001–02	648	759	2023–24	776	759
2002–03	724	759			
2003–04	710	759			

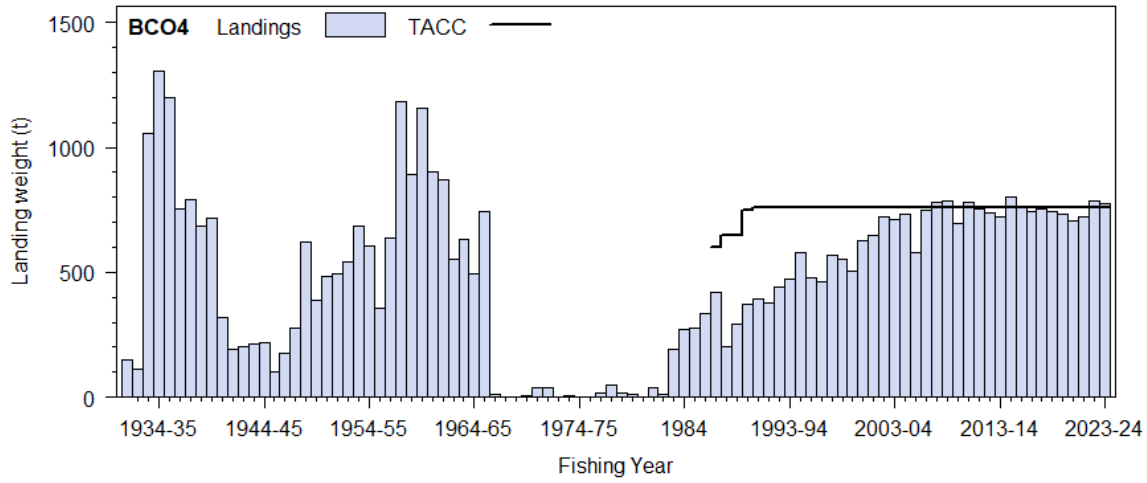


Figure 1: Reported commercial landings and TACC for BCO 4 (South East Chatham Rise).

1.2.2 Estimates of recreational harvest

A background to the estimation on recreational harvest of blue cod is provided in the Introduction – Blue cod chapter. The only recreational harvest available for BCO 4 is 14.88 t (14 056 fish) in 2008-09 (Davey et al 2011). The 1996, 1999–2000, and 2000–01 national marine recreational fishing surveys and the 2011–12, 2017–18 and 2022–23 National Panel Surveys did not include the Chatham Islands.

1.3 Customary non-commercial fisheries

No quantitative data on historical or current blue cod customary non-commercial catch are available. However, bones found in middens show that blue cod was a significant species in the traditional Māori take of pre-European times.

1.4 Illegal catch

No quantitative data on the levels of illegal blue cod catch are available.

Table 4: Minimum legal size (MLS in cm), blue cod specific daily bag limit (DL), and combined species daily bag limit (CDL) for BCO 4 from 1986 to present.

Fishstock Area	BCO 4 South East (Chatham Is.)	
	MLS	DL
1986	30	30
1993	30	30
1994	30	30
2001	30	30
2008	30	30
2014	30	30
2017	30	30
2020	33	15

1.5 Other sources of mortality

For further information on other sources of mortality for blue cod refer to the Introduction – Blue cod chapter.

2. BIOLOGY

For further information on blue cod biology refer to the Introduction – Blue cod chapter. No BCO 4 specific studies have been undertaken. Natural mortality *M* is assumed to be 0.17 for all BCO stocks (Doonan 2020).

3. STOCKS AND AREAS

The FMAs are used as a basis for Fishstocks, except FMAs 5 and 6, and FMAs 1 and 9, which have been combined. The choice of these boundaries was based on a general review of the distribution and relative abundance of blue cod within the fishery.

There are no data that would alter the current stock boundaries. However, tagging experiments suggest that blue cod populations may be geographically isolated from each other, and there may be several distinct sub-populations within each management area (particularly those occurring in sounds and inlets).

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

4.1.1 CPUE analyses

The cod potting fishery in BCO 4 is entirely targeted on blue cod and reported on the daily CELR form. The spatial resolution of the catch effort data is therefore defined by general statistical area and by day (or part of a day). CPUE was standardised for the cod pot fishery operating in Statistical Areas 049 to 052 up to 2017–18 (Holmes et al 2022). The analysis was based on a Weibull model of positive allocated landed catches from a core fleet of vessels. This methodology follows that used in the previous CPUE standardisation (Bentley & Kendrick in prep). Detailed examination of model residuals and the distribution of catch per vessel day suggested that the Weibull distribution provided a better fit to the data than the lognormal distribution and other alternative distributions. The previous analysis found that there appears to have been a change in the underlying frequency distribution of catch categories in the late 1990s, which may be a result of several factors, including changes in the fleet composition, fishing methods, and/or reporting practices. Consequently, the indices for the fishing years up to, and including, 1996–97 are considered to be less reliable and may not be comparable with the indices from the latter part of the series. The working group considered that the current CPUE standardisation should only include analysis of the fishing years from 1997–98.

Overall, the annual indices from the standardisation model have fluctuated without trend since the late 1990s (Figure 2).

Figure 2: Standardised CPUE index for BCO 4 based on records of positive BCO catch by core vessels, 1997–98 to 2017–18 (Holmes et al 2022).

4.2 Future research considerations

Future research considerations relevant to all BCO stocks are provided in the Introduction – Blue cod chapter.

5. STATUS OF THE STOCKS

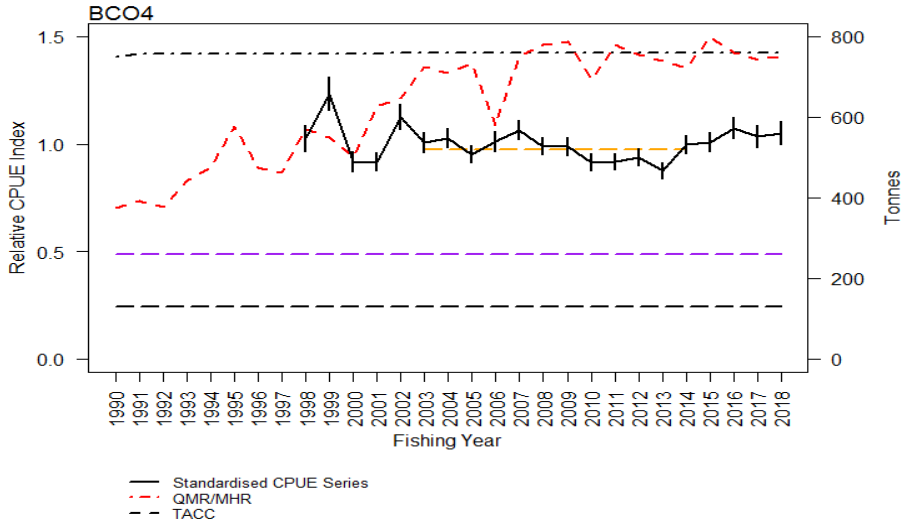
- **BCO 4**

Stock Structure Assumptions

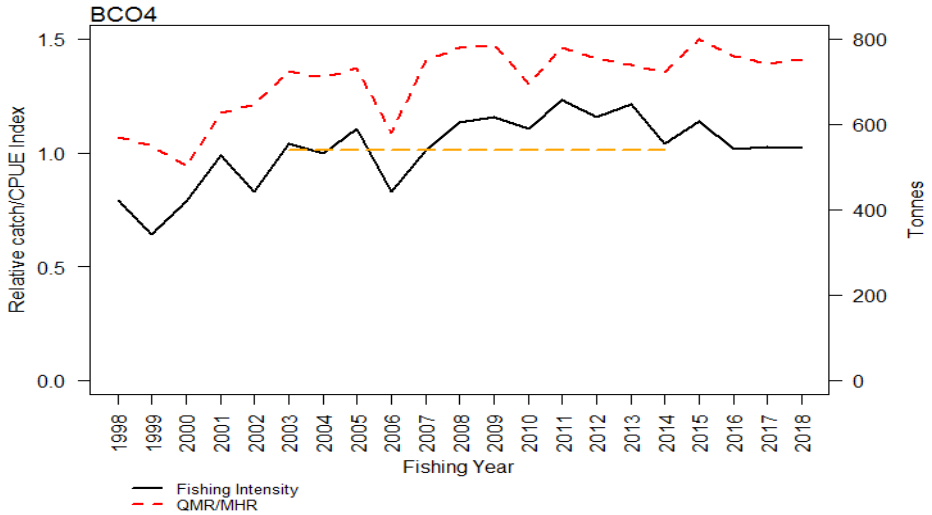
For the purposes of this summary BCO 4 is considered to be a single management unit.

Stock Status		
Most Recent Assessment Plenary Publication Year	2019	
Intrinsic Productivity Level	Low	
Catch in most recent year of assessment	Year: 2017–18	Catch: 752 t
Assessment Runs Presented	CPUE index based on landed catch	
Reference Points	Interim Target: B_{MSY} proxy based on mean CPUE for the period 2002–03 to 2013–14 (a period with high yield when both catch and CPUE were stable) Soft Limit: 50% B_{MSY} proxy Hard Limit: 25% B_{MSY} proxy Overfishing threshold: F_{MSY} proxy based on mean relative exploitation rate for the period 2002–03 to 2013–14	
Status in relation to Target	Likely (> 60%) to be at or above the target	
Status in relation to Limits	Soft Limit: Very Unlikely (< 10%) to be below Hard Limit: Very Unlikely (< 10%) to be below	
Status in relation to Overfishing	About as Likely as Not (40–60 %) to be occurring	

Historical Stock Status Trajectory and Current Status



BCO 4 standardised CPUE series for 1998–2018. Also plotted are the QMR/MHR landings and the BCO 4 TACC. The orange line represents the B_{MSY} proxy of mean CPUE from 2003 to 2014. The purple line is the Soft Limit=0.5*[B_{MSY} proxy] and the grey line is the Hard Limit=0.25*[B_{MSY} proxy].



BCO 4 fishing intensity (=catch/CPUE) plot based on the standardised CPUE series from 1997–98 to 2017–18 and the QMR/MHR landings. Horizontal orange line represents the mean 2003–2014 fishing intensity associated with the interim B_{MSY} proxy.

Fishery and Stock Trends	
Recent Trend in Biomass or Proxy	CPUE has fluctuated without trend since 1997–98.
Recent Trend in Fishing Intensity or Proxy	Relative exploitation rate has declined since 2010–11 and in 2017–18 was near the overfishing threshold.
Other Abundance Indices	-
Trends in Other Relevant Indicators or Variables	-

Projections and Prognosis	
Stock Projections or Prognosis	The current catch and TACC are Unlikely (< 40%) to cause the stock to decline.
Probability of Current Catch or TACC causing Biomass to remain below or to decline below Limits	Soft Limit: Very Unlikely (< 10%) Hard Limit: Very Unlikely (< 10%)

Probability of Current Catch or TACC causing overfishing to continue or to commence	-

Assessment Methodology and Evaluation		
Assessment Type	Level 2 - Partial Quantitative Stock Assessment	
Assessment Method	Fishery characterisation and standardised CPUE analysis	
Assessment Dates	Latest assessment Plenary publication year: 2019	Next assessment: Unknown
Overall assessment quality rank	1 – High Quality	
Main data inputs (rank)	- Catch and Effort 1997–98 to 2017–18	1 – High Quality
Data not used (rank)	- Catch and Effort 1989–90 to 1996–97	2 – Moderate or Mixed Quality: compromised by changes in fleet composition and reporting practices
Changes to Model Structure and Assumptions	-	
Major Sources of Uncertainty	-	

Qualifying Comments
-

Fishery Interactions
The catch is almost entirely taken by target cod potting and there is little interaction with other species.

6. FOR FURTHER INFORMATION

Bentley, N; Kendrick, T H (in prep) Fishery characterisation and Catch-Per-Unit-Effort indices for blue cod in BCO 4; 1989–90 to 2013–14. (Draft New Zealand Fisheries Assessment Report held by Fisheries New Zealand.)

Cranfield, H J; Carbines, G; Michael, K P; Dunn, A; Stotter, D R; Smith, D L (2001) Promising signs of regeneration of blue cod and oyster habitat changed by dredging in Foveaux Strait, southern New Zealand. *New Zealand Journal of Marine and Freshwater Research 35:* 897–908.

Davey, N K; Hartill, B; Carter, M (2011) Characterisation of marine non–commercial fishing around the Chatham Islands during the 2008–09 fishing year, including catch estimates for selected species. *New Zealand Fisheries Assessment Report 2011/49.* 72 p.

Doonan, I (2020) Stock assessment of blue cod (*Parapercis colias*) in BCO 5 using data to 2019. *New Zealand Fisheries Assessment Report 2020/14.* 48 p.

Holmes, S J; Large, K; Bian, R; Datta, S; Beentjes, M (2022b) Characterisation of the blue cod (*Parapercis colias*) commercial fishery in BCO 4 and an update of the standardised CPUE to the 2017–18 fishing year. *New Zealand Fisheries Assessment Report 2022/26*. 35 p.