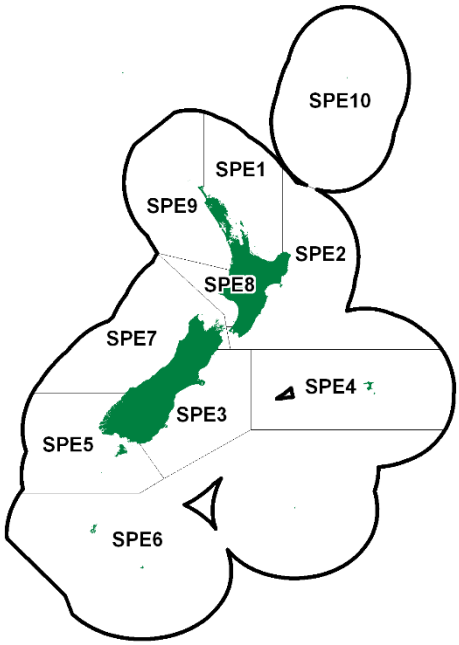
SEA PERCH (SPE)

(*Helicolenus percoides*)
Pohuiakaroa



1. FISHERY SUMMARY

Sea perch was introduced into the QMS from 1 October 1998. Current TACs, TACCs and allowances for non-commercial fishers are displayed in Table 1.

Table 1: Recreational and customary non-commercial allowances and Current TACCs, by Fishstock, for sea perch.

	Recreational	Customary non-	Other sources	TACC	TAC
SPE 1	1	1	3	53	58
SPE 2	9	5	0	79	93
SPE 3	11	11	0	1 000	1 022
SPE 4	0	0	46	910	956
SPE 5	1	1	0	36	38
SPE 6	0	0	0	9	9
SPE 7	8	8	0	82	98
SPE 8	4	2	0	15	21
SPE 9	1	1	0	6	8
SPE 10	0	0	0	0	0

1.1 Commercial fisheries

From 1 October 2000 the TACC for SPE 3 was increased from 738 t to 1000 t under the Adaptive Management Programme (AMP). The TACC for SPE 4 was increased from 533 t to 910 t from 1 October 2004 under the low knowledge bycatch framework. The TACC for SPE 1 was increased from 18 t to 33 t from 1 October 2006, and to 53 t from October 2013. TACCs in SPE 2, 5 & 6, 7, 8, and 9 have remained unchanged since their introduction in 1998.

In SPE 1 landings were above the TACC for a number of years prior to 2006 and 2013; the TACC was consequently increased to the average of the previous 7 years plus an additional 10%. In SPE 2 landings were above the TACC for a number of years from 1999-00 to 2010-11 but landings have since decreased, averaging about 50 t annually from since 2012. In SPE 3 landings have been well below the TACC since it was increased in 2000, and in SPE 4 landings gave been below the TACC since it was increased in 2004. In SPE 7 landings have been above the TACC in most years since the introduction of the TACC, but only 47 t were recorded in 2018-19, and 57 t in 2019–20. The historical landings and TACC values for the four major SPE stocks are depicted in Figure 1.

Very small quantities of sea perch have been landed for local sale for many years, but were largely unreported. Catches have been made by foreign vessels since the 1960s, but were also not recorded (they were most probably included within a "mixed" or "other finfish" category), and most were probably discarded. Despite poor reporting rates, estimated landings are thought to have increased from 400 t in the early 1980s to approximately 1300 t in recent years (Table 3); an unknown quantity has been discarded over this period.

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

Year	SPE 1	SPE 2	SPE 3	SPE 4	Year	SPE 1	SPE 2	SPE 3	SPE 4
1931	0	0	0	0	1957	0	0	1	0
1932	0	0	0	0	1958	0	0	1	0
1933	0	0	0	0	1959	0	0	1	0
1934	0	0	0	0	1960	0	0	1	0
1935	0	0	0	0	1961	0	0	1	0
1936	0	0	0	0	1962	0	0	0	0
1937	0	0	0	0	1963	0	0	0	0
1938	0	0	0	0	1964	0	0	1	0
1939	0	0	0	0	1965	0	0	2	0
1940	0	0	0	0	1966	0	0	1	0
1941	0	0	0	0	1967	0	0	1	0
1942	0	0	0	0	1968	1	0	1	0
1943	0	0	0	0	1969	1	0	3	0
1944	0	0	4	0	1970	1	2	7	0
1945	0	0	2	0	1971	6	0	7	0
1946	0	0	2	0	1972	1	1	2	0
1947	0	0	2	0	1973	0	0	0	0
1948	0	0	1	0	1974	0	0	0	0
1949	0	0	2	0	1975	0	0	0	0
1950	0	0	1	0	1976	0	0	0	0
1951	0	0	5	0	1977	0	0	0	0
1952	0	0	2	0	1978	0	0	2	11
1953	0	0	1	0	1979	0	18	92	248
1954	0	0	0	0	1980	0	1	8	100
1955	0	0	1	0	1981	6	0	70	253
1956	0	0	0	0	1982	22	1	176	164
1931	0	0	0	0	1957	0	0	0	0
1932	0	0	0	0	1958	0	0	0	0
1933	0	0	0	0	1959	0	0	0	0
1934	0	0	0	0	1960	0	0	0	0
1935	0	0	0	0	1961	0	0	0	0
1936	0	0	0	0	1962	0	0	0	0
1937	0	0	0	0	1963	0	0	0	0
1938	0	0	0	0	1964	0	0	0	0
1939	0	0	0	0	1965	0	0	0	0
1940	0	0	0	0	1966	0	0	0	0
1941	0	0	0	0	1967	0	0	0	0
1942	0	0	0	0	1968	0	0	0	0
1943	0	0	0	0	1969	0	1	0	0
1944	29	0	0	0	1970	0	13	0	0
1945	0	0	0	0	1971	0	0	0	0
1946	0	0	0	0	1972	0	0	0	0
1947	0	0	0	0	1973	0	0	0	0
1948	0	0	0	0	1974	0	0	0	0
1949	2	0	0	0	1975	0	0	0	0
1950	2	0	0	0	1976	0	0	0	0
1951	1	0	0	0	1977	0	0	0	0
1952	0	0	0	0	1978	13	11	0	0
1953	0	0	0	0	1979	54	14	1	3
1954	0	0	0	0	1980	40	38	0	0
1955	0	0	0	0	1981	32	15	0	1
1956	0	0	0	0	1982	31	17	1	1

Notes:

1. The 1931–1943 years are April–March but from 1944 onwards are calendar years.
2. Data up to 1985 are from fishing returns: Data from 1986 to 1990 are from Quota Management Reports.
3. Data for the period 1931 to 1982 are based on reported landings by harbour and are likely to be underestimated as a result of under-reporting and discarding practices. Data includes both foreign and domestic landings. Data were aggregated to FMA using methods and assumptions described by Francis & Paul (2013).

About 75% of New Zealand's landed sea perch is taken as a bycatch in trawl fisheries off the east coast of the South Island, including the Chatham Rise. A small catch is made in some central and southern line fisheries, e.g., for groper. Recent reported landings of sea perch by QMAs are shown in Table 3. The most important QMAs in most years are QMA 3 (east coast South Island) and QMA 4 (Chatham Rise).

The catch from SPE 3 is spread throughout the fishing year. There is a variable seasonal distribution between years. A higher proportion of the catch is taken during April, May and September and catches are lower from December to February, and in July. Most of the SPE 3 catch is taken as a bycatch from the

red cod (about 30%) and hoki fisheries (15%) and from the sea perch target fishery (21%). The remainder is taken as a bycatch from the target barracouta, flatfish, ling, squid and tarakihi fisheries. Virtually all the SPE 3 catch is taken by bottom trawling, with a small proportion taken by bottom longline. SPE 3 catch rates are highest between 150–400 m depth.

Table 3: Reported landings (t) of sea perch by Fishstock and fishing year, 1983–84 to present. The data in this table have been updated from that published in previous Plenary Reports by using the data up to 1996–97 in table 38 on p. 278 of the "Review of Sustainability Measures and Other Management Controls for the 1998–99 fishing year - Final Advice Paper" dated 6 August 1998. [Continued on next page].

Fishstock	SPE 1		SPE 2		SPE 3		SPE 4		SPE 5 & 6	
FMA	1		2		3		4		5 &6	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1983–84	14	-	2	-	150	-	58	-	36	-
1984–85	10	-	2	-	290	-	70	-	26	-
1985–86	14	-	2	-	213	-	218	-	28	-
1986–87	19	-	2	-	507	-	71	-	19	-
1987–88	20	-	1	-	544	-	63	-	18	-
1988–89	14	-	1	-	262*	-	36	-	18	-
1989–90	2	-	6	-	287*	-	177	-	9	-
1990–91	5	-	9	-	559*	-	68	-	33	-
1991–92	12	-	8	-	791*	-	222	-	36	-
1992–93	15	-	15	-	783*	-	317	-	55	-
1993–94	16	-	26	-	690*	-	223	-	28	-
1994–95	25	-	66	-	626*	-	415	-	18	-
1995–96	23	-	50	-	1 047*	-	404	-	62	-
1996–97	19	-	77	-	655*	-	435	-	45	-
1997–98	24	-	54	-	913	-	656	-	29	-
1998–99	21	18	79	79	903	738	872	533	27	45
1999–00	27	18	82	79	862	738	821	533	28	45
2000–01	25	18	81	79	798	738	840	533	19	45
2001–02	41	18	89	79	720	1 000	910	533	22	45
2002–03	19	18	78	79	696	1 000	1 685	533	25	45
2003–04	30	18	80	79	440	1 000	1 287	533	28	45
2004–05	27	18	104	79	372	1 000	894	910	24	45
2005–06	40	18	73	79	436	1 000	502	910	24	45
2006–07	30	33	98	79	519	1 000	591	910	31	45
2007–08	38	33	91	79	422	1 000	568	910	20	45
2008–09	27	33	46	79	328	1 000	338	910	13	45
2009–10	47	33	53	79	428	1 000	345	910	21	45
2010–11	53	33	83	79	644	1 000	572	910	24	45
2011–12	50	33	55	79	349	1 000	555	910	17	45
2012–13	40	33	43	79	495	1 000	492	910	27	45
2013–14	47	53	69	79	500	1 000	332	910	22	45
2014–15	32	53	42	79	734	1 000	475	910	15	45
2015–16	38	53	44	79	774	1 000	436	910	37	45
2016–17	44	53	49	79	589	1 000	424	910	24	45
2017–18	52	53	54	79	625	1 000	490	910	14	45
2018–19	53	53	46	79	555	1 000	432	910	23	45
2019–20	42	53	33	79	497	1 000	442	910	20	45

Fishstock	SPE 7		SPE 8		SPE 9		SPE 10			
FMA	7		8		9		10		Total	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1983–84	16	-	2	-	55	-	0	-	333	-
1984–85	14	-	1	-	2	-	0	-	415	-
1985–86	12	-	2	-	4	-	0	-	493	-
1986–87	11	-	3	-	1	-	0	-	633	-
1987–88	8	-	6	-	0	-	0	-	660	-
1988–89	5	-	2	-	1	-	0	-	339	-
1989–90	14	-	1	-	0	-	0	-	496	-
1990–91	28	-	1	-	0	-	0	-	703	-
1991–92	20	-	2	-	0	-	0	-	1 091	-
1992–93	71	-	18	-	0	-	2	-	1 276	-
1993–94	52	-	10	-	0	-	0	-	1 045	-
1994–95	67	-	7	-	0	-	0	-	1 224	-
1995–96	78	-	7	-	1	-	0	-	1 672	-
1996–97	64	-	7	-	1	-	< 1	-	1 304	-
1997–98	118	-	5	-	7	-	< 1	-	1 807	-
1998–99	109	82	< 1	15	2	6	0	0	2 014	1 516
1999–00	80	82	2	15	5	6	0	0	1 907	1 516
2000–01	80	82	4	15	3	6	0	0	1 850	1 778
2001–02	95	82	6	15	3	6	0	0	1 886	1 778
2002–03	103	82	4	15	4	6	0	0	2 614	1 778
2003–04	95	82	6	15	3	6	0	0	1 969	1 778
2004–05	47	82	5	15	2	6	0	0	1 475	2 155
2005–06	75	82	5	15	2	6	0	0	1 157	2 155
2006–07	67	82	2	15	2	6	0	0	1 340	2 170
2007–08	103	82	2	15	2	6	0	0	1246	2 170

Table 3 [Continued]

	SPE 7 7		SPE 8 8		SPE 9 9		SPE 10 10		Total	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
2008–09	96	82	2	15	4	6	0	0	854	2 170
2009–10	117	82	4	15	3	6	0	0	1 018	2 170
2010–11	124	82	3	15	2	6	0	0	1 505	2 170
2011–12	82	82	3	15	3	6	0	0	1 115	2 170
2012–13	89	82	4	15	4	6	0	0	1 197	2 170
2013–14	100	82	4	15	5	6	0	0	1 077	2 190
2014–15	118	82	4	15	7	6	0	0	1 427	2 190
2015–16	89	82	4	15	7	6	0	0	1 428	2 190
2016–17	90	82	3	15	9	6	0	0	1 232	2 190
2017–18	118	82	4	15	11	6	0	0	1 368	2 190
2018–19	47	82	3	15	8	6	0	0	1 166	2 190
2019–20	57	82	2	15	6	6	0	0	1 097	2 190

*These numbers may contain erroneous landings data, the situation is currently under investigation and the data will be amended if an error is identified during the course of that investigation.

The trawl fisheries operating in SPE 4 catch sea perch along the northern and southern edge of the Chatham Rise between 200 and 700 m depth. The majority of the SPE 4 catch is taken as a bycatch of the hoki target fishery (about 59%), with the ling and hake fisheries accounting for around 25% and 10% of the total SPE 4 catch, respectively.

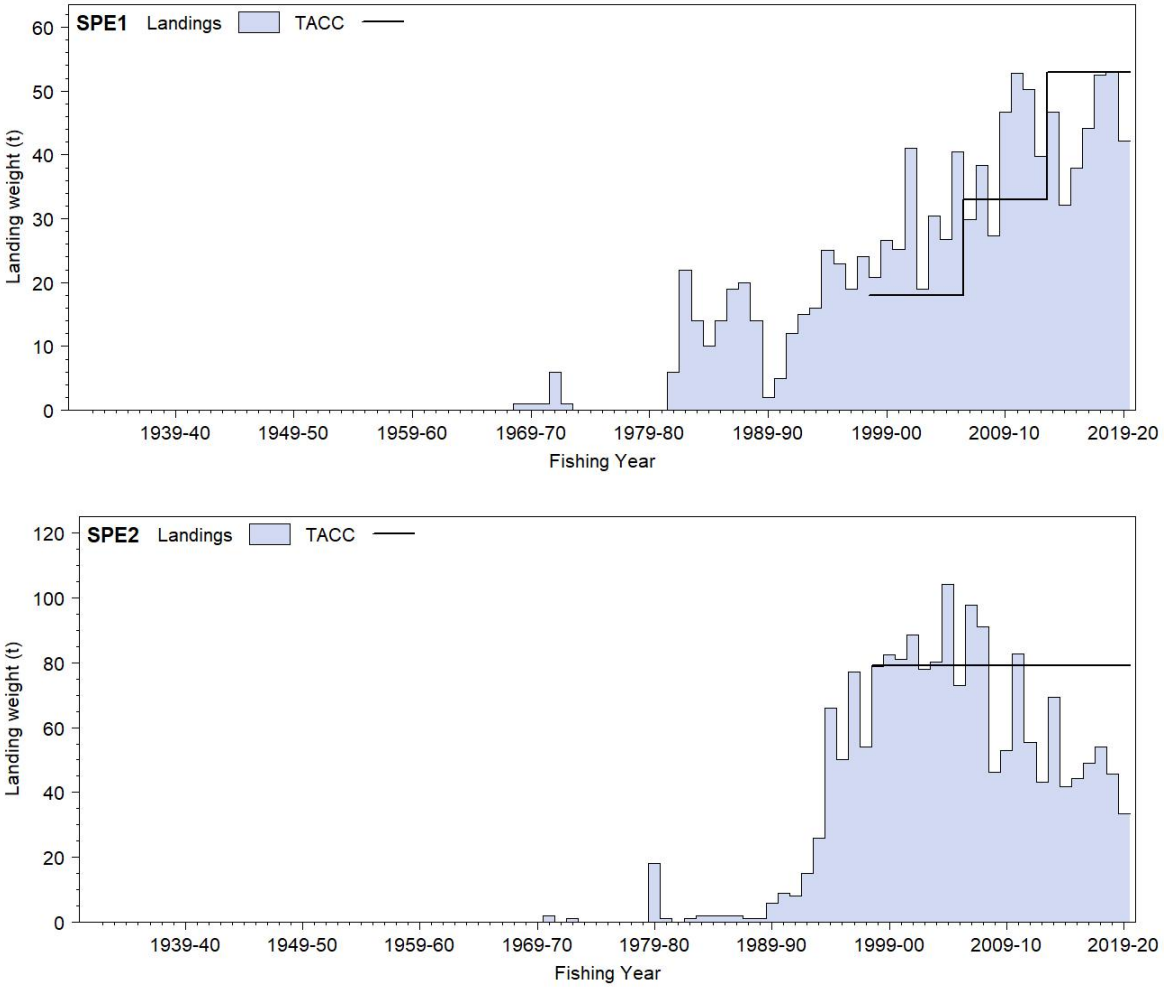


Figure 1: Reported commercial landings and TACC for the five main SPE stocks. SPE 1 (Auckland East) and SPE 2 (Central East)) [Continued on next page].

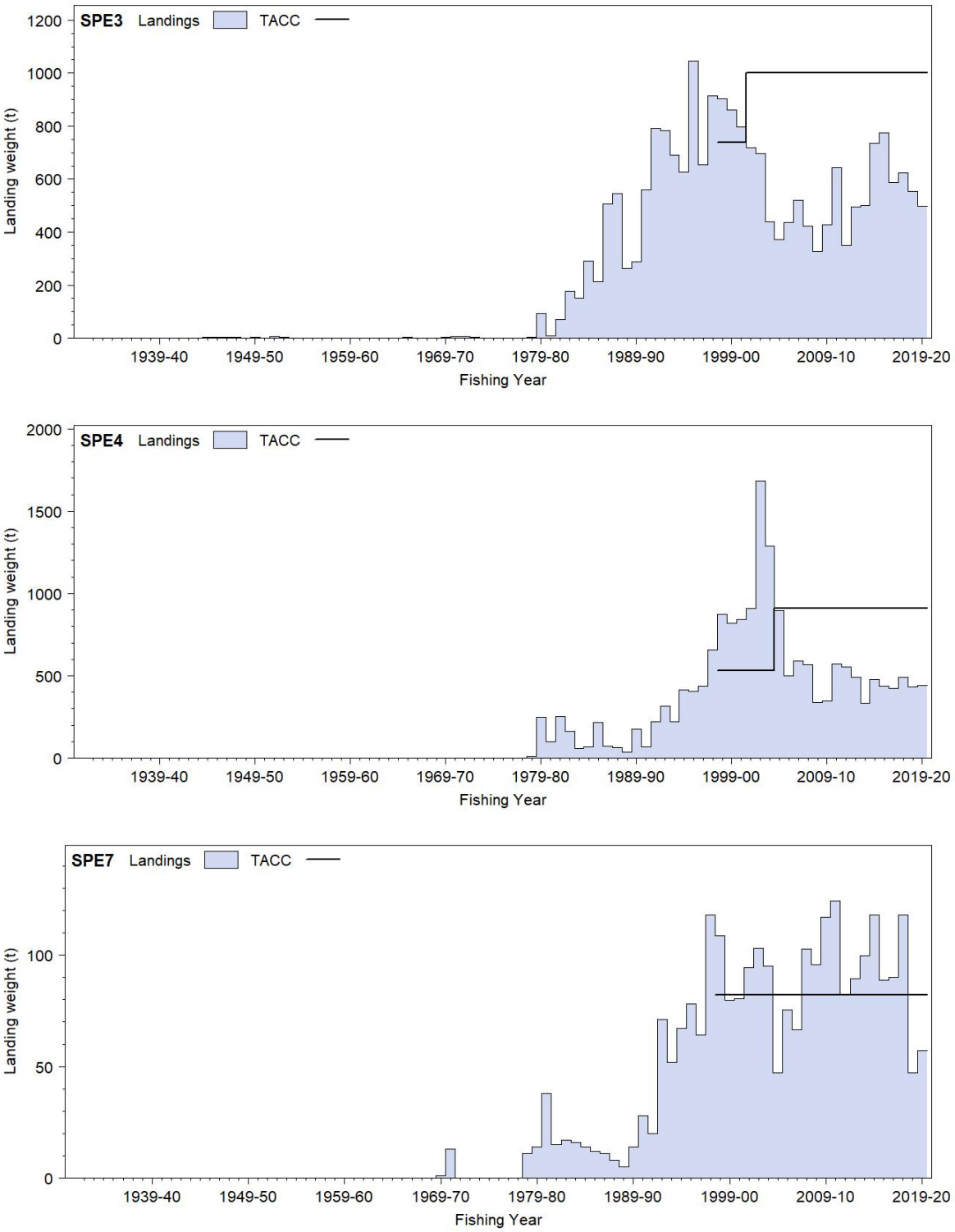


Figure 1 [Continued]: Reported commercial landings and TACC for the five main SPE stocks. SPE 3 (South East Coast), SPE 4 (South East Chatham Rise), and SPE 7 (Challenger).

1.2 Recreational fisheries

Sea perch are seldom targeted by recreational fishers, but are widely caught in reasonable numbers. Some are used for bait, and many were likely to have been discarded in the past. The quality of sea perch as an eating fish has been increasingly recognised and they are now less likely to be discarded. They are predominantly taken on rod and reel (98.6%) with a small proportion taken by longline (1%). The catch is taken predominantly from boat (93.7%) with a small proportion from land based fishers (3%). The allowances within the TAC for each Fishstock are shown in Table 1.

1.2.1 Management controls

The main method used to manage recreational harvests of sea perch are minimum legal sizes (MLS) and daily bag limits. General spatial and method restrictions also apply. A sea perch MLS for recreational fishers of 26 cm applies only in the Kaikoura Marine Area. Fishers can take up to 20 sea perch as part of their combined daily bag limit in Kaikoura Marine Area. Fishers can take up to 10 sea perch as part of their combined daily bag limit in the Fiordland Marine Area. No bag limit is currently in place in the Auckland, Central, Challenger, South-East, or Southland Fishery Management Areas.

1.2.2 Estimates of recreational harvest

There are two broad approaches to estimating recreational fisheries harvest: the use of onsite or access point methods where fishers are surveyed or counted at the point of fishing or access to their fishing activity; and, offsite methods where some form of post-event interview and/or diary are used to collect data from fishers.

Table 4: Estimated number and weight of sea perch recreational harvest by Fishstock and survey. Regional surveys were carried out in different years in the MAF Fisheries regions: South in 1991–92, Central in 1992–93, North in 1993–94 (Teirney et al 1997), and national surveys ran in 1996 (Bradford, 1998) and 1999–00 (Boyd & Reilly 2002). National panel surveys ran in 2011–12 and 2017–18 (Wynne-Jones et al 2014, 2019) using mean weights from boat ramp surveys (Hartill & Davey 2015, Davey et al 2019).

Fishstock	Survey	Number	Harvest (t)	CV%
1991–92				
SPE 3	South	110 000		25
SPE 5	South	18 000		35
SPE 7	South	16 000		-
1992–93				
SPE 2	Central	27 000		-
SPE 3	Central	< 500		-
SPE 5	Central	< 500		-
SPE 7	Central	65 000		40
SPE 8	Central	11 000		-
1993–94				
SPE 1 + 9	North	< 500		-
SPE 2	North	< 500		-
SPE 8	North	< 500		-
1996				
SPE 1 + 9	National	2000		37
SPE 2	National	23 000		-
SPE 3	National	28 000		17
SPE 5	National	3000		-
SPE 7	National	20 000		17
SPE 8	National	11 000		-
1999–00				
SPE 2	National	10 000		94
SPE 2	National	16 000		64
SPE 3	National	154 000		38
SPE 5	National	10 000		58
SPE 7	National	63 000		46
SPE 8	National	< 500		101
2011–12				
SPE 1	Panel	1 464	0.7	40
SPE 2	Panel	8 165	4.3	33
SPE 3	Panel	113 955	57.1	25
SPE 5	Panel	4 517	2.1	57
SPE 7	Panel	28 781	12.6	39
SPE 8	Panel	3 699	1.7	48
2017–18				
SPE 1	Panel	478	0.2	87
SPE 2	Panel	3 287	1.6	40
SPE 3	Panel	67 712	40.5	24
SPE 5	Panel	27 993	13.2	89
SPE 7	Panel	13 824	5.4	29
SPE 8	Panel	3 654	1.7	67

The first estimates of recreational harvest for sea perch were calculated using offsite telephone-diary surveys between 1991 and 2000 (Table 4, from Teirney et al 1997, Bradford 1998, Boyd & Reilly 2002). The harvest estimates provided by these telephone-diary surveys 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 fishing year using very similar methods to produce directly comparable results (Wynne-Jones et al 2019). Recreational catch estimates from the two national panel surveys are given in Table 4. Note that national panel survey estimates do not include recreational harvest taken under s111 general approvals.

1.3 Customary non-commercial fisheries

The customary non-commercial take has not been quantified.

1.4 Illegal catch

There is no quantitative information on illegal fishing activity or catch, and given the low commercial value of sea perch, such activity is unlikely.

1.5 Other sources of mortality

No quantitative estimates are available about the impact of other sources of mortality on sea perch stocks. However, they are commonly caught as bycatch and a moderate quantity, particularly of small fish, is undoubtedly discarded.

2. BIOLOGY

Sea perch are widely distributed around most of New Zealand, but are rare on the Campbell Plateau. They inhabit waters ranging from the shoreline to 1200 m and are most common between 150 and 500 m. Previously it was believed that there were two species of sea perch, *H. percoides* and *H. barathri* in New Zealand waters. However, genetics research determined that there is probably only one species of sea perch in New Zealand waters, *H. percoides* (Smith 1998). Because of confusion between *H. percoides* and *H. barathri* until recent years, there is limited information on sea perch biology. Trawl surveys from about 1990 show sea perch size to vary with depth and locality without an obvious pattern, possibly representing population differences as well as life history characteristics.

Sea perch are viviparous, extruding small larvae in floating jelly-masses during an extended spawning season. Sex ratios observed in trawl survey samples show more males, generally in the ratio 1:0.7 to 1:0.8. Sea perch are opportunistic feeders and prey on a variety of animals on or close to the seafloor.

Table 5: Estimates of biological parameters for sea perch.

Fishstock	Estimate						Source
1. Natural mortality (*M*)							
SPE 3	0.10–0.13 (Hoenig method)						Paul & Francis (2002)
SPE 3	0.07–0.09 (Chapman Robson estimator)						Paul & Francis (2002)
2. Weight = a (length)^b (Weight in g, length in cm fork length)							
	Both sexes						
	a			b			
SPE 3	0.007767			3.219132			Schofield & Livingston (1996)
3. von Bertalanffy growth parameters							
	Females			Males			
	K	t_0	L_∞	*K*	t_0	L_∞	
ECSI 1996	0.128	-0.725	40.7	0.117	-0.64	43.6	Paul & Francis (2002)
ECSI 2000	0.13	-0.895	37.9	0.116	-0.956	42.4	Paul & Francis (2002)

Growth is relatively slow throughout life. After about age 5 years, males appear to grow faster than females (there is some uncertainty due to small sample sizes). Males mature at 19–25 cm, about 5–7 years,

whereas females mature at between 15 and 20 cm, around 5 years (Paul & Francis 2002). Maximum observed ages estimated for sea perch from the east coast South Island and Chatham Rise were 32 and 43 years. The natural mortality estimates derived from these are 0.13 and 0.10 (using the Hoenig method) and 0.07–0.09 (using the Chapman-Robson estimator) (Paul & Francis 2002). Ageing studies have not identified the species involved, but the maximum age of Australian fish listed as *H. percoides* by Withell & Wankowski (1988), is about 40 years. The maximum size for sea perch is about 56 cm.

Biological parameters relevant to stock assessment are shown in Table 5.

3. STOCKS AND AREAS

There are no data relevant to stock boundaries. However, regional variation in colouration suggests that separate populations could exist.

4. STOCK ASSESSMENT

4.1 Estimates of fishery parameters and abundance

Estimates of relative abundance from trawl surveys are presented in Table 6. Annual biomass estimates from the winter and summer east coast South Island and Southland surveys have been variable between years, and were determined with only moderate precision (generally CVs around 30%) (see Figures 4 and 5).

The time series of biomass estimates from the West Coast South Island surveys increased between 1992 and 1995 and declined substantially from 667 t in the subsequent surveys. The 2005 estimate of relative biomass was 150 t (Figure 2). Annual trawl survey biomass estimates from the Chatham Rise have a low associated coefficient of variation (8–15%). The time series of indices is relatively constant between 1992 and 1994, drops significantly in 1995, and recovers in 1996. Biomass estimates increased dramatically from 2713 t in 1997 to 8417 t in 2002, but then declined until 2008. (Figure 3). The 2010 estimate was 5594 t (Table 6).

4.1.1 Biomass estimates

Indices of relative biomass are available from recent *Tangaroa* and *Kaharoa* trawl surveys of the Chatham Rise, East Coast South Island and West Coast South Island (Table 6, and Figures 2–5).

West Coast South Island Trawl Survey

SPE 7 is one of a suite of inshore stocks the WCSI trawl survey is designed to monitor. The depth range for this survey is 30–400 m on the west coast of the South Island and >20 m in Tasman and Golden Bay (MacGibbon & Stevenson, 2013). Biomass estimates increased from 1991 to 1995, declined to well below the series average by 2003, increase to a second peak in 2011, and then dropped substantially in 2013 (Figure 2).

The Chatham Rise Trawl Survey was designed primarily for hoki and covers the depth range 200–400 m. It therefore excludes a small portion of sea perch habitat around the Mernoo Bank in less than 200 m. The survey biomass estimates for sea perch increased three fold from 1997 to 2002, declined to below the series average by 2008 and then increased to 2013 (Figure 3). However, the survey biomass estimates have declined in the last two surveys in 2014 and 2016 (Figure 3). The size composition of sea perch caught by the Chatham rise survey includes a substantial proportion of fish in the 30–45 cm TL range, whereas those caught during the ECSI trawl surveys are mostly under 30 cm TL.

East Coast South Island Trawl Survey

The ECSI winter surveys from 1991 to 1996 (depth range 30–400 m) were replaced by summer trawl surveys (1996–97 to 2000–01) which also included the 10–30 m depth range, but these were discontinued after the fifth in the annual time series because of the extreme fluctuations in catchability between surveys (Francis et al 2001). The winter surveys were reinstated in 2007, and this time included strata in the 10–30 m depth range, in order to monitor elephantfish and red gurnard which were

officially included in the list of target species in 2012. Only the 2007, 2012, 2014, 2016 and 2018 surveys provide full coverage of the 10–30 m depth range.

Sea perch biomass shows no trend over the core strata time series (Table 6, Figure 4) (MacGibbon et al. 2019). The 2018 biomass was a 33% decrease from the time series high in 2016. Pre-recruit biomass has remained a small and reasonably constant component of the total biomass estimate on all surveys (3–8% of total core strata biomass) and in 2018 it was 3%. The juvenile to adult biomass ratio (based on length-at-50% maturity) was relatively constant over the time series at 23–36% juvenile, and in 2018 it was 18% juvenile (Figure 5). There was no sea perch caught in the 10–30 m strata and hence the addition of the shallow strata in 2007 is of no value for monitoring sea perch.

The spatial distribution of sea perch hot spots within the survey area varies, but overall this species is consistently well represented over the entire survey area, most commonly from about 70 to 300 m

The size distributions of sea perch on each of the twelve ECSI winter surveys were similar and generally unimodal with a right hand tail reflecting the large number of age classes (MacGibbon et al. 2019). Sea perch from the ECSI sampled on these surveys were generally smaller than those from the Chatham Rise and Southland surveys (Bagley & Hurst 1996, Livingston et al. 2002). This suggests that this area may be an important nursery ground for juvenile sea perch and/or that sea perch tend to be larger at greater depths and the ECSI survey does not extend to the full depth range of sea perch which are found as deep as 800 m. However, it is thought that there are at least two different species referred to as sea perch around New Zealand; *Helicolenus percoides* and *H. barathri* (Roberts et al. 2015. Bentley et al. (2014) also found notable difference in catch rates at depth with *H. percoides* occurring from 0–250 m in depth with a peak at around 150 m whereas *H. barathri* occur from around 300–1000 m in depth with a peak at around 600 m. Further, Paul & Horn (2009) found difference in growth rates, mortality, and implied year class strengths between ECSI and Chatham Rise sea perch. It is likely that most 'sea perch' caught on the ECSI winter time series are *H. percoides* although some *H. barathri* could occur in the deeper range of the 200–400 m strata.

4.2 Yield estimates and projections

No estimate of *MCY* can be made. The method $MCY = cY_{AV}$ (Method 4) requires a longer period of relatively stable, or at least known, catches (in view of a potential longevity of 40 years) than is available.

No estimates of current biomass, fishing mortality, or other information are available which would permit the estimation of *CAY*.

4.4 Other factors

Factors influencing yield estimates (species identification, catch history, biomass estimates, longevity/mortality, and natural fluctuations in population size) are poorly known for sea perch and preclude any reliable yield estimates at present.

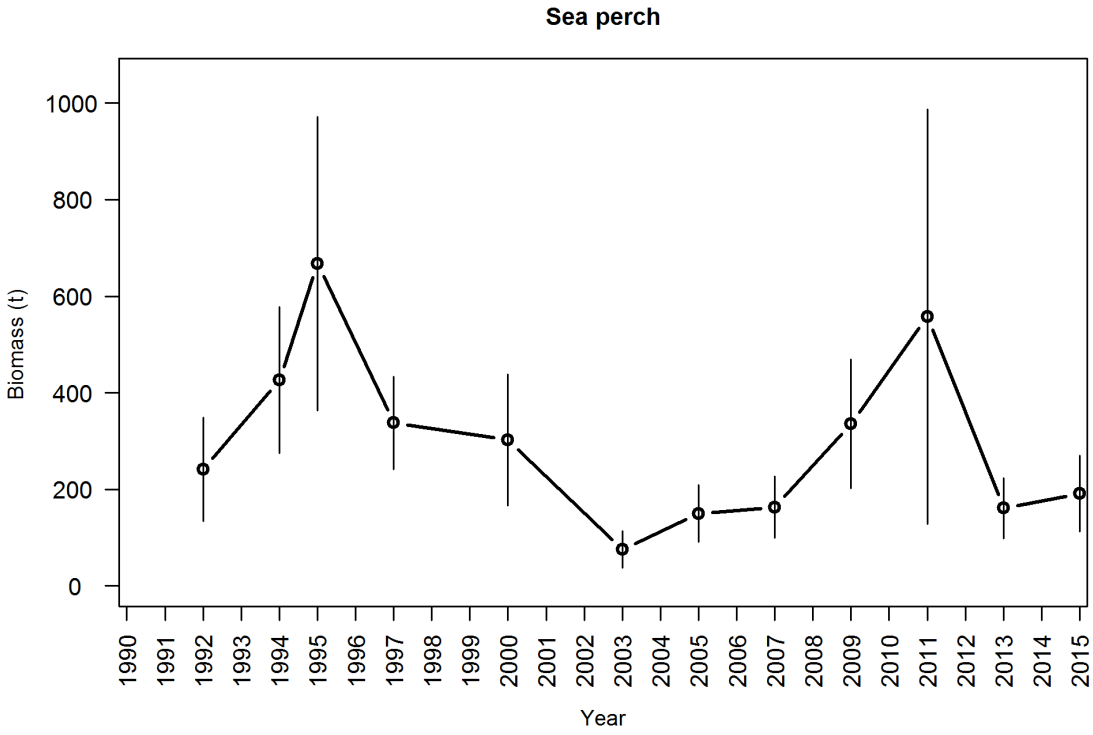


Figure 2: Biomass estimates ±2 standard errors from the West Coast South Island trawl survey.

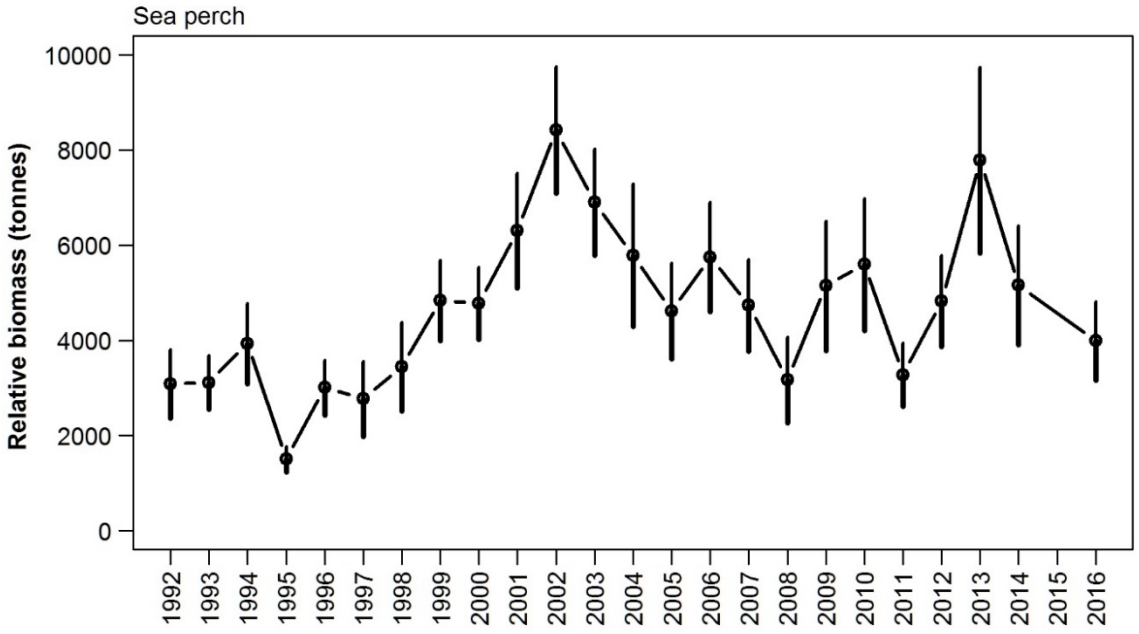


Figure 3: Biomass estimates from the Chatham Rise survey. Error bars are ± 2 standard errors.

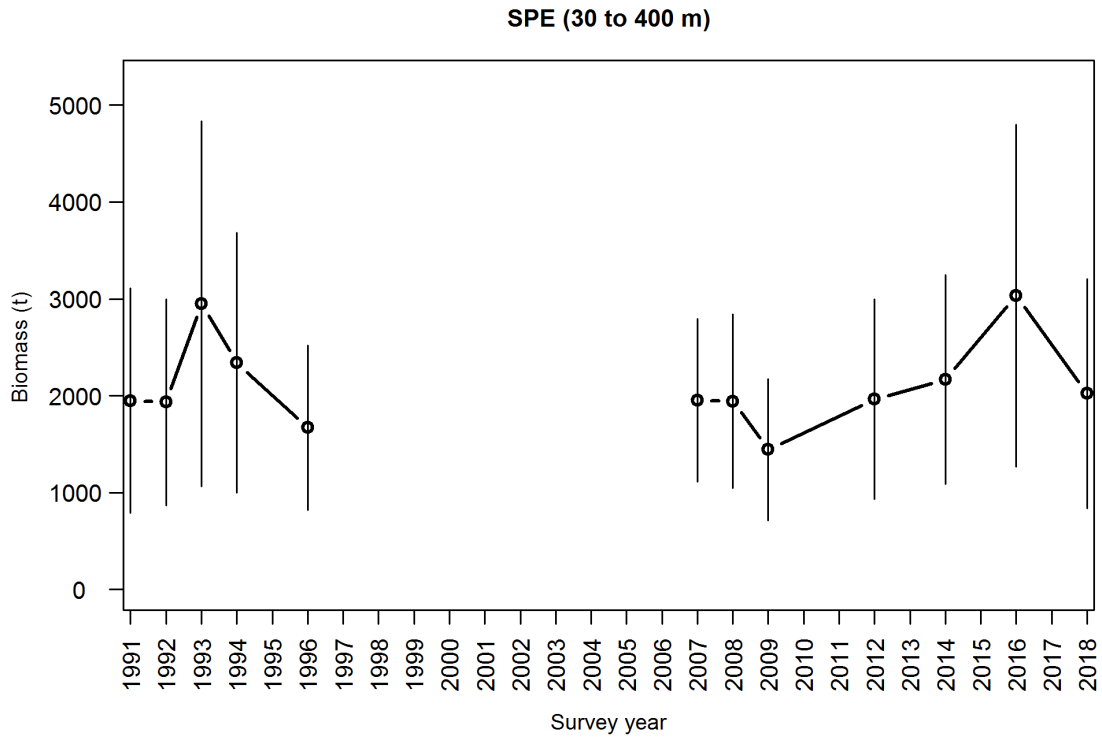


Figure 4: Sea perch total biomass for ECSI winter surveys in core strata (30–400m). Error bars are ± 2 standard errors.

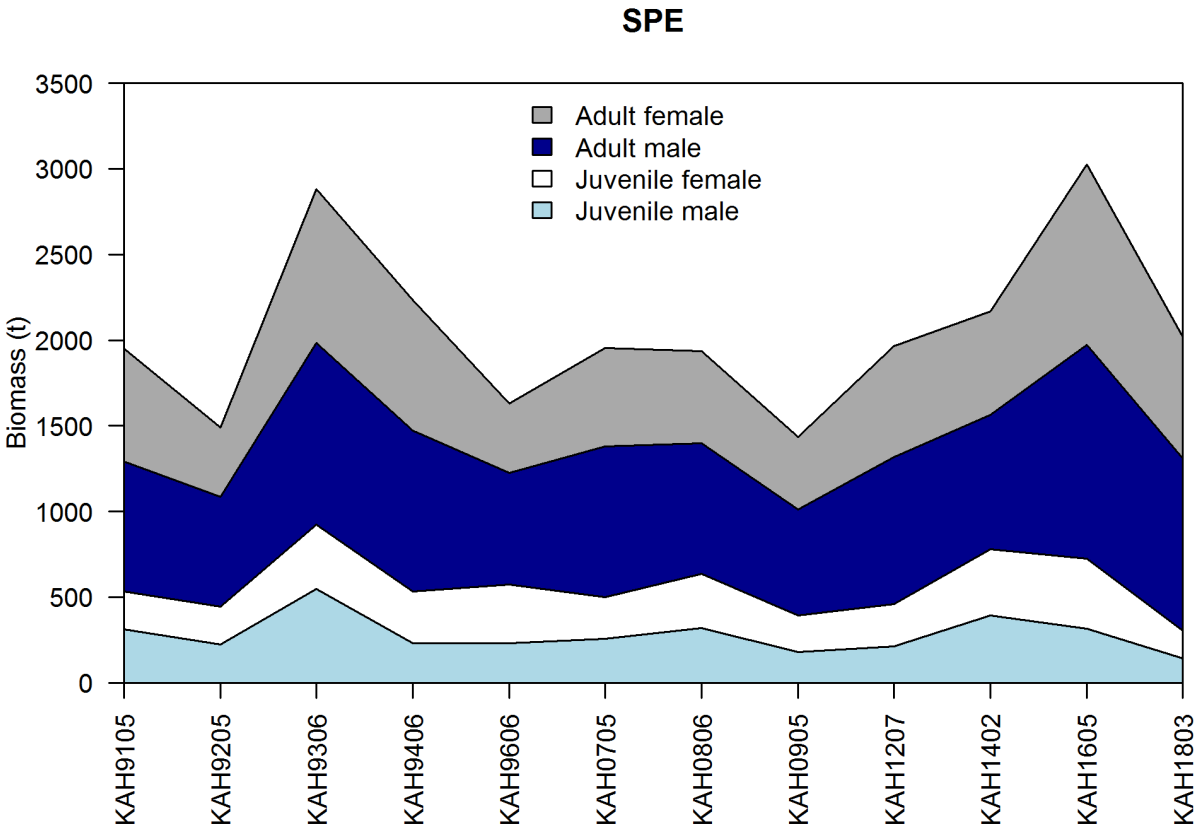


Figure 5: Sea perch juvenile and adult biomass for ECSI winter surveys in core strata (30–400 m), where juvenile is below and adult is equal to or above length at which 50% of fish are mature.

Table 6: Relative biomass indices (t) and coefficients of variation (CV) for sea perch for east coast South Island (ECSI) - summer and winter, west coast South Island (WCSI), the Stewart-Snares Island survey areas, and the Chatham Rise*. Biomass estimates for ECSI in 1991 have been adjusted to allow for non-sampled strata (7 & 9 equivalent to current strata 13, 16 and 17). The sum of pre-recruit and recruited biomass values do not always match the total biomass for the earlier surveys because at several stations length frequencies were not measured, affecting the biomass calculations for length intervals. – , not measured; NA, not applicable. Recruited is defined as the size-at-recruitment to the fishery (20 cm). [Continued on next page].

Region	Fishstock	Year	Trip number	Total Biomass estimate	CV (%)	Total Biomass estimate	CV (%)	Pre-recruit	CV (%)	Pre-recruit	CV (%)	Recruited	CV (%)	Recruited	CV (%)
ECSI(winter)	SPE 3				30–400 m		10–400m		30–400 m		10–400 m		30–400 m		10–400 m
		1991	KAH9105	1 716	30	-	-	70	44	-	-	1 483	30	-	-
		1992	KAH9205	1 934	28	-	-	51	28	-	-	1 441	28	-	-
		1993	KAH9306	2 948	32	-	-	178	76	-	-	2 770	30	-	-
		1994	KAH9406	2 342	29	-	-	78	24	-	-	2 264	29	-	-
		1996	KAH9606	1 671	26	-	-	58	45	-	-	1 613	25	-	-
		2007	KAH0705	1 954	22	-	-	74	18	-	-	1 880	22	-	-
		2008	KAH0806	1 944	23	-	-	144	20	-	-	1 800	24	-	-
		2009	KAH0905	1 444	25	-	-	82	18	-	-	1 363	26	-	-
		2012	KAH1207	1 964	26	-	-	66	25	-	-	1 898	27	-	-
		2014	KAH1402	2 168	25	-	-	182	29	-	-	1 986	26	-	-
		2016	KAH1605	3 032	29			109	25			2 923	30		
		2018	KAH1803	2 023	29			64	19			1 959	30		
ECSI(summer)	SPE 3	1996–97	KAH9618	4 041	47	-	-	-	-	-	-	-	-	-	-
		1997–98	KAH9704	1 638	25	-	-	-	-	-	-	-	-	-	-
		1998–99	KAH9809	3 889	41	-	-	-	-	-	-	-	-	-	-
		1999–00	KAH9917	2 203	27	-	-	-	-	-	-	-	-	-	-
		2000–01	KAH0014	1 792	20	-	-	-	-	-	-	-	-	-	-
WCSI	SPE 7	1992	KAH9204	293	24	-	-	-	-	-	-	-	-	-	-
		1994	KAH9404	510	18	-	-	-	-	-	-	-	-	-	-
		1995	KAH9504	667	23	-	-	-	-	-	-	-	-	-	-
		1997	KAH9701	338	14	-	-	-	-	-	-	-	-	-	-
		2000	KAH0004	302	22	-	-	-	-	-	-	-	-	-	-
		2003	KAH0304	76	25	-	-	-	-	-	-	-	-	-	-
		2005	KAH0503	150	20	-	-	-	-	-	-	-	-	-	-
		2007	KAH0704	163	19	-	-	-	-	-	-	-	-	-	-
		2009	KAH0904	336	20	-	-	-	-	-	-	-	-	-	-
		2010	KAH1004	558	39	-	-	-	-	-	-	-	-	-	-
		2013	KAH1305	161	20	-	-	-	-	-	-	-	-	-	-
Stewart-Snares	SPE 5	1993	TAN9301	469	33	-	-	-	-	-	-	-	-	-	-
		1994	TAN9402	443	26	-	-	-	-	-	-	-	-	-	-
		1995	TAN9502	450	27	-	-	-	-	-	-	-	-	-	-
		1996	TAN9604	480	29	-	-	-	-	-	-	-	-	-	-

Table 6 [Continued]: Relative biomass indices (t) and coefficients of variation (CV) for sea perch for east coast South Island (ECSI) - summer and winter, west coast South Island (WCSI), the Stewart-Snares Island survey areas, and the Chatham Rise*. Biomass estimates for ECSI in 1991 have been adjusted to allow for non-sampled strata (7 & 9 equivalent to current strata 13, 16 and 17). The sum of pre-recruit and recruited biomass values do not always match the total biomass for the earlier surveys because at several stations length frequencies were not measured, affecting the biomass calculations for length intervals. – , not measured; NA, not applicable. Recruited is defined as the size-at-recruitment to the fishery (20 cm).

Region	Fishstock	Year	Trip number	Total Biomass estimate	CV (%)	Total Biomass estimate	CV (%)	Pre-recruit	CV (%)	Recruited	CV (%)
Chatham Rise	SPE	1991	TAN9106	3 050	12	-	-	-	-	-	-
		1992	TAN9212	3 110	9	-	-	-	-	-	-
		1994	TAN9401	3 914	11	-	-	-	-	-	-
		1995	TAN9501	1 490	9	-	-	-	-	-	-
		1996	TAN9601	3 006	10	-	-	-	-	-	-
		1997	TAN9701	2 713	14	-	-	-	-	-	-
		1998	TAN9801	3 448	14	-	-	-	-	-	-
		1999	TAN9901	4 842	9	-	-	-	-	-	-
		2000	TAN0001	4 776	8	-	-	-	-	-	-
		2001	TAN0101	6 310	10	-	-	-	-	-	-
		2002	TAN0201	8 417	8	-	-	-	-	-	-
		2003	TAN0301	6 904	8	-	-	-	-	-	-
		2004	TAN0401	5 786	13	-	-	-	-	-	-
		2005	TAN0501	4 615	11	-	-	-	-	-	-
		2006	TAN0601	5 752	10	-	-	-	-	-	-
		2007	TAN0701	4 737	10	-	-	-	-	-	-
		2008	TAN0801	3 081	14	-	-	-	-	-	-
		2009	TAN0901	5 149	13	-	-	-	-	-	-
		2010	TAN1001	5 594	12	-	-	-	-	-	-
		2011	TAN1101	3 278	10	-	-	-	-	-	-
		2012	TAN1201	4 827	10	-	-	-	-	-	-
		2013	TAN1301	7 785	13	-	-	-	-	-	-
		2014	TAN1401	5 158	12						
		2016	TAN1601	3 989	10						

5. STATUS OF THE STOCKS

No estimates of current and reference biomass are available. For all SPE Fishstocks it is not known if recent catch levels are sustainable.

7. FOR FURTHER INFORMATION

Bagley, N.W.; Hurst, R.J. (1996). Trawl survey of middle depth and inshore bottom species off Southland, February-March 1995 (TAN9502). *New Zealand Fisheries Data Report No. 73*. 48 p.

Beentjes, M P; Horn, P L; Bagley, N W (2007) Characterisation of the Chatham Rise sea perch fishery. *New Zealand Fisheries Assessment Report 2007/16.* 84 p.

Beentjes, M P; MacGibbon, D; Parkinson, D (2016) Inshore trawl survey of Canterbury Bight and Pegasus Bay, April–June 2016 (KAH1605). *New Zealand Fisheries Assessment Report 2016/61*. 135 p.

Bentley, N; Kendrick, T H; MacGibbon, D J (2014). Fishery characterisation and catch-per-unit-effort analyses for sea perch (Helicolenus spp.) in New Zealand, 1989–90 to 2009–10. *New Zealand Fisheries Assessment Report 2014/27* 181 p.

Boyd, R O; Reilly, J L (2002) 1999/2000 national marine recreational fishing survey: harvest estimates. Draft New Zealand Fisheries Assessment Report. (Unpublished report held by Fisheries New Zealand.)

Bradford, E (1998) Harvest estimates from the 1996 national recreational fishing surveys. New Zealand Fisheries Assessment Research Document 1998/16. 27 p. (Unpublished report held by NIWA library, Wellington.)

Challenger Finfish Management Company (CFMC) (2001) Performance of the SPO 7 Adaptive Management Programme dated 7 May 2001. (Unpublished report held by Fisheries New Zealand.)

Davey, N; Hartill, B; Carter, M (2019) Mean weight estimates for recreational fisheries in 2017–18. *New Zealand Fisheries Assessment Report 2019/25*. 36 p.

DOC, MFish. (2007) Department of Conservation and Ministry of Fisheries. Hector's and Maui's dolphin Threat Management Plan, 29 August 2007. Available at www.fish.govt.nz/en-nz/Environmental.

Francis, R I C C; Hurst, R J; Renwick, J A (2001) An evaluation of catchability assumptions in New Zealand stock assessments. *New Zealand Fisheries Assessment Report 2001/1*. 37 p.

Francis, M P; Paul, L J (2013) New Zealand inshore finfish and shellfish commercial landings, 1931–82. *New Zealand Fisheries Assessment Report 2013/55*. 136 p.

Hart, A M; Walker, N A (2004) Monitoring the recreational blue cod and sea perch fishery in the Kaikoura - North Canterbury area. *New Zealand Fisheries Assessment Report 2004/45*. 88 p.

Livingston, M.E.; Bull, B.; Stevens, D.W.; Bagley, N.W. (2002). A review of hoki and middle depths trawl surveys of the Chatham Rise, January 1992–2001. *NIWA Technical Report 113*. 146 p.

MacGibbon, D J; Stevenson, M L (2013) Inshore trawl survey of the west coast South Island and Tasman and Golden Bays, March-April 2013 (KAH1305). *New Zealand Fisheries Assessment Report 2013/66.* 115 p.

MacGibbon, D.J.; Beentjes, M.P.; Lyon, W.L.; Ladroit, Y. (2019). Inshore trawl survey of Canterbury Bight and Pegasus Bay, April–June 2018 (KAH1803). *New Zealand Fisheries Assessment Report 2019/03.* 136 p.

Park, T J (1994) Ocean perch, *Helicolenus* sp. *In:* Tilzey, R D J (Ed.), *The South East Fishery. A scientific review with particular reference to quota management*. pp. 237–246. Bureau of Resource Sciences, Canberra. 360 p.

Paul, L J (1998) A summary of biology and commercial landings, and a stock assessment of the sea perches, *Helicolenus* spp. (Scorpaenidae) in New Zealand waters. New Zealand Fisheries Assessment Research Document 1998/29. 30 p. (Unpublished report held by NIWA library, Wellington.)

Paul, L J; Francis, M P (2002) Estimates of age, growth, and mortality parameters of sea perch (*Helicolenus percoides*) off the east coast of the South Island, New Zealand. Final Research Report for Ministry of Fisheries Research Project SPE2000/01 Objectives 1 & 2. (Unpublished document held by Fisheries New Zealand.)

Paul, L.J.; Horn, P.L. (2009). Age and growth of sea perch (*Helicolenus percoides*) from two adjacent areas off the east coast of South Island, New Zealand. Fisheries Research 95: 169–180.

Paulin, C D (1982) Scorpion fishes of New Zealand. *New Zealand Journal of Zoology* 9(4): 437–450.

Paulin, C D (1989) Redescription of *Helicolenus percoides* (Richardson) and *H. barathri* (Hector) from New Zealand (Pisces, Scorpaenidae). *Journal of the Royal Society of New Zealand* 19(3): 319–325.

Roberts C.D.; Stewart A.L.; Struthers C.D. (eds). (2015). The Fishes of New Zealand. Te Papa Press, Wellington. Vols. 1–4. 2008 pp.

Schofield, K A; Livingston, M E (1996) Trawl survey of hoki and middle depth species on the Chatham Rise, January 1996 (TAN9601). *New Zealand Fisheries Data Report* No. 71. 50 p.

Seafood Industry Council (SeaFIC) (2003) 2003 performance report SPE 3 Adaptive Management Programme. AMP-WG-2003/05 11 p. (Unpublished report held by Fisheries New Zealand.)

Seafood Industry Council (SeaFIC). (2003) 2004 performance report SPE 3 Adaptive Management Programme. AMP-WG-2004/05 11 p. (Unpublished report held by Fisheries New Zealand.)

Seafood Industry Council (SeaFIC). (2004) Report to the Adaptive Management Fishery Assessment Working Group: Performance of the SPE 3 Adaptive Management Programme. AMP-WG-2004/07 53 p. (Unpublished report held by Fisheries New Zealand.)

Smith, P (1998) Molecular identification of sea perch species. Final Report to the Ministry of Fisheries for Project MOF706. 17p. (Unpublished report held by Fisheries New Zealand, Wellington.)

Southeast Finfish Management Company (SEFMC) (2001) SPE 3 Adaptive Management Programme Proposal - 2001 dated 7 May 2001.

Starr, P J; Kendrick, T H; Bentley, N; Lydon, G J (2008) Review of the SPE 3 Adaptive Management Programme. 82 p. (Unpublished manuscript available from the NZ Seafood Industry Council, Wellington).

Starr, P J; Kendrick, T H; Lydon, G J (2006) Full Term Review of the SPE 3 Adaptive Management Programme. 71 p. (Unpublished manuscript available from the NZ Seafood Industry Council, Wellington).

Starr, P; Langley, A (2000) Inshore fishery observer programme for Hector's dolphins in Pegasus Bay, Canterbury Bight, 1997/98. Published client report on contract, 3020.

Stevens, D W; O'Driscoll, R L; Dunn, M R; Ballara, S L; Horn, P L (2012) Trawl survey of hoki and middle depth species on the Chatham Rise, January 2011 (TAN1101). *New Zealand Fisheries Assessment Report 2012/10*. 98 p.

Stevens, D W; O'Driscoll, R L; Oeffner, J; Ballara, S L; Horn, P L (2014) Trawl survey of hoki and middle depth species on the Chatham Rise, January 2013 (TAN1301). *New Zealand Fisheries Assessment Report 2014/02.* 110 p.

Stevens, D W; O'Driscoll, R L; Ladroit, Y; Ballara, S L; MacGibbon, D J; Horn, P L (2015) Trawl survey of hoki and middle depth species on the Chatham Rise, January 2014 (TAN1401). *New Zealand Fisheries Assessment Report 2015/19.* 119 p.

Stevens, D W; O'Driscoll, R L; Ballara, S L; Ladroit, Y (2017) Trawl survey of hoki and middle-depth species on the Chatham Rise, January 2016 (TAN1601). *New Zealand Fisheries Assessment Report 2017/08*. 131 p.

Stewart, P (Comp.) (1993) Ocean perch. *In:* Kailola, P J; Williams, M J; Stewart, P C; Reichelt, R E; McNee, A; Grieve, C (Eds.), *Australian Fisheries Resources*. Pp. 241–242. Bureau of Resource Sciences, Canberra. 422 p.

Teirney, L D; Kilner, A R; Millar, R E; Bradford, E; Bell, J D (1997) Estimation of recreational catch from 1991/92 to 1993/94 New Zealand. Fisheries Assessment Research Document 1997/15. 43 p. (Unpublished report held in NIWA library, Wellington.)

Withell, A F; Wankowski, J W (1988) Estimates of age and growth of ocean perch. *Helicolenus percoides* Richardson, in south-eastern Australian waters. *Australian Journal of Marine and Freshwater Research* 39(4): 441–457.

Wynne-Jones, J; Gray, A; Heinemann, A; Hill, L; Walton, L (2019). National Panel Survey of Marine Recreational Fishers 2017–2018. *New Zealand Fisheries Assessment Report 2019/14*. 108 p

Wynne-Jones,J; Gray, A; Hill, L; Heinemann, A (2014) National Panel Survey of Marine Recreational Fishers 2011–12: Harvest Estimates. *New Zealand Fisheries Assessment Report 2014/67*.