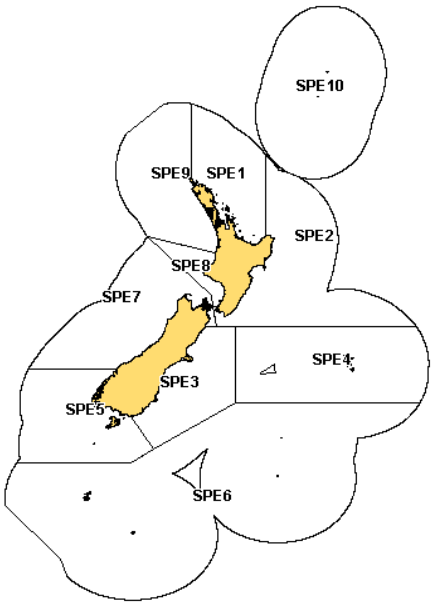
SEA PERCH (SPE)

(*Helicolenus percoides*)



1. FISHERY SUMMARY

(a) Commercial fisheries

Very small quantities of sea perch have been landed for local sale for many years, but are 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 2000 t in recent years; an unknown quantity has been discarded over this period.

Sea perch was introduced into the QMS from 1 October 1998. From 1 October 2000 the TACC for SPE 3 was increased 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 and from 1st October 2006 the TACC for SPE 1 was increased from 18 to 33 t. In SPE 1 landings were above the TACC for a number of years and the TACC has been increased to the average of the previous 7 years plus an additional 10%.

Current TACCs and allowances for non-commercial fishers are in Table 1.

Table 1: Recreational and Maori allowances and Current TACCs, by Fishstock, for sea perch.

Fishstock	Recreational Allowance	Māori Customary Allowance	Other sources of mortality	TACC
SPE 1	1	1	0	33
SPE 2	9	5	0	79
SPE 3	11	11	0	1000
SPE 4	0	0	46	910
SPE 5	1	2	0	36
SPE 6	0	0	0	9
SPE 7	8	2	0	82
SPE 8	4	1	0	15
SPE 9	0	0	0	6
SPE 10	0	0	0	0
Total	**34**	**22**	**46**	**2155**

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 2. 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 (~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.

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 (~ 59%), with the ling and hake fisheries accounting for around 25% and 10% of the total SPE 4 catch, respectively.

Table 2: Reported landings (t) of sea perch by fishstock and fishing year, 1983–84 to 2005–06. The data in this table have been updated from that published in previous Plenary Reports by using the data through 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.

Fishstock	SPE 1		SPE 2		SPE 3		SPE 4		SPE 5 & 6	
FMA	1		2		3		4		5 & 6	
	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC
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

Table 2 continued

Fishstock	SPE 7		SPE 8		SPE 9		SPE 10			
FMA	7		8		9		10		Total	
	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC	Landings	TAC
1983–84	16	-	2	-	55	-	0	-	0	-
1984–85	14	-	1	-	2	-	0	-	0	-
1985–86	12	-	2	-	4	-	0	-	0	-
1986–87	11	-	3	-	1	-	0	-	0	-
1987–88	8	-	6	-	0	-	0	-	0	-
1988–89	5	-	2	-	1	-	0	-	0	-
1989–90	14	-	1	-	0	-	0	-	0	-
1990–91	28	-	1	-	0	-	0	-	0	-
1991–92	20	-	2	-	0	-	0	-	0	-
1992–93	71	-	18	-	0	-	2	-	2	-
1993–94	52	-	10	-	0	-	0	-	0	-
1994–95	67	-	7	-	0	-	0	-	0	-
1995–96	78	-	7	-	1	-	0	-	0	-
1996–97	64	-	7	-	1	-	<1	-	1 310	-
1997–98	118	-	5	-	7	-	<1	-	1 808	-
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	1 853	1 778
2001–02	95	82	6	15	3	6	0	0	1 888	1 778
2002–03	103	82	4	15	4	6	0	0	2 619	1 778
2003–04	95	82	6	15	3	6	0	0	1 972	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

(b) Recreational fisheries

Sea perch are seldom targeted by recreational fishers, but are caught in large numbers. Some are used for bait, but most are probably discarded.

Three recreational fishing surveys were carried out by the Ministry of Fisheries in the 1990s (Table 3). However, because of identification problems and incomplete records, recreational fishing surveys probably do not provide good estimates of the recreational sea perch catch. Highest reported recreational catch of sea perch was from QMAs 2, 3 and 7.

A key component of estimating recreational harvest from diary surveys is determining the proportion of the population that fish. The Recreational Working Group has concluded that the methodological framework used for telephone interviews produced incorrect eligibility figures for the 1996 and previous surveys. Consequently the harvest estimates derived from these surveys are considered to be unreliable. However, relative comparisons can be made between stocks within these surveys. The Recreational Working Group considered that the 2000 survey using face-to-face interviews better estimated eligibility and that the derived recreational harvest estimates are believed to be more accurate. FMA2 catches are nevertheless considered to be over-estimate, probably because of an unrepresentative diarist sample. The 1999/2000 Harvest estimates for each Fishstock should be evaluated with reference to the coefficient of variation.

Table 3: Estimated number and weight of sea perch harvested by recreational fishers by Fishstock and survey. Surveys were carried out in different years in the Ministry of Fisheries regions: South in 1991–92, Central in 1992–93, North in 1993–94 (Teirney et al., 1997) and Nationally in 1996 (Bradford, 1998) and 1999-00 (Boyd & Reilly, 2005).

Fishstock	Survey	Number	C. V.%
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	2 000	37
SPE 2	National	23 000	–
SPE 3	National	28 000	17
SPE 5	National	3 000	–
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

(c) Maori customary fisheries

The Maori customary take has not been quantified.

(d) 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.

(e) 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, but 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 has 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

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 to 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. Maximum size for sea perch is about 56 cm.

Biological parameters relevant to stock assessment are shown in Table 4.

Table 4: 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							
SPE 3	a = 0.007767 b = 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	-0.640	43.6	Paul & Francis (2002)
ECSI 2000	0.130	-0.895	37.9	0.116	-0.956	42.4	Paul & Francis (2002)

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

(a) Estimates of fishery parameters and abundance

Estimates of relative abundance from trawl surveys are presented in Table 5. 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%).

Table 5: Relative biomass indices (t) and coefficients of variation (CV) for west coast South Island, Stewart-Snares Island, east coast South Island (ECSI) – summer and winter, and Chatham Rise trawl surveys. Note, because trawl survey biomass estimates are indices, comparisons between different seasons (e.g. summer and winter ECSI) are not strictly valid.

Region	Survey	Date	Biomass (t)	CV *(%)*
West coast, South Island	KAH9204	Mar-Apr 1992	293	24
	KAH9404	Mar-Apr 1994	510	18
	KAH9504	Mar-Apr 1995	667	23
	KAH9701	Mar-Apr 1997	338	14
	KAH0004	Mar-Apr 2000	302	22
	KAH0304	Mar-Apr 2003	76	25
	KAH0503	Mar-Apr 2005	150	20
Southland (Stewart-Snares shelf)	TAN9301	Feb-Mar 1993	469	33
	TAN9402	Feb-Mar 1994	443	26
	TAN9502	Feb-Mar 1995	450	27
	TAN9604	Feb-Mar 1996	480	29
East coast. South Island (Winter)	KAH9105	May-Jun 1991	1 802	30
	KAH9205	May-Jun 1992	2 288	27
	KAH9306	May-Jun 1993	3 348	30
	KAH9406	May-Jun 1994	2 327	29
	KAH9606	May-Jun 1996	1 671	26
East coast. South Island (Summer)	KAH9618	Dec-Jan 1996–97	4 041	47
	KAH9704	Dec-Jan 1997–98	1 638	25
	KAH9809	Dec-Jan 1998–99	3 889	41
	KAH9917	Dec-Jan 1999–00	2 203	27
	KAH0014	Dec-Jan 2000–01	1 792	20
Chatham Rise	TAN9106	Dec-Jan 1991–92	3 050	12
	TAN9212	Dec-Jan 1992–93	3 110	9
	TAN9401	Jan 1994	3 914	11
	TAN9501	Jan 1995	1 490	9
	TAN9601	Jan 1996	3 006	10
	TAN9701	Jan 1997	2 713	14
	TAN9801	Jan 1998	3 448	14
	TAN9901	Jan 1999	4 842	9
	TAN0001	Jan 2000	4 776	8
	TAN0101	Jan 2001	6 310	10
	TAN0201	Jan 2002	8 417	8
	TAN0301	Jan 2003	6 904	8
	TAN0401	Jan 2004	5 786	13
	TAN0501	Jan 2005	4 615	11
	TAN0601	Jan 2006	5 752	10

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. 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 have declined since then. The 2006 estimate was 5 752t.

(b) Biomass estimates

Estimates of current and reference absolute biomass are not available.

(c) Estimation of Maximum Constant Yield (MCY)

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.

(d) Estimation of Current Annual Yield (CAY)

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

(e) 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.

5. ANALYSIS OF ADAPTIVE MANAGEMENT PROGRAMMES

The Ministry of Fisheries revised the AMP framework in December 2000. The AMP framework is intended to apply to all proposals for a TAC or TACC increase, with the exception of fisheries for which there is a robust stock assessment. In March 2002, the first meeting of the new AMP Working Group was held.

Two changes to the AMP were adopted:
- a new checklist was implemented with more attention being made to the environmental impacts of any new proposal,
- the annual review process was replaced with an annual review of the monitoring requirements only. Full analysis of information is required a minimum of twice during the 5 year AMP.

SPE 3

SPE 3 was introduced in the QMS with a TACC of 738 t in October 1998. The TACC was increased to 1000 t under AMP management in October 2001.

Full-term Review of SPE 3 AMP in 2006

In 2006 the AMP FAWG reviewed the performance of the AMP after 4 years in its current 5-year term (Starr et al., 2005). The WG noted:

Characterisation
- SPE 3 was introduced in the QMS with a TACC of 738 t in October 1998. The TACC was increased to 1000 t under AMP management in October 2001.
- The reported annual catch has declined since 1997/98, and the new TACC has been substantially under-caught in each year since its introduction. The 2004/05 catch was less than half the TACC. Total landings have been below the pre-AMP TACC since the 2001/02 fishing year.
- The majority of the SPE 3 catch is taken by bottom trawlers targeting RCO, HOK, BAR, and SPE. The target bottom trawl fishery for SPE has declined in importance due to the withdrawal of the major participant in 2001/02. This withdrawal also accounts in part for the failure to reach the TACC since the inception of the SPE 3 AMP.

CPUE standardisation
- The original analysis on which the SPE 3 AMP was accepted was based on catch and effort data generated by a target SPE 3 bottom trawl fishery that primarily took place in statistical area 018. As noted above, the major participant withdrew from the fishery in 2001/02, thus compromising the capacity to track SPE 3 abundance using this subset of the data. The interpretation of this index in the future will also be difficult if and when new participants enter the target fishery because there will be insufficient overlap of effort to calibrate the two periods of the fishery, thus effectively starting a new series.
- CPUE data from two other fisheries – the offshore Hoki bottom trawl fishery and the inshore mixed species bottom trawl fishery targeting sea perch, red cod, barracouta and tarakihi - were investigated as potential indices of SPE 3 abundance.

- Unfortunately sea perch was not reliably reported in these two fisheries until after this species was introduced into the QMS in 1998. This means the CPUE analysis period must begin in 1998/99.
- Based on diagnostics, biology, and inter-annual variation, the CPUE index based on data from the mixed bottom trawl fishery appeared to be reasonably credible while the series based on the bycatch in the hoki fishery was less credible. These two fisheries were analysed separately as the mixed bottom trawl fishery tends to operate closer to shore in shallower water and is based on a fleet of smaller vessels. Standardised SPE 3 CPUE (Lognormal GLM of non-zero catches) for the mixed species bottom trawl fishery declined consistently from 1998/99 to 2004/05
- The use of a plus group to include all non-core vessels was not acceptable. It would be better to drop non-core vessels and associated data from the analysis.

Trawl survey abundance indices

- Biomass indices from the discontinued inshore trawl surveys on the east coast of the South Island showed no trend for sea perch in either the winter series (1991–1996) or the summer series (1997–2001), although both series were highly variable and many of the indices had large CVs.
- The winter series will, however, be re-initiated in May 2007.
- Biomass indices for sea perch from the summer Chatham Rise survey showed no long-term trend over the period 1992 to 2006, although the sea perch biomass reached a peak in 2002, declined steadily to 2005 and increased in 2006. Biomass in 2006 is still well above the threshold biomass of the series, which was defined by the AMP WG as 65%*mean (B_{1996}–B_{2001}).
- A series of sea perch biomass indices calculated from the western part of the Chatham Rise, which covers that part of the Chatham Rise which lies mainly in SPE 3, also showed no trend in the index over time. However, this series is much less precise, with larger CVs on most of the biomass indices compared to the index for the entire Chatham Rise. Both series showed an upturn in 2006.

Effects of fishing

- Rates of capture/mortality of non-fish bycatch were not reported.
- However there is little targeting of sea perch at present so additional impact on the environment as a result of the AMP is likely to be negligible.

Log Book Programme

- No logbook data have been collected since the 2001/02 fishing year.

Conclusion

- Given that the target SPE 3 fishery was primarily based in a single statistical area (018), the decline in CPUE from 1998–99 to 2001–02 for this fishery may have been due to localised depletion. This index has since remained flat at the 2001–02 level, but is unreliable due to the lack of data. Sea perch may be prone to localised depletion as they have relatively low productivity (long lived), and apparently low movement as adults with limited ability for long distance larval dispersal as they are sedentary live bearers.
- Standardised CPUE for the mixed bottom trawl fishery appears to be the best candidate for future monitoring of SPE 3, and this index will become more useful as more years are added to the time series.
- Trawl surveys of the Chatham Rise and the east coast of the South Island indicate that sea perch are not found much deeper than 500 m. Given the deep trough (>600 m) between the Chatham Rise and the South Island, and the fact sea perch may not move much as adults due to their biology, the sea perch populations on the Chatham Rise and on the shelf off the east coast of the South Island may comprise separate stocks.
- Research trawl survey results indicate that the stability of sea perch biomass on the portion of the Chatham Rise occurring within SPE 3 may not be applicable to the sea perch population occurring off east coast of the South Island.
- The east coast South Island winter trawl survey series will be re-initiated in 2007 with the depth range extended to deeper strata so that it will be better able to index sea perch abundance.
- Owing to the uncertainty of the available indices, and to the relationships between sea perch on the Chatham Rise and the east coast of the South Island, it is not clear whether the sea perch population off the east coast of the South Island should be considered to be separate from the

population on the Chatham Rise. In either case, it is not possible to determine where the SPE 3 biomass is in relation to B_{MSY}.

6. STATUS OF THE STOCKS

No estimates of current and reference biomass are available.

For all other Fishstocks, it is not known if recent catch levels are sustainable or at levels that will allow the stock to move towards a size that will support the MSY.

TACCs and reported landings of sea perch in the 2005/06 fishing year are summarised in Table 6.

Table 6: Summary of TACCs (t), and reported landings (t) of sea perch for the most recent fishing year.

Fishstock		QMA	2005–06 Actual TACC	2005–06 Reported landings
SPE 1	Auckland (East)	1	18	40
SPE 2	Central (East)	2	79	73
SPE 3	South-east (coast)	3	1000	436
SPE 4	South-east (Chatham)	4	910	502
SPE 5	Southland	5	36	24
SPE 6	Sub-Antarctic	6	9	<1
SPE 7	Challenger	7	82	75
SPE 8	Central (West)	8	15	5
SPE 9	Auckland (West)	9	6	2
SPE 10	Kermadec	10	0	0
Total			2155	1157

7. FOR FURTHER INFORMATION

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