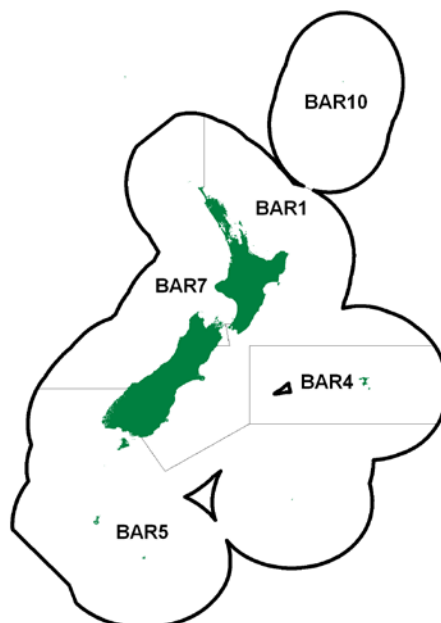


BARRACOUTA (BAR)*(Thyrsites atun)*

Manga, maka

**1. FISHERY SUMMARY****1.1 Commercial fisheries**

Barracouta are caught in coastal waters around mainland New Zealand, The Snares and Chatham Islands, down to about 400 m and have been managed under the Quota Management System since 1 October 1986. Catches increased significantly in the late 1960s and peaked at about 47 000 t in 1977. Between 1983-84 and 2004-05, catches fluctuated between 18 000 and 28 000 t per annum (annual average about 24 000 t). Landings have increased from the lower level of the early 2000s to 26 000 to 30 000 t in the last 8 years (Table 2). Figure 1 shows the historical landings and TACC values for the main BAR stocks.

Table 1: Reported landings (t) by nationality from 1977 to 1987-88.

Fishing Year	New Zealand		Foreign			Total (FSU)	Total (QMS)
	Domestic	Chartered	Japan	Korea	USSR		
1977	4 697	0	34 357	8 109	0	47 163	-
1978-79	5 335	58	4 781	2 481	0	12 655	-
1979-80	7 748	6 679	4 339	3 879	47	22 922	-
1980-81	10 058	4 995	4 227	15	60	19 355	-
1981-82	12 055	11 077	2 813	373	0	26 328	-
1982-83	10 814	7 110	1 746	1 888	31	21 589	-
1983-83*	7 763	2 961	803	1 115	0	12 642	-
1983-84	12 390	10 226	1 786	4 355	0	28 757	-
1984-85	7 869	10 425	1 430	5 252	0	24 976	-
1985-86	8 427	7 865	1 371	815	0	18 478	-
1986-87	9 829	13 732	1 575	742	0	25 878	27 660†
1987-88	9 335	12 077	896	609	0	22 971	26 607†

* 6 month changeover in fishing years.

† The discrepancies between QMS and FSU total landings are due to under-reporting to the FSU.

Over 99% of the recorded catch is taken by trawlers. Major target fisheries have been developed on spring spawning aggregations (Chatham Islands, Stewart Island, west coast South Island and northern and central east coast South Island) as well as on summer feeding aggregations, particularly around The Snares and on the east coast of the South Island. Barracouta also comprise a significant proportion of the bycatch in the west coast North Island jack mackerel and The Snares squid fisheries. Catches have increased in recent years in BAR 1 to the level of the TAC, but have dropped

BARRACOUTA (BAR)

in BAR 4 in the last 3 years. The TACC in BAR 5 was reduced from 9282 t to 7470 t on 1 October 1998 with a 2 t customary and 3 t recreational allocation and a TAC of 7475 t. Recent catches have fluctuated about the new TAC in this fishery. In BAR 7 the catch limit was exceeded from 2004-05 to 2006-07 (catches nearly reached 15 000 t in 2006-07), but catch has decreased since to well below the TAC.

Table 2: Reported landings (t) of barracouta by Fishstock from 1983-84 to 2011-12 and actual TACCs (t) from 1986-87 to 2011-12. QMS data from 1986-present.

Fishstock FMAs	BAR 1 1, 2, 3		BAR 4 4		BAR 5 5 & 6		BAR 7 7, 8, 9	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1983-84*	7 805	-	1 743	-	11 291	-	7 222	-
1984-85*	5 442	-	1 909	-	12 487	-	4 425	-
1985-86*	5 395	-	1 509	-	6 380	-	4 536	-
1986-87	8 877	8 510	3 084	3 010	7 653	9 010	8 046	10 510
1987-88	9 256	8 837	1 775	3 010	6 457	9 011	9 117	10 603
1988-89	5 838	9 426	946	3 010	5 323	9 011	8 071	10 702
1989-90	9 209	9 841	1 349	3 016	5 960	9 282	7 050	10 925
1990-91	9 401	9 957	1 399	3 016	8 817	9 282	7 138	10 925
1991-92	6 733	9 957	1 156	3 016	6 897	9 282	7 326	10 925
1992-93	9 032	9 969	2 251	3 016	7 019	9 282	10 141	10 925
1993-94	7 299	9 969	606	3 016	3 410	9 282	8 030	10 925
1994-95	10 023	9 969	331	3 016	2 645	9 282	9 345	10 925
1995-96	11 252	9 969	2 234	3 016	4 255	9 282	8 593	10 925
1996-97	11 873	11 000	1 081	3 016	2 839	9 282	10 203	10 925
1997-98	11 543	11 000	1 966	3 016	6 167	9 282	8 717	10 925
1998-99	9 229	11 000	459	3 016	7 302	7 470	4 427	10 925
1999-00	10 032	11 000	1 911	3 016	6 205	7 470	3 288	10 925
2000-01	7 118	11 000	2 122	3 016	6 101	7 470	6 890	10 925
2001-02	6 900	11 000	1 160	3 019	5 883	7 470	7 655	11 173
2002-03	7 595	11 000	573	3 019	7 843	7 470	9 025	11 173
2003-04	5 949	11 000	477	3 019	6 919	7 470	9 114	11 173
2004-05	6 085	11 000	98	3 019	8 593	7 470	12 156	11 173
2005-06	7 030	11 000	687	3 019	9 479	7 470	10 685	11 173
2006-07	5 351	11 000	3 233	3 019	6 334	7 470	14 699	11 173
2007-08	5 987	11 000	2 975	3 019	8 561	7 470	10 451	11 173
2008-09	8 861	11 000	968	3 019	7 659	7 470	8 955	11 173
2009-10	10 635	11 000	1 223	3 019	6 951	7 470	9 642	11 173
2010-11	11 420	11 000	1 190	3 019	8 199	7 470	6 128	11 173
2011-12	9 304	11 000	1 423	3 019	7 071	7 470	8 645	11 173

Fishstock FMAs	BAR 10 10		Total	
	Landings	TACC	Landings	TACC
1983-84*	0	-	28 061	-
1984-85*	0	-	24 263	-
1985-86*	0	-	17 820	-
1986-87	0	10	27 660	31 050
1987-88	0	10	26 605	31 471
1988-89	0	10	20 178	32 159
1989-90	0	10	23 568	33 073
1990-91	0	10	26 755	33 190
1991-92	0	10	22 212	33 190
1992-93	0	10	28 443	33 202
1993-94	0	10	19 345	33 202
1994-95	0	10	22 345	33 202
1995-96	0	10	26 334	33 202
1996-97	0	10	25 996	34 233
1997-98	0	10	28 393	34 233
1998-99	0	10	21 417	32 421
1999-00	0	10	21 436	32 421
2000-01	0	10	22 231	32 421
2001-02	0	10	21 598	32 672
2002-03	0	10	25 036	32 672
2003-04	0	10	22 459	32 672
2004-05	0	10	26 919	32 672
2005-06	0	10	27 881	32 672
2006-07	0	10	29 617	32 672
2007-08	0	10	27 968	32 672
2008-09	0	10	26 443	32 672
2009-10	0	10	28 451	32 672
2010-11	0	10	26 937	32 672
2011-12	0	10	26 442	32 672

* FSU data.

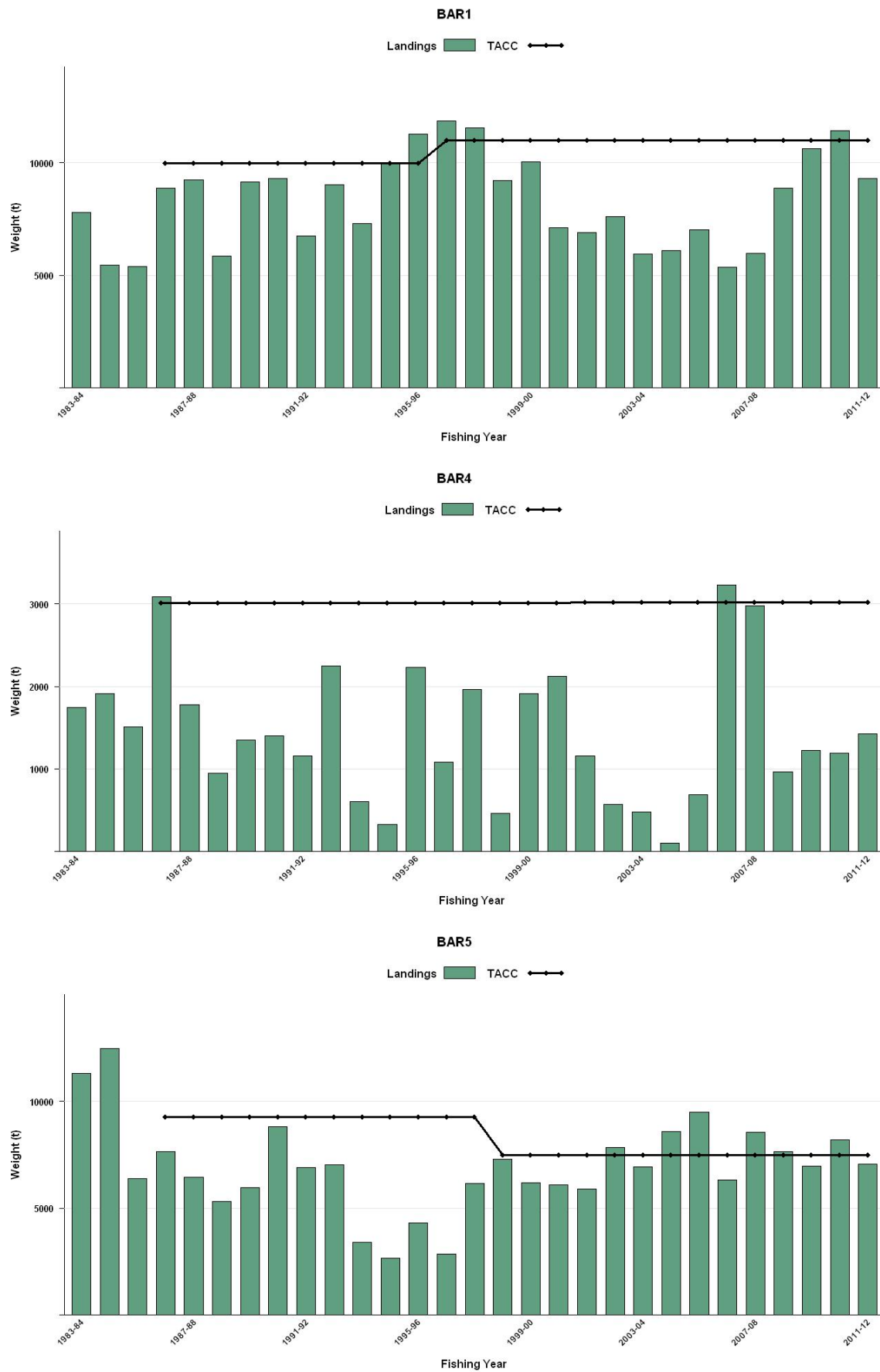


Figure 1: Historical landings and TACC for the four main BAR stocks. From top to bottom: BAR1 (Auckland East), BAR4 (Chatham Rise), and BAR5 (Southland). [Continued on next page].

BARRACOUTA (BAR)

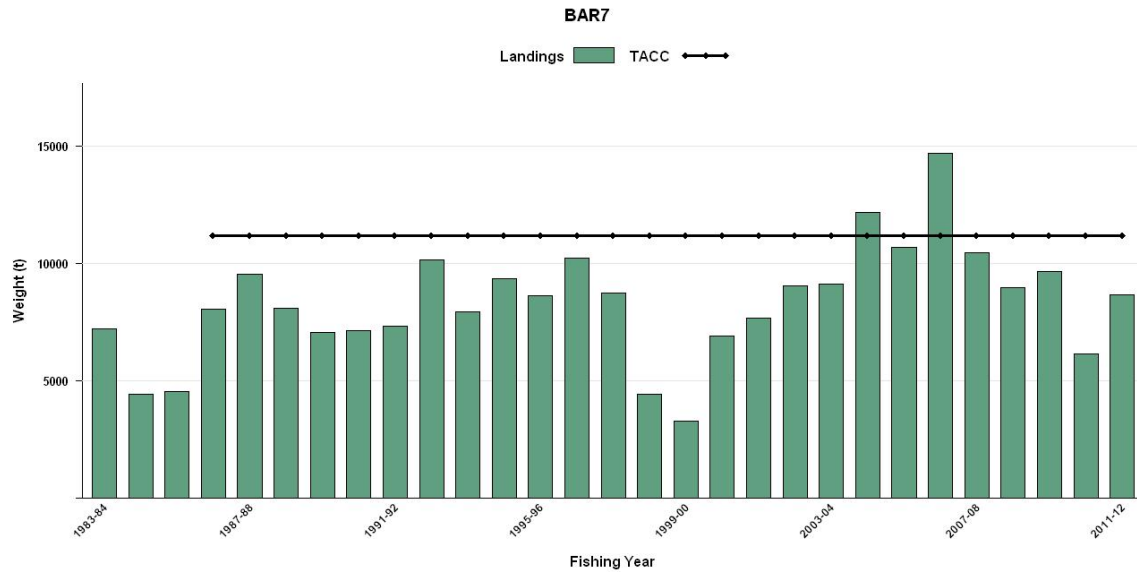


Figure 1 [Continued]: Historical landings and TACC for the four main BAR stocks. BAR7 (Challenger).

1.2 Recreational fisheries

Estimates of recreational catch from the Ministry for Primary Industries recreational catch and effort surveys are shown in Table 3.

A key component of the 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 considerably underestimated and not reliable. 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. FMA 2 catches are nevertheless considered to be over-estimated, probably because of an unrepresentative diarist sample. The 1999-00 harvest estimates for each Fishstock should be evaluated with reference to the coefficient of variation.

1.3 Customary non-commercial fisheries

Quantitative information on the current level of customary non-commercial take is not available.

Table 3: Estimated number and weight of barracouta harvested by recreational fishers by Fishstock and survey*.

Fishstock	Survey	Total		Survey harvest (t)
		Number	CV	
BAR 1	South	27 000	47%	1991-92
BAR 7	South	2 100	44%	30-90
				-
				1992-93
BAR 1	Central	17 000	22%	25-35
BAR 7	Central	15 600	24%	25-35
				1993-94
BAR 1	North	*		-
BAR 7	North	*		-
				1996
BAR 1	National	68 000	8%	160-190
BAR 7	National	74 000	15%	160-220
				1999-00
BAR 1	National	156 000	35%	182 -377
BAR 5	National	2 000	51%	2-7
BAR 7	National	35 000	28%	68-120

* data not available

* Surveys were carried out in different years in the Ministry for Primary Industries regions: South in 1991-92, Central in 1992-93, North in 1993-94 (Teirney *et al.* 1997) and nationally in 1996 (Bradford 1998) and 1999-2000 (Boyd & Reilly 2002). The estimated Fishstock harvest is indicative and made by combining estimates from the different years.

1.4 Illegal catch

Quantitative information on the level of illegal catch is not available.

1.5 Other sources of mortality

There may have been considerable amounts of barracouta discarded prior to the QMS, either because of quota restrictions under the deepwater policy, low value, or undesirable small size fish. There is also likely to be some mortality associated with escapement from trawl nets. Some discarding may also have occurred in BAR 1 because of the lack of quota availability and the high deemed value in relation to the low value of the fish.

2. BIOLOGY

Barracouta spawn mainly in late-winter/spring (August-September) on the east and west coasts of both of the main islands, and in late spring (November-December) in Southland and in the Chatham Islands. Some spawning activity may also extend into summer/autumn. Sexual maturity is reached at about 50-60 cm fork length (FL) at about 2-3 years of age.

Juvenile barracouta have been recorded from inshore areas (< 100 m) all around New Zealand and the Chatham Islands, although they appear to be less common on the west coast of the South Island. Adult fish are found down to about 400 m depth. Tagged barracouta have moved considerable distances to spawn (up to 500 nautical miles).

No age data is available for the period prior to the onset of commercial fishing, which developed rapidly from 1968. Ageing studies carried out in the mid-1970s showed that the maximum age rarely exceeded 10 years. Data have been validated for fish up to 3 years old by following modal progressions over time.

M was estimated using 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. Using 10 years for the maximum age suggests an M of up to 0.46. The effect of fishing on age structure prior to the mid-1970s is unknown, but M is unlikely to be less than 0.3, which has been assumed in previous stock assessments.

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

Table 4: Estimates of biological parameters.

Fishstock		Estimate		Source
<u>1. Natural mortality (<i>M</i>)</u>				Hurst (unpub. data)
All-both sexes		Less than 0.46 <i>M</i> = 0.30 considered best estimate for all areas for both sexes		
<u>2. Weight = a(length) (Weight in g, length in cm fork length).</u>				
	Females		Males	
	a	b	a	b
BAR 4	0.0074	2.94	0.0117	2.82
BAR 5	0.0075	2090	0.0075	2.90
<u>3. Von Bertalanffy growth parameters</u>				
	Both sexes			
	<i>K</i>	<i>t</i> ₀	<i>L</i> _∞	
Tasmania	0.45	0.166	91.17	(unconstrained)
	0.42	-0.25	91.01	(constrained, <i>t</i> ₀ fixed)

Hurst & Bagley (1992)

Hurst & Bagley (1992)

Grant *et al.* (1978)

3. STOCKS AND AREAS

There are no new data which would alter the stock boundaries given in previous assessment documents.

BARRACOUTA (BAR)

Four barracouta management areas were established in 1983, based on knowledge at the time: EEZ areas E + F, G + H, B + C and D. Stock boundaries are not well understood, but the Chatham Islands stock is probably separate. However, there may be some overlap between mainland stock management areas as currently defined (from analysis of tagging data, commercial fishery data, biological data (i.e., length frequencies, otoliths, parasites, spawning areas and seasons) and from seasonal relative biomass estimates). In particular, it appears that there is considerable overlap of Southland fish with other areas, probably the west coast of the South Island and possibly the east coast as well. However, there is not enough data at this stage to alter the existing stock boundaries.

4. STOCK ASSESSMENT

There are no new data which would alter the yield estimates given in the 1997 Plenary Report. The obsolete *MCY* estimates based on biomass estimates from trawl surveys have been removed and yield estimates are based on commercial landings data only. These estimates have not changed since 1992.

4.1 Estimates of fishery parameters and abundance

The results from trawl surveys carried out during the mid 1980s (sometimes from a variety of different vessels) were used to provide an approximate estimate of minimum absolute biomass. This approach required an assumption about catchability to convert the trawl survey catches to estimates of absolute biomass. This method is now considered obsolete and the estimates of absolute biomass have not been included.

A time series of trawl surveys was carried out in the Southland area (QMA 5) in February–March from 1993 to 1996 using *Tangaroa* (Table 5). Trawl surveys on the east and west coasts of the South Island in autumn using *Kaharoa* may help interpretation of trends in biomass around the South Island.

4.2 Biomass estimates

Biomass in the core strata (30–400 m) of the East Coast South Island trawl survey appears to be increasing and is about three-fold larger in 2009 and 2012 than the average biomass of the early 1990s. Coefficients of variation are generally low ranging from 16 to 34%, but were below 20% on the last four surveys. The additional biomass captured in the 10–30 m depth range accounts for 15% and 6% of the biomass in the core plus shallow strata (10–400 m) for 2007 and 2012 respectively, indicating that shallow strata should be monitored for this species (Figure 2).

4.3 Length frequency distributions

The length distributions from the East Coast South Island trawl survey show at least three clear pre-recruit modes at about 20 cm, 25 cm, and 50 cm (combined males, females, and unsexed) consistent with ages of 0+, 1+, and 2+ (Harley *et al.* 1999). Plots of time series length frequency distributions are consistent, showing the presence of the pre-recruited cohorts on nearly all surveys, with indications that these could be tracked through time (modal progression). The addition of the 10–30 m depth range does not change the shape of the length distribution (Figure 3)

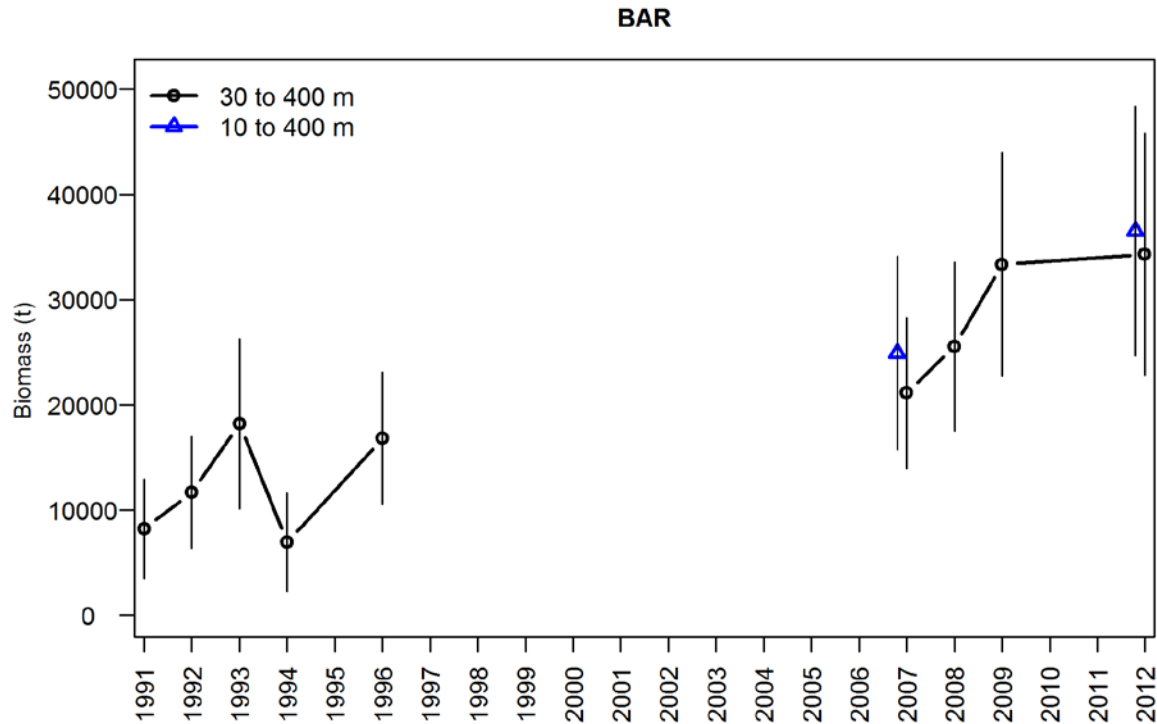


Figure 2: Barricuta total biomass and 95% confidence intervals for the all ECSI winter surveys in core strata (30–400 m), and core plus shallow strata (10–400 m) in 2007 and 2012.

Table 5: Relative biomass indices (t) and coefficients of variation (CV) for barricuta for east coast South Island (ECSI) - winter, east coast North Island (ECNI), west coast South Island (WCSI) and Southland survey areas*. 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). – , not measured; NA, not applicable.

Region	Fishstock	Year	Trip number	Total Biomass estimate	CV (%)	Total Biomass estimate	CV (%)
ECSI (winter)	BAR			30-400m		10-400m	
		1991	KAH9105	8 361	29	-	-
		1992	KAH9205	11 672	23	-	-
		1993	KAH9306	18 197	22	-	-
		1994	KAH9406	6 965	34	-	-
		1996	KAH9608	16 848	19	-	-
		2007	KAH0705	21 132	17	24 939	19
		2008	KAH0806	25 544	16	-	-
		2009	KAH0905	33 360	16	-	-
		2012	KAH1207	34 325	17	36 526	16
ECNI	BAR	1993	KAH9304	2 673	15	-	-
		1994	KAH9402	8 433	33	-	-
		1995	KAH9502	2 103	29	-	-
		1996	KAH9602	2 495	23	-	-
WCSI	BAR	1992	KAH9203	2 478	14	-	-
		1994	KAH9404	5 298	16	-	-
		1995	KAH9504	4 480	13	-	-
		1997	KAH9701	2 993	19	-	-
		2000	KAH0004	1 787	11	-	-
		2003	KAH0304	4 485	20	-	-
		2005	KAH0503	2 763	13	-	-
Southland	BAR	1993	TAN9301	11 587	18	-	-
		1994	TAN9402	6 151	20	-	-
		1995	TAN9502	4 539	17	-	-
		1996	TAN9604	7 693	19	-	-

BARRACOUTA (BAR)

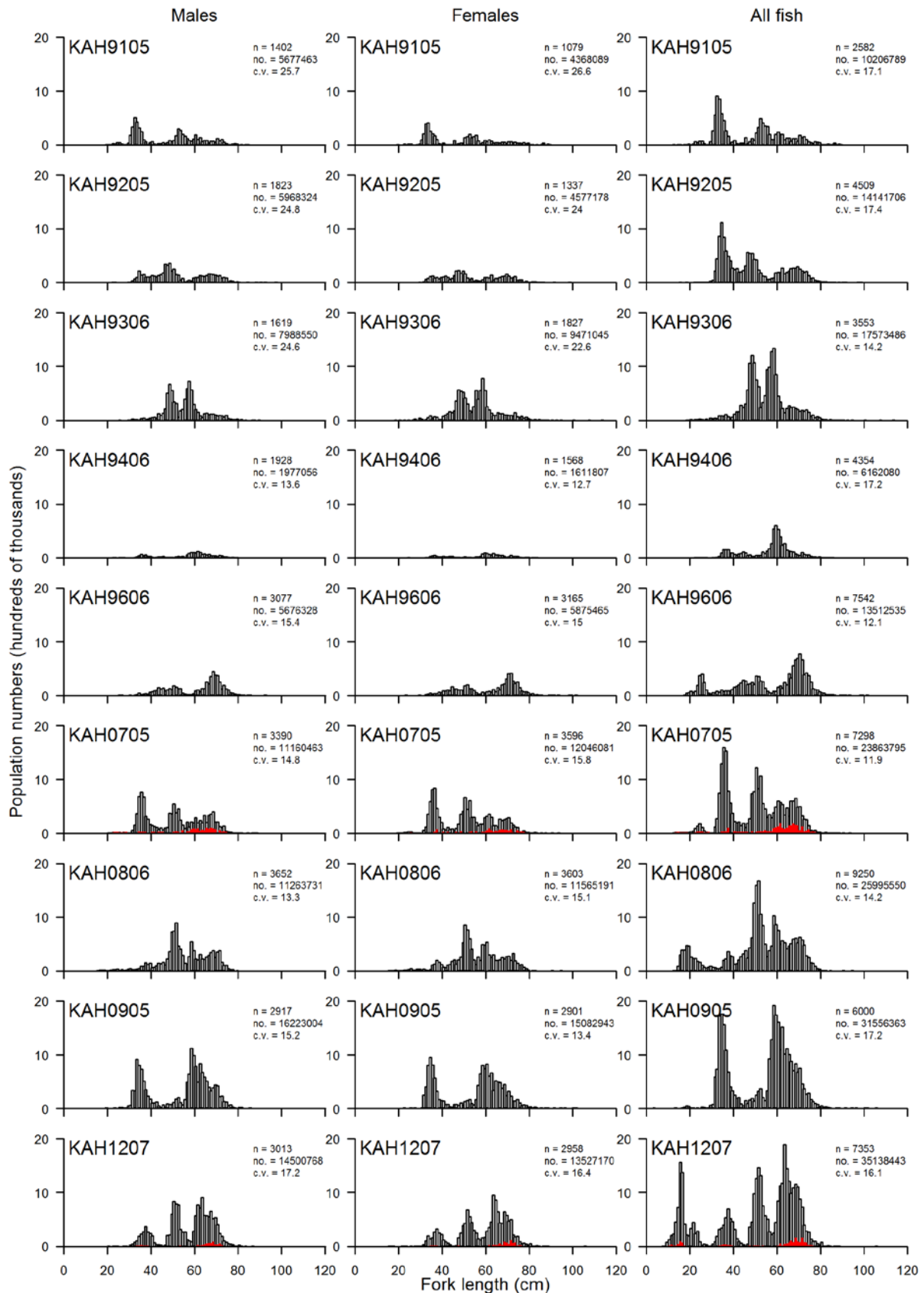


Figure 3: Scaled length frequency distributions for barracouta in core strata (30–400 m) for all nine ECSI winter surveys. The length distribution is also shown in the 10–30 m depth strata for the 2007 and 2012 surveys overlaid in red for species with many length classes, otherwise in light grey (not stacked). Population estimates are for the core strata only. n, number of fish measured; no., population number; c.v., coefficient of variation.

4.4 Yield estimates and projections

It is not feasible to estimate *MCY* from commercial landings data for most Fishstocks (except for BAR 1), as the amount of effort has varied considerably since the beginning of the fishery in the late 1960s i.e., foreign licensed access has declined, effort was encouraged by subsidies in 1979 and 1981, an unknown amount of fish has been and may still be dumped, and effort is related to availability of more preferred, higher value species. These, and other factors, also result in CPUE data being of limited use.

Estimates of current biomass are not available and *CAY* cannot be estimated.

4.4.1 Auckland (East), Central (East) and South-East (Coast) (BAR 1)

MCY was estimated using the equation $MCY = cY_{AV}$ (Method 4), where Y_{AV} average estimated catch from 1968-1975 and $c = 0.7$. The estimated average catch includes 2000 t which is assumed to have been caught and either dumped or not reported. Fishing activity is assumed to have been on the total stock, even though the entire area was not fished. Due to problems with QMA boundaries not corresponding to the fishing history boundaries, 500 t is subtracted and added to BAR 7.

$$MCY = 0.7 * (12\ 000\ t - 500\ t) = 8050\ t.$$

The level of risk to the stock by harvesting the population at the estimated *MCY* value cannot be determined. However, the risk is probably low given the sustainability of catches at about the *MCY* level since 1970.

MCY has not been determined for the other Fishstocks.

4.5 Other factors

The relationship of the southern area stock to the east and west coast South Island stocks is uncertain, so these areas have been treated separately as in the past. However, if fish from BAR 5 overlap significantly with other South Island stocks, then the *MCYs* for all Fishstocks on the South Island may all need adjusting downward.

Barracouta are part of the shelf (30-300 m) mixed fishery and are usually the dominant species in these depths around the South Island (except perhaps in good red cod years in Canterbury Bight). Any increase or decrease in barracouta quotas will have overflow effects onto bycatch species. The economics of targeting on barracouta is probably affected by its availability relative to other more preferred species and this will, in turn, affect fishing patterns.

An analysis of trends in biomass of the Southland fishery suggests that recruitment may have been relatively low in the years after 1989 and that biomass may have declined between surveys by the *Shinkai Maru* (1981 and 1986) and the *Tangaroa* (annually 1993 to 1996). The scale of decline appeared to be greater than could be explained by different catching efficiency of the two vessels.

5. STATUS OF THE STOCKS

Estimates of current and reference biomass are not available for any barracouta stocks and therefore it is not known if current TACCs and recent catches are sustainable or whether they are at levels which will allow the stocks to move towards a size that will support the maximum sustainable yield.

BARRACOUTA (BAR)

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

		QMA	MCY	2011-12 Actual TACC	2011-12 Reported landings
Fishstock					
BAR 1	Auckland (East), Central (East), South-East (Coast)	1, 2, & 3	8 050	11 000	9 304
BAR 4	South-East (Chatham)	4	-	3 019	1 423
BAR 5	Southland, Sub-Antarctic	5 & 6	-	7 470	7 071
BAR 7	Challenger, Central (West), Auckland (West)	7, 8, & 9	-	11 173	8 645
BAR 10	Kermadec	10	-	10	0
Total				32 672	26 442

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