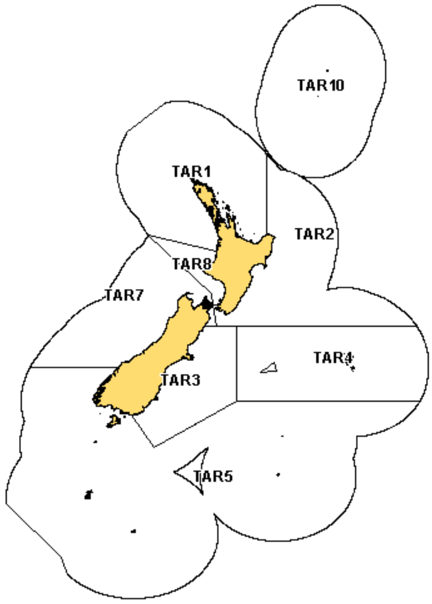
TARAKIHI (TAR)

(*Nemadactylus macropterus*)



1. FISHERY SUMMARY

(a) Commercial fisheries

Tarakihi are caught in coastal waters of the North and South Islands, Stewart Island and the Chatham Islands, down to depths of about 250 m. The fishery appears to have been relatively stable since the initial development phase. Between 1968 and 1985 domestic and foreign landings combined ranged between 4082 t and 6444 t, averaging 5042 t per year (Tables 1 and 2). Since the introduction of the QMS, the total landings have been around 5000-6000 t. Reported landings and actual TACCs are shown in Table 2.

Table 1: Reported total landings (t) of tarakihi from 1968 to 1982–83.

Year	Landings	Year	Landings	Year	Landings
1968	5683	1974	5294	1980–81 *	4990
1969	4082	1975	4941	1981–82 *	5193
1970	5649	1976	4689	1982–83 *	4666
1971	5702	1977	6444		
1972	5430	1978–79 *	4427		
1973	4439	1979–80 *	4344		

Source – MAF data.
* Sums of domestic catch for calendar years 1978 to 1982, and foreign and chartered vessel catch for fishing year April 1 to March 31.

Tarakihi are caught by commercial vessels in all areas of New Zealand from the Three Kings Islands in the north to Stewart Island in the south. The main fishing method is trawling. The major target trawl fisheries occur at depths of 100–200 m and tarakihi are taken as a bycatch at other depths as well. The major fishing grounds are west and east Northland (QMA 1), the western Bay of Plenty to Cape Turnagain (QMAs 1 and 2), Cook Strait to the Canterbury Bight (mainly QMA 3), and Jackson Head to Cape Foulwind (QMA 7). Around the North Island 70–80% of the tarakihi catch is targeted. Around the South Island only about 30% of the tarakihi are targeted; much of the remainder is reported as bycatch in target barracouta and red cod bottom trawl fisheries. In addition, there is a small target tarakihi setnet fishery off Kaikoura.

Table 2: Reported landings (t) of tarakihi by Fishstock from 1983–84 to 2005–06 and TACCs (t) from 1986–87 to 2005–06.

Fishstock	TAR 1		TAR 2		TAR 3		TAR 4		TAR 5	
FMA (s)	1 & 9		2		3		4		5 & 6	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC	Landings	TACC
1983–84*	1326	–	1118	–	902	–	287	–	115	–
1984–85*	1022	–	1129	–	1283	–	132	–	100	–
1985–86*	1038	–	1318	–	1147	–	173	–	48	–
1986–87†	912	1210	1382	1410	938	970	83	300	42	140
1987–88†	1093	1286	1386	1568	1024	1036	227	314	88	142
1988–89†	940	1328	1412	1611	758	1061	182	314	47	147
1989–90†	973	1387	1374	1627	1007	1107	190	315	60	150
1990–91†	1125	1387	1729	1627	1070	1148	367	316	35	153
1991–92†	1415	1387	1700	1627	1132	1148	213	316	55	153
1992–93†	1477	1397	1654	1633	813	1168	45	316	51	153
1993–94†	1431	1397	1594	1633	735	1169	82	316	65	153
1994–95†	1390	1398	1580	1633	849	1169	71	316	90	153
1995–96†	1422	1398	1551	1633	1125	1169	209	316	73	153
1996–97†	1425	1398	1639	1633	1088	1169	133	316	81	153
1997–98†	1509	1398	1678	1633	1026	1169	202	316	21	153
1998–99†	1436	1398	1594	1633	1097	1169	104	316	51	153
1999–00†	1387	1398	1741	1633	1260	1169	98	316	80	153
2000–01†	1403	1398	1658	1633	1218	1169	242	316	58	153
2001–02†	1480	1399	1742	1633	1244	1169	383	316	75	153
2002–03†	1517	1399	1745	1633	1156	1169	218	316	92	153
2003–04†	1541	1399	1638	1633	1089	1169	169	316	53	153
2004–05†	1527	1399	1692	1796	905	1403	262	316	57	153
2005–06†	1409	1399	1986	1796	1010	1403	339	316	62	153

	TAR 7		TAR 8		TAR 10			
	7		8		10		Total	
	Landings	TACC	Landings	TACC	Landings	TACC	Landings§	TACC
1983–84*	896	–	109	–	0	–	5430	–
1984–85*	609	–	102	–	0	–	4816	–
1985–86*	519	–	122	–	0	–	5051	–
1986–87†	904	930	185	190	0	10	4446	5160
1987–88†	840	1046	197	196	0	10	4855	5598
1988–89†	630	1059	121	197	0	10	4090	5727
1989–90†	793	1069	114	208	0	10	4473	5873
1991–92†	710	1087	190	225	2	10	5417	5953
1992–93†	929	1087	189	225	0	10	5158	5989
1990–91†	629	1087	131	225	<1	10	5086	5953
1993–94†	780	1087	191	225	0	10	4878	5990
1994–95†	978	1087	171	225	0	10	5129	5991
1995–96†	890	1087	105	225	0	10	5375	5991
1996–97†	1013	1087	133	225	0	10	5512	5991
1997–98†	685	1087	153	225	0	10	5287	5991
1998–99†	1041	1087	175	225	0	10	5501	5991
1999–00†	964	1087	189	225	0	10	5719	5991
2000–01†	1178	1087	178	225	0	10	5935	5991
2001–02†	1000	1088	223	225	0	10	6119	5993
2002–03†	1069	1088	211	225	0	10	6008	5993
2003–04†	1116	1088	197	225	0	10	5723	5993
2004–05†	1056	1088	184	225	0	10	5683	6390
2005–06†	1114	1088	285	225	0	10	6205	6390

* FSU data.
† QMS data.
§ Includes landings from unknown areas before 1986–87.

(b) Recreational fisheries

Tarakihi are taken by recreational fishers using lines and setnets. Estimates of recreational catch of tarakihi are given for three separate surveys in Tables 3 and 4. The most recent nationwide recreational survey was undertaken in 2001, but the results are still under review and are not currently available

Table 3: Estimated number and weight of tarakihi 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 and North in 1993–94 (Teirney et al., 1997).

		Total		
Fishstock	**Survey**	**Number**	**CV (%)**	**Survey harvest (t)**
TAR 1	North	333 000	15	225–400
TAR 1	Central	18 000	55	10–20
TAR 2	North	7000	–	0–5
TAR 2	Central	48 000	25	20–40
TAR 3	South	1000	–	0–5
TAR 5	South	1000	–	0–5
TAR 7	Central	29 000	25	5–15
TAR 7	South	6000	33	0–5
TAR 8	Central	10 800	60%	0–10

Table 4: Estimates of annual number and weight of tarakihi harvested by recreational fishers from national diary surveys in 1996 (Bradford, 1998) and Dec 1999-Nov 2000 (Boyd & Reilly, 2005). The mean weights used to convert numbers to catch weight are considered the best available estimates. Estimated harvest is also presented as a range to reflect the uncertainty in the point estimates.

Fishstock	Number caught	CV (%)	Estimated harvest range (t)	Point estimate (t)
1996				
TAR 1	498 000	8	280–330	305
TAR 2	114 000	14	55–75	65
TAR 3	3000	–	–	–
TAR 5	3000	–	–	–
TAR 7	69 000	13	20–30	24
TAR 8	46 000	17	25–35	28
1999/2000				
TAR 1	1 035 000	19	516-755	636
TAR 2	310 000	27	139-243	191
TAR 3	25 000	51	8-23	15
TAR 5	10 000	57	3-9	6
TAR 7	87 000	18	27–39	33
TAR 8	66 000	38	19-42	30

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 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. FMA 2 catches are nevertheless considered to be an 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.

The TAR 1 recreational harvest estimated during the 1999/2000 survey was almost half (i.e. 46%) of the commercial catch over that period.

(c) Maori customary fisheries

No quantitative information on the level of Maori customary fishing is available.

(d) Illegal catch

No quantitative information on the level of illegal tarakihi catch is available.

(e) Other sources of mortality

No information is available.

2. BIOLOGY

Sexual maturity is reached at 25–35 cm fork length (FL) at an age of 4–6 years, after which the growth rate slows. This species reaches a maximum age of 40+ years.

Tarakihi spawn in summer and autumn in several areas around New Zealand. The three main identified spawning grounds are Cape Runaway to East Cape, Kaikoura to Pegasus Bay, and the west coast of the South Island near Jackson Bay.

Few larval and postlarval tarakihi have been caught and identified. The postlarvae appear to be pelagic, occur in offshore waters, and are found in surface waters at night. Postlarval metamorphosis to the juvenile stage occurs in spring or early summer when the fish are 7–9 cm FL and 7–12 months old.

Several juvenile nursery areas have been identified in shallower, inshore waters, including the southwest coast of the North Island, Tasman Bay, near Kaikoura, northern Pegasus Bay, Canterbury Bight, Otago and the Chatham Islands. Juveniles move out to deeper water at a length of about 25 cm FL at an age of 3–4 years. Only a small proportion of tarakihi found in commercial catches are immature, suggesting that they do not become vulnerable to fishing operations until they reach sexually maturity.

The results of tagging experiments carried out near Kaikoura during 1986 and 1987 indicate that some tarakihi are capable of moving long distances. Fish have been recaptured from as far away as the Kaipara Harbour on the west coast of the North Island, south of Whangarei on the east coast of the North Island, and Timaru on the east coast of the South Island.

The best available estimate of M is a value of 0.10 as determined from the age frequency distribution of unexploited and lightly exploited populations. Estimates of Z for the area near Kaikoura made during 1987 ranged from 0.12–0.16 for fish between 8 and 20 years old. Assuming M = 0.10 suggests that F ranged between 0.02–0.06. Estimates of Z for the area near the Chatham Islands made during 1984 were equal to or less than 0.20.

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

Table 5: Estimates of biological parameters of tarakihi.

Fishstock	**Estimate**						**Source**
1. Natural mortality (M)							
All	0.08–0.15						Annala (1987)
	M = 0.10 considered best estimate for all areas for both sexes						Annala et al. (1989, 1990)
2. Weight = a (length)^b (Weight in g, length in cm fork length)							
		Females		**Males**			
	a	**b**	**a**	**b**			
TAR 3	0.0400	2.79	0.0433	2.77			Annala et al. (1990)
TAR 4	0.023	2.94	0.017	3.02			Annala et al. (1989)
3. von Bertalanffy growth parameters							
		Females			**Males**		
	K	**t_0**	**L_∞**	**K**	**t_0**	**L_∞**	
TAR 3	0.2009	– 1.103	44.6	0.2085	– 1.397	42.1	Annala et al. (1990)
TAR 4	0.2205	– 1.026	44.6	0.1666	– 2.479	44.7	Annala et al. (1989)
TAR 7	0.2210	– 0.690	46.1	0.2510	– 0.550	43.2	Stevenson & Horn (2004)

3. STOCKS AND AREAS

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

The results of tagging experiments have shown that tarakihi move large distances around the coasts of the main islands of New Zealand. The long pelagic larval phase of 7–12 months indicates that larvae will also be widely dispersed. Taken together with the lack of any evidence of genetic isolation, this suggests that tarakihi around the main islands of New Zealand consist of one continuous stock, and for stock assessment purposes they are considered to be one stock. However, because of the large distance between the mainland and the Chatham Islands, and the separation of these two areas by water deeper than that which is usually inhabited by adult tarakihi, the tarakihi around the Chatham Islands are considered to be a separate stock.

A second species of tarakihi, "king" tarakihi, has recently been described. Catches of this newly described species have been reported as *N. macropterus* in the past.

4. STOCK ASSESSMENT

There are no new data which would alter the yield estimates given in the 1996 Plenary Report. The yield estimates are based on commercial landings data. Estimates of fishery parameters are given in Table 6.

(a) Estimates of fishery parameters and abundance

(i) Biological parameters

Table 6: Estimates of fishery parameters for tarakihi.

	Fishstock	Estimate	Comments	Source
1. Fishing mortality (F)				
	TAR 3	0.02–0.06	For both sexes during 1987	Annala et al. (1990)
	TAR 4	≤0.10	For both sexes during 1984	Annala et al. (1989)
2. Total mortality (Z)				
	TAR 3	0.12–0.16	For both sexes during 1987	Annala et al. (1990)
	TAR 4	≤0.20	For both sexes during 1984	Annala et al. (1989)
3. $F_{0.1}$				
Females	TAR 3	0.11	With M = 0.10	Annala et al. (1990)
	TAR 4	0.11	With M = 0.10	Annala et al. (1989)
Males	TAR 3	0.12	With M = 0.10	Annala et al. (1990)
	TAR 4	0.11	With M = 0.10	Annala et al. (1989)

(ii) Trawl survey indices

Indices of relative biomass are available from recent *Kaharoa* trawl surveys in TAR 2, TAR 3 and TAR 7 (Table 7). Note that these estimates were revised in 1996 as a result of new doorspread estimates becoming available from SCANMAR measurements. In TAR 2 and TAR 3 no trend is apparent in the biomass estimates. In TAR 7 the biomass estimates declined from 1992 to 2003 with a dramatic increase in 2005. Relative biomass indices are currently being used to estimate biomass and yields for TAR 7. Results will be available in early 2008.

Table 7: Relative biomass estimates (t) and coefficients of variation (CV) for tarakihi available from trawl survey data. S = summer and W = winter survey (Note: because trawl survey biomass estimates are indices, comparisons between different seasons e.g. summer and winter in the same area are not strictly valid).

QMA	Area	Year	Trip Code	Biomass (t)	CV (%)
TAR 2	Cape Runaway to Cook Strait	1993	KAH9304	885	27
		1994	KAH9402	1128	20
		1995	KAH9502	791	23
		1996	KAH9602	943	15
TAR 3	Pegasus Bay to Canterbury Bight	1991 W	KAH9105	1657	33
		1992 W	KAH9205	932	26
		1993 W	KAH9306	3805	55
		1994 W	KAH9406	2050	41
		1996 W	KAH9606	1656	24
		1996 S	KAH9618	3818	21
		1997 S	KAH9704	2036	24
		1998 S	KAH9809	4277	24
		1999 S	KAH9917	2606	15
		2000 S	KAH0014	1510	13

Table 7 ***(Continued)***

TAR 7	Tasman Bay to Haast	1992	KAH9204	1409	14
		1994	KAH9404	1420	14
		1995	KAH9504	1389	11
		1997	KAH9701	1087	12
		2000	KAH0004	964	19
		2003	KAH0304	912	20
		2005	KAH0503	2050	12

Summer surveys in the Bay of Plenty (from Mercury Islands to Cape Runaway) have been carried out since 1983. The surveys were extended to 250 m, in February 1996 (KAH9601) and 1999 (KAH9902), so that tarakihi depths would be covered. However, the estimates of biomass were low (35 t CV 46% in 1996 and 50 t CV 27% in 1999). Most of the catch in the 1999 survey was taken in 150 to 200 m.

(iii) CPUE analysis

Standardised CPUE indices (1989/0 -1998/99) were estimated for the bottom trawl fisheries in TAR 1W, 1E, 2, 3, and 7, and the setnet fishery in TAR 3 as a possible means of monitoring abundance in these areas (Hanchet & Field, 2001). All trawls where tarakihi were targeted and/or caught were extracted from the TCEPR and CELR databases. Linear models of log (catch/hour/vessel day) were calculated for each area. For the bottom trawl fisheries, standardised CPUE was estimated for all vessels combined and for a subset of vessels with a continuous representation in the fishery. In all cases there was little difference in the indices resulting from the two datasets. However, the all vessels models generally explained more of the variation in CPUE than the subset models, had 1.5–2 times the amount of data, and lower standard deviations.

An update of the TAR 2 bottom trawl indices (1989/90 – 2001/02) revealed that analyses using all vessels and the subset (with continuous representation in the fishery) had similar indices and explained similar amounts of variation in the data (Figure 1). However, the diagnostics for the core vessels were superior, so it is recommended that core vessel results be used in any modelling.

Based on the results of the initial analysis (Hanchet & Field, 2001), the Inshore FAWG concluded that the CPUE analyses calculated for TAR 3 from bottom trawl data were probably not tracking abundance. More recent analyses (SeaFIC, 2003), based on both lognormal (successful tows) and binomial (probability of zero catch) indices, and spanning a longer period (1989/90 – 2001/02), have, however, shown more promise.

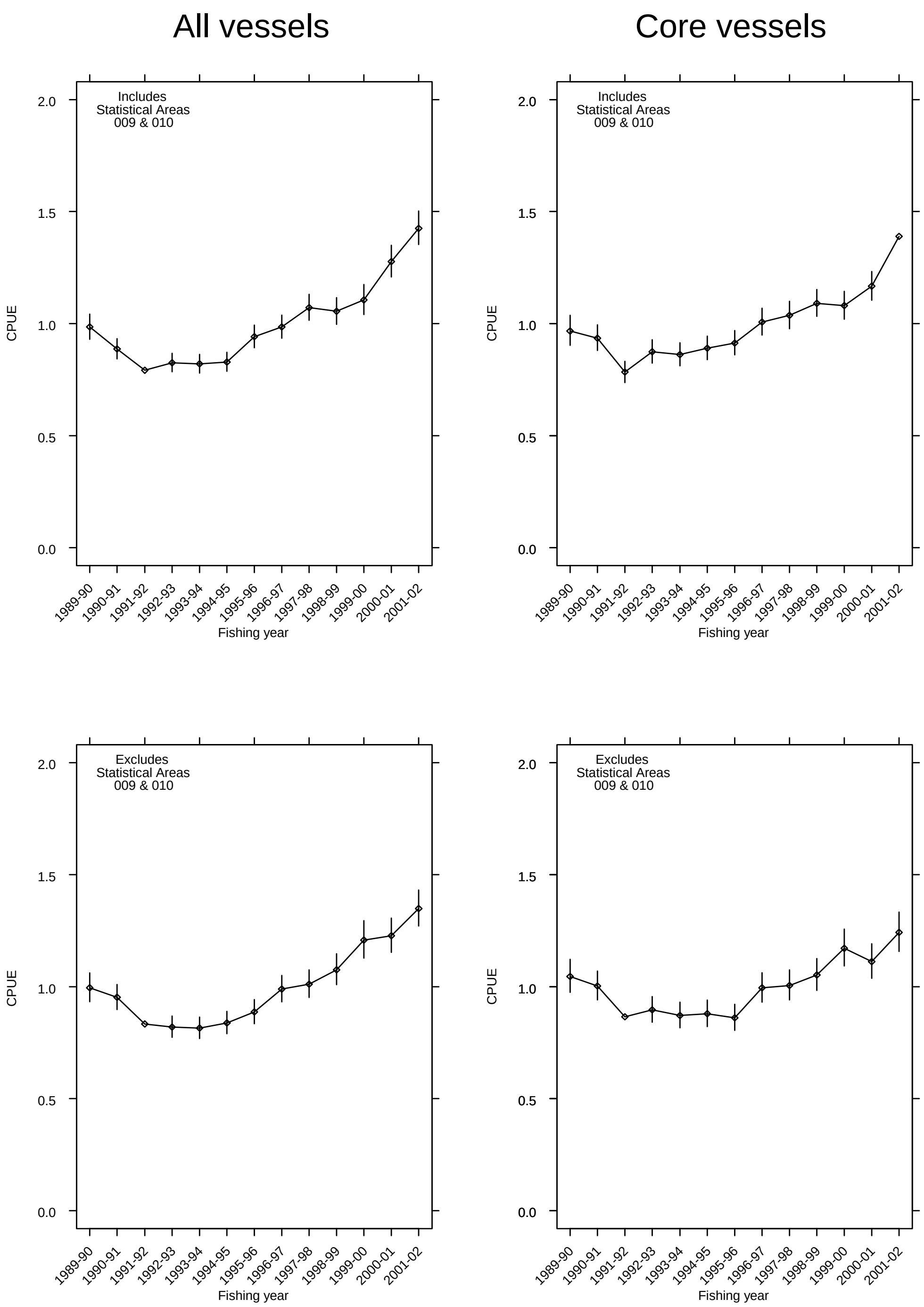


Figure 1: Relative year effects and approximate 95% confidence intervals for TAR 2 by vessel selection and Statistical area. Top left, all vessels including Statistical areas 009 & 010; top right, core vessels including Statistical areas 009 & 010; bottom left, all vessels excluding Statistical areas 009 & 010; bottom right, core vessels excluding Statistical areas 009 & 010.

TAR 1W, 1E, and 2

The indices for TAR 1W, 1E and 2 are based on relatively large data sets, and most of the tarakihi catch is targeted. The Working Group considered that the indices are probably monitoring tarakihi abundance in these areas. TAR 1 indices were recently updated to 2003/04 (Kendrick, 2006). Standardized CPUE series for the West Coast and East Northland showed some structure, possibly related to recruitment strength, but no overall trend between 1989/90 and 2003/04. Standardized CPUE in the Bay of Plenty was reasonably stable until 1999/2000 and then increased sharply, possibly as a result of good recruitment in 2000/01. Standardized CPUE indices based on successful tows from the TAR 2 bottom trawl fishery declined slightly from 1989/90 to 1991/92, followed by moderate annual increases until 2001/02.

TAR 3, 7

In TAR 3 and 7, tarakihi are mainly reported as bycatch of the red cod and barracouta fisheries. This partly reflects the mixed species nature of these fisheries, but also the target species nominated to allow the bycatch trade. Standardised trawl CPUE for TAR 3 has increased steadily since 1992/93. Although equivalent estimates for the setnet fishery have been fairly stable, the trawl CPUE is regarded to be a better index of abundance owing to much better spatial coverage (Figure 2). The Working Group considered that the CPUE indices calculated for TAR 7 (1989/90 – 1998/99) were not monitoring tarakihi abundance in the area, and rejected them as indices of abundance.

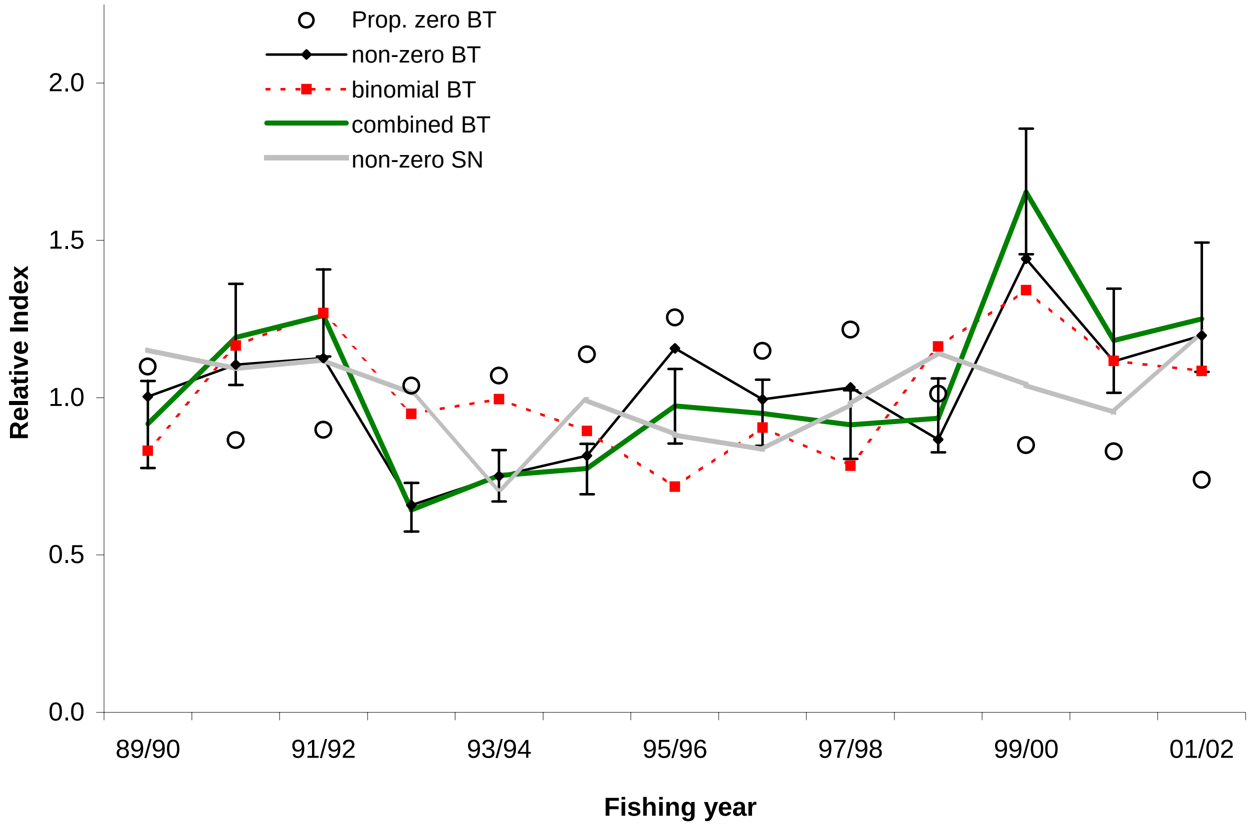


Figure 2. Plot of the lognormal, binomial and combined models from the east coast South Island bottom trawl fishery (SeaFIC, 2003). Error bars for the combined BT index are 95% bias corrected confidence intervals based on 1000 bootstrap replicates. Also shown is the proportion of zero trips in the BT fishery and the lognormal index from the Area 018 setnet fishery. All indices and the proportion of zero catches have been standardised relative to the geometric mean of each series.

(b) Biomass estimates

Estimates of current absolute biomass are not available.

(c) Estimation of Maximum Constant Yield (MCY)

(i) North and South Islands (all areas except TAR 4 & 10)

MCY was estimated using the equation MCY = cY_{av} (Method 4). Y_{av} was the average of the combined domestic and foreign landings from 1968 to 1985 (5042 t). This period was one of comparative stability following the developmental phase of the fishery, and fishing mortality and effort were assumed to be relatively constant. Natural mortality is low (0.08 to 0.15), the species is long lived (40+ years), and there are generally at least 10 year classes in the fishery. Recruitment is not known to vary much. The value of c was set at 0.9 based on the estimate of M = 0.10.

$$MCY = 0.9 * 5042 \text{ t} = 4538 \text{ t (rounded to 4540 t)}.$$

The MCY estimate has not changed since 1989.

(ii) Chatham Islands (TAR 4)

MCY cannot be determined.

(d) Estimation of Current Annual Yield (CAY)

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

Yield estimates are summarised in Table 8.

Table 8: Yield estimates (t) of tarakihi.

Parameter	Fishstock	Estimate
MCY	All except TAR 4 & 10	4 540
CAY	All	Cannot be determined

5. ANALYSIS OF ADAPTIVE MANAGEMENT PROGRAMMES (AMP)

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 Adaptive Management Programme 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.

TAR 2

TAR 2 TACC was increased by 10% (from 1633 to 1796 t) under AMP management, on 1 October 2004.

Mid-term Review of TAR 2 AMP in 2007

In 2007 the AMP FAWG reviewed the performance of the AMP (Anon, 2007) after one year of the current 5-year term. The WG noted:

Characterisation

- A description of the vessels used is needed; 52 vessels landed 92% of the catch.
- More characterisation of the fishery is needed. More detailed effort data may provide information on how the fishery has changed, in particular, fishing methods. Core vessels need to be identified. The distribution of underlying data should be presented and coefficients plotted.

CPUE Analysis

- There was possibly a problem with the data presented as the fishing year was defined incorrectly. October, November and December seem to have been assigned to the previous fishing year.
- The CPUE analysis needs to include zero catches.
- The unstandardised CPUE was not in the correct units as it should use in tonnes per hour so that it is comparable to the standardised CPUE.
- The shift over to TCEPR was gradual but there is a jump in CPUE followed by a decline in CPUE and the Working Group needs more detail to try and explain what is happening. The working group needs to see the plots of all relevant data that may suggest what is causing the declining CPUE as it may be a data issue e.g. has there been an increase in tow duration, or a change in some other variable. What were the effects of fishing duration by statistical area?
- Twin rig boats have entered the inshore fishery in the last 3-5 years, which may affect the CPUE data. This needs further investigation.

Logbook Programme

- Note that this is a shed sampling programme and not a true logbook. There are some problems with the samples as it cannot be determined where all the catch comes from.
- It may be better to select tows randomly and collect a sample and then sample that portion of the catch. This would give tow by tow information which will be much more valuable than the current data collection procedure. This would have to have all the associated effort information relevant to a TCEPR form.

Environmental Effects

- 98-99% of the catch is from bottom trawls and there has been an increase in the number of smaller vessels with no quantifiable environmental data recorded. The following data are therefore subjective.
- There are no observer data and few data from the Department of Conservation on seabirds. The three main concerns are:
    - Discarding of bycatch - typically no discarding while towing.
    - Exposure to warps - but low warps of small vessels reduces risk.
    - Entanglement on surface - short time the net on the surface as vessels are small so risk is lower than for large vessels.
- There is no code of practice in this fishery.
- Marine mammals: There have been no captures of hectors or Maui dolphins and few interactions with bottlenose dolphins. Larger dolphins such as pilot whales and orcas are not thought to be caught.
- Fur seals are a possible bycatch but no data is available.
- Effects on benthos are great as it is mostly a bottom trawl fishery.
- The working group would like to see the distribution of fishing effort over time to see if the fishery has increased spatially over the AMP as the total number of tows has increased. The specifics of the incremental effects of the AMP on all aspects of the environment are needed.

TAR 3

The TAR 3 TACC by 20%, from 1169 t to 1403 t, under AMP management, on 1 October 2004.

<u>Mid-term Review of TAR 3 AMP in 2007</u>

In 2007 the AMP FAWG reviewed the performance of the logbook monitoring programme. The WG noted:

Catch History

- The TACC for tarakihi was set at 970 t when the stock first entered the QMA in 1986/87. This was sequentially raised in response to appeals to 1169 t by 1993/94. The TACC was increased by 20% in October 2004 from 1169 t to 1403 t when it entered the AMP programme. An additional allowance for recreational and customary catches brought the total TAC to 1503 t.
- The tarakihi fishery has a long history, being the third most important species in domestic catches until the mid 1970s. Substantial unreported catches were also made at that time by foreign vessels.
- Past reporting areas differ from current QMA boundary definitions, but an approximate reconstructed catch history for TAR 3 estimates that catches doubled after 1945 from ~1000 t to about the 2000 t level, around which catches fluctuated until the mid 1960s. Average annual catches over the 22 year period from 1945 - 1966 were ~1760 t.
- Catches dropped sharply back to the ~100 t level in 1967, primarily as a result of many east coast fishing vessels departing to participate in the Chatham Islands rock lobster fishery at the time. Subsequent catches over the period 1970 to 1986 fluctuated between about 650 t – 1350 t.
- TAR 3 catches fluctuated from 750 t to 1200 t until 1998/99, and then exceeded the TACC from 1999/00 to 2001/02, prompting the request for entry into an AMP. However, catches immediately declined to <1000 t, well below the previous TACC, and have remained at about the 1000 t level.
- Estimates of recreational tarakihi catch are highly uncertain, but the recreational catch is unlikely to exceed 10 t per year.

Fishery Characterisation

- 70% of the QMA 3 tarakihi catch is taken in the bottom trawl fisheries targeting red cod, tarakihi, barracouta and flatfish. There is a high level of targeting, and 40% of the TAR 3 catch is taken in the tarakihi targeted trawl fishery. The remaining 30% of the catch is virtually all taken in the setnet fishery.
- Trawled tarakihi are mainly caught in the Pegasus Bay and Canterbury Bight areas, with reasonable catches in the Kaikoura area. The setnet catch is almost all taken in the Kaikoura area.
- The bottom trawl fishery takes tarakihi throughout the year, whereas the setnet fishery is a seasonal late summer - autumn, from December - June.

CPUE Analysis

- Two fishery definitions were used in developing standardised CPUE indices for TAR 3: the bottom trawl fishery targeting red cod, tarakihi and barracouta, and the tarakihi-targeted setnet fishery.
- CPUEs for these fishery definitions were standardised using a lognormal model based on non-zero catches. In additional, a binomial model was used to investigate the effect of changing proportion of non-zero catches.
- The standardised bottom trawl index shows a generally increasing trend in catch rate from 1989/90 to a peak in 1999/00, followed by a marked decline to near the lowest levels in the series by 2005/06. Standardisation has a substantial effect on recent CPUE, converting the increase in unstandardised CPUE in the past few years into a decline. Increased targeting for tarakihi appears to be the main cause of this standardisation effect.
- The setnet index shows a similar trend, except that it shows a trough in catch rates where the trawl index shows a peak in 1999/00, and is rather stable from 1989/90 to 1998/99. It is not clear whether the inverse relationship between the two series in 1999/00 may have resulted

from a shift in catchability from the setnet fishery to the trawl fishery in that year. The decline 2001/02 to 2005/06 is similar in the two series.

- The Working Group noted that increased targeting may not be the entire cause of the changes seen in standardisation, and concluded that area effects were probably being underestimated as a result of combining areas, and due to vessels aliasing for area. The Working Group recommended that trawl CPUE analyses should be conducted separately for north and south of the Banks Peninsula in the full-term review.

Trawl Surveys

- Indices of tarakihi abundance were produced by the five ECSI winter trawl surveys from 1991 - 1996, and the four summer trawl surveys from 1997 - 2001. However, these surveys primarily catch pre-recruit tarakihi, and show very low precision and high inter-annual variability. These surveys therefore do not appear to have provided reliable abundance estimates for tarakihi.
- Tarakihi has been included in the ECSI winter trawl survey programme when these surveys resume in May/June 2007, and is one of the species for which these surveys will be optimised.

Logbook Programme

- A bottom trawl logbook programme was initiated by the SE Finfish Management Company in 2002, primarily as part of the ELE 3 AMP proposal. The program was only extended to tarakihi in 2004/05.
- Although quite a few vessels participated (11 and 7), coverage of TAR 3 catch has been very low in the two years of this program, achieving 3.1% in the first year, and declining to only 0.6% in 05/06. The numbers of fish sampled were 361 and 416.
- The program has been focussed in area 22, and failed to sample catches in the equally important area 20. Seasonal coverage has also been poor.
- Length-frequency distributions of fish sampled differ between the two years, with a spread of larger fish above the mode in 2005/06.
- Noting the possibility of different tarakihi stock components north and south of Banks Peninsula, the Working Group emphasized the need to ensure representative logbook coverage of the Pegasus Bay area as well.

Effects of Fishing

- A general overview of the effects of setnet and trawl fishing along the South Island East Coast is presented under AMP reviews for SPO 3, SCH 3 and GUR 3.
- No additional information was presented on specific effects of the ELE 3 fishery.
- It was noted that current TACC catches under the AMP do not represent an increase over recent historic levels, and are about half the catch levels in the 1950s and 1960s. It is unlikely that the AMP has had much effect in increasing the area or intensity of fishing impacts.

Conclusions

- The standardised bottom trawl CPUE index indicates that abundance is near its lowest point across the series, having declined steadily from a peak in 1999/00. However, the Working Group noted that the bottom trawl fishery catches smaller fish, and primarily provides a recruitment index. Trends in the trawl fishery also appear to have resulted to a large extent from increased targeting and/or shifts between areas. It is therefore difficult to interpret to what extent this is an index of abundance.
- The setnet fishery is indexing the adult population, and this index is flatter, but still shows a declining trend since 2001/02, similar to that in the trawl index.

6. STATUS OF THE STOCKS

TAR 1
Based on relatively stable indices of abundance current catches and the TACC for TAR 1 appear to be sustainable.

TAR 2
An abundance index of that has increased consistently since 1990/91 suggests that the current TACC (little change since 1988/89) for TAR 2 is sustainable.

TAR 3
For TAR 3 estimates made in the mid 1980s indicated that F was less than $F_{0.1}$. These estimates are probably still relevant due to the long, stable catch history in these areas. Levels of F near or below $F_{0.1}$ are generally considered sustainable. The increasing trend in the TAR 3 CPUE index (1989/90 - 2001/02) further indicates that current TACC and catch levels are sustainable.

TAR 4
For TAR 4, the fishery around the Chatham Islands has generally been lightly fished and the stock can probably support higher catch levels for the next few years.

Overall, landings from the North and South Islands have remained relatively stable, since at least the late 1960s, despite changes in effort and methods of fishing. Given the long, stable catch history of this fishery, current catch levels and TACCs are thought to be sustainable. However, for all Fishstocks it is not known if the current TACCs and recent catch levels will allow the stocks to move towards a size that will support the maximum sustainable yield.

Yield estimates, TACCs and reported landings for the 2005/06 fishing year are summarised in Table 9.

Table 9: Summary of yield estimates (t), TACCs (t) and reported landings (t) of tarakihi for the most recent fishing year.

Fishstock	**QMA**		**MCY**	**2005–06 Actual TACC**	**2005–06 Reported landings**
TAR 1	Auckland (East) (West)	1 & 9		1399	1409
TAR 2	Central (East)	2		1796	1986
TAR 3	South–East (Coast)	3	4540	1403	1010
TAR 4	South–East (Chatham)	4	–	316	339
TAR 5	Southland and Sub–Antarctic	5 & 6		153	62
TAR 7	Challenger	7		1088	1114
TAR 8	Central (West)	8		225	285
TAR 10	Kermadec	10	–	10	0
Total				6390	6205

7. FOR FURTHER INFORMATION

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