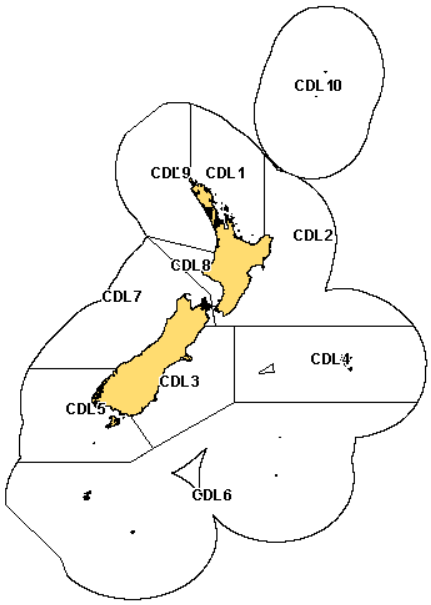
BLACK CARDINALFISH (CDL)

(Epigonus telescopus)
Akiwa



1. FISHERY SUMMARY

1.1 Commercial fisheries

Several species of *Epigonus* are widely distributed in New Zealand waters, but only black cardinalfish (*E. telescopus*) reaches a marketable size and is found in commercial concentrations. It occurs throughout the New Zealand EEZ at depths of 300–1100 m, mostly in very mobile schools up to 150 m off the bottom over hills and rough ground. Black cardinalfish have been caught since 1981 by research and commercial vessels, initially as a bycatch of target trawling for other high value species. The preferred depth range of schools (600–900 m) overlaps the upper end of the depth range of orange roughy and the lower end of alfonsino and bluenose. The exploitation of these species from 1986 resulted in the development of the major cardinalfish fishery in QMA 2.

It is sold on the domestic rather than the export market due to the short freezer life of fillets. The species has a section of dark flesh under the lateral line that has caused problems with overseas marketing. The fillets can be tainted if this flesh is not removed quickly.

Estimated landings available from various sources (since 1982–83) are summarised by fishing year in Table 1. For the 1982–83 to 1985–86 fishing years, the best estimate of landings was the sum of the FSU Inshore and FSU Deepwater, (i.e., FSU Total) catch returns. For 1986–87 to 1988–89 the best estimate was taken as the greater value of either the FSU Total or the LFRR. From the 1989–90 fishing year, the best estimate was taken as the higher of either the LFRR or the sum of the CLR and CELR Landed data. In theory, the CELR estimated and landed values produced by the smaller (generally inshore) vessels should be approximately equal. Larger (deep water) vessels provide TCEPR estimated and processed totals and a CLR total which should also be comparable. However, there are numerous reasons for differences between these columns of data (see Field *et al*. 1997). Landings for 1998–99 to 2003–04 are from QMR totals following introduction of the species into the QMS for 1998–99. The best estimate of total landings derived above was split between the nine QMAs and ET (outside the EEZ) based on FSU and QMS data (Table 2). For FSU data (1982–83 to 1987–88 fishing years), catch where area was unknown was pro-rated to QMAs according to the catch level where area was reported. For QMS data (1988–89 to 1994–95 fishing years), catch by area in CELR Landed and CLR reports were scaled to equal the best estimate of the total catch presented in Table 1. Commercial landings of black cardinalfish have been made in QMAs 1–9 and outside the EEZ (ET).

In most years since 1982 more than 65% of black cardinalfish landings were from the east coast of the North Island (QMA 2). The large increase in landings from this area in 1986–87 was associated with the development of the orange roughy fishery around the Ritchie Banks and Tuaheni High, and an increase in targeted fishing to establish a catch history when it was anticipated to become a quota species. Landings from the Bay of Plenty (QMA 1) have fluctuated since 1988. The relatively large landings in 1990–91 were a combination of bycatch of the orange roughy fishery and target fishing for black cardinalfish. Since 1992 large catches have been taken from outside the EEZ on the northern Challenger Plateau and the Lord Howe Rise.

Black cardinalfish was introduced into the QMS on 1 October 1998 and quotas were set for QMAs 2–8. Quotas for QMAs 1 and 9 were subsequently set for 1999–00. TACCs were increased from 1 October 2006 in CDL 4 to 66 t and in CDL 5 to 22 t. In these stocks landings were above the TACC for a number of years and the TACCs have been increased to the average of the previous 8 years plus an additional 10%.

Table 1: Reported landings (t) of black cardinalfish by fishing year, from various sources. –, no data.

Year	FSU			CELR		TCEPR		CLR	LFRR	Best estimate
	Inshore	Deepwater	Total	Estimated	Landed	Estimated	Processed			
1982–83	<1	77	78	–	–	–	–	–	–	78
1983–84	30	190	220	–	–	–	–	–	–	220
1984–85	54	478	532	–	–	–	–	–	–	532
1985–86	209	83	292	–	–	–	–	–	–	292
1986–87	972	131	1 103	–	–	–	–	–	1 814	1 814
1987–88	572	1 066	1 638	–	–	–	–	–	1 427	1 638
1988–89	351	577	928	35	25	133	133	244	1 800	1 800
1989–90	–	–	–	2 499	1 633	329	3	714	2 385	2 385
1990–91	–	–	–	2 186	1 353	152	57	2 958	4 284	4 311
1991–92	–	–	–	187	199	987	120	1 639	1 653	1 838
1992–93	–	–	–	211	113	1 536	175	2 051	2 366	2 366
1993–94	–	–	–	348	210	2 692	154	3 591	3 793	3 801
1994–95	–	–	–	231	153	2 621	78	3 218	3 710	3 710

Table 2: Reported landings (t) of black cardinalfish by QMA and fishing year (1 October to 30 September) from 1982–83 to 2006–07. The data in this table has been updated from that published in previous Plenary Reports by using the data through 1996–97 in table 32 on p. 262 of the "Review of Sustainability Measures and Other Management Controls for the 1998–99 Fishing Year – Final Advice Paper" dated 6 August 1998. Data for 1997–98 based on catch and effort returns, since 1998–99 on QMR records. –, no data.

Year	QMA 1	2	3	4	5	6	7	8	9	Total (EEZ)	ET	Total
1982–83	–	76	<1	<1	–	–	<1	–	–	78	–	78
1983–84	–	212	7	<1	–	–	<1	–	–	220	–	220
1984–85	<1	189	341	<1	–	–	1	–	–	532	–	532
1985–86	<1	238	50	3	2	–	<1	–	45	292	–	292
1986–87	1	1 738	72	2	<1	<1	<1	–	–	1 814	–	1 814
1987–88	3	1 556	28	1	3	–	2	<1	<1	1 638	–	1 638
1988–89	305	1 434	57	4	–	–	2	–	–	1 798	2	1 800
1989–90	613	1 718	20	18	–	–	15	–	–	2 385	<1	2 385
1990–91	233	3 473	598	1	4	–	1	<1	–	4 311	–	4 311
1991–92	7	1 652	146	3	<1	2	11	–	–	1 821	17	1 838
1992–93	23	1 550	519	2	<1	–	2	–	–	2 096	270	2 366
1993–94	364	2 310	277	10	5	–	6	–	–	2 972	829	3 801
1994–95	1 162	2 207	51	7	1	<1	51	–	<1	3 479	231	3 710
1995–96	1 418	2 621	57	4	10	–	26	–	–	4 150	340	4 490
1996–97	2 001	1 910	100	7	–	–	27	–	–	4 045	522	4 567
1997–98	995	1 176	40	351	–	–	76	–	108	2 338	405	2 743
1998–99	24	1 268	181	41	–	<1	16	<1	<1	1 531	390	1 921
1999–00	980	2 158	215	36	<1	<1	27	0	<1	3 415	962	4 377
2000–01	294	1 135	99	35	74	<1	2	0	3	1 642	571	2 213
2001–02	455	1 693	146	29	18	<1	3	0	5	2 349	490	2 839
2002–03	583	1 845	172	80	9	<1	27	0	5	2 721	275	2 996
2003–04	481	966	96	148	27	<1	2	0	6	1 727	58	1 785

Table 2 (*Continued*):

									QMA	Total		
Year	1	2	3	4	5	6	7	8	9	(EEZ)	ET	Total
2004–05	267	1 102	43	49	15	<1	2	0	1	1 479	204	1 683
2005–06	643	2 153	50	53	<1	<1	<1	0	2	2 901	44	2 945
2006–07	415	1 692	66	31	10	<1	1	0	1	2 216	2	2 218
TACC	1 200	2 223	196	66	22	1	39	0	4	3 751	–	3 670

1.2 Recreational fisheries

There is no known current recreational fishery for black cardinalfish.

1.3 Customary non-commercial fisheries

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

1.4 Illegal catch

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

1.5 Other sources of mortality

A known source of mortality for black cardinalfish has been the discarding at sea of this species while target fishing for higher value species.

2. BIOLOGY

The average size of black cardinalfish landed by the commercial fishery is about 50–60 cm fork length (FL). Length frequency distributions from research surveys are unimodal with a peak at 55–65 cm FL. They reach a maximum length of about 75 cm FL. Unvalidated otolith readings from over 700 fish from QMA 2 indicate that this species is relatively slow-growing and long lived. Maximum ages of over 100 years were reported, with the bulk of the commercial catch being between 35 and 55 years of age. Life history parameters are given below in Table 3.

Table 3: Life history parameters for black cardinalfish (derived from fish in QMA 2).

Fishstock	Estimate	Source
1. Natural mortality (M)	0.034	(Tracey *et al*. 2000)
Age at recruitment (A_r)	45	(Tracey *et al*. 2000)
Age at maturity (A_s)	45	(Tracey *et al*. 2000)
Gradual recruitment (S_r)	13	
Gradual maturity (S_m)	13	

2. Weight = a(length) (Weight in g, length in cm fork length).

Both sexes	
A	b
0.027	2.87

3. Von Bertalanffy growth parameters (Tracey *et al*. 2000)

Both sexes			Female			Male		
L_∞	k	t_0	L_∞	k	t_0	L_∞	K	t_0
70.8	0.034	-6.32	70.9	0.038	-4.62	67.8	0.034	-8.39

The reproductive biology of black cardinalfish is not well known. Indications from research survey and Observer Programme data are that spawning may occur in May–June. A probit analysis indicates fish become sexually mature at around 50 cm length, at an age of approximately 35 years.

Prey items from research trawl samples include mesopelagic fish, natant decapod prawns and octopus.

Elevated levels of mercury (Hg) have been recorded in a sample of black cardinalfish from the Bay of Plenty. The mean mercury level was 1.47 $mg.kg^{-1}$ (range 0.59–2.15), which is well above the maximum permissible level of 0.5 $mg.kg^{-1}$ set by the New Zealand Department of Health.

3. STOCKS AND AREAS

It is not known if there is more than one stock of black cardinalfish in New Zealand. There are no data on genetics, distribution of spawners, or movement of black cardinalfish which indicate possible stock boundaries.

4. STOCK ASSESSMENT

The first stock assessment for black cardinalfish was conducted in 1997, although no estimates of biomass or yield were made. A new assessment for QMA 2 was attempted in 2001 using abundance indices from a standardised CPUE analysis and new estimates of age and growth from QMA 2 fish. However, this assessment was not accepted by the Plenary. Further CPUE analyses were completed by Dunn (2007).

4.1 Estimates of fishery parameters and abundance

Standardised CPUE indices were calculated for the cardinal fishery in QMA 2. A regression analysis was applied to four alternative sets of catch-effort data: all tows (from 1990–91), only short tows, Tuaheni target tows and a short Tuaheni series from 1994–95 (Dunn 2007). However, the analysis was very uncertain and the models accounted for up to 19% only of the variance in catch rates.

Unstandardised CPUE (t/tow) are given in Table 4 for the 2 main fisheries on the ECNI at Tuaheni and the Ritchie Bank and Rockgarden fishery. At Tuaheni the catch rates declined rapidly when the fishery began but have been variable since. In the other fishery CPUE shows no trend and may be unrelated to abundance.

Table 4: Unstandardised CPUE (t/tow) for cardinalfish in the target cardinalfish fishery in East Cape (QMA 2).

(a) Tuaheni

Fishing year	Total tows	P(zero)	Unstandardised CPUE (t/tow)
1990–91	219	0.49	7.6
1991–92	48	0.58	8.5
1992–93	55	0.45	6.0
1993–94	99	0.51	4.4
1994–95	93	0.42	6.2
1995–96	154	0.48	2.4
1996–97	183	0.53	2.4
1997–98	47	0.72	0.2
1998–99	105	0.70	1.9
1999–00	150	0.61	2.9
2000–01	136	0.38	2.5
2001–02	143	0.48	3.5
2002–03	275	0.54	2.8
2003–04	134	0.53	3.5
2004–05	214	0.65	2.3

(b) Ritchie and Rockgarden

Fishing year	Total tows	Proportion zero	Unstandardised CPUE (t/tow)
1990–91	53	0.79	1.9
1991–92	67	0.61	2.8
1992–93	69	0.62	3.0
1993–94	52	0.75	1.2
1994–95	34	0.56	0.9
1995–96	95	0.45	1.6

1996–97	91	0.46	2.5
1997–98	200	0.46	3.0
1998–99	202	0.52	1.2
1999–00	204	0.50	2.5
2000–01	170	0.49	2.1
2001–02	285	0.47	3.0
2002–03	252	0.48	1.6
2003–04	57	0.39	1.8
2004–05	81	0.57	0.8

4.2 Biomass estimates

Estimates of current and reference biomass are not available for QMA 2.

A deterministic stock reduction analysis technique (after Francis 1990) was applied to several indices from CPUE analyses to estimate virgin (B_0) and current ($B_{1999–2000}$, mid-season 1999–00) biomass. However, the stock reduction analysis using the standardised CPUE index was not accepted by the Plenary because (1) the results of the CPUE analysis were uncertain and indicated a decline in biomass that was inconsistent with the unstandardised CPUE data and the estimated broad age structure of the catch; and (2) the results of the stock reduction analysis suggested a stock biomass during recent years that was incompatible with the level of removals during the period and the estimated broad age structure of the catch.

4.3 Estimates of Maximum Constant Yield (MCY) and Current Annual Yield (CAY)

MCY and CAY have not been determined.

5. STATUS OF THE STOCKS

QMA 2

The status of the stock is unknown, and it is not known if recent catches or the current TACC are sustainable or will allow the stock to move towards the size that will support the MSY. Unstandardised CPUE indices at Tuaheni are variable from year to year after an initial steep decline from 1990 to 1996. The other fisheries at Ritchie/Rockgarden and Wairarapa show variations from year to year that appear to be unrelated to abundance.

Other QMAs

There is no information on the status of cardinalfish stocks in other QMAs.

TACCs and reported landings for the 2006–07 fishing year are summarized in Table 5.

Table 5: Summary of TACCs (t) and reported landings (t) for black cardinal fish for the most recent fishing year.

Fishstock		QMA	FMA	2006–07 Actual TACC	2006–07 Estimated landings
CDL 1	Auckland (East)		1	1 200	415
CDL 2	Central (East)		2	2 223	1 692
CDL 3	South-east (Coast)		3	196	66
CDL 4	South-east (Chatham)	4	5	66	31
CDL 5	Southland		5	22	10
CDL 6	Sub-Antarctic		6	1	<1
CDL 7	Challenger		7	39	1
CDL 8	Central (West)		8	0	0
CDL 9	Auckland (West)		9	4	1
CDL 10	Kermadec		10	0	
Total				3 751	2 216

6. FOR FURTHER INFORMATION

Clark MR., King KJ. 1989. Deepwater fish resources off the North Island, New Zealand: results of a trawl survey, May 1985 to June 1986. New Zealand. Fisheries Technical Report 11. 55p.

Dunn MR. 2007. Analysis of catch and effort data from New Zealand black cardinalfish (*Epigonus telescopus*) fisheries up to the 2004–05 fishing year. New Zealand Fisheries Assessment Report 2007/27. 55p.

Dunn MR. 2005 Descriptive analysis of catch and effort data from New Zealand black cardinalfish (*Epigonus telescopus*) fisheries for the fishing years 1979-80 to 2002-03. New Zealand Fisheries Assessment Report 2005/32. 47p.

Field KD., Clark MR. 2001. Catch-per-unit-effort (CPUE) analysis and stock assessment for black cardinalfish *Epigonus telescopus* in QMA 2. New Zealand Fisheries Assessment Report 2001/23. 22p.

Paulin C., Stewart A., Roberts C., McMillan P. 1989. New Zealand Fish: a complete guide. National Museum of New Zealand Miscellaneous Series No: 19. 279p.

Phillips NL. 2002 Descriptive and catch-per-unit-effort (CPUE) analyses for black cardinalfish (*Epigonus telescopus*) in QMA 1. New Zealand Fisheries Assessment Report 2002/55. 54p.

Tracey DM., George, K., Gilbert DJ. 2000. Estimation of age, growth, and mortality parameters of black cardinalfish (*Epigonus telescopus*) in QMA 2 (east coast North Island. New Zealand Fisheries Assessment Report 2000/27. 21p.