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A summary of information on, and an assessment of the fishery for, black cardinalfish, *Epigonus telescopus* (Risso, 1810) (Percoidei: Apogonidae)

K.D. Field, D.M. Tracey, and M.R. Clark

**NIWA
PO Box 14-901
Kilbirnie
Wellington**

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This series documents the scientific basis for stock assessments and fisheries management advice in New Zealand. It addresses the issues of the day in the current legislative context and in the time frames required. The documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

A summary of information on, and an assessment of the fishery for, black cardinalfish, *Epigonus telescopus* (Risso, 1810) (Percoidei: Apogonidae)

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1. EXECUTIVE SUMMARY

1. Black cardinalfish are not in the Quota Management System. However, they form a substantial commercial fishery.
2. Catch summaries have been compiled, using data from various Fisheries Statistics Unit (FSU) and Quota Management System (QMS) sources. Estimates of catch are given for fishing years from 1982–83 to 1994–95 and by Fisheries Management Area (FMA).
3. Landings were small until 1986–87, when catches increased as a bycatch of developing deepwater fisheries. Since then, they have also been a target species. In 1994–95 reported landings were 3700 t. The main fishery occurs off the east coast North Island (FMA2).
4. Biological information from research surveys and Scientific Observer Programme sampling is summarised. There are limited data on size, reproduction, age, and feeding.
5. Stock relationships and boundaries are unknown. Research trawl survey data are regarded as inadequate for black cardinalfish. Commercial catch and effort data could be used, but there are major reservations about whether this would be appropriate given the impact of non-fishing factors on CPUE. Consequently, biomass, yield, and status of the stocks are not estimated.

2. FISHERY SUMMARY

Commercial fisheries

Several species of *Epigonus* are widely distributed in New Zealand waters (Paulin *et al.* 1989), 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 (Figure 1), 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 (*Hoplostethus atlanticus*), and the lower end of alfonsino (*Beryx splendens*) and bluenose (*Hyperoglyphe antarctica*). The exploitation of these species from 1986 resulted in the development of the major cardinal fishery QMA 2 (*see* Table 2).

Black cardinalfish is sold on the domestic rather than the export market because of 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 Licensed Fish Receiver Returns (LFRR). From the 1989–90 fishing year, the best estimate was taken as the higher of either the LFRR or the sum of the Catch Landing Returns (CLR) and Catch and Effort Landing Returns ($CELR_{landed}$) data.

In theory, the $CELR$ estimated and landed values produced by the smaller (generally inshore) vessels should be approximately equal. Larger (deepwater) vessels provide Trawl Catch and Effort Landing Returns (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 (Table 1). The $CELR_{estimated}$ returns include cardinalfish only if it was one of the five most abundant species in the catch that day. The $CELR_{landed}$ data record all fish landed, and so could have excluded catches of black cardinalfish if they were dumped. The data show that since the QMS began, inshore vessels have consistently landed significantly less than their estimated catch. This may be due to misestimation on board, or discarding.

The $TCEPR_{estimated}$ returns include black cardinalfish only if it was one of the five most abundant species in the trawl. The $TCEPR_{processed}$ data record all fish processed on a particular day, and so could have excluded catches of black cardinalfish if they were dumped. The CLR data record all fish landed ashore, and although there is facility on these forms to record dumped species, there is no legal requirement to record discarded black cardinalfish as they are not a quota species. The CLR annual totals were always substantially greater than those from TCEPRs, implying that black cardinalfish were often processed even though they were frequently not abundant in the catch.

The unknown quantities that have been discarded and not recorded are likely to have resulted in under-reported total catches over the full period for which data are available. The landings reported in the 1994–95 fishing year are likely to be relatively accurate as by this time black cardinalfish had been proposed as a potential quota species and fishers would be attempting to establish a catch history in the fishery.

The best estimate of total landings derived above was split between the nine FMAs and ET 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 FMAs 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 FMAs 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 (FMA 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 Tuahine 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 (FMA 1) have fluctuated since 1988. The relatively large landings in 1994–95 were at first a bycatch of the developing orange roughy

fishery, and subsequently a result of 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.

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

Year	FSU			CELR		TCEPR			Best estimate	
	Inshore	Deepwater	Total	Estimated	Landed	Estimated	Processed	CLR		LFRR
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 FMA and fishing year. Total landings for each fishing year are equal to the best estimate from Table 1. Landings for which area was unknown were pro-rated according to catch where area was reported. –, no data

Year	FMA									ET	Total
	1	2	3	4	5	6	7	8	9		
1982–83	–	76	<1	<1	–	–	<1	–	–	–	78
1983–84	–	212	7	<1	–	–	<1	–	–	–	220
1984–85	<1	189	341	<1	–	–	1	–	–	–	532
1985–86	<1	238	50	3	2	–	<1	–	45	–	292
1986–87	1	1 738	72	2	<1	<1	<1	–	–	–	1 814
1987–88	3	1 556	28	1	3	–	2	<1	<1	–	1 638
1988–89	305	1 434	57	4	–	–	2	–	–	2	1 800
1989–90	613	1 718	20	18	–	–	15	–	–	<1	2 385
1990–91	233	3 473	598	1	4	–	1	<1	–	–	4 311
1991–92	7	1 652	146	3	<1	2	11	–	–	17	1 838
1992–93	23	1 550	519	2	<1	–	2	–	–	270	2 366
1993–94	364	2 310	277	10	5	–	6	–	–	829	3 801
1994–95	1162	2 207	51	7	1	<1	51	–	<1	231	3 710

Non-commercial fisheries

There is no known current Maori, recreational, or other non-commercial fishery for black cardinalfish.

3. 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 (Clark & King 1989, Tracey 1993). They reach a maximum length of about 75 cm FL. Unvalidated otolith readings from 30 black cardinalfish sampled from the east coast North Island commercial fishery indicate that this species is relatively long lived (Tracey 1993). Fork lengths of 45–72 cm ranged in age from 15 to 42 years.

Reproductive biology is not well known. Indications from research survey and Scientific Observer Programme data are that spawning may occur in early winter, with fish becoming sexually mature at 40–50cm length.

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

Elevated levels of mercury have been recorded in an east coast sample of black cardinalfish (Tracey 1993). The mean mercury level was 1.47 mg.kg^{-1} (range 0.59–2.15) well above the maximum permissible level of 0.5 mg.kg^{-1} set by the New Zealand Department of Health under the Food Regulations (1984/262). More recently 50 black cardinalfish from the northwest Challenger Plateau and Lord Howe Rise were tested for mercury content. This sample had a mean mercury level of 1.02 mg.kg^{-1} (range 0.34–1.56) (NIWA unpub. data).

4. STOCKS AND AREAS

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

5. STOCK ASSESSMENT

No estimates of absolute biomass, reference fishing mortalities, or instantaneous natural mortality are available for black cardinalfish. It is regularly caught, usually in very small quantities, as a bycatch on research trawl surveys. However, none of the surveys were designed to sample this species which forms large, extremely mobile schools over hills and rough ground, and at times aggregates some distance off the sea bottom. No survey is considered to have adequately sampled its geographical or depth distribution for the purpose of estimating biomass.

An analysis of CPUE data was not attempted and would be unlikely to produce reliable indices of abundance because (a) at various times black cardinalfish have been the subject of a target fishery, and at other times have been landed as a bycatch of numerous target trawl fisheries; (b) effort has been affected by major changes in demand for the species by overseas markets, and (c) the extent of under-reporting and dumping is unknown, and may have changed in recent years.

It may be possible to calculate maximum constant yield (MCY) using the formula $MCY = cY_{av}$ (Annala & Sullivan 1996). However, further work would be required to determine a period on

which to base estimates of Y_{av} which "contains no systematic changes in fishing mortality (or fishing effort)". At various times fishing for black cardinalfish has been both a bycatch and target fishery. It is thought that the level of target fishing has varied with marked changes in the level of demand for the species by overseas markets, efforts by fishers to establish a catch history before the introduction of the QMS in the mid-1980s and in 1994–95, and changes in the quota levels of other commercial species.

6. STATUS OF THE STOCKS

Estimates of current and reference biomass are not available. The status of the stock is unknown.

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Figure 1: Distribution of black cardinalfish (*Epigonus telescopus*) from research trawls.

