ORANGE ROUGHY WEST COAST SOUTH ISLAND (ORH 7B)

1. FISHERY SUMMARY

(a) Commercial fisheries

This fishery centres on an area near the Cook Canyon in fishery statistical areas 033, 034 and 705. Most of the catch is taken in winter, when the fish form aggregations for spawning. Reported domestic landings and TACs are shown in Table 1.

Table 1: Reported landings (t) of orange roughy and TACs (t) for ORH 7B from 1983–84 to 2004–05.

Fishing year	Reported landings	TAC
1983–84*	2	–
1984–85*	282	–
1985–86*	1 763	1 558
1986–87*	1 446	1 558
1987–88†	1 413	1 558
1988–89†	1 750	1 708
1989–90†	1 711	1 708
1990–91†	1 683	1 708
1991–92†	1 604	1 708
1992–93†	1 139	1 708
1993–94†	701	1 708
1994–95†	290	1 708
1995–96†	446	430
1996–97†	425	430
1997–98†	330	430
1998–99†	405	430
1999–00†	284	430
2000–01†	161	430
2001–02†	95	110
2002–03†	90	110
2003–04†	119	110
2004–05†	106	110

* FSU data.
† QMS data.

Catches in 1992–93, 1993–94 and especially 1994–95 were well below the TACC. The TACC was reduced to 430 t for the 1995–96 fishing year, and then was reduced further to 110 t from 1 October 2001.

(b) Recreational fisheries

There is no known recreational fishery for orange roughy in this area.

(c) Maori customary fisheries

There is no known Maori customary fishing for orange roughy in this area.

(d) Illegal catch

There is no quantitative information available on illegal catch.

(e) Other sources of mortality

There is no quantitative information available on other sources of mortality in this fishery.

2. STOCKS AND AREAS

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

Orange roughy in this fishery are thought to be a single stock. Genetic studies have shown that samples of Cook Canyon orange roughy are significantly different from Challenger Plateau and Puysegur Bank samples. Moreover, the size structure and parasite composition differ from fish on the Challenger Plateau. Spawning occurs at a similar time to fish on the Challenger Plateau and the Puysegur Bank.

3. STOCK ASSESSMENT

The previous assessment for this stock was carried out in 2001 and is summarised in the 2003 Plenary Report. This has been updated with the addition of catch data (from 2000-01, 2001-02, and 2002–03) and a new standardised CPUE indices based on mean catch per hour (instead of mean catch per tow as was used in the previous assessment). These data were incorporated in a Bayesian stock assessment with deterministic recruitment to estimate stock size and do forward projections.

(a) Estimates of fishery parameters and abundance

Commercial catch and effort data are available from 1985 and were examined using both an unstandardised and a standardised analysis. Unstandardised catch rates have declined substantially over the course of the fishery but have shown no clear trend in recent years (Table 2).

Most recent effort in the fishery has been by small, inshore vessels. Effort (in vessel days) has decreased each year for the last four years, the total drop being 54% from four years ago. The average distance towed in the last four years is more than three times its initial level.

Table 2: Summary of groomed data from TCEPR and CELR forms.

Fishing year	Number of vessel days	Number of tows	Total recorded catch (t)	Mean daily catch rate (t/tow)	Mean daily catch rate (t/h)	Mean tow speed* (kt)	Mean tow length* (h)	Mean tow length* (nm)
1985–86	138	357	1544	4.5	2.9	2.3	1.8	4.4
1986–87	132	405	1250	4.0	2.7	2.3	1.9	4.3
1987–88	132	420	1250	3.4	2.3	2.8	1.6	4.6
1988–89	133	368	827	2.5	1.6	2.9	1.7	4.9
1989–90	123	356	1282	4.5	5.6	2.8	1.6	4.4
1990–91	208	632	1657	2.8	3.3	2.9	1.6	4.7
1991–92	238	810	1601	2.0	1.4	2.9	1.9	5.4
1992–93	258	784	1128	1.5	2.3	3.0	1.7	5.2
1993–94	298	708	660	1.1	0.9	2.8	2.3	6.6
1994–95	162	361	320	0.9	1.6	2.9	2.0	5.8
1995–96	66	150	275	2.2	1.7	2.9	2.1	6.1
1996–97	90	182	244	1.3	7.5	2.8	3.1	8.6
1997–98	96	228	170	0.7	0.3	2.8	2.5	7.0
1998–99	188	566	359	0.6	0.2	2.6	2.6	6.8
1999–2000	213	647	259	0.4	0.1	3.5	4.5	16.4
2000-2001	149	442	162	0.4	0.1	3.5	3.5	12.5
2001-2002	117	282	76	0.3	0.1	3.8	4.7	17.8
2002-2003	97	292	112	0.4	0.2	3.8	3.6	14.1

* TCEPR data only

The standardised analysis used mean daily catch per hour for tows in June and July in a linear regression model. Indices from this model (Table 3) show a similar trend to unstandardised catch rates. There was a strong decline in the first years of the fishery, followed by a period of stability, and then lower catch rates in recent years but with a slight upward trend for the last two years.

Table 3: Standardised CPUE indices (relative year effect) with number of vessel days fished during June-July from 1985–86 to 2002–03.

Year	CPUE index	c.v.	Number of days
1985–86	14.97	0.28	33

1986–87	8.01	0.29	62
1987–88	2.71	0.27	107
1988–89	2.38	0.26	75
1989–90	2.64	0.29	89
1990–91	3.02	0.22	119
1991–92	1.24	0.26	192
1992–93	0.78	0.25	205
1993–94	0.35	0.25	232
1994–95	0.60	0.30	78
1995–96	1.28	0.37	36
1996–97	0.54	0.33	72
1997–98	0.26	0.31	38
1998–99	0.46	0.29	54
1999–00	0.22	0.32	70
2000–01	0.17	0.37	54
2001-02	0.23	0.40	29
2002-03	0.46	0.41	31

(b) Biomass estimates

The only data available for the stock assessment were relative abundance indices from the standardised CPUE analysis (Table 3). These indices were assumed to be log-normally distributed with the *c.v.s* estimated by bootstrapping (Table 3), and a process error that was estimated within the stock assessment model. Biological parameters were the same as those derived for the Chatham Rise stock (ORH 3B) (see Tables 1-3 of the Introduction), with a maturity ogive based on otolith data.

The catch history included in the model is presented in Table 1. Reported catch overruns are likely to occur because of fish loss from torn nets, and discarding of small or damaged fish. There is no estimate of the size of the overrun, but it means that actual catch is greater than reported catch. However, because overrun have not been added in the catch history, this will have no affect on the assessment as long as future overruns are similar to those in the past.

Two alternative assessments are presented. In the first, labelled Beta1, it was assumed that the CPUE was proportional to biomass. In the second, labelled EstBeta it was assumed that the relationship between CPUE and the biomass could be non-linear with CPUE proportional to the biomass to the power of β.

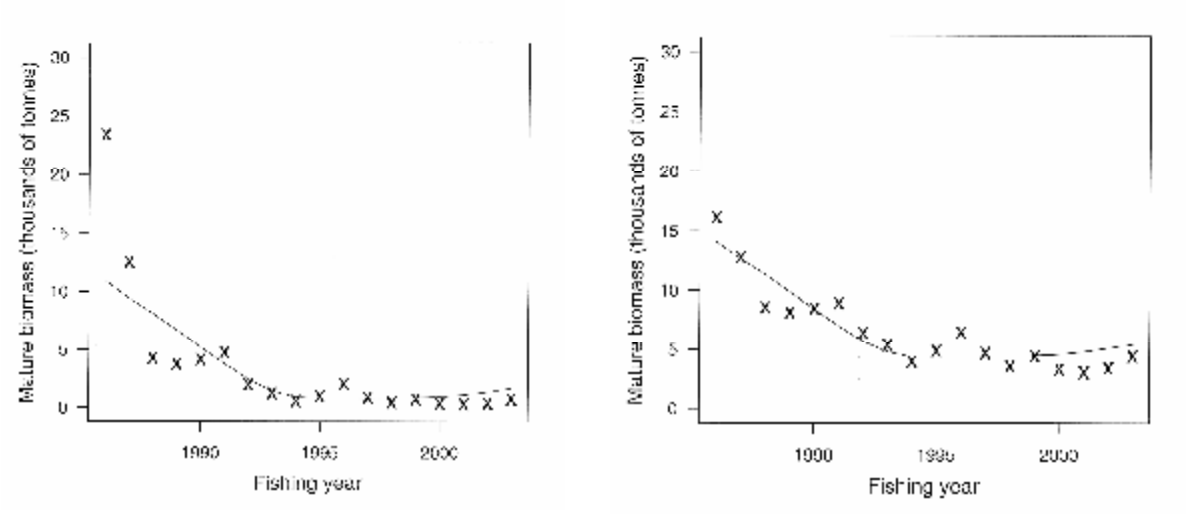
The best estimate of B_0 from the Beta1 assessment was 12 100 t. The 95% confidence interval was 11 800 t to 12 900 t (derived from MCMC analysis) (Table 4). The EstBeta assessment gave an estimated B_0 of 17 900 t (95% confidence interval 12 300–32 000 t), with $\beta = 3.4$ (Table 4). Biomass trajectories and their fits to the CPUE are show in Figure 1.

Table 4: Estimates of mid-year biomass (t) with 95% confidence intervals in parentheses. $B_{current}$ is the mid-year biomass in 2004. Estimates are medians of the posterior distribution derived from MCMC analysis (with a fixed process error).

Assessment	process error	β	B_0	$B_{current}$(t)	$B_{current}$(t)(%B_0)
Beta1	0.58	1	12 100 (11 800 – 12 900)	2020	17 (14 – 23)
EstBeta	0.53	3.4	17 900 (12 300 – 32 000)	7950	45 (18 – 69)

(c) Projections

Forward projections were carried out over a 5-year period using a range of constant-catch options. For each catch option, three measures of fishery performance were calculated: (1) the median biomass in 2008-09 (expressed as a percentage of B_0), (2) the probability that the biomass in 2008-09 is greater than 20% B_0 [P(B_{2009} > 20%B_0)], and (3) the probability that the biomass in 2008-09 is greater than 30% B_0 [P(B_{2009} > 30%B_0)] (30% B_0 has conventionally been taken as a proxy for B_{MSY} in orange roughy assessments).



(a) (b)

Figure 1: Biomass trajectories derived from Maximum Posterior Density (MPD) estimates of the model parameters. The biomass trajectories are shown by the solid lines; crosses denote the CPUE index scaled to biomass (a) Beta1 (b) EstBeta.

For both assessments the projections (Table 5) indicated that the biomass would increase for all but the highest catch level (500 t per year).

Table 5: Probability of the mid-year spawning biomass in 2008–09 exceeding 20% B_0 ($P_{0.2}$) and 30% B_0 ($P_{0.3}$), and the median biomass in 2008–09 as a percentage of B_0 (Bmed) for the west coast South Island stock for each of two assessments and six constant catch options. The current biomass, $B_{2003–04}/B_0$ (%), is given in parentheses next to the assessment name for Bmed.

		Annual catch (t, over five–year period)					
Performance measure	**Run**	**50**	**75**	**100**	**125**	**150**	**500**
$P_{0.2}$	Beta1	1.00	1.00	1.00	1.00	1.00	0.016
$P_{0.2}$	EstBeta	1.00	1.00	1.00	1.00	1.00	0.92
$P_{0.3}$	Beta1	0.36	0.23	0.13	0.08	0.05	0.001
$P_{0.3}$	EstBeta	0.98	0.97	0.96	0.95	0.94	0.75
Bmed (%)	Beta1 (17)	29.2	28.3	27.4	26.5	25.5	12.6
Bmed (%)	EstBeta (45)	53.3	52.6	52.0	51.4	50.8	42.1

4. STATUS OF THE STOCK

The estimated status of the stock depends strongly on which alternative assessment is used. If CPUE is assumed to be directly proportional to biomass (Beta1) then the current biomass is estimated to be 17% B_0 with a 95% confidence interval of 14–23% B_0. When this assumption is relaxed (EstBeta) the current biomass is much higher at 45% B_0, with a 95% confidence interval of 18–69% B_0. All yield estimates are higher than both the TACC and recent catches, and both assessments indicate that recent catches are allowing the stock to rebuild. One concern is that the model results indicate that the stock has been slowly rebuilding since the mid 1990s, whereas trends in catch rates and tow duration are not consistent with this conclusion.

5. FOR FURTHER INFORMATION

Annala, J.H.; Sullivan, K.J.; O'Brien, C.J.; Smith, N.W.McL.; Graying S.M. (Comps.) (2003). Report from the Fishery Assessment Plenary, May 2003: stock assessments and yield estimates. 616 p. (Unpublished report held in NIWA Greta Point library, Wellington.)

Clark, M.R.; Tracey, D.M. (1988). Assessment of the west coast South Island and northern North Island orange roughy fisheries. N.Z. Fisheries Assessment Research Document 88/20. 11 p.

Clark, M.R.; Field, K.D. (1995). Assessment of the ORH 7B orange roughy fishery for the 1995–96 fishing year. N.Z. Fisheries Assessment Research Document 95/19. 15 p.

O'Driscoll, R.L. (2001). Assessment of the west coast South Island orange roughy fishery (ORH 7B) for the 2001–02 fishing year. N.Z. Fisheries Assessment Research Document 2001/31. 29 p.