ORANGE ROUGHY CHALLENGER PLATEAU (ORH 7A)

1. FISHERY SUMMARY

(a) Commercial fisheries

The fishery occurs in the southwestern region of the Challenger Plateau, both inside the EEZ and outside. Fish are caught throughout the year, with most effort in winter when the orange roughy form aggregations for spawning. Domestic vessels catch most of the quota. Reported commercial catches and TACs from 1980–81 to 2004–05 are shown in Table 1.

Table 1: Reported catches (t) and TACs (t) from 1980–81 to 2004–05.

Fishing year	Inside EEZ	Outside EEZ	Total catch	TAC
1980–81†	1	32	33	–
1981–82†	3 539	709	4 248	–
1982–83†	4 535	7 304	11 839	–
1983–84†	6 332	3 195	9 527	4 950
1984–85†	5 043	74	5 117	4 950
1985–86†	7 711	42	7 753	6 190
1986–87†	10 555	937	11 492	10 000
1987–88‡	10 086	2 095	12 181	12 000
1988–89‡	6 791	3450	10 241	12 000
1989–90‡	3 709	600 *	4 309 *	2 500
1990–91‡	1 340	17	1 357	1 900
1991–92‡	1 894	17	1 911	1 900
1992–93‡	1 412	675	2 087	1 900
1993–94‡	1 594	138	1 732	1 900
1994–95‡	1 554	82	1 636	1 900
1995–96‡	1 206	463	1 669	1 900
1996–97‡	1 055	253	1 308	1 900
1997–98‡	+	+	1 502	1 900
1998–99‡	+	+	1 249	1 425
1999–00‡	+	+	629	1 425
2000–01‡	+	+	<1	1
2001–02‡	+	+	<1	1
2002–03‡	+	+	4	1
2003–04‡	+	+	<1	1
2004–05‡	+	+	<1	1

† FSU data.
‡ QMS data.
* This is a minimum value, because of unreported catches by foreign vessels fishing outside the EEZ.
\+ Unknown distribution of catch.

From the 2000–01 fishing year the TACC for this stock was reduced to 1 t.

(b) Recreational fisheries

There is no known recreational fishing 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

In previous stock assessments, catch overruns from various sources (including lost and/or discarded fish, use of nominal tray weights and low conversion factors) have been estimated as: 1980–81 to 1987–88, 30%; 1988–89, 25%; 1989–90, 20%; 1990–91, 15%; 1991–92 to 1992–93, 10%; 1993–94 onwards, 5%.

2. BIOLOGY

Biological parameters used in this assessment are presented in the Biology section at the beginning of the Orange Roughy section.

3. STOCKS AND AREAS

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

Orange roughy on the Challenger Plateau are regarded as a single separate stock. Size structure, parasite composition, flesh mercury levels, allozyme frequency and mitochondrial DNA studies show differences to other major fisheries. Spawning occurs at a similar time to fish on the Chatham Rise, Puysegur Bank, Ritchie Banks, Cook Canyon and Lord Howe Rise.

4. STOCK ASSESSMENT

An assessment was carried out for this stock in 2000 (Annala et al., 2000; Field and Francis, 2001) and is reported here. It was similar to the 1998 assessment (Annala et al., 1998; Field, 1999) in using standardised CPUE in a stock reduction analysis (Francis, 1990), but differs from that assessment in allowing stochastic recruitment (i.e., it uses the enhanced stock reduction method of Francis et al., 1992; *see* Appendix of Francis et al., 1995 for details).

In 2005 the working group considered a revised assessment, although no new data have been available for this stock since 2000. The primary reason for the re-assessment was to determine whether a Bayesian modelling framework, similar to that used for other orange roughy stock assessments, would give a substantially different result. A new standardised CPUE series was calculated with the additional fishing year 1999–2000, shown in Table 2 alongside the CPUE series used in the 2000 assessment. The trawl survey biomass indices and length frequencies from 1987 to 1990 were included in the 2005 analysis, along with observer length frequencies from the 1987–88 and 1988–89 fishing years. Results from the 2005 assessment are summarised qualitatively in section 4(d), but no new quantitative estimates are presented here.

(a) <u>Estimates of fishery parameters and abundance</u>

In the 2000 assessment, commercial catch and effort data were examined from 1983 using both an unstandardised and standardised analysis. CPUE indices from both methods are given in Table 2. Unstandardised mean catch per tow during winter months declined rapidly until the late 1980s, and has continued to decline since then, but at a slower rate. The standardised analysis used catch per nautical mile for tows in all months and all areas in a linear regression model. Indices from this model show a similar trend to unstandardised catch rates except that the initial decline was more extreme. This reflects increasing tow length and shifts to new areas within the fishery, which could not be incorporated in the unstandardised analysis. For this reason, the Working Group decided not to use unstandardised results in the stock assessment.

Table 2: CPUE indices from unstandardised data (mean catch [t/trawl] in the June-September period, all N.Z. vessels combined), and from standardised data (all months included) from 1982–83 to 1999–2000. A new standardised CPUE index was added to the table in 2005.

Fishing year	2000 Unstandardised index	2000 Standardised index	2005 Standardised index
1982–83	15.8	1.00	1.000
1983–84	15.3	1.30	1.038
1984–85	13.5	0.37	0.712
1985–86	10.8	0.59	0.652
1986–87	9.4	0.28	0.418
1987–88	5.3	0.084	0.212
1988–89	3.5	0.062	0.110
1989–90	5.8	0.089	0.071
1990–91	3.9	0.038	0.088
1991–92	4.3	0.038	0.139
1992–93	2.7	0.026	0.112
1993–94	3.2	0.025	0.086
1994–95	3.8	0.027	0.066
1995–96	3.7	0.024	0.058
1996–97	1.8	0.012	0.043
1997–98	1.6	0.021	0.032
1998–99	0.9	0.017	0.020
1999-00	—	—	0.033

(b) Biomass estimates

In the 2000 assessment, stochastic stock reduction analyses were carried out using relative abundance indices from the standardised CPUE analysis (Table 2), which were assumed to be normally distributed with a c.v. of 0.3. The catches used in the model were the "Total catch" given in Table 1, adjusted by the estimated overrun (*see* Section 1(e)). The model treats sexes separately, and has natural mortality occurring prior to fishing mortality (the Challenger fishery occurs largely in June and July, near the end of the fishing year).

In terms of virgin biomass, the 2000 estimate of 91 000 t (Table 3) is similar to the range estimated (95 000–99 000 t) in the 1998 assessment. However, in terms of current biomass the assessments are very different: 3% B_0 in 2000, compared to 15–19% B_0 in 1998. This difference is because the stochastic model fits the CPUE data reasonably well, whereas the deterministic model does not (Figure 1).

Table 3: Estimates of mid-year biomass (t), with upper and lower bounds for 95% confidence intervals. B_{2000} is the mid-year biomass in 1999–00; B_{MSY} is calculated as 30% B_0, which is the mean biomass under a CAY policy (evaluated following Francis 1992).

	B_0(t)	B_{MSY}(t)	B_{2000} (t)	B_{2000} (%B_0)
Estimate	91 000	27 000	2 500	3
Lower bound	60 000	18 000	1 300	1
Upper bound	130 000	39 000	5 400	6

(c) Estimation of yields

Estimates of MCY, CAY and MAY were calculated in 2000 using the method of Francis (1992). Long-term yields ($MCY_{long\text{-}term}$ and MAY) are similar to catches near the end of the 1990's, but short-term yields ($MCY_{2000–01}$ and CAY) are very much smaller (Table 4).

Table 4: Yield estimates (t, corrected for an assumed overrun of 5%), with upper and lower bounds for 95% confidence intervals.

	$MCY_{2000–01}$	$MCY_{long\text{-}term}$	CAY	MAY
Estimate	170	1 200	220	1 600
Lower bound	50	800	90	1 100
Upper bound	500	1 700	520	2 300

(d) Outcome of the 2005 assessment

The ORH 7A assessment in 2005 with the new CPUE series proved inconclusive. The stochastic stock reduction model fit was not persuasive because fitting nearly 80 parameters to 19 CPUE data points is questionable. Relatively small changes in the CPUE were accommodated through large perturbations in the recruitment residuals, indicating that the model was over fitted. Adding the survey and observer data did not change the model predictions, but the model was not able to fit the data convincingly, even under the assumption of stochastic recruitment. It is not known if this outcome is due to unreliable data or to model mis-specification. The estimation of a hyperdepletion parameter helped to fit the early part of the 2005 CPUE series but not the latter part.

It was concluded that the stock status in 2000 when the fishery was closed was likely to have been poor, although the actual stock size is uncertain. Predictions of the amount of rebuilding that has taken place since the closure of the fishery are even more uncertain due to a complete lack of post-closure data.

5. STATUS OF THE STOCK

For this stock, B_{MSY} is interpreted as the mean biomass under a CAY policy (B_{MAY}), which is estimated to be 30% B_0.

In terms of stock status and yields, the 2000 assessment was much more pessimistic than the 1998 assessment. This is because the stochastic model used in 2000 fitted the CPUE data reasonably well, whereas the previously used deterministic model did not (Figure 1).

The 2000 assessment of this stock indicated that it was about one tenth of B_{MSY} (range: 7% to 14% of B_{MSY}) in the year 2000. The TACC was reduced to 1 t (effectively closing the fishery) in 2000-01 to promote the rebuilding of the stock towards B_{MSY}. The extent to which the stock has rebuilt since the closure of the fishery cannot be determined without the collection of additional data.

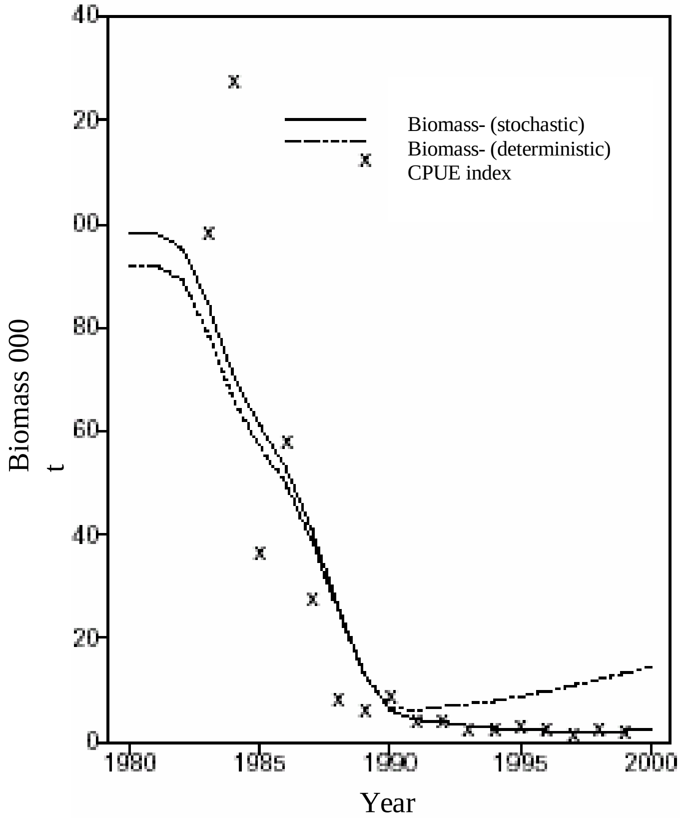

Figure 1: Biomass trajectories estimated in the 2000 assessment (solid line) and also using the deterministic model of the 1998 assessment (broken line).

6. FOR FURTHER INFORMATION

Annala, J.H.; Sullivan, K.J.; O'Brien, C.J.; Iball, S.D. (Comps.) (1998). Report from the Fishery Assessment Plenary, May 1998: stock assessments and yield estimates. 409 p. (Unpublished report held in NIWA Greta Point library, Wellington.)

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Francis, R.I.C.C.; Robertson, D.A.; Clark, M.R.; Coburn, R.P. (1992). Assessment of the ORH 3B orange roughy fishery for the 1992–93 fishing year. N.Z. Fisheries Assessment Research Document 92/4.