

ORANGE ROUGHY NORTHERN NORTH ISLAND (ORH 1)

1. FISHERY SUMMARY

(a) Commercial fisheries

This region extends northwards from west of Wellington around to Cape Runaway. Prior to 1993–94 there was no established fishery, and reported landings were generally small (Table 1). A new fishery developed in winter 1994, when aggregations were fished on two hill complexes in the western Bay of Plenty. In 1996 catches were also taken off the west coast of Northland.

A TACC of 190 t was set from 1989–90. Prior to that there had been a 10 t TAC and various levels of exploratory quota. From 1995–96, ORH 1 became subject to a five year adaptive management programme, and the TACC was increased to 1190 t. A catch limit of 1000 t was applied to an area in the western Bay of Plenty (Mercury-Colville ‘box’), with the former 190 t TACC applicable to the remainder of ORH 1. In 1994 and 1995, research fishing was carried out under Special Permit (not included in the TACC). For the period June 1996–June 1997, a Special Permit was approved for exploratory fishing. This allowed an additional 800 t (not included in the TACC) to be taken in designated areas, although there were individual feature limits on catches.

Table 1: Reported landings (t) and TACs (t) from 1982–83 to 2004–05. – no TAC. The reported landings do not include catches taken under an exploratory special permit of 699 t in 1998–99 and 704 t in 1999–00.

Fishing year	West coast	North-east coast	Reported landings	
			Total	TAC
1982–83*	< 0.1	0	< 0.1	–
1983–84*	0.1	0	0.1	–
1984–85*	< 0.1	96	96	–
1985–86*	< 1	2	2	–
1986–87*	0	< 0.1	< 0.1	10
1987–88†	0	0	0	10
1988–89†	0	19	19	10
1989–90†	37	49	86	190
1990–91†	0	200	200	190
1991–92†	+	+	112	190
1992–93†	+	+	49	190
1993–94†	0	189	189	190
1994–95†	0	244	244	190
1995–96†	55	910	965	1190
1996–97†	+	+	1021	1190
1997–98†	+	+	511	1190
1998–99†	+	+	845	1190
1999–00†	+	+	771	1190
2000–01†	+	+	858	800
2001–02†	+	+	1294	1400
2002–03†	+	+	1123	1400
2003–04†	+	+	986	1400
2004–05†	+	+	1 151	1400

* FSU data.

† QMS data.

+ Unknown distribution of catch.

Reported catches have varied considerably between years, and the location of the catch in the late 1980s/early 1990s is uncertain, as some may have been taken from outside the EEZ, as well as misreported from other areas. Research fishing carried out under Special Permit in 1994 and 1995 resulted in catches of 45.2 t and 200.7 t, respectively (not included in Table 1).

Based on an evaluation of the results of an Adaptive Management Programme (AMP) for the Mercury-Colville box initiated in 1995, the AMP was concluded and the TACC was reduced to 800 t for the 2000–01 fishing year. Catch limits of 200 t were established in each of four areas in ORH 1, with an individual seamount feature limit of 100 t. From 1 October 2001, ORH 1 was reintroduced into the AMP for the coming five years, and the TACC was increased from 800 to 1400 t.

In recent years the fishery has also developed off the west coast and sizeable catches have been taken off the Tauroa Knoll and West Norfolk Ridge. The current management of the fishery is described in section 4 (Analysis of adaptive management programme) with a 2005 review of the performance of the AMP.

(b) Recreational fisheries

There is no known non-commercial fishery for orange roughy in this area.

(c) Maori customary fisheries

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

d) Illegal catch

No quantitative information is available on the level of illegal catch in this area.

(e) Other sources of mortality

There may be some overrun of reported catch because of fish loss with trawl gear damage and ripped nets. In other orange roughy fisheries, a level of 5% has been estimated.

2. STOCKS AND AREAS

Orange roughy are distributed throughout the area. Spawning is known from hills in the western Bay of Plenty. Stock status/affinities within the QMA are unknown. The Mercury-Colville grounds in the Bay of Plenty are about 120 n.miles from fishing grounds at East Cape (ORH 2A North), and spawning occurs at a similar time. Hence, it is likely that these are separate stocks. The Mercury and Colville Knolls in the Bay of Plenty are about 25 miles apart and may form a single stock. Stock affinities with other fishing hills in the southern and central Bay of Plenty are unknown. The Tauroa Knoll and outer Colville Ridge seamounts are distant from other commercial grounds, and these fish may also represent separate stocks.

3. STOCK ASSESSMENT

An assessment for the Mercury-Colville box was carried out in 2001 and is repeated here. A deterministic stock reduction technique (*after* Francis 1990) was used to estimate virgin biomass (B_0) and current biomass (B_{curr}) for the Mercury-Colville orange roughy stock. The model was fitted to the biomass indices using maximum likelihood and assuming normal errors. In common with other orange roughy assessments, the maximum exploitation rate was set at 0.67. The model treats sexes separately, and assumes a Beverton-Holt stock-recruit relationship. Confidence intervals of the biomass estimates were derived from bootstrap analysis (Cordue & Francis 1994).

(a) Estimates of fishery parameters and abundance

A series of trawl surveys of the Mercury-Colville box to estimate relative abundance were agreed under an Adaptive Management Programme. The first survey was carried out in June 1995 with a second survey in winter 1998 (Table 2). The biomass index of the latter survey was much lower than 1995, and it was uncertain whether the 1998 results were directly comparable to the 1995 results because of warmer water temperatures. They were not incorporated in the decision rule for the adaptive management programme. A third survey was carried out in June 2000, with the results suggesting that the abundance of orange roughy in the box had decreased considerably and was at low levels. However,

these estimates are uncertain because of the suggestion that environmental factors may have influenced the distribution of orange roughy.

The abundance indices from trawl survey and commercial catch-effort data used in the assessment are given in Table 2.

Table 2: Biomass indices and reported catch used in estimation of B_0 . Values in square brackets are included for completeness; they are not used in the assessment.

Year	1993-4	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00
Trawl survey	–	76 200	–	–	[2 500]	–	3 800
CPUE	8.3	9.1	5.4	4.2	[0.5]	1.5	(2.0)
Catch (t)	230	440	915	895	295	140	250

The trawl survey indices had *c.v.*'s of 0.27, 0.39 and 0.29 for 1995, 1998, and 2000 respectively.

The CPUE series is mean catch per tow (sum of catches divided by number of tows, target ORH) from Mercury Knoll in the month of June. This is the only month when adequate data exist from the fishery to compare over time. A *c.v.* of 0.30 was assigned to the CPUE data.

Catch history information is derived from TCEPR records, scaled to the reported total catch for ORH 1. Figures differ slightly from unscaled data summarised by Clark (1999), but this would make little difference to the assessment. Overrun of reported catch (e.g., burst bags, inappropriate conversion factors) was assumed to be zero, as even if there was some, it is likely that it was similar between years. The catch in 1999–00 was assumed to be 250 t.

Assessments were carried out for three alternative sets of biomass indices (Table 3).

Table 3: Three alternative sets of biomass indices used in the stock assessment.

Alternative	Trawl survey indices	CPUE indices
1	1995, 2000	All except 1998
2	1995, 2000	None
3	1995, 2000	All except 1998 and 2000

Biological parameters used are those for the Chatham Rise stock, except for specific Bay of Plenty values for the maturity and recruitment ogives (Annala et al., 2000).

(b) Biomass estimates

The estimated virgin biomass (B_0) is very similar for all three alternative assessments (Table 4). With alternative 1 the estimated B_0 is 3200 t, with a current biomass of 15% B_0 . For both alternatives 2 and 3, the estimated B_0 is 3000 t, which is B_{\min} , the minimum stock size which enables the catch history to be taken given a maximum exploitation rate of 0.67.

Table 4: Biomass estimates (with 95% confidence intervals in parentheses) for stock assessments with the three alternatives of Table 3. B_0 is virgin biomass; B_{MSY} is interpreted as B_{MAY} , which is 30% B_0 ; B_{current} is mid-season 1999–00; and B_{beg} is the biomass at the beginning of the 2000–01 fishing year. Estimates are rounded to the nearest 100 t (for B_0), 10 t (for other biomasses), or 1%.

Biomass	Alternative 1		Alternative 2		Alternative 3	
B_0 (t)	3200	(3000, 3600)	3000	(3000, 3500)	3000	(3000, 3300)
B_{MSY} (t)	960	(900, 1080)	900	(900, 1050)	900	(900, 990)
B_{current} (t)	490	(290, 890)	290	(290, 790)	290	(290, 590)
B_{current} (% B_0)	15	(10, 25)	10	(10, 23)	10	(10, 18)
B_{beg} (t)	480	(270, 900)	270	(270, 800)	270	(270, 590)

The model fits the CPUE data reasonably well but estimates a smaller decline than is implied by the two trawl survey indices.

(c) Estimates of Yield

Yield estimates were determined using the simulation method described by Francis (1992) and the relative estimates of MCY , E_{CAY} and MAY , as given by Annala et al. (2000).

Yield estimates are all much lower than recent catches (Table 5). Estimates of current yields (MCY_{current} and CAY) lie between 16 t and 35 t; long-term yields (MCY_{long-term} and MAY) lie between 44 t and 67 t.

Table 5: Yield estimates (t) for stock assessments with the three alternatives of Table 3.

Yield	Alternative 1		Alternative 2		Alternative 3	
MCY _{current}	35	(22,53)	22	(22,51)	22	(22,44)
MCY _{long-term}	47	(44,53)	44	(44,51)	44	(44,49)
CAY	29	(16,54)	16	(16,48)	16	(16,36)
MAY	67	(58,70)	58	(58,68)	58	(58,64)

CSP for this stock is just under 100 t for any B₀ between 3000 t and 3600 t.

4. ANALYSIS OF ADAPTIVE MANAGEMENT PROGRAMME

The ORH 1 TACC was increased from 800 to 1400 t in October 2001/02 under the Adaptive Management Programme. The objectives of this AMP (scheduled to end in Sept 2006) are to determine stock size, geographical extent, and long-term sustainable yield of the ORH 1 stock. This is a complex AMP, with ORH 1 divided into four sub-areas (see Fig. 1), each with total catch and “feature” catch limits (a “feature” was defined as being within a 10 nm radius of the shallowest point).

ORH 1 Subarea	Proposed Catch Limit	Feature Limit (t/fishing year)
Area A	200 t	100 t
Area B	500 t	150 t
Area C	500 t	150 t
Area D	400 t	75 t

Feature limits also serve as limits to the total catch in any area due to the limited number of available productive features. The Mercury-Colville “Box” (located within Area D) has been given a specific limit of 30 t per year to allow for the bycatch of orange roughy when fishing for black cardinalfish. The catch of orange roughy in the Mercury-Colville “Box” will be included in the overall limit for Area D.

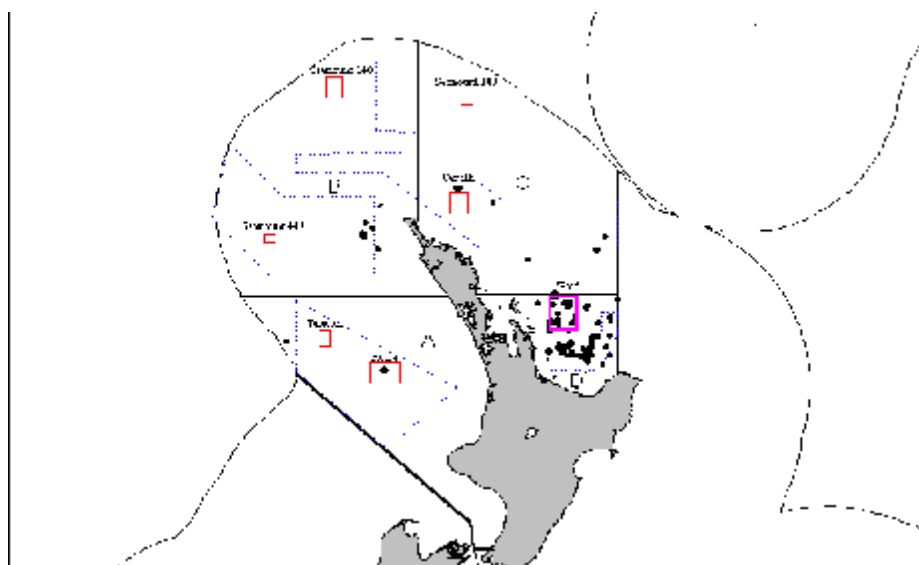


Figure 1. Four sub-management areas for the ORH 1 AMP (labelled A-D). Dotted lines enclose the exploratory fishing areas defined in the special permit issued on 6 July 1998. Solid lines enclose seamount closures and the Mercury-Colville Ohena ‘box’ (labelled at their top). Trawls (dots) where orange roughy were reported as the target species and caught during 1997–98 and 1998–99 are shown. Note that the lines separating Areas A and D from Areas B and C are incorrectly drawn at 36° S latitude rather than 35°30’ S latitude.

Full-term Review of ORH 1 AMP in 2006

In 2006 the AMP FAWG reviewed the performance of the AMP after 4 years in its current 5-year term. The WG noted:

ORH 1 Decision Rule (abbreviated)

Decision rules for each of the ORH 1 sub-areas are based on the aggregate CPUE (t/tow) for each area. When the CPUE drops below the following threshold levels, the corresponding actions are required:

	Drop below 2.0 t/tow	Drop below 1.5 t/tow
Area A	Undefined (monitoring will only commence once 100 t of ORH is taken from this area)	Undefined (monitoring will only commence once 100 t of ORH is taken from this area)
Area B	500 t annual limit 100 t annual feature limit for Tauroa Knoll West Norfolk Ridge: subject to review	500 t annual limit 50 t annual feature limit for Tauroa Knoll West Norfolk Ridge: subject to review
Area C	500 t annual limit 100 t annual feature limit for North Colville & East Northland Directed exploratory fishing in North Colville & East Northland	500 t annual limit 75 t annual feature limit for North Colville & East Northland Directed exploratory fishing in North Colville & East Northland
Area D	Not Applicable	Not Applicable

Note that as only directed fishing is proposed for Area D, CPUE-based rules are not applicable.

Indices of Abundance

- Unstandardized CPUE (t/tow) is proposed as the major monitoring tool for this fishery.
- Owing to problems with the accuracy of catch and effort data (resulting from an undetermined degree of misreporting), the CPUE analysis was postponed until such time as the misreported data had been corrected.

Scientific Observer Programme

- The target of the observer programme is to observe 50% of the ORH 1 effort (although there was some discussion that the original target had been to place observers on 50% of the trips). Actual coverage was 25% to 37% of estimated catch between 2001/02 and 2004/05. Temporal and spatial coverage was reasonable considering the small number of trips to many features. In the future, coverage should be presented in terms of effort (number of trips and tows). Given that the MFish SOP design protocol specifies that only one tow per day is required to be sampled, it is likely that the 50% coverage target is not achievable even if an observer is present on every ORH 1 trip.
- Observers should concentrate on sampling as many tows as possible. The chairman undertook to contact the SOP in this regard.
- Biological data indicated that, although most fish spawn in June/July, some fish appear to spawn in October and February/March. Paul Starr, Malcolm Clark and Owen Anderson undertook to verify the data that suggested spawning outside of the established winter season.
- Cumulative plots of the size composition of fish from each feature would be useful to determine whether observed differences were persistent across years and seasons.
- Number of otoliths collected should be recorded.
- Non-fish bycatch recorded by observers should also be recorded.

Sub-area D Directed Adaptive Exploratory Fishing Programme

- The purpose of this exercise was to establish whether fish populations shift between features in different years in sub-area D. In theory, if the fish changed features between years, spawning aggregations would be found on different features from one year to the next.
- Directed exploratory fishing was carried out in the Bay of Plenty during the spawning season of four fishing years: 4 July – 2 August 2002; 18 June – 4 July 2003; 23 June to 9 July 2004 and 29 Jun – 8 Jul 05.

- One of the problems in sampling orange roughy spawning aggregations is that the plumes can appear or disappear within very short time frames (hours). As a result, multiple surveys/trawls of each feature are necessary to determine whether a spawning aggregation is present within a given spawning season.
- Many features were only sampled using one or two tows during the 2002 and 2003 “surveys”, with the result that it is unclear whether the observation that there was no spawning on some of the features was due to random chance or to an actual lack of spawners. The AMP FAWG recommended that the design of these “surveys” be reconsidered and that more tows over a longer period be directed at fewer features in order to meet the overall objectives of the directed exploratory fishing.
- All features sampled were visited and trawled twice during the 2004 and 2005 surveys. The WG recommended that the 2006 survey should concentrate on the four or five features that had consistently produced orange roughy in previous surveys. These should be visited twice, placing 4 or 5 tows per visit to reduce uncertainty on CPUE and the presence of spawning. The features recommended by the WG include Colville Knolls, Mercury Knolls, Nukuhou Knoll and Waitotahi Knoll. Acoustic traces associated with each tow should be recorded to provide qualitative information on the size of the spawning aggregation. Clarification was later provided to indicate that the protocol of associating acoustic information with each tow was already in place for this work.
- Based on the designated exploratory fishing projects completed thus far, it is evident that catches from all features contained a high proportion of ripe or ripe running ovaries and that synchronised spawning occurred on a range of hills during winter.
- Future presentations should include more detailed analysis of size structure on each feature to determine if persistent signatures exist.

Conclusions

- Without the CPUE analyses it was not possible to make any conclusions on the status of ORH 1, or sustainability of the area specific TACCs.

5. STATUS OF THE STOCKS

A new fishery developed in the area in 1994. Indications from commercial fishing and the results of fishing under Special Permit were that there was potential for the fishery to develop, at least in the short-term, beyond the TACC. An adaptive management programme was instituted in 1995, under which catches of 1000 t/yr could be taken from the Mercury-Colville area (Area D) for up to 5 years. Exploratory fishing in 1996 gave indications of additional fishing grounds within the QMA.

It is clear that, for whatever reason, fish abundance in the Mercury-Colville box has been considerably reduced, and is now at low levels. The assessment is uncertain because of concerns that environmental factors may have influenced availability or catchability of the fish. However, research and commercial CPUE data both show strong declines in recent years. It is likely that the stock is below B_{msy} , and a catch limit of 30 t has been set for the box. The assessment indicates that a catch level of about 100 t will probably maintain the stock at its current size (assuming deterministic recruitment), and levels between 16 t and 35 t are consistent with MCY or CAY strategies, which may allow the stock to rebuild slowly.

In other areas, the level of catch and effort has varied. In some areas, stocks have been lightly exploited and the fishery is thought to still be in the fishing down phase. Therefore, the current stock size is probably above that which will support the maximum sustainable yield. From 1 October 2001, the TACC for ORH 1 was increased to 1400 t within the AMP. However, it is not known if recent catch levels and the current TACC are sustainable in the long term. For other areas, such as seamounts near White Island and the Tauroa Knoll, stock status is unknown.

6. FOR FURTHER INFORMATION

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