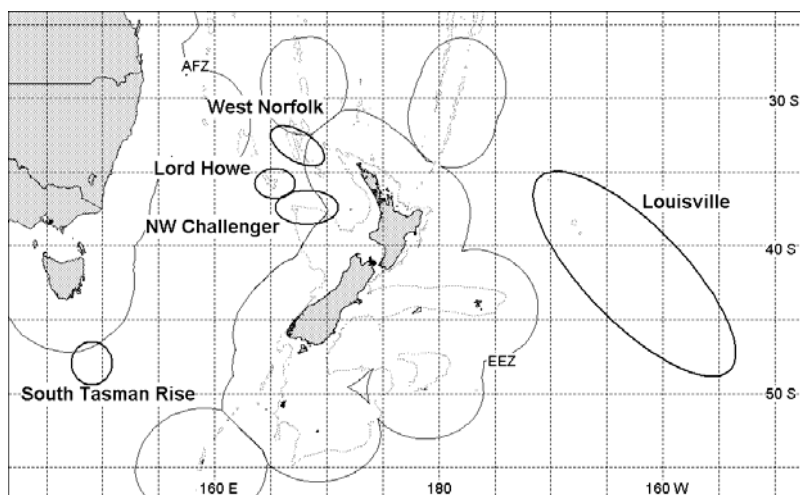


ORANGE ROUGHY OUTSIDE THE EEZ (ORHET)



1. FISHERY SUMMARY

(a) Commercial fisheries

Fisheries outside the EEZ in the New Zealand region occur on ridge systems and seamount chains in the Tasman Sea and southwest Pacific Ocean. There are 5 main fishing areas: Lord Howe Rise, Northwest Challenger Plateau, West Norfolk Ridge, South Tasman Rise, and Louisville Ridge (see figure above).

Fisheries outside the EEZ developed firstly on the “Westpac Bank” close to the main fishing grounds on the southwest Challenger Plateau in the early-mid 1980s. This is included in the stock area of ORH 7A, and so is not covered here. Further exploration in the region resulted in discoveries of commercial fisheries on the Lord Howe Rise in 1987–88, Northwest Challenger Plateau in 1988–89, Louisville Ridge in 1993–94, South Tasman Rise in 1997–98, and West Norfolk Ridge in 2001–02 (Table 1).

Catch totals include data from New Zealand and Australian vessels available from tow by tow fishing records, with estimated catches added for vessels from Japan, USSR, Korea, Norway, South Africa and China. Catch statistics are likely to be incomplete.

These fisheries have been unregulated, with the exception of the South Tasman Rise area, where catches by Australian and New Zealand vessels have at times been restricted by a TAC imposed under a Memorandum of Understanding between the two countries.

Table 1: Estimated catches (t) of orange roughy for ORH ET fisheries from 1987–88 to 2005–06
(Data from New Zealand (FSU, QMS), Australia (AFMA), and various sources for other countries. Note the fishing year for South Tasman Rise is March to February, all others are October to September).

Fishing year	Lord Howe	NW Challenger	Louisville	West Norfolk	South Tasman	Total ET
1987–88	4000	5	0	0	0	4005
1988–89	2430	297	0	0	0	2727
1989–90	927	425	0	0	0	1352
1990–01	282	123	0	0	0	405
1991–02	859	620	0	0	0	1479
1992–03	2300	2463	0	0	0	4763
1993–04	840	1731	689	0	0	3260
1994–05	761	1138	13 252	0	0	15 151
1995–06	5	500	8816	0	0	9321
1996–07	139	332	3209	0	5	3685
1997–08	26	397	1404	0	3930	5757
1998–09	440	961	3164	0	705	5270
1999–00	52	473	1369	0	4110	6004
2000–01	428	1228	1598	10	830	4094
2001–02	120	2075	1004	649	170	3729
2002–03	272	1010	1296	94	110	2782
2003–04	324	654	1419	90	3	2490
2004–05	430	464	1510	277	55	2736
2005–06	240	201	669	727	12	1849

Lord Howe Rise

Commercial quantities of orange roughy were found by Japanese vessels in winter 1988, and New Zealand vessels joined the fishery the following year. A number of countries fished the Rise in the late 1980s, but since then it has been largely a New Zealand and Australian fishery. Tows were relatively long at the start of the fishery, when most fishing effort was on the flat ground of the broad platforms. However, shorter tows have become more common associated with a shift onto rough ground and small hill features in the area. Levels of catch and effort decreased to low levels in the mid 1990s, but in recent years have tended to increase, along with unstandardised catch rates (Table 2).

Table 2: Catch and effort data from NZ vessels for the Lord Howe Rise.

Fishing year	Number of tows	Total recorded catch (t)	Mean tow length (h)	Mean catch rate (t/tow)	Mean catch rate (t/h)	Mean catch rate (t/nmile)
1988–89	181	766	3.0	4.2	5.2	1.5
1989–90	63	127	2.9	2.0	1.0	0.3
1990–91	14	52	2.9	3.7	2.0	0.7
1991–92	70	479	1.7	6.8	7.6	2.5
1992–93	825	1363	1.3	1.7	3.6	1.2
1993–94	1263	777	0.9	0.6	1.9	0.8
1994–95	110	61	1.2	0.6	0.5	0.2
1995–96	26	5	0.7	0.2	0.5	0.2
1996–97	179	44	0.8	0.2	0.8	0.3
1997–98	57	15	0.3	0.3	1.8	0.5
1998–99	138	48	1.0	0.3	0.5	0.2
1999–00	121	34	1.1	0.3	1.3	0.5
2000–01	136	145	0.7	1.1	2.9	1.0
2001–02	191	110	0.7	0.6	2.3	0.7
2002–03	280	208	0.5	0.7	4.3	1.3
2003–04	207	180	0.7	0.9	4.5	1.5
2004–05	218	255	0.6	1.2	5.5	1.8
2005–06	71	123	0.3	2.1	17.8	5.8

A reduced data set has been examined for 22 vessels that have fished for several years in the area (Table 3). CPUE peaked in 1991–92, declined rapidly to low levels from 1994–95 to 1998–99, and has increased over the last 5 years. Most fishing now takes place in the period from May to July.

Table 3: Unstandardised CPUE indices for core vessels from Lord Howe Rise.

Fishing year	Number of tows	Catch (t)	t/tow	t/n.mile	t/hr
1988–89	72	291	4.1	0.5	1.5
1989–90	63	128	2.0	0.3	1.0
1990–91	16	52	3.3	0.6	1.8
1991–92	76	481	6.3	2.3	7.1
1992–93	539	1108	2.1	1.2	3.7
1993–94	897	618	0.7	0.7	1.7
1994–95	109	60	0.6	0.2	0.5
1995–96	29	5	0.2	0.2	0.5
1996–97	184	45	0.2	0.3	0.8
1997–98	58	15	0.3	0.5	1.7
1998–99	49	3	0.1	0	0.1
1999–00	77	28	0.4	0.7	1.9
2000–01	127	146	1.2	1.1	3.2
2001–02	162	106	0.7	0.8	2.6
2002–03	269	206	0.8	1.4	4.4
2003–04	148	144	0.9	1.5	4.4
2004–05	87	170	2.0	3.8	12.0
2005–06	40	97	2.4	7.4	22.8

Northwest Challenger Plateau

New Zealand and Norwegian vessels began working the northwestern margins of the Challenger Plateau in the late 1980s. Fishing initially was on relatively flat bottom but from 1990 onwards developed more on small hill and pinnacle features, and mean tow length became relatively short (Table 4). Effort declined during the mid 1990s but increased substantially in 2000–01. Tow length increased also, as the fishery moved eastwards along the northern flanks of the Plateau in towards the EEZ. The hill fishery has decreased. Effort has also extended southwards along the western margins of the Challenger Plateau, although catches there have been small.

Table 4: Catch and effort data from NZ vessels for Northwest Challenger.

Fishing year	Number of tows	Total recorded catch (t)	Mean tow length (h)	Mean catch rate (t/tow)	Mean catch rate (t/h)	Mean catch rate (t/nmile)
1988–89	33	107	3.2	3.3	1.5	0.5
1989–90	40	25	2.4	0.6	0.6	0.2
1990–91	4	1	0.2	0.3	1.5	0.4
1991–92	56	230	0.5	4.1	12.8	3.7
1992–93	1370	2250	0.8	1.6	3.9	1.2
1993–94	1499	1394	1.1	0.9	1.4	0.5
1994–95	877	1138	0.8	1.3	5.7	2.0
1995–96	270	500	1.0	1.9	10.0	3.4
1996–97	385	332	0.8	0.9	3.5	1.2
1997–98	215	228	0.7	1.1	6.0	2.0
1998–99	707	838	0.8	1.2	4.2	1.4
1999–00	598	335	1.0	0.6	2.6	0.9
2000–01	1002	944	2.6	0.9	1.5	0.5
2001–02 ¹	2431	1863	3.9	0.8	1.4	0.5
2002–03 ¹	1979	948	3.8	0.5	0.9	0.3
2003–04	869	495	3.5	0.6	0.9	0.3
2004–05	1007	442	4.7	0.4	0.7	0.2
2005–06	399	200	5.2	0.5	0.6	0.2

¹ Aggregated daily data are included in the vessel, tow, and catch totals, excluded from catch rate.

Unstandardised CPUE for vessels that have fished the area for several years has declined over time (Table 5). Average catch per tow has been less than 1 t since 2000, even though the success of catching orange roughy (expressed as % of zero catch trawls) has improved.

Table 5: CPUE indices for core vessels from all seasons.

Fishing year	Number of tows	Catch (t)	Unstandardised CPUE		
			t/tow	t/nmile	% zero catch
1992–93	474	819	1.7	0.9	20
1993–94	1115	1343	1.2	0.6	42
1994–95	869	1136	1.3	2.0	39
1995–96	266	499	1.9	3.5	36
1996–97	379	330	0.9	1.2	41
1997–98	211	227	1.1	2.0	35
1998–99	463	622	1.3	1.3	25
1999–00	430	190	0.4	0.6	29
2000–01	997	940	0.9	0.5	15
2001–02	2098	1633	0.6	0.5	10
2002–03	1822	896	0.5	0.3	12
2003–04	786	464	0.6	0.3	9
2004–05	828	385	0.5	0.3	7
2005–06	324	164	0.5	0.2	4

Catch rates in the hill fishery (winter, tow duration less than 30 minutes), has decreased (Table 6). From a peak at around 4 t/tow in the mid 1990s it has dropped to less than 1 t. Effort in June during the last 2 years was low.

Table 6: CPUE indices for cropped data from June only.

Fishing year	Number of tows	Catch (t)	Unstandardised CPUE		
			t/tow	t/nmile	% zero catch
1992–93	182	385	2.1	1.4	15
1993–94	187	283	1.5	1.3	28
1994–95	105	399	3.8	5.6	32
1995–96	103	426	4.1	8.3	33
1996–97	131	244	1.9	3.1	31
1997–98	80	108	1.4	3.6	26
1998–99	251	367	1.5	1.9	26
1999–00	101	64	0.6	1.8	33
2000–01	65	49	0.7	1.3	32
2001–02	203	301	1.5	2.7	20
2002–03	174	127	0.7	1.2	26
2003–04	143	123	0.9	1.3	24
2004–05	38	7	0.2	0.5	16
2005–06	5	2	0.4	0.2	0

The fishery has for many years now been worked solely by New Zealand and Australian vessels, mostly between April and July.

West Norfolk Ridge

This is a recent fishery that followed exploratory fishing inside the EEZ on the West Norfolk Ridge (ORH 1). In 2001–02 Australian vessels were involved as well as New Zealand vessels. Catches quickly increased to almost 300 t, but then dropped substantially the following year (Table 7). Catches were low for 2 years but have increased since as new hills along the ridge were fished.

Table 7: Catch and effort data from NZ vessels for the West Norfolk Ridge orange roughy fishery.

Fishing year	Number of tows	Total recorded catch (t)	Mean tow length (h)	Mean catch rate (t/tow)	Mean catch rate (t/h)	Mean catch rate (t/nmile)
2000–01	1	0.2				
2001–02	297	586	0.3	2.0	9.0	3.0
2002–03	91	35	0.3	0.4	2.4	0.8
2003–04	90	88	0.5	1.0	2.3	0.8
2004–05	248	274	0.4	1.1	4.4	1.5
2005–06	337	727	0.4	2.2	15.3	5.1

Fishing has been spread over the year, although highest catch rates have occurred in June and July (Table 8).

Table 8: Monthly distribution of catch rates (t/tow) by NZ vessels in the West Norfolk Ridge orange roughy fishery. Blanks indicate months when there was no effort.

Fishing year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2000–01				0.2								
2001–02	0.1	6.0	7.1	1.6	1.4	1.5	1.1	3.5	2.5	1.9	0.4	
2002–03	0.9	0.5	0.8	0.1			0.2	0.7	0.1	0.1		
2003–04	0.5		0.4				0.2	0.7	1.4	2.8		0.7
2004–05	1.0	0.6		0.2		0.6	2.0	0.8	1.5	1.2		
2005–06	1.8	0.5	0.7	0.7		1.3	0.4	0.7	7.0	3.3	0.7	

Louisville Ridge

The Louisville Ridge is a chain of more than 60 seamounts extending for over 4000 km southeast from the Kermadec Ridge. Fishing began in 1993–94 in the central part of the ridge, and spread both northwest and southeast in subsequent years. The fishery has comprised largely New Zealand vessels, although vessels from Australia, China, Russia, Ukraine, Korea and Japan are known to have fished the ridge also (mainly in the first few years). The New Zealand catch peaked in 1994–95 at over 11 000 t (Table 9), and in recent years has generally been between 1000 and 1500 t. Catch rates have varied, and shown no consistent trend, either overall or divided into sub-areas (Table 10). Both catch and effort decreased in 2005–06.

Table 9: Catch and effort data from NZ vessels for the Louisville Ridge.

Fishing year	Number of tows	Total recorded catch (t)	Mean tow length (h)	Mean catch rate (t/tow)	Mean catch rate (t/h)	Mean catch rate (t/nmile)
1993–94	134	189	1.4	1.4	1.5	0.6
1994–95	4294	11 340	0.7	2.6	10.6	4.2
1995–96	4024	8764	0.7	2.2	7.4	3.0
1996–97	1849	3209	0.8	1.7	5.3	2.1
1997–98	787	1404	0.5	1.8	14.2	4.8
1998–99	1093	3025	0.5	2.7	14.2	5.2
1999–00	918	1369	0.5	1.5	11.4	3.8
2000–01	749	1598	0.5	2.1	18.0	2.3
2001–02	889	1004	0.6	1.1	7.4	2.4
2002–03	736	1296	0.4	1.8	13.8	4.6
2003–04	1336	1419	0.4	1.1	8.7	2.8
2004–05	745	1510	0.4	2.0	13.1	4.3
2005–06	581	669	0.6	1.2	6.0	1.9

Table 10: Average catch rate (tonnes per tow) of orange roughy by New Zealand vessels from the Louisville Ridge, by season and sub-area from 1993–94 to 2005–06. The winter column is for June–August.

	Full Area		North		Central		South	
	All year	Winter	All year	Winter	All year	Winter	All year	Winter
1993–94	1.4	1.9			1.5	1.9		
1994–95	2.6	2.7	1.7	3.9	2.7	2.6	2.3	11.0
1995–96	2.2	3.6	3.0	6.0	1.4	2.1	2.8	3.9
1996–97	1.7	2.1	1.2	1.4	1.8	2.0	3.3	3.5
1997–98	1.8	2.0	1.7	1.9	2.0	2.4	0.7	0.7
1998–99	2.7	2.7	2.0	2.1	3.0	2.9	1.8	1.7
1999–00	1.5	1.8	1.4	2.1	1.5	1.6	2.3	2.8
2000–01	2.1	2.3	2.4	2.6	1.9	2.0	1.9	1.9
2001–02	1.1	1.3	0.8	0.9	1.9	2.3	2.8	3.9
2002–03	1.7	1.9	1.6	1.7	1.2	1.2	5.3	5.3
2003–04	1.1	1.1	0.7	0.7	1.4	1.4	1.6	1.8
2004–05	2.0	2.1	1.6	1.8	1.6	1.6	2.8	2.9
2005–06	1.1	1.1	1.0	1.0	1.0	1.0	1.6	1.6

CPUE, from individual seamounts shows variable patterns. The fishery on some seamounts has lasted only a few years, while on others it has continued, or fluctuated over time. Seamounts in the northwestern and southeastern sections of the Ridge have not sustained consistent catches, and some localised depletion has occurred.

South Tasman Rise

Exploratory fishing south of Tasmania located aggregations of orange roughy on the South Tasman Rise just outside the Australian Fishing Zone (AFZ) in late 1997. The fishery rapidly increased in the next 4 years (Table 11), with Australian and New Zealand vessels working several small hill features on the Rise. However, New Zealand vessels have not fished the South Tasman Rise since 2000–01. Effort has dropped continuously since 2001–02, and mean catch per tow in 2004–05 was about 1 t/tow. Note that insufficient vessels fished in 2005–06 to enable presentation of catch or effort summaries.

Table 11: Catch and effort data from the South Tasman Rise (combined Australian and New Zealand data).

Fishing year	Number of tows	Total recorded catch (t)	Mean tow length (h)	Mean catch rate (t/tow)	Mean catch rate (t/h)
1996–97	61	4	0.6	0.1	0.5
1997–98	1132	3930	0.7	3.5	17.4
1998–99	1332	1705	0.6	1.3	10.4
1999–00	1086	3360	0.5	3.1	21.1
2000–01	1155	830	0.4	0.7	6.7
2001–02	201	170	0.8	1.0	3.5
2002–03	164	110	0.5	0.9	7.9
2003–04	67	2	0.3	0.1	0.4
2004–05	47	55	0.3	1.2	14.7

The fishery was formally regulated by a Memorandum of Understanding between Australia and New Zealand from December 1998. A precautionary TAC of 2100 t was applied, increased to 2400 t in 2000–01, and then progressively reduced to 600 t for 2004–05.

Monthly distribution of catch and effort have been affected by the quotas and fishing year, but typically catch rates during winter months, when orange roughy spawn, have been variable and inconsistent (Table 12).

Table 12: Monthly distribution of catch rates (t/tow) in the South Tasman Rise orange roughy fishery (combined NZ and Australian data). Blanks indicate months when there was no effort.

Fishing year	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
1996–97												
1997–98	0		0	0		0	1.9	5.5	1.4		3.6	5.1
1998–99	2.5	0			0	6.6	0	0.2	0.1	0	0	1.3
1999–00	1.2	3.7	5.1	9.8	0		0	0		0		0
2000–01	0.2	0.1	0.2	1.7	1.4	0.3	0		0	0	0	0
2001–02	0	0	0.1	0	2.7	1.1	0		0.5		0	0
2002–03	0		0		1.1	0.4					1.0	0
2003–04	0			0	0	0		0	0.1	0		
2004–05		1.1	1		1.8	0.1	0.9			2.4		0

(b) Summary of trends in commercial fisheries

Most fisheries outside the New Zealand EEZ continue to have variable levels of catch and effort between years. Catch levels have decreased for all fisheries since they began, but in recent years the total catch by New Zealand vessels has been consistent at 2000–2500 t. Trends in catch and effort have been difficult to interpret, given changes in the vessel composition over time and the areas fished between years.

Mean catch rates for the Lord Howe Rise have increased in recent years as the fishery has moved to hill features. The fishery appears to have become more consistent from year to year following a period of low catch and effort in the mid 1990s. The orange roughy catch in the Northwest Challenger Plateau fishery has declined substantially in the last few years. Unstandardised CPUE has been at relatively low levels since 2000–01, and associated with a shift towards long tows on the flat, the winter fishery on the hills declined considerably in 2004–05. The Louisville Ridge fishery has been the largest of those in the New Zealand region, and catch and effort levels are broadly similar to those in recent years, although the patterns on individual seamounts differ, with some appearing stable, while others have declined. The fishery on the South Tasman Rise has decreased to very low levels, and New Zealand vessels have not fished the Rise since 2001. The West Norfolk Ridge fishery developed rapidly in 2001–02, and after an initial decrease in catch and effort, these increased in 2004–05 as new sites were fished. Catches increased substantially in 2005–06.

(c) Recreational fisheries

There is no known non-commercial fishery for orange roughy in these areas.

(d) Maori customary fisheries

No Maori customary fishing for orange roughy is known in these areas.

(e) Illegal catch

In most of these areas, there are no regulations regarding limits on catch in international waters. The South Tasman Rise region has been subject to catch restrictions for Australian and New Zealand vessels under a Memorandum of Understanding between the two countries. In 1999–2000 vessels registered in South Africa and Belize fished the region. The estimated catch of at least 750 t has been included in the catch total for that year. No other information is available on any possible illegal catch on the South Tasman Rise, or the Westpac Bank region of ORH 7A.

(f) Other sources of mortality

There may be some overrun of reported catch because of fish loss with trawl gear damage, ripped nets, discards, and conversion factor inaccuracies. In a number of other orange roughy fisheries, a current level of 5% has been applied (higher in the past). No corrections are made here because of limited information on the sources which may differ with each fishery.

2. STOCKS AND AREAS

The five fishing grounds are all regarded as separate stocks.

The Lord Howe Rise and Northwest Challenger Plateau fisheries are based on fish that have a different size structure, different age/size at maturity, similar timing of spawning, and a geographical separation of about 120 n miles. Their genetic make-up differs from fish on the southwest Challenger Plateau (ORH 7A). Morphometric differences have also been shown between orange roughy from Lord Howe and Puysegur Bank areas.

Orange roughy on the South Tasman Rise are regarded as a straddling stock with fish inside the AFZ.

The Louisville Ridge is a long seamount chain, and little is known about stock structure within the area. There are several known spawning sites, and it would seem likely that there could be multiple stocks or sub-populations along the ridge.

3. STOCK ASSESSMENT

There are currently no accepted stock assessments for these orange roughy fisheries outside the EEZ. Several have been attempted (for Lord Howe, Northwest Challenger Plateau, Louisville Ridge) based on catch per unit effort data, but these have not been accepted as sufficiently robust by the Deepwater Fishery Assessment Working Group. This was generally on account of highly variable levels of effort and catch between years within each of the fisheries, which can make the use of CPUE as an index of abundance uncertain.

4. STATUS OF THE STOCKS

The status of the fisheries is unknown. Unstandardised CPUE has declined in a number of areas. However, it is not known if recent catch levels are sustainable, or whether they will allow the stocks to move towards a size that will support the MSY.

5. FOR FURTHER INFORMATION

- Anderson, O.F. (2006). A summary of biological information on the New Zealand fisheries for orange roughy (*Hoplostethus atlanticus*) for the 2003–04 fishing year. *New Zealand Fisheries Assessment Report 2006/16*. 25 p.
- Clark, M.R. (2003). Estimation of orange roughy biomass on the Louisville Ridge: application of “Seamount Meta-analysis” results. Final Research Report to the Ministry of Fisheries for ORH2002/03. (Unpublished report held by MFish, Wellington.)
- Clark, M.R. (2004). Descriptive analysis of orange roughy fisheries in the New Zealand region outside the EEZ: Lord Howe Rise, Northwest Challenger Plateau, West Norfolk Ridge, South Tasman Rise, and Louisville Ridge to the end of the 2002–03 fishing year. *New Zealand Fisheries Assessment Report 2004/51*. 36 p.
- Clark, M.R. (2006a). Descriptive analysis of orange roughy fisheries in the New Zealand region outside the EEZ: Lord Howe Rise, Northwest Challenger Plateau, West Norfolk Ridge, South Tasman Rise, and Louisville Ridge to the end of the 2003–04 fishing year. *New Zealand Fisheries Assessment Report 2006/25*. 37 p.
- Clark, M.R. (2006b). Descriptive analysis of orange roughy fisheries in the New Zealand region outside the EEZ: Lord Howe Rise, Northwest Challenger Plateau, West Norfolk Ridge, South Tasman Rise, and Louisville Ridge to the end of the 2004–05 fishing year. *New Zealand Fisheries Assessment Report 2006/56*. 38 p.
- Clark, M.R.; Anderson, O.F. (2001). The Louisville Ridge orange roughy fishery: an update of commercial catch-effort data and CPUE analysis of the fishery to the end of the 1999–2000 fishing year. *New Zealand Fisheries Assessment Report 2001/74*. 31 p.
- Clark, M.R.; Anderson, O.F. (2003). The Louisville Ridge orange roughy fishery: an analysis of commercial catch-effort data and stock assessment of the fishery to the end of the 2000–01 fishing year. *New Zealand Fisheries Assessment Report 2003/3*. 26 p.
- Clark, M.R.; O’Driscoll, R.L. (2002). Descriptive analysis of orange roughy fisheries in the Tasman Sea outside the New Zealand EEZ: Lord Howe Rise, Northwest Challenger Plateau, and South Tasman Rise from 1986–87 to the end of the 2000–01 fishing year. *New Zealand Fisheries Assessment Report 2002/59*. 26 p.
- Clark, M.; Tilzey, R. (1996). A summary of stock assessment information for orange roughy fisheries on the Lord Howe Rise: 1996. Bureau of Resource Sciences, Canberra. 23 p. (Available from BRS, P.O. Box E11, Canberra, Australia).
- Clark, M.; Tilzey, R. (2001). A summary of commercial catch and effort information for the orange roughy (*Hoplostethus atlanticus*) fishery on the South Tasman Rise from 1987 to 1999. *New Zealand Fisheries Assessment Report 2001/3*. 16 p.
- O’Driscoll, R.L. (2001). CPUE analysis of orange roughy fisheries outside the New Zealand EEZ: Lord Howe Rise and Northwest Challenger Plateau, to the end of the 1999–2000 fishing year. *New Zealand Fisheries Assessment Report 2001/36*. 26 p.
- O’Driscoll, R.L. (2003). Catch-per-unit-effort analysis of orange roughy fisheries outside the New Zealand EEZ: Lord Howe Rise and Northwest Challenger Plateau to the end of the 2001–02 fishing year. *New Zealand Fisheries Assessment Report 2003/36*. 38 p.
- Smith P.J., Robertson, S., Horn, P., Bull, B., Anderson O., Stanton, B.R., Oke, C.S. (2002). Multiple techniques for determining stock relationships between orange roughy, *Hoplostethus atlanticus*, fisheries in the eastern Tasman Sea. *Fisheries Research* 58: 119–140.
- Tilzey, R. (2000). South Tasman Rise trawl fishery. In: Caton, A., McLoughlin, K. (eds) Fishery status reports 1999: resource assessments of Australian Commonwealth fisheries. BRS, Canberra.
- Wayte, S., Bax, N., Clark, M.; Tilzey, R. (2003). Analysis of orange roughy catches on the South Tasman Rise, 1997–2002. Report provided to the Orange Roughy Assessment Group. 14 p. (Unpublished report held by CSIRO, Hobart.)