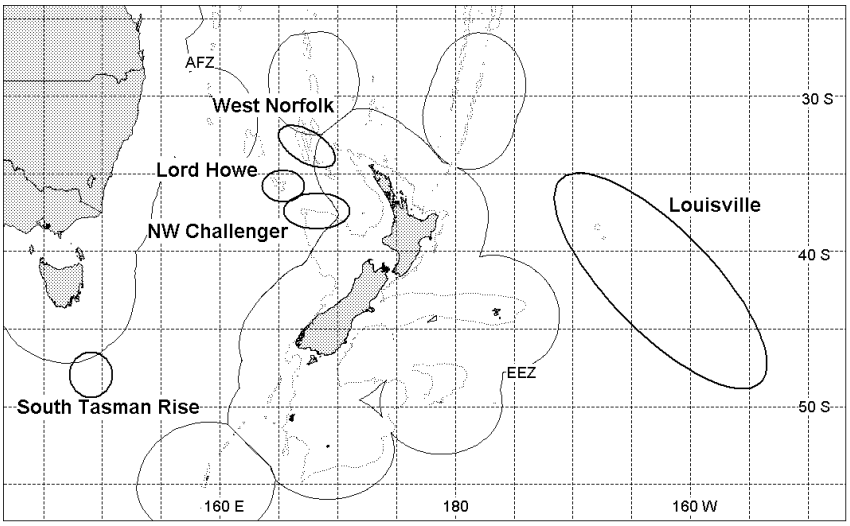
# ORANGE ROUGHY OUTSIDE THE EEZ (ORH ET)




## 1. FISHERY SUMMARY

### 1.1 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 five main fishing areas: Lord Howe Rise, Northwest Challenger Plateau, West Norfolk Ridge, South Tasman Rise, and Louisville Ridge (see figure above).

The first orange roughy fishery outside the EEZ developed on the Westpac Bank close to the main fishing grounds on the southwest Challenger Plateau in the early-mid 1980s. Catches were recorded as part of the straddling stock crossing into ORH 7A, and therefore excluded from this chapter, up until 2007. Further exploration in the region resulted in the development 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. Catches from all these fisheries are tabulated by fishing year up to 2006–07, excluding Westpac Bank catches (Table 1), and by calendar year from 2007 to present (Table 2), as required by the South Pacific Fisheries Management Organisation (SPRFMO).

**Table 1: Estimated catches (t) of orange roughy for ORH ET fisheries from 1987–88 to 2006–07. (Data from New Zealand (FSU, QMS), Australia (AFMA), and various sources for other countries. Note that the fishing year for South Tasman Rise is March to February, all others are October to September). See Table 2 for catches from 2007 onwards.**

| Fishing year | Lord Howe | NW Challenger | Louisville | West Norfolk | South Tasman | Total ET |
|---|---|---|---|---|---|---|
| 1987–88 | 4 000 | 5 | 0 | 0 | 0 | 4 005 |
| 1988–89 | 2 430 | 297 | 0 | 0 | 0 | 2 727 |
| 1989–90 | 927 | 425 | 0 | 0 | 0 | 1 352 |
| 1990–01 | 282 | 123 | 0 | 0 | 0 | 405 |
| 1991–02 | 859 | 620 | 0 | 0 | 0 | 1 479 |
| 1992–03 | 2 300 | 2 463 | 0 | 0 | 0 | 4 763 |
| 1993–04 | 840 | 1 731 | 689 | 0 | 0 | 3 260 |
| 1994–05 | 761 | 1 138 | 13 252 | 0 | 0 | 15 151 |
| 1995–06 | 5 | 500 | 8 816 | 0 | 0 | 9 321 |
| 1996–07 | 139 | 332 | 3 209 | 0 | 5 | 3 685 |
| 1997–08 | 26 | 397 | 1 404 | 0 | 3 930 | 5 757 |
| 1998–09 | 440 | 961 | 3 164 | 0 | 705 | 5 270 |
| 1999–00 | 52 | 473 | 1 369 | 0 | 4 110 | 6 004 |
| 2000–01 | 428 | 1 228 | 1 598 | 10 | 830 | 4 094 |
| 2001–02 | 120 | 2 075 | 1 004 | 649 | 170 | 3 729 |
| 2002–03 | 272 | 1 010 | 1 296 | 94 | 110 | 2 782 |
| 2003–04 | 324 | 654 | 1 419 | 90 | 3 | 2 490 |
| 2004–05 | 430 | 464 | 1 510 | 277 | 55 | 2 736 |
| 2005–06 | 240 | 201 | 675 | 727 | 12 | 1 855 |
| 2006–07 | 40 | 96 | 323 | 552 | 0 | 1 011 |

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 were historically 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. The South Tasman Rise fishery is currently closed by SPRFMO.

**South Pacific Regional Fisheries Management Organisation (SPRFMO) Convention Area**

The SPRFMO Convention was closed for signature in January 2011 and formally entered into force in August 2012. Since that time, monitoring and assessment of catches and fisheries, including for orange roughy, has been overseen by the SPRFMO Scientific Committee. New Zealand reports annual catch and effort information in an Annual Report available on the SPRFMO website.

Regulation of these fisheries was implemented following adoption of the SPRFMO interim measures in May 2007, and specific high sea fishing permits for the SPRFMO Area have been issued since 2007–08. Table 3 shows the number of New Zealand vessels that fished and their orange roughy catch by area. From 2007 to 2019, an orange roughy catch limit was applied for New Zealand vessels, being the average annual catch between 2002 and 2006 (1852 t). Australia implemented analogous limits for its vessels, and no other nations fished orange roughy in the SPRFMO area.

From 2019, SPRFMO has implemented orange roughy catch limits that are subsequently allocated to SPRFMO Members who are permitted to fish under SPRFMO Conservation and Management Measures. In 2019 and 2020, catch limits were set for the Tasman Sea (comprises NW Challenger, W. Norfolk Ridge, and Lord Howe Rise), for the Louisville Ridge, and for the Westpac Bank. For 2021, the catch limit in the Tasman Sea was divided to represent the three Tasman Sea stocks.

For 2023 the catch limits were adjusted based on an update stock assessment (see stock assessment section below) and the Louisville Ridge was divided into North, Central and South Louisville (Table 3).

**Table 2: Annual effort and catch (t) data for orange roughy from New Zealand vessels, by area, for the SPRFMO Area (calendar years). Westpac Bank is on the Challenger Plateau but is considered part of the straddling stock ORH 7A so landings from that area are tabulated separately. Australian catches over this period, mostly from the Tasman Sea, ranged from 0 to 148 t, mean 46 t per annum). No other nations fished in this area.**

| Year | Number of Vessels | Number of tows | Lord Howe | NW Challenger | West Norfolk | Westpac | Louisville | Other | All areas |
|---|---|---|---|---|---|---|---|---|---|
| 2007 | 8 | 415 | 34 | 36 | 515 | – | 280 | – | 866 |
| 2008 | 4 | 208 | 380 | 31 | 426 | – | – | – | 837 |
| 2009 | 6 | 545 | 403 | 238 | 233 | 23 | – | 31 | 928 |
| 2010 | 7 | 1 170 | 385 | 415 | 79 | 5 | 584 | 6 | 1 474 |
| 2011 | 7 | 1 158 | 1 | 675 | 113 | 5 | 285 | – | 1 079 |
| 2012 | 6 | 652 | 121 | 247 | 49 | 8 | 288 | 8 | 721 |
| 2013 | 5 | 760 | 344 | 230 | 19 | 3 | 565 | 3 | 1 164 |
| 2014 | 5 | 403 | 79 | 57 | – | 54 | 754 | 54 | 998 |
| 2015 | 5 | 959 | 157 | 530 | 20 | 118 | 462 | – | 1 287 |
| 2016 | 6 | 943 | 208 | 486 | – | 234 | 27 | – | 954 |
| 2017 | 5 | 1 423 | 215 | 307 | 22 | 129 | 420 | – | 1 093 |
| 2018 | 6 | 858 | 180 | 399 | 5 | 569 | 81 | – | 1 232 |
| 2019 | 4 | 221 | 38 | 171 | 0 | 111 | 139 | – | 460 |
| 2020 | 3 | 329 | 2 | 76 | 3 | 88 | 133 | – | 301 |
| 2021 | 1 | 17 | - | - | - | 20 | - | - | 20 |

**Table 3: Total and New Zealand allocated catch limits (t) from 2023.**

| Year | Lord Howe | NW Challenger | West Norfolk | Tasman Sea NZ limit | Westpac | Westpac NZ limit | Louisville North | Louisville Central | Louisville South | Louisville NZ limit | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023 | 174 | 160- | 44 | 302 | 258 | 245 | 116 | 305 | 160 | 523 | – |

### 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 four years (Table 4), 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 dropped continuously from 2001–02, and mean catch per tow in 2004–05 was about 1 t/tow. Note that insufficient numbers of vessels have fished since 2005–06 to enable presentation of catch or effort summaries.

**Table 4: 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 | 1 132 | 3 930 | 0.7 | 3.5 | 17.4 |
| 1998–99 | 1 332 | 1 705 | 0.6 | 1.3 | 10.4 |
| 1999–00 | 1 086 | 3 360 | 0.5 | 3.1 | 21.1 |
| 2000–01 | 1 155 | 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. The fishery was closed to all trawling in 2007. This area is now managed through SPRFMO and has a catch limit of zero tonnes.

## 1.2 Summary of trends in commercial fisheries

Information presented to the SPRFMO Scientific Committee shows that New Zealand catches of orange roughy have declined since the early 2000s and were relatively stable at about 1000 t between 2006-2018 and have decreased in 2019, 2020 and 2021. The distribution of catches between areas has varied substantially by year (Figure 1).

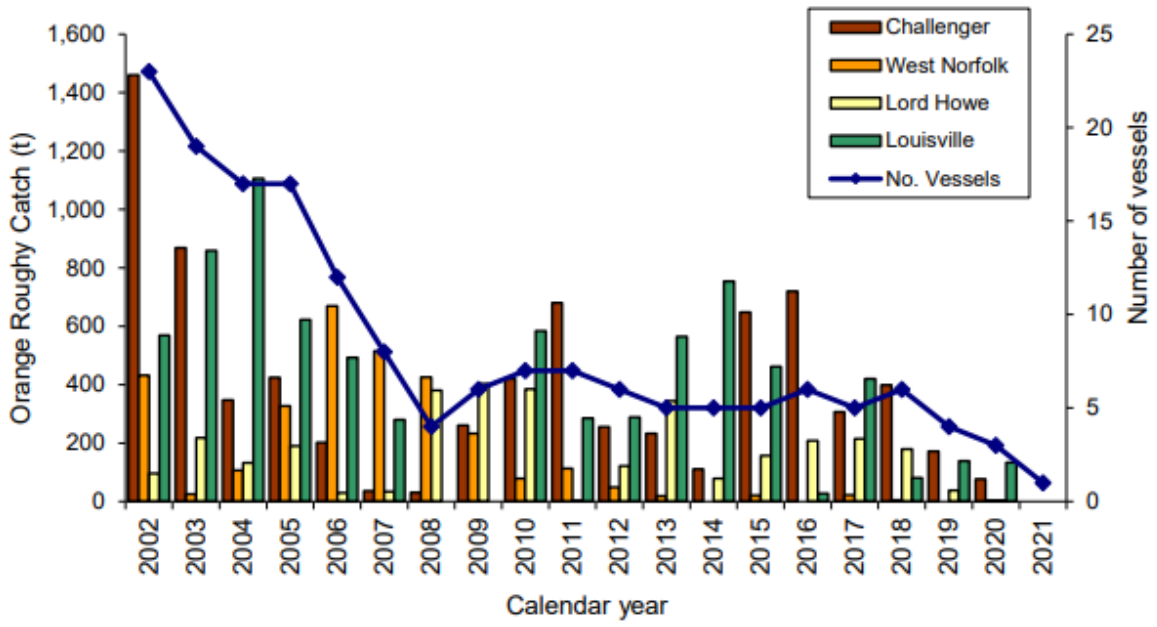



**Figure 1: Trends in effort (number of vessels bottom trawling) and total landings of orange roughy (tonnes) for each of the four main areas fished by New Zealand vessels in the SPRFMO area by calendar year from 2002–2021.**

Catch rates have varied considerably. Roux & Edwards (2017) developed a spatially-disaggregated CPUE index of stock abundance that corrects for some of the known issues with CPUE for orange

roughy (Figure 2). This index shows less variability between years than unstandardised or standard GLM modelled-CPUE, but it is still not known whether it indexes biomass.

### 1.3 Recreational fisheries

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

### 1.4 Customary non-commercial fisheries

There is no customary non-commercial fishing for orange roughy in these areas.

### 1.5 Illegal catch

In most of these areas, there were no regulations regarding limits on catch in international waters before 2007. 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 part of ORH 7A.

### 1.6 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

Stock structure is uncertain but Clark et al (2016) analysed multiple data sets and recommended that fishing grounds in the following areas be considered as separate units for the purpose of stock assessment: Lord Howe Rise; NW Challenger; SW Challenger; West Norfolk Ridge; South Tasman Rise; and North, Central, and South Louisville (Figure 2).

Orange roughy on the South Tasman Rise are regarded as a straddling stock with fish inside the AFZ. Those on the Westpac Bank on the SW Challenger Plateau are regarded as a straddling stock with fish inside New Zealand's EEZ and the ORH 7A stock.

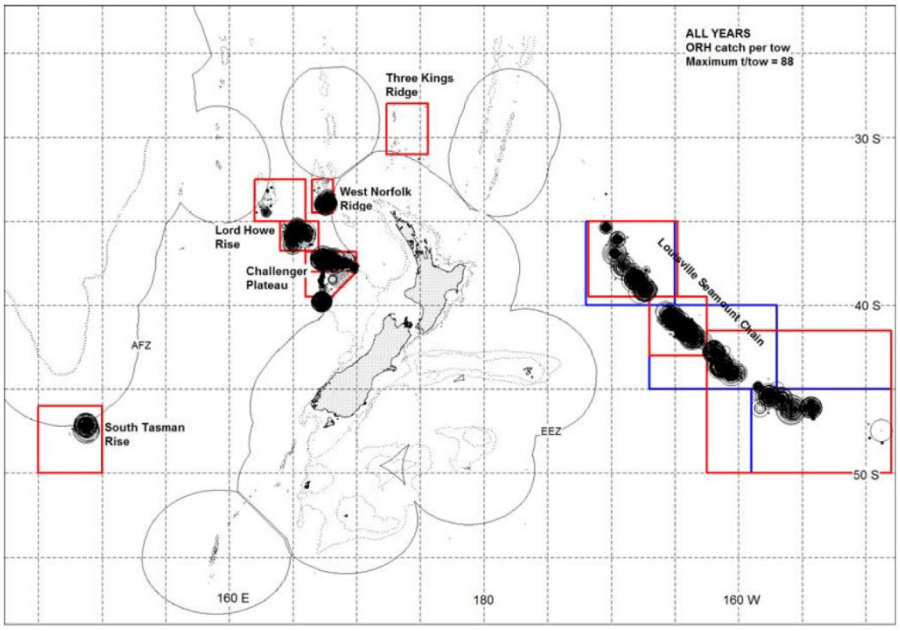



**Figure 2: Comparison of new areas assumed for stock assessment purposes (in red) and previous areas (in blue) overlaid on the total distribution of catch rates for orange roughy. Where both areas are coincident, red boxes overlay blue boxes. See Clark et al (2016) for details.**

## 3. STOCK ASSESSMENT

In 2022, stock assessment models using catch history, and age and length compositions, were used to estimate the minimum pre-fishing biomass that could have supported historical catches for each stock (Stephenson et al., 2022). Estimates of the minimum pre-fishing biomass ($B_{min}$) were made for central, south, and north Louisville stocks, West Norfolk stock, Lord Howe Rise stock, and Northwest Challenger stock.

The $B_{min}$ estimates replaced the previous Bayesian stock assessments after simulation modelling in 2022 found the data were insufficient to inform the most-likely (median) biomass estimates ($B_0$), and the previous assessments were therefore misleading (Stephenson et al., 2022).

$B_{min}$ was assumed to be the minimum initial biomass that did not incur a catch penalty (in deterministic calculations), or that incurred a catch penalty less than 5% or 10% of the time (in stochastic calculations). The catch penalty was incurred if the proportion of any age of fish that was caught in any year (the exploitation rate) was greater than 0.67. Recruitment was assumed constant in all estimates. $B_{min}$ was calculated across a range of fixed $B_0$ and natural mortality rate ($M$) values, with deterministic calculations made for all stocks, and stochastic calculations also made for stocks having age frequency data (Central Louisville Ridge, Lord Howe Rise, and Northwest Challenger).

$B_{min}$ was used as a proxy for $B_0$, with sustainable yields calculated by applying a fixed scalar associated with an MCY policy (1.45%) to the $B_{min}$ (i.e., sustainable yield = 0.0145 × $B_{min}$). The MCY scalar of 1.45% was intended to be applied to $B_0$, therefore the yields here, being calculated using $B_{min}$, are precautionary.

## 4. STATUS OF THE STOCKS

The status of the stocks in the SPRFMO Convention Area is not well-known. The SPRFMO Scientific Committee has accepted stock assessments based on deterministic $B_{min}$ with M = 0.03 for the main stocks (Tables 5 and 6).

**Table 5: $B_{min}$ estimates (t) as a proxy for $B_0$ for different assumed $M$, stochastic estimated probability of incurring the catch penalty (5% or 10%), and deterministic estimate (all parameters fixed).**

| | 5% | | 10% | | Deterministic | |
|---|---|---|---|---|---|---|
| | $M$ = 0.030 | $M$ = 0.045 | $M$ = 0.030 | $M$ = 0.045 | $M$ = 0.030 | $M$ = 0.045 |
| Louisville Ridge central | 26 000 | 28 000 | 25 000 | 26 000 | 21 000 | 23 000 |
| Louisville Ridge north | – | – | – | – | 8 000 | 8 000 |
| Louisville Ridge south | – | – | – | – | 11 000 | 10 000 |
| West Norfolk Ridge | – | – | – | – | 3 000 | 3 000 |
| Lord Howe Rise | 12 000 | 11 000 | 12 000 | 11 000 | 12 000 | 11 000 |
| Northwest Challenger | 11 000 | 9 000 | 11 000 | 9 000 | 11 000 | 9 000 |

**Table 6: Sustainable yield estimates (t) by multiplying B*min* from different assumed *M* and calculation methods (Table 5) by a fixed scalar of 0.0145.**

| | 5% | | 10% | | Deterministic | |
|---|---|---|---|---|---|---|
| | $M$ = 0.030 | $M$ = 0.045 | $M$ = 0.030 | $M$ = 0.045 | $M$ = 0.030 | $M$ = 0.045 |
| Louisville Ridge central | 377 | 406 | 363 | 377 | 305 | 334 |
| Louisville Ridge north | – | – | – | – | 116 | 116 |
| Louisville Ridge south | – | – | – | – | 160 | 145 |
| West Norfolk Ridge | – | – | – | – | 44 | 44 |
| Lord Howe Rise | 174 | 160 | 174 | 160 | 174 | 160 |
| Northwest Challenger | 160 | 131 | 160 | 131 | 160 | 131 |

# 5. FOR FURTHER INFORMATION

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