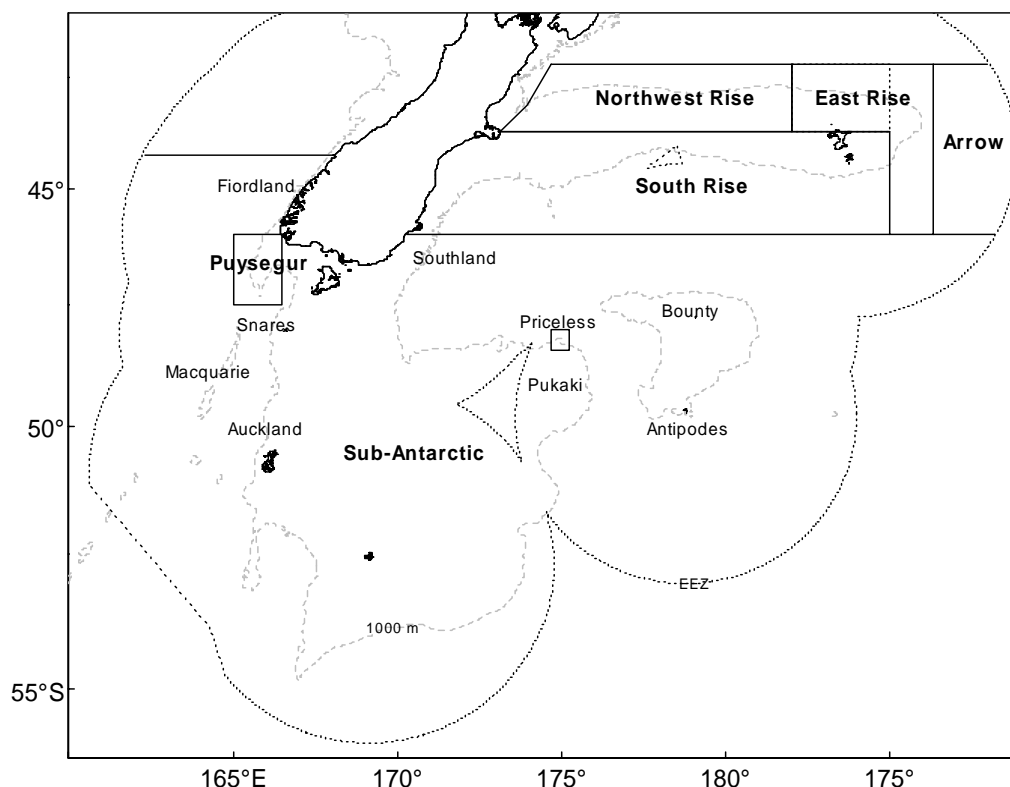


# ORANGE ROUGHY (ORH 3B)

Figure 1: ORH 3B Quota Management Area and sub-stock boundaries



## Executive Summary

- 1 ORH 3B is a large and spatially complex fishery and it is generally agreed that it is comprised of several biological stocks. A range of sub-QMA catch limits were requested by the Minister in 2006 and are managed under a voluntary agreement by the Deepwater Group (DWG) which represents 97.95% of the ORH 3B quota owners. Monthly reports on catch by sub-stock and sub-area are provided to MFish.
- 2 Although information at the stock level is uncertain, on balance MFish considers that the ORH 3B stock is likely to be below BMSY and that it is appropriate to manage this stock under section 13(2)(b) of the Act. MFish considers that the management measures in place for the Northwest Rise, Arrow Plateau, Puysegur and the Sub-Antarctic sub-stocks are appropriate. Options considered in the paper address management measures for the South and East Rise.
- 3 No new stock assessment information is available this year. A proposed South Rise assessment was not progressed due to evidence to suggest that the East and South Rise do not constitute separate sub-stocks. Separate stock

assessments for the areas within the East Rise were accepted by the Plenary in 2006. While the reasons for rejecting the South Rise assessment raise concerns over the stock assessment boundaries, the East Rise assessments stand as the best available information on the status of the East Rise fishery. Based on the 2006 assessments the Andes and the Northeast Hills sub-areas are below BMSY.

- 4 Prior to the 2006-07 fishing year, Industry proposed a staged reduction of the catch limits on the East and South Chatham Rise of 1 000 t per year for three years. The Minister ultimately supported this reduction in combination with a reduction in the catch limit on the Northwest Rise, and reduced the ORH 3B TAC accordingly. As part of his decision, the Minister also requested that Industry limit the catch taken from the two principal feature complexes on the East Rise (the Andes Complex and the Northeast Hills sub-areas) in response to his concerns of localised depletion. Industry expressed the view that managing to these sub-area limits was not possible, nor was it warranted on the basis that fish moved freely between features on the East and South Rise. Accordingly, Industry has not managed to the sub-area limits for the Andes and the Northeast Hills, although the sub-stock catch spreading arrangements (Northwest Rise, East Rise, South Rise, Spawning Box, and sub-Antarctic) requested by the Minister have been respected.
- 5 MFish considers that, although uncertain, there remain sustainability concerns for the South and East Rise sub-stocks. Industry share this view and have confirmed their support for a further 1 000t reduction to the TAC for the 2007-08 fishing year, to be effected by a reduction in catch levels on the South and East Rise. Industry remains opposed to sub-area feature limits.
- 6 MFish proposes under options 2 and 3 to retain the existing South Rise boundary and to simplify the management arrangements within the East Rise. These simplified arrangements retain catch spreading arrangements to ensure that effort is not concentrated on any of the recognized feature complexes within the East Rise. Effectively they provide for the East Rise catch limit to be spread between the spawning box, the Northeast Rise (incorporating the Northeast Hills) and the Southeast Rise (incorporating the Andes Complex).
- 7 Under option 2, a 1 000 t reduction in the TAC would be effected by reducing the South and East Rise catch limits, spread between the South Rise and the three East Rise areas. Option 3 proposes a reduction of 2 000 t incorporating the same catch split arrangements.

## Summary of Options

- 8 The proposals for TAC/TACC and sub-stock and sub-area catch limits for ORH 3B in the 2007-08 fishing year are summarized in Table 1 and 2, and are detailed in full below.

ORH 3B Sub-Areas	Option 1 - status quo
<b>Northwest Chatham Rise</b>	<b>750</b>
<b>East and South Chatham Rise</b>	<b>8650</b>
East Chatham Rise	(Maximum) 7250
<i>Spawning Box (Jun-Aug)</i>	4000
<i>NE Hills</i>	200
<i>Andes Complex</i>	700
<i>Spawning box (outside Jun- Aug) + Eastern Flats</i>	2350
South Chatham Rise	(Maximum) 2000
<b>Puysegur</b>	<b>0</b>
<b>Arrow Plateau</b>	<b>0</b>
<b>Sub-Antarctic</b>	<b>1850</b>
Feature limit	500
<b>Research survey allowance</b>	<b>250</b>
<b>TACC</b>	<b>11500</b>
<b>Other sources of fishing related mortality</b>	<b>575</b>
<b>TAC</b>	<b>12075</b>

Table 1. Summary of proposed catch splitting arrangements for ORH 3B in 2007-08 under option 1

ORH 3B Sub-Areas	Option 2	Option 3
<b>Northwest Chatham Rise</b>	<b>750</b>	<b>750</b>
<b>East and South Chatham Rise</b>	<b>7650</b>	<b>6650</b>
East Chatham Rise	(Maximum) 6500	(Maximum) 5500
<i>Spawning Box (Jun-Aug)</i>	3200	3200
<i>Northeast Rise</i>	1650	1150
<i>Southeast Rise</i>	1650	1150
South Chatham Rise	(Maximum) 1750	(Maximum) 1750
<b>Puysegur (research)</b>	<b>0</b>	<b>0</b>
<b>Arrow Plateau</b>	<b>0</b>	<b>0</b>
<b>Sub-Antarctic</b>	<b>1850</b>	<b>1850</b>
Feature limit	500	500
<b>Research survey allowance</b>	<b>250</b>	<b>250</b>
<b>TACC</b>	<b>10500</b>	<b>9500</b>
<b>Other sources of fishing related mortality</b>	<b>525</b>	<b>475</b>
<b>TAC</b>	<b>11025</b>	<b>9975</b>

Table 2. Summary of proposed catch splitting arrangements for ORH 3B in 2007-08 under options 2 and 3

### **Option 1 - Status quo**

- 9 Under this option the existing management arrangements for ORH 3B will continue. This option will:
- a) Maintain the Total Allowable Catch (TAC) for orange roughy in ORH 3B at 12 075 tonnes for the 2007-08 fishing year, and within the TAC:
    - i) Retain an allowance of 575 tonnes for other sources of fishing related mortality;
    - ii) Retain zero allowances within the TAC for customary Maori and recreational fishing interests; and
    - iii) Retain the Total Allowable Commercial Catch (TACC) at 11 500 tonnes;
  - b) Request that industry retain the following designated sub-area catch limits within the TACC:
    - i) Northwest Chatham Rise be retained at 750 tonnes;
    - ii) East and South Chatham Rise be retained at 8 650 tonnes and within that catch limit;
      - Retain a maximum catch limit of 7 250 tonnes on the East Chatham Rise; and within that catch limit retain the following sub-area catch limits;
        - retain the 'spawning box' fishery at 4 000 tonnes during the spawning aggregation months of June-August;
        - retain the Northeast Hills fishery at 200 tonnes;
        - retain the Andes Complex fishery at 700 tonnes;
        - spread the remainder of the East Chatham Rise catch (2 350 t) about the Northeastern flats and the Spawning Box outside the spawning months (i.e. the two periods October – May and September);
      - Retain a maximum catch limit of 2 000 tonnes on the South Chatham Rise;
    - iii) The Arrow Plateau and Puysegur to remain closed;
    - iv) Retain a catch limit of 250 tonnes for Industry research surveys;
    - v) The Sub-Antarctic to be retained at 1 850 tonnes; and within that catch limit retain a feature limit of 500 tonnes.

### **Option 2**

- 10 Under this option the catch limit for the south and East Rise would be reduced by 1000 tonnes. Arrangements under this proposal would be to:
- a) Reduce the TAC for orange roughy in ORH 3B to 11 025 tonnes for the 2007-08 fishing year, and within the TAC:

- i) Set an allowance of 525 tonnes for other sources of fishing related mortality;
  - ii) Retain zero allowances within the TAC for customary Maori and recreational fishing interests; and
  - iii) Set the TACC at 10 500 tonnes;
- b) Request that Industry implement the following designated sub-area catch limits within the TACC:
- i) East and South Chatham Rise be reduced to 7 650 tonnes and within that catch limit;
    - Set a maximum catch limit of 6 500 tonnes on the East Chatham Rise; and within that catch limit retain the following sub-area catch limits;
      - set the ‘spawning box’ fishery at 3 200 tonnes during the spawning aggregation months of June-August;
      - set the Northeast Chatham Rise (including the NE Hills and the Spawning Box outside the spawning months) at 1 650 tonnes;
      - set the Southeast Chatham Rise (including the Andes Complex) at 1 650 tonnes;
    - Set a maximum catch limit of 1 750 tonnes on the South Chatham Rise;
  - ii) Catch limits for the Northwest Chatham Rise, Arrow Plateau, Puysegur and the catch and sub-area limits in the Sub-Antarctic would remain unchanged.
  - iii) Retain a catch limit of 250 tonnes for Industry research surveys;
- c) Request that Industry spread catch between features within each of the sub-area catch limits.

### **Option 3**

- 11 Reduce the TAC by 2 000 t. Arrangements under this proposal would be to:
- a) Reduce the TAC for orange roughy in ORH 3B to 9 975 tonnes for the 2007-08 fishing year, and within the TAC:
    - i) Set an allowance of 475 tonnes for other sources of fishing related mortality;
    - ii) Retain zero allowances within the TAC for customary Maori and recreational fishing interests; and
    - iii) Set the TACC at 9 500 tonnes;
  - b) Request that industry implement the following designated sub-area catch limits within the TACC:
    - i) East and South Chatham Rise be reduced to 6 650 tonnes and within that catch limit;

- Set a maximum catch limit of 5 500 tonnes on the East Chatham Rise; and within that catch limit retain the following sub-area catch limits;
    - set the ‘spawning box’ fishery at 3 200 tonnes during the spawning aggregation months of June-August;
    - set the Northeast Chatham Rise (including the NE Hills and the Spawning Box outside the spawning months) at 1 150 tonnes;
    - set the Southeast Chatham Rise (including the Andes Complex) at 1 150 tonnes;
  - Set a maximum catch limit of 1 750 tonnes on the South Chatham Rise;
- ii) Catch limits for the Northwest Chatham Rise, Arrow Plateau, Puysegur and the catch and sub-area limits in the Sub-Antarctic would remain unchanged.
  - iii) Retain a catch limit of 250 tonnes for Industry research surveys;
- c) Request that Industry spread catch between features within each of the sub-area catch limits.

### **Additional considerations common to all options**

- 12 Request that industry re-confirm the voluntary agreement on catch limits within ORH 3B that is currently in place; and
- i) acknowledge the objectives and operational implementation of the Deepwater Fisheries Management Agreement prior to the 1 October 2007 fishing year;
  - ii) continue to submit annual updates and specific DWG annual agreements that pertain to the ORH 3B fishery to MFish;
  - iii) continue to submit monthly monitoring reports pertaining to catch levels by both sub-stock and sub-area to MFish;
  - iv) continue to notify MFish when catch reaches 80% of the sub-stock and sub-area limits, and also notify MFish when any limit has been reached;
  - v) request that DWG continue to work with MFish Science group to develop and present a stock assessment research programme for the Sub-Antarctic.

### **Rationale for Management Options**

- 13 ORH 3B is a large and spatially complex fishery and it is generally agreed that it is comprised of several biological stocks of orange roughy although there remains debate as to where boundaries between these biological stocks may be drawn. To avoid confusion between biological stocks and the stock defined at

the QMA level, biological stocks will be referred to here as sub-stocks<sup>1</sup>. Where it is necessary to consider areas within the sub-stock boundaries they will be referred to generically as sub-areas<sup>2</sup>.

- 14 Sub-stock and sub-area boundaries are defined in Appendix 2 and Appendix 3 respectively.

### ***The Minister's 2006 decision***

- 15 The 2005 Plenary reported on new stock assessments for the Northwest and East Chatham Rise sub-stocks. As a result of this assessment the catch limits for the Northwest Chatham Rise were judged to be unsustainable and the Minister reduced the catch limit.
- 16 Both the Minister and Industry also expressed concern over the status of the sub-stocks on the East and South Rise. DWG, representing 97.95% of ORH 3B quota owners, offered a staged reduction in catch levels on the East and South Rise over three years and the Minister ultimately agreed to adopt the Industry offer for the first year of that process. In his decision letter for the current fishing year the Minister reserved comment on the proposed reductions for 2007-08 until he was able to consider the results of the proposed 2007 stock assessment for the South Rise.
- 17 The Minister also agreed with an Industry proposal to close the Arrow Plateau as at that time this area was being considered for inclusion in the Benthic Protected Areas Proposal which proposed a ban on bottom trawling in this area. The Puysegur fishery remained closed and the catch limit for Sub-Antarctic was increased to 1 850 tonnes. A 250 tonne allowance for Industry research surveys was retained.
- 18 New stock assessments reported in the 2006 Plenary identified sustainability concerns for sub-areas within the East Rise - specifically the Northeast Hills and the Andes complex. In response, the Minister decreased the TAC for ORH 3B on the understanding that Industry would enact this reduction through voluntary arrangements to decrease the catch limit on the South and East Rise. Voluntary sub-area limits in the East Rise were also requested by the Minister.
- 19 As a part of his decision the Minister agreed to allow DWG to manage the spreading of commercial catch between the designated sub-stocks and sub-areas of ORH 3B. Industry, through DWG, agreed to implement the catch spreading arrangements at the sub-stock level and for sub-areas in the sub-Antarctic.
- 20 During the decision-making process DWG wrote to the Minister to express the Industry view that the sub-area limits on the East Rise that had been proposed by MFish and subsequently requested by the Minister were not justified or warranted. The essence of the Industry position was that the sub-areas within this part of the Chatham Rise formed components of the same population and

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<sup>1</sup> DWG refers to these sub-stock boundaries as 'designated sub-areas'.

<sup>2</sup> DWG refers to these sub-areas as 'sub-area components'

fish movement between these areas would render the proposed sub-area limits ineffective as sustainability measures. DWG also submitted that the timing of the decision made it difficult to implement the sub-area limits. By that time most of the ACE trading arrangements for the 2006-07 fishing year had already been concluded, and quota owners were therefore unable to impose conditions on this ACE.

- 21 In reply the Minister reaffirmed his concern over the localised depletion on the East Rise if the sub-area limits were not respected – specifically he requested again that the spawning box limit of 4 000 t during the spawning season and the 700 t limit for the Andes be observed for the 2006-07 fishing year.

### ***Existing catch spreading arrangements***

- 22 Genetic data has demonstrated that there are two distinct main sub-stocks within ORH 3B – the Chatham Rise and Puysegur - and that these sub-stocks are distinct from adjacent areas. Genetic data also suggests that there are multiple sub-stocks within the Chatham Rise although no clear boundaries have been determined. The boundaries currently used for assessing the Chatham Rise sub-stocks divide it into three areas: the Northwest, the East and the South Chatham Rise. The Arrow Plateau is an area located to the east of the Chatham Rise fisheries and the remaining southern portion of ORH 3B is referred to as the sub-Antarctic (figure 1).
- 23 Due to the aggregating nature of orange roughy, there are suggestions that there may be localised depletion within a number of these sub-stocks, particularly on the East Chatham Rise, and that this may indicate a sustainability concern. The most recent stock assessments in 2005 were undertaken on individual sub-areas on the East Rise: the Spawning Box, the Northeast Hills and the Andes. There is also some evidence of spawning fish on both the Andes and the Northeast Hills although it is unclear whether these suggest a resident population on these features. Orange roughy may also demonstrate feeding site fidelity whereby fish that spawn elsewhere may return to particular features or feature complexes to feed. Experience with orange roughy to-date suggests that the biomass found on such features may be reduced to levels that will no longer support a localised fishery and that recovery from such levels is uncertain.
- 24 Although the Act requires TAC decisions to be made at the QMA stock level, management of sub-stocks and sub-areas within these sub-stocks have historically relied on agreements with Industry to manage them independently. A key component of the management options put in place were a suite of voluntary catch spreading arrangements and DWG's commitment to collect catch data by sub-stock and sub-area, and to submit regular reports to MFish.
- 25 Catch by sub-stock for the first and second quarters of the fishing year and reported by DWG accounted for 99% of the catch reported to FishServe for the same period. No sub-stock catch limit had been exceeded. While there were some instances of non-reporting in the first quarter, these problems appear to have been rectified. The reporting framework at the sub-stock level

appears to be working well and the DWG reports are providing full information.

- 26 DWG has also provided MFish with catch data by sub-area in the sub-Antarctic and on the East Rise. DWG agreed to inform MFish when catch for any sub-area within the sub-Antarctic reached 80% of the agreed limit. Reports to DWG have indicated that catch reached 95% of the 500t feature limit for Priceless early in the fishing year. This feature was subsequently closed by Industry agreement on 4 December 2006. Although it remains unclear exactly how much orange roughy has been taken from this feature it is likely to be close to the feature limit.
- 27 Preliminary analysis suggests that both of the sub-area limits on the East Chatham Rise that the Minister requested (i.e. the Andes and the Northeast Hills) have been significantly over-caught. Although accurate figures are yet to be determined, the reported catch appears to be in excess of twice, and may be as much as three times, the limit requested by the Minister. Catch taken from these areas so far this year appears to significantly exceed that taken in 2005-06. Key Industry members have agreed to refrain from fishing these areas for the remainder of the fishing year.
- 28 There are a number of factors that may have contributed to Industry exceeding the sub-area limits on the East Rise. Subsequent to the Ministers decision in 2006, there was ongoing correspondence between DWG, the Minister and MFish with regard to the catch-splitting arrangements on the East Rise. The issue remained unresolved at the start of the fishing year, providing little time for DWG to put in place arrangements with operators for management at the sub-area scale.
- 29 This correspondence also made it clear that Industry did not support the proposed sub-area management arrangements. This was primarily due to uncertainty regarding the movement patterns of orange roughy between features on the East Rise – both spatially and temporally. Industry contends that fish move freely between features on the East Rise making sub-area limits meaningless. As a consequence, it is likely that, as these arrangements are voluntary, at least some operators have simply chosen not to abide by them. A contributing factor may also have been concern that reporting arrangements had insufficient resolution to accurately allocate tows to features.
- 30 Industry have had time to put arrangements in place for the Spawning Box prior to the June-July period over which this sub-area limit applies. MFish will continue to monitor the DWG reports and will be in a position to provide catch information from the spawning box sub-area over at least a portion of the winter spawning period in the final advice to the Minister.

### ***Stock assessment information***

- 31 No new stock assessment information is available subsequent to the Minister's decision in 2006. A proposal to produce an updated stock assessment for the South Chatham Rise using updated catch and effort data was considered by the Working Group in 2007. However concerns were raised as to whether the

East and South Rise constitute separate sub-stocks as both geography and catch data suggest that the South Rise may be continuous with the East Rise. Doubts were also raised over the current stock assessment models due to their poor fit to catch and effort data.

- 32 Stock assessment information reported in the 2006 Plenary identified sustainability concerns for sub-areas within the East and South Chatham Rise - specifically the Northeast Hills and the Andes. The assessment of the Northeast Hills indicated that the biomass had been fished down to a level of about 14%B<sub>0</sub> (range 7-32 %), but had increased slightly in the two years preceding the assessment. The catch in 2004-05 was 540 t which was higher than the CAY and MAY yield estimates. The assessment for the Andes indicated that the biomass was about 29%B<sub>0</sub> (range 14-74%) and was predicted to decrease further at the 2004-05 catch level of 1,410 t but remain stable at catch levels between 800 and 1 000 t. CAY and MAY yield estimates were both about half of the 2004-05 catch.
- 33 The reasons for not proceeding with a South Rise assessment this year may also raise concerns regarding these previous East Rise assessments, particularly in regard to whether it was appropriate to consider each of the sub-areas separately. DWG have consistently argued that there is no basis for separate assessments for sub-areas within the East Rise, or indeed the South Rise.
- 34 Nonetheless, the 2006 assessments for the East Rise sub-areas have not been rejected by the Plenary and there remains a consensus amongst Industry and the scientific community that the catch limits for the East and South Rise should be reduced to ensure the sustainability of the stock.
- 35 No new stock assessments are proposed for the 2007-08 fishing year. A proposed research project will however look at the stock distribution across the Chatham Rise and may provide a basis for the consideration of sub-stock boundaries in the future.

### ***Fisheries plans***

- 36 In light of the uncertainty in the status of the orange roughy stocks across ORH 3B, the likelihood that no new stock assessment data will be available in the short and possibly medium term, and concerns over the location of sub-QMA stock assessment and management boundaries, a new approach is required to derive management solutions for ORH 3B. Industry has recognized the need to decrease orange roughy catch and will participate in the fisheries plan process to develop and implement the range of measures that will be required.
- 37 Over the coming year MFish is investing considerable resources in the development of fisheries plans across a number of fisheries including ORH 3B. A fisheries plan for orange roughy is proposed for implementation prior to the start of the 2008-09 fishing year. This plan will build on collaborative work already underway between MFish and DWG. A successful conclusion will rely on willingness by all parties to engage meaningfully in the process and to ultimately respect management actions included in the completed fisheries plan.
- 38 MFish considers that the development of an orange roughy fisheries plan is a high priority to provide a durable, long-term management approach to New Zealand's orange roughy fisheries. A suite of new management measures will flow from this process, which is likely to include, but not be limited to, consideration of a potential reduction in the TAC, realignment of management boundaries, fleet consolidation and better vessel co-ordination.

### ***The 2007-08 DWG proposal***

- 39 Industry have reconfirmed their support of a TAC reduction of 1 000 t for the 2007-08 fishing year to be effected by a reduction in the catch limit on the South and East Rise. The proposed cut is intended to facilitate a 'soft landing' in anticipation of further TAC cuts derived from the Fisheries Plan process. This proposal is the second step in the staged reduction which was initiated in 2006-07.
- 40 No details were provided on how the 1 000 t reduction would be apportioned within the South and East Rise.

## **Assessment of Management Options**

### ***Considerations at the stock (QMA) level***

#### *Total allowable catch*

##### Section 13 (2)

- 41 The ORH 3B stock is managed under section 13 of the Act which requires that the Minister sets a TAC that moves the stock to or above, or maintains the stock at or above, a biomass level that can produce the maximum sustainable yield ( $B_{MSY}$ ). An assessment of the status of the entire ORH 3B stock relative to  $B_{MSY}$ <sup>3</sup> is not available.
- 42 Stock assessment information reported in the Plenary considers ORH 3B by sub-stock – specifically the Northwest, East (the spawning box and Northeast Flats, the Northeast Hills and the Andes) and South Chatham Rise, and the Sub-Antarctic (Puysegur, Pukaki South and the remaining southern areas). The 2006 Plenary concluded that the Northwest Rise (11%  $B_o$ ), the Andes (29%  $B_o$ ), the Northeast Hills (14%  $B_o$ ), and Puysegur were below  $B_{MSY}$ , and the Spawning Box and Northeast Flats was likely to be above  $B_{MSY}$ . The Plenary reached no conclusions on the status of the other components of the ORH 3B stock. While information to underpin an assessment of the overall status and long-term yield of the ORH 3B stock is not available, on balance MFish considers it likely that the ORH 3B stock is below  $B_{MSY}$ .
- 43 Given the concerns over catch levels and stock status, MFish proposes to set the TAC for ORH 3B under section 13(2)(b) of the Act. Section 13(2)(b) is appropriate in cases where the stock biomass is likely to be below  $B_{MSY}$  and requires a TAC that restores a stock biomass towards (at or above) a level that can produce the maximum sustainable yield, having regard to the interdependence of stocks, biological characteristics and environmental conditions. However, MFish acknowledges that estimates of unfished biomass, current absolute biomass, or the biomass that will produce MSY are unavailable for ORH 3B and, as such, there is no certainty whether or not the proposed TACs will restore the stock to a size that will support MSY.

##### Section 13 (3)

- 44 Section 13 (3) requires that, in considering the way and the rate that the stock may be moved towards a level that can produce MSY under s 13(2)(b), the Minister shall have regard to such social, cultural and economic factors as he or she considers relevant.
- 45 The proposed reduction in the TAC of 1 000 t under option 2 has been supported by Industry. A conservative estimate of the landed value of 1 000 t of orange roughy derived from the 2006-07 port price in ORH 3B equates to a value of \$3.67 million. Since the majority of orange roughy is exported a better estimation of value may be derived from export earnings. On the basis

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<sup>3</sup> For orange roughy stocks,  $B_{MSY}$  is interpreted as the mean biomass under a CAY policy, which is estimated to be 30%  $B_o$ .

of export value (all product states) 1 000 t of orange roughy is worth approximately \$11.56 million.

- 46 The economic cost of the TAC reduction under option 2, while significant, has been accepted by the owners of 97.5% of the ORH 3B quota. The proposed sub-area catch spreading arrangements provide greater flexibility for Industry to manage their fishing operations than those under the status quo. This is likely to have an economic benefit for operators although MFish is not in a position to quantify this effect. MFish requests that Industry provide information on the costs and benefits of such flexibility through the consultation process.
- 47 Option 3 proposes a reduction in the TAC of 2 000 t which equates to a value of \$7.34 million based on port price and \$23.11 million based on export value (average price across all product states). MFish notes that the staged reduction in the TAC proposed by DWG included a further reduction of 1 000 t for the 2008-09 fishing year, although this has not been confirmed. Option 3 essentially accelerates the staged reduction proposed by Industry. Their proposal of annual 1 000 t cuts was to provide a 'soft landing' by allowing operators a period of time over which to rationalise their operations at progressively lower TAC levels rather than to inflict a single large TAC reduction.
- 48 MFish considers that the economic consequences of a staged TAC reduction to the level proposed over two years is likely to be acceptable to Industry. However, under option 3, a TAC reduction to this level for the 2007-08 fishing year may have adverse economic and management implications for operators, and these could be significant.
- 49 MFish requests that industry, through the submission process, provide any additional information on social, cultural and economic factors relevant to this decision.

### ***TACC and Allowances***

- 50 The TAC must be apportioned between the relevant sectors and interests set out under the provisions of s 20 and s 21 of the Act. Section 21 prescribes that the Minister shall make allowances for Maori customary non-commercial interests, recreational fishing interests, and for any other sources of fishing-related mortality, before setting the TACC. In determining these allowances, the Minister should consider how the allowances will enable people to provide for their social, economic and cultural wellbeing (as provided for in the purpose of the Act).
- 51 There are no known Maori customary or recreational fisheries for orange roughy. MFish proposes that the Minister sets allowances of zero tonnes for recreational and Māori customary fishing under all options. This is consistent with the *status quo* and the approach that has been adopted since orange roughy became a QMS species in 1986.

- 52 Other sources of fishing related mortality has been previously set at 5% of the TACC to account for lost fish, discards, discrepancies in tray weights and conversion factors. There is no information to support a variation to this figure at this time.

## **Sub-QMA catch spreading arrangements**

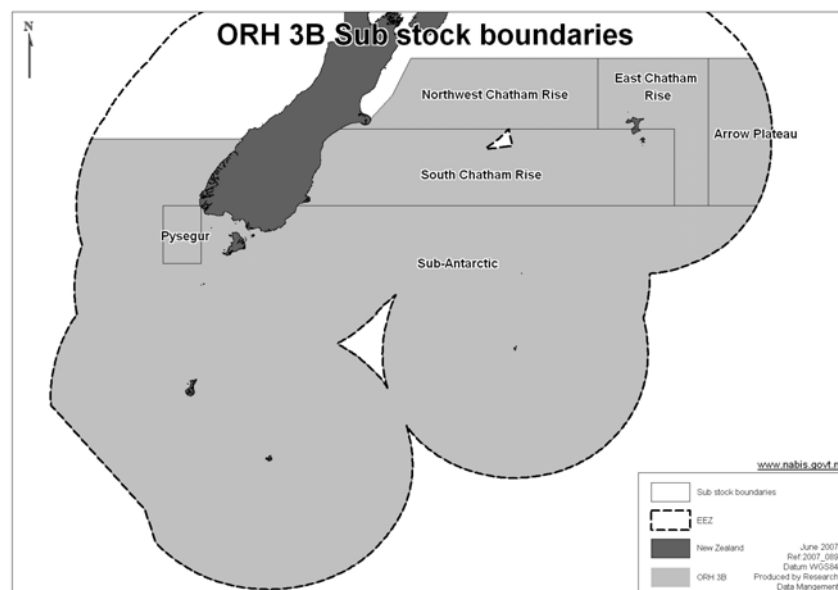
53 Proposed sub-stock and sub-area catch limits for the 2007-08 fishing year are discussed below. MFish recommend that catch limits and reporting requirements continue to be managed by DWG. Under all options MFish will monitor DWG reports against data provided by FishServe and to monitor operators fishing patterns to evaluate voluntary catch limits. MFish will ensure that, through joint MFish-DWG communications, operators are fully informed as to the progress of catch taken against sub-stock and sub-area limits.

### **Considerations at the sub-stock level**

#### **Stock boundaries**

54 While there is some debate over the location of stock assessment and management boundaries within ORH 3B, there is no consensus position on what changes are necessary at this time. The location and need for boundaries will be considered as part of the development of a fisheries plan for ORH 3B and no changes are proposed at this time.

55 The existing sub-stock boundaries are shown in figure 2 and are defined in Appendix 2.



**Figure 2 Sub-stock boundaries within the ORH 3B QMA.**

#### **Sub-stock catch limits**

##### Northwest Chatham Rise

56 The catch limit for the Northwest Chatham Rise was decreased in response to sustainability concerns identified in the 2006 stock assessment. MFish consider that the 2006 decisions were appropriate and in the absence of new stock assessment information, do not propose varying the current management arrangements for this sub-stock at this time.

57 All three options retain the existing catch limit for the Northwest Rise.

### East and South Chatham Rise

- 58 MFish notes that the Working Group raised concerns over both the stock assessment model and the stock assessment boundaries this year and there is considerable uncertainty as to when new stock assessment information will be available. Nonetheless MFish remains concerned that the current catch levels on the East and South Rise may not be sustainable. Industry shares these concerns as demonstrated by their proposal of a 1 000 t reduction in catch levels. MFish therefore recommends that the catch limit on the East and South Rise be reduced for the 2007-08 fishing year.
- 59 There is considerable debate over the separation of the East and South Rise sub-stocks and MFish remains concerned that the removal of this sub-stock boundary at this time would be premature. A research project to be completed in 2008 will examine orange roughy stock distribution across the Chatham Rise. MFish considers that discussion on the appropriateness or otherwise of an East Rise / South Rise split for stock assessment and/or management purposes should be informed by the results of this project and is better progressed through the fisheries plan process.
- 60 In the interim, MFish proposes that the existing East Rise / South Rise split be retained – that is, a catch limit for the combined South and East Rise with maximum catch limits for each area. This approach ensures that catch is spread between feature complexes and provides Industry a degree of flexibility about where their catch is taken. The South Rise catch is largely taken off the Chiefs – a complex of hills at the eastern end of the South Chatham Rise – and MFish considers there is a sustainability risk should no limit be set for the South Rise. All options retain the East/South split pending the outcome of a more detailed and informed analysis.
- 61 The Industry proposal of a 1 000 t reduction in the catch limit for the East and South Rise does not address how this should be apportioned between the two areas. MFish considers that it is appropriate, in the absence of additional information to retain the existing catch split proportions to effect the Industry proposal. Options 2 and 3 therefore include a reduction in the maximum catch from the South Rise to 1 750 t. This is above the projected South Rise catch for 2006-07.

### Arrow Plateau

- 62 The Arrow Plateau has been closed to bottom trawling under the BPA initiative and the catch limit for this portion of the stock will remain at zero.
- 63 All three options retain a zero tonne catch limit for the Arrow Plateau.

### Puysegur

- 64 The fishery has been voluntarily closed since 1997-98.
- 65 All three options retain a zero tonne catch limit for Puysegur.

### Sub-Antarctic

- 66 The catch limit for the sub-Antarctic was increased in 2006 to 1 850 tonnes. MFish considers that the 2006 decisions were appropriate and in the absence

of new stock assessment information, does not propose varying the current management arrangements at this time.

- 67 All three options retain a catch limit of 1 850 tonnes for the Sub-Antarctic.

### *Considerations at the sub-area level*

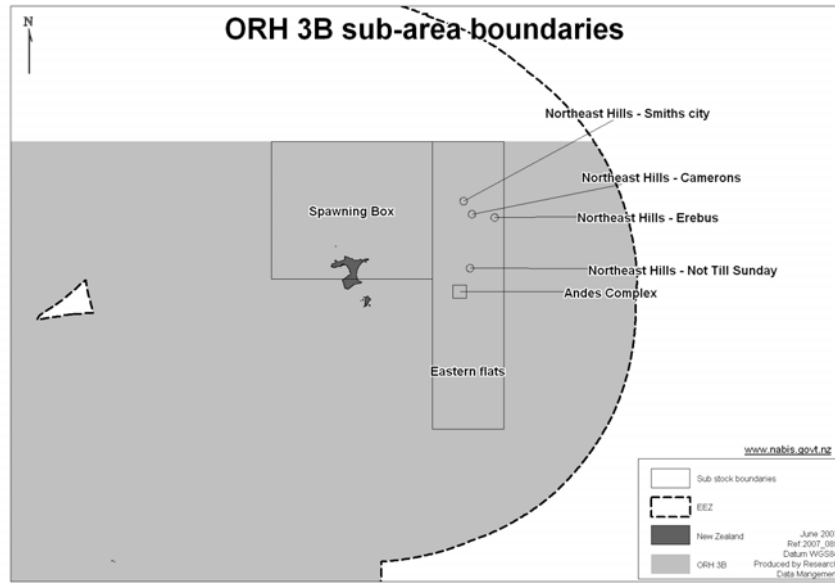
#### **Catch spreading by sub-area**

##### Sub-Antarctic sub-area limits

- 68 MFish consider that the 2006 decisions were appropriate and that the voluntary catch spreading and reporting arrangements are working well. In the absence of new stock assessment information MFish do not propose varying the current management arrangements at this time.
- 69 MFish will monitor DWG reports against data provided by FishServe and to monitor operators fishing patterns to evaluate the effectiveness of these voluntary catch limits. MFish will also ensure that, through joint MFish-DWG communications, operators are fully informed as to the progress of catch taken against the sub-Antarctic feature limits.

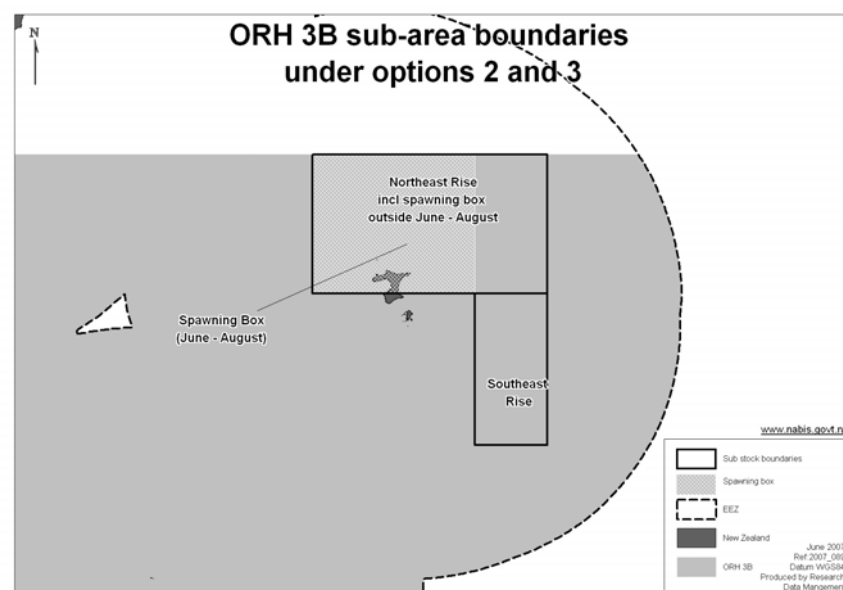
##### East Chatham Rise

- 70 MFish acknowledges that the orange roughly taken from the various sub-areas across the East Rise may comprise the same population although there is significant uncertainty regarding this contention. Nonetheless MFish remains concerned that fishing pressure at the level seen so far in 2006-07 on the Andes Complex and the Northeastern Hills may constitute a sustainability risk to the East Rise sub-stock. The Spawning Box has yet to be fished this year and MFish will continue to monitor catches from this area during the spawning period.
- 71 In his 2006 decision, the Minister requested that the Industry abide by sub-area catch limits. This decision reflected the Minister's concern about localised depletion largely based on the stock assessment information for the East Rise sub-areas. The East Rise sub-areas for which the Minister requested catch limits in his 2006 decision are shown in figure 3 and are defined in Appendix 3.



**Figure 3 Existing sub-area boundaries within the East Chatham Rise.**

- 72 Concerns about the use of the sub-area boundaries used in these assessments have been raised by Industry. The Industry view that the sub-area boundaries have little management utility, coupled with the reliance on voluntary catch spreading arrangements, has contributed to the sub-area catch limits requested by the Minister for the current fishing year being largely ineffective.
- 73 In light of concerns over the efficacy of these sub-area boundaries for stock management purposes, the significant risk that Industry will disregard such fine-scale voluntary management, and information suggesting that the East and South Rise may comprise a single stock, MFish does not recommend persevering with this approach for the 2007-08 fishing year.
- 74 Options 2 and 3 provide an alternative management arrangement that incorporates a simplified catch spreading framework. These options will reduce the risk of localised depletion on the South and East Rise, and the sustainability risk at the broader sub-stock level, while providing Industry with flexibility as to how they fish.
- 75 Under both options the East Rise would be divided into three sub-areas, based on spatial and temporal considerations, with maximum catch levels requested for each of the following divisions;
- i) the Spawning Box (in June – July);
  - ii) the Northeast Rise (including the Spawning Box outside June and July, the Northeast Flats and the Northeast Hills); and
  - iii) the Southeast Rise (incorporating the Andes Complex and the larger Andes Box)
- 76 The location of these sub-area boundaries are shown in figure 4 and are defined in Appendix 4. They largely conform to the 2006 East Rise stock assessment boundaries.



**Figure 4 Proposed sub-area boundaries within the East Chatham Rise.**

- 77 The approach taken in options 2 and 3 would constitute a temporary arrangement with new management options derived from the fisheries plan process intended to be put in place for the 2008-09 fishing year. MFish considers that this approach is likely to garner a broader base of Industry support than the existing arrangements, as well as allay many of the concerns raised in the Minister's decision letter and reflected in his catch spreading requests for the 2006-07 fishing year. Although the sub-areas under this approach are larger than the existing sub-areas, if respected by Industry they will provide greater protection against localised depletion on the Northeast Hills and the Andes Complex than the current in-effective sub-area arrangements.
- 78 Options considered under this approach for voluntary catch spreading by sub-area within the East and South Rise catch limit are summarized in Table 3 and discussed further below.

<b>ORH 3B Sub-Areas</b>	<b>Voluntary catch limits under option 2</b>	<b>Voluntary catch limits under option 3</b>
<b>East and South Chatham Rise</b>	<b>7650</b>	<b>6650</b>
East Rise	(Maximum) 6500	(Maximum) 5500
<i>Spawning Box(Jun-Aug)</i>	3200	3200
<i>Northeast Rise</i>	1650	1150
<i>Southeast Rise</i>	1650	1150
South Rise	(Maximum) 1750	(Maximum) 1750

**Table 3. Summary of proposed sub-area catch splitting under options 2 and 3**

- 79 Under both options the method used to derive the catch limit for the Spawning Box is consistent with that used to derive the South Rise catch limit. That is the existing catch limit has been reduced proportionately based on the Industry support for a 1 000 t reduction across the South and East Rise.
- 80 The current limits for the Northeast Rise and the Southeast Rise, which were derived from the 2005 stock assessments, provide some guidance on appropriate catch levels for these areas, although, as discussed, there are some concerns with this information. Past fishing practices may also provide some guidance. In the absence of better information, MFish propose to split the East Rise catch outside the spawning box equally between the Northeast Rise and the Southeast Rise. This approximates both the current catch split as effected by Industry, and the Minister's 2006 decision at a coarser scale than was requested at that time.
- 81 The removal of the existing fine scale sub-area limits may increase the risk of localised depletion, particularly on the Northeast Hills and the Andes Complex. As a part of this approach, Industry would be requested to spread catch between individual features within the broader sub-area catch limits but MFish do not propose to recommend specific feature limits at this time. Feature limits have failed for the current fishing year and there is no information to suggest that Industry would respect arrangements requested at

this scale for the 2007-08 fishing year. An agreement by Industry to spread catch across the various East Rise features will provide some measure of confidence that the risk of localised depletion and sub-stock sustainability will be mitigated until this issue can be more satisfactorily addressed through the fisheries plan process.

- 82 Option 2 effects the Industry proposal of a 1 000 t cut across the East and South Rise and requests a voluntary catch limit of 1 650 t from both the Northeast and southeast Rise.
- 83 The removal of the fine-scale sub-area management arrangements under option 2 may increase the fishing pressure on the Andes Complex and the Northeast Hills. This may cause localised depletion on these feature complexes and may ultimately constitute a sustainability risk to the East Rise sub-stock. Option 3 is available if this risk is considered unacceptable.
- 84 Under option 3 the catch limit for the East Rise has been reduced by a further 1 000 t, effected by reducing the sub-area catch limits for the Northeast and Southeast Rise by a further 500 t each. MFish considers that these reductions, when compared to option 2, will decrease the risk of localised depletion on the feature complexes and will move the sub-area limits closer to the current limits for the Andes and the Northeast Hills. Although they remain higher than the existing levels, they also encompass significantly more area.
- 85 These limits, although more restrictive than those under option 2, provide greater flexibility to Industry than the existing sub-area limits and are therefore more likely to be respected. There remains a risk that Industry will consider these limits too restrictive and if they are not adhered to, may ultimately compromise the success of the voluntary arrangements across the fishery.
- 86 Option 3 places greater weight on the possible risk of localised depletion if the information that suggests there is a single East Rise, or East and South Rise, sub-stock is wrong, or that that there is in fact greater site fidelity within the East Rise sub-areas.
- 87 Existing sub-area boundaries are defined in Appendix 3 and sub-areas proposed for the East Rise under options 2 and 3 are defined in Appendix 4.

### ***Other options***

- 88 It is open to the Minister to implement other options. If the Minister considers that the risk of localised depletion producing sustainability concerns is unacceptable and that voluntary arrangements are not satisfactory he may choose to sub-divide the QMA under section 25 to allow the use of statutory tools to be used at a finer spatial scale than is currently available to him. Alternatively he could close areas by Gazette Notice under section 11 of the Act.
- 89 Given the information currently available, MFish does not propose either of these options at this time. Although it is generally accepted that there may be two or more orange roughy stocks on the Chatham Rise it is unclear where a boundary between distinct stocks could be drawn. Closing individual features

is also not currently proposed as there is concern that this would only serve to focus pressure elsewhere. Any increase in pressure on the spawning plume would be of particular concern.

## ***Environmental considerations***

- 90 MFish is in the process of developing environmental standards – including a seabird standard and a benthic impact standard - to ensure that statutory obligations to avoid remedy or mitigate the adverse effects of fishing are met. These standards will ultimately be used to inform fisheries plan development.
- 91 Key environmental issues in relation to the ORH 3B fishery and the options proposed in this paper are discussed below.

### ***Finfish Bycatch***

- 92 While a number of deepwater species that share similar habitat to orange roughy are taken in the ORH 3B fishery (including oreo, ribaldo, rubyfish and gemfish) targeted orange roughy fishing historically captures over 90% orange roughy. No increase in the orange roughy TAC is contemplated and consequently there should be no additional adverse implications for fish bycatch.

### ***Shark Bycatch***

- 93 Some concern has been raised regarding highly vulnerable deepwater sharks, although sharks account for less than 1% of the bycatch in orange roughy fisheries. A specific national plan of action for deepwater sharks is in preparation by MFish.

### ***Marine Mammals***

- 94 MFish considers that the management proposal will have no additional adverse implications for fur seals and other marine mammals as none of the options should result in an increase in fishing effort.

### ***Seabirds***

- 95 Trawl fisheries for orange roughy are known to interact with seabirds, and fishing-related mortalities of seabird species are known to occur, although it is difficult to quantify the overall impact as knowledge of the population characteristics of seabird species is typically limited. It is known however that the Chatham Rise and Sub-Antarctic regions are areas of vulnerable and threatened sea bird species such as the Chatham Island Albatross (International Union for the Conservation of Nature, (IUCN) status: critically endangered), Black Browed and Northern Albatross (IUCN status: endangered), the Shy Albatross and Northern Giant Petrel (IUCN status: near Threatened).
- 96 The management proposal should have no additional adverse implications for seabirds as no increase in orange roughy catch entitlements is proposed.

### ***Benthic impacts and coral bycatch***

- 97 Bottom trawling can affect fragile benthic invertebrate communities but adverse effects may be reduced if vessels repeatedly trawl along the same towlines in a fishery. The Minister requested Industry to follow known trawl tracks in the South Chatham Rise as part of his 2006 decision.

- 98 Two other initiatives are in place to address benthic impacts. In 2001 the Minister initiated a trawl closure covering a selection of 19 seamounts of varying size and depth within New Zealand. In addition further areas have recently been closed to bottom trawling under the BPA proposal, including the Arrow Plateau.

### ***Compliance implications***

- 99 Key offences that may occur in ORH 3B include mis-reporting of QMA, species and weights, fishing in closed areas and bycatch targeting. MFish consider that the proposed management options should not increase the incentive to offend.
- 100 Industries adherence to voluntary catch spreading arrangements is currently monitored through monthly reports to MFish pertaining to catch levels by both sub-stock and sub-area. Industry also notifies MFish when catch reaches 80% of the sub-stock and sub-area limits, and also notify MFish when any limit has been reached. These arrangements are retained under all the proposed options

# APPENDIX 1

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## Statutory Considerations

101 In forming this management proposal, the following statutory considerations have been taken into account:

- a) **Section 8** of the Act describes the purpose of the Act as being to provide for the utilisation of fisheries resources while ensuring sustainability, and defines the meanings of utilisation and sustainability. The management options presented seek to achieve the purpose of the Act. The proposals allow for variable levels of utilisation through the setting of catch limits. The proposals ensure sustainability under the respective catch limits via different fine-scale management and monitoring measures that address risk as appropriate to the different levels of catch, and take into account the respective costs of management versus the utilisation benefits.
- b) **Section 13(2)** requires that the Minister sets a TAC that maintains the stock at or above a biomass level that can produce the MSY, or moves it towards or above such a level, having regard to the interdependence of stocks. An assessment of the current status of the entire ORH 3B stock or stock complex relative to  $B_{MSY}$  is not available and no new stock assessment information is available this year. After considering the available stock assessment information, on balance MFish considers it likely that the ORH 3B stock is below  $B_{MSY}$ . MFish considers that the proposed TACs (along with the proposed catch limits on the South and East Rise) should restore the stock to a biomass that can produce MSY.
- c) The proposed TAC proposal is also based on –
  - i) Section 13(2) considerations that, where a stock is below  $B_{MSY}$  (s 13(2)(b)), the TAC be set to move the stock towards or above the  $B_{MSY}$  level within an appropriate period, having regard to the biological characteristics of the stock and any environmental conditions affecting the stock. No specific environmental conditions affecting the ORH 3B stock have been identified.
  - ii) However, it is known that orange roughy are very long-lived and late maturing, which are biological characteristics that render them slow to recover from overfishing. There is no information to suggest the interdependence of stocks should affect the level of the TACs and sub-area catch limits set for ORH 3B at this time. The fishery is relatively clean, and bycatch proportions are low given that the fishery primarily targets aggregations of orange roughy.
  - iii) Spawning occurs in dense aggregations at depths of 700–1 000 m and is often associated with bottom features such as pinnacles and canyons. Orange roughy also form aggregations outside the spawning period, presumably for feeding, thus

rendering orange roughy susceptible to overfishing and localised depletion.

- d) **Section 13(3)** requires the Minister, in considering the way and rate at which a stock is moved towards  $B_{MSY}$ , to have regard to such social, cultural, and economic factors as he considers being relevant when determining the way and rate at which to move the stock biomass toward or above the  $B_{MSY}$  level.

Economic considerations have been discussed in the body of the paper.

Industry proposes a consolidation of the fleet deployed in the ORH 3B fishery. Such a consolidation is likely to significantly reduce the number of personnel involved in this fishery and will have a greater social impact than any of the proposed TAC reductions.

MFish is not aware of any recreational or customary Maori interest in the fishery and no other cultural factors that MFish consider are relevant to the Ministers determination under section 13(3).

- e) **Sections 9(a) and (b)** require decision-makers to take into account that associated or dependent species (those that are not harvested) be maintained at or above a level that ensures their long-term viability, and that the biological diversity of the aquatic environment should be maintained. The specific nature and extent of effects of fishing on any particular sub-stock in ORH 3B and the environment are generally understood to be localised and specific to aggregations of orange roughy at 850-1 200 metre depths. While some bycatch of non-harvested species is known, the impact that fishing for ORH 3B has on the long term viability and biological diversity of the aquatic environment is of greater concern in regions of steep sloping and highly diverse topographic features. Some features within ORH 3B have been set aside from all trawling, including seamounts and the Arrow Plateau, to mitigate the benthic effects of fishing.

The main prey species for orange roughy include mesopelagic and benthopelagic prawns, fish and squid, with other organisms such as mysids, amphipods and euphausiids occasionally being important. MFish has considered the effects on associated and dependent species and biodiversity that would affect the setting of the TAC and determined the impact is addressed under the catch spreading arrangements.

- f) **Section 9(c)** requires that decision-makers take into account the principle that habitat of particular importance for fisheries management should be protected.

While trawling can adversely affect fragile benthic invertebrate communities, the commercial bycatch of benthic invertebrates is seldom recorded or examined. Research has revealed marked differences in the bottom fauna of fished and unfished seamounts off New Zealand and Tasmania, and those differences have been ascribed to the impact of bottom trawling. Researchers have reported anecdotal evidence of bycatch of coral species in developing orange roughy fisheries in New Zealand.

Nineteen seamounts of varying size and depth within New Zealand waters have been closed to trawling, and ten of these are within ORH 3B. In addition, eleven BPA's are within ORH 3B. These closures should therefore protect faunas in a variety of habitats from the effects of fishing.

- g) **Sections 5(a) and (b)** require the Act to be interpreted consistently with New Zealand's international obligations with respect to fishing and with the provisions of the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. Provisions of general international instruments such as the United Nations Convention on the Law of the Sea (UNCLOS) and the Fish Stocks Agreement have been implemented through the provisions of the Fisheries Act 1996 and given effect here. MFish considers that the options are consistent with both New Zealand's international obligations relating to fishing and the provisions of the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992.
- h) **Section 11(1)(a)** The Minister must in his decision take into account any effects of fishing on any stock and the aquatic environment. No information about any effects of fishing on any stock or on the aquatic environment additional to that discussed elsewhere in the paper is considered relevant to the consideration of sustainability measures for ORH3B at this time.
- i) **Section 11(1)(b)** requires any existing controls under the Act to be taken into account. For ORH 3B, the measures that apply currently are a TAC, TACC and an allowance for incidental fishing-related mortality. No other controls under the Act apply specifically to ORH 3B. Specific seamount closures are located within ORH 3B.
- j) **Section 11(1)(c)** requires the Minister to take into account the natural variability of the stock when setting or varying any sustainability measure. Orange roughy year-to-year biomass is not known to be highly variable, and therefore the natural variability of orange roughy is not a concern in setting the TAC for ORH 3B..
- k) **Section 11(2A)(b)** requires the Minister to take into account any relevant fisheries plan approved under the Act. A fisheries plan incorporating ORH 3B is proposed for development in 2007-08. However, at present, no such plan has been finalised or approved by the Minister.
- l) **Sections 11(2A)(a) and (c)** require that before setting or varying any sustainability measure, the Minister must take into account any conservation or fisheries service, or any decision not to require such services. MFish does not consider that existing or proposed services materially affect the proposals for the ORH 3B stock. No decision has been made to require or not require a service in this fishery at this time.
- m) **Sections 11(2)(a) and (b)** require the Minister to have regard to any provisions in any policy statement or plan under the Resource Management Act 1991, or any management strategy or plan under the Conservation Act 1987, that are relevant to the setting of any

sustainability measure for the ORH 3B stock. MFish is not aware of any such provisions that should be taken into account for ORH 3B.

- n) **Section 11(2)(c)** requires the Minister to have regard to ss 7 and 8 of the Hauraki Gulf Marine Park Act 2000. The distribution of orange roughy in the ORH 3B QMA does not intersect with the Park boundaries.
- o) **Section 21** requires the Minister to allow for non-commercial Maori and recreational fishing interests, and other sources of fishing-related mortality when setting or varying the TACC. The nature of the ORH 3B fishery and the interests of recreational and customary fishers have been considered in proposing the TACCs. Section 21 also requires that any mātaihai reserve or closure/restriction under s 186A to facilitate customary fishing be taken into account. There are mātaihai reserves and s 186A measures in ORH 3B generally, but none intersect with the ORH 3B fishery. No area has been closed or fishing method restricted (that affects the fishery within ORH 3B) under the customary fishing provisions of the Act. Section 21 also requires that any regulations to prohibit fishing made under s 311 be taken into account when setting allowances for recreational interests. No restrictions under s 311 have been placed on fishing in any area within ORH 3B.
- p) **Section 10** of the Act sets out the information principles, which require that decisions be based on the best available information, taking into account any uncertainty in that information, and applying caution when information is uncertain, unreliable, or inadequate. In accordance with s 10, the absence of information should not be used as a reason to postpone, or fail to take, any measure to achieve the purpose of the Act, including providing for utilisation at levels considered to be sustainable. The status of the entire ORH 3B stock complex relative to  $B_{MSY}$  is uncertain, and concerns raised at the 2007 Working Group meetings in relation to the stock assessment model and the stock assessment boundaries serve to increase this uncertainty. In the body of the paper, MFish has also endeavoured to set out the relevant uncertainty in, and inadequacy of, that information so that the appropriate caution can be applied in assessing the proposed management options. On balance MFish considers that the options provided are derived from the best available information and cover an appropriate range of caution in response to the uncertainty in that information.

## APPENDIX 2

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### Definition of ORH 3B sub-stock boundaries

Note: All positions are given in degrees, minutes and decimal minutes format.  
Figures in brackets are decimal degrees with western longitudes given as a progression of eastern longitude (for example 179° W is given as 181).

#### ***Northwest Chatham Rise***

The area within the box defined by the points:

42°10.0' S, 174 °42' E	(-42.166667, 174.700000)
42°10.0' S, 178 °00' W	(-42.166667, 182.000000)
44°00.0' S, 178 °00' W	(-44.000000, 182.000000)
44°00.0' S, Coastline	(-44.000000, coastline )
43°44.3' S, 173 °07.5' E	(-43.738333, 173.125000)
43°08' S, 173 °57' E	(-43.133333, 173.950000)

#### ***South Chatham Rise***

The area defined by the points:

44°00' S, 171 °55.8' E	(-44.000000, 171.930000)
44°00' S, 175 °00' W	(-44.000000, 185.000000)
46°00' S, 175 °00' W	(-46.000000, 185.000000)
46°00' S, 170 °15.6' E	(-46.000000, 170.260000)

Note that for the area defined above, points 1 and 4 are linked by the coastline. For reporting purposes the following rectangular box that overlaps with the South Island may be used:

44°00' S, 170 °15' E	(-44.000000, 170.256977)
44°00' S, 175 °00' W	(-44.000000, 185.000000)
46°00' S, 175 °00' W	(-46.000000, 185.000000)
46°00' S, 170 °15.6' E	(-46.000000, 170.260000)

#### ***East Chatham Rise***

The area within the area defined by the points below:

42°10' S, 178 °00' W	(-42.166667, 182.000000)
42°10' S, 173 °40' W	(-42.166667, 186.333333)
46°00' S, 173 °40' W	(-46.000000, 186.333333)
46°00' S, 175 °00' W	(-46.000000, 185.000000)
44°00' S, 175 °00' W	(-44.000000, 185.000000)
44°00' S, 178 °00' W	(-44.000000, 182.000000)

### ***Arrow Plateau***

The area within the area defined by the points:

42°10' S, 173 °40' W	(-42.166667, 186.333333)
42°10' S, 171°00.07' W	(-42.166667, 188.998833)
46°00' S, 171°46.68' W	(-46.000000, 188.222000)
46°00' S, 173 °40' W	(-46.000000, 186.333333)

Note that for the area defined above, points 2 and 3 are linked by the boundary of the EEZ.

### ***Puysegur***

The area within the rectangular box defined by the points:

46°00' S, 165 °00' E	(-46.000000, 165.000000)
46°00' S, 166 °30' E	(-46.000000, 166.500000)
47°30' S, 166 °30' E	(-47.500000, 166.500000)
47°30' S, 165 °00' E	(-47.500000, 165.000000)

### ***Sub-Antarctic***

The remaining area within ORH 3B. Specifically the area (excluding Puysegur) within the EEZ and below 46°00' S on the East Coast and 44°15.6' S on the West Coast.

## APPENDIX 3

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### Definition of the existing ORH 3B sub-area boundaries

Note: All positions are given in degrees, minutes and decimal minutes format.  
Figures in brackets are decimal degrees with western longitudes given as a progression of eastern longitude (for example 179° W is given as 181).

#### ***Spawning Box***

The area within the rectangular box defined by the points:

42°10' S, 178 °00' W	(-42.166667, 182.000000)
42°10' S, 175 °00' W	(-42.166667, 185.000000)
44°00' S, 175 °00' W	(-44.000000, 185.000000)
44°00' S, 178 °00' W	(-44.000000, 182.000000)

#### ***Eastern flats***

The area within the rectangular box, excluding the Andes complex and the Northeastern Hills, defined by the points:

42°10' S, 175 °00' W	(-42.166667, 185.000000)
42°10' S, 173 °40' W	(-42.166667, 186.333333)
46°00' S, 173 °40' W	(-46.000000, 186.333333)
46°00' S, 175 °00' W	(-46.000000, 185.000000)

#### ***Andes Complex***

The area within the rectangular box defined by the points:

44°05' S, 174 °37' W	(-44.080000, 185.383333)
44°05' S, 174 °22' W	(-44.080000, 185.633333)
44°15' S, 174 °22' W	(-44.250000, 185.633333)
44°15' S, 174 °37' W	(-44.250000, 185.383333)

#### ***Northeast Hills***

The area within a 3nM radius circle centred on the points

<i>Smiths City</i>	42°57.6'S, 174°25.2'W	(-42.96, 185.58)
<i>Cameron's</i>	43°08.0'S, 174°15.8'W	(-43.133, 185.737)
<i>Erebus</i>	43°10.7'S, 173°50.4'W	(-43.178, 186.16)
<i>Not Till Sunday</i>	43°51.2'S, 174°18.0'W	(-43.854, 185.7)

For reporting purposes rectangular boxes defined by the points below may be used.

### *Smith's City*

42°54.60' S, 174 °29.29' W	(-42.910033, 185.511828)
42°54.60' S, 174 °21.11' W	(-42.910033, 185.648172)
43°00.60' S, 174 °21.11' W	(-43.009966, 185.648172)
43°00.60' S, 174 °29.29' W	(-43.009966, 185.511828)

### *Cameron's*

43°04.98' S, 174 °19.87' W	(-43.083033, 185.668828)
43°04.98' S, 174 °11.69' W	(-43.083033, 185.805172)
43°10.98' S, 174 °11.69' W	(-43.182966, 185.805172)
43°10.98' S, 174 °19.87' W	(-43.182966, 185.668828)

### *Erebus*

43°07.68' S, 173 °54.49' W	(-43.128033, 186.091828)
43°07.68' S, 173 °46.31' W	(-43.128033, 186.228172)
43°13.68' S, 173 °46.31' W	(-43.227966, 186.228172)
43°13.68' S, 173 °54.49' W	(-43.227966, 186.091828)

### *Not Till Sunday*

43°48.24' S, 174 °22.09' W	(-43.804033, 185.631828)
43°48.24' S, 174 °13.91' W	(-43.804033, 185.768172)
43°54.24' S, 174 °13.91' W	(-43.903966, 185.768172)
43°54.24' S, 174 °22.09' W	(-43.903966, 185.631828)

## **Definition of Sub-Antarctic sub-area boundaries**

The area within the rectangular box defined by the points:

### *Priceless*

48°05.5' S, 174 °42' E	(-48.091667, 174.700000)
48°05.5' S, 175 °13' E	(-48.091667, 175.216667)
48°26.5' S, 175 °13' E	(-48.441667, 175.216667)
48°26.5' S, 174 °42' E	(-48.441667, 174.700000)

## APPENDIX 4

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### Definition of the East Rise sub-area boundaries under options 2 and 3

Note: All positions are given in degrees, minutes and decimal minutes format.  
Figures in brackets are decimal degrees with western longitudes given as a progression of eastern longitude (for example 179° W is given as 181).

#### ***Spawning Box***

The area within the rectangular box defined by the points:

42°10' S, 178 °00' W	(-42.166667, 182.000000)
42°10' S, 175 °00' W	(-42.166667, 185.000000)
44°00' S, 175 °00' W	(-44.000000, 185.000000)
44°00' S, 178 °00' W	(-44.000000, 182.000000)

#### ***Northeast Rise***

The area within the rectangular box defined by the points:

42°10' S, 178 °00' W	(-42.166667, 182.000000)
42°10' S, 173 °40' W	(-42.166667, 186.333333)
44°00' S, 173 °40' W	(-44.000000, 186.333333)
44°00' S, 178 °00' W	(-44.000000, 182.000000)

#### ***Southeast Rise***

The area within the rectangular box defined by the points:

44°00' S, 175 °00' W	(-44.000000, 185.000000)
44°00' S, 173 °40' W	(-44.000000, 186.333333)
46°00' S, 173 °40' W	(-46.000000, 186.333333)
46°00' S, 175 °00' W	(-46.000000, 185.000000)

