

## Overview

The purpose of this briefing note is to provide MRAG-US assessors with an update of the probable status of the North West Chatham Rise orange roughy stock based on the 2012 AOS acoustic survey results.

This note also provides analyses of annual catches and possible catch limit scenarios for 2013-14.

## ORH3B (NWR)

Biomass estimates of  $B_{current}$  were calculated from three model runs (Alldata, Nobiomass and NoCPUE) in 2006.

Model Run	$B_0$ (t)	$B_{current}$ (t)	$B_{current}$ (% $B_0$ )
Alldata	55,000	6,000	11
Nobiomass	52,500	4,400	9
NoCPUE	79,800	30,900	39

The outputs of these runs provided biomass estimates that were either above the management target (30%  $B_0$ ) or fluctuating near the hard limit (10%  $B_0$ ).

Biomass projections (at end of 5 year period 2006-2011) at assumed annual catches of 0, 500, 1000, 1,500 and 2000 t resulted in the following predictions for the biomass in 2011: This projections showed that the stock would rebuild slowly under a catch limit of 1,500 tonnes, but would not rebuild to the soft limit (20%  $B_0$ ) within 5 years.

Model Run	Annual catch (t) over five year period				
	0	500	1000	1500	2000
Alldata	23% $B_0$	20% $B_0$	17% $B_0$	14% $B_0$	11% $B_0$
Nobiomass	21% $B_0$	17% $B_0$	14% $B_0$	11% $B_0$	8% $B_0$
NoCPUE	49% $B_0$	47% $B_0$	44% $B_0$	41% $B_0$	39% $B_0$

Since 2006 the deterministic model used for these assessments has been set aside as being ineffective at providing robust orange roughy population simulations.

These 2006 stock assessments led to the reduction of a catch limit from 1,500 t to 750 t (50%) for this fishery for the start of the 2006-07 year. In 2010-11 ORH3B quota owners implemented a zero catch limit for this fishery for 3 years to promote the rate of rebuild towards the target of 30% $B_0$  and to undertake further biomass surveys to monitor progress.

### ORH 3B (NWR) Biomass estimates

In June/July of 2012, a survey using multi-frequency Acoustic Optical System (AOS) was completed on the two main UTFs within the NWCR area (Graveyard and Morgue).

This survey of these two UTFs provided preliminary estimates of current biomass ( $B_{2012}$ ) (Table 1). These estimates were presented to MPI's Deepwater Fisheries Assessment Working (DWWG) Group in May.

The preliminary results for  $B_{2012}$  assumes an estimate of  $B_0$  of 55,000 t. Furthermore the preliminary results provide an indicative  $B_{current}$  in the vicinity of 28,257 t for these two hills (using Op. No. 18 from Graveyard and Op.No. 22 from Morgue as these two estimates have the lowest deadzone estimate and the lowest CVs).(see Table 1):

Table 1: Preliminary biomass estimates from the Morgue and Graveyard

Biomass estimates at Graveyard					
Snapshot No.	Frequency (kHz)*	SSB (t)	Mature (t)	Dead Zone	CV
3	38	6,670	9,938	49%	0.28
11	38	5,828	8,684	52%	0.22
18	38	4,153	6,187	35%	0.23

Biomass estimates at Morgue					
Snapshot No.	Frequency (kHz)*	SSB (t)	Mature (t)	Dead Zone	CV
2	38	7,386	11,005	40%	0.14
6	38	8,255	12,300	43%	0.15
15	38	5,895	8,784	46%	0.43
22	38	14,812	22,070	27%	0.11

\*only 38 kHz estimates can be considered here due to calibration problems with the 120 kHz transducer during the survey.

The DWWG (upon the second presentation by CSIRO of the survey results) considered method used employed showed improvements in estimating acoustic biomass of orange roughy occurring in mixed species aggregations.

However, as the details of the AOS methods used have yet to be fully evaluated, the DWWG has reserved their final determination, until further discussion and agreement that the results of the 2012 survey represent the most reliable estimate of current biomass.

### In Summary

This round of results (see [Ryan and Kloser \(2013\) Biomass estimates of orange roughy in June 2012 at Northwest Chatham Rise using a net attached acoustic optical system.](#) 40p) provided estimates the 2012 spawning biomass as seen in Tables 2 and 3 :

Table 2: Estimates of Mature Biomass where Mature =1.49X Spawning

	Minimum Spawning Biomass (t)	Minimum Mature Biomass (t)	B <sub>0</sub> (t)	B <sub>2012</sub> /B <sub>0</sub>
Including SZ	18,965	28,258	53,750	53%
Excluding SZ	13,465	20,063	53,750	37%

Doonan I.& Hart A. (2003) used a different scaling factor as a 'spawning ratio' to scale up their 2002 acoustic survey biomass estimate (see: Notes on the abundance of mature orange roughy on the NW Chatham Rise and Graveyard Hills, ORH 3B, 20 June - 7 July 2002. WG-Deepwater- 03/01. Unpublished report held by Ministry of Fisheries, Wellington). Questions have been raised both to the efficacy of this scalar, and its application especially when the ratios it produces differ so markedly.

Using this lower scaling factor, B<sub>2012</sub> can be estimated to be 48% B<sub>0</sub>, with a lower bound of 34% B<sub>0</sub>, as is shown in Table 6 below:

Table 3: Estimates of Mature Biomass where Mature =1.35X Spawning

	Minimum Spawning Biomass (t)	Minimum Mature Biomass (t)	B <sub>0</sub> (t)	B <sub>2012</sub> /B <sub>0</sub>
Including SZ	18,965	28,258	53,750	53%
Excluding SZ	13,465	20,063	53,750	37%

The DWWG was understandably concerned about an estimate that included 29% of fish that were not directly measured.

However, the video results from each of these three biomass surveys, along with video observations from the 'moored camera' work on the hill Morgue by NIWA, indicate that ORH do occur within the near seabed 'shadow zone' in densities that appear to be comparable (or higher) to those observed in mid water.

Consequently DWG submits that the best estimate from the 2012 survey of 18,965 t can be readily used as the best estimate of spawning biomass in this fishery, with the estimate of 13,465 t being used as a plausible lower bound.

The most recent stock assessment accepted by the DWWG estimates  $B_0$  to have been either 52,000 t or 55,000 t (MPI (2013) Fisheries Assessment Plenary Report). The average of these is 53,750 t, estimated as mature biomass.

We propose that we use the same process that is currently applied to the management of ORH3B E&SCR to calculate a stock status for the ORH3B NWCR fishery.

On this basis,  $B_{2012}$  can be estimated to be 53%  $B_0$ , with a lower bound of 37%  $B_0$ , as is shown in Table 1 above:

### Application of the ORH Harvest Strategy to 2012 Biomass Survey Results

Table 3 ORH3B (NWR)  $B_{current}$  and Catch Limit Determinations

Estimates of Mature Biomass			
	$B_{current}$ (t)	$B_{current}/B_0$ (%)	$F_{msy}$ (t)
Mature = 1.35 X SB (Excl SZ)	18,178	34%	818
Mature = 1.49 X SB (Excl SZ)	20,063	37%	903
Mature = 1.35 X SB (Incl SZ)	25,603	48%	1153
Mature = 1.49 X SB (Incl SZ)	28,258	53%	1271

Notwithstanding the  $F=4.5\%$  strategy, All of these estimates provide for a catch of at least 818 t (at the lower scale where mature = 1.35 X SB and the shadow zone is excluded) or a catch of ~1,200 t (at the upper end where mature = 1.49 X SB the shadow zone is included). At the current 750 t catch limit, the current F is 2.6%.

In the context of MSC, ORH3B (NWR)  $B_{current}$  is currently 51%  $B_0$ . This is above the 30%  $B_0$  management target for orange roughy.

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