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New Zealand Orange Roughy Fishery

Third Surveillance Report

Prepared for
Deepwater Group Limited (DWG)
Level 12, 36 Kitchener Street, Auckland 1010, New Zealand

Certificate No: MSC-F-31281 (MRAG-F-0059)

MRAG Americas, Inc.

April 22, 2020

Conformity Assessment Body (CAB)	MRAG Americas, Inc.
Assessment team	Robert J. Trumble, Amanda Stern-Pirlot, and André Punt
Fishery client	Deepwater Group (DWG)
Assessment Type	Third Surveillance

1 Contents

2 Executive summary

This report contains the findings of the 3rd surveillance cycle in relation to the New Zealand Orange Roughy Fishery and an update on the fishery since the 2nd surveillance audit. This audit followed the surveillance audit process as defined in the MSC Fishery Certification Requirements v2.0. Conditions 2 and 3 were closed as a result of this audit and PIs 2.3.1 and 2.3.3 were rescored in section 4.4.

MRAG Americas confirms that the New Zealand Orange Roughy Fishery continues to meet the MSC Fisheries Standard and shall remain certified following the completion of this surveillance. No changes in the fishery occurred that would adversely affect the certification of orange roughy.

3 Report details

3.1 Surveillance information

Table 1. Surveillance information

1	Fishery name

	New Zealand Orange Roughy	
2	Surveillance level and type	
	Level 4, off-site audit	
3	Surveillance number	
	1st Surveillance	
	2nd Surveillance	
	3rd Surveillance	X
	4th Surveillance	
	Other (expedited etc.)	
4	Team leader	
	Amanda Stern-Pirlot	
5	Team members	
	André Punt and Bob Trumble A discussion between team members regarding conflict of interest and biases was held and none were identified.	
6	Audit/review time and location	
	Remotely via video conference on Feb 27/28, 2020.	
7	Assessment and review activities	
	The surveillance reviewed changes in science and management and progress in closing out any applicable conditions.	

3.2 Background

Update on the fishery since the 2nd surveillance audit

3.2.1 Target stocks update

A Management Strategy Evaluation (MSE) conducted in 2014, which defined a harvest strategy including limit reference points, target biomass range, and a harvest control rule, was described in the Public Certification Report (PCR). The MSE was reviewed by the MPI-chaired Deepwater Fisheries Assessment Working Group (DWFAWG), which accepted its application to orange roughy stocks to inform the setting of Total Allowable Catch (TAC), Total Allowable Commercial Catch (TACC) and agreed sub-area catch limits within a TACC on a case by case basis. The 2014 MSE defined a harvest control rule (HCR) optimized for the characteristics of orange roughy. The objective of the HCR is to maintain the stock within the management target range (30-50% B_0) whilst ensuring there is very low probability of the stock falling below the soft limit (20% B_0). Under the HCR, catch limits are recommended dependent on the estimated stock status in relation to the management target range. Where a stock is estimated to be below the midpoint of the target range, recommended catch limits are lower than for a stock near the top of the target range. A review of the harvest control rule was conducted during 2019 and its results will be reviewed during the next audit.

Table 2 summarizes stock status (biomass relative to B_0) and the probability of being below the limit and target reference points based on the base models from the most recent stock assessments.

Table 2. Summary of the stock status for the three UoC based on the base model runs.

Stock	Most recent assessment	Depletion [Year]	P < Limit	P < Target
ORH 3B NWCR	2018	0.38 B_0 (2017)	<1%	<1%
ORH 3B ESCR	2018	0.33 B_0 (2017)	<10%	<1%
ORH 7A	2019	0.47 B_0 (2019)	<1%	<1%

3.2.1.1. ORH 3B NWCR and ESCR

No new stock assessment was conducted for either the ORH 3B NWCR or the ORH 3B ESCR UoC during 2019. An update of the 2018 stock assessment for ORH 3B ESCR is being undertaken during 2020. The next full assessment for these two UoCs is scheduled for 2021. During 2017-18, 302 and 225 otolith samples and 1,253 and 921 length samples were respectively collected from the NWCR and the ESCR (FNZ, 2019a).

During the 2018-19 sustainability review, MPI's advice provided the Minister of Fisheries with three options for the TAC and TACC for ORH 3B and for the agreed ORH 3B NWCR and ORH 3B ESCR sub-area catch limits (MPI, 2018a):

- Option 1: The status quo (i.e., a TACC for ORH 3B of 5,197 t for the 2018-19 fishing year, with sub-area catch limits of 1,250 t for NWCR and 3,100 t for ESCR).
- Option 2: An increase to the values from the HCR (i.e., a TACC for ORH 3B of 7,667 t for the 2018-19 fishing year, with sub-area catch limits of 1,150t for NWCR and 5,670t for ESCR).
- Option 3. An increase to the values from the HCR for the ORH 3B ESCR fishery over three fishing years and an immediate change to the HCR output for NWCR (i.e., a TACC for ORH 3B of 6,091 t for the 2018-19 fishing year, with sub-area catch limits of 1,150 t for NWCR and 4,095 t for ESCR).

Option 3 was recommended by MPI based on the rationale that it is a prudent approach in light of the large proposed increase in the TACC and that doing so will allow monitoring of any fishing impacts associated with increasing fishing effort to determine if any impacts on Endangered, Threatened or Protected (ETP) species are adverse and, therefore, additional management action may be required (MPI, 2018b). The staged increase in the agreed catch limit for ORH3B ESCR allows Fisheries New Zealand (FNZ)[1] to make subsequent adjustments to their advice to the Minister should the biomass estimates be too optimistic.

The options were consulted on and submissions were received from industry, conservation groups and Iwi. The Minister of Fisheries decided on Option 3, noting that he would consult further with stakeholders prior to making separate TAC and TACC decisions for the 2019-20 and 2020-21 fishing years (Minister of Fisheries, 2018).

During 2019, Fisheries New Zealand provided advice to set the TACC for 2019-20 based on Option 3 as agreed by the Minister of Fisheries in 2018 (FNZ, 2019b). Following consultation (FNZ, 2019c, 2019d), the Minister agreed with the recommendation and set the TAC for ORH 3B to 7,116t (TACC 6,772t), with catch limits of 1,150t for the NWCR and 4,775t for the ESCR (Minister of Fisheries, 2019). The Minister reaffirmed that he would consult with stakeholders prior to making his TAC and TACC decisions in 2020 (i.e., prior to the third year of the planned phased increase in TAC/TACC and the ESCR catch limit (Minister of Fisheries, 2019).

3.2.1.2. ORH 7A[2]

A new stock assessment for ORH 7A was conducted during 2019 (Cordue, 2019), which updated the last assessment conducted in 2014 (Cordue, 2014). The new stock assessment was again based on CASAL (Bull et al., 2012). Structurally, the assessment was nearly identical to the 2014 assessment (single-sex, age-structured model fitted to

[1] Fisheries New Zealand (FNZ) is the business unit within the Ministry for Primary Industries (MPI) responsible for fisheries-related issues including science and management. Compliance and enforcement responsibilities remain within MPI.
[2] The ORH 7A fishery and UoA include both the area inside New Zealand's EEZ, QMA ORH 7A, and the designated area outside of the EEZ and immediately adjacent, known as Westpac Bank. Orange roughy here are managed as a straddling stock.

acoustic and trawl survey indices of abundance and age-frequency data), although unlike the 2014 assessment, the 2019 modelled two fisheries, one in the NZ EEZ and one on the Westpac Bank where slightly older fish are caught. The 2019 assessment estimated year-classes up to 1995 (1985 for the 2014 assessment).

Compared to the 2014 assessment, the 2019 assessment included a new data point from the 2018 *Thomas Harrison* biomass survey, additional age frequency data, including for the Volcano feature close the boundary of the New Zealand EEZ, and substantially updated acoustic estimates of abundance. The acoustic estimates were reviewed and revised for the assessment and estimates provided separately for the west and east spawning aggregations and the Volcano feature. Given the change to acoustic data, the 2019 assessment was based on different priors for acoustic catchability than the 2014 assessment. This prior for catchability for the *Thomas Harrison* was also updated. An estimate of biomass was obtained during the 2018 survey (Ryan et al., 2019) for Volcano but not used in the assessment owing to concerns whether the biomass pertained to spawning fish (FNZ, 2019e).

The assessment involved a base model run and several sensitivity tests. The base model fitted the indices of abundance adequately but the fit to the age data for Volcano in 2018 (which was down-weighted) was quite poor owing to the presence of older individuals. The priors for catchability were updated as was the case in the 2014 assessment.

<u>Assessment results</u>
Virgin biomass, B_0, was estimated (posterior median) to be between 94,000-107,000t for all runs (Table 3), larger than that estimated during the 2014 assessment (64,000-67,300t). Current stock status varied between 37% B_0 and 57% B_0, with the most pessimistic result when the value for natural mortality (M) was reduced and the means of the priors for acoustic catchability increased (the "LowM-Highq" run), but for all runs, current status was estimated to be within (or above) the management target range of 30-50% B_0.

Table 3. MCMC estimates of ORH 7A virgin biomass (B_0) and stock status (B_{2019} as %B_0) for the base model and four sensitivity runs (source: FNZ, 2019e).

Run	M	B_0 (1,000t)	95% CI	B_{2019} (%B_0)	95% CI
Base	0.045	94	86-104	47	39-55
All trend	0.045	107	94-126	57	46-57
Estimate M	0.037	97	89-106	40	31-51
LowM-Highq	0.036	95	88-103	37	30-45
HighM-Lowq	0.054	94	85-106	56	48-65

Figure 1 shows the estimated time-trajectory for ORH 7A spawning biomass, illustrating that the stock declined to around 15% B_0 in 1990 and then recovered during a period of fishery closure, 2000-01 to 2009-10, to promote rapid rebuilding, with biomass estimated to have peaked at ~48% B_0 in 2015.

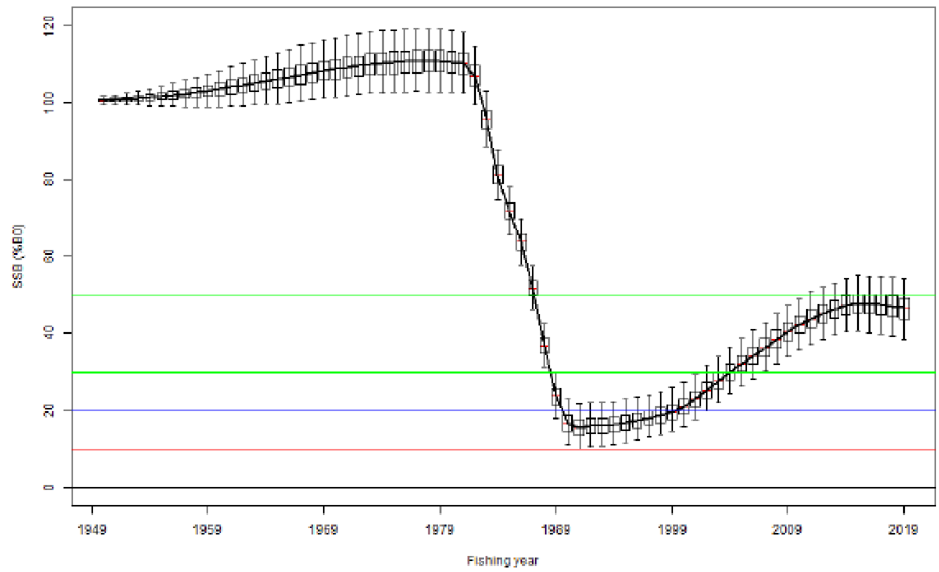


Figure 1. **Base, MCMC estimated ORH 7A spawning-stock biomass trajectory. The box in each year covers 50% of the distribution and the whiskers extend to 95% of the distribution. The hard limit 10% B_0 (red), soft limit 20% B_0 (blue), and biomass target range 30–50% B_0 (green) are marked by horizontal lines (source, FNZ, 2019e).**

Application of the HCR, projections and TACC setting

The HCR for ORH 3B (Figure 2) was applied to the results of the assessment, leading to a value of 2,448t (Cordue, 2019). Projections were undertaken for the current TACC of 1,600t, leading to a predicted decline in spawning biomass under the base and LowM-Highq runs, with the LowM-Highq run considered a "worst case" (Figure 3).

During the 2019-20 sustainability review, FNZ's advice provided the Minister of Fisheries with four options regarding the TAC and TACC for ORH 7A (FNZ, 2019f):

- Option 1: The status quo (i.e., a TACC for ORH 7A of 1,600 t for the 2019-20 fishing year).
- Option 2: An increase to the TACC of 29% (i.e., a TACC for ORH 7A of 2,060 t for the 2019-20 fishing year.
- Option 3: An increase to the TACC of 38% (i.e., a TACC for ORH 7A of 2,220 t for the 2019-20 fishing year.
- Option 4: An increase to the value from the HCR (i.e., a TACC for ORH 7A of 2,433 t for the 2019-20 fishing year).

The options were consulted on and submissions were received from industry, conservation groups and Iwi (FNZ, 2019c, 2019d). The Minister of Fisheries decided on Option 2, a TACC of 2,058t with an allowance for Mãori customary harvest of 2t (Minister of Fisheries, 2019).

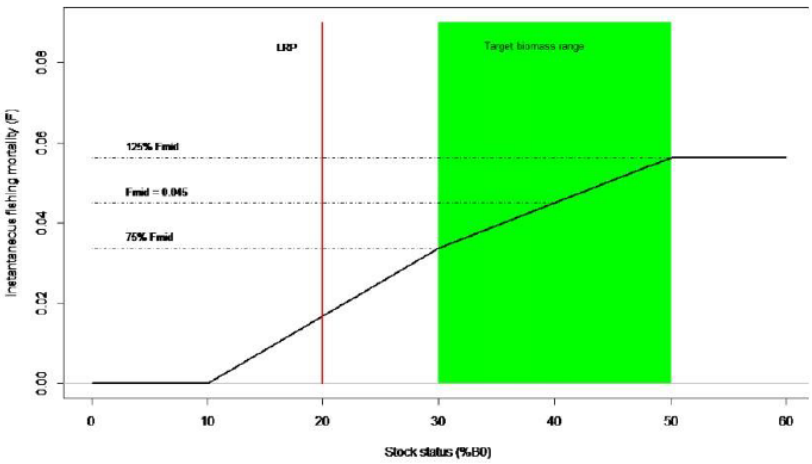


Figure 2. The Harvest Control Rule as applied to the three UoAs - ORH 3B ESCR, ORH 3B NWCR and ORH 7A.

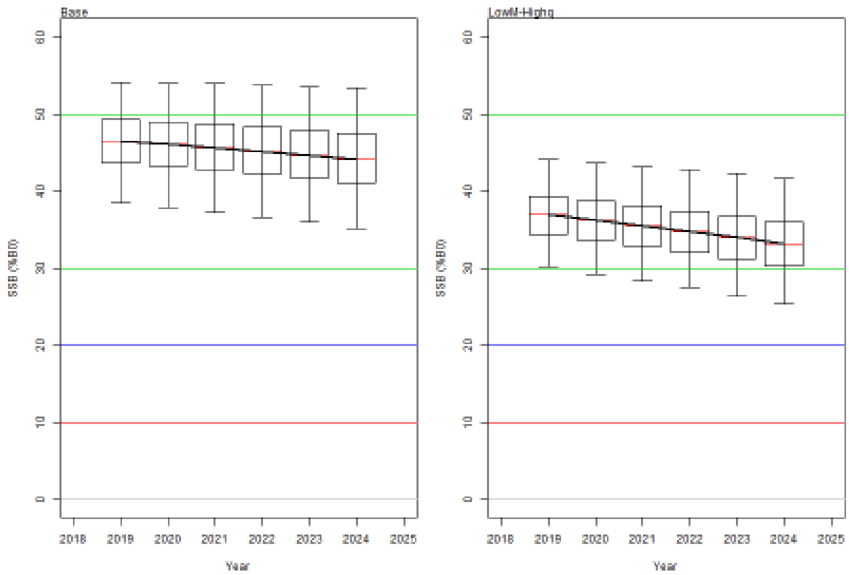


Figure 3. MCMC projections for ORH 7A with a constant catch of 1,600 t (plus a 5% allowance for incidental catch) for the base model (left) and the LowM-Highq model (right). The box in each year covers 50% of the distribution and the whiskers extend to 95% of the distribution. The target biomass range (30–50% B_0) is indicated by horizontal green lines, the hard limit (10% B_0) by a red line and the soft limit (20% B_0) by a blue line (Source; FNZ, 2019e).

Principle 1 References

Bull, B, Francis, R.I C.C, Dunn, A., McKenzie, A., Gilbert, D.J., Smith, M.H., Bian, R. & Fu, D (2012). CASAL (C++ algorithmic stock assessment laboratory): CASAL user manual v2.30-2012/03/21. *NIWA Technical Report 135*. 280 p.

Cordue, P.L. (2014). The 2014 orange roughy stock assessments. *New Zealand Fisheries Assessment Report 2014/50*. 135 p.

Cordue. P.L. (2019). A 2019 stock assessment of ORH 7A including Westpac Bank. *New Zealand Fisheries Assessment Report* 2019/33.45 p.

FNZ (2019a). Annual Review Report for Deepwater Fisheries 2017/18. Fisheries New Zealand Information Paper No: 2019/01. 112 p.

FNZ (2019b). Review of Sustainability Measures for Orange Roughy (ORH 3B) for 2019/20. 13p.

FNZ (2019c). October 2019 Sustainability Round: Submissions Received 1.

FNZ (2019d). October 2019 Sustainability Round: Submissions Received 2.

FNZ (2019e). Fisheries Assessment Plenary, May 2019: stock assessments and stock status. Compiled by the Fisheries Science and Information Group, Fisheries New Zealand, Wellington, New Zealand. 1637p. Orange Roughy, pp. 800-841.

FNZ (2019f). Review of Sustainability Measures for Orange Roughy (ORH 7A) for 2019/20. 15p.
Minister of Fisheries (2018). Changes to sustainability measures and other management controls for 1 October 2018, and closure of the Kaipara Harbour to the taking of scallops. 24 p.
Minister of Fisheries (2019). Changes to sustainability measures and other management controls for 1 October 2019. 16 p.
MPI (2018a) Sustainability measures for 1 October 2018: Consultation document. 48 p.
MPI (2018b) Sustainability measures for 1 October 2018: Decision document. 477 p.
Ryan, T., Tilney, R., Cordue, P. and Downie, R. (2019). South-west Challenger Plateau Trawl and Acoustic Biomass Survey June/July 2018. Draft FAR, August 2019. 66 p.

3.2.2 Ecosystem update

Retained species and bycatch

MPI provided updated catch compositions of QMS and non-QMS catches for the ORH 3B ESCR ORH 3B NWCR, and ORH 7A fisheries (Table 4, Table 5, Table 6, Table 7, Table 8, and Table 9).

Table 4 ESCR UoA estimated average annual QMS catches based on observer data

ESCR UoA QMS species 2014-15 to 2018-19	Estimated Average Annual Catch (t)	Estimated % Catch
Orange roughy	6,892.4	69.3%
Smooth oreo	2,245.6	22.6%
Black oreo	231.0	2.3%
Ribaldo	52.5	0.5%
Hoki	74.8	0.8%
Spiky oreo	39.0	0.4%
Cardinalfish	6.2	0.1%
Alfonsino	15.3	0.2%
Hake	2.7	0.03%
Pale ghost shark	1.7	0.02%
Ling	3.5	0.04%
Totals	**9,564.7**	**96.3%**

**Only average annual catches >1 tonne are provided*

Table 5 ESCR UoA estimated average annual non-QMS catches based on observer data

ESCR UoA Non- QMS species 2014-15 to 2018-19	Estimated Average Annual Catch (t)	Estimated % Catch
Baxters lantern dogfish	37.7	0.38%
Other sharks and dogs	25.5	0.26%
Slickhead	32.9	0.33%
Slender cods	34.6	0.35%
Shovelnose spiny dogfish	24.6	0.25%
Rattails	16.7	0.17%
Morid cods	10.8	0.11%
Longnose velvet dogfish	7.9	0.08%
Basketwork eel	7.6	0.08%
Warty squid	8.2	0.08%
Deepwater dogfish	14.9	0.15%

Seal shark	4.2	0.04%
Javelin fish	4.6	0.05%
Smooth skin dogfish	2.8	0.03%
Widenosed chimaera	2.1	0.02%
Leafscale gulper shark	1.5	0.01%
Plunket's shark	2.2	0.02%
Long-nosed chimaera	2.1	0.02%
Small-headed cod	1.5	0.02%
Smallscaled brown slickhead	2.5	0.02%
Giant chimaera	1.0	0.01%
Totals	**245.7**	**2.47%**

Table 6 NWCR UoA estimated average annual QMS catches based on observer data

NWCR UoA QMS Species 2014-15 to 2018-19	Estimated Average Annual Catch (t)	% Catch
Orange roughy	**660.3**	**74.4%**
Smooth oreo	48.7	5.5%
Hoki	17.3	2.0%
Hake	3.8	0.4%
Pale ghost shark	2.5	0.3%
Ribaldo	0.7	0.1%
Black oreo	0.7	0.1%
Ling	0.4	0.0%
Sea perch	0.1	0.0%
Alfonsino	1.5	0.2%
Totals	**736.1**	**83.0%**

**Only average annual catches >1 tonne are provided*

Table 7 NWCR UoA estimated average annual non-QMS catches based on observer data

NWCR UoA Non-QMS species 2014-15 to 2018-19	Estimated Average Annual Catch (t)	% Catch
Slickhead	28.3	3.2%
Slender cods	22.7	2.6%
Baxters lantern dogfish	9.6	1.1%
Warty squid	5.9	0.7%
Deepwater dogfish	5.4	0.6%
Long-nosed chimaera	4.8	0.5%
Morid cods	3.6	0.4%
Smallscaled brown slickhead	3.2	0.4%
Shovelnose spiny dogfish	4.0	0.4%
Widenosed chimaera	3.4	0.4%
Basketwork eel	2.9	0.3%
Smooth skin dogfish	2.4	0.3%
Longnose velvet dogfish	2.7	0.3%

Seal shark	2.6	0.3%
Plunket's shark	2.1	0.2%
Javelin fish	1.9	0.2%
Other sharks and dogs	2.0	0.2%
Leafscale gulper shark	1.2	0.1%
Totals	**108.5**	**12.2%**

**Only average annual catches >1 tonne are provided*

Table 8 ORH 7A UoA estimated average annual QMS catches based on observer data

ORH 7: QMS Species 2014-15 to 2018-19	Estimated Average Annual Catch (t)	Estimated % Catch
Orange roughy	4,616	88.1%
Spiky oreo	78	1.5%
Ribaldo	44	0.8%
Hake	23	0.4%
Pale ghost shark	13	0.2%
Hoki	8	0.2%
Cardinalfish	3	0.1%
Smooth skate	1	0.0%
Sea perch	1	0.0%
Smooth oreo	1	0.0%
Totals	**4,787**	**91.4%**

**Only average annual catches >1 tonne are provided*

Table 9 ORH 7A UoA estimated average annual non-QMS catches based on observer data

ORH 7: Non-QMS species 2014-15 to 2018-19	Estimated Average Annual Catch (t)	Estimated % Catch
Baxters lantern dogfish	44.2	0.84%
Other sharks and dogs	40.6	0.77%
Slickhead	39.9	0.76%
Slender cods	40.4	0.77%
Shovelnose spiny dogfish	36.2	0.69%
Rattails	19.0	0.36%
Morid cods	11.0	0.21%
Longnose velvet dogfish	9.0	0.17%
Basketwork eel	8.6	0.16%
Warty squid	8.0	0.15%
Deepwater dogfish	8.9	0.17%
Seal shark	6.1	0.12%
Javelin fish	3.4	0.06%
Smooth skin dogfish	2.8	0.05%
Widenosed chimaera	2.3	0.04%
Leafscale gulper shark	2.2	0.04%
Plunket's shark	3.5	0.07%
Long-nosed chimaera	2.6	0.05%

Oilfish	0.6	0.01%
Small-headed cod	3.8	0.07%
Smallscaled brown slickhead	4.6	0.09%
Totals	**297.5**	**5.68%**

The bycatch of smooth oreo (reporting code SSO) in NWCR (5.5% of total catch) and in ESCR (22% of total catch) means it is a 'main' retained species in both UoAs. As the OEO 4 management area overlaps the key orange roughy fishery areas in ORH 3B NWCR and ORH 3B ESCR, the SSO 4 stock assessment is applicable to both UoAs. There are no 'main' bycatch species in any of the UoAs.

A 2019 stock assessment of smooth oreo in OEO 4 estimated B_{2018} at 40% B_0 for the base model (Figure 6). B_{2018} is 'About as Likely as Not' (40-60%) to be at or above the target of 40% B_0. Stock projections indicated there would be little change in biomass over the next five years at annual catches of 2,300-3,000 t (Cordue, 2019). The catch limit for smooth oreo in OEO 4 is currently 2,600 t (DWG, 2019).

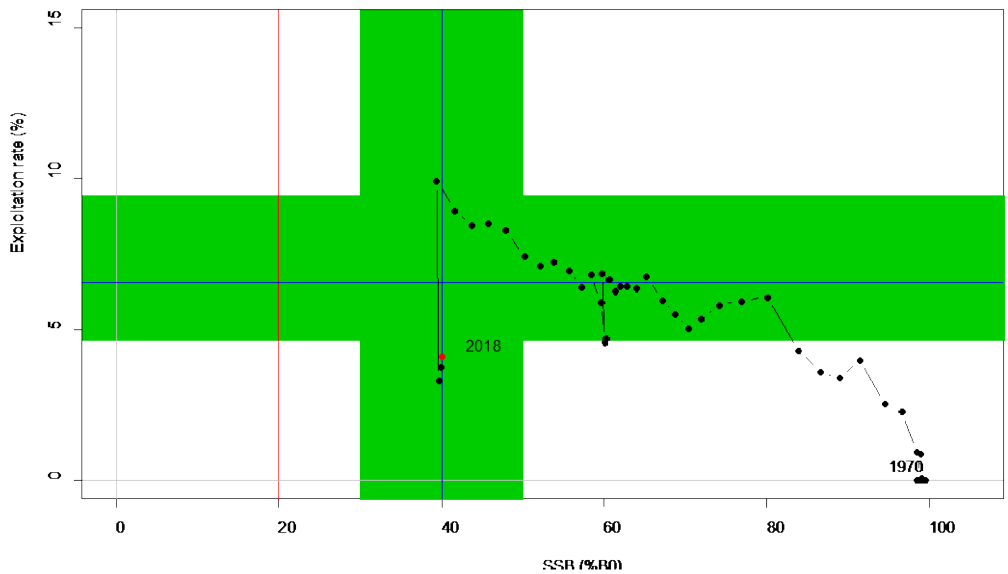


Figure 4 Historical trajectory of SSO 4 spawning biomass (% B_0) and exploitation rate (%) (base model, medians of the marginal posteriors). A reference range of 30–50% B_0 and the corresponding exploitation rate range are coloured in green. The soft limit (20% B_0) is marked by a red line and the target biomass (40% B_0) and associated exploitation rate limit are marked by blue lines (Cordue, 2019).

ETP Species

Seabirds and Marine mammals

Updated data on seabird and marine mammal captures in the orange roughy fisheries for recent years to 2017-18 sourced from the Dragonfly website (Dragonfly, 2019), and unpublished data for the 2018-19 fishing year sourced from FNZ (R. Tinkler, pers. comm.), indicated low levels of mortality, as is consistent with previous years.

Table 10 shows observed and estimated seabird captures in the orange roughy fishery UoAs. For the 2018-19 fishing year, there were 8 seabird capture observations, all from ORH 3B. Two were dead Chatham Island albatrosses, one was a dead white-chinned petrel, and the rest of the captures were released alive. There were no observed captures in ORH 7A. The total observed tows arriving at this number is 296 for ORH 3B ESCR, 63 for ORH 3B NWCR, and 108 for ORH 7A-WB. Though the IUCN classifies Chatham albatross as 'vulnerable,' the population is considered to be stable (Birdlife International 2020a). White-chinned petrel is also classified as vulnerable according to the IUCN and its population trend is decreasing (Birdlife international 2020b), citing longline fisheries (outside of New Zealand waters) as a primary threat.

Table 10. Observed and estimated seabird captures in the New Zealand orange roughy UoAs since 2014.

Fishing year	Observed	Estimated

	Chatham Rise	ORH 7A	Chatham Rise	ORH 7A
2014-15	0	0	2	3
2015-16	3	0	7	1
2016-17	1	1	7	2
2017-18	0	2	7	2
2018-19	8	0	*	*

*** not available**

There was one observed New Zealand fur seal capture in 2018-19 (Table 11), a capture rate with high certainty given the good observer coverage. There were no other marine mammal captures in 2018-19.

It is noteworthy that observations and estimates of bird and mammal captures have not appreciably increased even as observer coverage rates have increased in the past year, providing confidence that low observed interactions are (and have been) representative.

Table 11. Observed and estimated marine mammal captures in the New Zealand orange roughy UoAs since 2014.

	Observed	Estimated
2014-15	1 (fur seal)	1
2015-16	0	0
2016-17	0	0
2017-18	0	0
2018-19	1 (fur seal)	*

The assessment team is confident that the impact of the UoAs on seabirds and marine mammals remains very low.

Protected Corals

Table 12 provides the weight of observed coral captures in certified orange roughy UoAs for the 2018-19 season (FNZ, 2019).

Table 12. Observed coral captures from tows targeting orange roughy and oreo during the 2018-19 fishing year.

UoA	Observed Coral Capture (kg)	No. Coral Tows	No. Observed Tows	Coral per Observed Tow (kg)	Scaled Coral Catch (kg)
ORH 3B NWCR	136.3	22	90	1.5	470
ORH 3B ESCR	85.8	24	405	0.2	277
ORH 7A	0.1	1	170	0.0006	0.30
Totals	**222.2**	**47**	**665**	**1.72**	**747**

The coral species most abundant in NWCR catches are Scleractinian stony corals, particularly *Solenosmilia variabilis*. In ESCR, the main species encountered are the Alcyonacean bubblegum coral *Paragorgia arborea* and the Scleractinian bushy hard coral *Goniocorella dumosa* (Table 13).

Table 13. ETP corals, by group/species, observed captured during the 2018-19 fishing year (FNZ, R. Tinkler, 2019 pers. comm.).

Coral Group	UoA	Catch (kg)	Scientific name	Common name
Gorgonian corals – Alcyonacea	ORH 3B NWCR	1	*Chrysogorgia* spp	Golden coral
Gorgonian corals - Alcyonacea		0.1	No species id.	Gorgonian coral

Stony corals - Scleractinia		3	*Goniocorella dumosa*	Bushy hard coral
Stony corals - Scleractinia		106.9	No species id.	Scleractinia
Stony corals - Scleractinia		25.3	*Solenosmilia variabilis*	Deepwater branched
	Total	136.3		
Black corals Antipatharia	ORH 3B ESCR	1.6	No species id.	Black coral
Black corals Antipatharia		1	*Leiopathes* spp.	Black coral
Black corals Antipatharia		1	*Leiopathes secunda*	Black coral
Black corals Antipatharia		1	*Triadopathes* spp.	Black coral
Gorgonian corals - Alcyonacea		1.4	Keratosis spp.	Bamboo coral
Gorgonian corals - Alcyonacea		1.8	No species id.	Gorgonian coral
Gorgonian corals - Alcyonacea		0.1	No species id.	Bamboo corals
Gorgonian corals - Alcyonacea		54.3	*Paragorgia arborea*	Bubblegum coral
Stony corals - Scleractinia		8.2	No species id.	Stony branched
Stony corals - Scleractinia		17	*Goniocorella dumosa*	Bushy hard coral
Stony corals - Scleractinia		3	*Madrepora oculata*	Madrepora coral
	Total	85.8		
Gorgonian corals - Alcyonacea	ORH 7A	0.1	No species id.	Gorgonian coral
	Total	0.1		

Habitat and Ecosystem

The orange roughy fishery operates over two main habitat types, Underwater Topographical Features (UTFs) and 'slope' within the three orange roughy UoA areas and across the New Zealand EEZ as a whole, as characterized and described in the Public Certification Report.

Regarding trawl footprint changes, Table 14 shows the results of analyses for the orange roughy and oreo target fisheries in the three UoC areas since 1989-90. The footprint remains small, and the assessment team is monitoring small increases that have occurred in recent years for possible correlation with increases in the orange roughy TACCs as stocks continue to increase. The slight change in footprint does not change the conclusion from the full assessment PCR regarding potential impact of these UoAs on habitats.

The trawl footprint of orange roughy and oreo fisheries is monitored annually to assess the extent of their interactions with the benthic habitat (Baird & Wood, 2018, Baird & Mules, 2019, Black & Tilney, 2017, Black et al., 2013). Baird & Mules (2019) estimated that in 2016-17, all New Zealand OEO and ORH fisheries traversed 0.2% and 1.15% respectively of the EEZ fishable area between 800-1,600 m and in combination traversed 0.072% of the area of the Territorial Sea and EEZ.

ORH/OEO trawl footprints indicate that the fisheries have traversed between 1.1% and 3.6% of UoA fishable grounds (i.e. 800-1,600 m depths) over the most recent two years, which is around one-tenth the area fished during the period of peak orange roughy fishing in the late 1980s and early 1990s (Table 14). New area trawled in 2018-19 amounted to between 0.3% and 0.8% of the fishable area, much of which has involved 'in-filling' of previously untouched areas within the traditional fishing grounds. In NWCR there has been a trend towards longer tows on slope habitat to the west of the 180 hills in recent years, while in ESCR the fishing effort has remained spread between UTF and slope habitat, as before. In ORH 7A, there has been a marked expansion of the fishery eastwards as of 2015-16, which is reflective of the fishery operating outside of the spawning period (the spawning area is in the extreme western part of ORH 7A).

Table 14. UoA trawl footprint in relation to the fishable area 800-1,600 m (Baird & Mules, 2019; GNS, J. Black pers. comm., 2020).

UoA	All Years 1989-90 to 2018-19[1]	2016-17[2]	2017-18[1]	2018-19[1]	New Area 2018-19[1]	Closed Area
NWCR	37.6%	2.9%	3.6%	2.4%	0.3%	0.3%
ESCR	28.7%	1.5%	2.1%	2.0%	0.4%	4.6%
ORH 7A	12.3%	1.2%	1.1%	1.7%	0.8%	15.6%

[1]Black, 2020 [2] Baird & Mules, 2019.

A detailed analysis of the UoA trawl footprints for all years for which data are available (i.e. 1989-90 to 2018-19) and for the two most recent fishing years (i.e. 2017-18 and 2018-19) is provided in Table 15.

Table 15. Analysis of UoA trawl footprint during the years 1989-90 to 2018-19 and for 2018-19 (GNS, J. Black pers. comm., 2020).

Category	UoA ORH 7A-		UoA ORH 3B NWCR		UoA ORH 3B ESCR	
	All Years 1989-90 to 2018-19	2018-19	All Years 1989-90 to 2018-19	2018-19	All Years 1989-90 to 2018-19	2018-19
UoA Area (km^2)	233,607	233,607	137,583	137,583	196,856	196,856
Fishable Area (FA) (km^2)	78,869	78,869	17,398	17,398	38,198	38,198
Deeper than FA (km^2)	24,793	24,793	28,168	28,168	107,558	107,558
Closures within FA (km^2)	12,301	12,301	45	45	1,755	1,755
Closures within FA (%)	15.6%	15.6%	0.3%	0.3%	4.6%	4.6%
Swept area (km^2 in UoA)	9,910	1,319	6,948	419	11,756	764
Swept area (% of UoA)	4.2%	0.6%	5.0%	0.3%	6.0%	0.4%
Swept area (km^2 in FA)	9,740	1,319	6,539	419	10,969	764
Swept area (% FA)	12.3%	1.7%	37.6%	2.4%	28.7%	2.0%
New swept area (km^2 in UoA)		641		55		140
New swept area (% of FA)		0.8%		0.3%		0.4%
Number of tows	9,517	477	11,333	224	46,778	1,351

Analysis of trawl tows illustrated that most fishing occurs at just over 1,000 m in NWCR and at just over 800 m depth in ESCR. The proportions of tows on UTFs was around 30% in NWCR and around 65% in ESCR. Catches of orange roughy and oreo species in NWCR were higher on slope habitat while in ESCR they were roughly equal on slope and on UTF habitat (Table 16).

Table 16. Trawl fishing depths, numbers of tows on slope and on UTF habitat and ORH/OEO catches in 2017-18 and 2018-19 in the NWCR and ESCR UoAs (GNS, J. Black pers. comm., 2020).

Metric	UoA ORH 3B NWCR	UoA ORH 3B ESCR

	2017-18	2018-19	2017-18	2018-19
Tow depth - minimum	650	623	450	460
Tow depth - median	1031	1042	830	845
Tow depth - maximum	1323	1315	1498	1400
Total Number of tows	399	224	1261	1351
Number of tows on UTF	119	72	804	875
% of tows on UTF	30%	32%	64%	65%
Number of tows on slope	280	152	457	476
% of tows on slope	70%	68%	36%	35%
ORH/OEO catch on UTFs (t)	145	101	2,199	2,324
ORH/OEO catch on slope (t)	664	229	2,445	3,486

It is noted that there continues to be a small amount of new area swept each year, although exactly how much is unknown due to the trawl footprint resolution. The assessment team continues to monitor this information. Specific information pertaining to the open conditions on coral interactions is presented in the respective results tables.

P2 References:

Fisheries New Zealand (FNZ) 2019, R. Tinkler pers. comm. Summary of coral observations in the 2018-19 orange roughy fishery.

Institute of Geological and Nuclear Sciences (GNS) 2020, J. Black pers. comm. Analysis of orange roughy and oreo trawl footprint in UoA ORH 3B NWCR, ORH 3B ESCR and ORH 7A in 2017-18 and 2018-19.

Baird, S.L. and Wood, B.A. (2018). Extent of bottom contact by New Zealand commercial trawl fishing for deepwater Tier 1 and Tier 2 target fishstocks, 1989-90 to 2015-16. New Zealand Aquatic Environment and Biodiversity Report No. 193. 102 p. https://fs.fish.govt.nz/Page.aspx?pk=113&dk=24575

Baird, S.L. and Mules, R. (2019). Extent of bottom contact by New Zealand commercial trawl fishing for deepwater Tier 1 and Tier 2 target species determined using CatchMapper software, fishing years 2008-17. September 2019. AEBR 2019-229. 106 p. https://fs.fish.govt.nz/Page.aspx?pk=113&dk=24750

BirdLife International. 2020a. Species factsheet: *Thalassarche eremita*. Downloaded from http://www.birdlife.org on 07/04/2020

BirdLife International. 2020b. Species factsheet: *Procellaria aequinoctialis*. Downloaded from http://www.birdlife.org on 07/04/2020.

Black, J., Wood, R., Berthelsen, T. and Tilney, R. (2013). Monitoring New Zealand's trawl footprint for deepwater fisheries: 1989-90 to 2012-13. New Zealand Aquatic Environment and Biodiversity Report No. 110. 57 p. https://fs.fish.govt.nz/Page.aspx?pk=113&dk=23155

Black, J. and Tilney, R. (2017). Monitoring New Zealand's trawl footprint for deepwater fisheries: 1989-90 to 2012-13. New Zealand Aquatic Environment and Biodiversity Report No. 176. 65 p. https://fs.fish.govt.nz/Page.aspx?pk=113&dk=24212

Dragonfly (2019). Protected species bycatch 2002-03 to 2017-18. https://psc.dragonfly.co.nz/2019v1/released/

3.2.3 Management update

<u>Potential or actual changes to the management system</u>

No substantial changes in the management system have occurred that would adversely affect the certification of the orange roughy resources. A newly elected government separated the fisheries portfolio (now Fisheries New Zealand, FNZ) from other primary industries within the Ministry for Primary Industries (MPI); this change was intended to raise the profile for fisheries.

The Public Certification Report identified an area that fell behind schedule and continued behind schedule through the second surveillance: updating the National Deepwater Fisheries Plan (National Deepwater Plan). The National Deepwater Plan provides an integrated, transparent way of defining management objectives, actions, and services required to meet relevant legislative obligations and strategic directions for managing New Zealand's deepwater fisheries. The plan also provides a reporting mechanism to measure progress towards meeting objectives. The purpose of national fisheries plans is to provide clear management objectives to support the purpose and principles of the Fisheries Act 1996 and to identify key deliverables for MPI over the medium term (5 years). Work on the revision began in 2016, with consultation on a draft Plan in July and August 2017. In May 2019, MPI approved the plan (https://www.mpi.govt.nz/dmsdocument/18779/direct). The National Deepwater Plan consists of three parts:

- Fisheries management framework and objectives:
    - Part 1A - strategic direction for deep water fisheries
    - Part 1B - fishery-specific chapters and management objectives at the fishery level
- Annual Operational Plan (AOP) – detailing the management actions for delivery during the financial year (FNZ, 2019)
- Annual Review Report – reporting on progress towards meeting the five-year plan and on the annual performance of the deepwater fisheries against the AOP (FNZ, 2019a).

MPI published a Medium Term Research Plan (MTRP) for the period 2018-19 to 2022-23 (https://www.mpi.govt.nz/dmsdocument/21746). This MTRP outlines the scientific monitoring and research needs to inform management of New Zealand's deepwater fisheries.

The science needs in this MTRP are based on the longer-term planning that has previously been consulted on with stakeholders, but not provided publicly with descriptions, context and rationale for the planned work. The MTRP remains a living document and will be updated regularly to reflect changes in management priorities where these occur, and identification of new areas of research. Annual research plans will be consulted with stakeholders through the National Deepwater Fisheries Plan forums and reported in the Annual Operational Plans (AOP) and Annual Review Reports for deepwater fisheries. The 2018-19 AOP describes proposed research in section 9.3.1.

<u>Observer coverage</u>

At the time of the Public Certification Report, observer coverage in the 2013-14 orange roughy fishery had dropped to the lowest levels in the historical coverage pattern consequent to a priority reallocation of observers onto Foreign Charter Vessels (as orange roughy fisheries are fished by domestic vessels only). Stakeholders expressed concern that the observer coverage at the time of certification no longer provided sufficient information to support management objectives. While observer-reported maturity data for orange roughy are used to assist in the research planning of some surveys, as fisheries-independent research surveys are undertaken to assess spawning stock biomass, little or no observer-derived information is used in the stock assessments for these fisheries. Low seabird and marine mammal incidental capture rates also do not support the need for extensive observer coverage. MPI consultations with the assessment team demonstrated intent to increase coverage in following years. Observer coverage is fishery-specific, with objectives primarily to enable reliable estimation of protected species interactions and to provide a high level of confidence in fishers' at-sea compliance with regulatory and non-regulatory measures (FNZ 2019). In general, FNZ considers 30% coverage as being sufficient, but this coverage level may increase or decrease depending upon the fisheries-specific objectives.

MPI's Scientific Observer Programme (SOP) collects data from fisheries, including ETP incidental capture information. Monitoring of interactions with ETP species is primarily the role of the Department of Conservation (DOC), in conjunction with MPI. For deepwater fisheries, the costs of observers are recovered through levies on quota owners, or directly from vessel owners for specific deployments. All observer deployments are managed by the SOP. The level of observer coverage for the different fisheries/sectors is tailored to suit the data and information requirements, including for stock assessment, compliance monitoring and ETP species captures. FNZ considers that 30% coverage is sufficient for most fisheries/sectors but implements high (up to100%) coverage for fisheries where management may identify a need, such as in fisheries considered to pose high-risks to ETP species (e.g. squid and southern blue whiting trawl fisheries where operations overlap with foraging sea lions). MPI's observer coverage plans for deepwater fisheries in 2019-20 are provided in their Annual Operational Plan (FNZ, 2019).

Performance delivery against targeted observer coverage in previous years is reviewed in their Annual Review Report (FNZ, 2019a).

MPI and DOC consult to distribute the available observer days: MPI prioritizes fisheries coverage and DOC prioritizes protected species coverage (MPI, T. Bock, *pers. comm.*). As a result of the low level of protected species interactions in the orange roughy fisheries, the DOC share of observer coverage is < 10% of the total. The high level of compliance in the orange roughy fisheries provides good information on ETP interactions and warrants lower than average observer coverage. However, FNZ has prescribed coverage >30%, and up to 40-50%, for the MSC UoAs to obtain sufficient biological data (e.g., age structures). Coverage levels in the 2014-15 to 2018-19 fishing years underwent substantial increases from 2013-14, averaging 29% in NWCR and ESCR and 34% in 7A (Table 16). As a standard permit condition all demersal fishing on the High Seas, including the Westpac Bank area adjacent to New Zealand's EEZ, is required to have 100% observer coverage. Orange roughy on Westpac Bank and in ORH 7A are assessed and managed as a straddling stock.

Table 17. Observer coverage in the orange roughy trawl fisheries 2014-15 to 2018-19.

NWCR UoA	2014-15	2015-16	2016-17	2017-18	2018-19	5-year Average
Commercial tows	266	392	456	392	217	345
Observed tows	117	91	100	123	64	99
% Observed tows	44%	23%	22%	31%	29%	29%
ESCR UoA	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**5-year Average**
Commercial tows	964	1229	1179	1249	1250	1174
Observed tows	254	690	324	49	384	340
% Observed tows	26%	56%	27%	4%	31%	29%
ORH 7A UoA	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**5-year Average**
Commercial tows	696	560	533	547	475	562
Observed tows	52	242	153	402	109	192
% Observed tows	7%	43%	29%	73%	23%	34%

For the 2017-18 financial year, the observer program planned 220 observer days on Chatham Rise for deepwater fisheries, including orange roughy, and achieved 161 days, or 73% coverage. For ORH 7A, planned days equalled 40 and achieved days equalled 65, or 163% (FNZ 2019a). The 2018-19 observer schedule called for 220 days planned for the Chatham Rise Deepwater fishery complex and 60 days for the West Coast Deepwater fishery complex (FNZ 2019). Observer performance during 2018-19 had not been reviewed at the time of writing. For 2019-20 the planned observer coverage has been increased to 300 days for Chatham Rise deepwater fisheries and to 100 days for the West Coast deepwater fishery (FNZ 2019).

Enforcement

The MRAG assessment team discussed general enforcement issues, including performance against the MSC performance indicator for enforcement (PI 3.2.3) and specific areas of compliance risk to monitor in 2020. MPI maintains a comprehensive compliance programme, which includes both encouraging compliance through support and creating effective deterrents. This strategy is underpinned by the VADE model, which focuses on all elements of the compliance spectrum as follows:

1. Voluntary compliance – outcomes are achieved through education, engagement and communicating expectations and obligations
2. Assisted compliance – reinforces obligations and provides confidence that these are being achieved through monitoring, inspection, responsive actions and feedback loops
3. Directed compliance – directs behavioural change and may include official sanctions and warnings
4. Enforced compliance – uses the full extent of the law and recognises that some individuals may deliberately choose to break the law and require formal investigation and prosecution.

Since 1994, all trawlers over 28 m (i.e., all vessels fishing orange roughy in the three UoCs) have been required by law to be part of the Vessel Monitoring System (VMS) which, through satellite telemetry, enables MPI to monitor all orange roughy vessel locations at all times. This system is now being replaced by Geospatial Position Reporting. MPI still combines this functionality with at-sea and aerial surveillance, supported by the New Zealand Defence Force. This independently provides surveillance of activities of deep water vessels through inspection and visual capability to ensure these vessels are fully monitored and verified to ensure compliance with both regulations and with industry-agreed Operational Procedures.

Simon McDonald, MPI Fisheries Compliance, previously noted that the risks for the deepwater fisheries is not perceived as high, which allowed enforcement time to continue its activities from the past year. There was no focused compliance work in the orange roughy MSC fisheries during the 2018-19 fishing year and MPI's Compliance database does not contain any compliance activity relating to orange roughy fisheries for the 2018-19 fishing year.

Regulations and monitoring requirements for New Zealand fisheries call for a digital system for tracking, monitoring and reporting of commercial fishing (https://www.mpi.govt.nz/protection-and-response/sustainable-fisheries/strengthening-fisheries-management/fisheries-change-programme/digital-monitoring-of-commercial-fishing/). All New Zealand vessels now report catch daily on an event-by-event basis. These reports are validated against positional data allowing for timely interventions and compliance oversight in near real-time. It should be noted that the deepwater fleet (including those vessels catching orange roughy) implemented vessel position reporting in 1994 and electronic catch reporting in 2010. These data are transmitted to MPI to monitor fishing activity. The new system, however, provides MPI faster (daily) access to data, which will provide greater opportunity to target compliance risk, and as a consequence further reduce the potential for unreported catch and area misreporting.

Commercial fishermen face prosecution and risk severe penalties, which include automatic forfeiture of vessel and quota upon conviction of breaches of the fisheries regulations (unless the court rules otherwise). Financial penalties are also imposed in the form of deemed values to discourage fishermen from over-catching their ACE holdings.

The extensive regulations governing these fisheries are complemented by additional industry-agreed non-regulatory measures, known as the New Zealand Deepwater Fisheries Operational Procedures. The Minister of Fisheries relies on the effectiveness of both regulatory and non-regulatory measures to ensure the sustainable management of these fisheries.

The MRAG assessment team concludes that enforcement continues at a high level for the orange roughy fishery.

Changes or additions/deletions to regulations

There have been no changes in the regulations affecting the fishery since the previous surveillance audit, other than those reported in the enforcement section, above.

Personnel changes in science, management or industry to evaluate impact on the management of the fishery

The re-organization of the Ministry for Primary Industries (MPI) into five business units and four functional areas, as reported in the first and second surveillance reports, was finalized in 2018.

Fisheries New Zealand (FNZ) was established as one of these business units within MPI, with FNZ consisting of four Directorates:

- Fisheries Management
- Fisheries Science and Information

- Digital Monitoring
- Aquatic and Branch Support

Dan Bolger is Deputy Director General of MPI and head of FNZ. Stuart Anderson is head of Fisheries Management.

The Fisheries Management Directorate has the responsibility to carry out the full range of statutory regulatory functions, duties, and powers to manage New Zealand's fisheries resources, including:

- analysis and advice related to allocation decisions (catch limits and allowances) that allow for the sustainable utilisation of fisheries resources;
- analysis and advice on applications for use of marine space;
- development and implementation of national standards, National Plans of Actions (NPOAs), National Fisheries Plans, and all other aspects of the operational policy framework for fisheries management; and
- negotiation of agreements with Tangata Whenua seeking fisheries redress, and development, implementation and operation of customary fishing regulations.

The Fisheries Management Directorate has three subdivisions consisting of eight teams (Figure 7), including the Deepwater Fisheries Team headed by Tiffany Bock. A new lead scientist for deepwater fisheries and chair of the deepwater working group, Gretchen Skea, was appointed at MPI in 2019, following the departure of Alistair Dunn.

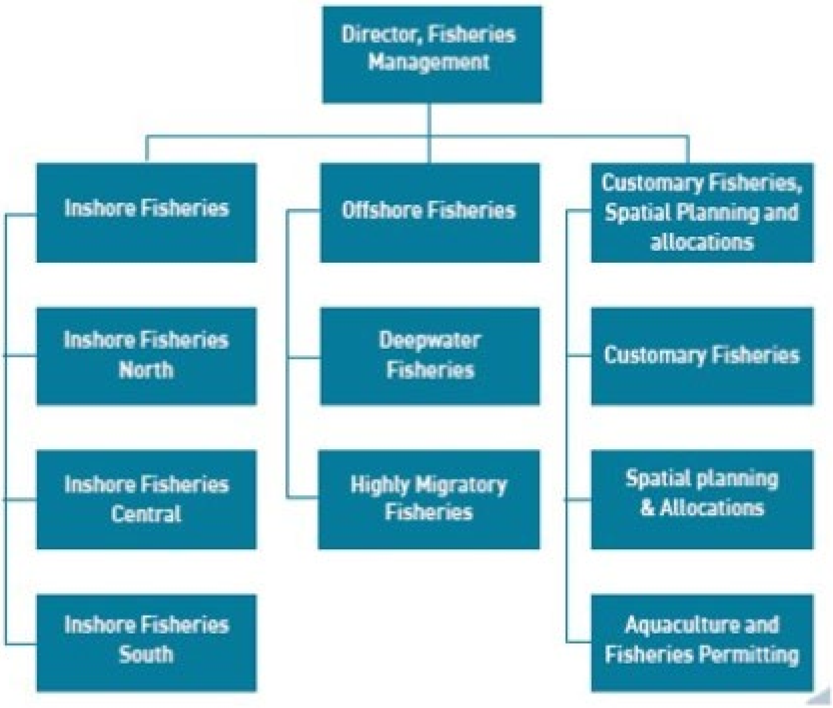


Figure 5 Organogram for Fisheries Management Directorate (Source: MPI).

The CEO of the Deepwater Group, George Clement, remains in place. Sharleen Gargiulo, DWG sustainability manager, has been on maternity leave. Rob Tilney has been her replacement while she is on leave.

None of these changes in personnel or organization pose any threat to the integrity of the certification.

Potential changes to the scientific base of information, including stock assessments

Digital data collection has been in place for the past two years, enabling more precision in tow location to inform trawl footprint. The next biomass surveys for the two Chatham Rise UoAs are scheduled for this winter (June/July 2020). The results of the 2020 surveys will be used to inform two new stock assessments to be completed by May 2021. In 2020, DWG has funded an update to the 2018 stock assessment for ORH 3B ESCR to provide the best available information to inform the sustainability review for the third catch limit increase planned for this UoC, scheduled for 2020-21.

Traceability Update

No changes have occurred that affect the traceability or segregation of product from the fishery. The fishery monitoring system remains robust and well suited to confirming traceability.

3.3 Version details

Table 18. – Fisheries program documents versions

Document	Version number
MSC Fisheries Certification Process	**Version 2.1**
MSC Fisheries Standard	**Version 1.3**
MSC General Certification Requirements	**Version 2.4.1**
MSC Surveillance Reporting Template	**Version 2.01**

4 Results

4.1 Surveillance results overview

4.1.1 Summary of conditions

The client's responses to the conditions of certification were set out in the Client Action Plan (CAP). Progress associated with the actions set forth in the CAP was examined as a part of this surveillance audit. For each condition, the report sets out progress to date. This progress has been evaluated by MRAG Americas Audit Team (set out below as "Progress on Condition") against the commitments made in the CAP. Conditions 1 and 4 were rescored and closed out at the second surveillance (MRAG Americas 2019).

The two remaining conditions at the third surveillance were those for NWCR and ESCR in P2.

The assessment team provides updates in the results section for the two conditions reviewed in this audit. All reporting on conditions used the same narrative or metric form as the original condition. The team has documented progress against interim milestones and closed out Conditions 2 and 3; see Section 4.4 for rescoring tables.

Table 19. Summary of conditions.

Condition number	Condition	Performance Indicator (PI)	Status	PI original score	PI revised score
Add rows as needed	Add condition summary		Choose from: New / Closed / Ahead of target / On target / Behind target. If closed, indicate surveillance number when closed.	PI score from most recent assessment	PI score after this surveillance, or 'Not revised'.
1		1.1.1	Closed (2nd audit)	70	90
2		2.3.1	Closed (3rd audit)	75	**85**
3		2.3.3	Closed (3rd audit)	75	80

4		3.2.5	Closed (2nd audit)	70	90

4.1.2 Total Allowable Catch (TAC) and catch data

Table 20. Catch data ORH 3B NWCR

TACC*	Year	2018-19	Amount	**6,091 mt**
UoA agreed catch limit	Year	2018-19	Amount	1,150 mt
UoA share of ORH 3B TACC	Year	2018-19	Amount	19%
Total green weight catch by UoC	Year (most recent)	2018-19	Amount	294 mt
Total green weight catch by UoC	Year (second most recent)	2017-18	Amount	724 mt

Table 21. Catch data ORH 3B ESCR

TACC*	Year	2018-19	Amount	**6,091 mt**
UoA agreed catch limit	Year	2018-19	Amount	4,095 mt
UoA share of ORH 3B TACC	Year	2018-19	Amount	67%
Total green weight catch by UoC	Year (most recent)	2018-19	Amount	4,143 mt
Total green weight catch by UoC	Year (second most recent)	2017-18	Amount	3,328 mt

* Note the ESCR catch limit for 2018-19 was 4,095 mt and the apparent overage is covered by carry-forward provisions (up to 10% of ACE may be carried forward into the next year).

Table 22. Catch data ORH 7A

TACC	Year	2018-19	Amount	**1,600 mt**
UoA share of TACC	Year	2018-19	Amount	100%
UoA share of total TACC	Year	2018-19	Amount	100%
Total green weight catch by UoC	Year (most recent)	2018-19	Amount	1,589 mt
Total green weight catch by UoC	Year (second most recent)	2017-18	Amount	1,780 mt*

*covered by carry-forward provisions (up to 10% of ACE may be carried forward into the next year)

4.1.3 Recommendations

The assessment team strongly recommends that FNZ include in future Plenary or Stock Assessment Reports the calculations presented in Cordue (2018) documenting how the vulnerable biomass is computed, including any weighting scheme, the exploitation rate (U) used, and hence the product of the two. The HCR has a sliding scale of U depending on estimated biomass and the values of each are not clear in the standard documents FNZ produces.

4.2 Conditions

Condition 1	
Performance Indicator	1.1.1 (ORH 3B stock)
Score	70
Justification	(Original; not as updated during 2nd surveillance): The ORH3B ESCR stock is, however, estimated to be just below the lower bound of the target management range for the base-case analysis in 2014 ($0.296B_0$; Cordue 2014d). The stock is projected to increase above the lower limit of management target range in 2015 for the base-case analysis and in 2025 for the “worst case” “lowM-high q analysis. However, given the uncertainty in the estimate, more than one year at or above the lower limit or a lower uncertainty is needed to assure that the stock has reached the harvest range. Hence this stock is not considered to meet the SG80, resulting in a condition.
Condition	Provide evidence that the ORH3B ESCR stock is at or fluctuating around its target reference point.
Milestones	Year 1 to Year 3: provide estimates of ESCR stock relative to target reference point. This may result in a score ≥80 if evidence demonstrates the stock is at or fluctuating around the target reference point. Year 4: provide evidence that the ESCR stock is at or fluctuating around the target reference point. This will result in a score ≥80.
Consultation on condition	N/A
Progress on Condition (Year 1)	The client has provided evidence in the form of the draft stock assessment (see section 2.4.1) that a new stock status update is imminent. By the time of the next surveillance, the stock assessment will have undergone final peer review and finalization via the 2018 Stock Assessment Plenary. The draft stock assessment shows that the stock continues to increase and the estimated abundance has exceeded the bottom of the target range. Finalization of the stock assessment will allow the assessment team to determine the stock size against the target range.
Progress on Condition (Year 2)	A stock assessment completed in 2018 demonstrated that the ORH3B ESCR stock is above the lower limit of the management target range (Figure 2; Table 2) and increasing under the base-case assessment. The stock is estimated to have reached the lower limit of the management target range in 2015. The base run demonstrates that the ESCR population has increased for the past 8-yrs, and that the abundance has been at or above the lower end of the management target range for the past three years. The ESCR stock has an 86% probability of being above the lower limit of the target range for the base-case analysis. Therefore, the assessment team concludes that the ESCR meets the SG80 requirement of being at the target reference point.
Status	The condition is closed.
Additional information	

Condition 2

Performance Indicator	2.3.1
Score	75
Justification	See Section 4.4-Rescoring performance indicators
Condition	For the ORH3B NWCR and ORH3B ESCR, by the end of the certification period, the direct effects of ORH fishing must be highly unlikely to create unacceptable impacts to ETP coral species.
Milestones	Year 1: Present a plan to increase certainty regarding the impact of ORH fishing in the two UoAs on ETP coral groups. Years 2- 3: Carry out the plan developed for the Year 1 milestone. Year 4: Demonstrate that the fishery is highly unlikely to create unacceptable impacts to ETP coral species in the NWCR and ESCR UoA areas. This will result in a score ≥80.
Consultation on condition	N/A
Progress on Condition (Year 1)	By the first surveillance audit, the client was required to review the outcome status of ETP coral and develop a plan to increase understanding of the direct effects of fishing on ETP coral, so as to reduce uncertainty in relation to the impacts of fishing on ETP coral. Ahead of the first surveillance audit, the client produced such a plan (Update on the Conditions of Certification 2 and 3 (ETP Corals), published here: http://deepwatergroup.org/update-on-conditions-2-3-corals/. This plan has three objectives initially relevant to this condition: 1. To improve understanding of predicted coral distribution; 2. To improve understanding of gear impacts on protected coral species; and 3. To improve confidence in predicted coral distribution models. The resulting work from these three objectives is designed to enable the client to eventually be able to demonstrate that the fishery is meeting the 80 scoring guidepost for this performance indicator. According to this plan, reports will be produced, fulfilling the three objectives listed above, during subsequent surveillance audits.
Progress on Condition (Year 2)	The Client presented a progress report outlining the work completed and underway to meet each of the Plan's objectives (DWG 2018). This included: • A workshop held by DOC in 2017 to identify research needs, which is now being used to inform research priorities and plans • A national literature review underway on the state of knowledge of New Zealand's protected corals, expected to be completed in 2019 • An international literature review underway on the depth distributions of New Zealand's protected corals, expected to be completed in 2019 • Ongoing annual trawl footprint monitoring, which is expected to increase in precision with new tow position reporting required to the nearest three or four decimal degrees (previously required to the nearest minute) • A spatial analysis conducted on the nature and extent of coral captures to better understand where, what and when captures have occurred • A benthic biodiversity survey on the Chatham Rise was undertaken in 2017 using a towed camera system with HD digital video and still image cameras and a multicorer, which concentrated particularly on areas previously under-sampled with the aim to improve distribution information and models • An inventory of all benthic samples within the Benthic Protection Areas to improve distribution information and models was underway • Three coral population projects in DOC's Conservation Services Programme for 2018/19. The Conservation Services Plan 2018/19 lists three industry/government co-funded projects related to the Client Action Plan for years 2 and 3 of this condition: 1. The age and growth of New Zealand protected corals at high risk (Project Code: POP 2017-07); 2. Improved habitat suitability modelling for protected corals in New Zealand waters (Project Code: POP 2018-01); and 3. Protected coral connectivity in New Zealand (Project code: POP2018- 06).

	The first of these projects was completed in June of 2018 and resulted in a methodology to determine the age and growth characteristics of protected New Zealand cold-water coral species which is needed to better understand the productivity inputs for an Ecological Risk Assessment on these protected species (Tracey et al. 2018). The second project is intended to update the distribution modelling of protected corals initially carried out by Anderson et al. in 2014. This project will include updated datasets of observer presence records for protected corals, recent research and biodiversity trawl survey data for protected corals, revised and extensive regional environmental data layers, and the updated trawl footprint for the region. Catch effort data will be considered. The project is slated for completion in late June, 2020 with the following planned outputs: a. Data on coral distribution in an electronic format suitable for use in risk assessment. b. A technical report describing the methods used along with maps of the presence and predicted distribution of protected corals in relation to commercial fishing effort. c. Recommendations for any future research required to further improve the estimation of risk to protected corals from commercial fishing. The third project will review connectivity information on deep sea corals in New Zealand, based on existing genetics studies in the region. Following the information review, a genetic study investigating previously identified at risk coral species would be undertaken on a species of the protected black coral group, where genetic connectivity data in New Zealand is particularly limited. The analyses will be focused on archived specimens for which existing molecular markers are available. Analyses will assess connectivity at various temporal and spatial scales and, if possible, will address on contemporary vs. historical connectivity. The project is scheduled for completion in mid-2019 with the following outputs identified: a. A technical report summarizing coral genetic connectivity studies carried out to date in the New Zealand region, and methods applied and results obtained from a genetic connectivity assessment of a 'high-risk' coral species. b. Data obtained, suitable for use in further analyses such as fisheries risk assessment. In addition, observer coverage (funding for which is supplemented by the CSP) for orange roughy and oreo deepwater bottom trawl fisheries will be focused on assessing the extent of protected coral landed on vessels (as well as monitoring and recording interactions with, and behaviours of, seabirds). Sub-samples of corals will be taken for identification when required. This directed observer sampling will support data collection for the second two projects listed above.
Progress on Condition (Year 3)	For this annual audit, the client has brought forward several analyses and studies (some based on new data) that have been undertaken to better understand the direct effects of orange roughy fishing in the NWCR and ESCR UoAs. These include: 1. An update on the fishery footprint overlap with observed and predicted coral distributions using data on current fishing performance. 2. New evidence, based on swath mapping data, showing the proportion of the hard benthic habitat that is considered very likely to be coral habitat within the UoAs, that is contacted by trawls. 3. New evidence, based on an analysis of coral depth records for deepwater corals, both in New Zealand waters and internationally, showing the degree to which the UoA fisheries potentially overlap with the known depth distributions of these corals. 4. New evidence, based on an analysis of the proximity between known coral capture localities on Underwater Topographic Features (UTF) and slope habitat in the UoAs, indicating the degree of connectivity between recorded coral locations within each UoA and across the Chatham Rise. **Information from New Coral Studies:** 1. **An update on the fishery footprint overlap with observed and predicted coral distributions** A key tool used for assessing the probable effects of trawl fishing on protected coral communities on the Chatham Rise has been to assess the extent of overlap between the fishery footprint and areas where coral is known to occur, using coral capture locality records collected by MPI's Scientific Observer Programme and using coral locality data from New Zealand's Research Database (MRAG, 2016). The method involves coral capture localities being expressed as areas of 1 km x 1 km extent which are then overlaid with the recent trawl footprint to provide an indication of probable fishery impact.

However, the observer and research datasets are both deficient in areal coverage as noted in MRAG (2016).

The observer capture localities are collected entirely from within the fishing grounds, and as the NWCR and ESCR ORH/OEO fisheries have swept only 5% and 6% of these UoAs respectively over the 30-year period 1989-90 to 2018-19, the potential for underestimation of coral distribution is evident (i.e. more than 94% has not been "sampled" for corals). This brings a very conservative bias to an analysis of the extent of overlap of the trawl fishery footprint against the observer coral dataset.

The research dataset, while not restricted to the trawl grounds, similarly cannot be assumed to be representative of the distribution over the entire extent of the Chatham Rise UoAs, either by area or depth, as it is predominantly based on trawl survey records, which have the objective of assessing the biomass of fished stocks and not the nature and extent of epibenthic fauna. These are strong reasons not to rely solely on the observer or research coral datasets as a basis for assessing the impact of UoA fisheries on corals, and the reason for the conservative evaluation by the assessment team during the full assessment (i.e. this was the best information we had at the time).

The combined trawl footprint for the 2017-18 and 2018-19 fishing years was assessed against the updated observer and research coral locality datasets (the 'observed' distribution) for the period 2013-14 to 2017-18. Importantly, the 2017-18 fishing year marked the commencement of catch locality reporting at a finer resolution (i.e. longitude and latitude to 4 decimal places, or less than 20 m) than previously (i.e. to the nearest minute of arc, or about 1.852 nm) (FNZ, 2019). This new reporting regulation has negated the requirement for random jittering of tow start and finish positions, which was previously applied to trawl datasets to provide a more realistic spread of effort and has improved the precision of the trawl footprint estimate.

The overlap of the 2017-18 to 2018-19 trawl footprint with the updated observed coral distribution is very similar to that previously considered by the assessment team (Clark et al., 2015). For the NWCR UoA the assessed overlap with black corals has increased from 14.4% to 18.8% but has remained largely unchanged for gorgonian and stony corals at 5.4% and 8.0% respectively (Table 1). Note that a fourth protected coral group, hydrocorals (all species from family Stylasteridae in the order Anthoathecata) has been included in the analysis.

Table 1: Overlap of the combined 2017-18 and 2018-19 trawl footprint against the 'observed' distribution of the four protected coral groups based on the 2013-14 to 2017-18 observer and research datasets (GNS, J. Black pers. comm. 2020).

Coral Group	UoA	Estimated coral distribution from observed records (km^2)	Overlap of 2017-19 footprint with observed coral distribution (km^2)	% overlap with observed coral distribution
Black corals – O. Antipatharia	ORH 3B NWCR	5.00	0.94	18.8%
Gorgonian corals – O. Alcyonacea		11.00	0.59	5.4%
Stony corals – O. Scleractinia		65.00	5.23	8.0%
Hydrocorals – O. Anthoathecata		6.00	0.00	0.0%
Black corals – O. Antipatharia	ORH 3B ESCR	15.00	3.63	24.2%
Gorgonian corals – O. Alcyonacea		26.00	6.31	24.3%
Stony corals – O. Scleractinia		34.00	6.18	18.2%
Hydrocorals – O. Anthoathecata		3.00	0.27	9.0%

In the knowledge of the deficiencies and biases of analyses based on the observed coral distribution for assessing fishery impact, much time and effort has been applied to the development of models to produce predicted coral habitat distributions (e.g. Anderson et al., 2014, 2015, 2019).

Although the assessment team determined that the Anderson et al. (2014) predicted habitat distribution model could not be relied upon as an indicator of true coral distribution at the time of the full assessment, the predicted coral distributions have been subsequently twice revised and updated through incorporation of additional data and model types (Anderson et al., 2015, 2019). These revisions have advanced the methodologies used and have produced modified predicted coral distributions in the UoA areas.

The Anderson et al. (2015) predicted habitat distribution differed from the Anderson et al. (2014) outputs in that the methodology used was slightly different in consideration of real coral absence data from the benthic stations dataset (i.e. as opposed to 'pseudo-absence' data used in the 2014 study), and in interpolating the models to the resolution of the true sea floor topography rather than the modelled sea floor.

The predicted coral distributions were broadly similar to those in Anderson et al. (2014) but were more in alignment with sea floor bathymetry. The trawl footprint for the 2017-18 and 2018-19 fishing years was plotted against the Anderson et al. (2015) predicted coral distributions at the >50th percentile level for each of the four protected coral groups (Table 2).

Table 2: Overlap of the combined 2017-18 and 2018-19 trawl footprint against the updated predicted habitat distribution of Anderson et al. (2015) for black, gorgonian and stony corals. Note: determination of 50th percentile occurrence is based on the predicted coral distribution across the entire New Zealand region (GNS, J. Black pers. comm., 2020).

Coral Group	UoA	Predicted coral distribution >50th percentile (km^2)	Overlap of 2017-19 footprint with predicted coral distribution (km^2)	% overlap with predicted coral distribution
Black corals – O. Antipatharia	ORH 3B NWCR	9,620	113	1.18%
Gorgonian corals – O. Alcyonacea		7,008	325	0.96%
Stony corals – O. Scleractinia		33,906	11	0.15%
Black corals – O. Antipatharia	ORH 3B ESCR	26,637	847	3.18%
Gorgonian corals – O. Alcyonacea		33,058	589	1.78%
Stony corals – O. Scleractinia		15,312	90	0.59%

Although the biases (in opposite directions) inherent in both the observed and predicted coral distributions are acknowledged, the 'truth' probably lies somewhere between the two, and with updated methods and data, the assessment team is more confident in the more recent predicted coral distribution data as of this audit, particularly as cross-verified by the data generated through the swath mapping research described in 2, below.

2. Swath mapping assessment of areas of hard benthic habitat (HBH)

The Orange Roughy Management Company conducted a side-scan sonar survey on the Chatham Rise in 1994 using the industry vessel FV *Arrow* (Figure 1) (Patchell, 2019). The purpose of the survey was to identify areas of interest for orange roughy fishing, primarily UTFs. The survey followed the 1,000 m depth contour around the Chatham Rise and provided coverage of depths between 800 and 1,400 m on average (i.e. the main orange roughy fishery depths). The survey system recorded digital bathymetry and acoustic backscatter data from which swath maps were generated (Figure 2).

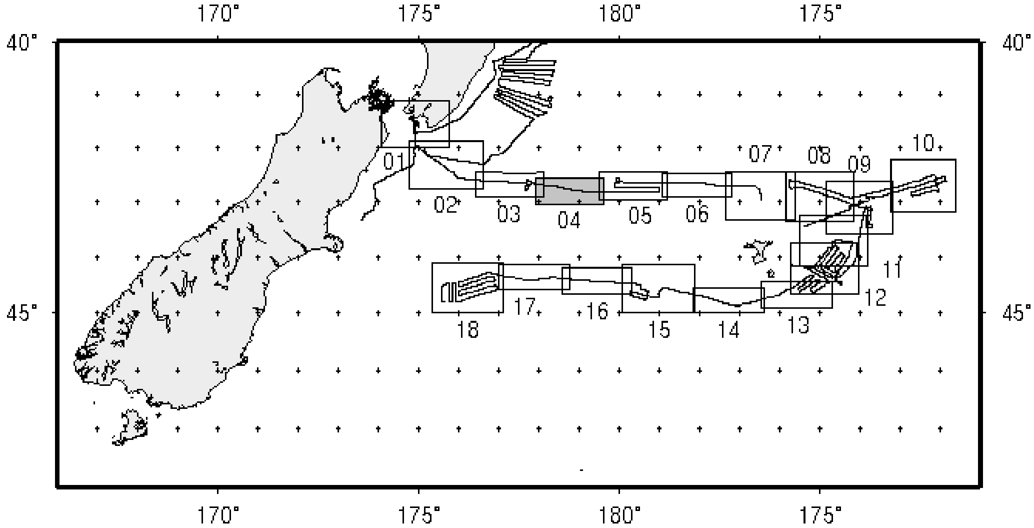


Figure 1: Side-scan survey tracks on the Chatham Rise from the 1994 survey aboard FV *Arrow*.

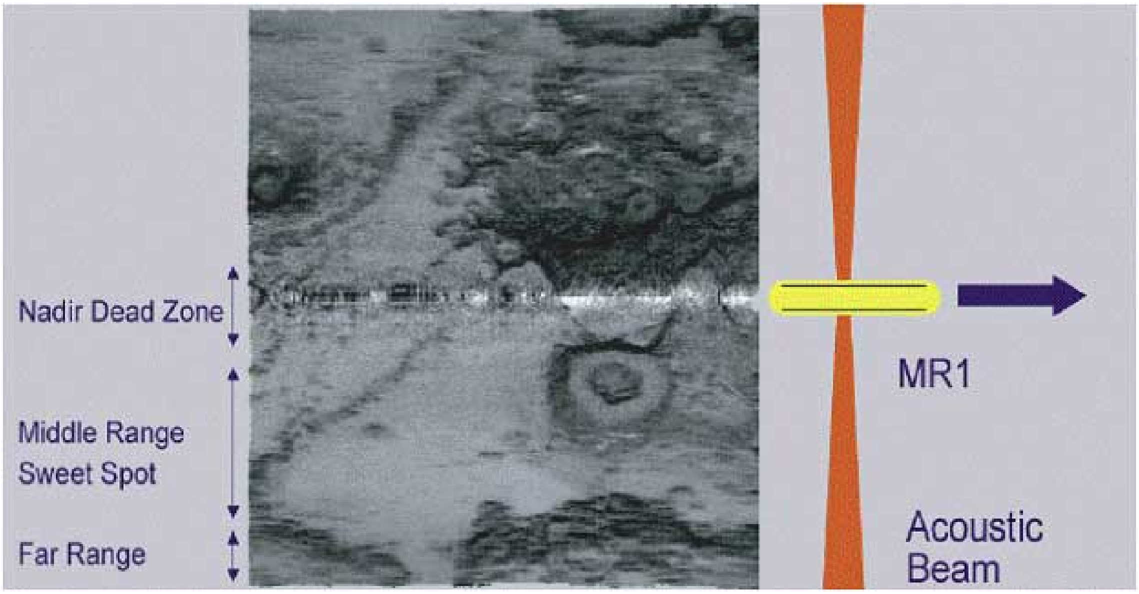


Figure 2: Swath image from side-scan sonar data showing volcanic cones and other bathymetric features. Harder benthic substrata have stronger acoustic reflectivity and show up as darker grey shades. Softer sediments (mud and sand) show up as lighter grey shades.

Interpretation of the swath imagery was supported using skippers' local knowledge of the grounds. The side-scan sonar imagery from the 1994 survey was made available to fishing vessels in printed and digital form, the latter being loaded onto plotters for real-time use while trawling. Interviews with over 20 skippers, who had used the imagery over many years while fishing and who had accumulated knowledge and detailed experiences of the fishing grounds, were used to ground-truth the side-scan imagery and to delineate areas of soft and hard substrate on the Chatham Rise. In combination, the bathymetry, swath maps and skippers' knowledge enabled the identification of large areas of rocky substratum interspersed within the broader sandy and muddy substrata that make up much of the Chatham Rise. Analysis of the swath-mapped acoustic data over the range of fishable depths enabled the characterisation of large areas of HBH, which are assumed likely to support coral growth.

A total of 772 km^2 of HBH was identified in the NWCR UoA and 3,517 km^2 in the ESCR UoA, amounting to 4.4% and 9.2% of the respective UoA areas. Less than 7% of this identified HBH area on the Chatham Rise has been traversed by trawl (Table 3, Figures 3 & 4). This, in combination with the fact that the side-scan sonar survey covered only a small portion of the Chatham Rise, further reduces the uncertainty associated with the probability of unacceptable impacts of these fisheries on ETP corals.

Table 3: The extent of hard benthic habitat (HBH) area within the Chatham Rise UoA areas, the swept areas within the HBH areas during 2017-18 and 2018-19, and the proportion of UTF habitat that falls within HBH areas (GNS, J. Black pers. comm., 2020).

Metric	UoA NWCR		UoA ESCR	
	2017-18	2018-19	2017-18	2018-19
Fishable Area (800 - 1,600 m)	17,398		38,198	
Hard Benthic Habitat (HBH) (km^2)	772		3,517	
HBH as % of fishable area	4.4%		9.2%	
Swept area ORH/OEO (km^2 in HBH area)	44	25	239	220
% swept area in HBH area	5.7%	3.2%	6.8%	6.3%
UTF area within HBH areas (km^2)	20		230	
% UTF area within HBH areas	94%		87%	

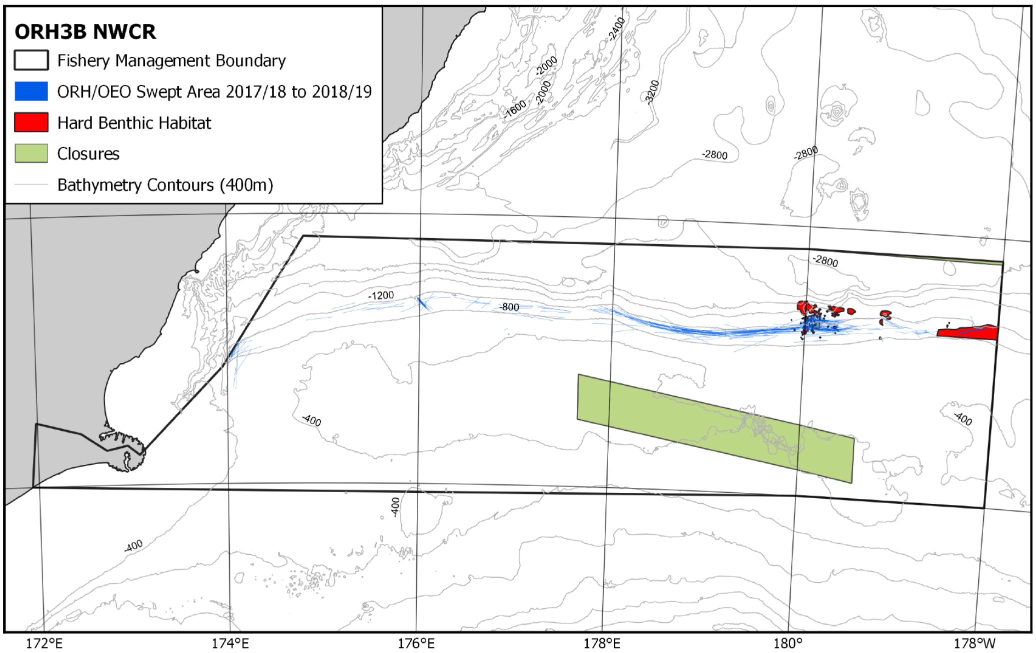


Figure 3: Areas of hard benthic habitat (red) within the NWCR UoA as determined from swath mapping surveys, and trawl footprint for the 2017-18 and 2018-19 fishing years combined (GNS, J. Black pers. comm., 2020).

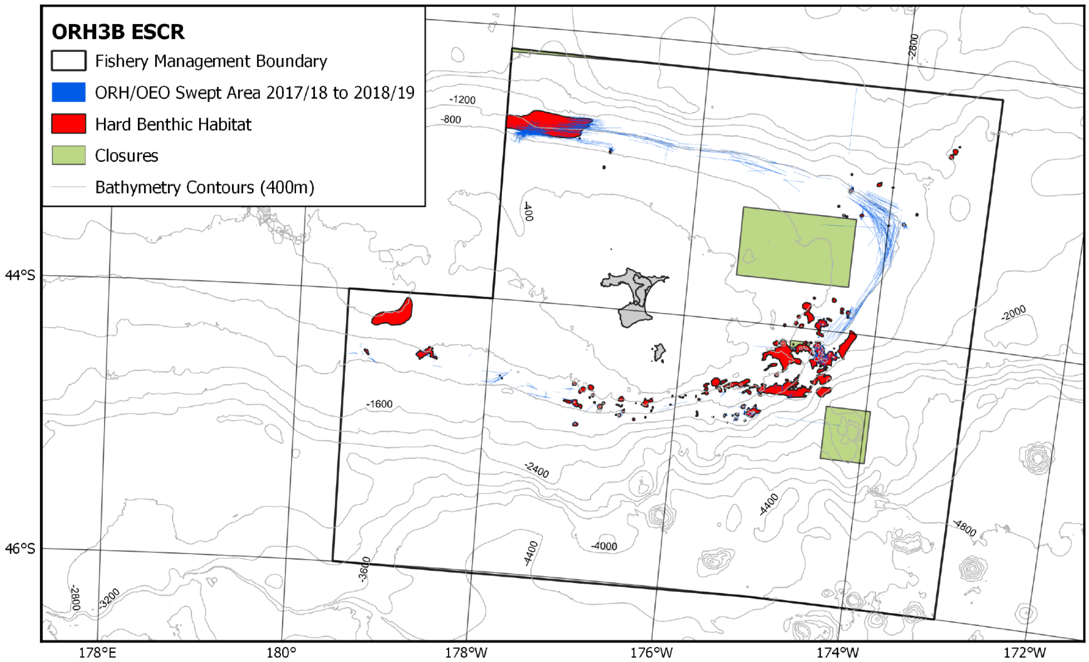


Figure 4: Areas of hard benthic habitat (red) within the ESCR UoA as determined from swath mapping surveys, and recent trawl footprint for the 2017-18 and 2018-19 fishing years combined (GNS, J. Black pers. comm., 2020).

3. Analysis of depth records for deep water corals in New Zealand

DWG commissioned analyses to determine the depth distributions for the four protected coral groups both in New Zealand waters and internationally (Finucci et al., 2019). The analysis for the New Zealand region revealed that they had a wide depth distribution ranging from very shallow depths down to 2,500 m and beyond. Antipatharia (black corals), Alcyonacea (gorgonian corals) and Scleractinia (stony corals) were frequently encountered at orange roughy fishery depths (800 – 1,200 m), with the latter also prevalent at shallower depths. Anthoathecata (hydrocorals) were less abundant at orange roughy depths and more abundant in shallower waters. Note that these records are largely from commercial trawl and research trawl and dredge catches and that there has been very little sampling at depths greater than ~1,600 m. DWG knowledge of the relative coral abundance deeper than this in New Zealand waters is poor. The analysis of the international databases revealed broadly similar overall depth distributions but with differences in abundance of records by depth compared to New Zealand. The international databases showed a higher abundance of records at depths greater than 1,000 m for Antipatharia (black corals) and Alcyonacea (gorgonian corals), and fewer for Scleractinia (stony corals) and Anthoathecata (hydrocorals) (Figure 5).

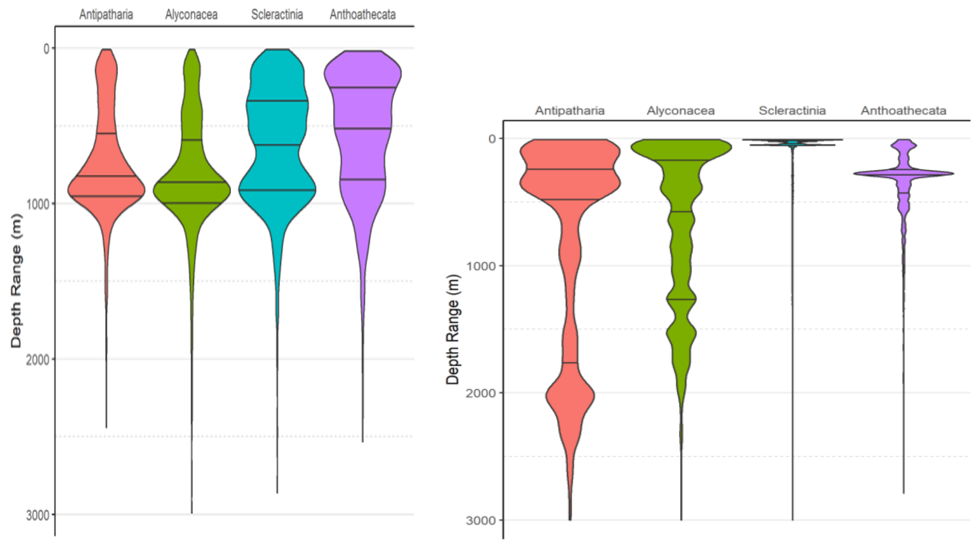
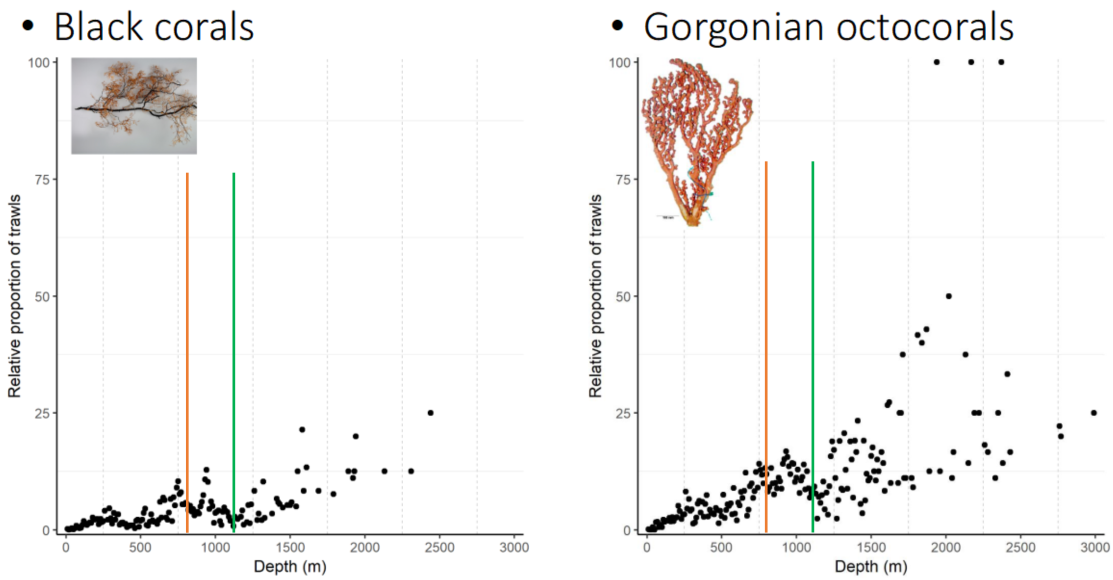


Figure 5: Violin plots illustrating coral capture records by 10 m depth bins for the four ETP coral groups from the New Zealand database (left) and the international database (right). Widths are representative of the numbers of coral records at each depth interval. Horizontal lines represent inter-quartile ranges. Note that these shapes are indicative rather than determinative as there will be sampling biases in the source data.

The analysis from the New Zealand database show that all four ETP coral groups occur both shallower and deeper than the depths prosecuted byChatham Rise orange roughy fisheries and may well prove to be more abundant at depths greater than the depths fished in the NWCR and ESCR UoAs (Figure 6).



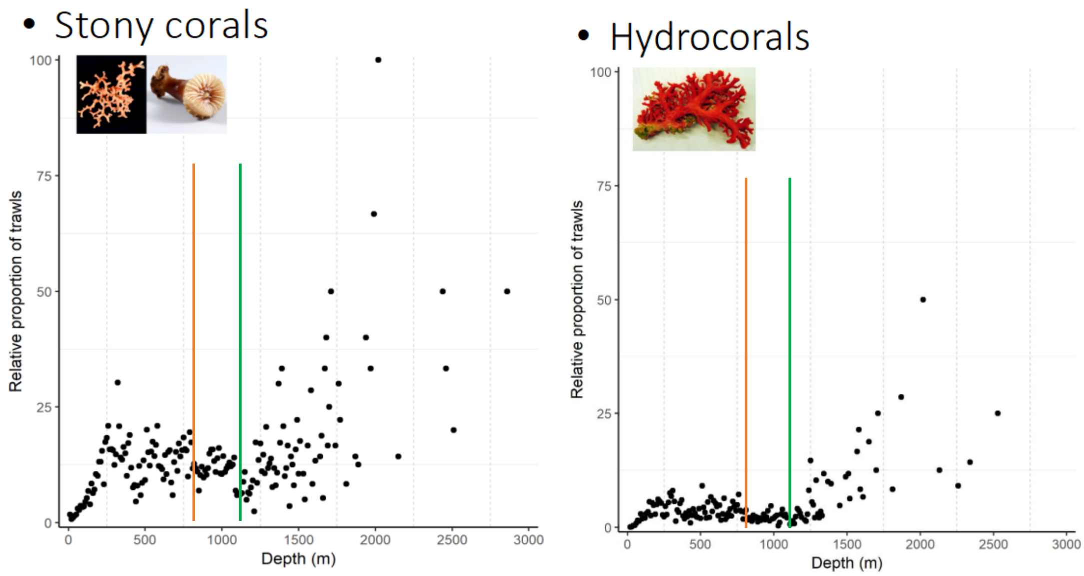


Figure 6: Proportional frequency of coral records by depth interval from the New Zealand database for the four protected groups. Vertical lines illustrate the median trawl tow depths by the ESCR (~840 m, orange) and NWCR (~1,035 m, green) UoA fisheries. Most orange roughy fishing occurs between approximately 800 m and 1,200 m in the two UoAs.

It is apparent from these analyses that the depth distribution of protected corals, in New Zealand waters and internationally, extends well beyond, both shallower and deeper, than the ~800 m to 1,200 m operational depths of the two UoA fisheries on the Chatham Rise and that trawling in each of the two UoAs will have only limited overlap with the known habitat ranges of these four coral groups in New Zealand.

4. Analysis of proximity between coral capture localities on the Chatham Rise

MRAG's Public Certification Report on the orange roughy MSC assessment determined that fishery impacts on protected corals in New Zealand should be considered at the scale of the UoAs, while the scale at which to determine population impacts is of the order of 100 km, and noted that there was little known about potential effects of local depletion at the population level due to lack of knowledge of connectivity among UTFs.

DWG commissioned an analysis to determine the degree of spatial connectivity between individual UTFs known to have coral in the NWCR and ESCR UoAs. The analysis showed that coral-bearing UTFs in the NWCR UoA are separated by a few tens of km at most. In the ESCR UoA there is only one UTF (Mt Muck), which is more than 100 km from the nearest coral-bearing UTF. There is, however, a very large area of slope habitat known to support coral just to the west of Mt Muck, as well as in areas to the east of it (Figure 7), (B. de Jong, pers. comm.). All of the rest of the ESCR UTFs are well clustered and interspersed with known areas of coral on slope habitat between them. This information on the distances between known coral locations on UTF and slope habitat within the UoAs is suggestive of reasonably good connectivity between them and leads to the assumption that coral larval dispersal between the identified coral habitat may be possible given favourable ocean current conditions.

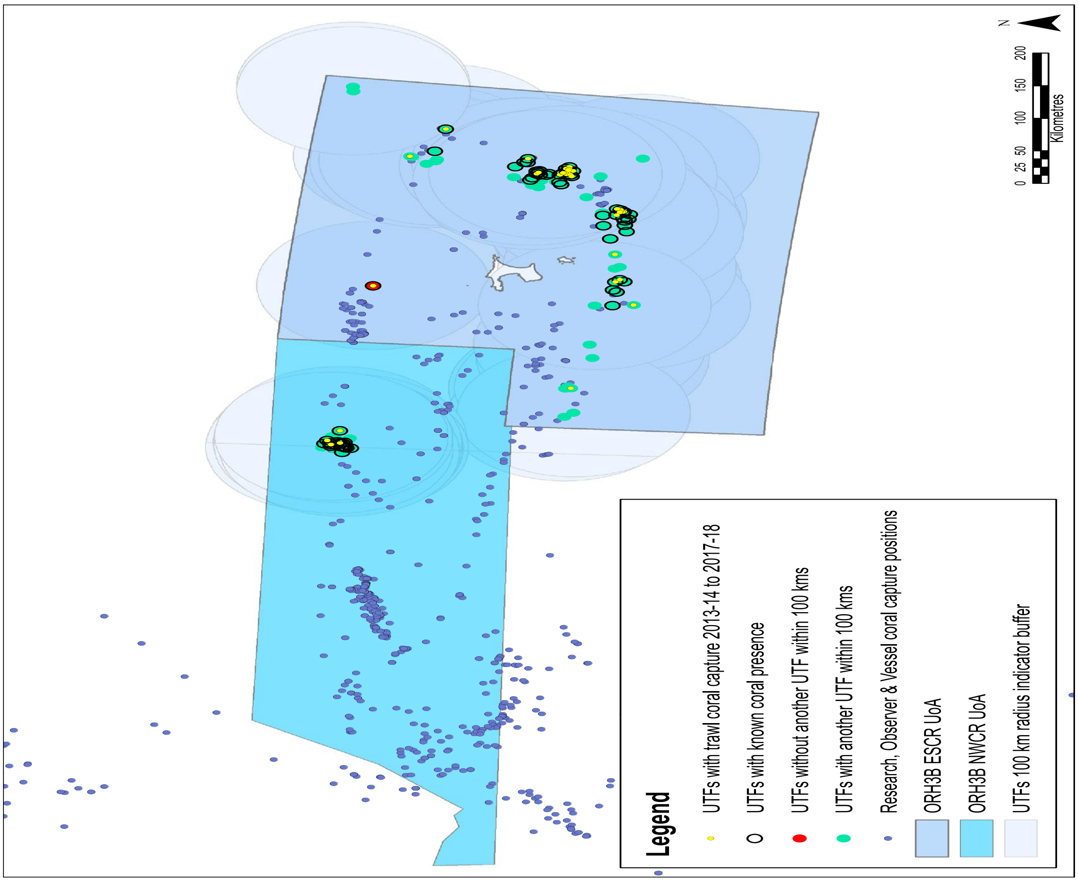


Figure 7: UTF localities (small circles), 100 km radius buffer areas around UTFs (large circles) and coral capture positions (blue dots) within the NWCR and ESCR UoA areas. The red dot in ESCR indicates the Mt Muck UTF.

Dunn & Devine (2010) showed that there was a general, eastward current flow along the north-west Chatham Rise at 900 m depth and postulated that a gyre situated to the north of the Graveyard UTF complex at ~180^0 longitude could help to retain orange roughy eggs and larvae spawned there.

It is not unreasonable to suggest that these currents could have a similar effect on coral propagules. In the NWCR UoA, they would likely be dispersed from west to east along the north Rise until they encountered the gyre, and then be retained. Further to the east, in the ESCR UoA, coral propagules could similarly be dispersed by these deep currents in an easterly and then southerly direction around the eastern edge of the Rise (Figure 8).

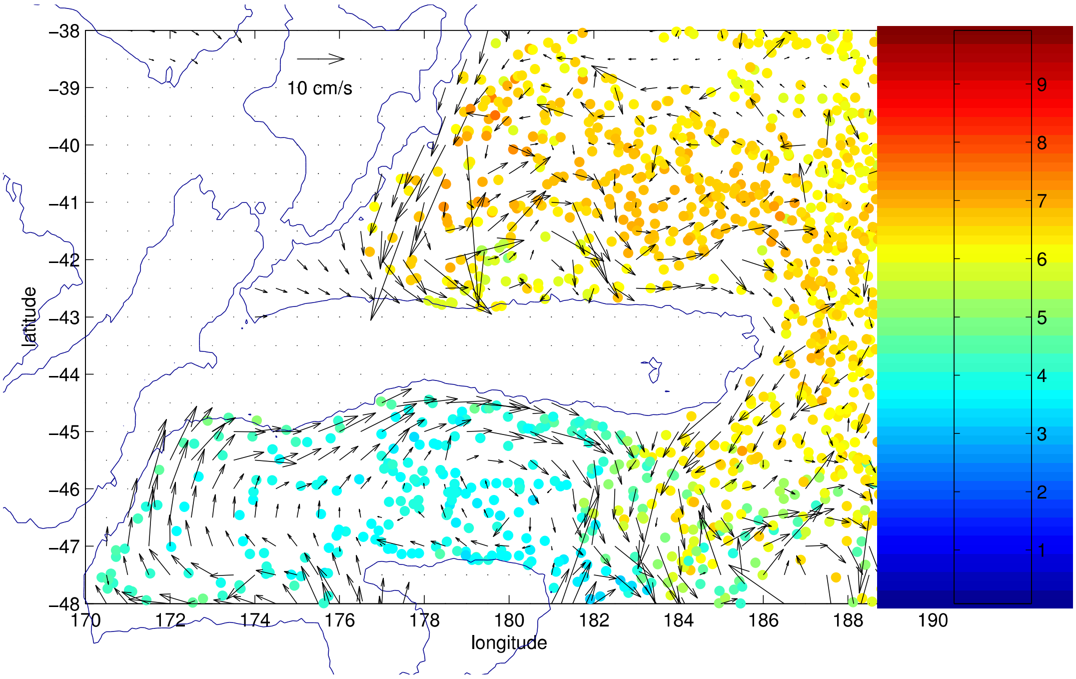


Figure 8: The Chatham Rise showing sea temperature (°C) measured at 900 m from Argo profiles (dots) with estimates of current velocity at 900 m overlaid (arrows). A gyre is evident on the northern edge of the Rise at ~180^{0}E. Further eastwards the currents are easterly and then southerly around the eastern edge of the Rise. A cold, easterly current flows along the southern edge of the Chatham Rise (after Dunn & Devine, 2010).

Potential evidence for dispersal distances for propagules of sessile invertebrates on the Chatham Rise is provided by a genetic study on a non-planktotrophic, benthic quill worm *Hyalinoecia longibranchiata*. A high degree of genetic connectivity was detected between samples taken from individuals on the northeast Chatham Rise approximately 240 km apart, and between samples taken from individuals on the southwest Chatham rise up to 400 km apart, but samples from the northeastern and southwestern areas, separated by an average distance of approximately 750 km, were genetically distinct. It was noted that the Sub-Tropical Front current system may have presented a barrier to genetic connectivity between the two sampling sites (Bors et al., 2012).

Zeng et al. (2017), suggested that dispersal distances of deepwater stony coral species may be related to oocyte size, where species with larger oocytes may have greater dispersal capability due to their greater energy resources resulting in longer larval stages. In a study involving three Scleractinian corals they found that *Madrepora oculata*, which has the largest mean oocyte size (2-3 times larger than other two species), was the only species for which significant differentiation amongst populations on large geomorphic features such as the Chatham Rise was not observed. The two other species, *Goniocorella dumosa* and *Solenosmilia variabilis*, which have smaller mean oocyte diameter, exhibited less connectivity on individual geomorphic features.

While coral connectivity is a complex issue, being dependent on several factors such as reproductive mode, current patterns and the scale of geographic separation, indications are that at the scale of the Chatham Rise UoAs there is a high likelihood of reasonably good connectivity for corals exhibiting sexual reproduction.

A project aimed at investigating the extent of genetic connectivity for New Zealand deep water corals is currently underway (POP 2018-06). The project will review the literature on genetic connectivity focussing on species highlighted by the pilot ERA (Clark et al., 2014) as being ‘high risk’. The information will be used to inform and support the identification of coral populations for management purposes should this prove necessary. It is envisaged that the data and information from the project will be used in a benthic risk assessment for trawl fisheries (CSP, 2018).

5. Predicted habitat suitability modelling

	In addition to the above studies, NIWA has been contracted by the Department of Conservation to further develop their studies on predicted habitat suitability modelling for protected corals in New Zealand waters (POP 2018-01). The methodology for this study (Anderson et al., 2019) uses models which: • Account for spatial autocorrelation in the sampling data • Estimate precision of the predicted distributions • Combine multiple model types • Assess model performance. In a change from previous studies, the environmental predictors used were derived primarily from outputs of the New Zealand Earth System Model. Other predictors such as recently revised and updated sediment data layers, seafloor slope and seamount distribution, were also incorporated. It is expected that the outputs from this project will provide for greatly improved and more accurate predicted habitat distributions for protected corals that will have greater utility for management purposes. The draft report will be presented to a meeting of the CSP Technical Working Group on 5 March 2020. When available, the GIS shapefiles from this project will be used to overlay the UoA area trawl footprints in order to quantitatively estimate the fishery impact on predicted coral distributions. **<u>Summary</u>** The new information provided here, from four separate analyses combined, convincingly demonstrates that the UoA fisheries contact only a small proportion of the potential ETP coral habitat on the Chatham Rise. It is, therefore, highly unlikely that the direct effects of orange roughy fishing create unacceptable impacts to ETP coral species in either the NWCR or ESCR fisheries. The reasons include results from: 1. The updated trawl footprint overlap with the observed and predicted coral distributions. 2. The areas of untrawled hard benthic habitat identified from swath mapping data. 3. The distribution of protected corals both shallower and deeper than orange roughy fishery depths. 4. The proximity between known coral habitats and the demonstrated genetic connectivity between benthic invertebrates at a scale of 200-400 km on the Chatham Rise. Maps illustrating the historic (i.e. 1989-90 to 2018-19) trawl footprints for each of the UoAs are provided aboveNote that areas of 'hard benthic habitat', as determined by swath mapping surveys undertaken by industry in 1994 (Patchell, 2019), have been added to the maps (in red) to illustrate probable coral habitat at orange roughy fishery depths in the NWCR and ESCR UoAs. Based on the above analyses and new information the assessment team has determined this condition can be closed.
Status	Closed at 3rd surveillance
Additional information	

Condition 3

Performance Indicator	2.3.3
Score	*75*
Justification	*See rescoring table for 2.3.3. in Section 4.4*
Condition	By the end of the certification period information must be sufficient to determine whether the fishery may be a threat to protection and recovery of ETP coral species.

Milestones	Year 1: Present a plan to reduce uncertainty regarding the threat of ORH fishing to the two UoAs on ETP coral groups. Years 2- 3: Carry out the plan developed for the Year 1 milestone. Year 4: Provide information sufficient to determine whether the fishery may be a threat to the protection and recovery of ETP coral species. This will result in a score >80.
Consultation on condition	N/A
Progress on Condition (Year 1)	According to the Client action plan, in year 1, the client was to supply a plan that establishes a sequence of analyses of existing data related to reducing uncertainty of the impacts of ORH fishing on ETP coral groups. Ahead of the first surveillance audit, the client produced such a plan (Update on the Conditions of Certification 2 and 3 (ETP Corals), published here: http://deepwatergroup.org/update-on-conditions-2-3-corals/. This plan has three objectives initially relevant to this condition: 1. To improve understanding of predicted coral distribution; 2. To improve understanding of gear impacts on protected coral species; and 3. To improve confidence in predicted coral distribution models. The resulting work from these three objectives is designed to enable the client to eventually be able to demonstrate that the fishery is meeting the 80 scoring guidepost for this performance indicator. According to this plan, reports will be produced, fulfilling the three objectives listed above, during subsequent surveillance audits.
Progress on Condition (Year 2)	The Client presented a progress report outlining the work completed and underway to meet each of the Plan's objectives (DWG 2018). This included: • A workshop held by DOC in 2017 to identify research needs, which is now being used to inform research priorities and plans • A national literature review underway on the state of knowledge of New Zealand's protected corals, expected to be completed in 2019 • An international literature review underway on the depth distributions of New Zealand's protected corals, expected to be completed in 2019 • Ongoing annual trawl footprint monitoring, which is expected to increase in precision with new tow position reporting required to the nearest three or four decimal degrees (previously required to the nearest minute) • A spatial analysis conducted on the nature and extent of coral captures to better understand where, what and when captures have occurred • A benthic biodiversity survey on the Chatham Rise was undertaken in 2017 using a towed camera system with HD digital video and still image cameras and a multicorer, which concentrated particularly on areas previously under- sampled with the aim to improve distribution information and models • An inventory of all benthic samples within the Benthic Protection Areas to improve distribution information and models was underway • Three coral population projects in DOC's Conservation Services Programme for 2018/19. The Conservation Services Plan 2018/19 lists three industry/government co- funded projects related to the Client Action Plan for years 2 and 3 of this condition: 1. The age and growth of New Zealand protected corals at high risk (Project Code: POP 2017-07); 2. Improved habitat suitability modelling for protected corals in New Zealand waters (Project Code: POP 2018-01); and 3. Protected coral connectivity in New Zealand (Project code: POP2018- 06). The first of these projects was completed in June of 2018 and resulted in a methodology to determine the age and growth characteristics of protected New Zealand cold-water coral species which is needed to better understand the productivity inputs for an Ecological Risk Assessment on these protected species (Tracey et al. 2018). The second project is intended to update the distribution modelling of protected corals initially carried out by Anderson et al. in 2014. This project will include updated datasets of

	observer presence records for protected corals, recent research and biodiversity trawl survey data for protected corals, revised and extensive regional environmental data layers, and the updated trawl footprint for the region. Catch effort data will be considered. The project is slated for completion in late June, 2020 with the following planned outputs: a. Data on coral distribution in an electronic format suitable for use in risk assessment. b. A technical report describing the methods used along with maps of the presence and predicted distribution of protected corals in relation to commercial fishing effort. c. Recommendations for any future research required to further improve the estimation of risk to protected corals from commercial fishing. The third project will review connectivity information on deep sea corals in New Zealand, based on existing genetics studies in the region. Following the information review, a genetic study investigating previously identified at risk coral species would be undertaken on a species of the protected black coral group, where genetic connectivity data in New Zealand is particularly limited. The analyses will be focused on archived specimens for which existing molecular markers are available. Analyses will assess connectivity at various temporal and spatial scales and, if possible, will address on contemporary vs. historical connectivity. The project is scheduled for completion in mid-2019 with the following outputs identified: a. A technical report summarizing coral genetic connectivity studies carried out to date in the New Zealand region, and methods applied and results obtained from a genetic connectivity assessment of a 'high-risk' coral species. b. Data obtained, suitable for use in further analyses such as fisheries risk assessment. In addition, observer coverage (funding for which is supplemented by the CSP) for orange roughy and oreo deepwater bottom trawl fisheries will be focused on assessing the extent of protected coral landed on vessels (as well as monitoring and recording interactions with, and behaviours of, seabirds). Sub-samples of corals will be taken for identification when required. This directed observer sampling will support data collection for the second two projects listed above.
Progress on Condition (Year 3)	See the above table for a comprehensive explanation of the new information considered, enabling the closure of the condition on PI 2.3.1 for ETP corals. Since condition 3 requires that information is sufficient to determine whether the fishery is a threat to these corals, this condition can also be closed on this basis. In addition, the study results from items 4 and 5 in the rationale provided under Condition 2, along with the continued monitoring of coral captures and trawl footprint within the UoA areas, has enabled the assessment team to determine present information availability, and continuing information gathering, as sufficient for this PI.
Status	Closed at 3rd surveillance
Additional information	

Condition 4	
Performance Indicator	3.2.5
Score	*70*
Justification	*(Original; not as updated during 2nd surveillance):* Progress against the objectives in the National Fisheries Plan for Deepwater and the Annual Operational Plan is reviewed annually and reported in the Annual Review Report. MPI conducts an extensive review of performance of the deep water fisheries (e.g., MPI 2015) that incorporates consultations with industry and other stakeholders. Parts of the management system, specifically science and enforcement, undergo external review. Although The internal review is very comprehensive and parties external to MPI participate, there is no explicit separate external review reported for the management system.

Condition	By the third annual surveillance the fishery-specific management system must undergo occasional external review.
Milestones	Year 1: Present a plan to establish occasional external review. Year 2: Carry out the plan developed for the Year 1 milestone. Year 3: Provide information that demonstrates occasional external review. This will result in a score >80.
Consultation on condition	N/A
Progress on Condition (Year 1)	MPI has contracted for an independent review, expected in January 2018 (MPI personal communication via Tiffany Bock at the 2017 site visit). DWG and MPI have discussed the need for a more regular review, with expectations for an annual process similar to the previously completed MFish Annual Report.
Progress on Condition (Year 2)	Both CABs (Acoura and MRAG Americas) assessing New Zealand deepwater fisheries discussed the findings of the Independent Quality Assurance Review Report Deep Water Fisheries Management conducted by Independent Quality Assurance New Zealand for MPI as part of harmonizing their assessments and audits of the New Zealand MSC-certified deep water fisheries (hoki, hake, ling, and southern blue whiting – Acoura, and orange roughy – MRAG Americas). The teams agreed that the Review met the SG80 requirements of PI 3.2.5 scoring issue b (CR v1.3) and PI 3.2.4 scoring issue b (CR v2.0). Rationale for the change in scoring is presented in Appendix 1.
Status	The condition is closed.
Additional information	N/A

4.3 Client Action Plan

Condition 1
Year 1 to Year 3: The client, in collaboration with MPI, will continue to monitor ESCR stock relative to its target reference point. The client will provide documentary evidence of the ESCR stock status.
Year 4: Documentary evidence will be supplied to demonstrate that the ESCR stock is at or fluctuating around the target reference point.

Condition 2
Year 1: The client will review the outcome status of ETP coral and develop a plan to increase our understanding of the direct effects of fishing on ETP coral so as to reduce uncertainty in relation to the impacts of fishing on ETP coral.
Years 2 - 3: The client will develop, conduct and begin reporting on studies to deliver the plan developed in Year 1.
Year 4: Using the outputs from the studies conducted during years 2 and 3, plus any additional management actions implemented to protect corals, the client will report with improved certainty the likelihood of unacceptable impacts of the ORH3B NWCR and ORH3B ESCR fisheries on ETP coral such that the SG 80 will be met for each fishery.

Condition 3
Year 1: The client will supply a plan that establishes a sequence of analyses of existing data related to reducing uncertainty of the impacts of ORH fishing on ETP coral groups.
Years 2 - 3: The client will develop, conduct and begin reporting on analyses to deliver the plan developed in Year 1.
Year 4: Using the outputs from the studies conducted during years 2 and 3, plus any additional management actions implemented to protect corals, the client will report with improved certainty the information necessary to determine the likelihood of unacceptable impacts of the ORH3B NWCR and ORH3B ESCR fisheries on ETP coral such that the SG 80 will be met for each fishery.

Condition 4
Year 1: The client will supply a plan that establishes occasional external review.
Year 2: The client will provide documentary evidence of the status of the plan and progress towards its implementation.
Year 3: The client will provide documentary evidence that demonstrates occasional external review.

4.4 Re-scoring Performance Indicators

Insertions and deletions made during the third surveillance audit are denoted in red text and ~~strikethrough~~, respectively. Rationale text pertaining to scoring elements and scoring issues that were already attaining at least an 80 score have not been updated from the rationales in the PCR, nor have original sources referenced in the un-updated section been included in the references section here. Please see the full assessment PCR for these details.

Evaluation Table for PI 2.3.1

<table>
<tr><td colspan="2">PI 2.3.1</td><td colspan="3">The fishery meets national and international requirements for the protection of ETP species

The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species</td></tr>
<tr><td colspan="2">Scoring Issue</td><td>SG 60</td><td>SG 80</td><td>SG 100</td></tr>
<tr><td rowspan="2">a</td><td>Guidepost</td><td>Known effects of the fishery are likely to be within limits of national and international requirements for protection of ETP species.</td><td>The effects of the fishery are known and are highly likely to be within limits of national and international requirements for protection of ETP species.</td><td>There is a high degree of certainty that the effects of the fishery are within limits of national and international requirements for protection of ETP species.</td></tr>
<tr><td>Met?</td><td>Mammals -Y
Birds-Y
Reptiles-Y
Fishes-Y
Coral-Y</td><td>Mammals -Y
Birds-Y
Reptiles-Y
Fishes-Y
Coral-Y</td><td>Mammals -Y
Birds-Y
Reptiles-Y
Fishes-Y
Coral-Y</td></tr>
</table>

<table>
<tr><td colspan="2">PI 2.3.1</td><td colspan="3">The fishery meets national and international requirements for the protection of ETP species
The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species</td></tr>
<tr><td></td><td>Justification</td><td colspan="3">Mammals: there are no indications of fishery-induced mortalities (Thompson and Berkenbusch 2013).

Seabirds: despite large numbers of seabirds seen around deepwater vessels, interactions are infrequent in these fisheries. In the period between 2002–03 and 2011–12 a total of 46 seabird captures were recorded in the three fisheries being assessed. Most of the observed seabird captures (36 captures) occurred on the East and South Chatham Rise and Northwest Chatham Rise (9 captures). Captures included Salvin's, Buller's, whitecapped, Chatham albatrosses and unidentified large albatross none of which are classed as endangered within the New Zealand seabird threat classification. The NZ NPOA-Seabirds shows that fishery interactions with these seabird species are at or above the potential biological removals (PBR), and therefore considered at risk. The orange roughy fisheries, however, contribute a negligible proportion of the interactions, thus not hindering the recovery of the seabird species.

There are no quantitative limits or defined levels of impact of fishing on seabird populations in New Zealand; the key management objective is to minimize impacts and mortalities. There is a process to undertake semi-quantitative estimates of the risk to New Zealand seabird species from all commercial fisheries. Captures by orange roughy trawl fisheries in the UoC areas of seabirds are very low each year (Thompson and Berkenbusch 2013), particulary when set against overall fisheries interactions with these species in NZ waters (MPI protected species bycatch database 2015)

Sharks: Some shark species (e.g., basking shark and great white shark) are prohibited species under the Fisheries Act. A single capture of a basking shark in NWCR has been recorded by orange roughy fisheries.

Benthic organisms: a variety of cold water corals are caught and brought up on deck, or disturbed by bottom trawling. Black corals (all species in the order Antipatharia); Gorgonian corals (all species in the order Gorgonacea); and, Stony corals (all species in the order Scleractinia) are protected under the provisions of the NZ Wildlife Act 1953. MPI (2015) provides a comprehensive analysis of the overlap of the orange roughy fisheries in the three UoC areas with observed and predicted distributions of protected coral species (Table 25). The overlap ranges from 4.4-38.8% of observed coral to 0.0-7.1% of predicted coral distributions for the most recent five years (2009-2013; see Section 3.4.2 and scoring issue B). National legislation does not set numerical limits on coral interactions, but does require minimizing impacts; the orange roughy fisheries tend to fish in previously fished areas on UTFs, which minimizes new damage.

New Zealand does not set quantitative limits on the interactions of the orange roughy fisheries, but has strong policies and strategies for minimizing interactions with marine mammals and seabirds. The policies also apply to corals, and measures such as closed areas and limited trawl lines apply to the fisheries. Therefore, the fisheries has a high degree of certainty to be within limits of national and international requirements for all ETP elements.</td></tr>
<tr><td rowspan="2">b</td><td>Guidepost</td><td>Known direct effects are unlikely to create unacceptable impacts to ETP species.</td><td>Direct effects are highly unlikely to create unacceptable impacts to ETP species.</td><td>There is a high degree of confidence that there are no significant detrimental direct effects of the fishery on ETP species.</td></tr>
<tr><td>Met?</td><td>All areas:
Mammals -Y
Birds-Y
Reptiles-Y</td><td>All areas:
Mammals -Y
Birds-Y
Reptiles-Y</td><td>All areas:
Mammals-Y
Birds-Y
Reptiles-Y</td></tr>
</table>

PI 2.3.1		The fishery meets national and international requirements for the protection of ETP species The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species		
		Fishes-Y Coral-Y	Fishes-Y Coral: ORH7A-Y; NWCR and ESCR-~~N~~ Y	Fishes-Y Coral-N

Justification

The zero to negligible interactions demonstrated in Scoring issue a and section 3.2.2. provide evidence that these fisheries have a high degree of confidence that unacceptable impacts for seabirds and marine mammals do not occur.

~~Clark et. al (2015) presents observed (from observer data) and predicted (from habitat suitability models) overlap of the fisheries with protected corals. Predicted overlap of the fisheries is much lower based on habitat suitability, likely because of the largely fishery-dependant nature of the coral observation data. The assessment team considered the observed overlap unrealisticaly conservative, and the predicted overlap too uncertain to take at face value. Therefore, the team considered both observed and predicted in assessing the overlap.The limited overlap (less than 20% for all coral groups over the past 5 years) of the fishery in the Challenger-Westpac area with corals for both observed and predicted distributions (Table 25) demonstrates that the fishery is at least highly unlikely (≤20%) to create unacceptable impacts, reaching the SG80. The higher overlap in NWCR and ESCR (≤30%) meets only the unlikely to create unacceptable impacts (SG60) level. It is not clear that sufficient analysis has occurred in the NWCR and ESCR areas to demonstrate that the fisheries are highly unlikely to have unacceptable impacts for deep sea corals, due to discrepancies between observed and predicted distribution of protected corals and the overlap with the orange roughy trawl footprint in the three UoC areas. Specifically of concern is high (>60%) observed overlap in NWCR and ESCR of the orange roughy fishery with black corals (MPI 2015), although this overlap has been reduced substantially over the five year period between 2009 and 2014. In the absence of ground-truthing of the predicitive model, and the fact that the trawl fishery does expand to new areas (albeit at a very slow and continually reduced rate), it is not possible to determine that the fishery does not pose a risk of serious or irreversible harm to ETP coral species in these areas with high liklihood as defined by the MSC standard.~~

A key tool used for assessing the probable effects of trawl fishing on protected coral communities on the Chatham Rise has been to assess the extent of overlap between the fishery footprint and areas where coral is known to occur, using coral capture locality records collected by MPI's Scientific Observer Programme and using coral locality data from New Zealand's Research Database (MRAG, 2016).

The method involves coral capture localities being expressed as areas of 1 km x 1 km extent which are then overlaid with the recent trawl footprint to provide an indication of probable fishery impact. However, the observer and research datasets are both deficient in areal coverage as noted in in MRAG (2016).

The observer capture localities are collected entirely from within the fishing grounds, and as the NWCR and ESCR ORH/OEO fisheries have swept only 5% and 6% of these UoAs respectively over the 30-year period 1989-90 to 2018-19, the potential for underestimation of coral distribution is evident (i.e. more than 94% has not been "sampled" for corals). This brings a very conservative bias to an analysis of the extent of overlap of the trawl fishery footprint against the observer coral dataset.

The research dataset, while not restricted to the trawl grounds, similarly cannot be assumed to be representative of the distribution over the entire extent of the Chatham Rise UoAs, either by area or depth, as it is predominantly based on trawl survey records, which have the objective of assessing the biomass of fished stocks and not the nature and extent of epibenthic fauna. These are strong reasons not to rely solely on the observer or research coral datasets as a basis for assessing the impact of UoA fisheries on corals, and the reason for the conservative evaluation by the assessment team during the full assessment (i.e. this was the best information we had at the time).

The combined trawl footprint for the 2017-18 and 2018-19 fishing years was assessed against the updated observer and research coral locality datasets (the 'observed' distribution) for the period 2013-14 to 2017-18. Importantly, the 2017-18 fishing year marked the commencement of catch locality reporting at a finer resolution (i.e. longitude and latitude to 4 decimal places, or less than 20 m)

(FNZ, 2019), than previously (i.e. to the nearest minute of arc, or about 1.852 nm). This new reporting regulation has negated the requirement for random jittering of tow start and finish positions, which was previously applied to trawl datasets to provide a more realistic spread of effort and should improve the precision of the trawl footprint estimate.

The overlap of the 2017-18 to 2018-19 trawl footprint with the updated observed coral distribution is very similar to that previously considered by the assessment team (Clark et al., 2015). For the NWCR UoA the assessed overlap with black corals has increased from 14.4% to 18.8% but has remained largely unchanged for gorgonian and stony corals at 5.4% and 8.0% respectively (Table 1). Note that a fourth protected coral group, hydrocorals (all species from family Stylasteridae in the order Anthoathecata) has been included in the analysis.

Table 1: Overlap of the combined 2017-18 and 2018-19 trawl footprint against the 'observed' distribution of the four protected coral groups based on the 2013-14 to 2017-18 observer and research datasets (Black, 2020).

Coral Group	UoA	Estimated coral distribution from observed records (km^2)	Overlap of 2017-19 footprint with observed coral distribution (km^2)	% overlap with observed coral distribution
Black corals – O. Antipatharia	ORH3B NWCR	5.00	0.94	18.8%
Gorgonian corals – O. Alcyonacea		11.00	0.59	5.4%
Stony corals – O. Scleractinia		65.00	5.23	8.0%
Hydrocorals – O. Anthoathecata		6.00	0.00	0.0%
Black corals – O. Antipatharia	ORH3B ESCR	15.00	3.63	24.2%
Gorgonian corals – O. Alcyonacea		26.00	6.31	24.3%
Stony corals – O. Scleractinia		34.00	6.18	18.2%
Hydrocorals – O. Anthoathecata		3.00	0.27	9.0%

In the knowledge of the deficiencies and biases of analyses based on the observed coral distribution for assessing fishery impact, a lot of time and effort has been applied to the development of models to produce predicted coral habitat distributions (e.g. Anderson et al., 2014, 2015, 2019).

Although the assessment team determined that the Anderson et al. (2014) predicted habitat distribution model could not be relied upon as an indicator of true coral distribution at the time of the full assessment, the predicted coral distributions have been subsequently twice revised and updated through incorporation of additional data and model types (Anderson et al., 2015, 2019). These revisions have advanced the methodologies used and have produced modified predicted coral distributions in the UoA areas.

The Anderson et al. (2015) predicted habitat distribution differed from the Anderson et al. (2014) outputs in that the methodology used was slightly different in consideration of real coral absence data from the benthic stations dataset (i.e. as opposed to 'pseudo-absence' data used in the 2014 study), and in interpolating the models to the resolution of the true sea floor topography rather than the modelled sea floor.

The predicted coral distributions were broadly similar to those in Anderson et al. (2014) but were more in alignment with sea floor bathymetry. The trawl footprint for the 2017-18 and 2018-19 fishing years was plotted against the Anderson et al. (2015) predicted coral distributions at the >50th percentile level for each of the four protected coral groups (Table 2).

Table 2: Overlap of the combined 2017-18 and 2018-19 trawl footprint against the updated predicted habitat distribution of Anderson et al. (2015) for black, gorgonian and stony corals. Note: determination of 50th percentile occurrence is based on the predicted coral distribution across the entire New Zealand region (Black, 2020).

Coral Group	UoA	Predicted coral distribution >50th percentile (km^2)	Overlap of 2017-19 footprint with predicted coral distribution (km^2)	% overlap with predicted coral distribution
Black corals – O. Antipatharia	ORH3B NWCR	9,620	113	1.18%
Gorgonian corals – O. Alcyonacea		7,008	325	0.96%
Stony corals – O. Scleractinia		33,906	11	0.15%
Black corals – O. Antipatharia	ORH3B ESCR	26,637	847	3.18%
Gorgonian corals – O. Alcyonacea		33,058	589	1.78%
Stony corals – O. Scleractinia		15,312	90	0.59%

Although the biases (in opposite directions) inherent in both the observed and predicted coral distributions are acknowledged, the 'truth' probably lies somewhere between the two, and with updated methods and data, the assessment team is more confident in the more recent predicted coral distribution data as of this audit, particularly as cross-verified by the data generated through the swath mapping research described in 2, below.

Swath mapping assessment of areas of hard benthic habitat (HBH)

The Orange Roughy Management Company conducted a side-scan sonar survey on the Chatham Rise in 1994 using the industry vessel FV *Arrow* (Figure 1) (Patchell, 2019). The purpose of the survey was to identify areas of interest for orange roughy fishing, primarily UTFs. The survey followed the 1,000 m depth contour around the Chatham Rise and provided coverage of depths between 800 and 1,400 m on average (i.e. the main orange roughy fishery depths). The survey system recorded digital bathymetry and acoustic backscatter data from which swath maps were generated (Figure 2).

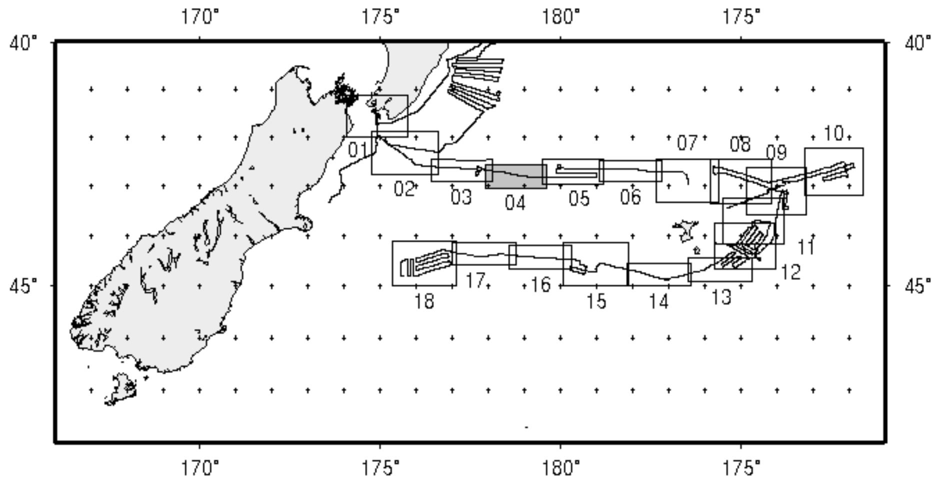


Figure 1: Side-scan survey tracks on the Chatham Rise from the 1994 survey aboard FV *Arrow*.

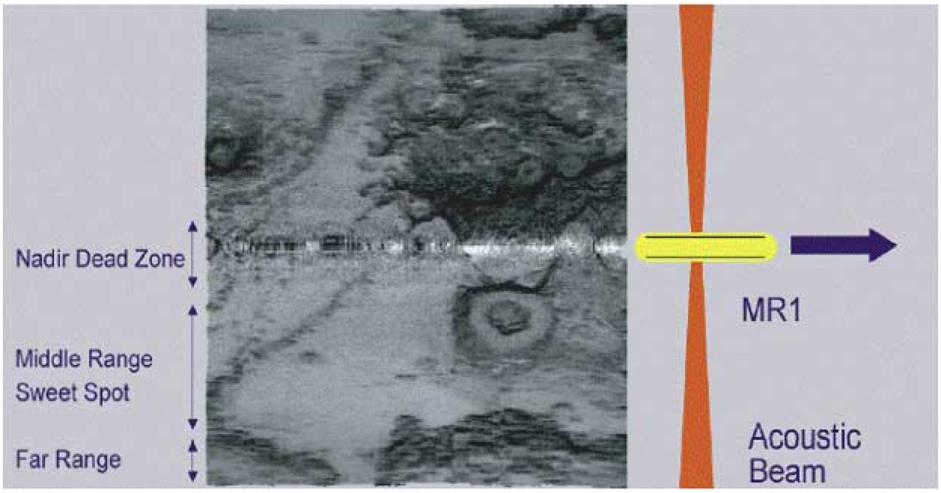


Figure 2: Swath image from side-scan sonar data showing volcanic cones and other bathymetric features. Harder benthic substrata have stronger acoustic reflectivity and show up as darker grey shades. Softer sediments (mud and sand) show up as lighter grey shades.

Interpretation of the swath imagery was supported using skippers' local knowledge of the grounds. The side-scan sonar imagery from the 1994 survey was made available to fishing vessels in printed and digital form, the latter being loaded onto plotters for real-time use while trawling. Interviews with over 20 skippers, who had used the imagery over many years while fishing and who had accumulated knowledge and detailed experiences of the fishing grounds, were used to ground-truth the side-scan imagery and to delineate areas of soft and hard substrate on the Chatham Rise. In combination, the bathymetry, swath maps and skippers' knowledge enabled the identification of large areas of rocky substratum interspersed within the broader sandy and muddy substrata that make up much of the Chatham Rise. Analysis of the swath-mapped acoustic data over the range of fishable depths enabled the characterisation of large areas of HBH, which are assumed likely to support coral growth.

A total of 772 km^2 of HBH was identified in the NWCR UoA and 3,517 km^2 in the ESCR UoA, amounting to 4.4% and 9.2% of the respective UoA areas. Less than 7% of this identified HBH area on the Chatham Rise has been traversed by trawl (Table 3). This, in combination with the fact that the survey covered only a small portion of the Chatham Rise, further reduces the uncertainty associated with the probability of unacceptable impacts of these fisheries on ETP corals.

A substantial part of the Kermadec Bioregion that supports the ETP coral groups discussed here, lies outside of the New Zealand EEZ (Figure 19). There are, therefore, substantial areas of coral habitat and coral abundance outside of the EEZ (e.g. Clark *et al*., 2015). While parts of the area outside of the EEZ have also been fished for orange roughy, as evidenced by the fishery on the Westpac Bank, the fishing is managed by the conservation and management measures (CMMs) set by the non-tuna RFMO, SPRFMO[3], and implemented by its members. The vast majority of the SPRFMO Convention Area (>98%) is not fishable, being deeper than 2,000m (Table 3.1.1.1. Williams et al., 2011). Of the 1.1% of the SPRFMO Convention Area that is shallower than 2,000 m, about 0.5% is deeper than 1,500 m and thus deeper than orange roughy fisheries normally operate, has never been fished and is not within any footprint declared to SPFRMO. This means that >99% of the SPRFMO Convention Area is either outside of the combined Australian and NZ footprint and therefore formally closed to bottom fishing by the binding bottom fishing CMM implemented by SPRFMO, or effectively inaccessible to bottom fishing due to depth.

In 2019, DWG commissioned analyses to determine the depth distributions for the four protected coral groups both in New Zealand waters and internationally (Finucci et al., 2019). The analysis for the New Zealand region revealed that they had a wide depth distribution ranging from very shallow depths down to 2,500 m and beyond. Antipatharia (black corals), Alcyonacea (gorgonian corals) and Scleractinia (stony corals) were frequently encountered at orange roughy fishery depths (800 – 1,200 m), with the latter also prevalent at shallower depths. Anthoathecata (hydrocorals) were less abundant at orange roughy depths and more abundant in shallower waters. Note that these records are largely from commercial trawl and research trawl and dredge catches and that there has been very little sampling at depths greater than ~1,600 m. DWG knowledge of the relative coral abundance deeper than this in New Zealand waters is poor. The analysis of the international databases revealed broadly similar overall depth distributions but with differences in abundance of records by depth compared to New Zealand. The international databases showed a higher abundance of records at depths greater than 1,000 m for Antipatharia (black corals) and Alcyonacea (gorgonian corals), and fewer for Scleractinia (stony corals) and Anthoathecata (hydrocorals) (Figure 5).

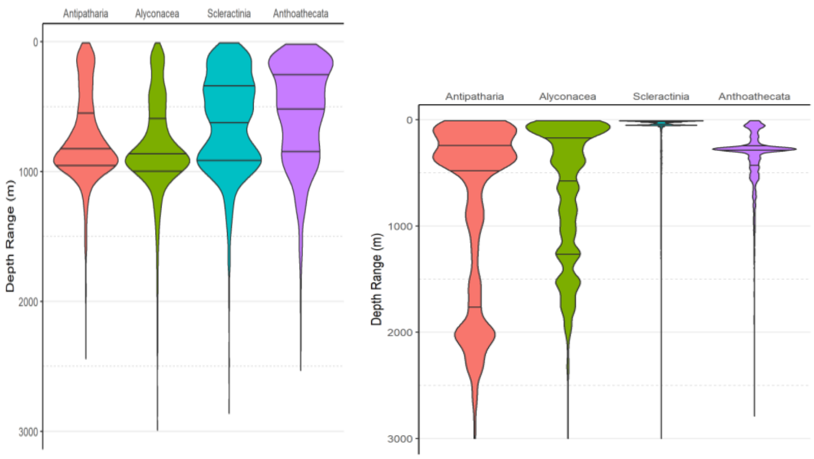


Figure 5: Violin plots illustrating coral capture records by 10 m depth bins for the four ETP coral groups from the New Zealand database (left) and the international database (right). Widths are representative of the numbers of coral records at each depth interval. Horizontal lines represent inter-quartile ranges. Note that these shapes are indicative rather than determinative as there will be sampling biases in the source data.

PI 2.3.1		**The fishery meets national and international requirements for the protection of ETP species** **The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species**
		The analysis from the New Zealand database show that all four ETP coral groups occur both shallower and deeper than the depths prosecuted by Chatham Rise orange roughy fisheries and may well prove to be more abundant at depths greater than the depths fished in the NWCR and ESCR UoAs than (Figure 6 in Condition 2 results). It is apparent from these analyses that the depth distribution of protected corals, in New Zealand waters and internationally, extends well beyond, both shallower and deeper, than the ~800 m to 1,200 m operational depths of the two UoA fisheries on the Chatham Rise and that trawling in each of the two UoAs will have only limited overlap with the known habitat ranges of these four coral groups in New Zealand.

[3] www.sprfmo.int

		In addition, Scleractinian corals are found at depths below those at which the orange roughy fisheries operate (see Figure 54 in Clark *et al.*, 2015). For depth distribution of tows see Figure 4 in MFish, 2008). Williams *et al*. (2011) provide estimates of areas by depth zone, with the area in South Pacific Regional Fisheries Management Organisation (SPRFMO) Convention Area between 1,500 m and 2,000 m deep, which has seen very little fishing. Within the SPRFMO Convention Area, the unfished area was estimated at 273,389 km^2 which represents about 43% of the area between 200 m and 2,000 m (Williams *et al*., 2011). This represents a considerable area for coral to exist without disturbance from fishing. However, according to Clark *et al.* (2011) connectivity of fauna between UTFs is important for maintaining the productivity of the system. The dispersal capabilities of benthic invertebrates are not well known, but a review of inshore invertebrate taxa indicated most were able to disperse less than 100 km (Kinlan and Gaines 2003). So while it is true that a substantial area of coral habitat within the bioregion as a whole is unimpacted by fishing, it is possible that fished UTFs isolated by 100 km or more from other UTFs will have slower recolonization that more connected UTFs. The time scale of the recolonization would depend on what recruitment could occur from more distant features and on the amount or coral remaining on the fished UTF. ~~On balance, it is possible that on the scale of the UoAs, due to the large overlap between the orange roughy fishery, particularly on the Chatham Rise, and observed coral distributions, could be having an impact on the ability for ETP coral species to recover from disturbance.~~ In 2019 DWG commissioned an analysis to determine the degree of spatial connectivity between individual UTFs known to have coral in the NWCR and ESCR UoAs. The analysis showed that coral-bearing UTFs in the NWCR UoA are separated by a few tens of km at most. In the ESCR UoA there is only one UTF (Mt Muck), which is more than 100 km from the nearest coral-bearing UTF. There is, however, a very large area of slope habitat known to support coral just to the west of Mt Muck, as well as in areas to the east of it (Figure 7), (B. de Jong, pers. comm.). All of the rest of the ESCR UTFs are well clustered and interspersed with known areas of coral on slope habitat between them. This information on the distances between known coral locations on UTF and slope habitat within the UoAs is suggestive of reasonably good connectivity between them and leads to the assumption that coral larval dispersal between the identified coral habitat may be possible given favourable ocean current conditions.

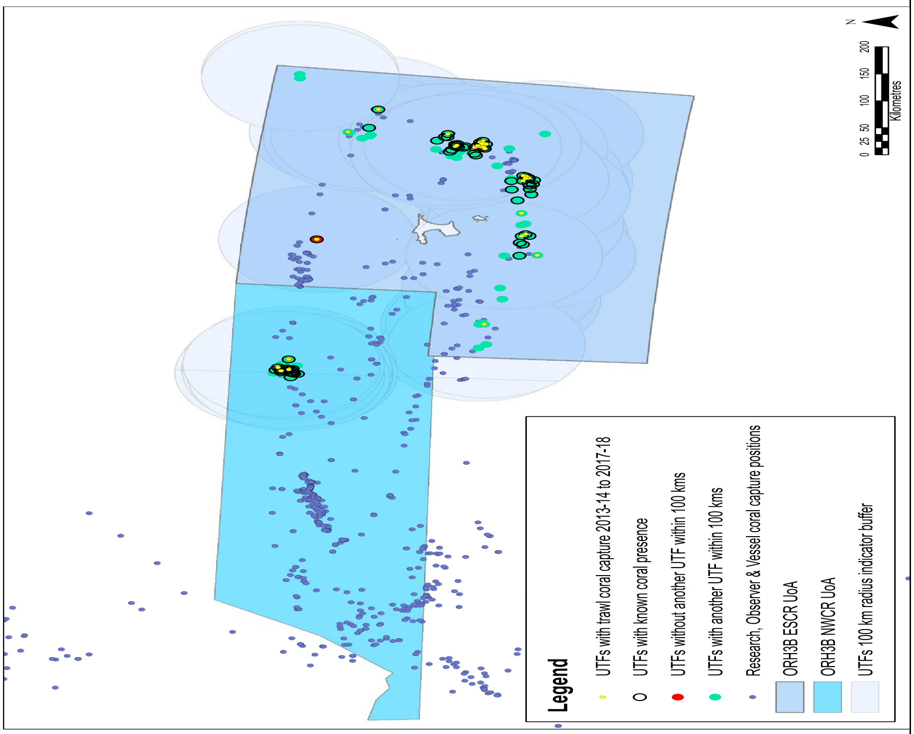


Figure 7: UTF localities (small circles), 100 km radius buffer areas around UTFs (large circles) and coral capture positions (blue dots) within the NWCR and ESCR UoA areas. The red dot in ESCR indicates the Mt Muck UTF.

Dunn & Devine (2010) showed that there was a general, eastward current flow along the north-west Chatham Rise at 900 m depth and postulated that a gyre situated to the north of the Graveyard UTF complex at ~180^0 longitude could help to retain orange roughy eggs and larvae spawned there.

It is not unreasonable to suggest that these currents could have a similar effect on coral propagules. In the NWCR UoA, they would likely be dispersed from west to east along the north Rise until they encountered the gyre, and then be retained. Further to the east, in the ESCR UoA, coral propagules could similarly be dispersed by these deep currents in an easterly and then southerly direction around the eastern edge of the Rise (Figure 8).

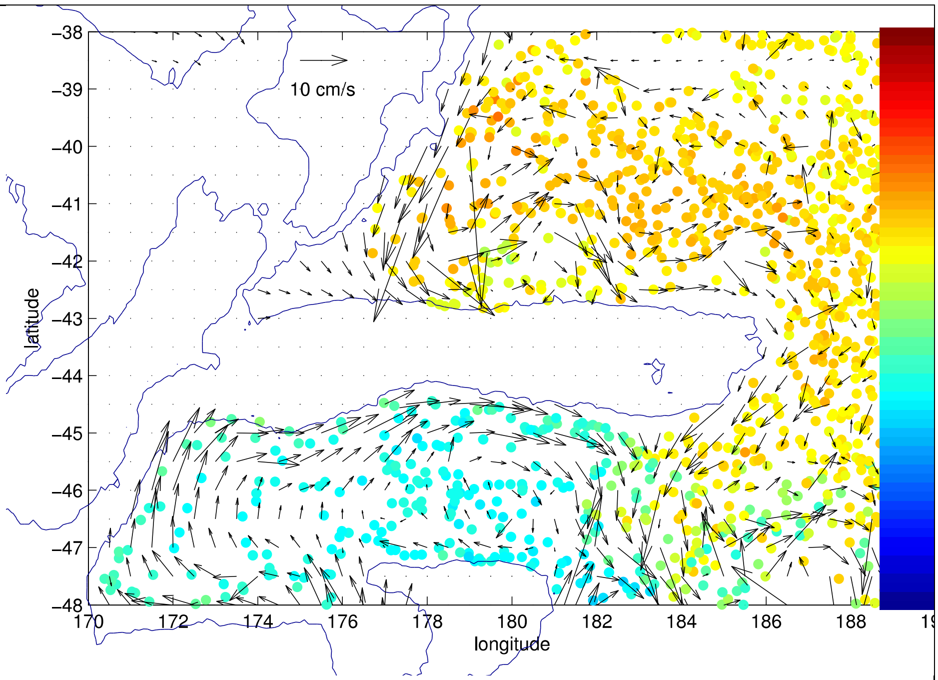


Figure 8: The Chatham Rise showing sea temperature (°C) measured at 900 m from Argo profiles (dots) with estimates of current velocity at 900 m overlaid (arrows). A gyre is evident on the northern edge of the Rise at ~180⁰E. Further eastwards the currents are easterly and then southerly around the eastern edge of the Rise. A cold, easterly current flows along the southern edge of the Chatham Rise (After Dunn & Devine, 2010).

Potential evidence for dispersal distances for propagules of sessile invertebrates on the Chatham Rise is provided by a genetic study on a non-planktotrophic, benthic quill worm *Hyalinoecia longibranchiata*. A high degree of genetic connectivity was detected between samples taken from individuals on the northeast Chatham Rise approximately 240 km apart, and between samples taken from individuals on the southwest Chatham rise up to 400 km apart, but samples from the northeastern and southwestern areas, separated by an average distance of approximately 750 km, were genetically distinct. It was noted that the Sub-Tropical Front current system may have presented a barrier to genetic connectivity between the two sampling sites (Bors et al., 2012).

Zeng et al. (2017), suggested that dispersal distances of deepwater stony coral species may be related to oocyte size, where species with larger oocytes may have greater dispersal capability due to their greater energy resources resulting in longer larval stages. In a study involving three Scleractinian corals they found that *Madrepora oculata*, which has the largest mean oocyte size (2-3 times larger than other two species), was the only species for which significant differentiation amongst populations on large geomorphic features such as the Chatham Rise was not observed. The two other species, *Goniocorella dumosa* and *Solenosmilia variabilis*, which have smaller mean oocyte diameter, exhibited less connectivity on individual geomorphic features.

While coral connectivity is a complex issue, being dependent on a number of factors such as reproductive mode, current patterns and the scale of geographic separation, indications are that at the scale of the Chatham Rise UoAs there is a high likelihood of reasonably good connectivity for corals exhibiting sexual reproduction.

A project aimed at investigating the extent of genetic connectivity for New Zealand deep water corals is currently underway (POP 2018-06). The project will review the literature on genetic connectivity focussing on species highlighted by the pilot ERA (Clark et al., 2014) as being 'high risk'. The information will be used to inform and support the identification of coral populations for management purposes

PI 2.3.1		The fishery meets national and international requirements for the protection of ETP species The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species		
		should this prove necessary. It is envisaged that the data and information from the project will be used in a benthic risk assessment for trawl fisheries (CSP, 2018). Therefore it can be said, for NWCR and ESCR, that direct effects of orange roughy fishing are highly unlikely to create unacceptable impacts to ETP species and the SG80 is met. ~~MSC requires for the SG80 to be met, that “known direct effects of the fishery are highly unikely to hinder recovery or rebuilding of ETP species/stocks.”~~ ~~The assessment team is aware of unanalyzed data from a number of projects that, when analysed, could be a source of reduced uncertainty. However, the assessment team cannot analyse raw data to draw conclusions; only after the analyses can the data inform the conclusion, thus the SG80 level is not met for NWCR and ESCR with regard to ETP coral species.~~		
c	Guidepost		Indirect effects have been considered and are thought to be unlikely to create unacceptable impacts.	There is a high degree of confidence that there are no significant detrimental indirect effects of the fishery on ETP species.
	Met?		All groups and areas-Y	All areas: Mammals –Y Birds-Y Reptiles-Y Fishes-Y Coral-N
	Justification	No ETP species have been identified where orange roughy is a significant element of its diet, and the levels of by-catch are low, thus competition between the fishery and ETP species for food is extremely unlikely (Dunn 2013). Regarding corals, studies as reported in MPI (2015) show the possibility of indirect trawl impacts on corals created from the trawl ‘sediment plume,’ particularly over soft substrates. UTFs considered to be heavily fished still contain diverse assemblages of corals and other epibenthic fauna and no difference in species numbers or community structures in coral-dominated UTFs within or outside of protected areas (coral dominance indicated no or only light fishing) has been observed (Consalvey, 2006; Clark et al., 2015b). This suggests that coral diversity continues to be maintained on fished UTFs, as most UTFs are fished only on established tow lines, leaving areas of many UTFs unfished because the seabed is too rough or steep to trawl, or where orange roughy do not aggregate. Recent information from trawl surveys supports a conclusion that coral will remain well established on fished UTFs, although not at the density prior to trawling. However, as there are no known studies specifically examining sediment mobilization by fishing gear in deep-sea fisheries and its effects, there is not a high degree of confidence that there are no significant detrimental indirect effects of the fisheries on ETP species in the UoCs under assessment.		
References		Thompson and Berkenbusch 2013; MPI 2015 Protected species bycatch database 2015 (https://data.dragonfly.co.nz/psc/v20140201/explore/) Anderson, O., Tracey, D., Bostock, H., Williams, M. and Clark, M. (2014). Refined habitat suitability modelling for protected coral species in the New Zealand EEZ. NIWA Client Report prepared for Department of		

PI 2.3.1	**The fishery meets national and international requirements for the protection of ETP species** **The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species**
	Conservation. WLG2014-69. https://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/reports/protected-coral-distribution-modelling-final-report.pdf Anderson, O., Mikaloff Fletcher, S. and Bostock, H. (2015). Development of models for predicting future distributions of protected coral species in the New Zealand Region. NIWA Client Report prepared for Department of Conservation. WLG2015-65. 28 p. https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/models-predicting-future-distributions-corals-nz-niwa-dec-2015.pdf Anderson, O., Tracey, D. and Rowden, A. (2019). Habitat suitability modelling for Protected Corals in New Zealand Waters. Final methodology report, prepared for Conservation Services Programme, Dept. Conservation, April 2019. 20 p. https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pop2018-01-finalmethods.pdf Bors, E.K., Rowden, A.A., Maas, E.W., Clark, M.R. and Shank, T.M. (2012). Patterns of Deep-Sea Genetic Connectivity in the New Zealand Region: Implications for Management of Benthic Ecosystems. PLoS ONE, 7(11), e49474. 16 p. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3504039/pdf/pone.0049474.pdf Clark, M.,Tracey, D., Anderson, O. and Parker, S. (2014). Pilot ecological risk assessment for protected corals. Report prepared by the National Institute of Water and Atmospheric Research for the New Zealand Department of Conservation, Wellington. 32p. http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation- services/reports/pilot-ecological-risk-assessment-for-protected-corals-final-report.pdf Clark, M., Anderson, O., Dunkin, M., Mackay, K., Notman, P., Roux, M-J. and Tracey, D. (2015). Assessment of orange roughy and oreo trawl footprint in relation to protected coral species distribution. MSC PI 2.3.1. February 2015. NIWA Client Report No. WLG2014-56. Prepared for Deepwater Group Limited. 57 p. CSP (2018). Conservation Services Programme Annual Plan 2018/19. Department of Conservation. 80 p. https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/plans/csp-annual-plan-2018-19.pdf Dunn, M. and Devine, J.A. (2010). An holistic approach to determining stock structure of orange roughy on the Chatham Rise. New Zealand Fisheries Assessment Report 2010/17. 65 p. https://fs.fish.govt.nz/Doc/22294/10_17_FAR.pdf.ashx Finucci, B., Anderson, O. and Tracey, D. (2019). Distribution of protected coral groups in New Zealand. Report prepared for Deepwater Group Ltd. 17 p. FNZ (2019). Fisheries (Geospatial Position Reporting Devices) Circular 2019. November 2019. 10 p. https://www.fisheries.govt.nz/dmsdocument/37985-fisheries-geospatial-position-reporting-devices-circular-2019 MRAG (2016). Full Assessment New Zealand Orange Roughy Fisheries. Public Certification Report, December 2016. Volume 1: Report; Scoring; Peer

PI 2.3.1	**The fishery meets national and international requirements for the protection of ETP species** **The fishery does not pose a risk of serious or irreversible harm to ETP species and does not hinder recovery of ETP species**
	Review. Prepared by MRAG Americas, Inc. for Deepwater Group Limited. 225 p. Patchell, G.J. (2019). Orange Roughy Fishery Benthic Habitat Mapping ORH3B. Report prepared for Deepwater Group Ltd, January 2019. 28 p. Zeng, C., Rowden, A.A., Clark, M.R. and Gardner, J.P.A (2017). Population genetic structure and connectivity of deep-sea stony corals (Order Scleractinia) in the New Zealand region: Implications for the conservation and management of vulnerable marine ecosystems. *Evolutionary Applications.* 2017;10:1040–1054. https://www.onlinelibrary.wiley.com/doi/pdf/10.1111/eva.12509

OVERALL PERFORMANCE INDICATOR SCORE:	**ORH3B ESCR-85** **ORH3B NWCR-85** **ORH7A-95**
CONDITION NUMBER (if relevant):	~~**2**~~

Evaluation Table for PI 2.3.3

PI 2.3.3		**Relevant information is collected to support the management of fishery impacts on ETP species, including:** • **Information for the development of the management strategy;** • **Information to assess the effectiveness of the management strategy; and** • **Information to determine the outcome status of ETP species.**		
Scoring Issue		SG 60	SG 80	SG 100
a	**Guidepost**	Information is sufficient to qualitatively estimate the fishery related mortality of ETP species.	Sufficient information is available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for ETP species.	Information is sufficient to quantitatively estimate outcome status of ETP species with a high degree of certainty.
	Met?	Y	Y	N – All areas
	Justification	Sufficient information is available to allow fishery related mortality and the impact of fishing to be quantitatively estimated for all ETP species groups. This information includes interactions between the fishery and protected species from observer data, VMS tracks (in relation to coral habitat and BPAs), supported by ecological risk assessments pertaining to the likely effects of orange roughy fishing on ETP species (e.g. Boyd 2013). The MPI protected species bycatch database contains good records and anaysis of fisheries interactions by gear, vessel size, and ETP bird, mammal and reptile species across NZ commericial fisheries. In addition, regular analysis and monitoring of the ORH fishery trawl footprint in relation to ETP coral groups is a relevant quantitative proxy for fishery related mortality on these benthic species. However, there is only quantitative estimates of outcomes status for some ETP species and this is not sufficient to reach the SG100 level, which requires a 'high degree of certainty'.		

PI 2.3.3		Relevant information is collected to support the management of fishery impacts on ETP species, including: • Information for the development of the management strategy; • Information to assess the effectiveness of the management strategy; and • Information to determine the outcome status of ETP species.		
b	Guidepost	Information is adequate to broadly understand the impact of the fishery on ETP species.	Information is sufficient to determine whether the fishery may be a threat to protection and recovery of the ETP species.	Accurate and verifiable information is available on the magnitude of all impacts, mortalities and injuries and the consequences for the status of ETP species.
	Met?	Y	Y-all groups in ORH7A, and all groups ~~except corals~~ in ORH3B ESCR and NWCR ~~N-corals in ORH3B ESCR and NWCR~~	N –all areas ~~ORH7A; Not scored – ORH3B ESCR and NWCR~~
	Justification	Information on interactions between the fishery and protected species comes from observer data, VMS tracks (in relation to coral habitat and BPAs), supported by ecological risk assessments (e.g. Boyd 2013) is sufficient for determining the likely effects of orange roughy fishing on ETP species except coral. The MPI protected species bycatch database contains good records and anaysis of fisheries interactions by gear, vessel size, and ETP bird, mammal and reptile species across NZ commericial fisheries. ~~Although there has been a comprehensive analysis on the distribution of corals and its overlap with orange roughy fisheries in the three UoC areas as well as contained within BPAs in these areas (MPI 2015), the large descrepency between observed and predicted occurances of coral and the commensurate large descrepency in observed vs predicted degree of overlap of protected corals with the orange roughy fisheries creates uncertainty in determining whether the fishery may be threat to the protection of these species in the Chatham Rise UOAs. See justification under 2.3.1 scoring issue B for further rationale.~~ See the justification under 2.3.1 scoring issue B for full rationale including the available research, analysis and ongoing data collection relative to coral impacts in these UoAs.		
c	Guidepost	Information is adequate to support measures to manage the impacts on ETP species.	Information is sufficient to measure trends and support a full strategy to manage impacts on ETP species.	Information is adequate to support a comprehensive strategy to manage impacts, minimize mortality and injury of ETP species, and evaluate with a high degree of certainty whether a strategy is achieving its objectives.
	Met?	Y	Y	N – ~~ORH7A; Not scored – ORH3B ESCR and NWCR~~

PI 2.3.3	**Relevant information is collected to support the management of fishery impacts on ETP species, including:** • **Information for the development of the management strategy;** • **Information to assess the effectiveness of the management strategy; and** • **Information to determine the outcome status of ETP species.**
Justification	The strategic framework for managing protected species interactions with deepwater fisheries is described under PI 2.3.1. When impacts of fishing are such that they are causing an adverse effect on the Marine Environment (Fisheries Act s2, s8), measures are to be taken pursuant to the Conservation Act 1987 and the Director-General of where the Department of Conservation will implement measures, including: • research relating to those effects on protected species: • research on measures to mitigate the adverse effects of commercial fishing on protected species: • the development of population management plans under the Wildlife Act 1953 and the Marine Mammals Protection Act 1978. Information collected through observers, vessel monitoring systems, research surveys, and other research projects, such as analyses in MPI (2015) making use of existing datasets to understand fishery interactions with protected species or sensitive habitats is sufficient to measure trends and support the above-described strategy for managing impacts on ETP species. In addition, regarding protected coral species, regular monitoring and reporting of the ORH trawl footprint in relation to coral habitat provides trend data relevant for evaluation of the likely impact of the fishery on these protected species.
References	MPI 2015; Boyd 2013

OVERALL PERFORMANCE INDICATOR SCORE:	**80~~-ORH7A~~** **~~75-ESCR, NWCR~~**
CONDITION NUMBER (if relevant):	**~~3~~**

5 Appendices

5.1 Evaluation processes and techniques

5.1.1 Site visits

Information supplied by the clients and management agencies, much of which was made available at the DWG website: https://deepwatergroup.org/certification/orange-roughy-audit-2020/ , was reviewed by the assessment team ahead of the remote meeting, and discussions with the clients and management agencies centered on the content within the provided documentation. In addition, the assessor not in attendance supplied a list of follow-up questions and requests for discussion at the site visit following his review of the advance material. In cases where relevant documentation was not provided in advance of the meeting, it was requested by the assessment team and subsequently supplied during or shortly after the meeting.

Thirty days prior to the surveillance audit, all stakeholders from the full assessment were informed of the meeting and the opportunity to provide information to the auditors in advance of, or during, the meeting.

The MRAG Americas surveillance carried out the following as part of the surveillance audit:

- Audit public claims made by the client regarding its certified status (including but not restricted to those made on printed material such as brochures).
- Review any potential or actual changes in management systems.
- Review any changes or additions/deletions to regulations.
- Review any personnel changes in science, management or industry to evaluate impact on the management of the fishery.
- Review any potential changes to the scientific base of information, including stock assessments.
- Evaluate progress against any conditions placed on the certificate, as well as for continued compliance with the *MSC Fisheries Standard (v1.3)* as specified in the Public Certification Report.

The surveillance team has the responsibility, if it identifies an issue requiring further investigation, to:

- Report and record the existence of the issue, and/or
- Immediately conduct a limited assessment to determine if a full re-assessment of the fishery is warranted to continue the certification status, and/or
- Raise further conditions.

The surveillance audit was conducted remotely via video conference on February 27 (US participants)/February 28th (NZ participants), 2020.

The following participants were in attendance:

Name	Affiliation
Bob Trumble	MRAG Americas assessment team
Amanda Stern-Pirlot	MRAG Americas assessment team
George Clement	Deepwater Group (client)
Rob Tilney	Deepwater Group (client)
Geoff Tingley	Gingerfish Ltd (client consultant)
Robert Tinkler	Fisheries New Zealand (FNZ)
Andre Punt	MRAG Americas assessment team (via correspondence)

Private meetings with non-client meeting participants (including with MPI/Fisheries New Zealand) were offered but declined and the assessment team did not receive written comments.

5.1.2 Stakeholder participation

Thirty days prior to the surveillance audit, all stakeholders from the full assessment were informed of the meeting and the opportunity to provide information to the auditors in advance of, or during, the meeting. In addition, as the audit timing was three months after the anniversary date of the certification, stakeholders were notified of the revised timing. One stakeholder did make contact with the team regarding the timing of the audit but then did not submit any comments or request a meeting.

5.2 Stakeholder input

No stakeholder input was received.