New Zealand Orange Roughy Trawl Fishery Coral Interaction Analysis 2017/18 to 2019/20

J Black

GNS Science Consultancy Report 2021/133
January 2022

GNS SCIENCE
TE PŪ AO

DISCLAIMER

Use of Data:

Client and MPI consent required to use data.

BIBLIOGRAPHIC REFERENCE

Black J. 2022. New Zealand orange roughy trawl fishery coral interaction analysis 2017/18 to 2019/20. Lower Hutt (NZ): GNS Science. 26 p. Consultancy Report 2021/133.

CONTENTS

FIGURES

TABLES

APPENDICES

APPENDIX FIGURES

APPENDIX TABLES

EXECUTIVE SUMMARY

We undertake a spatial analysis of trawl footprint and coral capture in three New Zealand orange roughy fisheries. Analysis is carried out against two habitat types: Underwater Topographic Features (UTF) and 'flats'. Colour-coded trawl tows are mapped to illustrate tows that did not catch coral, tows that caught coral rubble and tows that captured less than or more than 50 kg of coral. Trawl tow data and observer- and vessel-reported coral capture data were sourced from Fisheries New Zealand (FNZ) for use in the analysis. The analyses were performed for orange-roughy- and oreo-targeted tows.

The study period is the most recent three-year period for which data are available (01/10/17 to 30/09/20). The three fisheries are Marine Stewardship Council (MSC)-certified ORH3B NWCR, ORH3B ESCR and ORH7A (including Westpac Bank), the three MSC Unit of Assessment (UoA) areas.

This page left intentionally blank.

1.0 INTRODUCTION

The Deepwater Group Ltd (DWG) asked GNS Science to undertake a spatial analysis of trawl footprint and coral interaction to assist with re-assessment of the three Marine Stewardship Council (MSC)-certified orange roughy fisheries against the MSC standard. Analyses were carried out for tows targeting orange roughy and oreo (ORH/OEO). The three fisheries are MSC-certified ORH3B North West Chatham Rise (ORH3B NWCR), ORH3B East and South Chatham Rise (ORH3B ESCR) and ORH7A, including Westpac Bank (ORH7A-WB), within the three MSC Unit of Assessment (UoA) areas. For the purposes of this study, only the portion of ORH3B ESCR east of 179°30' W is considered.

The study period is the most recent three years for which trawl data are available (01/10/17 to 30/09/20), as 2017 marked the commencement of tow position reporting to a higher level of precision (i.e. longitude and latitude to four decimal places or less than 20 m) than previously (i.e. to the nearest arc or about 1.852 nm).

Coral capture and fish catch data were obtained from Fisheries New Zealand (FNZ) by the DWG in the form of vessel-reported records and observer-reported records.

This study is the continuation of previous studies, including Black (2018) and Clark et al. (2015). Where possible, similar methodology has been applied.

Trawl data in this report are classified by FNZ as 'Commercial and In-Confidence'. Some of the analyses involve data from less than three sources and the report may therefore not be distributed.

2.0 DATA

2.1 Tow Data

Trawl fishing data were provided by FNZ as RepLog 13629 (fishing years 1989/90 to 2018/19) and RepLog 13723 (fishing year 2019/20). Fishing years start on the 1st of October in one year and end on the 31st of September in the following year. RepLog 13723 does not include tows outside of the Exclusive Economic Zone (EEZ; i.e. on Westpac Bank). Trawls in Westpac Bank are sourced from RepLog 12816, provided by FNZ in 2020.

The analyses are for the purpose of assessment of the three orange roughy fisheries. The agreed and accepted area of assessment for orange roughy fishing activity is within the depth range of 800–1600 m.

Filtering of suspect tows has not been carried out for the tow data, with the following exceptions:

1. A 770-km-long tow that crossed land has been removed.
2. Positions are edited for obvious +/- 180° errors.

The three RepLogs are combined as necessary and the ORH/OEO-targeted tows are plotted for the two species for each UoA during the period 2017/18 to 2019/20.

Trawl data provides the position of the vessel rather than the net during trawling. For analysis of trawl tows on Underwater Topographic Features (UTFs), the position of the net is needed. Based on fishery information, it is assumed that the net is towed behind the vessel offset by 1.8 x bottom depth at the tow start position and is assumed to angle down to the seabed (Figure 2.1). On some trawls, bottom depth is a reported attribute. For tows with no reported bottom depth, depth at the trawl start position is sampled from the bathymetry grid (Mitchell et al. 2012).

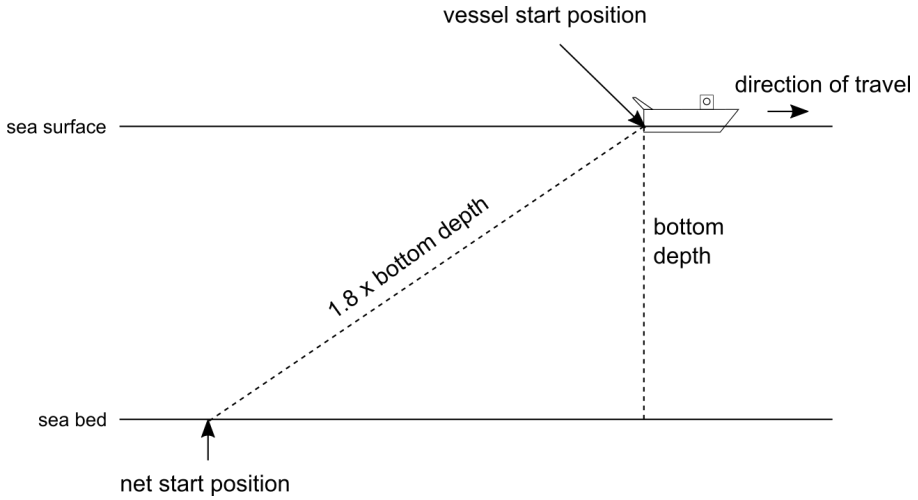

Figure 2.1 Estimation of net position in relation to reported vessel tow start position.

2.2 Coral Data

Coral capture data are sourced from observer-reported and vessel-reported datasets.

Tows in the observer- and vessel-reported data also exist in the main tow dataset and so require matching. Unfortunately, there is not always a unique identifier, and location data is captured differently in the different datasets. Where possible, they are matched using the unique 'Event Key', otherwise they are matched using a combination of tow start date, tow start time and vessel code, using the premise that a vessel can only be in one place at any one time. Approximate start and end locations are used as a check on the matching process. Tow start times are converted as necessary, as observer data are recorded in NZST all year whereas vessel and tow data are recorded as NZDT during daylight savings.

Where the trawl start and end locations have been reported differently in the tow data compared with the coral capture data, the location reported in the tow dataset is assumed to be superior unless there is a reason to think otherwise (e.g. tow crosses a closed area or is an unreasonably long tow).

2.3 Underwater Topographic Features Data

Analysis is carried out against two habitat types: UTFs and 'flats'. UTFs include hills (elevation <500 m) and knolls (elevation >500 m and <1000 m). No true seamounts (elevation >1000 m) are fished.

UTF summit locations are taken from Black et al. (2015), supplemented by newer UTF data (Clark 2021). Trawl patterns suggest that there are six further UTFs in ORH3B ESCR known by fishing vessels but not currently in the UTF dataset. These are also included, with their location estimated based on tow positions. In this report, they are known as 2021-A to 2021-F and are assumed to be hills.

Basal boundaries for some UTFs were constructed by Black et al. (2015). For the remaining UTFs, a circle is centred on the UTF summit and sized according to UTF type. The mean radius for each basal polygon in Black et al. (2015) is calculated giving a radius of 1.267 km for hills and 2.182 km for knolls. Due to the proximity between some adjacent UTFs, some basal polygons include multiple UTF summits.

Each tow is assigned to a specific UTF if the net position at the start of the tow is within 0.5 nm of the UTF summit position and the tow is less than 4500 m long. All remaining tows are classified as a 'flats' tows. Due to the higher precision in the location data compared with previous datasets, tows have not needed to be manually assigned to UTFs in the manner of Black (2018).

2.4 Other Data

Closures are areas closed to trawl fishing; these are Benthic Protection Areas (BPAs), Seamount Closure Areas (SCAs) and large marine reserves. Tows are not permitted in closed areas, so tows that appear to cross these are clipped to the closure boundary.

Contour lines were extracted from the bathymetry grid at 800 and 1600 m (Mitchell et al. 2012). The 1600 m contour lines were used to construct a polygon containing all parts of each UoA shallower than 1600 m; this is referred to as the 'fishable area' but may contain areas closed to trawl fishing. Contours were also extracted at 200 m intervals for use in maps.

Boundaries for ORH7A-Westpac Bank, ORH3B NWCR and ORH3B ESCR were received from FNZ. The union of ORH7A and Westpac Bank was taken and ORH3B ESCR clipped to contain only the area east of 179°30' W. All three UoA areas were clipped to the coastline.

2.5 Underwater Topographic Features Analysis

Maps are plotted showing the spatial relationship between ORH/OEO-targeted tows for which coral catch was reported and for which no coral catch was reported during the period 2017/18 to 2019/20. Maps are produced for 'flats' and UTF habitat. A small-scale map for each entire UoA area is provided and larger-scale maps within each UoA area are provided to illustrate localities of individual tows that captured coral. Tows are colour-coded by coral catch (regardless of whether they occurred on 'flats' or UTF habitat) (Table 2.1).

Table 2.1 Tow classification, based on observer- and vessel-reported coral capture data.

Coral Tow Type	Description
Red – Coral tows	Tows with reported coral catch more than 50 kg (total weight of coral caught on a tow, regardless of species)
Amber –Coral tows	Tows with reported coral catch less than 50 kg (total weight of coral caught on a tow, regardless of species)
Yellow – Rubble tows	Tows that reported coral rubble (coral codes CBB and CBD)
Green – No coral	Tows with no reported coral catch

A table is provided for each large-scale map listing individual tows with reported coral catch. The event code (a unique identifier) is given for these tows, along with the total weight of coral (regardless of species) caught on the tow and the total fish catch. These maps are provided in Figures A1.1 to A1.20.

UTFs with reported coral capture have been analysed in more detail. For each UTF, the number of tows, total coral catch (regardless of coral species), ORH catch and OEO catch are listed. This is repeated for slope tows with reported coral capture. See Tables A1.1 to A1.7.

Table A1.7 highlights UTFs with cumulative coral catch ≥ 50 kg in any one year during the period 2017/18 to 2019/20 and lists the coral and ORH catch per fishing year.

3.0 ACKNOWLEDGEMENTS

The authors thank FNZ and, in particular, Peta Abernathy for timely provision of data, Paul Viskovic and David Heron for providing GNS Science reviews, Rob Tilney of DWG for his input and the GNS Science Admin Team for formatting the report.

4.0 REFERENCES

Black J. 2018. GIS mapping of coral capture in ORH3B NWCR and ESCR fisheries. Lower Hutt (NZ): GNS Science. 48 p. Consultancy Report 2018/150. Prepared for Deepwater Group Ltd.

Black J, O'Brien G, Tilney R. 2015. Orange roughy and Oreo-dory trawl footprint analysis of slope habitat and summary analysis of UTF habitat (Part 1). Lower Hutt (NZ): GNS Science. 19 p. Consultancy Report 2015/58. Prepared for Deepwater Group Ltd.

Clark M. 2021. Update on Seamount Database for Deepwater Group Ltd. Wellington (NZ): National Institute of Water & Atmospheric Research Ltd. 6 p. Client Report 2021034WN. Prepared for Deepwater Group Ltd.

Clark M, Anderson O, Dunkin M, Mackay K, Notman P, Roux M-J, Tracey D. 2015. Assessment of orange roughy and oreo trawl footprint in relation to protected coral species distribution. Wellington (NZ): National Institute of Water & Atmospheric Research Ltd. 57 p. Client Report WLG2014-56. Prepared for Deepwater Group Limited.

Mitchell JS, Mackay KA, Neil HL, Mackay EJ, Pallentin A, Notman P. 2012. Undersea New Zealand, 1:5,000,000 [chart]. Wellington (NZ): National Institute of Water & Atmospheric Research. (Miscellaneous series; 92).

This page left intentionally blank.

APPENDICES

This page left intentionally blank.

APPENDIX 1 TRAWL TOW AND CORAL CAPTURE ANALYSIS

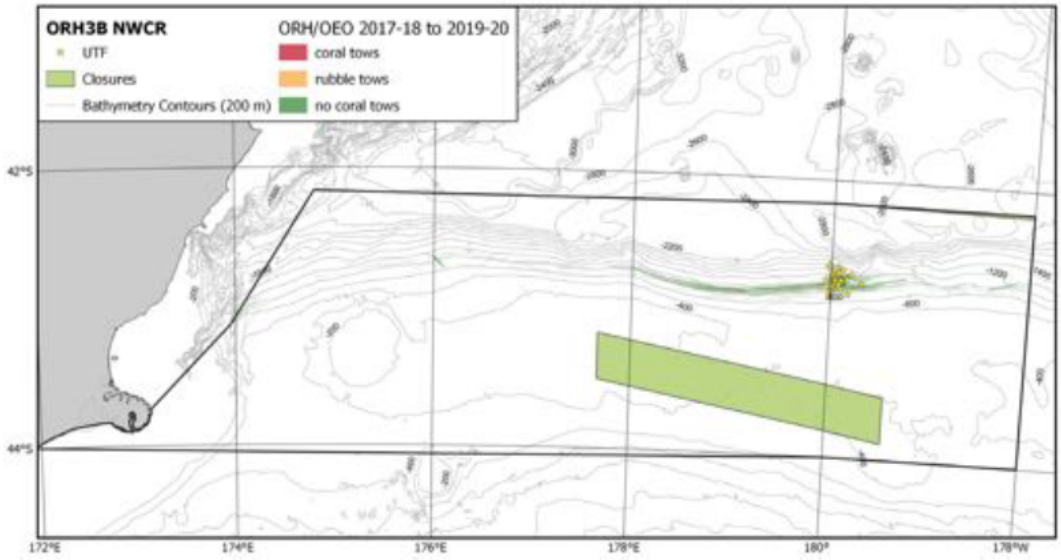

Figure A1.1 ORH/OEO trawl tows in the entire ORH3B NWCR Unit of Assessment area, 2017/18 to 2019-20.

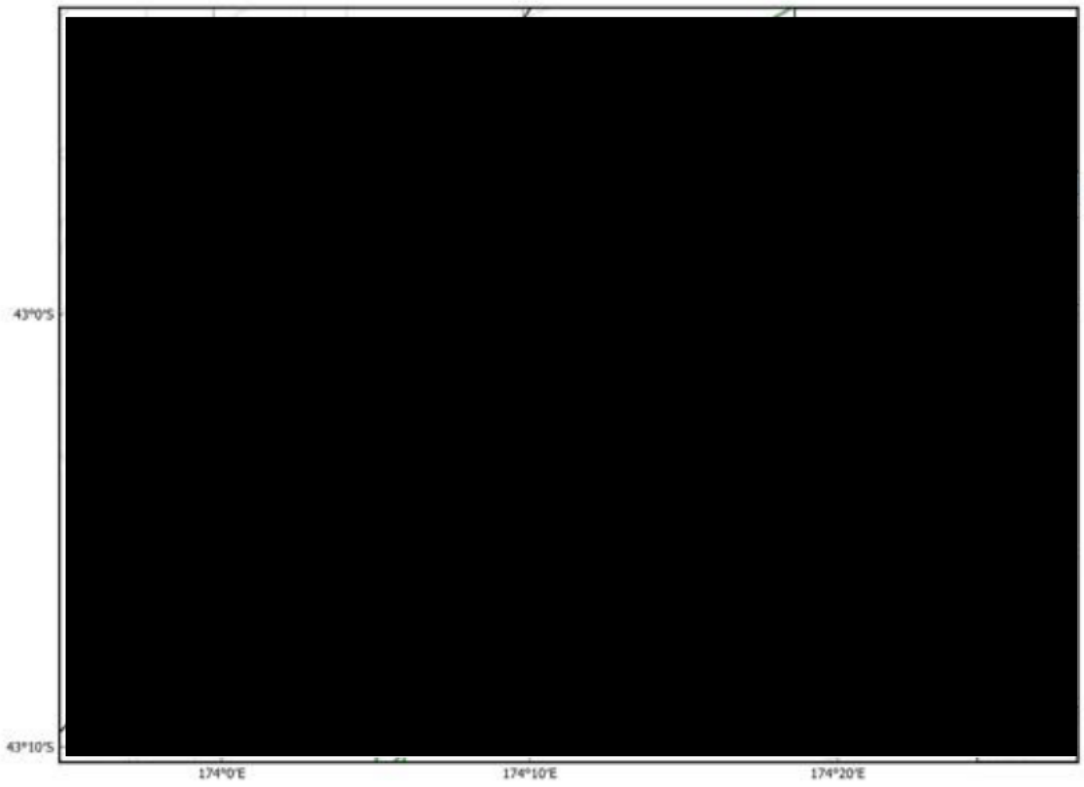

Figure A1.2 [redacted]

Figure A1.3 [redacted]

Figure A1.4 [redacted].

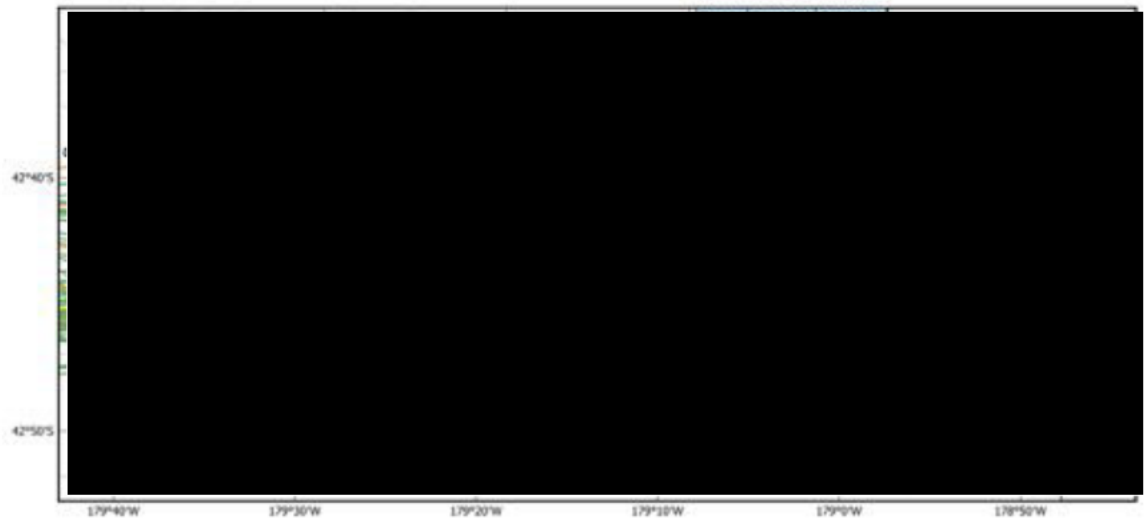

Figure A1.5 [redacted]

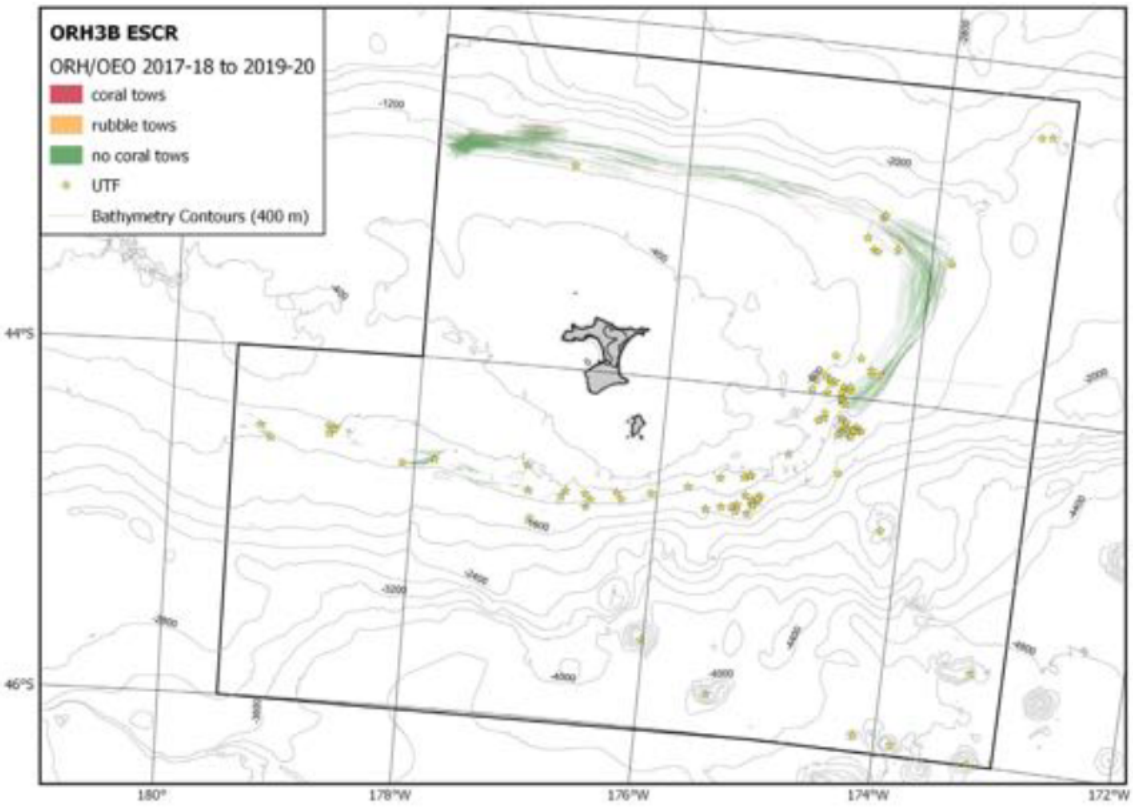

Figure A1.6 ORH/OEO trawl tows in the entire ORH3B ESCR Unit of Assessment area, 2017/18 to 2019/20.

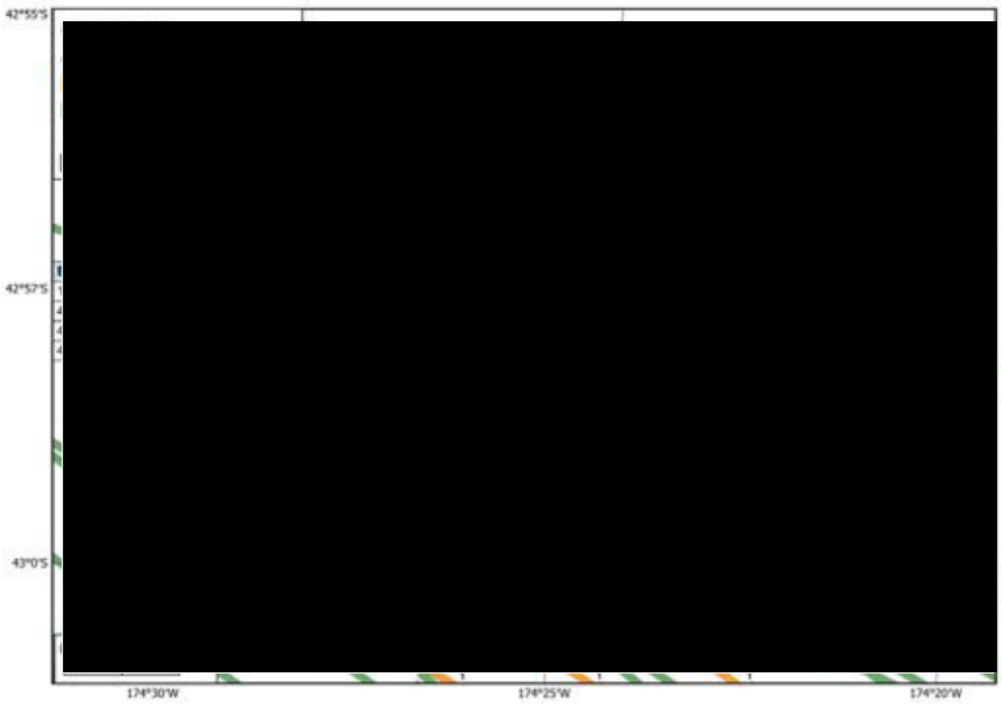

Figure A1.7 [redacted] 20.

Figure A1.8 [redacted]

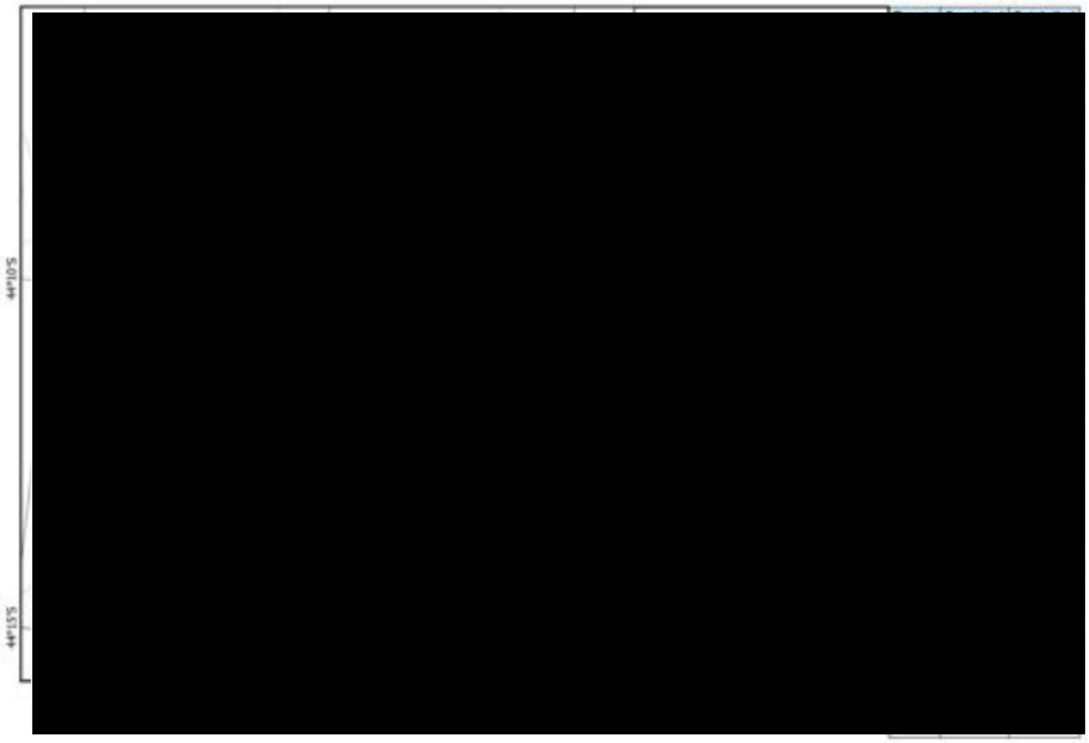

Figure A1.9 [redacted]

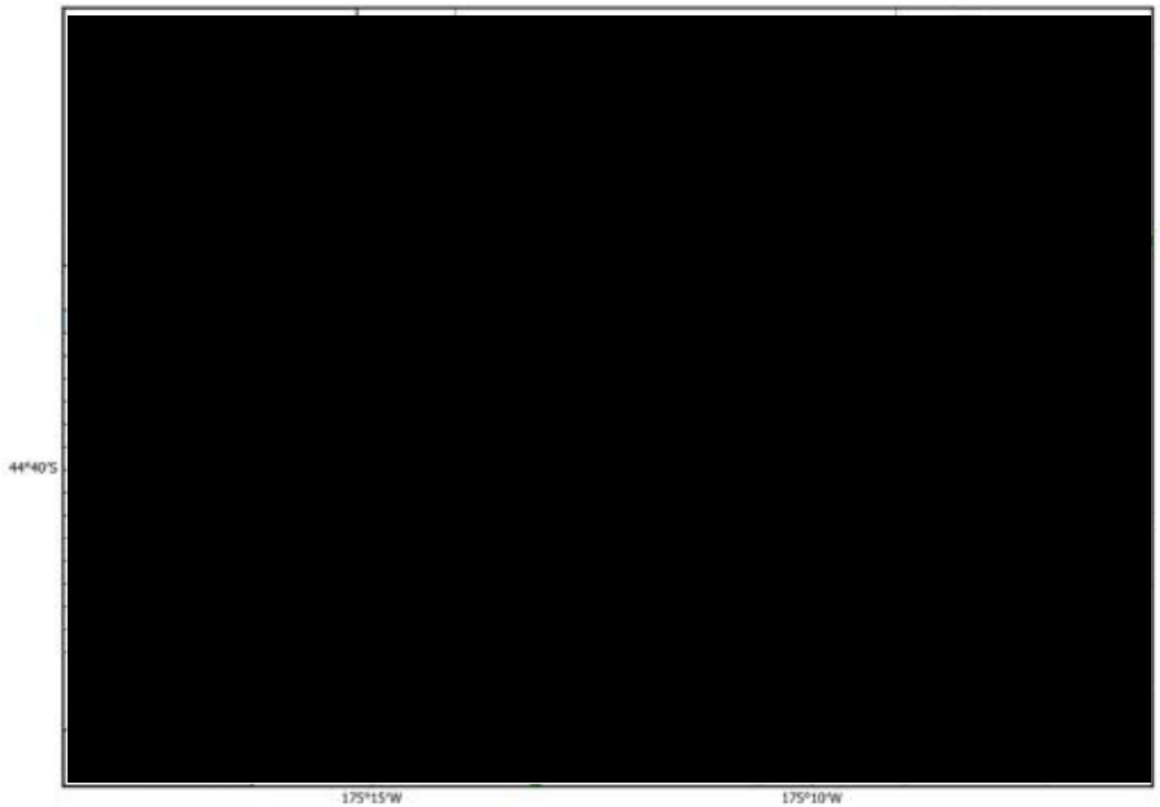

Figure A1.10 [redacted]

Figure A1.11 [redacted]

Figure A1.12 [redacted]

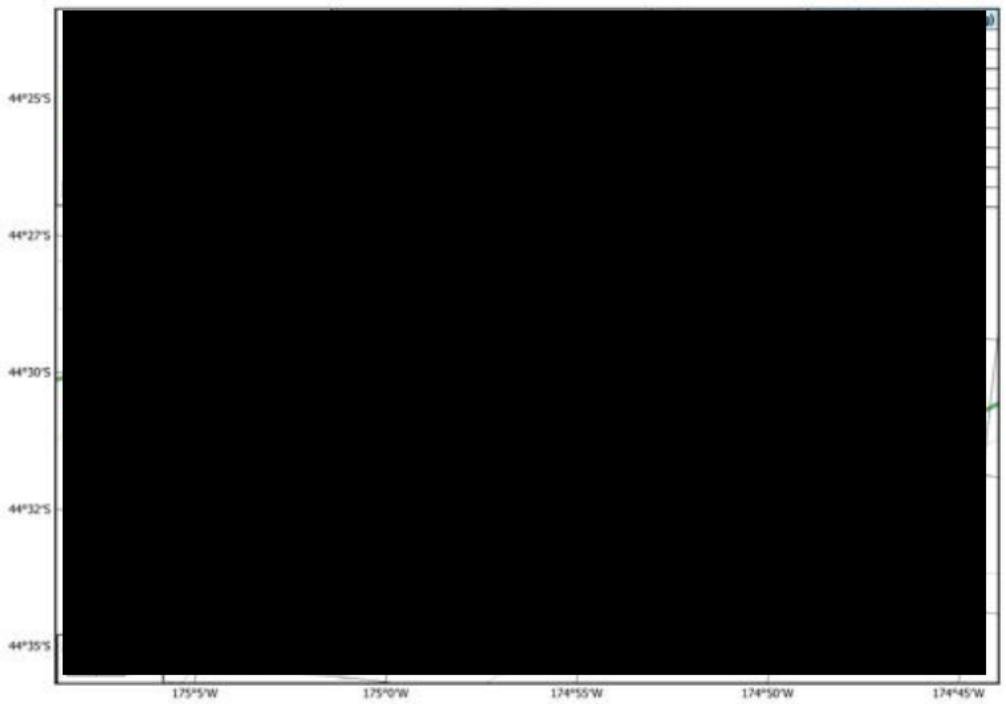

Figure A1.13 [redacted]

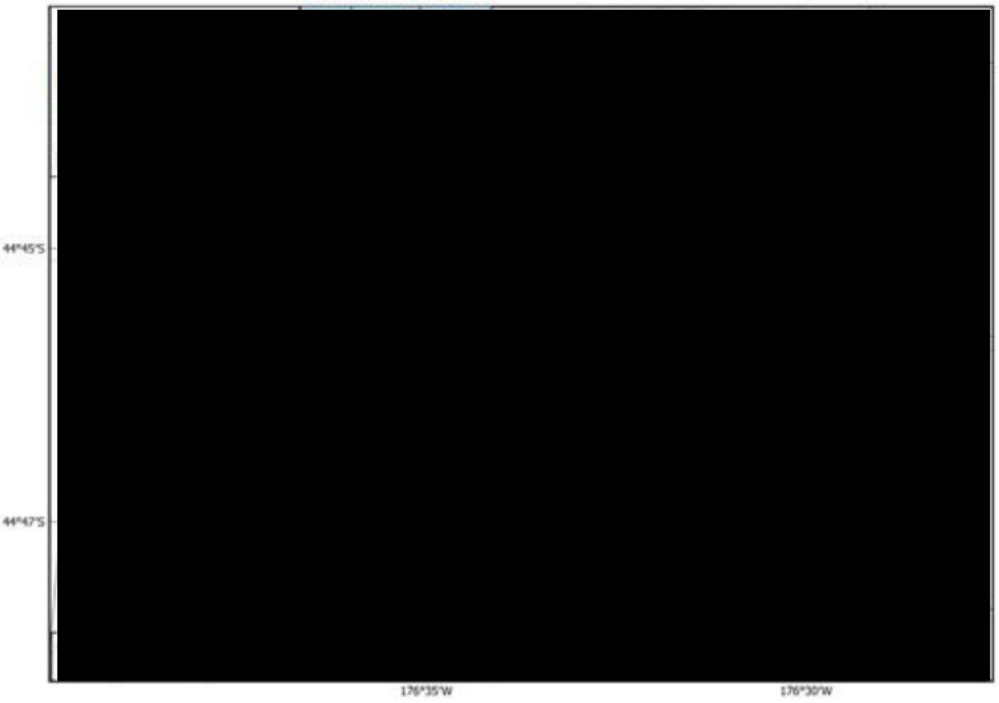

Figure A1.14 [redacted]

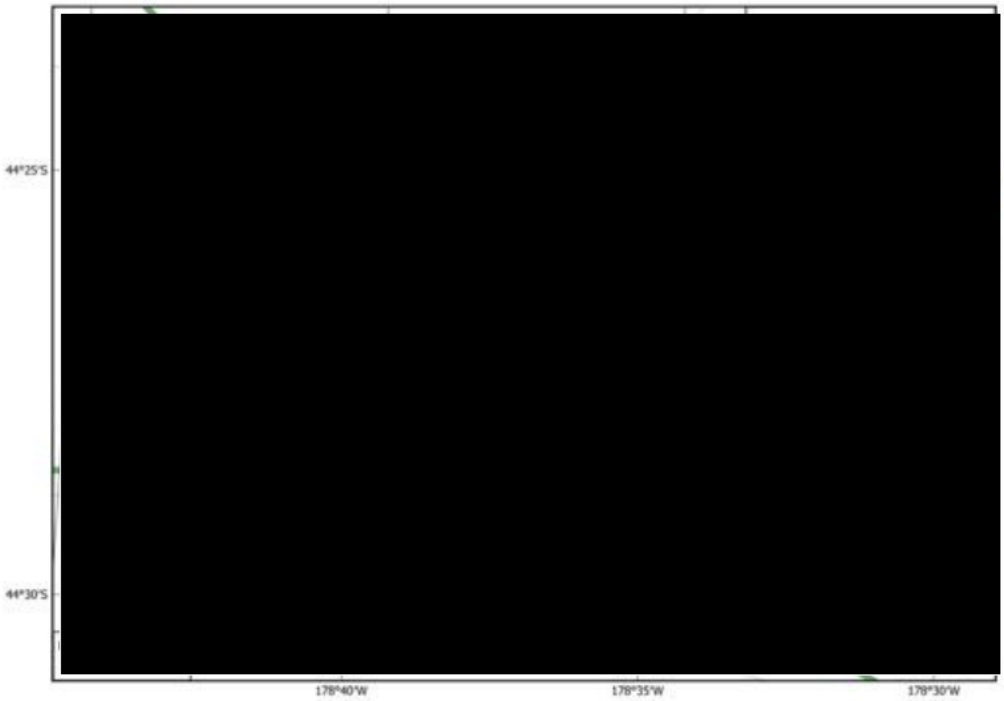

Figure A1.15 [redacted].

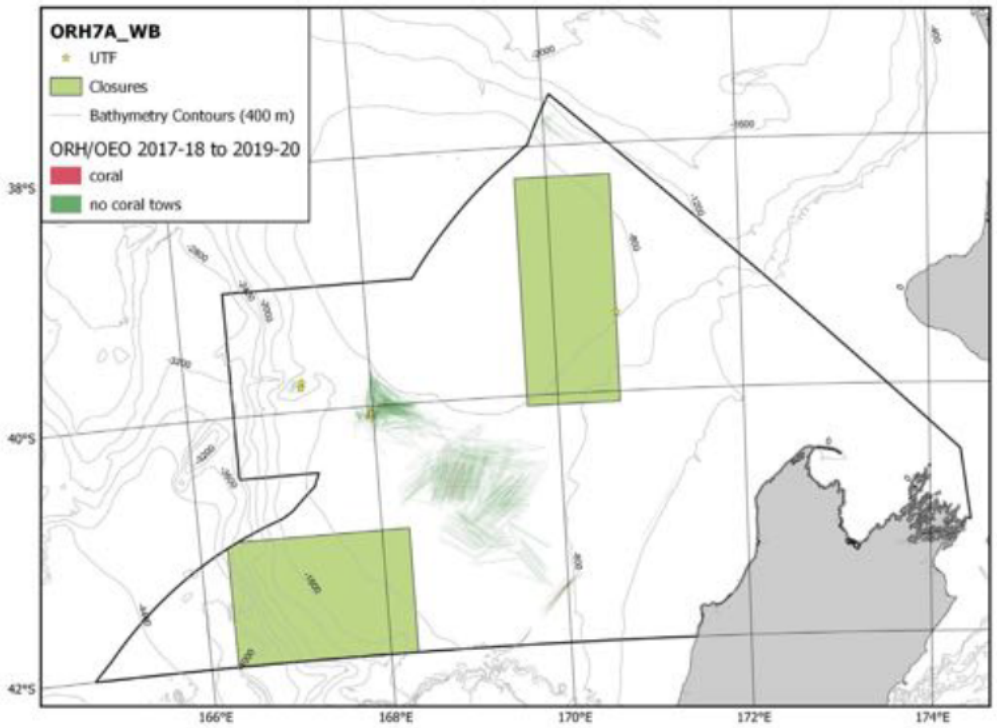

Figure A1.16 ORH/OEO trawl tows in the entire ORH7A-WB Unit of Assessment area, 2017/18 to 2019/20.

Figure A1.17 [redacted]

Figure A1.18 [redacted]

Figure A1.19 [redacted]

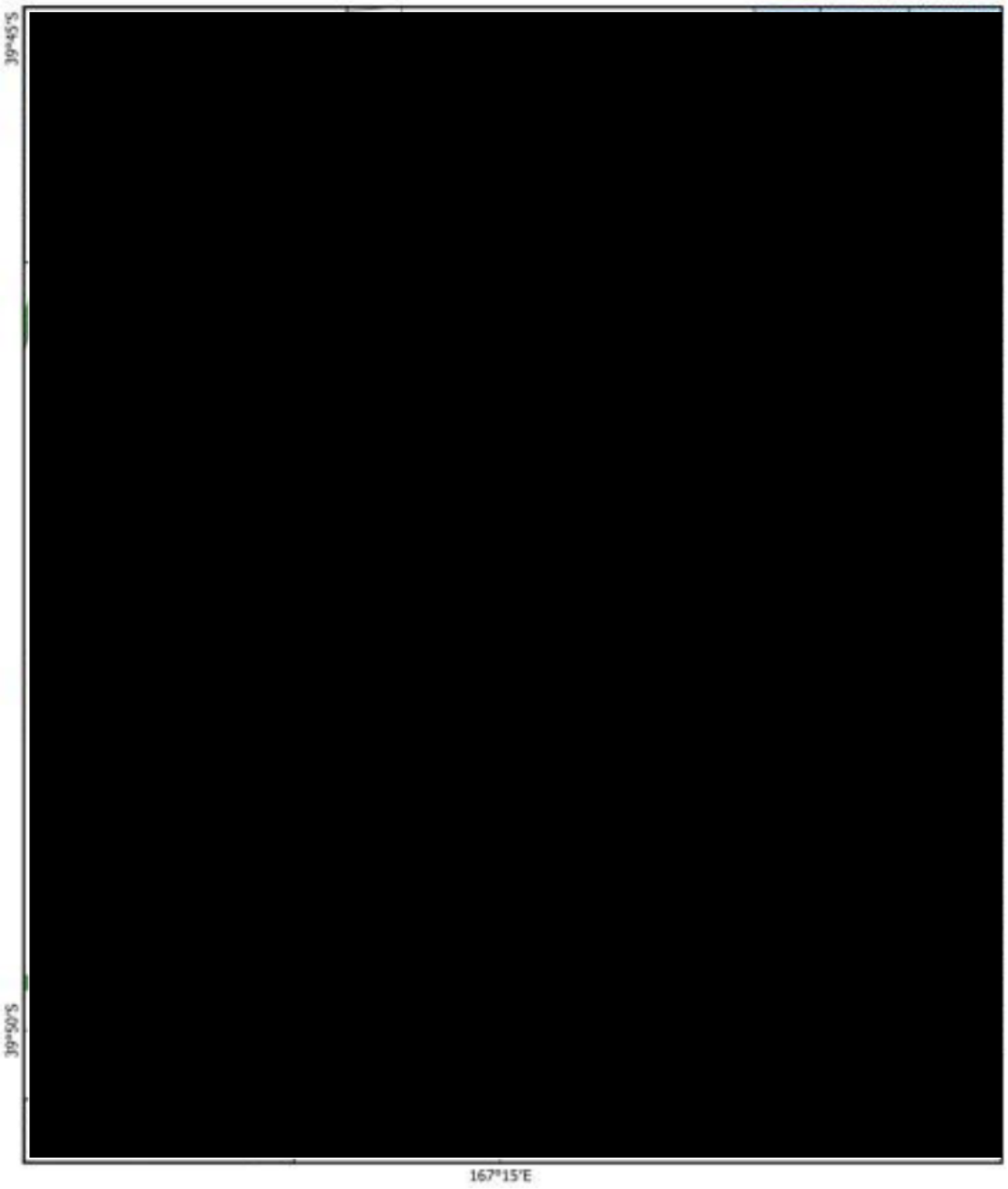

Figure A1.20 [redacted]

Table A1.1 ORH3B NWCR UTF tows with coral capture and associated fish catch, 2017/18 to 2019/20.

UTF	NWCR			
	Number of Tows	Coral Catch (kg)	ORH Catch (kg)	OEO Catch (kg)
[redacted]	3	7.00	160	-
[redacted]	1	3.00	12,043	-

Table A1.2 ORH3B ESCR UTF tows with coral capture and associated fish catch, 2017/18 to 2019/20.

UTF	ESCR			
	Number of Tows	Coral Catch (kg)	ORH Catch (kg)	OEO Catch (kg)
[redacted])	1	0.20	5580	-
[redacted]	1	80.00	151	-
[redacted]	1	50.00	30	-
[redacted]	3	4.50	1333	-
[redacted]	3	16.20	2920	-
[redacted]	2	43.00	15,240	-
[redacted])	1	1.00	-	465
[redacted]	1	1.00	363	-
[redacted]	1	1.00	105	-
[redacted]	1	0.20	235	-
[redacted]	1	-	800	-
[redacted]	1	2.00	145	-
[redacted]	1	0.40	-	4280
[redacted]	7	131.40	4202	-
[redacted])	3	32.00	1865	-
[redacted]	2	180.20	1737	-
[redacted]	4	8.00	5790	-
[redacted])	1	1.90	340	-
[redacted]	1	15.00	6000	-
[redacted]	5	76.00	3386	-
[redacted]	5	105.25	14,835	36
[redacted]	1	0.50	1545	-
[redacted]	3	253.00	3370	-
[redacted]	3	10.00	4260	-
[redacted]	3	35.00	6370	3000

Table A1.3 ORH7A-WB UTF tows with coral capture and associated fish catch, 2017/18 to 2019/20.

UTF	ORH7A-WB			
	Number of Tows	Coral Catch (kg)	ORH Catch (kg)	OEO Catch (kg)
[redacted]	4	1.20	3446	-
[redacted]	4	7.66	8233	-

Table A1.4 ORH3B NWCR flats tows with coral capture and associated fish catch, 2017/18 to 2019/20.

NWCR Flats			
Tows (Event No.)	Coral Catch (kg)	ORH Catch (kg)	OEO Catch (kg)
[redacted]	2.00	15,000	-
[redacted]	25,000.00	-	-
[redacted]	50.00	4894	-
[redacted]	20.00	-	-
[redacted]	2.00	72	-
[redacted]	1.00	4623	-
[redacted]	0.30	3200	-
[redacted]	1.00	3700	-
[redacted]	0.20	800	-
[redacted]	0.40	1100	-
[redacted]	1.00	2500	-
[redacted]	0.10	1700	-
[redacted]	0.30	1800	-
[redacted]	0.20	1500	-
[redacted]	0.30	7600	-
[redacted]	0.10	450	-
[redacted]	1.00	300	-
[redacted]	1.00	1239	-
[redacted]	0.02	358	-
[redacted]	1.00	584	-
[redacted]	0.50	615	-
[redacted]	1.00	720	-
[redacted]	1.00	525	-
[redacted]	1.00	1025	-
[redacted]	1.00	510	-
[redacted]	1.00	1993	-
[redacted]	1.00	573	-
[redacted]	1.00	2275	-
[redacted]	1.00	1120	-
[redacted]	0.01	208	-
[redacted]	0.20	7801	-
[redacted]	0.10	1032	-

Table A1.5 ORH3B ESCR flats tows with coral capture and associated fish catch, 2017/18 to 2019/20.

ESCR Flats			
Tows (Event No.)	Coral Catch (kg)	ORH Catch (kg)	OEO Catch (kg)
[redacted]	60.00	940	-
[redacted]	0.40	825	-
[redacted]	0.20	2920	-
[redacted]	1.10	65	-
[redacted]	-	2140	-
[redacted]	0.20	1390	-
[redacted]	1.00	155	-
[redacted]	1.00	20	-
[redacted]	1.00	170	-
[redacted]	30.00	75	-
[redacted]	10.00	165	-
[redacted]	4.00	1770	-
[redacted]	2.00	4530	-
[redacted]	15.00	900	-
[redacted]	2.00	9060	-
[redacted]	8.00	4760	-
[redacted]	1.00	210	-
[redacted]	1.00	620	-
[redacted]	1.00	564	-
[redacted]	0.50	151	-
[redacted]	1.00	595	-
[redacted]	1.00	5065	-
[redacted]	1.00	500	-
[redacted]	1.00	150	-
[redacted]	100.00	2080	-
[redacted]	20.00	190	-
[redacted]	25.00	4150	-
[redacted]	10.00	350	-
[redacted]	1.00	480	-
[redacted]	1.00	3085	-
[redacted]	1.00	7400	-
[redacted]	10.00	-	23,145
[redacted]	1.00	1970	-
[redacted]	1.00	1920	-
[redacted]	1.00	1580	-
[redacted]	3.00	1920	-
[redacted]	1.00	2148	-

ESCR Flats			
Tows (Event No.)	Coral Catch (kg)	ORH Catch (kg)	OEO Catch (kg)
[redacted]	1.00	3530	-
[redacted]	1.00	1490	-
[redacted]	1.00	2123	-
[redacted]	1.00	2030	-
[redacted]	1.00	-	36,100
[redacted]	1.00	1403	-
[redacted]	1.00	867	-
[redacted]	1.00	1165	-
[redacted]	1.00	680	-
[redacted]	1.00	977	-
[redacted]	1.00	862	-
[redacted]	1.00	1453	-
[redacted]	1.00	2560	-
[redacted]	1.00	2230	-
[redacted]	65.00	560	-
[redacted]	1.00	3041	-
[redacted]	1.00	1734	-
[redacted]	1.00	5026	-
[redacted]	1.00	2055	-
[redacted]	1.00	2055	-
[redacted]	1.00	339	-
[redacted]	5.00	400	-
[redacted]	4.00	1103	-
[redacted]	2.00	1007	-
[redacted]	3.00	24,575	-
[redacted]	15.00	11,150	-
[redacted]	2.00	440	-
[redacted]	15.00	1602	-
[redacted]	1.00	16,410	-
[redacted]	30.00	10,190	-
[redacted]	1.00	5385	-
[redacted]	1.00	12,000	-
[redacted]	2.00	-	-
[redacted]	0.03	1375	-
[redacted]	1.00	20,110	-
[redacted]	0.20	20,128	-

Table A1.6 ORH7A-WB flats tows with coral capture and associated fish catch, 2017/18 to 2019/20.

ORH7A-WB Flats			
Tows (Event No.)	**Coral Catch (kg)**	**ORH Catch (kg)**	**OEO Catch (kg)**
[redacted]	0.10	600	-
[redacted]	1.00	201	-
[redacted]	2.00	1231	-
[redacted]	0.10	30	-
[redacted]	1.00	-	-
[redacted]	0.10	121	-
[redacted]	-	18,400	-
[redacted]	0.50	92	-
[redacted]	0.20	1605	-
[redacted]	0.02	32	-
[redacted]	-	400	-
[redacted]	0.50	6445	-
[redacted]	0.20	406	-
[redacted]	0.50	1215	-
[redacted]	-	430	-
[redacted]	0.80	5	-
[redacted]	-	1000	-
[redacted]	0.60	1200	-
[redacted]	0.50	202	-
[redacted]	0.40	18,445	-
[redacted]	0.50	4895	-
[redacted]	2.00	408	-
[redacted]	1.00	11,240	-
[redacted]	1.00	3064	-
[redacted]	2.00	800	-
[redacted]	2.00	630	-
[redacted]	6.00	150	-
[redacted]	1.00	150	-
[redacted]	2.00	400	-
[redacted]	1.00	32	-
[redacted]	1.00	27	-
[redacted]	0.50	1702	-
[redacted]	1.00	750	-
[redacted]	0.20	1008	-
[redacted]	0.80	2838	-

ORH7A-WB Flats			
Tows (Event No.)	Coral Catch (kg)	ORH Catch (kg)	OEO Catch (kg)
[redacted]	0.40	1230	-
[redacted]	0.10	430	-
[redacted]	1.00	2000	-
[redacted]	0.10	1500	-
[redacted]	0.10	1750	-
[redacted]	0.10	2300	-
[redacted]	0.10	2600	-
[redacted]	0.10	2200	-
[redacted]	0.10	1500	-
[redacted]	0.10	2800	-
[redacted]	0.10	2500	-
[redacted]	0.10	2200	-
[redacted]	0.10	20,457	-
[redacted]	0.20	6040	-
[redacted]	0.10	430	-
[redacted]	1.00	6417	-
[redacted]	0.20	1672	-
[redacted]	0.20	1220	-
[redacted]	1.00	388	-
[redacted]	-	141	-
[redacted]	0.10	852	-
[redacted]	0.10	1218	-
[redacted]	0.10	823	-
[redacted]	0.30	201	-
[redacted]	-	31,215	-
[redacted]	-	1405	-
[redacted]	0.30	3,486	-
[redacted]	0.30	593	-
[redacted]	0.10	290	-
[redacted]	0.10	2709	-
[redacted]	0.10	1711	-

Table A1.7 UTF tows with ≥50 kg coral capture in any one year and associated fish catch, 2017/18 to 2019/20.

Unit of Assessment	UTF	Towline	Coral Catch 2017/18 (kg)	ORH Catch 2017/18 (kg)	Coral Catch 2018/19 (kg)	ORH Catch 2018/19 (kg)	Coral Catch 2019/20 (kg)	ORH Catch 2019/20 (kg)	Coral Catch Total (kg)	ORH Catch Total (kg)	OEO Catch Total (kg)
ESCR	[redacted]-B	NNW, S	-	-	150.00	100	103.00	3270	253.00	3370	-
ESCR	[redacted] [redacted]	NE	-	-	-	-	80.00	151	80.00	151	-
ESCR	[redacted] (aka [redacted]	NNE	-	-	50.00	30	-	-	50.00	30	-
ESCR	[redacted] [redacted]	SSW	-	-	101.40	3737	30.00	465	131.40	4202	-
ESCR	[redacted] [redacted]	N, SW	-	-	180.20	1737	-	-	180.20	1737	-
ESCR	[redacted]	SE, NW, S	-	-	70.00	210	32.25	14,625	105.25	14,835	36

www.gns.cri.nz

Principal Location

1 Fairway Drive, Avalon
Lower Hutt 5010
PO Box 30368
Lower Hutt 5040
New Zealand
T +64 4 570 1444
F +64 4 570 4600

Other Locations

Dunedin Research Centre
764 Cumberland Street
Private Bag 1930
Dunedin 9054
New Zealand
T +64 3 477 4050
F +64 3 477 5232

Wairakei Research Centre
114 Karetoto Road
Private Bag 2000
Taupo 3352
New Zealand
T +64 7 374 8211
F +64 7 374 8199

National Isotope Centre
30 Gracefield Road
PO Box 30368
Lower Hutt 5040
New Zealand
T +64 4 570 1444
F +64 4 570 4657