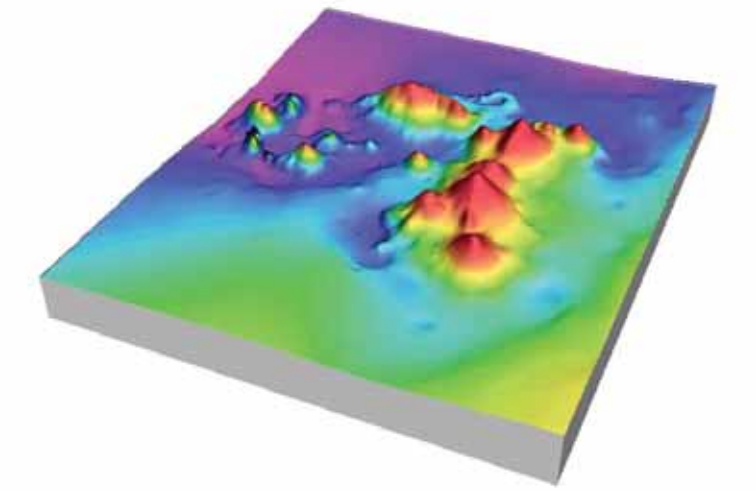
Summary information of Underwater Topographic Feature (UTF) habitat for orange roughy and associated trawl fisheries for orange roughy and oreo species. Part I.

(MSC PI 2.4.1)



Prepared for Deepwater Group Limited

December 2014

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NIWA Client Report No:	WLG2014-84
Report date:	December 2014
NIWA Project:	DWG14306

Caption for image. Underwater topographical features (UTF) Andes Knolls [NIWA]

Contents

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Background summary

The Deepwater Group Limited is undertaking an assessment of several orange roughy (*Hoplostethus atlanticus*) fisheries against Marine Stewardship Council fisheries standards as a process of development towards MSC certification. These fisheries are ORH7A & Westpac Bank, ORH3B Northwest Chatham Rise, and ORH3B East & South Chatham Rise (east of 179°30'W). Analyses were required to evaluate the extent of underwater topographic feature (UTF) habitat for orange roughy in each of the fishery areas and within the lower bathyal New Zealand Kermadec province (EEZ and non-EEZ bioregion), and to evaluate the footprint of trawling operations on such habitat.

This report summarises information on orange roughy UTF habitat and the occurrence of orange roughy and oreo (black oreo *Allocyttus niger*, smooth oreo *Pseudocyttus maculatus* and unspecified oreo species) target trawling in such habitat over the last five fishing years (from 1 October 2008 to 30 September 2013). Fishery catch and effort information (tow by tow TCEPR data) was obtained from MPI, error-checked and groomed, and is tabulated by UTF and fishing year in part II of this report.

The results will serve as a starting point to evaluate potential effects of orange roughy and oreo target trawling on the UTF habitat component of orange roughy populations in New Zealand (Marine Stewardship Council Performance Indicator 2.3.1).

1 Introduction

Deepwater Group Limited (DWG) is undertaking an assessment of three orange roughy (*Hoplostethus atlanticus*) (ORH) fisheries against Marine Stewardship Council (MSC) standards as part of a process of development towards MSC certification:

- ORH7A & Westpac Bank
- ORH3B Northwest Chatham Rise
- ORH3B East & South Chatham Rise

A preliminary series of meetings held in 2013 included an Assessment of the Environmental Effects of Fishing, for which NIWA undertook and presented analyses on aspects related to protected coral species (included in the Endangered, Threatened, or Protected (ETP) component), and aspects of the fishery on habitats associated with seamounts, knolls, and hills (referred to here as Underwater Topographical Features (UTFs) (Baird and Clark 2013, Clark 2013, Clark and Anderson 2013, Tracey and Clark 2013) . As part of the ongoing process involving meetings with MSC assessors in 2014, further work was required on two of the MSC Performance Indicators:

- PI 2.3.1 ETP species
- PI 2.4.1 Habitats outcome

NIWA was contracted by DWG to undertake trawl footprint analyses for each of the three orange roughy fishery areas (or 'units of assessment' (UoA)), the New Zealand EEZ and the lower bathyal New Zealand Kermadec province of the GOODS classification system (UNESCO, 2009) (hereinafter referred to as 'bioregion'), in order to determine the extent of the orange roughy trawl footprint relative to ETP coral species distributions and orange roughy habitat. This was divided into two projects:

Project 1. The effects of ORH target-trawling on ETP coral species assemblages (PI 2.3.1)

See Clark et al (2014) (in revision)

Project 2. The effects of ORH target-trawling on habitat structure and function (PI 2.4.1).

Project 2 is addressed in this report

The objectives of project 2 were to determine:

- The extent of the two ORH habitat types, UTFs and slope;
- The characteristics of these habitat types (e.g. substratum type, benthic biota);
- The proportions of these habitat types that are fished, unfished and closed to fishing in each fishery area (UoA) and on a regional (EEZ) and bio-regional (bioregion) basis;
- Provide informed commentary on the likely effects of ORH-targeted fishing on these habitat types.

Following meetings with MSC assessors in July 2014, the scope of both projects was amended to incorporate the oreo (OEO) trawl footprint (including black oreo *Allocyttus niger*, smooth oreo *Pseudocyttus maculatus*, and unspecified oreo species). In addition, the boundaries of the ORH3B East and South Chatham Rise fishery area were modified to comprise only the region east of 179°30'W (revised UoA).

This report presents the results of a summary evaluation of the extent of orange roughy UTF habitat and associated ORH/OEO target trawl fisheries in each of the three UoA and the bioregion (both within and outside the New Zealand EEZ) for the most recent five-year period (2008-09 to 2012-13 fishing years). Footprint analyses were condensed to simple metrics including annual numbers of targeted tows and total catches of orange roughy and oreo.

2 Methods

2.1. Trawl dataset

Commercial catch and effort (TCEPR) data for ORH and OEO target fisheries for the fishing years 2008-09 to 2012-13 (1 October 2008 through to 30 September 2013) were obtained from the Ministry for Primary Industries (MPI). Standard error-checking and grooming procedures were applied.

2.2. ORH depth distribution range on UTFs

With slope fisheries, the majority of orange roughy fishing occurs at depths of ≥800 m. Hence the depth range specified by DWG as ORH habitat at 800–1600 m is appropriate. However, with UTFs there is a different dynamic, and orange roughy are often found shallower than on the slope because of the localised physical characteristics and processes around the UTFs (e.g., current flows and upwelling pushing the nutrient and temperature profiles upwards). The topography can also make the summit and upper flanks suitable for feeding and spawning. In addition, the physical shape of the UTFs (in particular their slope) mean that, on many of them, the fishers need to land their gear on the broader summit to stabilise it before it is towed down the flanks. Hence, the orange roughy may be down the sides, but the tow begins much shallower. Rachel (Andes) is an example of this. The summit of the UTF is 590 m and, from a total of 580 tows catching or targeting ORH since 1989–90, 240 (about 41%) had a start depth of less than 700 m. The minimum recorded depth of capture of orange roughy in research bottom trawls was 409 m (Anderson et al. 1998). Proportions of tows in which the species was caught within the 500-700 m depth range at the scale of the EEZ varied from 1% to 20% (Anderson et al. 1998).

In consideration of such factors, the depth range for orange roughy habitat on UTFs was defined as 500-1600 m (summit depth) and basal depth ≥ 800 m.

2.3. UTF dataset

Data from all underwater topographic features located within the three UoA, the EEZ, and the bioregion (within and outside the EEZ) were extracted from the Seamounts (SEAMOUNT V2) database managed by NIWA (as described by Rowden et al. 2008). Only UTFs within the orange roughy distribution range (summit depth between 500-1600 m) were retained for analyses.

Information on UTF identifier, name (if any), summit location and depth and elevation were extracted from the database.

UTFs were classified into three categories based on the following elevation thresholds:

- 100-499 m = hill
- 500-999 m = knoll
- ≥ 1000 m = seamount

Basal polygon areas for all UTFs were estimated in ArcGIS 10.2 using the sinusoidal projection with a Central Meridian of 175° and the most recent NIWA bathymetry. Lateral surface (*LS*) was calculated based on elevation (*h*) and basal polygon radius (*r*), assuming a right circular conical shape for all UTFs:

$$l = \sqrt{r^2 + h^2}$$

$$LS = \pi r l$$

where l is the lateral height of the cone. In order to minimize conical area underestimation, the UTF radius r was estimated for the minimum bounding circle (i.e., circle encompassing all of the UTF basal polygon area, as generated using the *Minimum Bounding Geometry* data management tool in ArcGIS 10.2).

A coral presence/absence field was determined for each UTF within the New Zealand EEZ based on outputs from Project 1 (i.e., overlap with recorded coral observations extrapolated to 1 km^2 cells) (Clark et al. 2014). No coral information was available for UTFs located within the bioregion outside the EEZ.

Substrate information was not available for individual UTFs.

2.4. Assigning commercial tows to UTFs.

Two criteria were used to assign individual trawl tows to UTFs (as per DWG request):

1. Tow start position (at the vessel) located within 2 nm of UTF summit position.
2. Tow start depth ≤ 100 m deeper than summit depth.

The analyses of the fisheries data focused on numbers of tows (as an indicator of fishing occurrence and intensity) and associated total catch.

3 Results

Individual UTF ID, location, metrics, coral presence/absence and fishery catch and effort information for orange roughy and oreo target trawling (for the five year period) are presented in Part II, Appendix 1 of this report. The same fishery information is presented by UTF and fishing year in Part II, Appendix 2.

The UTF localities in each of the three UoA, the New Zealand EEZ and the Kermadec bioregion, are illustrated in Figure 1 and distinguished by UTF categories (hills, knolls and seamounts).

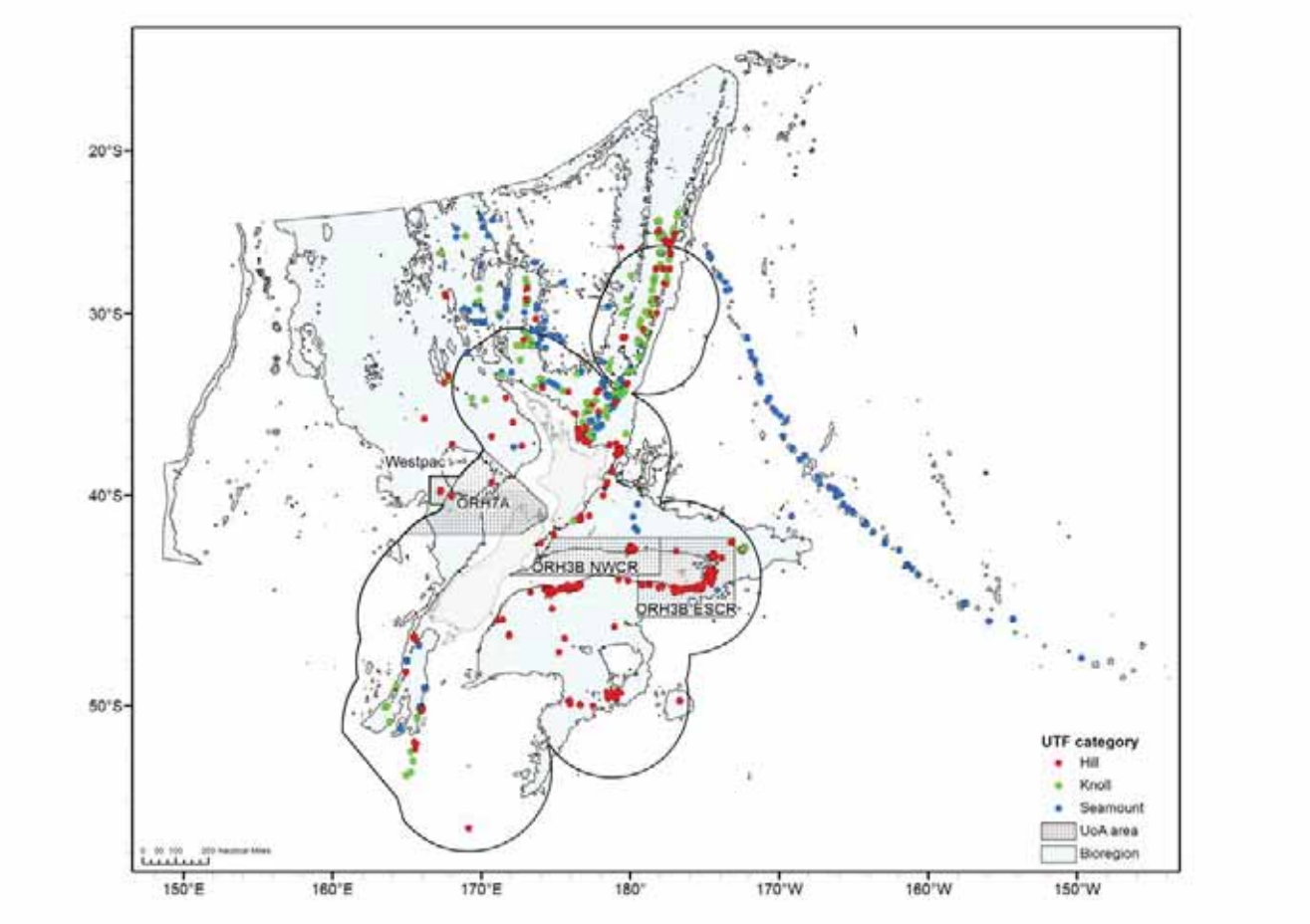


Figure 1: Hill (red), knoll (green) and seamount (blue) UTFs in the unit of assessment (UoA) areas ORH7A & Westpac Bank, ORH3B Northwest Chatham Rise, ORH3B East & South Chatham Rise, the New Zealand EEZ and the Kermadec bioregion. Note that there is a high degree of overlap of UTFs in some areas at this spatial scale.

- A total of 591 UTFs (318 hills, 136 knolls and 137 seamounts) were identified within the orange roughy distribution range in the New Zealand EEZ and Kermadec bioregion. Of these, 451 were in the EEZ and 573 were in the bioregion.
- 140 of the 573 UTFs in the bioregion were located outside the EEZ boundaries.
- Of the 451 UTFs inside the EEZ, 116 were located within the assessment units (UoA).
- All three UoA are located within the Kermadec bioregion.
- The total number of fished UTFs over the last five years was 156. Of these, 144 were in the EEZ, while 151 occurred in the bioregion.
- The total number of fished UTFs within the Kermadec bioregion (both within and outside the EEZ) was 151 (124 hills, 12 knolls and 15 seamounts).
- The total number of fished UTFs within the New Zealand EEZ between 2008-09 and 2012-13 was 144 (124 hills, 14 knolls and 6 seamounts), of which half (72) were located within the UoAs.

- Only twelve of the 140 UTFs located in the bioregion outside the EEZ were fished between 2008–09 and 2012–13.
- Coral layers have yet to be developed for regions located outside the EEZ boundaries. Thus, coral presence/absence on UTFs outside the EEZ was not assessed.
- A total of 85 UTFs (81 hills, 3 knolls and 1 seamount) were located within the ORH3B ESCR UoA. More than half (48) had coral presence and 58 were fished between 2008–09 and 2012–13. Of the 58 UTFs that were fished, 37 had coral records.
- Within the ORH3B NWCR UoA, a total of 26 UTFs (all hills) were identified, among which 19 had coral presence and 10 were fished in the period 2008-09-2012-13. Nine of the fished UTFs had coral presence.
- UoA ORH7A & Westpac had a total of 5 UTFs (all hills), including four that were fished. None had coral presence.

The above information is summarised in Table 1 and Figure 2 below for each of the three UoAs, the entire EEZ and the entire Kermadec bioregion.

Table 1: Summary by Unit of Assessment area (UoA), New Zealand EEZ and Kermadec bioregion, of the numbers of known UTFs (i.e. as contained in NIWA's "Seamount V2" database), numbers of UTFs target-fished for ORH/OEO/BOE/SSO and numbers of targeted trawl tows per fished UTF during the period 2008-09 to 2012-13 in the orange roughy depth range (500-1600 m).

UoA ORH7A & Westpac Bank

UTF Category	No. UTFs	No. Trawl Tows	Avg. No. Tows per UTF	No. UTFs with Coral Presence
Hills	5			0
Fished Hills	4	121	30	0
Fished Hills %	80%			
Knolls	0			-
Fished knolls	0		0	-
Fished Knolls %	-			
Seamounts	0			-
Fished Seamounts	0		0	-
Fished Seamounts %	-			
UTF Total	5			0
Fished UTF Total	4	121	30	0
Fished UTF Total %	80%			

UoA ORH3B NWCR

UTF Category	No. UTFs	No. Trawl Tows	Avg. No. Tows per UTF	No. UTFs with Coral Presence
Hills	26			19
Fished Hills	10	160	16	9
Fished Hills %	38%			
Knolls	0			-
Fished knolls	0	0	0	-
Fished Knolls %	-			
Seamounts	0			-
Fished Seamounts	0	0	0	-
Fished Seamounts %	-			
UTF Total	26			19
Fished UTF Total	10	160	16	9
Fished UTF Total %	38%			

UoA ORH3B ESCR

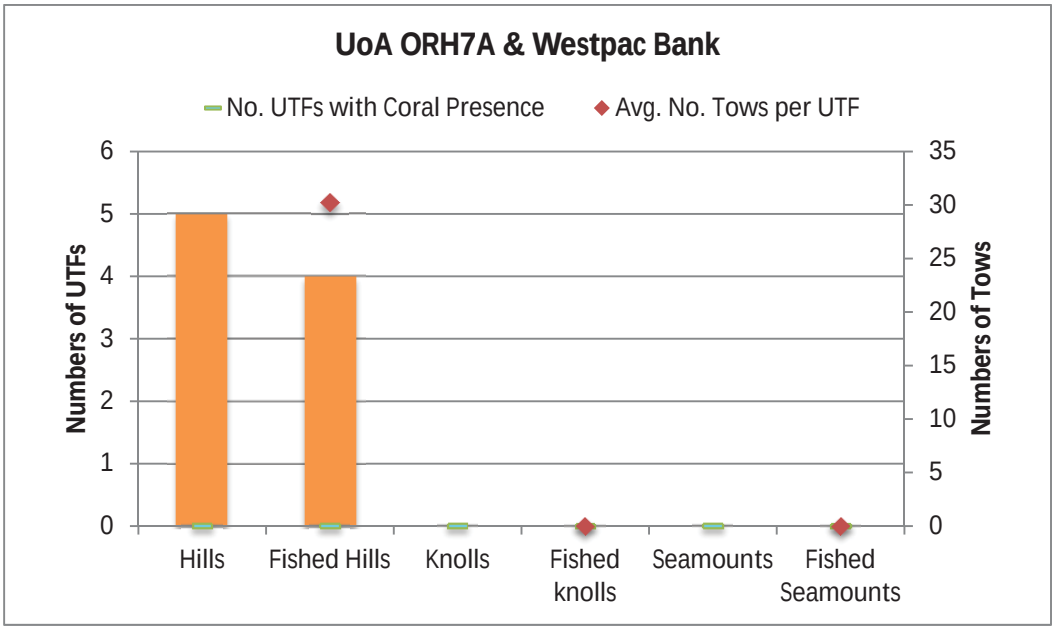
UTF Category	No. UTFs	No. Trawl Tows	Avg. No. Tows per UTF	No. UTFs with Coral Presence
Hills	81			45
Fished Hills	55	1836	33	34
Fished Hills %	68%			
Knolls	3	283		3
Fished knolls	3		94	3
Fished Knolls %	100%			
Seamounts	1			0
Fished Seamounts	0	0	0	-
Fished Seamounts %	0%			
UTF Total	85			48
Fished UTF Total	58	2119	32	37
Fished UTF Total %	68%			

New Zealand EEZ

UTF Category	No. UTFs	No. Trawl Tows	Avg. No. Tows per UTF	No. UTFs with Coral Presence
Hills	287			71
Fished Hills	124	3335	27	50
Fished Hills %	43%			
Knolls	106			4
Fished knolls	14	427	31	4
Fished Knolls %	13%			
Seamounts	58			1
Fished Seamounts	6	25	4	0
Fished Seamounts %	10%			
UTF Total	451			76
Fished UTF Total	144	3787	26	54
Fished UTF Total %	32%			

Kermadec bioregion (within and beyond EEZ)

UTF Category	No. UTFs	No. Trawl Tows	Avg. No. Tows per UTF	No. UTFs with Coral Presence
Hills	307			71
Fished Hills	124	3443	28	50
Fished Hills %	40%			
Knolls	129			4
Fished knolls	12	385	32	4
Fished Knolls %	9%			
Seamounts	137			1
Fished Seamounts	15	154	10	0
Fished Seamounts %	11%			
UTF Total	573			76
Fished UTF Total	151	3982	26	54
Fished UTF Total %	26%			



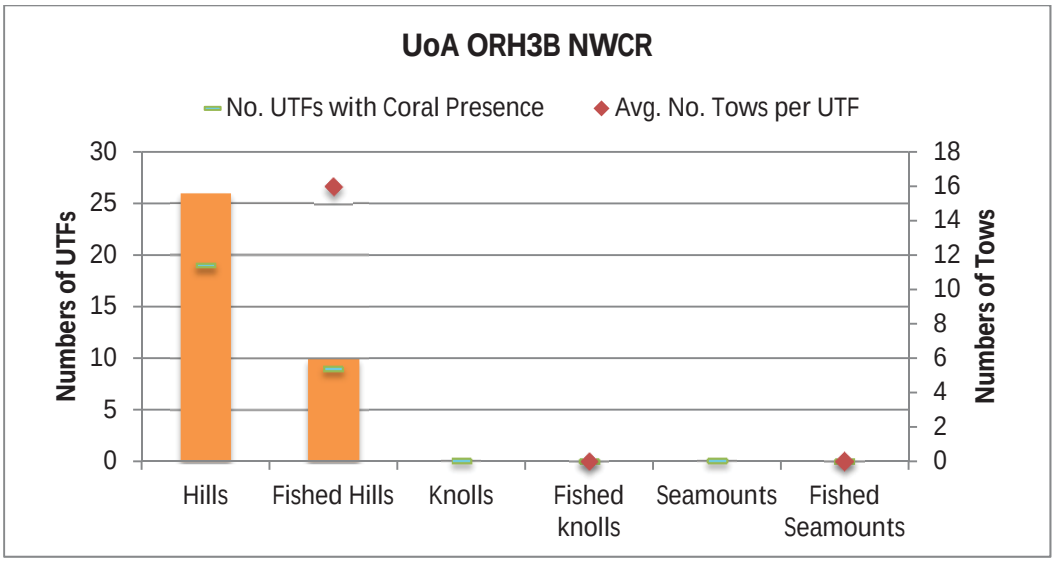
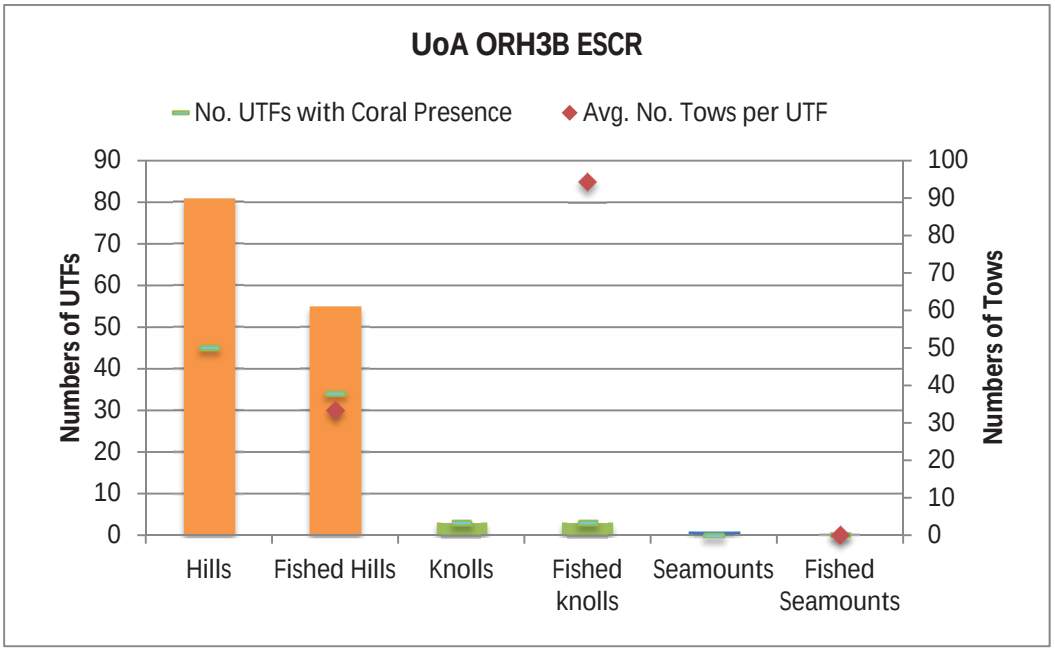


Figure 2: Numbers of UTFs by category (hills, knolls, seamounts), average numbers of trawl tows per fished UTF and numbers of UTFs with coral presence over the most recent 5-year period (2008-09 to 2012-13) in the orange roughy depth range (500-1600 m), for each of the three unit of assessment (UoA) areas, the New Zealand EEZ and the Kermadec bioregion. (Fig. 2 continued over page).



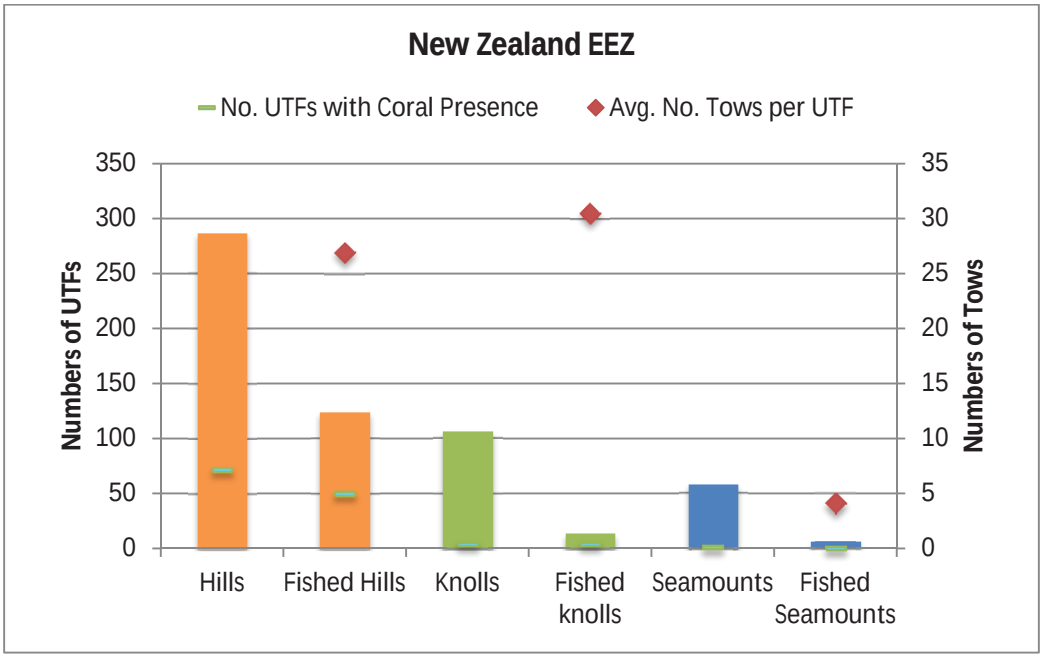
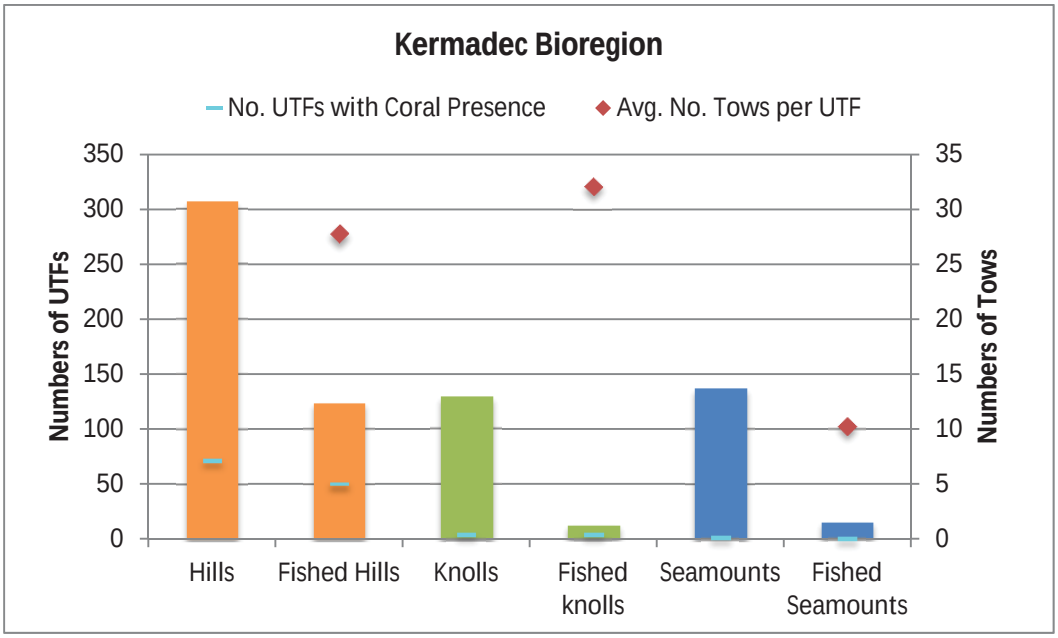


Figure 2 (contd.): Numbers of UTFs by category (hills, knolls, seamounts), average numbers of trawl tows per fished UTF and numbers of UTFs with coral presence over the most recent 5-year period (2008-09 to 2012-13) in the orange roughy depth range (500-1600 m), for each of the three unit of assessment (UoA) areas, the New Zealand EEZ and the Kermadec bioregion. (Fig. 2 continued over page).



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4 Acknowledgements

The authors wish to acknowledge Malcolm Clark for his involvement and valuable input at all phases of this project and for providing constructive comments on the manuscript.

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