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Appendix 13

Data on the Chatham Rise benthos:
Macro-faunal and in-faunal communities
(Beaumont et al. 2013a)

Chatham Rock Phosphate Ltd

Data on the Chatham Rise benthos: macro-faunal and infaunal communities

Prepared for Chatham Rock Phosphate Limited

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Executive summary

This report describes the epi- and in-faunal communities of the Chatham Rise crest and upper slope based on long-term databases maintained by NIWA, with particular reference to Chatham Rock Phosphate Limited’s phosphorite prospecting licence area.

Data extracted from *Specify, Trawl* and *AllSeaBio* databases were analysed to determine the number of taxa per phylum recorded within each 20 x 20 km grid square across the study area. Data from “Trawl” were also analysed to show the catch weight per taxonomic group per trawl. In addition, a review of soft-sediment infaunal communities on the Chatham Rise is provided

Both the licensed area and much of the Chatham Rise crest have been relatively poorly sampled compared to the rest of the Chatham Rise. In addition, it is important to note that much of the sampling has been carried out using gear targeted at sampling fish stocks and not the benthic invertebrate communities. Thus we cannot make any definitive statements about the uniqueness, or otherwise, of Chatham Rock Phosphate Limited’s licence area. However, there are indications that the central crest of the Chatham Rise, including the licence area, may be important for sponges, octopods and cnidarians, at least.

Note that, at the request of the client, no consideration or discussion of impacts or implications of extracting phosphorite nodules from the Chatham Rise or recommendations for further work are included within this report.

1 Introduction

The Chatham Rise is a submarine ridge extending eastwards from New Zealand into the southwest Pacific Ocean and sits within New Zealand's EEZ (Exclusive Economic Zone). The ridge is approximately 800 km long and 300 km wide with steeply sloping flanks rising to less than 500 m from water depths of more than 3000 m (the Hikurangi and Bounty troughs).

Chatham Rock Phosphate Limited have been granted a licence to prospect for phosphorite nodules within a defined area on the central Chatham Rise (Minerals Prospecting Licence 50270).

1.1 Previous knowledge of the licence area.

The principal biological and commercial fishing considerations with respect to phosphorite prospecting on the Chatham Rise were described and discussed by Beaumont and Baird (2010).

The Chatham Rise has been relatively well studied compared with many parts of the deep sea. Much of the detailed knowledge of benthic macro- and mega-fauna within the licenced area was gathered in 1981 onboard a joint German/New Zealand scientific voyage onboard the RV SONNE (voyage SO-17) (Kudrass and von Rad 1984b, Dawson 1984). While the observations made onboard the Sonne were adequate to characterise the principal epibenthic fauna and describe the substrates in the area, the video and still images captured were very poor relative to modern technology resulting in relatively poor quality data. In addition, much of the biological data available are qualitative rather than quantitative which restricts their usefulness with respect to the information that can be derived from it. As a result, the distribution of the taxonomic groups of the Chatham Rise benthos is known only crudely in terms of numbers and may not accurately reflect the diversity (Dawson 1984).

Analysis of all available benthic invertebrate data from within the licence area (Beaumont & Baird, 2010) demonstrated a paucity of information available by comparison with many other areas of Chatham Rise. Data that were available showed there to be high catch weights of sponge within the licence area and there was some evidence to show a possible relationship between the catch weight of sponge and the distribution of phosphorites as mapped by Cullen and Singleton (1977).

The mid Chatham Rise Benthic Protected Area (BPA) is one of 17 BPAs established by Government in 2007 in which the seafloor is protected from fisheries activity involving benthic trawl and dredge gears. The area on which Chatham Rock Phosphate Limited have been granted a licence to prospect for phosphorite nodules lies within the Chatham Rise BPA. The licence area covers approximately 4726 square kilometres in water shallower than 500 m (Figure 1).

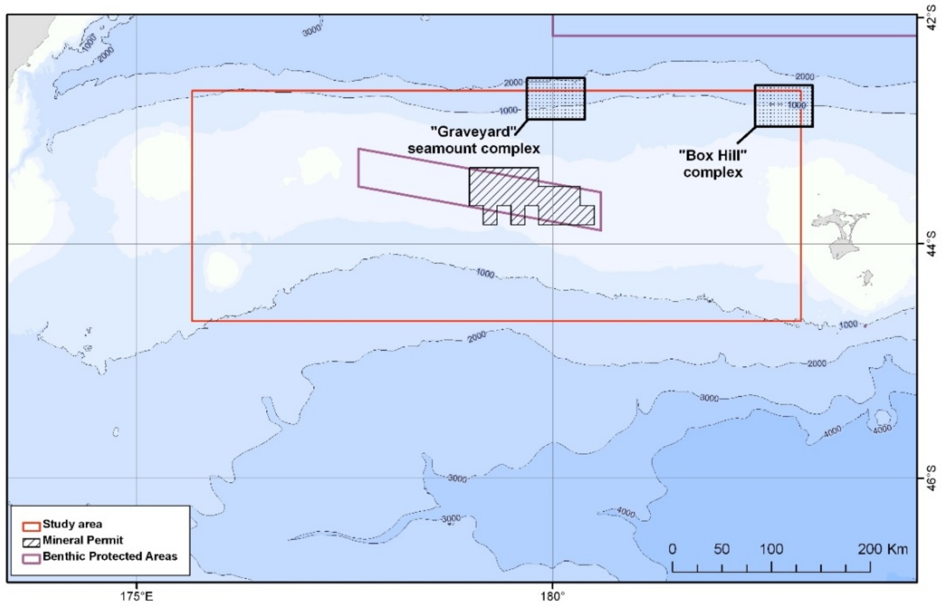

Figure 1: The Chatham Rise study area showing the location of Chatham Rock Phosphate Limited's licensed area for mineral prospecting, the location of the Chatham Rise Benthic Protected Area (BPA), and the approximate location of the Graveyard seamount and Box Hill complexes.

There are also some noteworthy topographic features within the study area. To the north of the licence area is the Graveyard seamount complex (Figure 1). This seamount complex comprises 28 volcanic hill features spread across about 140 km2 on the northern flank of the Chatham Rise. Each seamount is between 100 and 400 m high, rising from depths of between 1050 to 1200 m, resulting in summit depths of between 750 and 1000 m (Clark et al. 2010). These seamounts have been the subject of many scientific studies into the biodiversity and ecology of seamounts (e.g. Clark and Rowden, 2009). To the east of the Graveyard is the Box Hill complex, which includes a main hill (up to 200 m of elevation), three small hills (approximately 50 m elevation) and a small trench area (Tracey et al. 1997). This area is part of or close to a known spawning ground for orange roughy.

1.2 Objective of report

The present study was commissioned to place the benthic invertebrate data from the licence area (Beaumont & Baird, 2010) in the context of the wider Chatham Rise environment to determine if the licence area encompasses benthic habitats, communities and/or species that are not present elsewhere.

Macro- and mega-faunal data available from within the licensed area are summarised in detail in Beaumont and Baird (2010). That report mostly focussed on epifaunal communities, i.e., those animals living directly on the seafloor. Infaunal communities comprise the organisms that live within the sediment. Most are typically microscopic, although larger animals are usually apparent in some samples. In deep-sea studies, these organisms are generally classified according to their relative size. Macrofauna include all animals above a typical sieve size of 300 to 500 µm, with the mesh size dependent on the nature of the study.

In some instances, the larger macrofauna might also be termed megafauna. Meiofauna are those animals that live within the pore spaces between sediment grains and are classified as above 32, 45 or 63 µm, but less than the cut-off for macrofauna. Microfauna include all the single-celled organisms, primarily bacteria and protists, below about 2 µm in diameter, but typically greater than 0.2 µm. As in shallow water soft-sediment environments, infaunal deep-sea communities play significant roles in moderating and mediating the transfer of energy in benthic foodwebs. These organisms are important in the processing and remineralisation of organic matter, in nutrient cycling and in often providing the food upon which other benthic and pelagic organisms in the marine ecosystem rely.

This report describes the epifaunal and infaunal communities of the wider Chatham Rise area. Potential effects on these communities of extracting phosphorite nodules from the Chatham Rise are not discussed in this report. Recommendations for further data collection are also not included.

2 Methods

To put the findings of Beaumont and Baird (2010) into context with respect to the rest of the Chatham Rise, all available databases of epibenthic and infaunal data were queried within a study area encompassing the Chatham Rise from east of the Mernoo Bank to west of the Chatham Islands and out to approximately the 1000 m isobath.

2.1 Databases

Information on benthic invertebrate distributions across Chatham Rise was assembled by interrogation of three long-term databases maintained by NIWA; *Specify, AllSeaBio*, and *Trawl*.

Specify catalogues records of marine invertebrate specimens collected across the New Zealand EEZ and Ross Sea by New Zealand science programmes from 2005 to the present. It is maintained by the NIWA Invertebrate Collection (NIC), where physical specimens are preserved and stored. Records in Specify are qualitative rather than quantitative because generally only a subset of the specimens sampled at each site are recorded. These are often “voucher” specimens or specimens of interest (i.e. new records for a site). This is particularly true for earlier surveys and although it is now common practise to record all specimens collected, the combined data derived for the present investigation must be viewed as presence only, without abundances.

Specify was pre-dated by *AllSeaBio*, which captured biological samples retained in the NIC from 1950 until 2005.

Trawl contains records of biological samples collected during research trawl surveys using NIWA vessels (for example see Stevens et al. 2009). The principal objective of the Trawl survey programme, which generates the data within the *Trawl* database, is to survey fish stocks for fisheries management. However, the identities and weights of all benthic invertebrate bycatch are recorded routinely also. Data are recorded as wet weight of each taxonomic group or species together with a location (the start and finish positions of each trawl), making this one of the few quantitative datasets available. Trawls are standardised with a 3 n. mile tow length at each site. It should be noted that because the trawl surveys are primarily targeting fish populations the gear types used are not ideal for sampling benthic invertebrates. These limitations are discussed further in section 4.1

NIWA's M*arinedb* station database records the position information, gear types used and depth of all sampling stations from NIWA scientific voyages. This was queried to provide voyage details and station numbers for infaunal data. Data from each of these voyages were summarised from published literature.

The Ocean Survey 20/20 voyages to the Chatham Rise and Challenger Plateau (to the west of New Zealand) were comprehensive sampling initiative aimed at describing patterns of benthic habitat and biological diversity across extensive areas of the EEZ (Hewitt et al., in review). All data collected on these voyages are catalogued in *Specify*. These data have been analysed by Hewitt et al. (in review) within the Chatham-Challenger Ocean Survey 20/20 post-voyage analyses project (ZBD2007-01, Specific objective 10: *Biotic habitats and their sensitivity to physical disturbance*). This work is currently in review with the Ministry of Fisheries, and has yet to be peer-reviewed for publication. Following completion of the review process, the report by Hewitt et al. (in review) will be publically available as a New Zealand Aquatic Environment Biodiversity Report. However, the biotic habitat classifications in the report are pertinent to Chatham Rock Phosphate Limited's information requirements and are referenced within the current report.

2.2 Data analysis

Data from *Specify, Allseabio* and *Trawl* were combined at the lowest taxonomic level identified for each specimen, to indicate taxonomic richness within the study area using presence/absence data. Because identifications vary widely in their taxonomic detail (e.g. from species to family, order, or class) all are referred to here as "taxa".

Spatial analyses were carried out using a geographic information system (GIS, ESRI ArcGIS). The study area was overlaid with a regular grid of 20 x 20 km cells and the total number of benthic taxa recorded in each grid cell was calculated using all available taxon data. Totals were calculated for each major taxonomic group separately. Quantitative catch weight data from the *Trawl* database were also plotted in the GIS to show the spatial distribution, of catch weights, per phyla within the study area.

3 Results

Specimen data located within the study area were from 30 different scientific voyages.

3.1 Taxon richness

Figure 2 shows the sampling effort, per grid cell, across the study area. The majority of sampling in the area has been targeted at the Graveyard seamount and Box Hill complexes as well as the 1000 m isobath. Relatively little sampling has occurred on the central Chatham Rise, particularly in the vicinity of the BPA.

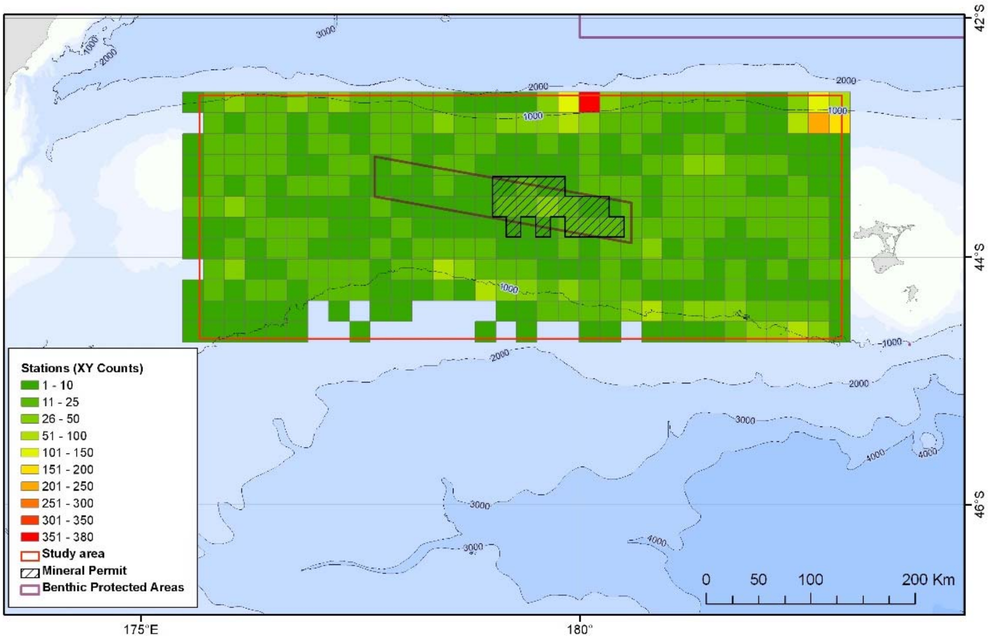

Figure 2: Number of sampling stations within the study area.

The highest number of taxa within the study area for all taxonomic groups, with the exception of the annelida, occurred on the Graveyard seamount complex (Figures 3 to 10).

Benthic and demersal fish had the greatest number of taxa within the study area with a maximum of 152 per cell (Figure 3). These fish were also recorded in almost all cells within the study area. Cells around the 1000 m contour lines had consistently high taxon richness, the highest of which were associated with the graveyard seamount complex, the Box Hill complex and a few areas in the NW of the study area. The lowest values of taxon richness for benthic and demersal fish were on the southern slope of the Chatham Rise in depths below 1000 m (with one exception in the far SW of the study area, in less than 1000 m depth south of Mernoo Bank). Intermediate values of taxon richness of benthic and demersal fish, ranging from 25 to 100 taxa per cell, were recorded on the central Chatham Rise, including Chatham Rock Phosphate Limited's licensed area.

Cephalopods (octopus and squid) were also recorded in almost all cells within the study area (Figure 4). These mobile molluscs showed a similar spatial distribution with respect to taxon richness to the benthic fish with the highest values recorded on the Graveyard seamount complex (up to 16 taxa per cell) and high values around the 1000 m depth contour. Cells in the licensed area had relatively low values of taxon richness, of between 1 and 8.

Porifera, the sponges, were recorded from the majority of cells within the study area, mostly with low (1 to 3) values of taxon richness (Figure 5). Cells with the highest number of taxa were over the Graveyard seamount complex, as well as a cell to the NW of the BPA. Sponge taxon richness was higher on the crest of the Chatham Rise than on the flanks, with many cells over the Chatham Rise flanks containing no porifera records. Relatively low numbers of taxa were recorded within the licensed area.

Crustacea were present in almost all cells within the study area, with the highest number of taxa per cell recorded over the Graveyard seamount complex (up to 40 per cell) (Figure 6). There were also some relatively high values of taxon richness along the 1000 m contour to the north of the Chatham Rise. The central Chatham Rise, including the BPA and Chatham Rock Phosphate Limited's licensed area, had relatively low values of taxon richness (between 1 and 15).

Echinoderms were also present in the majority of cells within the study area (Figure 7). Cells with the highest number of taxa were over the Graveyard seamount complex, with values up to 45 taxa per cell. With the exception of a few scattered cells on the main Chatham Rise with a taxon richness of between 20 and 30, the majority of cells within the study area had relatively low values. However, there does appear to be a slight east – west difference with more very low values in the west of the study area with slightly higher values in the mid and east of the study area, including the licence area (with taxon richness up to 20 per cell).

Mollusc (gastropods and bivalves) taxon richness was higher on the crest than on the flanks, with the exception of the Graveyard seamount complex area which had the highest mollusc taxon richness with up to 25 taxa per cell (Figure 8). There were also relatively high values of taxon richness (11-15) on the mid Chatham Rise, including immediately to the south of the BPA and licensed area.

Cnidaria (hard and soft corals, anemones, etc.) were present in most grid cells within the study area. The highest number of cnidaria taxa (up to 30 per cell) was recorded at the graveyard seamount complex to the north of the study area (Figure 9). However, it should be noted that high numbers of cnidaria taxa (up to 16 per cell) were also recorded immediately to the north of Chatham Rock Phosphate Limited's licensed area. These taxa included the deep sea anemones (Actinostolidae and Hormathiidae); corals including the bamboo coral (Keratoisis spp.), soft corals (Alcyonacea), cup corals, (*Desmophyllum dianthus* and *Flabellum spp*.), scleractinia (*Madrepora oculata*, *Goniocorella dumosa* and a bottle brush coral); and sea pens (Pennatulacea). The remainder of the Chatham Rise had relatively low cnidarian taxon richness.

Annelida (polychaetes and other worms) were the most poorly represented taxonomic group with no records in many of the grid cells within the study area (Figure 10). The highest annelida taxon richness was recorded on the west of the BPA, with up to 10 taxa per cell. However, their relatively high taxon richess was also recorded in grid cells scattered around the study area, including cells within and in the vicinity of the BPA, and on the western edge of Chatham Rock Phosphate Limited's licensed area.

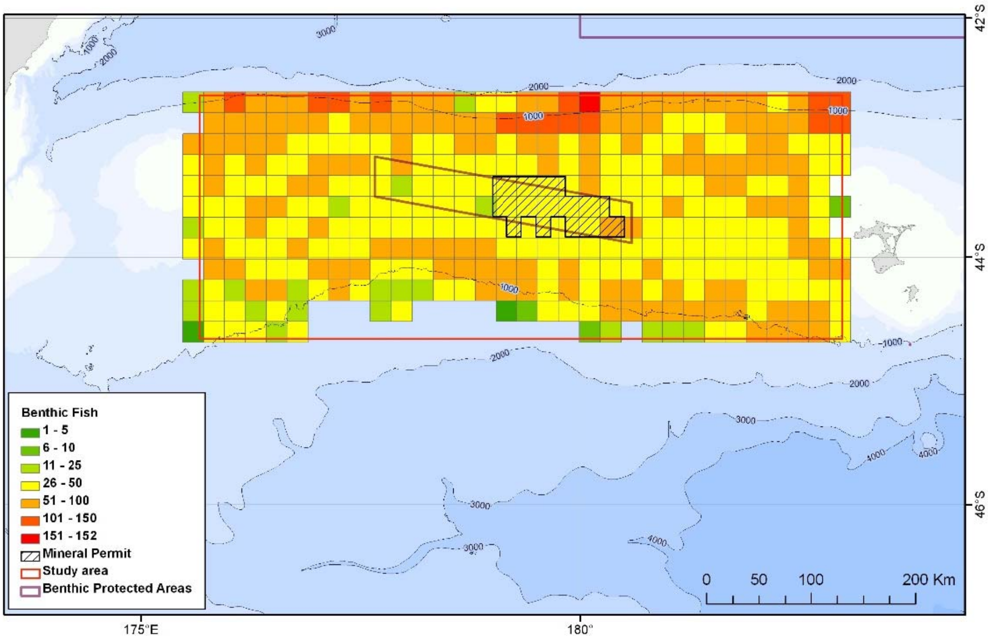

Figure 3: Benthic and demersal fish. Number of taxa per 20 x 20 grid cell within the study area. Tuna, Marlin and Swordfish were excluded from the analysis.

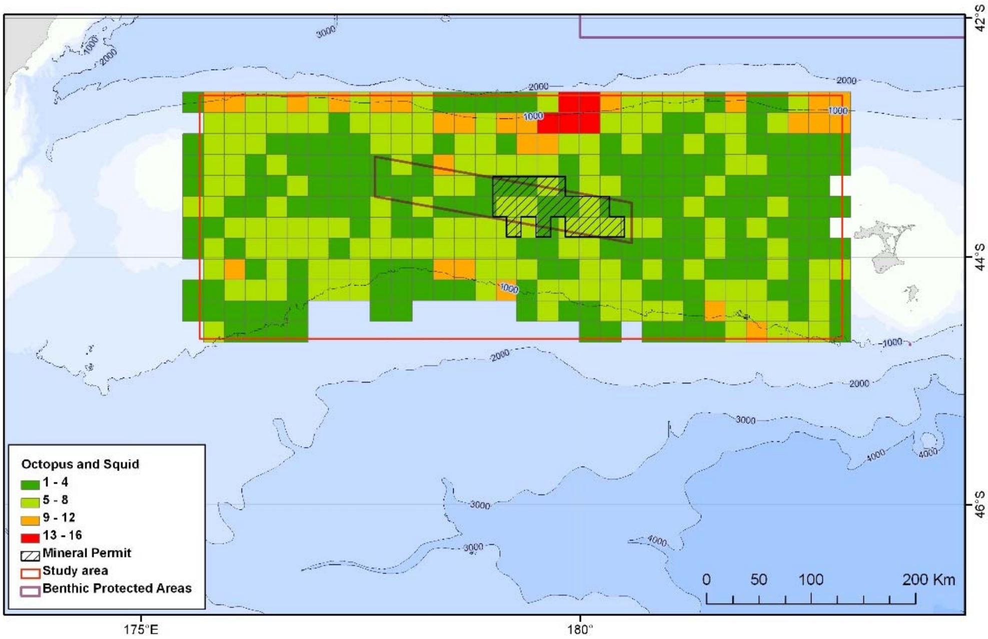

Figure 4: Octopus and squid. Number of taxa per 20 x 20 grid cell within the study area.

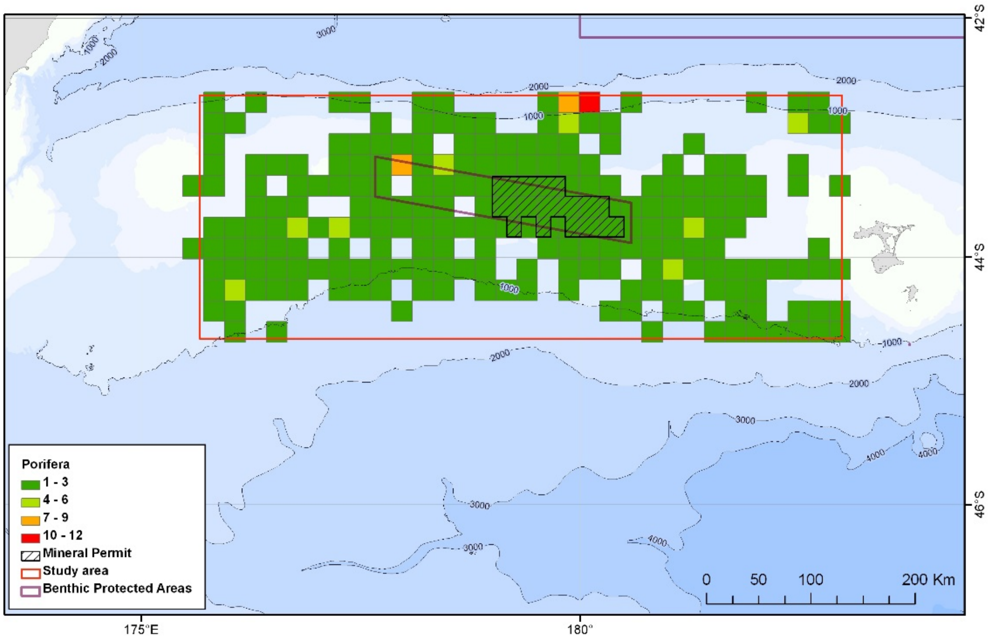

Figure 5: Porifera. Number of taxa per 20 x 20 km grid cell within the study area.

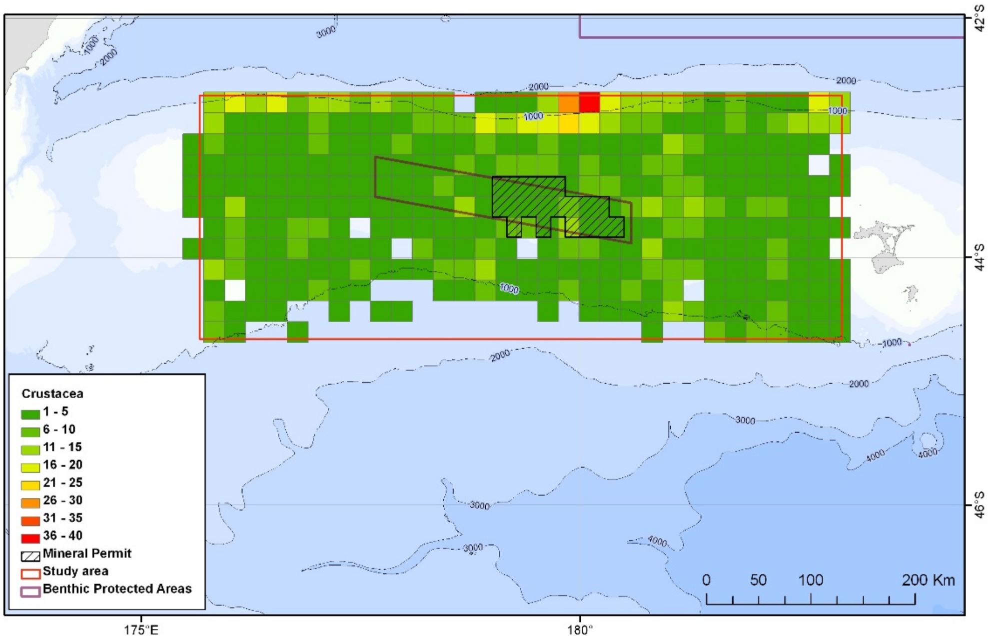

Figure 6: Crustacea. Number of taxa per 20 x 20 km grid cell within the study area.

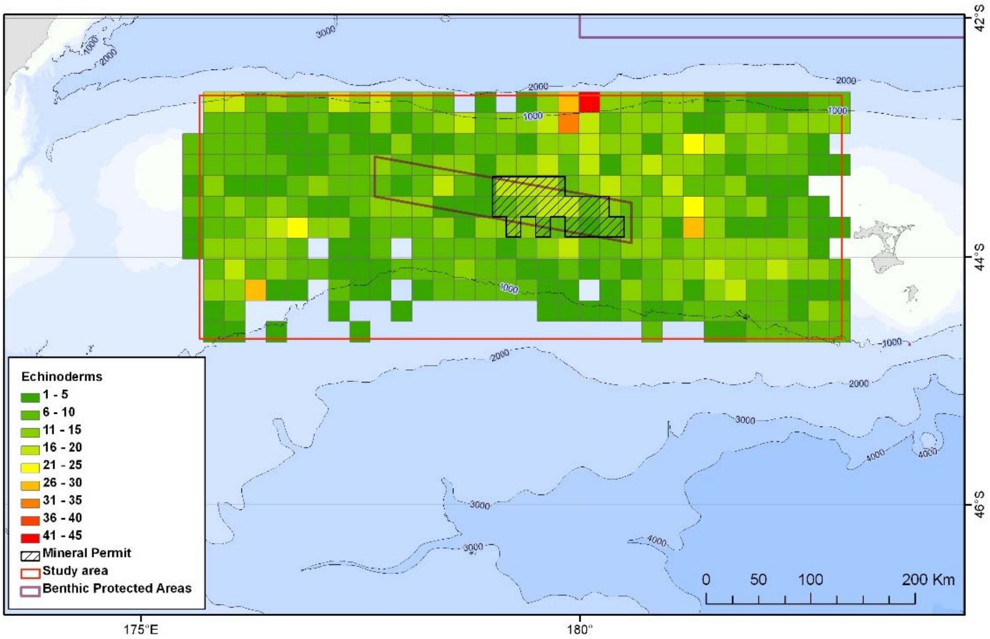

Figure 7: Echinoderms. Number of taxa per 20 x 20 km grid cell within the study area.

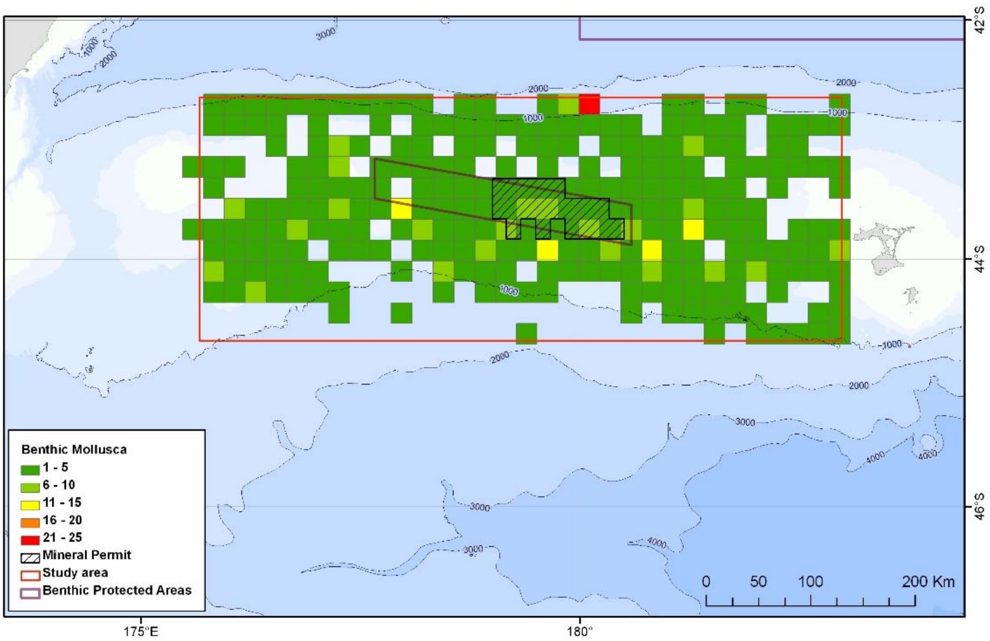

Figure 8: Benthic mollusca. Number of taxa per 20 x 20 km grid cell within the study area.

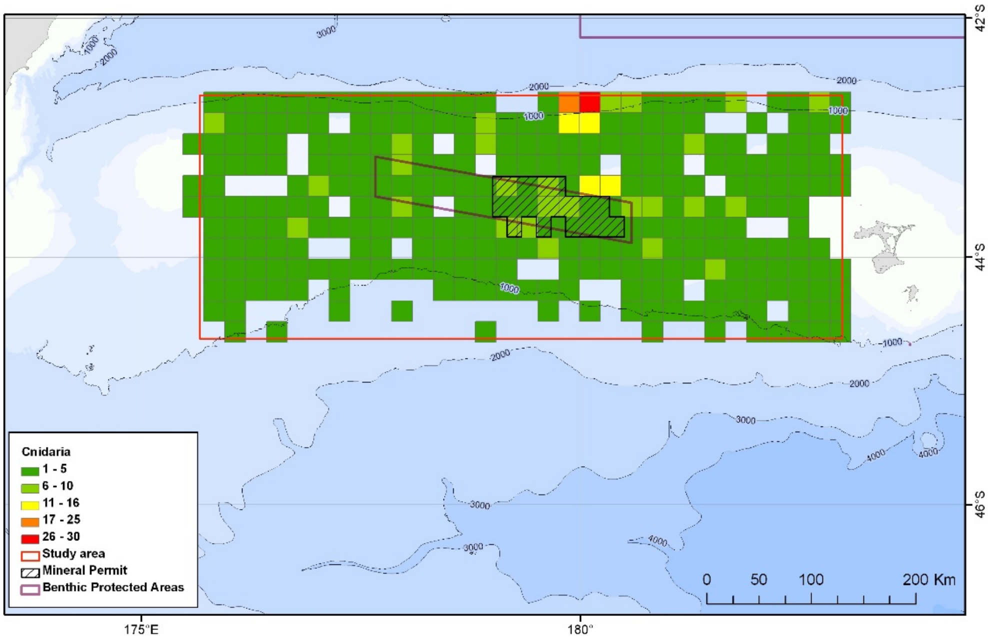

Figure 9: Cnidaria. Number of taxa per 20 x 20 km grid cell within the study area.

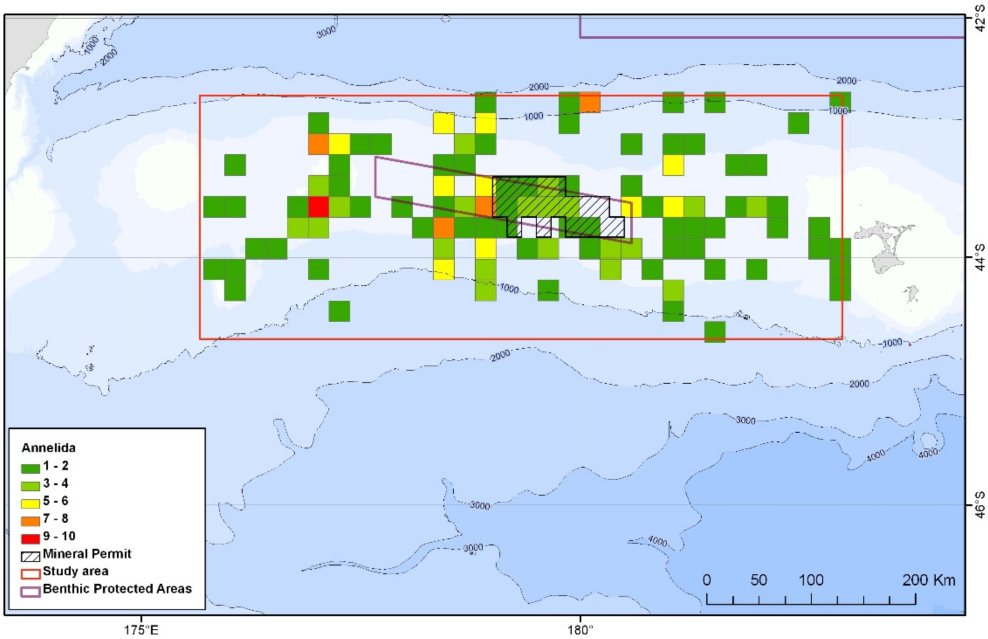

Figure 10: Annelida. Number of taxa per 20 x 20 km grid cell within the study area.

3.2 Catch weights (*Trawl* database only)

The Chatham rise has been relatively well sampled by fisheries research trawl programmes, with 111,515 records (species/taxa at a location) collected from 1972 to present. The locations of these records are plotted in Figure 11 where it can be seen that much of the sampling has targeted the 1000 m contour on both the north and south of the Chatham Rise as well as the seamount sites to the north and NE of the Rise. Sampling density across the Rise itself, including the Benthic Protected Area (BPA) and the licensed area, is relatively low.

The distribution patterns of taxonomic groups recorded within the Trawl database on the Chatham Rise are described in Figures 12 to 22 below. Although this report focuses on the macrobenthic invertebrates found on the Chatham Rise, benthic and demersal fish have been included in the analysis. There were 94,015 records of these fish in total. In order to plot a useful distribution of benthic and demersal fish on the Chatham Rise, only those trawls with catches of greater than 1000 kg were plotted (Figure 12). It is apparent that the greatest biomass of these fish (which include chimaera, rattails, eels, flatfish, rays and sharks) occurs on the 1000 m contour to the south of the Chatham Rise as well as at the Graveyard seamount and Box Hill sites to the north of the Rise. This latter area is also known as an orange roughy spawning area. There is also an area of high catch weight along the western 250 m contour to the east of the Chatham Rise. Few catches of greater than 1000 kg of fish (benthic and demersal) were recorded within either the Chatham Rise BPA or the licensed area.

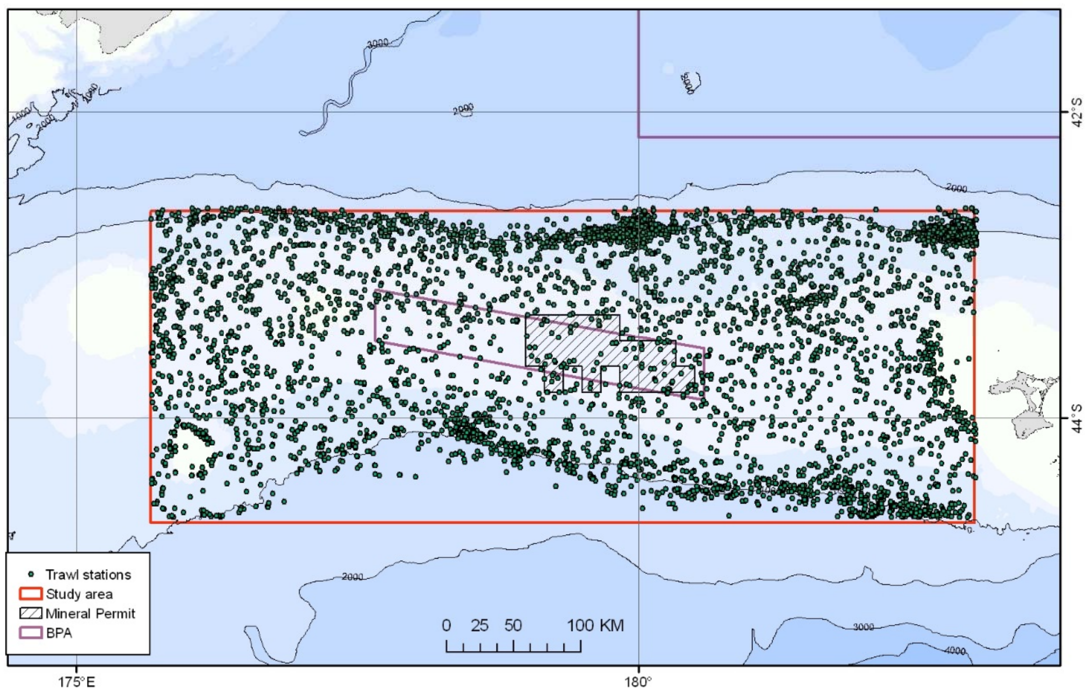

Figure 11: The location of trawl stations within the Chatham Rise study area.

Figure 13Squid follow similar distribution patterns to that of the fish (Figure 13). The greatest density of squid records are on the 1000 m contour, both to the north and south of the Chatham Rise and particularly in the Graveyard Seamount complex, the Box Hill complex, and the 250 m contour around the Chatham Islands. Large catch weights (up to 5000 kg) were recorded on the Graveyard complex, on the 250 m contour to the east of the Chatham Rise. There were also some large catches to the west and southwest of the BPA, particularly around the 250 m contours. All catch weights of squid from within the BPA and the licensed area were in the 0 to 50 kg range.

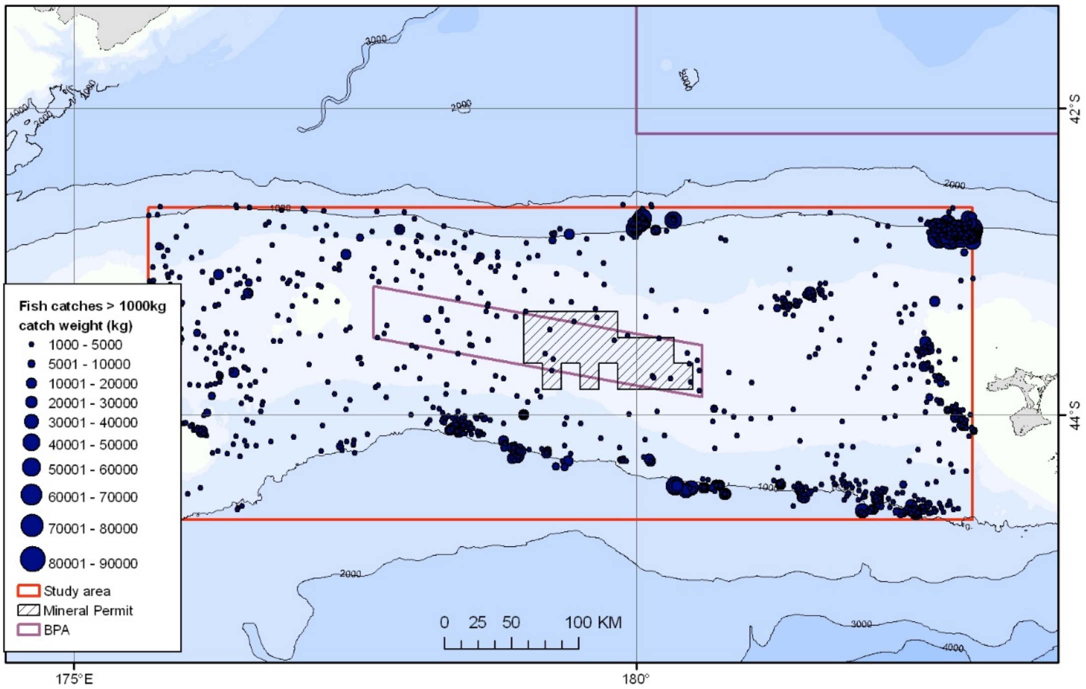

Figure 12: Benthic and demersal fish. Figure shows the largest 1,490 catches (all catches greater than or equal to 1000 kg) of 94,015 fish records within the study area.

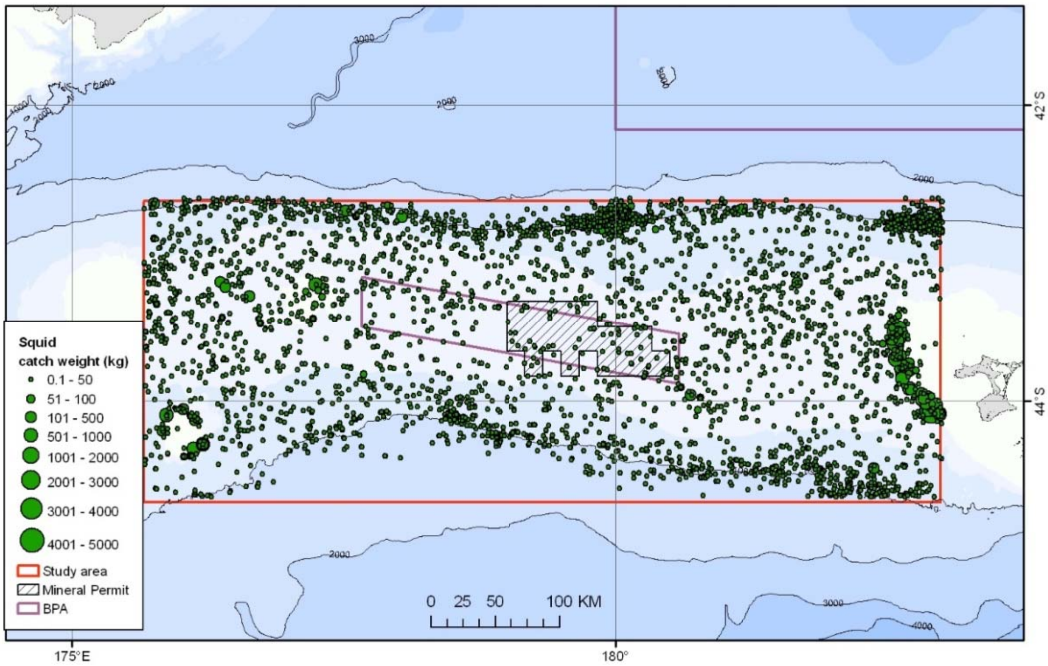

Figure 13: Squid. The location and catch weights of squid within the study area.

In contrast to fish and squid, the distribution of octopus on the Chatham Rise was focussed on the central Rise between the 250 m to 500 m depth contours (Figure 14). The greatest catch weights (up to 20 kg) were recorded on the edge of the licensed area, in the BPA, and in patches to both the east and west of the southern half of the Chatham Rise. Most of the records of octopus from greater than 500 m are of the *Granelodone spp*., the deep water octopus (Figure 15). It is interesting to note that the distribution of the other octopus species (most of the large catch records were of *Pinnoctopus cordiformis*) is very similar to that of the distribution of sponges (Figure 16).

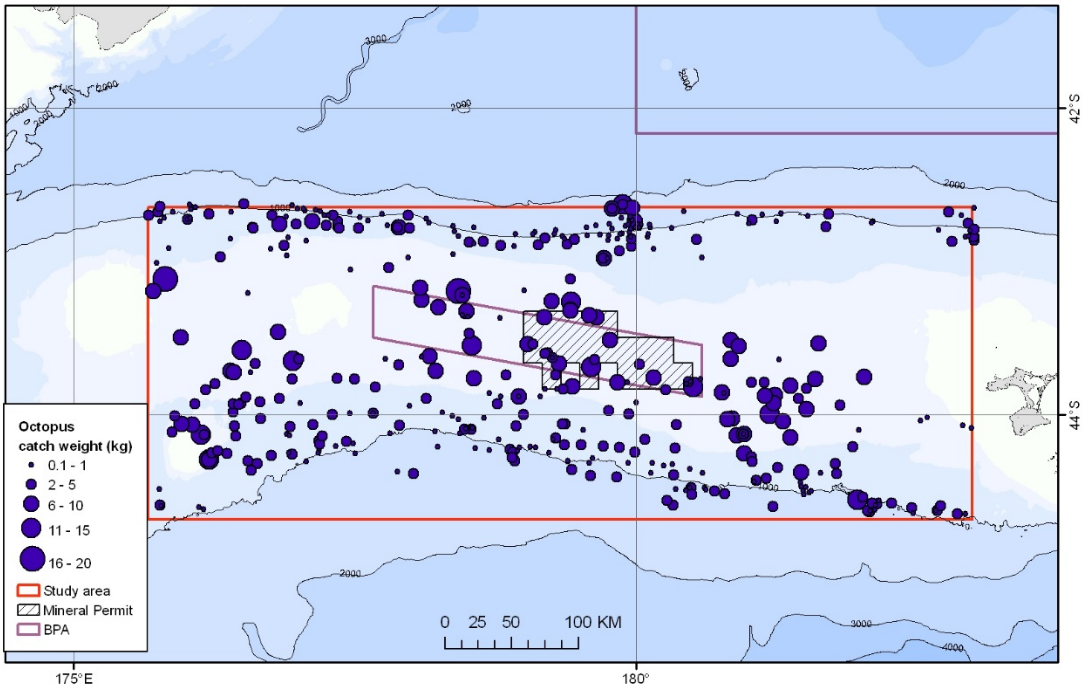

Figure 14: Octopus. Location and catch weight of all octopus within the study area.

Four main areas of sponge bed are apparent from the catch weight data. Of these, the greatest catch weights of sponge, representing the largest or most dense sponge beds, were recorded around the northern and southern boundaries of the BPA and particularly in the eastern half in and around Chatham Rock Phosphate Limited's licensed area.

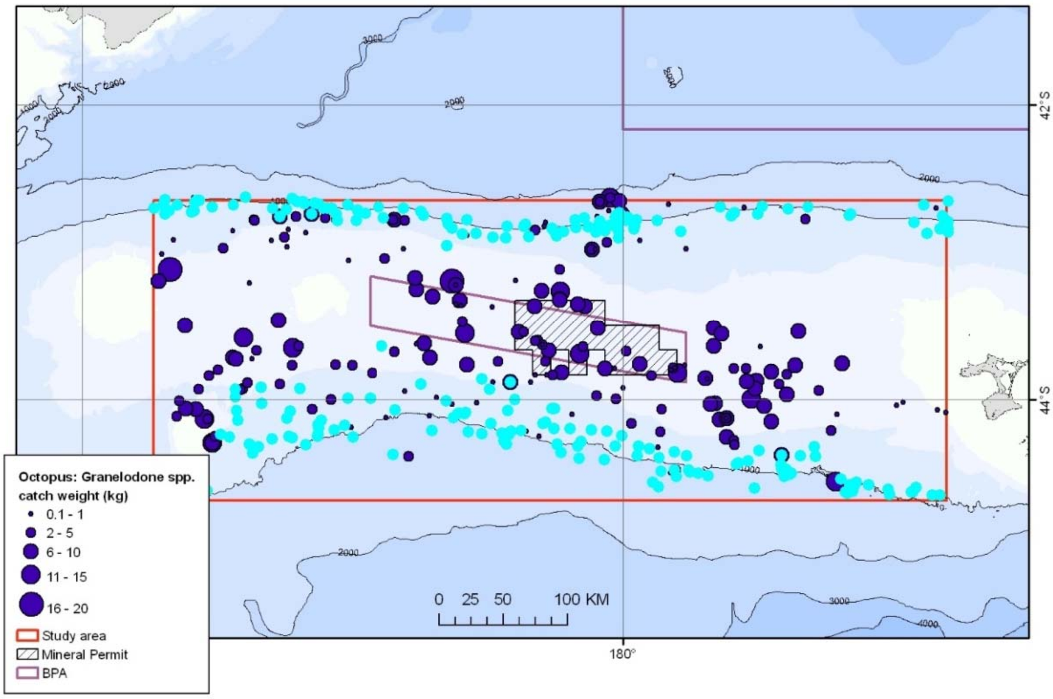

Figure 15: Octopus: *Granelodone* spp. Location and catch weights of the *Granelodone* spp. (deep water octopus) within the study area. *Granelodone* spp. records are highlighted in turquoise.

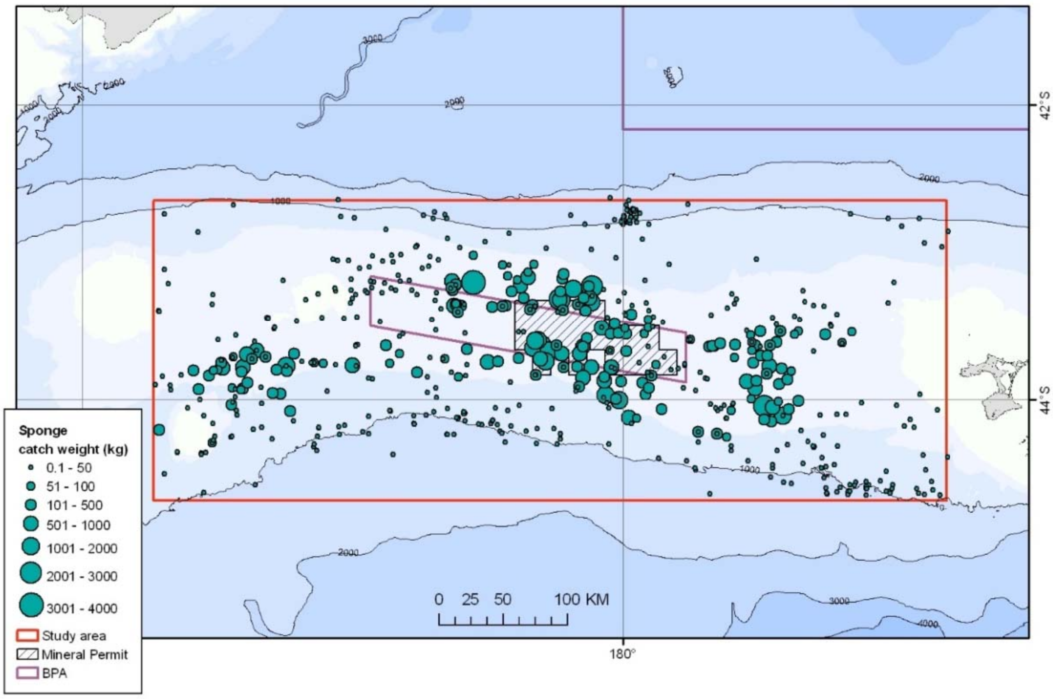

Figure 16: Sponge. Location and catch weight of sponges (porifera) within the study area.

Catch weights of crustacea were generally less than 10 kg across the Rise (Figure 17). The graveyard seamount complex and Box Hill complex, both on the northern 1000 m contour, had the greatest number of crustacean records in the study area. Twenty-eight records of crustacea had catch weights of 10 kg or more. All of these were catches of scampi, *Metanephrops challengeri*, with the exception of an 11 kg catch of rock lobster, *Jasus edwardsii*, on the 250 m contour a the Chatham Islands, on the eastern boundary of the study area, a 12.4 kg catch of the crab, *Paralomis hystrix*, approximately 25 km to the south of the licence area, and a 10 kg record of “crab” in the southwest of the study area. The largest catch weights of *M. challengeri* were recorded in the far west of the study area, on the NE flank of the Mernoo Bank.

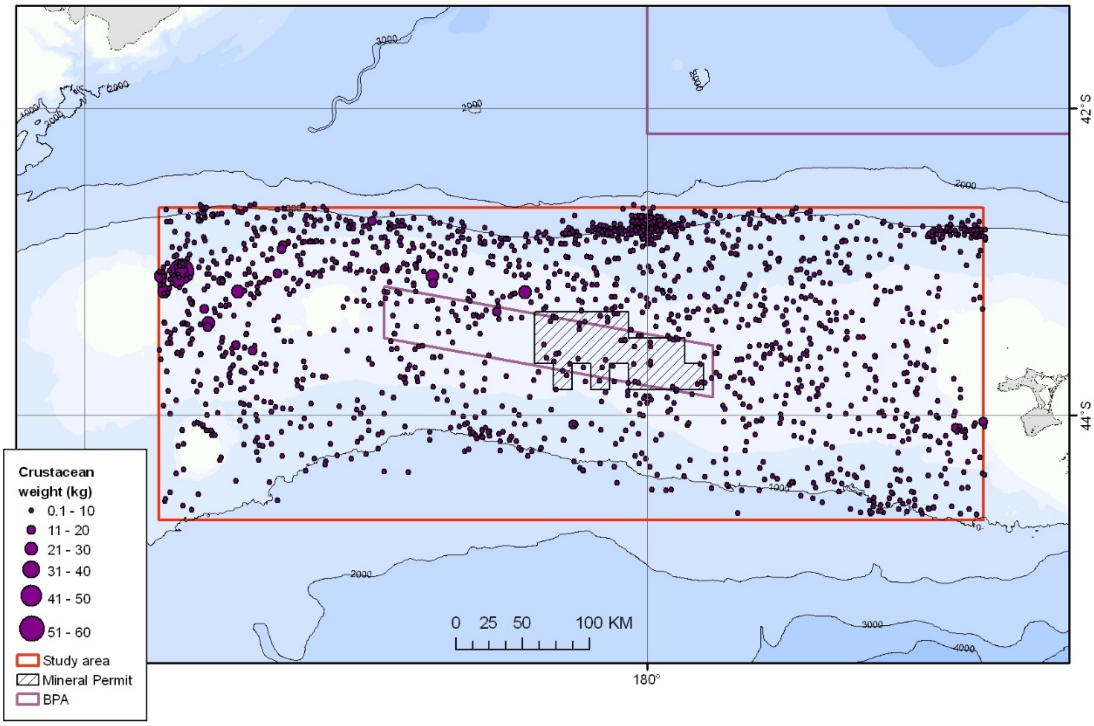

Figure 17: Crustacea. Location and catch weights of crustacea within the study area.

The majority of records for echinoderms were associated with the graveyard seamounts complex and the 1000 m depth contour nearby (Figure 18), although there were also a large number of records in the Box Hill complex area and around the 1000 m contour on the southern slope of the Chatham Rise. Records of echinoderms on the central Chatham Rise are relatively sparse. The highest catch weights recorded, up to 3001 kg, were located on the 1000 m contour to the west of the Graveyard seamounts complex. All of the 10 records over 100 kg to the north of the BPA and licensed area were around the 1000 m contour line, and all were records of holothurian catches. There were also some relatively high catch weights (100 – 200 kg) to the south of the BPA between 500 and 1000 m and, with the exception of one “echinoderm” record, these were all urchin records, *Gracilenchinus multidentatus*.

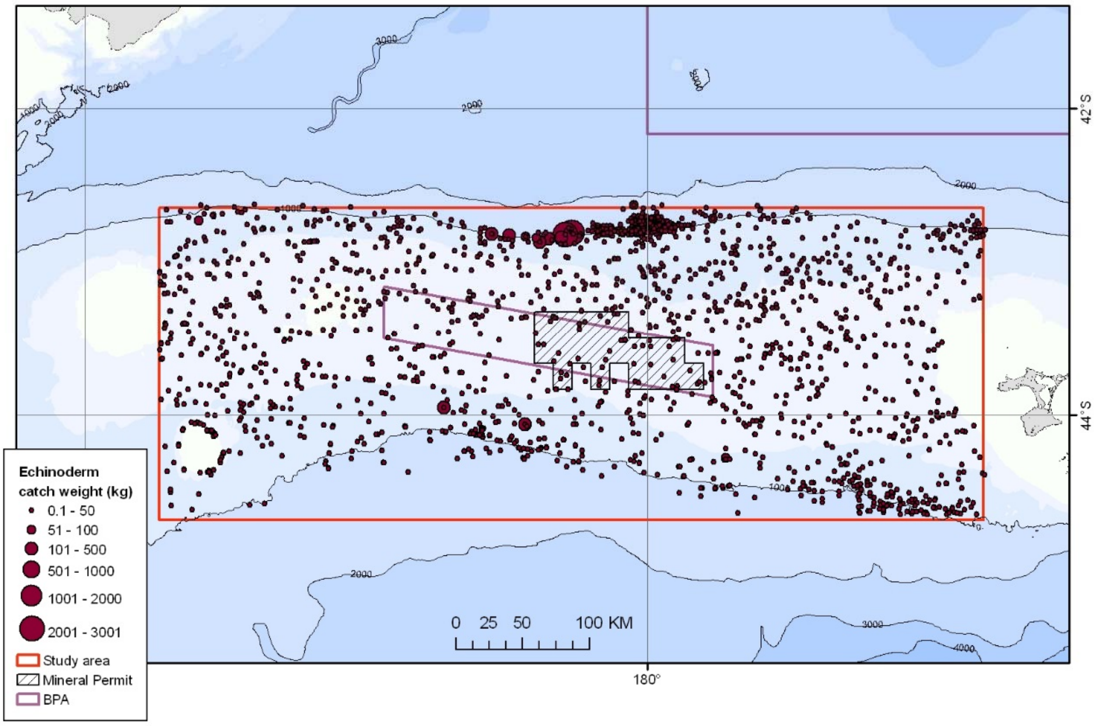

Figure 18: Echinoderm. Location and catch weights of echinoderms within the study area.

Benthic molluscs (excluding squid and octopus) were sparsely distributed across the Chatham Rise, with catch weights mostly less than 1 kg (Figure 19). However, with the exception of one large "mollusc" record on the Graveyard seamount complex, the largest catch weights were recorded in the vicinity of Chatham Rock Phosphate Limited's licensed area. The greatest catch weight was to the south of the SW corner of the licensed area where 6 kg of "gastropods" and 4 kg of *Fusitron magellanicus*, a large gastropod, were recorded. A large catch of bivalves (3 kg) was also recorded in the northwest corner of the licensed area.

Ten records of the giant limid bivalve, *Acesta* spp., noted as a potentially range restricted and important organism on the Chatham Rise in Beaumont and Baird (2010), were found within the study area (Figure 20). Both *A. maui* and *A. saginata* are known to have a wider distribution around the New Zealand region and are not restricted to the Chatham Rise (Te Papa online collection).

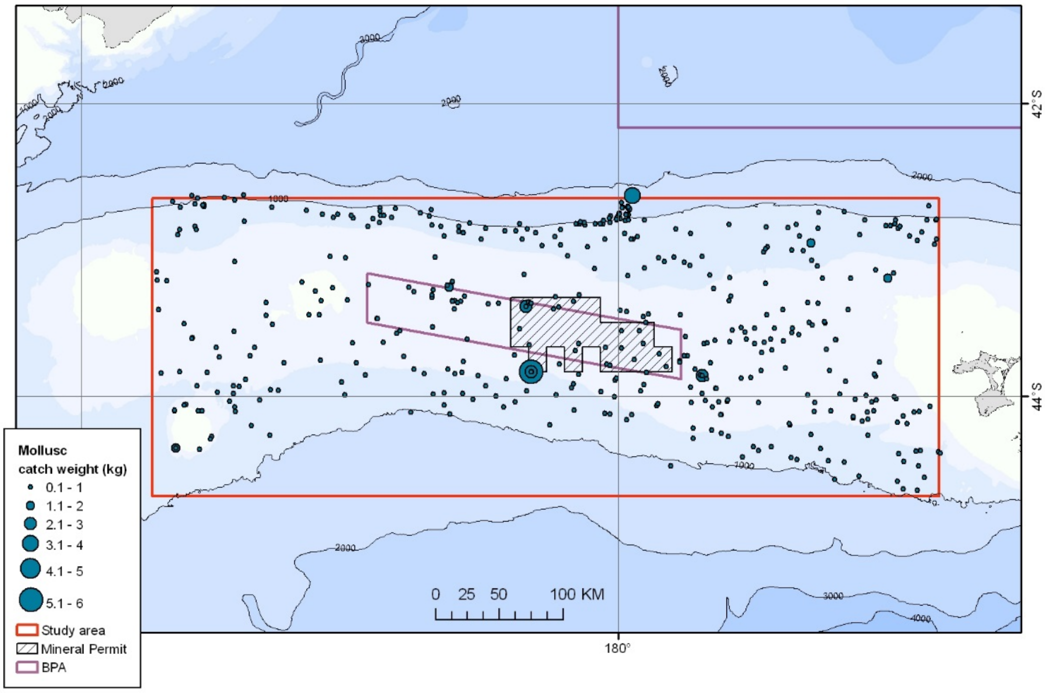

Figure 19: Benthic mollusc. Location and catch weight of benthic molluscs within the study area.

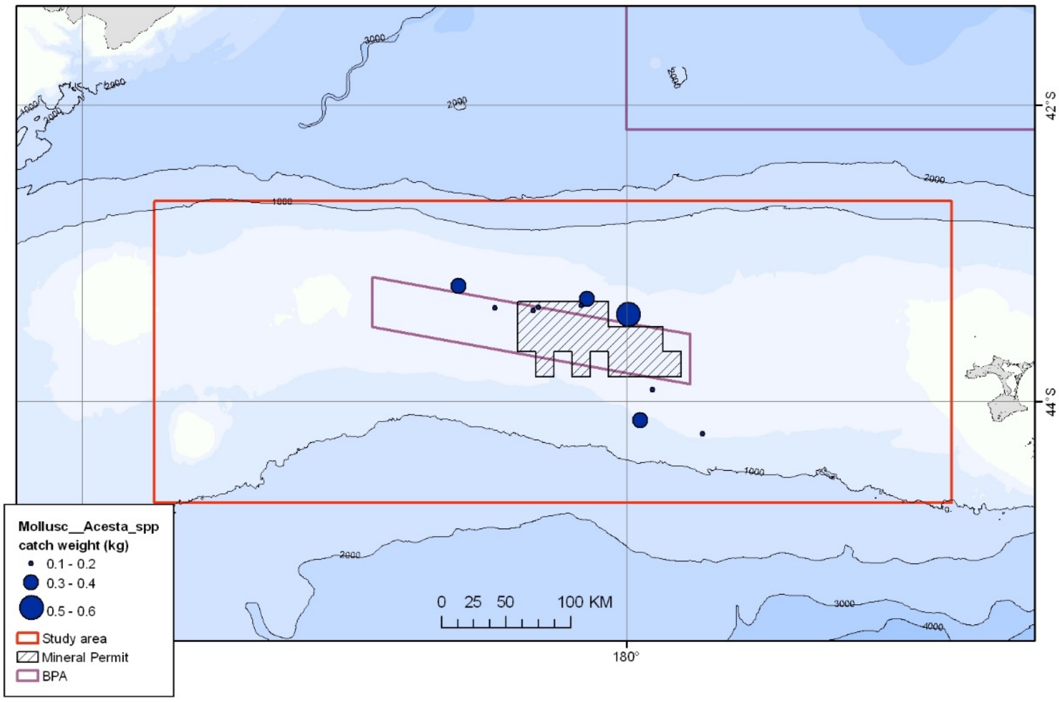

Figure 20: *Acesta spp*. Location of records of the giant limid bivalve, *Acesta* spp., within the study area. There were 9 records of *Acesta maui* and 1 record of *Acesta saginata*.

The majority of records of cnidaria, including the hard and soft corals and anemones, and the greatest catch weights in the study area were recorded from the Graveyard seamount complex (Figure 21). Catch weights were recorded up to 3000 kg. Cnidarian records from the remainder of the Chatham Rise, including the BPA and licensed area, were sparsely distributed with catch weights up to 50 kg.

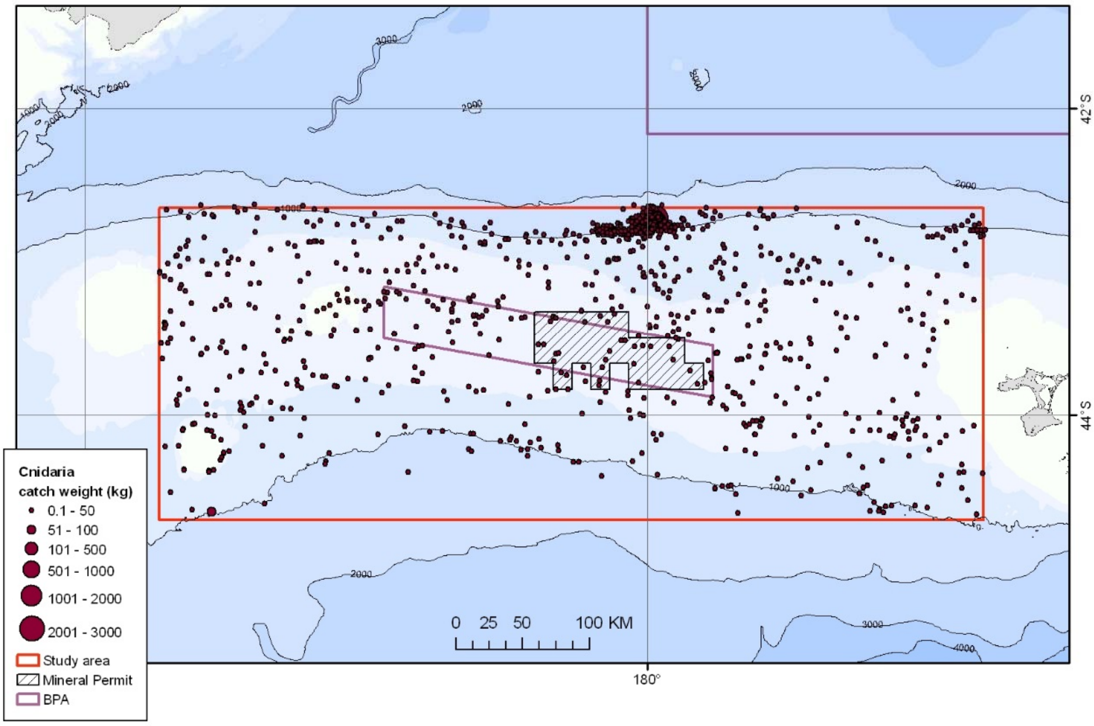

Figure 21: Cnidaria. Location and catch weights of benthic cnidaria within the study area. Records of jellyfish were excluded from the dataset.

The polychaetes had a very sparse distribution within the Chatham Rise study area (Figure 22), with most records having a catch weight of < 1 kg. However, close to the eastern boundary of the licensed area was a catch of 7 kg of *Eunice* sp., a large polychaete.

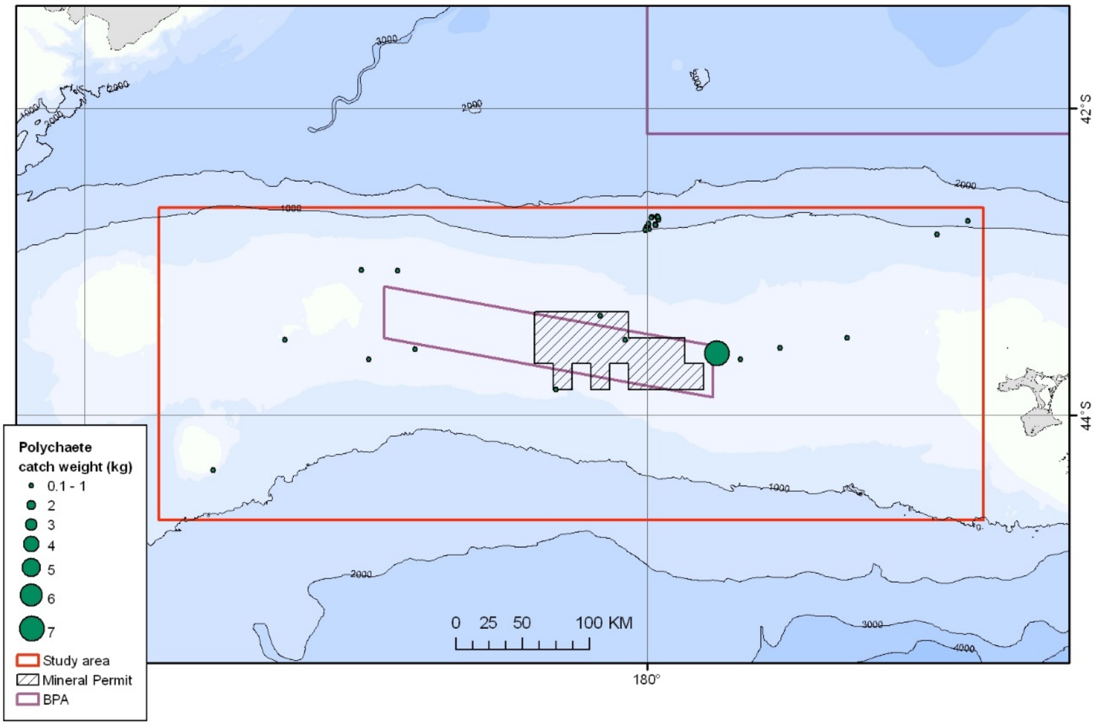

Figure 22: Polychaete. Location and catch weights of polychaetes within the study area.

3.3 Biotic habitats (Hewitt et al, in review)

Hewitt et al. (in review) has described nineteen spatially contiguous biotic habitats across the Chatham Rise (and Challenger Plateau), many of which were found to be associated with specific environmental factors or locations (Table 1). Eight major habitats, each represented by at least 3 sampling sites, were found on the Chatham Rise. Figure 23 shows the spatial distribution of these habitats within the Chatham Rise where it can be seen that sampling occurred over much of the Chatham Rise, but not within Chatham Rock Phosphate Limited's licensed area. However, sampling occurred in the vicinity of the licensed area and showed habitats B2, B5 and B7 to be dominant in that part of the Chatham Rise.

Table 1: Biotic habitat descriptions on the Chatham Rise taken from Hewitt et al. (in review).

Biotic habitat	Characterising taxa, functional attributes and biodiversity	Depth	Environmental characteristics
B1	Dominated by high densities of *Ophiomusium lymani* with low beta diversity, evenness and Simpson's diversity and a high proportion of infaunal species rare in abundance	1080 (212)	Low roughness, very muddy, high TOM
B2	Variable communities of sedentary epifauna (the Anthozoa *Radicipes* & *Anthioptilum* and the Sponge Cladhorizidae) providing habitat structure, mobile bioturbating Decapods (*Pycnoplax victoriensis, Campylonotus rathbue*) and small infauna.	469 (78)	Shallow, muddy, moderate detritus
B4	Dominated by mobile deposit feeders (the echinoid, *Gracilechinus multidentatus*, with some Ophiuroids and a Holothurian), low epifaunal Simpson's index and evenness.	1039 (265)	Low calcium carbonate, high phytodetritus
B5	Variable communities of surface bioturbators (Parapaguridae, Onuphids and Gastropods), containing some erect habitat structure (sponges), with a very varied community sampled by beam trawl	466 (114)	Shallow, low roughness, muddy
B6	Dominated by bioturbators (Parapaguridae and Spatangidae, Shrimps and 2 infaunal Gastropods) containing some erect habitat structure (sponges).	460 (255)	High phytodetritus
B7	Dominated by bioturbators (Decapods *Munida gracilis* & *Notopandalus magnoculus*) with moderate habitat structure (Chaetopterids), high epifaunal beta diversity.	370 (120)	
B8	Variable communities containing a Caridea decapod and a Holothurian with Parapaguridae, Gastropods, and an infaunal Sipunculid. Dominated by mobile bioturbators	930 (140)	Very muddy, moderate roughness and phytodetritus
B9	Variable community of deposit feeders, scavengers and burrowers, with high epifaunal species richness	927 (139)	Sandy mud, low phytodetritus
M10	Dominated by Anemones		High currents, sandy, low TOM, high calcium carbonate

Biotic habitat	Characterising taxa, functional attributes and biodiversity	Depth	Environmental characteristics
M11	Dominated mainly by mobile epifauna (Asteroids & Decapods) with some anemones	445	Very rough, low currents, moderately sandy and calcium carbonate, high phytodetritus
M12	Dominated by mobile epifauna and bioturbators (Holothurians & Shrimps)		
M13	Variable community (Polychaetes, Encrusting Sponges, Bryozoans and Anemones) with high habitat structure	124	
M14	Mobile epifauna (Holothurians & Ophiuroids)	1290	
M15	Sponges	80	
M16	Surface bioturbator (*Spatangus* sp.)	1816	
M18	Decapod (*Teratomaia richardsoni*) with habitat structure (Halichondrid)	187	
M19	Anthozoa and Scaphapoda	250	

Habitat B2, to the north of the licensed area, was characterised by variable communities of sedentary epifauna (e.g. anthozoa and sponges) providing habitat structure as well as mobile bioturbating decapods and small infauna. Habitat B5, to the south and east of the licence area, was characterised by variable communities of surface bioturbators (e.g. squat lobsters and gastropods) and some sponges providing erect habitat structure. Habitat B7, to the west of the licence area (with some occurrences to the south and east) was dominated by bioturbators (e.g. squat lobsters and prawns) with beds of erect tube worms (Chaetopterids) providing moderate habitat structure and a high epifaunal beta diversity (Hewitt et al., in review).

A diverse suite of functional traits and body types were present in the study sites, with biotic habitats generally differing between the northern and southern sides of the Chatham Rise (Hewitt et al., in review). However habitats were often dominated by suspension feeding and arborescent sessile species including sponges, anemones and bryozoans.

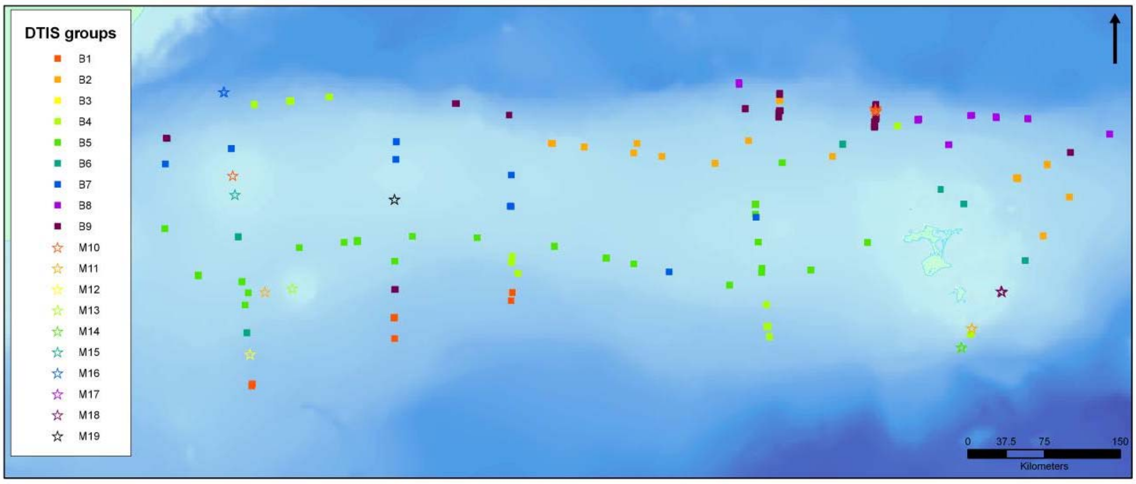

Figure 23: Spatial pattern of biotic habitats across the Chatham Rise (taken from Hewitt et al., in review).

3.4 Review of soft-sediment, infaunal, communities.

Semi-quantitative (e.g., from trawls and grabs) and quantitative information (e.g., from box corers and multicorers) on soft-sediment infaunal communities from the Chatham Rise is sparse. A summary of studies conducted and stations occupied by NIWA and its predecessor, the New Zealand Oceanographic Institute (NZOI), is provided in Appendix I, with station locations, relative to Chatham Rock Phosphate Limited's mineral prospecting licence area, depicted in Figure 24. Aspects of the Chatham Rise benthic biological communities and relationships to seabed habitats are summarised further by Carney (2005) and Nodder et al. (2010, submitted).

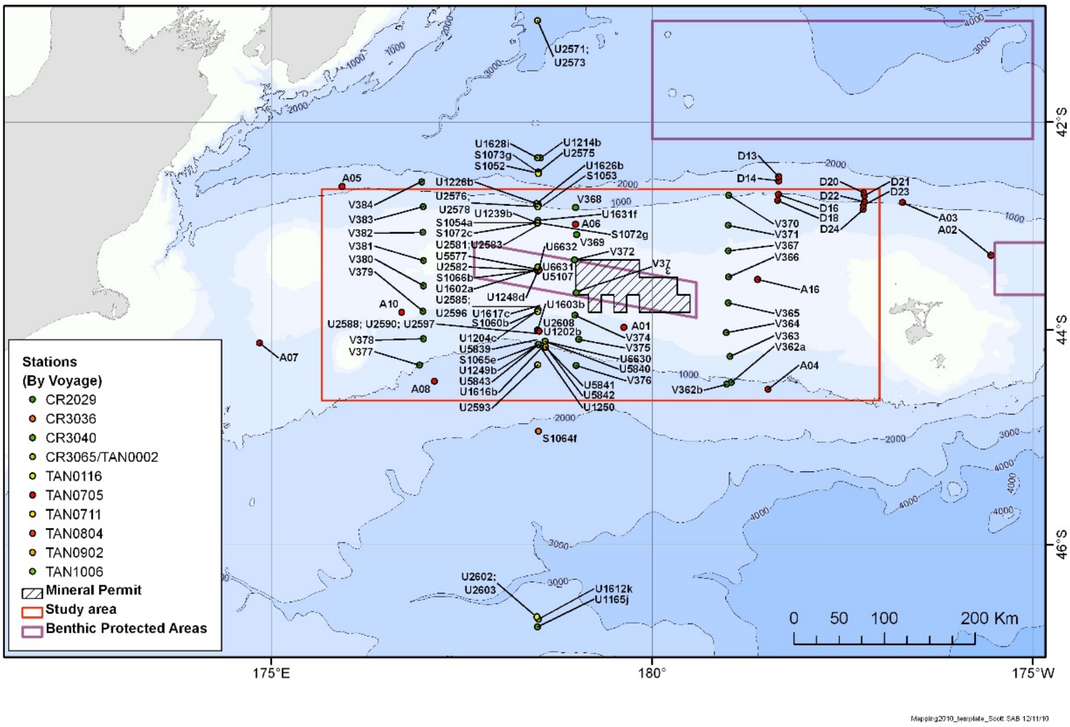

Figure 24: Location of historic semi-quantitative and quantitative infaunal sampling stations on the Chatham Rise, sampled by NIWA and predecessor institutions since 1989. Refer to Appendix I for sample site details.

There are only 89 locations across the greater than 160 000 km2 expanse of the Chatham Rise where semi-quantitative and/or quantitative (i.e., replicated) sampling of infauna has been undertaken. Relatively few stations are located in the immediate vicinity of Chatham Rock Phosphate Limited's mineral prospecting licence area, with two of these defining the westernmost boundary of the licence area (V372 and V373 from voyage CR2029; Appendix I, Figure 24). There are numerous stations from within the licence area (Beaumont and Baird, 2010) but, although these samples, described by Dawson (1984), were collected using large volume grabs and may have sampled animals that lived both in and on the sediment, they have not been analysed robustly (see text below). Multiple sampling efforts have been undertaken over the last 13 years at a site approximately ~40 kilometres to the west of the licence area at a similar water depth (340-360 m) to the licence area on the crest of the Chatham Rise, but no similar infaunal sampling has been undertaken within the actual licence area.

An initial summary of the benthic fauna of the Chatham Rise was undertaken by Dawson (1984) for the purpose of providing a basis for evaluating the possible effects of seafloor phosphorite mining. Many of the samples were collected during the Sonne SO-17C voyage (Kudrass and von Rad, 1984a) in the centre of Chatham Rock Phosphate Limited's present mineral prospecting licence area. Dawson's analysis also included archival samples housed at NZOI, although the stations used in this analysis were not specified. The report was purely descriptive (e.g., only relative proportions of major faunal groups and trophic levels were listed, and no statistical analyses were undertaken), and did not contain any quantitative information on the main faunal groups. In addition, there was no information that related specifically to the infauna, although the sampling methods (e.g., large volume grabs) would have sampled these components of the benthic community, together with those classified more correctly as "epifauna", or those animals living directly on the seafloor. In summary, Dawson (1984) indicated that the dominant groups were the Polychaeta (77%) and Gastropoda (74%) in terms of frequency of occurrence. Echinoids, ophiuroids (brittlestars) and bivalves were the next most abundant, ranging from 47-62%, followed by an assortment of crustaceans (galatheids, crabs), asteroid starfish and brachiopods (35-39%). In terms of trophic groups, Dawson (1984) indicated that the Chatham Rise benthos was dominated by carnivores (47%), followed by deposit (35%) and suspension feeders (19%). It was noted, however, that from photographic evidence the benthic communities on the rise displayed a mosaic of spatially variable habitats and assemblages, ranging from fine sediments with little visible fauna, but dominated by large deposit-feeding and carnivorous organisms (echinoids, asteroids, gastropods) to highly complex micro-habitats, especially in areas of phosphorite nodules, where suspension-feeding epifauna (such as sponges, corals, brachiopods and bivalves) dominated. No estimates of benthic and/or infaunal biomass were undertaken as part of this study.

Knox (1960) presented data on errant Polychaeta collected from 12 stations on the Chatham Rise over water depths of 180-600 m. The identified fauna was similar to that observed in a later study undertaken by Probert and co-workers in 1996 (see below).

The first voyage designed to systematically sample the Chatham Rise infauna was not undertaken until 1989 (NZOI voyage CR2029) (Appendix I, Figure 24). The sampling on this voyage focussed on collecting macrofauna and larger epibenthic organisms, summarised in Probert and McKnight (1993) and McKnight and Probert (1997), respectively. Samples used for infaunal analyses were collected semi-quantitatively using an anchor-box dredge and small sled-trawl, but no replication of sampling was undertaken and all sediment samples were sieved at 1 mm, so smaller infaunal animals were not included in subsequent analyses. Probert and McKnight (1993) showed that the macrofaunal wet weight biomass (> 1 mm) was elevated on the southern side of the Chatham Rise, compared to the northern side and to expected global trends with depth. They related this finding to the proximity of the highly productive Subtropical Front and associated increased fluxes of organic matter to the seafloor. Samples from this voyage were then used to characterise the polychaete assemblages on the rise since these animals proportionally dominated the macro-infaunal community (average 51% of all macro-invertebrate individuals; Probert et al., 1996). Multivariate analysis identified two distinct polychaete assemblages: one mainly on the rise crest (244-663 m water depths) and the other on the slopes of the rise (802-1394 m), representing 37 families and at least 126 species. Polychaete community composition also differed between the north and south sides of the Chatham Rise, similar to trends of total macrofaunal biomass (Probert and McKnight, 1993). On the southern slopes of the rise, the polychaete community was more homogeneous, with species, such as *Aricidea* (Allia) sp. A, *Terebellides aff. stroemi*, *Notomastus* sp. A and *Diplocirrus* sp. A, characteristic of the fauna. The southern slopes also supported higher polychaete densities and higher numbers of surface deposit feeders than the northern slopes. Overall, most of the polychaete individuals were surface deposit feeders (50%), followed by carnivores (33%). Despite a dearth of comparative data, Probert et al. (1996) concluded that "the Chatham Rise (polychaete) fauna does show some similarity to those recorded at other locations in the region" (p. 585) and that many of the identified species were widely distributed throughout the New Zealand and southern Australian region.

Following on from these initial pioneering studies, a comprehensive study of the Chatham Rise infaunal benthos was undertaken in the late 1990's and early 2000's (NIWA voyages CR3036, 3040 and 3065/TAN0002) (Appendix I, Figure 24). These studies focussed on a latitudinal transect across the middle of the rise along 178° 30'E, and sampled a complete suite of benthic components (e.g., macrofauna (>425 µm), meiofauna (63-425 µm) and sediment bacteria), as well as collecting data on benthic community functioning (e.g., sediment community oxygen consumption (SCOC) and sediment bacterial production, measured in ship-board experiments). Samples were collected using pseudo-replicated multi-cores from 5-10 sites over three seasons (autumn, spring and summer), summarised in Nodder et al. (2003). In general, SCOC and benthic biomass across all community components were elevated on the crest and upper southern flank of the rise, compared to the northern flank, matching previous observations (e.g., Probert and McKnight, 1993; Probert et al., 1996). In a subsequent study, Probert et al. (2009) examined replicate box-core samples for the polychaete fauna at the same sites as sampled in autumn 1997. A total of 169 putative species, representing 36 families, was identified and multivariate analysis grouped grouped the shallowest sites, at c.350–453 m, where numerical dominants included *Lumbrineris* sp., *Linopherus minuta*, *Dipolydora cf. socialis*, *Aglaophamus verrilli*, *Prionospio Pehlersi*, *Syllinae* sp. *Monticellina* sp., and *Cossura* sp. Samples from sites at c. 1000 m and 2300 m north and south of the Rise were more disparate in their faunal composition. A distinct assemblage was recorded from a site at c. 750 m on the southern flank of the Rise, which was dominated by *Paradoneis*, *Naineris*, *Notomastus*, *Harmothoinae*, *Prionospio Pehlersi*, *Levinsenia*, *Aricidea*, *Kebuita*, *Paraonella*, and *Leiochrus* species, perhaps related to focussed phytodetritus deposition and resuspension as documented later at this site by Nodder et al. (2007). It is difficult to reconcile identifications between the two polychaete assemblage studies by Probert et al. (1996, 2009) undertaken on the Chatham Rise due mainly to the differences in sampling methods, although in both studies faunal composition differed between the northern and southern flanks of the Rise. Surface deposit feeders were the most abundant feeding group, though in general relatively evenly represented across the rise at about 35-45 % of individuals, and faunal density again appeared to be highest on the southern side.

There was considerable seasonal (and perhaps interannual) variability apparent in the sampling undertaken in different seasons between 1997 and 2000, especially in meiofaunal and bacteria biomass; macrofaunal biomass was estimated only in autumn 1997 (NIWA voyage CR3036). Grove et al. (2006) and recently Leduc et al. (2010a, b) considered the meiofauna in more detail, showing that meiofaunal density and biomass were negatively correlated with water depth, and characterised by high values on the crest and upper southern flank, with nematodes dominating the biomass. For example, on the crest of the rise at 350 m water depth, average meiofaunal biomass over the top 5 cm of sediment varied from ~390 mgC m-2 in autumn 1997 to 220 mgC m-2 in spring 1997 and 200 mgC m-2 in summer 2000 (Grove et al., 2006).

Excluding deep sites (>1000 m), SCOC and bacterial production was highest typically on the uppermost southern flank (especially at 450 m water depth), although comparably elevated levels of microbial production were also found at 1000 m on the northern flank in summer

2000 (Nodder et al., 2003). While these studies provided quantitative information on benthic biomass and functioning for the first time in the Chatham Rise area, none of these samples was analysed taxonomically (i.e., individual species identified and counted), so the community composition of the infaunal assemblages has not been fully established, although the studies (Probert et al., 1996, 2009) provide taxonomic information and examine assemblage structure and patterns of polychaete diversity. No additional information on the diversity of the other components of the macrofauna, meiofauna or the sediment bacterial communities is available from these sites and sampling periods. In addition, there was only an incomplete data-set of bacterial production generated over such seasonal time-scales, with no data available for spring 1997, when sediment bacterial productivity might be expected to be higher than at other times (Nodder et al., 2003).

In September-October 2001, NIWA and the Royal Netherland Institute for Sea Research (NIOZ) collaborated in a research voyage to the Chatham Rise (TAN0116) (Appendix I, Figure 24). This voyage re-occupied all of the sites sampled in 1997-2000, but in addition to undertaking the same analyses as previously (i.e., macrofaunal, meiofaunal and bacterial biomass, ship-board SCOC and bacterial production), the voyage also deployed NIOZ's benthic landers that provided *in situ* measurements of SCOC, currents, particle concentrations and downward fluxes and near-bed video imagery, (Nodder et al., 2007). The biomass and in situ SCOC results in 2001 replicated previous observations, with elevated values on the crest and southern flanks of the Chatham Rise, especially at 750 m water depth where active phytodetritus (sinking algal plankton) deposition and resuspension were observed. This study highlighted the likely importance of the lateral advection of organic material within the Subtropical Front and on the Chatham Rise for fuelling the energy requirements of the benthic communities here, as hypothesised previously by Nodder et al. (2003). Only limited taxonomic information was obtained from these samples.

Hayward et al. (2002) completed an analysis of benthic foraminifera (single-celled, carbonate-secreting protists, >63 µm in size) from over 66 sites across the broader Hikurangi Plateau-Chatham Rise-Bounty Trough region. This study indicated a lower abundance of benthic foraminifera in western parts of the Chatham Rise crest, west of about 179°E, with these fauna characterised across the rise at depths shallower than about 500 m by a benthic foraminiferal assemblage (termed Bathyal Group, B1 by Hayward et al. (2002)) that is dominated by *Cassidulina carinata*, linked to the highly productive Subtropical Front. A more shallow water fauna, dominated by *Trifarina angulosa*, is also identified on the eastern crest of the rise from the Chatham Islands westwards to about 180° (Shallow water S1). The deeper flanks of the rise hosted another bathyal faunal assemblage (B2), dominated by *Abditodentrix psuedothalmanni* and *Alabaminella weddellensis* (Hayward et al., 2002). Note, however, that this study was not able to determine if the foraminiferans were alive or dead at the time of sampling, so the faunal compositions may be a mixture of living and fossil assemblages.

In recent years, major activities in benthic infaunal sampling on the Chatham Rise have included the Ocean Survey 20/20 (OS 2020) Chatham Rise-Challenger Plateau voyage in April-May 2007 (TAN0705) and several voyages in 2007-10 associated with NIWA's biophysical mooring programme (TAN0711, TAN0804, TAN0902, TAN1006) (Appendix I, Figure 24).

During the OS 2020 voyage in 2007 (TAN0705), 20 sites on the Chatham Rise were sampled quantitatively with a multi-corer, as used in the previous studies (Nodder et al., 2003, 2007). Sampling was across a variety of different soft-sediment habitats (i.e., sandy silts to rippled sands), ranging in water depths from 420 m on the crest of the rise to 1299 m on the flanks. Samples were processed for macrofaunal (>500 µm), meiofaunal (>32, 45 and 63 µm; Leduc et al., 2010a, b) and bacterial biomass (Nodder et al., in prep.), with replicate shipboard SCOC measurements also made at 11 selected sites ("A" stations; Nodder et al., in prep.). The macrofauna and meiofauna data have not been analysed fully, but Nodder et al. (in prep.) suggest that there are higher SCOC rates on the crest and upper western and southern flanks of the rise, with bacterial abundance, biomass and volume relatively elevated at selected sites on the southwestern side of the rise. Meiofaunal and specifically nematode biomass, morphology and taxonomic identifications have been undertaken on the OS 20/20 data-sets (Leduc et al., 2010a, b), but these have yet to be compiled into a coherent interpretation of the spatial differences in the structure and functioning of the entire infaunal benthic community on the Chatham Rise.

Regular benthic sampling has been instigated during NIWA-led biophysical mooring voyages in 2007-10 at a site on the Chatham Rise crest (340-360 m water depth) at about 43° 25' S, 173° 30' E. All other infaunal data-sets that have been collected on these Foundation of Research, Science & Technology-funded voyages (TAN0711, TAN0804, TAN0902, TAN1006) have been only partially analysed for various benthic components (see Appendix I) and cannot be reported on in this desk-top compilation.

4 Discussion

Although the Chatham Rise has been relatively well studied in comparison to many deep water areas, the shallow crest of the Chatham Rise in the vicinity of the BPA and Chatham Rock Phosphate Limited's licensed area have not been well sampled for epifauna or infauna. Nevertheless, it is clear that the Chatham Rise provides habitat for a relatively diverse benthic (and fish) community.

Limited data were available within the vicinity of the proposed area of phosphorite extraction. However, Beaumont and Baird (2010) described some high catch weights of sponge within the licensed area, and a possible association between these sponge beds and the density of phosphorite nodules on the seabed. Further analysis of catch weight and presence data in the present study has shown that sponges have both higher taxon richness and higher catch weights on the crest of the Chatham Rise than on the flanks. In addition, the largest catch weights of sponge on the Chatham rise were recorded within or in close proximity to the licensed area.

Analysis of taxonomic richness on the Chatham Rise area showed high values of cnidarian taxon richness on the central Chatham Rise in close proximity to Widepread Energy's licensed area. Taxa recorded here include the deep sea anemones (Actinostolidae and Hormathiidae); corals including the bamboo coral (Keratoisis spp.), soft corals (Alcyonacea), cup corals, (*Desmophyllum dianthus* and *Flabellum* spp.), scleractinia (*Madrepora oculata, Goniocorella dumosa* and a bottle brush coral); and sea pens (Pennatulacea).

Benthic molluscs also had higher taxon richness on the crest of the Chatham Rise than on the flanks (with the exception of the Graveyard seamount complex). Catch weights of octopus were highest on the Chatham Rise crest area, with many of the highest records being in the vicinity of the BPA and Widespread's licensed area, as well as an area to the East where high densities of phosphorite nodules are also known to occur.

It should be noted that the trawl surveys actively avoid sampling areas where high catch weights of sponge have been recorded in the past, not only to avoid damaging the vulnerable habitat but also because when a net is full of sponge it will not catch specimens from the target fish community (Neil Bagley, NIWA, pers. comm.). As a result, some of the records of high sponge catch weights are not recent. However, there are many records of sponge on the Chatham Rise from the past two decades and some sponge habitat was recorded within the Ocean Survey 20/20 biotic habitat assessment (Hewitt et al, in review) which shows that at least some of the sponge habitat still exists.

Biogenic habitats, such as sponge beds, may increase the overall diversity, abundance and productivity of a range of species that associate with them (Morrison et al 2009). Interestingly, the distribution of catch weights of octopus, particularly once records of deep sea octopus were excluded showed a close association with the high catch weights of sponge. It is apparently not uncommon for octopus to be found inside the larger sponges when they arrive on deck during the trawl surveys suggesting that the octopus may be utilising the sponge habitat structure for shelter (Neil Bagley, NIWA, pers. comm.). It is likely that the octopus, a predator, also hunts in the vicinity of the sponge beds. Squat lobsters are also often caught associated with large sponges (Di Tracy and Neil Bagley, NIWA, pers. comm.) and it is likely that many other organisms use the structure of the sponge for shelter also. In addition to providing habitat structure, these suspension feeders contribute to ecosystem productivity through their role in benthic-pelagic coupling; enhancing fluxes of nutrients, oxygen and carbon between the water column and the benthic environment (or seafloor).

Ocean Survey 20/20 data shows Habitat B2, to the north of the licensed area, was characterised by variable communities of sedentary epifauna (e.g. anthozoa and sponges) providing habitat structure as well as mobile bioturbating decapods and small infauna. Habitat B5, to the south and east of the licence area, was characterised by variable communities of surface bioturbators (e.g. squat lobsters and gastropods) and some sponges providing erect habitat structure. Habitat B7, to the west of the licence area (with some occurrences to the south and east) was dominated by bioturbators (e.g. squat lobsters and prawns) with beds of erect tube worms (Chaetopterids) providing moderate habitat structure and a high epifaunal beta diversity (Hewitt et al, in review).

The giant limid bivalve, *Acesta* spp., was highlighted in Beaumont and Baird (2010) as being potentially important species on the Chatham Rise with no other records in the NIWA Invertebrate Collection (NIC) database within the New Zealand region. The NIC are currently updating their database to include historic records and the database query for the present study revealed 10 records of *Acesta* spp. within the study area. Nine of these were *A. maui*, the giant limit bivalve, and one record of *A. saginata*, the lesser giant file shell. *A. maui* is known not to be unique to the Chatham Rise but has a distribution from the east coast of the South Island and south to Campbell Island. The Museum of New Zealand, Te Papa Tongawera's on-line mollusc collection (Te Papa online), has a holotype record of A. saginata from the Kermadec Islands region so this species is not unique to the Chatham Rise. However, it is worth noting that both species of *Acesta* spp. have been recorded only in small numbers, at a few locations on the Chatham Rise, and these locations are mostly in the vicinity of the licensed area.

In addition to the licensed area, particular attention is drawn to two locations within the study area that appear to support a particularly diverse biological community; the Graveyard seamount complex and the Box Hill complex. Both of these locations sit close to the 1000 m contour to the North of the Chatham Rise and have high taxon richness and often high catch weights for many taxonomic groups.

It is interesting to note that the polychaetes were particularly poorly represented in NIWA's *Trawl*, *Specify* and *AllSeaBio* databases despite Dawson (1984) noting that polychaetes as one of the dominant groups in his study within Chatham Rock Phosphate Limited's licensed area.

4.1 Data limitations

The objective of the trawl survey programme, which generates the data within the *Trawl* database, is to survey fish stocks for fisheries management. All catches are recorded, but the gear type is selected to maximise the catch of fish. For example, 500 mm bobbins are used at the trawl mouth, which raises the bottom of the net opening area to approximately 250 mm off the seabed. This means that many benthic invertebrates, especially small invertebrates, will not be captured. In addition, the trawl nets have a large mesh size so small specimens are not retained. Many species of annelid are small and the low number of records of annelida (polychaetes and other worms) within the *Trawl* and *Specify* datasets may be the result of the gear types used rather than a reflection of the annelid community on the Chatham Rise.

Sampling sites within the trawl survey are selected at random within the target area. However, sites where high catch weights of sponge have been previously recorded or are thought to be are not re-sampled for two main reasons. Firstly to avoid unnecessary damage to slow-growing, vulnerable habitat forming species such as sponges and secondly because when the trawl net becomes clogged with sponge the trawl does not capture the target species and the catch is recorded as a "foul" trawl and must be re-shot elsewhere. As a result, although there are recent records of high sponge biomass, some sponge records are not recent. In addition, it should be noted that other taxonomic groups in these areas are likely to be underestimated due to foul shots.

Historically only token specimens and specimens of interest were routinely entered into *AllSeaBio* and *Specify* databases, although some taxonomic groups were more consistently entered than others. More recently all samples recovered on scientific voyages are captured within the database. This means that although a site has been sampled, not all specimens captured may have been recorded. As a result the data, particularly the older data, are more usefully thought of as presence only data rather than presence/absence data. There are also inconsistencies with respect to the level of taxonomic identification recorded among voyages, particularly over time.

4.2 Uniqueness of the licensed area.

The licensed area and much of the Chatham Rise crest have been relatively poorly sampled compared to the rest of the Chatham Rise, particularly the slope and seamounts. In addition, much of the sampling has been carried out using gear targeted at sampling fish stocks and not the benthic invertebrate communities. Thus, we cannot, make any definitive statements about the uniqueness, or otherwise, of the licensed area. From the data presented here, however, there are indications that the central crest of Chatham Rise, including the licence area, may be important for sponges, octopods and cnidarians, at least.

4.3 Further information

O'Driscoll et al. (submitted) have recently completed a review of fish and bycatch data on the Chatham Rise from 19 surveys between 1992 and 2010. This report will be available to the public following the review process.

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6 References

Beaumont, J., Baird, S. (2010) Phosphorite prospecting on the Chatham Rise – biological and commercial fishing considerations. NIWA client report WLG2010-27: 45.

Carney, R.S. (2005) Zonation of deep biota on continental margins. Oceanography and Marine Biology: an Annual Review 43: 211–278.

Clark, M.R., Rowden, A.A. (2009) Effect of deepwater trawling on the macro-invertebrate assemblages of seamounts on the Chatham Rise, New Zealand. Deep Sea Research Part 1 56: 1,540-1, 554.

Clark, M.R., Rowden, A.A., Wright, I., Consalvey, M. (2010) Graveyard seamounts. Oceanography, 23(1): 146–147

Cullen, D.J., Singleton, R.J. (1977) The distribution of submarine phosphorite deposits on central Chatham Rise, East of New Zealand 1. Surface distribution from underwater photographs. NZOI Oceanographic Field Report: 24.

Dawson, E.W. (1984) The benthic fauna of the Chatham Rise: an assessment relative to possible effects of phosphorite mining. Geologisches Jahrbuch Reihe D65: 209–231.

Grove, S.L., Probert, P.K., Berkenbusch, K., Nodder, S.D. (2006) Distribution of bathyal meiobenthos in the region of the Subtropical Front, Chatham Rise, south-west Pacific. Journal of Experimental and Marine Biology and Ecology, 330: 342–355.

Hayward, B.W., Neil, H., Carter, R., Grenfell, H.R., Hayward, J.J. (2002) Factors influencing the distribution patterns of Recent deep-sea benthic foraminifera, east of New Zealand, Southwest Pacific Ocean. Marine Micropaleontology 46: 139–179.

Hewitt, J.E., Julian, K., Bone, E.K. (in review) Biotic habitats and their sensitivity to physical disturbance. Chatham-Challenger Ocean Survey 20/20 Post-Voyage Analyses project ZBD2007-01, Specific objective 10. Final Research Report to the Ministry of Fisheries August 2010: 28.

Knox, G.A., 1960. Biological results of the Chatham Islands 1954 expedition. Part 3. Polychaeta Errantia. New Zealand Oceanographic Institute memoir 6: 76-140

Kudrass, H.-R., von Rad, U. (1984a) Geology and some mining aspects of the Chatham Rise phosphorite: a synthesis of SONNE-17 results. Geologisches Jahrbuch Reihe D65: 233–252.

Kudrass, H.-R., von Rad, U. (1984b) Underwater television and photography observations, side-scan sonar and acoustic relectivity measurements of phosphorite-rich areas on the Chatham Rise (New Zealand). In: von Rad, U., Kudrass, H.-R. (Eds.). Phosphorite deposits on the Chatham Rise, New Zealand Sonne Cruise SO-17, 1981.

Leduc, D., Probert, P.K., Nodder, S.D. (2010a) Influence of mesh size and core penetration on estimates of deep-sea nematode abundance, biomass, and diversity. Deep-Sea Research I 57: 1354–1362.

Leduc, D., Probert, P.K., Berkenbusch, K., Nodder, S.D., Pilditch, C.A. (2010b) Abundance of small individuals influences the effectiveness of processing techniques for deep-sea nematodes. *Deep-Sea Research* I 57: 1363–1371.

McKnight, D.G., Probert, P.K. (1997) Epibenthic communities on the Chatham Rise, New Zealand. New Zealand Journal of Marine and Freshwater Research 31: 505–513.

Morrison, M.A., Lowe, M.L., Parsons, D., Usmar, N., McLeod, I. (2009) A review of land-based effects on coastal fisheries and supporting biodiversity in New Zealand. Aquatic Biodiversity and Biodiversity Report No 37: 100.

Nodder, S.D., Pilditch, C.A., Probert, P.K., Hall, J.A. (2003) Variability in benthic biomass and activity beneath the Subtropical Front, Chatham Rise, SW Pacific Ocean. Deep-Sea Research I 50(8): 959–985.

Nodder, S.D., Duineveld, G.C.A., Pilditch, C.A., Sutton, P.J., Probert, P.K., Lavaleye, M.S.S., Witbaard, R., Chang, F.H., Hall, J.A., Richardson, K.M. (2007) Focusing of phytodetritus deposition beneath a deep-ocean front, Chatham Rise, New Zealand. Limnology and Oceanography 52: 299–314.

Nodder, S., Maas, E., Bowden, D., Pilditch, C. (in preparation). Physical, biogeochemical and microbial characteristics of sediment samples from the Chatham Rise and Challenger Plateau. Draft Final Research Report on Chatham-Challenger Ocean Survey 20/20 post-voyage analyses: Specific Objectives 7 and 8. NIWA Contract Report WLG2008-80, prepared for the Ministry of Fisheries (MFish), Wellington (Contract No. ZBD2007-01): 34.

Nodder, S.D., Bowden, D.A., Pallentin, A., Mackay, K. (2010) (submitted). Seafloor habitats and benthos of a continental ridge: Chatham Rise, New Zealand. Submitted and in final review for inclusion in the GeoHab Atlas to be published by Elsevier Insights, Seafloor Geomorphology as Benthic Habitat: GeoHab Atlas of seafloor geomorphic features and benthic habitats, edited by P.T. Harris and E.K. Baker.

O'Driscoll, R.L., MacGibbon, D., Fu, D., Lyon, W., Stevens, D.W. (submitted). A review of hoki and middle depth trawl surveys of the Chatham Rise, January 1992–2010. New Zealand Fisheries Assessment Report 2010/xx: 814.

Probert, P.K., McKnight, D.G. (1993) Biomass of bathyal macrobenthos in the region of the Subtropical Convergence, Chatham Rise, New Zealand. Deep-Sea Research I 40: 1003–1007.

Probert, P.K., Grove, S.L., McKnight, D.G., Read, G.B. (1996) Polychaete distribution on the Chatham Rise, Southwest Pacific. Internationale Revue der gesamten Hydrobiologie 81: 577–588.

Probert, P.K., Glasby, C.J., Grove, S.L., Paavo, B.L. (2009) Bathyal polychaete assemblages in the region of the Subtropical Front, Chatham Rise, New Zealand. New Zealand Journal of Marine and Freshwater Research *43*: 1121–1135.

Stevens, D.W., O'Driscoll, R.L., Gauthier, S. (2009) Trawl survey of hoki and middle depth species on the Chatham Rise, January 2008 (TAN0801). New Zealand Fisheries Assessment Report 2009/18: 86.

Te Papa online: http://collections.tepapa.govt.nz/. Information accessed 11/11/2010.

Tracey, D.M., Anderson, O.F., Clark, M.R. (1997) A two-vessel survey of orange roughy in the Chatham Rise "Spawning Box" July – August 1995. New Zealand Fisheries Technical Report No. 49: 28.

Appendix 1

Appendix I Summary of historic semi-quantitative to quantitative infaunal sampling stations collected on the Chatham Rise by NIWA and predecessor institutions since 1989. SCOC = sediment community oxygen consumption (measured in ship-board incubations), in situ lander = benthic lander, deployed by the Royal Netherlands Institute for Sea Research, with in situ measurements of SCOC, currents, particle concentrations and downward fluxes and video imagery. Full references are provided at the end of the report.

Voyage	Sample site	Station (NIWA database)	Date	Latitude	Longitude	Water depth (m)	Sample types	Reference or data status
CR2029	1A	V377	14-Sept-89	44° 20.01’ S	176° 59.89’ E	1102	Macrofauna	1, 2
	2A	V378	14-Sept-89	44° 05.06’ S	177° 00.01’ E	663	Macrofauna	1, 2
	3A	V379	14-Sept-89	43° 49.45’ S	176° 59.38’ E	498	Macrofauna	1, 2
	4A	V380	15-Sept-89	43° 34.92’ S	176° 59.98’ E	334	Macrofauna	1, 2
	5A	V381	15-Sept-89	43° 20.50’ S	176° 59.88’ E	244	Macrofauna	1, 2
	6A	V382	15-Sept-89	43° 04.30’ S	176 ° 59.54’ E	330	Macrofauna	1, 2
	7A	V383	15-Sept-89	42° 49.31’ S	176° 59.59’ E	505	Macrofauna	1, 2
	8A	V384	15-Sept-89	42° 34.81’ S	176° 58.54’ E	1394	Macrofauna	1, 2
	1B	V376	13-Sept-89	44° 20.29’ S	179° 00.04’ E	1238	Macrofauna	1, 2
	2B	V375	13-Sept-89	44° 05.56’ S	179° 02.35’ E	802	Macrofauna	1, 2
	3B	V374	13-Sept-89	43° 51.64’ S	178° 59.11’ E	470	Macrofauna	1, 2
	4B	V373	13-Sept-89	43° 38.84’ S	179° 00.03’ E	392	Macrofauna	1, 2
	5B	V372	13-Sept-89	43° 20.11’ S	178° 58.87 E	417	Macrofauna	1, 2
	6B	V369	11-Sept-89	43° 05.62’ S	179° 00.50’ E	405	Macrofauna	1, 2
	7B	V368	11-Sept-89	42° 49.84’ S	178° 59.54’ E	1048	Macrofauna	1, 2
	1Ca	V362a	7-Sept-89	44° 29.89’ S	178° 57.88’ W	1065	Macrofauna	1, 2
	1Cb	V362b	7-Sept-89	44° 30.94’ S	179° 01.23’ W	1095	Macrofauna	1, 2
	2C	V363	7-Sept-89	44° 15.22’ S	178° 58.53’ W	547	Macrofauna	1, 2
	3C	V364	7-Sept-89	44° 01.60’ S	179° 01.60’ W	315	Macrofauna	1, 2
	4C	V365	8-Sept-89	43° 44.64’ S	178° 59.80’ W	391	Macrofauna	1, 2
	5C	V366	8-Sept-89	43° 29.86’ S	178° 59.72’ W	474	Macrofauna	1, 2
	6C	V367	8-Sept-89	43° 14.88’ S	179° 00.03’ W	467	Macrofauna	1, 2
	7C	V371	12-Sept-89	43° 00.10’ S	179° 00.01’ W	546	Macrofauna	1, 2
	8C	V370	12-Sept-89	42 42.73’ S	178 59.76’ W	1022	Macrofauna	1, 2
CR3036	2300 N	S1052	30-Apr-97	42° 29.73' S	178° 30.80' E	2330	Macrofauna, meiofauna, bacteria, SCOC	3, 4, 6
	2300 N	S1073g	8-May-97	42° 29.21' S	178° 30.39' E	2327	Macrofauna, meiofauna, bacteria, SCOC	3, 4, 6

1000 N	S1053	1-May-97	42° 48.54' S	178° 30.49' E	1004	Macrofauna, meiofauna, bacteria, SCOC	3, 4, 6
450 N	S1054a	1-May-97	42° 58.54' S	178° 29.64' E	442	Macrofauna, meiofauna, bacteria, SCOC	3, 4, 6
450 N	S1072c	7-May-97	42° 58.61' S	178° 29.95' E	446	Macrofauna, meiofauna, bacteria, SCOC	3, 4, 6
450 N	S1072g	8-May-97	42° 58.54' S	178° 29.59' E	439	Macrofauna, meiofauna, bacteria, SCOC	3, 4, 6
350 C	S1066b	3-May-97	43° 26.00' S	178° 29.90' E	350	Macrofauna, meiofauna, bacteria, SCOC	3, 4, 6
450 S	S1060b	3-May-97	43° 49.35' S	178° 29.66' E	453	Macrofauna, meiofauna, bacteria, SCOC	3, 4, 6
1000 S	S1065e	5-May-97	44° 08.41' S	178° 30.49' E	981	Macrofauna, meiofauna, bacteria, SCOC	3, 4, 6
2300 S	S1064f	4-May-97	44° 57.18' S	178° 30.62' E	2283	Macrofauna, meiofauna, bacteria, SCOC	3, 4, 6

CR3040	2300 N	U1214b	29-Oct-97	42° 20.88' S	178° 32.03' E	2294	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	1000 N	U1226b	30-Oct-97	42° 47.87' S	178° 30.24' E	1046	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	450 N	U1239b	2-Nov-97	42° 58.85' S	178° 30.00' E	464	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	350 C	U1248d	3-Nov-97	43° 26.37' S	178° 30.15' E	347	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	450 S	U1204c	26-Oct-97	43° 49.18' S	178° 29.82' E	453	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	750 S	U1202b	25-Oct-97	44° 00.07' S	178° 29.94' E	752	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	1000 S	U1249b	4-Nov-97	44° 08.24' S	178° 30.39' E	974	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	1200 S	U1250	4-Nov-97	44° 08.39' S	178° 30.64' E	1206	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	2600 S	U1165j	20-Oct-97	46° 44.91' S	178° 29.89' E	2678	Macrofauna, meiofauna, bacteria, SCOC	3, 4

CR3065/ TAN0002	2300 N	U1628i	5-Feb-00	42° 21.005' S	178° 29.868' E	2297	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	1000 N	U1626b	4-Feb-00	42° 47.488' S	178° 29.028' E	1000	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	450 N	U1631f	6-Feb-00	42° 57.253' S	178° 29.944' E	494	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	350 C	U1602a	25-Jan-00	43° 25.729' S	178° 29.864' E	350	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	450 S	U1617c	2-Feb-00	43° 48.602' S	178° 30.419' E	450	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	750 S	U1603b	25-Jan-00	44° 00.072' S	178° 29.812' E	750	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	1200 S	U1616b	1-Feb-00	44° 19.90' S	178° 29.66' E	1204	Macrofauna, meiofauna, bacteria, SCOC	3, 4
	2600 S	U1612k	28-Jan-00	46° 40.69' S	178° 30.49' E	2600	Macrofauna, meiofauna, bacteria, SCOC	3, 4

TAN0116	3100 N	U2571; U2573	29-Sept-01 to 1-Oct-01	41° 00.053’ S	178° 29.840’ E	3118	Macrofauna, meiofauna, bacteria, SCOC, in situ lander	Data collected, partially analysed
	2300 N	U2575	3-Oct-01	42° 30.049’ S	178° 30.367’ E	2326	Macrofauna, meiofauna, bacteria, SCOC, in situ lander	Data collected, partially analysed
	1000 N	U2576; U2578	3-Oct-01	42° 49.192’ S	178° 30.043’ E	980	Macrofauna, meiofauna, bacteria, SCOC, in situ lander	5, 7
	450 N	U2581; U2583	4-Oct-01	42° 58.606’ S	178° 29.907’ E	441	Macrofauna, meiofauna, bacteria, SCOC, in situ lander	5, 7
	350 C	U2582	5-Oct-01	43° 26.069’ S	178° 30.132’ E	348	Macrofauna, meiofauna, bacteria, SCOC, in situ lander	5, 7
	450 S	U2585; U2596	6-Oct-01	43° 49.584’ S	178° 30.052’ E	460	Macrofauna, meiofauna, bacteria, SCOC, in situ lander	5, 7
	750 S (1)	U2588; U2590; U2597	7-Oct-01 to 9-Oct-01	44° 00.434’ S	178° 30.006’ E	753	Macrofauna, meiofauna, bacteria, SCOC, in situ lander	5, 7

	750 S (2)	U2608	13-Oct-01	44° 00.348’ S	178° 30.022’ E	-	Macrofauna, meiofauna, bacteria, SCOC, in situ lander	5, 7
	1200 S	U2593	8-Oct-01	44° 19.941’ S	178° 30.068’ E	1205	Macrofauna, meiofauna, bacteria, SCOC, in situ lander	5, 7
	2800 S	U2602; U2603	10-Oct-01 to 12-Oct-01	46° 39.454’ S	178° 29.366’ E	2805	Macrofauna, meiofauna, bacteria, SCOC, in situ lander	Data collected, partially analysed
TAN0705	11-12, 21-22	A07	3-Apr-07 to 4-Apr-07	44° 07.55’ S	174° 50.69’ E	514-522	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9
	35-36, 38	A10	5-Apr-07	43° 49.95’ S	176° 42.72’ E	478-480	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9
	45, 48	A08	6-Apr-07	44° 29.12’ S	177° 08.46’ E	1241	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9
	62-63, 66	A41	7-Apr-07 to 8-Apr-07	44° 00.88’ S	178° 31.14’ E	764-766	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9
	78-80	A01	9-Apr-07	43° 58.63’ S	179° 37.80’ E	529-531	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9

95-96	A04	10-Apr-07	44° 33.66' S	178° 28.74' W	1072-1075	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9
131-132, 135	A02	13-Apr-07	43° 17.28' S	175° 33.08' W	644	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9
157-158, 161	A03	16-Apr-07	42° 46.92' S	176° 42.90' W	1025-1029	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9
172-174, 177	A16	17-Apr-07 to 18-Apr-07	43° 31.17' S	178° 37.05' W	420-424	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9
198-199	D14	19-Apr-07	42° 34.31' S	178° 20.18' W	1291-1295	Macrofauna, meiofauna, bacteria	Data collected, partially analysed
204	D13	20-Apr-07	42° 31.84' S	178° 20.34' W	1400	Macrofauna, meiofauna, bacteria	Data collected, partially analysed
206-207	D16	20-Apr-07	42° 42.32' S	178° 20.48' W	985-993	Macrofauna, meiofauna, bacteria	Data collected, partially analysed
208-209	D18	20-Apr-07	42° 45.71' S	178° 20.95' W	790-801	Macrofauna, meiofauna, bacteria	Data collected, partially analysed
223-225	D24	21-Apr-07	42° 51.03' S	177° 13.80' W	793-798	Macrofauna, meiofauna, bacteria	Data collected, partially analysed

	226-227	D23	21-Apr-07	42° 48.55’ S	177° 13.45’ W	895-898	Macrofauna, meiofauna, bacteria	Data collected, partially analysed
	228-229	D22	21-Apr-07	42° 46.61’ S	177° 12.74’ W	990-994	Macrofauna, meiofauna, bacteria	Data collected, partially analysed
	231-232	D21	22-Apr-07	42° 42.83’ S	177° 12.74’ W	1196-1201	Macrofauna, meiofauna, bacteria	Data collected, partially analysed
	233	D20	22-Apr-07	42° 41.35’ S	177° 13.17’ W	1299	Macrofauna, meiofauna, bacteria	Data collected, partially analysed
	246-247	A06	24-Apr-07	42° 59.49’ S	178° 59.51’ E	530-534	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9
	271-272	A05	26-Apr-07	42° 37.58’ S	175° 55.75’ E	1195-1197	Macrofauna, meiofauna, bacteria, SCOC	7, 8, 9
TAN0711	-	U5107	1-Sept-07	43° 26.20’ S	178° 30.11’ E	343	Bacteria	Data collected, partially analysed
TAN0804	-	U5577	1-May-08	43° 15.67’ S	178° 30.98’ E	345	Bacteria	Data collected, partially analysed

TAN0902	21	U5839	1-Feb-09	44º 06.60’ S	178º 35.62’ E	990	Macrofauna, meiofauna, bacteria, SCOC	Data collected, partially analysed
	22	U5840	1-Feb-09	44º 06.59’ S	178º 35.68’ E	991	Macrofauna, meiofauna, bacteria, SCOC	Data collected, partially analysed
	23	U5841	1-Feb-09	44º 09.77’ S	178º 36.18’ E	1011	Macrofauna, SCOC	Data collected, partially analysed
	24	U5842	1-Feb-09	44º 09.50’ S	178º 36.08’ E	1002	Macrofauna, meiofauna, bacteria, SCOC	Data collected, partially analysed
	25	U5843	1-Feb-09	44º 09.73’ S	178º 36.03’ E	1010	Meiofauna, bact	Data collected, partially analysed
TAN1006	23	U6630	7-May-10	44° 06.54’ S	178° 35.89’ E	990	Bacteria	Data collected, unanalysed
	24	U6631	7-May-10	43° 24.03’ S	178° 30.00’ E	360	Meiofauna, bact	Data collected, unanalysed
	25	U6632	7-May-10	43° 24.02’ S	178° 29.93’ E	360	Macrofauna	Data collected, unanalysed