

Voyage number: TAN2009
Title: Recovery of seamount communities
Area: Chatham Rise, Graveyard Seamounts
Period: 7 - 22 August 2020
Lead organization: NIWA
Voyage leader: Malcolm Clark

Background

Seamounts, knolls, and hills are prominent features of underwater topography in the New Zealand region and are often sites of high biodiversity and productivity. They are the focus of important commercial fisheries for deepwater species, with about 80% of known seamount features at suitable depths for deepwater fisheries having been exploited.

Benthic faunal communities on deepwater seamount features are commonly characterised by extensive growth of cold-water corals. These are vulnerable to impacts from bottom trawl gear, and substantial reductions in the biogenic habitat formed by corals have been recorded on fished seamount features. However, the overall resilience of such benthic communities, and the time frame required for recolonisation and regrowth is uncertain, yet such information is important for evaluating appropriate options for management of fishing.

On the Chatham Rise there are groups of small seamounts in close geographic proximity, of a broadly similar size, depth range, and elevation, and with varying levels of historical fishing effort. Two such groups are the “Graveyard Seamounts” on the northwest Chatham Rise, and the “Andes Seamounts” on the eastern margin of the Chatham Rise (Figure 1). A number of these features were closed to bottom trawling in 2001. The Graveyard seamounts in particular provide an opportunity to maintain a long-term monitoring study to determine the mechanisms and rates of recovery of benthic fauna, population connectivity, and linkages between proximate seamounts, as this area was surveyed in 2001, 2006, 2009, and 2015. Analysis of this 4-survey time series has shown little evidence of resilience of the benthic community, nor signs of settlement or recruitment of the main coral species. However, work off Hawaii indicates that measurable changes might be expected in the order of 2–3 decades, a time approaching with the Graveyard series. Hence the time series was funded to continue.

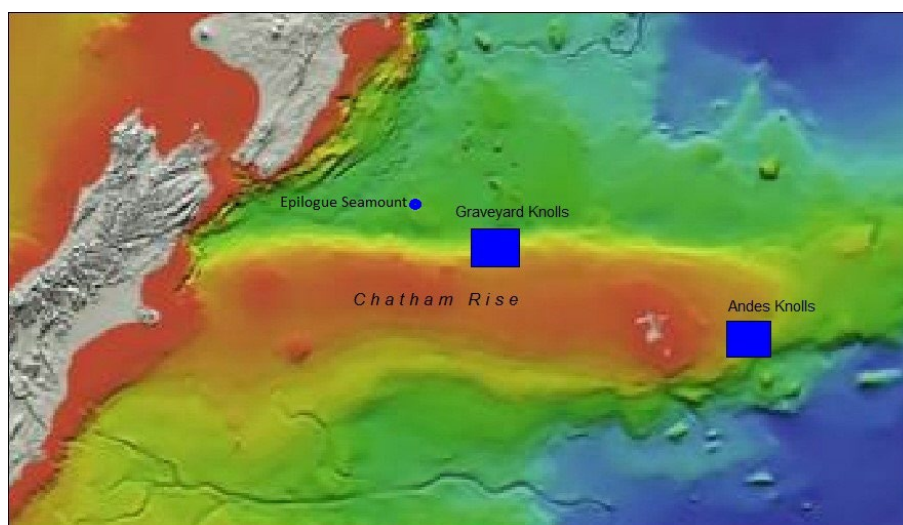


Figure 1: Seamount survey areas on the Chatham Rise

Survey objectives

Specific voyage objectives were to

- To repeat the quantitative photographic survey of benthic invertebrate communities on features of the Graveyard Knolls complex.
- To assess changes in benthic communities since the first survey in 2001.

These extended to the Andes seamounts as time and weather conditions permitted:

- To repeat the quantitative photographic survey of benthic invertebrate communities on features of the Andes Knolls (Diamond Head peaks)
- To gather data to assess changes in benthic communities since the first survey in 2009

Survey area

Graveyard seamounts

The Graveyard seamounts consist of about twenty small features ranging in depths from 750 m to 1250 m at their peaks, and from 1050 m to 1600 m at their bases (Figure 2). They lie in close proximity to one another, spanning an area of approximately 140 km².

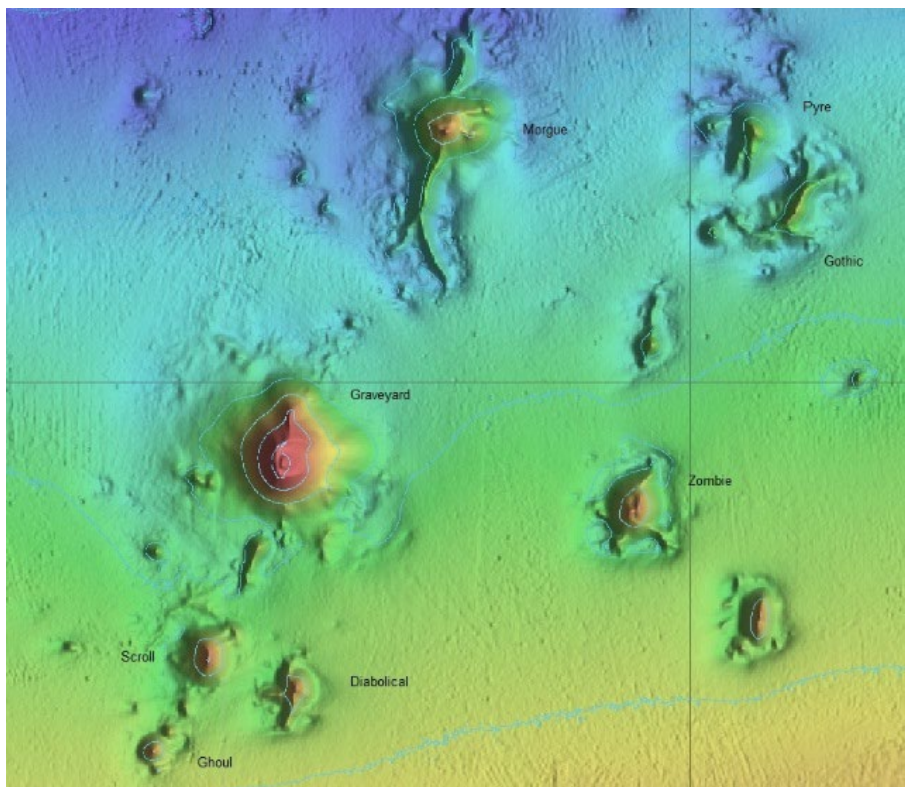


Figure 2: Detail of Graveyard Seamounts, Northwest Chatham Rise

A core set of six seamounts have been revisited over time (Table 1).

Table 1. Photographic surveys of seamounts in the Graveyard complex visited in each survey year.

Seamount	2001 (TAN0104)	2006 (TAN0604)	2009 (TAN0905)	2015 (TAN1503)	2020 (TAN2009)
Graveyard	Y	Y	Y	Y	Y
Morgue	Y	Y	Y	Y	Y
Diabolical	Y	Y	Y	Y	Y
Gothic	Y	Y	Y	Y	Y
Zombie		Y	Y	Y	Y
Ghoul		Y	Y	Y	Y
Pyre		Y			
Scroll		Y			

Andes seamounts

The Andes is a cluster of about 12 small knolls and hills 130 km east of the Chatham Islands. They range in depth from 500 m at the summit to 1300 m at their base (Figure 3). The region was surveyed during the Graveyard voyages in 2009 (but with only two camera transects) and more fully in 2015.

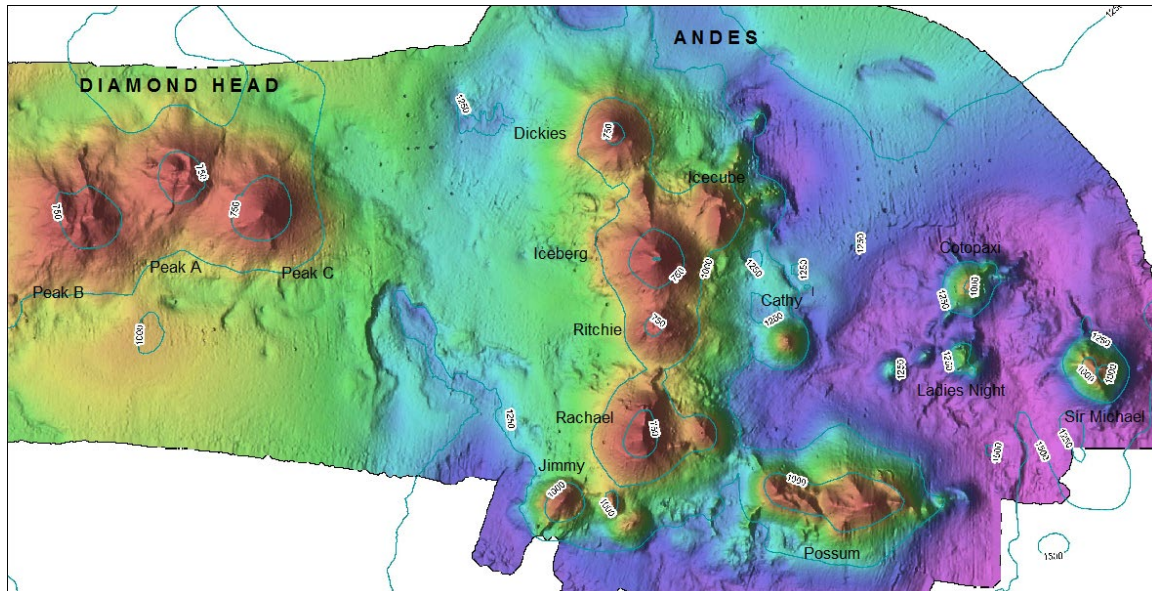


Figure 3: Andes Knolls, East Chatham Rise, including Diamond Head.

Methods: Photographic survey

Photographic transects were carried out from the summit of each seamount down the flanks to the base. Eight transects (N, NE, E, SE, S, SW, W, NW) were carried out on each feature. These replicated the seabed tracks of the 2015 transects where possible, as this was a survey that used the vessel Dynamic Positioning system for the first time and enabled much improved control over the speed and direction of the survey transects. On Morgue, more detailed coverage was undertaken

The camera gear used was NIWA’s “Deep Towed Imaging System” (DTIS) (Figure 4)

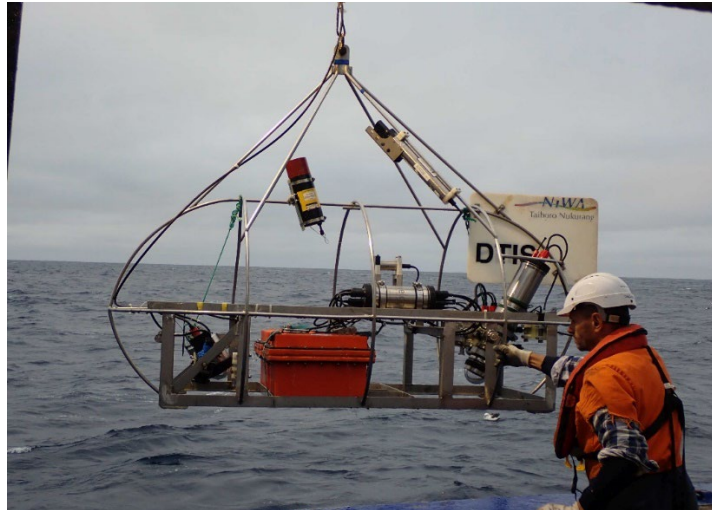


Figure 4: NIWAs Deep Towed Imaging System towed camera

During all deployments, spatially-referenced observations on the occurrence of biological assemblages (at relatively coarse taxonomic resolution) and substratum types were recorded in real time by observers using the OFOP system.

Results:

Sampling stations

A total of 86 stations was completed, of which 55 were in the main survey area of Graveyard (all camera), and 27 (24 camera, 3 sled) in the Andes (Table 2). There was also a single camera tow on Epilogue Seamount (see Figure 1) on the return transit to Wellington, and 3 deployments of the Continuous Plankton Recorder while in transits between Wellington and Graveyard, and Graveyard and Andes.

Table 2: Count of stations by gear type completed in the survey area during TAN2009. The number in parentheses indicate unsatisfactory tows that were repeated.

Seamount	No. Camera transects	No. sled tows
GRAVEYARD		
Graveyard	8	
Morgue	14	
Morgue (mooring)	4	
Gothic	8	
Diabolical	8	
Ghoul	4	
Zombie	9 (1)	
ANDES		
Diamond Head A	8	1
Diamond Head B	7	
Diamond Head C	9 (1)	
Iceberg		1
Rachael		1
EPILOGUE SEAMOUNT		
	1	
TOTAL	80	3

CTD data were collected from all DTIS stations. The locations of camera transects are shown in Figure 5.

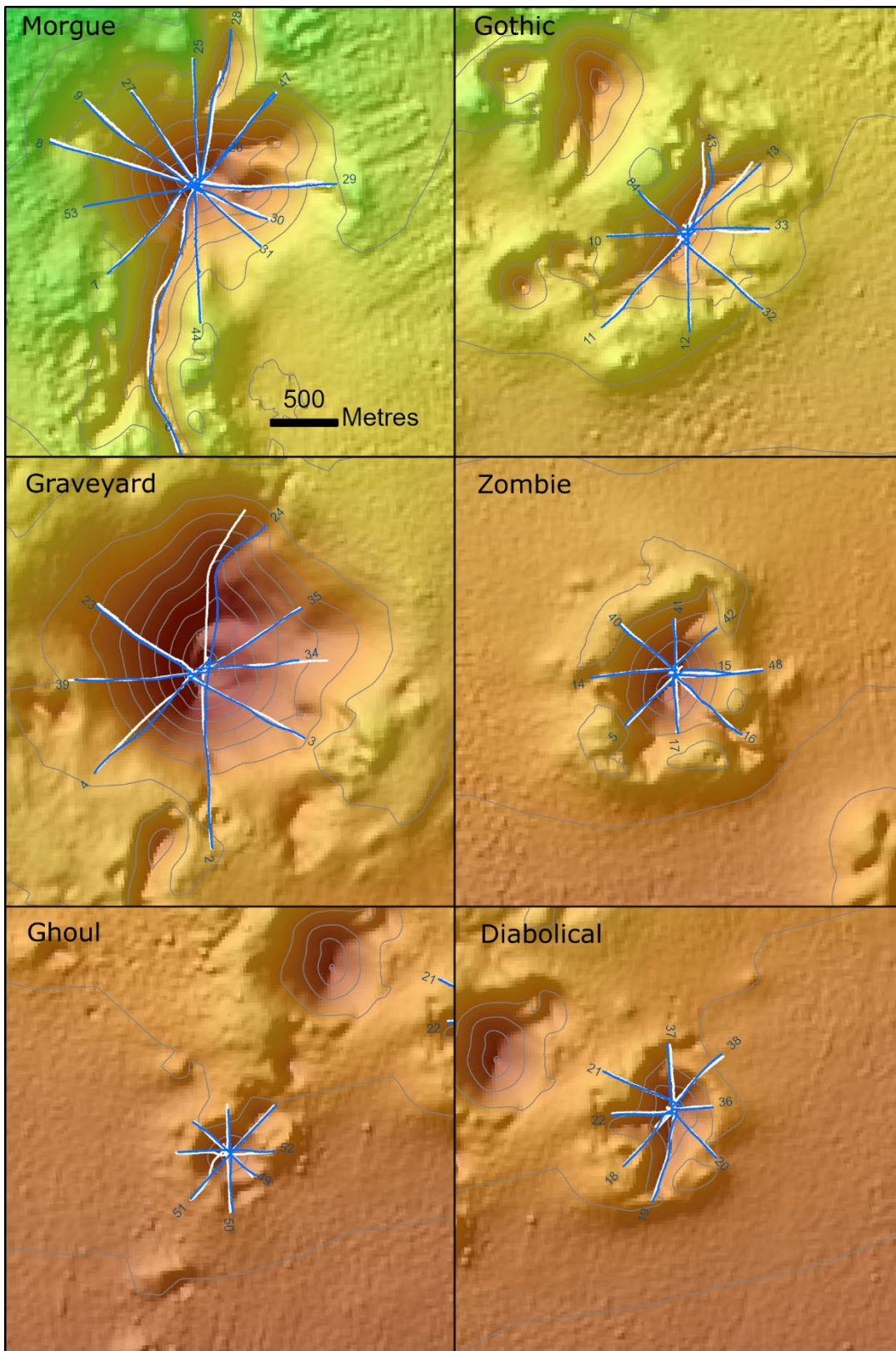


Figure 5: Seamount features surveyed in the Graveyard complex, showing TAN2009 camera transects (blue lines with station numbers) superimposed on corresponding transects from TAN1503 (white lines). All panels are to the same scale and isobaths are at 50 m intervals.

During the DTIS camera transects, more than 71 hours of video were recorded, and almost 18000 still images taken (Table 3). Image quality was very high, with video being High Definition (HD 1080p), and each still photograph taken at 24 MP resolution.

Table 3: Summary of DTIS data collected during TAN2009. Duration of video and number of still images per seamount.

Seamount	Stations	Stills number	Size (GB)	Video time (hr: min: secs)	Size (GB)
Graveyard	8	2023	22.4	7:23:14	88.74
Morgue	14	3502	38.36	14:17:30	160.66
Diabolical	8	1112	11.7	3:04:21	51.52
Gothic	8	1443	14.15	5:56:57	66.67
Zombie	9	1327	14.07	5:26:41	61.02
Ghoul	4	729	7.8	3:00:31	33.66
Morgue (mooring weight search)	4	2024	19.82	8:25:28	94.3
Diamond Head, peak A	8	1822	21.28	7:42:44	84.37
Diamond Head, peak B	7	1669	20.6	6:51:04	76.45
Diamond Head, peak C	9	1836	22.3	7:43:31	85
Epilogue	1	357	3.3	1:26:46	16.2
Total	80	17844	195.78	71:18:47	818.59

Biological stations

Short sled tows, using the seamounts epibenthic sled, were completed on three features in the Andes complex. These were targeted based on DTIS images from either the 2015 or 2020 surveys. Tow duration was kept as short as possible to minimise any bottom impact.

A total of 71 specimen lots were collected, comprising 350 invertebrate specimens from 6 phyla. These specimens provide additional material to augment that collected in 2009 and 2015, enabling more reliable image identification, and complete species descriptions to be undertaken by NIWA and international taxonomists. Several hard coral samples were subsampled as per requests:

- for microbiome (Sarah Seabrook, postdoc University of Auckland)
- for population genetics (Marcelo Kitahara, Universidade Federale de Sao Paulo, Brazil)
- for reproductive studies (Di Tracey, NIWA).

Moorings

Four specific DTIS deployments were carried out to target the location of weights from moorings deployed in orange roughy research between 2007 and 2012. The ships Dynamic Positioning System was used to shift small amounts (often 5 or 10 m in a search pattern), enabling the camera to slowly move between and around the reported locations of each mooring wheel (Figure 6).

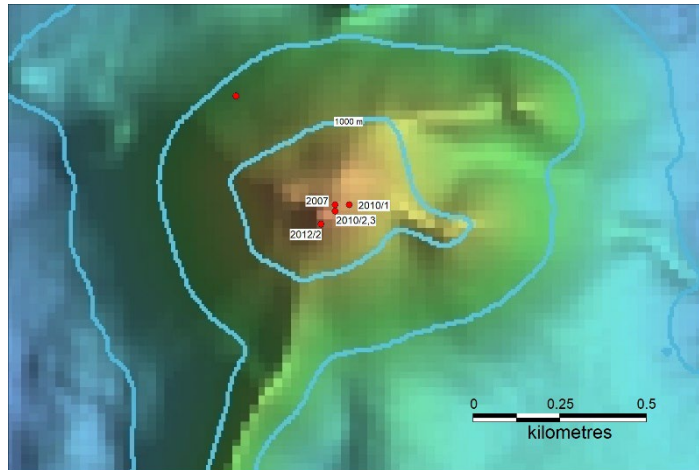


Figure 6: The reported location of mooring weight positions (red dots) on Morgue.

Moorings from 2010/1 and 2012/2 were located and showed some minor colonisation by stylasterid hydrocorals.

Data processing and analysis

Data from the survey is being processed and analysed under MPI project BEN2020-07, due for completion in May 2022.

Breakdown/downtime/weather days

There was no down-time due to weather or breakdown. At times we needed to change gear operations or area of operations because of wind, swell, or sea state (in particular where they limited DP operations) but these were able to be managed with no direct loss of time.

Data

All station and sample data were entered on appropriate station and catch record forms by NIWA personnel, and routinely entered into shipboard databases (Trawl Coordinator, niwainvert db). Image files (video and stills) and OFOP log files from DTIS deployments were stored to the ship's server, with independent backup to a stand-alone hard drive.

Media coverage and outreach

No media activities occurred during the voyage and there was no press release related to it.

A formal voyage report has been published by MPI as an Aquatic Environment and Biodiversity Report:

Clark, M.R., Bowden, D.A., Stewart, R., Schnabel, K., Quinn, W., Lennard, B., Goode, S.L., Davis, A. (2020). Seamount Recovery: factual voyage report of a survey of seamounts on the Northwest and Southeast Chatham Rise (TAN2009). *New Zealand Aquatic Environment and Biodiversity Report No. 262*. 116 p.