

Voyage number: TAN2005

Title: Sedimentation effects-the Resilience Of deep-sea Benthos to the Effects of Sedimentation (ROBES)

Area: Chatham Rise

Period: 8 - 22 June 2020

Lead organization: NIWA

Voyage leader: Malcolm Clark

Background

Sedimentation effects from human activities such as seabed mining or bottom trawl fisheries are poorly known yet are an important concern for environmental sustainability of such activities in the deep sea. In 2016 MBIE funded a NIWA-led programme to investigate the effects of sedimentation from such seabed disturbance using a combination of field survey experimentation with *in situ* observations, and laboratory-based experiments. The work is designed to determine the extent and persistence of sediment plumes, the immediate disturbance impact and subsequent recovery of seafloor characteristics and communities, and the sedimentation effect on the functioning of ecologically significant species.

This survey was the third of a series of three surveys in a seabed disturbance experiment. Disturbance operations occurred in 2018 and 2019 at two different scales. The priority for the survey in June 2020 was to repeat sampling sites filled in 2018 and 2019 to monitor changes over time and evaluate recovery and resilience of the seabed communities. The time series is important to understand both temporal and spatial variability in natural conditions, as well as changes in the environment and faunal communities that may not be immediately obvious from a single survey.

Survey objectives

The main aim of the voyage was to undertake monitoring of a sediment disturbance experiment to investigate the impacts of sedimentation on deep-sea benthic communities.

This objective had the following sub-components:

- a) To repeat sample monitoring sites from a wide area in 2018;
- b) To repeat sample monitoring sites from the “Butterknife” feature in 2019;
- c) To carry out CTD sampling to monitor oceanographic conditions;;
- d) To undertake experimental work on selected sediment cores;
- e) To monitor trawl disturbance sites from 2019;
- f) To undertake further sampling on disturbed/undisturbed sites as time permits;
- g) To collect animals for experimental sedimentation studies onshore.

The survey

The survey occurred on the central Chatham Rise, north of the crest around the 500m bathymetric contour (Figure 1). It is an area of relatively uniform slope, with no marked topographic features. It was the same area as surveyed previously in 2018 and 2019.

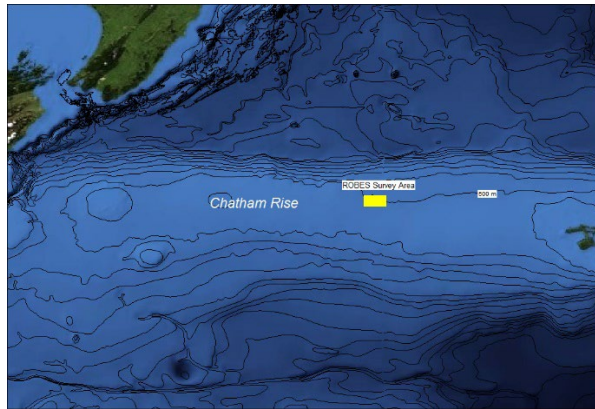


Figure 1: The general location of the ROBES survey area on Chatham Rise.

The survey was divided into two discrete parts, the first focused on repeat sampling of “core” sites from 2018-2019, and the second focused on a small area around a feature termed the “butterknife” (Figure 2).

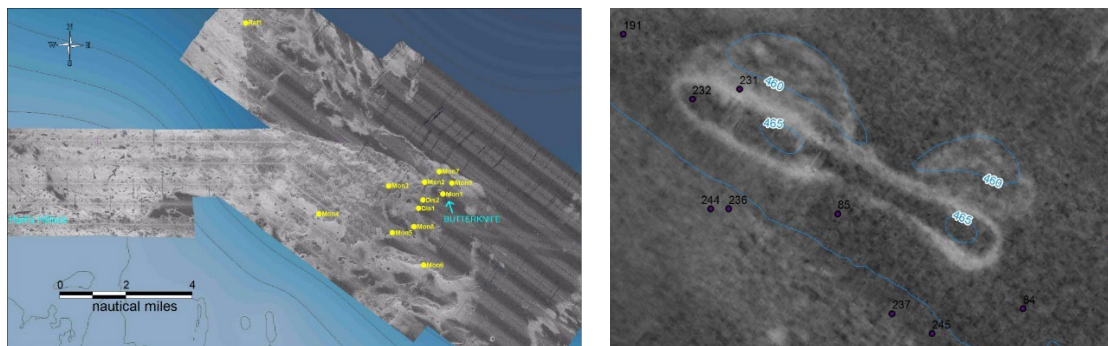


Figure 2: The survey area, with multibeam backscatter mosaic and regional bathymetry, showing Monitoring (MON) and Reference (REF) sites from 2018 (yellow circles), the Butterknife area (more detail in right figure), and Hart’s Hillock for coral collection.

The main Monitoring (MON) sites from 2018 were repeated, together with a Reference Site (REF), and a Disturbance site (DIS). Sampling occurred at 12 core sites, with towed camera (NIWAs Deep-Towed-Imaging-System (DTIS)) at all, and multicore deployments at seven sites. The distribution of sites, and gear deployments during TAN2005, are shown in the Figure 3.

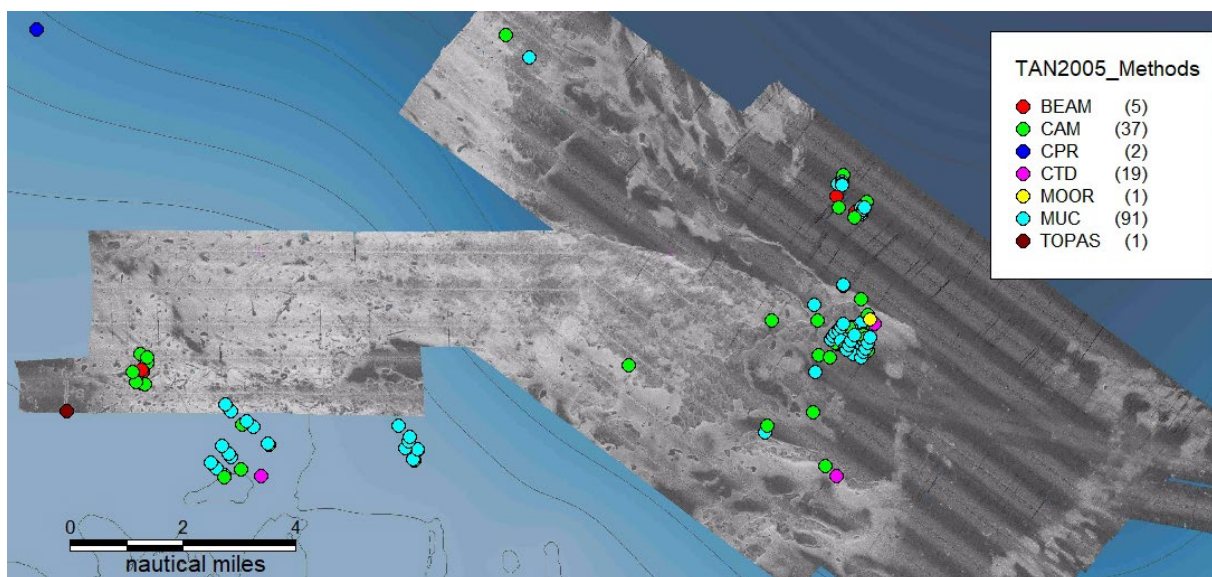


Figure 3: Location and number of gear deployments in the main ROBES survey area during TAN2005.

DTIS and multicore stations were completed on three iceberg scours in the southwest of the area (the dots off the multibeam map), as well as DTIS and beam trawl work further west at Hart’s Hillock. More detailed sampling (especially multicore) was carried out in the region of the Butterknife, and Conductivity-Temperature-Depth (CTD) stations were filled over a wider area to provide a broader regional context for the study (Figure 4).

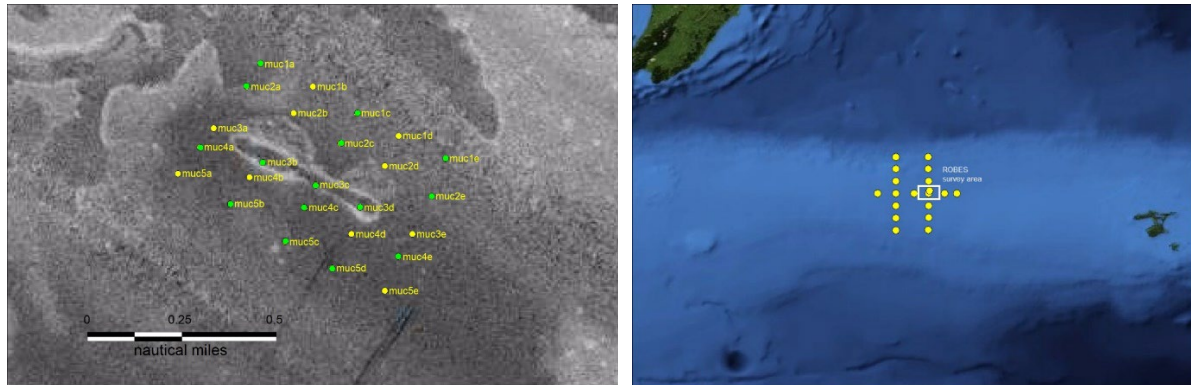


Figure 4: Left: The grid of Multicorer stations across the Butterknife area (green = SCOC sites). Right: The wider array of CTD sampling stations

The total number of stations completed was 156 (Table 1). Of these 36 were repeat sampling of 2018-2019 monitoring stations using DTIS and/or the multicorer (Table 2). There were 9 and 30 camera and multicorer deployments respectively around the Butterknife feature (Table 2).

Table 1: Number of deployments by sampling gear type. CAM = Deep Towed Imaging System (DTIS); MUC = multicorer; CTD = Conductivity-Temperature-Depth; MOOR = Mooring; ACO = Acoustics (TOPAS); BEAM = Beam Trawl, CPR = Continuous Plankton Recorder.

	CTD	MOOR	ACO	CPR	BEAM		
	37	91	19	1	1	2	5

Table 2: Number of sampling stations of the main gear types during the different phases of the survey. CAM = Deep Towed Imaging System (DTIS); MUC = multicorer; BEAM = beam trawl

Phase	CAM	MUC	BEAM	Total
2018 repeat	12	24		36
2019 repeat	9	30		39
Beam trawl impact	2	15	2	19
Iceberg scour	6	22		28
Coral capture			3	3

A subset of the Butterknife multicore sites (15 of the 25) was selected for more detailed experimental measurements (oxygen, community respiration, elutriation, sediment erosion) in the onboard laboratories. Coring was also carried out following beam trawl tows to create small scale disturbance we then sampled inside and outside; similar sampling inside and outside iceberg scours in the region were completed to look at long-term differences. Beam trawling was also carried out to capture live corals for sediment-tolerance experiments back at Greta Point (see Figure 5).

A single mooring was recovered which had been deployed in the 2019 ROBESII voyage. It had a current meter and sediment trap. The mooring showed rapid colonisation and growth of hydroids.



Figure 5: A clump of stony coral *Goniocorella Dumosa* on the seabed imaged by DTIS (left), multicoring operations on deck (middle) and the recovered sediment trap from the mooring (right).

Breakdown/downtime/weather days

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

Media coverage and outreach

No media activities occurred during the voyage and there was no press release related to it. However, outreach and iwi engagement is an important element of the research programme. NIWA's Pou Ārahi, Māori Development Leader, Lee Rauhina-August joined the voyage. She has been heavily involved in the engagement of the project with tangata whenua of the Chatham Islands and central South Island. This voyage gave Lee first-hand experience of the sort of science we are doing that can improve future engagement efforts. Two information flyers related to the voyage were prepared and subsequently distributed to stakeholders:

Clark, M.; Rauhina-August, L., Tracey, D. (2020). The resilience of deep-sea benthic communities to the effects of sedimentation. Information flyer 7. Final Voyage ROBES III. [<https://niwa.co.nz/coasts-and-oceans/research-projects/resilience-of-deep-sea-benthic-fauna-to-sedimentation-from-seabed-mining>]

Rauhina-August, L.; Clark, M.; Tracey, D. (2020). The resilience of deep-sea benthic communities to the effects of sedimentation. Information flyer 8. Te Haerenga Whakamutunga o ROBES. [<https://niwa.co.nz/coasts-and-oceans/research-projects/resilience-of-deep-sea-benthic-fauna-to-sedimentation-from-seabed-mining>]