VOYAGE PROGRAMME TAN0604: Northwest Chatham Rise "seamount" survey

Project title: Effects of fishing on underwater topographic features

Project code: ENV2005-16 (MFish, primary funding agency)
SFBF063 (FRST seamounts)
UCS05301 (CenSeam)

Vessel: R.V. *Tangaroa*

Area: North Chatham Rise

Period: 26 May – 10 June 2006 (TBA)

Voyage staff: Malcolm Clark (voyage leader), Owen Anderson, Rob Stewart, Alan Hart, Kerstin Kroeger, Kate Neil, Wilbert Knol, Aden Abdi, Mireille Consalvey, Michele Carter

OBJECTIVES

To monitor changes in fauna and habitats over time on selected seamount features in the Chatham Rise area that have a range of fishing histories (Graveyard hill complex)

To trial acoustic habitat mapping on several seamounts with a range of bottom types and fauna

To deploy a moored camera system on Morgue

To quantify the macro-invertebrate assemblage composition of other seamounts on the Chatham Rise if time permits

BACKGROUND

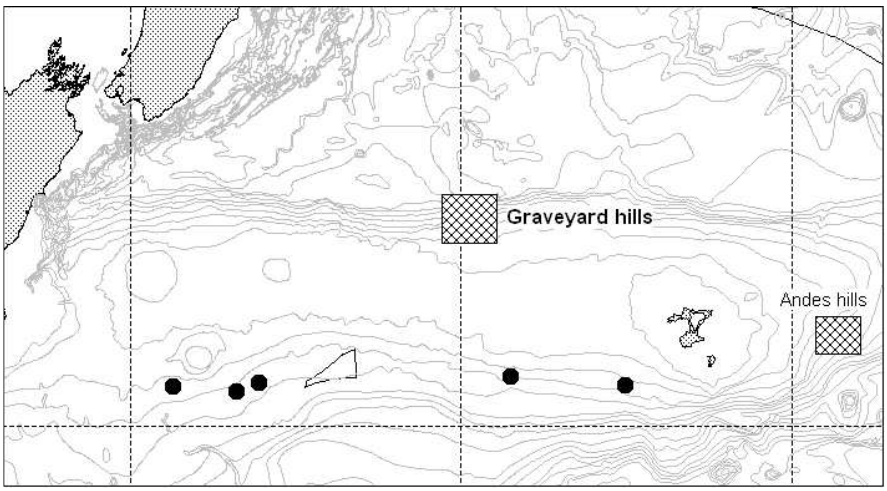
Seamounts, knolls, and hills are prominent features of underwater topography in the New Zealand region. They are often sites of high productivity, and the focus of important commercial fisheries. However, they can also comprise fragile habitat. Faunal communities on deepwater seamounts in the orange roughy depth range are commonly based on extensive coral growths, which are readily impacted by heavy bottom trawl gear. These corals may be long-lived and slow-growing, meaning their recovery from trawling could be slow.

Common changes with trawled ecosystems include a reduction in species diversity, biomass, and number of species. The dominant benthic species can change from large

sessile types (e.g. corals, hydroids, sponges) to small opportunistic species, scavengers, and juveniles. The age composition and size structure can change, and there is typically a reduction in habitat complexity.

There have been few studies on the effects of fishing on deepwater seamounts. Koslow et al. (2001) investigated the benthic macrofauna of small seamount features off southern Tasmania, many of which had been trawled in the orange roughy fishery. They found strong differences in faunal composition and distribution on fished and unfished seamounts, and concluded that trawling was responsible, although there was a marked depth difference in the fished and unfished seamounts.

In 2001, a similar "compare and contras" survey was carried out by NIWA on the Graveyard hills. This is a region that has been heavily fished since the early 1990s, but effort has concentrated on a small number of features, which enables study of seamounts in close proximity with similar physical characteristics, that have been fished to varying degrees. Preliminary results of this survey were given by Clark and O'Driscoll (2003), and showed that the unfished seamounts had greater coral cover, and some differences in species composition.



In this survey we will repeat coverage of the 2001 study, but cover the seamounts in greater detail, and also expand the number included in the survey. In addition we will carry out acoustic surveys of several hills to evaluate the application of such data for habitat mapping, which involves classifying the backscatter into components of the benthic habitat. Some data from the 2001 survey was tested for this, and indicated some potential for distinguishing bottom type and perhaps faunal composition. We will also deploy a camera system on Morgue seamount for the Deepwater Stakeholders Group, to see if a moored camera array will indicate the composition of extensive acoustic marks on the summit. Finally, if time permits, several other unsampled seamounts on the Chatham Rise will be surveyed to describe the benthic invertebrate composition.

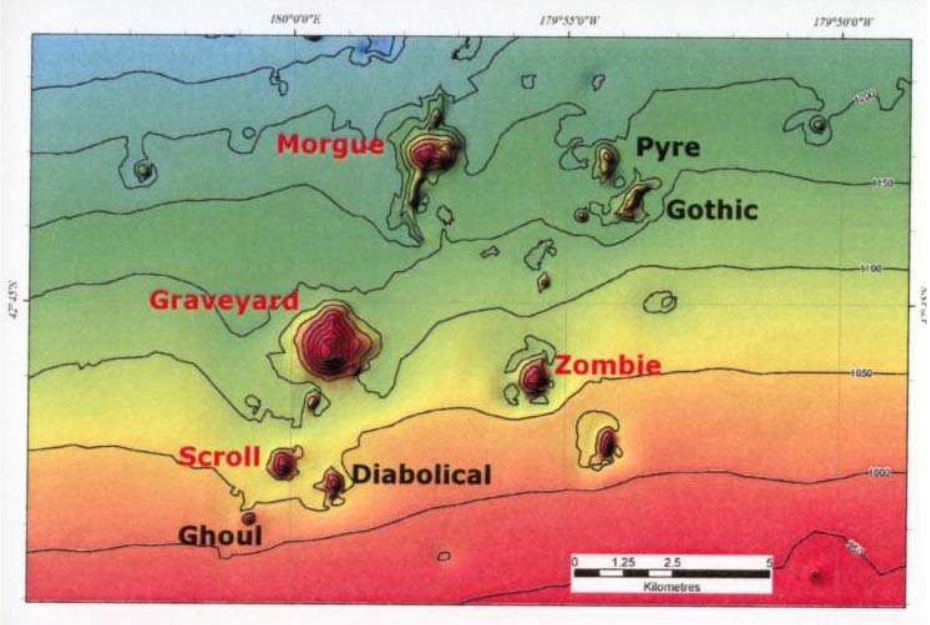
This survey is a combination of several projects. The main funding for the effects of fishing work is from the Ministry of Fisheries (ENV2005-16), supported by NIWAs

FRST-funded seamounts programme (project SFBF063). The Census of Marine Life seamount programme "CenSeam" is also providing support for the survey. The acoustic work, and biodiversity sampling, will be undertaken through the FRST-funded project SFAS063. The camera equipment to be deployed on Morgue is provided by the Deepwater Stakeholders Group in association with NIWA.

METHODS

Survey area and design

In 2001, 4 seamount features were surveyed using towed camera equipment and epibenthic sleds. These were Graveyard, Morgue, Diabolical, and Gothic. In addition, 4 more were sampled with sled: Pyre, Zombie, Scroll, and Ghoul (see Figure).



The survey this year will repeat the photographic work on the previous 4, and extend to several others:

Fishing	Frequency	Status	Seamount feature
Heavy	High	Open	Graveyard
Heavy	Low	Open	Scroll, Zombie
Heavy	High	Closed	Morgue
Light	Low-medium	Open	Diabolical, Ghoul/Wecnec
Light	Low	Closed	Pyre, Gothic

These features cover a good balance in combinations of the fishing effort and frequency of trawling events. Compare and contrast studies generally suffer from limitations on

replication. The survey this year will not solve this, but increases the samples from the range of fishing classification conditions.

Photographic transect survey

Photographic transects will be carried out from the summit of each seamount down the flanks as far as possible (to the base, or to the depth limitation of the equipment). At least 8 transects (N, NE, E, SE, S, SW, W, NW) will be carried out on each feature. Still and video cameras will be used. On Morgue, where we are attempting to monitor "recovery" (or at least changes since cessation of fishing), more detailed coverage may be needed. This is because settlement and growth of sessile fauna may be patchy in the early years of recolonisation, and the 8 line design may be too coarse. In addition, where an area/s of new growth/regrowth of sessile fauna are seen we propose to do a further series of vertical camera drops to obtain detailed coverage of an area/s that will be used as a small study site/s where growth rates or areal expansion of the fauna can be measured.

The camera gear to be used will depend upon how the new system works during the previous trip. This has real-time feed back to the vessel, and is the preferred system. However, if there are problems with the new equipment, we will use the "seamount/scampi" camera arrangement as deployed on the recent Antarctic survey. These will be deployed off the CTD winch at the cut-away.

Habitat mapping

The photographic coverage comprises a relatively small "footprint" of the bottom habitat. In order to improve the spatial scale of this, we propose to use the acoustic system in a frame higher off the bottom to gather backscatter data for habitat mapping. Frequencies of 38kHz and 70kHz are available. Single-beam habitat mapping has been used by NIWA in other areas to give information on the habitat: composition, structure, variability, and gradients in habitat features including three-dimensional structure. NIWA has investigated the acoustic data collected from the Graveyard hills in 2001, using QTC Seabed Classification software (Quester Tangent Corporation 2000). The data from 2001 proved unsuitable for detailed analysis, because of excessive acoustic scattering noise (the data were collected with the frame only 3-4 m above the seafloor), but the preliminary analysis results (NIWA unpublished data) indicated that the technique should be suitable for distinguishing classes such as coral, sand, rock, and also give information on the vertical extent of sessile fauna (such as coral). The frame will be flown at a greater height above the bottom (around 50 m, up to 100 m) to avoid near-bottom noise effects, and to increase the acoustic beam "footprint" (approximately 1 m width for every 10 m above the bottom). A parallel transect design will be used.

It is important to be able to determine what each recognisable acoustic "signature" represents in real life, and to know whether we can reliably identify the biological features of management interest (mostly large sessile epifauna such as large colonial hydroids, corals, the larger sponges, and biogenic heterogeneity in general) from various substrate

types. Hence, we will also target some photographic transects at areas giving particular acoustic signatures ("backscatter") to aid subsequent analyses.

Camera mooring deployment

The camera mooring will be deployed on the summit of Morgue seamount. The mooring will be put in position by lowering it on a suitable cable (trawl warp, CTD cable, etc, attached to the top of the mooring with an acoustic release) to within about 30 m of the bottom, positioning the ship over the top of Morgue, and then activating the acoustic release to allow the mooring to fall to the seafloor.

This will be carried out flowing completion of the regular survey sampling on Morgue. It will be left in position for several days before retrieval. This may be upon completion of the survey of the 8–9 Graveyard hills.

Direct sampling

A limited number of benthic samples will be taken from the Graveyard hills. These will be targeted on the basis of the photographic/acoustic results, as objectives are to identify specific faunal types that occur frequently, or are abundant, or are needed for size structure/growth analysis. Describing the overall biodiversity on a feature involves a considerable number of sled/trawl shots, and this is not a prime objective of the study in this region. A small epibenthic sled (1 m wide) will be used.

If other seamounts away from Graveyard are sampled for biodiversity, then a Van Veen type grab, and small beam trawl, will also be used, and more extensive sampling will occur. The grab and sled will be shot at each station, deployed to recover 4–6 samples from each seamount. Location will be based on a combination of random depth and random direction from the peak, as done on previous seamount surveys. The beam trawl is not designed for hard rough bottom. It will be used where the seafloor is relatively smooth, and targeted for such bottom rather than random.

Biological material recovered by the sampling effort will receive initial onboard sorting and processing. Macro-invertebrates will be identified to the lowest possible taxon that time and resources permit. Data will be entered first onto data log sheets (the new biodiversity format) and then subsequently into the Access database on a laptop. Information on number of samples and weight will be recorded. Fresh specimens will be photographed where possible, and then appropriately labeled and preserved. Station data for each shot will be entered in Trawl Coordinator.

The sequence at each seamount will be:

Swath survey of the feature if not previously mapped
Camera transects
Grab sampling
Sled sampling

(these may be done in pairs where appropriate depending on the distance between stations)
Beam trawl if bottom conditions allow

The grab will have a CN22 net monitor unit attached, which will aid holding the grab several metres above the bottom for a period before being lowered to take the sample. This will enable a stable video picture to be recorded of the type of habitat the grab is sampling, and how representative the resultant sample is (given its small size and patchy nature of the substrate).

Other areas

The Graveyard hills are a good site for the compare and contrast objectives of the survey. Depending on progress at the Graveyard, and given good weather and equipment performance, we anticipate there will be several days available for sampling other seamounts. The actual time left will determine how far east we are able to consider. A site that offers similar unfished-fished features is the "Andes" region (see Figure in Background section) on the eastern Chatham Rise. Diamond Head and Kenwood (lightly fished, infrequently fished, the former now closed), Cotopaxi, and Sir Michael (heavily fished, frequently fished) offer this contrast. However, this area is a days steam from Graveyard, and there may be insufficient time for this. If less time is available, we will select seamount features closer to the Graveyard where little is known of their benthic biodiversity. Candidates for this include features on the South Chatham Rise (see closed circles on Background section figure):
Pinnie: 44°32' S, 175°42' E, depth 600 m, a closed seamount.
Urry Knolls: 44°40' S, 174°30' E, depth 500 m.
Mt Sally: 44°38' S, 176°06' E, depth 813 m
Jumbo Jim: 44°35' S, 176°29'E, depth 654 m
Haegerville: 44°42.5' S, 177°03' W, depth 648 m

The first 4 of these have been relatively lightly fished. Heagerville has been heavily fished, but certain sectors of the feature are known to be very rough, and have probably not been trawled. This may provide good information on the unfished state of the seamount, and within-seamount contrast of fished-unfished habitat. Several other fished features on the South Rise are similar.

Vessel gear and scientific equipment

New deepwater video and still camera system
"Seamount" digital still camera frame and unit
PC for the camera, back-up facilities
Spares for the camera system
Modified CN22 net monitor (x2) for camera frame
CN22 slave monitor for set-up near bridge winch control
Scanmar depth sensor (x2)

Video camera for grab, and associated monitor, Hi-8 player etc
Laboratory camera set-up for specimen images

Epibenthic sled (x2), pre-rigged, spares
Van Veen grab (x1)
Beam trawl (x2), pre-rigged, 2 spare beams
Spares as appropriate for these gears
Sacrificial warp for towing sleds
Seabird CTD headline unit

38kHz deep-towed CREST system in Acoustics Frame
Towbody as back-up
38 kHz hullmounted system
2 pulley blocks
Spares as required
Pedestal winch ("Tardis")

Sample sorting table
Sampling buckets, bags, sacks, labels, gloves etc
Fixative chemicals: Formalin (5l) and Ethanol (200l, TBA)
Dissecting microscope
20 fish cases (onboard)
"Seamount" cases, no holes

Malcolm Clark
28 April 2006

Copies to:
NIWA General Managers (John McKoy (Fisheries), Don Roberston (Biodiversity))
Regional manager Greta Point (Rosie Hurst)
Manager, NIWA Vessels (Fred Smits), and John Hadfield
Master *Tangaroa* x2
Ships Notice Board
Voyage staff, plus Ashley Rowden, Gavin Macaulay, Richard Nelson
Central Data File x2
MFish: Martin Cryer, Mary Livingston