Tuingara to Blackhead Point Habitat Mapping

NIWA Client Report: HAM2004-094
June 2005

NIWA Project: DOC04274

Comment [NNTU1]: Complete Client Report No.

Comment [NNTU2]: Complete Month

Comment [NNTU3]: Complete Project No.

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Prepared for

Department of Conservation

NIWA Client Report: HAM2004-094
June 2005

NIWA Project: DOC04274

Comment [NNTU4]: Complete Client Report No.

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Contents

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Abstract

The purpose to this contract was to provide a subtidal habitat survey of the area between Tuingara Point and Blackhead Point, encompassing the reserve (Fig. 1) and 3 other subtidal reef systems outside the reserve, using acoustic mapping techniques and video. The video data fit well with a classification scheme developed by Shears et al. (2004) for North Island reefs. Five major reef habitat types were identified: Encrusting Invertebrates; Sponge flat; Mixed algae; *Ecklonia* forest; and Shallow *Carpophyllum* habitat. Only a small amount of this latter habitat was observed, probably due to the few samples taken in shallow waters. The major habitat type was, however, sand. Analyses were conducted to attempt to define habitats within the sand, however, the habitat was remarkably consistent: well-sorted medium sand, predominantly covered in ripples. Few epiflora or fauna, or biogenic structures were observed. Overall, the habitats were largely concordant with the side-scan imagery, allowing the habitats to be interpolated from the video sampled points, based on the side-scan imagery. Sponge flat and Encrusting invertebrate habitats, however, overlapped significantly, and they are presented as one habitat type in the interpolated map. Also, considerable variation was observed within the reef habitat types defined by Shears et al. (2004). This variation suggests that updating the reef habitats, as more data from different areas become available, may be useful.

Keywords:

Habitat mapping: Marine Surveys: Multi-resolution sampling strategies; Marine Reserves; Te Angiangi Marine Reserve

1. Introduction

The inshore marine environment along the Southern Hawke's bay coast from Pourerere to Blackhead point is generally characterised as having extensive intertidal reef platforms consisting predominantly of siltstone and several extensive subtidal reefs extending down to approximately 30m depth. In 1997 the Te Angiangi Marine Reserve was established between Aramoana Beach and Blackhead Beach, encompassing an area of ~ 446 hectares. Much of the coast along this area is relatively poorly surveyed, both in terms of biological assemblages and hydrography.

The Department of Conservation contracted NIWA to provide a subtidal habitat survey of the area between Tuingara Point and Blackhead Point, encompassing the reserve (Fig. 1) and 3 other subtidal reef systems outside the reserve. This multi-resolution survey was to include acoustic mapping techniques (side-scan sonar and bathymetry) and video mapping using a drop camera system to both ground-truth the side-scan data and provide information on species present and habitat assemblages. Side-scan surveys allow a large area of seafloor to be covered within a short space of time and can provide much information on seafloor topography and the extent of reef platforms. However, to prepare ecologically relevant maps, a sampling strategy is required that nests finer scale sampling within the broad scale side-scan survey (Hewitt et al. 2002). Previous studies have shown that video is a cost effective and appropriate way to carry out the finer scale sampling, compared to dive surveys where cost and safety are restrictive over large areas (Thrush et al. 2003).

The purpose of this survey was to identify the extent of habitats and document biological assemblages within the survey area for incorporation into a GIS map and ecosystem model of the marine resources of the East Coast Hawke's Bay Conservancy. Previous studies on classification of subtidal rocky reefs in New Zealand have used a number of broad habitat descriptions to classify and map subtidal communities based largely on the presence and cover of macroalgae species. These classification schemes generally are specific to a particular area. Shears et al. (2004) have revised these for the North Island to produce a more general classification scheme with 11 habitat classes. Four habitats are dominated by large brown algae, the remainder are based on low subcanopy algae, barrens, cobbles and encrusting communities and sponges. In this study we describe the reef systems within the survey area using the Shears et al. (2004) classification method for the rocky areas, and by using statistical classification techniques for the soft-sediments.

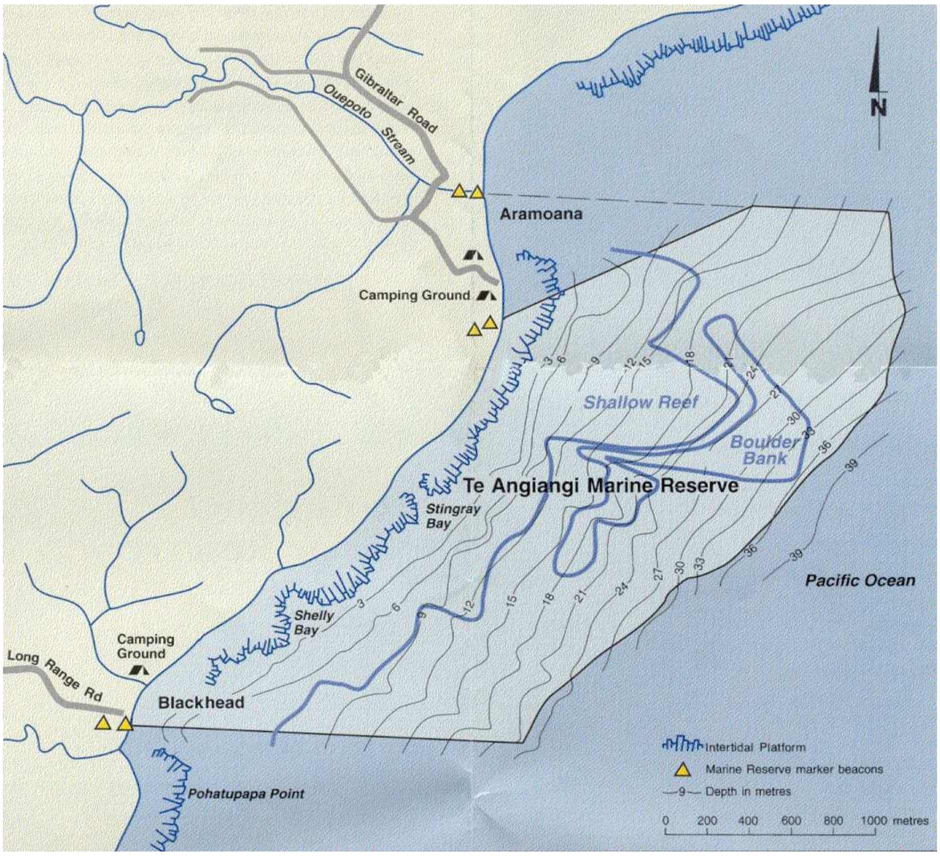

Figure 1: Location of Te Angiangi Marine Reserve, including existing bathymetry and habitat map.

2. Methods

The survey consisted of collecting three georeferenced datasets; side-scan sonar, bathymetry and video.

2.1 Side-scan

Seabed mapping was undertaken using a C-Max CM800 Sidescan Sonar system comprising a graphic recorder, a dual frequency tow fish operating in 100 kHz mode, with a steel armoured SCX tow-cable running through a digital pulley block for displaying layback. A new acquisition file was started at the end of each swath or whenever the layback was changed.

Swath width was 200m either side of the fish which was towed at between 2 and 4m from the bottom at about 4 knots boat speed. Sound velocity profiles were obtained at the start of each day using an AML SmartProbe.

During post-processing, adjacent swathes were mosaiced using the CODA DA50 mosaicing software and the data was output as a georeferenced TIFF file suitable for input into a GIS.

2.2 Bathymetry

During the course of this survey depths and associated positions were obtained using a range of high quality hydrographic tools, including differential GPS, single-beam echosounder, motion sensor, and hydrographic software.

An Omnistar 3100LR differential GPS receiver provided real-time positions with an accuracy of 2 to 5 metres. The Omnistar unit receives differential corrections from the Fugro system which broadcasts corrections via a communications satellite. A Trimble DSM212H GPS was used as a secondary source of position data and for UTC timestamp.

An Echotrac DF3200 echosounder was operated at a transmit frequency of 200kHz to obtain depths. The transducer was mounted on a pole on the starboard side of the vessel. A DMS 2 motion sensor (TSS UK Ltd) was located on the deck of the vessel in close proximity to the transducer pole to provide accurate measurements of heave.

The GPS units, echosounder and heave sensor were interfaced with a multiport computer. HydroPro Navigation software (Trimble Ltd) was used to display and log the data from each of the sensors. The distances (offsets) between the GPS antennas, transducer, and motion sensor were measured and recorded in the HydroPro Navigation software to enable calculation of the actual positions of each sensor based on these offsets. In addition to recording the depth, heave and positions, the HydroPro Navigation software converted the positions into NZ Map Grid coordinates, and provided immediate quality control data to the operator.

A bar check was carried out at the start of each day to calibrate the echosounder. The draft of the transducer was entered directly into the echosounder to ensure depths were measured from below the sea surface, rather than from below the transducer. Sound velocity was also measured daily using a SV Plus probe (Applied Microsystems Ltd).

Bathymetric data was logged during shore normal transects with a spacing of less than 200m. Due to adverse weather and sea conditions, only an area from Tuingara Point to Blackhead beach was surveyed. This included the entire marine reserve but did not incorporate the reef structures to the south of the reserve, between Blackhead beach and Blackhead Point.

The bathymetric data was processed using HydroPro NavEdit software for checking and editing the position, depth, and heave data. Tidal data based on NIWA's tidal model was applied to reduce the depths to a datum based on Lowest Astronomical Tide. The reduced depths and associated positions in NZ Map Grid coordinates are provided on CD and as a GIS layer.

2.3 Video

The video sampling was conducted using a high resolution (480 line) Simrad colour video camera with a 50watt light source. The camera was linked to the surface with an umbilical cable and the image recorded onto MiniDV video cassette tape using a Sony Digital Video Cassette recorder. Due to the rocky nature of the seafloor and the likelihood of snagging the camera or damage due to impact with rocks, a towed camera system was not used. Instead the camera setup consisted of a depressor weight, bridle, camera frame, floatation for buoyancy/stability and a length of chain to provide for height adjustment and cushioning of the camera hitting the bottom. As the camera is lowered on its depressor weight the frame also sinks due to the weight of the chain. When the chain reaches the seafloor the reduced weight increases the buoyancy of the frame. In stable conditions the frame is neutrally buoyant at approximately 30cm off the seafloor. Three red lasers (wavelength 633nm, 5mW) were mounted on the frame in a 12cm triangle, so as to provide scaling of seafloor objects as required. The camera was lowered to approximately 0.5-2m from the seafloor and video was recorded as the boat drifted over the site. This provided a good overview of the habitat characteristics and enabled estimates of canopy and subcanopy cover of algae and fauna. In addition, several times during the drift sample the camera came close enough to the substrate that the natural colours of encrusting and sub-canopy species were seen. Navigation to predefined locations for video sampling was accomplished using HydroPro navigation software. Sampling locations were chosen to give a general cover of the whole survey area, with other points added based on data produced from the side-scan survey.

For each length of video recorded, boat position and time of video recording were logged during the survey using HydroPro software (positions and depths are given in Appendix 6.1) and used to calculate the distance travelled by the video. For each length of video, a 10m segment of footage representative of the area covered was selected for analysis. If there were 2 or more obvious changes in habitat characteristics within the area, it was split into 2 or more 10m lengths for analysis. For example, if the camera travelled over sand ripples followed by a rocky area, then a ten-meter transect from each substrate was analysed. Once a segment had been chosen, analysis consisted of ranking the percent cover of canopy and subcanopy species (excluding fish) within the 10m segment. The ranking was based on the ranking system described by Braun-Blanquet (1964) where percent cover is ranked from 0-5 based on the following:

0 = Absent

1 = <1 to 10%

2 = 11 to 30%

3 = 31 to 50%

4 = 51 to 75%

5 = 76 to 100% cover

2.4 Statistical analyses

For the hard substrata data, average linkage clustering was run, on the flora and fauna data, to determine similarities (Bray-Curtis) between sites. The video segments were then classified into habitat types, based on Shears et al. (2004). Once the video had been classified, an analytical classification procedure (SIMPER; Primer, Clarke 1993) was run on the rank cover data to determine within group similarity. The statistical significance of differences between the habitat types was tested using a randomised permutation test on Bray-Curtis similarities (ANOSIM; Primer, Clarke 1993).

For the soft sediment data, average linkage clustering was run on the flora and fauna data to determine similarities between sites, and to determine whether any obvious community groupings occurred. The video segments were then classified into habitat types, using a 50% similarity level. After this, a SIMPER analysis was run to determine within-habitat similarity and the taxa contributing most to that similarity.

3. Results

3.1 Side-scan

The side-scan imagery (Fig. 2) reveals a number of distinctive habitat features. The reef systems (dark areas) are clearly differentiated from soft sediment areas, although mixed areas are present (Fig. 3). Differences within the reef areas are also apparent (Fig. 4). The survey covered an area of approximately 2224 hectares, with 1491 hectares being occupied predominately by sand.

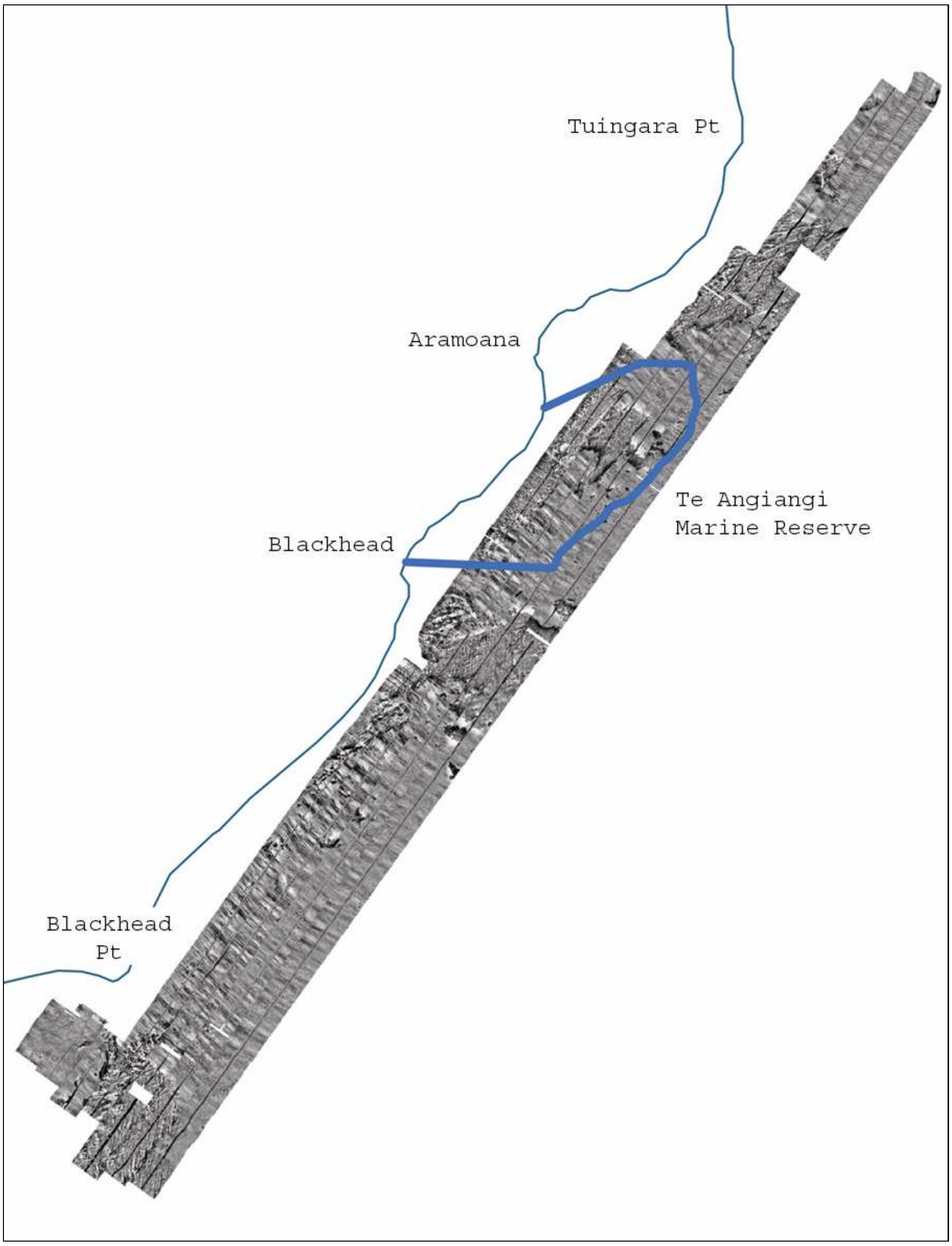

Figure 2: Side-scan imagery from the Te Angiangi reserve and surrounding areas. An ArcView GIS compatible layer showing high resolution raw sidescan is also provided on disk for incorporation into the DOC GIS system.

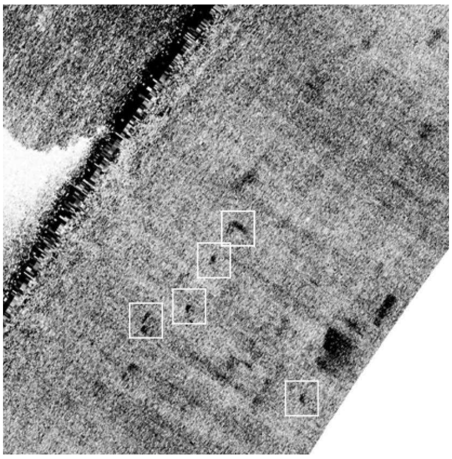

Figure 3: A close up of a section of side-scan where isolated rocks or boulders are present over what is predominantly a sand flat.

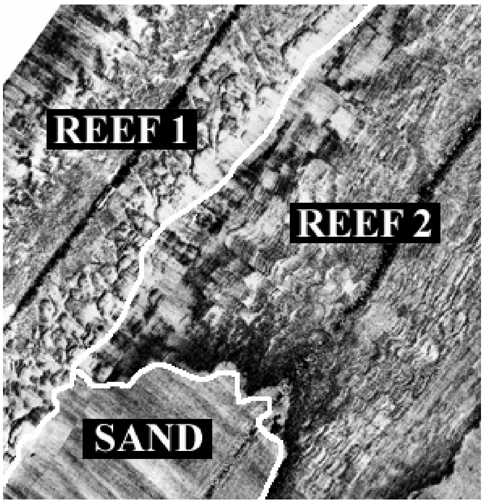

Figure 4: A section of a reef system located within the Te Angiangi reserve clearly showing different physical habitat types. Note that dark straight lines are the midpoints of the side-scan sonar sweeps.

3.2 Bathymetry

Bathymetry data is provided as an ARC View GIS layer separate to this report as New Zealand map grid (NZMG) coordinates and depth (relative to Lowest Astronomical Tide) on CD.

3.3 Video

Video samples were taken from 144 different locations within the survey area, with 73 being from rocky reef habitats.

3.3.1 Hard substrate

The video data could be allocated to five of the habitat types found by Shears et al. (2004). These included: *Ecklonia* forest, Encrusting invertebrates, Mixed algae, Shallow *Carpophyllum* and Sponge flat (Fig. 5). Of these, the Shallow *Carpophyllum* habitat was the most distinctive habitat (with-in group similarity 63.6). The *Ecklonia* forest habitat was less distinctive (with-in group similarity 54.1%), and the remaining habitats, Mixed algae, Encrusting invertebrates and Sponge flats, had within-group similarities of 44 – 48% only.

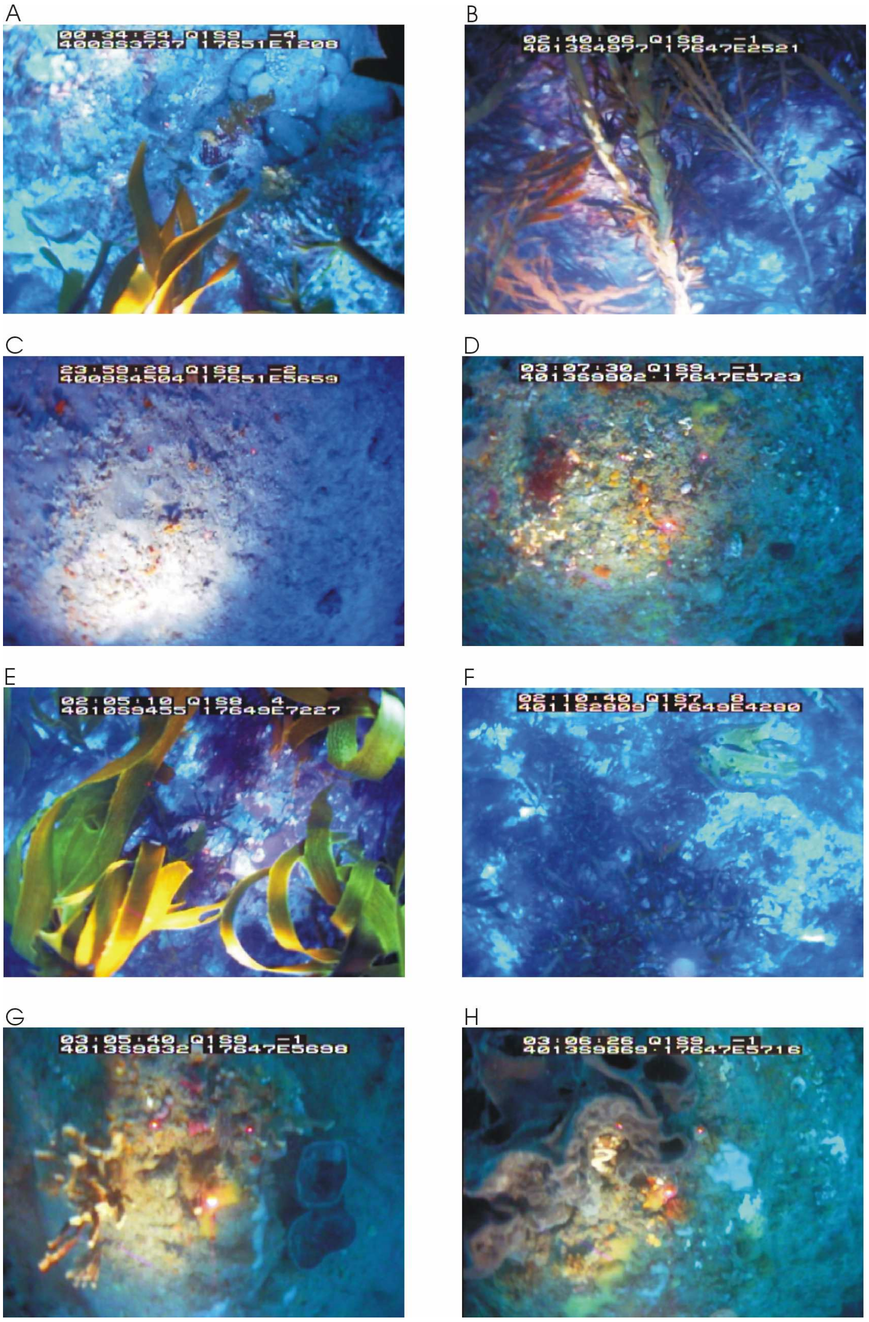

Figure 5: Examples of hard-substrata habitat types. A- *Ecklonia* forest, B- Shallow *Carpophyllum*, C & D- Encrusting invertebrates, E & F Mixed algae, G & H- Sponge flats.

To expand the habitat type descriptions, the species that contributed to similarities within a habitat were determined (Table 1). Similarity Percentages (SIMPER) are given for species contributing more than 5% to overall similarity. The greater the similarity percentage, the more a species contributes to defining a particular habitat group. Although, the species found in each habitat were generally similar to descriptions given in Shears et al. (2004), there were some notable differences. For example, soft bryozoans were an important component in the Sponge flat habitat, sponges and algae were important in the Encrusting invertebrate habitat, and coralline algae are important in both the *Ecklonia* forest and the Shallow *Carpophyllum* habitats.

Table 1: Description of the hard substrate habitat types found in this study. The degree to which a taxa contributes to the similarity of a habitat type is given as a percent of 100 (in brackets), for taxa contributing more than 5% to overall similarity.

Habitat Group	**Number of samples**	**Depth range**	**Taxa important for defining habitat type**
Ecklonia forest	26	8.8-20.8m	Crustose Coralline (15.8) *Ecklonia radiata* (15.3) Juvenile *Ecklonia* (8.9) Crimson Coralline Sponge (7.1) Algal Turf (5.6)
Encrusting Invertebrates	14	15.1-48.6	Encrusting fauna (36.0) Crustose Coralline (21.5) White Encrusting Sponge (14.3) Orange Encrusting Sponge (8.1) Unidentified Red/Brown Algae (5.3)
Mixed Algae	11	3.8-18.1	Crustose Coralline (25.4) *Ecklonia radiata* (11.8) Crimson Coralline sponge (11.1) *Zonaria angustata* (10.8) *Landsburgia quercifolia* (10.0) Juvenile *Ecklonia* (9.9) *Carpophyllum maschalocarpum* (6.6)
Shallow *Carpophyllum*	3	3.7-5.3	*Carpophyllum maschalocarpum* (26.7) Crustose Coralline (22.0) Crimson Coralline sponge (20.2) *Lessonia variegata* (12.0)
Sponge Flat	17	16.5-34.7	Soft Bryozoan (23.1) Encrusting fauna (16.6) Orange encrusting sponge (10.9) Crustose Coralline (10.2) Small Yellow/Orange sponge (9.5) Small White sponge (6.4) Finger sponge (6.2)

Average linkage cluster analysis of the video data shows a high degree of dissimilarity between sites (Fig. 6). At 50% similarity of communities, there were five major group splits that contained at least 7 video samples each. There were numerous minor groupings as well: six groups consisted of 2-4 video locations and nine were isolated video locations. The points 1 to 4 on the cluster diagram indicate where habitat classes based on the Shears et al. classification were separated out. Point #1, in general, indicates a split between the Encrusting invertebrate/Sponge flat class (to the left) and habitats based on algae species. Point #2 splits Ecklonia forest (to the right) from other algae classes and Point #3 separates Carpophyllum and mixed algae classes. A second occurrence of Encrusting invertebrates/Sponge flat occurs to the right of point #4, and separates it from Ecklonia forest. This second occurrence is due to a small amount of Ecklonia present in the samples, but note that the high dissimilarity at the split at point #4 indicates that it is not very similar to the Ecklonia forest habitat. Encrusting invertebrate and Sponge flat habitats could not be distinguished by average linkage cluster analysis and were therefore combined. For a few samples (shown by the asterisks) there was a poor relationship between the cluster analysis and the Shears groupings. While groupings generally related well to the Shears classification it does illustrate how variable the taxa found within habitat types are.

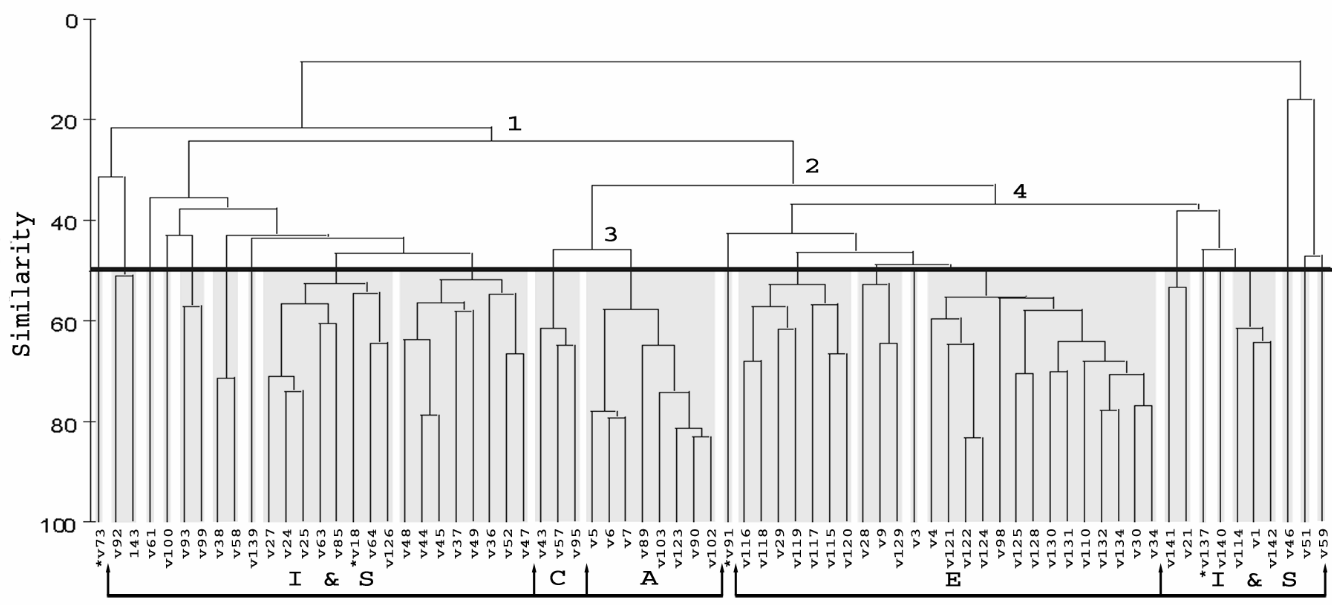

Figure 6: Average linkage cluster analysis of hard-substrate video data. Habitat classifications (based on Shears et al. 2004) are shown along the bottom axis (I = Incrusting invertebrates; S = Sponge flat; C = Carpophyllum; A = Mixed algae; E = Ecklonia forest).

3.3.2 Soft-substrata

Little structure and very few organisms were observed in the soft sediments found in this area. Sediment type was primarily sand, although some areas of finer sand/mud were observed, and an occasional sample had rock, boulders or cobbles. Ripples covered the sand surface at all but three sites; these were predominantly medium in size (1-3cm high, wavelength ~10 cm). The occasional gastropod was observed; but there were no signs of bioturbation, worm tubes or casts or shell aggregations.

Cluster analysis of the soft-sediment data shows, unlike the hard substrata, a high degree of similarity between sites (Fig. 7). Three major groups were observed with greater than 80% similarity. Except for the two samples to the far left of the classification tree, which were in areas containing rock or boulders, the groups are distinguished by the amount and size of ripples.

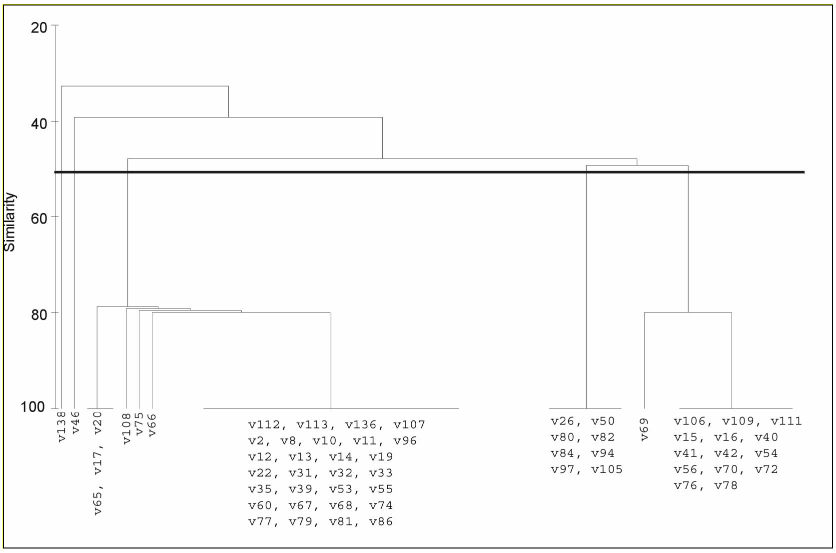

Figure 7: Average linkage cluster analysis of soft-sediment video data.

4. Discussion

4.1 Habitat maps

In general, the video survey identified broad habitat types that were concordant with visible changes in the side-scan printout. Note, however, that the Sponge flat and Encrusting invertebrate habitats are presented as one habitat type in the interpolated map (Fig. 8), because they were not well separated statistically. An isolated point off Aramoana indicates that there is a patch of 'Mixed algae' habitat further offshore than other video samples classified into this group. This is likely due to the raised elevation of the reef at this point compared to the other video locations the same distance from the shore (the depth is approximately 19.5m at this point).

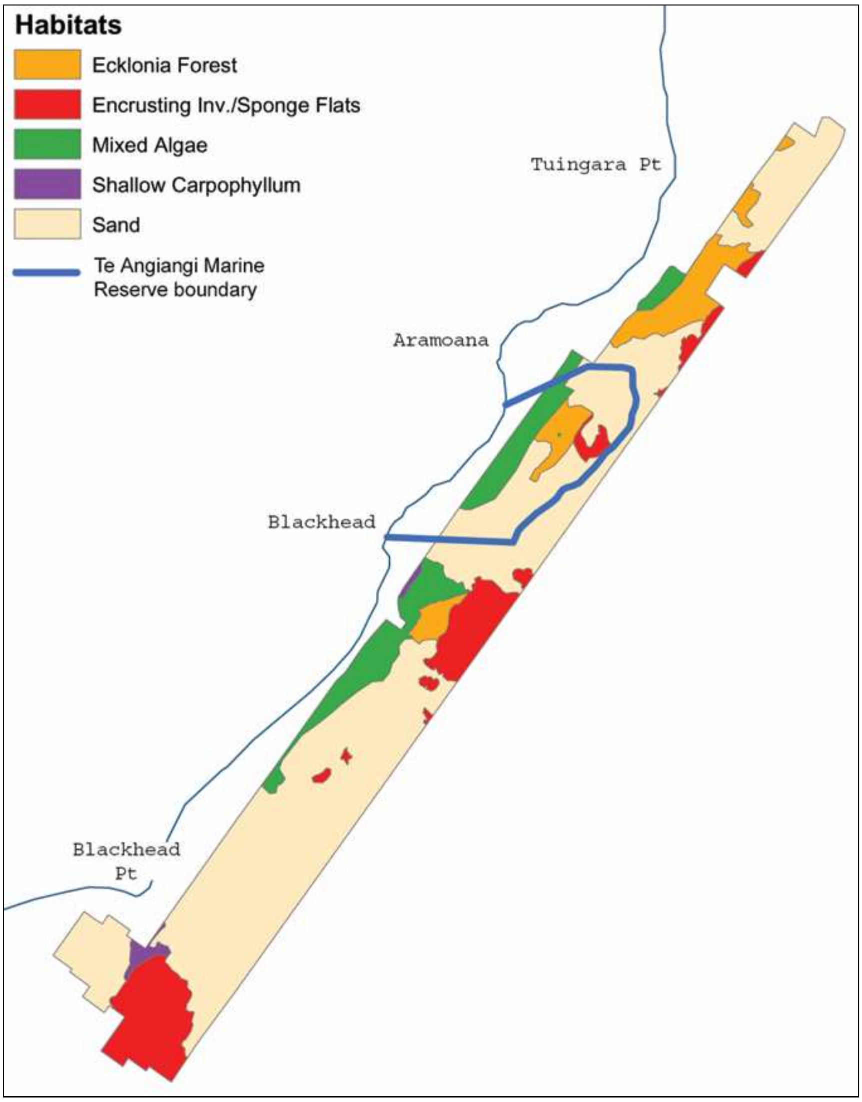

Figure 8: Subtidal reef habitats based on side-scan sonar and video information.

The most common reef habitat encountered in this survey was Encrusting Invertebrates/Sponge flat, with a total area of 303 hectares, making up 40% of the entire reef surveyed in this report. The other major habitat types were Mixed algae and *Ecklonia* forest with 226 hectares and 185 hectares respectively. The Shallow *Carpophyllum* habitat is likely under represented (at only 19 hectares) as it occurs in shallow water where the vessel was unable to survey due to safety concerns.

While no habitat classification scheme yet exists for soft sediments, we find the soft sediments in this area to be remarkably simple. They are comprised mainly of well-sorted medium sand, which is predominantly covered in ripples. There is a lack of epiflora and fauna, or any form of biogenic structure. At this stage, this sediment type is best treated as forming a single habitat type.

4.2 Caveats

It is important to note that, due to the sea conditions in the area of the survey, much of the very shallow habitat was not able to be surveyed.

It should also be noted that all video taxa identifications and cover estimates were conducted using a drop video camera system. No diving was undertaken to collect token species for accurate identification and therefore any species or taxa names included in the report should be used with caution. While remote survey technique involve an inherent lack of certainty, they do provide identification of broad habitat classifications, which was the contract objective.

The general agreement between the habitat types and the side-scan imagery provides a basis for interpolating the habitat extents based primarily on the side-scan results. However, the overlap of two main habitat types confirms that large-scale ground truthing continues to be necessary. Nesting the video within the acoustic survey has enabled a large area to be surveyed with a reasonable degree of accuracy.

The habitat types used by Shears et al. (2004) were appropriate for the majority of the survey area. This is important as it will allow the results to be easily compared with other surveys. However, it should be noted that there were sites that were not easily classified into the Shears et al. (2004) classification scheme and considerable variation was noted within habitats. Any classification scheme is specific to the data used to generate it and, even though the Shears classification was built on samples from a large geographical extent, it should be updated as more data from different areas become available. It is possible that in a few more years, analysis of combined datasets will allow more detailed classification. Although detail is desirable to a point, over-classification can be problematic. The goal to classification is to provide meaningful groups of species, with distinctive characteristics and functions, that provide different ecosystem services and affect habitat usage in different ways. When shifts occur to such groupings, they will reflect major changes to the ecosystem.

4.3 Addenda

In addition to the written report, this information is presented in a digitised format for incorporation into the ARC GIS system. Also, segments of the actual video footage have been produced in MPEG video format and included on a CD for viewing on a PC. The resolution of these MPEG's are comparatively low due to file size constraints, however they will provide the viewer an overview of the video site. The raw footage is provided in full resolution on Mini Digital Video Cassette format as a permanent record of the survey.

5. References

Braun-Blanquet. (1964).

Clarke, K.R. (1993). Non-parametric multivariate analyses of changes in community structure. *Aust J Ecol 18*: 117-143.

Hewitt, J.E.; Thrush, S.F.; Legendre, P.; Cummings, V.J. & Norkko, A. (2002). Integrating heterogeneity across spatial scales: interactions between *Atrina zelandica* and benthic macrofauna. *Marine Ecology Progress Series 239*: 115-128.

Shears, N.T.; Babcock, R.C.; Duffy, C.A.J.; Walker, J.W. (2004). Validation of qualitative habitat descriptors commonly used to classify subtidal reef assemblages in north-eastern New Zealand. *New Zealand Journal of Marine and Freshwater Research 38*: 743-752.

Thrush, S.F.; Hewitt, J.E.; Funnell, G.A.; Nicholls, P.; Budd, R.; Drury, J. (2003). Development of mapping and monitoring strategies for soft-sediment habitats in marine reserves Prepared for Department of Conservation NIWA Client Report: HAM2003-118

6. Appendices

6.1 Drop camera positions in New Zealand Map Grid, including depth and habitat group.

Video sample label	Shears et al. (2204) Groups (plus soft sediments)	Depth	Easting	Northing
v110	*Ecklonia* forest	16.7	2836541.06	6106670.67
v115	*Ecklonia* forest	17.1	2840746.09	6112203.47
v116	*Ecklonia* forest	17.1	2840738.52	6112196.2
v117	*Ecklonia* forest	12.2	2840504.74	6112303.68
v118	*Ecklonia* forest	13.5	2840393.79	6112039.35
v119	*Ecklonia* forest	13	2840393.22	6112029.55
v120	*Ecklonia* forest	12.5	2840556.32	6111879.78
v121	*Ecklonia* forest	15.5	2840390.43	6111575.05
v122	*Ecklonia* forest	15.5	2840368.41	6111568.97
v124	*Ecklonia* forest	19.6	2840354.19	6111383.41
v125	*Ecklonia* forest	19.6	2840362.63	6111361.73
v128	*Ecklonia* forest	17.3	2840090.98	6111197.23
v129	*Ecklonia* forest	17.3	2840107.09	6111172.07
v130	*Ecklonia* forest	11.3	2839881.54	6111301.4
v131	*Ecklonia* forest	8.8	2839648.85	6111240.96
v132	*Ecklonia* forest	15	2839832.47	6111079.19
v134	*Ecklonia* forest	15	2839866.26	6111006.39
v18	*Ecklonia* forest	20.8	2838338.683	6109244.748
v28	*Ecklonia* forest	14.1	2838043.648	6109504.876
v29	*Ecklonia* forest	14.1	2838052.281	6109490.978
v3	*Ecklonia* forest	19.5	2838612.178	6109728.987
v30	*Ecklonia* forest	13.1	2838052.836	6109477.43
v34	*Ecklonia* forest	14.9	2838459.37	6110056.494
v4	*Ecklonia* forest	17.1	2838453.103	6109732.194
v9	*Ecklonia* forest	16	2837955.423	6108909.766
v98	*Ecklonia* forest	13.8	2836507.04	6107054.14
v1	Encrusting Invertebrates	24.6	2838765.177	6109743.084
v114	Encrusting Invertebrates	24.4	2841095.85	6112013.84
v137	Encrusting Invertebrates	24.1	2840282.19	6110851.33
v141	Encrusting Invertebrates	19.5	2837334.6	6107161.54
v142	Encrusting Invertebrates	17	2835214.16	6104871.45
v143	Encrusting Invertebrates	17	2835216.38	6104850.42
v24	Encrusting Invertebrates	27.4	2838678.483	6109315.201
v25	Encrusting Invertebrates	30.6	2838702.757	6109249.12
v27	Encrusting Invertebrates	32.5	2838738.201	6109184.776
v44	Encrusting Invertebrates	15.1	2832387.054	6101760.56
v45	Encrusting Invertebrates	21	2832518.597	6101452.787
v48	Encrusting Invertebrates	22.2	2832652.503	6101170.846

Video sample label	Shears et al. (2204) Groups (plus soft sediments)	Depth	Easting	Northing
v52	Encrusting Invertebrates	33.5	2832776.465	6100905.629
v61	Encrusting Invertebrates	48.6	2832863.68	6099960.98
v92	Encrusting Invertebrates	25.5	2838595.99	6109497.19
v102	Mixed Algae	7.3	2835950.16	6106655.8
v103	Mixed Algae	8.6	2835502.7	6106055.23
v123	Mixed Algae	6.1	2840128.48	6111802.31
v140	Mixed Algae	19.5	2837339.98	6107180.76
v5	Mixed Algae	10.1	2838221.207	6109842.49
v6	Mixed Algae	7.8	2837906.432	6109615.314
v7	Mixed Algae	8.1	2837682.06	6109230.26
v73	Mixed Algae	5	2833035.1	6103621.52
v89	Mixed Algae	6.7	2837268.08	6108759.3
v90	Mixed Algae	3.8	2837510.11	6109106.55
v91	Mixed Algae	18.1	2838369.03	6109550.77
v43	Shallow *Carpophyllum*	3.7	2832241.126	6102087.283
v57	Shallow *Carpophyllum*	5.3	2832551.324	6102384.703
v95	Shallow *Carpophyllum*	4.5	2836298.89	6107719.31
v100	Sponge flat	30.4	2836875.15	6105981.7
v126	Sponge flat	28.7	2840536.05	6111181.68
v139	Sponge flat	33.4	2837787.54	6107401.82
v21	Sponge flat	31.5	2838975.789	6109460.666
v36	Sponge flat	27.1	2832402.454	6101263.603
v37	Sponge flat	18.8	2832201.073	6101292.399
v38	Sponge flat	25	2832196.224	6101262.038
v47	Sponge flat	23.3	2832533.237	6101416.593
v49	Sponge flat	22.2	2832656.733	6101153.621
v51	Sponge flat	23.1	2832678.734	6101106.923
v58	Sponge flat	20.5	2832612.827	6101631.051
v59	Sponge flat	16.5	2832616.017	6101622.578
v63	Sponge flat	31	2832626.95	6100503.53
v64	Sponge flat	24.7	2832425.68	6100773.72
v85	Sponge flat	34.7	2840311.51	6110311.87
v93	Sponge flat	25.5	2838609.29	6109495.87
v99	Sponge flat	26.7	2836974.14	6106696.59
v10	Soft sediments	16	2837961.385	6108889.87
v101	Soft sediments	18	2836332.1	6106399.22
v104	Soft sediments	18	2835889.22	6105766.97
v105	Soft sediments	8.8	2835025.21	6105425.54
v106	Soft sediments	24.9	2835730.12	6104901.09
v107	Soft sediments	25.1	2835362.68	6104164.23
v108	Soft sediments	13.6	2834648.83	6104628.08
v109	Soft sediments	14.1	2835967.56	6106166.71
v11	Soft sediments	26.1	2838258.125	6108597.62
v111	Soft sediments	15.4	2840816.26	6112575.74
v112	Soft sediments	10.4	2841015.07	6112494.6

Video sample label	Shears et al. (2204) Groups (plus soft sediments)	Depth	Easting	Northing
v113	Soft sediments	27.4	2841300.61	6112315.56
v12	Soft sediments	26.5	2838030.434	6107998.375
v127	Soft sediments	23.9	2840361.59	6111083.89
v13	Soft sediments	33	2838194.154	6107838.058
v133	Soft sediments	15	2839847.84	6111043.69
v135	Soft sediments	22.6	2840075.84	6110931.67
v136	Soft sediments	24.1	2840274.35	6110870.39
v138	Soft sediments	12.7	2839101.3	6110763.69
v14	Soft sediments	17	2837484.172	6107966.673
v15	Soft sediments	11.4	2837166.825	6108137.516
v16	Soft sediments	7.5	2836917.043	6108362.483
v17	Soft sediments	33	2838785.596	6109146.96
v19	Soft sediments	14.5	2838065.669	6109259.01
v2	Soft sediments	24.6	2838775.687	6109729.844
v20	Soft sediments	38	2839436.854	6109377.601
v22	Soft sediments	32.7	2838977.455	6109407.609
v23	Soft sediments	26.8	2838632.637	6109372.402
v26	Soft sediments	32.2	2838733.022	6109196.487
v31	Soft sediments	15.5	2838074.224	6109449.455
v32	Soft sediments	21.6	2839516.659	6110491.238
v33	Soft sediments	16.5	2838563.653	6110077.899
v35	Soft sediments	16	2838475.273	6110033.016
v39	Soft sediments	13.7	2831873.058	6101704.51
v40	Soft sediments	9	2831599.515	6102189.312
v41	Soft sediments	10.8	2831641.792	6102078.396
v42	Soft sediments	7.7	2832007.293	6102151.545
v46	Soft sediments	23.5	2832526.049	6101441.168
v50	Soft sediments	23.6	2832662.871	6101137.797
v53	Soft sediments	31.9	2833335.544	6101318.897
v54	Soft sediments	19.6	2833070.529	6101678.716
v55	Soft sediments	14.9	2832964.116	6101819.99
v56	Soft sediments	10.2	2832729.77	6102137.54
v60	Soft sediments	48.6	2832867.62	6099973.41
v62	Soft sediments	48.6	2832859.3	6099945.05
v65	Soft sediments	17.4	2831917.73	6101350.44
v66	Soft sediments	45	2833225.84	6100524.77
v67	Soft sediments	41	2833283.59	6100825.38
v68	Soft sediments	32.2	2833884.75	6101510.43
v69	Soft sediments	24.8	2833642.71	6101720.33
v70	Soft sediments	15.3	2833318.51	6102018.23
v71	Soft sediments	10.3	2832879.21	6102437.56
v72	Soft sediments	6.3	2832590.58	6102711.67
v74	Soft sediments	10.5	2833389.94	6103357.35
v75	Soft sediments	21	2834250.22	6102590.9
v76	Soft sediments	25.5	2834913.53	6103187.25

Video sample label	Shears et al. (2204) Groups (plus soft sediments)	Depth	Easting	Northing
v77	Soft sediments	15.2	2834157.99	6103690.66
v78	Soft sediments	4.8	2833556.83	6104229.05
v79	Soft sediments	44.6	2839785.29	6109045.8
v8	Soft sediments	16	2837961.043	6108931.197
v80	Soft sediments	40.6	2839475.71	6109120.99
v81	Soft sediments	36.7	2839052.27	6109055.88
v82	Soft sediments	29.4	2839206.41	6109772.05
v83	Soft sediments	37.3	2839790.78	6109748.62
v84	Soft sediments	22.3	2839272.42	6110213.99
v86	Soft sediments	27.8	2838411.19	6108839.4
v87	Soft sediments	43	2838934.77	6108315.51
v88	Soft sediments	20.6	2837877.12	6108343.31
v94	Soft sediments	27.4	2838854.16	6109586.19
v96	Soft sediments	12.5	2836741.53	6107541.05
v97	Soft sediments	13.8	2836507.95	6107065.22