Tuingara to Blackhead Point Habitat Mapping

NIWA Client Report: HAM2004-094
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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.

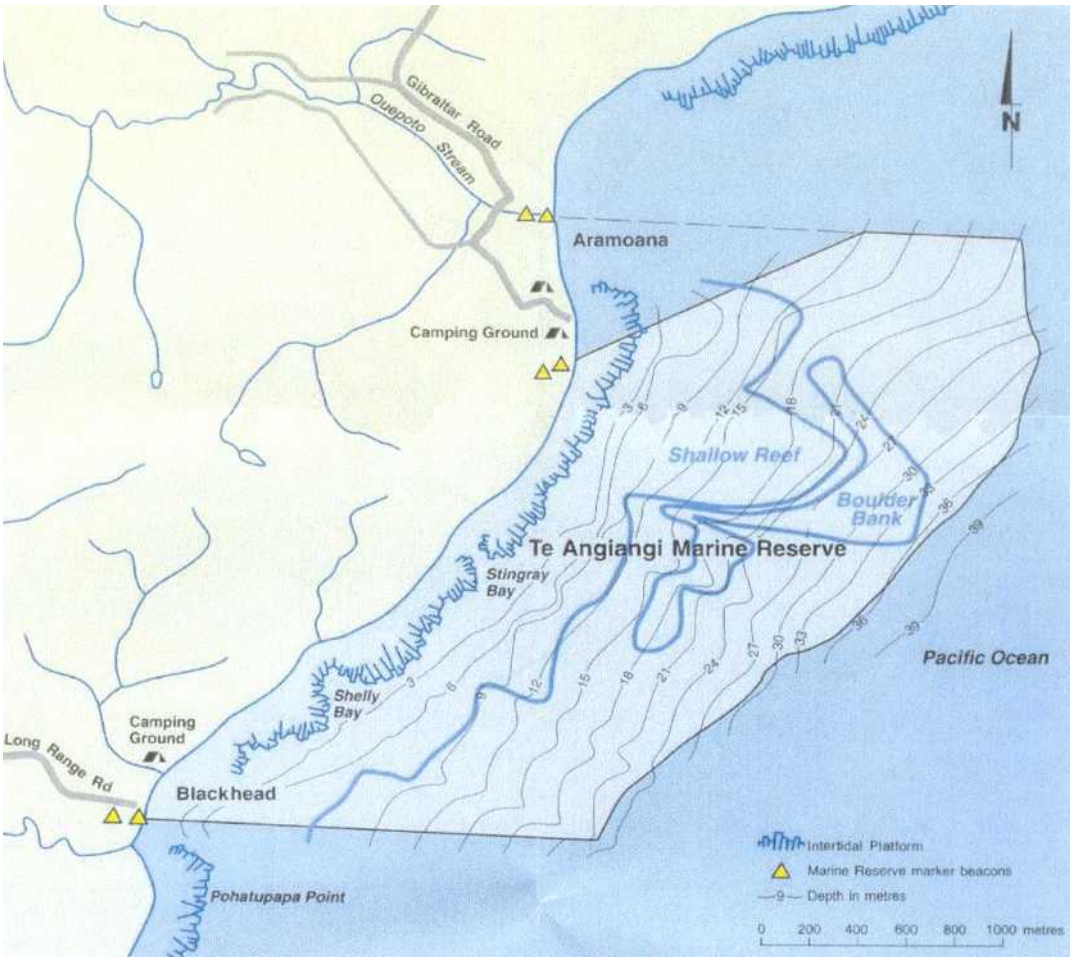

Figure 1: Location of Te Angiangi Marine Reserve, including existing bathymetry and habitat map.

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 =<1to10%

2=11to30%

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.

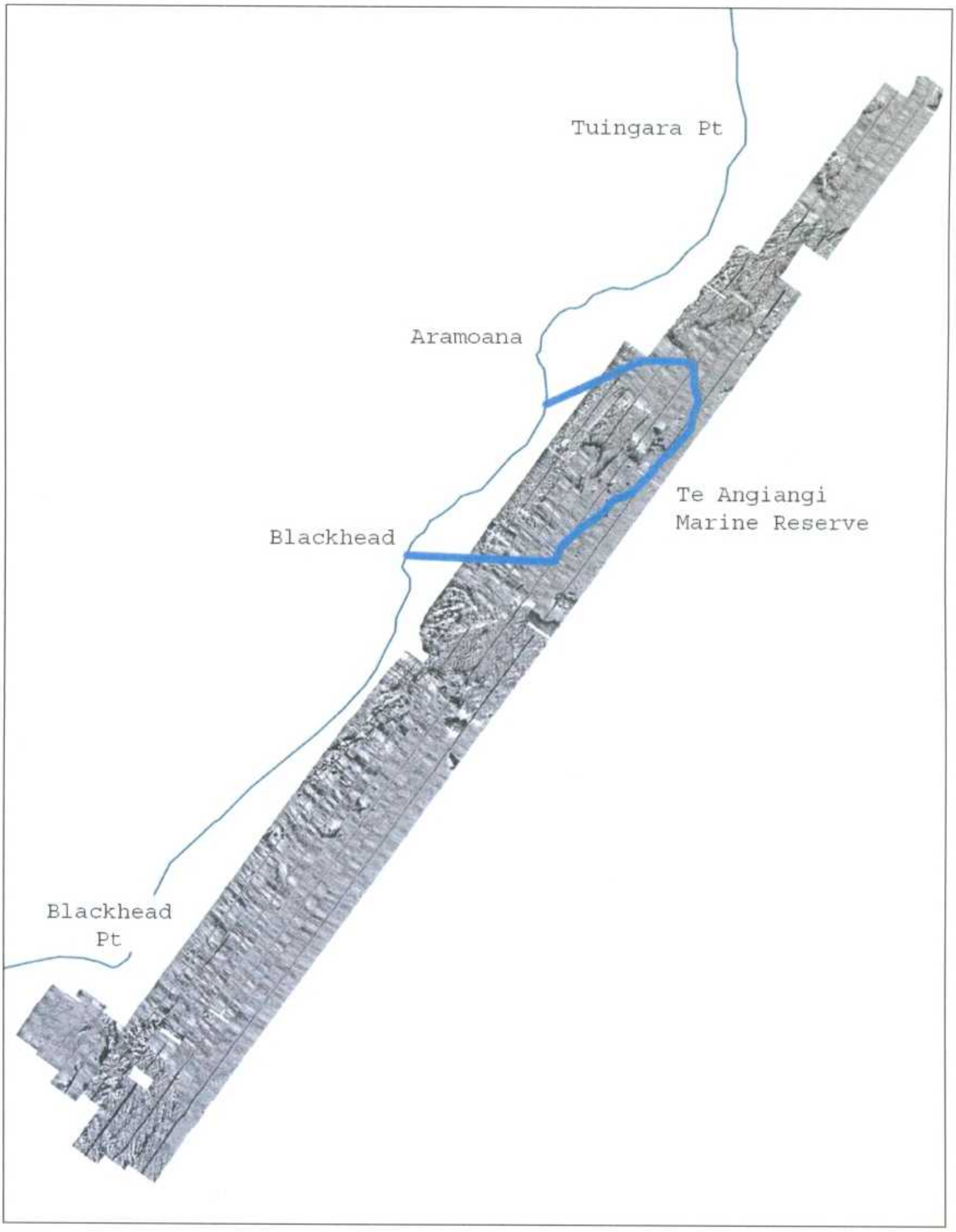

Figure 2: Side-scan imagery from the Te Angiangi reserve and surrounding areas. An ArcView GIS compatible layer showing high resolution raw sidescan is also provided on disk for incorporation into the DOC GIS system.

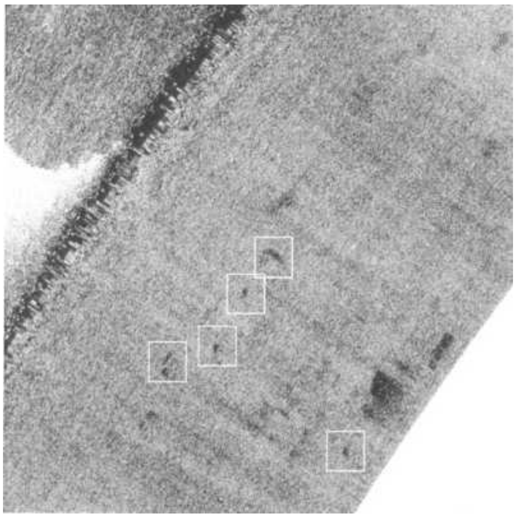

Figure 3: A close up of a section of side-scan where isolated rocks or boulders are present over what is predominantly a sand flat.

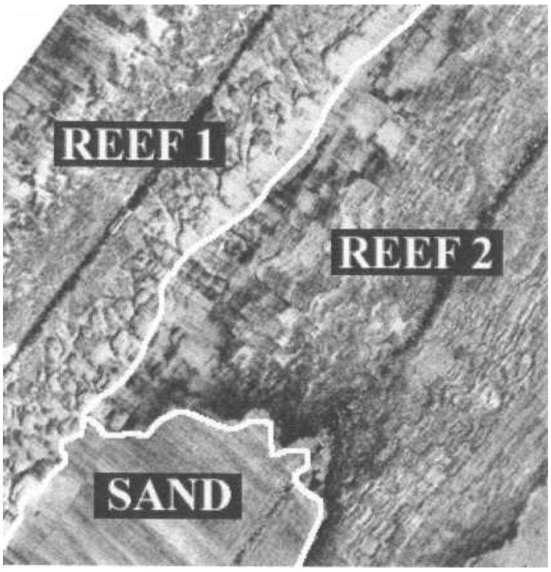

Figure 4: A section of a reef system located within the Te Angiangi reserve clearly showing different physical habitat types. Note that dark straight lines are the midpoints of the side-scan sonar sweeps.

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.

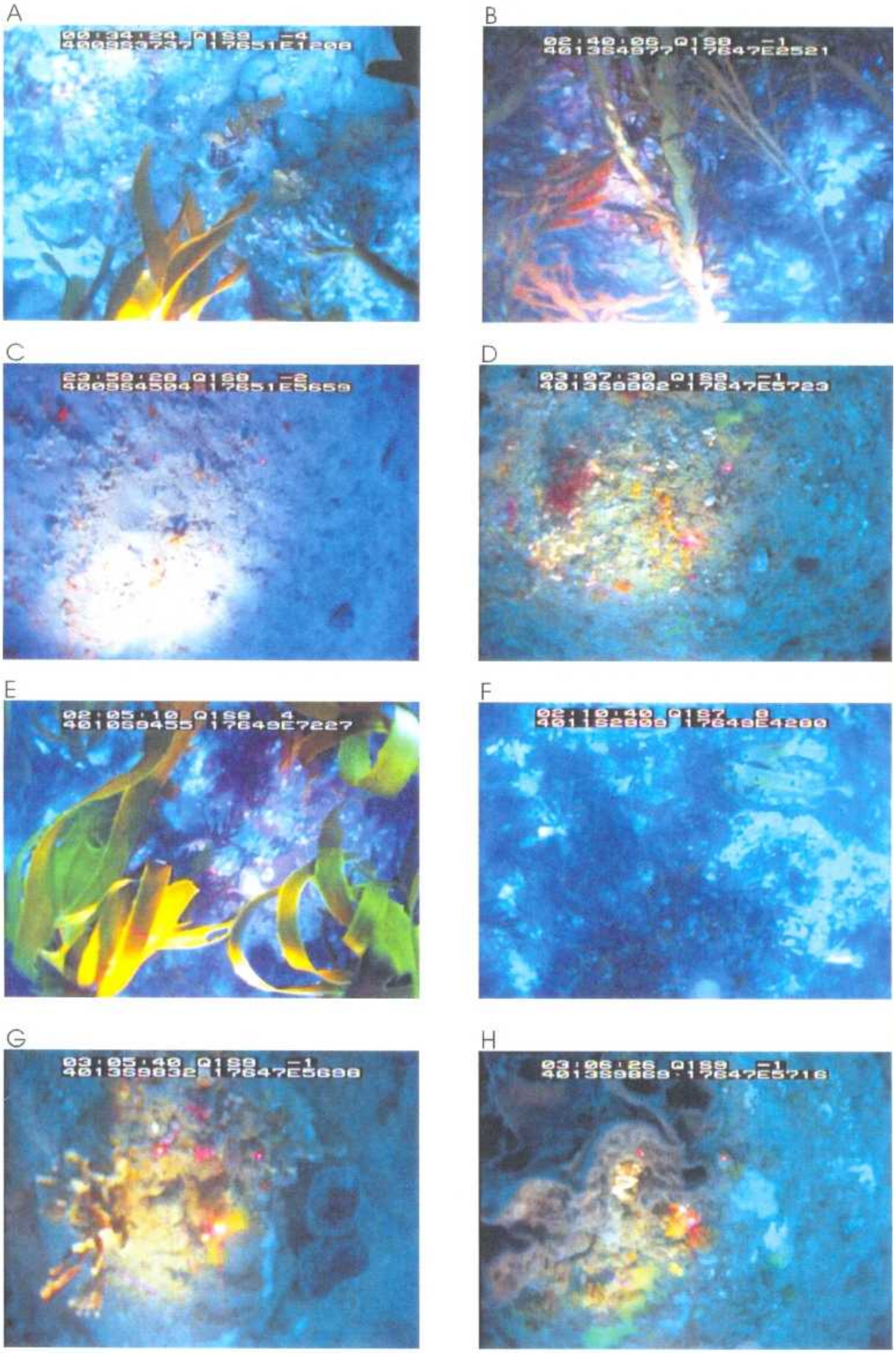

Figure 5: Examples of hard-substrata habitat types. A- *Ecklonia* forest, B- Shallow *Carpophyllum*, C & D- Encrusting invertebrates, E & F Mixed algae, G & H- Sponge flats.

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.

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