

**INSTITUTE OF APPLIED SCIENCES
THE UNIVERSITY OF THE SOUTH PACIFIC**

**MARINE BASELINE SURVEY OF
BALAWA BEACH, NACULA ISLAND,
YASAWAS**

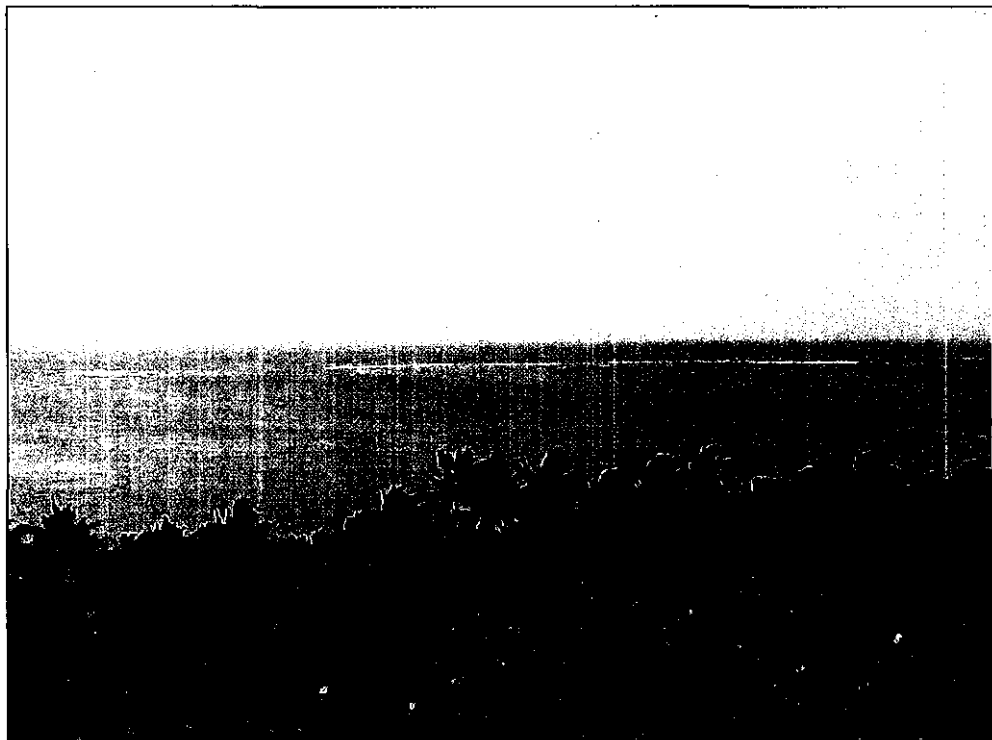
IAS ENVIRONMENT REPORT NO. C187

by

**Make Movono
James Comley**

November, 2006

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Introduction & Objectives

The Institute of Applied Sciences (IAS) of the University of the South Pacific was commissioned by Environmental and Resource Management Consultants (ERMC) to undertake a marine baseline assessment the area adjacent to Balawa beach on Nacula Island in the Yasawas. The area is to be developed as an upper-class backpackers resort. The resort will consist of 11 Bures, with a maximum capacity of 60 people. The main purpose of the survey is to assess the existing condition and the extent of the marine flora and fauna in and around the project area and the likely impact of the resort development.

This survey was conducted from the 24th to the 25th October, 2006 at Balawa beach, Nacula Island, Yasawas. The study team comprised of two personnel from IAS, James Comley and Make Movono.

Specific objectives of the assessment were to:

- Present baseline marine inventories of marine biodiversity focusing on current conditions of corals and dominant reef fish (visual assessment)
- Provide visual description of the presence of any algal seaweed- their abundance and significance.
- Locate any sensitive habitats and significant natural sites
- Identify species with potential to become a nuisance, vectors or dangerous
- Determine if mangroves are present

Balawa Beach & Marine Environment

Balawa beach is located on the western side of Nacula Island which is in the Northern part of the Yasawa group of islands (ref to Fig 1 & 2).

The marine environment The beach is comprised of calcareous white sand which stretches ... meters in length. The marine environment includes the inner reef flat which is submerged even at low tide from which a fringing reef extends featuring a large deep channel and two smaller ones (Fig 2). Generally three zones prevailed

within the study area- the inner reef fat, the middle reef and back reef. A few mangroves trees were observed on adjacent to a creek which was dry.

At the time the fieldwork was undertaken, there was a large quantity of pumice stone evident on the beach and in the near shore environment. This pumice has been brought by wind-borne currents to Fiji from a sub aquatic volcano sited between Fiji and Tonga. The presence of the pumice in the water reduced underwater visibility and is evident as particulate matter in some of the underwater photographs taken at the site.

Figure 1. Map of Yasawa Islands showing Nacula Island

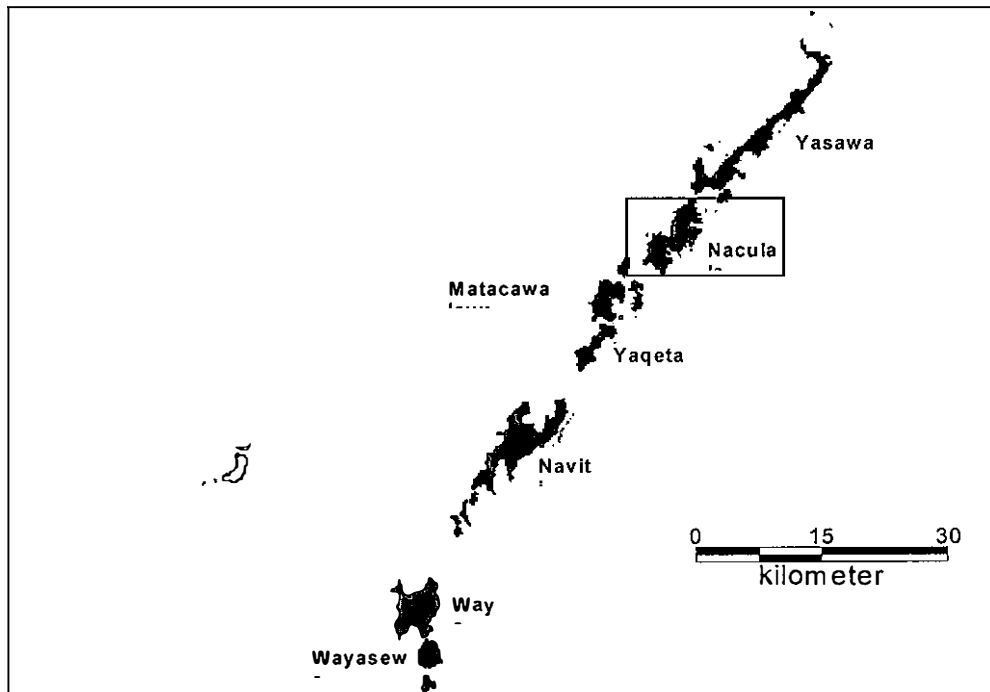


Figure 2. Aerial photo showing the Balawa beach project area and area surveyed



Methodology

i) Habitat Mapping

A reconnaissance survey of the different marine habitats within the bay was carried out using manta tows on the first day (24th October). This comprises of a person being towed behind a boat and recording the different marine habitats (Figure 3). There was a recorder on boat taking GPS positions of where the each habitat starts and another begins. Also the recorder on board mapped out the general study area.

Two reference points were taken from one end of the study area and the other was marked on the other end. The estimated line (transects) which connected one reference point to the next ran parallel to the beach. This resulted in the manta tow surveys including different zones within the study area. Six (6) manta tow transects were completed within the study area.

The GPS positions taken were then overlaid on top of the aerial photo to map out the specific locations of the different habitat types.

Figure 3. Manta tow surveying



ii) Flora and Fauna surveys

On the second day of the survey (25th October) snorkeling was carried out over the entire study area for two and a half hours noting dominant and rare species of corals, algae, fish and invertebrates observed. Photographs were also taken for visual identification. Species were then listed in a species index.

Results

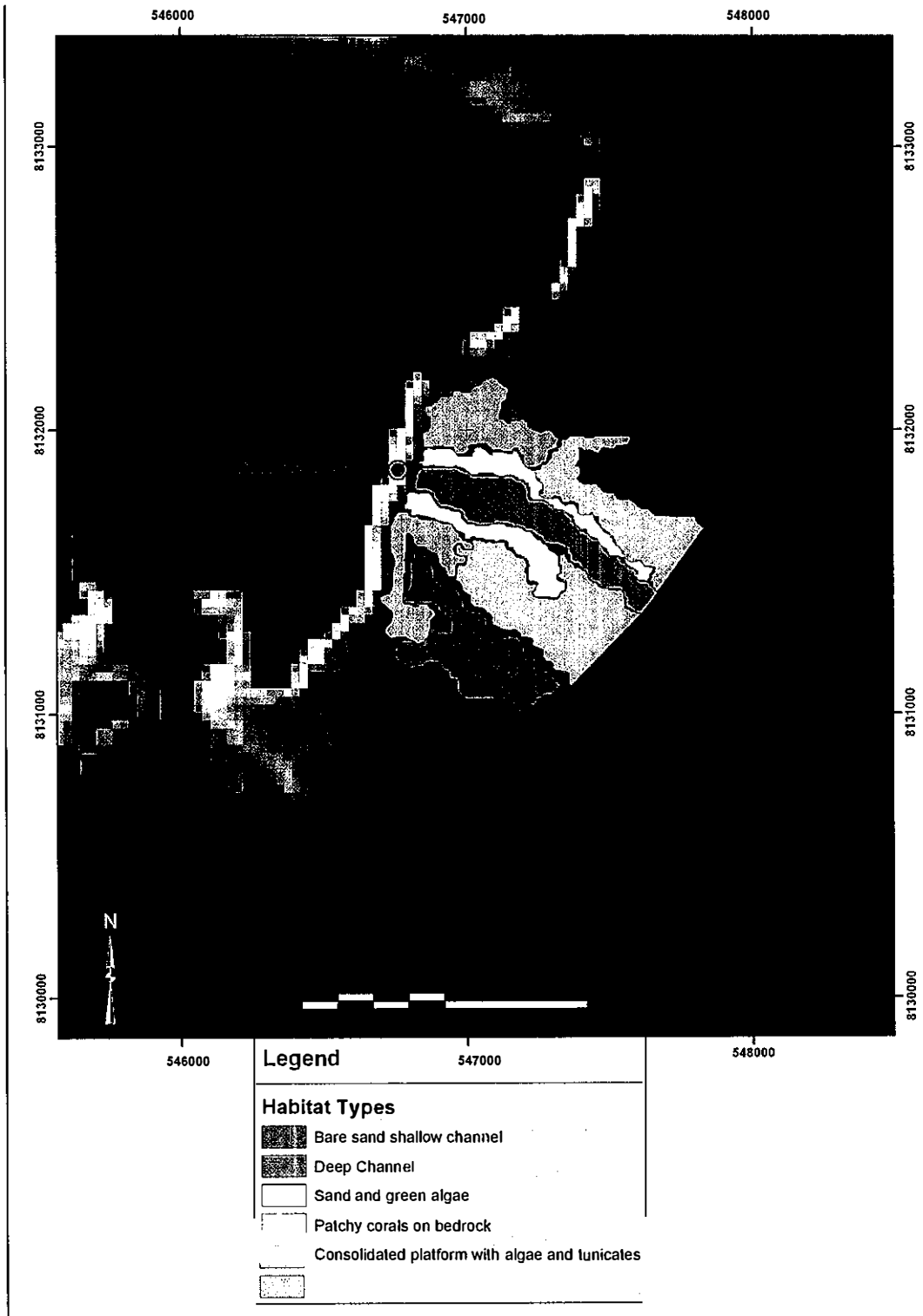
i) Habitat Types & Substrate

A total of five discrete marine habitat types were observed in the study area. The location and coverage of each of these habitat types is shown in Figure 4 below and statistics on the area of each is given in Table 1. In addition, each habitat is described both pictorially and in text in Table 2.

Table 1. Spatial distribution of the five habitat types encountered in the study area

Habitat Type	Area (square meters)	Percentage of total area
Patchy corals on bedrock	248381	35
Consolidated platform with algae and tunicates	131737	19
Bare sand shallow channel	122817	17
Deep Channel	111221	16
Sand and green algae	91498	13
Total	705654	100

Figure 4. Map showing the distribution of the five habitat types found in the study area




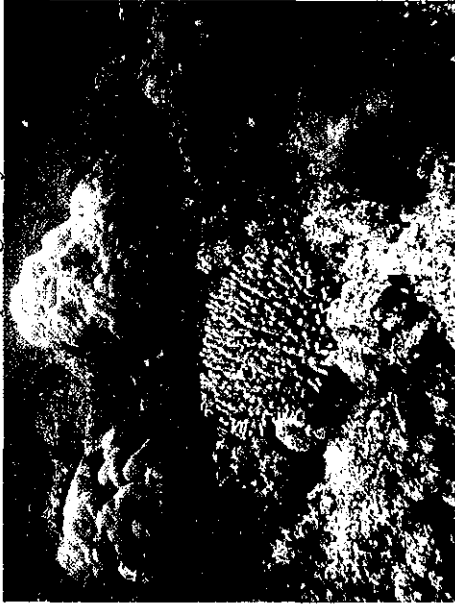
The most commonly encountered habitat type was the patchy corals on bedrock. However within this class there was a large degree of heterogeneity with live hard coral ranging from less than 5% to over 30%. Live hard coral cover was greatest at the margins of this zone bordering both the deep and shallow channels as well as at the seaward margin of the reef platform. In addition, the patch of this zone found to the south of the deep channel had far higher live hard coral cover than the corresponding zone to the north of the channel with overall diversity being correspondingly greater.

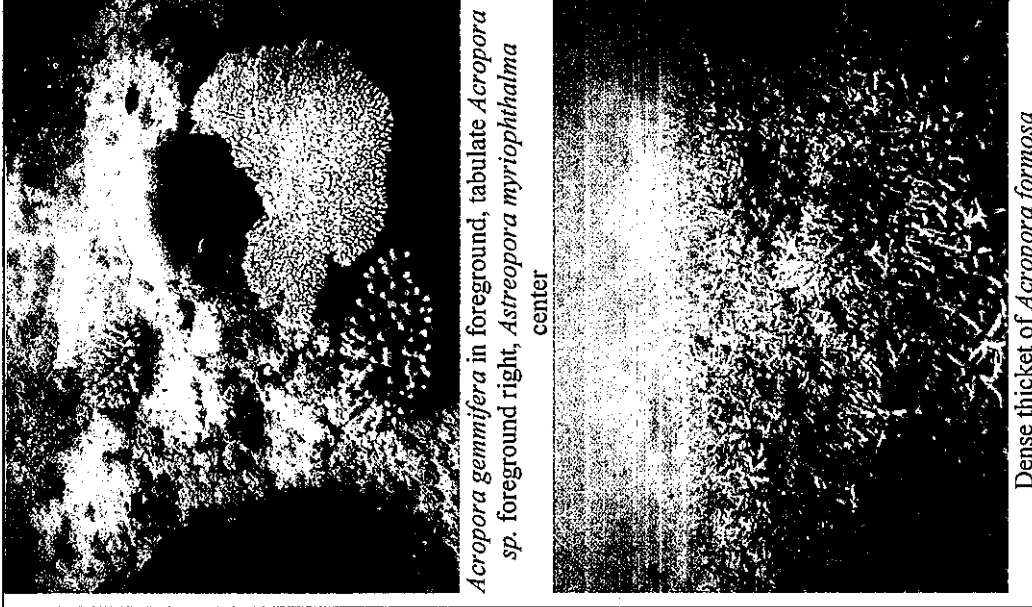
Closer into shore, the dominant zone encountered is described as a consolidated platform with algae and tunicate cover. The substrate in this habitat was divided between consolidated coral rubble and patches of bedrock. Between these areas of hard substrate, patches of sand and Foraminifera skeletons were found. By far the most dominant organisms found in this zone were the calcified green algae and a tunicate of the family Didemnidae, the latter of which occupied locally in excess of 50% of the substrate.

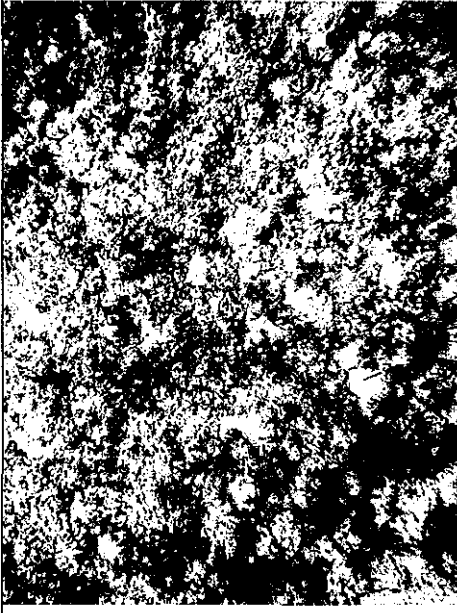
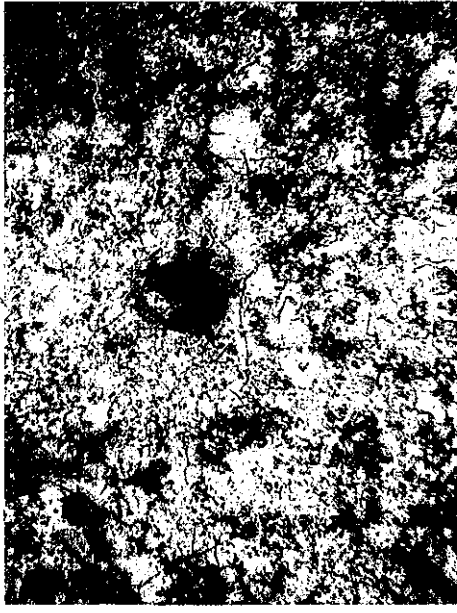
Both the shallow and deep channels were characterised by being primarily composed of bare sand however in the case of the latter, sand in the deeper areas of the channel had locally a covering of blue-green algae or Cyanobacteria.

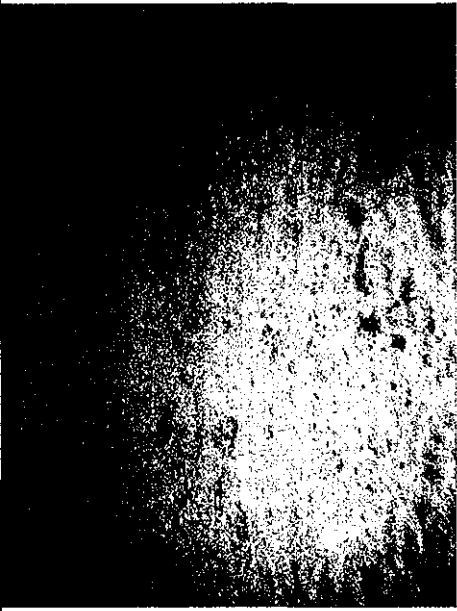
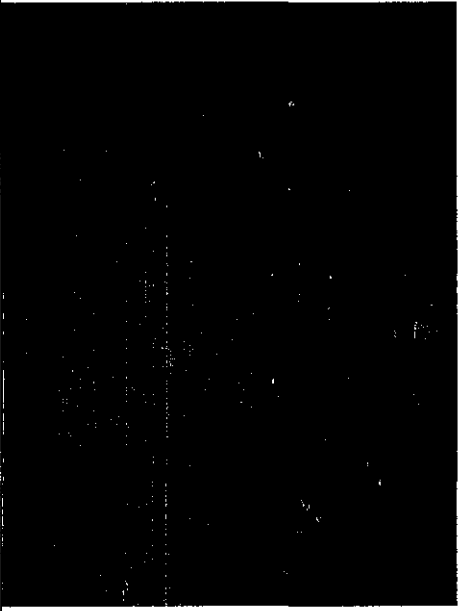
Bordering the channels and acting as a buffer between the sand channels and hard substrate habitats is a thin band of sand that is colonised by the green algae *Halimeda cylindracea*. In places this algae covered on excess of 50% of the area.


Table 2. Habitat Type describing substrate, corals and algae observed

Habitat Type	Description	Depth (m)	Substrate	Algae	Live Hard Coral	Other Invertebrates	Photographs
Patchy corals on bedrock	These areas are found adjacent to the channels further away from shore. The coral colonies are found colonising the bedrock substrate in places forming elevated bommies	2-5	Bedrock interspersed with sand and rubble	<i>Jania capillacea</i> found in bedrock crevices. <i>Caulerpa racemosa</i> , <i>Halimeda cylindracea</i> - both found in patchy abundance and <i>Chlorodesmis hildebrandtii</i> occasionally found attached to rocky outcrops	<i>Porites lobata</i> , <i>Porites australiensis</i> , <i>Porites lutea</i> , <i>Porites rus</i> , <i>Porites cylindrica</i> , <i>Favites complanata</i> (?), <i>Goniastrea dwardsi</i> , <i>Platygyra daedalea</i> , <i>Acropora formosa</i> , <i>Acropora patifera</i> , <i>Acropora nobilis</i> , <i>Acropora clathra</i> , <i>Acropora hyacinthus</i> , <i>Acropora gemmifera</i> , <i>Acropora humilis</i>		 <p>Stand of <i>Acropora gemmifera</i></p>  <p><i>Acropora gemmifera</i> in center, <i>Astreopora myriophthalma</i> foreground right, and <i>Porites lutea</i> in background</p>

Habitat Type	Description	Depth (m)	Substrate	Algae	Live Hard Coral	Other Invertebrates	Photographs
Pachy corals on bedrock (continued)							 <p data-bbox="263 78 1300 683"><i>Acropora gemmifera</i> in foreground, tabulate <i>Acropora</i> sp. foreground right, <i>Astreopora myriophthalma</i> center</p> <p data-bbox="263 683 1300 884">Dense thicket of <i>Acropora formosa</i></p>

Habitat Type	Description	Depth (m)	Substrate	Algae	Live Hard Coral	Other Invertebrates	Photograph
Consolidated platform with unicates and algae	These areas are found adjacent close to the headlands and follow to the edges of the channels. Unlike the bedrock and coral habitat (previous), this habitat was encountered close to shore	1-4	Consolidated rubble and bedrock with sand and Foraminifera skeletons	<i>Caulerpa racemosa</i> , <i>Halimeda opuntia</i> and <i>Caulerpa cupressoides</i> , dominant with <i>Halimeda cylindracea</i> and Cyanobacteria found in sandy patches and <i>Chlorodesmis hildebrandtii</i> found attached to patches of hard substrate	<i>Porites lutea</i> , <i>Porites cylindrica</i> , <i>Acropora formosa</i> , though corals extremely rare in these areas.	By far the most dominant covering in excess of 30% of the substrate was an unidentified tunicate of the Family Didemnidae (possibly <i>Atrorium robustum</i>)	 <p>Consolidated rubble covered in <i>Caulerpa racemosa</i>, <i>Caulerpa cupressoides</i> with patchy <i>Halimeda cylindracea</i></p>  <p>Small colony of <i>Porites lutea</i></p>

Habitat Type	Description	Depth (m)	Substrate	Algae	Live Hard Coral	Other Invertebrates	Photograph
Bare sand shallow channel	Found to the south of the study site	4-8	Sand	No conspicuous species	No conspicuous species	No conspicuous species	 <p>Bare sand</p>
Deep channel	Found extending from the drop-off to close into shore in the middle of the study site	8-16	Sand	Blue-green algae or Cyanobacteria covering in places	No conspicuous species	No conspicuous species	 <p>Sand covered in mat of blue-green algae</p>

Habitat Type	Description	Depth (m)	Substrate	Algae	Live Hard Coral	Other Invertebrates	Photograph
Sand and green algae	Found at the margin between bedrock and consolidated platforms and both deep and shallow channels	6-10	Sand	By far the most abundant and dominant species is <i>Halimeda cylindracea</i> which was found in thick stands in places	No conspicuous species	No conspicuous species	 <p><i>Halimeda cylindracea</i> stands on bare sandy areas</p>

ii) Fish

The diversity of fish within the habitats found in the project area is relatively high. A total of 25 species were identified, however there were more which were identified to family names (refer to Appendix 1). A few important commercial species were encountered including the Jacks, groupers, snappers, parrotfish, rabbit fish, and wrasses. Aquarium fishes observed included the damsels, sandperch, blennies and butterfly fish. The most common species encountered were the jacks, snappers, surgeon fishes and damselfishes. There were no endangered species encountered but 2 localized species, those only found in Fiji, *Neoglyphidodon carlsoni* (Damselfish) and *Ecsenius fijiensis* (blenny) were present. Most of the fishes were found around the coral patches on the coral on bedrock type habitat. The trevallies/jacks were the ones schooling closer inshore in the sand algae type habitats.

Discussion and Recommendations

The study site displays evidence both in its geomorphology and also its ecology of being a highly exposed site. The dominant organisms found at the site were fast growing stress tolerant organisms that are adapted to life in a high energy environment.

The overall diversity of most of the habitats can be considered to be low. Perhaps the most important habitat in terms of conservation and management needs is the patchy corals on bedrock habitat. In turn, the most diverse area of this habitat was found to the south of the channel. In terms of potential impacts from the proposed development on the other habitats, these habitats can be considered not to be ecologically fragile.


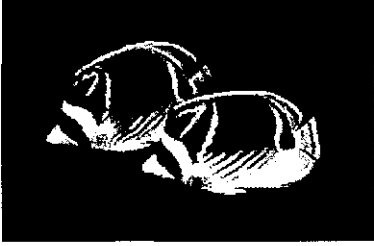




The fish diversity was good as compared to other areas in Fiji. However, this it is typical of the Yasawa marine environment, where the human population is small thus there is less fishing pressure resulting in diversity of fish species. Impacts which would affect the fishes as a result of the proposed development such as siltation from construction activities, pollution from sewage and solid waste, and habitat destruction, should thus be minimised.

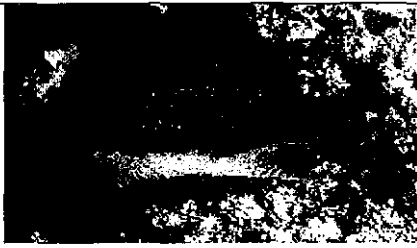





No significant growth of macroalgae was observed at the site and no species with a potential to become nuisances or dangerous were found. A few mangrove trees of the species *Rhizophora* were observed adjacent to the small dried up creek.


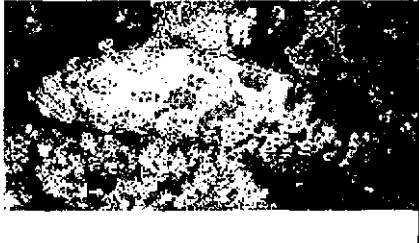
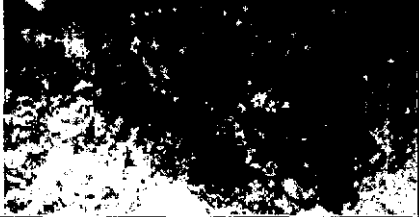




The following recommendations are put forward regarding the proposed development;

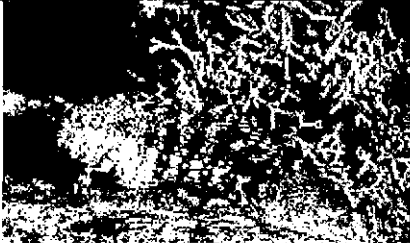

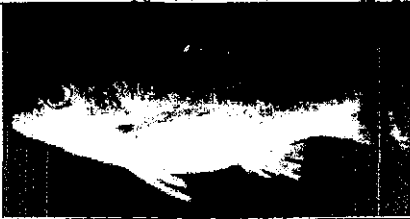
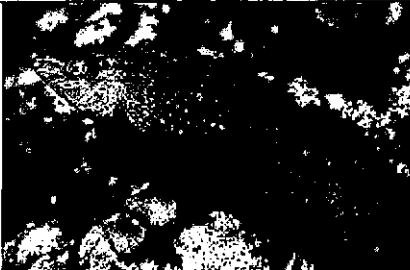
- Boat access into and out of the development should be provided through the deep channel.
- Care should be taken especially at low tide in order that the patchy coral area to the south of the channel is not damaged by boat use. This could be assured by creating a physical demarcation of this area using for example floating buoys.
- In turn this demarcation can be used to act as markers for the creation of a no-take or Tabu zone.
- The patchy coral on bedrock area to the south of the deep channel represents the best area for snorkeling- whilst it is moderately sheltered compared to the outer reef drop-off, it does have organisms that would be of interest to guests.
- To ensure however that damage to this area from physical contact with snorkelers is limited, it is recommended that this area is only used for snorkeling at and around high tide.
- Boat anchoring should be restricted to a defined zone immediately close to shore at the end of the deep channel to prevent excess damage to the surrounding environments.
- Waste water treatment and disposal from the development should be if possible tertiary treatment. Whilst the habitats immediately adjacent to the shore can be considered to not be ecologically fragile, there is the possibility of detrimental affects associated with nutrient enrichment on this environment such as growth of macroalgae and steps should be taken to mitigate against it.
- There were no specific organisms found that pose a threat either to the health of the coral reef or guests of the proposed development. However, the proposed development should ensure a policy of 'look but don't touch' is in place with all its guests to safeguard both the health of the guests and the environment.

Appendix 1. Fish species observed off Balawa Beach

Common Name	Species	Picture
Threadfin butterflyfish	<i>Chaetodon auriga</i>	 A black and white photograph of a Threadfin butterflyfish, showing its characteristic horizontal stripes and a prominent dorsal fin.
Raccoon butterflyfish	<i>Chaetodon lunula</i>	 A black and white photograph of a Raccoon butterflyfish, characterized by its dark, mottled pattern and a white crescent-shaped mark on its side.
Threeband pennantfish	<i>Heniochus chrysostomus</i>	 A black and white photograph of a Threeband pennantfish, showing its three distinct dark vertical bands and a long, thin dorsal fin.
Saddle butterflyfish	<i>Chaetodon ephippium</i>	 A black and white photograph of a Saddle butterflyfish, featuring a prominent white saddle-shaped mark on its side.
Carlson's damsel	<i>Neoglyphidodon carlsoni</i>	 A black and white photograph of Carlson's damsel, a small fish with a dark body and a prominent dorsal fin.
Semicircle angelfish	<i>Pomacanthus semicirculatus</i>	 A black and white photograph of a Semicircle angelfish, showing its characteristic white crescent-shaped mark on its side.

Sapphire devil	<i>Chrysiptera cyanea</i>	
Threeband damselfish	<i>Chrysiptera tricineta</i>	
Sapphire damsel	<i>Pomacentrus pavo</i>	
White-freckled surgeonfish	<i>Acanthurus maculiceps</i>	
Peppered spinefoot	<i>Siganus punctatissimus</i>	
Blue trevally	<i>Carangoides ferdau</i>	

White trevally	<i>Pseudocaranx dentex</i>	
Greasy grouper	<i>Epinephelus tauvina</i>	
Foursaddle grouper	<i>Epinephelus spilotoceps</i>	
Bleeker's parrotfish	<i>Chlorurus bleekeri</i>	
Bicolor blenny	<i>Ecsenius bicolor</i>	
Lady Musgrave blenny	<i>Cirripectes chelomatus</i>	
	<i>Chlorurus microrhinos</i>	

Jewelled blenny	<i>Salarias fasciatus</i>	
Latticed sandperch	<i>Parapercis clathrata</i>	
Onespot snapper	<i>Lutjanus monostigma</i>	
Argus wrasse	<i>Halichoeres argus</i>	
Spottail coris	<i>Coris caudimacula</i>	