APPENDIX 10C

Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road – Final Supplementary Ecological Survey Report, July 2009

AECOM

Highways Department

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Hong Kong-Zhuhai-Macao Bridge
Hong Kong Link Road
Supplementary Ecological Survey

Final Supplementary Ecological Survey Report

July 2009

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1 BACKGROUND

1.1 AECOM Asia Co. Ltd. was commissioned by Highways Department to provide professional services in relation to the Supplementary Ecological Survey with a view to provide all necessary information to facilitate the investigation of Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road. Ecological profile of the Survey Area based on survey findings would be provided so as to enable the impact assessments in the EIA Study.

1.2 The Study is to complete the following:

(a) field surveys and investigations covering both the wet and dry seasons;
(b) investigation and description of the existing wildlife uses of various habitats; and
(c) establish the ecological profile of the Survey Area and description of the characteristics of each habitat found.

2 INTRODUCTION

2.1 This Final Supplementary Ecological Survey Report presents the marine ecological baseline information (dry season and wet season) at the southeast of Airport Island to facilitate the assessment on the potential ecological impacts on benthic, coral and intertidal communities of the Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road.

3 SURVEY METHODOLOGY

3.1 The Survey Area is located at the southeast of Airport Island (**Figure 1** refers). The survey methodology and schedule are described below.

Table 1 Survey Programme for Ecological Surveys

Items	2009				
	Jan	Feb	Mar	Apr	May
Marine grab sampling	■				■
Dive survey		■			
Intertidal survey	■	■		■	■

3.2 Marine Grab Sampling

3.2.1 To survey marine soft bottom benthic fauna, grab sampling of seabed sediment were carried out in dry (January 2009) and wet (May 2009) seasons. Eight sampling sites were proposed at the Survey Area (**Figure 1** refers). At each of the sampling sites, five replicates of grab samples were collected using a van Veen grab. Each grab sample covered over 0.1 m^2 of seabed substrate. Samples were then sieved through 0.5 mm sieves, preserved in 5% borax-buffered formalin and stained with Rose Bengal. Collected organisms were counted, weighed and identified to the lowest practicable taxon as possible.

3.2.2 Species composition, abundance, biomass, species diversity *H'* and evenness *J* were calculated for pooled data, using the formulae:

$$H' = -\sum (Ni / N) \ln (Ni / N); \text{ and}$$
$$J = H' / \ln S$$

where S is the total number of species in the sample, N is the total number of individuals, and Ni is the number of individuals of the i^{th} species.

3.2.3 Abundance / Biomass Comparison (ABC) plots were also provided for evaluating and ranking the ecological values.

3.3 Dive Survey

3.3.1 Spot reconnaissance dives for corals and other hard substrate marine organisms were conducted in February 2009 to check for the presence of corals (including hard corals, octocorals and black corals) and other marine organisms with conservation importance within the Survey Area. Eight dive spots were proposed at the Survey Area (**Figure 1** refers). Circular paths at each dive spot were adopted during the reconnaissance dives due to low underwater visibility. Rapid Ecological Assessment (REA) was conducted at two locations within the Survey Area based on the findings of the spot reconnaissance dives (**Figure 1** refers). REA surveys were performed along 100 m and 50 m transects parallel and perpendicular to the coastlines. Depth and substrate along the perpendicular transects were recorded at 3 m interval. Benthic cover, taxon abundance and ecological attributes of the transects were recorded in a swathe of 2 m wide. Locations and routes of REA transects were recorded on site by GPS and map. Representative photographs of dive locations and fauna found were taken. Details of REA are given in **Annex A**.

3.4 Intertidal Survey

3.4.1 Intertidal surveys for epifauna communities were conducted in dry (January and February 2009) and wet (April and May 2009) seasons at four locations within the Survey Area (**Figure 1** refers). Horizontal transects (50 m) at three tidal levels (high, middle and low) were established. Ten 0.5 m x 0.5 m quadrats were deployed on each transect. The infauna within the top 5 cm sediment inside the quadrat as well as from one core (10 cm x 20 cm depth) were also collected, identified and recorded for soft shores. Species found and their abundance were recorded. Diversity index and evenness index were provided. Walk-through survey was conducted at each site by two surveyors for 30 minutes. The walk-through survey could help assess whether the sampling exercise had collected representative data (e.g. the number and type of species encountered) and whether the sampling effort is deemed adequate.

4 SURVEY FINDINGS

4.1 Benthic Community

4.1.1 Marine grab sampling was conducted in dry (17th January 2009) and wet (1st May 2009) seasons. The sediment samples collected from the Survey Area consisted of about 85% silt-clay fraction (particle diameter <64 µm) and 15% coarse materials (gravels, coarse sand and leaf litter). The sediment was grey in colour and no special odour was detected.

4.1.2 A total of 917 and 345 organisms were identified from the sediment samples collected in dry and wet season surveys. Out of 105 taxa recorded, 100 taxa were identified to genus or species levels. The most diverse phylum was polychaetes (51 species) followed by molluscs (18 species), crustaceans (13 species), echinoderms (6 species), fishes (5 species), cnidarians (4 species), echiurans (3 species), and sipunculan (1 species).

4.1.3 In dry season, 43%, 35%, 11%, 6% and 5% of organisms collected (in terms of number of individuals) were polychaetes, crustaceans, molluscs, nemerteans and other phyla, respectively. The total biomass (wet weight) was 119.68 g, in which 71%, 13%, 9%, 5% and 2% of total biomass were accounted by molluscs, echiurans, fishes, polychaetes and other phyla, respectively. In wet season, 58%, 15%, 12%, 8% and 7% of organisms collected were polychaetes, molluscs, crustaceans, echinoderms and other phyla, respectively. The total biomass was 130.87 g, in which 52%, 27%, 15% and 6% of total biomass were accounted by echinoderms, molluscs, crustaceans and other phyla, respectively. **Table 2** lists the total abundance and biomass of each faunal group.

Table 2 Total Abundance and Biomass of Each Faunal Group

Faunal Group	No. of Individuals	Percentage (%) (1)	Biomass (g)	Percentage (%) (1)
Dry Season				
Polychaeta	397	43	5.7830	5
Crustacea	325	35	1.9302	2
Mollusca	103	11	84.7337	71
Nemertea	58	6	0.4037	0
Echiura	14	2	15.3756	13
Echinodermata	7	1	0.4026	0
Fish	6	1	10.9851	9
Cnidaria	4	0	0.0689	0
Sipuncula	2	0	0.0015	0
Phoronia	1	0	0.0001	0
Total	**917**	**100**	**119.6844**	**100**
Wet Season				
Polychaeta	200	58	2.6714	2
Mollusca	52	15	35.4167	27
Crustacea	40	12	19.3636	15
Echinodermata	27	8	67.5864	52
Nemertea	12	3	0.2896	0
Sipuncula	5	1	0.0267	0
Fish	4	1	3.5464	3
Cnidaria	3	1	1.9587	1
Platyhelminthes	2	1	0.0061	0
Total	**345**	**100**	**130.8656**	**100**

Note:

(1) 0% means total individual / biomass of the faunal group is less than 1% of all organisms recorded.

4.1.4 In dry season, the total number of species, abundance and biomass ranged between 14 – 54 spp. 0.5 m^{-2}, 50 – 686 individual m^{-2} and 4.5 – 104.7 g m^{-2}, respectively among the eight sampling points. In wet season, the number of species, abundance and biomass decreased to 12 – 27 spp. 0.5 m^{-2}, 48 – 110 individual m^{-2} and 7.6 – 72.0 g m^{-2}. The *H'* and *J* were similar at different sites in the Survey Area with no seasonal pattern, which ranged between 1.91 – 3.11 and 0.61 – 0.96 respectively. **Table 3** lists the total number of species, abundance, biomass, species diversity and evenness at each sampling point.

Table 3 Total Number of Species, Abundance, Biomass, Species Diversity and Evenness at Each Sampling Point

	B1	B2	B3	B4	B5	B6	B7	B8
Dry Season								
Total no. of species (spp. 0.5 m^{-2})	30	30	39	26	16	14	54	16
Total abundance (individual m^{-2})	142	196	384	138	144	50	686	94
Total biomass (g m^{-2})	24.2	11.5	104.7	4.5	35.5	7.2	35.9	16.0
Species diversity (*H'*)	2.82	2.74	2.94	2.81	2.26	2.31	2.42	2.10
Species evenness (*J*)	0.83	0.80	0.80	0.86	0.82	0.88	0.61	0.76
Wet Season								

	B1	B2	B3	B4	B5	B6	B7	B8
Total no. of species (spp. 0.5 m^{-2})	21	22	17	23	27	12	23	13
Total abundance (individual m^{-2})	96	110	56	104	104	48	102	70
Total biomass (g m^{-2})	72.0	38.2	32.7	43.8	23.0	19.3	25.1	7.6
Species diversity (*H'*)	2.75	2.37	2.73	2.59	3.11	2.24	2.95	1.91
Species evenness (*J*)	0.90	0.77	0.96	0.83	0.94	0.90	0.94	0.75

4.1.5 In dry season, polychaetes and crustaceans were the dominant groups at all sampling points that they constituted about 80% of total abundance. The Survey Area was dominated by amphipods and polychaetes *Mediomastus* sp. and *Sigambra hanaokai*. In wet season, polychaetes became the dominant group (dominated by *Mediomastus* sp.) with approximately 60% of total abundance. **Table 4** and **Table 5** present the proportion of each faunal group (in total abundance) and the five most abundant species at each sampling point. A complete list of collected organisms is shown in **Appendix 1**. All the species recorded are common and no rare species or species with conservation importance was found.

Table 4 Percentage Proportion of Faunal Groups (in Total Abundance) at Each Sampling Point

% Proportion of Faunal Groups	B1	B2	B3	B4	B5	B6	B7	B8
Dry Season								
Polychaeta	45	50	60	49	65	44	28	26
Crustacea	24	32	14	35	7	32	56	45
Nemertea	17	9	5	6	11	8	3	9
Mollusca	11	7	19	9	15	4	8	11
Others	3	2	2	1	1	12	5	11
Wet Season								
Polychaeta	58	64	46	54	54	63	51	77
Mollusca	19	9	11	31	13	13	14	6
Crustacea	13	11	14	6	21	4	16	3
Echinodermata	10	11	18	4	2	13	8	3
Others	0	5	11	5	10	7	11	11

Table 5 The Five Most Abundant Species at Each Sampling Point

Sampling Point	Group (1)	Species	Mean Density (individual m^{-2})	Mean Biomass (g m^{-2})	Relative Abundance (%)
Dry Season					
B1	C	Amphipod spp.	28	0.0076	20
	N	Nemertean spp.	24	0.2142	17
	P	*Mediomastus* sp.	20	0.0212	14
	P	*Aglaophamus dibranchis*	8	0.0262	6
	P	*Linopherus paucibranchiata*	4	0.0268	3
B2	C	Amphipod spp.	52	0.0110	27
	P	*Sigambra hanaokai*	26	0.0068	13

Sampling Point	Group (1)	Species	Mean Density (individual m^{-2})	Mean Biomass (g m^{-2})	Relative Abundance (%)
	N	Nemertean spp.	18	0.0354	9
	P	*Mediomastus* sp.	16	0.0292	8
	P	*Glycera alba*	10	0.0084	5
B3	P	*Mediomastus* sp.	82	0.2388	21
	C	Amphipod spp.	46	0.0126	12
	P	*Sigambra hanaokai*	34	0.0090	9
	M	*Paphia undulata*	30	31.8768	8
	N	Nemertean spp.	20	0.3860	5
B4	C	Amphipod spp.	36	0.0188	26
	P	*Sigambra hanaokai*	10	0.0058	7
	P	*Laonice cirrata*	10	0.0854	7
	P	*Poecilochaetus hystricosus*	10	0.0406	7
	N	Nemertean spp.	8	0.0318	6
B5	P	*Mediomastus* sp.	38	0.0904	26
	P	*Sigambra hanaokai*	26	0.0096	18
	N	Nemertean spp.	16	0.0624	11
	P	*Schistomeringos rudolphi*	16	0.0174	11
	M	*Paphia undulata*	10	17.7178	7
B6	C	Amphipod spp.	16	0.0010	32
	P	*Notomastus* sp.	6	0.0546	12
	N	Nemertean spp.	4	0.0036	8
	P	*Aglaophamus dibranchis*	4	0.0132	8
	P	*Mediomastus* sp.	2	0.0190	4
B7	C	Amphipod spp.	364	0.1590	53
	M	*Paphia undulata*	22	7.7270	3
	P	*Lumbrineris nagae*	20	0.1914	3
	N	Nemertean spp.	18	0.0664	3
	P	*Glycera chirori*	14	0.0924	2
B8	C	Amphipod spp.	42	0.0098	45
	N	Nemertean spp.	8	0.0076	9
	P	*Mediomastus* sp.	8	0.0164	9
	P	*Sigambra hanaokai*	6	0.0024	6
	Eh	*Urechis* sp.	4	7.5602	4
Wet Season					
B1	P	*Mediomastus* sp.	20	0.0298	21
	M	*Paphia undulata*	10	3.2622	10
	C	Amphipod spp.	8	0.0108	8
	Ec	*Acaudina molpadioides*	8	63.4606	8
	P	*Notomastus* sp.	6	0.0248	6
B2	P	*Mediomastus* sp.	46	0.0942	42
	Ec	*Protankyra bidentata*	8	28.0116	7

Sampling Point	Group (1)	Species	Mean Density (individual m^{-2})	Mean Biomass (g m^{-2})	Relative Abundance (%)
	C	Amphipod spp.	6	0.0092	5
	P	*Lumbrineris shiinoi*	6	0.0036	5
	P	*Sigambra hanaokai*	4	0.0010	4
B3	P	*Mediomastus* sp.	6	0.0034	11
	Ec	*Amphiura hexactis*	6	0.1724	11
	N	Nemertean spp.	6	0.2156	11
	P	*Terebellides stroemii*	4	0.0434	7
	P	*Ophelina acuminata*	4	0.3456	7
B4	P	*Mediomastus* sp.	26	0.0620	25
	M	*Paphia undulata*	22	25.1432	21
	M	*Macoma candida*	8	11.9442	8
	N	Nemertean spp.	4	0.1262	4
	P	*Terebellides stroemii*	4	0.0272	4
B5	C	Amphipod spp.	10	0.0048	10
	P	*Glycera rouxii*	10	0.4208	10
	M	*Macoma candida*	8	9.5050	8
	P	*Mediomastus* sp.	6	0.0086	6
	N	Nemertean spp.	6	0.1988	6
B6	P	*Mediomastus* sp.	14	0.0286	29
	Ec	*Protankyra bidentata*	6	7.2698	13
	P	*Aglaophamus sinensis*	4	0.0088	8
	P	*Laonice cirrata*	4	0.0218	8
	M	*Azorinus coartata*	4	5.2096	8
B7	C	Amphipod spp.	16	0.0074	16
	Sp	*Apionsoma trichocephalus*	8	0.0458	8
	M	*Paphia undulata*	6	4.4786	6
	P	*Lumbrineris nagae*	6	0.3144	6
	P	*Euchymene oerstedii*	6	0.0196	6
B8	P	*Mediomastus* sp.	34	0.1062	49
	P	*Notomastus* sp.	6	0.0392	9
	P	*Sigambra hanaokai*	6	0.0034	9
	N	Nemertean spp.	4	0.0260	6
	Cn	*Metedwardsia akkeshi*	4	3.9132	6

Note:

(1) P=Polychaeta; C=Crustacea; M=Mollusca; N=Nemertea; Eh=Echiura; Ec=Echinodermata; Sp=Sipuncula; Cn=Cnidaria

4.1.6 The benthic community was spatially divided into four groups in Hong Kong waters (Shin *et al*., 2004). The biodiversity and evenness of benthic community lied between "Eastern and Southern Waters" and other polluted groups, reflecting a mild pollution status (**Table 6** refers).

The Abundance / Biomass Comparison plots were shown in **Appendix 2**. The positive values of *W* statistics of the Abundance / Biomass Comparison plots showed that all sampling points were under "mildly disturbed" conditions (Clarke, 1990).

Table 6 Comparison of Mean *H'* and *J* of Benthic Communities at Different Hong Kong Waters with the Survey Area

Water Zone	Southeast of Airport Island (Survey Area)	Tolo Harbour	Eastern and Southern Waters	Victoria Harbour	Deep Bay
H'	2.55 (Dry) 2.58 (Wet)	1.36	2.82	1.64	2.32
J	0.79 (Dry) 0.87 (Wet)	0.83	0.81	0.44	0.73

4.2 Coral Community

4.2.1 The marine water around Hong Kong (especially in the west) is relatively turbid and has low salinity, due to the influence of the Pearl River to the west. Corals mainly grow in the northeastern and eastern waters, where the waters are both sheltered and free from the influence of the Pearl River. Therefore, the general absence of hermatypic corals from the Survey Area at the southeast of Airport Island is not unexpected.

4.2.2 Spot reconnaissance dives in the current survey were conducted on 14th and 15th February 2009. The weather conditions for the dive surveys were summarised in **Table 7**. A total of eight spot reconnaissance dives were carried out (**Figure 1** refers) and the site conditions were given in **Table 8**.

Table 7 Weather Conditions during the Spot Reconnaissance Dive Surveys

Survey Date	Weather Condition	Underwater Visibility (m)
14th February 2009	Cloudy with southeast force 3	0.5
15th February 2009	Cloudy with southeast force 2 – 3	0.5

Table 8 Conditions of the Spot Reconnaissance Dive Sites

Site	Starting Location (GPS)	Maximum Depth (m)	Bottom Substrate	Visibility (m)
D1	E113°56'17.4" N22°17'43.1"	4	Boulder / Rock	0.5
D2	E113°56'14.2" N22°17'55.7"	3	Bedrock / Boulder	0.5
D3	E113°56'11.2" N22°18'03.7"	3	Bedrock / Rubble	0.5
D4	E113°56'17.6" N22°18'08.9"	3	Boulder / Rock	0.5
D5	E113°56'23.3" N22°18'15.9"	3	Sand / Rubble	0.5
D6	E113°56'20.7" N22°18'21.2"	3	Bedrock / Boulder	0.5

Site	Starting Location (GPS)	Maximum Depth (m)	Bottom Substrate	Visibility (m)
D7	E113°56'25.2" N22°18'41.4"	3	Boulder / Rock	0.5
D8	E113°56'29.1" N22°18'44.5"	4	Boulder / Rock	0.5

4.2.3 D1 and D8 were mainly composed of slopping boulders and rocks at the bottom (**Appendix 3** refers). Substrates beyond the maximum depth were muddy with visibility of less than 0.5 m. Snail *Thais luteostoma* was found on surfaces of big boulders while green mussel *Perna viridis* was found at shallow water in the clefts between boulders (**Appendix 4** refers). Both species are commonly found in Hong Kong. No hard coral was recorded in these two sites. One species of gorgonian coral *Echinomuricea* sp. was found on the boulder surfaces (**Appendix 4** refers). The gorgonian is a very common octocoral species found in Hong Kong. This species is adapted to harsh and turbid environment with low visibility and could be found in many places in Hong Kong. The percentage cover of the gorgonian recorded was low (<1%) and the gorgonians were in fair condition (**Table 9** refers).

Table 9 Coral Species Found during the Spot Reconnaissance Dives

Site	Coral Species	Coverage (%)	Size in Height (cm)
D1	*Echinomuricea* sp.	<1	5 – 20
D8	*Echinomuricea* sp.	<1	5 – 20

4.2.4 D2, D3, D4, D6 and D7 are composed of natural bedrock and scattered boulders with sand and smaller rocks at the bottom (**Appendix 3** refers). Common species including black mussel *Septifer virgatus*, snail *Thais luteostoma* and green algae *Ulva* sp. were recorded on the surface of bedrocks and boulders. No coral was found in these sites.

4.2.5 D5 is a natural sandy beach with scattered rubbles at the bottom. Black mussel *Septifer virgatus*, green algae *Ulva* sp. and unidentified oyster were found on the surfaces of the scattered rocks. The species recorded are common in Hong Kong. No coral was recorded.

4.2.6 All the sites in the Survey Area supported limited marine life only (**Table 10** refers). No hard coral was found in the Survey Area. One species of gorgonian *Echinomuricea* sp. was found on boulder surfaces at D1 and D8. All the fauna found in the Survey Area are common, occurred in low abundance and sparsely distributed. No rare or species of conservation importance was recorded. As gorgonian was recorded, more detailed REA was carried out at D1 and D8.

Table 10 Dominating Species and Coral Found during the Spot Reconnaissance Dives

Site	Dominating Species	Rarity	Coral Species	Rarity
D1	*Thais luteostoma, Perna viridis*	Common	*Echinomuricea* sp.	Common
D2	*Thais luteostoma, Septifer virgatus, Ulva* sp.	Common	N/A	N/A
D3	*Thais luteostoma, Septifer virgatus, Ulva* sp.	Common	N/A	N/A
D4	*Thais luteostoma, Septifer virgatus, Ulva* sp.	Common	N/A	N/A

Site	Dominating Species	Rarity	Coral Species	Rarity
D5	*Septifer virgatus, Ulva* sp.	Common	N/A	N/A
D6	*Thais luteostoma, Septifer virgatus, Ulva* sp.	Common	N/A	N/A
D7	*Thais luteostoma, Septifer virgatus, Ulva* sp.	Common	N/A	N/A
D8	*Thais luteostoma, Perna viridis*	Common	*Echinomuricea* sp.	Common

4.2.7 REA surveys were conducted on 28th February 2009. **Table 11** gives the weather condition on the day of survey. Two 100 m transects and two 50 m (due to low underwater visibility) transects were laid parallel and perpendicular to the shore respectively, covering D1 and D8 (**Figure 1** refers). The site conditions were summarised in **Table 12**.

Table 11 Weather Conditions during the REA Surveys

Survey Date	Weather Condition	Underwater Visibility (m)
28th February 2009	Sunny with northeast force 4	1

Table 12 Conditions of the REA Transects

Site	Starting Location (GPS)	Ending Location (GPS)	Maximum Depth (m)	Bottom Substrate	Visibility (m)
D1	Horizontal		4	Boulder / Rock	1
	E113°56'17.7" N22°17'42.4"	E113°56'15.8" N22°17'46.2"			
	Perpendicular		5	Boulder / Muddy	0.5
	E113°56'15.7" N22°17'45.5"	E113°56'16.5" N22°17'45.6"			
D8	Horizontal		4	Boulder / Rock	1
	E113°56'24.8" N22°17'41.1"	E113°56'28.1" N22°18'44.5"			
	Perpendicular		5	Boulder / Muddy	0.5
	E113°56'27.1" N22°18'43.3"	E113°56'27.6" N22°18'43.0"			

4.2.8 The ecological composition of D1 and D8 were similar. The REA transects at both sites were mainly composed of boulders down to 4 m depth. Areas deeper than 4 m were muddy with visibility of less than 0.5 m. The sites supported limited marine life only, with snail *Thais luteostoma* and green mussel *Perna viridis* found on surfaces of boulders and at the clefts between boulders at shallow water, respectively. **Table 13** gives the ecological and substratum attributes of the horizontal and perpendicular transects at D1 and D8.

Table 13 REA Ecological and Substratum Attributes of Transects at D1 and D8

	Site 1		Site 8	
	Horizontal Transect	Perpendicular Transect	Horizontal Transect	Perpendicular Transect
Ecological attributes	*Rank*	*Rank*	*Rank*	*Rank*
Hard corals	0	0	0	0

	Site 1		Site 8	
	Horizontal Transect	**Perpendicular Transect**	**Horizontal Transect**	**Perpendicular Transect**
Octocorals (soft corals and gorgonians)	1	1	1	1
Black corals	0	0	0	0
Dead standing corals	0	0	0	0
Substratum	*Rank*	*Rank*	*Rank*	*Rank*
Bedrock / continuous pavement	0	0	0	0
Boulder blocks (diameter >50 cm)	5	3	5	3
Boulder blocks (diameter <50 cm)	2	2	2	2
Rubbles	2	0	0	0
Other	0	0	0	0
Soft substrata	0	0	0	0
Sand	0	0	2	0
Mud / silt	2	5	2	5

* Rank in percentage cover: 0=None recorded; 1=1-5%; 2=6-10%; 3=11-30%; 4=31-50%; 5=51-75%; 6=76-100%.

4.2.9 Both D1 and D8 supported sparse and patchy cover (1 – 5%) of gorgonian coral *Echinomuricea* sp.. A total of 23 and 18 colonies of gorgonian were recorded in the REA transects at D1 and D8 respectively, and all of them were found attached on boulders and rock surfaces. The gorgonians were small in size (about 10 – 20 cm at D1 and 5 – 20 cm at D8) and recorded in low coverage. Most of the colonies were in fair condition with some of them exhibited a mortality of 10 – 20% at D1 and 10 – 30% at D8 (**Appendix 1** refers).

4.3 Intertidal Community

4.3.1 Intertidal surveys were conducted at four selected sites in dry (17th January 2009 and 14th February 2009) and wet (25th April 2009 and 23rd May 2009) seasons. The majority of the Survey Area was artificial shores or modified shorelines. Sections of rocky shore remnants and patchy sandy beaches were scattered among the artificial shores. **Table 14** gives the descriptions of the four sites and photos of the habitats are given in **Appendix 3**.

Table 14 Characteristics of Intertidal Survey Sites in the Survey Area

Site	**Characteristics**
T1	- Located northward to the artificial seawalls at the southeast end of Airport Island. - Mainly a boulder shore covered by rocks of irregular shapes and cobbles.
T2	- Located to the south of the Dragonair / CNAC Building. - A boulder shore with partially sandy substrates.
T3	- Located to the north of the Dragonair / CNAC Building. - A sandy beach with artificial riprap slope at both ends.
T4	- Located near an airport signal lighthouse. - Mainly boulder and sandy at the northern end and rocky shore remnant at the southern end.

4.3.2 A total of 19 taxa were recorded during the quantitative surveys in dry and wet seasons, which had low species richness. The most frequently recorded species included rock oyster *Saccostrea cucullata*, snails *Monodonta labio* and *Nerita yoldii*, littorid snails *Echinolittorina raidata* and *Echinolittorina trochoides*, and crab *Gaetice depressus*. All the species found are common and widespread intertidal fauna in Hong Kong. The abundance of the intertidal fauna recorded was generally low, especially in areas covered by sandy substrates. No infauna was recorded in the top 5 cm of sediment and from the core samples in sandy substrates. A list of intertidal organisms recorded and representative photos of the species recorded were shown in **Appendix 1** and **4** respectively. A total of 26 species of intertidal epifauna and flora were observed during the walk-through surveys (**Appendix 1** refers). The species recorded were similar to that from the transect surveys. All the species recorded are common and widespread.

4.3.3 Species diversity (*H'*) and evenness (*J*) were shown in **Table 15**. The average diversity index recorded were 1.85 (dry season) and 2.04 (wet season) with the evenness index of around 0.80 (dry season) and 0.84 (wet season), demonstrating low diversity and evenness.

Table 15 Species Diversity and Evenness of Intertidal Community in the Survey Area

Site	T1	T2	T3	T4
Dry Season				
January 2009				
H'	1.93	1.82	1.74	2.04
J	0.81	0.79	0.75	0.85
February 2009				
H'	1.96	1.71	1.79	1.83
J	0.82	0.78	0.81	0.80
Wet Season				
April 2009				
H'	2.18	1.95	1.79	2.14
J	0.88	0.84	0.78	0.84
May 2009				
H'	2.23	1.98	1.91	2.13
J	0.90	0.82	0.83	0.81

5 ECOLOGICAL PROFILE

5.1 Benthic Community

5.1.1 All the recorded species are common without conservation importance. Although some sensitive species were present such as polychaetes *Ophelina acuminata*, *Aglaophamus dibranchis*, *Aglaophamus sinensis*, *Terebellides stroemii* and *Loimia* sp. (Borja *et al*., 2000; Cheung *et al*., 2008), the abundance was very low.

5.2 Coral Community

5.2.1 The gorgonian coral species *Echinomuricea* sp. found during the spot reconnaissance dives and REA are widespread and common in Hong Kong waters, including more turbid and harsh environment in the western waters. They are sparsely distributed (<1% coverage) and small-sized.

5.3 Intertidal Community

5.3.1 The intertidal community in the Survey Area had low species richness, with only 26 taxa recorded. All species recorded are common and widespread in Hong Kong. No species of conservation importance was recorded.

6 CONCLUSION

6.1 The marine species recorded in the Survey Area during the surveys are common and widespread in Hong Kong. No species of conservation importance was found.

7 REFERENCE

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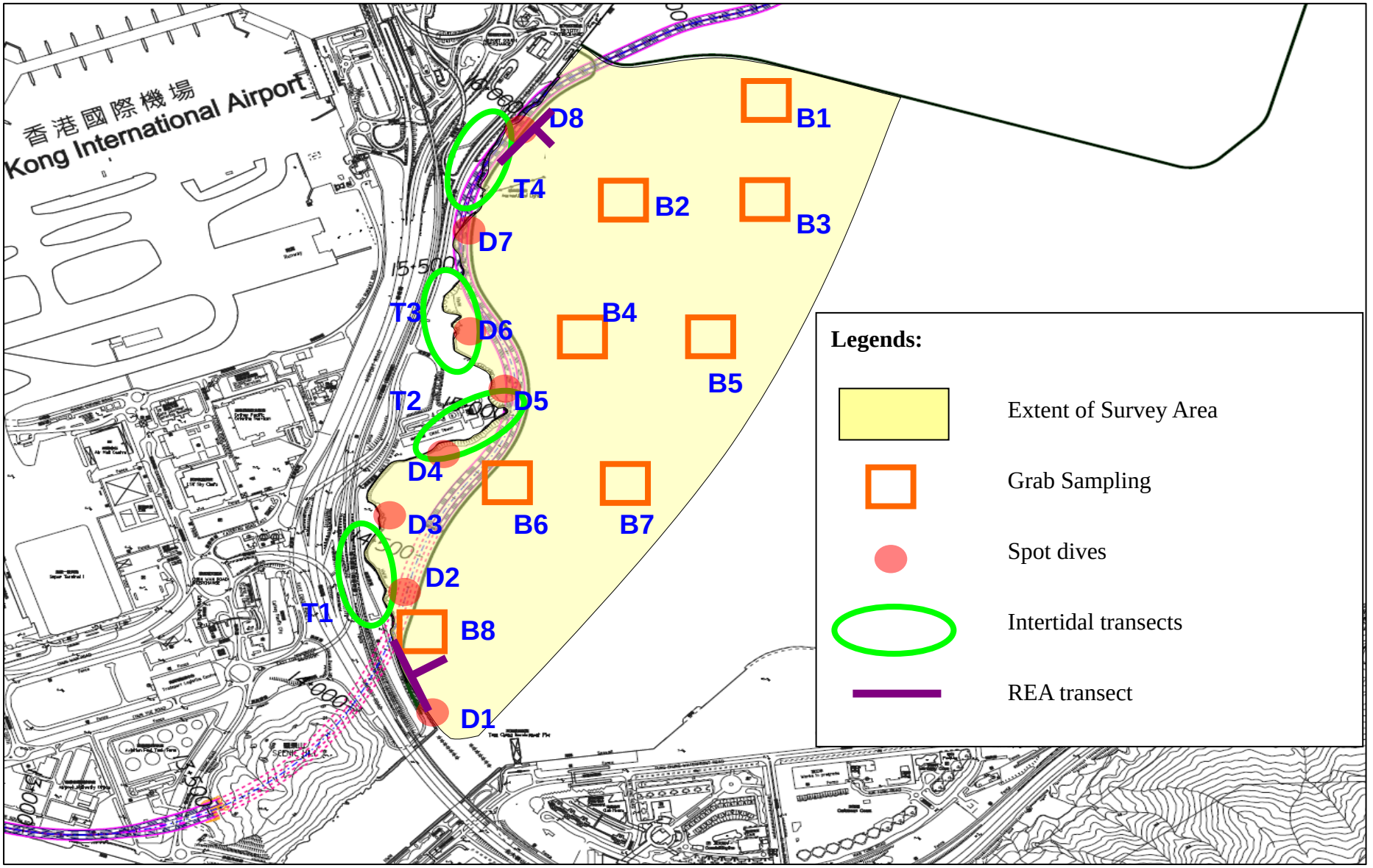
FIGURE 1

SAMPLING LOCATIONS WITHIN THE SURVEY AREA

Figure 1 Sampling Locations within the Survey Area



APPENDIX 1

MARINE FAUNA RECORDED FROM THE SURVEY AREA

Appendix 1 - Marine Fauna Recorded from the Survey Area

Benthic Organisms

Group	Species	Abundance (individual 0.5 m^{-2})	Wet Weight (g 0.5 m^{-2}) [(1)]
Dry Season			
B1			
Polychaeta	*Aglaophamus dibranchis*	4	0.01
Polychaeta	*Ehlersileanira hwanghaiensis*	1	0.00
Polychaeta	*Euchymene oerstedii*	1	0.00
Polychaeta	*Glycinde gurjanovae*	1	0.00
Polychaeta	*Harmothoe asiatica*	1	0.00
Polychaeta	*Laonice cirrata*	1	0.00
Polychaeta	*Linopherus paucibranchiata*	2	0.01
Polychaeta	*Loimia bandera*	1	0.91
Polychaeta	*Loimia medusa*	1	0.30
Polychaeta	*Lumbrineris shiinoi*	1	0.00
Polychaeta	*Mediomastus* sp.	10	0.01
Polychaeta	*Neanthes* sp. 1	1	0.00
Polychaeta	*Otopsis* sp.	1	0.00
Polychaeta	*Phyllodoce* sp. 1	1	0.00
Polychaeta	*Poecilochaetus hystricosus*	1	0.00
Polychaeta	*Schistomeringos rudolphi*	2	0.00
Polychaeta	*Sigambra hanaokai*	1	0.00
Polychaeta	*Terebellides stroemii*	1	0.00
Sipuncula	*Apionsoma trichocephalus*	1	0.00
Nemertea	Nemertean spp.	12	0.11
Echiura	*Urechis* sp.	1	3.24
Crustacea	Amphipod spp.	14	0.00
Crustacea	*Diastylis* sp.	1	0.00
Crustacea	*Neoxenophthalmus obscurus*	1	0.06
Crustacea	*Typhlocarcinus villosus*	1	0.32
Mollusca	*Mabellarca consociata*	1	0.86
Mollusca	*Macoma candida*	2	3.09
Mollusca	*Nitidotellina minuta*	2	0.01
Mollusca	*Paphia undulata*	2	2.79
Mollusca	*Solen dunkerianus*	1	0.33
Total		71	12.09
B2			
Polychaeta	*Aglaophamus sinensis*	1	0.00
Polychaeta	*Anobothrus* sp.	1	0.00
Polychaeta	*Bhawania brevis*	1	0.00
Polychaeta	*Glycera alba*	5	0.00
Polychaeta	*Gyptis pacificus*	1	0.00
Polychaeta	*Laonice cirrata*	1	0.00
Polychaeta	*Loimia medusa*	2	1.45
Polychaeta	*Lumbrineris nagae*	2	0.28
Polychaeta	*Mediomastus* sp.	8	0.01
Polychaeta	*Minuspio cirrifera*	1	0.00
Polychaeta	*Ophiodromus obscura*	2	0.00
Polychaeta	*Paraprionospio pinnata*	2	0.02
Polychaeta	*Poecilochaetus hystricosus*	4	0.02
Polychaeta	*Rhynchospio* sp.	2	0.00
Polychaeta	*Schistocomus* sp.	1	0.00
Polychaeta	*Sigambra hanaokai*	13	0.00
Polychaeta	*Terebellides stroemii*	1	0.05
Polychaeta	*Tharyx* sp.	1	0.00
Nemertea	Nemertean spp.	9	0.02
Echiura	*Amphioplus lucidus*	1	0.01
Echinodermata	*Urechis* sp.	1	1.42
Crustacea	Amphipod spp.	26	0.01
Crustacea	*Diastylis* sp.	1	0.00
Crustacea	*Miyadiella podophthalmus*	3	0.10
Crustacea	*Typhlocarcinus villosus*	1	0.15
Mollusca	*Dosinia* sp. 1	1	0.38
Mollusca	*Mabellarca consociata*	1	0.81
Mollusca	*Macoma candida*	1	0.53
Mollusca	*Paphia undulata*	2	0.20
Mollusca	*Solen dunkerianus*	2	0.26
Total		98	5.73
B3			
Polychaeta	*Aglaophamus dibranchis*	9	0.02
Polychaeta	*Aglaophamus sinensis*	1	0.00
Polychaeta	*Euchymene oerstedii*	1	0.00
Polychaeta	*Glycera alba*	1	0.00
Polychaeta	*Glycera chirori*	3	0.05
Polychaeta	*Glycinde gurjanovae*	5	0.01
Polychaeta	*Harmothoe imbricata*	1	0.00
Polychaeta	*Laonice cirrata*	5	0.01
Polychaeta	*Linopherus paucibranchiata*	4	0.01
Polychaeta	*Lumbrineris nagae*	1	0.00
Polychaeta	*Lumbrineris shiinoi*	2	0.00
Polychaeta	*Lumbrineris* sp. 1	1	0.00
Polychaeta	*Mediomastus* sp.	41	0.12
Polychaeta	*Minuspio cirrifera*	5	0.00
Polychaeta	*Ophiodromus obscura*	1	0.00
Polychaeta	*Paraprionospio pinnata*	3	0.01

Group	Species	Abundance (individual 0.5 m^{-2})	Wet Weight (g 0.5 m^{-2}) [1]
Polychaeta	*Poecilochaetus hystricosus*	4	0.01
Polychaeta	*Prionospio malmgreni*	1	0.00
Polychaeta	*Schistomeringos rudolphi*	7	0.00
Polychaeta	*Sigambra hanaokai*	17	0.00
Polychaeta	Syllidae spp.	1	0.00
Polychaeta	*Tharyx* sp.	1	0.00
Nemertea	Nemertean spp.	10	0.19
Echiura	*Thalassema sabinum*	1	0.31
Echiura	*Urechis* sp.	1	3.87
Crustacea	Amphipod spp.	23	0.01
Crustacea	*Apseudes* sp.	1	0.00
Crustacea	*Miyadiella podophthalmus*	1	0.00
Crustacea	*Neoxenophthalmus obscurus*	1	0.00
Mollusca	*Anodontia* sp. 1	1	9.16
Mollusca	*Estellarca olivacea*	2	2.13
Mollusca	*Mabellarca consociata*	3	1.30
Mollusca	*Macoma candida*	9	13.14
Mollusca	*Mactra* sp. 1	2	0.11
Mollusca	*Nitidotellina minuta*	4	0.03
Mollusca	*Paphia undulata*	15	15.94
Mollusca	*Timoclea lionota*	1	0.13
Fish	*Cryptocentrus filifer*	1	0.89
Fish	*Trypauchen vagina*	1	4.87
Total		192	52.34
B4			
Polychaeta	*Aglaophamus dibranchis*	2	0.01
Polychaeta	*Ceratonereis marmorata*	1	0.00
Polychaeta	*Euchymene oerstedii*	2	0.01
Polychaeta	*Glycera alba*	1	0.00
Polychaeta	*Laonice cirrata*	5	0.04
Polychaeta	*Linopherus paucibranchiata*	1	0.00
Polychaeta	*Lumbrineris nagae*	2	0.18
Polychaeta	*Lumbrineris shiinoi*	1	0.00
Polychaeta	*Lumbrineris* sp. 1	2	0.00
Polychaeta	*Mediomastus* sp.	2	0.01
Polychaeta	*Minuspio cirrifera*	3	0.00
Polychaeta	*Ophelina acuminata*	1	0.12
Polychaeta	*Poecilochaetus hystricosus*	5	0.02
Polychaeta	*Rhynchospio* sp.	1	0.00
Polychaeta	*Sigambra hanaokai*	5	0.00
Nemertea	Nemertean spp.	4	0.02
Cnidaria	*Cerianthus filiformis*	1	0.05
Crustacea	Amphipod spp.	18	0.01
Crustacea	*Apseudes* sp.	1	0.00
Crustacea	*Miyadiella podophthalmus*	2	0.01
Crustacea	*Neoxenophthalmus obscurus*	1	0.20
Crustacea	*Typhlocarcinus villosus*	2	0.46
Mollusca	*Anodontia* sp. 1	1	0.54
Mollusca	*Nitidotellina iridella*	1	0.03
Mollusca	*Nitidotellina minuta*	1	0.02
Mollusca	*Solen dunkerianus*	3	0.50
Total		69	2.24
B5			
Polychaeta	*Glycera alba*	1	0.00
Polychaeta	*Linopherus paucibranchiata*	1	0.00
Polychaeta	*Mediomastus* sp.	19	0.05
Polychaeta	*Minuspio cirrifera*	4	0.00
Polychaeta	*Schistomeringos rudolphi*	8	0.01
Polychaeta	*Sigambra hanaokai*	13	0.00
Polychaeta	*Tharyx* sp.	1	0.00
Nemertea	Nemertean spp.	8	0.03
Crustacea	Amphipod spp.	4	0.00
Crustacea	*Typhlocarcinus nudus*	1	0.32
Mollusca	*Mabellarca consociata*	1	0.22
Mollusca	*Macoma candida*	3	1.31
Mollusca	*Mactra* sp. 1	1	5.09
Mollusca	*Natica tigrina*	1	1.75
Mollusca	*Paphia undulata*	5	8.86
Fish	*Cryptocentrus filifer*	1	0.11
Total		72	17.75
B6			
Polychaeta	*Aglaophamus dibranchis*	2	0.01
Polychaeta	*Linopherus paucibranchiata*	1	0.00
Polychaeta	*Lumbrineris nagae*	1	0.12
Polychaeta	*Mediomastus* sp.	1	0.01
Polychaeta	*Notomastus* sp.	3	0.03
Polychaeta	*Paraprionospio pinnata*	1	0.00
Polychaeta	*Rhynchospio* sp.	1	0.01
Polychaeta	*Sigambra hanaokai*	1	0.00
Nemertea	Nemertean spp.	2	0.00
Echiura	*Urechis* sp.	1	0.04
Phoronia	Phoronids	1	0.00
Crustacea	Amphipod spp.	8	0.00
Mollusca	*Saccella cuspidata*	1	0.02
Fish	*Taenioides anguillaris*	1	3.35

Group	Species	Abundance (individual 0.5 m^{-2})	Wet Weight (g 0.5 m^{-2}) (1)
Total		25	3.58
B7			
Polychaeta	*Aglaophamus dibranchis*	6	0.02
Polychaeta	*Aglaophamus sinensis*	6	0.03
Polychaeta	*Chloeia parva*	1	0.74
Polychaeta	*Euchymene oerstedii*	5	0.01
Polychaeta	*Glycera alba*	3	0.00
Polychaeta	*Glycera chirori*	7	0.05
Polychaeta	*Glycinde gurjanovae*	5	0.01
Polychaeta	*Harmothoe asiatica*	1	0.00
Polychaeta	*Harmothoe imbricata*	2	0.21
Polychaeta	*Harmothoe* sp. 1	1	0.00
Polychaeta	*Laonice cirrata*	2	0.01
Polychaeta	*Leonnates persica*	1	0.00
Polychaeta	*Linopherus paucibranchiata*	1	0.00
Polychaeta	*Loimia medusa*	4	0.12
Polychaeta	*Lumbrineris nagae*	10	0.10
Polychaeta	*Lumbrineris shiinoi*	2	0.00
Polychaeta	*Lumbrineris* sp.1	1	0.00
Polychaeta	*Magelona* sp.	3	0.00
Polychaeta	*Marphysa sanguinea*	4	0.12
Polychaeta	*Mediomastus* sp.	4	0.01
Polychaeta	*Micronephtys sphaerocirrata*	2	0.00
Polychaeta	*Notomastus* sp.	1	0.01
Polychaeta	*Ophiodromus obscura*	2	0.00
Polychaeta	*Paraprionospio pinnata*	4	0.24
Polychaeta	*Phyllodoce* sp.1	3	0.00
Polychaeta	*Poecilochaetus hystricosus*	2	0.00
Polychaeta	*Prionospio malmgreni*	7	0.01
Polychaeta	*Schistocomus* sp.	2	0.00
Polychaeta	*Scolelepis squamata*	1	0.00
Polychaeta	*Sternaspis sculata*	1	0.00
Polychaeta	*Tharyx* sp.	3	0.02
Sipuncula	*Apionsoma trichocephalus*	1	0.00
Nemertea	Nemertean spp.	9	0.03
Echiura	*Arhynchite* sp.	1	0.01
Echiura	*Urechis* sp.	6	2.71
Cnidaria	*Cerianthus filiformis*	1	0.00
Cnidaria	*Palythoa* sp.	1	0.02
Echinodermata	*Amphioplus laevis*	5	0.39
Echinodermata	*Amphioplus lucidus*	1	0.00
Crustacea	Amphipod spp.	182	0.08
Crustacea	*Apseudes* sp.	5	0.00
Crustacea	*Atypopenaeus stenodactylus*	1	0.16
Crustacea	*Diastylis* sp.	4	0.00
Crustacea	*Neoxenophthalmus obscurus*	1	0.02
Mollusca	*Anodontia* sp.1	2	4.14
Mollusca	*Azorinus coartata*	1	3.98
Mollusca	*Dosinia* sp.1	1	0.09
Mollusca	*Epicodakia divergens*	2	0.03
Mollusca	*Mactra* sp. 1	1	0.04
Mollusca	*Nitidotellina minuta*	5	0.10
Mollusca	*Paphia exarata*	1	0.25
Mollusca	*Paphia undulata*	11	3.86
Mollusca	*Saccella cuspidata*	2	0.02
Mollusca	*Solen dunkerianus*	2	0.32
Total		343	17.97
B8			
Polychaeta	*Harmothoe imbricata*	2	0.04
Polychaeta	*Mediomastus* sp.	4	0.01
Polychaeta	*Ophiodromus obscura*	1	0.00
Polychaeta	*Prionospio malmgreni*	1	0.00
Polychaeta	*Sigambra hanaokai*	3	0.00
Polychaeta	*Tharyx* sp.	1	0.00
Nemertea	Nemertean spp.	4	0.00
Echiura	*Urechis* sp.	2	3.78
Cnidaria	*Cerianthus filiformis*	1	0.00
Crustacea	Amphipod spp.	21	0.00
Mollusca	*Anodontia* sp. 1	1	2.25
Mollusca	*Marctra* sp. 1	2	0.11
Mollusca	*Nitidotellina minuta*	1	0.00
Mollusca	*Saccella cuspidata*	1	0.02
Fish	*Taenioides anguillaris*	1	1.29
Fish	*Trypauchen vagina*	1	0.48
Total		47	7.99
	Wet Season		
B1			
Polychaeta	*Aglaophamus dibranchis*	2	0.01
Polychaeta	*Aglaophamus sinensis*	1	0.04
Polychaeta	*Ehlersileanira hwanghaiensis*	2	0.00
Polychaeta	*Glycinde gurjanovae*	1	0.00
Polychaeta	*Laonice cirrata*	2	0.01
Polychaeta	*Loimia medusa*	1	0.39
Polychaeta	*Mediomastus* sp.	10	0.01
Polychaeta	*Notomastus* sp.	3	0.01

Group	Species	Abundance (individual 0.5 m^{-2})	Wet Weight (g 0.5 m^{-2}) [(1)]
Polychaeta	*Ophiodromus obscura*	1	0.00
Polychaeta	*Poecilochaetus hystricosus*	1	0.00
Polychaeta	*Sigambra hanaokai*	2	0.00
Polychaeta	*Terebellides stroemii*	2	0.04
Crustacea	Amphipod spp.	4	0.01
Crustacea	*Atypopenaeus stenodactylus*	1	0.79
Crustacea	*Typhlocarcinus villosus*	1	0.36
Echinodermata	*Acaudina molpadioides*	4	31.73
Echinodermata	*Amphiura hexactis*	1	0.02
Mollusca	*Nitidotellina minuta*	2	0.07
Mollusca	*Paphia undulata*	5	1.63
Mollusca	*Solen dunkerianus*	1	0.28
Mollusca	*Tegillarca nodifera*	1	0.63
Total		48	36.0206
B2			
Polychaeta	*Aglaophamus dibranchis*	1	0.00
Polychaeta	*Aglaophamus sinensis*	2	0.03
Polychaeta	*Linopherus paucibranchiata*	1	0.00
Polychaeta	*Lumbrineris shiinoi*	3	0.00
Polychaeta	*Mediomastus* sp.	23	0.05
Polychaeta	*Notomastus* sp.	1	0.00
Polychaeta	*Sigambra hanaokai*	2	0.00
Polychaeta	*Sternaspis sculata*	1	0.00
Polychaeta	*Terebellides stroemii*	1	0.01
Platyhelminthes	*Platyhelminthes* sp.	2	0.01
Crustacea	Amphipod spp.	3	0.00
Crustacea	*Tritodynamia horvathi*	1	0.75
Crustacea	*Typhlocarcinus nudus*	1	0.13
Crustacea	*Typhlocarcinus villosus*	1	0.24
Echinodermata	*Acaudina molpadioides*	1	2.98
Echinodermata	*Amphiura hexactis*	1	0.08
Echinodermata	*Protankyra bidentata*	4	14.01
Mollusca	*Estellarca olivacea*	1	0.43
Mollusca	*Nitidotellina iridella*	2	0.16
Mollusca	*Nitidotellina minuta*	1	0.03
Mollusca	*Paphia undulata*	1	0.16
Nemertea	Nemertean spp.	1	0.00
Total		55	19.0916
B3			
Polychaeta	*Chloeia parva*	1	0.20
Polychaeta	*Euchymene oerstedii*	1	0.00
Polychaeta	*Glycera chirori*	1	0.11
Polychaeta	*Linopherus paucibranchiata*	1	0.01
Polychaeta	*Lumbrineris nagae*	1	0.00
Polychaeta	*Lumbrineris shiinoi*	1	0.01
Polychaeta	*Mediomastus* sp.	3	0.00
Polychaeta	*Ophelina acuminata*	2	0.17
Polychaeta	*Terebellides stroemii*	2	0.02
Crustacea	*Macrophthalmus latreillei*	2	13.25
Crustacea	*Typhlocarcinops canaliculata*	2	1.41
Echinodermata	*Amphioplus depressus*	2	0.52
Echinodermata	*Amphiura hexactis*	3	0.09
Mollusca	*Dosinia* sp.1	1	0.03
Mollusca	*Nitidotellina minuta*	1	0.04
Mollusca	*Paphia undulata*	1	0.40
Nemertea	Nemertean spp.	3	0.11
Total		28	16.3624
B4			
Polychaeta	*Cirriformia* sp.	1	0.01
Polychaeta	*Glycera chirori*	1	0.27
Polychaeta	*Glycera rouxii*	1	0.07
Polychaeta	*Gyptis pacificus*	1	0.02
Polychaeta	*Harmothoe* sp. 1	1	0.01
Polychaeta	*Linopherus paucibranchiata*	1	0.00
Polychaeta	*Loimia medusa*	1	0.31
Polychaeta	*Lumbrineris shiinoi*	2	0.00
Polychaeta	*Lumbrineris* sp. 1	1	0.01
Polychaeta	*Mediomastus* sp.	13	0.03
Polychaeta	*Notomastus* sp.	1	0.01
Polychaeta	*Schistomeringos rudolphi*	1	0.00
Polychaeta	*Sigambra hanaokai*	1	0.00
Polychaeta	*Terebellides stroemii*	2	0.01
Crustacea	Amphipod spp.	2	0.00
Crustacea	*Typhlocarcinus villosus*	1	0.32
Echinodermata	*Amphioplus depressus*	1	0.18
Echinodermata	*Protankyra bidentata*	1	1.67
Fish	*Muraenichthys sp.*	1	0.24
Mollusca	*Macoma candida*	4	5.97
Mollusca	*Paphia undulata*	11	12.57
Mollusca	*Tegillarca nodifera*	1	0.14
Nemertea	Nemertean spp.	2	0.06
Total		52	21.9095
B5			

Group	Species	Abundance (individual 0.5 m^{-2})	Wet Weight (g 0.5 m^{-2}) (1)
Polychaeta	*Aglaophamus sinensis*	3	0.00
Polychaeta	*Ehlersileanira hwanghaiensis*	2	0.00
Polychaeta	*Glycera rouxii*	5	0.21
Polychaeta	*Glycinde gurjanovae*	1	0.00
Polychaeta	*Laonice cirrata*	2	0.01
Polychaeta	*Linopherus paucibranchiata*	3	0.02
Polychaeta	*Loimia medusa*	1	0.07
Polychaeta	*Lumbrineris shiinoi*	1	0.00
Polychaeta	*Magelona* sp.	1	0.00
Polychaeta	*Mediomastus* sp.	3	0.00
Polychaeta	*Neanthes* sp. 1	1	0.00
Polychaeta	*Ophelina acuminata*	1	0.11
Polychaeta	*Ophiodromus angutifrons*	1	0.00
Polychaeta	*Tharyx* sp.	3	0.00
Crustacea	Amphipod spp.	5	0.00
Crustacea	*Austinogebia edulis*	1	0.09
Crustacea	*Metapenaeopsis dalei*	1	0.01
Crustacea	*Typhlocarcinus nudus*	2	0.46
Crustacea	*Typhlocarcinus villosus*	2	1.24
Echinodermata	*Protankyra bidentata*	1	1.64
Fish	*Cryptocentrus filifer*	1	0.02
Mollusca	*Clausinella calophylla*	1	1.85
Mollusca	*Macoma candida*	4	4.75
Mollusca	*Nitidotellina iridella*	1	0.03
Mollusca	*Tegillarca nodifera*	1	0.86
Nemertea	Nemertean spp.	3	0.10
Sipuncula	*Apionsoma trichocephalus*	1	0.00
Total		52	11.4947
B6			
Polychaeta	*Aglaophamus sinensis*	2	0.00
Polychaeta	*Dorvillea* sp. 1	2	0.00
Polychaeta	*Ehlersileanira hwanghaiensis*	1	0.00
Polychaeta	*Laonice cirrata*	2	0.01
Polychaeta	*Mediomastus* sp.	7	0.01
Polychaeta	*Notomastus* sp.	1	0.00
Crustacea	*Philyra olivacea*	1	0.30
Echinodermata	*Protankyra bidentata*	3	3.63
Fish	*Taenioides anguillaris*	1	2.89
Mollusca	*Azorinus coartata*	2	2.60
Mollusca	*Paphia undulata*	1	0.15
Nemertea	Nemertean spp.	1	0.01
Total		24	9.6308
B7			
Polychaeta	*Aglaophamus sinensis*	1	0.00
Polychaeta	*Euchymene oerstedii*	3	0.01
Polychaeta	*Eunice indica*	2	0.02
Polychaeta	*Glycinde gurjanovae*	2	0.00
Polychaeta	*Laonice cirrata*	1	0.00
Polychaeta	*Lumbrineris nagae*	3	0.16
Polychaeta	*Lumbrineris shiinoi*	1	0.00
Polychaeta	*Magelona* sp.	2	0.00
Polychaeta	*Mediomastus* sp.	1	0.00
Polychaeta	*Neanthes* sp. 1	1	0.00
Polychaeta	*Prionospio malmgreni*	2	0.00
Polychaeta	*Schistocomus* sp.	3	0.01
Polychaeta	*Sternaspis sculata*	2	0.01
Polychaeta	*Tharyx* sp.	2	0.00
Crustacea	Amphipod spp.	8	0.00
Cnidaria	*Edwardsia japonica*	1	0.00
Echinodermata	*Acaudina molpadioides*	1	9.33
Echinodermata	*Amphioplus laevis*	3	0.11
Fish	*Odontamblyopus rubicundus*	1	0.40
Mollusca	*Anodontia* sp. 1	1	0.11
Mollusca	*Dosinia* sp.1	3	0.12
Mollusca	*Paphia undulata*	3	2.24
Sipuncula	*Apionsoma trichocephalus*	4	0.02
Total		51	12.5467
B8			
Polychaeta	*Euchymene oerstedii*	1	0.01
Polychaeta	*Laonice cirrata*	1	0.00
Polychaeta	*Mediomastus* sp.	17	0.05
Polychaeta	*Notomastus* sp.	3	0.02
Polychaeta	*Paraprionospio pinnata*	1	0.00
Polychaeta	*Phyllodoce* sp.1	1	0.00
Polychaeta	*Sigambra hanaokai*	3	0.00
Crustacea	Amphipod spp.	1	0.00
Cnidaria	*Metedwardsia akkeshi*	2	1.96
Echinodermata	*Acaudina molpadioides*	1	1.60
Mollusca	*Nitidotellina minuta*	1	0.08
Mollusca	*Paphia undulata*	1	0.06
Nemertea	Nemertean spp.	2	0.01
Total		35	3.8093

Note:

(1) Biomass = 0.00 g 0.5 m^{-2}: the organism with total biomass less than 0.01 g 0.5 m^{-2}

Appendix 1 - Marine Fauna Recorded from the Survey Area

Corals (Recorded in REA)

Coral Colony	Coral Species	Size (cm)	Health Condition	Mortality (%)	Translocation Feasibility
D1					
1	*Echinomuricea* sp.	10	Fair	0	Yes
2	*Echinomuricea* sp.	15	Fair	10	Yes
3	*Echinomuricea* sp.	10	Fair	0	Yes
4	*Echinomuricea* sp.	12	Fair	0	Yes
5	*Echinomuricea* sp.	12	Fair	0	Yes
6	*Echinomuricea* sp.	15	Fair	10	Yes
7	*Echinomuricea* sp.	20	Fair	15	Yes
8	*Echinomuricea* sp.	12	Fair	0	Yes
9	*Echinomuricea* sp.	12	Fair	10	Yes
10	*Echinomuricea* sp.	12	Fair	0	Yes
11	*Echinomuricea* sp.	10	Fair	0	Yes
12	*Echinomuricea* sp.	15	Fair	0	Yes
13	*Echinomuricea* sp.	20	Fair	20	Yes
14	*Echinomuricea* sp.	20	Fair	15	Yes
15	*Echinomuricea* sp.	11	Fair	0	Yes
16	*Echinomuricea* sp.	18	Fair	0	Yes
17	*Echinomuricea* sp.	12	Fair	0	Yes
18	*Echinomuricea* sp.	17	Fair	0	Yes
19	*Echinomuricea* sp.	15	Fair	0	Yes
20	*Echinomuricea* sp.	15	Fair	0	Yes
21	*Echinomuricea* sp.	15	Fair	0	Yes
22	*Echinomuricea* sp.	10	Fair	10	Yes
23	*Echinomuricea* sp.	10	Fair	0	Yes
D8					
1	*Echinomuricea* sp.	5	Fair	0	Yes
2	*Echinomuricea* sp.	10	Fair	0	Yes
3	*Echinomuricea* sp.	10	Fair	0	Yes
4	*Echinomuricea* sp.	5	Fair	0	Yes
5	*Echinomuricea* sp.	8	Fair	0	Yes
6	*Echinomuricea* sp.	15	Fair	10	Yes
7	*Echinomuricea* sp.	15	Fair	15	Yes
8	*Echinomuricea* sp.	12	Fair	0	Yes
9	*Echinomuricea* sp.	15	Fair	0	Yes
10	*Echinomuricea* sp.	7	Fair	0	Yes
11	*Echinomuricea* sp.	5	Fair	0	Yes
12	*Echinomuricea* sp.	20	Fair	30	Yes
13	*Echinomuricea* sp.	10	Fair	0	Yes
14	*Echinomuricea* sp.	15	Fair	0	Yes
15	*Echinomuricea* sp.	10	Fair	0	Yes
16	*Echinomuricea* sp.	5	Fair	20	Yes
17	*Echinomuricea* sp.	10	Fair	15	Yes
18	*Echinomuricea* sp.	10	Fair	0	Yes

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms

Jan-09										
T1										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	49			15	1	3			4	72
Echinolittorina trochoides	7	18	11	13	3	7	54	48	31	15
Littoraria articulata										
Monodonta labio										
Nerita yoldii		2			1	1			3	
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	15%	10%	<1%	20%	20%					25%
Septifer virgatus										
Cellana grata	4	2		1						4
Echinolittorina radiata							1			
Echinolittorina trochoides	2									
Littoraria articulata										
Monodonta labio	4	5	15		1	3	1	1	6	
Nerita yoldii	13	14		11	16			3	9	8
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica			10							
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens		1		3						5
Saccostrea cucullata	15%	30%		70%	80%		5%	5%	10%	75%
Septifer virgatus										
Cellana grata	6	70		10						3
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio	14		17	5		11	15	15	31	18
Nerita yoldii	13		12	2	5	15	3	5	25	35
Thais clavigera	2	1		1					5	
Balanus amphitrite			2		10			10		
Capitulum mitella										
Tetraclita japonica		10								
Ligia exotica			1							
Gaetice depressus	8		8			19	7	5	6	
T2										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata						2	1			1
Echinolittorina trochoides	8		11		5	3	6	4	12	3
Littoraria articulata										
Monodonta labio								1		
Nerita yoldii						1		4		
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms

Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	<5%		<1%	<5%	4%		<1%			
Septifer virgatus				16						
Cellana grata										
Echinolittorina radiata										
Echinolittorina trochoides			3						9	
Littoraria articulata										
Monodonta labio	5				34	4		18		2
Nerita yoldii					3	1	1	5	2	
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria								5%		
Green algae										
Red algae										
Haliplanella lineata						1				
Barbatia virescens	15									
Saccostrea cucullata	50%					5%	10%	45%	5%	55%
Septifer virgatus	35									
Cellana grata	25					8				10
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata	40									15
Monodonta labio	10					65		23	45	20
Nerita yoldii						31		15	21	
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus						15		3	10	
T3										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata		3		23	1	12	9	10	25	2
Echinolittorina trochoides	8	4			3	6	12		4	15
Littoraria articulata										
Monodonta labio										
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae							25%	20%		
Red algae								60%		
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	10%							15%	30%	5%
Septifer virgatus									5	
Cellana grata	7								5	
Echinolittorina radiata										
Echinolittorina trochoides								1		
Littoraria articulata									5	
Monodonta labio	6									19
Nerita yoldii	2									
Thais clavigera										
Balanus amphitrite									10	
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										3
Gaetice depressus										9
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms										
Saccostrea cucullata	40%									
Septifer virgatus										
Cellana grata	10									
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio										
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
T4										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	13	8						73	27	45
Echinolittorina trochoides	1	7						32	18	10
Littoraria articulata										
Monodonta labio										
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae										10%
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	35%							<1%		15%
Septifer virgatus	8									
Cellana grata	13									15
Echinolittorina radiata								35	37	
Echinolittorina trochoides	15							45		
Littoraria articulata									16	40
Monodonta labio									7	5
Nerita yoldii								3	15	
Thais clavigera										
Balanus amphitrite										
Capitulum mitella								5		
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens								15	9	
Saccostrea cucullata								15%	70%	
Septifer virgatus								60	11	
Cellana grata								25	30	
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio								5	9	
Nerita yoldii										
Thais clavigera										
Balanus amphitrite	85							9		
Capitulum mitella										
Tetraclita japonica								8	21	
Ligia exotica										
Gaetice depressus										
Feb-09										
T1										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms

Septifer virgatus										
Cellana grata										
Echinolittorina radiata	23	15		6	19	10	31		9	50
Echinolittorina trochoides	15	8	2	4	15	11	23	56	28	22
Littoraria articulata										
Monodonta labio										
Nerita yoldii	1	1			1		1		1	5
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	5%	15%	5%	25%	10%		5%			30%
Septifer virgatus										
Cellana grata	2	3	3				1			1
Echinolittorina radiata								6		
Echinolittorina trochoides	10		3							
Littoraria articulata										
Monodonta labio		3	10			4	1	1	2	1
Nerita yoldii	10	11	1	11	15		2		2	5
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica				16						
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens	3			1					2	
Saccostrea cucullata	20%	20%		50%	60%	2%	5%	10%	5%	65%
Septifer virgatus										
Cellana grata	2	20	30	10	5		3			3
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio	17	3	10	2	1		15	17	11	41
Nerita yoldii	10	5	10	5	1	5	5	7	15	16
Thais clavigera	1	2		3				1	1	3
Balanus amphitrite	2		5		5		2	6		1
Capitulum mitella										
Tetraclita japonica	5	5					3			
Ligia exotica	2		3			3				
Gaetice depressus	1		3	11		14	2		1	
T2										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	3		1			3				
Echinolittorina trochoides	12		9			2	5	5	13	2
Littoraria articulata										
Monodonta labio		3						2		
Nerita yoldii					2	1		1		
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	10%		5%	<1%	<1%			<1%		5%
Septifer virgatus	5				10					
Cellana grata										
Echinolittorina radiata										
Echinolittorina trochoides				5						

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms

Littoraria articulata										
Monodonta labio	5	2			19		11	8		2
Nerita yoldii		2			1		6	2	2	
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria							5%			**5%**
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens	5	11								
Saccostrea cucullata	35%		5%	10%		10%	15%	10%	20%	
Septifer virgatus			10	10				6		
Cellana grata	10			3			5			
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata	10			6			12			21
Monodonta labio	16				16	60		26	10	35
Nerita yoldii	2				15	35		5	2	27
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus	5								6	
T3										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	6	10	2	12	21	10	5		18	5
Echinolittorina trochoides	5	12			11	5			21	14
Littoraria articulata										
Monodonta labio										
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae						20%	10%	10%		5%
Red algae						20		30%		
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	10%							20%	25%	5%
Septifer virgatus									10	
Cellana grata	7							5	5	2
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata									5	7
Monodonta labio	11								5	16
Nerita yoldii	5									3
Thais clavigera										
Balanus amphitrite									10	2
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										5
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens	2									
Saccostrea cucullata	45%									
Septifer virgatus										
Cellana grata	7									
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio										
Nerita yoldii										
Thais clavigera										

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
T4										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	19	11						94	35	20
Echinolittorina trochoides	10	2						36	21	5
Littoraria articulata										
Monodonta labio										
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae	5%									5%
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	40%							5%		15%
Septifer virgatus	5									
Cellana grata	5							4		15
Echinolittorina radiata								27	45	
Echinolittorina trochoides								49	5	
Littoraria articulata								5	10	37
Monodonta labio								2	3	2
Nerita yoldii									13	5
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens								23	11	
Saccostrea cucullata								20%	70%	
Septifer virgatus								59	13	
Cellana grata								11	12	
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio									11	
Nerita yoldii										
Thais clavigera										
Balanus amphitrite								10		
Capitulum mitella										
Tetraclita japonica								14		
Ligia exotica										
Gaetice depressus										
Apr-09										
T1										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	35	31	20	14	22	16	31	45	22	33
Echinolittorina trochoides	21	17	12	14	25	9	23	41	41	26
Littoraria articulata										
Monodonta labio										
Nerita yoldii			6			3		1		1
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms

Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	35%	30%			25%	15%	15%		45%	25%
Septifer virgatus										
Cellana grata	6	5	5			2			5	1
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata	5			10				8		
Monodonta labio	15	10	5	17		9	1	1	2	21
Nerita yoldii	5	10		10		2		6		8
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens	5				6				2	4
Saccostrea cucullata	30%	35%	25	60%	80%	20%			25%	75%
Septifer virgatus										
Cellana grata	15				21				3	4
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio	25	21	40			15			44	23
Nerita yoldii	20	5		12		10		8	31	16
Thais clavigera	1	2		1	3					4
Balanus amphitrite			15	25	45				35	10
Capitulum mitella										
Tetraclita japonica			15	25	10				15	5
Ligia exotica	15		25	10	10	5			15	5
Gaetice depressus	2	6			2	2	25	18	12	5
T2										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	15				8	5	11		11	5
Echinolittorina trochoides	5		16	12	10	6	6	4	6	5
Littoraria articulata										
Monodonta labio										
Nerita yoldii	3					3				
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	10%	5%	5%	15%			10%		5%	
Septifer virgatus	24	5					13		10	
Cellana grata										
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata	5	16								
Monodonta labio	10		19	28	37				27	12
Nerita yoldii	5		10	5	15		6		6	8
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria				5	5					
Green algae										

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms

Red algae										
Haliplanella lineata		2	5		2					
Barbatia virescens		21	10							
Saccostrea cucullata		60%			15%		25%	5%	55%	65%
Septifer virgatus		15	38		5					
Cellana grata		5	23		13			10	10	5
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata		24	10		2			5		11
Monodonta labio		24	20		51			32	11	54
Nerita yoldii			5		21			5	11	5
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus		2	5					17	2	5
T3										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	12	31	15	15	1	12	9	10	25	
Echinolittorina trochoides	21	15	19	34	3	12	9		6	11
Littoraria articulata										
Monodonta labio										
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae			15%		25%					
Red algae							5%			
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata		10%	10%		5%		20%		30%	25%
Septifer virgatus			8		2					
Cellana grata	7		6		3					
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata			10		11				5	
Monodonta labio	2		10		15				8	9
Nerita yoldii	2		5						2	
Thais clavigera										
Balanus amphitrite			21		15					
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										3
Gaetice depressus										9
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	40%				50%					
Septifer virgatus										
Cellana grata	2				1					
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio					5					
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
T4										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms

Cellana grata										
Echinolittorina radiata	24	21				15		65	56	85
Echinolittorina trochoides	5	26				10		35	23	21
Littoraria articulata										
Monodonta labio										
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata	2									
Barbatia virescens										
Saccostrea cucullata	25%		25%		10%			15%	5%	25%
Septifer virgatus	10		2		3					
Cellana grata	11				2			2	6	8
Echinolittorina radiata	5			11		25	37			
Echinolittorina trochoides	15			9		36	16			
Littoraria articulata								21	16	23
Monodonta labio								23	17	
Nerita yoldii								23	5	
Thais clavigera										
Balanus amphitrite										
Capitulum mitella									15	5
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens								12	17	5
Saccostrea cucullata								40%	25%	65%
Septifer virgatus								55	20	21
Cellana grata								5	15	31
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio								6	15	15
Nerita yoldii										
Thais clavigera										
Balanus amphitrite	65		68		90			26	39	26
Capitulum mitella										
Tetraclita japonica								5	18	35
Ligia exotica	5		15		26			23	10	
Gaetice depressus										

May-09

T1

Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	45	62	23	22		12		42	35	46
Echinolittorina trochoides	12	51	20	5		15		24	53	26
Littoraria articulata										
Monodonta labio										
Nerita yoldii	6		12			5			1	2
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	35%	40%			35%	10%	20%		55%	30%
Septifer virgatus										
Cellana grata	8	2	3			6	2		2	1
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata	15	5		21		5		3		2

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms										
Monodonta labio	13	2	16	21		6			6	4
Nerita yoldii	6	5	5	15		10			5	2
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens	6	2		1	4					3
Saccostrea cucullata	35%	30%	20%	55%	65%	45%	15%		20%	35%
Septifer virgatus										
Cellana grata	6	8		2	16		7			1
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio	12	35	21	2		5		1	38	35
Nerita yoldii	12	14	5	16		17		1	32	31
Thais clavigera		4	3		2	1				2
Balanus amphitrite		15	20	20	35	15			45	15
Capitulum mitella										
Tetraclita japonica		5	20	20	5	5			5	15
Ligia exotica	25	10	10	35	35	35		5	5	25
Gaetice depressus		8	8		5	3	19	18	10	10
T2										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	14		11	5	15		11	21		19
Echinolittorina trochoides	5		16	12	10		6	14		32
Littoraria articulata										
Monodonta labio										
Nerita yoldii	2		2							
Thais clavigera									1	
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	15%	10%	10%	15%		5%	5%		10%	
Septifer virgatus	16	2		2			10		8	
Cellana grata										
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata	11			5			6			
Monodonta labio	8	6	13	16	35		16		21	26
Nerita yoldii	12	12	2	3	24				14	6
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus				3			2			1
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria		5		5						
Green algae										
Red algae										
Haliplanella lineata	1		1		6					
Barbatia virescens	16		10		6					
Saccostrea cucullata	50%		5		20%		15%	15%	65%	55%
Septifer virgatus	12		38		5					
Cellana grata			6		3			16	11	10
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata	21		10		2			15		8
Monodonta labio	16		20		51			37	26	36
Nerita yoldii	3		5		21			3	6	11
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms

Ligia exotica										
Gaetice depressus	1	2	6					10	11	1
T3										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	23	26		36	35	10	5	16	31	5
Echinolittorina trochoides	11	15		43	17	5	16		16	17
Littoraria articulata										
Monodonta labio										
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	5%	15%	15%		10%		15%	5%	35%	25%
Septifer virgatus	5		3		6			2		
Cellana grata	2	2	4					6		
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata	8	11	6		15			2		
Monodonta labio	12	2	15		2			6	8	9
Nerita yoldii	10	5	5					7	8	
Thais clavigera										
Balanus amphitrite	15	15	20		15			10		
Capitulum mitella										
Tetraclita japonica										
Ligia exotica				9			6			10
Gaetice depressus				2						3
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata	55%		10%		55%					
Septifer virgatus										
Cellana grata										
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio			5		15					
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
T4										
Species	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**H7**	**H8**	**H9**	**H10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens										
Saccostrea cucullata										
Septifer virgatus										
Cellana grata										
Echinolittorina radiata	15	25		19		34		55	67	74
Echinolittorina trochoides	5	21		2		19		29	18	25
Littoraria articulata										
Monodonta labio										
Nerita yoldii										
Thais clavigera										
Balanus amphitrite										
Capitulum mitella										
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**
Cyanobacteria										
Green algae										

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms

Red algae										
Haliplanella lineata	1		1		2					
Barbatia virescens										
Saccostrea cucullata	35%	5%	20%		15%			20%	15%	15%
Septifer virgatus	16		11		5					
Cellana grata	2		1					2	3	
Echinolittorina radiata	5			15		16	21			
Echinolittorina trochoides	15			15		32	26			
Littoraria articulata					10			18	32	21
Monodonta labio								34	15	3
Nerita yoldii					3			2	15	
Thais clavigera										
Balanus amphitrite										
Capitulum mitella									10	10
Tetraclita japonica										
Ligia exotica										
Gaetice depressus										
	L1	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
Cyanobacteria										
Green algae										
Red algae										
Haliplanella lineata										
Barbatia virescens								5	11	8
Saccostrea cucullata								40%	30%	60%
Septifer virgatus								43	35	25
Cellana grata								2	12	6
Echinolittorina radiata										
Echinolittorina trochoides										
Littoraria articulata										
Monodonta labio								12	24	35
Nerita yoldii										
Thais clavigera								6	8	2
Balanus amphitrite	95		75		85			36	45	36
Capitulum mitella										
Tetraclita japonica								5	18	35
Ligia exotica	10		5		16			35	10	10
Gaetice depressus										

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms (Walk-through Survey)

Dry Season				
Species	**T1**	**T2**	**T3**	**T4**
Cyanobacteria	✓	✓	✓	
Green algae	✓	✓	✓	✓
Red algae		✓	✓	✓
Haliplanella lineata				✓
Hincksia mitchelliae		✓		
Gelidium pusillum				✓
Porphyra suborbiculata				✓
Barbatia virescens		✓		
Saccostrea cucullata	✓	✓	✓	✓
Septifer virgatus	✓	✓	✓	✓
Cellana grata	✓	✓	✓	✓
Cellana toreuma		✓		✓
Siphonaria laciniosa				✓
Patelloida pygmaea				✓
Echinolittorina radiata	✓	✓	✓	
Echinolittorina vidua	✓	✓		
Echinolittorina trochoides	✓	✓	✓	
Littoraria articulata		✓	✓	
Monodonta labio	✓	✓	✓	✓
Nerita yoldii	✓	✓	✓	
Thais clavigera				✓
Balanus amphitrite				✓
Capitulum mitella				✓
Tetraclita japonica	✓			✓
Ligia exotica	✓		✓	✓
Gaetice depressus		✓		

Appendix 1 - Marine Fauna Recorded from the Survey Area

Intertidal Organisms (Walk-through Survey)

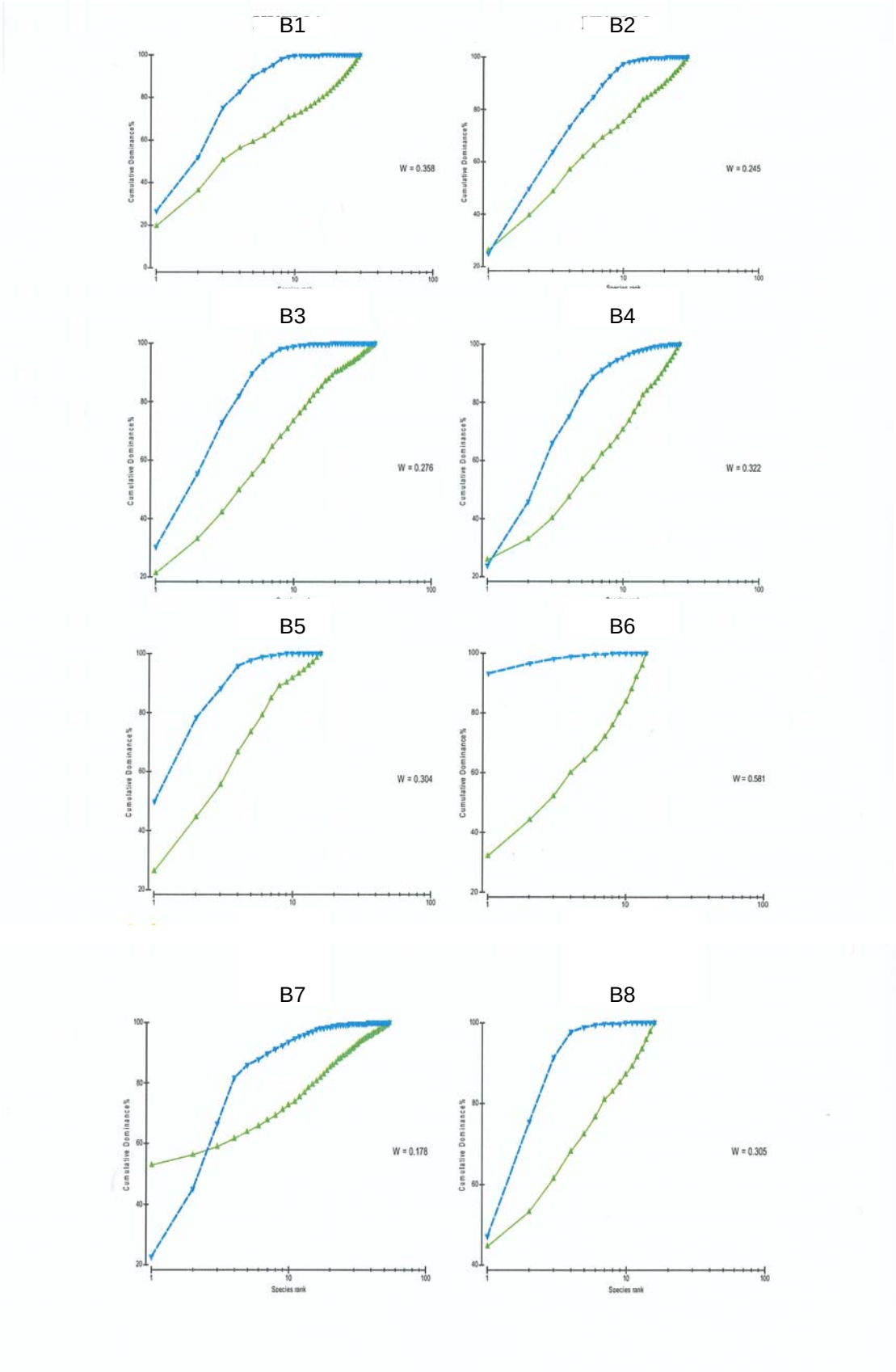
Wet Season				
Species	**T1**	**T2**	**T3**	**T4**
Cyanobacteria	✓	✓	✓	
Green algae	✓	✓	✓	✓
Red algae		✓	✓	✓
Haliplanella lineata	✓			✓
Hincksia mitchelliae		✓		
Gelidium pusillum				✓
Porphyra suborbiculata				✓
Barbatia virescens		✓		
Saccostrea cucullata	✓	✓	✓	✓
Septifer virgatus	✓	✓	✓	✓
Cellana grata	✓	✓	✓	✓
Cellana toreuma		✓		✓
Siphonaria laciniosa				✓
Patelloida pygmaea				✓
Echinolittorina radiata	✓	✓	✓	
Echinolittorina vidua	✓	✓		
Echinolittorina trochoides	✓	✓	✓	
Littoraria articulata		✓	✓	
Monodonta labio	✓	✓	✓	✓
Nerita yoldii	✓	✓	✓	
Thais clavigera		✓		✓
Balanus amphitrite		✓		✓
Capitulum mitella				✓
Tetraclita japonica	✓			✓
Ligia exotica	✓	✓	✓	✓
Gaetice depressus		✓		

APPENDIX 2

ABC PLOTS OF BENTHIC SAMPLING POINTS

Appendix 2 ABC Plots of Benthic Sampling Points (blue dotted line: biomass curve; green solid line: abundance curve)

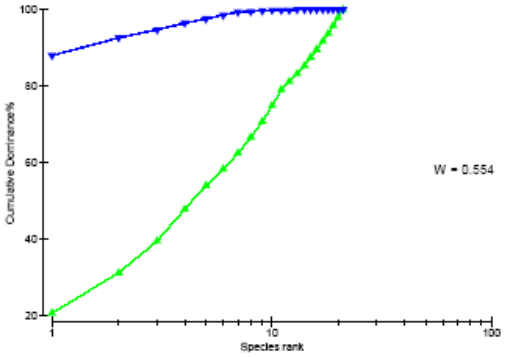
Dry Season



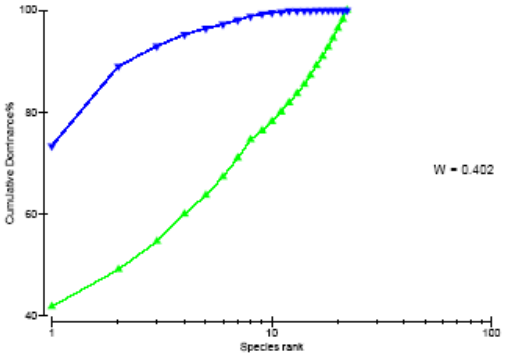
Appendix 2 ABC Plots of Benthic Sampling Points (blue dotted line: biomass curve; green solid line: abundance curve)

Wet Season

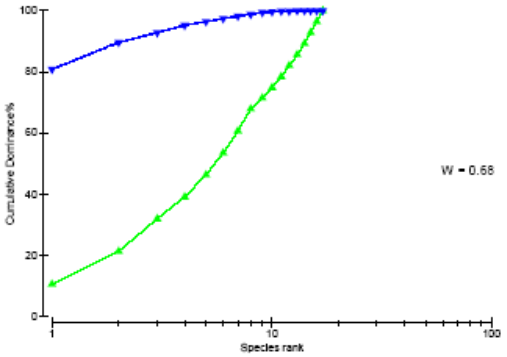
B1



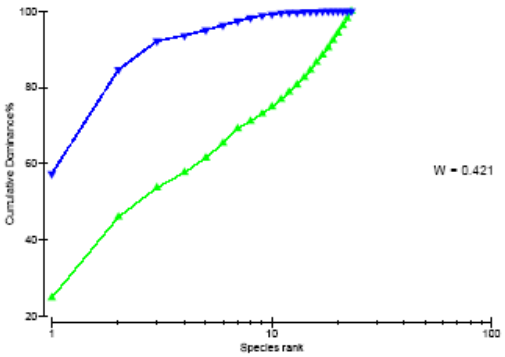
B2



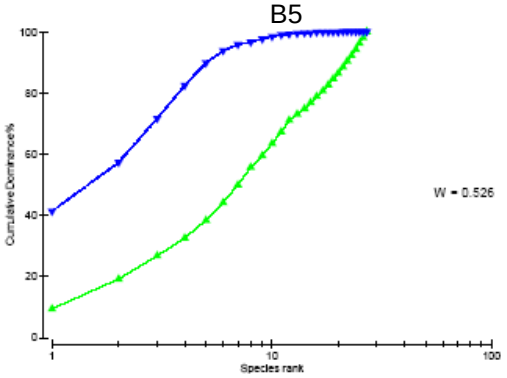
B3



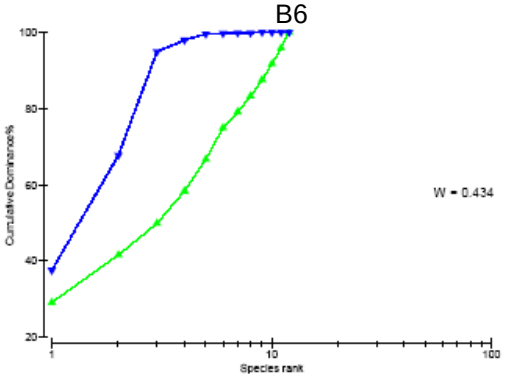
B4



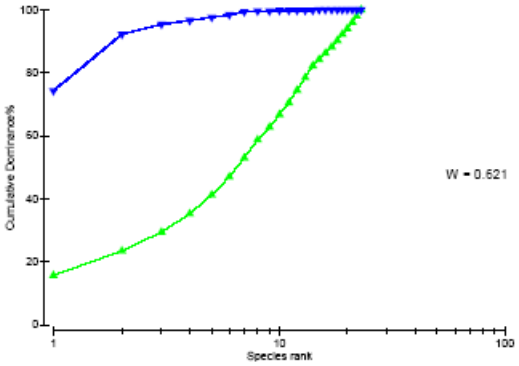
B5



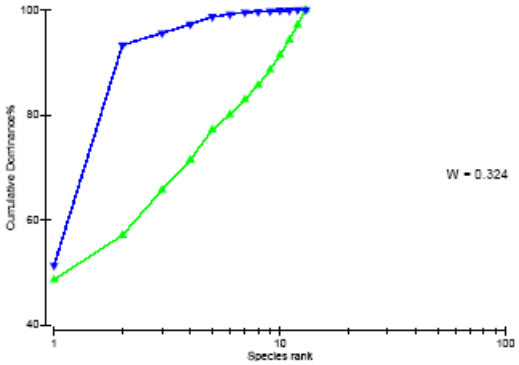
B6



B7



B8



APPENDIX 3

REPRESENTATIVE PHOTOGRAPHS OF HABITATS RECORDED WITHIN THE SURVEY AREA

Appendix 3 - Representative Photographs of Habitats Recorded within the Survey Area

Artificial Slopping Boulders at D1

Natural Bedrock at D4

Natural Coastline at D5

Natural Coastline at D6

Underwater Boulders

Underwater Boulders

Muddy Bottom

Sandy Bottom

Appendix 3 - Representative Photographs of Habitats Recorded within the Survey Area

Intertidal Transect at T1

Intertidal Transect at T2

Intertidal Transect at T3

Intertidal Transect at T4

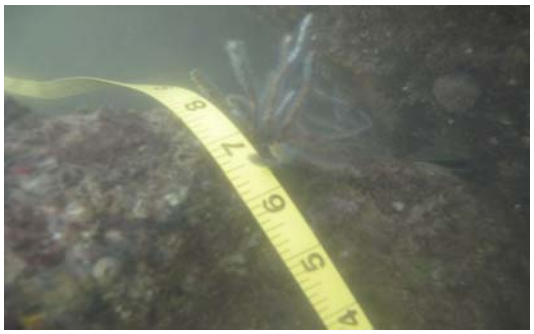
APPENDIX 4

REPRESENTATIVE PHOTOGRAPHS OF FAUNA RECORDED WITHIN THE SURVEY AREA

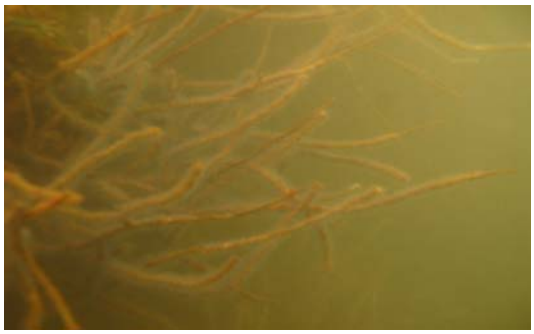
Appendix 4 - Representative Photographs of Fauna Recorded within the Survey Area

Echinomuricea sp.

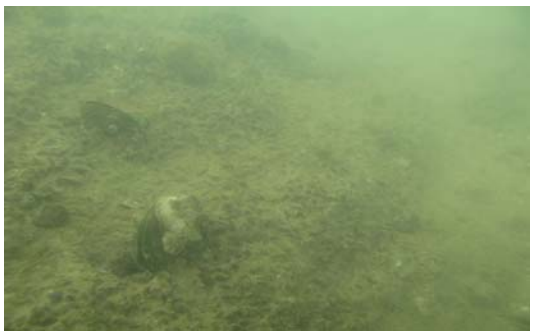
Echinomuricea sp.



Echinomuricea sp.



Echinomuricea sp.



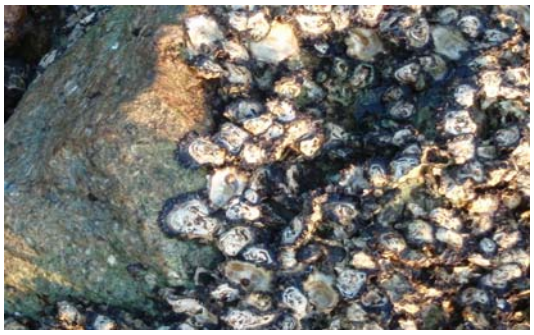
Septifer virgatus and *Perna viridis*

Perna viridis

Unidentified Oyster

Thais luteostoma

Appendix - 4 Representative Photographs of Fauna Recorded within the Survey Area



Saccostrea cucullata

Nerita yoldii

Thais clavigera

Gaetice depressus

Cellana toreuma

Littoraria articulata

Echinolittorina radiata

Echinolittorina trochoides

Appendix - 4 Representative Photographs of Fauna Recorded within the Survey Area

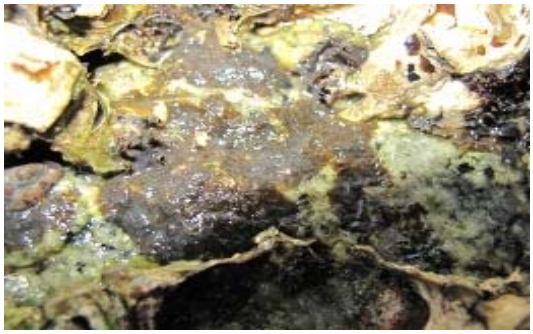
Monodonta labio

Capitulum mitella

Tetraclita japonica

Balanus amphitrite

Septifer virgatus



Hincksia mitchelliae

Green Algae

Red Algae

ANNEX A

RAPID ECOLOGICAL ASSESSMENT

Annex A Rapid Ecological Assessment

Rapid Ecological Assessment involves 'semi-quantitative' swim-surveys allowing for assessment and classification of survey areas. The field data are collected by divers experienced in the underwater identification of sessile benthic taxa, swimming down-current along coral communities or identified sections of coastline on SCUBA from haphazardly-chosen starting points.

REA surveys provide information on the assessment of relative cover of coral and other major benthic groups, as well as an inventory of sessile benthic taxa used to define community types.

Five ecological and seven substratum attributes shall be assessed on site and/or by reviewing video footages. Each of the attributes (**Table A-1**) should be assigned to one of the seven standard ranked categories (from zero to six, representing percentage cover from none to over 76%) (**Table A-2**).

An inventory of benthic taxa shall be complied for transect. Taxa shall be identified in situ to the following levels:

1) Hard corals to species level where possible;
2) Soft corals, anemones and macroalgae to genus level where possible; and
3) Other benthos to genus level where possible or phylum with growth form.

Each taxon in the inventory shall also be ranked to one of the six categories (**Table A-3**) in terms of abundance (from 0 to 5, representing from absent to dominant) in the community.

Table A-1 Ecological and Substratum attributes used in REA

Ecological attributes
Hard coral
Dead standing corals
Soft corals
Sea anemone beds
Macroalgae

Substratum
Hard substrate

Continuous pavement
Bedrock/boulders/sand
Rubble
Cobbles
Sand with gravel
Mud

Table A-2 Ranking of Ecological and substratum attributes

Rank	Percentage cover (%)
0	None recorded
1	1-5
2	6-10
3	11-30
4	31-50
5	51-75
6	76-100

Table A-3 Ranking of Benthos abundance

Rank	Abundance
0	Absent
1	Sparse
2	Uncommon
3	Common
4	Abundant
5	Dominant