MARINE RESERVE IMPLEMENTATION PROGRAMME: CENTRAL WEST COAST

A COLLABORATIVE PROJECT BETWEEN THE CALM MARINE CONSERVATION BRANCH, MIDWEST REGIONAL OFFICE AND MOORA DISTRICT OFFICE

BROAD-SCALE MAP AND BIOLOGICAL DATA OF THE MAJOR BENTHIC HABITATS OF THE Central West Coast (CERVANTES-CLIFF HEAD)

Data Report: MRIP/MW - 01/1997

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June 1997

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ACKNOWLEDGMENTS

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- Tim Daly - Technical Officer, MCB
- Ray Lawrie - Marine Information Officer, MCB
- David Rose - Manager, Moora District
- Ron Shepherd - Programme Leader, Nature Conservation, Midwest Region
- Michelle Drew - CALM volunteer
- Emma Parkes - CALM volunteer

Funding and resources

- Resources totaling more than $18,000 have been provided by the MCB, including approximately $6,000 of funds, as part of the Marine Reserve Implementation Programme.
- Resources including, scientific supervision, technical assistance, logistical support and instrumentation have been provided by the MCB.
- Resources including, technical assistance and logistical support have been provided by CALM's Midwest Region and Moora District Offices

This report may be cited as:

Burt J S, Lawrie R and Parkes E. (1997). Broad-scale map and biological data of the major benthic habitats of the Central West Coast (Cervantes - Cliff Head). Data Report MRIP/MW - 01/1997. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry St., Fremantle, Western Australia, 6160). Unpublished report.

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SUMMARY

More than 350 ground-truthing sites were surveyed along the Central West Coast from Beagle Islands to Cervantes between 13-24 January 1997, to provide the information required to validate the biological and spatial accuracy of the existing digital marine habitat map for these waters

This survey was conducted as part of CALM's Marine Reserve Implementation Programme, coordinated by the Marine Conservation Branch (MCB) of the Department of Conservation and Land Management (CALM) and conducted in collaboration with CALM's Midwest Regional and Moora District offices.

The survey has resulted in a substantial revision of the existing marine habitat map for this region. The major benthic habitat types and the relative cover of these habitats in the study area are as follows: seagrass meadow (10 %); seagrass interspersed with sand patches and some reef, > 10m depth (1 %); seagrass interspersed with sand patches and some reef, < 10m depth (10 %); bare sand with sparse seagrass (7 %); limestone pavement (1 %); subtidal reef with predominately macroalgal cover, interspersed with sand patches (33 %); shallow reef platforms (5 %); limestone pavement interspersed with sand, macroalgae and seagrass (33 %).

The main purpose of the revised marine habitat map is to provide CALM with a better regional perspective of the major marine habitats along the Central West Coast in relation to considering candidate areas for marine reservation in these waters. Given the regional nature of the map, use at a local scale (< 1 km) should be undertaken with caution.

1 INTRODUCTION

1.1 General background

This data report presents the results of a field survey undertaken between 13-24 January 1997, ground-truthing the major benthic habitat types for the waters from the Beagle Islands to Cervante, to provide the information required to validate the biological and spatial accuracy of the existing marine habitat map for this region. These waters include the Beagle Islands and Jurien Bay, areas which are recommended in *the Report Of The Marine Parks And Reserves Selection Working Group* (CALM, 1994; known as the Wilson Report) as worthy of consideration for reservation.

The CALM Act (1984), allows for the establishment of multiple-use marine reserves for the purposes of conservation of marine flora and fauna and public recreation. Commercial activities, such as fishing, aquaculture and petroleum exploration and production, are also acceptable within specific zones of multiple-use marine reserves. Commercial and recreational fisheries in marine reserves are managed by the Fisheries Department.

The CALM Act specifies the statutory process for the reservation of marine reserves, including a public planning process via an advisory committee for the development of management zones that allow multiple-use and, if necessary, for the spatial separation of incompatible activities within a reserve. In anticipation of this consultative process, the major marine resources and current uses of areas recommended for reservation in the Wilson Report, are being identified and mapped in a Geographical Information System (GIS) by CALM's Marine Conservation Branch (MCB) as part of the departments Marine Reserve Implementation Programme.

The formal process for considering Jurien Bay and surrounding waters for marine reservation was recently initiated by the Minister for the Environment through the establishment of a marine reserve advisory committee as the first step in the public consultation process. The main purpose of this survey therefore was to provide CALM with a better regional perspective of the major marine habitats along the Central West Coast for input into this consultative process.

The field survey was carried out by the Marine Conservation Branch of CALM (Contact: Jim Burt, Marine Ecologist) in collaboration with the CALM's Midwest Regional office (Contact: Ron Shepherd, Programme Leader, Nature Conservation) and Moora District office (Contact: Dave Rose, District Manager).

Jim Burt was the Project Leader and Field Team Leader. The field team also included Tim Daly (Technical Officer, MCB), Michelle Drew and Emma Parkes (CALM volunteers), and Ron Shephard.

1.2 Objectives

The objectives of the January 1997 field survey were as follows.

Primary objective

- To ground-truth the biological and spatial accuracy of the existing benthic habitat map for the waters off the Central West Coast from Cervantes to Cliff Head.

Secondary objectives

- The opportunistic collection of still photographs and video footage of marine wildlife and benthic communities in the study area.
- The identification of potential long-term monitoring and control sites.
- To assist CALM's Midwest Regional office with the 1996/7 census of Australian Sealion populations.

2 METHODS

2.1 Field survey

The major benthic habitat type (e.g. seagrass meadows, subtidal reef etc.) and the visually dominant benthic species were recorded at the ground-truthing sites using a drop-down underwater video.

The distribution of ground-truthing sites was designed to provide a relatively high density of sites in the proposed Beagle Islands and Jurien marine reserves, within a broad regional coverage (Figure 1). In selecting sites, priority was also assigned to areas where the error associated with the original habitat classification was considered to be highest. Ong *et al*. (1995), in a similar ground-truthing survey in Perth's southern metropolitan coastal waters, found that the effect of depth was a significant factor confounding the classification of benthic habitats, particularly in the shallower nearshore waters. For example, areas of bare sand within bathymetric features, such as depressions or basins, were often miss-classified as seagrass or macroalgae.

Sites were positioned at least 50m away from the boundary between habitat types to account for the spatial inaccuracy of the existing digital map.

Further details of the survey methodology can be found in Burt (1996).

2.2 Data processing

The existing digital map of the major habitat types of the Central West Coast was derived from Thematic Mapper satellite imagery (30 m pixels) processed by the Remote Sensing Applications Centre (RSAC) and classified by Dr Hugh Kirkman (CSIRO) and Paul Catalano (Ministry of Planning, formerly the Department of Planning and Urban Development). This image was derived from parts of TM scenes 113-081 and 113-082, collected on 15 November 1990. The spatial accuracy of this information is considered by RSAC to be about 50 m (A. Wylie, personal communications). The classification of habitat types is largely based on an interpretation by Hugh Kirkman however the lack of comprehensive ground-truthing meant the overall accuracy of the classification was uncertain.

The revised broad-scale map of the major marine habitat types for the Central West Coast (Figure1) was complied using the ground-truthing information obtained from this survey, in conjunction with aerial photographs (1:20 000) and marine charts of the area. Using this information the boundaries of the habitat types were defined on a hardcopy of the original TM satellite image (see above) then digitized by hand. The purpose of the ground-truthing survey was to obtain an accurate representation of the current distribution of the major benthic habitat types along the Central West Coast, and as such, the habitat categories were broadly defined and the mapping units in most habitat types were in the order of 1-2km^2. **Given the regional nature of the map, use at a local scale (< 1 km) should be undertaken with caution.**

2.3 Data curation

A digital copy of all the data, including the Data Report, is held on 11 floppy discs (IBM format) in the Marine Conservation Branch library and backed up on the t-drive of the Branch's server (t:/Jim/Jurien/Data0197). The text and Appendix I of the Data Report were created in Word For Windows, on a PC using a Microsoft Windows NT operating system. Appendix II of the Data Report is on an Excel spreadsheet.

A digital copy of the original TM satellite image and the original and revised marine habitat maps are held on the Marine Conservation Branch's Geographical Information System (GIS) as part of the Branch's statewide digital information database.

3 RESULTS

3.1 Site and habitat data

More than 350 ground-truthing sites were surveyed along the Central West Coast from the Beagle Islands to Cervantes between 13-24 January 1997. Most of the 200 scheduled sites (Burt 1996) were visited, apart from some northern sites in the Cliff Head area as a result of time and weather constraints, and over 200 additional sites were visited, particularly in the deeper waters (>20m) outside the reef break. A summary of the site information is provided in Appendix I. Detailed site information is recorded on hardcopy (Appendix II) and digital Habitat Data Sheets (see data curation).

The survey has resulted in a substantial revision of the existing marine habitat map for this region (Figure 1). The major habitat types and the relative cover of these habitats in the study area are as follows: seagrass meadow (10 %); seagrass interspersed with sand patches and some reef, > 10m depth (1 %); seagrass interspersed with sand patches and some reef, < 10m depth (10 %); bare sand with sparse seagrass (7 %);

limestone pavement (1 %); subtidal reef with predominately macroalgal cover, interspersed with sand patches (33 %); shallow reef platforms (5 %); limestone pavement interspersed with sand, macroalgae and seagrass (33 %). A more detailed description of these eight marine habitat types is provided below.

- Sand (S)

Areas of bare mobile sand with sparse seagrass.

- Seagrass and sand patches (SSG)

Seagrass patches interspersed with consolidated areas of sand.

- Seagrass meadow (SG)

Sites with dense seagrass growth.

- Intertidal reef (IR)

Intertidal reef platform and shallow sublittoral reef (<2m depth) with breaking waves.

- Inshore limestone pavement (ILP)

Low relief subtidal reef with sparse macroalgal growth, patches of sand covering the limestone pavement and some invertebrates (mussels and echinoderms). Inshore denotes areas inside the outer reef break.

- Subtidal reef with dense macroalgae (SR)

High relief reef with attached macroalgae, interspersed with patches of sand.

- Offshore (OS)

Sites showing a range of habitat types including bare sand, sparse seagrass, seagrass meadow, limestone pavement, and sparse macroalgae. Offshore denotes areas outside the outer reef break in >20m water depth.

3.2 Video footage and still photography

Underwater video footage was recorded at the majority of ground-truthing sites. This footage is coded by site number and referred to in the habitat data sheets. The footage provides examples of all habitat types encountered. Above water still photography was taken whenever possible to record local features and landmarks and provide records of wildlife encountered. This information has been archived in the Marine Conservation Branch's slide and video collections.

3.3 Census of Australian Sealion populations 1996/97

The survey team successfully completed a census of Australian Sealion's on Fisherman and Beagle Island's, providing transport and extra team members. The results will be collated by Ron Shepherd (CALM, Midwest Regional office) as part of the 1996/97 census report.

3.4 Community Liaison

Every opportunity was made to ensure the local community was informed of the objectives of the field survey. Informal discussions were held with representatives from local government authority's, professional and recreational fishing committee's and the broader community. The Field Programme Report (Burt, 1996) was circulated to key decision makers and representatives of local community groups.

4 REFERENCES

Burt J S (1996). Marine Reserves Implementation Programme. Biological and spatial validation of the major benthic habitats off the Central West Coast (Cervantes - Cliff Head): January 1997. Field Programme Report MRIP/CWC-05/96. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry St., Fremantle, Western Australia, 6160). Unpublished report.

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Ong C, Burt J S, Hick P and Wyllie A (1995). Marine habitat mapping using data from the GEOSCAN airborne multispectral scanner. Proceedings of the Third Thematic Conference on Remote Sensing for Marine and Coastal Environments. Vol. 2: 728-739.

Figure 1. Satellite image of the Central West Coast from Cliff Head to Cervantes showing ground-truthing sites, and maps of the major marine habitat types in these waters and land tenure for the adjacent coastal zone.

APPENDIX I

Location, habitat type and water depth of ground-truthing sites

Habitat Classification

- *Sand (S)*

Bare sand.

- *Sand with sparse seagrass. (SSG)*

Predominantly sand with sparse seagrass.

- *Seagrass meadow. (SG)*

Dense seagrass meadows.

- *Inshore limestone pavement. (ILP)*

Low relief subtidal reef with sparse macroalgal growth interspersed with patches of sand. Inshore denotes areas inside the outer reef break (~20 m).

- *Inshore limestone pavement with macroalgae. (ILPM)*

Low relief subtidal reef with attached macroalgae. Inshore denotes areas inside the outer reef break (~20 m).

- *Subtidal reef. (ST)*

High relief reef with macroalgae attached.

- *Offshore limestone pavement. (OLP)*

Low relief subtidal reef, including limestone pavement, interspersed with sand, macroalgae and seagrass, in deep water (>20 m). The predominant seagrass species recorded was *Thalassodendron Pachyrhizum* a species known to grow in deep water in the Jurien Bay area (Kirkman 1987).

Site No.	Latitude Degree	Minutes	Longitude Degree	Minutes	Habitat Type	Depth (m)
18	29	41.994	114	52.168	S	20
19	29	42.012	114	53.161	SR	14
20	29	42.665	114	53.515	S	12
21	29	42.313	114	54.389	SR	7
22	29	42.032	114	56.974	ILP	3
23	29	42.864	114	56.558	ILP	4
24	29	43.240	114	59.143	ILP	6
25	29	44.100	114	56.960	SG	3
26	29	44.310	114	55.880	SG	7
27	29	45.191	114	54.799	SR	6
28	29	45.658	114	53.963	SG	12
29	29	45.620	114	52.460	SR	8
30	29	45.950	114	51.170	S	17
31	29	46.060	114	51.610	S	12
32	29	47.470	114	51.920	SR	4
33	29	47.390	114	52.330	S	10
34	29	47.380	114	52.780	SG	7
35	29	47.300	114	53.140	SG	8
36	29	47.240	114	53.740	SG	8
37	29	46.660	114	54.130	SSG	10
38	29	46.670	114	55.290	SG	10
39	29	46.461	114	57.090	SG	4
40	29	47.051	114	56.711	SG	5
41	29	48.300	114	57.009	SG	5
42	29	48.298	114	57.319	SG	5

Site No.	Latitude Degree	Minutes	Longitude Degree	Minutes	Habitat Type	Depth (m)
43	29	49.162	114	57.150	SG	7
44	29	49.170	114	56.190	S	12
45	29	49.580	114	55.650	SR	8
46	29	49.200	114	55.130	S	10
47	29	49.290	114	54.090	S	6
48	29	49.320	114	53.410	SR	4
50	29	48.340	114	51.530	S	9
52	29	47.670	114	50.510	S	26
53	29	47.370	114	50.100	S	34
54	29	51.120	114	52.000	S	28
55	29	51.080	114	53.390	ILPM	13
56	29	51.060	114	54.130	SR	13
57	29	51.550	114	54.900	SR	13
58	29	50.930	114	56.440	SG	14
59	29	50.932	114	56.939	SG	7
61	29	55.346	114	52.919	S	32
62	29	55.346	114	53.879	SR	20
63	29	55.885	114	54.753	ILP	13
64	29	55.461	114	55.725	ILPM	10
65	29	55.266	114	56.554	SR	12
66	29	54.920	114	56.992	SR	5
67	29	55.228	114	57.433	SR	8
68	29	55.170	114	57.863	SSG	8
69	29	57.425	114	57.539	SG	6
70	29	58.320	114	56.532	SR	9
71	29	59.706	114	53.692	S	23
72	29	59.929	114	55.083	SR	9
75	30	0.357	114	56.690	SSG	9
76	30	1.336	114	53.476	OLP	33
77	30	1.683	114	54.897	SR	9
78	30	2.293	114	54.981	SR	11
79	30	2.456	114	55.947	SR	9
84	30	6.228	114	56.856	SR	9
85	30	6.337	114	57.216	SR	5
88	30	8.921	114	57.360	SR	8
89	30	8.861	114	58.147	SG	8
90	30	9.745	114	59.533	SG	8
91	30	9.858	114	59.761	SG	7
94	30	11.217	114	58.704	SR	9
95	30	12.840	114	57.015	OLP	26
96	30	12.664	114	57.525	SR	14
97	30	12.979	114	58.027	SR	12
99	30	14.224	114	57.922	S	17
100	30	16.498	114	56.527	SR	33
101	30	15.992	114	58.142	SR	9
102	30	15.890	114	58.399	SR	8
103	30	15.656	114	59.257	S	12
104	30	15.681	115	0.010	SSG	14
106	30	15.697	115	1.526	SR	7
107	30	16.200	115	1.715	SG	7
108	30	16.500	115	1.088	S	9
109	30	16.991	115	1.330	S	4
110	30	17.445	115	1.785	SSG	10
111	30	17.950	115	1.754	SSG	8
112	30	17.892	115	0.420	S	4
113	30	17.910	114	59.520	SG	10
114	30	17.163	114	59.586	S	10
115	30	17.460	114	57.821	S	18
116	30	17.518	114	57.058	S	31
117	30	18.539	114	57.906	SR	14
118	30	19.699	114	58.632	S	10
119	30	20.297	114	59.396	S	6
120	30	19.880	114	59.726	SG	6

Site No.	Latitude Degree	Minutes	Longitude Degree	Minutes	Habitat Type	Depth (m)
121	30	20.837	115	0.665	S	5
122	30	20.770	115	0.824	SSG	5
123	30	20.913	115	1.342	SG	6
124	30	21.555	115	0.884	SG	11
125	30	21.751	115	0.286	SSG	6
126	30	21.990	114	58.812	S	12
127	30	23.764	114	58.226	OLP	25
128	30	23.773	114	58.929	SR	13
129	30	23.599	114	59.895	SG	8
130	30	22.755	115	1.855	S	8
131	30	22.045	115	2.027	SSG	10
132	30	21.854	115	2.554	SG	8
133	30	22.747	115	2.618	SSG	6
134	30	22.785	115	2.733	SG	5
135	30	24.098	115	2.780	SSG	5
136	30	24.160	115	2.126	SG	6
137	30	23.800	115	0.930	S	7
138	30	24.381	115	0.129	S	6
139	30	24.776	114	59.426	SR	6
140	30	24.862	114	58.848	SR	12
141	30	25.052	114	58.463	S	24
142	30	26.594	114	58.944	S	23
143	30	26.678	114	59.414	SR	10
144	30	26.719	115	0.028	SR	8
145	30	26.422	115	0.783	S	10
146	30	27.175	114	59.010	S	29
147	30	27.087	114	59.591	SR	8
148	30	27.382	114	59.859	SR	30
149	30	27.433	115	0.165	SR	10
150	30	27.392	115	0.650	SR	9
151	30	27.507	115	1.851	SG	2
152	30	27.160	115	2.486	SG	4
153	30	29.181	114	59.383	SR	26
154	30	29.152	115	0.217	SR	11
155	30	28.694	115	1.638	SR	4
156	30	28.709	115	2.872	SG	3
158	30	29.400	115	4.061	SG	2
159	30	29.997	115	2.533	SR	7
160	30	30.033	115	2.039	SR	4
161	30	30.395	115	0.690	SR	7
162	30	30.451	115	0.396	SR	14
163	30	0.319	115	0.902	S	26
164	30	32.268	115	1.610	SR	8
165	30	32.453	115	2.017	ILPM	11
167	30	32.747	115	2.815	SR	8
168	30	32.714	115	3.602	SR	11
169	30	32.714	115	4.553	SG	6
170	30	33.135	115	4.294	SG	6
171	30	33.506	115	4.334	SR	8
172	30	33.792	115	3.886	SR	4
173	30	34.318	115	3.431	SR	6
174	30	35.100	115	2.890	SR	10
175	30	34.924	115	2.663	S	10
177	30	35.611	115	3.871	SR	8
178	30	35.452	115	4.150	SR	8
179	30	35.598	115	4.324	SR	3
180	30	35.527	115	5.171	SR	7
181	30	28.670	115	4.036	SG	3
182	30	28.655	115	3.524	SG	3
183	30	29.284	115	1.264	SR	8
184	30	28.304	115	2.140	SG	4
185	30	28.378	115	0.833	SR	7
186	30	25.973	115	0.936	SG	6

Site No.	Latitude Degree	Minutes	Longitude Degree	Minutes	Habitat Type	Depth (m)
187	30	25.440	115	0.835	S	5
188	30	25.263	115	0.196	S	7
189	30	25.325	115	0.651	SG	6
190	30	25.777	115	0.488	SG	7
191	30	26.219	115	0.750	SG	10
192	30	25.363	115	1.517	SG	6
193	30	24.406	115	2.350	S	5
194	30	24.471	115	2.819	SG	4
195	30	25.292	115	0.025	SR	6
196	30	24.886	115	0.356	SG	8
197	30	24.305	115	1.727	SG	6
198	30	23.177	115	2.274	SG	6
199	30	23.028	115	0.490	SR	10
200	30	20.342	115	1.669	SG	7
201	30	20.420	115	1.784	SG	7
202	30	20.963	115	1.762	SG	7
203	30	20.689	115	1.685	SG	8
204	30	20.631	115	2.334	SG	1
205	30	20.796	115	0.850	SG	4
206	30	21.736	115	0.179	SG	6
207	30	21.916	115	0.392	S	15
208	30	22.088	115	0.901	SSG	13
209	30	22.207	115	1.453	SSG	13
210	30	21.724	115	2.228	SG	6
211	30	21.659	115	2.075	SSG	8
212	30	22.543	115	2.728	SG	4
213	30	22.532	115	2.793	SG	3
214	30	22.660	114	58.682	S	20
215	30	23.330	114	58.700	SSG	20
216	30	23.770	114	56.977	OLP	35
217	30	24.915	114	57.197	OLP	35
218	30	26.368	114	57.665	ILP	3
219	30	25.250	115	0.038	SR	8
220	30	25.190	114	59.996	SR	9
221	30	25.112	115	0.113	SG	8
222	30	25.422	115	0.061	SR	8
223	30	25.299	115	0.292	SG	8
224	30	25.403	115	1.913	SG	6
225	30	25.607	115	2.440	SG	5
226	30	25.969	115	2.655	SG	5
227	30	25.874	115	0.318	SR	5
228	30	26.712	115	0.855	SG	10
229	30	28.633	115	0.802	ILPM	10
230	30	27.381	115	2.164	SSG	5
231	30	36.069	115	5.809	SG	2
232	30	35.936	115	5.740	SR	9
233	30	35.815	115	5.932	SR	6
234	30	35.374	115	5.732	SG	5
235	30	35.277	115	4.566	SR	4
236	30	34.929	115	4.116	SG	5
237	30	34.698	115	4.127	SG	3
238	30	34.785	115	4.697	SG	4
239	30	35.087	115	4.556	SG	5
240	30	34.268	115	4.841	SG	3
241	30	34.018	115	4.285	SG	8
242	30	33.749	115	3.428	SR	10
243	30	33.609	115	5.208	SR	2
244	30	33.610	115	5.119	SG	4
245	30	33.631	115	4.746	SG	6
246	30	32.873	115	4.277	SG	7
247	30	32.177	115	2.720	SG	4
248	30	32.181	115	3.503	SG	7
249	30	31.937	115	4.403	SG	3

Site No.	Latitude Degree	Minutes	Longitude Degree	Minutes	Habitat Type	Depth (m)
250	30	41.639	115	4.285	SG	2
251	30	31.257	115	4.179	SG	3
252	30	31.336	115	3.902	SG	2
253	30	31.924	115	3.950	SG	4
254	30	31.973	115	3.623	SG	6
255	30	32.388	114	59.489	OLP	31
256	30	32.451	114	58.912	OLP	36
257	30	34.152	114	59.533	OLP	35
258	30	36.031	114	59.903	OLP	35
259	30	35.423	115	2.386	SSG	23
260	30	34.043	115	1.823	OLP	25
261	30	31.200	114	58.507	OLP	35
262	30	30.730	114	59.850	SSG	25
263	30	30.043	115	2.739	SG	4
264	30	30.139	115	3.230	SG	1
265	30	29.892	115	3.661	SG	2
266	30	28.715	115	2.732	SR	3
267	30	28.253	115	2.642	SG	6
268	30	28.118	115	3.688	SG	4
269	30	28.188	115	3.422	SG	3
270	30	28.824	115	2.419	SR	8
271	30	29.100	115	3.100	SG	7
272	30	29.091	115	3.036	SR	5
273	30	28.882	114	58.320	OLP	31
274	30	27.216	114	57.822	OLP	31
275	30	25.655	114	57.155	OLP	34
276	30	24.384	114	57.161	OLP	34
277	30	22.752	114	57.469	OLP	32
278	30	22.010	114	57.526	OLP	34
279	30	22.053	114	55.970	OLP	37
280	30	20.893	114	55.870	OLP	37
281	30	19.805	114	56.043	OLP	37
282	30	19.929	114	57.507	OLP	31
283	30	19.066	114	57.259	S	31
284	30	17.277	114	58.059	SR	7
285	30	17.455	114	55.528	OLP	38
286	30	16.029	114	55.624	OLP	36
287	30	16.073	114	57.165	S	26
288	30	17.090	115	2.123	SG	8
289	30	16.630	115	2.251	SR	6
290	30	16.087	115	2.188	SG	4
291	30	14.860	115	1.728	SG	4
292	30	15.106	115	1.259	SG	6
293	30	14.302	115	0.777	SG	4
294	30	13.957	115	0.104	SR	4
295	30	14.109	115	0.089	S	6
296	30	14.283	115	0.051	S	12
297	30	14.849	114	59.604	SR	9
298	30	14.818	115	0.000	SR	11
299	30	14.862	114	58.887	SR	13
300	30	16.316	114	59.286	SR	11
301	30	16.813	114	59.474	SR	12
302	30	18.991	114	58.946	SR	14
303	30	18.327	115	0.524	SG	6
304	30	18.627	115	0.388	SG	5
305	30	18.075	115	1.028	SSG	9
306	30	17.782	115	1.236	S	12
307	30	17.467	115	1.470	SSG	11
308	30	17.223	115	1.467	SSG	9
309	30	17.207	115	1.822	S	12
310	30	14.187	114	58.304	SR	13
311	30	14.282	114	56.895	OLP	31
313	30	12.953	114	55.935	OLP	32

Site No.	Latitude Degree	Minutes	Longitude Degree	Minutes	Habitat Type	Depth (m)
315	30	12.896	114	58.765	SR	5
316	30	12.239	114	58.823	SR	9
317	30	12.073	114	59.079	SG	6
318	30	11.986	114	59.355	SR	2
319	30	11.285	114	59.264	SR	8
320	30	11.468	114	58.657	SR	9
321	30	10.700	114	58.726	SR	10
322	30	10.912	114	57.736	SR	7
323	30	10.881	114	56.720	SR	14
324	30	10.591	114	55.878	OLP	30
325	30	10.639	114	54.781	OLP	33
326	30	9.852	114	54.160	OLP	36
327	30	9.788	114	55.992	S	25
328	30	9.896	114	56.765	SR	5
329	30	9.920	114	57.286	SR	6
330	30	9.837	114	58.568	SR	7
331	30	10.449	114	59.751	SR	3
332	30	10.550	114	59.631	SSG	8
333	30	10.535	114	59.298	S	12
334	30	9.915	114	59.155	SG	11
335	30	9.336	114	59.078	SSG	9
336	30	8.906	114	59.621	SG	3
337	30	8.837	114	59.006	SG	6
338	30	4.850	114	54.021	OLP	31
339	30	4.829	114	54.643	SR	20
340	30	4.910	114	55.025	SR	8
342	30	4.668	114	56.871	SR	10
343	30	4.280	114	57.277	SR	9
344	30	3.712	114	57.370	SG	5
345	30	3.282	114	56.294	SR	10
346	30	0.821	114	52.113	OLP	37
347	30	7.860	114	56.841	SG	3
348	30	7.912	114	57.166	SG	5
349	30	7.885	114	57.755	SG	5
350	30	7.908	114	58.483	SG	4
351	30	7.876	114	59.438	SG	4
352	30	8.345	114	59.404	SG	4
353	30	8.404	114	59.861	SG	4
354	30	8.319	114	58.428	SG	7
355	30	8.269	114	57.468	SR	6
356	30	7.250	114	57.638	SSG	4
357	30	6.720	114	57.398	SG	9
358	30	6.640	114	58.646	SG	5
359	30	7.024	114	59.012	SG	3
360	30	6.361	114	58.983	SG	6
361	30	6.412	114	58.101	SG	5
362	30	5.470	114	58.450	SG	5
363	30	4.711	114	58.237	SG	4
364	30	5.488	114	57.433	SR	9
365	30	5.281	114	56.912	SR	3
366	30	1.692	114	56.337	SR	7
367	30	0.739	114	56.713	SG	7
368	30	0.482	114	57.573	SG	3
369	30	0.565	114	57.064	SG	4
370	29	29.503	114	56.684	SG	8
371	29	58.521	114	57.389	SG	3
372	29	56.528	114	57.893	SG	4
373	30	0.305	114	55.856	SR	8
374	30	0.218	114	55.409	S	9
375	29	59.864	114	54.497	SG	9
376	29	59.673	114	52.174	OLP	33
377	29	58.183	114	53.645	OLP	19
378	29	58.266	114	54.460	ILPM	12

Site No.	Latitude Degree	Minutes	Longitude Degree	Minutes	Habitat Type	Depth (m)
379	29	58.394	114	55.594	SR	8
380	29	56.048	114	57.071	SR	7
381	29	54.956	114	38.346	SG	4
382	29	52.858	114	52.709	OLP	23
383	29	53.006	114	53.945	ILPM	15
384	29	53.007	114	54.890	SR	12
385	29	53.048	114	55.913	SR	12
386	29	53.060	114	57.151	ILPM	9
387	29	53.167	114	57.778	ILPM	5
388	29	53.728	114	58.170	SR	7
389	29	53.090	114	58.188	SG	4
390	29	53.129	114	57.735	SSG	6
391	29	50.824	114	57.877	SG	4
392	29	45.186	114	54.494	SSG	12
393	29	44.472	114	54.892	SG	7
394	29	45.230	114	56.360	SG	4
395	29	47.380	114	52.040	SG	5
396	29	48.140	114	53.670	SG	5
397	29	48.250	114	53.490	SG	4
398	29	45.560	114	53.160	SR	7
399	29	46.410	114	50.340	SG	30
400	29	49.260	114	50.680	OLP	31
401	29	49.310	114	49.870	OLP	33
402	29	51.080	114	50.610	OLP	33
403	29	48.910	114	54.720	SG	4
404	29	48.830	114	55.290	SSG	9
405	29	48.341	114	57.505	SG	3
406	29	47.640	114	56.184	SG	5
407	29	45.388	114	56.936	SG	3
408	29	42.914	114	56.976	ILP	3
409	29	42.952	114	56.055	SG	9
410	29	43.017	114	55.152	SG	7
411	29	43.002	114	54.720	SG	5
412	29	44.169	114	53.592	SR	8
413	29	44.175	114	52.093	S	20
414	29	43.044	114	51.899	OLP	22
415	29	42.344	114	55.206	SG	7
416	29	42.326	114	56.236	SG	7
417	29	42.237	114	56.686	SR	3

APPENDIX II

HABITAT DATA SHEETS

Terminology used in data sheets

Only terms differing from those described in Burt (1996) are listed.

Recorder: Name of the person who was primarily responsible for recording the original notes. Observations were made by Jim Burt (J.Bu), Emma Parkes (E.P) and Michelle Drew (M.D).

GPS Lat and GPS Long: The GPS site coordinates were recorded as degrees, minutes and decimals of a minute. **The GPS was set up to use the AGD 66 datum.**

Transect End Point: The habitat type was recorded along a transect at some sites. Lat/Long coordinates were recorded at the beginning and end of the transect and these sites are noted by a 'T' preceeding the site number.

Major Habitat Type: Defined in Appendix I

Habitat description: General description of the habitat with quantitative measures, such as percentage cover, if possible.

Video reference: Video footage of a site is referred to as **JB /# 100**, where JB denotes Jurien Bay and 100 is the site number.