MARINE RESERVE IMPLEMENTATION PROGRAMME: CENTRAL WEST COAST

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

BIOLOGICAL AND SPATIAL VALIDATION OF THE MAJOR BENTHIC HABITATS OFF THE CENTRAL WEST COAST (CERVANTES-CLIFF HEAD): 13-24 JANUARY 1997

Field Programme Report: MRIP/CWC - 05/96

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Department of Conservation and Land Management

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ACKNOWLEDGEMENTS

Direction

- Kieran McNamara - Director, Nature Conservation Division.
- Dr Chris Simpson - Manager, Marine Conservation Branch (MCB), Nature Conservation Division.
- Greg Leaman - Manager, Midwest Region.

CALM Collaboration

- Jim Burt - Project leader, MCB
- Tim Daly - Field Team Leader, MCB
- Ron Shephard - Programme Leader, Nature Conservation, Midwest Region
- David Rose - Manager, Moora District
- Michelle Drew - CALM volunteer

Funding and resources

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- 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

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CONTENTS

SUMMARY

This report presents details of a field survey proposed for 13-24 January 1997, 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.

This survey is part of the CALM's Marine Reserve Implementation Programme and is being 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 primary objective of the field survey is to ground-truth the current digital map of major benthic habitat types for the waters of the central west coast, between Cervantes and Cliff Head, to improve the accuracy of the habitat classification and the spatial accuracy of the map. A field survey grid of 200 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. The secondary objectives of this survey are 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, and to assist with the 1996/7 census of Australian Sealion populations.

1 INTRODUCTION

1.1 General background

This report presents details of a field programme proposed for 13-24 January 1997, to ground-truth the biological and spatial accuracy of CALM's benthic habitat map for the waters off the central west coast from Cervantes to Cliff Head. These waters include Jurien and the Beagle Islands, areas 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 (Figure 1).

The CALM Act, 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 for the development of management zoning schemes that allow for the spatial separation of incompatible activities in a marine park. In anticipation of this 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 the Marine Conservation Branch (MCB) as part of the Marine Reserve Implementation Programme.

CALM's 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). 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 means the overall accuracy of the classification is unknown.

The field survey outlined here is part of CALM's Marine Reserve Implementation Programme and is being coordinated by the Marine Conservation Branch of CALM (Contact: Jim Burt, Marine Ecologist) and conducted in collaboration with the CALM's Midwest Regional office (Contact: Ron Shephard, Programme Leader, Nature Conservation) and Moora District office (Contact: Dave Rose, District Manager).

Jim Burt is the Project Leader and Tim Daly (Technical Officer, MCB) is the Field Team Leader.

1.2 Objectives

The objectives of this field programme are 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 with the 1996/7 census of Australian Sealion populations.

2 METHODS

The major benthic community types (e.g. seagrass meadows, coral reef etc.) and the visually dominant species will be recorded using a drop-down underwater video at more than 200 habitat ground-truthing sites. All habitat data and related observations will be recorded on standardised hardcopy sheets and electronic data files which have been pre-formatted and stored on a laptop computer. All written data is to be transferred to computer files during the field survey, and preferably on the day of collection. Examples of the habitat data sheets are presented in Appendix I.

The field survey grid of habitat ground-truthing sites was designed to provide a relatively high sample density in the proposed Beagle Islands and Jurien Marine Reserves within a broad regional coverage (Figure 2). A listing of the sites

In site selection, priority was 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. Relatively deep bathymetric features, such as holes or basins in otherwise shallow waters were often miss-classified as seagrass or macroalgae.

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

The surveying of the 200 habitat ground-truthing sites listed in Appendix II has highest priority. Other desirable sites can also be included opportunistically, but have a secondary priority, and should only be surveyed weather and time permitting. Appendix II provides the space to record the GPS coordinates of these opportunistic sites. In the event of disruptions to the field work (e.g. poor weather or mechanical breakdown) priority should be given to obtaining a broad coverage of the high priority sites, not a high density of these sites within a locality. The survey will commence from the southern end of the study area to assist with the proposed census of Australian Sealions (see below) planned for the latter part of the second week.

To improve the spatial rectification of the habitat map, accurate position fixing using a differential GPS (~ 3m) will be undertaken at a number of sites (10 to 20) throughout the study area. The data sheets for recording the GPS coordinates, and descriptions, of the sites to be used for spatial rectification of the digital habitat map are presented in Appendix II. The selection of these sites is on the basis that they can be accurately located on both the digital habitat map and higher resolution aerial photographs (1:20,000), which should enable positions to be resolved to sub-pixel accuracy (<30m). The aerial photographs used in this project were part of the 1994/95 Cape Leeuwin to Kalbari data set (Job No. 940590.

A monthly census of the Australian Sealion, *Neophoca cinera,* will be undertaken between November 1996 and January 1997, for the known breeding islands of the central west coast including Buller, North Fisherman and Beagle Islands, and some of the islands in the Abrolhos group. The census is being co-ordinated by Ron Shephard and conducted by the Midwest Region and Moora District offices. The methods used in this survey are outlined in Gales *et al*., (1992) and are the same as previous surveys to enable temporal comparisons with this historical data. This census of Australian Sealions is a **secondary** priority for this project.

The collection of still photographs and high quality video footage of marine wildlife and benthic communities is also a **secondary** priority however the opportunity to collect this information is highly weather dependent and therefore very limited. Given the opportunistic nature of this objective, the field team leader has the discretion to divert from the primary surveying function, providing it does not compromise the completion of the primary objective. The preparation of the video housing, the operation of the camcord underwater video recorder and the maintenance of this equipment is detailed in Appendix IV.

A detailed list of all the equipment required for the field survey is provided in Appendix V.

3. FIELD PROGRAMME

3.1 Field itinerary

Table 2 Field itinerary for the central west coast marine habitat survey, January 1997.

Date	Activity
11/1/97	*Bidthangara* departs Fremantle (am) and arrives at Jurien Bay (pm). Approximate traveling time 8-9 hrs. Skipper Tim Daly, plus one crew member.
12/1/97	Jim Burt (MCB) plus other required staff drive to Jurien Bay (pm).
13/1//97	**Field survey commences (am).**
15/1/97	Jim Burt returns to Perth
21/1/97	Jim Burt departs for Jurien Bay
24/1/97	**Field survey completed (pm).**
	Jim Burt and field team, including Tim Daly return to Perth (pm).
26/1/97	Tim Daly drives to Jurien Bay (pm) for the commencement of the MCB's oceanographic survey.

3.2 Safety

Jim Burt, the Project leader, in consultation with Tim Daly, the skipper of the *Bidthangara*, will determine the day's field programme in relation to prevailing and forecast weather and sea conditions. In the event of Jim leaving the field he will delegate his responsibility to another member of the field team. The skipper will be responsible for all aspects of crew and boat safety and hence will have the final authority to determine the safety of **all** proposed work programmes on the vessel. There will be no compressed air diving during this survey.

The Field Team Leader is responsible for ensuring that all field work undertaken by CALM staff, including volunteers, is conducted according to CALM's departmental safety procedures and protocols.

3.3 Emergency contacts

General

CALM, Moora: Ph. 096 51 1424, Fax 096 51 1698

CALM, Cervantes: Ph. 096 52 7043, Fax 096 52 7340

CALM, Marine Conservation Branch, Fremantle: Ph 09 432 5100

Department of Fisheries, Jurien: Ph. 096 521 048

Jurien Police: Ph. 096 521 017

Jurien Silver Chain Nursing Post: Ph. 096 521 050

Fremantle Hyperbaric/Diving Service: 09 431 2233 or 09 431 3333

Jurien salvage operators: Scott Wuillin, 096 52 1534

Radio

Marine HF - channel 2182, 4620. These channels will establish contact with:

VIP Perth radio (09 30 20104), VIC Canarvan radio
Dept of Transport, Jurien Bay Marina: 096 521323

Marine VHF: channel 16 (any station)

CALM VHF: channel 12 Wedge Island
channel 16 Jurien Bay.

3.4 Resources

i) Marine Conservation Branch budget

Costs

Item	**$**
Staff	
Tim Daly (32 days @ $154/day)	4928
Accommodation and meals	
4 persons x 12 days @ $50/person/day	2400 *
Vessel costs (14 days @ $400/day)	5600
Vessel fuel	
i Fremantle -Jurien Bay	280 *
ii Field work	2500 *
Photography	100 *
Marine charts	100 *
C-CAT underwater video cost (12 days @ $25/day)	300
Differential GPS costs, including satellite time (12 days @ $100/day)	1200
Vehicle costs	
i Toyota landcruiser, 13 days @) $10/day	130
ii Station-wagon, 7 days @) $10/day	70
Vehicle fuel	400 *
Consumables	100 *
Contingency	200 *
Sub-total (* funds)	**$6080**
Total value	**$18,308**

Staff resources	**Days**
Preparation	
Ray Lawrie (GIS maps)	5
Jim Burt	8
Tim Daly	10
Field trip	
Jim Burt (includes 0.5 days leave in lieu)	7
Tim Daly (includes 4 days leave in lieu)	18
MCB volunteer	14
Curation of video footage, hardcopy data sheets and electronic data	
Tim Daly	2
Preparation of data report	
Jim Burt	1
Tim Daly	2
Adjustments to digital habitat map	
Ray Lawrie	3
Total (excluding Tim Daly's time, see above)	**38 days**

NB. Daily staff rates are as follows:
Jim Burt $238
Ray Lawrie $230
Salaries are normally multiplied by 2.7 to determine the total cost to CALM.

ii) External resources

Item

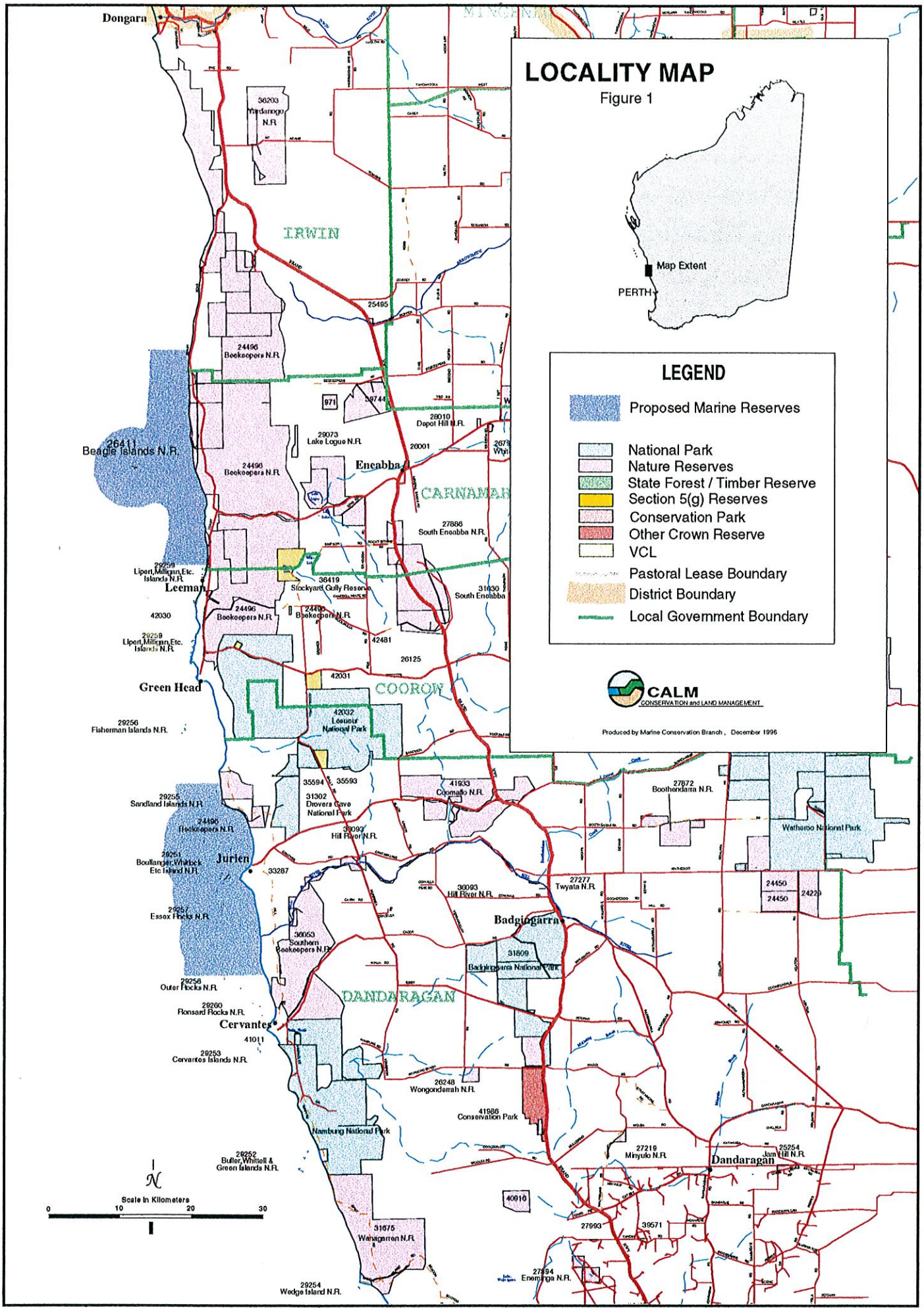
1 officer (or equivalent)	Mid-west Region (includes 2 days leave in lieu)	14 days

4. REFERENCES

Christie C A, Bass D K, Neale S J, Osborne K and Oxley W G (1996). Surveys of sessile benthic communities using the video technique. Long-term monitoring of the Great Barrier Reef. Standard Operational Procedure Number 2. Australian Institute of Marine Science, Townsville, Queensland.

Department of Conservation and Land Management (1994). A representative marine reserve system for Western Australia. Report of the Marine Parks and Reserves Selection Working Group. (National Parks and Nature Conservation Authority, Crawley, Western Australia, 6009).

Ong C, Burt J S, Hick p and Willie 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. **2**: 728-739.


LOCALITY MAP
Figure 1
Map Extent
PERTH
LEGEND
Proposed Marine Reserves
National Park
Nature Reserves
State Forest / Timber Reserve
Section 5(g) Reserves
Conservation Park
Other Crown Reserve
VCL
Pastoral Lease Boundary
District Boundary
Local Government Boundary
CALM
CONSERVATION and LAND MANAGEMENT
Produced by Marine Conservation Branch, December 1996
Dongara
IRWIN
CARNAMAH
COOROW
DANDARAGAN
Beagle Islands N.R.
Leeman
Green Head
Jurien
Cervantes
Dandaragan
Badgingarra
Eneabba
Lake Logue N.R.
Depot Hill N.R.
South Eneabba N.R.
Stockyard Gully Reserve
Leseuer National Park
Drovers Cave National Park
Hill River N.R.
Coomallo N.R.
Boothendarra N.R.
Watheroo National Park
Twyata N.R.
Badgingarra National Park
Nambung National Park
Wongondemah N.R.
Conservation Park
Minyulo N.R.
Jam Hill N.R.
Wahagarren N.R.
Enemiga N.R.
Wedge Island N.R.
Fisherman Islands N.R.
Sandland Islands N.R.
Boullanger, Whitlock Etc Island N.R.
Essex Rocks N.R.
Outer Rocks N.R.
Ronsard Rocks N.R.
Cervantes Islands N.R.
Buller, Whitell & Green Islands N.R.
Lipert, Milligan, Etc. Islands N.R.
Scale in Kilometers
0 10 20 30

GROUND TRUTHING SITES FOR CALM BENTHIC HABITAT MAP

CENTRAL WEST COAST

Figure 2

DONGARA

White Point

Leander Reef

Cliff Head

Illawong

Beagle Islands

Coolimba

Leeman

LEGEND

Bathymetry in metres

5

10

20

50

Marine Habitats

Intertidal Reef

Sand

Marine Vegetation

Subtidal Reef

Ground Truthing Sites

SCALE

3 0 3 6 9 12 15

Kilometers

CALM

Conservation and land Management

Produced by Marine Conservation Branch Nov 1996

Green Head

Sandy Point

North Head

JURIEN

Escape Island

Outer Rocks

CERVANTES

Fisherman Islands

LIMIT OF STATE TERRITORIAL WATERS

LIMIT OF STATE TERRITORIAL WATERS

APPENDIX I

HABITAT DATA SHEET

HABITAT DATA SHEET

Project	MARINE RESERVE IMPLEMENTATION PROGRAM (CENTRAL WEST COAST)				**Field Survey**	DECEMBER 1996	
Site No.		**Name**		**Date**		**Recorder**	
Vessel		**Time**		**Weather**			
Sea		**Water depth (m)**		**Water visibility (m)**			
GPS Latitude		**GPS Longitude**		**Differential**			
° ' S		° ' E		**Yes**	☐	**No**	☐
Site location							

Major Habitat Type	

Habitat Description

Dominant Species

Seagrass	
Macro-algae	
Coral	
Fish	
Invertebrates	

Other Features

Impact or Activity

Video ref	MRIP/ /#	**Aerial ref**	/WA /RUN /
Slide ref		**Print ref**	

To assist with the standardisation of data recording and survey methodologies used in field surveys by CALM's Marine Conservation Branch the following is a brief explanation of the terms and methodologies used in the attached habitat data sheet.

Site No: All sites visited were designated a site number. Each site number begins with CWC (denoting Central West Coast) and ends in a number or number/letter combination. It is anticipated that these site numbers will remain with these locations in all future CALM studies and are therefore key designators for any other information or records kept relating to each site.

Site Name: Most sites have been given a name, chosen either as one that is formally recognised (such as a chart location) or a name introduced by the study team to enable quick identification.

Date and Time: This is the date and time at which the data at the site were collected.

Recorder: This is the name of the person who was primarily responsible for the recording of original notes.

Vessel Name: Name of survey vessel.

Weather: The percent cloud cover and wind speed (km/hr) and direction (degrees) were estimated.

Sea: The sea state was described as calm (no wind, calm sea), slight (breeze was influencing surface water), moderate (wind was generating wind waves up to 1 metre) or rough (windy with wind waves greater than 1 metre).

Water Depth: Depths are approximate and were read off an echo sounder.

Water Visibility: This is an estimation of horizontal in-water visibility at the time of observation.

GPS Lat and GPS Long: The GPS coordinates of a site are recorded as degrees, minutes, seconds and decimals of a second. The GPS **must be** setup to use the AGD 66 or AGD 84 datum.

Differential: If a differential GPS was used then 'yes' is noted. GPS readings utilising a differential system allowed for position fixing described by latitude and longitude to within about 3 m or less.

Location of site with ref. to lat/long: On occasions observations were made after swimming some distance from the position of the anchored vessel. Hence, a note of the actual location of the observations and/or visual recordings that were made is given with respect to the latitude and longitude of the anchored vessel.

Habitat description: This is a general note of the habitat type and its percentage cover. As cover can vary within the general vicinity of a site the described percentage cover can have an error of approximately 20%.

Dominant Species: This is a list of the most common or readily observed species of marine life at the site. It reflects what an observer might expect to see when visiting the site in the future. Taxa are usually described to genus .

Other Habitat Notes: Features of interest at or nearby the site are noted.

Activity or Impact Noted: Signs of activity or impacts that were observed at the site are noted.

Video reference: Video image taken of the site is referred to as

160496/cwc5/0.00.00-4.24.56/hv, where

160496 is the date
cwc5 is the site number
0.00.00-4.24.56 is the time code for the relevant segment of video footage
hv means hand held video (*dv* means drop down video and *av* means acquired video)

Photo reference and Slide reference: A photograph or slide image taken of the site is referred to as

180496/cwc60/01/p, where

180496 is the date
cwc60 is the site number
01 is the photo or slide number
p refers to 'photo' (alternatively *s* refers to 'slide')

Aerial reference: Aerial photographs of the site are referred to as

11.9.90/2/5124-5136, where

11.9.90 is the date of the photography
2 is the run number, where applicable
5124-5136 are the photograph reference numbers

APPENDIX II

Data sheet; GPS coordinates for the habitat ground-truthing sites.

Site	Latitude Degree	Mins	Secs	Longitude Degree	Mins	Secs
1	29	30	33.87	114	54	51.21
2	29	31	19.01	114	54	52.28
3	29	31	24.68	114	53	23.05
4	29	31	43.13	114	56	29.81
5	29	32	14.97	114	52	51.35
6	29	32	16.87	114	53	21.97
7	29	32	58.56	114	52	43.37
8	29	33	8.08	114	53	48.33
9	29	33	3.81	114	55	15.56
10	29	32	24.56	114	58	34.82
11	29	34	13.14	114	53	58.28
12	29	33	9.45	114	58	17.79
13	29	35	7.09	114	55	11.04
14	29	35	53.24	114	55	23.39
15	29	39	45.03	114	54	36.62
16	29	40	5.02	114	53	5.75
17	29	41	31.89	114	52	28.38
18	29	41	57.07	114	52	14.92
19	29	42	0.77	114	53	9.79
20	29	42	37.83	114	53	33.25
21	29	42	14.09	114	54	39.99
22	29	42	7.02	114	56	59.13
23	29	42	51.93	114	56	32.36
24	29	43	15.05	114	57	7.45
25	29	44	7.11	114	56	58.31
26	29	44	18.75	114	55	50.17
27	29	45	1.33	114	54	36.54
28	29	45	30.13	114	53	44.02
29	29	45	34.53	114	52	26.49
30	29	45	58.68	114	51	9.98
31	29	46	3.49	114	51	45.46
32	29	47	32.11	114	51	29.02
33	29	47	24.43	114	52	17.07
34	29	47	24.09	114	52	46.81
35	29	47	18.01	114	53	3.12
36	29	47	14.54	114	53	45.25
37	29	46	38.23	114	54	8.65
38	29	46	40.72	114	55	16.53
39	29	46	29.59	114	56	57.02
40	29	47	3.24	114	56	43.04
41	29	48	14.16	114	57	7.83
42	29	48	17.26	114	57	25.56
43	29	49	6.47	114	57	14.86
44	29	49	6.95	114	56	14.98
45	29	49	33.19	114	55	38.85
46	29	49	10.12	114	55	6.96
47	29	49	20.45	114	54	6.88
48	29	49	17.41	114	52	25.02
49	29	48	26.69	114	52	29.33
50	29	48	14.42	114	51	28.11
51	29	47	40.25	114	51	9.43
52	29	47	40.98	114	50	27.36
53	29	47	22.22	114	50	1.89
54	29	51	8.52	114	52	3.24
55	29	51	4.23	114	53	27.49

Site	Latitude Degree	Mins	Secs	Longitude Degree	Mins	Secs
56	29	51	3.43	114	54	6.35
57	29	51	19.31	114	54	28.68
58	29	50	53.03	114	56	32.22
59	29	50	54.95	114	57	4.55
60	29	51	38.67	114	57	3.66
61	29	55	19.11	114	52	57.83
62	29	55	20.02	114	53	54.49
63	29	55	54.71	114	54	47.22
64	29	55	27.35	114	55	41.23
65	29	55	16.09	114	56	34.09
66	29	54	54.66	114	56	56.41
67	29	55	12.04	114	57	25.21
68	29	55	9.62	114	57	51.17
69	29	57	20.61	114	57	37.16
70	29	58	11.76	114	56	29.68
71	29	59	43.62	114	53	40.84
72	29	59	59.16	114	55	11.28
73	30	0	11.42	114	56	12.62
74	30	0	24.34	114	56	26.94
75	30	0	21.74	114	56	41.58
76	30	1	49.78	114	54	18.71
77	30	1	41.73	114	54	44.82
78	30	2	19.94	114	54	52.12
79	30	2	56.76	114	56	30.27
80	30	5	18.43	114	54	9.44
81	30	5	23.44	114	54	58.01
82	30	6	2.16	114	55	37.76
83	30	6	4.16	114	56	15.04
84	30	6	19.00	114	57	1.78
85	30	6	20.63	114	57	16.35
86	30	7	11.72	114	56	5.52
87	30	8	4.06	114	56	14.17
88	30	8	50.41	114	57	31.12
89	30	8	51.01	114	58	10.07
90	30	9	43.06	114	59	31.08
91	30	9	50.31	114	59	44.64
92	30	10	33.45	114	56	1.31
93	30	10	46.91	114	56	52.99
94	30	11	2.78	114	58	46.34
95	30	12	48.37	114	57	1.84
96	30	12	40.37	114	57	31.25
97	30	12	57.77	114	58	1.75
98	30	13	15.72	114	59	7.99
99	30	14	13.91	114	57	58.56
100	30	16	29.39	114	56	31.25
101	30	15	55.58	114	58	4.59
102	30	15	50.21	114	58	22.58
103	30	15	39.76	114	59	16.43
104	30	15	39.04	115	0	1.95
105	30	15	39.56	115	0	36.06
106	30	15	37.55	115	1	29.74
107	30	16	11.62	115	1	43.68
108	30	16	29.37	115	1	4.32
109	30	16	59.23	115	1	19.97
110	30	17	26.42	115	1	45.44

Site	Latitude Degree	Mins	Secs	Longitude Degree	Mins	Secs
111	30	17	54.65	115	1	46.05
112	30	17	53.42	115	0	25.23
113	30	17	52.06	114	59	31.06
114	30	17	10.32	114	59	34.08
115	30	17	27.02	114	57	48.08
116	30	17	30.54	114	57	2.48
117	30	18	30.61	114	57	54.89
118	30	19	41.81	114	58	37.33
119	30	20	15.05	114	59	28.69
120	30	19	52.71	114	59	43.78
121	30	20	3.58	115	1	11.59
122	30	20	47.09	115	0	50.01
123	30	20	55.01	115	1	23.42
124	30	21	33.69	115	0	51.75
125	30	21	44.32	115	0	16.79
126	30	21	55.25	114	58	49.04
127	30	23	44.06	114	58	12.04
128	30	23	46.99	114	58	57.04
129	30	23	35.58	114	59	53.92
130	30	22	48.14	115	1	53.82
131	30	22	1.73	115	2	14.85
132	30	21	51.96	115	2	33.07
133	30	22	45.06	115	2	37.15
134	30	22	47.94	115	2	44.83
135	30	24	6.09	115	2	45.85
136	30	24	3.26	115	2	5.99
137	30	24	0.98	115	0	48.77
138	30	24	24.92	115	0	8.37
139	30	24	47.07	114	59	25.41
140	30	24	52.72	114	58	49.25
141	30	25	3.52	114	58	25.84
142	30	26	35.53	114	58	57.43
143	30	26	41.55	114	59	25.65
144	30	26	38.73	115	0	0.49
145	30	26	28.03	115	0	48.36
146	30	27	10.18	114	59	0.59
147	30	27	5.14	114	59	35.47
148	30	27	23.25	114	59	51.85
149	30	27	25.77	115	0	11.12
150	30	27	22.86	115	0	39.53
151	30	27	28.34	115	1	46.41
152	30	27	24.85	115	2	50.09
153	30	27	8.05	114	59	44.55
154	30	29	8.51	115	0	14.18
155	30	28	49.87	115	1	49.92
156	30	28	56.11	115	2	33.62
157	30	29	4.04	115	3	55.94
158	30	29	45.94	115	3	21.06
159	30	29	59.71	115	2	32.34
160	30	30	1.48	115	2	1.37
161	30	30	22.58	115	0	41.03
162	30	30	27.91	115	0	24.16
163	30	32	18.86	115	0	54.13
164	30	32	15.01	115	1	34.18
165	30	32	26.71	115	2	10.05

Site	Latitude Degree	Mins	Secs	Longitude Degree	Mins	Secs
166	30	32	45.99	115	2	30.03
167	30	32	45.02	115	2	52.23
168	30	32	43.63	115	3	36.11
169	30	32	40.00	115	4	32.92
170	30	33	12.25	115	4	24.55
171	30	33	30.04	115	4	20.33
172	30	33	48.69	115	3	58.03
173	30	34	17.24	115	3	26.51
174	30	35	5.85	115	2	53.29
175	30	34	55.64	115	2	41.88
176	30	35	29.73	115	3	22.48
177	30	35	40.35	115	4	0.98
178	30	35	27.07	115	4	8.98
179	30	35	31.71	115	4	20.05
180	30	35	32.47	115	5	12.09
181	30	28	42.86	115	3	57.64
182	30	28	50.11	115	3	20.13
183	30	29	18.38	115	1	15.84
184	30	28	13.13	115	1	55.82
185	30	28	29.95	115	0	47.18
186	30	25	54.93	115	0	55.48
187	30	25	26.95	115	0	50.09
188	30	25	17.42	115	0	11.16
189	30	25	18.95	115	0	38.18
190	30	25	45.61	115	0	29.91
191	30	26	13.74	115	0	44.08
192	30	25	21.98	115	1	30.92
193	30	24	23.62	115	2	23.61
194	30	24	31.79	115	2	47.91
195	30	25	12.74	114	59	57.09
196	30	24	53.05	114	0	23.25
197	30	24	18.51	115	1	41.21
198	30	23	9.84	115	2	16.07
199	30	22	52.71	115	1	50.66
200	30	20	19.65	115	1	40.86
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Site	Latitude Degree	Mins	Secs	Longitude Degree	Mins	Secs
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APPENDIX III

Data sheet; GPS coordinates for the spatial rectification sites.

	GPS coordinates		Site description
Site No.	Latitude	Longitude	
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APPENDIX IV

UNDERWATER VIDEO SYSTEM

Preparation of underwater housing and video camcorder

Step-by-step instructions on preparing the StingRay SR-700 housing and Blaupunkt CC894 camcorder are given below. This procedure is adapted from the AIMS Standard Operational Procedure Number 2: "Surveys of sessile benthic communities using the video technique" (Christie *et al.,* 1996).

Where possible, store and prepare the equipment at room temperature to prevent condensation on the lenses of the camcorder and housing. Carry out these preparations in a dry, dust and spray-free environment. For more details refer to the relevant instruction manual.

Housing

1) Open the housing by simultaneously releasing and rotating the two black plastic catches at the rear of the housing. Carefully remove the monitor back and place to one side. Remove the camera tray by depressing the small black plastic catch on the left hand side and simultaneously sliding out the tray. Check the inside of the housing for any dust or other particulate matter, and clean out using a lens cloth and blower brush if necessary. Check the inside of the lens and the red filter and clean using blower brush, lens tissues and lens cleaning fluid if necessary. Check which lens is attached to the housing - super wide-angle (the shorter of the two available optics) or zoom-macro.

2) If using the SunRay lighting system, install a fully charged battery in each of the battery pods mounted on both sides of the housing (see StingRay instruction manual).

3) Remove the two O-rings from the monitor back, clean them with lens tissues and check for any cracks or scratches. If there is any damage to the O-rings, discard and replace with new ones. Apply a small amount of silicone grease (2-3 mm) between thumb and index finger and run the O-ring through several times to spread this evenly. Repeat with the second O-ring. **Ensure that you do not use too much grease as this could cause the seal to leak!** Remember that the grease is there to keep the O-rings supple and not to actually form a seal.

4) Clean out each O-ring groove with a cotton bud, and carefully replace the clean and greased O-rings back into the grooves without twisting them. Ensure that there is no particulate matter sticking to the O-rings. The housing is now ready for the camcorder to be inserted.

Camcorder

5) Place the camcorder on a clean, dry, flat surface and attach the StingRay battery adapter to the rear. Attach a fully charged Sony NP-78 battery pack to the battery adapter. Remove the lens cap, check the lens and clean if necessary. Attach a yellow or orange filter if required (see point No. 24).

6) If the housing zoom-macro lens system is being used, attach the zoom-macro adaptor to the front of the camcorder. This accessory lens pushes on in front of the camcorder lens, so that it lies flush with the manual focusing ring.

7) Press the eject switch (small switch with blue button on top of camcorder) and insert a blank Hi 8 video tape into the cassette holder, ensuring that the red copy protection switch is switched off. Close the cassette holder by gently pressing the 'PUSH' mark on the right side - the top section of the cassette holder will then close down automatically. **Do not push it down manually.**

8) Switch the camcorder on by sliding the OPERATE switch (front left side with green button) to CAMERA. Turn the REC switch (rear left side with red button) to STANDBY.

9) Select the camcorder settings. Turn the IMAGE STABILIZER switch (below the AUTO MODE cover on left side) to ON. Open the AUTO MODE cover and set the functions as follows:

FOCUS- the focus mode can be selected when the camcorder is inside the housing.

EXPOSURE - leave the exposure mode in automatic setting (no exposure indicator on the left side of the LCD display).

PROGRAM - select the desired shutter speed by pressing the PROGRAM button. The SPORTS setting (indicated by a running figure on the LCD display) gives a shutter speed of 1/50 to 1/500 of a second. **This will be suitable for most video transect work**. On occasions when camcorder shake may be excessive, or when trying to video fast-moving subjects such as marine mammals or fish it would probably be better to select the HIGH SPEED setting

WHITE- the white balance setting can be selected when the camcorder is inside the housing (see point No. 18).

10) Ensure the viewfinder lens is removed, and the viewfinder is locked in the down position (see camcorder instruction manual for details).

11) Ensure that the timecode function is switched on (TC displayed on the top right side of the LCD display). If it is off, press the COUNTER/TIMECODE button below the LCD display so that TC is displayed.

12) Mount the camcorder on the StingRay camera tray, ensuring that the camcorder is correctly aligned and that the screw on the bottom of the tray is tightened firmly. Attach the cables from the tray to the camcorder, in the following order:

    i) attach the video cable (yellow label) to the VIDEO OUT plug (front right side), ensuring that it is routed snugly under the base of the battery and inside the camcorder grip strap (otherwise it will not reach the plug);

    ii) attach the power-out cable (green label) from the battery adapter to the DC power jack on the camera tray;

    iii) attach the remote cable (blue label) to the blue REMOTE plug (back right side);

    iv) attach the microphone cable (red label) to the red MIC plug (front right side),ensuring that it is routed under the lens and clear of the camera tray.

13) Slide the camera tray assembly into the grooves in the housing and push forward gently until it will not go in any further. Check that the assembly is locked in place and cannot be withdrawn without depressing the small black plastic locking button at the rear left hand side of the camera tray.

14) Ensure that the two black plastic catches on the outside of the housing are in the vertical position with the slots facing towards you. Place the monitor back onto the rear of the housing, ensuring that the two black plastic guide pins go into the guide holes on the camera tray. Simultaneously rotate the locking catches towards you, ensuring that the stainless steel guide pins on the monitor back enter the slots on the catches. Continue to rotate the catches until they lock in the horizontal position. Inspect around the circumference of the monitor back to ensure that it is properly seated.

15) Assemble the monitor back screen shade and place it in the tracks of the monitor back. Slide it down until it locks in place.

Pre-filming checks

16) Power up the camcorder by sliding the PWR switch (right side rear) towards you and holding it in place for 2 seconds. A green LED comes on at the bottom centre of the monitor back, and the screen display will come on. Check the screen display to ensure that all the camcorder functions are set correctly. At the top right side of the display there should be Hi8 and SP (indicating that the tape is Hi8 format and record mode is set for short play), and STBY (indicating that the camcorder is in standby mode). Underneath these symbols the time code indicator and the remaining tape indicator, will be displayed. At the bottom right side the battery indicator will be displayed. At the top left side there will be a hand symbol (indicating that the image stabilization system is on), and a running figure symbol (indicating that the shutter speed is set to SPORTS mode), and a hand symbol with the letter F inside (indicating that the manual focus mode is on). Check the manual focus by holding the focus switch (left side front) to both N (near) and F (far) positions.

17) To switch to autofocus mode, toggle (push and immediately release) the PWR switch towards you. Do not hold the switch in place or the camcorder will turn off. To return to manual focus mode, toggle the AF switch away from you. Use automatic focus for panoramic shots and manual focus for filming the transects.

18) Toggle the WB switch (left side) towards you repeatedly to change the white balance mode (as indicated by symbols in the top left side of display). The settings available are:

AUTO MODE- (no symbol): automatic white balance setting.

HOLD MODE - (HOLD): the last automatic white balance setting is locked and maintained, even if lighting conditions change.

OUTDOOR MODE - (sun symbol).

INDOOR MODE - (light bulb symbol).

For video transect work the most suitable settings are AUTO or OUTDOOR. Use the OUTDOOR mode in shallow (<3 m) water, on bright sunny days when the water visibility exceeds 8 m. Otherwise, leave the white balance in AUTO mode.

19) If there are any other symbols displayed on the screen check the camcorder instruction manual to determine what they represent.

20) Ensure that the zoom function is set to full wide-angle. Move the zoom switch (right side front) to the W position and hold it there. Check the zoom indicator on the left side of the screen display. (*Note: When using the super wide-angle lens and the auto focus mode, the camcorder will only zoom in and stay in focus for about 50 % of the full range before going out of focus. To zoom in closer than 50 % the zoom-macro lens system should be fitted).*

21) Turn the power off by moving the power/record switch to PWR and holding it there for 5 seconds. the screen display and the green LED will turn off.

22) Check that there is no condensation on the camcorder lens or housing lens. If condensation is present, delay filming until it disappears (approximately 10 minutes). The housing should be kept out of the sun during transport.

23) Once in the water, if visibility is good (>8m) and transects are in water >3m deep, slide the red filter down over the lens by turning the knob on the front plate of the housing. If transect is in water <3m deep, or if the visibility is poor it will probably be necessary to use a yellow or orange filter that screws on to the camcorder, directly in front of the lens.

24) Check the housing for leaks. This may be indicated by a moisture condensation symbol on the screen display (refer to camcorder instruction manual), bubbles coming from the housing, or water droplets visible inside the housing when you look through the housing lens.

25) Before starting to film, check the front of the housing lens for small air bubbles. Gently wipe away any that are present with your hand. Check for air bubbles regularly.

26) If lighting conditions are poor, switch on both SunRay lamps.

27) Turn the power on (move the power/record switch to PWR position and hold it there for 2 seconds) and commence recording (toggle the switch to the REC/STBY position. A red LED will come on at the bottom centre of the monitor back, and the REC symbol will appear at the top left side of the screen display.

Post-dive procedure

28) After every dive immerse the housing in fresh water. Leave it there for 10-15 minutes and wash the controls and monitor back with running water. Remove the monitor back screen shade.

29) Wipe the housing with a clean, dry towel and leave in a clean, dry, airy and salt-free environment to dry completely.

30) Wipe carefully around the rear seal of the housing before opening so that no water gets onto the camcorder. Open the housing by simultaneously rotating the black plastic catches at the rear of the housing. Remove the camera tray assembly by depressing the small black plastic locking button at the rear left side and sliding the tray out. Detach the cables and remove the camcorder from the tray. Attach caps to both housing and camcorder lens. **Do not open the housing where salt spray is present.**

31) Switch the camcorder to video by sliding the OPERATE button to VTR. Rewind the tape using the either the controls on the top of the camcorder or the remote commander. Connect the camcorder to the TV monitor (refer to camcorder instruction manual) and view the footage. Transcribe the system settings and time code information onto the main Habitat Data Sheet (Appendix I). Label the tape clearly (using a permanent marker pen) with the designated tape number, the site number and the date of recording.

Tape numbering

The video tapes should be consecutively numbered according to the following coding system:

Project acronym (JMRIP)/Sampling method (bvt - benthic video transect)/Date (05.08.96)/Tape number (#1 onwards).

Thus, the first tape would be labeled as: **JMRIP/bvt/05.08.96/#1**

If the tape contains footage spanning more than one day the tape number should indicate this (eg. **JMRIP/bvt/05-06.08.96/#1).**

32) Before commencing filming at another site, ensure that the tape is wound forward to the end of the footage recorded at the previous site. This will ensure that no data is recorded over accidentally. Once a tape is complete the red copy protect switch on the tape should be switched on to prevent loss of site data. The tapes should be stored in a waterproof container and duplicated at the end of the field trip.

33) Clean the video heads with the head cleaning cassette after approximately 10 hours of use. Follow the instructions carefully to avoid damage to the video heads. Refer to the camcorder instruction manual for more details.

Recharging the battery packs

34) New batteries should be fully charged and discharged several times before use to prolong their life. The Sony NP-78 batteries should last between 75 and 90 mins, when using the monitor back. Before recharging a used battery, make sure it is fully discharged first (use the REFRESH function on the battery charger or a battery discharger). Once the battery is totally discharged, slide the indicator switch on the top of the battery so that a red dot is visible. This serves as a reminder that the battery is totally discharged. Connect it to a battery charger and charge it completely. This will take approximately 2 hours and 20 minutes for a Sony NP-78 battery. Once it is charged, slide the indicator switch to hide the red dot, indicating that the battery is fully charged and ready to be used. At the end of the field trip, leave all batteries discharged.

APPENDIX V

EQUIPMENT LIST

1. Underwater Camera Equipment

Video system

- Blaupunkt CC894 Hi 8 video camcorder, with battery pack (2), battery charger (1), battery discharger (1), yellow and orange filters
- StingRay SR-700 underwater video housing with colour monitor back, super wide-angle and zoom-macro lenses, and built-in red filter
- SunRay underwater lighting system with battery pack (3), battery charger (1), and spare lamps (2).
- Instruction manuals
- Video transect data sheets
- Sony professional 90 min Hi 8 video tapes (15)
- Housing O-ring kit and silicone grease
- Cleaning kit
- Back-up underwater video system (Sony VHS system)

Still photography

- Camera 1: Nikonos IV and 35mm lens
- Camera 2: Nikonos V, 35mm lens and close up kit
- Camera 3: Nikonos V, 28mm lens and SB102 strobe unit
- Spare 15mm lens
- 36 exposure print film
- 36 exposure slide film
- Log books for cameras 1, 2 and 3
- Kit of camera spares

2. Safety

- Comprehensive first aid kit
- Emergency response flowsheet
- Emergency contact flow chart
- Patient information log
- Log sheets for accidents

3. Information

- Marine Charts: DMH 171, DMH 422, DMH 628, WA 705, WA 728
- Reference books for the identification of corals, fish, birds, marine mammals and marine fauna
- Scientific reference file
- Arial photography and satellite image of the Central West Coast
- CALM GIS habitat maps of the Central West Coast
- Habitat data log sheets
- 1 laptop computer plus floppy discs

4. Position fixing

- 1 Omni star differential GPS unit, antennae and accessories

5. Habitat data recording

- 1 drop down camera with colour monitor and VCR.
- 1 C-CAT ROV with colour monitor and VCR (backup).
- 1 drop down camera and cable.
- Associated cables, batteries and 240v power supplies.

6. Mechanical and electrical repair kits

- Comprehensive mechanical tool kit

- Comprehensive electrical repair kit
-

7. Accessories

- 1 dive flags
- 1 large spare parts and repair kit
- 1 box of rubber bands
- 1 box of pencils
- 1 viewfinder

8. Administration

- 1 equipment log book

9. Other items

- 200 AAA batteries
- 50 D batteries
- 100 C batteries
- 10 VHS 3 hr tapes
- 2 motorbike batteries and chargers

10. Equipment suppliers and relevant contacts

The following list gives contact details of the suppliers of major items of equipment.

Drop -down camera: Watershed, Geoff Reeves, Ph. 5813224
Omnistar differential GPS: Fugro, Gary Allen, Ph. 3225295
Underwater video system: Sea Optics, David Hull, Ph. 08 3626161

DISTRIBUTION LIST

Marine Reserve 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.

Gary Snook, Chairman, Central Coast Regional Planning Committee

Lance Croft, Chief Executive Officer, Shire of Carnamah
Stan Hazeldine, Chief Executive Officer, Shire of Coorow
Barry Golding, Chief Executive Officer, Shire of Dandaragan
Guy Leyland, Executive Officer, Western Australian Fishing Industry Council
Simon Bennison, Executive Officer, Aquaculture Council
Ian Elliot, Senior Lecturer, Geography Department, University of Western Australia

Kieran McNamara, Director, Nature Conservation Division, CALM
Dr Chris Simpson, Manager, Marine Conservation Branch, CALM
Greg Leaman, Manager, Midwest Region, CALM
David Rose, Manager, Moora District, CALM
Ron Shephard, Program Leader, Nature Conservation, Midwest Region, CALM
Tim Daly, Field Team Leader, MCB, CALM