MARINE RESERVE IMPLEMENTATION:
CENTRAL FOREST

BIOLOGICAL VERIFICATION OF THE MAJOR BENTHIC HABITATS OF THE GEOGRAPHE BAY-CAPES-HARDY INLET REGION (GEOGRAPHE BAY TO FLINDERS BAY): 13-20 DECEMBER 1998

Field Programme Report: MRI/CF/GBC - 16/1998

A collaborative project between
CALM Marine Conservation Branch and the Central Forest Regional Office
A project funded through
the National Heritage Trust's Coast and Clean Seas Marine Protected Areas Programme

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ACKNOWLEDGEMENTS

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- Dr Chris Simpson - Manager, Marine Conservation Branch (MCB), Nature Conservation Division

Calm Collaboration

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- Ray Lawrie - GIS Coordinator, MCB
- Kevin Bancroft - Marine Conservation Officer, MCB
- Tim Daly – Marine Operations Officer
- Mike Lapwood – Marine Operations Officer, MCB
- Roger Banks - Manager, South West Capes District
- Charlie Broadbent - Senior Operations Officer, Southwest Capes District

Funding and Resources

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- Resources including scientific and technical assistance, and logistical support are being provided by MCB.
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Copies of this report may be obtained from:
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SUMMARY

This report presents details of a shore-based field survey to be undertaken from the 13th to 20th December 1998, along the coast of southwestern Western Australia from Geographe Bay to Flinders Bay.

This survey is part of the Biological Inventory Portfolio of the Marine Reserve Implementation Function of CALM's Marine Conservation Branch (MCB), coordinated by the MCB and conducted in collaboration with CALM's Central Forest Region, South West Capes District Office.

The primary objective of the field survey is to ground-truth the existing digital benthic habitat map for the coastal waters of the Leeuwin-Naturaliste coast between Geographe Bay and Flinders Bay. The results of the survey will provide additional data on major benthic community types and improve the accuracy of habitat classification and spatial rectification of the existing habitat maps.

A field survey grid of 350 predetermined locations was designed to provide relatively high-density coverage of sites in the proposed Geographe Bay-Capes-Hardy Inlet marine conservation reserve.

Further details of the benthic communities in the survey area will assist in the planning of the sampling methodology and in the selection of sampling sites for a systematic marine biological survey. The biological survey of the Leeuwin-Naturaliste coast between Geographe Bay and Flinders Bay is proposed for January/February 1999. These data will be important in the determination of the relative conservation values of the proposed Geographe Bay-Capes-Hardy Inlet marine conservation reserve. It will also contribute to the information base for the boundary and zoning planning process for the proposed reserve.

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INTRODUCTION

GENERAL BACKGROUND

This report presents details of a field programme proposed for the 13th to 20th December 1998, to ground-truth the biological and spatial accuracy of CALM's benthic habitat map for the waters off the southwestern Western Australia between Geographe Bay and Flinders Bay. These waters include the Geographe Bay-Cape Leeuwin and Hardy Inlet areas recommended in *the Report of the Marine Parks and Reserves Selection Working Group* (CALM 1994) as worthy of consideration for reservation (Figure 1).

The CALM Act allows for the establishment of multiple-use marine conservation 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 conservation reserves. The Fisheries Department manages commercial and recreational fisheries in marine conservation reserves.

The CALM Act specifies the statutory process for the reservation of marine conservation 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 a number of the areas recommended for reservation in the Marine Park and Reserve Selection Working Group Report, are being identified. This data is used for mapping in a Geographical Information System (GIS) by the Marine Conservation Branch (MCB) as part of their Marine Reserve Implementation function.

In December 1997, the Western Australian Government, following advice provided by the WA Marine Parks and Reserves Authority, announced that the Geographe Bay-Capes-Hardy Inlet region as one of three priority areas for the establishment of marine conservation reserves under the *CALM Act*. Reservation of the waters of the Geographe Bay-Capes region was also recommended in the Leeuwin-Naturaliste Ridge Statement of Policy Report (WAPC 1997).

CALM's existing digital map of the major benthic habitat types of the Geographe Bay-Capes region was derived from Thematic Mapper satellite (Landsat) TM imagery (30 m pixels) processed by the Remote Sensing Applications Centre (RSAC) and classified by Dr Hugh Kirkman (CSIRO). The spatial accuracy of this information is considered by RSAC to be about 50 m (A. Wylie, personal communications). Hugh Kirkman largely based the classification of habitat types on an interpretation, however the lack of comprehensive ground-truthing means the overall biological accuracy of the classification is unknown.

This survey is part of the Biological Inventory Portfolio of the Marine Reserve Implementation Function of CALM's Marine Conservation Branch (MCB), coordinated by the MCB and conducted in collaboration with CALM's Central Forest Region, South West Capes District Office.

OBJECTIVES

The objectives of this field survey are as follows:

Primary objectives

- To ground-truth the biological and spatial accuracy of the existing benthic habitat map for coastal waters from Geographe Bay to Flinders Bay; and,

- To provide additional data on major benthic community types.

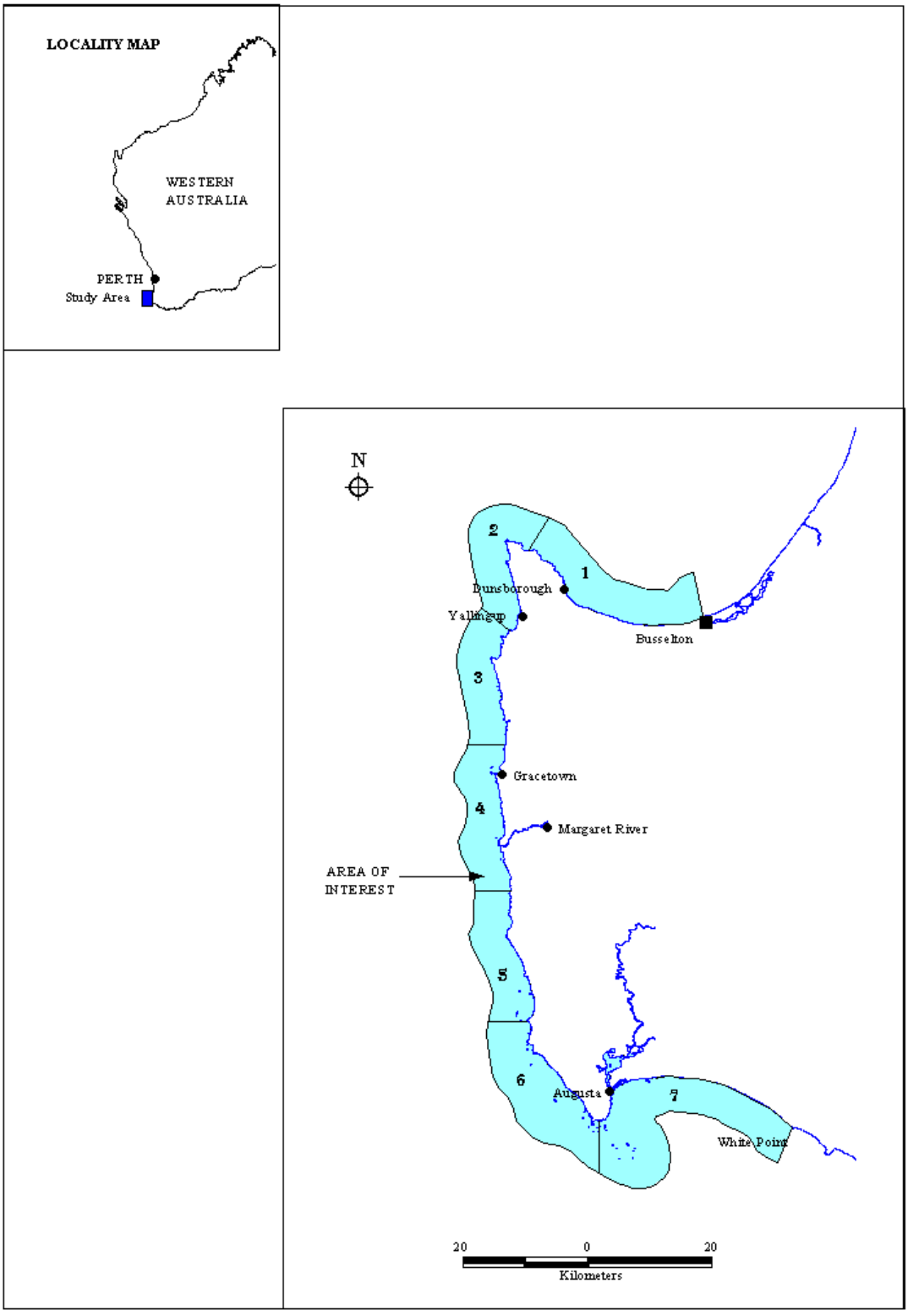

Figure 1: Survey location: Geographe Bay-Capes-Hardy Inlet region.

METHODS

SURVEY AREA

The area targeted for this survey is from the Busselton Jetty in Geographe Bay to White Point on the eastern edge of Flinders Bay, and extends seaward to the State Territorial Limits, described as 3 nm from the state baseline (Figure 1).

SITE SELECTION

Three hundred and fifty sampling sites were predetermined by identifying gaps in the existing data and identifying habitat changes from Landsat imagery and aerial photography (Figure 2). The selection of these sites is on the basis that they can be accurately located on both the existing digital benthic habitat map and on higher resolution aerial photographs (1:20,000) which will enable positions to be resolved to sub-pixel accuracy (<30 m). More information regarding sampling sites such as latitude, longitude, expected depth and expected habitat are detailed in Appendix I.

In site selection, priority was assigned to areas where the error associated with the original habitat classification was considered the 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 compounding 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 misclassified as seagrass or macroalgae. Sites have been positioned at least 50 metres away from the boundary between habitat types to account for the spatial inaccuracy of the existing digital map. The surveying of the 350 ground-truthing sites listed in Appendix 1, has highest priority. Other desirable sites can be included opportunistically, but have a secondary priority and will only be surveyed if weather and time permit. In the event of disruptions to the field work (eg. poor weather or equipment failure), priority will be given to obtaining a broad coverage of the high priority sites, not a high density of these sites within a locality.

FIELD METHODS

To facilitate biological verification of benthic habitat maps, video footage of the major benthic community types (e.g. seagrass meadows, limestone reef etc.) and the visually dominant flora and fauna in coastal waters between Geographe Bay and Flinders Bay, will be recorded using a manually deployed drop-down underwater camera system. The existing benthic habitat maps will serve as an indication of bottom type expected at any particular site. The video camera will be lowered over the side of the field survey vessel and 30 seconds of video footage of the seabed will be recorded at each of these sites. Site number, date, time, water depth, DGPS coordinates and habitat description will be recorded for each section of video footage on the standardized habitat data sheets (Appendix II). DGPS coordinates will be recorded for the point at the end of 30 seconds of video footage.

Operating instructions for the drop-down camera and video system are included as Appendix III.

Operating instructions for the differential GPS are included in Appendix IV.

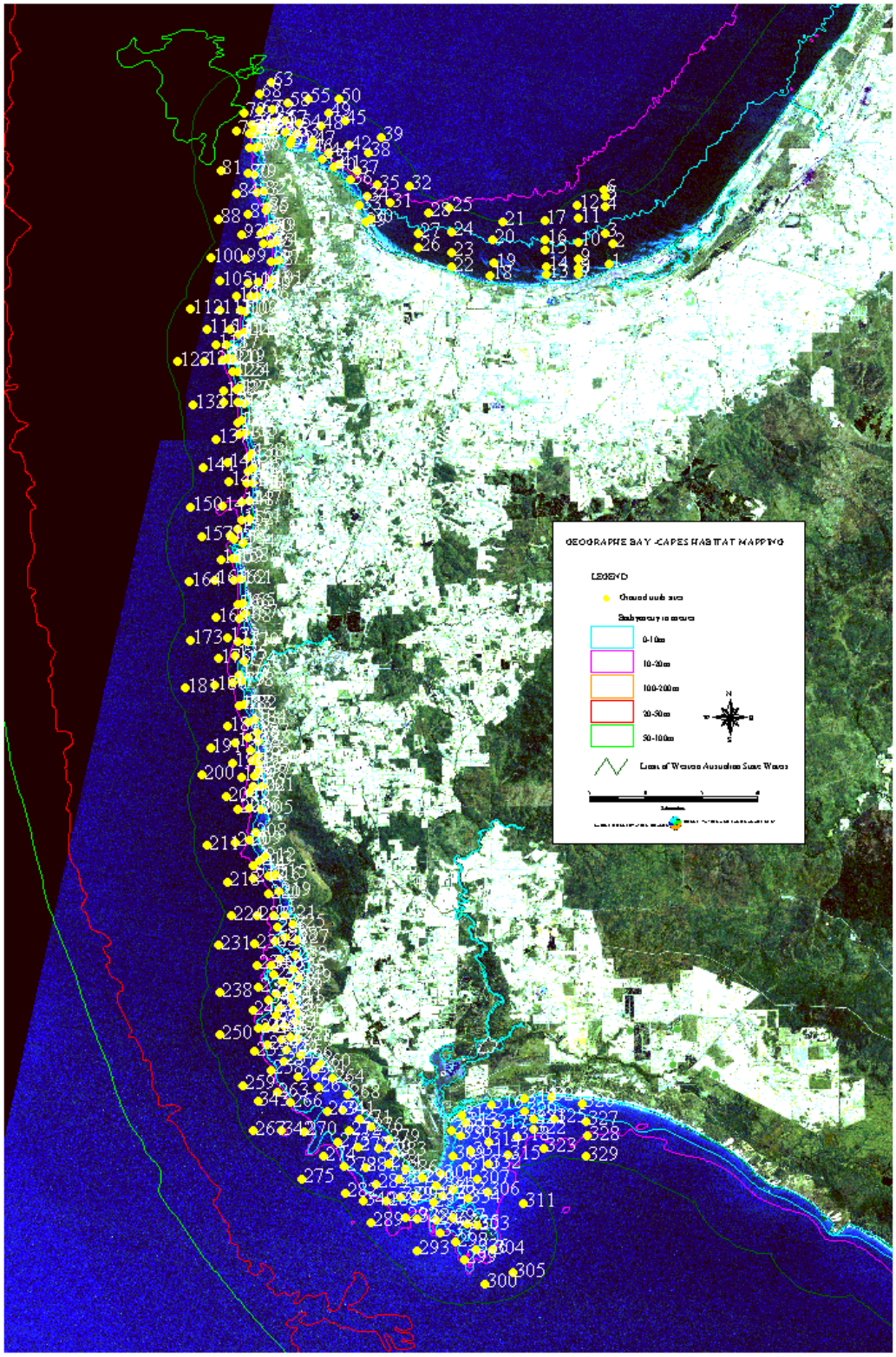

Figure 2: Predetermined sampling sites overlaying Landsat TM image.

PROJECT MANAGEMENT

SURVEY TEAM

CALM Marine Conservation Branch personnel

Dr Jeremy Colman	Project Leader/Marine Ecologist	Ph: 95432 5110 Fax: 9430 5408
Kevin Bancroft	Marine Conservation Officer	Ph: 9432 5109 Mob: 0417 401 200 Fax: 9430 5408
Mike Lapwood	Skipper/Marine Operations Officer	Ph: 9432 5108 Mob: 0419 045 285 Fax: 9430 5408
Sue Elscot	Team Member	Ph: 9756 8260

CALM South West Capes District Office personnel

Charlie Broadbent	Senior Operations Officer	Ph: 9752 1677 Mob: 0418 931 099 Fax: 9572 1432

FIELD ITINERARY

Due to the reliance on sea and weather conditions, it may be difficult to maintain timelines on activities undertaken during the field survey. Table 1 outlines the proposed itinerary for the survey.

Table 1: Itinerary details for the Geographe Bay-Capes-Hardy Inlet habitat mapping survey.

Date	Activity
12/11/98	Pick up hire vessel from Malaga at 1700 Pack vehicle and vessel
13/12/98	Depart Perth for Dunsborough
14/12/98	Launch at Quindalup Field work in Area 1 (*see* Figure 1) Retrieve at Dunsborough
15/12/98	Launch at Canal Rocks Field work in Area 2 (*see* Figure 1) Retrieve at Dunsborough Depart Dunsborough for Prevelly Park
16/12/98	Launch at Cowaramup Bay Field work in Area 3 (*see* Figure 1) Retrieve at Canal Rocks

Date	Activity
17/12/98	Launch at Prevelly Park Field work in Area 4 (*see* Figure 1) Retrieve at Cowaramup Bay
18/12/98	Launch at Hamelin Bay Field work in Area 5 (*see* Figure 1) Retrieve at Prevelly Park Depart Prevelly Park for Augusta
19/12/98	Launch at Flinders Bay Field work in Area 6 (*see* Figure 1) Retrieve at Hamelin Bay
20/12/98	Launch at Flinders Bay Field work in Area 7 (*see* Figure 1) Retrieve at Flinders Bay Depart Augusta for Perth
21/12/98	Unpack vehicle and vessel Return hire vessel to Malaga

ACCOMMODATION

Accommodation is booked at three locations over the period of the survey. Dates and contact details are listed in Table 2.

Table 2: Accommodation details for the Geographe Bay-Capes-Hardy Inlet habitat mapping survey

Dates	Location	Contact persons/numbers
13/12/98-15/12/98	Beachside villa 2/2 Le Caille Court Dunsborough	Mrs Viv Munroe Ph: 9306 3900 Mob: 0412 925 387 Fax: 9306 2278
15/12/98-18/12/98	Margarets Beach Resort Riedle Drive Gnarabup Beach	Blanche Young Ph: 9757 1227 Fax: 9757 1226
18/12/98- 20/12/98	Augusta Sheoak Chalets Hillview Road Augusta	Steve Williams Ph: 9758 1443 Fax: 9758 1458

SAFETY

General

Field operations shall be carried out in accordance with departmental procedures and protocols. Overall responsibility of field procedures during this survey and the personal safety of all team members rests with the Project Leader.

Alterations to survey procedures based on safety aspects related to weather conditions and sea state are the responsibility of the Project Leader in consultation with the boat Skipper.

Boating

All boating operations shall be carried out in accordance with Department of Transport regulations and also conform to CALM's Draft Departmental Boating Policy and Procedures. All safety aspects relating to navigation and sea conditions are the responsibility of the designated Skipper of the vessel.

COMMUNICATIONS AND EMERGENCY CONTACTS

General

- The survey team will log on with the local volunteer sea rescue upon launching and log off upon return.
- The vessel being used is equipped with marine VHF and 27 MHz radios.
- The vehicle is equipped with a CALM VHF radio.
- The survey team will also have mobile phones but coverage may be intermittent in places (Mike Lapwood 0419 045 285, Kevin Bancroft 0417 401 200).

If communications with the survey team is required the mobile number should be tried first. Messages can be left with accommodation providers (Table 2) or local CALM offices. If urgent communications are required the relevant volunteer sea rescue group can be contacted and a message relayed by radio.

CALM Offices

Marine Conservation Branch, Fremantle:	Ph: 9432 5100 Fax: 9430 5408. CALM VHF channel 17 .
Busselton:	Ph: 9752 1677 Fax: 9752 1432. CALM VHF channels 8, 16, and 22.
Yallingup:	Ph: 9755 2144 Fax: 9755 2144. CALM VHF channels 8, 16 & 22.
Cowaramup:	Ph: 9755 5324 CALM VHF channels 8, 16 & 22.
Margaret River:	Ph: 9757 2322 Fax: 9757 2930 CALM VHF channels 8, 16 & 22.
Augusta:	Ph: 9758 1756 Fax: 9758 1275 CALM VHF channels 8, 16 & 22.

Volunteer Sea Rescue Groups

ACRM Base Capel:	Ph: 9727 2451 Channel 88 (27 MHz) Channel 16 (VHF).
Geographe Bay Sea Rescue Group (Busselton):	Ph: 9752 4410 Fax: 9754 2866 Channels 88 and 91 (27 MHz) Channel 16 (VHF).
Naturaliste Sea Rescue Group (Dunsborough):	Ph: 9755 3594 Channels 88 and 90 (27 MHz) Channel 16 (VHF).
Yallingup Sea Rescue Group:	Ph: 9755 2145 Channel 88 (27 MHz).
Margaret River Sea Rescue Group:	Ph: 9757 3387 Channel 88 (27 MHz).
Augusta Sea Rescue Group:	Ph: 97581888. Channel 88 (27 MHz).

BUDGET

This project is partially funded by the National Heritage Trust, Coast and Clean Seas Marine Protected Areas Programme, with support in kind being provided by CALM's Marine Conservation Branch and CALM's Central Forests Region, South West Capes District. The budget breakdown is described in Table 3.

Table 3: Budget breakdown for the Geographe Bay-Capes-Hardy Inlet habitat mapping survey

Budget Item			CALM ($ in kind)	MPA funds ($)	Total costs ($)
Travel					
Vehicle	MCB Triton - 45 c per km for 1000 km (fuel included)			450.00	450.00
		Sub-Total		450.00	450.00
Accommodation					
Dunsborough	29 Nov-1 Dec (3 nights @ $210)			420.00	420.00
Prevelly Park	1 Dec-4 Dec (3 nights @ $135)			405.00	405.00
Augusta	4 Dec-6 Dec (2 nights @ $90)			180.00	180.00
		Sub-Total		1005.00	1005.00
Staff					
J.G. Colman	10 days @ $220		2200.00		2200.00
K.P. Bancroft	10 days @ $178			1780.00	1780.00
Mike Lapwood	10 days @ $149			1490.00	1490.00
Sue Elscott	2 days @ $114			228.00	228.00
		Sub-Total	2200.00	6580.00	8708.00
Vessel & other equipment					
6m charter boat	Bluewater Charter- 8 days			780.00	780.00
Fuel & oil	7 days @ $100			700.00	700.00
Drop-down camera	7 days @ $50			350.00	350.00
D-GPS unit	7 days @ $35			245.00	245.00
Backup video	7 days @ $50			350.00	350.00
Backup DGPS	7 days @ $35			245.00	245.00
		Sub-Total		2670.00	2670.00
Maps/Charts/Aerials					
Aerial photographs				756.00	756.00
Charts/habitat maps/Landsat images				100.00	100.00
		Sub-Total		856.00	856.00
Consumables					
Provisions	3 persons for 7 days @ $30			630.00	630.00
Other				100.00	100.00
		Sub-Total		730.00	730.00
Contingency					
Administration overruns	10% of funding			1500.00	1500.00
		Sub-Total		1500.00	1500.00
		TOTAL	**$2,200.00**	**$11,599.00**	**$13,799.00**

EQUIPMENT HIRE

- 6.2 metre hire vessel — Bluewater Boat Hire
  Unit 1c/288 Gnangara Rd
  Landsdale
  Mr Peter Jasinski
  Mob: 0412 388 411
  A/H: 9296 1420

- Drop down camera — Cunard Technology
  5/55 Poole Rd
  Welshpool
  Ph: 9458 4022

- Backup DGPS — Fugro Survey Pty. Ltd.
  18 Prowse Street
  West Perth
  Ph: 9322 4955
  Fax: 9322 1775

EQUIPMENT

Boating

CALM DGPS unit
Backup DGPS unit
Backup GPS unit
Charts
Site map/coordinates
First aid kit
Sunscreen
Hats
Wet weather gear
Snorkeling gear

Drop down camera

TV/video unit
Backup 6" monitor and video recorder
Drop down camera and cable
Backup drop down camera and cable (with light) (available from Cunard Technology)
12v truck battery x 2
12v motorbike batteries x 3
Battery charger x 2
Cigarette lighter adapter x 2
Spare splitter
Video tapes (6 x 180 min)
C-cat ROV system

Miscellaneous

Habitat data sheets
Clapper boards (2)
Chalk
Pens, pencils, erasers, etc.

Electrical tool box

Mechanical tool box
Desktop Computer
Jumper leads
Torch
Esky
Water cooler
Glass bottom bucket
Camera

On hired vessel

GPS
Plotter
Safety equipment

DATA MANAGEMENT

FIELD PROGRAMME REPORT

Hard copies of the Field Programme Report will be held at three locations:

1. Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry St., Fremantle Western Australia, 6160.

2. Woodvale Library, Science and Information Division, Ocean Reef Rd., Woodvale, Western Australia, 6026.

3. Archives, Woodvale Library, Science and Information Division, Ocean Reef Rd., Woodvale, Western Australia, 6026.

The Marine Conservation Branch will hold digital copies of the Field Programme Report at three locations:

1. The Marine Conservation Branch Server:
   mcb on StreetTalk\User Data@CALM.FREM@CALM [T:/Reports/MRI/MRI_1698]

2. MCB Server full backup DAT tape [T:/Reports/MRI/MRI_1698]

3. CD-ROM [MRI_1698]

DATA REPORT

Collected raw data will be written into a Marine Reserve Implementation Data Report and copies will be held at the same locations as for the Field Programme Report. GIS data layers will be stored digitally at three locations:

1. The Marine Conservation Branch Server:
   GIS Data@FREM.SHARED@CALM on StreetTalk [L:/GIS/MCB/CFR/Capes/]

2. MCB Server full backup DAT tape [L:/GIS/MCB/CFR/Capes/]

3. On GIS Information Coordinator's Computer. [H:/MCB/CFR/Capes]

VIDEO RECORDS

Collected video footage will be held at two locations:

1. VHS masters to be archived at the CALM Information Management Branch, Como.

2. VHS copies to be stored at CALM Marine Conservation Branch, Fremantle.

REPORT DISTRIBUTION

Copies of this report will be distributed to:

- Dr Chris Simpson Manger, Marine Conservation Branch
- Bob Chandler Manager, Central Forests Region
- Roger Banks Manager, South West Capes District
- All survey team members (5).

PUBLICITY/EDUCATION

PUBLIC RELATION OPPORTUNITIES

It is intended that a short article regarding the field survey will be placed in various local newspapers (eg. Augusta Margaret River Mail, Busselton-Dunsborough Mail and Busselton-Margaret Times). Opportunities for radio interviews will be identified and utilized (eg. Radio West Broadcasters, ABC regional office).

EDUCATION OPPORTUNITIES

No education opportunities have been identified.

REFERENCES

CALM (1994). A Representative Marine Reserve System for Western Australia. Report of the Marine Parks and Reserves Selection Working Group. Department of Conservation and Land Management, Perth.

Ong, C., Burt, J.S., Hick, P. & Willie, A. (1995). Marine habitat mapping using data from the GEOSCAN airborne multi-spectral scanner. Proceedings of the Third Thematic Conference on remote sensing for marine and coastal environments. Volume 2 728-739pp.

WAPC (1997). Leeuwin-Naturaliste Ridge Statement of Planning Report. Prepared for the Western Australian Planning Commission by the Ministry for Planning in conjunction with the Shire of Busselton and the Shire of Augusta-Margaret River. Western Australian Planning Commission, Perth.

APPENDICIES

APPENDIX I: SAMPLING SITES INFORMATION

Comments	No	Latitude (degrees)	(minutes)	Longitude (degrees)	(minutes)
patchy seagrass	1	-33	38.539	115	20.431
sandy	2	-33	37.583	115	20.666
seagrass	3	-33	37.048	115	20.220
seagrass	4	-33	35.778	115	20.243
patchy/sand	5	-33	35.272	115	20.248
seagrass	6	-33	34.957	115	20.238
patchy seagrass	7	-33	39.028	115	18.653
sandy ridge	8	-33	38.751	115	18.658
seagrass	9	-33	38.300	115	18.671
seagrass	10	-33	37.458	115	18.667
seagrass	11	-33	36.338	115	18.685
patchy	12	-33	35.669	115	18.662
seagrass	13	-33	39.014	115	16.802
seagrass	14	-33	38.611	115	16.795
sand/patchy	15	-33	37.832	115	16.759
seagrass	16	-33	37.308	115	16.745
reef	17	-33	36.413	115	16.739
seagrass	18	-33	39.001	115	13.573
patchy	19	-33	38.434	115	13.785
seagrass	20	-33	37.294	115	13.736
reef	21	-33	36.410	115	14.316
seagrass	22	-33	38.574	115	11.311
seagrass	23	-33	37.881	115	11.334
seagrass	24	-33	36.895	115	11.340
patchy	25	-33	35.685	115	11.329
seagrass	26	-33	37.580	115	9.512
patchy	27	-33	36.933	115	9.512
patchy	28	-33	35.945	115	10.102
seagrass	29	-33	36.341	115	6.463
patchy	30	-33	36.176	115	6.788
patchy	31	-33	35.429	115	7.922
patchy	32	-33	34.618	115	9.052
fringing reef	33	-33	35.531	115	6.169
seagrass	34	-33	35.104	115	6.571
seagrass	35	-33	34.553	115	7.219
seagrass	36	-33	34.292	115	5.647
seagrass	37	-33	33.845	115	6.014
patchy	38	-33	32.996	115	6.726
patchy	39	-33	32.227	115	7.471
rocky reef	40	-33	33.661	115	4.707
seagrass	41	-33	33.536	115	4.975
patchy	42	-33	32.621	115	5.605
seagrass	43	-33	33.265	115	4.034
seagrass	44	-33	32.922	115	4.433
unknown	45	-33	31.390	115	5.390
rocky reef	46	-33	32.707	115	3.412
patchy	47	-33	32.380	115	3.564
unknown	48	-33	31.630	115	3.986
unknown	49	-33	31.007	115	4.441
unknown	50	-33	30.330	115	5.079
seagrass	51	-33	32.470	115	2.240
sparse seagrass	52	-33	32.318	115	2.307
unknown	53	-33	31.979	115	2.572
unknown	54	-33	31.520	115	2.785
unknown	55	-33	30.327	115	3.327
rocky reef	56	-33	31.929	115	1.957
unknown	57	-33	31.338	115	1.933
unknown	58	-33	30.473	115	2.126
rocky reef	59	-33	31.906	115	1.221
sand patch	60	-33	31.577	115	1.223
sparse seagrass	61	-33	31.386	115	1.257
unknown	62	-33	30.815	115	1.211
unknown	63	-33	29.492	115	1.213
rocky reef	64	-33	31.783	115	0.387
sparse seagrass	65	-33	31.705	115	0.451
sparse seagrass	66	-33	31.526	115	0.587
unknown	67	-33	30.827	115	0.466
unknown	68	-33	30.009	115	0.508
rocky reef	69	-33	31.841	115	0.199
unknown	70	-33	31.771	115	0.136
unknown	71	-33	31.540	115	0.003
unknown	72	-33	30.950	114	59.587
rocky reef	73	-33	31.970	115	0.105
unknown	74	-33	31.946	114	59.838
unknown	75	-33	31.787	114	59.155
rocky reef	76	-33	32.575	115	0.403
unknown	77	-33	32.636	115	0.196
unknown	78	-33	32.616	114	59.852
rocky reef	79	-33	33.923	115	0.148
unknown	80	-33	33.889	114	59.742
unknown	81	-33	33.683	114	58.166
rocky reef	82	-33	34.729	115	0.609
unknown	83	-33	34.784	115	0.224
unknown	84	-33	34.852	114	59.095
sand	85	-33	35.506	115	0.850
rocky reef	86	-33	35.644	115	0.754
unknown	87	-33	35.830	114	59.714
unknown	88	-33	36.070	114	57.994
patchy	89	-33	36.533	115	1.168
reef	90	-33	36.516	115	0.927
patchy	91	-33	36.653	115	0.686
unknown	92	-33	36.774	115	0.454
unknown	93	-33	36.834	114	59.336
reef	94	-33	37.195	115	1.297
sand	95	-33	37.282	115	1.022
reef	96	-33	37.298	115	0.548
reef	97	-33	38.081	115	1.417
patchy	98	-33	38.141	115	0.953
unknown	99	-33	38.004	114	59.474
unknown	100	-33	37.935	114	57.521
reef	101	-33	39.037	115	1.001
reef	102	-33	39.327	115	0.811
reef	103	-33	39.126	115	0.254
patchy	104	-33	39.182	114	59.618
unknown	105	-33	39.059	114	57.980
reef	106	-33	39.784	115	0.131
reef	107	-33	39.817	114	59.730
unknown	108	-33	39.817	114	58.950
reef	109	-33	40.553	114	59.440
reef	110	-33	40.486	114	59.117
unknown	111	-33	40.441	114	57.969
unknown	112	-33	40.385	114	56.253
patchy	113	-33	41.511	114	59.318
sand	114	-33	41.633	114	59.050
unknown	115	-33	41.366	114	58.560
unknown	116	-33	41.355	114	57.189
reef	117	-33	42.124	114	58.280
unknown	118	-33	42.094	114	57.721
patchy	119	-33	42.817	114	58.647
unknown	120	-33	42.837	114	58.382
unknown	121	-33	42.847	114	58.046
unknown	122	-33	42.898	114	57.038
unknown	123	-33	42.908	114	55.490
patchy	124	-33	43.459	114	58.907
unknown	125	-33	43.450	114	58.634
reef	126	-33	44.278	114	59.078
unknown	127	-33	44.321	114	58.813
unknown	128	-33	44.381	114	58.087
reef	129	-33	45.004	114	59.266
patchy	130	-33	44.944	114	58.924
unknown	131	-33	44.935	114	58.096
unknown	132	-33	44.995	114	56.320
reef	133	-33	45.815	114	59.129
patchy	134	-33	45.900	114	58.881
reef	135	-33	46.395	114	59.291
patchy	136	-33	46.498	114	58.915
unknown	137	-33	46.677	114	57.575
reef	138	-33	47.411	114	59.632

Comments	No	Latitude (degrees)	(minutes)	Longitude (degrees)	(minutes)
patchy	139	-33	47.607	114	59.393
unknown	140	-33	47.838	114	58.258
unknown	141	-33	48.026	114	56.798
patchy	142	-33	48.119	114	59.684
unknown	143	-33	48.299	114	59.419
patchy	144	-33	48.828	114	59.692
unknown	145	-33	48.802	114	59.351
unknown	146	-33	48.734	114	58.318
patchy	147	-33	49.682	114	59.436
unknown	148	-33	49.741	114	59.009
unknown	149	-33	49.937	114	57.865
unknown	150	-33	49.946	114	56.030
patchy	151	-33	50.568	114	59.451
unknown	152	-33	50.643	114	58.975
sand patch	153	-33	51.019	114	58.737
reef	154	-33	51.745	114	59.038
patchy	155	-33	51.557	114	58.537
reef	156	-33	51.357	114	58.324
unknown	157	-33	51.382	114	56.633
reef	158	-33	52.474	114	58.655
patchy	159	-33	52.495	114	58.392
unknown	160	-33	52.505	114	57.725
reef	161	-33	53.486	114	58.857
patchy	162	-33	53.506	114	58.473
unknown	163	-33	53.486	114	57.350
unknown	164	-33	53.567	114	55.864
reef	165	-33	54.618	114	58.978
patchy	166	-33	54.669	114	58.655
reef	167	-33	55.164	114	59.130
sand	168	-33	55.376	114	58.746
unknown	169	-33	55.306	114	57.371
patchy	170	-33	56.511	114	59.162
patchy	171	-33	56.499	114	58.630
sand	172	-33	56.281	114	58.037
unknown	173	-33	56.378	114	55.919
reef	174	-33	57.419	114	59.005
patchy	175	-33	57.165	114	58.460
unknown	176	-33	57.298	114	57.517
reef	177	-33	58.072	114	58.642
sand	178	-33	58.435	114	58.787
patchy	179	-33	58.472	114	58.279
unknown	180	-33	58.605	114	57.263
unknown	181	-33	58.678	114	55.508
reef	182	-33	59.488	114	58.957
patchy	183	-33	59.524	114	58.630
patchy	184	-34	0.214	114	59.537
patchy	185	-34	0.347	114	59.138
unknown	186	-34	0.517	114	57.916
patchy	187	-34	0.856	114	59.610
patchy	188	-34	1.255	114	59.731
reef	189	-34	1.073	114	59.114
unknown	190	-34	1.315	114	58.339
unknown	191	-34	1.570	114	56.912
patchy	192	-34	1.970	114	59.698
reef	193	-34	1.690	114	59.250
reef	194	-34	2.345	114	59.642
reef	195	-34	2.177	114	59.322
patch	196	-34	2.282	114	58.194
reef	197	-34	2.690	114	59.778
patchy	198	-34	2.938	114	59.435
unknown	199	-34	2.971	114	58.667
unknown	200	-34	2.858	114	56.394
reef	201	-34	3.470	114	59.860
patchy	202	-34	3.451	114	59.369
sand	203	-34	3.755	114	59.094
unknown	204	-34	3.912	114	57.760
reef	205	-34	4.579	114	59.801
patchy	206	-34	4.462	114	59.075
sand	207	-34	4.520	114	58.417

Comments	No	Latitude (degrees)	(minutes)	Longitude (degrees)	(minutes)
reef	208	-34	5.678	114	59.418
reef	209	-34	6.041	114	59.075
sand	210	-34	6.120	114	58.270
unknown	211	-34	6.257	114	56.641
patchy	212	-34	6.876	114	59.909
reef	213	-34	7.043	114	59.634
unknown	214	-34	7.288	114	59.261
patchy	215	-34	7.720	115	0.497
patchy	216	-34	7.808	115	0.134
unknown	217	-34	7.877	114	59.251
unknown	218	-34	8.044	114	57.789
patchy	219	-34	8.544	115	0.753
unknown	220	-34	8.672	115	0.134
reef	221	-34	9.682	115	1.037
patchy	222	-34	9.673	115	0.389
unknown	223	-34	9.712	114	59.458
unknown	224	-34	9.673	114	57.926
reef	225	-34	10.154	115	1.479
patchy	226	-34	10.271	115	0.576
patchy	227	-34	10.889	115	1.734
sand	228	-34	10.752	115	1.018
reef	229	-34	10.958	115	0.478
unknown	230	-34	11.056	114	59.242
unknown	231	-34	11.086	114	57.190
seagrass	232	-34	11.660	115	1.609
patchy	233	-34	11.783	115	0.713
patchy	234	-34	12.097	114	59.359
seagrass	235	-34	12.337	115	1.469
patchy	236	-34	12.558	115	0.301
unknown	237	-34	13.166	114	59.428
unknown	238	-34	13.382	114	57.161
patchy	239	-34	13.196	115	1.283
sand	240	-34	13.490	115	0.468
rocky	241	-34	13.647	115	1.273
patchy	242	-34	14.030	115	1.450
patchy	243	-34	14.138	115	0.664
unknown	244	-34	14.285	114	59.065
rock	245	-34	14.442	115	1.685
patchy	246	-34	14.874	115	1.547
rock	247	-34	15.001	115	0.871
patchy	248	-34	15.100	114	59.830
unknown	249	-34	15.139	114	59.350
unknown	250	-34	15.424	114	57.142
patchy	251	-34	15.644	115	1.686
patchy	252	-34	15.577	115	1.253
rock	253	-34	15.739	115	0.698
unknown	254	-34	15.969	114	59.885
unknown	255	-34	16.267	114	59.154
patchy	256	-34	16.443	115	1.794
patchy	257	-34	16.741	115	0.806
unknown	258	-34	17.161	115	0.102
unknown	259	-34	17.878	114	58.423
patchy	260	-34	16.889	115	2.878
patchy	261	-34	17.161	115	2.606
rock	262	-34	17.512	115	1.618
unknown	263	-34	18.257	115	0.386
patchy	264	-34	17.621	115	3.622
rock	265	-34	18.054	115	2.783
unknown	266	-34	18.772	115	1.185
unknown	267	-34	20.085	114	58.991
patchy	268	-34	18.419	115	4.489
patchy	269	-34	19.192	115	3.270
unknown	270	-34	20.166	115	1.957
patchy	271	-34	19.640	115	5.186
reef	272	-34	20.185	115	4.524
reef	273	-34	20.730	115	3.902
patchy	274	-34	21.392	115	3.007
unknown	275	-34	22.442	115	1.735
patchy	276	-34	20.003	115	5.834

Comments	No	Latitude (degrees)	(minutes)	Longitude (degrees)	(minutes)
rock	277	-34	20.963	115	5.043
unknown	278	-34	21.910	115	4.200
reef	279	-34	20.613	115	6.820
patchy	280	-34	21.054	115	6.250
patchy	281	-34	21.962	115	5.446
unknown	282	-34	23.182	115	4.291
reef	283	-34	21.249	115	7.171
patchy	284	-34	21.781	115	6.820
unknown	285	-34	22.780	115	6.055
reef	286	-34	22.079	115	7.768
patchy	287	-34	22.572	115	7.443
unknown	288	-34	23.597	115	6.613
unknown	289	-34	24.608	115	5.718
patchy	290	-34	22.546	115	8.728
patchy	291	-34	23.428	115	8.338
unknown	292	-34	24.401	115	7.729
unknown	293	-34	26.023	115	8.364
sand	294	-34	22.922	115	9.557
patchy	295	-34	23.701	115	9.363
unknown	296	-34	24.570	115	9.493
unknown	297	-34	24.492	115	10.414
unknown	298	-34	25.660	115	10.543
unknown	299	-34	26.503	115	11.075
unknown	300	-34	27.696	115	12.204
patchy	301	-34	22.352	115	9.872
patchy	302	-34	23.114	115	10.456
unknown	303	-34	24.865	115	11.851
unknown	304	-34	26.065	115	12.710
unknown	305	-34	27.184	115	13.910
sand	306	-34	23.228	115	12.480
sand	307	-34	22.640	115	11.882
reef	308	-34	20.252	115	10.439
seagrass	309	-34	21.473	115	10.514
seagrass	310	-34	21.988	115	11.204
unknown	311	-34	23.834	115	14.567
patchy	312	-34	19.529	115	11.083
patchy	313	-34	19.880	115	11.273
patchy	314	-34	20.818	115	12.562
unknown	315	-34	21.506	115	13.686
reef	316	-34	19.030	115	12.764
patchy	317	-34	19.994	115	13.024
sand	318	-34	20.594	115	14.233
reef	319	-34	18.770	115	14.717
reef	320	-34	19.407	115	14.697
unknown	321	-34	19.777	115	15.256
patchy	322	-34	20.262	115	15.217
sand	323	-34	21.175	115	15.814
unknown	324	-34	18.713	115	16.312
unknown	325	-34	19.769	115	16.412
patchy	326	-34	19.037	115	18.104
patchy	327	-34	19.925	115	18.283
unknown	328	-34	20.633	115	18.357
unknown	329	-34	21.627	115	18.230
reef	330	-34	20.479	115	10.922
patchy	331	-34	21.286	115	11.545
patchy	332	-34	21.908	115	12.559
reef	333	-34	23.387	115	9.895
patchy	334	-34	23.560	115	11.372
reef	335	-34	24.793	115	11.240
patchy	336	-34	26.006	115	11.759
reef	337	-34	25.190	115	9.763
reef	338	-34	24.485	115	8.387
reef	339	-34	23.402	115	7.457
reef	340	-34	23.593	115	5.291
patchy	341	-34	19.173	115	4.208
patchy	342	-34	20.103	115	0.629
reef	343	-34	18.676	114	59.253
patchy	344	-34	16.211	115	1.019
reef	345	-34	15.155	115	0.317
patchy	346	-34	14.512	115	0.458
reef	347	-34	13.777	114	59.975
patchy	348	-34	12.942	115	0.863
seagrass	349	-34	12.781	115	1.792
reef	350	-34	12.094	115	0.182

APPENDIX II: STANDARDIZED HABITAT DATA SHEETS

Department of Conservation and Land Management

MARINE CONSERVATION BRANCH

HABITAT MAPPING DATA SHEET

SITE ID			
HABITAT TYPE			
SUBSTRATE TYPE			
LAT	° ’ ……. ……. S	**LONG**	° ’ ……. ……. E
DEPTH (m)		**TIME**	
BIOLOGICAL ASSEMBLAGE	…… …… …… …… …… ……		
RECORDER		**OBSERVATION METHOD**	
VIDEO TAPE No.		**DATE**	
SITE		**REGION**	
DGPS/GPS		**DATUM**	

SITE ID	
HABITAT TYPE	
SUBSTRATE TYPE	
LAT	° ……. ……
DEPTH (m)	
BIOLOGICAL ASSEMBLAGE	…… …… …… …… …… ……
RECORDER	
VIDEO TAPE No.	
SITE	
DGPS/GPS	

APPENDIX III: DROPDOWN CAMERA AND VIDEO INSTRUCTIONS

Setup

1. Connect sheathed coax cable to splitter box and camera
2. Ensure the sheath is tied to the camera in a way that prevents any load on the coax itself
3. Connect splitter box to TV/video unit via short lead (aerial in socket)
4. Connect TV/video unit to 12 volt power supply
5. Tune TV to channel 0
6. Connect camera power leads to 12 volt battery
7. Ensure that the polarity of the battery leads are correct or the 1 amp splitter box fuse will rupture

Operation

1. Write site number, date and location on the clapper board
2. Place clapper board in front of the camera and record for about 30 seconds then press pause
3. Lower camera to the bottom and press pause to recommence recording.
4. Record about 30 seconds of benthic habitat footage
5. Fill out habitat data sheet
6. Switch video and camera power off
7. Retrieve camera
8. Check footage regularly to ensure correct operation

Equipment Care

1. Don't allow twists or knots in the cable. Figure eight the cable on the deck or in a nally bin
2. Don't step on the cable
3. Clean and silicon grease camera connection plug daily
4. Do not use CRC, WD40 or similar on electrical connections
5. Don't attach weights or other objects to camera or cable
6. Beware of propeller
7. Don't allow camera to hit the side of the boat when deploying or retrieving
8. Don't allow camera to hit or drag along bottom
9. Always keep remote control in sealed plastic bag (one drop from a wet hand will destroy it)
10. 240 volt power is not to be used on boats. Use only 12 volt power supply
11. Keep splitter box and batteries in a dry place
12. Disconnect power to camera when not in use

APPENDIX IV: DIFFERENTIAL GPS OPERATIONAL INSTRUCTIONS

Note: These instructions should be used in conjunction with those supplied by Scoutmaster and Fugro (kept with unit).

Warning! Don't mess with the settings on the Omnistar demodulator (black box) if you don't know what you are doing! Technical settings instructions provided with the unit are to be used only in conjunction with verbal advice from Fugro (93210284) or Tim Daly (CALM MCB 94325106).

1. Plug in mushroom aerial and check that button aerial is still plugged in. Note: Scoutmaster aerial (button type) should have as clear a view of the sky as possible. The DGPS aerial (mushroom type) must have a clear view to the north east sky.
2. Press scoutmaster on button. Wait a few seconds and check that display is indicating LOC.
3. Press return and then wait for at least three satellites. This could take from 30 seconds to 10 minutes depending on satellite availability and location of the DGPS unit.
4. When you have at least 3 satellites you will be given a GPS coordinate. When you have this press the big red button and wait for the GPS coordinate to become a DGPS coordinate. **Note: When the red button is on it is costing about $20 per hour**.
5. If the scoutmaster is disconnected from it's power source for more than about 30 minutes it may cause some settings to default back to the factory pre-set. The main problem is that the mapping datum reverts back to a North American setting. The danger is that the unit will give coordinates as usual but there will be some error. **Check datum prior to use (WGS 84)**. If the main battery is to be disconnected for charging then connect the backup battery to maintain power to the unit or remove the power adapter from the Scoutmaster and install the AA battery pack.