MARINE MANAGMENT SUPPORT
SWAN REGION

METROPOLITAN MARINE PARKS MARINE MONITORING PROGRAM:
ESTABLISHMENT OF LONG-TERM MONITORING SITES IN BENTHIC COMMUNITIES IN MARMION, SHOALWATER ISLANDS AND SWAN ESTUARY MARINE PARKS IN SPRING 2002

Field Program Report: MMS/SR/MMP/SIMP/SEMP– 52/2002

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1. INTRODUCTION

1.1 GENERAL

This field program report presents information on the first series of surveys, in the Marmion Marine Park (MMP), Shoalwater Islands Marine Park (SIMP) and Swan Estuary Marine Park (SEMP), conducted in Spring 2002 (October and December 2002), as part of the *Metropolitan Marine Park Marine Monitoring Program* (*MMPMMP* (Figure 1). The main aim of the *MMPMMP* is to establish a network of long-term re-locatable monitoring sites to gather quantitative baseline data that can be used to assess the status of the key ecological and social values of each marine park. Re-locatable monitoring sites will be established in areas of low human usage (to assess natural variability) and also in areas of high human usage (to assess impacts from human activities).

The first series of field surveys in Spring 2002 will establish a network of approximately 47 re-locatable long-term monitoring sites in sub-tidal seagrass, macroalgae and intertidal communities in the three marine parks (Table 1). Approximately eight and six natural variability sites will be established in MMP and SIMP in sanctuary zones to monitor both natural changes to benthic communities. Approximately ten, nine and nine surveillance monitoring sites will be established in MMP, SIMP and SEMP to monitor for broad scale changes in benthic communities due to both human activities (e.g. nutrients) and natural events (e.g. storms). Approximately two, one and two compliance monitoring sites will be established in MMP, SIMP and SEMP in areas where benthic communities are directly impacted by human activities (e.g. propeller scouring and mooring areas). Where possible, monitoring networks will link to existing monitoring programs conducted by other management agencies (e.g. Department of Environmental Protection) and other groups (e.g. Water Corporation and Edith Cowan University).

These field surveys will be coordinated by the Marine Conservation Branch (MCB) of the Department of Conservation and Land Management (DCLM) (Project Supervisor: Tim Grubba) in collaboration with the Swan Coastal District (SCD) of DCLM (contact: John Edwards). Fieldwork preparation will be coordinated by Tim Grubba with assistance from John Edwards, Kylie Ryan and Chris Mather. The Field Team Leader will be Tim Grubba. The Dive Supervisor will be John Edwards.

Field staff will include Tim Grubba and Kevin Bancroft from MCB, DCLM and John Edwards, Chris Mather, Kylie Ryan, Deanne Pember and Murray Banks from SCD, DCLM.

1.2 BACKGROUND

The management of WA's marine conservation reserves is now based on an outcome-based 'best practice' model of management (ANZECC, 1997). The 'best practice' model facilitates the assessment (auditing) of management performance allowing for a more adaptive and effective management style. To facilitate the conversion to this new model, DCLM is developing marine work plans (MWP) for each marine park as an interim bridging mechanisms. The MWP for each marine park identifies all the ecological and social values, listing for each value:

- existing and potential uses and/or pressures,
- management objectives,
- strategies,
- performance measures/s,
- desired trends, and
- targets.

In addition the MWP prioritizes values and management strategies using a value/threat framework (Simpson *et. al,* 2000 draft). Values identified as having the highest priority and most threatened by anthropogenic impacts are classified as Key Performance Indicators (KPI). For each KPI there are established short-term and long-term targets, which can be audited. Lower priority values are classified using the scale: high, medium and low. Priority is given to monitoring programs that provide

the quantitative baseline data necessary to identify trends and assess whether established management targets of KPIs are being met (i.e. Auditing).

Monitoring programs generally comprise of one or more of the following components: (i) local scale impact or *compliance monitoring* that examines the effects of human activities in a localised area; (ii) temporally-constrained, broadscale *surveillance monitoring* to assess the response of the enviornment to episodic regional physical and biological processes (eg the effect of storms and predators) and (iii) spatially-constrained, long-term monitoring of key biological parameters to determine the extent and cause of *natural variation* (eg seasonal and inter-annual variability) of key ecosystem attributes.

The first field surveys will establish compliance, surveillance and natural variation monitoring sites that will provide baseline data to assess the management targets of a number of the main KPIs of each marine park (Table 2). In the future additional monitoring sites and networks will be established to address the remaining KPIs.

Table 1. Summary of monitoring sites proposed to be established in Spring 2002 as part of the Metropolitan Marine Park Marine Monitoring Program.

Site No	Habitat type	Site	Latitude	Longitude
MA1	Low relief macroalgae	Surveillance	31° 46.3380	115° 42.8388
MA2	Seagrass	Surveillance	31° 46.3752	115° 43.1598
MA3	High relief macroalgae	Natural variability	31° 47.4276	115° 42.9144
MA4	Seagrass	Natural variability	31° 47.6526	115° 43.0698
MA5	High relief macroalgae	Surveillance	31° 47.6946	115° 42.0156
MA6	Seagrass	Surveillance	31° 48.8550	115° 43.4496
MA7	Low relief macroalgae	Surveillance	31° 48.9276	115° 43.5630
MA8	Seagrass	Control	31° 48.7206	115° 42.5196
MA9	Low relief macroalgae	Control	31° 48.7530	115° 42.4656
MA10	Seagrass	Control	31° 49.5918	115° 43.9440
MA11	High relief macroalgae	Control	31° 49.5594	115° 43.9278
MA12	Seagrass	Surveillance	31° 50.1468	115° 44.2392
MA13	Low relief macroalgae	Surveillance	31° 51.0816	115° 42.8526
MA14	Seagrass	Surveillance	31° 51.3846	115° 43.8384
MA15	Intertidal macroalgae	Compliance	31° 52.3968	115° 45.0372
MA16	Intertidal macroalgae	Compliance	31° 51.9312	115° 45.0642
MA17	Intertidal macroalgae	Natural variability	31° 51.1200	115° 44.9940
MA18	Intertidal macroalgae	Natural variability	31° 46.0362	115° 43.7502
MA19	Seagrass	Surveillance	31° 43.8324	115° 42.4482
MA20	Low relief macroalgae	Surveillance	31° 43.8480	115° 42.2862
SI1	Seagrass	Surveillance	32° 15.5148	115° 41.7978
SI2	Macroalgae	Surveillance	32° 15.4794	115° 41.1702
SI3	Seagrass	Natural variability	32° 17.5194	115° 41.6676
SI4	Macroalgae	Natural variability	32° 17.6754	115° 41.3934
SI5	Seagrass	Surveillance	32° 18.1980	115° 41.7258
SI6	Seagrass	Surveillance	32° 18.4092	115° 42.6060
SI7	Seagrass	Surveillance	32° 18.6330	115° 43.3170
SI8	Seagrass	Surveillance	32° 19.1556	115° 42.2220
SI9	Seagrass	Natural variability	32° 19.0644	115° 41.7642
SI10	Macroalgae	Natural variability	32° 19.1190	115° 41.4744
SI11	Macroalgae	Surveillance	32° 20.1426	115° 41.3238
SI12	Seagrass	Compliance	32° 21.9396	115° 43.4916
SI13	Seagrass	Surveillance	32° 21.6870	115° 42.7638
SI14	Seagrass	Natural variability	32° 21.4788	115° 42.1716
SI15	Macroalgae	Natural variability	32° 21.7260	115° 40.9776
SI16	Macroalgae	Surveillance	32° 18.1056	115° 41.1324
SE1	Seagrass	Surveillance	32° 58.7976	115° 50.6916
SE2	Seagrass	Compliance	32° 59.0184	115° 50.5122
SE3	Seagrass	Surveillance	31° 59.1648	115° 50.8098
SE4	Seagrass	Surveillance	31° 59.4216	115° 51.0060
SE5	Seagrass	Surveillance	31° 59.3670	115° 49.3188
SE6	Seagrass	Compliance	31° 59.4540	115° 49.5324
SE7	Seagrass	Surveillance	31° 59.430	115° 49.7478
SE8	Seagrass	Surveillance	32° 1.0980	115° 48.4986
SE9	Seagrass	Surveillance	32° 1.2978	115° 48.8802
SE10	Seagrass	Surveillance	32° 1.4586	115° 49.3230
SE11	Seagrass	Surveillance	32° 1.1796	115° 49.5258

Note: Coordinates in decimal degrees (4 decimal places) in the datum GDA94 (equivalent to WGS84)

Table 2. Metropolitan Marine Park Key Performance Indicators

Marmion Marine Park	Shoalwater Islands Marine Park	Swan Estuary Marine Park
• **Seagrass** • **Macroalgae** • **Intertida**l • Australian sea lions • Water quality • Seascapes • Coastal use	• **Seagrass** • **Macroalgae** • Seabirds • Little penguins • Seascapes • Aesthetics • Coastal usage	• **Seagrass** • Migratory birds • Benthic invertebrate fauna • Seascapes • Coastal usage

KPIs in bold will be addressed during fieldwork (October - December 2002).

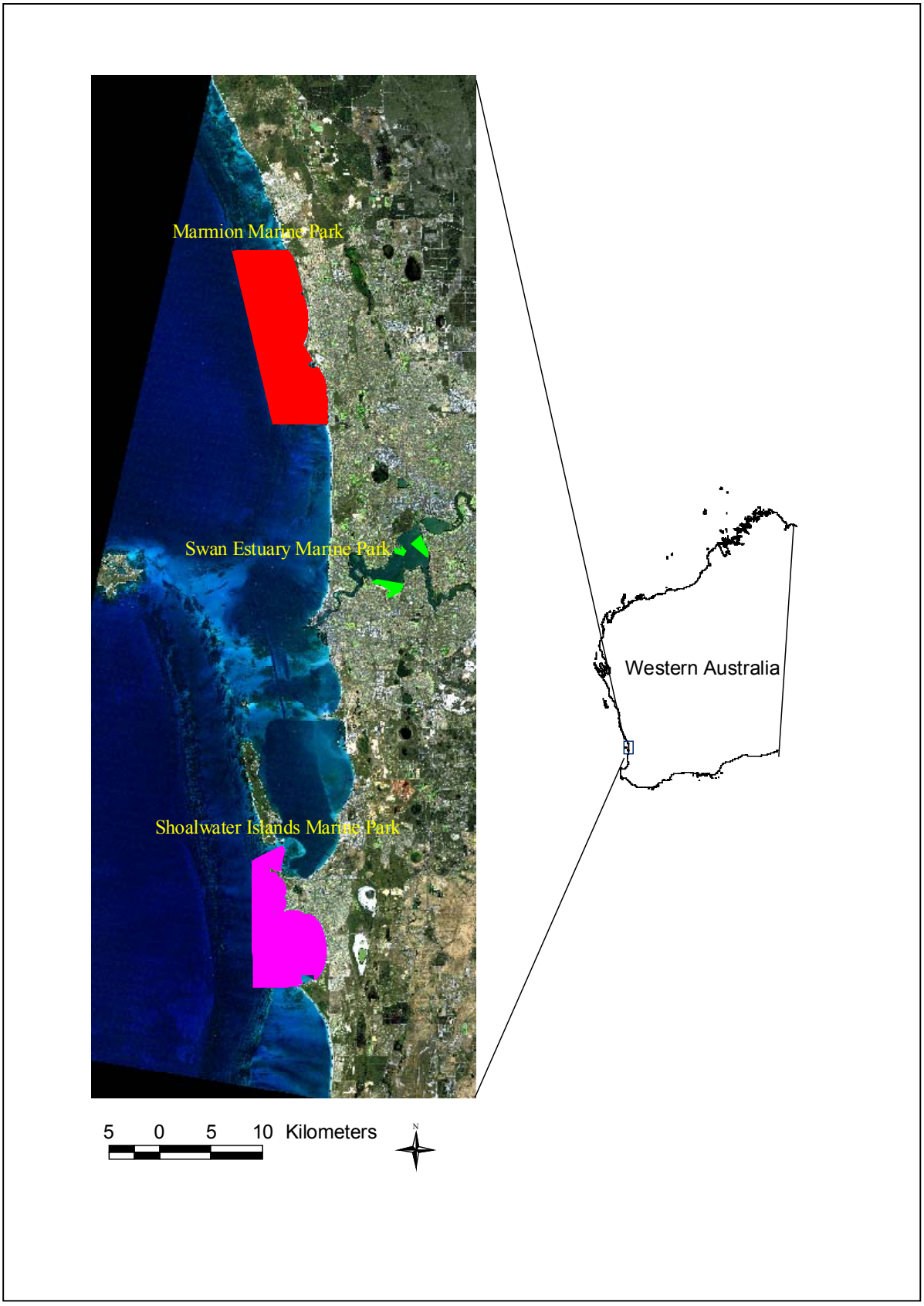

Figure 1. Location of the three metropolitan marine parks (Marmion Marine Park, Shoalwater Islands Marine Park and Swan Estuary Marine Park).

1.3 AIMS OF MMPMMP

The main aim of the *MMPMMP* is to establish a network of re-locatable long-term monitoring sites to monitor the status of key ecological and social values in the three metropolitan marine parks (MMP, SIMP and SEMP).

- To establish a network of re-locatable natural variability monitoring sites in representative undisturbed areas (i.e. sanctuary zones) of the three metropolitan marine parks (MMP, SIMP and SEMP) to assess the effects of natural processes on Key Performance Indicators.
- To establish a network of re-locatable surveillance monitoring sites in representative areas throughout the three metropolitan marine parks (MMP, SIMP and SEMP) to assess the effects of human activities and natural processes on Key Performance Indicators.
- To establish a network of re-locatable compliance monitoring sites in areas of human activity/pressure in the three metropolitan marine parks (MMP, SIMP and SEMP) to assess the impacts of human activities on Key Performance Indicators.
- To determine the presence/absence and relative abundance (if appropriate) of key species at each monitoring site.
- To take still images and video footage of benthic communities at representative sites on an opportunistic basis to assist with the future education programs.

1.4 OBJECTIVES OF FIELDWORK (OCTOBER - DECEMBER 2002)

The objectives of the fieldwork (October - December 2002) are:

Marmion Marine Park

- To establish five re-locatable surveillance monitoring sites in seagrass communities.
- To establish four re-locatable surveillance monitoring sites in low relief macroalgae communities.
- To establish one re-locatable surveillance monitoring site in high relief macroalgae communities.
- To establish three re-locatable natural variability monitoring sites in seagrass communities.
- To establish two re-locatable natural variability monitoring sites in high relief macroalage communities.
- To establish one re-locatable natural variability monitoring site in low relief macroalgae communities.
- To establish two re-locatable compliance monitoring sites in intertidal communities.
- To establish two re-locatable natural variability monitoring sites in intertidal communities.

Shoalwater Islands Marine Park

- To establish six re-locatable surveillance monitoring sites in seagrass communities.
- To establish three re-locatable surveillance monitoring sites in macroalgae communities.
- To establish three re-locatable natural variability monitoring sites in seagrass communities.
- To establish three re-locatable natural variability monitoring sites in macroalgae communities.
- To establish one re-locatable compliance monitoring site in seagrass communities.

Swan Estuary Marine Park

- To establish nine re-locatable surveillance monitoring sites in seagrass communities.
- To establish two re-locatable compliance monitoring sites in seagrass communities.

General

- To survey ground truth sites in MMP and SIMP as part of DCLM's Benthic Habitat Mapping Program.
- To take still images and video footage of benthic communities at representative sites on an opportunistic basis to assist with the future education programs and habitat mapping.
- To provide Swan Coastal District operational staff with 'hands-on' training in monitoring methods.

2. SITE SELECTION AND METHODS AND EQUIPMENT

2.1 SITE SELECTION

The *MMPMMP* will establish networks of natural variability, surveillance, and compliance monitoring sites in the three marine parks during the next few years. The first field survey (Spring 2002) will begin to build these networks with the establishment of approximately 20 sites in MMP, 16 sites in SIMP and 11 sites in SEMP. Sites will be selected on the basis of the following criteria with respect to a value (e.g. seagrass and macroalgae):

1. That sufficient sites are located within areas representative of the KPI in question (e.g. seagrass).
2. That sufficient sites are located in areas of the KPI in question where human activity has been assessed to pose or potentially pose a threat to the integrity of that value
3. That where prior studies has established relevant research and/or monitoring of parameters of use for the objectives of the MMPMMP, sites are located at those points are included to take opportunistic advantage of useful historical data.

The following sections provide the rationale for site selection in the metropolitan marine parks.

2.1.1 Marmion Marine Park

The first field survey will establish sites in MMP to collect baseline data to determine the status of seagrass and macroalgae communities (KPIs). A total of 20 permanent 'transect' monitoring sites will be established in sub-tidal seagrass and macroalgae and intertidal communities in the MMP and include:

- five surveillance monitoring sites in seagrass communities.
- four surveillance monitoring sites in low relief macroalgae communities.
- one surveillance monitoring site in high relief macroalgae communities.
- three natural variability monitoring sites in seagrass communities.
- two natural variability monitoring sites in high relief macroalage communities.
- one natural variability monitoring site in low relief macroalgae communities.
- two compliance monitoring sites in intertidal communities.
- two natural variability monitoring sites in intertidal communities.

Natural variability ‘transect’ sites will be established in the park’s three sanctuary zones (The Lumps, Little Island and Boyinaboat Reef). Surveillance 'transect' sites will be established throughout the park to collect baseline data on the response of seagrass and macroalgae communities to broad-scale natural impacts (e.g. storms) and ‘non-point source’ pollution (e.g. ground water contaminated with nutrients). Non-point source pollution is potentially an issue in the southern waters of the park adjacent to coastal suburbs using septic tanks for waste water treatment, which can contaminate ground water. Ground water contamination in the northern park waters is less likely given that these coastal suburbs use deep sewage. Surveillance sites adjacent to natural variability sites will be used to determine the effectiveness of sanctuary zones. Compliance monitoring sites will be established in intertidal areas to collect baseline data on human impacts including trampling, collection of marine life and non-point source pollution.

The establishment of monitoring sites will link with the monitoring programs conducted by the Water Corporation of Western Australia as part of the Perth Long-Term Ocean Outlet Monitoring (PLOOM) program. The PLOOM program has established a number of control sites in the northern section of the marine park. Seagrass sites should be located in waters either 2 – 2.5 m or 7-8 m as historical reference data on shoot densities exists.

Refer to Figure 2 and Table 1 for the locations of proposed monitoring sites.

2.1.2 Shoalwater Islands Marine Park

The first field survey will establish monitoring sites in SIMP to collect baseline data to determine the status of seagrass and macroalgae communities (KPIs). A total of 15 permanent ‘transect’ sites and one ‘non-transect’ site will be established in seagrass and macroalgae communities in the park and include:

- six surveillance monitoring sites in seagrass communities.
- three surveillance monitoring sites in macroalgae communities.
- three natural variability monitoring sites in seagrass communities.
- three natural variability monitoring sites in macroalgae communities.
- one compliance monitoring site in seagrass communities.

Natural variability 'transect' sites will be established in the park's three sanctuary zones (Penguin Island, Third Rocks and Three Sisters. Surveillance 'transect' sites will be established throughout the park to collect baseline data on the response of seagrass and macroalgae communities to broad-scale natural impacts (e.g. storms) and 'non-point source' pollution (e.g. ground water contaminated with nutrients). Non-point source pollution is potentially an issue in the waters of Warnbro Sound with the adjacent to coastal suburbs and industry contaminating the ground water. Surveillance sites adjacent to natural variability sites will be used to determine the effectiveness of sanctuary zones. Compliance monitoring sites will be established in the designated mooring area at Safety Bay to collect baseline data on the impacts of boat anchors and moorings.

The establishment of monitoring sites will link with the monitoring programs conducted by Edith Cowan University which has sites established at Bird Island. Seagrass sites should be located in waters either 2 – 2.5 m or 7-8 m as historical reference data on shoot densities exists.

Refer to Figure 3 and Table 1 for the locations of proposed monitoring sites.

2.1.3 Swan Estuary Marine Park

The first field survey will establish sites in SEMP to collect baseline data to determine the status of seagrass communities (KPIs). Nine permanent 'transect' and two 'non-transect' sites will be established in seagrass communities in SEMP: The SEMP is surrounded by extensive urban development and is therefore subjected high human pressures. Therefore it will be not possible to establish natural variability sites or spatial controls; instead surveillance monitoring sites will be used as controls on a temporal scale. Surveillance monitoring sites will be used to monitor broad-scale anthropogenic impacts including nutrient and pollutant contamination of ground water, and terrestrial runoff entering the waters of SEMP. Compliance sites will be established at sites where localised anthropogenic impacts are observed, such as propeller scouring. In January 2002, a field survey conducting habitat ground truthing noted a number of propeller scars (approximately 20cm wide and 30m in length) through seagrass meadows at Milyu and Pelican Point.

Refer to Figure 4 and Table 1 for the locations of proposed monitoring sites.

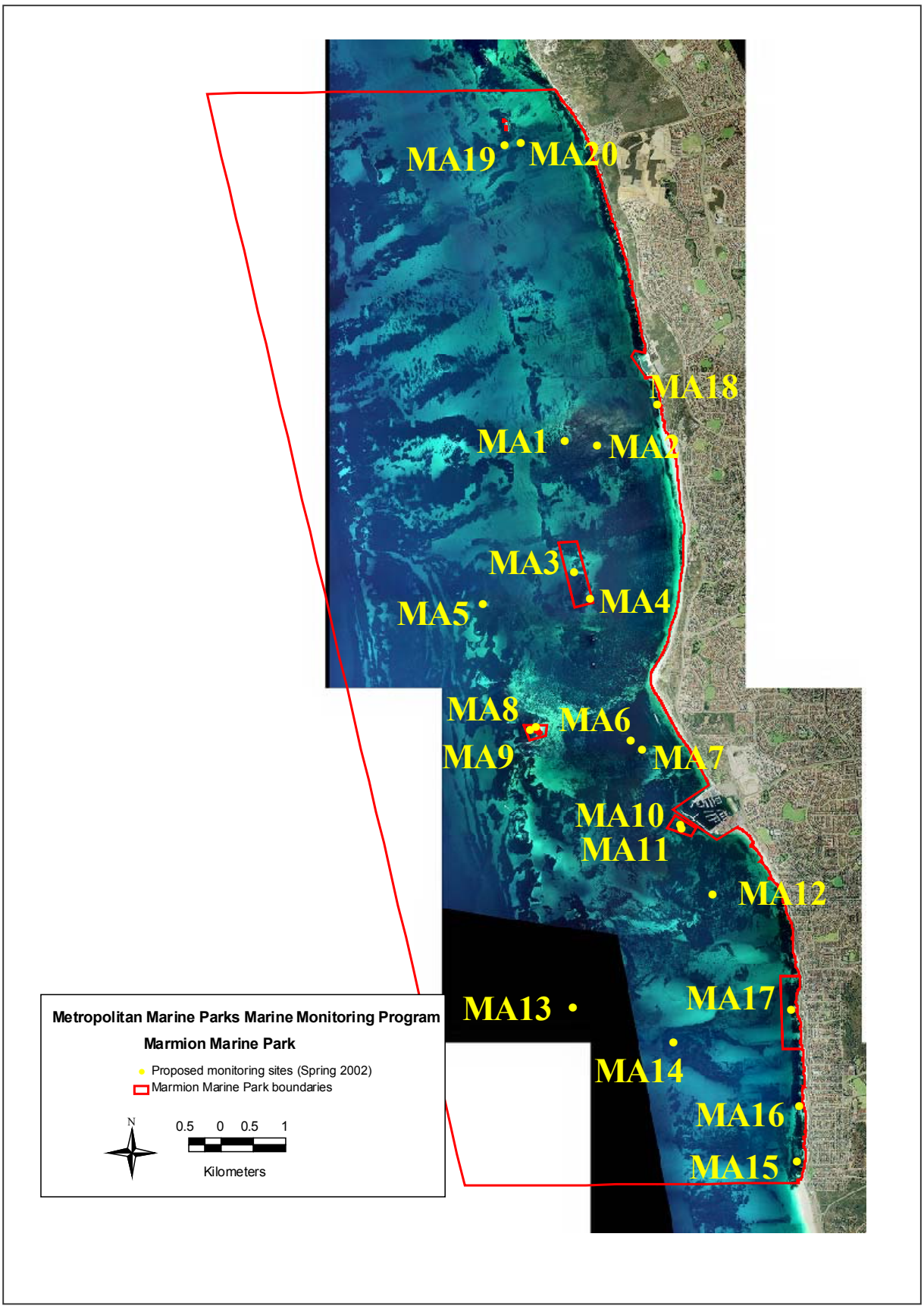

Figure 2. Location of proposed monitoring sites in Marmion Marine Park.

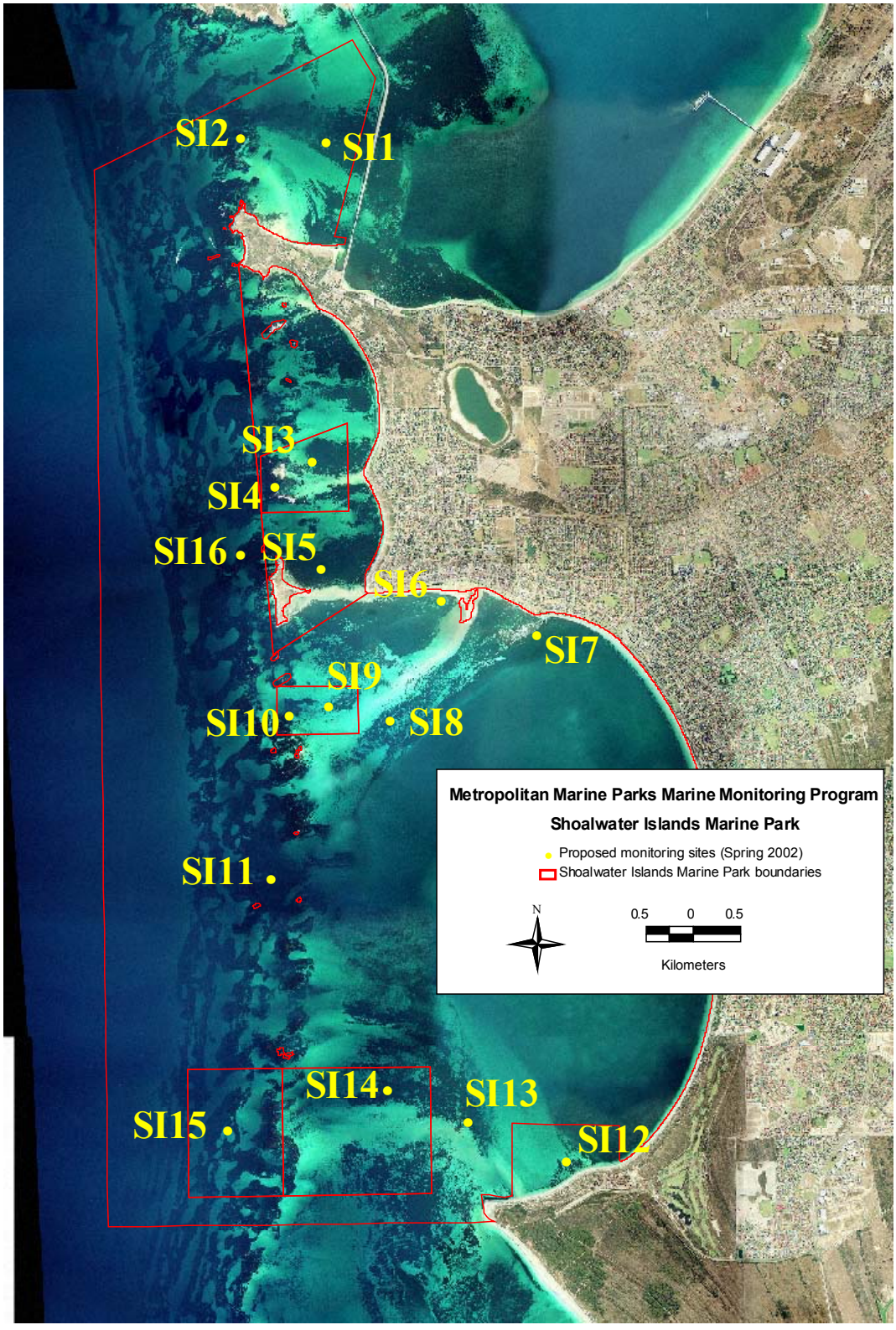

Figure 3. Location of proposed monitoring sites in Shoalwater Islands Marine Park.

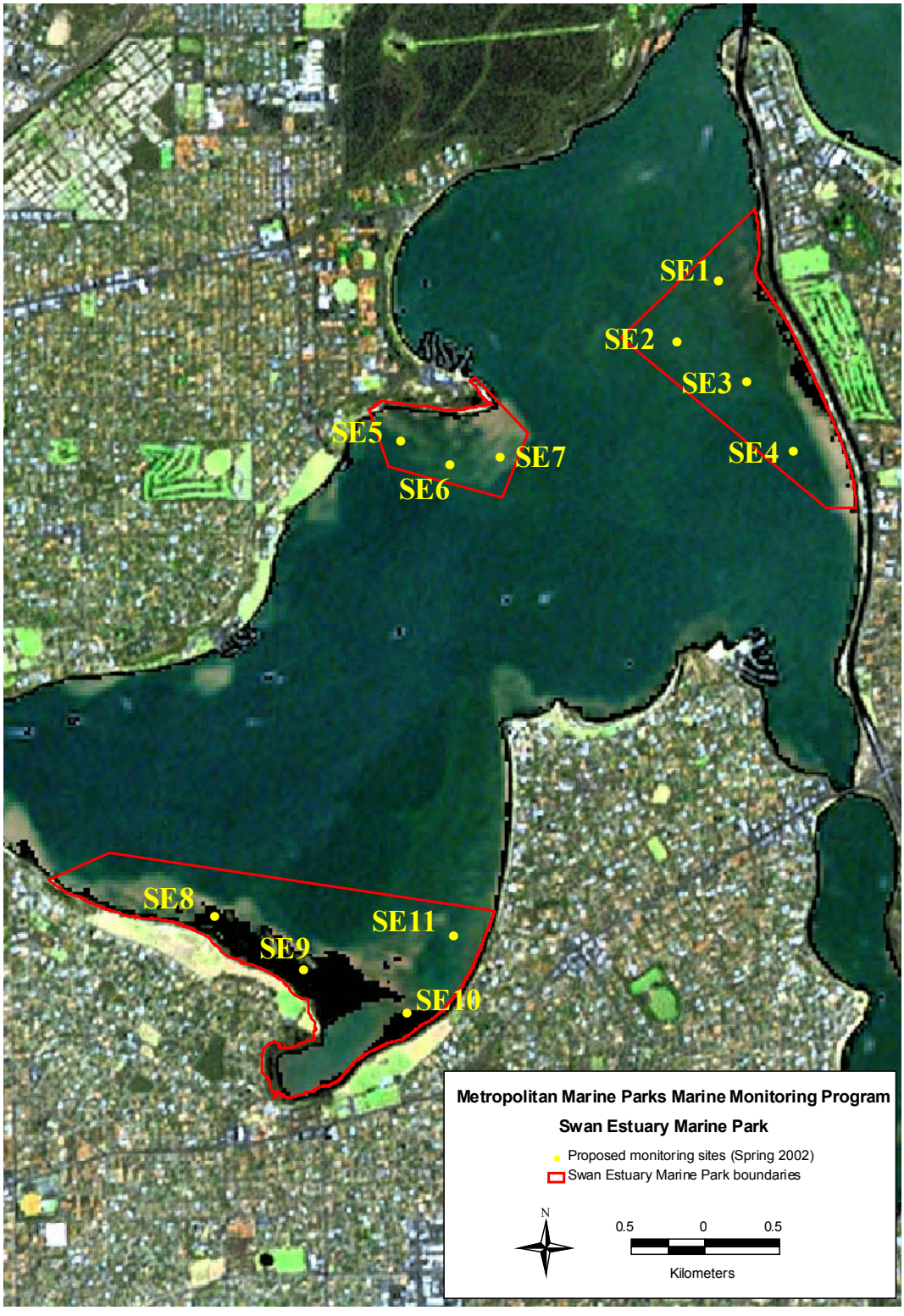

Figure 4. Location of proposed monitoring sites in Swan Estuary Marine Park.

2.2 METHODS

The monitoring methods used in the MMPMMP are compatible with existing monitoring programs and allow for data comparisons to be made. These programs include:

- Water Corporation PLOOM program in MMP.
- Fisheries Department of Western Australia Abalone monitoring program in MMP.
- Department of Environmental Protection – Cockburn Sound Monitoring Program conducted by Edith Cowan University.

2.2.1 General procedures

The field survey will conducted two days a week (Thursday/Friday) between October and December 2002. This however will be dependent on the weather conditions and the availability of field staff.

Three Swan Coastal District (SCD) vessels will be used during the field surveys including the *Gandara*, a 5m-aluminium vessel and an Achilles inflatable. The primary vessel will be the *Gandara*, which will be used in both MMP and SEMP and possibly SIMP. The 5m-aluminium patrol vessel will be used in the SIMP. The Achilles inflatable will be used as required (e.g. accessing sites in shallow water). The inflatable will operate within sight and/or within radio contact of the primary vessel and will require an additional suitably qualified team member to operate.

A total of seven people will be available for fieldwork and the availability of each person will need to be checked the week prior to the fieldwork. Table 3 presents a list of field crew and lists the potential roles that each could hold. The field survey will also include a training component to ensure that Swan Coastal District staff are suitably trained in monitoring methods used.

It may be possible to rotate the roles of the field crew to some degree to increase surface intervals when diving at deeper sites. Rotation however is dependent on the capabilities of each team member (Table 3).

Table 3. Potential roles of field team members

	Data Recorder	Transect	Video Operator	Tender Operator	Data Entry
Tim Grubba	✔	✔	✔	✔	✔
Kevin Bancroft	✔	✔	✔	✔	✔
John Edwards				✔	
Chris Mather				✔	
Kylie Ryan	✔	✔	✔	✔	✔
Deanne Pember		✔		✔	
Murray Banks				✔	
Volunteer	?	?	?	?	?

2.2.2 'Non-transect' sites

A minium of three 'non-transect' sites will be established in areas of high human usage e.g. mooring areas, etc. during the field survey (Table 1). Pre-selected sites will be located using a global positioning system (GPS) loaded with the coordinates listed in Table 1 (datum WGS84). Once a site is located a general survey will be conducted to determine the spatial extent and type of human activities and impacts at the site. Following this survey a sample area is temporarily marked out using weighted marker buoys on each corner. The position of each marker buoy will be determined using a differential GPS (DGPS) and a site map drawn which will be recorded on the Long-term monitoring site data sheet (Appendix 1).

At each site, digital video footage will be taken of any damage to benthic communities from assumed human activities (e.g. anchor or diver damage) and any observed litter. In addition the following observations are recorded: (Appendix 1):

- habitat description, including dominant species and those vulnerable to impacts by humans;
- type and extent of impacts from human activities on benthic communities;
- type of litter and number of items;
- presence/absence and relative abundance of non-cryptic indicator species. Four categories (absent, rare, uncommon, and common) will be used to determine relative abundance and the number of species per category will vary between species.
    - Fish
        - Dhufish
        - Sea dragons
    - Molluscs
        - Abalone
        - Cowrie

Any other distinctive species can also be recorded (e.g. Port Jackson Shark).

The data recorded on underwater slates or notebooks will be entered electronically into standard data files. All written data is to be transferred to the computer files during the field survey, and preferably on the day of collection.

2.2.2.1 Methods for the establishment of 'non-transect' sites

The following outlines the field procedures to be used when establishing 'non-transect' monitoring sites. The procedures are based on a team of four people with each team member playing the following roles:

- *BOAT OPERATOR (BO)*: operates the boat
- *DECK PERSON (DR1)*: draws a site map and records DGPS coordinates;
- *OBSERVER 1 (VO)*: operates the video camera for benthic community monitoring; and
- *OBSERVER 2 (DR2)*: records habitat data.

In the event that a fifth person is available they will be assigned the role of Data Recorder 3 (DR3). The non-transect method only required two divers so DR3 would remain aboard the boat to assist BO and DR1.

1. Navigate to the site using pre-selected site coordinates loaded into a GPS unit in conjunction with other reference materials (e.g. habitat map, electronic ortho aerial photographs in OziExplorer).
1. Temporarily mark the boundaries of the site using weighted marker buoys. Refer to human usage data, site maps and if necessary conduct a general survey of the area to determine the spatial scale of the human activities/impacts occurring at the site.
2. The VO and DR2 enter the water and descend to the base of a marker buoy. The VO records video footage of the general area (360º pan) from one of the marker buoys before swimming through the entire site recording video footage of visible impacts (e.g. litter, etc.) and anything else of significance.

3. The DR2 follows the VO and records general observations such as dominant species, general health and any visible impacts etc. The DR2 draws a detailed site map that marks the location of impacts in relation to prominent site features.
4. The BO and DR1 record the coordinates for each corner marker buoy of the site using a DGPS (datum: WGS84, decimal degrees to four decimal places) (Appendix 2) and draw a site map.
5. The VO and DR2 are retrieved from the water.
6. Once the site has been surveyed all temporary markers are removed prior to leaving the site.

2.2.3 Sub-tidal 'transect' sites

Permanent ‘transect’ sites will be established in sub-tidal seagrass and macroalgae communities in the three marine parks (Table 1). Pre-selected sites will be located using a global positioning system (GPS) loaded with the coordinates listed in Table 1 (datum WGS84). Refer to Section 2.1 for the rationale for site selection.

At each ‘transect’ site two permanent 50m transects will be established, with each transect being a replicate. The position and alignment of transects will be governed by bathimetry and the benthic composition. Whenever possible the transects should be established in a line in a north-south orientation. The area required for the configuration will be 50+50 = 100m. If this configuration is impractical at a particular site then the two 50m transects can be set up parallel to each other or in what ever configuration is appropriate for the area to ensure each transect is a replicate.

Each transect will be permanently marked using galvanised star pickets, at the start of transect 1, start of transect 2, and end of transect 2. Whenever possible the start of transect 1 and the end of transect 2 will be positioned so that they are adjacent to a distinctive physical feature, that can be used to assist in the future site re-location. The position of each star picket will be recorded using DGPS set to the datum: WGS84 and in the format decimal degrees recorded to three decimal places. The DGPS has an accuracy of approximately 3-4m. In addition, comprehensive site maps will be drawn to describe the start of each transect in relation to distinctive physical features. This information is recorded on the *Long-term Monitoring Site* data sheet printed on underwater paper (Appendix 1).

A 50 m scaled (every 10cm) and weighted transect line is laid out between the star pickets making sure that it follows the contour of the seabed. Digital video footage is taken (set height and speed) to record the sessile benthic composition along each transect, resulting in a belt transect approximately 50m x 1m being sampled. This survey technique provides a permanent record of benthic habitats that can be analysed at a latter date.

Depending on whether the site is located in seagrass or macroalgae communities, one of the following two methods will be used.

Seagrass

At seagrass 'transect' sites a 0.2m x 0.2m quadrat will be placed at 10m intervals (0,10,20,30,40m) along the 50m transect and the following information is recorded (Appendix 1):

- seagrass species present;
- percent cover of each seagrass species (%);
- density of seagrass shoots (shoots per m^2)
- maximum length of seagrass shoots (cm);
- presence/absence of seagrass rhizome for quadrats over sand; and
- type and percent cover of seagrass epiphytes.

Macroalgae

At macro-algae 'transect' sites a 0.5m x 0.5m quadrat is placed along the 50m transect at 10 m intervals (0,10,20,30,40m) and the following information is recorded (Appendix 1):

- the number of individual plants (<10cm in length) of the dominant macroalgae; and
- percent cover of each category of macroalgae (red, brown, and green).

At all sites the following observations are recorded (Appendix 1):

- habitat description, including dominant species and those vulnerable to impacts by humans;
- type and extent of impacts from human activities on benthic communities;
- type of litter and number of items;
- presence/absence and relative abundance of non-cryptic indicator species. Four categories (absent, rare, uncommon, and common) will be used to determine relative abundance and the number of

species per category will vary between species. Data on fish will be collected along a 10 m belt (five meters either side of the transect line) and data on invertebrates along a one belt (one meter on one side of the transect line). The following species should be recorded,

- Fish
  - Sea dragons
  - Dhufish
- Molluscs
  - Abalone
  - Cowrie

Any other distinctive species can also be recorded (e.g. Port Jackson Shark).

The data recorded on underwater slates or notebooks will be entered electronically into standard data files. All written data is to be transferred to the computer files during the field survey, and preferably on the day of collection.

2.2.3.1 Methods for the establishment of sub-tidal 'transect' sites

The following outlines the field procedures to be used when establishing 'transect' monitoring sites. The procedures are based on a team of four with each member playing the following roles:

- *BO OPERATOR (BO)*: operates the tender;
- *TRANSECT LAYER (TL)*: installs star pickets, lays/retrieves transect lines, draws site maps and records DGPS coordinates;
- *OBSERVER 1 (VO)*: operates the video camera for benthic community monitoring and draws site maps, surveys quadrats;
- *OBSERVER 2 (DR)*: installs star pickets, records habitat data, surveys quadrats .

In the event that a fifth person is available they will be assigned the role of Data Recorder 2 (DR2). DR2 will dive with the VO and conduct the quadrat survey after the transect has been video footage has been captured.

Site identification

1. Navigate to the site using pre-selected site coordinates loaded into a GPS unit in conjunction with other reference materials (e.g. habitat map, electronic ortho aerial photographs in OziExplorer).
2. From the vessel reconnoitre the general area referring to reference materials.
3. The benthic habitat is viewed using a viewfinder or by snorkelling to identify a prominent physical feature (e.g. limestone bommie, patch of sand) from which to end the first transect and start the second transect, ensuring enough room to lay two transects.
4. A weighted marker buoy is deployed at the end of transect 1 and start of transect 2.
5. The vessel travels 50m south from the first marker following the direction that the transect will run. Mark the start of transect 1 using a weighted marker buoy.
6. The vessel travels 50m north of the first deployed marker buoy, following the compass bearing of transect 1. Mark the end of transect 2 using a weighted marker buoy.
7. The vessel returns to the start of transect 1 and stands by.

'Transect' installation and line deployment

1. As soon as the three marker buoys have been deployed the vessel/s can deploy the TL and DR at the end of transect 1 and the start of transect 2 to install the first star picket. Once in the water the TL and DR are provided with a galvanised star picket (the length of the star picket is dependent on substrate type and water depth – star pickets come in 30, 60 and 90cm lengths), a sledgehammer, a length of stainless wire and a PVC cap or plastic star picket cap . The TL and DR take turns in hammering the star picket into the substrate ensuring the picket is firmly embedded with only the top third visible. Once in place a cap is wired onto the top of the star picket.
2. The TL and DR hand the sledge hammer back to the vessel and receive the transect reel. The TL takes a compass bearing of the marker buoy for the start of transect 1 and clips the transect line to the marker buoy and lays out the 50m transect line along the bottom following the compass bearing.

3. The DR follows behind the TL ensuring the transect line follows the bottom contours While doing this the TL records general observations such as dominant species, general health and any visible impacts etc.
4. The TL and DR are handed the sledgehammer, stark picket, stainless steel wire and cap and as per step 1, install the star picket marking the end of transect 1 and the start of transect 2.
5. When installation of the second star picket is completed the VO (and DR2 if available) can be deployed at the start of transect 1.
6. The TL and DR repeat steps 2-3 for transect 2 and then install the final star picket marking the end of transect 2
7. In some circumstances (e.g. strong currents, flat bottom) it is possible to deploy the transect line from a vessel following the compass bearing.

'Transect' survey

1. The VO descends to the start of transect 1 and draws a site map that details the start of the transect in relation to any distinctive benthic features.
2. The VO records video footage (a 360º pan) of the general area at the start of the transect and the site and transect details written on the PVC cap or underwater slate.
3. The VO records video footage along the length the transect (section 2.2.3.2).
4. The VO repeats steps 1-3 for the second transect.
5. The VO also records video footage of any unusual species or impacts observed.
6. If a DR2 is available they can swim behind the VO and use a quadrat (0.2x0.2m for seagrass and 0.5 x 0.5m for macroalgae) to sample every 10m along the transect line (O, 10, 20, 30, 40m). The quadrat is placed so that the bottom left hand corner of the quadrat lies on the 0, 10, 20, 30, 40m mark.
7. For seagrass transects, the quadrat should be gently laid over the seagrass meadow. Seagrass shoots should be gently pulled through the quadrat so that quadrat lies on the sediment and shoots are not covered by the quadrat. Shoot densities should be counted for all meadow-forming species (e.g. *Posidonia* and *Amphibolis*). Empemeral species (e.g. *Halophila*) do not need to be counted.
8. For macroalgae transects, the quadrat should be gently laid over the macroalgae. Macroalgale fronds should be gently pulled through the quadrat so that the quadrat lies on the substrate and fronds are not covered by the quadrat. The number of individual plants, over 5cm in length in each category (greens, browns and reds) should be counted.
9. If a DR2 is not available the DR will carry out steps 6-8 after assisting the TL.
10. Depending on the type of 'transect' seagrass or macroalgae will determine the types of data collected refer to Section 2.2.4.
11. The DR2 or DR repeats steps 6-8 for transect 2.
12. When the VO has finished the camera is returned to the vessel and the VO can assist the DR or DR2 complete the quadrat survey.

'Transect' coordinates and transect line retrieval

1. When the TL and DR have completed installing the star pickets and laying the two transects the TL is retrieved by the tender. The TL draws surface site maps and record the coordinates of the start of each transect and the end of transect 2 (using the marker buoys as reference points) using DGPS (datum WGS84, decimal degrees to four decimal places) (Appendix 2).
2. When the first transect has been surveyed and its coordinates recorded the TL is deployed to retrieve the transect lines. The VO, DR and DR2 can also assist in retrieving transect lines if they are finished.

2.2.3.2 Methods for obtaining video footage of permanent transects

The transect sampling technique is adapted from the AIMS Standard Operating Procedure No. 2 (Christie *et al*., 1996). The recording of data for each transect should be carried out according to the following steps:

1. Fill in the following details on an underwater slate: the site number, date, transect number, and recorder's name.

2. Before beginning to film the transect, record a panoramic shot of the area adjacent to the start of the transect (for instructions on the set up and use of the video see Appendix 3). Start at the beginning of the transect, hold the camera in a horizontal position and turn slowly clockwise, videoing the immediate surroundings and ending at the initial view. Move in on top of the star picket to record the site number and transect number written on the PVC cap.
3. Record footage of the site details written on the underwater slate or on the PVC cap.
4. Record a few seconds of video footage at the base of the star picket before moving along the transect line. Keep the housing lens parallel to the substrate at a distance of 50cm.
5. Follow the transect line keeping the housing at the set height of 50cm, ensuring that the screen image is in focus. Adjust your swimming speed so that it is constant and you cover 10m approximately every minute, and not faster. This is important to ensure a high quality of image. Each 50m transect should take between 5 and 6 minutes in total. At the end of the transect, video the weight of the marker buoy for a few seconds.
6. If video recording along a transect has to be aborted for any reason, or if there is considerable variation in the height or speed of the recorder, then the entire transect should be re-sampled, beginning again from the beginning of the transect. It is important to record the details of re-sampling on the underwater slate and to record footage of the details on the underwater slate.
7. Proceed to the next transect. Once the two transects at a site have been completed and the tape has been viewed and checked, full details must be recorded on the main video transect data sheet (Appendix 1). Any repeated or incomplete transects, or situations where transects were recorded out of order or with false starts should be noted on the data sheets.
8. A total of three sites should be recorded on each 60min digital videotape. The tape and tape cover should be clearly labelled (using a permanent marker) with the designated tape number (Appendix 3), the site number and date of recording. The copy protect switch on the tape should be switched on to prevent accidental recording over any data, and the tapes should be stored in a waterproof case at all times.

2.2.4 Intertidal 'transect' sites

Permanent 'transect' sites will be established in intertidal communities in Marmion Marine Park (Table 1). Pre-selected sites will be located using a global positioning system (GPS) loaded with the coordinates listed in Table 1 (datum WGS84). Refer to Section 2.1 for the rationale for site selection.

At each 'transect' site, two transects will be established, with each transect being a replicate. The length of the transect is dependent on the width of the intertidal zone at the site but should be a no less than 25 m in length. The transect length at each site will be kept constant during subsequent monitoring. Transects will be aligned across the intertidal zone, parallel to each other and separated by a 5 – 10 m gap. The start of the transect will be in the upper intertidal area and will end at the edge of the intertidal platform.

Transects will be permanently marked using small galvanised pegs, at the start and end of each transect. The start of transect one will be positioned so that it is adjacent to a distinctive physical feature, that can be used to assist in the future site re-location. The position of each peg will be recorded using DGPS set to the datum: WGS84 and in the format decimal degrees recorded to three decimal places. The DGPS has an accuracy of approximately 3-4m. In addition, comprehensive site maps will be drawn to describe the start of each transect in relation to distinctive physical features. This information is recorded on the *Long-term Monitoring Site* data sheet printed on underwater paper (Appendix 1).

A 50 m scaled (every 10cm) and weighted transect line is laid out between the star pickets making sure that it follows the contour of the seabed. Digital video footage is taken (set height and speed) to record the sessile benthic composition along each transect, resulting in a belt transect approximately 50m x 1m being sampled. This survey technique provides a permanent record of benthic habitats that can be analysed at a latter date.

At intertidal 'transect' sites a 0.5m x 0.5m quadrat is placed along the transect at 5 m intervals (0,5,10,15,20 ….m) and the following information is recorded onto the *Habitat* data sheet printed on underwater paper (Appendix 1):

- the number of individual plants (<10cm in length) of the dominant macroalgae; and
- percent cover of each category of macroalgae (red, brown, and green).

At all sites the following observations are recorded: (Appendix 1):

- habitat description, including dominant species and those vulnerable to impacts by humans;
- type and extent of impacts from human activities on benthic communities;
- type of litter and number of items;
- presence/absence and relative abundance of non-cryptic indicator species. Four categories (absent, rare, uncommon, and common) will be used to determine relative abundance and the number of species per category will vary between species. Data on invertebrates along a one belt (one meter on one side of the transect line). The following species should be recorded:
    - Molluscs
        - Abalone
        - Cowrie
        - Sea urchin

Any other distinctive species can also be recorded (e.g. Octopus).

The data recorded on underwater slates or notebooks will be entered electronically into standard data files. All written data is to be transferred to the computer files during the field survey, and preferably on the day of collection.

2.2.4.1 Methods for the establishment of intertidal 'transect' sites

The following outlines the field procedures to be used when establishing 'transect' monitoring sites in intertidal areas. The procedures are based on a team of three with each member playing the following roles:

- *TRANSECT LAYER (TL)*: installs pegs, lays/retrieves transect lines, draws site maps and records DGPS coordinates;
- *OBSERVER 1 (VO)*: operates the video camera for benthic community monitoring and draws site maps, surveys quadrats;
- *OBSERVER 2 (DR)*: installs pegs, records habitat data, surveys quadrats .

Site identification

1. Navigate to the site using pre-selected site coordinates loaded into a GPS unit in conjunction with other reference materials (e.g. habitat map, electronic ortho aerial photographs in OziExplorer).
2. Reconnoitre the general area looking for a rocky intertidal platform that is at least 25m in width.
3. Identify a prominent physical feature (e.g. limestone outcrop) from which to start transect 1 and transect 2, ensuring enough room to lay two transects.
4. A weighted marker is placed at the start and end of transect 1 and 2

'Transect' installation and line deployment

1. As soon as the two transects have been marked out the TL and DR can install the pegs at the start of each transect. The pegs should be hammered in so that only the top is visible.
2. The TL clips the transect line to the pegs and lays out the transect line across the intertidal zone.
3. At the end of each transect line the TL and DR install marker pegs.

'Transect' survey

1. The VO draws a site map describing the start and end of each transect in relation to distinctive features.
2. The VO records video footage (a 360º pan) of the general area at the start of the transect and the site and transect details written on a clipboard.
3. The VO records video footage along the length the transect (section 2.2.3.2).
4. The VO repeats steps 2-3 for the second transect.
5. The VO also records video of any unusual species or impacts for latter consideration.
6. The DR and walk along behind the VO and uses the quadrat to sample every 5m along the transect line (O, 5, 10, 15, 200m). The quadrat is placed so that the bottom left hand corner of the quadrat lies on the 0, 5, 10, 15, 20m mark.
7. The DR repeats step 6 for transect 2.
8. When the VO has finished they can assist either the DR with the quadrat survey.

'Transect' coordinates and transect line retrieval

1. When the TL has completed installing the pegs and laying the two transects they record the coordinates of the start and end of each transect using DGPS (datum WGS84, decimal degrees to four decimal places) (Appendix 2).
2. When the first transect has been surveyed and its coordinates recorded the TL can retrieve the transect lines. The VO and DR can also assist in retrieving transect lines if they are finished.

2.2.4.2 Methods for obtaining video footage of permanent transects

The transect sampling technique is adapted from the AIMS Standard Operating Procedure No. 2 (Christie *et al*., 1996). The recording of data for each transect should be carried out according to the following steps:

1. Before beginning to film the transect, record a panoramic shot of the area adjacent to the start of the transect (for instructions on the set up and use of the video see Appendix 3). Start at the beginning of the transect, hold the camera in a horizontal position and turn slowly clockwise, videoing the immediate surroundings and ending at the initial view. Record the site number and transect number written on a clipboard.

2. Record the start time code on the data sheet. Press REC and video the base of the peg for a few seconds and then move along the transect line. Keep the housing lens parallel to the substrate at a distance of 50cm.
3. Follow the transect line keeping the housing at the set height of 50cm, ensuring that the screen image is in focus. Adjust your walking speed so that it is constant and you cover 10m approximately every minute, and not faster. This is important to ensure a high quality of image. Each 25m transect should take between 3 and 4 minutes in total. At the end of the transect, video the marker peg for a few seconds and then press STBY.
4. Record the finish time code on the data sheet.
5. If video recording along a transect has to be aborted for any reason, or if there is considerable variation in the height or speed of the recorder, then the entire transect should be re-sampled, beginning again from the start point of the transect. It is important that the new start and finish time codes for any repeated transects are clearly recorded on the data sheets.
6. Proceed to the next transect. Once all two transects at a site have been completed and the tape has been viewed and checked, full details must be recorded on the main video transect data sheet (Appendix 1). Any repeated or incomplete transects, or situations where transects were recorded out of order or with false starts should be noted on the data sheets.
7. A total of three sites should be recorded on each 60min digital videotape. The tape and tape cover should be clearly labelled (using a permanent marker) with the designated tape number (Appendix 3), the site number and date of recording. The copy protect switch on the tape should be switched on to prevent accidental recording over any data, and the tapes should be stored in a waterproof case at all times.

2.2.5 Contingency for adverse conditions

In the event of adverse weather or sea conditions the Field Team Leader in consultation with the vessel skipper/s may choose to re-evaluate the day's field program and change the schedule if necessary. This would primarily involve the abandonment of a site at which conditions are unsuitable and the replacement of the site with a site that is sheltered from the wind and/or offers better sea conditions for underwater work.

3. PROJECT MANAGEMENT

3.1 SURVEY TEAM

3.1.1 DCLM personnel

The survey team will be comprised of two DCLM (MCB) personnel (Tim Grubba and Kevin Bancroft) assisted by John Edwards, Chris Mather and Kylie Ryan (SCD).

Tim Grubba	Project leader and Field Team Leader Marine Ecologist	Ph (w) (08) 9432 5118 Fax (08) 9430 5408 Ph (mobile) 0414 637 718
Kevin Bancroft	Marine Ecologist	Ph (w) (08) 9336 0118 Fax (08) 9430 5408 Ph (mobile) 0417 401 200
John Edwards	Dive Supervisor Conservation Officer (Marine)	Ph (w): (08) 4336 0114 Fax: (08) 9430 5408 Ph (mobile) 0412 95 8191
Chris Mather	Marine Ranger	Ph (w): (08) 9336 0120 Fax: (08) 9430 5408 Ph (mobile) 0439 907 801
Kylie Ryan	A/Conservation Officer (Marine)	Ph (w) (08) 9336 0115 Fax (08) 9430 5408 Ph (mobile) 0412 053 909
Deanne Pember	Assistant Operations Officer	Ph (w) (08) 9336 0113 Fax (08) 9430 5408 Ph (mobile) 0412 893 801

Murray Banks		Ph (w) (08) 9592 2636
	Ranger	Fax (08) 9592 2636
		Ph (mobile) 0407 478 969
Not yet known		Ph (w) (08) 9336 0100
	DCLM Volunteer	Fax (08) 9430 5408
		Ph (h)

3.2 FIELD ITNERARY

Table 4. Field itinerary for the period October - December 2002

Date	day	Site number location	Activity
17/10/02	Thu	MMP	• Field trip preparation and dry run at Field Station
18/10/02	Fri	MMP	•
24/10/02	Thu	MMP	•
25/10/02	Fri	MMP	•
31/10/02	Thu	MMP	•
01/11/02	Fri	MMP	•
14/11/02	Thu	SIMP	•
15/11/02	Fri	SIMP	•
21/11/02	Thu	SIMP	•
22/11/02	Fri	SIMP	•
28/11/02	Thu	SIMP	•
29/11/02	Fri	SEMP	•
05/12/02	Thu	SEMP	•
06/12/02	Fri	SEMP	•

3.3 SAFETY

3.3.1 General

Field operations shall be carried out in accordance with DCLM procedures and protocols. Overall responsibility for field procedures during this field trip and the personal safety of all team members rests with the Field Team Leader –Tim Grubba.

3.3.2 Diving

All diving activities, both SCUBA and snorkelling shall be accordance with the code of practice document ‘Safe Work in CALM Scientific Diving’ (DCLM May 2002). The Dive Supervisor is responsible for diving safety at all times. The primary Dive Supervisor will be John Edwards. A dive plan has been lodged to the Departmental Dive Officer (DDO) and approved.

3.3.3 Boating

Boating and navigation are the responsibility of the boat skipper and shall be conducted in accordance with the 'DCLM Boating Policy' document (Draft). Safety issues are the responsibility of the vessel skippers in consultation with the Field Team Leader. People qualified to be skippers include John Edwards, Chris Mather, Kylie Ryan, Deanne Pember and Tim Grubba.

3.4 COMMUNICATIONS AND EMERGENCY CONTACTS

3.4.1 General

- The survey team will be based out of the Fremantle office of MCB and SCD and will check in daily.
- Hand-held VHF radios will be carried on board all vessels.
- The field staff have mobile phones (Tim Grubba:# 0438 940 018, John Edwards: # 0412 958 191, Chris Mather: # 0439 907 801, Kylie Ryan: # 0412 053 909 and Deanne Pember: # 0412 893 801)

3.4.2 DCLM offices

Marine Conservation Branch, Fremantle: Ph (08) 9432 5100; Fax (08) 9430 5408

Swan Coastal District, Fremantle: Ph (08) 9432 5111; Fax (08) 9430 5408

3.4.3 Emergency

Fremantle Hospital District Hospital/Ambulance: Ph.(08) 9192 9222, fax (08) 9192 2322
Fremantle Hyperbaric/Diving Service: Paul Cookson (08) 9192 1748, mob: 0418 715 717

3.4.4 Suppliers

Aerial photos: DOLA, Gary Caporn, Ph. 9273 7209
Underwater video system: Sea Optics, David Hill, Ph. (08) 3626161

3.5 BUDGET

Table 5. Budget reconciliation for the Metropolitan Marine Parks Marine Monitoring Program – May 2002 Field Trip.

Budget Item		DCLM MCB Funds ($) in kind & Operational.	DCLM SCD Funds ($) in kind & Operational	Total costs ($)
Travel				
Vehicles	DCLM MCB vehicle - $0.45/km for 1,000 km	*1,500*		1,500
	DCLM SCD vehicle - $0.45/km for 500 km		225	225
		1,500	**225**	**1,725**
Staff				
Tim Grubba		16,618		16,618
Kylie Ryan			11,600	11,600
John Edwards			3,600	3,600
Chris Mather			2,400	2,400
Mark Sheridan		1,260		1,262
Dive medical		*150*		150
Diving allowances		*500*		500
		18,528	**17,600**	**36,128**
Equipment				
Boat	10 days @ $200		2,000	2,000
Boat	10 days @ $150		1,500	1,500
Boat - inflatable	15 days @ $100		1,500	1,500
DGPS unit	15 days @ $150		2,250	2,250
2x SCUBA sets	15 days @ $200	3,000		3,000
4x SCUBA sets	15 days @ $400		6,000	6,000
11 x SCUBA cylinders	15 days @ $100	1,500		1,500
5 x SCUBA cylinders	15 days @ 50		750	750
1 x Laptop Computer	15 days @ $100	1,500		1,500
2 x Underwater digital videos	15 days @ $150	2,250		2,250
		8,250	**14,000**	**22,250**
Consumables				
Fuel and oil		*3,000*		
SCUBA cylinder refills		*1,000*		
Star pickets and extensions	100 @ $5	*500*		500
Digital video tapes	15 x DVM – E60 @ $14.75	*222*		222
Digital video backup tapes	15 x DVM – E60 @ $14.75	*222*		222
Slide film	10 x Slide film and Processing	*100*		100
Printing		*1,000*		500
Other consumables		*1,500*		1,500
		7,544		**5,550**
	Total	**35,822**	**31,825**	**67,647**
	Total Operational cost	**9,694**		

3.6 EQUIPMENT

3.6.1 Video systems

DCLM MCB

Primary Unit

- Canon MV1 digital video camera with battery packs (4) and chargers (2).
- Amphibico underwater video housing
- Housing O-ring kit and silicone grease
- Cleaning kit
- Video transect data sheets
- Instruction manuals
- Digital video tapes (30)
- Leads, remote control, and spares

Backup Unit

- Canon MV1 digital video camera.
- Amphibico underwater video housing
- Housing O-ring kit and silicone grease
- Cleaning kit
- Instruction manuals
- Leads, remote control and spares

3.6.2 Still photography

DCLM MCB

- Digital still camera
- Underwater housing for digital still camera

3.6.3 Safety

DCLM MCB

- Comprehensive diving first aid kit
- Oxy-viva unit (1)
- Spare oxygen D cylinder
- Sunscreen

DCLM SCD

- Comprehensive diving first aid kit
- Oxy-viva unit (1)
- Emergency response flowsheet
- Emergency contact flow chart
- Patient information log
- Accident log sheets

3.6.4 Information

DCLM MCB

- Reference books for the identification of marine fauna and flora
- Scientific reference file
- Global Information Systems (GIS) Arcview project with all relevant data layers
- Habitat data sheets
- Long-term monitoring site data sheets
- Video data sheets
- 1 laptop computer
- 4 waterproof field notebooks
- 1 box of pencils

- equipment log book

DCLM SCD

- Electronic ortho-photographs of the marine parks and other relevant data layers (e.g . park boundaries) for use in the software "OziExplorer".
- Reference books for the identification of marine fauna and flora

3.6.5 Diving

DCLM MCB

- Personal dive gear (x 2 people)
- 11 scuba tanks
- 2 BCD's
- 3 regulators with alternate airsource and gauges
- 1 spare masks and snorkels
- 1 spare pairs of fins
- 2 dive computers
- 1 spare weight belts, each with 24 lb of weight
- 1 compasses
- 1 dive spare parts and repair kits
- 2 boat dive flags
- 1 personal dive flag
- 6 pocket size underwater slates, grips and pencils
- 4 large underwater slates, grips and pencils
- 2 catch bags
- 100 sheets underwater paper
- box graphite sticks
- box elastic bands
- printed underwater paper for recording video codes
- 1 viewfinder
- Scuba log book
- Dive torch

DCLM SCD

- Personal dive gear (4 people)
- 5 scuba tanks
- 4 BCD's
- 4 regulators with alternate airsource and gauges
- 4 dive computers
- 1 spare BDC and regulator with alternative airsource and gauges

3.6.6 Vessels and Vehicles

DCLM MCB

- Back-up MCB, DCLM 3.5m zodiac with all safety equipment for survey exempt vessel, fitted with 25hp Yamaha outboard. Two 20-litre containers for fuel.

DCLM SCD

- *Gandara* – Patrol vessel in survey.
- 5m Aluminium patrol vessel on trailer
- 4m Achilles inflatable boat on trailer

3.6.7 Position fixing and Communications

DCLM MCB

- 2 hand held Lowrance Globalmap 100 GPS units and accessories

DCLM SCD

- Hand held radios
- On board navigation and communication equipment
- 1 differential GPS unit, antennae and accessories

3.6.8 Transect establishment

DCLM MCB

- 8 x pre cut marker buoys (3 x 5m, 3 x 10m, 3 x 20m)
- 4 x 50m weighted transect lines, marked at 10cm increments
- 40 x 300mm galvanised steel pickets
- 40 x 600mm galvanised steel pickets
- 40 x 900mm galvanised steel pickets
- 150 x caps for pickets
- 150 x 250mm stainless steel for fixing caps
- 3 x permanent markers for marking caps
- 2 x 15lb sledge hammers
- 10 x 8lb weights

3.6.9 Miscellaneous Equipment

DCLM MCB

- 20 AA batteries

DCLM SCD

- Comprehensive mechanical tool kit

4. DATA MANAGEMENT

4.1 FIELD PROGRAM REPORT

Hard copies of this Field Program Report will be held at three locations:

1. Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry St., Fremantle, Western Australia, 6160. Ph (08) 9432 5100 Fax (08) 9430 5408.
2. Woodvale Library, Science and Information Division, Ocean Reef Rd., Department of Conservation and Land Management, Woodvale, Western Australia, 6026. Ph (08) 9405 5100 Fax (08) 9306 1641.
3. Archived with CD ROM, Woodvale Library, Science and Information Division, Ocean Reef Rd., Department of Conservation and Land Management, Woodvale, Western Australia, 6026. Ph (08) 9405 5100 Fax (08) 9306 1641.

The Marine Conservation Branch will hold digital copies of the Field Program Report:

1. On CD-ROM [mms_5202] held onsite at the Marine Conservation Branch
2. On the MCB homepage located within the framework of the Department of Conservation and Land Management Intranet (i.e. CALMweb):
3. http://calmweb.calm.wa.gov.au/drb/ncd/mcb/rep_mms.htm#2002

4.2 DATA

Collected raw data will be:

1. Entered into electronic copies of the data sheets (Microsoft Word) database 'Streettalk\userdata@FREM.MCB@CALM' T:\current projects\mms\MMPMMP\MMP_Monitoring_Program\ MMPMMP_Survey1_03_02\ Datasheets_03_02
2. Written into a Marine Management Support Data Report and copies will be held at the same locations as for the Field Program Report.

4.3 VIDEO RECORDS

Collected mini digital video (MDV) footage will be held at two locations:

1. Video masters (MDV) to be archived at the Information Management Branch (File: 1999F000508, Box: HOLD 08), Department of Conservation and Land Management, 50 Hayman Road, Como, Western Australia.
2. MDV copies to be stored at the Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry Street, Fremantle, Western Australia.

4.4 SLIDE RECORDS

All photographic slides taken by DCLM to be stored at the Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry Street, Fremantle, Western Australia.

5. PUBLICITY/EDUCATION

5.1 PUBLIC RELATIONS OPPORTUNITIES

An article entitled "*Metropolitan Marine Parks Monitoring Program*" was written for issue seven of the Marine Conservation Branch, Department of Conservation and Land Management newsletter "*Marine Conservation Matters*".

5.2 EDUCATION OPPORTUNITIES

6. REFERENCES

ANZECC (1997). Best Practice in Performance Reporting in National Resource Management. Department of Natural Resources and Environment, Melbourne.

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.

Simpson C J, Colman J G and Hill A K. (2000 - draft). A strategic framework for marine research and monitoring in Shark Bay World Heritage Property. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry ST., Fremantle, Western Australia, 6160). Unpublished Report.

7. DISTRIBUTION LIST

Department of Conservation and Land Management
Dr. Chris Simpson, Manager, MCB, DCLM
Nick D' Adamo, Senior Oceanographer, MCB, DCLM
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John Edwards, Nature Conservation Officer (Marine), SCD, DCLM
Chris Mather, Marine Ranger, SCD, DCLM
Kylie Ryan, A/ Nature Conservation Officer (Marine), SCD, DCLM
Deanne Pember, Assistant Operations Officer, SCD, DCLM

APPENDIX 1: DATA RECORDING SHEETS

LONG-TERM MONITORING SITE DATA SHEET

METROPOLITAN MARINE PARKS MARINE MONITORING PROGRAM

SITE NO.		**SITE NAME**			
DATE ESTABLISHED		**TIME**		**RECORDER**	
MPRSWG		**IMCRA BIOREGION**			
MARINE PARK		**SITE TYPE**			
MPA ZONE		**SITE ZONE**			
WATER DEPTH (MEAN)		**CORRECTED WATER DEPTH (MEAN)**			
METHOD		**GPS/DGPS**		**DATUM**	
NOTES					

COMPLETE FOR TRANSECT SITES

TRANSECT NUMBER	1	**DIRECTION OF TRANSECT (BEARING °)**			
START: LATITUDE (DECIMAL DEGREES)	S	**START: LONGITUDE (DECIMAL DEGREES)**	E		
TRANSECT MARKER (START)		**TRANSECT MARKER (END)**		**WATER DEPTH**	
NOTES					

TRANSECT NUMBER	2	**DIRECTION OF TRANSECT (BEARING °)**			
START: LATITUDE (DECIMAL DEGREES)	S	**START: LONGITUDE (DECIMAL DEGREES)**	E		
END: LATITUDE (DECIMAL DEGREES)	S	**END: LONGITUDE (DECIMAL DEGREES)**	E		
TRANSECT MARKER (START)		**TRANSECT MARKER (END)**		**WATER DEPTH**	
NOTES					

COMPLETE FOR NON-TRANSECT SITES

BOUNDARIES

1. LATITUDE (decimal degrees)	S	**1. LONGITUDE (decimal degrees)**	E
2. LATITUDE (decimal degrees)	S	**2. LONGITUDE (decimal degrees)**	E
3. LATITUDE (decimal degrees)	S	**3. LONGITUDE (decimal degrees)**	E
4. LATITUDE (decimal degrees)	S	**4. LONGITUDE (decimal degrees)**	E
WATER DEPTH		**NOTES**	

SITE MAP TO BE COMPLETED FOR EACH SITE (include north indicator, scale, vessel location, water depth, transect locations and other features of interest)

Transect 1	**Transect 2**

HABITAT SHEET

METROPOLITAN MARINE PARKS MARINE MONITORING PROGRAM

SITE NO		SITE NAME			
DATE		TIME		RECORDER	
WEATHER/SEA CONDITIONS		WATER DEPTH (MEAN)		CORRECTED WATER DEPTH (MEAN)	
HABITAT TYPE		SUBSTRATE			
NOTES					

MACROALGAE

DOMINANT MACRO-ALGAE	NUMBER	DOMINANT MACRO-ALGAE	NUMBER
Ecklonia radiata (B)			
Sargassum sp.(B)			
Ulva (G)			
% MACROALGAE (BROWN)		% MACROALGAE (GREEN)	
% MACROALGAE (RED)		% MACROALGAE (RED ENCRUSTING)	
NOTES			

SEAGRASS

Species:

QUADRAT NO.	% COVER	SHOOT DENSITY	MAX SHOOT LENGTH	RHIZOMES (P/A)	DOMINANT EPIPHYTE	% EPIPHYTE
1						
2						
3						
4						
5						

Species:

QUADRAT NO.	% COVER	SHOOT DENSITY	MAX SHOOT LENGTH	RHIZOMES (P/A)	DOMINANT EPIPHYTE	% EPIPHYTE
1						
2						
3						
4						
5						

Species:

QUADRAT NO.	% COVER	SHOOT DENSITY	MAX SHOOT LENGTH	RHIZOMES (P/A)	DOMINANT EPIPHYTE	% EPIPHYTE
1						
2						
3						
4						
5						

INDICATOR SPECIES

FISH	RELATIVE ABUNDANCE				FISH	RELATIVE ABUNDANCE			
	0	1	2	3		0	1	2	3
Dhufish					Common sea dragon				
Leafy sea dragon									
NOTES									

MOLLUSCS	RELATIVE ABUNDANCE				OTHER INVERTEBRATES	RELATIVE ABUNDANCE			
	0	1	2	3		0	1	2	3
Abalone									
Cowrie									
Baler shell									
NOTES									

HUMAN ACTIVITIES/IMPACTS

HUMAN ACTIVITIES	TYPE OF DAMAGE
NOTES	

LITTER TYPE	NUMBER OF ITEMS	LITTER TYPE	NUMBER OF ITEMS
NOTES			

LEGEND

FISH

FISH	CATEGORIES			
	0 (Absent)	1 (Rare)	2 (Uncommon)	3 (Common)
1.				
2.				
3.				
4.				

MOLLUSCS

MOLLUSCS	CATEGORIES			
	0 (Absent)	1 (Rare)	2 (Uncommon)	3 (Common)
1.				
2.				
3.				

OTHER INVERTEBRATES

INVERTEBRATES	CATEGORIES			
	0 (Absent)	1 (Rare)	2 (Uncommon)	3 (Common)
1.				
2.				

VIDEO DATA SHEET

METROPOLITAN MARINE PARKS MARINE MONITORING PROGRAM

SITE NO.		**SITE NAME**			
DATE		**TIME**			
RECORDER		**TAPE ID**			
METHOD		**VIDEO FORMAT**		**DIGITAL COPY**	
TIME CODING FOR SITE (START)		**TIME CODING FOR SITE (FINISH)**			
TAPE DESCRIPTION					

COMPLETE FOR EACH TRANSECT VIDEO

TRANSECT NUMBER	1		
START TIME CODE		**FINISH TIME CODE**	
TOTAL TIME CODE			
NOTES			

TRANSECT NUMBER	2		
START TIME CODE:		**FINISH TIME CODE:**	
TOTAL TIME CODE			
NOTES			

COMPLETE FOR ALL OTHER FOOTAGE

DESCRIPTION			
START TIME CODE		**FINISH TIME CODE**	
TOTAL TIME CODE		**NOTES**	

DESCRIPTION			
START TIME CODE		**FINISH TIME CODE**	
TOTAL TIME CODE		**NOTES**	

METROPOLITAN MARINE PARKS MARINE MONITORING PROGRAM
VIDEO DATA SHEET

DESCRIPTION			
START TIME CODE		FINISH TIME CODE	
TOTAL TIME CODE		NOTES	

DESCRIPTION			
START TIME CODE		FINISH TIME CODE	
TOTAL TIME CODE		NOTES	

DESCRIPTION			
START TIME CODE		FINISH TIME CODE	
TOTAL TIME CODE		NOTES	

DESCRIPTION			
START TIME CODE		FINISH TIME CODE	
TOTAL TIME CODE		NOTES	

DESCRIPTION			
START TIME CODE		FINISH TIME CODE	
TOTAL TIME CODE		NOTES	

DESCRIPTION			
START TIME CODE		FINISH TIME CODE	
TOTAL TIME CODE		NOTES	

APPENDIX 2: NOTES ON GPS USE

It is essential that prior to using the *Lowrance Globalmap 100* that the operator checks the unit's setting to ensure that the correct datum, coordinate format and units have been set. The following are the standard settings used:

- Datum: WGS84 (equivalent to GDA94);
- Coordinate format as decimal degrees (four decimal places); and
- Meters.

It is also good practice to calibrate the unit prior to use by comparing readings taken at known local Department of Land Administration (DOLA) benchmarks. DOLA can provide summary sheets for each DOLA benchmark. Any variations between the coordinates displayed on the DGPS unit and those of the benchmark will be recorded in the field book.

Operators should refer to the Lowrance Globalmap 100 user manual on how to operate the unit. Prior to going into the field all coordinate data for the sites to be re-surveyed should be uploaded to the GPS unit.

In addition operators should always check the datum of any coordinate data entered into the unit, to ensure that it is in datum GDA94/WGS84. In situations where the coordinate data is in a datum not WGS84, then the datum should where possible be converted or noted on the relevant data sheets and field notebooks.

APPENDIX 3: UNDERWATER VIDEO SYSTEM

PREPARATION OF UNDERWATER HOUSING AND VIDEO CAMCORDER

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.
The following is to be used as a general guide only. Users should refer to the relevant instruction manual for full details on settings, care and use.

Housing

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 clean using blower brush, lens tissues and lens cleaning fluid if necessary.
Remove the O-ring from the housing, clean it with lens tissues and check for any cracks or scratches. If there is any damage to the O-ring, discard and replace with a new one. 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. **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-ring supple and not to actually form a seal.
Clean out the O-ring groove with a cotton bud, and carefully replace the clean and greased O-ring back into the groove without twisting it. Ensure that there is no particulate matter sticking to the O-ring. The housing is now ready for the camcorder to be inserted.

CAMERA SETUP

Set the OPERATE switch to CAMERA
Set the STANDBY LEVER (front right) to MOVIE
Press MENU button
Use the small joy stick controller, on the left hand side of the camera, to move around the menu
Set movie mode to PRO SCAN
Set the PROGRAM SELECT switch to AUTO ("A" inside a square)

POST-DIVE PROCEDURE

After every dive immerse the housing in fresh water for about 10-15 minutes. Occasionally operate the external controls to ensure they are well rinsed.
Wipe the housing with a clean, dry towel and leave in a clean, dry, airy and salt-free environment to dry completely.
Wipe carefully around the rear seal of the housing before opening so that no water gets onto the camcorder. Open the housing and remove the camera. **Do not open the housing where salt spray is present.**
Rewind the tape using the either the controls on the back 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 Video Transect Data Sheet (Appendix II). Label the tape clearly (using a permanent marker pen) with the designated tape number, the site number and the date of recording as described below.

TAPE NUMBERING

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

Project acronym (MMPMMP)/Sampling method (bvt - benthic video transect or nthu - non-transect human use)/Date (03.08.99)/Tape number (#1 onwards).

Thus, the first tape might be labeled as: **MMPMMP/bvt/03.10.02/#1**

If the tape contains footage spanning more than one day the tape number should indicate this (e.g. **MMPMMP/bvt/07-08.10.02/#1).**

A total of two sites should be recorded on each 60 minute digital tape. 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 any loss of site data. The tapes should be stored in a waterproof container and duplicated at the end of the field trip.