SHARK BAY MARINE RESERVES MONITORING PROGRAM

INITIALISATION AND RESAMPLING OF LONG-TERM MONITORING SITES: APRIL 1997

Data Report MMSP/MW/SBMP-3/1997

A collaborative project between CALM Marine Conservation Branch, Geraldton Regional Office and Gascoyne District Office

Project No. 151/95 - National Ecotourism Program
Commonwealth Department of Tourism

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Field notes and general documentation relating to the Shark Bay Marine Reserves Monitoring Program (SBMRMP) are archived in the following Marine Conservation Branch files:

MMSP/MW/BIO/1997/1
MMSP/MW/SOC/1997/1
MMSP/MW/GEN/1997/1

Access to these files and copies of this report are available at:

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SUMMARY

This data report presents the results of the third field survey of the Shark Bay Marine Reserves Monitoring Program during April 1997, conducted mainly in the vicinity of Bernier and Dorre Islands and the Wooramel Seagrass Bank. Twenty three sites were visited during this survey, with 15 of these sites being permanent 'transect' sites, five sites were 'non-transect' sites and three impacted sites initiated in August 1996 were resampled. This survey followed on from the preliminary field survey of the Shark Bay Marine Reserves Monitoring Program (SBMRMP), conducted in April 1996 (D'Adamo, Colman and Pobar, 1996) and the field survey of August 1996 (Cary and Pobar, 1997).

The SBMRMP was coordinated by the Marine Conservation Branch (MCB) of the Department of Conservation and Land Management (CALM) and conducted in collaboration with CALM's Midwest Region and Gascoyne District offices. Funding was obtained from the Commonwealth Department of Tourism, under a National Ecotourism Program grant (Project No. 151/95).

The main objective of this survey was to establish a long-term monitoring program and provide baseline quantitative benthic habitat data along re-locatable transects to enable changes to the key conservation attributes of the Marine Park to be detected before unacceptable or irreversible impacts occur. Position-fixing of each transect was achieved by differential GPS to better than 3 m accuracy. High quality video footage was taken along three 50 m transects per site. Three of the sites showing obvious signs of impact, initiated in the August 1996 field survey, were resampled.

ACKNOWLEDGEMENTS

Direction

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

CALM Regional/District collaboration

Geraldton Region - Ron Shephard, Program Leader, Nature Conservation.
Gascoyne District - Paul Brown, District Manager; Brad Barton, Operations Officer.
Field Team Leader - Jennie Cary, MCB.

Resources

Funding for the Shark Bay Marine Reserves Monitoring Program is from the following sources:

$50,000 through Commonwealth Department of Tourism - National Ecotourism Program (Category - Baseline Studies and Monitoring, Infrastructure Projects, Regional Ecotourism Planning; Project reference number - 151/95).

CALM resources:

Funding	$30 000 through MCB cooperative funding and $10 000 through CALM assistance in kind
People	100 person days

1 INTRODUCTION

1.1 General

This data report presents details relating to the third survey of the Department of Conservation and Land Management's ***Shark Bay Marine Reserves Monitoring Program (SBMRMP)***. The survey was conducted during April 1997 based on the field program report (Cary, 1997) and involved the initialisation of 15 long-term monitoring sites and five 'non-transect' sites within the Shark Bay Marine Park and three impacted sites initiated in August 1996 were resampled. Background information and data from the preliminary and first survey of the SBMRMP, conducted in April 1996 and August 1996 are found in D'Adamo, Colman and Pobar (1996) and Cary and Pobar (1997) respectively. The locality and boundaries of Shark Bay Marine Park, Hamelin Pool Marine Nature Reserve and Shark Bay World Heritage Area and surrounds are shown in Figure 1.

The field survey was coordinated by the Marine Conservation Branch of CALM (Principle contact: Dr Chris Simpson, Manager, Marine Conservation Branch) and conducted in collaboration with the Geraldton Regional Office (Contact: Ron Shephard) and the Gascoyne District Office (Contact: Paul Brown).

Jennie Cary (Marine Conservation Branch) was the Field Team Leader and coordinated all activities in the field.

Other CALM field staff included Tim Daly and Lea McQuillan (volunteer) from the Marine Conservation Branch, Ron Shephard from the Geraldton Regional Office, Brad Barton from the Gascoyne District Office. Matz Berggren a shrimp ecologist from Kristineberg Marine Research Station, Sweden currently of the Marine Biology Laboratory of the University of Western Australia and Eva Boogard, a professional underwater photographer also took part in the field survey.

1.2 Background

The SBMRMP is an integration of two projects: (i) ***Baseline Studies and Monitoring of Visitor Sites in the Shark Bay Marine Park*** (Project No. 151/95, granted under the *National Ecotourism Program* by the Commonwealth Department of Tourism in 1995) and (ii) ***Habitat Mapping for Shark Bay Marine Reserves Program*** funded by CALM's World Heritage Area funds. Although technically separate, there is considerable overlap in these two projects. As a result, some of the objectives of the 'Baseline Studies' project directly service the requirements of the 'Habitat Mapping' project (Cary, Daly and McQuillan, 1997).

The SBMRMP is being undertaken in three phases. Phase I, which has been completed, comprised a review of the current state of knowledge, in relation to monitoring information requirements, and the preliminary exploratory field survey of April 1996. Phase II involved designing the monitoring program and the preparation of the field program report SBMRMP-03/96 (D'Adamo, Colman and Pobar, 1996). Phase III establishes the long-term monitoring locations and initialises the monitoring program. Data from the August 1996 field survey (Cary and Pobar, 1997) and data from this survey complete Phase III.

The objective of the *Baseline Studies and Monitoring of Visitor Sites in the Shark Bay Marine Park* project was to establish and initialise a monitoring program to ensure that recreation and tourism activities are ecologically sustainable. Quantitative and qualitative biological information was obtained using video and still photography from relocatable transects throughout the Shark Bay Marine Park. The location of sites was fixed to better than 3 m accuracy with a differential GPS. Video footage and photographs taken during the April field survey were archived for future reference and held with the Marine Conservation Branch. These data will complement data collected during the preliminary survey of the SBMRMP conducted in April 1996 (D'Adamo, Colman and Pobar, 1996) and August 1996 (Cary and Pobar, 1997).

The SBMRMP is linked to the recommendations of the *Shark Bay Marine Reserves Management Plan 1996-2006* relating to the research and monitoring required to ensure that activity in the Bay is consistent with its World Heritage, Marine Park and Marine Nature Reserve status (see Figure 1).

Figure 1 Location map of Shark Bay

1.3 Aims

The aims of the April 1997 survey are separated into primary and secondary objectives, as follows.

Primary aims

- The initialisation of re-locatable long-term monitoring sites to provide baseline ecological data from which the potential impacts of recreational usage can be monitored and managed.

- The establishment of scientific control sites having ecological attributes that are representative of the major habitats in the Marine Park and which will be used to provide information on the natural variation of key attributes of the ecosystem.

- To resample long-term monitoring sites, initialised in August 1996, which showed signs of impact from recreational usage.

Secondary aims

- The opportunistic collection of still photographs and video footage of major habitat types and visually dominant flora and fauna of the Shark Bay region.

- The opportunistic collection of qualitative information on the Crustacea of the Shark Bay area.

2 SITE SELECTION

2.1 Impacted sites

Site observations during the April 1996 preliminary survey (D'Adamo, Colman and Pobar, 1996) enabled direct impacts from common activities such as fishing and diving to be determined. The results of a 1993 visitor survey (presented in CALM's GIS user survey habitat maps) were also used to guide the selection of the sites, and are therefore important to the selection of permanent long-term monitoring sites.

In site selection, highest priority was assigned to sites subjected to tourism/recreational pressures. In the Shark Bay Marine Park there are large expanses of mono-specific floral habitats such as seagrass meadows. Although there may be mono-specificity in the flora of these regions their faunal populations can show significant diversity and these regions have therefore been considered in the long-term monitoring program.

2.2 Control sites

A number of sites were established as 'control' sites. These sites have ecological attributes that are representative of habitat types in the Marine Park that are likely to have minimal impacts and which can therefore provide information on natural variation. The results of long-term monitoring at sites subjected to recreational pressures will be assessed in the context of natural variation at the control sites. This is a fundamental requirement for effective management.

Much of the Shark Bay Marine Park is largely free of human activity or impact and hence finding control sites was not difficult, particularly in view of the large areas of similar habitat types around the Park. The exception is that of coral reef habitat, which is only recorded at relatively few locations, and there is variability of species composition at each location.

2.3 Sites of scientific or historic interest

Certain sites were selected on the basis of their intrinsic value in either a scientific or historical sense.

2.4 Site location

Twenty three sites were visited during the survey, with 15 of these sites being permanent transect monitoring sites ('transect' sites), five sites as non-transect monitoring sites ('non-transect' sites) and three impacted sites initialised in August 1996 were resampled. Site locations are shown in Figure 2. The *Transect data sheets* present the differential

GPS latitude and longitude for the three transects set at each 'transect' site. For the 'non-transect' sites the GPS readings are found in the *Habitat data sheets* and Table 1.

3 Methods

The 'transect site' was selected randomly after a broad visual surveillance of the benthic habitat. Three permanent 50 m transects were then established to allow monitoring of spatial and temporal changes in benthic community composition. The transects were, in general, set parallel to each other approximately 100 m apart. Transects were permanently marked using star pickets at each end. At some sites the substrate was too hard to use star pickets and steel rods were used instead. A 50 m fibreglass scaled and weighted rope marked the transect line across the seabed between the star pickets. The position of the start and end of each transect was recorded using differential GPS, providing an accuracy of better than 3 m. The sessile benthic community along each transect was then recorded using a high quality video camera (Blaupunkt CC894 camcorder in a stingray SR-700 housing) with a 20 mm lens. The video was held 50 cm above the benthic community. For eg. in a seagrass meadow the video was held 50 cm above the seagrass canopy.

Appendix 1 describes the method for estabishing permanent 'transect' sites and appendix 2 describes the sampling method used for the collection of benthic video imagery.

The video sampling method was developed by the Australian Institute of Marine Science (AIMS) to monitor the status of coral dominated benthic communities by detecting and quantifying major spatial and temporal changes in the percentage cover of sessile benthos (Christie *et al.* 1996). This survey technique is more suitable than the time-consuming line intercept transect method as it is faster to carry out in the field and requires no extensive field identification and taxonomic knowledge. It also provides a permanent record of benthic habitats which can be later analysed in a variety of different ways. This method is designed for identifying change and for highlighting impacts that may result from recreational and commercial usage.

At new sites (i.e., not previously visited during the preliminary survey of April 1996) recordings of benthic composition using the video transect technique was complemented with general information on the major benthic community types (eg. seagrass meadows, coral reef etc.). The visually dominant species and the nature and extent of impacts (if present) were recorded either by direct observation from the boat (ie. by viewfinder and/or remote video), or by divers taking general video footage and still photographs.

At each 'transect' site habitat data and related observations were recorded onto data sheets. The written data was then transferred to pre-formatted data sheets on the lap-top computer on the same day as collected. The following data sheets were used at each 'transect' site.

1. *Transect data sheet* - with differential GPS latitude and longitudes for each of the 3 transects at each site.
2. *Long-term monitoring site data sheet* - a site map which includes vessel location, transect locations and other features of interest.
3. *Habitat data sheet* - describes the habitat at the site including dominant species and notes any impact or activity at the site.
4. *Video data sheet* - gives the video time codes for each transect at each site.

At the 'non-transect' sites the only information recorded was on the *Habitat data sheets*.

At the 'resampled' sites data was recorded on the *Habitat data sheet* and *Video data sheet*.

4 Results

Each 'transect' site has data recorded on four data sheets; the *Transect data sheet, Long-term monitoring site data sheet, Habitat data sheet and Video data sheet*. The sites appear in the order shown in Table 1.

Each 'non-transect' site has data recorded on a *Habitat data sheet.*

Each 'resampled' site has data recorded on a *Habitat data sheet* and a *Video data sheet*.

The Hi-8 video tapes, plus VHS duplicates with the permanent transect data are stored at the Marine Conservation Branch in Fremantle.

Figure 2 Approximate locations of long-term monitoring sites from the April 1997 field survey

Table 1 'Transect' and ' non-transect' sites established or revisited in the April 1997 field survey. The latitude and longitudes listed for the 'Transect' sites indicate the position of the beginning of 'Transect' 1.

Site number	Site name	Dominant factor in site selection	latitude and longitude	Habitat	Video Footage
'Transect' sites established April 1997			DGPS		
SB 21	Bar Flats	Recreation site	25° 51.194' S 113° 20.724' E	Coral reef	Yes
SB 70	Louisa Bay	Recreation site	25° 45.833' S 113° 04.727' E	Coral reef	Yes
SB 90	Turtle Bay	Recreation site	25° 29.856' S 112° 59.324' E	limestone pavement/coral	Yes
SB 149	Gladstone/Halodule	Dugong feeding ground-control	25° 56.215' S 114° 13.886' E	Seagrass	Yes
SB 150	Disappointment Reach Sanct. Zone	Dugong feeding ground-control	25° 45.296' S 114° 01.750' E	Seagrass	Yes
SB 151	Disappointment Reach-North	Representative of Wooramel Bank	25° 35.533' S 113° 54.763' E	Seagrass	Yes
SB 152	Grey Point-West	Representative of Wooramel Bank	25° 08.985' S 113° 38.961' E	Seagrass	Yes
SB 153	Carnarvon-South	Representative of Wooramel Bank	25° 00.141' S 113° 36.939'E	Seagrass	Yes
SB 200	Uranie Bank	Control site	25° 11.189' S 113° 08.696' E	Seagrass	yes
SB 201	Cape St Cricq-North	Control site	25° 16.102' S 113° 04.870' E	Coral reef	Yes
SB 202	Castle Point	Control site	25° 07.706' S 113° 06.699' E	Coral reef	Yes
SB 204	Cleft Rock	Recreation site	24° 48.533' S 113° 09.886' E	Coral reef	Yes
SB 205	East Koks Island	Recreation site	24° 45.312' S 113° 09.700' E	Coral reef	Yes
SB 213	Red Cliff Point-South	Control site	24° 55.966' S 113° 09.110' E	Coral reef	Yes
SB 214	Hospital Bay	Recreation / Anchorage	24° 47.739' S 113° 10.157' E	Coral reef	Yes
Site number	Site name	Dominant factor in site selection	latitude and longitude	Habitat	Video Footage
'Transect' sites established in August 1996 and revisited in April 1997			DGPS		
SB 20	Heirisson Flats	Recreation site	25° 58.599' S 113° 19.451' E	Seagrass	Yes
SB 105	Broadhurst Reef	Recreation site	25° 38.091' S 113° 22.330'E	Coral reef	Yes
SB 120	80 Acres	Recreation site	25° 32.741' S 113° 31.708'E	Limestone pavement/coral	Yes
Site number	Site name	Dominant factor in site selection	latitude and longitude	Habitat	Video Footage
'Non transect' sites established in April 1997			DGPS		
SB 199	Dirk Hartog-West	Recreation site	25° 30.54' S 112° 56.42'E	Coral reef	Yes
SB 207	Cape Couture-West	Control site	24° 59.02' S 113° 07.17' E	Lagoon/intertidal coral reef	Yes
SB 208	Cape Ronsard-West	Control site	24° 45.34' S 113° 09.45' E	Coral reef	Yes
SB 210	Dampier Reef	Control site	25° 21.60' S 113° 04.50' E	Coral reef	Drop down video only
SB 212	Disaster Cove	Recreation site	24° 59.82' S 113° 07.36' E	Small sandy bay/ coral	Yes

SITE DATA SHEETS

5 References

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

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Appendix 1

Establishment of permanent 'transect' sites

The following sequence describes the basic field procedure that was followed to establish three permanent transects at each site. The entire procedure took between 2 and 4 hours, depending on *in situ* conditions, enabling at least two sites to be visited per day.

- The boatman and two divers conducted a general survey of the site from the tender (a Zodiac inflatable). Observations of the benthic habitats were made either by using the viewfinder from the vessel or by in-water observations on snorkel, using the manta-tow technique or underwater scooter. The boatman and divers then proceeded back to the main vessel to decide on the size, location and alignment of the transect grid.

- The tender was then equipped with three transect kits, with this activity coordinated by the field officer onboard the main vessel. Each kit comprised of a porous plastic crate attached to a rope (with a buoy attached to the end) of length chosen to suit the approximate depth of the respective transects, and with each crate containing two star pickets, a scaled 50 m line, a mallet, a picket driver and an underwater writing slate, all fastened to the inside of the crate. The specifications for the respective kits (rope length and contents) were tailored to suit each of the three respective transects (nominally called Transects T1, T2 and T3).

- The boatman transported the three transect kits and the two divers to the start point of Transect T1.

- The two divers provided the boatman with confirmation of the path that they will traverse to establish the three transects including where they wanted to be retrieved after establishing the three transects.

- The kit for Transect T1 was lowered over the side of the tender to the seabed.

- The two divers then entered the water at this site and descended to the seabed. If there was a problem at this stage they ascended to the surface and informed the boatman of the problem. If there were no problems then the divers were to proceed with the establishment of Transect T1, followed by Transects T2 and T3.

- After the two divers descended to the bottom at the start point of Transect T1, the boatman left Transect T1 and progressively dropped the two remaining transect kits at the start points of Transects T2 and T3, respectively.

- From this time onwards the boatman kept a watch on the transect zone in which the divers operated in order respond to requests for assistance, such as the delivery of equipment, towing of divers or retrieval of divers.

- While the two divers were establishing the transects the boatman returned to the main vessel and took delivery of the cameras. The boatman then waited for a signal from the divers.

- After establishing the transects the divers signalled to the boatman. The boatman then retrieved the two divers and returned them to the start point of Transect T1, where the divers were given the video recorder and stills camera. The divers descended to the bottom and then proceeded to acquire video footage and selected still photography along the three respective transect alignments. The sampling methodology for the collection of benthic habitat video imagery is detailed in Section 2.2.2.

- While the divers were videoing the boatman returned to the main vessel where the fourth field officer boarded the tender with the differential GPS and then proceeded to fix the positions of the start points of transects T1, T2 and T3. After the positions were fixed the boatman returned the field officer to the main vessel.

- After the divers had completed videoing they signalled to the boatman pick them up.

- The divers then decommissioned each transect by fastening the scaled lines, mallets and drawing sheets into their respective crates.

- Upon receiving a signal from the divers the boatman then retrieved the two divers and proceeded to retrieve the three transect kits.

- The boatman and divers then returned to the main vessel.

- Data recording and field notes were processed on board the main vessel. Field notes were written into pre-formatted data file sheets and stored electronically.

NOTE: A new technique to lay the transect lines was also trialed during the April 1997 field survey. This involved using the zodiac to set and retrieve the transect compared to using the divers as described above. Both techniques have their advantages and disadvantages depending on the site. For example, it would be advantageous to use the zodiac to set the transect in seagrass and shallow water sites and during calm wind and low current conditions. Using the zodiac reduces the length of time divers are underwater and therefore there is less air consumption and the divers are not as tired. DGPS readings are also recorded for the beginning and end of the transect, not just the beginning in the technique described above. However, one potential problem with the technique is that the transect line does not always follow the contour line of the substrate and therefore is not always visible in the video footage. This occurs because the transect line is pulled tight from one end, to ensure that the transect line is straight.

Appendix 2

Sampling methodology for the collection of benthic habitat video imagery

This sampling technique is adapted from the AIMS Standard Operating Procedure No. 2 (Christie *et al.*, 1996). The steps required for preparation of the underwater housing and video camcorder are included in Appendix IV. The recording of data for each transect was carried out according to the following steps:

- Record the site number, date, transect number, and recorder's name on the in-water data sheet (located on the top of the housing).

- The camcorder was set to **autofocus** and a panoramic shot was taken of the start of the transect, then the star picket, The camera was held in a horizontal position and turned slowly clockwise, videoing the immediate surroundings and ending at the initial view. The top of the star picket was videoed to record the site number and transect number written on the white plastic cap. The STBY button was pressed

- The start time code was recorded on the data sheet. The REC button was pressed and the base of the star picket was videoed for a few seconds. It was then moved along the scaled rope, kept approximately 10 cm in from the right hand side of the field of view. The housing lens was kept parallel to the substrate or benthic community at a distance of 0.5 cm.

- The transect line was followed keeping the housing at the set height of 50 cm. The swimming speed was adjusted so that it was constant and the diver covered approximately 10 m every minute using the scaled rope as a guide Therefore to swim a 50 m transect took approximately 5 minutes however an error of +1minute was considered acceptable. The transect was revideod if this error was exceeded. At the end of the transect the base of the star picket was videod for a few seconds and then the STBY button was pressed.

- The finish time code was recorded on the data sheet.

- If video recording along a transect was aborted for any reason, or if there was considerable variation in the height or speed of the recorder, then the entire transect was re-sampled, beginning again from the start point of the transect.

- Once all three transects at a site were completed and the tape was viewed and checked back on the vessel and full details were recorded on the main video transect data sheet. Any repeated or incompleted transects, or situations where transects were recorded out of order or with false starts were noted on the data sheets.

- On average a total of four sites were recorded on each 90 min Hi8 tape. The tape and tape cover were clearly labelled (using a permanent marker) with the designated code numbers, the site number and date of recording.

- The Hi-8 tapes were duplicated in VHS format. The Hi-8 tapes are archived in the Video Transect Cabinet at the MCB in Fremantle. The tapes have been duplicated.

DISTRIBUTION LIST

SHARK BAY MARINE RESERVES MONITORING PROGRAM. ESTABLISHMENT OF LONG-TERM MONITORING SITES: AUGUST 1996. Data Report MMSP/MW/SBMP-2/1997

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