MARINE MANAGMENT SUPPORT
NINGALOO

NINGALOO MARINE PARK MONITORING PROGRAM: JULY/AUGUST 2001 FIELD TRIP TO RE-SURVEY AND ESTABLISH MONITORING SITES

Field Program Report: MMS/NIN/NMP-39/2001

A collaborative project between the Marine Conservation Branch
and Exmouth District Office of CALM

Part funded by *Coasts and Clean Seas*

Coasts & Clean Seas

an initiative of the Natural Heritage Trust

Natural Heritage Trust
Helping Communities Helping Australia

Prepared by Tim Grubba and Jennie Cary

May 2001

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

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

ACKNOWLEDGMENTS

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Field Team Leaders – Tim Grubba MCB, CALM.

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1 INTRODUCTION

1.1 GENERAL

This field program report presents information on the July/August 2001 field survey of the *Ningaloo Marine Park Monitoring Program* (NMPMP). The main aim of the NMPMP is determine the health of the key benthic habitats of the Ningaloo Marine Park and the proposed southern extension. The locality and boundaries of Ningaloo Marine Park and surrounds are shown in Appendix 1.

Three previous field surveys have been conducted by CALM as part of the NMPMP:

- May 1998 (Cary *et al.;* 1999)
- August 1999 (Cary *et al.;* 2000)
- May 2000 (Cary and Grubba 2000)
- December 2000 (Grubba and Williams 2000)

The NMPMP has established a network of 52 monitoring sites in 1998 and 1999 along the back reef and lagoon areas of the NMP and proposed southern extension. Thirty sites are permanent 'transect' long-term monitoring sites that form a network of surveillance monitoring sites. Twenty-two sites are 'non-transect' sites that form a network of human usage monitoring sites.

This survey will re-survey 11 'non-transect' sites located in areas of high human usage identified during the December 2000 survey as high impact sites. The survey will establish an additional four 'non-transect' sites and one 'transect' site to fill 'gaps' that have been identified in the network of human usage monitoring sites. The survey will also establish a further four 'transect' sites in sub-tidal and low human usage areas to fill 'gaps' that have been identified in the network of surveillance monitoring sites. See Appendix 2.

The field survey will be coordinated by Marine Conservation Branch (MCB) of CALM (Project Supervisor: Jennie Cary) in collaboration with the Exmouth District of CALM (contact Doug Myers). Tim Grubba (MCB) will coordinate the field trip preparation with Exmouth District.

Tim Grubba will be Field Team Leader and will coordinate all activities in the field. Adam Meyer will supervise all diving activities in the field, and will be the designated Dive Supervisor. Two volunteers, one from Exmouth (Gordon Hutton) and one from Perth (Ian Anderson) will participate in the field survey.

1.2 BACKGROUND

The successful management of the marine environment is contingent upon comprehensive long-term monitoring programs that provide information on natural variability and long-term trends in key biological communities. They must determine the status of important natural attributes at regular intervals and identify undesirable trends resulting from human activities in time for remedial management action to be implemented effectively. Monitoring programs generally comprise of one or more of the following complementary objectives: (i) local scale impact and/or *compliance monitoring* that examines the effects of human activities in a localised area; (ii) temporally-constrained, broadscale *surveillance monitoring* to assess the impact of episodic regional physical and biological processes (eg the effect of cyclones 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 aim of the *Ningaloo Marine Park Monitoring Program* (NMPMP) is to assess the 'health' of major benthic habitats of the marine park and its southern extension. Long term monitoring sites established during 1999 will provide baseline data from which the impacts from human activities can be monitored and managed to ensure that all activities are ecologically sustainable. This report

describes one of a number of field surveys that will be conducted as part of the NMPMP. The spatial and temporal scale of on-going monitoring will determine the type of monitoring ie. surveillance, compliance or natural variability. As the coral communities are the most dominant benthic habitat, the major focus of the field program was to monitor the coral communities.

1.3 AIMS

- to assess the impact of human activities on benthic communities at 11 'non-transect' sites in the marine park;
- to establish four 'transect' monitoring sites in sub-tidal coral communities in areas of low human activity where there are currently 'gaps' in the network of surveillance monitoring sites; and
- to establish three 'non-transect' and one 'transect' monitoring sites in areas of high human usage where there are currently 'gaps' in the network of human usage monitoring sites.

2 METHODS

2.1 SITES TO BE RE-SURVEYED

The July/August 2001 field trip will re-survey 11 'non-transect' monitoring sites located in areas of high human usage (Table 1) (Appendix 2). These sites were selected for re-survey on the basis that observations of human activity were recorded during the December 2000 field survey (Grubba and Williams 2000).

Table 1. Description of sites scheduled to be surveyed and/or established

Site No	Site name	Most common human activity	Possible impact	Question posed
N27	Bundegi	Snorkel site	Coral damage/litter	Trends
N58	Navy Pier	Diving and shipping	Coral damage/litter	Trends
N38	Lakeside	Proposed day visit site	Potential toxic algae presence	Presence/absence
N33	Tantabiddi	Fishing, boating, diving	Coral damage/litter	Trends
N56	Tantabiddi boat ramp	Toilet block	Increased algae due to nutrients	Presence/absence
N34	Mangrove Walk	Tourist walk	Mangrove damage/litter	Trends
N37	Turquoise Bay	Snorkel site	Coral/damage/litter	Trends
N45	The Lagoon	Snorkel site	Coral damage/litter	Trends
N46	Coral Bay Mooring	Boating	Coral damage/litter	Trends
N52	Coral Bay snorkel	Snorkel site	Coral damage/litter	Trends
N57	Monck Head channel marker	Boat channel	Coral damage	Trends

Sites will be re-located by referring to the 'non-transect' site data sheet completed during the establishment of the site (Appendix 3). In most cases DGPS coordinates for each corner of each site were recorded, but in some cases only one site coordinate was recorded along with a description of the site.

At each site digital video footage will be taken of damage to benthic communities from assumed human activities (eg anchor or diver damage), and any observed litter. In addition the following observations are recorded onto the habitat sheets and 'non-transect' data sheets (Appendix 4):

- habitat description, including dominant species, etc;
- type and extent of impacts from human activities on benthic communities;
- type of litter and number of items;
- presence and abundance of targeted species eg
  - crayfish;
  - oysters;
  - fish;
- coral predators eg *Drupella* (density – number per m^2).

The data from the data sheets will be entered electronically onto 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.

2.1.1 Methods for re-surveying 'non-transect' sites

The following outlines the field procedures to be used when re-surveying 'non-transect' monitoring sites. The procedures are based on a team of four people operating from either the shore or from a boat depending on the site location. The roles of each member include:

- *BOAT OPERATOR (BO)*: operates the boat, draws a site map and records site coordinates;
- *TRANSECT LAYER (TL)*: lays and retrieves the transects and records site coordinates;
- *OBSERVER 1 (VO)*: operates the video camera; and
- *OBSERVER 2 (DR)*: records data.

1. Refer to the original 'non-transect' data sheet for the sites coordinates and site description in order to re-locate the site.
2. Refer to the original 'non-transect' data sheet to determine the spatial coverage of the site and temporarily mark the site boundaries using weighted marker buoys (marine sites) or flagging tape (terrestrial sites).
3. The VO records video footage of the general area (360º pan) before moving (walk, swim) through the entire site recording video footage of visible impacts (eg. broken coral, litter, etc.) and anything else of significance.
4. The DR follows the VO and records general observations such as dominant species, general health and any visible impacts etc. The DR draws a detailed site map that marks the location of impacts in relation to prominent site features (for new sites) or up-dates the existing site map.
5. The BO and TL record the coordinates of each corner of the site (marker buoys/flagging tape) using a DGPS (datum: WGS84, decimal degrees to three decimal places) (Appendix 5). When working from a boat the BO should watch for the VO and DR working in the water.
6. Once the site has been re-surveyed the temporary markers should be removed.

2.1.2 Methods for re-surveying 'Non-transect' sites in Mangroves

In addition to the methods described in 2.1.1, the method from the *Marine Community Monitoring Manual* will be used (accompanying data sheets will be completed). See Appendix 6 for the method.

2.2 SITES TO BE ESTABLISHED

2.2.1 Human usage sites ('non-transect')

Long-term monitoring sites will be established in areas identified as having a high level of human usage where there are currently 'gaps' in the network of human usage monitoring sites. To assist in the identification of 'gaps' the existing site coordinates were plotted using GIS and reference was made to human usage data (Cary *et al*., 2000). Monitoring sites will be established at each boat mooring at Bundegi, Tantabiddi and Coral Bay (Table 2) (Appendix 2). A monitoring site will also be established in the area impacted by the grounding of the fishing vessel 'Quobba' in February 2001 (Table 2) (Appendix 2).

Table 2. Description of sites scheduled to be established

Site No	Site name	Most common human activity	Possible impact	Question posed
N59	Bundegi moorings	Boating	Coral damage/ litter	Presence/type of impacts
N60	Tantabiddi moorings	Boating	Coral damage/ litter	Presence/type of impacts
N61	Quobba grounding site	Vessel grounding	Coal damage	Presence/type of impacts
N62	Coral Bay day use moorings and channel markers	Fishing, boating, diving	Coral damage/litter	Presence/type of impacts

At each non-transect site the site location and size will be determined by carrying out a survey of the site to determine the spatial coverage of human activities and impacts. The site location and size will

be recorded on a non-transect' site data sheet (Appendix 4). DGPS coordinates of each corner of each site will be recorded.

At each site digital video footage will be taken of damage to benthic communities from assumed human activities (eg anchor or diver damage), and any observed litter. In addition the following observations are recorded onto the habitat sheets and 'non-transect' data sheets (Appendix 4):

- habitat description, including dominant species, etc;
- type and extent of impacts from human activities on benthic communities;
- type of litter and number of items;
- presence and abundance of targeted species eg
  - crayfish;
  - oysters;
  - fish;
- coral predators eg *Drupella* (density – number per m^2).

The data from the data sheets will be entered electronically onto 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.

2.2.1.1 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 operating from either the shore or from a boat depending on the site location. The roles of each member include:

- *BOAT OPERATOR (BO)*: operates the boat, draws a site map and records site coordinates;
- *TRANSECT LAYER (TL)*: lays and retrieves the transects and records site coordinates;
- *OBSERVER 1 (VO)*: operates the video camera; and
- *OBSERVER 2 (DR)*: records data.

1. Select a site based on human usage data.
2. Determine the spatial scale of the human activities/impacts occurring at the site by conducting a brief survey of the area. Temporarily mark the boundaries of the site using weighted marker buoys (marine sites) or flagging tape (terrestrial sites).
3. The VO records video footage of the general area (360º pan) before moving (walk, swim) through the entire site recording video footage of visible impacts (eg. broken coral, litter, etc.) and anything else of significance.
4. The DR follows the VO and records general observations such as dominant species, general health and any visible impacts etc. The DR draws a detailed site map that marks the location of impacts in relation to prominent site features (for new sites) or up-dates the existing site map.
5. The BO and TL record the coordinates for each corner (marker buoys/flagging tape) of the site using a DGPS (datum: WGS84, decimal degrees to three decimal places) (Appendix 5). When working from a boat the BO should watch for the VO and DR working in the water.
6. Once the site has been surveyed all temporary markers should be removed prior to moving to the next site.

2.2.1.2 Methods for the establishment of 'non-transect' sites at boat moorings

The following outlines the field procedures to be used when establishing 'non-transect' monitoring sites at boat moorings. The procedures are based on a team of four people operating from a boat. The roles of each member include:

- *BOAT OPERATOR (BO)*: operates the boat, draws a site map and records site coordinates;
- *TRANSECT LAYER (TL)*: lays and retrieves the transects and records site coordinates;
- *OBSERVER 1 (VO)*: operates the video camera; and
- *OBSERVER 2 (DR)*: records data.

1. From the boat, determine the spatial coverage of each mooring and mark the extremities of the mooring ground tackle using weighted marker buoys.

2. Where possible tie the boat to the mooring.
3. From the surface the VO records video footage of the mooring and the surrounding area.
4. The VO and DR enter the water and descend to the base of the mooring.
5. The DR draws a site map that clearly describes the layout of the mooring ground tackle in relation to all prominent physical features and records a compass bearing and length for each 'arm' of the mooring ground tackle.
6. The VO records video footage in the vicinity of the mooring and records any impacts observed.
7. The BO and TL record the site coordinates of the main mooring buoy and the marked extremities of the mooring using a DGPS (datum: WGS84, decimal degrees to three decimal places). The BO should watch for the two divers working below.

2.2.2 Surveillance sites ('Transect')

Long-term monitoring sites will be established at subtidal sites identified as having a low level of human usage where there are currently 'gaps' in the network of surveillance monitoring sites in subtidal sites. To assist in the identification of 'gaps' the existing site coordinates were plotted using GIS and each site was classified as being subtidal or inter-tidal based on the sites corrected water depth (refer to Appendix 7 for hourly predicted tide heights). Four 'gaps" were identified in the monitoring network with two sites in the northern section of the park at Mesa Camp (N63) and Pilgonaman Bay (N64) and two sites in southern section of the park at Maggies (N65) and Alison Pt (N66) (Appendix 2).

In addition a 'transect' site (N67) will be established in the Coral Bay mooring area, a high human usage area. The site will allow the potential impacts of boat moorings on corals to be monitored (Appendix 2).

At each transect site three permanent 50 m transect sites will be established. The alignment of the transects will be governed by bathimetry, the benthic composition and the source of the impact. Where practical the transects will be set in a line, one after the other with the transect start and end points separated by a 10 m space. For this configuration the distance between the start of the first transect and the end of the last transect will be 50+10+50+10+50 = 170 m. If this configuration is impractical at a particular site then the three 50m transects can be set up parallel to each other or in what ever configuration is appropriate for the area to be monitored.

All transects are to be permanently marked using star pickets at the start and end points. The start of the first transect will be positioned so that it is adjacent to a distinctive physical feature (that should be easy to re-locate). The position of the start and end of each transect will recorded using a differential DGPS (datum: WGS84, decimal degree to three decimal places) which provides an accuracy of 3-4 m. In addition comprehensive site maps will be drawn that describe the start of each transect in relation to distinctive physical features. This information is recorded on the transect data sheet (Appendix 4).

A 50 m scaled (every 10cm) and weighted transect line that follows the contour of the seabed is laid out. Digital video footage is taken (set height and speed) to record the sessile benthic composition along each transect, resulting in a strip transect 50 m being sampled. This survey technique provides a permanent record of benthic habitats that can be latter analysed using the line intercept transect method (LIT).

In addition the following observations are recorded onto the habitat sheet (Appendix 4):

- habitat description, including dominant species, etc;
- type of litter and number of items;
- presence and abundance of targeted species eg
  - crayfish;
  - oysters;
  - fish;
- coral predators eg *Drupella* (density – number per 1500m^2).

The data from the data sheets will be entered electronically onto 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 '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 people operating from a boat. The roles of each member include:

- *BOAT OPERATOR (BO)*: operates the boat, draws a site map and records site coordinates;
- *TRANSECT LAYER (TL)*: lays and retrieves the transects and records site coordinates;
- *OBSERVER 1 (VO)*: operates the video camera; and
- *OBSERVER 2 (DR)*: records data.

1. In the boat reconnoitre the general area referring to pre-marked aerial photographs and DGPS readings for guidance.
2. View the site using a viewfinder or by snorkelling to identify a prominent physical feature (eg coral bommie, patch of sand) from which to start the transect, ensuring a enough room to lay all three transects.
3. Mark the start of transect 1 using a weighted marker buoy which has the transect 1 reel attached to it.
4. Travel 60 m from the first marker following the direction that the transect will lie (roughly south). Mark the start of transect 2 using a weighted marker buoy which has transect 2 reel attached to it. Record the compass bearing to the first float.
5. Travel another 60 m from the second marker following the compass bearing used for transect 1. Mark the start of transect 3 using a weighted marker buoy which has transect 3 reel attached to it.
6. Travel a final 50 m from the third marker using the same compass bearing used for transects 1 and 2. Mark the end of transect 3 using a weighted marker buoy.
7. The boat returns to the start of transect 1 and deploys the TL and the DR.
8. The TL and DR install the star picket and attach the pvc cap (labelled with the site and transect number).
9. The TL clips the end of the transect to the star picket and lays the transect line so that it follows the bottom and the compass bearing recorded previously.
10. When the transect line has been laid out (50 m transect and 10 m spacer) the TL installs the next star picket and attaches the end of the spacer line to the star picket. The TL may need to re-position the weighted marker buoy so that it marks the end of the transect.
11. The TL repeats steps 8 and 9 for transects 2 and 3.
12. When the TL has finished the BO picks up the TL.
13. The BO and TL record the coordinates of the start of each transect and the end of transect 3 (using the marker buoys as reference points) using DGPS (datum WGS84, decimal degrees to three decimal places) (Appendix 5).
14. As soon as the TL and DR have installed the first star picket and laid out transect 1 the VO and DA can survey tansect 1.
15. The VO records video footage (360º pan) of the general area at the start of transect and the site and transect details written on the pvc cap.
16. The VO records video footage along the length the transect (section 2.2.2.2).
17. The DR follows behind the VO and records general observations such as dominant species, general health and any visible impacts etc. The DR also draws a site map that describes the start of the transect in detail in relation to prominent physical features.
18. The VO and DR repeat steps 14 to 17 for the remaining two transects.
19. When transect 1 has been surveyed and DGPS coordinates recorded the TL is dropped at the end of transect 1 and the transect line is re-wound onto the reel. The boat picks up the TL and reel and retrieves the weighted marker buoy.
20. Step 18 is repeated for transects 2 and 3.
21. The boat picks up the VO and DR when they have completed transect three.

22. If the TL has not finished retrieving the transect lines the VO and/or DR can assist.

2.2.2.2 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 out the details on the in-water data sheet (positioned on the top of the housing) identifying the transect. Record 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 setup and use of the video see Appendix 8). 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 the start time code on the data sheet. Press REC and video the base of the star picket for a few seconds and then move along the transect line, keeping it approximately 10cm in from the right hand side of the field of view. Keep the housing lens parallel to the substrate at a distance of 50cm.
4. 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 10 m approximately every minute, and not faster. This is important to ensure a high quality of image. Each 50 m 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 and then press STBY.
5. Record the finish time code on the data sheet.
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 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.
7. Proceed to the next transect. Once all three 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 4). 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 two sites should be recorded on each 60min digital video tape. The tape and tape cover should be clearly labelled (using a permanent marker) with the designated tape number (Appendix 8), 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.
9. At the end of the field trip and before data analysis the tapes must be duplicated in digital format and original archived and stored separately from the duplicates.

2.2.3 Contingency for adverse conditions

In the event of adverse weather, sea or road (track) conditions the Field Team Leader in consultation with the boat skipper 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, and/or is accessible by road.

3 PROJECT MANAGEMENT

3.1 SURVEY TEAM

The survey team will be comprised of 2 CALM personnel (Tim Grubba, Marine Conservation Branch and Adam Meyer, Exmouth District office) and two volunteers one from Exmouth (Gordon Hutton) and one from Perth (Ian Anderson).

3.1.1 CALM personnel

Tim Grubba	Field leader	Ph (w): (08) 9432 5118
	Marine Ecologist	Fax: (08) 9430 5408
	Marine Conservation Branch	Ph (h) (08) 9271 5560
Adam Meyer	Dive supervisor	Ph (w): (08) 9949 1676
	Reserves Officer (Marine)	Fax: (08) 9949 1580
	Exmouth District office	Ph (h): (08) 9949 2847

3.1.2 Volunteers

Ian Anderson	Ph (w): (08) 944 77500
	Ph (h) (08) 9341 1648
	Ph (mobile) 0409107456
Gordon Hutton	Ph (w): (08)
	Ph (h): (08)

3.2 FLIGHT ITNERARY

Flight details are as follows
Name: Tim Grubba and Ian Anderson

Perth to Learmonth

Departure flight:	AN6563
Departure date and time:	Monday, 30 July at 1020
Arrival time:	1305

Learmonth to Perth

Departure flight:	AN6564
Departure date and time:	Friday, 10 August at 1045
Arrival time:	1330

3.3 FIELD ITINERARY

Table 3. Field itinerary for the period 30 July to 10 August 2001.

Date	Day	Site number location	Activity	Base
30/7/01	Mon		• Fly to Exmouth (depart @ 1020 hrs Arrive 1305 hrs) Prepare gear	Exmouth
31/7/01	Tue	N27, **N59**, N58	• Re-survey and establish sites	Exmouth
1/8/01	Wed	N31, N38, **N60**, N56	• Re-survey and establish sites	Exmouth
2/8/01	Thur	N34, **N61**, **N63**	• Re-survey and establish sites	Exmouth
3/8/01	Fri	**N64**, N37	• Re-survey and establish site	Exmouth
4/8/01	Sat	N45	• Travel and re-survey site	Coral Bay
5/8/01	Sun	**N65**	• Establish site	Coral Bay
6/8/01	Mon	**N66**	• Establish site	Coral Bay
7/8/01	Tue	**N67**, **N68**, N46, N52	• Re-survey and establish sites	Coral Bay
8/8/01	Wed	**N62**, N57	• Re-survey and establish sites	Coral Bay
9/8/01	Thur		• Drive to Exmouth, unpack gear, arrange cartage	Exmouth
10/8/01	Fri		• Depart for Perth (depart @ 1045hrs Arrive 1330 hrs)	Exmouth

Note: Bold represents the establishment of additional sites

3.4 SAFETY

3.4.1 General

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

3.4.2 Diving

All diving activities, both SCUBA and snorkelling shall be accordance with 'Safe Diving in CALM: (September 1998)' document. The Dive Supervisor is responsible for diving safety at all times. The Dive Supervisor will be Adam Meyer

3.4.3 Boating

Boating and navigation are the responsibility of the relevant boat skipper and shall be conducted in accordance with CALM Boating Policy (Draft). Safety issues are the responsibility of the vessel skippers in consultation with the Field Team Leader, Tim Grubba. The boat skippers will be Adam Meyer, Tim Grubba, Gordon Hutton and Ian Anderson.

3.5 COMMUNICATIONS AND EMERGENCY CONTACTS

3.5.1 General

- The survey team will contact CALM Exmouth District office at 1200 hrs everyday to collect any messages
- A hand-held CALM VHF radio will be carried on board the field vessel
- The vehicle is equipped with a CALM VHF radio.
- The survey team will also have mobile phones but coverage maybe intermittent in places
- The survey team will have a satellite phone (# 0404820731)

The method of communication with the survey team is as follows

- Before 0700 hrs ring the accommodation or satellite phone.
- Between 0700 and 1600 contact CALM Exmouth District office and leave a message (the survey team will contact the Exmouth District office at approximately 1600 hrs everyday).
- After 1600 hrs leave a message at the accommodation or satellite phone.

Contact with the field team should be made through the Exmouth District Office of CALM.

3.5.2 CALM offices

CALM, Exmouth: Ph.(08) 9949 1676 and (08) 9949 2113, Fax (08) 9949 1580
Marine Conservation Branch, Fremantle: Ph (08) 9432 5100; Fax (08) 9430 5408
CALM VHF Radio: Monitored at Exmouth office, use channel 11 (north of Yardie Creek) and channel 17 (south of Yardie Creek)
Marine VHF: A hand held unit will be carried on vessels

3.5.3 Emergency

Exmouth Hospital/Ambulance: Ph.(08) 9949 1011, fax (08) 9 949 1017
Exmouth Police: Ph. (08) 9 949 2444
Fremantle Hyperbaric/Diving Service: (08) 9431 2233 or (08) 9431 3333
Royal Flying Doctor Service: Admin., Ph (08) 9414 1200
Coral Bay Volunteer Rescue Group: Ph. (08) 9942 5933, Call Sign: VMR679, Channel 90 (UHF,VHF)
Coral Bay Nursing Post: Ph. (08) 9942 5828 (Maureen Woodhams private Ph. (08) 942 5825)
Exmouth Sea Rescue Group: Ph. (08) 9949 2382, Call Sign: VMR682, Channel 90 (UHF, VHF)

3.5.4 Other

Fisheries Department, Exmouth: Ph (08) 9949 2755
Exmouth Dive Centre: Coral Bay Ph (08) 9942 5824; Exmouth Ph (08) 9949 1201

3.5.5 Suppliers

Aerial photos: DOLA, Gary Caporn, Ph. 9273 7209
Ansett: Flights, Ph. 131644
Ansett air freight: Ph 13 2767
Transport: Cape Transport (Mick & Jane Stamp, or Shane) Ph. (08) 9949 1041
Exmouth automotive and marine Alan Waddingham; (08) 99492795
Underwater video system: Sea Optics, David Hill, Ph. (08) 3626161
DGPS: Fugro, Silvi, Ph. (08) 9322 4955
DGPS Hire: Global Positioning, Marina, Ph. (08) 9388 7333

3.6 ACCOMMODATION

Exmouth: Adam Meyer Ph (h): (08) 9949 2847

Coral Bay: House 22
Ken Upton, 9729 1165

3.7 BUDGET

Table 4. Budget reconciliation for July/August 2001 field trip

Budget Item			CALM MCB ($ in kind)	CALM Region ($ in kind)	NHT Funds ($)	Total Costs ($)
Travel						
Vehicles	CALM Exmouth vehicle - $0.45/km for 3080 km				1,386	1,386
Tire repair etc					200	200
		Sub-total	**-**		**1,586**	**1,586**
Taxi fares	Inglewood/Airport				50	50
Air fares	1 x return Perth-Exmouth (based on full fare)				650	650
	1 x return Perth-Exmouth (based on full fare)					
Accommodation	Coral Bay				600	600
Food and drink	4 people @ $40/person/day x 14				2,240	2,240
		Sub-total	**-**		**3,540**	**3,540**
Staff						
Adam Meyer	7 days @ $197.72			3,898		3,898
Tim Grubba	14 days* @ $237.23				7,737	7.737
Dive medicals	1 x $150				150	150
Diving allowances	30 hours @ $3.90			60	60	120
		Sub-total	**-**	**3,958**	**7,947**	**11,905**
Equipment						
Exmouth boat hire & 25 hp o/b	12 days @ $100			1,200		1,200
GPS units (Capital purchase)	2 @ $550 + accessories @ $400				1,500	1,100
DGPS unit	12 days @ $150		1,800			1,800
DGPS Unit (hire)	12 days @ $50				600	600
1 x SCUBA sets	12 days @ $100		1,200			1,200
10 x SCUBA cylinders	12 days @ $50			600		600
Handled VHF radios	12 days @ $15			180		180
Satellite phone	12 days @ $10 plus 60 min @ $1.80/minute				228	228
Laptop Computer	12 days @ 50		600			600
2 x Underwater digital videos	12 days @ $100		1,200			1,200
		Sub-total	**4,940**	**1,980**	**2,328**	**8,848**
Consumables						
Fuel and oil					500	500
Air fills	50 @ $10				500	500
Digital video tapes	10 x DVM-E60 @ $14.75				148	148
Digital video backup tapes	10 x DVM-E60 @ $14.75				148	148
Slide Film	5 x Fuji Sensia 200 & processing				150	150
Freight costs	Perth – Exmouth and Exmouth - Perth				700	700
Dive medical	Tim Grubba				150	150
Other consumables	Gloves/pencils/chalk/erasers/batteries…etc				500	500
		Sub-total	**-**	**-**	**2,796**	**2,796**
		Total	**4,940**	**5,938**	**18,197**	**28,675**

* Includes days pre and post

3.8 EQUIPMENT

3.8.1 Marine Conservation Branch

3.8.1.1 Video systems

Primary

- Canon MV1 digital video camera with battery packs (4) and chargers (1)
- Amphibico underwater video housing
- Pelican case
- Housing O-ring kit and silicone grease
- Cleaning kit
- Instruction manuals

- Digital video tapes (4)
- Leads, remote control, spares
- TV/video unit

Backup

- Canon MV1 digital video camera with battery packs (4) and chargers (1)
- Amphibico underwater video housing
- Housing O-ring kit and silicone grease
- Cleaning kit
- Instruction manuals
- Leads, remote control, spares

3.8.1.2 Still photography

- Land camera
- 2 rolls of 36 exposure slide film
- log book for cameras
- kit of camera spares

3.8.1.3 Diving

- Personal dive gear
- 1 BCD
- 2 regulators with alternate airsource and gauges
- 1 weight belts
- 2 dive computers
- 1 compasses
- 4 underwater slate and pencil
- 100 sheets of underwater paper
- box elastic bands
- printed underwater paper for recording video codes
- Scuba log book

3.8.1.4 Information

- Reference books for the identification of corals, fish and marine fauna
- Selected aerial photographs
- Habitat data sheets
- Transect data sheets
- Non-transect monitoring site data sheets
- Video data sheets
- Laptop computer (ArcView installed and CD-ROM of NMPMP project)
- 2 field notebooks
- 1 box of pencils
- 1 stationary box
- equipment log book

3.8.1.5 Position fixing and communications

- 2 hand held GPS units and accessories
- Demodulator unit (DGPS)
- 1 Mobile/satellite phone
- 1 CALM hand-held radio and charger

3.8.1.6 Additional equipment

- 8 x pre cut marker buoys
- 4 x 8lb weights
- 3 x 50 m weighted transect lines marked at 10 cm increments (and 1 spare)
- Comprehensive mechanical tool kit
- Comprehensive electrical repair kit
- 20 AA batteries (for GPS unit)

3.8.2 CALM Exmouth

3.8.2.1 Safety

- Comprehensive diving first aid kit
- Emergency response flowsheet
- Emergency contact flow chart
- Patient information log
- Accident log sheets
- Oxy-viva units (1)
- Spare oxygen D cylinder and regulator
- Sunscreen
- Vinegar and flask hot water

3.8.2.2 Diving

CALM Exmouth Office will supply diving equipment. (Except for personal dive gear, regulator, and BCD)

- Personal dive gear
- xxx scuba tanks (how many scuba tanks)
- 3 BCD's
- 3 regulators with alternate airsource and gauges
- 3 weight belts
- 3 dive computers
- 1 compasses
- 1 boat dive flags
- 1 personal dive flag
- dive spare parts and repair kits

3.8.2.3 Vehicles

- 4WD vehicle (fitted with CALM VHF)
- Off road safety gear (tyre inflator couple to SCUBA cylinder)

3.8.2.4 Boating

- All safety equipment for survey exempt vessel
- Quintrex- Aluminium with 40hp outboard
- 3.7 m Quicksliver inflatable with 15 hp outboard
- Bags, repair kit, ropes, oars and lines, and fuel tanks

3.8.2.5 Communications

- 1 CALM hand-held radio and charger
- CALM vehicle equipped with CALM VHF

3.8.2.6 Additional equipment

- Comprehensive mechanical tool kit
- Comprehensive electrical repair kit

4 DATA MANAGEMENT

4.1 FIELD PROGRAMME 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_3901] 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#2001

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\NMP\NMP_Monitoring_Program\ NMPMP_Survey5_08_01\ Datasheets_08_01
2. written into a Marine Management Support Data Report and copies will be held at the same locations as for the Field Programme 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 to be stored at the Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry Street, Fremantle, Western Australia..

5 REPORT DISTRIBUTION LIST

Copies of this report will be distributed to:
- Chris Simpson, Manager, Marine Conservation Branch.
- Jennie Cary, Senior Marine Ecologist, Marine Conservation Branch.
- Doug Myers, Manager, Exmouth District.
- All survey team members (4).

6 PUBLICITY/EDUCATION

6.1 PUBLIC RELATIONS OPPORTUNITIES

An article will be presented in the MCB newsletter, *Marine Conservation Matters*.

6.2 EDUCATION OPPORTUNITIES

Nothing is planned for this field survey

7 REFERENCES

Cary JL, Grubba T, Hogstrom A, Milton K, Williams C 2000. Human Usage in Ningaloo Marine Park. Data Report MMS/NIN/NMP – 20/2000. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry St., Fremantle, Western Australia, 6160). Unpublished report.

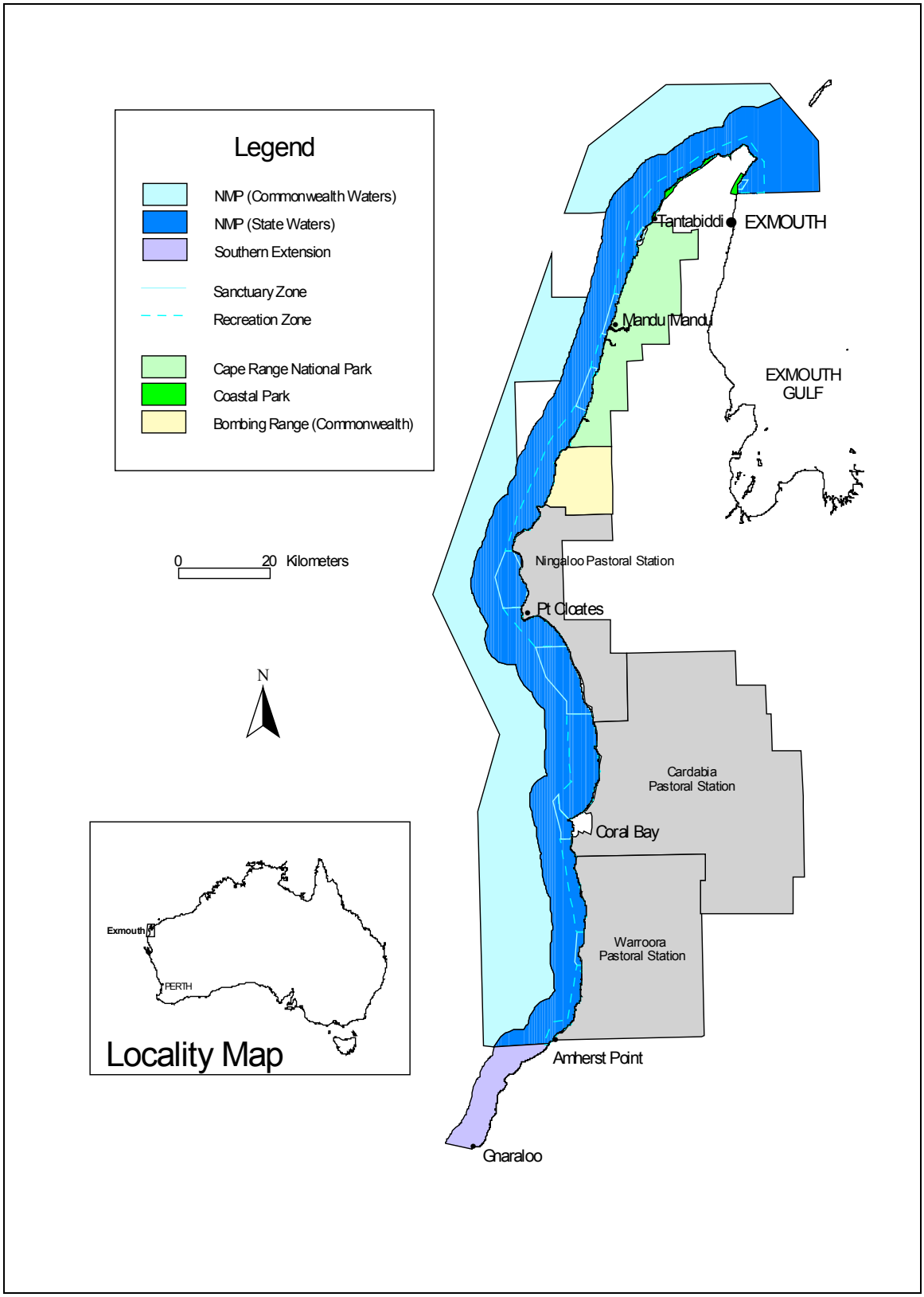
Cary J L, Grubba T L and Myers J (1999). Ningaloo Marine Park Monitoring Program: Benthic Monitoring sites established in 1998. Data Report MMSP/PI/NMP-18/98. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry Street, Fremantle, Western Australia, 6160). Unpublished report.

Cary J L, Grubba T L, Mahendran M & Radford B (2000). Ningaloo Marine Park Monitoring Program: Benthic monitoring sites established in 1999. Data Report: MMS/PI/NMP_21/2000 (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry St., Fremantle, Western Australia, 6160). Unpublished report.

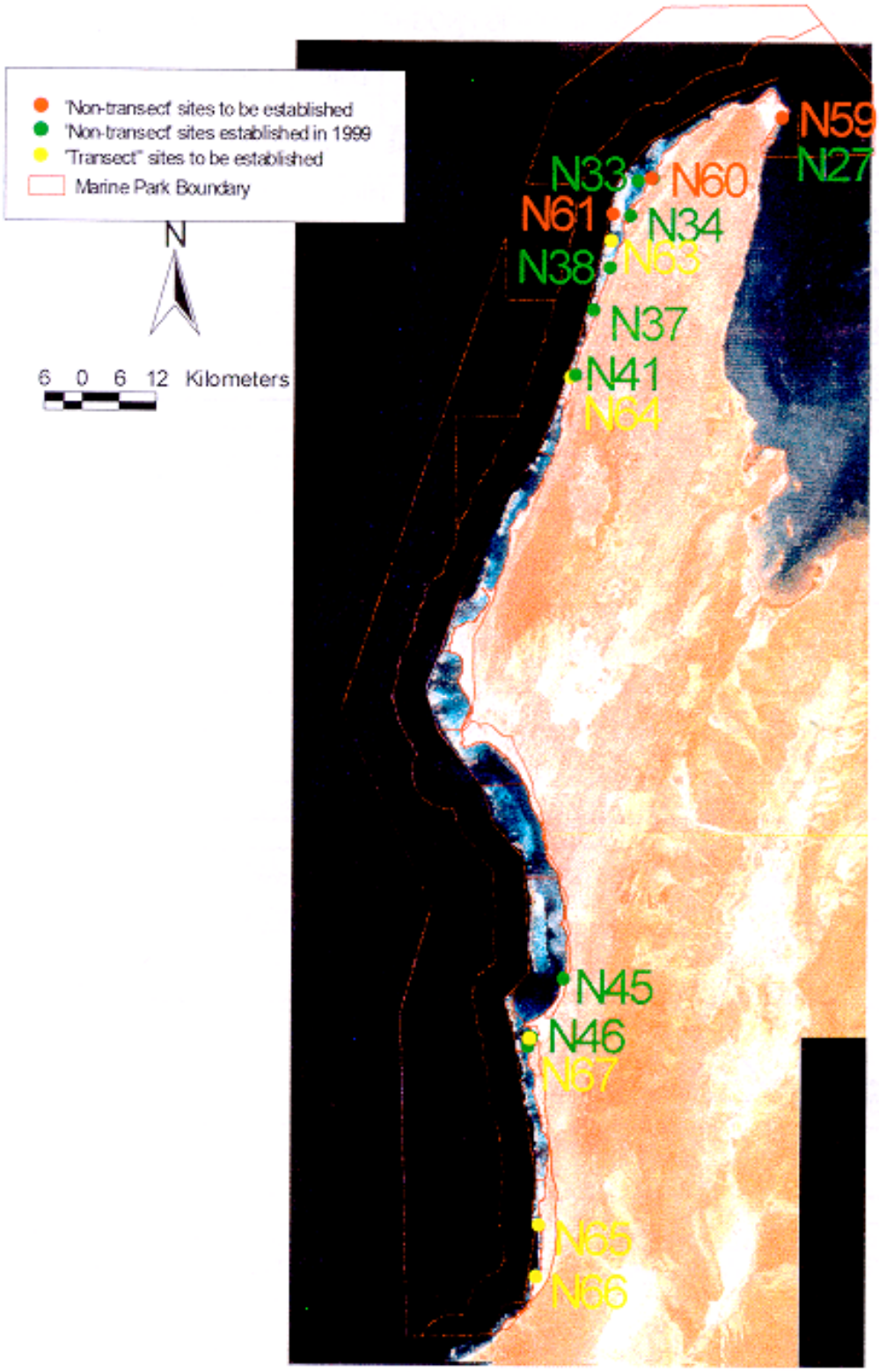
Cary J L and Grubba T L (2000). Survey of the monitoring sites established in 1989 after coral mortality in Bills Bay from the coral mass spawning event of March 1989. Field Program Report MMS/NMP-24/2000 (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry Street, Fremantle, Western Australia, 6160). Unpublished report.

APPENDICES

APPENDIX 1: LOCATION MAP OF NINGALOO MARINE PARK AND THE PROPOSED SOUTHERN EXTENSION



APPENDIX 2: LOCATION MAP OF 'NON-TRANSECT' MONITORING SITES TO BE RE-SURVEYED AND 'NON-TRANSECT' AND TRANSECT SITES TO BE ESTABLISHED IN NINGALOO MARINE PARK DURING JULY/AUGUST 2001



APPENDIX 3: COMPLETED DATA SHEETS

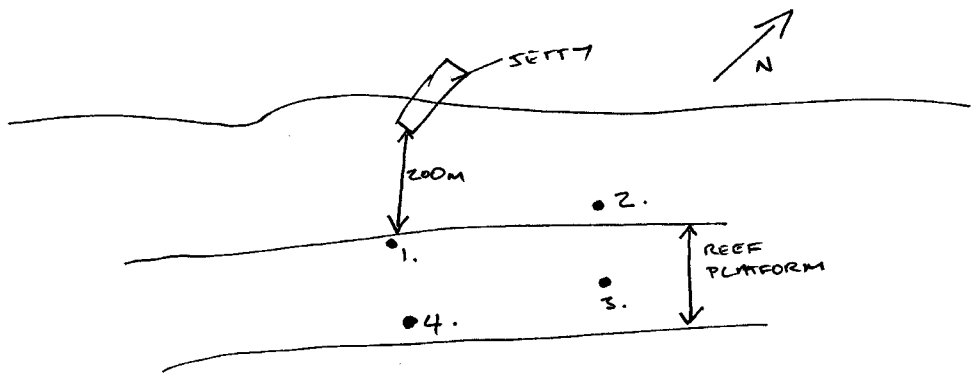
NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N27	**Site Name**	Bundegi- human usage	**Date**	4-08-99	**Observer**	Cary

Co-ordinates of Boundary Markers			**Observed Impacts**
	DGPS Latitude	**DGPS Longitude**	Extensive cyclone damage (cyclone Vance, 1999).
1	21° 49.669' S	114° 10.783' E	
2	21° 49.683' S	114° 10.797' E	
3	21° 49.666' S	114° 10.816' E	
4	21° 49.644' S	114° 10.809' E	
5			1x piece of fishing line 20m S of NW corner
6			

No video footage taken

Video operator		**Tape no.**	NMPMP/ / /#	**Main Human Activity**	
Time coding for all video footage at site:		**From:**	: : :	**To:**	: : :



Notes:

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N27	**Site Name**	Bundegi - human usage	**Date**	4-8-99	**Recorder**	Cary
Vessel	AIMS 4.3M NAIAD CALM 3.5M Zodiac	**Time**	12:00	**Weather**	Fine		
Sea	Calm	**Water depth (m)**	1.0-2.0	**Water visibility (m)**	8.0		

GPS Latitude	GPS Longitude	Differential			
21° 49.669' S	114° 10.783' E	**Yes**	☒	**No**	☐

Site location	Site located on back reef 200m offshore from the Bundegi jetty.

Habitat Description

Back reef – coral dominated by Acropora sp. (branching and digitate) with large areas of dead coral. Fungidae are common and occasional *Galaxea* sp., *Favia* sp. and *Platygyra* sp.

Dominant Species

Seagrass	
Macro-algae	
Coral	*Acropora* sp. (branching and digitate).
Fish	Labridae (wrasse), Scaridae (parrotfish), Pomacentridae (damselfish) and pipefish
Invertebrates	1 large crown of thorn star fish.

Other Features

Turtle and ray seen near site

Impact or Activity

Cyclone damage (cyclone Vance, 1999) evident masks any possible impacts caused by human activities such as snorkelling. Litter included one length (30 cm) of fishing line. No targeted reef fish or *Panulirus* sp. (rock lobster) was sighted. No *Drupella* sighted.

Video reference	No video footage taken	**Aerial reference**	5158/WA 2286/RUN3/840048
Slide reference		**Print reference**	

NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				Field Survey	AUGUST 1999
Site No.	N58	Site Name	Navy Pier	Date	11-5-98	Observer	Tim Grubba

Co-ordinates of Boundary Markers			Observed Impacts
	DGPS Latitude	DGPS Longitude	
1	21° 49.010' S	114° 11.550' E	Litter – debris on seabed and fishing lines/sinkers on pier pylons
2			Discharge of cooling water half way along the pier
3			
4			
5			
6			

Video operator	Cary / Grubba	Tape no.	NMPMP/bvt /12-5-98 /#4	Main Human Activity	Diving
Time coding for all video footage at site:		From:	:00:00:00	To:	:06:02:02

Site Map (include north indicator, scale, water depth, boundary markers & approximate location of observed impacts):

Notes: The site was surveyed in 1998 but was not included in the 1998 data report.

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N58	**Site Name**	Navy Pier	**Date**	11-5-98	**Recorder**	Cary
Vessel	Shore Dive	**Time**	7:15am	**Weather**	Slight Breeze		
Sea	Calm	**Water depth (m)**	12.0	**Water visibility (m)**	15.0		
GPS Latitude		**GPS Longitude**		**Differential**			
21° 49.010' S		114° 11.550' E		**Yes**	☒	**No**	☐
Site location	Site located at the Navy Pier at Pt. Murat.						

Habitat Description

The dive site is dominated by the pier pylons and cross braces which provide extensive habitat for a high diversity of fouling species such as sponges, soft corals, molluscs, etc. The seabed surrounding the pier is predominantly coarse sand with outcrops of limestone, colonised by small coral colonies. Scattered along the bottom are considerable amounts of litter (eg. tyres, metal grating) which provide additional settlement substrates for sponges, ascidians, corals.

Dominant Species

Seagrass	
Macro-algae	
Coral	Small colonies of Favids, *Platygyra* sp., soft corals (sea fans, gorgonians)
Fish	High diversity of fish including Serranidae (Queensland groper, coral trout), Carangidae (trevally), Lutjanidae (red emperor, north west snapper), Mullidae (goatfish), Labridae (baldchin goper), Sphyraenidae (barracuda) and Holocentridae (squirrelfishes).
Invertebrates	Sponges, ascidians, hydroids, octopus, barnacles and molluscs

Other Features

Impact or Activity

The navy pier is a popular commercial dive site, with the Australian Navy permitting local dive shops to access and dive the pier. Despite fishing being prohibited from the pier in 1986, there is still evidence of fishing activities including the presence of fishing line, and sinkers entangled on pier pylons. There is a considerable amount of litter around the pier including, tyres, pipes and grating that have originated from the pier and vessels tied to the pier. A cooling water discharge pipe is located half way along the pier. The water discharged from this pipe is salt water and is a couple of degrees warmer than the sea. The water originates from the navy power station and also contains small amounts of sewerage. There are no visible impacts from this discharge. In the past (early eighties) when the base was used by the Americans, cooling water was sometimes contaminated by oil. No *Drupella* sighted

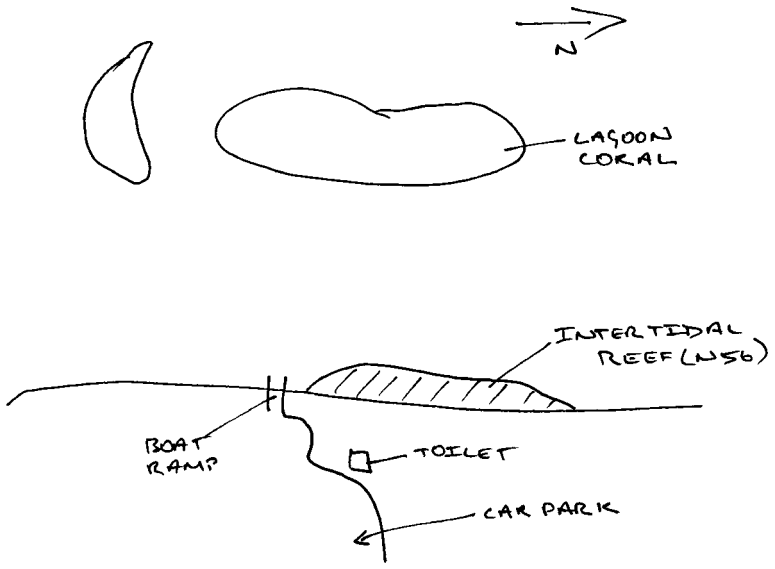
Video reference	NMPMP/bvt /19-5-98 /#9	**Aerial reference**	5169/WA 3405/RUN16/940592
Slide reference		**Print reference**	

NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				Field Survey	AUGUST 1999
Site No.	N56	Site Name	Tantabiddi boat ramp	Date	8-8-99	Observer	Cary

Co-ordinates of Boundary Markers			Observed Impacts
	DGPS Latitude	DGPS Longitude	
1	21° 54.700' S	113° 58.748' E	
2			
3			
4			
5			
6			

Video operator	Cary	Tape no.	NMPMP/bvt/18-8-99 /#3	Main Human Activity	Toilet block
Time coding for all video footage at site:		From:	:9:00:	To:	:13:00:



Notes:

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N56	**Site Name**	Tantabiddi boat ramp	**Date**	8-8-99	**Recorder**	Cary
Vessel		**Time**	15:00	**Weather**	Slight SE		
Sea		**Water depth (m)**		**Water visibility (m)**			

GPS Latitude	GPS Longitude	Differential			
21° 54.700' S	113° 58.748' E	**Yes**	☒	**No**	☐

Site location	Site located on an intertidal reef north of the Tantabiddi boat ramp.

Habitat Description

Intertidal reef covered in *Ulva* sp.

Dominant Species

Seagrass	
Macro-algae	*Ulva* sp. and *Padina* sp.
Coral	
Fish	
Invertebrates	Many small molluscs and gastrropods

Other Features

Impact or Activity

The large amounts of *Ulva* sp. could be natural or due to possible nutrient enrichment from toilet block. No litter sighted. No *Drupella* sighted.

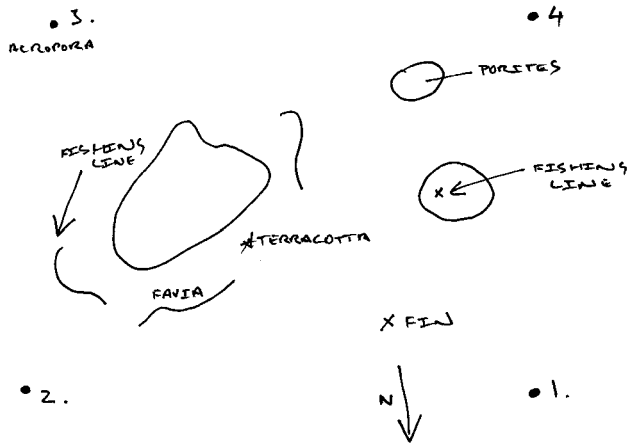
Video reference	NMPMP/bvt/8-8-99 /#3	**Aerial reference**	/WA /RUN /
Slide reference		**Print reference**	

NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				Field Survey	AUGUST 1999
Site No.	N33	Site Name	Tantabiddi-Snorkel	Date	9-8-99	Observer	Williams

Co-ordinates of Boundary Markers			Observed Impacts
	DGPS Latitude	DGPS Longitude	
1	21° 54.913' S	113° 57.330' E	5 x separate pieces of fishing line- on top of *Porites* sp.
2	21° 54.922' S	113° 57.378' E	2 x pieces terracotta
3	21° 54.948' S	113° 57.363' E	
4	21° 54.936' S	113° 57.328' E	
5			
6			1 x Snorkelling fin outside area

Video operator	Williams	Tape no.	NMPMP/ bvt/9-8-99 /#4	Main Human Activity	Snorkel Fishing
Time coding for all video footage at site:		From:	:0:0:0	To:	:12:07:00



Notes: This map should be read in conjunction with N35 map. N35 glass bottom boat tour finished at snorkel site (N33)

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N33	**Site Name**	Tantabiddi-Snorkel	**Date**	9-8-99	**Recorder**	Williams
Vessel	AIMS 4.3M NAIAD CALM 3.5M Zodiac	**Time**	10:30	**Weather**	SE 8- 10 NE 10-15		
Sea	Calm	**Water depth (m)**	3.5	**Water visibility (m)**	8.0		

GPS Latitude	GPS Longitude	Differential			
21° 54.913' S	113° 57.330' E	**Yes**	☒	**No**	☐

Site location	Site located adjacent to the Tantabiddi boat ramp at the glass bottom boat snorkelling site.

Habitat Description

Lagoon – coral dominated by *Porites* sp. with white sand patches

Dominant Species

Seagrass	Few *Halophila* sp. floating past
Macro-algae	
Coral	*Porites* sp., *Millepora* sp., *Favia* sp., Mussidae, and very sparse *Acropora* sp.
Fish	Pomacentridae (damselfish), Labridae (wrasse), Scaridae (parrot fish), Mullidae (goatfish), and *Sillago* sp. (whiting),
Invertebrates	Urchins x 4 spp., few Holothurians, and *Asteroidea*

Other Features

Few juvenile Lethrinidae (north west snapper)
1 x *Triaenodon obesus* (whitetip shark) (1m)
No *Panulirus* sp. (rock lobster).
1 Cowrie shell
4- 5m diameter *Porites* sp. (massive) surrounded by *Millepora* sp.

Impact or Activity

The site is used by the glass bottom boat operator at Tantabiddi, for snorkelling. There is no evidence of impacts due to snorkelling.
Litter at the site included: one fin (on the bottom outside the area), five pieces of old fishing line snagged on *Acropora* sp. and on the tip of *Porites* sp and two pieces of terracotta. No *Drupella* sighted.

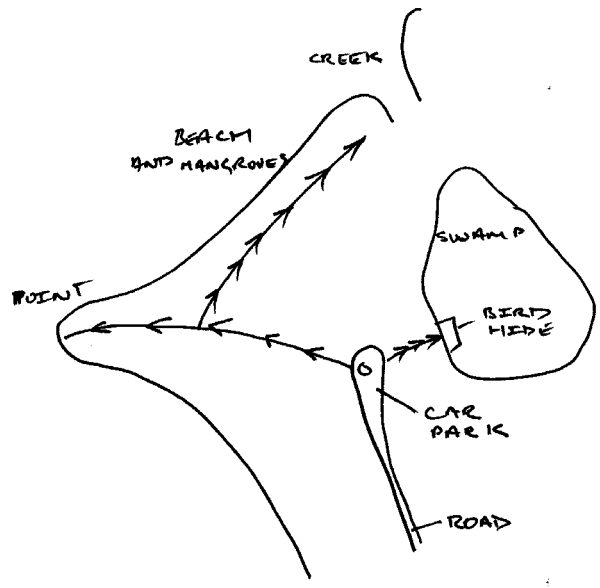
Video reference	NMPMP/bvt/9-8-99 /#4	**Aerial reference**	5031/WA 3405/RUN4/940592
Slide reference		**Print reference**	

NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999
Site No.	N34	**Site Name**	Mangrove Walk	**Date**	7-8-99	**Observer**	Williams

Co-ordinates of Boundary Markers			**Observed Impacts**
	DGPS Latitude	**DGPS Longitude**	Litter along beach (three cans)
1	21° 57.858' S	113° 56.579' E	Bird watchers trampling on the mangrove
2			
3			
4			
5			
6			

Video operator	Daly	**Tape no.**	NMPMP/bvt/7-8-99 /#3	**Main Human Activity**	Bird watching
Time coding for all video footage at site:		**From:**	:0:0:0	**To:**	:6:01:14



Notes: Footage of sign, walk track and bird hide. No coordinates taken.

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N34	**Site Name**	Mangrove Walk	**Date**	7-8-99	**Recorder**	Williams
Vessel		**Time**	10:30	**Weather**	Fine, sunny 25knots SE		
Sea		**Water depth (m)**		**Water visibility (m)**			

GPS Latitude	GPS Longitude	Differential			
21° 57.858' S	113° 56.579' E	**Yes**	☒	**No**	☐

Site location	Site located onshore only and included the bird hide and adjacent mangroves.

Habitat Description

Mangrove *Avicennia marina* and *Rhizophora stylson*

Dominant Species

Seagrass	
Macro-algae	
Coral	
Fish	
Invertebrates	

Other Features

Birds: Mangrove Gerygone
Eastern reef heron

Impact or Activity

The site is used as a day use area with the most popular activity being bird watching. Litter spread along the beach including: cans x 6, bottle x 1, plastic bags etc.

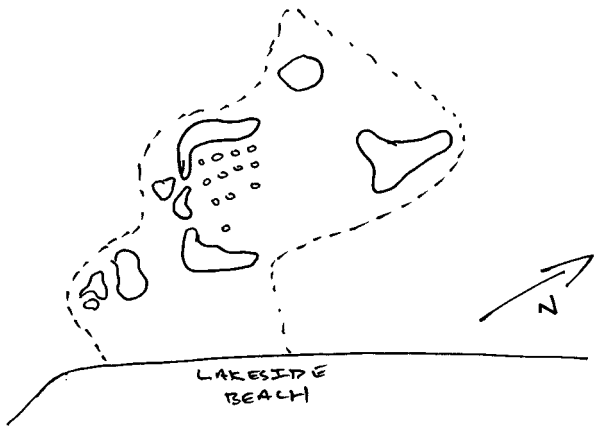
Video reference	NMPMP/bvt/7-8-99 /#3	**Aerial reference**	5043/WA 3405/RUN5/940592
Slide reference		**Print reference**	

NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999
Site No.	N38	**Site Name**	Lakeside	**Date**	5-8-99	**Observer**	Cary

Co-ordinates of Boundary Markers			**Observed Impacts**
	DGPS Latitude	**DGPS Longitude**	Litter- fishing line found at 4 spots
1	22° 02.295' S	113° 54.585' E	
2			
3			
4			
5			
6			

Video operator	Cary/ Daly	**Tape no.**	NMPMP/ bvt/5-8-99 /#3	**Main Human Activity**	Snorkelling/ fishing
Time coding for all video footage at site:		**From:**	:00:00:	**To:**	:14:56:



Notes: From CALM dive and snorkel book

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N38	**Site Name**	Lakeside	**Date**	5-8-99	**Recorder**	Cary
Vessel		**Time**	16:00	**Weather**	5 knot N/W		
Sea		**Water depth (m)**	3	**Water visibility (m)**	15		

GPS Latitude	GPS Longitude	Differential			
22° 02.295' S	113° 54.585' E	**Yes**	☐	**No**	☐

Site location	Site located in the lagoon adjacent to the Lakeside access ("Lakeside bommies" in *CALM Dive and Snorkel sites in Western Australia*).

Habitat Description

Lagoon – corals include *Porites* sp. (bommies 0.5-4m), and some *Acropora* sp. (branching and tabular).

Dominant Species

Seagrass	
Macro-algae	
Coral	*Porites* sp. x 3 spp., *Acropora* sp. (tabular and branching) and *Pocillopora* sp.
Fish	Scaridae (parrotfish), Labridae (wrasse), *Amphiprion* sp.(Anemonefish), *Epinephelus tukula* x 1(Potato cod – 90cm) and Plotosidae (catfish).
Invertebrates	*Sepioteuthis lessoniana* (squid), *Melo amphora* (baler shell), *Octopus* sp (Octopus), Holothurians (sea cucumber), Cypraeidae x 5 spp. (cowries), Anemone and *Sepia* sp. (cuttlefish)

Other Features

Chelonia mydas (green turtle),

Impact or Activity

On average 10 people per day use Lakeside between April and October. The following litter was sighted at the site: fishing line found at four spots and terrestrial debris from cyclone Vance in 1999. CALM Exmouth region clean the site annually. Evidence of impacts including damage to *Acropora* sp (branching) that could be due to anchoring and snorkelling (fin damage). No size targeted fish species or *Panulirus* sp. (rock lobster) sighted. *Drupella* were sighted at two spots on *Acropora* sp. (tabular).

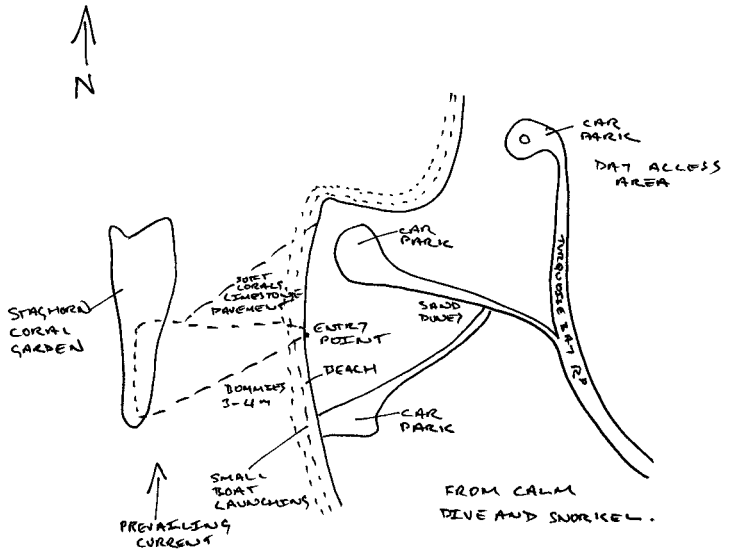
Video reference	NMPMP/ bvt/5-899 /#3	**Aerial reference**	5049/WA 3405/RUN5/940592
Slide reference		**Print reference**	

NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				Field Survey	AUGUST 1999		
Site No.	N37	Site Name	Turquoise Bay	Date	7-8-99	Observer	Daly Williams	

Co-ordinates of Boundary Markers			Observed Impacts
	DGPS Latitude	DGPS Longitude	Small parts of broken *Porites* sp. (difficult to determine whether impact due to cyclone or snorkelling)
1	22° 05.979' S	113° 53.056' E	Litter (1 piece of clothing found)
2			
3			
4			
5			
6			

Video operator	Daly	Tape no.	NMPMP/ bvt/7-8-99 /#3	Main Human Activity	Snorkelling
Time coding for all video footage at site:		From:	:6:01:14	To:	:16:22:01



Notes:.

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N37	**Site Name**	Turquoise Bay	**Date**	7- 8 -99	**Recorder**	Williams
Vessel		**Time**	12:00	**Weather**	17 knots S/E		
Sea		**Water depth (m)**	5.0	**Water visibility (m)**	15.0		

GPS Latitude	GPS Longitude	Differential			
22° 05.979' S	113° 53.056' E	**Yes**	☐	**No**	☐

Site location	Site located at Turquoise Bay ("Turquoise Bay – southern drift and Turquoise Bay brain coral" in *CALM Dive and Snorkel sites in Western Australia*).

Habitat Description

Lagoon – coral dominated by *Acropora* sp (digitate and branching) and *Sinularia* sp. (soft coral).

Dominant Species

Seagrass	Sparse *Cymodocea* sp. and *Halophila ovalis*
Macro-algae	
Coral	*Acropora* sp. (digitate and branching), *Sinularia* sp. (soft coral) and large *Porites* sp.
Fish	Lethrinidae (north west snapper), Labridae (wrasse), Scaridae (parrotfish) and Pomacentridae (damselfish).
Invertebrates	Holothurians (sea cucumbers)

Other Features

Carcharhinus limbatus (blacktip sharks).

Impact or Activity

Evidence of impacts includes small amounts of broken *Porites* sp. however it is difficult to establish whether damage is due to snorkelling or cyclone Vance, 1999. Only one piece of litter was sighted a piece of clothing. No target recreational fished species or *Panulirus* sp. (rock lobster). No *Drupella* sighted.

Video reference	MPMP/ bvt/7-8-99 /#3	**Aerial reference**	5028/WA 3405/RUN6/940592
Slide reference		**Print reference**	

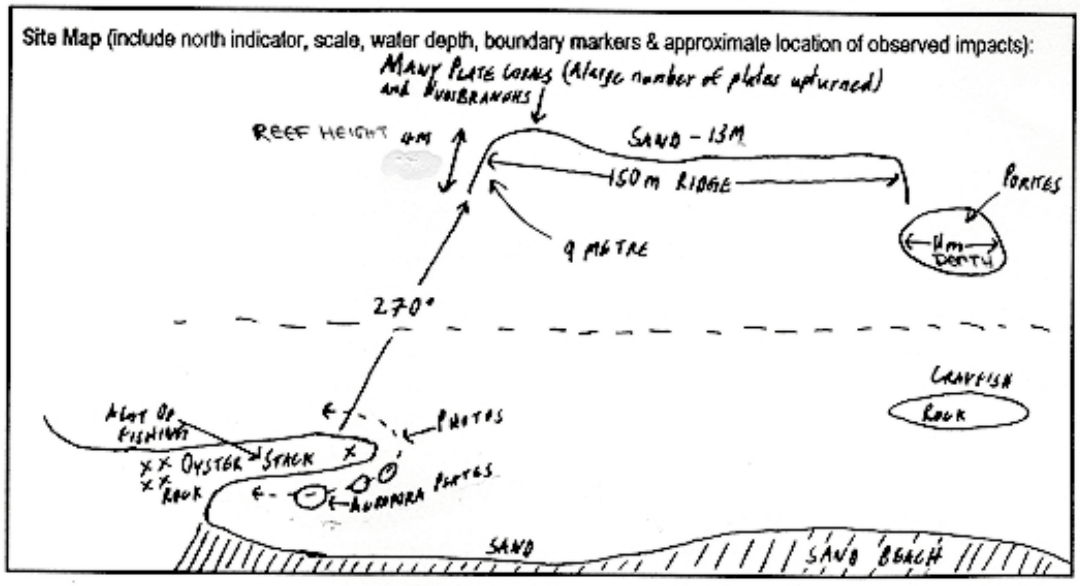
NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				Field Survey	AUGUST 1999
Site No.	N45	Site Name	The lagoon	Date	9-8-99	Observer	Cary

Co-ordinates of Boundary Markers			Observed Impacts
	DGPS Latitude	DGPS Longitude	This is a popular spot for recreation activities such as fishing, squiding, swimming and scuba diving.
1	23° 03.433' S	113° 49.272' E	
2			
3			
4			
5			
6			

Video operator	Daly	Tape no.	NMPMP/bvt/19-8-99/#7	Main Human Activity	Snorkel 4wd day trippers 4 wheel motor bike tours
Time coding for all video footage at site:		From:	0:00:00:0	To:	0:01:41:00

Site Map (include north indicator, scale, water depth, boundary markers & approximate location of observed impacts):



Notes: Onshore footage taken on 19-8-99

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N45	**Site Name**	The lagoon	**Date**	9-8-99	**Recorder**	Cary
Vessel		**Time**	10:00	**Weather**	Slight breeze		
Sea		**Water depth (m)**		**Water visibility (m)**			

GPS Latitude	GPS Longitude	Differential			
23° 03.433' S	113° 49.272' E	**Yes**	☐	**No**	☐

Site location	Site located approximately 9.5km from Pt. Maud.

Habitat Description

Lagoon - coral reef dominated by *Acropora* sp. (digitate).

Dominant Species

Seagrass	*Halophila* sp.
Macro-algae	
Coral	*Acropora* sp. (digitate) and *Sinularia* sp. (soft coral).
Fish	
Invertebrates	*Drupella*

Other Features

Turtles are common at the site.
Area between Oyster bridge and Five mile.
The area 250m 270° from Oyster Stack is a ridge (4m height in 9-11m of water).

Impact or Activity

A popular site for fishing, squiding, swimming and scuba diving (commercial dive operators and dive schools use the area). Two locals told the story of a recreational fisher three years ago that caught bags of *Panulirus* sp. (rock lobster) at the site. If the fisher could not reach rock lobsters under plate corals then a rope was attached to the base of the plate and pulled over using a boat. No *Panulirus* sp. (rock lobster) were sighted. Litter at the site is fishing tackle with 20 coral colonies observed to have fishing line, gang hooks and squid jigs. *Drupella* abundance is medium to high, with approximately 60 individuals sighted during the survey.

Video reference	NMPMP /bvt /19-08-99 /#7	**Aerial reference**	DMH 612
Slide reference	Yes	**Print reference**	

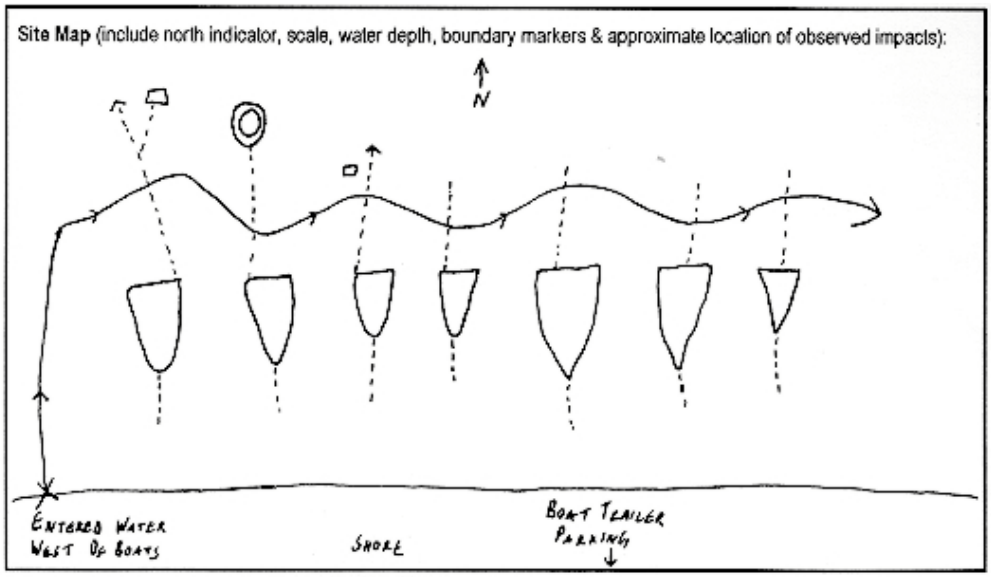
NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N46	**Site Name**	Coral Bay Moorings	**Date**	18-8-99	**Observer**	Daly Williams

	Co-ordinates of Boundary Markers		**Observed Impacts**
	DGPS Latitude	**DGPS Longitude**	Coral rubble swept into heaps by mooring chains
1	23° 08.482' S	113° 46.198' E	Litter : beer cans and tree branches (possibly due to cyclone)
2			Mooring chains secured to coral bommies
3			
4			
5			
6			

Video operator	Daly	**Tape no.**	NMPMP/bvt /18-9-99 /#7	**Main Human Activity**	Boat moorings
Time coding for all video footage at site:		**From:**	0:00:00:00	**To:**	0:20:25:00

Site Map (include north indicator, scale, water depth, boundary markers & approximate location of observed impacts):



Notes: Snorkel only, see chart DMH 612 for location.

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N46	**Site Name**	Coral Bay Moorings	**Date**	18-8-99	**Recorder**	Daly
Vessel		**Time**	16 00	**Weather**	20 km SW Fine		
Sea	Calm inshore	**Water depth (m)**	2.0 – 5.0	**Water visibility (m)**	6.0		

GPS Latitude	GPS Longitude	Differential			
23° 08.482' S	113° 46.198' E	**Yes**	☐	**No**	☐

Site location	Site located in boat moorage on shore south Bill's Bay adjacent to the Coral Bay settlement.

Habitat Description

Lagoon – coral community dominated by coral rubble and sand with some small clumps of live coral (*Acropora* sp.).

Dominant Species

Seagrass	
Macro-algae	
Coral	*Acropora* sp., *Porites* sp. and Faviidae.
Fish	Labridae (wrasse), Pomacentridae (Damselfish) and *Lethrinus nebulosus* (spangled emperor).
Invertebrates	Holothurian (sea cucumber).

Other Features

Impact or Activity

The area is used by recreational and commercial vessels for mooring, anchoring, re-fuelling, loading and unloading, boat launch. The area is highly degraded by the use of anchors, mooring chains and vessel groundings. In some cases large *Porites* sp (massive) have been damaged by mooring chains being wrapped around them. Litter at the site includes old moorings, drink containers, 44-gallon drums and other general rubbish. There is also terrestrial debris such as tree branches, possibly due to cyclone Vance in 1999. No *Drupella* were sighted.

Video reference	NMPMP/ bvt /18-8-99 /#7	**Aerial reference**	DMH 612
Slide reference		**Print reference**	

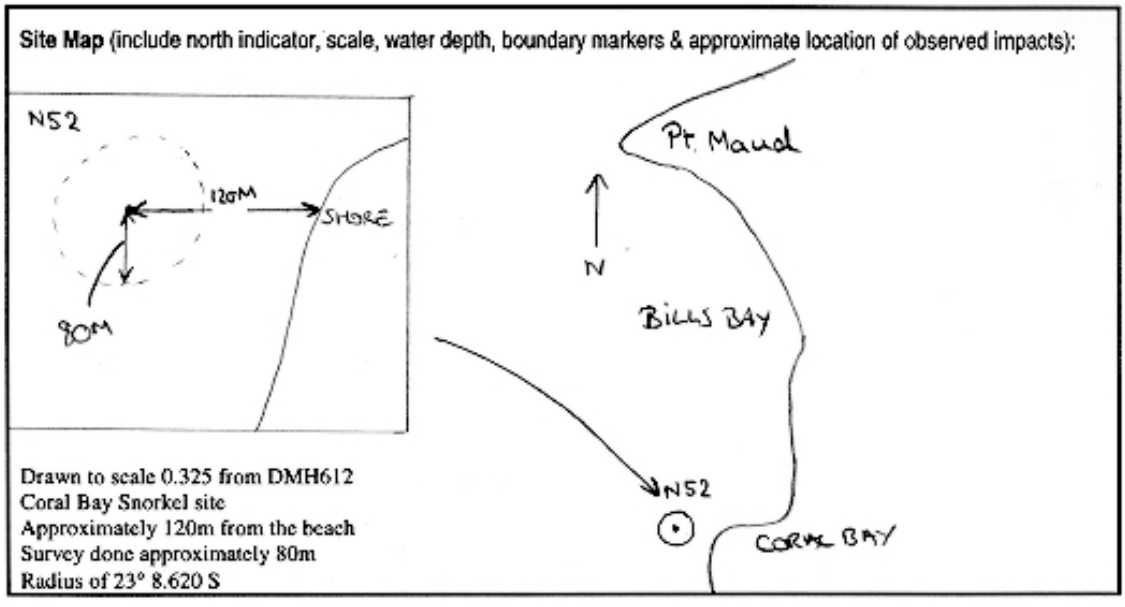
NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				Field Survey	AUGUST 1999
Site No.	N52	Site Name	Coral Bay Snorkel	Date	20-8-99	Observer	Daly Mahendran

Co-ordinates of Boundary Markers			Observed Impacts
	DGPS Latitude	DGPS Longitude	Broken glass (bottles and plates), Plastic bag, Recently broken sections of plate coral (possibly snorkelers), Up turned plate corals (damage 1-2 years old), Old mooring, Some coral bleaching and *Drupella* scars sighted.
1	23° 08.477' S	113° 46.042' E	
2			
3			
4			
5			
6			

Video operator	Mahendran Daly	Tape no.	NMPMP/bvt/18-8-99 /#8	Main Human Activity	Snorkel Snuba
Time coding for all video footage at site:		From:	0:0:0:0	To:	0:23:14:00

Site Map (include north indicator, scale, water depth, boundary markers & approximate location of observed impacts):



Notes: Some good general footage

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N52	**Site Name**	Coral Bay Snorkel site	**Date**	20-8-99	**Recorder**	Mahendran
Vessel		**Time**	14:00	**Weather**	20 knots		
Sea	SSW Fine	**Water depth (m)**	3.0 – 4.0	**Water visibility (m)**	10.0		

GPS Latitude	GPS Longitude	Differential			
23° 08.477' S	113° 46.042' E	**Yes**	☐	**No**	☐

Site location	Site located approximately 2.3km south of Pt Maud.

Habitat Description

Lagoon – coral dominated by *Acropora* sp. and *Pocillopora* sp.

Dominant Species

Seagrass	
Macro-algae	
Coral	*Pocillopora* sp., *Montipora* sp., *Echinopora* sp., *Acropora* sp. (tabular and branching) and occasional *Favia* sp. and *Favites* sp.
Fish	Lethrinidae (north west snapper), Plotosidae (catfish), Labridae (wrasse), Pomacentridae (damselfish), *Kyphosus* sp (buff bream), Mullidae (goatfish) and *Rhinecanthis aculeatus* (white-barred triggerfish)
Invertebrates	Holothurians (sea cucumber)

Other Features

Green turtle (70cm)

Impact or Activity

The site is located very close to the Coral Bay settlement and is a popular spot for swimming and snuba. Evidence of impacts from snorkelling and boating activities including broken corals. Litter includes one plastic bag, six broken bottles and five broken plates. No *Panulirus* sp. (rock lobster) sighted. No *Drupella* sighted.

Video reference	NMPMP/bvt/20-8-99 /#7	**Aerial reference**	DMH 612
Slide reference		**Print reference**	

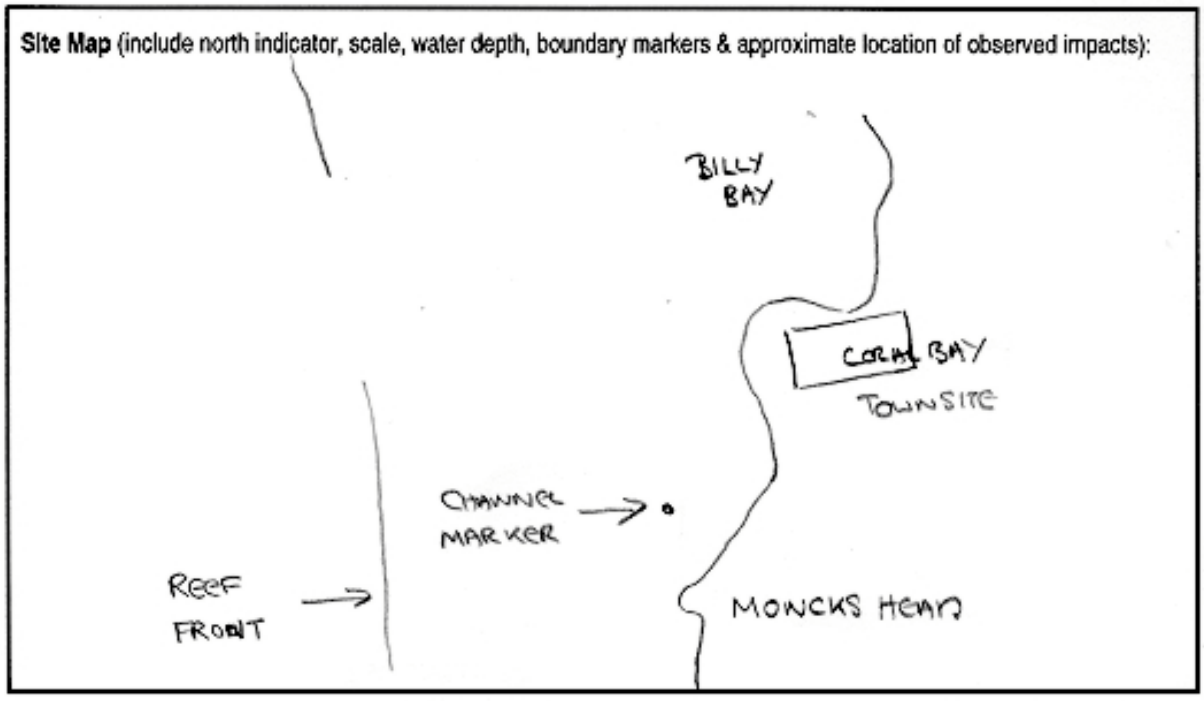
NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				Field Survey	AUGUST 1999
Site No.	N57	Site Name	Monck Head channel marker	Date	15-5-98	Observer	Cary

Co-ordinates of Boundary Markers			Observed Impacts
	DGPS Latitude	DGPS Longitude	
1	23° 09.250' S	113° 45.800' E	Coral damage by boats with deep draft
2			
3			
4			
5			
6			

Video operator	Cary / Grubba	Tape no.	NMPMP/bvt /19-5-98 /#9	Main Human Activity	Boating
Time coding for all video footage at site:		From:	:00:00:00	To:	:20:40:20

Site Map (include north indicator, scale, water depth, boundary markers & approximate location of observed impacts):



Notes: Although site established in 1998 it was not included in the 1998 data report.

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**	AUGUST 1999	
Site No.	N57	**Site Name**	Monck Head channel marker	**Date**	19-5-98	**Recorder**	Cary
Vessel		**Time**		**Weather**	Slight Breeze		
Sea		**Water depth (m)**	1- 3m	**Water visibility (m)**	5 m		

GPS Latitude	GPS Longitude	Differential			
23° 09.250' S	113° 45.800' E	**Yes**	☐	**No**	☐

Site location	Site located at Monck Head channel marker.

Habitat Description

Lagoon – coral dominated by *Acropora* sp. (branching).

Dominant Species

Seagrass	
Macro-algae	
Coral	*Acropora* sp. (branching)
Fish	
Invertebrates	

Other Features

Impact or Activity

Extensive coral damage caused by deep drafted boats navigating through the channel. In many cases there are distinctive v-shaped cuts through colonies of *Acropora* sp. (branching). The channel marker mooring chain as also caused localised damage around the mooring site. No *Panulirus* sp. sighted. No *Drupella* sighted.

Video reference	NMPMP/bvt /19-5-98 /#9	**Aerial reference**	5169/WA 3405/RUN16/940592
Slide reference		**Print reference**	

APPENDIX 4: BLANK DATA SHEETS

TRANSECT LOCATION DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**		Jul/Aug 2001
Site No.		**Site Name**		**Date**		**Recorder**	
Time		**Video tape no.**			**Video operator**		

T1	**Length (m)**		**Compass bearing (°)**		**Distance to T2 (m)**		
Transect	**DGPS Lat**		**DGPS Long**		**Depth (m)**	**Picket type**	**Picket ht (m)**
Start	° ’ S		° ’ E				
Finish	° ’ S		° ’ E				
Notes:							

T2	**Length (m)**	**50**	**Compass bearing (°)**	180	**Distance to T3 (m)**	60
Transect	**DGPS Lat**		**DGPS Long**		**Depth (m)**	**Picket type**	**Picket ht (m)**
Start	° ’ S		° ’ E				
Finish	° ’ S		° ’ E				
Notes:							

T3	**Length (m)**	**50**	**Compass bearing (°)**	195	**Distance to T1 (m)**	170
Transect	**DGPS Lat**		**DGPS Long**		**Depth (m)**	**Picket type**	**Picket ht (m)**
Start	° ’ S		° ’ E				
Finish	° ’ S		° ’ E				
Notes: .							

LONG-TERM MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**		Jul/Aug 2001
Site No.		**Site Name**		**Date**		**Recorder**	

T1 Latitude start	**T1 Longitude start**	**Differential**			
° ' S	° ' E	**Yes**	☐	**No**	☐

Habitat type			
Video reference		**Aerial reference**	

Notes:

HABITAT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**		Jul/Aug 2001
Site No.		**Site Name**		**Date**		**Recorder**	
Vessel		**Time**		**Weather**			
Sea		**Water depth (m)**		**Water visibility (m)**			
DGPS Latitude		**DGPS Longitude**		**Differential**			
° ’ S		° ’ E		**Yes**	☒	**No**	☐
Site location							

Habitat Description

Dominant Species

Seagrass	
Macro-algae	
Coral	
Fish	
Invertebrates	

Other Features

Impact or Activity

Video reference		**Aerial reference**	
Slide reference		**Print reference**	

VIDEO DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**		Jul/Aug 2001
Site No.		**Site Name**		**Date**		**Recorder**	
Start time		**Finish time**		**Depth (m)**		**Visibility (m)**	

Underwater Video System	Canon MV1 digital camcorder in Amphibico housing.														
Focus mode				**Exposure mode**				**Program mode**				**White balance mode**			
Auto	☒	Manual	☐	Auto	☒	Manual	☐	Sports	☐	High-speed	☒	Auto	☒	Outdoor	☐
Lens system				**Filters**								**Lights**			
Wide-angle	☒	Zoom-macro	☐	None	☒	Red	☐	Yellow	☐	Orange	☐	On	☐	Off	☒

Video operator		**Tape no.**		**Height above substrate (cm)**	
Time coding for all video footage at site:		**From:**		**To:**	

Transect time coding	**Start**	**Finish**	**Total time (mins/secs)**
T1			
T2			
T3			

NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM					Field Survey	Jul/Aug 2001
Site No.		Site Name		Date		Observer	

Co-ordinates of Boundary Markers			Observed Impacts
	DGPS Latitude	DGPS Longitude	
1	° ' S	° ' E	
2	° ' S	° ' E	
3	° ' S	° ' E	
4	° ' S	° ' E	
5	° ' S	° ' E	
6	° ' S	° ' E	

No video footage taken

Video operator		Tape no.	NMPMP/ / /#	Main Human Activity	
Time coding for all video footage at site:		From:	: : :	To:	: : :

Notes:

APPENDIX 5: 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 degrees and decimals of a minute (three 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 the DOLA bench mark should 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 6: MANGROVE 'HEALTH' (FROM THE *MARINE COMMUNITY MONITORING MANUAL*)

5 MANGROVE HEALTH

SKILL RATING: ♀ EQUIPMENT RATING: ♀ ♏

TIME RATING: ⧖⧖⧖ FREQUENCY RATING: 🔔🔔🔔🔔🔔

5.1 OBJECTIVE

To monitor the health of mangrove forests in areas likely to be affected by existing and potential coastal developments.

5.2 BACKGROUND

Mangroves are a diverse group of largely tropical trees, shrubs, palms and ferns that have adapted for life between the tides on sheltered shores, estuaries and tidal creeks. There are 39 species of mangroves in Australia. Australia's mangroves are of world significance and rank third largest in area (11,558 square kilometres) and occur along 22 per cent of the coastline.

In Western Australia there are 2,517 sq km of mangrove forest and 18 mangrove species. Mangrove communities line extensive stretches of sheltered shores between Bunbury in the south and the Northern Territory border. Mangroves have the highest diversity in the humid tropics where 16 species are represented. The diversity drops to six species along the more arid Pilbara coast. South of the Pilbara, diversity drops to just one species that reaches Bunbury.

The two most common and widespread mangrove species in Western Australia include the Red Mangrove, *Rhizophora stylosa* and the Grey or White Mangrove, *Avicennia marina*. The Red Mangrove extends from the Northern Territory border south to Yardie Creek, adjacent to Ningaloo Marine Park. The White Mangrove is the only species that occurs south of Yardie Creek.

Mangroves have a high ecological and commercial importance. They are important nurseries and habitats for many species of fish, including many commercially important fish. They are an important source of nutrients for many species of migratory animals (eg. shore birds). Mangroves protect the coast from erosion due to storm waves and contribute to shoreline accretion by acting as sediment traps.

Mangroves make a significant contribution to estuarine and inshore productivity through energy pathways involving decomposition of leaves and branches after they fall onto the microbial rich sediment below. Food chains, which rely on the microbes and products of plant decomposition, support dense populations of resident and migratory animals both within the mangrove communities and in adjacent habitats.

Mangrove communities are impacted by natural events such as cyclones, tidal waves or coastal erosion. They are also threatened by a variety of human activities such as land filling, dredging, deforestation, changes in adjacent agricultural practices, pollution and discharges from power and desalination plants. Clearing and reclamation of mangroves is occurring at around one per cent per annum in the Philippines, Thailand, Malaysia and Ecuador. If this trend continues, Australia will have the Indo-Pacific region's least disturbed mangrove forests.

5.3 RELEVANCE TO MANAGEMENT

Most of the mangrove forests in Western Australia are in good condition. Some mangrove forests have been lost as a result of salt farms, ports and road works and industrial and urban landfill.

Information from this method would be used by managers to address the cause of any decline in mangrove health.

5.4 LINKS TO OTHER METHOD/S & PROGRAM/S

The method is linked to:

- Method 2.2 Water temperature (thermometer); and
- Method 2.3 Water temperature (temperature logger).

5.5 SUMMARY OF METHODOLOGY

Count the number of dead and living trees in a 100-m^2 area and estimate the percentage of living leaves on 20 tagged mangrove trees.

5.6 EQUIPMENT

NECESSARY

- plastic tags (refer to Information Sheet 5.1);
- *Site Registration Form 5.1*;
- *Data Sheet 5.1*;
- *Information Sheet 5.1*; and
- set of five nautical mile grid sheets for WA (refer to Part I section 13).

OPTIONAL

- GPS unit (Most effective means of determining site position) (refer to Part II section 1.4); and
- aerial photograph/s (refer to Part II section 3.10).

5.7 MANGROVE IDENTIFICATION

This method requires the identification of two species of mangrove. The following are excellent sources to assist in identifying mangroves.

⚔ **INFORMATION SHEET 5.1**

⚔ **PART II SECTION 9:** *REFERENCES*

5.8 SITE SELECTION

Select sites that have significant numbers of mature mangrove trees. Mangrove forests occur predominantly in the north of the State but do extend south to Bunbury. When selecting mangrove forests try to:

- select mangrove forests that may be threatened by existing and/or proposed developments; and
- select trees in the upper reaches of the mangrove forests range ie. the furthermost distance from the coast, as these trees are most susceptible to changes in environmental conditions.

5.9 SITE DESCRIPTION

Once a monitoring site is established *Site Registration Form 5.1* should be completed and submitted to CALM to obtain a *Site Registration Number*. This should be recorded, along with the site name, on all data sheets for that site.

The following details need to be recorded on *Site Registration Form 5.1*:

- five nautical mile grid reference number;
- site name;
- site position in latitude and longitude (degrees, minutes and decimals of a minute); and
- 'mud' map indicating the positions of marked trees.

⚔ **PART II SECTION 1**: *SITE DESCRIPTION (ALL SUBSECTIONS)*

5.10 HOW TO MONITOR

ESTABLISHING A MONITORING SITE

The following should be carried out when the site is visited/monitored for the first time:

- determine the size of the site to be established (10m x 10m). Mark the corners of the quadrat by attaching flagging tape to trees or using wooden pickets;
- indicate the location of the quadrat on the 'mud' map on *Site Registration Form 5.1;*
- select approximately 20 mature mangrove tree from within this area;
- assign each living tree a number and attach a tag inscribed with an identification number to a branch. Attach the tag so that it won't come off but not so tight as to ring-bark the tree; and
- indicate the position of the marked trees on the mud map on *Site Registration Form 5.1*.

MONITORING

The following should be carried out during subsequent visits/monitoring of the site:

- record the numbers of dead and living mangrove trees within the quadrat. Only count mangrove trees, which have the greater portion of their trunk/s within the quadrat;
- re-locate each of the marked trees by referring to *Site Registration Form 5.1*;
- record an estimate of the percentage of living leaves and dead leaves for each tagged tree; and

- record an estimate of the percentage cover of canopy for each tagged tree (assess canopy coverage of other trees in area away from human activities to assist in this estimation):

0 %	1 – 24%	25 – 49%	50 – 74%	75 - 100%

⚔ **INFORMATION SHEET 5.1:** *PERCENTAGE OF LIVING LEAVES AND LIVING /DEAD TREES*

⚔ **INFORMATION SHEET 5.1:** *TAGGING TREES*

5.11 OPTIONAL METHODS

If an camera or video camera is available it is a good idea to photograph or video the tagged trees. Refer to the information sheet for standard methods. If photographs or video footage are taken the details should be recorded on the *Data Sheet 5.1*.

⚔ **INFORMATION SHEET 5.1**: *UNDERWATER PHOTOGRAPHY AND VIDEO.*

5.12 WHEN TO MONITOR

The tagged mangrove trees should be monitored annually.

5.13 DATA COLLECTION AND DATA MANAGEMENT

The data collected should be entered on *Data Sheet 5.1*. Data submitted to CALM will be entered in the *Marine Community Monitoring Database*. There is currently no mechanism to display this data on the *WA Atlas* internet site, http://www.wallis.wa.gov.au/atlas.

5.14 ADDITIONAL NOTES

Please read the following and refer to the relevant sections:

- this method requires participants to work in mangrove areas. If sites are located in the north of the state, beware of saltwater crocodiles.
- this method involves the installation of pickets that can pose a safety hazard and prior to their installation it is essential that observers read the safety section.

⚔ **PART II SECTION 4**: *SAFETY ISSUES*

⚔ **PART II SECTION 6**: *BE ENVIRONMENTALLY SENITIVE WHEN MONITORING.*

DATA SHEET 5.1 MANGROVE HEALTH

PLEASE READ THIS SECTION BEFORE COMPLETING THE DATA SHEET.

Fill in the data sheet every time that a site is monitored. Refer to the Marine Community Monitoring Manual *for details on the method, safety and being environmentally friendly.*

DATE / /
DD / MM / YY

TIME : AM PM
HH : MM

CONTACT DETAILS

IDENTIFICATION NUMBER *

* *Only complete if you are registered with the CALM/AMCS WA Marine Community Monitoring Program*

FIRST NAME

LAST NAME

SITE DETAILS

SITE REGISTRATION NUMBER *

* *from* ***Site Registration Form***

SITE NAME *

* *Official or descriptive name*

REQUIRED OBSERVATIONS

NUMBER OF DEAD MANGROVE TREES IN QUADRAT

NUMBER OF LIVING MANGROVE TREES IN QUADRAT

TOTAL NUMBER OF MANGROVE TREES IN QUADRAT

DOMINANT MANGROVE SPECIES (Tick the applicable box)

RHIZOPHORA STYLOSA ☐ ***AVICENNIA MARINA*** ☐

OTHER SPECIES ☐

Mangrove trees

Tree number	% of living/dead leaves		% cover of canopy				Option	
	% of living leaves	% of dead leaves	0% - 24%	25% - 49%	50% - 74%	75% - 100%	Photograph	Video
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

INFORMATION SHEET 5.1 MANGROVE 'HEALTH'

WARNING

Remember if you are monitoring in the Northern part of Western Australia **BEWARE OF SALTWATER CROCODILES**. Ensure that someone in the group always keeps a look out. Avoid working near water bodies. If there are known to be residential crocodiles in the area it maybe wise to select another site.

Also BEWARE of other harmful marine fauna such as stingrays and sea snakes.

IDENTIFICATION OF MANGROVE TREES

Approximately 18 species of Mangrove trees/shrubs occur along sheltered coastal sections of Western Australia. Mangroves are distributed from Bunbury in the south to the Northern Territory boarder. The two most common species are the red mangrove (*Rhizophora stylosa*) and the grey or white mangrove (*Avicennia marina*). The red mangrove only occurs as far south as Yardie Creek, Ningaloo. While the grey mangrove is the only species that occurs south of Yardie, Ningaloo Marine Park.

This method doesn't require participants to be able to identify specific species of mangrove tree/shrubs. Instead participants only need to be able to identify a typical mangrove tree/shrub. Refer to the following photographs as an identification guide.

Red Mangrove (*Rhizophora stylosa*) (Photograph from Marine Life in Western Australia CD-ROM)

Grey or white Mangrove (*Avicennia marina*) (Photograph from Marine Life in Western Australia CD-ROM)

Grey or white Mangrove (*Avicennia marina*) (Photograph from Marine Life in Western Australia CD-ROM)

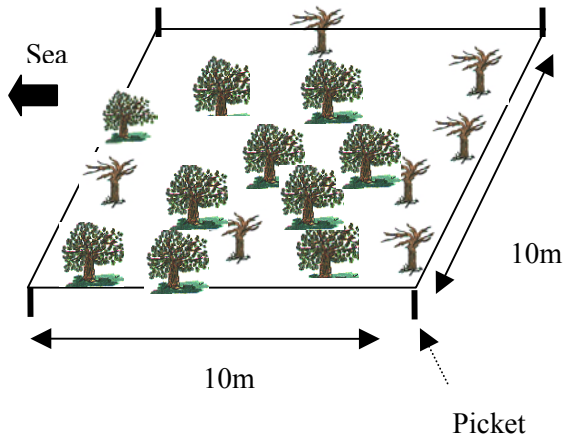
PLASTIC TAGS

A variety of plastic tags can be purchased from hardware stores, or you can make your own by cutting up an ice cream container lid into small squares and punching a hole through one end. Write the numbers on the tags using a waterproof marker. The tags should be attached to a main branch of the tree using wire. When attaching tags ensure that they will not ringbark the tree. The tags should be placed where they are visible. To make tags more visible tie a piece of flagging or surveyors tape on the tree. This tape is also handy for marking the corners of the quadrat.

PERCENTAGE CANOPY COVER

This method requires the observer to be able to estimate the percentage coverage of the canopy for each tagged tree. To assist in this estimation observers should assess the canopy cover of other trees in the area (away from the impact).

PERMANENTLY MARKED QUADRAT EXAMPLE



Remember to only count trees that have their trunk within the quadrat

In 100m2 quadrat there are

Number of dead trees = 7
Number of living trees = 10
Total number of trees = 17

SITE REGISTRATION FORM 5.1 MANGROVE HEALTH

PLEASE READ THIS SECTION BEFORE COMPLETING THE SITE REGISTRATION FORM.

A Site Registration Form *should be completed for each permanent re-locatable site. Sites only need to be registered once, when first visited/monitored. Completed forms should be submitted to CALM who will provide a* Site Registration Number. *The* Site Registration Number *must be written on all* Data Sheets *for that site. The* Site Registration Form *should be referred to when re-locating the site, so it is* ***ESSENTIAL*** *that the form is filled in completely and accurately.*

SITE REGISTRATION NUMBER

** This number will be provided by CALM/AMCS WA*

DATE AND TIME

DATE ***TIME***

/ /	: AM PM
DD / MM / YY	HH : MM

SITE REGISTERED BY

REGISTRATION NUMBER *

** ID number from the* ***Registration Form***

FIRST NAME

LAST NAME

SITE DESCRIPTION/DETAILS

SITE NAME *

** Official or descriptive name*

FIVE NAUTICAL MILE GRID REFERENCE

Letter	*Number*

LATITUDE AND LONGITUDE *

LATITUDE		S
LONGITUDE		E

** Record in degrees, minutes and decimals of a minute (3 decimal places)*

HOW WAS THE LAT/LONG DETERMINED (Tick the applicable box)

NAUTICAL CHART ☐ **GPS** ☐

WAS DATUM WGS 84 USED (Tick the applicable box)

YES ☐ **IF NO WHICH DATUM** ☐

WATER DEPTH (Tick the applicable box)

LAND ☐

IMPACTS – HUMAN AND NATURAL

TYPE OF MONITORING SITE (Tick the applicable box)

CONTROL ☐ **IMPACT** ☐

HUMAN IMPACTS IN THE VICINITY OF THE SITE (Tick the applicable box/s)

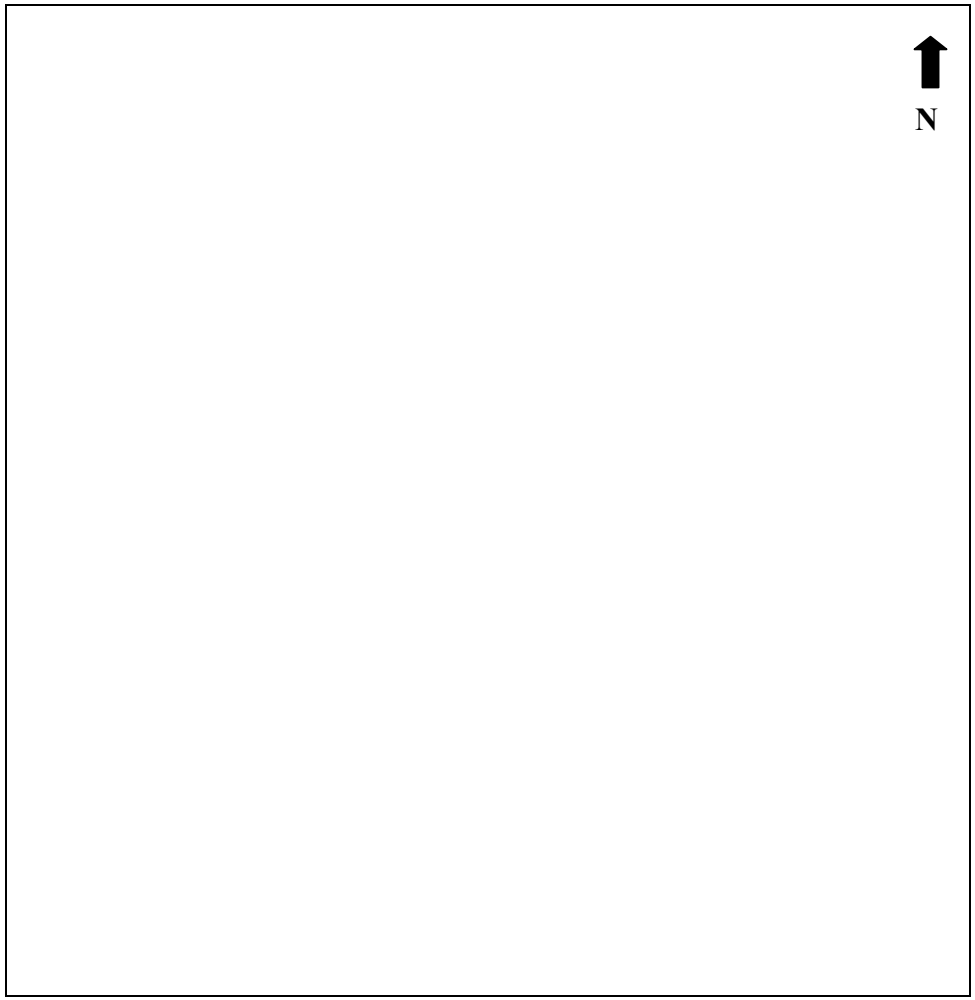
INDUSTRIAL POLLUTION	☐
SEWAGE POLLUTION	☐
DREDGING ACTIVITY	☐
MINING (MINERALS, OIL AND GAS)	☐
RECREATIONAL FISHERIES	☐
COMMERCIAL FISHERIES	☐
AQUACULTURE/PEARLING	☐
ANCHORAGE/MOORAGE	☐
COMMERCIAL TOURISM	☐

NATURAL IMPACTS IN THE VICINITY OF THE SITE (Tick the applicable box/s)

RECENT STORM DAMAGE	☐
RIVER MOUTH	☐
ELEVATED WATER TEMPERATURE (BLEACHING)	☐

SITE 'MUD' MAP

SKETCH A 'MUD' MAP OF THE SITE IN THE BOX



APPENDIX 7: PREDICTED TIDE HEIGHTS IN CMS: CORAL BAY AND TANTABIDDI (JUL/AUG 2001)

CORAL BAY

WESTERN STANDARD TIME -- PREDICTED TIDE HEIGHTS IN CMS

July 2001		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Sun	1	90	98	109	123	135	145	148	145	135	121	106	91	81	76	76	81	89	97	104	107	107	103	99	94
Mon	2	93	95	102	113	126	139	149	152	148	138	122	104	87	74	67	66	71	81	92	102	108	110	108	103
Tue	3	98	95	97	105	116	130	143	153	155	150	138	120	99	80	66	59	58	65	77	92	104	112	114	112
Wed	4	106	99	95	98	106	118	133	147	156	157	150	135	114	91	71	57	51	53	63	79	96	109	117	117
Thu	5	113	105	97	94	98	107	121	137	151	158	157	147	129	106	82	61	50	46	52	66	85	103	115	120
Fri	6	118	111	101	93	92	98	109	125	141	154	159	155	141	120	95	71	53	45	45	55	73	93	110	120
Sat	7	122	116	107	96	89	91	99	112	129	145	156	158	150	133	110	84	62	48	43	48	63	83	103	117
Sun	8	123	121	112	100	90	87	91	101	117	134	148	156	154	142	122	98	73	55	45	46	56	74	95	112
Mon	9	122	124	117	106	94	87	86	92	105	121	138	149	153	147	131	110	86	64	51	47	53	68	88	106
Tue	10	119	125	122	112	100	90	85	87	95	109	125	139	147	146	136	119	97	75	59	51	53	64	81	100
Wed	11	115	124	125	119	108	96	87	85	89	98	112	127	137	141	137	124	106	86	69	58	56	63	77	95
Thu	12	111	123	127	125	116	105	94	87	86	91	101	113	125	131	132	125	112	95	79	67	62	65	75	90
Fri	13	106	119	127	129	124	114	103	93	88	87	92	101	111	119	123	121	114	102	88	76	69	69	75	88
Sat	14	102	115	125	131	130	123	113	102	93	88	87	91	98	105	111	113	111	104	94	85	78	75	78	87
Sun	15	98	111	122	130	133	131	124	114	102	93	86	85	87	91	96	101	103	102	98	92	86	83	83	87
Mon	16	96	106	118	128	134	137	134	126	115	102	91	83	79	79	81	86	91	95	97	96	93	90	89	90
Tue	17	94	102	112	122	132	139	141	138	129	116	101	87	76	70	68	70	76	84	91	95	97	97	96	94
Wed	18	95	98	105	114	126	137	145	147	143	132	117	99	81	67	59	56	60	68	79	90	98	102	102	100
Thu	19	97	96	98	105	116	129	142	151	154	148	135	117	94	73	57	47	46	52	64	79	93	103	107	107
Fri	20	102	96	93	95	103	116	132	148	158	160	153	137	115	89	65	47	38	38	48	64	84	100	110	112
Sat	21	108	100	92	87	90	100	116	135	153	164	165	156	137	110	81	56	39	32	35	49	70	92	109	117
Sun	22	116	108	96	85	80	85	97	115	137	156	167	167	155	133	104	73	48	34	30	38	57	81	103	118
Mon	23	123	117	105	90	78	75	80	94	114	137	156	166	164	149	125	96	66	44	33	34	47	69	94	115
Tue	24	126	127	117	102	85	73	70	77	91	112	135	152	160	156	140	115	87	60	43	38	43	60	85	108
Wed	25	126	133	129	116	99	81	70	68	74	89	110	130	144	150	144	127	104	78	58	47	46	57	77	100
Thu	26	121	134	137	130	115	97	80	69	67	73	87	105	122	133	136	129	113	93	73	59	54	59	72	93
Fri	27	113	130	139	139	130	114	96	80	71	68	73	85	99	112	120	121	114	101	86	72	64	64	72	87
Sat	28	105	123	135	142	139	129	114	97	82	73	70	73	81	92	101	107	108	102	93	83	75	72	75	84
Sun	29	98	114	127	137	141	138	129	115	99	85	75	70	71	76	83	90	95	97	95	90	84	81	80	85
Mon	30	93	105	117	128	136	140	137	129	116	101	87	76	69	67	69	74	81	87	91	92	91	89	88	88
Tue	31	92	98	107	117	127	135	139	137	129	117	102	87	74	66	62	62	67	75	84	91	95	96	96	94

CORAL BAY

WESTERN STANDARD TIME -- PREDICTED TIDE HEIGHTS IN CMS

August 2001		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Wed	1	93	94	98	105	115	125	134	139	138	130	118	102	85	70	60	55	56	63	74	85	95	101	103	102
Thu	2	98	94	92	96	103	113	125	135	140	139	131	117	98	79	63	52	49	52	62	77	91	102	108	108
Fri	3	104	97	90	88	92	101	113	127	138	143	141	130	113	92	71	54	46	45	52	66	84	100	110	113
Sat	4	110	102	92	84	84	89	100	115	131	142	146	140	126	106	82	61	47	41	45	57	75	94	109	116
Sun	5	115	107	96	84	79	80	89	103	120	136	145	146	136	118	95	71	52	42	41	49	67	87	106	117
Mon	6	119	113	102	88	77	74	79	90	107	125	140	146	142	128	107	83	60	45	41	45	60	80	101	116
Tue	7	122	119	108	94	79	71	72	80	94	113	130	141	142	134	117	94	70	52	43	44	55	74	96	114
Wed	8	124	124	116	101	85	73	68	71	82	99	117	131	138	135	122	103	81	60	48	46	53	70	91	110
Thu	9	124	128	123	110	94	78	69	67	73	86	103	119	129	131	124	109	89	70	55	50	54	67	86	106
Fri	10	122	130	129	119	104	87	73	67	68	76	89	105	117	123	122	112	96	79	64	56	56	65	82	101
Sat	11	118	129	132	127	114	98	82	71	67	69	78	91	103	112	115	110	100	86	72	63	61	67	79	97
Sun	12	114	126	133	132	123	110	94	80	70	67	70	79	89	98	104	104	99	90	80	71	68	70	79	93
Mon	13	108	122	131	134	130	120	107	92	79	71	68	70	76	84	90	94	94	91	85	79	75	75	81	90
Tue	14	103	116	126	132	134	129	120	107	93	80	71	67	67	70	75	81	85	87	86	84	82	81	84	89
Wed	15	98	108	118	127	133	134	130	122	109	95	82	71	64	61	61	65	72	78	83	86	87	88	88	90
Thu	16	94	100	108	117	127	134	137	135	127	114	99	83	68	58	52	51	56	65	75	84	90	94	94	93
Fri	17	92	93	96	104	114	126	136	142	141	134	120	102	82	63	49	42	43	51	63	78	90	98	101	100
Sat	18	95	89	86	89	97	109	125	139	148	148	140	124	102	78	56	41	35	38	50	68	86	101	108	108
Sun	19	102	92	82	76	79	89	105	124	142	153	154	144	125	99	71	48	34	31	38	56	78	100	114	118
Mon	20	113	101	85	71	66	70	82	102	125	145	156	156	143	120	91	62	41	31	32	45	68	94	115	126
Tue	21	126	115	97	76	61	56	62	76	99	124	145	155	152	136	111	82	55	38	33	40	58	85	111	129
Wed	22	136	129	113	90	68	53	50	57	73	98	123	141	148	142	124	99	72	50	39	40	53	76	103	126
Thu	23	140	141	129	109	84	62	49	47	55	73	97	118	133	137	128	110	87	64	49	45	52	69	94	119
Fri	24	137	146	141	126	103	79	59	48	47	56	74	95	112	122	123	113	97	77	61	53	55	66	86	109
Sat	25	130	142	146	138	120	98	76	59	51	51	60	75	91	103	110	109	100	86	72	63	61	67	81	100
Sun	26	119	134	142	141	131	115	95	76	62	56	56	64	75	86	94	98	96	90	80	72	68	71	79	93
Mon	27	108	122	132	137	134	125	110	94	79	67	61	61	66	72	80	85	89	88	85	80	77	77	81	89
Tue	28	99	111	120	127	130	128	120	109	95	83	72	66	64	65	68	73	79	83	85	85	85	85	86	89
Wed	29	94	100	108	115	121	124	123	118	110	99	87	76	67	62	61	63	68	75	82	87	91	92	92	92
Thu	30	92	93	97	102	109	116	121	123	120	113	102	89	76	65	58	55	58	66	76	86	94	98	100	98
Fri	31	94	90	88	91	96	105	114	122	126	124	116	103	87	71	58	51	51	57	68	82	94	103	106	104

TRANSPORT - WA
Coastal Management Branch
Tides and Waves

TANTABIDDI

WESTERN STANDARD TIME -- PREDICTED TIDE HEIGHTS IN CMS

July 2001		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Sun	1	92	100	112	126	140	152	156	154	146	131	114	97	84	78	78	83	93	104	113	117	117	114	107	100
Mon	2	96	97	104	115	129	144	155	160	158	148	132	112	93	77	68	67	73	84	99	111	118	121	118	112
Tue	3	104	99	99	105	117	132	147	159	164	160	149	130	107	85	67	58	57	65	80	98	113	122	125	122
Wed	4	115	105	98	98	106	119	135	151	163	167	161	146	124	99	75	57	49	51	63	82	103	119	128	129
Thu	5	124	113	102	95	97	107	121	139	156	167	168	158	140	116	88	63	48	43	49	66	89	111	127	132
Fri	6	130	122	108	96	92	96	108	124	144	160	169	167	153	132	104	76	54	42	42	53	75	100	121	132
Sat	7	134	128	116	101	91	89	97	111	130	149	163	169	162	145	120	91	65	47	40	46	63	87	111	128
Sun	8	136	133	124	109	94	87	89	99	116	136	154	164	165	154	134	107	79	56	44	43	55	76	101	122
Mon	9	134	136	130	117	102	89	85	90	103	122	141	156	162	158	144	121	94	68	51	45	52	68	92	114
Tue	10	129	137	134	125	110	96	87	86	94	109	128	145	154	156	149	131	107	82	62	51	52	64	84	107
Wed	11	124	135	137	131	119	105	92	86	88	98	114	132	144	150	148	137	118	95	74	60	56	63	79	99
Thu	12	118	131	138	136	128	115	101	91	88	91	102	117	131	140	142	137	124	106	86	70	63	65	76	93
Fri	13	112	127	136	139	135	125	112	99	92	89	94	104	117	127	132	132	126	113	97	82	73	70	77	90
Sat	14	106	122	133	139	140	134	123	110	99	92	90	94	102	111	119	122	122	115	105	93	84	79	81	89
Sun	15	102	116	128	137	141	140	134	123	110	99	91	88	90	95	102	108	112	112	108	102	94	89	88	91
Mon	16	99	110	122	133	141	144	142	135	124	111	98	88	82	81	84	91	97	103	106	105	103	99	96	96
Tue	17	99	106	115	126	137	145	149	146	139	126	111	94	81	73	69	72	79	88	98	104	108	108	106	103
Wed	18	101	102	108	117	129	141	151	155	153	144	129	109	89	71	60	56	60	69	83	97	108	113	114	111
Thu	19	106	101	101	106	117	131	146	158	163	160	148	130	106	80	60	47	44	50	64	83	102	115	120	119
Fri	20	113	104	97	96	103	116	133	151	165	171	166	152	128	100	71	48	36	35	45	65	89	110	123	126
Sat	21	122	112	99	90	90	99	115	135	156	172	177	170	152	125	92	61	39	29	32	47	72	100	121	131
Sun	22	131	122	108	92	82	83	95	114	137	161	176	180	170	148	118	83	52	33	27	34	55	85	112	131
Mon	23	138	133	120	102	84	75	78	91	113	139	162	176	177	165	141	108	74	46	31	30	44	70	100	125
Tue	24	140	142	133	117	95	78	70	74	89	112	139	160	171	170	155	130	98	66	44	35	40	59	88	116
Wed	25	137	147	145	133	113	90	74	67	72	88	112	136	154	162	158	142	117	88	62	46	43	54	77	105
Thu	26	129	146	151	146	131	109	88	72	67	72	88	110	130	144	149	143	128	105	81	62	53	58	72	95
Fri	27	120	139	151	153	145	129	108	88	73	68	73	87	105	121	131	134	128	114	96	78	66	63	71	88
Sat	28	109	129	145	153	152	143	127	107	89	76	71	74	85	98	109	118	119	114	104	92	81	74	76	86
Sun	29	101	118	134	146	152	150	141	126	109	92	79	73	74	80	89	98	105	107	105	100	93	87	85	88
Mon	30	97	108	122	134	144	149	147	140	127	111	95	81	73	70	72	79	87	95	100	102	101	99	96	95
Tue	31	97	102	111	121	132	141	146	146	140	128	113	96	81	69	64	64	70	79	90	99	104	107	106	104

TANTABIDDI

WESTERN STANDARD TIME -- PREDICTED TIDE HEIGHTS IN CMS

August 2001		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Wed	1	101	100	103	109	119	129	140	148	147	141	129	113	94	76	63	56	56	64	77	91	103	111	114	113
Thu	2	108	102	98	100	106	116	128	140	148	149	142	129	110	88	68	54	49	51	63	80	98	112	119	120
Fri	3	116	107	98	93	95	103	115	130	144	152	152	142	126	104	79	58	46	43	51	68	89	109	121	125
Sat	4	123	114	101	90	86	91	101	117	135	149	156	152	139	119	93	67	48	40	43	56	78	102	120	129
Sun	5	129	121	108	92	82	81	89	103	122	141	154	158	150	133	108	80	56	41	39	48	68	93	115	130
Mon	6	134	128	116	98	83	75	78	90	108	129	147	156	155	143	122	94	66	47	39	43	59	84	109	127
Tue	7	136	134	124	107	88	75	72	78	94	115	136	150	154	148	132	107	79	56	43	42	54	76	102	123
Wed	8	136	139	131	116	96	79	70	71	82	101	123	140	149	148	137	117	91	66	50	45	52	71	95	118
Thu	9	134	141	137	125	107	87	73	68	73	87	108	127	140	144	138	123	102	77	59	50	53	67	89	113
Fri	10	131	141	142	133	117	97	80	70	68	76	93	112	128	135	135	126	109	88	69	58	57	66	85	107
Sat	11	127	139	144	140	128	110	90	76	69	70	80	96	112	123	127	124	113	97	79	67	63	68	82	102
Sun	12	121	135	143	143	136	122	104	87	75	70	73	83	96	108	115	116	112	102	89	77	71	73	82	98
Mon	13	115	130	140	144	141	132	118	101	86	76	71	74	81	90	99	104	105	101	95	87	81	80	85	96
Tue	14	109	123	134	141	143	139	130	117	102	88	77	72	72	75	81	88	93	96	95	93	90	89	90	95
Wed	15	104	115	125	134	141	143	140	132	120	106	91	78	69	65	65	70	76	84	91	95	97	97	97	98
Thu	16	101	106	114	123	133	140	145	144	138	127	111	93	76	63	55	54	59	68	80	92	101	105	106	104
Fri	17	101	100	101	108	118	130	141	150	152	147	134	116	93	71	53	44	43	50	65	84	100	111	115	113
Sat	18	107	99	92	92	99	112	128	144	157	161	155	140	117	90	63	43	34	36	48	70	94	113	123	124
Sun	19	117	105	91	81	81	90	106	127	149	163	168	160	141	114	82	53	34	28	35	54	82	109	127	134
Mon	20	130	118	99	79	69	69	81	101	128	152	168	170	160	138	107	72	44	30	28	42	68	100	126	141
Tue	21	143	133	114	89	68	58	60	75	100	129	154	167	167	153	128	95	62	39	30	35	56	88	119	142
Wed	22	152	148	131	107	79	58	50	54	72	100	130	151	162	159	142	115	83	54	38	36	49	76	108	136
Thu	23	154	158	148	127	98	70	52	46	53	73	102	128	145	152	145	127	101	72	51	43	48	68	97	126
Fri	24	148	160	158	144	120	91	65	50	48	56	77	102	123	135	138	129	111	88	66	54	53	65	87	115
Sat	25	138	154	160	154	137	112	86	65	52	51	61	80	100	115	123	123	114	98	80	67	61	67	82	104
Sun	26	126	143	154	155	146	129	107	85	67	57	58	67	81	95	105	110	109	101	90	79	73	73	82	97
Mon	27	114	130	142	148	146	137	123	104	87	73	65	65	70	79	88	95	99	98	94	89	84	83	86	95
Tue	28	106	117	128	136	140	138	131	119	106	92	79	72	69	69	74	80	86	91	93	94	93	93	94	97
Wed	29	102	108	115	122	128	132	132	128	120	110	97	85	75	68	65	67	72	80	88	95	99	102	103	103
Thu	30	102	102	104	109	115	122	128	131	130	124	114	101	86	72	63	59	61	68	80	92	102	108	111	110
Fri	31	106	100	96	97	101	109	119	128	134	134	128	117	100	81	65	55	52	57	70	86	102	113	118	118

TRANSPORT - WA
Coastal Management Branch
Tides and Waves

APPENDIX 8: CANNON MV1 DIGITAL VIDEO CAMERA AND UNDERWATER HOUSING INSTRUCTIONS

PREPARATION OF UNDERWATER HOUSING AND DIGITAL VIDEO UNIT

Where possible, store and prepare the equipment at room temperature to prevent condensation on the lenses of the digital video camera 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 digital video camera 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 video camera. 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 video camera or the remote commander. Connect the video camera to the TV monitor (refer to video camera instruction manual) and view the footage. Transcribe the system time code information onto the main 'non-transect' data sheet (Appendix I). Label the tape clearly (using a permanent marker pen) with the designated tape number, the site number and the date of recording as described below.

TAPE NUMBERING

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

Project acronym (NMPMP)/Sampling method (bvt - benthic video transect)/Date (03.08.99)/Tape number (#1 onwards).

Thus, the first tape might be labelled as: **NMPMP/bvt/03.08.99/#1**

If the tape contains footage spanning more than one day the tape number should indicate this (eg. **NMPMP/bvt/07-08.08.99/#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.