**MARINE MANAGMENT SUPPORT**
**PILBARA**

# 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**

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*

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**Marine Conservation Branch**

**May 2000**

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## ACKNOWLEDGMENTS

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# 1 INTRODUCTION

## 1.1 GENERAL

This field program report presents information on the May 2000 field survey to be undertaken in the Bills Bay and Bundegi areas, located in the Ningaloo Marine Park (Figure 1).

The primary objective is to re-survey 17 monitoring sites established in Bills Bay (off Coral Bay) in 1989 and re-surveyed in 1994 (Figure 2). The survey will provide information on the level of coral recovery in the ten years since coral spawn slicks caused mass mortality of corals in the bay during March 1989.

A secondary objective is to validate the re-locatability of monitoring sites established in 1998/99 in Bills Bay and Bundegi as part of the *Ningaloo Marine Park Monitoring Program* (NMPMP) to assist in planning future field trips (Figure 3). These sites were originally positioned with a DGPS, whose accuracy is specified at ± 1 m. This proposed exercise will ascertain the ease with which these sites can be relocated with a DGPS, given the original recordings.

If time is available a third objective will be to re-survey monitoring sites established in the Bundegi area as part of the NMPMP in 1998/99 in order to document a recent coral bleaching event (Figure 3).

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

The Project Supervisor (Jennie Cary) will also have the role of MCB Field Team Leader and will coordinate all activities in the field.

Caroline Williams and Adam Meyer will supervise all diving activities in the field, and will both be designated Dive Supervisors.

Other CALM staff will include Chris Simpson and Tim Grubba from the MCB and Arvid Hogstron from the Exmouth District Office.

## 1.2 BACKGROUND

MASS MORTALITY OF CORALS WITHIN BILLS BAY DUE TO CORAL SPAWN SLICKS IN MARCH 1989

In March 1989 the majority of the corals in Bills Bay, off the north-western coastline of Australia, spawned several nights earlier than usual. Flood, rather than ebb, tides at the time of spawning combined with light north-west winds and low swell conditions to restrict the dispersal of coral propagules and, as a result, large amounts of coral spawn were trapped in the bay forming extensive slicks. Fish and other animals began to die almost immediately and, over the following few days, over one million fish consisting of at least 80 species were washed ashore. A survey of the benthic communities revealed extensive mortality of corals and other reef animals over an area of about three square kilometres. Live coral cover in this area decreased from 42.9% to 9.4% and several large coral colonies up to 10 meters in diameter were killed (Appendix I). The observed mortality was believed to be the result of hypoxia (oxygen depletion) created initially by the respiratory demand of the coral spawn and maintained by the biological oxygen demand of the decomposing spawn slicks and dead animals (Simpson et al 1991).

Anecdotal reports of corals and other reef animals dying in the vicinity of coral spawn slicks on other reefs in Western Australia suggest that this phenomenon may be a relatively common event on shallow

coral reefs where coral mass spawning occurs (Simpson et al 1991). These records and observations document, for the first time, a new source of natural disturbance that has a significant influence on the community structure of some coral reefs.

THE NINGALOO MARINE PARK MONITORING PROGRAM (NMPMP)

The aim of the *Ningaloo Marine Park Monitoring Program* (NMPMP) is to assess the 'health' of major benthic habitats of the marine park and proposed southern extension. Long term monitoring sites were established in 1998 and 1999 to provide baseline ecological data from which the impacts from human activities can be monitored and managed to ensure that all activities are ecologically sustainable.

Two previous field surveys have been conducted by CALM in collaboration with the Australian Institute of Marine Science (AIMS) as part of the NMPMP (Cary and Grubba, 1998 and Cary *et al.* 1999).

- In May 1998 twenty-one long term monitoring sites (all permanent transects) were established approximately every 15 kms along the back-reef of the marine park and proposed southern extension
- In August 1999 thirty long term monitoring sites (of which nine are permanent transects) were established in areas of high human usage

CORAL BLEACHING

The Exmouth District Office of CALM observed coral bleaching in Exmouth Gulf in April 2000 during aerial reconnaissance. Bleaching was observed in the following areas:

1. Bundegi;
2. western side of reef at Serrurier Island Nature Reserve;
3. western side of Y Island Nature Reserve;
4. western side of Burnside Island Nature Reserve and
5. western side of Simpson Island Nature Reserve

## 1.3 AIMS

PRIMARY AIM

- to re-survey 17 monitoring sites established in Bills Bay (off Coral Bay) in 1989 and re-surveyed in 1994 (Figure 2). The survey will provide information on the level of coral recovery in the ten years since coral spawn slicks caused mass mortality of corals in the bay during March 1989.

SECONDARY AIMS

- to validate the re-locatability of monitoring sites established in 1998/99 in Bills Bay and Bundegi as part of the *Ningaloo Marine Park Monitoring Program* (NMPMP) to assist in planning future field trips (Figure 3). These sites were originally positioned with a DGPS , whose accuracy is specified at ± 1 m. This proposed exercise will ascertain the ease with which these sites can be relocated with a DGPS, given the original recordings
- If time is available re-survey monitoring sites established in the Bundegi area as part of the NMPMP in 1998/99 in order to document a recent coral bleaching event (Figure 3).

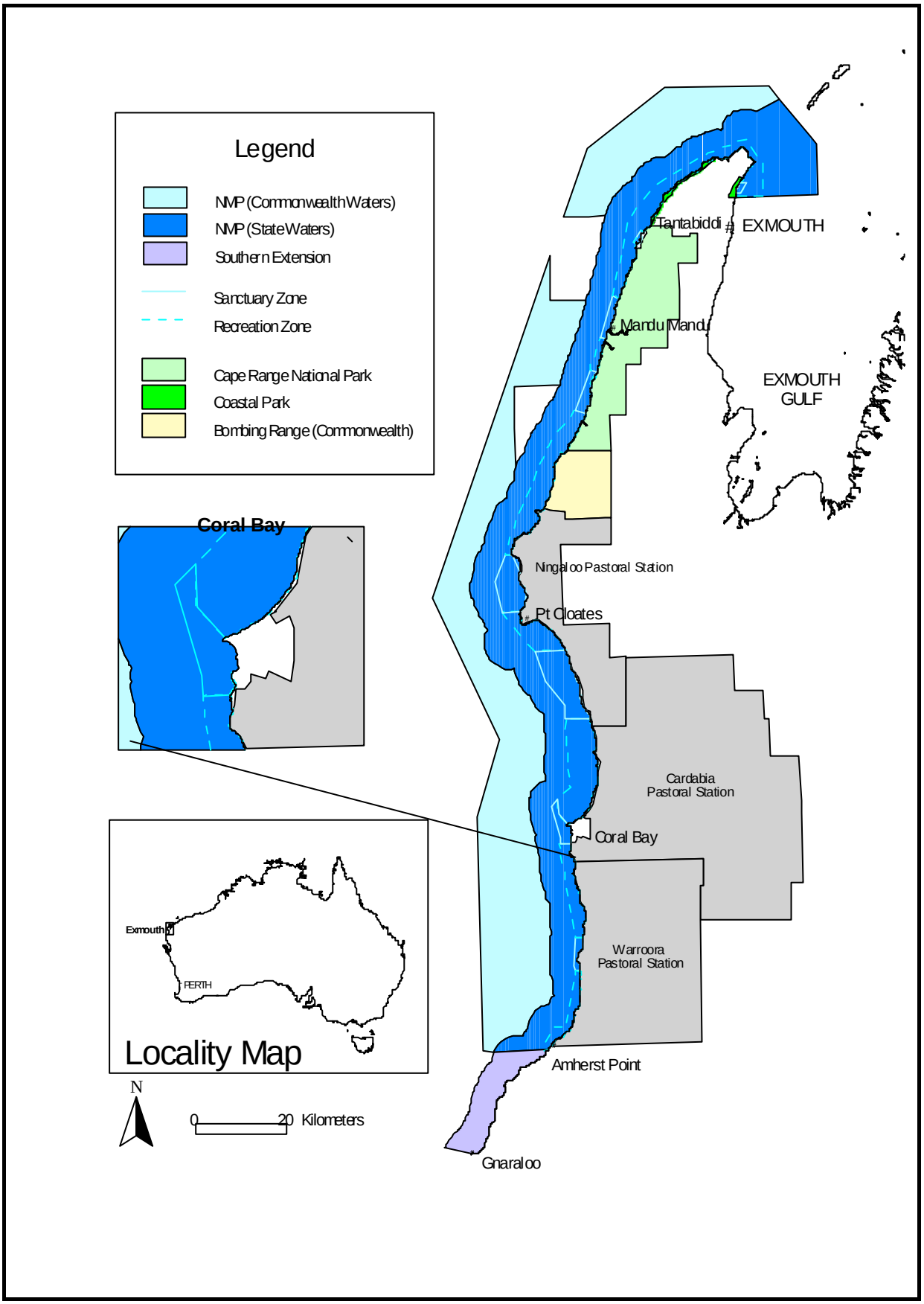


**Figure 1. Location map of Ningaloo Marine Park and proposed southern extension.**

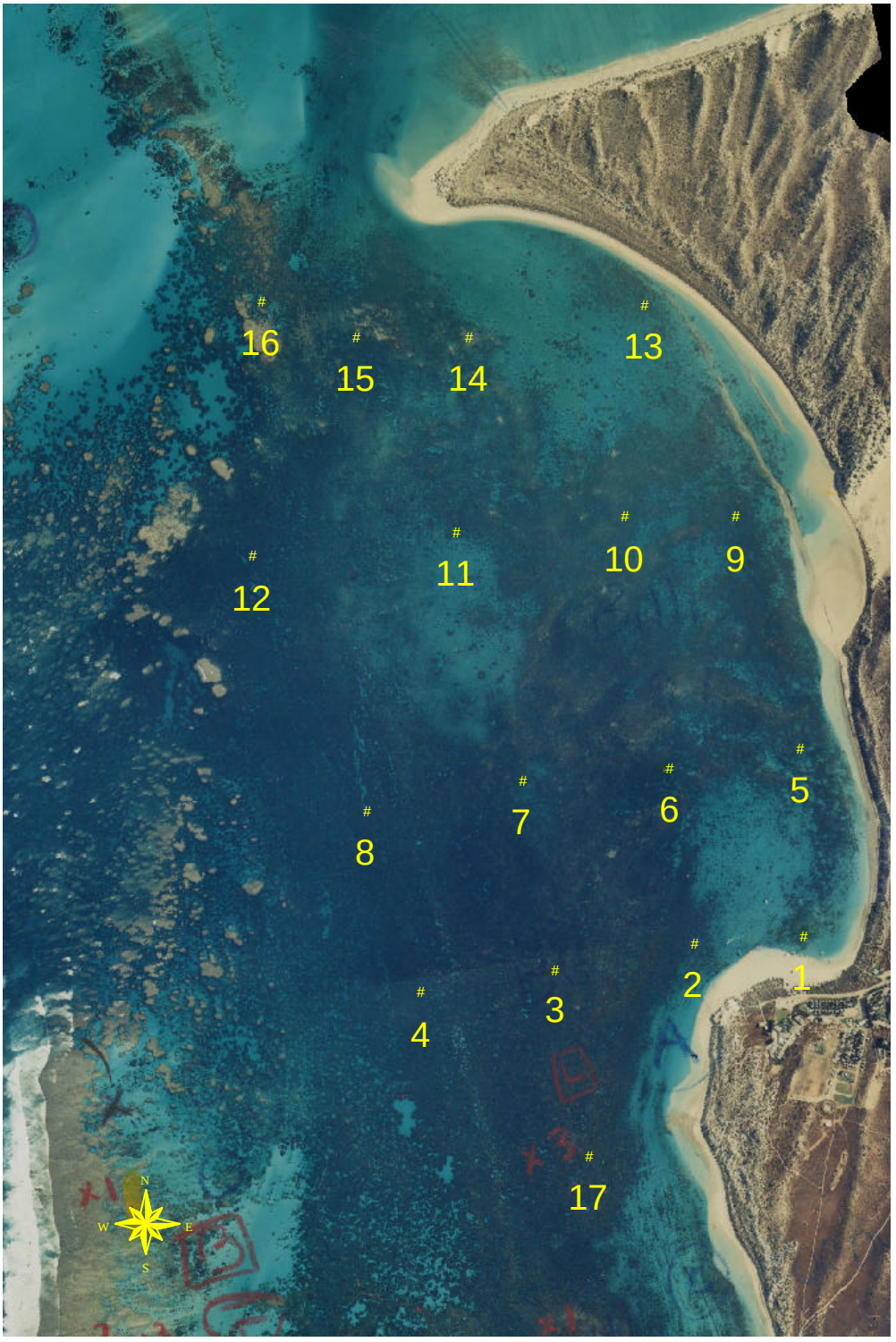


**Figure 2. Location map of monitoring sites established in Bills Bay in March1989**

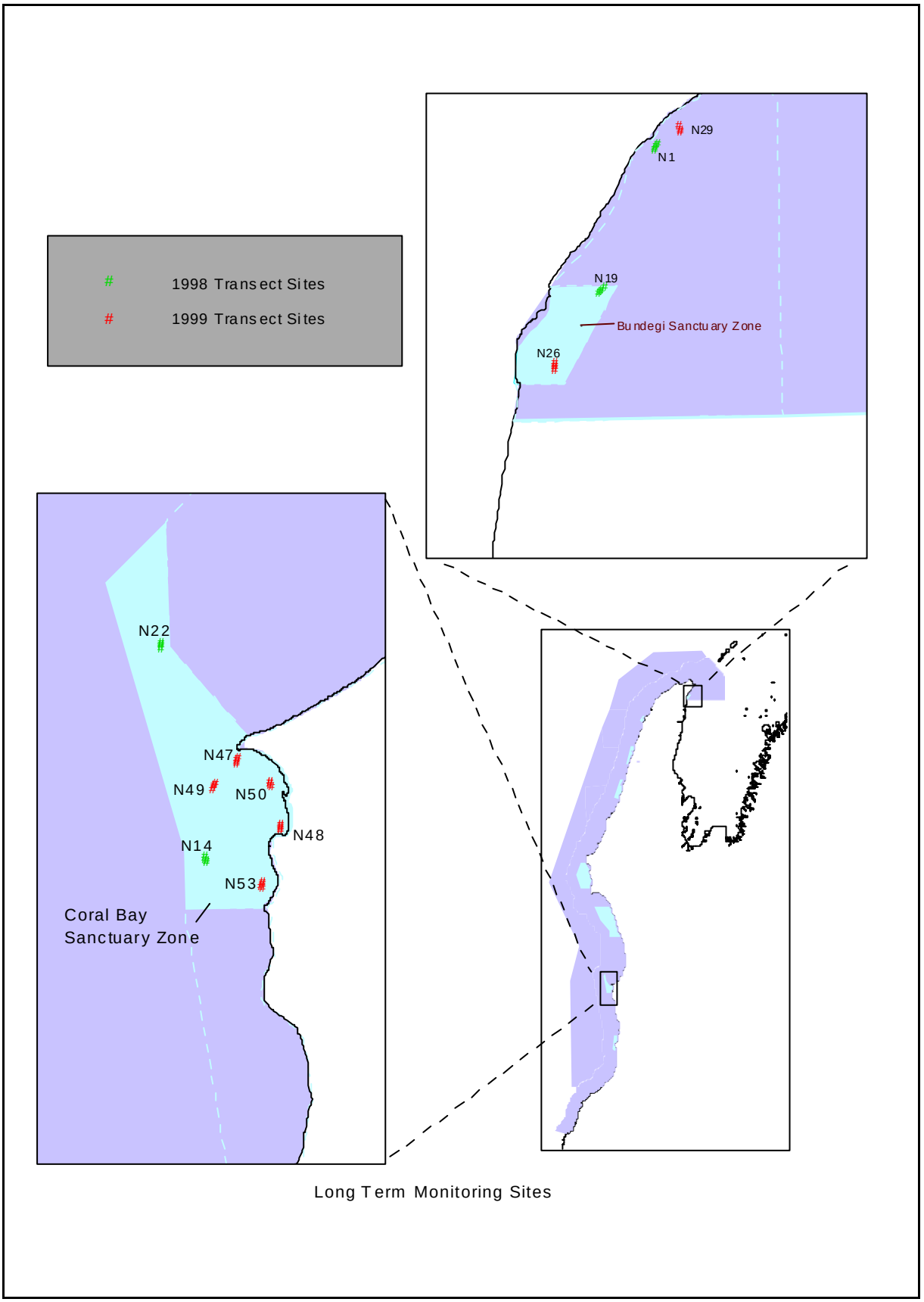


**Figure 3. Location map of permanent long-term monitoring transect sites established in the Bundegi and Bills Bay areas during the Ningaloo Marine Park monitoring program**

# 2 STUDY AREA, METHODS AND EQUIPMENT

## 2.1 STUDY AREA

The Ningaloo Reef, is a fringing-barrier coral reef enclosing a shallow lagoon that extends for about 280 kilometres along the west coast of Australia between latitudes 21º 47' - 24º S (Figure 1). The width of the lagoon ranges from 0.5 to 6 kilometres (average 2.5 kilometres) and has a mean depth at AHD of about 2 metres (Hearn et al., 1986). In 1987 the Ningaloo Marine Park (State waters) was gazetted as Marine Park Reserve No. 2 (Figure 1).

Two areas of the Ningaloo Marine Park will be visited during the May 2000 field trip including the Bundegi and Bills Bay areas.

BUNDEGI AREA

The Bundegi area is situated in the northern part of the marine park on the eastern shores of the North West Cape in the Exmouth Gulf. The Bundegi area is not typical of the reef structure found throughout the majority of the marine park. There is a near shore reef with poorly defined lagoon that is exposed to the Exmouth Gulf waters which have a high sediment load. The Bundegi area was impacted in April 1999 by Cyclone Vance which crossed the coast in the Bundegi area. In mid April 2000 the area experienced some coral bleaching.

BILLS BAY AREA

The Bills Bay area is situated in the lower half of the marine park adjacent to the Coral Bay settlement. Bills Bay is typical of the Ningaloo reef with a fringing-barrier reef, enclosing a shallow lagoon (average water depth 3 metres) that is between 2 –2.5 kilometres wide. The majority of the lagoon is zoned as a sanctuary zone (Figure 3). The area has been a marine reserve for the past 20 years and, as such, as been largely unaffected by human activities. A significant percentage of corals within the bay were killed as a result of the coral spawn slick in March 1989.

## 2.2 METHODS

### 2.2.1 Re-survey of Bills Bay sites established in 1989 after coral mortality from the coral mass spawning event of March 1989

The seventeen monitoring sites established in Bills Bay lagoon in 1989 will be re-surveyed (Figure 2). The sites were established near prominent seabed features identified from an aerial photograph of Bills Bay. The site locations were recorded on a line diagram (Figure 2). The line diagram was enlarged (~120 %) to fit over an aerial photograph produced by the Department of Marine and Harbours WA (Coral Bay DMH 612, 1991), as the original aerial photograph could not be located. Each site is comprised of three 50 m transects laid in an east – west orientation. The transects will laid parallel to each other with a 20 m spacing between each transect. The sites will be re-surveyed using the transect video sampling method (Christie *et al.* 1996).

All habitat data and related observations will be recorded electronically onto standard data files, which have been pre-formatted and stored on a laptop computer. Data sheets for written data recordings will also be made available. All written data is to be transferred to the computer files during the field survey, and preferably on the day of collection. Examples of data recording sheets are presented in Appendix II.

FIELD PROCEDURES

This procedure has been approved by the Departmental Diving Officer (Alan Byrne)

The following outlines the field procedures to be used when re-surveying the Bills Bay sites. The procedures are based on using one boat with a crew of four. An additional boat is available and can be used if required. The roles of each crew member include:

- *BOAT OPERATOR*: Operates the boat
- *SNORKELLER*: works with the boat operator in supporting the divers in the water and assisting in DGPS recordings (ie. holds boat over the site while DGPS coordinates are determined)
- *DIVER 1*: operates the video camera
- *DIVER 2*: records data

1. Locate the position of the site in the boat using GPS coordinates and the pre-marked aerial photograph

2. Mark the site position using a weighted marker buoy (see 4.1 or 5.1)

3. The site is then viewed using a viewfinder or a snorkel diver to confirm the site.

4. If conditions are calm with low current and relatively flat bathymetry, the three 50m transect lines can be deployed and retrieved by boat rather than divers

    4.1. The end of transect two is clipped to the weight of a marker buoy

    4.2. Transect two is deployed while driving the boat in a straight line along a pre-determined compass bearing (west to east)

    4.3. When transect two has been deployed the start of the transect is clipped to the weight of a marker buoy

    4.4. The start of the transect one is clipped to the weight of a marker buoy. The transect is deployed in a straight line (west to east) 20m to the north and parallel to transect two

    4.5. When transect one has been deployed the transect end is clipped to the weight of a marker buoy

    4.6. The start of the transect three is clipped to the weight of a marker buoy. The transect is deployed in a straight line (west to east) 20m to the south and parallel to the transect two

    4.7. When transect three has been deployed the transect end is clipped to the weight of a marker buoy

    4.8. Once the three transects have been deployed, a visual check should be carried out to ensure that the transects were laid straight and parallel. The visual check can be made either from the boat or by a snorkeller. If necessary the transect line should be adjusted by the snorkeller or SCUBA divers

5. If conditions are adverse with strong winds, currents and/or irregular bathymetry, the three 50m transect lines should be deployed using divers

6. The two divers are deployed at the start of transect one (west end) and the boat stands by (clear of the divers) and waits for the two divers to film transect one

7. One diver has the role of video camera operator and the second diver is a data recorder (Appendix III)

8. The camera operator films the area adjacent to the start of transect. Anything that is of significance is also filmed. The site and transect details inscribed on an underwater slate are filmed. The diver then films along the transect line (Section 2.2.4)

9. The data recorder diver follows the video operator who is filming the transect. This diver is recording general observations such as dominant species, general health and any visible impacts etc. This diver will also draw mud-maps of the position of the transect in relation to prominent features to assist in future relocation (Appendix II)

10. The divers will signal the boat that they have completed the first transect and will move on to the start of transect two (east end) and carry out steps 8 and 9

11. The boat operator and snorkeller will record the DGPS coordinates of transect one (marker buoys) (Appendix IV)

12. The divers will signal the boat that they have completed transect two and will move on to the start of transect three (west end) and carry out steps 8 and 9

13. The boat operator and snorkeller will record the DGPS coordinates of transect two (marker buoys) (Appendix IV)

14. When the divers signal that they have completed transect three the boat retrieves the divers and records the DGPS coordinates of transect three (marker buoys)

15. The boat then retrieves the transect lines and weighted marker floats. In the event of a line becoming snagged the snorkeller enters the water to unsnag the line

16. The boat then moves to the next site or returns to the boat ramp

### 2.2.2 Re-locating monitoring sites (transect) established as part of NMPMP

A number of permanent transects established in 1998/99 in Bills Bay and Bundegi will be re-located in May 2000 (Figure 1). The exact number of sites will depend on the amount of time available. The time taken to re-locate each site will be recorded and will assist in the planning of future field trips.

FIELD PROCEDURES

This procedure has been approved by the Departmental Diving Officer (Alan Byrne)

The following outlines the field procedures to be used when re-locating the Bills Bay and Bundegi sites. The procedures are based on using one boat with a crew of four. An additional boat is available and can be used if required. The roles of each crew member include:

- BOAT OPERATOR: Operates the boat
- 1-3 SNORKELLERS: one snorkeller assists the boat operator with DGPS recordings (holds boat over site while DGPS coordinates being determined) and the other snorkellers assist in site location

1. From the boat use the Garmin GPS unit to locate the general site position using the 1998/1999 DGPS coordinates (the start of the first transect) (Appendix IV). Pre-marked aerial photographs and site descriptions (eg. mud maps) will also be referred to

2. After the general location has been reached refine the search using the DGPS unit

3. Once the coordinates (1998/1999) of the site have been reached, the position should be marked using a weighted marker buoy

4. Snorkellers equipped with four weighted marker buoys enter the water to determine whether the first deployed marker buoy marks the position of the star picket which defines the start of the first transect

5. If the star picket can not been seen, then the snorkellers should begin a coordinated search of the surrounding area by searching in an expanding circular pattern from the deployed marker buoy

6. Once snorkellers have found a star picket they should mark its location with a weighted marker buoy

7. When a star picket is found the snorkeller should determine which star picket they have found by reading the transect details inscribed on the pvc cap (if the pvc cap is still present and inscription is still legible). This information can orient the snorkeller in regards to the position of the remaining star pickets (remembering there are three transects, laid end to end, in a north south orientation)

8. Once all the star pickets have been found and marked the snorkellers should return to the boat

9. If star pickets are missing pvc caps and the details of the star picket are known (eg. N14 T3) then where possible a new pvc cap should be installed. The boat operator should inscribe the relevant details onto the pvc cap and the snorkeller should wire the cap into place

10. If the site is in the Bundegi area then the transects will be surveyed using the video transect method (Refer to sections 2.2.3 and 2.2.4)

11. With a snorkeller positioning the boat/DGPS antennae over the star picket re-record the DGPS coordinates using the datum WGS84. Repeat this process for all the star pickets (Appendix IV)

12. If there is time and the site was located far from the original DGPS coordinates then it is worth experimenting with the DGPS unit by changing the datum from WGS84 to another possible datum (eg. AGD 84, or North American Datum) to check if the original coordinates were in that datum

13. The boat then retrieves the weighted marker floats. In the event of a line becoming snagged a snorkeller enters the water to unsnag the line

14. The boat then moves to the next site or returns to the boat ramp

### 2.2.3 Re-surveying NMPMP sites in Bundegi to assess the impact of the April 2000 coral bleaching event

If there is time, the NMPMP permanent transect sites at Bundegi will be surveyed using the transect video method as per previous NMPMP surveys. The Bundegi sites are to be surveyed in order to document recent coral bleaching events in the area reported by the CALM Exmouth office.

All habitat data and related observations will be recorded electronically onto standard data files, which have been pre-formatted and stored on a laptop computer. Data sheets for written data recordings will also be made available. All written data is to be transferred to the computer files during the field survey, and preferably on the day of collection. Examples of data recording sheets are presented in Appendix II.

FIELD PROCEDURES

This procedure has been approved by the Departmental Diving Officer (Alan Byrne)

The following outlines the field procedures to be used to re-survey Bundegi sites. The procedures are based on using one boat with a crew of four. An additional boat is available and can be used if required. The roles of each crew member include:

- BOAT OPERATOR: Operates the boat
- SNORKELLER: works with the boat operator in supporting the divers in the water and assisting in DGPS recordings (holds boat over site while DGPS coordinates being determined)
- DIVER 1: operates the video camera
- DIVER 2: records data

1. Refer to section 2.2.2 for procedures on site relocation

2. If conditions are calm with low current and relatively flat bathymetry, the three 50m transect lines can be deployed and retrieved by boat rather than divers

    2.1. The start of the first transect line is clipped to the weight of the first marker buoy

    2.2. The first transect line is deployed while driving the boat in a straight line along a pre-determined compass bearing towards the second marker buoy

    2.3. When the first 50m transect line has been deployed the transect end is clipped to the weight of the second marker buoy

    2.4. The start of the of the second transect line is also clipped to the weight of the second marker buoy which is then re-deployed

    2.5. The second transect line is deployed as per 2.2

    2.6. When the second 50m transect line has been deployed the transect end is clipped to the weight of the third marker buoy

    2.7. The start of the of the third transect line is also clipped to the weight of the third marker buoy which is then re-deployed

    2.8. The third transect line is deployed as per 2.2 and 2.5

    2.9. When the third 50m transect line has been deployed the transect end is clipped to the weight of the fourth marker buoy which is then re-deployed

2.10. Once the three transects have been deployed, a visual check should be carried out to ensure that the transects were laid straight. The visual check can be made either from the boat or by a snorkeller. If necessary the transect line should be straightened by the snorkeller or SCUBA divers

3. If conditions are adverse with strong winds, currents and/or irregular bathymetry, the three 50m transect lines should be deployed using divers

3.1. The start of the first transect line is clipped to the first weighted marker buoy or star picket

3.2. The first transect line is deployed by a diver swimming along a pre-determined compass course (north to south) while unrolling the transect from it's reel.

3.3. When the first transect has been laid the transect end is clipped to the weight of the second marker buoy or star picket

3.4. The start of the second transect line is also clipped to the weight of the second marker buoy or star picket

3.5. The second transect line is deployed as per 5.2

3.6. When the second transect line has been deployed the transect end is clipped to the weight of the third marker buoy or star picket

3.7. The start of the third transect line is also clipped to the weight of the third marker buoy or star picket

3.8. When the third transect line has been deployed the transect end is clipped to the weight of the fourth marker buoy or star picket

4. The two divers are deployed and the boat stands by (clear of the divers) and waits for the two divers to film the first transect

5. One diver has the role of video camera operator and the second diver is a data recorder (Appendix III)

6. The camera operator films the area adjacent to the start of first transect. Anything that is of significance is also filmed. The site and transect details inscribed on an underwater slate are filmed. The diver then proceeds filming along the transect line (Section 2.2.4)

7. The data recorder diver follows the video operator who is filming the transect. This diver is recording general observations such as dominant species, general health and any visible impacts etc. This diver will also draw mud-maps of the position of the transect in relation to prominent features to assist in future relocation (Appendix II)

8. The divers will signal the boat that they have completed the first transect and will move on to the second transect as per 6 and 7

9. The boat operator and snorkeller will record the DGPS coordinates of the start of the first transect (marker buoy) followed by the start of the second transect (Appendix IV)

10. The divers will signal the boat that they have completed the second transect and will move on to the third transect as per 6 and 7

11. When the divers signal that they have completed the third transect the boat retrieves the divers and records the DGPS coordinates of the end of the second transect (marker buoy) and third transect

12. The boat then retrieves the transect lines and weighted marker floats. In the event of a line becoming snagged the snorkeller enters the water to unsnag the line

13. The boat then moves to the next site or returns to the boat ramp

### 2.2.4 Obtaining video imagery of 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 IV). At the start of the transect, hold the camera in a horizontal position and turn slowly clockwise, filming the immediate surroundings and ending at the initial view. Video the underwater slate to record the site number and transect number written on the underwater slate

3 Record the start time code on the data sheet. Press REC and film the start of the transect tape for a few seconds and then move along the tape or scaled rope, keeping it approximately 10 cm in from the right hand side of the field of view. Keep the housing lens parallel to the substrate at a distance of 50 cm

4 Follow the transect line keeping the housing at the set height of 50 cm, ensuring that the screen image is in focus. Adjust your swimming speed so that it is constant and you cover approximately 10 m every minute, and not faster. This is important to ensure a high quality of image. Each 25m transect should take between 2 ½ and 3 minutes in total or each 50m transect between 5 and 6 minutes in total. At the end of the transect video the end of the transect for a few seconds and then press STBY

5 Record the finish time code on the data sheet

6 If filming of 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 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 II). Any repeated or incomplete transects, or situations where transects were filmed out of order or with false starts should be noted on the data sheets

8 A total of four 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 III), the site number and date of recording. The copy protect switch on the tape should be switched from REC to SAVE 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 the originals archived and stored separately from the duplicates

### 2.2.5 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 programme 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.

## 2.3 EQUIPMENT

### 2.3.1 Video systems

**Primary**

- Canon MV1 digital video camera with battery packs (4) and chargers (2)
- Amphibico underwater video housing
- Housing O-ring kit and silicone grease
- Cleaning kit
- Video transect data sheets
- Instruction manuals
- TV/video unit
- Digital video tapes (15)
- Leads, remote control, spares

**Backup**

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

### 2.3.2 Still photography

- Camera 1: Nikonos V, 35mm lens, 15mm lens, SB102 strobe unit and close up kit
- Land Camera
- 5 rolls of 36 exposure print film
- 5 rolls of 36 exposure slide film
- Log books for cameras
- Kit of camera spares

### 2.3.3 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
- 4 wet weather jackets
- Sunscreen
- Spare sunglasses
- Vinegar and flask hot water per vessel

### 2.3.4 Information

- Marine Charts: Satellite photos, coastal maps, sanctuary zone maps with latitudes and longitudes
- Reference books for the identification of corals, fish, birds, marine mammals and marine fauna
- Scientific reference file
- Full set of aerial photographs of Ningaloo Marine Park
- Laminated scanned copies of aerial photographs of the sites for field use
- Habitat data sheets
- Long-term monitoring site data sheets

- Transect data sheets
- Video data sheets
- 1 laptop computer plus 10 floppy discs
- 4 field notebooks
- 1 box of pencils
- 1 stationary box
- equipment log book

### 2.3.5 Diving

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

### 2.3.6 Vessels and Vehicles

- CALM MCB 12'6" zodiac (C401)with all safety equipment for survey exempt vessel, fitted with 35hp Yamaha outboard. Two 20-litre containers for fuel
- Additional boat (Quintrex- Aluminium with 40hp outboard or 3.7 m Quicksliver inflatable with 15 hp outboard)
- Bags, repair kit, ropes, oars and lines, and fuel tanks
- MCB Mitsubishi Triton 4x4
- MCB heavy duty trailer with spare wheel, outboard rack and roof racks for inflated zodiac
- CALM Exmouth vehicle
- Vehicles to have full tool kit, battery jumper leads, tyre inflator coupled to scuba cylinder valve

### 2.3.7 Position fixing and Communications

- 1 hand held GPS unit
- 1 hand held GPS units and accessories (DGPS)
- 1 Omni star differential GPS unit, antennae and accessories
- 1 calm hand-held radio and charger
- 1 waterproof bag for radios
- CALM vehicle equipped with CALM VHF

### 2.3.8 Transect establishment

- 9x pre cut marker buoys (6 x 5m, 3 x 10m)
- 3 x 50m weighted transect lines, marked at 10cm increments
- 5 x 600mm galvanised steel pickets
- 5 x 1800mm galvanised steel pickets
- 10 x 600m PVC caps for pickets
- 20 x 250mm stainless steel for fixing caps
- 3 x permanent markers for marking caps
- 1 x 15lb sledge hammers
- 1 x picket drivers
- 1 x driver extensions
- 10 x 8lb weights

### 2.3.9 Miscellaneous Equipment

- Comprehensive mechanical tool kit
- Comprehensive electrical repair kit
- 10 AA batteries
- 10 D batteries
- 10 C batteries
- 2 motorbike batteries and chargers
- 1 x MCB esky

## 3 FIELD PROGRAMME

### 3.1 FIELD ITINERARY

**Table 1. Field itinerary for the period 12 May to 22 May 2000.**

| Date | Day | Site number location | Activity |
|---|---|---|---|
| 12 May | F | | • Vehicle and trailer packed and ready to leave |
| 13 May | S | | • Leave Perth at approx 5AM<br>• Arrive Coral Bay approx 6PM<br>• Unpack equipment<br>• Set up equipment (ie inflate zodiac) |
| 14 May | S | N22, N47,N48, N49, N50, N14, N53 | • Relocate NMPMP sites and check DGPS coordinates |
| 15 May | M | CB12,CB11,CB10,CB9 | • Resurvey 1989 Bills Bay sites<br>• Chris Simpson picked by Doug Myers from the Learmonth Airport at 1:05PM at brought to Coral Bay |
| 16 May | T | CB16,CB15,CB14,CB13 | • Resurvey 1989 Bills Bay sites |
| 17 May | W | CB8,CB7,CB6,CB5,CB17 | • Resurvey 1989 Bills Bay sites |
| 18 May | T | CB4,CB3,CB2,CB1 if time is available then N26, N19, N1, N29 | • Resurvey 1989 Bills Bay sites in the morning<br>• If time is available relocate NMPMP sites and check DGPS coordinates<br>• If time is available resurvey NMPMP sites<br>• Chris Simpson to be at the Learmonth Airport by 12:30PM |
| 19 May | F | | • Pack the vehicle and trailer early morning and depart for Perth |
| 20 May | S | | • Equipment to Kevin Bancroft |
| 26 May | M | | • Unpack and clean equipment etc. |

### 3.2 EQUIPMENT SUPPLIERS AND RELEVANT CONTACTS

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

**Aerial photos:** DOLA, Alan Warton, Ph. 92737166
**Ansett:** Flights, Ph. 131644
**Calm, Exmouth:** Ph. (08) 99 491676 (fax) (08) 99 491580
**Transport:** Cape Transport (Mick & Jane Stamp, or Shane) Ph. 08 99491041
**Exmouth automotive and marine** Alan Waddingham; (08) 99492795
**John Houghton (Courier Service Exmouth to Mildura via Coral Bay):** 08 99491020
**Omnistar differential GPS:** Fugro Pty Ltd, Gary Allen, Ph. 93225295
**PVC picket extensions**: Swan Irrigation, Steve Carrie, Ph 9446 9966
**Underwater video system:** Sea Optics, David Hill, Ph. 08 3626161
**Zodiac inflatable vessel:** Wiltrading, Geoff Jordan, Ph. 3359155
**Exmouth Tourist Bureau:** (08) 9 949 1176

## 4 SAFETY

Safety issues relating to:

- field work are the responsibility of the Field Team Leader, Jennie Cary
- diving are the responsibility of the Diving Supervisor, Caroline Williams
- boating and navigation are the responsibility of the boat skipper (rotation of suitably qualified team members)

### 4.1 EMERGENCY CONTACTS

There will be daily contact with the Exmouth District Office of CALM via the Mobile Ranger (Bruce Bond) stationed at Coral Bay. Contact with the field team should be made through the Exmouth District Office of CALM.

***General***

**CALM, Exmouth:** Ph.(08) 9 949 1676 and (08) 9 949 2113, Fax (08) 9 949 1580
**CALM, Marine Conservation Branch, Fremantle:** Ph (08) 9 432 5100; Fax (08) 9 430 5408
**Fisheries Department, Exmouth:** Ph (08) 9 949 2755
**Coral Bay Nursing Post:** Ph. (08) 9 942 5828 (Maureen Woodhams private Ph. (08) 9 942 5825)
**Exmouth Dive Centre:** Coral Bay Ph (08) 9 942 5824; Exmouth Ph (08) 9 949 1201
**Exmouth Hospital/Ambulance:** Ph.(08) 9 949 1011, fax (08) 9 949 1017
**Exmouth Police:** Ph. (08) 9 949 2444
**Fremantle Hyperbaric/Diving Service:** (08) 9 431 2233 or (08) 9 431 3333
**Royal Flying Doctor Service:** Admin., Ph (08) 9 414 1200
**Coral Bay Volunteer Rescue Group:** Ph. (08) 9 942 5933 , Call Sign: VMR679, Channel 90 (UHF,VHF)
**Exmouth Sea Rescue Group:** Ph. (08) 9 949 2382, Call Sign: VMR682, Channel 90 (UHF, VHF)

***Radio***

**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

# 5 BUDGET

**Table 2. Budget reconciliation for the Coral Bay 2000 Field Trip**

| Budget Item | | | CALM (MCB) | CALM (Exmouth) | Total costs ($) |
|---|---|---|---|---|---|
| Travel | | | | | |
| Vehicles | MCB Triton - $0.45/km for 3000 km | | 1350.00 | | 1350.00 |
| Tire repair etc | | | 205.00 | | 205.00 |
| | | **Sub-total** | **1555.00** | | **1555.00** |
| Accommodation | | | 500.00 | | 500.00 |
| Food and Drink | 4 people @ $40/person/day x 7 | | 1120.00 | | 1120.00 |
| Airfares | 1return ticket Perth-Exmouth | | 570.00 | | 570.00 |
| | | **Sub-total** | **2190.00** | | **2190.00** |
| Staff | | | | | |
| Caroline Williams | 6 days @ $361.00 | | | 2166.00 | 2166.00 |
| Tim Grubba | 20* days @ $230.00 | | 4600.00 | | 4600.00 |
| Jennie Cary | 8* days @ $300.00 | | 2400.00 | | 2400.00 |
| Chris Simpson | 4 days @ 430.00 | | 1720.00 | | 1720.00 |
| Diving allowances | 24 hours @ $3.90 | | 93.60 | | 93.60 |
| | | **Sub-total** | **8813.6** | **2166.00** | **10979.60** |
| Equipment | | | | | |
| MCB inflatable & 25 hp o/b | 7 days @ $100 | | 700.00 | | 700.00 |
| 2nd vessel | 6 days @ $100 | | | 600.00 | 600.00 |
| DGPS unit | 7 days @ $150 | | 1050.00 | | 1050.00 |
| Handheld GPS unit | 7 days @ $5.00 | | 35.00 | | 35.00 |
| 3 x SCUBA sets | 7 days @ $100 | | 700.00 | | 700.00 |
| 4 x SCUBA cylinders | 6 days @ $20 | | | 120.00 | 120.00 |
| 4 x SCUBA cylinders | 7 days @ $20 | | 140.00 | | 140.00 |
| Handheld VHF radios | 7 days @ $15 | | 105.00 | | 105.00 |
| Lock-up off-road trailer | 7 days @ $15 | | 105.00 | | 105.00 |
| Laptop Computer | 7 days @ $15 | | 105.00 | | 105.00 |
| 2 x Underwater digital videos | 7 days @ $100 | | 700.00 | | 700.00 |
| Mobile Phone | 7 days @ $20 | | 140.00 | | 140.0 |
| | | **Sub-total** | **3780.00** | **720.00** | **4500.00** |
| Consumables | | | | | |
| Fuel and oil | | | 250.00 | | 250.00 |
| Air fills | 45 @ $5 | | 225.00 | | 225.00 |
| Star pickets and extensions | 10 @ $5 | | 50.00 | | 50.00 |
| Digital video tapes | 15 x DVM-E60 @ $14.75 | | 221.25 | | 221.25 |
| Digital video backup tapes | 15 x DVM-E60 @ $14.75 | | 221.25 | | 221.25 |
| Other consumables | Gloves/pencils/chalk/erasers/batteries…etc | | 500.00 | | 500.00 |
| | | **Sub-total** | **1467.50** | | **1467.50** |
| | | **Total** | **17806.10** | **2886.00** | **20692.10** |

** Includes days pre and post field*

# 6 PUBLICITY/EDUCATION

## 6.1 PUBLIC RELATIONS OPPORTUNITIES

1. A short article regarding the field survey will be placed in a local newspaper
2. A radio interview will be sought with local radio outlets

3. A copy of the field program report will be sent to CALM Corporate Relations Division as the basis of a press release

### 6.2 EDUCATION OPPORTUNITIES

Nothing is planned for this field survey

## 6 REFERENCES

Cary J L and Grubba T L (1998). Ningaloo Marine Park Monitoring Program. Initialisation of long-term benthic monitoring sites: May 1998: Field Program Report MMSP/MW/NMP-10/98. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry Street, Fremantle, Western Australia, 6160). Unpublished report.

Cary J L, Grubba T L and Myers J (1998). Ningaloo Marine Park Monitoring Program. Establishment of Baseline Benthic Monitoring sites: December 1998: Data Report MMSP/MW/NMP-14/98. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry Street, Fremantle, Western Australia, 6160). Unpublished report.

Cary JL, Lawrie R, Baxter K and Fuller M (1999). Establishment of Baseline Benthic Monitoring sites: 1999: Spatial Rectification of Aerial Photography and Benthic Habitat Groundtruthing; 19 July – 2 August. Field Program Report MMSP/MW/NMP-16/99. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry Street, Fremantle, Western Australia, 6160). Unpublished report.

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

Department of Conservation and Land Management (1989). Ningaloo Marine Park Management Plan 1989-1999. Management Plan No. 12. Department of Conservation and Land Management, Perth, Western Australia.

Simpson C.J, Cary J.L. and Masini R.J (1991). Destruction of corals and other reef animals by coral spawn slicks on Ningaloo Reef, Western Australia.

Simpson C.J. and Field S (1995). Survey of water quality, groundwater, sediments and benthic habitats at Coral Bay, Ningaloo Reef, Western Australia. Technical Series 80. A report to the Department of Conservation and Land Management.. (Department of Environmental Protection Perth, Western Australia, 6000)

## 7 DISTRIBUTION LIST

**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-23/2000**

Dr Chris Simpson, Manager, Marine Conservation Branch, CALM
Chris Muller, Manager, Pilbara Region, CALM
Doug Myers, Manager, Exmouth District, CALM
Caroline Williams, Marine Conservation Officer, Exmouth District, CALM
Adam Meyer, Marine Reserves Officer, Exmouth District, CALM
Mitzi Vance, Media Liaison Officer, Corporate Relations Division, CALM

## APPENDIX I: RESULTS FROM CORAL BAY 1989/1994 SURVEYS

**MAJOR BENTHIC HABITAT TYPES IN 1989** (Simpson et al, 1991)

| SITE | LIVE CORAL BEFORE 26 MARCH (%) | | LIVE CORAL COVER BETWEEN 3-5 APRIL (%) | | BLEACHED CORAL COVER BETWEEN 3-5 APRIL (%) | |
|---|---|---|---|---|---|---|
| | mean | se | mean | se | mean | Se |
| 1 | 38.8 | 4.0 | 0.0 | | 3.8.8 | 4.0 |
| 2 | 52.7 | 7.3 | 23.5 | 1.7 | 29.2 | 5.6 |
| 3 | 43.0 | 11.8 | 7.2 | 7.2 | 35.8 | 4.6 |
| 4 | 65.8 | 7.0 | 65.8 | 7.0 | 0.0 | |
| 5 | 38.2 | 6.6 | 0.0 | | 38.2 | 6.6 |
| 6 | 69.4 | 10.6 | 3.2 | 3.2 | 66.2 | 13.8 |
| 7 | 51.5 | 1.3 | 10.7 | 3.5 | 40.8 | 2.2 |
| 8 | 52.0 | 2.0 | 52.0 | 2.0 | 0.0 | |
| 9 | 0.0 | | 0.0 | | | |
| 10 | 29.0 | 14.2 | 0.0 | | 29.0 | 14.2 |
| 11 | 39.2 | 0.6 | 5.2 | 2.4 | 34.0 | 2.8 |
| 12 | 43.6 | 1.6 | 9.2 | 2.8 | 4.4 | 4.4 |
| 13 | 0.0 | | 0.0 | | | |
| 14 | 19.1 | 14.3 | 1.2 | 1.2 | 17.9 | 15.5 |
| 15 | 47.7 | 2.9 | 13.5 | 6.3 | 34.2 | 3.4 |
| 16 | 33.3 | 8.3 | 33.3 | 8.3 | 0.0 | |
| 17 | 55.2 | 1.6 | 55.2 | 1.6 | 0.0 | |

**MAJOR BENTHIC HABITAT TYPES IN 1994** (Simpson & Field 1995)

| SITE | LIVE CORAL (%) | DEAD CORAL (%) | SAND (%) |
|---|---|---|---|
| 1 | 4.5 | 46.1 | 48.4 |
| 2 | 42.9 | 45.9 | 11.2 |
| 3 | 42.6 | 57.4 | 0.0 |
| 4 | 62.2 | 28.8 | 9.0 |
| 5 | 5.9 | 88.3 | 5.8 |
| 6 | 14.4 | 85.2 | 0.4 |
| 7 | 7.2 | 92.8 | 0.0 |
| 8 | 54.9 | 28.5 | 16.6 |
| 9 | 4.0 | 79.0 | 17.0 |
| 10 | 16.2 | 58.1 | 25.8 |
| 11 | 19.6 | 78.4 | 2.0 |
| 12 | 68.1 | 30.3 | 2.4 |
| 13 | 13.4 | 61.0 | 25.6 |
| 14 | 5.0 | 76.6 | 18.4 |
| 15 | 9.3 | 84.5 | 6.2 |
| 16 | 61.4 | 29.8 | 10.4 |
| 17 | 41.6 | 58.4 | 0.0 |

## APPENDIX II: BLANK DATA RECORDING SHEETS

# TRANSECT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 2000 |
| **Site No.** | N | **Site Name** | | **Date** | | **Recorder** | |
| **Time** | | **Video tape no.** | NMPMP/bvt/ /# | | **Video operator** | | |

| **T1** | **Length (m)** | **50** | **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: (**eg. description of habitat and dominant species along transect) | | | | | | |

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T3 (m)** | |
|---|---|---|---|---|---|---|
| **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 (°)** | | **Distance to T1 (m)** | |
|---|---|---|---|---|---|---|
| **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** | | MAY 2000 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N | **Site Name** | | **Date** | | **Recorder** | |
| **GPS Latitude** | | **GPS Longitude** | | | **Differential** | | |
| ° ' S | | ° ' E | | | **Yes** | ☐ | **No** ☐ |

| **Habitat type** | | | | | | |
|---|---|---|---|---|---|---|
| **Location of nearest transect from GPS position** | **Transect No.** | T | **Compass bearing (°)** | | **Distance (m)** | |

**Site Map** (include north indicator, scale, vessel location, water depth, transect locations & other features of interest):

**Notes:**

## HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 2000 |
| **Site No.** | N | **Site Name** | | **Date** | | **Recorder** | |
| **Vessel** | | **Time** | | **Weather** | | | |
| **Sea** | | **Water depth (m)** | | **Water visibility (m)** | | | |
| **GPS Latitude** | | **GPS 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** | NMPMP/bvt/ /# | **Aerial reference** | /WA /RUN / |
| **Slide reference** | | **Print reference** | |

## VIDEO DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 2000 |
| **Site No.** | N | **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.** | NMPMP/bvt/ /# | **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** | : : : | : : : | . |

**Notes**

| |
|---|
| |

## APPENDIX III: UNDERWATER VIDEO SYSTEM

### PREPARATION OF UNDERWATER HOUSING AND VIDEO CAMCORDER

Where possible, store and prepare the equipment at room temperature to prevent condensation on the lenses of the camcorder and housing. Carry out these preparations in a dry, dust and spray-free environment. The following is to be used as a general guide only. Users should refer to the relevant instruction manual for full details on settings, care and use.

**Housing**

Check the inside of the housing for any dust or other particulate matter, and clean out using a lens cloth and blower brush if necessary. Check the inside of the lens and clean using blower brush, lens tissues and lens cleaning fluid if necessary. Remove the O-ring from the housing, clean it with lens tissues and check for any cracks or scratches. If there is any damage to the O-ring, discard and replace with a new one. Apply a small amount of silicone grease (2-3 mm) between thumb and index finger and run the O-ring through several times to spread this evenly. **Ensure that you do not use too much grease as this could cause the seal to leak!** Remember that the grease is there to keep the O-ring supple and not to actually form a seal. Clean out the O-ring groove with a cotton bud, and carefully replace the clean and greased O-ring back into the groove without twisting it. Ensure that there is no particulate matter sticking to the O-ring. The housing is now ready for the camcorder to be inserted.

### CAMERA SETUP

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

### POST-DIVE PROCEDURE

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

### TAPE NUMBERING

The video tapes should be consecutively numbered according to the following coding system:
Project acronym (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.

## APPENDIX IV: OPERATING THE GARMIN GPS 12XL UNIT

**It is <u>ESSENTIAL</u> that prior to using the Garmin GPS unit that the operator checks what datum the GPS unit is set to read and how the position is displayed. Currently (as of April 2000) CALM uses the datum AGD 84 and the coordinates (latitude and longitude) are displayed in decimal degrees (to a minimum of five decimal places). The text below outlines the procedures that must be followed in order to operate the Garmin GPS, including checking and altering GPS settings (eg. datum and display).**

**It is also important to note that during site relocation it is essential to check what datum the coordinates were originally recorded in. Always ensure that the datum set on the GPS matches that of the datum is the same as the position you area trying to find. When using a nautical chart in conjunction with the GPS always check what datum the chart is in.**

**In cases where coordinates are recorded using a different datum or different format then it is <u>ESSENTIAL</u> that the datum and display used are noted on the appropriate data sheet.**

**It is also good idea prior to using a GPS unit to calibrate it using a local Department of Land Administration (DOLA) benchmark. An information sheet on each DOLA benchmark can be obtained from DOLA. This process will identify any major discrepancies in the reading obtained by the GPS unit. Any major discrepancies should be investigated and any minor discrepancies should be noted on all data sheets.**

### TURNING THE UNIT ON

- Press and briefly hold [ ] to turn the unit on

### WHEN THE UNIT IS FIRST TURNED ON

- Display [*WELCOME PAGE*]
- Display [*WARMING UP PAGE (DATABASE INFORMATION)*]

### ACQUIRING SATELLITES

- Display [ACQUIRING SATELLITE)
- The unit is searching for satellites
- Ensure that the GPS unit has a clear view of the sky (ie. Not indoors)
- When the GPS has locked onto satellites it will display the position
- If the GPS can't acquire satellites then it will beep and display the message [MESSAGE PRESS PAGE]
- Press the button [**PAGE**]
- Display [NEED TO SELECT INIT METHOD]
- Press the button [**PAGE**]

### INITIALISING THE GPS UNIT

- Display [CHOOSE INIT METHOD]
- Three options provided
- Press button [▲ ▼] to highlight one of the three choices.
- If you are unsure if the GPS if the unit has been initialised highlight [1 SELECT COUNTRY FROM LIST]
- If you are sure that the GPS can been initialised highlight [3 NO RE-INIT (CONTINUE ACQUIRING)]
- To select a highlighted choice press button [**ENTER**]
- If you chose [1 SELECT COUNTRY FROM LIST] then scroll through the country list by pressing [▲ ▼] to highlight [AUS-WESTERN]

- Select the highlighted choice by pressing [**ENTER**]
- The GPS will display [ACQUIRING SATELLITE]

**SET UP MENU**

- To locate the Set up Menu press [**PAGE**] to scroll through the various screen to reach the screen [MAIN MENU]
- Press button [▲ ▼] to highlight [SET UP MENU]
- Select the highlighted choice by pressing [**ENTER**]
- The GPS will display the [SET UP MENU]

**SELECTING/CHECKING THE DATUM**

- Go to the page [SET UP MENU]
- Press button [▲ ▼] to highlight [NAVIGATION]
- Select the highlighted choice by pressing [**ENTER**]
- The GPS will display the [NAV SET UP]
- If the [MAP DATUM] displays [WGS 84] then press [**PAGE**] or [**QUIT**] to move back to previous pages
- If [Map Datum] displays some other Datum then
- Press button [▲ ▼] to highlight [MAP DATUM]
- Press [ENTER] to select
- Press [▲ ▼] to highlight the Datum WGS84
- Press [**Enter**] to select

**SELECTING/CHECKING THE POSITION FORMAT**

- Go to the page [SET UP MENU]
- Press button [▲ ▼] to highlight [NAVIGATION]
- Select the highlighted choice by pressing [**ENTER**]
- The GPS will display the [NAV SET UP]
- If the [POSITION FRMT] displays [hddd°mm.mmm'] then press [**PAGE**] or [**QUIT**] to move back to previous pages
- If [POSITION FRMT] displays some other format then
- Press button [▲ ▼] to highlight [POSITION FRMT]
- Press [**ENTER**] to select
- Press [▲ ▼] to highlight the format hddd°mm.mmm'
- Press [**Enter**] to select

**TURNING THE UNIT OFF**

- Press and hold down [.]

## APPENDIX V: DATA SHEETS FOR NMPMP PERMENANT TRANSECT SITES TO BE RE-LOCATED

## TRANSECT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N1 | **Site Name** | Bundegi | **Date** | 5/5/98 | **Recorder** | Lapwood |
| **Time** | 12.10 | **Video tape no.** | NMPMP/bvt/05.05.98 /#1 | | **Video operator** | | Cary |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | 60 | **Distance to T2 (m)** | 10 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 21° 49.699' S | | 114° 10.718' E | 3.0 | 60 cm Star/ Steel | 0.15 |
| **Finish** | ° ' S | | ° ' E | | | |
| **Notes: (**eg. description of habitat and dominant species along transect)<br>Live hard coral: 35%; Dead coral: 50%; Algae: 4%; and Abiotic: 11% | | | | | | |

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | 60 | **Distance to T2 (m)** | 10 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 21° 49.725' S | | 114° 10.698' E | 3.0 | 60cm Star/ Steel | 0.15 |
| **Finish** | ° ' S | | ° ' E | | | |
| **Notes:**<br>Live hard coral: 11%; Dead coral: 62%; Algae: 11%; and Abiotic: 17% | | | | | | |

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | 60 | | |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 21° 49.750' S | | 114° 10.682' E | 3.0 | 60cm Star/ Steel | 0.15 |
| **Finish** | 21° 49.776' S | | 114° 10.678' E | 3 | 60cm Star/ Steel | 0.15 |
| **Notes:**<br>Live coral: 15%; Dead coral: 51%; Algae: 3%; and Abiotic: 32% | | | | | | |

## LONG-TERM MONITORING SITE DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N1 | **Site Name** | Bundegi | **Date** | 5/5/98 | **Recorder** | Lapwood |

| **GPS Latitude** | **GPS Longitude** | **Differential** | | | |
|---|---|---|---|---|---|
| 21° 49.699' S | 114° 10.718' E | **Yes** | ☒ | **No** | ☐ |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Habitat type** | Coral back reef. High Silt Load | | | | | |
| **Location of nearest transect from GPS position** | **Transect No.** | T1 | **Compass bearing (°)** | 190 | **Distance (m)** | 10.0 |

**Site Map** (include north indicator, scale, vessel location, water depth, transect locations & other features of interest):

**Notes:**

## HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N1 | **Site Name** | Bundegi | **Date** | 5/5/98 | **Recorder** | Cary |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.8M ZODIAC | **Time** | 1140 | **Weather** | 25 Knots SE | | |
| **Sea** | 20cm Waves | **Water depth (m)** | 3.0 | **Water visibility (m)** | 7.0 | | |

| **GPS Latitude** | **GPS Longitude** | **Differential** | | | |
|---|---|---|---|---|---|
| 21° 49.699' S | 114° 10.718' E | **Yes** | ☒ | **No** | ☐ |

| | |
|---|---|
| **Site location** | Just north of the Bundegi Public Jetty. |

**Habitat Description**

Depth: 2.8-3.0m
Immediately inshore of reef platform; Dense (30-40%) live coral cover. High level of sedimentation.
Live coral: 20% (mean)
Dead coral: 54% (mean)
Algae: 6% (mean)
Abiotic: 20% (mean)

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | Dictyota sp. (wide-branch) |
| **Coral** | Montipora & Acropora sp. (dominant). A hyacynathus plates and comrymbose forms |
| **Fish** | few fish species observed; medium-sized Scarids; Damsels, Chromis sp.; 4 Coral trout |

| | |
|---|---|
| **Invertebrates** | |

**Other Features**

| |
|---|
| |

**Impact or Activity**

| |
|---|
| Storm damage evident—few years ago; upturned plates. High level of sedimentation. |

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/bvt/05.05.98 /#1 | **Aerial reference** | 1985/WA 2286C /RUN /5157 |
| **Slide reference** | | **Print reference** | |

HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N1 | **Site Name** | Bundegi (Re-survey of 1998 survey) | **Date** | 4-08-99 | **Recorder** | Cary |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.5M Zodiac | | **Time** | 15:00 | **Weather** | | |
| **Sea** | Calm | | **Water depth (m)** | 3m | **Water visibility (m)** | | 10m |
| **GPS Latitude** | | **GPS Longitude** | | | **Differential** | | |
| 21° 49.699' S | | 114° 10.718' E | | | **Yes** | ☒ | **No** ☐ |
| **Site location** | Gulf side of NW Cape, north of Exmouth | | | | | | |

**Habitat Description**

There were obvious signs of damage to corals from cyclone Vance (March 1999)
Branching Acropora broken into small pieces

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | Significant algal growth over dead coral |
| **Coral** | Acropora (Branching, Corymbose), Montipora |
| **Fish** | Flathead (some50cm), Wrasse, Damsels, Parrot fish |
| **Invertebrates** | 1X Crown of thorn Starfish, 'Haliotis' feather star |

**Other Features**

Cyclone Vance passed over Exmouth in March 1999.
Winds were from the east

**Impact or Activity**

A lot of litter in general area- a lot could be from land due to cyclone Vance as Spinifex were also found.
1x Crown of Thorns starfish observed
Crayfish found
Pipe, terracotta, discarded octopus trap
Cans >20; pvc pipe 5m X 0.12m; boat windscreen; rope at 3 sites
Chain 1m X 20cm thick; 2X timber (one 1.5 X 0.5m X 0.2m)

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/ bvt/4-08-99 /#1 | **Aerial reference** | 5157/WA 2286/RUN3/840048 |
| **Slide reference** | | **Print reference** | |

## TRANSECT LOCATION DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N1 | **Site Name** | Bundegi (Re- survey of 1998 survey) | **Date** | 4-8-99 | **Recorder** | Cary |
| **Time** | 15:00 | **Video tape no.** | NMPMP/bvt/04-08-99 /# 1 | | **Video operator** | | Cary |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T2 (m)** | |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start 98** | 21° 49.699' S | | 114° 10.718' E | | | |
| **Finish** | ° ' S | | ° ' E | | | |

**Notes: (**eg. Description of habitat and dominant species along transect)
This site was established in 1998 and revisited in August 1999

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T3 (m)** | |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start 98** | 21° 49.725' S | | 114° 10.698' E | | | |
| **Finish** | ° ' S | | ° ' E | | | |

**Notes:**
At 27m found pipe, terracotta discarded octopus trap. At end of T2 10 cans (within 5m radius) in addition a lot of terrestrial debris spinifex and dead Gorgonian corals. Crayfish observed

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T1 (m)** | |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start 98** | 21° 49.750' S | | 114° 10.682' E | | | |
| **Finish98** | 21° 49.776' S | | 114° 10.678' E | | | |

**Notes**: *Montipora* dominant. West of T3 large quantities of litter. Cans >20; pvc pipe 5m X 0.12m; boat windscreen; rope at 3 sites. Chain 1m X 20cm thick; 2X timber (one 1.5 X 0.5m X 0.2m). One crown of thorn starfish near T3

## TRANSECT MONITORING SITE DATA SHEET

| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N1 | **Site Name** | Bundegi (Re-survey of 1998 survey) | **Date** | 4-8-99 | **Recorder** | Cary |

| **T1 Latitude start** | **T1 Longitude start** | **Differential** | | | |
|---|---|---|---|---|---|
| 21° 49.699' S | 114° 10.718' E | **Yes** | ☒ | **No** | ☐ |

| **Habitat type** | Back reef coral- High silt load | | |
|---|---|---|---|
| **Video reference** | NMPMP/ bvt/4-8-99 /#1 | **Aerial reference** | 5157/WA 2286/RUN3/840048 |

**Site Map** (include north indicator, scale, start point, water depth, transect locations & other features of interest):

**Notes:**
Re survey N1 transect. No wind and flooding tide when re- surveyed

| Bearings | T3(Start) | T3(End) |
|---|---|---|
| Dolphin on Pier | 055° | 045° |
| End of Jetty | 309° | 320° |
| White tower | 218° | 217° |

## TRANSECT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N19 | **Site Name** | Bundegi Sanctuary | **Date** | 5/5/98 | **Recorder** | Lapwood |
| **Time** | 13.00 | **Video tape no.** | NMPMP/bvt/05.05.98 /#1 | | **Video operator** | | Cary |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T2 (m)** | 10.0 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 21° 51.409' S | | 114° 09.982' E | 1.5-2.0 | 60cm Star/Steel | 0.15 |
| **Finish** | ° ' S | | ° ' E | | | |
| **Notes: (**eg. description of habitat and dominant species along transect)<br>Live coral: 24%; Dead coral: 22%; Algae: 0%; and Abiotic: 54% | | | | | | |

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T2 (m)** | 10.0 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 21° 51.429' S | | 114° 09.959' E | 1.5-2.0 | 60cm Star/Steel | 0.15 |
| **Finish** | ° ' S | | ° ' E | | | |
| **Notes:**<br>Live coral: 22%; Dead coral: 30%; Algae: 0%; and Abiotic: 53% | | | | | | |

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | | | |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 21° 51.453' S | | 114° 09.942' E | 1.5-2.0 | 60cm Star/Steel | 0.15 |
| **Finish** | 21° 51.472' S | | 114° 09.923' E | 1.5-2.0 | 60cm Star/Steel | 0.15 |
| **Notes:**<br>Live coral: 19%; Dead coral: 66%; Algae: 0%; and Abiotic: 41% | | | | | | |

## LONG-TERM MONITORING SITE DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N19 | **Site Name** | Bundegi Sanctuary | **Date** | 5/5/98 | **Recorder** | Lapwood |

| **GPS Latitude** | **GPS Longitude** | **Differential** | | | |
|---|---|---|---|---|---|
| 21° 51.409 ' S | 114° 09.982 ' E | **Yes** | ☐ | **No** | ☐ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Habitat type** | Backreef - coral | | | | | | |
| **Location of nearest transect from GPS position** | | **Transect No.** | T | **Compass bearing (°)** | | **Distance (m)** | |

**Site Map** (include north indicator, scale, vessel location, water depth, transect locations & other features of interest):

**Notes:**

## HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N19 | **Site Name** | Bundegi Sanctuary | **Date** | 5/5/98 | **Recorder** | Grubba |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.8M Zodiac | **Time** | 13.32 | **Weather** | > 5 knots | | |
| **Sea** | Calm | **Water depth (m)** | 2.0 | **Water visibility (m)** | 15.0 | | |
| **GPS Latitude** | | **GPS Longitude** | | **Differential** | | | |
| 21° 51.409' S | | 114° 09.982' E | | **Yes** | ☒ | **No** | ☐ |
| **Site location** | Immediately inside reef crest. | | | | | | |

**Habitat Description**

Backreef dominanted by high diversity of Acropora sp. and growth forms. Very narrow backreef and reef. High diversity of Pomacentridae and medium sized Scarids. Bottom is coral rubble with approximately 30% live coral cover.
Live coral: 22% (mean)
Dead coral: 39% (mean)
Algae: 0% (mean)
Abiotic: 41%

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | |
| **Coral** | Acropora sp. (high diversity—plate and branching), 1 Porites |
| **Fish** | Pomacentridae, Scaridae, Lutjanidae, Chaetodontidae |

| | |
|---|---|
| **Invertebrates** | 1 Panulirus versicolor |

**Other Features**

| |
|---|
| 1 Potato grouper (epinephelus tukula); 1 Reef Whitetip shark (Triaenodon obesus), uniquely shaped Acropora sp. |

**Impact or Activity**

| |
|---|
| No visual human impacts; Previous cyclone damage |

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/bvt/05.05.98 /#1 | **Aerial reference** | 1985/WA 3434C /RUN /5154 |
| **Slide reference** | | **Print reference** | |

## HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N19 | **Site Name** | Bundegi Sanctuary (Re-survey of 1998 site) | **Date** | 6-8-99 | **Recorder** | Cary |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.5M Zodiac | | **Time** | 15:00 | **Weather** | 15 knots SSE | |
| **Sea** | Calm | | **Water depth (m)** | 3 | **Water visibility (m)** | 5 | |

| **GPS Latitude** | **GPS Longitude** | **Differential** | | | |
|---|---|---|---|---|---|
| 21° 51.409' S | 114° 9.982' E | **Yes** | ☒ | **No** | ☐ |

| | |
|---|---|
| **Site location** | Immediately inside reef crest |

**Habitat Description**

| |
|---|
| Coral back reef with extensive cyclone damage. |

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |

| | |
|---|---|
| **Macro-algae** | |
| **Coral** | Montipora, Porites branching, Favites, Pocillopora (all alive) |
| **Fish** | |
| **Invertebrates** | Crayfish |

**Other Features**

| |
|---|
| |

**Impact or Activity**

| |
|---|
| A lot of crayfish |
| Cyclone damage |
| Most plates and branching Acroporas dead |
| Upturned plates, branching corals broken into small pieces |
| Small Acropora Corymbose (living) |
| A lot of small Acroporas- 10cm diameter |
| Prawn net found wrapped around coral |

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/bvt/6-8-99 /#2 | **Aerial reference** | 5155/WA 2286/RUN3/840048 |
| **Slide reference** | | **Print reference** | |

## TRANSECT LOCATION DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N19 | **Site Name** | Bundegi Sanctuary (Re-survey of 1998 site) | **Date** | 6-8-99 | **Recorder** | Cary |
| **Time** | 15:00 | **Video tape no.** | NMPMP/bvt/6-8-99 /#2 | | **Video operator** | | Williams |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T2 (m)** | |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** | |
| **Start** | 21° 51.409' S | 114° 9.959' E | 1.5-22.0 | 60 cm Star steel | 0.15 | |
| **Finish** | ° ' S | ° ' E | | | | |

**Notes: (**eg. description of habitat and dominant species along transect)
Same as 1998 Although couldn't find star pickets
(using Hired DGPS) Re- surveyed sites. T1 started at 1.5m plate only large live coral in area

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T3 (m)** | |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** | |
| **Start** | 21° 51.429' S | 114° 9.959' E | 11.5-2.0 | 60cm star steel | 0.15 | |
| **Finish** | ° ' S | ° ' E | | | | |

**Notes:**
Only live corals were montiporia, Porites (Branching) Acropora Corymbose, Pocillopora
Most plates and branching corals dead

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T1 (m)** | |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** | |
| **Start** | 21° 51.453' S | 114° 9.942' E | 1.5-2.0 | 60 cm Star steel | 0.15 | |

| | | | | | |
|---|---|---|---|---|---|
| **Finish** | 21° 51.453' S | 114° 9.923' E | 1.5-2.0 | 60cm Star steel | 0.15 |

**Notes:**
Live corals- Montipora, Porites (Branching), Pocillopora, Favites.

## TRANSECT MONITORING SITE DATA SHEET

| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N19 | **Site Name** | Bundegi Sanctuary (Re-survey of 1998 site) | **Date** | 6-8-99 | **Recorder** | Mahendran |
| **T1 Latitude start** | | **T1 Longitude start** | | **Differential** | | | |
| 21° 51.409' S | | 114° 09.982' E | | **Yes** | ☒ | **No** | ☐ |

| **Habitat type** | Coral backreef with extensive cyclone damage. | | |
|---|---|---|---|
| **Video reference** | NMPMP/bvt/6-8-99 /#2 | **Aerial reference** | 5155/WA 2286/RUN3/840048 |

**Site Map** (include north indicator, scale, start point, water depth, transect locations & other features of interest):

**Notes:**
Transect site established 5-5-98
Re-survey 6-8-99
Most plates and branching Acroporas dead.
Upturned plates, branching corals broken into small pieces

## HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N26 | **Site Name** | Bundegi sanctuary south | **Date** | 9-8-99 | **Recorder** | Mahendran |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.5M Zodiac | | **Time** | 14:50 | **Weather** | | |
| **Sea** | | **Water depth (m)** | | **Water visibility (m)** | | | |
| **GPS Latitude** | | **GPS Longitude** | | **Differential** | | | |
| 21° 52.222' S | | 114° 9.432' E | | **Yes** | ☒ | **No** | ☐ |
| **Site location** | Bundegi sanctuary southern boundary | | | | | | |

**Habitat Description**

| |
|---|
| Cyclone damaged branching and plate Acropora |

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | |
| **Coral** | Branching and plate Acropora (Fungiidae and Echinopora rare) |
| **Fish** | Damsels, Wrasse (small) |
| **Invertebrates** | 3 crays, some feather stars |

**Other Features**

| |
|---|
| Large cod (1.8m)<br>Porites bommie 4X3X3m |

**Impact or Activity**

| |
|---|
| None observed other than recent cyclone damage (Vance 1999) |

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/ bvt /9-08-99 /#5 | **Aerial reference** | 5154/WA 2286/RUN3/840048 |
| **Slide reference** | | **Print reference** | |

## TRANSECT LOCATION DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N26 | **Site Name** | Bundegi, sanctuary south | **Date** | 9-8-99 | **Recorder** | Meyer |
| **Time** | 14:50 | **Video tape no.** | NMPMP/bvt/9-08-99 /#5 | | | **Video operator** | Daly |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | 180 | **Distance to T2 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 21° 52.222' S | | 114° 09.432' E | | 60cm Star steel | 0.9 |
| **Finish** | ° ' S | | ° ' E | | | |
| **Notes: (**eg. description of habitat and dominant species along transect) | | | | | | |

| **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** | 21° 52.254' S | | 114° 09.432' E | | 60cm star steel | 0.9 |
| **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** | 21° 52.280' S | | 114° 9.434' E | | 60cm Star steel | 0.9 |
| **Finish** | 21° 52..308' S | | 114° 9.423' E | | | |
| **Notes:**<br>At 30m a large bommie lie due east | | | | | | |

## TRANSECT MONITORING SITE DATA SHEET

| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N26 | **Site Name** | Bundegi Sanctuary South | **Date** | 9-8-99 | **Recorder** | Mahendran |
| **T1 Latitude start** | | **T1 Longitude start** | | **Differential** | | | |
| 21° 52.222' S | | 114° 09.432' E | | **Yes** | ☒ | **No** | ☐ |

| **Habitat type** | Lagoon, rubble | | |
|---|---|---|---|
| **Video reference** | NMPMP/bvt/9-08-99 /#5 | **Aerial reference** | 5157/WA 2286/RUN3/840048 |

**Site Map** (include north indicator, scale, start point, water depth, transect locations & other features of interest):

**Notes:**

# HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N29 | **Site Name** | Bundegi North | **Date** | 13-8-99 | **Recorder** | George Watson |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.5M Zodiac | | **Time** | 12:00 | **Weather** | Fine ENE 19 knots | |
| **Sea** | Choppy | | **Water depth (m)** | 5m | **Water visibility (m)** | 3-4 | |
| **GPS Latitude** | | **GPS Longitude** | | | **Differential** | | |
| 21° 49.421' S | | 114° 11.082' E | | | **Yes** | ☒ | **No** ☐ |
| **Site location** | 300m from shore and halfway between Bundegi Jetty and the pier. | | | | | | |

**Habitat Description**

Cyclone damaged coral reef doimanated by Acropora (Staghorn and plates).

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | Some coraline algae and filamentous found on dead coral |
| **Coral** | Acropora, Fungiidae, Pocillopora, Millipora |
| **Fish** | Damsels, stone fish, parrot fish |
| **Invertebrates** | Crinoids, Drupella, nudibranchs |

**Other Features**

Upturned plates and broken staghorn (Cyclone damage)

**Impact or Activity**

| |
|---|
| Said to be a popular spot for boats (boating traffic)<br>Due to poor weather conditions during the time of survey no other boats observed<br>No other impact could be determined other than Cyclonic damage<br>Large fish species rare, dominated by damsels.<br>No crayfish found |

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/ bvt/13-8-99 /#5 | **Aerial reference** | 5158/WA 2286/RUN3/840048 |
| **Slide reference** | | **Print reference** | |

## TRANSECT LOCATION DATA SHEET

| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N29 | **Site Name** | Bundegi North | **Date** | 13-8-99 | **Recorder** | George Watson |
| **Time** | 12:00 | **Video tape no.** | NMPMP/bvt/13-8-99 /#5 | | **Video operator** | | Williams |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T2 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 21° 49.421' S | | 114° 11.082' E | <5m | 60cm Steel star | 0.8 |
| **Finish** | 21° 49.455' S | | 114° 11.087' E | <5m | 60cm Steel star | 1.6 |
| **Notes: (**eg. description of habitat and dominant species along transect) | | | | | | |

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T3 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 21° 49.455' S | | 114° 11.082' E | <5 | 60cm Steel star | 1.6 |
| **Finish** | 21° 49.479' S | | 114° 11.084' E | <5 | 60cm Steel star | 0.8 |
| **Notes:** | | | | | | |

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T1 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 21° 49.479' S | | 114° 11.087' E | <5 | 60cm Steel star | 0.8 |

| | | | | | |
|---|---|---|---|---|---|
| **Finish** | 21° 49.510' S | 114° 11.090' E | <5 | 60cm Steel star | 0.8 |

**Notes:**
Strong tidal flaw
Dive on slack water

## TRANSECT MONITORING SITE DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N29 | **Site Name** | Bundegi North | **Date** | 13-8-99 | **Recorder** | George Watson |

| **T1 Latitude start** | **T1 Longitude start** | **Differential** | | | |
|---|---|---|---|---|---|
| 12° 49.421' S | 114° 11.082' E | **Yes** | ☒ | **No** | ☐ |

| | | | |
|---|---|---|---|
| **Habitat type** | Cyclone damaged coral reef dominated by Acropora (Staghorn and Plate) | | |
| **Video reference** | NMPMP/bvt/13-8-99 /#5 | **Aerial reference** | 5158/WA 2286/RUN3/840048 |

**Site Map** (include north indicator, scale, start point, water depth, transect locations & other features of interest):

**Notes:**
Strong tidal flow

## TRANSECT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N14 | **Site Name** | Coral Bay/Billis Bay | **Date** | 19/5/98 | **Recorder** | Grubba |
| **Time** | 10.20 | **Video tape no.** | NMPMP/bvt/19.05.98 /#8 | | | **Video operator** | Myers |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | 180 | **Distance to T2 (m)** | 10.0 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 08.881' S | | 113° 44.965' E | 1.5-2.0 | 90cm Star/Steel | 0.15 |
| **Finish** | ° ' S | | ° ' E | | | |

**Notes: (**eg. description of habitat and dominant species along transect)
Started transect in sand on north edge of bommie. Glass bottom boat mooring 150m to the north.
Live coral: 13% Dead coral: 7%
Algae: 0% Abiotic: 26%

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | 180 | **Distance to T2 (m)** | 10.0 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 08.911' S | | 113° 44.971' E | 1.5-2.0 | 90cm Star/Steel | 0.15 |
| **Finish** | ° ' S | | ° ' E | | | |

**Notes:**
Live coral: 11%
Dead coral: 56%
Algae: 1%
Abiotic: 31%

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | 180 | | |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 08.945' S | | 113° 44.982' E | 1.5-2.0 | 90cm Star/Steel | 0.15 |

| | | | | | |
|---|---|---|---|---|---|
| **Finish** | 23° 08.960' S | 113° 44.980' E | 1.5-2.0 | 90cm Star/Steel | 0.15 |
| **Notes:** Re-positioned T3 to avoid sand; old end of transect 23 08.959' S 113 44.989' E | | | | | |

## LONG-TERM MONITORING SITE DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N14 | **Site Name** | Coral Bay/Billis Bay | **Date** | 19/5/98 | **Recorder** | Daly |
| **GPS Latitude** | | **GPS Longitude** | | | **Differential** | | |
| 23° 08.881 ' S | | 113° 44.965 ' E | | | **Yes** | ☐ | **No** ☐ |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Habitat type** | Backreef-coral | | | | | |
| **Location of nearest transect from GPS position** | **Transect No.** | T1 | **Compass bearing (°)** | | **Distance (m)** | 10 |

**Site Map** (include north indicator, scale, vessel location, water depth, transect locations & other features of interest):

**Notes:**

## HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N14 | **Site Name** | Coral bay/Bill's Bay | **Date** | 19/5/98 | **Recorder** | Grubba |
| **Vessel** | CALM Zodiac | | **Time** | 10.30 | **Weather** | 5 knots SE | |
| **Sea** | Calm | | **Water depth (m)** | 2.0 | **Water visibility (m)** | | 18.0 |
| **GPS Latitude** | | **GPS Longitude** | | | **Differential** | | |

| | | | | | |
|---|---|---|---|---|---|
| 23° 08.881' S | 113° 44.965' E | **Yes** | ☒ | **No** | ☐ |

| | |
|---|---|
| **Site location** | Directly out from Coral Bay township. 150m south of glass bottom boat mooring. |

**Habitat Description**

Backreef—dominated by massives/submassives/digitate Acropora sp. Dead Acropora plates, digitate and dead Branching Acropora. Transect passes through some sandy patches. Some large colonies of masssive corals. T2 passed through a rubble zone.
Live coral: 13% (mean)
Dead coral: 42% (mean)
Algae: 1%
Abiotic: 26% (mean)

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | Dictyota sp., Galazaura marginata, Filamentous blue-green algae |
| **Coral** | Acropora sp. (digitate, grandis), Monitpora sp., Favites, Platygyra, Echinoporal few fungia, Merulina sp.; Soft coral—Sinularia sp. |
| **Fish** | Pomacentridae, med sized Scaridae, Acanthuridae |
| **Invertebrates** | Several clams; few sea stars & Holothurians |

**Other Features**

No visible Drupella scars or animals. Acropora has not and has not been a dominant coral in this area.

**Impact or Activity**

Med to high energy site—seems to be some sand scouring (begginig T1). Some storm dammage. Glass bottom boat/ snorkelling/boat mooring 150m to the north. No Drupella observed.

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/bvt/19.05.98 /#8 | **Aerial reference** | 1994 /WA 3434C /RUN16/ 5169 |
| **Slide reference** | | **Print reference** | |

**TRANSECT DATA SHEET**

| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N22 | **Site Name** | Coral Bay North | **Date** | 21/5/98 | **Recorder** | Grubba |
| **Time** | 12.00 | **Video tape no.** | NMPMP/bvt/21.05.98 /#8 | | **Video operator** | | Myers |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T2 (m)** | 10.0 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** | |
| **Start** | 23° 05.942' S | 113° 44.397' E | 1.0 | 90cm Star/Steel | 0.15 | |
| **Finish** | ° ' S | ° ' E | | | | |

**Notes: (**eg. description of habitat and dominant species along transect)
Live coral: 8%
Dead coral: 84%
Algae: 0%
Abiotic: 8%

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T2 (m)** | 10.0 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** | |
| **Start** | 23° 05.978' S | 113° 44.390' E | 1.0 | 90cm Star/Steel | 0.15 | |
| **Finish** | ° ' S | ° ' E | | | | |

**Notes:**
Live coral: 5%
Dead coral: 89%
Algae: 5%
Abiotic: 1%

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | | | |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** | |
| **Start** | 23° 05.990' S | 113° 44.394' E | 2.0 | 90cm Star/Steel | 0.15 | |
| **Finish** | 23° 06.034' S | 113° 44.390' E | 2.0 | 90cm Star/Steel | 0.15 | |

**Notes:**
Live coral: 14%
Dead coral: 66%
Algae: 3%
Abiotic: 16%

## LONG-TERM MONITORING SITE DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N22 | **Site Name** | Coral Bay North | **Date** | 21/5/98 | **Recorder** | Daly |

| **GPS Latitude** | **GPS Longitude** | **Differential** | | | |
|---|---|---|---|---|---|
| 23 ° 05.942 ' S | 113 ° 44.397 ' E | **Yes** | ☐ | **No** | ☐ |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Habitat type** | Backreef -coral | | | | | |
| **Location of nearest transect from GPS position** | **Transect No.** | T | **Compass bearing (°)** | | **Distance (m)** | |

**Site Map** (include north indicator, scale, vessel location, water depth, transect locations & other features of interest):

**Notes:**

## HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | MAY 1998 |
| **Site No.** | N22 | **Site Name** | Coral Bay North | **Date** | 21/5/98 | **Recorder** | Myers |
| **Vessel** | CALM Zodiac | | **Time** | 12.00 | **Weather** | S 15 knots | |
| **Sea** | | **Water depth (m)** | 2.5 | **Water visibility (m)** | 15.0 | | |
| **GPS Latitude** | | **GPS Longitude** | | **Differential** | | | |

| | | | | | |
|---|---|---|---|---|---|
| 23° 05.942' S | 113° 44.397' E | **Yes** | ☒ | **No** | ☐ |
| **Site location** | east of marker than defines the bend in the sanctuary zone. | | | | |

**Habitat Description**

Backreef dominated by old (dead) Acropora plates (1.0m diam.) with about 5 % live coral cover. Many juvenile recruits seen of Acropora and a few Favites sp. Areas of sand and rubble seen—storm damage present. Few Drupella found and few scars seen. Diverse fish life. Some seagrass (Halophila) present.
Live coral: 9% (mean)
Dead coral: 80% (mean)
Algae: 3% (mean)
Abiotic: 8% (mean)

**Dominant Species**

| | |
|---|---|
| **Seagrass** | Halophila ovalis (sparse) |
| **Macro-algae** | Turbinaria sp, Dictyota sp., Filamentous blue-green algae, Valonia ventricosa |
| **Coral** | Dominant—Acropora sp. (plates & digitifera); few Platygyra sp. & Favites sp.; few Montipora sp.; few |
| **Fish** | Dominated by Labridae,Pomacentridae, Pomacanthidae and some schools of Chaetodontide; some Monacanthidae, Amphiprion sp. (Anemonefish); few Scarids |
| **Invertebrates** | Few Holothurians, Echinometra sp.; seastars (Linckia sp., Formia indica); few Anemone within rubble; giant clams |

**Other Features**

**Impact or Activity**

High energy site; evidence of storm damage, minimal Drupella impact seen

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/bvt/21.05.98 /#8 | **Aerial reference** | 1994 /WA 3434C /RUN16/ 5165 |
| **Slide reference** | | **Print reference** | |

**HABITAT DATA SHEET**

| | | | |
|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | **Field Survey** | AUGUST 1999 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Site No.** | N47 | **Site Name** | Bills Bay North | **Date** | 16-8-99 | **Recorder** | Williams/ Mahendran |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.5M Zodiac | | **Time** | 16:15 | **Weather** | 10-15knots W | |
| **Sea** | Flat | | **Water depth (m)** | 1.5- 4 | **Water visibility (m)** | 5 | |

| GPS Latitude | GPS Longitude | Differential | | | |
|---|---|---|---|---|---|
| 23° 7.463' S | 113° 45.552' E | **Yes** | ☒ | **No** | ☐ |

| | |
|---|---|
| **Site location** | Northern Bills Bay, 200m south of Pt Maud |

**Habitat Description**

Corilline algae covered rubble composed mostly of upturned plates with some new corals growing on top. Habitat was once reef with small sand patches approximately 3-4m across widely spaced.

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | Very little |
| **Coral** | Acropora sp (Corymbose), Fungiids, (Turbinaria sp, Echinopora, Acropora plates, rare) |
| **Fish** | Mainly juveniles and females *Chlorosus sorolidus*, blue damsels, Surgen fish, Chaetodon sp, Pomacentrus sp., (Daseyllus) |
| **Invertebrates** | Urchins X2sp |

**Other Features**

Site was notable in lack of other invertebrates, No cray fish observed
Very few massive corals
No sponges
Extra footage of caespitose- corymbose *Acropora cerealis*

**Impact or Activity**

Rubble caused by (unknown factor) possibly cyclone (not Vance)
Site very rarely visited by anyone due to shallow location in Sanctuary zone.

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/ bvt /16-8-99 /#6 | **Aerial reference** | DMS 612 |
| **Slide reference** | | **Print reference** | |

## TRANSECT LOCATION DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N47 | **Site Name** | Bills Bay North | **Date** | 16-8-99 | **Recorder** | Daly/ Myer |
| **Time** | 14:15 | **Video tape no.** | NMPMP/bvt/16-8-99 /#6 | | **Video operator** | | Williams |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | 180 | **Distance to T2 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 7.463' S | | 113° 45.552' E | 4m | 90cm Star steel | 0.25 |
| **Finish** | ° ' S | | ° ' E | | | |

**Notes: (**eg. description of habitat and dominant species along transect)
Rubble over dead shallow bommies (1.5m) down to small sand patches on floor (at 4m)

| **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** | 23° 7.493' S | | 113° 45.536' E | 3.5 | 90cm Star steel | 0.25 |
| **Finish** | ° ' S | | ° ' E | | | |

| **Notes:** |
|---|
| |

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | 180 | **Distance to T1 (m)** | 170 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 7.523' S | | 113° 45.538' E | 3m | 90cm Star steel | 0.25 |
| **Finish** | 23° 7.549' S | | 113° 45.534' E | 2m | 150cm Star steel | 0.25 |
| **Notes:** | | | | | | |

## TRANSECT MONITORING SITE DATA SHEET

| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N47 | **Site Name** | Bills Bay North | **Date** | 16-8-99 | **Recorder** | Daly/ Myer |
| **T1 Latitude start** | | **T1 Longitude start** | | **Differential** | | | |
| 23° 7.463' S | | 113° 45.552' E | | **Yes** | ☒ | **No** | ☐ |

| **Habitat type** | Coraline algae covered rubble composed mostly of upturned plates with some new corals growing on top. Habitat was once reef with small sand patches approximately 3-4m across widely spaced. | | |
|---|---|---|---|
| **Video reference** | NMPMP/bvt /16-8-99 /#6 | **Aerial reference** | DMH 612 |

**Site Map** (include north indicator, scale, start point, water depth, transect locations & other features of interest):

Drawn to scale 0.325 from DMH612

**Notes:**
Access from Southern Bill's Bay, path across the reef is strongly discouraged by CALM rangers and locals.

# HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N48 | **Site Name** | Bills Bay South | **Date** | 19-8-99 | **Recorder** | Williams Mahendran |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.5M Zodiac | **Time** | 14:40 | **Weather** | 19 knots SW | | |
| **Sea** | Slight current | **Water depth (m)** | 2-3m | **Water visibility (m)** | 8M | | |
| **GPS Latitude** | | **GPS Longitude** | | **Differential** | | | |
| 23° 8.476' S | | 113° 46.163' E | | **Yes** | ☒ | **No** | ☐ |
| **Site location** | This site is adjacent to the Coral Bay boat launching area in Bills Bay<br>Approximately 2km south of Pt Maud | | | | | | |

**Habitat Description**

Coral rubble with Montipora and branching Acropora.

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | |
| **Coral** | Montipora, Branching Acropora, Echinopora (moderate), (Fungids, Pocillopora, rare) |
| **Fish** | Wrasse, black and white Dacycallus, Blue Damsels, Angel fish, Chaethodon, Five lined seaperch |
| **Invertebrates** | Oyster |

**Other Features**

**Impact or Activity**

Large pipe (3m length), 1x large drum (40 cm diameter) and 1xbeer bottle, all found near T1.
No cray fish observed

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/ bvt/19-8-99 /#8 | **Aerial reference** | DMH 612 |
| **Slide reference** | | **Print reference** | |

## TRANSECT LOCATION DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N48 | **Site Name** | Bills Bay South | **Date** | 19-8-99 | **Recorder** | Williams |
| **Time** | 14:40 | **Video tape no.** | NMPMP/bvt/19-8-99 /#8 | | **Video operator** | | Daly |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | 0 | **Distance to T2 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 8.476' S | | 113° 46.163' E | 2-3 | 90cm Star steel | |
| **Finish** | ° ' S | | ° ' E | | | |
| **Notes: (**eg. description of habitat and dominant species along transect) | | | | | | |

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | 0 | **Distance to T3 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 8.446' S | | 113° 46.165' E | 2-3 | 90cm Star steel | |
| **Finish** | ° ' S | | ° ' E | | | |

| **Notes:** |
|---|

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | 340 | **Distance to T1 (m)** | 170 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 8.408' S | | 113° 46.387' E | 2-3 | 90cm Star steel | |
| **Finish** | 23° 8.387' S | | 113° 46.160' E | 2-3 | 90cm Star steel | |
| **Notes:** | | | | | | |

## TRANSECT MONITORING SITE DATA SHEET

| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N48 | **Site Name** | Bills Bay South | **Date** | 19-8-99 | **Recorder** | Williams |
| **T1 Latitude start** | | **T1 Longitude start** | | **Differential** | | | |
| 23° 8.476' S | | 113° 46.163' E | | **Yes** | ☒ | **No** | ☐ |

| **Habitat type** | Coral rubble with emerging Montipora and Branching Acropora | | |
|---|---|---|---|
| **Video reference** | NMPMP/bvt/19-8-99 /#8 | **Aerial reference** | DMH 612 |

**Site Map** (include north indicator, scale, start point, water depth, transect locations & other features of interest):

**Notes:**
Drawn to scale 0.325 from DMH612

T1 star picket located on south side of 2m bommie.

## HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N49 | **Site Name** | Bills Bay West | **Date** | 17-8-99 | **Recorder** | Williams |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.5M Zodiac | **Time** | 13:55 | **Weather** | 10-15 kts W | | |
| **Sea** | Slight surge | **Water depth (m)** | 10 | **Water visibility (m)** | 15 | | |
| **GPS Latitude** | | **GPS Longitude** | | **Differential** | | | |
| 23° 7.805' S | | 113° 45.205' E | | **Yes** | ☒ | **No** | ☐ |
| **Site location** | Western Bills Bay, approximately 1km from Pt Maud | | | | | | |

**Habitat Description**

| |
|---|
| High coral diversity and density dominated by branching and plate Acropora. |

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | |
| **Coral** | Branching and plate Acropora, Montipora, *Pocillopora eydouxi, P.verracosa*, *Turbinaria frondens* (rare), Echinopora (very large plates, common), (Favia, Favites, *Stylophora pistillata*, Galaxea and Fungids, rare) |
| **Fish** | Large parrot fish, Blue Damsels |
| **Invertebrates** | |

**Other Features**

| |
|---|
| |

**Impact or Activity**

No sized target fish species observed
No cray fish observed
No litter observed

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/ bvt/17-8-99 /#6 | **Aerial reference** | DMH 612 |
| **Slide reference** | | **Print reference** | |

## TRANSECT LOCATION DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N49 | **Site Name** | Bills Bay- West | **Date** | 17-8-99 | **Recorder** | Williams |
| **Time** | 13:55 | **Video tape no.** | NMPMP/bvt/17-8-99 /#6 | | **Video operator** | | Daly |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | 150 | **Distance to T2 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 7.805' S | | 113° 45.205' E | 10 | 90cm Star steel | |
| **Finish** | ° ' S | | ° ' E | | | |

**Notes: (**eg. description of habitat and dominant species along transect)

| **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** | 23° 7.834' S | | 113° 45.196' E | 10 | 90cm Star steel | |
| **Finish** | ° ' S | | ° ' E | | | |

| **Notes:** |
|---|

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T1 (m)** | 170 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 7.863' S | | 113° 45.182' E | 10 | 90cm Star Steel | |
| **Finish** | 23° 7.882' S | | 113° 45.166' E | | 90cm Star steel | |
| **Notes:** | | | | | | |

## TRANSECT MONITORING SITE DATA SHEET

| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N49 | **Site Name** | Bills Bay West | **Date** | 17-8-99 | **Recorder** | Williams |
| **T1 Latitude start** | | **T1 Longitude start** | | **Differential** | | | |
| 23° 7.805' S | | 113° 45.205' E | | **Yes** | ☒ | **No** | ☐ |

| **Habitat type** | High coral diversity and density dominated by branching and plate Acropora. | | |
|---|---|---|---|
| **Video reference** | NMPMP/ bvt/17-8-99 /#6 | **Aerial reference** | DMH 612 |

**Site Map** (include north indicator, scale, start point, water depth, transect locations & other features of interest):

**Notes:**
Drawn to scale 0.325 from DMH612

# HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N50 | **Site Name** | Bills Bay East | **Date** | 18-8-99 | **Recorder** | Mahendran |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.5M Zodiac | **Time** | 10:00 | **Weather** | SW 10knots | | |
| **Sea** | Calm | **Water depth (m)** | 2 | **Water visibility (m)** | 7 | | |
| **GPS Latitude** | | **GPS Longitude** | | **Differential** | | | |
| 23° 07.793' S | | 113° 46.018' E | | **Yes** | ☒ | **No** | ☐ |
| **Site location** | Eastern Bills Bay, approximately 800m south of Pt Maud | | | | | | |

**Habitat Description**

| |
|---|
| Long dead corals now partially covered in encrusting hard coral with some small plate and corymbose Acropora. |

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | |
| **Coral** | Pocillopora, (Fungids, Branching, corymbose and plate Acropora, rare) |
| **Fish** | Chaetodontidae (rare), 2X species of Parrot fish abundant (many females, very few males) Box fish, five lined seaperch (*Lutjanus quinquelineatus*) |
| **Invertebrates** | None observed |

**Other Features**

The transect should be visited during high tide (0.8m)
There are shallow bommies (Navigational hazard)
Not a very popular recreation site
No litter found
No sized recreational target fish found

**Impact or Activity**

Tim Daly notes large re-growth since 1995 visit to site after 1989 coral kill from coral spawning
No cray fish observed

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

## TRANSECT LOCATION DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N50 | **Site Name** | Bills Bay East | **Date** | 18-8-99 | **Recorder** | Williams |
| **Time** | 9: 30 | **Video tape no.** | NMPMP/bvt/18-8-99 /#8 | | **Video operator** | | Daly |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | 170 | **Distance to T2 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 7.793' S | | 113° 46.018' E | 3 | 90cm Star steel | |
| **Finish** | ° ' S | | ° ' E | | | |

**Notes: (**eg. Description of habitat and dominant species along transect)

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | 170 | **Distance to T3 (m)** | 170 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |

| | | | | | |
|---|---|---|---|---|---|
| **Start** | 23° 7.819' S | 113° 46.022' E | 3 | 90cm Star steel | |
| **Finish** | ° ' S | ° ' E | | | |
| **Notes:** | | | | | |

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | 170 | **Distance to T1 (m)** | 170 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 7.847' S | | 113° 46.030' E | 3 | 150cm Star steel | |
| **Finish** | 23° 7.873' S | | 113° 46.031' E | | | |
| **Notes:** | | | | | | |

## TRANSECT MONITORING SITE DATA SHEET

| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N50 | **Site Name** | Bills Bay East | **Date** | 18-8-99 | **Recorder** | Williams |
| **T1 Latitude start** | | **T1 Longitude start** | | **Differential** | | | |
| 23° 7.793' S | | 113° 46.018' E | | **Yes** | ☒ | **No** | ☐ |

| **Habitat type** | Encrusting hard coral covered rubble consisting mainly of plate and corymbose Acropora | | |
|---|---|---|---|
| **Video reference** | NMPMP/ bvt/18-8-99 /#8 | **Aerial reference** | DMH 612 |

**Site Map** (include north indicator, scale, start point, water depth, transect locations & other features of interest):

Drawn to scale 0.325 from DMH612

**Notes:**
Shallow site, requires 0.8m minimum tide for safe navigation

# HABITAT DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N53 | **Site Name** | Monks Head | **Date** | 17-8-99 | **Recorder** | Mahendran |
| **Vessel** | AIMS 4.3M NAIAD<br>CALM 3.5M Zodiac | | **Time** | 8:30 | **Weather** | | |
| **Sea** | Calm | | **Water depth (m)** | 5m | **Water visibility (m)** | | 15 |
| **GPS Latitude** | | **GPS Longitude** | | | **Differential** | | |
| 23° 9.260' S | | 113° 45.862' E | | | **Yes** | ☒ | **No** ☐ |
| **Site location** | 350m NW of Monk Head adjacent to boat channel | | | | | | |

**Habitat Description**

Coral lagoon dominated by branching and plate Acropora

**Dominant Species**

| | |
|---|---|
| **Seagrass** | |
| **Macro-algae** | |
| **Coral** | Branch and plate Acropora, Pocillopora, Turbinaria, (Montipora, Fungidae, rare) |
| **Fish** | Blue Damsels |
| **Invertebrates** | Drupella abundant |

**Other Features**

**Impact or Activity**

No target fish species observed
Large numbers of Drupella observed
No cray fish observed
No litter seen
Site of proposed boat launching site

| | | | |
|---|---|---|---|
| **Video reference** | NMPMP/bvt/17-8-99 /#6 | **Aerial reference** | DMH 612 |
| **Slide reference** | | **Print reference** | |

## TRANSECT LOCATION DATA SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
| **Site No.** | N53 | **Site Name** | Monks Head | **Date** | 17-8-99 | **Recorder** | Williams |
| **Time** | 8:30 | **Video tape no.** | NMPMP/bvt/17-8-99 /#6 | | **Video operator** | | Williams |

| **T1** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T2 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 9.260' S | | 113° 45.862' E | 2.5 | 90cm Star steel | |
| **Finish** | ° ' S | | ° ' E | | | |

**Notes: (**eg. Description of habitat and dominant species along transect)
On the edge of reef and sand patch adjacent to boating channel
Mainly branching Acropora

| **T2** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T3 (m)** | 60 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 9.230' S | | 113° 45.861' E | 2 | 90cm Star steel | |
| **Finish** | ° ' S | | ° ' E | | | |

| **Notes:** |
|---|

| **T3** | **Length (m)** | **50** | **Compass bearing (°)** | | **Distance to T1 (m)** | 170 |
|---|---|---|---|---|---|---|
| **Transect** | **DGPS Lat** | | **DGPS Long** | **Depth (m)** | **Picket type** | **Picket ht (m)** |
| **Start** | 23° 9.196' S | | 113° 45.865' E | 2.5 | 90cm Star steel | |
| **Finish** | 23° 9.170' S | | 113° 45.868' E | | | |
| **Notes:** | | | | | | |

## TRANSECT MONITORING SITE DATA SHEET

| **Project** | NINGALOO MARINE PARK MONITORING PROGRAM | | | | **Field Survey** | | AUGUST 1999 |
|---|---|---|---|---|---|---|---|
| **Site No.** | N53 | **Site Name** | Monks Head | **Date** | 17-8-99 | **Recorder** | Daly |

| **T1 Latitude start** | **T1 Longitude start** | **Differential** | | | |
|---|---|---|---|---|---|
| 23° 9.170' S | 113° 45.868' E | **Yes** | ☒ | **No** | ☐ |

| **Habitat type** | Coral reef lagoon dominated by branching and plate Acropora | | |
|---|---|---|---|
| **Video reference** | NMPMP/ bvt/17-08-99 /#6 | **Aerial reference** | DMH 612 |

**Site Map** (include north indicator, scale, start point, water depth, transect locations & other features of interest):

**Notes:**
T1 start is in sand on the edge of the dense coral patch