MARINE MANAGMENT SUPPORT
PILBARA

ESTABLISHMENT OF BASELINE BENTHIC MONITORING SITES IN NINGALOO MARINE PARK AUGUST 1999

Field Program Report: MMS/PI/NMP-17/1999

A collaborative project between CALM Marine Conservation Branch,
CALM Karratha Regional Office
and CALM Exmouth District Office

A project funded by the National Heritage Trust's
Coast and Clean Seas Coastal Monitoring Program

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1 INTRODUCTION

1.1 General

This field program report presents information on the August 1999 field survey of the *Ningaloo Marine Park Monitoring Program* (NMPMP). The main aim of the NMPMP is to determine the health of the key benthic habitats of the Ningaloo Marine Park and the proposed southern extension. The locality and boundaries of Ningaloo Marine Park and surrounds are shown in Figure 1.

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; Cary *et al*. 1998). In May 1998 twenty-one long term monitoring sites were established approximately every 15 kms along the back-reef of the marine park and its southern extension. These are surveillance monitoring sites and will be monitored to assess the impact of episodic regional physical and biological processes (eg the effect of cyclones and coral predators). A sub-set of these sites will be monitored to determine the extent and cause of natural variation (eg inter-annual variability) of key ecological attributes. Nineteen of these sites were re-surveyed in July 1999 (Cary *et al.* 1999).

This survey will involve the establishment of approximately 25 long-term monitoring sites in areas of high human usage, mainly in the lagoonal areas with some backreef areas.

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

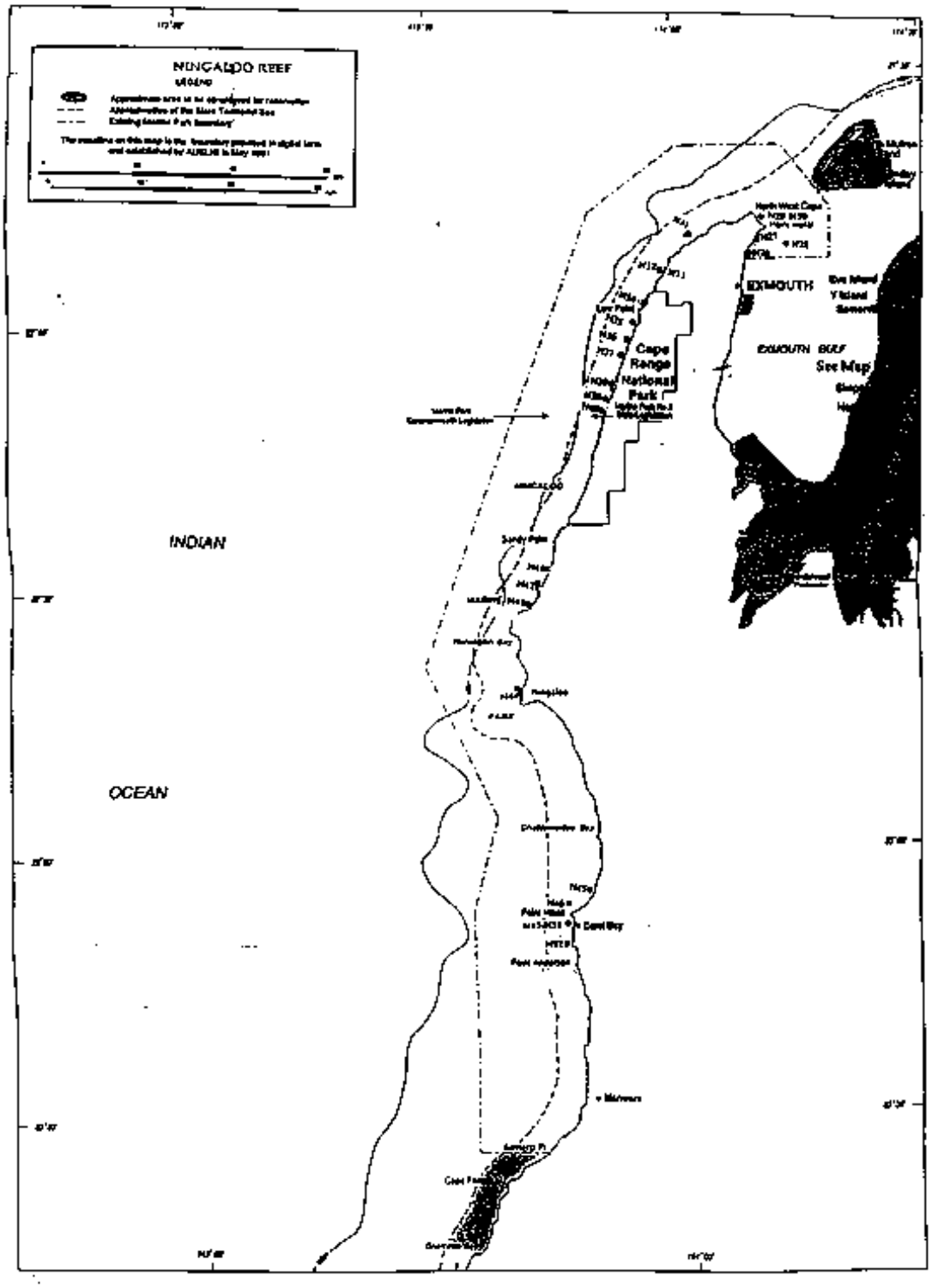
Tim Daly of the Marine Conservation Branch is the Field Team Leader and will coordinate all activities in the field.

Other CALM field staff will include Jennie Cary, Mike Lapwood and Murali Mahendran from the MCB. George Watson from the Pilbara Regional Office and Adam Meyer and Caroline Williams from Exmouth District Office.

1.2 Background

The successful management of the marine environment is contingent upon comprehensive long-term monitoring programs that provide information on natural variability and long-term trends in key biological communities. They must determine the status of important natural attributes at regular intervals and identify undesirable trends resulting from human activities in time for remedial management action to be implemented effectively. Monitoring programs generally comprise of one or more of the following complementary objectives: (i) local scale impact and/or *compliance monitoring* that examines the effects of human activities in a localised area; (ii) temporally-constrained, broadscale *surveillance monitoring* to assess the impact of episodic regional physical and biological processes (eg the effect of cyclones and predators) and (iii) spatially-constrained, long-term monitoring of key biological parameters to determine the extent and cause of *natural variation* (eg seasonal and inter-annual variability) of key ecosystem attributes.

The aim of the *Ningaloo Marine Park Monitoring Program* (NMPMP) is to assess the 'health' of major benthic habitats of the marine park and its southern extension. Long term monitoring sites will be established 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. This report describes one of a number of field surveys that will be conducted as part of the NMPMP. The spatial and temporal scale of on-going monitoring will determine the type of monitoring; i.e. surveillance, compliance or natural variability. As the coral communities are the most dominant benthic habitat, the major focus of the field program will be to monitor the coral communities. As the majority of human activities in the marine park occur within the easily accessible lagoon and back-reef (on the sea-ward edge of lagoon) the majority of monitoring sites will be established in these areas. Quantitative biological information to assess the 'health' of the coral communities will be obtained using video footage from re-locatable permanent transects in areas where potential broad-scale impacts are likely to occur (see 2.2.3). At popular dive and fishing spots, the impacts will be more localised and semi-quantitative biological information to assess the 'health' of coral communities will be collected using visual surveillance, supported by video footage, within re-locatable areas (Non-transect sites) (see 2.2.2).


NINGALOO REEF
INDIAN
OCEAN
EXMOUTH
EXMOUTH GULF
See Map
Cape Range National Park

The NMPMP is linked to the recommendations of the *Ningaloo Marine Park Management Plan 1989-1999;*

- Monitoring of marine flora and fauna be carried out to gain an understanding of factors which influence the stability of marine communities in the Park.
- Monitoring and periodic surveys of recreational and commercial use in and adjacent to the park be carried out to determine the effect of human usage on marine communities in the Park.

1.3 Aims

The main aim of the NMPMP is to determine the 'health' of the major benthic habitats of the Ningaloo Marine Park and the southern extension. Primary objectives of the August 1999 field survey include:

- The establishment of re-locatable long-term monitoring sites (transect and non-transect) on lagoonal and back-reef benthic communities in areas of high human activity in the Ningaloo Marine Park.

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

2 SITE SELECTION, METHODS AND EQUIPMENT

2.1 Site selection

2.1.1 Areas of high human usage

Long-term monitoring sites will be established in areas identified as having a high level of human usage. To assist in identifying areas of high human usage a spreadsheet identifying all human activities occurring in the marine park was developed (Appendix 1). The spreadsheet divided the Ningaloo Marine Park into 23 sectors and the types of activities occurring in each sector were identified by the CALM Exmouth office. The spreadsheet highlighted areas adjacent to Exmouth, Tantabiddi and Coral Bay as having the highest number of human activities but human activities were also reported in several other areas. Most areas of high human usage are located in the lagoon.

Specific information on human activities in the area was provided by CALM Exmouth staff and other people in the Region with a high degree of local knowledge. The CALM dive and snorkel book (by Carolyn Thompson) was also used to identify popular dive and snorkel sites. Planning reports were also used to determine potential development sites in the area:

- Environmental and Planning Guidelines for Tourism Development on the North West Cape by Department of Environmental Protection and Ministry for Planning (1999).
- Exmouth – Learmonth (North West Cape) Structure Plan by Western Australian Planning Commission (1998).
- Gascoyne Coast Regional Strategy by Western Australian Planning Commission (1996).

All the above information was used to assist in site selection.

2.1.2 Contingency for adverse conditions

In the event of adverse weather, sea conditions or road (track) conditions the Field Team Leader 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.

2.2 Methods

2.2.1 General Procedures

1. Personnel and equipment leave main camp and move to 'day camp' (a point on the beach as close as possible to the site).

2. Boats are launched, gear made ready.

3. Boat 1 leaves the beach followed by boat 2 about 15 minutes later.

4. Transect lines are set, filmed and retrieved as described in the methods below.

5. Boats 1 and 2 takes divers back to 'day camp' to change air tanks, camera batteries etc. and check video footage. Boat 2 also brings backs site data (start and end point coordinates, transect layout sketch, dive times, video times etc.) for shore person to enter onto data sheets.

6. Boats are retrieved and gear stored.

7. Personnel and equipment leave day base to either, return to base camp or move directly to second site (if applicable) and setup second 'day camp'.

During this survey a variety of monitoring techniques, as described below, will be used. At sites chosen to assess the impacts of possible broad-scale influences the transect method (section 2.2.3) will be used. For sites with localized high human usage, such as dive and snorkel sites, a non-transect method (section 2.2.2) of recording impacts will be used. General observations of impacts from shore based activities such as the mangrove walk, beach fishing, boat launching etc will also be recorded on data sheets and video.

2.2.2 Non-transect Method

Direct impacts from human activities such as diving, snorkeling and boating on benthic communities will be monitored during this field trip. The exact size and location of the area to be monitored will be determined by the field crew after a preliminary inspection of the proposed site. The area will be marked out with buoys and the exact position of the buoys will be ascertained using Differential GPS to enable the site to be accurately relocated in the future.
Divers will then traverse the site and record the extent and type of impacts. This shall be done by recording observations on an underwater slate and taking digital video footage of any observed impacts. Observations and video information will be transferred to non-transect data sheets post dive (see appendix II).

2.2.3 Transect Method

To monitor the impact of broad-scale human influences, such as those possible from large shore-based developments, three permanent 50 m transects will be established at each site to monitor spatial and temporal changes in benthic composition. The alignment of the transects will be governed by bathimetry, the benthic composition and the source of the impact. Where practical the transects will be set in a line, one after the other with the transect start and end points separated by a 10 m space. For this configeration the distance between the start of the first transect and the end of the last transect will be 50+10+50+10+50=170m. If this configuration is impractical at a particular site then three 50m transects can be set up parallel to each other or in whatever configeration is appropriate for the area to be monitored.

All transects are to be permanently marked using star pickets at the start and end points. A 50 m scaled (every 10cm) and weighted transect line is then run between the pickets following the contour of the seabed. The position of the start of each transect is recorded using differential GPS, providing an accuracy of better than 3 m. The sessile benthic composition along each transect is then recorded at a set height and speed, using a high quality video camera in an underwater housing, resulting in a strip transect 50 m being sampled.

The transect video sampling method was developed by the Australian Institute of Marine Science (AIMS) to monitor the status of coral dominated benthic communities by detecting and quantifying major spatial and temporal changes in the percentage cover of sessile benthos (Christie *et al.* 1996). This survey technique provides a permanent record of

benthic habitats that can be later analyzed in a variety of different ways. A visual record is a very compelling method for identifying change and for highlighting impacts that may result from recreational and commercial usage.

At all transect sites, recordings of benthic composition using the video transect technique will be complemented with general information on the major benthic community types (e.g., coral and seagrass meadows etc.). The visually dominant species and the nature and extent of impacts (if present) will be recorded either by direct observation from the boat (i.e. by viewfinder), or by divers taking general video footage and still photographs.

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.

The following sections describe the procedures for the establishment of transect sites. The entire procedure should take between 4 and 6 hours, depending on *in situ* conditions. The number of sites established per day will depend on road/track conditions between sites, prevailing sea conditions and distance from vessel launch site to the area of operation.

2.2.3.1 Methods for the Establishment of permanent transect sites.

Transect sites will consist of three permanent 50 meter transects. When the transects are laid end to end it is only necessary to drive in a star picket at the start of each transect and the end of the last one. In all other cases a star picket will be driven into the substrate at the start and end point of each transect. A weighted float will mark the position of the star pickets until DGPS coordinates can be obtained from the surface. Previous field trips have proven that transect deployment can be best achieved by using either procedures 2.2.3.2 or 2.2.3.3 below, or a combination of both depending on conditions, available vessels and personnel.

2.2.3.2 Establishment of transect using boat.

To be used in calm conditions with low current and relatively flat bathymetry. The transect lines will be laid out and retrieved by boat rather than by divers.

<u>Boat 1 (2 persons: 1 boat operator, 1 standby diver)</u>

1. Boat 1 will reconnoitre the general area using pre-marked aerial photographs and GPS coordinates as guidance.

2. The area chosen for the transect is then viewed using a viewfinder or a snorkel diver to confirm the suitability of the site.

3. The end of the transect line is clipped to the weight of the start point marker buoy as it is deployed.

4. The transect lines are run out by driving the boat in a straight line on a pre-determined compass bearing.

5. When the end of each 50m transect line is reached it is clipped to the weight of the end point marker buoy as it is deployed.

6. A visual check should then be done to ensure that the transect line was laid straight. This may be done from the boat or a snorkeler can be deployed to check and straighten as necessary. If the snorkeler is unable to correct the transect line, that person informs one of the SCUBA equipped divers whom will make the necessary adjustments.

7. Boat 1 stands by as it waits for boat 2 divers to install star pickets and video the transects.

8. Boat 1 then takes DGPS readings at the marker buoys to determine the coordinates of each transect.

9. Boat 1 then retrieves the transect lines and floats. In the event of a line becoming snagged a diver from boat 2 (or a snorkeller from boat 1) enters the water to unsnag the line.

Boat 2 (2 persons. Both divers)

1. As soon as boat 1 has set the transect line, boat 2 with two divers onboard moves into position at the end of transect 3 and drops anchor. The two divers are deployed and begin installing the star pickets and PVC extensions, ending up at the beginning of transect 1.

2. When the star pickets are installed the divers change tanks if necessary. One diver then has the role of video camera operator and the second diver is a data recorder.

3. The camera operator films the area adjacent to the transect start point. Anything that is of significance is also filmed. The site and transect details inscribed on the first picket extension are taped. Then the diver proceeds video taping along the transect line (Section 2.2.4).

4. The data recorder diver follows the video operator who is taping 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 star picket in relation to prominent features to assist in future relocation.

5. On completion, the divers return to boat 2, which is still anchored at the end of transect 3. Boat 2 stands by as boat 1 takes a DGPS fix of the marker floats then retrieves the floats and the transect lines. Boat 2 deploys a diver if the transect line becomes snagged during retrieval. Both boats then return to the launch site.

2.2.3.3 Establishment of transect by divers.

When adverse wind, current or irregular bathymetry make it impractical to deploy the transect lines from the boat it will be necessary for the divers to deploy them underwater. This will be achieved by the divers first hammering in a star picket at the transect start point then attaching the transect line to it and swimming on a pre-determined compass course while unrolling the line from it's reel.

2.2.4 Methods for obtaining video imagery of permanent transects.

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

1 Fill out the details on the in-water data sheet (positioned on the top of the housing) identifying the transect. Record the site number, date, transect number, and recorder's name.

2 Before beginning to film the transect, record a panoramic shot of the area adjacent to the start of the transect (for instructions on the setup and use of the video see Appendix III). Start at the star picket, hold the camera in a horizontal position and turn slowly clockwise, videoing the immediate surroundings and ending at the initial view. Move in on the top of the star picket to record the site number and transect number written on the extension.

3 Record the start time code on the data sheet. Press REC and video the base of the star picket for a few seconds and then move along the 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 50m transect should take between 5 and 6 minutes in total. At the end of the transect video the base of the star picket for a few seconds and then press STBY.

5 Record the finish time code on the data sheet.

6 If video recording along a transect has to be aborted for any reason, or if there is considerable variation in the height or speed of the recorder, then the entire transect should be re-sampled, beginning again from the start point of the transect. It is important that the new start and finish time codes for any repeated transects are clearly recorded on the data sheets.

7 Proceed to the next transect. Once all three transects at a site have been completed and the tape has been viewed and checked, full details must be recorded on the main video transect data sheet (Appendix II). Any repeated or incomplete transects, or situations where transects were recorded out of order or with false starts should be noted on the data sheets.

8 A total of two sites should be recorded on each 60min digital video tape. The tape and tape cover should be clearly labeled (using a permanent marker) with the designated tape number (Appendix III), the site number and date of recording. The red copy protect switch on the tape should be switched on to prevent accidental recording over any data, and the tapes should be stored in a waterproof case at all times.

9 At the end of the field trip and before data analysis the tapes must be duplicated, either in digital or VHS format, and the originals archived and stored separately from the duplicates.

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
- 15 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 (2)
- 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
- Maps with historical data
- Reference books for the identification of corals, fish, birds, marine mammals and marine fauna
- Scientific reference file

- Landsat imagery of Ningaloo Marine Park and southern extension
- 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 20 floppy discs
- 4 field notebooks
- 1 box of pencils
- 1 stationary box
- equipment log book

2.3.5 Diving

- Personal dive gear
- 10 scuba tanks
- 6 BCD's
- 6 regulators with alternate airsource and gauges
- 2 masks and snorkels
- 2 spare pairs of fins
- 4 dive computers
- 2 spare weight belts, each with 24 lb of weight
- 4 compasses
- 2 boat dive flags
- 1 personal dive flag
- 2 dive spare parts and repair kits
- 6 pocket size underwater slates, grips and pencils
- 4 large underwater slates, grips and pencils
- 4 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.
- AIMS 4.2 rigid hull inflatable plus 40 hp motor.
- 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 Karratha 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 units and accessories
- 1 Omni star differential GPS unit, antennae and accessories
- 2 calm hand-held radios and chargers

- 2 waterproof bags for radios
- CALM vehicle equipped with CALM VHF

2.3.8 Transect establishment

- 9x pre cut marker buoys (6 x 5m, 3 x 10m)
- 4 x 50m weighted transect lines, marked at 10cm increments
- 3 x 10m lines marked at 1m increments
- 20 x 600mm galvanised steel pickets
- 60 x 1800mm galvanised steel pickets
- 30 x 600m PVC caps for pickets
- 60 x 250mm stainless steel for fixing caps
- 3 x permanent markers for marking caps
- 2 x 15lb sledge hammers
- 2 x picket drivers
- 1 x driver extensions
- 10 x 8lb weights
- 2 x 100 m rope

2.3.9 Miscellaneous Equipment

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

3 FIELD PROGRAMME

Table 1. Description of sites scheduled to be visited.

Site No	Site Name	Human Activity	Possible Impact	Monitoring Method
N26	Bundegi	Possible urban development	Broadscale- nutrients etc	Transect – coral lagoon
N27	Exmouth	Snorkel site	Direct-fin/anchor damage/litter	Non-transect lagoon
N28	Exmouth	Dive site	Direct-fin/anchor damage/litter	Non-transect lagoon
N29	Naval Jetty	Shipping	Broadscale- oil spills/intro pests	Transect – coral lagoon
N30	Naval Jetty	Dive site	Direct- fin/anchor damage/litter	Non-transect lagoon
N31	Jurabi	Proposed day visit site	Direct- fin/anchor damage/litter	Non-transect lagoon
N32	Tantabiddi	High boat traffic	Broadscale – petrol spills	Transect – coral lagoon
N33	Tantabiddi	Fishing, boating, diving	Direct—anchor & fin damage;litter	Non-transect lagoon
N34	Mangrove Walk	Tourist walk	Direct – trampling; litter	Non-transect
N35	Mesa Camp	Proposed day visit site	Direct—anchor & fin damage;litter	Non-transect lagoon
N36	Milyering	Proposed ecotourism resort site	Broadscale – nutrients etc	Transect –coral lagoon
N37	Turquoise Bay	Snorkel site	Direct – fin damage;litter	Non-transect lagoon
N38	Lakeside	Snorkel site	Direct – fin damage;litter	Non-transect lagoon
N39	Oyster Stacks-north	Snorkel site	Direct – fin damage;litter	Non-transect lagoon
N40	Oyster Stacks-south	Snorkel site	Direct – fin damage;litter	Non-transect lagoon
N41	Pilgonaman Bay	Snorkel site	Direct – fin damage;litter	Non-transect lagoon
N42	Winderabandi	Proposed resort development	Broadscale	Transect- backreef coral -
N43	Lefroy Bay	Proposed resort development	Broadscale	Non-transect lagoon
N44	Ningaloo Beach	Proposed resort development	Broadscale	Non-Transect macroalgae
N45	The Lagoon	Snorkel site	Direct – fin damage;litter	Non-transect lagoon
N46	Pt Maud	Proposed resort development	Broadscale	Transect- backreef coral
N47	Coral Bay	Resort/urban developments	Broadscale	Transect- Bills Bay lagoon north
N48	Coral Bay	Resort/urban developments	Broadscale	Transect- Bills Bay lagoon south
N49	Coral Bay	Resort/urban developments	Broadscale	Transect- Bills Bay lagoon middle
N50	Coral Bay	Dive site	Direct—anchor & fin damage;litter	Non-Transect
N51	Coral Bay	Snorkel site	Direct—anchor & fin damage;litter	Non-Transect-back-reef/ lagoon
N52	Monks Head	Resort/urban	Broadscale	Transect- lagoon

developments

3.1 Field itinerary

Table 2. Field itinerary for the period 2 August to 24 August 1999.

Date	day	Site number location	Activity
2 Aug	M		Cary arrives Exmouth on AIMS boat and picks up house key for 18 Falls Street Exmouth from Ray White Real Estate, Maidstone Crs. MCB team depart Perth ~0800 hrs. Arrive Exmouth ~2000 hrs.
3 Aug	T	N26 Bundegi Transect	Unpack and prepare field equipment. Stock house. Field work. (Field team: Daly, Lapwood, Williams, Meyer, Cary, Mahendran)
4 Aug	W	N29 Naval Jetty Transect N30 Naval Jetty Non-transect	Field work
5 Aug	T	N27 Exmouth Non-transect N28 Exmouth Non-transect	Field work
6 Aug	F	N32 Tantabiddi Transect N33 Tantabiddi Non-transect	Field work
7 Aug	S	N36 Milyering Transect N31 Jurabi Non-transect	Field work; Lapwood departs for Perth 1055hrs, flight 6572.
8 Aug	S		Rest. Watson arrives from Karratha PM
9 Aug	M	N35 Mesa Camp Non-transect N38 Lakeside Non-transect	Field work
10 Aug	T	N39 Oyster Stacks Nth. Non-transect N40 Oyster Stacks Sth. Non-transect N34 Mangrove Walk Non-transect	Field work; Two teams: Mangrove Walk site only need 2 people. Oyster Stacks are close to shore.
11 Aug	W	N37 Turquoise Bay Non-transect N41 Pilgonaman Bay Non-Transect	Field work
12 Aug	T	N42 Winderabandi Transect	Field work. Cary departs for Perth 1300hrs, flight 6564.
13 Aug	F	N44 Ningaloo Beach Transect N43 Lefroy Bay Non-transect	Field work
14 Aug	S		Field work. Pack up. Clean house etc. Watson departs AM.
15 Aug	S		Rest
16 Aug	M	N50 Coral Bay Non-Transect	Move to Coral Bay and set up gear. Field work
17 Aug	T	N46 Pt Maud Transect	Field work
18 Aug	W	N47 Coral Bay Nth. Transect N51 Coral Bay Non- Transect	Field work
19 Aug	T	N49 Coral Bay Mid Transect N45 The Lagoon Non-transect	Field work
20 Aug	F	N48 Coral Bay Sth. Transect N52 Monks Head Transect	Field work
21 Aug	S		Pack up. Clean house. Secure boat.
22 Aug	S		Depart early AM for Perth
23 Aug	M		In Perth. Unpack and wash gear.

3.2 Equipment suppliers and relevant contacts

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

Aerial photos: DOLA, Gary Caporn, Ph. 92737209
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
Car: Budget, Todd Maskiell, Ph. 4791919
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
Pickets: supplied by: Whites wires, Lindsay, Ph 9353 2771 fax 9353 2776
galvanising: Lyons Galvanising, Paul, Ph 9356 1797
PVC picket extensions: Swan Irrigation, Steve Carrie, Ph 9446 9966
Scoutmaster GPS: Benchmark, Rob Fergusen, Ph. 08 2325405
Underwater video system: Sea Optics, David Hill, Ph. 08 3626161
Zodiac inflatable vessel: Wiltrading, Geoff Jordan, Ph. 3359155
Ningaloo Homestead: (Jane & Billy) Ph. (08) 9 942 5936
Exmouth Tourist Bureau: (08) 9 949 1176

4 SAFETY

Safety issues relating to:

- field work is the responsibility of the Field Team Leader.
- diving is the responsibility of the Diving Supervisor, Tim Daly or Mike Lapwood and have taken into account CALM's departmental safety procedures and protocols
- boating and navigation is the responsibility of the boat skipper.

4.1 Emergency contacts

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)
Emouth 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 3. Budget reconciliation for the Ningaloo Marine Park Monitoring Program. 1999 Field Trip.

Budget Item			CALM ($ in kind)	NHT funds ($)	Total costs ($)
Travel					
Vehicles	MCB Triton - $0.45/km for 5100 km			2295.00	2295.00
Tire repair etc				205.00	205.00
		Sub-total		**2500.00**	**2500.00**
Accommodation				2000.00	2000.00
Food and Drink	5 people @ $40/person/day x 21			4200.00	4200.00
Airfares	2 x one way from Exmouth to Perth			672.00	672.00
		Sub-total		**6872.00**	**6872.00**
Staff					
Caroline Williams	21 days @ $361		7581.00		7581.00
Adam Meyer	21 days @ $333		6993.00		6993.00
George Watson	14 days @ $374		5236.00		5236.00
Ray Lawrie	6 days @ $518		3108.00		3108.00
Tim Daly	61* days @ $360		12200.00	9760.00	21960.00
Mike Lapwood	22* days @ $360		7920.00		7920.00
Jennie Cary	30* days @ $604		18120.00		18120.00
Dive medicals	2 x $150			300.00	300.00
Hard living allowance	63 days @ $8.88			560.00	560.00
Diving allowances	120 hours @ $3.90			468.00	468.00
		Sub-total	**61 158.00**	**11 088.00**	**72246.00**
Equipment					
MCB inflatable & 25 hp o/b	21 days @ $100		2100.00		2100.00
DGPS unit	21 days @ $150		3150.00		3150.00
5 x SCUBA sets	21 days @ $100		2100.00		2100.00
Handheld VHF radios	21 days @ $15		315.00		315.00
Lock-up off-road trailer	21 days @ $15		315.00		315.00
Laptop Computer	21 days @ $15		315.00		315.00
2 x Underwater digital videos	21 days @ $100		2100.00		2100.00
		Sub-total	**10395.00**		**10395.00**
Consumables					
Fuel and oil				500.00	500.00
Air fills	84 @ $5			420.00	420.00
Star pickets and extensions	100 @ $5			500.00	500.00
Digital video tapes	15 x DVM-E60 @ $30			450.00	450.00
VHS video backup tapes	10 @ $5			50.00	50.00
Slide film	10 x Fuji Sensia 200 & processing			250.00	250.00
Other consumables	Gloves/pencils/chalk/erasers/batteries…etc			500.00	500.00
		Sub-total		**2670.00**	**2670.00**
		Total	**$71 553.00**	**$23 130.00**	**$94683.00**

* Includes days pre and post field

6 REFERENCES

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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.

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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.

Environmental Protection and Ministry for Planning (1999). Environmental and Planning Guidelines for Tourism Development on the North West Cape.

Western Australian Planning Commission (1996). Gascoyne Coast Regional Strategy.

Western Australian Planning Commission (1998). Exmouth – Learmonth (North West Cape) Structure Plan.

7 DISTRIBUTION LIST

NINGALOO MARINE PARK MONITORING PROGRAM. ESTABLISHMENT OF BASELINE BENTHIC MONITORING SITES IN NINGALOO MARINE PARK: AUGUST 1999.
Field Program Report MMS/PI/NMP-17/1999

Dr. Chris Simpson, Manager, Marine Conservation Branch, CALM
Chris Muller, Manager, Pilbara Region, CALM
George Watson, Pilbara Region, CALM
Doug Myers, Manager, Exmouth District, CALM
Caroline Williams, Exmouth District, CALM
Adam Meyer, Exmouth District, CALM

APPENDIX I

SPREADSHEET AND MAP OF HUMAN USAGE IN NINGALOO MARINE PARK

December 1997

Human Usage in Western Australian Marine Reserves

Ningaloo Marine Park

✓ Activity occurs

HUMAN ACTIVITIES	Sectors 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
URBAN & TOURISM DEVELOPMENT																																								
Urban development																																								
• existing																✓	✓																							
• proposed																✓																								
Resort																																								
• existing																																								
• proposed																																								
Camping																																								
• existing					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓		✓	✓	✓																	
• wild (free)			[illegible]								✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓																	
• proposed																																								
....																																								
....																																								
....																																								
....																																								
INDUSTRIAL DEVELOPMENT																																								
• shipping	✓	✓	✓																																					
• oil & gas exploration	✓	✓	✓	✓	✓	✓																																		
• oil & gas production																																								
• mining																																								
• other industry																																								
....																																								
....																																								
....																																								
....																																								
MARITIME INFRASTRUCTURE																																								
• anchorages	✓	✓	✓	✓	✓							✓		✓			✓																							
• shipping lanes ?																																								
• port facilities																																								
• marina facilities																																								
• moorings	✓		✓		✓									✓			✓																							

Human Usage in Western Australian Marine Reserves

Ningaloo Marine Park

✓ Activity occurs

HUMAN ACTIVITIES	Sectors 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
• groynes																																								
• boat ramps	✓		✓																																					
• navigation markers	✓		✓																																					
• fish attracting devices																																								
- Bundegi jetty	✓																																							

EXTRACTION OF LIVING RESOURCES

Commercial

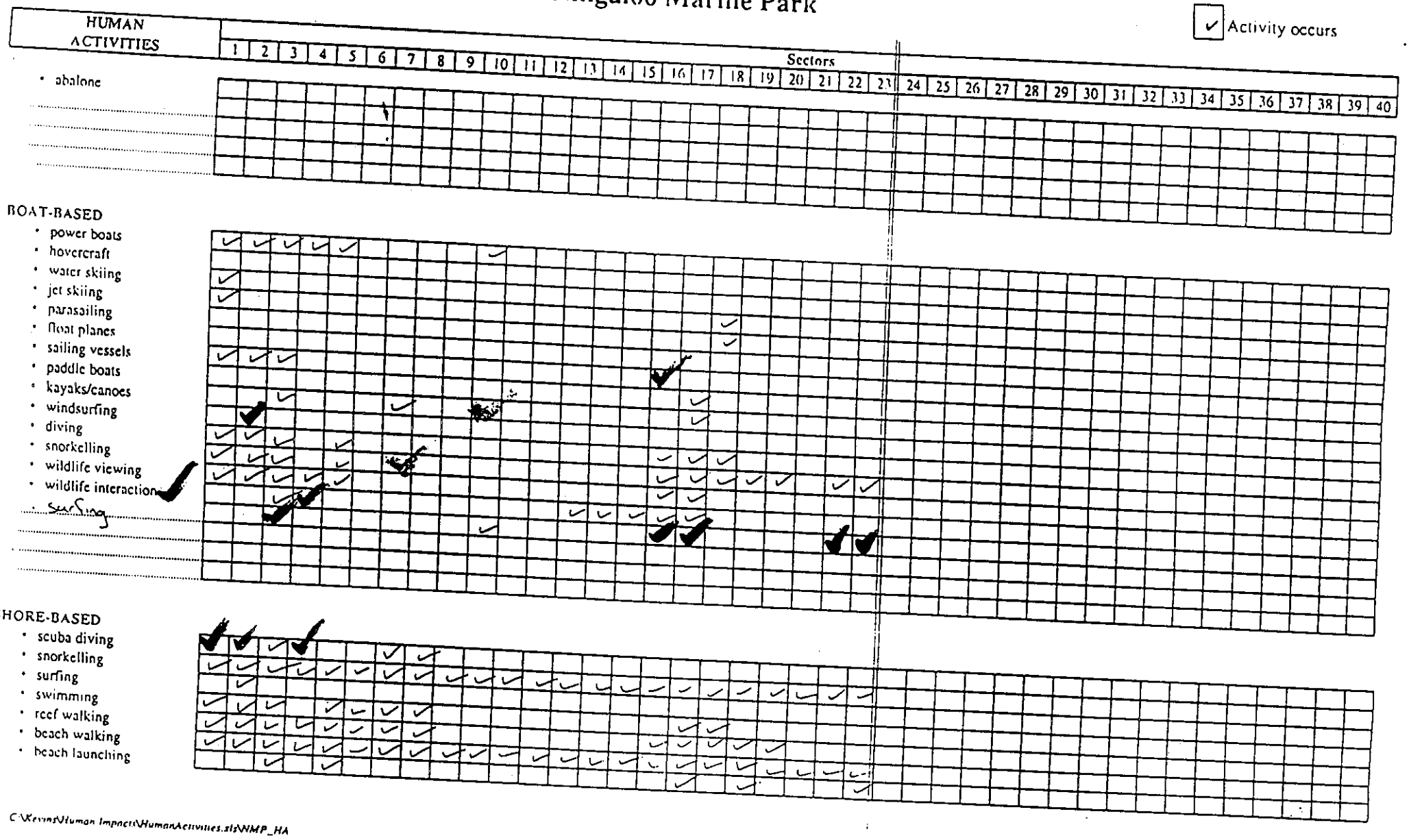
• trawling			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																													
• wetline fishing																																									
• netting																																									
• fish-trapping																																									
• rock lobster																																									
• abalone																																									
aquaculture																																									
• non-feeding																																									
• feeding																																									
collection																																									
• invertebrates		✓	✓																																						
• vertebrates																																									

Recreation

• rod & line fishing	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓			✓	✓	✓		✓	✓																		
• netting					✓						✓		✓							✓																						
• drop netting	✓	✓	✓	✓	✓	✓			✓		✓		✓	✓						✓																						
• spearfishing	✓	✓	✓							✓	✓	✓	✓	✓	✓					✓	✓	✓		✓	✓																	
• shell collection													✓	✓	✓	✓				✓	✓	✓		✓	✓																	
• rock lobster					✓	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓																							

Human Usage in Western Australian Marine Reserves

Ningaloo Marine Park



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Human Usage in Western Australian Marine Reserves

Ningaloo Marine Park

✓ Activity occurs

HUMAN ACTIVITIES	Sectors 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
• wildlife interaction			✓				✓									✓																								
turtle nesting			✓				✓									✓																								
OTHER																																							
Management Related																																							
research & monitoring	✓		✓													✓	✓																						
• extractive	✓		✓													✓	✓																						
• non-extractive																																							
OFF-RESERVE INFLUENCES																																							
• shipping			✓																																				
• oil & gas exploration																																							
• oil & gas production																																							
• mining																																							
• other industry																																							
• runoff (rivers & creeks)																																							

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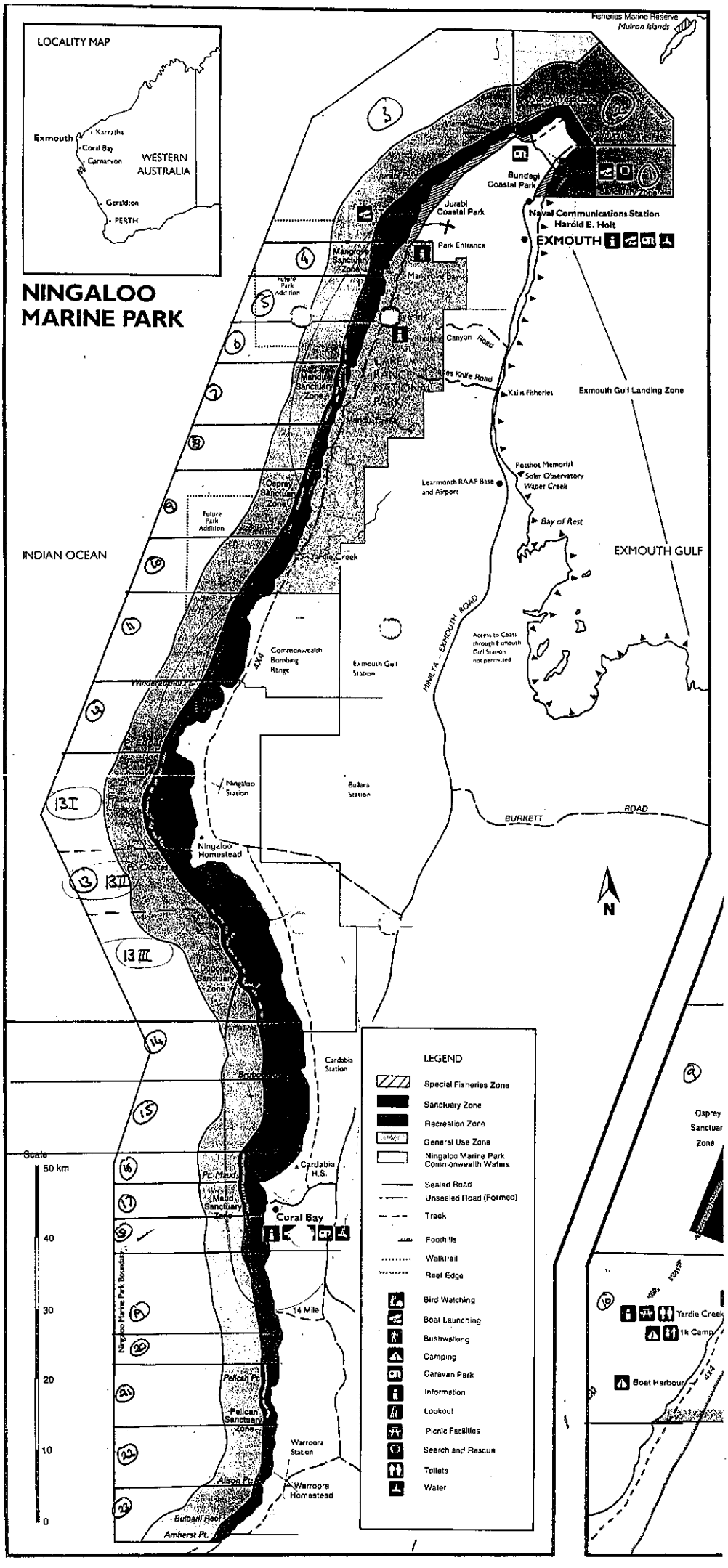
LOCALITY MAP
Exmouth
Karratha
Coral Bay
Carnarvon
WESTERN AUSTRALIA
Geraldton
PERTH
NINGALOO MARINE PARK
Fisheries Marine Reserve
Muiron Islands
Bundegi Coastal Park
Jurabi Coastal Park
Park Entrance
Naval Communications Station Harold E. Holt
EXMOUTH
Mangrove Sanctuary Zone
Future Park Addition
Mangrove Bay
Canyon Road
Charles Knife Road
CAPE RANGE NATIONAL PARK
Kails Fisheries
Exmouth Gulf Landing Zone
Osprey Sanctuary Zone
Learmonth RAAF Base and Airport
Postbot Memorial Solar Observatory Waper Creek
Bay of Rest
INDIAN OCEAN
EXMOUTH GULF
Yardie Creek
Commonwealth Bombing Range
Exmouth Gulf Station
MINILYA - EXMOUTH ROAD
Access to Coast through Exmouth Gulf Station not permitted
Ningaloo Station
Bullara Station
BURKETT ROAD
Ningaloo Homestead
N
Dugong Sanctuary Zone
Cardabia Station
Bruboo
Cardabia H.S.
Pt. Maud
Maud Sanctuary Zone
Coral Bay
14 Mile
Ningaloo Marine Park Boundary
Pelican Pt.
Pelican Sanctuary Zone
Warroora Station
Warroora Homestead
Alson Pt.
Bulbarl Reef
Amherst Pt.
Scale
50 km
40
30
20
10
0
LEGEND
Special Fisheries Zone
Sanctuary Zone
Recreation Zone
General Use Zone
Ningaloo Marine Park Commonwealth Waters
Sealed Road
Unsealed Road (Formed)
Track
Foothills
Walktrail
Reef Edge
Bird Watching
Boat Launching
Bushwalking
Camping
Caravan Park
Information
Lookout
Picnic Facilities
Search and Rescue
Toilets
Water
Osprey Sanctuar Zone
Yardie Creek
1k Camp
Boat Harbour

APPENDIX II

DATA RECORDING SHEETS

TRANSECT DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**		AUGUST 1999
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**		AUGUST 1999
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**		AUGUST 1999
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**		AUGUST 1999
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	: : :	: : :	.

NON-TRANSECT MONITORING SITE DATA SHEET

Project	NINGALOO MARINE PARK MONITORING PROGRAM				**Field Survey**		AUGUST 1999
Site No.	N	**Site Name**		**Date**		**Observer**	

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

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

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

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 or nthu - non-transect human use)/Date (03.08.99)/Tape number (#1 onwards).

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

If the tape contains footage spanning more than one day the tape number should indicate this (e.g. **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.