Assessing the effectiveness of sanctuary zones in the proposed Dampier Archipelago Marine Park

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Cover images: (small images, left to right) Survey team aboard the vessel named the 'Bidthangara' used during the 2007 field work; Overlooking the reef near one of the survey sites at Legendre Island; Survey team heading toward one of the sites aboard the vessel named the 'Iddybiddy'; One fish species targeted by recreational fishers in the area is the blackspot tuskfish (*Choerodon schoenleinii*); and (large image) Spangled emperor (*Lethrinus nebulosus*) are another fish species targeted by recreational fishers in the area. Photos - Department of Environment and Conservation/ Marine Science Program and Exmouth District.

SUMMARY

The proposed Dampier Archipelago Marine Park is located off the north-west coast of Western Australia approximately 1,650 km north of Perth and lies in the Pilbara Nearshore (PIN) marine bioregion. The marine environment of the area has considerable regional ecological and social conservation significance and is subject to increasing human impacts, including major industry expansion, associated port development and major dredging activities in Dampier Harbour. The mining town of Dampier/Karratha has the highest per capita boat ownership in WA and fishing is a major recreational activity in the area. Baseline resource condition data need to be determined before the establishment of the proposed marine park in order to detect trends in resource condition over time. Effort must be made to ensure that survey methods generate statistically robust data, are affordable to implement and maintain the integrity of historic data. In November 2007, a baseline survey was undertaken to obtain data on targeted fin fish abundance and length and cover of associated coral reef communities using diver operated stereo-video equipment and benthic transect video methods respectively. Twelve long-term monitoring sites were established at Legendre Island and Sailfish Reef at outer Dampier Archipelago using a nested survey design such that any differences over time between protected and non-protected zones of the proposed marine park can be detected. The data collected during this survey are provided within this report along with information on site positions, survey design and methods. A summary of the results including statistical analyses will be presented in a subsequent Marine Science Program Technical Report.

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INTRODUCTION

The proposed Dampier Archipelago Marine Park (DAMPA) is located off the north-west coast of Western Australia approximately 1,650 km north of Perth and lies in the Pilbara Nearshore (PIN) marine bioregion. The area comprises of a wide range of marine habitats that support diverse marine biota, including more than 736 fish species and 230 scleractinian coral species, making the Dampier Archipelago the second most diverse site in Western Australia for hard corals (Department of Environment and Conservation, 2005). The marine environment of the area has considerable regional ecological and social conservation significance and is subject to increasing human impacts, including major industry expansion, associated port development and major dredging activities in Dampier Harbour.

The region is subject to a range of commercial and recreational fishing activities. The Dampier Archipelago lies between the Onslow and Nickol Bay Prawn Fisheries with extraction occurring within the Archipelago and around its margins. The Pilbara Demersal Finfish Fishery operates offshore from the Archipelago. The Mackerel Interim Managed Fishery occurs within the Archipelago with sites concentrated to the outer margins. Some aquaculture ventures, namely pearling, also occur within the Archipelago. Approximately 80% of effort from Western Australia's marine aquarium fishery is exerted in the Archipelago, extracting a variety of fish, invertebrates, live rock, substrate and corals (Fletcher and Head 2006). The potential for impact on the environment from recreational fishers in the region is substantial. Western Australia has the highest per capita boat ownership globally; the Pilbara has the highest within Western Australia and Karratha/Dampier has the highest within the Pilbara region (Osborne *et al*. 2000; Tourism Western Australia, 2006). High use recreational fishing areas include; the eastern margin of Mermaid Sound, Hamersley Shoals, north of Miller Rocks, the northern perimeter of Dixon Island, the shoals northwest of Enderby Island, Sailfish Reef, shoals north of Legendre Island western tip and the costal margin southeast of North-East Regnard Island (Department of Environment and Conservation, 2005).

If trends in resource condition over time are to be detected, baseline resource condition data need to be determined before the establishment of the DAMPA. Effort must be made to ensure that survey methods generate statistically robust data, are affordable to implement and maintain the integrity of historic data. This project directly addresses these requirements and several of the Department of Environment and Conservation's (DEC) research and monitoring responsibilities for the proposed DAMPA.

Objectives of the survey:

- Obtain baseline data - Establish long-term monitoring sites to obtain before zoning enforcement data on the abundance and length of recreationally targeted fin fish species and cover of associated benthic coral reef communities.

- Pilot the survey methods - Determine the optimum transect length and number of replicate transects required for estimating fin fish abundance and cover of benthic reef communities to obtain a high level of statistical power and precision whilst maintaining survey cost efficiency.

- Identify long-term changes - Where possible identify long-term temporal changes in finfish abundance and coral cover by comparing current data to historical data.

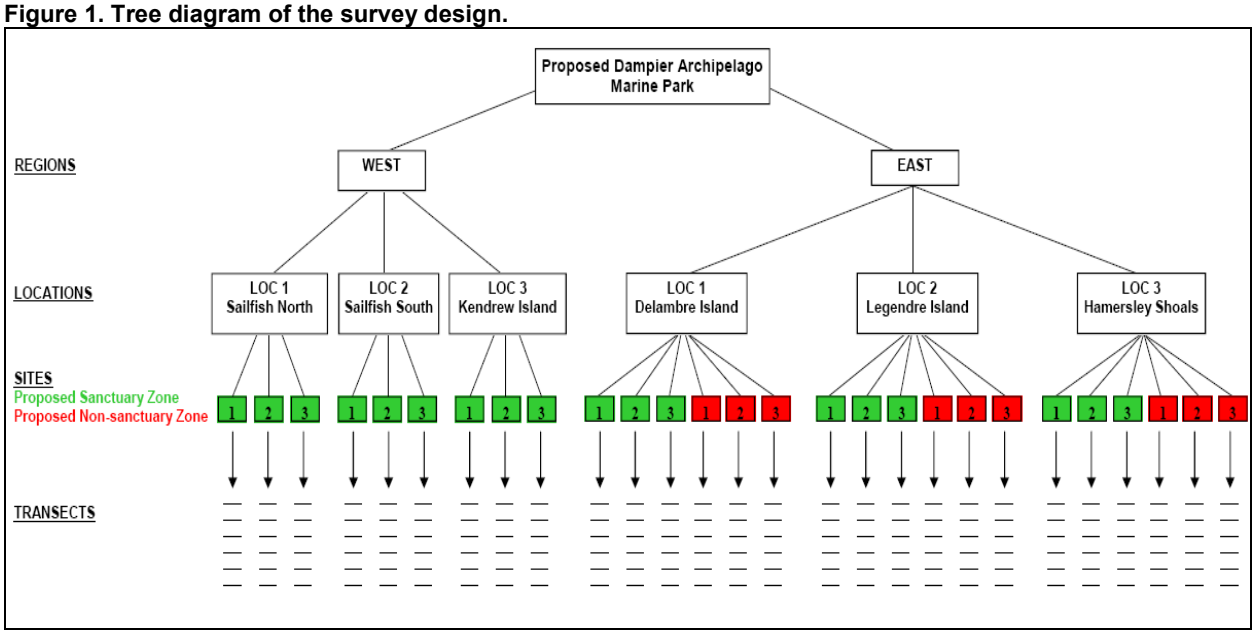
1 METHODS

1.1 Survey design

A nested (hierarchical) balanced survey design was used (Figure 1). There are a total of six monitoring locations, three within both the east and west regions of the proposed DAMPA (Figure 1). Each location has an inside and outside sanctuary zone component (reserve status) with the exception of the locations in the West DAMPA, as no comparable sanctuary zones are proposed for

this region, i.e. there are only non-sanctuary components to the locations within the proposed West DAMPA region (Figure 1 and Figure 2). At each of the location/reserve status combinations there are three replicate sites (Figure 1). At each site there are six 50 m transects running parallel with the reef crest with approximately 10 m between each transect. In 2007, due to adverse weather conditions and longer than anticipated travel time between locations only sites at Legendre Island, Sailfish North and Sailfish South were surveyed.

Figure 1. Tree diagram of the survey design.



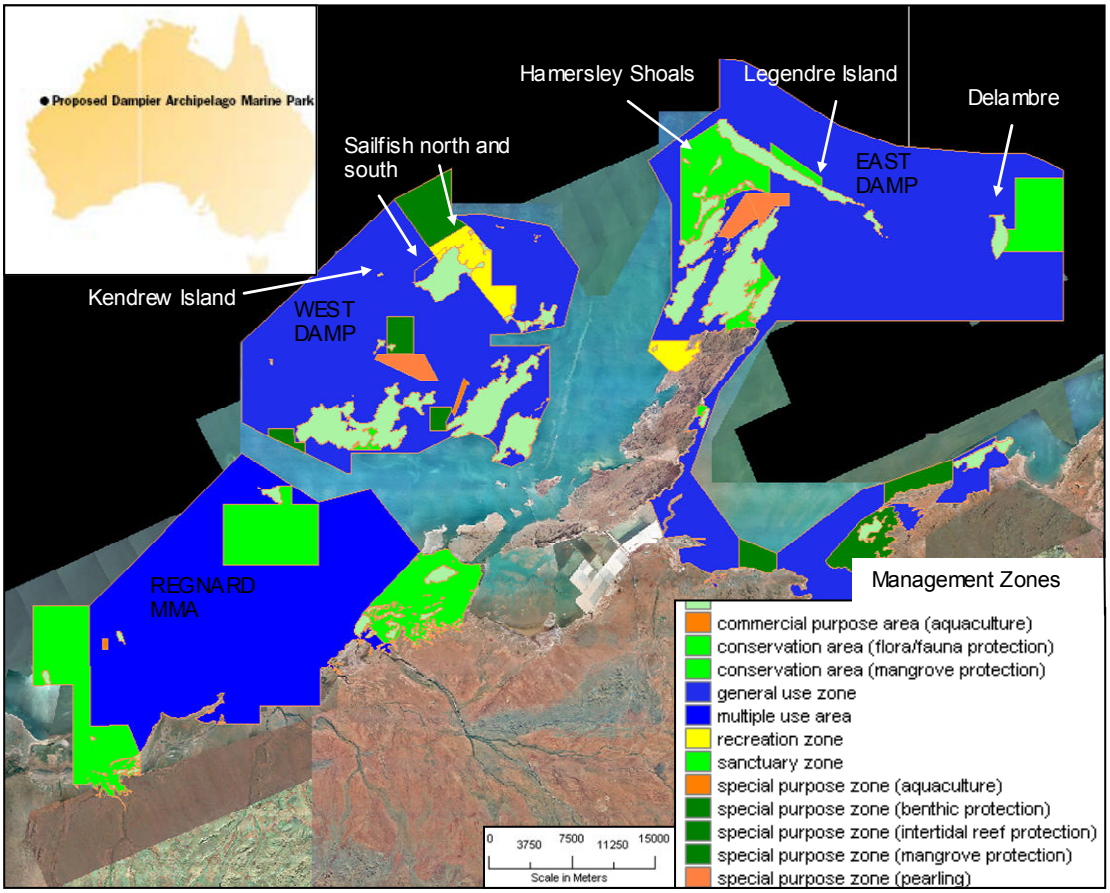


Figure 2. Proposed zoning scheme for the Dampier Archipelago Marine Park and the Regnard Marine Management Area.

1.2 Determining the number and length of transects per site for surveying fish populations

Prior to this survey no data were available to undertake a power analysis to determine the required number and length of transects needed per site for estimating fish abundance using the diver operated stereo-video (DOV) survey method (Figure 3) in a tropical coral reef environment. Therefore advice from experts in the field of DOVs and investigation into the numbers and length of replicate transects used by other researchers employing the same method in Western Australian tropical reef environments (Fitzpatrick & Harvey, 2007, Dianne Watson pers. comm., 2007) was used to estimate the likely number of transects required per site. The number and length of transects sampled per site was also restricted by available dive bottom time. For this reason the fish survey was effectively treated as a pilot study and the results will be used to statistically validate the number and length of transects needed per site (i.e. power analysis) to give a high level of statistical power to detect a desired level of relative change in fish abundance and length. The results of these analyses will be presented in a subsequent DEC Marine Science Program Technical Report.

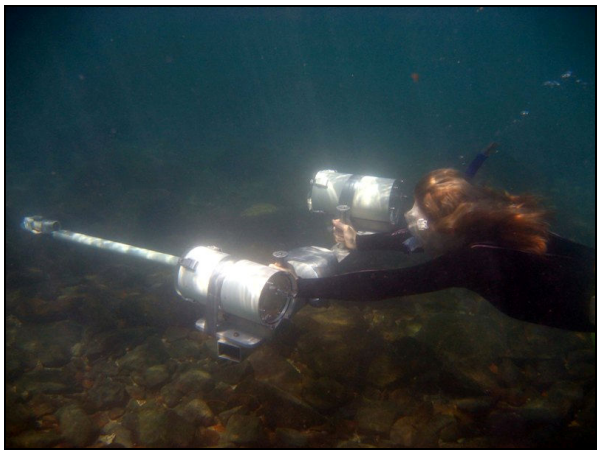


Figure 3. Photo showing the DOV equipment being used by a DEC diver.

1.3 Determining the number of transects per site for surveying benthic reef communities

Coral cover data collected by the Australian Institute of Marine Science (AIMS) at the Dampier Archipelago in 1993 was subjected to a power analysis to estimate the number of 50 m transects needed per site to maintain a high statistical power to detect 20, 30 and 40% relative change in live coral cover (Figure 4). Data from three outer reef sites was used in the analysis and alpha was set to 0.05. The results of the analysis determined that six replicate 50 m transects per site gives a statistical power of 80% for detecting a 40% relative change in live coral cover. The number of transects suggested by the power analysis must obviously be balanced with what is logistically viable in the field. It was likely that six 50 m transects could be completed during one dive. For these reasons, six 50 m transects were sampled per site.

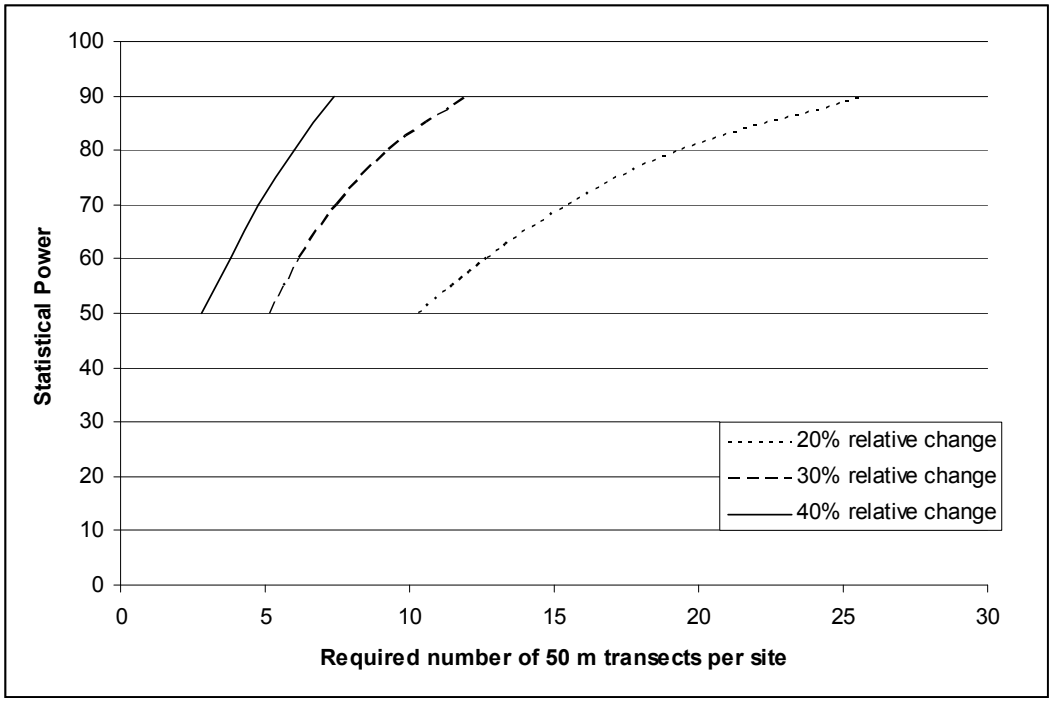


Figure 4. Resultant statistical power for detecting a relative 20, 30 and 40% change in live coral cover using a varied number of 50 m transects per site. Data from three outer-reef sites in the Dampier Archipelago were used in the analysis (data sourced from the Australian Institute of Marine Science).

1.4 Site selection

Previously compiled habitat maps, aerial photos, positions of previous study sites, proposed management zone boundaries and advice from researchers familiar with the area were used to identify positions of the study sites. Sampling was stratified by habitat and depth. To minimise the effect of habitat variability on changes to fish assemblages, effort was made to select sites of comparable coral cover and type. Sampling was undertaken within a depth range of approximately 2 to 7 m below chart datum.

Where possible sites were selected to be in the same position or within close proximity of where previous studies on fish abundance and/or coral cover have been undertaken (see Table 1 for information about these studies and Armstrong (2007) for GPS coordinates the study sites). Where possible comparisons will be made with historic data to enable long-term trends in fish abundance and length and coral cover to be determined. Effort will be made to ensure that any comparisons between data generated by different methods are statistically valid. The results of these comparisons will be provided in a subsequent technical report.

Figures 5 and 6 show the position of the (12) sites surveyed at Legendre Island, Sailfish North and Sailfish South in 2007 and Table 2 presents the GPS coordinates of each site. Figure 7 is an aerial photograph that shows the reef habitat surveyed at Legendre Island. Figures 8 to 10 show the position of the remaining (15) sites at Delambre Island, Kendrew Island and Hamersley Shoals that were unable to be surveyed in 2007. Table 3 presents the proposed GPS coordinates of these sites.

Note: Due to unforeseen circumstances gazettal of the DAMPA has been postponed. The proposed zoning scheme is currently under review and could possibly result in the removal of the proposed Delambre Island sanctuary zone. On gazettal of the MPA the proposed position of the sites at Delambre Island may need to be revised in light of the gazetted zoning scheme and boundaries.

Table 1. Information on other studies that have collected data on fish abundance and or coral cover within outer Dampier Archipelago.

Agency	Who	Contact details	When	What	Method	Technical notes	Sites GPS availability	Why	Reports	Completed /Ongoing
Sinclair Knight and Merz	Dr Peter Morrison (surveyed with WA Museum - Jones 2004)	Pmorrison@skm.com.au	1998-99	Benthic habitats	Video transect - random point analysis	1998: 19 stations, no replicates. 1999: 26 stations, 3 replicates per station. 25 m transects (Carelton and Done 1995), recording speed of ~ 0.2 m/sec at 0.5 m from the substrate, swath width ~0.6 m. Sinclair Kinght and Merz Video Transect Analysis Sys	GPS all: 35 sites 1998, 35 sites 1999	To provide a descrition of the subtidal habitats of the Dampier Archipelago	Morrison 2004, A general description of the subtidal habitats of Dampier Archipelago, p. 51-59, (In Jones 2004), Report on the results of the Western Australralian Museum/Woodside Energy Ltd. Perteership to explore the marine biodiversity of the Dampier A	Report completed
Departmnet of Conservation and Land Management	Kevin Bancroft	Kevin.Bancroft@dec.wa.gov.au	1999-2000	Benthic habitats	Drop down video	Video lowered from side of survey vessel capturing 30 seconds of footage per drop	GPS all: 1999 84 sites, 2000 166 sites	To develop habitat maps and assess the biological context of the region	Bancroft et al. 2000, Developing a broadscale habitat map of the Montebello/Barrow Islands and the Dampier Archipelago/Cape Preston regions, Marine Conservation Branch, Department of Conservation and Land Management, Perth, Western Australia, p. 59.	Report completed
Australian Institute of Marine Science	Johnson and Stoddart 1988		1987	Crown of Thorns	Manta towa and subsequent dives	Qualitative survey of COT abundance and coral cover via manta tows at ~2 knots for ~2 min intervals. Dives at target sites for COT collection, measurement and samples taken	4 sites (maps available, GPS evaluated)	To collect COT samples for genetic and morphomentric analysis	Johnson and Stoddart 1988, Report on surveys of the distribution, abundance and impact of Acanthaster planci on reefs within the Dampier Archipelago (Western Australia) April 1987, Townsville, Queensland, p. 15.	Report completed
Dampier Port Authority, Woodside, Pilbara Iron, Mermaid Marine (Mscience)	Peter Smith (DPA), David Gordon (Woodside)	Peter.Smith@dpa.wa.gov.au DAVID.GORDON@woodside.com.au	2003 - present	Benthic habitats	Multiple	Report of use of Mscience monitoring locations in Dampier Archipelago	Multiple (Maps available, GPS re: Mscience)	Monitoring and surveys in response to industrial activity	Mscience 2007, Dampier Port Authority Environmental Monitoring GIS, Mscience Pty. Ltd, Perth, Western Australia, p. 32.	Ongoing
Australian Institute of Marine Science	Felicity McAllister	f.mcallister@aims.gov.au	1993	Fish and coral survey	Quantitative		24 sites (GPS supplied)		No report produced (raw data sourced)	
ROBE (Rio Tinto)				Water quality and coral monitoring	Video transects	Video transect benthic habitat analysis by Sinclair Knight and Merz	10 sites (GPS supplied)	Monitoring and surveys in response to industrial activity	Pending	Ongoing

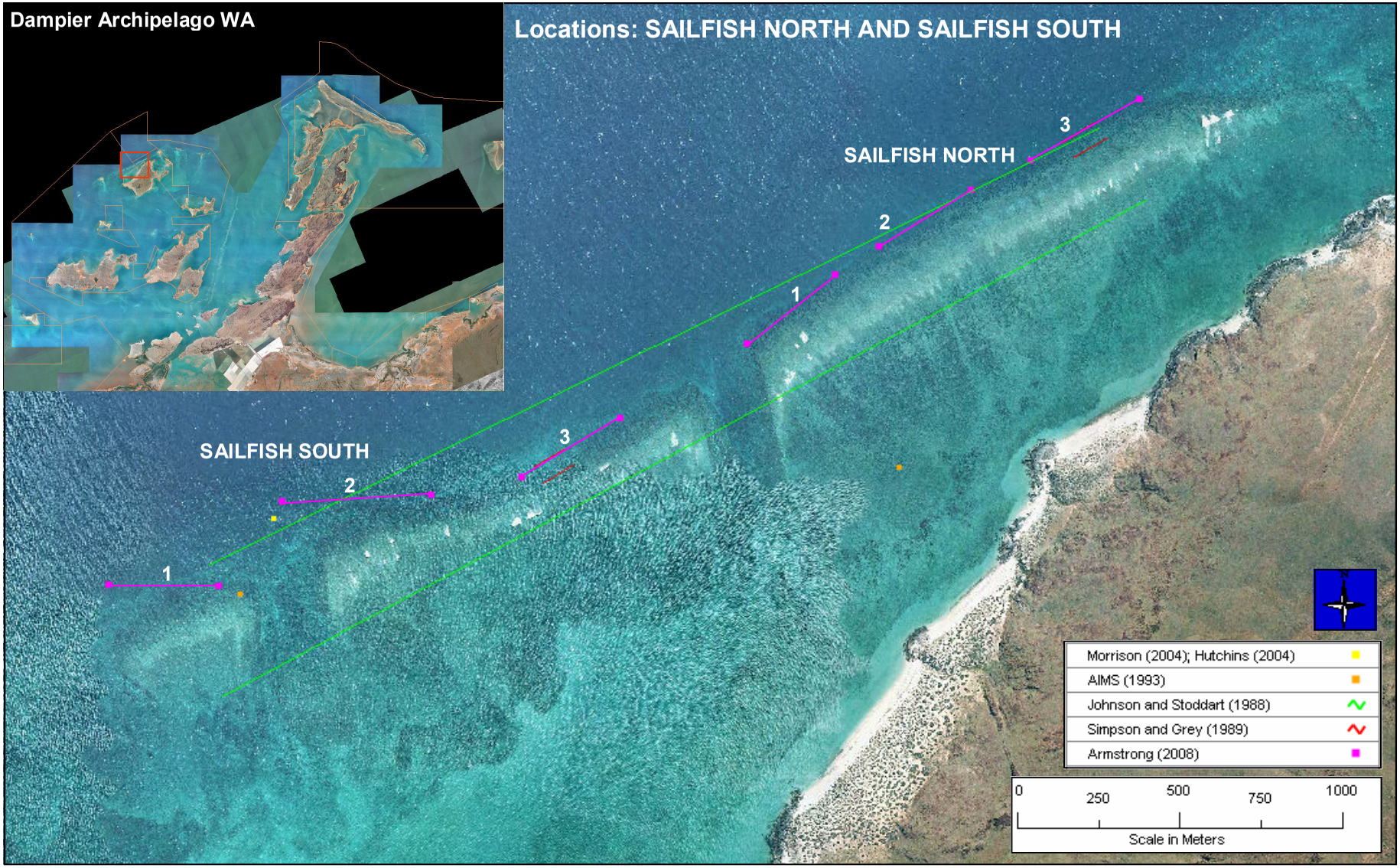


Figure 5. Positions of the sites (pink lines) at Sailfish Reef established in 2007. No sanctuary zones are currently proposed within this area of the proposed marine park. The positions of where other studies on either fish and/or coral communities have been undertaken are shown. See Armstrong (2008) for information regarding these surveys and their site positions.

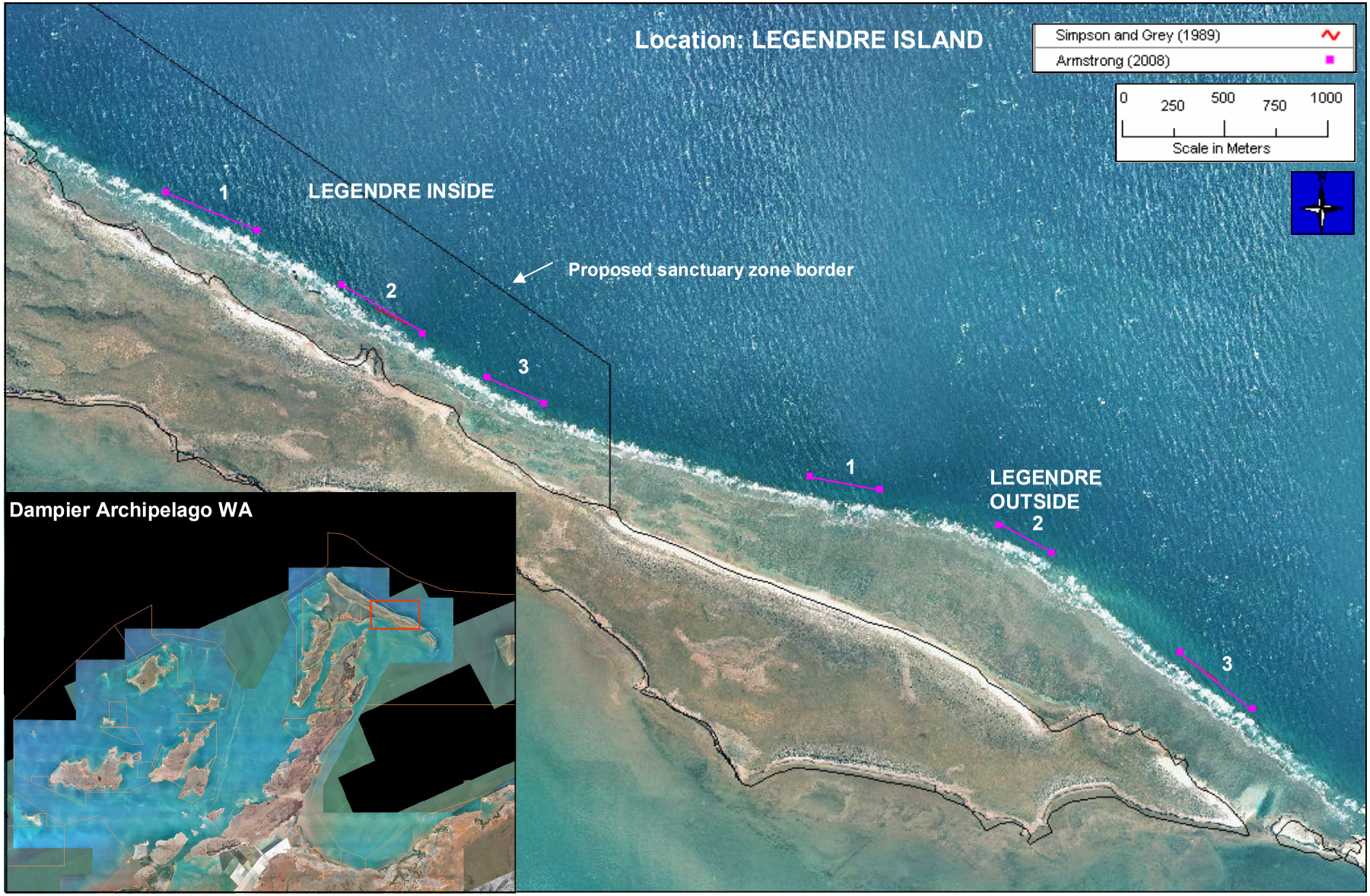


Figure 6. Positions of the sites (pink lines) at Legendre Island established in 2007. The location of the proposed sanctuary zone is shown. The positions of the Simpson and Grey (1989) survey sites are shown. See Armstrong (2008) for information regarding this survey and the site positions.

Table 2. GPS coordinates of the sites surveyed in 2007. NE and SW end refers to the where the six 50 m transects start and end at each site. Datum is WGS84.

	Decimal degrees	Deg/min/sec
Sailfish North 1 start (NE end)	S20.45675 E116.58642	S20 27.405 E116 35.185
Sailfish North 1 end (SW end)	S20.45869 E116.58381	S20 27.521 E116 35.029
Sailfish North 2 start (NE end)	S20.45435 E116.59044	S20 27.261 E116 35.426
Sailfish North 2 end (SW end)	S20.45592 E116.58772	S20 27.355 E116 35.263
Sailfish North 3 start (NE end)	S20.45183 E116.59546	S20 27.110 E116 35.728
Sailfish North 3 end (SW end)	S20.45352 E116.59224	S20 27.211 E116 35.534
Sailfish South 1 start (NE end)	S20.46544 E116.56823	S20 27.926 E116 34.094
Sailfish South 1 end (SW end)	S20.46540 E116.56503	S20.27.924 E116.33.902
Sailfish South 2 start (NE end)	S20.46293 E116.57450	S20.27.776 E116.34.470
Sailfish South 2 end (SW end)	S20.46310 E116.57011	S20.27.786 E116.34.207
Sailfish South 3 start (NE end)	S20.46242 E116.57719	S20 27.745 E116 34.631
Sailfish South 3 end (SW end)	S20.46078 E116.58010	S20 27.647 E116 34.806
Legendre Inside 1 start (NW end)	S20.39240 E116.90205	S20 23.544 E116 54.123
Legendre Inside 1 end (SE end)	S20.39406 E116.90632	S20 23.644 E116 54.379
Legendre Inside 2 start (NW end)	S20.39646 E116.91032	S20 23.787 E116 54.619
Legendre Inside 2 end (SE end)	S20.39859 E116.91407	S20 23.915 E116 54.844
Legendre Inside 3 start (NW end)	S20.40053 E116.91709	S20 24.032 E116 55.026
Legendre Inside 3 end (SE end)	S20.40172 E116.91978	S20 24.103 E116 55.187
Legendre Outside 1 start (NW end)	S20.40494 E116.93217	S20 24.296 E116 55.930
Legendre Outside 1 end (SE end)	S20.40550 E116.93543	S20 24.330 E116 56.126
Legendre Outsie 2 start (NW end)	S20.40710 E116.94095	S20 24.426 E116 56.457
Legendre Outside 2 start (SE end)	S20.40833 E116.94351	S20 24.500 E116 56.611
Legendre Outside 3 start (NW end)	S20.41271 E116.94952	S20.24.762 E116.56.971
Legendre Outside 3 start (SE end)	S20.41517 E116.95290	S20 24.910 E116 57.174

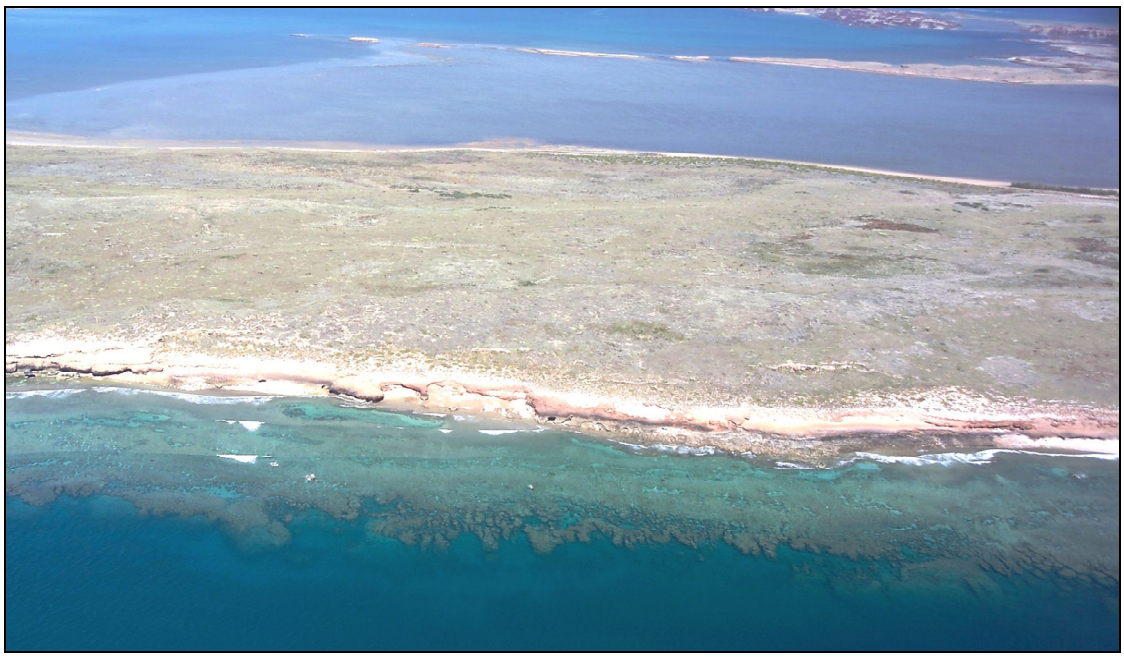


Figure 7. Example of reef habitat (foreground) surveyed at Legendre Island. Photograph by Cliff Winfield/DEC.

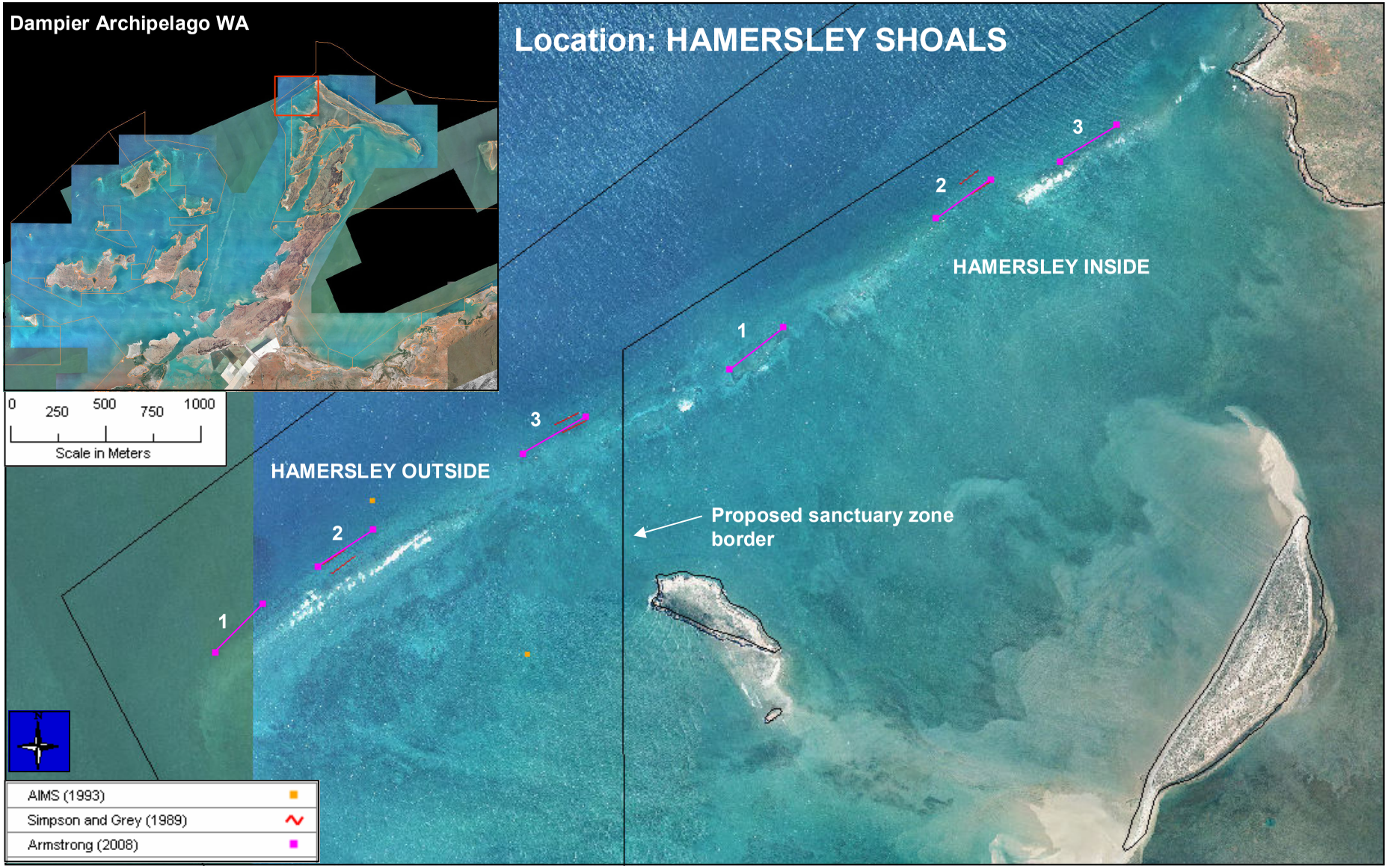


Figure 8. Proposed positions of the sites (pink lines) at Hamersley Shoals that were unable to be established in 2007 due to adverse weather conditions and longer than expected travel time between locations. The positions of where other studies on either fish and/or coral communities have been undertaken are shown. See Armstrong (2008) for information regarding these surveys and their site positions.

Figure 9. Proposed positions of the sites (pink lines) at Delambre Island that were unable to be established in 2007 due to adverse weather conditions and longer than expected travel time between locations. The location of the proposed sanctuary zone is shown. The positions of the Sinclair and Knight Merz (2007) survey sites are shown. See Armstrong (2008) for information regarding this survey and the site positions.

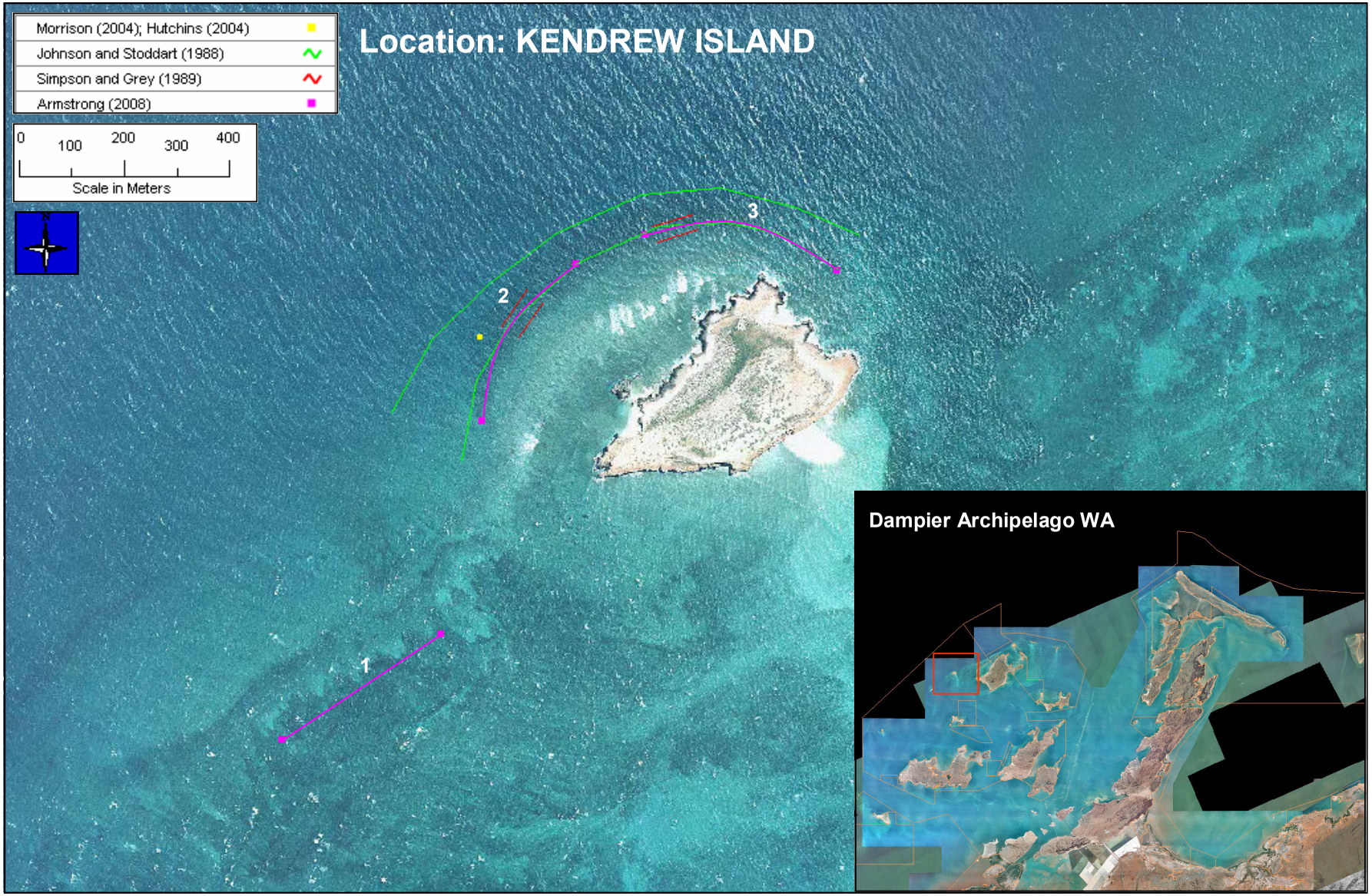


Figure 10. Proposed positions of the sites (pink lines) at Kendrew Island that were unable to be established in 2007 due to adverse weather conditions and longer than expected travel time between locations. No sanctuary zone is currently proposed within this area of the proposed marine park. The positions where previous surveys have been undertaken are shown. See Armstrong (2008) for information regarding these surveys and their site positions.

Table 3. Proposed GPS coordinates for the sites that were unable to be surveyed in 2007. Start and end refers to the where the six 50 m transects start and end at each site. Datum is WGS84.

	Decimal degress	Deg/min/sec
Hamersley Inside 1 start	S20.3743 E116.8053	S20.22.458 E116.48.318
Hamersley Inside 1 end	S20.3723 E116.8081	S20.22.338 E116.48.486
Hamersley Inside 2 start	S20.3671 E116.8158	S20.22.026 E116.48.948
Hamersley Inside 2 end	S20.3653 E116.8185	S20.21.918 E116.49.110
Hamersley Inside 3 start	S20.3645 E116.8221	S20.21.870 E116.49.326
Hamersley Inside 3 end	S20.3627 E116.8249	S20.21.762 E116.49.494
Hamersley Outside 1 start	S20.3877 E116.7795	S20.23.262 E116.46.770
Hamersley Outside 1 end	S20.3854 E116.7818	S20.23.124 E116.46.908
Hamersley Outside 2 start	S20.3837 E116.7846	S20.23.022 E116.47.076
Hamersley Outside 2 end	S20.3819 E116.7874	S20.22.914 E116.47.244
Hamersley Outside 3 start	S20.3783 E116.7950	S20.22.698 E116.47.700
Hamersley Outside 3 end	S20.3765 E116.7981	S20.22.590 E116.47.886
Delambre Inside 1 start	S20.4367 E117.1048	S20.26.202 E117.06.288
Delambre Inside 1 end	S20.4336 E117.1037	S20.26.016 E117.06.222
Delambre Inside 2 start	S20.4323 E117.1023	S20.25.938 E117.06.138
Delambre Inside 2 end	S20.4311 E117.0991	S20.25.866 E117.05.946
Delambre Inside 3 start	S20.4308 E117.0966	S20.25.848 E117.05.796
Delambre Inside 3 end	S20.4308 E117.0933	S20.25.848 E117.05.598
Delambre Outside 1 start	S20.4397 E117.0558	S20.26.382 E117.03.348
Delambre Outside 1 end	S20.4364 E117.0551	S20.26.184 E117.03.306
Delambre Outside 2 start	S20.4337 E117.0591	S20.26.022 E117.03.546
Delambre Outside 2 end	S20.4335 E117.0620	S20.26.010 E117.03.720
Delambre Outside 3 start	S20.4329 E117.0634	S20.25.974 E117.03.804
Delambre Outside 3 end	S20.4323 E117.0668	S20.25.938 E117.04.008
Kendrew 1 start	S20.4842 E116.5295	S20.29.052 E116.31.770
Kendrew 1 end	S20.4824 E116.5325	S20.28.944 E116.31.950
Kendrew 2 start	S20.4787 E116.5332	S20.28.722 E116.31.992
Kendrew 2 end	S20.476 E116.5350	S20.28.560 E116.32.100
Kendrew 3 start	S20.4755 E116.5362	S20.28.530 E116.32.172
Kendrew 3 end	S20.4761 E116.5398	S20.28.566 E116.32.388

1.5 Survey methods

1.5.1 Fish abundance and length

The abundance and length of fish was estimated using a DOV method (Figure 3) developed by researchers at the University of Western Australia (Harvey *et al.* 2001, 2002). The use of stereo-video enables conclusive identification of species from the video footage and tests have shown the accuracy of size estimates to be within 2 mm (Harvey *et al.* 2002). Video footage can be stored for long-term comparisons or re-analysis, and the method reduces measurement error in comparison to estimates made by novice and experienced scientific divers. This substantially increases the statistical power of a monitoring program to detect changes in the mean length of a population of fish. Fewer samples need to be taken per site, using the DOV method, to obtain an equivalent level of power compared to the underwater visual census (UVC) method, saving both time and money in the field (Harvey *et al.* 2001, 2002, 2004). However, further research is needed to determine the comparability of fish abundance and length estimates between the DOV and UVC methods.

Fish populations were sampled using the diver operated stereo-video (DOV) system along the entire length of each 50 m transect. Tags were filmed at the beginning of each site and each transect for site and transect identification and to distinguish between left and right side cameras. A tag was also filmed halfway along each transect (i.e. at 25 m) to enable investigation into optimum transect length. Filming occurred at a maximum speed of 10 m/minute, therefore each transect took approximately 5 minutes to complete. The diver filming fish would proceed along the transect prior to any other diver to avoid fish disturbance. A conventional tape measure was not used to define the transect line. Instead

a Chainman© which spools out biodegradable twine and displays the length of twine leaving was used. This method greatly increases the efficiency of the transect method since a line does not need to be laid or retrieved as would be necessary using the traditional tape measure approach (Babcock *et al.* 2007). The Chainman© was carried by a diver who proceeded along the transect line after the fish diver and signalled (e.g. tug on divers fin) to the fish diver when they reached the 25 and 50 m mark.

1.5.2 Benthic cover

The benthic community along each 50 m transect was recorded using a Sony HDR-HC1/E digital video camera in an Amphibico underwater housing. The diver swam slowly along the transect, holding the camera approximately 50 cm above the substratum on wide angle zoom whilst recording the entire 50 m transect. Each transect was filmed in normal definition rather than high definition format, to avoid potential problems during the analysis stage. Filming occurred at a maximum speed of 10 m/minute, therefore each transect took approximately 5 minutes to complete. A tag was filmed at the beginning of each site and transect to identify the site and transect number after which a panoramic shot of the reef surrounding the start of each transect was filmed. The benthic video diver was the last diver to proceed along each transect.

1.6 Data analysis

Analysis of the raw DOV fish data was undertaken under contract by the University of Western Australia in November 2007. Analysis of the benthic video data was undertaken under contract by Johnston Davidson from AIMS Townsville using a variation of the AVTAS method (Abdo *et al.* 2004). The benthic transect data were analysed using 50 frames per transect and 5 points per frame.

1.7 Data validation

The analysed DOV fish abundance data were checked for errors by summing abundance values from all sites for every species. Any species with a summed abundance over 100 was queried to check that it was a schooling fish species likely to be encounted in high numbers at the sites surveyed. Abundance estimates at the transect level were also manually checked for any peculiarities. The DOV fish length data were also checked for errors by manual search. All length estimates over 200 mm were queried to check that the measurement was realistic for that fish species. Data were validated at the transect level. During both data validation processes no errors were encounted.

The analysed benthic transect data were also checked for errors by manual search. Percent cover estimates of each benthic category at the transect level was checked for unusually high or low values. Checks that total benthic cover of each transect was equal to 100% were also made. During the data validation process no errors were encounted.

2 DATA MANAGEMENT

2.1 Report archival

Hard copies of this report are held at the following locations:

1. Marine Science Program, Science Division, Department of Environment and Conservation, 17 Dick Perry Avenue, Western Australia, 6152. Ph: (08) 9334 0333.

2. Woodvale Library, Science Division, Department of Environment and Conservation, Ocean Reef Road, Woodvale, Western Australia, 6026. Ph: (08) 9405 5100 Fax: (08) 9306 1641.

3. Archives, Woodvale Library, Science Division, Department of Environment and Conservation, Ocean Reef Road, Woodvale, Western Australia, 6026. Ph: (08) 9405 5100 Fax: (08) 9306 1641 (CD also attached).

4. Pilbara Region, Department of Environment and Conservation, Lot 3 Anderson Road, Karratha Industrial Estate, Karratha, Western Australia, 6530. Ph: (08) 9143 1488

Fax: (08) 91441118.

5. Serials Section, State Library of Western Australia. Alexander Library Building, Perth Cultural Centre, Perth, Western Australia, 6000.

A digital copy of this report is stored on the Marine Science Program Server. Ph: (08) 9334 0333.

2.2 Digital video

All DOV and benthic transect footage captured on mini digital video (MDV) during the survey are held at the following location:

MDV masters have been archived in the 'Dampier Archipelago Marine Park Long Term Monitoring Program Video Archive (Box)' file no. 2008/002194 held at the Information Management Branch, Department of Environment and Conservation, 17 Dick Perry Avenue, Kensington, Western Australia. Ph: (08)9334 0333.

2.3 Digital photographs

All digital still photographs taken during the survey are archived on the Marine Science Program Server. Ph: (08) 9334 0333.

2.4 Data sheets

All data sheets completed during the survey have been archived in the Dampier Archipelago Marine Park Long Term Monitoring Program corporate file no. 2008/002955 held at the Information Management Branch, Department of Environment and Conservation, 17 Dick Perry Avenue, Kensington, Western Australia. Ph: (08)9334 0333.

2.5 Analysed DOV and benthic transect data

The analysed benthic video data processed at the transect level is stored in a Microsoft Access database has been archived in the following locations:

1. On cd located in the back inside cover of this report.

2. On cd located in the 'Dampier Archipelago Marine Park Long Term Monitoring Program Video Archive (Box)' file no. 2008/002194 held at the Information Management Branch, Department of Environment and Conservation, 17 Dick Perry Avenue, Kensington, Western Australia. Ph: (08)9334 0333.

3 RESULTS

The tables of data resulting from this survey occupy too many pages to feasibly print. Therefore electronic copies of the following tables of data have been archived on a CD located in the back cover of this report.

- Table 1. Analysed 2007 benthic video transect data processed at the transect level.
- Table 2. Analysed 2007 DOV fish abundance data processed at the transect level.
- Table 3. Analysed 2007 DOV fish length data processed at the transect level.

4 SUMMARY OF DATA SHEET INFORMATION

Table 4. Summary of site information, environmental conditions during the time of survey, site description and other information recorded on the data sheets completed in September 2007.

Site information					Environmental conditions at site at time of surveying					Site description		
Location	**Site**	**GPS coordinate (start and end of each site)**	**Date surveyed**	**Approximate start and end time of surveying**	**Tide (m)**	**Visibility (m)**	**Water movement**	**Weather**	**Wind direction and strength (knots)**	**Habitat description**	**Approximate depth below chart datum**	**Other comments**
Sailfish North	1	S20.45675 E116.58642 S20.45869 E116.58381	19/09/2007	14:30 to 15:15	3.4 m	6 to 7 m	Minimum surge	Sunny	NE, 10 kt	Spur and groove reef crest with scattered coral/rock bommies. Some soft corals present.	4.6 m	
Sailfish North	2	S20.45435 E116.59044 S20.45592 E116.58772	26/09/2007	13:51 to 14:32	2.6 m	< 5 m	Very surgey	Sunny	NE, 10 -15 kt	Similar to above (spur and groove reef crest)	5.9 m	Strong surges due to swell. Visibility was poor.
Sailfish North	3	S20.45183 E116.59546 S20.45352 E116.59224	19/09/2007	12:00 to 12:55	2.9 m	6 to 7 m	Minimum surge	Sunny	NE, 15 kt	Similar to above (spur and groove reef crest)	5.6 m	
Sailfish South	1	S20.46544 E116.56823 S20.46540 E116.56503	23/09/2007	9:38 to 10:23	2.9 m	10 m	Minimum	Sunny	WSW, 10 kt	Behind the spur and groove reef crest. Less rugose than other locations. Less rugose than SS sites 2 and 3	4.1 m	Crown of thorns were present at the site.
Sailfish South	2	S20.46293 E116.57450 S20.46310 E116.57011	23/09/2007	11:13 to 12:07	2.5 m	7 m	Minimum	Sunny	WSW, 10 kt	Behind the spur and groove reef crest. Less rugose than other locations. Flat seafloor.	6.3 m	Crown of thorns were present at the site.
Sailfish South	3	S20.46242 E116.57719 S20.46078 E116.58010	23/09/2007	13:21 to 13:52	2.05 m	6 m	Medium surge	Sunny	WSW, 13 kt	Behind the spur and groove reef crest. Closer to reef slope than SS sites 1 and 2.	2. 35 m	
Legendre Island Inside	1	S20.39240 E116.90205 S20.39406 E116.90632	20/09/2007	10:30 to 11:20	2.2 m	7 m	Minimum	Sunny	SW, < 10 kt	Spur and groove reef. Reef became less rugose toward the eastern end of the site.	4.3 m	
Legendre Island Inside	2	S20.39646 E116.91032 S20.39859 E116.91407	20/09/2007	12:17 to 12:59	2.6 m	7 m	Minimum	Sunny	N, < 10 kt	Sloping, flat, spur and groove reef slope. A few gutters but not as many as LI Site 1.	5.9 m	
Legendre Island Inside	3	S20.40053 E116.91709 S20.40172 E116.91978	20/09/2007	13:40 to 14:18	3 m	6 m	Minimum	Sunny	N, < 10 kt	Sloping spur and groove reef slope.	5.5 m	
Legendre Island Outside	1	S20.40494 E116.93217 S20.40550 E116.93543	22/09/2007	around noon (time not recorded)	2.2 m	6 to 10 m	Medium	Sunny	W, < 10 kt	Spur and groove reef.	5. 8 m	
Legendre Island Outside	2	S20.40710 E116.94095 S20.40833 E116.94351	22/09/2007	11:47 to 12:29	2.3 m	10 m	Minimum	Sunny	WNW, <10 kt	Spur and groove reef with separate coral/rock bommies. Similar to other Legendre sites.	4.7 m	Many Faviid and Porites recruits.
Legendre Island Outside	3	S20.41271 E116.94952 S20.41517 E116.95290	22/09/2007	2:00 to 2:45	2.3	7 m	Minimum	Sunny	WNW, <10 kt	Spur and groove reef with separate coral/rock bommies. Less rugose than LO sites 1 and 2.	3.7 m	

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LIST OF EXSISITNG MARINE SCIENCE PROGRAM REPORTS

Data Report Series

MSPDR 1. Preliminary assessment of coral communities at selected sites in the proposed Dampier Archipelago Marine Park. Armstrong SJ (2008).

MSPDR 2. Anoxic impacts at Bill's Bay, Ningaloo Marine Park associated with the 2008 coral spawning event. Armstrong SJ, Syme R (2008).

MSPDR 3. Mapping the coral reef communities of the Shark Bay marine protected areas: Data collected during the February 2008 field survey. Bancroft KP (2008).

MSPDR 4. Establishing long-term coral community monitoring sites in the Montebello/Barrow Islands marine protected areas: Data collected in December 2006

MSPDR 5. Ningaloo Marine Park *Drupella* long-term monitoring program: Results of the 2008 survey. Armstrong SJ (2008).

Other Marine Science Program Reports

MSP 2006/01 Long-term monitoring program in the Montebello/Barrow Islands marine protected areas. Scoping field trip: 8-11 August 2006. Field Program Report. Bancroft KP, Simpson CJ, Long S (2006).

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