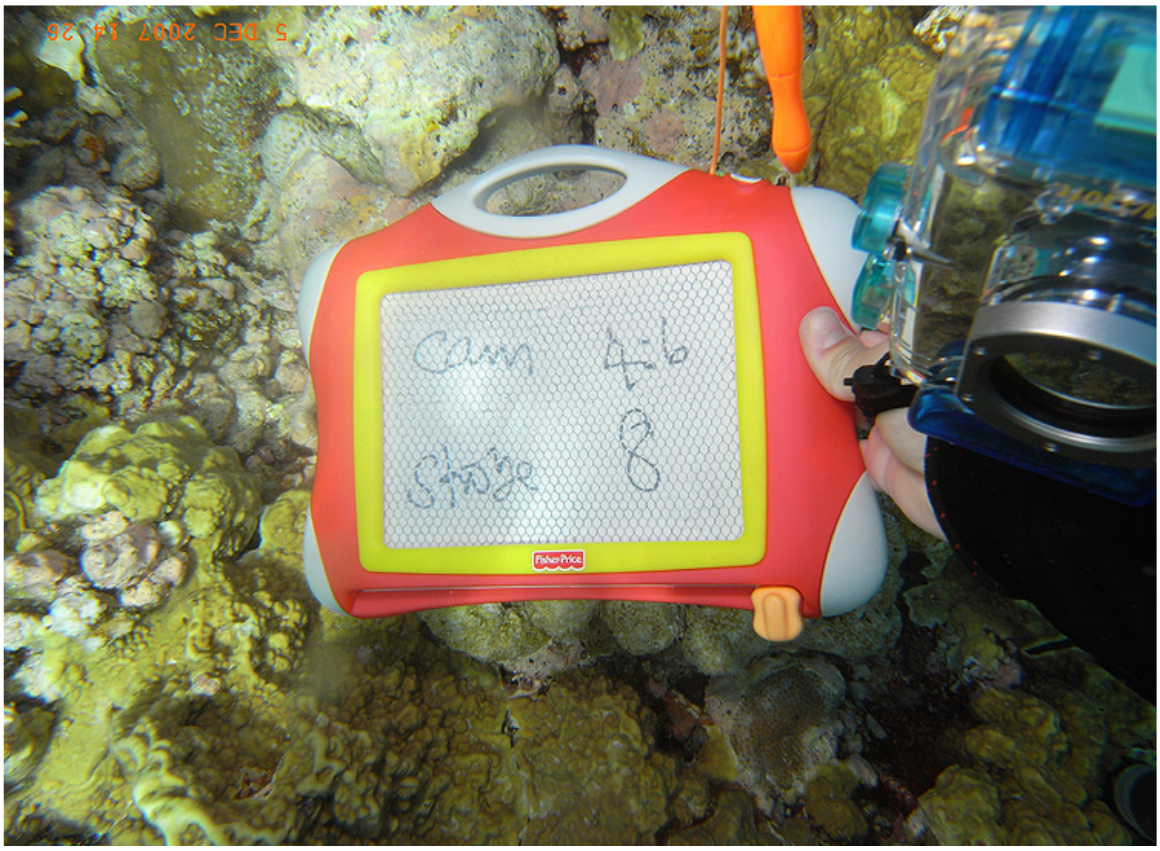
Comparative marine biodiversity survey of the Rowley Shoals
1-17 Dec 2007

METADATA REPORT



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Contents

1 Brief Introduction

1.1 The Rowley Shoals

The Rowley Shoals are comprised of three emergent reefs - Mermaid, Clerke and Imperieuse - located approximately 300 km west-northwest of Broome along the edge of the continental shelf. Due to their isolation and protection from most human impacts, the Rowley Shoals are likely to be amongst the most pristine coral reef environments remaining in the world (Bellwood *et al.* 2003; Gilmour *et al.* 2007). As coral reefs continue to degrade worldwide, careful management of the Rowley Shoals will be required to establish and maintain them as regional and potentially global benchmarks for coral reef biodiversity conservation.

However, successful management requires informed decision-making. Although all three shoals are managed by State or Commonwealth departments as marine protected areas, information about trends in marine biodiversity over time is essential for comparison and assessment of the effectiveness of the different management regimes in effect across the three shoals.

Please see the Rowley Shoals Marine Park Management Plan (MPRA and DEC, 2007) and the Mermaid Reef National Marine Nature Reserve Management Plan (DEWHA, in prep) for further information about the Rowley Shoals and their management.

1.2 Comparative marine biodiversity survey 1-17 Dec 2007

In response to management information needs, a major marine biodiversity survey of the Rowley Shoals, led by the Australian Institute of Marine Science in collaboration with the Western Australian Department of Environment and Conservation, was undertaken from 1-17 December 2007. The multidisciplinary survey aimed to collect data that could directly inform management of the Rowley Shoals Marine Park and the Mermaid Reef National Marine Nature Reserve. Please see the following documents for a full description of the survey's activities: Long (2007a,b,c) and Colquhoun (2008).

1.2.1 Aims of major projects

1.2.1.1 Benthic assemblages

Coral reef communities are naturally highly dynamic ecosystems. This dynamism is expressed in terms of shifts over time in competitively dominant species and relative cover of some of the key components of these communities: hard corals, soft corals, and algae. Shifts occur in response to both acute and chronic disturbances. Shifts observed in coral reef communities elsewhere include domination of substrate by soft corals or algae following stress-related reductions in hard coral cover, or the loss of sensitive habitat-forming corals like branching acroporids due to acute disturbances such as cyclones or bleaching. Both of these scenarios can cause significant detrimental flow-on effects to the ecosystem as a whole. Understanding the responses of coral reef communities to different kinds of disturbance is essential for effective conservation management, particularly as the nature of these responses signal the health of the ecosystem, which can also be thought of as its resilience to inevitably increasing levels of environmental stress.

This project aimed to provide a snapshot of the condition of the benthic communities of the Rowley Shoals by resurveying long-term benthic monitoring sites, and by quantifying the reefs' algal and soft coral biodiversity. All algal samples collected will be stored at the WA Herbarium.
Project leader: Dr Suzanne Long, DEC, Suzanne.long@dec.wa.gov.au
Algal specialist: Dr John Huisman, WA Herbarium/Murdoch/DEC, john.huisman@dec.wa.gov.au
Soft coral specialist: Dr Katharina Fabricius, AIMS, k.fabricius@aims.gov.au

1.2.1.2 Commercially important invertebrates

High-value edible holothurians, *Trochus* shells and giant clams perform important ecological functions and have been overfished on most Indo-Pacific reefs. Collection is prohibited at all three Rowley Shoals, and monitoring of populations of these commercially important invertebrates here could provide information about pristine population characteristics and/or give indications of illegal fishing.
Project leader: Jamie Colquhoun, AIMS, j.colquhoun@aims.gov.au

1.2.1.3 Shark habitat use

There is increasing concern worldwide that populations of sharks are declining, and yet we have little more than a very basic understanding of most aspects of their biology including home ranges, stock sizes and migration patterns. This information is essential if management strategies such as Marine Protected Areas (MPAs) are to be implemented at scales appropriate to ensure the survival of sharks in reef systems. The abundant populations of reefs sharks at the Rowley Shoals, primarily grey reef sharks *(C. amblyrhynchos)*, provide a unique opportunity to gather baseline biological information on habitat use and migration over time that can be used in the design and implementation of MPAs.
Using an array of acoustic listening stations and sonar tags we propose to monitor and describe the spatial and temporal patterns of reef use by common shark species at this locality. We will deploy acoustic transmitter tags on sharks of these species, track the movement of the sharks across the reef atolls, and use these data to determine patterns of reef attendance and habitat use, and migrations rates among reefs.
In addition, tissue samples will be collected from each individual for genetic analyses to determine population structure and morphometric measurements to allow ontogenetic comparisons.
Project leader: Dr Iain Field, AIMS/CDU, iain.field@cdu.edu.au

1.3 Why is a metadata report necessary?

If datasets are worth collecting, then it is worth describing them with metadata. Dataset collection is expensive, and public-funded bodies in particular need to be accountable for the resources expended in data collection and maintenance. Nonetheless, it is not uncommon for large organizations or collaborative projects to lose valuable resources by "forgetting", over time, that certain datasets have been collected. A metadata report, in combination with uploading of metadata to an online accessible storehouse such as BlueNet (the Australian marine science data network, www.bluenet.org.au), is a systematic method for describing datasets and thereby contributing to their preservation.

2 Survey metadata

2.1 Benthic assemblages

2.1.1 Long-term monitoring sites

Twenty-two long-term monitoring sites were resurveyed, and three new sites were established (Table 1). Established sites were located using handheld GPS, except in the case of AIMS sites, where previously installed star pickets marked the start and finish of each transect. At each site, five 50 m transects were filmed in series along the depth contour, with 5-10 m distance between transects. Data sheets recorded depths and described the habitats and dominant taxa at each site.

These data are maintained by DEC's Marine Science Program, and will be presented in analysed form in a forthcoming Marine Science Program data report.

2.1.2 Photoquadrats

Using a digital camera, GPS and tripod system developed by Dr Andrew Heyward (AIMS), a series of highly detailed, haphazard, georeferenced benthic photoquadrats was obtained for several sites across the three reefs (Table 2). These will be investigated for their usefulness in assessing rates of coral recruitment, cover of various crustose coralline algal groups on the reef crest, rates of recovery from anchor damage, and benthic habitat mapping.

These data are maintained by DEC and will be presented in a forthcoming data report to be produced by the Marine Science Program.

Table 1. Long-term benthic monitoring sites surveyed at the Rowley Shoals, 1-17 December 2007. Biodiversity samples (A=algal, SC=soft coral) were collected at most sites.

Date	Reef	Site name	GPS coordinates				Habitat description	Depth (m)	Samples?		Remarks
			start		finish						
			lat	long	lat	long			A	SC	
2/12/2007	I	AIMS-1995-RS3-1	17°32.905	118°58.428	17°33.042	118°58.420	Slope NE	6 - 9	y	y	*Acropora* plates with possible coral disease
2/12/2007	I	DEC-2001-I14	17.54897	118.96654	17.55138	118.9651	Lagoon	10	y	y	none
3/12/2007	I	DEC-2007-I23	17.50957	118.93439	17.50681	118.93583	Slope NW	9	n	y	none
3/12/2007	I	DEC-2001-I19	17.57958	118.93665	17.58214	118.93602	Southern lagoon, shallow, dominated by powdery sand (huge infauna activity) with occasional sparse *Acropora* thickets	6	n	n	Poor visibility
3/12/2007	I	DEC-2001-I13	17.5599	118.94205	17.56247	118.94195	Middle of lagoon, fragile forms of *Acropora*, occasional bommies	6	n	n	Poor visibility
4/12/2007	I	DEC-2001-I9	17.61058	118.97475	17.61278	118.97434	Slope SE. Highly rugose	7 - 13	y	n	Coral disease?
4/12/2007	I	DEC-2001-I12	17°35.330	118°57.819	17°35.467	118°57.840	Southern lagoon, undisturbed fragile *Acropora* forms interspersed with bommies	12	y	y	none
6/12/2007	I	DEC-2007-I24	17.6092	118.96384	17.61143	118.96307	Southern lagoon, undisturbed fragile *Acropora* forms interspersed with bommies	7 - 10	y	n	110 cm clam
7/12/2007	C	DEC-2007-C25	17°18.928	119°22.050	17°18.864	119°22.154	Southern edge of eastern lagoon. Murky shallow lagoon edge with very occasional bommies.	4 - 7	y	n	none
7/12/2007	C	DEC-2001-C5	17.34925	119.31541	17.35244	119.31586	Slope SW, reef crest at about 7 m then reef slope. Spur and groove structure, many large soft corals and sea whips below 12 m	9 - 12	y	n	Many juv maori wrasse
8/12/2007	C	AIMS-1995-RS2-1	17°17.057	119°22.615	17°17.201	119°22.625	Slope NE, low profile reef subject to strong wave action	6 - 10	n	n	Many long dead plates. Many deeper plates dying (coral disease?). Temperature logger attached to stake at northern end
8/12/2007	C	DEC-2001-C3	17.27987	119.32131	17.28142	119.32047	Slope NW, steep slope, low rugosity, high wave action. Large areas of *Acropora* rubble. Many *Acropora* recruits.	7 - 9	y	y	none
9/12/2007	C	DEC-2001-C20	17.30749	119.3713	17.30974	119.37156	Eastern lagoon, shallow lagoon, patches of *Acropora* rubble on bommie shoulders - destroyed thickets?	5 - 7	y	y	none

Date	Reef	Site name	GPS coordinates				Habitat description	Depth (m)	Samples?		Remarks
			start		finish						
			lat	long	lat	long			A	SC	
9/12/2007	C	DEC-2001-C1	17°14.862	119°20.682	Not recorded due to strong currents; approx 300m west of start along depth contour		North slope, quite strong current, low profile, many *Pocillopora* and *Sarcophyton*-like softies, high energy environment	6 - 7	y	y	*Drupella* observed
10/12/2007	C	DEC-2001-C12	17°18.193	119°20.151	17°18.304	119°20.074	Lagoon, patches of rubble, many clams, occasional bommie.	12	y	n	
10/12/2007	C	DEC-2001-C11	17°20.687	119°21.063	17°20.840	119°21.064	Southern lagoon, patches of rubble, occasional bommie, many juv maori wrasse	6	y	n	
11/12/2007	C	DEC-2001-C21	17°19.179	119°21.644	17°19.322	119°21.638	Small inner lagoon. Shallow lagoonal habitat with occasional bommies.	8	y	n	
11/12/2007	C	DEC-2001-C9	17°21.354	119°23.050	Not recorded due to strong currents; transects ran in a southerly direction along depth contour		SE Slope. Steep slope/wall with strong spur and groove structure.	8	y	n	No evidence of disease amongst plate acroporids. Filmed at 90 degrees to substrate.
12/12/2007	M	DEC-2001-M5	Not recorded due to strong currents. Transects ran in a southerly direction along 7 m contour adjacent to 17.1272° 119.5943° (old GPS mark for M5, further inshore)				SW slope. Surge and strong currents.	8	y	n	
14/12/2007	M	DEC-2001-M7	17.1641	119.6277	17.16352	119.62491	Southern tip/slope of Mermaid. Rugose, every stable surface was covered in pocilloporid and acroporid recruits, few large coral colonies xpt encrusters and the odd *Porites*	10	y	n	
14/12/2007	M	DEC-2001-M13	17.0891	119.63474	17.09034	119.62421	Northern lagoon. Patches of fragile *Acropora* with occasional small bommies sporting enormous plates. Some dead thickets covered in algae.	12	y	n	
15/12/2007	M	DEC-2001-M11	17.13371	119.6339	17.13336	119.63336	Southern lagoon. Transects ran around "hillocks" of staghorn rubble, clams and fungiids. Deeper areas with sparse fine *Acropora*, fungiids, and rubble with turf.	8 - 12	n	n	
15/12/2007	M	DEC-2001-M12	17.11469	119.63474	17.11421	119.63484	Middle lagoon. Transects ran around "hillocks" of staghorn rubble, clams and fungiids. Deeper areas with sparse fine *Acropora*, fungiids, and rubble with turf at 15 - 20 m.	8 - 12	n	n	

Table 2. Sites at which series of haphazard georeferenced benthic photoquadrats were made, Rowley Shoals, 1-17 Dec 2007.

Date	Reef	Site	Habitat	# quadrats
6/12/07	I	AIMS-1995-RS3-1	NE crest and slope, ranging from 1-13 m depth	70
8/12/07	C	Lagoon near anchoring zone	Sheltered lagoon with sand, rubble and *Acropora* thickets, 8-16 m depth; quadrats inside/outside anchoring zone	53
10/12/07	C	AIMS-1995-RS2-1	NE crest and slope, ranging from 1-16 m depth	84
16/12/07	M	NE reef crest and lagoon near anchoring zone	Shallow 2-4 m reef crest in vicinity of AIMS-1995-RS1-1; sheltered lagoon with sand, rubble and *Acropora* thickets, ~15 m depth, with quadrats both inside/outside anchoring zone	58

2.1.3 Octocoral samples

Octocoral biodiversity was surveyed at eighteen sites across all three Rowley Shoals (Table 3a). At each site, transects commenced at ~20 m depth and ascended gradually, finishing at ~5 m depth over a horizontal distance of ~300 m. All octocorals encountered were identified (so far as possible in the field), most were photographed, and duplicate samples were taken of new observations for later taxonomic analysis (Table 3b).

One set of samples as well as the data will be maintained by AIMS, and the WA Museum will hold the other set of samples. The data will be initially used to produce a basic photo ID guide to facilitate analysis of benthic monitoring video tapes from the Rowley Shoals.

Table 3a. Locations of octocoral surveys at the Rowley Shoals, 1-17 December 2007. AIMS TN = AIMS transect ID number.

Reef	Date	AIMS TN	DEC site code	Habitat	Orientation	Latitude	Longitude	Depth (m)
I	2/12/2007	458	AIMS-1995-RS3-1	Back	NE	17.54800	118.97367	8-3
I	2/12/2007	459	DEC-2001-I14	Lagoon	E	17.54900	118.96660	8-3
I	3/12/2007	460	DEC-2001-I23	Front	NNW	17.52500	118.93000	18-13
I	3/12/2007	460	DEC-2001-I23	Front	NNW	17.52500	118.93000	13-8
I	3/12/2007	460	DEC-2001-I23	Front	NNW	17.52500	118.93000	8-3
I	4/12/2007	461	DEC-2001-I12	Lagoon	E	17.58890	118.96340	13-8
I	4/12/2007	461	DEC-2001-I12	Lagoon	E	17.58890	118.96340	8-3
I	4/12/2007	461	DEC-2001-I12	Lagoon	E	17.58890	118.96340	3-1
I	4/12/2007	462	DEC-2001-I9	Back	E	17.61020	118.97470	18-13
I	4/12/2007	462	DEC-2001-I9	Back	E	17.61020	118.97470	13-8
I	4/12/2007	462	DEC-2001-I9	Back	E	17.61020	118.97470	8-3
I	4/12/2007	462	DEC-2001-I9	Back	E	17.61020	118.97470	3-1
C	8/12/2007	463	DEC-2001-C3	Front	W	17.27980	119.32130	25-18
C	8/12/2007	463	DEC-2001-C3	Front	W	17.27980	119.32130	18-13
C	8/12/2007	463	DEC-2001-C3	Front	W	17.27980	119.32130	13-8
C	8/12/2007	463	DEC-2001-C3	Front	W	17.27980	119.32130	8-3
C	9/12/2007	464	DEC-2001-C1	Flank	N	17.24600	119.34600	18-13
C	9/12/2007	464	DEC-2001-C1	Flank	N	17.24600	119.34600	13-8
C	9/12/2007	464	DEC-2001-C1	Flank	N	17.24600	119.34600	8-3
C	9/12/2007	464	DEC-2001-C1	Flank	N	17.24600	119.34600	3-1
C	9/12/2007	465	DEC-2001-C20	Lagoon	E	17.30740	119.37140	8-3
C	9/12/2007	465	DEC-2001-C20	Lagoon	E	17.30740	119.37140	3-1

Reef	Date	AIMS TN	DEC site code	Habitat	Orientation	Latitude	Longitude	Depth (m)
C	10/12/2007	466	no DEC site	Lagoon	E	17.28157	119.37018	8-3
C	10/12/2007	466	no DEC site	Lagoon	E	17.28157	119.37018	3-1
C	10/12/2007	467	AIMS-1995-RS2-1	Back	E	17.28428	119.37692	18-13
C	10/12/2007	467	AIMS-1995-RS2-1	Back	E	17.28428	119.37692	13-8
C	10/12/2007	467	AIMS-1995-RS2-1	Back	E	17.28428	119.37692	8-3
C	10/12/2007	467	AIMS-1995-RS2-1	Back	E	17.28428	119.37692	3-1
C	10/12/2007	467	AIMS-1995-RS2-1	Back	E	17.28428	119.37692	1
C	11/12/2007	468	no DEC site	Flank	S	17.39529	119.36212	18-13
C	11/12/2007	468	no DEC site	Flank	S	17.39529	119.36212	13-8
C	11/12/2007	468	no DEC site	Flank	S	17.39529	119.36212	8-3
C	11/12/2007	468	no DEC site	Flank	S	17.39529	119.36212	3-1
C	11/12/2007	468	no DEC site	Flank	S	17.39529	119.36212	1
C	11/12/2007	469	DEC-2001-C9	Back	E	17.35620	119.38340	18-13
C	11/12/2007	469	DEC-2001-C9	Back	E	17.35620	119.38340	13-8
C	11/12/2007	469	DEC-2001-C9	Back	E	17.35620	119.38340	8-3
C	11/12/2007	469	DEC-2001-C9	Back	E	17.35620	119.38340	3-1
M	12/12/2007	470	DEC-2001-M5	Front	W	17.12720	119.59430	18-13
M	12/12/2007	470	DEC-2001-M5	Front	W	17.12720	119.59430	13-8
M	12/12/2007	471	DEC-2001-M1	Flank	N	17.02860	119.61810	18-13
M	12/12/2007	471	DEC-2001-M1	Flank	N	17.02860	119.61810	13-8
M	12/12/2007	471	DEC-2001-M1	Flank	N	17.02860	119.61810	8-3
M	13/12/2007	472	DEC-2001-M4	Front	W	17.07620	119.59650	18-13
M	13/12/2007	472	DEC-2001-M4	Front	W	17.07620	119.59650	13-8
M	13/12/2007	472	DEC-2001-M4	Front	W	17.07620	119.59650	8-3
M	13/12/2007	473	DEC-2001-M13	Lagoon	S	17.08910	119.63580	13-8
M	13/12/2007	473	DEC-2001-M13	Lagoon	S	17.08910	119.63580	8-3
M	13/12/2007	474	DEC-2001-M7	Back	SE	17.16352	119.62491	18-13
M	13/12/2007	474	DEC-2001-M7	Back	SE	17.16352	119.62491	13-8
M	13/12/2007	474	DEC-2001-M7	Back	SE	17.16352	119.62491	8-3
M	13/12/2007	474	DEC-2001-M7	Back	SE	17.16352	119.62491	3-1
M	15/12/2007	475	no DEC site	Lagoon	S	17.06920	119.64321	13-8
M	15/12/2007	475		Lagoon	S	17.06920	119.64321	8-3
M	15/12/2007	475		Lagoon	S	17.06920	119.64321	3-1
M	16/12/2007	476	Front reef near channel entrance	Front/Channel	E	17.06299	119.64783	18-13
M	16/12/2007	476	Front reef near channel entrance	Front/Channel	E	17.06299	119.64783	13-8
M	16/12/2007	476	Front reef near channel entrance	Front/Channel	E	17.06299	119.64783	8-3

Table 3b (next page). Specimens collected during the octocoral biodiversity survey at the Rowley Shoals, 1-17 December 2007.

Date	Reef	Sample	Photo	Site name		Depth (m)	Habitat	Aspect	GPS coordinates	
				DEC	AIMS				Lat	Long
2/12/2007	I	1207-01	y	AIMS-1995-RS3-1	458	8	Back	NE	17.548	118.97367
2/12/2007	I	1207-02	y	I14	459	8	Lagoon	E	17.549	118.9666
2/12/2007	I	1207-03	y	I14	459	8	Lagoon	E	17.549	118.9666
3/12/2007	I	1207-04	y	I23	460	15	Front	NNW	17.525	118.93
3/12/2007	I	1207-05	y	I23	460	15	Front	NNW	17.525	118.93
3/12/2007	I	1207-06	y	I23	460	15	Front	NNW	17.525	118.93
3/12/2007	I	1207-07	y	I23	460	15	Front	NNW	17.525	118.93
3/12/2007	I	1207-08	N	I23	460	15	Front	NNW	17.525	118.93
4/12/2007	I	1207-09	y	I12	461	3-12	Eastern Lagoon	E	17.5889	118.9634
4/12/2007	I	1207-10	y	I12	461	8	Eastern Lagoon	E	17.5889	118.9634
4/12/2007	I	1207-11	y	I12	461	3-12	Eastern Lagoon	E	17.5889	118.9634
4/12/2007	I	1207-12	y	I12	461	12	Eastern Lagoon	E	17.5889	118.9634
8/12/2007	C	1207-13	y	C3	463	18	Front	W	17.2798	119.3213
8/12/2007	C	1207-14	y	C3	463	20-25	Front	W	17.2798	119.3213
9/12/2007	C	1207-15	y	C1	464	8-20	N Flank	N	17.246	119.346
9/12/2007	C	1207-16	y	C1	464	20	N Flank	N	17.246	119.346
9/12/2007	C	1207-17	y	C1	464	20	N Flank	N	17.246	119.346
9/12/2007	C	1207-18	y	C1	464	20	N Flank	N	17.246	119.346
9/12/2007	C	1207-19	y	C1	464	20	N Flank	N	17.246	119.346
9/12/2007	C	1207-20	y	C20	465	8	Lagoon	E	17.3074	119.3714
9/12/2007	C	1207-21	y	C20	465	8	Lagoon	E	17.3074	119.3714
9/12/2007	C	1207-22	N	C20	465	10	Lagoon	E	17.3074	119.3714
10/12/2007	C	1207-23	y	C1	465	18	Lagoon	E	17.3074	119.3714
11/12/2007	C	1207-24	N	-	468	18	Flank	S	17.39529	119.36212
11/12/2007	C	1207-25	N	-	468	18	Flank	S	17.39529	119.36212
11/12/2007	C	1207-26	y	-	468	15	Flank	S	17.39529	119.36212
12/12/2007	M	1207-27	y	-	469	20	Back	E	17.3562	119.3834
12/12/2007	M	1207-28	N	-	470	20	Front	W	17.1272	119.5943
12/12/2007	M	1207-29	y	-	470	15	Front	W	17.1272	119.5943
12/12/2007	M	1207-30	y	-	471	15	N Flank	N	17.0286	119.6181
12/12/2007	M	1207-31	y	-	471	15	N Flank	N	17.0286	119.6181
12/12/2007	M	1207-32	y	-	471	15	N Flank	N	17.0286	119.6181
14/12/2007	M	1207-33	y	-	474	15	Back	SE	17.16352	119.62491
14/12/2007	M	1207-34	y	-	474	15	Back	SE	17.16352	119.62491
16/12/2007	M	1207-35	y	-	475	15	Front	NE	17.06299	119.64783
16/12/2007	M	1207-36	y	-	475	15	Front	NE	17.06299	119.64783
16/12/2007	M	1207-37	y	-	475	15	Front	NE	17.06299	119.64783
16/12/2007	M	1207-38	y	-	475	15	Front	NE	17.06299	119.64783
16/12/2007	M	1207-39	y	-	475	15	Front	NE	17.06299	119.64783
16/12/2007	M	1207-40	y	-	n/a	5	Lagoon (north)	N	n/a	n/a
16/12/2007	M	1207-41	y	-	n/a	5	Lagoon (north)	N	n/a	n/a

2.2 Commercially important invertebrates

Trochus, holothurian and giant clam populations were surveyed in various habitats across all three shoals (Table 4). New sites were established at Clerke and Imperieuse reefs, while sites that had been previously surveyed were revisited at Mermaid. Replicate 500 m transects (usually three) were swum at each site. Individuals were counted, identified to species, and the basal width of each *Trochus* shell was measured. These data are maintained by AIMS.

Table 4. Reefs and habitats surveyed for commercially important invertebrates at the Rowley Shoals, 1-17 December 2007.

Date	Reef	Site description/ habitat	Number of transects
2/12/2007	I	Back-reef zone	5
3/12/2007	I	Front-reef zone. High energy swept habitat with large areas of bare substrate, gutters, and areas of good coral cover.	12
3/12/2007	I	Back-reef zone. Diverse habitat with high coral cover, gutters and bare patches with algae.	6
4/12/2007	I	Lagoon, sand and patch-reef habitat	6
4/12/2007	I	Back-reef zone, diverse habitat with good coral cover, gutters and bare patches with algae	3
5/12/2007	I	Back-reef zone. Diverse habitat with high coral cover, gutters and bare patches with algae.	6
6/12/2007	I	Back-reef zone. Diverse habitat with high coral cover, gutters and bare patches with algae.	3
6/12/2007	I	Lagoon. First three transects were in shallow sand habitats with patch-reefs and good visibility. Last was in deeper sand habitat with patch-reef with low visibilty due to nutrient blooms.	4
7/12/2007	C	Front reef zone. Diverse habitat with high coral cover, gutters and high energy.	9
7/12/2007	C	Lagoon nearest to channel, 3 in the deeper parts of the lagoon, patch-reefs and sand mounds and burrow habitat. Three more transects in the shallower sandy edge of the lagoon, larger areas of sand with less patch-reefs.	6
8/12/2007	C	Northern end of front reef zone. High coral cover.	2
8/12/2007	C	Lagoon near the island. Shallow sandy patch-reefs, good visibility in shallow areas and poor vis in the deeper areas.	5
9/12/2007	C	First transect was at the northern point of the reef and current was significant. Second was still in the north but in the back-reef zone. Habitat was high coral cover with gutters and sandy patches beyond the back-reef.	6
9/12/2007	C	Lagoon (on SCUBA). Large stands of staghorn *Acropora*, patch-reefs and sandy bottom.	3
10/12/2007	C	n/a	20
11/12/2007	C	n/a	18
12/12/2007	M	n/a	15
13/12/2007	M	n/a	9
14/12/2007	M	n/a	15
15/12/2007	M	n/a	21
16/12/2007	M	n/a	6

2.3 Shark habitat use

Thirty-seven sharks were tagged across all three shoals, after being captured using baited barbless hooks (Table 5). The VEMCO acoustic transmitter tags (V9-1h; VEMCO, Halifax, Nova Scotia, Canada) were attached to the dorsal fin except for one small shark whose fin was considered too small to support the transmitter. For this individual, the tag was surgically implanted in the body cavity. Two additional sharks were captured but were considered too small to tag. Biometric data was recorded for each captured grey reef shark, and tissue samples (fin clips) were taken and stored in DMSO for later genetic analyses. Numerous other sharks were caught – mainly white tip reef sharks *(Triaenodon obesus)* - but were considered too small to tag. Fifteen VEMCO acoustic receivers (VR2w; VEMCO, Halifax, Nova Scotia,

Canada) were deployed attached to star pickets at selected strategic locations across the three shoals. In addition five sentinel tags were deployed attached to star pickets, to monitor changes in the receptivity of the listening stations with tide and time.
Data will be downloaded from the listening stations periodically over the next eighteen months. These data will be analysed and maintained by AIMS.

Table 5. Acoustic tag and receiver deployments at the Rowley Shoals, 1-17 December 2007.

Date	Reef	Deployments			Tissue samples
		Sharks tagged	Acoustic Receivers	Sentinel tags	
2/12/07 to 6/12/07	I	13 Grey Reef Sharks *(Carcharhinus amblyrhynchos)*, 2 Silver Tip Sharks *(C. albimarginatus)*	7	2	All tagged sharks plus 1 juvenile *C. amblyrhynchos* (too small to tag)
7/12/07 to 11/12/07	C	16 Grey Reef Sharks *(C. amblyrhynchos)*	6	2	All tagged sharks plus 1 juvenile *C. amblyrhynchos* (too small to tag)
12/12/07 to 16/12/07	M	6 Grey Reef Sharks *(C. amblyrhynchos)*	2	1	All tagged sharks

3 Other datasets relevant to the Rowley Shoals

In addition to the data collected during the 2007 survey, and the sources compiled in Gilmour *et al.* (2007), various other as yet unpublished or grey literature datasets and reports exist that are relevant to the Rowley Shoals, and which may be of use for researchers and managers. These include:

- Bibliography of published research relevant to the Rowley Shoals. Draft Marine Science Program report. Contact: Suzanne Long (DEC).
- Database of current and proposed research relevant to the Rowley Shoals. Draft Marine Science Program report. Contact: Suzanne Long (DEC).
- Keyword-searchable database inventory of all marine specimens in the Western Australian Museum (WAM) collected from the oceanic atolls of Western Australia, including the Rowley Shoals. Contact: Clay Bryce (WAM) or Suzanne Long (DEC).
- Octocorals of the Rowley Shoals: basic photo ID guide compiled by Katharina Fabricius (AIMS), available through AIMS and DEC websites.
- Macroalgae of the Rowley Shoals: basic photo ID guide compiled by John Huisman (WA Herbarium/DEC/Murdoch), available through DEC website.
- Human use of the Rowley Shoals Marine Park. Draft DEC internal report. Contact: Fiona Galloway (West Kimberley District, DEC).
- Swath map and bathymetry data for Mermaid Reef, developed by Fugro for DEWHA. Contact: Chantal Simakoff-Ellims (DEWHA).
- Deepwater biodiversity of NW Shelf, including numerous sampling locations at Imperieuse and Mermaid Reefs. Contact: Alan Williams (CSIRO).
- Deepwater fish biodiversity of the Rowley Shoals. Contact: Steve Newman (WA Fisheries).
- Underwater visual census and other observations of selected fish species (including *Plectropomus* spp.) at the Rowley Shoals, 2007. Contact: Howard Choat (JCU) or Steve Newman (WA Fisheries).
- Installation of water temperature loggers and data collection throughout Australia, including the Rowley Shoals. Contact: Ray Berkelmans (AIMS).

- Baited remote underwater video survey of shallow reef slope fish assemblages at the Rowley Shoals, plus BRUVS of lagoonal fish assemblages inside Mermaid lagoon. Contact: Mike Cappo (AIMS).
- Underwater visual census of lagoonal and shallow reef slope fish assemblages at the Rowley Shoals. Contact: Andrew Heyward (AIMS).
- Various oceanographic and current studies relevant to the Rowley Shoals. Contact: Andrew Heyward (AIMS).
- Foreign fishing vessel effort in northern Australia, estimated from Coastwatch surveillance data. 2007 report to AFMA by John Salini (CSIRO).
- Assessment of the utility of DIVE as an MPA management support tool: Rowley Shoals case study. Contact: Gary Carroll (CSIRO).
- Genetic connectivity of damselfish populations of WA's coral reefs, including the Rowley Shoals (study underway Jan 2008). Contact: Jim Underwood (AIMS).

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