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WAMMP – Fish and Coral Surveys of the Rowley Shoals, 2011

Meta Data Report
MDR_FishCoral_RSMP_201109

30/09/2011

Tom Holmes
Kim Friedman
Kevin Bancroft
Stuart Field

Marine Science Program
Science Division
Department of Environment and Conservation

Department of
Environment and Conservation
Our environment, our future

Report

What is the title of the study/project?	WAMMP – Fish and Coral Surveys of the Rowley Shoals, 2011
Who is submitting this report?	Tom Holmes
Date report submitted?	31/01/2012
Who has reviewed this report?	

Field leader: **Tom Holmes** **Signature:** 

Date handed over: 31/01/2012

Project supervisor: **Kim Friedman** **Signature:** 

Date handed over: **23 Feb 2012**

Program leader: **Chris Simpson** **Signature:**

Date signed off:

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Part a) Post field trip report

Actual date of departure: 22/09/2011
Actual date of return: 1/10/2011
Were all of the science objectives met? Yes
If No, what objectives were not met and why were they not met: N/A
Were there any OHS incidents to report? No
If Yes, have you completed the appropriate DEC incident forms and what actions/notifications have been taken in regard to OHS issues to prevent a similar incident on future trips. N/A
What actions/notifications have been taken in regard to OHS issues, equipment damage and planning to complete outstanding work that remains uncompleted from the trip? N/A
Were there any equipment and logistics failures during the fieldtrip? Yes. - Continued issues with DOV cameras changing from auto to Manual focus in the middle of use - Scratch on front of DOV camera housings - Spare diode failed to work
What actions/notifications have been taken in regard to equipment and logistics failures to prevent a similar incident on future field trips. Discussions have been initiated regarding the potential upgrade of DOV equipment
Were there any other incidences that caused interruptions with the successful completion of the fieldtrip? No
If yes, Outline actions and responsibilities that have been made that would reduce the likelihood of this occurring on future trips? N/A

Incident forms (please complete and attach where necessary)
http://intranet/csd/People_Services/rm/Documents/FLOW%20CHART%20-%20incident%20reporting%20protocol.pdf
http://intranet/csd/People_Services/rm/Documents/Incident%20Investigation.doc

Filing

Signed Field Operations Plan	Yes
Signed JSA	Yes
Signed dive log	Yes
Completed dive report and dive logs submitted to the DDO	Yes
Have your personnel claimed all allowances?	Yes
Have you returned all equipment used and signed off the loans list	

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Part b) Metadata report

What	
What is the title of the study/project?	WAMMP – Fish and Coral Surveys of the Rowley Shoals, 2011
SPP number if relevant (refers to internal MSP projects)	None
What kind of data was collected (e.g. species richness, species inventory, abundance or density, % coral cover, etc)	Fish abundance Fish species diversity Target fish species biomass Benthic cover Coral diversity Coral Size Distribution Key invertebrate abundance Key invertebrate diversity
What would be some key words for searching for these data?	Monitoring, Fish, Coral, Invertebrates, Rowley Shoals
Who	
Who did the research/monitoring? Please list names, duties and their affiliations.	Tom Holmes (THO) — Field Leader/Fish Coordinator — MSP Stuart Field — Benthic Coordinator — MSP Kim Friedman — Invertebrates Coordinator — MSP Kevin Bancroft — Diver — MSP Teresa Coutts Kimberly District — Diver Greg Sousari — Dive Officer/Tender Driver — AIMS
Who is point of contact in case of questions? Please list their contact details - is there a generic contact that could be used to ensure longevity?	Tom Holmes Marine Science Program Department of Environment and Conservation Kensington WA 6151 Ph: (08) 9219 9769 Thomas.holmes@dec.wa.gov.au
Who else should be acknowledged and what contribution did they make (field, technical, GIS support, post-processing)?	Ryan Douglas — Imagery post-processing — MSP
Why	
Why was the research done? Provide an abstract that summarises the aim	The WAMMP's long term monitoring program examines the condition, pressures and management responses for a number of key marine assets throughout WA's marine park network. The Rowley Shoals Marine Park is a tropical coral reef atoll system situated approximately 300km off the north west coast (RSMP) and forms a part of this

and objectives of the research and where it might be used. This may be taken directly from SPP for internal MSP projects.	marine network. Long term benthic monitoring sites were first established by DEC in the Rowley Shoals in 2001, before a subset was re-sampled in 2007. The location of these sites covered the full extent of all three of the shoals (Mermaid, Clerke and Imperiuese), both inside and outside the well developed lagoon systems. Although AIMS has established fish monitoring sites on the outer north-eastern edge of each shoal which are surveyed at regular intervals (every 2-3 years), to date there has been no quantitative assessment of finfish communities throughout other slope areas or within the lagoon systems. To provide a full baseline of finfish communities for the WAMMP monitoring program, it is important to acquire this information to allow for the tracking of change through time. Similarly, it is important to monitor the condition of benthic communities at appropriate intervals in order to provide effective management strategies and intervention where deemed necessary. As such, the purpose of this field work is, in collaboration with AIMS researchers, to survey the fish, benthic and invertebrate communities of Clerke and Imperiuese reefs within the Rowley Shoals. Mermaid reef was not visited on this trip due to problems associated with acquiring commonwealth permits in the required time.
How	
How was the research done? (e.g. instrumentation, brief description of procedure)?	<u>Fish</u> Diver Operated Video (DOV) units were used to measure fish community structure. Six replicate 50 metre transects were swum by the two diver team within each site. Sites were chosen to roughly correspond to the coral Long Term Monitoring (LTM) sites. Transects started and finished approximately 100 metres either side of the coral LTM sites, and ran across the same area. The first person in the dive team swam the DOV unit, with the second person following, using a modified Chainman (with Cotton Spool) to measure transect length. Once the 50 metre mark was reached, the second diver signalled to the first diver to finish the transect with a small tug on the fins. Each transect was separated by 5-10 metres. Care was taken to keep the transect over representative coral habitat at approximately the same water depth. The DOV unit was swum approximately 0.5 metre above the substrate on a slight downward facing angle at all times. <u>Coral</u> Benthic still photographs was used to assess coral communities. Three replicate 50 metre transects were swum by a two diver team at each site. The first person in the dive team swam out a 50 metre transect tape to designate the position of the transect. Care was taken to ensure that the transect remains over representative habitat at approximately the same water depth, therefore transects were not necessarily laid in a straight line. The second diver initially photographed the start of the transect providing landscape images southwards along the transect line, then westwards, northwards and eastwards, in that order, the second diver then followed behind with a still camera, taking downward facing photos at 1 metre intervals along the eastern (or left hand) side of the transect tape. The photographs were taken from a standard height above the substrate (standardised using an arm extending downwards from the camera) that resulted in an approximately 1m x 1m image of the benthos. This resulted in four landscape images and 50 benthic images per transect. Post processing will be undertaken using point count methodology to elucidate the proportions of coral and other groups that comprise the benthic cover, and size frequency measures will be taken of individual coral colonies to allow for a demographic approach to monitoring. In addition to still photography, the continued trial of the 'Benthic DOV' methodology was continued at a subset of the sites. This unit comprises a smaller version of the Fish DOV unit, swum along a 50m transect whilst facing directly downwards. The increasing resolution of video technology is now allowing semi-high resolution snap shots to be taken from this video transect for analysis, and also allows for the measurement of coral colony size, using the Stereo-video setup. The survey procedure for this method follows that described above for the still photographs, with the camera unit being maintained at a height of ~1m above the substrate as it was swum along the same 50m transect tape set-up for the benthic stills. At this height, the combined stereo video unit has an approximate 'measuring' field of view of between 1.3 and 1.5m. Still images will later be extracted from the recorded video, with post processing undertaken using point count methodology and stereo-video utilised to measure the size of individual coral colonies.

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	Invertebrates A single diver followed behind the coral divers to assess key invertebrates on a subset of benthic survey transects. Recorded invertebrates included bivalves (*Tridacna* spp., *Pinctada margaritifera*_swathe 1m), gastropods (*Trochus niloticus*, *Tectus pyramis*, *Turbo argyrostomus*_1 m swathe), sea cucumbers (*Actinopyga* spp. *Holothuria* spp. *Stichpus* spp._swathe 1m), sea stars (*Linckia* spp., *Fromia* sp._swathe 1m), Urchins (*Echinometra mathei*, *Diadema setosum,* and *Echinothrix* spp. *Tripneustes gratilla*_swathe 1m) and tropical lobster (all spp._swathe 2m). Additional data on other less common or more cryptic invertebrate species will also be collected. Crown of thorns starfish (*Acanthaster planci*._swathe 2m) and the coralivourous gastropod *Drupella* (first 20m of each transect_swathe 0.5m) are examples of such datsets.
Please give a brief overview of the sampling design (spatial and temporal), including the spatial array of sample collection, how often measurements were taken and the specific unit of time or space that was used to aggregate samples (e.g. 20 sites, 10 inside sanctuary zones and 10 outside. 5 fixed transects at each site, each transect, surveyed twice a year, once in the summer and once in the winter, etc)?	Fish A total of 21 sites (13 at Clerke and 8 at Imperiuese) were surveyed during the September field trip. Of the 13 surveyed at Clerke, 4 were on the eastern outer reef slope, 1 was on the back reef and 8 were within the lagoon complex. 3 of these sites within the lagoon were located within the Recreational zone, whilst all others were within Sanctuary Zone. Of the 8 sites surveyed at Imperiuese, 4 were on the eastern outer reef slope, 1 was on the back reef and 3 were within the lagoon complex. All sites were within the Sanctuary Zone, with no other zoning present on the reef as a whole. Coral and Invertebrates Benthic quadrats recording of coral A total of 26 sites were sampled using the benthic photo-quadrat method; • 16 sites were surveyed at Clerke Reef and 10 sites at Imperiuese Reef. • Four sites at each atoll were on the eastern back reef slope. • Nine lagoonal sites were surveyed at Clerke Reef and four sites at Imperiuese. • Three intertidal sties sites were surveyed at Clerke Reef and two sites at Imperiuese. • At Clerke Reef there were three sites located in Recreation Zone, one in General Use Zone and 12in Sanctuary Zones. • All sites at Imperiuese Reef were located in Sanctuary Zone Benthic Stereo Video A total of 12 sites were sampled using the benthic stereo video method; • 8 sites were surveyed at Clerke Reef and 4 sites at Imperiuese Reef. • Four sites at Clerke and three sites at Imperiuese were on the eastern back reef slope. • Four lagoonal sites were surveyed at Clerke Reef and 1 at Imperiuese. • 1 intertidal site was surveyed at Imperiuese. • All sites at Imperiuese Reef were located in Sanctuary Zone Benthic invertebrates A total of 24 sites were sampled; • 14 sites were surveyed at Clerke Reef and 10 sites at Imperiuese Reef. • At Clerke, 4 sites were sampled from external ref slope (1 gen use, 3 sanctuary). Seven sites were lagoonal (1 recreational, 6 sanctuary). Three sites were intertidal (sanctuary). • At Imperierieuse, 4 sites were sampled from external ref slope (all sanctuary). Four sites were lagoonal (all sanctuary). Two were intertidal (sanctuary).

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How are the data currently stored, that is what format is the data? (e.g. GIS shapefiles, Access database or geodatabase, compressed AVI etc.) Please provide as much information as possible.	GIS Shapefiles • Benthic sites: RSMP_201109_sites_ll_wgs84; • Benthic transects: RSMP_201109_transects_ll_wgs84 MapSource GPS File MS Excel Spreadsheet • Benthic Sites: RSMP_201109_sites_ll_wgs84.txt Compressed AVI JPEG
When	
When was the research carried out? When were the start and end dates?	23/09/2011-30/09/2011
Where	
Where was the research done? As a minimum Please indicate the 'bounding box' in latitude/longitude (decimal degrees) (e.g. North bound latitude -22.00; West bound longitude 113.00; East bound longitude 114.00; South bound latitude -23.00)	Rowley Shoals Marine Park North Boundary: -17.24607 South Boundary: -17.5804 East Boundary: 119.38393 West Boundary: 118.9369
Site names and GPS co-ordinates (in latitude/longitude (decimal degrees)	Table 1: Location of Fish sites surveyed during September 2011 field trip

Site	Location	Depth	Zoning	Start Latitude	Start Longitude	Finish Latitude	Finish Longitude
RS2-1	Clerke	7-9m	Sanctuary	-17.2843	119.3769		
RS2-3	Clerke	6-9m	Sanctuary	-17.2927	119.3781		
C1B	Clerke	7-9m	Sanctuary	-17.24607	119.35201	-17.24611	119.3506
C13	Clerke	4-6m	Sanctuary	-17.31065	119.36750	-17.31248	119.36799
C25	Clerke	3-6m	Sanctuary	-17.31550	119.36750	-17.31475	119.36945
C9	Clerke	8-10m	Sanctuary	-17.35516	119.38393	-17.3574	119.38432
C14	Clerke	2-4m	Sanctuary	-17.28312	119.37301	-17.2846	119.37273
C20	Clerke	2-6m	Sanctuary	-17.30694	119.37064	-17.30824	119.37272
C12	Clerke	5-10m	Recreational	-17.30364	119.33673	-17.30415	119.3355
C26	Clerke	4-6m	Recreational	-17.29772	119.3423	-17.29941	119.33968
C11	Clerke	3-6m	Recreational	-17.34453	119.35083	-17.34641	119.34887
C21	Clerke	3-6m	Sanctuary	-17.31882	119.3605	-17.31996	119.35811
C29	Clerke	3-6m	Sanctuary	-17.2909	119.35929	-17.29372	119.3594
RS3-1	Imperiuese	7-8m	Sanctuary	-17.548	118.9737		
I19	Imperiuese	2-4m	Sanctuary	-17.5804	118.9369	-17.58229	118.93501
I13	Imperiuese	3-5m	Sanctuary	-17.56045	118.94214	-17.56138	118.93979
RS3-3	Imperiuese	7-8m	Sanctuary	-17.5582	118.9724		
I1B	Imperiuese	6-8m	Sanctuary	-17.50218	118.96276	-17.50039	118.96061
I24	Imperiuese	4-7m	Sanctuary	-17.6089	118.96364	-17.61138	118.96309
I14	Imperiuese	2-3m	Sanctuary	-17.54741	118.96884	-17.5493	118.96845
I9	Imperiuese	4-7m	Sanctuary		118.9747	-17.61207	118.97383

Table 2: Location of Coral sites surveyed using Benthic Stills during September 2011 field trip

Site	Transect	Lat	Long
C1b_S		-17.24607	119.35201
C1b_F		-17.24566	119.35078
RS2-1_S		-17.28430	119.37690
RS2-1-F		-17.28526	119.37709

RS2-3_S		-17.29270	119.37810
RS2-3_S		-17.29376	119.37851
C9_S		-17.35620	119.38340
C9_F		-17.35760	119.38340
C9_deep_S		-17.35627	119.38424
C9_deep_F		-17.35692	119.38415
C11_S		-17.34480	119.35110
C11_F		-17.34610	119.35060
C12_S		-17.30330	119.33590
C12_F		-17.30460	119.33560
C13_S		-17.31100	119.36790
C13_F		-17.31240	119.36780
C14_S		-17.28300	119.37300
C14_F		-17.28420	119.37390
C20_S		-17.30740	119.37140
C20_F		-17.30880	119.37130
C21_S		-17.31970	119.36080
C21_F		-17.32100	119.36070
C25_S		-17.31550	119.36750
C25_F		-17.31440	119.36920
C26_S		-17.29812	119.34254
C26_F		-17.29827	119.34113
C27_1_S	1	-17.31390	119.37816
C27_1_F	1	-17.31347	119.37833
C27_2_S	2	-17.31346	119.37837
C27_2_F	2	-17.31304	119.37846
C27_3_S	3	-17.31300	119.37843
C27_3_F	3	-17.31256	119.37852
C28_1_S	1	-17.29965	119.37575
C28_1_F	1	-17.29922	119.37581
C28_2_S	2	-17.29917	119.37581
C28_2_F	2	-17.29874	119.37580
C28_3_S	3	-17.29870	119.37579
C28_3_F	3	-17.29828	119.37582
C29_S		-17.54800	118.97370
C29_F		-17.54914	118.97366
RS3-1_S		-17.54800	118.97370
RS3-1_F		-17.54914	118.97366
RS3-3_S		-17.55820	118.97240
RS3-3_F		-17.55933	118.97226
I1B_S		-17.50218	118.96276
I1B_F		-17.50137	118.96169
I9_S		-17.61020	118.97470
I9_F		-17.61128	118.97430
I10_S		-17.61010	118.97000
I10_F		-17.61130	118.96930
I13_S		-17.56010	118.94190
I13F		-17.56060	118.94050
I14_S		-17.54900	118.96660
I14_F		-17.54990	118.96620
I19_S		-17.58040	118.93690
I19_F		-17.58150	118.93600
I24_S		-17.60920	118.96384
I24_F		-17.61069	118.96326
I26_S		-17.57900	118.96872
I26_F		-17.58035	118.96873

Table 3: : Location of Coral Sites surveyed using Benthic DOV's during September 20011 field trip

Site	Location	Start Latitude	Start Longitude	Finish Latitude	Finish Longitude
RS2-1	Clerke	-17.28430	119.37690	-17.28526	119.37709
RS2-3	Clerke	-17.29270	119.37810	-17.29376	119.37851
C1B	Clerke	-17.24607	119.35201	-17.24566	119.35078
C9	Clerke	-17.35620	119.38340	-17.35760	119.38340
C9 - Deep	Clerke	-17.35627	119.38424	-17.35692	119.38415

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C13	Clerke	-17.31100	119.36790	-17.31240	119.36780
C20	Clerke	-17.30740	119.37140	-17.30880	119.37130
C25	Clerke	-17.31550	119.36750	-17.31440	119.36920
I1B	Imperiuse	-17.50218	118.96276	-17.50137	118.96169
I9	Imperiuse	-17.61020	118.97470	-17.61128	118.97430
I24	Imperiuse	-17.60920	118.96384	-17.61069	118.96326
I26	Imperiuse	-17.57900	118.96872	-17.58035	118.96873

Table 4: Location of Invertebrate sites surveyed during September 2011 field trip

Clerke

Label	type	General use	Recreation	Sanctuary
C14	intertidal reef			1
C27	intertidal reef			1
C28	intertidal reef			1
C29	Lagoonal			1
C9_deep	Lagoonal			1
C11	Lagoonal		1	
C13	Lagoonal			1
C20	Lagoonal			1
C21	Lagoonal			1
C25	Lagoonal			1
C9	back reef slope			1
C1b	back reef slope	1		
RS2-1	back reef slope			1
RS2-3	back reef slope			1

Imperieuse

Label	type	Sanctuary	General use
I10	intertidal reef	1	
I26	intertidal reef	1	
I13	Lagoonal	1	
I14	Lagoonal	1	
I19	Lagoonal	1	
I24	Lagoonal	1	
I9	back reef slope	1	
RS3-1	back reef slope	1	
RS3-3	back reef slope	1	
I1B	back reef slope	1	

Where in the vertical column of the ocean was the research undertaken? (e.g. minimum and maximum depth)	2-12m

GIS/ Remote Sensing (to be filled in by the GIS officer responsible for the work)

Supporting Imagery			
What satellite sensor/s or raster data type (ie Landsat , WV2 or bathymetry data)	N/A		

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What was the date of imagery capture?	N/A		
Imagery location: What regional mosaic or path/row was used?	N/A		
What is the imagery file name?	N/A		
What are the names of any derived raster products?	N/A		
Site Selection			
Which datasets were used for site selection?	N/A		
Provide a brief description of the site selection method used	N/A		
GPS format created for use in the field	N/A		
What are the names of any derived vector products?	N/A		
Data Creation date	N/A		
Who is the custodian of the GIS products? Please list names, duties and their affiliations.	N/A		
Where is the original source data stored? (database, computer directory and computer name)	N/A		
Where are the derived data stored? (computer directory and computer name)	N/A		
How to Access			
Where are the raw data stored (include full file name and location, corporate file number etc)?	<u>Fish</u> - Tom Holmes, Kensington Offices, External HDD - Video Archive Box, Corporate Information Services, Kensington (Rowley Shoals Marine Park – Long Term Monitoring Program – Video Archive – Marine Science Program – 2008/001941-1) - MSP NAS Server (L:\Fish\!results\RSMP_2011-09_DOV)		

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	Coral - Benthic stills MSP NAS Server (L:\benthic\RSH_2011-09_Benthic) - Benthic DOV's MSP NAS Server (L:\benthic\BENTHIC DOVS\RSH_2011-09_BDOV) On corporate file: as DVDs titled "RSMP BENTHIC SURVEY SEP 2011" numbers 1-4. Video Archive Box: Corporate Information Services, Kensington (Rowley Shoals Marine Park – Long Term Monitoring Program – Video Archive – Marine Science Program – 2008/001941-1 as DVDs titled "RSMP BENTHIC SURVEY SEP 2011" numbers 1-4. Invertebrates - MSP NAS Server (L:\inverts\RS_INVERTS_Sept2011surveys) On corporate file: as DVDs titled "RS_INVERTS_Sept2011surveys".
Where are derived data products and processed data stored (include full file name and location)?	Fish - Tom Holmes, Kensington Offices, External HDD - Video Archive Box, Corporate Information Services, Kensington (Rowley Shoals Marine Park – Long Term Monitoring Program – Video Archive – Marine Science Program – 2008/001941-1) - MSP NAS Server (L:\Fish\!results\RSMP_2011-09_DOV) Coral No data has been analysed as yet but will be stored on the MSP NAS Server (L:\benthic\!results) Invertebrates No data has been analysed as yet but will be stored on the MSP NAS Server (L:\inverts\!results) Field notes attached to this document as an appendix
Where are any other related publications/information about the research published - if any? (e.g. url)	- Field Operations Plan T:\529-CALMscience\Shared Data\Marine Science Program\REPORTS\POST 2009 REPORTS\FIELD OPERATIONS PLANS\FOP_FishCoral_RSMP_201109.doc -Reports from previous surveys T:\529-CALMscience\Shared Data\Marine Science Program\REPORTS\PRE 2009 REPORTS\DATA REPORTS\POST 2008\MSPDR7.pdf
What constraints/restrictions would you place on the data and access to it (e.g. legal, usage - purposes that shouldn't use the data)	None
Supplementary information -	

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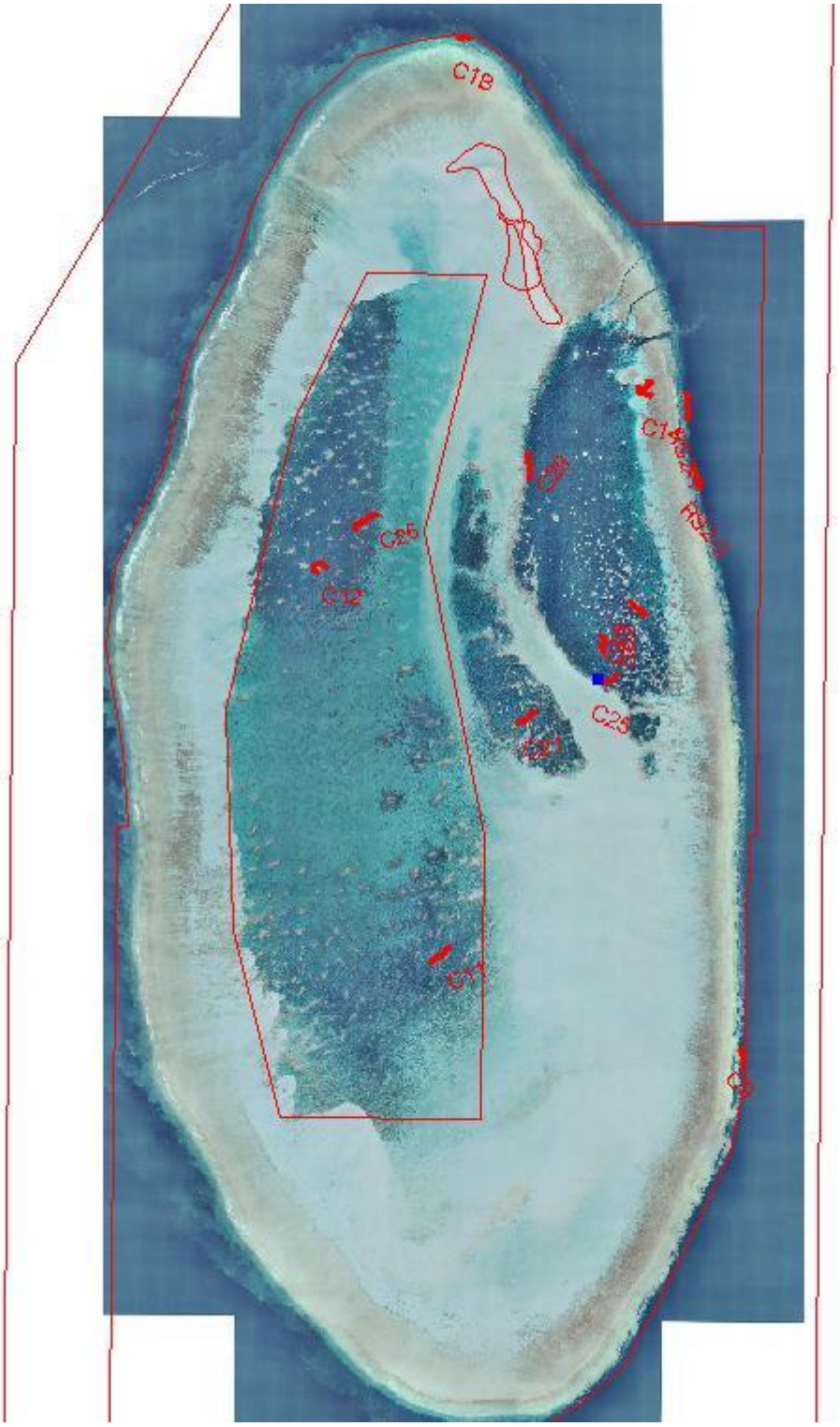
Please attach any further information you think would be useful for future researchers	 Figure 1: Fish Survey Sites at Clerke Reef

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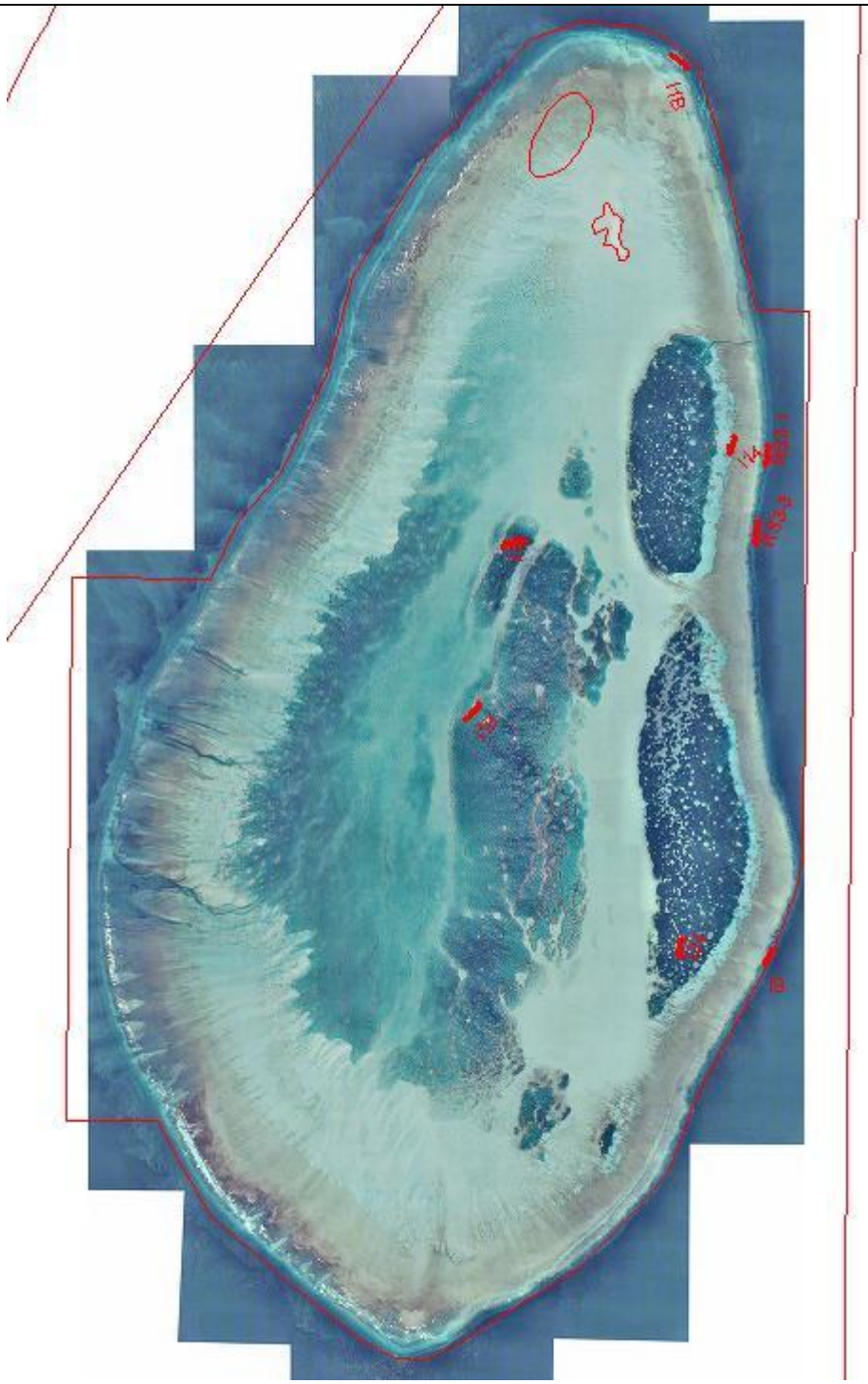


Figure 2: Fish Survey Sites at Imperiuese Reef

Site Maps:

Figure 3: Fish Survey Site C1B

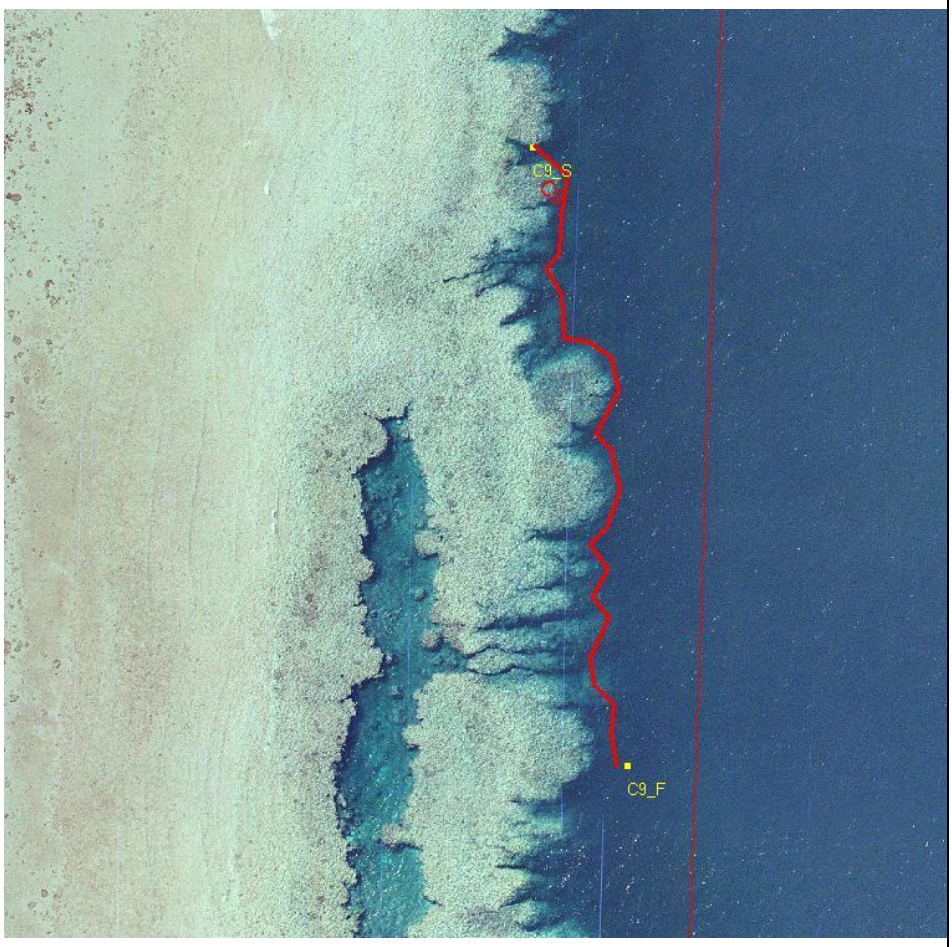


Figure 4: Fish Survey Site C9

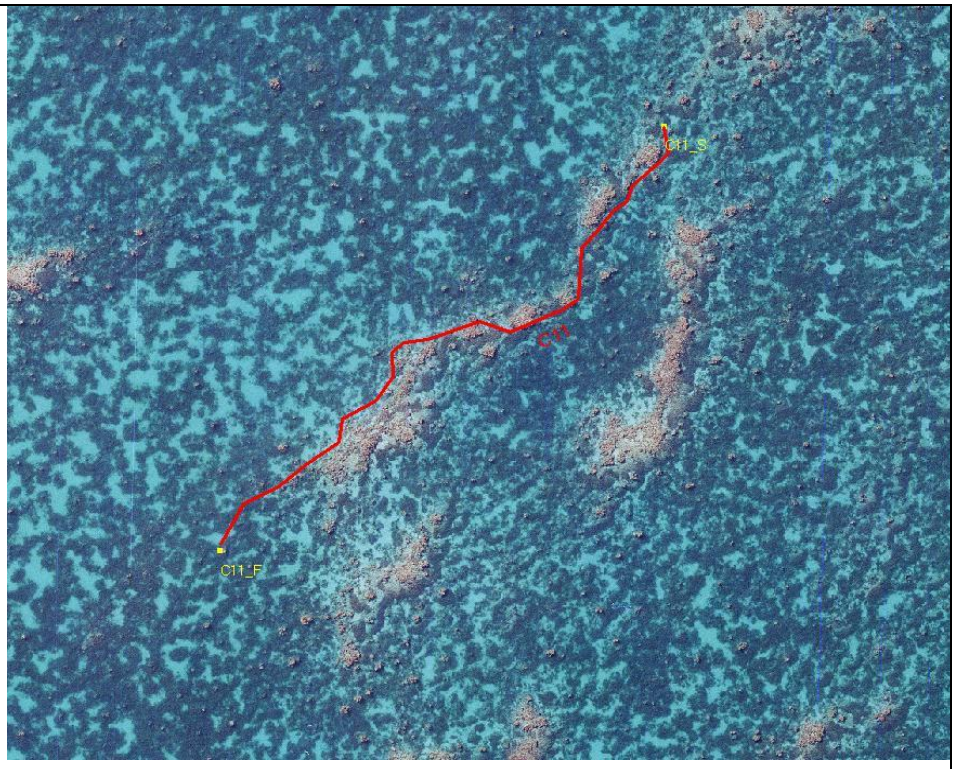


Figure 5: Fish Survey Site C11

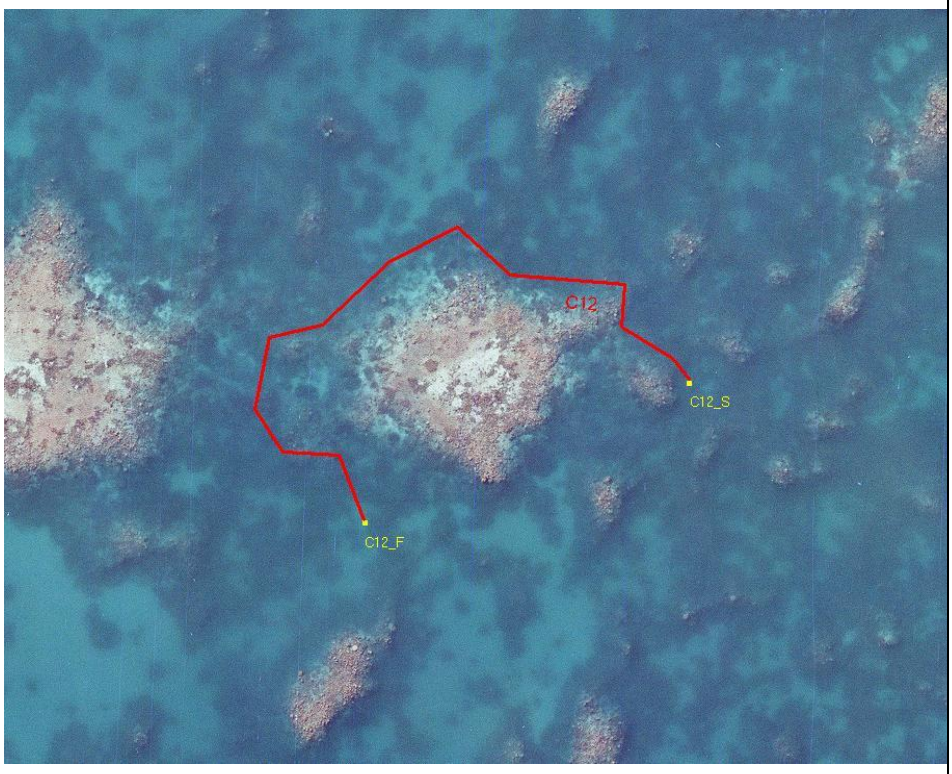


Figure 6: Fish Survey Site C12

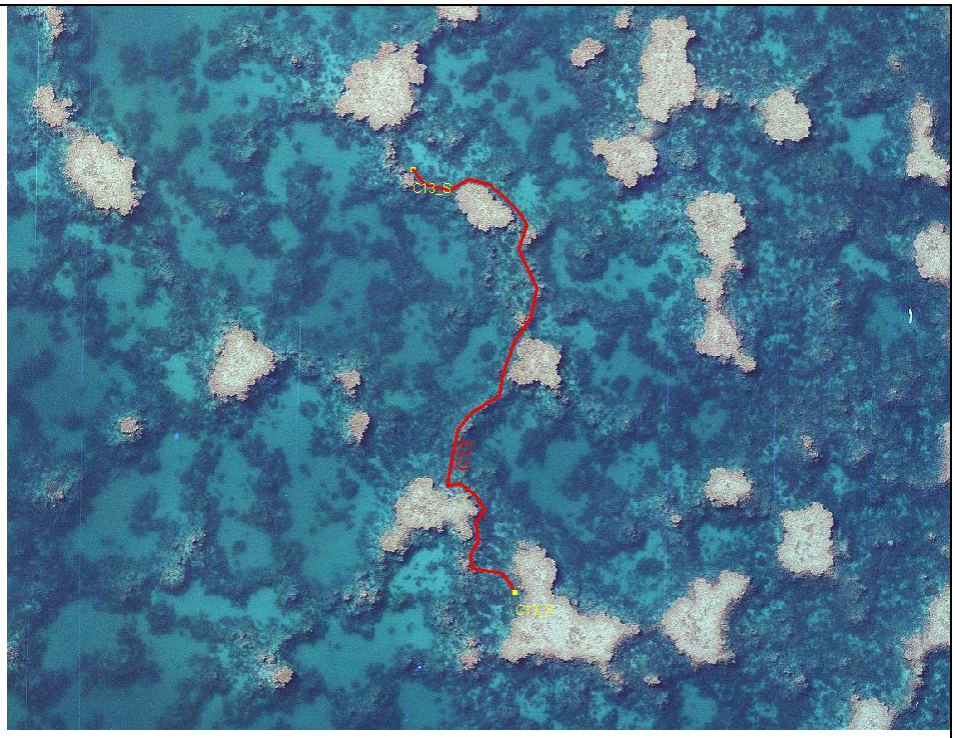


Figure 7: Fish Survey Site C13

Figure 8: Fish Survey Site C14

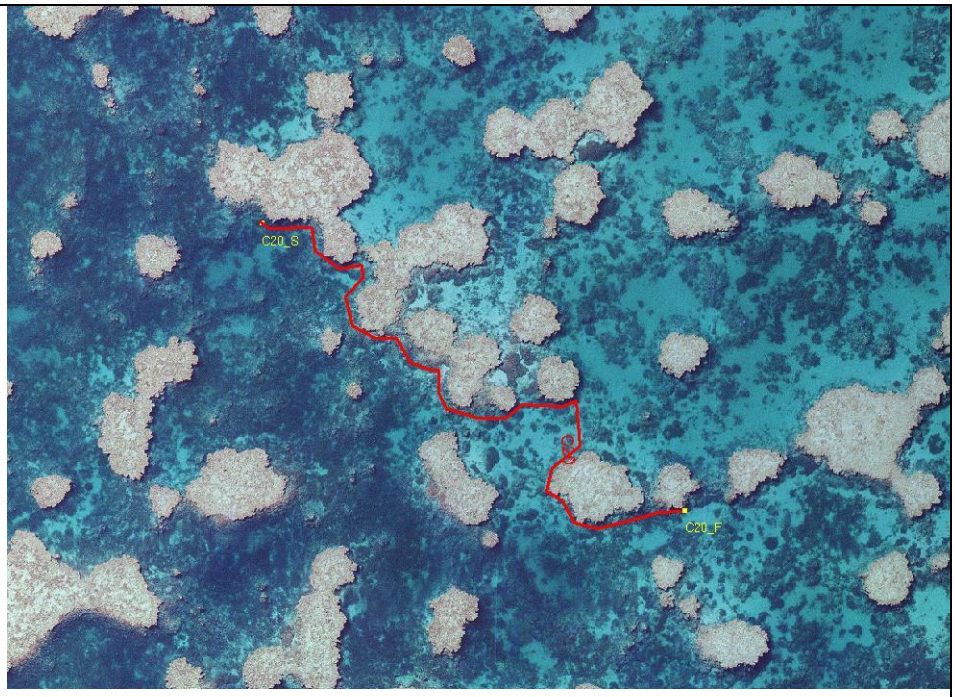


Figure 9: Fish Survey Site C20

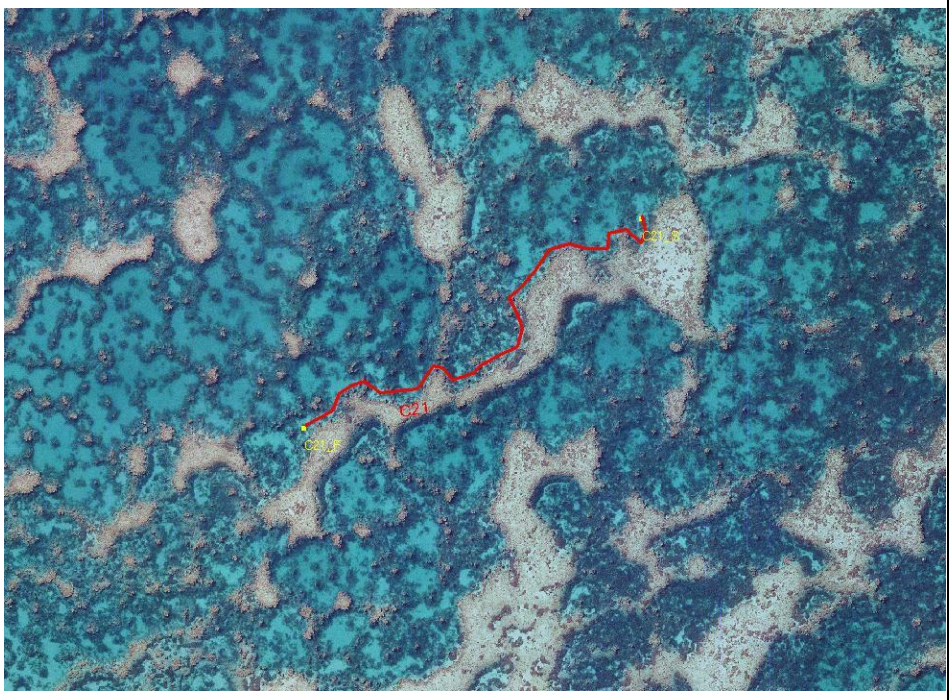


Figure 10: Fish Survey Site C21

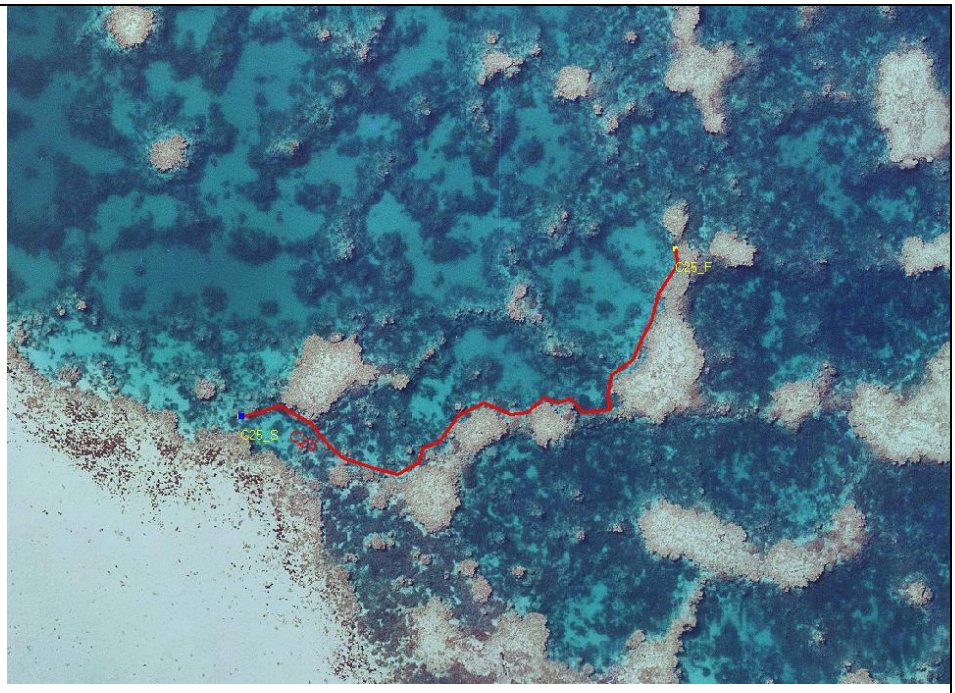


Figure 11: Fish Survey Site C25

Figure 12: Fish Survey Site C26

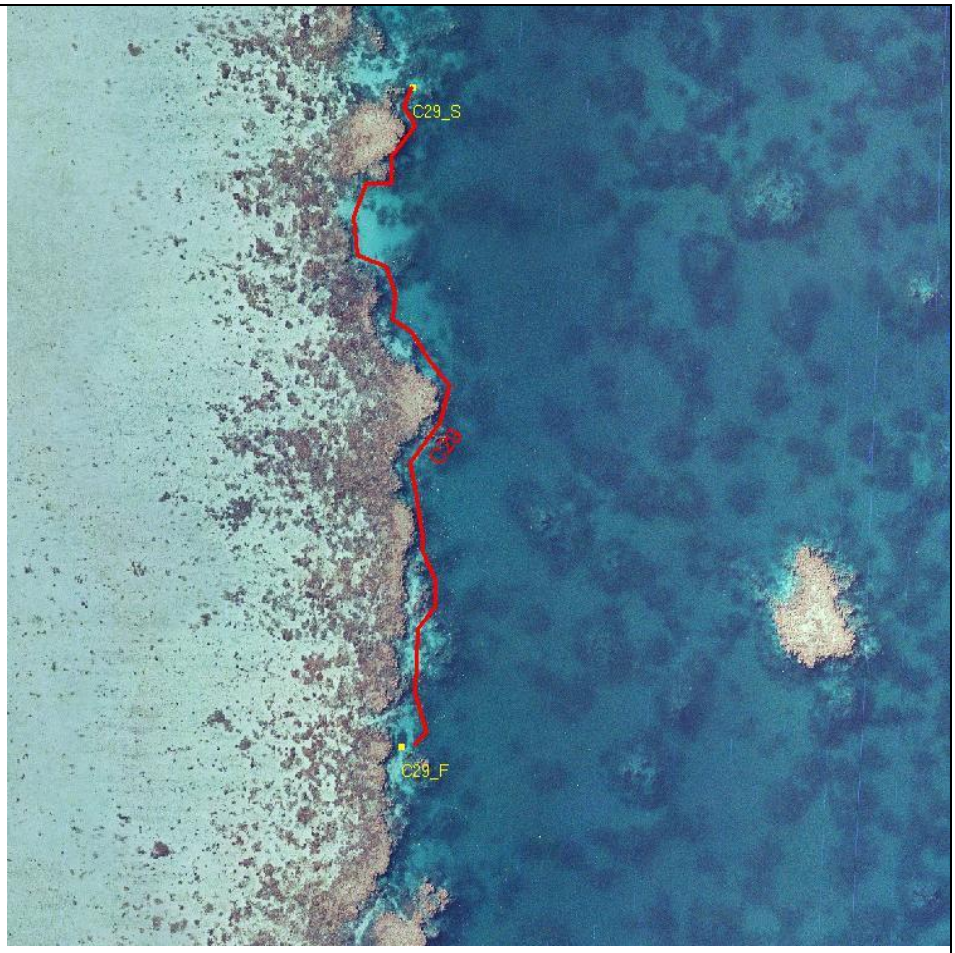


Figure 13: Fish Survey Site C29

Figure 14: Fish Survey Site RS2-1

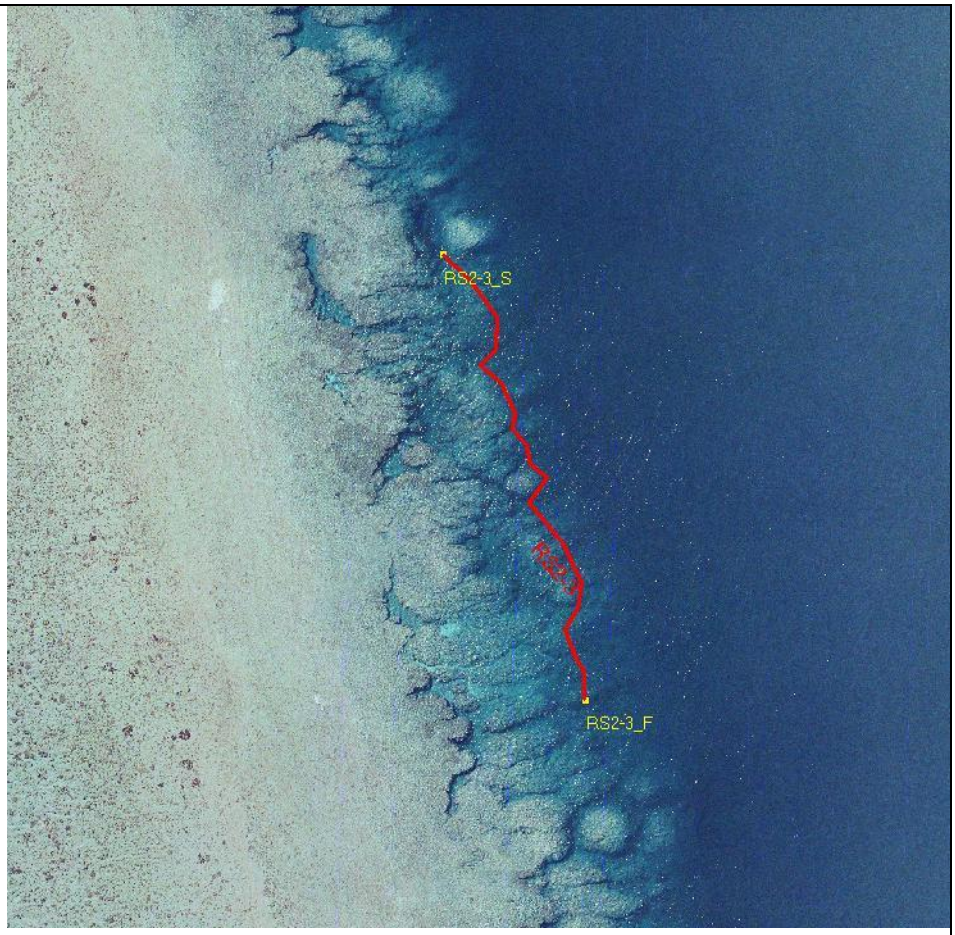


Figure 15: Fish Survey Site RS2-3

Figure 16: Fish Survey Site I1B

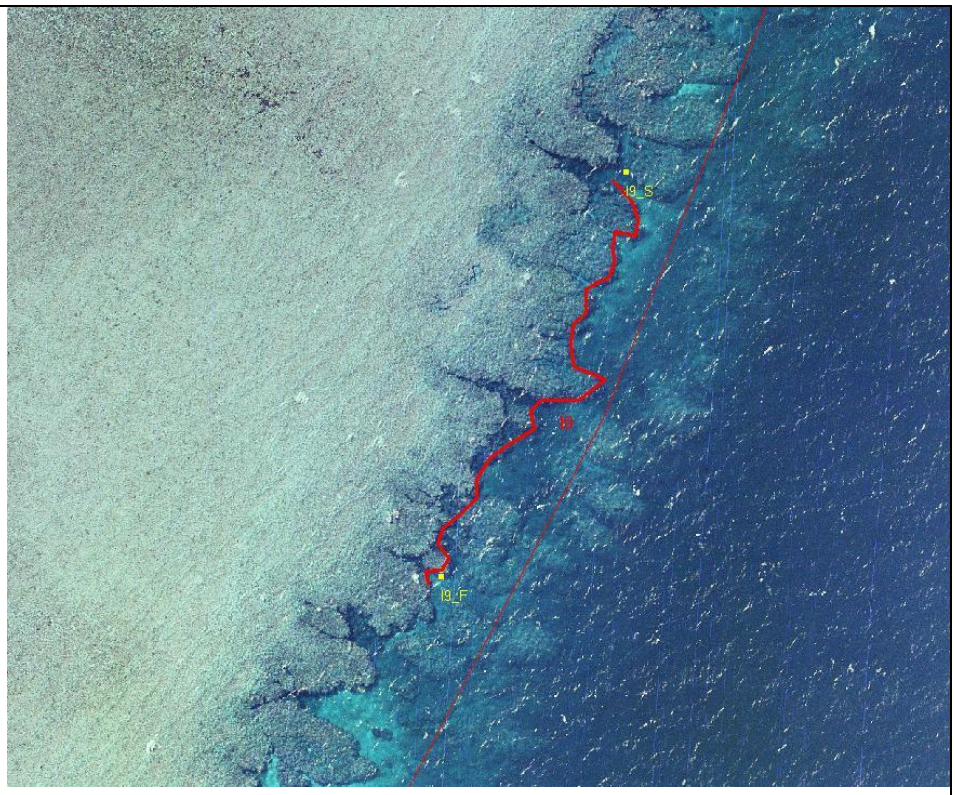


Figure 17: Fish Survey Site I9

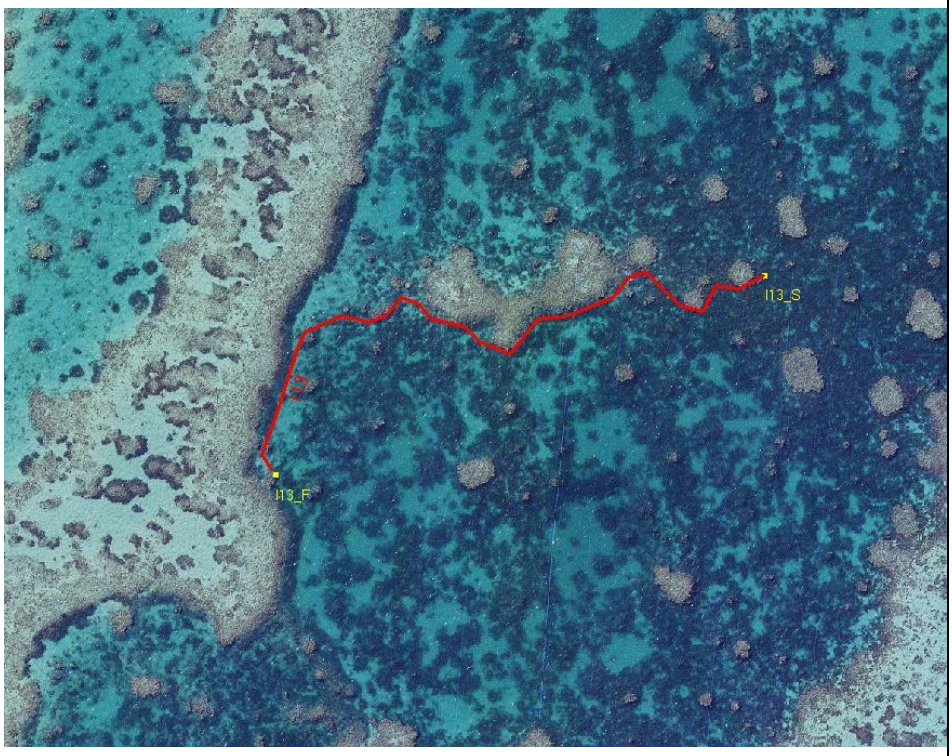


Figure 18: Fish Survey Site I13

Figure 19: Fish Survey Site I14

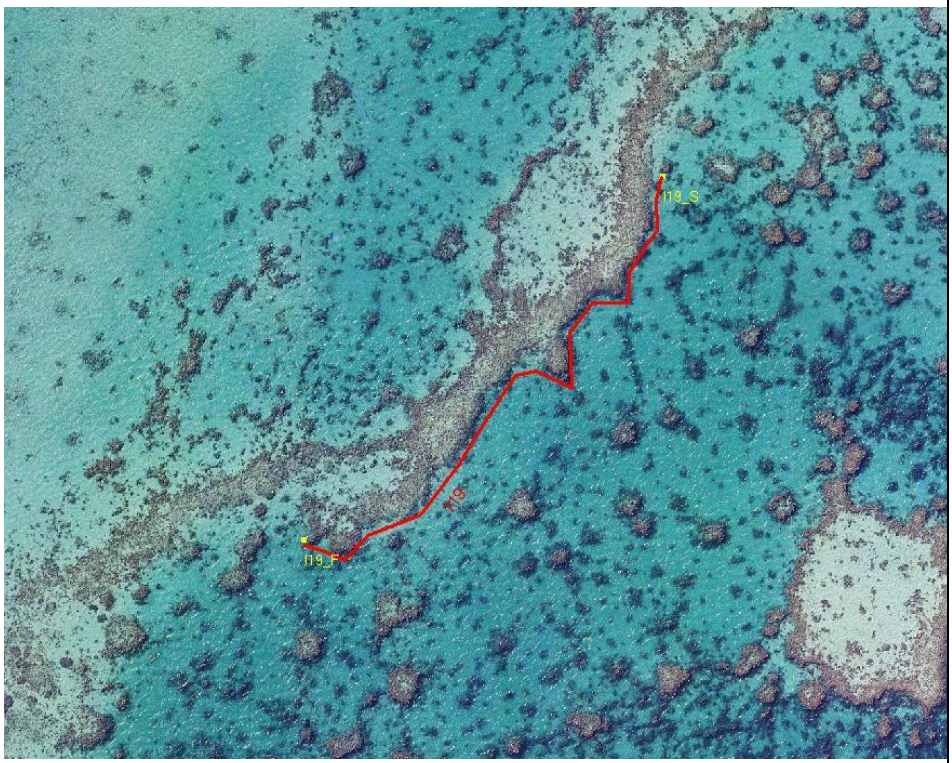


Figure 20: Fish Survey Site I19

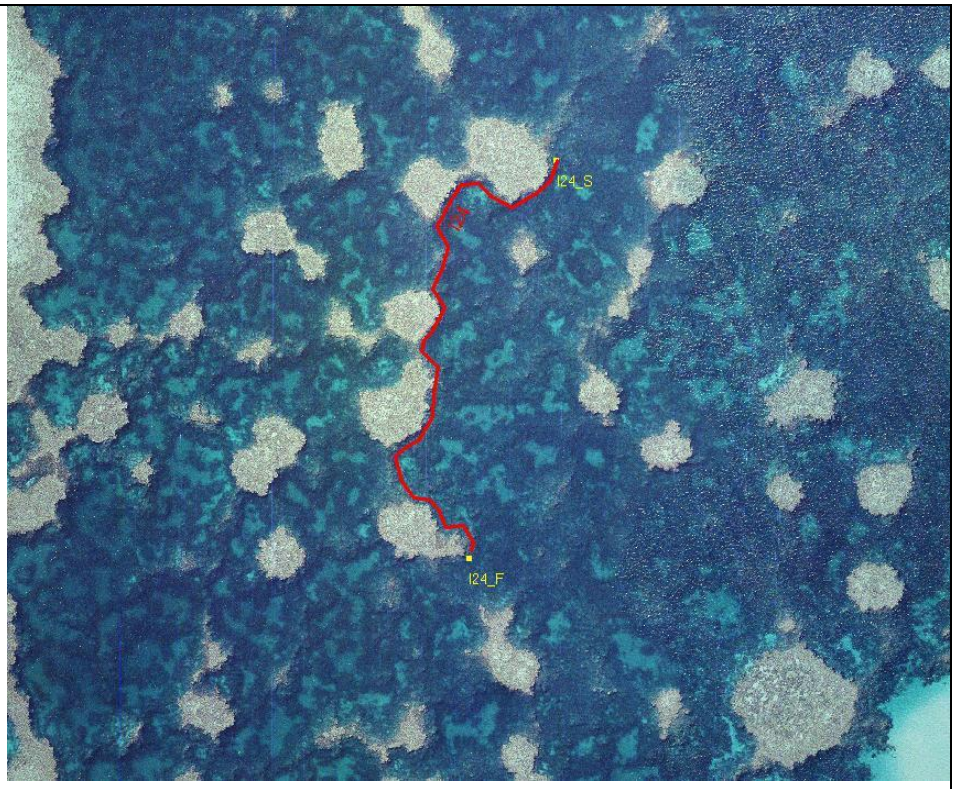


Figure 21: Fish Survey Site I24

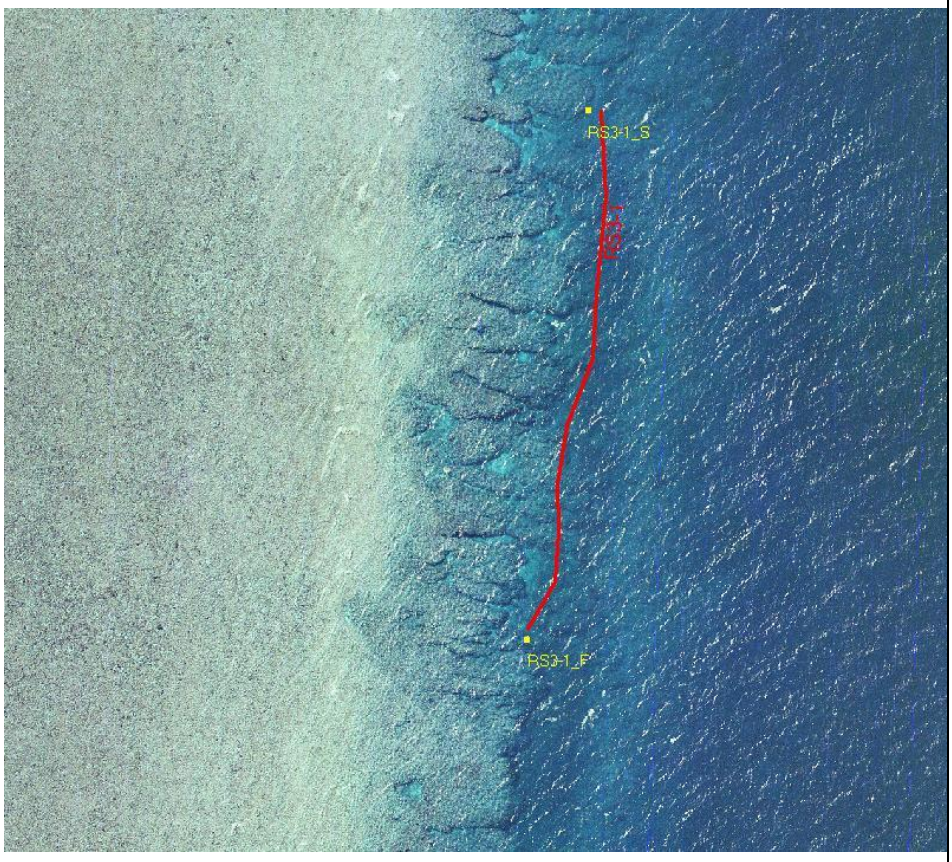
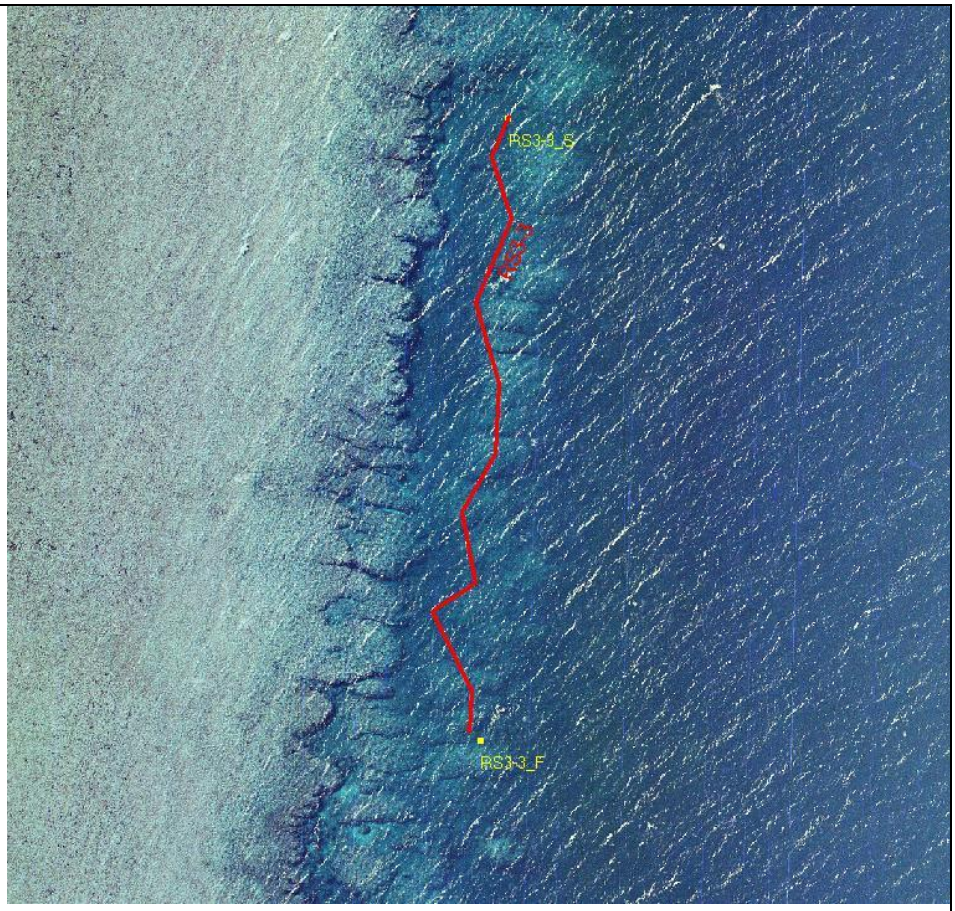


Figure 22: Fish Survey Site RS3-1

	 Figure 23: Fish Survey Site RS3-3
	Benthic Survey maps

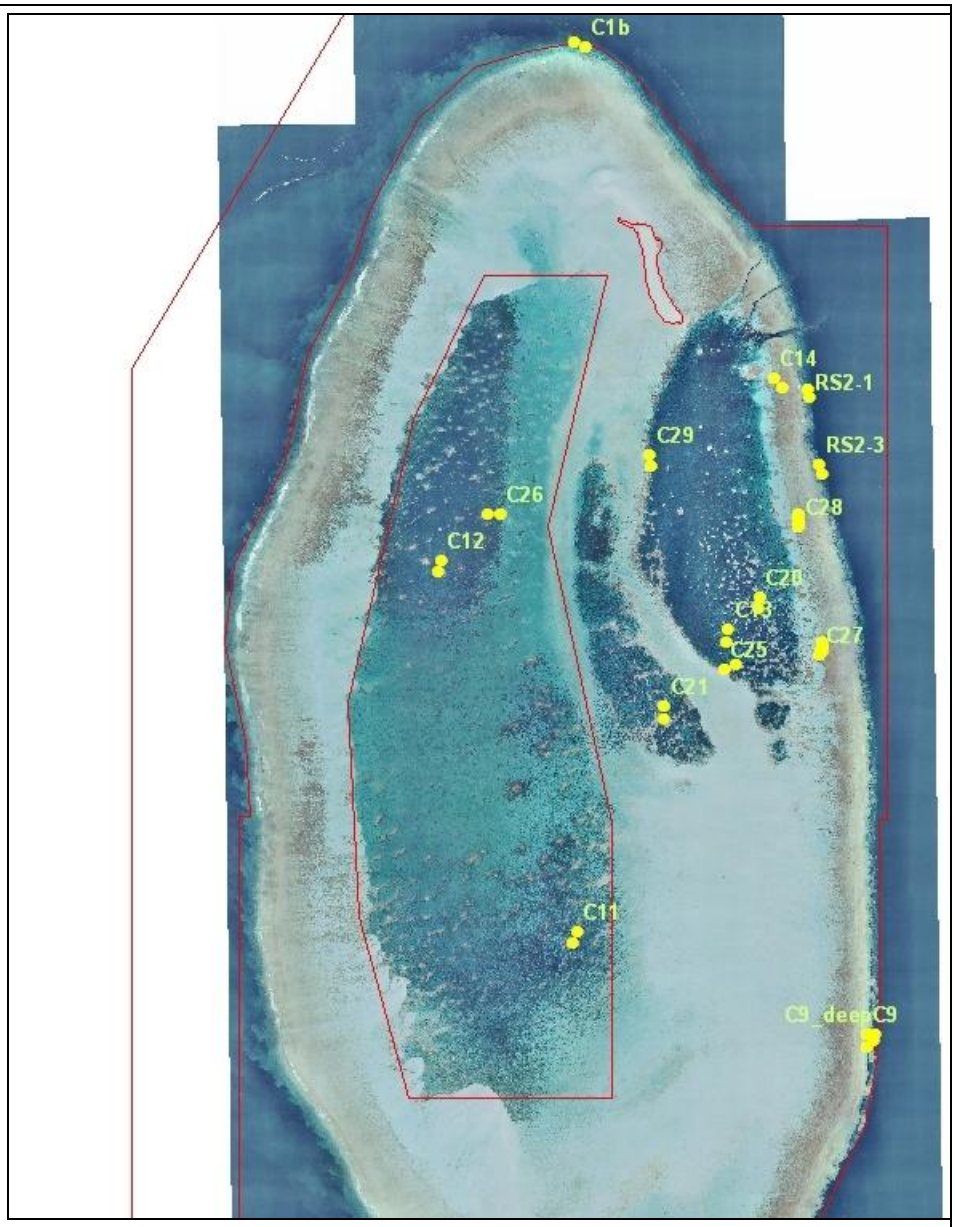


Figure 24: Benthic Survey Sites at Clerke Reef

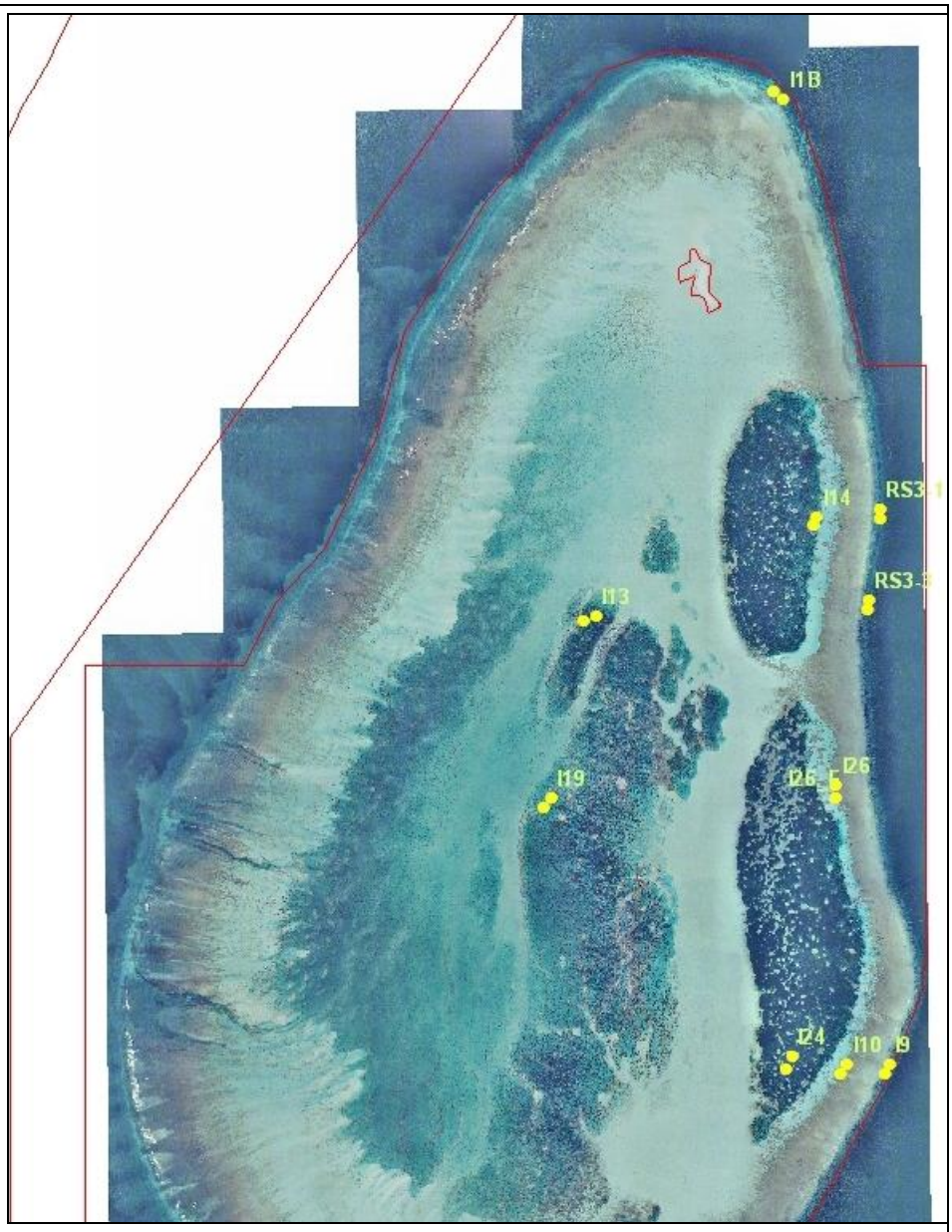


Figure 25 Benthic Survey Sites at Imperiuese Reef

Figure 26 Benthic Survey Site C1b at Clerke Reef, Rowley Shoals Marine Park

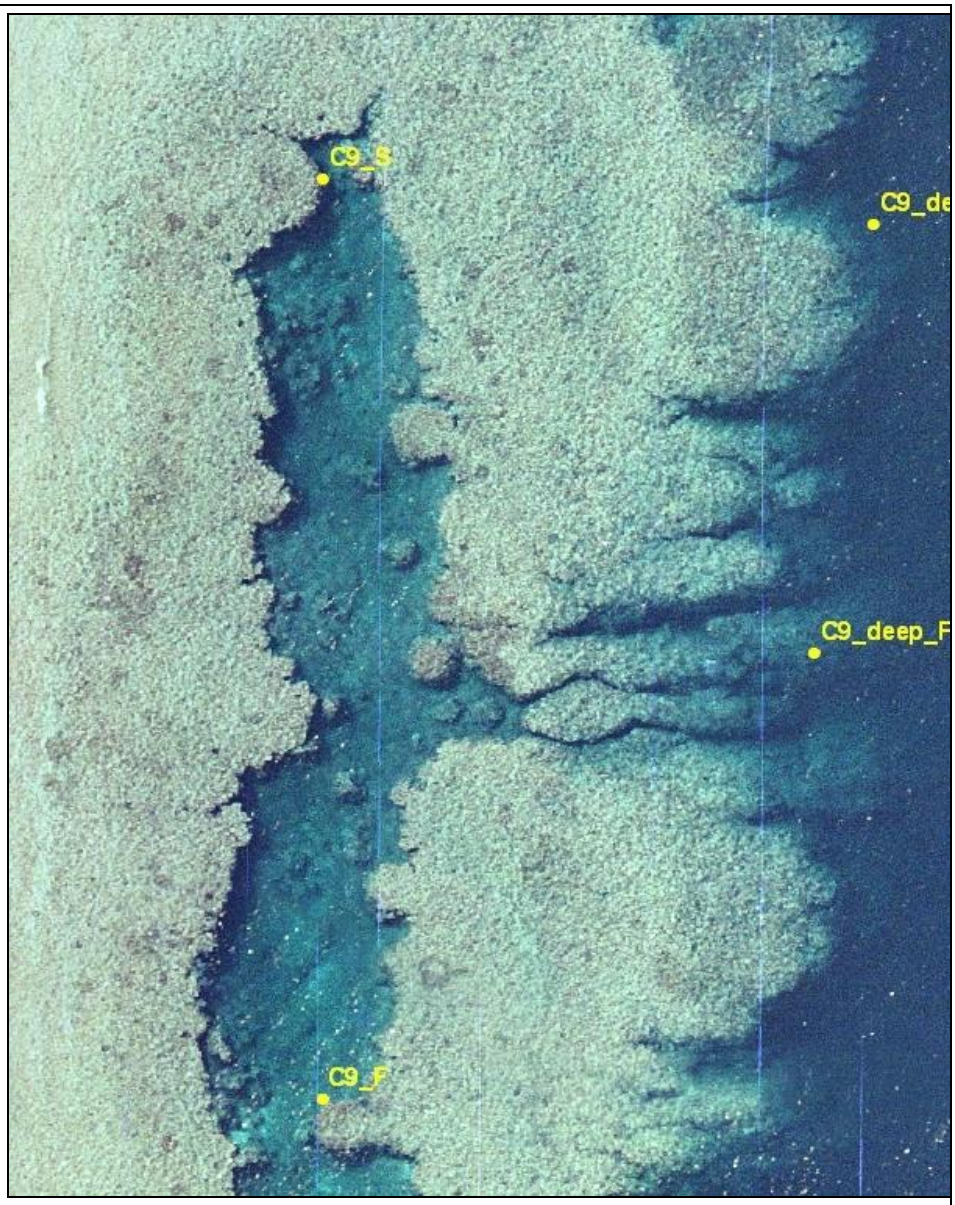


Figure 27 Benthic Survey Site5 C9 and C9_deep at Clerke Reef, Rowley Shoals Marine Park

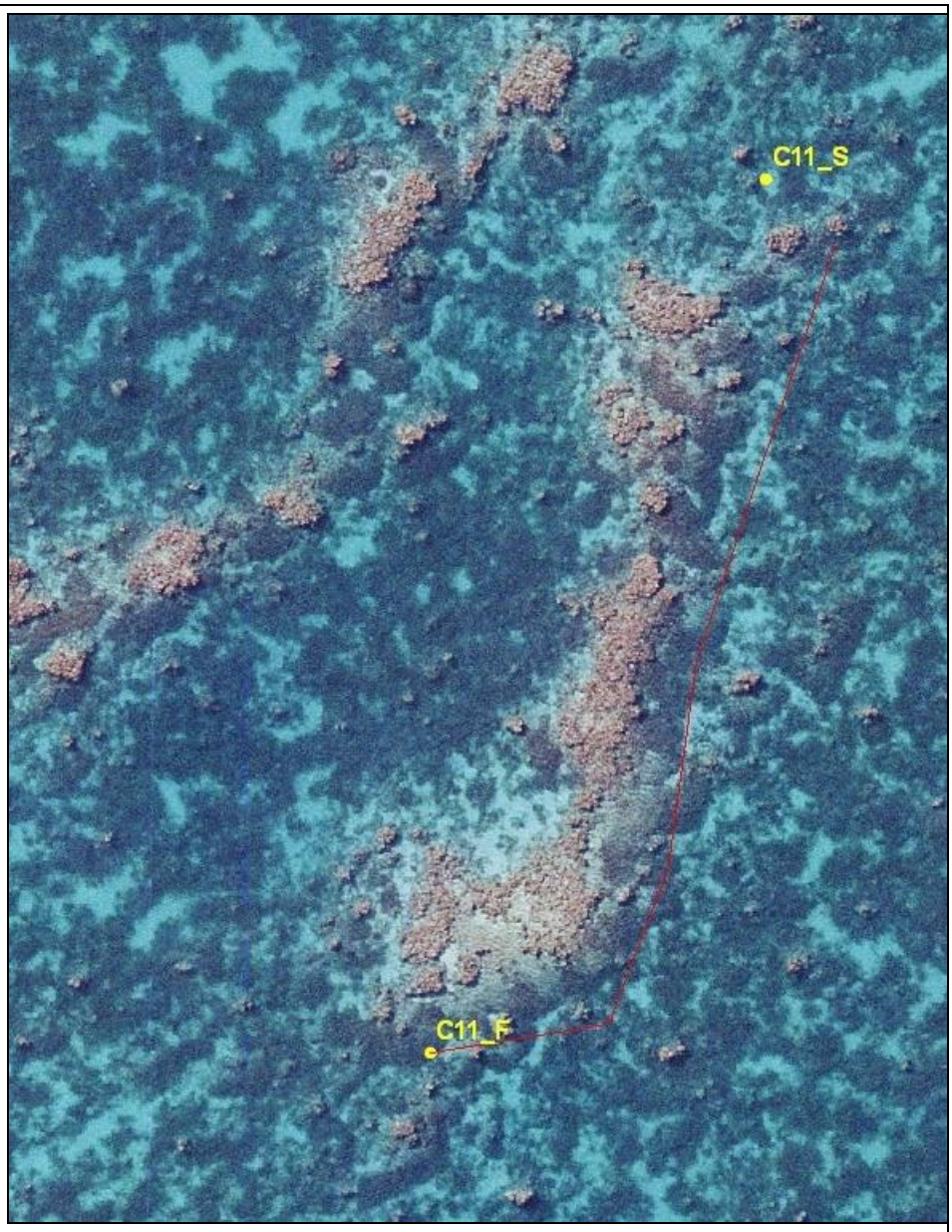


Figure 29 Benthic Survey Site C11 at Clerke Reef, Rowley Shoals Marine Park

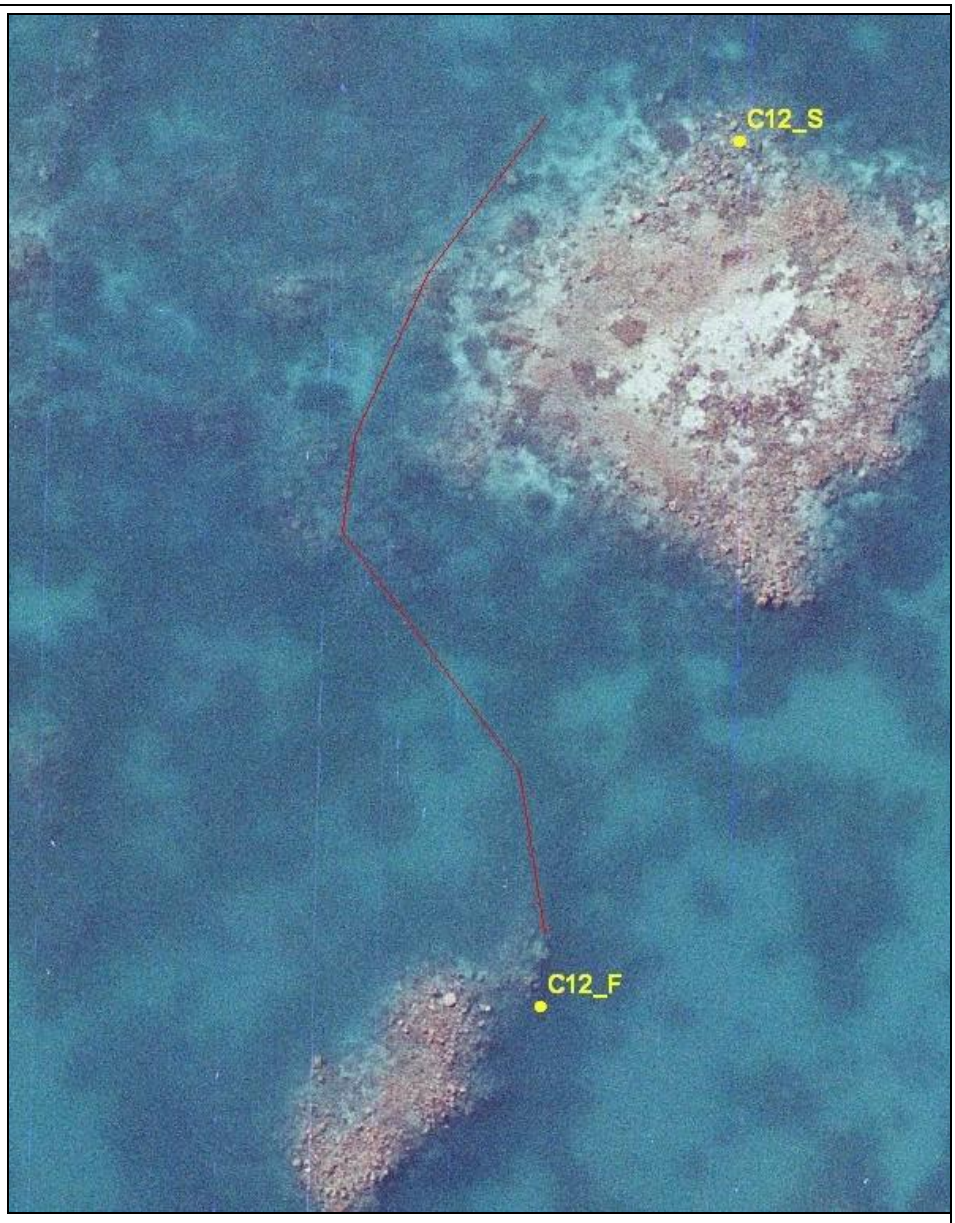


Figure 30 Benthic Survey Site C12 at Clerke Reef, Rowley Shoals Marine Park

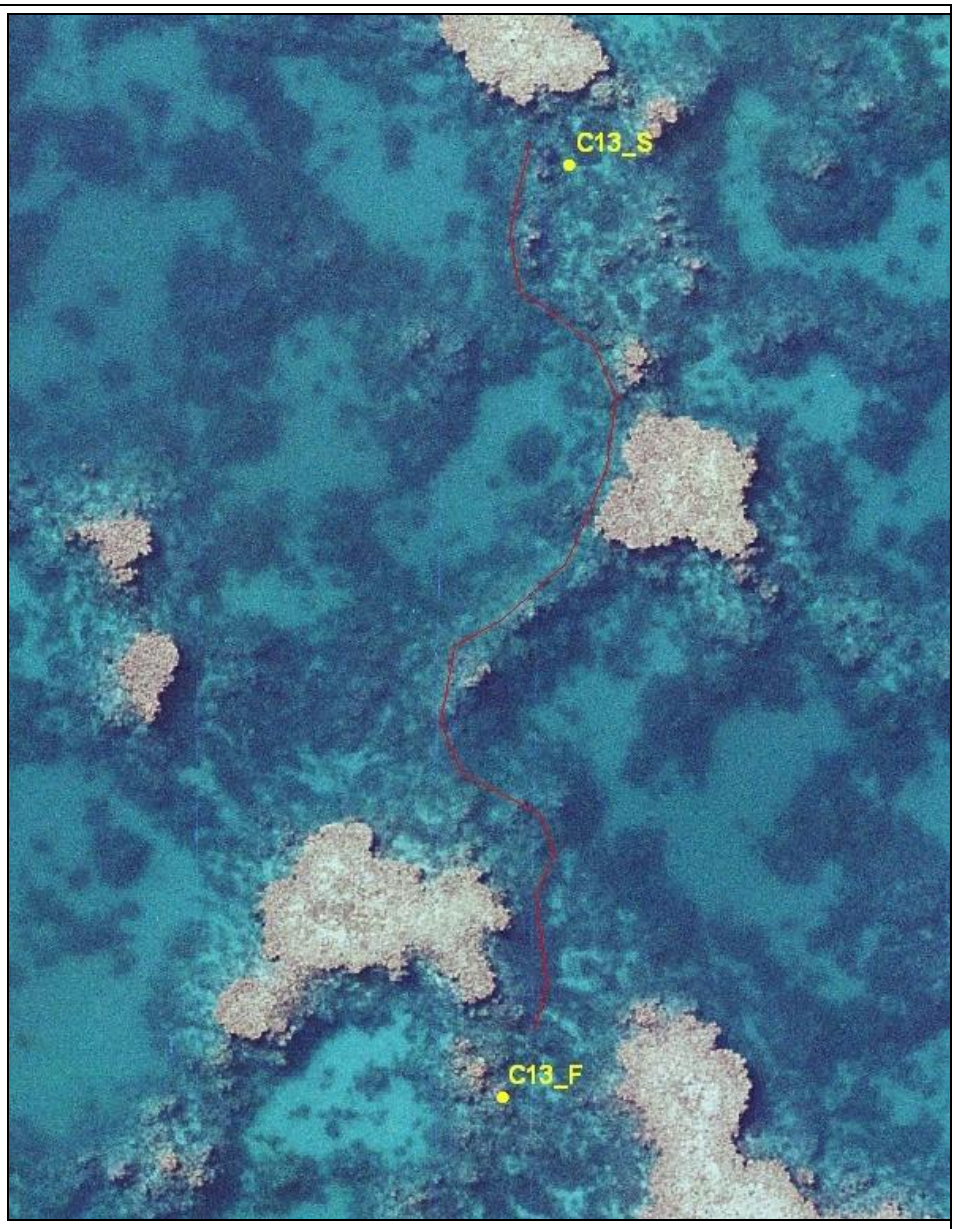


Figure 31 Benthic Survey Site C13 at Clerke Reef, Rowley Shoals Marine Park

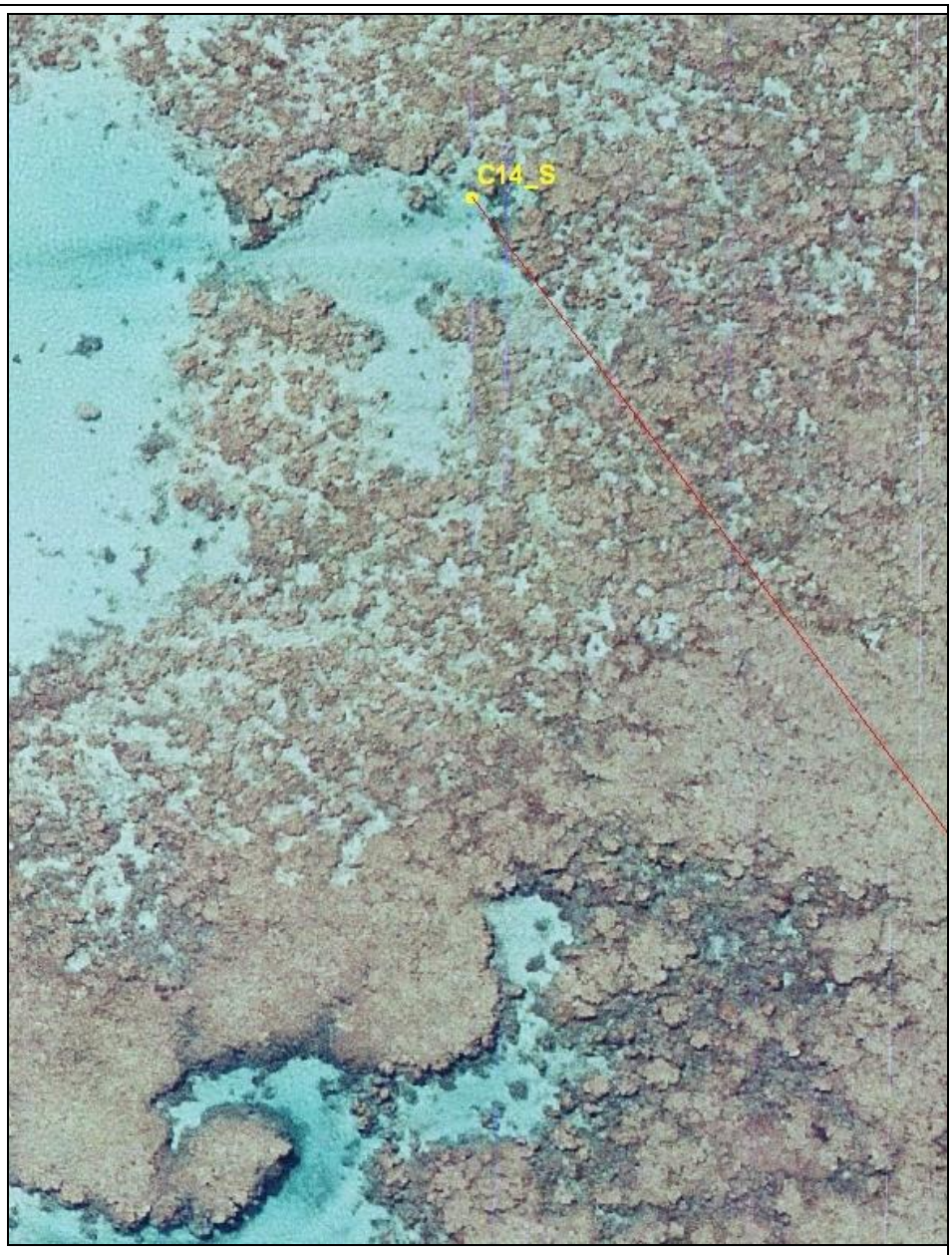


Figure 32 Benthic Survey Site C14 at Clerke Reef, Rowley Shoals Marine Park

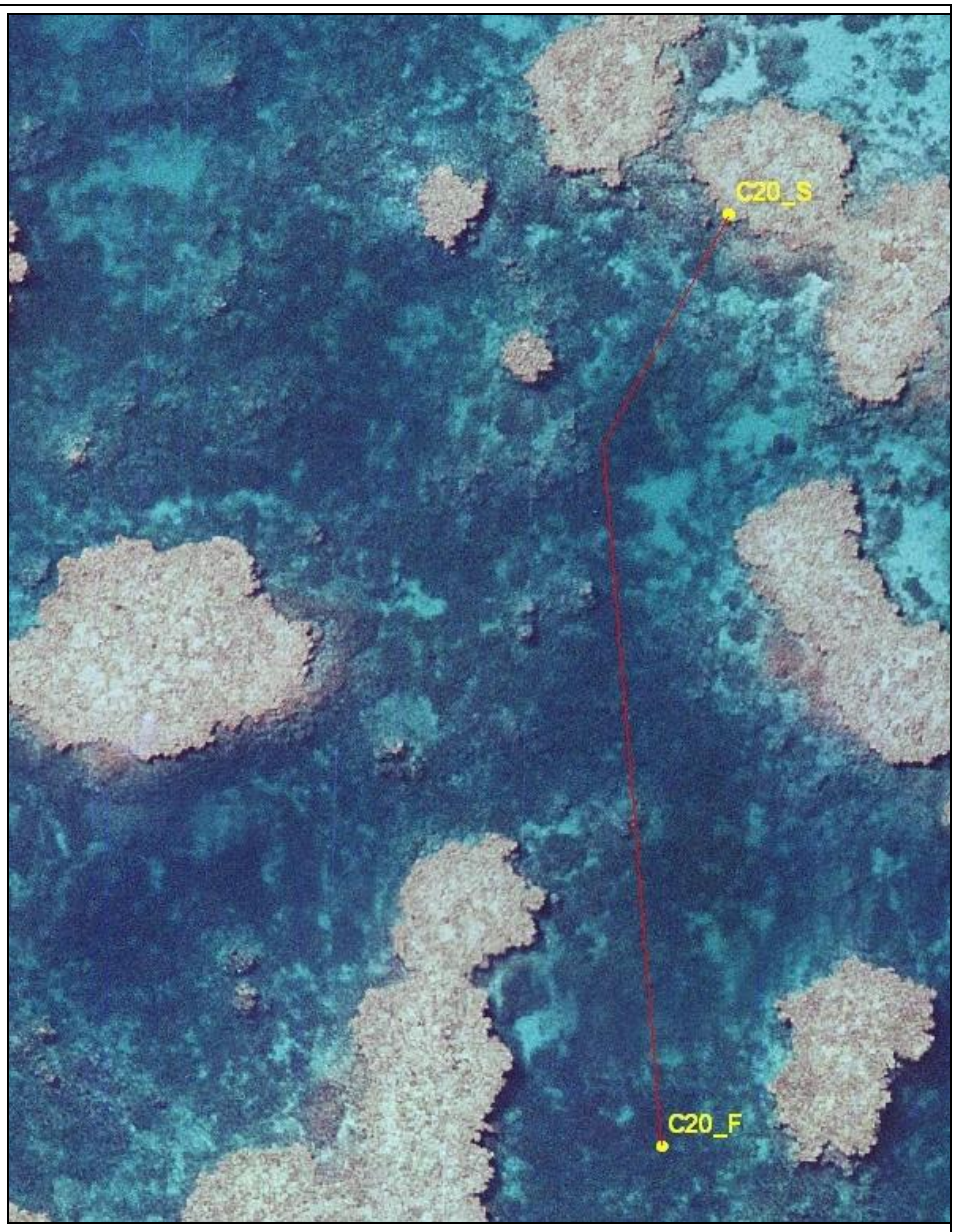


Figure 33 Benthic Survey Site C20 at Clerke Reef, Rowley Shoals Marine Park

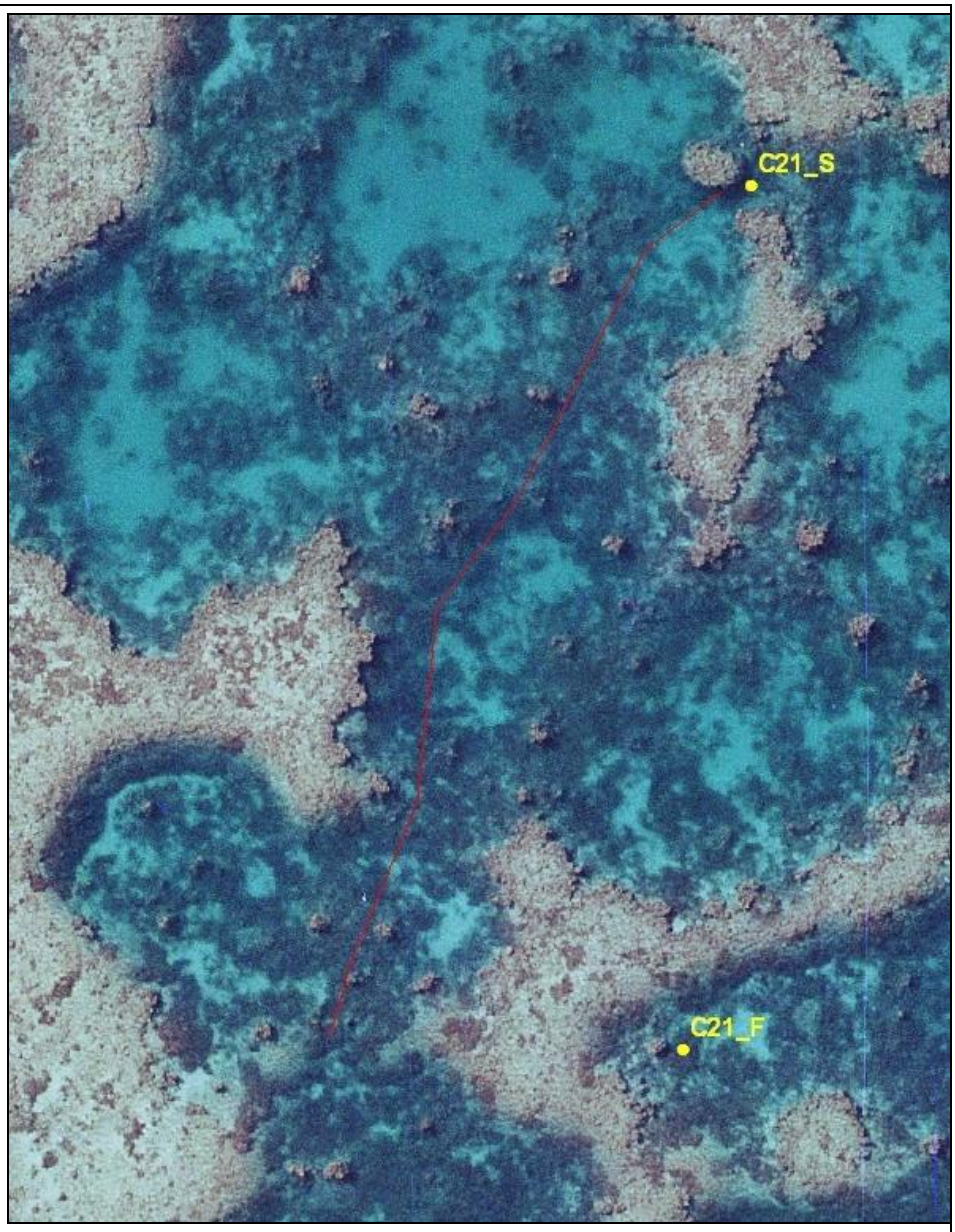


Figure 34 Benthic Survey Site C21at Clerke Reef, Rowley Shoals Marine Park

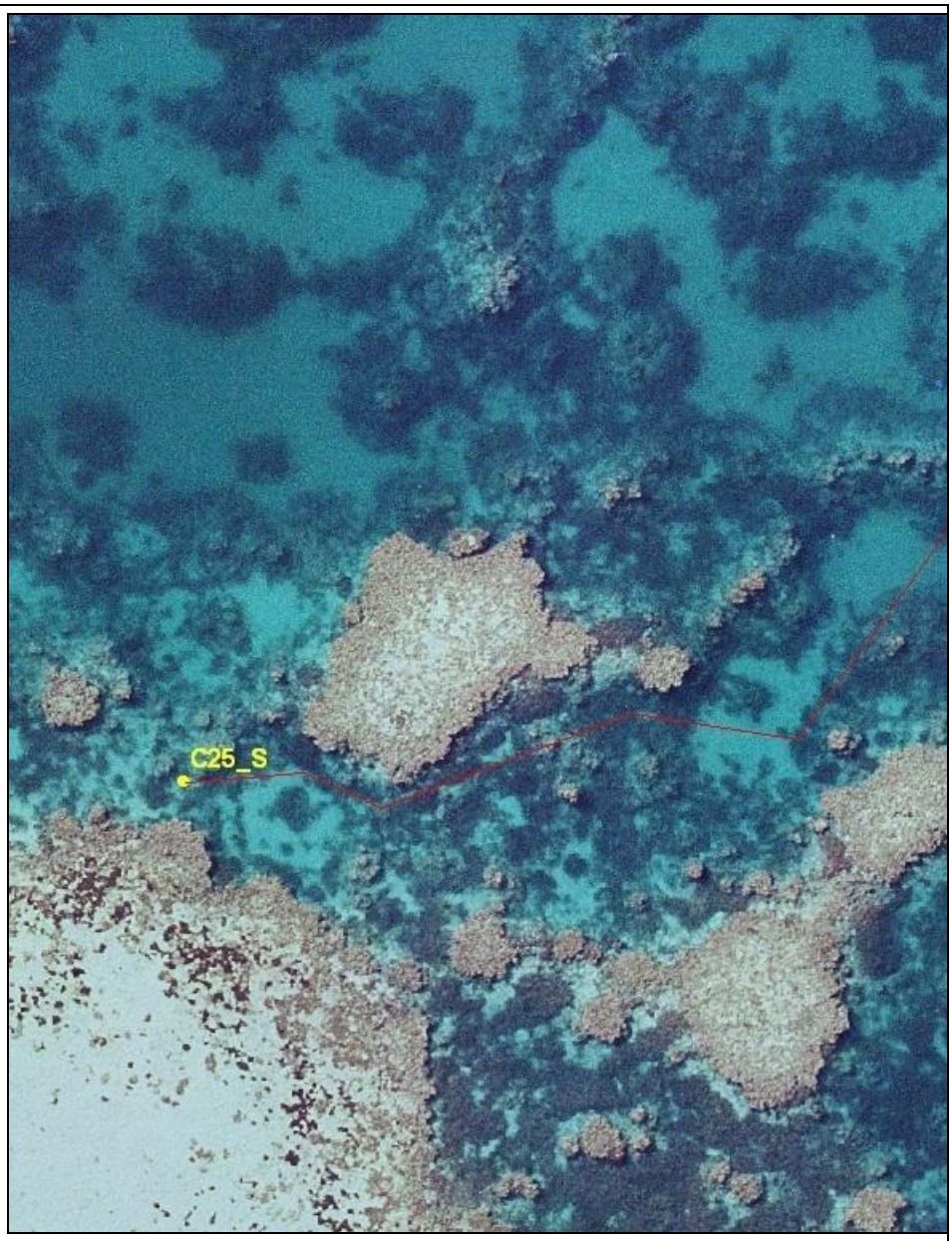


Figure 35 Benthic Survey Site C25 at Clerke Reef, Rowley Shoals Marine Park

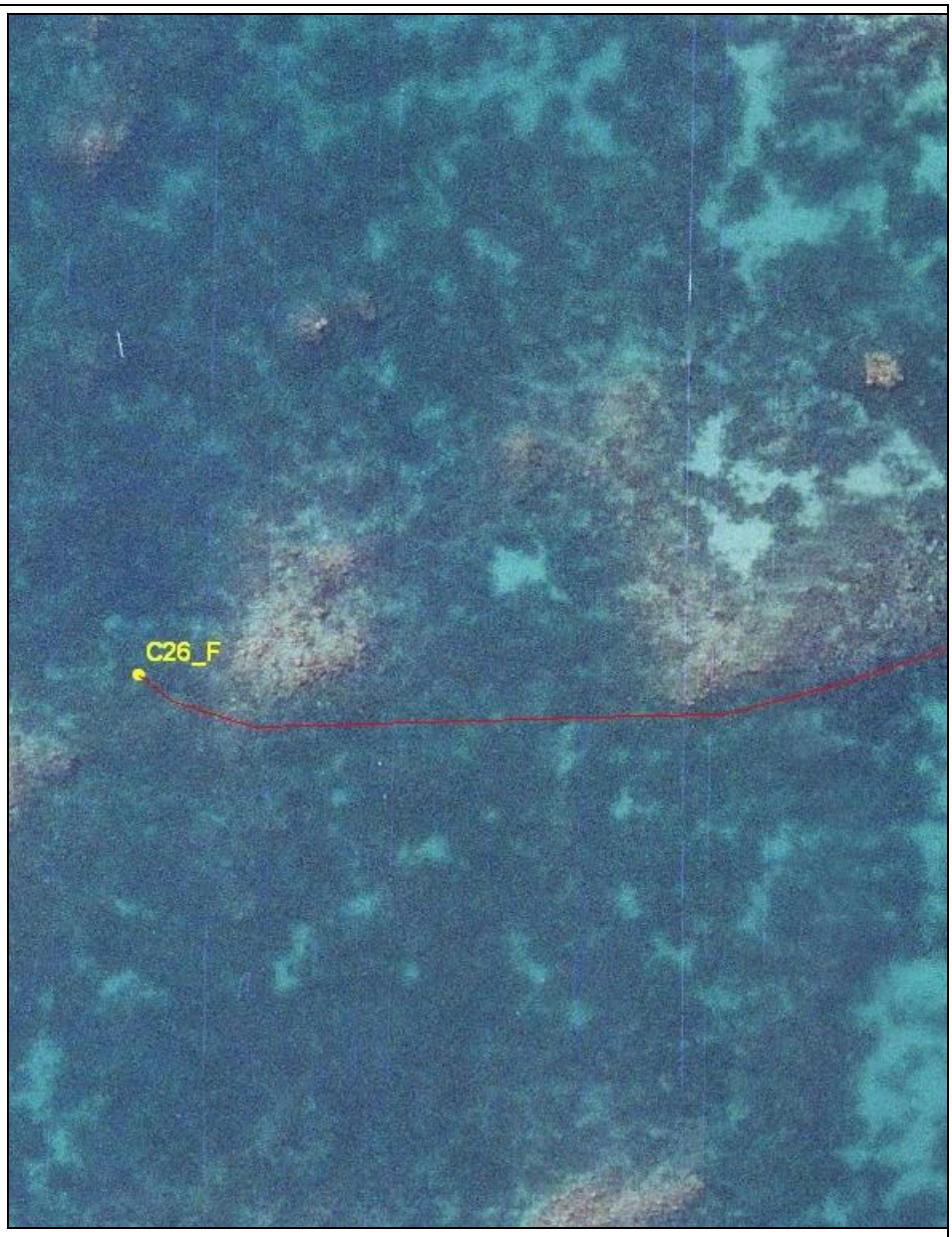


Figure 36 Benthic Survey Site C26 at Clerke Reef, Rowley Shoals Marine Park

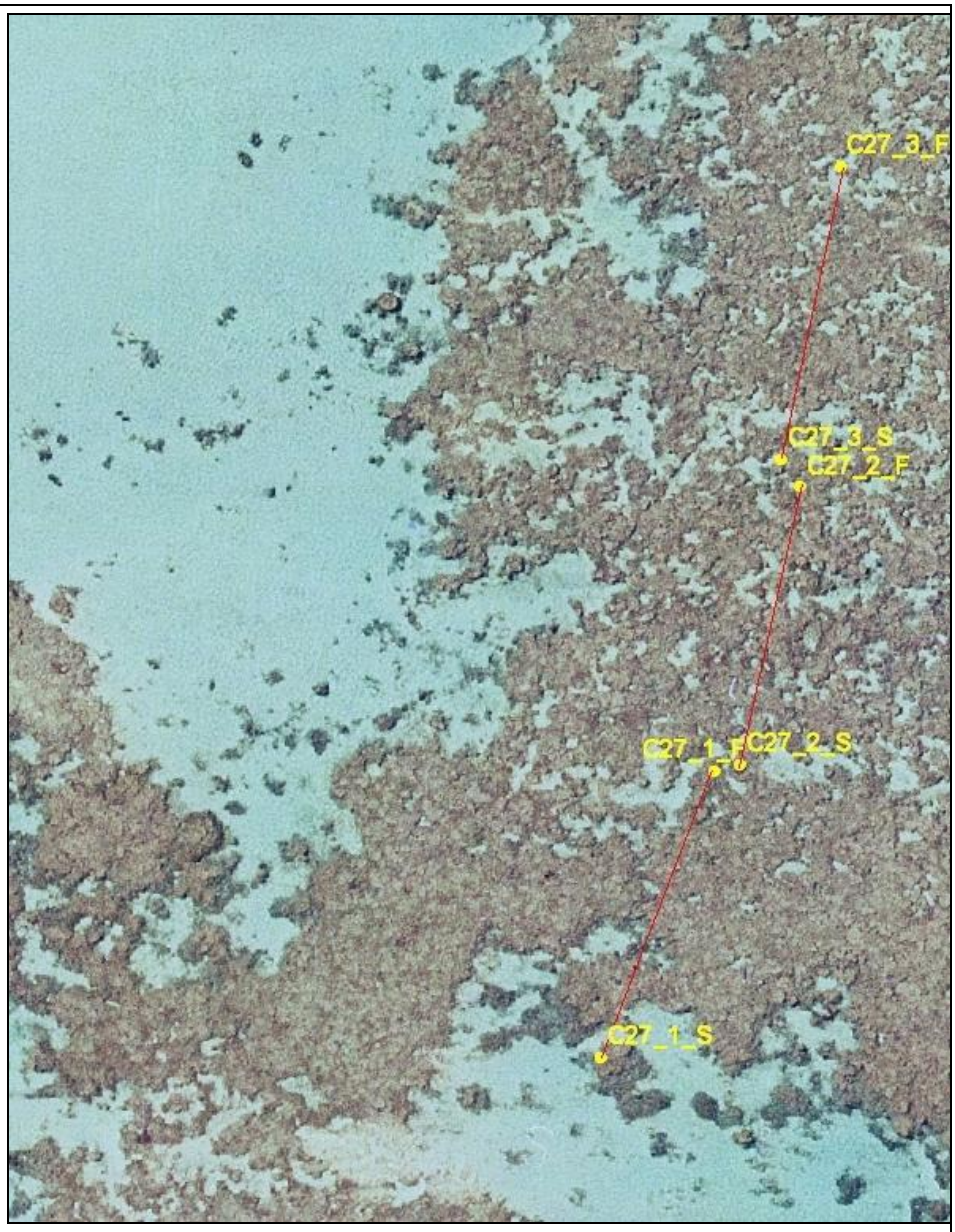


Figure 37 Benthic Survey Site C27 at Clerke Reef, Rowley Shoals Marine Park

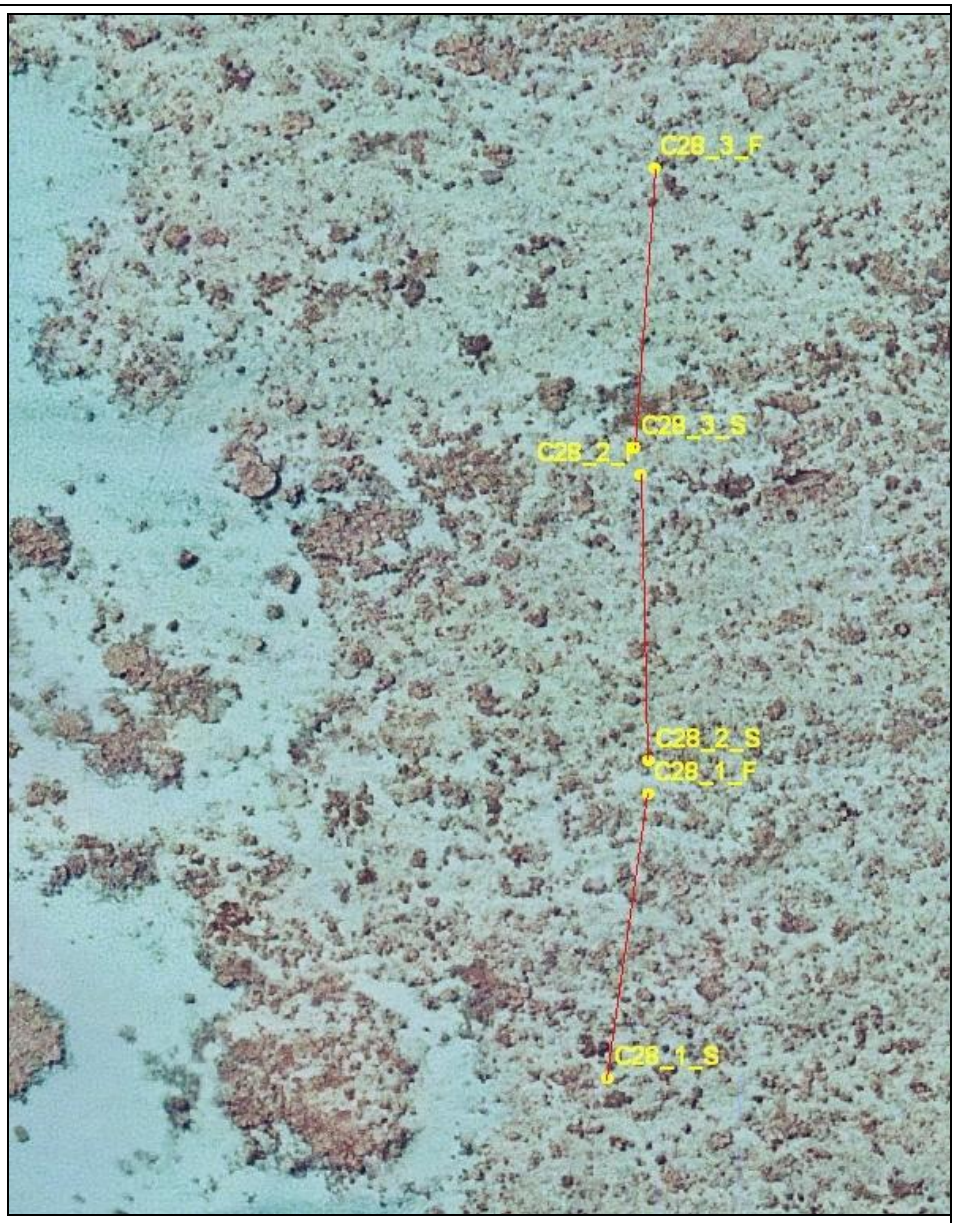


Figure 38 Benthic Survey Site C28 at Clerke Reef, Rowley Shoals Marine Park

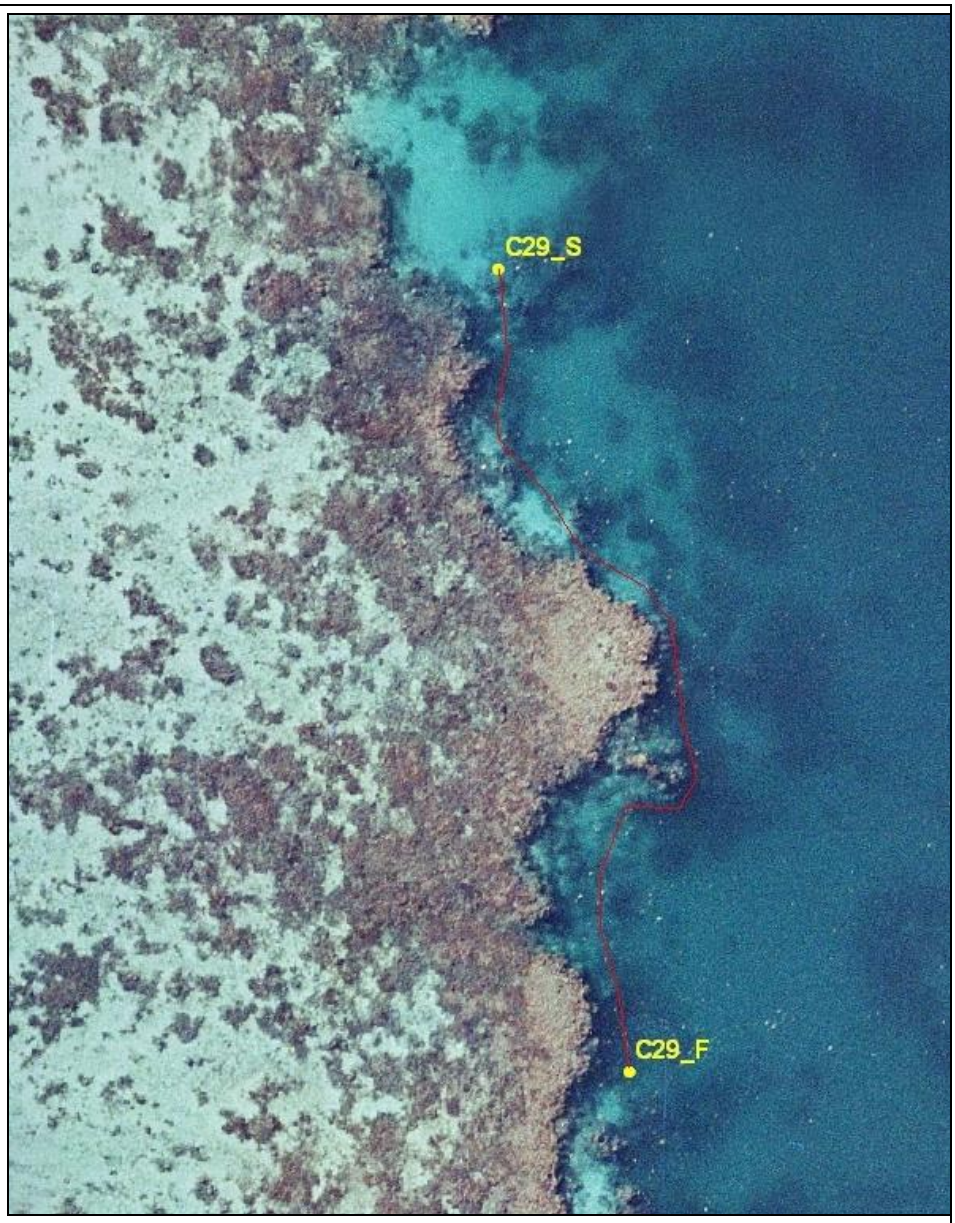


Figure 39 Benthic Survey Site C29 at Clerke Reef, Rowley Shoals Marine Park

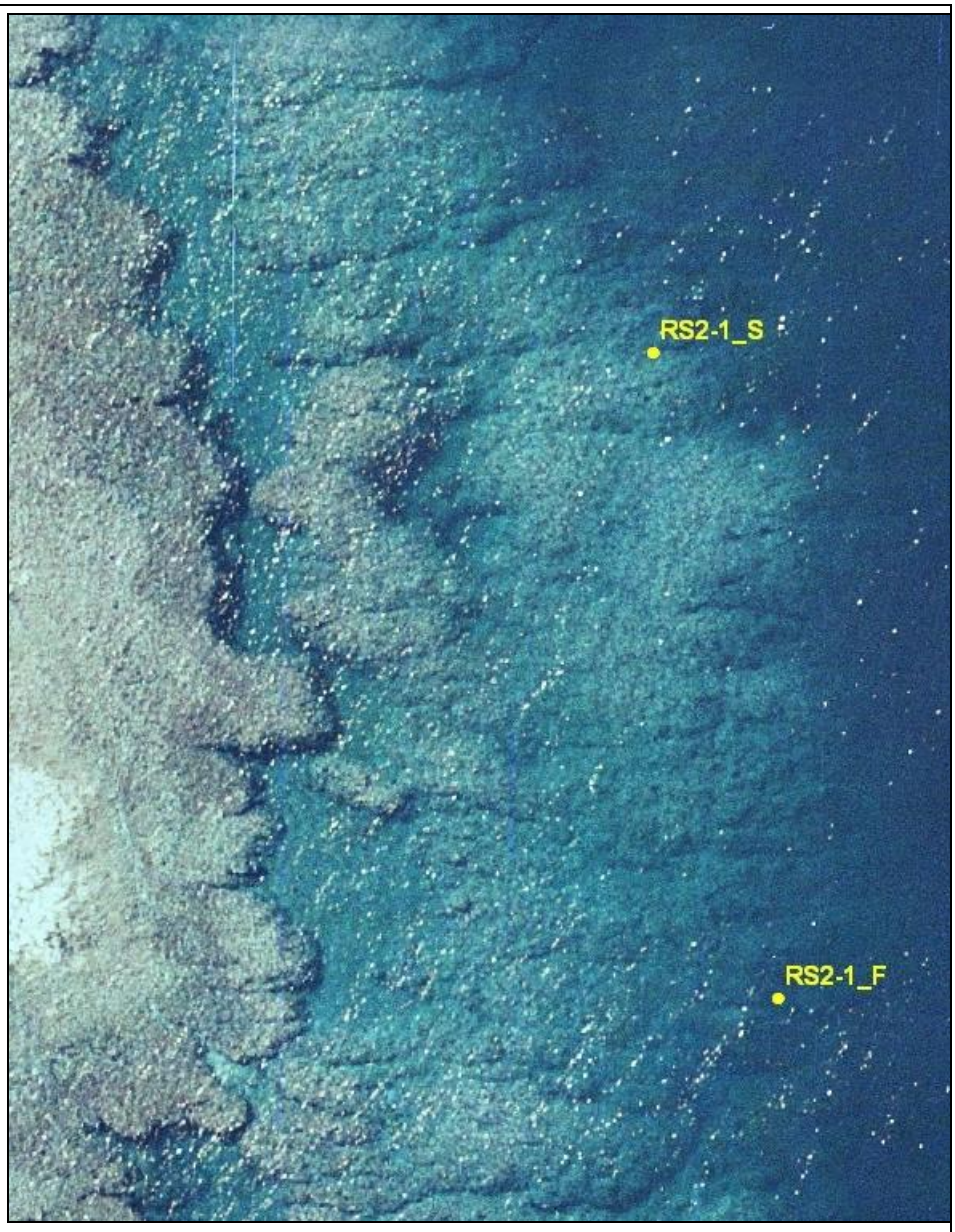


Figure 40 Benthic Survey Site RS2-1 at Clerke Reef, Rowley Shoals Marine Park

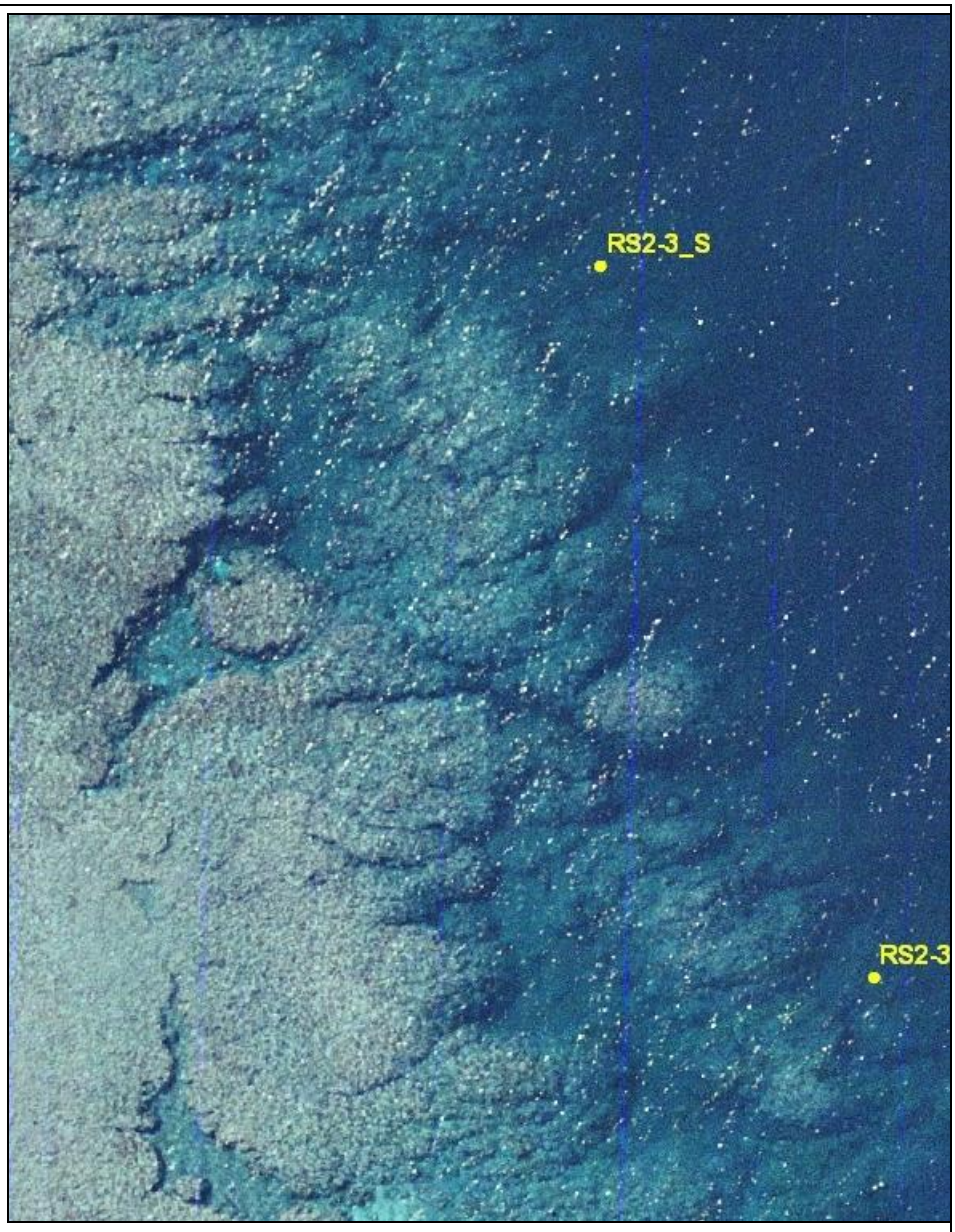


Figure 41 Benthic Survey Site RS2-3 at Clerke Reef, Rowley Shoals Marine Park

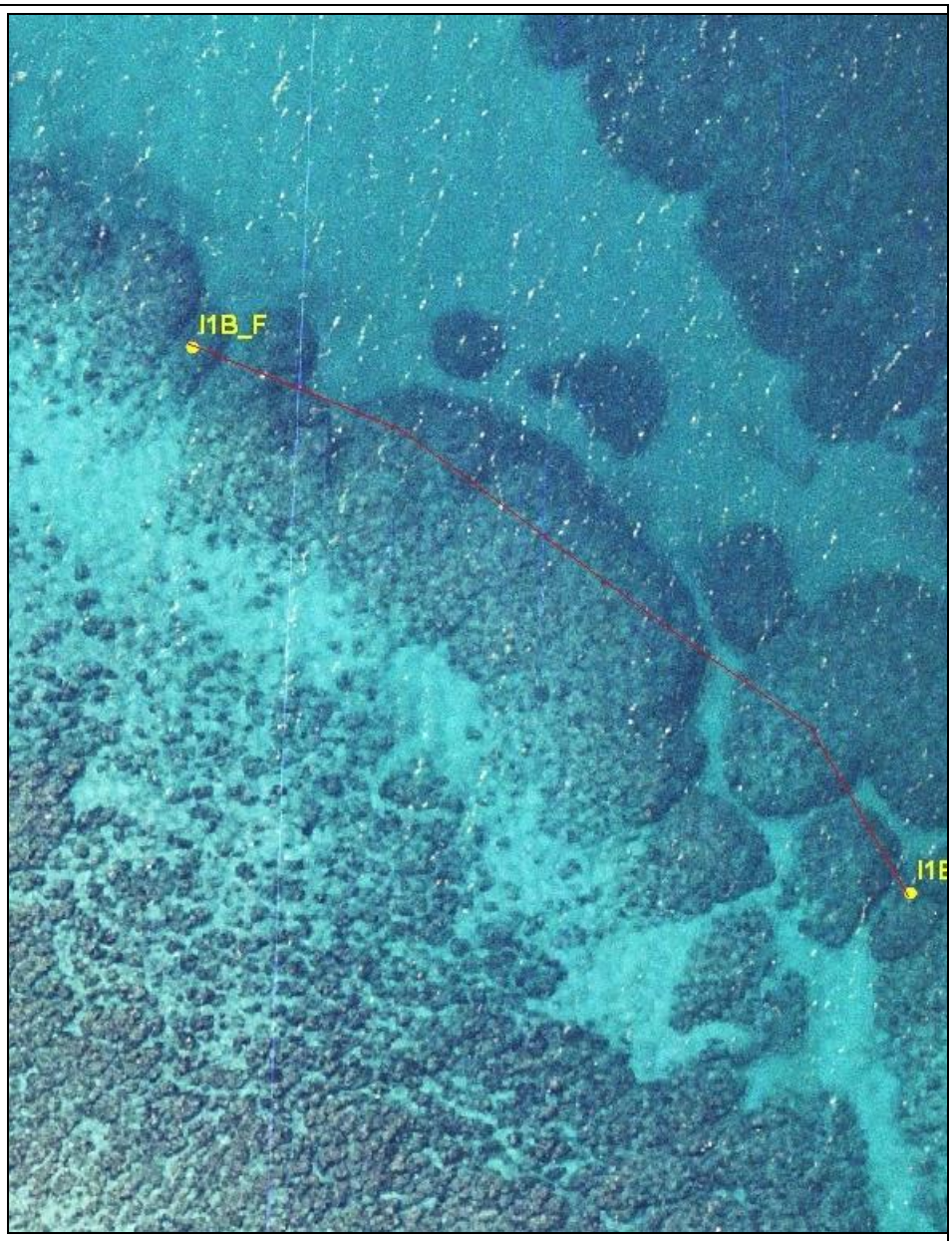


Figure 42 Benthic Survey Site I1b at Imperiuese Reef, Rowley Shoals Marine Park

Figure 43 Benthic Survey Site I9 at Imperiuese Reef, Rowley Shoals Marine Park

Figure 44 Benthic Survey Site I10 at Imperiuese Reef, Rowley Shoals Marine Park

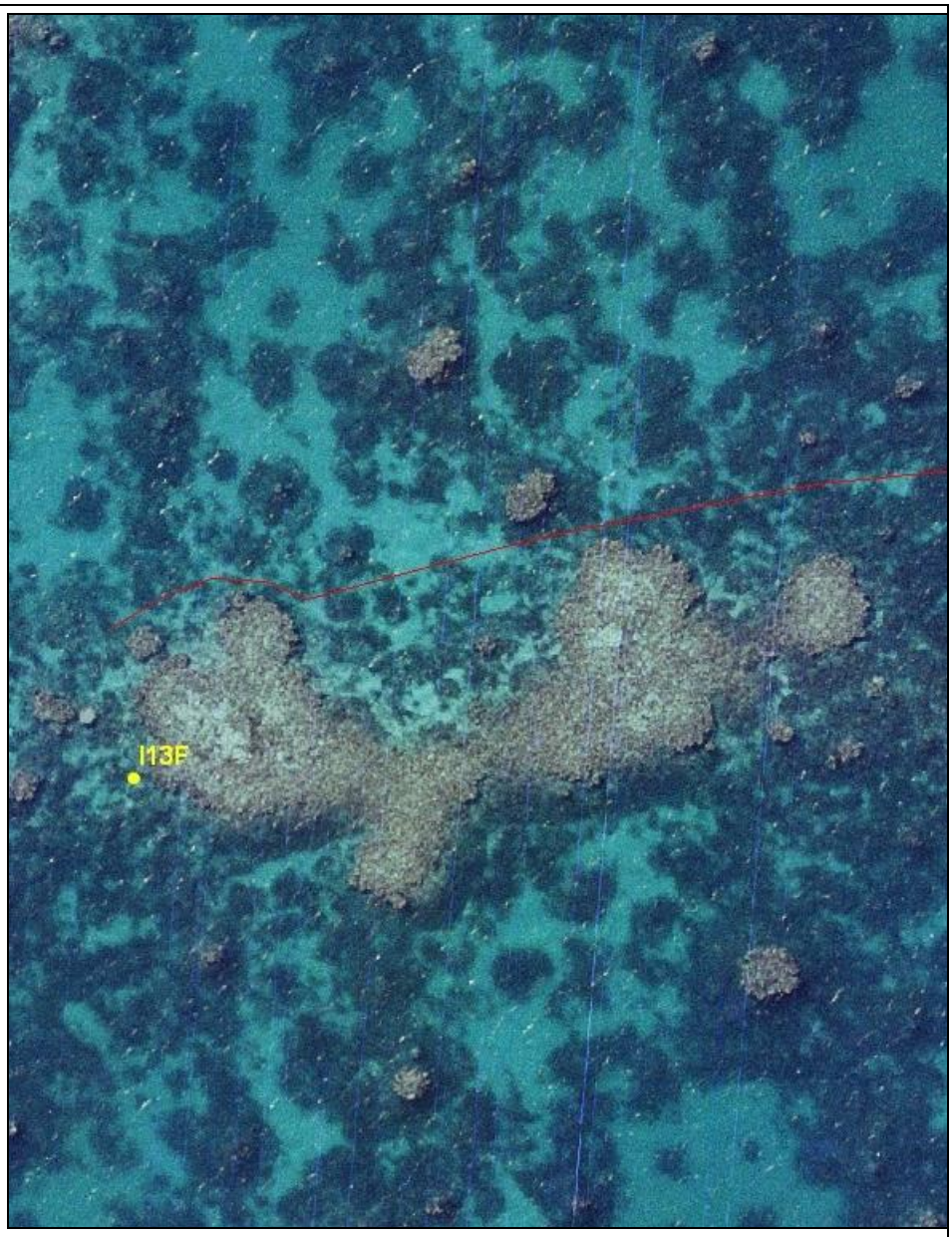


Figure 45 Benthic Survey Site I13 at Imperiuese Reef, Rowley Shoals Marine Park

Figure 46 Benthic Survey Site I14 at Imperiuese Reef, Rowley Shoals Marine Park

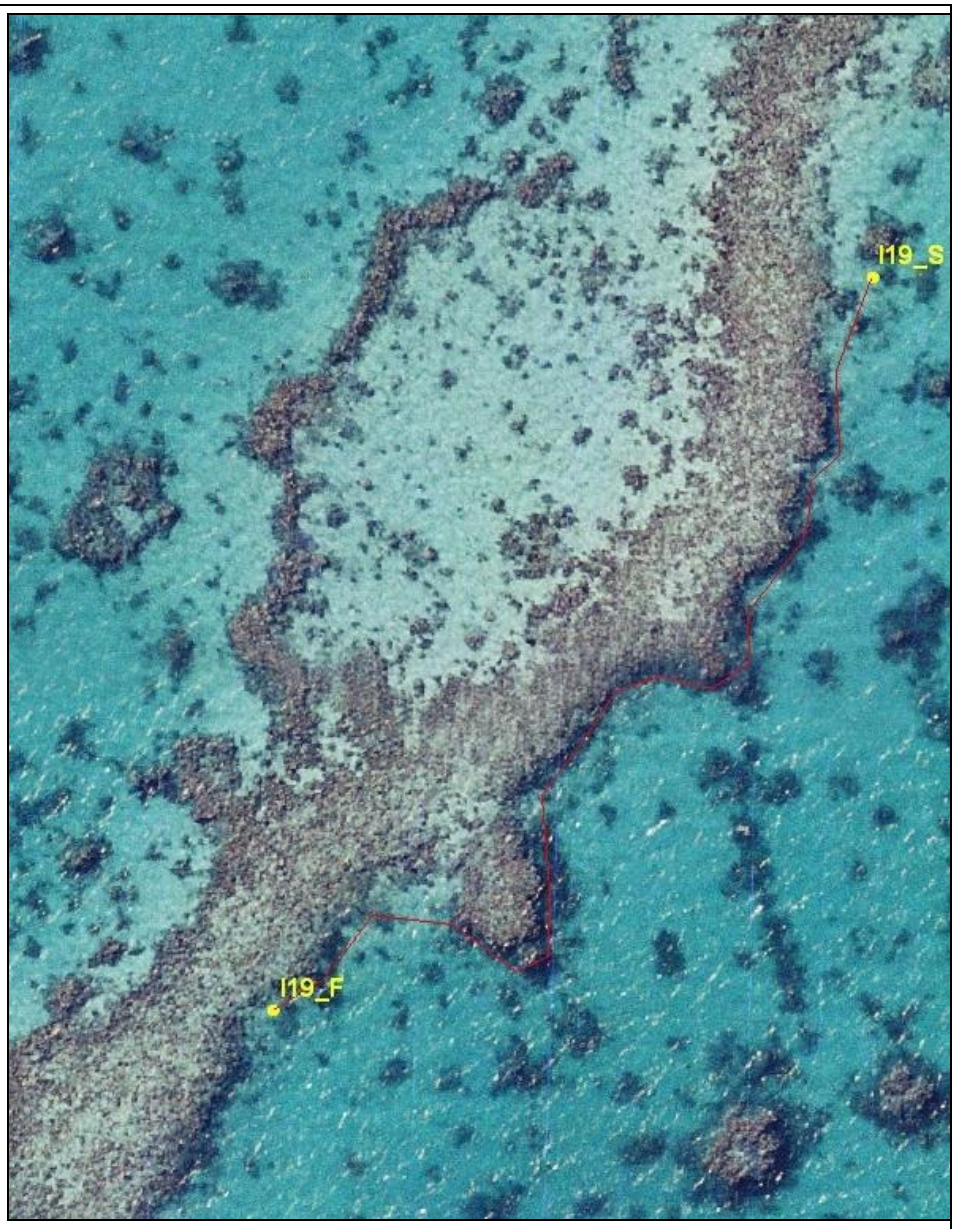


Figure 47 Benthic Survey Site I19 at Imperiuese Reef, Rowley Shoals Marine Park

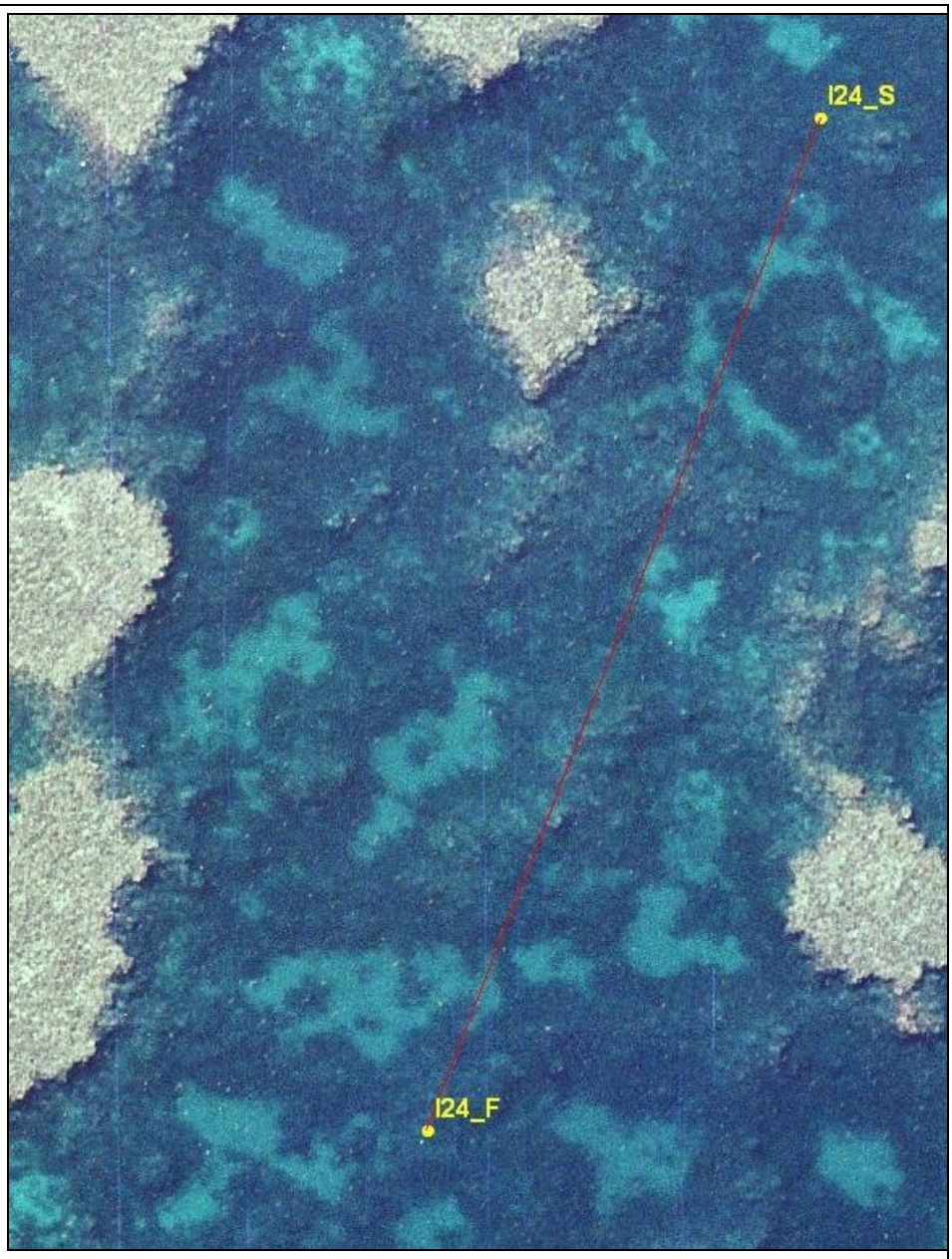


Figure 48 Benthic Survey Site I24 at Imperiuese Reef, Rowley Shoals Marine Park

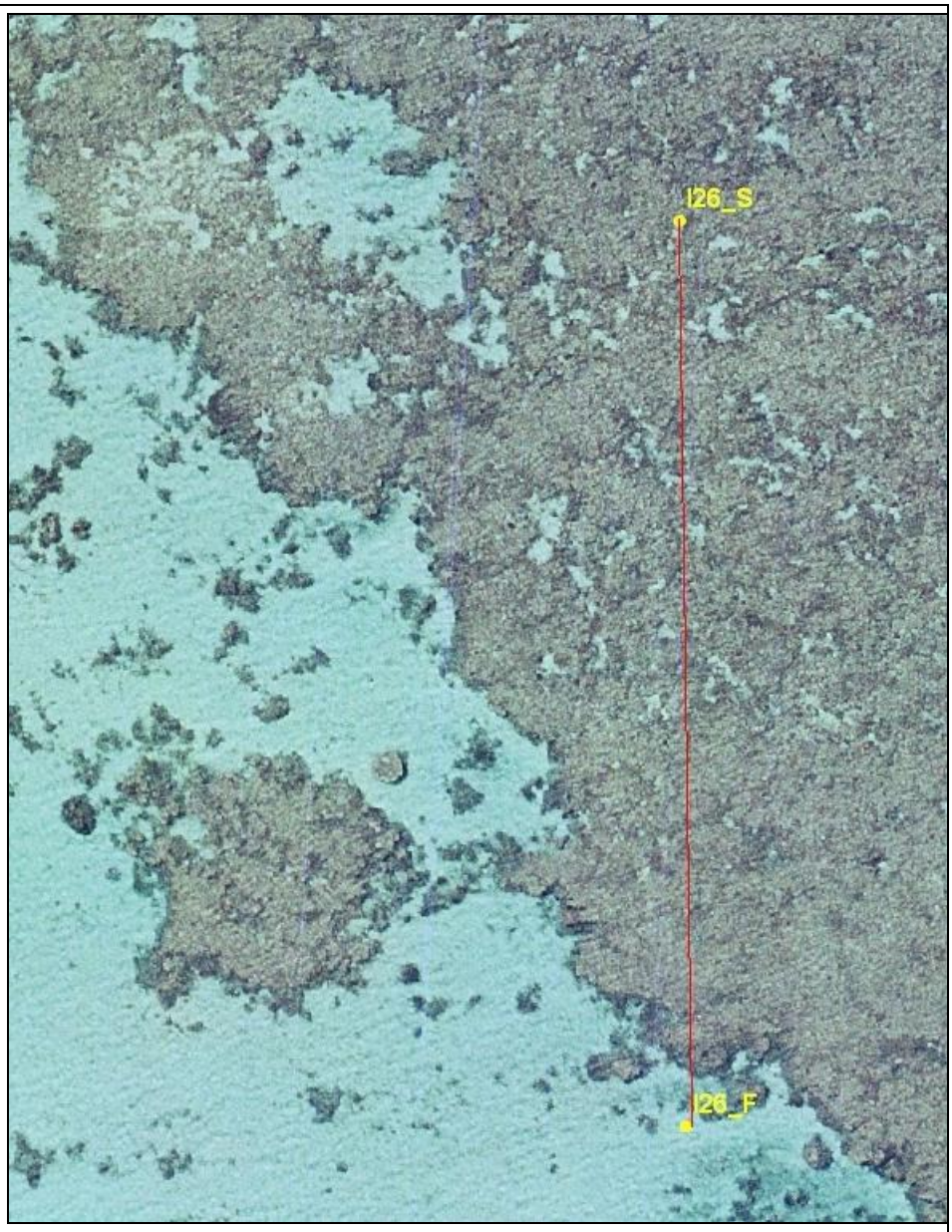


Figure 49 Benthic Survey Site I26 at Imperiuese Reef, Rowley Shoals Marine Park

DEC MSP Data report/post field trip report template (includes MEST metadata requirements)

Supplementary data

Site details, survey metadata

Site	Transect	Lats	Longs	way pt accuracy	original direction	type	comment	Benthic cameraman	inverts surveyed	invert surveyor
C1b_S	0	-17.24607	119.35201		E-W	back reef slope	may be exposed to wave action, Started the site from the South, photographed the left hand side at 1 m from substrate every 1 m, took the panoramic from N, E, S, W sides at the Nth (finish) end. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
C1b_F	0	-17.24566	119.35078	estimated	E-W	back reef slope	may be exposed to wave action, Started the site from the South, photographed the left hand side at 1 m from substrate every 1 m, took the panoramic from N, E, S, W sides at the Nth (finish) end. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
RS2-1_S	1	-17.28430	119.37690		N-S	back reef slope	started from the North and headed south, photographed the left side every 1m at 1m intervals. panoramas on North end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
RS2-1_F	0	-17.28526	119.37709	estimated	N-S	back reef slope	started from the North and headed south, photographed the left side every 1m at 1m intervals. panoramas on North end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
RS2-3_S	3	-17.29270	119.37810		N-S	back reef slope	Left side every metre, panoramas photographed at beginning of each transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	STU	yes	
RS2-3_F	0	-17.29376	119.37851	estimated	N-S	back reef slope	Left side every metre, panoramas photographed at beginning of each transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	STU	yes	
C9_S	0	-17.35620	119.38340		N-S	back reef slope	Started the site from the South, photographed the right hand side at 1 m from substrate every 1 m took the panorama from N, E, S, W sides at the Nth (finish) end. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
C9_F	0	-17.35760	119.38340		N-S	back reef slope	Started the site from the South, photographed the right hand side at 1 m from substrate every 1 m took the panorama from N, E, S, W sides at the Nth (finish) end. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	

DEC MSP Data report/post field trip report template (includes MEST metadata requirements)

Site	Transect	Lats	Longs	way pt accuracy	original direction	type	comment	Benthic cameraman	inverts surveyed	invert surveyor
C9_deep_S	0	-17.35627	119.38424		N-S	Lagoonal	Left side every metre, panoramas photographed at beginning of each transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	STU	yes	
C9_deep_F	0	-17.35692	119.38415		N-S	Lagoonal	Left side every metre, panoramas photographed at beginning of each transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	STU	yes	
C11_S	0	-17.34480	119.35110		N-S	Lagoonal	not on top of bommies, transect to the sides.	STU	yes	
C11_F	0	-17.34610	119.35060		N-S	Lagoonal	not on top of bommies, transect to the sides.	STU	yes	
C12_S	0	-17.30330	119.33590		N-S	Lagoonal	not on top of bommies, transect to the sides. three transects, started from the North and headed south, photographed the left side every 1m at 1m intervals. panoramas on North end of transect (i.e. beginning)	KBA	no	
C12_F	0	-17.30460	119.33560		N-S	Lagoonal	not on top of bommies, transect to the sides. three transects, started from the North and headed south, photographed the left side every 1m at 1m intervals. panoramas on North end of transect (i.e. beginning)	KBA	no	
C13_S	0	-17.31100	119.36790		N-S	Lagoonal	not on top of bommies, transect to the sides. Started South end photographed RH side every 1 m. Followed edge of ridge, panorama at beginning of transect (sth end). Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
C13_F	0	-17.31240	119.36780		N-S	Lagoonal	not on top of bommies, transect to the sides. Started South end photographed RH side every 1 m. Followed edge of ridge, panorama at beginning of transect (sth end). Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
C14_S	0	-17.28300	119.37300		NW-SE	intertidal reef	Left side every metre, panoramas photographed at beginning of each transect	KBA	yes	
C14_F	0	-17.28420	119.37390		NW-SE	intertidal reef	Left side every metre, panoramas photographed at beginning of each transect	KBA	yes	
C20_S	0	-17.30740	119.37140		N-S	Lagoonal	Started the site from the South, photographed the right hand side; panorama on the north end of each transects. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
C20_F	0	-17.30880	119.37130		N-S	Lagoonal	Started the site from the South, photographed the right hand side; panorama on the north end of each transects. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
C21_S	0	-17.31970	119.36080		N-S	Lagoonal	started from the South and headed north photographed the left side every 1m at 1m intervals. panoramas on North end of transect	KBA	yes	
C21_F	0	-17.32100	119.36070		N-S	Lagoonal	started from the South and headed north photographed the left side every 1m at 1m intervals. panoramas on North end of transect	KBA	yes	

DEC MSP Data report/post field trip report template (includes MEST metadata requirements)

Site	Transect	Lats	Longs	way pt accuracy	original direction	type	comment	Benthic cameraman	inverts surveyed	invert surveyor
C25_S	0	-17.31550	119.36750		W-E	Lagoonal	Started on the West buoy and headed east. photographed on the left hand side. benthic photos 1m above substrate every metre. Panoramas from W, N, E, S, on the west end of each transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
C25_F	0	-17.31440	119.36920	estimated	W-E	Lagoonal	Started on the West buoy and headed east. photographed on the left hand side. benthic photos 1m above substrate every metre. Panoramas from W, N, E, S, on the west end of each transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
C26_S	0	-17.29812	119.34254		E-W	Lagoonal	started from the East and headed West photographed the left side every 1m at 1m intervals. panoramas on East end of transect (i.e. beginning)	KBA	no	
C26_F	0	-17.29827	119.34113		E-W	Lagoonal	started from the East and headed West photographed the left side every 1m at 1m intervals. panoramas on East end of transect (i.e. beginning)	KBA	no	
C27_1_S	1	-17.31390	119.37816		S-N	intertidal reef	started from the South and headed North photographed the left side every 1m at 1m intervals. panoramas on Southend of transect (i.e. beginning)	KBA	yes	
C27_1_F	1	-17.31347	119.37833		S-N	intertidal reef	started from the South and headed North photographed the left side every 1m at 1m intervals. panoramas on Southend of transect (i.e. beginning)	KBA	yes	
C27_2_S	2	-17.31346	119.37837		S-N	intertidal reef	started from the South and headed North photographed the left side every 1m at 1m intervals. panoramas on Southend of transect (i.e. beginning)	KBA	yes	
C27_2_F	2	-17.31304	119.37846		S-N	intertidal reef	started from the South and headed North photographed the left side every 1m at 1m intervals. panoramas on Southend of transect (i.e. beginning)	KBA	yes	
C27_3_S	3	-17.31300	119.37843		S-N	intertidal reef	started from the South and headed North photographed the left side every 1m at 1m intervals. panoramas on Southend of transect (i.e. beginning)	KBA	yes	
C27_3_F	3	-17.31256	119.37852		S-N	intertidal reef	started from the South and headed North photographed the left side every 1m at 1m intervals. panoramas on Southend of transect (i.e. beginning)	KBA	yes	
C28_1_S	1	-17.29965	119.37575		S-N	intertidal reef	started from the South and headed north photographed the left side every 1m at 1m intervals. panoramas on south end of transect	KBA	yes	
C28_1_F	1	-17.29922	119.37581		S-N	intertidal reef	started from the South and headed north photographed the left side every 1m at 1m intervals. panoramas on south end of transect	KBA	yes	
C28_2_S	2	-17.29917	119.37581		S-N	intertidal reef	started from the South and headed north photographed the left side every 1m at 1m intervals. panoramas on south end of transect	KBA	yes	
C28_2_F	2	-17.29874	119.37580		S-N	intertidal reef	started from the South and headed north photographed the left side every 1m at 1m intervals. panoramas on south end of transect	KBA	yes	
C28_3_S	3	-17.29870	119.37579		S-N	intertidal reef	started from the South and headed north photographed the left side every 1m at 1m intervals. panoramas on south end of transect	KBA	yes	

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Site	Transect	Lats	Longs	way pt accuracy	original direction	type	comment	Benthic cameraman	inverts surveyed	invert surveyor
C28_3_F	3	-17.29828	119.37582		S-N	intertidal reef	started from the South and headed north photographed the left side every 1m at 1m intervals. panoramas on south end of transect	KBA	yes	
C29_S	0	-17.29164	119.35914		N-S	Lagoonal	started from the North and headed South photographed the left side every 1m at 1m intervals. panoramas on North end of transect	KBA	yes	
C29_F	0	-17.29285	119.35934	estimated	N-S	Lagoonal	started from the North and headed South photographed the left side every 1m at 1m intervals. panoramas on North end of transect	KBA	yes	
RS3-1_S	0	-17.54800	118.97370		N-S	back reef slope	started from the North and headed South photographed the left side every 1m at 1m intervals. panoramas on North end of transect	KBA	yes	
RS3-1_F	0	-17.54914	118.97366	estimated	N-S	back reef slope	started from the North and headed South photographed the left side every 1m at 1m intervals. panoramas on North end of transect	KBA	yes	
RS3-3_S	0	-17.55820	118.97240		N-S	back reef slope	started from the North and headed South photographed the left side every 1m at 1m intervals. panoramas on North end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
RS3_3_F	0	-17.55933	118.97226	estimated	N-S	back reef slope	started from the North and headed South photographed the left side every 1m at 1m intervals. panoramas on North end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
I1B_S	0	-17.50218	118.96276		SE-NW	back reef slope	started from the south east and headed north west photographed the left side every 1m at 1m intervals. panoramas on South end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
I1B_F	0	-17.50137	118.96169		SE-NW	back reef slope	started from the south east and headed north west photographed the left side every 1m at 1m intervals. panoramas on South end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
I9_S	0	-17.61020	118.97470		N-S	back reef slope	started from the North and headed south photographed the left side every 1m at 1m intervals. panoramas on North end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
I9_F	0	-17.61128	118.97430		N-S	back reef slope	started from the North and headed south photographed the left side every 1m at 1m intervals. panoramas on North end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
I10_S	0	-17.61010	118.97000		NE-SW	intertidal reef	Left side every metre, panoramas photographed at beginning of each transect	STU	yes	

DEC MSP Data report/post field trip report template (includes MEST metadata requirements)

Site	Transect	Lats	Longs	way pt accuracy	original direction	type	comment	Benthic cameraman	inverts surveyed	invert surveyor
I10_F	0	-17.61130	118.96930		NE-SW	intertidal reef	Left side every metre, panoramas photographed at beginning of each transect	STU	yes	
I13_S	0	-17.56010	118.94190		E-W	Lagoonal	Left side every metre, panoramas photographed at beginning of each transect	STU	yes	
I13F	0	-17.56060	118.94050		E-W	Lagoonal	Left side every metre, panoramas photographed at beginning of each transect	STU	yes	
I14_S	0	-17.54900	118.96660		N-S	Lagoonal	Left side every metre, panoramas photographed at beginning of each transect	STU	yes	
I14_F	0	-17.54990	118.96620		N-S	Lagoonal	Left side every metre, panoramas photographed at beginning of each transect	STU	yes	
I19_S	0	-17.58040	118.93690		NE-SW	Lagoonal	started from the North and headed south photographed the left side every 1m at 1m intervals. panoramas on North end of transect. not on top of bommies, transect to the sides.	KBA	yes	
I19_F	0	-17.58150	118.93600		NE-SW	Lagoonal	started from the North and headed south photographed the left side every 1m at 1m intervals. panoramas on North end of transect. not on top of bommies, transect to the sides.	KBA	yes	
I24_S	0	-17.60920	118.96384		N-S	Lagoonal	started from the South and headed North photographed the Right side every 1m at 1m intervals. panoramas on North end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
I24_F	0	-17.61069	118.96326		N-S	Lagoonal	started from the South and headed North photographed the Right side every 1m at 1m intervals. panoramas on North end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
I26_S	0	-17.57900	118.96872		N-S	intertidal reef	started from the North and headed South photographed the Left side every 1m at 1m intervals. panoramas on North end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	
I26_F	0	-17.58035	118.96873		N-S	intertidal reef	started from the North and headed South photographed the Left side every 1m at 1m intervals. panoramas on North end of transect. Benthic Video of site was completed on left hand side of the transect at a camera height of 1m from the substrate. 360o video was completed at the start of each transect to provide site context.	KBA	yes	

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Image	
If you have one handy please also attach a picture (JPEG preferable) that best describes your research. This will be used as the thumbnail image next to the metadata records in the MEST	

DEC MSP Data report/post field trip report template (includes MEST metadata requirements)

Appendix: Invert Field Notes (Kim Friedman)
Rowley Shoals Inverts
Clerke Atoll
Overview

Survey time: Friday 23 – Tuesday 27

Weather:
Fine conditions 8-13 knots SW winds

Swell:
Swell was moderate and evident from the north, west and south

Tides:
Neap tides (1.6 to 2.6 m) and going towards springs (0.7 to 3.8 m)

Lagoonal:
Intertidal back-reef: 3 sites (9 50m x 1m reps)
Reef slope external:
Limitations: no sampling of wave impacted areas or backreef of wave impacted crests

Water conditions:
Oceanic influenced system with high throughflow, despite sedimentary fines in the water column and lagoon being suspended/re-suspended in the water column reducing visibility (5-6m). This was under neap conditions with low wind stress (<15knots). Water temp 27ºC at the surface down to 24ºC at 10m depth.

Coral Benthos:
Large amount of coral benthos, either branching *Acropora* over fine sediment or bommie habitat with more permanent stands. Many wide bommies (20-30m) coming up from substrate/sand with live coral tops that remain emerged at low tide. Coral bordering the lagoon is live as are the coral flats that lead to the atoll edges. Spur and groove coral slopes are all covered in live coral except for some areas where a strong recovery is seen, with many small coral recruits.

Coral predators in the way of *Drupella*, Crown of Thorns Starfish (COTS), and *Culcita* were present but at very low density.

Inverts
The coral habitat and mixed coral-rubble-sand benthos of Clerke is not rich in filter feeders other than coral and clams, with little sign of non-autotrophic bivalves such as rock oysters or sponges. Coral bordering the lagoon is live and the edges here where the lagoon drains on a falling tide have high densities of sea cucumbers and clams which extend onto the extensive coral flats, being found in dips and holes. Within coral habitat in the lagoon again there is little in the way of filter feeding ascidians, sponges, bivalves (*Spondylus*, few *Chama* and no *Atrina*, *Hyotisa*, *Lopha* or pearl oysters located), gastropods (e.g. *Trochus*, *Tectus*, Turbins, *Conus*) or sea cucumbers, which reflects a paucity of available food. Despite the fact that there was no night work completed, no lobsters were recorded and few crabs and hermit crabs were noted on all the coral and fish dives.

Whether this is a result of the lack of upwelling in the vicinity, the macro-tidal environment that washes out the lagoon very quickly, the extensive wall of mouths that has the ability to clear the water of incoming larvae or food, that is the extensive internal and external coral reefs, or the lack of a connected system of reefs in this isolated atoll is unknown, but apart from coral and giant clams (both partly autotrophic), there was little in the way of invertebrates to be found. There were exceptions, as the large number of *Thelonota ananas* was notable, which is well adapted to high flow, low food environments, such as is found in the atoll. *Tridacna gigas* was another exception. This species which has been heavily depleted elsewhere in the Indo Pacific was plentiful.

It is not know how or if the system is recruitment limited, but the number and size of the fisheries resource topshell, *Trochus niloticus* might give a clue. Despite the suitable conditions found at a number of locations on the outer slopes and reeftops, and in the channel, this species was in small abundance and stocks comprised only a single large cohort with few juveniles despite the parent stock and habitat being present.

Rowley Shoals Inverts
Imperieuse Atoll
Overview

Survey time: Wed 28 – Friday 30

Weather:
Fine conditions 6-12 knots SW winds

Swell:
Swell was small to moderate and evident from the north, west and south

Tides:
Going into spring tides and springs (0.0 to 4.2m)
Sites sampled for inverts:
Lagoonal:
Intertidal back-reef: ? sites (9 50m x 1m reps)
Reef slope external:
Limitations: no sampling of wave impacted areas or backreef of wave impacted crests

Water conditions:
Again an oceanic influenced system with high throughflow, with less of the sedimentary fines in the lagoon water compared to Clerke, the water clarity being greater than 15m. This was under spring conditions with low wind stress (<13knots). Water temp 27^0 C at the surface down to 24^0 C at 10m depth.

Coral Benthos:
Again, large amount of coral benthos, either branching *Acropora* over sandy sediment or bommie habitat with more permanent stands. Many wide bommies (10-30m) coming up from sand with live coral tops that remain emerged at low tide. Coral bordering the lagoon is live as are the coral flats that lead to the atoll edges. Spur and groove coral slopes are all covered in live coral except for some areas where wave action was noted.

Coral predators in the way of *Drupella*, Crown of Thorns Starfish (COTS), and *Culcita* were present but at very low density.

Inverts:
Like Clerke, the coral habitat and mixed coral-rubble-sand benthos was not rich in filter feeders other than coral and clams. Non-autotrophic filter feeders and grazers were also not at high density. No lobsters were recorded. There was a noteable absence of sponges octocorals (gorgonians, seawhips etc.) and filter feeding ascidians and mollusks.

Commercial topshell, *Trochus niloticus* was again present, and again recorded in a skewed size frequency profile that suggests there is little regular recruitment of juveniles. These gastropods have a short larval cycle (<10 days), which is similar to giant clams. Common bivalves with longer larval cycles of 15 days+, e.g. the black lipped pearl oyster (Pinctada margaritifera) were not recorded. However recruitment signals from giant clams stocks indicated that regular recruitment of *T. maxima* and *T. crocea* was taking place, as was the case for corals, with juvenile corals recordered on the outer slope and across the lagoons.

At one reef slope site, there was high cover of soft corals (*Sinularia* spp *Napanthia* ?? spp)…..