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# Project methods and station geomorphology related to a multi-taxon survey (2009–2014) of the Kimberley

Clay Bryce[1*], Monika Bryce[1] and Ben Radford[2,3]

[1] Department of Aquatic Zoology, Western Australian Museum, Locked Bag 49, Welshpool DC, Western Australia 6986, Australia

[2] School of Earth and Environment and the UWA Oceans Institute, The University of Western Australia, 35 Stirling Highway, Crawley, Western Australia 6009, Australia

[3] Australian Institute of Marine Science, UWA Oceans Institute (M096), 35 Stirling Highway, Crawley, Perth, Western Australia 6009, Australia

* Email: clay.bryce@museum.wa.gov.au

**ABSTRACT –** The marine environments off the Kimberley coast are being subjected to ever increasing human-induced pressures, with little known of the region's marine biodiversity, and therefore, which conservation approaches are appropriate. Consequently, the Western Australian Museum with partner agencies undertook to survey the region over a six year period (2009–2014). Thirty eight locations involving 179 survey stations were visited within the defined Project Area, which ranged from the Kimberley coast to the continental shelf edge. Geomorphic data from these stations, along with additional data from a 2006 survey, were incorporated into the analyses, providing a total of 224 survey stations. Analyses revealed a three-way differentiation of the surveyed stations demonstrating continental shelf zonation, an intertidal and subtidal distinction and a turbidity gradation.

**KEYWORDS:** ecological assessment, natural history collections, species inventory, Kimberley Project Area, north-west Australia, Indian Ocean, biodiversity, Woodside Collection Project

## INTRODUCTION

The Kimberley marine regions off the north-west of Western Australia have always been considered remote (Halpern et al. 2008), but this status is being challenged by increasing incursions and expectations from tourism, fishing and various resource industries. The status of the marine environments and their associated flora and fauna, in the face of these increasing anthropogenic uses, is still relatively unknown (Wood and Mills 2008). The need to rectify this knowledge deficiency is now a priority and considerable effort has been, and is being made, by several agencies to remedy the situation (Wilson 2014). The *Woodside Collection Project (Kimberley) 2008–2015* (the Project) was one such initiative. The Project was a multiagency initiative involving the Museum and Art Gallery of the Northern Territory, Queensland Museum, Australian Museum, Museum Victoria, the Western Australian Herbarium (WAH) and Curtin University, with Western Australian Museum (WAM) as lead agency.

The Project consisted of two components, with the first (2008–2011) being a historical assessment of the marine biological records from Australian museums and WAH within a defined area (the Project Area; Figure 1) as detailed by Sampey et al. (2014), but re-stated here for convenience. The Project Area is defined by the coordinates 19.00°S 121.57°E; 19.00°S 118.25°E; 12.00°S 129.00°E; 12.00°S 121.00°E, with the coastline forming a natural inshore boundary. This irregular polygon stretches north along the coast from Cape Jaubert, south of Broome, to the Western Australia/Northern Territory border, and extends westward beyond the 1000 m bathymetric contour to include the continental shelf edge atolls (Hibernia Reef to Imperieuse Reef, northernmost to southernmost respectively) (Figure 1). Wilson (2014) has reviewed the habitats, geology and historical exploration of the Project Area. The historical data concerned nine targeted marine taxa (marine plants, sponges, marine worms, hard corals, soft corals, molluscs, crustaceans, echinoderms and fishes) and have been published (Jones et al. 2017).

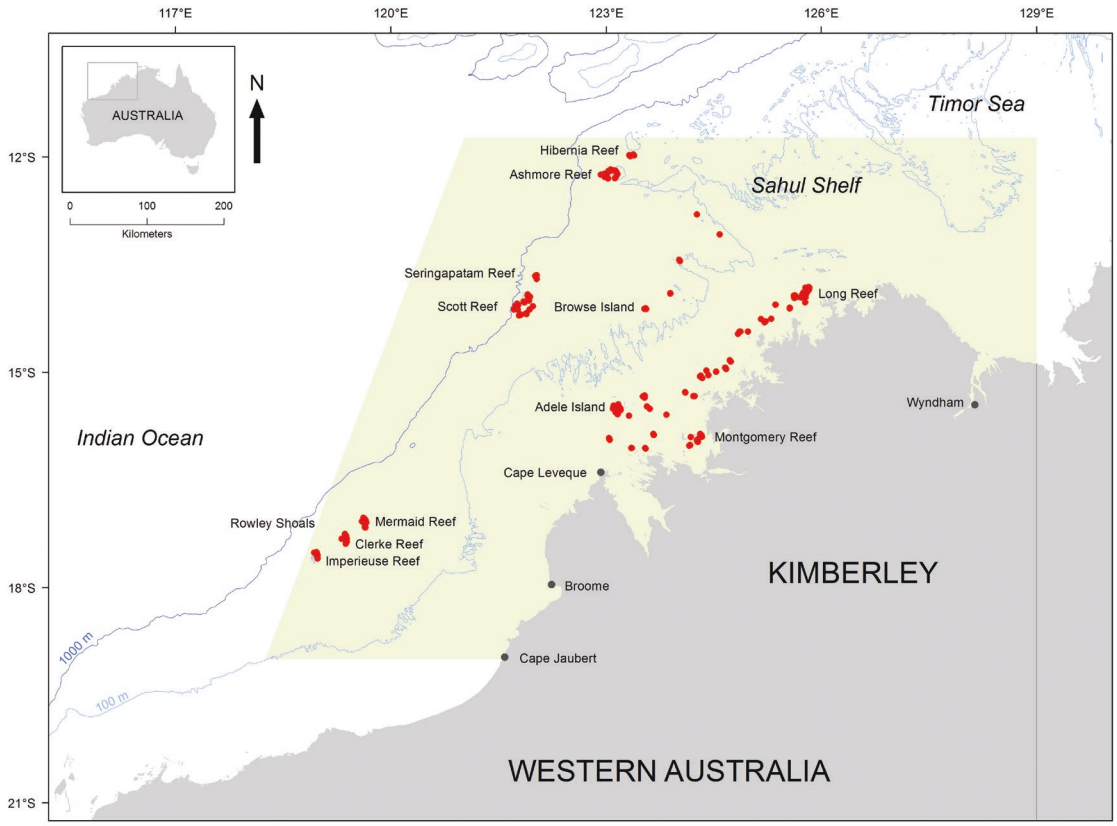


FIGURE 1 Map depicting surveyed Project stations (2009–2014) and the survey stations undertaken in 2006 (Mermaid, Scott and Seringapatam Reefs). Station details can be found in Table 1. Project Area is delineated by the light green (~476,000 km$^2$).

The second component (2009–2014) of the Kimberley Project comprised a series of six surveys within the Project Area that also defined the data capture area for the historical component. This paper is the first in a series concerning these surveys, with other papers covering water quality, transect habitat data and biodiversity data from the same nine marine taxa targeted during the historical component. The scope of this initial paper is to provide an overview of the Project's general survey methodology and to present station geomorphic data and does not present biological data. As such, this paper will provide comprehensive meta-data underpinning the other papers in this series, which are currently in preparation. Method nuances, composition of collected specimen vouchers, biodiversity inventory records and transect abundance data will be detailed and discussed within each of the taxa papers constituting this series.

## PROJECT AIMS

The aims of the project were threefold: to record the shallow water (<30 m) marine flora and fauna (restricted to fishes and targeted invertebrates – see Methods) along with associated transect habitat and geomorphic data from surveyed stations throughout the Project Area; to collect appropriate voucher specimens for lodging in Australian natural science collections; and to provide information on survey station geomorphology, biodiversity and associated biogeography.

The aim of the present paper is to provide an overview of the Project's general survey methodology and to present station geomorphic data.

## PROJECT METHODS

### PROJECT OVERVIEW

Marine fieldwork in the Kimberley is logistically difficult and expensive, and has significant occupational health and safety issues associated with it. Strong currents, macro-tides, dangerous marine life and the remote location require careful planning. Balancing safe work activities with subtidal and intertidal survey locations against project logistical constraints, such as available time and funding required the exclusion of mangroves and soft sediment habitats (e.g. extensive sandy spines at Montgomery and Long Reefs) from the survey program. Further rationalisations concerning Project occupational health and safety

were also undertaken by limiting survey work away from nearshore coastal islands and river mouths where crocodile densities are highest and water turbidity a complicating factor.

The six shallow water (<30 m) surveys were undertaken during the months of September to October 2009–2014, one trip annually. The Project surveys ranged from Fraser Island, just north of Cape Leveque, to Long Reef in the far north Kimberley (a straight line distance of ~400 km); westward to the atolls and reefs at the edge of the continental shelf (~300 km from shore), including the midshelf shoals and Browse Island from Hibernia Reef in the north to Imperieuse Reef (Rowley Shoals) in the south (~680 km).

The Project Area was divided into continental-shelf *zones*, using the following bathymetric ranges: inshore (coastal shoreline to 50 m), midshelf (51–150 m) and offshore (>150 m). Within these broad zones, locations (defined below) were chosen from the available reefs, to maximise spatial spread of the stations (defined below).

For the purpose of these surveys a 'location' was defined as a recognisable geographical point observable on standard navigation charts. The locations would fall within one of the three bathymetric zones (inshore, midshelf or offshore) contained within the Project Area. These locations may or may not have a name as confirmed by the Western Australian Geographic Names Committee. At each location one or more survey 'stations' were undertaken, defined as a geographical point adjacent to or part of a location and identified by latitude and longitude (Table 1).

The completed survey stations (Figure 1 and Table 1) spanned approximately four degrees of longitude and six degrees of latitude, within the greater Project Area (~476,000 km$^2$), providing significant latitudinal and longitudinal biological gradient possibilities. This coverage included many of the outer inshore island and reef groups, several of the midshelf shoals and all of the shelf-edge atolls, except for South and North Scott Reefs and Seringapatam Reef, which were surveyed by WAM in 2006, along with Mermaid Reef (Rowley Shoals) (Bryce 2009). This latter reef was re-surveyed as part of this project in 2014 (Table 2).

## STATION DATA OVERVIEW

Numbering of the stations followed a sequential format from project start to finish (1–181) with differentiation made for each survey year (K9, K10, K11 etc.), i.e. station 1 would be 1/K09, while station 181 would read 181/K14. Stations from the 2006 Scott Reef survey were annotated as s1–s45 to differentiate them.

At all stations, except for the nine non-transect stations (Table 1 and see below), encountered targeted taxa were recorded, vouchers collected and species abundances determined. Station effort was standardised by limiting survey time to one hour. Once transect sampling had been completed any remaining time was spent off-transect recording and vouchering targeted taxa. The non-transect stations were the result of either logistical constraints (16/K09, 121/K12 and 181/K13) or depth of water (107/K12–109/K12 and 146/K13–148/K13). These latter stations were from the midshelf region where shallowest dive depths were approximately 20 m resulting in limited bottom times and complicated by an open ocean aspect rendering transect survey work risky and difficult (see Table 1). Data recorded for the non-transect stations were similar to the transect stations, except for the absence of habitat and species abundance counts.

## TRANSECT STATIONS

Stations were classified as either intertidal or subtidal. At 'intertidal' stations, sponges, hard corals, soft corals, molluscs, crustaceans, echinoderms and marine worms were recorded quantitatively along 50 m transect tapes. Fish were collected and recorded qualitatively from tide pools, and marine plants were collected throughout the stations, but covering as many habitat types as possible. Some intertidal stations were dived or snorkelled when the sites were covered by water.

'Subtidal' dive stations were surveyed similarly to the intertidal stations. The seven invertebrate taxa were recorded along 50 m transects laid at approximately 12 m depth. Fish were recorded on depth-decreasing, timed swims of 60 minutes, equating to a swim distance between 250–300 m. Marine plants were recorded by using a station-wide sampling approach across representative habits. It should be noted that the station transect depth and maximum depth (see Table 1) were absolute, relative to the prevailing tide height. This was necessary due to the macrotidal environment and logistics.

## TRANSECT BENTHIC COVER

Where possible, subtidal and intertidal transects (except for fish and marine plants) were recorded on video or point intercept data were collected to quantify habitat cover proportions (Richards et al. 2018). Transect rugosity was also determined using a 10 m chain and tape method (Risk 1972) at three replicates per transect, for stations surveyed in years 2011–2014.

## WATER QUALITY

Water quality measurements were recorded at most stations during 2011–2014 and these will be reported on separately.

TABLE 1 Station and habitat data for 181 stations, including aborted stations 70/K11 and 71/K11, for the survey period 2009–2014.

| Date | | Site | Station / K09 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
|---|---|---|---|---|---|---|---|---|
| | | **ADELE ISLAND** | | | | | | |
| 13/10/2009 | 12:50pm | Dive: sublittoral fore-reef slope | 1 | S15.52343° | E123.20053° | 20 | 14 | 5 |
| | | Patch reef: Rocky outcrop with vertical sides deeply undercut and ledged to seaward. Outcrop sloped back to shoreward to broken ground with scattered, smaller outcrops. Coarse coralline sands in the interspaces – site dusted with very fine silt. Encrusting corals, sea whips and hydroids. | | | | | | |
| 14/10/2009 | 8:00am | Dive: sublittoral fore-reef slope | 2 | S15.5192° | E123.19572° | 14 | 11 | 5 |
| | | Patch reef shoreward of 1/K09: Shallow patch reef of small and large rocky outcrops on a slope of coarse coralline sand overlaid with fine silt. Larger outcrops coalesced to form a seaward edge of the reef crest. Outcrops were vertically sided, ledged and undercut; covered in hard and soft corals. | | | | | | |
| 14/10/2009 | 1:00pm | Intertidal: midlittoral reef platform | 3 | S15.52833° | E123.19352° | 0 | 0 | N/A |
| | | Inshore of 1/K09 and 2/K09: A porous reef platform consisting of shallow tidal pools and drainage channels with coarse coralline sand and coral gravel. Macro algae and small coral colonies dominated the reef tops with scattered turnable coral rubble evenly spread. Large specimens of the giant clam, *Tridacna squamosa* present in some pools. | | | | | | |
| 14/10/2009 | 3:15pm | Dive: sublittoral fore-reef slope | 4 | S15.50062° | E123.19753° | 15 | 13 | 6 |
| | | Vertical wall with encrusting corals and bare rock dusted with fine silt. Wall ledged and undercut with a silty, rubble strewn slope continuing down from 16 m. | | | | | | |
| 15/10/2009 | 8:00am | Dive: sublittoral channel slope | 5 | S15.4576° | E123.17438° | 16 | 12 | 8 |
| | | Edge of Frazer Inlet: Small and large rocky outcrops with corals, hydroids and soft coals. Outcrops deeply ledged and undercut. Between outcrops small coral colonies and large coral rubble slabs scattered over very fine sediment (silt), with coarse sands beneath. | | | | | | |
| 15/10/2009 | 1:30pm | Dive: sublittoral channel slope | 6 | S15.4446° | E123.17082° | 21 | 12 | 8 |
| | | Edge of Frazer Inlet: Large rocky outcrops forming a broken vertical wall, deeply ledged and undercut. To seaward another line of large outcrops forming a similar wall. General impression is of a long-reef spur and groove topography. Walls covered with hard and soft corals with exposed rock dominating at deeper depths (20 m). Sediment is fine (silt) with deeper gullies having coarse coralline sand. | | | | | | |
| 15/10/2009 | 3:15pm | Intertidal: midlittoral reef platform | 7 | S15.49123° | E123.1633° | 0 | 0 | N/A |
| | | Reef platform at head of Frazer Inlet: Platform heavily etched with small drainage channels giving a crumbly, porous appearance. Several low, widely spaced ridges run parallel to the reef edge with long, rubble filled pools between. Ridges are a series of long, low, yet wide, corrugations. Turnable coral rubble plentiful, platform covered with the macro algae, *Padina* sp. | | | | | | |

| Date | | Site | Station / K09 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
|---|---|---|---|---|---|---|---|---|
| 16/10/2009 | 8:30am | Dive: sublittoral back reef slope | 8 | S15.4624° | E123.10335° | 6 | 6 | 12 |
| | | North west corner of reef. Reef pavement with thin covering of coarse coralline sand, coral rubble dominated by macro algae, *Sargassum.* Small isolated coral outcrops scattered about with a reasonable diversity of echinoderms. | | | | | | |
| 16/10/2009 | 1:00pm | Dive: sublittoral fore-reef slope | 9 | S15.50413° | E123.0961° | 18 | 12 | 10 |
| | | Sloping rock pavement shallowing to a series of large, low and flat rocky outcrops at the slope crest (12 m). Outcrops appear to have coalesced with shallow channels defining their edges (i.e. running parallel and across the reef front). Channels vertically sided and undercut, coarse coralline sand covered with fine silt. Outcrops free of sand or silt and covered with soft and encrusting plate-coral with numerous colonies of bryozoa. Reef was swept by strong tidal currents evidenced by biota assemblages and lack of any sediment coating. | | | | | | |
| 17/10/2009 | 8:00am | Dive: midlittoral back reef slope | 10 | S15.54048° | E123.12772° | 3.5 | 3.5 | 12 |
| | | Intertidal high energy site: Current swept, cemented reef platform with many depressions leading to a labyrinth of under-platform tunnels. Reef depressions with coarse sand and coral rubble slabs. Live "coral nodules" of several species evident in depressions. | | | | | | |
| 17/10/2009 | 1:00pm | Dive: midlittoral back reef slope | 11 | S15.58158° | E123.16322° | 2.5 | 2.5 | 10 |
| | | Intertidal site: Similar to 8/K09: Reef pavement with thin covering of coarse coralline sand, coral rubble, dominated by the macro-alga, *Sargassum.* Small isolated coral outcrops and coral rubble slabs scattered about. | | | | | | |
| 18/10/2009 | 8:00am | Dive: sublittoral fore-reef slope | 12 | S15.58017° | E123.15733° | 11 | 7.5 | 8 |
| | | Large, loosely packed rocky outcrops with encrusting coral cover. Outcrops have steep sides and were deeply undercut and ledged. As a geomorphic unit they created a broken rampart in front of the reef platform. Spaces between the outcrops formed a labyrinth of white sandy channels free of rubble and coral debris. More extensive areas of sand had large, widely spaced sand ripples – evidence of rolling surf. | | | | | | |
| 18/10/2009 | 1:30pm | Dive: sublittoral fore-reef slope | 13 | S15.55773° | E123.13402° | 17 | 11 | 8 |
| | | Similar to 12/K09 except for presence of smaller sand ripples and covering of fine silt over all, but the very tops of larger outcrops. | | | | | | |
| | | **MONTGOMERY REEF** | | | | | | |
| 19/10/2009 | 5:30am | Intertidal: lower-littoral reef platform | 14 | S15.89692° | E124.32552° | 0 | 0 | N/A |
| | | Steep, narrow fore-reef ramp of consolidated coral rubble (porous) rising to a flat midlittoral zone at 15/K09. Ramp was cut with major and minor drainage channels. Water flow was constant and gravity forced throughout the tidal period, both down the channels and through the reef itself. Small coral colonies, sponges and macro-algae dominated. | | | | | | |

| Date | | Site | Station / K09 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
|---|---|---|---|---|---|---|---|---|
| 19/10/2009 | 6:45am | Intertidal: midlittoral reef platform | 15 | S15.89718° | E124.32397° | 0 | 0 | N/A |
| | | Terrace of flat reef with low, flat-topped, long-shore ridges consisting of consolidated coral rubble, sand and Rhodolith nodules. Tide pools between the ridges were of differing depths, but shallow and elongate with coarse sand, coral rubble slabs and macro algae. | | | | | | |
| 19/10/2009 | 4:30pm | Intertidal: midlittoral reef platform | 16 | S15.91905° | E124.29552° | 0 | 0 | N/A |
| | | Biodiversity collection site: This was due to the tide still running and loss of daylight. A steep forward ramp leading to a terrace with wide and raging tide drainage channels on either side. Terrace had long-shore ridges of rubble, Rhodolith and sand. Differential deposition was evident with the lighter sand being deposited along the front edge of the ridges with the back edges damming the pools. Small isolated coral colonies were numerous, especially in the pools. | | | | | | |
| 20/10/2009 | 5:45am | Intertidal: lower-littoral reef platform | 17 | S15.85538° | E124.31458° | 0 | 0 | N/A |
| | | Low, flat reef platform forming a peninsula consisting of consolidated rock and coral rubble with a dense covering of *Sargassum*. Tide pools were long-shore, with coarse sand and coral rubble. | | | | | | |
| 20/10/2009 | 7:15am | Intertidal: midlittoral reef platform | 18 | S15.87647° | E124.32988 | 0 | 0 | N/A |
| | | A sculptured, brittle reef platform with many interlocking pools containing dead coral slabs. There were many small colonies of hard and soft corals around the edge of the pools, which were undercut and with coarse, coralline sand. | | | | | | |
| 20/10/2009 | 8:20am | Intertidal: midlittoral reef platform | 19 | S15.87878° | E124.3267° | 0 | 0 | N/A |
| | | Flat consolidated reef platform with cropped algae, sand and small coral colonies. Pools were shallow, filled with Rhodolith nodules, coral rubble and sand. This site was separated from the previous (18/K09) by a band of coral rubble that did not appear to be high enough to form a rampart. | | | | | | |
| 21/10/2009 | 7:40am | Intertidal: midlittoral reef platform | 20 | S15.89825° | E124.18168° | 0 | 0 | N/A |
| | | Steep consolidated reef ramp, with a coating of fine grey silt and cut by fast flowing drainage channels. Ramp face was bare, pitted 'beach rock' with many hard and soft coral colonies, especially where drainage channels cut the face. Base of ramp had a tidal moat contained to seaward by sand flats. Sand flats were large and bisected by fast flowing tidal channels. Ramp rose to a flat, terraced reef-platform, which did not appear to completely drain or stop flowing. Terrace with macro-algae, small patches of sparse seagrass (*Thalassia* sp.) and clean, coralline sand dominated. Transects were laid out on the terrace. | | | | | | |
| 22/10/2009 | 6:34am | Intertidal: midlittoral reef platform | 21 | S15.9597° | E124.26907° | 0 | 0 | N/A |
| | | Steep consolidated pavement with algal turf, small tidally bossed coral colonies – aspect was of a smooth yet porous reef. The lower-littoral section of the station had formed a sand, coral and coral rubble bench, which was not repeated along the channel with any consistency. | | | | | | |
| 22/10/2009 | 7:47am | Intertidal: midlittoral reef platform | 22 | S15.94432° | E124.26673° | 0 | 0 | N/A |
| | | A channelled ramp extended to a terrace with a long-shore containment ridge (116 m wide) of sand, coral rubble and Rhodolith nodules. Station was established lagoon side of the containment. Limestone pavement with sand and coral rubble, live corals and macro-algae dominated. Pavement gave way to a series of deeper elongated pools (running long-shore). Site was flooded but may dry on a spring tide. | | | | | | |

| Date | | Site | Station / K09 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
|---|---|---|---|---|---|---|---|---|
| 22/10/2009 | 9:05am | Intertidal: lower-littoral reef platform | 23 | S15.96815° | E124.28197° | 0 | 0 | N/A |
| | | Flat lower-terrace of coral rubble and macro-algae with inter-spaces of coralline sand that at checked points was approximately 10 cm deep. Small colonies of coral were common but more numerous towards the channel. There is a possibility that this zone may be part of the main lagoon. | | | | | | |
| 23/10/2009 | 7:27am | Intertidal: midlittoral reef platform | 24 | S16.01442° | E124.17315° | 0 | 0 | N/A |
| | | Gently sloping ramp extending to a porous, terraced reef-platform. The site was bordered by fast running drainage channels with lower areas dusted with fine silt. The slope scattered with tidal pools. | | | | | | |
| 23/10/2009 | 8:32am | Intertidal: midlittoral reef platform | 25 | S16.01192° | E124.17077° | 0 | 0 | N/A |
| | | Flooded and terraced reef platform leading to a long-shore Rhodolith, sand and coral rubble containment ridge. Platform and containment ridge covered with macro algae (*Sargassum*). Contained lagoon shallow with many sand ridges backed by deeper troughs. Dead coral and giant clams may indicate a very motile environment where moving sand ridges periodically cover the live sessile biota then over time expose the dead skeletons. | | | | | | |
| 23/10/2009 | 9:58am | Intertidal: midlittoral reef platform | 26 | S16.02067 | E124.15912 | 0 | 0 | N/A |
| | | A gently sloping ramp of consolidated rock and rubble with macro algae (*Sargassum*). Crest of the ramp acted as a containment ridge for the flooded lagoon. The contained lagoon was shallow with many sand ridges backed by deeper troughs. Dead coral and giant clams may indicate a very motile environment where moving sand ridges periodically cover the live sessile biota then expose the dead skeletons. | | | | | | |
| 24/10/2009 | 7:00am | Intertidal: midlittoral reef platform | 27 | S15.895° | E124.339° | 0 | 0 | N/A |
| | | Consolidated reef platform with tidal pools and a small amount of coral rubble. Algal turf and cropped macro-algae cover the platform, but nearest to the water the rocks were bare. | | | | | | |

| Date | | Site | Station / K10 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
|---|---|---|---|---|---|---|---|---|
| | | **CASSINI ISLAND** | | | | | | |
| 14/10/2010 | 9:30am | Dive: sublittoral fore-reef slope | 28 | S13.95663° | E125.63877° | 20 | 12 | 5 |
| | | Patch reef on a gentle slope: small rocky outcrops with coral rubble and dead coral slabs in the interspaces and fine sediment between. Inshore, the outcrops coalesced to form a more substantial reef of large scattered coral outcrops with sponges, sea fans and the soft coral, *Dendronephthya* spp., as well as the coral, *Turbinaria mesenterina,* which dominated. The site was dusted with very fine silt. | | | | | | |

| Date | | Site | Station / K10 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
|---|---|---|---|---|---|---|---|---|
| 14/10/2010 | 2:15pm | Dive: sublittoral fore-reef slope | 29 | S13.95110° | E125.64840° | 14 | 13 | 5 |
| | | Flat rocky reef gently sloping to shoreward with small to medium size coral outcrops. Fine sediment and crustose coralline rubble in the interspaces. Corals, sponges, sea whips and the soft coral, *Dendronephthya* and the coral, *Turbinaria mesenterina* dominated. The site was dusted with very fine silt. | | | | | | |
| 15/10/2010 | 8:50am | Dive: sublittoral fore-reef slope | 30 | S13.95603° | E125.62313° | 20 | 11 | 6 |
| | | Steep, forward reef slope extending down from the reef crest at 4 m to the base of a rocky slope at 20+ m. Deeper depths with low coral outcrops, rubble and coral slabs. All were dusted with fine silt. Moving up the slope communities of encrusting corals, a diverse community of soft corals (gorgonian fans, *Dendronephthya* sp. and sea whips) and hydroids (*Aglaophenia* sp.) dominated. | | | | | | |
| 15/10/2010 | 2:00pm | Dive: sublittoral fore-reef slope | 31 | S13.94252° | E125.62173° | 20 | 10 | 5 |
| | | Similar to 30/K10. Steep, forward reef slope extending down from a reef crest at 4 m to the base of a rocky slope at 20+ m. Deeper depths with occasional low coral outcrops dusted with fine silt. The whole slope was deeply incised with small caves and fissures. The slope was encrusted with corals, a diverse community of soft corals (gorgonian fans, *Dendronephthya* sp. and sea whips) and the hydroid, *Aglaophenia* sp. | | | | | | |
| 16/10/2010 | 8:00am | Intertidal: midlittoral reef platform | 32 | S13.92910° | E125.62160° | 0 | 0 | N/A |
| | | Intertidal site: A flat midlittoral reef platform with extensive *Sargassum* cover interspersed with occasional sandy blowouts. Sand coarse and coralline. Scattered small ledges and larger dead coral boulders evident. | | | | | | |
| 16/10/2010 | 8:30am | Dive: midlittoral reef platform | 33 | S13.92816° | E125.62334° | 2 | 1.8 | 8 |
| | | Intertidal site: Reef platform with large tidally restricted coral outcrops forming monolithic micro-atolls. Algal turf growing on the uppermost bare sections. A live coral fringe surrounded the edge of the micro-atoll. Large giant clams (*Tridacna squamosa* and *T. maxima*) were evident. Surrounding reef covered with algal turf and cropped *Sargassum* with fine to coarse coralline sediment. | | | | | | |
| 16/10/2010 | 2:00pm | Dive: sublittoral fore-reef slope | 34 | S13.9321° | E125.61823° | 20 | 12 | 10 |
| | | Steep forward reef slope extending down from the reef crest at 6 m to the base of a rocky slope at 20+ m. Deeper depths are mostly bare, silt-dusted, rocky outcrops with a diverse community of soft corals. The station was unusual with no encrusting bivalves, such as *Hyotissa* or *Chama*. Shallower zones (15 m to 6 m) were cut with surge channels and steep walled fissures. A diverse community of hard coals, encrusting soft corals and hydroids dominated the shallower depths – there was very little molluscan life or dead shell. | | | | | | |
| 17/10/2010 | 10:00am | Dive: midlittoral reef platform | 35 | S13.94119° | E125.62308° | 3 | 3 | 15 |
| | | Intertidal site: Flat consolidated reef pavement behind the reef crest leading to a small embayment. Sand and cropped *Sargassum* with occasional turnable coral rubble. Large, steep sided depressions formed tidal pools in the reef with coarse coralline sand and coral rubble floors. Internal rim of the depressions were fringed with corals. Holothurians *(Holothuria* spp., *Stichopus chloronotus*) of several species were conspicuous. | | | | | | |

| Date | | Site | Station / K10 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
|---|---|---|---|---|---|---|---|---|
| 17/10/2010 | 2:00pm | Dive: sublittoral fore-reef slope | 36 | S13.94960° | E125.62073° | 20 | 11 | 10 |
| | | Steep forward reef slope extending down from the reef crest at 5 m to a rocky slope at 20+ m. At this depth the slope was deeply fracture and the rock surfaces silt dusted. There was a diverse community of soft corals and some encrusting corals. At the shallower depths there was a high diversity of hard and soft corals. | | | | | | |
| 18/10/2010 | 8:00am | Dive: midlittoral reef platform | 37 | S13.95156° | E125.62412° | 3 | 3 | 10 |
| | | Flat consolidated reef pavement behind the reef crest with a high density of the bivalve mollusc, *Chama* sp. Large, steep-sided depressions in the reef formed what would be coralline sand and coral rubble floored tidal pools at low tide. Fringing corals lined the rim of the depressions. | | | | | | |
| 18/10/2010 | 9:30am | Dive: midlittoral reef platform | 38 | S13.96087° | E125.62395° | 8 | 4 | 10 |
| | | An outer reef lower-mid littoral reef platform station circumscribing a large tidal pool complex with coral outcrops and fringed with corals. The pool sediment was very fine and heavily mixed with coral rubble fragments and turnable coral slabs. The whole site was well covered with live coral, hydroids and other sessile marine life. | | | | | | |
| 18/10/2010 | 2:15pm | Dive: sublittoral fore-reef slope | 39 | S13.93453° | E125.63797° | 20 | 11 | 15 |
| | | Gently inclined sandy slope of coarse coralline sediment extending from 20+ m to the shallower depths. Coral outcrops were sparse at the deeper end, increasing in both number and size towards the shallower depths. Coral rubble and dead coral slabs between the outcrops increased correspondingly. The deeper, smaller outcrops were festooned with large sponges, while the shallower and larger coral outcrops were covered with a diverse coral community with many encrusting bivalve molluscs (*Hyotissa sinensis* and *Lopha cristigalli*). | | | | | | |
| 19/10/2010 | 8:30am | Dive: sublittoral fore-reef slope | 40 | S13.92577° | E125.63702° | 20 | 12 | 5 |
| | | A gentle rocky slope covered with fine sediment extending from 20+ m. Many corals, gorgonian fans and sponges were evident. From 15 m to 5 m there were larger rocky outcrops with coral rubble in between, which increased towards the shallower depths. There was a high diversity of both tabular and branching *Acropora* species forming high relief with good understory cover. Fish numbers increased in the shallower depths. | | | | | | |
| 19/10/2010 | 1:00pm | Dive: midlittoral reef platform | 41 | S13.93026° | E125.63647° | 8 | 3 | 8 |
| | | A flat, rocky platform covered with sessile marine life and a high diversity of corals. Small outcrops with both tabular and branched coral were evident. In the interspaces there was coralline sand with a dusting of fine silt. Large patches of coral rubble were also intermittently present. | | | | | | |
| 19/10/2010 | 2:30pm | Dive: midlittoral reef platform | 42 | S13.93463° | E125.63551° | 5 | 3 | 8 |
| | | A flat and gently sloping reef platform with small, sparse outcrops supporting some hard corals and other sessile marine life. Urchins (*Diadema setosum*) were plentiful. Interspaces with coral rubble with small areas of coralline sands. Occasional larger outcrops were evident with tabular coral forming numerous shaded recesses. | | | | | | |

| Date | | Site | Station / K10 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| | | **LONG REEF** | | | | | | |
| 20/10/2010 | 9:30am | Dive: sublittoral fore-reef slope | 43 | S13.92155° | E125.73268° | 20 | 12 | 8 |
| | | Steep outer reef wall descending to 20+ m where the bottom is of fine silt; scattered about were isolated rocky outcrops with very few sponges or soft corals. Rising from this deeper depth, the honeycombed wall extended upwards with encrusting corals and soft corals, which rapidly increased in coverage. This first rise was at 15 m then descended to a long-reef gutter. Across the gutter the reef, still honeycombed with deep, steep sided crevasses, rose again to 4.5 m. Wall and upper levels had extensive coral cover with a high diversity of the plate coral, *Porites*. | | | | | | |
| 20/10/2010 | 12:00pm | Dive: sublittoral fore-reef slope | 44 | S13.88867° | E125.74942° | 20 | 10 | 8 |
| | | Steep and fractured outer reef with a near vertical wall extending from 20+ m to 4 m. The wall is heavily pocked with small caves and deep, steep-sided fissures. At 20 m there were large rocky outcrops forming long-reef gullies with the wall on the other side almost devoid of life, probably due to the heavy siltation. Sediment in between the rocky outcrops was very fine and smothering. Some scattered soft corals and occasional encrusting corals occurred at this depth. The latter increasing as the depth decreased. | | | | | | |
| 20/10/2010 | 3:00pm | Intertidal: midlittoral reef platform | 45 | S13.88893° | E125.75087° | 0 | 0 | N/A |
| | | Flat reef pavement with algal turf just behind the reef crest. Station had a small lower terrace and reef ramp similar to Montgomery Reef, but significantly less pronounced. A system of tidal pools, with fringing coral colonies and coarse coralline sands, increased in number with distance from the reef crest. | | | | | | |
| 21/10/2010 | 11:00am | Dive: sublittoral reef platform | 46 | S13.85676° | E125.82485° | 3 | 3 | 5 |
| | | Submerged flat reef of consolidated pavement with extensive covering of *Sargassum.* Extensive coral rubble areas overlaying coarse coralline sand were evident in the depressions. Scattered, dead coral slabs with soft corals and isolated coral colonies were sparsely distributed over the area. | | | | | | |
| 21/10/2010 | 2:00pm | Dive: sublittoral patch reef | 47 | S13.81995° | E125.83393° | 6.4 | 6 | 2 |
| | | Edge of a shallow coral reef sloping down one metre to a floor of coralline sand overlaid with fine silt. Extensive areas of coral rubble with turnable coral slabs edged the reef. Small, isolated coral outcrops dotted the sand areas. Two large, steep sided coral outcrops with encrusting corals were included along the transect. The coral reef had massive and encrusting corals, as well as thickets of *Acropora.* | | | | | | |
| 21/10/2010 | 4:00pm | Intertidal: midlittoral reef platform | 48 | S13.83015° | E125.83257° | 0 | 0 | N/A |
| | | Boulder zone at the reef front edge, which gently sloped back (boulders decreasing) to a coral rubble plain forming a lagoonal containment. The rubble plain was covered with algal turf but generally devoid of sessile life. The lagoon edge was shallow but appeared rich in coral life. This site was reminiscent of Montgomery Reef but with less dramatic topography. | | | | | | |
| 22/10/2010 | 11:00am | Dive: sublittoral reef platform | 49 | S13.90180° | E125.79108° | 2 | 2 | 5 |
| | | Possible intertidal site: Coarse coralline sand over rocky pavement with scattered coral rubble and turnable coral slabs. *Sargassum* covered much of the site. Some soft and hard corals scattered about. | | | | | | |

| Date | | Site | Station / K10 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| 22/10/2010 | 2:00pm | Dive: lagoon | 50 | S13.91545° | E125.77433° | 2 | 2 | 5 |
| | | Inner lagoon dive near a sand cay. Rocky pavement overlaid with coarse coralline sand and coral rubble. Both medium and small sized outcrops with coral colonies and the sponge, *Phyllospongia* was evident. | | | | | | |
| 22/10/2010 | 4:10pm | Intertidal: midlittoral reef platform | 51 | S13.95334° | E125.78288° | 0 | 0 | N/A |
| | | Lower midlittoral reef flat edge with the appearance of a forward reef ramp. Several fast flowing water channels bisected the site. The platform appeared to have been formed from consolidated coral rubble and coral slabs. *Sargassum* and other algae were dominant. | | | | | | |
| 23/10/2010 | 5:30am | Intertidal: midlittoral reef platform | 52 | S13.80989° | E125.82413° | 0 | 0 | N/A |
| | | Honeycombed reef flat with coral rubble and dead coral slabs. Rubble formed wide poorly defined, flat-toped ridges. Reef was very crumbly where the coral had overgrown small depressions and troughs. Very few molluscs and no dead shell were evident on the sand or rubble tidal pool floors. | | | | | | |
| 23/10/2010 | 9:00am | Dive: sublittoral fore-reef slope | 53 | S13.81868° | E125.77966° | 20 | 12 | 5 |
| | | Fore-reef vertical wall extending down to 20 m where the sediment was very fine. Wall was deeply undercut at this depth with no sessile growth or molluscs. Corals, sponges and other life began at around 15 m with increased coverage to 5 m where corals, sponges and hydroids dominated. | | | | | | |
| 23/10/2010 | 2:00pm | Dive: lagoon | 54 | S13.83208° | E125.81186° | 2 | 2 | 8 |
| | | Shallow broken coral reef extending into a low profile *Acropora* thicket. Interspaces with fine coralline sands and rubble. Turnable coral slabs with a low level of encrusting sessile life. | | | | | | |
| 23/10/2010 | 4:30pm | Intertidal: midlittoral reef platform | 55 | S13.81973° | E125.78002° | 0 | 0 | N/A |
| | | Flat midlittoral reef pavement with algal turf cover and steep-sided tide pools. Pools were fringed with small coral colonies and had coralline sand and rubble floors. Reef extended down to a narrow, honeycombed fore-reef ramp. Back towards the reef centre, but within the station confines, the pavement was lined with low containment ridges. These dammed the water forming terraces. Sediment cover decreased seaward to the reef edge where constant drainage had swept the pavement clean. This site was reminiscent of Montgomery Reef but with less dramatic topography. | | | | | | |
| 24/10/2010 | 5:45am | Intertidal: midlittoral reef platform | 56 | S13.95704° | E125.71846° | 0 | 0 | N/A |
| | | Flat midlittoral reef pavement with algal turf cover and sloping-sided tide pools. Pools were fringed with small coral colonies. Some had small coral covered outcrops with coralline sand and rubble floors. The reef extended down to a narrow, honeycombed fore-reef ramp. This ramp had a very high cover (mean coverage 27%) of the soft coral, *Tubipora* sp. The reef was terraced (10–20 cm in height) forming small drainage waterfalls. This site was similar in structure to Montgomery Reef, but to a less dramatic extent. | | | | | | |
| 24/10/2010 | 11:15am | Dive: sublittoral fore-reef slope | 57 | S14.02517° | E125.77409° | 20 | 11 | 7 |
| | | Steep scree-slope made up of coral rubble and slabs with large to medium rocky outcrops. At shallower depths these were covered with corals, hydroids and gorgonian fans. At various points of the transect broken coral reef, with rubble interspaces, abutted the coral outcrops. At deeper depths (15–20+ m) the outcrops were bare and covered with fine silt but sea whips, sponges and a few coral colonies were observed. | | | | | | |

| Date | | Site | Station / K10 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| | | **CASSINI ISLAND (continued)** | | | | | | |
| 24/10/2010 | 2:00pm | Dive: fore-reef slope | 58 | S13.94216° | E125.64340° | 20 | 12 | 15 |
| | | Gently sloping gradient with undercut coral outcrops covered in soft corals *(Dendronephthya* sp. and various sea fans), encrusting corals, sponges and hydroids. Undercuts had a heavy encrustation of the bivalve molluscs, *Hyotissa sinensis* and *Lopha cristigalli*. Sediment was very fine but not covering the outcrops. Evidence of heavy ray predation at base of outcrops where sediment was disturbed. | | | | | | |
| 25/10/2010 | 5:45am | Intertidal: midlittoral reef platform | 59 | S13.93366° | E125.61908° | 0 | 0 | N/A |
| | | Flat reef pavement with an extensive cover of *Sargassum* over a dusting of sediment. Seaward, the *Sargassum* was replaced by corals and algal turf covered pavement. Shallow tidal pools covered an extensive area of the station and these had an extensive cover of fringing hard corals with numerous soft corals. Floor of the pools were of coarse coralline sand, rubble and dead coral slabs Reef front was heavily fractured and honeycombed with an extensive cover of coralline algae amid the coral growth. | | | | | | |
| 25/10/2010 | 7:00am | Intertidal: midlittoral reef platform | 60 | S13.96199° | E125.62469° | 0 | 0 | N/A |
| | | Flat reef pavement covered with algal turf and long-shore, shallow tidal pools. Some scattered large boulders were evident inshore of the station. The reef front was heavily fractured and honeycombed with an extensive cover of coralline algae amid the coral growth. Pools had an extensive assemblage of fringing hard corals. Floor of the pools were of coarse coralline sand, rubble and dead coral slabs. | | | | | | |

| Date | | Site | Station / K11 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| | | **WILDCAT REEFS** | | | | | | |
| 14/10/2011 | 4:45pm | Intertidal: midlittoral reef platform | 61 | S15.28229° | E124.10500° | 0 | 0 | N/A |
| | | Flat fractured reef platform with cemented coralline boulders. Many isolated encrusting corals and algal turf patches. Platform has small shallow tidal pools with white coralline sediment, and the pool edges fringed with *Sargassum.* The holothurian, *Hothothuria leucospilota* was very abundant. | | | | | | |
| | | **CHAMPAGNEY ISLANDS** | | | | | | |
| 15/10/2011 | 6:28am | Intertidal: midlittoral reef platform | 62 | S15.33242° | E124.23597° | 0 | 0 | N/A |
| | | Crumbly, rubble-strewn reef platform (biscuit reef) with a fine dusting of silt. Large and small sized coral rubble scattered over the area, with many shallow tide pools. The station was on the edge of a large *Sargassum* meadow. Many shallow tide pools. The small octopus, *Ameloctopus litoralis* was abundant. | | | | | | |

| Date | | Site | Station / K11 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| 15/10/2011 | 7:45am | Intertidal: midlittoral reef platform | 63 | S15.33074° | E124.21692° | 0 | 0 | N/A |
| | | Cemented reef platform with shallow tidal pools containing coarse coralline sand. The whole area was dusted with fine silt. A large reef of *Heliopora coerulea*, undercut with large, clear tide pools, was situated to one side of the station. Some turnable rubble and small patches of algal turf were present. | | | | | | |
| | | **WHITE ISLAND** | | | | | | |
| 15/10/2011 | 2:00pm | Dive: patch reef | 64 | S15.05540° | E124.31065° | 15 | 12 | 1.5 |
| | | Patch reef on a gentle slope consisting of many isolated coral outcrops of high topographical relief. Outcrops are steep sided and deeply undercut. The tops and sides are festooned with a diverse community of corals. Interspaces are of coarse coralline sand intermixed with fine silt to form a cloying substrate littered with coral rubble of varying sizes. Many fish were present as well as a significant number of the urchin, *Diadema setosum*. | | | | | | |
| 16/10/2011 | 7:00am | Intertidal: midlittoral reef platform | 65 | S15.04597° | E124.32135° | 0 | 0 | N/A |
| | | High Energy reef platform on the exposed side of White Island. Platform edge with a diverse array of coral colonies and small surge channels forming a crumbly reef edge. The actual platform was consolidated with small shallow tidal pools, colonies of branching *Acropora* and algal turf. There was very little sediment covering the platform. Sampling of the site was cut short (30 min) due to the rising tide. | | | | | | |
| 16/10/2011 | 8:00am | Intertidal: midlittoral reef platform | 66 | S15.05950° | E124.32514° | 0 | 0 | N/A |
| | | Flat cemented reef pavement with shallow tide pools with sloping sides down to a sand and rubble. The platform was pocked with small drainage channels, but otherwise had very little topographical relief. The platform was covered with closely cropped algal turf and sand. | | | | | | |
| | | **BLACK ROCKS** | | | | | | |
| 16/10/2011 | 1:00pm | Dive: sublittoral fore-reef slope | 67 | S15.0391° | E124.4278° | 20 | 14 | 2 |
| | | Reef slope with small coral-encrusted outcrops. Whole area was indicative of a high energy reef with many sea whips (*Junceella fragilis*) and other soft corals. Reef base littered with coral rubble and coarse sediment in the interspaces. The hydroid, *Aglaophenia cupressina* was very abundant. Large *Montipora* colonies were abundant; *Alveopora* colonies also present. | | | | | | |
| | | **WHITE ISLAND** | | | | | | |
| 17/10/2011 | 7:30am | Dive: midlittoral reef platform | 68 | S15.07639° | E124.33999° | 16 | 14 | 6 |
| | | Similar to Stn 67/K11 except coral encrusted outcrops were larger, undercut and ledged. Dark recesses with an extensive coverage of invertebrate life. Outcrop tops with encrusting corals, hydroids and sea whips. In the interspaces the reef base was littered with coral rubble and coarse sediment, and a fine dusting of silt. | | | | | | |

| Date | | Site | Station / K11 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| | | **UN-NAMED OUTCROP NW BLACK ROCKS** | | | | | | |
| 17/10/2011 | 1:00pm | Dive: sublittoral fore-reef slope | 69 | S14.9741° | E 124.3974° | 20 | 14 | 12 |
| | | Steep forward reef slope extending up to the reef crest at 14 m. Slope dissected by narrow surge grooves with vertical sides marked by caves and ledges. Transect sited on the crest of the slope where small coral outcrops and the underlying base rock were covered with encrusting corals and soft coral communities, dominated by *Sinularia* and *Sarcophyton* as well as several species of gorgonian. Mid-dive the area was washed by a very turbid, rolling cloud that appeared to be tidally driven. This extended up to 10 m. The site was very rich in schooling fish that tended to stay above the sediment cloud. | | | | | | |
| | | **OSBORN REEFS** | | | | | | |
| 18/10/2011 | 8:11am | Isolated outcrop – water quality only | 70 | S15.16444° | E 124.20068° | Aborted | | |
| | | Dive aborted due to visibility and current. Isolated outer reef outcrop. | | | | | | |
| | | **ISOLATED REEF NW OF WILDCAT REEFS** | | | | | | |
| 18/10/2011 | 2:00pm | Isolated outcrop – water quality only | 71 | S15.25040° | E124.08324° | Aborted | | |
| | | Dive aborted due to visibility and current. Isolated outer reef outcrop. Current very strong as tide changed. Exploratory bounce dive showed that the visibility from 6 m down rapidly reduced to 15 cm at 15.8 m by a thick cloud of suspended rolling sediment cloud. | | | | | | |
| | | **BEAGLE REEF** | | | | | | |
| 19/10/2011 | 7:40am | Intertidal: midlittoral reef platform | 72 | S15.31946° | E123.53640° | 0 | 0 | N/A |
| | | Fractured reef pavement with many shallow tide pools both small and large. Pools with coarse coralline sand. *Sargassum* was plentiful but scattered into small clumps over the reef. Coral rubble evenly spread over the site. Most dominant marine life was *Holothuria atra* and the hard coral, *Goniastrea.* | | | | | | |
| 19/10/2011 | 9:10am | Intertidal: midlittoral reef platform | 73 | S15.32661° | E123.53571° | 0 | 0 | N/A |
| | | Flat rock pavement with shallow tide pools forming drainage channels. The whole site was inundated with sand from the main sand cay. Most dominant alga was *Sargassum,* which was also plentiful and evenly distributed over the bare rock areas. Site littered with coral rubble. | | | | | | |
| 19/10/2011 | 1:44pm | Dive: sand and coral outcrops | 74 | S15.33630° | E123.51290° | 16 | 16 | 1.5 |
| | | Sand plain with low profile isolated rocky outcrops festooned with a high diversity of sponges. Sediment was coarse and coralline with very few dead molluscs. | | | | | | |

| Date | | Site | Station / K11 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| 20/10/2011 | 8:06am | Dive: lower midlittoral reef platform | 75 | S15.35217° | E123.53654° | 13 | 12 | 1.5 |
| | | Low profile flat reef with many small outcrops, which tended to coalesce. The occasional larger coral outcrop was undercut and ledged, but with little invertebrate growth. Outcrops had a variety of sponges, encrusting hard corals and some soft corals. In the interspaces there was coralline sand with a dusting of fine silt. Large patches of coral rubble were also intermittently present. Evidence of extensive ray activity in the larger sandy areas. | | | | | | |
| | | **MAVIS REEF** | | | | | | |
| 20/10/2011 | 11:30am | Dive: sublittoral fore-reef slope | 76 | S15.47641° | E123.56820° | 14 | 10 | 1.5 |
| | | Edge of large isolated rock outcrop with steep sides and deep ledges. High diversity of hard corals and plentiful coral rubble at the base of the outcrop edge. Sediment at the deeper end was of very fine silt with coarser coralline sediment beneath. The shallower end of the site merged into a wide drainage channel forming narrow coral rubble field. | | | | | | |
| 20/10/2011 | 4:00pm | Dive: sublittoral reef | 77 | S15.50517° | E123.60825° | 11.5 | 13 | 3 |
| | | Low profile consolidated reef of small and large outcrops covered with a high diversity of invertebrate life, including sponges, hydroids, hard and soft corals. Interspaces between the outcrops were of coarse sand with a fine silt overlay, coral rubble was plentiful. | | | | | | |
| 21/10/2011 | 8:00am | Dive: sublittoral reef | 78 | S15.50519° | E123.60824° | 12 | 13 | 2 |
| | | Low profile consolidated reef of small and large outcrops covered with a high diversity of invertebrate life, including sponges, hydroids, hard and soft corals. Several large *Porites* colonies were evident and small mini-reefs had formed around them. Coral rubble was plentiful and the whole area, except for the outcrops, was covered with thick, cloying silt. | | | | | | |
| | | **ALBERT REEF** | | | | | | |
| 21/10/2011 | 12:40pm | Dive: sublittoral fore-reef slope | 79 | S15.60440° | E123.31788° | 16 | 12 | 5 |
| | | Series of large outcrops forming a consolidated reef. Outcrops ledged and undercut, but with little invertebrate life except for sunlit sides and tops. Base of outcrops with coarse coralline sand and littered with rubble. High diversity of soft corals with many large sea fans. | | | | | | |
| | | **BRUE REEF** | | | | | | |
| 22/10/2011 | 10:45am | Dive: sublittoral fore-reef slope | 80 | S15.93867° | E123.05080° | 17 | 12 | 5 |
| | | Large coral outcrop at reef edge with steep, ledged sides and undercut at the base. Little marine life, except for the turret coral, *Tubastrea*, was evident in the ledges and underside of the base. Sediment was variable with a mix of fine silt overlaying coarse coralline sand littered with coral rubble of a turnable size. Many crinoids in the outcrop pockets and encrusting corals adorned the sides and upper outcrop edge. | | | | | | |

| Date | | Site | Station / K11 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| 22/10/2011 | 1:10pm | Intertidal: midlittoral reef platform | 81 | S15.93634° | E123.04786° | 0 | 0 | N/A |
| | | Flat, cemented reef-pavement with tidal pools forming long drainage channels. Reef platform punctuated by oyster covered outcrops. Sediment of coarse coralline sand without any fine silt overlay. *Sargassum* and small coral colonies littered the platform. | | | | | | |
| 22/10/2011 | 2:15pm | Intertidal: midlittoral reef platform | 82 | S15.93243° | E123.04630° | 0 | 0 | N/A |
| | | Similar to Station 81/K11. Flat, cemented reef-pavement with tidal pools forming long drainage channels. Sediment of coarse coralline sand without any fine silt overlay. *Sargassum* and small coral colonies littered the platform. | | | | | | |
| 23/10/2011 | 8:00am | Dive: sublittoral fore-reef slope | 83 | S15.91360° | E123.03940° | 20 | 12 | 12 |
| | | Steep reef front with many encrusting and plate corals. Coralline algae covered the interspaces. Hydroids, black coral and sea whips were plentiful. Narrow surge channels with ledges containing minimal invertebrate life bisected the reef. At the bottom of the channels the sediment was very fine. Very few sponges or molluscs were evident. | | | | | | |
| | | **FRASER ISLAND** | | | | | | |
| 23/10/2011 | 1:30pm | Intertidal: midlittoral reef platform | 84 | S16.05308° | E123.35886° | 0 | 0 | N/A |
| | | Eroded reef platform with crumbly edged tide pools. Algal turf and *Sargassum* dominated the platform while coral colonies were sparse and small. Platform progressed shoreward to a sand inundated zone that a spring tide would drain forming many interconnected sandy tidal pools. This inundated zone led to a white sand beach defined by rocky headlands. The commercial trochus shell, *Tectus niloticus* and the giant clam, *Hippopus hippopus* was reasonably common. | | | | | | |
| 24/10/2011 | 8:05am | Dive: sublittoral fore-reef slope | 85 | S16.05467° | E123.35044° | 20 | 12 | 2 |
| | | Steep, undercut wall with many ledges. Large caves and recesses in some areas of the transect. There were several large outcrops just seaward of the wall. The sides and tops of the reef and outcrops were covered with encrusting corals, hydroids and sea fans. There was minimal invertebrate life within the ledges and caves, however on large soft coral, *Umbellulifera* sp. was collected from the floor of the cave. At the base of wall was a low profile reef, fine silt and some coral rubble. Many seafans and sea whips were evident. The site showed evidence (sea fans) of tidally driven long-shore currents. | | | | | | |
| | | **KING AND CONWAY ISLANDS** | | | | | | |
| 24/10/2011 | 1:00pm | Dive: sublittoral fore-reef slope | 86 | S15.87163° | E123.66347° | 15 | 11 | 2 |
| | | Cluster of large isolated outcrops, along the forward reef edge, covered with a high diversity of encrusting, branching and tabular corals. Sea whips and hydroids were common at the lower depths. Outcrops were ledged and undercut. Sediment was very fine and deep and a light dusting covered low profile outcrops at depth. | | | | | | |

| Date | | Site | Station / K11 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
|---|---|---|---|---|---|---|---|---|
| 24/10/2011 | 3:25pm | Intertidal: midlittoral reef platform | 87 | S15.87005° | E123.66517° | 0 | 0 | N/A |
| | | Sand inundated reef platform with the algae, *Sargassum* and *Sirophysalis* dominating. Shallow, algal fringed tide pools with clean coralline sand became more common towards the shore. Few turnable coral slabs were evident but a reasonable diversity of molluscs, except for the giant clams, were recorded. Corals colonies were few as were echinoderms – no holothurians were seen. | | | | | | |
| 25/10/2011 | 8:00am | Dive: sublittoral fore-reef slope | 88 | S15.85791° | E123.66049° | 18 | 12 | 3 |
| | | Steep forward slope with many small ledges and the occasional narrow chasm, both features being steep sided and ledged. Encrusting corals were common down to 16 m and many sea whips were evident over the whole site. There were very few molluscs or echinoderms. The site was dusted with fine silt. Base of slope and bottom of gullies the sediment was coarse coralline sand and rubble with a fine silt overlay. | | | | | | |
| | | **IRVINE AND BATHURST ISLANDS** | | | | | | |
| 25/10/2011 | 3:25pm | Intertidal: midlittoral reef platform | 89 | S16.05527° | E123.54637° | 0 | 0 | N/A |
| | | Crumbling reef platform (biscuit reef) with small terraces beside a long, deep tidal pool. Coral colonies numerous and their height tidally influenced. Coarse coral rubble replaced any sand sediment. Coral slabs were common with encrusting invertebrate life on the underside. Few echinoderms observed. | | | | | | |
| 26/10/2011 | 5:15am | Intertidal: midlittoral reef platform | 90 | S16.06108° | E123.55023° | 0 | 0 | N/A |
| | | Crumbling reef platform (biscuit reef) with small terraces. Small, shallow tidal pools interconnected to form cascading drainage. Coral colonies numerous and their height tidally influenced. Coarse coral rubble with patches of white sand at the base of the terraces. Coral slabs common with encrusting invertebrate life on the underside. Few echinoderms observed. | | | | | | |

| Date | | Site | Station / K12 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| | | **ROSELLA SHOALS** | | | | | | |
| 11/10/2012 | 2:11pm | Dive: sand and shell rubble plain | 91 | S15.58797° | E123.84163° | 16 | 14 | 5 |
| | | Gently sloping sediment plain of coarse coral fragments and dead shell with no emergent rocks evident. High energy, motile environment with sediment ridges 1.5 m high and 2 m wide. No echinoderms or live molluscs evident. Two species of sponge (*Cinachyrella australiensis* and *Tethya robusta)* and a single species of soft coral (*Nephthyigorgia* sp.*)* were found on exposed limestone bedrock. No fish or other taxa seen. | | | | | | |

| Date | | Site | Station / K12 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| | | **WILDCAT REEFS** | | | | | | |
| 12/10/2012 | 8:45am | Dive: patch Reef | 92 | S15.27486° | E124.10310° | 16.8 | 14 | 0.1 |
| | | Patch Reef at front of fore-reef slope. Very soft sediment dusting the entire reef that appeared to have a diverse community of marine life, but poor visibility made the determination uncertain. | | | | | | |
| | | **WHITE ISLAND** | | | | | | |
| 12/10/2012 | 2:30pm | Dive: patch Reef | 93 | S15.06938° | E124.33061° | 16 | 14 | 6 |
| | | Broken patch reef, generally low in profile, with small and large outcrops covered with encrusting corals, soft corals and sponges. Sides of outcrops steep and undercut low down near the substrate. Sediment was coarse with coral rubble and covered with fine silt. | | | | | | |
| | | **De FREYCINET ISLAND** | | | | | | |
| 13/10/2012 | 9:15am | Dive: sublittoral fore-reef slope | 94 | S14.98867° | E124.53304° | 16 | 12 | 8 |
| | | Seaward side of the island in a small reef embayment. Steep fore-reef edge with large outcrops further seaward, forming long-shore gutters between. Reef front was deeply incised with crevasses and caves. The wall of the outer slope was covered with diverse assemblages of encrusting corals, soft corals and sea whips. The floors of the caves were covered with fine silt and coral rubble. Many fish were present as well as several species of crinoid, but other echinoderm groups were significantly absent. Mollusc diversity was generally poor except for Phyllidiid nudibranchs, which were diverse and plentiful. | | | | | | |
| 13/10/2012 | 3:00pm | Dive: sublittoral fore-reef slope | 95 | S14.99347° | E124.53580° | 15 | 11 | 5 |
| | | Vertical slope leading to a sediment and coral rubble floor. Large and small outcrops littered the bottom of the slope. These were covered with many species of soft corals (~30 species), an indication of a reasonable long-shore current, as well as many hard encrusting corals. The asteroid sea star, *Culcita schmideliana* was recorded as well as several species of crinoid and ophuroid. | | | | | | |
| | | **HEDLEY ISLAND** | | | | | | |
| 14/10/2012 | 10:17am | Dive: sublittoral fore-reef slope | 96 | S14.93606° | E124.66444° | 18 | 11 | 5 |
| | | Sloping reef edge at 11 m covered with small and large outcrops covered with fine sediment over coral rubble. Outcrops with small colonies of encrusting corals as well as colonies of *Acropora*. Soft corals were few, as were molluscs and echinoderms. Whole station covered with a fine dusting of silt. | | | | | | |
| 14/10/2012 | 3:15pm | Intertidal: midlittoral reef platform | 97 | S14.93457° | E124.66100° | 0 | 0 | |
| | | Flat, cemented reef platform with scattered tide pools. Reef covered with sand, algal turf and macro algae. Small isolated coral colonies were scattered about. Pools with sloping sides leading to a sandy bottom with many *Diadema setosum* present. | | | | | | |

| Date | | Site | Station / K12 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| 14/10/2012 | 4:40pm | Intertidal: midlittoral reef platform | 98 | S14.95373° | E124.67258° | 0 | 0 | |
| | | Flat, cemented reef platform similar to 97/K12. | | | | | | |
| | | **OUTCROP NORTH OF COLBERT ISLAND** | | | | | | |
| 15/10/2012 | 10:43am | Dive: isolated outcrop | 99 | S14.83227° | E124.72337° | 14 | 12 | 8 |
| | | Isolated submerged outcrop north of Colbert Island. Current swept reef with high relief topography dropping off steeply into deep water. Channels with coral rubble covered with fine silt. Reef free of sediment with scattered colonies of encrusting corals and hydroids. | | | | | | |
| | | **WOODWARD ISLAND** | | | | | | |
| 15/10/2012 | 4:15pm | Intertidal: midlittoral reef platform | 100 | S14.84764° | E124.73986° | 0 | 0 | |
| | | Low-tide station on north side of island. Reef platform dominated by cropped *Sargassum.* Small scattered colonies of soft and hard corals, including colonies of *Acropora,* were evident down to a monolithic hard coral zone at the seaward edge of the station. Tidal pools with sandy floors and fringed with *Sargassum* and occasional hard and soft corals. Site with very few turnable rocks. | | | | | | |
| | | **BROWSE ISLAND** | | | | | | |
| 16/10/2012 | 09:00am | Dive: patch reef | 101 | S14.10463° | E123.55341° | 16 | 11 | 25 |
| | | Low profile patch reef of small coalescing outcrops covered with colonies of hard and soft corals colonies. Coarse coralline sand and some patches of accumulated rubble, possibly from previous cyclonic activity were between the outcrops. Seaward of the site was a large sand plain with moderately high ripples indicating possible strong current flow or wave action. | | | | | | |
| 16/10/2012 | 1:50pm | Dive: sublittoral fore-reef slope | 102 | S14.11258° | E123.53458° | 20 | 12 | 20 |
| | | Gently sloping wave scoured outer reef with scattered corals, both monolithic corals and plate *Acropora.* Reef rock exposed and depressions filled with coral rubble and coarse sand. Large sponges were evident in the deeper sections of the station. | | | | | | |
| 16/10/2012 | 4:45pm | Intertidal: midlittoral reef platform | 103 | S14.11369° | E123.55461° | 0 | 0 | |
| | | Low profile, flat reef platform with many small outcrops, which tended to coalesce. The occasional larger coral outcrop was undercut and ledged, but with little invertebrate growth. Outcrops had a variety of sponges, encrusting hard corals and some soft corals. In the interspaces there was coralline sand with a dusting of fine silt. Large patches of coral rubble were also intermittently present. Evidence of extensive ray activity in the larger sandy areas. | | | | | | |

| Date | | Site | Station / K12 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| 17/10/2012 | 6:03am | Intertidal: midlittoral reef platform | 104 | S14.10808° | E123.55514° | 0 | 0 | |
| | | Low profile, flat reef platform similar to station 103/K12 except that the seaward edge of the station merged into a cemented reef platform covered with algal turf and sand. Small coral colonies were scattered about. The coralline sand appears to be very motile and probably shifts seasonally. | | | | | | |
| 17/10/2012 | 10:10am | Dive: sublittoral fore-reef slope | 105 | S14.11754° | E123.53898° | 18 | 12 | 20 |
| | | Outer reef station along the top of a convoluted ridge with isolated coral colonies. In general, the ridge was wave swept with a predominance of bare rock covered with coralline algae. Bottom of adjoining gutter with coral rubble overlayed with coarse coral sand. Small, coral encrusted rocky outcrops were scattered about the gutter. | | | | | | |
| 17/10/2012 | 3:00pm | Dive: patch Reef | 106 | S14.11675° | E123.55955° | 13 | 13 | 20 |
| | | Tidally swept coarse, coralline sand plain with small to large rocky outcrops adorned with soft and hard coral colonies, and some sponges. Large Porites coral outcrops were scattered about, as well as many plate and branching *Acropora* colonies. Sides and undercuts of larger outcrops were covered with benthic invertebrate life, especially soft corals and sea fans. | | | | | | |
| | | **ECHUCA SHOAL** | | | | | | |
| 18/10/2012 | 11:45am | Dive: submerged Shoal | 107 | S13.89635° | E123.89476° | 22 | NA | 25 |
| | | Biodiversity site only. Wave and current swept isolated shoal. Mostly bare rock, coarse coralline sand and rubble with small to medium rocky outcrops. These had encrusting corals, both branching and plate *Acropora*, as well as sponges, soft corals, including sea fans and sea whips. Undercut sections of the outcrops supported a rich variety of benthic invertebrate life. Pelagic fish were very plentiful and echinoderms were more abundant than previous sites. | | | | | | |
| 18/10/2012 | 3:15pm | Dive: submerged Shoal | 108 | S13.90069° | E123.89345° | 20 | NA | 25 |
| | | Biodiversity site only. Similar to station 107/K12. | | | | | | |
| | | **HEYWOOD SHOAL** | | | | | | |
| 19/10/2012 | 1:10pm | Dive: submerged Shoal | 109 | S13.43058° | E124.01858° | 21 | NA | 25 |
| | | Biodiversity site only. Similar to Echuca Shoal (Stations 107 and 108/K12) except that the station had more coral boulders and turnable rocks. There appeared to be more molluscan life under the rocks than at Echuca Shoal. Shallow surge channels with coarse coralline sand and small sized coral rubble dissected the station. Outcrops adorned with sponges, plate corals and soft corals, including sea whips. | | | | | | |

| Date | | Site | Station / K12 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| | | **JAMIESON REEF** | | | | | | |
| 20/10/2012 | 7:15am | Dive: patch reef | 110 | S14.05740° | E125.36179° | 18 | 12 | 8 |
| | | Patch reef with outcrops coalescing in places. Reef at edge of a ledge that descended steeply to 18 m. Reef was covered with encrusting corals, plate *Acropora,* soft corals and sea fans. Many large barrel sponges (*Xestospongia testudinaria)* were also a station feature. Sediment was fine with coral rubble. | | | | | | |
| 20/10/2012 | 12:30pm | Dive: patch reef | 111 | S14.05731° | E125.36195° | 15 | 12 | 10 |
| | | Similar to 101/K12 except that the rocky outcrops were lower in profile. There were also many overturned coral slabs, which may be evidence of a past cyclonic event. | | | | | | |
| | | **CONDILLAC ISLAND** | | | | | | |
| 21/10/2012 | 7:30am | Intertidal: midlittoral reef platform | 112 | S14.09939° | E125.55891° | 0 | 0 | |
| | | Cemented reef platform with many tide pools and surrounded on three sides by basalt rocks supporting a high density of barnacles and the oyster, *Saccostrea cucculata*. Platform was covered with sand, algal turf and patches of brown macro-algae. Tide pools with a high diversity of marine life and fringed with small coral colonies. Sediment was white coralline sand. | | | | | | |
| 21/10/2012 | 12:30pm | Dive: sloping sand plain | 113 | S14.11046° | E125.55947° | 17 | 13 | 4 |
| | | Revisit of 1988 WA Museum site. A sloping sandy plain with large, sometimes coalescing outcrops, with steep, undercut sides. Outcrops covered with a high diversity of coral, sponges and soft corals. Sediment was coarse coralline sand with a fine dusting of silt. Many encrusting oysters on the vertical sides and underhangs of the outcrops. | | | | | | |
| | | **PATRICIA ISLAND** | | | | | | |
| 22/10/2012 | 8:00am | Dive: sublittoral fore-reef slope | 114 | S14.25298° | E125.30443° | 17 | 12 | 3 |
| | | Seaward reef edge made up of single and coalesced outcrops at edge of a slope. Reef broken, steep sided and undercut with very few encrusting oysters or other benthic marine life. Tops covered with corals, soft corals and sponges and a fine dusting of silt. Sediment was fine over coarse coralline sand mixed with coral rubble. | | | | | | |
| | | **HERITAGE REEF** | | | | | | |
| 22/10/2012 | 2:15pm | Dive: sublittoral fore-reef slope | 115 | S14.25455° | E125.15963° | 20 | 12 | 20 |
| | | Fore-reef vertical wall descending to a coral rubble bottom. Reef crest and sides with a high diversity of hard and soft corals (especially sea fans) and sponges. Vertical wall with small caves and ledges, which had little benthic invertebrate life, except for sea fans and hydroids. Caves and seafloor dusted with fine silt. | | | | | | |

| Date | | Site | Station / K12 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| | | **WEST MONTALIVET ISLAND** | | | | | | |
| 23/10/2012 | 8:40am | Dive: sublittoral fore-reef slope | 116 | S14.30367° | E125.20915° | 12 | 16 | 5 |
| | | Edge of fore-reef slope with coral, soft coral and sponge communities. The slope was gradual to steep to 15 m with small undercuts and ledges. Sea whips and encrusting corals and sponges were found at the bottom of the slope. Sediment was coralline sand dusted with fine silt. | | | | | | |
| 23/10/2012 | 2:30pm | Dive: sublittoral fore-reef slope | 117 | S14.28833° | E125.22556° | 15 | 12 | 8 |
| | | Patch reef on the eastern side of the island with small and large outcrops that tended to coalesce. Outcrops steep sided and undercut with little benthic invertebrate life. Corals, soft corals, especially sea whips and fans, as well as sponges were diverse and plentiful. Very large examples of the large barrel sponge, *Xestospongia testudinaria,* were well represented at the station. | | | | | | |
| | | **ROBROY REEFS** | | | | | | |
| 24/10/2012 | 9:00am | Dive: sublittoral fore-reef slope | 118 | S14.42952° | E124.86136° | 20 | 12 | 15 |
| | | Same site as 118/K12. High energy vertical outer reef edge dropping to a ledge at 20 m. Ledge with sea whips and fans and some encrusting corals. The ledges and caves floors were dusted with fine silt. The caves on the vertical wall had minimal benthic invertebrate life. At shallower depths down to 4 m coralline algae dominated. Sponges and a variety of encrusting coral colonies, including *Pocillopora* colonies in the surge depressions, dominated at deeper depths. | | | | | | |
| 24/10/2012 | 1:30pm | Dive: sublittoral patch reef | 119 | S14.43068° | E124.87519° | 17 | 12 | 15 |
| | | Station was a plain of coarse coralline sand with rocky outcrops. Tops and sides of outcrops were covered with hard corals, sponges and hydroids. The outcrops were undercut with a high diversity of benthic invertebrate cover. Coral rubble and slabs littered the depressions and around the base of the larger outcrops. | | | | | | |
| | | **MARET ISLANDS** | | | | | | |
| 25/10/2012 | 8:00am | Dive: sublittoral fore-reef slope | 120 | S14.42968° | E124.97859° | 15 | 12 | 2 |
| | | Station disrupted by poor visibility. Rocky outcrops with extensive top cover of corals, sponges and soft corals. Sides were steep and undercut. Site was covered with very fine silt overlaying coral rubble and fine sand. This silt was easily disturbed and the dive was suspended. | | | | | | |
| | | **ROBROY REEFS: EXPLORATORY DIVE** | | | | | | |
| 25/10/2012 | 11:15am | Dive: sublittoral fore-reef slope | 121 | S14.46157° | E124.83981° | 26 | NA | 10 |
| | | Light garden bottom at base of drop-off similar to station 118K/12. Many soft corals, sponges and small hard-coral colonies scattered about. Base was rock with coarse coral rubble in the depressions overlayed with a fine silt. Small ledges and rocky outcrops were scattered about with sea fans and whips. Biodiversity collection station in some taxonomic groups only. | | | | | | |

| Date | | Site | Station / K13 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| | | **ASHMORE REEF** | | | | | | |
| 25/09/2013 | 12:00pm | Dive: lagoon back reef | 122 | S12.23065° | E122.99998° | 13 | 10 | 9 |
| | | Lagoon back reef at edge of channel dotted with large flat topped coral outcrops. Transect was at base of the where the coralline sands sloped from 10–13 m. Small outcrops were plentiful, some coalescing to form short ridges, and all festooned with soft corals, sponges and isolated hard corals. Larger outcrops were undercut and covered with encrusting sponges and soft corals. Sediment was finer at deeper depths and inundated with coral rubble. A single giant clam, *Tridacna derasa* was seen at the end of a transect, as was he sea cucumbers, *Holothuria fuscopuncta* and the vulnerable, *H. fuscogilva.* | | | | | | |
| | | **ASHMORE REEF LAGOON: NR WEST ISLAND** | | | | | | |
| 26/09/2013 | 7:35am | Intertidal: midlittoral | 123 | S12.23284° | E122.97277° | 0 | 0 | N/A |
| | | Reef platform inundated with motile coralline sand. Flat turnable rocks covered with algal turf and sand were scattered about. Corals were mostly absent. The seagrass, *Thalassa* was sparse, but widely distributed. The coralline algae, *Halamedia cylindricea* was also present. | | | | | | |
| | | **ASHMORE REEF NORTHERN CHANNEL** | | | | | | |
| 26/09/2013 | 10:30am | Dive: lagoon back reef | 124 | S12.21418° | E123.02014° | 15 | 12 | 8 |
| | | Lagoon back reef slope near entrance channel. Slope was steep with scattered and coalesced outcrops covered with soft corals, sea fans and sponges. Hard corals more evident at shallower depths, but sparse along the transect. Larger outcrops deeply undercut with encrusting sponges and soft corals. Substrate was of coarse coralline sand overlayed with finer coralline silt that also dusted the outcrops. | | | | | | |
| | | **NORTH SIDE OF ASHMORE REEF** | | | | | | |
| 26/09/2013 | 2:30pm | Dive: sublittoral fore-reef slope | 125 | S12.19378° | E123.0284° | 30 | 12 | 12 |
| | | Large isolated rocky outcrop along the outer reef slope. An exposed site subject to significant wave action. Cemented reef with an extensive coverage of sponges, encrusting soft corals and stunted *Acropora*. Deeper sections of the slope (down to 35 m) consisted of sea whips, large barrel sponges and soft coral colonies. Pelagic fish species were a significant feature of the site. | | | | | | |

| Date | | Site | Station / K13 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| 27/09/2013 | 8:50am | Dive: sublittoral fore-reef slope | 126 | S12.18392° | E123.10063° | 30 | 12 | 6 |
| | | Outer reef slope with a vertical wall pocked with small caves and narrow ledges. Caves and ledges with small coral rubble and fine coral sediment. Wall with diverse communities of corals, soft corals and sponges. At 20 m the wall ended with coralline sand and occasional outcrops covered with larger filter feeding benthos. At shallower depths (5 m) was an extensive coverage of hard coral (*Acropora*, *Pocillopora* and *Stylopora*). | | | | | | |
| | | **EAST SIDE OF ASHMORE REEF** | | | | | | |
| 27/09/2013 | 1:30pm | Dive: sublittoral fore-reef slope | 127 | S12.23728° | E123.16004° | 15 | 12 | 6 |
| | | Gentle outer reef slope with a diverse coverage of hard corals and sponges. Soft corals were a little less diverse, but with high abundance. Branching *Acropora* a feature of the reef. Reef depressions filled with coral rubble and coarse coralline sand. Reef bordered with two flat rubble plains with imperfect rhodoliths evident. | | | | | | |
| | | **SOUTH SIDE OF ASHMORE REEF** | | | | | | |
| 28/09/2013 | 9:00am | Dive: sublittoral fore-reef slope | 128 | S12.29350° | E123.12373° | 13 | 12 | 12 |
| | | Outer reef slope sand plain within a reef embayment. Large and small outcrops covered with hard corals (branching and plate *Acropora*), soft corals and sponges. Sediment was coarse coralline sand and very motile due to heavy surf on the nearby reef spur. Coral rubble was plentiful and piled. Undercuts of the outcrops had a extensive coverage of sea fans and bryozoans. | | | | | | |
| | | **EAST SIDE OF ASHMORE REEF** | | | | | | |
| 28/09/2013 | 1:00pm | Snorkel: intertidal midlittoral reef platform | 129 | S12.27733° | E123.13609° | 1 | 0.5 | 12 |
| | | Consolidated reef platform on the outer reef edge. Coarse coralline sand and coral rubble with *Thalassia* and *Halimeda* occurring sparsely. Large tidal pool was a feature of the zone and fringed with coral, floored with coarse coralline sand and fine rubble. Fish species were a mix of outer reef and platform species. | | | | | | |
| | | **NORTH SIDE OF ASHMORE REEF** | | | | | | |
| 29/09/2013 | 8:15am | Dive: sublittoral fore-reef slope | 130 | S12.18848° | E123.12887° | 20 | 12 | 8 |
| | | Vertical wall on outer slope. Wall deeply incised with caves and small ledges with many soft corals, sea fans and hard corals. At the top of wall (5-7 m) was a diverse assemblage of hard corals and the soft corals, *Sarcophyton* and *Lobophyton*. Base of wall at 20 m was a narrow rubble band merging to coarse coralline sand with scattered coral rubble and soft corals and sponges. Caves of wall and underhangs well covered with encrusting invertebrates. | | | | | | |

| Date | | Site | Station / K13 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| 29/09/2013 | 12:30pm | Intertidal: midlittoral reef platform | 131 | S12.1929° | E123.12888° | 1 | 1 | 5 |
| | | Reef platform inundated with motile coralline sand. Turnable coral rubble scattered about, but with little invertebrate growth beneath. Area was well washed with tide and swell generated waves marking the area as high energy. | | | | | | |
| 29/09/2013 | 2:45pm | Dive: sublittoral fore-reef slope | 132 | S12.17297° | E123.06116° | 16 | 12 | 6 |
| | | Coral rubble cemented reef slope (about 45°) dominated by *Halimeda distorta*. Soft coral and hard coral communities were diverse, but scattered as individual colonies. At the bottom of the slope was a narrow rubble zone with coarse sand between. Soft corals and sponges dominated, with algal turf covering the exposed rubble. Some larger hard coral colonies of *Porites lichen* were present along with an abundance of *Isopora palifera*, *Isopora bruggemannai* and *Heliopora coerulea*. The slope steepened at one end of the transect to a small, deeply undercut vertical wall (2 m), but with little invertebrate growth. | | | | | | |
| | | **SOUTH SIDE OF ASHMORE REEF** | | | | | | |
| 30/09/2013 | 8:30am | Dive: sublittoral fore-reef slope | 133 | S12.27478° | E122.98128° | 15 | 12 | 20 |
| | | High energy, fore-reef front consisting of reef pavement with many small to medium outcrops providing the impression of a jagged landscape. Undercuts and caves of larger outcrops, and beneath the larger coral rubble, there was little invertebrate growth. Tops and sides of the outcrops encrusted with soft corals, sponges and hard corals, including branching and plate *Acropora.* Pavement scoured by very coarse coralline sand, which had settled in the shallow surge channels and outcrop interspaces. | | | | | | |
| 30/09/2013 | 1:00pm | Dive: sublittoral fore-reef slope | 134 | S12.29602° | E123.02718° | 14 | 12 | 8 |
| | | High-energy patch reef forming large hillocks covered with sponges, soft and hard corals. At the base of the hillocks was a narrow rubble zone leading to extensive areas of heavily-ridged coarse, coralline sand. Sediment at the base of the outcrops was removed by wave action forming low undercuts. | | | | | | |
| | | **WEST SIDE OF ASHMORE REEF** | | | | | | |
| 01/10/2013 | 8:00am | Dive: sublittoral fore-reef slope | 135 | S12.24369° | E122.92641° | 14 | 12 | 25 |
| | | High energy station swept by wave action and strong currents. Reef pavement with shallow surge grooves deepening towards the reef. Coarse coral sand with small coral rubble in the surge channels but not on the spurs or flat areas. Many soft corals, dominated by *Sinularia* and *Lobophyton.* Hard corals sparse and encrusting. Algae dominated by *Halimeda* spp. | | | | | | |

| Date | | Site | Station / K13 | Latitude (WGS84 Datum) | Longitude (WGS84 Datum) | Max-depth (m) | T-Depth (m) | Visibility (m) |
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| | | **ASHMORE REEF NORTHERN CHANNEL** | | | | | | |
| 01/10/2013 | 12:00pm | Dive: lagoon back reef | 136 | S12.19448° | E122.92641° | 6 | 6 | 10 |
| | | Lagoon back-reef sand and rubble field with isolated coral outcrops. Tops of outcrops with encrusting corals as well as branching and plate *Acropora*. Soft corals and hydroids common. Caves and underhangs with a diverse cover of encrusting invertebrates. Rubble field consisting of both dead coral and rhodoliths. Sand coarse and coralline. | | | | | | |
| | | **SOUTH SIDE OF ASHMORE REEF** | | | | | | |
| 02/10/2013 | 7:30am | Intertidal snorkel: midlittoral reef platform | 137 | S12.26233° | E122.98484° | 1.5 | 1.5 | 25 |
| | | Sand inundated midlittoral platform with occasional coral rubble of turnable size. Sand consolidated with the seagrass, *Thalassia hemprichii*. Sediment was coarse coralline sand overlayed with finer coralline silt. | | | | | | |
| 02/10/2013 | 8:45am | Dive: midlittoral tide pool | 138 | S12.27858° | E123.01711° | 6.5 | 5 | 15 |
| | | Large midlittoral tide pool with fringing coral descending to a narrow coral rubble zone. Pool edge undercut with moderate invertebrate cover. Bottom of pool was of fine coralline sand heavily pitted by the action of damsel fish and worms. Acropora thickets dominated throughout the pool. | | | | | | |
| | | **ASHMORE REEF LAGOON** | | | | | | |
| 02/10/2013 | 1:45pm | Dive: lagoon | 139 | S12.24147° | E122.99586° | 15 | 10 | 4 |
| | | Large lagoonal outcrop amid several others. Top of outcrop with a high diversity of corals and two species of giant clam, *Tridacna derasa* and *T. gigas*. Side of outcrop sloping (45°) with branching and foliaceaous corals leading to a silty sediment floor with many small outcrops and coral rubble mounds. Soft corals were plentiful. Underside of larger rubble, and in small caves, the invertebrate life was minimal. Whole site was dusted with fine coralline silt. | | | | | | |
| | | **EAST SIDE OF ASHMORE REEF** | | | | | | |
| 03/10/2013 | 8:45am | Dive: sublittoral fore-reef slope | 140 | S12.20775° | E123.14563° | 21 | 13 | 25 |
| | | Gently sloping patch reef with large outcrops rising above the general reef. Surge channels with coral rubble floors dissected the reef, which had a high diversity of corals and soft corals. Underhangs and underside of larger turnable coral rubble with a extensive coverage of encrusting invertebrates. | | | | | | |
| 03/10/2013 | 1:45pm | Intertidal snorkel: midlittoral reef platform | 141 | S12.21021° | E123.14406° | 0.5 | 0.5 | 15 |
| | | Consolidated reef platform on the outer reef edge. High energy reef with seasonal scouring from wave and tidal action. Coarse coralline sand and coral rubble in the shallow reef depressions and larger outcrops lined the edge of the reef. *Halimeda* was sparse but the dominant algae but sparse. | | | | | | |

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| | | **HIBERNIA REEF** | | | | | | |
| 04/10/2013 | 9:30am | Dive: sublittoral fore-reef slope | 142 | S11.98815° | E123.33585° | 20 | 10 | 25 |
| | | Transect was at the top of a sloping reef front dropping to 30+ m to a sand and rubble bottom. Moderately steep slope with a diverse coverage of soft and hard corals with the occasional larger outcrop rising above the slope. Sediment was coarse and generally consisted of *'Halimeda* sand' with white coralline sand beneath, turnable coral rubble was scattered about in the slope depressions. *Halimeda* was dominant between the benthos. | | | | | | |
| 04/10/2013 | 1:30pm | Dive: sublittoral fore-reef slope | 143 | S11.96167° | E123.37858° | 15 | 13 | 25 |
| | | High ridges of reef with steep sides, occasionally with caves and undercuts, festooned with diverse assemblages of hard and soft corals and smaller sponges. Between the ridges the sand was coarse and mostly consisted of *'Halimeda* sand' with white coralline sand deeper down and on the floor of the caves and underhangs. *Halimeda* was the dominate algae on the reef. | | | | | | |
| 05/10/2013 | 8:00am | Dive: sublittoral fore-reef slope | 144 | S11.97404° | E123.32208° | 15 | 13 | 25 |
| | | Fore-reef cemented slope consisting of separate 'hillocks' joined at the base with deep 'gullies' between. High diversity of soft and hard corals. There is some evidence of past bleaching events with all the plate *Acropora* dead and covered with turf encrusting coralline algae. Small depressions with coarse coralline sand and some small turnable rubble. *Halimeda* was the dominant algae. | | | | | | |
| 05/10/2013 | 1:30pm | Dive: sublittoral fore-reef slope | 145 | S11.97605° | E123.38967° | 15 | 13 | 25 |
| | | Fore-reef cemented slope consisting of separate 'hillocks' joined at the base with deep 'gullies' between, but the gullies were wider than at 144/K13, and with plentiful coral rubble. High diversity of soft and hard corals with everything covered in a film, which may have been of cyano-bacteria origin. Small depressions with coarse coralline sand and some small turnable rubble. *Halimeda* was the dominant algae. | | | | | | |
| | | **VULCAN SHOAL** | | | | | | |
| 06/10/2013 | 8:30am | Dive: Submerged Shoal | 146 | S12.79930° | E124.26672° | 21 | N/A | 25 |
| | | Biodiversity site only. A well scoured, wave and current swept shoal. Mostly bare rock, coarse coralline sand and rubble with small to medium rocky outcrops. Several outcrops were large monolithic coral colonies. Rocky outcrops had encrusting corals, both branching and plate *Acropora,* as well as sponges and soft corals, including sea fans and sea whips. Undercut sections supported a veneer of encrusting invertebrate life. | | | | | | |

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| | | **EUGENE McDERMOTT SHOAL** | | | | | | |
| 06/10/2013 | 2:15pm | Dive: submerged shoal | 147 | S13.07686° | E124.58352° | 22 | N/A | 25 |
| | | Biodiversity site only. A well scoured wave and current swept shoal. Mostly bare rock covered with algal turf, coarse coralline sand and wide, but shallow, surge grooves filled with rubble. Small to medium sized rocky outcrops. Rocky outcrops had small isolated coral colonies, soft corals, including sea fans and sea whips, and large sponges. Undercut sections of the outcrops supported a veneer of encrusting invertebrate life. | | | | | | |
| | | **HEYWOOD SHOAL** | | | | | | |
| 07/10/2013 | 8:30am | Dive: submerged shoal | 148 | S12.44741° | E124.03244° | 22 | N/A | 25 |
| | | Biodiversity site only. Overall, similar to most other shoals in their wave swept appearance. Bare rock with some algal turf and turnable sized coral rubble scattered about. Low lying areas with coral rubble overlaying coarse sand. Presence of a low profile ledge provided a concentration point for marine life with sponges, soft corals and plate *Acropora*. Crinoids were numerous on the outcrops. Some large outcrops, which were undercut with a thin veneer of marine life, were covered with sponge and coral growth. | | | | | | |

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| | | **MERMAID REEF** | | | | | | |
| 01/10/2014 | 2:00pm | Dive: sublittoral fore-reef slope | 149 | S17.06287° | E119.64845° | 14 | 12 | 20 |
| | | Large flat-topped outcrop of cemented reef, which had broken from the main reef creating a 15 m deep channel; eastern side of outcrop was fronted by open ocean. Outcrop had steep vertical sides, deeply undercut with small caves and crevasses covered with encrusting corals, plate coral and other smaller coral colonies. Gorgonian sea fans and occasional *Dendronephthya* colonies were also present in the caves and underhangs. Several large specimens of holothurian, *Thelonotus annanas* and *Bohadschia argus,* were also present. | | | | | | |
| 02/10/2014 | 7:35am | Dive: lagoon | 150 | S17.07240° | E119.62708° | 14 | 12 | 20 |
| | | Valley between two large outcrops of consolidated coral rubble. Area consisted of large patches of *Acropora* thicket with underlying coral rubble and fine calcareous sand. Small rocky outcrops, festooned with encrusting and branching corals and large Spondylid bivalves, were scattered about. Several specimens of *Tridacna squamosa* and a single specimen of *Tridacna derasa* were evident. | | | | | | |

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| | | **CLERKE REEF** | | | | | | |
| 02/10/2014 | 3:33pm | Dive: sublittoral fore-reef slope | 151 | S17.25188° | E119.35901° | 20 | 12 | 20 |
| | | Consolidated reef front site with an extensive spur and groove structure. Upper levels were encrusted with coralline algae and heavily pocked. Continuing down the slope to 20 m was an extensive coverage of encrusting and small, solitary coral colonies to where the reefs meets a coarse coralline sand floor, which continued sloping gently. The reef slope and deep grooves had small caves and low underhangs with the hydroid, *Aglaophenia cupressina* common. | | | | | | |
| 03/10/2014 | 08:30am | Dive: sublittoral fore-reef slope | 152 | S17.36311° | E119.38384° | 20 | 12 | 30 |
| | | Collapsed steep reef-front site of consolidated reef: spur and groove formations. Continuing down the slope to 20 m was an almost complete coverage of corals with coral rubble on small ledges and floor of small underhangs. Bottom of slope at 30 m was coarse coral sand, large sea fans and solitary sponges. | | | | | | |
| 03/10/2014 | 01:30pm | Dive: lagoon | 153 | S17.28432° | E119.36871° | 13 | 12 | 10 |
| | | Lagoonal patch-reef with several species of scattered *Acropora* forming small thickets. Occasional scattered outcrops added topographical relief to a meandering, low-lying reef interspersed with fine coralline sand and coral rubble. | | | | | | |
| 04/10/2014 | 08:00am | Dive: sublittoral fore-reef slope | 154 | S17.27991° | E119.37663° | 20 | 12 | 25 |
| | | Collapsed reef-front site of consolidated reef: spur and groove formations, but less steep than Stn 152/K14. Transect was on a wide undulating ledge with small outcrops forming small caves with encrusting invertebrates. Upper levels were encrusted with coralline algae and heavily pocked. Continuing down the slope to 20 m was an almost complete coverage of corals with coral rubble on small ledges and floor of small underhangs. Bottom of slope at 30 m was coarse coral sand, large sea fans and solitary sponges. | | | | | | |
| 04/10/2014 | 11:15am | Dive: lagoon | 155 | S17.29773° | E119.35914° | 15 | 12 | 5 |
| | | Lagoonal reef-edge in centre of main lagoon with reef outcrops forming a protected spur. Transect was in the interspace running through meandering submerged reef, *Acropora* thicket, calcareous sand and coral rubble. Larger outcrops were covered with corals, including some plate *Acropora*, sponges and soft corals *(Lobophyton* and *Sarcophyton* spp.*).* Very few molluscs except for several specimens of *Phyllidia nigra.* | | | | | | |
| 05/10/2014 | 08:20am | Dive: sublittoral fore-reef slope | 156 | S17.29298° | E119.37819° | 20 | 12 | 25 |
| | | Collapsed reef-front site of consolidated reef: spur and groove formations, but less steep than Stn152/K14. Transect was on a wide undulating ledge with small outcrops forming small caves with encrusting invertebrates. Upper levels were encrusted with coralline algae and heavily pocked. Continuing down the slope to 20 m was an almost complete coverage of corals with coral rubble on small ledges and floor of small underhangs. Bottom of slope at 30 m was coarse coral sand, large sea fans and solitary sponges. | | | | | | |

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| | | **IMPERIEUSE REEF** | | | | | | |
| 05/10/2014 | 3:30pm | Dive: sublittoral fore-reef slope | 157 | S17.50697° | E118.96577° | 15 | 12 | 20 |
| | | Patch reef along fore-reef front with large monolithic coral colonies joined by coral encrusted reef. Small caves were formed under and around the large coral outcrops. At the reef base (15 m) was an extensive motile sand plain that intruded into the reef along the steep sided gutters. The sand plain was host to a large number of garden eels, while the reef exhibited a diverse number of fish species, especially unicorn fish and spotted sweetlip. Corals and soft corals were also diverse. | | | | | | |
| 06/10/2014 | 8:00am | Dive: sublittoral fore-reef slope | 158 | S17.53597° | E118.97325° | 20 | 12 | 30 |
| | | Wide coral-covered fore-reef slope with spur and groove structure and large monolithic coral outcrops common. Bottom of grooves with *Acropora* rubble suggesting significant storm damage, probably due to the wide slope. Between coral encrusted areas the underlying reef is cemented with coralline algae. Site is a part of a long term monitoring program with a data logger to the immediate south of transect. | | | | | | |
| 06/10/2014 | 12:30pm | Dive: lagoon | 159 | S17.53744° | E118.96240° | 14 | 12 | 8 |
| | | Patch reef around the base of a large flat-topped lagoon outcrop. A low profile meandering reef, with larger outcrops of rocky reef covered with plate *Acropora* and other encrusting invertebrates, surrounded the main outcrop. Fine sediment covered the lagoon floor and dusted much of the site. Different assemblage of soft corals existed to that of the fore-reef slope. | | | | | | |
| 06/10/2014 | 3:30pm | Intertidal: midlittoral | 160 | S17.50915° | E118.96316° | 0 | 0 | N/A |
| | | Cemented reef flat with many small, low-profile coral colonies. Small, shallow pools provided some relief for many fish and invertebrates. A significant number of the sea cucumber, *Holothuria whitmaer*i were present in the low lying areas. Coral rubble was plentiful, but with minimal invertebrate diversity beneath. | | | | | | |
| 07/10/2014 | 8:00am | Dive: sublittoral fore-reef slope | 161 | S17.54793° | E118.97383° | 18 | 9 | 30 |
| | | Fore-reef slope similar to 157/K14 and 158/K14, but with a flatter profile leading to a steep slope. Site dominated by a spur and groove formation with considerable *Acropora* rubble in the grooves and depressions. Beneath the rubble was coarse coralline sand. Coral colonies and large monolithic corals were plentiful. Site of a DPaW/AIMS data logger, which was changed. | | | | | | |
| 07/10/2014 | 11:30am | Dive: lagoon | 162 | S17.55509° | E118.96511° | 14 | 8 | 20 |
| | | Eastern side of lagoon amid isolated flat top outcrops. Transect was around the base and along a meandering reef with thickets of *Acropora.* Sand was fine, but with a rich in-fauna of worms and molluscs. Larger subtidal outcrops were covered with encrusting and plate coral, and some sponge. | | | | | | |

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| 07/10/2014 | 3:30pm | Intertidal: midlittoral | 163 | S17.53619° | E118.97094° | 0 | 0 | N/A |
| | | South side of channel on a coral dominated reef flat. Site was of cemented reef rock and rubble with very little turnable coral rubble on the surface, except for a minor amount in the depressions. High abundance of large specimens of the giant clam, *Tridacna crocea* were very evident. The reef was undercut with an extensive channel system providing a high degree of drainage. | | | | | | |
| 08/10/2014 | 8:15am | Dive: lagoon | 164 | S17.56070° | E118.94100° | 8 | 7 | 10 |
| | | East side of west lagoon near dividing spine. Transect was around base of a large flat-topped outcrop amid extended thickets of *Acropora* with very fine coralline sediment. Several large submerged outcrops were scattered about and all were covered with encrusting plate corals and colonies of *Acropora.* Site was almost devoid of molluscan life except for two large clams – *Tridacna gigas* and *T. derasa*. | | | | | | |
| 08/10/2014 | 2:00pm | Dive: sublittoral fore-reef slope | 165 | S17.59347° | E118.97723° | 18 | 12 | 10 |
| | | A spur and groove (wide in profile) site along the south-east quarter of the atoll. Large expansive mat of low profile *Acropora.* Spurs were well covered with corals while grooves were filled with *Acropora* rubble, similar to site 161/K14. At 30 m the bottom was all coral rubble, predominantly *Acropora.* | | | | | | |
| 09/10/2014 | 5:30am | Intertidal: midlittoral | 166 | S17.50573° | E118.96272° | 0 | 0 | N/A |
| | | Reef flat covered with algal turf and sand. Coral colonies were small, isolated and widely scattered, except at the lower littoral. *Tectus niloticus* were reasonably abundant at this lower level. Large pieces of coral rubble were scattered about the site with encrusting marine life beneath. Molluscan and echinoderm fauna were not diverse. | | | | | | |
| 09/10/2014 | 9:45am | Dive: sublittoral fore-reef slope | 167 | S17.51110° | E118.93266° | 20 | 12 | 15 |
| | | High energy spur and groove on the windward side of the atoll. Spurs with minimal cover, mostly small colonies of encrusting corals and heavily scoured by the motile coralline sands in the grooves. Grooves were wide and meandering, reducing in width to form crevasses towards the reef flat. Large and small pieces of coral rubble were scattered about, probably from the spur tops. | | | | | | |
| 09/10/2014 | 3:00pm | Dive: sublittoral fore-reef slope | 168 | S17.56666° | E118.97271° | 20 | 12 | 20 |
| | | Similar to Stn 165/K14. | | | | | | |
| | | **CLERKE REEF** | | | | | | |
| 10/10/2014 | 6:30am | Intertidal: midlittoral | 169 | S17.38771° | E119.37061° | 0 | 0 | N/A |
| | | Flat reef pavement covered with algal turf and sand. Rubble sparse, but what was there was mostly flat *Acropora* plate. Many juvenile *Tridacna crocea* were imbedded into pavement. Lower littoral had an almost complete coverage of small to medium sized coral colonies. | | | | | | |

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| 10/10/2014 | 10:00am | Dive: sublittoral fore-reef slope | 170 | S17.31697° | E119.38378° | 18 | 12 | 25 |
| | | Collapsed reef-front site of consolidated reef: spur and groove formations; the grooves were wide and filled with *Acropora* rubble. Transect ran across the spurs with small outcrops forming small caves with encrusting invertebrates. Upper levels were encrusted with coralline algae and heavily pocked. Continuing down the slope to 20 m was an almost complete coverage of corals with coral rubble on small ledges and floor of small underhangs. Bottom of slope at 30 m was coarse coral sand and large sea fans. | | | | | | |
| 10/10/2014 | 2:00pm | Dive: lagoon | 171 | S17.31431° | E119.37496° | 8 | 6 | 15 |
| | | Lagoon dive amid flat-topped, steep sided outcrops consisting of *Acropora* rubble down to a base of heavier coral rubble and out to fine coralline sand. Thickets of coral were abundant, both around the outcrops and over the sand. Evidence of severe storm damage could be seen from the amount coral rubble and sand inundation. Giant clams (*Tridacna gigas* and *T. derasa*) were scattered about. The echinoderm, *Holothuria whitmaei* was observed spawning. | | | | | | |
| 11/10/2014 | 6:00am | Intertidal: midlittoral | 172 | S17.275° | E119.37576° | 0 | 0 | N/A |
| | | Consolidated reef pavement with an abundance of isolated corals forming nearly 90% cover – the overall look of the reef was flat due to air pruning. The mollusc, *Tectus niloticus* was relatively abundant on the lower littoral. Small tidal pools were scattered about creating attractive living aquariums with coarse coralline sand and rubble. Soft corals were also abundant. | | | | | | |
| 11/10/2014 | 1:00pm | Dive: sublittoral fore-reef slope | 173 | S17.31753° | E119.31216° | 18 | 12 | 15 |
| | | Verticle fore-reef rampart with small caves on the wall. Wall base at 25 m consisted of a narrow band of rock and coral rubble giving way to coarse coralline sand and scattered small outcrops covered with soft corals. Top of wall had scattered corals and a very pocked reef due to its high energy situation. There was evidence of scouring. | | | | | | |
| 12/10/2014 | 6:15am | Intertidal: midlittoral | 174 | S17.30587° | E119.38068° | 0 | 0 | N/A |
| | | The lower-littoral had a high coverage of hard corals and deeply undercut from below. *Tectus niloticus* was very evident at this level. The midlittoral consisted of reef pavement covered with algal turf and sand with some turnable coral rubble scattered about. Juvenile *Tridacna crocea* were plentiful and larger specimens were few. | | | | | | |
| 12/10/2014 | 8:45am | Dive: lagoon | 175 | S17.1546° | E119.36826° | 17 | 12 | 10 |
| | | Site along the base of the eastern side of the central lagoon spine. Large flat-topped outcrops rising to near the surface with smaller, submerged outcrops spaced along a low profile meandering reef. Thickets of *Acropora* and other fragile corals were scattered about. At the base of the outcrops was a substantial amount of coral rubble – possible evidence of accelerated natural attrition through storm damage. Sediment was fine and the whole site was dusted with a very fine silt. Molluscs and echinoderms were conspicuously absent. | | | | | | |

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| | | **MERMAID REEF (continued)** | | | | | | |
| 12/10/2014 | 2:30pm | Dive: lagoon | 176 | S17.09053° | E119.64928° | 13 | 12 | 12 |
| | | East side of lagoon, south of channel: a storm ravaged reef amid larger rocky outcrops adjacent to a back-reef sand zone. Larger outcrops with small caves and ledges with encrusting corals. Outcrop ledges and areas between the outcrops were covered with coral debris, as was the larger surrounding area; a state of massive destruction of a coral reef with few corals surviving. Coral rejuvenation is evident and the area has a high abundance and diversity of fungiid corals. Coralline sediment was coarse and intermingled with coral debris – mostly *Acropora*. | | | | | | |
| 13/10/2014 | 6:15am | Intertidal: midlittoral | 177 | S17.09209° | E119.65665° | 0 | 0 | N/A |
| | | Reef was low in profile with flooded sections at low tide. The lower littoral had good coverage of *Acropora* plate making for a very fragile and difficult reef to walk on. Below the coral was reef pavement, albeit very channelled with many inter-linking small tidal flows. At the midlittoral the coral cover continued, but overlayed a flat, consolidated reef-pavement. Where this was exposed it was covered with algal turf and sand as was the coral rubble. Coralline sand and coral rubble covered the base of the tidal pools. Many reef fish were observed in these pools. | | | | | | |
| 13/10/2014 | 11:00am | Dive: sublittoral fore-reef slope | 178 | S17.16154° | E119.64710° | 18 | 12 | 25 |
| | | A steep, high profile reef at the south east end of the atoll. Reef was dissected with steep sided, *Acropora* rubble filled gutters, which meandered down to the base of the reef wall. At this depth the bottom was made up of *Acropora* rubble over coarse coralline sand. Sides of the walls had small under-hangs and caves with a low diversity of encrusting invertebrates. | | | | | | |
| 13/10/2014 | 3:20pm | Dive: lagoon | 179 | S17.07449° | E119.61616° | 15 | 12 | 8 |
| | | Site was towards the middle of the lagoon where a shallow spine of reef ran down the middle. Reef had suffered from past storm damage with significant devastation evident. Thickets of *Acropora* were dominant at the base of the reef, while the sides were covered with coral rubble and occasional tall outcrops. These were festooned with plate and other encrusting corals. Soft corals were also a conspicuous feature at this site. Several species of giant clam were observed (*Tridacna gigas, T. derasa, T. crocea* and *T. squamosa*) | | | | | | |
| 14/10/2014 | 7:30am | Intertidal: midlittoral | 180 | S17.04502° | E119.63652° | 0 | 0 | N/A |
| | | The reef was low in profile. Lower littoral was of reef-rock covered with colonies of fragile plate and other coral of various species. At the midlittoral the coral gave way to algal turf and sand over reef pavement with some turnable coral rubble. Interlinking shallow poos were flooded at low tide providing habitat for many reef fishes. These pools contained coarse coralline sediment and small outcrops. *Tectus niloticus* was reasonably abundant at the lower littoral. | | | | | | |
| 14/10/2014 | 12:00pm | Dive: sublittoral fore-reef slope | 181 | S17.02658° | E119.6189° | 25 | N/A | 25 |
| | | A steep fore-reef, which developed into a vertical wall at 20 m. Wall was covered with sponges and soft corals, mostly soft corals and seafans. Caves, underhangs and crevasses were a feature, and all with a diverse array of encrusting invertebrates. Floor of caves and ledges was coralline sand mixed with small rubble pieces. Fish were diverse and plentiful. Biodiversity site. | | | | | | |

TABLE 2 Surveyed Project locations with year completed. The number of sampling days and stations completed, and an indication of cross-shelf zoning with totals are also annotated. Cross-shelf zoning: I = Inshore; M = Midshelf; O = Offshore.

| Year | Sampling days by year | Sampling locations with replication excluded (refer to Table 1 for location details) | Number of locations surveyed | Number of stations completed | Cross-shelf zoning |
|---|---|---|---|---|---|
| 2009 | 12 | Adele Island | | 13 | I |
| | | Montgomery Reef | | 14 | I |
| | | **Number stations completed** | | **27** | |
| | | **Surveyed locations** | **2** | **2** | |
| 2010 | 15 | Cassini Island | | 18 | I |
| | | Long Reef | | 15 | I |
| | | **Number stations completed** | | **33** | |
| | | **Surveyed locations** | **2** | | |
| 2011 | 13 | Wildcat Reefs | | 2 | I |
| | | Champagney Islands | | 2 | I |
| | | White Island | | 5 | I |
| | | Black Rocks | | 1 | I |
| | | Un-named outcrop NW Black Rocks | | 1 | I |
| | | Osborn Reefs | | Aborted | |
| | | Isolated Reef NW of Wildcat Reefs | | Aborted | |
| | | Beagle Reef | | 4 | I |
| | | Mavis Reef | | 3 | I |
| | | Albert Reef | | 1 | I |
| | | Brue Reef | | 4 | I |
| | | Fraser Island | | 2 | I |
| | | King and Conway Islands | | 3 | I |
| | | Irvine and Bathurst Islands | | 2 | I |
| | | **Number stations completed** | | **30** | |
| | | **Surveyed locations** | **12** | | |
| 2012 | 15 | Rosella Shoals | | 1 | I |
| | | De Freycinet Island | | 2 | I |
| | | Hedley Island | | 3 | I |
| | | Outcrop North of Colbert Island | | 1 | I |
| | | Woodward Island | | 1 | I |
| | | Browse Island | | 6 | M |
| | | Echuca Shoal | | 2 | M |

| Year | Sampling days by year | Sampling locations with replication excluded (refer to Table 1 for location details) | Number of locations surveyed | Number of stations completed | Cross-shelf zoning |
|---|---|---|---|---|---|
| | | Heywood Shoal | | 2 | M |
| | | Jamieson Reef | | 2 | I |
| | | Condillac Island | | 2 | I |
| | | Patricia Island | | 1 | I |
| | | Heritage Reef | | 1 | I |
| | | West Montalivet Island | | 2 | I |
| | | Robroy Reefs | | 3 | I |
| | | Maret Islands | | 1 | I |
| | | **Number stations completed** | | **30** | |
| | | **Surveyed locations** | **15** | | |
| 2013 | 13 | Ashmore Reef | | 20 | O |
| | | Hibernia Reef | | 4 | O |
| | | Vulcan Shoal | | 1 | M |
| | | Eugene Mcdermott Shoal | | 1 | M |
| | | **Number stations completed** | | **26** | |
| | | **Surveyed locations** | **4** | | |
| 2014 | 14 | Mermaid Reef (Rowley Shoals) | | 8 | O |
| | | Clerke Reef (Rowley Shoals) | | 13 | O |
| | | Imperieuse Reef (Rowley Shoals) | | 12 | O |
| | | **Number stations completed** | | **33** | |
| | | **Surveyed locations** | **3** | | |
| | | **Total stations attempted** | | **181** | |
| | | **Total stations surveyed** | | **179** | |
| **Total days** | **82** | **Total surveyed locations** | **38** | | |
| 2006 | 16 | Mermaid Reef | | 16 | O |
| | | South Scott Reef | | 14 | O |
| | | North Scott Reef | | 10 | O |
| | | Seringapatam Reef | | 5 | O |
| | | **Stations surveyed** | | **45** | |
| | | **Surveyed locations** | **4** | **4** | |
| **Totals** | **98** | **Total surveyed locations** | **42** | **224** | |

### STATION AND GEOMORPHIC DATA (THIS PAPER)

The survey station attributes represent whole of station data and were recorded by the senior author in all cases. They detail survey date, time, location, identifier (station number), station description and coordinates (latitude and longitude), the survey method (dive, snorkel or intertidal walk), maximum station depth, transect depth and horizontal water visibility. The station descriptions contain details such as sediment type, dominant benthic taxa, tide and current information, and other relevant data. 'Maximum station depth' was taken as the deepest depth worked. 'Horizontal water visibility' was used as a proxy to provide an indication of station turbidity and measured at the start of each station as the horizontal distance (in metres) along the transect tape at which discernible shapes could be distinguished. For intertidal stations this measurement was taken as the maximum transect length (100 m).

The 22 geomorphic criteria in Table 3 were assigned to each of the 179 completed stations along with the 45 stations of the 2006 survey (Bryce 2009). These included the three cross-shelf zones (offshore, midshelf and inshore), geomorphic structure (island, reef, shoal or atoll), reefal features (fore-reef, back-reef, lagoon, reef platform) and substratum.

The presence, or absence, of the criterion 'Silt', either as a main substrate or as a dusting over the general topography, was recorded as a proxy for the existence of depositional fine sediments (silt) at each station. Similarly, the presence, or absence, of 'Coralline sands' demonstrated if a station was subject to clear oceanic water, free of any coastal or lagoonal originating sediment. Other criteria, such as 'Sand ripples' provided an indication of strong water flow, and a reef with a 'Vertical or steep drop-off' indicated a high-energy reef-front providing a wave-breaking rampart with high topographic habitat. This is in contrast to the stations with a lower topography ('Flat reef – patch or platform') that would be subject to a different sheering water-movement regime across their surface to that experienced by a vertical wall (Lugo-Fernández et al. 1998; Gourlay 1994).

Patterns of similarity of the sampled stations and those from the 2006 survey (Bryce 2009) were examined using multivariate analyses. This included hierarchical clustering and non-Metric Multidimensional Scaling (nMDS) performed in the software package PRIMER v6 (Clarke and Warwick 2001; Clarke and Gorley 2006). These analyses were based on square-root transformed geomorphic data per station derived from Table 1 and published data from the 2006 survey (Bryce 2009) using a Bray-Curtis dissimilarity coefficient. The patterns were visualised using an nMDS ordination (Figure 2) and a cluster dendrogram, with group-average linkage, to demonstrate the strength of the site relationships (Figure 3). The purpose of this analysis was to examine the similarity of sampled stations in order to complement the analyses undertaken for the targeted taxa data in the following papers of this series.

## RESULTS

### GENERAL PROJECT

Of the 181 survey stations attempted, 179 were completed from 38 locations, with two stations (70 and 71) aborted due to poor water visibility and tidal current (Figure 1 and Table 1). The cross-shelf station and location breakdown comprised: 110 inshore stations (28 locations), 12 midshelf (5) and 57 offshore (5). Adding the 45 stations and 4 locations from the 2006 survey (Bryce 2009) increased the offshore representation to 102 stations from 8 locations. In total, 224 stations from 42 locations have been surveyed since 2006 and were included in the analyses of the present paper (Table 2).

Examination of Project locations (Table 2 and Figure 1) at each of the corners of the Project Area demonstrate a greater replication of geomorphic zones (i.e. more stations per location providing finer scale sampling) compared to the surveyed locations between. These corner locations are: offshore north-west at Ashmore and Hibernia Reef (24 stations) and Rowley Shoals in the south-west (33); inshore south-east at Adele Island and Montgomery Reef (27), and Cassini Island and Long Reef (33) in the north-east. These four corners of the Project Area account for 117 stations, while the remaining 34 locations account for the balance of stations (62). The transect habitat coverage implications for this geomorphic zone clustering will be dealt with elsewhere (Richards et al. 2018).

### GEOMORPHIC DATA

Examination of the similarity plot (Figure 2) reveals a three way differentiation of the 224 stations surveyed (2009–2014 and 2006 surveys), which can be identified by cluster (C) numbers. Firstly, by their continental shelf zonation (distance from the coast): inshore clusters (coastal islands and reefs) C3, C5 and C8; midshelf

TABLE 3 Geomorphic parameters used for Figure 2 and 3 as extracted from Table 1 and Bryce 2009.

| Geomorphic criteria | Measurement | Proxy |
|---|---|---|
| Inshore | coast to 50 m depth | Distance from coast |
| Midshelf | 51–150 m depth | Distance from coast |
| Offshore | >150 m depth | Distance from coast |
| Island | Yes/no | Geomorphic structural influences |
| Reef | Yes/no | Geomorphic structural influences |
| Shoal | Yes/no | Geomorphic structural influences |
| Atoll | Yes/no | Geomorphic structural influences |
| Fore-reef slope | Presence/absence | Water energy + geomorphic structure |
| Back reef/lagoon | Presence/absence | Water energy + geomorphic structure |
| Coralline sands | Presence/absence | Water energy + sediment deposition |
| Dusting of silt | Presence/absence | Water energy + sediment deposition |
| Silt substrate | Presence/absence | Water energy + sediment deposition |
| Sand ripples | Presence/absence | Water energy |
| Slope - sand | Presence/absence | Geomorphic structure + sediment deposition |
| Slope - reef | Presence/absence | Geomorphic structure + water energy |
| Vertical/steep drop-off | Presence/absence | Geomorphic structure + water energy |
| Flat reef – patch or platform | Presence/absence | Geomorphic structure + water energy |
| Rocky/coral outcrops | Presence/absence | Geomorphic structure |
| Maximum station depth | Metres | Subtidal/intertidal influences |
| Horizontal water visibility | Metres of transect | Turbidity |
| Latitude | Decimal degees | Location: north south gradient |
| Longitude | Decimal degees | Location: east west gradient |

(Browse Island and submerged shoals) C2 and C7; and offshore (continental edge atolls) C1, C4 and C6. Secondly, an intertidal and subtidal distinction can be observed with the intertidal zone represented by C1–5. This intertidal zone is further divided into walked reef-platform stations (C1–3) and stations SCUBA dived or snorkelled (C4 and C5) (indicated by the broken line). Stations in C6–8 were all subtidal and sampled using SCUBA. Other than the intertidal/subtidal distinction, the offshore subtidal stations (C6) can further be defined into quiet lagoonal and high-energy fore-reef slope sites, thus demonstrating the relative simplicity of the offshore atoll habitats compared to the more complex inshore locations.

Finally, a turbidity gradation can be observed, as indicated by the red arrows within C4–8. The stations within these clusters are arranged from low to high turbidity in line with the direction of the red arrows. The general trend is for increasing turbidity radiating out from the central plot area, represented by the clear water midshelf, and those offshore and inshore stations adjacent to the midshelf. It could be argued that the reverse trend, i.e. one radiating towards the central midshelf from the outer stations of each cluster, would represent increasing energy flow (water movement). This assertion is based on the midshelf stations (C7) and stations close to the midshelf demarcation lines bordering C6 and C8, having coarse coralline sands and fore-reef slopes, i.e. stations at locations sited at the outer demarcation of the inshore, which are also outside any sediment plume and subject to high-energy wave action. In contrast, the outer stations of C6 and C8 had siltier sediments being sited within relatively silty lagoonal/back reef situations or close to

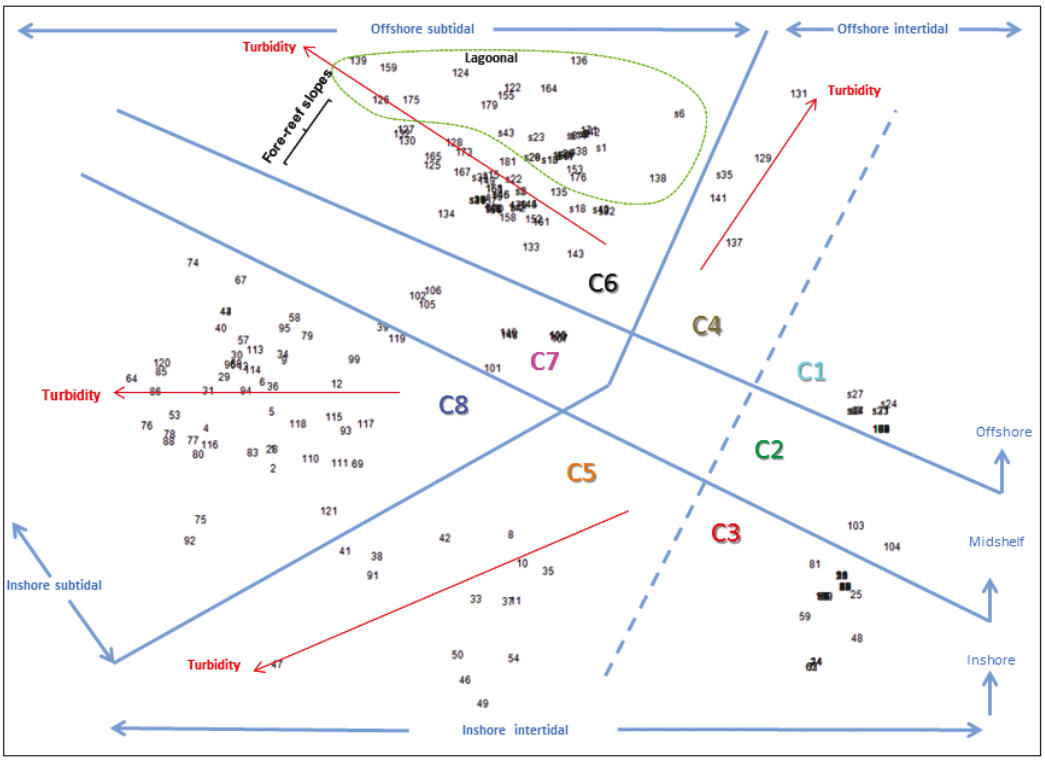


FIGURE 2 MDS ordination of 224 stations surveyed during 2009–2014 (179 stations) and 2006 (45 stations). A three way differentiation of the stations is indicated: intertidal (C1–3 and C4 & C5) and subtidal (C6–8), inshore to offshore and turbidity. The broken line delineates those intertidal stations walked (C1–3) and those snorkelled or dived (C4 and C5). Colour coded Cluster numbers equate to those used in Figure 3 and Table 4. Final stress in 2D = 0.14.

inshore macro-tidal environments. The same is true for C4 and C5, but the high to low energy gradient is less pronounced as these stations are intertidal and protected somewhat by their reef ramparts from high-energy wave action. The distance from the midshelf demarcation lines by the closest stations (station 8/K09 in C5 and 137/K13 in C4) is also indicative. The stations in these two clusters were generally within close proximity to inshore, shallow reefs and islands (C5) or offshore environments with fine sediments (C4).

The hierarchical clustering in the dendrogram (Figure 3) reveals comparable patterns with those seen in the station similarity MDS plot (Figure 2). To provide comparative detail the dendrogram (Figure 3) was maintained as a single figure, with Table 4 supplying the station data/cluster reference and ordered commensurately with that seen in Figure 3. There are two main cluster breaks: intertidal/subtidal (similarity 0.71) and offshore/inshore (similarity 0.79), with an inter-cluster break for C6 into fore-reef slopes and lagoonal sites (similarity 0.88).

## DISCUSSION

The Project Area is large at approximately 476,000 km$^2$ providing considerable latitudinal and longitudinal gradients, the latter spanning across the shallow water zones (<30 m) of the wide continental shelf from coast to continental edge. The Kimberley inshore is complex with a high diversity of habitats created by over 2,500 islands and a convoluted ria coastline (Wilson, 2014), which contrasts with the simpler, more well-defined offshore habitats of the deeper reefs, shoals and atolls of the continental slope. The complexity of the inshore is further complicated by the macro-tides and corresponding light-impeding, silt-laden waters. Offshore the environment is oceanic by nature with clear water and greater bathymetric scope and as such, subject to different environmental drivers compared to the inshore. This difference in environmental complexity is demonstrated in Figure 2 with the stations of the offshore subtidal stations (C6), including the subtidal midshelf C7, being closely clustered (greater habitat similarity

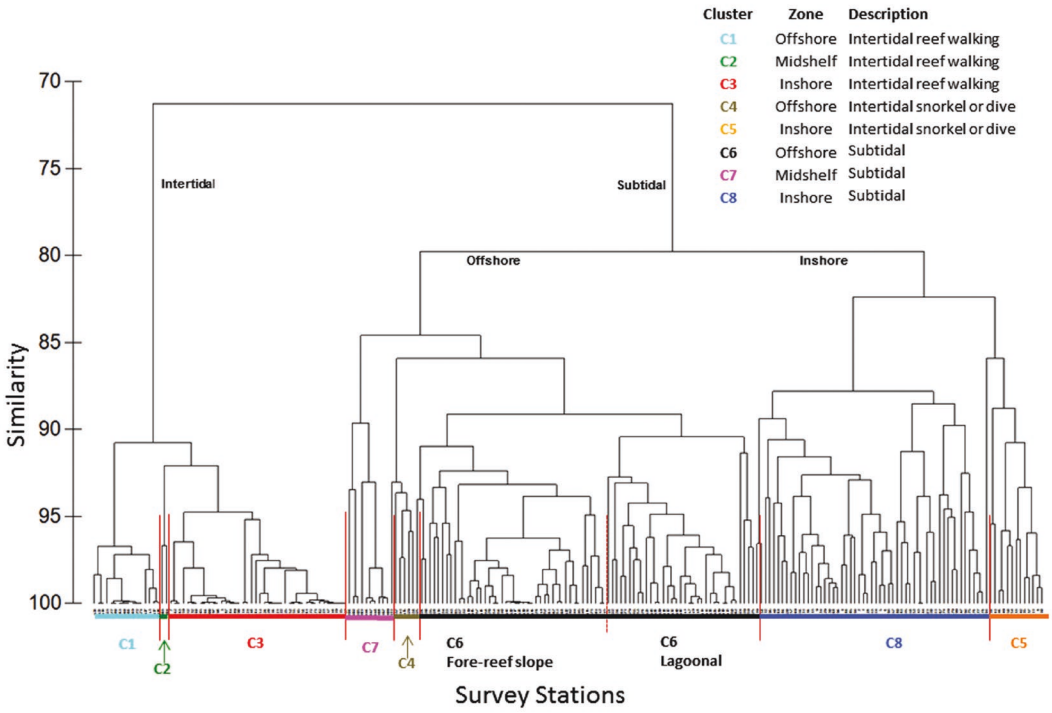


FIGURE 3 Dendrogram for hierarchical clustering of 224 stations (2009–2014 and 2006) throughout the Project Area using group-average linking of the Bray Curtis similarities, calculated on square root transformed habitat data from 20 geomorphic measures (Table 3). Two main cluster breaks are indicated: intertidal (similarity 0.91) and offshore/inshore (similarity 0.85), with a further inter-cluster break for C6 (fore-reef slopes and lagoonal habitats). Colour coded Cluster numbers (C) equate to those used in Figure 2 with full station numbers/cluster in Table 4.

within each cluster), in comparison to the inshore stations (C5 and C8), which have a more loosely clustered aspect (greater habitat diversity). This is also reflected in the intertidal clusters of C1 and C3, albeit to a lesser extent.

It is suggested here that the environmental complexity of the subtidal inshore C8 is further demonstrated in the dendrogram (Figure 3, Table 4). Any attempt to further refine the habitats of this cluster, in a similar fashion as for the offshore subtidal C6 into fore-reef slopes and lagoonal stations, was unresolved and will require further examination and, in all probability, finer metrics than those recorded for this project. The inclusion of biological data (future papers of this project) will undoubtedly help to resolve this issue and enable further analyses.

The distribution of completed survey stations, including those of the 2006 survey, represents a significant contribution to our understanding of the Kimberley marine environments, the habitats, biodiversity and geomorphology. Implementing this project method, with station effort limited to 60 minutes, for sampling a vast area of shallow water environments is easily transferred to other regions and offers adaptability for different situations. The range of targeted marine taxa, with a mix of mobile and sessile phyla, delivers a significant and meaningful assessment of a region's biodiversity, provides insights into the various biogeographic implications of the marine life and places the habitat associations into context. However, the over-riding caveat is that all the recorded data is a snapshot in time and not a comprehensive examination of the changes, seasonal, annual or otherwise, which are so characteristic of this dynamic Kimberley region.

These data provide a foundation to evaluate the region's marine biodiversity and habitats, allowing for informed decision making by government, industry and conservation agencies. These surveys will aid in the determination and management of the region's marine reserve systems, both established and yet to be declared (e.g. Anon 2011, Moore et al. 2016). The outcomes of this project (papers in prep) with the associated data and museum/herbarium research voucher specimens across the nine marine taxa will also provide a foundation for future research as ongoing analyses exposes and identifies knowledge gaps.

TABLE 4 Survey stations per cluster ordered to match Figure 3 with commensurate location data extracted from Table 1.

| Station # | Locations |
|---|---|
| **C1: Offshore intertidal walking** | |
| s24 | South Scott Reef |
| s21 | South Scott Reef |
| s33 | North Scott Reef |
| 123 | Ashmore Reef |
| 177 | Mermaid Reef (Rowley Shoals) |
| 180 | Mermaid Reef (Rowley Shoals) |
| 163 | Imperieuse Reef (Rowley Shoals) |
| 160 | Imperieuse Reef (Rowley Shoals) |
| 166 | Imperieuse Reef (Rowley Shoals) |
| 169 | Clerke Reef (Rowley Shoals) |
| 172 | Clerke Reef (Rowley Shoals) |
| 174 | Clerke Reef (Rowley Shoals) |
| s27 | South Scott Reef |
| s3 | Mermaid Reef (Rowley Shoals) |
| s37 | North Scott Reef |
| s44 | Seringapatam |
| **C2: Midshelf intertidal walking** | |
| 103 | Browse Island |
| 104 | Browse Island |
| **C3: Inshore intertidal walking** | |
| 7 | Adele Island |
| 62 | Champagney Islands |
| 63 | Champagney Islands |
| 59 | Cassini Island |
| 112 | Condillac Island |
| 32 | Cassini Island |
| 60 | Cassini Island |
| 65 | White Island |
| 66 | White Island |
| 100 | Woodward Island |
| 97 | Hedley Island |
| 98 | Hedley Island |
| 3 | Adele Island |
| 87 | King and Conway Islands |
| 84 | Fraser Island |
| 89 | Irvine and Bathurst Islands |
| 90 | Irvine and Bathurst Islands |
| 14 | Montgomery Reef |
| 24 | Montgomery Reef |
| 48 | Long Reef |
| 81 | Brue Reef |
| 51 | Long Reef |
| 26 | Montgomery Reef |
| 20 | Montgomery Reef |
| 16 | Montgomery Reef |
| 21 | Montgomery Reef |
| 22 | Montgomery Reef |
| 25 | Montgomery Reef |
| 52 | Long Reef |
| 55 | Long Reef |
| 45 | Long Reef |
| 56 | Long Reef |
| 61 | Wildcat Rocks |
| 72 | Beagle Reef |
| 73 | Beagle Reef |
| 82 | Brue Reef |
| 23 | Montgomery Reef |
| 17 | Montgomery Reef |
| 18 | Montgomery Reef |
| 19 | Montgomery Reef |
| 15 | Montgomery Reef |
| 27 | Montgomery Reef |
| **C7: Midshelf subtidal** | |
| 106 | Browse Island |
| 102 | Browse Island |
| 105 | Browse Island |
| 101 | Browse Island |
| 146 | Vulcan Shoal |
| 147 | Eugene Mcdermott Shoal |
| 148 | Heywood Shoal |
| 108 | Echuca Shoal |
| 107 | Echuca Shoal |
| 109 | Heywood Shoal |

| Station # | Locations |
|---|---|
| **C4: Offshore intertidal dive/snorkel** | |
| 131 | Ashmore Reef |
| 137 | Ashmore Reef |
| 141 | Ashmore Reef |
| s35 | North Scott Reef |
| 129 | Ashmore Reef |
| 138 | Ashmore Reef |
| **C6: Offshore subtidal fore-reef slopes** | |
| 125 | Ashmore Reef |
| 126 | Ashmore Reef |
| 130 | Ashmore Reef |
| 135 | Ashmore Reef |
| 128 | Ashmore Reef |
| s34 | North Scott Reef |
| 134 | Ashmore Reef |
| 133 | Ashmore Reef |
| 143 | Hibernia Reef |
| 165 | Imperieuse Reef (Rowley Shoals) |
| 127 | Ashmore Reef |
| 132 | Ashmore Reef |
| s19 | South Scott Reef |
| s45 | Seringapatam Reef |
| 157 | Imperieuse Reef (Rowley Shoals) |
| s16 | Mermaid Reef (Rowley Shoals) |
| 158 | Imperieuse Reef (Rowley Shoals) |
| 170 | Clerke Reef (Rowley Shoals) |
| 154 | Clerke Reef (Rowley Shoals) |
| 156 | Clerke Reef (Rowley Shoals) |
| 140 | Ashmore Reef |
| s41 | Seringapatam Reef |
| s20 | South Scott Reef |
| s17 | South Scott Reef |
| s28 | South Scott Reef |
| s30 | South Scott Reef |
| s31 | North Scott Reef |
| s36 | North Scott Reef |
| 178 | Mermaid Reef (Rowley Shoals) |
| s4 | Mermaid Reef (Rowley Shoals) |
| 152 | Clerke Reef (Rowley Shoals) |
| 161 | Imperieuse Reef (Rowley Shoals) |
| 167 | Imperieuse Reef (Rowley Shoals) |
| 151 | Clerke Reef (Rowley Shoals) |
| 168 | Imperieuse Reef (Rowley Shoals) |
| s22 | South Scott Reef |
| 142 | Hibernia Reef |
| 144 | Hibernia Reef |
| 145 | Hibernia Reef |
| 149 | Mermaid Reef (Rowley Shoals) |
| s15 | Mermaid Reef (Rowley Shoals) |
| 173 | Clerke Reef (Rowley Shoals) |
| 181 | Mermaid Reef (Rowley Shoals) |
| s2 | Mermaid Reef (Rowley Shoals) |
| s5 | Mermaid Reef (Rowley Shoals) |
| **C6: Offshore subtidal lagoonal** | |
| s6 | Mermaid Reef (Rowley Shoals) |
| 122 | Ashmore Reef |
| 136 | Ashmore Reef |
| 164 | Imperieuse Reef (Rowley Shoals) |
| 171 | Clerke Reef (Rowley Shoals) |
| 179 | Mermaid Reef (Rowley Shoals) |
| 155 | Clerke Reef (Rowley Shoals) |
| 153 | Clerke Reef (Rowley Shoals) |
| 176 | Mermaid Reef (Rowley Shoals) |
| s23 | South Scott Reef |
| s43 | Seringapatam Reef |
| s26 | South Scott Reef |
| s29 | South Scott Reef |
| s18 | South Scott Reef |
| s12 | Mermaid Reef (Rowley Shoals) |
| s32 | North Scott Reef |
| s40 | North Scott Reef |
| s42 | Seringapatam Reef |
| s1 | Mermaid Reef (Rowley Shoals) |
| s7 | Mermaid Reef (Rowley Shoals) |
| s9 | Mermaid Reef (Rowley Shoals) |
| s8 | Mermaid Reef (Rowley Shoals) |
| s14 | Mermaid Reef (Rowley Shoals) |
| s11 | Mermaid Reef (Rowley Shoals) |
| s38 | North Scott Reef |
| s25 | South Scott Reef |

| Station # | Locations |
|---|---|
| s39 | North Scott Reef |
| s10 | Mermaid Reef (Rowley Shoals) |
| s13 | Mermaid Reef (Rowley Shoals) |
| 150 | Mermaid Reef (Rowley Shoals) |
| 162 | Imperieuse Reef (Rowley Shoals) |
| 124 | Ashmore Reef |
| 139 | Ashmore Reef |
| 159 | Imperieuse Reef (Rowley Shoals) |
| 175 | Clerke Reef (Rowley Shoals) |
| **C8: Inshore subtidal** | |
| 39 | Cassini Island |
| 58 | Cassini Island |
| 12 | Adele Island |
| 95 | De Freycinet Island |
| 40 | Cassini Island |
| 64 | White Island |
| 86 | King and Conway Islands |
| 120 | Maret Islands |
| 57 | Long Reef |
| 69 | Un-named outcrop NW Black Rocks |
| 116 | West Montalivet Island |
| 31 | Cassini Island |
| 36 | Cassini Island |
| 13 | Adele Island |
| 9 | Adele Island |
| 34 | Cassini Island |
| 29 | Cassini Island |
| 30 | Cassini Island |
| 68 | White Island |
| 96 | Hedley Island |
| 4 | Adele Island |
| 88 | King and Conway Islands |
| 85 | Fraser Island |
| 94 | De Freycinet Island |
| 2 | Adele Island |
| 1 | Adele Island |
| 28 | Cassini Island |
| 113 | Condillac Island |
| 114 | Patricia Island |
| 5 | Adele Island |
| 6 | Adele Island |
| 93 | White Island |
| 117 | West Montalivet Island |
| 80 | Brue Reef |
| 83 | Brue Reef |
| 115 | Heritage Reef |
| 118 | Robroy Reefs |
| 53 | Long Reef |
| 43 | Long Reef |
| 44 | Long Reef |
| 121 | Robroy Reefs |
| 110 | Jamieson Reef |
| 111 | Jamieson Reef |
| 67 | Black Rocks |
| 74 | Beagle Reef |
| 119 | Robroy Reefs |
| 79 | Albert Reef |
| 99 | Outcrop North of Colbert Island |
| 47 | Long Reef |
| 92 | Wildcat Rocks |
| 75 | Beagle Reef |
| 76 | Mavis Reef |
| 77 | Mavis Reef |
| 78 | Mavis Reef |
| **C5: Inshore intertidal dive/snorkel** | |
| 91 | Rosella Shoals |
| 38 | Cassini Island |
| 41 | Cassini Island |
| 46 | Long Reef |
| 49 | Long Reef |
| 50 | Long Reef |
| 54 | Long Reef |
| 33 | Cassini Island |
| 42 | Cassini Island |
| 35 | Cassini Island |
| 37 | Cassini Island |
| 11 | Adele Island |
| 8 | Adele Island |
| 10 | Adele Island |

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