Operation Wallacea
Conservation research through academic partnerships

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Dominica marine site (Fort Shirley) 2016 Report: Surveys

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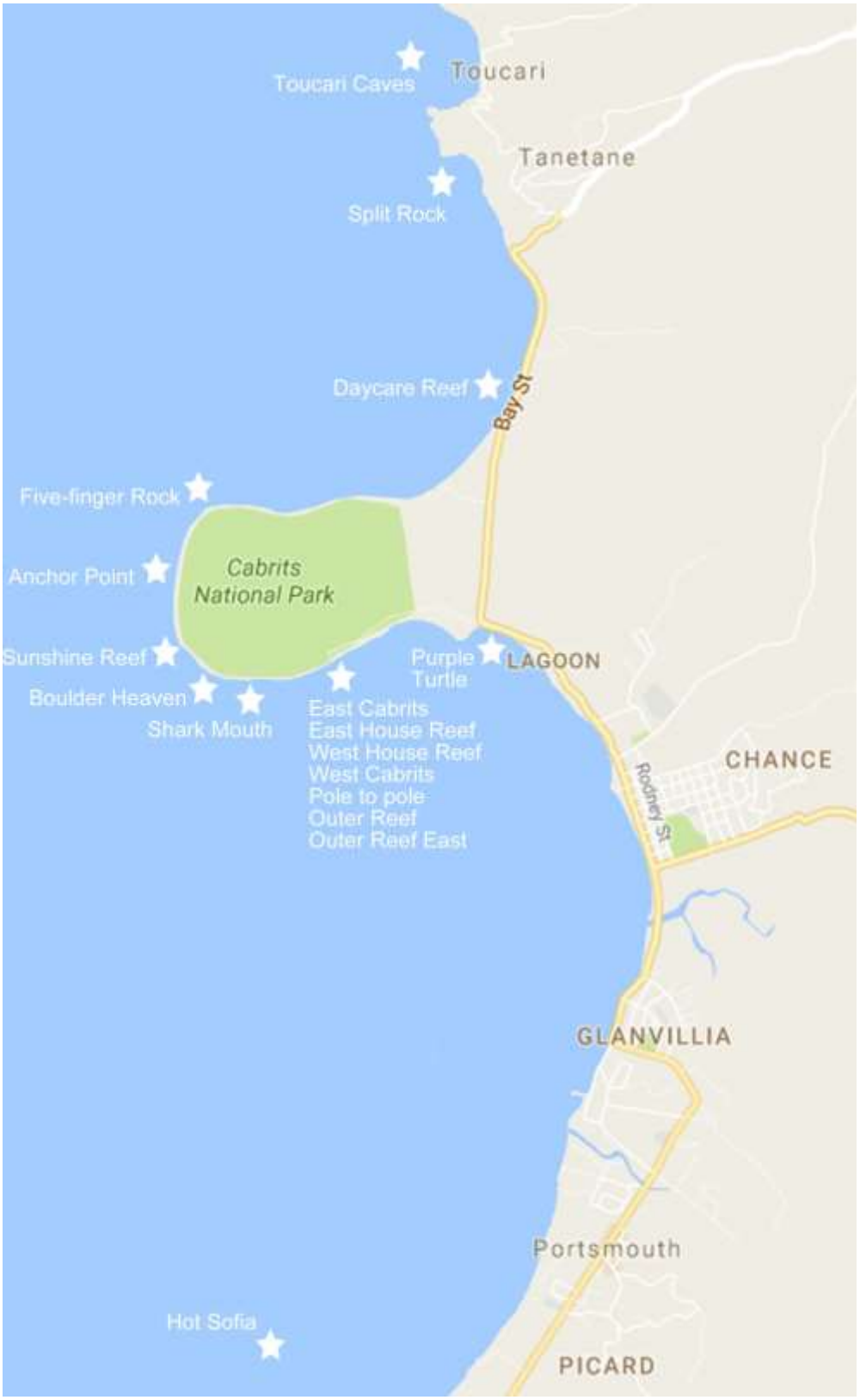
This document is an extract of the full marine site report on the activities at the marine site in Dominica during the 2016 season. It is intended as a log of the data that was collected and what could be possible for future research.

1.1 Survey team

Operation Wallacea were based at Fort Shirley in the Cabrits Marine Park, Prince Ruperts Bay, Dominica from 13 June – 8 August 2016. During this time several marine surveys were conducted under the supervision of Dr Jon Chamberlain, a researcher from the University of Essex (UK), with the help of Operation Wallacea staff, visiting teachers and students and the staff of JC Ocean Adventures.

1.2 Dive sites


Toucari Caves
Toucari
Tanetane
Split Rock
Daycare Reef
Bay St
Five-finger Rock
Anchor Point
Cabrits
National Park
Sunshine Reef
Boulder Heaven
Shark Mouth
East Cabrits
East House Reef
West House Reef
West Cabrits
Pole to pole
Outer Reef
Outer Reef East
Purple
Turtle
LAGOON
CHANCE
Rodney St
GLANVILLIA
Portsmouth
Hot Sofia
PICARD

Site name	Depth	Access	GPS	Description
East Cabrits	2-6m	Jetty or East Ramp	15°34.965'N 61°28.254'W	Gently sloping, sediment-covered boulders with some hard and soft corals. Large sandy patch on the West end used for dive training.
East House Reef	2-6m (flat), 6-10m (slope)	Jetty	15°34.948'N 61°28.285'W	Gently sloping flat of boulders with hard corals and sponges, dropping down at 45 degrees to sand at 10m at the base of the slope.
West House Reef	2-6m (flat), 6-14m (slope)	Jetty	15°34.934'N 61°28.314'W	Gently sloping flat of boulders with hard corals and sponges, dropping steeply to sand between 10-14m at the base of the slope.
West Cabrits	2-6m (flat), 6-18m+ (slope)	Jetty or West Ramp	15°34.919'N 61°28.335'W	Gently sloping flat of boulders with hard corals and sponges, dropping steeply to sand between 14-18m+ at the base of the slope.
Pole To Pole	0-12m	Jetty	15°34.922'N 61°28.289'W	A series of circular metal legs approx. 50cms diameter, rising from a sandy seabed to above the surface. Covered in sponges, hard corals, hydroids and algae, as well as lots of mobile life including crabs, fish and occasional seahorse.
Seagrass Meadow	6-18m+	Jetty	15°34.912'N 61°28.274'W	A wide (30m) strip of turtle grass (*Thalassia testudinum*) separating the house reef from the outer reef. Occasional sponge and coral bommies, mobile life including gurnards, rays and fish.
Outer Reef	16-18m+	Jetty	15°34.884'N 61°28.269'W	A series of sponge-dominated reef platforms separated by sandy patches. Many large barrel sponges, as well as other species of sponge.
Outer Reef East	6-10m	Jetty or East Ramp	15°34.920'N 61°28.220'W	Algae-dominated reef system with occasional sponges and soft coral. Schools of reef squid and fish.
Shark Mouth	6-18m+	West Ramp	15°34.886'N 61°28.504'W	Steeply-sloping reef covered in hard and soft corals, large barrel sponges and large areas of rope sponge. Many fish and mobile life.
Boulder Heaven	6-18m+	Boat	15°34.919'N 61°28.615'W	Steeply-sloping reef with large boulders at the top. Hard and soft corals, sponges and patches of sand.
Sunshine Reef	6-18m+	Boat	15°34.955'N 61°28.677'W	Sloping reef with hard and soft corals, sponges and patches of sand.
Anchor Point	6-18m+	Boat	15°35.041'N 61°28.747'W	Large boulder-strewn area of sand, with a reef gently sloping down beyond 18m.
Five-finger Rock	10-18m+	Boat	15°35.457'N 61°28.622'W	Large rock that protrudes from the water and drops down to the reef at 10m. Reef wall has lots of hard and soft coral, sponges and mobile life. May be current.
Daycare Reef	5m	Shore or boat	15°35.693'N 61°27.826'W	An old pyroclastic flow covered in sponges, corals and many mobile animals. Can be done as a snorkel or easy shore dive.
Split Rock	8-16m	Boat	15°36.318'N 61°27.945'W	Large algae-dominated area with occasional large and diseased barrel sponges, soft corals and hydroids. Split rock is a large, geological formation of rocks fallen from the cliff that divers can swim through.
Toucari Caves	8-18m+	Boat	15°36.639'N 61°28.039'W	Large area of reef chunks rising several meters from the sand, several containing swim-throughs and arches. Sloping reef of hard and soft corals beyond this. A good first dive of a 2-dive boat trip as the caves are above 10m.
Hot Sofia	16-30m	Boat	15°33.902'N 61°28.639'W	Hydrothermal springs producing hot sand and fresh water upwellings (and occasional bubbles) at 22-30m. On either side of the springs are reef outcrops, rising from sand at around 20-22m to 16-18m high, covered in hard corals, sponges and fish.
Purple Turtle Beach	3m	Shore	15°35.022'N 61°27.778'W	Training site for PADI Open Water. Shallow sloping sandy beach leading to seagrass at 4m and beyond. Some boat traffic and visibility affected by rain water from a nearby outflow.

2. Data collection and surveys

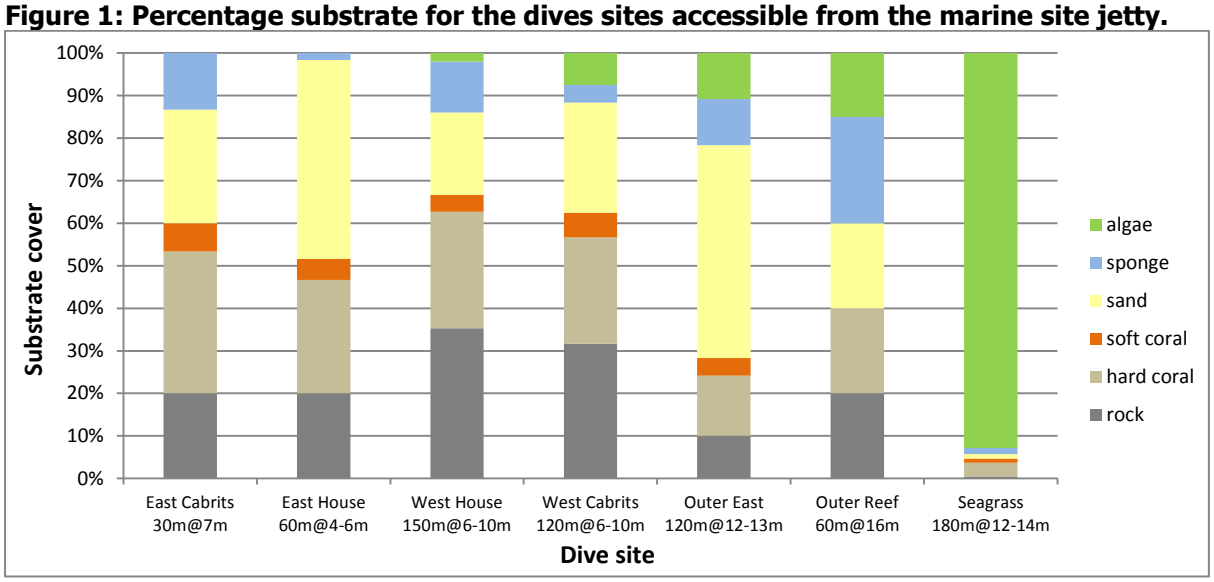
2.1 Habitat mapping

Each local dive site was dived and snorkelled numerous times in order to create a general habitat description. Additionally, 30m substrate transects were performed in order to quantify coral, algae and sponge cover. The substrate of every meter under the transect tape was recorded. Habitat mapping typically took place at the same time as the urchin surveys. The aim of the habitat mapping was to determine substrate cover of each reef area.

2.1.1 Results

The substrate of dive sites show a distinction between areas that could potentially be used for research purposes – see Figure 1. The eastern sites (East Cabrits, East House and Outer East) are characterised by more sand and less rock than the other sites. All the house reef sites had a similar quantity of hard coral cover, whilst the outer reefs had less hard coral and more sponge and algae. The seagrass meadow was predominantly seagrass with small bommies of rock, hard and soft corals and sponges.

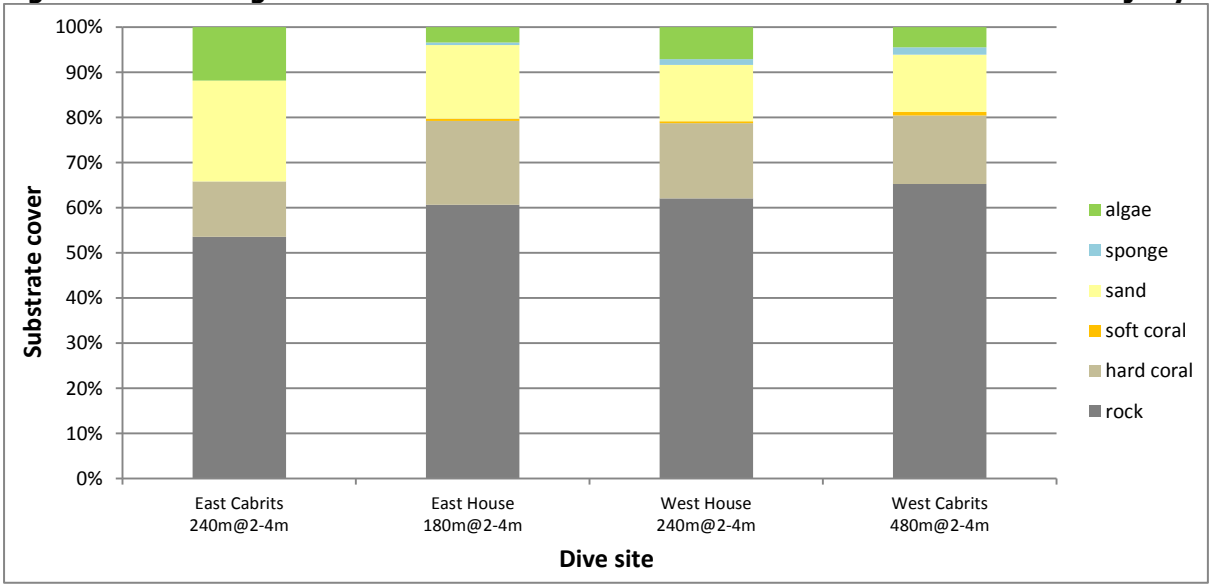
Figure 1: Percentage substrate for the dives sites accessible from the marine site jetty.



The substrate of the snorkel sites were very similar, although East Cabrits had more sand and less hard coral (understandable as the large sandy patch used for diver training is within this site) – see Figure 2. Due to the topography of the area the eastern sites and beyond become shallower and flatter with more sand and seagrass, whilst the western sites become progressively rockier and steeper to depth. The jetty is in a good position as a central point making these sites good for depth comparison studies.

It is worth noting that fire coral was abundant at all the snorkel sites but was most commonly recorded as hard coral (fire coral is actually a hydroid) by the survey teams. Future surveys should have better instructions on how to identify benthic cover and possibly even a qualifying quiz to ensure more accurate data quality.

Figure 2: Percentage substrate for the snorkel sites accessible from the marine site jetty.



2.2 Invasive species (*Pterois volitans*) survey

Lionfish (*Pterois volitans*) were monitored in a similar way to keystone species (Section 6.4); however, they were actively hunted during the Opwall season which made assessing their abundance difficult. A better approach may have been to use a timed survey at a set depth range on a set dive location and catch every lionfish that is found. These can then be weighed, measured and the contents of their stomachs examined to see what they have been eating. They can also be assessed for egg masses. The lionfish survey was not completed in 2016.

2.3 Coral Watch survey

Coral bleaching surveys were conducted by snorkelers and divers in shallow (<5m) water according to the instructions laid out by the University of Queensland project. 20 corals were selected at random on each part of the reef surveyed. For each coral the lightest and darkest part of the coral were coded (using the laminated colour chart) and also whether the coral was branching, boulder, plate or soft. This data was returned to the University of Queensland. The aim of this survey was to introduce students to citizen science, as well as collect data on coral bleaching on the reef. Approx. 30 Coral Watch survey forms were submitted in 2016.

2.4 Keystone species (*Diadema antillarum*) survey

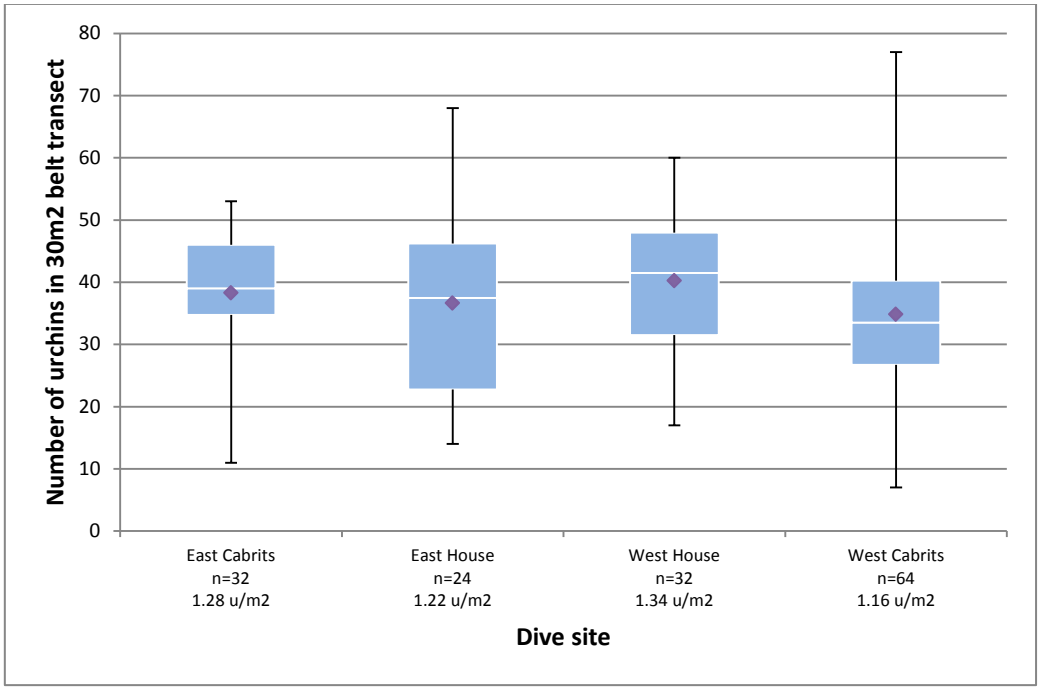
Snorkelers were used to survey four 60m transects along the house reef between 2-4m depth. The transect locations were determined by above-water visual cues but were always in slightly random locations each time. The urchin (*Diadema antillarum*) counts were completed by 2 snorkelers doing 30m transects, each counting a 1m belt transect either side of the tape one way, then counting a 1m belt transect on the other side of the tape in the opposite direction. This was repeated to create a 60m transect. The aim of the urchin survey was to quantify the abundance of urchins along the house reef.

2.4.1 Results

The snorkel survey of four sites at Fort Shirley show a healthy average number of urchins/m^2, ranging from 1.16 to 1.34 (over 1 urchin/m^2 is considered a promising sign of reef recovery http://www.healthyreefs.org/cms/diadema-abundance/) – see Figure 3. The number of urchins recorded was quite variable on each survey, partly because the urchins aggregate in certain areas at each site and partly due to the substrate and average depth of the sites (East Cabrits has more sand and being overall flatter; West Cabrits has more rock and a steeper incline to depth).

Previous research of urchin abundance on Dominica in 2002 showed a higher overall abundance (1.47 urchins/m^2) at their most northern sites at Tabby Bay on the south side of Prince Ruperts Bay (Smith et al, 2002) but this may be regional variation rather than an indicator of reef health over time.

Figure 3: Boxplot of urchin abundance at the four snorkel survey sites.



Smith Q, McKinney J, Komoroske L, Petterson L. (2002) Dominica coral reef status 2002: assessment of the sea urchin Diadema antillarum, reef fishes and algae. ITME Research Reports 12:1-4. Student Research Reports, Fall September 2002.

2.5 Barrel sponge (*Xestospongia muta*) survey

The obvious existence of orange-band barrel sponge wasting disease in the area (most notably at the Split Rock dive site in Douglas Bay) led to a small monitoring project to record the size, location and abundance of barrel sponges (*Xestospongia muta*) along the western house reef. A 50m transect was laid across the reef at 10m depth by divers, from a location that could be easily found again in the future (starting at the western end of the jetty). Any barrel sponge located within 2m of the transect (creating a 4m total belt transect) had several measurements taken:

- Distance along transect
- Distance from transect to closest point of attachment on the reef
- Circumference of the widest point of the sponge
- Circumference of the base of the sponge
- Osculum (the hole at the top) diameter at the widest point
- Height, from the base to the top of the sponge
- Depth of the base of the sponge

These measurements could then be used to assess the age of the barrel sponge (http://people.uncw.edu/pawlikj/xmuta_calc.html). Additionally, each sponge had a photograph taken along with an identifying number on a slate taken at a parallel angle to the transect tape, as well as a photo of any signs of disease, damage or whitening. Any very large barrel sponges spotted along the reef (outside of the transect) were also recorded to assess maximum age of sponges on the reef. The aim of the barrel sponge survey was to create a record of sponges that could be used as a future baseline, as well as estimate the age of the barrel sponges on the reef.

2.5.1 Results

There were a total of 65 individual sponges found on the 50x4m belt transect, equal to 0.325 sponges/m^2. Average (mean) age of individual sponges was 12.2 years (SD 8.6) with a minimum age of 1 year old and maximum age estimated to be 46 years. Some of the largest sponges outside of the transect on the West Cabrits reef were estimated to be between 150-250 years old, although the age estimation is likely to be inaccurate at these extreme age ranges.

There was no indication of disease in the sponges on the transect (although some had damage from fishing line and epibonts); however, at the furthest western end of the West Cabrits dive site some sponges were showing significant signs of disease and decay. It is possible (depending on the disease transmission process) that the barrel sponges on the house reef will start to show signs of disease in the future.

2.6 Sea slug (*Opistobranchia sp.*) diversity

Photographic records of *Opistobranchia sp.* (including *Nudibranchia sp.*) were recorded from various locations in Dominica. Diversity of Opistobranchia is assumed to be low in the Caribbean so search efforts focused on turning over cobbles in the shallows (via snorkelling) and checking mooring ropes (via diving). Additionally, some cryptic habitat material (seagrass, dislodged hydroid masses in the shallows etc.) were collected and examined via microscope. The aim of this survey was to record the diversity of sea slugs in Dominica.

2.6.1 Results

16 species of sea slugs (Opistobranchia) were found (also 1 unknown and 1 flatworm species).

Name	Location found	Abundance	
Aplysia dactylomela	Purple Turtle Beach	Frequent	
Aplysia parvula	Seagrass meadow	Rare	
Berthella stellata	West Cabrits	Occasional	

Catriona maua	Daycare reef	Rare	
Cyphoma gibbosum	West Cabrits Split Rock	Frequent	
Doto uva	Daycare reef Split rock	Occasional	
Elysia crispata	All reefs	Common	

Elysia ornata	Seagrass meadow	Rare	
Hofstenia miamia (Acoela/flatworm)	Seagrass meadow	Occasional	
Learchis poica	Daycare reef	Frequent	
Limenandra nodosa	West Cabrits	Rare	

Navanax aenigmaticus	Anchorage house reef	Rare	
Noumeaella kristenseni	Anchorage house reef	Rare	
Phidiana lynceus	Champagne reef West Cabrits	Frequent	
Pleurobranchus albiguttatus	Anchorage house reef	Rare	

Stylocheilus striatus	Anchorage house reef	Frequent	
Taringa telopia	West Cabrits	Occasional	 
Unknown (Velutinid snail? Haminoeidae?)	Anchorage house reef	Rare	

2.7 Hydrothermal vent survey

Photographic records and water samples were taken during one dive at the Hot Sofia dive site in Prince Rupert Bay. Three separate water samples were taken at various sites using recycled and rinsed 500ml water bottles. These samples were Ph tested at the Barracks and averaged. Logistical information, as well as site information, was also considered. The aim of the survey was to do an initial assessment of its suitability as a site for scientific research in the future.

2.7.1 Results

The hot water vents (28m) at Hot Sofia had an average Ph of 8.57 (8.5; 8.5; 8.7) and the surrounding reef (20m) had an average Ph of 8.7 (8.7; 8.7; 8.7). The temperature of the water was not accurately tested but recorded 29°C on a dive computer.

The water of the West Cabrits reef (18m) had an average Ph of 8.63 (8.6; 8.6; 8.7), although this was after a period of heavy rainfall. The Outer Reef had an average Ph of 8.53 (8.5; 8.5; 8.6). The temperature of the Cabrits reefs was recorded on a dive computer as 28°C, which is normal for the area).

It is unclear whether the water quality at the two sites is sufficiently different to enable studies of ocean acidification. There are 2 closer reefs to Hot Sofia called Rock Crusher and Coconut Beach Reef which might offer testing sites in a similar environment.