

Vauxhall Reef 2015-2024

David Patriquin

Prof. of Biology,
Dalhousie University (retired)

Naturalist/CORALL volunteer

CORALL AGM
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*Annotated slides from
the presentation*

www.versicolor.ca/barbados



Comment:

I was introduced to Barbados and tropical marine biology when, as a McGill student, Prof Mel Goldstein of McGill invited me to assist him and Prof William Randolph Taylor of the University of Michigan with collecting seaweed specimens from Barbados in February of 1966. In turn, in the summer of 1966 I attended a field course on Tropical Marine Biology at the Bellairs Research Institute of McGill University in Holetown. It was given by Dr. John Lewis, the Bellairs founder and first Director and several other McGill profs. Lewis's specialty was coral reefs; he wrote some of the now classical papers on Barbados reefs*.

We spent most of our field time on a very healthy fringing reef on our doorstep, the "Bellairs Reef". When Profs. Lewis and Goldstein asked me if I would be interested in studying seagrass beds for my PhD, I had no hesitation replying. I spent the years from mid-1967 to early 1970 doing just that accompanied by my spouse, Nina; my field sites were in Barbados (mainly at Bath on the east coast) and around the island of Carriacou, Grenada.

We returned to Barbados intermittently over the years and always I poked around the fringing reefs on the west coast just for the enjoyment but enough to notice sharp declines in reef quality over the years.

*Particularly pertinent to fringing reefs:

- Lewis, John B. "The coral reefs and coral communities of Barbados, WI." *Canadian Journal of Zoology* 38.6 (1960): 1133-1145.

- Lewis, John B. "The *Acropora* inheritance: a reinterpretation of the development of fringing reefs in Barbados, West Indies." *Coral Reefs* 3 (1984): 117-122.

- Lewis, John B. "Biology and ecology of the hydrocoral *Millepora* on coral reefs." *Advances in marine biology* 50 (2006): 1-55.

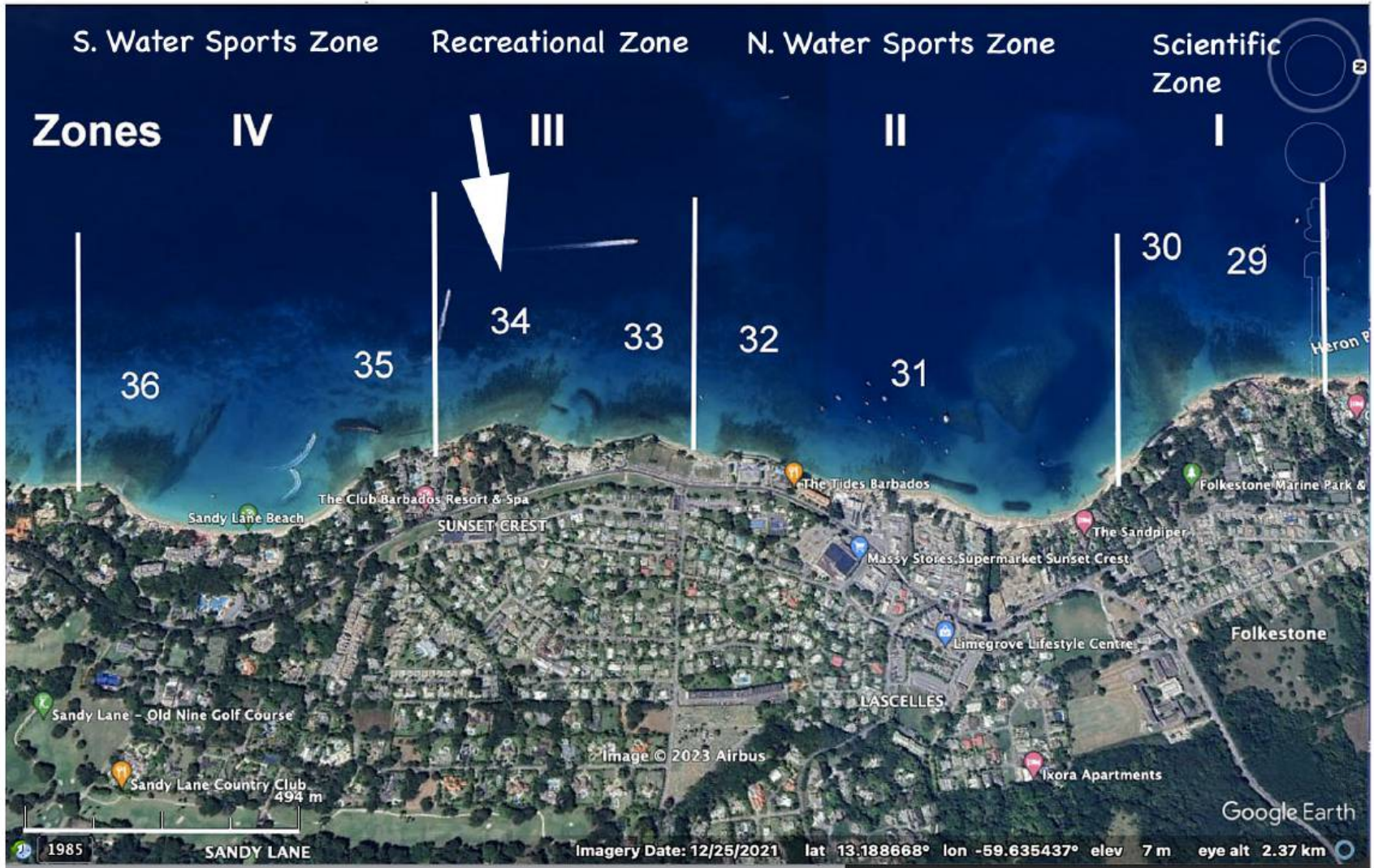
Comment (continued):

In 2015/2016, well into retirement years, I returned to repeat surveys on seagrass beds at Barbados and Carriacou that I had first surveyed in 1969. Residing in the Holetown area, in 2015, I “discovered” the very healthy fringing reef at Vauxhall (or Beachlands). Enjoyment of that reef was a factor inducing us to return to Barbados for 3 months every year since (except 2021 and 2022, re:covid issues).

In this presentation, I explain some of what I have learned about the natural history of the reef and why I see it as a very special place. I joined CORALL, a volunteer organization promoting conservation and restoration of Barbados reefs, in 2016. In 2019, I set up a website to collate my materials, literature etc related to “Barbados Fringing Reefs and Seagrass Beds”. The website is at www.versicolor.ca/barbados

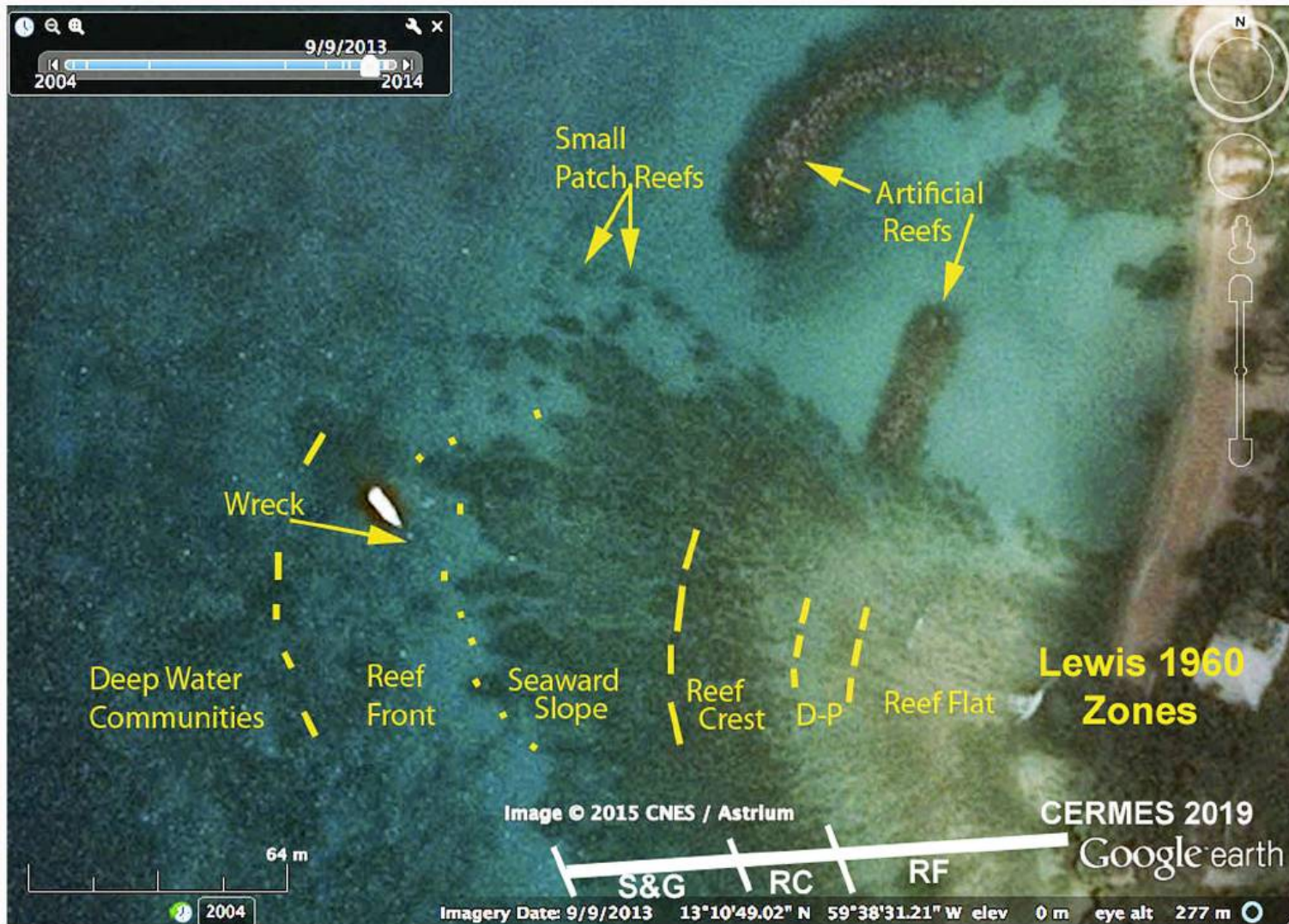
Vauxhall Reef is one of 8 fringing reefs located within the Folkestone Marine Protected Area on the west coast of Barbados (**Slide S2**); in my view, it is by far in the best shape. (There are 2 reefs, #35 and 34, at Vauxhall; my reference to Vauxhall Reef is to Reef 34.)

Fringing Reefs in the Folkestone MPA



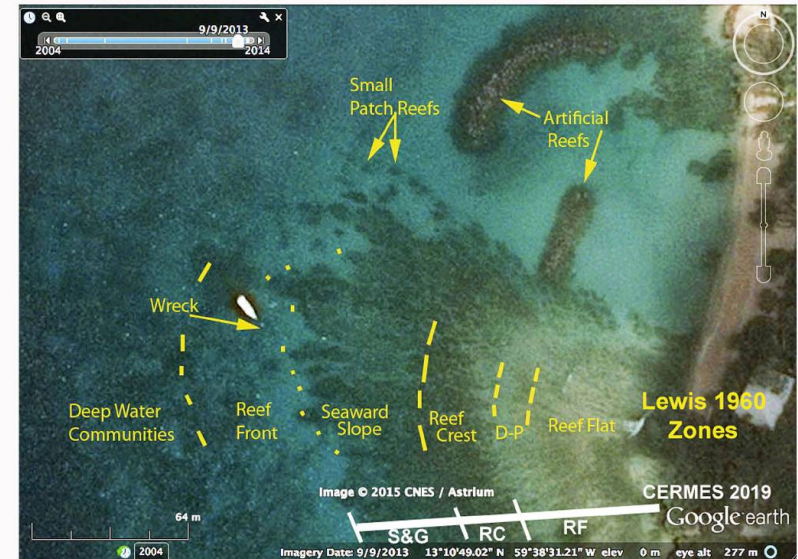
Reef Numbers are from Table 2, and Figs 22-24 in Maclean & Oxenford, 2016. The MPA Zones extend further seaward than shown above (to 660- 950 meters from shore). Total area is 2.1 sq kilometers, There are patch and bank reefs situated offshore from the fringing reefs. Reefs 34 and 35 are identified as “Vauxhall” in Maclean & Oxenford, 2016.

Zones of Barbados Fringing Reefs



Approx. limits of zones as defined by Lewis (1960) and CERMES (2019) at Vauxhall. View section on Zones at www.versicolor.ca/Barbados for details

Zones of Barbados Fringing Reefs



Comment:

Slide S3 is a Google Earth image of the Vauxhall/Reef area with the zones of the fringing reef according to two systems (Lewis 1960, and CERMES, 2019)* overlain.

The systems differ mainly in extent. The CERMES system extends to the end of the contiguous fringing reef; it includes 3 zones - Reef Flat, Reef Crest, and “Spur and Groove”.

Lewis describes 4 zones for the same area – Reef Flat, Diploria-Palythoa, Reef Crest and Seaward Slope. He adds two additional zones to the seaward of the contiguous reef – the Reef Front, and the Deep Water Communities (extending seaward to approx. 30 m depth).

Lewis (1960) provides a detailed description of the topography and species composition of each zone.

In **Slides S4 to S16**, each of the Lewis zones is illustrated with scenes from these zones as seen at Vauxhall today (2015-2024).

*See the section on Zones at www.versicolor.ca/barbados for details.

A wreck, “The Pamir”, deliberately sunk on the Reef Front in 1985, is a popular site for boat-based snorkelling ventures (the surface of the wreck lies at about 25 feet depth.) The snorkellers typically venture into the Seaward Slope/Spur and Groove zone of the fringing reef as well; this zone at Vauxhall has a high percentage of living coral cover and supports many and a great variety of fishes.

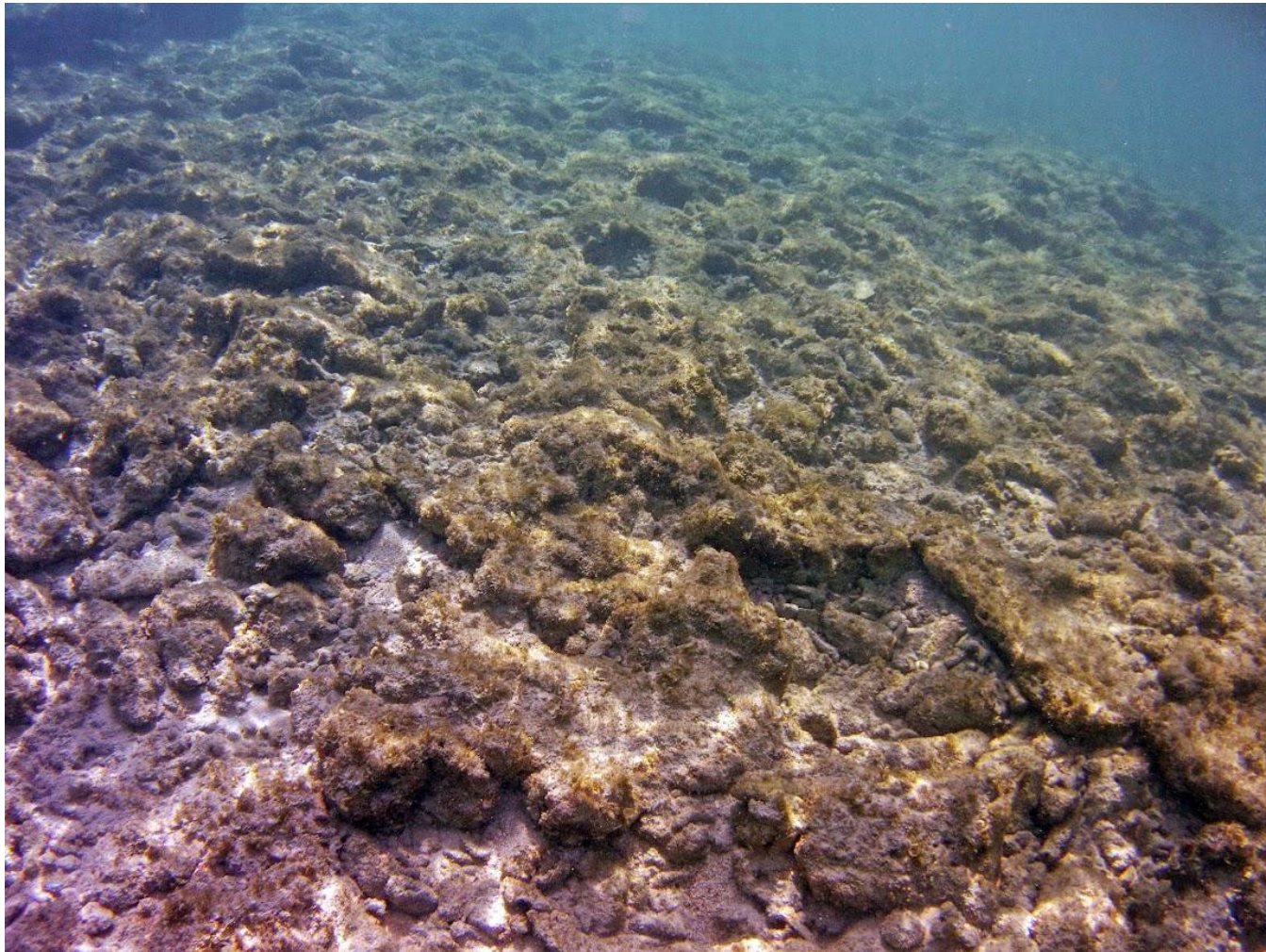
S4



View across the northern edge from shore. Waves are breaking on Reef Crest (Zone 3). Snorkel boat at right in the distance is close to The Wreck

S5

Lewis Zone 1: Reef Flat



”The bottom consists chiefly of reef debris, flat circular stones, loosely cemented calcareous fragments mixed with sand, or a flat rock pavement. The rock pavement is usually covered with a thick algal turf”

S6

Lewis Zone 1: Reef Flat



A lot of life beneath the flattened boulders



At Vauxhall, Knobby Brain Coral is common throughout most the Reef Flat. Larger specimens are quite striking. Several other coral species occur on Reef Flat at Vauxhall

Lewis Zone 1: Reef Flat



Juvenile Sargeant Majors in the Reef Flat Zone, a few meters from shore. This area seems to provide a refuge for these small fish where they are free from predators. The leafy seaweed is a species of *Padina*. Larger fish make feeding forays inshore when tide is up, early or late in the day.

Lewis Zone 2: Diploria-Palythoa



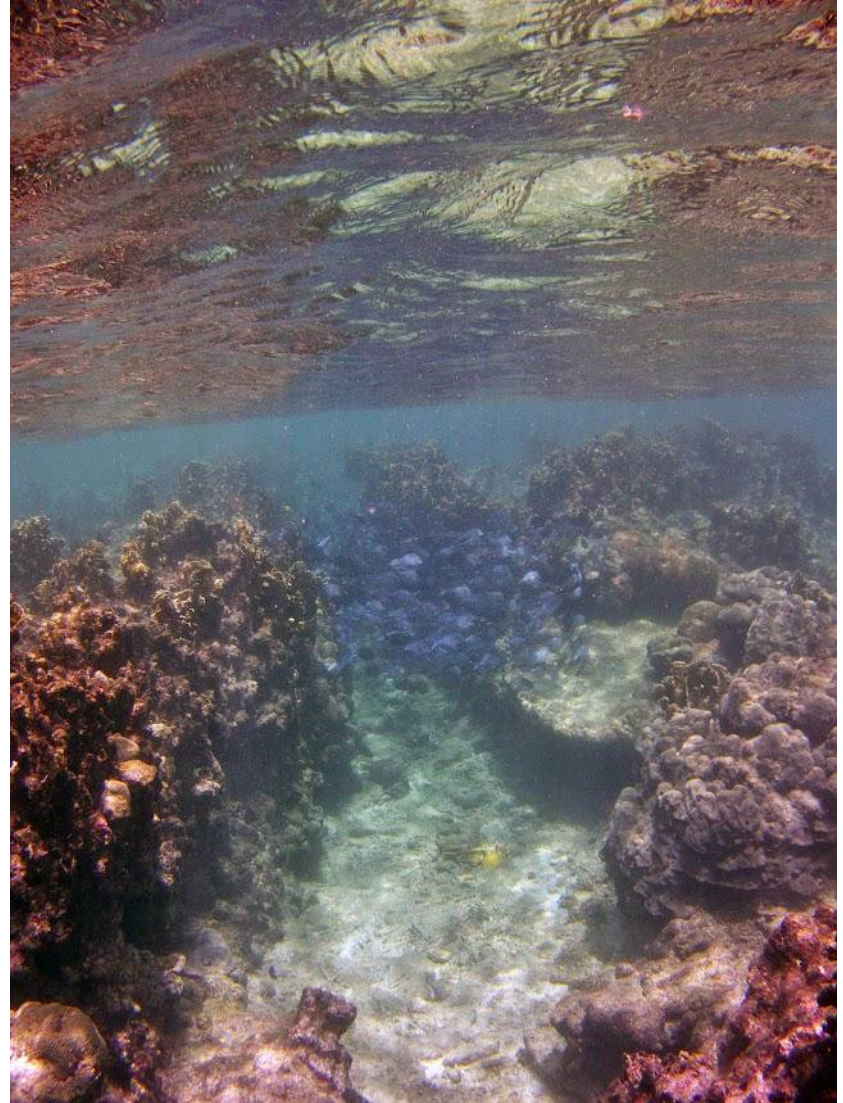
“This zone is characterized by the extensive colonization of two forms, the coral *Diploria clivosa* [now *Pseudodiploria clivosa*] and the colonial zooanthid *Palythoa mammillosa* [or *Palythoa caribaeorum*] and by the increased irregularity of the bottom topography.”

S10

Lewis Zone 3: Reef Crest

“The reef crest is a region of prolific coral growth and, in terms of development and succession of corals, it is the climax zone of the living reef. The width of the zone varies from 20 to 100 meters. Its seaward limit is defined as the point at which the profile of the reef begins to slope downwards towards the bottom. Between this point and the outer edge of the previous zone, the reef maintains a more or less horizontal surface 2 to 4 feet below water at mean low tide.

“The basic feature of this zone is a series of spurs or ridges which project outwards towards the sea and alternate with irregular winding valleys. The height of these spurs from the bottom is 4 to 6 meters at the outer limit.”



S11

Lewis Zone 3 : Reef Crest



“Towards the outer edge of the zone, the walls are composed chiefly of *Montastrea annularis* which forms shingle- like plates, simple sheet-like faces, or **lobular colonies.**” [*M. annularis* is now *Orbicella annularis*]

S12

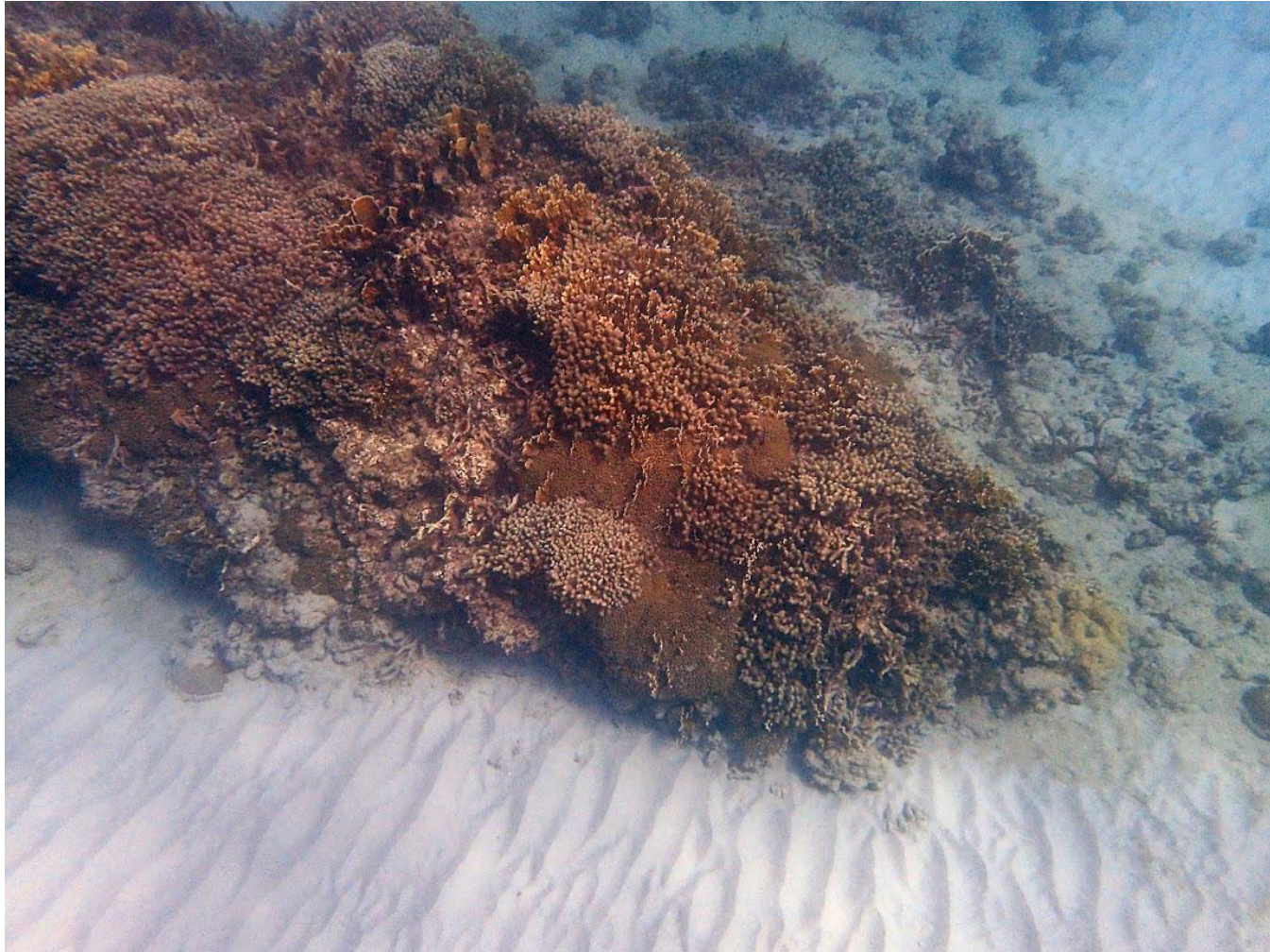
Lewis Zone 4 : Seaward Slope



“This zone is characterized by a gradual slope of the reef surface from the crest to the bottom at a depth of 5 to 6 meters.”

S13

Lewis Zone 4 : Seaward Slope



“At the outer limit, 30 to 150 meters beyond the reef crest, low ridges appear as outcrops 1 to 3 meters high from a sand or rubble bottom..”

S14

Lewis Zone 5 : Reef Front



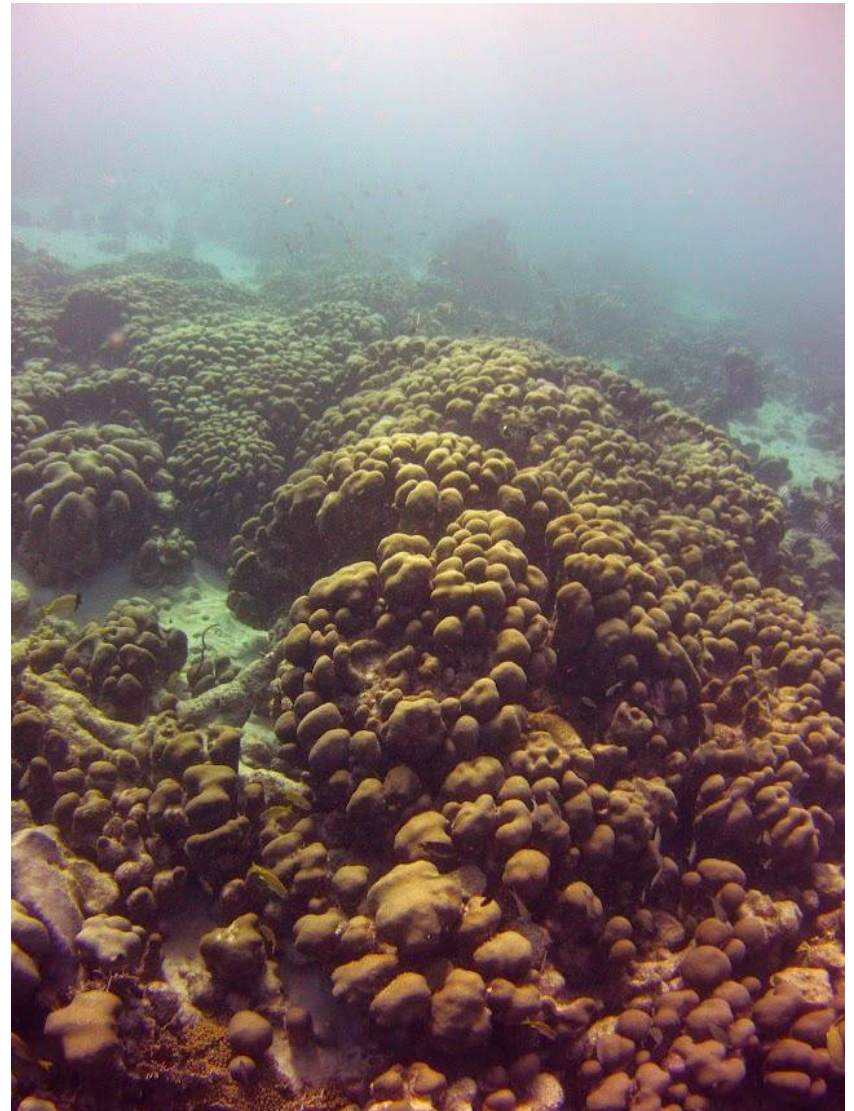
“As the forward edge of the seaward slope decreases in height, the low ridges disappear and are replaced by scattered patches of coral heads. A band of sand and rubble bottom, which is dotted with these patches, lies along most of the leeward coast at depths of about: 0 to 10 meters.”

S15

Lewis Zone 5: Reef Front

The dominant coral of this zone is again *M. annularis*. It forms groups of lobular colonies and is the chief structural base for the settlement of other species of corals. The clumps reach a height of about 4 feet and vary from 2 to 8 feet in diameter.”

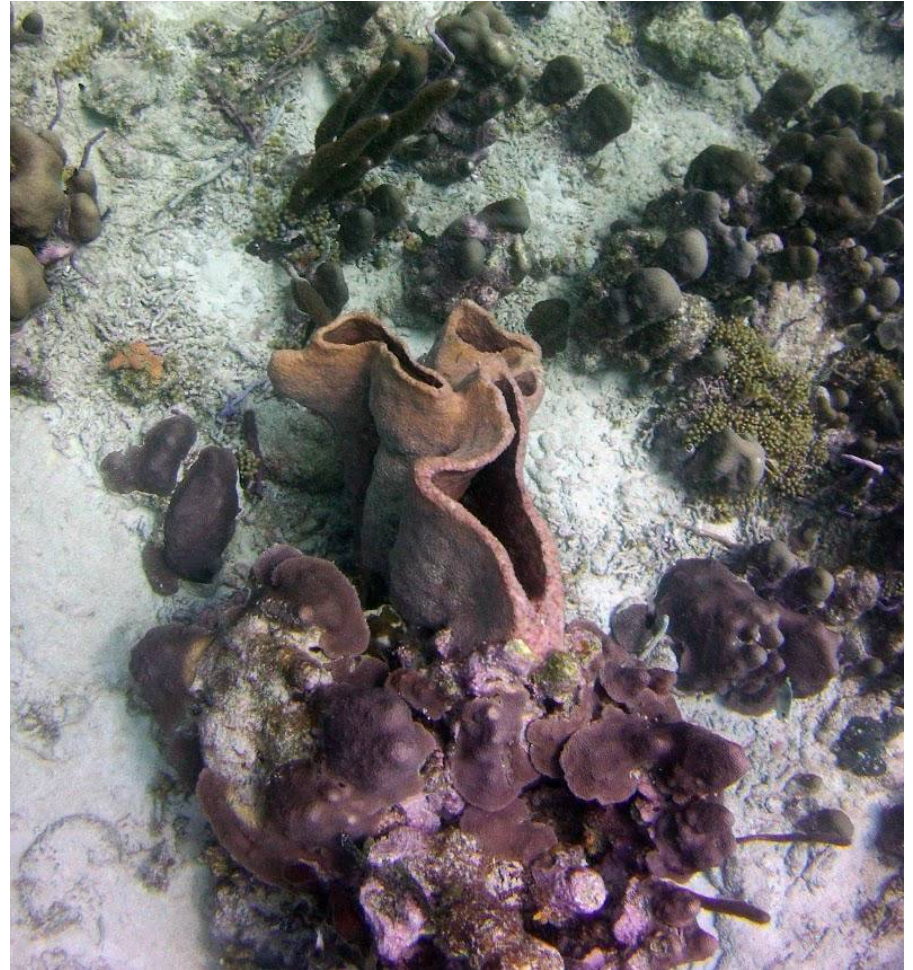
Photo at right: circa 25 ft depth, outer Reef Front



“The bottom communities of corals from depths of 10 meters outwards to the limit of the investigations at about 30 meters is an extremely rich one. There are not only extensive mixed stands of corals, but there is a great diversity of species of corals and of other invertebrates.

“Two types of communities are present: pure stands of *Madracis asperula* (mixed with *Porites porites* at shallower depths, and mixed stands of nearly two dozen coral species.”

Amongst the species: *Acropora cervicornis*, was common in DWC, mounds reaching 3 or 4 ft in height



Comment:

I think you can see that these zones can be recognized in the field quite readily, first by the simple topography including depth, coral/hard surface cover and distance from shore; and second by species and/or coral cover characteristic of the zones. In the field, recognizing the zones gives one a sense of “where you are” on the reef and of “what’s next” as you proceed towards the open sea, towards the shore, or parallel to shore. Recognizing the zones helps in understanding the ecology of the reef and its species and is informative when describing occurrence of particular features or species.


While the zones at Vauxhall are very similar to the zones described by Lewis (1960) in terms of species composition, on degraded reefs in particular, some or most of those species may be sparse or lacking. On other reefs, the species composition may have changed or never have been quite the same as described by Lewis – but the zones can still be recognized by the topographic features.

When I am taking photos on the reef of particular subjects, I also take photos that illustrate what zone I am in, and I periodically take a photo of the shoreline.

Then, generally, I can recognize on Google Earth images, approximately where I was or where a particular photo was taken. This is especially helpful if you want to upload photos to iNaturalist which requires a location; iNaturalist allows one to indicate approximately where the photo was taken (you don’t need the exact location as recorded by a GPS unit).

Comment (continued)

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jackpine22
🌳 1,813 observations

Observed: Mar 6, 2024 · 8:37 AM AST Submitted: Mar 6, 2024 · 1:53 PM AST

Map Satellite



Google Map Data 50 m Terms

📍 Holetown, Saint James Barbados Details ▾


Lat: 13.178934 Lon: -59.640596 Accuracy: 33m

Notes

In Seward Slope zone (Lewis 1960); a pair, my first observation of this species at Vauxhall Reef

Community Taxon [What's this?](#)

Spotfin Butterflyfish (*Chaetodon ocellatus*)
Cumulative IDs: 2 of 2



Above is an example of a post on iNaturalist in which I gave the approx. location based on my field observation of where I was zone-wise and in relation to prominent features such as breakwaters, boats over the wreck, features on land etc.

S17 A surprise in Lewis Zones 5&6 in 2015: *Acropora cervicornis*

Dense bed of *A. cervicornis* in outer Reef Front/inner DWC on Mar 7, 2015.

Older, dead branches below the surface of the colony base suggest the colony had been around for a while.



Comment

The previous and next several slides describe the occurrence of the 3 Acroporoid corals of the Caribbean – *Acropora palmata* (elkhorn coral), *A. cervicornis* (staghorn coral) and *A. prolifera* (fused staghorn coral or "hybrid coral") – at Vauxhall in 2015 and onward.

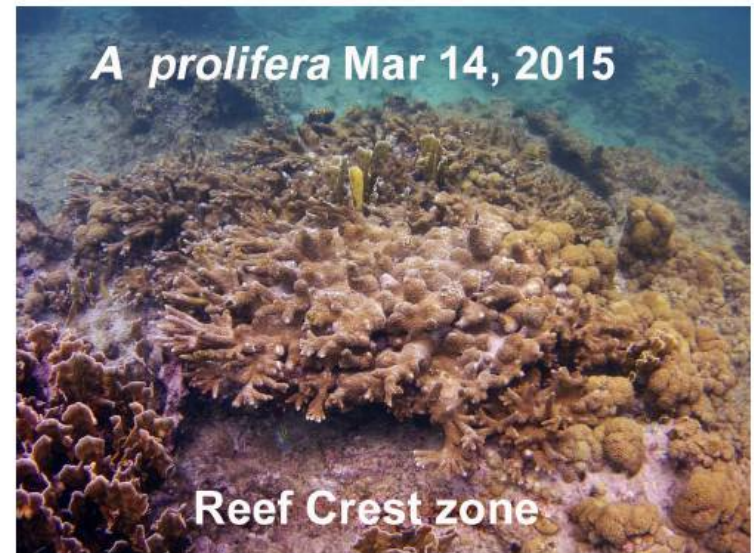
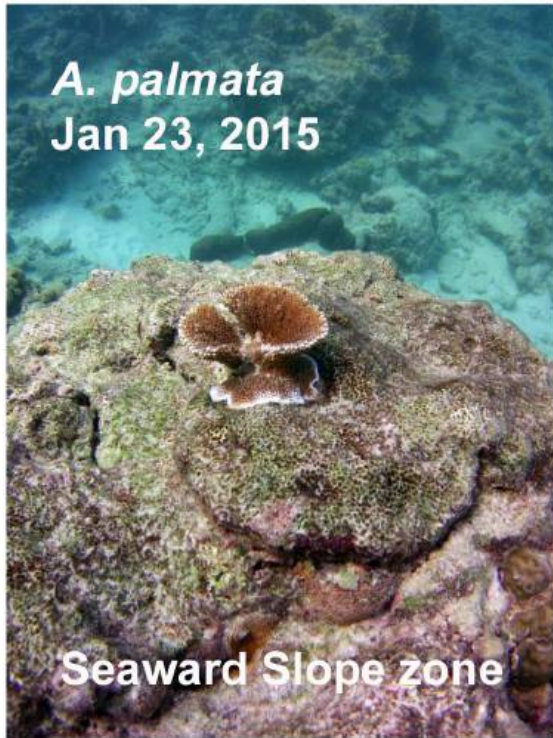
These occurrences were unexpected as *A. palmata* was mostly eliminated from Barbados by 1960 due to land disturbance/sedimentation; and both *A. cervicornis* and *A. palmata* were close to eliminated throughout the Caribbean by White Band Disease, active mid-1970s through mid 1990s.

A. prolifera is a hybrid between *A. cervicornis* and *A. palmata*; It was rarely observed 'in the old days'. (I had never seen it previously).

In 2015, I observed all 3 species at Vauxhall, each in different zones (shown in **Slide 19**). Most surprising to me were large colonies of *A. prolifera* in the Reef Flat and Diploria-Palythoa zones, and a large 'Mother Colony Complex' at the beginning of the Reef Crest zone (lower right image in **Slide 18**).

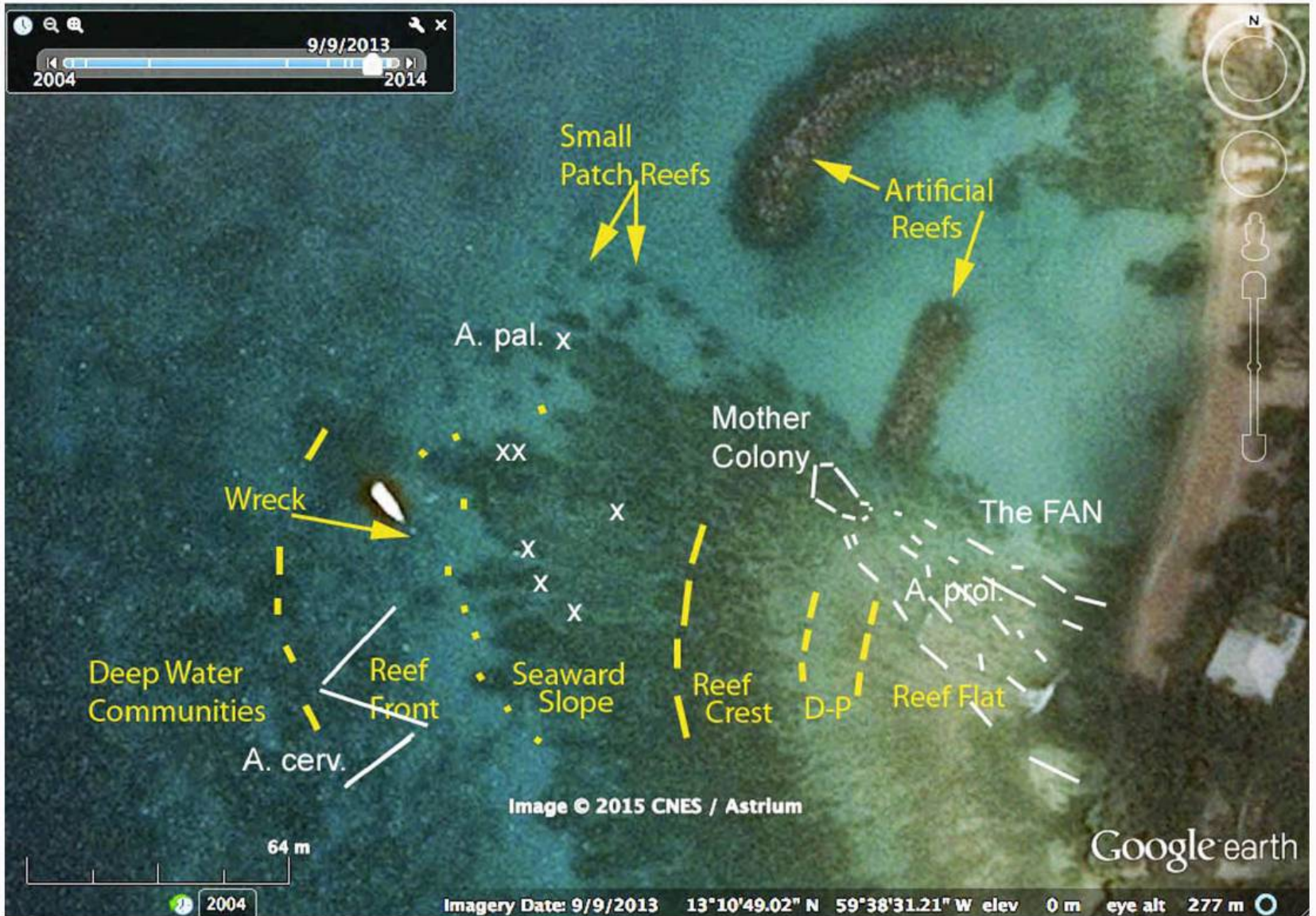
I reported my observations to Barbados Government personnel who told me that there were indeed anecdotal reports of *A. palmata* colonies on the west coast which they were investigating. In 2016 MacLean and Oxenford at UWI published a detailed report on a survey of fringing reefs for acroporoids conducted in the summer of 2015. They confirmed the presence of *A. palmata* and *A. prolifera* at Vauxhall and cited my informal report on *A. cervicornis* at Vauxhall (otherwise they did not encounter *A. cervicornis* in their surveys which were limited to shallower areas).

Acropora species on Vauxhall Reef 2015



S19

Approx. distribution of the 3 Acroporoids at Vauxhall Reef 2023





- *A. palmata* & *A cervicornis* are major reef builders in Caribbean

- Lewis: *A.palmata* rare in Barbados by 1960; attributed to land disturbances beginning with European settlers in 1600s.
- *A. cervicornis* was still common in Deep Water Communities

- White Band Disease Mid 1970s-Mid 1990s caused widespread losses of both species throughout the Caribbean; essentially eliminated from Barbados by early 1980s.

- Mid 1990s some recovery noted e.g. in Grenadines

Barbados 2015 Anecdotal Reports of *A. palmata*. MacLean & Oxenford (2016) conduct survey of 46 fringing reefs in summer of 2015

707 colonies in total; most *A palmata* 21 definitely *A. prolifera* (14 at Vauxhall)

So Vauxhall Reef was looking 'pretty good' in 2015...



- Overall Healthy Reef from Reef Flat to DWC
- High living coral cover and fish diversity on Seaward Slope
- Vigorous growth of *A. prolifera* at inner Reef Crest
- Significant economic benefits



**& Continued to look ‘pretty good’
2015 to early 2023**

Vauxhall visited Jan-Apr

2015 Annual measts on
A. prolifera begun

2016 CORALL

2017

2018

2019 Website, iNat

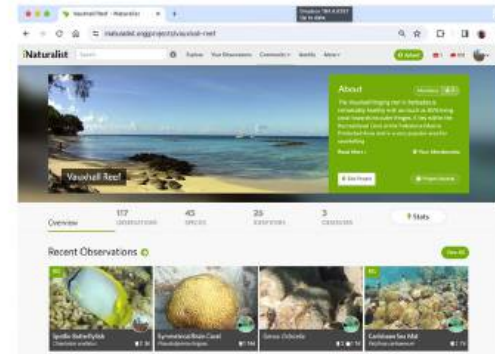
2020

(2021 missed)

(2022 missed)

2023...Regional Stresses

2024



Map of Observations



Comment

Beginning in 2015, each year I measured the “Maximum Linear Dimension” of all specimens of the hybrid coral (*A. prolifera*) that I could find so that I could get some sense of the growth rates and how old they might be (data still being processed). Otherwise my observations were not very “scientific”; I mostly just enjoyed the reef, getting nice photos and videos and learning about the subjects.

I explored/photographed other fringing reefs in the MPA, in most areas out to the Deep Water Communities. There were many quite nice patches of healthy reef, but definitely Vauxhall/Reef was the “star”.

I joined CORALL in 2016 and collaborated on several projects. In 2019, I set up a website to post/collate observations, related materials etc., and began to post species observations on iNaturalist. We visited Barbados in 2020 but missed returning in 2021 and 2022. Up to 2020, the reef only looked better each year...

One concern I had was possible impacts of development on the shore at Beachlands - there were some large luxury residences being built. I kept an eye out on the Reef Flat in particular as I figured it would be first area impacted. Through to this year (2024) I have seen no evidence of any deterioration that might be associated with the developments (**Slide 23**). That’s a big relief, as the Vauxhall Reef occupies a small area which make it especially sensitive to changes in the local environment.

S23



There have been no evident impacts of onshore development 2015-2024 on Vauxhall Reef - Nina still very happy!

Comment

2023 turned out to be the “Year of the Vicissitudes”, when the all-good-news story about Vauxhall would change due to causes originating well beyond the shores of Barbados.

The first vicissitude was associated with the arrival of **Stony Coral Tissue Loss Disease (SCTLD)**, originating in the Florida area years earlier (**Slide 24**). Often described as “the worst coral disease ever”, it progressed rapidly through the reef while I was in Barbados January to early April, 2023. I did my best to formally document it; a CORALL-mediated project with the McGill Geography students was a big help (**Slide S25**).

Then the **extreme warming/coral bleaching** occurred in the fall of 2023. I looked for its impacts at Vauxhall immediately on my arrival in early 2024. It was reported to be especially hard on acroporoid and stinging corals, corals that had not been impacted by SCTLD. Unfortunately, the impacts of the extreme warming events were all too evident. All of the hybrid coral was dead and overgrown with epiphytes (**Slide S27**). *A. palmata* fared much better, and there were a few vestiges of living coral on *A. cervicornis* specimens. The very common stinging coral *Millepora complanata* was heavily impacted, but not the branched stinging coral *M. alcicornis* (**Slide S28**).

The Vicissitudes of 2023 1. Stony Coral Tissue Loss Disease



Up to 34 species
 Many brain corals,
 & massive corals;
 NOT Acroporoids

From AGGRA
 Caribbean SCTLD
 Dashboard



Corals on 'The Wreck'
 2015-2024



From Report to
AGGRA #22
 Mar 23, 2023
 On Reef Front
 7 m depth

Infected
Orbicella annularis



Occurrence of Stony Coral Tissue Loss Disease on Vauxhall Reef and a Breakwater in the Folkstone Marine Protected Area of Barbados

K.Cassidy, L Chan, C. Davies
 A. Fleming, S. Gleason.
 R. Lawrence, M.Leger,
 A Nikolaeva

Dept of Geogaphy
 Geo 496, McGill University
 Apr 2023

McGill Geography/CORALL Project



WPD



SCTLD

Figure 2. Pseudodiploria strigosa infected with SCTLD



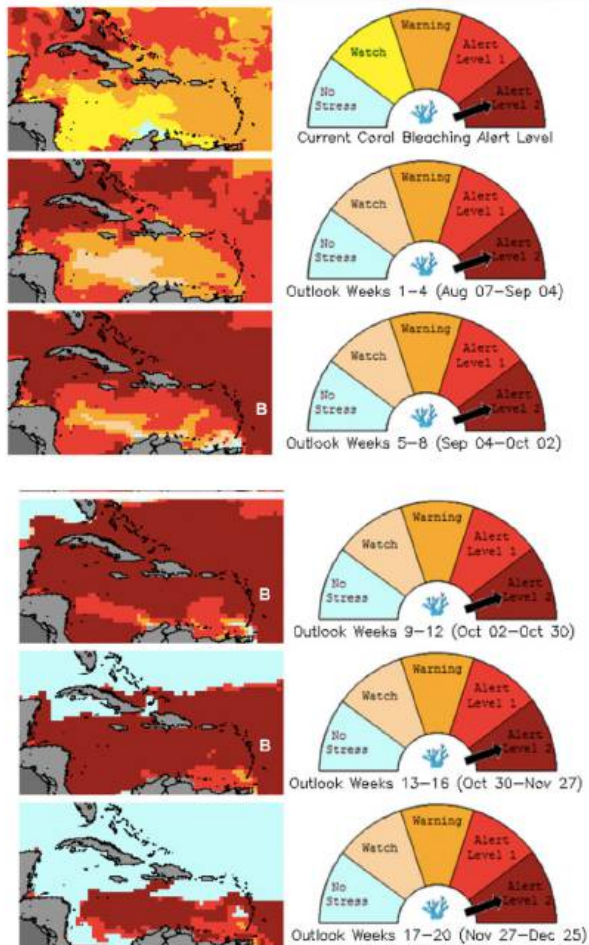
Results

SURFSIDE	Stony Coral Tissue Loss Disease			White Plague Disease			TOTAL	
	<i>Pseudodiploria clivosa</i>	<i>Pseudodiploria strigosa</i>	<i>Siderastrea radians</i>	<i>Pseudodiploria clivosa</i>	<i>Pseudodiploria strigosa</i>	<i>Siderastrea radians</i>	SCTLD	WPD
TOTAL	1	3	1	10	126	1	5	137
-ZONE TOTALS-								
ZONE 1 (1-2)	0	0	0	0	9	0	0	9
ZONE 2 (2-3)	1	0	0	2	29	0	1	31
ZONE 3 (3-4)	0	0	0	1	19	0	0	20
ZONE 4 (4-5)	0	0	0	1	9	0	0	10
ZONE 5 (5-6)	0	0	0	0	4	0	0	4
ZONE 6 (6-7)	0	3	1	1	32	1	4	34
ZONE 7 (7-8)	0	0	0	5	24	0	0	29

Table 1. Total number of corals infected with SCTLD and WPD at the Surfside breakwater

The Vicissitudes of 2023 2: Extreme Warming/Coral Bleaching Oct & Nov 2023

Caribbean Satellite Bleaching
Alert: Area & Outlook 2023-08-09



“The entire world is suffering record high temperatures, and the Caribbean is in the forefront of global warming...

”The most affected species are the elkhorn, staghorn, and fire corals that build the reef crest and beaches.

“The event is only starting: all corals are fully bleached from loss of internal algae caused by extreme high temperature. Most are bright white, but turning brown day by day as they die and are overgrown by bacteria.

”Decades of progress regenerating corals have been wiped out.

- Tom Goreau on Oct 14, 2023



Dieback of *Acropora* spp 2023-2024

A. prolifera at Vauxhall: 100% to date

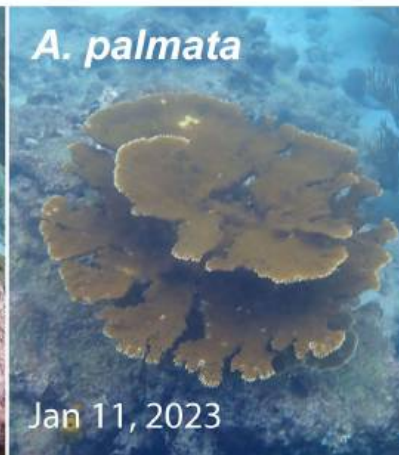
A. cervicornis at Vauxhall: 99%

A. palmata at Vauxhall & north within MPA : 0 to 100%

3 specs: 100%

1 spec: 75%

4 specs: 0%



A. cervicornis

Dieback of *Millepora* spp

attributed to extreme warming in fall of 2023



M. complanata

- massive dieback but not 100%



M. alcicornis

- minimal dieback if any

Comment:

To be “scientific” about my interpretation of the impacts of the 2023 warming events, I had to compare photos of particular sites or coral specimens from early 2023 (before the warming) with photos of the same sites in 2024. That wasn’t a problem in regard to *Acropora prolifera* because I had been attempting to photograph all specimens each year.

But when it came to other species – in particular *Millepora complanata* (fire coral), it meant going over my very many pre-2024 photos and finding ones, preferably taken in 2023, with specimens that I could recognize/find in 2024. (Without the earlier pics, I wouldn’t know when the coral had died.) I managed to find some but it’s very much a hit-and-miss approach.

I mention this issue because while my description of the Vauxhall Reef is based largely on informal documentation (dated photos/approx. or exact locations, use of iNaturalist) and could be applied to describe other fringing reefs, for monitoring over time, permanent plots (e.g. squares 10 x 10 m) are really needed. For CORALL, I suggest permanent plots could be set up relatively easily, and could be valuable for educational purposes as well as for formal monitoring.

In the final slide (**S29**), I cite some features to watch as the Vauxhall Reef recovers from the “vicissitudes of 2023”, some reasons to think there will be some recovery, and why at Vauxhall there is still lots to enjoy, monitor and nurture.

I am very grateful to CORALL, the Folkestone MPA and all Bajans for their past and ongoing efforts to conserve and as possible restore these reefs.

S29

Vauxhall Reef 2024 on....

Disease:

- Resistant species
- Many resistant indiv. specimens of susceptible spp

Extreme Warming

- Significant survival of *A. palmata* overall
- Poss some recovery of *A. cervicornis*; *A. prolifera*??
- **Rapid growth/spread of *M. complanata* “nodes”** that did not bleach?

Porites/Madracis-dominated spurs & associated fish populations

- mostly still very healthy at Vauxhall

Lots to enjoy, monitor, nurture!

Small area: local protection very important



Thanks CORALL, Folkestone MPA, & Bajans All!