Monitoring of the coral communities of a marine protected area (Guadeloupe) with photo-quadrats from 2012 to 2016

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Introduction

The National Park of Guadeloupe Island (Lesser Antilles) was created in 1989. From June 2009, the park is composed of multipolar "cores" (21,000 hectares), a "partnership zone (90,000 ha) and a "sustainable development marine zone" (130,000 ha). The cores constitute privileged areas for conservation management.

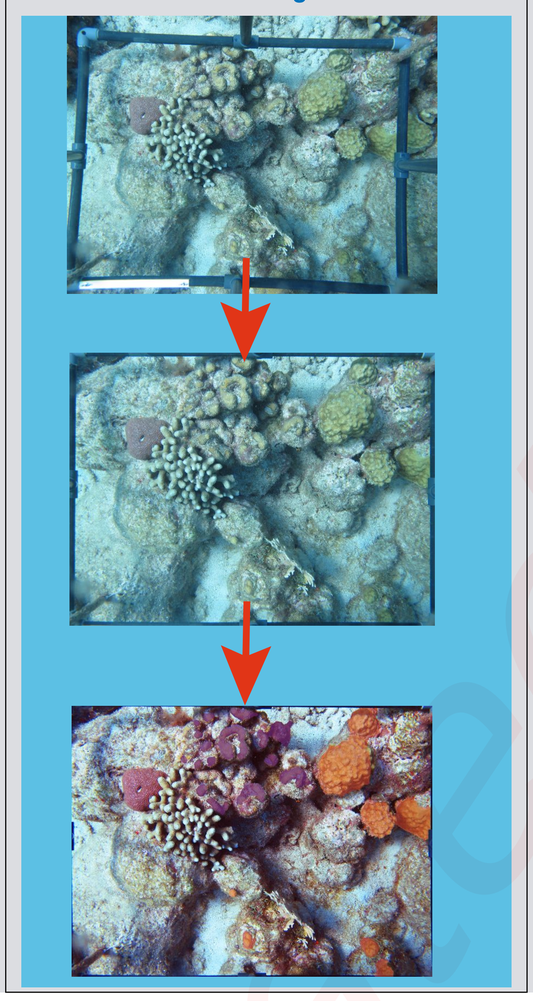
The Pigeon islets, located on the leeward coast of Guadeloupe constitute one of the "cores" of the National Park. These islets constitute a hotspot of marine biodiversity for the French Antilles.

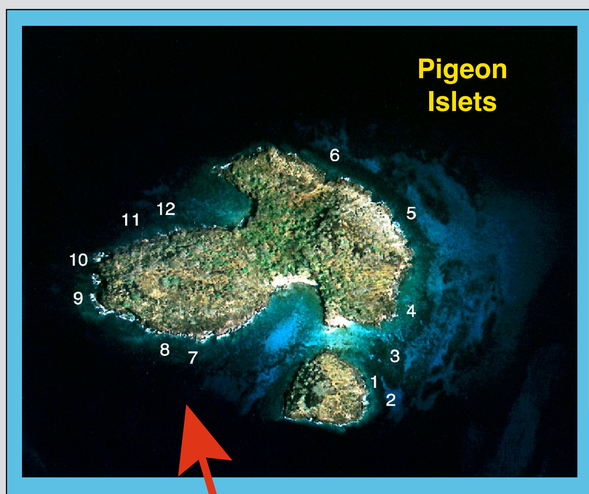
A long term monitoring programme of the coral communities around the islets has been set up by the National Park of Guadeloupe in collaboration with the University of Antilles

This monitoring programme is part of the thematic priorities identified at the national level like the global climatic change and the fight against the erosion of biodiversity.

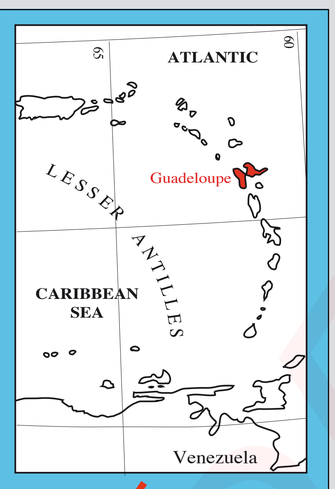
Data treatment

At each of the 12 sites around the islets, several photographs were taken. Then the best ones were chosen and geometrically rectified using specific softwares (Photoshop, Image J). The photographs were then submitted to corrections of contrast and colours. The next step was the calculation of all the surfaces occupied by benthic organisms to constitue a database.
On each photograph several bioindicators were measured:
- surfaces occupied by the different organisms;
- recruitment of new organisms;
- bleaching of corals;
- rate of necrosis of coral colonies;
- corals and gorgonians diseases;
- abundance of macroalgae.





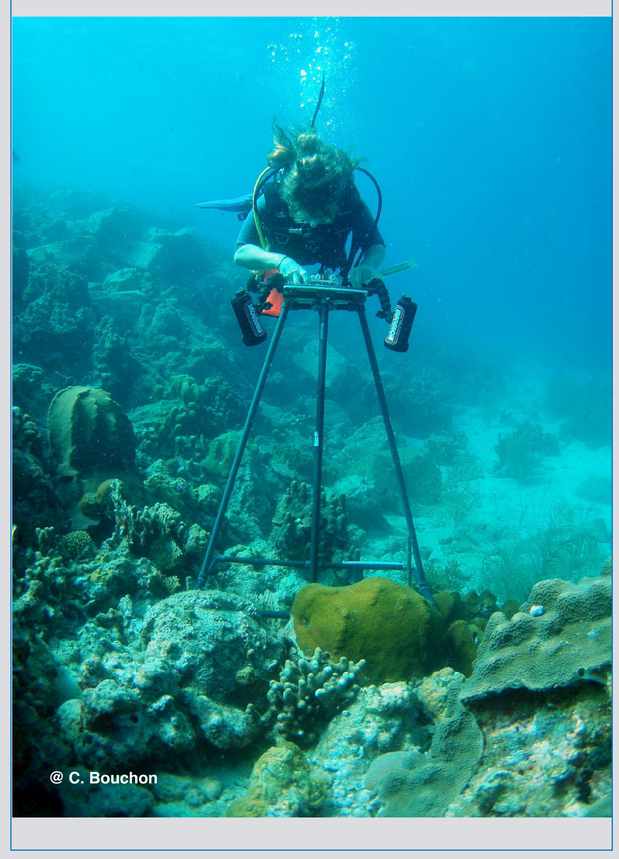
The study site is located in the Caribbean coast of Guadeloupe Island on Pigeon Islets. From 2009, the Pigeon islets became a core of the National Park of Guadeloupe.
Twelve photoquadrats were settled between 4 to 17 m around the islets.



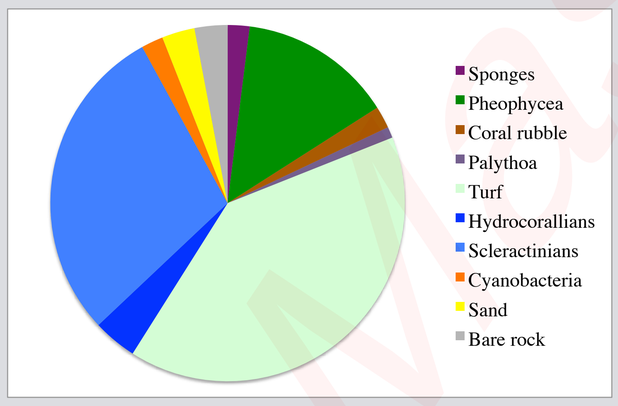
Guadeloupe

Sampling techniques

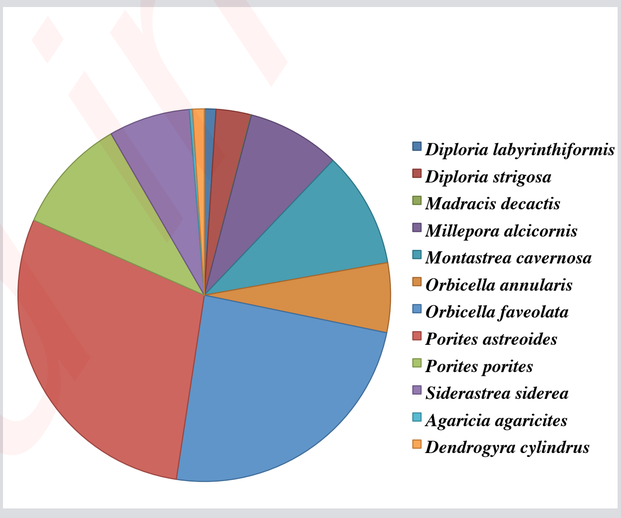
The technique of "photo-quadrats" has been selected, because it does not necessarily need the intervention of a specialist of the coral reef flora and fauna in the field. Photos can be stored for future analyses.
Moreover, this method is non-destructive and adapted to the intervention inside the core of a park.
In order to perpetuate the position of the transects on the bottom, holes were drilled in the substrata with a pneumatic tool. Then, iron steel bars were sealed in the holes with epoxy cement. Twelve photo-quadrats (80 x 60 cm) were set up in areas of maximum biodiversity and of good health of organisms. They were photographed twice a year (wet and dry season) in order to take into consideration seasonal variations in the benthic communities.
From 2012 to 2016, a total of 120 photographs could be obtained for the analyses.



Composition of benthic communities



Coverage rate of coral species



Results

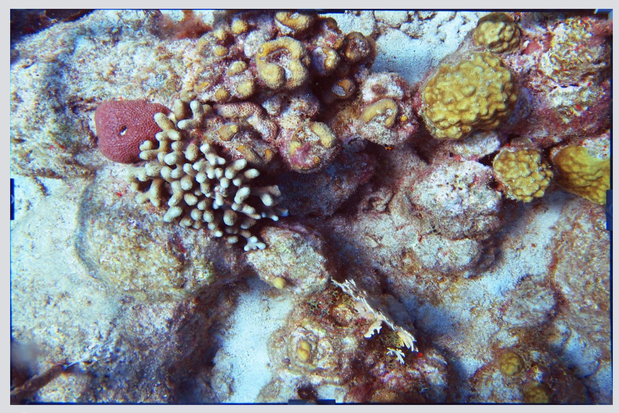
Benthic communities :

During the study period, turf (40%) and corals cover (33%) dominate the community of each quadrat. Phaeophycea are also part of the dominant groups (14 %). Scleractinians and Hydrocorallians represent together 33 % of the total coverage (all quadrats pooled).
No statistical significant difference was found concerning the temporal evolution of the structure of benthic communities (Test of Friedman ; p : 0,97).
Considering each group of organisms, the correlation coefficient of Spearman revealed some statistically significant results :
- a significant growth of sponges ($p < 0.02$) ;
- a marginally significant decrease of Cyanobacteria ($p < 0.08$).

Coral assemblage:

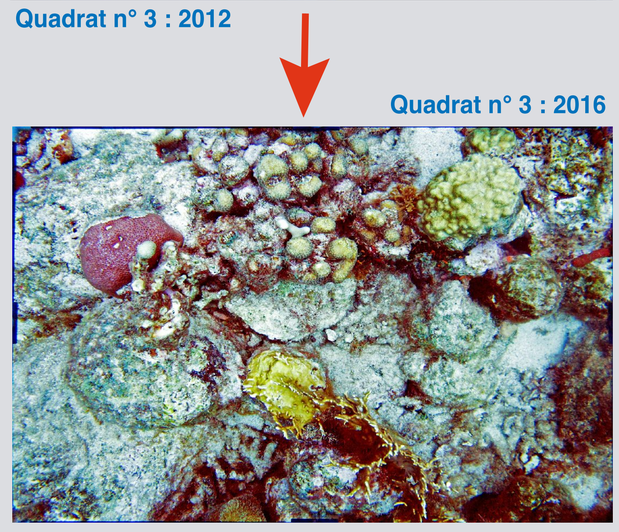
A total of 12 scleractinian corals and one hydrocorallian were found in the quadrats (2 to 5 species per quadrat). Coral coverage by quadrat fluctuated between 6 to 53%. *Porites astreoides* (29%) and *Orbicella faveolata* (24%) were the dominant species in coverage of the substratum. There was no significant variation in the composition of the coral assemblage over time (Friedman test, $p = 0.55$). Considering the evolution of the corals, species per species (Spearman ranks correlation coefficient), *Orbicella faveolata* and *Diploria strigosa* presented a significant growth over the studied period. On the contrary, *Diploria Labyrinthiformis, Dendrogyra cylindrus, Porites porites* and *Meandrina meandrites* significantly regressed.

Porites astreoides was the only coral species that has presented recruits in the quadrats during the studied period.



Quadrat n° 3 : 2012

Quadrat n° 3 : 2016



Conclusions

The results of this work have shown the efficiency of the system set up by the National Park of Guadeloupe and shall constitute a basis for future monitoring.