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Coral assemblages of Cabo Verde: preliminary assessment and description

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Abstract. A preliminary ecological assessment of coral communities was conducted in Cabo Verde (North Atlantic). Two fieldtrips recorded underwater transects with DAFOR semi-quantitative scale to estimate relative abundance of coral species. This effort, together with a review of historical records, allowed a preliminary identification and description of three major coral biotopes: i) antipatharian facies in vertical walls; ii) *Siderastrea radians* pavements over shallow bedrock; and iii) diverse coral coverage over rocky reef with sand patches. Coral species diversity in these biotopes is lower than in other tropical reef ecosystems. Sal Island, where a more extensive survey was possible, revealed greater living coverage and biodiversity on the leeward side when compared with the windward side of the island. Depth and hard substratum orientation (vertical/horizontal) appear to act as major environmental factors structuring communities in these biotopes. The importance of other factors affecting their distribution, structure and diversity, such as water temperature, West African upwelling influence and dust deposition from Sahara desert, by prevailing and Harmattan winds, are briefly discussed.

Key words: Ecological assessment, coral diversity, biotopes

Introduction

Sited at 15.02N, 23.34W, the Cabo Verde archipelago comprises ten islands and five islets located about 300 nautical miles WNW off the coast of Dakar, Senegal (Fig. 1). Volcanic in origin, the islands rise from the deep abyssal plain beyond the African continental shelf.

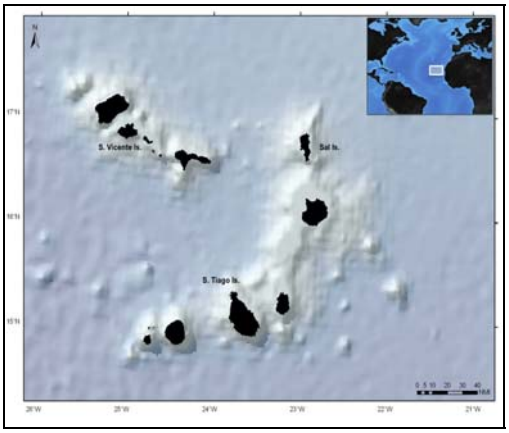

Figure 1: Geographical location of Cabo Verde Islands.©*Imag*DOP

These islands are considered to be an important hotspot of tropical reef biodiversity and one of the top ten priority locations worldwide for the conservation of reef habitats (Roberts et al. 2002). Despite the absence of major coral reef structures and of the relatively low richness of coral species and reef-associated fauna, these islands' coral communities constitute unique habitats as many species display a small distributional range (Laborel 1974; Moses et al. 2003; Roberts et al. 2002).

These coral communities are of major importance for coastal ecosystems (providing habitat and supporting other fauna and flora) and play a key role on the sustainability of local fishing and economy (Wells 1988; Wilkinson 2004).

Recent efforts to characterize coral communities and associated fauna and flora have been conducted in specific locations of São Vicente Island (Delgado 2006) and Sal Island (Henriquez et al. 2006). Although providing valuable information and extensive lists of coral species and associated fauna and flora, studies are site restricted and lack a uniform approach that relates species composition and its variance to environmental conditions.

The goal of the present work was a preliminary ecological assessment of coral communities in Cape Verde Islands, setting the basis for the experimental design of a more detailed characterization of these coral communities. Determining the species composition and its variance within and between locations, related to physical and environmental parameters and gradients, such as depth and substratum nature and orientation, allows one to determine areas of uniform environmental conditions providing a living place for a specific

assemblage of organisms (Jokiel 2002; Wallenstein and Neto 2006). Accordingly, accessing i) conspicuous coral species, relative abundance and distribution and closely associated species composition, and; ii) major physical and environmental parameters/gradients determining coral distribution, provided valuable data and information to identify major coral communities' biotopes and produce the necessary background for following characterization of these communities.

Material and Methods

Fieldwork conducted in Cabo Verde included two survey missions (November and July 2007) at three islands (Fig. 2) where coral communities had been reported by Laborel (1974) and Moses et al. (2003). Within each location, five sites were selected and surveyed using depth and substratum nature and orientation (horizontal/vertical) as major determining factors conditioning coral and associated species' composition and distribution limits.

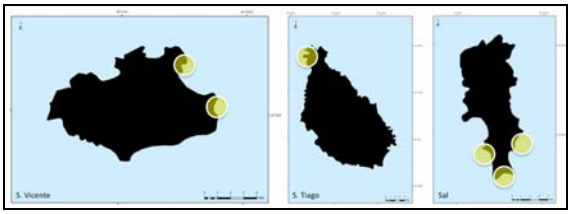

Figure 2: Visited locations during survey missions to S. Vicente Is. and S. Tiago Is. (July 2007) and Sal Is. (November 2007)©*Imag*DOP

Each site was surveyed (using SCUBA) with four underwater transects, parallel to a depth gradient between 5 and 20 meters of depth. Transects were randomly distributed using a two digit random number table. The first digit determined the direction of following placement: heading towards the shore, an even first digits meant the following transect would be placed to the right and odd digits meant it would be placed to the left of the previous transect (first transect placed in relation to the start point of the dive). The second digit determined the distance, in meters, for the placement of the following transect (first transect placed in relation to the start point of the dive). For example (Fig. 3), having the first transect ended at 20 m, the random number 27 would mean that the following transect would start at that depth, 7 meters to the right (heading shoreward). Whenever transect placement would fall outside hard bottom substratum with coral coverage, the following random number would be considered.

Coral species relative abundance was accessed with DAFOR (**D**ominant, **A**bundant, **F**requent, **O**ccasional and **R**are) semi-quantitative scale (Hawkins and Jones 1992, Wallenstein and Neto 2006), at each 5 meters of depth. Conspicuous associated fauna and flora composition substratum nature and orientation was also accessed throughout these transects. Hard bottom substratum, where coral occurs, was classified into three categories: i) bedrock, ii) bedrock patches and boulders over sand bottom, and iii) vertical and sub-vertical walls. DAFOR values were averaged from transects over the three major kinds of substratum where coral species occur for overall values.

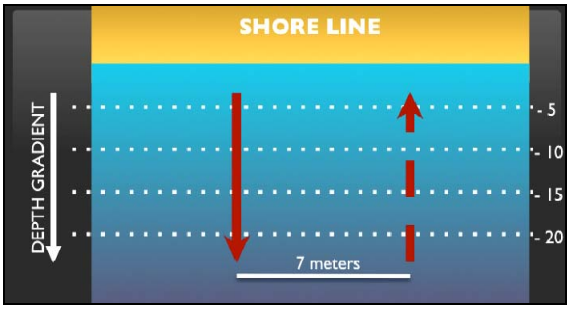

Figure 3: Scheme of two consecutive transects' placement using a random number equal to 27. Second transect (dashed) start point placed 7 meters to the right of previous transect end point.

Results

Biological data against depth, bottom type and orientation suggested that these physical parameters determined local coral species composition and limits. Restricted to hard bottom substratum, coral species distribution and DAFOR values were fit into the three categories of hard bottom substratum. Raw transect data were averaged within each category and depth (Table I). These values refer exclusively to coral species, describing relative abundance within this group.

Based on depth gradient, bottom type, orientation, as well as coral species composition, distribution and relative abundance, three different biotopes were identified:

Shallow Rocky Reef

Rocky platforms, reefs and bedrock between -4 m and -10m were clearly dominated by *Palythoa caribaeorum*, which overgrew several other coral species such as *Porites astreoides* and *Siderastrea radians. Millepora spp, Porites spp.* and *Siderastrea spp.*. *P. caribaeorum* dominance was clearest at Sal Is. and less so at other islands, where the species was dominant or abundant but did not overgrow other corals.

Siderastrea Pavements

Sandy bottom substratum, with bedrock patches and medium boulders, between -5 m and -15 m (occasionally to -20m), restricted to sheltered bays. A clear *Siderastrea spp*. dominance, forming pavements over almost all available hard substratum.

Table 1: Coral species relative abundance over different substrata (overall DAFOR values, D=Dominant, A=Abundant, F=Frequent, O=Occasional and R=Rare). * On the bottom edges over sand.

	Bedrock Reef				Bedrock patches and boulders				Vertical wall			
	5 m	10 m	15 m	20 m	5 m	10 m	15 m	20 m	5 m	10 m	15 m	20 m
ANTIPATHARIA												
Antipathella spp.	-	-	-	-	-	-	-	-	-	O	D	D
Stichopathes sp.	-	-	-	-	-	-	-	-	-	R	F	O
Tanacetipathes wirtzi	-	-	-	-	-	-	-	-	-	O	A	A
GORGONACEA												
Leptogorgia capverdensis	-	-	-	R*	-	-	R*	F*	-	-	R*	F*
Leptogorgia spp.	-	-	-	R*	-	-	R*	F*	-	-	-	F*
SCLERACTINIA												
Favia fragum	O	O	-	-	O	O	O	-	-	-	-	-
Madracis sp.	-	-	-	-	-	R	-	-	-	-	R	-
Porites astreoides	A	A	O	-	O	O	O	-	-	-	-	-
Porites sp.	F	-	-	-	O	R	-	-	-	-	-	-
Siderastrea radians	F	F	-	-	D	D	D	D	-	-	-	-
Siderastrea sp.	O	R	-	-	A	A	F	F	-	-	-	-
Schizoculina africana	-	-	-	-	-	-	-	R	-	-	-	R
Tubastrea spp.	R	-	-	-	-	.	-	-	-	D	A	O
Dendrophyllia spp	R	-	-	-	-	-	-	-	-	R	-	-
ZOANTHIDEA												
Palythoa caribaeorum	D	D	-	-	-	O	-	-	-	-	-	-
MILLEPORINA												
Millepora spp.	A	O	-	-	O	F	R	-	R	-	-	-

Occasional presence of *Porites spp., Favia fragum,* and *Schizoculina africana*. Presence of *Leptogorgia spp,* over sand at the edges of hard substratum.

Walls

Vertical and subvertical facies between -10 and -20 m were dominated by antipatharians with low or no presence of scleractinians other than *Tubastrea spp.* that were abundant at lower depths, in crevices and other places with low lighting. *Leptogorgia spp.* was common over sandy bottom close to the lower edge of these walls.

Associated Fauna and Flora

Qualitative assessment of associated fauna and flora showed a clear dominance by *Dictyota spp.* and a strong presence of *Asparagopsis taxiformis* over horizontal hard bottoms. *Caulerpa sp.*, *Codium sp.* and cyanophytes were similarly abundant over bedrock patches with sand deposition. Conspicuous fauna within these biotopes include the sponges *Aplysina aerophoba* and *Chondrosia reniformes*, the gastropod *Stromba sp.,* nudibranchs *Hypseledoris spp.* and the polychaete *Hermodice carunculata.* Ichthyofauna over horizontal substrata included *Myripristis jacobus*, *Coris julis*, *Chromis multilineatus*, *Synodus saurus*, *Sparisoma cretense.* On vertical walls *Myripristis jacobus, Aulostomus strigosus, Sargocentron hastatum* and *Gymnothorax miliaris* were the most abundant species.

Discussion

This preliminary ecological assessment reveals importance of depth, type of substratum and orientation on community structure (Veron 2000; Wells 1988; Wilkinson 2004). Surveys at Sal Is. suggest a difference between living coverage on the leeward and the windward sides of the island. Factors such as temperature might be acting on a local scale due to prevailing currents. Wind regime, West African upwelling and currents together with cyclic Harmattan winds (blowing offshore from the African mainland) may cause significant deposition of dust on the windward (East) side of the island, with an impact on turbidity and light penetration in the water (Moses et al. 2003; Shinn et al. 2000) besides the negative effect of sedimentation on the organisms. The dominance and overgrowth of *P. caribaeorum* was striking at some sites. This species is known for its resilience and for smothering other corals by overgroth (Suchanek 1981). It may thus be a potential hazard for local coral communities and should be monitored.

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