

Distribution and photo-physiology of bleached and non-bleached *Sarcophyton* sp. in Rodrigues reefs, Republic of Mauritius

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Abstract. Ramkalam MK, Korimbocus AM, Jogee SY, Gerzer F, Nundlall Y, Chatoolsingh D, Anansamy M, Kaullysing D, Casareto BE, Suzuki Y, Reimer J, Wijayanti DP, Nascimento B, Bhagooli R. 2025. Distribution and photo-physiology of bleached and non-bleached *Sarcophyton* sp. in Rodrigues reefs, Republic of Mauritius. *Indo Pac J Ocean Life* 9: 156-164. Soft corals are key contributors to reef ecosystems, especially where hard coral cover is declining, yet their responses to bleaching stress remain poorly understood in the Indian Ocean. This study investigated the distribution and abundance of soft corals, alongside the photosynthetic performance of bleached and non-bleached *Sarcophyton* sp. around Rodrigues Island, Republic of Mauritius. Field surveys were carried out using Line Intercept Transects (LIT) across four sites: Ti Trou, Plateau Benitiers, Var Brulee, and Pate Reynieux, revealing significant variations in the soft coral communities. For healthy and bleached *Sarcophyton* colonies, chlorophyll fluorescence was measured using a JUNIOR Pulse-Amplitude-Modulated (J-PAM) to assess the photo-physiology (Y(II), rETR_{max}, NPQ_{max}). Results showed that soft corals flourished at shallow southern sites (65.00±0.26% and 51.67±4.72%) with lower levels of nitrate and phosphate. The photo-physiological analyses showed that healthy *Sarcophyton* sp. had higher Y(II) (0.509±0.004) and rETR_{max} values (15.23±4.2) compared to bleached *Sarcophyton* sp. (Y(II); 0.163±0.05, rETR_{max}; 0.97±0.42), while NPQ_{max} values remained similar (healthy looking; 0.09±0.02, bleached; 0.06±0.008). The retention of quenching activity suggests that even bleached the *Sarcophyton* samples still had some protective mechanisms hence the possibility of remaining symbionts. These findings demonstrate the physiological plasticity and resilience of *Sarcophyton* sp., which may contribute to adaptation and resilience to stress conditions and contributes to shifts in reef communities.

Keywords: Bleaching, chlorophyll fluorometry, coral distribution patterns, Rodrigues Island, *Sarcophyton*

Abbreviations: CF: Chlorophyll Fluorescence, DO: Dissolved oxygen, ETR: Electron transport rate, Fm: Maximal fluorescence yield of dark adapted sample with closed PSII centers, Fm': Maximal fluorescence yield of illuminated sample with closed PSII centers, HC: Hard Coral, LIT: Line intercept transect, NPQ: Non-photochemical quenching parameter, PAM: Pulse Amplitude Modulation, PB: Plateau Benitiers, PR: Pate Reynieux, PS: Maximum potential rETR, PSII: Photosystem II, rETR_{max}: Maximum photosynthetic capacity, RLC: Rapid light curve, SC: Soft Coral, sp.: species, TT: Ti Trou, VB: Var Brulee, WIO: Western Indian Ocean, Y(II): Effective quantum yield, Y: Quantum yield calculated through PAM, α : Photosynthetic efficiency of PSII; ascending slope of a rapid light curve, β : Photoinhibition of PSII; descending slope of a rapid light curve

INTRODUCTION

Ubiquitous in many benthic marine environments, from tropical to polar waters, from intertidal to deep waters, octocorals are sessile benthic organisms within the class Octocorallia (Cnidaria: Anthozoa) (Alderslade 1987). Unlike their hard scleractinian coral counterparts, soft corals lack a calcareous skeleton or internal axis, and

instead, possess a flexible, often gelatinous body structure supported by microscopic, calcified sclerites (Hardman et al. 2007). Soft corals can settle and grow on a wide range of substrates, including coral reefs and rocky substrates, depending on the species (Chanmethakul and Chansang 2009). These filter feeders would create vibrantly coloured colonies by joining polyps together (Fabricius and Alderslade 2001; Behera et al. 2024). However, due to their

diversity and morphological plasticity, soft corals are often hard to identify to species-level (Fabricius and Alderslade 2001).

Soft corals rely less on reef-building than their hard coral counterparts, though Jeng et al. (2011) demonstrated that *Sinularia* species can contribute to reef frameworks through spiculate formation. Such structures occur in various parts of the world including the south of Japan, Australia and Somalia. However, the formation and growth of colonies depend on various physical environmental factors of their habitat, such as water flow, current, depth, and turbidity (Fabricius and Klumpp 1995; Fabricius and De'ath 1997; Chanmethakul and Chansang 2009), as well as irradiance for zooxanthellate species. Their ecological success is linked to both structural and chemical strategies. In the absence of a protective skeleton, many species deploy antioxidant responses, heat-shock proteins, and secondary metabolites to defend against stress and predation (Feder and Hofmann 1999; Wah et al. 2007). These metabolites have also attracted biomedical interest, showing activities such as anti-inflammatory, antimicrobial, and anticancer effects (Zubair et al. 2015; Jahajeeah et al. 2023a, b).

Despite their ecological attributes and pharmaceutical relevance, little research has been conducted in Rodrigues Island situated in the western Indian Ocean. The existing baseline ecological and physiological data regarding Rodrigues' octocorals are extremely sparse, representing only a handful of taxonomic surveys from the late 1900s and one recent ecological assessment. Part of the Mascarene Islands and the Republic of Mauritius, Rodrigues harbours one of the most abundant and diverse marine ecosystems. Species of soft corals were identified and reported by Tixier-Durivault (1966) and Michel (1974), including species from the genera *Alcyonium*, *Cladiella*, *Lobophytum*, *Pareythroplodium*, *Sarcophyton*, *Sinularia*, *Nephtea* and *Stereonephthya*. The most recent study conducted by Jahajeeah et al. (2021) reported valuable insights on the Rodriguans soft corals, mainly their diversity and abundance around the island, with species from the genera *Sinularia*, *Lobophytum* and *Sarcophyton* being the most commonly observed. Other genera, such as *Cladiella*, *Dendronephthya* and *Heteroxenia* were also observed but in lesser numbers (Jahajeeah et al. 2021).

Similar to hard scleractinian corals, zooxanthellate soft corals also bleach and suffer other stress-related impacts when exposed to higher temperatures, fluctuating light intensities, and shifts in water quality (Michalek-Wagner and Willis 2001; Slattery et al. 2019). Zooxanthellate soft corals bleach under stress conditions due to the loss of these symbionts or their photosynthetic pigments (Suzuki et al. 2015; Casareto et al. 2016). Induced under conditions of environmental stress, such as rising sea temperatures, intense light, and salinity and nutrient changes, which affect the delicate balance of the symbiosis and cause large-scale bleaching events threatening the survival of coral reef ecosystems (Bhagooli et al. 2021, 2022). Photophysiology, therefore is a valuable tool to understand how symbiotic soft corals respond to environmental

stressors such as heat, light, and salinity changes. Temperature has a significant impact on the optimal growth and photosynthetic efficiency of symbionts (Fitt et al. 2000; Mattan-Moorgawa et al. 2012, 2018; Sammarco and Strychar 2013; Bhagooli et al. 2022; Jeetun et al. 2023). Slattery et al. (2019) reported that continuous thermal stress caused a decline in resistance, resilience, and population density and increased mortality of soft corals in Guam. These coral species span a variety of environments and thus have differential responses to climate changes based on their unique adaptations. For instance, Robinson and Warner (2006) reported that differences in Symbiodiniaceae adapted to different environments can result in large differences in their photosynthetic responses to thermal stress. The dysfunction in photosynthesis is a key trigger for symbiont cell loss and eventual coral bleaching.

Studies on distributions, abundances, and photosynthetic performances of soft corals are needed to contribute to a better understanding of the ecological dynamics of coral reef ecosystems. Such studies are sparse for the waters around Rodrigues Island. Therefore, the aim of this study was to evaluate the distributions and abundances of soft corals around Rodrigues Island. Furthermore, this study also assessed the photobiology of bleached and non-bleached *Sarcophyton* sp., which was one of the widely distributed species around Rodrigues Island, to examine its physiological responses during a period of high sea surface temperatures.

MATERIALS AND METHODS

Study area

Rodrigues Island is a small volcanic island located in the southwest Indian Ocean (19°42'33"S, 63°26'33"E) and an autonomous outer island of the Republic of Mauritius. The island features a rich marine ecosystem, characterized by extensive coral reefs that are recognized as a global biodiversity hotspot. For this research, four study sites around the island, two in the north and two in the south, were selected based on preliminary visual observations and previous reports (Figure 1; Table 1) to ensure presence of soft corals.

Field surveys

Surveys were conducted using the Line Intercept Transect (LIT) method by Niamaimandi et al. (2017) during April 2024. These surveys were carried out by snorkeling and/or diving at depths ranging from 1 meter to 10 meters across four study sites around Rodrigues. At each study site, three transects of 50 meters each were laid parallel to shoreline. Data was recorded systematically at each transect, noting the length of the transect intersecting with soft coral colonies. Soft corals were identified to genus level during the survey based on their morphology, which was then verified using identification guides (Fabricius and Alderslade 2001; McFadden et al. 2025) using images taken along video transects. Genus, growth form, and intersection length (cm) were used to calculate percentage cover. Physical properties such as sea surface

temperature and salinity were documented at every station (3 measurements per transects) using a thermometer and a digital refractometer (Milwaukee Digital Salinity refractometer) respectively. water samples (n=3 per site) were collected to analyze nutrient concentration and stored in ice before laboratory analysis as described by Margeson et al. (1980) and Murphy and Riley (1962) (Table 1).

Chlorophyll fluorescence measurement

Photosynthetic performances of collected *Sarcophyton* sp. samples were measured using a JUNIOR Pulse Amplitude Modulation (JUNIOR-PAM, Walz GmbH, Germany) fluorometer. The JUNIOR-PAM measures the variations of Chlorophyll Fluorescence (CF) of a biological material (Schreiber et al. 1986). It consists of a 50 cm long plastic fiber which releases saturating pulses measuring the variable CF emitted by the photosystem II of living materials.

Bleached and healthy-looking tissue samples of soft coral colonies from the genus were collected at approximately 5 m water depth. Colonies were classified as 'healthy-looking' when exhibiting usual brown or colourful pigmentation and 'bleached' when displaying paling tissue paling or whitening consistent with symbiont loss. For each condition, three colonies were selected, and three tissue samples were collected from each colony. The JUNIOR-PAM fiber was placed onto the surface of both the healthy and bleached soft coral samples to measure the CF of that specific area after a minimum of 20 min dark adaptation period. A minimum of three area of interest was selected for each soft coral sample. Photosynthetic parameters

including YII, $rETR_{max}$, and NPQ_{max} of the both soft coral samples were obtained using the software Wincontrol-3 (v3.36, Heinz Walz GmbH). Rapid light curves were conducted using the following actinic light intensities and/or PAR (photosynthetically active radiation at the time of measurement); 0, 65, 90, 125, 190, 285, 420, 625, and 820 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$. Each measurement was taken for about 60 seconds. Y(II), $rETR$ and NPQ was calculated as indicated.

Effective quantum yield (YII):

$$Y(II) = (F_m' - F) / F_m'$$

Where:

F : Fluorescence yield

F_m : Maximal fluorescence yield of sample after adaptation in dark

F_m' : Maximal fluorescence yield of sample in illumination (Schreiber and Klughammer 2008)

Maximum electron transport rate ($rETR_{max}$):

$$rETR = Y(II) \times PAR \times 0.5 \text{ (}\mu\text{mol electrons m}^{-2} \text{s}^{-1}\text{)}$$

$$rETR_{max} = P_{max} \text{ (determined from light curve)}$$

Where:

PAR: Photosynthetically Active Radiation at the time of measurement ($\mu\text{mol photons m}^{-2} \text{s}^{-1}$)

$rETR$: Relative electron transport rate ($\mu\text{mol electrons m}^{-2} \text{s}^{-1}$)

Y(II): Effective quantum yield of photosystem II

0.5: Factor assuming equal distribution of light energy between photosystems I and II (Ralph and Gademann 2005)

Table 1. Coordinates and description of selected study sites across Rodrigues Island, Republic of Mauritius

Study sites	Coordinates	Site description			
		Protected/ Non protected	Depth	Reef type	Substrate type
Ti Trou	19.6625°S 63.4389°E	Non protected	5 - 10 m	Reef crest	Fine sediment with patches of coral rubbles
Plateau Benitiers	19.66722°S 63.43556°E	Non protected	5 - 10 m	Reef crest	Fine sediment with patches of coral rubbles
Var Bruleee	19.747722°S 63.472667°E	Protected	~ 2 m	Reef flat	Coral rubbles with patches of sand
Pate Reyneux	19.749444°S 63.468889°E	Protected	~ 2 m	Reef flat	Coral rubbles with patches of sand

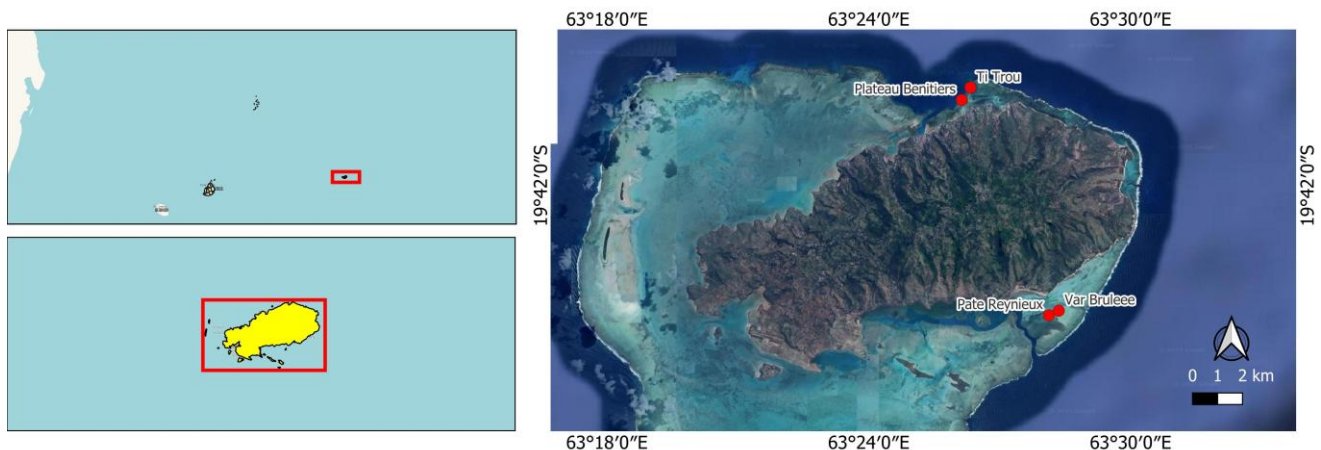


Figure 1. Map of Western Indian Ocean showing the location of Rodrigues Island (left) and Map of Rodrigues Island (Republic of Mauritius) showing locations of study sites

Non-Photochemical Quenching (NPQ):

$$NPQ = (F_m - F_m') / F_m'$$

Where:

F_m : Maximum fluorescence emission recorded in dark-adapted condition

F_m' : Maximum fluorescence value recorded at distinct intervals of time during illumination (Klughammer and Schreiber 2008)

NPQ_{max} : Was determined from the rapid light curves

Statistical analysis

The data collected were analysed using statistical methods to determine the distribution patterns and abundance of soft corals across the surveyed sites. All analyses were carried out using IBM SPSS software. Shapiro-Wilk Test was performed to ensure normality of data and non-normal data sets were transformed using “Log10”. The Shapiro-Wilk test indicated normally distributed data ($p > 0.05$) for all sites and hence data was retained. Due to small sample size ($n < 15$), Kruskal-Wallis test was used to compare differences in abundances of octocorals between different sites. Spearman’s rank correlation was used to examine the relationships between environmental parameters and the abundances of soft corals. While transects were nested within sites, the limited number of replicates per site restricted the possibility of mixed-effects modeling. Therefore, due to site-level differences and given the limitations on the number of transects conducted, using Kruskal-Wallis test was deemed appropriate. Kruskal-Wallis test was also used to evaluate the variation between the photosynthetic performances of both healthy and bleached *Sarcophyton* sp. tissue samples. Additionally, Spearman’s rank correlation (p -value < 0.05) was used to understand the difference in the photosynthetic capacity of the bleached and healthy samples.

To quantify diversity of soft corals at genus level at each site, Shannon-Wiener Index (H) was used.

Shannon Index (H) Formula:

$$H = -\sum (P_i \ln P_i)$$

Where:

H: Shannon Index

P_i : Proportion of individuals that belong to the i th genus (relative abundance of corals)

In: Natural logarithm (Shannon and Weaver 1963)

To evaluate the dominance of soft and hard corals at genus level within groups across study sites, Simpson’s Dominance Index (D) was used.

Simpson’s Dominance Index Formula:

$$D = \sum (P_i)^2$$

Where:

D: Simpson’s Dominance Index

S: Total number of genus

P_i : Proportion of individuals of the i th genus (Simpson 1949)

To estimate the evenness in distribution of soft corals at genus level in the reef community, Pielou’s Evenness Index (J) was used.

Pielou’s Evenness Index Formula:

$$J = H' / \ln(S)$$

Where,

J: Pielou’s Evenness Index

H' : Shannon-Wiener Diversity Index

S: Total number of genus in the sample

In: Natural logarithm (Pielou 1966)

RESULTS AND DISCUSSION

Physico-chemical conditions

Temperatures recorded from all study sites, namely Ti Trou (TT), Plateau Benitiers (PB), Var Brulee (VB), and Pate Reynieux (PR), showed significant difference across study sites ($p < 0.05$) (Tables 1 and 2). Depth ($p = 0.028$) and chemical qualities of the seawater, particularly nitrate ($p = 0.045$) concentration, showed significant disparities between the northern sites and southern sites. VB and PR had the lowest concentrations of nitrate while TT and PB had the highest (Table 1).

Benthic composition

The coral cover data from the four sites showcases significant differences in coral composition and diversity indices ($p < 0.05$). Among the four survey sites, TT had relatively low soft coral covers at $3.67 \pm 2.31\%$ (Table 3). TT and PB, showed similar profiles, with high scleractinian hard coral covers of $81.33 \pm 4.72\%$ and $75 \pm 2.31\%$, respectively. Soft coral genera present in the northern sites included *Sarcophyton*, *Cladiella* and *Simularia* (Figure 2). On the other hand, VB and PR had higher percentages of soft coral cover, $65.00 \pm 0.26\%$ and $51.67 \pm 4.72\%$, respectively. *Heteroxenia* and *Cespithularia* were most commonly observed genera in the southern sites, where they formed large blue soft coral “carpets” in the relatively shallow waters (Figure 3). VB was observed to have the highest soft coral cover and lowest substrate cover ($5 \pm 0.51\%$), implying very low levels of non-living substrate exposure. Substrates upon which soft corals in the southern sites grew included dead coral rubble, fine sand, and live and dead hard corals.

The Shannon-Weiner Index, a measure of soft coral diversity, was highest at PR (0.79 ± 0.14) and at TT (0.86 ± 0.14), indicating low to moderate diversity of soft corals compared to the other two sites which indicated moderate diversity. The dominance index for soft corals showed a higher value at PR (0.51 ± 0.33) followed by VB (0.51 ± 0.30) indicating that one or two soft coral genera was contributing, disproportionately, to the overall percentage cover. In contrast, the TT and PB hard coral assemblages had lower D values (~ 0.40) indicating a greater evenness among hard coral genera. Pielou’s Evenness Index, which indicates how evenly individuals distributed among the species present, was highest at PB (0.88 ± 0.07), hence showing that PB had a more evenly distributed soft coral distribution, with a considerable composition of hard and soft corals at $50.67 \pm 2.31\%$ and $33.67 \pm 2.31\%$, respectively, followed by TT (0.81 ± 0.30) and PR (0.79 ± 0.31) (Table 3).

Photosynthetic performance

The average effective quantum yield (Y(II)) of healthy *Sarcophyton* sp. samples were observed to be significantly higher (0.509 ± 0.004) compared to that of the bleached samples (0.163 ± 0.05) (Figure 4). Similarly, the maximum photosynthetic activity (rETR_{max}) was found to be markedly greater ($p < 0.05$) in healthy *Sarcophyton* samples (15.23 ± 4.2) than bleached *Sarcophyton* samples (0.97 ± 0.42). Notably, the non-photochemical quenching activity (NPQ_{max}) between the healthy samples (0.09 ± 0.02) and the bleached samples (0.06 ± 0.008) were not found to differ significantly (Figure 4, Table 4).

Discussion

Distribution patterns of soft corals

This study provides new evidence of the diversity and composition of soft coral assemblages around Rodrigues Island, an area where baseline ecological data remain limited. The soft coral communities encountered exhibited clear spatial heterogeneity, with the southern sites (Var Brulee and Pate Reynieux) supporting higher soft coral cover than the northern sites (Ti Trou and Plateau Benitiers). The most prevalent genera encountered in the north were *Sarcophyton*, *Cladiella*, and *Sinularia*, while *Heteroxenia* and *Cespitularia* were encountered in the south in accordance with previous assessment of Rodrigues' octocoral communities (Jahajeeah et al. 2021). Of particular interest is that the study also reports on benthic change at certain sites, with soft corals outnumbering hard corals, most particularly at Var Brulee. The observation substantiates earlier findings and suggests ongoing or incipient structural change in the reef, possibly due to synergistic natural and anthropogenic stress. While soft corals dominated total benthic cover at southern sites, their lower to moderate diversity values signify lower internal diversity but greater dominance by fewer species, which lines up with observations made whereby *Heteroxenia* and *Cespitularia* genus were the most

abundant. Clear dominance by *Heteroxenia* and *Cespitularia* genera, expressed by their high percentage cover, to create extensive carpets in shallow lagoon areas is a significant feature of Rodrigues reefs not earlier well-characterized in the literature.

Ecological indices such as Shannon-Wiener diversity and Pielou's evenness also reflect differences in coral community structure among the sites. For example, Pate Reynieux had dense soft coral cover together with an uneven species distribution. The environmental conditions, in particular, nitrate and phosphate concentrations at the southern sites correlated with the higher soft coral abundance suggesting they may be associated to the nutrient-poor conditions of those areas, possibly due to the fact that hard corals are less competitive under nutrient-poor conditions, making it less competitive for the soft corals and allowing them to dominate (Baum et al. 2016). The widespread distribution of *Heteroxenia* and *Cespitularia* at the southern sites is consistent with the literature regarding these genera serving as opportunistic colonizers in shallow reef flats dominated by rubble or sand (Benayahu and Loya 1984; Fabricius and Alderslade 2001; Baum et al. 2016). Their carpet-like formations could reflect ecological release from competitive effects of scleractinians in these habitats. This study offers valuable observation data on current soft coral distribution patterns and emphasizes the need for longer duration and larger extent monitoring on Rodrigues reefs.

Table 2. Summary of Kruskal-Wallis test for the effect of depth, temperature, nitrate and phosphate among study sites

Physico-chemical conditions	df	H	P-value
Depth	3	10.913	0.012*
Temperature	3	10.913	0.012*
Nitrate	3	9.925	0.018*
Phosphate	3	7.814	0.051 ^{NS}

Note: *: $p < 0.05$, NS: Not Significant

Table 3. Environmental parameters around study sites in Rodrigues (Mean \pm SD)

Sites	Physico-chemical conditions				
	Depth (m)	Water current	Temperature (°C)	Nitrate ($\mu\text{mol/L}$)	Phosphate ($\mu\text{mol/L}$)
Ti Trou (TT)	10.70	Strong	30.0	0.04 ± 0.001	0.09 ± 0.01
Plateau Benitiers (PB)	11.40	Strong	30.0	0.57 ± 0.30	0.28 ± 0.01
Var Brulee (VB)	2.00	Low	29.5	0.003 ± 0.001	0.03 ± 0.001
Pate Reynieux (PR)	2.00	Low	30.0	0.01 ± 0.02	0.03 ± 0.01

Table 4. Coral cover and ecological indices at the four study sites around Rodrigues Island, Mauritius

Sites	Live benthic cover		Ecological indices		
	Soft coral (%)	Hard coral (%)	Shannon-Weiner Index	Simpson's Dominance Index (SC)	Pielou's Evenness Index
TT	3.67 ± 2.31	81.33 ± 4.72	0.64 ± 0.12	0.43 ± 0.001	0.81 ± 0.30
PB	33.67 ± 2.31	50.67 ± 2.31	0.65 ± 0.15	0.42 ± 0.001	0.88 ± 0.07
VB	65.00 ± 0.26	30.00 ± 6.47	0.86 ± 0.14	0.51 ± 0.30	0.78 ± 0.16
PR	51.67 ± 4.72	41.33 ± 5.28	0.79 ± 0.14	0.51 ± 0.33	0.79 ± 0.31

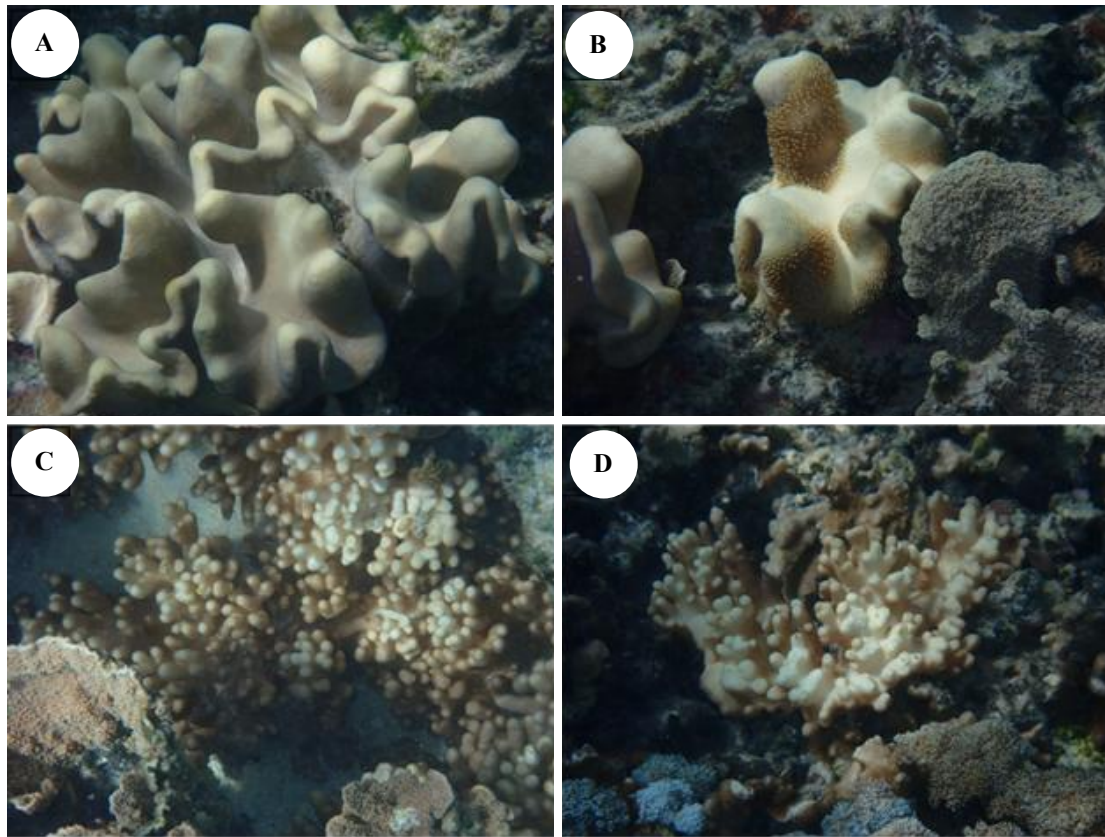


Figure 2. Corals at Ti Trou, Rodrigues Island, Mauritius. A and B. Bleached *Sarcophyton*, C and D. Partly bleached *Cladiella* at Ti Trou

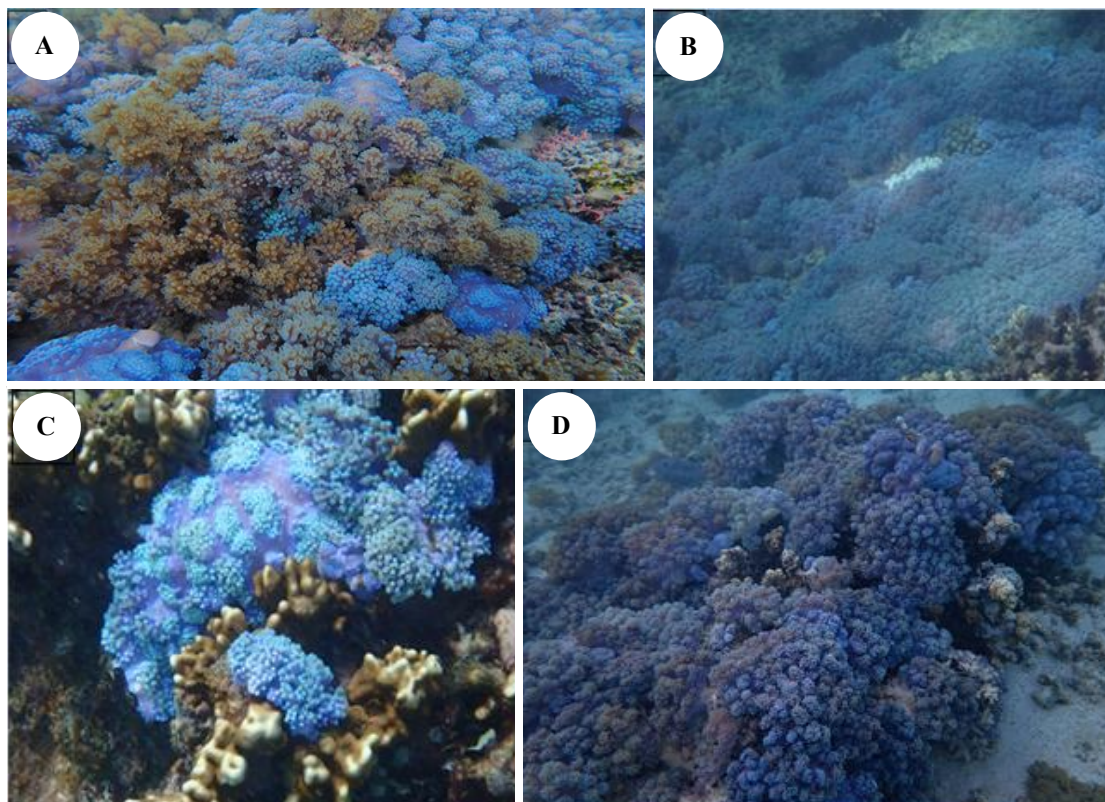


Figure 3. Corals in the Southern sites of Rodrigues Island, Mauritius. A. *Heteroxenia* sp. and *Cespithularia* sp., B. "Blue Soft Coral Carpet", C and D. Blue soft coral growing on top of hard corals

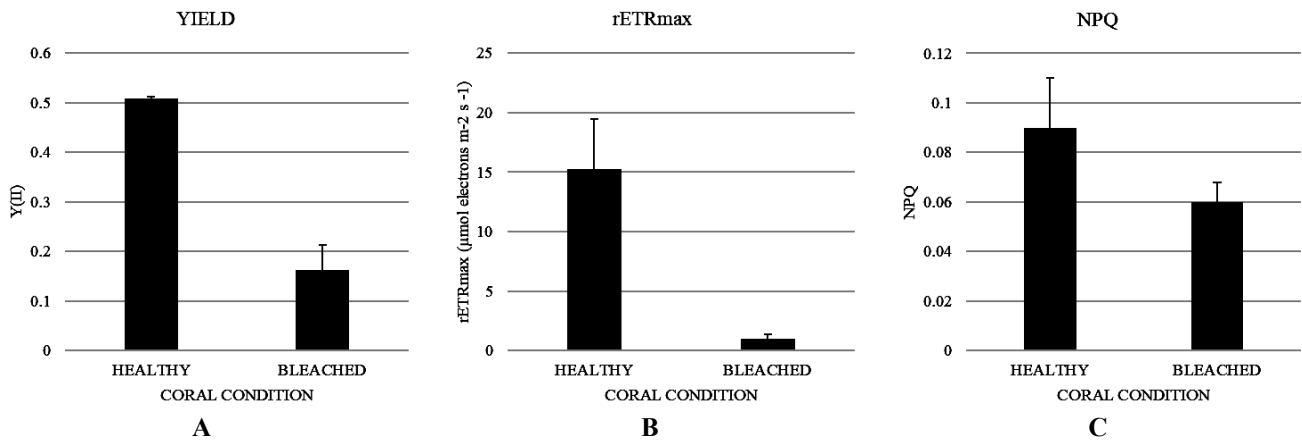


Figure 2. Photo-physiology of Bleached and Non-bleached *Sarcophyton* sp. samples. A. Quantum yield, B. rETR_{max} and C. NPQ_{max}

Table 5. Kruskal-Wallis test to test effect of healthy-looking (non-bleached) and bleached conditions in *Sarcophyton* sp. on quantum yield (Y(II)), relative maximum electron transport rate (rETR_{max}) and non-photochemical quenching (NPQ_{max})

Photosynthetic parameters	df	H	P-value
Y(II)	1	7.507	0.01**
rETR _{max}	1	9.530	0.00**
NPQ _{max}	1	0.940	0.487 ^{NS}

Note: **: Significant difference at $p < 0.01$, NS: Not Significant

Photophysiology of *Sarcophyton*

Extreme levels of heat, light, and other environmental parameters have long been recognized to be among the main causes of bleaching events among zooxanthellate anthozoan species. Observations made during this study highlight significant distinctions between the photosynthetic apparatus of the healthy and bleached *Sarcophyton* sp. colonies. The physiological adaptability of soft corals is a key factor in their distribution and ecological success (Rocha et al. 2013; Dummee et al. 2023). The significantly higher effective quantum yield (Y(II)) and maximum photosynthetic activity (rETR_{max}) pointed towards the adequate efficiency of PSII photochemistry and overall good metabolic health in the healthy *Sarcophyton* samples (Table 5). In contrast, the bleached samples showed a drastic decline in photosynthetic performance. Elevated temperatures are one of the major contributing factors of coral bleaching events which may prompt photosynthetic dysfunction and loss of zooxanthellae cells (Michalek-Wagner and Willis 2001; Chavanich et al. 2009). High temperatures (30°C) were recorded across the sampling site during the study. This might suggest that the use of light energy for metabolic processes was impaired mostly likely due heat induced loss or disturbance of symbiotic zooxanthellae. Concurring with past studies which have also reported on the negative impact of elevated temperature on the photophysiology of the genera *Sarcophyton* (Chavanich et al. 2009; Baum et al. 2016).

Perhaps of most interest, samples from both conditions, healthy and bleached, showcased Similar Non-Photochemical Quenching (NPQ) activity. The non-photochemical quenching is a crucial protective mechanism adapted by phototrophs to dissipate excess light energy (radiation) through heat dissipation to protect the photosystem II from damage (Schreiber and Klughammer 2008; Bhagooli 2010; Bhagooli et al. 2021). Having similar quenching values imply that the symbionts or pigments may remain in the bleached soft coral sample hence the functioning of the protective mechanism. The high NPQ in the healthy samples suggests, however, that even these corals were experiencing light stress and reacting by deploying energy dissipating defense. Just like NPQ durability has been recorded in certain scleractinian corals under bleaching scenarios (Bhagooli 2010; Bhagooli et al. 2021), NPQ or similar photoprotective responses have been observed in *Sarcophyton* studies such as Farag et al. (2021). The sustaining of NPQ mechanisms in *Sarcophyton* may be linked to genus resilience in response to bleaching for soft corals.

In conclusion, this study showcases clear special variability in soft coral distribution and highlights differential photophysiology performance of *Sarcophyton* sp. across Rodrigues Island. The water quality along with other environmental factors seemed to act as important factors influencing soft coral assemblages in a region with limited baseline data. Additionally, the observed retention in *Sarcophyton* sp. protective mechanisms underscores its resistance to environmental stressors such as high temperatures. It also suggests their capacity to recover from bleaching stress, considering the possible presence of recovering symbiont. The findings highlight the ecological importance and adaptive strategies of soft corals in changing habitat conditions. The shifts in benthic reef communities from hard coral to soft coral emphasize the importance for adequate monitoring and further studies regarding the resilience and ecosystem functioning of soft corals. A limitation of this study is that the sampling effort was a single-timepoint and not longitudinal or repeated, which limits its generalization. The imprecision of the data set is still useful as a preliminary baseline for Rodrigues

soft corals community, which indicates the need for longer and broader temporal and spatial monitoring.

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