

Coral Health in the Solitary Islands Marine Park

2012 - 2015

In early 2012 Coffs Harbour's Solitary Islands Underwater Research Group (SURG) Inc. received \$34,164 from the NSW Government through the NSW Environmental Trust to conduct research into the health of coral communities in the Solitary Islands Marine Park. SURG is comprised of citizen scientists from the Coffs Harbour area and the Clarence Valley.

With summer 2015 round of surveys recently concluded the project is now complete, reefs adjacent to seven islands having been surveyed. A total of 25 sites were investigated, with 59 community members participating in coral health surveys spending 1400 person-hours on or under the sea.

The CoralWatch protocol, developed by the University of Queensland (<http://www.coralwatch.org>), was used to conduct 12,805 assessments of coral colonies. Coral health, as indicated by the incidence of bleaching in the coral community in response to changing sea temperature, can be readily observed and monitored by well-trained citizen scientists using this protocol. Essentially a coral colony can be assigned a colour score, the value of which is indicative of its 'health'. The lower the colour score, the less healthy (or more stressed) the colony is.

When a coral bleaches, often due to high water temperatures during summer, it expels symbiotic algae vital to its health from its tissues, leading to an observed paling in colour. As the sea temperatures cool during winter, corals that have not starved as a result of losing their algae may recover. However, even if they do survive, their reproductive capacity is reduced, which may lead to shifts in reef associated communities that are generally dominated by corals.

Past studies in the marine park by scientists from the National Marine Science Centre (Southern Cross University) and SURG volunteers ascertained that several families of hard corals are more susceptible to bleaching, and it is these families of corals the study centred on. Five families of hard corals (Faviidae, Pocilloporidae, Dendrophylliidae, Poritidae, Acroporidae) were assessed and whilst abundances of each vary between islands, corals from the Pocilloporidae and Poritidae families were significantly more stressed at all study sites when water temperatures of 24°C and above were reached.

The most abundant coral type recorded during the study was the 'Branching', which included the Acroporidae and Pocilloporidae families, making up 44% of all colonies assessed. The 'Boulder', 'Plate' and 'Soft' coral types, with the 'Soft' type contributing only 3% of assessments made, followed it in descending order. Other coral families found within

SIMP were not the target of this project, but can be broadly categorised into one of these four coral types.

Average colour scores (Av. CSs), regardless of family or coral type, have a cyclical pattern with lower Av. CSs evident each summer compared to the preceding winter period. Given that modelling predicts a rise in coral bleaching, and thus a lower colour score, during periods of warmer water, i.e. during summer, then this observation supports the model.

The summer 2015 survey period recorded the highest frequency of low colour scores, with scores for 1, 1.5, 2, 2.5 and 3 more common than for summer 2013 and 2104 equivalent colour scores. SURG members were questioned on their perceptions of the number of 'unhealthy' corals observed over each of the three summer survey periods. They unanimously agreed that the 2015 summer survey period had a higher number of bleached/partially-bleached corals than other survey periods, thus supporting the data collected. Even so, the majority of corals surveyed would be deemed to be moderately healthy. In a survey of a 'healthy' (unaffected) reef you would expect a higher frequency of scores of 4 and above compared to those surveyed in this study.

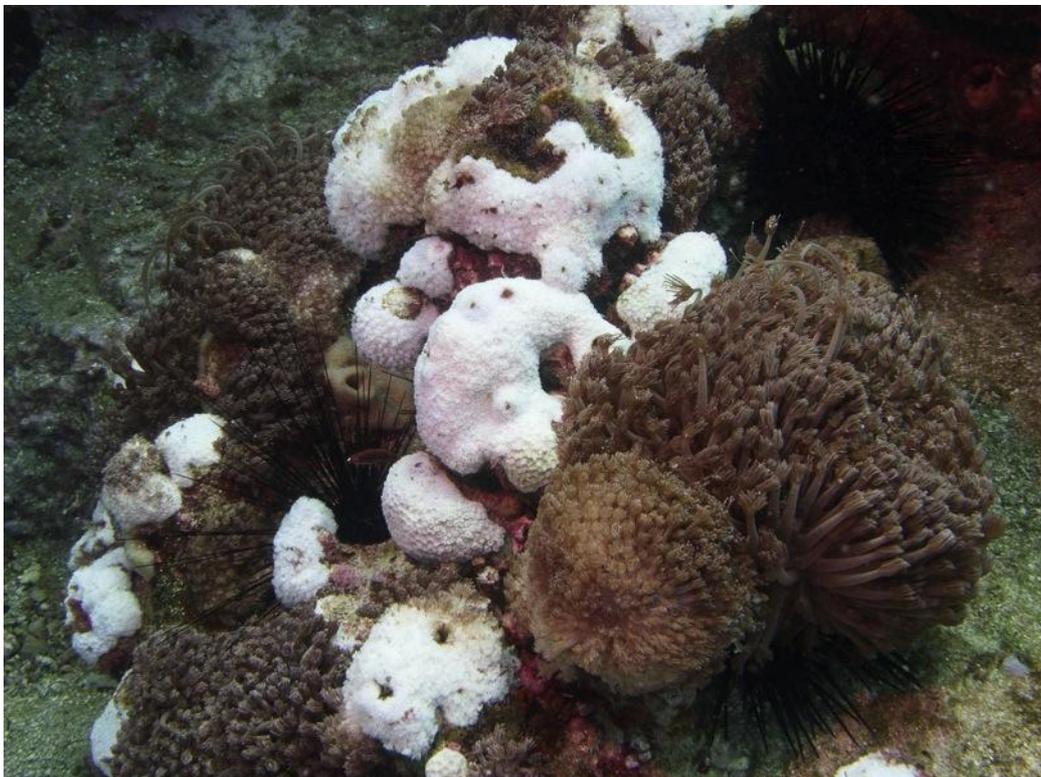
The data indicate that for all colonies surveyed at temperatures of 24°C and above the frequency of lower colour scores (3 and below) were higher compared to colonies surveyed at temperatures of 23°C and below. If the data for the Pocilloporidae and Poritidae are used in this comparison then the difference is even more obvious. Inshore sites (South West and Split Solitary Islands) had higher Av. CSs than offshore islands (North, North West and South Solitary Islands) for three of the families, the Acroporidae, Pocilloporidae and Poritidae. Corals belonging to these families tended to be less healthy in offshore locations. It seems likely there was another factor, other than water temperature, coming into play resulting in lower Av. CSs for these three families in an offshore context.

Of the five families, the Pocilloporidae and Poritidae had the lowest Av. CSs. When the combined data from these families are examined for each offshore island a clinal gradation is evident. North Solitary, the northernmost, furthest offshore and tropically influenced island, had a significantly lower Av. CS (3.7) than either of the other two islands. North West Solitary Island, lying latitudinally between North and South Solitary, had a significantly lower Av. CS (4.0) than the southernmost island, South Solitary (4.5). It was primarily the Pocilloporidae, a branching growth-habit family and the most commonly surveyed coral family, which contributed to this pattern, with Av. CSs increasing significantly from north to south. This is consistent with a previous study in which total bleaching response (moderate and severe combined) was highest in the Pocilloporidae compared to the other four families during 2005 summer surveys.

The analysis of the Av. CSs for each of the coral 'types' indicates the 'Branching' type had a relatively low score, which is to be expected given that the Pocilloporidae comprised the majority records for this 'type'. The low Av. CS for the 'Soft' coral type is not so much an indication of health of these colonies, but rather a typical light colour hue possessed by the species observed.

There was no evidence of widespread bleaching events in the Solitary Islands Marine Park during the study and all common coral families are generally in good condition. However, the recent prediction of a prolonged and intense El Nino event for later this year (<http://www.bom.gov.au/climate/enso/>) does not bode well for our local coral communities, with high water temperatures for lengthy periods potentially leading to a severe and widespread bleaching event.

The data generated in this study provide important information on the natural and seasonal variation in coral pigmentation. Generally, coral pigmentation tends to be more variable within individual colonies during summer. This difference is likely due to a general response to lower light conditions experienced during winter compared to summer months. As a general observation, when data for all corals, regardless of growth form or family, are examined, corals are more stressed (less healthy) when seawater temperatures are 24°C and above.



A partially bleached encrusting Poritid coral at North Solitary Island, showing its normal brownish hue and areas bleached white due to loss of symbiotic algae.