Symbiosis: Responding to Coral Bleaching in the Two Samoas

Coral reefs get their structure from calcium carbonate skeletons built by individual corals (animals) which take many shapes and their colors from symbiotic algae called zooxanthellae that inhabit small cavities with the coral tissues. These algae are responsible for much more than just the coral's color, they also give the coral most of the nutrients needed for life and growth. The algae and coral skeleton together build the complex, textured neighborhoods that foster reef ecosystems – stripped, spotted and camouflaged fish, invertebrates both soft-bellied and armored, and occasional prowling shadows of predators, among hundreds more life forms. The symbiotic relationship that makes all of this life possible is fragile. If stressed, coral can expel the algae from its tissue in a process called coral bleaching. Without the food the algae provides, the now pale coral stops growing, may die, and the once vibrant neighborhoods emigrate.

The Two Samoas Region experienced some bleaching in early 2015, such as this bleached coral pictured in Samoa in February 2013. Source: MNRE.

Changes in water temperature, acidity, nutrient concentrations and other stressors can cause bleaching. In the Pacific, mass coral bleaching is often related to phases of the El Niño Southern Oscillation (ENSO), a semi-cyclical climate phenomenon that can raise ocean temperature in Samoa, causing bleaching. El Niños can also lower sea level in the Samoas, often exposing reefs to air increased sunlight causing bleaching and other damage. This phenomenon is so well documented that Samoan language has a distinct word, *taisama*, for the stench of dying reefs exposed to the air during periods of low sea level brought by El Niño. Additionally, increasing ocean temperatures in a changing climate will make coral bleaching events increasingly common. Reefs around the world are at risk and marine managers are working to protect them, using information about climate variability and climate change to inform actions.

KEY MESSAGE

Be aware that impacts due to a changing climate exist along with (and often exacerbate) impacts from a myriad of non-climate stressors – this means that climate adaptation will be most effective when it is integrated with disaster risk reduction, sustainable development, and other such multi-sectoral approaches to planning and policy development.

"The territory decided – with some major coral bleaching events happening internationally," said Kristine Bucchianeri, the Coral Reef Advisory Group (CRAG) Coordinator for the Territory of American Samoa, "that we wanted to create a territorial coral bleaching response plan, which was in 2011." The diverse reefs of the Samoa region – in both American Samoa and the Independent State of Samoa – in the Western South Pacific have experienced coral bleaching with increasing frequency in the past 2 decades.

The CRAG spent about a year developing a draft of the plan, consulting with community members and partner agencies including the American Samoa Department of Marine and Wildlife Resources, the National Park, the Community College, the EPA and multiple offices from within NOAA. "From those conversations, we realized that there were a lot more coral threats that might potentially negatively affect the coral in American Samoa so we expanded it to include multiple threats and changed the name to Assessment and Rapid Reef Response Plan. So the other threats included in the plan are crown of thorns outbreak, storm damage and coral disease – with the idea that no matter what kind of threat hits the coral, we would collaboratively respond and react together as an interagency group," said Bucchianeri.

The document was published in 2013, but the CRAG continues to update and expand it to address new science and threats. "We don't like to call it final. We refer to it as a living document – we change it and edit it."

The plan takes a creative, adaptive approach to addressing threats. "We call it a 'Choose Your Own Adventure Novel,'" explained Bucchianeri, referring to the series of children's books in which the reader chooses the actions of the main character. In the case of the response plan, CRAG chooses different actions to respond to the event depending on the severity of bleaching. Some of those measures include community education, reducing land-based sources of pollution or seasonal closures of herbivorous fish species – by grazing on the algae that can smother corals, herbivores provide areas for new corals to settle and grow.

Local co-author Juney Ward, Principal Marine Conservation Officer of the Ministry of Natural Resources and Environment (MNRE) of Samoa. Source:

In order for the CRAG to effectively implement their response plan, they will need to employ local climate information. Sea level data associated with El Ninõ, available from the Pacific ENSO Applications Climate (PEAC) Center among other sources, will be an important variable to track in order to effectively respond to *taimasa*. For sea surface temperature (SST) data, the CRAG relies on a combination of information from the Weather Service Office in Pago Pago, local monitoring, and the NOAA Coral Reef Watch (CRW), which produces outlooks for sea surface temperature with associated risk of coral bleaching.

Though useful approximations, the CRW products the CRAG was using were regional outlooks without specific reference to the Samoas region. Sea surface temperature can vary widely within a region so localized information can be crucial to understanding and responding to bleaching. "We don't have a lot of data or information that's specifically local, said Bucchianeri. "I think we could use some of these services to be more specifically based in American Samoa."

At the USAID-funded Climate Services Dialogs held by NOAA in partnership with the Two Samoas Initiative in Samoa and American Samoa in June 2103, local marine managers approached CRW about producing outlooks specific to the two Samoas. "We had asked if it was possible to put in a virtual station for Samoa – just to monitor the sea surface temperature," said Juney Ward, Principal Marine Conservation Officer of the Ministry of Natural Resources and Environment (MNRE) of Samoa, which is similarly developing a coral reef response plan, in partnership with the Fisheries Division of the Ministry of Agriculture and Fisheries and the Secretariat of the Pacific Community (SPC), which will address coral bleaching and other threats to reefs.

KEY MESSAGE

Commit to robust and sustained monitoring and assessment –the maintenance and expansion of existing monitoring networks will lead to an improved ability to understand and predict a changing climate and associated impacts over both the short and long terms.

In response to the CRAG and MNRE's request, CRW created a 'virtual station' for the Samoas region which reports a forecast for local sea surface temperature and a qualitative coral bleaching risk from 'No Stress' through 'Warning' up to 'Alert Level 2' (see graphic). The inter-agency coordination of the CRAG, MNRE and

CRW to create a climate service that benefits both marine management agencies will improve bleaching response in the region. As a result of this collaboration, the CRAG and MNRE began exchanging emails on threat conditions and extent on their respective reefs which will further benefit them as they work on similar plans.

CRAG and MNRE recently exchanged emails to assess respective conditions related to a rising coral bleaching alert level at the Samoas Region virtual station in March 2015. "We just started to see some bleaching in the last month or six weeks," said Bucchianeri, "and the projected water temperatures are looking not very good for our coral."

"Some of our team were out just yesterday trying to get baseline surveys on the areas we identified as priorities in the plan to assess current baselines so we can measure the progression of bleaching – which hopefully doesn't happen," said Bucchianeri. Resources and attention devoted to monitoring reef conditions both before and during bleaching or other reef threats are required to establish baselines and verify model forecasts.

As part of their monitoring, MNRE engages with community members who are often some of the first witnesses of changes to reef ecosystems. MNRE asks tour operators, fishermen and recreational swimmers to notify them of usual bleaching or crown-of-thorns outbreaks.

In addition to coral bleaching, the reefs of the Two Samoas region face threats such as crown-of-thorns starfish that prey on coral. Photo: CRAG.

"Because sometimes the communities will see the changes before us and we'll actually get the information quite late sometimes. So we're trying to build on and strengthen our collaboration with communities so that when they're seeing changes in their reef system, they can immediately inform us and we're able to respond early and document these changes. And also to help them realize that when we're experiencing mass bleaching, that there's certain things that need to be done so that we're not adding extra pressure to the reefs that are already being impacted by the bleaching."

KEY MESSAGE

Engage with the community and other stakeholders early and often – building community ownership and participation from the beginning leads to more positive, sustainable outcomes.

This community involvement serves multiple purposes – increasing monitoring capacity while spreading conservation messages thereby decreasing human stressors on the reef. Just as the CRAG engaged a number of stakeholders and community members in their response plan, community engagement is key to successful development of climate services.

MNRE has intended to create a coral bleaching response plan for quite some time and the current bleaching lends an extra sense of urgency to sitting down to complete it. “There was never a time that we sat down until now, when we are actually experiencing the bleaching,” said Ward. “We’re now sitting down and getting on top of that bleaching response plan.”

At the CRAG, Bucchianeri and her team are taking this opportunity to test and improve their plan. “We’re taking notes, because this is the first bleaching event that we’ve actually used the Assessment and Rapid Reef Response Plan for. So we’re just taking notes to see if it’s good, if it works, if it needs to be improved for next time,” said Bucchianeri.

The Pacific Islands Climate Storybook can be found at: http://pacificislandsclimate.org/csdialogs/
Climate Stories can be found at: http://www.pacificislandsclimate.org/csstories/

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