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Announcements

1. July's theme: Coral Bleaching



Partly bleached coral at Haddummati Atoll, Maldives. It is mostly rimmed by barrier reefs and the broadest of which are topped by islands. (Photographed by Jamie Oliver)

The phenomenon of coral bleaching can be described as the stress-related loss of symbiotic algae (zooxanthellae) or their photosynthetic pigments. Under normal conditions these pigments help to lend corals their colour, and so their loss results in bleached corals appearing white as the limestone skeleton becomes visible through the transparent tissues of the coral polyps (Douglas, 2003). As simple as this mechanism may seem, the physiological consequences of bleaching can be very severe for corals, which depend heavily upon their zooxanthellae for energy and nutrients. Post-bleaching impacts range from decreased growth and reproduction, to mortality in the case of severe bleaching, with subsequent negative ecological consequences for reef ecosystem structure and function.

The issue of coral bleaching has been the subject of increasing global attention in recent years. As the incidence and severity of 'mass bleaching' events (bleaching over large geographic areas) have increased with warming sea temperatures, it has become clear that the phenomenon of mass bleaching is closely related to global climate change (Hoegh-Guldberg, 1999). With levels of CO₂ and sea temperatures continuing to rise, severe bleaching may occur regularly on reefs within the next 30-50 years (Donner et al., 2005) and is likely to have serious consequences for the world's corals. Recently, the first comprehensive global assessment of the conservation status of reef-building corals estimated that 1/3 of that the 704 species assessed are at risk of extinction, and that bleaching is one of the most serious threats they face (Carpenter et al., 2008).

The urgent need to address the problem of bleaching has been identified by scientists and global leaders as reefs in many regions are now at critical risk of losing part or all of their valuable reef ecosystems due to bleaching and other ongoing stressors. Much more remains to be learned and better understood about the specific factors that contribute to coral resilience and recovery. While the urgency to protect the remaining reef resources from coral bleaching and its management responses continues to increase, information sharing has become one of the key components for supporting research and management of reefs.

To help respond to this need, ReefBase hosts and maintains an extensive range of coral bleaching-related resources. These include the largest global repository of coral bleaching data, relevant publication references, a gallery of coral bleaching photos, ReefGIS coral bleaching maps, and Degree Heating Weeks Maps, all of which are publicly available for use. Among the studies of coral bleaching which have benefitted from the bleaching data and information provided by ReefBase are papers that have examined the potential role of an 'ocean thermostat' in determining regional bleaching events (Kleypas et al., 2008) and determined Caribbean-wide trends in temperature-induced coral bleaching (McWilliams et al., 2005).

Featured in this issue of the newsletter are some recommended readings relating to coral bleaching (Literature Database) and also an introduction to the Degree Heating Weeks (DHW) GIS Maps available on the ReefBase website.

2. ReefBase call for coral bleaching data

One of the ReefBase's main focuses is to maintain a global repository of coral bleaching data to support coral reef monitoring and related research. There rises an urgent need to obtain a more complete information and data on coral bleaching as the phenomenon continues to emerge as one of the most significant and widespread threat to coral reefs around the world.

The gathering of coral bleaching information is hence a key action to the scientific understanding and the prediction of the fate of coral reefs- subsequently to develop feasible and effective management strategies. Hence, ReefBase has strived to maintain the most up-to-date global database on coral bleaching events available, as well as a comprehensive collection of images and reports related to bleaching. Below are the various useful resources that relating to coral bleaching monitoring:

- If you have any information on bleaching events, please submit a bleaching report to ReefBase using a form available [here](#). Other data relating to coral bleaching can also be submitted in the form of publication references, photos and maps. These data will then be synthesized and integrated into graphs and ReefGIS maps.
- ReefBase also provide a global protocol for assessment and monitoring of coral bleaching - developed by the WorldFish Center and WWF which can be downloaded [here](#).
- Another alternative method for assessing the level of bleaching is to use specially prepared color cards- called the CoralWatch Do It Yourself Coral Health Monitoring Kit. More information on this method, developed by the University of Queensland can be obtained [here](#).
- [The Nature Conservancy](#) and [World Wildlife Fund](#) have established a working group that work with MPA practitioners around the world to evaluate the vulnerability of existing coral reef MPAs to conditions that cause coral bleaching and death, and to recommend application of the new knowledge to management approaches. Responses to the questionnaire will allow the testing of a range of hypotheses that various environmental factors actually confer bleaching resistance and recovery. Please follow the link to the [Bleaching Resilience Questionnaire](#).

3. ReefBase Activities in the 11th ICRS, Fort Lauderdale



The recent 11th International Coral Reef Symposium (ICRS) in Fort Lauderdale, Florida (7th to 11th July 2008) has brought together more than 3,000 participants and coral reef experts of different disciplines from around the world. In what was claimed to be the world's major coral reef meeting - the oral and poster presentations were held this year was centered on the theme "Reefs for the Future". The ReefBase team (A.Tewfik, J.Oliver, M.K. Tan, M.Tupper, P.Allison, P.Cohen and S.L. Tan) has participated in the various exhibition, poster presentation and plenary session about coral reef management in this symposium. Apart from that, The WorldFish Center has set

up an exhibition booth to promote and disseminate information on the Center's activities, ReefBase Projects, database products (CD and DVD formats) from ReefBase's information systems (Global Environment Facility Lessons Learned and ReefBase Pacific) and helped spread the awareness of natural resource management in support of coral reef research around the world. The convention has enabled the team to meet with the coral reef scientists, partners and researchers – consolidating a quality time of networking as well as information sharing. The team was also exposed to the latest technology in coral reef studies, existing research and findings related to marine ecosystems - which is pivotal in understanding the current status of the global coral reef research and its future directions and demands.

4. Release of the 9th and 10th ICRS Proceedings

The recent 11th International Coral Reef Symposium (ICRS) held early this July saw a tremendous response of participation by students, scientists and resource managers from all around the world, attending the largest gathering of such after the last ICRS held 4 years ago. ReefBase is pleased to announce that the 9th and 10th ICRS proceedings are now available online. Visit the ReefBase website for the proceedings:

http://www.reefbase.org/resource_center/publication/icrs.aspx.

ReefBase Publication Database (Recommended Readings on Coral Bleaching)

1. Coral Bleaching: Causes, Consequences, and Response. Selected Papers presented at the Ninth International Coral Reef Symposium on "Coral Bleaching: Assessing and Linking Ecological and Socioeconomic Impacts, Future Trends and Mitigation Planning"

- Coral bleaching events are increasing in frequency, extent and severity. These large-scale bleaching events are linked to global climate change and are expected to be a recurring problem. Because most island and coastal populations in the East Asia-Pacific region depend on coral reefs for nutrition, fisheries and tourist income, as well as coastal protection, mass coral bleaching and mortality create an environmental and socioeconomic crisis that requires development of a focused, coordinated response.

Schuttenberg, H. Z. (ed.). 2001. Coral Bleaching: Causes, Consequences, and Response." Selected Papers presented at the Ninth International Coral Reef Symposium on "Coral Bleaching: Assessing and Linking Ecological and Socioeconomic Impacts, Future Trends and Mitigation Planning". Coastal Management Report #2230, Coastal Resources Center, University of Rhode Island: 102 pp.

http://www.reefbase.org/resource_center/publication/main.aspx?refid=12052

2. A global protocol for assessment and monitoring of coral bleaching

- There is an urgent need to obtain better information on coral bleaching events around the world. This information is crucial to scientific understanding of the fate of coral reefs, and to the feasibility and practicality of developing management strategies to increase the resistance and resilience of reefs to bleaching and associated mortality events.

Oliver, J, P. Marshall, N. Setiasih and L. Hansen. 2004. A global protocol for assessment and monitoring of coral bleaching. WorldFish Center, Penang, Malaysia and WWF Indonesia, Jakarta. 35 p.

http://www.reefbase.org/resource_center/publication/main.aspx?refid=21611

3. The Adaptive Hypothesis of Bleaching

- Despite the perception that corals and coral reefs are limited to stable habitats distinguished by very narrow environmental parameters, the coral-algal symbiosis is capable of surviving in a variety of extreme conditions. Through the process of photoadaptation, corals and their algal symbionts adjust algal densities and pigment concentrations to function over a wide range of light levels ranging from direct exposure to full sunlight in intertidal corals to virtual darkness at the extreme limits of the photic zone (>200m) on reef slopes.

Buddemeier, R.W., A. C. Baker, D. G. Fautin and J. R. Jacobs. 2004. The Adaptive Hypothesis of Bleaching. In Rosenberg, E. (Editor). Proceedings of the Coral Health and to Disease Meeting, Israel, 23-29 April 2003.

http://www.reefbase.org/resource_center/publication/main.aspx?refid=20460

4. Determining thermal stress using indices: sea surface temperature anomalies, degree heating days and heating rate to allow for-casting of coral bleaching risk

- Sea temperatures in many tropical regions have increased by almost 1 degree over the past 100 years and are currently increasing at 1-2 degree celsius per century. Satellite and compiled in situ observations of sea surface temperatures have greatly increased the ability to detect anomalous and persistent warm water and are being widely used to predict climate change, coral bleaching and mortality.

Afrin, Z. 2007. Determining thermal stress using indices: sea surface temperature anomalies, degree heating days and heating rate to allow for-casting of coral bleaching risk. Institute of Marine Resources. Suva. 6pp.)

http://www.reefbase.org/resource_center/publication/main.aspx?refid=A0000003072

5. Modeling Ecological Susceptibility of Coral Reefs to Environmental Stress Using Remote Sensing, GIS and in-situ Observations: A case study in the Western Indian Ocean

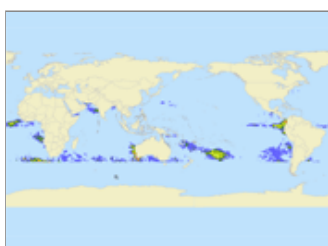
- This study aims to determine relative importance of historical and short-term environmental conditions to coral bleaching and to develop a susceptibility map of coral reef systems based on parameters which correlate with resistance to thermal stress. We investigate the interaction of these factors in the Western Indian Ocean, at a scale detectable by moderate resolution remote sensors using modeling approach

Mbui, J. M. 2007. Modeling Ecological Susceptibility of Coral Reefs to Environmental Stress Using Remote Sensing, GIS and in-situ Observations: A case study in the Western Indian Ocean. International Institute for Geo-Information Science and Earth Observation, Enschede, The Netherlands, 91 p., M.S. Thesis.

http://www.reefbase.org/resource_center/publication/main.aspx?refid=26242

Online GIS

1. June 2008 NOAA Coral Reef Watch's Satellite Monitoring Products

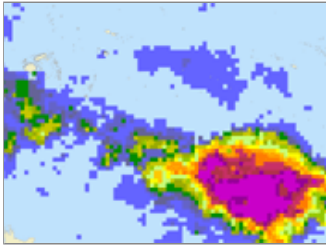


This map shows the global observations of coral bleaching occurrences combined with NOAA Coral Reef Watch's satellite monitoring products including Sea Surface Temperature, Sea Surface Temperature Anomaly, Bleaching HotSpot and Degree Heating Weeks. These datasets are added into ReefBase Online GIS each month.

To view the latest June 2008 maps, click here.

<http://reefgis.reefbase.org/redirect.aspx?urlid=2498>

2. Tips to ReefGIS – Degree Heating Weeks (DHW) Maps



The NOAA Degree Heating Weeks (DHW) Maps are global to regional images that display the intensity and duration of unusually warm sea surface temperatures (SSTs) using remotely sensed data. Both these factors are important in predicting the onset and severity of a mass bleaching event. DHW maps combine the intensity of temperature anomalies with the duration of exposure to provide a composite picture of accumulated temperature stress over the last 12 weeks.

To better utilize the map, one must understand that one DHW is equivalent to one week of SSTs 1°C greater than the expected summertime maximum. Meanwhile, two DHWs are equivalent to two weeks at 1°C greater than the expected summertime maximum. At four DHW, the Coral Reef Watch program issues a Coral Bleaching Alert that a mass bleaching event may occur. Severe stress and possibly mortality is likely to occur at 8 DHW.

The interactive DHW maps provided in ReefBase allows the users to filter the layers according to the desired data such as the date range, the bleaching severity and also attain the detailed DHW graph for each 50x50km grid through the query function.

<http://reefgis.reefbase.org/redirect.aspx?urlid=2498>

ReefBase::A Global Information System For Coral Reefs

Website: <http://www.reefbase.org>

Email: reefbase@cgiar.org