

FORUM:	Environment Commission
ISSUE:	Measures to Mitigate Coral Bleaching and Marine Ecosystem Collapse in Southeast Asia
STUDENT OFFICER:	YuJu Jeon
POSITION:	Deputy Chair of Environment Commission

Introduction



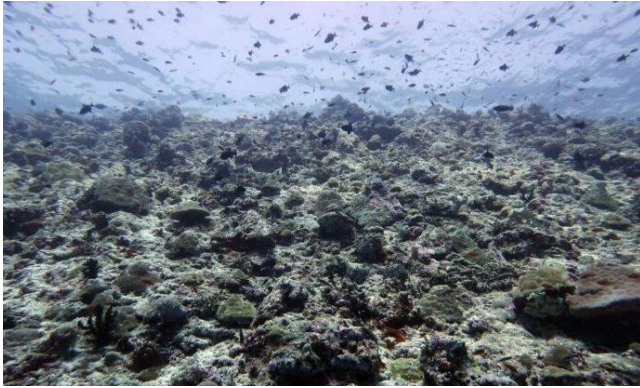
Corals undergoing color loss

Known as the global epicenter of marine biodiversity, Southeast Asia's coral reefs provide habitats, nourishment, and oxygen for numerous marine species. However, these essential ecosystems are gradually being destroyed through environmental issues. These changes have affected not only marine life's survival, but also human food security and the economy. Since coral reefs support more than 7000 species of marine life, they are essential for the continuation of the oceanic ecosystem. Dead corals would lead to a loss of habitat and resources for the ecosystem, affecting the food webs and biodiversity. For humans, the decrease in fish populations, which is vital for the food security of millions

of people and the global fishing industry, would affect their provisions and economies. Therefore, the issue of coral bleaching and marine ecosystem collapse demands feasible solutions for both marine biodiversity conservation and human socio-economic stability.

Spanning from early 2023 to mid-2025, mass bleaching of coral reefs has been confirmed throughout the tropical areas on Earth, including the Great Barrier Reef in Australia. This event was the most severe issue on record, impacting about 84.4 percent of the coral reef population on Earth. Through this event, NOAA Coral Reef Watch, an organization established to monitor global coral reef ecosystems and predict coral bleaching, has developed the Coral Bleaching Alert Scale that could detect heat stress on coral reefs around the world. Currently, due to the burden of initial investment costs and a lack of relevant organizations and technologies, recovery from coral bleaching and marine ecosystem collapse is restricted.

Background



Collapse of the marine ecosystem due to bleached corals

Environmental causes, including heat stress, pollution, and overexposure to sunlight, are essential causes that led to the coral bleaching and marine ecosystem collapse phenomenon. Similarly, coral bleaching and ecosystem collapse are affected by rising sea water temperatures and global warming. When corals are exposed to a stressed environment, they expel the marine algae, called zooxanthellae.

While some corals can feed themselves, most of the corals would starve without zooxanthellae and lose their colors, eventually turning white. Even though corals can recover from bleached coral to healthy coral, it would require months for the recovery, and most of the corals die out. Similarly, marine ecosystems are destroyed, affecting a great number of marine lives, such as corals, sea otters, and whales. Specifically, because foundational species including corals are gradually affected by physical changes, the population of pelagic species that rely on corals decreases, and predators that prey on pelagic animals lose their food.

To resolve the issue, the research team at Newcastle University attempted to use the method of selective breeding to enhance coral heat tolerance to marine heatwaves. As a result, the research found that selective breeding enables corals to improve their population resilience at a moderate level. Moreover, the study indicates that selective breeding could be one of the effective solutions if urgent climate actions are taken simultaneously. Even though local policies on the designation of marine protected areas, pollutant management, and overfishing are still vital to the solution, coral bleaching and the ongoing collapse of the marine ecosystem cannot be prevented unless the rise in ocean temperatures is controlled. Currently, the main cause of rising temperatures is greenhouse gases from fossil fuel combustion, and these greenhouse gases trap solar heat in the Earth, leading to global warming, which affects ocean temperatures.

Problems Raised

Salinization of Coastal Groundwater

Healthy corals have a vital role in coastal protection. They act as a low-crested breakwater, absorbing and scattering up to 97 percent of the incident wave energy at most. By minimizing the waves that would strike inland, corals protect 18,000 people every year and prevent over 1.8 billion dollars in annual economic loss in the U.S. However, as the bleached and dead corals increase annually in the



TIANMUN

world, the seafloor gradually erodes due to the erosion of coral fragments, and the waves hit the land without the energy being distributed. Since seawater permeates coastal groundwater, water sources become salinized, causing water alkalization. This would affect people's drinking water and health, limiting access to clean and safe water. Furthermore, unpurified water damages agriculture and infrastructure, since salinized water hinders the growth of crops and severely harms agricultural productivity. As a result, governments face the economic burden of reconstructing infrastructure and water purification systems, straining national budgets for sustainable development.

Disruption of Marine Life Navigation

Coral bleaching leads to the collapse of marine ecosystems. Numerous marine life forms, such as fingerlings, post-larvae, and larvae, are born in the ocean, and they search for the corals that they will be living in through the sounds made by corals. Healthy corals make clamorous sounds, which are used as acoustic cues for ocean life to find their shelters, and they release chemical elements that has its own significant odor. However, bleached and dead corals rarely make a sound and do not release their scent, leading to navigation failure for the



Difference between healthy corals and bleached corals

creatures. Consequently, since the animals are not able to find their habitat, they eventually die after drifting in the ocean for their lives. Furthermore, the loss of these structural landmark species disrupts species' migratory routes, leading to the population decline of marine organisms. This reduction in biodiversity not only affects marine species but also impacts human society by undermining food supplies and the fishery industry. Therefore, the widespread occurrence of coral bleaching accelerates the collapse of marine ecosystems as a whole.

International Actions

International Frameworks for Coral Protection

The Paris Agreement has been adopted by numerous countries that are willing to respond to severe climate change under the UN Framework Convention on Climate Change (UNFCCC). This agreement aims to limit global warming to 1.5°C by the end of the century and to transition toward achieving a net-zero-carbon economy by the mid-21st century, because over 70 percent of corals might die if the global temperature rises above 1.5°C. This system operates on a five-year cycle, with countries



submitting their national climate plans each cycle, including the content that encourages coral reef ecosystem adaptation strategies. In addition, the Paris Agreement encourages developed countries to financially and technically support developing countries to participate in taking climate actions. The financial support is provided via private funds and public funds from international organizations such as the Green Climate Fund (GCF) and the Global Environment Facility (GEF) for various climate actions like the Heat-Tolerant Coral Restoration Project. Technical support is provided by developing and transferring the latest technology, mainly by the Climate Technology Centre and Network (CTCN), which supplies climate technology requested by developing nations. Utilizing this support from various organizations and countries, developing nations develop the technology for eco-friendly and low-carbon infrastructure, eventually reducing their vulnerability to coral and marine ecosystems.



The destruction of the marine ecosystem

Kunming-Montreal Global Biodiversity Framework



The conference for the Kunming-Montreal Global Biodiversity Framework

Established by the UN Convention on Biological Diversity, the Kunming-Montreal Global Biodiversity Framework aims to preserve and manage at least 30 percent of global terrestrial, inland water, coastal, and marine areas by 2030, addressing coral bleaching and marine ecosystem collapse with the 30x30 goal. More than 190 countries worldwide are participating in this project, making it a global environmental objective.

This project includes numerous minor goals. For instance, expanding protected areas where high-biodiversity coastal and marine ecosystems are vulnerable to climate stress, such as coral habitats, aims to prevent pollution that would harm the ecosystem. Going beyond the expansion of protected areas, continuous monitoring of the surroundings and marine species, along with adequate financial and human resources, is guaranteed to increase effectiveness. Additionally, expanding the management of protected ecosystems is another part of the framework. Enlarging the management would minimize heat stress and external shocks for corals, and it would provide the corridors that enable the reef species to migrate to a new habitat if their original habitats are affected by climate change.



TIANMUN

Key Players

Australia

The Great Barrier Reef, which is the world's largest coral reef system, is located on the coast of Queensland, Australia. Throughout the past 20 years, 91 percent of the coral reefs in the Great Barrier Reef have experienced coral bleaching, marking Australia as a country that has been damaged by global warming the most. Due to this indelible phenomenon, Australia is undergoing a national crisis that affects human activities. Australia views coral bleaching not only as a pollution issue, but also as a climate crisis that is affected by global warming and rising sea temperatures and asserts that the problem will be resolved when fossil fuels are converted into renewable energy. As one of the parties that signed the Paris Agreement, Australia is currently implementing its NDC submitted to the UN, aiming for a 43 percent cut in greenhouse gas emissions from 2005 levels and legislation of net-zero by 2050. Moreover, the Reef Restoration and Adaptation Program (RRAP) is a major technology from Australia to prevent coral bleaching and enhance the adaptation of corals and the marine ecosystem. This system suggests multiple technologies, including Heat-Tolerant Coral Breeding, Coral Probiotics, and a Coral Gene Bank. Especially, the Coral Gene Bank plays a vital role in rescuing endangered corals and marine life through conserving various genes from different corals and animals, artificial reproduction, and restoration supply.

United Nations Environment Programme (UNEP)



Distribution of warm-water corals

The UNEP views coral bleaching and marine ecosystem collapse not only as damage to marine species, but also as an initial warning of global warming and its vulnerability to the marine ecosystem. This organization has found that corals are bleaching and dying more frequently than in past records, depriving the critical window for corals to survive. As

a result, the UNEP warns that algae extracted from the corals during the process of bleaching are destroying the intrinsic three-dimensional structural complexity of coral reefs and the biodiversity underwater, affecting the marine ecosystem by a knock-on effect. The organization considers that about 70 percent of the marine ecosystem would collapse if the average temperature of Earth increases by 1.5°C, and that over 99 percent of the ecosystem, including corals, would crumble. Accordingly, the collapse of the ecosystem would impact the economy and the food security of over five hundred million people. The UNEP is currently putting in its efforts by mobilizing both public and private financial



resources to directly fund local coral restoration projects, in order to resolve the issue by establishing the funding system, the Global Fund for Coral Reefs (GFCR), and leading the 30x30 goal.

Possible Solutions

Marine Pollution and Plastic Reduction

A central solution to coral bleaching and marine ecosystem collapse is reducing marine pollution and plastics. This can be achieved by implementing the UN Plastic Treaty, which regulates plastic production and usage, and reusing plastics to increase the recycling rate. To this end, the treaty should establish legally binding targets to limit disadvantageous plastic production and remove harmful chemical additives in plastics by setting global standards for eco-friendly product design. Moreover, obstructing microplastics from flowing into the ocean would mitigate the risk of bacterial infection and illness for marine organisms. Marine pollution from chemical products could be prevented by enhancing the standard of release of toxic substances such as agricultural chemicals that would compromise coral thermal tolerance and fostering Eco-Buffer zones that would purify chemical pollutants from estuaries, coastal areas, or the wetlands. By optimizing marine water quality through controlling the pollutants that can flow into the ocean water, corals can gain natural immunity and the ability to recover and overcome heat stress.

Advanced Marine Biotechnology

Constructing the biotechnology and sharing global knowledge can help to handle and monitor corals effectively. Systems like automated seeding, application of probiotics and microbiomes, and digital twin integration can help corals and marine species to remain healthy and prevent the excessive use of chemicals used in the water to keep it pristine.



Applying probiotics to corals underwater

Furthermore, cultivating expertise in local areas would enhance local presence, which could operate their underwater deployment technical training program and appropriate technology that combines local resources. To this end, experts from local areas can be trained by professionals from developed countries and through sharing technology. Ultimately, collaborative biotechnology and localized systems would accelerate the recovery rate of the corals more than the rate of climate change. Through this process, marine ecosystems would also be able to coexist with corals, fulfilling mutual beneficial relationship.



Glossary

Heat Stress

A burden caused by the rise in water temperature inflicts to the corals

Coral Bleaching Alert Scale

A system made by NOAA to track the degree of risk for bleached corals

Socio-Economic Stability

Human life's stability for economic activities and society

Zooxanthellae

Algae that live inside the tissues of marine animals, especially corals

Population Resilience

The ability for the population of corals to recover from the stress received from the heat

Net-Zero

Balance between the greenhouse gases put into the atmosphere and those taken out

Knock-on Effect

Chain reaction where one event causes the second event

Larva

Young species

Sources

Book.com/Unep. “Intergovernmental Negotiating Committee on Plastic Pollution.” *UNEP*,

www.unep.org/inc-plastic-pollution. Accessed 30 July 2026.

“Causes and Effects of Climate Change.” *United Nations*, www.un.org/en/climatechange/science/causes-effects-climate-change. Accessed 30 July 2026.

“Coral Bleaching on the Reef - WWF-Australia: Coral Bleaching on the Reef.” *WWF Australia*,

wwf.org.au/what-we-do/oceans/great-barrier-reef/coral-bleaching-on-the-reef/. Accessed 30 July 2026.

Coral Bleaching: What to Know & How to Stop It | WWF,

www.worldwildlife.org/resources/explainers/everything-you-need-to-know-about-coral-bleachingand-how-we-can-stop-it/. Accessed 30 July 2026.

“Coral Larvae Use Sound to Find a Home on the Reef.” *Woods Hole Oceanographic Institution*, 20 July 2020, www.whoi.edu/press-room/news-release/coral-larvae-use-sound-to-help-find-a-home-on-the-reef/. Accessed 30 July 2026.

“Coral Reef Conservation Program.” *Coral Reef Conservation Program* | Home, coralreef.noaa.gov/. Accessed 30 July 2026.

Coral Reef Ecosystems | National Oceanic and Atmospheric Administration,

www.noaa.gov/education/resource-collections/marine-life/coral-reef-ecosystems. Accessed 30 July 2026.

ee320. “Investigating Coral Reef Acoustics to Aid Reef Restoration.” *Exeter Marine*, 3 July 2019, sites.exeter.ac.uk/exetermarine/2019/07/03/investigating-coral-reef-acoustics-to-aid-reef-restoration/. Accessed 30 July 2026.

Environment, UN. “Coral Bleaching Futures.” *UNEP*, www.unep.org/resources/report/coral-bleaching-futures. Accessed 30 July 2026.



TIANMUN

- Garrido, Paula. “Un Adopts High Seas Treaty to Protect Biodiversity .” *Impact Investor*, 23 June 2023, impact-investor.com/un-adopts-high-seas-treaty-to-protect-biodiversity/. Accessed 30 July 2026.
- Humanes, Adriana, et al. “Selective Breeding Enhances Coral Heat Tolerance to Marine Heatwaves.” *Nature News*, Nature Publishing Group, 14 Oct. 2024, www.nature.com/articles/s41467-024-52895-1. Accessed 30 July 2026.
- NOAA Confirms 4th Global Coral Bleaching Event* | *National Oceanic and Atmospheric Administration*, www.noaa.gov/news-release/noaa-confirms-4th-global-coral-bleaching-event. Accessed 30 July 2026.
- “The Oceanic Crisis: Capitalism and the Degradation of Marine Ecosystem.” *Monthly Review*, 8 Sept. 2025, monthlyreview.org/articles/the-oceanic-crisis-capitalism-and-the-degradation-of-marine-ecosystem/. Accessed 30 July 2026.
- Open Data Platform*, data.footprintnetwork.org/?_ga=2.168079525.503145526.1715316580-1723327057.1715220559#/. Accessed 12 Aug. 2026.
- Reef Restoration and Adaptation Program* | *AIMS*, www.aims.gov.au/research/reef-recovery/RRAP. Accessed 30 July 2026.
- Role of Reefs in Coastal Protection* | *U.S. Geological Survey*, www.usgs.gov/centers/pcm/science/role-reefs-coastal-protection. Accessed 30 July 2026.
- Unfccc.Int*, unfccc.int/process-and-meetings/the-paris-agreement. Accessed 30 July 2026.
- US Department of Commerce, National Oceanic and Atmospheric Administration. “What Is Coral Bleaching?” *NOAA’s National Ocean Service*, 15 Mar. 2010, oceanservice.noaa.gov/facts/coral_bleach.html. Accessed 30 July 2026.
- US Department of Commerce, National Oceanic and Atmospheric Administration. “What Species Live in and around Coral Reefs?” *NOAA’s National Ocean Service*, 1 June 2013, oceanservice.noaa.gov/facts/coral_species.html. Accessed 30 July 2026.



Watch, NOAA Coral Reef. *NOAA Coral Reef Watch Current Global Bleaching: Status Update & Data Submission*, coralreefwatch.noaa.gov/satellite/research/coral_bleaching_report.php. Accessed 30 July 2026.

“Why We’re Committing to 30x30: Protect 30% of Land & Water by 2030.” *The Nature Conservancy*, www.nature.org/en-us/what-we-do/our-priorities/protect-water-and-land/land-and-water-stories/committing-to-30x30/. Accessed 30 July 2026.

