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Submission to the Report of the United Nations Secretary General:
Protection of coral reefs for sustainable livelihoods and development

This submission describes the unique importance of coral reefs to the ecosystems, economy, livelihoods and sustainable development of the Pacific Small Island Developing States (Pacific SIDS) and provides input to the Secretary General's report on the protection of coral reefs for sustainable livelihoods and development, pursuant to General Assembly resolution 65/150 of 16 February 2011.

1. Importance of Protecting Coral Reefs for Sustainable Livelihoods and Development

Coral reefs, the nurseries of the sea, are among the most biologically diverse and productive ecosystems on earth; they are home to 25% of all marine life on the planet.[1] More than 1 billion people around the world depend on the sea for their primary source of protein.[2] Of the estimated 30 million small-scale fishers in the developing world, for example, most are dependent on coral reefs for food and livelihoods, with 25% of all fish caught in these regions coming from coral reefs.[3]

Dependence on reefs is complex and highly variable in different parts of the world.[4] Coastal communities rely on reefs for multiple ecosystem functions and services including food security, fisheries employment, reef-derived exports (e.g. live fish, seaweeds), reef tourism, and shoreline protection providing resistance to erosion and the coral rock needed to maintain coral islands.[5]

A recent comprehensive report published by the World Resources Institute states that: "More than any other region, the people of the Western Pacific are closely connected to coral reefs. At least 7.5 million people in the Pacific islands live in coast areas within 30 km of a coral reef, representing about 50 percent of the total population."[6] Papua New Guinea and the Solomon Islands for example, make up part of the Coral Triangle, the global center of reef diversity, with more species of fish and corals than anywhere else on the planet.[7]

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1 Coral Reef Alliance, www.coral.org/resources/about_coral_reefs/why_care
2 UNEP: People and reefs: successes and challenges in the management of coral reef marine protected areas. UNEP Regional Seas Reports and studies No. 176. UNEP 2004. *See also:* Pacific Marine Environmental Laboratory (PMEL), National Oceanographic and Atmospheric Administration. What is Ocean Acidification? PMEL Carbon Program. www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification?3F
3 UNEP-WCMC (2006). In the front line: shoreline protection and other ecosystem services from mangroves and coral reefs. UNEP-WCMC, Cambridge, UK.
4 Loper, C. et al. 2008. Socioeconomic Conditions Along the World's Tropical Coasts: 2008. Silver Spring, MD: National Oceanic and Atmospheric Administration, Global Coral Reef Monitoring Network, and Conservation International.
5 Whittingham, E., J. Campbell, and P. Townsley. 2003. Poverty and Reefs. Volume 1: A Global Overview. Paris, France: DFID–IMM–IOC/UNESCO.
6 Burke, L. et al. Reefs at Risk Revisited. World Resources Institute. 2011
7 Veron, J. E. N., L. M. Devantier, E. Turak, A. L. Green, S. Kininmonth, M. Stafford-Smith, and N. Peterson, "Delineating the Coral Triangle." Galaxea, Journal of Coral Reef Studies 11: 91-100. 2009

For many citizens of the Pacific SIDS, healthy coral reef and related marine ecosystems are essential to supporting local subsistence fisheries, export fisheries and tourism, and to protecting coastal communities and infrastructure from the sea.

Citizens of small island developing states are highly dependent on fishing and related processing industries and tourism, and will suffer both in terms of economic and food security as a result of coral reef degradation. Fish consumption in Pacific SIDS is typically at least two to four times higher than the global average of 16.5kg/capita.[8] As of 2009, UN-DESA reported that the fishing industry contributed more than 6% of GDP in all SIDS generally.[9]

Marine-based tourism is also important to many Pacific SIDS economies, and is adversely affected by declines in coral reefs and related biodiversity. Tourism in the SIDS is projected to be impacted, seriously affecting the economy of many small islands. Increasing frequency and severity of extreme weather, sea-level rise and accelerated beach erosion, degradation of coral reefs (including bleaching) are likely to reduce attractiveness of SIDS as a tourist destination.[10] The critical importance of reefs to local livelihoods is underlined in many Pacific islands by a lack of readily available alternative livelihoods beyond those provided by fisheries and tourism.

2. Local and Global Stressors on Coral Reefs and Related Ecosystems

Environmental stresses from local human activities, principally pollution run-off, damaging fishing practices and over-fishing, already threaten the majority of reefs in many regions, including many in the Pacific. The accelerating impacts of global climate change, including ocean warming and acidification, are increasing and compounding the stress on coral reefs and related biodiversity.[11] The severity of impacts on marine ecosystems is dependent on the interaction of these multiple environmental stressors. Coral reefs are likely to be particularly affected because of the combined impact of coral bleaching caused by stress from both increased water temperature and acidification.

An estimated 58% of global coral reefs are threatened, and many will be gone by 2040 due to rising ocean temperatures and acidification.[12] Almost 50 percent of reefs in the Pacific region are currently considered threatened, with about 20% rated as highly or very highly threatened, including for example in Federated States of Micronesia and the Republic of the Marshall Islands.

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8 Gillett, Robert, Fisheries in the Economies of the Pacific Island Countries and Territories. Asian Development Bank. 2009
9 UN-DESA, Division for Sustainable Development. Ocean Acidification: A Hidden Risk for Sustainable Development. Copenhagen Policy Brief No. 1. 2009
10 United Nations Framework Convention on Climate Change. Impacts, Vulnerabilities and Adaptation in Developing Countries: Regional Impacts of and Vulnerabilities to Climate Change. http://unfccc.int/resource/docs/publications/impacts.pdf
11 Burke, L. et al. Reefs at Risk Revisited. World Resources Institute. 2011.
12 UNEP. Global Environmental Outlook 4: Past, present and future perspectives. Earthscan Publications Ltd, London. 2007.

Overfishing and pollution run-off from land-based sources are the major current local stressors, however the combined impacts of ocean warming and acidification are projected to push the percentage of threatened reefs globally to more than 90% by 2030. By 2050, nearly all reefs will be affected by warming and acidification and almost all reefs will be classified as threatened, unless there is significant action taken to reduce local stress on reefs from pollution and fishing.[13]

The Pacific SIDS are particularly vulnerable to global impacts on corals and related ecosystems from ocean warming and acidification, which significantly compound (and, in future, may outstrip) the environmental impacts of local human activities.
Ocean warming has already had negative consequences on coral growth, survival and reproduction. Bleaching events of increasing intensity and frequency have resulted in losses of 20-50 percent of the living coral in some locations. Recovery varies depend on how many other stresses reefs are experiencing, including overfishing, pollution and disease. Future projections suggest the possibility of annual bleaching in some locations. There is some evidence of historical capacity for adaptation of reef systems to temperature changes, but there is no evidence for rapid adaptation to changes of 2°C or greater over the period of decades to a century.

In addition to warming, the oceans have become 30% more acid since the beginning of the industrial revolution;[14] this change is 100 times faster than any change in acidity experienced by marine organisms for at least the last 20 million years.[15] Acidification impacts processes fundamental to the overall structure and function of marine ecosystems, thus can have far-reaching consequences for the oceans of the future and the millions of people that depend on its food and other resources for their livelihoods.[16]

Experimental evidence shows that acidification will have direct negative impacts on some organisms, but there will be winners and losers. The most likely losers are corals and crustose coralline algae, which also affects coral reefs because they cement reefs together and are the substrate on which coral larvae settle. The most likely winners are non-calcifying photosynthesizers, like fleshy seaweeds and seagrasses that are a hallmark of biological dead zones in the tropics.

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13 Burke, L. et al. Reefs at Risk Revisited. World Resources Institute. 2011

14 The chemistry of the acidification process is straightforward and certain. Changes in pH in surface waters can be predicted with high accuracy. Acidification occurs nearly instantaneously throughout the mixed ocean layer (to roughtly 50-100 meters in Pacific coastal waters, covering the entire range of coral growth.

15 Scott C. Doney, Victoria J. Fabry, Richard A. Feely, and Joan A. Kleypas. Ocean Acidification: The Other CO2 Problem. Annu. Rev. Marine. Sci. 2009.1:169-192. *www.annualreviews.org*. 2009. *See also:*
Scot t C. Doney, William M. Balch, Victoria J. Fabry, and Richard A. Feely. Ocean Acidification: A Critical Emerging Problem for the Oceans. *Oceanography* Vol. 22, No.4. 2009

16 Cooley, S.R. et al. Ocean acidification's potential to alter global marine ecosystem services. *Oceanography*. 22(4):172-183. 2009.

By reducing living corals and coral diversity, health and range, acidification will affect tourism, food security, shoreline protection and biodiversity.[17] Coral calcification rates have already declined in recent decades, although it is impossible to attribute causation between multiple drivers, including warming, pollution and acidification.[18] The interaction of ocean warming and acidification, on top of the impacts of local pollution and other stressors, is likely to make reductions in coral growth even worse, reducing coral constructive capacity of the Pacific islands and elsewhere around the world.

Most aspects of global change are beyond the ability of individual SIDS in the Pacific or elsewhere to control, but local actions, including responsible management of marine resources, halting destructive practices, establishing marine protected areas, mangrove planting and controlling pollution can make an enormous difference, especially over the short to medium term. Many islands will require technical assistance, capacity development and financial support to put these measures in place, or, where initiatives exist, to strengthen their implementation and increase their geographic range.

3. Increasing Coral Reef Resilience

Increased stress on reef and marine ecosystems from human activities has been widely demonstrated to cause significant harm to corals and other species, including decreased numbers of key species, damage to coral physical structure and other habitats, and loss of ecological functions, all leading to reduced resilience to additional stresses like climate change.[19] The analogy with human health is straightforward: if a patient's immune system is already weakened by other environmental stresses, it is less able to resist disease. Reduced coral ecosystem resilience is doubly concerning because of the projected impacts of climate change, which will be severe or even catastrophic for certain ocean species and ecosystems, and thus the many coastal communities that are dependent upon them. Degraded ecosystems – those that have lost biodiversity, species health or ecological functions – are less resilient, and therefore have less capacity to withstand the additional stresses of climate change.[20]

Deep reductions in global CO_2 emissions is the only strategy that can reduce ocean warming and acidification and their impacts on reefs and related ecosystems in the medium and long term. However, because the ocean-atmosphere system has not yet

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17 Intergovernmental Oceanographic Commission of UNESCO et al., Ocean Acidification: A Summary for Policymakers from the Second Symposium on the Ocean in a High-CO2 World. 2008. www.ocean-acidification.net

18 UN-DESA, Division for Sustainable Development. Ocean Acidification: A Hidden Risk for Sustainable Development. Copenhagen Policy Brief No. 1. 2009.

19 IUCN World Commission on Protected Areas. (IUCN-WCPA). Establishing Resilient Marine Protected Area Networks – Making it Happen. IUCN-WCPA, NOAA and TNC. Washington DC, 2008.

20 Hughes, TP, et al. New paradigms for supporting the resilience of marine ecosystems. Trends in Ecology and Evolution 20:380. 2005. *See* also: Sandin, S.A. et al., Baselines and degradation of coral reefs I the Northern line Islands. PLoS ONE 3(20): e1548.doi:10/1371/jornal.pone.0001548. 2008.

reached equilibrium with the current atmospheric concentration of CO_2 the oceans will continue to warm and acidify even with ambitious CO_2 emissions reductions. Hence immediate and ambitious action to increase reef resilience to climate threats by reducing local stressors such as pollution is critical to help corals and the marine biodiversity that depends upon them weather cope with unavoidable future climate impacts.

Leading marine scientists believe that by reducing local stressors where possible, and improving the health of coral reefs, an ecosystem's resilience to and ability to recover and rebound from adverse climate related impacts such as coral bleaching episodes – i.e. "resilience" – will also improve. This strategy is twofold: 1) reduce local stressors to improve reef health so that they may withstand and better recover from shocks; and 2) identify and protect reef areas that are naturally likely to be hardier and more resilient to warming and acidification, so that they may serve as nurseries to help re-populate nearby areas affected by climate change impacts.

Approaches to increase the resilience of coral reefs and related ecosystems include, *inter alia*:

- halting destructive fishing practices and reducing unsustainable fishing levels;
- establishing networks of marine protected areas to ensure sizable and diverse areas/pockets of resilience that can repopulate damaged ecosystems;
- significantly reducing land-based pollution run-off via watershed and coastal development management, planning and controls;
- reducing marine-based pollution;
- managing and limiting coastal development;
- increasing international cooperation for monitoring and research of the health of reefs and related ecosystems; and
- improving methods for economic valuation of reefs and the ecosystem functions and services they provide.[21]

4. The way forward: Strengthening international law and cooperation to protect coral reefs and related ecosystems

A fuller analysis of policy options to implement the approaches to building resilience noted in the previous section, together with an evaluation of their appropriateness for the Pacific SIDS and other coral regions, is an important early step in the activities that can be catalyzed by the Secretary General's report.

One promising way forward is to build on existing international law processes and platforms by giving them an explicit mandate to work on the protection of coral reefs for sustainable livelihoods and development. The mandate would request the body to

21 *See generally,* Burke, L. et al. Reefs at Risk Revisited. World Resources Institute. 2011.

generate proposals for both strengthening international law standards and implementation, and for increasing international cooperation on corals, including monitoring and research, capacity development, technology transfer and finance.

Enhanced scientific monitoring and reporting on the state of corals and related ecosystems is also essential. There are a number of projects upon which to build, including the European Project on Ocean Acidification, the United Nations General Assembly annual reviews of the implementation of UNCLOS along with other related oceans processes. In this role, the General Assembly has in past encouraged States and UN organs to undertake further research, for example on ocean acidification, and to increase efforts to address the projected impacts on vulnerable marine ecosystems, particularly coral reefs.[22]

Numerous existing International law platforms and processes are relevant to the inherently cross-cutting task of improving resilience to protect coral reefs for sustainable livelihoods and development, and could be tasked with contributing to an integrated effort. These include *inter alia*:[23]

- Programmes of Action for the Sustainable Development of Small Island Developing States such as the Barbados Programme of Action for Sustainable Development of Small Island Developing Sates;[24] and, the Mauritius Strategy for Further implementation of the Programme of Action of for the sustainable Development of Small Island Developing States,[25]
- The Johannesburg Program of Implementation, which established goals for marine protection including on and the protection of the marine environment from land-based pollution and destructive activities; the establishment of marine protected areas to reduce the rate of biodiversity loss; implementing FAO and other programs to reduce

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22 UN-DESA, Division for Sustainable Development. Ocean Acidification: A Hidden Risk for Sustainable Development. Copenhagen Policy Brief No. 1. 2009.
Additional important initiatives undertaken by the General Assembly relevant to the protection of corals, livelihoods and sustainable development include *inter alia*: the global reporting and assessment of the marine environment (such as the Open-ended Informal Consultative Process on Oceans and the Law of the Sea; the *Ad Hoc* Working Group of the Whole to study and recommend a course of action on regular process for global reporting and assessment of the state of the marine environment, including socio-economic aspects (established by the General Assembly in 2002 following the recommendation of the UN World Summit on sustainable Development); and, on ongoing initiative at UNEP and UNESCO's Intergovernmental Oceanographic Institute.
23 For additional information *see*: The Pew Environment Group: Bringing the Ocean Back into the Earth Summit – Briefing and Recommendations to the First Intersessional Meeting of UNCSD (Rio+20). New York, NY. 10-11 January 2011. www.pewenvironment.org
24 Report of the Global Conference on the Sustainable Development of Small Island Developing States, Bridgetown, Barbados, 25 April-6 May 1994 (United Nations publication, sales No. E.94.1.18.
25 Report of the International Meeting to Review the Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States, Port Louis, Mauritius, 10-14 January 2005 (United Nations publication, Sales No. E.05.II.A.4}

unsustainable fishing; and the establishment of a transparent and effective coordination mechanism on oceans and coastal issues across the United Nations system.[26]

- The United Nations Convention on the Law of the Sea to help regulate fishing, and MARPOL (the International Convention for the Prevention of Pollution from Ships) to improve control of pollution from ships.

- The Convention on Biological Diversity (CBD), which at its 10th meeting of the Conference of the Parties (2010) adopted the following target: "by 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning." Additionally, the CBD had adopted a decision on Marine and Coastal Biodiversity, encouraging States and relevant intergovernmental organizations to cooperate on the identification, conservation and sustainable use of "ecologically or biologically significant areas," hopefully paving the way for further consideration of the adoption of new MPAs. [27]

There are also regional initiatives in the Pacific SIDS on which to build, including Pacific Oceanscape; the Coral Triangle Initiative; and the Micronesia Challenge.

Finally, Rio+20 should be a milestone international platform on which to address the protection of coral reefs for sustainable livelihoods and development. Chapter 17 of Agenda 21 – the seminal plan of action for the environment adopted at the first Rio Earth Summit in 1992[28] – laid out a plan for the protection of the oceans and the rational use of their living resources.

Twenty years later, in the face of new global climate threats to the oceans, member states should use Rio+20 to give urgency and prominence to the protection of coral reefs, requesting that relevant United Nations bodies such as the Convention on Biological Diversity and regional bodies such as South Pacific Regional Environment Program, take up work to increase coral resilience as a priority issue in 2012 and 2013. A promising way forward would be for the community of nations, through the Rio+20 statement, to request the annual meeting of the Open-ended Informal Consultative Process on Oceans and the law of the Sea (UNICPLOLOS) and/or one or more of the processes noted above, to dedicate a priority work program to generating policy options for strengthening international cooperation and law to protect coral reefs and related ecosystems with the objective of ensuring that the millions of people around the world can continue to rely upon them for sustainable livelihoods, ecosystem services and development.

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26 Plan of Implementation, World summit on Sustainable Development, Johannesburg. September 2002.
27 See COP decision on Marine Biodiversity: http://www.cbd.int/doc/meetings/cop/cop-10/official/cop-10-27-en.pdf
28 RIO DECLARATION ON ENVIRONMENT AND DEVELOPMENT. A/CONF.151/26 (Vol. I). 12 August 1992.