U.S. Coral Reef Task Force

Climate Change Working Group

Progress Report on Resolution 18:1: Coral Reefs and Climate Change

Presented to the U.S. Coral Reef Task Force

Saipan, CNMI

September 2010

Table of Contents

Photo Credit: Dave Burdick; guamreeflife.com

Background

In August of 2007, at the 18th meeting of the U.S. Coral Reef Task Force (USCRTF) in Pago Pago, American Samoa *Resolution 18.1: Coral Reefs and Climate Change* was approved by the Task Force. This *Resolution* established the U.S. Coral Reef Task Force Climate Change Working Group (CCWG), a standing working group of the Task Force that has been working since 2007 to address the charges set forth in that Resolution. The USCRTF CCWG is providing this Progress Report on steps taken to address the impacts of climate change and to fulfill the charge to the working group. The full text of *Resolution 18.1* is attached as Appendix 1 and summarizes the threat that climate change poses to coral reefs, as well as previous actions that the USCRTF has taken to address the impacts of climate change to coral reef ecosystems. This document provides a progress report on the activities of the working group as well as other pertinent actions by agencies and jurisdictions that are responsive to *Resolution 18.1*. A summary of the USCRTF Mandate as well as the Timeline of Climate Change related USCRTF Actions and Resolutions can be found in Appendix 2. What follows is a summary of the accomplishments of the CCWG and the federal agencies and jurisdictions represented on the working group.

Progress on Resolution 18.1 Statement Decision(s)

1. Reaffirms the need to address the major threat that global climate change poses to coral reef ecosystems, as stated in A National Coral Reef Action Strategy;

2. Recognizes the importance of ongoing and continued actions by members and partners to reduce greenhouse gas emissions;

3. Affirms the need to assess the vulnerability of coral reef ecosystems to climate change;

4. Affirms the need to develop and implement adaptation strategies that promote resilience to climate-related impacts to these ecosystems and the communities that depend on them;

5. Affirms that regional Marine Protected Area (MPA) networks can be an important tool for protecting the diversity of coral reefs and ecological connectivity among islands in the face of future losses that may result due to climate change impacts.

6. Recognizes the vulnerability of island and coastal communities to changes in shoreline protection, fisheries, and tourism as a result of climate change effects to coral reefs.

7. Forms a standing Climate Change Working Group (CCWG) and calls on Task Force member organizations to identify CCWG members with appropriate expertise including climate change science specifically related to coral reefs, coral bleaching, ocean acidification, and management actions relevant to the coral reef/climate nexus;

8. Charges the CCWG to

a. Develop a toolbox of management actions to minimize the potential risk to coral reefs associated with climate changes, building on A Reef Manager's Guide to Coral Bleaching;

NOAA: NOAA, with non-government organization (NGO) partners and Australia's Great Barrier Reef Marine Park Authority, has developed a training curriculum based on the Reef Manager's Guide and has offered workshops to managers and partners from all U.S. coral reef jurisdictions. Since 2007, workshops have been held in Australia, American Samoa, Florida, Hawai'i, Bonaire, Guam, and the U.S. Virgin Islands. NOAA is now engaging in Training of Trainers (ToT) workshops based on this curriculum with The Nature Conservancy. The first ToT was held in 2010 in Florida and involved coral reef managers from around the Caribbean. In addition, *The NOAA Coral Reef Conservation Program (CRCP) Goals and Objectives 2010-2015* includes an objective to collaborate with reef managers to develop, test, and apply the best available science to provide new and innovative tools to help managers prepare and respond to climate change and ocean acidification related impacts as well as a goal to support management efforts to increase survivorship of coral reef species and enhance reef resilience by evaluating and implementing promising intervention strategies that directly reduce climate change and ocean acidification impacts. NOAA Coral Reef Watch is continuing to test and improve tools to help managers such as its Experimental Coral Bleaching Outlook to augment early warning systems for bleaching. NOAA will also be involved in research to identify and develop adaptation strategies and techniques under the Federal Ocean Acidification Research and Monitoring Act (FOARAM) passed by Congress in 2009.

USFWS: In 2010, the USFWS directly funded or supported the following climate projects in climate change science and management through the Pacific Islands Climate Change Cooperative (PICCC):

1) "High Resolution Dynamic Projections of Climate Changes for Hawai'i", in partnership with the University of Hawai'i. This project is conducting numerical climate change projection experiments for Hawai'i through development and application of a nested regional atmospheric modeling system with high resolution over limited areas. The modeling is being performed at 30 km resolution with 0.5 to 1 km resolution over the area of the islands, which is at a scale that is ecologically relevant to management of natural resources.

2) "Temporal and Spatial Patterns of Sea-level Rise Impacts to Coastal Wetlands and Other Ecosystems", in partnership with the University of Hawai'i. This project is identifying vulnerability of coastal native ecosystems by mapping potential climate change impacts. Working with stakeholders at sites of high management significance, it is providing a spatial and temporal model of SLR to define impacts, developing responses, and mapping out logistical needs. It is also working closely with the PICCC members to depict the spatial extent of impacts on the coastal plains of Oahu and Maui (and other locations if desired), by providing map visualizations on time scales of concern at the highest possible resolution based on available airborne LiDAR, Aerial Photo, and Quickbird imagery. Following initial mapping and frequency analysis, stakeholder workshops will be used to assess needs and define gaps to identify and

design final products. The overall scale of the work will provide localized, high resolution definition to the problem of SLR (with replication potential to other Pacific islands) so that place-based solutions can be formulated among key stakeholders.

3) "Scaling up Cooling and Shading to Combat Coral Bleaching, and Increasing pH to Combat Ocean Acidification on Coral Reefs in American Samoa", in partnership with the Climate Foundation and American Samoa Department of Marine & Wildlife Resources. Based on success at reversing coral bleaching in a small-scale cooling experiment, this project is exploring methods to scale up cooling to larger areas, using water pumps to pump cool water from deep areas off the edge of the reef. It is also testing shading to see if it can cause bleached corals to recover, and experimenting at scaling shading up to much larger areas. It is further testing methods of locally increasing pH on reefs and scaling those that show best promise up to larger areas. While monitoring the efficacy of these experiments, the project will also be monitoring nearby bleaching levels and using these data to validate NOAA's predictive bleaching model.

4) "Projection of global climate change scenarios onto the Hawaiian Islands: Estimating the characteristics of rainfall for the 21st century", in partnership with the University of Hawai'i, U.S. Geological Survey, and U. S. Fish and Wildlife Service. This project is building on existing experience with statistical downscaling methods to derive comprehensive estimates of the future rainfall changes over the Hawaiian Islands for the mid and late 21st century (2046-2065 and 2080-2100, respectively). Changes in the seasonal mean rainfall, daily variability, frequency of dry/wet spells, and the frequency of extreme events will be estimated. The project is also adjusting the statistical downscaling to provide optimized estimates for key climate targets that may have the highest risk potential for endangered species in Hawaiian terrestrial and marine ecosystems.

5) "Field Monitoring and Analysis of Climate Change Across a Wide Range of Ecosystems in Hawai'i", in partnership with the University of Hawai'i, U. S. Geological Survey, and the National Park Service. The goal of this ongoing project is to ensure continued operation and maintenance of the HaleNet climate and ecosystem monitoring network, including field operations, equipment maintenance and replacement, sensor recalibration, data communication improvements, data screening/archival, data analysis, and dissemination of results. The high temporal and spatial resolution of the data produced by HaleNet are critical to calibration and validation of downscaled climate models for Hawai'i, and allow attribution of ecological changes to climate variables.

EPA: EPA led the production of a large interagency report produced for the U.S. Climate Change Science Program, *Preliminary Review of Adaptation Options for Climate Sensitive Ecosystems and Resources* (2008*),* which includes a chapter on strategies for Marine Protected Area management in light of climate change, with an emphasis on coral reefs. The chapter includes an analysis of management goals, interacting climate and non-climate stressors that threaten attainment of goals, and available management options for supporting resilience to climate change in coral reefs. The

assessment results for coral reefs were adapted into a presentation and fact sheet that was presented at the 20th Meeting of the USCRTF in Kona, Hawai'i in August 2008.

NASA: A large part of NASA's Earth Science Division's objectives include research into understanding the mechanisms, causes, impacts and feedbacks of climate variability and change. Specific examples of research efforts relevant to climate and coral reefs include: NASA funded the integration of high spatial resolution MODIS SST products with the Global Coral Reef Millennium Map to augment the NOAA Coral Reef Watch decision support system of coral reef bleaching alerts. Partners in this work include NOAA, the University of South Florida, NASA, and the United Nations Environmental Programme – World Conservation Monitoring Centre. NASA has also supported five years of research into causes and impacts of ocean acidification on coral reefs in the Carbon Cycle Science research announcement, competed every three years (most recently in 2010).

American Samoa: American Samoa has active research being conducted on mitigating coral bleaching on small scales.

Guam: Members of the working group have attended workshops to develop skills in rapid responses to impacts to Guam's coral reefs and are currently discussing the formation of a Rapid Response Team.

CNMI: Beginning in 2011 funding has been secured for the development of the *CNMI Reef Resilience and Monitoring Plan*, the development of education and outreach protocols, and contracted support for bleaching monitoring and baseline setting through a coordinated effort of local and federal partners. Working group members have also attended workshops to help understand the threats and response alternatives to dealing with climate change issues.

Hawai'i: *The Hawai'i Rapid Response Contingency Plan for Bleaching and Disease* was completed in 2009 and workshops were held to train responders.

U.S. Virgin Islands: The USVI is working with local and federal partners (academia, NGOs, and NOAA) to develop new and identify existing management practices to minimize risk to coral reefs from climate change and to build these management practices into a comprehensive resilience plan for the territory and to incorporate such strategies into local area management plans and standard operating procedures (SOPs).

Puerto Rico: Representatives from Puerto Rico benefitted from a workshop offered on the toolbox of management actions related to climate change and bleaching held in USVI in 2010. They are expected to contribute to the local response and management efforts that include drafting a response plan and participating as part of the response team.

Florida: Florida continues to support the development, research, and testing of new tools to reduce coral reef ecosystem stress from climate change and ocean acidification, and recently benefitted from two NOAA and TNC sponsored workshops, the *Disturbance and Bleaching Monitoring Plan: A Learning Exchange for Coral Reef Managers*, and *Responding to Climate Change Workshop for Trainers*. These workshops focused on how to better design and implement Marine Spatial Planning for the protection

of coral reef resources, with a specific focus on the use of resilience principles to address the effects of climate change. Additionally, Florida continues to participate in the Florida Reef Resilience Program (FRRP), which just recently released its *Climate Change Action Plan for the Florida Reef System: 2010-2015.* The Action Plan adds to the NOAA CRCP 2009 framework with Florida-specific actions designed to accomplish three main goals; increasing resilience through active management, enhancing communications and awareness, and conducting targeted research. The plan can be downloaded from the website: http://frrp.org/SLR%20documents/FL%20Reef%20Action%20Plan-WEB.pdf

b. Improve our understanding of the potential impacts of and management responses to ocean acidification;

General CCWG Activities: The CCWG prepared and presented the *Response to the Honolulu Declaration on Ocean Acidification* at the 22nd Meeting of the USCRTF in San Juan, Puerto Rico. This document summarized what federal agencies and jurisdictions were doing to address the threat of ocean acidification.

NOAA: NOAA recently released the *NOAA Ocean and Great Lakes Acidification Research Implementation Plan,* which includes coral reef ecosystems. The NOAA CRCP is currently drafting the *NOAA CRCP Ocean Acidification Science Plan* which will address the strategy for coral reef ecosystems exclusively in more detail. In addition, *The NOAA CRCP Goals and Objectives 2010-2015*, as well as the *International Strategy*, specifically call out the need to address climate change impacts (one of the three primary threats identified by the NOAA CRCP) by increasing coral reef resilience to climate change and ocean acidification through effective management strategies. Under the FOARAM Act, NOAA is directed to conduct research to identify and develop ocean acidification adaptation strategies and techniques and the NOAA CRCP provides funding to NOAA labs in the Caribbean and Pacific to better understand the potential impacts of ocean acidification to coral reef ecosystems.

USFWS: The USFWS is funding several research projects through the Pacific Islands Climate Change Cooperative (see above) designed to better assess the climate changes driving ocean acidification in the Pacific, and assessing the impact of ocean acidification on reefs in the region.

EPA: EPA recently published a Federal Register notice seeking comments on how to address ocean acidification under the Clean Water Act Section 303(d) impaired waters program, including whether EPA should issue guidance regarding the listing of waters as threatened or impaired for ocean acidification (http://edocket.access.gpo.gov/2010/pdf/2010-6239.pdf). EPA also requested information regarding recommendations for Total Maximum Daily Load development for waters impaired by ocean acidification. EPA will complete a memorandum by November 15, 2010 that describes how the Agency will approach ocean acidification under the 303(d) program.

NASA: NASA has funded the development of ocean acidification tracking from space for the Greater Caribbean Region using satellite derived sea surface temperature, wind speed, and ocean color together with carbonate chemistry algorithms. Partners in this project included the NOAA Atlantic

Oceanographic and Meteorological Laboratory (AOML) and Texas A&M University. The research is part of the continued goal of better understanding and modeling the impacts of climate variability and change on the global carbon cycle and global ecosystems, particularly with an ocean acidification focus. The research program that supports this project is under review for 2010.

Puerto Rico: Puerto Rico is undertaking the lowering of pollutant loadings to coral reef systems through watershed planning, best management practice implementation and conservation practices in coordination with the PR Coastal Zone Management Program (PR CZMP), Natural Resource Conservation Service (NRCS), NOAA, U.S. EPA and municipal governments.

Florida: Florida continues to support initiatives that reduce the impacts of climate change with emphasis on efforts that target local activities contributing to climate change and ocean acidification. The FRRP's *Climate Change Action Plan for the Florida Reef System: 2010 -2015 "*identifies ways to increase reef resilience to climate change and minimize negative impacts on reef-dependent industries such as diving and snorkeling tourism, and commercial and recreational fishing. Built on well-established resilience principles, it outlines a holistic, adaptable five-year program that Florida's reef managers can undertake in collaboration with reef users and other stakeholders to minimize the damage and associated impacts of climate change".

c. Expand education and outreach efforts to include climate change and its impacts on coral reefs;

General CCWG Activities: The CCWG has contacted the USCRTF Education and Outreach working group about working together on integration of climate change and impacts to coral reefs into education and outreach materials and would like to discuss a joint project on communicating about climate.

NOAA: The NOAA Office of Education, with many partners across NOAA, has published resources for teachers, students of all levels, and the public on climate change. NOAA leads the USCRTF Education and Outreach Working Group, which will coordinate efforts with the CCWG to include climate change and impacts to coral reefs in education and outreach materials. The NOAA CRCP is in the final stages of developing a *National Communication, Education, and Outreach Strategy,* which includes climate change impacts on coral reef ecosystems and the CRCP currently funds a broad range of education and outreach programs that address climate change. This includes work to develop educational materials on ocean acidification. Many of these resources are made available at national meetings of groups such as the National Science Teachers Association. The Program also released a redesigned CRCP website at the 22nd Meeting of the USCRTF in San Juan, Puerto Rico geared towards the public, including information on climate change impacts as one of the three priority threats to coral reef ecosystems.

EPA: EPA Region 9 hosted Ken Caldeira of Stanford University to discuss ocean acidification and its impacts on coral reefs at EPA Region 9's climate change lecture series.

American Samoa: American Samoa has held workshops and is publishing articles in local newspapers explaining climate change and actions citizens can take and is working with Department of Education to incorporate climate change and ocean impacts into curriculum at several grade levels.

Guam: Students at University of Guam (M.Sc. Students in marine biology and undergraduates in Biology) continue to be involved in public education and outreach, and are active participants in all public events where environment and conservation is a focus.

CNMI: Beginning in 2011 funding has been secured for the development of the CNMI Reef Resilience and Monitoring Plan which will include education and outreach protocols to be implemented by local agency outreach coordinators. The CNMI introduced the "Take the Right Route" project, engaging the community in the reduction of their carbon footprint by encouraging carpools, biking and walking

U.S. Virgin Islands: The USVI has held workshops for managers and researchers to discuss climate change impacts to coral reefs and a public communication plan is being developed as part of a comprehensive resilience plan for the territory.

Puerto Rico: Puerto Rico is developing updated Education and Outreach materials, to address climate change and its impacts on coral reefs, such as coral bleaching issues and concerns. For example, of the six public service announcements (PSAs) that are broadcast on the radio, we have two PSAs (in Spanish and English, for radio and TV) on climate change, the warming ocean waters and coral bleaching which were produced in collaboration with the Urban Arts Institute and the Puerto Rico Coral Reef Conservation and Management Program (CRCMP). There is a plan to produce more climate related PSAs.

Florida: Throughout Florida, climate change related information has been integrated into ongoing education programs for the general public (e.g. home owners associations, fishing/boating clubs, and community events). The new climate change specific messages aim to increase the awareness and appreciation of the Florida Reef Tract and encourage a sense of urgency for its protection. Florida is also supporting the incorporation of climate change and ocean acidification related permit conditions into regulatory programs.

d. Identify and engage in cooperative efforts with other climate-focused groups such as the U.S. Climate Change Science Program across federal, state, and local governments, academia, and NGOs;

General CCWG Activities: The CCWG is a standing working group of the USCRTF working across federal, state and local government agencies to address climate impacts to coral reef ecosystems.

NOAA: The NOAA CRCP recently finalized a Cooperative Agreement with The Nature Conservancy. This agreement was established to address the three primary global threats to coral reef ecosystems, including climate, in the U.S. coral reef jurisdictions and priority international geographies. On a much larger scale, the Department of Commerce and NOAA announced in February the establishment of a NOAA Climate Service. The NOAA Climate Service will encompass a core set of longstanding NOAA

capabilities with proven success. The climate research, observations, modeling, predictions, and assessments generated by NOAA's top scientists will provide the scientific foundation for extensive on-the-ground climate services that respond to several requests each day for data and other critical information. The CRCP is already engaging with groups building the NOAA Climate Service to determine ways to best engage this new NOAA endeavor.

USFWS: The Department of the Interior has recently created a set of Landscape Conservation Cooperatives (LCCs) in various regions of the country to facilitate landscape-level conservation planning and management via local partnerships. Among these is the Pacific Islands Climate Change Cooperative (PICCC), a self-directed, non-regulatory conservation alliance whose purpose is to assist those who manage native species, island ecosystems and key cultural resources in adapting their management to climate change for the continuing benefit of the people of the Pacific Islands. The mission of the PICCC is to improve the ability of native island species and ecosystems to accommodate future climate change and related perturbations, and support the long-term protection of key cultural resources by providing useful projections of climate and natural resource change in the Pacific Islands, innovative management options, and a membership that supports coordinated action among institutional and community stakeholders.

The PICCC provides information, tools, and analyses to guide biocultural adaptation planning in the Pacific Islands region, with an initial focus on Hawaiian, Marianas, and Samoan archipelagos. Within this region are thousands of unique island plant and animal species, including 410 on the Endangered Species list, many of which are found within a large network of protected areas, including 22 National Wildlife Refuges, 11 National Parks, 4 Marine National Monuments, and local and private conservation lands. Global climate change threatens Pacific Island species, places and rich, living cultures by altering local island environments in unprecedented ways, including elevated air and ocean temperatures, changes in precipitation and storm patterns, sea level rise, and ocean acidification.

The PICCC is governed by a Steering Committee which first met in September 2009, under the auspices of the Hawai'i Conservation Alliance. As of August 2010, two dozen charter members sit on the Steering Committee representing federal and State of Hawai'i natural and cultural resource agencies, education institutions, and non-governmental organizations. The U.S. Department of Interior (DOI) is funding the PICCC as part of its initiative to establish a national network of Landscape Conservation Cooperatives. Each Cooperative is forming based on the unique ecoregional challenges posed by climate change and those entities working to meet them, and each is governed by its Steering Committee.

> "The PICCC strives to work with existing partnerships in order to enhance our collective capacity to tackle the enormous challenge of climate change adaptation. Future opportunities with the USCRTF may include partnering with the Task Force on the following goal:"[C]ollaborate with reef managers to develop, test, and apply the best available science to provide new and innovative tools to help managers prepare and respond to climate change and ocean acidification related impacts as well as a goal to support management efforts to increase survivorship of coral reef species and enhance

reef resilience by evaluating and implementing promising intervention strategies that directly reduce climate change and ocean acidification impacts."

The PICCC also will offer annual science grant funding in support of regional climate science and adaptation efforts, provide information and expertise for adaptation planning, and host researchers, managers, and cultural practitioners at its offices in Honolulu, Hawai'i to facilitate the highest level of collaboration.

EPA: EPA co-chairs the Ecosystems Interagency Working Group of the U.S. Climate Change Science Program and is active in discussions of recommendations for the next IPCC assessment report. EPA also led the production of a large interagency report produced under the auspices of the U.S. Climate Change Science Program, *Preliminary Review of Adaptation Options for Climate Sensitive Ecosystems and Resources* (2008).

NASA: The NASA Ocean Biology and Biochemistry (OBB) Program is involved in interagency efforts with the U.S. Global Change Research Program, the Carbon Cycle Science Program, including the North American Carbon Program and Ocean Carbon and Biogeochemistry Program, as well as integration with the International Ocean Color Coordinating Group. NASA has been a contributing agency to the U.S. Global Change Research Program's Synthesis and Assessment Products Reports, and plans to fund work to support the upcoming National Assessment activities through targeted research announcements.

CNMI: The CNMI is working with coordinators in Florida, Guam, and Australia's Great Barrier Reef Marine Park Authority and other agencies to develop a holistic reef monitoring and resilience plan.

U.S. Virgin Islands: The USVI is working with NOAA, academia and NGOs in developing a territorial comprehensive resilience plan and the USVI POC has participated in webinars and provided feedback on local needs to the NOAA Climate Service.

Florida: Florida continues to engage in the Florida Reef Resilience Program (FRRP), which includes representatives from U.S. federal, state, and local governments, academia, and NGOs as well as the Great Barrier Reef Marine Park Authority. Additionally, Florida participates in local climate change working groups.

e. Report through the Steering Committee to the Task Force on the above actions.

General CCWG Activities: The CCWG presented the *U.S. Coral Reef Task Force Climate Change Working Group Progress Report on Resolution 18:1: Coral Reefs and Climate Change* at the 24th Meeting of the USCRTF in Saipan, CNMI. The CCWG also developed and presented the *Response to the Honolulu Declaration on Ocean Acidification* at the 22nd Meeting of the USCRTF in San Juan, Puerto Rico. This document summarized what federal agencies and jurisdictions were doing to address the threat of ocean acidification. The CCWG includes representatives from many of the federal agencies and state and local jurisdictional governments of the seven U.S. coral reef jurisdictions.

NOAA: NOAA co-chairs the CCWG and the reports generated by the CCWG are collated and edited by NOAA.

EPA: EPA co-chairs the CCWG and reports on its activities through that body.

9. Encourages all federal partners to engage with coral reef jurisdictions to develop strategies to address impacts of climate change on coral reef ecosystems;

General CCWG Activities: The CCWG sponsored a workshop at the 20th Meeting of the USCRTF in Kona, Hawai'i to discuss the topics of climate change impacts to coral reefs and renewable energy to provide an opportunity for the federal agencies to engage with the jurisdictions around these topics. The CCWG sponsored a workshop at the 24th Meeting of the USCRTF in Saipan, CNMI to discuss climate change adaptation for coastal communities.

NOAA: NOAA is engaging with many partners to provide training and assistance in developing strategies to address the impacts of climate change to coral reef ecosystems as discussed above. The NOAA CRCP is also committed to work with managers to address climate impacts as evidenced in *The NOAA CRCP Goals and Objectives 2010-2015.* Objective include collaborations with reef managers to develop, test, and apply the best available science to provide new and innovative tools to help managers prepare and respond to climate change and ocean acidification related impacts as well as a commitment to support management efforts to increase survivorship of coral reef species and enhance reef resilience by evaluating and implementing promising intervention strategies that directly reduce climate change and ocean acidification impacts. The CRCP also provides funding to the U.S. coral reef jurisdictions through grants and NOAA offices in the regions to do coral reef and climate change related work as well as support LAS projects. In addition, many other offices within NOAA, including the NOAA Coastal Service Centers and the Office of National Marine Sanctuaries have provided trainings on dealing with climate change impacts and conducting risk and vulnerability assessments to inform efforts to plan for adaptation to climate change.

EPA: EPA is soon to release a manual, *Coral Reef Biological Criteria: Using the Clean Water Act to Protect a National Treasure*, which provides technical guidance to States, Territories and Commonwealths to establish biological criteria for water quality standards under the Clean Water Act. The purpose of biological criteria is to define thresholds that represent biological integrity and use these to report attainment or non-attainment (impairment) of water bodies. This includes impairment from climate change stresses, which is critical for recognition of climate change effects on coral reefs and for supporting reductions of exacerbating local stressors.

In Florida, EPA contributed to the development of the *Climate Change Action Plan for the Florida Reef Tract 2010-2015*, which aims to guide coordination of reef management across many jurisdictions. The Action Plan contains Florida-specific actions designed to accomplish three main goals: increasing resilience by management, communications and raising awareness, and research. In the Pacific, EPA's

comments on the Guam and CNMI Military Relocation DEIS included comments on and recommendations for addressing climate change impacts on coral reefs.

10. Encourages all coral reef jurisdictions to develop local action strategies (LAS) to assess and address impacts of climate change on coral reef ecosystems;

NOAA: The NOAA Coral Reef Conservation Program has supported the development of the LASs and the implementation of LAS projects within the U.S. coral reef jurisdictions.

USFWS: The USFWS Coastal Conservation Program works with local LASs to evaluate and facilitate implementation of LAS projects within the U.S. coral reef jurisdictions.

EPA: Based on the Hawai'i LAS on Climate Change and Coral Disease, EPA is participating in the oversight of two geographically focused projects (one on Maui and one on Big Island of Hawai'i) where efforts are underway to reduce all threats to corals. In addition American Samoa has a Climate Change LAS, and EPA participates with the Coral Reef Advisory Group in charge of its implementation.

American Samoa: The American Samoa Climate Change LAS is in final stages of local approval and projects are underway.

Guam: Temperature monitoring is ongoing in conjunction with quarterly monitoring of bleaching, disease and changes in coral cover and community cover composition on targeted reefs.

CNMI: The CNMI is in the process of developing a new Fisheries LAS that will include climate change elements and priorities which complement the developing reef resilience plan.

Hawai'i: Hawai'i completed the *Climate Change and Marine Disease Local Action Strategy in 2008* and is currently implementing the strategy.

U.S. Virgin Islands: Management for resilience to climate change and related impacts was highlighted as a territorial coral reef management priority and is being incorporated LAS plans

Puerto Rico: Puerto Rico included Climate Change as one of the LAS for which we are in the initial stages of developing strategies.

Florida: Florida recognizes climate change as a high priority focus and will be incorporating it into the development and implementation of new LAS projects.

11. Supports the development of plans for the reduction of greenhouse gas emissions for jurisdictions;

General CCWG Activities: The CCWG sponsored a workshop at the 20th meeting of the USCRTF in Kona, Hawai'i to discuss among other topics, examples of renewable energy in Hawai'i.

EPA: On December 15, 2009, EPA issued the Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act; Final Rule (http://www.epa.gov/climatechange/endangerment/downloads/Federal_Register-EPA-HQ-OAR-2009-0171-Dec.15-09.pdf). The findings include an explicit notation that "Climate change and ocean acidification will likely impair a wide range of planktonic and other marine calcifiers such as corals." The findings do not in and of themselves impose any emission reduction requirements but rather allow EPA to finalize the greenhouse gas emission standards for new light-duty vehicles under the Clean Air Act as part of the joint rulemaking with the Department of Transportation (http://fdsys.gpo.gov/fdsys/pkg/FR-2010-05-07/pdf/2010-8159.pdf).

American Samoa: The American Samoa Climate Change LAS objective 4 is to "Reduce American Samoa's carbon footprint and encourage progress towards a sustainable low carbon economy" and actions are in the planning stages to implement this objective.

Hawai'i: The *Hawai'i Global Warming Solutions Act of 2007* was signed into law by Governor Linda Lingle in June, 2007. It is now state policy, according to the Act, to "get Hawai'i's greenhouse gas emissions down to 1990 levels by 2020". Implementation is of this Act is ongoing.

Puerto Rico: Puerto Rico enacted several laws and executive orders to reduce green house gas emissions. For example, Law 29 of 2008 promotes water and energy efficiency in government buildings; Law 246 in 2008 establishes public policy on mitigating global warming; Executive Order OE-2008-09, created a commission on climate change and adaptation to climate change that submitted a report to the Governor; OE- 2007-40, deals with reducing greenhouse gas emissions, use of alternative energy sources, providing tax incentives for solar water heating systems and others; and OE-2007-41 which deals with sustainable construction of buildings that comply with LEED -U.S. Green Building Council.

Florida: In 2007, Florida's Governor Charlie Crist issued Executive Orders (EO) 07-126 and 07-127 which committed Florida to "becoming a leader in reducing emissions of greenhouse gas". Examples of the provisions in the EOs include the immediate implementation of the U.S. Green Building Council's Leadership in Energy and Environmental Design for Existing Buildings for all buildings currently owned and operated by the Florida Department of Environmental Protection, a call for the initiation of rulemaking to require utilities to produce at least 20% of their electricity from renewable sources (e.g. solar and wind sources), and the establishment of greenhouse gas reduction targets for the State of Florida (e.g. by 2017, reduce emissions to 2000 levels; by 2025 reduce emissions to 1990 levels; and by 2025, reduce emissions by 80% of 1990 levels).

12. Supports the development of coral bleaching response plans for all jurisdictions; and

NOAA: Through the Reef Resilience and Climate Change Workshop series, and Training of Trainer workshops, NOAA and partners are working with jurisdictions to draft Bleaching Response Plans.

These efforts are being funded in part by the CRCP as well as through the NOAA-The Nature Conservancy Cooperative Agreement.

EPA: EPA led the production of a large interagency report, *Preliminary Review of Adaptation Options for Climate Sensitive Ecosystems and Resources* (2008), which includes specific management strategies for supporting resilience to coral reefs that can be used in coral bleaching response plans. EPA also routinely participates in activities such as NOAA's 2008 workshop for Hawai'i's coral reef managers on "Responding to Climate Change" and Hawai'i's "Eyes of the Reef" volunteer monitoring network for detecting bleaching, disease, and invasive species.

American Samoa: American Samoa has developed a draft response plan for mass coral bleaching events.

Guam: Rapid Response Team formation is being discussed and planned and the individuals likely to be involved in this team have been identified.

CNMI: Coral Bleaching Forecasts for the period from July through November 2010 proclaimed a severe bleaching risk for the CNMI which has led to a variety of proposal requests and method analysis for dealing with and monitoring the resilience of our reefs to explore both severity and extent of damage. This outline and analysis will be incorporated directly into the developing CNMI Reef Resilience and Monitoring Plan which is under development.

Hawai'i: The *Hawai'i Rapid Response Contingency Plan for Bleaching and Disease* was completed in 2009 and workshops were held workshop to train responders.

U.S. Virgin Islands: Bleaching response plans are being developed for the USVI in partnership with NGOs and academia, as well as a comprehensive territorial resilience program (modeled after the Florida Reef Resilience Program)

Puerto Rico: Puerto Rico is drafting a response plan for coral bleaching events. While Puerto Rico has been taking action in response to bleaching events, these were not formally written down or standardized. This response plan formalizes these actions and also makes improvements to our response.

Florida: Florida continues to participate in the annual FRRP Disturbance Response Monitoring for bleaching events, and will be working to develop tools for management actions related to climate change and bleaching including a Bleaching Communication Plan, and a Disturbance and Bleaching Monitoring Plan.

13. To the extent practicable and appropriate, commits to reducing energy use and utilizing offsets and other means to make USCRTF meetings and documents carbon neutral.

General CCWG Activities: The Planning Committee for the 20th Meeting of the USCRTF in Kona, Hawai'i submitted a "Green Meeting" document to the CCWG with recommendations on how to reduce the carbon footprint of TF Meetings. They also reported on the results of their efforts at the Kona Meeting to reduce the carbon footprint of that event.

Appendix 1:

U.S. Coral Reef Task Force Meeting

Pago Pago, American Samoa

Approved August 23, 2007

Resolution 18.1: Coral Reefs and Climate Change

Points of Contact:

USCRTF Steering Committee and Climate Change Working Group

Issue Statement: Coral reefs are under stress from many different sources, some of which are local in nature, while others have global influence. The world's climate is changing, in part due to anthropogenic increases in greenhouse gas concentrations. The Intergovernmental Panel on Climate Change (IPCC) recently concluded that anthropogenic emissions of carbon dioxide are very likely to have increased global temperatures. Further, the IPCC also noted that increasing atmospheric carbon dioxide concentrations are leading to increased acidification of the world's oceans. Both of these factors have important consequences for coral reefs. In response to the growing climate threat to coral reefs, the USCRTF encourages its members to take actions to confront the serious challenge of climate change

Background:

Coral reefs are under stress from many different sources, including increased sea surface temperatures, ocean acidification, pollution, overfishing, destructive fishing practices, coastal uses, invasive species, and extreme events (*e.g.*, hurricanes and coastal flooding). Climate change, in particular, increases global air and ocean temperatures and threatens coral reef ecosystems. The IPCC Working Group II Summary for Policymakers noted with very high confidence that corals are vulnerable to thermal stress and have a low capacity to adapt. The report also concluded that sea surface temperatures are projected to increase and could result in more frequent coral bleaching events and widespread mortality. Climate change may also threaten corals through decreasing resistance to disease, sea level rise, increasing storm damage, and declining seawater pH. As the pH of ocean waters decline, the anticipated decrease in carbonate ion availability can slow the growth of corals, increasing reef erosion and compromising reef resilience. Loss of coral reefs could adversely affect coastal economies through reduction in fisheries, shoreline protection, and tourism. Island communities in particular are dependent upon local resources for their livelihoods and are especially vulnerable to changes in coral reef ecosystems that may occur as a result of climate change.

The USCRTF has a history of specifically addressing the issue of climate change and its impacts to coral reef ecosystems. Specific to climate change, the USCRTF has passed four targeted resolutions highlighted below and has developed Climate Change Local Action Strategies in two of seven jurisdictions.

Pertinent Mandates and Action to address climate change and its impacts

Executive Order #13089 for the Protection of Coral Reefs mandates that the U.S. Coral Reef Task Force "…shall develop and implement, with the scientific community, research aimed at identifying the major causes and consequences of degradation of coral reef ecosystems…[and] shall develop, recommend, and seek or secure implementation of measures necessary to reduce and mitigate coral reef ecosystem degradation."

The Coral Reef Action Plan calls for efforts to reduce global threats to coral reefs through exercising global leadership in shaping priorities and approaches that conserve coral reef ecosystems, and to strengthen international research, monitoring and assessment efforts aimed at understanding, predicting, preventing and responding effectively to the impacts of large-scale phenomena such as bleaching and disease, and their socioeconomic impacts.

The USCRTF, in 1999, passed ***Resolution 2-3 to Support the Dept. of State's Statement on Coral Bleaching and Climate Change*****,** which acknowledged that it is likely that anthropogenic activities contributed to increasing sea surface temperatures, the extensive coral bleaching, and the coral mortality that occurred simultaneously in 1998.

Resolution 8-5: Coral Reefs and Climate Change. The USCRTF, in 2003, committed to the development of an interagency public/private partnership for planning a comprehensive, integrative program for understanding local and system-wide coral reef responses to climate change, including application of this knowledge for local reef management. To support this, the USCRTF sponsored a workshop on Coral Reefs, Climate and Coral Bleaching with participation by over 100 scientists and managers from local and federal governments, universities, the private sector, and non-governmental organizations. As a direct output from this workshop (***Resolution 10-6: Proposal on Coral Reefs, Climate and Coral Bleaching Initiative*****)**, the USCRTF and partners, both domestic and international, developed *A Reef Manager's Guide to Coral Bleaching* which articulates the state of knowledge on the causes and consequences of coral bleaching and provides information on responding to mass bleaching events, developing bleaching response plans, assessing ecological, social and economic impacts, and tools for identifying and building long-term reef resilience.

In 2005, coral reefs in the wider Caribbean suffered a widespread and severe bleaching event that resulted in extensive coral death in much of the region. The USCRTF passed ***Resolution 14-2: Call for Action to Respond to the Caribbean/Atlantic Bleaching Event***, in November 2005 to mobilize efforts across the Caribbean to monitor, assess, and research short- and long-term impacts of the 2005 warming and bleaching event. The USCRTF Bleaching Committee coordinated the efforts of NOAA, NASA, DOI (USGS & NPS), other government agencies, non-governmental organization partners, university researchers, and local managers to take steps to better understand and address the underlying causes of massive bleaching events.

Resolution 16.8: Support Development and Implementation of Response Plans to Coral Bleaching. The USCRTF reiterated its support for development of Local Action Strategies and other tools and plans to minimize the impacts of coral bleaching and climate change on coral reef ecosystems. This resolution

also called for the Steering Committee to develop a review and evaluation of the statement submitted by American Samoa Governor Togiola Tulafono on "Global Climate Change" consistent with national policy and protocols.

Global Climate Change Statement by Governor Togiola Tulafono, American Samoa. At the 16th USCRTF Meeting in the U.S. Virgin Islands, American Samoa Governor Togiola Tulafono requested that the USCRTF take action on climate change. In particular, Gov. Tulafono suggested four steps: (1) Develop science-based policies to reduce local stressors to coral reefs, and provide protections at the regional level, (2) curtail global greenhouse gas emissions, (3) increase public and leadership awareness and build the support needed to respond to the climate threat, and (4) amend the Task Force's National Action Plan, Objective 5 of Goal 11, by adding: *"and support efforts at the local, state, national and global levels to reduce emissions of greenhouse gases."*

Response:

Protection of coral reefs from the impacts of climate change will require two approaches. First, federal, state, and territory governments need to partner with other key players, including industry, to reduce the rates of greenhouse gas emissions. Second, as coral reefs continue to decline globally, reef managers must strengthen efforts to build resilience into their ecosystems by working with communities to address local threats. To complement these local-scale initiatives, larger regional, national, and international efforts are needed to manage entire ecosystems and watersheds that influence them. *A Reef Manager's Guide to Coral Bleaching* provides management strategies to help reef managers increase the resilience of coral reefs and related ecosystems to expected changes in the global climate system. Another resource that is slated for release in 2007 is a federal report by the U.S. Climate Change Science Program entitled, *Preliminary Review of Adaptation Options for Climate Sensitive Ecosystems and Resources*. This report examines climate adaptation options for marine protected areas – including coral reefs – and also analyzes barriers and opportunities for implementation by managers.

Statement Decision(s):

The USCRTF:

1. Reaffirms the need to address the major threat that global climate change poses to coral reef ecosystems, as stated in *A National Coral Reef Action Strategy*;

2. Recognizes the importance of ongoing and continued actions by members and partners to reduce greenhouse gas emissions;

3. Affirms the need to assess the vulnerability of coral reef ecosystems to climate change;

4. Affirms the need to develop and implement adaptation strategies that promote resilience to climate-related impacts to these ecosystems and the communities that depend on them;

5. Affirms that regional Marine Protected Area (MPA) networks can be an important tool for protecting the diversity of coral reefs and ecological connectivity among islands in the face of future losses that may result due to climate change impacts.

6. Recognizes the vulnerability of island and coastal communities to changes in shoreline protection, fisheries, and tourism as a result of climate change effects to coral reefs.

7. Forms a standing Climate Change Working Group (CCWG) and calls on Task Force member organizations to identify CCWG members with appropriate expertise including climate change science specifically related to coral reefs, coral bleaching, ocean acidification, and management actions relevant to the coral reef/climate nexus;

8. Charges the CCWG to

a. Develop a toolbox of management actions to minimize the potential risk to coral reefs associated with climate changes, building on *A Reef Manager's Guide to Coral Bleaching*;

b. Improve our understanding of the potential impacts of and management responses to ocean acidification;

c. Expand education and outreach efforts to include climate change and its impacts on coral reefs;

d. Identify and engage in cooperative efforts with other climate-focused groups such as the U.S. Climate Change Science Program across federal, state, and local governments, academia, and NGOs; and

e. Report through the Steering Committee to the Task Force on the above actions.

9. Encourages all federal partners to engage with coral reef jurisdictions to develop strategies to address impacts of climate change on coral reef ecosystems;

10. Encourages all coral reef jurisdictions to develop local action strategies (LAS) to assess and address impacts of climate change on coral reef ecosystems;

11. Supports the development of plans for the reduction of greenhouse gas emissions for jurisdictions;

12. Supports the development of coral bleaching response plans for all jurisdictions; and

13. To the extent practicable and appropriate, commits to reducing energy use and utilizing offsets and other means to make USCRTF meetings and documents carbon neutral.

Appendix 2:

USCRTF Mandate: Coral Reef Protection Executive Order #13089 established the U.S. Coral Reef Task Force in 1998, and mandated that this body "…shall develop and implement, with the scientific community, research aimed at identifying the major causes and consequences of degradation of coral reef ecosystems…shall develop, recommend, and seek or secure implementation of measures necessary to reduce and mitigate coral reef ecosystem degradation." Over the course of 1999, the Task Force drafted an implementation strategy. This *National Action Plan to Conserve Coral Reef* calls for efforts to reduce global threats to coral reefs through exercising global leadership in shaping priorities and approaches that conserve coral reef ecosystems, and to strengthen international research, monitoring and assessment efforts aimed at understanding, predicting, preventing and responding effectively to the impacts of large-scale phenomena such as bleaching and disease, and their socioeconomic impacts. In the years since the Task Force has passed a number of Resolutions and taken a series of actions to address these issues.

Timeline of Climate Change related USCRTF Actions and Resolutions: In the years leading up to the August 2007 Task Force meeting in American Samoa, a number of Resolutions were passed that addressed the impacts that climate change poses to coral reef ecosystems and their dependent human communities.

- *Resolution 2.3 Support the Department of State's Statement on Coral Bleaching and Climate Change* (USVI, 1999): This Resolution acknowledged that it is likely that anthropogenic activities contributed to increasing sea surface temperatures, the extensive coral bleaching, and the coral mortality that occurred simultaneously in 1998.

- *Resolution 8.5 Coral Reefs and Climate Change* (Puerto Rico, 2002): The USCRTF committed to the development of an interagency public/private partnership for planning a comprehensive, integrative program for understanding local and system-wide coral reef responses to climate change, including application of this knowledge for local reef management. To support this, the USCRTF sponsored a workshop on Coral Reefs, Climate and Coral Bleaching with participation by over 100 scientists and managers from local and federal governments, universities, the private sector, and non-governmental organizations.

- *Resolution 10.5 Proposal on Coral Reefs, Climate and Coral Bleaching Initiative* (Guam/CNMI, 2003):As a direct result of the workshop mentioned in the bullet above, the USCRTF and partners, both domestic and international, developed *A Reef Manager's Guide to Coral Bleaching* which articulates the state of knowledge on the causes and consequences of coral bleaching and provides information on responding to mass bleaching events, developing bleaching response plans, assessing ecological, social and economic impacts, and tools for identifying and building long-term reef resilience.

- *Resolution 14.2 Call for Action to respond to the Caribbean/Atlantic Bleaching Event* (Koror Republic of Palau, 2005): In 2005, coral reefs in the wider Caribbean suffered a widespread and severe

bleaching event that resulted in extensive coral death in much of the region. In November 2005, the Task Force passed Resolution 14-2 to mobilize efforts across the Caribbean to monitor, assess, and research short- and long-term impacts of the 2005 warming and bleaching event. The USCRTF Bleaching Committee coordinated the efforts of NOAA, NASA, DOI (USGS & NPS), other government agencies, non-governmental organization partners, university researchers, and local managers to take steps to better understand and address the underlying causes of massive bleaching events.

- *Resolution 16.8 Support Development and Implementation of Response Plans to Coral Bleaching* (USVI, 2006): The USCRTF reiterated its support for development of Local Action Strategies and other tools and plans to minimize the impacts of coral bleaching and climate change on coral reef ecosystems. This resolution also called for the Steering Committee to develop a review and evaluation of the statement submitted by American Samoa Governor Togiola Tulafono on "Global Climate Change" consistent with national policy and protocols. In particular, Gov. Tulafono suggested four steps: (1) Develop science-based policies to reduce local stressors to coral reefs, and provide protections at the regional level, (2) curtail global greenhouse gas emissions, (3) increase public and leadership awareness and build the support needed to respond to the climate threat, and (4) amend the Task Force's National Action Plan, Objective 5 of Goal 11, by adding: *"and support efforts at the local, state, national and global levels to reduce emissions of greenhouse gases."*

Appendix 3: Points of Contact for Agency and Jurisdiction Responses

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