



NOAA
Coral Reef Conservation Program
Pacific CREIOS Workshop Report

Workshop held November 18-20, 2008, in Honolulu, HI



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NOAA
CORAL REEF
CONSERVATION PROGRAM

Table of Contents

Section I: Executive Summary.....	1
Introduction.....	1
Key Points.....	2
Section II: Workshop Structure.....	3
Section III: Summary of Mapping and Monitoring Needs.....	4
American Samoa.....	4
Commonwealth of the Northern Mariana Islands.....	8
Guam.....	10
Hawaii.....	13
Section IV: Summary of NOAA Capabilities and Potential Solutions.....	15
Mapping.....	15
Physical Oceanographic Monitoring.....	16
Biological Monitoring.....	17
Near-shore Water Quality Monitoring.....	18
Section V: National Priorities.....	19
National-level Mapping and Monitoring.....	19
Discussion on Meeting Management Needs.....	20
Section VI: Conclusions.....	22
Next Steps.....	22
The Path Forward.....	23
Appendices.....	A
Appendix 1: Workshop Agenda.....	A
Appendix 2: Workshop participant list.....	E
Appendix 3: Briefing book and presentations.....	G

Section I: Executive Summary

Introduction

The National Oceanic and Atmospheric Administration (NOAA) Coral Reef Conservation Program (CRCP) is reviewing and revising long-term plans for its monitoring, mapping, and assessment activities, collectively known as the Coral Reef Ecosystem Integrated Observing System (CREIOS), to ensure they are cost-effective, aligned with management needs, and allow for the timely delivery of required products and services to all essential users, given funding constraints. As a first step in a strategic planning effort to strengthen the link between science and management goals, the Pacific CREIOS workshop was held November 18-20, 2008, in Honolulu, HI, to address needs of coral reef managers in the U.S. Pacific States and Territories. The purpose of this workshop was to gather input to guide the future direction of the CRCP's mapping, monitoring, and assessment activities, including:

- Bathymetric and benthic habitat mapping
- Physical oceanographic monitoring
- Biological monitoring
- Near-shore water quality monitoring of land-based sources of pollution

The objectives of the workshops were to:

- 1) identify mapping and monitoring needs to address management for coral reef conservation;
- 2) identify possible products and solutions to meet management needs; and
- 3) gather input on national-level mapping and monitoring activities.

The outcomes from this meeting are expected to inform strategic long-term funding decisions with regard to the CRCP's CREIOS program. This workshop was an opportunity for the managers and NOAA service providers to provide input that will be used to frame various funding scenarios to be considered for fiscal year (FY) 2010 planning and beyond.

More than 25 representatives from local agencies of Hawaii, Guam, the Commonwealth of the Northern Mariana Islands (CNMI), and American Samoa (AS), as well as the Papahānaumokuākea Marine National Monument (PMNM), the Western Pacific Fishery Management Council (WESPAC), and the Department of the Interior (DOI), attended this workshop. NOAA scientists from the National Environmental Satellite, Data, and Information Service (NESDIS), the National Marine Fisheries Service (NMFS), the National Ocean Service (NOS), and the Office of Oceanic and Atmospheric Research (OAR) participated alongside the managers in order to discuss scientific capabilities and understand location-specific needs directly from the managers.

NOAA Pacific CREIOS Workshop Report

Key Points

The Pacific CREIOS Mapping and Monitoring Workshop was successful in gathering information from participants on both their priority needs for information, as well as their input on CRCP program national priorities. It is clear from the results of the workshop that there is a need for increased technical capacity within jurisdictions, improved communication of scientific information to general audiences, and improved dissemination of NOAA data and information products.

Specific monitoring and mapping needs developed by each management entity will be critical for the CRCP to evaluate its mapping and monitoring activities. This workshop gave participants from the management entities the opportunity to share their top mapping and monitoring needs with NOAA scientists and staff. The following is a summary of top needs for each location. More detailed information and a list of all needs described by each management entity can be found in Section III of this report.

American Samoa reported that their top mapping and monitoring needs to support management are:

- Mapping of marine resource distributions to support Marine Protected Area (MPA) design and the ‘Two Samoas’ initiative
- Information on near-shore oceanic currents to better understand connectivity among sites within and surrounding American Samoa
- Information on nutrient and sediment loading in near-shore waters

CNMI listed the following as their top mapping and monitoring needs for support of management:

- Bathymetric data to fill gaps in critical shallow-water areas
- An archipelago-wide hydrographic model to investigate larval connectivity

Participants from Guam characterized their top mapping and monitoring needs as:

- Maps of Apra Harbor to assist with planning, assessment, and mitigation efforts associated with the military expansion
- Hydrographic data (*i.e.*, currents) to support planning many management efforts

Additionally, CNMI and Guam both indicated that they need assistance with integrating various types of data and information (benthic, oceanographic and fisheries) contained in the upcoming Mariana Archipelago Reef Assessment and Monitoring Program (RAMP) (MARAMP) report for 2003-2007.

Participants from Hawaii reported that their top mapping and monitoring needs to support management are:

- Improved satellite imagery for critical areas in the Northwestern Hawaiian Islands (NWHI)
- Filling in bathymetric data gaps in the Main Hawaiian Islands (MHI)
- Acoustic surveys to understand the magnitude of legal fishing pressure and as a tool for enforcement in MPAs
- Integration of watershed information and addressing information gaps

NOAA Pacific CREIOS Workshop Report

The information gathered at this workshop will help inform the CRCP about the most effective ways to build capacity and provide support for successful and productive partnerships to meet mapping and monitoring needs. The *Workshop Report* will be used by the CRCP in examining its portfolio of mapping, monitoring, and assessment activities, and be used as a preamble to the identification of priorities and the capacity assessments for each location.

An initial outcome of this workshop has been improvements in communication between NOAA service providers and managers. Section VI of this report includes information on short-term actions determined necessary at the workshop, including the status and person responsible for each action (Table 3). These are the first steps in continuing the after-workshop dialogue as implementation of the CRCP's *Roadmap for the Future* proceeds.

A similar workshop will take place in May 2009 examining the mapping, monitoring, and data needs of managers in the Atlantic/Caribbean region.

Section II: Workshop Structure

Prior to the workshop, preparation was required by both the managers and NOAA service providers to articulate management needs and evaluate current activities. The CRCP's "site visits," a combination of one-on-one phone calls, group conference calls, email requests, and in-person site visits to each location, engaged decision-makers, managers, and scientists in developing location-specific lists of management and monitoring needs. The information collected from the pre-workshop site visits is summarized in the *Workshop Briefing Book* and panel presentations, available on the CRCP website (see Appendix 3 for details).

Following these site visits, the facilitated workshop in Honolulu was intended to be a forum for discussing managers' needs for monitoring and mapping data to achieve the common goals of increasing understanding of coral reef ecosystems and improving coral reef ecosystem condition. NOAA and other scientists participated alongside the managers in order to discuss scientific capabilities and identify location-specific needs directly from the managers. The full agenda can be found in Appendix 1.

Breakout Groups: Defining Needs

On the first day of the meeting, the participants from the management entities met in breakout groups by location. Prior to the workshop, presentations were developed by each to share with all workshop participants on the mapping and monitoring needs to address management efforts. During this first breakout session, the presentations were reviewed and participants from each location agreed on primary topics to focus on during the workshop.

Panel Presentation and Discussion: Mapping and Monitoring Needs

Each location presented their mapping and monitoring needs and participated in a panel discussion. The complete presentations can be viewed on the CRCP website (see Appendix 3 for details). A summary of the primary management needs is synthesized by location. There was a discussion period after each presentation. The bullets under each discussion session represent comments made by individual workshop participants and are not necessarily consensus of all who attended.

NOAA Pacific CREIOS Workshop Report

Panel Presentation and Discussion: NOAA's Solutions to Address Management Needs

On the second day of the workshop, NOAA scientists shared information on NOAA capabilities and services that can address management needs for coral mapping and monitoring. NOAA panelists presented on the following topics:

- *Mapping*
- *Physical Monitoring*
- *Biological Monitoring*
- *Near-shore Water Quality Monitoring*

See Section IV of this report for summaries of these presentations.

Breakout Groups: Brainstorming Potential Products and Solutions

To develop solutions for specific management needs, each jurisdiction met with each NOAA technical group. The groups discussed NOAA products and services available to address their management needs and what could be developed in the future. See Section III of this report for summaries of these discussions.

Breakout Groups: Refining Potential Solutions

After the management communities met with all of the technical groups, they identified the primary products and solutions that would best fit their management needs. This information was then shared with all workshop participants. This information is also contained in Section III of this report.

Plenary Discussion: National-Scale Mapping and Monitoring Needs

On the final day of the workshop, Program Manager Kacky Andrews presented the Coral Reef Conservation Program's current National-level goals, needs and activities. Workshop participants asked questions related to the presentation and provided input and comments to help guide the future focus of the program. Results of this session are in Section V of this report.

Section III: Summary of Mapping and Monitoring Needs

NOAA capabilities for mapping and monitoring can be found in Section IV. Superscripts refer to short-term action items found in Table 3 of Section VI. Presentations on mapping and monitoring needs, and NOAA presentations on capabilities, can be found on the CRCP website (see Appendix 3 for details).

American Samoa

CONTEXT

The AS team began the workshop by reviewing the results from the site visit interviews, and identifying priority needs for AS coral reef management and conservation that can be addressed via mapping, monitoring and assessment.

NOAA Pacific CREIOS Workshop Report

AS's management priorities are:

- Building local capacity
- Fisheries management
- Establishment of an MPA Network
- Habitat degradation and land-based pollution
- Population growth

AS's top mapping and monitoring needs to support management are:

- Information on near-shore oceanic currents to better understand connectivity among sites within and surrounding American Samoa³
- Mapping of marine resource distributions to support MPA design and the 'Two Samoas' initiative
- Information on nutrient and sediment loading in near-shore waters

AS also has the following related needs:

- Increased technical staff capacity in order to better utilize the available data, including possible reestablishment of the NOAA Geographic Information System (GIS) fellowship program sponsored by the NOAA Pacific Services Center
- Better data dissemination and increased communication on product availability from NOAA scientists
- Staff exchanges and personnel sharing among partners. An FBNMS Research Coordinator position should be backfilled and a NOAA Coral Reef Ecosystem Division (CRED) staff member could be located in American Samoa on a 1-2 year rotation to communicate monitoring results to the community and managers; AS proposed a shared position between Fagatele Bay National Marine Sanctuary (FBNMS), CRED, and the American Samoa Government (ASG), which would benefit all parties, and would support National Park Service's work servicing sensors⁹

MAPPING

- Information gaps for MPA process: A major management priority is the governmental mandate for establishing MPAs. The lack of base maps is a significant hindrance to choosing areas for MPAs. AS needs information in some areas, including integrated shallow-to-deep maps, habitat maps for the seamounts and banks around Tutuila¹¹, and maps of areas that have not been mapped (about 15% of the National Park) due to cloud cover over the island.
- Bathymetric data: AS needs good bathymetric data for hydrodynamic modeling. AS also needs a pseudo-bathymetric product; a composite product is available but may not include all the area and data needed. AS needs access to Light Detection and Ranging (LIDAR) data from the Navy¹⁰. Both Samoa and American Samoa need access to digital topographic data (for terrestrial areas) collected by New Zealand. AS National Park Service (NPS) has imagery but needs assistance to sort or process it. The priority is to gather data from multiple sources and begin integrating Samoa and American Samoa data.
- Benthic habitat map products: AS needs greater ground-truthing and evolution away from the coral-centric classification. AS needs help identifying what products (*i.e.*, maps, imagery) are available and applying the maps to support local monitoring and management via GIS expertise. Graduate student projects and partnerships with the NOAA Pacific Services Center (PSC) could

NOAA Pacific CREIOS Workshop Report

help disseminate imagery, conduct analyses and re-interpret data. The priority is to develop seamless simplified substrate maps (*i.e.*, hard vs. soft surfaces) from the shoreline to 1000 m. AS does not necessarily need higher resolution.

- Airport expansion: AS needs an integrated GIS product that could inform this process.

PHYSICAL MONITORING

- Current modeling for larval dispersal/connectivity: AS needs coarse surface circulation information that could be used to identify finer-scale areas of interest, and information on currents and flushing for areas like Pago Pago Harbor and Vatia Bay. Several models could provide this information: Office of Naval Research (ONR) model, HYbrid Coordinate Ocean Model (HYCOM), Ocean Surface Current Simulations (OSCURS) model, and Delft3D model. AS needs ocean current and circulation data in areas of interest, and dedicated staff time and expertise to apply and validate models with existing *in situ* and satellite data³.
- Hydrographic data for water quality modeling: AS needs data on flushing rates and water residency times for key embayments and near-shore areas, including Fagasa, Fagaalu Bay, and Alofau. AS Coastal Zone Management (CZM) has approached the Army Corps of Engineers about this work; U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) is active in Alofau, but does not have sufficient technical expertise to conduct this work.

BIOLOGICAL MONITORING

- Regulatory Environmental Assessments: AS needs accurate coral growth rate measurements to be used in modeling recovery rates after vessel groundings or other disturbances (*e.g.*, airport expansion). AS Environmental Protection Agency (EPA) may request assistance on this; U.S. EPA may also be able to help.
- Invertebrates: AS suggests that CRED's invertebrate sampling on RAMP cruises is marginally useful and could be reduced to allow for expansion of other sampling (*e.g.*, fish or benthic) efforts.
- Fisheries regulations: AS needs more assistance in gathering information that feeds into fisheries regulations. AS needs tow-board surveys and assessments to support fisheries regulation more frequently than every two years.
- RAMP cruise frequency: AS would like the RAMP program to continue with the current 2-year schedule or increase the frequency to every 6 months or every year. AS would be willing to provide in-kind support for NOAA to keep the ship at the current schedule (though they are aware of the fuel and budget issues) if that would be helpful.
- RAMP methodology: AS would like to improve communication with NOAA partners, regarding how best to use the data and any potential shift in the sampling methodology. Department of Marine and Wildlife Resources (DMWR) conducts coral surveys that closely replicate CRED methods, and the amount of coral cover seems to be commensurate. Similar methodologies and field sampling protocols were used, although CRED only monitors at the *genus* level due to the number of species present.

NEAR-SHORE WATER QUALITY MONITORING

- Change analysis: Change analysis is a priority, but AS needs products specifically tailored to areas of interest to deal with local issues such as topography and land cover/land use. AS requests information on how to get into the queue for coastal change analysis projects.
- Watersheds: AS needs site-based work within particular watersheds. Several sites were suggested, including Alofau, Fagasa, Vatia, and Pago Pago Harbor, which have issues with non-point source pollution and sedimentation. It was suggested that two watersheds be selected with input from the community to ensure that management of those areas is integrated with community efforts to reduce land-based sources of pollution as well as community-based fisheries management efforts.
- Nutrient monitoring: AS EPA monitors nutrients in a limited way, and although they can collect samples and download data (telemetered instruments are too expensive to deploy and maintain), they need assistance to analyze the samples. AS needs real-time data to close beaches or take legal action. In addition to monitoring, AS needs to bring agencies and communities together to effect change and to make information available to decision makers and fishing cooperatives.
- Sediment contamination: AS needs analyses of sediment contamination to determine their sources and rates of accumulation. The National Status and Trends (NS&T) program measures contamination of sediments and benthic and faunal community structure, but managers must first define the questions this information might help answer and identify potential actions that could be taken to reduce inputs.
- Contaminants and biota: AS needs to track contaminants in biota and use the data to pinpoint sources of pollutants. An oyster commonly found in Pago Pago harbor could be used for the study. There are various programs, protocols and laboratories that could be utilized in this effort, including NS&T Benthic Surveillance, Mussel Watch, and USDA impact of confined animal feeding operations (CAFOs). U.S. Geological Survey (USGS) in Honolulu has done some work on contaminated fish as well. CRED looks at algal infections on coral and sub-lethal effects of other coral diseases.

NOAA's *Coral Reef Ecosystem Monitoring Report for American Samoa (2002-2006)*¹²

- Accessibility and analyses: AS needs a simplified *Coral Reef Ecosystem Monitoring Report* that is more accessible to readers. It would be useful to have training or a workshop to share the outcomes so that managers understand the implications of the data and can use the information to support management decisions. A first step would be translation of the information into an expanded executive summary. AS also needs further directed analysis of the monitoring data to answer local management questions.
- Feedback and evaluation: A report template was discussed with jurisdictions long ago, but there needs to be an evaluation form included during report distribution to make sure the template provides the information needed by the jurisdiction. The report template should be adaptable and more flexible. One way to do this would be to have a more formal review process on how to improve the process for the template.

Commonwealth of the Northern Mariana Islands

CONTEXT

The CNMI team began the workshop by reviewing the results from the site visit interviews, and identifying priority management needs for the CNMI coral reef conservation initiative. After identifying their priorities they met with the Guam team to compare results, recognizing that they share similar goals and are both part of larger regional efforts (*i.e.*, the Micronesia Challenge). Through this discussion it was obvious that CNMI and Guam share similar management priorities and agreed management efforts should be carried out in a more regional context where appropriate.

CNMI's management priorities are:

- Land-based sources of pollution
- Fisheries management, fish and coral population issues, and connectivity
- Ecosystem links between trophic groups, understanding life history, and stock assessments

CNMI's top mapping and monitoring needs to support management are:

- An archipelago-wide hydrographic model to investigate larval connectivity³
- Bathymetric data to fill gaps in critical shallow-water areas
- Assistance with integration of various types of data and information (benthic, oceanographic and fisheries) contained in the upcoming MARAMP report for 2003-2007¹⁸

CNMI also has the following related needs:

- Training for on-island managers, including having dedicated staff on the ground or having NOAA available to respond to requests when needed¹
- Social monitoring work is important and would help make education and outreach efforts more effective in causing behavior change

MAPPING

- Habitat maps: Benthic shallow water habitat mapping is being done by NOAA Center for Coastal Monitoring & Assessment (CCMA) at a smaller mapping unit in the Caribbean (funded by the NPS) and using a new classification system which is a dominant habitat cover scheme combining structure and cover (though it does not differentiate coral habitat by dominant species). CNMI expressed interest in learning more about this new classification system once it is finalized in the Caribbean¹⁹.
- Change analysis: CNMI is interested in using maps and remote sensing imagery for change detection and expressed interest in leveraging purchasing power for new imagery through NOAA. The National Aeronautics and Space Administration (NASA) had previously offered support with hyperspectral data⁶.
- Bathymetric data: Bathymetric data has been collected by CRED in water depths of 15-1000 m, which leaves a gap in critical near-shore areas (<15 m) that are too shallow for the ship to enter, and to date has been filled by estimated depths derived from IKONOS imagery and shallow-water habitat maps. CNMI would like access to the Navy's LIDAR data to fill additional gaps in bathymetric data for some locations¹⁶.

NOAA Pacific CREIOS Workshop Report

- Benthic habitat map products: CNMI needs to receive technical support on any new or updated map products, and requests more involvement in the design of future mapping surveys¹⁷. CRED has addressed classification issues in deeper waters via a GIS database using a variety of layers (*e.g.*, rugosity and benthic complexity) rather than producing a final benthic habitat map²⁰. CNMI also needs a process for rapid and on-demand creation of GIS maps for managers to address specific and immediate questions.
- Map resolution: CNMI needs increased spatial resolution on their baseline shallow water habitat maps in selected areas, especially Saipan Lagoon (15-20 meters).
- Instrumentation: CNMI expressed interest in using the *R/V AHI* (Acoustic Habitat Investigator), as well as the independent use of the Towed Optical Assessment Device (TOAD).

PHYSICAL MONITORING

- Current modeling for larval dispersal/connectivity: An archipelago-wide hydrographic model is a high priority for CNMI to investigate connectivity questions (currents, larvae/plankton sources and sinks). A variety of modeling methods and options were discussed, some of which would include biological and physical data³.
- ICON/CREWS Station: NOAA is funding the installation of an Integrated Coral Observing Network (ICON) /Coral Reef Early Warning (CREWS) station in CNMI. NOAA should continue coordination with CNMI to ensure that the location of the station is based on CNMI's specific data needs and objectives¹⁵.
- Instrumentation: CNMI is interested in both archival data (to understand dynamics) and near-real-time data (for current conditions) but questioned the need for some of the CRED instrumentation in CNMI. Clarification of the management questions will help determine if archival data or (much more expensive) near-real-time data would be appropriate.
- Data delivery: CNMI expressed concerns with formatting of the CRED data available through the file transfer protocol (FTP) site. CNMI needs to have rapid access to the data to be able to make its own graphs and maps. CRED is working on making the data accessible in network common data form (NetCDF) format rather than as raw data¹.

BIOLOGICAL MONITORING

- Change analysis: CNMI needs change analyses, and cause and effect information, which is critical to engage legislators into making management decisions.
- Fisheries data: CNMI needs information on fisheries life history that can be used for stock assessments, particularly in relation to the deeper depth ranges (*i.e.*, from 30-100 meters), where the fish stock size and structures are unknown. Options were discussed including the addition of fishery-focused RAMP cruises or the harvest of fish during regular RAMP cruises. CRED will have increased capacity to get information on deeper ranges (>100 meters) through a partnership with Woods Hole to use an autonomous underwater vehicle (AUV) for benthic still photography, which would benefit CNMI if the technology allows for assessment of fish.
- RAMP objectives: CNMI needs to understand NOAA's national mandates and responsibilities, the purpose for the RAMP cruises, the questions driving federal research efforts, and how CNMI fits within those priorities. CNMI would like NOAA to clarify its objectives so that both can work together better. CNMI views NOAA monitoring activities as focusing on regional questions not local ones, and voiced concern about current products not meeting their local

NOAA Pacific CREIOS Workshop Report

needs. CNMI is concerned that CRED's regional focus may not address local management questions.

- RAMP methodology: CNMI expressed concerns about CRED's monitoring sampling design and statistical robustness of the resulting data, as well as concerns with the lack of flexibility to modify methodologies. CNMI prefers that monitoring efforts spend more time and gather more details in specific sites, rather than do more assessments in a higher number of sites. CNMI is concerned about the excessive variety of information gathered by CRED at the cost of more focused, detailed and higher quality data.
- RAMP data dissemination: CNMI is concerned with NOAA's timeliness in providing data. Although the need for quality assurance/quality control (QA/QC) is well understood, data that is 1-2 years old is no longer timely or useful to managers. Inquiries were made about NOAA's policy on data management and whether there are any time requirements for release of federally-funded data. Since CNMI participates in the acquisition of that data, it is seen as an inefficient use of their time. CNMI is interested in quick resource feedback before the final polished product is available.
- RAMP report: CRED is working on development of the MARAMP report, which is modeled after the American Samoa report. CRED will be adding more socioeconomic information. CNMI reiterated the need for assistance with the integration of the various types of data (benthic, oceanographic and fisheries), since they do not have enough resources to dedicate to data analysis and interpretation or pulling out the information that will be of interest to managers. CRED is working with Hawaii Institute of Marine Biology (HIMB) to create better linkages between the data, and is working with CNMI and Guam to discuss other improvements to the report¹⁸.

NEAR-SHORE WATER QUALITY MONITORING

- Watersheds: CNMI needs an inventory of watersheds with land-use classifications to allow them to begin focusing their efforts on priority areas.
- Contaminants: CNMI is interested in the NOAA tools and services related to conducting pollution and water quality monitoring, including Mussel Watch and the Jobs Bay partnership with USDA; CNMI needs information on what services are available and how to access them¹⁴. CNMI also requested information regarding costs of analytical chemistry¹³.
- Science funding: CNMI voiced concern about the loss of CZM funding for the 310 Program, which allowed for funding of land-based sources of pollution (LBSP) -related projects that are not currently eligible for funding under the CRCP management grant program.

Guam

CONTEXT

The Guam team began the workshop by reviewing the results from the site visit interviews, summarizing Guam's priority management needs, and identifying specific case studies to discuss with the NOAA technical teams. After this review, they met with the CNMI team to compare results, recognizing that they share similar goals and are both part of larger regional efforts (*i.e.*, the

NOAA Pacific CREIOS Workshop Report

Micronesia Challenge). Through this discussion it was obvious that Guam and CNMI share similar management priorities and both jurisdictions agreed that a regional approach to management efforts should be pursued where appropriate.

Guam's management priorities are:

- Watershed impacts
- Fisheries management
- Military expansion
- Reef resiliency
- Bridging social and scientific aspects of coral reef management

Guam's top mapping and monitoring needs to support management are:

- Maps of Apra Harbor to assist with planning, assessment, and mitigation efforts associated with the military expansion²¹
- Hydrographic data (*i.e.*, currents) to support planning many management efforts³
- Assistance with integration of various types of data (benthic, oceanographic and fisheries) in the upcoming MARAMP report for 2003-2007²⁸

Guam also has the following related needs:

- Assistance from NOAA to address capacity building issues, the lack of funding for assessments and water quality monitoring, and funding mechanisms (such as contracts) to expedite activities
- Assistance from NOAA to develop alternate means for outreach to convey conservation messages (*e.g.*, YouTube or MySpace), and
- Assistance from NOAA to leverage opportunities with other agencies, US Coral Reef Task Force (CRTF) partners, and non-governmental organizations
- Guam specifically needs to build capacity via a specialist in statistical and survey design to assist with local plans, and a facilitation specialist to help develop and prioritize specific questions for mapping and monitoring needs
- Guam is challenged by its legal mandates' all-encompassing purview which result in difficulties in setting targeted management activities, monitoring, and research
- Guam expressed the importance of augmenting science with a better understanding of the social components to deal with the root problems of why people do what they do

MAPPING

- Apra Harbor: Guam has an immediate need for maps of Apra Harbor to assist with planning, assessment, and mitigation efforts associated with the military expansion. The Department of Defense (DoD) and Port Authority of Guam are planning large dredge projects in Apra Harbor soon, which could cause significant changes to the harbor and the unique coral reef ecosystems found within it.
- Bathymetric data: Guam needs to obtain, better understand, and apply multibeam, backscatter, and LIDAR data products to management questions²⁶.
- Benthic habitat map products: Guam requests more information about NOAA's benthic habitat mapping capabilities, including higher resolution mapping, assessment accuracy, and repeat mapping as a basis for change detection.

NOAA Pacific CREIOS Workshop Report

- Map resolution: NOAA capabilities may be suitable for particular high priority sites, but not for island wide assessments. Guam needs focused application such as the creation of higher resolution maps to address management concerns regarding *Acropora* as a signature in early warnings for bleaching, and to tease out the difference among soft and hard coral areas. Guam recognizes their reliance on NOAA for these data sets, but wants to better understand how they can get their local priority needs addressed by NOAA²⁷.

PHYSICAL MONITORING

- Hydrographic data: Guam needs technical assistance and critical data about currents to support the planning processes for major efforts such as the military buildup and Micronesia Challenge. This lack of data has made it especially challenging to address issues associated with near-shore pollution, resiliency, and connectivity (both locally and regionally).
- Current modeling for larval dispersal/connectivity: Guam needs hydrographic information to support hydrodynamic modeling at several scales, including: embayment-scale (coral settlement and recruitment), island-scale integrating embayment- to archipelago-scale models (larval dispersal), archipelago-scale (large-scale connectivity, large-scale resilience and connectivity planning), regional-scale (supports regional planning in accordance with Micronesia Challenge goals, connectivity linkages to other islands).
- Hydrographic data for water quality modeling: Guam needs hydrographic information to support water quality modeling: embayment-scale (LBSP and watershed restoration work, sediment dynamics), and island-scale (sediment and nutrient transport around the island).
- ICON/CREWS Station: Guam needs technical assistance to increase its capacity for collecting physical water quality data parameters, particularly sediments and nutrients. Guam would benefit from continuous near-real-time data sets. Guam expressed interest in exploring the ICON/CREWS station capabilities (*i.e.*, data types and timescales) in relation to watershed restoration efforts²⁵.

BIOLOGICAL MONITORING

- Trend analysis: Guam needs monitoring information that is capable of determining the trends.
- Data tools: Guam needs a data integration product to alleviate the time and workforce burdens of piecing multiple data sets and project information together.
- RAMP objectives: Guam is concerned with all the information that is collected from CRED cruises and how it is used to address management driven needs. Guam reiterated the need for better communication between scientists and managers when developing and prioritizing needs¹. Guam is interested in getting at the source of problems with targeted research to understand correlations for causality to drive management actions.
- RAMP methodology: Guam expressed concerns with the statistical robustness of the data provided by CRED.

NEAR-SHORE WATER QUALITY MONITORING

- Watersheds: Guam needs more information on the types of data NOAA could provide for watershed activities^{22,23,24}. Guam's goals for watershed restoration are to restore lost ecological function, regain diversity, and return to a more robust and resilient coral reef ecosystem. Guam

NOAA Pacific CREIOS Workshop Report

needs data or information that clearly demonstrates the linkages between terrestrial activities such as reforestation or engineering features that have directly resulted in a positive impact on the adjacent reef environment; this information is necessary to get both community and fiduciary support for further restoration work.

Hawaii

CONTEXT

The Hawaii (HI) team began the workshop by reviewing the results from the site visit interviews, and identifying priority management needs for Hawaii coral reef management and conservation that can be addressed via mapping, monitoring and assessment.

Hawaii's management priorities are:

- Understanding ecosystem structure, function, and natural variability with respect to fish populations, water quality, and climate change
- Determining causes of local declines in marine ecosystems
- Understanding the role of water quality on reef ecosystem condition, and the cumulative impacts of land-use on marine ecosystems
- Invasive species

Hawaii's top mapping and monitoring needs to support management are:

- Improved satellite imagery for critical areas in the NWHI
- Filling in bathymetric data gaps in the MHI
- Acoustic surveys to understand the magnitude of legal fishing pressure and as a tool for enforcement in MPAs
- Integration of watershed information and addressing information gaps

Hawaii also has the following related needs:

- Hawaii appreciates the NOAA focus on the big picture, but wants to ensure that managers can utilize data that is relevant for site-specific decisions.
- Hawaii appreciates that NOAA's efforts toward more powerful basic science has proved useful for local management applications, but states that there is a need to balance basic and applied science, and answer local as well as regional management questions.

MAPPING

- Bathymetric data: Hawaii has a critical need to fill bathymetric data gaps in areas not covered by existing LIDAR and ship-based multibeam (20-250 m) data in the MHI. While there is high-resolution bathymetric LIDAR data available for most of the MHI, only 25-50% of the necessary data has been collected in the NWHI. In general, CRED focuses bathymetric data collection in depths of 15-250 m, which leaves a gap in shallow-water near-shore areas (<15 m). In the NWHI, shallow water depths have been estimated from IKONOS imagery, but that pseudo-bathymetry product is unreliable in depths greater than ~7m. Both the NWHI and MHI

NOAA Pacific CREIOS Workshop Report

have a critical need for additional satellite imagery to replace some existing scenes with poor image quality (due to cloud cover, turbidity, and other optical issues).

- Data access: Hawaii needs access to NOAA bathymetric data for the MHI²⁹. Department of Land and Natural Resources (DLNR) and NPS need assistance on existing products, and arrange to better coordinate with the University of Hawaii Pacific Islands Benthic Habitat Mapping Center³¹.
- Instrumentation: Hawaii expressed interest using the *R/V AHI* (Acoustic Habitat Investigator) to identify and assess critical fish habitat.

PHYSICAL MONITORING

- Current modeling for larval dispersal/connectivity: Hawaii needs integrated offshore and near-shore current models to inform management decisions regarding MPAs and fisheries management. Bringing these models together could assist HI managers with understanding connectivity, determining how much annual variability (changes in recruitment) is driven by physical processes, and answering questions such as whether larvae are getting off the reef. This information could also be used to identify areas more resilient for potential protection from climate change³.
- Instrumentation: Hawaii has a priority need for acoustic surveys (such as the Ecological Acoustic Recorders), both to understand the magnitude of legal fishing pressure and as a tool for enforcement in MPAs.

BIOLOGICAL MONITORING

- Fisheries data: Hawaii needs NOAA assistance with fishery information, ranging from estimates of fishing pressure to analysis of 20 years of creel survey data.
- RAMP methodology: Hawaii suggests that RAMP sampling design be modified to integrate better with other data and improve statistical robustness. Other options discussed include possible calibration methods to make data more comparable. This continues to be a subject of much debate, as a variety of methodologies are being utilized. A mini-workshop held just prior to the CREIOS workshop examined fish monitoring methodologies and illustrated the wide range of methods used even within a specific type of monitoring (such as belt transects).
- RAMP data dissemination: Hawaii requested assistance with improving dissemination of NOAA data, specifically a clear conduit for exchange (*i.e.*, who should they go through), and access in more useful formats. CRED has initiated a Scientific Liaison program to provide a main technical point of contact for each jurisdiction, including one liaison each for MHI and the NWHI¹.

NEAR-SHORE WATER QUALITY MONITORING

- Watersheds: Hawaii is interested in expanding integrated watershed studies such as the Jobos Bay partnership to specific sites in Hawaii. This information and the partnerships with stakeholder agencies would allow prioritization of sites for management actions to reduce nutrient loading/sedimentation. Hawaii would like to continue discussions with a wider suite of partners, such as the Army Corps of Engineers, the Hawaii Department of Health, the DLNR liaison, the CZM program, and non-governmental organizations (NGOs). NOAA and the EPA

NOAA Pacific CREIOS Workshop Report

are willing and able to assist, but the State needs to prioritize activities/locations and in some cases specifically request assistance.

- **Watershed information gaps:** A necessary step in site prioritization is integration of watershed information from sources such as USGS (impervious surface maps), the EPA (National Pollutant Discharge Elimination System [NPDES] permits), *etc.* Gaps include unmapped storm drainage systems and a more general understanding of what happens before and after stream channelization or management actions. Potential differences in response along a gradient of severely impacted to more pristine watersheds are also unknown. Turbidity analyses using remote sensing (analysis of Landsat imagery) may be a promising avenue for quantifying turbidity plumes resulting from stream channelizations³⁰.
- **Contaminants:** Hawaii needs to increase capacity to monitor for toxins and pollutants (*e.g.*, Mussel Watch).

Section IV: Summary of NOAA Capabilities and Potential Solutions

NOAA scientists at the workshop shared information on NOAA capabilities and services that can address management needs of the jurisdictions for coral mapping and monitoring. NOAA panelists presented on the following topics:

- *Mapping*
- *Physical Monitoring*
- *Biological Monitoring*
- *Near-shore Water Quality Monitoring*

Mapping

The CRCP has established mapping goals to:

- Provide a comprehensive suite of digital map products for U.S. coral reefs to define the spatial extent and habitat types of the Nation's coral reef ecosystems
- Support management needs & objectives
- Develop technologies to more efficiently map coral habitats

The CRCP funds two types of mapping efforts in coral reef areas:

- Shallow-water near-shore benthic habitat mapping, which is based on visual interpretation of satellite imagery and aerial photos, which provide information about the underlying geologic structure and biological cover within different habitats in water depths from 0-30 m
- Mid- and deep-water surveys, which utilize a variety of acoustic technologies and optical validation instruments, provide high-resolution bathymetry and derivative products (*e.g.*, backscatter, slope, rugosity) in water depths between ~15-1000+ m

NOAA Pacific CREIOS Workshop Report

CRCP products meet national-level requirements while providing critical information to regional, state, and local coastal managers. Most U.S Pacific locations now have shallow water benthic habitat maps and moderate depth acoustic and optical maps (see Table 1).

Table 1. Mapping progress to date in the U.S. Pacific.

Jurisdiction	Benthic Habitat Maps		Bathymetric Maps	
	Shallow-water (<30 m)	Moderate depth (30-1000 m)	Shallow-water (<30 m)	Moderate depth (30-1000 m)
Main Hawaiian Islands	75-100%	0-25%	75-100%	75-100%
Northwestern Hawaiian Islands	50-75%	0-25%	25-50%	25-50%
American Samoa	75-100%	0-25%	25-50%	75-100%
Pacific Remote Island Areas	0-25%	0-25%	0-25%	75-100%
CNMI	75-100%	0-25%	50-75%	75-100%
Guam	75-100%	0-25%	75-100%	75-100%

The CRCP has identified various solutions to the needs identified by managers:

- Develop procedures to more effectively get information to managers
- Providing training on how to efficiently apply data and GIS products to answer specific management questions
- Develop a standard suite of habitat mapping schemes (GIS layers) that are seamless from the shoreline to 1000 m
- Initiate iterative mapping for change analysis in targeted locations
- Develop new technologies to more efficiently produce integrated biological habitat utilization maps to support living marine resource management

Physical Oceanographic Monitoring

The CRCP's physical oceanographic monitoring efforts provide information on:

- Spatial structure of oceanographic, physical, and chemical parameters
- Near-real-time environmental conditions
- Small- to large-scale patterns of currents and waves
- Nowcasting and forecasting for potentially detrimental events (*e.g.*, coral bleaching).

The CRCP supports four sets of activities that are components of physical monitoring of coral reef environments (see Table 2):

- Ship-based spatial oceanographic and near-shore surveys
- *In situ* instrumentation
- Satellite observations and derived products
- Hydrodynamic and ecological modeling

NOAA Pacific CREIOS Workshop Report

Table 2. Physical oceanographic capabilities, and their roles in monitoring key parameters.

Capability	Tools			
	Ship-based surveys	<i>In situ</i> instrumentation	Satellite products	Modeling
Long-term environmental trends	✓	✓	✓	✓
Regional comparisons	✓		✓	✓
Causes of ecological change	✓	✓	✓	✓
Ocean acidification	✓	✓	✓	✓
Coral bleaching condition nowcasting		✓	✓	
Bleaching event forecasting		✓	✓	✓
Sea level rise		✓	✓	✓
Ecological modeling	✓	✓	✓	✓
Spawning event prediction	✓	✓	✓	✓
Biological indicators for alien species	✓	✓		
Vessel detection and poaching		✓		
Connectivity and larval transport	✓	✓	✓	✓
Land-based sources of pollution	✓	✓	✓	✓
Water quality data	✓	✓	✓	
Land use changes			✓	✓

The CRCP has identified various solutions to the needs identified by managers:

- Tailor information products to management needs
- Improve access and ensure timely delivery
- Increase spatial and temporal resolution to answer management questions
- Better integrate data within and across disciplines
- Provide automated observations where needed for management
- Improve detection, modeling, and prediction of climate change impacts

Biological Monitoring

The CRCP has established biological monitoring goals to measure temporal and spatial variations in:

- Sustainable living resources
- Resource habitat composition
- Community and ecosystem condition
- Biological diversity
- Species of concern

There are five components to CRCP biological monitoring in the Pacific region:

- Towed-diver observations
- Site-based rapid ecological assessments (REAs)

NOAA Pacific CREIOS Workshop Report

- Specimen collection for further biological analysis (*e.g.*, life histories, stock assessment, histology, species/biodiversity confirmation)
- *In situ* instrumentation
- Grant-supported biological monitoring conducted by local partner agencies

There are a variety of applications of biological monitoring data for managers:

- Baseline resource characterization
- Regional comparisons of ecosystems
- Understanding unexpected phenomena
- Responding to environmental and anthropogenic disturbances
- Defining and evaluating MPAs
- Assessing impacts specific threats, *i.e.*, pollution, overfishing, and fishing-related habitat impacts

The CRCP has identified various solutions to the needs identified by managers:

- Improve monitoring reports to meet managers' needs
- Increase spatial and temporal resolution to answer management questions

Near-shore Water Quality Monitoring

The CRCP has four core capabilities related to LBSP:

- Monitoring and assessment of marine waters, sediments, *etc.*
- Ocean remote sensing
- Watershed modeling, assessment and planning
- Review, mitigation, and restoration

There are a variety of applications of water quality and LBSP monitoring data for managers:

- Assessing environmental contamination, toxicity, and coral community condition
- Assessing coral disease and linkages with natural and anthropogenic impacts
- Evaluating the effectiveness of Best Management Practices (BMPs)
- Prioritizing areas for conservation
- Modeling nonpoint source pollution and erosion rates

Section V: National Priorities

On the final day of the workshop, Program Manager Kacky Andrews presented the Coral Reef Conservation Program's current National-level goals, needs and activities.

National-level Mapping and Monitoring

The CRCP derives its mandates and responsibilities from the Coral Reef Conservation Act of 2000 (CRCA), including the following goals:

- To preserve coral reef ecosystems
- To promote wise use and sustainable management
- To develop sound scientific information on the condition of ecosystems and the threats
- To assist preservation of coral reefs by supporting conservation programs
- To provide financial resources for programs and projects

The CRCP has national-level responsibilities to:

- Administer the national program and grant programs
- Be responsive to Congress and NOAA leadership
- Partnership development
- National outreach, communications and education
- International program development
- Be able to answer the question “How are the reefs doing?” via basin-wide monitoring, mapping, assessment and data analysis
- Assess efficacy of MPAs

In an ideal world, the CRCP could support a national program to map, assess, monitor, understand, effectively manage, and conserve all U.S. coral reef ecosystems, which would answer the following questions:

- Where are the reefs? (mapping)
- What are the reef resources there? (assessment)
- How are the reef resources changing over time? (monitoring)
- Why are the reef resources changing over time? (environmental and human dimension monitoring)

There are many benefits of having a national-level program:

- Achieve a greater economy of scale for activities – federal investment in research vessels, satellites, data collection instruments
- Promote consistency in data collection, analysis and dissemination
- Demonstrate status and trends in coral reef ecosystems across wide geographic range
- Compare changes across jurisdictions
- Increase the ability to forecast ecosystem-scale events (*e.g.*, bleaching)
- Engage the general public, Congress and international partners in coral reef conservation efforts.

Discussion on Meeting Management Needs

The workshop facilitators led the participants in a “town hall” session by providing discussion topics and inviting all participants to comment. The following bullets summarize the discussion of all the participants (including both NOAA service providers and local managers); no consensus or agreement on the discussion topics was sought.

General comments on the CRCP National Program:

- The CRCP should do all of the things in the National Program, but needs to prioritize based on management needs and at an appropriate management timescale.
- The CRCP should partner with other NOAA programs and external assets to leverage funding, since some of the needs of the jurisdictions go beyond the CRCP’s purview. NOAA needs additional support from other agencies to understand the social drivers.
- The CRCP has done a good job providing tools, mapping, monitoring to the managers, but the condition of coral reefs has not improved. It is the responsibility of both NOAA and the jurisdictions to improve coral condition.
- There is a limit to the utility of science, given that many of the challenges faced by corals in crisis are more related to policy issues (*i.e.*, human behavior and its impact on resources). The CRCP is missing the social aspect in many respects. NOAA needs to bring social science experts together and help jurisdictions with resources to address social issues. There is a gap between what we know and what we believe (*i.e.*, we know about fisheries and protected areas but people still want and need to go fishing) - we have to get to the behavior change.
- The CRCP should address climate change at the national level.

Discussion topic: What additional analyses or data products are most needed to support management decisions?

- Both CRCP and the local agencies need to continue monitoring to evaluate changes in the condition of coral ecosystem components.
- The local agencies request improved access for products, via websites and email listings. The CRCP should have a better-integrated email listing for all agency personnel from a given jurisdiction in order to improve communications.
- There are challenges with maintaining both websites and email listings.

Discussion topic: What should the balance of CRCP activities be between conserving remote areas versus reefs closer to people?

- Remote areas are protected in their remoteness, so the CRCP should address populated areas in order to build a more accurate idea about resources in impacted areas.

Discussion topic: What should be the CRCP’s role in analyzing mapping and monitoring data to provide policy recommendations?

- The CRCP’s role should be to provide the scientific information to be able to support or reject different policy options.
- The CRCP should work with the local agencies to translate technical information so that the managers have what they need to accomplish their goals.

NOAA Pacific CREIOS Workshop Report

- The Florida Keys National Marine Sanctuary (FKNMS) is a good example of how to bridge the gap between science/research and local management needs by bringing all the people with common interests together.

Discussion topic: Should the CRCP conduct national-level education and outreach?

- The CRCP should work to inform Congress of coral issues (via education and outreach) in order to increase federal funding; the local agencies cannot serve this role since their responsibility is to address local management issues.
- The CRCP should support education and outreach, but not necessarily conduct it. Education and outreach requirements or components should be part of all funded activities, so that they also have a local component, since national messages don't resonate very well locally.
- Outreach and education should be part of all proposals, and the proposals should demonstrate that the local jurisdiction supports the project.

Discussion topic: Should NOAA put federal staff in the jurisdictions in order to build their capacity for managing coral resources?

- The CRCP should address the need for capacity building. Local agencies should identify short-term needs, on a case by case basis, that can be filled by NOAA expertise until jurisdictions can build their capacity. It is important for the local areas to build their own capacity, and not continue to rely on short-term help from NOAA.
- The NOAA Pacific Services Center GIS fellowship program in American Samoa was successful and there was a recommendation to re-visit that effort. Mapping analyses could be improved by having that capacity locally, which would also help bring science and management closer. Eventually it would be good to have a local person trained into this position.
- The NOAA office in Guam needs to be expanded.
- An exchange program would help build capacity to train others.
- A federal-to-local detail program would also have advantages, since that person will better understand the individuals and issues in local level, and will bring that capacity back to the federal agency (*i.e.*, capacity building both ways).
- Trainings on the *Reef Manager's Guide to Coral Bleaching* have gotten positive feedback. This concept could be extended to additional aspects of the CRCP.
- The local agencies request a public information officer at NOAA who can be the contact for managers and the public, and can answer questions from managers about NOAA information and capabilities.

Discussion topic: How often should the CRCP produce a "State of the Reefs" Report?

- The CRCP could shift to a 4-year cycle where the *Report* would come out a year before the International Coral Reef Symposium (ICRS), and would thereby contribute to international reports in a regular way.
- The *Report* is too big to be useful. It may be better to produce Pacific and Atlantic *Reports* in alternate years, each with a condensed national summary.
- It is possible that too infrequent Reports will lose attention from Congress.

NOAA Pacific CREIOS Workshop Report

Discussion topic: How can the CRCP improve the process for contributing to the Report?

- The CRCP should look at the *Report* holistically to minimize redundancies.

Discussion topic: How can the CRCP improve the Report to better meet management needs?

- Information on fisheries and catches should go into the *Report*.
- The CRCP should publish each chapter of the *Report* separately as a reference for local communities.
- The following additional products would be very effective, but would require reformatting and rewriting: 2-page illustrated summaries for policy-makers, lesson guides for teachers, and guided tour booklets for communities.

Section VI: Conclusions

Next Steps

An initial outcome of this workshop has been improvements in communication between NOAA scientists and local managers. Additionally, action items identified in this document are laid out in the Table 3 and include information on who is responsible for following up with the information and the status of each action item. These are the first steps in continuing the after-workshop dialogue as implementation of the CRCP's *Roadmap for the Future* proceeds.

Table 3. Status of short-term action items identified by the CRCP, and points of contact.

	Action Item	NOAA POC	Status
All Jurisdictions			
1	Develop a Scientific Liaison program within CRED that will provide a main technical point of contact for each jurisdiction	Rusty Brainard	Done
2	Provide info to CRCP on BloomWatch	John Christensen	Done
3	Coordinate CRW, CRED and AOML on an OSCURS/HYCOM product for coarse regional hydrography for all jurisdictions, and make available existing modeling products	Mark Eakin	Pending
4	Send invitations to workshop participants to join Coral-List	Jim Hendee	Done
5	Develop fact sheets on new satellite Virtual Stations for each jurisdiction	Jessica Morgan	Pending
6	Follow up on NASA support with hyperspectral data	Steve Thur	Done
7	Set up and host a contacts list with emails of participants, and keep up to date	Steve Thur	In development
8	Distribute summaries of monitoring grants activities to the jurisdictions	Jenny Waddell	Pacific completed
American Samoa			
9	Work on joint CRED, American Samoa and FBNMS scope of work	Rusty Brainard	Started
10	Determine what LIDAR is available for American Samoa	Joyce Miller	Done
11	Send existing Ofu mapping data to American Samoa	John Rooney	Done
12	Follow up with American Samoa regarding suggestions for improving the monitoring report for Guam and CNMI, and develop a synopsis document for American Samoa	Joyce Miller	Done

NOAA Pacific CREIOS Workshop Report

Action Item		NOAA POC	Status
CNMI			
13	Provide CNMI with cost schedules for analytical chemistry	John Christensen	Done
14	Provide info to CNMI on BloomWatch	John Christensen	Done
15	Continue coordination with CNMI regarding location of the new ICON/CREWS station	Jim Hendee	In progress
16	Determine what LIDAR is available for CNMI and level of restrictions on access	Joyce Miller	Done
17	Plan 2009 mapping surveys in CNMI in consultation with jurisdiction	Joyce Miller	Started
18	Follow up regarding suggestions for improving the monitoring report for CNMI	Joyce Miller	In progress
19	Provide CNMI with new Caribbean benthic classification system.	Mark Monaco	Pending
20	Send existing benthic habitat classifications to CNMI	John Rooney	Done
Guam			
21	Follow up on role CRCP will play in assisting Guam with military expansion	Kacky Andrews	Ongoing
22	Follow up on turbidity work for Guam	John Christensen	Done
23	Provide Guam with cost schedules for analytical chemistry	John Christensen	Done
24	Provide info on MERIS and LANDSAT imagery to Guam	John Christensen	Done
25	Follow up with Guam to explore ICON/CREWS station capabilities for watershed restoration efforts	Jim Hendee	Pending
26	Determine what LIDAR is available for Guam	Joyce Miller	Done
27	Plan 2009 mapping surveys in Guam in consultation with jurisdiction	Joyce Miller	In progress
28	Follow up regarding suggestions for improving the monitoring report for Guam	Joyce Miller	In progress
Hawaii			
29	Follow up with Hawaii DAR regarding the Main Hawaiian Islands bathymetric data	Kacky Andrews	Done
30	Follow up on turbidity work for Hawaii	John Christensen	Done
31	Work with Hawaii DLNR and NPS on existing products and arrange visits to the mapping center	Joyce Miller	Pending

The Path Forward

The workshop was successful in eliciting priority information needs from managers, and highlighted important issues of concern, including the need for:

- 1) increased technical capacity;
- 2) improved information and data dissemination;
- 3) improved communication of scientific information to non-scientific audiences; and
- 4) increased emphasis on mapping, monitoring, and assessing resources at finer scales in specific areas of importance to managers.

The CRCP clearly heard that there was much that can be done to increase the efficiency and effectiveness of its mapping, monitoring, and assessment activities. As articulated in the *Roadmap for the Future*, the CRCP's primary objective is to meet strategic management needs. As the Program moves forward, the information collected during this workshop will assist the CRCP in striking the appropriate balance between answering nationally-important questions and fulfilling managers' specific needs. It should also be recognized that the CRCP does not have the financial or human resources necessary to address all of the needs articulated during the workshop, and many of those

NOAA Pacific CREIOS Workshop Report

needs fall outside the scope of the NOAA CRCP. While the CRCP will not be able to address everything that was raised, we are committed to working with other NOAA programs and other Federal agencies to bring their expertise and resources to bear on coral reef managers' needs.

The information gathered at this workshop will help inform the CRCP about the most effective ways to build capacity and provide support for successful and productive partnerships to meet mapping and monitoring needs. The *Workshop Report* will be used by the CRCP in examining its portfolio of mapping, monitoring, and assessment activities, and be used as a preamble to the identification of priorities and the capacity assessments for each location

A similar workshop will take place in May 2009 examining the mapping/monitoring/data needs of managers in the Atlantic/Caribbean region. Concurrently, consultants for CRCP are undertaking management prioritization efforts in each of the seven jurisdictions. The input from both regions on mapping/monitoring/assessment needs, the identified coral reef ecosystem management priorities from each jurisdiction, and the goals and objectives provided by the threat-based working groups will allow the CRCP to optimize synergies between what managers need the most and what NOAA can best provide. This will help the CRCP better define what *must* be done to improve coral reef ecosystem condition and meet obligations for the national program while addressing the priorities of specific regions and jurisdictions.

Specific monitoring and mapping needs developed by each local management agency will be critical for the CRCP to evaluate its mapping and monitoring activities. This information will guide the balancing of location-specific monitoring programs that are designed to address managers' data needs with CRCP's national program needs, while taking advantage of existing monitoring expertise. Potential reallocation of monitoring efforts may redistribute responsibilities among agencies (*i.e.*, via CRCP monitoring grants), NOAA service providers, and other relevant entities, but will ensure, to the extent practical, that monitoring efforts at all levels are aligned and working toward meeting coordinated management objectives.

NOAA Pacific CREIOS Workshop Report

Appendices

Appendix 1: Workshop Agenda

NOAA Pacific CREIOS Workshop

November 18-20, 2008

Hilton Waikiki Prince Kuhio Hotel

2500 Kuhio Ave, Honolulu, HI

(808) 922-0811

Purpose of Workshop

Gather input to guide the future direction of mapping and monitoring activities of NOAA's Coral Reef Conservation Program.

Workshop Objectives

- 1) Identify mapping and monitoring needs to address management for coral reef conservation
- 2) Identify possible products and solutions to meet management needs
- 3) Gather input on national mapping and monitoring needs

Weekly schedule at-a-glance

Monday November 17	Tuesday November 18	Wednesday November 19	Thursday November 20
Travel	8:00 - 12:25 Registration Welcome remarks from Kacky Andrews Breakout groups: defining needs Jurisdictional panel presentations & discussion	8:30 - 12:10 NOAA technical panel presentations & discussion Breakout groups: potential products and solutions	9:00 - 12:00 NOAA's National Program presentation & Town Hall discussion Closing remarks from Kacky Andrews
	12:25 Lunch (on your own)	12:10 Lunch (on your own)	Travel
	1:25 - 5:35 Jurisdictional panel presentations & discussion Breakout groups: refining needs	1:10 - 5:35 Breakout groups: potential products and solutions Breakout groups: refining solutions	

Monday Evening - Social Event
Day 1 - Tuesday, November 18 - Agenda

8:30 – 12:25 Morning Session

- **Registration and Coffee**
- **Welcome (Kacky Andrews)**
- **Workshop Objectives, Expectations, and Introductions**
- **Breakout Groups: Defining Needs**
Objective: Jurisdictions develop primary topics to focus discussion on.
Participants from the 4 jurisdictions (CNMI, Guam, American Samoa, and Hawai'i) will break into groups by jurisdiction with a facilitator to discuss mapping and monitoring needs with respect to management issues and actions.
- **Panel Presentation and Discussion: Jurisdictional Mapping and Monitoring Needs to Address Management Efforts**
Objective: Share and clarify management needs from jurisdictions.
Each jurisdiction will present their mapping and monitoring needs, followed by a facilitated panel discussion. Each panel will have 60 minutes, as follows:
 - (15 minutes) - Presentation of mapping and monitoring needs.
 - (10 minutes) - Additional comments from the panel
 - (30 minutes) - Discussion - questions and answers from audience.**10:15am Guam, 11:25am CNMI, 1:25pm American Samoa, 2:35pm Hawaii**

12:25 - 1:25 Lunch (on your own)

1:35 – 5:35 Afternoon Session

- **Panel Presentation and Discussion: Jurisdictional Mapping and Monitoring Needs to Address Management Efforts**
- **Breakout Groups: Refining Needs**
Objective: Identify additional needs based on presentations from other jurisdictions and revisit primary topics.
Participants will break into groups by jurisdiction with a facilitator to discuss the outcomes from the panel presentations and discussions.
- **Report Outs from Breakout Groups**
Objective: Share refined information from break out groups with all participants.
(15 minutes per group) - A representative from each group will present the results of the breakouts.
- **Wrap Up of Day 1**

Evening (on your own)

Day 2 - Wednesday, November 19 - Agenda

8:30 – 12:10 Morning Session

- Review Day 1 Outcomes and Objectives for Day 2
- **Panel Presentations and Discussions: NOAA's Solutions to Address Management Efforts**
Objective: Share information on NOAA's capabilities and services, and clarify product and information needs from participants.
NOAA experts in 4 areas of technical expertise (mapping, physical monitoring, biological monitoring, and water quality monitoring) will present NOAA's capabilities and services, followed by a facilitated panel discussion. Each panel will have 30 minutes, as follows:
(20 minutes) - Presentation of current products and potential solutions.
(10 minutes) - Discussion - questions and answers from audience.
9:00am Mapping, 9:30am Physical, 10:00am Biological, 10:45am Water Quality
- **Rotating Breakouts by Jurisdiction/Technical area: Brainstorming Potential Products and Solutions**
Objective: Jurisdictions and NOAA experts brainstorm and have dialogue about specific products and services needed to address management needs.
Each jurisdiction will break out with each NOAA technical panel and a facilitator to discuss potential products and solutions.

12:10 - 1:10 Lunch (on your own)

1:35 – 5:35 Afternoon Session

- **Rotating Breakouts by Jurisdiction/Technical area: Brainstorming Potential Products and Solutions**
- **Breakout Groups: Refining Solutions**
Objective: Identify primary products and solutions based on NOAA presentations and breakout group discussions.
Participants will break into groups by jurisdiction with a facilitator to discuss the outcomes from the panel presentations and discussions.
- **Report Outs from Breakout Groups**
Objective: Share refined information from break out groups with all participants.
(15 minutes per group) - A representative from each group will present the results of the breakouts.
- **Wrap Up of Day 2**

Evening - Social Event

Day 3 - Thursday, November 20 - Agenda

9:00 – 12:00 Morning Session

- Review Day 2 Outcomes and Objectives for Day 3
- **“Town Hall” Presentation and Discussion: NOAA’s National-Scale Mapping and Monitoring Goals, Needs, and Activities (Kacky Andrews)**
Objective: Gather input on national-level mapping and monitoring needs.
A facilitated forum for comment on and discussion of NOAA’s national program for mapping and monitoring in U.S. coral reef areas.
- Wrap Up
- Next Steps (Kacky Andrews)

12:00 Adjourn

NOAA Pacific CREIOS Workshop Report

Appendix 2: Workshop participant list

Kacky Andrews	NOAA CRCP	kacky.andrews@noaa.gov
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NOAA Pacific CREIOS Workshop Report

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Appendix 3: Briefing book and presentations

The following information contained in the *Workshop Briefing Book* can be found on the web at <http://coralreef.noaa.gov/creios/welcome.html>

Workshop Overview

Workshop Agenda

Workshop Attendees

Local Agency Interview Summaries:

- American Samoa
- Commonwealth of the Northern Mariana Islands
- Guam
- Hawaii
- Western Pacific Regional Fisheries Management Council
- Pacific Remote Island Areas

NOAA CRCP Factsheet

NOAA CRCP FY07 Accomplishments

NOAA CRCP Program Factsheets:

- NOAA National Coral Reef Ecosystem Monitoring Program
- NOAA Center for Coastal Monitoring and Assessment
- NOAA Coral Reef Watch
- NOAA Coral Reef Information System (CoRIS)
- NOAA Integrated Coastal Observing Network
- NOAA PIFSC Coral Reef Ecosystem Division

The following presentations made during the workshop can be found on the web at <http://coralreef.noaa.gov/creios/welcome.html>

Day 1: Mapping and Monitoring Needs

- American Samoa
- Commonwealth of the Northern Mariana Islands
- Guam
- Hawaii

Day 2: NOAA's capabilities

- Mapping
- Monitoring Physical and Chemical Processes Influencing Reef Health
- Biological Monitoring
- Water Quality and Land Based Sources of Pollution

Day 3: NOAA's National Program

- NOAA's National Coral Reef Conservation Program