

A. Grant Number: NA11NOS4820011

B. Cooperative Agreement Title: Building sustainable coral reef monitoring and management capacity for the Micronesia Challenge, and Beyond”

C. Grantee: Micronesia Conservation Trust (MCT)

D. Award Period: October 1, 2011 to September 30, 2014

E. Period Covered by this Report: October 1, 2011 to September 30, 2014

This report composes three sections. The first section provides highlights of the gains we have achieved and are achieving to date as well as how we are achieving them. The second section highlights the focus areas that we need to strengthen in order to secure and perpetuate the gains from the last three years of the cooperative agreement. The final section provides a snapshot of expenditures over the last three years, and presents issues and challenges surrounding sub-grant disbursements to be addressed in the new cooperative agreement between MCT and NOAA.

1. Gains to date and how we are achieving them

With all four project objectives met, the last three years of the cooperative agreement with NOAA has enabled MCT and its partners in the FSM, RMI, ROP and CNMI to prepare a solid foundation from which to 1. Strengthen management as well as institutional capacity in sustainable coral reef monitoring and management for the Micronesia Challenge and 2. Effect tangible gains in marine resource management through increased numbers and improved management of marine protected areas (MPAs) as well as through sustainable policies in fisheries management across the jurisdictions.

Key progress has been made with the jurisdictional coral-reef monitoring programs as a result of effective technical training and mentoring from Dr. Peter Houk (formerly Pacific Marine Resources Institute, now University of Guam Marine Laboratory) and Dr Yimnang Golbuu at the Palau International Coral Reef Center. The culmination of monitoring efforts is perhaps best demonstrated by the capability to now conduct a formal and standardized assessment of regional datasets for evaluating the current status of coral reefs for the region. This accomplishment was recently completed in October 2014, and highlights the synthesis of milestones in the three-year cooperative agreement (outcome details presented below in the discussions under Objective 3). Led by Dr Houk, this work is currently being developed for peer-reviewed publication, and will be made available to NOAA as soon as it is available. MCT and its partners will share the results with decision makers at all levels in ways that can affect meaningful and science based management decisions. To maximize understanding and engagement across community, state and national leaders, the results will be developed and communicated strategically in images and graphs as well as presented in culturally receptive events.

Stronger monitoring data is already influencing decisions such as in the acknowledgment of the benefits of MPAs for near shore marine resource management. Since 2012, there have been significant increases in the number of MPAs across the region. As of December 2014, there are now 70 sites in the RMI (up from 4 sites) 54 in the FSM (16 in Pohnpei, 10 in Kosrae, 13 in Chuuk and 15 in Yap - up from 7 sites) and 16 in the ROP (up from 5 sites). The MPA management effectiveness tool (developed by TNC) continues to be tested across the regional sites, with additional resource managers receiving training on its application. After two years of application, the Tool is now undergoing review for improvement. A list of monitored sites in the last three years is available upon request.

The significant growth in MPAs is being complemented by work in fisheries management that are producing tangible policies. This last year (2014), current datasets and findings have been particularly useful in evaluating and refining management. For example, the dataset obtained for Pohnpei enabled a summary of its ecosystem status as currently facing heavy fishing pressure. This powerful finding is currently being used to support improved fisheries legislation and enforcement in coordination with a current Packard Foundation Western Pacific grant through MCT. Recent gains for Pohnpei's fisheries include the establishment of a traditional leaders governing body (Menin Katengensed Advisory Council); the development of a coordinated Workplan that brings together the three State bodies overseeing coral reef fisheries management in Pohnpei: Department of Lands and Natural Resources (DLNR), Office of Fisheries and Aquaculture (OFA), Division of Fish and Wildlife (DFW) under the Department of Public Safety (DPS); and the passing of new fisheries regulations that will be enforced in 2015. These include minimum size limits for sale of groupers, trevallies, sweetlips, paddletail snapper and brown-marbled grouper; an increase in net-mesh size to 4 inches gillnets; a ban on speared lobster; and a 10-year moratorium of four of Pohnpei's endangered species, including humphead wrasse, bumphead parrotfish, giant clam, and giant grouper. An extension of the grouper sales ban to include February for all groupers and January to May for squaretail coral grouper will also become enforceable. The implementation of the Workplan in 2015 is anticipated to address the challenges of sustainability for Pohnpei's near shore marine resources.

Current monitoring datasets have also been instrumental in supporting policy decisions in Chuuk as a result of outreach communication of data collected in recent years. Some significant gains include the proclamation by the Governor of Chuuk on a six year moratorium on sea cucumber exportation; the enactment of regulations to ban the harvesting of bump-head parrotfish and napoleon wrasse (which are fish species protected under the Convention on International Trade of Endangered Species); the enactment of municipal level laws on Parem island (a monitoring programme site) to regulate traditional marine protected areas; and two additional sites adjacent to monitoring sites are now also declared protected areas and are in the process of developing management plans. Thanks in particular to outreach efforts from a project (funded under the Margaret Cargill grant through MCT) that supports community-based marine resources management efforts through enhanced fisheries management and monitoring in Chuuk, there seems to be significant buy-in from fishers and market owners who understand the need for further fisheries regulation, and are somehow supportive of the new laws, despite not having received formal consultations on the development of the new laws. A further initiative taken on by the project is the ongoing live reef-fish trade fishing vessel that currently operates in Chuuk. During the project, community leaders, management agencies, and the general public were engaged to put a stop to the operations. While careful not to claim direct attributions, it seems that at least in part, the monitoring data collected under the project can claim some responsibility for the conviction and ban of one of the two operating vessels in Chuuk lagoon. The data can also claim to have some influence on the inclusion of the new fishing laws that ban the export of napoleon wrasse and bumphead parrotfish.

Palau continues to demonstrate exemplary monitoring and outreach work for the region. The Palau International Coral Reef Center's (PICRC) monitoring work continues to support the continued ban on harvesting of sea cucumbers, on harvesting of bumphead parrotfish and of Napoleon wrasse. Fishing for grouper for 4 months from April-July has been banned in Palau since 1994. The monitoring of the aggregation sites (MPAs) showed that grouper density continued to decrease and that the current aggregations extend beyond the 4-months closed season. That led to increasing the closed season to 7 months by Palau National Congress. There is now data that seems to show that the grouper populations at the aggregations are on the increase. PICRC has, in addition, continued to work with partners to strengthen site enforcement. Both the increase in length of closed season and also the support from the Palau Protected Area Network (PAN) for site enforcement can be said to have a positive influence on the

currently healthier numbers of groupers in the waters of Palau. PICRC's monitoring work has also led to the establishment of a new PAN site, the baseline assessment for which was made possible through an MCT grant from the Packard Foundation's Western Pacific program. Furthermore, PICRC is working with other partners in Palau to gather, summarize and provide the different data from monitoring and other research work to inform the design of the existing PAN network in Palau and to refine it to include resilience to climate change. The scenarios are being created and once ready, PICRC will work with PAN office and the State to review and implement the design.

Indeed, a model success story for the region comes from Palau - that of the Ebiil Society's one-year Ngarchelong-Northern Reef Fishery Monitoring project which ended in July 2014 (under MCT's Margaret Cargill grant). The project is a model of how monitoring work and its results are used by villagers and state and national governments to design and/or improve MPA and fisheries management. The data collected and reported under the project has enabled community ownership of fisheries management within their community, allowed for a national-level movement to introduce size control for fishing in Palau, and secured assistance from the Palau Bureau of Marine Resources in the form of fish aggregate device (FAD) systems installations and conducting of training for clam farming as an alternative livelihood option. As a result of this project also, a shift in focus to fishery management within Palau's largest conservation organization has become apparent. Recently advertised in Palau's national newspaper was a position for a Fishery Management Coordinator for the Palau Conservation Society. In the text box below, is an account of the community project gains shared by Anne Singeo, Ebiil Society's Executive Director:

Since the beginning of the project the fishers community of Ngarchelong has become more cohesive and eager to work together to find solutions to managing their fishery. It has also attracted much support from government and non-governmental agencies in developing and strengthening fisheries management in Palau. During community meetings, the fishers would discuss how the results of this project has shed light on the needs for their improved fishery and how the support keeps coming in, and that for once they feel important and part of the decision making. Other communities look at what is happening in the Northern Reef community and want to be part of the successful story. As such, beginning in September, the Ngarchelong fishers will meet with the Melekeok fishers to help them begin their own monitoring as a means to developing their fishery management plans.

Going into other communities and seeing how difficult it is for fishers and state marine law enforcement teams to communicate with each other, makes us realize that the relationship between the same parties in Ngarchelong has really developed and matured over the years as a result of our community work. Our work really began with a camp, as the fishers are the teachers/trainers, and as we began the monitoring project that further strengthened the fishers role as conservationist and when we call fishers meetings to review the data/ information all the marine law enforcement team would show up in their uniform and participate as law enforcement and as fishermen. In the other communities, the fishers would sit in dark corners of the meeting halls, while the law enforcement would sit in the center, and the dialogue is mostly fishers questioning intent of State conservation laws and law enforcement defending it. The dialogue is not as fluid. We end up coaching and playing referee between both parties. It is one of our major goal to use this monitoring project to develop a good working relationship between the State government and the fishers for effective fishery management.

Success stories such as these are enabled by a supportive institutional framework that enables coordination, skills as well as financial leveraging, and financial support across the region. In this regard, MCT has proven to remain a critical coordinating and financing mechanism for the jurisdictional partners. To support the institutional strengthening of the region's monitoring gains, MCT has been able to maximize gains from this Cooperative Agreement by strategically applying its suite of grants, particularly NFWF, Margaret Cargill Foundation, UNEP GEF 4, PEW Trust and the Packard Foundation Western Pacific and Science grants to strengthen capacities and partnerships in coral reef monitoring for the region. Together with its main partners - UoG (Dr Peter Houk), PICRC, The Micronesia Islands Nature Alliance and The Nature Conservancy, MCT remains an instrumental part of the 'regional node' that act as anchors for perpetuating regional gains in coordinating data collection, storage and use but also continued training and up-skilling of data teams across the jurisdictions.

Below is a detailed end of term report for each of the four project objectives, followed by a discussion on lessons learned and next steps going forward in the next cooperative agreement.

Objective 1: By the end of Year One, coral reef management and monitoring capacity needs in the FSM, Palau, and RMI have been identified and recommendations to fill gaps are initiated

Status: COMPLETED

With assistance from Dr Houk and Dr Golbuu, management and capacity needs have been identified across the jurisdictions. Recommendations to fill gaps are actively being addressed by MCT and partners. While this objective can be classified as fully achieved, it is important to recognize that addressing the gaps is an ongoing process. For example, a quick survey amongst the jurisdictional teams has shown the importance of additional training in coral taxonomy. This is due to a turnover of monitoring team members, particularly in the FSM and RMI. It is important to recognize also that capacity needs are site-based. In the case of the RMI, for instance, Majuro is largely benefitting from an augmentation in capacity while management and monitoring in the outer islands continue to prove a difficult challenge. In the ROP, ongoing training is being offered to conservation officers and coordinators in coral reef monitoring and management, with further training planned to address more specific capacity needs in the coming years.

Most of the coral-reef monitoring programs across Micronesia are well equipped with staff that have attended numerous trainings on field protocols. However their level of taxonomic expertise and quantitative background greatly differ. Together, taxonomy and quantitative expertise represent the greatest challenges for Micronesia, and the former has been the subject of several workshops that continue to improve basic analytical skills. To date, Dr. Peter Houk (along with UOGML graduate students who have the required expertise) have been filling in the gaps while monitoring side-by-side local programs. This partnership has led to the current set of standardized data, analytical outputs, regional publications, and science translation pieces. The MC scorecard results within this report (see discussions under Objective 3) are the latest example of this. Ideally, each jurisdiction would have a lead biologist with a formal Master of Science degree in marine sciences, similar to Guam, CNMI, Hawaii, and American Samoa. However, the current level of funding provided to local teams, although growing over the years, is not enough to fill this need. The common dilemma over the years has been to strike a balance between providing regional expert support while developing the basic skills-sets of local teams. This has been difficult when considering per-jurisdiction funding for UOGML to support these needs (approximately at \$10,000 per annum, inclusive of travel, fieldwork, data development, publications, and translations for stakeholders). It is not likely that individuals without formal graduate school training will be able to produce rigorous and defensible science from their datasets, but rather, workshops help them to produce basic graphics supporting locally-managed MPAs and such. These basic skills are essential for their day-to-day needs, hence their focus to date. Key contributions from local teams are in-water skills-sets, logistical expertise, and connections with island societies to translate the science being developed. As such, our approach has been (and is planned for the next Cooperative Agreement cycle) to provide analytical and taxonomic expertise as needed through partnerships with UOGML, and build translations in partnership with local programs who disseminate this information to stakeholders. Some examples of success are the analytical metrics developed for FSM/RMI and their current application to new fisheries regulations being developed in Pohnpei and Chuuk (mentioned above). In addition, our findings currently highlight the success of regional RARE campaigns, and are the subject of past and ongoing translation pieces in the Journal of Micronesian Fishing (www.micronesianfishing.com/home). On a broader scale, the Micronesia Challenge (MC) measures metrics will be presented to the Micronesian Chiefs Executive Summit once they are formalized and published within the next two years of this new cooperative agreement. This is expected to provide the strongest support for the Micronesia Challenge to date, and highlight management effectiveness and needs.

Objective 2: By the end of Year Three, all FAS States have trained and well-coordinated monitoring teams.

Status: COMPLETED. A note here that, while this objective can be considered completed from the perspective of the cooperative agreement's three-year project life, staff turnover within most of the jurisdictional teams render the work as partially complete. A possible solution to this problem using 'regional nodes' is discussed in section 2.

All FAS states have trained and well-coordinated monitoring teams. As mentioned above, the ROP monitoring program has a particularly strong training program under PICRC. Conservation officers accompany and learn on the ground from PICRC staff for every site, monitored. The teams in the FSM and RMI jurisdictions, however, are faced with a high turnover of trained members, on the one hand and a need for additional trained members, on the other. For example, RMI currently has a monitoring team of approximately 10 people. Each person has his or her own expertise with no back-up if one member is not available or leaves. In Yap, a recent turn-over of staff means that newly recruited and trained members need to practice newly acquired skills to be more comfortable out in the field in order to ensure proper collection of accurate data. In addition, there are some variations in the capacity of teams across the FSM, with Pohnpei and Kosrae having more well functioning teams than Chuuk and Yap.

As a response to these challenges, the Kosrae team is showing that it may be possible to increase capacity by strengthening a network between NGO and state-based organizations. The team has initiated a new monitoring program that more closely involves members from Kosrae Island Resource Management Authority, staff from the Department of Resources and Economic Affairs and the Marina Operators. In addition, 'regional nodes' such as the support provided by MCT, PICRC and UOG (Dr Houk) is proving to support coordination across the jurisdictions.

During the three-year project period, supporting key milestones included:

- 1) Introduction of a standardized protocol to all local programs that is capable of answering pressing management questions at local, island, and regional spatial scales (Year 1).
- 2) Collection of standardized set of baseline data using these protocols in partnership with local programs (Years 1 and 2).
- 3) Quality Assurance/Quality Check all data generated (Years 1 to 3).
- 4) Provision of training and feedback to key jurisdictional monitoring team members regarding taxonomy, protocols, and techniques used to collect data. This included the development of step-by-step guidance materials, technical PowerPoint presentations that serve as reference documents, and regular communication by Dr. Houk (Years 1 to 3, samples available upon request).
- 5) Data analysis workshops that facilitated local programs to generate their own queries for local needs, with continued emphasis on improving summary graphics (Years 2 and 3).
- 6) Analysis of datasets in greater depth for professional, peer-reviewed publication in coordination with other local and federal grants that funded the time/effort needed for deeper investigations of datasets (Years 2 and 3, publications available upon request).
- 7) Production of outreach materials to disseminate information regarding the status of their reefs and fisheries (Years 2 and 3, samples available upon request).

The following is the current status of jurisdictional monitoring teams as at December 2014 for the FSM, RMI and ROP.

FSM

Yap: Lead agency Yap Community Action Program, Marine Division

Lead members:

- Former lead Eva Buthung (recently left YapCAP position; currently recruiting for replacement)
- Current lead – Anthony Yalan (was working with Eva prior to departure, current YapCAP employee), photo quadrat analysis, corals, macroinverts

Support: Community members that form in-water dive teams during survey events. Known by first names only. They are all hired on a part-time basis when monitoring gets going and data need to be analyzed.

They are all critical to success:

- Joe – Macroinverts, corals, good taxonomy
- Mike Gaag – fish surveys and boat captain, good fish taxonomy using Yapese names
- Jesse – fish surveys and boat captain, good fish taxonomy using Yapese names
- Jabo – Macroinvertebrates, GIS, Tamil community representative
- Interns – vary, come and go from time to time from community college and high school
- Teams augmented by Dr. Houk for coral assemblage surveys and calibration of fish surveys

Chuuk: Lead agencies Chuuk State Marine Resources Division and Chuuk Conservation Society (CCS)

Lead Members: Curtis Graham – Critical for successful monitoring in Chuuk, Deputy Director of Marine Resources, benthic images, macroinvertebrates, overall logistics

Support: Employees of marine resources and CCS that form the dive team. Known by first names only. They are all full time employees. All are influential for success:

- Seyson – Macroinverts, Chuuk names for taxonomy
- Chimres – fish surveys and boat captain, fish taxonomy using Chuukese names
- Laurentino – benthic images, photoquads
- Teams augmented by Dr. Houk for coral assemblage surveys and graduate student for fish surveys and calibration

Pohnpei: Lead agencies Conservation Society of Pohnpei (CSP) and Pohnpei State Marine Resources Division.

Leader Members: the three key individual leaders for Pohnpei monitoring team include:

- Yorg Anson – Overall manager of CSP marine program. Benthic photographs, image processing, data analysis, graphing, presentation to the communities and legislature
- Selino Maxin – Key monitoring biologist with very expertise in both coral and fish taxonomy. Critical for successful monitoring in Pohnpei, also processes and enters datasets for subsequent analyses.
- Kirino Olpet – logistical coordinator and boat captain. Also critical for success of the current program.

Support: Employees of CSP and marine resources that are essential members of dive team. They are all full time employees:

- Kesdy Ladore – fish, scientific names for taxonomy
- Scotty Malakai – macroinvertebrates, very good taxonomy
- Pelsin Moses– macroinvertebrates, very good taxonomy
- Teams augmented by Dr. Houk for coral assemblage surveys and GIS work

Kosrae: Lead agencies include Kosrae Conservation and Safety Organization (KCSO) and Kosrae Island Resource Management Authority (KCSO)

Leader Members:

- Overall head for monitoring is the marine program manager at KCSO, Marston Luckymis. Benthic photographs, image processing, data analysis, graphing, presentation to the communities and legislature.
- Osamu Nedlic – Key monitoring biologist with very much expertise in both coral and fish taxonomy. Critical for successful monitoring in Kosrae, also processes and enters datasets for subsequent analyses.

Support: excellent support from a private entity, the Kosrae Village Resort. Employees of KIRMA and KVR that are essential members of dive team. Known mostly by first names. They are all full time employees or business owners.

- Katrina Adams – owner of Kosrae Village Resort, and provides her time and many resources in-kind to support coral monitoring efforts. This is a very unique situation for Micronesia. Benthic quadrates, very good coral and fish taxonomy, diver calibration
- Numerous individuals from KIRMA, change over the years (too many to name all) – macroinvertebrates, good taxonomy, fish belt transects as well
- Teams augmented by Dr. Houk for coral assemblage surveys and graduate student for calibrating local fish surveyors

RMI

Lead Agencies include the College of the Marshall Islands (CMI), Marshall Islands Marine Resource Authority (MIMRA), and the Marshall Islands Conservation Society (MICS)

Lead Members: overall head for monitoring is Don Hess from CMI. Overall manager of RMI monitoring program and logistics.

Support: essential support from numerous key members from MIMRA, many who already have obtained Mater of Science degrees.

- Emma Kabua – fish surveyor, image processing, data analysis, graphing, presentation to the communities and legislature.
- Melba White – Key monitoring biologist with much expertise in fish taxonomy.
- Jesse Capelle - Key monitoring biologist with much expertise in macroinvertebrate taxonomy.

- Interns – rotational, current leader is Lyla Lemari – excellent dedication and contribution towards data analysis and photo quadrat work, and will be heading to college soon. Interns are critical to the success of RMI coral monitoring.
- Karl Fellenius – SeaGrant Extension, CMI. He started working with the team after monitoring began and is now a key member for overall team guidance, benthic substrate images, and database development.
- Teams augmented by Dr. Houk for coral assemblage surveys and graduate student for calibrating local fish surveyors.

ROP

Lead Agencies include the Palau International Coral Reef Centre (PICRC)

Lead Members: overall head for monitoring is Yimnang Golbuu, Director PICRC

Support:

Conservation Officers across the Palau Protected Areas Network, trained by PICRC staff:

- Biological Researchers: Kevin Polloi, Marine Guezo, Lincoln Rehm
- Researcher Assistants: Randa Jonathan, Dawnette Olsudong, Geory Merep
- Extension Agent - Geraldine Rengiil
- Socioeconomic Researcher - Shirley Koshiba

Objective 3: By end of Year 3, all monitoring teams are conducting standardized monitoring protocols and established databases are functional and accessible to all resource owners.

Status: COMPLETED.

All monitoring teams are conducting standardized monitoring MC protocols, due largely to the support provided by UoGML (Dr Houk) and PICRC in this area. In addition, Dr Houk has provided important training on data quality assurance, local storage and control and has facilitated peer learning across the jurisdictional teams.

Following the establishment of the MC monitoring protocol for ecological monitoring in the second MC Measures Group meeting in 2012, the MC database for ecological monitoring continues to be improved and meaningful reporting is now available. The database at PICRC is not currently available online, individuals can contact PICRC to request access. The data/database housed at the University of Guam Marine Laboratory is also available to NOAA to access. Currently the data is in localized formats (excel/txt files). Through a grant from the Margret A. Cargill Foundation, the team at the University of Guam is working to establish an online storage and distribution system by 2016 to allow remote access to the database. This work is currently ongoing and on track.

After three years of working with jurisdictional teams on coral monitoring in the region, Dr Houk, has been able to lead the completion of a formal and standardized assessment method of all regional datasets. The present datasets and findings are now appropriate for their use in defining and refining management and can be used to evaluate the current status of coral reefs across Micronesia. Importantly, the datasets will eventually enable full evaluation and reporting of the Micronesia Challenge (MC) goal of 30% near shore marine conservation for each jurisdiction. The MC goal requires that sites attain an overall ecological condition scores of 80% of the maximum value, or higher, in order to be considered as

‘effective conservation’. Results indicate that the MC goals were well assessed through this standardized, comparative process. Each jurisdiction has at least one reeftype with $\geq 30\%$ of the reefs showing effective conservation, as well as one or more reeftypes where effective conservation is not evident on $\geq 30\%$ of the reefs. In general, inner reefs and channels had lower condition scores as compared to outer reefs. Additionally, it seems clear that proximity to main population centers and boat launch areas were strong predictors of declining reef status (further investigations planned for next year aim to tease this apart with respect to watersheds, human populations, fishing proxies, and environmental regimes such as wave exposure). Results also highlight the interesting fact that the standard deviation among condition scores (or variances) appears to be a useful indicator of the stability, or risk of perpetuating the current status of the ecosystems. Lowest variances were found for the sparsely inhabited islands of Namdrik and Kosrae, as reef condition scores showed least variation. Variances grew with human population, and attain their maximum for Chuuk, where highest fishery exploitation rates currently exist despite having the largest amount of reef habitat and very good present condition scores. So, while ecosystem condition is presently high for places like Chuuk, variances provide a means of assessing the stability of reef condition into the future. Deeper investigations into these patterns remain the subject of continued analyses and information dissemination in the coming year. Once more fully established, MINA also plans to popularize the data into an ‘MC scorecard’ format that scores the MC goals with biological data to influence decision-making at leadership level.

Details of the datasets, analysis and findings discussion are in Appendix 1: “Utilizing standardized coral-reef monitoring to evaluate the current status of resources and the Micronesian Challenge: Examples from FSM and RMI programs”.

Objective 4: By end of Year 3, local jurisdictional teams are effectively providing ongoing training and mentoring in community-based observation, compliance, and enforcement for protected areas in at least two new jurisdictions.

Status: COMPLETED

This objective has been fully achieved with ongoing transfer of knowledge to community-driven monitoring and management, and often funded by additional sources, including matching funds from MCT’s grants under NFWF, PEW Trust, Margaret Cargill and Packard Foundation’s Western Pacific Program. Enforcement trainings have now been conducted across all the jurisdictions of the RMI, ROP and FSM states (the training in Chuuk was conducted within this reporting period). All partner agencies have worked with PIMPAC and Guam Fish and Wildlife Officers to conduct these trainings. Facilitation for community members across the jurisdictions to develop Standard Operation Procedures (SOPs) has also been provided. For a snapshot of what these trainings involve, visit the KCSO website at <http://www.kosraeconservation.org> to see Vol. 4, 2nd Quarter Issue. In Yap, a group of relevant agencies (YapCAP, EPA and Yap Fishing Authority) in collaboration with PIMPAC are currently working with the AG’s office for a legislation to be passed requiring all boats to be registered with the State to allow for effective enforcement. In Pohnpei, the monitoring team continues to provide its yearly training and refresher courses to a select-number of Community Conservation Officers under the Pohnpei MPA Network to improve capacity at the community level.

The main enforcement project under MCT during the life of the cooperative agreement was entitled, “Enforcement Training to Benefit Coral in Micronesia,” funded by NFWF. From June 2012 until December 2013, project activities were undertaken within three Micronesian Jurisdictions (Palau, Federated States of Micronesia and the Marshal Islands) to support on-going conservation enforcement capacity-building activities within the region. The project provided follow-on training and capacity building to conservation law enforcement departments or management programs across the region. Key

accomplishments include: strengthening of conservation law enforcement networks; development of standard operating procedures and compliance and enforcement plans for programs; highlighting of shark awareness conservation and enforcement issues; improvement of communication with remote atoll locations; and capacity building through targeted training, site-visits, and skill and lesson sharing. All activities were coordinated with NOAA's Pacific Island Managed and Protected Area Community (PIMPAC) and implementing NGO or government agency partners in support of the Micronesia Challenge conservation goals.

The project outcomes for Palau included:

- Increased standardization of protocols and opportunities for effective collaboration for Palau conservation officers through the development of a foundational nation-wide SOP applicable in Palau's 16 states
Greater technical skills and knowledge of conservation and public safety officers through two nation-wide trainings on marine conservation law enforcement, which included a total of 74 participants.
- Improved capacity in fundamental law enforcement skills through targeted trainings in report writing (10 participants), communications and outreach training (10 participants), and First Aid and CPR (14 participants).

The project outcomes for the RMI included:

- A growing network of resource managers and community conservation officers well-versed and increasingly skilled in natural resource regulation, compliance, and enforcement.
- Increasing awareness of conservation capacity skills, needs, and solutions through the development of compliance and enforcement plans, including a draft plan for the Rongelap Atoll Local Government.

The project outcomes for the FSM included:

- Greater cooperation and coordination with communities and government and NGO partners in Pohnpei
- Increased technical skills to undertake responsibilities more effectively and safely
- Increased recognition of the need for on-going Division of Fish and Wildlife training and capacity building
- Improved communications with two (2) remote atolls in Yap State, FSM.
- Greater understanding of two (2) outlying island communities of the importance of, and mechanism for, reporting suspicious vessel activity to the FSM National Police, safety-at-sea practices, and disaster response protocols.

2. Lessons Learned and Next Steps: from “Building to Enhancing Sustainable Coral Reef Monitoring and Management Capacity for the Micronesia Challenge, and Beyond”

The past three years have been instructive in how MCT, NOAA and partners can enhance the current coral reef monitoring work for Micronesia. The four main focus areas to address in the next two years include, the continued development of jurisdictional monitoring and enforcement capacities, the further development of the MC Database, the strengthening of socioeconomic monitoring, and improved communications between MCT, NOAA and other partners.

2.1 Jurisdictional Monitoring and Enforcement Capacities and Regional Nodes

One of the key take-home themes during the past three years is that local monitoring programs across Micronesia working together are much stronger than their independent programs in the past. This has been evidenced by the development of a team of expert scientists and local stakeholders that together comprise the MC measures working group, and defined the protocols and designs for the standardized reef monitoring. However, the high staff turn-over and realistic skills-set levels of jurisdictional team members discussed in section 1 above, can hinder these gains. As MCT, NOAA and partners work through the challenges in monitoring capacities for the region, it is important to note that the model of simply centralizing monitoring to a single entity is not likely to succeed across Micronesia due to a predictable lack of ownership of the program and of the analytical findings (consider, for example, the complicated situation between NOAA National Monitoring Program and associated jurisdictions, despite the obvious logistical benefits a centralized program has for funding agencies like NOAA). What is clear from the lessons learned in the past three years is that partnerships will always be key to successful science-to-management frameworks, and the challenge is to strike the appropriate balance, given funding limitations. Due to financial limitations, taxonomic expertise training has been limited to one-on-one work with regional experts during data collection events only. MCT, NOAA and partners must therefore continue to improve upon this into the future by diversifying funding sources to support monitoring. There must also be targeted support to ‘regional nodes’; collaborations with scientists like Dr. Houk and Dr Yimnang Golbuu provides much-needed technical support, mentorship and direction to jurisdictional teams and the datasets being developed.

Lessons learned on the importance of partnerships and regional technical nodes also apply to the enforcement programs. Specific lessons learned include the importance of networking, establishments of standard operating procedures, development of partnerships and the building of capacities. Networking among officers and program has proven to be a valuable strategy in addressing lack of resources and capacity needs across a jurisdiction. It was also learned that each island jurisdiction in Micronesia has different government and community roles in resource management. And because of this, we have had to be mindful of these contexts, and arrangements need to be flexible enough to develop sound and appropriate mechanisms that can strengthen collaboration between partners. Capacity building in effective conservation enforcement remains a priority for the Micronesia region today and will continue to be into the future; although communities and governments have made great strides in establishing protected areas and enacting resource rules, communities and government agencies responsible for enforcing these rules continue to lack basic financial support, institutional organization, and skills for enforcement to be considered effective. MCT, NOAA and its partners must therefore continue to secure funding for enforcement program expansion and provide targeted support to the ‘regional nodes’ for enforcement, currently being led by Wayne Andrew of the Hatohobei Organization for People and the Environment(HOPE), based in Palau.

2.2 The MC Database

At the last MC Measures Group meeting in September 2014, the decision was made to move into cloud database, based in Guam, so as to enable all jurisdictions improved access for data uploading and reporting. The slow internet connection in Palau has made it a challenge for other jurisdictions to fully use the database currently being maintained by PICRC. Currently, the cloud database has a set of benthic substrates data for the Micronesia region and is being further developed by Dr Houk at the University of Guam Marine Laboratory to include the other two key biological metrics: fish and coral assemblages, agreed on in 2012. MCT has secured a one-year funding under its Margaret Cargill grant to further develop the accessibility and capabilities of this integrative and open access database in 2015. Key next steps include expanding analysis to include CNMI, Guam, and Palau, so that the entire MC can be

evaluated taking a similar approach. This is a planned topic for discussion at the next measures meeting scheduled for the fall of 2015. In addition, next steps with the recently awarded FY 15-16 NOAA CA will be to publish these findings, create compelling outreach materials, and provide summary presentations to stakeholders to effect decision-making. Data collection efforts will of course be maintained during the FY1 15-16 NOAA CA while findings to date are presented.

It is important to note here Palau's unique position in the region in terms of its comparative advantage in having most trained and experienced monitoring team, most developed datasets and most developed jurisdictional database under the PICRC. Going forward, Palau will therefore undertake its own stand-alone data analysis and publications. However, maintaining a close partnership with PICRC will ensure that the same techniques under the MC Protocol will be followed. Reporting for the MC as a whole will therefore remain possible.

2.3. Socioeconomic Monitoring

A main lesson learned on ecological monitoring underway, is the important, complementing role of socioeconomic monitoring data in informing management decisions. For example, the pilot socioeconomic report on a village in Palau, produced by PICRC under this grant, and in collaboration with the University of Columbia Fisheries Centre (March 2014),¹ is able to present an assessment the perception of the site community and was thereby able to determine the level of community awareness in relation to their protected areas. The survey showed high fishing pressures in the site community, with the great majority of the households surveyed (94%) reporting that one or more of their family members participated in fishing. However, almost all respondents did not attribute any changes to fishing activities due to the protected areas. The report therefore concludes on the importance of educational awareness on the benefits of protected areas to ease the fishing pressure within the community.

In order to make ecological monitoring data effective at a holistic (i.e. across community, states, nation, region) level, MCT, NOAA, MINA, PICRC and other partners will work to continue building the socioeconomic monitoring capabilities and data for the region. MCT will ensure coordination between the socioeconomic work under the FY 15-16 CA with its NFWF grant on the compilation of existing data collection across the jurisdiction. Key partnerships development on technical assistance with NOAA affiliates, such as with Supin Wongbusarakum and Peter Edwards, will be critical to the success of a cohesive socioeconomic monitoring program for Micronesia.

2.4. MCT, NOAA and Partners Communication

As the Micronesia coral reef monitoring program matures, effective communications between MCT, NOAA and key partners such as PICRC, UoGML, MINA and TNC will ensure a more informative, cohesive and supportive decision-making process for future directions and ensure our collective understanding of coral reef science-to-management frameworks across Micronesia. As well, skills and funding leveraging will continue to be maximized across the jurisdictions. As agreed in the teleconference meeting of partners in early November of this year, engagement of all relevant partners in science-to-management process will provide crucial opportunities for integrative feedback cycles. As agreed at the

¹ Kleiber, D. and Koshiba Shirley, *Micronesia Challenge Socioeconomic Pilot Study, Palau*, March 2014, PICRC Technical Report No. 14-08 (available: www.picrc.org). Socio-economic surveys for six more sites in Palau (Kayangel, Ngarchelong, Ngaraard, Ngiwal, Airai and Peleliu) are concurrently being conducted (2015) with first report drafts for publication expected to be completed by June 2016.

meeting also, MCT will therefore facilitate quarterly conference calls every one month after reports to NOAA are submitted. The next meeting is scheduled for 30 January 2015.

APPENDIX 1: Utilizing standardized coral-reef monitoring to evaluate the current status of resources and the Micronesian Challenge: Examples from FSM and RMI programs

By Dr Peter Houk, University of Guam Marine Laboratory.

Introduction and Background

The Micronesian Challenge represents a locally-driven conservation movement that was originated and perpetuated by the political leaders of Micronesia. The challenge is for jurisdictions to meet effective conservation thresholds across 30% of their marine resources and 20% of their terrestrial resources by 2020. Through the Micronesian Challenge (MC), several smaller working groups were created to facilitate progress and create relevant, regional networks. This process has led to the creation of the MC measures group, which has been highly influential to successful coral-reef monitoring activities across Micronesia during the period of our NOAA Cooperative Agreement. This working group comprises resource managers and scientists from all Micronesian jurisdictions. At the second meeting for the measure group, standardized coral-reef monitoring protocols were developed and agreed upon. Shortly after, the Micronesian Conservation Trust was awarded the present NOAA Cooperative Agreement to improve monitoring and management of marine resources across Micronesia, and also to help move the Micronesian Challenge along. This marked the initiation of our current three year grant period, and the initiation of work between FSM and RMI coral monitoring programs and Dr. Houk, as well as regional involvement from the Palau International Coral Reef Research Center. Here, progress between Dr. Houk and local monitoring programs is summarized. Past annual reports, publications, and technical reports submitted along with this document all describe protocols in great detail. Here, a summary of the question-driven monitoring design is provided, followed by a novel synthesis of regional monitoring dataset that highlights clear accomplishments in coral monitoring and information dissemination for these jurisdictions.

Context

Appendix 1 represents a regional synthesis of knowledge gained from coral-reef monitoring activities, and also a process by which the Micronesia Challenge is being evaluated for FSM, CNMI, and RMI. There are plans to (i) work this into a peer-reviewed publication (ongoing), and (ii) expand this to include Palau and Guam into the future. In summary, this appendix provides support for the strength of a unified regional monitoring program in moving the Micronesia Challenge forward, but also identifies localized stressors of greatest concern across both local and regional scales. Individual jurisdictions also examine their own datasets in more detail along with Dr. Houk to produce state of the reef summaries that describe which reefs are in poor condition, what the key stressors impacting these reefs are, and what is lacking in current management frameworks.

Standardized monitoring protocols

Monitoring designs were developed based upon clear, concise questions of greatest importance to regional stakeholders. These question operate at varying spatial and temporal scales, yet they are all rooted in a

site-based design (i.e., the least common denominator, Figure 1). It was imperative for designs to answer individual site-level questions (i.e., MPA effectiveness), as well as evaluate regional conservation movements (i.e., the Micronesian Challenge).

In order to develop a single program that can address the suite of questions noted above, a site-based design was essential. When addressing questions at larger spatial scales, it is imperative that sites were selected around each island, across all major environmental and management regimes (Figure 2). Taking this approach, site-based designs can then be scale up to the island and regional level. This has resulted in approximately 20 sites being selected on each island, with variation (higher and lower) based upon the size of each island.

Benefits of a shared, standardized monitoring design

There have been many benefits of our shared, standardized monitoring designs that facilitated the very successful accomplishments of all milestones. Key benefits of the shared design have included integrated data analysis workshops and trainings, development of standardized online databases, and common approaches for developing outreach materials (Figure 3). These benefits are highlighted in the standardized evaluation process for Micronesian reefs below.

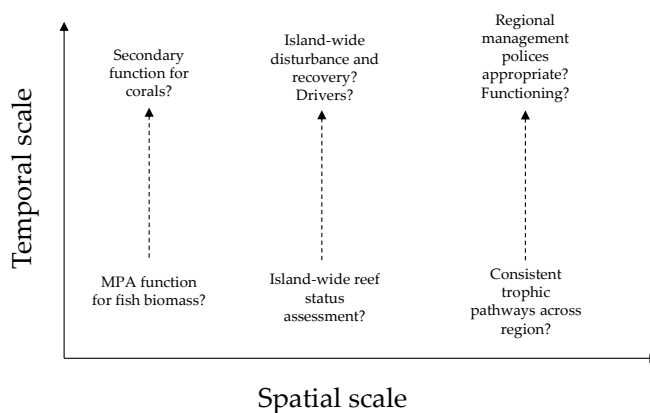


Figure 1. Diagram of the question-driven monitoring process with respect to spatial and temporal scales of investigation.

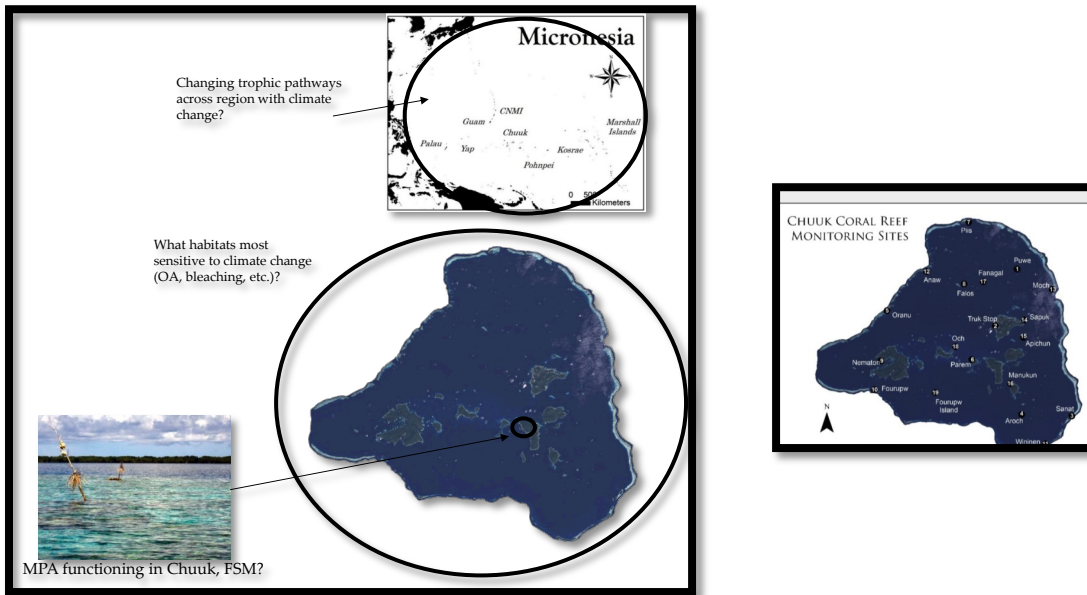


Figure 2. Site-based designs associated with regional monitoring, and how they scale up to answer regional questions through time (left). Monitoring design for Chuuk, FSM, across reeftypes, island geography, management regimes, and wave exposure (right).

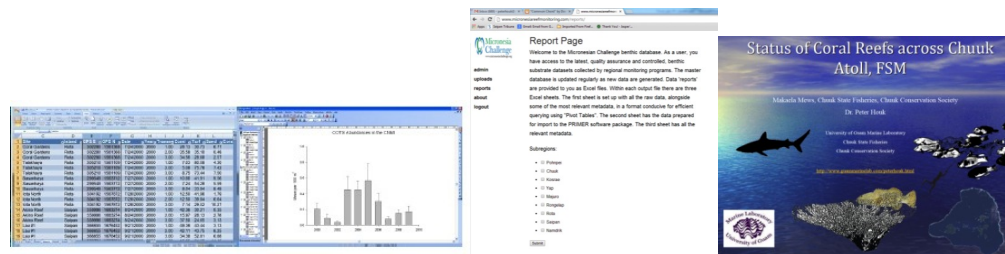


Figure 3. Benefits of a shared, standardized monitoring program: shared learning on data analysis training (left), creation of an online database to access the latest QA/QC data (middle), and common approaches towards disseminating information to stakeholders (right).

Application of monitoring data towards assessing ecosystem status and evaluating the Micronesian Challenge

One of the greatest needs for monitoring data was its immediate utility in assessing reef condition and evaluating the progress of the Micronesian Challenge (MC). The underlying premise behind the MC is that islands might take varying management approaches towards improving their marine resources. Existing management tools include legislative no-take marine protected areas (MPA), traditional and rotational MPA, watershed and mangrove rehabilitation and rezoning, and other fisheries strategies such as seasonal closures and size-class limitations. Regardless of specific management actions, the MC simply requires that 30% of marine resources are ‘effectively conserved’. One of the first tasks of the measures group was to define effective conservation. Three definitions were agreed upon, based upon data availability and temporal scale of investigation: 1) simply add up the area of reefs that are currently represented by MPA, regardless of whether MPA are proven to be effective or not, 2) given a set of

standardized monitoring data, segregate reefs by their major habitat and evaluate key biological metrics relative to an anchor point (i.e., a highly functioning MPA or remote reef of high quality), and 3) given temporal data, evaluate the rates of change of key biological metrics with respect to an anchor point. The present analysis follows the second definition above, given the recent collection of standardized, baseline data across the region. We utilize the below process to evaluate reef status on the four main islands that comprise the Federated States of Micronesia (Yap, Chuuk, Pohnpei, and Kosrae), as well as a sparsely inhabited atoll in the Marshall Islands (Namdrik) to provide a better understanding of human footprints within coral-reef ecosystems across Micronesia. Together, these islands represent locations where standardized monitoring data derived in partnership with Dr. Houk currently exist.

Key biological metrics and the evaluation process

During the second MC measure group meeting, a set of key biological metrics were put forth to be indicative of overall coral reef ‘condition’. These metrics were numerous, but ultimately they were grouped into three latent variables: 1) fish assemblages, 2) benthic substrates, and 3) coral assemblages. Within each latent variable category, several metrics such as herbivore size, shark biomass, coral diversity, and macroalgal cover were generated. Once tabulated, individual metrics were binned into the latent variable categories, standardized for scaling, and averaged to produce site-based measures for each latent variable described above. Because they are standardized, these variables represent relative measures of integrity that are appropriate for site-to-site comparisons. Last, overall ‘condition’, or ‘status’, was estimated by taking the mean of the three latent variables. This resulted in a single ecosystem condition score for each site. Because major reeetypes drive inherent differences in fish, benthic, and coral assemblages, this process was done separately for each reeetype within each island. Using this approach, a standardized evaluation process was conducted to assess the current status of marine resources across Micronesia.

Current evaluation of coral reef status across Micronesia

Major reeetypes defined inherent species distribution patterns and resource abundances for all islands. The evaluation process first stratified major reeetypes that existed on each island (Figure 4). Major reeetypes were similar across the region, but varied based upon natural geology. For instance, the inner, channel, and outer reefs on Yap and Chuuk were all distinct, while patch/inner reefs in Pohnpei were inherently similar. These features are artifacts of the geological age of the islands, and the depth/nature of island lagoons. Kosrae, for instance, only has inner and outer reefs, and a very shallow lagoon that is mainly exposed at low tide.

The next step in the evaluation process was to generate the suite of biological metrics that constitute the three latent variables described above. This was done for all islands and reeetypes (Figure 5, example from Yap). Next, latent variables were scored by taking the mean of the standardized metrics, providing a gradient of scores for three major functional components of the reef ecosystem, fish, corals, and benthic substrate. The last step in this process was to take the overall mean of the three latent variables which represents a single ecosystem condition score. Final condition scores were normalized with respect to an anchor point, in order to facilitate an evaluation of the Micronesian Challenge goals (Figure 6). The MC goals define that sites must attain an overall ecological condition scores of 80% of the maximum value, or higher, in order to be considered as ‘effective conservation’.

Results and present evaluation of reef condition across Micronesia

Results indicated that the Micronesian Challenge goals were well assessed through this standardized, comparative process. Each jurisdiction has at least one reeftype with $\geq 30\%$ of the reefs showing effective conservation, as well as one or more reeftypes where effective conservation is not evident on $\geq 30\%$ of the reefs (Figure 6). In general, inner reefs and channels had lower condition scores as compared to outer reefs. Additionally, it seems clear that distance from main population centers and boat launch areas were strong predictors of declining reef status, yet further investigations planned for next year aim to tease this apart with respect to watersheds, human populations, fishing proxies, and environmental regimes such as wave exposure. Results also highlight the interesting fact that the standard deviation among condition scores (or variances) appears to be a useful indicator of the stability, or risk of perpetuating the current status of the ecosystems. Lowest variances were found for the sparsely inhabited islands of Namdrik and Kosrae, as reef condition scores showed least variation. Variances grew with human population, and attain their maximum for Chuuk, where highest fishery exploitation rates currently exist despite having the largest amount of reef habitat and very good present condition scores. So, while ecosystem condition is presently high for places like Chuuk, variances provide a means of assessing the stability of reef condition into the future. Deeper investigations into these patterns remains the subject of continued analyses and information dissemination next year.

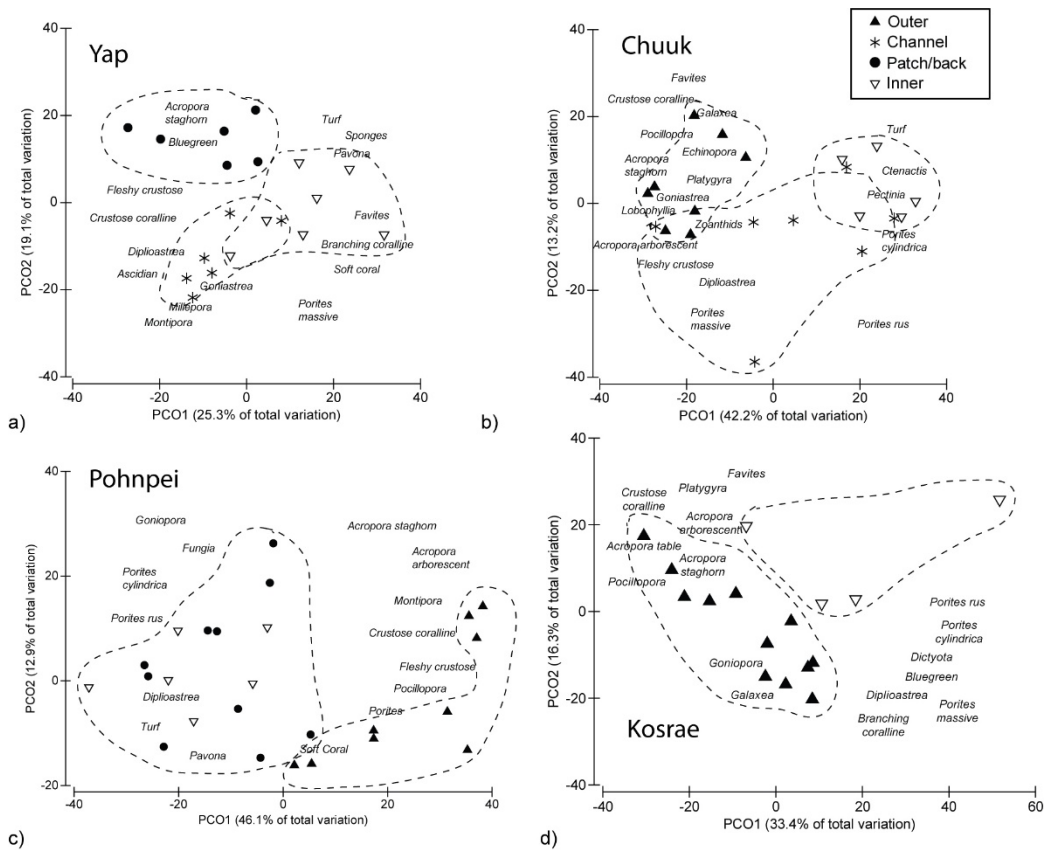


Figure 4. Principle components analysis distinguishing between foundational benthic substrates across major reeftypes on Micronesian islands. Principle components analyses is a multivariate statistical procedure that captures as much of the variation in species-by-site matrices in two-dimensions as possible. See attached publications for greater details on this procedure. Dashed lines represent distinct reeftypes on each island, names represent benthic substrates and corals that accounted for the group separation.

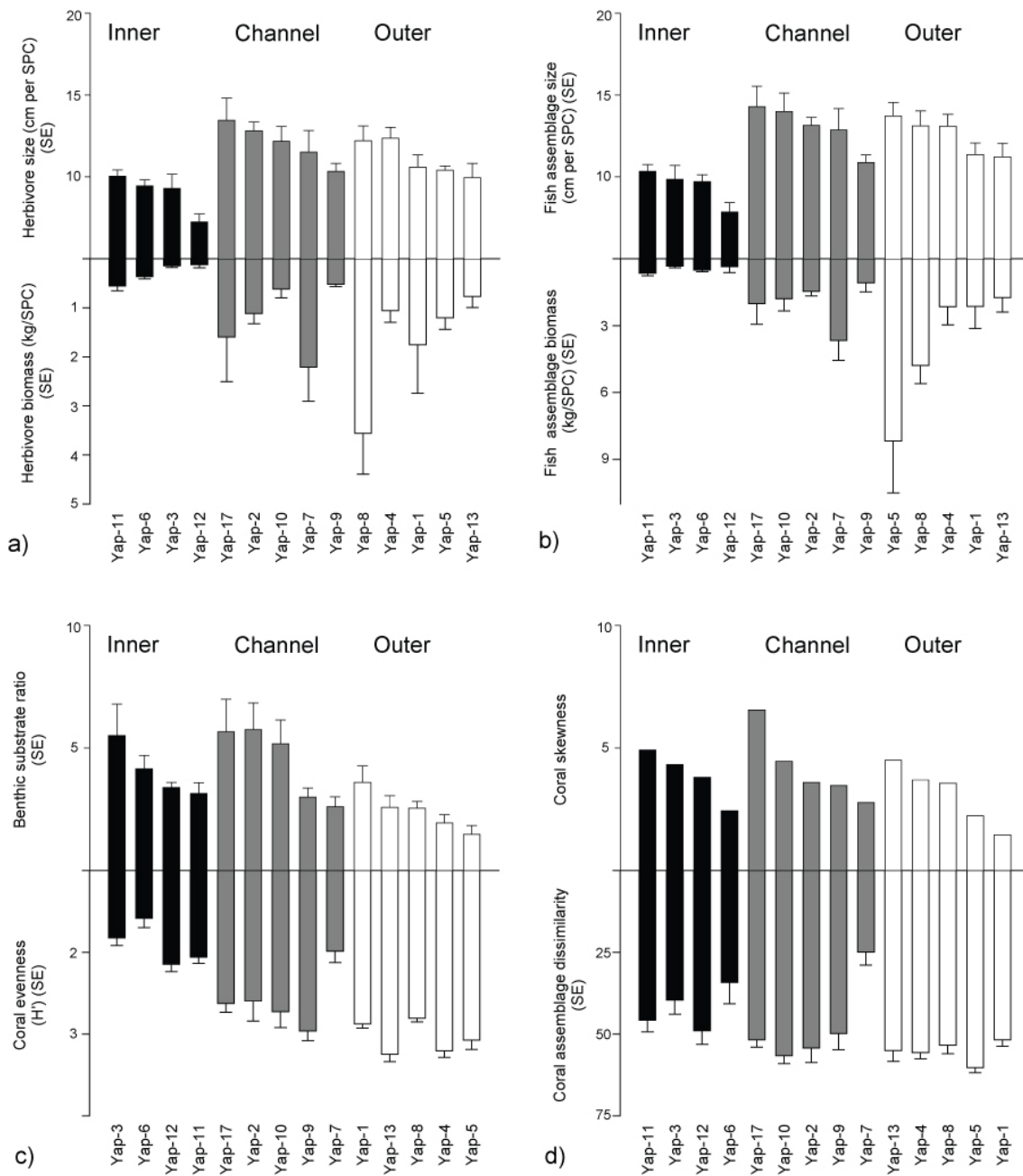


Figure 5. Raw values of individual metrics that constitute the three latent variables used for ecosystem condition assessment: fish, benthic, and coral assemblages. Fish metrics included herbivore size/biomass (a), overall fish assemblage size/biomass (b), and tertiary predator biomass (not shown). Benthic metrics included a ratio of heavily calcifying to turf/macroalgal substrates (c), coral genus evenness (c), and overall coral cover (not shown). Coral metrics included population skewness (d), multivariate dissimilarity between replicate sample also termed heterogeneity (d), and species richness (not shown). Further details on these metrics can also be found in the attached publications.

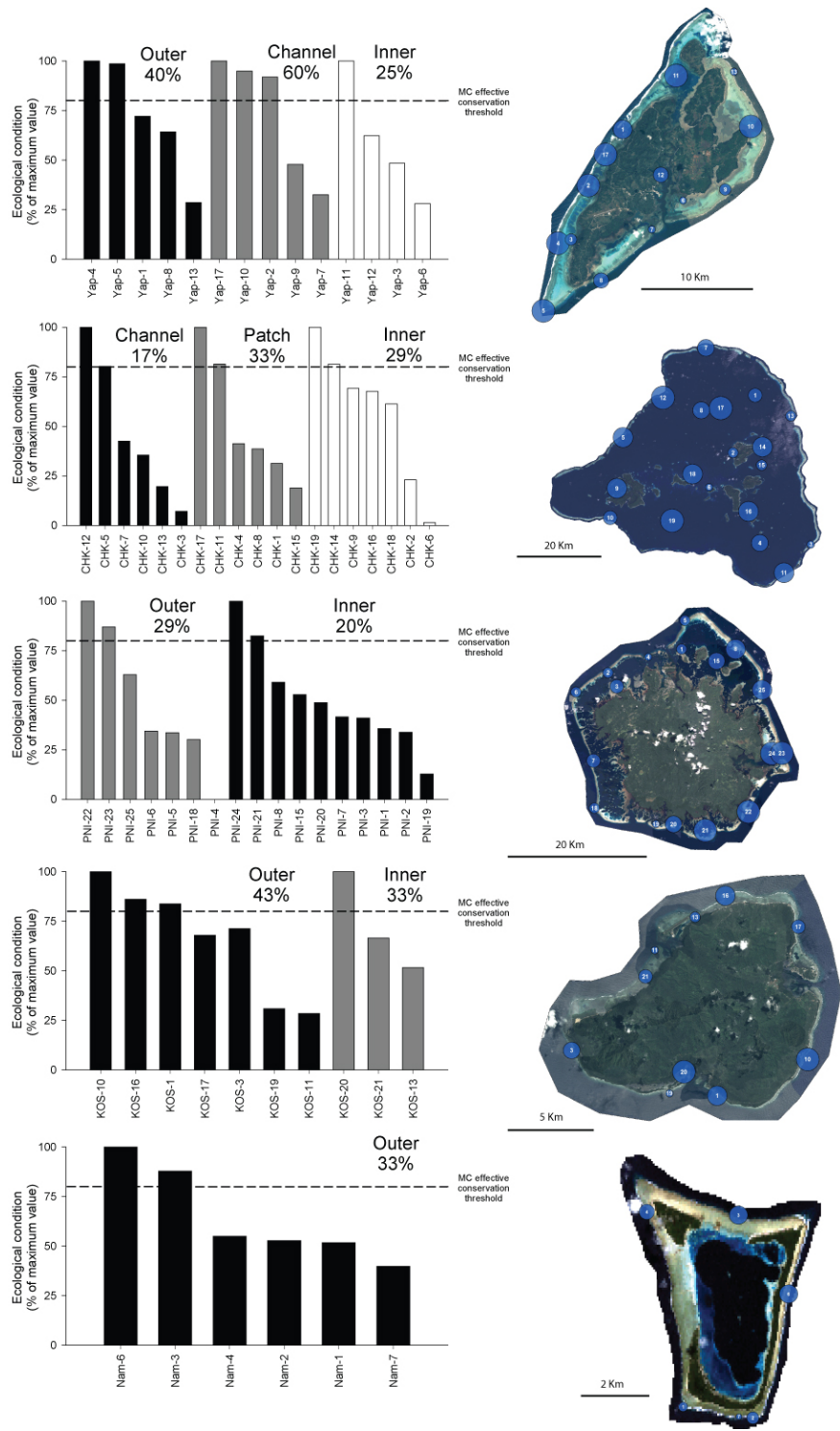


Figure 6. Overall ecological condition scores for monitoring sites across Micronesia. Scores have been normalized to the maximum value within each island and reef type. The Micronesian Challenge goals define that sites must attain overall ecological condition scores of 80% of the maximum value, or higher, in order to be considered as 'effective conservation'. Thresholds (dashed lines) and percentages are based upon these criteria.

-end-