

Improving local capacity for coral monitoring programs in the Federated States of Micronesia and the Republic of the Marshall Islands

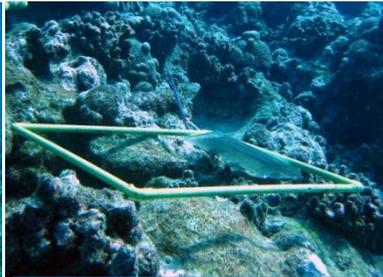
Final Progress Report



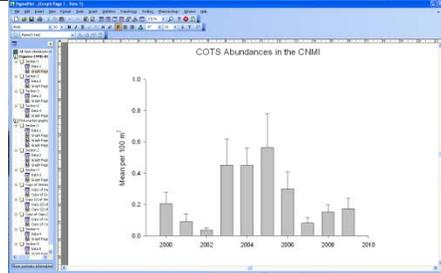
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Site	Island	GPS E	GPS N	Date	Year	Transect	Coral	Turf	Sand	Cora
1	Coral Gardens	302280	1561368	7/24/2000	2000	1.00	28.13	30.73	6.77	
2	Coral Gardens	302280	1561368	7/24/2000	2000	2.00	35.58	35.10	0.48	
3	Coral Gardens	302280	1561368	7/24/2000	2000	3.00	34.56	28.68	2.57	
4	Talakaya	305210	1561109	7/24/2000	2000	1.00	7.03	80.08	4.30	
5	Talakaya	305210	1561109	7/24/2000	2000	2.00	5.08	75.78	7.42	
6	Talakaya	305210	1561109	7/24/2000	2000	3.00	8.75	73.44	7.50	
7	Sasenhaya	299549	1563712	7/27/2000	2000	1.00	10.96	41.91	8.56	
8	Sasenhaya	299549	1563712	7/27/2000	2000	2.00	7.24	54.28	5.59	
9	Sasenhaya	299549	1563712	7/27/2000	2000	3.00	8.04	33.94	8.48	
10	Iota North	304192	1567672	7/28/2000	2000	1.00	12.50	41.96	1.79	
11	Iota North	304192	1567672	7/28/2000	2000	2.00	12.50	39.84	6.64	
12	Iota North	304192	1567672	7/28/2000	2000	3.00	7.14	29.02	10.27	
13	Akino Reef	359996	1683274	8/24/2000	2000	1.00	42.36	30.21	0.35	
14	Akino Reef	359996	1683274	8/24/2000	2000	2.00	15.97	29.13	2.78	
15	Akino Reef	359996	1683274	8/24/2000	2000	3.00	37.50	24.65	3.13	
16	Lau #1	366655	1676452	9/21/2000	2000	1.00	49.38	43.44	3.13	
17	Lau #1	366655	1676452	9/21/2000	2000	2.00	42.11	43.75	8.25	
18	Lau #1	366655	1676452	9/21/2000	2000	3.00	34.38	52.81	6.88	



August, 2012

I. Executive Summary

Since 2009, the Pacific Marine Resources Institute (PMRI) has been building professional relationships with the coral-reef monitoring programs across Micronesia. The overall goal of this collaboration has been to improve the local capacity to collect statistically sound datasets and interpret emergent trends. The present project was built upon existing efforts, and provided one-on-one collaborations between PMRI and the respective programs to help re-design coral-reef monitoring programs and begin standardized data collection across Micronesia. Year 1 completed activities were founded in an initial workshop where key staff from the jurisdictional monitoring programs came together and agreed upon a standard set of regional and local questions that drive survey designs and protocol selection. These efforts resulted in a standardized monitoring-to-management framework developed for regional programs that will address the needs of the Micronesian Challenge and beyond. After refining monitoring-to-management frameworks and associated survey designs, PMRI began conducted monitoring alongside the local programs in select jurisdiction. Monitoring in the Republic of the Marshall Islands and Yap State was conducted through a FY 09-10 NOAA general coral reef conservation award and a Western Pacific Coral Reef Initiative award to PMRI. Through the year 1 cooperative agreement, PMRI was able to continue standardized monitoring in Chuuk, Pohnpei, and Kosrae. In addition, the year 1 cooperative agreement facilitated the development of standardized, quality controlled datasets pertaining to the coral reef assemblages across Micronesia (appendices), and allowed PMRI to begin working with jurisdictions in initial analyses for their monitoring grant reports to NOAA. The collective efforts have yielded a consistent set of monitoring data across the region that encompasses 10 sites on each main island of the Federated States of Micronesia and the Republic of the Marshall Islands, sampled along gradients of human influence and management.

Key outcomes, attached as appendices, included:

- Summary power points that describe the current state of the reefs for numerous jurisdictions, and Micronesia as a whole;
- Step-by-step guides that compare and contrast expert fish observer datasets with datasets collected by local programs across Micronesia. Guidance documents aim to isolate upon common problems and limitations that local programs face in order to improve the capacity for the future generation of high-quality data;
- Standardized datasets pertaining to benthic assemblages, coral communities, and fish abundances across Micronesia;
- Localized analyses that summarize the efficacy of key management actions such as marine protected areas;
- Regional analyses that summarize key linkages between fish, benthic and coral assemblages in the form of trophic cascades across Micronesia. Such analyses highlight that apex predators and humans have opposite roles in structuring Micronesia's coral-reef food webs.

These initial analyses will be formally developed during year two of the cooperative agreement with PMRI. Clearly there is a strong need to translate the ensuing data assessments into compelling products that will aid decision making and improve management effectiveness. As this process develops through efforts such as the Micronesian Challenge, standardized, high-quality monitoring data will continue to provide the knowledge-base for decision making and reporting progress.

II. Background and Introduction

Since 2009, the Pacific Marine Resources Institute (PMRI) has been building professional relationships with the coral-reef monitoring programs across Micronesia. The overall goal of this collaboration has been to improve the local capacity to collect statistically sound datasets and interpret emergent trends. In 2009, the Micronesian Conservation Trust (MCT) hired Dr. Peter Houk, PMRI, to travel to each region and: 1) help programs interpret the statistical power and technical value of their existing datasets, 2) help improve their data collection programs to match pressing management concerns, and 3) try to introduce a standardized framework for coral monitoring efforts across Micronesia. In short, while a lot of datasets existed, and much insight was gained through their analyses, relatively few had adequate statistical power to evaluate change over time and judge the effectiveness of pressing management concerns through time. Recommendations for continued improvement were made together with local resource monitoring partners, keeping in mind jurisdictional constraints due to funding and/or available personnel.

Building from this effort, PMRI was subsequently awarded two grants to help build local monitoring capacity. First, through the Pacific Islands Marine Protected Area Consortium (PIMPAC), funding was administered to produce a step-by-step guidebook teaching local partners key steps and techniques for data handling, processing, and evaluation. Second, the National Fish and Wildlife Foundation (NFWF) awarded PMRI a grant to host a workshop to introduce this guidebook to regional partners, and introduce improved techniques for data interpretation and analysis (http://www.pacmares.com/Data_Workshop.html). This effort afforded programs a better opportunity to reflect upon their status and trends independently, and build desirable future directions and strategic plans.

The present project continued to build upon this foundation by providing one-on-one collaborations between PMRI and the respective programs to help re-design coral-reef monitoring programs and begin standardized data collection across Micronesia. Through the year 1 cooperative agreement award to PMRI, we have improved and standardized program structure, began creating regional databases, conducting monitoring alongside jurisdictional programs to improve capacity, and prepared insightful data summaries and reporting that directly relate to pressing management needs.

III. Progress Summary and Products

Standardizing monitoring program designs –

The first activities associated with the present award were focused upon getting programs to agree upon a standard set of regional and local questions that drive survey design and protocol selection. In order to accomplish this goal, a workshop was held for programs to assess the questions being inferred by their current survey designs. Because the questions being addressed by existing sampling designs were not well aligned with the suite of management concerns that existed, we spent time explicitly defining improved monitoring-to-management frameworks (Figure 1). This framework was rooted in a suite of regional and local questions that were used to refocus survey designs and protocols in a consistent manner.

Preliminary questions that served to focus monitoring efforts included:

- (1) What is an appropriate geographic scale for monitoring?
- (2) What environmental regimes should be accounted for in survey designs?
- (3) How are resources naturally distributed across the study regions being examined?

Answers to these questions provided a foundation for structuring monitoring designs, and for efficiently focusing upon the resources of interest. This background set the stage for developing long-term monitoring designs that are focused upon answering questions such as:

- (4) Which coral-reefs are most resistant to disturbance regimes, including *Acanthaster planci* outbreaks, typhoons, and climate-induced bleaching?
- (5) Which coral reefs recover fastest following disturbance?

Eventually, the results from this type of long-term monitoring program will identify one or more locales where expected resistance or recovery is not occurring. In this sense, ‘surveillance’ monitoring paves the way for ‘targeted’ monitoring, that is designed to answer critical questions directly related to management decisions, such as:

- (6) How do watershed pollution and fishing pressure relate to surveillance monitoring trends depicting disturbance and recovery?
- (7) What are acceptable pollution and fishing limits needed to ensure sustainable coral-reef resources through time?
- (8) Where are negative trends expected through time due to localized stressors, and what is their magnitude?
- (8) Are MPA networks successful in protecting fish stocks at local and regional scales, and do they translate improved ecosystem health?

Collaborative monitoring –

After refining monitoring-to-management frameworks and associated survey designs for FSM and RMI monitoring programs, PMRI began conducted monitoring alongside the local programs. This intensive effort has yielded a consistent set of monitoring data across the region that encompasses 10 sites on each main island of the Federated States of Micronesia and the Republic of the Marshall Islands, sampled along gradients of human influence. Data are currently being deposited in the Micronesian Challenge database, housed within the Palau International Coral Reef Center, for long-term use. In addition, many general summaries of the data have been compiled to highlight the long-term potential of these datasets (Figure 2), and formal analyses are scheduled during year 2 of the cooperative agreement. Present outcomes and products include:

- Summary power points that describe the current state of the reefs for numerous jurisdictions, and Micronesia as a whole (see attached .ppt for Kosrae and presentation provided to the Association of the Pacific Islands Legislature during their 2012 annual meeting).
- Step-by-step guides to help local programs improve the quality of their fish data collection. These guides compare and contrast expert fish observer datasets with datasets collected by local staff across Micronesia. Guidance documents aim to isolate upon common problems and limitations that local programs face in order to improve the capacity for the future generation of high-quality data (see attached summary document for Pohnpei).

- Standardized datasets pertaining to benthic assemblages, coral communities, and fish abundances across Micronesia (see attached summary databases for Chuuk).
- Localized analyses that summarize the efficacy of key management actions such as marine protected areas (Figure 3). Currently, several marine protected areas across Micronesia are showing minimal effectiveness. Highlighting such trends will be key to improve local buy-in and enforcement policies.
- Regional analyses that summarize key linkages between fish, benthic and coral assemblages in the form of trophic cascades (Figure 4). Such analyses highlight that apex predators and humans have opposite roles in structuring Micronesia’s coral-reef food webs. Apex predators, such as sharks, served to increase the mean size of herbivore/detritivore fish assemblages (Figure 5), thereby increasing grazing and facilitating a more diverse coral assemblage. In contrast, humans served to destabilize coral-reef food webs, and cause negative trophic cascades that increase algal and heterotrophic substrates, and reduce coral diversity. These initial analyses will be formally developed during FY 13.

IV. Conclusions and Future Directions

The present project has facilitated the expansion and standardization of coral-reef monitoring programs across Micronesia through expert collaborations and tangible products. Through continued efforts such as these, the overall goals of PMRI are to maintain dedicated relationships that ensure the development of high-quality, standardized monitoring datasets, and begin to translating their meaning. Clearly there is a strong need to translate the ensuing data assessments into compelling products that will aid decision making and improve management effectiveness. As this process develops through efforts such as the Micronesian Challenge, standardized, high-quality monitoring data will continue to provide the knowledge-base for decision making and reporting progress.

V. Figures

Figure 1. An example of the monitoring program re-design process undertaken for all programs. Coral-reef monitoring program designs across Micronesia were initially focused upon evaluating only marine protected areas (Chuuk shown below). However, programs were re-designed to evaluate a larger suite of pressing management questions that existed, inclusive of MPA’s.

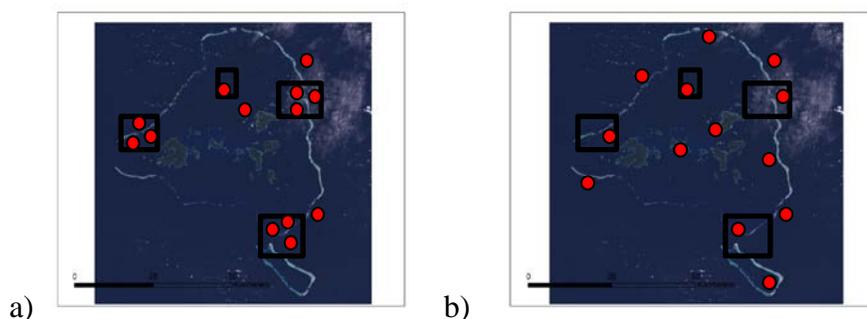


Figure 2. Standardized coral-reef monitoring data collected across Micronesia. Here, fish biomass and trophic-level trends across Micronesia are shown from high to low biomass (left to right). SPC refers to stationary point counts, a technique in which the observer records fish within a specified radius (5m) for a pre-defined amount of time (3-min).

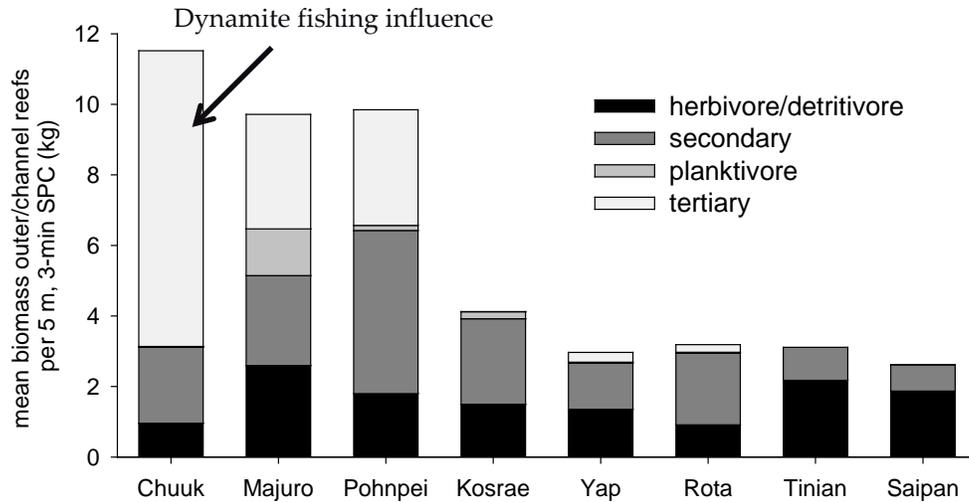


Figure 3. Results from fish assemblage assessments conducted on the inner reefs in Pohnpei within marine protected areas (Mwand and Sapwitik) and a reference site (Palikir). The results indicate a limited effectiveness of the two MPA surveyed. However, beyond highlighting the undesirable trend, professional results such as these are needed to inform decision makers and communities, and sway opinion for improving compliance policies. SPC refers to stationary point counts, a technique in which the observer records fish within a specified radius (5m) for a pre-defined amount of time (3-min).

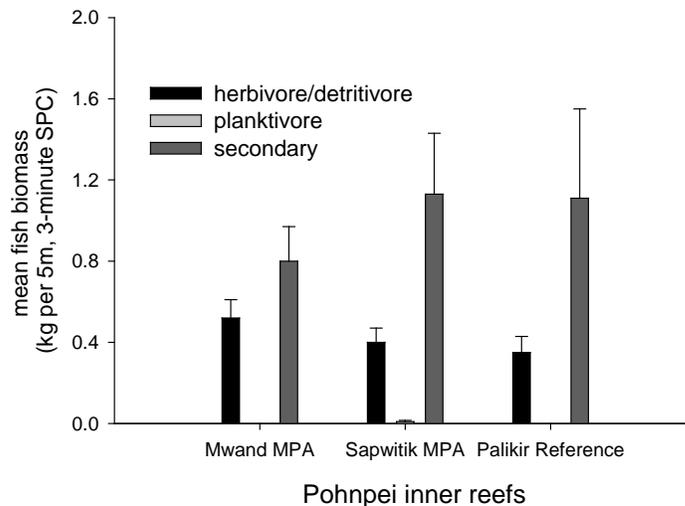


Figure 4. Regional models that have been developed to show the prevalence of trophic cascades across Micronesia. Two significant cascades exist. First, apex predators serve to protect herbivore/detritivore fish assemblages, thereby improving grazing and reducing algal substrates, and enhancing the diversity of corals (standardized correlation coefficients are shown next to arrows, path analyses were used to indicate the significance of the overall cascade of interactions). Second, humans play an opposite role and serve to reduce fish populations, increase algal substrates, and decrease coral diversity.

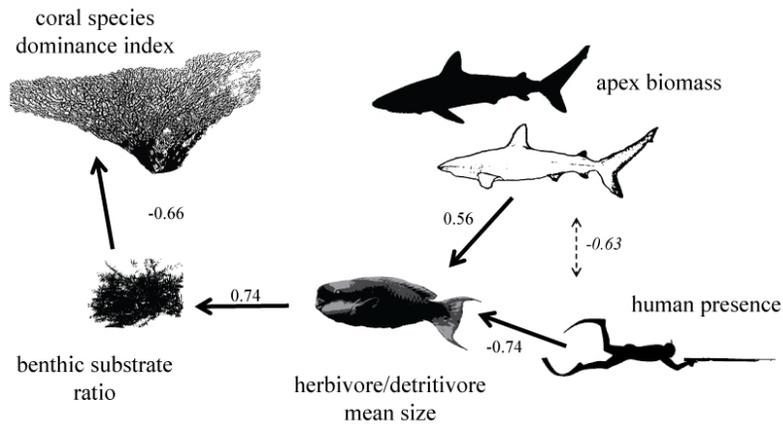


Figure 5. Relationship between apex predator biomass and mean herbivore/detritivore body size across Micronesia. This relationship represents a key finding that underpins the overall trophic cascade noted above.

