Yap State Coral Reef Monitoring Program 2012

Implemented by the Yap Community Action Program

NOAA FY2011 Contract No. NOAA2011-004
Final Report

Executive Summary

The 2012 Yap State Coral Reef Monitoring Program was successfully implemented by the Yap Community Action Program (Yap CAP) in the summer of 2012. Basic data analyses for fish and macro-invertebrates have been performed with the same pending for benthic photographs. This year's program built on previous years' data collection – monitoring was conducted in locations with previous baseline data either from Rapid Ecological Assessments (REAs) or from previous monitoring efforts. Future directions for the program will ideally include the dissemination of data and reports to the relevant communities around Yap State to aid in the management of their marine resources.

Project Description

The Yap State Coral Reef Monitoring Program is executed by Yap CAP with the long term goal of characterizing reef community development and assessing the impacts of various stressors on the state's reefs. Baseline data is established at different sites around Yap Proper and coral reef health at these sites is monitored over time by evaluating specific indicators – counts of fish and macro-invertebrates as well as determining percent benthic substrate cover. Ultimately, this information will enable local managers and communities to document changes and make decisions regarding appropriate courses of action to minimize adverse impacts on reef communities around the state and to help promote conservation efforts.

Accomplishments and Evaluation of Project

Project funds were effectively utilized to support the 2012 Yap State Coral Reef Monitoring Program. Twenty (20) sites were selected based on the availability of 2011 REA data and previously monitored sites and were surveyed this year by the coral reef monitoring team. Data processing and analysis has commenced (refer to activity report section) in regards to fish and macro-invertebrate data. Benthic substrate cover data analysis is still pending due to a lack of resources. Furthermore, materials, supplies, equipment, fuel and stipends for community representatives have been funded under the grant.

Coral Reef Conservation/Management

The data collected from the Coral Reef Monitoring Program has the ultimate goal of providing insight to making sound and informed management decisions regarding the state's marine resources. Communities have the opportunity to utilize the data resulting from the program to determine which course of action will best suite their coral reef conservation and management efforts. Since the inception of the program, Yap CAP has played an integral role in helping communities realize their goals and objects in conserving their coral reefs; examples include the Nimpal Channel Marine Conservation Area (MCA), the Ngulu Atoll Marine Managed Area (MMA), the Reey MCA, the Tamil MMA, the Balabat Marine Conservation Project and the West Fanif MCAs.

Activity Report

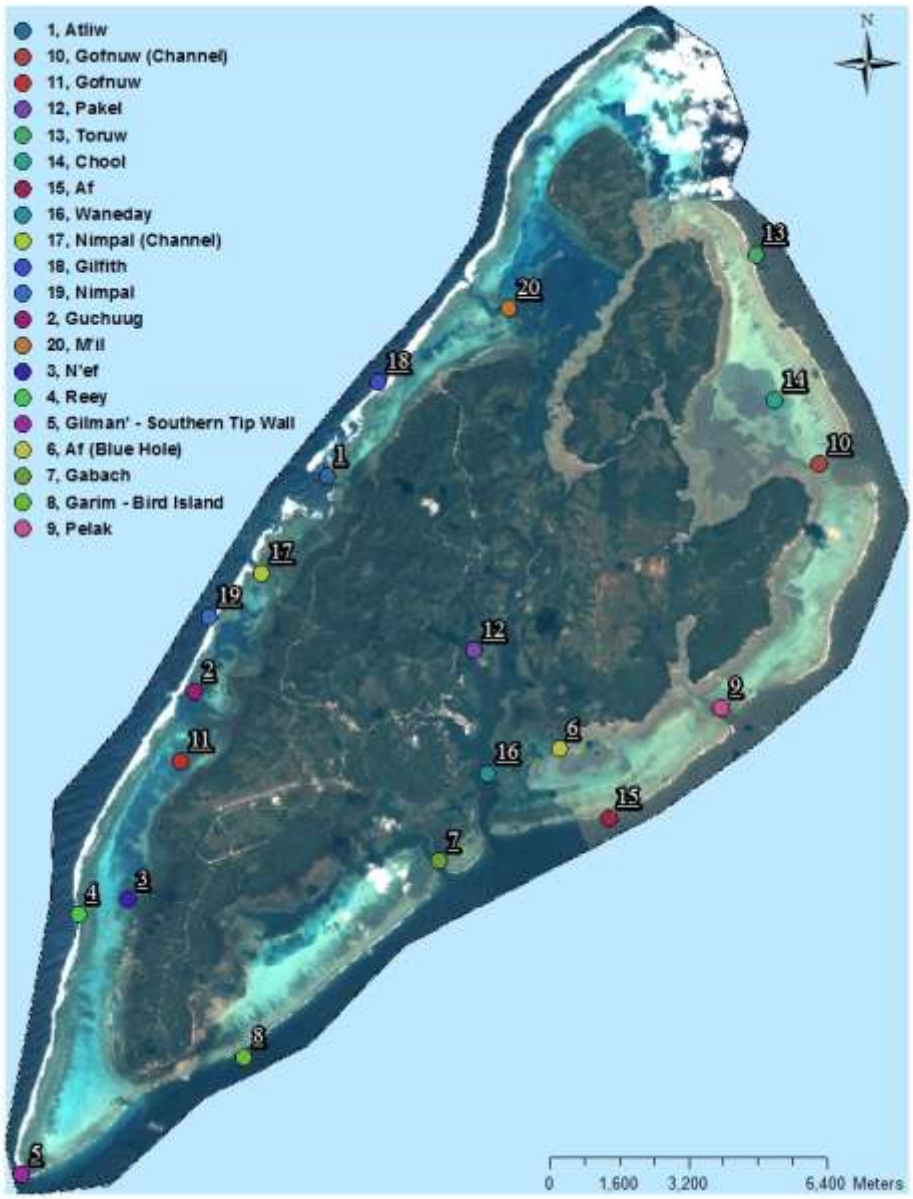
The Yap State Coral Reef Monitoring Program was implemented by Yap CAP's Environment Program during the fourth quarter of the fiscal year 2012. Monitoring typically takes place during either the third or fourth quarter of each fiscal year to take advantage of calm seas and weather. Reef monitoring and data collection were initiated during the week of July 23 at twenty monitoring sites. Eleven (11) of these sites were previously established monitoring sites – Atliw, Gachug, Reey, Gabach, Pelak, Gofnuw (Channel), Gofnuw (Outer Reef), Nimpal (Channel), Nimpal (Outer Reef), Gilfith and M'il. The other nine (9) sites were recommended by Dr. Peter Houk from the Pacific Marine Resources Institute (PMRI) to provide a more comprehensive picture of the State's coral reef health – N'ef, Gilman' Southern Tip Wall, Af (Blue Hole), Garim – Bird Island, Pakel, Toruw, Chool, Af (Outer Reef) and Waneday. Refer to Table 1 for the site chart. Community based marine conservation areas, both established and works in progress, monitored this quarter include the Reey MCA, Nimpal MCA, West Fanif MCA, the Tomil MMA and the Rull MCA. Refresher training dives were held on the 19th of July and a team of 10 divers with 2 support members (boat crew) conducted all surveys this year. With the exception of the new Environment Program Development Officer (EPDO), all were veteran members of the coral monitoring team made up of trained Yap CAP staff and community representatives.

Table 1 – Monitoring site chart for the 2012 Yap State Coral Reef Monitoring Program.

Island	Site ID on Map	Site Name	Reef Type	Depth	Coordinates		Number of Site Visits	Visit Date(s) *
					Latitude	Longtitude		
Yap Proper	1	Atliw	Channel	3-5m	N 09° 33' 56.7"	E 138° 05' 47.3"	2	July 25, 2012 & July 27, 2012
Yap Proper	2	Gachug	Channel	3-5m	N 09° 31' 14.0"	E 138° 04' 08.8"	2	August 6, 2012 & August 29, 2012
Yap Proper	3	N'ef	Blue Hole	3-5m	N 09° 28' 37.6"	E 138° 03' 20.0"	1	August 13, 2012
Yap Proper	4	Reey	Outer Reef	7-9m	N 09° 28' 26.2"	E 138° 02' 42.2"	1	July 27, 2012
Yap Proper	5	Gilman' - Southern Tip Wall	Outer Reef	7-9m	N 09° 25' 10.6"	E 138° 02' 01.0"	1	August 13, 2012
Yap Proper	6	Af (Blue Hole)	Blue Hole	3-5m	N 09° 30' 33.1"	E 138° 08' 45.0"	1	August 10, 2012
Yap Proper	7	Gabach	Channel	3-5m	N 09° 29' 08.2"	E 138° 07' 14.7"	1	July 23, 2012
Yap Proper	8	Garim - Bird Island	Outer Reef	7-9m	N 09° 26' 39.8"	E 138° 04' 48.6"	1	July 23, 2012
Yap Proper	9	Pelak	Channel	3-5m	N 09° 31' 07.0"	E 138° 10' 47.5"	2	August 1, 2012 & August 31, 2012
Yap Proper	10	Gofnuw (Channel)	Channel	3-5m	N 09° 34' 08.5"	E 138° 12' 00.3"	1	August 1, 2012
Yap Proper	11	Gofnuw	Outer Reef	7-9m	N 09° 33' 23.027"	E 138° 12'49.400"	1	August 27, 2012
Yap Proper	12	Pakel	Channel	3-5m	N 09° 31' 46.5"	E 138° 07' 39.9"	1	August 10, 2012
Yap Proper	13	Toruw	Outer Reef	7-9m	N 09° 36' 45.8"	E 138° 11' 10.6"	1	August 1, 2012
Yap Proper	14	Chool	Blue Hole	3-5m	N 09° 34' 48.8"	E 138° 11' 26.0"	2	August 6, 2012 & August 31, 2012
Yap Proper	15	Af	Outer Reef	7-9m	N 09° 29' 41.7"	E 138° 09' 22.9"	1	July 23, 2012
Yap Proper	16	Waneday	Channel	3-5m	N 09° 30' 14.6"	E 138° 07' 51.2"	1	August 10, 2012
Yap Proper	17	Nimpal (Channel)	Channel	3-5m	N 09° 32' 44.6"	E 138° 05' 06.4"	2	July 25, 2012 & July 27, 2012
Yap Proper	18	Gilfith	Outer Reef	7-9m	N 09° 35' 07.4"	E 138° 06' 25.8"	1	July 25, 2012
Yap Proper	19	Nimpal	Outer Reef	7-9m	N 09° 32' 30.10"	E 138° 04' 32.58"	1	August 27, 2012
Yap Proper	20	M'il	Channel	3-5m	N 09° 36' 03.4"	E 138° 08' 03.8"	2	August 15, 2012 & August 29, 2012

* Second dates only for picture quadrats (benthic substrate)

Figure 1 – Monitoring site map for the 2012 Yap State Coral Reef Monitoring Program



Monitoring site design for this year was developed by the previous EPDO in association with Dr. Peter Houk. Current protocol was intended to more effectively and efficiently meet the objectives of the monitoring program as well as to take into consideration the limited time, personnel and other resources available. As a result this years' monitoring site design resulted in a selection of sites that covered a wider and more representative area of the State's reefs and did not place emphasis solely on the marine protected/conservation areas and control/reference sites. Additionally, the Palau Protocol for Monitoring Marine Protected Areas as developed by the Palau International Coral Reef Center (PICRC) was utilized and parameters were recorded using the indicated methods and protocols; refer to Table 2. The fish surveyor performs the fish count using the developed list of locally and commercially significant fish species followed by one diver laying the transect tapes. Two teams of two benthic surveyors take quadrat pictures along different transects (e.g. transects 1 and 2 for one team and

transects 3, 4 and 5 for the other team) while two macro-invertebrate surveyors perform their counts along all five (5) transects, also using a developed list of locally and commercially significant invertebrate species.

Table 2 – Monitoring protocol/method based on PICRC developed protocols as detailed in the Protocol for Monitoring marine Protected Areas Protected Areas Network adopted by the Ministry of Natural Resources, Environment and Tourism (Republic of Palau) On April 2, 2012.

Parameter/Indicator of Reef Health	**Measurable Indicator**	**Survey Protocol/Method**
Target Reef Fish Species Richness/Diversity	Species density (no./m^2) Species size (cm)	Underwater visual count using SCUBA: - Five (5) fifty meter (50m) transects. - Survey area: five meters (5m) wide on both sides of each transect. - One (1) station per dive site. Three-five meters (3-5m) depth in inner reefs and channels; seven-nine meters (7-9m) depth in outer reefs.
Target Macro-Invertebrate Species Richness/Diversity	Species density (no./m^2)	Underwater visual count using SCUBA: - Five (5) fifty meter (50m) transects. - Survey area: five meters (5m) wide on both sides of each transect. - One (1) station per dive site. Three-five meters (3-5m) depth in inner reefs and channels; seven-nine meters (7-9m) depth in outer reefs.
Benthic Community Species Richness/Diversity	Percentage (%) coral cover Percentage (%) Benthic cover (sand, rubble, carbonate, algae, etc.)	Photo quadrat method by SCUBA: - Five (5) fifty meter (50m) transects. - Survey area: every meter interval along one side of each transect using a 0.5m x 0.5m quadrat. - One (1) station per dive site. Three-five meters (3-5m) depth in inner reefs and channels; seven-nine meters (7-9m) depth in outer reefs.

All data have been collected and maintained at the office – fish, macro-invertebrates and benthic photographs; refer to attached Excel files for the raw data. Fairly basic analyses have been conducted for the fish and macro-invertebrate data with the processing and analysis of benthic substrate data still pending. Without examining the benthic data, we remain unable to get a complete picture of coral reef health in terms of substrate composition and the inter-relationships between that and counts of fish and macro-invertebrates. That said however, the fish count and macro-invertebrate data will at least provide a simple picture of trends between sites. Historical data does exist for some of the sites surveyed this year; however, there are still issues with those data in regards to completeness.

This year's fish count data offers a picture of overall fish biomass as measured between sites, refer to Figures 2 and 3. Among the 20 surveyed sites, it would appear that Nimal (Channel), Gilfith, Gilman' – Southern Tip Wall, Nimpal, Reey and Toruw all show relatively large mean fish biomass (kg). Additionally, there seems to be larger biomass in the MCAs relative to non-MCA sites. Figure 3 also depicts a possible relationship whereby secondary consumers seem to make up significant portions of

the biomass in MCA sites; note however that no statistical significance has been calculated at this point. Further visual examination of these 6 sites (Figure 4) show that large-bodied snappers (i.e. *goychaf*, *gadaw*), large-bodied parrotfish (i.e. *gamiygul*, *alabal*), and large-bodied acanthurids (i.e. *math*) make up a disproportionate part of the fish biomass – most likely owing to their larger sizes. Additional inspection (Figure 5) shows that Nimpal outer reef had a large number of *gadaw* – a secondary consumer (benthivore) – and this may be due to Nimpal's long-term establishment of its conservation area. Specific reasons as to why there would be more of this particular secondary consumer will require supplementary research into species and location characteristics.

Figure 2. Overall fish biomass by site and reef type.

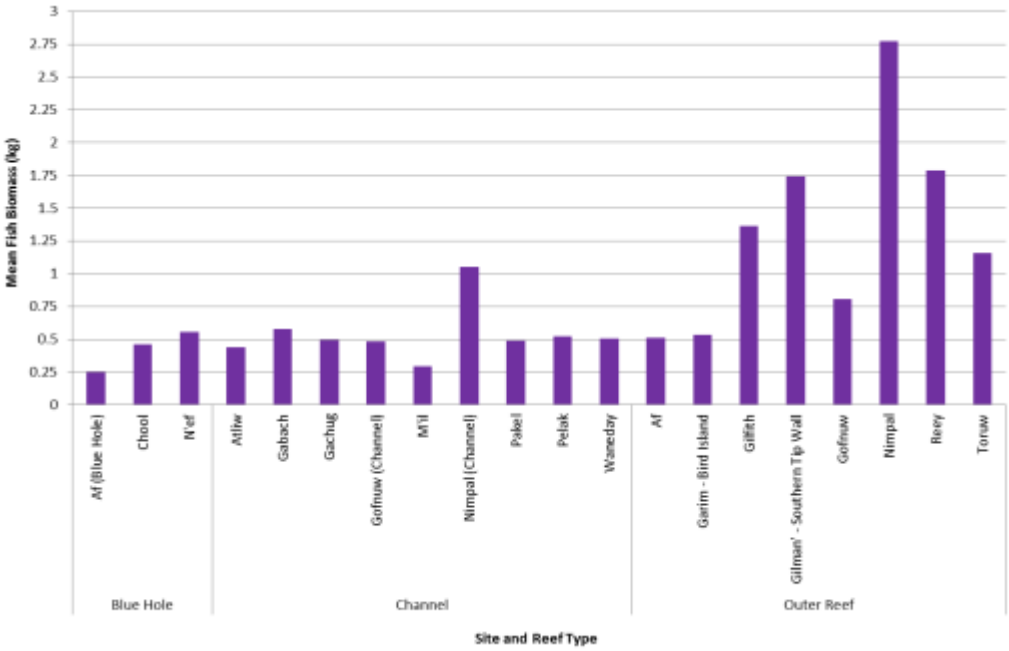


Figure 3. Overall fish biomass by site, reef type, MCA status and trophic level

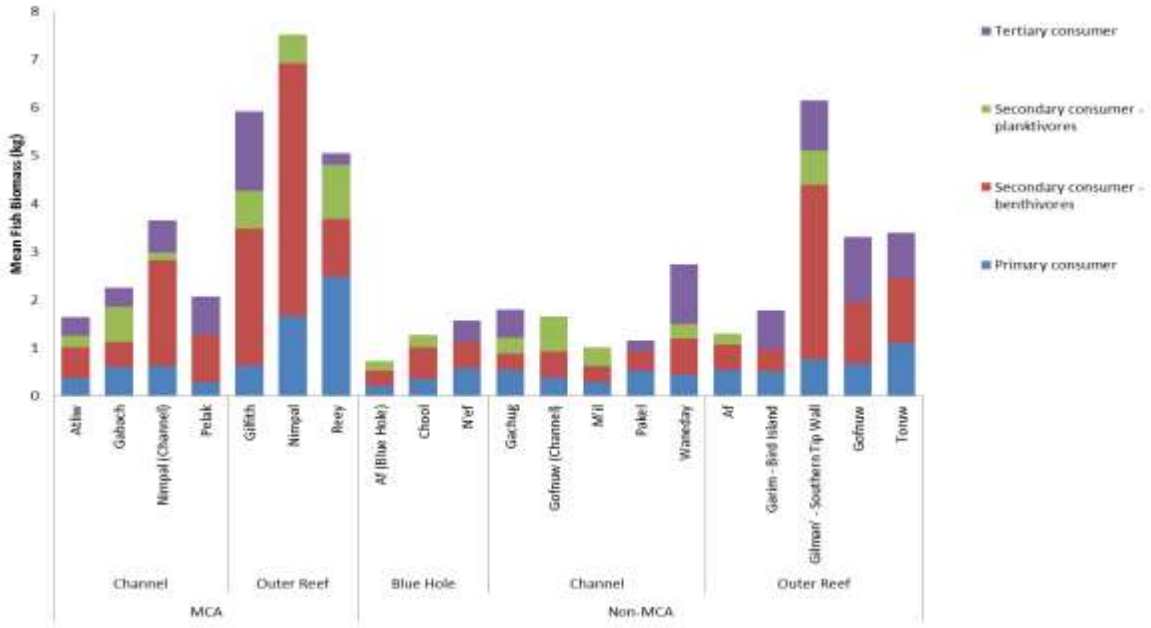


Figure 4. Fish biomass according to site, fish grouping and Yapese name.

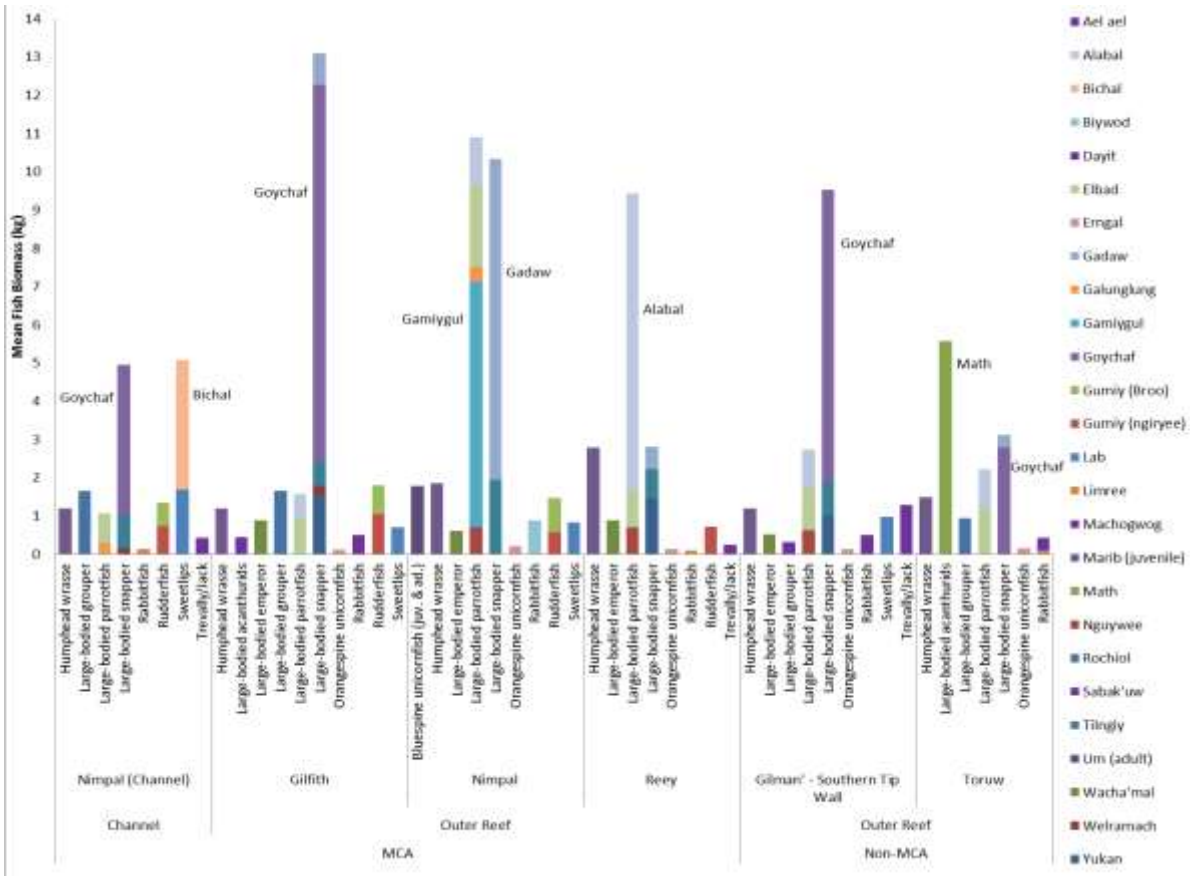
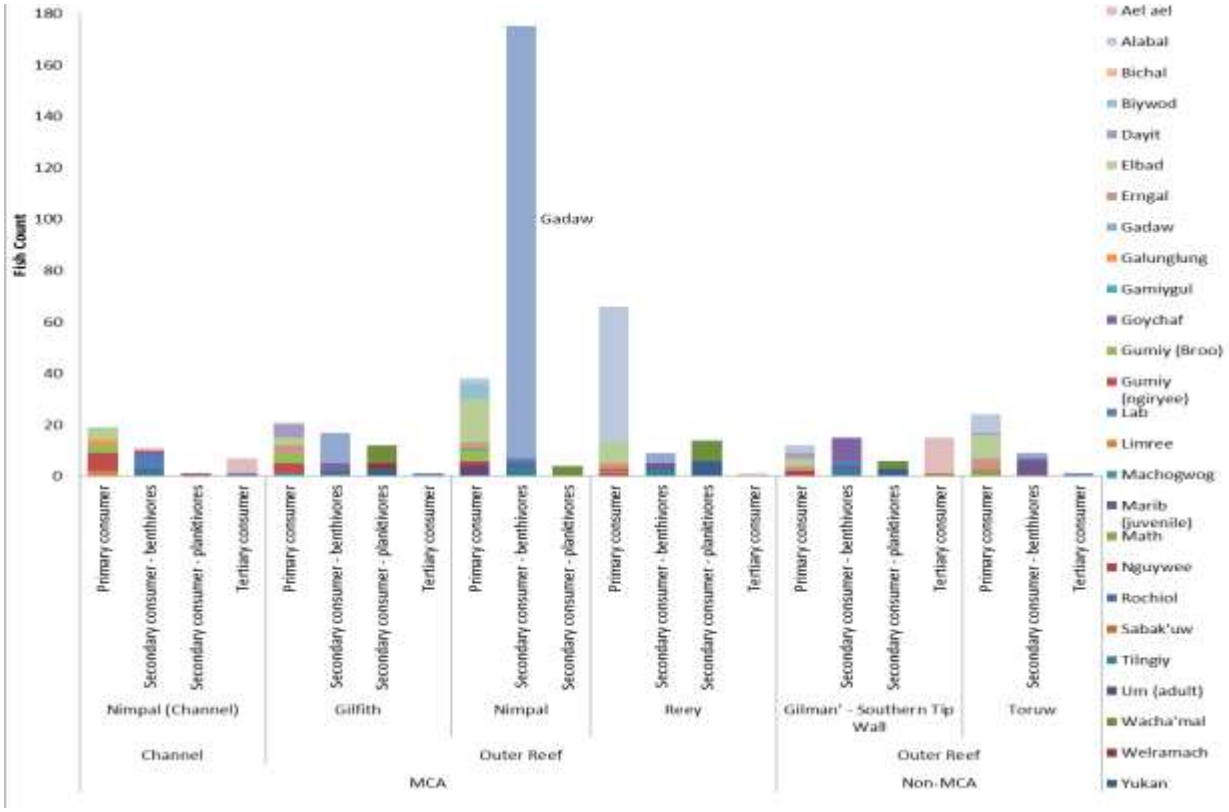


Figure 5. Fish count according to site, trophic level and Yapese name.



In examining trends among reef types, visual inspection shows larger fish biomass in the outer reefs relative to the channels and blue holes (Figure 6). Possible reasons include easier access to fishermen in terms of currents, wave action and proximity to land. Figure 7 shows that while blue holes are relatively sparse, among all three reef types primary and secondary consumers (benthivores) make up most of the biomass in each area. In looking at the count of fish (Figure 8), there are large numbers of large-bodied parrotfish and snappers in the outer reefs with fewer numbers in the channels and the blue holes. The large-bodied parrotfish in particular (i.e. gamiygul) has seen a historical trend (based on fishermen accounts) of moving into deeper waters off-shore and away from high-impact fishing areas such as the blue holes.

In terms of macro-invertebrates, counts of sea cucumbers are highest in areas of higher sedimentation, run-off, etc, for example the Waneday channel (human impacts); trochus counts are highest on the outer reefs (deeper with high wave action). Refer to Figure 9.

Figure 6. Mean fish biomass by reef type.

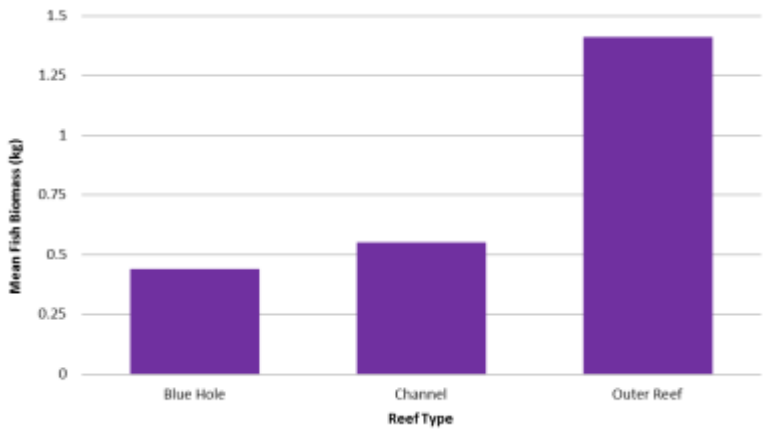


Figure 7. Mean fish biomass by reef type, trophic level and Yapese name.

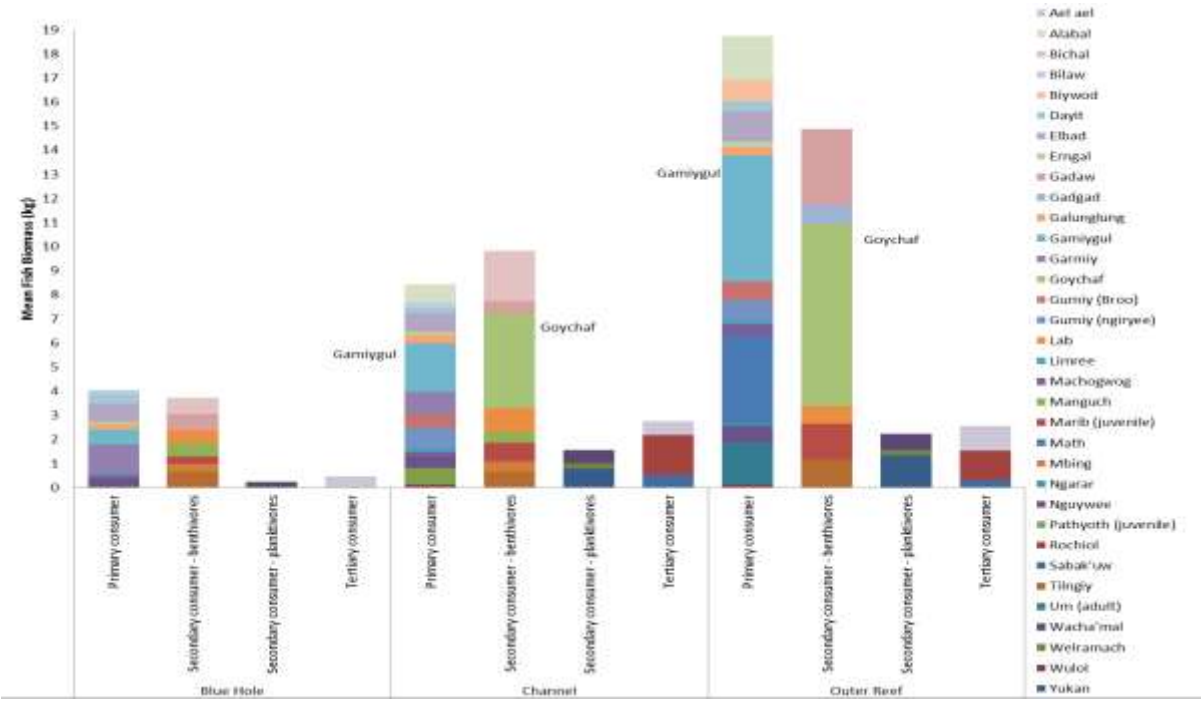


Figure 8. Fish count by reef type, trophic level and fish grouping

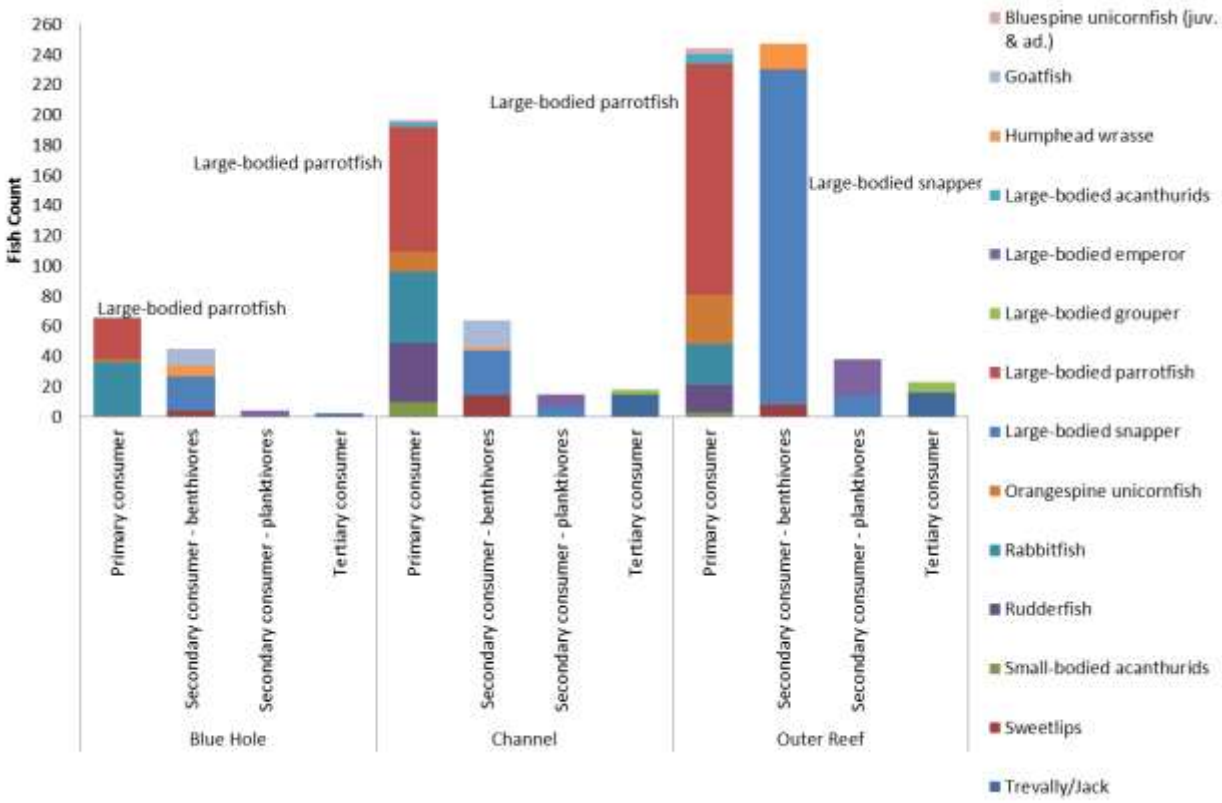
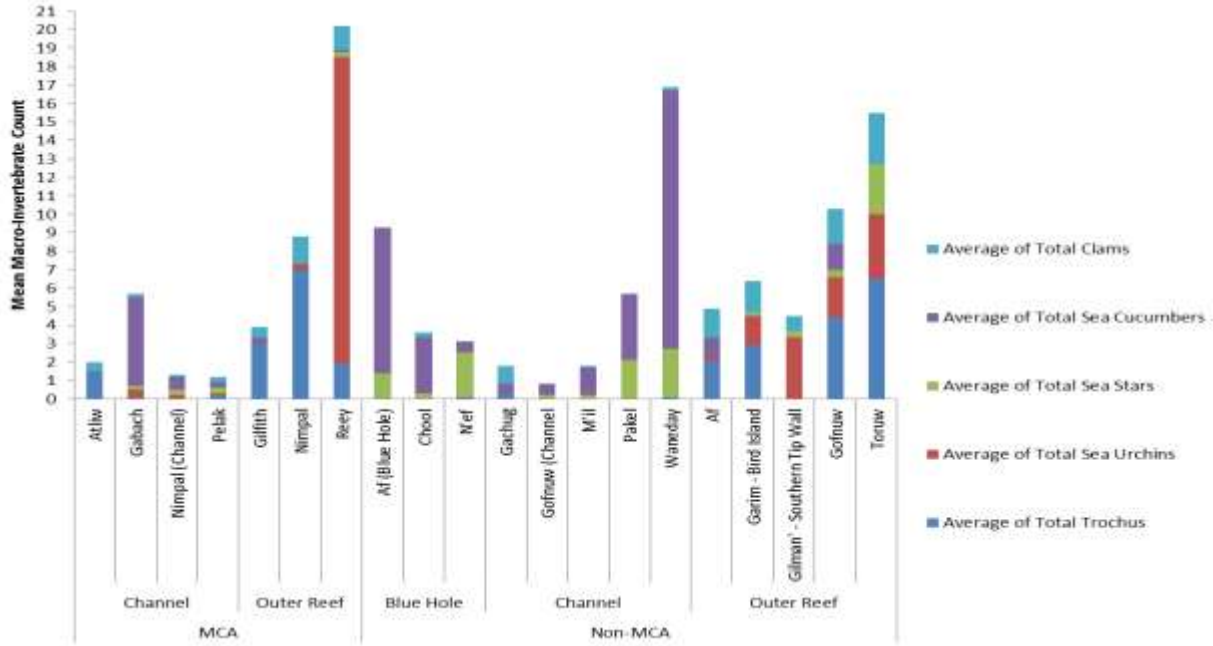


Figure 9. Macro-invertebrate count by site, reef type, MCA status and major macro-invertebrate type.



Challenges and Delays

The execution of the monitoring program this year did not come without challenges and delays. Weather conditions typically require that monitoring take place during the summer to take advantage of more favorable conditions and this year was not an exception. Additionally, it took some time to review, revise and approve the contract before the funds could be utilized to supplement the monitoring program's operations. Furthermore, the former EPDO Vanessa Fread had officially resigned the previous quarter (3rd) which, combined with the departure of another coral reef monitoring team member off-island for other employment opportunities necessitated the decision to not perform coral population quadrat surveys as was done in previous years. This survey required at least two (2) very capable divers to take six (6) samples along each transect utilizing 1m x 1m quadrats. Also, one municipality, Rumung, closed its waters to monitoring by Yap CAP this year; as a result, we are lacking 2012 data for much of the northern part of Yap Proper (the four main islands). Finally, the Environment Program continues to be significantly under-staffed considering the number of projects and activities being managed. This is not a recently realized situation and one that has been compounded by the hiring of the new EPDO whose training required significant time to be brought up to speed with the Environment Program's roles and operations. During this quarter as well, quite a few community engagement projects have begun to start up again. As such, data processing and analysis only took place the week of November 26, 2012 and benthic cover still remains to be analyzed.

In light of the above mentioned challenges however, the program continues to move forward. Activities that remain to be completed in regards to the 2012 coral monitoring program include the following:

- Data Analysis
  - Submit 2012 benthic quadrat photographs to PICRC for analysis (pending receipt of external hard drives)
  - Complete analysis of previous years' data

- Coral Reef Monitoring 2013
  - Develop coral reef monitoring schedules for training. Approach potential new team members from communities and state agencies.
  - Develop coral reef monitoring schedules for data collection.
  - Continue to work with outside partners who are assisting with the project in adjusting research design - sites, methodologies and data collection, processing and analyses.

As the program progresses into the future, training for community members will continue on various aspects of monitoring and data entry. On-going consultation with PICRC and Dr. Peter Houk from PMRI will be utilized to adjust research design – sites, methodologies and data collection, processing and analyses.