



**Western
Pacific
Regional
Fishery
Management
Council**

June 29, 2012

Ms. Elizabeth Fairey
Program Officer
NOAA Fisheries
Office of Habitat Conservation
1315 East West Highway
Silver Spring, MD 20910

Dear Ms. Fairey,

Enclosed is the Final Report on the activities that occurred under the Western Pacific Regional Fishery Management Council's Coral Reef Conservation Grant Award No. NA10NMF4410061 between October 1, 2010 and March 31, 2012. These activities are reported under the general categories of meetings and travel, contracts, equipment, supplies and other.

Award Details:

Award Number: NA10NMF4410061
Program Officer: Elizabeth Fairey, 301-427-8632, Liz.Fairey@noaa.gov
Office: Fisheries Habitat Conservation Program Office (HCPO)
Award Period: 10/01/2010 - 03/31/2012
Project Title: FY 2009 Assessment and Management of Western Pacific Coral Reef Ecosystem Resources and Habitat
Recipient Name: Western Pacific Regional Fishery Management Council
Investigator(s): None Designated

Report Details:

Report Type: Project Progress Report
Reporting Period: 10/01/2010 - 03/31/2012
Final Report: Yes
Report Due Date: 06/30/2012

Sincerely,

Kitty M. Simonds
Executive Director

**Project Progress Report
for
Grant NA10NMF4410061
(Projects to Amend Coral Reef FMPs)**

Reporting Period October 1, 2010 to March 31, 2012

1. Travel

a. US Coral Reef Task Force

The Council, during this reporting period, used funding provided through the grant for the Council's island coordinator on Guam and a Council Member to travel to Saipan for the 24th meeting of the USCRTF. The Council's coordinator in Guam worked with the coordinator in CNMI to provide education and outreach on the Council's coral reef program and projects to the USCRTF participants.

Funding was also used to provide Council participation in the 25th meeting of the USCRTF in Washington D.C. in February 2011. The Council Chair was able to provide comments to the USCRTF on important coral reef fishery issues being faced by the Council in the Western Pacific region, particularly those in Guam with the impending military buildup. Dredging, training exercises, and other military build-up related issues are a concern for Guam residents who are heavily dependent upon their natural resources in the coral reef ecosystem for sustenance and commercial activities.

b. Other Coral Reef Related Meetings

The Council proposed to utilize funding for providing a presentation on the Council's work at the "Ecosystems 2010" conference. However, due to the timelines for request for proposals being due ahead of notification of the award, the Council was not able to participate in this conference. The Council used funds to promote the Council's coral reef program at the International Coral Reef Symposium in July 2012, providing a report on developing Annual Catch Limits for coral reef species in the Western Pacific Region.

2. Contracts

a. Project 1- Coral Reef Science and Management Capacity Building

Continuing the Council's effort to build capacity in the region and utilize its partnerships with academic institutions. During this reporting period, the Council put out a Request For Proposals on the following projects and selected contractors for each of the projects..

i. Hawaii Coral Reef Fish Market Study

The Council worked with NMFS Pacific Islands Fisheries Science Center staff to develop a scope of work and select a contractor for this project. The goal of this project was to survey local markets that sell coral reef associated species to understand the market dynamics, systems and channels for coral reef species in Hawaii. The study will be used to fill in the gaps in the Council's understanding of the extent and importance of coral reef fish.

Utilizing social science methodologies to capture data on coral reef species at the dealer level, the contractor interviewed coral reef fishery dealers on Maui, Kauai, Oahu, and Hawaii Islands. A total of 113 dealers were interviewed in-person to collect general dealer information, retailer

reliance on coral reef fish, the distribution and imports, general market trends, and reporting and management. While many of the dealers may have been captured through this survey, the extent of the informal market is unknown.

Results of the study show that coral reef fish sales take place in multiple contexts within the state: Formal fish sales occur between fishermen and a licensed dealer; informal sales and gifting takes place between fishermen and their networks of friends, family, and coworkers; informal sales also occur between fishermen who may not have a commercial marine license and the general public through roadside sales. The market size and significance on each island varies, with the largest markets for coral reef fish located in Honolulu and Waipahu (Oahu) and in Kahului and Wailuku (Maui). The majority of distributors purchased coral reef fish directly from fishermen, with Akule (bigeye scad) and Opelu (mackerel scad) being the species distributed to grocery store chains the most. Oahu distributors have greater access to supply and are able to purchase larger quantities of reef fish than the other island distributors.

Those stores that purchase directly from fishermen have close relationships, compared to the distributor-supermarket relationships. Dealers also reported that they obtain less than 15% of their revenue from sales of coral reef fish and only a few reported over 50% of total revenue from coral reef fish in 2011. The study also notes that in the rural areas, coral reef fish are harder to find in the stores because “local people fish for themselves for reef fish species.”

One outcome of the study was that the dealers reported preferences by their customers, particularly for “hook-caught” fish (because of the appearance and quality over gill nets or spears), as well as ethnic preferences for coral reef fish. The study also notes that these strong ethnic preferences appear on both the consumption and supply-side of the market, and notes that there is a relationship between ethnicity and economic well-being: as an ethnic group’s longevity in the islands increased, along with their economic well-being, their preferences shift to include more pelagic and bottomfish species.

ii. Coral Reef Spearfishing Assessment in the Marianas Archipelago

This project is being developed to characterize the coral reef spearfishing fishery in the Marianas (Guam and CNMI) to provide information on the types of gears, catch, etc., that can provide the Council with information on this sector of the coral reef fishery. Spearfishing is a traditional fishery in the Marianas, and the major participants in the fishery are a tight-knit community upon itself. It is assumed that outside of this tight-knit group, the spearfishery is composed of individual subsistence fishermen that do not take as many fish. It is also assumed that spearfishermen are employing advanced techniques and gear that allow them to fish deeper, longer, and for a larger variety of fish. These assumptions need to be verified and characterized to provide much needed information on the fishery for possible future allocations dealing with Annual Catch Limits and Catch Shares, both of which would necessitate an amendment to the Mariana Archipelago Fishery Ecosystem Plan.

A contractor was selected to analyze the existing data and literature regarding the spearfishing fishery in the Marianas and determine any patterns or trends in the existing data. The study also looked at the components involved in the fishery, including the number of participants and gears, as well as the type of species caught and the areas where they are caught.

Results of this study have provided valuable information for the Council to use in considering regulations that may affect spearfishing when developing amendments to the Marianas FEP. While there are some fishermen that use gears and equipment that are more “modern” and similar to that which is used in Hawaii and elsewhere in the United States, there is a large

amount of people (particularly ethnic immigrants) that use hand-made spearguns, fins, and goggles. There is also the use of the “Hawaiian sling” in the Marianas, being cheaper and easier to use than spearguns.

Spearfishing is done at both night and day with most of the spearfishing occurring on the reef flat/slope/edge and within the lagoons and the channels at night, and offshore during the day. While SCUBA spearfishing is banned in the CNMI, there is some use of SCUBA in the Guam spearfishing fishery, most often at night to catch large fish that are deep on the reef.

Estimates of spearfishers are difficult to determine because of the times (night) and locations (from shore or boat), but conservative estimates for Guam number spearfishermen at around 150 (however many traditional/subsistence fishermen may also claim to be spearfishermen as well), with around 20% being primarily spearfishermen. In CNMI it is even more difficult because of the number of islands and their remoteness. Surveys of each of these islands show that there are only a handful of fishermen on each of the islands with many of them considering themselves to be subsistence/recreational spearfishermen, and the most numbers of spearfishermen are on Saipan.

While small in number, the spearfishery makes up the primary catch of coral reef fish in the CNMI, as many of the net gears are specifically prohibited. Estimates of over 100,000 pounds of commercially-speared coral reef fish for 2011 shows that spearfishermen are a valuable portion of the reef fish market chain with many sales going either directly to consumers or value being added through wholesale markets and restaurants. Guam spearfishing fishery is more of a subsistence fishery with fewer market channels and many more imported fish from Micronesia. This could be reflective of the greater development and less available time for Guam’s fishermen to provide fish for the markets.

iii. Development of Stock Assessment Models to Aid in the Development of Annual Catch Limits in the Western Pacific

The Council has been working with Hawaii Pacific University (HPU) to identify students to develop stock assessment models. A previous project funded under the Council’s coral reef grant looked at Kona Crab (*Ranina ranina*) and was recently recommended for additional modeling and review by the State of Hawaii and NMFS. The Council, in conjunction with developing Annual Catch Limits (ACLs) for coral reef species in the region, looked at the top species caught in each of the region and developed a list of species to focus its attention on. The species for Hawaii includes:

- *Myripristis spp.* (Menpachi/Uu-Bigeye Soldierfish) [as a complex]
- *Parapeneus porphyreus* (Kumu-whitesaddle goatfish) [endemic to Hawaii]
- *Scarus rubroviolaceus* (Palukaluka-Ember Parrotfish)
- *Chlorurus perspicillatus* (Uhu uliuli?-Spectacled Parrotfish) [endemic to Hawaii]
- *Acanthurus dussumieri* (Palani-Eyestripe Surgeonfish)
- *Naso unicornus* (Kala-Unicornfish)
- *Albula glossodonta* (Oio-bonefish)
- *Parupeneus cyclostomus* (Moana kea-blue goatfish)
- *Parupeneus bifasciatus* (Munu-doublebar goatfish)

The Council used this list to work with the State of Hawaii and HPU to determine which species may be most appropriate for the development of a stock assessment model. This project

looked at an endemic goatfish to Hawaii, *Parapeneus porphyreus* (Kumu, or white-saddle goatfish). The goal of this project was to utilize the Hawaii commercial catch data to assess variations in the relative abundance and identify possible explanations for any fluctuations in CPUE.

The initial stages of this project included a literature review of the species to determine the life history and any known information to identify both data sources and stock assessment modeling parameters. Using the commercial catch data, CPUE was determined and different techniques were used to look at standardizing CPUE for input into Generalized Linear Models, Surplus Production Models, and looking at using Bayesian approaches for stock assessments.

Due to the multitude of data needed to be extracted and cleaned-up, much of the work is ongoing to standardize the CPUE and develop the models. A more detailed look at Kumu in the fish trap fishery is presented under that project.

iv. Recreational Coral Reef Fishery Assessment in the Western Pacific

The Council, particularly in light of the mandated Annual Catch Limits, is in need of analyzing all available information to make informed management decisions. One area that had been lacking information is the non-commercial coral reef fisheries of each of the island areas. This project used the data from the creel survey programs in American Samoa, Guam, and CNMI as well as the Hawaii Marine Recreational Fishing Survey (HMRFS) to provide an analysis of the data as well as draft modules for the Council's annual reports.

The contractor worked with the NMFS PIFSC as well as the staff of the local island fishery agencies to assess the quality of the data as well as develop an algorithm for data manipulations and estimation.

The results show that most shore-based fishing is non-commercial in American Samoa, Guam, and the CNMI. Non-commercial fishing accounts for a much smaller proportion of the boat-based versus shore-based coral reef fishery catch. The shore-based fishing gear associated with the most catch in all regions is some form of hook and line. Bottomfishing is the most important method for catching coral reef species in the boat-based fisheries. *Selar crumenophthalmus*, jacks, and surgeonfish are the top components of the catch in all regions. In Hawai'i, the availability of weight data is too sparse to support weight based analyses so only number of fish can be assessed. Bait fish species are caught in the highest numbers.

In this project, it was noted that sampling and survey design limited the accuracy of the analysis and that incomplete sampling frames of non-commercial fishing activity may introduce error and bias into the estimation procedure. Recommendations that the Council are taking into account for future data collection modification and projects include looking at pulse fisheries or rarely encountered methods to remove potential variances. Other limitations based upon the estimation and potential errors, as well as consultations with the local fishery specialists, cautioned the Council that there are limitations to the data. The results of the project were presented to the Council's Plan Teams for its consideration and incorporation into the annual report for each jurisdiction's fisheries. The project has provided the Council, NMFS, and the local fishery agencies with a greater understanding of the data and its limitations, as well as provided for recommendations for improving the data and estimation procedures and identified possible biases and potential error for future rectification.

v. Using Fish Trap Data as a Long-term Ecosystem Indicator

This project was developed to utilize fish trap data collected by the State of Hawaii and determine its usefulness as a long-term indicator of ecosystem health. In comparison to other gears, the trap is assumed to have less fluctuation in terms of effort and catchability across time, particularly in Hawaii.

The study looked at the commercial catch data from the State of Hawaii from 1948-2011, splitting the data at the year 1985. This is because up until 1985, one gear codes for the fishing reports accounted for all types of traps. After 1985, specific types of traps obtained their own gear codes. Regulations such as minimum sizes, trap dimension and sizes, and changes to the commercial marine catch reporting form were made that were also taken into account in this study.

The trap fishery in Hawaii for coral reef fish had a few spikes in trips in the early 1960s and late 1990s, while catch and effort fluctuated throughout the time series with peaks in the late 1970s and early 2000s. The top species caught also fluctuated from year to year, with a different composition between the different data segments (1948-1985, and 1986-2011). In the earlier part of the time series, Mullidae, *Parupeneus multifasciatus*, *Acanthurus dussumieri*, *Parupeneus porphyreus*, and Carangidae, were more common, and the latter part of the time series species composition included *Acanthurus dussumieri*, *Lutjanus kasmira*, *Scarus* spp. (misc.), *Acanthurus olivaceus*, and *Mulloidichthys pflugeri*. Both groups of top species accounted for around half of the landings for their respective segment of the time series. It was also found that species composition doesn't necessarily change by area.

When looking at the catch and effort by area, Oahu contributed the highest total catch and the highest total effort, but Kauai had the highest CPUE. However, analyses of the data show that the Oahu fishery drives the catch, effort, and CPUE trends throughout the time series.

Results of this study show that when considering all trap types, the trap fishery in Hawaii could not be used as an ecosystem indicator, but, one gear code for fish traps has been relatively consistent compared to the combined trap type codes and should be looked at further to see if it could be used to assess the ecosystem (although it could only be used for data after 1985). The trap fishery is not as static as was previously assumed, and fisher effort and locations have changed through time. The trap fishery may also be more selective and be targeting market-driven species as well. While the data may not be used as an ecosystem indicator, trends of individual fishers could also be looked at to determine any possible ecosystem changes.

b. Project 2- Coordinating Fishing Communities and Collecting Coral Reef Ecosystem Associated Species Life-history Data

This project continued the Council's coral reef program initiatives to collect information on the life history of coral reef ecosystem associated species. The Council met with its plan teams in Hawaii, American Samoa, and the Marianas, as well as with staff from NMFS PIFSC to determine the biosampling needs in each island area. The Council worked with NMFS PIFSC Life History program to provide training to the local agencies on biosampling techniques.

The Council has also provided presentations on biosampling as well as demonstrations at many of the community and advisory group meetings in CNMI, Guam and American Samoa in cooperation with the NMFS PIFSC biosampling technicians in each of these areas. The technicians provided demonstrations on otolith removal, length-weight measurement, fish identification, data collection, and gonad removal.

c. Project 3-Assessment of Fresh Water Impacts on Coral Reef Fisheries in Hawaii

This project looked at the effects that fresh water (abundance or lack thereof) may have on the coral reef fishery and ecosystems of Hawaii. The Council worked with a contractor to develop a list of marine species that are impacted by fresh water and stream flow change, document changes in freshwater flow and its impacts on the coral reef fishery, and interpret impacts. The project looked at commonly caught traditional coral reef species as well case studies of particular areas. The results described below are some of the more general information provided in the report to the Council.

Links between specific marine species, particularly native mullet (*'ama`ama*) and flagtail (*aholehole*) and freshwater input to the ocean are widely described. Although no discrete threshold has been established, juvenile *'ama`ama* appear to prefer water with salinity below 15 ppt. When salinity becomes > 15 ppt, juvenile *'ama`ama* will abandon an area and move in search of fresher water. Salinity preferences for *aholehole* are less established than that for *'ama`ama*, but the seasonal use of nursery habitat by *aholehole* is similar to that of *'ama`ama*. *Ulua* (Carangidae) and *akule* (bigeye scad) have also been linked to marine nurseries and climatic conditions in some reports, but not as specifically as linkages of *'ama`ama* and *aholehole*.

Striped mullet is a classic estuary organism. It is part of a group of fishes that must spawn in the marine high salinity sea water but whose juveniles move into bays and estuaries and up into streams. A major decline in Hawai'i consumer use of fresh mullet (*'ama`ama*) since 1900 and evidence that *'anae holo*, or seasonal migrations of *'ama`ama* off O`ahu have ceased, provide solid evidence of the disruption of striped mullet patterns in Hawai'i. This issue deserves far more attention from scientists.

The catch records compiled by Hawaii's Department of Land and Natural Resources (DLNR) are for commercial fishing methods only. Confidentiality of fishermen further limits the potential uses of the commercial catch data. Despite these limitations, attempts are made in the present report to compare long series of Hawai'i fishing records for marine species with peaks and valleys related to peak freshwater discharges.

d. Project 4-Coral Reef Fishery Ecosystem Assessments

The original aim of this project was to look at factors (including, but not limited to fishing) that affect coral reef ecosystems in the Marianas Archipelago. However, due to the factors beyond the control of the contractor and the Council, the project for the Marianas Archipelago was terminated and identical work was done in American Samoa. The new project looked at developing an assessment of the coral reef ecosystem in American Samoa looking at catch rates and effort and benchmarking natural disturbances.

The contractor first analyzed the existing catch and effort data for the coral reef fisheries in American Samoa developing a time series of the information based on gears and species composition. This data was then compared to natural disturbances and the study found that determining the impact of severe natural disturbances such as cyclone, hurricanes and tsunamis on fish stocks is difficult given the background noise in the variability of processes affecting natural populations. The timing of these events also confounds the impacts. In addition, these natural disturbances are also not amenable to experiments which make the analyses of their impacts more complicated. Natural populations fluctuate in number through time due to

variabilities in the processes operating in the pre-recruitment, recruitment and post-recruitment stages of marine organisms. Therefore, inferring impacts entails looking at pattern congruence among fish stocks and/or significant changes relative to the whole temporal trends in catch-per-unit effort and changes in fish composition.

Results of these efforts have shown that the impact of severe natural disturbances on coral reef fisheries has always not been clearly shown and will be difficult to show due to their timing and the background variability of processes affecting natural populations. However, this does not mean that they are not important factors. In contrast, the impact of these disturbances should be studied as they have implications on what can be said of the status of exploited stocks.

e. Project 5-Coral Reef Technical Assistant

As part of the Council's partnership with HPU, this reporting period was used to identify potential students that had the ability to work with the Council to compile available habitat information on coral reef ecosystems in the region. The Council worked with students from HPU to do a literature review on some of the coral reef species in Hawaii and identify habitats for these species. Utilizing this information, the students looked at how they utilize the available information to re-define Essential Fish Habitat and Habitat Areas of Particular Concern for the top coral reef finfish species.

The study looked at using GIS to estimate available habitat for each of the major species using available multibeam bathymetry and backscatter data, and benthic habitat maps in water shallower than 30 m. To demonstrate the usefulness of this approach, a pilot-project was undertaken looking at Manini (*Ctenochatus triostegus*) habitat and presented to the Council's Plan Team.

Using fish abundance data from NOAA's Coral Reef Ecosystem Division's Reef Assessment and Monitoring Program and benthic habitat data from NOAA's Center for Coastal Monitoring and Assessment, the project looked at the utility of estimating total fish abundance by habitat. The project shows how habitat-specific density data might be used to designate EFH using Manini. This approach illustrates the strengths and deficiencies of currently available habitat and abundance data that would be needed for refining EFH designations. Despite limitations in some of the data, this approach may be useful in delimiting EFH for some species, particularly those well covered by NOAA's RAMP sampling. In any case, the pilot-project showed that there is also a need to ground-truth some of the locations projected as EFH and that high relative abundance at predicted EFH sites could validate this approach.

f. Project 6-Coral Reef Education and Outreach

i. American Samoa 2011 Traditional Lunar Calendar

The American Samoa Community College's Samoan Studies Institute (ASCC SSI) was contracted to conduct research in November 2010 in Independent Samoa to inform the 2011 traditional lunar calendar for American Samoa. The lunar calendar is used as an outreach and management tool for coral reef conservation. Interviews were conducted with the Fishery Department, Meteorology Office, South Pacific Regional Environmental Program, and with fishermen and elders on the islands of Upolo and Manono and in the Aana District. ASCC SSI provided the Council with the traditional Samoan names of the lunar months, their meanings, the two seasons and the corresponding European months. It was noted that Samoans seem to label months in pairs, e.g., Taumafamua and Toetaumafa; Palolomua and Palolomuli; Utuvamua and Toeutuva. They also learned about four traditional forms of fishing Samoa had in the past. The

researchers noted that Samoans like all other Pacific islands fish and manage their natural resources through their ability to read and understand their environment. The researchers will be submitting a final report once they have completed the transcripts of the interviews.

The 2011 American Samoa lunar calendar takes into account research conducted ASCC SSI. It includes an explanation of each lunar month provided by the SSI and features a local fish each month, provided by the WPRFMC On-site Coordinator in American Samoa. Moon rise and set times are for Pago Pago (Samoa standard time) from data provided by the U.S. Naval Observatory at www.usno.navy.mil/USNO. The start of each lunar month is based on the visibility predictions for the new crescent moon for Pago Pago provided by the HM Nautical Almanac Office at www.hmnao.com.

The 2011 American Samoa Lunar Calendar also features the winning entries from the 2010 student art contest conducted by the WPRFMC in partnership with the American Samoa Department of Marine and Wildlife Services (DMWR). The theme of the contest was the "American Samoa archipelago ecosystem." The winners represented K-12 students from Manumalo Baptist School, Pavaiai Elementary School, Coleman Elementary School, Fa'asao Marist High School and Nuuuuli Vocational-Technical High School. The judges included Okenaisa Fauolo (director, ASCC SSI); Donald L. Hoffman (art director, American Samoa Department of Education), Maria Mauga-Vaofanua (environmental information coordinator, American Samoa DMWR), Fatima Sauafea-Leau (coral ecologist, NOAA), Veni Sopoaga (art specialist, American Samoa Department of Education) and Va'asa Ta'amu (American Samoa Environmental Protection Agency).

Copies of the calendar were distributed by the Council at various Council-associated meetings, forums and student symposiums held in American Samoa in March 2011. At the community meeting, student symposium and Fishers Forum, ASCC SSI provided a booth and guest presenter on the lunar calendar. Additional copies were given to DMWR and ASCC SSI for distribution. The calendar is also available on the Council website.

ii. Mariana Archipelago Traditional Lunar Calendar

Following the recommendations of fishermen, indigenous communities and educators in the Mariana Archipelago, separate traditional lunar calendars were produced for Guam and CNMI.

The 2011 Fanha'aniyan Pulan CHamoru (Chamorro Lunar Calendar) featured the contributions and advice of the Chamorro Lunar Calendar Committee on Guam, which was initiated by the WPRMC. The calendar highlights traditional fishing and conservation practices of the indigenous Chamorro of the Mariana Archipelago (Guam and the Commonwealth of the Northern Mariana Islands) and aims to raise public awareness about the Mariana Archipelago Fishery Ecosystem Plan, developed by the Council and implemented by the National Marine Fisheries Service in federal waters surrounding the archipelago. Traditional knowledge and wide community involvement are integral parts of the ecosystem-based approach to fishery management. The tide charts with the moon rise and set times are in Chamorro time for Hagatña, Guam. They were provided by Barry Smith, retired, University of Guam's Marine Laboratory. The seasonal fishing predictions were provided by the fishermen in the Chamorro Lunar Calendar Committee and consolidated by committee member Jesse Rosario.

The Chamorro calendar features some of the winning entries from a student art contest held on Guam. The theme of the competition was *Fino' Gualåffon: Respeta I Tano' yan I Tasi* (Moonlight Talk: Respect the Land and the Ocean). This theme encouraged discussion on the importance of respecting our land and ocean resources, the lunar cycles that affect the life cycles

of the flora and fauna of the land and ocean, and their importance to the people and the culture of the Mariana Archipelago. Teachers were encouraged to include this contest in their lesson plans. The K-12 students who placed in the contest represent the following schools: Mercy Heights, Agana Heights Elementary School, Bishop Baumgartner Memorial Catholic School, Bishop Baumgartner Memorial Catholic School, Benavente Middle School, Father Duenas Memorial School and Simon Sanchez High School.

The 2011 *Refaluwasch Pápáál Maram* (Refaluwasch Lunar Calendar) features the contributions and advice of the CNMI Lunar Calendar Committee, which was initiated by the WPRFMC. The calendar highlights traditional fishing and conservation practices of the Refaluwasch, who along with the Chamorro, are the indigenous people of the Mariana Archipelago (Guam and the CNMI). The first Refaluwasch to settle in the Marianas came from Satwal and Elato around 1815 or 1816. There have been subsequent migrations from all of the islands of the Central Caroline Islands. Refaluwasch is an official language of the CNMI along with English and Chamorro. The tide charts with the moon rise and set times are in Chamorro time for Saipan. They were provided by Barry Smith, retired, University of Guam's Marine Laboratory. The seasonal fishing predictions were provided by the fishermen on CNMI and Guam.

The Refaluwasch calendar features some of the winning entries from a student art contest held in the CNMI in late 2010. The theme of the competition was *Awawel Kikilil Pungil Maram Ngely Malawas, Set Me Bwel*, which means understanding moon phases in relation to our natural resources. This theme encourages understanding of the different moon phases in the lives and surroundings of the people of the Mariana Archipelago. Teachers were encouraged to include this contest in their lesson plans. The winning posters were submitted by K-12 students from Grace Christian Academy, Oleai Elementary School, Hopwood Jr. High School and Marianas High School.

Distribution of the calendars were launched at the Traditional Lunar Calendar Workshop, held in Saipan, CNMI, January 26-27, 2011, and at the 3rd annual Chamorro Lunar New Year event on Guam on January 30, 2011. Both events were widely covered by print, radio and television. Additional calendars were distributed to schools, fishermen, indigenous communities and other members of the public by the Council's on-site coordinators on these islands. The calendars are also available for download on the Council website.

iii. American Samoa Student Symposium

The American Samoa Student Symposium was held at the Lee Auditorium (Fale Laumei), Utulei, on March 5, 2011 (Saturday) from 8:30 a.m. to 3 p.m. The students heard presentations on the Humphead Wrasse Population Survey by Marlowe Sabater, WPRFMC; Kanaka Perspectives on Marine Resource Management by Iolani Kauhane, UH Hilo marine science student; Watershed Monitoring by Lucas Moxey, NOAA Ocean Watch; fishbox.org by Mark Mitsuyasu, WPRFMC; American Samoa Coastal Circulation Mapping by Phil Wiles, American Samoa Environmental Protection Agency; and Community-based Marine Protected Areas by Selaina H. Vaitautolu, American Samoa Department of Marine and Wildlife Resources (DMWR). They also had the opportunity to meet with experts and engage in hands-on activities at a variety of informational booths including fishbox.org (Mark Mitsuyasu, WPRFMC), watershed monitoring (Lucas Moxey, NOAA Ocean Watch), biosampling (Damingo Ochavillo, DMWR), federal fishery management plans and decision-making process (Sylvia Spalding, WPRFMC), American Samoa Traditional Lunar Calendar (Nunuimalo Apisaloma Toleafoa,

Samoan Studies Institute), Community-based Marine Protected Areas (Selaina Vaitautolu, DMWR), fish preparation and cooking demonstrations (American Samoa Department of Education Lunch Program), Fagatele Bay National Marine Sanctuary Program and the Department of Agriculture's Natural Resources Conservation Program. The event concluded with group discussions and an activity that tested the students on what they learned, with prizes given to the students who answered correctly. Teachers with the most students attending were awarded water monitoring kits and GPS units. A student art contest on the coral reef ecosystem was also conducted in conjunction with the event. The art entries were displayed at the event, and the winners received prizes. The event was well publicized by the local print, radio and television media.

iv. Native Hawaiian Lunar Calendar and Place Names

In February, the Council met with prospective researchers from the University of Hawaii at Hilo and from the Hui Malama O Moomomi regarding the development of the informational aspects of the calendar, including observational worksheets that can be utilized as part of a curriculum, traditional Native Hawaiian fishery management practices related to the lunar calendar, relevant traditional place names, and artwork. The researchers identified a location, community and school on the Big Island where the calendar research might focus.

The Council worked with lunar calendar expert Kalei Nuuhiwa to work with the Native Hawaiian charter school and community in the ahupuaa of Honohononui, District of Keaukaha, on Moku o Keawe (Big Island) to create a traditional lunar calendar for the moku. The calendar includes worksheets to engage students and fishermen to record observations based on the lunar cycle and to utilize these to better understand traditional Native Hawaiian fisheries management practices. The calendar also promotes the use of traditional place names that are related to fisheries and fisheries management in the ahupuaa. In July, Council staff met with the contractor and the school in their ahupuaa. In August, the observational sheet to be included in the calendar was showcased at the Council for Native Hawaiian Advancement with positive feedback from Hawaiian communities that have fishponds. The worksheet was also showcased at the Hawaii Fishing and Seafood Festival in early October 2011. Work was also done with University of Guam retired professor Barry Smith and the Pacific Islands Ocean Observing System to produce a tide chart for the moku. The calendar was originally scheduled for publication in October 2011 and distribution before the Makahiki (Hawaiian New Year), in November. However, community approval delayed this schedule and the calendar was produced and distributed in November 2011.

Discussion of the calendar was highlighted at several community and public meetings in the Hilo area, including one meeting at the Papahānaumokuākea Marine National Monument Mokupapapa Discovery Center. Council staff flew to Hilo to attend one of these meetings. The calendar was also featured at a traditional knowledge poster session of The Wildlife Society's annual conference in Kona in November, as well as in an article published in the National Marine Educators Association's newsletter. The Calendar is available to the public on the Council's website and by request.

v. Engaging Western Pacific Fishermen and Communities in Fisheries Ecosystem Management

The Western Pacific Regional Fishery Management Council hosted a community meeting in the villages of Matu'u and Faganeanea, American Samoa, on March 4, 2011; a meeting with more than 50 mayors on March 7, 2011, at the Office of Samoan Affairs in Utulei, American Samoa; and a Fishers Forum at the Lee Auditorium (Fale Laumei), Utulei, American Samoa, on March 8, 2011. These meetings included presentations, informational booths and a discussion on ways local fishermen and communities can help with sustainable fisheries development and management of fisheries and habitat, including coral reef ecosystems, and why their participation is important. These meetings also provided a forum to obtain ideas on further implementing ecosystem-based management of fisheries in American Samoa. The meetings featured presentations in Samoan (or translated into Samoan) from guest speakers, displays and handouts on the American Samoa Fishery Ecosystem Plan, the decision-making process for federal fisheries management, new fisheries management measures such as annual catch limits, recent fishery-related scientific information pertaining to American Samoa wrasse habitat and population distribution and coastal circulation and fish larvae transport, the 2011 American Samoa traditional lunar calendar, community-based marine protected areas, watershed monitoring and other important issues. The participants found the information provided useful and asked for more support with outreach and education, enforcement of marine protected areas, ecosystem monitoring and fisheries development.

In addition to these events, the Council provided outreach at the Saipan Mahimahi Fishing Derby in April, Saipan International Fishing Tournament in July, and August fishermen tournament and festival on Guam and spearfishing derby in Saipan. New banners, a new interactive educational exhibit and other materials were provided. The Council also held community meetings at Merizo, Guam, and in Tinian, Rota and Saipan, CNMI, in March 2012. The meetings in CNMI were held in collaboration with the CNMI Division of Fish & Wildlife. They were well advertised and attended (about 30 persons per meeting), and both the fishermen and the government expressed gratitude and praise to the Council for the success of the meetings. New displays were made, and the fishermen held fruitful discussions and provided recommendations that were forwarded to the Council, which met the week following the community meetings.

vi. Developing a Fishermen Code of Conduct for Hawaii

The Council convened community meetings across the State of Hawaii in 2010 and 2011 culminating with a statewide meeting in Honolulu on November 19-20, 2010, to discuss Aha Moku management with fishermen, native Hawaiian communities and other interested parties. One of the main components of the Aha Moku management process that was discussed is a code of conduct. Comments and suggestions for what should go into a code of conduct were provided to the Council, which was then drafted into more formal guidelines for fishermen's conduct and ethics.

A Fishers Forum on a Code of Conduct for Hawaii Ocean Users was held Oct. 20, 2011, at the Waikiki Aquarium to solicit fishermen and public comment on the Code. A meeting was held with the Pacific Islands Fishing Group (PIFG), which has opted to pursue a fishermen's pledge rather than a code of conduct that has similar wording. An MOU was signed with the Hawaii Division of Boating and Ocean Recreation (DOBOR) to have the Code posted as signs at harbors on Oahu and Molokai. The signs were fabricated by a professional sign company according to the DOBOR specs and installed at the harbors. In addition, an ad with the pledge was published in the *Lawaia* fishing magazine, a publication of PIFG.

vii. Traditional Lunar Calendar Project Performance Analysis

The Council contracted with Q-Mark Research to evaluate the traditional lunar calendars as an outreach and management tool in Guam, CNMI, American Samoa and Hawaii. The CNMI and Guam research was completed in March 2011.

Results of the analysis showed that the Council's efforts to promote traditional fisheries management practices related to the lunar cycle is very well appreciated by the people of each of the island areas. The strong features/successes of the calendar include the visual aesthetics and the educational use and information. Some of the weaknesses of the calendar was that the calendar is a little unclear, doesn't promote the ecosystem or natural resource conservation and management.

Those surveyed also made recommendations to help the Council improve the calendar in future iterations including providing more traditional names and words; more information on regulations and ecosystem effects; include more information, as well as pictures, on traditional gear and fishermen; and note environmental dangers and fishing restrictions in the calendar. Overall, the calendar is well accepted in the community and everyone agreed that the calendar is needed and that the project should be continued. The Council hopes that the communities start taking responsibility for the calendar in hopes that it is perpetuated through the community and used appropriately.