



**Western
Pacific
Regional
Fishery
Management
Council**

April 30, 2009

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

Dear Ms. Koss,

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. NA06NMF4410115 between October 1, 2006 and December 31, 2008.

Award Details:

Award Number: NA06NMF4410115
Program Officer: Jennifer Koss, 301-713-0299, Jennifer.Koss@noaa.gov
Program Office: Fisheries Habitat Conservation Program Office (HCPO)
Award Period: 10/01/2008 - 03/31/2010
Project Title: FY 2008 Assessment and Management of Western Pacific Coral Reef
Recipient Name: Ecosystems and Habitat
Western Pacific Regional Fishery Management Council
Investigator(s): None Designated

Report Details:

Report Type: Project Progress Report
Reporting Period: 10/01/2006 - 12/31/2008
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Sincerely,

Kitty M. Simonds
Executive Director



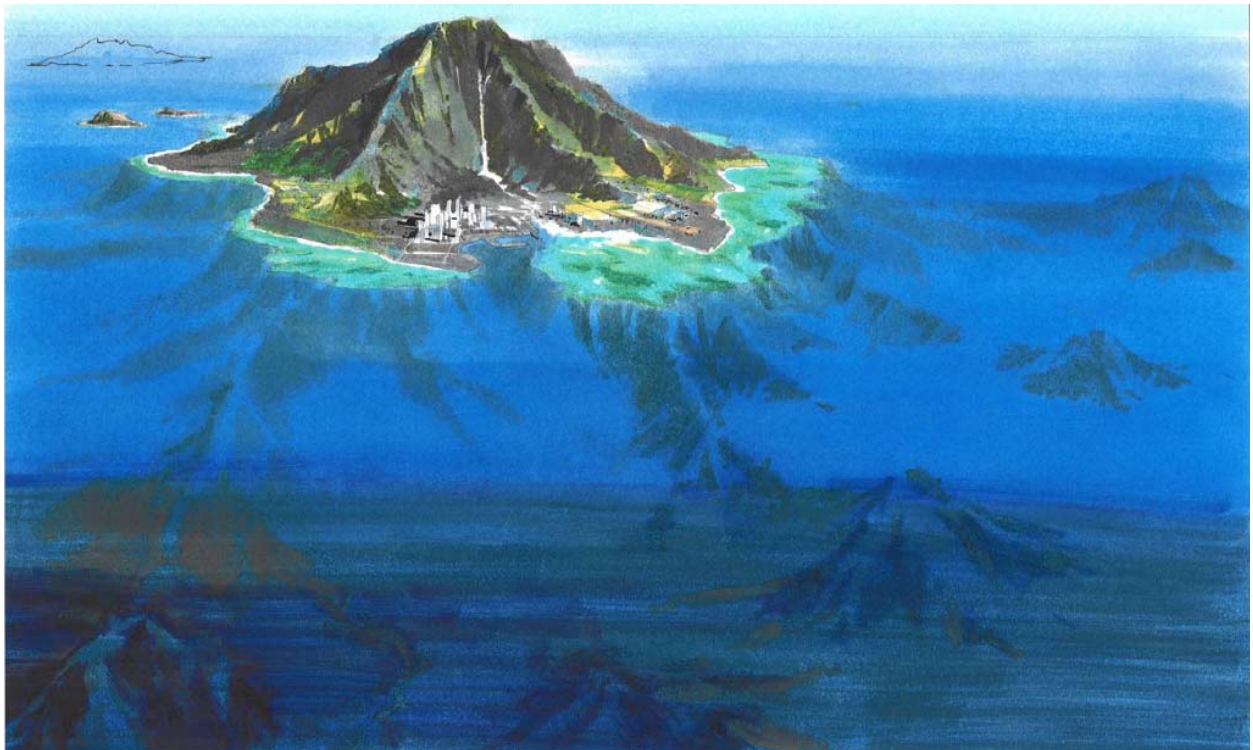
**WESTERN
PACIFIC
REGIONAL
FISHERY
MANAGEMENT
COUNCIL**

FINAL REPORT

NOAA Grant Award #NA06NMF4410115

Assessment and Management of Coral Reef Ecosystem Resources and Habitat
(Projects to Improve or Amend Coral Reef Fishery Management Plans)

Award Period: October 1, 2006 to December 31, 2008



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A. INTRODUCTION

The principal objectives of NOAA's Projects to Improve or Amend Coral Reef Fishery Management Plans Grant Program (CRFMPPG) are to support programs and projects by the Regional Fishery Management Councils (Councils) to conserve and manage coral reef fisheries by: (1) reducing the adverse impacts of fishing and other extractive uses on coral reefs and associated ecosystems; and (2) incorporating conservation and sustainable management measures into existing or new Federal fishery management plans (FMPs). This program supports value added studies or projects by Councils with responsibilities for fishery management plans that include coral reefs or fishery resources that depend on these reef ecosystems, as established under the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.), designed to enhance the conservation of coral reef fishery resources. CRFMPPG funding is not intended to support normal Council activities or responsibilities.

For FY 2006, NOAA identified seven categories for priority funding under the CRFMPPG. These categories included: (1) Identification, mapping and characterization of essential fish habitat, habitat areas of particular concern, or reef fish spawning aggregation sites; (2) Monitoring reef fish stocks; (3) Efforts to reduce overfishing of coral reef resources; (4) Identification and reduction of adverse effects of fishing and fishing gear, including the elimination of destructive and habitat-damaging fishing practices; (5) Assessment of the adequacy of current coral reef fishing regulations; (6) Education and outreach efforts to recreational and commercial fishers; and (7) Ecosystem-scale studies and inclusion of ecosystem approaches into coral reef fishery management plans. In October 2006, NOAA awarded the Western Pacific Regional Fishery Management Council (Council) \$517,514 in NOAA Coral Reef Conservation Program funding to undertake projects which address the principle objectives and priorities of the CRFMPPG. The Council's strategy in 2006 (and for the future), is to focus on partnerships which contribute to the preparation of a stock assessment for coral reef ecosystem fishery resources including projects to obtain information needed to complete life history parameters, habitat requirements for important coral reef ecosystem fishery resources and the linkages between shallow-water reef environments and deep-reef ecosystems. Additionally, the Council continues to work with federal, state, and diverse local partners to develop scientifically-based ecosystem approaches to management that are appropriate for individual island ecosystems and acceptable to island communities and sensitive to indigenous cultures. A summary of the major project activities accomplished under this grant award is described below.

B. SUMMARY OF MAJOR PROJECT ACTIVITIES

1. Guam Parrotfish

The original proposal approved by NOAA was to conduct a study on the biological characteristics of grouper spawning aggregations from Guam and CNMI. In developing the original proposal, Council staff working with the University of Guam and relied on studies published by the Secretariat of the Pacific Communities and other organizations which report large grouper spawning aggregations in many places throughout Micronesia, including Palau, Chuuk, Pohnpei. In reviewing Guam DAWR inshore and offshore creel surveys, it was determined that nearly 30 species of groupers (Family Serranidae) are reported to be caught in Guam, many of which are reported to form spawning aggregations in parts of Micronesia.

However, after working with local fishermen and spending some time in the field, the principle investigator determined that there would be difficulty in acquiring a large enough sample size of groupers to allow for statistically significant results as several field surveys found limited number of grouper spawning aggregations of sufficient size. Faced with a potential for low project success and concerns over mortality caused by scientific collections, the collaborators decided to shift their focus to parrotfish which is more abundant than groupers within safe dive survey depths.

In the past 15 years Guam has experienced significant declines in parrotfish landings, particularly the large-bodied species such as *Bolbometopon muricatum* and *Chlorurus microrhinos*. For these and other species like *C.sordidus* that exhibit complex reproductive traits such as sex-change are challenging for fisheries managers, particularly those in developing countries where life-history information is rarely collected, mostly from lack of funding. It may also explain why traditional fisheries management practices have failed, even for those sectors that are regulated, and why many of these stocks are now considered overexploited. Critical information for these populations such as determining the size and age at which sex change takes place is therefore lacking. It is now apparent that incorporating hermaphroditism into traditional stock assessment models is essential. Failing to do so violates the principal assumption of constant recruitment in per-recruit models because of a lack of individuals from one sex. Likewise, growth spurts, which have been found to precede sex change, when ignored in yield models, can provide over-estimates of maximum yield and optimal effort and thus have severe, negative effects on the targeted fish populations.

Project Accomplishment

Observations during the initial sampling stage revealed the species chosen for this study *Chlorurus sordidus* does not form classic spawning aggregations. Instead large, terminal phase (TP) males establish temporary home ranges, in which they display lek-like spawning behaviour. This was confirmed by a detailed study of the spawning behaviour of this species at Asan, Guam during 2007-2008 by another research group at the UOG Marine Lab (K.Chop unpub.data). This same study revealed *C.sordidus* spawn on a daily basis and throughout the year with no clear seasonal patterns.

A detailed demographic study was therefore conducted by representatively sampling from numerous sites around Guam and Saipan to determine: a) if the smallest female *C.sordidus* are actively participating in spawning and b) whether the largest females are making a disproportionate contribution to the reproductive output of the population. Demographic data collected from the otoliths of the same individuals provided valuable information on c) the size and age these species begin to participate in spawning, d) the age structure of the populations, e) possible age and sex differences in growth rates at different sites, f) individual age and sex specific reproductive output and g) a comparison of the age structure and growth rates of individuals both on Guam and neighbouring islands. Sampling within Guam's Marine Preserves added another important component allowing us to determine if there has been significant build-up of the older age classes in the time since their closure in 2000. As a supplement to the demographic and reproductive data, detailed surveys were conducted on the distribution and abundance of *C.sordidus* and all other parrotfish species around Guam, Rota and Saipan. This provided valuable data on the spatial composition of this important group of herbivores. Lastly, a

detailed analysis of the creel survey harvest data (collected by Division of Aquatic and Wildlife Resources - DAWR) was also performed on these species to examine if any had experienced declines in mean size over several decades. This lengthy time series offers a unique opportunity to look at fishing and other impacts on individual fish species.

The final report was completed and its authors are considering publication of the research in a peer-reviewed journal. The final report will be made available on the Council's website. Below is a summary of some of the results of this project:

a) Age and growth

For Guam, there were considerable differences in the size structures estimated by the visual surveys and collection of specimens. It would appear the smaller size classes, the 10 and 13 cm initial phase individuals which dominate the reef slopes of Guam, were under sampled during the collections. Instead there was a clear bias towards sampling larger individuals >19 cm. This was not the case on Saipan where the two size structures were in fact very similar.

b) Reproduction

The gonads of 309 *C. sordidus* were examined using histological techniques. These individuals ranged from 124 to 242 mm TL and 1 to 9 years for females (n = 173) and from 173 to 265 mm TL and 1 to 7 years for males (n = 123). Transitional fish (n = 13) ranged from 196 to 242 mm TL and 2 to 8 years although 85% of these were 2 or 3 years old.

Four combinations of color phase and sexual development were identified in *C. sordidus*: initial phase (IP) females, initial phase (IP) primary males, terminal phase (TP) primary males, and terminal phase (TP) secondary males. Of the 13 transitional fish, 12 were terminal phase (TP), indicating that color phase change is likely completed before the completion of sex change.

c) Distribution and Abundance

An examination of the UVC data showed little difference in the size structure of *C. sordidus* between shallow (3-6 m) and deep (9-12 m) parts of the reef slope on Guam. Clearly, this species has very little habitat preference below 3 m depth contour.

d) Discussion and Conclusions

A comparison of size frequency distributions across all sites revealed this species showed no apparent preference for habitat between 3 and 12 m. However multiple regression analysis suggests the abundance of this species in shallow areas is driven largely by the presence of the "farming" surgeonfish, *Acanthurus lineatus*.

Two species *Chlorurus microrhinos* and *C. sordidus* have been identified as the dominant group of bioeroders and producers of sediment in the Indo-Pacific. They erode material from the reef, modify the sediment size and transport it away from the reef proper. For larger excavator species like *C. microrhinos*, sedimentation is directly removed from the reef through defecation in deeper areas. Smaller eroding and scraping species like *C. sordidus* that defecate in their own feeding areas, however reworked material (particularly smaller size sediment) is returned to the reef then lost through hydrological processes.

The reduction in the mean size of parrotfish, observed from the creel survey data has wider implications beyond a loss of biomass and reproductive potential. A reduction in mean body size also impacts ecosystem function because of the non-linear relationship between parrotfish body size and function performance.

2. Guam Offshore bank and Boating Community Coordinator

In developing precautionary ecosystem approaches to fisheries management, the Council is advocating partnerships with communities to develop proactive management plans for federal waters to prevent depletion of fishery resources, minimize impacts to habitat, and eliminate user conflicts. The Council initiated a Mariana Archipelago FEP pilot project to establish partnerships with Guam's boating community (i.e. commercial, recreational and subsistence fishermen, dive charters and other stakeholders) to develop strategies to manage and monitor marine resources of the southern bank area.

A contractor was hired by the Council to work with the boating community to develop a scientifically sound and socially inclusive management regime for Guam's offshore bank resources based on information provided by the boating community. The contractor coordinated with the Guam boating community, NMFS Western Pacific Fisheries Information Network (WPacFIN), Guam Fishermen's Cooperative Association, Guam Division of Aquatic and Wildlife Resources (DAWR) and the University of Guam to develop a plan whereby Guam boating communities would be responsible for conducting the collection and monitoring of fisheries and environmental data.

Project Accomplishment

a) Data collection

The contractor collected data on the spawning and life cycles of various bottomfish species within Guam's waters. Fishermen were interviewed about the time and place of their bottomfishing and their catch weighted and measured. Gonad samples were also collected for analysis. The contractor also developed a database of participating bottomfish fishermen in Guam. Although inclement weather hampered fishing in Guam during the project period and thus much of the data collection effort, a total of 69 samples of bottomfish were collected. Of these species, 52 were Onaga (Ruby or Long-tail Snapper, *Etelis coruscans*), nine were Lehi (Longtailed Pink Snapper, *Aphareus rutilans*), three were Ehu (Yellowstriped Red Snapper, *Etelis carbunculus*), and one each of Opakapaka (Pink Snapper, *Pristipomoides filamentosus*), 8-bar Grouper (*Epinephelus octofasciatus*), Giant Skipjack, Sweetlips (family Plectorhinchinae), and Liliok (Longnose emperor, *Lethrinus olivaceus*).

The four sampled months were directly within the rainy-typhoon season for Guam and were by far the worst bottomfishing period throughout the year. The targeted species such as Onaga, Lehi and Ehu were not difficult to catch by most of the participating fishermen and landing good numbers were also not considered far-fetch. Participants were quick to point out that based on their fishing experiences over the last 15-20 years, bottomfish populations have not shown any decline and that their catch per unit efforts have remained constant and on numerous occasions even better. However, participants did provide some explanations with regard to some of the drawbacks they have been experiencing which they felt were contributing to the recorded low landings. These include poor weather conditions, shark predation and high fuel-costs.

Another important aspect is the availability of good weather condition during appropriate lunar cycles/moon phases for bottomfishing. Most of the experienced bottomfish fishermen have been conducting their fishing activities around the various moon-phases throughout the year and this particular year has been very rough in terms of good moon-phase with good weather.

Also, Guam has been going through a transitional period with its breed of bottomfishermen. Majority of the avid and experienced fishermen from the 1980s have either stopped fishing or have already passed away and have been slowly replaced by younger generation of fishermen who are still learning the unique trade of the fishery and are still getting their feet wet. It will take at least another 10-15 years before these new breed of fishermen master this fishery and be able to deliver the level of landings Guam has been accustomed to.

b) Data processing

All Guam Fishermen Cooperative Association (GFCA) staff had undergone basic hands-on training on Interviewing Fishermen to gather information on their time and place of fishing activities, measuring and weighing individual bottomfish, identifying and determining gonad sexuality and maturity stages, collecting gonads and proper storage for transportation to proper facility for further analysis.

Aspects for the determination and collection of gonad as provided to the GFCA staff involved proper identification of reproductive organs, which produce roe or eggs (females) or smelt or sperm (males) as well knowing its location (located at the top of the gut cavity, just below the fish's backbone). Even though it is relatively simple to determine the sex of a fish just from looking at the color and shape of the gonad, a more detailed examination is sometimes required to tell the sex and developmental stage of the fish, a process known as histology. The process is quite technical, but it basically involves a few straightforward steps. The process this project has taken are as follows:

- First, the gonads are removed from the fish and placed in chemicals to preserve the tissues and prevent decay;
- Second, slices or sections are cut from the gonad and placed in small blocks of wax to enable ease of handling during processing. These sections are around 5mm thick.
- Third, the section is stained to improve the appearance of eggs and sperm when viewed under a microscope. The stains turn different parts of the gonad tissues into different colors and so allow easier identification of the main features of the gonad.
- Finally, the thin, stained sections are viewed under a microscope to determine if the fish is a male or a female, or in some cases the process of changing sex.

Samples have not been processed and histology has not been conducted. The samples are being stored at the proper facilities at the University of Guam for future analysis.

c) Conclusions and recommendations

The data collection project covered a sampling period that did not reflect the actual bottomfishing season by Guam's standard and that the result of gathered data should not be viewed as a conclusive reflection of island's bottomfish resources current status. A full year of data collection must be performed in order to allow for a more conclusive result. The project should complete a full calendar-year that includes the peak months from March to June, where

the weather is normally at its best conditions. It is also during these months that Guam's avid fishermen are very active and good fishing plans are in place.

With the training the GFCA staff has already obtained, increased data sampling expected during the good months will not pose any difficulty in their ability to perform such activity. In addition, Guam's bottomfish fishermen are now more informed and understanding of the project and that their overall participations should bring better coverage and results.

The Council has received funding from the NOAA Coral Reef Conservation Program in FY2007 to continue this project. Contracting for this project is currently being done by the Council and the selected contractor.

3. Integration of Ecosystem Parameters in Coral Reef Ecosystem Annual Report

The weakness of understanding ecosystem effects on fish populations is that monitoring mechanisms under fishery management plans are species oriented and primarily require the use of fisheries dependent data. Until recently, monitoring of environmental cycles and changes in relation to resource dynamics were entirely neglected. As the Council moves towards fisheries ecosystem management, the need for including environmental conditions as an integral component of its annual reports grew. This project was to modify the Council's existing annual report format to a prototype better suited for ecosystem-based management approaches.

Project Accomplishment

The Council worked to develop an integrated coral reef ecosystem report and began its work with American Samoa. With assistance from the former Chief Scientist of the American Samoa Department of Marine and Wildlife Resources (DMWR), a draft framework report was developed which would detail important ecosystem parameters relevant to American Samoa's nearshore fisheries. Much of the biological information is available in disparate formats and was compiled by DMWR staff. The proposed content of the report included the following parameters:

- Biotic Ecosystem Components. This information includes a time series of harvest and production (g/carbon) by trophic level (apex predator, herbivore, and autotroph/detritivore), conversion of sunlight to primary production (g/carbon) and nutrient recycling (percent of harvested nitrogen returned to local ecosystem).
- Abiotic Ecosystem Components. This information includes a time series of temperature and salinity, sunlight, compensation depth (phytoplankton, coral and benthic algae) and particulates and turbidity.
- Fishery Effort. This information includes annual estimated boat-based effort and shore-based effort for each island broken down into two sections: North and South. Effort will be reported for the major gear types used to harvest nearshore reef fish (all species combined) including bottom gear, spearfishing (separated by daytime/nighttime), rod and reel, hand gleaning, gill net, and thrownet. All other unique or minor gear types (i.e. palolo worm, octopus lure, etc) may be reported separately. Additionally, fishing conducted under American Samoa DMWR's Community Based Fishery Management Plan will be reported separately.
- Fishery Landings. For all gear-types analyzed under fishing effort, time series trends will also be produced documenting major species composition (based on creel survey

sampling), species seasonality, length frequency (when available), estimates of CPUE (numbers/gear hours), and annual estimates of pounds per trip.

The Council continues to develop the appropriate reporting methods for the archipelagic-based FEPs and its Plan Teams continue to work on generating catch and effort reports according to the recommended structure. In meetings of the Plan Teams in 2007 and 2008, recommendations were made for generating the catch tables and figures for the annual reports and Council staff continue to work on developing the annual report.

4. American Samoa Coral Reef Program Manager

The American Samoa Department of Marine and Wildlife Resources (DMWR) selected, and the Council hired, a Coral Reef Program Manager (CRM) to assist the DMWR Chief Fisheries Biologist in the day-to-day coordination and management activities of coral reef-related activities. These activities included staff assignments and accomplishments, drafting reports, preparing and managing budgets, tracking objectives and accomplishments, and communicating with other agencies and organizations regarding DMWR coral reef programs.

Project Accomplishment

The CRM has participated in the US Coral Reef Task Force meetings and workshops, the Coral Reef Advisory Group and assisted in the DMWR inshore creel surveys. The CRM has also attended and represented DMWR at several interagency coral reef related meetings and workshops convened by the Department of Commerce, Fagatele Bay National Marine Sanctuary, and the American Samoa Coral Reef Advisory Group.

The DMWR has utilized the assistance of the CRM in the assessment, monitoring and research of nearshore and offshore areas around Tutuila. With the CRM's assistance, the DMWR has documented and characterized fish and benthic communities at long-term and randomly selected monitoring sites. In addition, the CRM has assisted DMWR's Maintenance and Operations Division with numerous projects including daily maintenance of facilities and work on the boating access marina and DMWR vessels that support DMWR's coral reef biological investigations.

5. Ulua Tagging Project Off-Island Coordinator

The Council assisted the State of Hawaii in its efforts to undertake stock assessments for ulua/papio (trevally species) by providing funding to expand the ulua/papio tagging program and continue contracting a full-time neighbor island program coordinator to implement the program on Kauai, Maui, Molokai, Lanai and the Big Island.

With funding provided by the CRFMPGP, the Council hired a contractor to be housed at the State of Hawaii Department of Land and Natural Resources, Division of Aquatic Resources to assist with the Ulua Tagging Project. The project is a state-wide volunteer angler-based fish tagging program which utilizes fishermen to capture, tag and release species of carangid jacks commonly known in Hawaii as ulua or papio (juvenile). These species are a popular recreationally caught marine fish, however very little information is available regarding the status of these species. The program encourages fishermen participation in collecting vital information which assists fishery managers in understanding seasonal recruitment, growth rates,

and movement patterns of these species. The primary tasks of the contractor was to assist the Hawaii Division of Aquatic Resources (HDAR) in their efforts to expand their Ulua Tagging Project to the islands of Hawaii, Maui, Kauai, Lanai and Molokai and assist in the analysis of mark/recapture data collected by fishermen.

Project Accomplishments

The Ulua Tagging Project, Neighbor Island Coordinator assisted the Hawaii Division of Aquatic Resources expand the project to neighbor islands by participating in state-wide fishing club meetings and tournaments and disseminating tagging kits to anglers and distributing HDAR tagging newsletters which provides commercial and recreational fishermen with information on the number of fish tagged, recaptured, days at liberty as well as growth between captures.

The Neighbor Island Coordinator also assisted HDAR staff in updating and maintaining the Ulua Tagging database, including data entry of information received from fishermen via data information cards and phone calls. When fish are tagged, information such as length, weight and capture location are recorded by the angler and submitted to HDAR. This information was then key-punched into a database along with the name, address and other contact information of each volunteer angler and the serial number of each individual tag issued to the angler. When tagged fish are recaptured, the information is again recorded in the database and used to generate summaries of growth, movement and other population parameters. Additionally, HDAR is now collecting information such as weather patterns, tide data, and other observations in order to identify patterns that may help indicate preferred environmental conditions/indicators for ulua species.

Fishermen who participate in the tagging program and tag or recapture fish are provided with reward items such as T-shirts, stickers and other prizes for participating. The Neighbor Island Coordinator assists HDAR in processing tagging information, verifying the identity of the angler and preparing and distributing reward packets. In addition, The Neighbor Island Coordinator assisted HDAR in calculating the number of fish tagged by each individual angler. This information was listed in the Ulua Tagging Newsletter which provides a feedback mechanism to fishermen on how their information is being used by managers.

The contractor distributed tagging kits, to major fishing and tackle stores, as well as DAR tagging newsletters providing commercial and recreational fishermen with information on the number of fish tagged, recaptured, days at liberty as well as growth between captures. Over the course of the project, a total of 75 *papio* tagging kits and 51 *uluu* tagging kits have been distributed to fishing tackle and supply stores in Hilo, Kona, Kailua-Kona, Kamuela Wailuku, Lihue, and Kaunakakai.

In May 2006, the HDAR released its first technical report (No. 06-01) on the results of this project from 2000 through 2004. According to the report, the Ulua Tagging Program has recruited over 1,200 volunteer fishermen with 865 on Oahu, 60 on Kauai, 156 on Maui, and 166 on the Big Island. According to the report, over 22,000 fishes were tagged and a total of 2,900 fish recaptured (12.7%) with several individuals being recaptured on different islands.

With assistance of the Neighbor Island Coordinator, the Ulua Tagging Project has resulted in over 30,000 fish being tagged through December 2007 with approximately 3700 tagged on Hawaii Island (900 tagged in 2007), 5700 on Maui (460 tagged in 2007), 1000 on Kauai (218 tagged in 2007), 424 tagged on Molokai (21 tagged in 2007) 131 on Kahoolawe (14 tagged in 2007) and nearly 50 on Lanai (3 tagged in 2007).

This project and its associated data were presented to the Council and its advisory bodies for its management consideration. From these presentations, it was recommended that a stock assessment model be developed for use by the State of Hawaii and Council for fishery management.

C. SUMMARY OF OTHER PROJECT ACTIVITIES

1. Ecosystem Policy Workshop

On January 3-5, 2007, the Council convened its third and final ecosystem workshop to help inform the implementation of ecosystem approaches to management via its Fishery Ecosystem Plans (FEPs). The first workshop, convened on April 18-22, 2005, focused on identifying requirements for data, models indicators from the natural science context. The second workshop convened in January 2006 focused on requirements from the social science context. This third workshop engaged local, regional, and national experts to assist in synthesizing output from the first two workshops and to develop viable ecosystem policy options for use in the Council's fishery ecosystem planning process. A critical objective of the event was to deliberate on and arrive at ways to meet the inevitable challenges of implementing new marine resource management policies in the diverse social and biophysical settings that are characteristic of the region.

Project Accomplishment

A total of 35 biological and social scientists, federal and local natural resource managers, and academics attended the workshop. Over the course of the three-day workshop, participants engaged in a facilitated process to address three policy issues: (1) Governance; (2) Integration of indigenous practitioner knowledge and stakeholder input; and (3) Facilitating ecosystem policy via research and monitoring.

Regarding the Governance dimension, participants found that the most practical and feasible means for the Council to ensure the success of its Regional Ecosystem Advisory Committee (REAC) was to:

- Build trust with each of the REAC members over the course of time;
- Convene the REAC on a regular basis;
- Establish and communicate objectives for establishing each REAC;
- Establish Terms of Reference for participation in the REAC;
- Consider developing reasons beyond their potential for facilitating communication and consider developing a MOU or other form of elevated agreement;
- Seek to galvanize cooperation amongst REAC members while recognizing potentially competing interests; and
- Identify a pilot project that agencies can get behind while being careful that resources are actually available to support them.

Regarding integration of indigenous practitioner knowledge and stakeholder input, the participants found that there were many options available for gathering traditional knowledge about marine ecosystems and suggested ways how such information might be used in conjunction with other forms of science-based information.

Regarding research and monitoring, the participants found that there were also several options to conduct ecological research and monitor effects of the new approach including:

- Partnerships with educational institutions and interests throughout the region;
- Seek funding from a wide range of sources;
- Using multi-tiered data systems involving local observers, local jurisdictions, and regional science centers;
- Share valid data with/from NGOs as feasible/appropriate;
- Find ways to cross-reference various data to maximize its utility; and
- Develop annual reports on trends and data needs (monitoring).

2. Community Marine Management Forum

The Council convened the inaugural meetings of the Fishery Ecosystem Plan's Regional Ecosystem Advisory Committee (REAC) in Saipan, CNMI on February 5, 2007, in Guam on February 9, 2007, in Pago Pago, American Samoa on April 4, 2007, and in Honolulu, Hawaii on April 26, 2007. The REACs are comprised of Council members and representatives from federal, state/territorial/commonwealth, and local governments; businesses; and non-governmental organizations that have responsibility or interest in land-based and non-fishing activities that potentially affect that area's marine environment. The REAC also includes a community marine management forum where the community and all participants can share information on issues, programs and activities, as well as to coordinate management efforts or resources to address fishing or non-fishing related issues that affect ocean and coastal resources. A report on each of the REAC meetings as well as their recommendations was presented to the Council for its consideration and following Council meetings.

Project Accomplishments

a) Mariana Archipelago

A total of 18 local, federal agencies, businesses and non-governmental organizations, institutions and communities were represented at the meeting in Saipan and a total of 35 local and federal agencies, businesses and non-governmental organizations, institutions and communities were represented at the Guam meeting. In both areas, education and outreach, non-fishing impacts, and the consideration of traditional knowledge were common themes. Some of the specific recommendations made by the REACs were:

- Continue efforts to record and document traditional knowledge so that it may not be lost;
- Adequately monitor near shore pollution and its impacts on CNMI coral reefs and fisheries and study the impact of non-fishing activities on water quality, fish populations, fish habitat and other resources within the Guam local MPAs; and
- Establishing wide reaching education and outreach programs for various user groups (fishermen, tour operators, beach goers, general public) on programs, regulations, policies of government agencies, and translated into the various languages of the residents and visitors of Guam.

b) American Samoa Archipelago

In American Samoa, a total of 40 individuals representing local, federal agencies, businesses and non-governmental organizations, institutions and communities attended the April 4, 2007 meeting. A common theme expressed by participants was the need for assistance and support for community initiatives, and funding for community development projects and programs. Some of the specific needs identified were:

- Assisting communities to evaluate the effectiveness of the village-based marine protected area (MPA) program as well as assist vililages in their efforts to manage their marine resources;
- Identifying funding for legal training or workshops for community members conducting “watch” activities in their village areas;
- Enhancing local research capacity so that there is appropriate staff to monitor, collect, and thoroughly analyze collected fisheries data;
- Obtaining information on how much fish is being imported (e.g. reef fish from Samoa) and being sold in American Samoa markets; and
- Training for governmental agencies on how to properly approach communities regarding traditional fishing practices as well as other community projects.

c) Hawaii Archipelago

Hawaii’s REAC meeting had a total of 44 individuals from local and federal government agencies, community and non-governmental organizations, businesses and institutions. This meeting focused on community ocean resource management issues like ocean access for subsistence, recreation and cultural purposes; coastal development and impacts to natural and cultural resources; the use of traditional knowledge in marine resource management; community-based compliance and enforcement; and developing a community consultation process. The REAC did not make recommendations but the group emphasized the need and desire to begin fostering broader relationships with communit8ies, business organizations and agencies from all levels of government to participate and engage in dialogue to better improve coordination with the goal of improving the condition of Hawaii’s ocean resources.

2. Coral Reef Fishery and Conservation Education

a. Traditional Management Information and Displays

In the Pacific, traditional fishing and farming practices were linked to the moon cycles and phases of the moon. Depending on the location, fishermen could predict the best times to fish or farm and could identify when fish were spawning or feeding based on the phases of the moon. This information was also used to place limits on certain species of fish when they were spawning.

Project Accomplishment

The Council produced 500 moon calendars each for the Mariana Archipelago (Guam and Saipan, Hawaii Archipelago and American Samoa Archipelago illustrating the various phases and names of the moon for the 12 months of the year. The calendars also included information on what days were good or bad times for certain types of fishing. The artwork that accompanied the moon calendars were winners of a Council-sponsored Archipelago Ecosystem Art Contest for students in grades K-12 from schools in each of the areas.

b. Development of Coral Reef Ecosystem-related Educational Media Messages

The Council promoted responsible fisheries and best practices for coral reef fisheries to Hawaii's communities through educational media messages during the Council's outreach events. These media messages included public service announcements on local radio station announcing the Council's *Fishers Forum* on such topics as recreational fishing, data collection, traditional ecological knowledge, and a public hearing for the management of coral reef-related species. These topics are important to the protection and management of the coral reef ecosystem because the coral reefs are the areas most vulnerable to recreational fishing and there are many gaps in the data for the coral reef fisheries. While the knowledge of managing the nearshore/coral reef resources has been around for generations in the islands, it is just in its infancy in terms of being incorporated into modern fisheries management. Through these forum, the Council is able to provide the public with information and at the same time, collect information from the public for use in its management decisions.