

PACIFIC ISLANDS FISHERIES SCIENCE CENTER



A Summary of the Rose Atoll Marine National Monument
and American Samoa Archipelago
Ecosystem Science Implementation Workshop
Utulei, American Samoa
May 26-27, 2015

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and American Samoa Archipelago
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May 26-27, 2015

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LIST OF ACRONYMS

ASCC	American Samoa Community College
ASEPA	American Samoa Environmental Protection Agency
CFMP	Community-based Fisheries Management Program
COTS	Crown of Thorns Starfish (<i>alamea</i>)
CRAG	Coral Reef Advisory Group
DMWR	Department of Marine and Wildlife Resources
EEZ	Exclusive Economic Zone
GIS	Geographic Information Systems
LiDAR	Light Detection and Ranging
MPA	Marine Protected Area
NMFS	National Marine Fisheries Service
NMSAS	National Marine Sanctuary American Samoa
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPSA	National Park Service American Samoa
OSA	Office of Samoan Affairs
PIFSC	Pacific Islands Fisheries Science Center
PIRO	Pacific Island Regional Office
RAMNM	Rose Atoll Marine National Monument
SPC	Secretariat of the Pacific Community
VMPA	Village Marine Protected Area
WPRFMC	Western Pacific Regional Fishery Management Council

INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) Pacific Islands Fisheries Science Center (PIFSC) held a 2-day workshop in Utulei, American Samoa in May 2015, to gain insight from local scientists and managers on marine ecosystem and fisheries research needs within the American Samoa Archipelago. This information will be incorporated into a NOAA Fisheries Pacific Islands Fisheries Science Center American Samoa Marine Research Implementation Plan for 2017-2022. These plans aid PIFSC in identifying and prioritizing research activities.

More than 60 people representing a broad spectrum of organizations in American Samoa, including resource managers, scientists, and local community members attended the workshop. Following a series of background presentations by scientists and others, workshop participants identified key topics for research that could be implemented in the next 5 years. They assembled a wide-ranging list of research priorities including threats to coral reefs from crown of thorns starfish (COTS) outbreaks, environmental contaminants, land-based nutrients, and coral bleaching; effectiveness of Marine Protected Areas (MPAs); larvae seeding/spillover; occurrence, location, and seasonality of spawning aggregations; mapping of shallow near-shore marine environments using LiDAR and other technologies; and more

This report is a synthesis of the workshop information and findings and details the discussions, results and prioritization process. This information will be incorporated into a Rose Atoll Marine National Monument (RAMNM) and American Samoa Archipelago Ecosystem and Fisheries Science Action Plan which will be used to guide marine ecosystem and fisheries research planning across the American Samoa Archipelago.

MATERIALS AND METHODS

On May 26-27, 2015, the NMFS convened a 2-day workshop in Utulei, American Samoa. The workshop focused on formulating a 5-year (2017-2022) research implementation strategy to 1) address knowledge gaps identified in existing Science Plans; and 2) contribute to existing baseline data on the linkages between biological, geophysical, and human components of the American Samoa Archipelago Ecosystem (including the RAMNM).

NMFS Pacific Islands Fisheries Science Center (PIFSC) and Pacific Islands Regional Office (PIRO) staff planned the workshop in consultation with a committee of scientists and resource managers from the American Samoa government and academia. Ms. Risa Oram (NMFS-PIFSC) served as the workshop chair.

Planning committee members included:

- Risa Oram (NMFS-PIFSC)
- Hoku Johnson (NMFS-PIFSC)
- Gataivai Talamoa (NMFS-PIFSC-AS)

- Richard Hall (NMFS-PIRO)
- L. Hokulani Ka'aekuahiwi (NMFS-PIRO)
- Atuatasi-Lelei Peau (NMSAS)
- Gene Brighthouse (NMSAS)
- Dr. Ruth Tofiga-Matiga ---Director (DMWR)
- Kelley Anderson Tagarino (University of Hawai'i Sea Grant College Program AS Community College)
- Tim Clark (NPSA)
- Amanda Pollock (USFWS)
- Dr. Domingo Ochavillo---Fishery Chief (DMWR)
- Tepora Lavatai--CMFP/Pelagic (DMWR)
- High Talking Chief "Tuiagamoā" (Deputy Secretary of the Office of Samoan Affairs)
- High Chief "Togotogo" Potumoe Sotoa (American Samoa Alia Association)
- High Chief "Ufagafa" Ray Tulafono (Retired DMWR)

The 2015 workshop aimed to identify research aligned with NMFS core mandates: a) Ensure the productivity and sustainability of fisheries and fishing communities through science-based decision-making and compliance with regulations; and b) Recover and conserve protected resources through the use of sound natural and social sciences.

With this in mind, the planning committee identified a variety of subjects for discussion, including biosampling and life history of reef fish and bottomfish, South Pacific albacore biology, The American Samoa longline observer program, currently funded NOAA projects, biological connectivity, coral reefs, coral bleaching, crown-of-thorns starfish, communicating with the broader community, contaminants and nutrients, disease; ocean acidification, socioeconomics, habitat mapping and geospatial data, Marine Protected Areas, Muliava (Rose Atoll), sea turtles, and marine mammals.

The planning committee identified subject matter experts and asked them to deliver short (15 minute) presentations focused on the current state of knowledge, data gaps, research needs, and collaboration opportunities (see *APPENDIX 1—Workshop Agenda*).

This document is a report-out on the workshop itself, summarizing presentations, discussion, potential research needs and collaboration opportunities. Next, NMFS will incorporate this information into a Rose Atoll Marine National Monument and American Samoa Archipelago Ecosystem and Fisheries Science Action Plan.

The workshop included the following activities:

- 28 presentations by regional subject matter experts¹
- Open discussion on research priorities and knowledge gaps; and
- Identification of viable research strategies to address gaps and priorities.

NMFS would like to thank all of the participants who took time out of their schedules to attend and contribute to this meeting. More than 60 people representing American Samoa natural resource agencies, the American Samoa Community College, the Western Pacific Regional Fishery Management Council, the Rose Atoll Intergovernmental Council, NOAA, and other scientists and stakeholders attended the meeting. Remote connections were made available to NOAA staff in Honolulu and interested parties

¹(http://www.pifsc.noaa.gov/news/american_samoa_ecosystem_and_fisheries_research_prioritization_workshop_2015.php)

elsewhere (via teleconferencing). Unfortunately, the remote links were not optimal (call quality was poor). A full list of participants is provided in Appendix 2.



Figure 1.--Workshop participants.

DISCUSSION

DISCLAIMER: Summaries of presentations given at the workshop reflect the view of the presenter only; all presentations and discussions do not necessarily represent the opinions or positions of the Department of Commerce, NOAA or NMFS.

Workshop Day 1

Welcome by District Governor of the West and American Samoa Department of Marine and Wildlife Resources

The workshop opened with a prayer led by Deacon Kaio Ah Hing, followed by the Faga'itua High School Choir. Opening ceremonies were followed by welcoming remarks by Dr. Ruth Matagi-Tofiga from the American Samoa Department of Marine and Wildlife Resources (DMWR), on behalf of Lieutenant Governor Lemanu Peleti Mauga. Dr. Matagi-Tofiga discussed the importance of the workshop to the fisheries of American Samoa and the conservation, preservation, and protection of all the marine resources in the American Samoa Archipelago. Dr. Matagi-Tofiga then introduced the Western District Governor of American

Samoa, High Chief Lualemaga E. Faoa. High Chief Faoa welcomed workshop attendees and encouraged robust participation in the 2-day workshop.



Figure 2.--Gataivai Talamoa (NOAA) introduces dignitaries.

Workshop Overview

Following this welcome, our senior scientist attending the workshop, Dr. Robert L. Humphreys, Jr. provided an overview of what the workshop would cover. The workshop chair, Ms. Risa Oram provided an overview of expected actions of the workshop (to identify research priorities) and workshop outputs: (1) workshop report; and (2) a future NOAA Fisheries American Samoa Archipelago Ecosystem and Fisheries Science Action Plan, including Rose Atoll Marine National Monument. She assured the audience of NMFS' commitment to partnership in the sciences between NOAA and the communities of the American Samoa Archipelago, calling attention to discussions on scientific research and exploration of the American Samoa Archipelago Ecosystem including the Rose Atoll Marine National Monument. Ms. Oram requested that workshop participants think about research needs during workshop presentations, and to share these ideas, either during the discussion session, writing on the post-it pads provided, or contacting her directly after the workshop. Ms. Oram explained that the steering committee will continue to be encouraged to provide input in the workshop report as well as the science action plan.

Session 1: Fisheries

Biosampling / Life History of Reef Fish and Bottomfish

Dr. Domingo Ochavillo

Chief Fisheries Biologist

American Samoa Department of Marine and Wildlife Resources

The goals of the bio-sampling program conducted in American Samoa since 2011 are four-fold: 1) to obtain length-weight data of landed commercial catch; 2) identify to species measured fish; 3) support life history studies of 10 select species through otolith and gonad sampling; and 4) expand capacity of DMWR staff to conduct sampling and laboratory studies. The data outcomes of these goals include fisheries data to support future stock assessments annual catch limits (ACLs) determination, and to support life history studies to determine age and growth and size at 50% maturity. Significant accomplishments include the training of seven DMWR staff to identify fish catch to species, establishing cooperative relations with both spearfish and bottomfish fishermen that allows for regular measurement and sampling of their landed catch, obtaining length measurements for > 216,000 fish and collection of ~ 4,000 otoliths and gonads from 10 species for life history studies. These data collections have also contributed to the development of species length-weight relations and species-level summaries of fish catch.



Figure 3.--Domingo Ochavillo (DMWR) presenting to the group.

The Commercial Fisheries Bio-Sampling Program conducted by DMWR staff in American Samoa provides the otolith and gonad samples necessary for the NMFS PIFSC Life History Program staff to subsequently conduct age & growth and length at 50% maturity studies, respectively. Otoliths are transversely sectioned, ground, polished, and fixed to glass slides for microscopy viewing to interpret and enumerate annual growth zones to determine age. Gonad samples are sent to a histology contractor where they are processed into ultra-thin stained histology sections mounted on glass slides and then viewed with microscopy to determine gender and reproductive development stage. The data derived from these studies are statistically analyzed to provide length-at-age growth curves and maturity ogives that provide important life history information for stock assessment and resource managers. Preliminary life indicates that females attain length-at-50% maturity at smaller sizes than males (♀ 16.6 cm vs. ♂ 17.8 cm fork length for *M. berndti* and ♀ ~15 cm vs. ♂ 16.3 cm fork length for *S. tiera*). Current otolith age estimates indicate that *M. berndti* are 3-6 years old within a size range of 15-20 cm fork length, reflective of the size range typically landed for this species. Currently, the Life History Program has a large backlog of otolith and gonad samples to process and analyze due to limited staffing and large sample sizes also collected from commercial species sampled in Hawai'i, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI). Future collaborations with DMWR will include obtaining the very smallest and largest sizes of targeted species and future life history training for DMWR staff.



Figure 4.--Bob Humphreys (NOAA) presenting to the group.

Pelagics: American Samoa Observer Program

Michael Marsik

Observer Program

NMFS, Pacific Islands Regional Office

Observer coverage of the American Samoa albacore longline fishery provides data on fishing effort, catch composition, and protected species interactions. Since 2006, 16% of the 1,157 longline trips had observer coverage. Trips are an average of 41 days in length; the longest trip was 162 days. The Observer Program collaborates on a number of projects, including assisting DMWR with stranding responses, with the Pacific Islands Fisheries Science Center on biological sample collection, collection of economic and shark bycatch data, and internationally with the Secretariat of the Pacific Community (SPC) on data from various species. Currently, the Observer Program is providing 25% coverage of local longline fishing trips using 3 observers and monitoring 15 longline vessels currently active out of Pago Pago Harbor.

Michael Marsik is the Biologist with the American Samoa Pelagic Longline Observer Program with the NMFS Pacific Island Regional Office. The Program focuses primarily on the albacore fishery. There is about 20% observer coverage for the fleet. The Program collects economic data for PIFSC, biological data for the Life History Program, information on the mechanics of the fishery using temperature and depth recorders, shark bycatch data for SPC, and biological samples from the fish to create a catalogue of different species throughout the Pacific for SPC.



Figure 5--Michael Marsik (NOAA) presenting to the group.

Pelagics: South Pacific Albacore Biology

Dr. Robert L. Humphreys, Jr.

*Fisheries Research and Monitoring Division – Life History Program
NMFS, Pacific Islands Fisheries Science Center*

This presentation reviewed recent biological publications that are the outcome of an extensive South Pacific albacore sampling program initiated by Commonwealth Scientific and Industrial Research Organisation Australia throughout the western, central, and eastern South Pacific during 2006-2011. Sampling in the area of American Samoa accounted for some 10% of albacore sampled during this sampling program. Length-at-age growth curves based on age reading of transversely sectioned sagittal otoliths revealed that males display a faster growth rate after age 4 years and reach a maximum age of 14 years. For both sexes, growth rates were faster in the eastern vs. western South Pacific region (Williams et. al. PLoS ONE 2012). Spawning season ranged from October through March with peak spawning during October-December. Length-at-50% maturity for females is attained at ~ 87 cm fork length corresponding to an age of ~ 4.5 years. Length-at-50% maturity varied by latitude as a result of the geographic distribution of mature and immature females (Farley et. al. PLoS ONE 2013; Farley et. al. PLoS ONE 2014). Otolith elemental microchemistry analysis of the otolith sagittal edge revealed that the three areas sampled (New Caledonia, New Zealand, and French Polynesia) could be distinguished with 85% accuracy based on regionally distinct elemental compositions. However, core analysis could only distinguish samples from French Polynesia; further research is needed to evaluate the utility of this technique to identify natal origin of adults based on unique regional otolith core elemental compositions (Macdonald et al. Fisheries Research 2013). Albacore implanted with satellite tags in tropical waters (off New Caledonia and Tonga) have revealed diving behavior down to 200-300 m depths during daylight hours while residing in the upper 100 m during the night. Albacore tagged off New Zealand only infrequently dove beyond 100 m depths during the day (Williams et. al. Deep-Sea Research II 2015). A recent publication by Montes (2012) suggests genetic differences exist within South Pacific albacore however a current stock assessment of South Pacific albacore identifies a single stock for this region. Future efforts should investigate the basis of longitudinal differences in albacore across the South Pacific to better understand growth differences, movement patterns, spawning areas, and population structure with American Samoa as an important sampling location within the central south Pacific region.

Current NOAA-Funded Projects

Kara Miller

Grants Program

NMFS, Pacific Islands Regional Office

In 2014, the NMFS PIRO funded more than \$11 million in grants, cooperative agreements and financial assistant awards to constituents in support of the NMFS mission. Our partnerships and supported projects in American Samoa are some of our most critical and support a series of

programs ranging in topics relating to ocean, conservation, marine education and training, fisheries research and management.

Kristine Bucchianeri
American Samoa Coral Reef Advisory Group

The Coral Reef Advisory Group (CRAG) coordinates American Samoa's coral reef management efforts and activities. Member agencies work to manage coral reefs with the vision of protecting and conserving reefs in American Samoa. The CRAG leads a Territorial coral reef monitoring program that assesses the health and resiliency of reefs in American Samoa and also participates in COTS eradication efforts.

Fatima Sauafea-Le'au
Habitat Conservation Division
NMFS, Pacific Islands Regional Office

The goals of the NOAA Internal Coral Reef Conservation Program (CRCP) grant are to support the implementation of National Goals and Objectives and jurisdictional management priorities; help support coral reef management in coral jurisdictions; and to enhance collaboration and coordination with local management community. One example of a CRCP funded project is the inter-disciplinary study of flow dynamics and sedimentation effects on coral colonies in Faga'alu Bay conducted by Oliver Vetter and Dr. Bernardo Vargas-Angel of PIFSC. This project examined the susceptibility of coral reefs in Faga'alu Bay to land-based sources of pollution. Surveys of the bay were conducted to assess the dispersal and effects of terrigenous sediments in nearshore coral habitats. Another project example is the coral reef ecosystem monitoring training and capacity building to support improved resource management in American Samoa conducted by Dr. Bernardo Vargas-Angel (PIFSC). This project provided training and capacity building in November 2014 to local American Samoa partners on coral demographic surveys and analyses. The project helps to assist DMWR in the collection of baseline data at one of several priority management areas around Tutuila. A final project example is the comprehensive baseline assessment and pilot test of outcome performance measures in Faga'alu Bay by Susie Holst (NOS). This project collected baseline ecological data to support the development, implementation, and effectiveness of local, reef-to-ridge watershed conservation and management action plans, by providing information that is necessary to understand the impact of land-based sources of pollution on the coral reef community in Faga'alu Bay. Other funded projects include coastal communities mapping by Dr. Arielle Levine (NOS/CRCP), and improving watershed management in Faga'alu through the eradication of *Tamaligi* invasive trees and improving coral reef management in American Samoa through resilience and capacity building by Fatima Sauafea-Le'au of NMFS. Future projects for CRCP FY16 include working with jurisdiction partners and the Coral Point of Contact (POC) to identify priorities. Priorities should complement and/or align with National Goals and Objectives and jurisdictional management goals. American Samoa priorities will be identified through the Local Action Strategies (LAS) groups and in collaboration with POC. NOAA CRCP FY16 Request for proposals and spend plan were unveiled in June 2015.



Figure 6--Fatima Sauafea-Le'au (NOAA) presenting to the group.

Session 1: Discussion

This section captures the main points and questions raised during and immediately following Session 1 presentations. Bullet points show comments/ideas by or one more participants and do not necessarily reflect group consensus.

Biosampling: Life History of Reef Fish and Bottomfish

- Participants discussed the importance of conducting further analysis of parrotfish and grouper bio-sampling data including life history and length/age and discussed what inferences could be drawn from life history research.
- The group discussed the fish life history data that are currently available and which may be useful for research prioritization and management.
- Prioritize parrotfish and grouper life history analysis.
- Conduct further research into fish spawning aggregation periods, particularly on fish that are commercially, recreationally and culturally important to American Samoa.
- Conduct further research to allow managers and regulators to set size and catch limits on fish and potentially seasonally restrict fishing for certain species of fish.
- Further research needed to determine recommended minimum size limits on reef fish.
- Members of the group questioned the drivers of the *akule* fishery, what are the environmental variables driving this fishery?
- Does life history data translate into something that you can say about the status of the fisheries themselves? Are they overfished? Are the catches in terms of sizes and populations appropriate and sustainable? Have researchers observed changes over time in the sizes of fish that being caught? This is particularly relevant to targeted reef species such as groupers and parrotfishes that exhibit specialized reproductive strategies (e.g.,

protogynous hermaphroditism), wherein size as sex change may be skewed as a result of increased or sustained fishing pressure.

- Based on the available bio-sampled data on those ten indicator species, what inferences can you make, if any?
- Would researchers consider sampling the cast net fishery?
- Looking at spawning periods/seasons for management purposes in American Samoa is important.
- Need to prioritize life history research on reef fish over the next 3 years, including parrotfishes, soldier and squirrelfish.
- Are fish populations declining, with emphasis on 3 main species: *Myripristis berndti*, *Acanthurus lineatus*, *Scarus oviceps*?

Pelagics: American Samoa Observer Program / South Pacific Albacore Biology

- Conduct more research on albacore density in Exclusive Economic Zone (EEZ) and time of year.
- Produce a model showing relationship between the distance to shore and FAD productivity, catch data, seasonality of catch data and present this model to fishermen.
- Study pelagic populations in our one protected area for pelagics - Rose Atoll Monument.
- When tuna reach the American Samoa EEZ they spawn a lot, could it be that the albacore is territorial in our EEZ? Or does it just continue to move back and forth? Can a study be conducted where we can know the density/stocks of albacore in our EEZ and what times of the year? Some tuna stay around the island (homegrown) and others go elsewhere (halos). Is catch of the homegrown going down, or is the availability of food moving further off shore?

Session 2: Ecosystem

Connectivity

Domingo Ochavillo

Chief Fisheries Biologist

American Samoa Department of Marine and Wildlife Resources

This presentation was a review of present and past research on the level of biological connectivity in the Samoan archipelago. Connectivity is usually measured directly through oceanographic studies and tracking movement of animals and indirectly by patterns of similarities of population and community processes. According to the current hypothesis, there is connectivity in the Samoan archipelago with Rose Atoll National Monument as a potential larval source. This hypothesis has been largely based on previous drifter studies and consistent with the South Equatorial Current and Counter-current patterns. Numerical modeling of potential larval sources also suggested connectivity especially with scenarios of high-planktonic larval duration and low larval mortality. In a smaller scale, drifter patterns and modeling indicated connectivity among community marine protected areas. However, there are indications of island-

effect and/or ecological filtering based on population demographic patterns and coral community species assemblages. Available demographic data for reef fish indicated significance among-island size differences of similarly-aged fishes. In addition, there was a significant among-island age and longevity difference. This can either indicate different fish stocks and/or different rates of processes operating among the islands. Finally, an analysis of hard coral species assemblages strongly indicated distinct communities among the islands. Currently, there is a study on the genetic connectivity among populations of three species in the archipelago. This latter study will provide a different perspective on archipelago-wide patterns and test current hypotheses on levels of connectivity in the Samoan Archipelago.



Figure 7.--Tim Clark (National Park Service American Samoa) presenting to the group.

Tim Clark
National Park Service American Samoa

This presentation provided information on a relatively new study looking at fishery movement patterns along the north coast of Tutuila. Fish are tagged and tracked up and down the coast, looking at both short-term and long-term movement. This information will ultimately be considered when establishing marine protected areas. In addition, this project is also looking at spatial and temporal patterns of spawning and spawning aggregation sites, critical habitat for fishes and will utilize genetic information to establish genetic connectivity. Fish are tagged using internal acoustic transmitters that emit pings. Fish are caught using nets on scuba, or via traditional hook and line fishing. The tagging process requires surgery, and tagging retention has been excellent. Daily fish movements are tracked utilizing a hydrophone. Tracking occurs in the field for 3-5 days in duration, 24 hours a day. Student interns help with the project and work in shifts. In addition, the fish-tracking project is looking at fish movement over longer time periods by utilizing stationary receivers to understand the number of fish using different

geographic areas. Currently, 15 deployed receivers are looking at migratory routes of fishes both within and outside the National Park Service American Samoa. Species of fishes being studied include Humphead wrasses, groupers, parrotfishes, snappers, and some species of surgeonfishes. This project is looking at fish species important to fisheries, and protected species like the Humphead wrasse.

Coral Reefs

Mareike Sudek

Benthic Ecologist

American Samoa Department of Marine and Wildlife Resources

Coral reefs in American Samoa face various threats to their health such as nutrient runoff, sedimentation, overfishing, COTS, coral bleaching as well as cyclones and tsunamis. The priority of local agencies is to assess the condition of the coral reefs in American Samoa on a long-term basis, providing data for an informed management of these reefs. Currently, the DMWR, the CRAG and National Park Service American Samoa (NPSA) have monitoring programs in place to conduct annual monitoring of fish biomass and diversity as well as the benthic assemblage, such as coral cover and diversity. Further research into water quality and its effect on reef assemblage, the identification of high resiliency areas, and connectivity on a small and large-scale basis are needed in the Territory. In addition, some of the research needs related to coral reefs in American Samoa include research on the impact of nutrients / land-based pollutants, habitat mapping, endangered species distribution and wide-scale disease surveys.

Bernardo Vargas-Angel

Coral Reef Ecosystem Division

NMFS, Pacific Islands Fisheries Science Center

Supported by the NOAA Coral Reef Conservation Program, the Coral Reef Ecosystem Division (CRED) leads the Pacific Reef Assessment and Monitoring Program (Pacific RAMP) designed to advance understanding on the status and trends of environmental conditions and living resources of shallow coral reef ecosystems (0 – 30 m) in the U.S Pacific and provide sound science to support integrated resource management. Beginning in 2002, CRED has conducted seven coral reef monitoring research cruises in American Samoa; biennially from 2002 to 2012 and triennially thereafter. Using complementary methods, the benthic composition, abundance, and diversity of corals, invertebrates, algae, and fishes are assessed in the context of their habitats and associated oceanographic and water-quality conditions. This program also includes work designed to expand understanding of the cryptic biodiversity of coral reef ecosystems and to assess the level and effect of major threats to coral reefs, including bleaching, disease, and ocean acidification. CRED also furthers management effectiveness research projects to support jurisdiction-specific management needs, associated to mitigating the effects of overfishing and land-based sources of pollution. Lastly, CRED also provides technical assistance and capacity building for ecosystem approaches to fisheries management in the Coral Triangle and Southeast Asia areas.



Figure 8. Atuatasi Lelei Peau (NOAA) contributes to the discussion.

Session 2: Discussion

This section captures the main points and questions raised during and immediately following Session 2 presentations. Bullet points show comments and ideas by one or more participants and do not necessarily reflect group consensus.

Connectivity

- Study ocean current models to gain better insight into flow of genes, larvae and species from island/atoll to island/atoll.
- Conduct fine-scale connectivity research (e.g., MPA, genetics, next generation genetic techniques).
- Develop methods to further integrate different data (e.g., connectivity and fishery data).
- Conduct species-specific connectivity studies (genetics).
- Analyze satellite imagery - chlorophyll for productivity zones, SST, etc. and correlate these data with fishery data, monitoring data, and connectivity surveys.
- Use trace elements and stable isotope signatures in otoliths for fish natal origin studies.
- Conduct nearshore connectivity studies.

- Conduct research on the ways different island areas affect growth rates; and how this differs across islands.
- Further research on the population genetics of *Myripristis berndti*, *Acanthurus lineatus*, and *Scarus oviceps*.
- Additional studies are needed on modeling nearshore ocean currents and modeling nearshore connectivity.
- Since we are looking at setting up MPAs, it would be great to really understand how our current protected areas and no take areas are connected to areas nearby.
- Make maps available utilizing the recent mapping conducted by NOAA Ship *Hi'ialakai*.
- Gain better understanding of distribution of ESA listed species.
- Conduct wide-scale coral and fish disease surveys.
- Conduct research into self-seeding at different island-areas within the American Samoa Archipelago.

Coral Reefs

- Utilize science-based approaches to coral reef management (e.g., life history information, population status fisheries-based information, etc.).
- Analyze satellite imagery - chlorophyll for productivity zones, SST, etc. and correlate these data with fishery data, monitoring data, and connectivity surveys.
- Conduct research on (1) impacts of climate change on coral reefs; (2) impacts of human pressure on coral reefs.
- Develop a coral ecosystem health index.
- Share Coral Reef Conservation Program priority areas / national goals and objectives - make sure they are integrated into research planning.
- Research into self-seeding on reefs / how much larvae come back?
- Conduct resilience analyses on monitoring data to further assess sites in American Samoa.
- Conduct workshops to teach coral identification.
- Build / write a coral ID guide for American Samoa corals.
- Identify areas more resilient to climate change.
- Continue long-term monitoring of both Fagatele Bay and Larsen Bay.
- Utilize coral taxonomy tool to study coral disease, bleaching, etc.
- Identify areas more resilient to bleaching and disease and use this information as a decision tool when establishing additional MPAs.
- Continue collecting monitoring data, including continuing Chuck Birkeland's monitoring data in Fagatele Bay.
- More closely identify and examine coral by species rather than by genera for better insight into coral bleaching, resilience and disease specific to species.

Session 3: Understanding and Addressing Threats

Coral Bleaching

Wendy Cover

*Research Coordinator, National Marine Sanctuary of American Samoa
NOAA Office of National Marine Sanctuaries*

Mass coral bleaching, caused by sea surface temperatures higher than average for a sustained period, has caused coral mortality on many reefs worldwide and is likely to increase with continued global climate change. As predicted by NOAA's Coral Watch, American Samoa has experienced substantial coral bleaching this year. Bleaching extent and severity has been monitored by several agencies, including the Department of Marine and Wildlife Resources (in association with the Coral Reef Advisory Group and Dr. Doug Fenner), NOAA's Coral Reef Ecosystem Division, and the National Marine Sanctuary. Additionally, several research groups travel to American Samoa to conduct research into factors that contribute to bleaching; these groups include Dr. Steve Palumbi's lab from Stanford University, a multi-university group including Drs. Tom Oliver, Cheryl Logan, and Ruth Gates conducting the Samoan Coral Local Environmental Resistance Atlas (SCLERA) project, and future work by Dr. Dan Barshis' lab at Old Dominion University. American Samoa is fortunate to have cutting-edge research happening in the territory but could use more capacity for consistent monitoring efforts.



Figure 9.--Wendy Cover (NOAA) presenting to the group.

Crown of Thorns Starfish

Tim Clark

National Park Service American Samoa

Eradication efforts conducted over the last 3 years on outbreaks of *alamea*, or crown of thorns starfish (COTS) have resulted in a decrease of outbreaks. COTS are corallivores and when there are outbreaks of COTS, corals die in large numbers. COTS occur naturally, but not in outbreak mode where there are thousands of them eating coral. Individual COTS can consume 150 cm² of coral a day, and have synchronized spawning events during October – January. COTS are highly fecund, each female produces approximately 65 million eggs per year. COTS larvae stage is limited by food availability, and the juveniles are highly cryptic and nocturnal; COTS reach sexual maturity at 2 years of age. Outbreaks occur in deep water and move toward shallower water over time. The recent COTS outbreaks started in 2011 where more than 100 *alamea* were observed during one dive. The National Park Service American Samoa started eradication efforts in 2013, and continued in 2014 and 2015. The recent bleaching events in 2015 have made locating COTS outbreaks difficult because researchers need to find COTS coral scars to locate outbreaks and bleaching makes it harder to locate scars. The National Marine Sanctuary of American Samoa has also used outside divers to assist in eradicating COTS. Efforts to eradicate, or reduce COTS include (1) Conduct towboard surveys to locate outbreaks and (2) Inject each COTs with ox bile. In addition to the injection, biological measurements (size, etc.) are taken from each COTS to provide information on age structure. Towboard surveys in 2015 show a reduction in COTS outbreaks. More than 18,000 COTS have been eradicated since efforts began in 2013.

Session 3: Discussion

This section captures the main points and questions raised during and immediately following Session 3 presentations. Bullet points show comments/ideas by one or more participants and do not necessarily reflect group consensus.

Coral Bleaching

- Conduct studies on pollution / nutrient input mapping and correlate that data with recorded bleaching events.
- Further research into utilization of cooling to study / mitigate coral bleaching (cold deepwater).
- Locate and identify geographic areas that are most resilient to coral bleaching events.
- Investigate other alternatives to prevent / control / reduce bleaching.
- Find out how much bleaching affects individual coral species.
- Conduct water clarity / visibility studies.
- Conduct research to determine if bleaching is anthropogenic.

Crown of Thorns Starfish

- Comprehensive life history research is needed on juvenile COTS to identify location and behavior of juveniles.
- Analyze satellite imagery for plankton blooms and correlate with COTS populations and outbreaks.
- Conduct life history research on natural predators of COTS: (1) humphead wrasse; (2) triton's trumpet.
- Find links between water quality and the start of COTS outbreaks.
- COTS have contributed to about 10% of coral loss and although climate change is the primary contributing factor in coral bleaching, nutrients have showed to negatively affect coral as well. Areas that tend to have high pollution are likely to suffer more. Getting a handle on where the biggest problem areas are is important. Do septic issues, litter, piggeries, etc. contribute to COTS outbreaks?
- COTS have natural predators (e.g., humphead wrasse and triton's trumpet) which are not common in Samoa. Research on predator affects onto COTS is really important.

Session 4: Community Involvement

Communicating with the Broader Community

*Fatima Sauafea-Leau
Habitat Conservation Program
NMFS, Pacific Islands Regional Office*

The broader community in American Samoa is aware of the decline and depletion on their resources and environment as a result of poor management, overexploitation, natural disasters, and human activities. The science, through past and current studies, highlights the effects of these threats on the environment and its resources. To better inform the community and improve management of these resources, it is important to provide effective communication through trainings, educational and awareness opportunities to enhance community support, participation, and collaboration in managing the resources of American Samoa. Communication tools should be made appropriate for the Samoan culture and should be well selected to fit the targeted audience. Several communication tools are used by many management programs to deliver their own messages and build trust with their communities. A good communication plan with appropriate tools will not only aid effective community participation but will be more efficient whereby the local knowledge helps to minimize wasted time and energy and can deliver results more rapidly.



Figure 10.--Kristine Bucchianeri (CRAG) presenting to the group.

Kristine Bucchianeri
American Samoa Coral Reef Advisory Group

CRAG plans to create a dive program so that CRAG member agencies are on the same page for diving reciprocity. CRAG is planning a 2-day long science symposium possibly in February to include American Samoa Community College (ASCC) and other partners. There is a desire to disseminate information to students, scientists and managers about marine science research and get more people exposed to work going on in American Samoa. The Marine Option Program and the Quantitative Underwater Ecological Survey Techniques are a few options available at the University of Hawai‘i and ASCC for continued studies.



Figure 11.--Workshop participants discussing community outreach and scientific collaborations during a public session.

Session 4: Discussion

This section captures the main points and questions raised during and immediately following Session 4 presentations. Bullet points show comments/ideas by one or more participants and do not necessarily reflect group consensus.

Communicating with the Broader Community

- Important to continue hands-on outreach with the community with an emphasis on school-age children. Hands-on activities include getting people in the water, on boats and facilitating other field-based education activities
- More emphasis also needs to be placed on science curriculum and science programs in schools
- Need to continue offering scholarships to students interested in majoring in marine science
- Need to teach about marine management and fisheries-based sciences in schools
- Continue Marine Options Programs in American Samoa
- Important to emphasize higher learning including providing opportunities for students to obtain master and doctoral degrees.
- Need to do a 2-day long symposium to present the research that is ongoing.
- Need to work with the Department of Education to make more marine science available in the curriculum. Right now it has nothing to do with fisheries management.

INTERACTIVE FISHERIES STATIONS: BIOSAMPLING, CORAL REEFS AND WESTERN REGIONAL PACIFIC FISHERIES MANAGEMENT COUNCIL'S STATION

Biosampling Station

The bio-sampling station provided information on the efforts of DMWR and NMFS to continue life history studies on fishes in American Samoa. The bio-sampling staff demonstrated proper removal of otoliths from *malau* (*Mypristes berndti*) and placed a prepared otolith slide under a microscope for examination.



Figure 12.--DMWR bio-sampling team demonstrating how to extract an otolith from a fish and examining under microscope.



Figure 13.--Community member Leland Slater reviewing outreach materials.

Western Regional Pacific Fisheries Management Council's Station

The Western Regional Pacific Fisheries Management Council (WRPFMC) set up an information booth and brought two short reports and a poster on commercial fishes.

Workshop Day 2

The workshop opened with a summary of the talks and research needs shared during the previous day and then moved directly into Session 5. The workshop chair highlighted the previous' days discussion and presented the agenda for the day.

Session 5: Understanding and Addressing Threats

Contaminants / Nutrients

Christopher Shuler

Ph.D. Candidate

University of Hawai'i – Mānoa, Water Resources Research Center

Faga'alu Valley in American Samoa was designated as a priority watershed by the NOAA Coral Reef Conservation Program in 2010. In this coral-rich bay, terrigenous sediments, nutrients, and other pollutants are easily transported to the near-shore region via stream and groundwater discharge. These inputs to the coastal ecosystem may be causes of eutrophication, coral die back or other environmental problems. Stream derived sediment and nutrient loading has already been shown to be deleterious to reef health, however, the flux of nutrients to the bay via submarine groundwater discharge (SGD) is unknown. Under the direction of Dr. Henrieta Dulaiova, a field study was performed to evaluate surface-water-groundwater interactions within Faga'alu stream and to quantify SDG derived nutrient transport to Faga'alu Bay. Preliminary results indicate

a significant potential for groundwater to contribute nutrients to the stream and directly to the bay. Quantification of groundwater and nutrient fluxes are currently underway. Additionally an assessment of terrestrial nutrient sources is being undertaken in order to propose recommendations for remediation actions in eliminating nutrient excess within groundwater reservoirs. Preliminary data from around the island indicate the potential for excessive nutrient loading to other sites as well. A proposed expansion of this work to Pala Lagoon and Vatia Bay is underway and will commence in summer 2015.

Mia T. Comeros-Raynal
Research Scientist
American Samoa Environmental Protection Agency

American Samoa uses a watershed-based management and water-quality monitoring system to determine trends in water quality by tracking changes in designated use support as defined by the Section 305(b) process of the US-EPA Clean Water Act. The main causes of water quality impairment of watersheds in the Territory are non-point sources of pollution, improper land-use designations, and increased production of solid waste and sewage. Additionally, pathogen indicators from collection system failure and intensive animal feeding operations have led to impaired streams in watersheds and surrounding coastal waters. These impaired watersheds are targeted for enhanced management measures and monitoring. Water quality monitoring is conducted by the American Samoa Environmental Protection Agency (AS-EPA); this is done through the different assessment programs targeting streams, nearshore marine waters, piggery compliance and an island-wide assessment of reef flats. Previous studies on water quality have shown broad-scale analyses on stream water chemical parameters (Bardi *et al.* 2005) and coastal water quality (DiDonato *et al.* 2009). Ongoing research efforts to address the causes of watershed impairment are conducted at several priority sites by federal and academic institutions in collaboration with local agencies. AS-EPA is assisting with these efforts and is taking the lead on tracking water quality at the watershed level across the Territory. The identification of the most important causes of watershed impairment can help make informed decisions that can enable systematic prioritization for protection of valuable water resources in American Samoa.



Figure 14.--Mia Comeros-Raynal (AS-EPA) presenting to the group.

Disease

Thierry Work

U.S. Geological Survey, National Wildlife Health Center

The USGS partnered with Dr. Greta Aeby with the University of Hawai‘i on coral and fish disease research in American Samoa over the last couple of years. This presentation focused on approaches to monitoring and identifying coral disease. Researchers take coral samples collected from other coral reef research and view those specimens via microscope to try and identify and understand the cause of coral diseases. Corals respond to disease threats by either losing tissue, becoming discolored or growing tumors. Corals examined via microscope may have different microscopic findings, and it is difficult to conclusively understand coral disease by looking at corals alone. To gain further insight into coral disease, researchers are looking at environmental factors (e.g. pollution, weather events, etc.) to better understand disease. To better identify and categorize coral disease, Dr. Work has developed coral disease identification cards for research divers to identify and record sightings of coral disease.

Fish diseases are also being documented and studied with a focus on blue line snapper in American Samoa. Blue line snapper is prevalent throughout the Pacific including in Hawai‘i, French Polynesia, and American Samoa, and researchers have discovered a parasite in their spleen that indicates disease. A fish health index was produced that ranks fish according to their appearance and parasite load and when compared to the fish health index, blue line snapper appears to be one of the least healthy fishes that exists.



Figure 15.--Mareike Sudek (DMWR) presenting to the group.

Mareike Sudek

Benthic Ecologist

American Samoa Department of Marine and Wildlife Resources

A variety of coral diseases has been documented by Doug Fenner of which “white-diseases” are most common. Currently, none of the local agencies have strategic disease surveys in their monitoring programs. A Coral Disease Workshop is planned for June 2015, led by Thierry Work with the intent that local agencies will be able to integrate basic disease surveys into the monitoring programs and establish a Coral Disease Outbreak Rapid Response Team.

Past and current research has found that disease levels are relatively low, but more research is needed to determine baseline levels to detect change over time, as well as what impact land-based pollution can have on these disease levels. Additional priority research needs for American Samoa include the following: conducting more baseline surveys to detect change, priority sites or wide-scale disease surveys, prevalence and diversity, understanding how land based sources of pollution affect coral reef function, and further research on which coral species are the most susceptible to diseases is needed.

Ocean Acidification

Bernardo Vargas-Angel
Coral Reef Ecosystem Division
NMFS, Pacific Islands Fisheries Science Center

Supported by NOAA's Coral Reef Conservation Program, this project aims at establishing robust baselines of spatial patterns and initiating long-term monitoring to detect changes of the key parameters of coral reef ecosystems predicted to be most impacted by ocean acidification across the US Pacific Islands. Incorporating an interdisciplinary approach, this project collects and processes surface and benthic water samples to document seawater carbonate chemistry; collects coral cores to assess calcification and extension rate chronologies of massive reef-building corals; uses calcification accretion units (CAUs) to detect changes in net reef accretion rates (mostly crustose coralline algae); and uses autonomous reef monitoring structures (ARMS) to detect changes in benthic biodiversity and community structure. These data will enable CRED to compare carbonate system parameters, quantify crustose coralline algae, hard coral and other calcifying invertebrates' accretion rates, and assess cryptobiota diversity and community composition in coral reef ecosystems. Comparisons between islands and between archipelagos across the US Pacific can be immediately drawn from within this project format. And, with future data collection, comparisons to these present-day measurements will facilitate the detection and reasonable attribution of temporal and spatial changes on coral reef ecosystems as a consequence of changing carbonate chemistry (expected lowering of aragonite saturation states and pH) associated with ocean acidification.



Figure 16.--Bernardo Vargas-Angel (NOAA) presenting to the group.

Session 5: Discussion

This section captures the main points and questions raised during and immediately following Session 5 presentations. Bullet points show comments/ideas by one or more participants and do not necessarily reflect group consensus.

Contaminants / Nutrients

- Conduct contaminant studies related to inputs from the Futiga landfill into nearshore marine environments especially around Fagatele Bay, an MPA which is nearby the Futiga landfill.
- Additional research is needed on water quality specifically in Vatia and Pala Lagoon, and there is a need to develop a management plan identifying solutions to clean up both areas.
- Conduct island-wide contaminant studies.
- Identify locations of sediment settling out on reefs around the islands and circulation patterns that affect where nutrients are concentrated.

Disease

- Determine "natural" baseline levels of disease and which areas deviate and why.
- Survey diseases affiliated with certain coral species and conduct more frequent surveys of coral disease.
- Conduct research on the feasibility and practicality of active removal of tumors from corals. Are there studies on active removal of coral anomalies / tumors?
- Diseases in the system are natural. Reefs that are stressed are more vulnerable to disease, so maintaining clean and healthy reefs is a growing concern. It would be good to know current disease levels for monitoring purposes in the future. More work needs to be done to keep the waters clean. More frequent disease surveys are needed.

Ocean Acidification

- Model effects of ocean acidification on reef accretion on Rose Atoll (dominated by crustose coralline algae) and how it will keep up with sea level rise (or not).
- Model ocean acidification effects on reef accretion within National Park Service waters.

Session 6: Ecosystem

Socioeconomics

Justin Hospital

Socioeconomics Program

NMFS, Pacific Islands Fisheries Science Center

The PIFSC Socioeconomics Program conducts a broad range of research across the Pacific Islands region to support fisheries management by exploring the economic, social and cultural values associated with living marine resources. This presentation described recent research efforts and existing data collection programs in American Samoa from

both the Economics Team and Human Dimensions Research Team. Potential areas of future socioeconomic research were explored in the context of data requirements and research questions, including commentary on how the research could support monitoring and management of American Samoa fisheries. Proposed topics included an examination of the determinants of fishery participation, improved monitoring of seafood markets, and attitudes and perceptions of the community towards various aspects of marine protected areas. Lastly, project updates were provided for recent NOAA Coral Reef Conservation Program-funded research projects.

Habitat Mapping / Geospatial Data

Bryan Dieter
Science Operations Division
NMFS, Pacific Islands Fisheries Science Center

The three main topics presented here include: 1) the availability and accessibility of various geospatial datasets for the American Samoa region, with emphasis on web-based data viewers and services; 2) habitat mapping efforts in the region by the Pacific Islands Benthic Habitat Mapping Center; and 3) a brief introduction to the Mariana Trench Marine National Monument web mapping pilot project.

Kelley Anderson Tagarino
American Samoa Community College & University of Hawai'i SeaGrant

This presentation focused on discussion of an inundation simulation video of Amouli village made by Dr. Chip Fletcher with the University of Hawai'i. The video was finished prior to the collection of LiDAR data in 2012 and utilized manual elevation data. The village of Amouli is the only village with a completed resiliency plan and that completed plan is considered the *gold standard* for American Samoa and the model looked at by other villages when developing their respective resiliency plans. The inundation video was the thing that galvanized the village of Amouli to finalize their resiliency plan. In addition, now that there is LiDAR data for American Samoa, making simulation videos showing inundation events is a lot easier.



Figure 17.--Saumaniafaese Urikirifi (DMWR) presenting to the group.

Marine Protected Areas

Saumaniafaese Urikirifi

Community-based Fisheries Management Program

American Samoa Department of Marine and Wildlife Resources

Traditional management of marine resources in American Samoa through the Community-based Fishery Management Program (CFMP) has proven to be an effective tool in implementing conservation measures to facilitate the sustainable management of the local subsistence and recreational fishery, and increase the abundance of marine resources. The CFMP has been active since 2001 and currently 11 sites are designated as Village Marine Protected Areas (VMPA) which are co-managed by village communities and the DMWR, through the development and implementation of village fishery management plans, which are legally established through the American Samoa Administrative Code.

Effective management of these sites can be attributed to the development of good relationships with the village communities, through regular community visits, education and outreach activities, and the implementation of fisheries management activities. Management activities include regular biological and socio-economic monitoring, capacity building training and the annual deputization of village mayors to enforce the regulations in each VMPA. Each village community is responsible for enforcement of their VMPA, with the assistance of the DMWR Enforcement Division when needed, which ensures local empowerment and buy-in to the process and therefore compliance with their VMPA regulations.

The successful establishment of VMPAs in American Samoa has increased awareness, motivation, and support from village communities to work collaboratively with the local government to manage near-shore fisheries and coral reef ecosystems as a whole.



Figure 18.--Workshop participants listening to presentations.

Jeremy Raynal
MPA Coordinator
Coral Reef Advisory Group

The American Samoan Marine Protected Area Network is made up of coordinated subunits, each managed by one of four federal (NMSAS, NPSA, NMFS, and USFWS) or three territorial partner agencies (DMWR, American Samoan Department of Commerce, and American Samoan Department of Parks and Recreation). Fishing is restricted in approximately 11% of territorial reef areas and 7% of American Samoan reefs are in No-Take zones. MPAs within the network vary in size, averaging near 0.4 km² (DMWR), 4.0 km² (NPSA), or 20 km² (NMSAS), depending on the managing agency. While progress in the MPA Network program is encouraging, challenges and capacity gaps remain, including a range of issues falling into four general categories: (1) public support including need for further public education and empowerment, as well as coordination among villages and public groups; (2) management support including need for further training and coordination of science, policy, MPA design, and enforcement; (3) consistent long term political support; and (4) further scientific support is required to better understand what uses of American Samoan coral reef resources are sustainable. Collaboration among federal and territorial agencies can help to overcome each of these gaps to ensure that the American Samoan MPA Network is scientifically sound, socially and politically supported, and functionally effective in meeting coral reef resource management goals according to territorial, federal, and international standards.



Figure 19.--Jeremy Raynal (CRAG) presenting to the group.

Muliava (Rose Atoll)

Frank Pendleton

Former Rose Atoll Refuge Manager, U.S. Fish and Wildlife Service

Brian Peck

Current Rose Atoll Refuge Manager, U.S. Fish and Wildlife Service

Rose Atoll became a National Wildlife Refuge in 1973 and a Marine National Monument in 2009. It is the only atoll in the Samoan archipelago, and is a breeding site for several species of sea birds as well as green turtles. This presentation provided a summary of geologic and oceanographic factors that have created present-day Rose Atoll, and provided an introduction into many of the research and management programs that have taken place at Rose Atoll since becoming a National Wildlife Refuge. Research summaries were included for sea birds, green turtles, fish, corals, and other projects.



Figure 20.--Brian Peck (USFWS Rose Atoll Refuge Manager) introducing himself to the group..

Session 6: Discussion

This section captures the main points and questions raised during and immediately following Session 6 presentations. Bullet points show comments/ideas by one or more participants and do not necessarily reflect group consensus.

Socioeconomics

- Conduct study looking at connectivity between social and biological aspects centered around MPAs.
- Research into the perception of communities in American Samoa on the establishment of MPAs
- Research on historical fisheries data – changes in catch, size, composition, changes in numbers of fishers over the years.
- Develop indicators to evaluate MPA effectiveness.
- Research to better understand the carrying capacity of island related to the landfill and clean water.
- Conduct economic studies on alia fleet.
- Studies and education / outreach on MPA terminology (e.g. what is allowed vs. prohibited within/around MPAs).
- Research on human dimensions aspects of MPAs.
- Studies looking at dependency of communities on fisheries.
- A socioeconomic study was conducted in 2009 (UH East West Center). Community engagement assisted with the start the community resiliency project, thus helping managers to understand the community on vulnerability, adaptability, and food security. Continue and develop socioeconomic factors of communities, like where communities are getting their food. Is it from the ocean? Is it from the land? Are they government dependent?

- Future socioeconomic surveys should be tailored to management needs. Do people know about the management factors of a MPA and why it is beneficial?
- The territory is relying heavily on imported goods. Is this because there aren't enough fish to sustain our population? Is the fish population declining? Maybe what we need is for someone to look at all the socioeconomic studies and to identify the gaps and areas that need more coordination/research.
- What is the carrying capacity of Tutuila? How much water is available? People complain about a lot of restriction and regulations, but we have to live for the conservation of the future and not just the present and right now. *Identify carrying capacity of Tutuila (population, water, etc.).

Habitat Mapping / Geospatial Data

- Prioritize LiDAR for the shallow near-shore marine environment.
- Develop sea level rise models.
- Utilize American Samoa Community College as a repository for data.

Marine Protected Areas

- Develop performance tools / management scorecard for MPAs.
- Develop methods to evaluate effectiveness of MPAs. Does the establishment of MPAs actually protect and conserve coral reefs? Increase fish populations?
- Analyze data on enforcement and compliance related to MPAs.
- What factors make a successful MPA (seeding / spillover)?
- It is really important to have both socioeconomic and ecological assessments of MPAs. Developing indicators to show the effectiveness of MPAs could give us some sort of indicator of success.
- Conduct human dimensions research: awareness of allowable and prohibited activities for MPAs. There are several types of MPAs in American Samoa, so it is important to obtain peoples input about their awareness in terms of what is allowed within MPAs. Include this aspect into future research studies.
- Assessing the perception of communities on establishing MPAs (In Aunu'u community?) Develop ways to assist managers in understanding the needs of having these outreach opportunities.
- One of the big problems worldwide with MPAs is enforcement and compliance. There is a need for data on enforcement and compliance. How often is enforcement conducted? Are people actually complying with regulations? Bio-monitoring is less meaningful without the enforcement info.

Muliava (Rose Atoll)

- Survey corals on reef flats to see if they are different from slopes.
- Conduct coral reef community comparisons between islands (i.e., island effects).
- Model impact of ocean acidification and sea level rise on sea crest.
- Rose Atoll Marine National Monument overlaps the sanctuary, but it is a large pelagic no-take area. Studies on pelagic fish populations around RAMNM should take place.

Session 7: Protected Species

Sea Turtles

Shawn Murakawa
Protected Species Division
NMFS, Pacific Islands Fisheries Science Center

2014 was the third year of a 5-year pilot study for Rose Atoll to monitor nesting activity, assess abundance, tag nesting and juvenile turtles, and satellite track migrations to elucidate the importance of the atoll for the regional populations of both hawksbill and green turtles in the South Pacific. The tags monitor the spatial and physiological behavior of the female turtles and provide novel and interesting scientific data. Beyond their ecological value, the data from this study are also considered crucial for conservation management.

Since 2012, a total of 21 satellite transmitters were applied to nesting green turtles at Rose; 14 of those went to Fiji, 3 to Samoa, 1 to New Caledonia, 1 to Papua New Guinea, and 1 to the Solomon Islands. One solar tag was deployed in 2014 but, unfortunately, only two transmissions were received. Working together with our partners at Rose allow us to provide training such as stranding response, performing necropsies, and applying flipper tags and satellite transmitters so that they can perform these functions on Tutuila and the Manu`a islands. The partnership, between NMFS, USFWS, DMWR, and NPSA is of great value in managing these turtle populations and by having this collaborative effort we are able to successfully accomplish the research at Rose Atoll and within American Samoa.

Mark MacDonald
Wildlife Division
American Samoa Department of Marine and Wildlife Resources

This presentation provided an overview of the marine turtle program in the American Samoa Department of Marine and Wildlife Resources. The main components of the program are (1) nesting beach monitoring; (2) outreach activities; (3) stranding response and (4) telemetry research. Nesting beach monitoring includes walking specific index beaches and recording all nesting activity including confirmed nests. After nests are identified, follow up monitoring is conducted throughout the entire nesting season. Genetic samples are also taken from dead hatchlings to identify which specific turtles are leading reproductive efforts. Outreach efforts include visiting school-age children on Ofu and Olosega and playing games and educating children on turtle biology. Additional outreach efforts include placing Samoan/English signs on turtle nesting beaches that warn people of nesting activity occurring in the area. Stranding response efforts include freeing trapped turtles and collecting dead carcasses. In addition, biologists assist with making sure turtle hatchlings return to the ocean. Entanglement hazards (e.g., fishing gear) cause about 25% of turtle deaths each year. Telemetry research includes placing

satellite tags on sea turtles to track their movements. In 2014 five satellite tags were deployed on two green turtles and three hawksbill turtles. The green turtles swam west while the hawksbill turtles swam to Fiji, Independent Samoa and the northern part of the Cook Islands. Future priorities include expanding nesting beach monitoring to Ta'u, conducting additional threat mitigation (light pollution, derelict fishing gear) and expanding telemetry research.



Figure 21.--Mark MacDonald (DMWR) presenting to the group.

Marine Mammals

Adam Miles

Wildlife Division

American Samoa Department of Marine and Wildlife Resources

This presentation was conducted on behalf of Jooke Robbins, Senior Scientist with the Center for Coastal Studies, and David Mattila, with the International Whaling Commission, conducting research mostly on Humpback Whales. In Oceania, Humpback whales are still considered an endangered subpopulation. There are approximately 3,000 – 5,000 whales in the South Pacific. This research is investigating recovery rates of the South Pacific Humpback whale. In American Samoa there is an important breeding ground for humpback whales. Humpback whales that breed in American Samoa, winter in Antarctica. Researchers annually conduct photo-identification of whale flukes and conduct skin and blubber sampling for genetics, sex, aging, health, and hormone studies.

In the South Pacific, humpback whales have dialects unique to the area. In the breeding grounds, researchers are trying to chase down ‘competitive’ groups of breeding males (where males are competing for females) and retrieve genetic samples. American Samoa is considered a low-density breeding ground; approximately 310 whales have been catalogued since 2003. Approximately 6% of the whales identified have been re-identified over the years and 13% have matched up with other areas of Oceania. Areas around Tutuila appear to be the best habitat for whales in the Samoan archipelago. This research has been in collaboration with the American Samoa DMWR, the NPSA, the NMSAS and the Samoa Division of Environmental Conservation.



Figure 22.--Adam Miles (DMWR) presenting to the group.

Session 7: Discussion

This section captures the main points and questions raised during and immediately following Session 7 presentations. Bullet points show comments/ideas by one or more participants and do not necessarily reflect group consensus.

Sea Turtles

- Conduct research on sand mining on beaches and its effect on turtles.
- Map critical habitat for resting and foraging areas of green and hawksbill sea turtles.
- Conduct research into sea turtle critical habitat.

Marine Mammals

- Consider stock assessment of cetaceans.

- Longline fisheries have had quite a few incidents of silky shark interactions. This is a species of concern for SPC. There may be an opportunity to explore more work with looking into the shark populations in Samoa as well.
- There are no fishes or any other marine species that are on the protected species list. Perhaps the IUCN Red List could be expanded by using other data sets, at least for fishing.

Other Protected Species Discussion Topics

- Look at longline interactions with sharks.
- Expand endangered species list based on localized threats.
- Expanded protected species list (e.g., fishes?).
-

RESULTS

The following tables are the research topic discussion notes that were identified per session by workshop participants. Large pieces of paper were labeled with each subtopic and posted around the room for participants’ consideration. Participants were asked to add suggestions about research topics to any subtopic throughout the workshop as they thought of new ideas. Workshop support staff also took notes during discussions and recorded them on these large pieces of paper.

Table 1.--Session 1 Research Needs.

Session 1: Research Needs	
Biosampling & Life History	<ul style="list-style-type: none"> • What drives the <i>akule</i> fishery? • Species specific genetic studies - <i>Myripristis berndti</i>, <i>Acanthurus lineatus</i>, <i>Scarus oviceps</i> • Research to set fish size limits • Analyze and use creel surveys • Local capacity to do surveys and studies • Implement fishing limits • Determine spawning aggregations • GPS on creel surveys tracks • Utility of life history information for resource management and conservation for priority species (groupers and parrotfish) • Spawning aggregations
Pelagics	<ul style="list-style-type: none"> • Fish populations: are they declining: 3 main species • Tuna studies • Looking at FADS productivity • Fish populations (Increase? Decrease? Same?)

Table 2.--Session 2 Research Needs.

Session 2: Research Needs

Connectivity

- Species specific connectivity studies (by genetics)
- Study ocean current models
- Species specific connectivity studies
- Use trace elements and isotope sign for otolith studies of fish
- Connectivity studies of fish and coral
- Currents, genetics, otolith chemistry
- Intra/inter island scale
- Fine-scale nearshore current / connectivity studies

Coral Reefs

- Potential for resilience based on monitoring data to assess sites in AMSA
- Development of ecosystem health index
- Continue long-term monitoring of Fagatele-Larsen Bay Sanctuary Unit
- Development of coral ID guide & workshop – identify funding
- ID areas more resilient to climate change
- Continue long-term monitoring (Fagatele Bay / Larsen Bay)
- Self-seeding on reefs / how much larvae comes back?
- Impacts of human pressure
- Monitoring of reef resilience
- Long-term monitoring studies development
- Ecosystem Health Index
- Determine level of human impact on reefs
 - COTS (as possible case study)
- Nutrient input maps (landfill, etc.)
- Disease
- COTS
- Bleaching, etc.
- Long-term monitoring of coral reefs
- Reef resilience studies
- Education and outreach: climate change
- Coral taxonomy

Table 3.--Session 3 Research Needs.

Session 3: Research Needs
<p>Coral Bleaching</p> <ul style="list-style-type: none"> • Identify bleaching hotspots and evaluate potential synergistic/additive effect with LBSP and fisheries; evaluate potential effect on disease prevalence. • Determine if causes of coral bleaching are anthropogenic • Studies on land based pollution • Resilient reef studies • Mapping nutrient pollution input and find ways to combat • Education and outreach of coral bleaching • Coral bleaching adaptation responses, find resistant colonies or areas <p>Crown of Thorns Starfish</p> <ul style="list-style-type: none"> • More research on natural predators • What causes population explosions of COTS? • Juvenile studies (where are they and when do they recruit to reefs?) • Spawning areas and larval recruitment

Table 4.--Session 4 Research Needs.

Session 4: Research Needs
<ul style="list-style-type: none"> • Important to continue hands-on outreach with the community with an emphasis on school-age children. Hands-on activities include getting people in the water, on boats and facilitating other field-based education activities • More emphasis also needs to be placed on science curriculum and science programs in schools • Need to continue offering scholarships to students interested in majoring in marine science • Need to teach about marine management and fisheries-based sciences in schools • Continue Marine Options Programs in American Samoa • Important to emphasize higher learning including providing opportunities for students to obtain graduate and doctorate degrees

Table 5.--Session 5 Research Needs.

Session 5: Research Needs
Contaminants / Nutrients <ul style="list-style-type: none">• Island-wide contaminant studies• More work in Vatia and Pala Lagoon• Contaminated studies related to inputs from landfills• Conduct more frequent surveys because it can be done more easily• Archipelago-wide to serve as baseline<ul style="list-style-type: none">○ Hotspots based on H₂O quality• Follow-up on Whitall studies on landfill into nearshore environment• Look into source of contaminants and follow-up with outreach• Effects of contaminants from landfills• More work in Vatia
Ocean Acidification <ul style="list-style-type: none">• Modeling effects of Ocean Acidification on reef accretion on Rose Atoll and within the National Park

Table 6.--Session 6 Research Needs.

Session 6: Research Needs
<p>Socioeconomics</p> <ul style="list-style-type: none"> • Develop indicators to evaluate MPS effectiveness • What is the carrying capacity of the island related to landfills and clean water? • Perceptions of community on establishment of MPAs • What is carrying capacity of island? • Studies and education on MPA terms/types (allowed vs. prohibited activities) • Studies on MPA effectiveness and awareness, biological and social aspects and community perceptions • Study on carrying capacity of island • Working to overcome community obstacles that are preventing incorporating change • Survey of land-based spear fishing to learn about amount of effort • Clarifying goals of MPAs for long-term benefit • MPA effectiveness through socioeconomic studies, biological surveys • Education and outreach on MPAs terminology, different levels of protection, etc. <p>Habitat Mapping / Geospatial Data</p> <ul style="list-style-type: none"> • LiDAR • LiDAR data for shallow water areas • Local capacity for mapping (LiDAR) • Shallow near-shore environment mapping <p>Marine Protected Areas</p> <ul style="list-style-type: none"> • Evaluating effectiveness of MPAs • Understanding factors that make a successful MPA • Data on enforcement and compliance • Enforcement is an issue: lack of will to enforce regulations <ul style="list-style-type: none"> ○ Look at successes • Evaluating biology and socioeconomic aspects / effectiveness • Factors that make a successful MPA <p>Muliava (Rose Atoll)</p> <ul style="list-style-type: none"> • Where are the apex predators? • Coral reef community comparisons between islands • Model impacts of ocean acidification and sea level rise on reef crest • Enforcement of yachts and other boats • Long-term monitoring • Survey corals on reef flats to see if different from slopes • Coral reef community comparisons between islands • Reef accretion modeling on Rose Atoll

Table 7.--Session 7 Research Needs.

Session 7: Research Needs
Sea Turtles <ul style="list-style-type: none">• Look at sand mining on beaches (turtles)• Map critical habitat for nesting and foraging areas of sea turtles• Surveys and assessment of protected species interaction with longline
Marine Mammal <ul style="list-style-type: none">• Stock assessment of cetaceans• Surveys and assessment of protected species interaction with longline
Other Protected Species Research Needs <ul style="list-style-type: none">• Look at longline interactions<ul style="list-style-type: none">○ Sharks• Expand protected species list<ul style="list-style-type: none">○ IUCN standards○ Include Triton's trumpet and Humphead for sure• Expand protected species list based on local threats• Look at critical habitat for management, protection of ESA / threatened species



Figure 23.--Risa Oram (NOAA) providing instructions and Hoku Johnson (NOAA) recording research needs

DISCUSSION

Upon completion of the subject matter expert presentations, participants were randomly divided into six breakout groups and were provided instructions on how to provide a consensus list of priority projects per breakout group. Six “session stations” were set up around the room, each containing the corresponding subtopic notes written on the large pieces of paper presented in the previous section. Each breakout group had approximately 10 minutes to rotate through each station and develop a collective list of their respective research priorities based on the research topic discussion notes provided at each station. Upon conclusion of the breakout priority review session, each group presented their top priorities to the entire workshop group. Results from each group are below.

Group 1
<p><i>STOCK ASSESSMENT</i></p> <ul style="list-style-type: none"> • How spatially explicit can the bottomfish stock assessment be? Interested in understanding stock assessment around Anu'u in the NE Sanctuary Unit • Expand creel surveys • Expand stock assessment research • What life history information is useful for prioritization and management <p><i>PELAGICS</i></p> <ul style="list-style-type: none"> • Fish populations: are they declining?: 3 main species <p><i>ECOSYSTEMS</i></p> <ul style="list-style-type: none"> • Study ocean connectivity • Study fine-scale connectivity <p><i>CORAL REEFS</i></p> <ul style="list-style-type: none"> • Potential for resilience based on monitoring data to assess sites in American Samoa • Development of ecosystem health index • Continue long-term monitoring of Fagatele-Larsen Bay Sanctuary Unit • Development of coral ID guide & workshop – identify funding <p><i>BLEACHING</i></p> <ul style="list-style-type: none"> • Identify bleaching hotspots and evaluate potential synergistic/additive effect with LBSP and fisheries; evaluate potential effect on disease prevalence. <p><i>COTS</i></p> <ul style="list-style-type: none"> • More research on juveniles • More research on natural predators <p><i>LBSP</i></p> <ul style="list-style-type: none"> • Contaminant studies related to inputs from the landfills nearshore marine ecosystem • More work at Vatia and Pala lagoon <p><i>OCEAN ACIDIFICATION</i></p> <ul style="list-style-type: none"> • Modeling effects of OA on reef accretion on Rose Atoll and NPS <p><i>SOCIOECONOMICS</i></p> <ul style="list-style-type: none"> • Develop indicators to evaluate MPAs effectiveness • What is the carrying capacity of the island related to landfills and clean water? • Perceptions of community on establishment of MPAs <p><i>MULIAVA</i></p> <ul style="list-style-type: none"> • Where are the apex predators?

Group 2

STOCK ASSESSMENT

- Stock assessments for reef fish complex, bottomfish complex (includes life history and creel surveys)

BIOSAMPLING & LIFE HISTORY

- What drives the akule fishery?
- Species specific genetic studies

CONTAMINANTS & NUTRIENTS

- Island-wide contaminant studies

CORAL BLEACHING

- Determine if causes of coral bleaching are anthropogenic

CORAL REEFS

- ID areas more resilient to climate change
- Continue long-term monitoring (Fagatele Bay / Larsen Bay)

COTS

- What causes population explosion of COTS?

DISEASE

- Determine "natural" baseline levels of disease and which areas deviate and why?

MPAs

- Evaluating effectiveness of MPAs
- Understanding factors that make a successful MPA

MULIAVA (ROSE ATOLL)

- Coral reef community comparisons between islands

PELAGICS

- Tuna studies

PROTECTED SPECIES

- Look at sand mining on beaches (turtles)
- Stock assessment of cetaceans

SOCIOECONOMICS

- What is carrying capacity of island?
- Studies and education on MPA terms/types (allowed vs. prohibited activities)



Figure 24.--Workshop participants listening to presentations.

Group 3

BIOSAMPLING & LIFE HISTORY

- Research to set fish size limits
- Analyze and use creel surveys

CONNECTIVITY

- Species specific connectivity studies (by genetics)
- Study ocean current models

CONTAMINANTS & NUTRIENTS

- More work in Vatia and Pala Lagoon
- Contaminated studies related to inputs from landfills

CORAL BLEACHING

- Studies on land based pollution
- Resilient reef studies

CORAL REEFS

- Self-seeding on reefs / how much larvae comes back?
- Impacts of human pressure

DISEASE

- Determine natural baseline levels
- Survey which diseases are on which corals

HABITAT MAPPING

- LiDAR

MPAs

- Data on enforcement and compliance

MULIAVA (ROSE ATOLL)

- Model impacts of ocean acidification and sea level rise on reef crest

PELAGICS

- Looking at FADS productivity
- Fish populations (Increase? Decrease? Same?)

PROTECTED SPECIES

- Map critical habitat for nesting and foraging areas of sea turtles
- Look at longline interactions
 - Sharks

SOCIOECONOMICS

- Studies on MPA effectiveness and awareness, biological and social aspects and community perceptions
- Study on carrying capacity of island

Group 4

BIOSAMPLING & LIFE HISTORY

- Local capacity to do surveys and studies
- Implement fishing limits
- Determine spawning aggregations
- GPS on creel surveys tracks

CONNECTIVITY

- Species specific connectivity studies
- Use trace elements and isotope sign for otolith studies of fish

CONTAMINANTS & NUTRIENTS

- Conduct more frequent surveys because it can be done more easily
- Archipelago-wide to serve as baseline
 - Hotspots based on H2O quality
- Follow-up on Whittall studies on landfill into nearshore environment
- Look into source of contaminants and follow-up with outreach

CORAL BLEACHING

- Mapping nutrient pollution input and find ways to combat

CORAL REEFS

- Monitoring of reef resilience
- Long-term monitoring studies development
- Ecosystem Health Index
- Determine level of human impact on reefs
 - COTS (as possible case study)

COTS

- Juvenile studies (where are they and when do they recruit to reefs?)
- Spawning areas and larval recruitment

HABITAT MAPPING

- LiDAR data for shallow water areas
- Local capacity for mapping (LiDAR)

MPAS

- Enforcement is an issue: lack of will to enforce regulations
 - Look at successes

MULIAVA (ROSE ATOLL)

- Enforcement of yachts and other boats
- Long-term monitoring

PROTECTED SPECIES

- Surveys and assessment of protected species interaction with longliners

SOCIOECONOMICS

- Working to overcome community obstacles that are preventing incorporating change
- Survey of land-based spear fishing to learn about amount of effort
- Clarifying goals of MPAs for long-term benefit



Figure 25.--Small groups providing research priorities.

Group 5
<p><i>STOCK ASSESSMENT</i></p> <ul style="list-style-type: none"> • Biosampling and life history - Use limited data • Seasonal studies, etc. <p><i>SPAWNING AGGREGATIONS</i></p> <ul style="list-style-type: none"> • Locations and seasons <p><i>CONNECTIVITY</i></p> <ul style="list-style-type: none"> • Fish and coral • Currents, genetics, otolith chemistry • Intra/inter-island scale <p><i>CORAL REEFS</i></p> <ul style="list-style-type: none"> • Nutrient input maps (landfill, etc.) • Disease • COTS • Bleaching, etc. <p><i>LARGE SCALE COLLABORATION PROJECTS</i></p> <ul style="list-style-type: none"> • Large-scale education and outreach <p><i>MPAS</i></p> <ul style="list-style-type: none"> • Evaluating biology and socioeconomic aspects / effectiveness <p><i>PROTECTED SPECIES</i></p> <ul style="list-style-type: none"> • Expand protected species list <ul style="list-style-type: none"> ○ IUCN Standards ○ Include Triton's trumpet and Humphead for sure <p><i>SMALL-SCALE FOR HEADS OF INDIVIDUAL DEPARTMENTS</i></p> <ul style="list-style-type: none"> • Shallow-water LiDAR • Reef flat surveys Rose

Group 6

STOCK ASSESSMENT

- Stock assessments for data-limited fishery (coral reef / multi species fisheries)
- Bottomfish stock assessment

BIOSAMPLING & LIFE HISTORY

- Utility of life history information for resource management and conservation for priority species (groupers and parrotfish)
- Spawning aggregations

CONNECTIVITY

- Fine-scale nearshore current / connectivity studies

CONTAMINANTS & NUTRIENTS

- Effects of contaminants from landfills
- Vatia - more work

CORAL BLEACHING

- Education and outreach of coral bleaching
- Coral bleaching adaptation responses, find resistant colonies or areas

CORAL REEFS

- Long-term monitoring of coral reefs
- Reef resilience studies
- Education and outreach: climate change
- Coral taxonomy

COTS

- Juvenile *alamea* (crown of thorns) research

DISEASE

- Baseline knowledge of coral diseases
- Disease on w/c coral reefs

HABITAT MAPPING

- Shallow near-shore environment mapping

MPAS

- Factors that make a successful MPA

MULIAVA (ROSE ATOLL)

- Survey corals on reef flats to see if different from slopes
- Coral reef community comparisons between islands
- Reef accretion modeling on Rose Atoll

PROTECTED SPECIES

- Expand protected species list based on local threats
- Look at critical habitat for management, protection of ESA / threatened species

SOCIOECONOMICS

- MPA effectiveness through socioeconomic studies, biological surveys
- Education and outreach on MPAs terminology, different levels of protection, etc.



Figure 26.--Workshop participants discussing research priorities.

SUMMARY / CONCLUSION

Priorities

Once all of the group break-out presentations were finished, NOAA support staff compiled all the priority research topics into a list and ranked them according to the number of times a priority research topic was highlighted by each group. Several common research themes emerged from the small group exercise. The following table includes all of the priorities and group rank. Research topics were ranked very high, high, medium, medium-low and low based on the number of groups voting for each topic. Research topics receiving six votes were ranked very high, those receiving four votes were ranked high, those receiving three votes were ranked medium, topics receiving two votes were ranked medium-low, and those receiving one vote were ranked low. The top priorities are highlighted in the colored box at the top of the table:

Category	Research Topic	Group	Rank
Socioeconomics	Perceptions of community on establishment of MPAs, MPA terms/types (allowed vs. prohibited activities), etc.	1,2,3,4,5,6	Very High
Connectivity	Species-specific connectivity studies (by genetics).	2, 3, 4, 5	High
Contaminants and Nutrients	Disease and Contaminants: Follow-up on Whitall studies on landfill inputs into nearshore marine environment (especially Fagatele Bay nearby Futiga landfill)	1, 3, 4, 6	High
Habitat Mapping	Shallow near-shore marine environment mapping (using LiDAR data)	3, 4, 5, 6	High
Biosampling and Life History	Determine locations, seasons and periods of spawning aggregations	4, 5, 6	Medium
Connectivity	Study ocean current models for connectivity studies	1, 3, 5	Medium
Contaminants and Nutrients	More work in Vatia (1) H ₂ O quality/LBSP; (2) Management Plan	1, 3, 6	Medium
Coral Bleaching	Coral bleaching adaptation responses, find resistant/ resilient colonies or areas	3, 5, 6	Medium
COTS	More research on juvenile COTS (where are they and when they recruit to reefs)	1, 4, 6	Medium
MPAs	Understanding factors that make a successful MPA (seeding / spillover) biological and socioeconomic	2, 5, 6	Medium
Socioeconomics	What is the carrying capacity of the island? Especially related to landfills and clean water?	1, 2, 3	Medium
Biosampling and Life History	Use of trace elements and stable isotope signatures in otoliths for fish natal origin studies relating to connectivity	4, 5	Medium-Low
Connectivity	Fine-scale nearshore current / connectivity studies (e.g. MPA, genetics, next gen genetics)	1, 6	Medium-Low
Contaminants and Nutrients	More work in Pala Lagoon (1) H ₂ O quality/LBSP; (2) Management Plan	1, 3	Medium-Low
Contaminants and Nutrients	Disease and Contaminants: Archipelago- and island-wide to serve as baseline a. Hotspots base on H ₂ O quality	2, 4	Medium-Low
Contaminants and Nutrients	Disease and Contaminants: Look into source of contaminants & follow-up with outreach. Include mapping sources of nutrient inputs, find ways to combat	4, 5	Medium-Low
Coral Reefs	Development of coral ecosystem health index	1, 4	Medium-Low
Coral Reefs	Continue long-term monitoring of Fagatele-Larsen Bay Sanctuary Unit	1, 2	Medium-Low
Coral Reefs	Develop long-term monitoring studies of coral reefs	4, 6	Medium-Low
Coral Reefs	Determine level of human impact on reefs	3, 4	Medium-Low
Coral Reefs	Reef resilience studies	4, 6	Medium-Low
COTS	COTS (as possible case study)	4, 5	Medium-Low

Category	Research Topic	Group	Rank
Disease	Determine "natural" baseline levels of disease and which areas deviate and why?	2, 3	Medium-Low
Disease	Survey which diseases are on which coral species	3, 6	Medium-Low
Disease	Baseline knowledge of coral diseases	5, 6	Medium-Low
MPAs	Data on enforcement and compliance (lack of will to enforce regulations) a. Look at successes	3, 4	Medium-Low
Muliava (Rose Atoll)	Coral reef community comparisons between islands (i.e., island effects)	2, 6	Medium-Low
Muliava (Rose Atoll)	Survey corals on reef flats to see if different from slopes	5, 6	Medium-Low
Ocean Acidification	Modeling effects of OA on reef accretion on Rose Atoll (dominated by CCA) and how it will keep up with sea level rise (or not) and OA effect on reef accretion on NPS waters	1, 3	Medium-Low
Pelagics	Fish populations: (Increase? Decrease? Same?) 3 main species	1, 3	Medium-Low
Stock Assessment	Stock assessments for data-limited fishery (coral reef / multi species fisheries)	5, 6	Medium-Low
Stock Assessment	Bottomfish stock assessment (includes life history and creel surveys)	2, 6	Medium-Low
Biosampling and Life History	What drives the <i>akule</i> fishery? Environmental variables?	2	Low
Biosampling and Life History	Research needed to determine minimum recommended size limit on reef fish and limits on types of fish.	3	Low
Biosampling and Life History	Develop local capacity to do biosampling and life history surveys and studies	4	Low
Biosampling and Life History	Prioritize analysis of parrotfish and grouper biosampling data (life history and length / age analysis) for resource management and conservation.	6	Low
Biosampling and Life History	What inferences can we take from the life history data? What available life history information will be useful for research prioritization and management?	1	Low
Connectivity	Fish and coral connectivity studies	5	Low
Connectivity	Intra/inter island scale connectivity studies	5	Low
Contaminants and Nutrients	Disease and Contaminants: Conduct more frequent surveys because it can be done more easily	4	Low
Coral Bleaching	Identify coral bleaching hotspots and evaluate potential synergistic/additive effect with LBSP and fisheries; evaluate potential effect on disease prevalence	1	Low
Coral Bleaching	Determine if causes of coral bleaching are anthropogenic	2	Low
Coral Bleaching	Studies on land based pollution and its contribution to coral bleaching	3	Low
Coral Reefs	Potential for resilience based on monitoring data to assess sites	1	Low

Category	Research Topic	Group	Rank
	in NMSAS and AS		
Coral Reefs	Development of coral ID guide for American Samoa corals and workshop to teach coral ID -identify funding	1	Low
Coral Reefs	ID areas more resilient to climate change	2	Low
Coral Reefs	Self-seeding on reefs / how much larvae comes back?	3	Low
Coral Reefs	Use coral taxonomy tool to study coral disease, bleaching, etc.	6	Low
COTS	Research on natural predators - Humphead wrasse, Triton's trumpet	1	Low
COTS	What causes population explosion of COTS?	2	Low
COTS	Spawning areas and larval recruitment	4	Low
Habitat Mapping	Local capacity for mapping (LiDAR)	4	Low
Large scale education collaboration projects	Large-scale education and outreach on coral bleaching and climate change	5	Low
Muliava (Rose Atoll)	Where are the apex predators?	1	Low
Muliava (Rose Atoll)	Long-term monitoring	4	Low
Muliava (Rose Atoll)	Reef accretion modeling on Rose Atoll	6	Low
Pelagics	Tuna studies	2	Low
Pelagics	Looking at FAD productivity, fishermen data driven, seasonality of catch data - produce model showing relationship between distance to shore and present to fishermen	3	Low
Protected Species	Look at sand mining on beaches (turtles)	2	Low
Protected Species	Stock assessment of cetaceans	2	Low
Protected Species	Map critical habitat for resting and foraging areas of green and hawksbill sea turtles.	3	Low
Protected Species	Look at longline interactions with sharks. (Silky shark identified as priority for SPC, opportunity to collaborate with Samoa).	3	Low
Protected Species	Surveys and assessment of protected species interaction with longline	4	Low
Socioeconomics	Development of indicators to evaluate effectiveness of MPAs (socioeconomic / biological)	1	Low
Stock Assessment	How spatially explicit will the bottomfish stock assessment be? Interested in understanding stock assessment around Aunu'u in the NE Sanctuary Unit	1	Low
Creel	Expand creel surveys	1	Low
Creel	Analyze and use creel survey	3	Low
Creel	GPS on creel surveys tracks	4	Low
Stock Assessment	Expand stock assessment research	1	Low
Stock Assessment	Understanding seasonal fish stocks	5	Low
Stock Assessment	Stock assessments for reef fish complex (includes life history and creel surveys)	2	Low

Next Steps

The PIFSC Monument Science Program plans to conduct regular science planning meetings prior to the year that the NOAA Ship *Oscar Elton Sette* will be in American Samoa waters. If funding permits, the PIFSC Monument Science Program will also provide feedback on science and planning activities to the American Samoa research and management community. PIFSC and PIRO will continue to coordinate on their science research and management planning activities with other local and federal partners. The information learned during this workshop will be incorporated into an NOAA Fisheries Pacific Islands Fisheries Science Center American Samoa marine research implementation plan for years 2017-2022. These plans aid PIFSC in identifying and prioritizing research activities.

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APPENDIX 1—Workshop Agenda

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AGENDA

Rose Atoll Marine National Monument and American Samoa Ecosystem and Fisheries Research Workshop 2015

TUESDAY, MAY 26 – WORKSHOP DAY 1 – SUNIA OCEAN CENTER, UTULEI

8:00 - 8:30 AM	Sign in / Coffee and Refreshments	
8:30 - 8:35 AM	Master of Ceremonies	Gataivai Talamo
8:35 - 8:45 AM	Opening Prayer and Hymn	Deacon Kaio Ah Hing, Sergeant Major, United States Army Cadet Command, Senior Army Instructor, Faga'itua High School & Faga'itua High School Choir and Faculty
8:45 - 8:50 AM	Masters of Ceremonies (Samoan Introduction)	Gataivai Talamo
8:50 - 9:00 AM	Lt. Governor Welcome	HC Lemanu Peleti Mauga
9:00 - 9:15 AM	DMWR Introduction	TBD
9:15 - 9:30 AM	PIFSC Overview of Meeting / IGC Update	Bob Humphreys, Risa Oram / Richard Hall
9:30 - 10:45 AM	SESSION 1: Fisheries	
9:30 - 9:45 AM	Biosampling / Life History of Reef Fish and Bottomfish	Domingo Ochavillo / Bob Humphreys
9:45 - 10:00 AM	Pelagics: American Samoa Observer Program / South Pacific Albacore Biology	Michael Marsik / Bob Humphrey
10:00 - 10:15 AM	Break	
10:15 - 10:30 AM	NOAA Currently Funded Projects	Kara Miller, Fatima Sauafea-Leau, Kristine Bucchianeri
10:30 - 11:00 AM	SESSION 1 DISCUSSION **	
11:00 - 12:00 PM	SESSION 2: Ecosystem	
11:00 - 11:15 AM	Connectivity	Domingo Ochavillo, Tim Clark
11:15 - 11:30 AM	Coral Reefs	Bernardo Vargas-Angel / Doug Fenner / Wendy Cover
11:30 - 12:00 PM	SESSION 2 DISCUSSION **	
12:00 - 1:00 PM	Lunch (on your own, in local area)	
1:00 - 2:00 PM	SESSION 3: Understanding and Addressing Threats	
1:00 - 1:15 PM	Coral Bleaching	Wendy Cover
1:15 - 1:30 PM	Crown of Thorns Starfish	Tim Clark
1:30 - 2:00 PM	SESSION 3 DISCUSSION **	
2:00 PM	Change location	

AGENDA

Rose Atoll Marine National Monument and American Samoa Ecosystem and Fisheries Research Workshop 2015

TUESDAY, MAY 26 – PUBLIC SESSION DAY 1 – SADIES BY THE SEA CONFERENCE ROOM, UTULEI

3:00 - 3:30 PM	Welcome and Opening Remarks	Gataivai Talamoa / Bob Humphreys / Fatima Sauafea-Leau
<hr/>		
3:30 - 5:00 PM	SESSION 4: Community Involvement	
3:30 - 3:45 PM	Communicating with Broader Community	Fatima Sauafea-Leau, Kristine Bucchianeri
3:45 - 5:00 PM	Interactive Fisheries Stations: NOAA Fisheries, Biosampling, Traditional Fisheries, Coral Reefs, Crown of Thorns, Seabirds	Gataivai Talamoa/ Domingo Ochovilla / HC Afoa / Bernardo Vargas-Angel, HC Pua Tuaua
5:00 PM	Adjourn	

Rose Atoll Marine National Monument and American Samoa Ecosystem and Fisheries Research Workshop 2015

WEDNESDAY, MAY 27 – WORKSHOP DAY 2 – SUNIA OCEAN CENTER, UTULEI

8:00 - 8:30 AM	Sign in / Coffee and Refreshments	
8:30 - 8:45 AM	Welcome and Recap of Day 1	Risa Oram
8:45 - 10:00 AM	SESSION 5: Understanding and Addressing Threats (continued)	
8:45 - 9:00 AM	Contaminants / Nutrients	Christopher Shuler / Jewel Tuiasasopo
9:00 - 9:15 AM	Disease	Thierry Work and Mareike Sudek
9:15 - 9:30 AM	Ocean Acidification	Bernardo Vargas-Angel
9:30 - 10:00 AM	SESSION 5 DISCUSSION **	
10:00 - 10:15 AM	Break	
10:15 - 11:30 AM	SESSION 6: Ecosystem (continued)	
10:15 - 10:30 AM	Socioeconomics	Justin Hospital
10:30 - 10:45 AM	Habitat Mapping / Geospatial Data	Bryan Dieter / Kelley Tagarino
10:45 - 11:00 AM	Marine Protected Areas	Afa Urikirifi / Jeremy Raynal
11:00 - 11:30 AM	SESSION 6 DISCUSSION **	
11:30 AM - 12:30 PM	Lunch (on your own, in local area)	
12:30 - 1:45 PM	SESSION 7: Protected Species	
12:30 - 12:45 PM	Muliava (Rose Atoll)	Frank Pendelton / Brian Peck
12:45 - 1:00 PM	Sea Turtles	Marc MacDonald / Shawn Murakawa
1:00 - 1:15 PM	Marine Mammals	Adam Miles
1:15 - 1:45 PM	Session 7 DISCUSSION **	
1:45 - 2:00 PM	Break	
2:00 - 3:00 PM	Break Out Session to Prioritize Research	
3:00 - 3:30 PM	Report Out	
3:30 - 4:30 PM	Closeout	
4:30 PM	Adjourn	

APPENDIX 2—List of Participants

	Last Name	First Name	Affiliation	Role
1	Aveina	Mac	Western Pacific Regional Fishery Management Council	Participant, demonstration for public session
2	Brighthouse	Gene	NOAA-NOS, National Marine Sanctuary of American Samoa	Participant, planning committee member
3	Bucchianeri	Kristine	Coral Reef Advisory Group	Presenter, participant
4	Clark	Tim	National Park Service American Samoa	Presenter, participant
5	Comeros	Mia Theresa	American Samoa Environmental Protection Agency	Presenter, participant
6	Cover	Wendy	NOAA-NOS, National Marine Sanctuary of American Samoa	Presenter, participant, planning committee member
7	Dieter	Bryan	NOAA-NMFS, Pacific Islands Fisheries Science Center, Science Operations Division	Presenter (remote, Honolulu)
8	Eagan	Sean	National Park Service American Samoa	Planning committee member
9	Fainu'ulelei	Pouvave	Samoana High School Science Teacher	Participant
10	Faoa	Lualemega	Office of Samoan Affairs	Participant
11	Felise	Sean	American Samoa Department of Marine and Wildlife Resources	Participant, demonstration for public session
12	Fenner	Douglas	Independent consultant coral reefs	Participant
13	Hall	Richard	NOAA-NMFS, Pacific Islands Regional Office, Marine National Monument Program	Workshop support staff, planning committee member
14	Hospital	Justin	NOAA-NMFS, Pacific Islands Fisheries Science Center, Socioeconomics Program	Presenter (remote, Honolulu)
15	Humphreys	Robert	NOAA-NMFS, Pacific Islands Fisheries Science Center, Life History Program	Presenter, participant, planning committee member
16	Ilaoa	Nathan	Western Pacific Regional Fishery Management Council	Participant

	Last Name	First Name	Affiliation	Role
17	Johnson	Hoku	NOAA-NMFS, Pacific Islands Fisheries Science Center, Science Operations Division	Workshop support staff, planning committee member
18	Kobayashi	Don	NOAA-NMFS, Pacific Islands Fisheries Science Center, Ecosystems and Oceanography	Presenter (remote, Honolulu)
19	Langkilde	Tony	American Samoa Department of Commerce	Participant
20	Lavata'i	Tepora Toliniu	American Samoa Department of Marine and Wildlife Resources	Participant, planning committee member
21	Lawrence	Alice	American Samoa Department of Marine and Wildlife Resources	Participant
22	Letalie	TeeJay	American Samoa Department of Marine and Wildlife Resources	Participant, demonstration for public session
23	MacDonald	Mark	American Samoa Department of Marine and Wildlife Resources	Presenter, participant
24	Malae	Utu Abe	American Samoa Power Authority	Participant
25	Marsik	Michael	NOAA-NMFS, Pacific Islands Regional Office, American Samoa Fisheries Observer Program	Presenter, participant
26	Matagi-Tofiga	Ruth	American Samoa Department of Marine and Wildlife Resources	Presenter, participant, planning committee member
27	McGuire	Kim	Coral Reef Advisory Group	Participant
28	Miles	Adam	American Samoa Department of Marine and Wildlife Resources	Presenter (for Jooke Robbins' work), participant
29	Miller	Monika	93 KHJ Radio	Participant, news reporter
30	Miller	Kara	NOAA-NMFS, Pacific Islands Regional Office, Grants	Presenter (remote Honolulu)
31	Mortenson	Veronika	NOAA-NOS, National Marine Sanctuary of American Samoa	Participant
32	Murakawa	Shawn	NOAA-NMFS, Pacific Islands Fisheries Science Center, Turtle Research Program	Presenter (remote Honolulu), planning committee member

	Last Name	First Name	Affiliation	Role
33	Ochavillo	Domingo	American Samoa Department of Marine and Wildlife Resources	Presenter, participant, planning committee member, demonstration for public session
34	Oram	Risa	NOAA-NMFS, Pacific Islands Fisheries Science Center, Science Operations Division	Workshop Chair, planning committee member
35	Paulin	Joe	NOAA-NOS, National Marine Sanctuary of American Samoa	Participant
36	Peau	Atuatasi-Lelei	NOAA-NOS, National Marine Sanctuary of American Samoa	Participant, planning committee member
37	Peck	Brian	United States Fish and Wildlife Service	Presenter, participant
38	Pendleton	Frank	former United States Fish and Wildlife Service	Presenter (remote Honolulu)
39	Pollock	Amanda	United States Fish and Wildlife Service	Planning committee member
40	Que	Nerelle	American Samoa Department of Commerce	Participant
41	Raynal	Jeremy	Coral Reef Advisory Group	Presenter, participant
42	Rogers-Ka'aekuahiwi	L. Hokulani	NOAA-NMFS, Pacific Islands Regional Office, Marine National Monument Program	Workshop support staff, planning committee member
43	Sauafea-Leau	Fatima	NOAA-NMFS, Pacific Islands Regional Office, Habitat Conservation Program, American Samoa Liaison	Presenter, participant, planning committee member
44	Schuster	Ekueta	American Samoa Department of Marine and Wildlife Resources	Participant, demonstration for public session
45	Sesepesara	Henry	Independent Consultant to American Samoa Fishery Task Force	Participant
46	Shoji	Noriko	NOAA-NMFS, Pacific Islands Fisheries Science Center, Science Operations Division	Presenter, Workshop support staff
47	Shuler	Christopher	University of Hawai'i at Manoa	Presenter (remote Honolulu)
48	Slater	Leland	Community member	Participant
49	Sotoa	HC Togotogo Potumoe	American Samoa Alia Association	Planning committee member

	Last Name	First Name	Affiliation	Role
50	Sudek	Mareike	Coral Reef Advisory Group	Presenter, participant
51	Tagarino	Kelley	University of Hawai'i Sea Grant- American Samoa Community College	Presenter, participant, planning committee member
52	Talamoa	Gataivai	NOAA-NMFS, Pacific Islands Fisheries Science Center, Science Operations Division, American Samoa Liaison	Workshop support staff, planning committee member
53	Tanuvasa	HC Keneti	Office of Samoan Affairs	Participant
54	Tua	Alama	American Samoa Department of Marine and Wildlife Resources	Participant, demonstration for public session
55	Tuiagamoia	HTC	Office of Samoan Affairs	Planning committee member
56	Tulafono	HC Ufagafa Ray	American Samoa Department of Marine and Wildlife Resources (retired)	Planning committee member
57	Uikirifi	Saumaniafaese	American Samoa Department of Marine and Wildlife Resources	Presenter, participant, demonstration for public session
58	Vaeoso	Motusaga	Coral Reef Advisory Group	Participant
59	Vargas-Angel	Bernardo	NOAA-NMFS, Pacific Islands Fisheries Science Center, Coral Reef Ecosystems	Presenter, participant, planning committee member
60	Work	Thierry	United States Geological Survey	Presenter (remote Honolulu)
61	Yoshinaga	Chad	NOAA-NMFS, Pacific Islands Fisheries Science Center, Science Operations Division	Workshop support staff, planning committee member

APPENDIX 3—Workshop Support Staff and Speaker Biographies

Risa Oram (Workshop Coordinator, Facilitator)

Risa Oram is a Natural Resource Management Specialist for the Science Operations Division of the Pacific Islands Fisheries Science Center in Honolulu, Hawai‘i. As part of her duties Risa works with the Pacific Marine National Monument Science Program and conducts science planning and implementation for the Center. Risa leads a group of Field Office Liaisons from American Samoa, Commonwealth of the Northern Mariana Islands and Guam and is a NOAA scientific diver. Risa formerly worked for the DMWR and CRAG from 2004 to 2008 on coral reef and marine protected area issues. Risa has experience working with coral reef land-based sources of pollution issues, coral reefs, science and management planning, social science research and cultural issues.

Richard Hall (Workshop Support)

Richard Hall works for the PIRO Monuments Program and is a member of the Rose Atoll Marine National Monument Inter-Governmental Committee for management planning.

Hoku Johnson (Workshop Support)

Hoku Johnson is the NEPA specialist working in the Science Operations Division. She has over 10 years of experience working for Papāhānaumokuākea Marine National Monument.

Hoku Ka‘aekuahiwi (Workshop Support)

Hoku Ka‘aekuahiwi works for the PIRO Monuments Program as a Natural Resource Policy Management Specialist. She aids in the management and regulation of the monuments within the Pacific Island Region. Her areas of expertise are environmental law, native Hawaiian law, water law, community organization, traditional and customary rights, and public policy.

Nori Shoji (Workshop Support)

Nori Shoji is the Science Operations Division Director and oversees all aspects of the Science Operations Division, Pacific Islands Fisheries Science Center in Honolulu, Hawai‘i, including the Marine National Monument Science Program, Field Operations Program, Advanced Technologies and Survey Program, Technical Services, Dive Center, and Library. Nori is also the Vessel Coordinator for PIFSC and plans all research investigations on NOAA white ships.

Chad Yoshinaga (Workshop Support)

Chad Yoshinaga is the lead of the Field Operations Program in the Science Operations Division, Pacific Islands Fisheries Science Center in Honolulu, Hawai‘i. He oversees staff that work on Marine National Monument Science Research.

Kristine Bucchianeri (Sessions 1 and 4)

Kristine Bucchianeri is the American Samoa Government Coral Reef Advisory Group Coordinator. Kristine manages the Coral Reef Conservation Program's Territorial Management Grants.

Tim Clark (Sessions 2 and 3)

Dr. Tim Clark is the Marine Ecologist for the National Park Service American Samoa. Tim is interested in research and management of coral reefs, and how anthropogenic factors affect the health of coral research. His current research includes investigating the movement patterns of targeted coral reef fishes in order to design better marine protected areas, and on the management of crown of thorn outbreaks.

Mia T. Comeros-Raynal (Session 5)

Mia T. Comeros-Raynal is a Research Scientist at the American Samoa Environmental Protection Agency, where she conducts ecosystem-based research on pressing environmental issues. She holds an MS degree in Biology from Old Dominion University where she studied the different patterns and processes of higher extinction risk in marine fishes. Prior to being stationed in American Samoa, Ms. Comeros-Raynal worked for the International Union for Conservation of Nature conducting Red List assessments for marine species. Mia has over 8 years of experience in marine conservation management, specializing in systematic policy and conservation planning.

Wendy Cover (Session 3)

Dr. Wendy Cover has worked for nearly 4 years as the Research Coordinator for the National Marine Sanctuary of American Samoa. Previously, she conducted research on the effects of herbivores on coral reefs of Midway Atoll and worked for the Fisheries Department on Niue Island.

Bryan Dieter (Session 6)

Bryan Dieter is a Geographic Information Systems (GIS) Analyst with the Science Operations Division, Pacific Islands Fisheries Science Center in Honolulu, Hawai'i. Bryan works on a variety of GIS related projects for the center, including development of web-based mapping applications, geospatial database development and management, and creating custom scripts and tools. Prior to coming to PIFSC in 2013, Bryan worked as a hydrographic surveyor in the private sector and also with NOAA's Pacific Hydrographic Branch in Seattle. Bryan's academic career has included undergraduate studies at Seattle University focused on ecology and biology, and graduate work at Moss Landing Marine Laboratories' geological oceanography lab.

Justin Hospital (Session 6)

Justin Hospital is an economist with the PIFSC Socioeconomics Program. Hospital has been with the PIFSC since 2006 and has completed a wide range of research projects including seafood market analyses and survey-based research designed to describe the economic and social characteristics of small boat fisheries across the US-affiliated western Pacific. Hospital also serves as an advisor to the Western Pacific Regional Fishery Management Council's Social Science Planning Committee, Joint Archipelagic Ecosystem Plan Team, and Fisheries Data Collection and Research Technical Committee.

Dr. Robert L. Humphreys, Jr. (Session 1)

Robert Humphreys leads the Life History Program within the Fisheries Research & Monitoring Division of the Pacific Islands Fisheries Science Center in Honolulu, Hawai'i. As part of his duties, he works with each of the bio-sampling teams in the Pacific Territories in supporting the collection of life history samples (otoliths and gonads) from select reef fish and bottomfish species. Humphreys supervises a staff of 8 biologists/technicians responsible for conducting age & growth and reproductive maturity studies of bottomfish, reef fish, and pelagic fish species in Hawai'i and the Pacific Territories. Program staff also actively conducts at-sea sampling activities both from the large NOAA research vessel Oscar Elton Sette and from NOAA small boats. The program also uses state-of-the-art geochemical techniques (bomb radiocarbon and lead-radium dating) to validate the ages of long-lived (> 30 years) and otherwise difficult-to-age fish species. Humphreys has worked with NMFS for 38 years and has extensive experience as a Chief Scientist on some 25 research cruises during his career. His primary expertise is in life history studies of pelagic fish species and the ecology of seamount fishes.

Marc MacDonald (Session 7)

Marc MacDonald is a Wildlife Biologist at DMWR.

Michael Marsik (Session 1)

Michael Marsik is the Biologist with the American Samoa Pelagic Longline Observer Program with NMFS Pacific Island Regional Office.

Adam Miles (Session 7)

Adam Miles is a Wildlife Biologist at DMWR.

Kara Miller (Session 1)

Kara Miller is a Federal Programs Officer for the Pacific Islands Regional Office of NMFS. She is responsible for supporting and overseeing ~ 30 projects covering topics related to marine education and training, marine resource and protected species conservation and management, and fisheries in the Pacific Islands Region. She is responsible for supporting NMFS constituents and building / expanding partnerships throughout the region.

Shawn Murakawa (Session 7)

Shawn is a Biological Science Technician with the Protected Species Division of the Pacific Islands Fisheries Science Center in Honolulu, Hawai‘i. Shawn’s research interest is analyzing sea turtle growth rates using skeletochronology. She has travelled to American Samoa twice and hopes to return later in 2015 to continue this research project.

Domingo Ochavillo (Sessions 1 and 2)

Dr. Domingo Ochavillo is the current Chief Fisheries Biologist in the Department of Marine and Wildlife Resources in American Samoa. He has a background in reef fish ecology, fisheries stock assessment and population genetics. He currently manages various grants on creel survey, community-based marine protected areas, fisheries-independent surveys, wetland restoration and population genetics.

Brian Peck (Session 6)

Brian Peck is currently the US Fish and Wildlife Service Manager for Rose Atoll National Wildlife Refuge and Marine National Monument, based in American Samoa. He has worked for five Federal agencies over his career, primarily as a fisheries biologist in the US Pacific Northwest and in the South Pacific. He started his career as a Peace Corps volunteer in Gabon, Africa from 1992-1996, in aquaculture and fisheries management.

Frank Pendleton (Session 6)

Frank Pendleton was the US Fish and Wildlife Service Manager for Rose Atoll National Wildlife Refuge and Marine National Monument from 2011 – 2013. He has an undergraduate degree in wildlife management from Humboldt State University, and a graduate degree from the University of Maryland.

Jeremy Raynal (Session 6)

Jeremy Raynal’s background is in marine biology, biogeography, and genetics, and has focused his career on coral reef conservation in the Indo-Pacific. He has lived and worked extensively in the Philippines and Indonesia, and currently resides in American Samoa to assist territorial and federal partner agencies with science and management support of the American Samoan Marine Protected Area Network.

Fatima Sauafea-Leau (Sessions 1 and 4)

Born and raised in American Samoa, Fatima started her career in the Marine and Fisheries field when she worked at the DMWR in 1999 as a Fisheries Technician. In 2001, Fatima worked to coordinate and implement the CFMP for DMWR. She had also worked in coordinating numerous trainings and consultations with the SPC and the Fisheries in Samoa to assist with the implementation of community-based fisheries programs to Pacific Islands such as Fiji and Marshall Islands. In 2003, Fatima left DMWR for NMFS and is currently working for at the PIRO under the Habitat Conservation Division as a Fishery Biologist and the NOAA Coral Reef Conservation Program (CRCP) Fisheries Liaison for American Samoa. Fatima works to assist the local management and conservation efforts including the American Samoa Local Action

Strategies and priorities, particularly the Fisheries Management, Land-based Sources of Pollution, and Climate Change. In addition, Fatima assists with the implementation of federal mandates by evaluating Federal actions in American Samoa for impacts to U.S. trust resources, especially Essential Fish Habitat.

Christopher Shuler (Session 5)

Christopher Shuler is currently a graduate student with the University of Hawai'i Water Resources Research Center. Chris earned a bachelor of science degree from the University of Oregon in environmental science and a post-bachelorette certificate from the University of Minnesota Duluth in environmental education. Chris's primary interests revolve around groundwater issues in American Samoa. Chris's current research includes: assessing the sustainability of groundwater resources on Tutuila, evaluating the impact of land-use activities on groundwater quality, and attempting to understand how anthropogenically altered groundwater affects coastal systems.

Mareike Sudek (Sessions 2 and 5)

In 2013 Mareike Sudek holds a doctoral degree from Victoria University of Wellington, New Zealand researching coral disease in Hawai'i. In 2014 Mareike started working for the DMWR in conjunction with the CRAG as benthic ecologist leading the benthic monitoring for the NOAA CRCP American Samoa Coral Reef Monitoring Program.

Kelley Anderson Tagarino (Session 6)

Kelley Anderson Tagarino is a UH Sea Grant Extension Agent based in American Samoa. She was born and raised in Florida, USA where she earned her bachelor of science degree in Wildlife Ecology and Conservation, with a minor in Zoology, from the University of FL in 2006. She earned her masters of science degree in Oceanography from the College of Marine Science at the University of South Florida in 2008. Kelley has lived and worked in American Samoa since 2006, and has conducted various reef research, climate change research and outreach, and directed the Marine Science Program at the American Samoa Community College prior to working for UH.

Saumaniafaese Urikirifi (Session 6)

Saumaniafaese (Afa) Urikirifi is the lead for the Community-based Fishery Management Program at the American Samoa DMWR.

Bernardo Vargas-Angel (Sessions 2 and 5)

Bernardo Vargas-Angel works for NOAA's Coral Reef Ecosystem Division in Hawai'i leading efforts to evaluate, coordinate, and improve CRED's integrated assessment and long-term benthic monitoring program for coral reef ecosystems in the Pacific Ocean. Bernardo also leads the Program's coral disease research aimed at designing and developing protocols for identifying and characterizing coral disease in shallow-water coral reef ecosystems of the U.S. Pacific Islands. Bernardo holds a doctoral degree from the University of Miami, Rosenstiel School of Marine and Atmospheric Science. Bernardo's research interests include long-term monitoring of coral reefs; coral reef

community structure and dynamics; coral health and disease; and the effects of local and global threats, including land-based sources of pollution and climate change.

Thierry Work (Session 5)

Thierry Work is a wildlife disease specialist and project leader of the Honolulu Field Station. He has a bachelor of science degree in entomology from Texas A&M University, a master of science degree in entomology from University of California, Davis (UCD) and a doctorate in veterinary medicine and a master of science degree in preventive veterinary medicine from UCD. He completed a residency in wildlife medicine at UCD and worked for California Department of Fish and Game as a wildlife veterinarian before coming to Hawai'i in 1992.