



Pacific Insular Fisheries Monitoring, Assessment & Planning Summit (PIFMAPS)

Draft Report

**Ala Moana Hotel, Garden Lanai Room
August 19-23, 2019**

Overview and Setting the Review Stage

Purpose and Scope of the Workshop

The goal of the Pacific Insular Fisheries Monitoring, Assessment and Planning Summit (PIFMAPS) was to conduct a review of the United States (US) Pacific Island Territory data collection elements to better understand their utility in fisheries management processes. The long-term goal of the summit was to establish a comprehensive data collection program that can provide data, scientific information, and monitoring systems necessary for robust stock assessments and to support in-season fishery management in the Western Pacific Region (WPR).

The workshop objectives were to:

1. Determine if the current data collection processes are optimal for both territorial data needs and federal science data needs;
2. Determine how the current data collection processes are being used in territorial fisheries and federal fisheries management, and evaluate whether the processes meet the associated management needs;
3. Understand the catch/effort and life history data collection processes in each territory;
4. Achieve a common understanding of goals and expectations as well as associated responsibilities and timelines for achieving those goals;
5. Determine what data are needed to support effective monitoring of management unit species (MUS) and ecosystem component species (ECS);
6. Ascertain if the limited resources (i.e., both fiscal and personnel) are being used in an effective manner; and
7. To agree how data elements are added to data collection processes.

History of Fishery Data Collection Improvement in the Western Pacific Region

There have been several attempts to improve the data collection in the Western Pacific region. The Sustainable Fisheries Act (SFA) that amended the Magnuson Stevens Act (MSA) spurred six data workshops from the mid-nineties until the present. Despite the outcomes of each of the workshop, generally smaller projects were conducted to address the data collection gaps but it did not address the larger systematic issues. There were only few agencies that participated

in these workshops that stepped up and addressed the issues. Most of the pressing recommendations from these workshops still remain unaddressed.

Additionally, management needs have been evolving over time, but data collection has remained the same. The purpose of PIFMAPS is to decide whether to take a new approach toward the data collection systems in the territories or to find a more strategic solution within the existing framework that meets the science and management needs. Currently, WPR fisheries data have several issues, including concerns with how the data are expanded in the Annual Stock Assessment and Fishery Evaluation (SAFE) Reports, the territory bottomfish assessment data streams, and resource allocation associated with the ecosystem component (EC) amendment.

Overview of the Current State of Fishery Data and Monitoring

Guam

The Division of Aquatic and Wildlife Resources (DAWR) under the Department of Agriculture (DoAg) is responsible for collecting the fishery dependent information and manage the marine and aquatic resources for Guam. This is fulfilled by shore- and boat-based creel surveys, commercial purchase data, and marine protected area (MPA) violation arrest data. Fishers are frequently captured in the survey area, but some may not be adequately sampled due to the randomness of the survey. There are eight boat-based survey days per month, and four days each for shore-based creel surveys and participation surveys. There have been six commercial vendors reporting in 2019.

The commercial vendors are not the only avenue for sale or distribution of fish, but others, including roadside sales and flea markets, are hard to capture due to their voluntary nature. There were issues with data confidentiality if the amount of vendor is less than three. Fish are often given to friends and family for special events and holidays as well, which can also be difficult to track. Incentives, such as providing logbooks to fishermen, should be further explored going forward.

Another notable change in Guam's fisheries was a recent shift in fishing community efforts over the reefs. When availability of cargo for imports to Guam decreased due to the airlines reducing available space and increasing cost, the reef fish imports decreased. Eventually, the lack of imports led to an increase in commercially-caught reef fish in Guam. While there is still a fish import program capturing some of these data, there seems to be a direct correlation between the changes in available cargo space and relative levels of commercial reef fishing around Guam.

Commonwealth of the Northern Mariana Islands (CNMI)

The Division of Fish and Wildlife (DFW) maintains responsibility for collecting the fishery dependent information and manage the marine and aquatic resources for CNMI. Similar to Guam, CNMI has the same three main avenues of data collection: shore-based creel surveys, boat-based creel surveys, and commercial purchase receipts. Shore-based surveys are conducted on Saipan and are funded by the USFWS Wildlife and Sportfish Restoration Act. Boat-based surveys are conducted on Saipan via intercept interviews and trailer counts, and are funded by the Western Pacific Fisheries Information Network (WPacFIN).

Differing from Guam, however, CNMI DFW has been working towards a mandatory reporting requirement for their fisheries data program. Public Law 17-89 was enacted in

November 2012, adopting commercial fishing and recording and reporting regulations. Reporting requirements and non-compliance measures are in place. There were brief clarifications that Guam has its own EEZ separate from the CNMI, and that the 2012 regulatory mandate in CNMI is in place but not required or enforced by any agencies.

American Samoa

The Department of Marine and Wildlife Resources (DMWR) collects the fishery dependent information and manages the marine and aquatic resources for American Samoa. The shore- and boat-based creel surveys, in which a supervisor randomly selects four to five days in the week where each day will have three eight-hour survey periods at selected access points, are assessed by DMWR via several performance metrics, including evaluating the total number of participation runs/interviews versus those scheduled. However, the commercial invoices were noted to have generally provided more useful data than the creel surveys. The commercial receipt book system data collection is done once a month in addition to a pre-visit conducted for orientation. There have been issues associated with species identification during data collection, meaning that species composition data are limited. A discrepancy between the commercial invoice and creel survey data may also exist.

Budget Overview

The PIFSC Fisheries Research and Monitoring Division (FRMD) was established to provide the scientific foundation to inform effective implementation of ecosystem-based management and conservation strategies for fisheries throughout the U.S. Pacific Islands. FRMD staff provided a budget overview for the territory data collection programs, which included a breakdown of staff, contracts, and grants by territory from 2014 to 2019. The American Samoa contract and grant for DMWR were discontinued because the project was paused when they had no capacity to continue. There has been a small focus on capacity building there since then

Funding sources for territory data collection programs were compared across programs. Funding by NMFS has averaged just below \$200,000 per year for inshore creel surveys over the last decade, which is small relative to funding provided by the US Fish and Wildlife Service (USFWS). Territory boat-based surveys are supported by International Fishery Agreements (IFAs), whose money comes from a national fund that is allocated according to landings and values. CNMI and Guam use their funds to support fishing tournaments, while American Samoa uses the funds to offset money that WPacFIN would have otherwise supplied. There have been Saltonstall-Kennedy (SK) grants targeted towards the territories in recent years where DAWR and Guam Bureau of Statistics and Planning (BSP) have shared the funds. Additionally, there is Territory Science Initiative (TSI) funding that goes to PIFSC to support commercial receipt book data collection by providing technical support for vendors to enhance species resolution; the amount of these funds was estimated to be \$160,000 to \$180,000 annually.

Information on all of the various pots of money should be aggregated to clearly display what money goes into what programs due to the inherent complexity. The issue is that not all departments have a handle on all the projects happening in their jurisdiction because they are not all operating through the local territory offices. There needs to be better communication for data collection so that the managers know what is being collected and from what project.

Alternative Approaches to Fishery Monitoring

RAMP Surveys

The PIFSC Coral Reef Ecosystem Division (CRED) is in charge of the CRED Pacific Islands Rapid Assessment and Monitoring Program (RAMP) fishery-independent surveys, including their survey platform, sites, methods, training, and applications. The surveys occur via stationary point count over hard bottom habitat of approximately 30 meters or using a towed diver. Potential applications include estimating relative abundance incorporating habitat and environmental drivers to estimate status and depletion, estimating absolute abundance to generate a stock size estimate, and providing information on stock status for assessments.

The strengths of the survey include gathering data from a broad domain, gathering unbiased samples, pairing the data with habitat information, and gathering good data from experienced divers with substantial training and thorough Quality Control (QC). Limitations include visual errors, limited depth, habitat, and timing, and brief survey length for each visit. Some potential solutions include remote video surveys in deeper habitats, exploring survey approaches with lower diver impacts, and increasing the pooling of federal and territorial data.

These data are not currently being used in stock assessments, but have other uses such as starting points to try to understand the ecosystem baseline. There is uncertainty in the data because the survey does not have much coverage for certain species based on their habitat preference, capturing little information from the benthic environment. The available funding determines where and how many surveys can be completed. Going forward, data could be used to monitor ECS via trophic-level or spatial management as opposed to monitoring MUS with catch limits.

Electronic Reporting Pilot Programs

Mirae InfoDesign is a company contracted by the Council working on electronic reporting projects associated with Council pilot programs, such as bottomfish electronic reporting (e-reporting) through a tablet application and machine learning software for species identification and length estimation. E-reporting would allow fishers to report data at their convenience. Machine learning software for image recognition would make data collection more efficient for vendors by quickly estimating lengths for individual fish and determining species composition across larger catches. Both are expected to deploy in late 2019.

The development of the e-reporting application was showcased to fishers at the beginning of 2019 to help ensure that it collects data useful to them, and there are several CNMI fishers testing the application in the field. The hope is that the application will be a tool to improve data collection by making it easier for fishers to self-report. There is support from the CNMI bottomfish fishing community, and e-reporting can be considered in conjunction with creel survey data for validation. The use of a conveyor belt system for the image recognition software would also support the mandatory licensing and reporting efforts in the territories. The extent to which these technologies can increase efficiency over manual data collection is not clear, but they will almost certainly provide data in more real-time.

Analyzing Data Collection Programs

There is a current PhD candidate at the University of Hawaii at Mānoa who is evaluating different methods to analyze various potential data collection programs for application in the

territories. An overview of expansion performed on the territory creel survey data was given. It is necessary to expand the data to be representative given issues associated with data-poor circumstances in Western Pacific fisheries. The objective of the expansion process is to estimate island-wide total catch using total effort and CPUE estimates across different gear types from the samples collected from various surveys. There are issues associated with lack of survey times or areas as well as incomplete boat or participation logs, which can bias the expanded data.

Why Are the Data Being Collected?

PIFSC Stock Assessments and Biosampling

The PIFSC Stock Assessment Program is responsible for conducting state-of-the-art research on population biology, stock assessment, and population modeling within FRMD. The data elements that need to be collected for the stock assessment program were reviewed, the use of biosampling data in data-poor assessment approaches was discussed, and the reason why some data are not currently used in the bottomfish stock assessments was described. Abundance, biology, and catch are the most important factors for inclusion in stock assessments, though there are various different stock assessment models (e.g., catch-MSY, surplus production, structured) that can be used depending on circumstance. It was noted that biosampling data are not used for the bottomfish assessments due to representation and time series length, but the size data from the biosampling program were alongside creel survey data in Nadon's recent reef fish stock assessment. An accurate estimate of total catch is very important for scaling the stock assessment model so that the results are representative. The stock assessment timeline showed that the next bottomfish assessment for the territories is scheduled for February 2022.

Bottomfish are able to be harvested in inshore areas because the shallow- and deep-water bottomfish species are all grouped into one complex that includes some reef fishes as well. Shore-based fishing is more accessible year-round whereas boat-based fishing is only available some time of the year due to weather conditions. Fishers in Guam believe that the deep-water bottomfish stock is healthy; however, the consequences of the stock assessment will not differentiate the shallow- and deep-water species. There was a previous recommendation from the Council's Fishery Ecosystem Plan Team to split the complex because the shallow-water portion may be more overfished than the deep-water portion, but it still exists as a single complex. While many managers prefer a species-specific assessment, an aggregate approach may still be needed due to the lack of necessary data.

Federal Fishery Management

The federal fishery management goals for collecting these data include the need to specify annual catch limits (ACLs) and develop appropriate monitoring for ecosystem component species (ECS). For both MUS with ACLs as well as ECS, the drivers of federal fishery management are the MSA and National Standards. Federal managers must also adhere to FEP objectives, annual reports, and other MSA requirements.

Creel Surveys

Boat-based and Shore-based Creel Survey Review

Guam

Creel surveys in Guam are under the jurisdiction of DAWR. Images of trip logs and marina maps with access points for surveys were shown to the participants. On average, 95 of 96 scheduled surveys have been completed each year for the past three years. Fishing participation on Guam has been determined using trailer counts combined with ratios established several decades ago. The surveyors are able to tell the difference between trailers associated with recreational or commercial fishing because they often know who owns the trailer.

There are morning and afternoon creel surveys each day on Guam. Surveyors ask fishers if and where they intend to sell their catch, but this information cannot be directly linked to a sales record (i.e., there is no registry). There are currently eight staffers that perform the both the shore-based and boat-based surveys, with one surveyor per shift. If there is low activity during a collection shift, the surveyors remain on shift until complete. Aerial survey data for participation are incorporated into the WPacFIN database, but not considered for the expansion of effort data. All raw data is entered into the DFW database before being expanded, which happens separately for shore- and boat-based fishing on an annual basis. There is a need for finer spatial resolution in the catch to support future assessments, as some detail is lost when data are aggregated.

CNMI

The creel survey program in CNMI is conducted by DFW. Survey coverage can be impacted by factors that prevent surveys, such as weather, but surveyors attempt to fill these gaps with extra survey runs. Cancellations are not often, but when they do happen, four days are chosen at random to substitute for the missed days. When CPUE information cannot be collected from a site, it is assumed similar to other sites. There was a pilot study done for each potential site, and the three survey sites were chosen based on activity, fishing access, and available parking. CNMI has four staff that perform the shore- and boat-based creel surveys, and DFW is working toward mandatory reporting to increase coverage.

For shore-based surveys, the surveyor stays at an access point where interviews are conducted, and the rover goes to five sites before returning to the surveyor's site. The participation runs for shore- and boat-based creel surveys are done separately and record gear counts. For boat-based surveys, there is a trailer count roving survey that lasts for two hours at the five sites in addition to the all-day dock survey at a specific site. Surveys are done for 16 hours straight starting at 10:00 am; the hours from 2:00 am until 10:00 am are not captured. These time slots were likely chosen to capture the maximum number of returning vessels.

American Samoa

DMWR is responsible for collecting the fishery-dependent information through creel surveys. Fishing participation has been decreasing in American Samoa, with one likely factor being that older fishermen are not as active and the younger generation is not as interested. Participation data are usually collected by creel surveyors on their normal routes where they survey participation once, conduct interviews, and survey participation again on their way back.

CNMI has three runs on survey days that can either be participation or interview. Participation runs count fishers on the beach or in the water, and on their way back, the surveyors try to get interviews and another participation count. The total participation route covers all sites over about a six-hour period. In Guam, everyone who is fishing is noted and there is no differentiation between missed and refused interviews. The total participation route covers the southern half of the island, stretching approximately 65 miles.

Programs that Use the Creel Survey Data

Summary from the Questionnaire/Interviews

Responses from the questionnaire that the workshop organizers delivered orally to participants in advance spurred discussion on mitigating issues with fish species identification. It was not immediately clear where to address the issues associated with species identification, with dealers or with fishers. Regardless, issues can persist associated with distinguishing reef species in the same family. There is no exact protocol for handling fish in coolers during interviews to get species identification, as it is dependent on the fisherman and how many fish they have.

Surveyors in CNMI will typically take a sub-sample of the presented catch. In American Samoa, surveyors may weigh the entire cooler and allocate portions of the total weight among species or species groups for boat-based surveys, but they are able to measure all of the relatively smaller fish from shore-based surveys. In Guam, surveyors attempt to measure at least three randomly-selected individuals of each species to get a representative sample but sometimes take the fishermen's estimates. For larger catches, surveyors in Guam will weigh the entire cooler similar to what is done in American Samoa.

There may be impacts to sampling associated with accuracy of species identification and following sampling protocol due to staff turnover. In CNMI, they use staff shadowing and regularly scheduled staff trainings, and plan on developing criteria for new and existing staff to measure their abilities. In American Samoa, there has been relatively little staff turnover, and WPacFIN has assisted in training new staff when it has happened. The biggest issue in American Samoa is associated with the fishermen only knowing Samoan names of fish that the staff must translate while collecting data. It was noted here and throughout the summit that cameras and other imaging technology may help alleviate issues with species identification.

PIFSC

WPacFIN is a cooperative fisheries data warehouse that provides database management, programming, and technical services to support a network of US Pacific island partners; their new data portal allows access to both federal and territory managers. The several different types of data collected by each system in each of the territories as well as common data summaries were displayed. PIFSC uses these data for the Annual Report modules, Regional Fishery Management Organization (RFMO) reporting, Council and Scientific and Statistical Committee (SSC) Reports, regulation planning, stock assessments, data requests, and special interest studies. The territories use their data to study tendencies of shark interactions, inform special interest studies, develop reports to the governor, manage data requests, generate grant reports, and plan fisheries management.

Data gaps are still prevalent. Species composition is weak and provides rough estimates, but detailed studies would need to be performed to re-evaluate the model. Issues regarding species identification impact the specification of ACLs that require species-level information.

The creel expansion requires three interviews at minimum to estimate CPUE. Having to expand the data on an annual level before dividing the total catch amongst present species is problematic because real-time estimates are needed and there are not enough survey interviews for high resolution in the results. The protocol for subsampling large catches is also problematic. Data from the Marine Recreational Information Program (MRIP) are similarly not estimated by gear, and have a separate expansion methodology from the data gathered by creel surveys. MRIP, however, assumes that trolling gears have similar catch rates to spearfishing and formal surveys are not broken down by gear type, also causing issues.

PIRO and Council

Annual SAFE reports

The Council is able to use creel survey data in the production of their Annual SAFE Reports as well as FEPs and associated amendments. The SAFE Reports and FEPs are required by the MSA to describe different facets of the fisheries and specify the probable future condition of the fishery. The Council uses catch, effort, participation, CPUE, spatial distribution data, species composition of the fishery, and bycatch in the generation of these reports. However, there are issues from ACL specifications that are typically made for complexes in the territories. More real-time data are needed for monitoring, given that currently annual catch is compared with the specified ACL six months after the fishery year has ended.

Regulatory amendments

Pacific Islands Regional Office (PIRO) Sustainable Fisheries Division (SFD) is the primary group responsible for overseeing and implementing the region's FEPs, and they utilize creel survey data in developing regulatory amendments. SFD uses creel survey data in their Biological Evaluations (e.g., scalloped hammerheads in 2015; oceanic whitetip shark in 2019), National Environmental Policy Act (NEPA) files (e.g., bottomfish ACL specifications), and ACL reporting (e.g., to NMFS Headquarters' Species Information System).

Creel Survey Round Table Discussion

What are the issues with the data? What are the data gaps?

Species level identification was emphasized for all territories. Creel surveys have a good sample design, but have gaps in the time series (e.g., interviews for spearfishing stopped/declined). Spearfish-targeted species can be rare species with scant data. The goal is to get species-level data, but species are frequently lumped into family and gear type groups. Interannual variance is relatively high on the species level, suggesting that the sample size needs to be increased. If there are not enough data per strata for a species, one solution is to perform additional opportunistic surveys or classify species as ECS.

There are similar issues collecting data from spearfishers in American Samoa due to avoidance; there currently is no value for fishers to participate. Fishers may not want to share data (e.g., about their fishing hot spots), and subsidizing fuel as an incentive does not consider shore-based fishers. There is the need to educate fishers on the importance and uses of accurate data. Additionally, there is a low sample size for recreational fisheries, and effort needs to be increased where low samples are by adapting the survey design.

Issues with reporting include fishers being afraid that their records will be reported to government bodies such as the Internal Revenue Service in Guam. Fishers cannot afford to lose

their welfare benefit to report their catch either. Increasing transparency and accessibility may help to shift the attitude in Guam currently based on fear.

In Guam, there has been a change in demographics in fishing community due incoming migrants with new people and gear types that do not understand the rules; this situation has been improving and has resulted in more collaboration and data sharing. The Micronesian fishing community is the biggest consistent fishing group in Guam with 40 vessels fishing constantly.

How can the data be improved? Is it possible to increase samples or implement new methods?

It is possible to reallocate survey effort. There is no need for random surveys if there is low fisher participation (e.g., two boats), and the surveys need to be scheduled during more productive time slots. If there is seasonality in the fisheries, it is necessary to adjust sample size to coincide with seasonal efforts. Spatial effort should be adjusted to focus on highly utilized areas. Opportunistic surveys could be used to capture spearfishing data.

In American Samoa, there are three to six boats that report commercial bottomfish catch with no seasonality, but currents and wind determine fish size and effort. In CNMI, there are three to four small boats year-round and 15 to 20 boats in the good season; larger boats are not included in industry. In Guam, there are two full-time commercial boats, and six boats that occasionally fish.

Mandatory reporting requirements are gaining support in Guam, but it is not clear if the requirements are for vendors or fishers. The Guam government is considering enacting this regulation, but enforcement would frustrate fishers. Guam would like to see an example of mandatory reporting with bottomfish, and if it works, then it could maybe be done similarly for reef fish. The regulations would be difficult to enforce for reef fish, however, since there are relatively few large commercial sales. Self-reporting may be a good platform to record catches in Guam, and vendors have a good venue to participate in reporting. Fishers understand why reporting is important and will likely cooperate in Guam, but there is still no incentive.

Commercial Receipt Books/Dealer Data

The expectation remained that this summit would have different outcomes than previous data collection workshops. The reclassification of former MUS means that big changes are required associated with new needs and status quo is no longer an option. Creel surveys were developed and designed in 1980s with goal of getting an annual estimate of catch. Because the design is randomly stratified, chance encounters with fishermen have drastically gone down. The current data collection system is not designed to capture information associated with spearfishing, for example. At this summit, participants are looking to answer if current data collection systems are fiscally efficient.

The territorial bottomfish assessment will be released in October 2019 with an overfishing and/or overfished status, but there is lots of noise in data. There is a need to improve data streams that are used for assessment, but there are concerns about being able to collect the information that is required for management. Representative catch and CPUE are the most important factors to include for stock assessment, and concerns with the territory bottomfish assessment and its data are primarily with the CPUE time series. Bottomfish information comes from boat-based survey data, so it is important to get representative boat-based catch. The group agreed that the data collection processes should be mutually beneficial to PIFSC, the Council, and the territories. In addition, it is not clear if the bottomfish groupings are currently satisfactory because it seems as if the original groupings were out of convenience.

There were some issues with the proposed closing of the American Samoa bottomfish fishery as these species are very important culturally. There were errors noted in the participation data for American Samoa from 2017, and it is challenging to explain issues with the fishery to stakeholders with inaccurate data. Closing the fishery would occur in federal waters and most of the bottomfish habitat occurs in territory waters.

For Guam, there was expressed concern not only over bottomfish but over reef fish as well. Data collection processes for shallow- and deep-water fisheries need should separate, and the use of more fishery independent data, such as images collected by submersible camera, was suggested to improve estimates of fish biomass. The merits of photographing catches, fishermen self-reporting, and reporting incentives were also discussed. Panelists confirmed that video monitoring is used in other regions, and can be conditioned to suit the needs of the WPR.

Commercial Receipt Book Review

Guam

DAWR is also in charge of maintaining the available commercial receipt book and dealer data in Guam. Commercial sales data have been collected since 1980 on island, and the number of participating vendors has varied over that time period from one to nine. Staff visit vendors weekly, show vendors examples of paperwork, and help fill out the forms, but there has been limited success retaining participation. Every two weeks, receipts are collected and input by staff.

The difference between markets and vendors is that vendors are those who primarily sell fish, and there are less than ten participating on Guam. There is high turnover of vendors with only about half currently reporting, including those from the Micronesian fishing community. There are instances of restaurants buying fish directly from the boat and smaller stores selling to

“pocket customers”. There is hope of implementing regulations for mandatory licensing and reporting on Guam similar to how was done in the CNMI.

CNMI

DFW is also in charge of the available commercial receipt books and dealer data in the CNMI as well as regulatory requirements being implemented there. Managers in CNMI are hoping to employ electronic reporting to support the mandatory reporting regulation. Currently, information is gathered once per month. Commercial purchase data is made up by those vendors that participate, which has been 356 vendors over time but waned to 45 in 2016. It is often easier for people reporting fishery information to lump reef species that they cannot identify together on the commercial receipt form. Limitations in the data involve issues with vendor compliance, limiting the data to Saipan only, and the lack of bottomfish sales reported.

It was suggested that information be collected two times per month instead of one going forward. Vendors will need additional species identification training. Of the 45 active vendors in the CNMI, including restaurants, approximately 20 percent report consistently. In the last decade, use of local name has increased relative to use of the common name, complicating data collection. The data collection system has been evolving to add more bottomfish and reef fish common names. CNMI representatives said they would work with Council staff to develop a list of important fisheries species, but will need the help of the Council for training and outreach to teach vendors appropriate reporting techniques.

American Samoa

In American Samoa, commercial dealers are required to report by law. There have been 50 to 60 vendors since the 1990s, but DMWR is working with more vendors now than ever before. Vendors are anyone who purchases fish, so fishermen usually go directly to the vendors with prior arrangements. It is not clear as to why there has been a drop in the number of vendors reporting because they do not know the total number of vendors; there are similar issues in Guam and the CNMI with vendors closing and reopening without reporting. The panelists suggested that it is important that that a couple of different data systems are being used to provide results so that managers can run the systems in parallel for some period to allow for calibration.

Programs that Use Commercial Receipt Book Data

PIFSC

PIFSC utilizes the commercial receipt book data, comprised of trip ticket commercial invoices from fish vendors who purchase fish from fishermen harvesting in local waters, from each of the territories. Each invoice includes daily trip catch, but data collection depends on vendor participation. Data collected are typically total landings, which give insight into species landings, gear types, seasonality, etc., and fishing efforts from number of trips, fishers, and vendors to get CPUE. These data are adjusted using percent coverage statistics for all reports, and are primarily used for the SAFE Reports, stock assessments, summaries, and data requests. The territories use the data for harvesting and species interest studies, fisheries regulations and management planning, reports to the governor, grant reports, and data requests. PIRO’s needs are associated with improved compliance. Vendors in the territories would likely have no issue transitioning to e-reporting due to the prevalence of smartphones; this includes restaurants and flea market sales to support taxation requirements.

Council

Similar to the creel survey data, the Council uses commercial receipt book data to inform FEP amendments and the Annual SAFE Reports. The Council readily uses catch, effort, participants, CPUE, spatial distribution data, species composition of the fishery, and bycatch from these data.

Commercial Receipt Round-Table Discussion

The development of mandatory licensing and reporting requirements is appropriate, though the wording used in the regulations must be adequately considered. Surveyors should develop relationships with vendors concerned about local rights due to these regulations to reassure that they will not be disrespected. There were concerns that automating collection could displace data technicians, but moving into new technology means that they could shift into associated tasks.

A decline in participation may not be reflective fishery reduction, as demographics have changed and tsunamis have been responsible for inhibiting portions of the fishing fleets. There has been a downward trend in territory fisheries that has recently rebounded with the interest of the younger generation. Youth can report catch as well, and their interest could be further incentivized with a smartphone application. Similarly, while vessel monitoring systems may work for boat-based bottomfishers in the territories given the small number of boats, there would likely be more participation from e-reporting to estimate total effort more accurately. The total value of some of these fisheries is not relatively high, and it was noted that it may be worth considering subsidizing these fisheries rather than developing e-reporting. Data collection needs to be strategic regardless; doing more surveys does not create a proportional increase in data quality.

The group needs to determine reliable and reasonable data fields if they are to be updated, and territory representatives will need to have a reasonable discussion with vendors about the issue. Utility of data for stock assessments is currently low, and another source of data is needed to avoid problems in scaling up the catch numbers. There are some years with almost no information, and there is not necessarily a statistical solution for rare events. The commercial record system could potentially address some of the problems if revisited using scaling factors.

Biosampling Program

Biosampling Program Broad Overview

The PIFSC biosampling program is comprised of both a field sampling program (FSP) and life history program (LHP). The program was established to provide information necessary in assessments and for management when other data streams could not provide adequate information. Additionally, biosampling has different objectives from creel surveys and commercial receipt books in that the goal is to acquire accurate species identification and trip-level monitoring of markets, species length and weight metrics, and otolith and gonad samples for life history research.

The biosampling program is adapting to the unique characteristics of each territory such that fieldwork is tailored to produce minimum impact on markets and fisheries while gathering data needed for sustainable fisheries. The program started work in the territories in 2009 and 2010, and an external review of the program in 2016 found that the framework is sound. The review recommended a dedicated program manager, clearing the sample backlog, revising future sampling strategies, increasing vendor participation, developing opportunities for communication between the three territories' programs, and conducting fishery-independent sampling.

Biosampling Program Review

Guam

Specific History and Sampling Design

The Guam fisherman's co-op has played a large role in establishing the biosampling program there. The initial and current market sampling strategies and protocols for biosampling in the field were presented. Initial challenges and solutions include relationship building with the co-op, inadequate data collection time periods, fishers combining catches, species identification, and capacity. The current market sampling protocols include using a voice recorder, which has brought about its own issues. Quality control measures include verifying entries with audio files and triggering real-time error notifications when a new data entry is not within an expected bound.

The Guam commercial fisheries lab biosampling program involves borrowing the fish to gather data before giving the fish back to the markets where it can be sold. They incentivize the vendors to allow them to extract otoliths with ten dollars per fish. This has built trust between the co-op and PIFSC LHP over time, but there are still better relationships to be built with vendors to allow for a continuous supply of data.

The sampling protocols include risk-ranked and rare-event target lists in addition to those species considered commercially important (e.g., *Variola louti*, *Etelis coruscans*, etc.). Analysis protocols include getting the fork length and weight of the fish, removing and measuring the gonads, and extracting and analyzing the otoliths. Challenges include capacity, with few contractors to sample and only one market from which to sample. All sampling is only done at the fishermen's co-op, and data are not input in real-time. The relationship has elevated to the point that the fishers will hold catch for the agency to come down and collect data. Issues with the co-op data include giving a bias perspective of the fisheries; samples from other vendors are needed since there is not as much fish flowing into the co-op.

Data Collected

The ideal sampling design includes field sampling of 250 to 1,000 fish for a length-frequency distribution. The sampling distribution would have 200 to 400 individuals depending on species in 1 to 2.5 centimeter size bins. Temporal sampling can track age, growth, and reproduction. Other considerations include sampling distribution tails and variability in life history characteristics. In Guam, there were 266 species measured and weighed during field sampling, and 78 species sampled for life history information. The species with the highest estimated mean annual catch from field biosampling in Guam is *Naso unicornis*. The program focuses on commercial market information, and field surveys are not involved. The field survey cruises and biosampling program are entirely separate.

Uses

The original goals for the biosampling data were to establish species-specific length-weight relationships for each territory and to obtain species-specific otolith and gonad samples to develop life history parameters for each territory. Reed briefly reviewed important management metrics and other statistics frequently used in stock assessments. In Guam, there are 85 length-weight relationships, including those for the Pacific longnose parrotfish (*Hipposcarus longiceps*) as well as the orangespine (*Naso lituratus*) and bluespine unicornfishes (*Naso unicornis*). The ages of the samples are validated annually, but additional validation can be done with radiocarbon dating between young and old fish. There is currently work being done on a SK grant for onaga.

CNMI

Specific History and Sampling Design

The biosampling program in CNMI operates through Micronesian Environmental Services (MES) emphasizing the successful partnerships and participation required to have such programs exist. The biosampling program data stream includes market sampling where catches are sampled prior to sale. Other data collected include species identification, fish length and weight, CPUE, and catch location. Since 2011, there have been 2,911 fishing events where 214,987 fish were measured from 195 species, of which the most abundant were *Naso lituratus* and *Acanthurus lineatus*. Considering biomass, *Naso unicornis* was considered among the top fishes in CNMI.

The biosampling program purchases fish, and there is a specific process to obtaining these data. There are two vendors that are typically sampled at 3:00 am, but MES has been trying to survey more vendors. The data sometimes reflect that fishers are opportunistic, moving from one vendor to another based on price. Data streams for the program include vendor logs of purchases and life history collection from coordination with local partners. Similar to Guam, otolith and gonad extraction and analysis are performed. Other activities done by the program include opportunistic data collection at spearfishing derbies as well as education and outreach.

Data Collected

In CNMI, there were 242 species measured and weighed from field sampling, and life history sampling captured another 22 species. Schemmel displayed some of the reef and bottomfish monthly totals for data collected and life history parameters determined in the CNMI, and the species with the highest estimated biomass is *Naso lituratus*. Guam and CNMI fisheries

are similar with some notable exceptions. In the CNMI, there exists a better connection between the fishermen and managers, allowing more access to the markets. Guam is able to better capture nighttime activities such as spearfishing. Additionally, Guam allows SCUBA spearfishing, and the area of fisheries is larger in the CNMI despite fishing generally occurring around Saipan.

Uses

In CNMI, there are 83 length-weight relationships, including those for the orangestripe emperor (*Lethrinus obsoletus*) and yellowstripe goatfish (*Mulloidichthys flavolineatus*). There was an SK grant awarded to MES in CNMI to look into the expansion of the existing biosampling program into age, growth, and sexual maturity research for commercially important reef fish species.

American Samoa

Specific History and Sampling Design

The objectives of the biosampling program in American Samoa are to hire and train staff to identify catch to the species-level, develop systems to collect length-and-weight data from commercial fisheries (i.e., field biosampling), develop a protocol for collecting and processing otoliths, gonads, and fin clips (i.e., lab biosampling), and regularly evaluate lessons learned to make recommendations for improvements in the program. Bio-samplers in American Samoa began sampling of reef and bottom fish at the Fagatogo Market in Pago Pago during October 2010. Since then, the program has measured over 216,000 fish lengths and collected nearly 4,000 otoliths from ten species. The data collection protocols for both the field and lab programs, as well as species for which life history information is a priority to collect, were shown.

The biosampling program emphasizes deficiencies in the creel program, but there still needs to be appropriate QC of the data and the large backlog of samples must be addressed. The species chosen for sampling are decided by American Samoa DMWR with guidance from the SSC. Other issues and challenges in the American Samoa biosampling program are mostly associated with the utility of the data. For example, there were issues associated with integrating biosampling with creel survey data instead of using it to independently verify the data stream.

Data Collected

Field sampling in American Samoa weighed and measured 281 species, while life history sampling captured another 17 species. *Acanthurus lineatus* has highest mean annual catch in American Samoa from field biosampling data. Schemmel displayed some of the reef and bottomfish monthly totals for data collected and life history parameters determined.

Uses

American Samoa has 71 length-weight relationships from the reef and bottomfish species captured in the commercial biosampling, including those for the commercially-important species *Lethrinus xanthurus*, *Lutjanus gibbus*, and *Lutjanus rufolineatus*.

Biosampling Round-Table Discussion

Life history data in Guam are limited by both the methods of sampling and the fish. It is advisable to sample everything landed in addition to getting more vendors involved. Landings surveyed are mainly reef fish from spearfishing. The territories are not locked into determining

MSY in their stock assessments for inshore species like federal managers are, and they are able to use methodologies such as Spawning Potential Ratios if they so choose. Research to develop a nursery to restock fisheries and restore habitat in cooperation with local fishing communities and on aquaculture restoration would benefit from additional biological data.

Juvenile fish in Guam are also culturally important, as they are highly utilized as a food source. It has been noted that large annual changes in local fisheries tend to follow big juvenile runs. PIFSC suggested heavy sampling on a temporal scale to better understand juvenile runs as well as developing a list of the highest-priority species in each of the territories.

CNMI managers requested a species-level assessment to meet their needs. The benefits of life history data would include minimum sizes from that data to support size regulations. American Samoa emphasized the importance of culture in their fisheries as well, and suggested that family information may be the best available given how hard it is to get species-level identification. The panelists noted that species composition can be back-calculated depending on how the data reporting forms are configured, but that this method of back-calculation is more difficult for less abundant species. The biosampling program has species information from the markets that could be used to calculate species composition for commercial receipt books.

Review and Planning

Territories' Reports on Breakout Discussions

Guam

DAWR breakout discussions centered on the fact that, as of now, any changes to fishing regulations on Guam have to be approved by an indigenous fishing rights council, called the Guam Fisherman Ocean Council, with several groups being named to supply representatives. A couple of those groups no longer exist, so the council cannot convene. There was confusion regarding this council and the Guam Attorney's General's (AG) response to the Council's inquiry about disbanding it. The AG has agreed that it would be most efficient to repeal the law establishing the council, which could likely be done within a year.

CNMI

DFW breakout discussions emphasized mandatory reporting. Once mandatory reporting is approved, there will need to be a survey for the vendors, sellers, and restaurants to add to the database. They are interested in preparing a fish identification training system at the agency, for vendors, and at restaurants, training staff to understand the surveys' purpose and develop confidentiality forms, updating stakeholders on all changes that will be employed, setting up deadlines for the mandatory reporting system registry, providing updates on the reporting system, and receiving assistance from PIFSC on how to improve the system in place. CNMI managers are also in favor of electronic reporting due to its efficiency, but need some sort of internal compliance and quality control so they can have more confidence in the generated reports. Compliance will be part of the strategic plan, but there were enforcement concerns.

The territories have an opportunity to move into mandatory and e-reporting for vendors and vessels through a standardized system for each territory because they all have relatively similar issues. Modernizing leads to cost savings, and it is important that the WPR works towards modernizing the data collection process. Modernizing the approach does not mean getting rid of employees, but allowing them to be useful in other areas. The software development may take a while, but there is going to be good support along that avenue for funding.

Finding a long-term funding source to improve data collection systems, however, will not be as simple. There are a lot of opportunities for small island projects to help improve data collection, such as SK, National Fisheries and Wildlife Foundation grants, but they are small grants meant for shorter-term projects. The WPR heavily relies on the USFWS Sportfish Restoration Program and IFA from NMFS. USFWS funding is \$150,000 for inshore creel surveys annually, and the territories can decide how they want to use it based on MSA statutes, including for recreational and non-commercial fishing, because the funding is a state grant.

MRIP has not been explored for long-term funding, and they have a process for situating data collection programs before they start extended funding cycles. Projects have been identified, but the ability of the territories to submit proposals, perhaps due to lack of capacity, to address identified priorities has been a large impediment. Federal managers will continue coral reef surveys for ECS as long as they can. These data do not have to be fishery-dependent, and inshore MRIP data supplemented with commercial receipts could estimate harvest.

American Samoa

DMWR focused on first on e-reporting, suggesting that pilot studies may be needed before implementation. Staff could perhaps first train fishermen and vendors with the application to encourage their buy-in. The application should have functions that are uniquely useful to fishermen (e.g. weather reports). There were several other suggestions associated with data improvement including an overhaul of data reporting by direct sampling to better capture seasonality in the fisheries, exploring working with village mayors for shore-based surveys, incentivize reporting, and reorganizing the bottomfish complex to include appropriate species.

For the shore-based creel surveys, most reef fishing is from villages that are more populated, except for some boat divers in areas inaccessible from land. Perhaps three to four villages could be selected to have DMWR work with their mayors to educate them to buy into e-reporting. For boat-based creel surveys, self-reporting is an option because data collection is currently not able to cover all fishermen, but there may be a lack of consistency on the fishers' part. There are a few ways to approach this with e-reporting, such as by creating an incentive. The panelists suggested that American Samoa boat-based surveys move to 100 percent coverage of fishing vessels since there are a manageable number.

Panelists' Report

The panelists presented their prioritized recommendations for data collection improvement, critical decision points, agency commitments, and tasks and timelines, which are as follows:

Organizational:

- Remove duplicity - all of the programs are capturing estimates of total catch for some sectors/fisheries, need a unified approach;
- Increased alignment between the Creel Survey, Biosampling, and Commercial Receipts with the Stock Assessment program in order to obtain the best estimates of catch and effort, size composition;
- Strive for a unified territorial approach.

Creel Surveys:

- Strongly encourage engagement with MRIP;
- Survey statistician needed to provide guidance for optimizing survey design to meet territorial and federal scientific and management needs.

Commercial Receipts and Electronic Reporting:

- Commercial Receipt Books
 - Mandatory reporting from all fisheries;
 - Prioritize bottomfish fisheries.
- Electronic reporting
 - All commercial vendor receipts;
 - Boats in some fisheries (spearfish and bottomfish, specifically).

Biosampling:

- Update and prioritize the list of species that need further sampling for both federal management unit species and territorial species of interest;
- Define an appropriate biological sampling framework to optimize sampling efforts:

- Focus more sampling on bottom fish in all territories;
- Focus on size/age sampling for assessment (reallocate effort to fill gaps).
- Redevelop the data entry application with more flexibility for future updates;
- Develop visual system to rapidly record size and species identification.

Communication and Outreach:

- Promote outreach regarding the importance of reporting accurate data in support of fisheries management and resource sustainability;
- Communication planning in each territory to engage the appropriate audience, identify regional and territorial personal to lead the outreach.

Data collection programs need to have statistically valid approaches. Statisticians should be involved, whether from MRIP or not, to help managers think about the goals for the region and whether those goals are being met with current surveys. Approaches may need to be refined based on the desired data resolution at the single-species level. Misreported landings are a big issue because they set the catch level and relatively scale all of the data. Often, there are inclinations for fishers to underreport, which leads to underestimates of the population's maximum sustainable yield. Over-reporting could result in overharvesting, and population models may show that the stock is not very resilient.

Because nearshore resources are not the federal managers' biggest priority, they may move away from some of the shore-based surveys knowing that the territories have it under control. Federal managers will not totally move away; MRIP, for example, would remain. There are mechanisms by which the territories can get MRIP money to support some of the discussed recreational community science. MRIP provides support for expansion and access. It was suggested that the group request MRIP to do the review of the creel surveys similar to what HMFERS has done, and then they would be able to provide recommendations and regular funding. The requests would simply come from the heads of each of the relevant departments. WPacFIN will remain as the data repository given that it is more closely aligned with funding avenues than the territories.

PIFSC will continue as long as possible with the CRMP alongside periodic fishing to gather data streams associated with MUS. The next step is to identify priority complexes, potentially revisiting the definition of what a complex is, and to determine the next assessments that are going to take place. Biosampling will migrate from mostly reef fish to MUS in addition to expanding the vendors currently sampled. With regards to improving data streams, PIFSC plans on looking to improve their boat-based surveys by exploring relevant technologies.

The panelists suggested that providing identifiers for each fishing trip is potentially more important than other technical information associated with a fishing trip. Another relevant suggestion was to redevelop the reporting component of the biosampling data application to make e-reporting easier for fishermen. Additionally, mandatory and electronic reporting need to be tightly coupled because collecting reports is pointless if it is not known who should be submitting them. There were some territory-specific measures considered, but a unified territory approach was ultimately emphasized for the sake of efficiency.