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

Panel Report

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By Steve Turner, Jenny Suter, and Bob Ryznar

Purpose and Scope of Review

The Panel was tasked to review and evaluate the quality, relevance, and performance of the data collection system in American Samoa, Guam and the Commonwealth of the Northern Mariana Islands and its adequacy for generating robust scientific products and usefulness for the management it supports. The Panelists were asked to consider the following categories that were further described in the Terms of Reference (TOR) for the PIFMAPS Review:

- Relevance of the current fishery data collection systems. Do they produce data useful in fishery assessments and management actions both locally and federally, and to what extent are the data used?
- Scientific/Technical questions regarding data quality, statistical precision, and timeliness.
- Data specific questions regarding data sources, data limitations and weaknesses, protocols, confidentiality concerns and collection design.
- Communication questions regarding working relationships with vendors and fishermen, as well as territorial and federal staff, stakeholders and the public.
- Opportunities for leveraging that should be pursued but are not currently including mandatory reporting, electronic reporting, data management systems and training opportunities.

Background

Surveys of some territorial fisheries have been conducted since the 1960s when creel survey approaches were initiated in Guam. American Samoa (AS) initiated creel surveys in the mid-1980s and the Commonwealth of the Northern Mariana Islands (CNMI) began surveys in the early 2000s. The Pacific Islands Fisheries Science Center (PIFSC), the Western Pacific Regional Fisheries Management Council (WPRFMC), and the Western Pacific Fisheries Information Network (WPacFIN) have conducted reviews of these data collection systems many

times during the last 20 years. Those reviews have identified multiple difficulties with the data collection programs and suggested multiple ways of improving them. One of the more recent reviews (Bak 2012) indicated that many problems still existed, and the 2014 Strategic Planning Workshop (Fishery Data Collection and Research Committee, 2014) resulted in signed commitments to improve data quality and processes. Despite these efforts, PIFSC, WPRFMC, WPacFIN, and territorial personnel are concerned that the territorial sampling programs are not meeting the needs for federal and territorial fisheries and ecosystem management. Therefore the Pacific Insular Fisheries Monitoring & Assessment Planning Summit (PIFMAPS) was organized to consider whether substantial changes to data collection approaches might be needed.

The PIFMAPS review covered statistical surveys (shore-based and boat based creel), the commercial landing receipt programs, and the biosampling programs in each of the territories. Each of these programs provides some information needed for stock assessment and management. However, the catch and catch rate information currently collected often requires substantial manipulation for use in assessments, and only very simple assessment approaches can be used. To move to more sophisticated assessment methods, which would most likely provide more accurate indications of stock status, more comprehensive and integrated catch, effort, and biological data will be needed.

Program Review

Statistical Surveys (Shore-based and Boat-Based)

Shore-based and boat-based surveys for catch and effort data for reef and bottomfish in American Samoa and Guam have existed for nearly 40 years and for almost 20 years in CNMI. The survey programs have been reviewed and gaps in data collection and reporting revealed, yet the survey design itself has not evolved to truly address these problems. These unaddressed issues become more problematic when modern stock assessments are applied to these data streams. The data collection itself must be modernized in order to provide sound estimates of catch and effort.

Creel data are used for a suite of monitoring and reporting requirements. The data are of primary importance to PIFSC stock assessments. The council uses the creel survey data for nay purposes including developing and amending Fishery Ecosystem Plans (FEPs) by assessing total catch and effort, spatial distribution of effort, number of participants, species composition by fishery, and bycatch. The creel data are also used to provide catch and effort estimates for various reports to Regional Fishery Management Organizations (RFMOs), Fisheries of the United States (FUS), territorial reports for regulatory implementation, etc. The territories also use the data for local resource management and internal reporting.

The boat-based and shore-based surveys were originally designed to provide the number of boat-trips by gear type (participation) and the catch by gear type (interview). Unfortunately, the surveys do not produce the best estimates of catch and effort for some of the important fisheries, such as spearfishing for parrotfish and for bottom fishing in general. Reasons include poor coverage rates for some strata (no coverage during prime nighttime spearfishing, interview refusal or avoidance, and incomplete coverage for the small fleet of boats that target bottomfish in each territory). Various staffing issues were reported, such as lack of rigorous training in species identification and staff turnover. Additionally, the extrapolation procedure used to estimate total catch and effort is under review (outside of the purview of PIFMAPS) due to it not producing reliable and believable estimates in some fisheries.

The panel reviewed estimates of total catch and effort and their coefficients of variation (CVs) along with sampling rates, provided from the WPacFIN database (Matthews, pers. comm.). Some of the factors which may influence the variability in the estimates (large CVs) include low number of sampling assignments (or too many missed assignments), failure to follow the sampling design by missing scheduled assignments, inability to fully characterize landings (not identifying to species and not sampling the entire catch), and low sample size given the high diversity of fishing gears with very different selectivities (cast nets, spears, geaning, etc).

The coefficients of variation (CVs) about the estimated total catches (all species combined) from the creel surveys (Langseth, B pers. Comm. and Syslo, J. pers. comm.) were within ranges that might be acceptable for stock assessment (less than 20%) for American Samoa (often <15%) and Guam (often 10-25%) though they were somewhat higher for CNMI (often 15-30%).

However, the CVs about species-specific estimates (derived from the total catch estimates divided into species catches using bootstrapped species composition data from the surveys) (Langseth, B pers. Comm. and Syslo, J. pers. comm.) indicated that the estimates were extremely uncertain. Often the CVs indicated that the actual species-specific catch was somewhere between zero to three times the estimated value. This was the case both for commonly caught reef fish and bottom fish; for less commonly caught species the estimates would be even more uncertain. This indicates that the catch estimates by species would not be sufficient for use in even moderately sophisticated stock assessments.

The CVs about the species specific estimates of catch were markedly different between American Samoa and both Guam and CNMI. As with the total catch estimates, the AS estimates had substantially lower CVs which seemed odd because the WPacFIN data on the number of sampling day assignments compared to the number of completed sampling day assignments indicate a substantially lower sampling rate in AS (Matthews, pers. comm.). Such a pattern could be the result of differences in the fisheries between AS and the Marianas; if the AS fishery is primarily directed at pelagics and the Marianas fisheries made up of many fisheries with none

heavily dominant then the CVs about the AS estimates could be lower. If this is the case, then it might be necessary to refocus part of the AS creel surveys on reef and bottom fish fisheries.

Further comparison of the counts of sampling day assignments to the number of completed sampling day assignments showed that consistently only 30-70% of assignments were accomplished in some territories and sampling programs (shore-based or boat-based) in nearly all years in the last decade as well as in many earlier years. Failure to follow the sampling design by not conducting assignments can lead to samples that do not adequately represent the actual fishery and biased estimates of catch, cpue, and size. It can also lead to much larger confidence intervals about estimated catch and catch rates because of reduced numbers of observations.

Table 1: Current Metrics for Boat-based and Shore-based Creel Surveys (primary data source WPacFIN tabulations from Toby Matthews (pers comm))

Boat-based Creel Surveys	**CNMI**	**Am. Samoa**	**Guam**
# of Survey Staff	2 FT + 2 PT (shared among all surveys)	11 (shared among all surveys and some with other duties)	8 (3 of which do more surveys than the others and all shared among all the surveys)
Intercept Survey			
# of Ramps	3	4 (others opportunistically)	3
Total # of boats			300-350
Hours surveyed per day	16	17 (weekdays), 8.5 (weekends or holidays)	14-15
# of days per month	6	14	8
# days/weekday	3	12	4
# days/weekend or holiday	3	2	4
Survey Begin Time	10:00	5:00	05:00-06:00
Survey End Time	2:00	22:30 (weekdays), 13:30 (weekends)	24:00:00
Average Interview/Sample Day (2018)	2.23	0.87	9.06
Participation Survey			
# of Sites	5	4 (others opportunistically)	8

# days/weekday	3	12	4
# days/weekend or holiday	3	2	4
Average Interview/Sample Day (2018)	3.04	2.58	14.17
Shore-based Creel Surveys	**CNMI**	**Am. Samoa**	**Guam**
Miles of sampleable coastline	14	31	46
Miles of total coastline	54	63, but about 1/4 is entirely inaccessible	78
# of Survey Staff	2 FT + 2 PT (shared among all surveys)	11 (shared among all surveys and some with other duties)	8 (3 of which do more surveys than the others and all shared among all the surveys)
Intercept Survey			
Hours surveyed per day	3 (6 hours per day but half spent on participation)	3 (6 hours per day but half spent on participation)	10.5
# of days per Month	10.66	7	4
# weekdays	5.33	5	2
# weekend/holiday	5.33	2	2
Survey Begin Time	covers 24 hours	7:30	06:30 and 19:00
Survey End Time	covers 24 hours	0:00	12:00 and 24:00
Average Interview/Sample Day (2018)	1.44	0.45	4.83
Participation Survey			
Hours surveyed per day	3 (6 hours per day but half spent on participation)	3 (6 hours per day but half spent on participation)	about 11
# of days per Month	10.66	7	4
# weekday	5.33	5	2
# weekend/holiday	5.33	2	2

Survey Begin Time	covers 24 hours overall	7:30	06:30 and 19:00
Survey End Time	covers 24 hours overall	0:00	about 12:00 and 00:30
# trips per day (2018)	3.98	0.73	16.83

Commercial Receipt Books

All of the territories have some form of commercial receipt book program that has been in place for a few decades. Guam initiated receipt books in 1980, American Samoa in 1991, and CNMI in 1983. The programs vary in the businesses that they collect data from, in their regulations and enforcement, and the rate they collect data, as shown in Table 2.

The Council uses the commercial receipt book data for FEP development and amendments and for conducting economic impact analysis. PIFSC uses these data for stock assessments and many reports such as FUS, landing estimate augmentation, Fisheries Statistics of the Western Pacific, and others. The territories use these landing data for economic studies, fisheries regulations and management planning, grant reports, reports to the governor's office, and others.

Standardization among the territories is an issue. CNMI and AS commercial receipt programs include restaurants and smaller operations (e.g. road-side sales), where Guam only tracks the larger fish vendors. CNMI and AS have mandatory reporting, Guam does not, though reporting percentages are currently no better with mandatory reporting.

Table 2: Current metrics for Commercial Receipts Programs as reported by the Territories

Commercial Receipts	CNMI	Am. Samoa	Guam
# of Vendors	45	64	10
# Vendors Reporting		40	6
% Vendors Reporting	20%	63%	60%
Data Collection Rate	once per month	once per month	every 2 weeks
Vendor Types	Dealers, restaurants, small stores	Dealers, restaurants, small stores	Dealers only
Confidentiality	<3 vendors	?<3 vendors	<3 vendors
Mandatory	yes	yes	no
Enforced	no	no	n/a
Year Initiated	1983	1991	1980

Guam initiated its program in 1980 but has had limited success for buy-in. Currently, there is only about 50% participation (fish vendors only, restaurants not included). There is not a good census of the number of vendors selling per year, however, consideration is being given to linking the business license to reporting compliance.

CNMI has had mandatory reporting requirements in place since 2014, but the rules have not yet been implemented. It was mentioned that CNMI was waiting for the outcome of the PIFMAPS Data Summit before pushing for implementation. CNMI reported that about 20% of the active vendors are currently reporting commercial receipts.

American Samoa has mandatory reporting requirements but stated that currently only about 64% (40 of 64 total) of the vendors are reporting, 10 of which are not complying and have been referred to enforcement and 15 which do not seem to provide honest reports of their fresh fish deliveries.

All of the territories reported problems in estimating catch by species from the commercial receipts program since many vendors may not separate the landings by species.

Biological Sampling Program

Recently responsibility for the biological sampling (biosampling) program has shifted from WPacFIN to PIFSC. The biosampling program has been collecting data in all of the territories since 2009 (CNMI and Guam) and 2010 (American Samoa), and each territory has had different sampling protocols, collections sites, and challenges. An external review of the program was conducted in 2016 to assess the quality, relevance, and performance of the research and its usefulness for the management it supports. The primary goal of the program is to acquire accurate species identification, trip-level species composition, length:weight metrics, and otolith and gonad samples for life history research.

The program has two data collection components, the field sampling program (FSP) and the laboratory-based life history program (LHP). The FSP collects lengths and weights of fish and species identification, while the LHP collects otoliths, gonads, and fin clips that are later processed in various laboratory locations. Field samplers collect the length, weight, and species identification from the entire catch landed with the goal of covering the entire size range of all species caught in each territory. The biological samples are taken from an identified list of target species in each territory from throughout the entire size range of the catch.

Successes of the Biosampling program include:

- Building relationships with fishermen and fish vendors, especially in Guam and CNMI
- Thorough species identification and morphology guides (Guam)
- Estimates of length:weight equations for many species
- Estimates of life history parameters for many species

The PIFSC calculated between 70-85 length:weight equations for reef fish and bottomfish species in each of the territories (see Table 3). In recent years PIFSC staff processed age and reproductive samples to develop a broad set of parameters for growth and maturation for three species from Guam, four species from CNMI, and four species from American Samoa. Age and reproductive sample processing is continuing at PIFSC (Guam samples) and in the CNMI.

Comparison of the length and age of bottom fish from exploited areas in American Samoa and the Marianas and unexploited areas in both regions showed very similar length compositions within each region (Marianas or American Samoa) but very different age compositions. This indicates that age sample collection and processing of long-lived species such as bottomfish will be critical for tracking the status of the fished resources.

Table 3: Current metrics for the Biosampling Program (FSP and LHP)

Biosampling	**CNMI**	**Am. Samoa**	**Guam**
Average # of Vendors Sampled per year	2 + some opportunistically	vessel intercept	co-op only
Primary Fisheries Sampled	nighttime reef	spear, bottom, handline	bottom & reef
year range	2009 - 2019	2010 - 2017	2009 - 2019
# species sampled field	242	281	266
# species sampled lab	22	17	78
# l-w relationships completed	83	71	85
# life histories completed	2 (3 in prep)	4	1 (2 in prep)

Territorial personnel reported that the application used for recording, managing and extracting biological data was difficult to use, and WPacFIN indicated that the application was not being maintained.

PIFSC biosampling personnel indicated that on Guam a vendor was receiving payment for access to, and at times the sampling of landed catches and that for some years sampling was focused on that site. The panel was concerned that payment for access to a public resource (fisheries stocks) should be freely available to governmental agencies responsible for monitoring those resources.

Stock Assessments

PIFSC has conducted stock assessments of bottomfish stocks from American Samoa, Guam, and the CNMI and was able to develop management advice for two of the three territories. Territorial fishers and fisheries experts considered that the assessment had been conducted with care, but were highly critical of the input data, particularly the catch, which they considered was not reflective of the actual condition of the fisheries. Short-comings of the data used for assessment included:

- Roughly one third of the bottomfish landings were not identified to species and had to be calculated from survey data.
- The bottomfish assessments currently underway examined stock status for Guam and CNMI separately.
- Only 5 of 12 reef fish species had local life history parameters.
- Only 6 species/islands for bottomfish with ages (out of possible 37)

Review of Methods to Obtain Estimates of Total Catch

After reviewing the three data collection programs (creel surveys, commercial receipts, and biosampling), it was apparent to the panel that each of the programs collected information on the total catch for one or more of the species or fishery strata. Each approach has its strengths and weaknesses which may differ between the various fisheries.

Statistical Surveys

Statistical surveys can provide useful estimates of catch by species if properly designed and executed. In contrast to the other approaches for obtaining total catch, statistical surveys are designed for only sampling catch and effort and must use estimation algorithms to calculate the total.

Statistical surveys generally are not useful for sampling rare events such as infrequently encountered bottomfish or spearfish or for short term phenomena such as the inshore migrations of juveniles of some species which apparently occur over a small number of days.

They can provide unbiased estimates of catch if sufficient sampling is conducted. To develop robust catch estimates by species when there are many different types of fishing (cast nets, gleaning, hook and line, etc.) each with different species compositions, high sampling intensity is needed to ensure that all of the types of fishing are adequately sampled during the period in question (each year or season).

Commercial Receipt Programs

Commercial receipt programs such as those typical in all 50 US states attempt to collect information from all of the landings for all commercial fisheries, by species (or at least by market category) as a way to keep track of local commerce and catch statistics.

If commercial receipts are not obtained from all vendors then the reported catch will be lower than what is actually being removed from the resource. If mandatory reporting is not required and enforced, It can be difficult to determine how much catch is missing.

Some of the information provided by vendors may not be as accurate as the information available from the fisher. In the territories, vendors are more interested in the market value of the landings so they may not be a good source for the species identification of the landings, especially in light of turnover of staff. Additionally, vendors often have little or no information of the actual fishing gear, effort, and location.

Fisher Reports (aka logbooks)

Fishers are the preferred source for information on fishing gear, fishing location and effort. It was reported that the fishers usually know the species they are catching (for most groups) though usually in their native language, which often is not English.

Fish licensing programs in the US vary between states. In some state jurisdictions, fishing permits are issued to boats. In other state and territorial jurisdictions, licenses are issued to fishers. In cases where multiple license holders are fishing on the same trip and each is required to report separately, complications can develop especially when the total catch is shared.

If reporting is delayed (perhaps more than a week), fishers may not remember specifics of catch and effort so that accuracy of the reported information can be low.

Biological Sampling

Depending on the design, biological sampling programs can capture many different types of fisheries data from catch statistics to size and ages of fish by species. Preferably sampling occurs when the fish are unloaded from a boat or creel so that all fish landed are observed, not just fish that are sold. Often sampling programs are paired with commercial landings programs to provide better estimates of species composition.

Conceivably a comprehensive biological sampling program could sample all fishing trips and collect all of the information needed for stock assessment: information on catch (landings and discards), effort, and biological information (size, age samples, and at times additional samples for reproductive, stock identity and trophic studies). If every fish is identified and weighed, then the total weight of the landings is available. Such a system would require meeting every fishing trip which would be logistically difficult but might be feasible with a very small fishery.

Panel Recommendations

Statistical Surveys

The territories indicated that they need information on reef fish and bottomfish species for local resource management. Since the current design does not provide sufficient information to understand and adequately manage that resource, the survey must be redesigned. The panel recommends that the territories, WPacFIN, and the US Fish and Wildlife Service (USFWS) should work with survey statistician(s) to optimize the sampling design to provide far more precise estimates of catch particularly for individual species of interest. The panel also strongly

recommends that the territories engage with the NOAA Marine Recreational Information System (MRIP) for further support, resources, and possible certification of the creel surveys.

For the bottomfish fishery and perhaps other fisheries such as the spear fisheries, the panel recommends that data collection be shifted from the statistical survey approach to a mandatory trip reporting program, preferably via a smart phone application and not paper-based (see the Electronic Reporting section). A modern trip reporting program could eliminate or greatly reduce the uncertainty about the catch, could greatly increase the accuracy of species identification because fishermen often know the species they catch, and produce more real-time estimates of catch and effort. Additionally, boats with mandatory reporting requirements should be required to report all fishing effort not just fishing effort directed at bottomfish.

Though the expansion process is outside of the purview for the panel, the differences in CVs of the estimated catches between American Samoa and the Marianas (Guam and CNMI) was unexpected given the lower sampling intensity in AS. The panel suggests that the review of the estimation methods consider these differences both for total catches and catches by species.

Summarized recommendations

- **The lower CVs about AS estimated total catches should be investigated. Depending on the results of that investigation, consideration might be given to modifying creel survey designs to add increased focus on reef and bottom fish fisheries**
- **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 Fisher Reports

The panel felt that the difficulties with obtaining precise and accurate catch statistics for the bottomfish and spear fish fisheries indicated that creel survey approaches in general were not providing sufficient information for estimating total annual catch let alone annual catch by species for these fisheries. Workshop participants appeared to agree with that conclusion. The consensus was that the territories should shift to the collection of commercial receipts to obtain those landings.

The panel recommends that mandatory reporting regulations be implemented for all the territories and all categories of commercial vendors (from larger stores to road-side markets). Territories should explore linking business licenses to reporting requirements. PIFSC scientists are tasked with producing stock assessments of bottomfish species under the FEP, therefore promoting mandatory reporting of receipts for all bottomfish should be prioritized.

Requiring reports from both fishers (sellers) and from vendors (purchasers from boats) is encouraged as a way to try to ensure that nearly all of the commercial catch is recorded. However, fisher and vendor reports should be linkable so that they can be compared for each trip. This would require constant effort by fisheries staff preferably in near real time and can be difficult when a boat sells to multiple vendors.

The panel encourages the development of electronic reporting with a common platform for all the territories (See Electronic Technologies Section). PIFSC or WPacFIN should facilitate applying for FIS funding in FY21 to augment development costs.

Some of the territories stated that fishers and/or vendors received incentives for reporting. The panel is generally not in favor of providing incentives for reporting on / providing access to public marine resources. However, if this practice is to continue a committee made up of territorial representatives and the funding agencies should be formed to review and discuss a transparent program across the territories.

Boats should be required to report all catch whether it is sold, landed but not sold (personal use), or discarded at sea. This is a typical requirement of state-run commercial receipt programs. Catches should be recorded to the finest taxonomic level possible preferably using names used by the fishers and vendors.

Summarized recommendations

- **Use commercial receipts to obtain landings of bottomfish and perhaps other species groups (such as fish caught by spear)**
- **Mandatory reporting from all fisheries**
- **Prioritize bottomfish fisheries**
- **Promote electronic technologies**
- **Mandatory licensing of vendors and fishers or boat owners**

Total Catch and Calibration

It can be difficult to be sure that vendors are reporting all of the landings. One way to try to ensure that all landings are recorded is to require boats (and other commercial sellers) to report landings. The seller reports should be linked to vendor reports so that reporting gaps can be identified and resolved.

As changes to the historic data collection programs are made, it will be important to maintain the historical systems while the new systems are developed. Whenever two surveys are designed to measure the same things (fisheries catches in this case), there will be two different estimates. Calibration must be used to provide a conversion from the estimates of one series to the level of estimates from the other. Calibrated estimates will be needed to use the historical (collected by

some system) and future (collected by a different system) data sets for understanding the impact of fishing on exploited stocks.

Summarized recommendations

- **Boats and other sellers should be required to submit reports of catch and effort in a timely manner (daily, weekly).**
- **If a seller is encountered in a creel survey, information should be recorded which would allow the interview data to be linked to the mandatory seller report and to the vendor who will sell the fish.**
- **Territorial or WPacFIN staff should link seller and vendor reports on a real-time basis.**
- **Conduct commercial receipt collection and at least the boat-based creel survey for at least 3 years so that calibration between the creel and the commercial receipt approaches can be calculated assuming the creel survey(s) have observed the taxa of interest a sufficient number of times in the past for calibration to be of use.**

Biosampling

PIFSC should reevaluate the objectives and design of the biological sampling program. In addition to obtaining samples for age and reproductive samples, consideration should be given to obtaining samples representative of Management Unit (MU) species from the takes of specific fisheries such as the bottomfish and spear fisheries. Typically sampling programs aim to equally sample landings at all landings sites; an alternative approach that should be considered, would be to design the survey to obtain samples equally from the areas fished. Such a spatially (fishing area) based design, could result a more thorough representation of the biology of the exploited populations rather than one more indicative of the population in the more heavily exploited areas.

Biological sampling does not necessarily have to obtain information from *every trip*, though it would be important to continue recording information from *all fish* captured on a trip. A sampling design could establish target sampling fractions for each fishery so that sufficient trips are sampled for species composition and sufficient length and/or age samples are collected.

For at least long-lived fisheries, routine collection and processing of age samples will be needed because for many species because length is generally a poor indicator of age. If indicator species management approaches are selected, it will be important to periodically review the status (age structure and perhaps other biological and management parameters) of the other species in the complex to ensure that species that are more vulnerable to fishing are not over-exploited.

The panel strongly recommends that WPacFIN and the territories continue working to develop an application to greatly speed up biological data collection including length, weight, species

identification, and fish image collection. Such systems could greatly speed up the sampling process which can be burdensome to fishers. Possible funding mechanisms for developmental work would include the NMFS Fisheries Information System (FIS).

Summarized recommendations

- **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 and age sampling for assessments (reduce sampling efforts and spread effort to fill in other data gaps)**
- **Redevelop the reporting component of the biosampling application with more flexibility for future updates**
- **Develop visual system to rapidly record size and species identification**

Organization and Execution

The Creel Survey, Commercial Receipt, Biosampling, and Stock Assessment programs need to improve communication to better plan and coordinate data collections. There appears to be duplicity between programs (all programs capture estimates of total catch for some of the same strata). For instance, the biological sampling program does not need to be collecting information on every trip (essentially an entire fishery sample) when the creel surveys, the boat reports, and the dealer reports will also be attempting to obtain information on the entire catch. Additionally in some cases territorial personnel were not aware of what federal personnel or contractors were doing and in other cases, one sampling program had built a good working relationship with a local fish buyer, while the other two sampling programs were not able to collect any information from that same vendor. The panel recommends that WPacFIN, the territories, and PIFSC renew coordination activities to increase efficiency, reduce redundancy, and increase awareness of each other's activities.

Additionally shifting the mixture of data collection programs to put more emphasis on vendor and fisher reporting and somewhat less on creel surveys will likely not be simple. Data gaps may be identified due to logistical problems and/or problems with fisher/boat and vendor reporting. It may turn out that a mixture of approaches may be needed for obtaining catch, effort and biological information. The panel recommends that PIFSC, WPacFIN and the territories closely monitor the data collection approaches to determine the best combination of sampling programs to obtain the information needed for stock assessment and management.

Because of differences in the quality of data available from Guam and CNMI, stock assessments for those territories were conducted separately. However, since Guam and the CNMI are part of the same archipelago and are roughly 40 miles apart at the closest point, it is likely that many or all of the fisheries resources are biologically connected through larval

transport and should be treated as one population.. The panel recommends that the data collections in the Marianas be well coordinated so that sufficient information is available to assess the fisheries resources as single biological stocks if appropriate.

Summarized recommendations

- **Remove duplicity - all of the programs are capturing estimates of total catch for some sectors/fisheries, need a unified approach**
- **Promote 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**
- **Increase coordination**
- **Ensure the same types of data are collected throughout the Marianas so that Marianas-wide stock assessments can be conducted**
- **Strive for a unified territorial approach!**

Communication and Outreach

Since multiple changes to the data collection programs are recommended, well planned and extensive communication and outreach coordinated between the territories and WPacFIN is required to educate the agency staff, samplers, fishers, and the public.

Federal and Territorial agency staff and fishing public should also be educated on the importance of fishery management for maintaining healthy fishery resources into the future. Territorial personnel reported that fishers generally do not understand the need for accurate fisheries data and may think that under-reporting may result in calculations that a stock is only lightly exploited. WPacFIN and WPRFMC should develop outreach materials to educate fishers and all fisheries staff on the importance of accurate fisheries information for stock assessment. The outreach materials should be developed to demonstrate that under-reporting can result in catch limits being set too low while over-reporting can lead to overestimates of allowable catch, which can lead to stock crashes and/or the perception that the stock has weak recovery potential.

Summarized recommendations

- **Payment for access to data and catches for non-invasive sampling such as taking length and weight should be heavily discouraged**
- **Promote outreach regarding the importance of reporting accurate data in support of fisheries management and resource sustainability**
- **Effective communication planning in each territory should be sensitive to the regional languages and cultures**
- **Communication should be tailored to the varying audiences (vendors, fishers, staff, local governments, etc)**

- **Identify regional and territorial personal to lead the outreach**
- **Strive for a unified territorial approach!**

Electronic Technologies

Although not a specific topic on the PIFMAPS agenda, modernizing the data collection systems by implementing electronic technologies was a consistent theme throughout the data summit. Three specific solutions were identified: 1) an e-Reporting application for commercial vendor receipts and boats for prioritized fisheries such as spearfishing and bottomfish fisheries; 2) the redevelopment of the biological sampling systems; and 3) installation of cameras at boat ramps to capture effort.

1 - On the first day, a prototype of a web/mobile bottomfish e-Reporting application was presented. This application appeared to have all the features needed for fisher-based reporting, including offline storage when the user has no network connection (WiFi or Cellular). The data would be stored on Amazon Web Services (AWS) with a go-live date of October 31, 2019.

Vendor reporting did not seem to be part of the e-Reporting application, though the presentation mentioned a vendor sales report. The panel recommends that a similar application be developed for commercial vendor receipts.

Concern about internet/cellular connectivity and a technology-adverse user community was expressed by CNMI and AS representatives. Offline storage and automated data syncing when a network is available is common with current mobile applications. These issues would need to be addressed and solutions properly communicated to the users.

Rolling out the bottomfish e-Reporting application is a priority and key step in modernizing the territorial fisheries data collections. A solid implementation plan is critical before releasing the application and should be part of the larger organization and execution section as well as the communication and outreach section above. Failure to properly launch these new technologies will negatively impact the relationship with the communities for years to come.

2 - The current biological sampling data system was redeveloped in 2011 by WPacFIN. The primary author retired and current staff have difficulties prioritizing changes to the current system. A redevelopment effort should ensure data standards between territories, a flexible codebase, and improved data syncing capabilities to the WPacFIN database.

3 - With fewer than five boat ramps at each of the territories, video monitoring to capture effort 24-hours a day seems possible. Oregon successfully implemented this type of system in 2007 (Ames and Schindler, 2007).

WPacFIN mentioned that they are planning on modernizing their database architecture, but were holding off until after the PIFMAPS meeting. The panel recommends that they collaborate with the Pacific States Marine Fisheries Commission since they have modernized databases to hold both statistical survey data (RecFIN) and commercial landing, logbook, and commercial sampling databases in AKFIN and PacFIN. Also collaborating with the NOAA FIS Electronic Technologies Professional Specialty Group (ET-PSG) is encouraged for planning support and potential funding.

Summarized recommendations

- **Implement use of an application to collect all commercial vendor receipts**
- **Boats in some fisheries (spear and bottomfish specifically)**
- **Redevelop and modernize the biosampling applications**
- **Implement cameras at boat ramps to capture effort**
- **Extensive and well-planned outreach and training (implementation plan)**
- **Collaborate with FIS and other FINs for resource sharing**

Conclusions

As described in the PIFMAPS TOR, the panel reviewed and evaluated the quality, relevance, and performance of the data collection system in American Samoa, Guam and the Commonwealth of the Northern Mariana Islands and its adequacy for generating robust scientific products and usefulness for the management it supports. The panel concludes that they did indeed address each point presented in the Purpose and Scope of the Review section and answered in detail the overarching question about the data collection programs; *Do they produce data useful in fishery assessments and management actions both locally and federally, and to what extent are the data used?*

Although many reports are generated based on estimates from the current data collection systems, the panel concludes that the systems are *not* designed to meet the requirements of modern stock assessments and *do not* produce the best estimates of catch and effort.

The panel realizes that many of the problems outlined in this report have been studied and reported on many times in the past, but action to implement real change has been lacking. The panel truly believes that modernizing the data collection systems and emphasizing the collection of *total catch* and *total effort* from fisheries targeting management unit species under the current FEPs is the best path forward. In order for this to be successful, data collection needs to shift from statistical creel surveys to mandatory reporting by fishers and vendors.

Well-thought-out implementation of electronic technologies to ease data collection from fishers and vendors would increase the precision of catch and effort estimates. However, this will only

hold true if the reasons behind collecting this information are properly communicated (consequences of under and over reporting) and there is culturally-appropriate outreach to all of the stakeholders in the communities involved. The panel strongly encourages a *unified approach* to implement changes for all of the territories, while being sensitive to the cultural differences between these distinct communities. A unified approach should also be a goal of PIFSC leadership and the program managers of WPacFIN, the Stock Assessment Program, and the Biosampling Program for implementing effective change. With improved communication, alignment, and resource sharing between these programs, redundancy in collecting catch and effort data would be removed. The panel believes that this unified approach to data collection will be easier to implement, maintain for the future, be more streamlined, and more cost effective.

The panel would like to thank the staff of the WPRFMC, PIFSC, and WPacFIN for the opportunity to serve on the PIFMAPS panel and for the well organized and informative meeting. We would also like to thank the staff of American Samoa, Guam, and CNMI for their extensive efforts and open participation and PIFSC staff for their extensive and active contributions.

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