REPORT ON THE SSC WORKING GROUP AMERICAN SAMOA BOTTOMFISH FISHERY DATA WORKSHOP

DRAFT DATE: 11/28/2021

Thomas Remington[1] and Marlowe Sabater[1]

National Marine Fisheries Service
Pacific Island Fisheries Science Center

Western Pacific Regional Fishery Management Council

[1] Western Pacific Regional Fishery Management Council

[PAGE LEFT INTENTIONALLY BLANK]

Table of Contents

SSC WORKING GROUP BOTTOMFISH FISHERY DATA WORKSHOP

Western Pacific Regional Fishery Management Council
Pacific Island Fisheries Science Center

Thursday, November 18, 2021, 9 am – 1 pm (HST)

1. Welcome Remarks

The Western Pacific Regional Fishery Management Council's (Council) Scientific and Statistical Committee (SSC) Working Group Bottomfish Fishery Data Workshop (workshop) began just after 9:00 am HST. Participants expressed gratitude for the SSC's involvement and engagement in the new collaborative effort to prepare for the upcoming benchmark stock assessment for American Samoa bottomfish management unit species (BMUS) scheduled to be completed in 2023.

2. Introductions

The following individuals were in attendance from the National Marine Fisheries Service (NMFS) Pacific Islands Fisheries Science Center (PIFSC): Mia Iwane, T. Todd Jones, Erin Bohaboy, Marc Nadon, Felipe Carvalho, Robert Ahrens, Bradley Gough, Danika Kleiber, and Ashley Tomita. From the Council, Diana Kitiona, Marlowe Sabater, and Thomas Remington were in attendance. From the SSC, the following individuals were in attendance: Steve Martell, Craig Severance, Domingo Ochavillo, and Shelton Harley.

3. Background and Goals of the Data Workshop

The purpose of the workshop was to initiate discussions regarding the new benchmark stock assessment to be completed for American Samoa BMUS in 2023 and unite all relevant groups in a collaborative process. PIFSC's improvement plan for the upcoming assessment has five components: data, workshops, modeling, review, and management, each of which will occur over the next year and a half prior to the finalization of the next stock assessment. For the data component of the improvement plan, PIFSC conducted an in-depth review of all available BMUS fisheries data in American Samoa, which was reflected in a data report sent to workshop participants. By exploring available data, PIFSC hopes to promote a data-driven decision making process, but it is still essential to learn from the fishing community and DMWR about the local fisheries and context for the data. For the workshop component of the improvement plan, PIFSC intends to hold workshops such as the current one, believing in the benefit of shared understanding with stakeholders on the interpretation of data. The presentations for this workshop were very similar to those given at the DMWR bottomfish fishery data workshop on November 8, 2021. At the DMWR workshop, participants described the process for developing the new assessment as starting off with a "clean slate."

Social scientists attended the workshop because the PIFSC Fisheries Research and Monitoring Division (FRMD) and Stock Assessment Program (SAP) wished to collaborate on this effort. The goal of the social scientists was to determine how PIFSC engages with

stakeholders and research how to improve engagement processes. They took notes on how everyone is benefitting from the workshop and communication with one another, with the intent of using the information to guide future engagement processes.

The background and goal of the PIFSC data report prepared prior to the workshop was to determine steps to improve the next American Samoa BMUS benchmark stock assessment in 2023. Because the assessment will be a benchmark, PIFSC can revisit the model and methods used to determine stock status. In the most recent assessment, PIFSC utilized a surplus-production model, focusing on catch and catch per unit effort (CPUE) for the BMUS species complex. Utilizing an age-structure model, as PIFSC did for reef fish in Hawaii and Guam, which would incorporate life history and length data for species-specific assessments, would represent an improvement from the last assessment. However, the question remains if there are sufficient data to implement such a model. At the workshop, participants reviewed all available BMUS fishery data sources in American Samoa, including National Oceanic and Atmospheric Administration (NOAA) diver surveys, the Commercial Purchase Program, the NOAA Biosampling Program, shore-based creel surveys, boat-based creel surveys, and historical catch information. The workshop was not meant to result in management decisions but to focus on the data. Outcomes from the workshop will be presented at upcoming meetings of the Council and its advisory bodies.

4. Evaluation of the Available Data for BMUS

a. NOAA Diver Surveys

i. Summary

The NOAA diver surveys began in 2002 but were updated with an improved design in 2008. The surveys occur every three years, but the 2021 surveys were cancelled due to the COVID-19 pandemic. Paired divers remain stationary in two circles of a 15 m diameter, count fish that enter the area, determine the species, and estimate size. The surveys occur at all islands in the American Samoa archipelago, but are restricted to depths above 30 m. The depth limitations of the diver surveys cause them to encounter a limited number of BMUS, and the surveys are especially ineffective for deep water snapper species within the complex. The surveys provide size and abundance data (i.e., CPUE) from visual estimates by the divers.

Except for 2021, diver surveys were completed as scheduled for every island in American Samoa. In 2016, there were fewer surveys than usual on the south side of Tutuila, which may have been due to weather or ocean conditions preventing access. The surveys observed five of the 11 BMUS, including *Lutjanus kasmira*, *Variola louti*, *Aprion virescens*, *Lethrinus rubrioperculatus*, and *Caranx lugubris*, but only the first three have been observed in sufficient amounts for appropriate data analysis. *L. kasmira* was seen mostly around Manu'a and not as frequently around Tutuila. The size distributions are separated by area due to the difference in sample size between Manu′a and Tutuila. The index of abundance that is generated from the diver surveys allows managers to look at temporal trends in the number of fish counted to determine abundance over time. However, a main concern is how often species are observed. *L. kasmira* was observed in 37% of surveys in Manu'a but in only 2% of surveys around Tutuila. For the few BMUS observed during the surveys, there may be enough size and abundance data to generate a short trend starting in 2008.

ii. Discussion

There were no comments or questions on the NOAA diver surveys.

b. Commercial Purchase Program

i. Summary

The Commercial Purchase Program in American Samoa began in 1990 and requires all vendors to submit invoices for the purchase and sale of fish. The data from the program do not allow for an estimate of CPUE but do provide size data. Additionally, the commercial catch estimate from the program serves as a hard floor for creel survey estimates such that creel survey catch expansions, which estimate total catch, should be higher than the commercial estimates. There are 828 commercial reports that contain BMUS but do not report the number of pieces, so no estimate of mean length or size distribution can be generated from these reports. There are 67 reports that have one BMUS (i.e., an individual measurement), meaning that mean length or a size distribution can be developed. There are 766 commercial reports that have more than one BMUS, which can allow for an estimate of mean length but not size structure because there are no individual fish measurements. Many of the reports do not indicate the area fished, so it is not clear where the reported BMUS were harvested. The reports that do note location are mostly from fishing around Tutuila with bottomfishing gear. *L. kasmira* is the most frequent species in the reports followed by *Etelis carbunculus*. There are generally less than 30 reports per year for each species, which means there are likely not enough data to generate usable size distributions; the program was not originally meant to generate size data. Ultimately, the Commercial Purchase Program on American Samoa cannot give estimates of total catch or CPUE, and it does not provide much size data due to too many missing components in the vendor reports.

ii. Discussion

The PIFSC SAP was aware that the Commercial Purchase Program would not be a major source of species-specific size data since it was meant to support creel total catch estimates, but the data could possibly provide mean weight for a few species or a size structure if data are aggregated across multiple years. Because vendor reporting is mandatory in American Samoa, the commercial invoices do not represent a sample but a census. A primary issue in comparing the commercial data to creel surveys is that catch estimates are so variable, but an average could be calculated for each data stream to see what percentage of total catch that fishers generally sell. In certain years, the commercial data reflect higher catches than the creel survey estimates. Another issue with the commercial data is that there are sometimes multiple pieces that do not have individual weight or size reported; while there is information on every submitted vendor report, it is not clear if that information is always usable.

Regarding the confounding of *E. carbunculus* and *E. boweni* on commercial invoices, vendors identify most individuals as a general group rather than at the species level. The detail in reporting is vendor-dependent. It may be unlikely that most vendors would know the difference between *E. carbunculus* and *E. boweni*. Generally, *E. carbunculus* grows to a maximum of 50

cm, but *E. boweni* can grow to be over a meter. There has not yet been any way to split the species in past data streams.

Participants suggested that the assessment scientists ask DMWR if there has been a change in the size of fish being sold and if any shift in size distribution could be due to vendors explicitly deciding to sell larger or smaller fish over time. However, this may be difficult to determine since any change would reflect a change in marketing, which the Commercial Purchase Program was not designed to capture. Anecdotal information from talking to vendors could help to determine if there are preferences in sizes of fish being sold. In Hawaii, for example, some vendors selling to restaurants prefer to buy plate-sized fish and are not interested in large snappers that would need to be fileted. Larger fish were also more prevalent in American Samoa markets when there was an export program to Hawaii and during the dory project, but there was a shift in preference to reef fish soon thereafter because of the low bottomfish export price due to issues with quality. In the 1980s and 1990s, larger bottomfish would be presented ceremonially, but a change in demand toward smaller fish in recent years could be possible. Determining if there is size selectivity at the vendor level in American Samoa as there is in Hawaii would be useful but doing so would likely need to be anecdotal since such a pattern would not be clear in the available data. This is a question that PIFSC could ask at the upcoming stakeholder workshop in early 2022.

c. PIFSC Biosampling Program

i. Summary

The goal of the PIFSC Biosampling Program is to collect fish samples for life history data as well as length data used for stock assessments. The program was operational from 2010 to 2015 in American Samoa and collected more than a quarter million samples, mostly from reef species. There are 13,000 samples from BMUS. The data can be to determine size metrics for BMUS, but PIFSC cannot use the data to determine CPUE. Because the time series is so short, the data may not be especially useful for informing the model in the upcoming stock assessment.

Size observations were mostly from Tutuila, with the majority of samples collected for *L. kasmira* (>6,300), *L. rubrioperculatus* (>4,500), and *A. virescens* (>950). Approximately 100 samples are sufficient to determine size structure, but several BMUS do not have this many. *Pristipomoides filamentosus* has the least number of samples (7) as it is not commonly encountered. Most observations came from the bottomfishing gear or trips where both bottomfishing and trolling were utilized. The one exception is *V. louti*, as 70% of its samples came from spearfishing. Both *L. kasmira* and *L. rubrioperculatus* have around 1,000 samples per year, *A. virescens* and *V. louti* have about 100 samples per year, and the remaining BMUS have around 10 to 15 samples per year. For some BMUS, years may need to be aggregated to develop a size distribution, but the data are still viable for use. Most of the BMUS have clean size distributions such that the model could likely fit the data well (except for *P. filamentosus*). Another issue is with *E. carbunculus* and the recent discovery of a second, larger species, *E. boweni*. While *E. boweni* has existed around American Samoa throughout the development of the bottomfish fishery, it was not recognized as a separate species from *E. carbunculus* by data collectors and, until recently, data for the two species were combined. Because *E. boweni* can grow to be much larger than *E. carbunculus*, it can be difficult to distinguish the two species in

smaller individuals and the mixing of the species in the smaller size samples could be an issue in utilizing the data.

ii. Discussion

Participants discussed the prevalence of *L. rubrioperculatus* in the biosampling data despite it not being present in the commercial purchase reports. The prevalence of the species in the commercial data is highly dependent on what vendors are able to identify to the species level. It may be that *L. rubrioperculatus* is one of the species that is not explicitly identified in the commercial invoices, and the species may get grouped with general emperor or bottomfish assemblages; changes to commercial reporting categories and procedures should be considered. It is also possible that commercial reports that identify species to a more refined level better reflect the species that people choose to buy. Additionally, if *L. rubrioperculatus* is not found in the markets, it is possible that the species is usually distributed among family members or the community. However, it remains most likely that the species is reported in a general group on the commercial invoices.

Participants wondered about the acquisition of reports by Dick Wass that examined nearshore fisheries of American Samoa. Wass no longer has the reports, having left them at DMWR. The 2009 tsunami in American Samoa impacted the library that would house these reports, and many paper documents were lost.

d. Shore-Based Creel Surveys

i. Summary

The shore-based creel survey program in American Samoa captures shore-based fishing methods like throw net, gill net, spearfishing, and hook and line on lagoons or reefs, utilizing both participation surveys and interviews for catch composition. The program began in the 1970s, but the time series had little continuity until the Western Pacific Fisheries Information Network (WPacFIN) began managing the data stream in 1988. Shortly thereafter, in 1990, the survey route was modified on Tutuila. Shifting methodology over time limits the time series of the program, which captures up to 400 interviews per year.

The time series for shore-based creel surveys is split into an “early” period between 1988 and 1996 and a “recent” period from 2005 until the present. Early on, there were many interviews with BMUS (~10 to 30 per year), but there have been fewer more recently (1 to 6 per year). Interviews containing BMUS were mostly for nets in the early years of the survey, whereas, in recent years, BMUS-containing interviews mostly included hook and line as well as spearfishing. BMUS make up 0.3% of fish in the interviews by weight in the later years. In the early 1990s, there were many surveys observing *P. zonatus* and some *L. kasmira* in gill nets and throw nets. In more recent surveys, the number of fish being recorded dwindled, with just one to five total BMUS individuals being seen each year. Thus, the shore-based creel surveys are not usable to determine BMUS CPUE or size structure despite observing high numbers of *P. zonatus* early on.

ii. Discussion

Regarding the decrease in the number of species between the two time periods coinciding with fewer surveys being completed, workshop participants discussed if there were other possible reasons such as a change in fishing methods or location. It is possible that species were misidentified, however, it is difficult to determine changes in the fishery associated with the decrease in observed species. There have been shifts in methodology for data collection over the years, and the two time periods are separated by several years. Information from DMWR would be helpful on this front because their staff may remember how the fishery and its data collection shifted between the two time periods. Anecdotal information on shifts in the fishery may help explain the observed changes in the data over time, so discussion at the upcoming stakeholder workshop may help if fishers remember a pulse of deep water fish coming closer to shore. It was noted that there have always been issues with participation in the shore-based creel surveys, and DMWR fired one staff member for manufacturing data.

Workshop participants then addressed the disappearance of *P. zonatus* in the early 1990s despite being prevalent earlier in the time series. There was not a major reduction in shore-based effort observed since then, and it is not clear why *P. zonatus* and *L. kasmira* have not been recorded in the surveys recently. It is possible that the increased prevalence of *P. zonatus* could be due to an abnormal, shallow-water recruitment event, but the species has not been encountered in the NOAA diver surveys and were prevalent for about 15 years. Even in Hawaii, it is unprecedented to catch any juvenile *P. zonatus* with any shore-based gear type, and net-based gear types were rare in American Samoa during that time. Species misidentification by the surveyors is the most likely scenario, as the shore-based creel surveys were young in the 1990s and species identification was not standardized until the 2000s. The stock assessment scientists did not think that a recruitment event occurred in the 1990s unless anecdotal information can verify the occurrence.

The ban of SCUBA spearfishing may have contributed to the shift in the interviews, and spearfishing is normally a problematic method to survey because fishers can easily avoid the data collectors. Additionally, there was a change in the regulations for gill nets in particular, including stipulations on mesh seize, deployment time in the water, and categorization as an active instead of passive gear, which may have impacted the data for *P. zonatus*, but gill netting is not a dominant fishing method in American Samoa. The most prevalent methods in shore-based fishing are hook and line and spearfishing. Workshop participants requested that DMWR generate a timeline of the history and regulations relevant to the bottomfish fishery in American Samoa to help clarify if the changes in catch are due to species composition or other shifts (e.g., regulations, gear methodology, etc.). The timeline should also include staff turnover. Even anecdotal information would be helpful to have for the stock assessment scientists to better determine what may have caused observed shifts in the available data.

e. Boat-Based Creel Surveys

i. Summary

The boat-based creel survey is the strongest available dataset for BMUS in American Samoa. The program began in the early 1980s and was standardized in 1986. Similar to the shore-based creel surveys, there are two components, participation (trips) and catch interviews,

used to estimate annual boat-based catch and CPUE. Regarding participation, the number of trips logged for BMUS gear types by port shows that most data come from Fagatogo Marina Dock. In previous years, there were more trips originating from Manu'a than recently. Utilizing vessel identification numbers, the number of unique boats per year making fishing trips that harvest BMUS declined from >20 to around 10 in recent years. An expansion algorithm is used to estimate the total number of trips per year for relevant gear types, and there are many different influences for how many people go fishing (e.g., there are decreases in participation after large natural disasters such as typhoons or tsunamis).

Regarding catch interviews, bottomfishing gears predominantly harvest many BMUS species and typically have between 50 and 100 interviews containing BMUS per year. Interviews are mostly from Tutuila in recent years, but there were more from Manu'a prior to 2008. Since then, there has been no regular boat-based survey coverage of Manu'a, and there are usually only a few trips to offshore banks each year. PIFSC SAP is hoping to get information about the missing data from Manu'a through DMWR to standardize the time series; the SAP could even use an effort proxy using the number of fishing boats per year in the area to estimate catch. The amount of catch recorded as belonging to unspecified species groups, such as “bottomfishes” or “inshore snappers” was high in the beginning time series (1986 to 1987), which is challenging to handle because it is not clear how many of these species were BMUS. The proportion of catch by bottomfishing gears identified as non-BMUS has been increasing over time. In the catch interviews, some BMUS are more common than others and it varies by area. However, *A. virescens* has been fairly common and consistent across islands of the archipelago. For a time series of catch rates, it is important to determine how often the creel surveys do not observe species in interviews at all (e.g., for *P. filamentosus*). For length data during interviews, not every fish gets measured, but more recent surveys have collected a greater amount of size data. While a time series of length observations would be ideal, issues with subsampling early in the program limit the use of length observations from the survey data.

Expanded boat-based annual catch comes from an expansion that uses the number of trips per gear per type of day multiplied by the average catch per trip to get the total catch, but there are uncertainties associated with such an estimate. PIFSC has typically only applied the expansion algorithm to interviews on Tutuila because all trips in Manu'a were believed to have been observed, hence providing a census of the catch. Previously, the creel surveys sampled *V. louti* often but has very few landings recently, and *P. zonatus* was common in Manu'a early on before becoming more frequent around Tutuila. Thus, there are different trends over time and area for each species. In the expanded catch data, there are many unknown species groups such as bottomfish, groupers, snappers, and emperors, all of which could include BMUS. Ultimately, the PIFSC SAP could use boat-based creel survey data to estimate CPUE for some BMUS, and the data are a valuable source of length information since 2016 as well.

ii. Discussion

Regarding the sampling of lengths of fish during the creel surveys, data collectors do not measure every fish. When there are too many fish to measure them all, surveyors should be randomly selecting individuals to measure with no preference in size. The participants expressed a desire to communicate with surveyors working in the 1990s to determine if the data collectors

performed length measurements at random, but staff turnover at DMWR and individual sampling preferences would make it difficult to determine the exact sampling processes that different data collectors employed. It is likely that biases entered the data collection process, but the fishery managers would need to organize a group of people who fished and/or collected data in the 1990s to get a better idea of what occurred during that time period. Sunny Bak previously produced an assessment of the creel survey sampling protocol, but that report was relevant to a more recent time period (2011 to 2014) rather than previous decades.

Workshop participants discussed if the declining trends of *E. carbunculus* and *P. zonatus* were due to reduced survey reports from Manu'a; this seems to be the case especially for *P. zonatus* since much of its data came from that area. Conversely, reports for *L. rubrioperculatus* were mostly unaffected since that species was more prevalent in the Tutuila area. The PIFSC SAP is especially interested in any imbalances in survey effort based on area with respect to changes in species composition over time.

A main point of discussion was how to navigate the loss of survey effort in Manu'a for recent years as well as the sizable portion of unidentified bottomfish catch in 1986 and 1987. After the recent natural disasters in American Samoa in the 2000s, the Council helped prepare disaster relief that included a number of *alia* vessels that were lost and needed replacement. An analysis could occur to examine the rate of *alia* replacement after the diminishing of the fleet, which managers could track via interviews with residents since there are so few vessels. Council staff indicated that the records show only 35 entities that filed for disaster relief for *alia* vessels, but it is not clear how many of those are from either Tutuila or Manu'a. The Council will work with DMWR to understand how many of those 35 entities actually had their vessels repaired by checking the Council survey of damaged boats and determining which fishers received funding for repairs. The PIFSC SAP is mostly interested to know the number of boats that resumed fishing after the repairs, which they may be able to discover through additional discussions with fishers.

Regarding a table in the data report that showed fishers harvesting bottomfish were likely to sell their catch according to creel survey estimates, an SSC member asked how creel surveyors queried the fishers' disposition to sell their catch during the interviews and if the surveys occurred after fishers removed some of the catch for community use. The responses were different than in interviews previously completed in 1996, and DMWR believes that fishers retain most BMUS for their families and communities rather than selling their catch. Some of the data for the 1996 interviews were included in a 2013 paper, and there were details about the proportion of catch that was sold, retained, and used for cultural needs. It is important to note how interviewers asked the question regarding sale of catch, as some fishers did not understand what it meant to say catch was not sold. According to anecdotal observations, red fish remain important for Sunday distribution to Titled men of the villages, and *fa'a samoa* is still significant in the territory with respect to distributing fish at cultural ceremonies despite cultures tending to change rapidly.

PIFSC staff also noticed the discrepancy in the creel survey data for portions of the catch intended for sale against what is generally understood regarding the sale bottomfish catch given cultural considerations, and the difference is large between catch observed to be sold in the

commercial receipt books and catch estimated to be sold from the creel surveys. The difference has become an issue for the non-commercial modules of the annual Stock Assessment and Fishery Evaluation (SAFE) reports since the expansion of catch fishers intend to sell does not match data from the Commercial Purchase Program. While PIFSC is looking to work with DMWR to further summarize the data to understand the disparity better, workshop participants also noted that the table in question only showed a subset of data for BMUS with length measurements. PIFSC staff agreed to re-run the analysis regarding the estimated sales of BMUS catch without filtering samples without length measurements to see if the new results better align with the 1996 interviews. However, a cursory evaluation of the unfiltered data still showed a relatively high proportion of catch intended for sale, though this may be due to the creel surveys interviewing fishers that are more likely to sell their catch. Additionally, since DMWR requires commercial fishers to obtain a permit, vendors should be recording that permit number in their purchase reports; this may allow for a linkage between creel interviews with permit numbers to commercial invoices such that one could determine how much sampled catch that the fishers actually sold.

Another suggestion regarding the determination of boats in Manu'a over the past decade would be to work with DMWR to link commercial permit registrations with vessel identification numbers. Commercial fishers submit their vessel numbers when they apply for a permit. Since creel survey interviews record vessel identification numbers, it would be possible to cross-validate vessel numbers from the interviews with their vessel numbers to track participation in recent years; a commercial fisher would assumedly not apply to get a new permit each year if their fishing boat is damaged or otherwise unusable. An issue with this approach would be that non-commercial fishers do not have permits so DMWR cannot track them using vessel identification numbers. Even if some catch is sold using the permit, many commercial fishers only sell enough catch to recoup their costs before distributing the remaining catch among their family and the community. Additionally, non-commercial fishers have no reason to obtain a license. Another problem would be the fact that the field for vessel identification number is not often completed during creel surveys, and it would be hard to track Manu'a vessels in this way since there are next to zero interviews from Manu'a in the past decade.

f. Historic Landings

i. Summary

The PIFSC data report derived initial information on historical catch information going back to 1967 in American Samoa from a series of reports by David Itano. The U.S. Bureau of Commercial Fisheries, the predecessor to NMFS, awarded a grant for exploratory fishing off the banks in American Samoa using handlines to determine the viability of a commercial bottomfish fishery using periodic data collection. However, many reports from that time are challenging to find. Historical catch information is important to know as the assessment moves to single-species models since having a full catch history on a stock is informative with respect to what things were like when the stock was unexploited and total fish removals. PIFSC is still searching for a report by Swedloff on Tautai A'e surveys in 1972 and any DMWR annual report from the 1970s to 1980s.

Total bottomfish catches from historical reports show catch for some years between 1967 to 1985. There was a peak in catch in the 1970s during the dory project at over 80,000 lb of bottomfish, but it is unclear how much of that catch was BMUS. There is limited information on species composition, but older reports mentioned species like *L. kasmira*, *A. virescens*, and *Pristipomoides* and *Etelis* spp. Overall, bottomfish removals from 1967 to 1985 were relatively high, but there is a gap in the data from 1977 to 1981. The hope is to form an idea of how many boats were fishing in these historical time periods and to determine if fishers were harvesting bottomfish stocks greater than three nautical miles from shore prior to 1967.

ii. Discussion

It is difficult to obtain data reports on American Samoa fisheries from the mid- to late-20th century and before. Some data from the 1980s are available from NOAA, but other reports would have been done by the American Samoa government. Additionally, the U.S. Fish and Wildlife Service does not retain copies of reports past a certain age. At the DMWR workshop, participants asked DMWR staff about their knowledge of historical noncommercial bottomfish fishing to get an idea of the state of local fisheries prior to 1960, but there were no clear insights. Diana Kitiona agreed to speak with her grandfather, who was a commercial fisher in American Samoa in past decades, but he was fishing for reef fish rather than bottomfish during the time period in question. Other available knowledge of tradition fishing practices in the territory suggest that reef fish were historically more important than bottomfish. PIFSC staff plan to speak to fishers in American Samoa firsthand when they are able to visit. The social scientists in attendance agreed to research past archaeological papers to determine if they can glean any information from the analysis of old fish bones. A 1989 report on native rights to which Severance contributed also reviewed some of the available archaeology around that time. However, analysis of fish bones during many archaeological studies are generally only identifiable to the family or genus level rather than for individual species. For example, some analyses identify individuals of the family Lutjanidae, which could refer to a wide range of reef fish or be inclusive of BMUS.

The development of the bottomfish fishery in American Samoa is strongly tied with the development of the bottomfish fishery in western Samoa as well such that cultural fishing would likely be similar between the two areas. Previously, the Council recommended that the American Samoa Department of Agriculture communicate with the Samoan Ministry of Agriculture and Fisheries to exchange information on the history and nature of each of their fisheries. Some information on historical fishing could be extracted from western Samoa, but that dialogue is primarily government-to-government. Ochavillo suggested that it would be helpful for PIFSC SAP staff to send him bullet points of important questions to ask during those discussions. David Itano, SSC member, may be able to provide additional information on pre-commercial development of the American Samoa bottomfish fisheries as well.

5. Summary and Wrap Up

The goal of the workshop was to evaluate the available data for the upcoming BMUS stock assessment and take steps to improve the assessment. The PIFSC SAP will no longer use the previous approach utilizing a surplus-production at a complex level. To move forward with

assessment, the PIFSC SAP should utilize a species-specific, age-structured approach with appropriate life history information. The three main data types examined were catch and CPUE, fish size, and life history because a length-based or integrated model approach would not only rely on catch trends from fishers to determine status of a stock.

In their data report, PIFSC utilized seven evaluation criteria to determine if the available data would allow for a species-specific stock assessment, including (1) species identification, (2) historic catch, (3) spatial distribution, (4) overall species occurrence, (5) recent total catch, (6) individual size observations, and (7) life history studies. The evaluation criteria showed that, while a species- specific stock assessment would be viable for most BMUS, *Pristipomoides* spp. and *V. louti* would be the most difficult. Ultimately, PIFSC could likely generate single-species, age-structured models for all BMUS except for *P. filamentosus*. Additionally, there are issues *E. carbunculus* being confounded with *E. boweni* in the data.

The next steps in developing the 2023 benchmark stock assessment are presenting the outcomes of the DMWR and SSC data workshops the whole SSC in late November 2021, holding a data meeting with local stakeholders in February 2022, and then producing the assessment for peer review in early 2023. There is still some work to be done by the Council with DMWR to identify participants for the stakeholder meeting. It is a priority of PIFSC staff to hold the upcoming data meetings in person, especially the meeting with local stakeholders. PIFSC has not yet made any final decisions for the structure of the stock assessment, as the SAP will make these decisions after the data meetings. PIFSC will bring back the proposed assessment structure to the SSC during modeling discussions.

SSC members commented that, if the goal is to generate a single-species age-structured assessment model, the key ingredients would be sources of information on unbiased removals, life history, and unbiased abundances indices, and the PIFSC SAP could include additional information on size composition as well. However, the PIFSC SAP is considering a range of length-based models or a length-focused stock synthesis, knowing that they could incorporate abundance information alongside size data from the Biosampling Program even if only recent CPUE is viable for use. Catch and CPUE are not absolutely necessary to have for the assessment model, especially as conversations unfold regarding the transition from annual catch limits (ACLs) to rate-based limits under guidance of the Magnuson-Stevens Fishery Conservation and Management Act National Standard 1 flexibility provisions for data-limited species. In this scenario, assessment scientists would input length and life history information into an assessment model to estimate fishing rates, determine sustainable fishing rates, and then establish limits on fishing effort (e.g., bag limits). An example of this is the Guam reef fish assessment that utilized a length-based component to determine sustainable harvest rates, which easily passed peer review, and a component using diver and creel surveys to estimate population size and associated catch limits, which struggled during review because of the poor nature of the catch data. The Council would have to develop a Fishery Ecosystem Plan (FEP) amendment to rationalize the use of the flexibility provisions for American Samoa BMUS to allow the discussions to progress further. Ultimately, utilizing rate-based management would allow for more focus on length and life history data, which are much stronger than the current time series for catch. The main idea is that there are management tools that PIFSC can use other than absolute catch, but the Council

would need to initiate a regulatory amendment to their ACL framework that tells the NMFS how the Council wants to manage regional fisheries and determine their statuses.

Another concern by SSC members was the assessment producing precise outputs despite the data-limited situation. No matter the assessment model used, stock assessment scientists need to test the level of confidence in the results against the confidence of the input data such that all uncertainties are expressed. An SSC member suggested that some of the discussed methods (i.e., production- or length-based models) often provide a bit too much certainty in the status of the resource. However, in the Council's current process, assessments address uncertainties both within the assessment process as well as after using the P* process. In other data-limited, length-based assessments produced by PIFSC, assessment scientist explicitly included all sources of uncertainty in the assessment model using Monte Carlo simulations. A simple model that does not consider any other external uncertainties could have a constrained output that would lead to an optimistic determination of uncertainties around results, and the PIFSC SAP believes that a stock synthesis framework would allow for more modeling complexity to address sources of uncertainties in the inputs that would transfer to the results in a conservative manner in addition to the P* process. An SSC member noted that sustainability and utilization are common goals in lieu of the mindset that science should be conservative, and PIFSC could use a range of models (i.e., multi-model inference) to better represent structural uncertainties. The PIFSC SAP model addresses uncertainty with sensitivity runs for input parameters, but the upcoming benchmark stock assessment may be species-specific in an age-structure model; this could make synthesis more useful. In utilizing such a model, the PIFSC SAP would have to limit how much time goes to focusing on sensitive, key parameters for each of the 11 BMUS. The first step in the process will be to develop the single-species, age-structure model before building on it to add complexity or conduct ensemble modeling.

Workshop participants noted that discussions should focus on the evaluation of available data instead of determining modeling framework, as the SSC will have the opportunity to comment on the specifics of the assessment structure later in the assessment process. An SSC member felt, however, that analyzing data streams and model structure are not mutually exclusive. Part of the data filtering process is to try to build a data-integrated model to better understand how different frameworks respond to different inputs in their results. An integrated approach is an important consideration because, if managers begin to prioritize input controls over ACLs, NMFS would need to perform simulation testing to demonstrate that length-based approaches are robust. However, the simulations would be dependent on the representativeness of the data and, thus, data quality remains among the most key factors.

Another consideration for evaluating the quality of the data is the definition of the stock and if the data support that definition, as there are challenges with the spatial nature of where the data originate (e.g., the fishery operating in different areas in different years). If the FEP defines stock as occurring around all islands of the archipelago, there may be deficiencies in the data such that those managers should address those issues or the stock should be redefined. For example, based on the available data, there are only a few observations available from Manu'a since 2009 and scarce data from the offshore banks; thus, the data could be limited to reflecting the fisheries around Tutuila only. The assessment, however, cannot redefine the stock since the FEP manages the BMUS at the American Samoa archipelago-scale, and there are no analyses to

determine the connectivity of the populations around Tutuila and Manu'a. The FEP assumes good mixing of the BMUS stocks between Tutuila and Manu'a such that the CPUE indices in one area would track with the other. Localized fishing could impact local abundance, but recruitment would theoretically be distributed proportionally between the areas. Since the FEP defines the stock, the issue is if the challenges in the data are insurmountable to the point that assessment scientists cannot use the data for their preferred model frameworks. The PIFSC SAP was specifically looking for initial responses from the SSC as to whether or not the data are sufficient for use in the upcoming benchmark stock assessment.

Regarding the timeline with fishery regulatory and data collection changes that DMWR committed to developing at the previous workshop, the SSC participants also expressed a desire that the timeline include large natural disasters as well to better view how factors impacting the bottomfish fishery relate to one another. Similarly, understanding personnel changes over time is important to establish consistency in data collection. The SSC members were concerned that a DMWR fired a staff member in the past for fabricating data. A positive outcome of the recent personnel changes at DMWR is that the creel survey program strengthened its survey protocol and species identification methodologies such that the last five years of data have near 100 percent of sampled individuals identified to the species level.

While it was clear to workshop participants that *fa'a samoa* is still a driving cultural factor in American Samoa, the SSC members sought clarification if the practice of distributing bottomfish to the community on Sunday has waned in recent years relative to the 1990s. The prevalence of this cultural practice could influence the amount of participants in the fishery since, if a ceremony does not require bottomfish, fishers would have no incentive to harvest the BMUS. Determining the current cultural importance of bottomfish in American Samoa would require substantial social survey work with researchers directly interacting with those in the territory's villages (whose *alia* vessels may not be well-reflected in the creel surveys) and examining ceremonies. Recent studies have struggled to obtain valuable information, which has promoted a reliance on self-reported data that can be driven by the agenda of those reporting. Despite the lack of current information, there remains a general understanding that the cultural significance of bottomfish remains substantial. While large bottomfish may no longer be a priority to serve on Sundays, funerals for village chiefs almost certainly still utilize the fish. The PIFSC SAP can discuss the importance of bottomfish directly with fishers and any associated cultural shifts at the upcoming stakeholder meeting in early 2022.

During creel survey data collection, it is especially important to determine size structure that accurately reflects the population in the water. If fishers continuously release large fish for which they have no need, the data input would be problematic for the assessment model. The PIFSC SAP will also discuss at-sea selectivity and landing selectivity at the upcoming stakeholder meeting.

Regarding the differences in BMUS between Tutuila and Manu'a, the two areas have different habitat than one another (i.e., flat and simple vs. steep and complex, respectively) and, thus, support different assemblages. Differences in habitat could be reflected in species occurrence in both areas, so the question remained on how to appropriately handle the data knowing that there are a small amount of surveys done in Manu'a where the catches are

assumedly different than Tutuila. The PIFSC SAP noted that, unless there is a difference in growth curves for species between the two areas, the model should handle the data appropriately. Because there may be more of one species in one of the areas over the areas, the CPUE trends may not be at the same level but should track each other well if the two populations are well-connected as assumed in the FEP. A difference in the proportion of habitat alone would not disrupt the assessment.

Reflecting back to the possibility of management utilizing input controls rather than ACLs in the future, workshop participants discussed if they should think about the current assessment in terms of assessment structure that would still provide output control advice since that is the status quo in the current regulations. Because it would take so long for the Council to construct a regulatory amendment, PIFSC assumes that the upcoming assessment will need to generate an ACL. The suggestion of an overfishing limit or ACL may be problematic during peer review due to the poor nature of the catch data, but there should be no issue with determining stock status using the other available data inputs.

Regarding the SSC members being able to provide advice about what bottomfish fishery monitoring may be required to accommodate both output controls as well as any input controls for the future, the PIFSC SAP has been in close contract with the NMFS Pacific Islands Regional Office (PIRO) about the assessment process, structure, and potential products. The PIRO is familiar with the assessment plan, has not communicated an issue with utilizing a length-based, single-species stock assessment, and can act based on the science products proposed for the assessment. If PIFSC plans for the assessment to accommodate multiple scenarios, an ACL could still be generated by the assessment and its implementation would be dependent on if rate-based controls are approved during the current assessment cycle. Once the PIFSC SAP develops a single-species, age-structured model, formulating different management scenarios for rate-based limits would be a quick adjustment. With respect to monitoring by the creel surveys, the PIFSC SAP hired a postdoctoral researcher to evaluate the creel survey programs for stock assessment needs, and this evaluation will create opportunity to adjust the programs. Additionally, the current efforts toward electronic monitoring will create more opportunities for data integration by allowing for more efficient data collection, reducing the burden on fishers, and theoretically improving the quality of the data.

6. Recommendations

1) Workshop participants recommended exploring if there is a way to determine if size selectivity at the vendor level exists in American Samoa as it does in Hawaii. The PIFSC SAP could utilize anecdotal information stemming from the stakeholder workshop scheduled to be held in early 2022.

2) Workshop participants recommended that DMWR produce a timeline of changes in staff, data collection procedures, fishery-relevant regulations, and any other methodological changes or major events (e.g., natural disasters) that may have had an impact on the fishery data.

3) Workshop participants recommended assembling a group of creel survey data collectors that worked in previous decades (e.g., the 1990s) to have a focused

discission and provide insight into survey methodology, if the data collectors strictly followed protocols, or if there were issues with species identification for particular time periods, areas, or data collectors.

4) Workshop participants recommended generating an analysis of the estimated proportion of creel survey catch intended for sale by fishers versus catch retained without filtering for the portion of catch that had length measurements, as the presented analysis of percent sold in the PIFSC data report filters the data to focus on catches with length measurements available. The observed discrepancy in estimated amount sold may be due to life history data and sampling procedure.

5) Workshop participants recommended determining how many boats in the Manu'a area were repaired by the Council's boat repair program following the 2009 tsunami in American Samoa to better determine how many boats may have been fishing in Manu'a in the past decade.

6) Workshop participants recommended that the PIFSC SAP send DMWR a list of pertinent questions that can be asked during discussions between the agricultural departments/minitries of American Samoa and western Samoa.

7) Workshop participants recommended that PIFSC and DMWR make efforts to document the level of continuing cultural importance of BMUS for ceremonial-use needs over sample of smaller villages and ceremonies.