# BENCHMARK STOCK ASSESSMENTS FOR THE BOTTOMFISH MANAGEMENT UNIT SPECIES OF AMERICAN SAMOA, THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS, AND GUAM IN 2019

A Review Prepared For

Pacific Islands Fisheries Science Center (PIFSC), NOAA/NMFS

Pacific Islands Regional Offices (PIRO), NOAA/NMFS

Western Pacific Regional Fisheries Management Council

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## EXECUTIVE SUMMARY

This is a benchmark assessment for the Territorial Bottomfish Management Unit Species (BMUS). This review was conducted from April 15-18, 2019 at the offices of the Western Pacific Fisheries Management Council, Honolulu Hawaii. The review panel consisted of two CIE reviewers (Joe Powers, and John Neilson) and a member of the WPFMC SSC (Steve Martell). I also served as the chair of this review panel.

The review consisted of written materials provided online 2 weeks prior to the review and presentations from staff from PIRO and PIFSC. Presentations covered the details of fisheries operations for various gear types used to catch bottomfish, trends in fishing effort, changes in technology, and changes in fleet capacity. The history of assessment and management for bottomfish in the various regions were covered, and details regarding assumptions being used to quantify a unit of fishing effort.

Previous and present assessments are entirely dependent on fisheries-dependent catch data. Previous assessments have not incorporated any sort of CPUE standardization techniques. This is the first assessment that uses CPUE standardization for these data. I found that the analytical exercise alone of conducting the CPUE standardization was a critical part of engaging local stakeholders into the process of data collection, standardization, assessment and future fishing opportunity. However, CPUE standardization had only minimal impacts on policy variables in comparison to the change in definition of targeting.

Key to this assessment is the change in definition of a fishing trip. Previous assessments defined a trip where more than 50% of the catch by weight consisted of BMUS species. A much more comprehensive data filtering process has now been developed, and documented, that defines bottom fishing trips, including trips with 0 catch.

Life-history information for many of the BMUS are still lacking, but there are now at least 4 species with local life-history information being incorporated into the assessments. Furthermore, PIFSC is also continuing to address missing species, where priority is given to those with commercial importance that dominate the target catch.

Assessments were conducted for 3 regions: American Samoa, CNMI, and Guam. All 3 of these areas were assess with the same analytical tools for CPUE standardization, estimation of parameters and the associated uncertainty. I found the various methods used to reconstruct the catch and CPUE index for each of the regions using data collected from: creel surveys, boat-based surveys, and commercial purchase info is an improvement over previous methods. The methods, and software platform, used herein have been used in previous surplus-production models that have also been through the WPSAR review process, as well as published in the primary literature. The results are consistent with the expectations. There is very little contrasting information in the time series data from CNMI, and this is reflected in the highly uncertain estimates of MSY and stock status. Catch and CPUE data for American Samoa and Guam are much more informative about policy parameters (MSY & FMSY).

The primary axis of uncertainty in this assessment, relative to the previous assessment, has less to do with changes in methods, and more to do with the change in the list of target species and the definition of a trip in this fishery. These two changes along, change the underlying historical data that was used in previous assessments. My review focused on the data and methods used to inform policy. My review does not address the SSCs methods and justification for the changes in the species composition.

The change in species composition results in changing the historical trends in the catch and CPUE data that were used in previous assessments. Furthermore, the previous definition of a bottomfishing trip excluded all trips where less than 50% of the catch by weight was BMUS, including trips with 0s. To avoid bias created using such a filter, the authors made the appropriate choice of changing the definition of a trip, and to change the standardization methods that allow for inclusion of 0's.

Due to the aforementioned changes in the definitions and data, it is not possible to update the previous assessment models with an extended time series, nor is it possible to conduct a bridge assessment (e.g., examining the sensitivity of each structural change). By analogy, the previous assessment was based on "apples", this assessment is based on "oranges".

In conclusion, I find the documentation and methods for this report to be complete and likely to be very repeatable by future independent analysts. The authors have clearly laid out the key assumptions that have impacts on model results and consequently can be linked to policy implications. The document is very well written, organized, and laid out in a clear and sequential manner for providing scientific advice to managers. Figures 43-48 clearly define the risk of future catch options on overfishing and stock status.

I would like to acknowledge the work and effort that went into the document preparation, presentations, and additional analytical work. The review panel requested a number of sensitivity runs and further analysis that went into the data filtering and CPUE standardization. I very much would like to thank the analysts for putting in the extra time to explore these additional request. It is only through these additional perturbations the reviewer can then confirm his/her understanding to see if the results match his/her predictions. So again I thank the review team for laying out an excellent framework for this review.

The following subsections details my response to the reviews TOR.

## IS THE UNCERTAINTY WITH RESPECT TO INPUT DATA QUALITY AND FILTERING METHODS WELL DOCUMENTED, INCLUDING ITS POTENTIAL EFFECT ON RESULTS?

My standard test for the question of well documented is, "Are the results repeatable given the data and methods described repeatable?". The short answer is yes. The document references all of the source material and data used in the assessment. It clearly documents the underlying assumptions at the level of the raw data (e.g. 1 ticket corresponds to 1 day of fishing effort) to structural assumptions about population dynamics. Parameter values and descript justifications of prior distributions were given throughout.

Each regional assessment also is also informed by local knowledge and expertise and input from the fishing community. The largest source of uncertainty in all 3 of these assessments is the amount of unreported catch.

Increasing the precision in the levels of unreported catch translates into reduced uncertainty and increases the lower bound of the confidence interval for next years TAC.

Scaling information for all 3 regions, especially CNMI, were informed by additional priors on the estimates of MSY develop through the OLO documents. There were discussions about the origins of these estimates, and I had a sense that the analysts were somewhat dubious if the MSY estimates were informed by actual data. Nevertheless, the results are informed by these previously defined MSY estimates.

## IS THE CPUE STANDARDIZATION PROPERLY APPLIED AND APPROPRIATE FOR THIS SPECIES, FISHERY, AND AVAILABLE DATA?

Yes the CPUE standardization methods are well documented, and have been appropriately applied (to the best of my knowledge) in all 3 regions. Due to the small scale and the limited number of participants in the fisheries, it is difficult to determine if the regions, as represented by the assessment model, are adequately sampled on an annual basis.

The differences between the nominal CPUE estimates and the standardized CPUE estimates are relatively minor, and there is very little difference in the trend information. The change in trip definition between the 2016 assessment and this new benchmark has had a large effect on CPUE trends.

## ARE THE ASSESSMENT MODELS USED RELIABLE, PROPERLY APPLIED, ADEQUATE, AND APPROPRIATE FOR THE SPECIES, FISHERY, AND AVAILABLE DATA?

A surplus production model was used to estimate absolute abundance in weight. These models are widely used in fisheries stock assessment, especially in cases where only catch and CPUE data are available. This particular implementation was a Bayesian state-space model conditioned on catch and fitted to CPUE data by numerically sampling the joint posterior distribution. The weakness comes in the need to have contrasting information in the CPUE data to resolve the confounding between how large and how productive the stock is.

During the course of the review, the analysts demonstrated that the catch and CPUE information from CNMI are insufficient to resolve parameter confounding on its own, and that the informative prior distributions for productivity and scale parameters largely define the policy parameters. I would urge caution on the provision of catch advice for this stock until more information on abundance, or catchability, can be obtained. Catch advice for the other two regions were more robust to changes in the prior distributions, as the underlying CPUE data are more informative.

## ARE DECISION POINTS AND INPUT PARAMETERS REASONABLY CHOSEN?

The prior distributions for input model parameters were reasonably chosen based on life-history information, when available. A number of sensitivity tests to each of the prior density functions were provided in the

document. Given the results of these sensitivity tests, I felt the analysts have done a thorough job exploring the effects of alternative assumptions on the policy impacts.

Given that each of these assessments represents an assemblage of different species, that all have differing life-history strategies, it is difficult to determine if the priors are appropriate for a number of different reasons. The implied prior for the harvest rate (which is a function of the prior for r and m) in each of the regions roughly approximate 95% intervals between 0.05 and 0.5. I would only be concerned if this interval was very small (e.g. 0.2-0.25), thus limiting the parameter space of other confounded variables.

The global scaling of the biomass estimates in each of the regions was also sensitive to the prior mean for the carry capacity. Prior information from the Carry capacity was obtained from a report (OLO report) with undocumented method on how previous estimates of capacity was obtained.

## ARE PRIMARY SOURCES OF UNCERTAINTY DOCUMENTED AND PRESENTED?

Yes, this is one of the best documents I've reviewed in terms of laying out all the sources of uncertainty, and exploring key assumptions that have policy implications. The only shortcoming is that it is difficult to address any potential bias associated with sampling or estimation of absolute catch. In short, the inclusion of uncertainty does not address biases that might occur through under reporting of catch.

## ARE MODEL ASSUMPTIONS REASONABLY SATISFIED?

The principle assumptions in this assessment are that estimates of catch are unbiased, and the Standardized CPUE is proportional to the biomass of the stock complex. Furthermore, because this assessment is based on a complex of different species, the model further assumes a stationary production curve, regardless of how the abundance of each species within the complex varies over time. The principle concern given only these data, is that it is not possible to determine if any one species is over-fished or subject to over-fishing. However, the catch proportions have remained relatively stable over time, and no one-species has disappeared altogether. I would consider that these assumptions are reasonably satisfied based on the information provided and public testimony.

The catch and CPUE series for CNMI were not very informative about the underlying stock productivity-size tradeoff. Therefore, any bias in the absolute scale of the catch data will have profound impacts on the future catch advice. Furthermore, there are very few active boat-based participants in this fishery in which to broadly 'survey' the stock. I'm concerned that there is a potential of having a 'high-linger' effect (where the last remaining individuals are only remaining because they can achieve a higher CPUE than the average individual). The resulting CPUE series is likely to be hyperstable.

## ARE THE METHODS USED TO PROJECT FUTURE POPULATION STATE ADEQUATE AND APPROPRIATELY APPLIED FOR MEETING MANAGEMENT GOALS AS STATED IN THE RELEVANT FEP?

The projection methods are appropriately applied and address the parametric uncertainty in the stock projections. The cumulative probability density functions (e.g., Fig 48 in the assessment) reflect this uncertainty. These same figure are also great tools for decision makers in understanding the risk of overfishing and overfished biomass versus annual removals.

## IF ANY RESULTS OF THESE MODELS SHOULD NOT BE APPLIED FOR MANAGEMENT PURPOSES WITH OR WITHOUT MINOR SHORT-TERM FURTHER ANALYSES, INDICATE:

I felt that the analysts have done a very thorough job re-vetting the historical data, developing a more logical process for trip selection, and involving stakeholders to better understand the dynamics of these fishing operations, and the details that are unique to certain regions. I see no reason not to use these results for decision making purposes. However, I would urge caution in the advice given to CNMI as the data in this region are uninformative about stock size.

## RESEARCH RECOMMENDATIONS

In order of priority:

- These assessments are dependent on fisheries-dependent data. Community outreach programs would vastly improve the understanding of the problems with non-reporting of catch each year.
- Develop an alternative means of directly measuring catchability in the fishery. Mark-recapture programs, or bottom-camera survey combined with fishing experiments. These data would help with the uncertainty associated with global scaling.
- Local data workshops in American Samoa, CNMI and GUAM. Given the recent change in stock status for American Samoa, this might be an area of interest to start developing a better relationship with BMUS users and those who collect and conduction analyses using these data.