



## WESTERN PACIFIC STOCK ASSESSMENT REVIEW

“Stock Assessment Update for the Main Hawaiian Islands  
Deep 7 Bottomfish Complex in 2021, with Catch  
Projections Through 2025”

Panel Summary Report

By

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## Summary

A Western Pacific Stock Assessment Review (WPSAR) of the 2021 Main Hawaiian Islands Deep 7 bottomfish fishery update stock assessment was conducted online during December 16-17, 2020. The Deep 7 bottomfish complex consists of six snapper species: *Etelis carbunculus* called commonly “ehu”, *Etelis coruscans* called “onaga”, *Pristipomoides filamentosus* called “opakapaka”, *Pristipomoides sieboldii* called “kalekale”, *Pristipomoides zonatus* called “gindai” and *Aphareus rutilans* called “lehi”, and a grouper species: *Hyporthodus quernus* called hapu’upu’u. The update assessment (Syslo et al. 2021) incorporated an updated time series of data and used the methods of the preceding benchmark assessment including a Bayesian surplus production model fit to standardized CPUE for the Deep 7 complex and a single species (opakapaka). The WPSAR panel found that: (1) the uncertainty with respect to input data quality and filtering methods were well documented including the potential effect on results, (2) the CPUE standardization was applied properly and appropriate for this species, fishery, and available data, (3) the assessment model and methodology were generally the same as those used in the 2018 benchmark stock assessment, (4) the primary sources of uncertainty were documented and presented, (5) the results included estimated stock status in relation to the estimated biological reference points, and other results required to address management goals, and (6) the methods used to project future population state were the same as those used in the 2018 benchmark stock assessment. The panel determined that the update assessment represents the best scientific information available (BSIA) and can be used for management of the Main Hawaiian Islands Deep 7 bottomfish fishery. A number of prioritized recommendations are presented to improve future bottomfish stock assessments.

## Background

The federally managed bottomfish complex of Hawaii includes thirteen shallow and deep-water species of snappers and jacks with one endemic grouper species. The 2011 benchmark stock assessment was the first to assess the seven deep-water species separately from the shallow-water species within the complex (Brodziak et al. 2011). The Deep 7 bottomfish species include two eteline snappers; onaga (*Etelis coruscans*) and ehū (*Etelis carbunculus*); four additional snapper species; kalekale (*Pristipomoides sieboldii*), opakapaka (*P. filamentosus*), gindai (*P. zonatus*) and lehi (*Aphareus rutilans*); and the endemic grouper; hapu’upu’u (*Hyporthodus quernus*). A WPSAR panel of chair Erik Franklin and members Steve Martell and David Itano were tasked with reviewing the bottomfish update assessment relative to a Terms of Reference provided by the WPSAR Coordinating Committee. This review examines the draft 2021 assessment update to the 2018 benchmark assessment that incorporates three additional years of data with stock status determinations for 2018 with projections through 2025 (Syslo et al. 2021). This document examines the draft update assessment in relation to six terms of reference provided for this review. The panel summary responses to these TORs follow.

## Responses to TORs

The panel was requested to address eight TOR questions for this assessment review and provide a “yes” or “no” answer, with specific caveats if necessary. If responses to questions 1-6 were “no”, it should be noted as to why the answer was “no” and which alternative set of existing

stock assessment information/results should be used to inform fishery management. Detailed summary responses to the Term of Reference are given in the following sections.

TOR 1 *Is uncertainty with respect to input data quality and filtering methods well documented, including its potential effect on results?*

**Yes, the uncertainty with respect to input data quality and filtering methods were well documented including the potential effect on results.**

A series of PIFSC-hosted data workshops for the MHI bottomfish fishery that included the participation of the fishing community served as the basis for the recommended data inputs and filtering methods used for the update assessment (Yau 2018). The workshops greatly increased the overall utility of the available data and filtering approaches used in the assessment. The panel commends the authors for incorporating recommended approaches from the workshops in a well document and effective manner.

A primary source of uncertainty for this assessment is in unreported catch. Four different catch scenarios showed that the assessment model results were sensitive to the influence of unreported catch. A sensitivity analysis demonstrated that biomass scales with unreported catch almost proportionally, so an accurate representation of unreported catch is important. The effects on assessment results were clearly documented and suggest a need to further improve the estimation of unreported catch (i.e., non-commercial catch).

The methodology of the fishery independent data collection for the BFISH research fishing and stereo-video camera surveys (Ault et al. 2018, Richards et al. 2016) provided sufficient detail to evaluate the sampling design and biomass estimation methods. Significant sources of uncertainty with the survey data exist in the estimation of the effective sampling area and the potential species-specific selectivity biases that the camera gear may introduce which should be foci for further research.

A significant key to minimizing uncertainty in the data and filtering methods has been through fisher engagement and participation in the assessment process. The panel strongly recommends the continued connection with the fishing community through ongoing dialogue and future workshops for the next benchmark assessment.

TOR 2 *Is the CPUE standardization properly applied and appropriate for this species, fishery, and available data?*

**Yes, the CPUE standardization was applied properly and appropriate for this species, fishery, and available data.**

The CPUE standardization was performed properly using a generalized linear and linear mixed model of catch records using several fishery and environmental variables known to affect the catchability of the deep-7 complex. The standardization methods were the same as those used for the 2018 benchmark assessment. The CPUE standardization may still be improved and we recommend that the assessment authors explore the inclusion of additional factors that may have

an impact on bottomfish CPUE identified through communications with the fishing community and suggested at past bottomfish data workshops or as may be developed in future workshops. This should include further exploration of why models with time:area interactions for the historical period failed to converge.

TOR 3 Are the assessment model and methodology the same as those used in the 2018 benchmark stock assessment?

**Yes, the assessment model and methodology are the same as those used in the 2018 benchmark stock assessment.**

A Bayesian generalized surplus production model was fit to standardized CPUE time series in fishing years 1949-2018, using catch data from 1949-2019 for both the bottomfish complex and opakapaka single species models. The assessment model used in 2018 and 2021 differed from the 2011 model structurally in that the model was also fit to a fishery-independent biomass estimates and included two time periods for the CPUE observation fitting. The 2018 and 2021 assessments utilized new information on priors and error in unreported catches. The only substantial modification was the result of the review of the 2018 assessment, where the review process recommended using an informative prior distribution for the effective radius searched by the underwater camera stations.

TOR 4 Are primary sources of uncertainty documented and presented?

**Yes, the primary sources of uncertainty are documented and presented.**

The two primary sources of uncertainty in the assessment are the unreported catch and the fishery independent survey. The largest potential source of uncertainty in the assessment relates to the estimate of unreported catch (recreational/non-commercial) and to a lesser extent any under-reported CML effort. The magnitude of unreported catch likely exceeds reported catch, highlighting the importance of continued efforts to reduce uncertainty in unreported catch estimates in future benchmark assessments.

Visual survey data collected with the MOUSS stereo video system is important to the estimation of relative abundance and expansion to total biomass. However, a key uncertainty remains as to the effective area that is being sampled by the stereo-video system and how well the system is observing each species in the complex. Due to the deployment protocol of the video camera system, the effective sampling area can be impacted by survey limitations due to ambient light (daytime sampling only), demersal orientation, influence of baiting and species-specific differences in diurnal schooling, feeding and vertical behavior. The assessment update includes refined estimates of the effective area sampled, but further improvements may be possible. Currently, radius estimation is based on opakapaka for which the most complete life history data is available and then extrapolated to the other Deep 7 species. Considering the importance of the camera surveys on estimation of total biomass, the uncertainty regarding effective area and species sampling should be further examined and reduced in future benchmark assessments.

TOR 5 Do results include estimated stock status in relation to the estimated biological reference points, and other results required to address management goals stated in the relevant FEP or other documents provided to the review panel?

**Yes, the results included estimated stock status in relation to the estimated biological reference points, and other results required to address management goals stated in the relevant FEP or other documents provided to the review panel.** The assessment included estimates of B/BMSY, Overfished Probability, H/HMSY, and Probability of Overfishing with projections through 2025 for the Deep 7 complex.

TOR 6 Are methods used to project future population state the same as those used in the 2018 benchmark stock assessment?

**Yes, the methods used to project future population state are the same as those used in the 2018 benchmark stock assessment.** The assessment included projections for future population state and related biological reference points for the Deep 7 complex for the years 2021-2025

TOR 7 If responses to questions 1-6 are “no”, indicate for each: Why was the answer “no”; Which alternative set of existing stock assessment information/results should be used to inform fishery management in this case and why?

None of the responses to question 1-6 were “no” so there are no alternatives provided.

TOR 8 For consideration in future benchmark assessments, suggest and prioritize recommendations for improvements and research. For each recommendation prioritize o three categories (high, medium, low) dependent on importance to interpretation of this and future assessment results.

#### High Priority

Data workshops and stakeholder connections: Maintain direct communications with fishers about stock assessment activities. Conduct data workshops with the fishing community to develop collaborative contributions to the data and methods included in the next benchmark stock assessment.

Unreported catch: Unreported catch is a significant source of uncertainty. Continued collaborative efforts between NOAA, the Council and the fishing community should be pursued to improve the collection of data describing non-commercial catch. These activities could include improvements to MRIP, the federal non-commercial license program, and pilot programs to directly collect catch and effort data from non-commercial fishermen.

### Medium Priority

Complex and single-species assessments: Continue to present both the Deep 7 complex and single-species assessments for important species with sufficient information (e.g., opakapaka) in next benchmark assessment. We recommend further data collection and life history studies for other species in the complex to facilitate stock assessments.

Fishery independent survey methods: Perform research activities to provide improved empirical estimates of the survey area for the stereo-video method used in the fishery independent survey. Species specific issues should be investigated regarding diurnal schooling characteristics and vertical behavior in relation to the orientation and field of view of the camera system. The collection of life history and behavior data from Deep 7 species useful for improving fishery-independent survey data should be strongly promoted.

CPUE standardization: Explore the inclusion of additional factors that may impact Deep 7 CPUE identified at previous and future workshops on data standardization in future benchmark stock assessments. Interact with fishers and the scientific community for additional ideas to improve the standardization process. Where data is lacking to include potentially important factors, make recommendations to appropriate agencies to conduct research and collect these data.

### Low Priority

Software: there is a minor limitation in propagating process errors in the stock projections. There may be other modelling platforms (transition from JAGS, Stan, etc.) that more suitably capture the process error component. However, relative to the magnitude in the errors associated with the reported catch, this additional error may be infinitesimal.

### **Literature cited**

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- Yau, A. (ed.). 2018. Report from Hawaii Bottomfish Commercial Fishery Data Workshops, 2015-2016. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-PIFSC-XX.