
Summary Report

Western Pacific Stock Assessment Review of the 2024 Stock Assessment Update for the Guam Bottomfishes

7-8 February 2024

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Supported by:

NOAA Fisheries
Pacific Islands Fisheries Science Center
Pacific Islands Regional Office
Western Pacific Fishery Management Council
(WPSAR Coordinating Committee)

Executive Summary

In December 2023, the 197th Council Meeting recommended that the WPRFMC¹ convene a WPSAR panel comprising 3 SSC members to review a draft 2024 Guam Bottomfish Management Unit Species (BMUS) Stock Assessment Update (Bohaboy & Matthews 2024). That draft stock assessment is a scheduled *update*² of the 2019 *benchmark* assessment (Langseth et al 2019), which had previously concluded that the Guam BMUS³ was *overfished* but not experiencing overfishing.

The draft 2024 Guam Bottomfish Management Unit Species (BMUS) Stock Assessment Update was based on 42-year times series of catch and CPUE and concluded that the Guam BMUS was *not overfished* and not experiencing overfishing. Importantly, the 2024 update stock assessment found evidence for partial rebuilding of the 13-species Guam BMUS complex that was attributable to reduced catch⁴ from 2017-2020 — catch has since increased.

A summary of the Guam Bottomfish Management Unit Species complex assessment history since the 2005 benchmark assessment is shown below (includes the upcoming benchmark assessment).

Guam BMUS stock assessment history

Assessment type	Status year	CPUE data series	Overfished	Overfishing	Rebuilding	Annual catch limit
benchmark (2007)	2005	1982-2005	no	no	no	NA
update (2012)	2010	1982-2010	no	no	no	NA
update (2016)	2013	1982-2013	no	no	no	NA
benchmark (2019)	2017	1982-2017	yes	no	no	31k lbs
update (2024)	2023	1982-2023	no	no	yes	31-33k lbs
benchmark (2025)	2024	TBD	TBD	TBD	TBD	TBD

Note: annual catch limit = projected catch corresponding to a median overfishing probability of 40% in any year. NA = not comparable as used a Schaefer surplus production functional form whereas the 2019 benchmark and the 2024 update used a Pella-Tomlinson function form.

¹ WPRFMC = Western Pacific Regional Fishery Management Council, WPSAR = Western Pacific Stock Assessment Review

² An update stock assessment is by design meant to just update the previous benchmark assessment using more recent data series and not undertake a new benchmark assessment.

³ Guam BMUS treated as one multi-species complex comprising 13 specific bottomfish species such as onaga, opakapaka and ehu.

⁴ Catch lower than the prescribed catch limit.

The WPSAR 3-person review panel was convened on February 7-8 (2024) via the Webex by Cisco videoconferencing service supported by the WPRFMC. The review panel assessed whether the draft 2024 update stock assessment was a suitable basis for management decision-making purposes by addressing 8 specific Terms-of-Reference or ToRs provided by the WPRFMC/NOAA Fisheries Review Coordinating Committee (*see Appendix 1*) — including whether the input data sources, catch/CPUE standardization procedures and Bayesian state-space stock assessment modelling approach were complete with no consequential deviation from the 2019 benchmark assessment.

ToR 8 dealt with suggested Guam BMUS assessment improvements by the review panel for consideration in the upcoming benchmark assessment.

The WPSAR review panel (*see Appendix 2*) evaluated the draft 2024 update assessment in direct interactive dialogue during the 2-day on-line review with the NOAA Fisheries (PIFSC) stock assessment authors (*see Appendix 3*). The Panel also considered any substantive comments provided at the 2-day review by members of the public (*see Appendix 4*) responding to the 2024 assessment.

Each of the 3-person review panel completed their own independent evaluation report and these 3 reports (*see Appendix 5*) have then been synthesized in this overall Summary Report.

Main finding — the WPSAR review panel found that the draft 2024 Guam BMUS update stock assessment (Bohaboy & Matthews 2024) was complete and there were no consequential deviations from the 2019 benchmark assessment (Langseth et al 2019). The Review Panel concluded that the 2024 Guam BMUS update stock assessment was a suitable basis for management decision-making purposes and informing the setting of risk-based catch limits.

The 2019 Guam BMUS benchmark stock assessment estimated that an annual catch of 31k lbs corresponded to a median overfishing probability of 40% in any year while the 2024 update assessment estimates that annual catch limit as 31k lbs in 2025 increasing to 33k lbs in 2029.

The WPSAR review panel also made the following key⁵ recommendations for consideration in the upcoming for the Guam BMUS benchmark stock assessment:

Recommendations —

High priority —

Data:

- Explore latent structure and common trends in the catch and CPUE time series using Dynamic Factor Analytic approaches to better support the identification of common underlying species-specific trends in the current Guam BMUS multi-species complex to perhaps better account for the time-varying species composition in the catch.
- Examine the current DMWR boat-based survey protocols to identify and evaluate potential data gaps and ways to improve data collection useful for stock assessment.

⁵ This is not an exhaustive list of all the panel recommendations that can be found in the 3 individual reports.

Modelling:

- Use a single model likelihood for the data standardization component (such as hurdle-lognormal) rather than the 2-stage so-called delta modelling approach.
- Explore the utility of additional potentially informative covariates, such as SOI, PDO, MEI, lunar phase or moonlight intensity (*perhaps for adding to the process component of the Bayesian state-space population model for some and the observation process for others*).
- Use posterior predictive check tests to evaluate data standardization model performance in addition to the standard residuals-based diagnostic checks used.

Medium priority —

- Examine issue of shark depredation on catch and CPUE of the Guam bottom fishery⁶. Initially examine DMWR boat-based creel survey data on depredation.

Low priority —

- Explore model-based approaches for survey-based catch estimates such as multilevel modelling with post-stratification (Kennedy & Gelman 2021, Authier et al 2021, Broniecki et al 2022).
- Conduct a socioeconomic analysis of Guam bottomfishing participation. Anecdotal evidence from members of the fishing community suggests that fishing may have increased (including new entrants into the fishery) during the COVID pandemic.

Specific proposed edits or amendments to the draft update report

The WPSAR review panel suggests that the following edits or minor amendments be considered when revising the current version of the 2024 update stock assessment report (Bohaboy & Matthews 2024):

1. Not refer to the Guam BMUS as “deep-slope finfish” throughout the assessment document. Suggested to use “bottomfish” or “Guam BMUS” instead.
2. Provide a more detailed description of the assessed BMUS in the “Introduction” or “Description of Fisheries” that discusses depth preference and life history characteristics of the BMUS.
3. Provide figures or tables providing information on the estimated annual catch of the 13 BMUS over time to provide information on the relative importance of each species to the assessment and the fishery and examine how the proportion of species in the catch may or not have changed over time.
4. Provide greater detail in the “Description of Fisheries” describing the extent of the fishery, particularly in relation to the offshore banks and targeting of BMUS around the main island of Guam and at the offshore banks.
5. Duplicate Figure 17 indicating stock status for years 2016-2023.
6. Add a footnote to the 2024 update stock assessment acknowledging the presence of both *Etelis carbunculus* and *Etelis boweni* in the Guam bottomfishery though only *Etelis carbunculus* has been recognized in the stock assessments to date.

⁶ The issue of shark depredation was a major issue also raised via public comment during the on-line review such as by Manny Dueñas.

Background

In December 2023, the 197th Council Meeting recommended that the WPRFMC convene a WPSAR panel comprising 3 SSC members to review a draft 2024 Guam Bottomfish Management Unit Species (BMUS) Stock Assessment Update (Bohaboy & Matthews 2024). That draft stock assessment is a scheduled *update* of the 2019 *benchmark* assessment (Langseth et al 2019), which had previously concluded that the Guam BMUS was *overfished* but not experiencing overfishing.

Terms of Reference

See Appendix 1 for the full list of the WPSAR Panel Review Terms-of-Reference determined by the WPRFMC/NOAA WPSAR Coordinating Committee.

Documentation and Review presentation

The WPSAR Review Panel evaluated the following draft NOAA Technical Memorandum:

Stock Assessment Update of the Bottomfish Management Unit Species of Guam, 2024
 Erin C. Bohaboy, Toby Matthews
 NOAA Technical Memorandum NMFS-PIFSC-###, pp 53
<https://repository.library.noaa.gov/>

The authors of that update Guam BMUS stock assessment presented this during the on-line review.

Participants

See Appendix 2 for the WPSAR Review Panel membership. See Appendix 3 for the list of NOAA Fisheries presenters on the draft 2024 Guam BMUS update stock assessment — including the update authors. See Appendix 4 for a list of the Public/Observer participants.

Addressing specific terms of reference (ToR 1-8)

ToR 1: Are input data sources and filtering methods well documented and the same as those used in the 2019 benchmark assessment?

Yes. There were no substantive deviations in this draft update assessment (Bohaboy & Matthews 2024) from the Langseth et al (2019) benchmark assessment approach.⁷

Side comment —

⁷ Inconsequential increase on MCMC warmup iterations and other MCMC settings used to improve model convergence. JABBA (Winker et al 2018) with JAGS as the backend is a Bayesian inference platform that requires a substantial number of iterations.

- One issue that might warrant further attention prior to the upcoming benchmark assessment is the issue of using volunteer opt-in to the creel survey interviews. Currently, a designed-based approach is used to estimate catch per trip from the interviews but how representative are the respondents of the bottomfish fishing population? Perhaps model-based approaches could be considered in future using survey adjustment approaches such as multilevel modelling with post-stratification (Kennedy & Gelman 2021, Authier et al 2021).

ToR 2: Is the CPUE standardization methodology the same as those used in the 2019 benchmark stock assessment?

Yes⁸. There were no substantive deviations from the Langseth et al (2019) benchmark assessment approach.

Side comments —

- why no posterior predictive check tests in the data standardization model evaluation step?
PIFSC: these are being considered in future assessments such as the upcoming benchmark stock assessment.
- the time-varying species composition of this multi-species complex comprising 13 species needs further consideration in future assessments — perhaps by using a dynamic factor analysis or DFA modelling approach (Ward et al 2022) to determine whether the individual species-specific trends in catch can be aggregated into a common underlying latent trend or some other simplified pattern.

ToR 3: Are the assessment model and methodology the same as those used in the 2019 benchmark stock assessment?

Yes. There were no substantive deviations from the Langseth et al (2019) benchmark assessment using JABBA with JAGS as the backend (Winkler et al 2018). The shape parameter (m) of the Pella-Tomlinson production function was estimated as 1.65 (Table 6, p 31: Bohaboy & Matthews 2024) compared with 1.73 in the 2019 benchmark assessment (Langseth et al 2019) — suggesting perhaps a slight increase in productivity since 2017 due to lower catch (indicative apparently of partial rebuilding), which was the terminal year in the 2019 assessment.

Side comment —

- why no posterior predictive check tests in the Bayesian state-space model evaluation step?
PIFSC: these are being considered in future assessments such as the upcoming benchmark stock assessment.

⁸ The update assessment used GLMMs with either hurdle-lognormal likelihood but estimated using the so-called two-stage "delta-lognormal" approach - this comprises 2 separate models that then need to be combined instead of using a more direct mixture approach using a hurdle model likelihood. Here the response variable is separately a (1) Bernoulli (0,1) and then (2) a lognormal likelihood for CPUE. Why not a direct hurdle-lognormal likelihood to account appropriately for the model uncertainty in BOTH model components simultaneously? **PFSIC: this is being considered in future data standardizations for upcoming stock assessments.**

ToR 4: Are primary sources of uncertainty documented and presented?

Yes. No further comment.

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, update includes the stock status in relation to estimated biological reference points and other results required to address management goals for the Guam BMUS in the FEP, such as MSY, HMSY, BMSY and BMSY/K. A Kobe plot (*Fig 17: Bohaboy & Matthews 2024*) was provided that displayed stock status from 1982–2003 for H/HMSY and B/BMSY with associated credible intervals⁹. The status determination from this update assessment (Bohaboy & Matthews 2024) is shown in the following table along with all other previous assessment conclusions. The 2023 stock status is **Not Overfished nor Experiencing Overfishing**.

Guam BMUS stock assessment history

Assessment type	Status year	CPUE data series	Overfished	Overfishing	Rebuilding	Annual catch limit
benchmark (2007)	2005	1982-2005	no	no	no	NA
update (2012)	2010	1982-2010	no	no	no	NA
update (2016)	2013	1982-2013	no	no	no	NA
benchmark (2019)	2017	1982-2017	yes	no	no	31k lbs
update (2024)	2023	1982-2023	no	no	yes	31-33k lbs
benchmark (2025)	2024	TBD	TBD	TBD	TBD	TBD

Note: annual catch limit = projected catch corresponding to a median overfishing probability of 40% in any year. NA = not comparable as used a Schaefer surplus production functional form but the 2019 benchmark and 2024 update used a Pella-Tomlinson form.

The 2019 assessment concluded that the stock status was: **Overfished but not Experiencing Overfishing**. Retrospective analyses of the additional 6 years of data since 2017 by Bohaboy & Matthews (2024) support the **Not Overfished nor Experiencing Overfishing** finding. These retrospective analyses to explore the robustness of the status finding is a helpful component of the 2023 update assessment (Bohaboy & Matthews 2024).

⁹ Note that the 95% credible interval is broad and may be considered further when management establishes catch limits. The Panel suggested that it might be more informative to duplicate Figure 17 indicating stock status for years 2016-2023.

ToR 6: Are methods used to project future population state the same as those used in the 2019 benchmark stock assessment?

Yes. There were no substantive deviations from the Langseth et al (2019) benchmark assessment approach.

ToR 7: If responses to questions 1-6 are “no”, indicate for each:

Not Applicable since the responses to ToRs 1-6 were “yes”.

ToR 8: For consideration in future benchmark assessments, suggest and prioritize recommendations for improvements and research. For each recommendation prioritize to 3 categories (high, medium, low) dependent on importance to interpretation of this and future assessment results.

The WPSAR review panel also made the following recommendations for consideration in the upcoming for the Guam BMUS benchmark stock assessment (a shorter list is presented in the Executive Summary):

High priority —

Data:

- Explore latent structure and common trends in the catch and CPUE time series using Dynamic Factor Analytic approaches (Ward et al 2022) to better support the identification of common underlying species-specific trends in the current Guam BMUS multi-species complex to perhaps better account for the time-varying species composition in the catch.
- Investigate ways to improve the data quality from the creel surveys. Ongoing efforts between PIFSC and Guam DAWR to improve data quality should continue to be supported.
- Examine the current DMWR boat-based survey protocols to identify and evaluate potential data gaps and ways to improve data collection useful for stock assessment.
- Pursue efforts to group the 13 BMUS species into a smaller number of categories based on habitat utilization and biological parameters. This would begin with an analysis to split the BMUS into groups defined by primary depth distribution, moving to single-species stock assessments as data becomes available.

Modelling:

- Use a single model likelihood for the data standardization component (such as hurdle-lognormal) rather than the 2-stage so-called delta modelling approach.

- Explore the utility of additional potentially informative covariates, such as SOI, PDO, MEI, lunar phase or moonlight intensity (*perhaps for adding to the process component of the Bayesian state-space population model for some and the observation process for others*).
- Use posterior predictive check tests to evaluate data standardization model performance in addition to the standard residuals-based diagnostic checks used.
- Use posterior predictive check tests to evaluate the Bayesian state-space model performance in addition to the residuals-based diagnostic checks used.

Medium priority —

- Examine issue of shark depredation on catch and CPUE of the Guam bottom fishery. Initially examine DMWR boat-based creel survey data on depredation.
- Compare estimated biomass from assessment models to fishery-independent estimates of biomass. The BFISH surveys that are planned for Guam in 2024 should be a great opportunity to develop those independent estimates of abundance.

Low priority —

- Explore model-based approaches for survey-based catch estimates such as multilevel modelling with post-stratification (Kennedy & Gelman 2021, Authier et al 2021, Broniecki et al 2022).
- Conduct a socioeconomic analysis of Guam bottomfishing participation. Anecdotal evidence from members of the fishing community suggests that fishing may have increased (including new entrants into the fishery) during the COVID pandemic.

Overall findings

The WPSAR review panel found that the draft 2024 Guam BMUS update stock assessment (Bohaboy & Matthews 2024):

- was complete and there were no consequential deviations from the 2019 benchmark assessment (Langseth et al 2019)
- was adequate for management decision-making purposes
- represents “*best scientific information available*”

The WPSAR review panel commends this review report¹⁰ of the 2024 Guam BMUS update stock assessment (Bohaboy & Matthews 2024) to the SSC and Council for further consideration of these specific findings.

¹⁰ The 3 individual reports are also attached to this summary report.

Public Comment

Manny Dueñas (Guam Fisherman's Cooperative Association) provided several comments regarding the stock assessment. In particular, he highlighted issues concerning the quality of the creel survey data since 2000 and encouraged greater emphasis on improving the bio-sampling program. He also raised concerns about the apparently high number of shark interactions in the Guam fishery and its effects on BMUS CPUE. He also queried why offshore seamount habitats that are not readily accessible to Guam-based bottomfish fishers were not considered in the stock assessments.

Brent Tibbatts (Guam DAWR) advised that DAWR also collect voluntary interviews but also collect metadata. If an interview is refused, then that is also recorded so that DAWR can estimate the proportion of refusals (nonresponse rate). The response rate is around 90%. He also reiterated the importance of shark depredation to catch and CPUE and noted that DAWR do pass on concerns about shark depredation to the relevant plan teams.

References

Authier M, Rouby E, Macleod K (2021) Estimating cetacean bycatch from non-representative samples (I): a simulation study with regularized multilevel regression and post-stratification. *Frontiers in Marine Science* 8: 719956

Bohaboy E, Matthews T (2024) Stock Assessment Update of the Bottomfish Management Unit Species of Guam, 2024. NOAA Technical Memorandum NMFS-PIFSC-####, pp 53

Broniecki P, Leemann L, Wüest R (2022) Improved multilevel regression with poststratification through machine learning (autoMrP). *The Journal of Politics* 84: 597–601

Kennedy L, Gelman A (2021) Know your population and know your model: Using model-based regression and poststratification to generalize findings beyond the observed sample. *Psychological Methods* 26: 547–558

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Ward E, Anderson S, Hunsicker M, Litzow M (2022) Smoothed dynamic factor analysis for identifying trends in multivariate time series. *Methods in Ecology and Evolution* 13: 908–918

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Acknowledgements

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Appendices

Appendix 1:

Terms of Reference for the Peer Review under the Western Pacific Stock Assessment Review framework for the 2024 Stock assessment update for the Guam bottomfishes

For questions 1-6 and their subcomponents, reviewers shall provide only a “yes” or “no” answer. If necessary, caveats may be provided to these yes or no answers, but when provided they must be as specific as possible to provide direction and clarification to NMFS. Question 7 also asks for additional details when answers to earlier questions were “no”. Each panel member will provide a report based on their answers to these questions, and the Chair will provide a report summarizing the answers to these questions across the review panel.

1. Are input data sources and filtering methods well documented and the same as those used in the 2019 benchmark assessment?
2. Is the CPUE standardization methodology the same as those used in the 2019 benchmark stock assessment?
3. Are the assessment model and methodology the same as those used in the 2019 benchmark stock assessment?
4. Are primary sources of uncertainty documented and presented?
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?
6. Are methods used to project future population state the same as those used in the 2019 benchmark stock assessment?
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?
8. For consideration in future benchmark assessments, suggest and prioritize recommendations for improvements and research. For each recommendation prioritize to three categories (high, medium, low) dependent on importance to interpretation of this and future assessment results.

Appendix 2: Review Panel

Milani Chaloupka (Chair of Review Panel)
 Ecological Modelling Services Pty Ltd
 Marine Spatial Ecology Lab, University of Queensland, Australia
SSC: Western Pacific Fishery Management Council

Frank Camacho
 Biology Program, University of Guam
SSC: Western Pacific Fishery Management Council

David Itano
 Opah Consulting, Hawaii USA
 Hawaii Institute of Marine Biology, Kaneohe, Hawaii USA
SSC: Western Pacific Fishery Management Council

Appendix 3: Presenters

Erin Bohaboy
Research Fish Biologist
NOAA Fisheries, Pacific Islands Fisheries Science Center
Honolulu, USA

Toby Matthews
NOAA Fisheries, Pacific Islands Fisheries Science Center
Honolulu, USA

Felipe Carvalho
Stock Assessment Program Leader
NOAA Fisheries, Pacific Islands Fisheries Science Center
Honolulu, USA

Appendix 4: Observers

Manny Dueñas
(*Vice Chair: Western Pacific Regional Fishery Management Council*)
Guam Fishermen's Cooperative Association, Guam, USA

Brent Tibbatts
Division of Aquatic and Wildlife Resources
Department of Agriculture, Guam, USA

James Borja
Guam-Marianas Advisory Panel (2023-2026), Guam, USA

Felix Reyes
WPRFMC Guam Island Coordinator, Guam, USA

Eric Cruz,
NOAA/NMFS Guam Field Office, Guam, USA

Mike Gawel (AP Plan Team)
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Jason Biggs (*SSC: WPFMC*)
Division of Aquatic and Wildlife Resources
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Robert Ahrens
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Honolulu, USA

Appendix 5: WPSAR Review Panel Individual Reports

The 3 individual panelist reports follow ...