Summary Report

Western Pacific Stock Assessment Review of the 2025 Stock Assessment Update for the CNMI Bottomfish Management Unit Species

2-3 April 2025

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Chair — WPSAR Review Panel

1. Ecological Modelling Services Pty Ltd, Australia
2. Marine Spatial Ecology Lab, School of the Environment, University of Queensland
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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 March 2025, the 202nd Council Meeting recommended that the WPRFMC[1] convene a WPSAR panel comprising 3 SSC members to review a draft 2025 CNMI Bottomfish Management Unit Species (BMUS) Stock Assessment Update (Bohaboy & Matthews 2025). That draft stock assessment is a scheduled *update*[2] of the 2019 *benchmark* assessment (Langseth et al 2019), which had previously concluded that the CNMI BMUS[3] multi-species complex based on CPUE times series for 2000-2017 was **not overfished nor experiencing overfishing**.

The draft 2025 CNMI Bottomfish Management Unit Species (BMUS) Stock Assessment Update was based on a 24-year times series of catch and CPUE (2000-2023) and concluded that the CNMI BMUS was again **not overfished nor experiencing overfishing**. A summary of the CNMI Bottomfish Management Unit Species complex assessment history since the first formal 2007 benchmark assessment is shown below (includes the upcoming benchmark assessment).

CNMI BMUS stock assessment history

Assessment type	Status year	CPUE data series	Overfished	Overfishing	Rebuilding	Annual catch limit
benchmark (2007)	2005	1983-2005	no	no	no	NA
update (2012)	2010	1983-2005	no	no	no	NA
update (2016)	2013	1983-2005	no	no	no	NA
benchmark (2019)	2017	2000-2017	no	no	no	82k lbs
update (2025)	**2023**	**2000-2023**	**no**	**no**	**no**	**71-76k lbs**
benchmark (2026)	2025	TBD	TBD	TBD	TBD	TBD

Note: annual catch limit = projected catch corresponding to a median overfishing probability of 40% in any year. NA = not applicable. The 2025 update used a Pella-Tomlinson surplus production function form, but all previous assessments used a Schaefer surplus production functional form.

The WPSAR 3-person review panel was convened on April 2-3 (2025) via Webex by Cisco videoconferencing service supported by the WPRFMC.

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[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] CNMI BMUS treated as one multi-species complex comprising 13 specific bottomfish species such as onaga, opakapaka and ehu.

The review panel assessed whether the draft 2025 update 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 surplus production stock assessment modelling approach were complete with no consequential deviation from the Langseth et al (2019) benchmark assessment for the CNMI BMUS complex.

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

The WPSAR review panel (*see Appendix 2*) evaluated the draft 2025 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 considered all substantive comments (if any) provided at the 2-day review by members of the public (*see Appendix 5*) responding to the 2025 assessment. Each of the 3-person review panel completed their own independent evaluation report and these 3 reports (*see Appendix 6*) have then been synthesized in this overall Summary Report.

Main finding — the WPSAR review panel found that the draft 2025 CNMI BMUS update stock assessment (Bohaboy & Matthews 2025):

- was complete with no consequential deviations from the 2019 benchmark assessment (Langseth et al 2019)
- represents "**best scientific information available**"
- and hence is appropriate for management decision-making purposes and informing the setting of risk-based annual catch limits

The update added additional boat-based bottomfish creel survey data (2018–2023) that represents a 32% increase in survey data available for the update. A higher level of species identification in the creel surveys allowed for estimation of catch and CPUE for the13 species in the complex. Species-level catch was computed by allocating the total estimated catch of all BMUS according to the relative species compositions identified in boat-based creel survey interviews. Note that this creates a direct reliance on data sourced from voluntary opt-in creel surveys to estimate catch levels of BMUS taken by the overall fishery (shallow and deep, inshore/offshore).

The 2019 CNMI BMUS benchmark stock assessment (and Council adjustment) estimated that an annual catch of 82k lbs corresponded to a median overfishing probability of 40% in any year while the 2025 update assessment estimates that 40% risk based annual catch limit as 71k lbs in 2025 increasing to 76k lbs in 2029.

The WPSAR review panel commends this review report[4] of the 2025 CNMI BMUS update stock assessment (Bohaboy & Matthews 2025) to the SSC and Council for further consideration of these specific findings.

[4] The 3 individual reports are also attached to this summary report.

The WPSAR review panel also made the following key[5] recommendations for consideration in the upcoming CNMI BMUS benchmark stock assessment:

Key Recommendations —

High priority —

- Use a single model likelihood for the data standardization component (such as hurdle-lognormal, hurdle-gamma) rather than the 2-stage so-called delta modelling approach
- Use posterior predictive check tests to evaluate data standardization model performance in addition to the standard residuals-based diagnostic checks used
- Explore latent structure and common trends in the catch and CPUE time series using Dynamic Factor Analytic approaches to better support the identification of any underlying species-specific trends in the current CNMI BMUS multi-species complex to perhaps better account for the time-varying species composition in the catch

Medium priority —

- Explore use of the extended form of post-sample Mohn's ρ and associated inference for retrospective assessment of model robustness proposed by Breivik et al (2023)
- Undertake boat-based creel surveys on Tinian and Rota in addition to Saipan to represent the spatial distribution of bottomfish fishing effort throughout CNMI to support future benchmark stock assessments.
- Investigate the impact of shark depredation on the CPUE of BMUS in the CNMI fishery.

Low *priority —*

- Explore other fisher ID random effect structures in the GLMMs including the possibility to reclassify fishers as high-catch fishers v the rest and use that variable as the fisher ID.
- Explore model-based approaches for boat-based creel survey-derived catch estimates such as multilevel regression-based modelling with post-stratification (Kennedy & Gelman 2021, Authier et al 2021)

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 draft version of the 2025 update stock assessment report (Bohaboy & Matthews 2025):

- a revised figure for the estimated annual catch of the 13 BMUS over time to support further understanding on the relative importance of each species to the assessment and the fishery and to examine how the proportion of species in the catch has changed over time

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

Background

In March 2025, the 202nd Council Meeting recommended that WPRFMC convene a WPSAR panel comprising 3 SSC members to review a draft 2025 CNMI Bottomfish Management Unit Species (BMUS) Stock Assessment Update (Bohaboy & Matthews 2025). That draft assessment is a scheduled *update* of the 2019 *benchmark* assessment (Langseth et al 2019), which previously concluded that the CNMI 13-species BMUS complex was **not overfished nor 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 the Commonwealth of the Northern Mariana Islands, 2025
Erin C Bohaboy, Toby Matthews
US Department of Commerce. NOAA Technical Memorandum. NOAA-TM-NMFS-PIFSC-##.
https://repository.library.noaa.gov/

Participants

See Appendix 2 for the WPSAR Review Panel membership. See Appendix 3 for the list of NOAA Fisheries presenters on the draft 2025 CNMI BMUS update stock assessment — including the update authors. See Appendix 4 for a list of the Observer/Other 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 2025)[6] from the Langseth et al (2019) benchmark assessment approach.[7] Two sources of data were used for this 13 species complex **update assessment**: (1) catch time series and (2) abundance

[6] Bohaboy E, Matthews T (2025) Stock Assessment Update of the Bottomfish Management Unit Species of the Commonwealth of the Northern Mariana Islands. US Department of Commerce. NOAA Technical Memorandum. NOAA-TM-NMFS-PIFSC

[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.

indices (CPUE) from 2000-2023 sourced mainly from a **limited** number of CNMI Department of Land and Natural Resources boat-based and shore-based creel surveys. Few boat-based/shore-based creel survey interviews for 2024 so no reliable 2024 CPUE estimate currently possible and hence the terminal year for this update was 2023. Commercial purchase records were the primary data source used prior to the 2019 benchmark assessment and this update.

Background —

Reliable data are the foundation of fisheries stock assessments. The focus for future CNMI BMUS benchmark assessments will most likely be based on single-species assessments as opposed to the current approach based on a multi-species complex — but this is yet to be determined.

Side comment —

- an 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 multilevel modelling with post-stratification (Kennedy & Gelman 2021, Authier et al 2021).
- fishers claim that shark depredation is an ongoing issue in this fishery and is an issue of global concern (Mitchellet al 2023). Shark depredation should be considered in future benchmark assessments and with appropriate data collection procedures implemented.

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

Yes — uses a delta-type GLMM regression modelling approach with separate binomial and Gaussian likelihoods and a log-transformed response variable with fisher ID as an intercept-only random effect — the intention being to mimic a hurdle-lognormal likelihood.

Background —

Uses conditional type GLMM regression model residual diagnostics, which is appropriate, but don't yet use marginal-based test of predictive accuracy.

Side comments —

- interestingly, both this update assessment and the 2019 benchmark assessment used ONLY unique "vessel" as the intercept-only Gaussian random effect when the data is structured by "trip within vessel". So why not both "vessel" and "trip" as crossed random effects structure since that is how the data were collected? **PIFSC: not enough data to do so.**
- why no posterior predictive check tests in the data standardization model evaluation step? **PIFSC: being considered in upcoming benchmark assessments.**
- the time-varying species composition of this multi-species complex comprising 13 species needs further consideration in future assessments — perhaps use a dynamic factor analysis

or DFA modelling approach (Ward et al 2022, Clark & Wells 2023) to determine if the individual species-specific trends in catch can be aggregated into a common underlying latent trend or some other simplified pattern. **WPRFMC: being addressed as a SSC task.**

Side comment —

- gear technology of deepwater bottomfishing has advanced rapidly with the marketing of affordable depth sounders and GPS units that allow exact locations to be plotted and preserved. The adoption of fast, light but powerful electric reels spooled with small diameter spectra braided lines has revolutionized the deep-drop fishery and opened up access to the deepwater Eteline snappers and monchong (Bramidae spp). The adoption of new fishing gears should be documented to track efficiency-and-effort creep that might influence CPUE estimation.

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 fixed at 2: same as in the 2019 benchmark assessment (Langseth et al 2019).

Side comments —

- 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.**
- how are any potential MCMC pathologic behaviour such as predicting negative biomass accounted for? **PIFSC: negative biomass estimates (if any) are accounted for in JABBA by penalising any estimates outside a predetermined range.**
- The JABBA model adopted here used a Gaussian likelihood for both the observation and process components of the state-space specification of the surplus production model. Yet these are several extreme or outlier catch estimates for 2000 and 2012 which suggests that a `Student-t` likelihood with degrees of freedom estimated from the data might have been more appropriate (Járez & Steel 2010): so `dt()` rather than `dnorm()` in JAGS.
- The currently assessed BMUS contains a variety of species with differing life history and habitat preferences. Shifting to single-species stock assessments is an option if adequate data is available. Looking at examining subgroups of similar species such as the *Pristipomoides* complex is another option while also dealing with outliers like the single grouper *Variola louti*.

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

Yes — no further comment warranted.

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 2023 status determination from this update (Bohaboy & Matthews 2025) is shown in the following table along with all other previous assessment conclusions. The current stock status is **Not Overfished nor Experiencing Overfishing**. The update produced model parameters applicable for determining the prescribed biological reference points such as MSY, the harvest rate to produce MSY (Hmsy) and the exploitable biomass to produce MSY (Bmsy). These model-based estimates were very similar to those produced for the 2019 benchmark stock assessment.

Retrospective analyses in the update using the additional 6 years of data (2018-2023) support the previous **Not Overfished nor Experiencing Overfishing** finding in the 2019 benchmark assessment (Langseth et al 2019) — there was indication of any directional bias. These analyses to explore status finding robustness is a helpful component of the update (Bohaboy & Matthews 2025).

Background —

Evaluating retrospective patterns using the Mohn's ρ metric is very important in assessing the robustness of fisheries stock assessments (Carvalho et al 2021). Breivik et al (2023) extend the use of Mohn's ρ for retrospective pattern analysis and this extended form of post-sample Mohn's ρ and associated inference could be considered in future assessments.

CNMI BMUS stock assessment history

Assessment type	Status year	CPUE data series	Overfished	Overfishing	Rebuilding	Annual catch limit
benchmark (2007)	2005	1983-2005	no	no	no	NA
update (2012)	2010	1983-2005	no	no	no	NA
update (2016)	2013	1983-2005	no	no	no	NA
benchmark (2019)	2017	2000-2017	no	no	no	82k lbs
update (2025)	**2023**	**2000-2023**	**no**	**no**	**no**	**71-76k lbs**
benchmark (2026)	2025	TBD	TBD	TBD	TBD	TBD

Note: annual catch limit = projected catch corresponding to a median overfishing probability of 40% in any year. NA = not applicable. The 2025 update used a Pella-Tomlinson surplus production function form, but all previous assessments used a Schaefer surplus production functional form.

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.[8]

Background —

The model-derived posterior distributions of the model parameters were used in to produce the 5-year forward projections for 2026–2030, which are then used to determine the probability of overfishing and construct the overfishing risk table used for management decision-making.

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 CNMI BMUS benchmark stock assessment (a much shorter list was shown in the Executive Summary and more comprehensive lists in each individual report):

High priority —

- Use a single model likelihood for the data standardization component (such as hurdle-lognormal, hurdle-gamma) rather than the 2-stage so-called delta modelling approach.
- Use posterior predictive check tests to evaluate data standardization model performance in addition to the standard residuals-based diagnostic checks used.
- Explore latent structure and common trends in the catch time series using Dynamic Factor Analytic approaches to better support the identification of any underlying species-specific trends in the CNMI BMUS multi-species complex to better account for the time-varying species composition in the catch
- Strengthen locally supported bottomfish fishery data collection efforts in the CNMI to support future benchmark stock assessments.

[8] missing creel survey data for 2024 and incomplete data for 2025 precluded catch estimates from being available for 2024 and 2025 so the constant 5-year catch projections to estimate the probability of overfishing were from 2026 onwards.

Medium priority —

- Explore use of the extended form of post-sample Mohn's ρ and associated inference for retrospective assessment of model robustness proposed by Breivik et al (2023).
- Explore reasons for the apparently anomalously high CNMI BMUS catches recorded in 2000 and 2012.
- Investigate the impact of shark depredation on the CPUE of BMUS in the CNMI fishery.
- Undertake boat-based creel surveys on Tinian and Rota in addition to Saipan to represent the spatial distribution of bottomfish fishing effort throughout CNMI to support future benchmark stock assessments.

Low *priority* —

- Explore other fisher ID random effect structures in the GLMMs including the possibility to reclassify fishers as high-catch fishers v the rest and use that variable as the fisher ID.
- Explore model-based approaches for boat-based creel survey-derived catch estimates such as multilevel regression-based modelling with post-stratification (Kennedy & Gelman 2021, Authier et al 2021)
- Determine the relative abundance of *Etelis carbunculus* and *Etelis boweni* (giant ruby snapper) in the CNMI bottomfish fishery and incorporate this in future stock assessments. Only *E. carbunculus* and *E. coruscans* are currently recognized in the Fisheries Ecosystem Plan for the Mariana Archipelago while *E. boweni* is known to occur in the fishery and is likely to have previously been misidentified as *E carbunculus* (Dahl et al 2024).
- Conduct a socioeconomic assessment of the CNMI bottomfish fishery to better understand the fishery contribution to the CNMI economy.

Conclusion

The CNMI BMUS complex is currently **not overfished nor experiencing overfishing**.

The WPSAR review panel found that the draft 2025 CNMI BMUS update stock assessment (Bohaboy & Matthews 2025):

- was complete with no consequential deviations from the 2019 benchmark assessment (Langseth et al 2019)
- represents "**best scientific information available**"
- and hence is appropriate for management decision-making purposes

The WPSAR review panel commends this review report[9] of the 2025 CNMI BMUS update stock assessment (Bohaboy & Matthews 2025) to the SSC and Council for further consideration of these specific findings.

Public Comment

There was no public comment.

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 (2025) Stock Assessment Update of the Bottomfish Management Unit Species of the Commonwealth of the Northern Mariana Islands. US Department of Commerce. NOAA Technical Memorandum. NOAA-TM-NMFS-PIFSC-##. doi:10…

Breivik O, Aldrin M, Fuglebakk E, Nielsen A (2023) Detecting significant retrospective patterns in state space fish stock assessment. Canadian Journal of Fisheries and Aquatic Sciences. 80: 509-1518

Carvalho F, Winker H, Courtney D, Kapur M, Kell L, Cardinale M, Schirripa M, Kitakado T Yemane D, Piner K, Maunder M, Taylor I, Wetzel C, Doering K, Johnson K, Methot R (2021) A cookbook for using model diagnostics in integrated stock assessments. Fisheries Research 240: 105959

Clark N, Wells K (2023) Dynamic generalized additive models (DGAMs) for forecasting discrete ecological time series. Methods in Ecology and Evolution 14: 771-784

Dahl K, O'Malley J, Barnett B, Kline B, Widdrington J (2024) Otolith morphometry and Fourier transform near-infrared (FT-NIR) spectroscopy as tools to discriminate archived otoliths of newly detected cryptic species, *Etelis carbunculus* and *Etelis boweni*. Fisheries Research 272: 106927

Járez M, Steel M (2010) Model-based clustering of non-Gaussian panel data based on Skew-t distributions. Journal of Business and Economic Statistics 28: 52–66

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

Langseth B, Syslo J, Yau A, Carvalho F (2019) Stock Assessments of the Bottomfish Management Unit Species of Guam, the Commonwealth of the Northern Mariana Islands, and American Samoa. NOAA Technical Memorandum NMFS-PIFSC-86. https://doi.org/10.25923/bz8b-ng72

Mitchell J, Drymon J, Vardon J, Coulson P et al (2023) Shark depredation: future directions in research and management. Reviews in Fish Biology and Fisheries 33: 475–499

[9] The 3 individual reports are also attached to this summary report.

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

Winker H, Carvalho F, Kapur M (2018) JABBA: Just Another Bayesian Biomass Assessment. Fisheries Research 204: 275-288

Acknowledgements

The WPSAR Review Panel gratefully acknowledges the review support provided by the WPSAR Coordinating Committee comprising Mark Fitchett (WPRFMC, WCC Chair), Marlowe Sabater (NOAA Fisheries — PIFSC) & Keith Kamikawa (NOAA Fisheries — PIRO). We thank Zach Yamada (WPRFMC) for meeting logistics and WebEx support.

Appendices

Appendix 1: WPSAR Terms of Reference

Terms of Reference for the Peer Review
2025 Stock assessment update for the CNMI Bottomfishes

Peer Review under the Western Pacific Stock Assessment Review framework:
2025 Stock assessment update for the CNMI 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.

9) Draft a report (individual reports from each of the panel members and an additional Summary Report from Chair) addressing the above TOR questions.

Appendix 2: Review Panel

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

Keena Leon Guerrero
Fisheries Research Section, CNMI Division of Fish & Wildlife
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

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

Appendix 4: Observers or Other Participants

Eric Cruz
WPRFMC Guam Island Coordinator,
Guam, USA

Brett Schumacher
NOAA Fisheries, Pacific Islands Regional Office
Honolulu, USA

Appendix 5: Public Comment

There was no public comment.

Appendix 6: WPSAR Review Panel Individual Reports

The 3 individual panelist reports follow …

Individual Panelist Report on the Western Pacific Stock Assessment Review:

2025 Stock Assessment Update of the Bottomfish Management Unit Species of the Commonwealth of the Northern Mariana Islands

2-3 April 2025 (via WebEx)

Dr Milani Chaloupka [1,2,3]

WPSAR Review Panel

1. Ecological Modelling Services Pty Ltd, Australia
2. Marine Spatial Ecology Lab, School of Environment, University of Queensland
3. WPRFMC Science and Statistical Committee

Terms of Reference Responses[1] for the WPSAR Peer Review of the 2025 Stock Assessment Update[2] for the CNMI Bottomfishes

[1] 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". **See Appendix 1 for the full list of the ToRs.**

[2] **an update of**: Langseth B, Syslo J, Yau A, Carvalho F (2019) Stock Assessments of the Bottomfish Management Unit Species of Guam, the Commonwealth of the Northern Mariana Islands, and American Samoa. NOAA Technical Memorandum NMFS-PIFSC-86. https://doi.org/10.25923/bz8b-ng72

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 2025)[3] from the Langseth et al (2019) benchmark assessment approach.[4] Two sources of data were used for this 13 species complex **update assessment**: (1) catch time series and (2) abundance indices (CPUE) from 2000-2023 sourced mainly from a **limited** number of CNMI Department of Land and Natural Resources boat-based and shore-based creel surveys. Few boat-based/shore-based creel survey interviews so insufficient data for 2024 and hence the terminal year for this update is 2023. Commercial purchase records were the primary data sources used prior to the 2019 benchmark assessment and this update.

Background —

Reliable data are the foundation of fisheries stock assessments. The focus for future CNMI BMUS benchmark assessments will most likely be based on single-species assessments as opposed to the current approach based on a multi-species complex — but this is yet to be determined.

Side comment —

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 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?

Yes — uses a delta-type GLMM regression modelling approach with separate binomial and Gaussian likelihoods and a log-transformed response variable with fisher ID as an intercept-only random effect — the intention being to mimic a hurdle-lognormal likelihood.

Background —

Uses conditional type GLMM regression model residual diagnostics, which is appropriate, but don't yet use marginal-based test of predictive accuracy.

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[3] Bohaboy E, Matthews T (2025) Stock Assessment Update of the Bottomfish Management Unit Species of the Commonwealth of the Northern Mariana Islands. US Department of Commerce. NOAA Technical Memorandum. NOAA-TM-NMFS-PIFSC

[4] 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.

Side comments —

- interestingly, both this update assessment and the 2019 benchmark assessment used ONLY unique "vessel" as the intercept-only Gaussian random effect when the data is structured by "trip within vessel". So why not both "vessel" and "trip" as crossed random effects structure since that is how the data were collected? **PIFSC: not enough data to do so.**
- why no posterior predictive check tests in the data standardization model evaluation step? **PIFSC: being considered in upcoming benchmark assessments.**
- the time-varying species composition of this multi-species complex comprising 13 species needs further consideration in future assessments — perhaps use a dynamic factor analysis or DFA modelling approach (Ward et al 2022, Clark & Wells 2023) to determine if the individual species-specific trends in catch can be aggregated into a common underlying latent trend or some other simplified pattern. **WPRFMC: being considered as a SSC task.**

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 fixed=2 as in the 2019 benchmark assessment (Langseth et al 2019).

Side comments —

- 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.**
- how are any potential MCMC pathologic behaviour such as predicting negative biomass accounted for? **PIFSC: negative biomass estimates (if any) are accounted for in JABBA by penalising any estimates outside a predetermined range.**
- The JABBA model adopted here used a Gaussian likelihood for both the observation and process components of the state-space specification of the surplus production model. Yet these are several extreme or outlier catch estimates for 2012 and 2017, which suggests that a `Student-t` likelihood with degrees of freedom estimated from the data might have been more appropriate (Járez & Steel 2010): so `dt()` rather than `dnorm()` in JAGS.

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

Yes — no further comment warranted.

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 2023 status determination from this update assessment (Bohaboy & Matthews 2025) is shown in the following table along with all other previous assessment conclusions. The current stock status is **Not Overfished nor Experiencing Overfishing**. Retrospective analyses of the additional 6 years of data since 2017 by Bohaboy & Matthews (2025) support the previous **Not Overfished nor Experiencing Overfishing** finding in the 2019 benchmark assessment (Langseth et al 2019) — there was indication of any directional bias. These retrospective analyses to explore the robustness of the status finding is a helpful component of the 2023 update assessment (Bohaboy & Matthews 2025).

Background —

Evaluating retrospective patterns using the Mohn's ρ metric is very important in assessing the robustness of fisheries stock assessments (Carvalho et al 2021). Breivik et al (2023) extend the use of Mohn's ρ for retrospective pattern analysis and this extended form of post-sample Mohn's ρ and associated inference could be considered in future assessments.

CNMI BMUS stock assessment history

Assessment type	Status year	CPUE data series	Overfished	Overfishing	Rebuilding	Annual catch limit
benchmark (2007)	2005	1983-2005	no	no	no	NA
update (2012)	2010	1983-2005	no	no	no	NA
update (2016)	2013	1983-2005	no	no	no	NA
benchmark (2019)	2017	2000-2017	no	no	no	82k lbs
update (2025)	**2023**	**2000-2023**	**no**	**no**	**no**	**71-76k lbs**
benchmark (2026)	2025	TBD	TBD	TBD	TBD	TBD

Note: annual catch limit = projected catch corresponding to a median overfishing probability of 40% in any year. NA = not applicable. The 2025 update used a Pella-Tomlinson surplus production function form, but all previous assessments used a Schaefer surplus production functional form.

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.[5]

Background —

The model-derived posterior distributions of the model parameters were used in to produce the 5-year forward projections for 2026–2030, which are then used to determine the probability of overfishing and construct the overfishing risk table used for management decision-making.

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

Not Applicable.

ToR 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.

High priority —

- Use a single model likelihood for the data standardization component (such as hurdle-lognormal, hurdle-gamma) rather than the 2-stage so-called delta modelling approach.
- Use posterior predictive check tests to evaluate data standardization model performance in addition to the standard residuals-based diagnostic checks used.

Medium priority —

- Explore latent structure and common trends in the catch and CPUE time series using Dynamic Factor Analytic approaches to better support the identification of any underlying species-specific trends in the current CNMI BMUS multi-species complex to perhaps better account for the time-varying species composition in the catch.
- Explore use of the extended form of post-sample Mohn's ρ and associated inference for retrospective assessment of model robustness proposed by Breivik et al (2023).

[5] missing creel survey data for 2024 and incomplete data for 2025 precluded catch estimates from being available for 2024 and 2025 so the constant 5-year catch projections to estimate the probability of overfishing were from 2026 onwards.

Low priority —

- Explore other fisher ID random effect structures in the GLMMs including the possibility to reclassify fishers as high-catch fishers v the rest and use that variable as the fisher ID.

- Explore model-based approaches for boat-based creel survey-derived catch estimates such as multilevel modelling with post-stratification (Kennedy & Gelman 2021, Authier et al 2021)

Public Comment

There was no public comment.

Conclusion

The CNMI BMUS complex is currently **not overfished nor experiencing overfishing**. Based on review of all sources of data and model results presented I have concluded that the draft 2025 CNMI BMUS stock assessment update (Bohaboy & Matthews 2025):

- was complete with no consequential deviations from the 2019 benchmark assessment (Langseth et al 2019)
- represents "**best scientific information available**"
- and hence is appropriate for management decision-making purposes

References

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Acknowledgements

I thank the other members of the WPSAR CNMI BMUS Update Review Panel (Keena Leon Guerrero & David Itano). I also thank the members of the WPSAR Coordinating Committee: Marlowe Sabater (PIFSC), Keith Kamikawa (PIRO) & Mark Fitchett (WPRFMC). Grateful to Zach Yamada (WPRFMC) for meeting logistics and WebEx support.

Appendix 1: WPSAR Terms of Reference

Terms of Reference for the Peer Review
2025 Stock assessment update for the CNMI Bottomfishes

Peer Review under the Western Pacific Stock Assessment Review framework:
2025 Stock assessment update for the CNMI 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.

9) Draft a report (individual reports from each of the panel members and an additional Summary Report from Chair) addressing the above TOR questions.

Individual Panelist Report on the Western Pacific Stock Assessment Review:

2025 Stock Assessment Update of the Bottomfish Management Unit Species of the Commonwealth of the Northern Mariana Islands

2-3 April 2025 (via WebEx)

David Itano [1,2,3]

WPSAR Review Panel

1. Opah Consulting, Hawaii USA
2. Hawaii Institute of Marine Biology, Kaneohe, Hawaii USA
3. WPRFMC Scientific and Statistical Committee

Terms of Reference Responses[1] for the WPSAR Peer Review of the 2025 Stock Assessment Update[2] for the CNMI Bottomfishes

[1] 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". **See Appendix 1 for the full list of the ToRs.**

[2] **an update of**: Langseth B, Syslo J, Yau A, Carvalho F (2019) Stock Assessments of the Bottomfish Management Unit Species of Guam, the Commonwealth of the Northern Mariana Islands, and American Samoa. NOAA Technical Memorandum NMFS-PIFSC-86. https://doi.org/10.25923/bz8b-ng72

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

Yes – The data sources and filtering methods are well documented and the same as with the 2019 benchmark stock assessment (Langseth et al. 2019) with additional data inputs for 2000–2023 that provide estimates of 2023 stock status with projected catches through 2029.

Background –

- The 2025 update stock assessment incorporates additional boat-based bottomfish creel survey data (2018–2023) that represents a 32% increase in the amount of creel survey data available to the model. The higher level of species identification in the creel surveys allowed for the estimation of catch and CPUE for the13 species in the complex.

- Species-level catch was computed by allocating the total estimated catch of all BMUS according to the relative species compositions identified in boat-based creel survey interviews.

- This creates a direct reliance on voluntary creel survey data to estimate catch levels of BMUS taken by the overall fishery (shallow and deep, inshore/offshore, etc).

- The importance of reliable data to represent catch in the overall fishery cannot be overstated and should be carefully evaluated. This is important as the surveys are conducted on a voluntary basis. Sectors or participants in the fishery may be over or under sampled.

Side comment –

- Species-level estimates of BMUS should be made available in the 2025 update assessment using the estimation protocols described in the 2019 benchmark assessment.

    - Accurate species composition data will allow further discussion on dominant species harvested over time, key indicator species, changes in targeting over time and potential sample bias.

- Estimated total catch of BMUS for 2000 and 2012 were 176k and 140k pounds respectively. These amounts are far higher than the long-term averages and had correspondingly high CPUE estimates. These catches were the only time estimated catch exceeded 100k lbs throughout the data time series. The cause(s) of these unusually high catches should be investigated.

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

Yes – The CPUE standardization components and approach in the draft update 2025 stock assessment were essentially the same as for the 2019 benchmark stock assessment with the addition of 2018–2023 data. Non-expanded interview data from the boat-based creel survey were used as the basis for CPUE calculations in both assessments.

Side comments –

- CPUE was calculated from creel survey interviews reporting the use of bottomfish gear from boat-based creel surveys for 2000–2017. These data were updated for years 2018–2023 using boat-based interviews from WPacFIN.

- However, greater numbers of bottomfish creel survey interviews, mainly in 2020–2022 influenced stock dynamics parameters including a 11.9% reduction in MSY due to lower estimated stock productivity as calculated from the model. Further reductions in estimated MSY values should be examined carefully as landings in the fishery have exceeded 100k lbs in some years.

- Fishermen claim that shark depredation is a continuing problem in the fishery. Information on depredation should be collected in a way that its influence on CPUE can be evaluated in the 2026 benchmark assessment.

- The gear technology of deepwater bottomfishing has advanced rapidly in recent years with the marketing of affordable depth sounders and GPS units that allow exact locations to be plotted and preserved. The adoption of fast, light but powerful electric reels spooled with small diameter spectra braided lines has revolutionized the deep drop fishery and opened up access to the deepwater *Etelis* snappers and monchong. The adoption of new fishing gears should be documented to track efficiency and effort creep that may influence CPUE.

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

Yes – The update assessment is implemented in JABBA (Winker et al. 2018) following the same model and code structure, identical model set-up, and prior parameter specifications as used for the 2019 benchmark stock assessment (with one minor exception[3]).

[3] A minor change to the Markov Chain Monte Carlo (MCMC) specifications was made which was necessary due to slower convergence of the MCMC chains than was observed during the 2019 benchmark stock assessment.

Side comments –

- The currently assessed BMUS contains a variety of species with differing life history and habitat preferences. Shifting to single-species stock assessments is an option if adequate data is available. Looking at examining subgroups of similar species such as the *Pristipomoides* complex is another option while also dealing with outliers like the single grouper *Variola louti.*

- Conducting several single species stock assessments and setting ACLs for each is a considerable task and duplicating the effort between Guam and the CNMI doubles the effort. Combining the task to assess both territories through a Marianas wide assessment could be considered.

ToR 4
Are primary sources of uncertainty documented and presented?

Yes – The primary sources of model uncertainty were documented and presented. The Bayesian surplus production model used in the 2019 benchmark stock assessment and the 2025 update stock assessment accounts specifically for uncertainty in model estimates and catch projections.

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 update stock assessment produced model parameters directly useful to address biological reference points and relevant management goals. Median estimates and 95% confidence intervals produced estimates of maximum sustainable yield (MSY), the harvest rate to produce MSY (H_{msy}) and the exploitable biomass to produce MSY (B_{msy}).

These values were very similar to those produced for the 2019 benchmark stock assessment with a small reduction in estimated biomass and MSY levels. The update also produced a harvest control rule graphic and Kobe style plots indicating BMUS stock condition for 2000–2023 and for clarity a plot of stock condition for the recent years 2016–2023. The current stock status estimate from the 2025 update stock assessment is **Not Overfished nor Experiencing Overfishing** in agreement with the 2019 benchmark assessment results.

Side comment –

- A summary of the CNMI BMUS complex stock assessment history since the 2007 benchmark is shown below.

CNMI BMUS stock assessment history

Assessment type	Status year	CPUE data series	Overfished	Overfishing	Rebuilding	Annual catch limit
benchmark (2007)	2005	1983-2005	no	no	no	NA
update (2012)	2010	1983-2005[4]	no	no	no	NA
update (2016)	2013	1983-2005[4]	no	no	no	NA
benchmark (2019)	2017	2000-2017	no	no	no	82k lbs
update (2025)	**2023**	**2000-2023**	**no**	**no**	**no**	**71-76k lbs**
benchmark (2026)	2025	TBD	TBD	TBD	TBD	TBD

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

Yes – The methods used to project future population state are the same as those used in the 2019 benchmark stock assessment. These projections included the distribution of outcomes for probability of overfishing, biomass levels, harvest rates and probability of being overfished under a range of catch levels in CNMI updated to 2026-2030.

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

Not applicable. Responses to ToR 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 three categories (high, medium, low) dependent on importance to interpretation of this and future assessment results.

High Priority –

- Examine and improve species-level catch estimates of the 13 BMUS to examine trends in the relative importance of each species in the assessment and to the fishery over time.
    - Species-level catch within the 13 species BMUS is currently computed by allocating the total catch across all species by the relative species composition obtained from voluntary boat-based creel surveys.
    - There is a need to critically examine the boat-based creel survey methodology to ensure adequate catch sampling that accurately represents the fishery as a whole.

- Examine pros and cons to stock assessment to split the BMUS complex into sub-groups of similar species based on depth distribution and life history or to move to single-species stock assessments. Assess how best to handle outliers or biologically distinct species in the complex such as the shallow-water grouper *Variola louti* or the utility of focusing on a small number of indicator species.

- Investigate the impact of shark depredation on the CPUE of BMUS in the CNMI fishery. Improve data collection streams if necessary to capture this information.

Medium Priority –

- Examine possible explanations for the anomalously high catches and CPUE of BMUS in 2000 and 2012 (catch 176k, 140k; CPUE 5.82, 6.86 respectively). These levels far exceed recent estimates of BMUS MSY (approximately 70 – 80 k lbs.).

- Examine the pros and cons of combining Guam and CNMI BMUS stock assessment efforts into a single Marianas stock, or a southern vs northern stock. Consider including genetic studies.

- Record bottomfishing gear attributes that may influence CPUE and effort creep. Data can be collected during boat-based creel surveys, e.g. use of echosounder, GPS, electric reels, spectra line, etc. This information can eventually be added to the section on "Description of Fisheries" in future stock assessments.

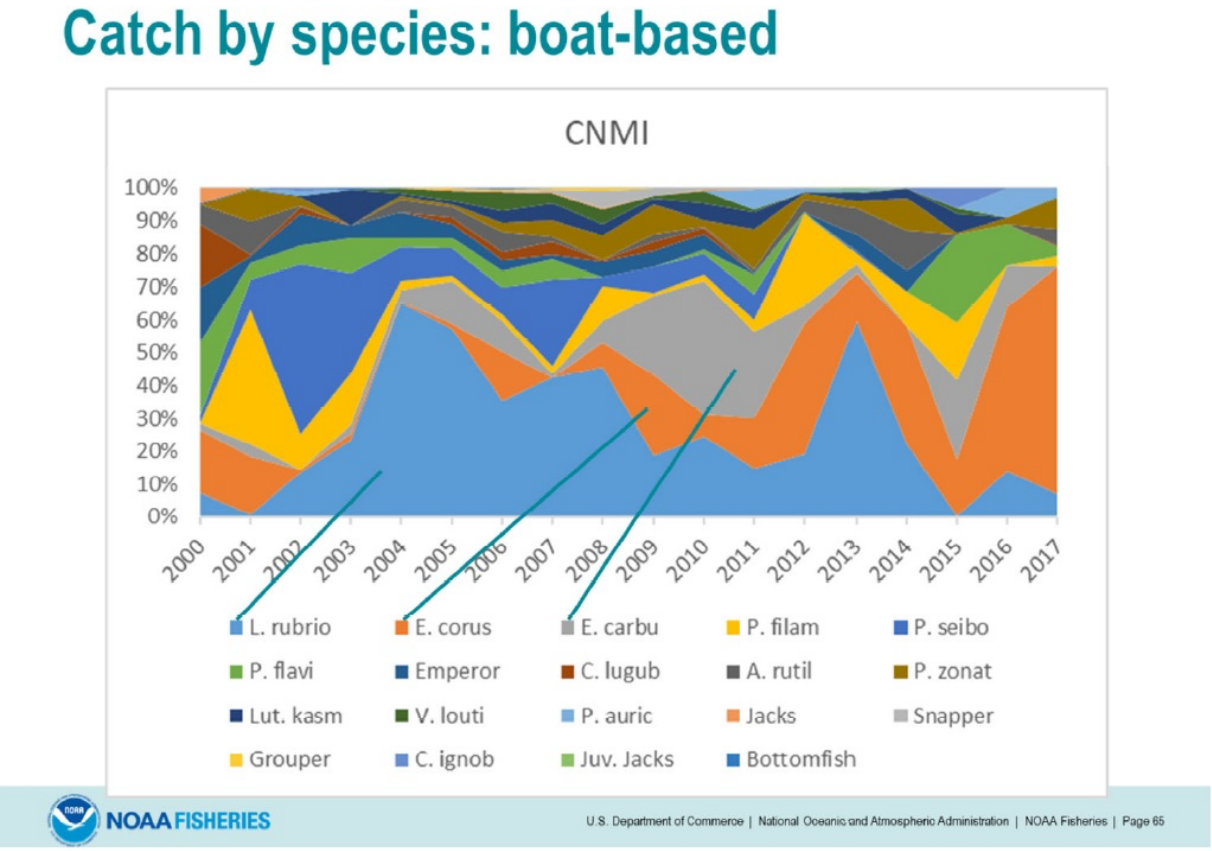
Low Priority –

- Determine the relative abundance of *Etelis carbunculus* and *E. boweni* (giant ruby snapper) in the CNMI fishery and incorporate this into future stock assessments. Only *E. carbunculus* is currently recognized in the Fisheries Ecosystem Plan for the Mariana

Archipelago (WPRFMC 2009) while *E. boweni* is known to occur in the fishery and is likely to have previously been misidentified as *E. carbunculus* (Dahl et al. 2024).

Specific proposed edits or amendments to the draft update report

- Provide a figure "Catch by Species: Boat based" that shows estimated catch of BMUS from 2000-2023 to provide information on the relative importance of each species within the assessment and to the fishery as a whole and examine how the proportion of species in the catch may have changed over time.
    - See figure below as an example that indicates a shift away from capture of the shallow water red-gill emperor (L. rubrio) with an increase in the estimated catch of the deep-water eteline snappers (*E. coruscans, E. carbunculus*) over time.



Public Comment

Day 1: There was no public comment.
Day 2: There was no public comment.

Conclusion

This reviewer noted with appreciation the Introduction section to the 2025 draft update assessment has been expanded to include an informative discussion on the life history, habitat and depth preference of the 13 BMUS in the CNMI region. This information provides useful background information on the species in question before entering into the details of the assessment. Further discussion on the similarities or differences exhibited by these species provides relevant information when considering the assessment of subgroups of BMUS (e.g. *Etelis spp.* and *Pristipomoides spp.*), reclassifying BMUS as ecosystem component species or for consideration as a candidate for single-species stock assessment. Additional information on the fishery to better understand fishing sectors and species targeting in the next benchmark assessment would be appreciated.

The update assessment included six years of additional data compared to the previous benchmark assessment representing a 32% increase in the amount of data available to the model in the update assessment. These additional creel survey data can be highly influential to the estimated species composition of the BMUS catch that are expanded from creel survey data. This emphasizes the importance of sampling evenly across the range of the fishery considering aspects of fishing grounds, targeting and fishing sector (subsistence, recreational, artisanal, commercial). Socioeconomic approaches and analysis could also be applied to examine issues such as the impact of typhoons, tourism levels and shifting market preference for different BMUS.

The draft stock assessment (Bohaboy and Matthews 2025) for the assessment of the BMUS of the Commonwealth of the Northern Mariana Islands was determined to be an update assessment of the 2019 benchmark stock assessment conducted by Langseth et al. (2019). The same data sources, CPUE standardization methodology and assessment model were used in both assessments.

This update assessment indicates exploitable stock biomass has been relatively stable since the benchmark 2019 assessment and concurs with the determination that the CNMI BMUS stock is **not overfished and not likely experiencing overfishing.**

The 2025 update assessment can be considered as BSIA on the stock condition and future projections for the BMUS of the Commonwealth of the Northern Mariana Islands and is considered appropriate for management purposes.

References

Bohaboy E, Matthews T (2025) Stock Assessment Update of the Bottomfish Management Unit Species of the Commonwealth of the Northern Mariana Islands. US Department of Commerce. NOAA Technical Memorandum. NOAA-TM-NMFS-PIFSC-##. doi:10…

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Langseth B, Syslo J, Yau A, Carvalho F (2019) Stock Assessments of the Bottomfish Management Unit Species of Guam, the Commonwealth of the Northern Mariana Islands, and American Samoa. NOAA Technical Memorandum NMFS-PIFSC-86. https://doi.org/10.25923/bz8b-ng72

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Acknowledgements

I thank the other members of the WPSAR CNMI BMUS Update Review Panel (Keena Leon Guerrero & Milani Chaloupka). I also thank the members of the WPSAR Coordinating Committee: Marlowe Sabater (PIFSC), Keith Kamikawa (PIRO) & Mark Fitchett (WPRFMC).

Appendix 1: WPSAR Terms of Reference

Terms of Reference for the Peer Review
2025 Stock assessment update for the CNMI Bottomfishes

Peer Review under the Western Pacific Stock Assessment Review framework:
2025 Stock assessment update for the CNMI 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.

9) Draft a report (individual reports from each of the panel members and an additional Summary Report from Chair) addressing the above TOR questions.

Individual Panelist Report on the Western Pacific Stock Assessment Review:

2025 Stock Assessment Update of the Bottomfish Management Unit Species of the Commonwealth of the Northern Mariana Islands

2-3 April 2025 (via WebEx)

Keena Leon Guerrero [1,2]

WPSAR Review Panel

1. CNMI Division of Fish & Wildlife, Fisheries Research Section
2. WPRFMC Science and Statistical Committee

Terms of Reference Responses[1] for the WPSAR Peer Review of the 2025 Stock Assessment Update[2] for the CNMI Bottomfishes

[1] 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". **See Appendix 1 for the full list of the ToRs.**

[2] **an update of**: Langseth B, Syslo J, Yau A, Carvalho F (2019) Stock Assessments of the Bottomfish Management Unit Species of Guam, the Commonwealth of the Northern Mariana Islands, and American Samoa. NOAA Technical Memorandum NMFS-PIFSC-86. https://doi.org/10.25923/bz8b-ng72

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

Yes, data sources and filtering methods are well documented and are consistent with those used in the 2019 benchmark assessment.

Side comment – For the 2012 data, it may be necessary to investigate whether charter or opportunistic interviews were mistakenly entered as regular fishing trips. This review could help clarify any unexpected variances or outliers in the 2012 data.

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

Yes, the same delta-type approach was used to model CPUE, consistent with the methodology from the 2019 benchmark stock assessment. The model structure includes factors such as year, depth, and type of day for the presence/absence process, and year, area, depth, type of day, and vessel-specific random intercepts for the positive process. This approach aligns with the methods used in the 2019 assessment.

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

Yes, the assessment model and methodology are the same as those in the 2019 benchmark assessment.

Side comment – Although the methodology remains consistent, Erin noted a minor exception regarding the MCMC specifications, which involved a longer burn-in period than was used in the 2019 benchmark stock assessment.

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

Yes, models of uncertainty were documented and presented.

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 and address management goals aligned with the relevant FEP. Projections indicated CNMI BMUS were neither being overfished nor experiencing overfishing.

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

Yes, the methods used in the update assessment had no significant deviations from the Langseth et al (2019) benchmark assessment.

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

Not applicable.

ToR 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.

Enhancing Local Data Collection Efforts in the CNMI (High Priority)
A high priority is to support and strengthen local data collection efforts in the CNMI, through continued training and increased funding. By enhancing local capacity for data gathering, the region can improve the accuracy for future stock assessments, ensuring management decisions are based on the best available information.

Shifting to Single-Species or Subgroup Stock Assessments (High Priority)
There is a growing need to reconsider the stock assessment approach, potentially shifting towards single-species assessments or assessments of subgroups, rather than focusing on a complex of species. This shift could provide more targeted and accurate data, allowing for more effective management. However, careful consideration is needed to determine whether a single-species or subgroup approach would offer the most valuable insights for managing the fishery.

Improving Spatial Scale Data Collection (Medium Priority)
There is a need to enhance data collection at finer spatial scales. Improving the resolution of spatial data will enable a more accurate understanding of fish distribution across the southern inhabited islands.

Creel Surveys on Tinian & Rota (Medium Priority)
There is concern that the current data on fishery numbers, primarily based on Saipan, do not accurately represent the broader CNMI region. To improve data accuracy and expand coverage, additional funding is needed for enhanced data collection efforts.

Metapopulation Dynamics in the Marianas (Medium Priority)
Understanding how fish populations interact across the Marianas will provide valuable insights into their sustainability and management.

Fishery-Independent Assessments of Bottomfish (Low Priority)
Although fishery-independent assessments of Bottomfish are a valuable goal, funding constraints currently make them infeasible. However, this remains a long-term objective.

Socioeconomic Assessment of Fisheries (Low Priority)
A better understanding of the local market and community impacts on fisheries is crucial. These factors may influence stock assessments more significantly than in other regions. The demand-driven shifts in species composition should be further explored to improve the overall understanding of the fishery's dynamics.

Public Comment

No public comment received.

Conclusion

The 2025 CNMI Bottomfish stock assessment update provides the most current and comprehensive scientific information available, confirming that the CNMI BMUS complex is **neither overfished nor experiencing overfishing**. This update incorporates additional data from 2018 to 2023, slightly decreasing the annual catch limit from 82k to 71-76k lbs. The methodology used in this update is consistent with the approach used in the 2019 benchmark stock assessment, ensuring continuity and reliability in the analysis.

By integrating the latest data, the 2025 update offers the best scientific information available on the stock status and future projections of BMUS for the CNMI.

References

Langseth B, Syslo J, Yau A, Carvalho F (2019) Stock Assessments of the Bottomfish Management Unit Species of Guam, the Commonwealth of the Northern Mariana Islands, and American Samoa. NOAA Technical Memorandum NMFS-PIFSC-86. https://doi.org/10.25923/bz8b-ng72

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Appendix 1: WPSAR Terms of Reference

Terms of Reference for the Peer Review
2025 Stock assessment update for the CNMI Bottomfishes

Peer Review under the Western Pacific Stock Assessment Review framework:
2025 Stock assessment update for the CNMI 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.

9) Draft a report (individual reports from each of the panel members and an additional Summary Report from Chair) addressing the above TOR questions.