Western Pacific Stock Assessment Review
Benchmark Review
Terms of Reference

This document serves as a Terms of Reference (TOR) for the Benchmark Review of the 2016 benchmark stock assessment of 28 species of reef-associated fish in the Main Hawaiian Islands, following guidelines established in the Western Pacific Stock Assessment Review (WPSAR) framework.

BACKGROUND

Section 301(a)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires that fishery conservation and management measures be based upon the best scientific information available. MSA § 302(g)(1)(E) provides that the Secretary of Commerce (Secretary) and each regional fishery management council "may establish a peer review process for that Council for scientific information used to advise the Council about the conservation and management of a fishery." Consistent with this provision, the Western Pacific Regional Fishery Management Council (Council), NOAA's National Marine Fisheries Service (NMFS) Pacific Islands Fisheries Science Center (PIFSC) and the Pacific Islands Regional Office (PIRO) have established the WPSAR process. WPSAR is a cooperative effort to improve the quality, timeliness, objectivity, and integrity of stock assessments and other scientific information used in managing fishery resources in the Pacific Islands Region. The WPSAR process may be applied to scientific information used by the Council directly to fulfill its management mandate in the execution of the MSA.

The WPSAR framework document outlines the scope of WPSAR, defines roles and responsibilities, summarizes the various review levels, describes the sequencing and timing of the WPSAR process in coordination with the larger Council process, and provides mechanisms for resolving disputes. This framework is available from the WSPAR website, at: http://www.pifsc.noaa.gov/peer_reviews/wpsar/index.php.

PROJECT DESCRIPTION

PIFSC scientists are conducting stock assessments on exploited coral reef fish species in the Pacific Islands Region which are listed in the Council's Fishery Ecosystem Plans. These stocks are generally classified as data-poor due to a lack of reliable, long-term, catch and fishing effort data. Historically, the Council has set and NMFS has approved setting of annual catch limits (ACLs) using a percentile of median historical catch levels and more recently, a biomass-augmented catch-MSY method has been applied (Sabater and Kleiber 2014, NOAA 2015).

In an effort to use additional available data sources for these stocks, scientists at PIFSC have conducted new coral reef fish assessments using length composition data, abundance data from diver surveys, and certain key population demographic parameters related to growth, maturity, and longevity. PIFSC scientists have been implementing an approach that uses the average length in the exploited phase of the population (L_{bar}) to obtain an estimate of total and fishing mortality rates for coral reef fish stocks (Beverton & Holt 1956; Ehrhardt & Ault 1992). These

rates, combined with population demographic parameters, are used in a numerical population model to obtain stock sustainability metrics (e.g., spawning potential ratio, F/F_{MSY}; see Ault et al. 1998, 2008). Overfishing limits can be generated by using recent total catch estimates and/or population size estimates from diver surveys. Furthermore, a novel meta-analytical approach using stochastic simulations was developed at PIFSC to obtain demographic parameter estimates for species with even less data than data-poor species ("data-less" species). These scientific methods recently underwent a rigorous independent review by a panel organized by the Center for Independent Experts, and have now been applied to individual species in the main Hawaiian Islands. There is a need to independently review these species-specific stock assessments prior to submission to a fishery management organization for consideration.

The format of reviewer-produced reports is attached in **Annex 1**. The Terms of Reference (TOR) questions for this peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

REVIEWER ROLES AND REQUIREMENTS

This Benchmark Review consists of an in-person panel of one review chair who is also a member of the Council's Scientific and Statistical Committee (SSC), plus 2 additional review members external to PIFSC, PIRO, and the Council and its affiliated bodies. The chair and review members shall have scientific expertise in data-poor stock assessment models and general fishery stock assessment methods. They will also have familiarity with requirements of fishery stock assessments under the Magnuson-Stevens Fishery Conservation and Management Act, and preferably will have familiarity with reef fish fisheries and/or life history.

The chair and review members have been asked to serve as independent and impartial scientific experts, and in their roles as reviewers they are not representing their respective institutions or affiliations. The chair and review members are expected to fulfill and comply with all elements specified in this TOR. The chair and review members are expected to review all required provided documents in advance of the meeting, actively contribute during the meeting and review further provided documents as needed, offer solutions with constructive criticism, and conduct themselves respectfully and professionally.

Review chair: The review chair shall facilitate the review to accomplish the stated goals and objectives articulated within this TOR. At the conclusion of the review, the chair will produce a report outlining **consensus** opinions from the review members addressing all aspects of this TOR especially as outlined in **Annex 2**, according to the review report format outlined in **Annex 1**. The chair will also present the consensus results of the review in-person to the Council's SSC after finalization of the reviewed benchmark stock assessment document. In cases where consensus cannot be reached on an individual TOR question, the review chair will describe the majority view and label the view as majority and not consensus. The review chair will also produce a second, independent review report indicating his or her scientific opinions addressing all aspects of this TOR especially as outlined in **Annex 2**, according to the review report format outlined in **Annex 1.**

Review members: Each review member will produce an independent review report indicating his or her scientific opinions addressing all aspects of this TOR especially as outlined in **Annex 2**, according to the review report format outlined in **Annex 1**.

The chair and review members will provide their respective consensus report and individual reports to the WPSAR Coordinating Committee point of contact after the close of the review, when the Coordinating Committee will check that reports satisfy the TOR and subsequently disseminate the reports. The reports will address all aspects of this TOR especially **Annex 2**, and follow the format as specified in **Annex 1**. The chair's consensus report, individual review member reports, as well as the reviewed final stock assessment document will be made available to the public on the WPSAR website shortly after they are finalized.

LOGISTICS

The WPSAR Coordinating Committee is responsible for setting up logistics of this review, including but not limited to travel arrangements, facility reservation and setup, security clearance in cases where reviews are held in federal facilities and/or where a reviewer is a foreign national, providing documents ahead of the review, and receiving and posting final review reports. The WPSAR Coordinating Committee point of contact for this review is [*insert name and email of CC lead for this review*].

This TOR may be modified by the WPSAR Coordinating Committee up to 1 month prior to the start of the review, but shall not be changed once the review has begun.

Timeline

This general timeline follows timeframes as outlined in the WPSAR framework.

Timeframe & date(s)	**Description**
2 weeks before review August 12, 2016	Documents distributed to chair and review members (generally via email)
Review August 29-Sep 2, 2016	In-person panel review
2 weeks after review Sep 19, 2016	Chair consensus report and individual review member reports submitted to WPSAR Coordinating Committee point of contact for a check on satisfaction of TOR. Coordinating Committee will then distribute and post accordingly
Following Council SSC meeting	Chair presents consensus opinions from review

Material To Be Provided

<u>Documents required to be read prior to review:</u>

Benchmark stock assessment for review (not to be distributed beyond reviewers):

Nadon, M. O. 2016. (draft) Stock assessment of the coral reef fishes of Hawaii, 2016. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-PIFSC-XX, XX p.

Previous independent peer review reports:

Dichmont, C. 2015. Center for Independent Experts (CIE) Independent Peer Review of Length-Based Assessment Methods of Coral Reef Fish Stocks in Hawaii and Other U.S. Pacific Territories.

Pilling, G. 2015. Center for Independent Experts (CIE) Independent Peer Review, Report of: Length-based stock assessment methods for coral reef fish stocks in Hawaii and other U.S. Pacific territories.

Stokes, K. 2015. Report on the independent peer review of length-based stock assessment methods for coral reef fish stocks in Hawaii and other U.S. Pacific territories.

Relevant management information:

Western Pacific Regional Fishery Management Council. 2009. Fishery Ecosystem Plan of the Hawaii Archipelago. Sections 4.5 and 5.6 only.

Western Pacific Regional Fishery Management Council. 2011. Amendment 3 to the Fishery Ecosystem Plan of the Hawaii Archipelago.

References:

Kritzer et al. (2001) Characterizing fish populations: effects of sample size and population structure on the precision of demographic parameter estimates. CJFAS 58: 1557-1568.

Nadon, M. O. et al. 2015. Length-based assessment of coral reef fish populations in the Main and Northwestern Hawaiian Islands. PLoS ONE e0133960.

Nadon, M. O. and Ault, J.S. (2016) A stepwise stochastic simulation approach to estimate life history parameters for data-poor fisheries. CJFAS (in-press).

Supplemental Background Documents:

Previous stock assessments:

National Oceanic and Atmospheric Administration. 2015. Environmental Assessment: Specification of Annual Catch Limits and Accountability Measures for Pacific Island Coral Reef Ecosystem Fisheries in Fishing Years 2015 through 2018. **(**RIN 0648-XD558)

Sabater, M. and Kleiber, P. (2014). Augmented catch-MSY approach to fishery management in coral-associated fisheries. In S.A. Bortone (Ed.), Interrelationships between Corals and Fisheries, CRC Press, Boca Raton, FL (2014), pp. 199–218 321 pgs.

Supplemental references:

Ault, J. S., J. A. Bohnsack, and G. A. Meester. 1998. A retrospective (1979-1996) multispecies assessment of coral reef fish stocks in the Florida Keys. Fishery Bulletin 96:395–414.

Ault, J. S., S. G. Smith, and J. A. Bohnsack. 2005. Evaluation of average length as an estimator of exploitation status for the Florida coral-reef fish community. ICES Journal of Marine Science 62:417–423.

Ault, J. S., S. G. Smith, J. Luo, M. E. Monaco, and R. S. Appeldoorn. 2008. Length-based

assessment of sustainability benchmarks for coral reef fishes in Puerto Rico. Environmental Conservation 35:221–231.

Beverton, R. J. H., and S. J. Holt. 1956. A review of methods for estimating mortality rates in exploited fish populations, with special reference to sources of bias in catch sampling. Rapports et proces-verbaux des reunions du Conseil International pour l'Exploration de la Mer 140:67–83.

Ehrhardt, N. M., and J. S. Ault. 1992. Analysis of two length-based mortality models applied to bounded catch length frequencies. Transactions of the American Fisheries Society 121:115–122.

Gedamke, T., and J. M. Hoenig. 2006. Estimating mortality from mean length data in nonequilibrium situations, with application to the assessment of goosefish. Transactions of the American Fisheries Society 135:476–487.

ANNEX 1: Format of Chair's Consensus Report and Individual Reports

Reports should be in pdf format.

1. Each report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations addressing Annex 2 Terms of Reference questions.

2. The main body of the report shall consist of a Background, Description of the Chair's Role or Individual Reviewer's Role in the Review Activities, Summary of Findings for each TOR question (Annex 2) in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the TOR.

    a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.

    b. *Review chair* should describe in a report the **consensus** views from the review members for each TOR question, and should not provide any non-consensus views which can be expressed in individual reports. In cases where consensus cannot be reached on an individual TOR question, the review chair will describe the majority view and label the view as majority and not consensus.

    c. *Review chair and review members* should each describe in an individual report, his or her independent views on each TOR question even if these were consistent with those of other panelists, and especially where there were divergent views. The review chair will thus provide two separate reports, a consensus report and an individual report.

    d. Each report shall be a stand-alone independent peer review report for others to understand the responses to TOR questions, and weaknesses and strengths of the science reviewed.

3. The reviewer report shall include the following appendices:

    Appendix 1: Bibliography of materials provided for review
    Appendix 2: A copy of this TOR
    Appendix 3: Panel membership, presenter information, or other pertinent information from the panel review meeting.

ANNEX 2: Terms of Reference Questions for Benchmark Review of Reef Fish in the Main Hawaiian Islands

For questions 1-4, reviewers shall provide a "yes" or "no" answer and will not provide an answer of "maybe". Only 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. Examples for specific caveats include specific species names, life history types as defined by specific parameter values, and data or method decision points.

1. Review whether each of the following short-term recommendations from the previous independent peer review were addressed properly for the general (not species-specific) approach, considering that the data sources themselves are not up for review. If they have not been addressed, indicate why not and suggest methods for addressing them.

    a. The development of a clear decision chart to increase transparency in the application of the approach. Clearly articulate the hierarchical nature of the three life history approaches and under which circumstances a method should (or should not) be used.
    b. Explore an alternative to calculating mean length across islands and applying that in the remainder of the process by using the sectoral mean lengths (the primary index of exploitation) through to the estimate of fishing mortality, and weight resulting estimates to calculate overall fishing mortality.
    c. Examine the sensitivity of final results to uncertainty in the value of length at first capture (Lc) used. Ensure the method to calculate Lc is more standardized and repeatable by other assessors.
    d. When incorporating uncertainty in parameter estimates, evaluate the data underlying the coefficients of variation (CVs) derived from Kritzer et al. (2001), and compare them to those derived for species around the Main Hawaiian Islands and U.S. Pacific territories that can be estimated using e.g. the length-at-age bootstrapping approach for von Bertalanffy parameters: growth rate (K) and asymptotic length at which growth is zero (Linf).
    e. Draw maximum length (Lmax) for the data poor life history simulation approach from a distribution rather than using a single point prior to capture this element of uncertainty.
    f. Explore the impact of heavily truncated size data in which the sampled Lmax is not representative of the biological Lmax, what is a safe error in Lmax in terms of biases, false positives and negatives; and relate this to the decision tree.
    g. For some Main Hawaiian Island stocks the available Lmax values extended beyond the range of estimates from which the life history parameter relationships were developed for the corresponding family. Therefore, consider the efficacy of estimates and uncertainty developed where input parameters for a species require extrapolation outside the range of data on which the relationships were based.
    h. Research the possibility of using female biomass only for SPR calculations where the male proportion is considered important (e.g. in the case of protogyny; Ault et al. 2008).
    i. Explore the option of including runs with negative fishing mortality estimates within all calculations and representations.
    j. Present OFL distributions arising from all relevant data set combinations separately to ensure levels of uncertainty are understood.

2. Review the appropriateness of the application of the general approach to each individual species being assessed: Determine if decision points and input parameters were reasonably chosen, assumptions reasonably satisfied, and primary sources of uncertainty documented and presented.

3. Determine whether the final results for each individual species are scientifically sound, including estimated stock status in relation to the selected biological reference points ($SPR_{30\%}$) and overfishing limits.

4. Determine whether the results for individual species from question 3 can be used for management purposes under the Magnuson-Stevens Act and relevant Fishery Ecosystem Plan (FEP), including biological reference points such as MSY-based BMSY, FMSY, and MSY (or their proxies) with no or minor further analyses or changes, considering that the data itself and the general approach have been accepted for stock assessment purposes. If results of this analysis should not be applied for management purposes with or without minor further analyses, indicate which alternative set of existing results should be used to inform setting fishery catch limits instead and describe why.

5. As needed, suggest recommendations for future improvements and research priorities. Indicate whether each recommendation should be addressed in the short/immediate term (2 months), mid-term (3-6 years), and long-term (5-10 years). Also indicate whether each recommendation is high priority (likely most affecting results and/or interpretation), mid priority, or low priority.

6. Draft a report (individual report from Chair and review members, an additional consensus report from Chair) addressing the above TOR questions.