WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

P* Working Group Meeting
May 28, 2013
1:00 pm – 5:00 pm
Pelagic Suite Conference Room
Council Office

Participants: Dr. Pierre Kleiber (ret. NMFS PIFSC), Dr. Eric Franklin (UH HIMB), Dr. Bob Humphreys (NMFS PIFSC), Mr. Ed Watamura (Advisory Panel Chair), Mr. Roy Morioka (H-FACT), Mr. Ed Ebisui (Council member, Program Planning Chair), Mr. Jarad Makaiau (NMFS – PIRO), and Marlowe Sabater (WPRFMC).
On Conference Call / WebEx: Dr. Todd Miller (c/o Michael Tenorio and Trey Dunn), and Dr. Frank Camacho (UOG)

DRAFT REPORT

1. Introduction

Marlowe Sabater opened and chaired the meeting of the P* working group.

2. Recommendations from previous Council meetings

At the 152nd meeting of the Western Pacific Regional Fishery Management Council, the Council recognized the under estimation of the Annual Catch Limits from using the 75th percentile of the entire catch time series based solely on creel survey data for American Samoa, Guam, and CNMI and the commercial marine license catch reports for Hawaii. The Council recommended utilizing other data sets and methods to better inform the ACL specification process. The Scientific and Statistical Committee of the Council at its 112th meeting evaluated four different models. These models include: 1) a bulk estimator of MSY using modified Schaefer and Fox model (Garcia et al. 1986); 2) depletion corrected average catches (MacCall 2009); 3) depletion-based stock reduction analysis (Dick and MacCall 2010); 4) catch-MSY estimator (Martell and Froese 2012). The SSC recommended exploring the catch-MSY approach with modifications: 1) to incorporate biomass as an input parameter; and 2) constrain the intrinsic rate of population growth parameter reflective of the species groups.

3. Overview of the P* process

The P* process is a methodology the Council adopted in its FEP to determine Acceptable Biological Catches (ABC) for management unit species (MUS) under tier 1 to 3 of the ABC control rules. It is a score-based system to determine scientific uncertainties under each of the 4 dimensions: 1) assessment information; 2) uncertainty characterization; 3) stock status; and 4) productivity and susceptibility. The total score is summed and deducted from 50% risk of overfishing usually equated (in this case) to the MSY.

4. Augmented Catch-MSY approach

The Council contracted Pierre Kleiber to develop the model and produce the model results. A modified catch-msy approach (Martell and Froese 2012) was used to estimate maximum sustainable yield (MSY) for coral reef stocks in the Western Pacific Region. The following modifications were made to the model: 1) biomass information from underwater visual surveys was utilized providing additional constraints on model biomass trajectories; 2) the computer code was parallelized to greatly speed up model runs. Initial runs showed incorporation of biomass information improves the MSY estimation making this approach appropriate for specification of acceptable biological catch after scientific uncertainties are accounted for. Scientific uncertainties can be incorporated at two levels: 1) adjusting process error of the Schaefer model; and 2) adjusting the coefficient of variation at the biomass level. Estimates of MSYs for various coral reef stocks are presented.

5. Preliminary results from model based approach

Preliminary model outputs showed good potential for management applications. The biomass information from CRED significantly improved the model and the results for some MUS. It also reduced the coefficient of variations in the model runs.

Table 1. Preliminary model results for American Samoa simulating various scenarios: 1) no constraints on r and k priors; 2) priors are constrained with biomass incorporated as input parameters; 3) priors are constrained with no independent input for biomass. The numbers for MSY and bounds are expressed in 1000 pounds.

MUS	Round 1 - no constraints				Round 2 - biomass + constraints				Round 2 – no biomass			
	MSY	low bound	high bound	CV	MSY	low bound	high bound	CV	MSY	low bound	high bound	CV
Atule	215	7	6606	0.32	19	11	34	0.10	20	12	34	0.09
Acanthuridae	148	89	247	0.05	144	80	258	0.06	49	26	89	0.08
Carangidae	44	5	384	0.29	19	11	31	0.08	13	7	24	0.12
Carcharhinidae	9	3	25	0.24	5	3	9	0.18	1	1	2	2.88
Holocentridae	10	5	20	0.16	10	5	21	0.17	6	3	12	0.17
Lethrinidae	28	7	108	0.20	26	14	47	0.10	17	9	31	0.11
Lutjanidae	172	36	830	0.15	58	43	79	0.04	19	10	38	0.12
Mollusks	82	4	1618	0.34	15	8	26	0.11	15	9	26	0.10
Mugilidae	28	1	874	0.52	3	2	6	0.24	3	2	6	0.26
Scaridae	358	246	521	0.03	306	233	401	0.02	27	15	49	0.09
Serranidae	30	16	56	0.09	32	16	62	0.10	14	7	25	0.12
Other species	283	73	1100	0.12	154	92	257	0.05	21	12	36	0.09
Lobsters	17	1	249	0.48	4	2	7	0.24	4	2	7	0.25
Crustaceans	22	1	489	0.50	4	2	7	0.25	4	2	8	0.26

Table 2. Comparison of recent catches, established ACLs and estimated MSYs using the modified catch-MSY model in American Samoa

Family	2012 catch	ACLs	MSY
Acanthuridae-surgeonfish	6,394	19,516	144,000
Lutjanidae-snappers	2,240	18,839	58,000
S. crumenopthalmus-atule	7,314	8,396	19,000
Mollusk-turbo snails, octopus, clam	4,549	16,694	15,000
Carangidae-jacks	2,374	9,460	19,000
Lethrinidae-emperors	1,889	7,350	26,000
Scaridae-parrotfish	2,807	8,145	306,000
Serranidae-groupers	1,325	5,600	32,000

Holocentridae-squirrelfish	905	2,585	10,000
Mugilidae-mullets	1,252	2,857	3,000
Crustaceans-crabs	1,055	2,248	4,000

6. Review of the P* Dimensions and Criteria

The current form of the P* analysis is designed for a tier 1 stock with a full on stock assessment. Some of the criteria do not apply for the model being evaluated. First, the assessment criteria describe elements found in stock assessment that the current model does not have. Second, the parameters for the stock status do not apply because the model does not generate an estimate of B/B_{MSY} and F/F_{MSY}. Thirdly, averaging across a diverse range of species in the productivity and susceptibility analysis may not make any biological sense.

One working group member pointed out that these are legitimate concerns. However, if the standards for evaluation is a stock assessment then the current criteria still apply except that the resulting scores would be high therefore the end P* result would be significantly be reduced. Staff argued that the situation is complicated due to the control rule process already prescribes what needs to be done. Any other strategy would require an amendment to the FEP (e.g. not doing a P* analysis for Tier 3 stocks but rather incorporate conservative measures into the model itself). Another solution is to revise the criteria of the P* analysis to make it suitable for the modeling approaches like catch-MSY, depletion corrected average catch, and depletion-based stock reduction analysis.

7. Working group scoring session

The working group conducted a preliminary scoring exercise to gauge the applicability of the current criteria to the model being evaluated. The results are described below.

Assessment Information Dimension

Assessment Information Description	Score
Perfect. Quantitative assessment provides estimates of exploitation and B; includes MSY-derived benchmarks	0.0
Quantitative assessment provides estimates of exploitation and B; includes MSY-derived benchmarks; no spatially-explicit information	2.0
Good. Measures of exploitation or B, proxy reference points, no MSY benchmarks; some sources of mortality accounted for	4.0
Relative measures of exploitation or B, proxy reference points, absolute measures of stock unavailable	6.0
No benchmark values, but reliable catch history	8.0
Bad. No benchmark values, and scarce or unreliable catch records	10.0

The working group deemed the model approach lies between a quantitative assessment (2.0) to a good assessment (4.0). In order to properly score the dimension, the group scored the "assessment" aspect. A score of 1 indicates that aspect is not captured in the assessment. A score of 0.5 means partial capture; and a score of 0 indicates the aspect is captured in the assessment.

The inverse nature of the scores created confusion for the working group. The bottomline is the lower the score the lesser the reduction.

Assessment Aspects (AAs)	Score
Reliable catch history	0
Standardized CPUE	1
Species-specific data	1
All sources of mortality accounted for	0.5
Fishery independent survey	0
Tagging data	1
Spatial analysis	1
SUM	4.5

The score of 4.5 was transformed to a scaled equivalent of 3.3. However, the team noted that some of the family groupings did not have biomass information thus the score would be 1 for that assessment aspect bumping the total score to 5.5 resulting in a scaled equivalent of 3.6.

Uncertainty Characterization Dimension

Uncertainty Characterization Description	Score
Complete. Key determinant – uncertainty in both assessment inputs and environmental conditions included	0.0
High. Key determinant – reflects more than just uncertainty in future recruitment	2.5
Medium. Uncertainties are addressed via statistical techniques and sensitivities, but full uncertainty is not carried forward in projections	**5.0**
Low. Distributions of F_{MSY} and MSY are lacking	7.5
None. Only single point estimates; no sensitivities or uncertainty evaluations	10.0

The group scored this dimension as 5.0 since uncertainties can be adjusted by controlling for the range of r and k as well as the process error of the Schaefer Model. By process of elimination it cannot be scored as 7.5 because there is an estimate of MSY and probability distribution around that MSY.

Stock Status Dimension

The group scored this dimension as 10.0 since the stock status cannot be determined by the model. A working group member cited the guideline document that describes the precautionary rule that if the information is lacking then one assumes the score of 10.0. There should be a better guidance on this dimension since this dimension is for tier with stock assessments generating stock status information. There are ancillary information available to determine the relative status of the stock however these are not incorporated in the model not generated by the model itself. There should be a way to determine stock status using the information available.

The model generates MSY from biomass projections. This information can be used to determine whether the stock is overfished or not. Whether the stock is experiencing overfishing, effort information needs to be incorporated but it will not be built into the model itself. Based on the MSY and the distribution around it one can compare current catch. The current catch has an effort estimate associated with that catch and effort at MSY can be extrapolated. The ratio of current F and F at MSY can be used as a proxy for determining stock status.

Stock Status Description	Biomass level and Fishing level	Score
Neither overfished nor overfishing.	Stock > MSST and B_{MSY}, F < MFMT	0.0
Neither overfished nor overfishing.	Stock > MSST, F < MFMT	2.0
Neither overfished nor overfishing.	Stock ≥ MSST, F ≤ MFMT	4.0
Stock is not overfished, overfishing is occurring	Stock >MSST, F > MFMT	6.0
Stock is overfished, overfishing is not occurring	Stock <MSST, F ≤ MFMT	8.0
Stock is overfished, overfishing is occurring	Stock <MSST, F > MFMT	**10.0**

Productivity and Susceptibility Dimension

The group tentatively scored this dimension as 5.0 based on the assumption that the model currently utilized "medium" resilience to run the model. The group questioned the reliability of this dimension in terms of making any biological significance since each family groupings are made up of a diverse set of species. Of greater concern is the general groupings such as mollusk which are comprised of shellfish and octopus and more problematic is the category of "remaining 10% of the catch" which are composed of species from various families and even phyla.

Productivity and Susceptibility Description	Score
Low risk. High productivity, susceptibility low.	0.0
Low/Medium	2.5
Medium risk. Moderate productivity, and susceptibility	**5.0**
Medium/High	7.5
High risk. Low productivity, high susceptibility	10

8. Summary of scores and P* recommendations

Preliminary scores summed up to 23.3 to 23.6. Applying the reduction to the 50% risk of overfishing, results showed massive reduction in the risk of overfishing to P*=26.7% to 26.4%. The conclusion was more work needs to be done in refining the results and the P* analysis. The current form of the P* criteria does not allow for an unbiased scoring of the model since it was designed for an assessment. The following recommendations were made by the working group:

1. Refine the model by utilizing appropriate resilience (very low to very high) for each family groups instead of a default value of medium;
2. Refine the P* criteria under each dimension to suit the Tier 3 models;
3. Utilize additional information to estimate stock status and revise the Stock Status Dimension accordingly;
4. Score the Productivity-Susceptibility Dimension focusing on species that dominates the catch and where such information is available;
5. Prepare the risk tables for each family groups based on the probability distribution around the MSY estimate by the next meeting
6. Include in the technical report estimates of fishing effort to determine relative measure of fishing pressure to inform the stock status dimension;
7. Next meeting was set June 12, 2013 at 1:00 pm (HST)

References

Garcia, S. P. Sparre & J. Csirke. 1989. Estimating Surplus Production and Maximum Sustainable Yield from Biomass Data when Catch and Effort Time Series are not Available. Fisheries Research 8 13-23.

MacCall, A. D. 2009. Depletion-corrected average catch: a simple formula for estimating sustainable yields in data poor situations. – ICES Journal of Marine Science, 66: 2267–2271.

Dick, E.J. & A,D. MacCall. 2011. Depletion-Based Stock Reduction Analysis: A catch-based method for determining sustainable yields for data-poor fish stocks. Fisheries Research 110, 331-341.

Martell, S, & R. Froese. 2012. A simple method for estimating MSY from catch and resilience. Fish and Fisheries DOI: 10.1111/j.1467-2979.2012.00485.x