WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

Final Report of the P* and SEEM Working Groups: Deliberations for the Main Hawaiian Island Deep 7 Bottomfish Complex ACL

151st Council Meeting
Honolulu, HI

The Council, at its 150th Council meeting, recommended the creation of the P* Working Group and SEEM Working Group (WG) to address the ACL determination for the Main Hawaiian Island Deep 7 Bottomfish stock complex. The P* Working Group was to develop a methodology to determine Council's acceptable risk of overfishing, or P*, to use in the ABC determination, and the SEEM Working Group was to develop a methodology for quantifying social, economic, ecological, and management uncertainty factors for the ACL specification. Both groups met twice since the 150th Council meeting and successfully responded to the Council's request.

Determination of the Risk of Overfishing, P*

The P* WG utilized the dimensions presented previously in the amendment document:

1. Assessment information,
2. Assessment uncertainty,
3. Stock status, and
4. Productivity and susceptibility.

The WG developed a scoring system as well as established the categories within each dimension. The P* WG chose to use scores for each dimension as high as 10, such that the dimensions added up to a maximum of 40. The summed score is subtracted from the P^*_{MAX} of 50% OFL, or a maximum of 50% risk of overfishing, to determine the P*. The justification was that the group thought the results of its deliberations should never result in a P* of zero, or no fishing, thus the lowest P* is equivalent to a 10% risk of overfishing.

For the first dimension, the P* WG created 6 levels starting from perfect assessment information in which the quantitative assessment provides estimates of exploitation and biomass, to poor assessment information for which there are no benchmark values and scarce or unreliable catch records (Table 1). The P* WG scored various assessment aspects (Table 1b) which were then summed and scaled to fit within a scale of 0-2 (between the first two levels of the dimension). The resulting score was 1.3.

Table 1a. Dimension 1: Assessment Information

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
Poor. No benchmark values, and scarce or unreliable catch records	10.0

Table 1b. Assessment aspects used in determining the score for the first dimension

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

(1 = not captured in the stock assessment, 0 = captured in the stock assessment)

The second dimension that addresses characterization of uncertainty had five levels ranging from complete uncertainty characterization to no uncertainty characterization (Table 2). The P* WG determined that the MHI Deep 7 stock assessment was well characterized, thus attributed a score of 0 to the uncertainty characterization description.

Table 2. Dimension 2: Uncertainty Characterization

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 Fmsy and MSY are lacking	7.5
None. Only single point estimates; no sensitivities or uncertainty evaluations	10.0

The third dimension assesses the stock status by looking at biomass and fishing levels compared to reference points, including minimum stock size threshold (MSST), biomass at MSY (BMSY), fishing mortality (F), and maximum fishing mortality threshold (MFMT) (Table 3). The table of Biomass against Fishing Mortality (Table 4) was developed to create more reflective scores for the available scenarios of biomass level and fishing mortality level.

Table 3. Dimension 3: 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

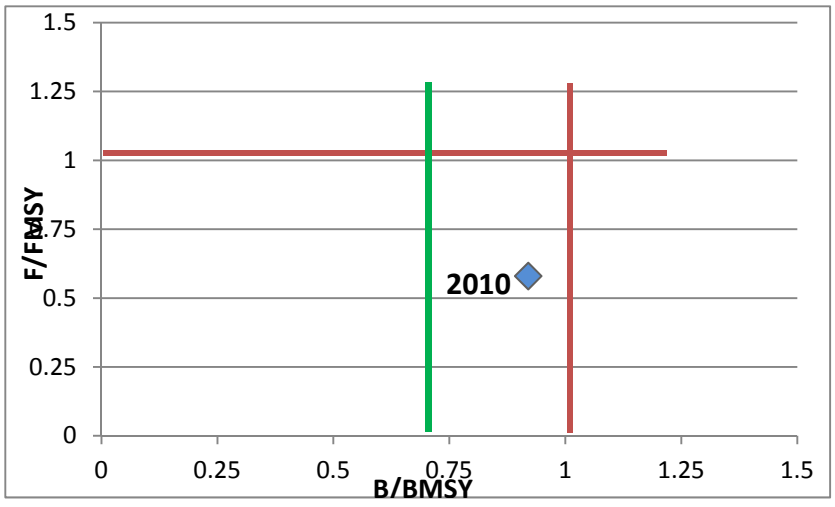
Table 4. Scores associated with different levels of biomass and fishing mortality.

		Biomass			
		Above B_{MSY}	Above MSST	Near* MSST	Below MSST
Fishing Mortality	Below MFMT	0	2.0	5.0	8.0
	Near* MFMT	1.0	3.0	6.0	9.0
	Above MFMT	2.0	4.0	7.0	10.0

*The definition of "near" for the purposes of the working group was "equal to or on the good side of," thus "near" for F/MFMT is equal to 1.0 or less, and "near" for B/MSST is 0.7 and above.

The P* Working Group discussed that, because the MHI Deep 7 Bottomfish stock complex has a B/B_{MSY} of 0.92 and F/ MFMT of 0.58, the stock is neither overfished nor is overfishing occurring, and it is well beyond its overfishing benchmark (Figure 1). However, the Stock Status score was raised from 2 to **3** because of concern about the stock assessment being conducted on a stock complex as opposed to individual stocks.

Figure 1. B/B_{MSY} to F/F_{MSY} plot for 2010 stock status.



The fourth dimension assesses the stock or stock complex's biological productivity and susceptibility to fishing. The P* WG defined 5 levels within the dimension (**Table 5**). The P* Working Group sought outside input from individuals with more expertise in bottomfish biology and ecology, namely Dr. Robert Humphreys and Dr. Robert Moffitt. The P* WG accepted the average of their scores to define the productivity and susceptibility for each fish within the MHI Deep 7 bottomfish complex (**Table 6**). This resulted in an overall score for this dimension of 4.9.

Table 5. Dimension 4: Productivity and Susceptibility

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

Productivity and Susceptibility were scored separately based on the scoring system below, and then the overall average is used as the final score for this dimension. Biological productivity was scored 0 if the fish has high productivity because its productivity directly impacts its ability to recover from any sort of depletion event, thus a fish with high productivity should impact the acceptable biological catch (ABC) less than a fish with low productivity. The more susceptible a fish is to fishing, i.e. the ease with which it's caught, the higher its susceptibility score, which will result in a greater impact on the ABC.

Productivity	Score
High	0
High/medium	2.5
Medium	5
Medium/low	7.5
Low	10

Susceptibility	Score
High	10
High/medium	7.5
Medium	5
Medium/low	2.5
Low	0

Table 6. Averages of biological productivity and susceptibility to fishing for each of the MHI Deep 7 bottomfish species from expert opinion

Species	Productivity	Susceptibility	Total	Average
Opakapaka	5	6.25	11.25	5.625
Onaga	5	5	10	5
Ehu	2.5	7.5	10	5
Hapuupuu	5	8.75	13.75	6.875
Gindai	3.75	5	8.75	4.375
Kalekale	2.5	3.75	6.25	3.125
Lehi	5	3.75	8.75	4.375
			Overall Average =	4.9

The final P* is the sum of the four dimensions subtracted from the P^*_{MAX} of 50 (or 50% OFL).

Dimension	Score
Assessment Information	1.3
Uncertainty Characterization	0
Stock Status	3
Productivity and Susceptibility	4.9
Final Score	**9.2**

The final P* is 40.8 (50-9.2), which corresponds to an ABC of 345,522 lbs.

Determination of the SEEM Score

The social, economic, ecological, and management uncertainty (SEEM) analysis is used to reduce the ACL from the ABC, as well as determine the reduction to ACT if one is required. The analysis consists of four dimensions (social, ecological, economic, and management uncertainty) with factors that are ranked. The SEEM Working Group (WG) first considered factors that could be used in the four dimensions. Many of the considered factors were then consolidated with strawman factors to create overarching, applicable factor statements. Others, if viewed irrelevant to affecting the ACL, were dropped from consideration.

For the social dimension, many factors were considered that included food source, food security, preservation of a way of life, and historical dependence. The SEEM WG determined that the relevant factors for the social dimension included:

1. Perpetuates cultural and traditional values,
2. Provides symbolically-valued and culturally-important fish,
3. Bottomfishing is a unique, highly-skilled occupation that is waning and should be maintained, and
4. Contributes to Hawaii's food security.

The group felt it was important to capture the cultural and traditional values and practices associated with bottomfish in Hawaii. It was also important to emphasize that bottomfish fishing is very difficult and requires many years of experience to be successful. Additionally, fewer individuals are learning this occupation.

Many factors were considered for the economic dimension, including markets for the fishery, capitalization, price for fish, and tourism. The factors selected by the SEEM WG for scoring included:

1. There is economic reliance of other industries on the fishery,
2. Financial security of the fishery and its participants is readily compromised by Management decisions, and
3. Provides a unique product.

There was much discussion about the impacts of bottomfishing on other industries and multiplier effects. Bottomfish from Hawaii are a unique product that are never frozen, have a low carbon footprint (not flown in and fishing grounds are close to landing sites), and are a signature fish in regional cuisine. Lastly, the financial security of the fishery as well as its participants is readily compromised by management decisions, whether that be decisions for closed areas, TACs, or

other measures that restrict the fishery. However, focus was drawn away from overall importance to the local economy because it was pointed out that all fishing in Hawaii contributes relatively little to the local economy. Also, while the group discussed including capitalization as a factor within the economic dimension, it was best suited for discussion purposes. Capitalization is not an issue in the MHI Deep 7 bottomfish fishery as in other regions. Thus it would be unfair to consider capitalization an important topic in the determination of the ACL. Lastly, carbon footprint was included under "unique product" because although it was initially discussed for inclusion as a stand-alone factor, it would be better used as a marketing tool than a factor upon which to base an ACL.

Many factors were considered for the ecological dimension, including key indicator species, depth range overlaps of bottomfish species, impacts of the fishery, impacts of population booms of particular species, and the loss of a fish species due to kahala. The factors that were ultimately selected for use in scoring were:

1. Uncertainty of ecosystem dynamics, and
2. Shift of fishing pressure onto species outside Deep 7 upon closure of Deep 7 fishery.

The group chose to lump many considered factors into uncertainty of ecosystem dynamics, capturing the fact we do not know what happens with a reduction on one or more species within the bottomfish complex. Similarly, it is unknown if there are distinct niches that one or more of the species fill or if any are indicators of ecosystem function. It was determined that CPUE and catchability being influenced by weather was more appropriate for the management uncertainty dimension.

The last dimension is management uncertainty. The WG brainstormed factors such as quantification of catch, high-grading issues, complicated reporting, and risk of exceeding the limit. However, the group determined that many of the items could be encompassed in 5 major overarching factors:

1. Unreported recreational landings,
2. Commercial catch reporting, including misreporting,
3. Weather influences ability to fish and productivity of fishing,
4. Monitoring, including ability to forecast, and
5. Recreational discard mortality associated with high-grading.

The group concluded that monitoring and reporting should be considered separately, and that recreational and commercial reporting should be divided to avoid the "double barrel" problem where one item should receive one score, but another item should receive a lower or higher score. In this case, the group felt that commercial data is significantly better and greater than recreational data (there is no mandatory recreational reporting, only catch estimates from surveys). There were also concerns voiced about discard mortality associated with recreational fishing – if one can only catch five fish, the goal may be to catch the biggest fish. Lastly, the group decided weather should be included in management uncertainty. If the weather is calm and the fishermen are close to reaching the limit, then arguably they will reach it faster and perhaps faster than current monitoring accounting. On the other hand, if weather is bad and the closure date is set, the fishery may not come close to the predicted target. There were suggestions during this conversation to make the information about the various fishermen more

precise, which included more questions on the bottomfish fishing vessel registration pertaining to the type and frequency of fishing that will be taking place. Currently, there are no details about primary fishing activity captured on the registration.

The group created a scoring system that is currently based on a -2 to 2 scale. First, the individuals within the group selected scores for each factor within the dimensions. Next, the scores were summed for each dimension. The average of the group was then calculated for each dimension. Upon assessing the results, all had selected primarily positive scores for the social, economic, and ecological dimensions, and primarily negative scores for the management uncertainty dimension. The end result was a net positive score, which would mean the ACL would be greater than the ABC recommended by the Council. As a result, the group decided to utilize the first three dimensions as justification for maintaining the ACL equal to ABC, and then utilizing the management uncertainty to reduce the limit to the ACT. The group concluded that using an ACT would buffer against the risk of exceeding the ACL, thus removing the need for the fishery to pay back any overages or for the system to be revised. Past experience shows that the fishery typically goes over their TAC, but by only a small percentage. Penalizing the fishermen because the system is unable to work perfectly is inequitable. Below are the tables used for scoring, as well as a table with averages.

SOCIAL DIMENSION

Selected Factors	**Score**				
Perpetuates cultural and traditional values	-2	-1	0	1	2
Provides symbolically-valued and culturally-important fish	-2	-1	0	1	2
Bottomfish fishing is a unique, highly-skilled occupation that is waning and should be maintained	-2	-1	0	1	2
Contributes to Hawaii's food security	-2	-1	0	1	2

ECONOMIC DIMENSION

Selected Factors	**Score**				
There is economic reliance of other industries on the fishery (multiplier effect)	-2	-1	0	1	2
Financial security of the fishery and its participants is readily compromised by management decisions	-2	-1	0	1	2
Provides a unique product (never frozen, fresh, low carbon footprint, signature fish in regional cuisine)	-2	-1	0	1	2

ECOLOGICAL DIMENSION

Selected Factors	**Score**				
Uncertainty of ecosystem dynamics	-2	-1	0	1	2
Shift of fishing pressure onto species outside Deep 7 upon closure of Deep 7 fishery	-2	-1	0	1	2

MANAGEMENT UNCERTAINTY DIMENSION

Selected Factors	Score				
Unreported recreational landings	-2	-1	0	1	2
Commercial catch reporting, including misreporting	-2	-1	0	1	2
Weather influences ability to fish and productivity of fishing	-2	-1	0	1	2
Monitoring, including ability to forecast	-2	-1	0	1	2
Recreational discard mortality associated with high-grading	-2	-1	0	1	2

TABLE of AVERAGES

Dimension	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6	Person 7	Person 8	Person 9	Person 10	Ave-rage
Social	5	7	6	5	6	7	5	2	6	7	5.6
Economic	6	5	6	5	6	6	4	1	5	5	4.9
Ecological	-1	-1	2	-1	0	1	0	2	0	-1	0.1
Management Uncertainty	-7	-5	-5	-7	-5	-10	-6	-3	-8	-4	-6

Based on the tables above, the SEEM WG determined that the ACL should be equal to the ABC, but the ACT should be reduced from the ACL by 6% to account for management uncertainty. The working group is comprised of 12 individuals, which includes Council staff. Council staff did not participate in the scoring exercise, thus the average represents the input from the commercial bottomfish fishery, State of Hawaii, and representatives with social, economic, and biological expertise.

The results of this working group are captured by the following statement:

> There was a consensus in the SEEM Working group that, for the Main Hawaiian Islands bottomfish Deep 7 fishery, the annual catch limit (ACL) be set equal to the acceptable biological catch (ABC), and that the score of 6% from the management uncertainty dimension be used to set the annual catch target (ACT) as a reduction from the ACL. The social, economic, and ecological dimensions demonstrate the importance of the Deep 7 bottomfish fishery to the State of Hawaii.

Conclusions for the MHI Deep 7 Bottomfish Fishery

Based on the analyses by the P* WG, the P* WG determined that the P* should be 40.8, which corresponds to an ABC of 345,522 lbs. The SEEM WG analyses resulted in the consensus statement that the ABC should equal ACL, and an ACT should be used that is 6% less than the ACL, which equals 324,790 lbs.