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Re-specifying Annual Catch Limits for the Coral Reef Species of Concern in the Western Pacific Region

160th Meeting of the Western Pacific Regional Fishery Management Council
June 25-27, 2014

The Council's Task

At the 160th Meeting of the Western Pacific Regional Fishery Management Council (Council), Council members are tasked to re-specify the Annual Catch Limits (ACLs) for the coral reef species of concern. The initial specification completed in 2012, was only for one year. The succeeding ACL specifications were roll over of the 2012 ACL because there is no new information available to adjust the ABC and ACL. There is no catch time series available for humphead wrasse, bumphead parrotfish, and reef sharks. The initial ABC specification was based on an ad hoc method not described in the FEP using 5% of expanded biomass. The Council then set the ACL equal to ABC

ACL will need to be re-specified for the 2015 fishing year and may consider a multi-year specification similar to the coral reef management unit species. There is still no new information to change the ABC for humphead wrasse and bumphead parrotfish. The SSC considered setting the ABC using the Biomass-Augmented Catch-MSY approach (Sabater and Kleiber 2014). MSY values of 12,400 lbs, 2,900 lbs, and 2,300 were generated for the reef sharks in Hawaii, Guam, and American Samoa, respectively. The P* analysis determined the appropriate risk of overfishing for reef sharks to be at 35% for Hawaii and American Samoa and 30% for Guam rounding to the nearest 5% since the risk tables are in 5% increment. The ABCs were set at the corresponding catch level associated with these risks are 9,800 lbs, 1,700 lbs, 2,000 lbs for Hawaii, American Samoa and Guam, respectively. CNMI will continue to use the 2012 ACL due to absence of catch time series and the model-based approach cannot be used to estimate MSY for CNMI reef sharks.

The three options that the Council will consider in specifying the ABC for fishing year 2015-2018 include:
Option 1 – No Action – Maintain the ACL at 2012 specification level
Option 2 – Set the ACL equal to the new ABC
Option 3 – Set the ACL less than the new ABC from the SEEM analysis

It is projected that there will be no significant new information that would be available for the coral reef species of concern in the next 4 years hence for a multiyear ABC and ACL specification can be considered for fishing year 2015-2018.

Current catch information

Bumphead parrotfish and humphead wrasse does not exist in Hawaii. There were no catches of bumphead parrotfish in the Territories. Humphead wrasse catch was recorded in Guam at 319 lbs

out of an ACL of 1,960 lbs. There were no catch record of humphead wrasse in American Samoa and CNMI. Reef shark catches were recorded in Guam and Hawaii at 12 lbs and 2,512 lbs, respectively.

SSC's ABC determination

MSY was estimated for the reef sharks using the catch-MSY approach originally developed by Martell and Froese (2012) where it implemented a Monte-Carlo simulation to generate a biomass project using a range value of rate of population increase, *r*, and carrying capacity, *k*, minus the catch at any step in the time series. This approach was augmented by adding biomass information as one of the priors (Sabater and Kleiber 2014). The augmented approach is useful if there is a biomass estimate. In the absence of the biomass estimate, the model defaults to running the original routine as described by Martell and Froese (2014). Biomass values used for the analysis were from Williams 2010. The model approach was not used for CNMI because CNMI does not have a catch time series for sharks, hence the ABC for CNMI will remain the same in absence of no new information.

The following MSYs were generated for Hawaii, American Samoa, and Guam

Jurisdiction	MSY	sigma	mode	5%	95%
Hawaii	12,400	600	12,500	4,300	34,700
Guam	2,900	700	2,900	1,000	8,900
CNMI	No catch time series to run the model				
American Samoa	2,300	900	2,400	600	9,600

At the 115th SSC Meeting and the 159th Council Meeting, the SSC and Council, respectively, heard the presentation on the final results of the P* Analysis conducted by the P* Working Group. This analysis covered the first two dimensions of the P* analysis with a total of 8 point deduction to the 50% risk of exceeding MSY. In order to specify the ABC, the SSC must deliberate the score for the stock status using the following rules:

Description	Fishing level	Score
Lightly harvested	Catch << 1/3MSY	0.0
Moderately harvested	Catch < MSY	2.5
Fully harvested	Catch ≈ MSY	5.0
Over harvested	Catch > MSY	7.5
Severely Over harvested	Catch > 2x+MSY	10.0

Once applied, the following scores were derived:

Area	MSY	ACL	ave 3 yrs	1/3 MSY	2/3 MSY	2x MSY	3x MSY	0	2.5	5	7.5	10
Hawaii	12,400	111,566	2,467	4,133	8,267	24,800	37,200	0	F	F	F	F
Guam	2,900	6,942	1,062	967	1,933	5,800	8,700	F	2.5	F	F	F
American Samoa	2300	1309	33	767	1,533	4,600	6,900	0	F	F	F	F
CNMI												

Stock Status scores for reef sharks in Hawaii = 0
Stock Status scores for reef sharks in American Samoa = 0
Stock Status scores for reef sharks in Guam = 2.5

Regarding the productivity-susceptibility dimension, scores are given at 2.5 point reduction increment. A productivity score of 0 point reduction is given to stocks that are highly productive, 5 point reduction for medium productivity, and a score of 10 point reduction for low productivity stocks. For susceptibility, a score of 0 point reduction for stock that are not vulnerable or has high resilience, 5 point reduction for mid-level vulnerability, and a 10 point reduction score for species that are highly susceptible to overfishing or getting overfished. The PSAs are mostly based on the life history characteristics and the type of fishery the species are harvest.

The species in the reef shark complex pertains to the white tip, black tip, gray reef, and some minor shark species that intermittently show up in the catch records. Typically, reef sharks are considered slow growing. A study by Jack Randall published in Pacific Science[1] showed the white tip shark grows on average 4 cm per year for males and 2.3 cm for females based on tagging studies. Reef sharks are also live bearing animals that produce 4-5 offspring per birth. Of the 13 pregnant specimen gathered, each female had 1-5 embryo on average. Given this life history trait, productivity score can be a low productivity earning a **reduction score of 10**.

Ecological underwater surveys of CRED also showed that reef sharks are less abundant in areas near the population centers[2]. This could be due to interaction of the sharks life history traits with the impacts occurring in the areas near population centers. It is well known that sharks are vulnerable to fishing impact through direct removal and may have an effect on ecosystem functions[3]. Some also assert that reef sharks are headed to ecological extinction[4]. However, commercial reef shark fisheries do not exist in the Western Pacific region. Very small amount of catch have been recorded. For years, the Marianas fishermen were also complaining about the high rate of shark depredation on their catches. In addition, local laws have been established to

[1] Randall J.E. 1977. Contribution to the biology of the white tip reef shark (*Trienodon obesus*). Pacific Science 31(2): 143-164.
[2] Nadon, M. O., Baum, J. K., Williams, I. D., McPherson, J. M., Zgliczynski, B. J., Richards, B. L., ... & Brainard, R. E. (2012). Re-Creating Missing Population Baselines for Pacific Reef Sharks. Conservation Biology, 26(3), 493-503.
[3] Stevens, J. D., Bonfil, R., Dulvy, N. K., & Walker, P. A. (2000). The effects of fishing on sharks, rays, and chimaeras (chondrichthyans), and the implications for marine ecosystems. ICES Journal of Marine Science: Journal du Conseil, 57(3), 476-494.
[4] Robbins, W. D., Hisano, M., Connolly, S. R., & Choat, J. H. (2006). Ongoing collapse of coral-reef shark populations. Current Biology, 16(23), 2314-2319.

ban landing of sharks. Considering all these factors, the susceptibility score can be placed at medium with a **reduction score of 5**.

This would result in the following scores for the spiny lobster in the PSA dimension:

PSA scores for reef sharks in Hawaii = 7.5
PSA scores for reef sharks in American Samoa = 7.5
PSA scores for reef sharks in Guam = 7.5

Summing all the dimension scores results in the following P* values:

	Scientific Information	Uncertainty Characterization	Stock Status	PSA	Summ scores	P*
Hawaii	3	5	0	7.5	15.5	34.5 ≈ 35
American Samoa	3	5	0	7.5	15.5	34.5 ≈ 35
Guam	3	5	2.5	7.5	18	32 ≈ 30
CNMI						

The risk tables generated by the Catch-MSY approach shows the catch level associated with the respective risk levels corresponding to the ABC:

	P*	ABC (lbs)
Hawaii	34.5 ≈ 35	9,800
American Samoa	34.5 ≈ 35	1,700
Guam	32 ≈ 30	2,000
CNMI		

Summary of options

The table below shows the summary of options for the Council:

Management Unit Species	Most recent catch (2013) (lbs)	Option 1: Status quo/Roll over (lbs)	Option 2: ACL = $ABC_{updated}$	Option 3: ACL < ABC (by 5%)
Bumphead parrotfish				
• Hawaii	N/A	N/A	N/A	N/A
• American Samoa	0	235	235 (no new info)	223
• CNMI	0	797 (GU&CNMI)	797 (GU&CNMI)	757
• Guam	0			
Humphead wrasse				
• Hawaii	N/A	N/A	N/A	N/A
• American Samoa	0	1,743	1,743 (no new info)	1,637

• CNMI	0	2,009	2,009 (no new info)	1,909
• Guam	319	1,960	1,960 (no new info)	1,862
Reef sharks				
• Hawaii	2,512	111,566	9,800	9,310
• American Samoa	0	1,309	1,700	1,615
• CNMI	0	5,600	5,600 (no catch data)	5,320
• Guam	12	6,942	2,000	1,900

Pros and Cons for the Council ACL Setting Options

Option 1: Maintain status quo and roll over the 2014 ACLs to fishing year 2015-1018

PROS	CONS
• Environmental and socioeconomic analysis has already been done but may need to be updated with more current numbers	• The specification is still based on an ad-hoc approach using percentage of biomass
• Minimizes administrative burden on respecifying numbers especially for changes that are insignificant	• The ACL for Hawaii is too high brought about by the high archipelagic scale biomass used in the initial specification
• Minimizes public confusion on the new ACLs	
• Remains precautionary due to the low numbers and promotes conservation at the same time	
• Only reef sharks for the three areas had new information	
• None of the ACL had been exceeded to date	

Option 2: Set ACLs equal to the ABCs for fishing year 2015-2018

PROS	CONS
• Complies with National Standard 2 in using the best scientific information available	• There is no buffer between ACLs and ABCs hence following the accountability measure recommended at the 159th CM (AM will be triggered if the average catch exceeded the ABC)
• Incorporates other information than catch only data	
• Increases the ACL from the previous specification with analysis specific for the stock	
• P* analysis was conducted based on information from the dominant species in	

the complex	
• Risk tables generated are from information specific to the stock	
• Would minimize triggering the accountability measures	
• Although for Hawaii and Guam, there was a reduction from the previous ACL, the ACL is high enough that the recent catch does not exceed the ACL	

Option 3: Set ACLs less than the ABCs by 5% from existing SEEM analysis for fishing year 2015-2018

PROS	CONS
• Complies with National Standard 2 in using the best scientific information available	• The ACL will be reduced by 5%
• Applied the process specified in the FEP using the SEEM process	• The existing SEEM analysis was specific to coral reef fisheries and may not be applicable to reef sharks because there is no fishery targeting reef sharks
• ACLs for American Samoa reef sharks will still be higher than status quo even with the reduction by 5%	
• More precautionary and increases the buffer between ABC and ACL	
• May not trigger accountability measure if ACL is exceeded as long as it is below the ABC as per recommendation at the 159th CM	