Review of 2014 SEDAR 31 Gulf of Mexico Red Snapper Update Assessment

Gulf of Mexico Standing and Special Reef Fish SSC

SEDAR41-RD78

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Gulf of Mexico Fishery Management Council
Standing and Special Reef Fish SSC
Review of 2014 SEDAR 31 Update Assessment
Tampa, Florida
January 6-8, 2015

The meeting of the Standing and Special Reef Fish SSC was held January 6-8, 2015.

2014 SEDAR 31 Red Snapper Update Assessment

Dr. Shannon Cass-Calay presented a NMFS update to the SEDAR 31 red snapper benchmark assessment. The written assessment report was not yet available for review. However, given that this is an update and the methods used were the same as SEDAR 31, except for instances when the assessment team was responding to specific terms of reference from the Council, the Science center staff felt that the PowerPoint presentation to the SSC should suffice for the SSC meeting. The assessment input and output files were provided on the Council's file server in case anyone was interested in the technical specifications.

The SEDAR 31 Stock Synthesis 3 base model plus two alternative models using a low natural mortality rate (M) and a high M were used with landings data updated through 2013. The recreational MRIP landings were adjusted using methods from the September 2014 MRIP Calibration workshop, where possible. A review of the MRIP Calibration workshop results was included in the October 2014 SSC meeting report. In addition, a selectivity block (2011-2013) was used on all recreational fleets to accommodate recent changes in fishing behavior that indicates a shift in in selectivity to older (heavier) fish in recent years. The results of the MRIP adjustments on retained landings and on discards are shown below in Figures 1a and b and 2a and b. The east and west portions of the stock were modeled separately.

The revised recreational landings are generally 10% to 20% higher than in SEDAR 31. However, the revised discards show proportionately higher rates than in SEDAR 31. After investigating the reason for this, the NMFS Science Center staff stated that at least part of this was due to an MRIP adjustment to account for landings made outside of peak fishing hours. MRIP made this adjustment by calculating a ratio of total catches to catches made in peak periods. However, these ratios were calculated separately for type A, B1, and B2 catches, resulting in different adjustments for each type of catch.

Figure 1a and 1b. Effect of Rescaling MRIP Estimates - Landings

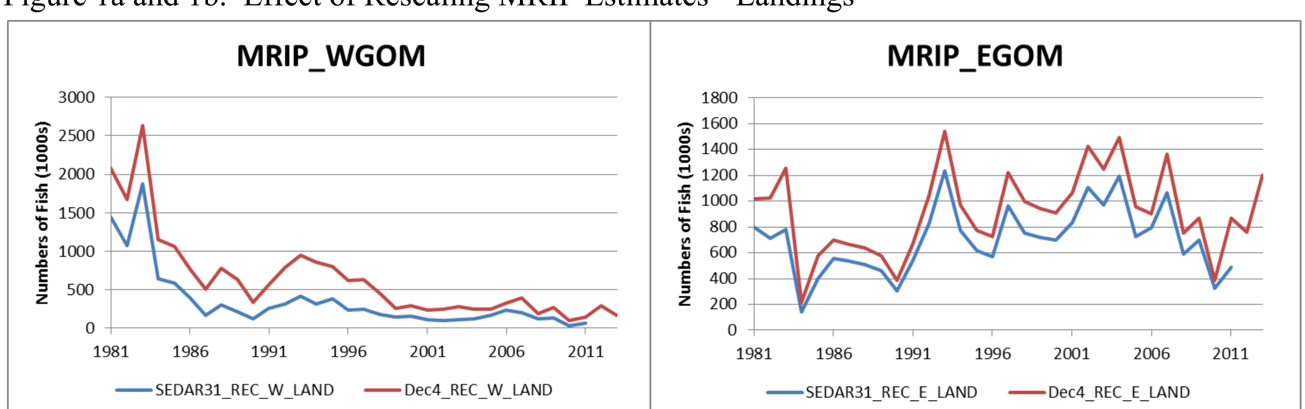
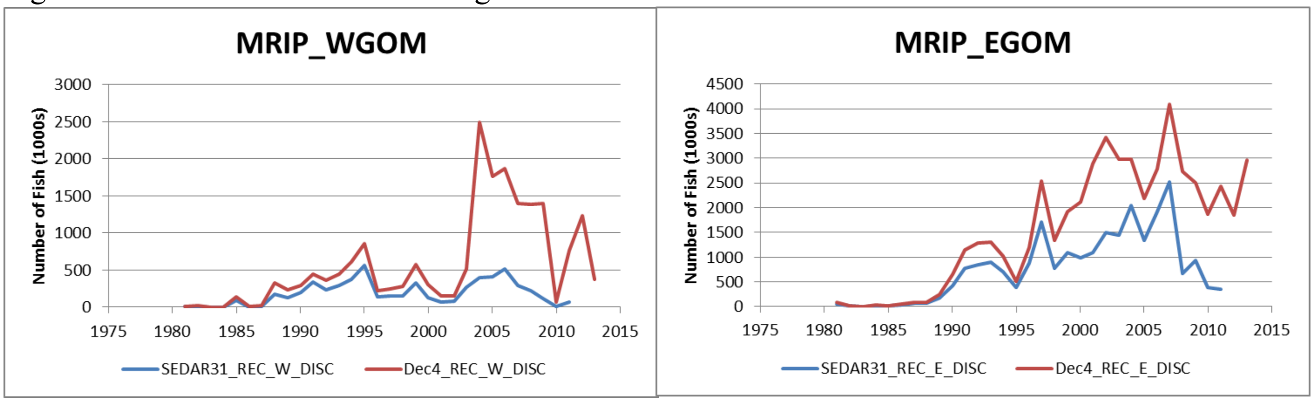


Figure 2a and 2b. Effect of Rescaling MRIP Estimates - Discards



The results of the assessment indicated that stock biomass estimates are continuing to increase in both the east and west, but remain below the management target of 26% SPR (Figure 3). Stock biomass estimates in the east show a slight downtrend in the most recent years, which results from strong year-classes exiting the stock, as well as recent low recruitment estimates.

The combined east and west stock biomass estimates, while increasing, remain below the minimum stock size threshold (Figure 4a), indicating that the stock remains in an overfished condition. However, estimated fishing mortality remains below the maximum fishing mortality threshold (Figure 4b), indicating that overfishing is not occurring.

Figure 3. Estimated red snapper spawning biomass levels relative to management target. Area 1 (red) is west Gulf, and Area 2 (blue) is east Gulf. The management target line indicates a Gulf-wide spawning potential ratio of 26%.

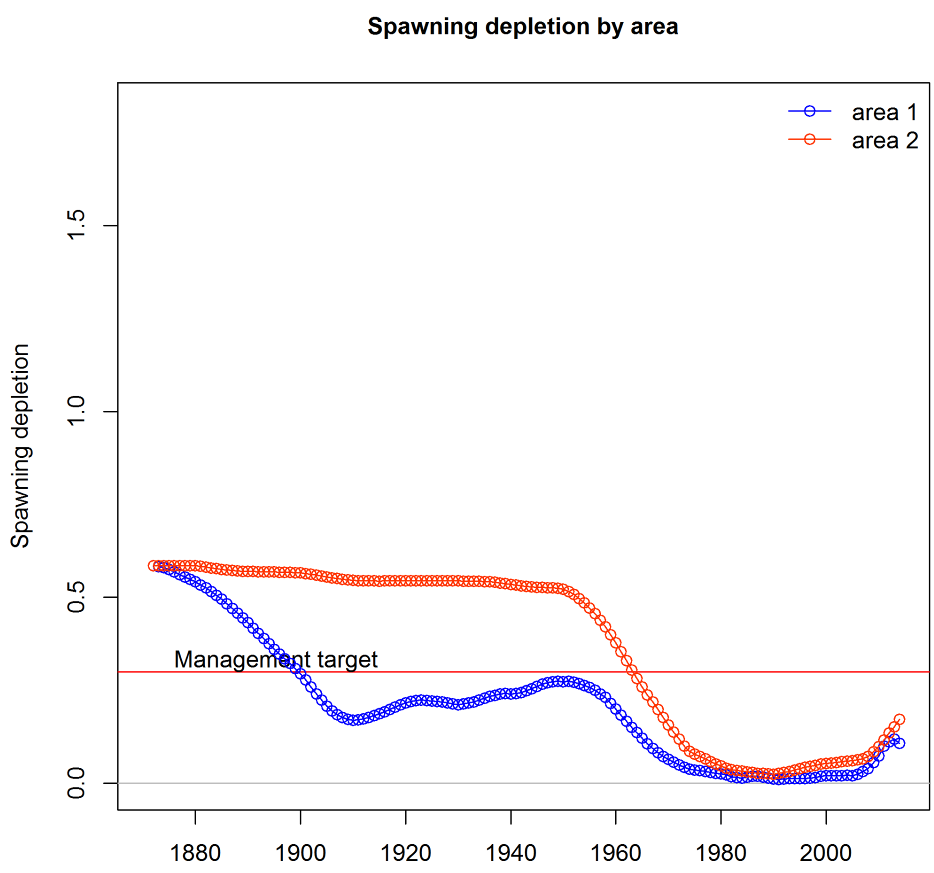
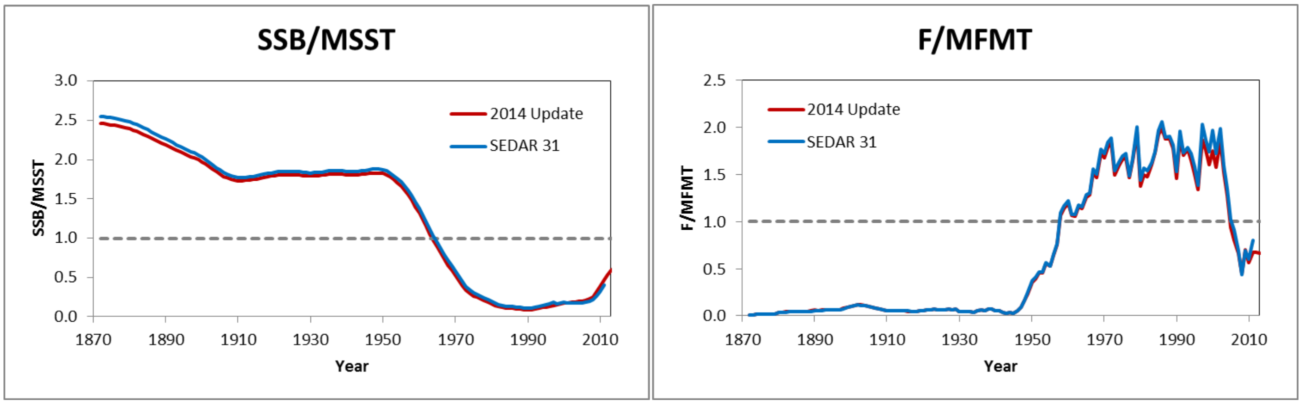


Figure 4a and b. Estimated spawning stock biomass and fishing mortality rate relative to status determination criteria thresholds.

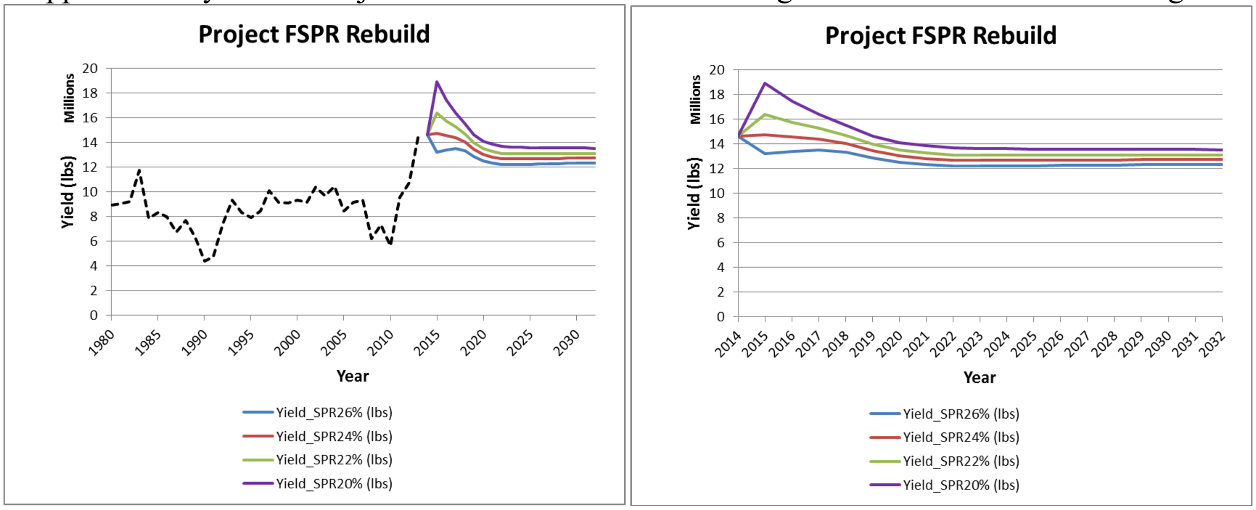


Based on the assessment presentation plus additional sensitivity runs requested by the SSC, the following motion was passed.

> **The SSC moves that the red snapper update base assessment model is the best scientific information available and is acceptable for management purposes. The stock is estimated to remain overfished, but is not undergoing overfishing.**
>
> **Motion passed 14-0, with one abstention.**

Projections for future landings were made under several alternative levels of fishing mortality, and assuming average recent recruitment levels. The projections for rebuilding yields show a decline to equilibrium levels over time as a result of strong year classes exiting the fishery combined with recent poor recruitment in the eastern Gulf (Figure 5a and b). For lower SPR target levels, greater yield could be taken in the near term under the assumption of rebuilding stock biomass to a given SPR target by 2032. However, the SSC received input from Dr. Roy Crabtree that rebuilding timelines would likely change under different SPR targets given that the Magnuson-Stevens Fishery Conservation and Management Act and the National Standard guidelines require that rebuilding must be accomplished in ten years if possible, or if the stock cannot be rebuilt in ten years or less, one generation time plus the time to rebuild in the absence of fishing mortality.

Figure 5a and b. Historical red snapper yields (Figure 5a) and projected yields to rebuild the red snapper stock by 2032. Projections assume that 2014 landings are the same as 2013 landings.



The SSC reviewed several yields when fishing a different F_{MSY} proxies (Table 1). The proxy specified in the red snapper rebuilding plan is $F_{SPR26\%}$. The yields at other proxies were calculated by NMFS at the request of the Council in order to facilitate a discussion of alternative MSY reference points. That discussion is included later in this report. For purposes of setting the OFL, the current proxy specified in the rebuilding plan was used.

Table 1. Red snapper annual yields for OFL in millions of pounds whole weight when projected for various F_{MSY} proxies.

Projected Yield at FSPR (millions of lbs)
(Note: Does not achieve rebuild target by 2032)

YEAR	FSPR 26%	FSPR 24%	FSPR 22%	FMAX (SPR20%)	SEDAR 31 (FSPR 26%)
2015	14.73	16.03	17.42	18.94	12.52
2016	14.56	15.50	16.46	17.44	11.25
2017	14.40	15.08	15.75	16.41	10.88
2018	14.02	14.54	15.03	15.49	10.92
2019	13.44	13.86	14.26	14.63	10.94
2020	13.03	13.42	13.78	14.11	11.10
Equil.	**12.87**	**13.13**	**13.37**	**13.57**	**11.69**

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The SSC thought that projections beyond three years are highly uncertain, and therefore established OFL for three years. The red snapper assessment should be updated no later than 2017 in order to establish OFL for subsequent years.

The SSC recommends that the OFL (Fmsy proxy = $F_{SPR26\%}$) for red snapper be set at:
2015 - 14.73 mp ww
2016 - 14.56 mp ww
2017 - 14.40 mp ww

Motion passed unanimously.

The SSC noted that although fishing at the F_{MSY} proxy is projected to result in the target stock level, being achieved, it will not do so within the time constraint of rebuilding by 2032. In order to rebuild by 2032, the yield stream shown in Table 2 is the maximum at which the stock could be fished.

Table 2. Red snapper annual yields to rebuild the stock by 2032 in millions of pounds whole weight when projected for various F_{MSY} proxies.

Projected Yield at FSPR REBUILD (millions of lbs) (Note: Achieves rebuild target by 2032)

YEAR	FSPR 26%	FSPR 24%	FSPR 22%	FMAX (SPR20%)	SEDAR 31 (FSPR 26%)
2015	13.22	14.71	16.38	18.21	11.44
2016	13.40	14.55	15.74	16.98	10.45
2017	13.51	14.39	15.26	16.10	10.20
2018	13.33	14.01	14.67	15.28	10.29
2019	12.87	13.43	13.97	14.46	10.35
2020	12.51	13.03	13.51	13.96	10.53

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To calculate ABC yields, the SSC used a probability distribution function (PDF) on OFL from the base model and a P* of 0.427. These are the parameters used in SEDAR 31 for setting ABC. However, when applied to the OFL yields, the resulting ABCs exceeded the rebuilding yields in Table 2. In order to avoid exceeding the rebuilding yields, the ABC values were based on reductions from $F_{Rebuild}$. This is consistent with the approach taken after SEDAR 31. The resulting yields are shown in Table 3 along with the associated OFL and $F_{Rebuild}$ yields. Only yield streams for ABC at $F_{SPR26\%}$ were produced, but NMFS staff indicated that they could produce ABC yield streams for other F_{MSY} proxies.

Table 3. ABC yield stream in millions of pounds whole weight based on reduction from $F_{Rebuild}$ yields at $F_{SPR26\%}$ and P* = 0.427. OFL and $F_{Rebuild}$ yield streams from Tables 1 and 2 are included for comparison.

Year	OFL	$F_{Rebuild}$ Yield by 2032	ABC yield at $F_{SPR26\%}$ and P* = 0.427
2015	14.73	13.22	13.00
2016	14.56	13.40	13.21
2017	14.40	13.51	13.32
2018	14.02	13.33	13.13
2019	13.44	13.87	12.67
2020	13.03	12.51	12.33

SSC members questioned why the ABC and $F_{Rebuild}$ yield stream increased in the early years while the OFL yield stream decreased. Science Center staff suggested that at lower yields strong year classes from the mid-2000s were projected to persist longer in the population. However, eventually all yield streams would move down under a constant average recruitment projection given recent lower recruitment levels.

Staff reminded the SSC that the Council preferred constant catch ABCs to declining yield streams. However, the SSC, after discussion felt that providing the ABCs based on the control rule provided the Council with the options to set the ACL at either the maximum ABCs for each year or at a constant catch ACL that did not exceed any of the ABCs. As with OFL, the SSC felt that setting ABC beyond three years entailed too much uncertainty.

The SSC recommends that the ABC for red snapper be set using a PDF of yield from the base model projected at F Rebuild to SSB at 26% SPR in 2032 and applying a P* of 0.427.
2015 - 13.00 mp ww
2016 - 13.21 mp ww
2017 - 13.32 mp ww

Motion passed unanimously.

It was noted that these OFLs and ABCs are based on an assumption that the 2014 recreational landings will be the same as the 2013 landings. Preliminary indications are that the 2014 landings are less than 2013. If so, OFL and ABC for 2015 and beyond could increase once the final 2014 landings are determined and incorporated into the projections.

Discussion of Alternative Red Snapper MSY Proxies

At the request of the Council, the Science Center produced a series of red snapper projected yield streams at alternative F_{MSY} proxies of $F_{SPR26\%}$, $F_{SPR24\%}$, $F_{SPR22\%}$, and F_{MAX} equivalent to $F_{SPR20\%}$.

These yields are shown in Tables 1 (for fishing at a constant F_{proxy} level) and Table 2 for fishing at a rate that will rebuild to the B_{proxy} biomass level by 2032. SSC members noted that the spawner-recruit relationship for red snapper is not well-determined, thus steepness was set at 0.99 in the model. Furthermore, the spawner-recruit relationship was not utilized to project future recruitment. As indicated above, the implicit assumption under such an approach is that future recruitment projected in the near term will resemble recruitment in the recent past, and the mean of recent recruitment (with recruitment deviations) is utilized in projections.

The SSC noted that MSY, hence F_{MSY}, could not be estimated directly for red snapper given the lack of a reliable spawner-recruit relationship. When steepness equals 1.0, F_{MSY} equals F_{MAX}. Therefore, the SSC earlier indicated F_{MAX} would be a poor proxy as well. This leaves the question of what is the best proxy to use for F_{MSY}. A proxy of $F_{SPR30\%}$ is commonly used for reef fish and was recommended by the SEDAR 38 review panel for Gulf king mackerel using similar rationale (i.e., no reliable spawner-recruit relationship and steepness of that function set to 0.99). The current FMSY proxy for red snapper is $F_{SPR26\%}$ differs from $F_{SPR30\%}$, which may create some confusion. However, this disparity ($F_{SPR26\%}$ vs. $F_{SPR30\%}$) resulted from analysis done by the SEFSC following SEDAR 7 in 2005 when examining maximum sustainable marginal yield to attempt to reduce effort among the various fisheries and fleets that contribute to the annual red snapper harvest.

If a proxy different than the current proxy of $_{SPR26\%}$ is adopted by the Council, the time allowed in the rebuilding plan would also likely change because the time to rebuild to the biomass proxy level in the absence of fishing mortality (F_0) would be less. Consequently, the rebuilding timelines for each proxy level would need to be recomputed, and Table 2 would need to be revised. If the time to rebuild under F_0 is less than ten years, then the Magnuson-Stevens Act requires the plan to rebuild the stock in ten years or less. This could potentially result in the need for more restrictive management measures under the rebuilding plan even at lower biomass target levels. NMFS staff will produce revised estimates of the revised time and yields to rebuild to various proxy levels including estimates of the times needed under F_0.

Standing and Special Reef Fish SSC
Meeting Summary: Pertinent Red Snapper Discussions
Alternative F_{MSY} Proxies
New Orleans, Louisiana
May 20, 2015

The meeting of the Standing and Special Reef Fish SSC was held on May 20, 2015.

Analysis of Alternative F_{MSY} proxies for Red Snapper

Dr. Dan Goethel presented a review of alternative F_{MSY} proxies for red snapper. Global MSY is the highest sustainable yield that could hypothetically be taken from a stock if fishing is restricted to an optimal age class using knife-edge selectivity (no harvest above or below that age class), no discard mortality, and the relationship between spawning stock biomass (SSB) and recruitment is known. Proxies for MSY are used for red snapper because the stock-recruit function is not well-defined (Figure 1). Additionally, it is impossible to implement optimal age selectivity from a management perspective, because catch cannot be constrained to a single age class, and control of bycatch and discarding is extremely difficult. Proxies are often utilized to approximate MSY or the associated SSB at MSY, and can be based on either yield-per-recruit (YPR) or spawning potential ratio (SPR) analyses. YPR aims to approximate MSY, but SPR aims at maintaining biomass within safe biological limits with no specific goal of maximizing yield.

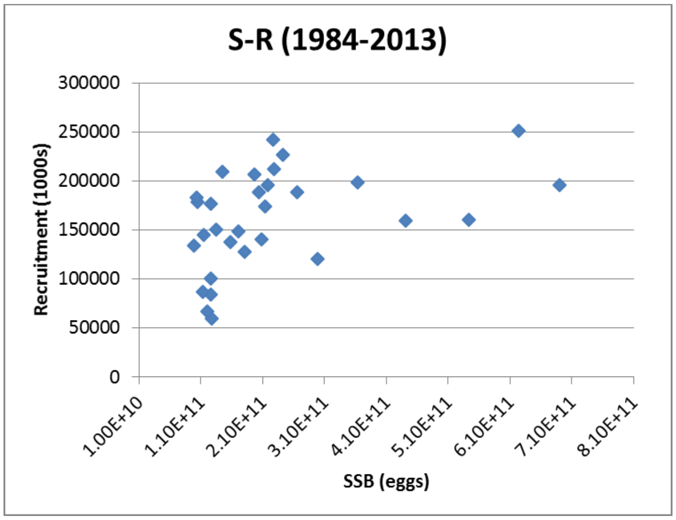


Figure 1. Red snapper spawner-recruit levels for 1984-2013. Spawning stock biomass (SSB) is in number of eggs produced. Recruitment is in abundance (1000s) of age-0 fish.

Maximum YPR (or F_{MAX}) harvest control rules maximize yield from an 'average' recruit by optimizing the time of capture (i.e., the knife-edge selectivity assumption is maintained as assumed in MSY calculations) based on the tradeoff between growth (weight) and natural mortality. YPR analysis does not account for the relationship between spawners and recruits. Maximum YPR does not result in the MSY unless there is truly no spawner-recruit relationship. If a spawner-recruit relationship does exist, maximum YPR will usually overestimate MSY causing a lower resulting SPR[1]. Recruitment overfishing can occur when maximum YPR is used as a management target if the stock is unable to replace itself (i.e., yield exceeds growth).

Due to the unrealistic assumption of knife-edge selectivity at an optimal age required for global MSY or maximum YPR, management often chooses to use a conditional MSY or YPR (depending on whether the stock-recruit relationship is known). Conditional analyses assume that existing selectivity and discard mortality patterns are maintained throughout the projections. The spawning stock biomass levels resulting from conditional MSY will be lower than global SSB_{MSY}, and the spawning stock biomass levels resulting from conditional maximum YPR will be even lower. As bycatch mortality increases, the resulting SSB tends to decrease, which can result in very low SPR values.

[1] Exceptions to maximum YPR exceeding MSY do exist, most notably with gag, where the stock assessment found that F_{MAX} was a more conservative estimate of F_{MSY} that $F_{30\%\ SPR}$. However, this may be due to the fact that gag is a protogynous hermaphrodite.

SPR analyses are life history-based proxies, which are dependent on the demographics of the species such as longevity, growth, and natural mortality. Yield is not an explicit consideration for SPR analysis. As with YPR, it does not account for a spawner-recruit relationship. Typical values for SPR proxies range from 20-60% of virgin spawning stock. Based on simulations (Clark, 1993), within this range of SPR levels the resulting equilibrium yield is at least 75% of MSY regardless of the true stock-recruit relationship.

Currently, a global MSY cannot be calculated for red snapper, because the spawner-recruit relationship is unknown. Additionally, global MSY or maximum YPR would be impossible to implement, because optimal selectivity is impractical to achieve. Despite the inability to achieve global MSY, the SSB associated with global MSY is still attainable if global MSY can be calculated. However, with no definitive stock-recruit relationship, the closest approximation to global MSY is true maximum yield-per-recruit (i.e., assuming a single fleet that harvests at an optimal age). The SEFSC has ongoing work attempting to calculate the true maximum YPR for red snapper, but the intricacies of the stock synthesis framework may impede the ability to determine a reliable value. Given the difficulties encountered with red snapper, the most appropriate proxy for MSY is likely to be the SSB or SPR associated with the maximum YPR, but this value has not yet been calculated.

The SEDAR 7 and 31 assessments used an alternate approximation to the global MSY referred to as 'MSY-link', which was calculated as the maximum YPR (i.e., because no stock-recruit relationship was implemented) when all sources of fishing mortality (directed, closed-season, and bycatch) were scaled up or down in the same proportion. Yield-per-recruit was then maximized by scaling the overall fishing mortality, while maintaining the ratios of relative fishing mortality by fleet. The SSB and associated SPR corresponding to the maximum yield obtained from the MSY-link scenario was then used as the SPR target proxy.

Using the MSY-link scenario, the 2005 SEDAR 7 red snapper assessment calculated SPR_{MSY} as SPR_{MSY} = 26%. In the current analysis, the MSY-link scenario resulted in an SPR_{MSY} = 23%. The change in SPR was due to different relative fishing mortalities in the terminal year of the assessment model. However, the MSY-link scenario is not a practicable proxy because it requires scaling bycatch fishing mortality in the same proportion as directed fishing mortality. Since projections indicate that short-term yield could be increased and the SPR proxy could still be obtained in 2032, the analyses implicitly suggest that bycatch should be increased. In practice, directed and discard mortality rates are not linked.

The SEFSC was asked to examine several levels of target SPR from 40% to 20%, plus the maximum conditional yield-per-recruit and the resulting SPR. The yield streams (Acceptable Biological Catches; ABCs) to rebuild by 2032 are shown in Table 1. Many of the scenarios would result in the stock able to rebuild to the target SPR level in 10 years or less, so yield streams assuming a 10-year rebuilding plan are shown in Table 2. The conditional maximum YPR resulted in a Gulf-wide SPR of 12%, but this would cause an SPR in the eastern region of 2%.

Table 1. Yield streams and equilibrium yield for several levels of target SPR and the MSY-link scenario (23% SPR) for rebuilding by 2032.

ABC (Retained Yield Million Pounds Whole Weight) – Rebuild by 2032							
YEAR	**SPR 40%**	**SPR 30%**	**SPR 26%**	**SPR 24%**	**SPR 22%**	**SPR 20%**	**MSY-LINK**
2015	6.55	11.54	14.28	15.87	17.63	19.59	15.00
2016	7.26	11.79	13.96	15.11	16.31	17.55	14.25
2017	7.91	12.02	13.74	14.61	15.45	16.28	13.72
2018	8.32	11.99	13.38	14.05	14.67	15.26	13.10
2019	8.37	11.67	12.85	13.40	13.91	14.39	12.36
2020	8.31	11.40	12.49	12.99	13.46	13.90	11.86
2021	8.24	11.24	12.29	12.78	13.23	13.64	11.56
2022	8.21	11.15	12.18	12.65	13.08	13.48	11.38
2023	8.27	11.17	12.17	12.62	13.04	13.42	11.33
2024	8.35	11.22	12.19	12.63	13.03	13.40	11.31
2025	8.41	11.25	12.21	12.63	13.02	13.37	11.30
2026	8.47	11.29	12.22	12.63	13.01	13.35	11.29
2027	8.53	11.31	12.23	12.64	13.00	13.34	11.28
2028	8.58	11.34	12.24	12.64	13.00	13.32	11.28
2029	8.62	11.36	12.25	12.64	12.99	13.31	11.27
2030	8.66	11.38	12.26	12.64	12.99	13.30	11.26
2031	8.70	11.40	12.26	12.65	12.99	13.29	11.26
2032	8.73	11.41	12.27	12.65	12.99	13.29	11.25
Equil	9.05	11.61	12.40	12.74	13.04	13.30	11.26

Table 2. Yield streams and equilibrium yield for several levels of target SPR and the MSY-link scenario (23% SPR) for rebuilding within 10 years, by 2026.

ABC (Retained Yield Million Pounds Whole Weight) – Rebuild by 2016							
YEAR	**SPR 40%**	**SPR 30%**	**SPR 26%**	**SPR 24%**	**SPR 22%**	**SPR 20%**	**MSY-LINK**
2015	4.27	9.71	12.78	14.59	16.63	18.91	15.00
2016	4.92	10.23	12.80	14.19	15.64	17.14	14.25
2017	5.54	10.67	12.84	13.92	14.98	16.01	13.72
2018	5.98	10.84	12.67	13.52	14.33	15.07	13.10
2019	6.14	10.66	12.25	12.97	13.63	14.24	12.36
2020	6.16	10.47	11.93	12.59	13.20	13.76	11.86
2021	6.13	10.34	11.75	12.39	12.98	13.51	11.56
2022	6.13	10.27	11.66	12.28	12.84	13.35	11.38
2023	6.19	10.31	11.67	12.27	12.81	13.30	11.33
2024	6.27	10.37	11.70	12.28	12.81	13.28	11.31
2025	6.34	10.42	11.72	12.30	12.81	13.26	11.30
2026	6.40	10.46	11.75	12.31	12.81	13.24	11.29
Equil	7.03	10.88	12.00	12.47	12.88	13.22	11.26

Over the long-term, fishing at target SPR levels less than 30% will result in declines in the eastern Gulf stock of red snapper, while in the west the SPR will increase at all SPR levels between 20% and 40% (Figure 2). Current (2015) SPR levels are 11% for the eastern Gulf, 19% for the western Gulf, and 16% Gulf-wide.

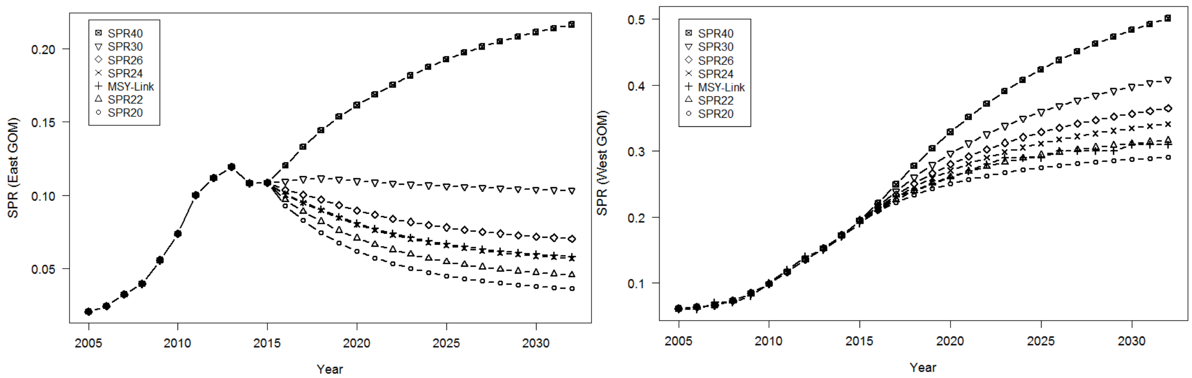


Figure 2. Regional trends in SPR when fishing for red snapper at target Gulfwide SPRs of 20% to 40% for a rebuilding target date of 2032.

Yield streams at conditional SPRs less than 26% provide short-term increases in ABC, but over the longer term target SPRs of 20% to 30% tend to converge to similar ABC levels (Figure 3).

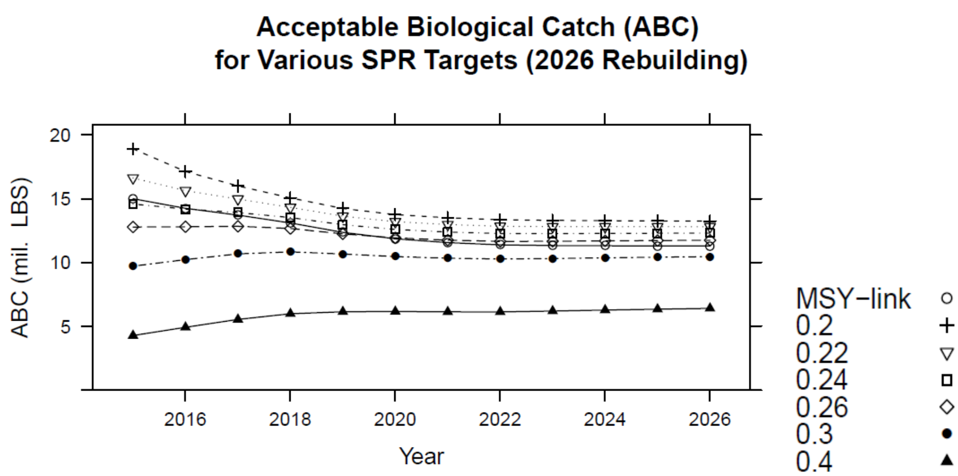


Figure 3. Trends in ABC yield streams for conditional SPR levels of 20% to 40% for a rebuilding target date of 2026.

The SSC concluded that even though the current proxy of 26% SPR was derived using the MSY-linked method, which is now considered impractical, there was little long-term benefit to changing the SPR. Additionally, lower target SPRs or conditional maximum YPR were projected to drive the stock in the eastern Gulf to very low SSB levels. The following motion was passed.

Motion: The SSC recommends, based on the latest analysis provided by the SEFSC, that there is insufficient biological evidence for a better MSY proxy than what is currently used by the Council (the yield corresponding to 26% SPR) for Gulf red snapper.

Motion carried unanimously

MRIP recalibration, selectivity changes and allocation

Dr. Shannon Cass-Calay gave two presentations on factors affecting changes in red snapper OFL and ABC projections. The first presentation reviewed the results of a series of sensitivity runs to evaluate the effect of recalibrated recreational removals and recreational selectivity on OFL and ABC projections. This analysis was previously presented to the Council. The sensitivity runs consisted of using the update assessment base model with the following projections:

- Project the annual OFLs at F26%SPR and the ABCs at FREBUILD from 2015-2032 using pre-MRIP recalibrated estimates.
- Project the annual OFLs at F26%SPR and the ABCs at FREBUILD from 2015-2032 using pre-MRIP recalibrated estimates and no new recreational selectivity block for 2011-2013

There is some evidence that recreational fishing selectivity in recent years has been shifting toward larger and older red snapper. Therefore, in these runs the model was allowed to re-estimate recreational selectivities in the most recent years (2011-2014). The OFL and ABC trends resulting from the two sensitivity runs and the base model run are shown in Figure 4.

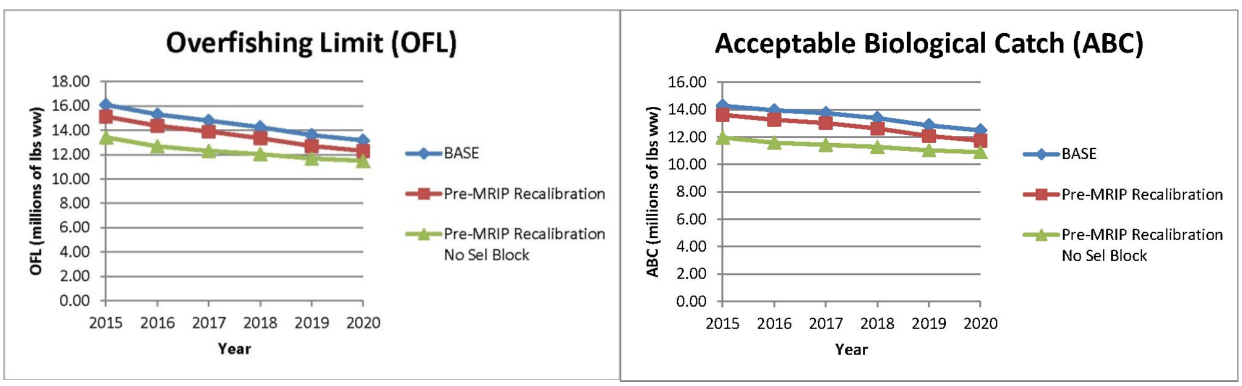


Figure 4. Trends in OFL and ABC projected by the red snapper update assessment base mode and two sensitivity runs.

The runs suggest that there are two reasons why higher OFLs and ABCs were projected in the update assessment: 1) use of the larger MRIP recalibrated estimates of recreational catch, and 2) recalibration of recreational selectivity in recent years.

The second presentation evaluated the effects of changing the commercial/recreational allocation. The recreational allocation was adjusted from the status quo 49% up to 70%. The

Council has selected a recreational allocation of 51.5%. The resulting OFL and ABC yield streams are shown in Tables 3 and 4.

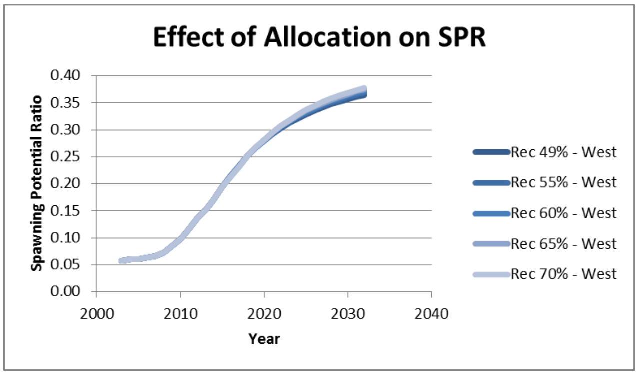
Table 3. Red Snapper OFL Yield streams and equilibrium yield for several allocations of recreational harvest and a target of 26% SPR by 2032.

OFL (Retained Yield Million LBS WW)						
YEAR	**Rec 49%**	**Rec 51.5%**	**Rec 55%**	**Rec 60%**	**Rec 65%**	**Rec 70%**
2015	16.10	16.35	16.70	17.19	17.69	18.17
2016	15.31	15.50	15.72	16.06	16.39	16.71
2017	14.79	14.96	15.12	15.38	15.64	15.89
2018	14.25	14.40	14.54	14.77	15.00	15.23
2019	13.60	13.73	13.87	14.09	14.31	14.52
2020	13.17	13.29	13.43	13.65	13.86	14.07
Equil	12.91	13.00	13.11	13.27	13.42	13.57

Table 4. Red Snapper ABC Yield streams and equilibrium yield for several allocations of recreational harvest and a target of 26% SPR by 2032.

ABC (Retained Yield Million Pounds Whole Weight						
YEAR	**Rec 49%**	**Rec 51.5%**	**Rec 55%**	**Rec 60%**	**Rec 65%**	**Rec 70%**
2015	14.29	14.49	14.76	15.18	15.61	16.05
2016	13.96	14.13	14.31	14.62	14.93	15.24
2017	13.75	13.89	14.04	14.29	14.53	14.78
2018	13.39	13.52	13.65	13.87	14.09	14.32
2019	12.85	12.97	13.10	13.31	13.52	13.73
2020	12.49	12.60	12.73	12.94	13.15	13.35
Equil	12.40	12.48	12.59	12.73	12.87	12.98

The OFL and ABC yields for the directed fisheries increased with increasing recreational allocation. All of the above yield streams achieve a Gulf-wide stock rebuilding to 26% SPR by 2032, but with regional differences. SPR in the western Gulf continues to increase, but the SPR in the eastern Gulf declines, and the decline is exacerbated by increasing allocation to the recreational sector. At 70%, the eastern SPR decreases to 4% of unfished condition in 2032 (Figure 5).



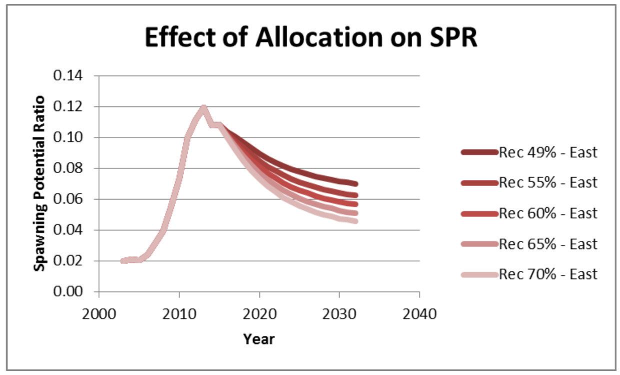


Figure 5. Regional trends in west and east red snapper SPR under various recreational allocations. Note that the graphs are drawn to different Y-axis scales.

The difference in SPR changes between the eastern and western stocks occurs because the distribution of the red snapper population and fishing effort differs. Increasing the recreational allocation disproportionately increases the fishing effort in the east (where most recreational fishing occurs) leading to an increased fraction of the population removed in the east as the recreational allocation increases. In addition, the selectivity patterns differ, with the recreational sector in the east selecting larger fish than the commercial sector.
One SSC member noted that the eastern SPR has been increasing until 2012, and asked for an explanation of why the trend changed. Dr. Cass-Calay explained that the increase until 2012 was due to reduced fishing mortality in the east and high recruitment years in the mid-2000s. However, from 2011-2014 there have been no strong recruitments observed, and some indices of abundance have suggested a decline. The projections are carried forward with average recruitment and do not assume any strong recruitment years, resulting in continued declines.

One SSC member suggested that since OFL and ABC would increase with reallocation, the existing management measures would not exceed the new OFL and ABC. Therefore, the Council would have the option to not make any changes.

Following the presentations, the SSC passed the following motion:

Motion: The SSC reviewed the changing allocation scenarios between the commercial and recreational sectors of the Gulf red snapper fisheries and concluded that if the Council changes the allocation between the two sectors, this would prompt the need to reevaluate the OFL and ABC projections.

Motion carried unanimously