LSU
Department of Oceanography and Coastal Sciences • School of the Coast and Environment • Baton Rouge, LA 70803-7503

8 August 2015

I have been asked by several recreational and commercial fishers to provide my thoughts concerning Amendment 28 that will be before the Council for final action later this month. I have not been compensated in any way, so I offer my opinion only because I was asked to comment on this issue.

The notion that reallocation of red snapper from the commercial sector of the fishery to the recreational sector is a conservation measure is indefensible. Here's why. Red snapper live more than 50 years and long-lived species like red snapper usually are year-class dominated; i.e., they do not need to produce a strong year class every year to keep the population stable over time. As long as a good one is produced every 5 to 7 years, the population remains stable in the absence of exploitation. Over the history of management of reef fish in the Gulf, each time a strong year class is produced by red snapper catches are raised in response to increasing numbers and biomass. Three to 4 years later, the catch has to be reduced because overfishing resumes. If one simply looks at the history catches, they were raised then lowered as the 1989-year class moved into and through the fishery. The same thing occurred after 1995, and 1999-2000 and will happen again after 2004-2006. In the figure below, the red and green lines are relative red snapper recruitment. While the 2004 and 2006 years classes were not exceptionally high it is unusual to get good year classes separated by only a year. Recruitment from 2008-2014 has been average to low, especially in the eastern Gulf.

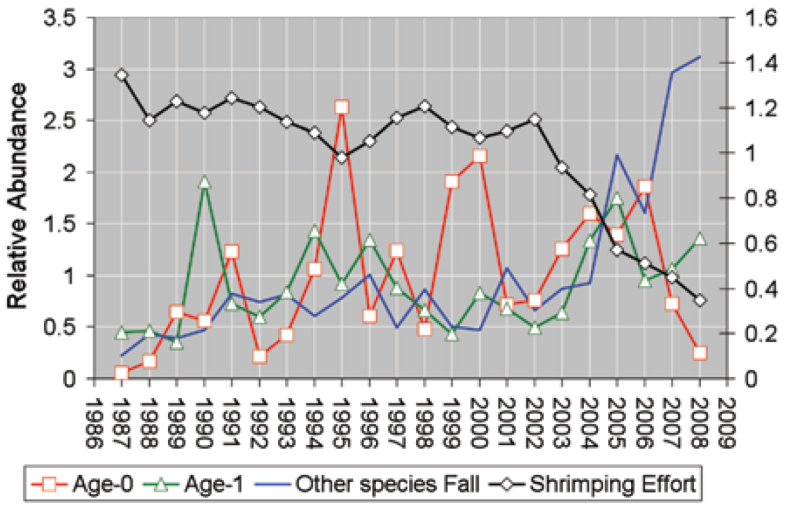
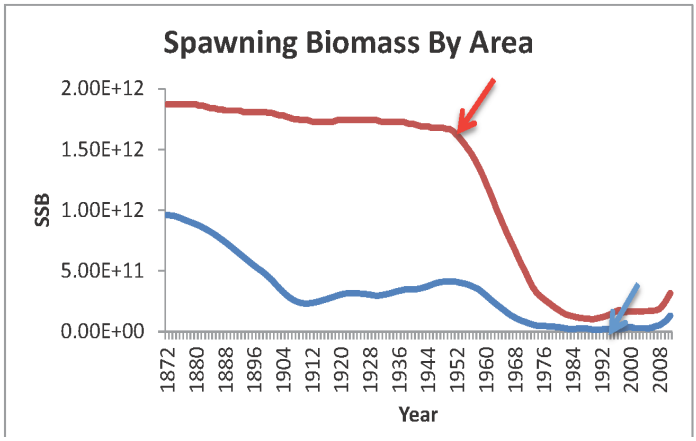


Figure 6. Relative abundance of age-0 and age-1 red snapper and total biomass of other species captured in the Southeast Area Monitoring and Assessment Program (SEAMAP) fall ground fish survey. Also shown is relative shrimping effort, which has been declining rapidly

The figure below is the estimated red snapper spawning stock biomass in the Gulf as of the 2012 assessment. Basically, this shows the estimated combined weight of all of the reproductively mature red snapper females in the Gulf. As it turns out, there is considerable information available reporting that a well-established red snapper fishery in the northwestern Gulf began as early as 1892 (Carpenter 1965), despite what some have said to the contrary. The arrows indicate when artificial reefs (ARs) began to be deployed in large numbers. ARs took the form of oil and gas platforms in the western Gulf and all manner of things in the east. In either case there is no indication that artificial habitats have increased SSB because overfishing was occurring until only recently, and changed in response to the strong year classes. The artificial reef argument is not true now, nor has it been in the past.



The process of converting this figure to an image file resulted in misplacement of the arrows. Oil and gas platforms were first deployed in 1947 and the first artificial permit zone off AL was created in 1986

When red snapper produced during strong year classes age to become part of the fishable biomass, everybody gets excited and fisheries governance invariably pushes to raise catches against the advice of their own advisory panels and/or the commercial and charter fishermen that generally support a more precautionary response. Unfortunately, when that happens we overexploit members of strong year classes, so there are not enough survivors reaching older ages, the importance of which is explained below.

It is much easier to increase fishing pressure when times are good than it is to dial back fishing pressure when things start going south (this is called the "ratchet effect" as defined in Ludwig et al. 1992). It's not complicated, and it happens every time a strong year class is produced. The only thing unique about the last few years is that we had two pretty good year classes separated by only one year (2004 and 2006); this had not previously been observed over the period of record, which only goes back to the early 1980s. I suspect that it has happened before, but it may not happen often.

Larger, older females (>10-12 years) devote more of their growth to reproduction, and they tend to start spawning earlier in the season than smaller fish (Porch et al. 2015); they also spawn more times per season than do smaller females. This acts to extend the amount of time that eggs are in the water column, which increases the probability of producing strong year classes (i.e., not all of the eggs are in one basket). It is also important to recognize that despite these very high numbers of annual egg production, most females will likely not produce a survivor in any given year. This is a typical life history strategy in marine fishes. Over their lifetime, females release millions or billions of little eggs with very little investment by the female, expecting that most will die within a few days. Mortality begins to stabilize when the juveniles approach age 1. This circles back to the protracted spawning season issue. If eggs are in the water column for a longer period of time, the probability of a strong year class increases because eggs and larvae are around to take advantage of times when ocean conditions are just right. This life history strategy in fishes is among the most common in nature, but can be problematic if the stock is heavily exploited owing to the ratchet effect described above.

Red snapper is still overfished both in the eastern and western Gulf. I believe that raising the ACL, reallocation of more of the fishery to recreational sector, along with state management of the resource, will result in overfishing again within two to four years as the members of the strong 2004 and 2006 years classes exit the fishery. The new increase in catches currently is being justified by the small upturn in biomass that began in 2006 when the 2004 year-class started to show up in the landings. So, yes, biomass is higher, probably as high as it been since the 1960s; we all see this, including fisheries managers and scientists that are studying red snapper. Unfortunately, in our work in the western Gulf, we have begun to see decreases in CPUE as these strong year classes age off deep-water oil platforms and the natural shelf edge reefs.

The table below shows the estimated instantaneous fishing mortality rate and clearly shows the impact of the strong year classes.

Year	Fishing Mortality	Standard Deviation
1988	1.31	0.18
1989	2.62	0.39
1990	1.89	0.29
1991	1.91	0.29
1992	1.59	0.20
1993	1.52	0.19
1994	1.41	0.20
1995	1.43	0.21
1996	1.05	0.14
1997	1.20	0.18
1998	1.11	0.17
1999	1.44	0.23
2000	1.70	0.29
2001	1.06	0.15
2002	1.33	0.19
2003	1.45	0.19
2004	1.43	0.17
2005	0.86	0.10
2006	0.56	0.07
2007	0.41	0.04
2008	0.18	0.02

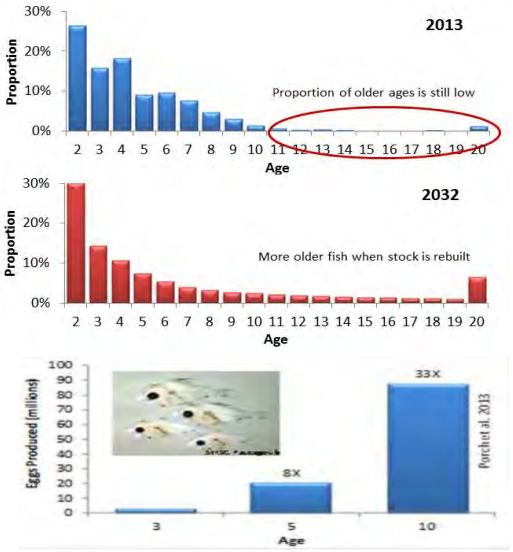
I added the yellow highlights to show that fishing mortality decreased by nearly 3-fold in 2006 when the 2004 year-class became fully vulnerable to the fishery. It dropped another 3 fold when the 2006 year-class became vulnerable in 2008. Since then, at least through 2011, rates are stable. Couple this with the figure of SSB and it's change in direction, the relationship is undeniable.

However, the figure below is the current age frequency (proportional age distribution) of adult red snapper in the Gulf based upon the most recent benchmark assessment. Fish produced in the most recent strong year classes dominate catches, but it is not clear whether enough fish are escaping to older ages. Remember that red snapper live to be 55 years old. The age frequency (proportion) in 2013 are the bars in blue, those in red represent the structure when the stock gets fully rebuilt. I also interject here that our data (LSU) support the figure from 2013.

Truncated Age Structure

- Truncated around the strong year classes 2004 and 2006
  - Less than 6 % of RS were older than 10 years
  - RS can live upwards of 50 years
- Fishing mortality
  - Selective removal of larger and older individuals
  - Overfishing leads to shifting age distributions (Hsieh et al. 2010)

Photo Credit Top Right: NMFS.gov



Why is this important? A single 7 to 9 year old red snapper female produces about 42 million eggs per year per female. Females older than 10 years produce more than 82 million eggs per fish per year, although it is hard to find fish > 10 years old, so sample size of older fish is low. But just to show you how quickly they ramp up, a 600 mm female will produce about 2 million eggs per batch, while a 650 mm female produces about 7 million eggs per batch. Red snapper spawn 30 to 40 or more times (every 4 to 7 days) each year; the older ones spawn more often because they can invest more energy in reproduction rather than somatic growth. Gonad weight at age 9 is about 175 grams, while gonads of females that are >10 -12 years old weigh about 450 grams on average. **Given these numbers, females older than age 10+ now produce about 70% of the eggs each year but this could be much higher if there were more old fish.** Because larger females devote more of their growth to reproduction, they tend to start spawning earlier in the season than smaller fish, and they also spawn more times than do smaller females. This acts to extend the amount of time that eggs are around, which increases the probability of producing a strong year class (i.e., not all of the eggs are in one basket).

More recently, members of my laboratory and I have been focused on comparing the relative value of natural versus artificial habitats for red snapper in the western Gulf off Louisiana. We sampled six standing and five toppled platforms (two of the platforms were unlit) and four of the natural shelf edge reefs off the coast of Louisiana. All of the sites are exposed to water quality that is suitable for red snapper (the standing and toppled are actually in the Louisiana Artificial Reef Planning areas). The natural reefs we sampled represent an east-west gradient in both depth of the reef crest and habitat complexity, terminating near the Flower Gardens Banks National Marine Sanctuary). Samples are being collected twice per quarter and began in 2008. To be perfectly honest, we were startled by the results. By every measure possible (i.e., tissue caloric density, liver somatic index, size and weight at age, diet complexity and nutritional quality, etc.) red snapper on the natural reefs are in better condition. The data below indicate how dramatic the differences are with respect to egg production. Recent data (June and July this year) are consistent with those reported below. All of this information has already been made available to NOAA Fisheries SEFSC.

Descriptive fecundity variables of same age female red snapper *(Lutjanus campechanus)* sampled during spawning season (June, July, August). Means N ± SD (Standard Deviation)(data provided by H. Glenn, LSU). Artificial habitat in this table refers to standing and toppled oil and gas platforms. Natural habitats are shelf-edge reefs off Louisiana (http://etd.lsu.edu/docs/available/etd-10232014-133051/)

Characteristic	Artificial Habitat	Natural Habitat
Batch Fecundity Estimate (eggs/batch)	41,878 ± 48,027	704,563 ± 693,573
Annual Fecundity Estimates (eggs/season)	1,369,334 ± 1,600,920	26,323,179 ± 26,147,495

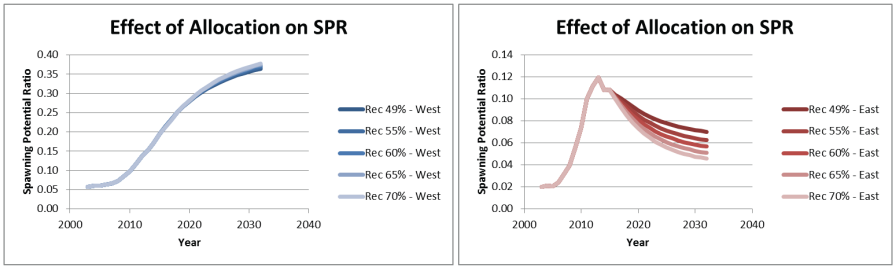
In my opinion, there appears to be no justification for a reallocation **given that the fundamental problem with the recovery of the stock is not the availability of fishable biomass, rather it is age truncation.** I am even more concerned by our results regarding reproductive potential (we are seeing this in red snapper collected from platforms in June and July 2015). We have just received funding from S-K to try to estimate the relative proportion of red snapper on artificial vs. natural reefs in the western Gulf.

Here are my final thoughts in summary:

There appears to be no justification for reallocation given that the fundamental problem with the recovery of the stock is not availability of fishable biomass, rather it is age truncation. I believe that private recreational fishers are more likely to seek larger red snapper as a consequence of trophy hunting. Given that participation by the private recreational sector is the only sector of the red snapper fishery that is free to grow without constraint, I believe that the proposed reallocation will result in an increased risk of failure to reach the 2032 stock rebuilding target. Why?

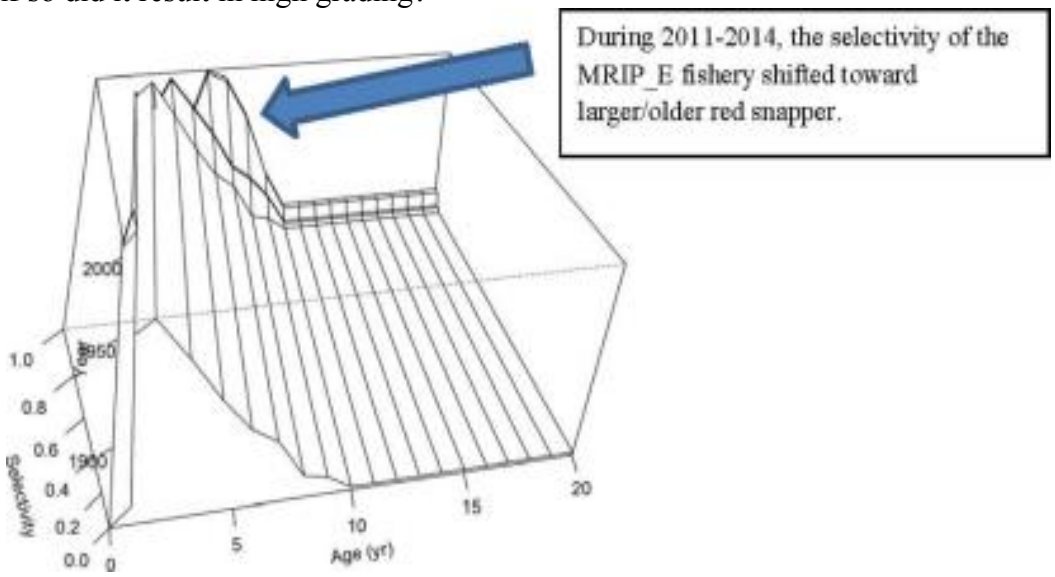
1) If the proportion of red snapper on artificial reefs in the western Gulf is high, and those fish are reproductively constrained by poorer nutrition, then the current estimate of SSB in the west may be called to question.

2) Information provided by NOAA Fisheries in the figures below show clearly that any change in the allocation of red snapper could cause significant declines in SPR of the snapper stock in the eastern Gulf, and under the most extreme example, collapse to levels not seen since the 1980s. If number 1 above is true, SSB in the western Gulf may not provide as strong a buffer against failure to reach the 2032 stock rebuilding target as has been previously assumed.



3) Irrespective of the recalibration due to MRIP, selectivity by the recreational sector appears to have increased substantially. I suspect that some of this is attributable to the growth of fish produced during the two aforementioned strong year classes, but there may be other consequences. The questions below addressed my concerns:

- Do we know whether the availability of larger fish caused the increase in selectivity, and if so did it result in high grading?



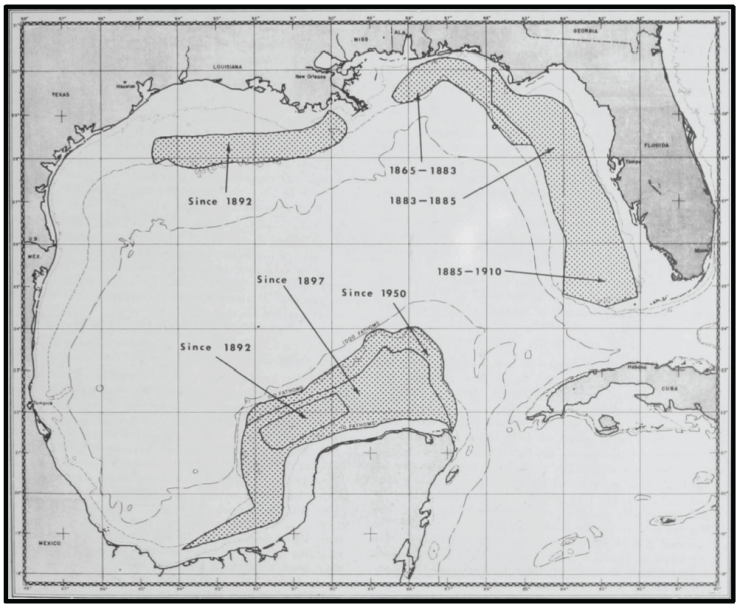
- Do we know if recreational fishers are fishing farther offshore in pursuit of trophy fishes? If so, discard mortality rates are likely to be much higher than the 10% used in the SEDAR 31. Jaxion-Harm and Szedlmayer (2015) suggest that size distribution of red snapper increases with depth in the reef permit zones off Alabama; if this is true, are faster boats with better electronics allowing targeting of larger fish which in the past have been less vulnerable?

- Do we know how defiance of federal fishing seasons and bag limits by private recreational anglers in noncompliant states is affecting discard mortality (high grading?), and selectivity?

- Given that a high proportion of the total recreational red snapper fishing effort occurs in the eastern Gulf, and the stock size in the east is recognized to be considerably smaller than in the western Gulf, what is to prevent effort shifting by the private recreational sector to the western Gulf as fish in the east become depleted?

4). Finally, most of the red snapper caught by the commercial sector are caught in the western Gulf. Currently, this sector of the fishery in both the east and western Gulf are fishing at a rate below F_{MSY}. In fact, the rate is likely close to F_{MEY} given the discussion provided by Punt et al. (2014) and the current estimate of $SPR_{3S\text{-}40\%}$ in the western Gulf by NOAA Fisheries in the effort allocation figure above. This is considered to be risk adverse for species for which the S-R relationship is poorly known.

Personally, I will never be convinced that the steepness value for a species with a life history such as red snapper can be as high as 0.99, which effectively says that recruitment is independent of stock size. Given the history of the fishery, and the well-documented collapses that progressed eastward from Mobile-Pensacola from 1865 to 1910, culminating off south Florida, the current S-R steepness seems impossible. The commercial extinction in the eastern Gulf persisted until well after I moved to Alabama and became involved with red snapper in 1992.



From Carpenter 1965

I may be thick-headed, but I don't get it. I do know that the red snapper ITQ program seems to have had the intended affect of increased stewardship by the commercial sector, and will likely do the same for the for hire sector. Perhaps it is time for the private recreational sector to begin thinking more seriously about fishing sustainably in these days of rapidly increasing fishing power operating on a relatively small, but renewable, resource. We have demonstrated over and over again that there is sufficient fishing capacity in the US Gulf to deplete red snapper stocks. From an historical perspective red snapper has been, and is, fished by other sectors that have been around since long before recreational fishing was popular. It would not be difficult to include private recreational anglers in a dedicated access program that would end the derby conditions they face. Such a program would also greatly reduce the likelihood of quota overruns, thus the imposition of accountability measures. In the absence of such a program, it seems likely that reallocation would result in an increase in the chance that accountability measures will continue to plague private recreational anglers for the foreseeable future.

James H. Cowan, Jr.

Department of Oceanography and Coastal Sciences
Louisiana State University
Lifelong Recreational Angler
Award of Excellence in Fisheries Management from the American Fisheries Society 2007
Chair, Reef Fish Stock Assessment Panel 1992-2004
Member, Standing Scientific and Statistical Committee, 1995-2006
I served on both of the above are advisory panels at the behest of the Gulf of Mexico Fisheries Management Council