COBIA QUESTIONS & ANSWERS

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This document was prepared to examine questions that may be raised by the Council concerning the cobia AM application for 2016. It is in no way intended to serve as an analysis of the status of cobia or the management changes necessary to prevent overfishing in 2016. Rather, it is intended to provide a simple, summary overview of some of the major trends in the fishery, place them in context of stock status as estimated by the 2013 stock assessment, and consider whether some of the typical causes of sudden, unexpected spikes in MRIP landings estimates are at work in this situation.

How does the 2015 landings spike compare to long-term trends in the fishery?

- The 2015 estimate of landings in MRIP is the highest on record

Landings values as reported by MRIP, for GA to NY, were plotted for 1981-2015 to show how 2015 compares with the past. Values were obtained from an MRIP website query, so no calibration for 2013-2015 APAIS survey changes is applied and weight values will not match exactly to those from the SERO ACL database. Initial estimates were obtained April 4, and then updated on March 1 to include any Wave 6 landings (there were none for 2015). Landings from the headboat fishery are not included, so the figures here do not represent the full recreational component. Therefore, any overages of OFL or ACL were actually greater than shown here.

A hypothetical "recreational OFL" was derived to provide some reference for overfishing, by multiplying the annual OFL (in pounds) by the recreational allocation of 92%. Note this is not an official management parameter, it was simply derived for illustration purposes in this document, intended to provide some context on the potential impact of the 2015 landings on the stock.

Amendment 20B to the CMP FMP established and OFL based on landings consistent with the 50% P* recommendation of the SSC, and an ABC based on landings consistent with the P* recommendation of 40%. Management quantities chosen by the Council and based on the SSC recommendations are shown in Table 1.

Table 1. Management parameters for GA-NY cobia stock, 2014 and 2015. Values are in pounds, whole weight.

	Total		Landed (A20B)		Recreational		
YEAR	ABC	OFL	ABC	OFL	ACL	ACT	"rec OFL"
2015	726,700	792,800	693,000	756,000	630,000	520,000	695,520
2016	706,500	766,700	674,000	731,000	620,000	500,000	672,520

Preliminary recreational landings in pounds for 2015, not including headboat landings or MRIP Wave 6, are an all-time high at 1.7mpds (Type A+B1; A is observed harvest, b1 is unobserved harvest)(Figure 1). This value is well above the management benchmarks and any measure of prior landings (NOTE: this is the value reported by MRIP. It differs from the value in the ACL database used by SERO to monitor quotas and evaluate AMs due to an alternative approach for dealing with

gaps in weight samples). It is 1.5x the prior peak observed in 2006, 3.7x the estimate for 2014, 2.9x the average from 2010-2014, and 2.7x the 2015 recreational ACL. Considering values in numbers, the 43,737 estimate of A+B1 harvest in 2015 is a series high, 1.7x the previous high of 25,554 reported in 2006 and 2.1x the average of the last 5 years.

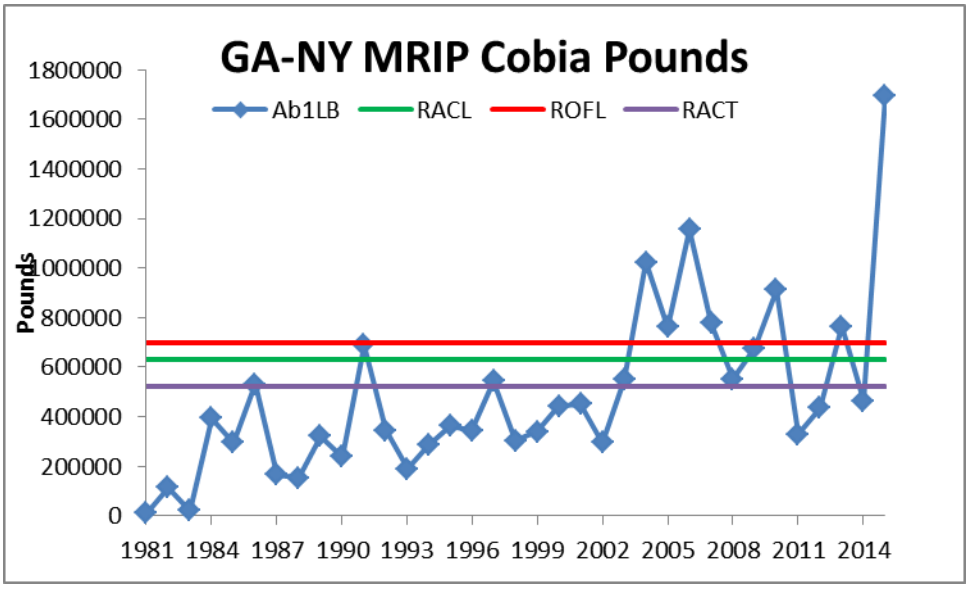

Figure 1. Cobia landings for New York through Georgia in pounds reported by MRIP for catch types A+B1 (AB1LB), 1981-2015, with reference lines denoting the 2015 recreational ACL (RACL), hypothetical recreational OFL component (ROFL), and the 2015 recreational ACT (RACT). Reference lines were extended back in time to indicate how past landings match current productivity estimates and management parameters; please keep in mind that these are annual values that were not in place until 2014.

Is there any evidence that the 2015 recreational spike is an anomaly, perhaps related to a spike in landings in a single area or to a substantial change in average weight?

- No evidence that the increase is narrow in range.

2015 landings increased in all states, in pounds as well as in numbers. Type A+B1 numbers were up in 2015 relative to 2014 by 2.9 in GA, 3.6 in SC, 1.6 in NC and 3.4 in VA.

- Trips targeting and catching cobia increased in 2015.

Effort directed toward cobia, as evidenced by trips indicating cobia as a target species, increased in 2015 (Table 2). Successful trips, as evidence by trips that encountered a cobia (indicated as Type A (observed harvest), Type B1 (discarded alive), or Type B2 (unobserved harvest, discarded dead or unseen by samplers)) also increased in 2015 relative to 2014.

Table 2. Trips that targeted or encountered cobia, 2014 and 2015 as reported by MRIP for GA-NY.

Year	Target Trips	Successful Trips	Successful %
2014	165,369	40,951	0.25
2015	206,528	60,313	0.29

- There is indication of a slightly higher mean weight in 2015.

Overall, numbers of fish were up by 2.4x and pounds of fish were up by 3.65x in 2015 relative to 2014. Mean weight, calculated from overall A+B1 estimates in pounds and numbers and shown in Figure 2, increases about 50% from 25 to 38 pounds between 2014 and 2015. The average 2010-2014 average is 28 pounds. To consider if the change in mean weight is a reason for the landings spike, the 5 year average mean weight was substituted for the 2015 value to estimate an alternative A+B1 in pounds (multiplying the alternative mean by A+B1 numbers). This produces an alternative estimate of pounds landed of 1,223,374, which is still nearly 2x the 2015 OFL. Therefore, the 2015 landings are a peak even if the mean weight change is removed.

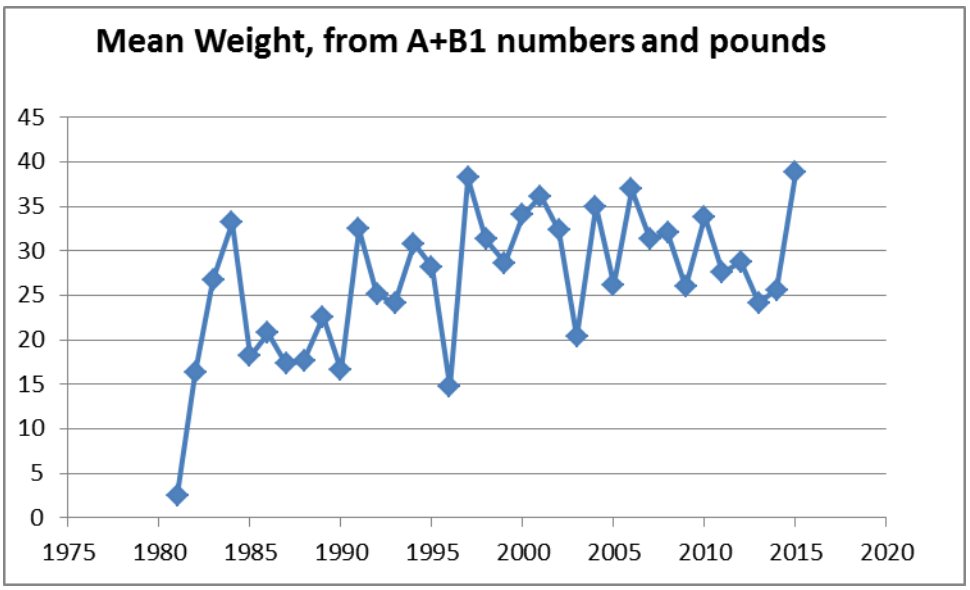

Figure 2. Mean weight for cobia, calculated from MRIP reported landings in pounds and numbers.

The 2015 mean weight is the peak of the series, beating the 1997 value by half a pound. While the increase over 2014 and 2013, and from 2011-2014 is noticeable, the 2015 estimate is not an obvious outlier when the whole time series is considered.

- 2015 mean weight is high, but this does not appear to be the sole explanation for the increased landings.

Is there any evidence that the 2015 recreational catch estimate is particularly uncertain?

- No evidence of an increase in PSE in 2015.

The MRIP program provides a value for "PSE", Percent Squared Error, which is a measure of statistical uncertainty and error in the estimation that is calculated such that it can be compared across species regardless of their level of catch or frequency in the survey. Recall that MRIP is a survey based estimate procedure, and all surveys have some level of error in their estimates. Higher PSE values indicate an estimate with higher error and lower precision. The amount of data used for an estimate directly influences its precision, so species commonly encountered by anglers and thus encountered by MRIP samplers of those anglers typically have lower PSE, on the order of 10 – 20. Rare species can have much higher PSEs, even exceeding 100.

Since sample size affects PSE, its value depends on whether a fine scale catch estimate is desired, such as for a wave, mode, year and state, or whether a broader scale estimate is desired, such as for a region and year. While MRIP provides various regional aggregations for catch estimates, there is not one that matches the range of the GA-NY cobia stock. Using an aggregation of the full Atlantic Coast would include FL, thereby including both a separate stock and an area of high cobia encounters, thereby biasing the overall PSE downward and implying greater precision than exists for the GA-NY stock. Special queries can be conducted, but doing so was beyond the intent and time available for this analysis. Therefore, PSE was examined on a state and year basis to provide an illustration of overall trends in precision.

Most cobia from this stock are landed in VA and NC, followed by SC and GA. Typically lower PSE scores in VA and NC therefore reflect the greater frequency of cobia (Figure 3). MD to NY are not included as cobia seldom appear in the catches in those areas; in recent years the only reports are of small numbers of discarded cobia in NJ in 2015, 2012 and 2010. Cobia PSE values in 2015 are among the best in recent years in VA and NC. PSEs scores are also trending downward recently, perhaps reflecting ongoing efforts to improve the MRIP program.

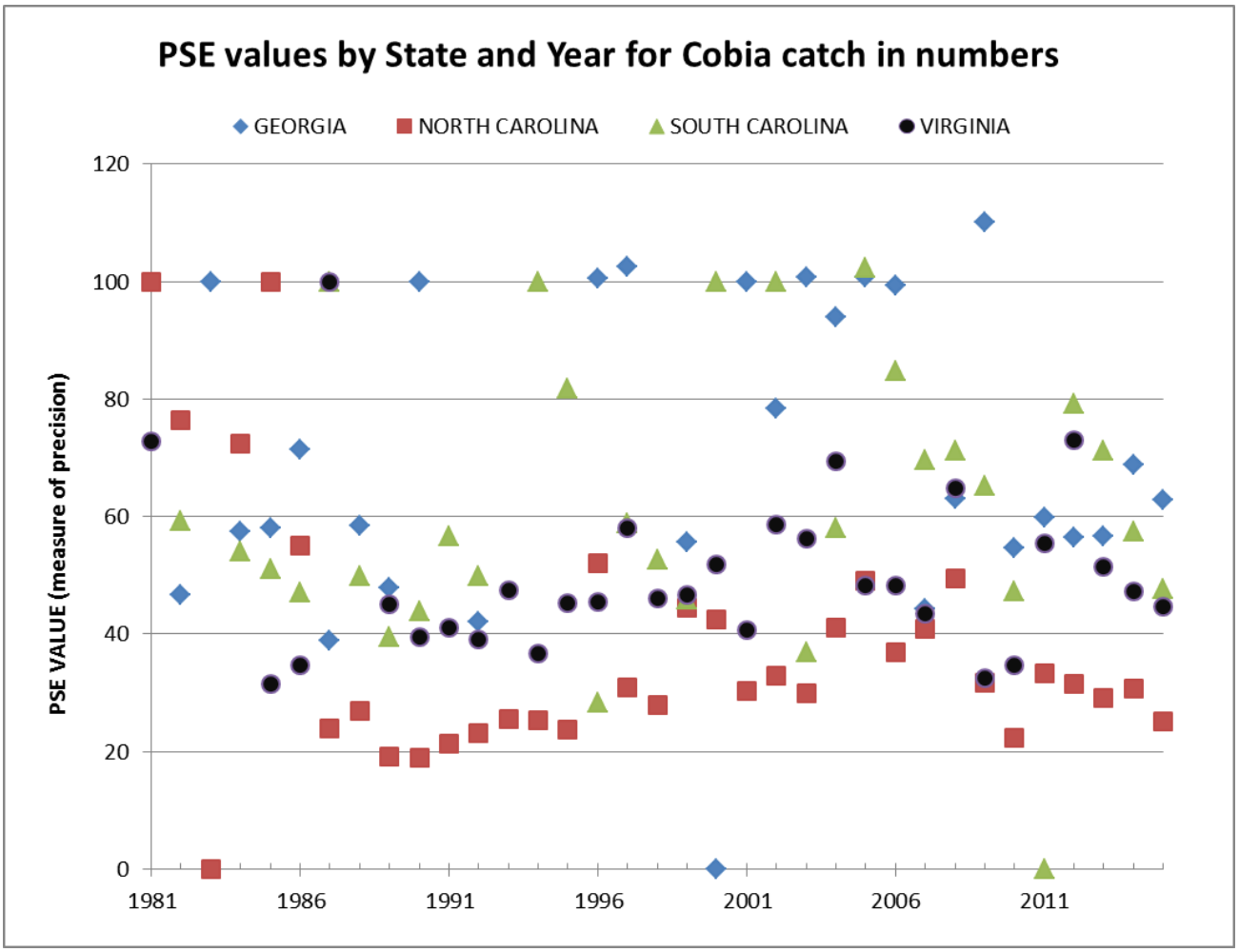

Figure 3. PSE values for Cobia, by state and year.

Did overfishing occur during 2004-2010, when there are numerous years of landings exceeding the estimated Rec OFL?

Figure 1 suggests that overfishing of cobia was occurring in the recent past, since landings exceeded the overfishing levels. However, many recall that the assessment outcomes indicated the stock was neither overfished nor overfishing. The time series of the overfishing measure, F/Fmsy was added to the landings plot to compare trends in the two measures of the population (Figure 4). This shows that overfishing was approached, in 2006, but the threshold MFMT was not exceeded.

- The stock assessment did not show a period when overfishing occurred.

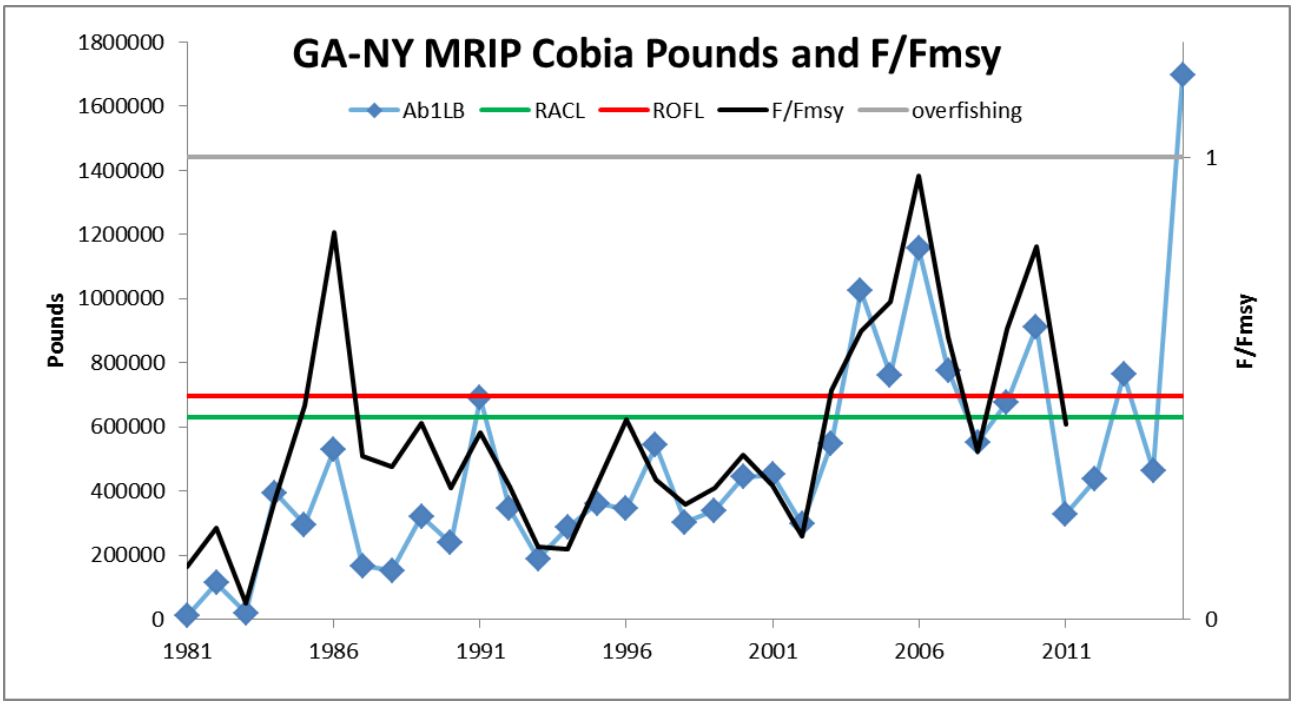

Figure 4. Cobia landings trend and 2015 benchmarks as shown in figure 1, overlaid with F/Fmsy estimated from the last assessment. Note that F/Fmsy is referenced on the right hand axis, and values exceeding 1 indicate overfishing.Assessment results indicate that overfishing is not estimated to have occurred during those years when OFL was exceeded (F/Fmsy<1).

It may seem counterintuitive that overfishing was not occurring despite landings exceeding benchmarks and equilibrium MSY. However, that this can and does happen illustrates the difference between yield and exploitation (fishing mortality) rates, and the role of stock biomass in the relation between those two measures of stock performance. When biomass is very high, above Biomass at MSY levels as was the case for cobia in the 1990's, yield exceeding MSY can be taken for a short while and maintain fishing mortality rates below Fmsy. This is the same mechanism that the Council has used to 'fish down' other stocks temporarily, such as mackerel and black sea bass, taking yields that exceed equilibrium MSY values while staying within fishing mortality (MFMT) thresholds.

Examining the biomass estimates for cobia indicate high spawning stock biomass relative to MSY levels in the 1990's and 2000's (Figure 5). At that time SSB was as much as 2.5 times SSB/SSBmsy, and such biomass levels could support short term landings above MSY without leading to excessive exploitation rates. However, removing more than the average the stock can support has a cost, and such action is called "fishing down" because that is exactly what it does to the stock biomass. The effect of landings exceeding MSY are apparent in the declining SSB after the mid 1990's. In fact, the terminal estimate from the assessment was the lowest in the time series and was only slightly above SSB msy (SSB/SSBmsy 20111 = 1.29). Over about a 20 year period the stock went from 2.5x SSBmsy to 1.3x SSBmsy. In real terms, this was a 53% decline in SSB. It is interesting that the decline in SSB initially starts during a time of relatively low landings and low F. This could perhaps be due to a series of poor year classes in the early to mid-1990's, as there is some recovery a few years later. Regardless, the decline is SSB has been consistent over most of the last 20 years, and was accelerated by the landings increase beginning around 2004. Given the terminal SSB estimates

and landings history of the last few years, it seems likely that overfishing will occur if landings on the order of those from 2004-2007 were to occur today.

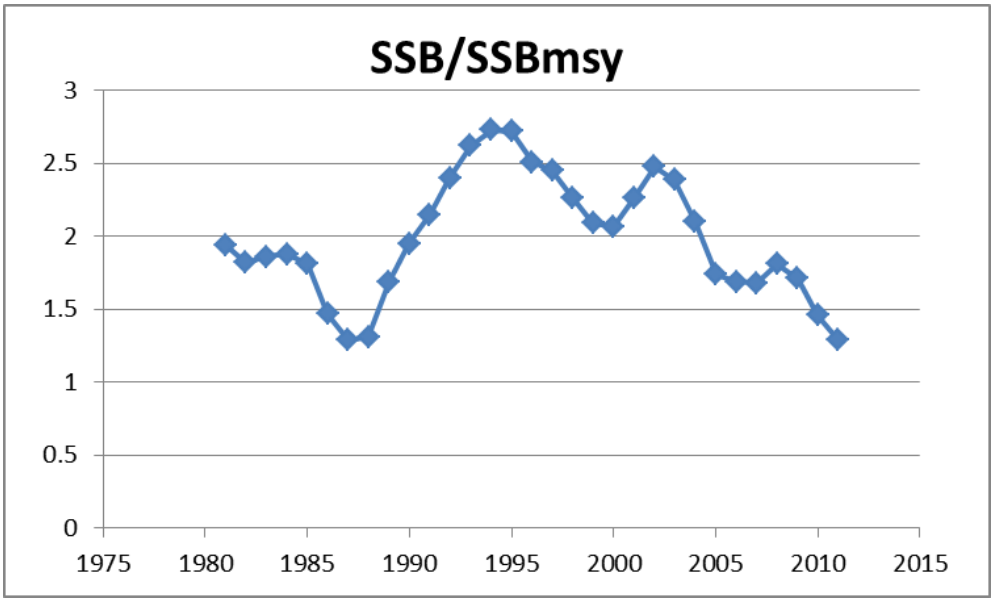

Figure 5. Spawning stock biomass relative to the MSY biomass reference for 1981-2011. SSB estimates are available farther back in time; this period was chosen to highlight the impact of landings during this time on SSB estimates.

Is there reason for concern and precaution with Cobia?

It appears so.

- Terminal assessment results indicate declining biomass and peak fishing mortality rates bumping up against the limits.
- Recreational landings for 7 of the last 12 years exceed the hypothetical recreational share (92%) of the equilibrium MSY (808,000 pounds).
- Landings have increased considerably in the last decade, with those from 2004 to 2014 twice those from 1992-2002.
- It seems unlikely that the APAIS calibration will have enough impact to resolve the ACL overage.
- Based on the use of landings relative to OFL as a measure of overfishing for years since the terminal assessment year, overfishing occurred in 2015.

Data Source Caveat

- Data used in this analysis to represent recreational landings in pounds and numbers are taken from a direct query of the MRIP website on February 4, 2015.
    - They do not include Wave 6 2015 although estimates since available show there were no wave 6 cobia landings
    - Headboat landings are not included
    - Weight values and mean weights derived here may not match information provided by SERO directly, due to different calculation of mean weight by SEFSC for the official ACL tracking database.