**Response to "Comments on the SRFS/MRIP Validation documentation
for GAG, Lynne Stokes (5/26/22)"**

Prepared by B. Sauls, T. Cross and C. Shae
Fish and Wildlife Research Institute
Florida Fish and Wildlife Conservation Commission
June 22, 2022

1. *"The method they propose appears only in the form of documentation in R code. The R code calls on functions that I am unfamiliar with, but on reading appears to make a numerical approximation to a delta method. When the calculation needed is as simple as delta method approximation for the ratio of two independent random variables* $(V\left(\frac{Y}{X}\right) \approx \frac{\mu_y^2}{\mu_x^2}\left(\frac{\sigma_y^2}{\mu_x^2} + \frac{\sigma_y^2}{\mu_x^2}\right))$*, one should provide the formula that is used and confirm that the function is computing it properly. However, I know nothing about how well that function works and none is offered. I suggest that using an R function when a simple formula is available should not be used as documentation."*

   o This statement raised concern that there may be something wrong with how the R package calculates variance using the delta method. Table 1 below compares the values calculated in R with the values calculated using the equation that Lynne provided above. There is no difference in the values out to 9 decimal places.

Table 1. Ratio variance differences by calculation method (*msm* package deltamethod() function vs. closed form delta method formula.

	Ratio Variance - Deltamethod() function	Ratio Variance – Closed form formula
Landings (no. fish)	0.003771268	0.003771268
Releases (no. fish)	0.001795235	0.001795235
Landings (pounds)	0.001569502	0.001569502

2. Bullet point 2 states: *"The documentation also states that a correlation of 0 was "assumed" for the next step, which was to approximate the variance of the product of the calibration factor and each historical FCAL estimate of total. Actually, this is not an assumption at all, but rather the actual correlation, since there should be no correlation due to the fact that the samples from the two terms of the product are temporally unrelated (don't overlap)."*

   o This statement is incorrect. The MRIP and SRFS have been conducted side-by-side since May 2015, and the calibration calculation uses paired estimates and variances across all months and years that the two surveys overlap.

- o APAIS data are included in both the MRIP and SRFS estimates, thus the two estimates are not completely independent.
- o The delta method was recommended by one of the MRIP consultants during a GRFS calibration review call held in March 2020 because it may be used when estimated values are potentially correlated.

Bullet point 2 further states, *"there is no reason to use a delta method approximation for the product of two random variables, since the exact variance of the product can be written in closed form. (See Goodman 1962, Journal of the American Statistical Association, 57, 54-60.)"*

- o The Goodman's method was one of two methods that FWRI proposed in our initial documentation that was provided to MRIP consultants for review in March 2020.
- o A call was held in March 2020 to discuss the two proposed methods. During that call, one of the MRIP consultants informed us that it was not appropriate to use Goodman's method if the two estimates are potentially correlated.
- o In a follow-up email to consultants and Richard Cody in June 2020, we provided new documentation that included recalculated variances approximated using the delta method, as recommended by consultants in March.
  - o This documentation was also provided as a background document, along with a PowerPoint presentation that was given at the August 2020 Calibration Workshop hosted by the Gulf Council: https://gulfcouncil.org/council/aug-calibration-workshop-rs-2020/
  - o During the workshop, MRIP consultants recommended assigning 0% correlation as the most conservative approach. Reversing course and using the Goodman's method was not discussed.
- o The impact of switching back to Goodman's method is essentially negligible. We compared calibrated time-series using the Goodman's method to the delta method with 0% correlation. The PSE's around all of annual calibrated estimates differ by less than 1%, and the average difference across the entire time-series is 0.13%.

3. Bullet point 3 states: *"there is a notation that NA is replaced with 0. I am not sure what NA represented. Does it mean that the estimate itself was 0 and the variance estimate was 0?"*

- o Occasionally, NA values occur when data sets for the MRIP and SRFS domain level estimates are merged together in R. This is an artifact of how MRIP Public Use Data files are formatted and output when post-stratified MRIP catch estimates are generated. This only happens on rare occasions when none of the reef fish trips intercepted in the APAIS for a post-stratified domain level catch estimate landed or released a single fish of that particular species (i.e., CPUE=0 for both landed and released catch). When this happens, a post-stratified estimate of 0 for the given cell

is not included in the output file. When MRIP domain level estimates are merged with overlapping SRFS estimates for the ratio calculation, R reads this as a missing value for MRIP and auto fills the value as "NA". To fix this, a line is included in the R code to convert NA to 0 if this occurs.

- o For the GRFS Gag calibration, there are NO instances where this occurs.

Bullet 3 further states, "There were several months when the FCAL estimate = 0 with a variance of 0 and the GRFS estimate is not 0. This clearly indicates a problem with the GRFS estimate, which cannot be improved when backcasting with a multiplicative calibration factor (since it will still be a zero). So I believe it would be better to exclude those months from the calibration exercise. In other words, the calibration factor will only be used (or make any difference) for those months when the FCAL estimate is non-zero. So I suggest including only such months in the calibration calculation.

- o There is a legitimate reason for the observation that several months when the MRIP estimate = 0, the GRFS estimate is greater than 0
  - o When no reef fish angler trips intercepted in the APAIS catch a particular species, the MRIP catch estimate for that species is 0. However, if during that same time period one or more anglers intercepted during supplemental intercept survey assignments for SRFS catch that species, then the SRFS estimates a value greater than 0 fish caught (since SRFS estimates include intercept data from both APAIS and supplemental SRFS assignments).
  - o Specifically for Gag, this can and does occur during months when the Gulf harvest season is closed in most of the state, but state regulations allow anglers to legally harvest Gag from state waters adjacent to four counties in Florida's Big Bend. During some of these months the APAIS does not intercept any trips that harvested Gag, but additional SRFS assignments conducted in the Big Bend do intercept some trips that harvested Gag. This results in SRFS estimating a small amount of landings when the MRIP survey does not detect any.

- o It is unclear what is meant by the statement that a GRFS estimate will "still be zero" when "backcasting with a multiplicative calibration factor". There may be a lack of understanding for how the calibration factor is calculated and applied backwards in time.
  - o For a given species and disposition (harvested or released catch), an overall ratio calibration factor is calculated as the sum of SRFS estimates for all months that the survey overlaps with MRIP, divided by the sum of MRIP estimates over the same months.
  - o To hindcast estimates for years prior to when the SRFS was initiated, the ratio described above is applied to the annual MRIP estimate.
    - ▪ There are no instances in the time series (for either survey) where an annual estimate equals 0.