

Multi-year calibration ratios for converting Florida's State Reef Fish Survey (SRFS) to NOAA MRIP FES and CHTS estimates of Red Snapper landings in numbers and pounds of fish: an update.

Tiffanie Cross
Florida Fish and Wildlife Conservation Commission
Fish and Wildlife Research Institute

Prepared for:
Gulf of Mexico Fishery Management Council Standing, Reef Fish,
Socioeconomic and Ecosystem SSC Meeting
January 2023



Review of Calibration Methods

- Red Snapper Calibration Workshop (August 2020)
 - Methods reviewed, recommended for use in management
- Gulf State Recreational Catch and Effort Surveys Transition-(February 2022)
 - Calibration method independently reviewed
 - Statistically valid
- SEDAR 72, Gulf Gag Grouper
 - Calibration method independently reviewed
 - Recommended for use in assessment



SRFS Overview

- Implemented in May 2015
 - Gulf coast of FL, excluding Monroe County
- Expanded statewide in Wave 4, 2020 – State Reef Fish Survey (SRFS)
 - No changes to methodology
- *Runs continuously side-by-side with MRIP*
- Effort Estimation → Independent of MRIP
 - Monthly mail survey
 - Address list obtained from reef fish angler registry license requirement
 - Under-coverage estimated from intercept survey
- CPUE Estimation → NOT independent of MRIP
 - Combines complementary APAIS and supplemental SRFS intercept data



SRFS Overview

Included in SRFS estimates:

- Private boat mode
- Monthly effort, landings and discards for:
 - Snappers: Red, Vermilion, Yellowtail, Mutton
 - Groupers: Red, Gag, Black
 - Gray Triggerfish, Hogfish
 - Greater and Lesser Amberjacks
 - Almaco Jack, Banded Rudderfish
- Gulf coast, excluding Monroe County
 - May 2015 to June 2020
- Gulf, Atlantic, and Keys
 - July 2020 to present



NOT included in SRFS estimates:

- Charter & Shore modes
- Non-SRFS species



How Do MRIP and SRFS Compare?

- MRIP Coastal Household telephone survey (CHTS)
 - Overlapped with SRFS May 2015 to December 2017
 - SRFS estimates similar to MRIP, but more precise
- MRIP Fishing Effort Survey (FES)
 - Implemented in 2018
 - Annual estimates consistently higher than SRFS
 - MRIP estimates less precise
- Relevance for Red Snapper management targets
 - Currently based on CHTS
 - Future assessments will be based on FES



Goal and Objectives

- Goal is to convert catch advice derived from future stock assessments using MRIP FES to the same currency as the SRFS.
 - Stock assessments outputs are at the annual scale.
- Objectives:
 - Develop species-specific conversion factors that may be applied to annual, fully calibrated MRIP estimates.
 - Useful for tracking state ACL for red snapper in SRFS currency.
 - Produce historic time series in the same currency as the SRFS.
 - Useful as an alternative time series or for sensitivity analyses in stock assessments.



Approach

- Quantify overall differences between SRFS and FES estimates across variable years and waves over which the two surveys overlap
- Apply a single calibration factor to annual FES estimates back in time.
 - Widely variable recreational harvest seasons off the Gulf coast of Florida prior to 2018 across state and federal jurisdictions.
 - Historically, 6-12 month season, consistent in state & EEZ
 - SRFS and MRIP surveys overlapping years:
 - 2015-2017: weeks or days, varied in state & EEZ
 - 2018-present: two months+, consistent in state & EEZ
 - Not appropriate to apply calibrations at a fine scale back in time
 - e.g. by month, area fished



Step 1: Sum estimates and variance

- For each species (s) and variable (v = number landed, pounds landed, or number released), estimates and variances from each estimation method (m = *GRFS* or *FES*) were summed across:
 - All years (y)
 - All two-month waves (w)
 - All areas fished (a = EEZ, state waters)

$$\hat{E}_{m,s,v} = \sum_{m,s,v} \hat{E}_{y,w,a,m,s,v}$$

$$\hat{V}(\hat{E}_{m,s,v}) = \sum_{m,s,v} \hat{V}(\hat{E}_{y,w,a,m,s,v})$$



Step 2: Calculate ratios and variance

- For each of the paired sums, the ratio was calculated as the total SRFS estimate divided by total FES estimate
 - Note: FES estimates include Monroe County. Separate ratios may be calculated with Monroe County excluded.

$$\hat{R}_{S,v} = \frac{\hat{E}_{SRFS,S,v}}{\hat{E}_{FES,S,v}}$$

- Delta method was recommended to approximate the variance of the ratios
 - Incorporates error associated with both the numerator (SRFS estimates) and denominator (FES estimates).
 - R package 'msm' used to carry out variance calculations (R Core Team 2018; Jackson 2011).



Accounting for Correlation

- SRFS incorporates catch data collected through MRIP
 - The two estimates are correlated, but degree is unknown
- Delta method approximated variances at three levels of correlation:
 - $\rho = 0$, most conservative approximation, ignores correlation between the two survey estimates
 - $\rho = 0.5$, assumes some correlation between estimates is explained by shared data that both surveys have in common
 - $\rho = 0.9$, upper limit based on linear regressions
- Recommended: $\rho = 0.0$



Step 3: Convert to SRFS currency

- Multiply the annual FES estimate for each year, species, and variable (number landed, pounds landed, number released) with the corresponding ratio

$$\hat{E}_{GRFS-hind,y,s,v} = \hat{R}_{s,v} \hat{E}_{FCAL,y,s,v}$$

- Variance was again approximated using the delta method
 - No additional correlation included in this step



Calibration Update

- No changes to the ratio and variance calculation method
 - Previous reports included MRIP-FES to SRFS conversion using 2015-2019 private boat mode MRIP estimates publicly available from NOAA OS&T
- For this update, NOAA SERO provided MRIP private boat mode estimates (FES and CHTS) that excluded charter estimates
 - Added most recent years to the overlapping time series
 - 2020 excluded due to suspended and reduced intercept survey sampling due to COVID-19
 - Added MRIP-CHTS to SRFS calibration ratios and variance
- Monroe County included in MRIP (FES and CHTS) and excluded from SRFS across all years



Calibration Update

Considered the following scenarios:

- 1) May 2015 to December 2019
 - the years originally included in Cross et al. (2020);
- 2) May 2015 to December 2017
 - SRFS, CHTS, and FES overlap, and
 - the years recommended and approved for Florida by the Gulf SSC during their August 2020 meeting;
- 3) Years 2018, 2019, and 2021
 - the years SRFS and FES overlap; and
- 4) All available overlapping estimates from May 2015 to December 2021, excluding 2020.

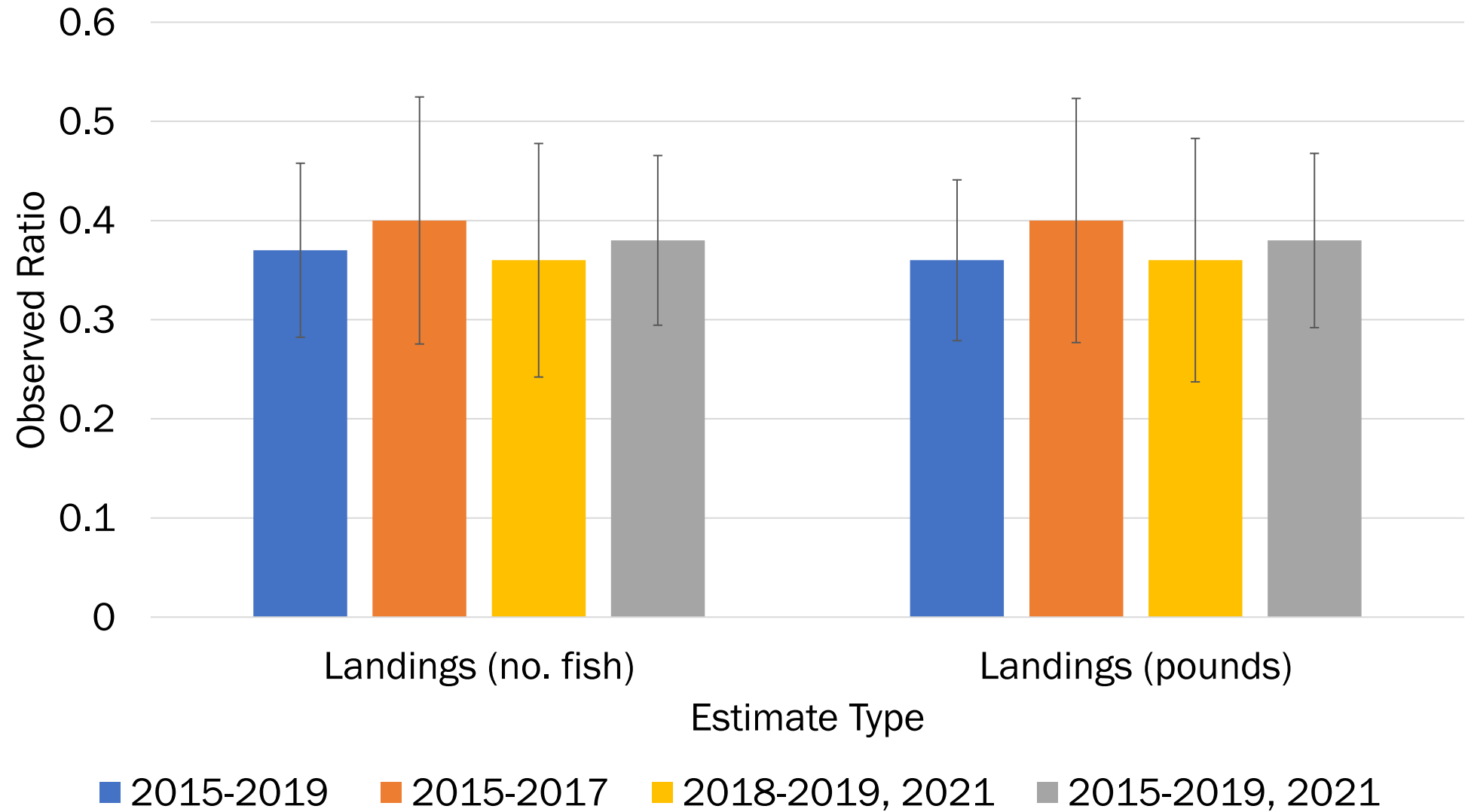


Calibration Update

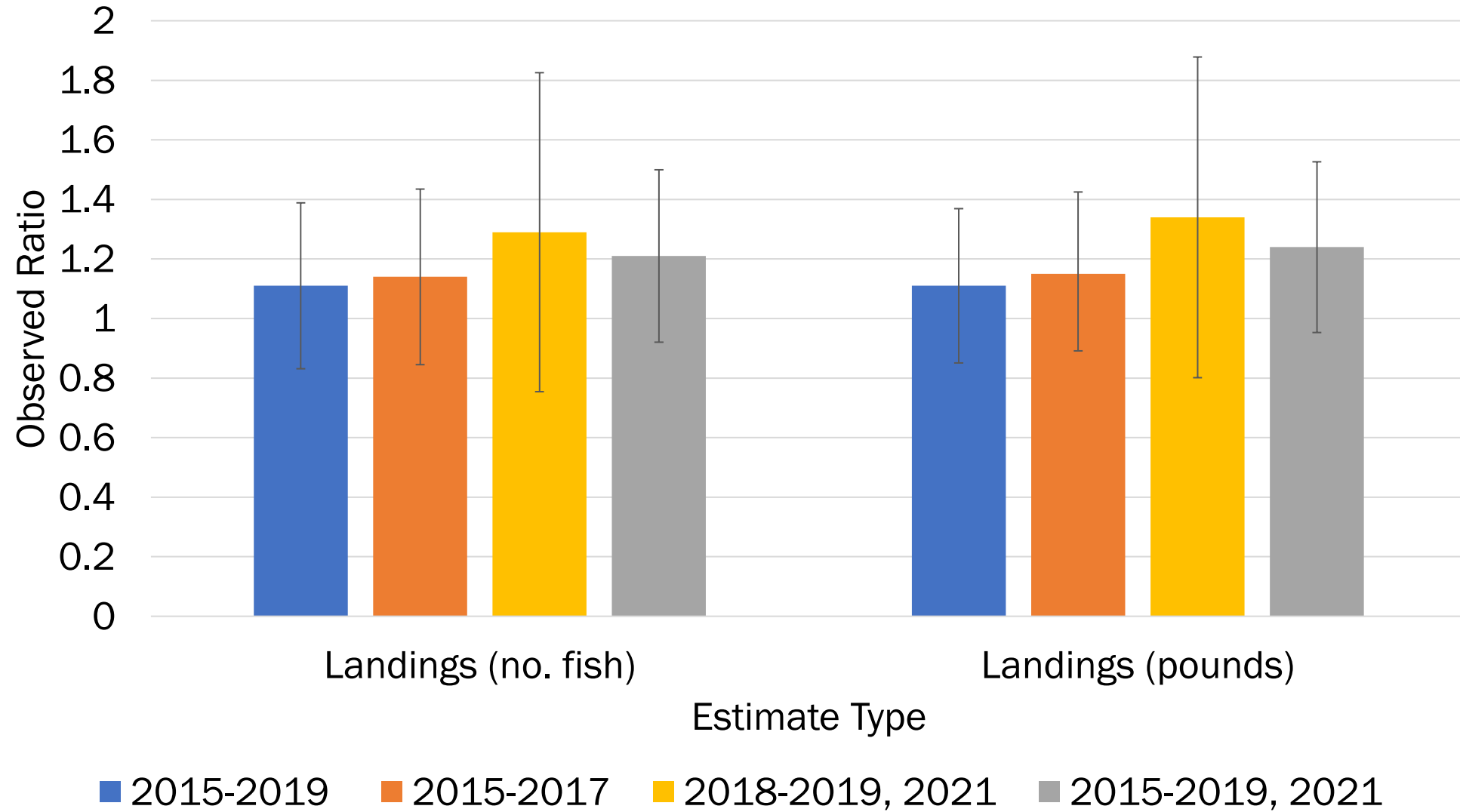
Table 1. Annual and summed SRFS, MRIP-FES, and MRIP-CHTS landings estimates in pounds and numbers of fish, and associated variances for Red Snapper. Note: Monroe County is included in MRIP estimates but not SRFS estimates.

Estimate Type	Year	SRFS sum	SRFS CV	MRIP-FES sum	MRIP-FES CV	MRIP-CHTS sum	MRIP-CHTS CV
Landings (no. fish)	2015	210,968	0.16	442,902	0.21	162,607	0.24
	2016	296,519	0.15	669,649	0.17	291,827	0.18
	2017	485,004	0.12	1,366,131	0.24	418,954	0.15
	2018	404,290	0.12	1,008,548	0.21	334,198	0.32
	2019	247,883	0.21	1,009,579	0.23	277,264	0.31
	2021	347,279	0.18	792,566	0.30	161,397	0.33
	TOTAL	1,991,943	0.06	5,289,759	0.10	1,646,247	0.10
Landings (pounds)	2015	1,139,846	0.12	2,333,283	0.23	831,998	0.22
	2016	1,338,059	0.10	3,290,551	0.19	1,436,908	0.18
	2017	2,440,328	0.08	6,698,077	0.24	2,026,113	0.17
	2018	1,913,216	0.08	4,679,190	0.21	1,553,416	0.32
	2019	1,244,312	0.13	5,198,177	0.22	1,428,408	0.30
	2021	2,274,100	0.18	5,186,791	0.33	1,072,334	0.34
	TOTAL	10,349,862	0.05	27,386,069	0.11	8,349,177	0.11

Red Snapper SRFS to MRIP-FES Conversions



Red Snapper SRFS to MRIP-CHTS Conversions



SRFS to MRIP-CHTS Conversions

Table 2. Calibration ratios for SRFS to MRIP-CHTS and SRFS to MRIP-FES conversions, and associated PSEs at 0%, 50%, and 90% correlation for Red Snapper landings in pounds and numbers of fish under four different scenarios: 1) years 2015 to 2019; 2) years 2016 to 2019; 3) years 2018, 2019, 2021; and 4) years 2015 to 2019, and 2021.

Conversion Type	Estimate Type	Years included	Ratio	Ratio PSE		
				0% corr.	50% corr.	90% corr.
SRFS to MRIP-CHTS	Landings (no. fish)	2015-2019	1.11	12.8	9.6	5.8
		2015-2017	1.14	13.2	9.5	4.7
		2018-2019, 2021	1.29	21.2	16.3	11.0
		2015-2019, 2021	1.21	12.2	9.1	5.5
	Landings (pounds)	2015-2019	1.11	11.9	9.6	7.3
		2015-2017	1.15	12.2	9.3	6.2
		2018-2019, 2021	1.34	20.5	16.1	11.5
		2015-2019, 2021	1.24	11.8	9.2	6.3
SRFS to MRIP-FES	Landings (no. fish)	2015-2019	0.37	12.1	8.9	5.1
		2015-2017	0.40	15.9	8.5	7.2
		2018-2019, 2021	0.36	16.7	12.1	6.5
		2015-2019, 2021	0.38	11.5	8.5	4.8
	Landings (pounds)	2015-2019	0.36	11.5	9.2	6.9
		2015-2017	0.40	15.7	9.2	9.9
		2018-2019, 2021	0.36	17.4	13.1	8.3
		2015-2019, 2021	0.38	11.8	9.2	6.3

Reference Document

Cross, Shea and Sauls. 2020. A ratio-based method for calibrating GRFS and MRIP-FCAL estimates of total landings (numbers and pounds of fish), and releases (numbers of fish). Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, St. Petersburg, FL.

Available on Gulf Council website for this meeting:

<https://gulfcouncil.org/meetings/mrip-state-federal-calibration-workshop/>

