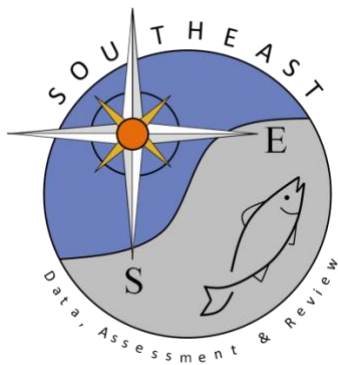


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Estimation of length composition of commercial discards for Gulf of Mexico red snapper

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Introduction

The general approach for estimating discards for the commercial reef fish fleet in the Gulf of Mexico utilizes catch-per-unit-effort (CPUE) from the coastal reef fish observer program and total fishing effort from the commercial reef logbook program to estimate total catch,

$$totalCatch = CPUE * totalEffort.$$

For discard estimation, CPUE is computed for total discards, including fish released alive, released dead, released in unknown condition, and used for bait. Length compositions of discards are also derived from observer data. In many cases, discard estimation involves stratification of observer sample units, i.e., observer trips, by management time periods and catch or effort levels (e.g., low catch and high catch trips). This was the case for Gulf of Mexico red snapper commercial discards (Martinez et al. 2022) to account for over- or under-sampling of high catch trips by observers relative to the commercial fleet (i.e., logbook trip catches). When stratification is necessary, estimation of discard length compositions needs to be carried out accordingly; simply using nominal length observations will likely result in biased stock-wide length compositions for discards. This working paper describes the general methodology for producing stratum-weighted discard length compositions, and applies the procedures to estimate length compositions of commercial discards for Gulf of Mexico red snapper.

Methods

The length frequency distribution for discards for a given geographical subregion and management time frame was computed in the following manner. Average discard CPUE in stratum h was scaled to stratum total effort \hat{X}_h

$$\hat{Y}_h = \overline{CPUE}_h \times \hat{X}_h$$

and multiplied by stratum proportion of length L to obtain the stratum total discards \hat{Y} at length L ,

$$\hat{Y}(L)_h = \hat{Y}_h \times p(L)_h \quad .$$

These were summed over all strata to obtain the survey frame total \hat{Y} at length L

$$\hat{Y}(L)_{st} = \sum_h \hat{Y}(L)_h \quad ,$$

and then converted to relative proportion of length L ,

$$p(L)_{st} = \frac{\hat{Y}(L)_{st}}{\sum_h \hat{Y}_h} \quad . \quad (1)$$

Annual discards-at-length were computed by multiplying eq. (1) and annual estimates of total discards (see Martinez et al. 2022).

Data sources (coastal observer program, commercial logbooks) and discard estimation procedures for GOM red snapper are detailed in Martinez et al. (2022). Discard length compositions were computed separately by gear (vertical line and bottom longline) and spatial

subregion (East, Central, West). Vertical line estimates were computed for three management time periods (2007, 2008-2013, 2014-2019) and stratified by trip catch levels. Due to sparse sampling of bottom longline trips by observers, data were pooled across years, and catch level strata were defined for the Western zone only. Following Martinez et al. (2022), estimates of discards-at-length for the Central zone were based on pooling bottom longline data for the East and Central zones.

Results

For vertical line data, management regimes were based on patterns in annual discard rates, length composition, and minimum size limit changes (Martinez et al. 2022). Management regimes were classified as First (2007), Second (2008-2013), and Third (2014-2019). Statistical sample sizes in terms of observer trips (n) and numbers of measured discarded fish are given in **Table 1** by spatial zone, management time periods, and catch level strata.

For bottom longlines, years were pooled into a single management regime due to sparse observer sampling. Statistical sample sizes of observer trips and measured discarded fish are given in **Table 2** by spatial zone and catch level strata.

Tables of discard length frequencies by management period and annual discards-at-length were provided to stock assessment analysts via the S-Drive for each gear type. Example annual discards-at-length for vertical lines in the East zone are illustrated in **Figure 1**.

Literature Cited

Martinez Rivera, S., S.F. Atkinson, S.G. Smith and K.J. McCarthy. 2022. CPUE expansion estimation for commercial discards of Gulf of Mexico red snapper. SEDAR Working Paper SEDAR74-DW-19. SEDAR, North Charleston, SC. 34 pp.

Table 1. Red Snapper vertical line sample sizes in terms of observer trips (n) and number of measured discarded fish by management regime and catch level strata for GOM spatial zones (East, Central, West). Delineations of catch level strata are detailed in Martinez et al. (2022); catch level stratum ‘A’ is all levels (i.e., no stratification) for the management regime, “H”, “M” and “L” are high, moderate and low, respectively.

Zone (E)

Management Regime	Catch Level	Number of Observer Trips (n)	Number of Measured Fish
First (2007)	H (>144 lbs)	4	76
First (2007)	L (\leq 144 lbs)	24	259
Second (2008-2013)	H (>152 lbs)	79	1,875
Second (2008-2013)	L (\leq 56 lbs)	94	2,399
Second (2008-2013)	M (>56, \leq 152 lbs)	22	431
Third (2014-2019)	H (>133 lbs)	67	2,278
Third (2014-2019)	L (\leq 34 lbs)	68	571
Third (2014-2019)	M (>34, \leq 133 lbs)	31	352

Zone (C)

Management Regime	Catch Level	Number of Observer Trips (n)	Number of Measured Fish
First (2007)	A	43	957
Second (2008-2013)	A	240	4,377
Third (2014-2019)	H (>522 lbs)	80	3,031
Third (2014-2019)	L (\leq 522 lbs)	123	1,989

Zone (W)

Management Regime	Catch Level	Number of Observer Trips (n)	Number of Measured Fish
First (2007)	H (>1486 lbs)	4	611
First (2007)	L (\leq 1486 lbs)	13	98
Second (2008-2013)	A	78	3,637
Third (2014-2019)	H (>2880 lbs)	56	1,947
Third (2014-2019)	L (\leq 749 lbs)	30	490
Third (2014-2019)	M (>749, \leq 2880 lbs)	17	113

Table 2. Red Snapper bottom longline sample sizes in terms of observer trips (n) and number of measured discarded fish by catch level strata for GOM spatial zones (East, Central, West). Delineations of catch level strata are detailed in Martinez et al. (2022); catch level stratum ‘A’ is all levels (i.e., no stratification), ‘H’ and ‘L’ are high and low, respectively. Due to sparse observer sampling in the Central zone, data were pooled for the East and Central zones for discards-at-length estimation (see Martinez et al. 2022).

Zone	Catch Level	Number of Observer Trips (n)	Number of Measured Fish
East	A	317	13,467
Central	A	329	13,870
West	H (>694 lbs)	10	31
West	L (\leq 694 lbs)	19	522

Figure 1. Example annual discard length compositions for Red Snapper in GOM East zone for vertical line gears, accounting for catch level stratification by management period (see **Table 1**).

Zone (E)

