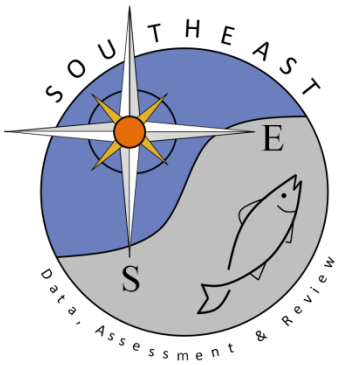
Proxy Discard Estimates of Yellowtail Snapper (*Ocyurus chrysurus*) from the US Gulf of Mexico and South Atlantic Headboat Fishery

Matthew A. Nutttall

SEDAR96-WP-06

23 August 2024



Please cite this document as:

Nuttall, Matthew A. 2024. Proxy Discard Estimates of Yellowtail Snapper (*Ocyurus chrysurus*) from the US Gulf of Mexico and South Atlantic Headboat Fishery. SEDAR96-WP-06. SEDAR, North Charleston, SC. 12 pp.

SEDAR 96-WP-06

Proxy Discard Estimates of Yellowtail Snapper (*Ocyurus chrysurus*) from the US Gulf of Mexico and South Atlantic Headboat Fishery

NOAA Fisheries
Southeast Fisheries Science Center
Sustainable Fisheries Division
Data Analysis and Assessment Support Branch
75 Virginia Beach Drive
Miami FL 33149

Matthew A. Nuttall

08-23-2024

Abstract

Discard data were not routinely collected as part of the Southeast Region Headboat Survey (SRHS) until 2004, prior to which SRHS discard estimates are not available. These data are self-reported and not currently validated within the SRHS program. As a form of validation, SRHS discard rates were compared to those from the Headboat At-Sea Observer Program to determine those years for which SRHS discard estimates should be used (SEDAR 96-WP-02), from which the decision was to retain SRHS discard estimates between 2008-2023. For those years prior (1981-2007), proxy discard estimates were calculated using the srhs-mean approach, with annual calculations conducted at the region level.

Introduction

The Southeast Region Headboat Survey (SRHS) logbook form was modified in 2004 to standardize collection of discard data for each reported trip (Fitzpatrick et al. 2017, SEDAR 79-DW-06). Some logbooks prior to 2004 allowed for discards to be reported, but these had to be handwritten (by species) and were rarely reported. Between 2004-2012, discard information was collected from logbook forms as the number of fish (by species) and their discard condition (e.g. released alive or released dead). Port agents instructed each captain on criteria for determining the condition of discarded fish, in that a fish was considered "released alive" if it was able to swim away on its own and "released dead" if it was unable to swim, floated off, or was obviously dead. As of Jan 1, 2013, the SRHS began collecting logbook data electronically. Changes to the required reporting were also made at this time, one of which was the removal of the condition category for discards. Current forms only require information on the total number of fish released, regardless of condition, due to the subjectivity in determining the condition of released fish. Live and dead releases for 2004 to 2012 are typically combined as total discards for consistency with SRHS data collection in later years.

Underreporting of discard information on SRHS logbooks was a concern in the initial years of data collection (e.g., 2004-2007) (SEDAR PW-07) as many headboat captains expressed confusion with the new data fields. Because logbook data are self-reported, discard data are not currently validated within the SRHS program. To assess the validity of annual SRHS discard estimates, discard rates from SRHS logbooks can be compared to those from the Headboat At-Sea Observer Programs. These programs were implemented to collect more detailed information on headboat catch, particularly for discarded fish. In the Gulf of Mexico, headboat observers operate mainly in western Florida (beginning in 2005), with limited coverage in Alabama in certain years (beginning in 2004) (SEDAR 61-WP-13) and Texas in 2011 (Donaldson et al. 2013). In the South Atlantic, headboat observers began sampling in North and South Carolina in 2004 and in Georgia and Florida in 2005 (SEDAR 68-DW-23). Inconsistent funding and natural phenomenon (e.g., 2020 COVID-19 pandemic) have led to short breaks in the sampling for some of these surveys (e.g., no observer coverage of Gulf of Mexico headboats in 2008). Within these programs, headboat vessels are randomly selected throughout the year in each state, with the west coast of Florida further stratified into three sample regions (i.e., panhandle, western peninsula, and the FL Keys) and the east coast of Florida into two sample regions (i.e., north vs. south). Biologists board selected vessels with permission from the captain and observe a subset of anglers as they fish on the recreational trip. Data collected include the number of fish landed and discarded by species.

Because discards were not added to the SRHS logbook form until 2004, a proxy method is needed to provide headboat discard estimates for prior years (e.g., 1981-2003) and/or for any years for which SRHS discard estimates are considered inaccurate (e.g., 2004-2007). This working paper identifies how SRHS proxy discards were estimated in SEDAR 96 and the associated justifications for any required decisions (e.g., selection of method and years to include in the estimation).

Methods

Validation of SRHS Catch Rates

Discard rates of Gulf of Mexico and South Atlantic yellowtail snapper (ratio of discards to total catch) from SRHS logbooks were compared to those from the Headboat At-Sea Observer Programs to validate SRHS discard estimates. This comparison is used to identify the appropriate start year for SRHS discard estimates (e.g., 2004 or 2008) and any calibrations needed to offset potential misreporting of SRHS discard rates. SRHS discard estimates in the early years of data collection (i.e., 2004-2007) were also compared to those in subsequent years to further evaluate the likelihood of under-reporting. For SEDAR 96 (SEDAR 96-WP-02), the decision is to retain SRHS discard estimates for years 2008 – 2023, and to impute proxy discard estimates for any years prior (1981-2007). Note that this differs from the decision made in SEDAR 64 (SEDAR 64-DW-10), where the SRHS discard timeseries started with the first year of data collection (i.e., in 2004) and proxy discards were imputed for 1981-2003.

Discard proxy

Several sources of proxy (SRHS) discard estimates have been considered in past SEDAR stock assessments, including the preferred superratio approach (SEDAR-PW-07). All of these methods are based on scaling historic SRHS landings estimates (e.g., 1981-2007) by some assumed discard rate(s), but what differs between the approaches is how these discard rate(s) are estimated, most being derived from some subset of MRIP catch data (described in SEDAR 96-WP-01). SRHS catch estimates for SEDAR 96 Gulf of Mexico and South Atlantic yellowtail snapper are provided in SEDAR 96-WP-02.

Of those methods considered in SEDAR 96:

- Super-Ratio (charterboat) approach rescales past (e.g., 1981-2007) discard rates of the MRIP charterboat mode (discards:landings) by the ratio of mean discard rates between the MRIP charterboat mode and SRHS headboat mode from recent years (e.g., 2008-2023). This approach is the current "Best Practice" method for calculating discard proxies as it allows for changes in management and year class effects to be incorporated into the estimation (annual discard proxies estimated from SRHS landings and discard rates for the same year) and accounts for potential differences in the magnitude of MRIP vs. SRHS discards (i.e., rescaling with superratios) (SEDAR-PW-07, Issue #11). Additionally, the discard rates for this method are estimated from those of charterboat anglers, who are generally assumed to fish in areas and use fishing methods most similar to headboat anglers.
- SRHS-Mean approach applies an average SRHS discard rate from recent years (e.g., 2008-2023). This approach is limited to (native) estimates from the SRHS and not influenced by any inherent differences in the magnitude (of discards) between the MRIP and SRHS. However, this approach relies on (average) SRHS discard rates

calculated from years that differ from those for which discard proxies are being calculated, and so does not account for any changes in management or year class effects. The SRHS-Mean approach has been applied in past SEDAR stock assessments, offering an alternative when MRIP discard rates are highly variable and/or do not agree with SRHS discard rates (e.g., SEDAR 68).

To determine the most appropriate set of proxy estimates for SEDAR 96 Gulf of Mexico and South Atlantic yellowtail snapper, discard rates and the associated proxy estimates were compared to the corresponding SRHS estimates for those years where SRHS estimates were considered reliable and retained for use in this assessment. This comparison includes visual inspection of the resultant timeseries, both between methods and with actual SRHS discard estimates (2008-2023).

At the request of the SEDAR 96 assessment analysts, proxy discards were estimated from data limited to the state of Florida, which accounts for the vast majority of yellowtail snapper catch by SRHS headboats across the southeast region. Proxies were calculated at the region-level, effectively splitting Florida into two spatial areas: a 'West' region dominated by yellowtail snapper catch from the Florida Keys (~75% of total SRHS landings and ~81% discards) and a 'East' region dominated by catch from southeast Florida (~23% landings and ~17% discards).

Uncertainty estimates for SRHS proxy discards are provided as coefficients of variation, with associated variances calculated using standard statistical equations. Variances of annual discard rates ($var(r_{B2:AB1})$) are approximated using a Taylor Series expansion ignoring covariance terms (SEDAR 74-DW-10, Equation 2):

$$var(r_{B2:AB1}) = \frac{var(B2)}{AB1^2} + \frac{B2^2 * var(AB1)}{AB1^4}$$

SRHS estimates of catch and associated uncertainties are provided in SEDAR 96-WP-02. GenRec estimates of catch and associated uncertainties are provided in SEDAR 96-WP-01. For those methods that require an average discard rate (e.g., superratios, SRHS-Mean), the associated variance is calculated as $\frac{\sum variance}{n^2}$. With variances available for discard rates ($r_{B2:AB1}$) and SRHS landings estimates ($AB1$), variances of the associated proxies ($var(\widehat{B2})$) are approximated using Goodman's Formula (SEDAR 74-DW-10, Equation 5):

$$var(\widehat{B2}) = \left(AB1^2 * var(r_{B2:AB1})\right) + \left(r_{B2:AB1}^2 * var(AB1)\right) - \left(var(r_{B2:AB1}) * var(AB1)\right)$$

Results

Discard Proxy

Despite differences in the magnitude of recreational discard rates and associated proxy estimates in some years (Figure 1), the general trends in these estimates were fairly similar across proxy methods and to those from the SRHS for years where SRHS discard estimates were available, considered reliable, and retained for use in SEDAR 96 (2008-2023). Each method considered in this analysis produced proxy discards (1981-2007) that tended to be higher than those over the more recent time period (2008-2023). Across those years for which proxy discards are needed in SEDAR 96 (1981-2007), proxy estimates from the preferred Super-Ratio approach were relatively variable, and produced suspect discard estimates for a few strata. These estimates are discussed further in the Discussion section. Conversely, proxy estimates from the SRHS-Mean approach had less variability and more closely aligned with actual SRHS estimates.

Discussion

For SEDAR 96, the SRHS-Mean approach is recommended to provide proxy SRHS discard estimates for years 1981-2007 (Table 1, Figure 2). The superratio approach is the preferred proxy method according to SEDAR Best Practices, with alternative methods considered when this approach fails (SEDAR-PW-07). For Gulf of Mexico and South Atlantic yellowtail snapper, the superratio approach produced proxy discards that were highly variable and suspect in some years. In particular, the high proxy discard estimated in 1991 for the West region was a function of a relatively high discard rate from MRIP charterboats (Figure 1) and not believed representative of a true trend in SRHS headboat catch (i.e., it is not seen in the corresponding SRHS landings timeseries). Similarly, in the East region, the superratio approach produced zero discard estimates in multiple years requiring a proxy (e.g., 1986-1991, 1994-1997), relatively low proxy estimates in 2015-2016 (which underestimates what was seen in the SRHS survey), and relatively high estimates in 2022 (in contrast to actual SRHS discards, which were relatively in-line with those in 2021 and 2023).

Given these concerns with the preferred superratio approach, the SRHS-Mean approach is recommended as an alternative. Although the SRHS-Mean approach does not account for any changes in management or year class effects, inter-annual discard rates from SRHS logbooks were quite stable over the time period from which the average SRHS discard rate was calculated (2008-2023, Figure 7 in SEDAR 96-WP-02). Over this same time period, there also does not appear to be any changes to management regulations with appreciable

influence on discarding behavior. Taken together, this assumption of a constant annual discard rate in the SRHS-Mean approach appears valid for SEDAR 96 yellowtail snapper. This decision to use the SRHS-Mean approach differs from that made in SEDAR 64 (SEDAR 64-DW-10), which used the preferred superratio approach to provide proxy discard estimates.

References

Allen, S, L Herdter, and K Fitzpatrick. 2019. SEDAR 64-DW-10. Overview of the Southeast Region Headboat Survey and Data Related to Yellowtail Snapper (*Ocyurus chrysurus*). SEDAR, North Charleston, SC. 25pp.

Binion-Rock, SM. 2024. SEDAR 96-WP-01. General Recreational Survey Data for Yellowtail Snapper in the Gulf of Mexico and South Atlantic. National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC) Sustainable Fisheries Division. Miami, FL.

Cheshire, RT, K Brennan, and ME Green. 2023. SEDAR 79-DW-06. Headboat Data for Mutton Snapper in the Southeast US Atlantic and Gulf of Mexico. SEDAR, North Charleston, SC. 55pp.

Cheshire, RT, K Brennan, ME Green, A Poholek, and J Silvennoinen. 2024. SEDAR 96-WP-02. Headboat Data for Yellowtail Snapper in the Southeast US Atlantic and Gulf of Mexico. National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC) Fisheries Statistics Division. Miami, FL.

Donaldson, D, G Bray, B Sauls, S Freed, B Cermak, P Campbell, A Best, K Doyle, A Strelcheck, and K Brennan. 2013. Final Report: For-Hire Electronic Logbook Pilot Study in the Gulf of Mexico. Submitted to the Marine Recreational Information Program Operations Team. 284pp. Retrieved from: https://www.st.nmfs.noaa.gov/Assets/recreational/pdf/Charter_Boat_Logbook_Project_report.pdf

Fitzpatrick, EE, EH Williams, KW Shertzer, KI Siegfried, JK Craig, RT Cheshire, GT Kellison, KE Fitzpatrick, and K Brennan. 2017. The NMFS Southeast Region Headboat Survey: History, Methodology, and Data Integrity. Marine Fisheries Review 79(1): 1-27. Retrieved from: https://repository.library.noaa.gov/view/noaa/51771

Lazarre, D. 2018. SEDAR 61-WP-13. A Summary of Red Grouper Size Distribution Data from Recreational Fishery Surveys in the Gulf of Mexico. SEDAR, North Charleston, SC. 17pp.

Lazarre, D, C Wilson, K Fitzpatric. 2020. SEDAR 68-DW-23. Scamp Length Frequency Distributions from At-Sea Headboat Surveys in the South Atlantic, 2005 to 2017. SEDAR, North Charleston, SC. 11pp.

NMFS Office of Science and Technology. 2022. SEDAR 74-DW-10. Methodology Description for a Calibration of Texas Private Boat Red Snapper Annual Landings Estimates. National Marine Fisheries Service (NMFS) Office of Science and Technology (OST) Fisheries Statistics Division. Silver Spring, MD.

SEDAR. 2015. SEDAR-PW-07. SEDAR Procedural Workshop 7: Data Best Practices. SEDAR, North Charleston SC. 151pp. Available online at: https://sedarweb.org/documents/sedar-pw-07-data-best-practices-final-report-sept-2015/

Table 1. Timeseries of SRHS Proxy Discard Estimates and associated Coefficients of Variation (1981-2007) for SEDAR 96 Gulf of Mexico and South Atlantic yellowtail snapper. Proxy discards were calculated using the SRHS-MEAN approach, with annual calculations conducted at the region level.

Year	SID	Proxy	CV
1981	WEST	35,251	0.547
1981	EAST	18,045	0.171
1982	WEST	66,667	0.377
1982	EAST	12,766	0.516
1983	WEST	80,675	0.555
1983	EAST	7,379	0.331
1984	WEST	57,951	0.543
1984	EAST	7,161	0.626
1985	WEST	52,982	0.555
1985	EAST	5,435	0.603
1986	WEST	83,179	0.513
1986	EAST	6,440	0.510
1987	WEST	94,011	0.438
1987	EAST	7,813	0.545
1988	WEST	111,837	0.578
1988	EAST	11,654	0.576
1989	WEST	57,497	0.617
1989	EAST	9,501	0.612
1990	WEST	80,301	0.570
1990	EAST	10,383	0.602
1991	WEST	75,476	0.561
1991	EAST	11,271	0.644
1992	WEST	70,987	0.350
1992	EAST	11,705	0.465
1993	WEST	81,813	0.242
1993	EAST	9,696	0.458
1994	WEST	78,711	0.355
1994	EAST	16,237	0.595
1995	WEST	57,358	0.222

Year	SID	Proxy	CV
1995	EAST	7,677	0.606
1996	WEST	54,084	0.304
1996	EAST	4,938	0.879
1997	WEST	53,449	0.211
1997	EAST	5,693	0.709
1998	WEST	49,442	0.274
1998	EAST	3,404	0.743
1999	WEST	40,016	0.268
1999	EAST	5,217	0.933
2000	WEST	45,983	0.348
2000	EAST	2,576	0.933
2001	WEST	45,874	0.506
2001	EAST	1,057	0.866
2002	WEST	55,988	0.623
2002	EAST	591	0.817
2003	WEST	46,611	0.644
2003	EAST	2,202	0.960
2004	WEST	52,022	0.629
2004	EAST	1,811	0.917
2005	WEST	62,604	0.609
2005	EAST	3,566	0.922
2006	WEST	45,639	0.553
2006	EAST	551	0.814
2007	WEST	40,613	0.366
2007	EAST	3,976	0.838

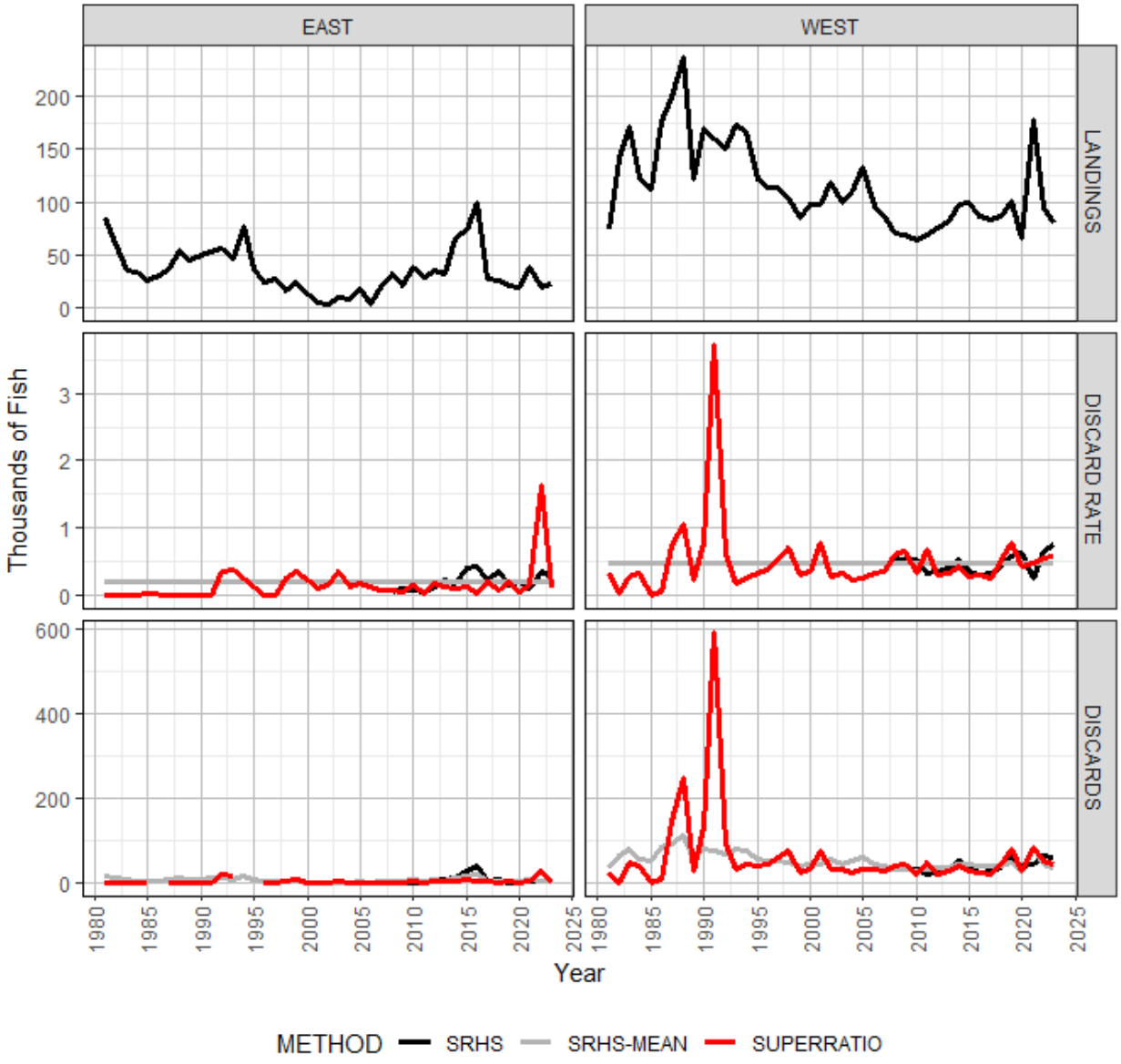


Figure 1. *Comparison of SRHS discard proxies for Gulf of Mexico and South Atlantic yellowtail snapper from various approaches (METHOD) applied in past SEDAR stock assessments. Proxy estimates are needed for years 1981-2007 in SEDAR 96, but shown through 2023 to compare proxies to actual SRHS estimates (black lines). Each method calculates discard proxies (third row) as the product of annual SRHS landings estimates (first row) and discard rates from other surveys or years (second row).*

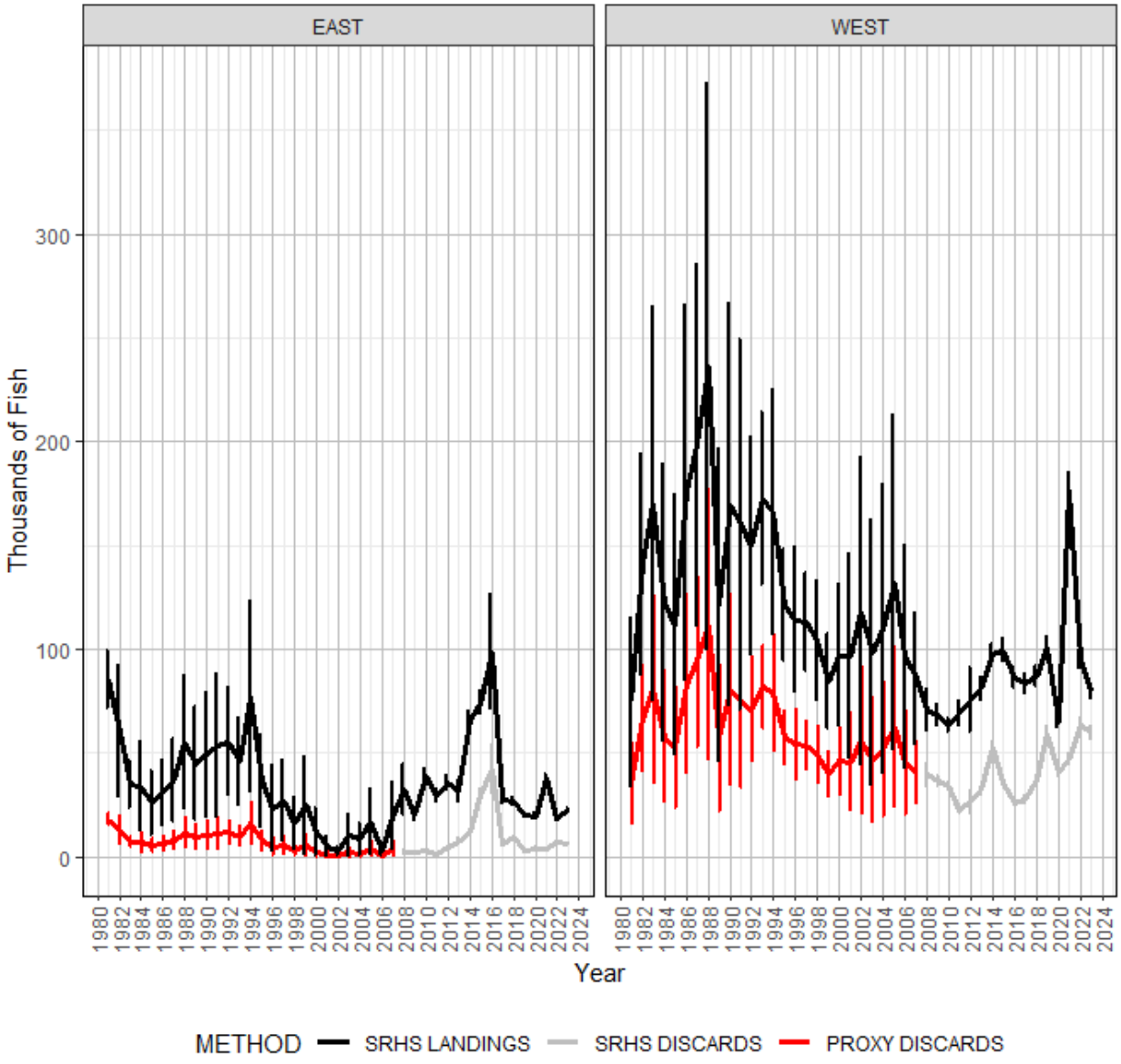


Figure 2. *Timeseries of SRHS landings (1981-2023), SRHS discards (2008-2023), and proxy discard estimates (1981-2007) for SEDAR 96 Gulf of Mexico and South Atlantic yellowtail snapper with associated estimates of uncertainty. Proxy discard estimates were provided by the SRHS-MEAN approach, with annual calculations conducted at the region level.*

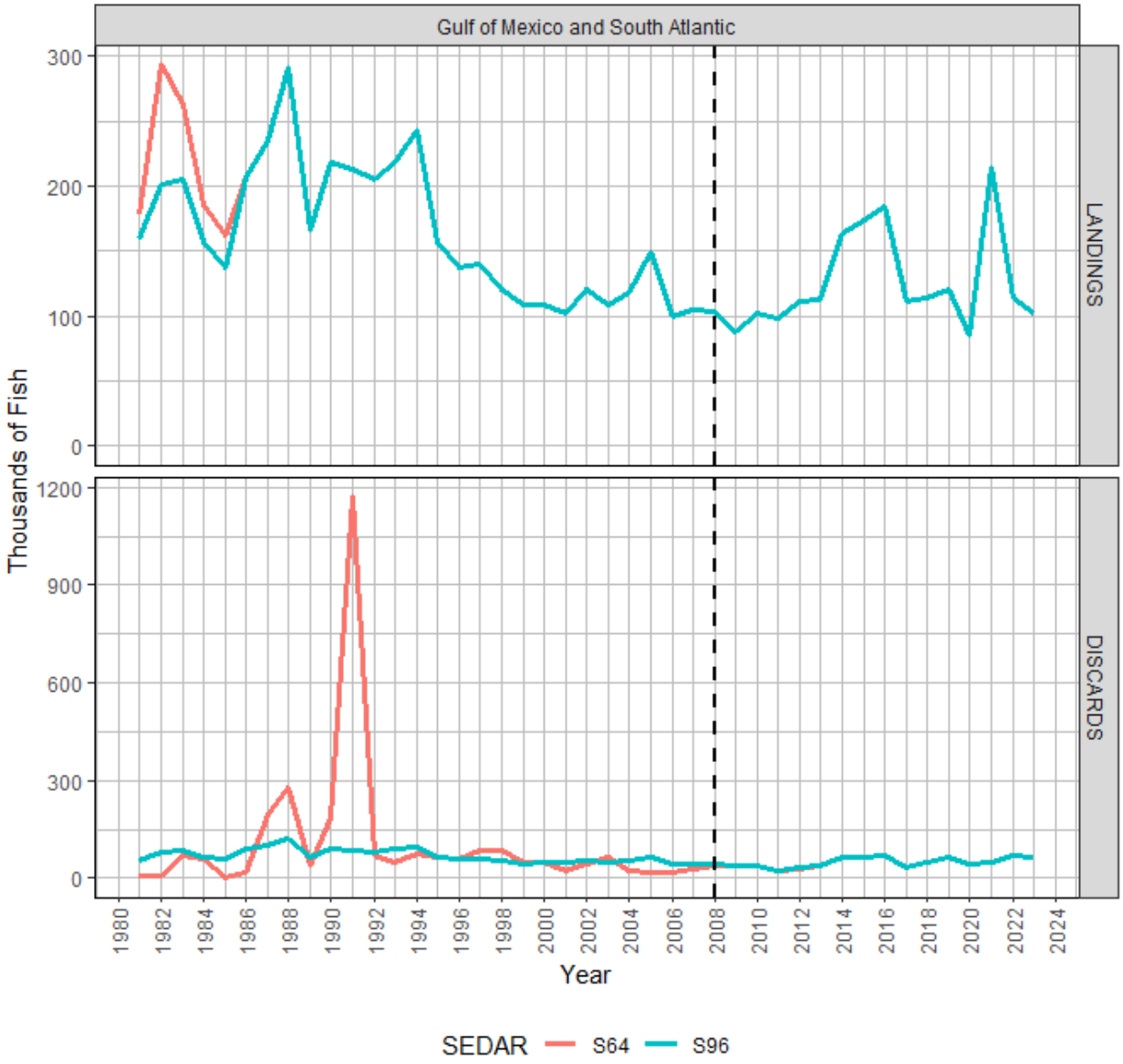


Figure 3. *Comparison of total SRHS landings and discard estimates provided for Gulf of Mexico and South Atlantic yellowtail snapper between SEDAR 96 and SEDAR 64, the terminal years of which are 2023 and 2016 respectively. A dashed black line is drawn in 2008 to separate years where SRHS discard estimates were retained for use in SEDAR 96 (2008-2023) versus those where proxy discard estimates are needed (1981-2007).*