# Proxy Discard Estimates of Gray Triggerfish (*Balistes capriscus*) from the US Gulf of America Headboat Fishery

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SEDAR100-DW-08

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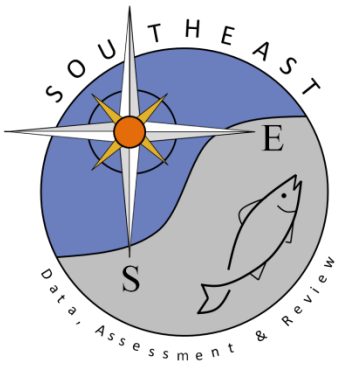

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SEDAR 100-DW-08

# Proxy Discard Estimates of Gray Triggerfish (*Balistes capriscus*) from the US Gulf of America Headboat Fishery

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**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. Proxy discards are estimated for years prior to 2004, when discard data were not routinely collected in the SRHS, and for years when discard data were collected but not deemed reliable. Following concerns of underreporting in the initial years of data collection, SRHS discard estimates for 2004-2007 were excluded from this analysis. The decision for SEDAR 100 was to retain SRHS discard estimates between 2008-2024 and to calculate proxy discard estimates for those years prior (1986-2007) using the superratio approach, with annual calculations conducted at the subregional level (i.e., West, East).

## 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 (i.e., 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 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 America, 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). 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 America 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). 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., 1986-2003) and 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 100 and the associated justifications for any required decisions (e.g., selection of method and years to include in the estimation).

## Methods

*Exclusion of Initial SRHS Discard Estimates*

For SEDAR 100, the decision is to retain SRHS discard estimates for years 2008 - 2024 and to impute proxy discard estimates for any years prior (1986-2007). Given concerns with underreporting in the first few years of discard data collection in the SRHS, and no evidence to the contrary, the SRHS discard estimates for 2004 - 2007 are excluded from this analysis and will be imputed along with those proxy discards needed for years before discard data collection started. Note that this differs from the decision made in SEDAR 43 (SEDAR 2015), 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., 1986-2007) by some assumed discard rate(s), but what differs between the approaches is how these discard rate(s) are estimated, with most being derived from some subset of MRIP catch data (described in SEDAR 100-DW-02). SRHS catch estimates are provided in SEDAR 100-DW-01.

Of those methods considered in SEDAR 100:

- Super-Ratio (charterboat) approach rescales past (e.g., 1986-2007) 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., 2008-2024, 2008-2012). 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.
- MRIP-Charterboat approach applies (unaltered) discard rates of MRIP charterboat anglers from past years (e.g., 1986-2007). This method allows for changes in management and year class effects to be incorporated into the estimation, but does not account for any differences in the magnitude of MRIP vs. SRHS discards. Additionally, 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. This is the same method assessment analysts applied in previous stock assessments to estimate proxy discards for SRHS headboats (SEDAR 09 and 43).

To determine the most appropriate set of proxy estimates for SEDAR 100 Gulf of America Gray Triggerfish, 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 (2008-2024) (Figure 1). This comparison includes visual inspection of the resultant time series, both between methods and with actual SRHS discard estimates.

As further evaluation of the chosen proxy method, the combined discard timeseries (i.e., proxies from 1986-2007 added to SRHS estimates from 2008-2024) is rescaled to that representative of dead discards using the assumed discard mortality rate (of 25%) from the previous stock assessment for Gulf of America Gray Triggerfish (SEDAR 62), facilitating comparisons of actual removals from the population (i.e., landings vs. dead discards, Figure 2). A comparison of proxy discards estimated between SEDAR 100 and the last assessment where proxy discards were provided (SEDAR 43) is also shown (Figure 3). Proxy headboat discard estimates were not provided during SEDAR 62, for which the reason is unclear.

All proxy discards considered for SEDAR 100 were calculated at the subregional level, splitting the Gulf of America into two spatial areas: a WEST region that includes Texas and Louisiana (~33% of regional headboat landings and <1% of discards) and an EAST region that includes Mississippi, Alabama, and Florida (~67% of regional headboat landings and >99% of 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 100-DW-01. GenRec estimates of catch and associated uncertainties are provided in SEDAR 100-DW-02. For those methods that require an average discard rate (e.g., superratios), 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*

Fishing behavior can change for any number of reasons, including management actions, ecosystem drivers, and the relative productivity or availability of the stock or any populations with which it interacts. Because data sources are often lacking for many of these potential drivers, a more precautionary approach was applied in SEDAR 100 wherein any static ratios used in the imputation of proxy discards (e.g., SRHS:MRIP superratios) were constrained to the first few years of valid SRHS discard estimates (2008-2012). The number of years selected in this estimation (i.e., five) is a trade-off between minimizing the potential for bias from inclusion of years over which an undetected change in discarding behavior may have occurred while also retaining an adequate sample size to account for the inter-annual variability inherent in discard rates.

As support for this decision, recreational discard rates from SRHS in the Eastern region were relatively stable over these five years (2008-2012), averaging ~2 between 2008-2013 before jumping to ~9 in 2014 and ~550 in 2015 (Figure 1). Note that 2013 was considered for inclusion in the calculation of superratios, but this results in non-zero proxy discards being estimated for the Western region, a function of 2013 being the first year after 2006 where MRIP discard estimates for Western charterboats were not zero. Allowing proxy discards to be calculated in the Western region results in a suspiciously high estimate in 1989, which has a relatively low MRIP charterboat landings estimate (of 40 fish, SEDAR 100-DW-02) and a high discard rate (~83) (Figure 1). Coupled with the fact that the vast majority of Gray Triggerfish discards come from the East (~99% of both GenRec and SRHS), the decision in SEDAR 100 was to constrain the superratio calculation to years 2008-2012, and assume Western discards were negligible historically. This decision as to which years to include in the superratio calculation was not needed in past SEDAR stock assessments for Gulf Gray Triggerfish, which applied the MRIP-Charterboat approach.

Interestingly, proxy discard estimates from the “Best Practice” superratio approach were almost identical to those from the MRIP-Charterboat approach applied in past assessments for this stock. This was due to MRIP and SRHS discard rates being close to identical in the Eastern region for years 2008-2012, the associated superratio being estimated at 0.96. Additionally, the general trends in these proxy estimates were fairly similar to those from the SRHS for years where SHRS discard estimates were available, considered reliable, and retained for use in SEDAR 100 (2008-2024). Exceptions include 2015 and 2017, the estimates of which include a relatively low MRIP charterboat landings estimate (370 fish, SEDAR 100-DW-02) and relatively low SRHS headboat landings estimate (1 fish, SEDAR 100-DW-01), respectively.

## Discussion

For SEDAR 100, the superratio approach is recommended to provide proxy SRHS discard estimates for years 1986-2007 (Table 1, Figure 2). The relative agreement between actual SRHS discard estimates and proxies calculated from MRIP charterboat discard rates (2008-2024) provides support for the use of these methods in other years (1986-2007). The superratio approach is the preferred proxy method according to SEDAR Best Practices, with alternative methods considered when this approach fails (SEDAR-PW-07). Given no clear indication of failure by the preferred superratio approach, it was chosen for this assessment.

This decision to use the superratio approach differs from that made in past assessments for this stock (SEDAR 09 and 43), which applied the MRIP-Charterboat approach to provide proxy discard estimates, but differences in the proxy discards estimated by these two approaches was negligible. This is seen in the SEDAR Comparison plot (Figure 3), which shows general agreement between the proxy discards provided in these assessments. This agreement also supports the assumption that headboat discards were negligible for the Western region historically, which were assumed zero in SEDAR 100 but allowed to be estimated in SEDAR 43.

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**Table 1.** Timeseries of SRHS Proxy Discard Estimates and associated Coefficients of Variation (1986-2007) for SEDAR 100 Gulf of America Gray Triggerfish by SID domain. Proxy discards were calculated using the SUPERRATIO approach, with annual calculations conducted at the subregional level (i.e., West, East).

| | EAST | | WEST | |
|---|---|---|---|---|
| Year | Proxy | CV | Proxy | CV |
| 1986 | 249 | 1.01 | 0 | 0.00 |
| 1987 | 269 | 0.87 | 0 | 0.00 |
| 1988 | 213 | 0.79 | 0 | 0.00 |
| 1989 | 799 | 0.87 | 0 | 0.00 |
| 1990 | 24,426 | 0.68 | 0 | 0.00 |
| 1991 | 642 | 0.57 | 0 | 0.00 |
| 1992 | 2,277 | 0.52 | 0 | 0.00 |
| 1993 | 5,745 | 0.63 | 0 | 0.00 |
| 1994 | 689 | 0.55 | 0 | 0.00 |
| 1995 | 4,666 | 0.76 | 0 | 0.00 |
| 1996 | 7,728 | 0.58 | 0 | 0.00 |
| 1997 | 5,038 | 0.56 | 0 | 0.00 |
| 1998 | 14,303 | 0.54 | 0 | 0.00 |
| 1999 | 4,827 | 0.47 | 0 | 0.00 |
| 2000 | 2,273 | 0.52 | 0 | 0.00 |
| 2001 | 4,125 | 0.49 | 0 | 0.00 |
| 2002 | 2,980 | 0.49 | 0 | 0.00 |
| 2003 | 3,120 | 0.40 | 0 | 0.00 |
| 2004 | 5,007 | 0.38 | 0 | 0.00 |
| 2005 | 4,409 | 0.40 | 0 | 0.00 |
| 2006 | 2,395 | 0.48 | 0 | 0.00 |
| 2007 | 4,382 | 0.43 | 0 | 0.00 |

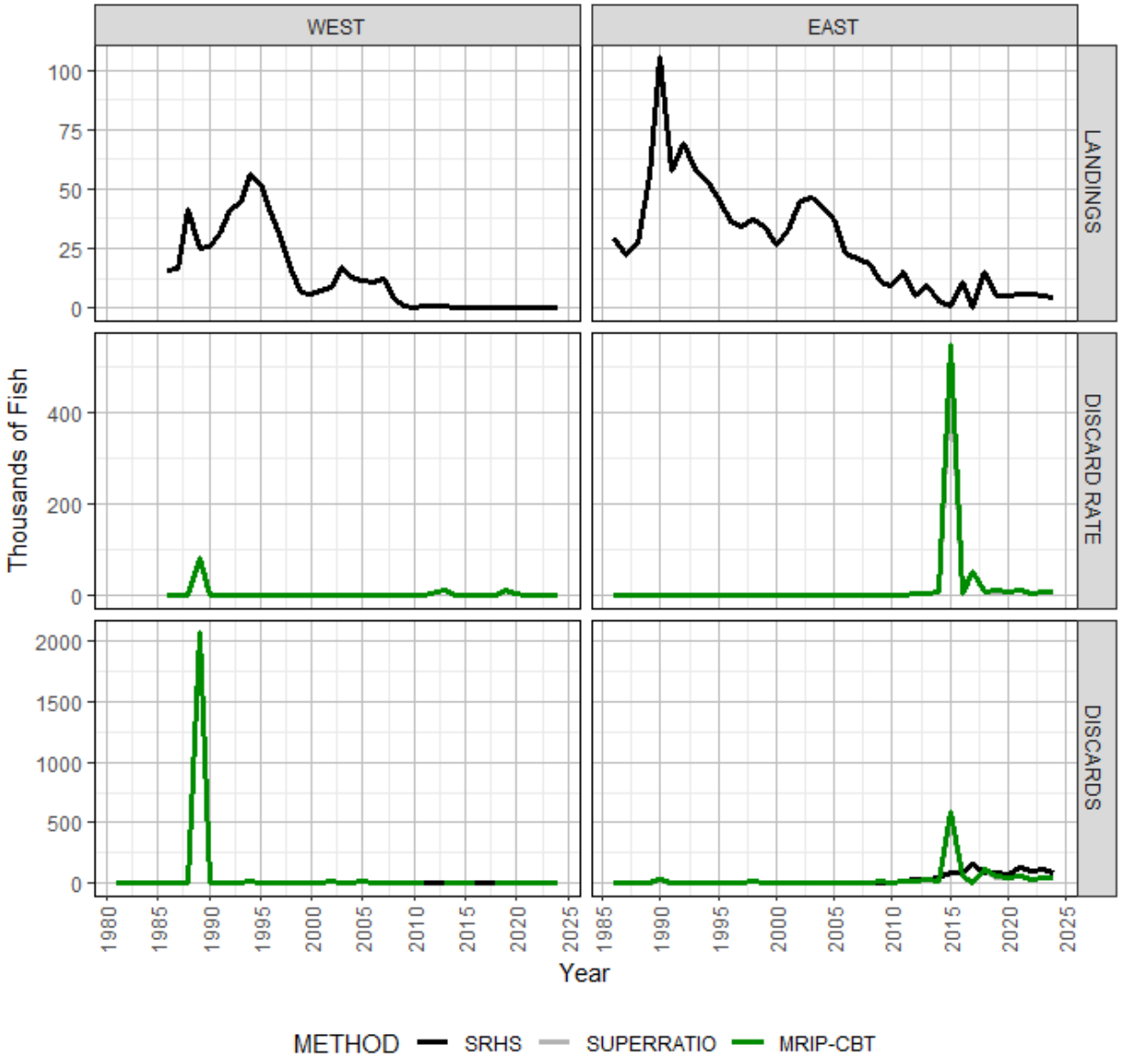


***Figure 1.*** *Comparison of SRHS discard proxies for Gulf of America Gray Triggerfish from various approaches (METHOD) applied in past SEDAR stock assessments. Proxy estimates are needed for years 1986-2007 in SEDAR 100, but shown through 2024 to compare proxies to actual SRHS estimates (black lines). 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). As noted in the text, discard estimates between the superratio and MRIP-Charterboat proxy methods are nearly identical (i.e., green and gray lines overlap).*

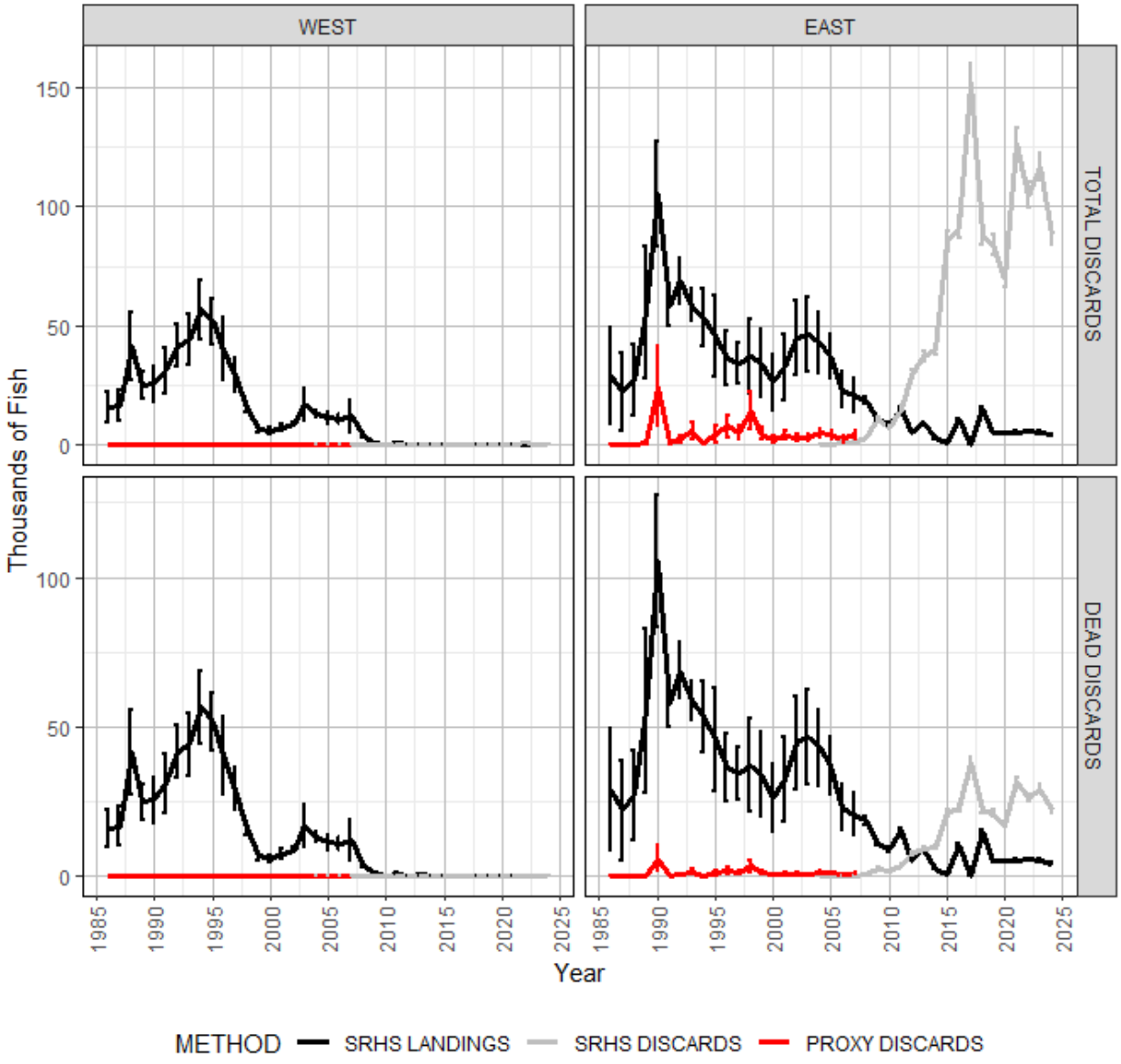


***Figure 2.*** *Timeseries of SRHS landings (1986-2024), SRHS discards (2008-2024), and proxy discard estimates (1986-2007) for SEDAR 100 Gulf of America Gray Triggerfish with associated estimates of uncertainty. Proxy discard estimates were provided by the SUPERRATIO approach, with annual calculations conducted at the subregional level (i.e., West, East). Dead discards (lower panel) were calculated by applying an assumed discard mortality rate of 25% from the previous assessment (SEDAR 62).*

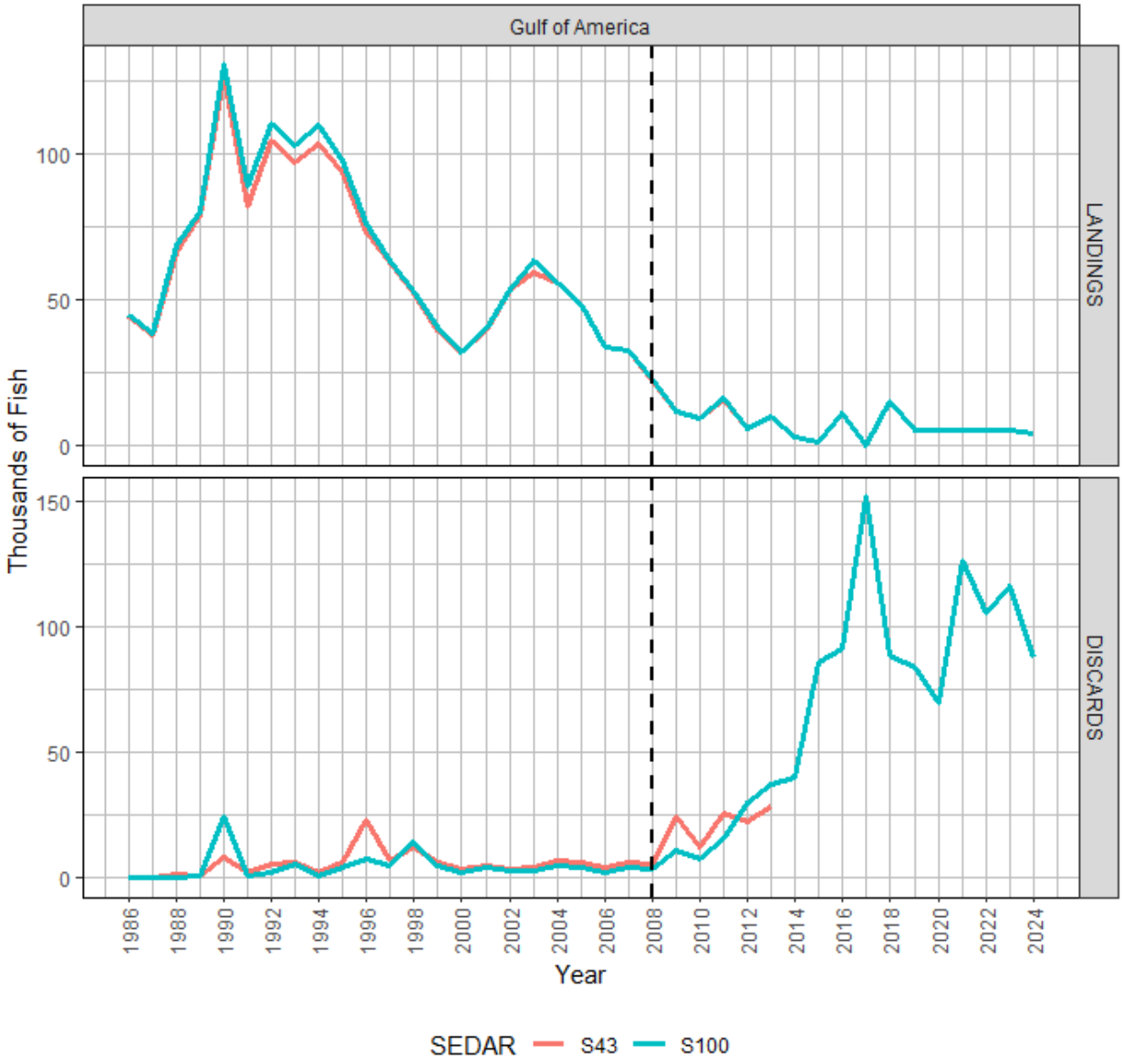


***Figure 3.*** *Comparison of total SRHS landings and discard estimates provided for Gulf of America Gray Triggerfish between SEDAR 100 and SEDAR 43, the terminal years of which are 2024 and 2013 respectively. A dashed black line is drawn in 2008 to separate years where SRHS discard estimates were retained for use in SEDAR 100 (2008-2024) versus those where proxy discard estimates are needed (1986-2007). Note that this comparison is not made to SEDAR 62 because proxy discards were not calculated for SEDAR 62.*