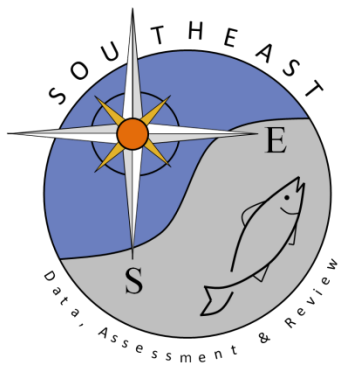


Proxy Discard Estimates of Gag (*Mycteroperca microlepis*) from the US Gulf of America Headboat Fishery

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Proxy Discard Estimates of Gag (*Mycteroperca microlepis*) from the US Gulf of America Headboat Fishery

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Abstract

Discard data from the Southeast Region Headboat Survey (SRHS) were not routinely collected until 2004, prior to which SRHS discard estimates are not available. Discard 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 105 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 State (equivalent) 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 (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. On 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 105 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 105, 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. This decision aligns with that made in SEDAR 72 (2021).

Discard proxy

Several sources of proxy SRHS discard estimates have been considered in past SEDAR stock assessments, including the preferred Super-Ratio 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 105-WP-02). SRHS catch estimates are provided in SEDAR 105-WP-01. Headboat landings in Texas for years 1981-1985, for which neither MRIP nor SRHS provide estimates, were imputed from the average of SRHS-Texas catch between 1986-1988. This is the same imputation approach applied in SEDAR 72 (2021).

Of those methods considered in SEDAR 105:

- Super-Ratio (charterboat) approach rescales past (e.g., 1986-2007) discard rates of the MRIP charterboat mode (discards:landings) by a superratio scalar, calculated as 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. This is the same method assessment analysts applied to estimate proxy discards for SRHS headboats in SEDAR 72 (2021).
- 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 to estimate proxy discards for SRHS headboats in SEDAR 33 (2014) and the 33-Update (2016).

To determine the most appropriate set of proxy estimates for SEDAR 105 Gulf of America Gag, 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 12%) from the previous stock assessment for Gulf of America Gag (SEDAR 2021, Tables 22-24), facilitating comparisons of actual removals from the population (i.e., landings vs. dead discards, Figure 2). A comparison of proxy discards estimated between SEDAR 105 and the previous stock assessment is also shown (Figure 3).

All proxy discards considered for SEDAR 105 were calculated at the state (equivalent) level, splitting the Gulf of America into four spatial areas: Texas, Louisiana, Mississippi, and a combined Alabama + western Florida domain. For Gulf gag grouper, the combined FLW_AL strata accounts for ~98% of regional landings and >99% of regional 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 105-WP-01. GenRec estimates of catch and associated uncertainties are provided in SEDAR 105-WP-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):

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

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 105 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 are relatively stable over these five years (2008-2012), especially in comparison to the substantial uptick in discard rates over the last couple years when the length of the gag fishing season was significantly reduced (e.g., 48 days in 2023 and 15 days in 2024). Similar trends are also seen in GenRec data (Figure 8 in SEDAR 105-WP-02). This approach differs from that applied in SEDAR 72 (2021), for which all years with valid SRHS discard estimates were retained in this estimation (i.e., 2008+), resulting in (slightly) larger estimates for proxy discards (Figure 3).

Both the general trends and overall magnitude of proxy estimates (Figure 1) from the preferred Super-Ratio and MRIP-Charterboat approaches were fairly similar to those from the SRHS for years where SRHS discard estimates were available, considered reliable, and retained for use in SEDAR 105 (2008-2024). Across these years of overlap, proxy discards from both approaches were also relatively variable compared to actual SRHS discard estimates, which is seen in the historical proxy discards as well (1985-2007). The overall magnitude of historical proxy discards (1985-2007) are fairly similar to actual SRHS discards (2008-2024), with average annual discards at ~25k fish from the Super-Ratio approach, ~30k from the MRIP-Charterboat approach, and ~26k from actual SRHS estimates (Figure 1), suggesting both approaches are providing accurate proxies for historical headboat discards. The similarities in proxy estimates between the two approaches is explained by the estimated superratio for the combined FLW_AL strata, which was close to one (~0.86) and so the associated MRIP-charterboat discard rates were similar for the strata dominating headboat catch in SEDAR 105.

Discussion

For SEDAR 105, the Super-Ratio 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 Super-Ratio 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 Super-Ratio approach, it was chosen for this assessment. This decision to use the Super-Ratio approach agrees with that made in the last assessment for this stock (SEDAR 72, 2021), but also incorporates a change to reduce the number of years considered in calculating the associated superratios, resulting in slightly smaller estimates (Figure 3). This decision differs from other Gulf Gag Grouper assessments wherein the MRIP-Charterboat approach was applied (SEDAR 33, 2014, 2016), the differences between which were also negligible (Figure 1).

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Table 1. Timeseries of SRHS Proxy Discard Estimates and associated Coefficients of Variation (1986-2007) for SEDAR 105 Gulf of America Gag by state. Proxy discards were calculated using the SUPERRATIO approach, with annual calculations conducted at the State (equivalent) level. Proxies for 1981-1985 were calculated from Texas headboat landings imputed from the average of SRHS-Texas catch between 1986-1988.

Year	TX		LA		MS		FLW_AL	
	Proxy	CV	Proxy	CV	Proxy	CV	Proxy	CV
1981	0	0.00						
1982	0	0.00						
1983	0	0.00						
1984	0	0.00						
1985	0	0.00						
1986	0	0.00	0	0.00	0	0.00	8,916	0.71
1987	0	0.00	0	0.00	0	0.00	4,448	0.77
1988	0	0.00	0	0.00	0	0.00	5,166	0.57
1989	0	0.00	0	0.00	0	0.00	18,673	0.69
1990	0	0.00	0	0.00	0	0.00	43,961	0.77
1991	0	0.00	0	0.00	0	0.00	1,047	0.99
1992	0	0.00	0	0.00	0	0.00	6,447	0.66
1993	0	0.00	0	0.00	0	0.00	11,484	0.65
1994	0	0.00	85	0.89	0	0.00	29,578	0.58
1995	0	0.00	2	0.91	0	0.00	41,326	0.59
1996	57	0.79	10	0.92	0	0.00	16,304	0.55
1997	0	0.00	0	0.00	0	0.00	16,044	0.44
1998	0	0.00	0	0.00	0	0.00	52,752	0.47
1999	50	0.70	14	0.89	0	0.00	46,028	0.45
2000	0	0.00	0	0.00	0	0.00	27,869	0.51
2001	592	0.75	28	0.90	0	0.00	29,062	0.59
2002	0	0.00	66	0.83	0	0.00	20,927	0.45
2003	582	0.73	36	1.00	0	0.00	43,982	0.39
2004	0	0.00	0	0.00	0	0.00	53,029	0.34
2005	208	0.69	0	0.00	0	0.00	38,754	0.30

Year	TX		LA		MS		FLW_AL	
	Proxy	CV	Proxy	CV	Proxy	CV	Proxy	CV
2006	73	0.71	0	0.00	0	0.00	11,561	0.42
2007	156	0.81	1	1.25	0	0.00	31,796	0.42

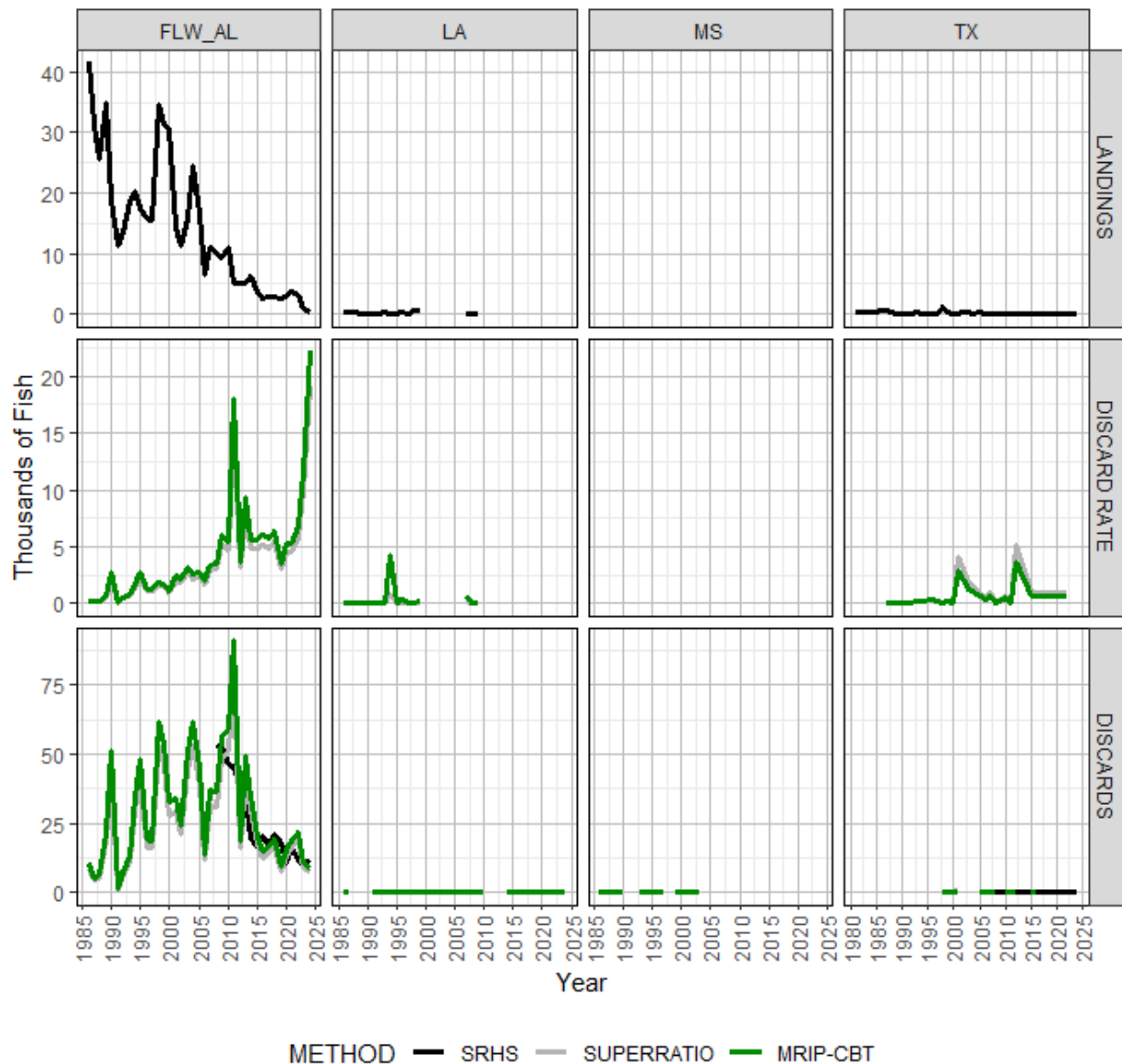


Figure 1. Comparison of SRHS discard proxies for Gulf of America Gag from various approaches (METHOD) applied in past SEDAR stock assessments. Proxy estimates are needed for years 1986-2007 in SEDAR 105, but shown through 2024 to compare proxies to actual SRHS estimates (black lines). Each method calculates discard proxies (third row) as the product of annual SRHS landings estimates (first row) and discard rates from other surveys or years (second row).

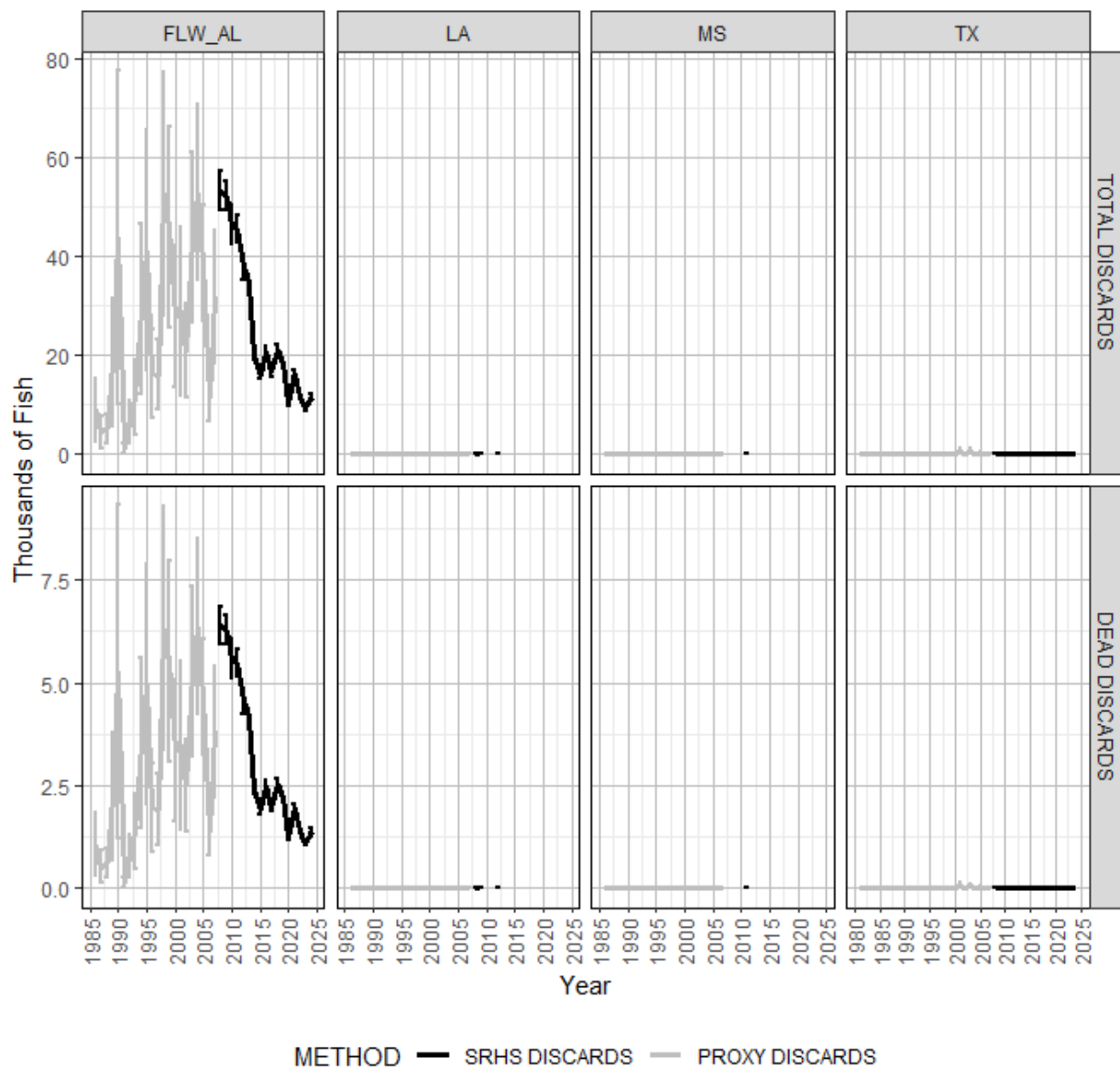


Figure 2. Timeseries of SRHS discards (2008-2024) and proxy discard estimates (1986-2007) for SEDAR 105 Gulf of America Gag with associated estimates of uncertainty. Proxy discard estimates were provided by the SUPERRATIO approach, with annual calculations conducted at the State (equivalent) level. Dead discards (lower panel) were calculated by applying an assumed discard mortality rate of 12% from the previous assessment (SEDAR 72, 2021).

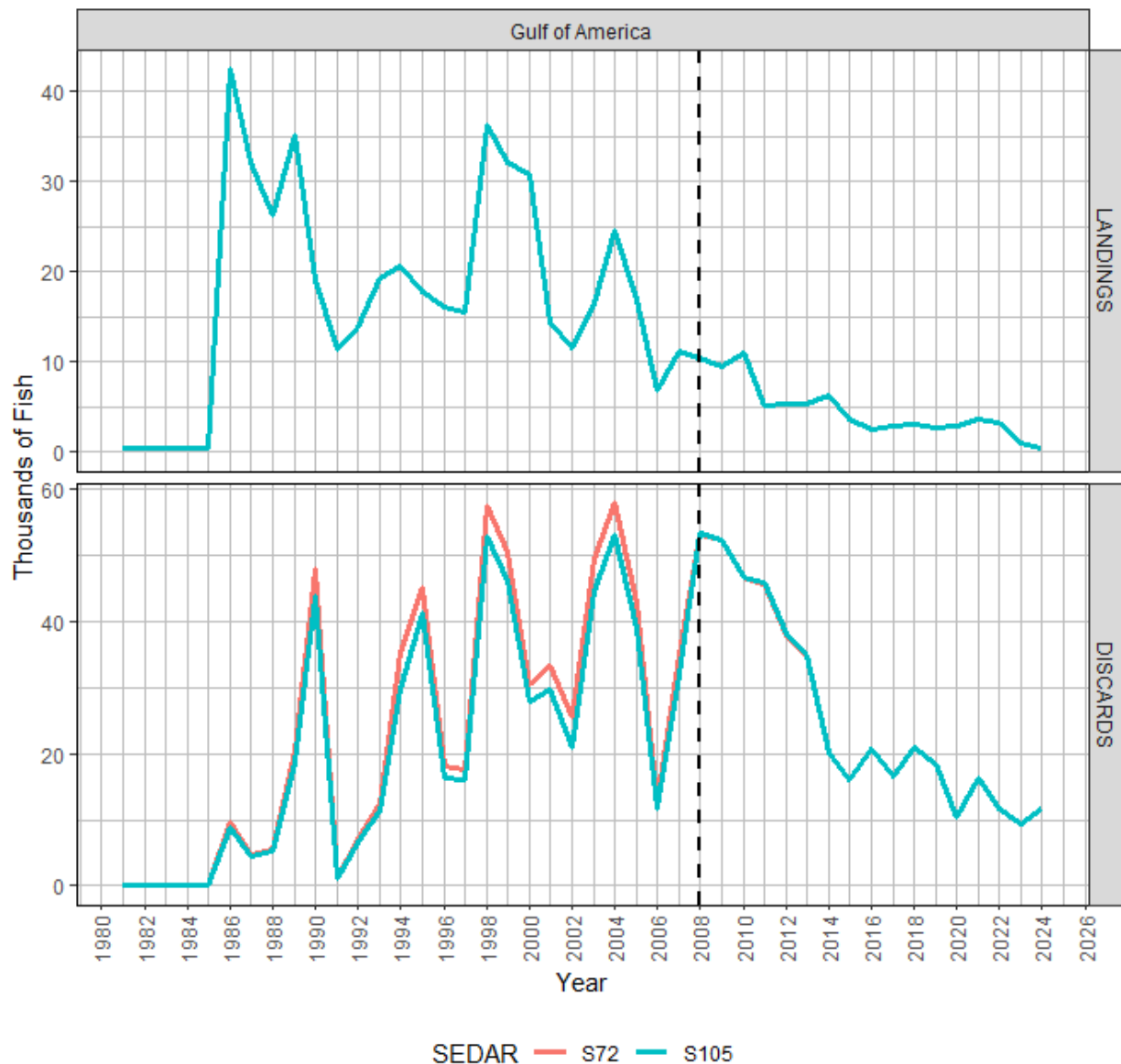


Figure 3. Comparison of total SRHS landings and discard estimates provided for Gulf of America Gag between SEDAR 105 and SEDAR 72, the terminal years of which are 2024 and 2020 respectively. A dashed black line is drawn in 2008 to separate years where SRHS discard estimates were retained for use in SEDAR 105 (2008-2024) versus those where proxy discard estimates are needed (1986-2007).