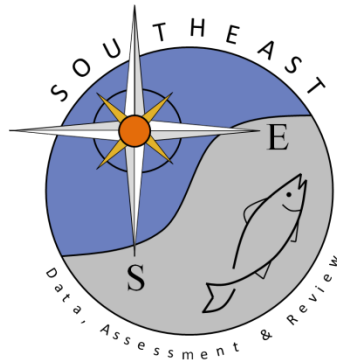


Estimated Commercial Discards of South Atlantic Golden Tilefish
(*Lopholatilus chamaeleonticeps*) Using Limited Observer Data

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SEDAR89-WP-05

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Introduction

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

$$totalDiscards = DPUE * totalEffort.$$

For discard estimation, DPUE is computed for total discards, including fish released alive, released dead, released in unknown condition, and used for bait. This species shows a very low rate of being caught on observer trips in this program, and as such the more robust analytical methods outlined in previous SEDARs in the South Atlantic (Atkinson et al. 2023; McCarthy et al. 2023) could not be applied for this SEDAR. The focus of these analyses and working paper is to show alternative, data-poor approaches for calculating discards using the observer and reef logbook programs and recommending which is most appropriate for this species and the subsequent annual discard estimates.

Methods

Data Sources

Bottom longline observer data collected by the SEFSC Panama City Laboratory from 2005-2023 were considered for estimating discards of South Atlantic Golden Tilefish. These data were collected under the Shark Bottom Longline Observer Program (SBLOP) and South Atlantic Reef Fish Observer Program (SARF) (Decossas & Mathers 2023a; 2023b). Only reef fish SBLOP trips were considered for use in this analysis. For these programs, scientific observers on commercial fishing vessels record detailed information on catch and effort for a subset of trips. Catch by species was recorded according to the disposition category: kept (landed), released alive, released dead, released undetermined, and used for bait. Length and weight were recorded for a subsample of individual fish.

Total effort was determined from the commercial Coastal Fisheries Logbook Program in which fishers reported basic information on effort and catch by species for every trip (Atkinson et al. 2021). The coastal logbook program began in 1990 for a subset of vessels in the South Atlantic, and expanded to all vessels in 1993; for these discard estimates, complete calendar years 1993-2022 were considered for trips that reported landings of Golden Tilefish.

Relevant Management History of South Atlantic Golden Tilefish

There are no size limits or species-specific management actions for Golden Tilefish in the South Atlantic. However, as part of a Grouper-Tilefish complex there were significant changes in the total landed pounds limit per trip during this time period relevant to this analysis. The total limit was initially 5,000 lb. from 1994-2005, then 6,000 lb. in 2006 and followed by a significant drop to 300 lb. from 2007-2012 where it went back up to 4,000 lb. in 2013 and for the remainder of the time series.

Gear

While the longline gear is sparsely sampled in the South Atlantic, Golden Tilefish catch in vertical line is minimal. As such, only discards were estimated for the bottom longline fishery.

Observer Discard Rates

Sample sizes for this species were very low in the observer data with only 10 total trips observing the species, 9 of which discarded Golden Tilefish (Table 1). Given the low observation rate of this species, observer discard rates had to be calculated straightforwardly. For this data, discards were calculated as 1) DPUE where effort is estimated in numbers at the trip- or set-level and 2) trip-level discard rate in pounds per kept pounds of South Atlantic Golden Tilefish. To provide analysts with options and to more fully explore these data-poor observer approaches, these different rate calculations were conducted:

1a) Trip Numbers, where discard rate (DR) is given by:

$$DR = \frac{\text{Discards (in numbers)}}{N \text{ Trips}}$$

1b) Set Numbers: $DR = \frac{\text{Discards (in numbers)}}{N \text{ Sets}}$

2) Trip Ratio in Pounds: $DR = \frac{\text{Discards lbs}}{\text{Kept lbs}}$

Discard Estimates – Logbook Effort Expansion

The calculated rates and standard deviations above were then used to calculate total discards and associated variance using the logbook data. All logbook trips that reported catch of Golden Tilefish were used within the geographic area of the assessment (Fig 1.). Each discard rate was applied to the appropriate metric in the logbook data to yield annual discard and variance estimates. These logbook rates were applied as:

1a) Trip Numbers, where annual discards (AD) is given by: $AD = Total \text{ Trips} \times DR$, and the annual SE is: $SE = \sqrt{\sum DRsd^2 \times TotalTrips^2}$

1b) Set Numbers: $AD = Total \text{ Sets} \times DR$; $SE = \sqrt{\sum DRsd^2 \times TotalSets^2}$

2) Trip Ratio in Pounds: $AD = Total \text{ Catch} \times DR$; $SE = \sqrt{\sum DRsd^2 \times TotalCatch^2}$

For the first method that used numbers, final discards were converted to weight using the observer data, calculated as the average weight of a discarded fish (*WTav*). Vice versa, method

two that used pounds, estimated discards in number using the same WT_{av} . This additional source of variation (average weight of discarded fish standard deviation; WT_{sd}) was then also incorporated into final estimates, so for example the annual standard error for total estimated discards using method 1b (set level in numbers) was:

$$SE = \sqrt{(WT_{sd}^2 \times AD^2) + (DR_{sd}^2 \times WT_{av}^2)}$$

These variance estimates were also converted to CVs.

Results and Discussion

Discard estimates were investigated for two previous Golden Tilefish assessments (SEDAR 25, SEDAR 4) using the discard logbook data, however Golden Tilefish were reported at very low rates (McCarthy 2011; Poffenberger 2004) and at the time observer data was not available. Ultimately, these discards estimates were not used in the final assessment models (SEDAR 2011). As such, discard estimates were not provided for SEDAR 66. This is the first attempt at incorporating observer data in commercial discard estimation for this species. Given the low sample sizes, these methods represent the extent of what could be attempted.

Previous to calculating discard rates, one observer trip in 2022 was removed as it was determined to be targeting different species and not representative of a Golden Tilefish fishing trip (the sample sizes in Table 1 reflect this final dataset). While the terminal year is 2022 for this assessment, a single trip in 2023 was used to provide additional data to an already data-poor observed species. Therefore, total of 9 observer trips were used for this analysis.

The annual number of trips and sets landing South Atlantic Golden Tilefish as well as the annual catch (in pounds) from the logbook data were analyzed for temporal trends in the bottom longline fishery (Fig. 2-4). The change in the trip limit of Grouper-Tilefish from 6,000 lb. to 300 lb. in 2007 drastically reduced the number of sets fished on a trip from an average of 9 sets from 1993-2006 to 3 sets from 2007-2022. For this reason, discard rates were computed by two management regimes (2005-2006 and 2007-2023).

All methods showed similar patterns in discards through time in this fishery though the magnitude of peaks varies by method (Fig. 5). Generally, estimated discards from method 2 (trip ratio in pounds) produced the lowest annual discards compared to method 1a and 1b. All show a steep decline in discards with the management change in 2006 and remain very minimal for the remainder of the time series (Fig. 5).

While all results show similar patterns and high variation of estimates, ultimately the recommendation is method 1b, where discard rates use number of sets as the effort metric. This is due to a very stable effort metric through time when broken up into two time periods and was directly reflecting fishery behavior as a function of management (Fig. 2). Catch and number of trips showed more variation and a generally decreasing trend through the time series (Fig. 3, 4). The set numbers calculation (method 1b) also had similar CVs to the trip numbers (method 1a), which were both notably lower than the trip ratio in pounds calculation (method 2) which had CVs over 1 (Table 2).

Final discard estimates in number and pounds are shown in Figure 6 and in Table 3. The calculated average weight of a discarded Golden Tilefish from the observer data was 5.9 lbs. The estimates illustrate a highly targeted fishery with few discards. Given the very low level of discards and the very high variation from the low sample sizes, the impact on assessment estimates and outcomes is likely limited. Ultimately, this outlines the general approaches used for Golden Tilefish and for potential future assessments that are data-poor under the current commercial observer sampling program in the South Atlantic.

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Table 1. Sample sizes for South Atlantic observer reef fish bottom longline trips with Golden Tilefish.

| Observer Program | Year | Total Observer Trips | Golden Tilefish Observer Trips | Kept Golden Tilefish Trips | Discard Golden Tilefish Trips |
|------------------|------|----------------------------|---|-------------------------------------|--|
| SBLOP | 2005 | 2 | 2 | 2 | 2 |
| SBLOP | 2006 | 2 | 2 | 2 | 2 |
| SBLOP | 2007 | 3 | 3 | 3 | 2 |
| SARF | 2022 | 3 | 2 | 2 | 2 |
| SARF | 2023 | 1 | 1 | 1 | 1 |

Table 2. Calculated observer discard rate, standard error, and CV values for each of the methods by management regime. Method 1a calculates a discard using number of trips as the effort metric, method 1b calculates a discard rate using number of sets as the effort metric, and method 2 calculates a trip-level ratio between discards and kept South Atlantic Gold Tilefish in pounds.

| Management Regime | Discard Rate Values | | | Standard Error Values | | |
|-------------------|---------------------|----------|----------|-----------------------|----------|----------|
| | Method 1a | Method1b | Method 2 | Method 1a | Method1b | Method 2 |
| 2005-2006 | 13.31959 | 2.51587 | 0.07626 | 4.50922 | 1.41598 | 0.08305 |
| 2007-2022 | 1.34615 | 0.23901 | 0.00333 | 1.02830 | 0.19944 | 0.00357 |
| CVs | | | | | | |
| | Method 1a | Method1b | Method 2 | | | |
| | 0.3385 | 0.5628 | 1.089 | | | |
| | 0.7638 | 0.8344 | 1.0741 | | | |

Table 3. Commercial discard estimates (in pounds and numbers) for the recommended set-level observer discard rate calculation in numbers (method 1b) for South Atlantic Golden Tilefish. The first management regime utilizes observer data from 2005-2006 and the second regime uses observer data from 2007-2023.

| Year | Management Regime | Discards (lbs) | SE | Discards N | SE |
|------|-------------------|----------------|----------------|------------|------------|
| | | | Discards (lbs) | | Discards N |
| 1993 | First | 84,036 | 78,229 | 14,139 | 7,958 |
| 1994 | First | 72,911 | 67,872 | 12,267 | 6,904 |
| 1995 | First | 57,016 | 53,076 | 9,593 | 5,399 |
| 1996 | First | 46,684 | 43,457 | 7,855 | 4,421 |
| 1997 | First | 43,125 | 40,144 | 7,256 | 4,084 |
| 1998 | First | 34,392 | 32,015 | 5,787 | 3,257 |
| 1999 | First | 36,037 | 33,546 | 6,063 | 3,413 |
| 2000 | First | 45,906 | 42,733 | 7,724 | 4,347 |
| 2001 | First | 39,043 | 36,344 | 6,569 | 3,697 |
| 2002 | First | 33,944 | 31,598 | 5,711 | 3,214 |
| 2003 | First | 31,192 | 29,036 | 5,248 | 2,954 |
| 2004 | First | 23,132 | 21,534 | 3,892 | 2,191 |
| 2005 | First | 14,579 | 13,572 | 2,453 | 1,381 |
| 2006 | First | 21,114 | 19,655 | 3,552 | 1,999 |
| 2007 | Second | 1,105 | 1,234 | 186 | 155 |
| 2008 | Second | 936 | 1,045 | 158 | 131 |
| 2009 | Second | 969 | 1,081 | 163 | 136 |
| 2010 | Second | 823 | 918 | 138 | 115 |
| 2011 | Second | 838 | 936 | 141 | 118 |
| 2012 | Second | 1,159 | 1,294 | 195 | 163 |
| 2013 | Second | 1,176 | 1,313 | 198 | 165 |
| 2014 | Second | 1,229 | 1,372 | 207 | 173 |
| 2015 | Second | 966 | 1,078 | 163 | 136 |
| 2016 | Second | 1,342 | 1,499 | 226 | 188 |
| 2017 | Second | 1,689 | 1,885 | 284 | 237 |
| 2018 | Second | 1,087 | 1,213 | 183 | 153 |
| 2019 | Second | 956 | 1,067 | 161 | 134 |
| 2020 | Second | 685 | 764 | 115 | 96 |
| 2021 | Second | 545 | 609 | 92 | 77 |
| 2022 | Second | 639 | 714 | 108 | 90 |

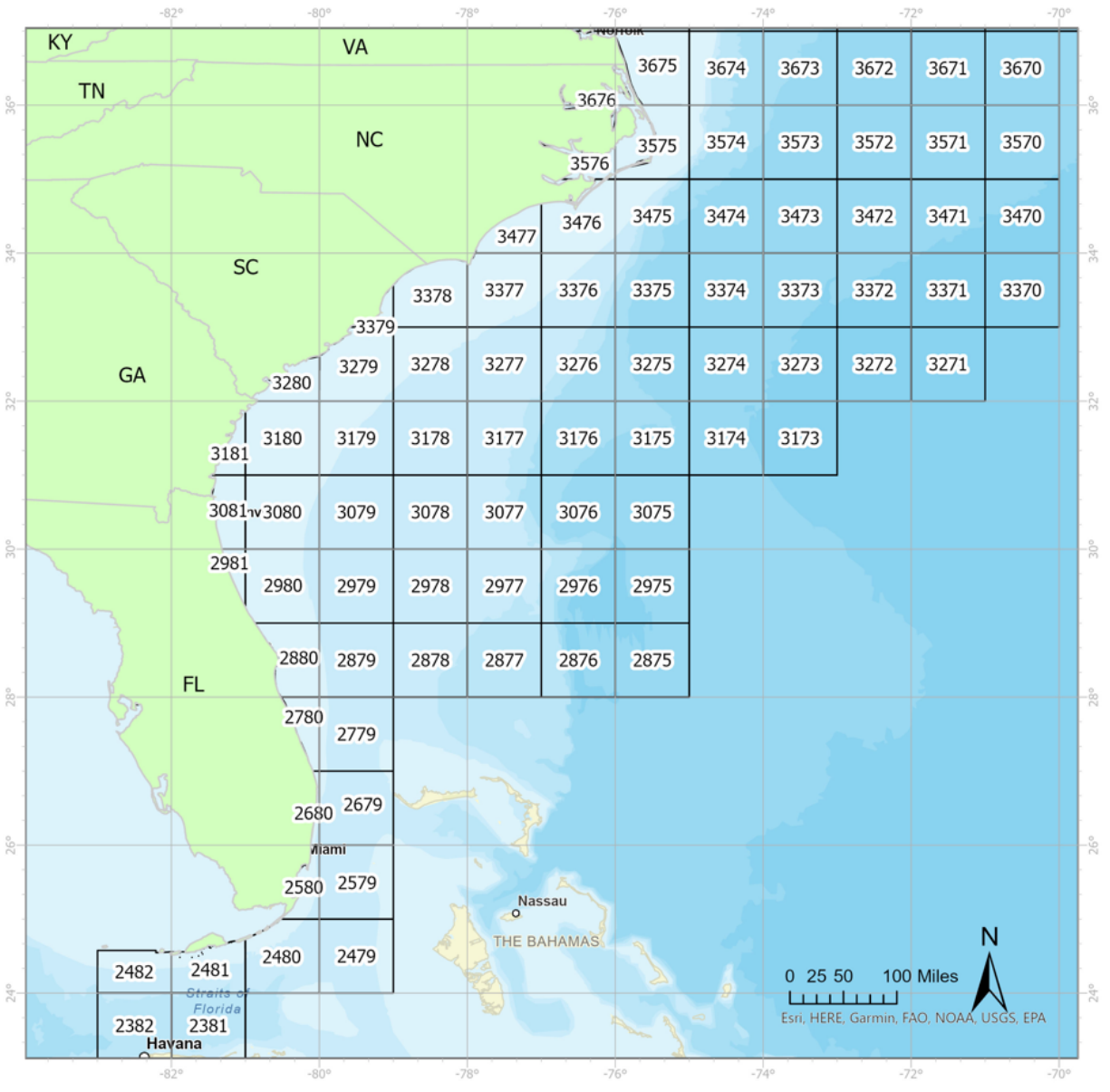


Figure 1. Coastal logbook fishing areas in the South Atlantic.

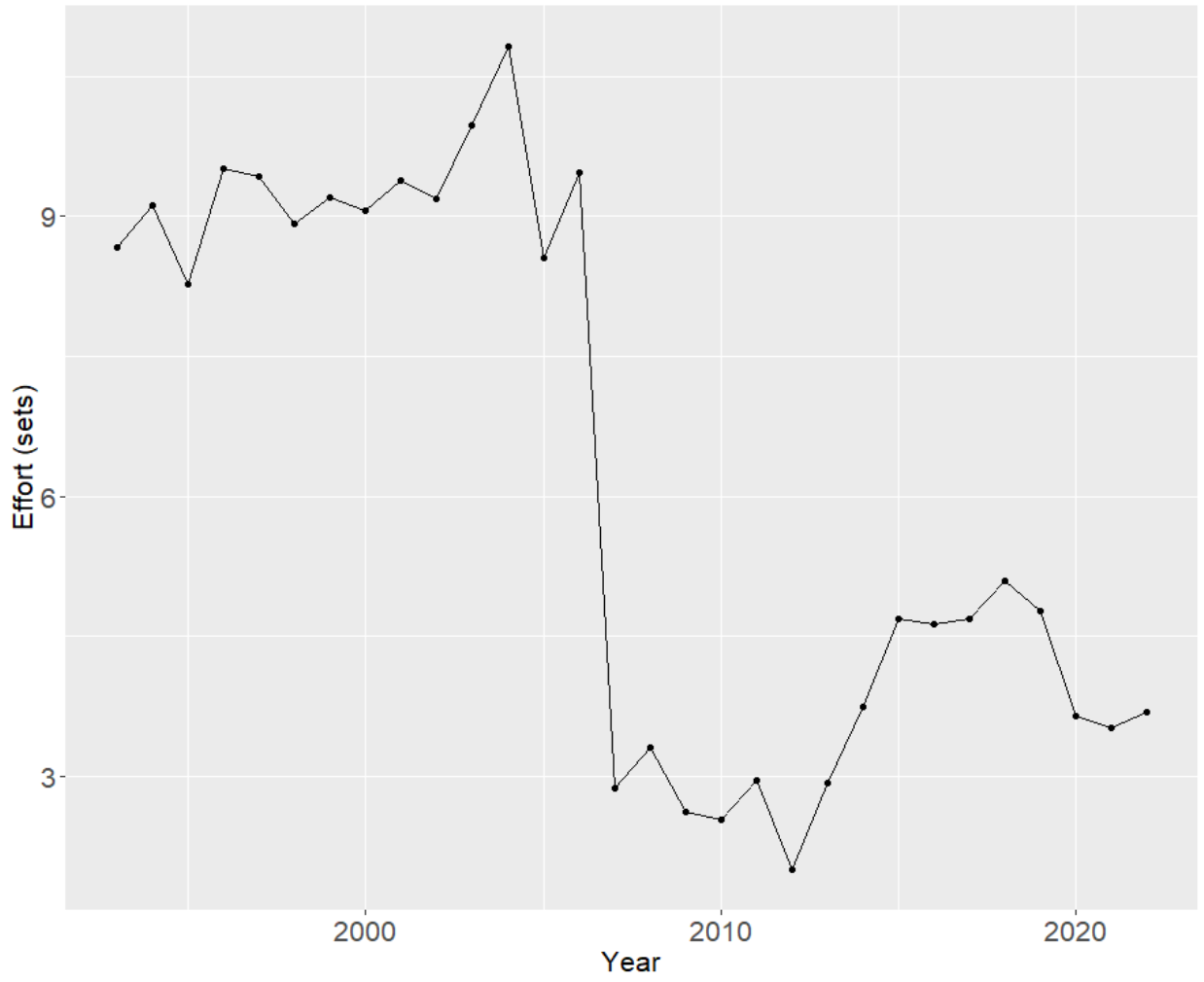


Figure 2. Mean logbook effort in number of longline sets per trip from 1993-2022.

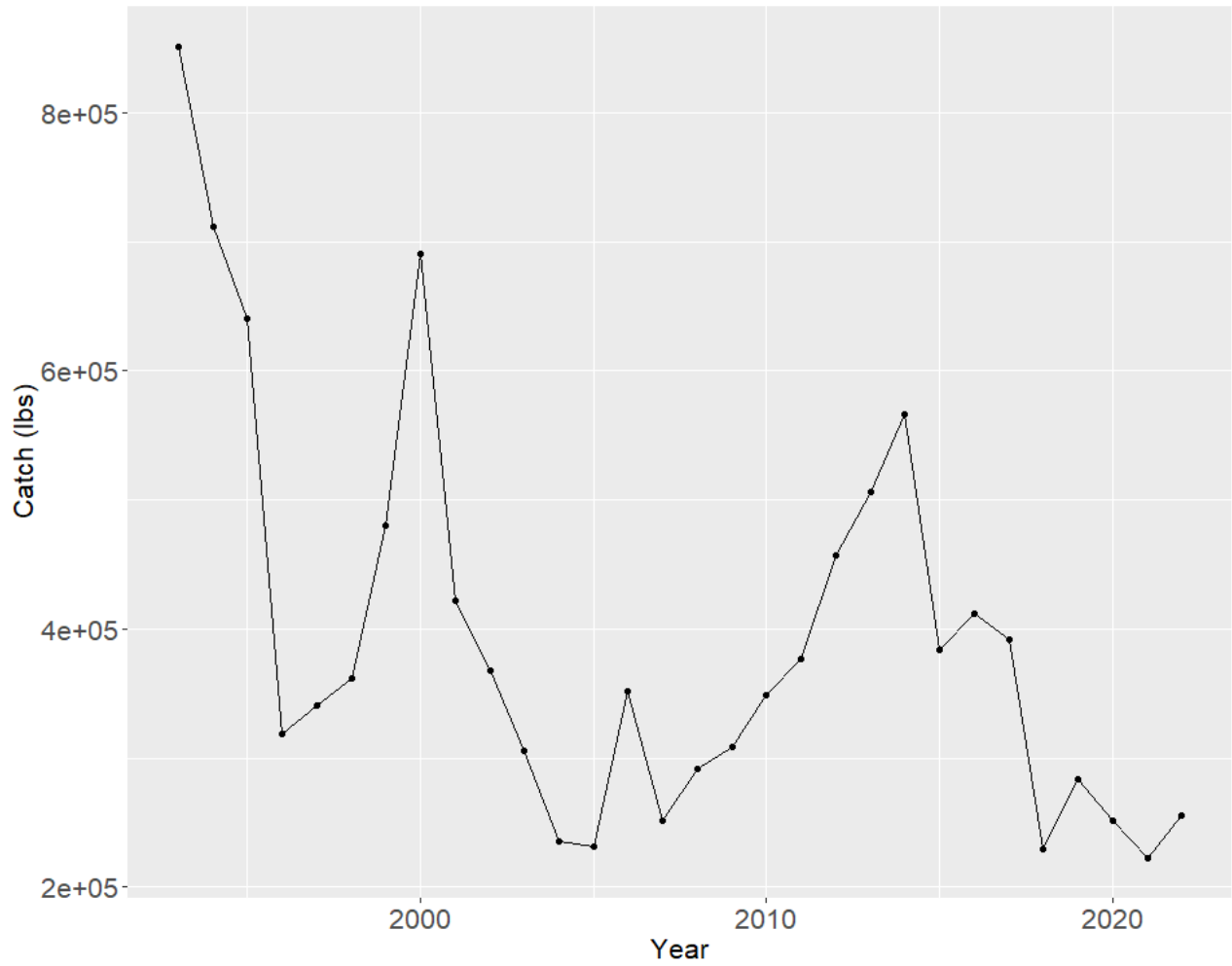


Figure 3. Total annual catch in pounds for South Atlantic Golden Tilefish from 1993-2022.

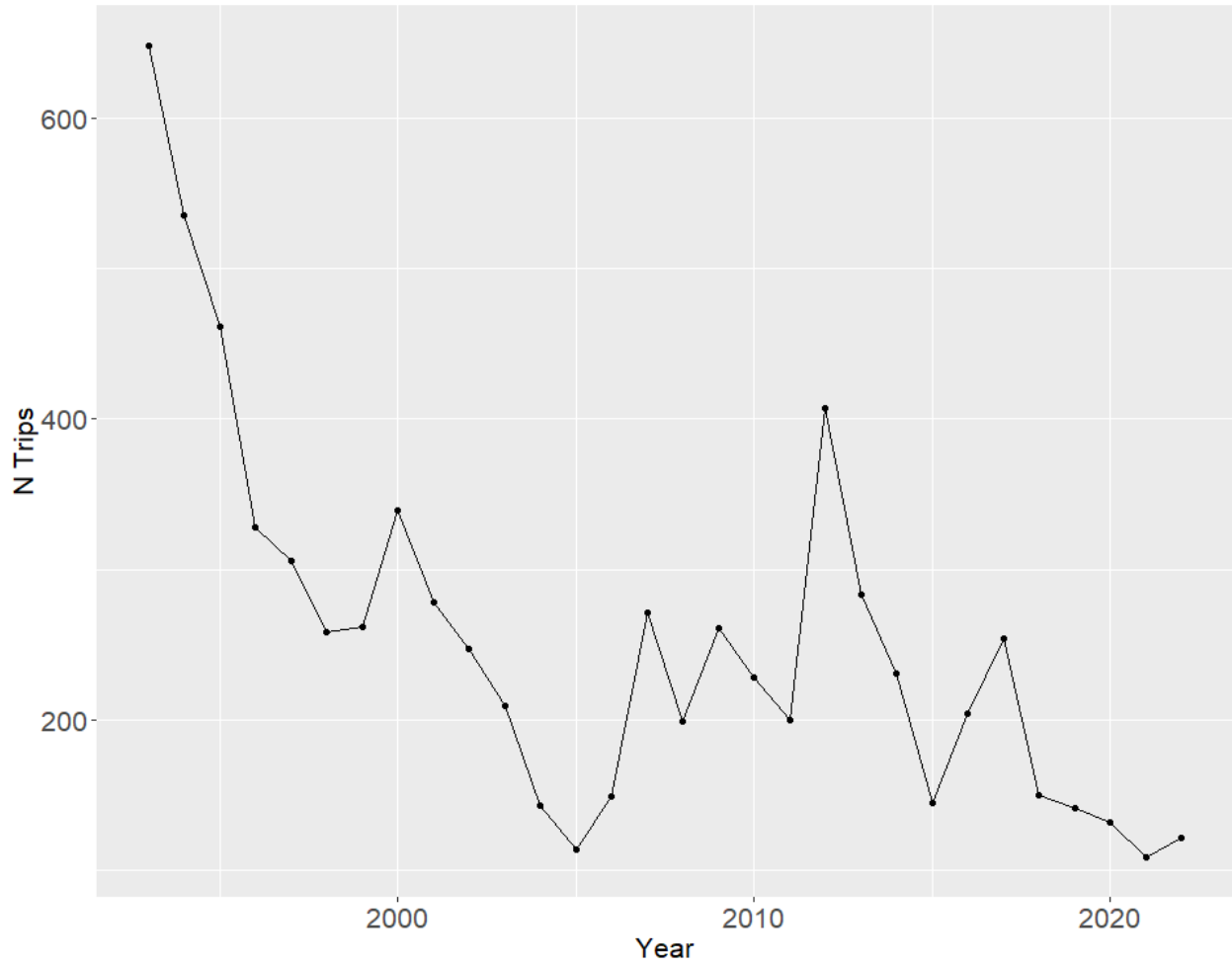


Figure 4. Annual total number of logbook trips reporting South Atlantic Golden Tilefish from 1993-2022.

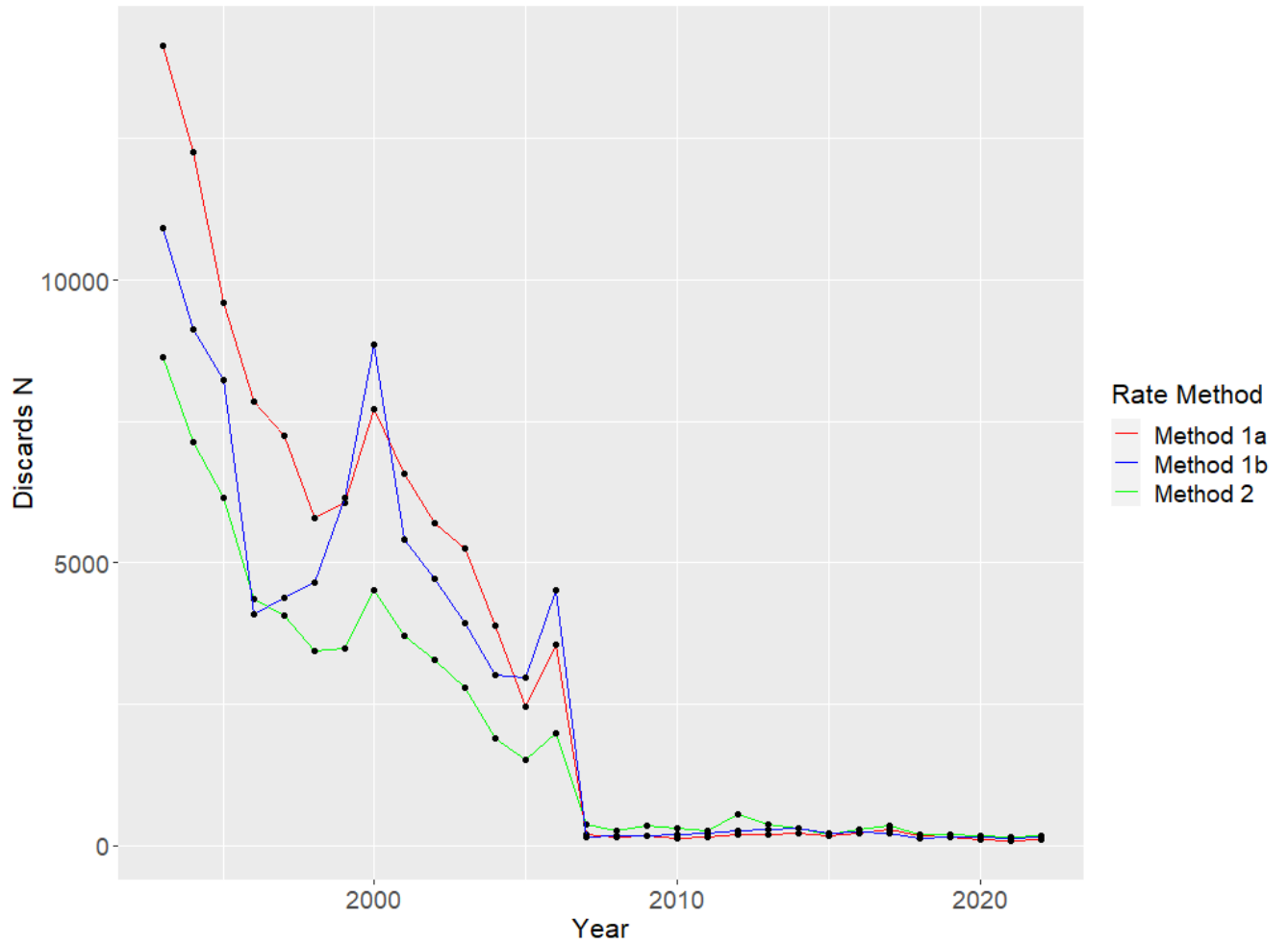


Figure 5. Trends in discards estimated using the different rates and effort metrics. Method 2 (discards in pounds) were converted to number for comparison to the other method.

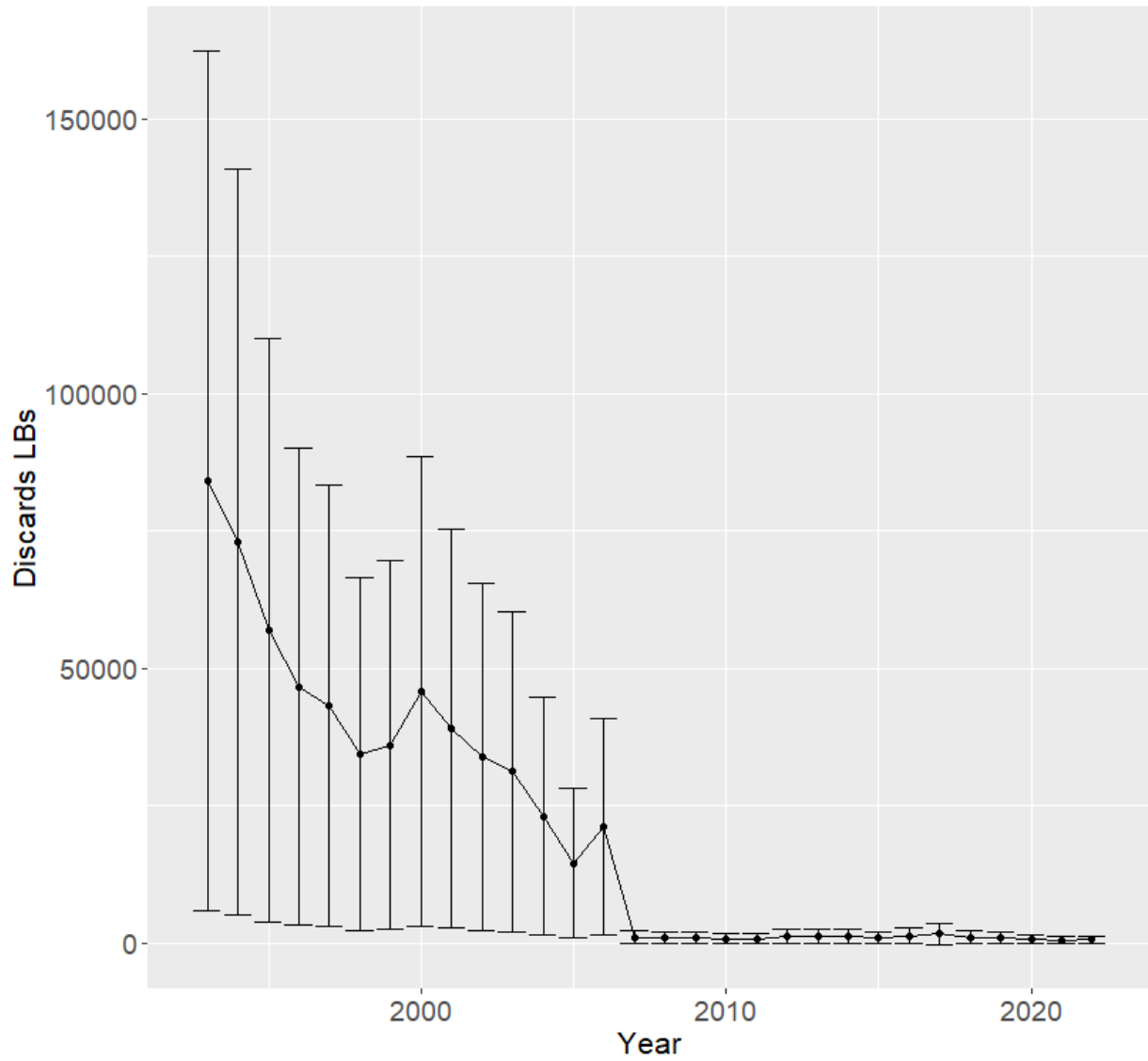


Figure 6. Estimated commercial discards (in number) and SE for the recommended method using a set-level observer discard rate.