# Reliability of the Discard Logbook for Use in Commercial Discard Estimates in the South Atlantic

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## Introduction

In the South Atlantic, the standard method for estimating commercial discards utilizes data from the Southeast Fisheries Science Center (SEFSC) coastal fisheries discard logbook program. However, there are concerns about the reliability of the information contained in the discard logbook data. A group of analysts examined various issues with the discard logbook data and investigated the feasibility of producing reliable discard estimates. This paper will present an overview of the discard logbook collection program and sampling methodologies, as well as indicate why the discard data from the logbook are not a useful source of data for discard estimation in the South Atlantic.

## Description of Discard Logbook Program

*Overview*

In the Southeast region, commercial vessels are required to submit catch and effort information through the Coastal Fisheries Logbook Program (CFLP). In addition to the coastal logbook, a portion of vessels are selected to submit additional discard information. The SEFSC Coastal Discard Logbook Program began as a supplemental discard program in August 2001.

A 20 percent sample of the vessels with a Gulf of Mexico reef fish, South Atlantic snapper-grouper, King Mackerel, Spanish Mackerel or shark permit are selected to report. Once selected, fishers are asked to provide the number of marine species by gear and fishing area that were discarded during the fishing trip and the estimated average individual weight of the species. They are also asked to record any interactions with marine mammals or endangered species that they had during the trip. In addition, they are asked to report the condition of the fish (animals) when they are released. The fisher may choose from 7 options for the condition of released fish. These options are: all animals are dead, majority of the animals are dead, all animals are alive when released, majority of animals are alive, fish are kept but not sold, unable to determine the condition of the animal, and a descending tool used to release fish. The fishers are also asked to specify one of two reasons why the fish (animals) were discarded. The choices are either regulatory discards or because of market conditions. For vessels that did not discard any species, there is an option to indicate the vessel had no interactions. These data are processed and placed in a database to be used for analyses.

*Sampling Design*

To assure that the sample is representative of the total universe of vessels with Federal permits, methods were developed to randomly sample all vessels with the above types of Federal permits. This selection process has changed over time to improve accuracy and representation.

The first year (2001) a 3-tiered stratification scheme was used. The first tier divided the universe into two geographical areas: the Gulf of Mexico (Florida Keys to the Texas-Mexican border) and the South Atlantic (which extends from the North Carolina - Virginia border to the Florida Keys). The second tier was based on the type of gear fished including handline, longline, trolling, trap and gill nets. The third tier was based on the fishing activity of the vessels during the calendar year 2000 and divided into two categories (1) vessels that made between 1 and 10 trips and (2) vessels that made more than 10 trips. In all, there were 20 strata for the sampling in the first year. However, there were too few boats that used gill nets in the Gulf of Mexico, so all of the boats that used gill nets in the Gulf were combined into a single stratum. As a result, 20 percent of the vessels in the 19 strata were selected at random to submit a discard form along with their regular coastal fisheries logbook form for each trip.

From 2002-2017, additional changes were made to the selection method. First, the selection was reduced to a 2-tiered stratification scheme. The fishing activity stratum was eliminated because too many of the vessels changed their fishing patterns and moved to a different stratum throughout the year. Consequently, 10 strata (two geographical and 5 gears) continued to be used for the random selection of vessels that were required to submit discard information. The selection was also made without replacement. That is, if a vessel is selected, it is removed from selection for the next couple of years, until all vessels have been selected in the respective strata.

The random sample without replacement was improved with a weighted method in 2018 to select vessels based on fishing effort in the previous year. Vessels are stratified by their prior year effort classification (active, submitted only no fishing reports, or new to the fishery) determined from logbook and no fish data collected during the period from November 1st to October 31st in the year prior to sampling. As of the 2021 selection, new and no fish vessels are treated as a single category due to lack of sufficient information to inform selection when broken down to the group level. Vessels are selected proportionally to stratum size and stratum variance of total discards calculated from the most recent complete year of data. Unlike previous methods, vessels are no longer removed from the pool for selection the following year. Vessels are required to submit discard reports from January 1 through December 31st of the year selected.

This results in active vessels selected with a higher probability than new or no fish vessels. It is not possible to stratify by region and gear type since at the time of selection strata are unknown for new and no fish vessels, meaning there is a chance for these vessels to end up with observations occurring in multiple strata. Rather, information on region and gear type combinations can be obtained through domain estimates after the sample is selected. Within strata, primary sampling units (vessels) are selected with equal weights. Analysts are unable to select proportionally to vessel effort calculated from the prior year since effort is unknown for new and no fish vessels, and there is no meaningful way of assigning effort measures to these vessels. There is also the complication of non-standard effort measures

between different gear types (i.e., effort is measured on a different scale depending on the gear used), which could introduce bias. Selecting with equal weights also alleviates the issue of vessels with very high relative effort being selected with certainty every year.

For this improved weighted selection method, vessel identification (ID) serves as the primary sampling unit in a one-stage cluster sample with clusters of unknown size. Unique combinations of gear, region, and schedule number serve as the secondary sampling units within each vessel ID. A census of secondary sampling units is taken (i.e., analysts collect data from all trip/region/gear combinations for each vessel that is selected). It is necessary to treat vessels as clusters since a sampling frame of all trip/region/gear combinations is non-existent at the time of selection.

## Data Issues and Limitations

*Reporting Accountability*

While several hundred vessels are selected to report discards each year, only a percentage of vessels comply with this request. On average, 60% of selected vessels adhere to the discard selection criteria (Table 1). Vessels who were not selected but chose to report voluntarily averaged 83 vessels a year. This data is accepted and processed in the same manner as the selected vessels' reports, however, including the data from vessels that were not selected could lead to a self-selection bias in analyses which can skew estimates (McCormick et al. 2013). Therefore, it is recommended to exclude data from all self-selected vessels.

Although 20 percent of the fleet is selected for mandatory reporting, permit renewal is not delayed due to nonreporting of discards. When a coastal logbook report is submitted without an associated discard report for those selected vessels, a discard due letter is sent. This letter requests the vessel to send the appropriate discard logbook report to the SEFSC Logbook Program for the specified date and vessel trip report (VTR) number of the received coastal logbook report. During the first several years of the Discard Logbook program (2002-2006), on average 37% of the coastal logbook trips had associated discard reports for selected vessels (Figure 1). From 2007 to present, an average of 84% of the logbook trips selected for discard reporting submitted discard reports. Unfortunately, discard logbook reporting does not affect permit compliance and if the vessel never sends discard reports, they are not held accountable.

*Recall Bias*

In addition to fishers not reporting for many trips, there may also be evidence of recall bias in the data that is submitted. Recall bias is dependent on a person's ability to remember and retrieve information from the past. Discard logbooks are often sent over a month after the fishing trip occurs, with an average reporting lag of 50 days from the time the fishing trip ended to the time

the report was received by NOAA Fisheries. Some discards are reported over a year after the fishing trip occurs, increasing the likelihood of recall bias (Tarrant et al. 1993).

*Zero Discard Reporting*

An increasing number of vessels have reported no interactions with discards since the beginning of the program in 2001. The issue of zero discard reporting is particularly evident in the South Atlantic, with "no discard interactions" trips increasing from 50% of discard reports in 2001, at the start of the program, to 75% of discard reports in 2022 (Table 2). One can expect a reporting rate to fluctuate over time, however a steady increase in "no discard interactions" reporting throughout the program is concerning to analysts.

Taking a closer look at "no discard interactions," trip characteristics were examined by vessel. There are vessels that report "no discard interactions" for the entire year, report discards for every trip fished in a year, or report a combination of the two (Figure 2). The percentage of vessels that report "no discard interactions" for every trip fished in a year is a substantial proportion of the data. While this may be believable for vessels that had very few trips in a year, vessels that fished six or more trips in a year would be expected to have some trips with reported discards (McCarthy 2013). On average 32% of selected vessels that fished six or more trips in a year reported "no discard interactions" for every trip report. Additionally, the reporting of "no discard interactions" is prevalent across all the major gear types SEFSC estimates discards for (Figure 3). On average 75% of discard reports fishing vertical line, troll line, gill net, or bottom longline gear declare "no discard interactions" and the trap fishery has 22% of the discard reports declaring "no discard interactions." Because so many trips claim to have "no discard interactions," it is difficult to parse out which trips are 'true' no discard trips and which are reporting discards to fulfill the reporting requirement. In analysis, much of these data are deemed unreliable and the discard logbook methodology attempts to remove some of these trips.

## Discard Estimation Methodologies

Methodologies using discard logbook data have changed over time and vary by species. In general, historic methodologies used a general linear model (GLM) to standardize discard estimates. The first iterations used GLM to estimate parameters that are statistically correlated with the numbers of discards of the target species (Poffenberger & McCarthy 2004). This average discard number was multiplied by gear specific logbook trips in the appropriate strata to expand to the entire fleet. Then the standardization procedure shifted to focus on discard rates (McCarthy 2006a).

SEDAR 24, South Atlantic Red Snapper, first presented a delta-lognormal modeling method to calculate a yearly least square means discard rate (McCarthy 2010). This method combined separate GLM analyses of the proportion of trips that discarded the target species and the discard

rates of trips that discarded the target species to construct a single standardized discard rate. This annual discard rate was multiplied by annual total effort for all gear specific logbook trips.

SEDAR 32, South Atlantic Gray Triggerfish and Blueline Tilefish, presented the nominal rate method for the entire time period (2002-2012) due to limited available discard data (McCarthy 2013). Discards were calculated separately for fish reported as discarded and those that were reported as "kept as bait or eaten." A discard logbook filtering approach to address potential false reporting of "no discard interactions" trips was also presented. Prior to SEDAR 32, all discard logbook data were used in analyses and an evaluation of "no discard" reports was not considered. The group recommended two filtering approaches to address the high percentage of "no discard" reports: (1) data from vessels that reported "no discard interactions" for the entire year were excluded and (2) data from vessels that took more than the 95 percentile to report a discard of any species (mean number of trips it takes a vessel to report a discard of any species plus two standard deviations of that mean) were also excluded.

SEDAR 41, South Atlantic Red Snapper, recommended the nominal rate method as the preferred method (McCarthy 2015). While there was enough data to estimate Red Snapper discard rates using the delta-lognormal modeling approach, the standardization of discard rates was deemed inappropriate for discard calculation. This is because nominal discard rates capture a range of fishing practices across the fishery that should be accounted for when calculating total discards. The working group also recommended that coastal logbook total effort exclude trips that reported only mackerel landings. The assumption was that such trips were unlikely to have Red Snapper discards. Methods proposed in SEDAR 32 and 41 became the standard practice for estimating discards using discard logbook data. Other than the filtering approaches developed for SEDAR 32, very little work has been done to further address the underreporting issues in the discard logbook data.

## Discard Logbook-Observer Comparison

The South Atlantic Reef Fish Observer Program (SARF) began to consistently collect observer data from the vertical line fishery in 2018. There have been 591 observed vertical line trips from 2018-2023. These observer trips were compared to discard logbook trips fishing vertical line gear. The assumption for this analysis is that the observer data are more accurate because it is information being recorded by an independent, trained scientist. However, there remains concern that the presence of an observer on a vessel trip may result in a bias due to altered fishing practices.

The percent of trips reporting "no discards" vastly differs by data source (Figure 4). Observers reported about 20 percent of the trips had no discards, while fishers reported about 80 percent of

trips had “no discards interactions.” This indicates the discard logbook is significantly overreporting the number of trips that had zero discards.

Discard logbook data were also matched to observer trips to assess trip-level differences in reporting between each program. Data were matched using the vessel ID and land date. Only trips with the same land date were used to limit this analysis to confident matches. From 2018-2023, a total of 144 trips from 53 vessels had a discard logbook report while an observer was onboard. The following comparisons were conducted to assess: (1) number of trips reporting no discards between the observer and discard logbook data and (2) number of individuals discarded between the observer and discard logbook data for species that were reported on both forms.

Table 3 highlights the number of trips reporting no discards between the observer and discard logbook programs. Even with matched trips where an observer was onboard, 50 percent of trips reported “no discard interactions” on the discard logbook form, compared to the observer data that recorded only 25 percent of trips having no discards of any species. This is evidence the discard logbook data inaccurately reports the number of trips with “no discard interactions.”

For trips that had the same discard species reported in both the discard logbook and observer data, the reported number of individuals discarded were compared (Figure 5). There were 49 trips and 82 matched records (trip-species) used in this comparison. The mean difference is not significantly different from zero (paired t-test;$p=0.685$), but there appears to be a negative skew, meaning fishers are in general overreporting the number of individuals discarded compared to the observers.

Ultimately, comparisons between the frequency of reporting no discards between these matched data are limited given sample size and not representative of the overall patterns in the discard logbook data. When the discard logbook data are used in total for analytical products in assessments, the high rate of reported zero discards results in incorrect characterization of the discard rates and numbers generated for a species in a fishery. This ultimately leads to underestimates of total discards in number or weight for the focal fishery when compared to the observer data (McCarthy et al. 2023). Unfortunately, given the lack of coverage of observer data in the region across space, gears, and species these comparisons are limited to few of the managed species in the South Atlantic.

## Conclusion and Recommendation

While strides have been made to improve and adjust the discard estimation for stock assessments using the discard logbook data, analysts have ultimately found the data source to be unreliable. In a letter to the Gulf Council in 1999, Nancy Thompson, SEFSC Director, advised the Executive Director of the Gulf Council that the general agreement amongst staff was that discard

logbook data collected thus far in the Northeast had not proven very useful for estimating discards and at-sea observers were a more trusted source for those data (Thompson 1999). Despite this disclosure, the South Atlantic and Gulf Councils requested the Science Center create a discard logbook program to collect this information. At the time, there were not enough funds to implement a comprehensive at-sea observer program in both regions.

Nearly 25 years after this recommendation, SEFSC analysts still believe at-sea observer data is the most reliable source for discard information. When discard logbook estimates are compared to observer discard estimates, there is an unsettling difference in the discard rates, driven by the high percentage of zero discard reports included in calculations. For each of the species analyzed, the observer data consistently calculated a higher average discard rate than the discard rate calculated from the discard logbook data. Other than the current discard logbook filtering approaches, very little can be done to accurately know the percentage of trips truly reporting "no discard interactions."

Unfortunately, funding is still proving to be a major hurdle to sufficient observer coverage in the South Atlantic. From 2018 to 2021 and as of 2024, the South Atlantic reef fishery is allotted 150 sea days (expected 50 trips) for coverage for the calendar year. For comparison, the Gulf of Mexico reef fishery is allotted 400 sea days for coverage for the calendar year. A temporary boost in funding to the South Atlantic Reef Fishery Observer Program in 2022 and 2023 led to more observer coverage, with 530 trips observed (309 in 2022; 221 in 2023; ~3% coverage rate in sea days), an increase from 59 observed in 2021 (~1% coverage rate in sea days), which resulted in increased confidence in discard estimates produced with those data and allowed for statistically valid comparison of observer and discard logbook data. Increased observer coverage will lead to improved reliability of discard estimates, given the ability to sample trips that fish both in the open and closed seasons of a fishery. Given that many reef fisheries in the South Atlantic have closed seasons, the current number of alloted sea days (~1% coverage) insufficiently captures these fisheries. More specifically, increased coverage would improve accuracy in discard rates as well as the total effort estimates by capturing a more accurate proportion of trips that discard only the target species.

With the steady increase in zero discard reporting, lack of accountability, and based on comparison to observer data, trust in the discard logbook as a useful dataset has diminished. Analysts have made efforts to adjust methodologies to account for the data limitations, however the reduced amount of discarded species information from the discard logbook makes it difficult to work with. It is for these reasons the Southeast Fisheries Science Center no longer recommends using the discard logbook to calculate discard estimates or rates for use in science and management.

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## Tables

**Table 1.** Number of selected reporters, number of vessels that reported, and number of vessels that self selected by year. The percentage of vessels fulfilling selection criteria reflects the number of vessels that adhered to the selection criteria. *Selection from January to December began in 2007, previous selection years spanned multiple years.

| Year | Number of Vessels Selected | Number of Vessels that Reported | Number of Vessels that Self-Selected | Percentage of Vessels Fulfilling Selection Criteria |
|---|---|---|---|---|
| 2007* | 449 | 260 | 81 | 57.91% |
| 2008 | 503 | 390 | 114 | 77.53% |
| 2009 | 534 | 245 | 150 | 45.88% |
| 2010 | 610 | 430 | 88 | 70.49% |
| 2011 | 573 | 387 | 87 | 67.54% |
| 2012 | 721 | 408 | 123 | 56.59% |
| 2013 | 738 | 396 | 101 | 53.66% |
| 2014 | 729 | 378 | 105 | 51.85% |
| 2015 | 710 | 374 | 95 | 52.68% |
| 2016 | 697 | 384 | 73 | 55.09% |
| 2017 | 731 | 381 | 74 | 52.12% |
| 2018 | 624 | 376 | 70 | 60.26% |
| 2019 | 623 | 430 | 47 | 69.02% |
| 2020 | 630 | 415 | 55 | 65.87% |
| 2021 | 613 | 391 | 52 | 63.78% |
| 2022 | 569 | 360 | 57 | 63.27% |
| 2023 | 607 | 404 | 41 | 66.56% |

**Table 2.** Total discard reports by positive and negative reporting of discards and percentage. Data is filtered to only include the South Atlantic and vessels selected for discard reporting.

| Land year | Total Discard Reports | Number of "no discard interactions" reports | Number of reports with discards | Percentage of "no discard interactions" reports |
|---|---|---|---|---|
| 2001 | 1,097 | 544 | 553 | 49.59% |
| 2002 | 2,457 | 1,251 | 1,206 | 50.92% |
| 2003 | 2,947 | 1,716 | 1,231 | 58.23% |
| 2004 | 1,792 | 1,102 | 690 | 61.50% |
| 2005 | 1,740 | 970 | 770 | 55.75% |
| 2006 | 1,450 | 1,011 | 439 | 69.72% |
| 2007 | 4,382 | 3,112 | 1,270 | 71.02% |
| 2008 | 8,206 | 5,590 | 2,616 | 68.12% |
| 2009 | 3,800 | 2,515 | 1,285 | 66.18% |
| 2010 | 9,708 | 7,281 | 2,427 | 75.00% |
| 2011 | 9,893 | 7,717 | 2,176 | 78.00% |
| 2012 | 8,398 | 6,162 | 2,236 | 73.37% |
| 2013 | 7,959 | 5,800 | 2,159 | 72.87% |
| 2014 | 8,250 | 5,514 | 2,736 | 66.84% |
| 2015 | 7,320 | 4,883 | 2,437 | 66.71% |
| 2016 | 9,500 | 6,790 | 2,710 | 71.47% |
| 2017 | 9,708 | 7,604 | 2,104 | 78.33% |
| 2018 | 7,131 | 5,415 | 1,716 | 75.94% |
| 2019 | 7,081 | 5,534 | 1,547 | 78.15% |
| 2020 | 6,265 | 5,052 | 1,213 | 80.64% |
| 2021 | 6,472 | 5,051 | 1,421 | 78.04% |
| 2022 | 4,766 | 3,614 | 1,152 | 75.83% |
| 2023 | 2,686 | 1,931 | 755 | 71.89% |

**Table 3.** Total number of matched observer and discard logbook trips from 2018-2023 as well as the number of matched trips with reported "no discard interactions" by program. The matched trips were limited to the most confident matches with the same land date.

| Year | Total Matched Trips | Number of Trips with "No Discard Interactions" | |
|---|---|---|---|
| | | Observer | Discard Logbook |
| 2018 | 5 | 1 | 1 |
| 2019 | 2 | 0 | 0 |
| 2020 | 7 | 2 | 5 |
| 2021 | 7 | 2 | 6 |
| 2022 | 52 | 15 | 28 |
| 2023 | 71 | 17 | 37 |

# Figures

**Figure 1**. Average percentage of coastal logbook trips that had an associated discard logbook report for selected vessels by year.

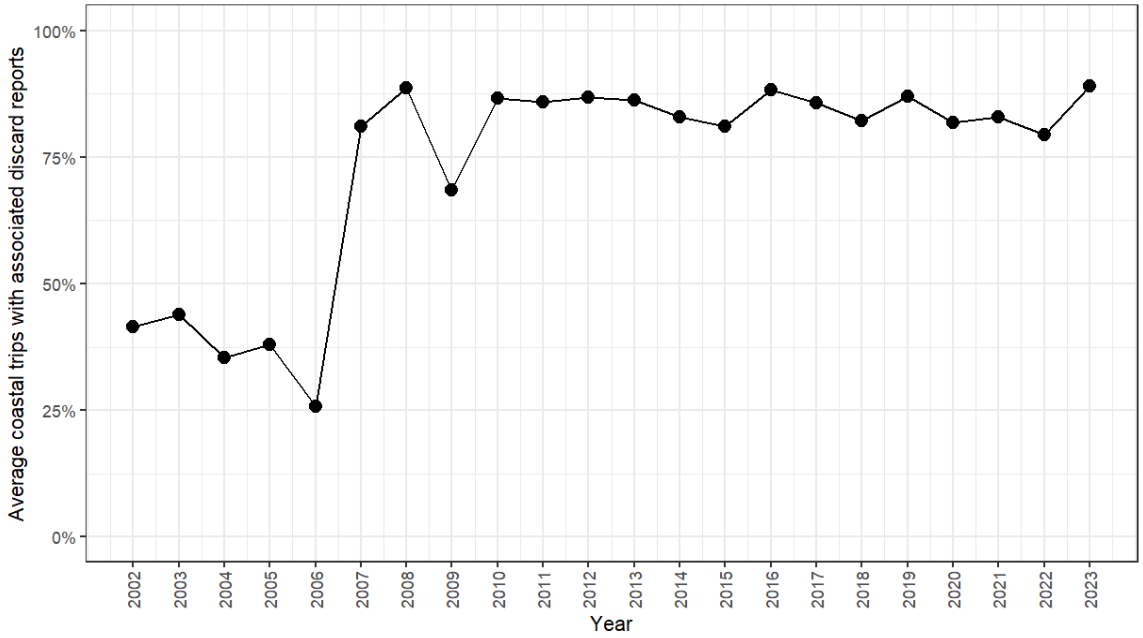


**Figure 2.** The percentage of vessels reporting to the discard logbook program by reporting type and year. The reporting type indicates vessels that reported a discard of a species for every trip fished, vessels that reported "no discard interactions" for every trip fished, or vessels that had a combination of "no discard interactions" and discards throughout the year. Since there is a chance for a vessel with few trips in a year to have "no discard interactions" all year, the vessels were further classified into two categories (less than 6 trips in a year or greater than and equal to 6 trips in a year).

**Figure 3.** The percentage of discard reports declaring “no discard interactions” by gear type from 2001-2023. Vertical gear includes hand line and electric/hydraulic bandit reels.

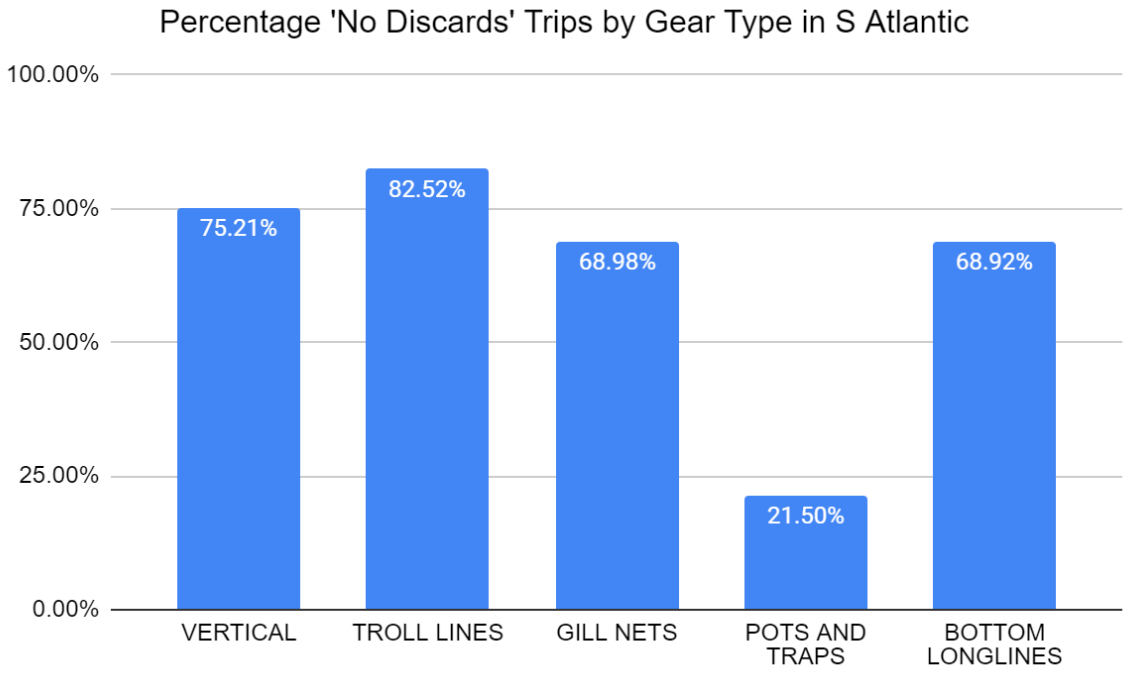



**Figure 4.** Proportion of trips reporting “no discard interactions” to the observer and discard logbook programs by year for the vertical line fishery.

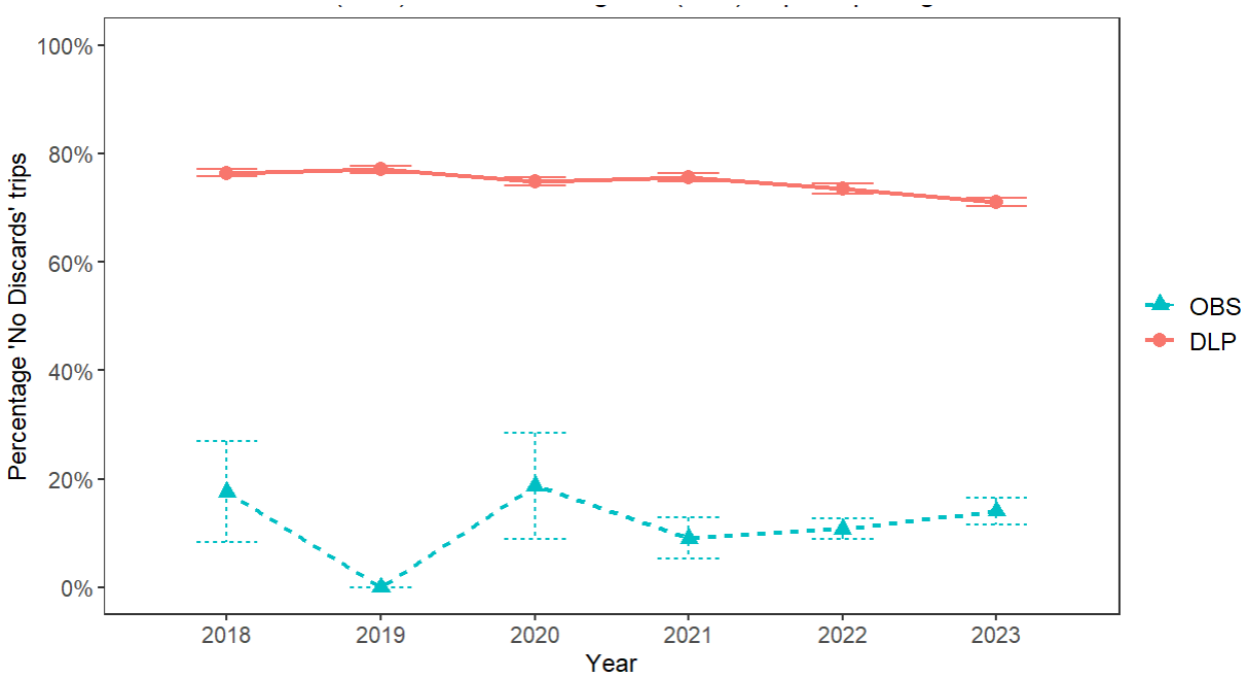
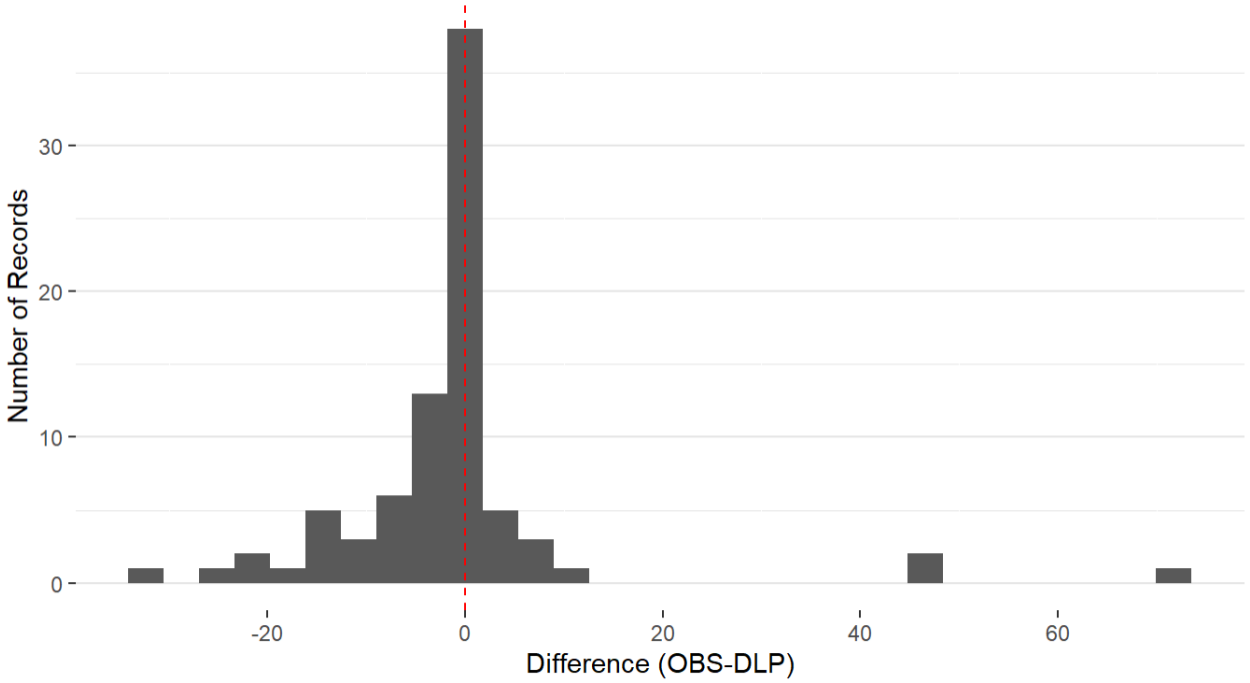

100%
80%
60%
40%
20%
0%
Percentage 'No Discards' trips
2018
2019
2020
2021
2022
2023
Year
OBS
DLP

**Figure 5.** Difference in the reported number of fish discarded for observer (OBS) and discard logbook (DLP) matched trips. This comparison is based on 49 matched trips (and 82 records) that had the same reported species discarded on that trip. The red line at zero indicates the number of reported fish discarded for a species is the same.



Appendix 1. Memo from SEFSC to GMFMC concerning discard collection on logbooks.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, Florida 33149

September 27, 1999

Wayne Swingle
Executive Director
Gulf of Mexico Fishery Management Council
The Commons at Rivergate
3018 U.S. Highway 301 North, Suite 1000
Tampa, Florida 33619-2266

Dear Mr. Swingle:

In response to your letter regarding the modification of logbook forms to collect bycatch information, the Center cannot begin to collect bycatch information on logbooks on January 1, 2000, because approval of the Office of Management and Budget has to be received before a new form can be implemented and this is not possible prior to the end of 1999. In addition, Center staff do believe logbooks are the best procedure to collect this bycatch or discard information. From the experience with discard data when it was included on the reef fish logbook form very few trips were reported with discards and the data that were reported were questionable. Similarly, the Northeast Regional Office has not been receiving very useful discard information on their vessel trip reports (logbooks).

The general agreement is that at-sea observers are the best method to collect detailed data on bycatch discard activities. However, the Center does not have the resources to implement a comprehensive at-sea observer program at this time. Funding sources such as the Gulfin appropriation for the Gulf States Marine Fisheries Commission and the Atlantic Coastal Cooperative Statistics Program may provide the means to support reliable observer programs for the Southeast Region in the future, and we will continue to work with these partners to develop and implement observer programs as funding allows.

In lieu of an at-sea observer program, the Center will investigate possible changes to the logbook form to collect some information on bycatch/discards. There are two substantial constraints to collecting these data. First, a determination of what questions need to be asked and second, one has to figure out how to incorporate these questions on the current logbook form. The Center will attempt to develop new forms in early 2000 and field test them in mid-2000 where appropriate. Actual implementation will depend on the results from the field tests and reactions from the fishing industry.

Appendix 1. Cont.

With respect to your request to collect depth information, the same two constraints exist. That is, a determination needs to be made on what information the fishermen are to be asked. Should they report average depth for the entire trip, or maximum depth or a range of depths, etc.? Second, the logbook form needs to be modified to accommodate the new information. Modifying the form is difficult because it means that something has to be taken off the current form (e.g., type of gear or area fished) in order to add the data on depth.

As the logbook forms are redesigned, Center staff will provide drafts to Council staff for their review and comments. Likewise, it may be appropriate to request the review and comment of the appropriate Advisory Panels.

Sincerely,

Bradford E. Brown
Science & Research Director