

Calculated discards of Spanish mackerel and cobia from commercial fishing vessels in the Gulf
of Mexico and US South Atlantic

K. McCarthy

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Calculated discards of Spanish mackerel and cobia from commercial fishing vessels in the Gulf of Mexico and US South Atlantic

Kevin McCarthy

National Marine Fisheries Service, Southeast Fisheries Science Center
Sustainable Fisheries Division, 75 Virginia Beach Drive, Miami, FL, 33149-1099
Kevin.J.McCarthy@noaa.gov

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Introduction

In August 2001, the Southeast Fisheries Science Center (SEFSC) initiated a program to collect commercial fishing vessel discard data from Gulf of Mexico and South Atlantic fisheries. A reporting form was developed that supplements the existing vessel coastal logbook forms that are currently mandatory for those fisheries (Poffenberger and McCarthy, 2004). Discard data from the SEFSC coastal fisheries discard logbook program were used to calculate the number of Spanish mackerel and cobia discarded from commercial vertical line (handline and electric/hydraulic reel, aka bandit rig), trolling, and gillnet vessels. More than 97.5 percent of reported Spanish mackerel and cobia commercial vessel discards were reported from vessels fishing those gears.

Data collection for the discard logbook program involves, each year, a 20% random sample of vessels with Gulf of Mexico reef fish, South Atlantic snapper-grouper, king mackerel, Spanish mackerel, dolphin/wahoo, and shark permits selected to report the number of animals discarded by species. To assure that the sample was representative of vessels with those Federal permits fishing in the Gulf of Mexico and South Atlantic, the universe of permitted vessels was stratified by region (Gulf of Mexico and South Atlantic) and gear fished. Fishing gear strata included handline, bandit rig, trolling, longline, fish trap, gillnet, and diving. A random sample (weighted by effort reported by each vessel during the prior year) was selected, without replacement, from each stratum. The selected fishers were instructed to complete a supplemental discard form for each fishing trip. Trips with no discards were reported as such.

Reported data included the numbers of discards by species and the estimated condition of the fish when released, and the fishing area where the animal was discarded. There were seven options for the condition of released fish: all animals are dead, majority of the animals are dead, all animals are alive when released, majority of animals are alive, the fish are kept but not sold, the condition of the animals is unknown, and unreported. To calculate species specific discard rates, discard data were matched to the landings and effort data reported (for the appropriate trip) to the coastal logbook program.

Methods

Spanish mackerel and cobia commercial discards were calculated for vessels fishing vertical lines (handline, electric reel/bandit rig), trolling, and gillnets in the US South Atlantic and Gulf of Mexico. Available data included the number of discards and fishing effort from self-reported discard logbooks for the years 2002-2010 for vessels with federal fishing permits (other than tuna and swordfish permits). Total commercial effort of vessels with federal fishing permits for the years 1993-2010 was also available. Two Spanish mackerel analyses were completed for the South Atlantic. A continuity analysis used the methods described in SEDAR 17-DW10 and was limited to the region 25°N to 37°N latitude (approximately the Dade/Monroe county Florida border to the North Carolina/Virginia border). In order to accommodate the new stock boundary definition of SEDAR 28, a new analysis (SEDAR 28 analysis) included data reported from the region south and east of the Florida Keys (including the Dry Tortugas) to 37°N latitude.

Approximately one percent of all logbook reported trips and 1.7% of Spanish mackerel trips were reported from north of 37°N, therefore, discards could not be reliably calculated for areas north of North Carolina. Spanish mackerel discards were also calculated for commercial vessels in the Gulf of Mexico. Cobia commercial discards were calculated for vessels fishing vertical lines, trolling, and gillnets in the Gulf of Mexico and South Atlantic.

Available data were filtered to remove records with logical inconsistencies (e.g., reported fishing more than 24 hours), records missing effort (vertical line and trolling gear: missing number of lines fished, hooks per line, or hours fished; gillnet: missing length or depth of net or hours fished). Data reported from trips with discards or fishing effort in both the South Atlantic and Gulf of Mexico were excluded from the analyses because discard rates and fishing effort cannot be reliably apportioned within single trips. Coastal logbook data (used to calculate total effort) were additionally filtered to remove likely data outliers. Those data that exceeded the 99.5 percentile of the population for any variable used to calculate effort (e.g., number of lines, hooks per line, length of gillnet) were excluded.

Commercial discards may be under reported. A 20 percent sample of fishers was required to report to the discard logbook program in order to renew their federal fishing permits. Fishers remain in reporting compliance by returning discard logbooks with reports of “no discards”. The percentage of discard reports from vertical line vessels returned with “no discards” has increased from 42 to 73 percent in southern Florida (McCarthy, 2011). Commercial vertical line trips that had fishery observers onboard, however, report only 10 percent of trips had no discards. Sample size of the observer trips in southern Florida was low (30 trips in areas 1-4, no observer coverage in the southern Florida portion of the South Atlantic), however the large discrepancy between observer reports of “no discards” and self-reported “no discards” suggests that under reporting may be occurring. To reduce the likelihood of using discard rates that were erroneously low, the data set was filtered to remove records from vessels with all discard logbook forms reporting “no discards”. Given that vessels with few trips may have had multiple trips with no discards, the records from vessels that had reported six or fewer trips were retained in the data set.

Self-reported discard disposition and instantaneous (at the vessel) discard mortality was also summed by region and gear. Total numbers of discarded fish of both species were too few to examine discard mortality among years or at finer spatial scales than whole region (South Atlantic or Gulf of Mexico).

SEDAR 17 continuity analysis

Calculation of Spanish mackerel discards in the South Atlantic was necessarily uncomplicated due to the limited number of trips reporting discards of the species. The analysis was spatially limited to the region north of 25°N and south of 37°N latitude, as in SEDAR 17 (SEDAR17-DW10). Spanish mackerel discard rates were calculated as the mean nominal discard rate among all trips, by gear, that reported to the discard logbook program during the period 2002-2010. Yearly gear-specific discards were calculated as the product of the gear-specific discard rate and gear-specific yearly total effort (vertical line and trolling effort = total hook-hours fished; gillnet effort = square yard hours fished) reported to the coastal logbook program. Discards were calculated for the years 1998-2010. Prior to 1998, federal permits were not required for vessels to land Spanish mackerel caught in federal waters. Total Spanish mackerel fishing effort, particularly for trolling vessels, was not reported to the coastal logbook program by all commercial vessels and calculations of total discards would be erroneously low for years prior to 1998.

SEDAR 28 analyses

Spanish mackerel discards from the commercial vertical line, trolling, and gillnet fisheries were calculated for the US South Atlantic (statistical areas 2300-3700; Figure 1) and Gulf of Mexico (statistical areas 1-21; Figure 1). Only vertical line, trolling, and gillnet vessels reported Spanish mackerel discards on more than 10 trips over the period 2002-2010 (Table 1). Such small numbers of trips with reported discards of Spanish mackerel limited the complexity of the discard analysis.

Methods for calculating discards were similar to those described for the continuity analysis. Spanish mackerel discard rates were calculated as the nominal discard rate among all trips reporting to the discard

logbook program, by gear, during the period 2002-2010. Total discards were calculated as the product of those gear-specific discard rates and the yearly gear-specific total fishing effort (vertical line or trolling = total hook-hours fished; gillnets = square yard hours fished) reported to the coastal logbook program. Discards were calculated for the years 1998-2010. As noted with the continuity analysis, calculation of discards for years prior to 1998 was not possible due to changes in permitting and reporting requirements for the Spanish mackerel commercial fishery.

Cobia

Cobia commercial discards were calculated for vessels fishing vertical lines (handline, electric reel/bandit rig), trolling, and gillnets in the US South Atlantic and Gulf of Mexico. Available data included the number of discards and fishing effort from self-reported discard logbooks for the years 2002-2010 from vessels with federal fishing permits (other than tuna and swordfish permits). Less than 2.5 percent of cobia discard reports for the period 2002-2010 was from trips reporting fishing gear other than vertical lines, trolling, or gillnets. Data from vessels reporting fishing those other gears were not included in the discard calculations.

Cobia discards from the commercial vertical line, trolling, and gillnet fisheries were calculated for the US South Atlantic (statistical areas 2900-3700; Figure 1) and Gulf of Mexico (statistical areas 1-21 and South Atlantic areas 2300-2900; Figure 1). As with the Spanish mackerel discard calculations, small sample size (Table 2) prevented complex analysis. Discard calculations of cobia followed the methods used for calculating Spanish mackerel discards with total cobia discards calculated as the product of gear-specific discard rates (mean rate among the years 2002-10) and the yearly gear-specific total fishing effort (vertical line or trolling = total hook-hours fished; gillnets = square yard hours fished) reported to the coastal logbook program. Cobia discards were calculated for the years 1993-2010. Those years include the first year of full reporting of federally permitted vessels to the coastal logbook program. As noted above, total effort may have been higher prior to 1998 because effort from mackerel trips and gillnet effort was not reported to the coastal logbook program. Calculated discards would be erroneously low without fully reported effort.

Results and Discussion

SEDAR 17 continuity analysis

South Atlantic Spanish mackerel yearly total gear-specific sample sizes, total effort, and calculated discards (in number of fish) along with discard rates and discard rate coefficients of variation (CV) are provided in Table 3 for the continuity analysis. Discard sample size, rates, and CVs were calculated for the period 2002-2010. Discard sample size included trips that did not report Spanish mackerel discards. Discard rates were calculated using all Spanish mackerel discards reported to the discard logbook program including fish reported as “kept, not sold”. Discards summed by year are provided in Table 4 along with yearly discards calculated for SEDAR 17. Differences in the SEDAR 17 and continuity yearly total discards (Table 4) were primarily due to higher discard rates of gillnets in the SEDAR 17 analysis (SEDAR 17 discard rate = 0.000128; continuity discard rate = 0.000063). Discard rates differed because three more years of data were available for calculating mean discard rates for SEDAR 28. In addition, some small differences in yearly effort totals were found in some years because of data corrections and the removal of duplicate records since SEDAR 17. In all years gillnets accounted for the highest number of discards followed by vertical line gear. Total yearly discards calculated in the continuity analysis were less than 10,000 fish except for 1999. Discard rate coefficients of variation were high, likely due to the small sample size of trips reporting Spanish mackerel discards.

SEDAR 28 analyses

South Atlantic Spanish mackerel gear-specific yearly sample sizes, total effort, and calculated discards (in number of fish) are provided in Table 5. Discard rates, sample sizes, and discard rate CVs are also

included. Discard sample size, rates, and CVs were calculated for the period 2002-2010. Discard sample size included trips that did not report Spanish mackerel discards and discard rates were calculated using all Spanish mackerel discards reported to the discard logbook program including fish reported as “kept, not sold”. Yearly total discards calculated for the South Atlantic are presented in Table 6. The Gulf of Mexico gear-specific sample sizes, discard rates, discard rate CVs, total effort, and calculated discards are included in Table 7. Yearly Gulf of Mexico total discards summed across gears are provided in Table 8. Prior to 1998, vessels landing Spanish mackerel were not required to report to the coastal logbook program and the level of reporting and, therefore, total effort was unknown. Discards of Spanish mackerel could not be reliably calculated for the years prior to 1998.

The yearly calculated Spanish mackerel discards from the commercial fishery (of vessels with federal permits reporting to the coastal logbook program) were relatively low. During 10 of 13 years, fewer than 15,000 Spanish mackerel were discarded in the South Atlantic. Most South Atlantic discards were reported from vessels fishing gillnets. Calculated Spanish mackerel commercial discards were generally higher in the Gulf of Mexico than the South Atlantic, but were always less than 20,000 fish per year. Nearly all Spanish mackerel discards in the Gulf of Mexico were from vertical line vessels. The number of trips reporting Spanish mackerel discards was very small and the high discard rate coefficients of variation may be due to those low sample sizes. An additional concern was the possible under reporting of commercial discards due to the high percentage of fishers returning discard logbooks with reports of “no discards”. These results should, therefore, be used with caution. Discards calculated here may represent the minimum number of discards from the commercial fishery.

Cobia

Cobia South Atlantic yearly total gear-specific sample sizes, total effort, and calculated discards (in number of fish) along with discard rates and discard rate coefficients of variation (CV) are provided in Table 9. Discard sample size, rates, and CVs were calculated for the period 2002-2010. Discard sample size includes discard logbook trips that did not report cobia discards. Discard rates were calculated using all cobia discards reported to the discard logbook program including fish reported as “kept, not sold”. Discards summed by year are provided in Table 10. Gulf of Mexico calculated cobia discards, sample sizes, cobia discard rates, discard rate CVs, and total discards by year and gear are presented in Table 11. Cobia discards summed by year are provided in Table 12.

Calculated discards in the South Atlantic were fewer than 1,300 per year. More cobia discards were calculated for the Gulf of Mexico (here defined to include south and southeastern Florida) were higher, but did never exceeded 14,000 fish per year. The same data concerns associated with the Spanish mackerel discard calculations are applicable to the cobia calculations. Results should be used with caution and discards calculated here may represent the minimum number of discards from the commercial fishery.

Discard mortality

More than 90 percent of Spanish mackerel discards were reported as “dead” or “majority dead” in the South Atlantic gillnet fishery (Table 13). Discard logbooks from vertical line and trolling vessels from both regions, however, report 41 to 59 percent of fish that may have otherwise been discards as “kept” (Table 13). Vertical line and trolling vessels reported 25 to 40 percent of Spanish mackerel discards were “alive” or “majority alive”. The low percentage of fish reported as discarded “dead” or “majority dead” suggests that the majority of those fish not “kept” in the vertical line and trolling fisheries had high survival, at least immediately upon release. Delayed mortality cannot be determined from the discard logbook data.

A high percentage (71-94%) of cobia discards were reported as “all alive” or “majority alive” when released regardless of the gear used (Table 14). In the Gulf of Mexico trolling fishery, 29% of fish that might otherwise have been discarded were reported as “kept, not sold”. Survival of discarded cobia was reportedly high in the commercial fishery. Only in the South Atlantic gillnet fishery were more than seven

percent of discards reported as “majority dead” or “all dead”, however, only 87 discarded cobia were observed in that fishery.

Literature Cited

McCarthy, K. 2008. Discards of Spanish Mackerel and Vermilion Snapper Calculated for Commercial Vessels with Federal Fishing Permits in the US South Atlantic. SEDAR 17-DW10.

McCarthy, K. 2011. Calculated discards of yellowtail snapper from commercial vertical line fishing vessels in southern Florida. SEDAR 27-RD02.

Poffenberger, J. and K. McCarthy. 2004. Estimates of red snapper discards by vessels with Federal permits in the Gulf of Mexico. SEDAR 7-DW-22.

Table 1. Number of trips reporting Spanish mackerel discards by region and gear fished; all years combined (2002-2010). “Other species” totals include all other reports to the discard logbook program. Also included in “other species” totals are trips with no reported discards. Trips with multiple gears fished reported or that fished in both regions may be counted more than once. Totals include only those vessels with federal fishing permits.

Region	Species	Gillnet	Vertical line	Trolling	All other gears
GOM	Spanish Mackerel	0	39	17	0
	Other species (sm boundaries)	73	14,423	1,342	2,532
SA	Spanish Mackerel	37	84	46	confidential
	Other species (sm boundaries)	2,470	23,990	14,079	3,541

Table 2. Number of trips reporting cobia discards by region and gear fished; all years combined (2002-2010). “Other species” totals include all other reports to the discard logbook program. Also included in “other species” totals are trips with no reported discards. Trips with multiple gears fished reported or that fished in both regions may be counted more than once. Totals include only those vessels with federal fishing permits.

Region	Species	Gillnet	Vertical line	Trolling	All other gears
GOM	Cobia	0	349	83	29
	Other species (cobia boundaries)	586	32,072	13,224	4,203
SA	Cobia	43	44	13	6
	Other species (cobia boundaries)	1,952	6,049	2,165	1,838

Table 3. Yearly discards of Spanish mackerel by gear from US South Atlantic commercial fishing vessels calculated using SEDAR 17 methodology (continuity analysis). Discards are reported as number of fish. The number of trips reporting discards for each gear (Trips discards) was summed across the years 2002-2010 and often exceeds the gear-specific yearly number of trips reporting to the coastal logbook (Trips total effort).

Year	Gear	Trips (discards)	Trips (total effort)	Discard Rate	Discard Rate CV	Total Effort	Calculated Discards
1998	Gillnet	2,479	2,182	0.00006	14.0	68,319,392	4,277
	Vertical line	15,226	11,074	0.00213	28.0	1,179,546	2,518
	Trolling	13,888	9,964	0.00343	36.4	519,180	1,782
1999	Gillnet	2,479	1,697	0.00006	14.0	107,826,010	6,750
	Vertical line	15,226	9,489	0.00213	28.0	967,908	2,066
	Trolling	13,888	9,892	0.00343	36.4	468,674	1,609
2000	Gillnet	2,479	1,779	0.00006	14.0	78,244,203	4,898
	Vertical line	15,226	8,725	0.00213	28.0	1,026,869	2,192
	Trolling	13,888	10,613	0.00343	36.4	561,239	1,927
2001	Gillnet	2,479	1,693	0.00006	14.0	83,909,664	5,253
	Vertical line	15,226	9,244	0.00213	28.0	1,079,411	2,304
	Trolling	13,888	10,309	0.00343	36.4	514,606	1,767
2002	Gillnet	2,479	1,696	0.00006	14.0	94,771,378	5,933
	Vertical line	15,226	10,026	0.00213	28.0	1,254,285	2,678
	Trolling	13,888	8,776	0.00343	36.4	325,965	1,119
2003	Gillnet	2,479	1,431	0.00006	14.0	66,584,702	4,168
	Vertical line	15,226	10,237	0.00213	28.0	1,110,361	2,370
	Trolling	13,888	9,284	0.00343	36.4	301,688	1,036
2004	Gillnet	2,479	1,466	0.00006	14.0	51,634,828	3,232
	Vertical line	15,226	9,697	0.00213	28.0	769,342	1,642
	Trolling	13,888	7,164	0.00343	36.4	238,734	820
2005	Gillnet	2,479	1,682	0.00006	14.0	65,057,240	4,073
	Vertical line	15,226	8,764	0.00213	28.0	720,028	1,537
	Trolling	13,888	6,544	0.00343	36.4	215,397	740
2006	Gillnet	2,479	2,078	0.00006	14.0	55,474,032	3,473
	Vertical line	15,226	10,219	0.00213	28.0	827,910	1,767
	Trolling	13,888	7,057	0.00343	36.4	231,598	795
2007	Gillnet	2,479	2,157	0.00006	14.0	51,533,696	3,226
	Vertical line	15,226	11,302	0.00213	28.0	905,122	1,932
	Trolling	13,888	8,405	0.00343	36.4	284,855	978
2008	Gillnet	2,479	1,769	0.00006	14.0	46,112,280	2,887
	Vertical line	15,226	11,598	0.00213	28.0	936,763	2,000
	Trolling	13,888	8,718	0.00343	36.4	275,402	946
2009	Gillnet	2,479	2,043	0.00006	14.0	41,077,507	2,572
	Vertical line	15,226	13,615	0.00213	28.0	964,511	2,059
	Trolling	13,888	9,587	0.00343	36.4	298,382	1,024
2010	Gillnet	2,479	1,532	0.00006	14.0	35,166,486	2,202
	Vertical line	15,226	11,705	0.00213	28.0	790,475	1,688
	Trolling	13,888	7,779	0.00343	36.4	236,751	813

Table 4. Yearly Spanish mackerel calculated discards by gear, continuity analysis with SEDAR 17 methods (25°N to 37°N).

Year	Gillnet	Vertical line	Trolling	Total	SEDAR 17 total
1998	4,277	2,518	1,782	8,578	12,737
1999	6,750	2,066	1,609	10,426	17,282
2000	4,898	2,192	1,927	9,017	13,890
2001	5,253	2,304	1,767	9,324	14,542
2002	5,933	2,678	1,119	9,730	15,564
2003	4,168	2,370	1,036	7,575	11,606
2004	3,232	1,642	820	5,695	8,851
2005	4,073	1,537	740	6,349	10,401
2006	3,473	1,767	795	6,035	9,421
2007	3,226	1,932	978	6,136	8,864
2008	2,887	2,000	946	5,832	
2009	2,572	2,059	1,024	5,655	
2010	2,202	1,688	813	4,702	

Table 5. Yearly discards of Spanish mackerel by gear from US South Atlantic commercial fishing vessels calculated using SEDAR 28 methodology. Gillnet data were not reported prior to 1998. Discards are reported as number of fish. The number of trips reporting discards for each gear (Trips discards) was summed across the years 2002-2010 and often exceeds the gear-specific yearly number of trips reporting to the coastal logbook (Trips total effort).

Year	Gear	Trips (discards)	Trips (total effort)	Discard Rate	Discard Rate CV	Total Effort	Calculated Discards
1993	Gillnet						
	Vertical line	17,654	12,565	0.00213	26.6	1,384,090	2,948
1994	Trolling	9,348	1,967	0.00510	29.8	105,079	536
	Gillnet						
1994	Vertical line	17,654	15,275	0.00213	26.6	1,873,297	3,990
	Trolling	9,348	2,010	0.00510	29.8	131,643	671
1995	Gillnet						
	Vertical line	17,654	15,351	0.00213	26.6	1,762,995	3,755
1996	Trolling	9,348	2,471	0.00510	29.8	118,548	605
	Gillnet						
1996	Vertical line	17,654	16,582	0.00213	26.6	1,719,874	3,664
	Trolling	9,348	2,138	0.00510	29.8	109,200	557
1997	Gillnet						
	Vertical line	17,654	18,978	0.00213	26.6	1,886,385	4,018
1998	Trolling	9,348	2,713	0.00510	29.8	135,568	691
	Gillnet	1,661	2,249	0.00012	9.5	65,980,302	7,979
1998	Vertical line	17,654	18,625	0.00213	26.6	1,421,122	3,027
	Trolling	9,348	10,882	0.00510	29.8	496,130	2,531
1999	Gillnet	1,661	1,788	0.00012	9.5	118,568,655	14,339
	Vertical line	17,654	16,910	0.00213	26.6	1,255,285	2,674
2000	Trolling	9,348	10,758	0.00510	29.8	489,581	2,497
	Gillnet	1,661	1,913	0.00012	9.5	87,556,104	10,588
2000	Vertical line	17,654	15,501	0.00213	26.6	1,270,213	2,706
	Trolling	9,348	11,366	0.00510	29.8	539,876	2,754
2001	Gillnet	1,661	1,805	0.00012	9.5	82,606,587	9,990
	Vertical line	17,654	16,288	0.00213	26.6	1,273,737	2,713
2001	Trolling	9,348	10,888	0.00510	29.8	412,603	2,105
	Gillnet	1,661	1,829	0.00012	9.5	143,669,365	17,374
2002	Vertical line	17,654	17,073	0.00213	26.6	1,174,786	2,502
	Trolling	9,348	9,317	0.00510	29.8	335,170	1,710
2003	Gillnet	1,661	1,516	0.00012	9.5	60,604,634	7,329
	Vertical line	17,654	17,462	0.00213	26.6	1,000,964	2,132
2003	Trolling	9,348	9,695	0.00510	29.8	306,230	1,562
	Gillnet	1,661	1,546	0.00012	9.5	54,816,252	6,629
2004	Vertical line	17,654	16,232	0.00213	26.6	884,069	1,883
	Trolling	9,348	7,494	0.00510	29.8	247,442	1,262
2005	Gillnet	1,661	1,806	0.00012	9.5	66,645,365	8,060
	Vertical line	17,654	14,598	0.00213	26.6	809,465	1,724
2005	Trolling	9,348	6,734	0.00510	29.8	218,534	1,115
	Gillnet	1,661	2,112	0.00012	9.5	57,876,995	6,999
2006	Vertical line	17,654	15,815	0.00213	26.6	906,379	1,931
	Trolling	9,348	7,404	0.00510	29.8	239,871	1,224
2007	Gillnet	1,661	2,163	0.00012	9.5	53,403,456	6,458
	Vertical line	17,654	17,187	0.00213	26.6	984,777	2,098
2007	Trolling	9,348	8,830	0.00510	29.8	296,048	1,510
	Gillnet	1,661	1,748	0.00012	9.5	47,459,715	5,739
2008	Vertical line	17,654	17,203	0.00213	26.6	997,903	2,126
	Trolling	9,348	9,253	0.00510	29.8	284,837	1,453
2009	Gillnet	1,661	2,014	0.00012	9.5	37,330,927	4,515
	Vertical line	17,654	19,472	0.00213	26.6	1,050,292	2,237
2009	Trolling	9,348	10,229	0.00510	29.8	311,933	1,591
	Gillnet	1,661	1,613	0.00012	9.5	40,743,253	4,927
2010	Vertical line	17,654	16,771	0.00213	26.6	883,972	1,883
	Trolling	9,348	8,225	0.00510	29.8	248,748	1,269

Table 6. Spanish mackerel yearly total calculated discards from commercial gillnet, vertical line, and trolling vessels with federal fishing permits in the US South Atlantic (Florida Keys to 37°N latitude). Discards are reported as number of fish.

Year	Gillnet	Vertical line	Trolling	Calculated discards
1998	7,979	3,027	2,531	13,537
1999	14,339	2,674	2,497	19,510
2000	10,588	2,706	2,754	16,048
2001	9,990	2,713	2,105	14,808
2002	17,374	2,502	1,710	21,587
2003	7,329	2,132	1,562	11,023
2004	6,629	1,883	1,262	9,774
2005	8,060	1,724	1,115	10,899
2006	6,999	1,931	1,224	10,154
2007	6,458	2,098	1,510	10,066
2008	5,739	2,126	1,453	9,318
2009	4,515	2,237	1,591	8,343
2010	4,927	1,883	1,269	8,079

Table 7. Yearly discards of Spanish mackerel by gear from Gulf of Mexico commercial fishing vessels calculated using SEDAR 28 methodology. Gillnet data were not reported prior to 1998. Discards are reported as number of fish. The number of trips reporting discards for each gear (Trips discards) was summed across the years 2002-2010 and often exceeds the gear-specific yearly number of trips reporting to the coastal logbook (Trips total effort).

Year	Gear	Trips (discards)	Trips (total effort)	Discard Rate	Discard Rate CV	Total Effort	Calculated Discards
1993	Gillnet						
	Vertical line	13,638	10,914	0.00183	41.54	6,925,712	12,692
1994	Trolling	1,034	90	0.00408	14.61	9,491	39
	Gillnet						
1994	Vertical line	13,638	11,671	0.00183	41.54	7,893,326	14,466
	Trolling	1,034	171	0.00408	14.61	4,747	19
1995	Gillnet						
	Vertical line	13,638	11,843	0.00183	41.54	7,777,796	14,254
1996	Trolling	1,034	332	0.00408	14.61	23,508	96
	Gillnet						
1996	Vertical line	13,638	11,886	0.00183	41.54	8,650,235	15,853
	Trolling	1,034	671	0.00408	14.61	68,588	280
1997	Gillnet						
	Vertical line	13,638	12,145	0.00183	41.54	9,310,327	17,063
1998	Trolling	1,034	533	0.00408	14.61	65,412	267
	Gillnet	49	84	0		7,373,760	0
1998	Vertical line	13,638	12,359	0.00183	41.54	9,171,438	16,808
	Trolling	1,034	1,108	0.00408	14.61	152,873	623
1999	Gillnet	49	213	0		10,009,915	0
	Vertical line	13,638	13,126	0.00183	41.54	10,322,595	18,918
2000	Trolling	1,034	1,423	0.00408	14.61	149,767	611
	Gillnet	49	130	0		5,982,270	0
2000	Vertical line	13,638	13,080	0.00183	41.54	9,819,018	17,995
	Trolling	1,034	1,469	0.00408	14.61	88,969	363
2001	Gillnet	49	143	0		10,632,438	0
	Vertical line	13,638	12,810	0.00183	41.54	9,137,457	16,746
2002	Trolling	1,034	1,509	0.00408	14.61	94,418	385
	Gillnet	49	77	0		10,246,300	0
2002	Vertical line	13,638	13,844	0.00183	41.54	9,581,248	17,559
	Trolling	1,034	1,190	0.00408	14.61	82,767	337
2003	Gillnet	49	75	0		4,762,488	0
	Vertical line	13,638	13,801	0.00183	41.54	10,346,979	18,962
2004	Trolling	1,034	1,168	0.00408	14.61	84,522	345
	Gillnet	49	55	0		1,958,360	0
2004	Vertical line	13,638	13,472	0.00183	41.54	9,285,981	17,018
	Trolling	1,034	829	0.00408	14.61	61,499	251
2005	Gillnet	49	67	0		4,727,960	0
	Vertical line	13,638	11,258	0.00183	41.54	8,921,312	16,350
2006	Trolling	1,034	637	0.00408	14.61	41,297	168
	Gillnet	49	92	0		9,586,552	0
2006	Vertical line	13,638	10,930	0.00183	41.54	8,680,791	15,909
	Trolling	1,034	785	0.00408	14.61	68,327	279
2007	Gillnet	49	87	0		4,469,950	0
	Vertical line	13,638	7,991	0.00183	41.54	8,225,965	15,075
2008	Trolling	1,034	905	0.00408	14.61	72,255	295
	Gillnet	49	83	0		6,174,850	0
2008	Vertical line	13,638	8,081	0.00183	41.54	7,206,772	13,207
	Trolling	1,034	999	0.00408	14.61	53,319	217
2009	Gillnet	49	167	0		11,460,610	0
	Vertical line	13,638	8,714	0.00183	41.54	9,019,238	16,529
2010	Trolling	1,034	1,121	0.00408	14.61	53,385	218
	Gillnet	49	57	0		4,553,500	0
2010	Vertical line	13,638	6,178	0.00183	41.54	8,318,237	15,244
	Trolling	1,034	1,012	0.00408	14.61	37,420	153

Table 8. Spanish mackerel yearly total calculated discards from commercial gillnet, vertical line, and trolling vessels with federal fishing permits in the Gulf of Mexico. Discards are reported as number of fish. No Spanish mackerel discards were reported from gillnet trips in the Gulf of Mexico, although discards of other species were reported.

Year	Gillnet	Vertical line	Trolling	Calculated discards
1998	0	16,808	623	17,431
1999	0	18,918	611	19,528
2000	0	17,995	363	18,358
2001	0	16,746	385	17,131
2002	0	17,559	337	17,897
2003	0	18,962	345	19,307
2004	0	17,018	251	17,269
2005	0	16,350	168	16,518
2006	0	15,909	279	16,187
2007	0	15,075	295	15,370
2008	0	13,207	217	13,425
2009	0	16,529	218	16,747
2010	0	15,244	153	15,397

Table 9. Yearly discards of cobia by gear from US South Atlantic commercial fishing vessels. Gillnet data were not reported prior to 1998. Discards are reported as number of fish. The number of trips reporting discards for each gear (Trips discards) was summed across the years 2002-2010 and often exceeds the gear-specific yearly number of trips reporting to the coastal logbook (Trips total effort).

Year	Gear	Trips (discards)	Trips (total effort)	Discard Rate	Discard Rate CV	Total Effort	Calculated Discards
1993	Gillnet						
	Vertical line	5,314	4,139	0.00036	26.56	1,056,986	384
1994	Trolling	1,683	765	0.00029	14.09	45,884	13
	Gillnet						
1994	Vertical line	5,314	5,191	0.00036	26.56	1,317,277	479
	Trolling	1,683	849	0.00029	14.09	69,354	20
1995	Gillnet						
	Vertical line	5,314	5,171	0.00036	26.56	1,298,506	472
1996	Trolling	1,683	1,090	0.00029	14.09	67,005	19
	Gillnet						
1996	Vertical line	5,314	4,974	0.00036	26.56	1,251,611	455
	Trolling	1,683	851	0.00029	14.09	68,227	20
1997	Gillnet	1,364	34	0.00002	26.33	197,400	4
	Vertical line	5,314	5,209	0.00036	26.56	1,233,133	448
1997	Trolling	1,683	1,176	0.00029	14.09	83,226	24
	Gillnet	1,364	502	0.00002	26.33	20,923,780	453
1998	Vertical line	5,314	4,977	0.00036	26.56	924,144	336
	Trolling	1,683	2,192	0.00029	14.09	161,388	47
1999	Gillnet	1,364	569	0.00002	26.33	21,884,464	474
	Vertical line	5,314	4,003	0.00036	26.56	776,978	282
2000	Trolling	1,683	2,436	0.00029	14.09	182,600	53
	Gillnet	1,364	950	0.00002	26.33	32,984,923	714
2000	Vertical line	5,314	3,767	0.00036	26.56	833,134	303
	Trolling	1,683	2,388	0.00029	14.09	169,871	49
2001	Gillnet	1,364	931	0.00002	26.33	32,724,775	708
	Vertical line	5,314	3,942	0.00036	26.56	894,823	325
2001	Trolling	1,683	2,192	0.00029	14.09	138,679	40
	Gillnet	1,364	1,050	0.00002	26.33	44,471,893	963
2002	Vertical line	5,314	4,401	0.00036	26.56	828,406	301
	Trolling	1,683	1,809	0.00029	14.09	111,442	32
2003	Gillnet	1,364	970	0.00002	26.33	35,901,213	777
	Vertical line	5,314	3,503	0.00036	26.56	667,396	243
2004	Trolling	1,683	1,661	0.00029	14.09	93,205	27
	Gillnet	1,364	976	0.00002	26.33	31,873,640	690
2004	Vertical line	5,314	3,527	0.00036	26.56	618,909	225
	Trolling	1,683	1,637	0.00029	14.09	88,416	26
2005	Gillnet	1,364	1,045	0.00002	26.33	35,924,962	778
	Vertical line	5,314	3,516	0.00036	26.56	597,366	217
2006	Trolling	1,683	1,587	0.00029	14.09	87,437	25
	Gillnet	1,364	1,222	0.00002	26.33	42,455,095	919
2006	Vertical line	5,314	3,715	0.00036	26.56	651,860	237
	Trolling	1,683	1,638	0.00029	14.09	84,735	25
2007	Gillnet	1,364	1,187	0.00002	26.33	37,759,226	817
	Vertical line	5,314	4,134	0.00036	26.56	704,633	256
2008	Trolling	1,683	2,226	0.00029	14.09	115,285	33
	Gillnet	1,364	1,049	0.00002	26.33	35,389,802	766
2008	Vertical line	5,314	4,047	0.00036	26.56	702,404	255
	Trolling	1,683	1,983	0.00029	14.09	89,750	26
2009	Gillnet	1,364	1,316	0.00002	26.33	30,102,640	652
	Vertical line	5,314	4,136	0.00036	26.56	722,943	263
2010	Trolling	1,683	2,138	0.00029	14.09	110,263	32
	Gillnet	1,364	1,132	0.00002	26.33	35,090,431	760
2010	Vertical line	5,314	3,183	0.00036	26.56	599,433	218
	Trolling	1,683	1,210	0.00029	14.09	66,656	19

Table 10. Cobia yearly total calculated discards from commercial gillnet, vertical line, and trolling vessels with federal fishing permits in the US South Atlantic (29°N to 37°N latitude). Discards are reported as number of fish.

Year	Gillnet	Vertical line	Trolling	Calculated discards
1993		384	13	397
1994		479	20	499
1995		472	19	491
1996		455	20	475
1997		448	24	472
1998	453	336	47	836
1999	474	282	53	809
2000	714	303	49	1,066
2001	708	325	40	1,074
2002	963	301	32	1,296
2003	777	243	27	1,047
2004	690	225	26	941
2005	778	217	25	1,020
2006	919	237	25	1,181
2007	817	256	33	1,107
2008	766	255	26	1,047
2009	652	263	32	946
2010	760	218	19	997

Table 11. Yearly discards of cobia by gear from Gulf of Mexico commercial fishing vessels. Gillnet data were not reported prior to 1998. Discards are reported as number of fish. The number of trips reporting discards for each gear (Trips discards) was summed across the years 2002-2010 and often exceeds the gear-specific yearly number of trips reporting to the coastal logbook (Trips total effort).

Year	Gear	Trips (discards)	Trips (total effort)	Discard Rate	Discard Rate CV	Total Effort	Calculated Discards
1993	Gillnet						
	Vertical line	26,020	19,289	0.00126	20.70	7,219,733	9,131
1994	Trolling	8,685	1,302	0.00065	15.89	65,101	42
	Gillnet						
1995	Vertical line	26,020	21,765	0.00126	20.70	8,600,494	10,877
	Trolling	8,685	1,376	0.00065	15.89	66,092	43
1996	Gillnet						
	Vertical line	26,020	22,003	0.00126	20.70	8,101,595	10,246
1997	Trolling	8,685	1,714	0.00065	15.89	73,727	48
	Gillnet						
1998	Vertical line	26,020	23,480	0.00126	20.70	8,761,047	11,080
	Trolling	8,685	1,965	0.00065	15.89	110,159	71
1999	Gillnet						
	Vertical line	26,020	25,884	0.00126	20.70	9,765,734	12,350
2000	Trolling	8,685	2,063	0.00065	15.89	99,550	64
	Gillnet	333	1,831	0.00000		54,721,322	
2001	Vertical line	26,020	25,952	0.00126	20.70	9,373,286	11,854
	Trolling	8,685	9,760	0.00065	15.89	423,046	273
2002	Gillnet	333	1,429	0.00000		105,969,478	
	Vertical line	26,020	26,023	0.00126	20.70	10,729,162	13,569
2003	Trolling	8,685	9,728	0.00065	15.89	427,294	276
	Gillnet	333	1,065	0.00000		47,422,451	
2004	Vertical line	26,020	24,777	0.00126	20.70	10,075,953	12,743
	Trolling	8,685	10,388	0.00065	15.89	410,164	265
2005	Gillnet	333	1,013	0.00000		59,783,882	
	Vertical line	26,020	25,141	0.00126	20.70	9,367,503	11,847
2006	Trolling	8,685	10,200	0.00065	15.89	365,328	236
	Gillnet	333	849	0.00000		101,951,572	
2007	Vertical line	26,020	26,577	0.00126	20.70	9,901,767	12,522
	Trolling	8,685	8,704	0.00065	15.89	306,382	198
2008	Gillnet	333	613	0.00000		29,181,309	
	Vertical line	26,020	27,796	0.00126	20.70	10,583,839	13,385
2009	Trolling	8,685	9,196	0.00065	15.89	292,672	189
	Gillnet	333	609	0.00000		23,406,572	
2010	Vertical line	26,020	26,194	0.00126	20.70	9,263,642	11,715
	Trolling	8,685	6,683	0.00065	15.89	220,281	142
2011	Gillnet	333	821	0.00000		34,914,963	
	Vertical line	26,020	22,433	0.00126	20.70	9,030,529	11,421
2012	Trolling	8,685	5,786	0.00065	15.89	172,365	111
	Gillnet	333	976	0.00000		22,902,932	
2013	Vertical line	26,020	23,083	0.00126	20.70	8,956,530	11,327
	Trolling	8,685	6,541	0.00065	15.89	222,041	143
2014	Gillnet	333	1,039	0.00000		18,458,780	
	Vertical line	26,020	21,065	0.00126	20.70	8,482,827	10,728
2015	Trolling	8,685	7,499	0.00065	15.89	244,838	158
	Gillnet	333	791	0.00000		19,899,363	
2016	Vertical line	26,020	21,232	0.00126	20.70	7,497,442	9,482
	Trolling	8,685	8,251	0.00065	15.89	246,580	159
2017	Gillnet	333	877	0.00000		20,260,297	
	Vertical line	26,020	24,092	0.00126	20.70	9,305,784	11,769
2018	Trolling	8,685	9,182	0.00065	15.89	252,739	163
	Gillnet	333	542	0.00000		10,735,522	
2019	Vertical line	26,020	19,715	0.00126	20.70	7,557,178	9,557
	Trolling	8,685	8,012	0.00065	15.89	218,092	141

Table 12. Cobia yearly total calculated discards from commercial gillnet, vertical line, and trolling vessels with federal fishing permits in the Gulf of Mexico (GOM to 29°N Florida Atlantic coast). Discards are reported as number of fish. No Spanish mackerel were reported from gillnet trips in the Gulf of Mexico, although discards of other species were reported.

Year	Gillnet	Vertical line	Trolling	Calculated discards
1993		9,131	42	9,173
1994		10,877	43	10,919
1995		10,246	48	10,293
1996		11,080	71	11,151
1997		12,350	64	12,415
1998	0	11,854	273	12,127
1999	0	13,569	276	13,845
2000	0	12,743	265	13,008
2001	0	11,847	236	12,083
2002	0	12,522	198	12,720
2003	0	13,385	189	13,574
2004	0	11,715	142	11,858
2005	0	11,421	111	11,532
2006	0	11,327	143	11,471
2007	0	10,728	158	10,886
2008	0	9,482	159	9,641
2009	0	11,769	163	11,932
2010	0	9,557	141	9,698

Table 13. Self-reported discard mortality/disposition of Spanish mackerel caught on commercial fishing vessels with federal fishing permits, 2002-2010. No Spanish mackerel discards were reported from gillnet vessels in the Gulf of Mexico.

Region	Gear	Disposition							Number of fish
		All Dead	Majority Dead	All Alive	Majority Alive	Kept	Unable to Determine	Unreported	
South Atlantic	Gillnet	71%	24%	0%	0%	5%	0%	0%	398
	Handline/Electric	3%	3%	21%	4%	47%	23%	0%	577
	Trolling	1%	0%	33%	8%	58%	0%	0%	722
Gulf of Mexico	Gillnet	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
	Handline/Electric	12%	4%	3%	31%	41%	0%	9%	625
	Trolling	1%	0%	19%	21%	59%	0%	0%	126

Table 14. Self-reported discard mortality/disposition of cobia caught on commercial fishing vessels with federal fishing permits, 2002-2010. No cobia discards were reported from gillnet vessels in the Gulf of Mexico.

Region	Gear	Disposition							Number of fish
		All Dead	Majority Dead	All Alive	Majority Alive	Kept	Unable to Determine	Unreported	
South Atlantic	Gillnet	3%	23%	43%	28%	3%	0%	3%	87
	Handline/Electric	5%	2%	88%	6%	0%	0%	5%	65
	Trolling	0%	0%	93%	0%	7%	0%	0%	27
Gulf of Mexico	Gillnet	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0
	Handline/Electric	0%	1%	86%	4%	9%	0%	0%	774
	Trolling	1%	0%	66%	5%	29%	0%	1%	132

Figure 1. Coastal logbook statistical areas.

