

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

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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). As part of the data provided for the Southeast Data Assessment and Review (SEDAR) Data Workshop for south Atlantic Spanish mackerel and vermilion snapper, discard data from the SEFSC coastal fisheries logbook program were used to calculate the number of Spanish mackerel and vermilion snapper that were discarded during the period January 1, 2002 through December 31, 2007.

Data collection for the discard logbook program involves, each year, a 20% random sample of the vessels with South Atlantic snapper-grouper, Gulf of Mexico reef-fish, dolphin-wahoo, or 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, the universe of permitted vessels was stratified by region and gear fished. A random sample was selected, without replacement, from each stratum. Region was defined as the Gulf of Mexico (Gulf-side of the Florida Keys-Dry Tortugas to the Texas-Mexican border) and the South Atlantic (which extends from the North Carolina - Virginia border to the ocean-side of the Florida Keys- Dry Tortugas). Fishing gear strata included handline, electric reel (bandit rig), trolling, longline, trap, gillnet, diving, and other. The selected fishers were instructed to complete a supplemental discard form for every fishing trip that they made. Trips with no discards were reported as such.

Reported data included the numbers of discards by species, estimated condition of the fish when released, reason for release (due to regulations or unmarketable/unwanted), and the fishing area where the animal was discarded. There are six 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, and the condition of the animals is unknown. No reliable data are available for size or weight of discarded animals. 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

The objective of this analysis was to calculate the numbers of Spanish mackerel and vermilion snapper discarded by vessels that fish commercially for species other than shrimp or other shellfish. Fishing activity for these analyses did not include the surface longline vessels that typically fish for swordfish, pelagic sharks, tunas, and other highly migratory species. Spanish mackerel discards were calculated for areas north of 25°N to 37°N (approximately the Dade/Monroe county Florida border to the North Carolina/Virginia border). 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 calculated for areas north of North Carolina reliably. Vermilion snapper discards were calculated for areas south and east of the Florida Keys (including the Dry Tortugas) to 37°N.

The number of trips that reported discards of Spanish mackerel was very low, severely limiting any analysis. Only handline, trolling, and gillnet vessels reported Spanish mackerel discards on more than 10 trips over the period 2002-2007 (Table 1a). The number of reports was not consistent over all years and few discards were reported (Table 1b). Similar to the discard reports, the highest number of Spanish mackerel trips and landings were reported for gillnet, handline, trolling, and “other gear” trips (Tables 1c, 1d). The “other” category would include trips fishing cast nets, however only two trips classified as “other” gear reported Spanish mackerel discards. With such limited discard data available, Spanish mackerel discard rates were calculated as the nominal discard rate among all trips (by gear) that reported to the discard logbook program over the period 2002-2007. Rates were separately calculated for handline, trolling, and gillnet gears. Those discard rates were then applied to the yearly gear specific total fishing effort (handline or trolling: total hook-hours fished; gillnets: square yard hours fished) reported to the coastal logbook program for each of the three gears.

Discards of vermilion snapper were reported consistently and relatively frequently over the period 2002-2007 only for handline trips. Vermilion snapper discards were reported from fewer than five trips for any other single gear (Table 1a). The number of reported discards by year and gear are provided in Table 1b. Handline trips also accounted for the greatest number of trips reporting vermilion snapper landings in the south Atlantic (Table 1c) and the highest landings of that species (Table 1d). Discards were calculated only for handline trips. The number of trips, amount of landings, and number of discards reported from all south Atlantic handline vessels for the years 2002-2007 are provided in Table 2 along with the number of trips, pounds landed, and number of fish discarded from handline vessels reporting vermilion snapper landings or discards.

The available vermilion snapper data allowed for the examination of eight factors for their possible influence on vermilion snapper discard rates. These included:

Factor	Levels	Value
Year	6	2002-2007
Region	5	1=24° to <30° N latitude, 2=30° to <32° N latitude, 3=32° to <33° N latitude, 4=33° to <34° N latitude, 5=34° to <37° N latitude
Days at sea	8	1, 2, 3, 4, 5, 6, 7, 8-10
Crew	4	1- 2, 3, or 4-6 crew members
Vessel length	5	31 feet or less, 31-36, 36-42, >42, unknown
Number of lines fished	4	1-2, 3, 4-7
Number of hooks/line	2	1-2, 3-10
Hours fished	7	10 or fewer hours, 10-20, 20-30, 30-40, 40-60, 60-80, >80

Generalized linear model (GLM) analyses were used to determine any significant effect the above factors may have had and on the discard rates of handline trips reporting discards of vermilion snapper. Parameterization of each model was accomplished using a GLM procedure (GENMOD; Version 8.02 of the SAS System for Windows © 2000. SAS Institute Inc., Cary, NC, USA). A type3 model assuming lognormal error distribution was employed. The linking function selected was “normal”, and the response variable was $\ln(\text{CPUE})$. No analysis of the effect the above factors may have had on the proportion of trips reporting discards was attempted because the proportion of trips with vermilion snapper discards was so low that assumptions of the test were violated.

Significant effects on vermilion snapper discard rate was found for all factors examined. Such extensive stratification of the limited available data, however, resulted in a data matrix that was sparsely populated. The matrix was simplified to include only year and region, the two factors that explained most of the

variation in the data. Discard rate was calculated over all handline trips reporting to the discard logbook program within each year-region combination. Those rates were then applied to the total handline effort (total hook-hours fished) reported to the coastal logbook program for each year-region stratum. For years prior to 2002 (the first full year of discard reporting), total discards were calculated by applying the mean discard rate over all years for each region to the total handline effort from each region and year. For example, the mean discard rate in region 1 for all years 2002-2007 was applied to the total handline effort in region 1 for each year prior to 2002. This calculation was made for the years 1992 (the first full year of logbook reports from the south Atlantic) to 2001. In 1992 only 20% of vessels in Florida were selected to report to the coastal logbook program, therefore the number of calculated discards for region 1 in 1992 was increased by a factor of five.

Results and Discussion

Calculated total discards for each year are provided in Table 3a-3c for Spanish mackerel discarded from handline, gillnet, and trolling vessels, respectively. Prior to 1998, vessels landing Spanish mackerel were not required to report to the coastal logbook program and the level of reporting and, therefore, effort was unknown. Discards of Spanish mackerel could not be reliably calculated for the years prior to 1998.

Relatively few Spanish mackerel were reported as discarded. For handline and trolling gear, fewer than 2,300 fish were discarded each year. Less than 14,000 Spanish mackerel were discarded annually from the gillnet fishery. Often the number of discards of the species was less than 10,000. The number of trips upon which the calculations were based, however, was very small. These results should be interpreted with caution.

Calculated total discards for each region are provided in Table 4a for vermilion snapper discarded from handline vessels. The calculated discards from each region were summed by year to provide yearly total vermilion snapper handline vessel discards (Table 4b). Discards of vermilion snapper often exceeded 100,000 fish, although in recent years the number of discards has decreased to approximately 50,000 fish. There appears to be a trend among fishers in the south Atlantic to report “no discards” more frequently in recent years than during the first few years of the discard logbook program. The degree of impact of such reporting, resulting in more “no discard” trips, is unknown.

A high percentage of Spanish mackerel were reported as “dead” or “kept” when released regardless of the gear used (Table 5). More than 85% of vermilion snapper released in regions 1-4 were reported as “alive” or “majority alive”. Discards in region 5, however, were frequently reported (70%) as majority dead. The reason reported for discarding Spanish mackerel was most often given as “market conditions” for gillnet trips (95% of individuals) and trolling trips (73%). Regulations were cited in 47% of handline Spanish mackerel discards with another 39% discarded without a reason reported. The reason reported for almost all (98-99%) vermilion snapper discards was regulations.

The number of trips reporting either Spanish mackerel or vermilion snapper in the US south Atlantic was very low and the number of individuals of those species reported as discarded was also low. Stratification of the available data was limited because of the small sample sizes and, therefore, likely does not capture much of the variation in numbers of discards within the Spanish mackerel and vermilion snapper fisheries. How that may affect the number of calculated discards (over or under estimate) is unknown. This is particularly true for Spanish mackerel.

Literature Cited

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

Table 1a. Number of south Atlantic trips reporting discards by year and gear fished. SM=Spanish mackerel (Dade county Florida to North Carolina); VS=vermillion snapper (Florida Keys to North Carolina); other=all other species (Florida Keys to North Carolina).

Year	Diving			Gillnet			Handline			Longline			Other Gear			Trap			Trolling		
	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other
2002			10	21		182	1	206	2,033		4	23			51		4	95			248
2003			25			163		117	2,088			3	1		51			154	3		334
2004			28	6		151	1	63	1,474			6	1		26			48	7		320
2005	1		6	1		165	7	107	2,115			38			21			25	5		172
2006			1			108	3	123	1,270			42			1			28	1		159
2007			9	1		52		183	2,476			22			1		1	89		2	388
Total	1		79	29		821	12	799	11,456		4	134	2		100		5	439	16	2	1,621

Table 1b. Number of south Atlantic discards reported by year and gear fished. . SM=Spanish mackerel (Dade county Florida to North Carolina); VS=vermillion snapper (Florida Keys to North Carolina); other=all other species (Florida Keys to North Carolina).

Year	Diving			Gillnet			Handline			Longline			Other Gear			Trap			Trolling		
	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other
2002			52	190		4,274	3	16,759	44,753		20	94					137	30,177			1,137
2003			190			9,886		7,768	27,327			10	25		160			24,285	36		1,309
2004			152	48		4,425	25	3,920	20,517			30	10		77			2,283	223		964
2005	5		18	4		12,083	56	10,830	27,515			1,549			123			1,307	41		751
2006			1			5,305	20	7,173	22,399			919			1			1,583	10		905
2007			13	1		1,787		10,808	49,411			204			6		10	3,618		11	1,774
Total	5		426	243		37,760	104	57,258	191,922		20	2,806	35		367		147	63,253	310	11	6,840

Table 1c. South Atlantic trips reported to the coastal logbook program. . SM=Spanish mackerel (Dade county Florida to North Carolina); VS=vermilion snapper (Florida Keys to North Carolina); other=all other species (Florida Keys to North Carolina).

Year	Diving			Gillnet			Handline			Longline			Other Gear			Trap			Trolling		
	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other
2002		9	3,125	1,482	1	3,429	828	2,840	54,255	1		2,517	426		512	2	49	2,231	951	8	14,209
2003	1	6	2,718	1,169		3,519	715	2,145	50,562	1	1	2,323	614		770	1	10	1,934	723	16	13,998
2004	1	2	2,450	1,062		3,360	889	2,099	47,740		1	1,713	630		622		17	2,014	426	28	11,118
2005	2	3	2,226	1,321		4,283	862	2,127	43,594	1		1,529	659		766		24	1,398	627	16	9,922
2006	1	5	2,095	1,571		4,939	1,255	2,043	43,623			1,762	658		659		49	2,278	644	9	10,466
2007		14	2,669	1,652		5,509	1,589	2,450	46,593			976	610		788		37	1,654	877	22	12,451
Total	5	39	15,283	8,257	1	25,039	6,138	13,704	286,367	3	2	10,820	3,597		4,117	3	186	11,509	4,248	99	72,164

Table 1d. South Atlantic landings (pounds) reported to the coastal logbook program. . SM=Spanish mackerel (Dade county Florida to North Carolina); VS=vermilion snapper (Florida Keys to North Carolina); other=all other species (Florida Keys to North Carolina).

Year	Diving			Gillnet			Handline			Longline		
	sm	vs	other	sm	vs	other	sm	vs	other	sm	vs	other
2002		161	346,467	929,225	2	1,413,303	231,230	1,305,055	5,412,990	35		2,359,378
2003	70	48	319,336	740,792		1,441,463	222,342	766,783	5,744,425	12	3	2,144,413
2004	9	54	273,630	550,141		1,367,013	346,884	1,070,172	5,606,864		12	1,722,146
2005	6	144	249,200	793,271		1,526,140	400,935	1,150,967	5,285,999	17		1,539,178
2006	130	129	246,023	1,107,219		1,532,076	570,577	863,243	5,634,976			2,023,084
2007		134	308,881	1,227,634		1,292,760	651,350	1,093,684	5,692,554			940,558
Total	215	671	1,743,536	5,348,282	2	8,572,755	2,423,318	6,249,904	33,377,808	64	16	10,728,758

Table 1d. continued

Year	Other Gear			Trap			Trolling		
	sm	vs	other	sm	vs	other	sm	vs	other
2002	461,634		63,364	1,592	1,689	507,204	87,468	231	2,002,584
2003	774,476		74,704	409	498	567,848	55,132	1,937	2,325,247
2004	725,511		75,754		199	668,845	54,759	631	1,977,870
2005	671,542		69,464		734	431,506	74,843	250	1,973,802
2006	663,538		88,918		1,089	542,426	62,717	330	2,212,416
2007	519,541		126,715		1,469	389,908	94,509	1,421	2,465,903
Total	3,816,242		498,919	2,001	5,677	3,107,737	429,428	4,799	12,957,822

Table 2. South Atlantic handline trips and landings from vermilion snapper regions reported to the coastal logbook program. Discards are reported in number of fish.

Region	All Handline Trips				Handline Trips with Vermilion snapper			
	Logbook		Discards		Logbook		Discards	
	Trips	Pounds	Trips	N fish	Trips	Pounds	Trips	N fish
1	162,116	20,911,383	6,849	69,822	1,805	231,173	68	5,859
2	22,727	4,405,639	1,148	57,631	2,003	1,881,053	245	25,278
3	27,354	4,629,969	927	44,945	2,340	1,423,827	134	9,721
4	53,566	7,237,172	1,647	43,961	4,565	1,783,838	234	11,636
5	42,154	5,031,537	1,722	33,020	2,991	930,013	118	4,764

Table 3a. Calculated yearly total discards of Spanish mackerel by handline vessels. Discards are reported in number of fish.

Year	Mean Discards per Hook Hour	Discard Standard Deviation	Total Effort (Hook Hours)	Calculated Discards
1998	0.001781	0.048638	1,181,706	2,105
1999	0.001781	0.048638	975,510	1,737
2000	0.001781	0.048638	1,028,259	1,831
2001	0.001781	0.048638	1,081,936	1,927
2002	0.001781	0.048638	1,256,812	2,238
2003	0.001781	0.048638	1,111,641	1,980
2004	0.001781	0.048638	769,984	1,371
2005	0.001781	0.048638	720,595	1,283
2006	0.001781	0.048638	828,102	1,475
2007	0.001781	0.048638	878,993	1,565

Table 3b. Calculated yearly total discards of Spanish mackerel by gillnet vessels. Discards are reported in number of fish.

Year	Mean Discards per Square Yard Hour Fished	Discard Standard Deviation	Total Effort (net hours)	Calculated Discards
1998	0.000128	0.001248	68,319,392	8,755
1999	0.000128	0.001248	108,069,010	13,849
2000	0.000128	0.001248	78,265,803	10,030
2001	0.000128	0.001248	83,909,664	10,753
2002	0.000128	0.001248	94,771,378	12,145
2003	0.000128	0.001248	66,592,702	8,534
2004	0.000128	0.001248	51,634,828	6,617
2005	0.000128	0.001248	65,057,690	8,337
2006	0.000128	0.001248	55,474,032	7,109
2007	0.000128	0.001248	49,149,096	6,299

Table 3c. Calculated yearly total discards of Spanish mackerel by trolling vessels. Discards are reported in number of fish.

Year	Mean Discards per Hook Hour	Discard Standard Deviation	Total Effort (hook hours)	Calculated Discards
1998	0.003616	0.121036	519,180	1,877
1999	0.003616	0.121036	468,966	1,696
2000	0.003616	0.121036	561,299	2,029
2001	0.003616	0.121036	515,084	1,862
2002	0.003616	0.121036	326,773	1,181
2003	0.003616	0.121036	302,063	1,092
2004	0.003616	0.121036	238,797	863
2005	0.003616	0.121036	215,995	781
2006	0.003616	0.121036	231,498	837
2007	0.003616	0.121036	276,630	1,000

Table 4a. Calculated yearly total discards of vermilion snapper by handline vessels for each region.
Discards reported as number of fish.

Year	Region	Mean Discards per Hook Hour	Discard Standard Deviation	Total Effort (hook hours)	Calculated Discards
1992	1	0.0099	0.205123	447,395	4,425
1992	2	0.1630	0.689881	183,511	29,823
1992	3	0.2598	1.258511	93,486	24,284
1992	4	0.1253	0.310364	113,237	14,188
1992	5	0.0211	0.135165	109,333	2,304
1993	1	0.0099	0.205123	337,454	3,338
1993	2	0.1630	0.689881	169,754	27,587
1993	3	0.2598	1.258511	121,133	31,466
1993	4	0.1253	0.310364	147,225	18,447
1993	5	0.0211	0.135165	162,927	3,433
1994	1	0.0099	0.205123	389,151	3,849
1994	2	0.1630	0.689881	174,458	28,352
1994	3	0.2598	1.258511	138,551	35,991
1994	4	0.1253	0.310364	266,447	33,385
1994	5	0.0211	0.135165	191,221	4,030
1995	1	0.0099	0.205123	406,034	4,016
1995	2	0.1630	0.689881	233,212	37,900
1995	3	0.2598	1.258511	186,635	48,481
1995	4	0.1253	0.310364	268,843	33,685
1995	5	0.0211	0.135165	160,143	3,375
1996	1	0.0099	0.205123	480,133	4,749
1996	2	0.1630	0.689881	372,656	60,562
1996	3	0.2598	1.258511	229,976	59,739
1996	4	0.1253	0.310364	273,249	34,237
1996	5	0.0211	0.135165	240,039	5,058
1997	1	0.0099	0.205123	587,467	5,811
1997	2	0.1630	0.689881	312,503	50,786
1997	3	0.2598	1.258511	226,309	58,787
1997	4	0.1253	0.310364	250,170	31,345
1997	5	0.0211	0.135165	283,171	5,967
1998	1	0.0099	0.205123	479,798	4,746
1998	2	0.1630	0.689881	205,720	33,432
1998	3	0.2598	1.258511	181,943	47,262
1998	4	0.1253	0.310364	237,114	29,710
1998	5	0.0211	0.135165	220,782	4,653
1999	1	0.0099	0.205123	439,902	4,351
1999	2	0.1630	0.689881	189,941	30,868
1999	3	0.2598	1.258511	127,627	33,153
1999	4	0.1253	0.310364	222,116	27,830
1999	5	0.0211	0.135165	183,859	3,875
2000	1	0.0099	0.205123	441,322	4,365
2000	2	0.1630	0.689881	172,388	28,015
2000	3	0.2598	1.258511	151,152	39,264
2000	4	0.1253	0.310364	238,339	29,863
2000	5	0.0211	0.135165	155,399	3,275
2001	1	0.0099	0.205123	396,647	3,923
2001	2	0.1630	0.689881	212,817	34,586
2001	3	0.2598	1.258511	212,180	55,117
2001	4	0.1253	0.310364	219,504	27,503
2001	5	0.0211	0.135165	179,301	3,779

Table 4a. continued

Year	Region	Mean Discards	Discard Standard Deviation	Total Effort	Calculated Discards
2002	1	0.0152	0.218219	368,998	5,614
2002	2	0.0570	0.135477	225,020	12,825
2002	3	0.7634	2.234252	172,809	131,925
2002	4	0.3748	0.517807	213,110	79,880
2002	5	0.0347	0.145816	195,226	6,776
2003	1	0.0251	0.307799	360,207	9,044
2003	2	0.1061	0.137366	162,564	17,251
2003	3	0.1069	0.216987	157,374	16,816
2003	4	0.2884	0.467777	186,228	53,702
2003	5	0.0096	0.037239	153,459	1,471
2004	1	0.0009	0.015466	328,649	304
2004	2	0.1083	0.138965	135,594	14,685
2004	3	0.0500	0.166465	106,106	5,303
2004	4	0.1211	0.299846	243,375	29,467
2004	5	0.0000	0.000374	86,064	3
2005	1	0.0198	0.353024	269,288	5,363
2005	2	0.3444	0.739299	153,234	52,768
2005	3	0.0367	0.102502	121,260	4,454
2005	4	0.0606	0.190893	199,843	12,104
2005	5	0.0027	0.020229	95,240	256
2006	1	0.0005	0.009058	274,279	133
2006	2	0.1703	0.142243	116,329	19,423
2006	3	0.0666	0.108422	209,335	13,950
2006	4	0.0584	0.119395	226,496	13,225
2006	5	0.0040	0.036977	115,109	462
2007	1	0.0013	0.02548	264,188	353
2007	2	0.2041	1.188722	166,472	33,982
2007	3	0.0211	0.055875	217,611	4,595
2007	4	0.0273	0.096458	193,386	5,279
2007	5	0.0605	0.271843	124,971	7,565

Table 4b. Calculated yearly south Atlantic handline vessel vermilion snapper discards. Discards are reported in number of fish.

Year	Calculated Discards
1992	75,024
1993	84,271
1994	105,607
1995	127,457
1996	164,345
1997	152,696
1998	119,803
1999	100,077
2000	104,782
2001	124,908
2002	237,020
2003	98,284
2004	49,762
2005	74,945
2006	47,193
2007	51,774

Table 5. Estimated condition at release of Spanish mackerel and vermilion snapper discards. Numbers of fish and percent of total (in parentheses) are reported by gear and region (vermilion snapper).

Species	Region	All Dead	Majority Dead	All Alive	Majority Alive	Kept	Unknown	Unreported
Spanish mackerel (handline)				32 (16.08)	8 (4.02)	159 (79.90)		
Spanish mackerel (trolling)				6 (1.97)		299 (98.03)		
Spanish mackerel (gillnet)		224 (92.18)				19 (7.82)		
Vermilion snapper (handline)	1	7 (0.12)		452 (7.71)	5,390 (92.00)	10 (0.17)		
	2	136 (0.54)	1,185 (4.69)	5,910 (23.38)	15,717 (62.18)	2,330 (9.22)		
	3	220 (2.26)	266 (2.74)	1,554 (15.99)	6,933 (71.32)	311 (3.20)		437 (4.50)
	4	85 (0.73)	243 (2.09)	5,579 (47.95)	5,323 (45.75)	406 (3.49)		
	5	1 (0.02)	3,313 (69.54)	977 (20.51)	466 (9.78)	6 (0.13)	1 (0.02)	