

## Estimates of Sea Turtle Discards in the South Atlantic Commercial Snapper-Grouper Fishery

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### Introduction

On February 11, 2016, NOAA Fisheries' Sustainable Fisheries Division officially reinitiated formal Endangered Species Act Section 7 consultation on the continued authorization of the South Atlantic Fishery Management Council's Snapper-Grouper Fishery Management Plan. In response to this Section 7 consultation request, NOAA Fisheries Protected Resources Division will provide, among other items, an updated analysis of sea turtle discards in the South Atlantic commercial snapper-grouper fishery.

### Methods

Computed discards per unit effort by species, year, and gear from the Southeast Fisheries Science Center (SEFSC)'s Supplemental Discard Logbook Program (accessed April 2016). The Supplemental Discard Logbook Program began in 2001 and has provided approximately 20% random sampling coverage of the South Atlantic Snapper-Grouper fishery since 2002. Discards reported by spearfishers were omitted, as these were assumed to be sightings rather than attempts to spear sea turtles. Discard per unit effort estimates were expanded by the total effort in the Snapper-Grouper fishery, based on information from the SEFSC's Coastal Fisheries Logbook Program (April 2016). Uncertainty was expressed as 95% confidence intervals. Snapper-Grouper trips were defined as any commercial trip landing at least one pound of a species in the [Snapper-Grouper Fishery Management Unit](#). Effort was defined as hook-hours for hook-and-line gears (includes handline and electric/bandit rig), yard-hours for gillnet, number of traps for trap gear, total hooks fished on a trip for bouy gear and longline gear, and number of divers for spear and powerhead gear. Maps of mean annual effort (2012-2015) were prepared for commercial hook-and-line and longline gear by joining mean effort by depth and area reported to the commercial logbook to a bathymetric layer from the [NOAA Coastal Relief Model](#) parsed into 5 m depth bins and NOAA statistical reporting grids.

### Results

The majority of Snapper-Grouper target effort in recent years has used hook-and-line and longline gears (**Table 1**). Between 2012-2015, a mean of 17% (range 17-19%) of hook-and-line effort and 22% (range 12-30%) of longline effort was covered by discard logbook sampling. Hook-and-line effort was high along the shelf-edge between Northeast Florida and southern North Carolina (**Figure 1**); longline effort was primarily focused off Key West and the Dry Tortugas (**Figure 2**).

There were a total of 13 sea turtle encounters reported to the Supplemental Discard Logbook Program on Snapper-Grouper trips (**Table 2**). Three were loggerhead sea turtles (*Caretta caretta*). There were also 10 reported discards of unclassified turtles (i.e., sub-class *Anapsida*). Because the unclassified turtles were reported on trips that caught oceanic Snapper-Grouper species, these were assumed to be sea turtles. Because the leatherback sea turtle (*Dermochelys coriacea*) is easily identifiable, the unclassified Anapsids were further assumed to be hardshell sea turtles. A total of 13 hardshell sea turtle discards have been reported on Snapper-Grouper catch trips since the inception of the Supplemental Discard Logbook Program, with the most discards (4) reported in 2012. The majority of sea turtle

discards are reported as released alive (**Table 3**). Most discards were reported off North Carolina in November-December and in the Florida Keys in April.

Hardshell sea turtle discard estimates were exclusive to hook-and-line gear; no discards were reported for other gears. A loggerhead sea turtle was caught using longline targeting Dolphin-Wahoo; this trip also had an electric rig component targeting Snapper-Grouper. This longline capture was not counted towards the total or discard rate because the gear was targeting Dolphin-Wahoo. There were no reported encounters with green sea turtle (*Chelonia mydas*), Kemp's Ridley sea turtles (*Lepidochelys kempii*) or hawksbill sea turtles (*Eretmochelys imbricata*), and there is no field in the Supplemental Discard Logbook for reporting Olive Ridley sea turtles (*Lepidochelys olivacea*).

**Figure 3** shows expanded commercial discard estimates for hardshell sea turtles by year. The broad 95% confidence limits and many years with zero estimates indicate hardshell sea turtle discards may be a rare event. The empirical estimates are relatively high (~100 discards) during years with reported interactions (**Table 4**); it is reasonable to assume that there are unreported interactions during years with zero estimates, either because fishermen with turtle discards were not selected for the Supplemental Discard Logbook Program or chose not to report sea turtle discards on their form. Encounters of sea turtles by the Snapper-Grouper fishery appear to be a rare event. The highest discard estimates were for unclassified sea turtles. Encountered turtles identified to species were all loggerhead sea turtles. The 95% lower confidence limits typically cross zero, indicating high uncertainty and a rare event.

## Discussion

Substantial uncertainty exists in expansion of sea turtle discard rates from self-reported data from the commercial supplemental discard logbook program. Several disincentives to reporting exist, including the time required to complete the logbook form and the fear of burdensome regulations as a result of accurate reporting of sea turtle take. Additionally, the approach utilized does not account for seasonal or spatial differences in the distribution of fishing effort or sea turtle populations. Over the time series, turtle discards were not reported in January, February, May, August, September, and October. The discards in 2012 were from a single trip, highlighting the rarity of sea turtle discards and also the tendency for discards to cluster. The method applied does not account for spatial or temporal autocorrelation in discard rates. Finally, the method applied does not compensate for the abundance of zeroes in the data. A spatially-explicit, zero-inflated regression modeling approach would provide more robust estimates of sea turtle take, especially if the spatiotemporal distribution of vulnerable sea turtle age classes could be incorporated as a covariate.

Due to the substantial interannual variability in reported discards, a multi-year averaging approach is suggested to better capture uncertainty in the data when determining interaction risk. No discard estimates were generated for leatherback sea turtles. Mean hook-and-line effort 2012-2015 was 622,898 hook-hours. Applying the average hardshell discard rate 2012-2015 ( $4.86\text{E-}05$  turtles/hook-hour) results in a projection of 30 discards/year (95% CI: -29 to 89 turtle discards/year).

**Table 1.** Reported effort on South Atlantic Snapper-Grouper trips from the Southeast Fisheries Science Center Coastal Logbook Program and percent effort covered by Supplemental Discard Logbook Program reports, by year and gear (H: hook-and-line, L: longline, T: trap, TR: trolling). See text for effort definitions.

YEAR	LOGBOOK REPORTED TOTAL EFFORT				%COVERAGE IN DISCARD LOGBOOK			
	H	L	T	TR	H	L	T	TR
2001	927,262	2,232,310	43,532	33,413	5%	7%	9%	3%
2002	1,018,242	2,275,832	37,851	23,346	10%	8%	9%	9%
2003	868,646	2,340,932	31,042	23,463	10%	n/a	11%	9%
2004	753,687	1,715,557	30,923	19,633	11%	2%	4%	11%
2005	687,291	951,481	23,714	13,911	14%	11%	3%	8%
2006	733,301	1,448,225	30,747	11,328	12%	6%	1%	8%
2007	818,288	472,885	24,352	20,548	21%	16%	10%	25%
2008	811,519	611,585	17,764	14,041	58%	49%	44%	36%
2009	846,351	819,743	26,134	18,865	22%	13%	28%	22%
2010	702,162	1,127,522	14,453	11,802	57%	42%	65%	62%
2011	662,386	590,282	6,250	10,296	57%	49%	44%	61%
2012	603,033	1,069,610	8,372	9,021	52%	25%	53%	54%
2013	621,700	1,056,370	9,430	5,365	57%	44%	50%	52%
2014	654,387	1,117,990	7,544	9,232	53%	64%	67%	57%
2015	612,473	851,262	4,265	10,726	51%	43%	68%	38%

**Table 2.** Reported sea turtle discards on South Atlantic Snapper-Grouper trips from the Southeast Fisheries Science Center Supplemental Discard Logbook Program, by species and year.

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Grand Total
anapsida unclassified	0	3	0	0	1	0	0	2	0	0	0	4	0	0	0	10
loggerhead sea turtle	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3
leatherback sea turtle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
hardshell sea turtle	1	4	1	0	1	0	0	2	0	0	0	1	0	0	0	13

Source: SEFSC Supplemental Discard Logbook Program (April 2016) filtered for trips landing at least one pound of Snapper-Grouper FMU species.

**Table 3.** Year, month, area, and disposition of reported sea turtle discards on South Atlantic Snapper-Grouper trips from the Southeast Fisheries Science Center Supplemental Discard Logbook Program.

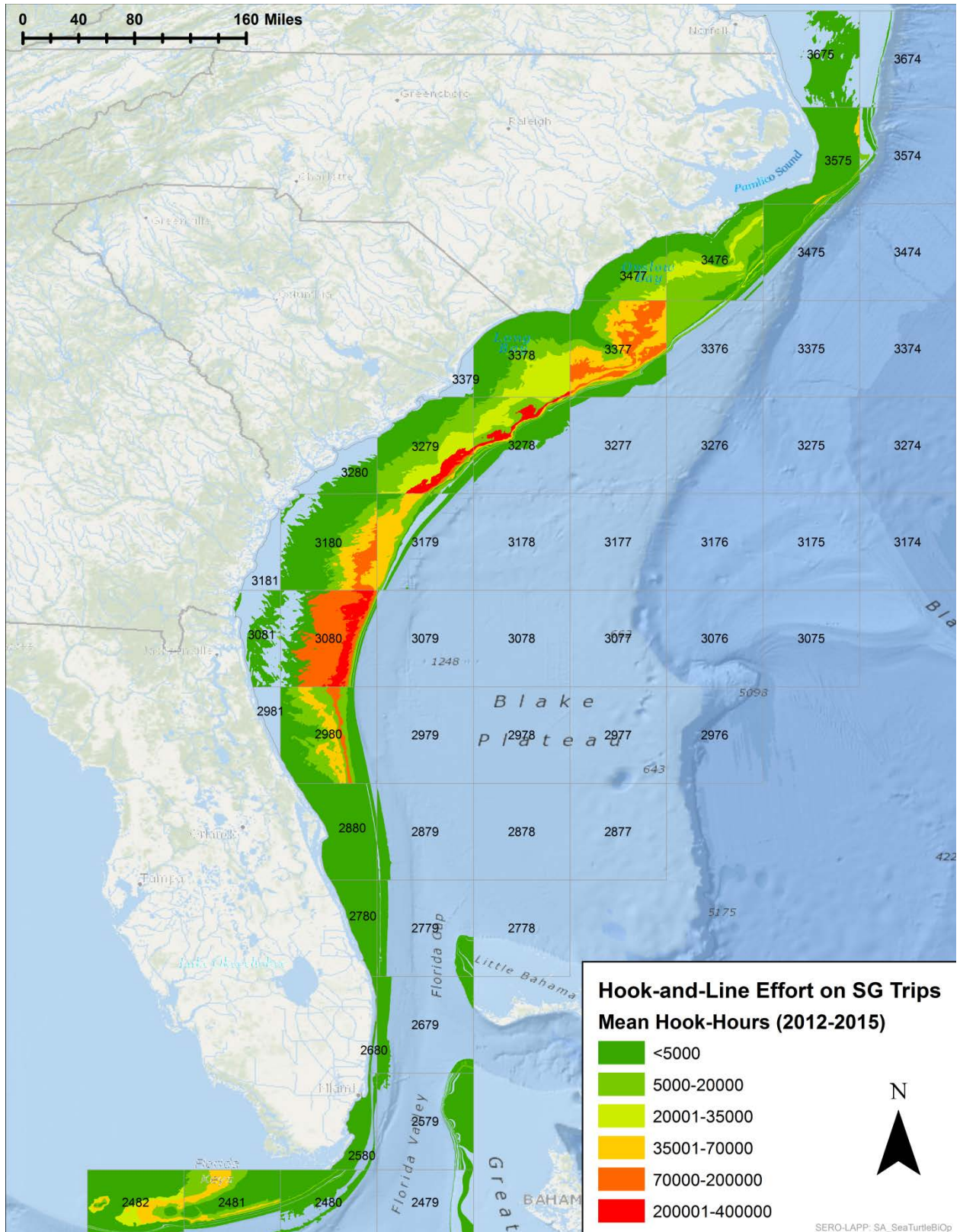
Year	Month	Species Caught	Area	Number Discarded	Disposition
2001	11	loggerhead sea turtle	3377	1	
2002	4	anapsida unclassified	2482	1	Alive
2002	11	loggerhead sea turtle	3474	1	
2002	11	anapsida unclassified	3476	1	Alive
2002	12	anapsida unclassified	3476	1	
2003	2	loggerhead sea turtle	2780	1	Alive
2005	6	anapsida unclassified	3476	1	
2008	3	anapsida unclassified	3378	1	Alive
2008	7	anapsida unclassified	3279	1	
2012	4	anapsida unclassified	2481	4	Some Dead

Source: SEFSC Supplemental Discard Logbook Program (April 2016) filtered for trips landing at least one pound of Snapper-Grouper FMU species.

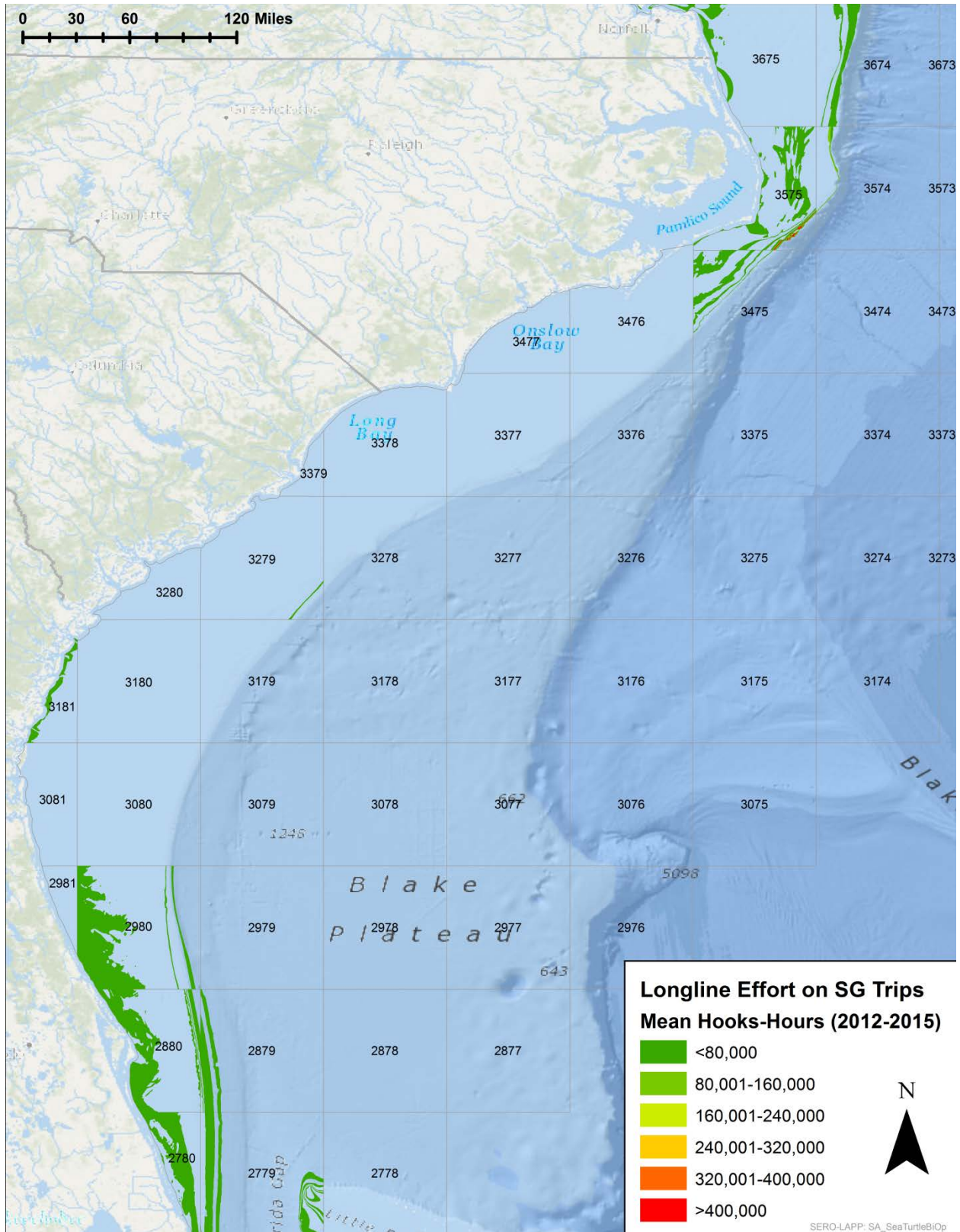
**Table 4.** Estimated discards of hardshell sea turtles, in numbers, by hook-and-line gear, with 95% confidence limits.

Year	Discards	95% LCL	95% UCL
2001	3	-3	10
2002	186	-23	395
2003	33	-32	98
2004	0	0	0
2005	4	-4	11
2006	0	0	0
2007	0	0	0
2008	3	-1	7
2009	0	0	0
2010	0	0	0
2011	0	0	0
2012	117	-112	346
2013	0	0	0
2014	0	0	0
2015	0	0	0

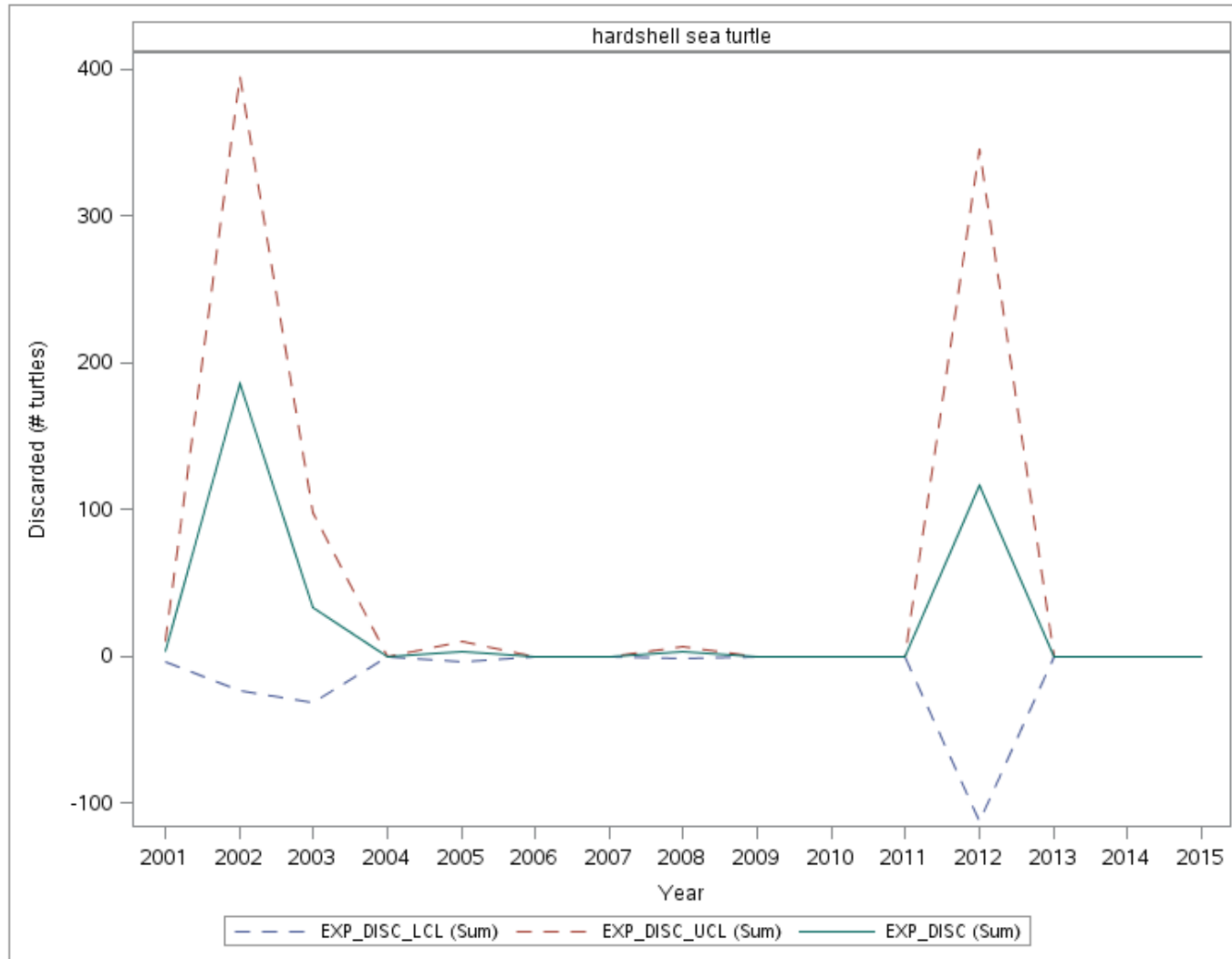
Source: Discard rates from SEFSC Supplemental Discard Logbook Program (April 2016) expanded to fishery effort from SEFSC Commercial Logbook Program (April 2016), filtered for trips landing at least one pound of Snapper-Grouper FMU species.



**Figure 1.** Mean annual commercial hook-and-line effort (2012-2015) on South Atlantic Snapper-Grouper trips. Effort expressed as hook-hours.



**Figure 2.** Mean annual commercial longline effort (2012-2015) on South Atlantic Snapper-Grouper trips. Effort expressed as number of hooks per trip.



**Figure 3.** Estimated expanded commercial discards of hardshell sea turtles on Snapper Grouper trips 2001-2015. Dashed lines denote upper and lower 95% confidence limits.