

Estimated Takes of Sea Turtles in the Bottom Longline Portion of the Gulf of Mexico  
Reef Fish Fishery July 2006 through 2007 Based on Observer Data.

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## Background

This report estimates total captures of protected species in a portion of the U.S. Gulf of Mexico (GOM) reef fish fishery for the second half of 2006 through the end of 2007. Fishers engaged in the GOM reef fish fishery use bottom longline, vertical line, and fish traps to target a variety of species, including some snappers, groupers, tilefish, jacks, and other assorted species<sup>1</sup>. The SEFSC started placing observers on GOM reef fish fishery vessels in the second half of 2006, and continued to sample the fishery through 2007. Two SEFSC observer programs, the Galveston laboratories reef fish observer program (RFOP) and the Panama City laboratories shark bottom longline observer program (SBLOP) each independently designed and implemented sampling regimes for different, but overlapping portions of the GOM reef fish fishery. For the purposes of this report, takes of protected species (hereafter “takes”) refers to protected species that were incidentally captured during fishing operations. Between them, these programs observed a total of 18 sea turtle captures (Table 1) in their samples of bottom longline gear and observed no other protected species in their samples of bottom longline or vertical line gear, therefore, this report was restricted to extrapolated takes of sea turtles in the bottom longline portion of the GOM reef fish fishery. This report estimates sea turtle takes based on catch per hook derived from samples of commercial vessels using bottom longline gear, extrapolated to reported hook effort. Reported effort was collected by the Fishery Logbook System database (FLS), coastal logbook at the Southeast Fisheries Science Center (SEFSC).

Estimation of the total fishery effort for extrapolation from the observed takes to total estimated takes was constrained by the information consistently and reliably reported in common between the FLS coastal logbook data and the two sources of observation data, the SBLOP and the RFOP. For this analysis we used two measures of effort, set and number of hooks in a set. The use of sets and hooks as effort variables was due in part to the use of these effort parameters and analysis types in similar fisheries, the commercial directed shark bottom longline (Richards 2006, SEFSC 2007) and the pelagic longline (e.g. Johnson et al. 1999, Walsh and Garrison 2005). The use of these effort variables was also constrained by what was considered to be reliably reported to the FLS coastal logbook. Other effort variables such as soak time, or other gear characteristics are not considered reliable, in part because of temporal changes in reporting requests (e.g. time fished per set vs. per trip<sup>1</sup>), or because some characteristics are set based rather than trip based (e.g. depth fished per set in observer data vs. average depth fished per trip in reported effort).

All stratified analyses approximately followed the observer program designs. For the purposes of this report, season 1 was defined as Jan 1 thru June 31, and season 2 as July 1 thru December 31, and GOM was spatially divided into east and west strata at 88 degrees W longitude.

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<sup>1</sup> Biological Opinion on the continued authorization of reef fish fishing under the Gulf of Mexico (GOM) Reef Fish Fishery Management Plan (RFFMP) and proposed Amendment 23.

### **Fishery Effort: FLS coastal logbook data**

Extrapolated estimates of total takes in this report were based upon self reported effort from SEFSC FLS coastal logbook program. All federally permitted commercial fishers report their activities by individual trip to the FLS coastal logbook without reference to a target fishery. To determine participation in the GOM reef fish fishery from the trip based coastal logbook program, we assumed that effort was a part of the fishery if the fishers reported using bottom longline gear and were not in possession of a directed shark permit, or if they were in possession of a directed shark permit, then if landings were greater than 2/3 by weight of species other than sharks.

The total bottom longline effort within the coastal logbook was allocated to the shark directed (“shark”), other catch (e.g. reef fish, tilefish, incidentally captured sharks, etc.), and effort of those with shark permits whose trips could not be allocated to either shark directed or “other” catch (“mixed”).

Allocation of effort to the directed portion of the fishery was based upon directed shark permits (from the Southeast Regional Offices (SERO) permit database), and expert opinion about what comprises a shark trip (that 2/3 of landings by weight were sharks) or a non-shark trip (“other”, which we assume belongs to the GOM reef fish fishery). The 2/3 by weight landings rule is subjectively based on our approximation of what comprises a directed shark trip (see SEFSC 2007). This rule was intended to balance the allocation of trip level effort to the commercial directed shark bottom longline fishery while allowing for allocation of all other shark catch (incidental shark catch) and other catch to the reef fish fishery. We also removed questionable data trips: those trips with less than 30 hooks per set and trips with sets greater than 25 miles in length (both were in the lower or upper 0.25% of the data).

Allocation to “other catch” was the sum of effort of those without directed shark permits and those with directed shark permits whose catch was greater than 2/3 by weight of species other than sharks. All other effort was unallocated, that is, those with directed shark permits, but did not either catch at least 2/3 by weight sharks or 2/3 by weight species other than sharks.

Total fishery effort that was used for extrapolation is summarized in Table 2. In our attempt to allocate all bottom longline effort within the coastal logbook to either directed shark or other catch, we found that the effort we could not allocate to either category was relatively small, between 2.2% and 2.6% (trip, set, or hook) of all bottom longline effort for 2006 and even less (0.3% to 0.5%) in 2007, (Figure 1). Nonetheless, this potentially indicates an underestimate of the total reef fish or directed shark effort (Figure 1, Appendix A).

### **Observed Effort: SBLOP and RFOP**

Sampling frames are different between the SBLOP and the RFOP, and we consider them independent random samples of their respective portions of the GOM reef fish fishery.

The SBLOP attempts to randomly sample those with directed shark permits, temporally stratified by three open shark seasons (Large Coastal Shark Complex Season dates for the GOM in 2006 were: Season 1- January 1 through April 15, Season 2 - July 6 through July 31, and Season 3- September 1 through November 7 [Hale and Carlson, 2007, Hale et. al. 2007]), and spatially divided into two strata at 88 degrees W longitude in the GOM by home port of the permit holder in statistical areas 1-10 (east), and statistical areas 11-21 (west). The RFOP attempts to randomly sample all vessels with reef fish permits proportional to effort stratified by gear type (hand, bandit, longline), season (January-March, April-June, July-September, October-December), and region (east and west GOM) based on historical (previous years) logbook landings. East and West GOM strata were divided at 86 degrees W longitude by effort in statistical areas 1-8 (east) and 9-21 (west). For the sampling of the GOM reef fish fishery, the RFOP essentially randomly samples from the total effort we allocated to both “other” and “other with directed shark permit”, while the SBLOP randomly samples from the total effort we allocated only to “other with directed shark permit” (Figure 1). The SBLOP records target species group (a few types of sharks, grouper/reef fish, and tilefish) by set; the RFOP does not record target.

There were a total of 16 observed takes of loggerhead turtles (*Caretta caretta*) and 2 observed takes of unknown hardshell sea turtles (Table 1, and Figure 2) from bottom longline gear targeting reef fish within the GOM. Approximately 24% of trips and 3.0% of sets captured turtles. There were no observations of sea turtles or other protected species within the handline/bandit reel portion of the reef fish fishery for the same time period. Observed bottom longline effort by observer program is shown in Table 3 for trips (sampling unit), sets and hooks. Percent observed of bottom longline effort varied between 0.42% and 2.15% depending upon strata, effort unit, and observer program (Table 4). The overall percent observed effort was between 1.5% and 2.1% depending upon effort type. The RFOP also observed 93 total vertical line trips (28 in season 2 of 2006, 36 in season 1 of 2007, and 29 in season 2 of 2007) but observed no takes of any protected species (total observer effort was about 1% of total fishery effort); therefore, we will not consider vertical line further in this report.

### **Take rate estimation methods**

A delta lognormal approach (Pennington 1983) was used to estimate the mean and variance of takes per hook per set per observed strata. This method combines a binomial model for the total observations by set with a lognormal model for the non-zero catch per unit effort (CPUE) data, which are assumed to be lognormally distributed. Extrapolated takes by the fishery were the multiplication of catch per hook by the total number of hooks subjectively extracted from the coastal logbook. The delta approach in this case does not really affect point estimates for most strata, as they are very similar to standard ratio estimators, due to the small number of non-zero samples, but does provide a more realistic estimate of the CV and confidence intervals. Sparse data are not likely to fit a critical assumption of the delta lognormal model (Pennington 1983) that the non-zero CPUE's are drawn from a lognormal distribution. One could argue that the sample could have been drawn from a larger population of captures within the fishery, and that this

larger population was lognormally distributed. In any case, the extrapolated estimates based upon sparse data sets should not be assumed to be reasonable without potentially invoking large assumptions regarding unobserved events. Although pooling the data across stratifications of season and region might be justified to reduce the sparseness of the data, such pooling may not be appropriate because it would ignore the non-random distribution of the sea turtles incidentally captured, and the potential differential operation of the fishery between areas or seasons.

### **Extrapolated takes**

Extrapolated estimated sea turtle takes are presented in Tables 5, 6, 7 and 8. Table 5 gives the estimated takes of only positively identified loggerheads in the Eastern GOM, while Table 6 gives the estimated takes including “unknown hardshells”. Tables 7 and 8 give the estimated takes of loggerheads only and including “unknown hardshells”, respectively, for the Eastern and Western GOM combined. “Unknown hardshells” was used by the observers because they didn’t get a chance to identify the turtle, except a glimpse to identify them as hardshell. While this doesn’t indicate the species, it does indicate that they were unidentifiable, not because it was a rare species that the observer was not familiar with. All information needed to produce these estimates is provided in Tables 1, 2, and 3: takes by set and trip, total effort, and observed effort, respectively. Sums of the extrapolated estimates and their associated CV’s and 95% confidence intervals by observer program are also provided and were estimated as the addition of the estimates and their associated variances over all temporal strata. Lognormal confidence intervals and CV’s are then recalculated using the summed variance. Weighted means for the RFOP or the SBLOP are also provided, determined as the proportion of total subjectively allocated effort in sets by strata.

Extrapolation that assumes capture is directly related to effort becomes particularly problematic when extrapolating across large spatial areas. No observations were made in the western GOM, therefore we did not estimate takes separately for this spatial stratum. Spatial stratification of the GOM could be considered post-hoc, and not part of the observer programs sampling design. In this alternative case, the entire GOM is the sampling unit, and extrapolated takes were generated under this assumption (Tables 7 and 8). We should caution that the GOM is a large area, and extrapolation to unobserved spatial strata has been termed “fantasy” (Walters, 2003), although the inclusion of the relatively small amount of effort that occurred in the western GOM adds little to the extrapolated takes.

We estimate the total number of interactions of the Gulf of Mexico reef fish fishery with hardshell turtles as 974 (95% CI 444.1-2137.0, Table 8). If we assume the death rate is constant over time and base our estimates of that rate on the Final Disposition field in Appendix B, we estimate 433 turtles were released alive, 325 were released dead or unresponsive, and the status at release was unknown for 216. Future research will address this assumption of the constant death rate.

### **Potential bias and unquantified uncertainty in the extrapolated takes**

Unallocated effort (effort that could not be clearly allocated to either the directed shark or the reef fish fisheries, Figure 1) creates a small underestimate in total takes in either this fishery or the commercial directed shark bottom longline fishery on the order of 2.6% for 2006, and 0.5% for 2007, depending upon how this effort is allocated. Unquantified uncertainty exists in the allocation itself, that is the application of our 2/3 landings by weight rule, and if the rule were changed it could affect the estimate in this report by a large amount, but whatever that percent increase or decrease in total effort allocation, it would be reciprocally represented as a decrease or increase in the commercial shark bottom longline fishery. The relatively small number of total observed takes (18, Table 1), and the lack of observed takes in some strata, are another cause for concern about the accuracy of the estimates. It is impossible to quantify the direction of potential bias due to unobserved strata or sparse data associated with relatively low sampling effort for the two fisheries. Increased observer effort at any level would improve our confidence in the estimate. To obtain observer effort at an expected take level of 5 observations or more per strata, based on observed rates in this report, would suggest an increase in observer effort of 3 to 5 times current effort, or about a 3% to 5% observer coverage.

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Thanks to Liz Scott-Denton, Kevin McCarthy, John Carlson, Steve Turner, Lori Hale, Jennifer Lee, Lesley Stokes, and Sheryan Epperly for facilitating getting all the various SEFSC data sets to us. We thank Janet L. Miller and Carolyn Sramek for SERO commercial directed shark permit information.

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Table 1: Observed takes by bottom longline trip and set in the eastern Gulf of Mexico by fishers targeting reef fish of loggerhead turtles and unidentified hardshell turtles. Seasons are; Season 1- January to June, and Season 2- July to December. RFOP is the Galveston laboratories reef fish observer program and SBLOP is the Panama City laboratories shark bottom longline observer program. See Appendix B for more information on each turtle.

<b>Year</b>	<b>Season</b>	<b>Trip</b>	<b>Set id.</b>	<b>Hooks</b>	<b>Species</b>	<b>Number</b>	<b>Obs Program</b>
2006	2	1	1	2077	Caretta caretta	1	SBLOP
2006	2	1	5	1815	Caretta caretta	1	SBLOP
2006	2	1	6	754	Caretta caretta	1	SBLOP
2006	2	1	11	1981	Caretta caretta	1	SBLOP
2006	2	1	17	1929	Caretta caretta	2	SBLOP
2006	2	1	21	1964	Caretta caretta	1	SBLOP
2006	2	2	5	1500	Caretta caretta	1	RFOP
2006	2	3	1	1400	Caretta caretta	1	RFOP
					Unidentified		RFOP
2006	2	3	1	1400	Hardshell	1	
2007	1	4	1	2400	Caretta caretta	1	RFOP
2007	1	5	4	2500	Caretta caretta	1	RFOP
2007	1	5	5	2500	Caretta caretta	1	RFOP
2007	1	5	16	2500	Caretta caretta	1	RFOP
2007	2	6	8	1475	Caretta caretta	1	RFOP
2007	2	6	15	1475	Caretta caretta	1	RFOP
					Unidentified		RFOP
2007	2	7	7	650	Hardshell	1	
2007	2	8	3	1100	Caretta caretta	1	SBLOP



Table 2(a-c): Subjectively categorized reported effort in trips, sets, and hooks from the Southeast Fisheries Science Centers coastal logbook for fishing vessels that reported using bottom longline gear, and either did not have a commercial directed shark permit or had a commercial directed shark permit and landed at least 2/3 by weight of species other than sharks. Seasons are; Season 1- January to June, and Season 2- July to December. GOM is Gulf of Mexico, divided into east and west strata at 88 degrees W longitude. See Appendix A for uncombined effort categories and see text for more details.

2a. Reported trips

Year - Season	GOM East		GOM West	
	Shark Permit	No Shark Permit	Shark Permit	No Shark Permit
2006-2	210	336	17	64
2007-1	287	360	11	55
2007-2	186	225	0	3

2b. Reported sets

Year - Season	GOM East		GOM West	
	Shark Permit	No Shark Permit	Shark Permit	No Shark Permit
2006-2	3,730	8,270	227	799
2007-1	5,468	7,448	342	1,391
2007-2	3,680	6,235	0	43

2c. Reported hooks

Year - Season	GOM East		GOM West	
	Shark Permit	No Shark Permit	Shark Permit	No Shark Permit
2006-2	5,160,988	8,499,235	340,500	994,900
2007-1	7,310,100	8,271,700	513,000	1,545,700
2007-2	4,849,190	7,163,228	0	21,500

Table 3(a-c): Observed reef fish bottom longline effort for the eastern Gulf of Mexico (GOM) in trips, sets, and hooks from the Panama City laboratories shark bottom longline observer program (SBLOP) and Galveston laboratories reef fish observer program (RFOP) by year and season. Observed mixed trips (shark targeted sets and grouper or tilefish targeted sets) were shown as a proportion of non-shark target sets. No effort was observed in the western GOM. Seasons are; Season 1- January to June, and Season 2- July to December.

## 3a: Trips

<b>Year</b>	<b>Season</b>	<b>SBLOP</b>	<b>RFOP</b>
2006	2	1.57	12
2007	1	5	5
2007	2	3.91	6

## 3b: Sets

<b>Year</b>	<b>Season</b>	<b>SBLOP</b>	<b>RFOP</b>
2006	2	27	200
2007	1	99	54
2007	2	79	100

## 3c: Hooks

<b>Year</b>	<b>Season</b>	<b>SBLOP</b>	<b>RFOP</b>
2006	2	40606	203300
2007	1	113311	111175
2007	2	85793	96825

Table 4(a-c): Percent observed of total reef fish bottom longline effort for the eastern Gulf of Mexico in trips, sets, and hooks from the Panama City laboratories shark bottom longline observer program (SBLOP) and Galveston laboratories reef fish observer program (RFOP) by year and season. Seasons are; Season 1- January to June, and Season 2- July to December.

4a: Percent Observed Trips

<b>Year</b>	<b>Season</b>	<b>SBLOP</b>	<b>RFOP</b>
2006	2	0.75	2.20
2007	1	1.74	0.77
2007	2	2.10	1.46

4b: Percent Observed Sets

<b>Year</b>	<b>Season</b>	<b>SBLOP</b>	<b>RFOP</b>
2006	2	0.72	1.67
2007	1	1.81	0.42
2007	2	2.15	1.01

4c: Percent Observed Hooks

<b>Year</b>	<b>Season</b>	<b>SBLOP</b>	<b>RFOP</b>
2006	2	0.79	1.49
2007	1	1.55	0.71
2007	2	1.77	0.81

Table 5. Estimated total takes of loggerhead sea turtles in the eastern Gulf of Mexico by year and season in the bottom longline portion of the reef fish fishery by the Panama City laboratories shark bottom longline observer program (SBLOP) and Galveston laboratories reef fish observer program (RFOP). Weightings determined by proportion sets allocated to the respective portions of the total effort that were sampled by an observer program (see text, and Table 2). Catch per 1000 hooks (CPUE) are provided for reference, they are total takes divided by the appropriate effort from Table 2. Seasons are; Season 1- January to June, and Season 2- July to December.

Eastern GOM total loggerhead sea turtle takes

Year	Season	Takes (CPUE)	95% CI	CV
<b>SBLOP</b>				
2006	2	836.6 (0.162)	391.3 - 1,789.0	0.40
2007	1	0	-	-
2007	2	55.8 (0.012)	10.9 – 285.3	1.00
Sum SBLOP stratified		892.4	433.0 - 1,839.3	0.38
<b>RFOP</b>				
2006	2	94.3 (0.007)	27.1 – 327.9	0.71
2007	1	466.5 (0.030)	189.3 – 1149.8	0.49
2007	2	162.9 (0.014)	47.0 – 564.5	0.70
Sum RFOP stratified		723.7	352.1 – 1,487.6	0.38
Mean sum stratified (weighted)		732.0	310.1 – 1,728.0	0.46

Table 6. Estimated total takes of all hardshell sea turtles (loggerhead and unknown hardshell) in the eastern Gulf of Mexico by year and season in the bottom longline portion of the reef fish fishery by the Panama City laboratories shark bottom longline observer program (SBLOP) and Galveston laboratories reef fish observer program (RFOP). Weightings determined by proportion sets allocated to the respective portions of the total effort that were sampled by an observer program (see text, and Table 2). Catch per 1000 hooks (CPUE) are provided for reference, they are total takes divided by the appropriate effort from Table 2. Seasons are; Season 1- January to June, and Season 2- July to December.

Eastern GOM hardshell turtle takes

Year	Season	Takes(CPUE)	95% CI	CV
<b>SBLOP</b>				
2006	2	836.6(0.162)	391.3 - 1,789.0	0.40
2007	1	0	-	-
2007	2	55.8(0.012)	10.9 – 285.3	1.00
Sum SBLOP stratified		892.4	433.0 - 1,839.3	0.38
<b>RFOP</b>				
2006	2	143.1(0.010)	38.6 – 530.8	0.75
2007	1	466.5(0.030)	189.3 – 1149.8	0.49
2007	2	345.5(0.029)	114.4 – 1043.0	0.61
Sum RFOP stratified		955.1	545.1 – 1670.7	0.29
Mean sum stratified (weighted)		902.4	410.6 – 1983.2	0.42

Table 7. Estimated total takes of loggerhead sea turtles in the Gulf of Mexico by year and season in the bottom longline portion of the reef fish fishery by the Panama City laboratories shark bottom longline observer program (SBLOP) and Galveston laboratories reef fish observer program (RFOP). Weightings determined by proportion sets allocated to the respective portions of the total effort that were sampled by an observer program (see text, and Table 2). Catch per 1000 hooks (CPUE) are provided for reference, they are total takes divided by the appropriate effort from Table 2. Seasons are; Season 1- January to June, and Season 2- July to December.

GOM loggerhead sea turtle takes

Year	Season	Takes(CPUE)	95% CI	CV
<b>SBLOP</b>				
2006	2	891.8(0.162)	417.1 – 1,907.0	0.40
2007	1	0	-	-
2007	2	55.8 <sup>1</sup> (0.012)	10.9 – 285.3	1.0
Sum SBLOP stratified		947.6	459.8 – 1,953.1	0.38
<b>RFOP</b>				
2006	2	103.5(0.007)	29.8 – 360.0	0.71
2007	1	528.1(0.030)	214.3 – 1,301.7	0.49
2007	2	163.2(0.014)	47.1 – 565.5	0.70
Sum RFOP stratified		794.83	386.7 – 1,633.9	0.38
Mean sum stratified (weighted)		799.6	339.4 – 1,883.6	0.46

<sup>1</sup> No reported effort for this stratum of the western GOM.

Table 8. Estimated total takes of all hardshell sea turtles (loggerhead and unknown hardshell) in the Gulf of Mexico by year and season in the bottom longline portion of the reef fish fishery by the Panama City laboratories shark bottom longline observer program (SBLOP) and Galveston laboratories reef fish observer program (RFOP). Weightings determined by proportion sets allocated to the respective portions of the total effort that were sampled by an observer program (see text, and Table 2). Catch per 1000 hooks (CPUE) are provided for reference, they are total takes divided by the appropriate effort from Table 2. Seasons are; Season 1- January to June, and Season 2- July to December.

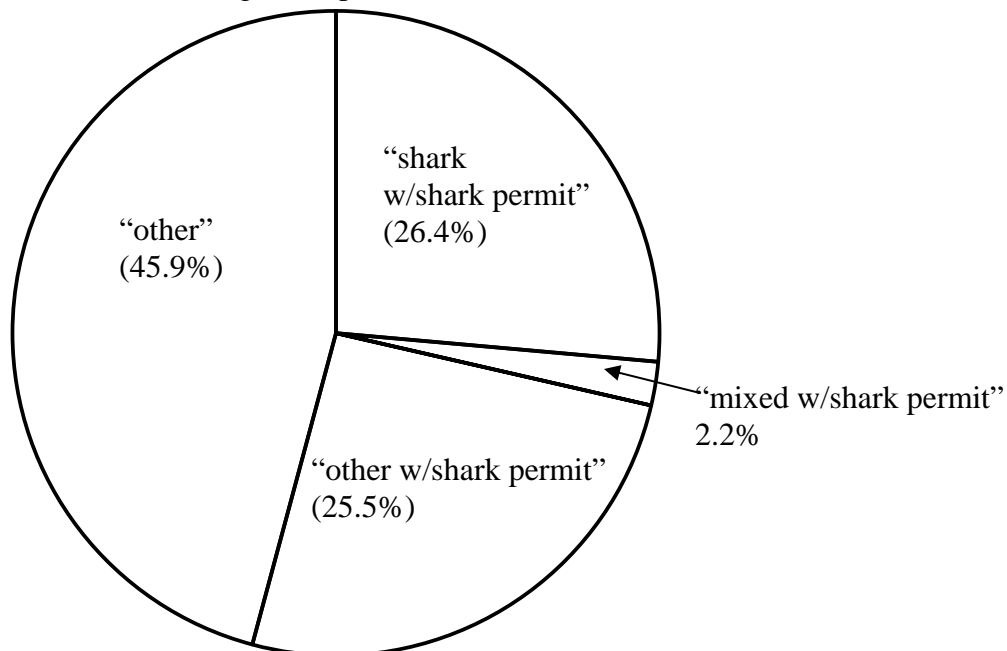
GOM total hardshell sea turtle takes

Year	Season	Takes(CPUE)	95% CI	CV
<b>SBLOP</b>				
2006	2	891.8(0.162)	417.1 – 1,907.0	0.40
2007	1	0	-	-
2007	2	55.8 <sup>1</sup> (0.012)	10.9 – 285.3	1.0
Sum SBLOP stratified		947.6	459.8 – 1,953.1	0.38
<b>RFOP</b>				
2006	2	157.1(0.010)	42.4 – 582.6	0.75
2007	1	528.1(0.030)	214.3 – 1,301.7	0.49
2007	2	346.1(0.014)	114.6 – 1,044.9	0.61
Sum RFOP stratified		1,031.3	589.6 – 1,804.0	0.29
Mean sum stratified (weighted)		974.2	444.1 – 2,137.0	0.42

<sup>1</sup> No reported effort for this stratum of the western GOM.

Figure 1: Allocation of bottom longline trips based on the 2/3 landings by weight rule to “shark”, “mixed”, “other w/directed shark permit”, and “other”. Both “other” categories comprise what we assume is the reef fish fishery.

1a: 2006 bottom longline trips



1b: 2007 bottom longline trips.

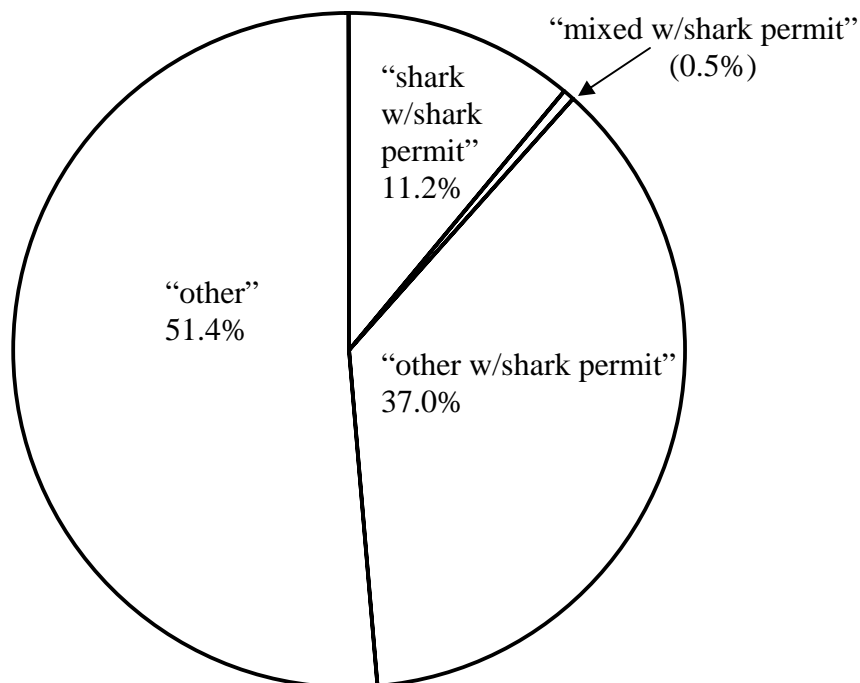
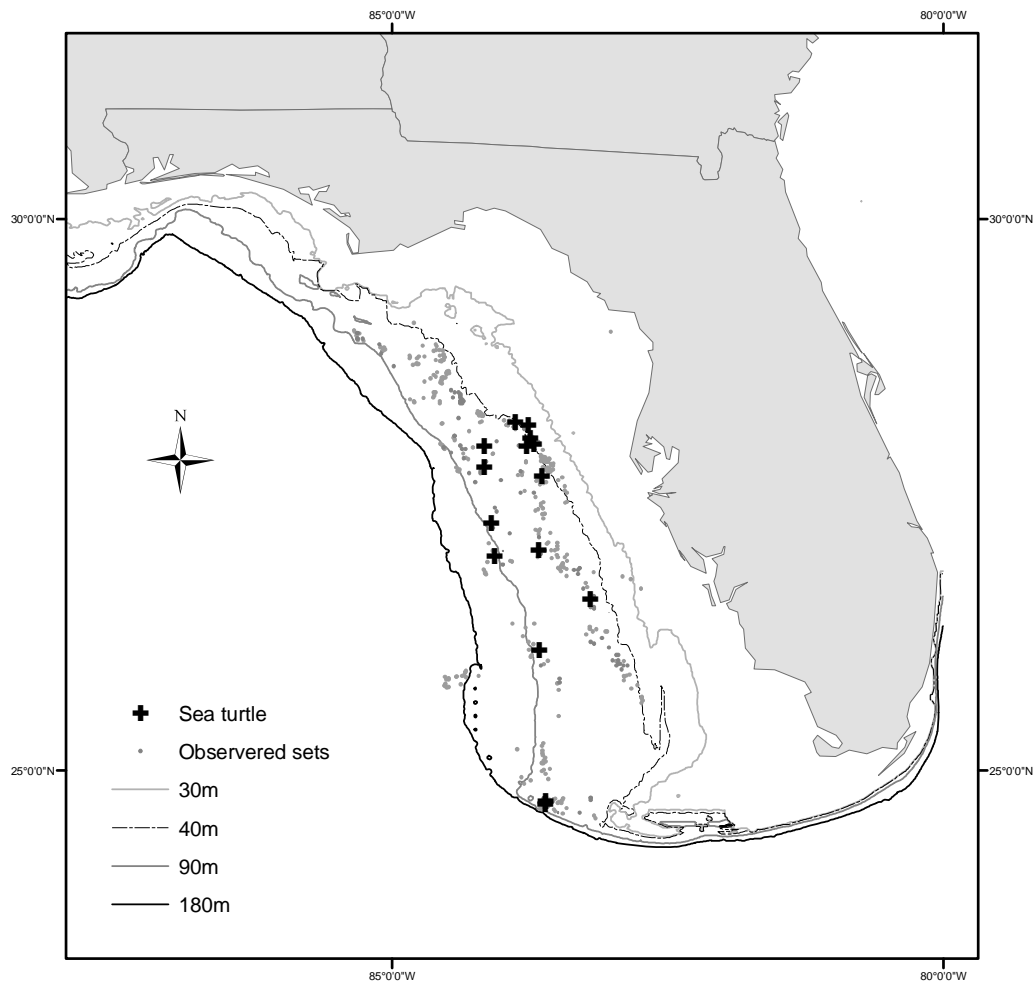




Figure 2: Locations in the Gulf of Mexico of observed bottom longline sets targeting reef fish and takes of sea turtles. Depth contours shown in meters; 20 fathoms is 36.6 m and would lie between the 30 m and 40 m contour lines, 50 fathoms is 91.4 m, and 100 fathoms is 182.9 m.



Appendix A: Bottom longline effort from the SEFSC coastal logbook, categorized to target by 2/3 landings rule (see text).

Year	subregion	target	permit	season	shark season	trips	sets	hooks
2006	east	mixed	1	1	closed	3	6	4,100
2006	east	mixed	1	1	open1	12	175	205,300
2006	east	other	0	1	closed	209	4,795	4,901,830
2006	east	other	0	1	open1	273	4,888	5,087,453
2006	east	other	1	1	closed	132	2,552	3,229,590
2006	east	other	1	1	open1	156	2,356	3,061,696
2006	east	shark	0	1	open1	8	9	11,800
2006	east	shark	1	1	closed	1	8	400
2006	east	shark	1	1	open1	167	484	331,110
2006	east	mixed	0	2	closed	1	10	1,200
2006	east	mixed	1	2	closed	2	32	25,200
2006	east	mixed	1	2	open2	8	156	178,000
2006	east	mixed	1	2	open3	20	350	482,700
2006	east	other	0	2	closed	166	4,313	4,329,155
2006	east	other	0	2	open2	48	1,264	1,211,380
2006	east	other	0	2	open3	115	2,666	2,939,170
2006	east	other	1	2	closed	130	2,239	2,964,100
2006	east	other	1	2	open2	20	362	542,450
2006	east	other	1	2	open3	60	1,129	1,654,438
2006	east	shark	0	2	open2	4	11	10,180
2006	east	shark	0	2	open3	2	6	8,150
2006	east	shark	1	2	closed	4	19	7,400
2006	east	shark	1	2	open2	114	310	256,906
2006	east	shark	1	2	open3	118	379	282,090
2006	west	other	0	1	closed	44	918	1,129,000
2006	west	other	0	1	open1	53	868	1,076,300
2006	west	other	1	1	closed	15	416	579,000
2006	west	other	1	1	open1	18	381	556,900
2006	west	shark	1	1	closed	3	11	8,400
2006	west	shark	1	1	open1	64	112	90,200
2006	west	mixed	1	2	closed	1	15	22,500
2006	west	mixed	1	2	open2	1	15	22,500
2006	west	other	0	2	closed	38	454	608,000
2006	west	other	0	2	open2	12	167	215,900
2006	west	other	0	2	open3	14	178	171,000
2006	west	other	1	2	closed	5	75	112,500
2006	west	other	1	2	open2	1	15	22,500
2006	west	other	1	2	open3	11	137	205,500
2006	west	shark	1	2	closed	2	3	2,400
2006	west	shark	1	2	open2	35	109	84,300
2006	west	shark	1	2	open3	60	154	109,500
2007	east	mixed	0	1	open1	1	8	960
2007	east	mixed	1	1	closed	2	8	6,400
2007	east	mixed	1	1	open1	1	14	28,000
2007	east	other	0	1	closed	327	6,830	7,589,910

## Appendix A continued:

year	subregion	target	permit	season	shark season	trips	sets	hooks
2007	east	other	0	1	open1	32	610	680,830
2007	east	other	1	1	closed	272	5,219	6,954,700
2007	east	other	1	1	open1	15	249	355,400
2007	east	shark	1	1	open1	35	74	51,180
2007	east	mixed	0	2	open2	1	2	3,400
2007	east	mixed	1	2	closed	1	11	17,600
2007	east	mixed	1	2	open2	2	45	49,040
2007	east	other	0	2	closed	216	5,342	6,136,428
2007	east	other	0	2	open2	38	891	1,023,400
2007	east	other	1	2	closed	171	3,313	4,333,690
2007	east	other	1	2	open2	15	367	515,500
2007	east	shark	1	2	closed	15	42	29,090
2007	east	shark	1	2	open2	63	210	159,440
2007	west	other	0	1	closed	53	1,296	1,424,200
2007	west	other	0	1	open1	2	95	121,500
2007	west	other	1	1	closed	11	342	513,000
2007	west	shark	1	1	closed	1	5	2,750
2007	west	shark	1	1	open1	9	16	8,700
2007	west	other	0	2	closed	3	43	21,500
2007	west	shark	1	2	closed	2	2	1,000
2007	west	shark	1	2	open2	21	39	24,300

Appendix B: Supplementary Gulf of Mexico non-directed shark bottom longline sea turtle captures from 2006 and 2007, information from the Sea Turtle Life History HMS Database. The table is split and rows are identified by record number.

Record Number	year	Season	Species	Capture Condition	Hook Type	Offset (degrees)	Bait	Bait Size (g)
1	2006	2	Caretta caretta	comatose, not successfully resuscitated	13/0 Circle	0	Squid	Unknown
2	2006	2	Caretta caretta	fresh dead	13/0 Circle	0	Squid	Unknown
3	2006	2	Caretta caretta	comatose, not successfully resuscitated	13/0 Circle	0	Squid	Unknown
4	2006	2	Caretta caretta	comatose, successfully resuscitated	13/0 Circle	0	Squid	Unknown
5	2006	2	Caretta caretta	comatose, unknown	13/0 Circle	0	Squid	Unknown
6	2006	2	Caretta caretta	comatose, not successfully resuscitated	13/0 Circle	0	Squid	Unknown
7	2006	2	Caretta caretta	unknown	13/0 Circle	0	Squid	Unknown
8	2006	2	Caretta caretta	alive, injured	13/0 Circle	0	Unknown	Unknown
9	2006	2	Caretta caretta	alive, injured	14/0 Circle	Unknown	Unknown	Unknown
10	2006	2	Unidentified Hardshell	alive, injured	14/0 Circle	Unknown	Unknown	Unknown
11	2007	1	Caretta caretta	alive, injured	14/0 Circle	0	Mackerel	Unknown
12	2007	1	Caretta caretta	unknown	14/0 Circle	10	Unknown	Unknown
13	2007	1	Caretta caretta	comatose, not successfully resuscitated	14/0 Circle	10	Unknown	Unknown
14	2007	1	Caretta caretta	alive, injured	14/0 Circle	10	Unknown	Unknown
15	2007	2	Caretta caretta	alive, injured	14/0 Circle	Unknown	Skate	Unknown
16	2007	2	Caretta caretta	comatose, not successfully resuscitated	14/0 Circle	Unknown	Unknown	Unknown
17	2007	2	Unidentified Hardshell	unknown	13/0 Circle	0	Unknown	Unknown
18	2007	2	Caretta caretta	alive, injured	14/0 Circle	0	Shark	100

## Appendix B continued:

Record Number	Final Disposition	Hook Location	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	SCL N-N (cm)
1	discarded marked dead/unresponsive carcass	roof of mouth	Yes	No	No	0.00		61	
2	discarded unmarked dead/unresponsive carcass	side jaw joint	No	No	No	1.00			
3	discarded marked dead/unresponsive carcass	beak (internal)/mouth, unknown	No	No	No	0.20		80.5	
4	released alive	side jaw joint	No	No	No	0.50		74	
5	Unknown	roof of mouth	No	No	No	0.50		73	
6	discarded marked dead/unresponsive carcass	side jaw joint	No	No	No	0.50			
7	Unknown	side jaw joint	No	No	No	2.00	4.00		
8	released alive	beak (internal)/mouth, unknown AND front flipper	No (mouth)/ Yes (flipper)	Unknown	Unknown	0.00			
9	released alive	beak (internal)/mouth, unknown	No	No	No	0.00			
10	released alive	beak (internal)/mouth, unknown	No	Unknown	No	0.50			
11	released alive	beak external, upper	No	No	No	0.50	3.50		
12	Unknown	unknown location	No	No	No	2.00	4.00		
13	discarded unmarked dead/unresponsive carcass	beak internal, lower jaw	Yes	No	No	0.00	4.00		
14	released alive	unknown location	No	No	No	4.00	4.00		
15	released alive	side jaw joint	Unknown	No	No	0.00		93.4	
16	discarded marked dead/unresponsive carcass	roof of mouth	Yes	No	No	0.00		77	
17	Unknown	not known if hooked	Unknown	Unknown	Unknown	1.00	3.00		
18	released alive	front flipper	Yes	No	No	0.00	5.00		