

Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery from 1 October to 31 December, 2012

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Background

The U.S. Atlantic Pelagic Longline fleet operates throughout the Northwestern Atlantic Ocean including along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the North Atlantic Ocean. The longline fishery has a documented history of incidental takes of non-target species including sea turtles and marine mammals. In June 2004, regulations were implemented to reduce interactions with sea turtles by requiring the use of “circle” hooks. The Biological Opinion also required quarterly reporting of interactions with protected species including sea turtles and marine mammals. The goal of this measure is to more closely monitor any short-term changes in interaction rates to allow more responsive management. This report meets this requirement and includes the observed fishery effort and incidental takes reported by the Pelagic Observer Program (POP) from 1 October to 31 December, 2012.

While it is desirable to estimate the absolute level of takes (i.e. the total number of turtles or mammals estimated to be taken by the fishery), fishery effort data are reported on logbook forms by fishing captains, and current data are therefore not available until several months after the end of any given quarter. Therefore, the bycatch rate (i.e. catch per unit effort) is presented in this report based solely on observer data as an indicator of the relative level of interactions with protected species. The observed bycatch rate by fishing area during Quarter 4 of 2012 is compared to that observed in during the prior five years (2007-2011) to determine if the current rates are unusually high or low. Bycatch rates were calculated by fishing area (Figure 1) using the delta log-normal method using hooks as the unit of effort. The analytical methods are described in detail in Garrison (2003).

Results and Discussion

A total of approximately 170 sets (~132,000 hooks) were observed during the fourth quarter with only circle hooks (16/0 and 18/0) recorded. The majority of observed sets occurred in the GOM fishing area (Figure 1). The effort in the NEC area and the exact total effort cannot be reported due to confidentiality restrictions.

The locations of observed sets and turtle interactions are shown in Figure 1. There were 15 observed interactions with leatherback turtles, and 8 observed interactions with loggerhead turtles (Table 2). One leatherback turtle in the GOM was observed dead (Appendix A).

Concerted efforts by fishers to remove hooks and disentangle captured turtles are mandated by the Biological Opinion. Specific information on injuries to sea turtles and gear characteristics of each interaction are shown in Appendix A. The release status for all turtles is summarized in Table 3. The information provided in Appendix A may be used to categorize turtles for post-release mortality estimates as described in SEFSC (2012). During the fourth quarter, none of the leatherback turtles were released with a hook and trailing line more than one-half of the carapace length or entangled. No loggerheads were released hooked with trailing gear more than ½ of the carapace length or entangled. Seven of the leatherbacks and five of the loggerheads were released with all gear removed (Table 3).

The quarterly and regional bycatch rates are summarized for sea turtles in Table 4. These rates were compared with the average for 2007-2011 (Table 5).

For leatherback turtles, the bycatch rate during Quarter 4 of 2012 was higher than that for 2007-2011 in the GOM, MAB, NEC, and SAB areas. Loggerhead turtle bycatch rates for Quarter 4 of 2012 were higher than those from 2007-2011 in the GOM and NEC areas and lower than average in the FEC and MAB areas.

Ten marine mammal interactions occurred during quarter 4 of 2012 including five serious injuries of pilot whales, one serious injury of a bottlenose dolphin and one serious injury of a Risso's dolphin (Table 6, Table 7). Serious injury determinations are preliminary pending additional review (NMFS 2012). Bycatch rates of pilot whales in 2012 were higher than in the fourth quarter for prior years in the MAB as were those for Risso's and bottlenose dolphins in the GOM. Interactions with pantropical spotted dolphins, unid. marine mammals, common dolphins, pygmy sperm whales, and false killer whales had been observed in prior years but not in 2012.

There are a number of caveats and uncertainties associated with the current analysis. First, while these data have undergone an initial audit and review, they are subject to change upon further review after the end of the 2012 calendar year. Second, the delta log-normal estimator was applied to calculate bycatch rates consistent with previous estimates (e.g., Garrison 2003). This approach assumed 1) that catch rates (animals per hook) were log-normally distributed, and 2) that the number of hooks was an appropriate unit of effort. The first assumption has been evaluated for turtles; however, violations of this assumption may have resulted in biased (positive or negative) estimates of catch rate and associated variances. The second assumption has not been examined critically in previous analyses. If this assumption was not correct, for example if there were saturation effects resulting in a non-linear relationship between the number of hooks and total catch, then there potentially may have been a bias in the estimate of bycatch rates.

The interaction between longline gear and protected species is a relatively rare event and is therefore inherently variable. Historically, there have been very large inter-annual fluctuations in bycatch rates and estimates of total bycatch. Thus, any differences observed between short term observations of bycatch rates and long term averages may be simply stochastic events and are not necessarily indicative of a significant change in the interactions between the longline fishery and protected species.

Literature Cited

Garrison, L.P. 2003. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2001-2002. NOAA Technical Memorandum NOAA NMFS-SEFSC-515: 52 p.

SEFSC. 2011. Revised 2012. Protocols for Categorizing Sea Turtles for Post-release Mortality Estimates. PRD Document Number #PRD-2011-07, Available from: Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149.
http://www.sefsc.noaa.gov/turtledocs/UPR_SEFSC_PHMortality_2012.pdf

NMFS 2012. Process for distinguishing serious from non-serious injury of marine mammals: Process for injury determinations. National Marine Fisheries Service Policy Directive PD 02-038-01. January 2012. <http://www.nmfs.noaa.gov/directives>.

Table 1. Number of sets and hooks observed in the U.S. Atlantic Pelagic Longline Fishery between 1 October and 31 December, 2012 by fishing area.

Area	Sets	Hooks
CAR	0	0
FEC	32	20,668
GOM	53	34,447
MAB	33	26,011
NCA	0	0
NEC	NR	NR
NED	0	0
SAB	11	8,303
SAR	36	34,775
TUN	0	0
Total	NR	NR

Table 2. Total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets beginning between 1 October and 31 December, 2012 by fishing area. Areas with missing values indicate no observer coverage during this time period. Counts include one leatherback turtle taken in an experimental set in the Gulf of Mexico.

Area	Leatherback	Loggerhead
CAR	-	-
FEC	2	2
GOM	7	1
MAB	1	3
NCA	-	-
NEC	1	2
NED	-	-
SAB	3	0
SAR	1	0
TUN	-	-
Total	15	8

Table 3. Release status and gear removal for sea turtles captured in the U.S. Atlantic Pelagic Longline Fishery between 1 October and 31 December, 2012. Condition columns refer to post-release mortality categories in Table 1 of SEFSC (2012). Counts do not include one leatherback turtle recovered dead.

Release Status	Leatherback	Loggerheads
Released entangled (Condition Column A)	0	0
Released with hook and line \geq ½ carapace length (Condition Column B)	0	0
Released with hook and line \leq ½ carapace length (Condition Column C)	7	3
Released with all gear removed (Condition Column D)	7	5

Table 4. Estimated bycatch rate (Catch per 1,000 hooks) for (A) Leatherback, and (B) Loggerhead turtles by geographic area and between 1 October and 31 December, 2012 in the U.S. Atlantic Pelagic Longline Fishery. Missing values indicate areas with no observer coverage. CV indicates the coefficient of variation of the estimated rate.

A. Leatherback Turtles

Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
CAR	Alive	0	-	-	-	-
FEC	Alive	32	2	0.128	0.699	0.037 – 0.442
GOM	Alive	53	6	0.157	0.396	0.074 – 0.332
GOM	Dead	52	1	0.045	1	0.009 – 0.230
MAB	Alive	33	1	0.030	1	0.006 – 0.155
NCA	Alive	0	-	-	-	-
NEC	Alive	NR	1	0.120	1	0.024 – 0.614
NED	Alive	0	-	-	-	-
SAB	Alive	11	3	0.412	0.549	0.151 – 1.126
SAR	Alive	36	1	0.029	1	0.006 – 0.148
TUN	Alive	0	-	-	-	-

B. Loggerhead Turtles

Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
CAR	Alive	0	-	-	-	-
FEC	Alive	32	2	0.104	0.740	0.029 – 0.381
GOM	Alive	53	1	0.025	1	0.005 – 0.130
MAB	Alive	33	3	0.079	0.563	0.028 – 0.220
NCA	Alive	0	-	-	-	-
NEC	Alive	NR	1	0.240	1	0.047 – 1.228
NED	Alive	0	-	-	-	-
SAB	Alive	11	0	0	-	-
SAR	Alive	36	0	0	-	-
TUN	Alive	0	-	-	-	-

Table 5. Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic Pelagic Longline fishery between 1 October and 31 December, 2012 compared to the second quarter average rate from 2007-2011. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates. These rates reflect combined alive, dead and unknown turtles.

A. Leatherback turtles

Area	2007-2011 CPUE	2007-2011 95% CI	2012 CPUE	2012 95% CI
CAR	-	-	-	-
FEC	0	-	0.128	0.037 – 0.442
GOM	0.068	0.041 – 0.113	0.202	0.100 – 0.407
MAB	0.069	0.043 – 0.110	0.30	0.006 – 0.155
NCA	-	-	-	-
NEC	0.043	0.012 – 0.148	0.120	0.023 – 0.614
NED	0.174	0.079 – 0.384	-	-
SAB	0.061	0.017 – 0.217	0.412	0.151 – 1.126
SAR	0.016	0.003 – 0.083	0.029	0.006 – 0.148
TUN	0.031	0.006 – 0.160	-	-

B. Loggerhead Turtles

Area	2007-2011 CPUE	2007-2011 95% CI	2012 CPUE	2012 95% CI
CAR	-	0	-	-
FEC	0.223	0.116 – 0.429	0.104	0.029 – 0.381
GOM	0.012	0.004 – 0.035	0.025	0.005 – 0.130
MAB	0.210	0.009 – 0.050	0.079	0.028 – 0.220
NCA	-	-	-	-
NEC	0.033	0.009 – 0.113	0.240	0.047 – 1.228
NED	0.163	0.064 – 0.415	-	-
SAB	0	-	0	-
SAR	0.092	0.041 – 0.206	0	-
TUN	0	-	-	-

Table 6. Interactions with marine mammals observed during 1 October – 31 December 2012 in the U.S. Atlantic Pelagic Longline Fishery by fishing area. Observer comments and criteria described in NMFS (2012) were used to make preliminary serious injury determinations.

Species	Region	# Released Uninjured	# Dead	#Serious Injury
Bottlenose Dolphin	GOM	0	0	1
Risso's Dolphin	GOM	0	0	1
Pilot Whale	MAB	3	0	5

Table 7. Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area for quarter 4 of 2012 in the U.S. Atlantic Pelagic Longline Fishery during normal fishing operations. CV indicates the coefficient of variation of the estimated rate. Interaction type indicates preliminary determination of serious injury (Alive = no serious injury, SI = serious injury) based upon NMFS (2012).

Species	Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
Bottlenose Dolphin	GOM	SI	53	1	0.024	1	0.005 – 0.121
Risso’s Dolphin	GOM	SI	53	1	0.045	1	0.009 – 0.230
Pilot Whale	MAB	SI	33	3	0.121	0.645	0.038 – 0.383
Pilot Whale	MAB	Alive	33	3	0.120	0.570	0.042 -0.339

Table 8. Bycatch rates for marine mammals in the U.S. Atlantic Pelagic Longline Fishery between 1 October and 31 December, 2012 compared to the third quarter average rate from 2007-2011. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates. CPUEs reflect total marine mammals caught including alive, dead, and seriously injured animals.

Species	Area	2007-2011 CPUE	2007-2011 95% CI	2012 CPUE	2012 95% CI
Bottlenose Dolphin	GOM	0.004	0.001 – 0.020	0.023	0.005 – 0.121
Pantropical Spotted Dolphin	GOM	0.004	0.001 – 0.020	0	-
Risso's Dolphin	GOM	0	-	0.045	0.009 – 0.230
Bottlenose Dolphin	MAB	0.012	0.004 – 0.034	0	-
Common Dolphin	MAB	0.004	0.001 – 0.020	0	-
Risso's Dolphin	MAB	0.021	0.009 – 0.048	0	-
Unid. Marine Mammal	MAB	0.0115	0.003 – 0.039	0	-
Pilot Whale	MAB	0.087	0.052 – 0.144	0.417	0.110 – 0.529
Pygmy Sperm Whale	MAB	0.005	0.001 – 0.024	0	-
Risso's Dolphin	NEC	0.036	0.011 – 0.124	0	-
False Killer Whale	TUN	0.035	0.007 – 0.172	-	-

Figure 1. Observed Pelagic Longline effort and turtle interactions between 1 October and 31 December, 2012. Pelagic longline fishing areas include: CAR = Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic Bight, NEC = Northeast Coastal, NED = Northeast Distant, NCA = North Central Atlantic, TUN = Tuna North. Year-round and seasonal closed areas are indicated by shaded polygons.

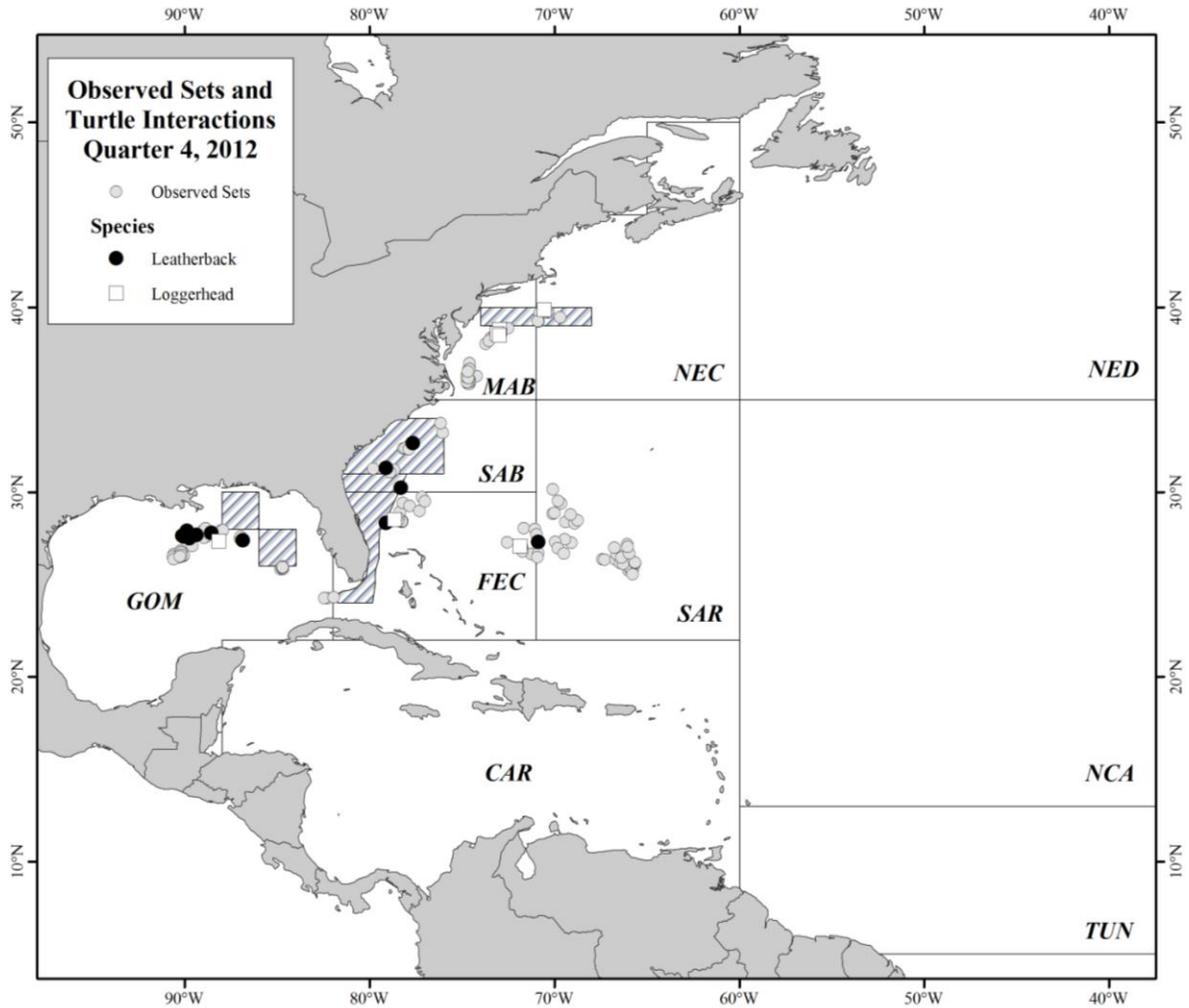
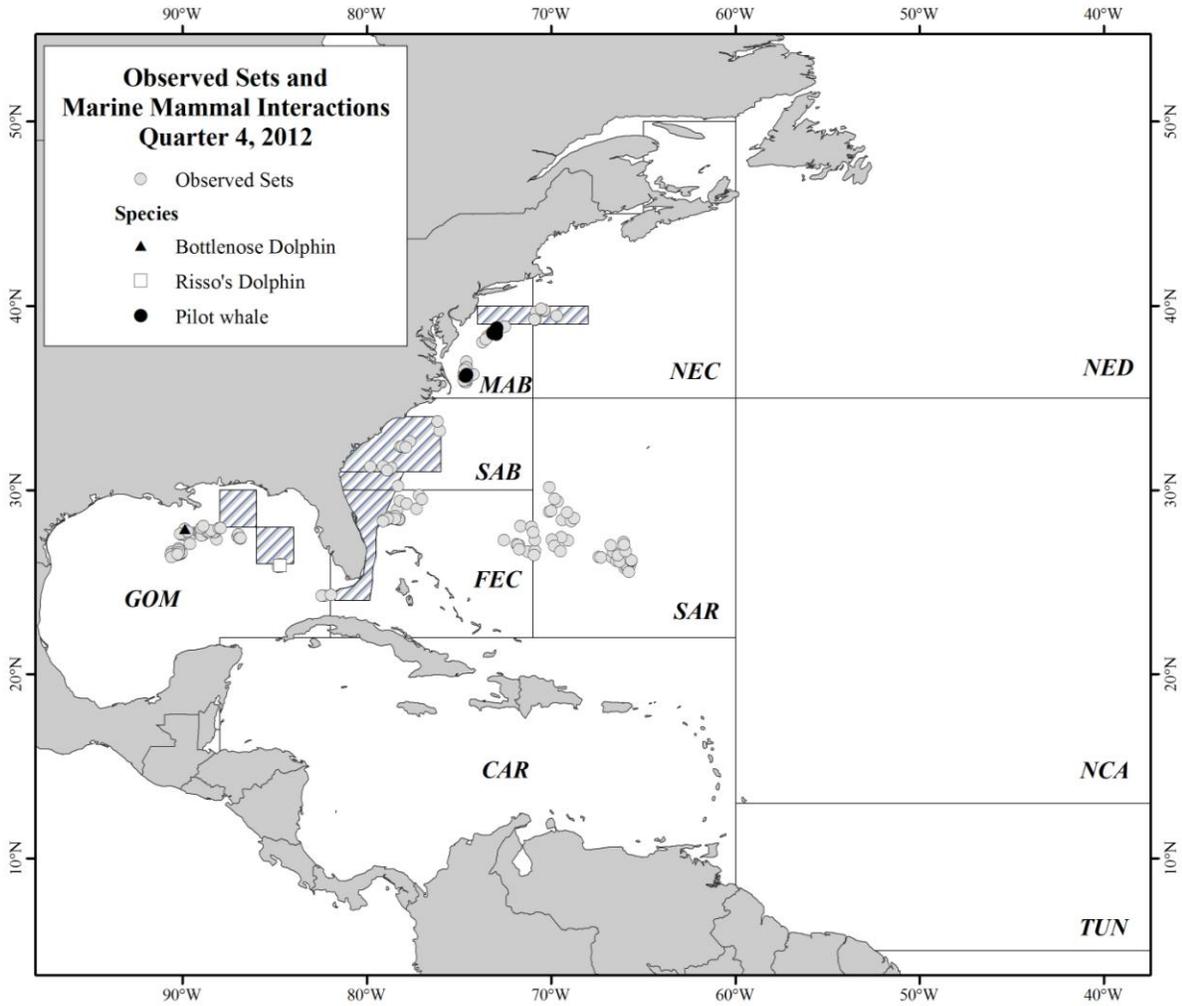


Figure 2. Observed Pelagic Longline effort and marine mammal interactions between 1 October and 31 December, 2012. Pelagic longline fishing areas include: CAR = Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic Bight, NEC = Northeast Coastal, NED = Northeast Distant, NCA = North Central Atlantic, TUN = Tuna North. Year-round and seasonal closed areas are indicated by shaded polygons.



Appendix A: Injury details and hook type for turtles captured in the U.S. Atlantic Pelagic Longline Fishery for sets between 1 October and 31 December, 2012. “Injury Cat. Row” and “Release Cond. Col” refer to rows and columns, respectively, for post-release mortality assignments in SEFSC (2012).

A1. Leatherback Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed ?	Entangled Capture?	Entangled Release?	Line Left (ft)	Injury Cat. Row	Release Cond. Col.	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	SAB	C-16/0	0	Squid or mackerel	252 or 423	Alive, uninjured	Released alive	Not hooked	N/A	Yes	No	0.0	V	C	4.0		
2	GOM	C-16/0	0	Squid, mackerel or mullet	140	Alive, uninjured	Released alive	Not hooked	N/A	Yes	No	0.0	V	D	6.0		
3	GOM	C-16/0	0	Squid	180	Alive, injured	Released alive	Roof of mouth	Yes	No	No	0.0	III	D	4.0		
4	NEC	C-16/0	0	Squid	239	Alive, injured	Released alive	Front flipper	Yes	No	No	0.0	I	D	3.0		
5	FEC	C-18/0	0	Squid	230	Alive, injured	Released alive	Armpit	No	No	No	0.3	I	C	5.0		
6	SAB	C-16/0	0	Squid or mackerel	225 or 333	Alive, uninjured	Released alive	Shoulder	Yes	No	No	0.0	I	D	5.6		
7	SAB	C-18/0	10	Squid or mackerel	302 or 410	Alive, injured	Released alive	Armpit	No	No	No	2.0	I	C	5.0		
8	SAR	C-18/0	10	Squid or mackerel	302 or 419	Alive, injured	Released alive	Shoulder	No	No	No	1.0	I	C	5.0		
9	GOM	C-16/0	0	Sardine	113	Fresh dead	Discarded dead	Not hooked	N/A	Yes	Yes	5.0	V	Dead	4.0		
10	FEC	C-16/0	0	Squid	198	Alive, uninjured	Released alive	Not hooked	N/A	Yes	No	0.0	V	D	4.0		
11	MAB	C-16/0	0	Squid	198	Alive, uninjured	Released alive	Not hooked	N/A	Yes	No	0.0	V	D	8.0		
12	GOM	C-16/0	0	Squid	189	Alive, injured	Released alive	Shoulder	No	No	No	2.0	I	C	4.5		

A1. Leatherback Turtles (cont.)

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed ?	Entangled Capture?	Entangled Release?	Line Left (ft)	Injury Cat. Row	Release Cond. Col.	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
13	GOM	C-16/0	0	Squid	189	Alive, injured	Released alive	Front flipper	No	No	No	2.0	I	C	4.5		
14	GOM	C-16/0	0	Squid	153	Alive, injured	Released alive	Shoulder	Yes	No	No	0.0	I	D	6.0		
15	GOM	C-16/0	0	Squid	153	Alive, injured	Released alive	Mouth side other	No	No	No	1.0	II	C	6.0		

A2. Loggerhead Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Capture Condition	Final Disposition	Hook Location	Hook Removed ?	Entangled Capture?	Entangled Release?	Line Left (ft)	Injury Cat. Row	Release Cond. Col.	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	FEC	C-16/0	0	Squid	189	Alive, injured	Released alive	Mouth lower jaw other	No	Yes	No	0.2	II	C	4.0		
2	NEC	C-16/0	0	Squid	239	Alive, injured	Released alive	Mouth side other	Yes	No	No	0.0	II	D		65.0	
3	NEC	C-16/0	0	Squid	239	Alive, injured	Released alive	Beak (internal) upper jaw	Yes	Yes	No	0.0	I	D		71.0	64.0
4	GOM	C-16/0	0	Squid	131	Alive, injured	Released alive	Roof of mouth	No	No	No	0.5	III	C	3.0		
5	FEC	C-18/0	0	Squid	230	Alive, injured	Released alive	Front flipper	Yes	No	No	0.0	I	D	2.0		
6	MAB	C-16/0	0	Squid	198	Alive, injured	Released alive	Swallowed hook not visible	No	No	No	0.3	IV	C		73.2	64.9
7	MAB	C-16/0	0	Squid	198	Alive, injured	Released alive	Mouth side other	Yes	No	No	0.0	II	D		69.0	64.7
8	MAB	C-16/0	0	Squid	212	Alive, injured	Released alive	Swallowed hook partially visible	Yes	No	No	0.0	III	D		59.9	53.5