

# **Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery from 1 April to 30 June, 2012**

Lance P. Garrison  
Lesley Stokes

Southeast Fisheries Science Center  
75 Virginia Beach Dr.  
Miami, FL 33149  
E-mail: [Lance.Garrison@noaa.gov](mailto:Lance.Garrison@noaa.gov)

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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 April to 30 March, 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 2 of 2012 are 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 420 sets (~285,000 hooks) were observed during the second quarter with only circle hooks (16/0 and 18/0) recorded. The majority of observed sets occurred in the GOM fishing area associated with enhanced observer coverage targeted at sampling bluefin tuna (Figure 1). The observed effort in the TUN area cannot be reported because it included three or

fewer vessels, and the exact total effort likewise cannot be reported. There were 77 experimental sets comprising 36,729 hooks in the GOM area to investigate the effectiveness of weak hook designs.

The locations of observed sets and turtle interactions are shown in Figure 1. There were 6 observed interactions with leatherback turtles, and 6 observed interactions with loggerhead turtles (Table 2). One of the leatherback interactions occurred in an experimental set in the GOM. All turtles were released alive (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 second quarter, 2 leatherback turtles were released with a hook and trailing line more than one-half of the carapace length and one was released entangled. Three loggerheads were released hooked with trailing gear less than  $\frac{1}{2}$  of the carapace length. Three of the leatherbacks and three 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 2 of 2012 was lower than that for 2007-2011 in the GOM area, but higher than average in both the FEC and SAB areas. The bycatch rates were statistically different from the 5-year averages. Loggerhead turtle bycatch rates for Quarter 2 of 2012 were higher than those from 2007-2011 in the FEC and NEC areas and lower than average in both the GOM and SAB areas.

Three marine mammal interactions occurred during quarter 2 of 2012 including one serious injury of a pilot whale and one mortality of a pantropical spotted dolphin in an experimental set (Table 6, Table 7). Serious injury determinations are preliminary pending additional review (NMFS 2012). Marine mammal bycatch has been observed at low rates during prior years in the GOM during the second quarter, associated with high observer coverage. However, no bycatch was observed in the GOM during quarter 2 of 2012 (Table 8). Bycatch of pilot whales was observed in prior years, but the rate observed in 2012 was lower than the five year average.

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](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/pr/pdfs/serious\\_injury\\_procedure.pdf](http://www.nmfs.noaa.gov/pr/pdfs/serious_injury_procedure.pdf).

**Table 1.** Number of sets and hooks observed in the U.S. Atlantic Pelagic Longline Fishery between 1 April and 30 June, 2012 by fishing area. NR indicates areas where effort cannot be reported due to confidentiality considerations. Total effort is not reported because this would allow simple calculation of the effort level in the TUN which includes fewer than 3 vessels.

<b>Area</b>	<b>Sets</b>	<b>Hooks</b>
CAR	0	0
FEC	35	19,769
GOM	292	191,207
MAB	40	32,977
NCA	0	0
NEC	12	8,091
NED	0	0
SAB	34	25,176
SAR	0	0
TUN	NR	NR
<b>Total</b>	<b>NR</b>	<b>NR</b>

**Table 2.** Total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets beginning between 1 April and 30 June, 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.

<b>Area</b>	<b>Leatherback</b>	<b>Loggerhead</b>
CAR	-	-
FEC	2	3
GOM	3	0
MAB	0	1
NCA	-	-
NEC	0	2
NED	-	-
SAB	1	0
SAR	-	-
TUN	0	0
<b>Total</b>	<b>6</b>	<b>6</b>

**Table 3.** Release status and gear removal for sea turtles captured in the U.S. Atlantic Pelagic Longline Fishery between 1 April and 30 June, 2012. Condition columns refer to post-release mortality categories in Table 1 of SEFSC (2012). Counts include one leatherback turtle taken in an experimental set in the Gulf of Mexico.

<b>Release Status</b>	<b>Leatherback</b>	<b>Loggerheads</b>
Released entangled (Condition Column A)	1	0
Released with hook and line $\geq$ $\frac{1}{2}$ carapace length (Condition Column B)	2	0
Released with hook and line $\leq$ $\frac{1}{2}$ carapace length (Condition Column C)	0	3
Released with all gear removed (Condition Column D)	3	3

**Table 4.** Estimated bycatch rate (Catch per 1,000 hooks) for (A) Leatherback, and (B) Loggerhead turtles by geographic area and between 1 April and 30 June, 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. NR indicates areas where effort cannot be reported due to confidentiality considerations.

**A. Leatherback Turtles**

Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
CAR	Alive	0	-	-	-	-
FEC	Alive	35	2	0.113	0.725	0.032 – 0.404
GOM	Alive	292	2	0.012	0.740	0.003 – 0.043
MAB	Alive	40	0	0	-	-
NCA	Alive	0	-	-	-	-
NEC	Alive	12	0	0	-	-
NED	Alive	0	-	-	-	-
SAB	Alive	34	1	0.038	1.000	0.007 – 0.194
SAR	Alive	0	-	-	-	-
TUN	Alive	NR	0	0	-	-

**B. Loggerhead Turtles**

Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
CAR	Alive	0	-	-	-	-
FEC	Alive	35	3	0.142	0.587	0.049 – 0.413
GOM	Alive	292	0	0	-	-
MAB	Alive	40	1	0.025	1.000	0.005 – 0.127
NCA	Alive	0	-	-	-	-
NEC	Alive	12	2	0.160	0.675	0.048 – 0.531
NED	Alive	0	-	-	-	-
SAB	Alive	34	0	0	-	-
SAR	Alive	0	-	-	-	-
TUN	Alive	NR	0	0	-	-

**Table 5.** Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic Pelagic Longline fishery between 1 April and 30 June, 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	0.070	0.014 – 0.359	-	-
FEC	0.025	0.007 – 0.090	0.113	0.032 – 0.404
GOM	0.092	0.076 - 0.112	0.012	0.003 – 0.043
MAB	0.043	0.012 – 0.148	0	-
NCA	-	-	-	-
NEC	0.084	0.029 – 0.240	0	-
NED	-	-	-	-
SAB	0.004	0.001 – 0.021	0.038	0.007 – 0.194
SAR	0	-	-	-
TUN	0	-	0	-

**B. Loggerhead Turtles**

Area	2007-2011 CPUE	2007-2011 95% CI	2012 CPUE	2012 95% CI
CAR	0	-	-	-
FEC	0.041	0.014 – 0.118	0.142	0.049 – 0.413
GOM	0.009	0.006 – 0.017	0	-
MAB	0.042	0.012 – 0.146	0.025	0.005 – 0.127
NCA	-	-	-	-
NEC	0.132	0.051 – 0.340	0.160	0.048 – 0.531
NED	-	-	-	-
SAB	0.045	0.023 – 0.087	0	-
SAR	0	-	-	-
TUN	0	-	0	-

**Table 6.** Interactions with marine mammals observed during 1 April – 30 June 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. Exp. indicates experimental set.

<b>Species</b>	<b>Region</b>	<b># Released Uninjured</b>	<b># Dead</b>	<b>#Serious Injury</b>
Pilot Whale	MAB	1	0	0
Pilot Whale	MAB	0	0	1
Pantropical Spotted Dolphin	GOM (Exp)	0	1	0

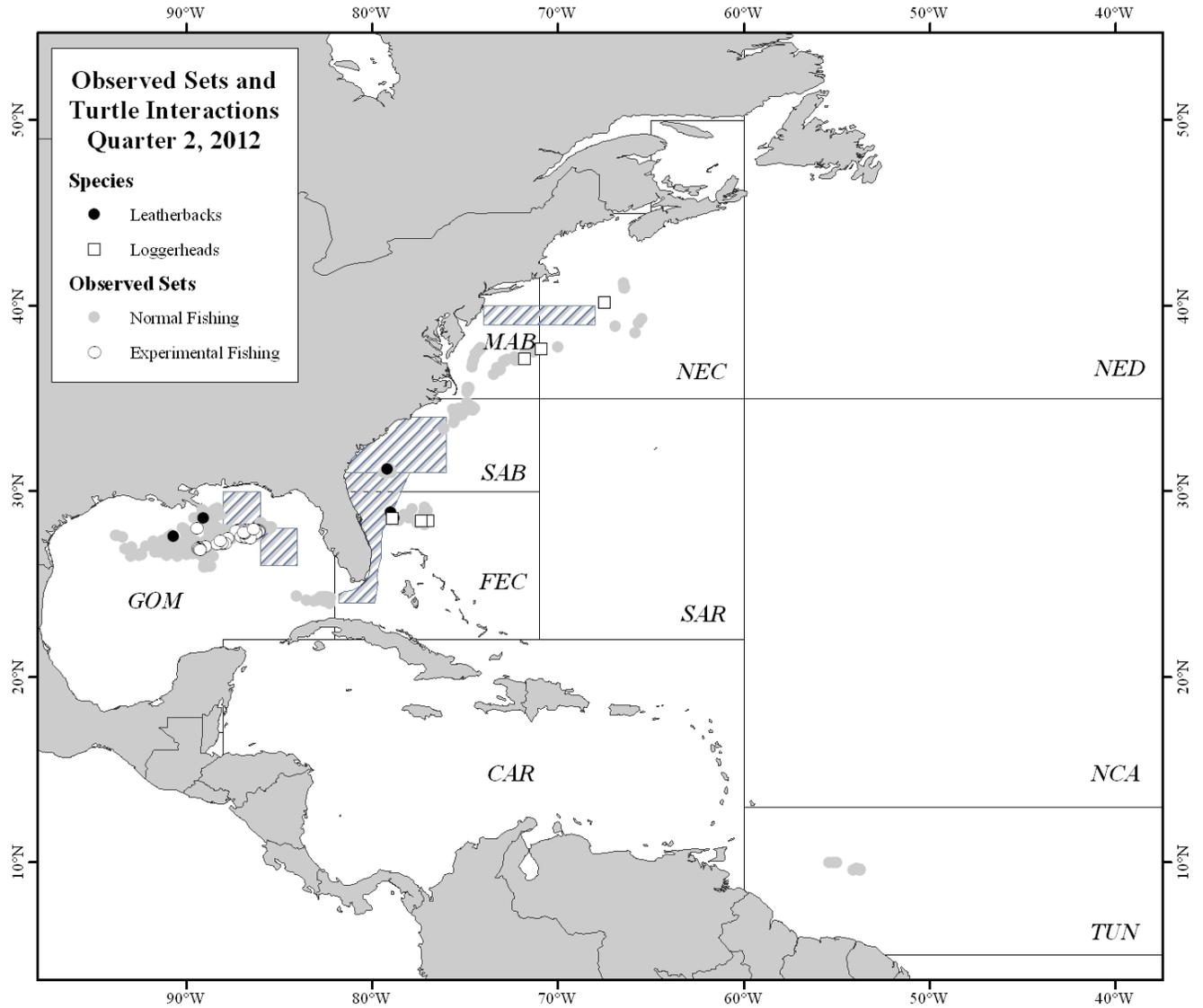
**Table 7.** Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area for quarter 2 of 2012 in the U.S. Atlantic Pelagic Longline Fishery during normal fishing operations. CV indicates the coefficient of variation of the estimated rate. Interaction type indicates preliminary determination of serious injury (Alive = no serious injury, SI = serious injury) based upon NMFS (2012).

<b>Species</b>	<b>Area</b>	<b>Interaction Type</b>	<b># Observed Sets</b>	<b># Positive Sets</b>	<b>Mean CPUE</b>	<b>CV CPUE</b>	<b>95% Confidence Interval</b>
Pilot Whale	MAB	SI	40	1	0.019	1.000	0.004 – 0.095
Pilot whale	MAB	Alive	40	1	0.021	1.000	0.004 – 0.109

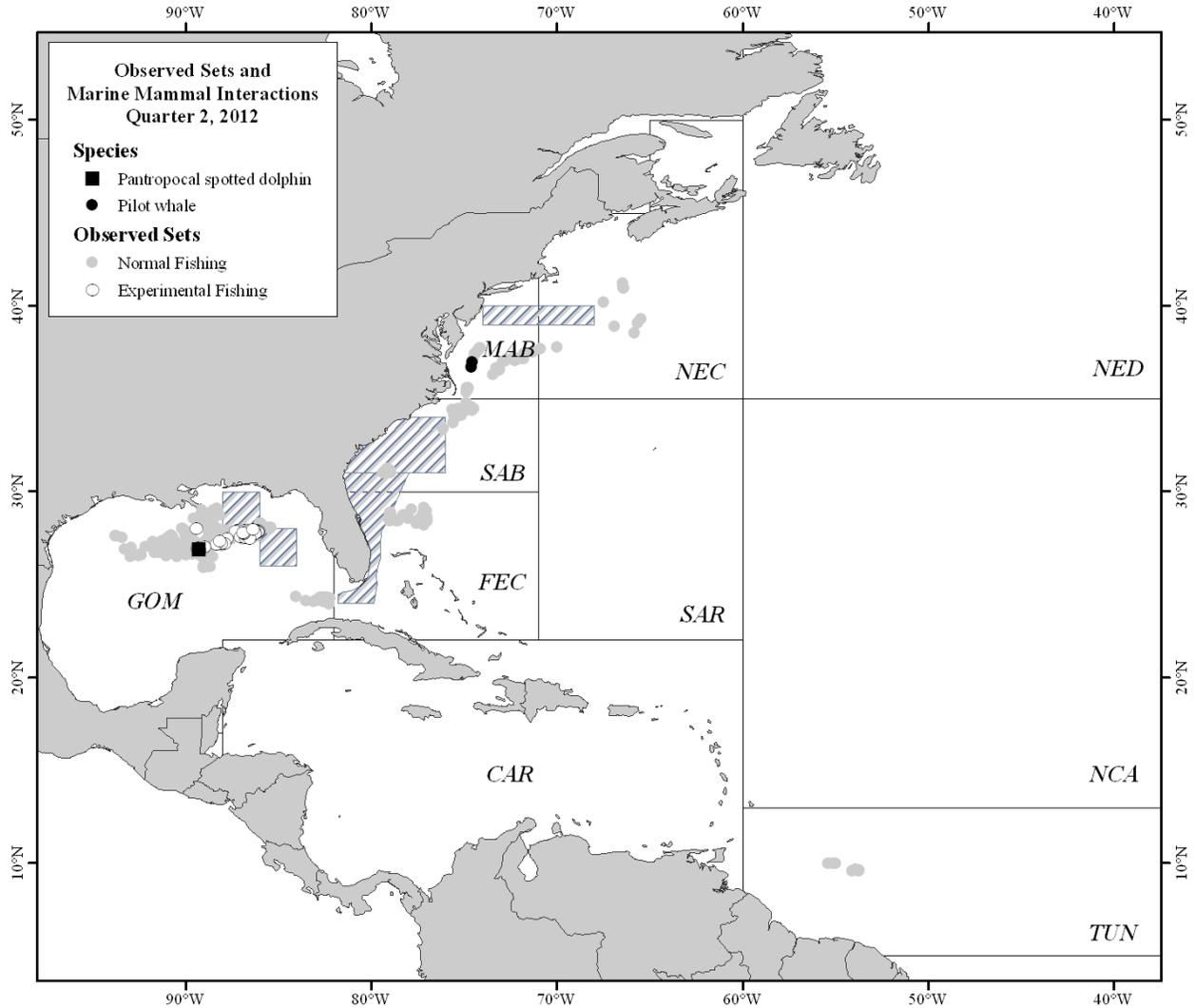
**Table 8.** Bycatch rates for marine mammals in the U.S. Atlantic Pelagic Longline Fishery between 1 April and 30 June, 2012 compared to the first quarter average rate from 2007-2011. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal 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
Cuvier's Beaked Whale	GOM	0.001	0.0001 – 0.003	0	-
Unid. Dolphin	GOM	0.003	0.001 – 0.007	0	-
Atlantic spotted dolphin	GOM	0.001	0.0001 – 0.006	0	-
Bottlenose dolphin	GOM	0.002	0.0001 – 0.006	0	-
Pantropical spotted dolphin	GOM	0.002	0.001 – 0.006	0	-
Risso's dolphin	GOM	0.004	0.001 – 0.010	0	-
Unid. marine mammal	GOM	0.001	0.0001 – 0.003	0	-
Killer whale	GOM	0.001	0.0002 – 0.006	0	-
Pygmy sperm whale	GOM	0.001	0.0001 – 0.003	0	-
Sperm whale	GOM	0.001	0.0001 – 0.003	0	-
Bottlenose dolphin	MAB	0.029	0.006 – 0.143	0	-
Pilot Whale	MAB	0.083	0.017 – 0.404	0.040	0.012 – 0.137
Risso's dolphin	NEC	0.051	0.015 – 0.171	0	-
Bottlenose dolphin	SAB	0.013	0.004 – 0.043	0	-

**Figure 1.** Observed Pelagic Longline effort and turtle interactions between 1 April and 30 June, 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 April and 30 June, 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 April and 30 June, 2012. “Injury Cat. Row” and “Release Cond. Col” refer to rows and columns, respectively, for post-release mortality assignments in SEFSC (2012). Exp. indicates that the take occurred in an experimental set.

**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	GOM	C-16/0	0	Squid	131	Alive, injured	Released alive	Roof of mouth	No	No	No	4.0	III	B	4.0		
2	SAB	C-18/0	10	Mackerel	Unk.	Alive, uninjured	Released alive	Not hooked	N/A	Yes	No	0.0	V	D	6.0		
3	GOM	C-16/0	0	Mackerel	153	Alive, uninjured	Released alive	Not hooked	N/A	Yes	No	0.0	V	D	6.0		
4	FEC	C-16/0 or C-18/0	0 or 10	Squid	284	Alive, injured	Released alive	Front flipper/shoulder/armpit	No	No	No	4.0	I	B	6.0		
5	FEC	C-16/0	0	Squid	945	Alive, uninjured	Released alive	Not hooked	N/A	Yes	Yes	14.0	V	A	6.0		
6	GOM Exp.	C-16/0	0	Sardine	117	Alive, injured	Released alive	Shoulder	Yes	No	No	0.0	I	D	5.0		

## 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	234	Alive, injured	Released alive	Mouth lower jaw other	Yes	No	No	0.0	II	D		69.0	66.5
2	FEC	C-16/0	0	Squid	945	Alive, injured	Released alive	Mouth lower jaw other	Yes	No	No	0.0	II	D	3.7		
3	NEC	C-16/0	10	Squid	221	Alive, injured	Released alive	Swallowed, hook partially visible	No	No	No	0.2	III	C		66.4	60.7
4	NEC	C-18/0	10	Squid	126	Alive, injured	Released alive	Swallowed, hook not visible	No	No	No	0.1	IV	C		57.1	53.0
5	MAB	C-18/0	10	Squid	126	Alive, injured	Released alive	Mouth side other	Yes	No	No	0.0	II	D		58.4	53.7
6	FEC	C-16/0	0	Squid	234	Alive, injured	Released alive	Swallowed, hook not visible	No	No	No	0.3	IV	C		75.5	71.5