

Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery from 1 July to 30 September, 2012

Lance P. Garrison
Lesley Stokes

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

April 2013
PRD Contribution: #PRD-2013-03

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 July to 30 September, 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 3 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 226 sets (179,146 hooks) were observed during the third 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 number of sets and hooks for the SAB and TUN areas cannot be reported due to confidentiality restrictions.

The locations of observed sets and turtle interactions are shown in Figure 1. There were 12 observed interactions with leatherback turtles, and 22 observed interactions with loggerhead turtles (Table 2). There was also one interaction with an unidentified hardshell turtle. 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 third quarter, none leatherback turtles were released with a hook and trailing line more than one-half of the carapace length and four were categorized as released entangled (Condition A in Table 3 and Appendix A). However, for three of the entangled leatherbacks it was unknown if they were entangled on release (Appendix A). One loggerhead was released hooked with trailing gear greater than ½ of the carapace length and one was released entangled, and the unidentified hardshell was released entangled. For both the loggerhead and unidentified turtle, it was unknown if they remained entangled on release (Appendix A). Seven of the leatherbacks and thirteen 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 3 of 2012 was higher than that for 2007-2011 in the GOM and SAB areas, and lower than average in the NEC areas. Loggerhead turtle bycatch rates for Quarter 3 of 2012 were higher than those from 2007-2011 in the FEC and GOM areas and lower than average in both the MAB and NEC areas. The lack of observer coverage in the NED during quarter 3 is notable since the bycatch rate for loggerhead turtles has been historically high in this area-quarter.

Twelve marine mammal interactions occurred during quarter 3 of 2012 including seven serious injuries 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 third quarter for prior years as were those for Risso's and bottlenose dolphins. Interactions with pantropical spotted dolphins, unid. marine mammals, false killer whales, and beaked 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 July and 30 September, 2012 by fishing area. NR indicates areas where effort cannot be reported due to confidentiality considerations.

Area	Sets	Hooks
CAR	0	0
FEC	39	23,168
GOM	59	42,005
MAB	55	46,628
NCA	0	0
NEC	54	54,857
NED	0	0
SAB	NR	NR
SAR	0	0
TUN	NR	NR
Total	226	179,146

Table 2. Total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets beginning between 1 July and 30 September, 2012 by fishing area. Areas with missing values indicate no observer coverage during this time period.

Area	Leatherback	Loggerhead	Unid. Hardshell
CAR	-	-	-
FEC	0	3	0
GOM	5	1	0
MAB	2	2	0
NCA	-	-	-
NEC	4	16	1
NED	-	-	-
SAB	1	0	0
SAR	-	-	-
TUN	0	0	0
Total	12	22	1

Table 3. Release status and gear removal for sea turtles captured in the U.S. Atlantic Pelagic Longline Fishery between 1 July and 30 September, 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.

Release Status	Leatherback	Loggerheads	Unid. Hardshell
Released entangled (Condition Column A)	4	1	1
Released with hook and line $\geq \frac{1}{2}$ carapace length (Condition Column B)	0	1	0
Released with hook and line $\leq \frac{1}{2}$ carapace length (Condition Column C)	1	7	0
Released with all gear removed (Condition Column D)	7	13	0

Table 4. Estimated bycatch rate (Catch per 1,000 hooks) for (A) Leatherback, and (B) Loggerhead turtles by geographic area and between 1 July and 30 September, 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	39	0	0	-	-
GOM	Alive	59	4	0.114	0.517	0.043 – 0.295
MAB	Alive	55	1	0.049	1	0.010 – 0.253
NCA	Alive	0	-	-	-	-
NEC	Alive	54	4	0.076	0.488	0.031 – 0.188
NED	Alive	0	-	-	-	-
SAB	Alive	NR	1	0.356	1.000	0.070 – 1.82
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	39	3	0.142	0.581	0.049 – 0.406
GOM	Alive	59	1	0.020	1.000	0.004 – 0.101
MAB	Alive	55	2	0.043	0.710	0.012 – 0.149
NCA	Alive	0	-	-	-	-
NEC	Alive	54	12	0.271	0.280	0.158 – 0.464
NED	Alive	0	-	-	-	-
SAB	Alive	NR	0	0	-	-
SAR	Alive	0	-	-	-	-
TUN	Alive	NR	0	0	-	-

C. Unid. Hardshell Turtle

Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
NEC	Alive	54	1	0.027	1.000	0.005 – 0.140

Table 5. Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic Pelagic Longline fishery between 1 July and 30 September, 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	-
GOM	0.010	0.002 – 0.049	0.114	0.043 – 0.295
MAB	0.031	0.015 – 0.066	0.049	0.010 – 0.253
NCA	-	-	-	-
NEC	0.141	0.095 – 0.208	0.076	0.031 – 0.188
NED	0.119	0.071 – 0.196	-	-
SAB	0	-	0.356	0.070 – 1.82
SAR	-	-	-	-
TUN	0	-	0	-

B. Loggerhead Turtles

Area	2007-2011 CPUE	2007-2011 95% CI	2012 CPUE	2012 95% CI
CAR	-	-	-	-
FEC	0.077	0.033 – 0.177	0.142	0.049 – 0.406
GOM	0.004	0.001 – 0.022	0.020	0.004 – 0.101
MAB	0.086	0.056 – 0.131	0.043	0.012 – 0.149
NCA	-	-	-	-
NEC	0.278	0.210 – 0.367	0.271	0.158 – 0.464
NED	0.633	0.409 – 0.982	-	-
SAB	0.077	0.022 – 0.265	0	-
SAR	-	-	-	-
TUN	0	-	0	-

Table 6. Interactions with marine mammals observed during 1 July – 30 September 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	NEC	1	0	1
Risso's Dolphin	MAB	0	0	1
Pilot Whale	FEC	0	0	1
Pilot Whale	MAB	2	0	5
Pilot Whale	NEC	0	0	1

Table 7. Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area for quarter 3 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
Pilot Whale	FEC	SI	39	1	0.043	1.000	0.008 – 0.219
Risso’s Dolphin	MAB	SI	55	1	0.023	1.000	0.004 – 0.116
Pilot Whale	MAB	SI	55	4	0.112	0.531	0.042 – 0.298
Pilot Whale	MAB	Alive	55	2	0.034	0.705	0.010 – 0.118
Bottlenose dolphin	NEC	SI	54	1	0.017	1.000	0.003 – 0.0877
Bottlenose Dolphin	NEC	Alive	54	1	0.016	1.000	0.003 – 0.083
Pilot Whale	NEC	SI	54	1	0.021	1.000	0.004 – 0.105

Table 8. Bycatch rates for marine mammals in the U.S. Atlantic Pelagic Longline Fishery between 1 July and 30 September, 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
Pilot Whale	FEC	0	-	0.043	0.008 – 0.219
Pantropical Spotted Dolphin	GOM	0.005	0.001 – 0.024	0	-
Risso’s Dolphin	MAB	0.010	0.003 – 0.035	0.023	0.004 – 0.116
Pilot Whale	MAB	0.089	0.058 – 0.136	0.145	0.066 – 0.322
Short-finned Pilot Whale	MAB	0.014	0.004 – 0.046	0	-
Bottlenose dolphin	NEC	0.005	0.001 – 0.023	0.033	0.010 – 0.116
Risso’s dolphin	NEC	0.028	0.013 – 0.069	0	-
Pilot Whale	NEC	0.008	0.002 – 0.028	0.021	0.004 – 0.105
Unid. Marine Mammal	NEC	0.005	0.001 – 0.026	0	-
False Killer Whale	NEC	0.005	0.001 – 0.026	0	-
Beaked Whale	NEC	0.005	0.001 – 0.022	0	-
Risso’s dolphin	NED	0.008	0.002 – 0.038	0	-

Figure 1. Observed Pelagic Longline effort and turtle interactions between 1 July and 30 September, 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.

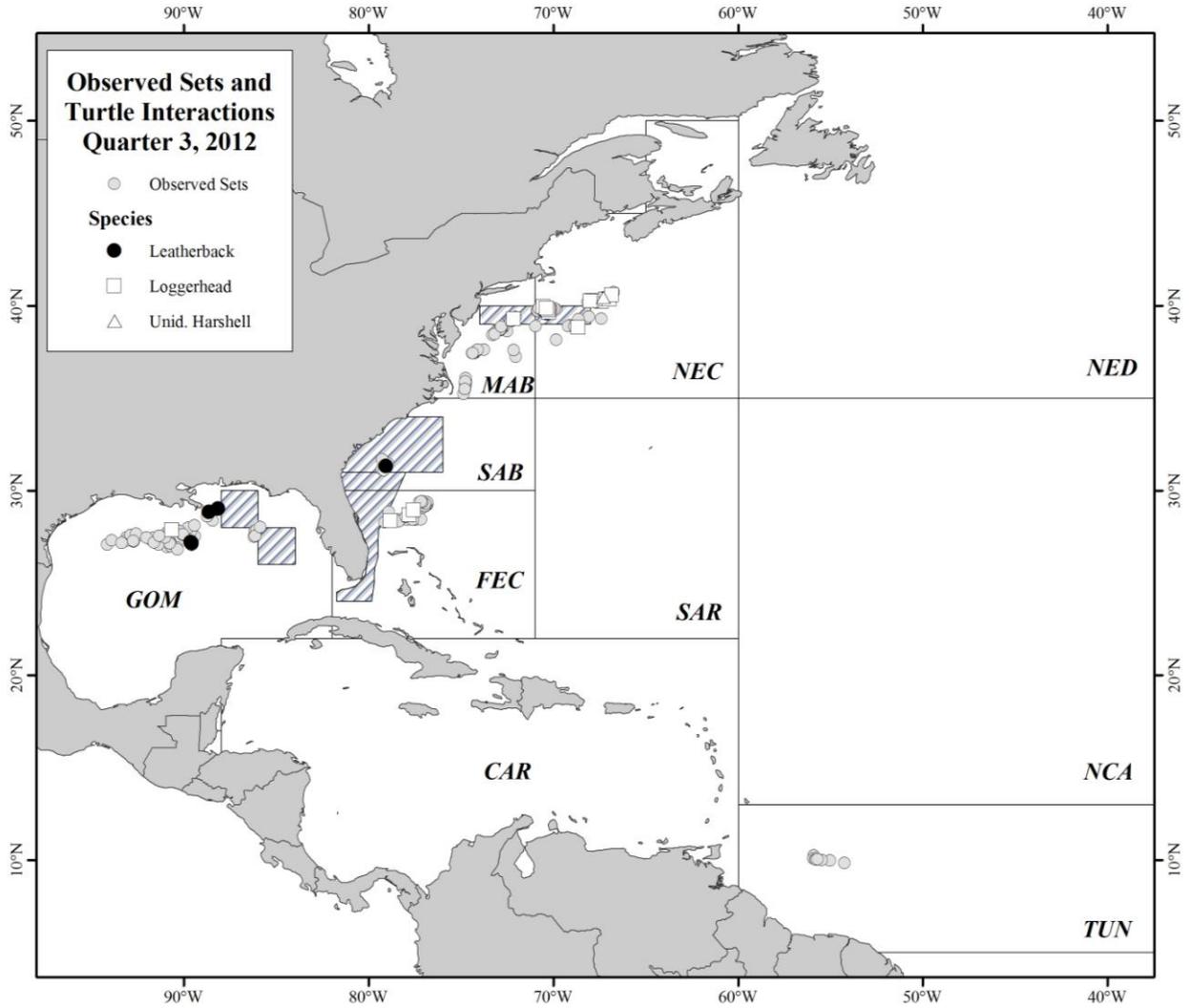
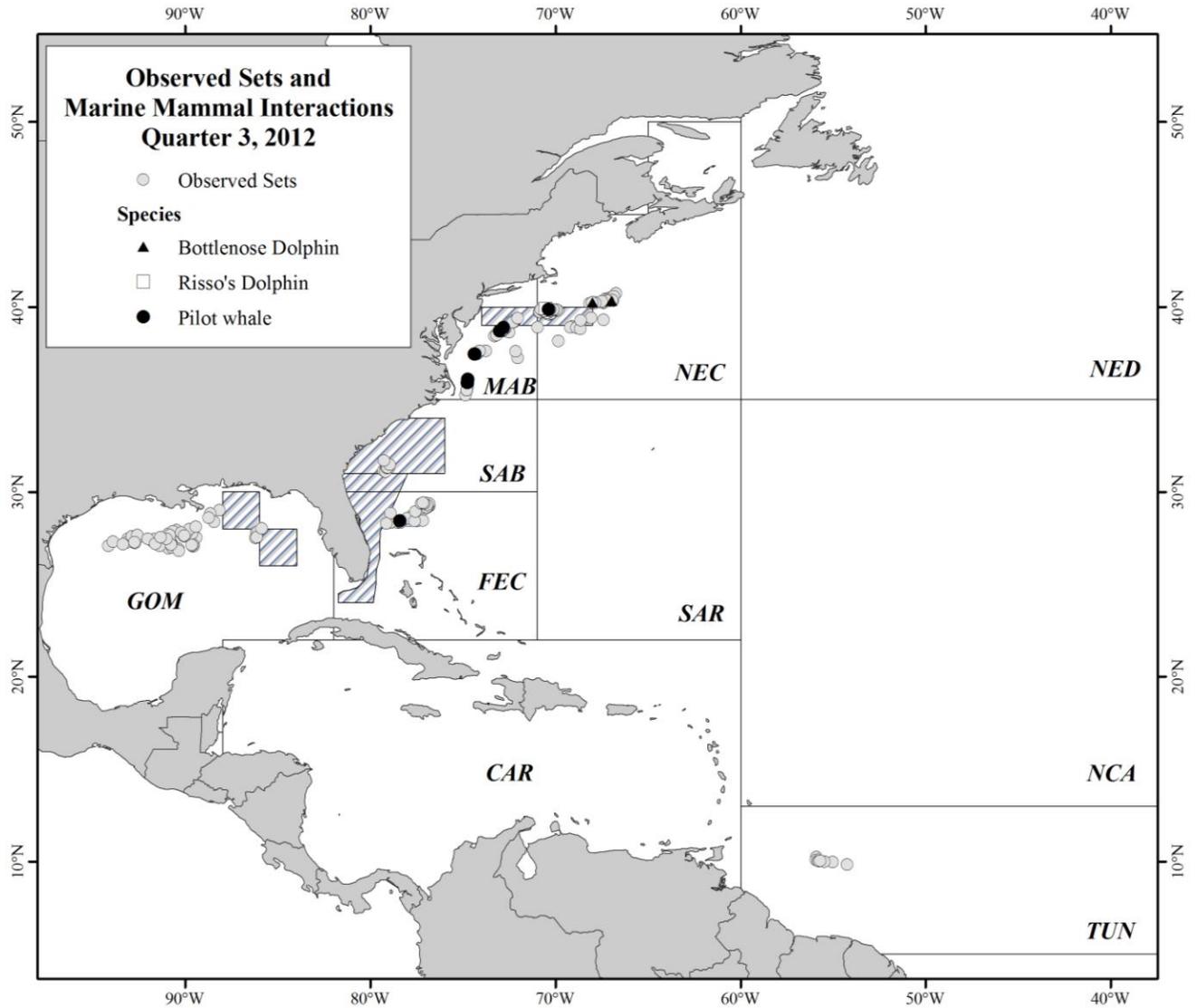


Figure 2. Observed Pelagic Longline effort and marine mammal interactions between 1 July and 30 September, 2012. Pelagic longline fishing areas include: CAR = Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic Bight, NEC = Northeast 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 July and 30 September, 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	Mackerel	239	Alive, uninjured	Released alive	Not hooked	N/A	Yes	No	0.0	V	D	6.0		
2	NEC	C-16/0	10	Squid	257	Alive, uninjured	Released alive	Not hooked	N/A	Yes	No	0.0	V	D	5.0		
3	GOM	C-16/0	0	Squid	153	Alive, injured	Released alive	Shoulder	Yes	No	No	0.0	I	D	5.0		
4	NEC	C-18/0	10	Squid	248	Alive, injured	Released alive	Front flipper	No	Yes	Yes	11.0	I	A	4.0		
5	NEC	C-16/0	10	Squid or mackerel	207 or 378	Alive, uninjured	Released alive	Not hooked	N/A	Yes	No	0.0	V	D	5.0		
6	GOM	C-16/0	0	Squid	180	Alive, injured (line abrasions)	Released alive	Not hooked	N/A	Yes	No	0.0	V	D	6.0		
7	NEC	C-16/0	10	Squid or mackerel	252 or 356	Alive, unknown	Released alive	Not known if hooked	Unknown	Yes	Unknown	Unknown	IV	A	5.0		
8	NEC	C-18/0 or C-16/0	10 or 0	Squid	239	Alive, unknown	Released alive	Not known if hooked	No	Unknown	Unknown	60.0	IV	A	4.0		
9	NEC	C-18/0 or C-16/0	10 or 0	Squid	239	Alive, unknown	Released alive	Not known if hooked	No	Unknown	Unknown	52.0	IV	A	5.0		
10	GOM	C-16/0	0	Squid	180	Alive, injured	Released alive	Front flipper	Yes	Yes	No	0.0	I	D	3.5		
11	GOM	C-16/0	0	Squid	189	Alive, injured	Released alive	Armpit	No	No	No	2.0	I	C	4.5		
12	GOM	C-16/0	0	Squid	180	Alive, injured	Released alive	Rear flipper	Yes	Yes	No	0.0	I	D	5.5		

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	NEC	C-18/0	10	Squid	185	Alive, injured	Released alive	Swallowed, hook partially visible	Yes	No	No	0.0	III	D		83.5	
2	FEC	C-18/0	0	Squid	189	Alive, injured	Released alive	Beak internal, lower jaw	Yes	No	No	0.0	I	D		68.8	60.6
3	NEC	C-16/0	10	Squid	257	Alive, injured	Released alive	Swallowed, hook not visible	No	No	No	0.2	IV	C		60.1	52.6
4	NEC	C-16/0	10	Squid	252	Alive, injured	Released alive	Swallowed, hook not visible	No	No	No	0.1	IV	C		67.0	60.1
5	NEC	C-16/0	10	Squid	261	Alive, injured	Released alive	Beak internal, lower jaw	Yes	No	No	0.0	1	D		75.0	67.9
6	NEC	C-16/0	10	Squid	252	Alive, injured	Released alive	Mouth, side, other	Yes	No	No	0.0	II	D		57.2	50.6
7	NEC	C-16/0	10	Squid	252	Alive, injured	Released alive	Swallowed, hook partially visible	Yes	No	No	0.0	III	D		67.9	61.4
8	NEC	C-16/0	10	Squid	252	Alive, injured	Released alive	Swallowed, hook partially visible	Yes	No	No	0.0	III	D		60.0	54.6
9	NEC	C-18/0 or C-16/0	10 or 0	Squid	239	Alive, injured	Released alive	Unknown internal	No	No	No	3.0	IV	B	2.0		
10	NEC	C-16/0	0	Squid	243	Alive, injured	Released alive	Front flipper	Yes	No	No	0.0	I	D	2.0		
11	NEC	C-16/0	10	Squid or mackerel	230 or 324	Alive, injured	Released alive	Swallowed, hook partially visible	No	No	No	0.0	III	C		70.1	64.6

A2. Loggerhead 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)
12	NEC	C-16/0	10	Squid or mackerel	230 or 324	Alive, injured	Released alive	Swallowed, hook not visible	No	No	No	0.2	IV	C		59.8	52.7
13	FEC	C-16/0	0	Squid	180	Alive, injured	Released alive	Swallowed, hook not visible	No	No	No	0.5	IV	C	2.0		
14	FEC	C-18/0	0	Squid	176	Alive, injured	Released alive	Beak external, unknown	Yes	No	No	0.0	I	D	4.5		
15	NEC	C-16/0	0	Squid	239	Alive, injured	Released alive	Tongue	Yes	No	No	0.0	III	D		60.7	55.7
16	NEC	C-16/0	10	Squid	248	Alive, injured	Released alive	Tongue	Yes	No	No	0.0	III	D		66.0	60.0
17	NEC	C-18/0 or C-16/0	10 or 0	Squid	239	Alive, injured	Released alive	Swallowed, hook not visible	No	No	No	0.4	IV	C			59.5
18	MAB	C-16/0	0	Squid	131	Alive, injured	Released alive	Mouth, side, other	Yes	No	No	0.0	II	D	4.0		
19	GOM	C-16/0	0	Squid	153	Alive, unknown	Released alive	Not known if hooked	No	Unknown	Unknown	144.0	IV	A	4.0		
20	NEC	C-18/0	10	Squid	167	Alive, uninjured	Released alive	Not hooked, holding bait	Yes	No	No	0.0	V	D	2.5		
21	NEC	C-18/0	10	Squid	167	Alive, uninjured	Released alive	Not hooked, holding bait	Yes	No	No	0.0	V	D	4.0		
22	NEC	C-18/0	10	Squid	144	Alive, injured	Released alive	Mouth, side, unknown	No	No	No	0.5	III	C	3.0		

A3. Unidentified 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	NEC	C-18/0	10	Squid or mackerel	171 or 297	Alive, unknown	Released alive	Not known if hooked	No	Unknown	Unknown	17.0	IV	A	4.0		