

Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery from 1 October to 31 December, 2009

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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, 2009.

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 2009 is compared to that observed in quarter 4 during the three year period prior to (2002-2004) and the period after (2005-2008) implementation of regulations 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 200 longline sets (~170,000 hooks) were observed during the fourth quarter of 2009 (Table 1) during normal fishing effort with only circle hooks (16/0 and 18/0) recorded. The level of effort in the SAR fishing area and the exact total cannot be reported due

to confidentiality restrictions. The majority of the observed sets occurred in the GOM fishing area (Figure 1).

In addition, a cooperative research program with NOVA Southeastern University was conducted that included longline fishing inside and outside of areas normally closed to fishing in the FEC area. Effort levels cannot be reported since fewer than 3 vessels were observed (Table 1). The experimental fishing, and associated bycatch, is not included in estimates of bycatch rates because they are not representative of the normal fishing effort.

The locations of observed sets and turtle interactions are shown in Figure 1. During normal fishing, there were 4 observed interactions with leatherback turtles and 6 observed interactions with loggerhead turtles (Table 2). There were no interactions with turtles in experimental fishing. 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. Of the 4 leatherback turtles released alive, 3 were released with either all gear removed or with the hook and trailing line less than one-half of the carapace length. One leatherback was released hooked with trailing line >50% of carapace length. Of the captured loggerhead turtles, 4 were released alive with all gear removed or with the hook and trailing line less than one-half the carapace length, and 2 were released hooked with trailing line >50% of carapace length (Table 3).

The quarterly and regional bycatch rates are summarized for sea turtles in Table 4. These rates were compared with those from the same quarter/area for 2002-2004 before the implementation of the circle hook regulations and the average for same quarter/area for 2005-2008 after implementation (Table 5).

For leatherback turtles, the observed bycatch rate in GOM during 2009 was lower than that observed during the fourth quarter in 2002-2004 and 2005-2008. The bycatch rate in the SAB was unusually high, as leatherback bycatch had not been observed in previous time periods. Bycatch was not observed in the MAB, NEC, or SAR during 2009, but it had been previously observed in these regions (Table 5a).

The observed bycatch rates for loggerhead turtles in 2009 were lower than those observed in prior years in the FEC, NEC, and SAR fishing areas. In the GOM, the bycatch rate was higher than the 2005-2008 period and was consistent with the rates during 2002-2004 (Table 5b).

A total of 5 marine mammals were observed interacting with longline fishing gear in the fourth quarter of 2009 (Table 6). Of these, 4 were classified as seriously injured based upon guidelines described in Angliss and DeMaster (1998), and there was one observed mortality of a common dolphin. Bycatch rates of marine mammals are summarized in tables 7 and 8. For marine mammals, the observation of bycatch of pantropical spotted dolphins observed in 2009 had not previously been observed in the Gulf of Mexico during quarter 4. The bycatch rates of pilot whales, common dolphin, and bottlenose dolphin in the MAB were all higher than in previous

years (Table 8). However, bycatch of other species was not observed during 2009 where it had been observed in prior years.

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 2009 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

Angliss, R.P. and D.P. DeMaster. 1998. Differentiating Serious and Non-Serious Injury of Marine Mammals Taken Incidental to Commercial Fishing Operations: Report of the Serious Injury Workshop 1-2 April 1997, Silver Spring, Maryland. NOAA Technical Memorandum NMFS-OPR-13: 48 p.

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.

Table 1. Number of sets and hooks observed in the U.S. Atlantic Pelagic Longline Fishery between 1 October and 31 December, 2009 by fishing area during (A) normal and (B) experimental fishery operations. NR indicates areas where effort cannot be reported due to confidentiality considerations.

A. Normal Fishing

Area	Sets	Hooks
CAR	0	0
FEC	23	15,571
GOM	77	59,375
MAB	48	43,253
NCA	0	0
NEC	22	23,935
NED	0	0
SAB	23	16,787
SAR	NR	NR
TUN	0	0
Total	NR	NR

B. Experimental Fishing

Area	Sets	Hooks
CAR	0	0
FEC	NR	NR
GOM	0	0
MAB	0	0
NCA	0	0
NEC	0	0
NED	0	0
SAB	0	0
SAR	0	0
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, 2009 by fishing area during (A) normal and (B) experimental fishing operations. Areas with missing values indicate no observer coverage during this time period.

A. Normal Fishing

Area	Leatherback	Loggerhead
CAR	-	-
FEC	0	2
GOM	1	2
MAB	0	0
NCA	-	-
NEC	0	1
NED	-	-
SAB	3	0
SAR	0	1
TUN	-	-
Total	4	6

B. Experimental Fishing

Area	Leatherback	Loggerhead
CAR	-	-
FEC	0	0
GOM	-	-
MAB	-	-
NCA	-	-
NEC	-	-
NED	-	-
SAB	-	-
SAR	-	-
TUN	-	-
Total	0	0

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, 2009.

Release Status	Leatherback	Loggerheads
Released entangled	0	0
Released with hook and line $\geq \frac{1}{2}$ carapace length	1	2
Released with hook and line $< \frac{1}{2}$ carapace length	2	1
Released with all gear removed	1	3

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, 2009 in the U.S. Atlantic Pelagic Longline Fishery during normal fishing operations. 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	23	0	0	-	-
GOM	Alive	77	1	0.0147	1.0000	0.0029 – 0.07512
MAB	Alive	48	0	0	-	-
NCA	Alive	0	-	-	-	-
NEC	Alive	22	0	0	-	-
NED	Alive	0	-	-	-	-
SAB	Alive	23	2	0.1706	1.0000	0.0489 – 0.5950
SAR	Alive	NR	0	0	-	-
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	23	2	0.0967	0.6949	0.0282 – 0.3308
GOM	Alive	77	2	0.0338	0.7024	0.0098 – 0.1170
MAB	Alive	48	0	0	-	-
NCA	Alive	0	-	-	-	-
NEC	Alive	22	1	0.0365	1.0000	0.0071 – 0.1867
NED	Alive	0	-	-	-	-
SAB	Alive	23	0	0	-	-
SAR	Alive	NR	1	0.1423	1.0000	0.0278 – 0.7275
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, 2009 compared to the third quarter average rate from 2002-2004 and from 2005-2008. 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	2002-2004 CPUE	2002-2004 95% CI	2005-2008 CPUE	2005-2008 95% CI	2009 CPUE	2009 95% CI
CAR	0	-	-	-	-	-
FEC	0	-	0	-	0	-
GOM	0.2300	0.0151 – 0.3503	0.1021	0.066 – 0.1583	0.0147	0.0029 – 0.07512
MAB	0.1423	0.0796 – 0.2542	0.0665	0.0374 – 0.118	0	-
NCA	-	-	-	-	-	-
NEC	0.2807	0.1476 – 0.5340	0.1099	0.0334 – 0.3611	0	-
NED	-	-	0.2324	0.1456 – 0.3708	-	-
SAB	0	-	0	-	0.1706	0.0489 – 0.5950
SAR	-	-	0.2385	0.1136 – 0.5005	0	-
TUN	-	-	0.0597	0.0122 – 0.2916	-	-

B. Loggerhead Turtles

Area	2002-2004 CPUE	2002-2004 95% CI	2005-2008 CPUE	2005-2008 95% CI	2009 CPUE	2009 95% CI
CAR	0.2451	0.0501 – 1.1981	-	-	-	-
FEC	0.5612	0.1756 – 1.7933	0.3183	0.1198 – 0.8457	0.0967	0.0282 – 0.3308
GOM	0.0350	0.0135 – 0.0905	0.0044	0.0009 – 0.0214	0.0338	0.0098 – 0.1170
MAB	0.1436	0.0805 – 0.2561	0.0419	0.0182 – 0.0967	0	-
NCA	-	-	-	-	-	-
NEC	0.0914	0.0279 – 0.2991	0	-	0.0365	0.0071 – 0.1867
NED	-	-	0.2142	0.1269 – 0.3617	-	-
SAB	0.4673	0.1544 – 1.4142	0	-	0	-
SAR	-	-	0.1932	0.0701 – 0.5323	0.1423	0.0278 – 0.7275
TUN	-	-	0	-	-	-

Table 6. Interactions with marine mammals observed during 1 October – 31 December, 2009 in the U.S. Atlantic Pelagic Longline Fishery by fishing area. Observer comments and criteria described in Angliss and DeMaster (1998) were used to evaluate serious injury.

Species	Region	# Released Un-injured	# Dead	# Serious Injury
Pantropical Spotted Dolphin	GOM	0	0	1
Bottlenose Dolphin	MAB	0	0	1
Common Dolphin	MAB	0	1	0
Pilot Whale	MAB	0	0	2

Table 7. Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area and quarter during 1 October – 31 December, 2009 in the U.S. Atlantic Pelagic Longline Fishery during normal fishing operations. CV indicates the coefficient of variation of the estimated rate. M in “Serious Injury” indicates a mortality.

Species	Serious Injury?	Area	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
Pantropical Spotted Dolphin	Y	GOM	77	1	0.0169	1.0000	0.0033 – 0.0864
Bottlenose Dolphin	Y	MAB	48	1	0.0207	1.0000	0.0040 – 0.1057
Common Dolphin	M	MAB	48	1	0.0207	1.0000	0.0040 – 0.1057
Pilot Whale	Y	MAB	48	2	0.3987	1.0000	0.0116 – 0.1382

Table 8. Bycatch rates for marine mammals in the U.S. Atlantic Pelagic Longline Fishery between 1 October and 31 December, 2009 compared to the third quarter average rate from 2002-2004 and the average rate from 2005-2008. 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	2002-2004 CPUE	2002-2004 95% CI	2005-2008 CPUE	2005-2008 95% CI	2009 CPUE	2009 95% CI
Pantropical Spotted Dolphin	GOM	0	-	0	-	0.0169	0.0033 – 0.0864
Bottlenose Dolphin	MAB	0	-	0.0070	0.0014 – 0.0341	0.0207	0.0040 – 0.1057
Common Dolphin	MAB	0.0313	0.0064 – 0.1531	0	-	0.0207	0.0040 – 0.1057
Risso's Dolphin	MAB	0.1274	0.0658 – 0.2465	0.0271	0.0110 – 0.0670	0	-
Pilot Whale	MAB	0.1969	0.0797 – 0.4867	0.1148	0.0596 – 0.2210	0.3987	0.0116 – 0.1382
Un-identified Dolphin	MAB	0	-	0.0128	0.0038 – 0.0430	0	-
Un-identified Marine Mammal	MAB	0	-	0.0247	0.0087 – 0.0700	0	-
Risso's Dolphin	NEC	0.2438	0.1178 – 0.5046	0.0476	0.0097 – 0.2327	0	-
Un-identified Dolphin	SAR	-	-	0.0441	0.0090 – 0.2155	0	-
Atlantic Spotted Dolphin	SAR	-	-	0.0735	0.0150 – 0.3592	0	-
Pilot Whale	TUN	-	-	0.0673	0.0138 – 0.3292	-	-

Figure 1. Pelagic Longline effort and turtle interactions observed between 1 October and 31 December 2009. 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 closed areas in the DeSoto Canyon (A) and the Florida East Coast (B) are indicated.

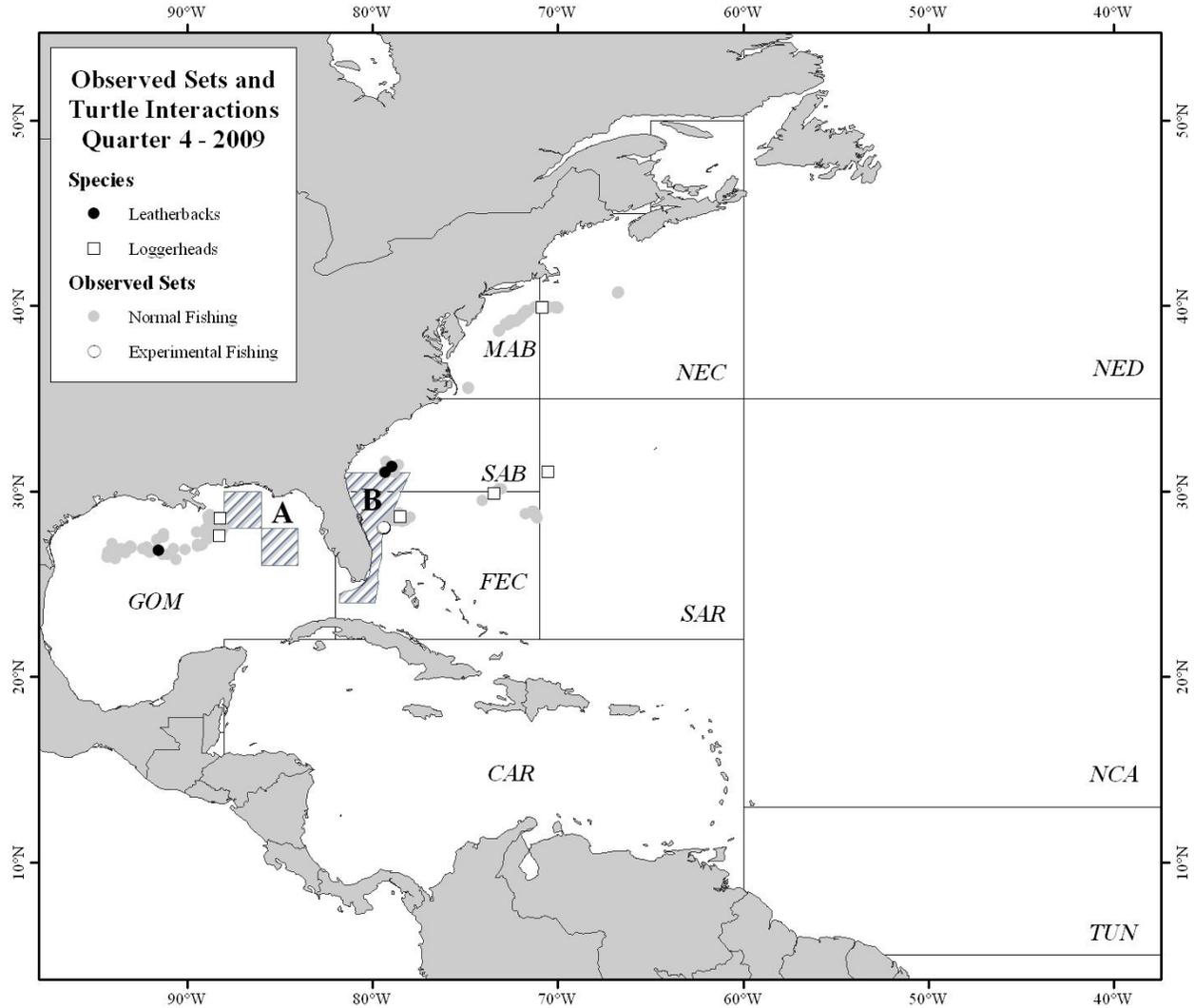
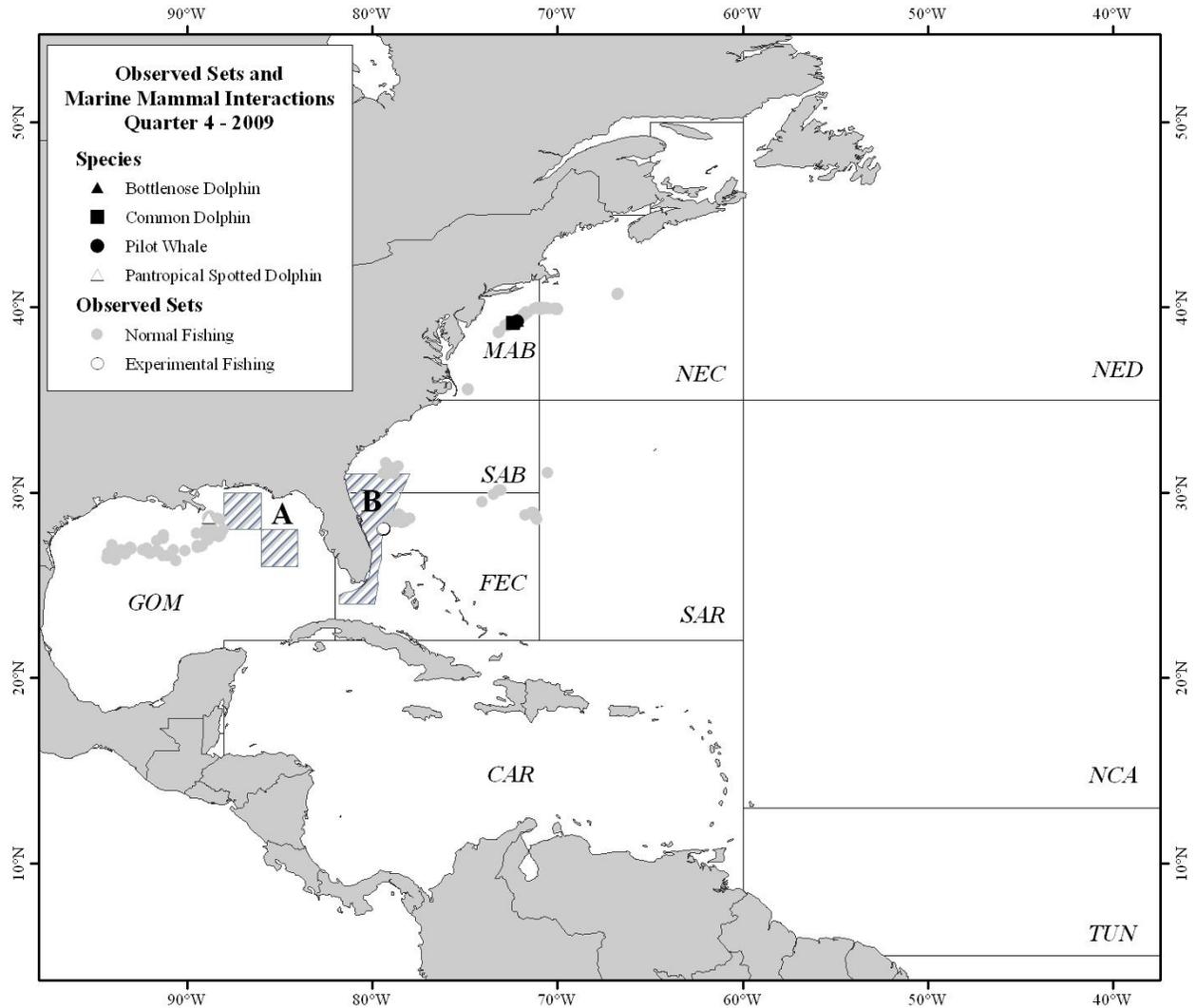


Figure 2. Pelagic Longline effort and marine mammal interactions observed between 1 October and 31 December, 2009. Pelagic longline fishing areas include: CAR = Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic Bight, NEC = Northeast Coastal, NED = Northeast Distant, NCA = North Central Atlantic, TUN = Tuna North. Year-round closed areas in the DeSoto Canyon (A) and the Florida East Coast (B) are indicated.



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, 2009.

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)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	SAB	C-18/0	10	Squid	255	Alive, uninjured	Released alive	not hooked	N/a	Yes	No	1.00	4.50		
2	SAB	C-18/0	10	Mackerel	282	Alive, injured	Released alive	plastron	No	No	No	1.00	5.50		
3	GOM	C-16/0	0	Squid	198	Alive, injured	Released alive	shoulder	No	No	No	0.10	5.00		
4	SAB	C-18/0	10	Mackerel	347	Alive, injured	Released alive	shoulder	No	No	No	8.00	5.00		

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)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	GOM	C-16/0	0	Squid	176	Alive, injured	Released alive	mouth, lower, other	No	No	No	5.00	2.50		
2	GOM	C-16/0	0	Squid	194	Alive, injured	Released alive	head external	No	No	No	4.00	2.50		
3	FEC	C-16/0	0	Squid	288	Alive, injured	Released alive	mouth, lower, other	Yes	No	No	0.00		78.4	
4	NEC	C-18/0	10	Squid	266	Alive, injured	Released alive	swallowed, hook not visible	No	No	No	0.10		77	65.4
5	SAR	C-18/0	10	Squid or Mackerel	248 or 243	Alive, injured	Released alive	mouth, lower, other	Yes	No	No	0.00		86	77
6	FEC	C-18/0	10	Squid or Mackerel	248 or 243	Alive, injured	Released alive	mouth, lower, other	Yes	No	No	0.00		63	59