

# **Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery from 1 January to 30 June, 2010**

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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 January to 30 June, 2010.

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 quarters 1 and 2 of 2010 are compared to that observed in during the three year period prior to (2002-2004) and the period after (2005-2009) 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**

Approximately 240 sets (~190,000 hooks) were observed during the first quarter and 329 sets (235,416 hooks) were observed during the second quarter (Table 1) with only circle hooks (16/0 and 18/0) recorded. The exact effort levels cannot be reported due to confidentiality restrictions.

The majority of the observed sets occurred in the GOM fishing area during enhanced coverage of the fishery with the intent to document catch of bluefin tuna (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 SAB and FEC areas. Effort levels cannot be reported since fewer than 3 vessels were observed (Table 1). Additional experimental fishing to examine the effectiveness of “weak hooks” was conducted in the GOM. 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 7 observed interactions with leatherback turtles and 5 observed interactions with loggerhead turtles during quarter 1 (Table 2). During quarter 2, there were 8 observed leatherback interactions and 5 with loggerheads (Table 2). There were no interactions with turtles during 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. During quarter 1, 6 of 7 leatherback turtles were released with either all gear removed or with the hook and trailing line less than one-half of the carapace length, and all 5 loggerhead turtles were released in these categories (Table 3). During quarter 2, 6 of 8 leatherbacks and all 5 loggerheads were released with minimal or no gear attached (Table 3). There was one leatherback turtle released entangled during quarter 2.

The quarterly and regional bycatch rates are summarized for sea turtles in Tables 4 and 6. 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 2005-2009 after implementation (Tables 5 and 7).

For leatherback turtles, the bycatch rate during quarter 1 of 2010 was lower than that for the 2002-2004 period for all areas except for CAR. The bycatch rate for 2010 was consistent with that for 2005-2009 with no statistically significant differences with the exception of the CAR region where the 2010 bycatch rate was much higher than historical averages. The TUN area was not observed in 2010 but did have bycatch of leatherbacks in prior years (Table 5a). Loggerhead turtle bycatch rates for quarter 1 of 2010 were also lower than those for 2002-2004 for all areas. The 2010 rates were consistent with those from 2005-2009. However, the bycatch rate for the SAR region was elevated relative to the recent averages, though this difference was not statistically significant (Table 5b).

During quarter 2, the 2010 bycatch rates for leatherback turtles were lower than the 2002-2004 and 2005-2009 averages in all areas with the exception of NEC (Table 7a). For loggerhead turtles, bycatch rates for 2010 were lower than the 2002-2004 period and were lower than those for 2005-2009 (Table 7b).

Four marine mammals were observed during the first quarter. This included an unidentified pilot whale in the FEC and a Minke whale in the SAB. A pantropical spotted dolphin and an unidentified marine mammal were observed in the Gulf of Mexico (Table 8a, Table 9a). During quarter 2, 4 marine mammals were observed caught in the Gulf of Mexico including a bottlenose dolphin in the experimental portion of the fishery. One pygmy sperm whale mortality was observed in the Gulf. In the MAB area, there was a very high catch rate of pilot whales, owing to one set where three animals were caught (Table 8b, 9b). The catch rates during quarter 1 reflect low frequency events that have been rarely observed in the past. There had been relatively high bycatch of pilot whales in the MAB during quarter 1 over the last several years, but no observed bycatch in quarter 1 of 2010 (Table 10). During quarter 2, the bycatch of bottlenose dolphin in the SAB and pilot whales in the MAB were higher than in recent years (Table 11). The observed interactions with marine mammals in the GOM continue the pattern of recent years where occasional interactions are observed with a diverse group of species associated with the very large numbers of sets observed during the enhanced coverage for bluefin tuna research.

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 2010 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 January and 30 June, 2010 by fishing area and quarter during (A) normal and (B) experimental fishery operations. NR indicates areas where effort cannot be reported due to confidentiality considerations.

**A. Normal Fishing**

	Quarter 1		Quarter 2	
Area	Sets	Hooks	Sets	Hooks
CAR	14	11,651	NR	NR
FEC	25	19,284	44	27,597
GOM	151	115,938	214	142,296
MAB	NR	NR	NR	NR
NCA	0	0	0	0
NEC	0	0	NR	NR
NED	0	0	0	0
SAB	16	10,106	52	47,807
SAR	18	16,213	NR	NR
TUN	0	0	0	0
<b>Total</b>	<b>NR</b>	<b>NR</b>	<b>329</b>	<b>235,416</b>

**B. Experimental Fishing**

	Quarter 1		Quarter 2	
Area	Sets	Hooks	Sets	Hooks
CAR	0	0	0	0
FEC	NR	NR	NR	NR
GOM	NR	NR	NR	NR
MAB	0	0	0	0
NCA	0	0	0	0
NEC	0	0	0	0
NED	0	0	0	0
SAB	0	0	NR	NR
SAR	0	0	0	0
TUN	0	0	0	0
<b>Total</b>	<b>23</b>	<b>16,855</b>	<b>60</b>	<b>43,171</b>

**Table 2.** Total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets beginning between 1 January and 30 June, 2010 by fishing area and quarter during (A) normal and (B) experimental fishing operations. Areas with missing values indicate no observer coverage during this time period.

**A. Normal Fishing**

Quarter 1			Quarter 2	
Area	Leatherback	Loggerhead	Leatherback	Loggerhead
CAR	2	2	0	0
FEC	1	1	0	0
GOM	3	0	7	1
MAB	0	0	0	0
NCA	-	-	-	-
NEC	-	-	1	1
NED	-	-	-	-
SAB	1	0	0	3
SAR	0	2	0	0
TUN	-	-	-	-
<b>Total</b>	<b>7</b>	<b>5</b>	<b>8</b>	<b>5</b>

**B. Experimental Fishing**

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

**Table 3.** Release status and gear removal for sea turtles captured in the U.S. Atlantic Pelagic Longline Fishery during (A) 1 January – 31 March 2010, and (B) 1 April – 30 June, 2010.

**A. Quarter 1**

<b>Release Status</b>	<b>Leatherback</b>	<b>Loggerheads</b>
Released entangled	0	0
Released with hook and line $\geq \frac{1}{2}$ carapace length	1	0
Released with hook and line $\leq \frac{1}{2}$ carapace length	4	3
Released with all gear removed	2	2

**B. Quarter 2**

<b>Release Status</b>	<b>Leatherback</b>	<b>Loggerheads</b>
Released entangled	1	0
Released with hook and line $\geq \frac{1}{2}$ carapace length	1	0
Released with hook and line $\leq \frac{1}{2}$ carapace length	1	1
Released with all gear removed	5	4

**Table 4.** Estimated bycatch rate (Catch per 1,000 hooks) for (A) Leatherback and (B) Loggerhead turtles by geographic area and between 1 January and 31 March, 2010 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. Quarter 1: Leatherback Turtles**

Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
CAR	Alive	14	1	0.1483	1.0000	0.0290 – 0.7585
FEC	Alive	25	1	0.0702	1.0000	0.0137 – 0.3588
GOM	Alive	151	2	0.0237	0.7348	0.0065 – 0.0860
MAB	Alive	NR	0	0	-	-
NCA	Alive	0	-	-	-	-
NEC	Alive	0	-	-	-	-
NED	Alive	0	-	-	-	-
SAB	Alive	16	1	0.0671	1.0000	0.0131 – 0.3429
SAR	Alive	18	0	0	-	-
TUN	Alive	0	-	-	-	-

**B. Quarter 1: Loggerhead Turtles**

Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
CAR	Alive	14	1	0.1841	1.0000	0.0360 – 0.9413
FEC	Alive	25	1	0.0339	1.0000	0.0066 – 0.1733
GOM	Alive	151	0	0	-	-
MAB	Alive	NR	0	0	-	-
NCA	Alive	0	-	-	-	-
NEC	Alive	0	-	-	-	-
NED	Alive	0	-	-	-	-
SAB	Alive	16	0	0	-	-
SAR	Alive	18	1	0.1097	0.6934	0.0321 – 0.3744
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 January and 31 March, 2010 compared to the first quarter average rate from 2002-2004 and from 2005-2009. 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. Quarter 1: Leatherback turtles**

Area	2002-2004 CPUE	2002-2004 95% CI	2005-2009 CPUE	2005-2009 95% CI	2010 CPUE	2010 95% CI
CAR	0.0372	0.0073 – 0.1902	0	-	0.1483	0.0290 – 0.7585
FEC	0.1895	0.1125 – 0.3192	0.1025	0.0503 – 0.2087	0.0702	0.0137 – 0.3588
GOM	0.1480	0.0961 – 0.2277	0.0349	0.0200 – 0.0611	0.0237	0.0065 – 0.0860
MAB	0.0472	0.0092 – 0.2415	0	-	0	-
NCA	0	-	-	-	-	-
NEC	-	-	-	-	-	-
NED	-	-	-	-	-	-
SAB	0.7970	0.2685 – 2.365	0.0527	0.0175 – 0.1588	0.0671	0.0131 – 0.3429
SAR	0.1262	0.0592 – 0.2692	0.0238	0.0047 – 0.1219	0	-
TUN	-	-	0.0476	0.0093 – 0.2435	-	-

**B. Quarter 1: Loggerhead Turtles**

Area	2002-2004 CPUE	2002-2004 95% CI	2005-2009 CPUE	2005-2009 95% CI	2010 CPUE	2010 95% CI
CAR	0.2845	0.1549 – 0.5227	0.2854	0.1081 – 0.7535	0.1841	0.0360 – 0.9413
FEC	0.2954	0.1877 – 0.4648	0.0531	0.0240 – 0.1174	0.0339	0.0066 – 0.1733
GOM	0.0066	0.0013 – 0.0337	0.0051	0.0015 – 0.01778	0	-
MAB	0.1372	0.0495 – 0.3802	0.0186	0.0036 – 0.0951	0	-
NCA	0.1612	0.0524 – 0.4955	-	-	-	-
NEC	-	-	-	-	-	-
NED	-	-	-	-	-	-
SAB	0.1131	0.0221 – 0.5781	0.0880	0.0353 – 0.2205	0	-
SAR	0.5604	0.3500 – 0.8973	0.0699	0.0249 – 0.1965	0.1097	0.0321 – 0.3744
TUN	-	-	0	-	-	-

**Table 6.** 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, 2010 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. Quarter 2: Leatherback Turtles**

Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
CAR	Alive	NR	0	0	-	-
FEC	Alive	44	0	0	-	-
GOM	Alive	214	7	0.0450	0.3795	0.0219 – 0.0922
MAB	Alive	NR	0	0	-	-
NCA	Alive	0	-	-	-	-
NEC	Alive	NR	1	0.0958	1.0000	0.0187 – 0.4898
NED	Alive	0	-	-	-	-
SAB	Alive	52	0	0	-	-
SAR	Alive	NR	0	0	-	-
TUN	Alive	0	-	-	-	-

**B. Quarter 2: Loggerhead Turtles**

Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
CAR	Alive	NR	0	0	-	-
FEC	Alive	44	0	0	-	-
GOM	Alive	214	1	0.0075	1.0000	0.0015 – 0.0383
MAB	Alive	NR	0	0	-	-
NCA	Alive	0	-	-	-	-
NEC	Alive	NR	1	0.0958	1.0000	0.0187 – 0.4898
NED	Alive	0	-	-	-	-
SAB	Alive	52	3	0.0652	0.5678	0.0231 – 0.1839
SAR	Alive	NR	0	0	-	-
TUN	Alive	0	-	-	-	-

**Table 7.** Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic Pelagic Longline fishery between 1 April and 30 June, 2010 compared to the first quarter average rate from 2002-2004 and from 2005-2009. 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. Quarter 2: Leatherback turtles**

Area	2002-2004 CPUE	2002-2004 95% CI	2005-2009 CPUE	2005-2009 95% CI	2010 CPUE	2010 95% CI
CAR	0.0598	0.0117 – 0.3058	0.0789	0.0154 – 0.4035	0	-
FEC	0.1847	0.0498 – 0.6845	0.0449	0.0121 – 0.1669	0	-
GOM	0.2920	0.2104 – 0.4054	0.0996	0.0820 – 0.1211	0.0450	0.0219 – 0.0922
MAB	0.3561	0.1710 – 0.7413	0.0649	0.01883 – 0.2242	0	-
NCA	0.0384	0.0075 – 0.1964	0	-	-	-
NEC	0.0814	0.0159 – 0.4162	0.3223	0.1368 – 0.7591	0.0958	0.0187 – 0.4898
NED	-	-	-	-	-	-
SAB	0.0437	0.0152 – 0.1251	0.0055	0.0011 – 0.0283	0	-
SAR	0	-	0	-	0	-
TUN	-	-	0	-	-	-

**B. Quarter 2: Loggerhead Turtles**

Area	2002-2004 CPUE	2002-2004 95% CI	2005-2009 CPUE	2005-2009 95% CI	2010 CPUE	2010 95% CI
CAR	0.0575	0.0112 – 0.2937	0	-	0	-
FEC	0.2195	0.0549 – 0.8774	0.0996	0.03967 – 0.2501	0	-
GOM	0.0582	0.0299 – 0.1131	0.0116	0.0068 – 0.0197	0.0075	0.0015 – 0.0383
MAB	0	-	0.0639	0.0185 – 0.2210	0	-
NCA	0.2324	0.0921 – 0.5867	0.0842	0.0165 – 0.4303	-	-
NEC	1.3817	0.6975 – 2.7374	0.1408	0.0419 – 0.4735	0.0958	0.0187 – 0.4898
NED	-	-	-	-	-	-
SAB	0.0714	0.0286 – 0.1779	0.0291	0.0115 – 0.0736	0.0652	0.0231 – 0.1839
SAR	0	-	0	-	0	-
TUN	-	-	0	-	-	-

**Table 8.** Interactions with marine mammals observed during (A) 1 January – 31 March 2010 and (B) 1 April – 30 June, 2010 in the U.S. Atlantic Pelagic Longline Fishery by fishing area. “Exp” indicates an experimental set. Observer comments and criteria described in Angliss and DeMaster (1998) were used to evaluate serious injury.

**A. Quarter 1**

<b>Species</b>	<b>Region</b>	<b># Released Un-injured</b>	<b># Dead</b>	<b># Serious Injury</b>
Pantropical Spotted Dolphin	GOM	1	0	0
Unidentified Marine Mammal	GOM	0	1	0
Pilot Whale	FEC	0	0	1
Minke Whale	SAB	1	0	0

**B. Quarter 2**

<b>Species</b>	<b>Region</b>	<b># Released Un-injured</b>	<b># Dead</b>	<b># Serious Injury</b>
Un-identified Dolphin	GOM	1	0	0
Bottlenose Dolphin	GOM (Exp.)	0	0	1
Unidentified Marine Mammal	GOM	0	0	1
Pygmy Sperm Whale	GOM	0	1	0
Pilot Whale	MAB	0	0	3
Bottlenose Dolphin	SAB	1	0	0

**Table 9.** Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area for (A) quarter 1 and (B) quarter 2 of 2010 in the U.S. Atlantic Pelagic Longline Fishery during normal fishing operations. CV indicates the coefficient of variation of the estimated rate. Type indicates Released Alive (Alive), Serious Injury (SI) and Mortality (Mort.).

**A. Quarter 1**

Species	Type	Area	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
Pilot Whale	SI	FEC	25	1	0.0702	1.000	0.0137 – 0.3588
Pantropical Spotted Dolphin	Alive	GOM	151	1	0.0078	1.000	0.0015 – 0.0401
Unidentified Marine Mammal	Mort.	GOM	151	1	0.0084	1.000	0.0017 – 0.0432
Minke Whale	Alive	SAB	16	1	0.1225	1.000	0.0240 – 0.6266

**B. Quarter 2**

Species	Type	Area	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
Unid. Dolphin	Alive	GOM	214	1	0.0065	1.000	0.0013 – 0.0334
Bottlenose Dolphin	SI	GOM (Exp.)	NR	1	0.0265	1.000	0.0052 – 0.1357
Unid. Marine Mammal	SI	GOM	214	1	0.0052	1.000	0.0010 – 0.0266
Pygmy Sperm Whale	Mort.	GOM	214	1	0.0052	1.000	0.0010 – 0.0265
Pilot Whale	SI	MAB	NR	1	0.8403	1.000	0.1643 – 4.297
Bottlenose Dolphin	Alive	SAB	52	1	0.0269	1.000	0.0053 – 0.1373

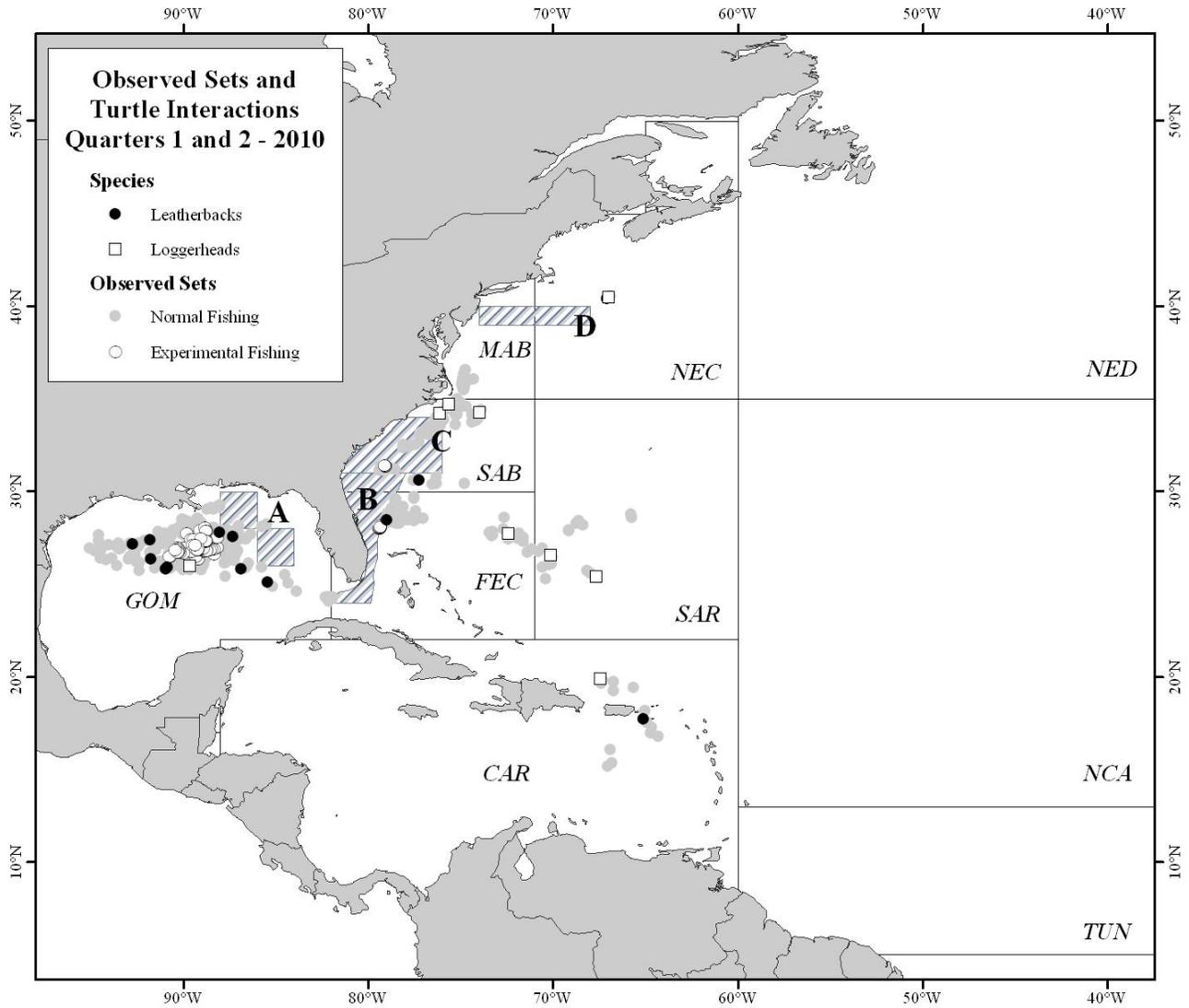
**Table 10.** Bycatch rates for marine mammals in the U.S. Atlantic Pelagic Longline Fishery between 1 January and 31 March, 2010 compared to the first quarter average rate from 2002-2004 and the average rate from 2005-2009. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (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	2005-2009 CPUE	2005-2009 95% CI	2010 CPUE	2010 95% CI
Beaked Whale	CAR	0.0544	0.0111 – 0.2660	0	-	0	-
Beaked Whale	SAR	0.0212	0.0044 – 0.1039	0	-	0	-
Bottlenose Dolphin	SAB	0	-	0.0122	0.0025 – 0.0594	0	-
Pantropical Spotted Dolphin	GOM	0	-	0	-	0.0078	0.0015 – 0.0401
Minke Whale	SAB	0	-	0	-	0.1225	0.0240 – 0.6266
Pilot Whale	CAR	0.061	0.0183 – 0.2011	0	-	0	-
Pilot Whale	FEC	0	-	0	-	0.0702	0.0137 – 0.3588
Pilot Whale	MAB	0.0527	0.0108 – 0.2578	0.2781	0.1251 – 0.6188	0	-
Risso's Dolphin	GOM	0	-	0.0061	0.0018 – 0.0206	0	-
Unid. Dolphin	GOM	0.0091	0.0019 – 0.0445	0	-	0	-
Unid. Marine Mammal	GOM	0	-	0	-	0.0084	0.0017 – 0.0432

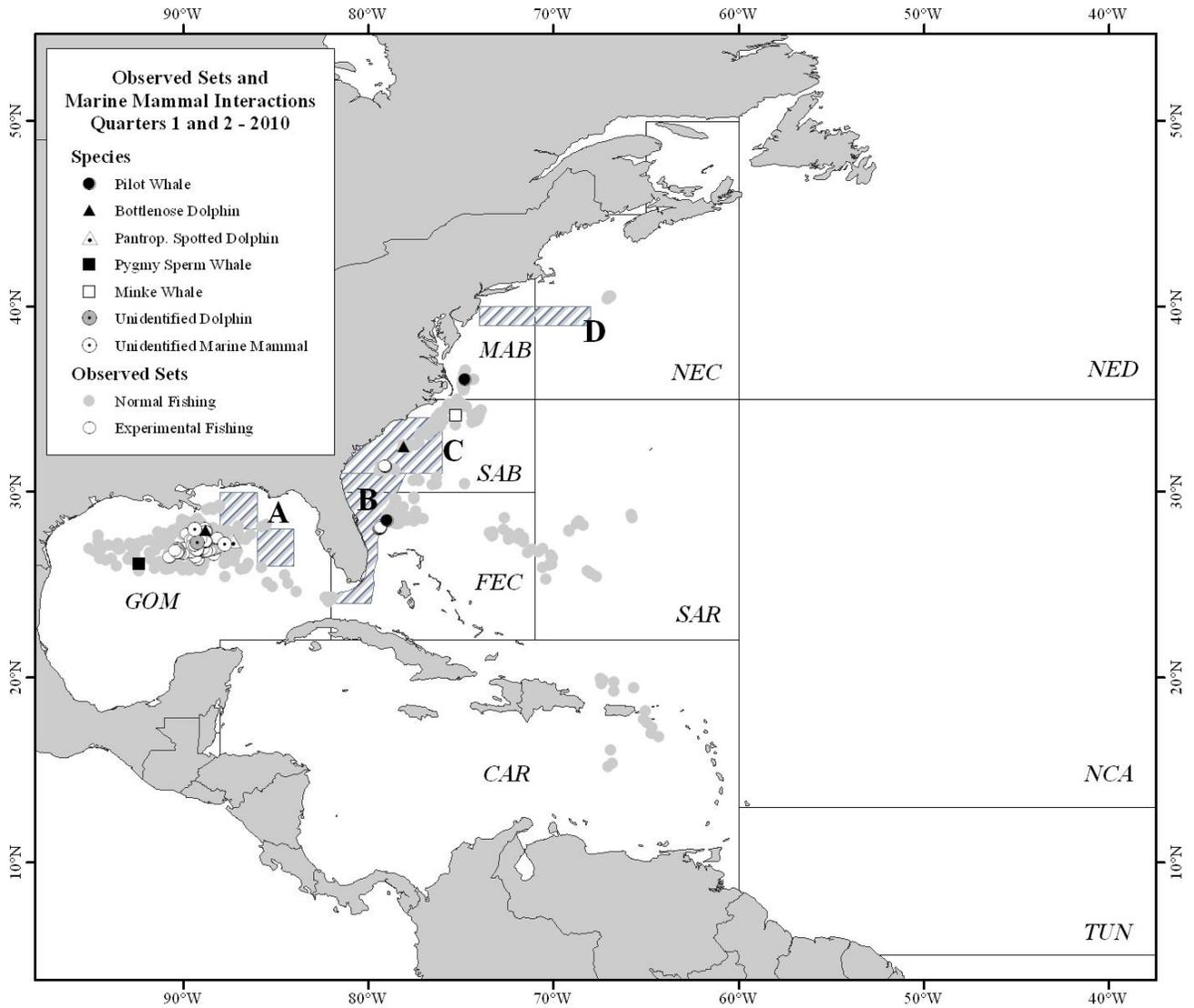
**Table 11.** Bycatch rates for marine mammals in the U.S. Atlantic Pelagic Longline Fishery between 1 April and 30 Jun, 2010 compared to the first quarter average rate from 2002-2004 and the average rate from 2005-2009. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (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	2005-2009 CPUE	2005-2009 95% CI	2010 CPUE	2010 95% CI
Atlantic Spotted Dolphin	MAB	0.0417	0.0085 – 0.2037	0	-	0	-
Beaked Whale	GOM	0	-	0.0006	0.0001 – 0.0031	0	-
Bottlenose Dolphin	GOM	0	-	0.0021	0.0006 – 0.0074	0	-
Bottlenose Dolphin	NCA	0.0384	0.0079 – 0.1877	0	-	-	-
Bottlenose Dolphin	SAB	0	-	0.0071	0.0015 – 0.03482	0.0269	0.0053 – 0.1373
Killer Whale	GOM	0	-	0.0015	0.0003 – 0.0072	0	-
Minke Whale	NEC	0.0882	0.0180 – 0.4311	0	-	-	-
Pantropical Spotted Dolphin	GOM	0	-	0.0023	0.0008 – 0.0064	0	-
Pilot Whale	GOM	0	-	0.0006	0.0001 – 0.0029	0	-
Pilot Whale	MAB	0.0338	0.0069 – 0.1652	0.0668	0.0201 – 0.2221	0.8403	0.1643 – 4.2967
Pygmy Sperm Whale	GOM	0	-	0	-	0.0052	0.0010 – 0.0265
Risso's Dolphin	GOM	0	-	0.0017	0.0005 – 0.0059	0	-
Risso's Dolphin	NEC	0.1389	0.0284 – 0.6789	0	-	0	-
Sperm Whale	GOM	0	-	0.0007	0.0001 – 0.0033	0	-
Unidentified Dolphin	GOM	0	-	0.0019	0.0007 -0.0054	0.0065	0.0013 – 0.0334
Unid. Marine Mammal	GOM	0	-	0	-	0.0052	0.0010 – 0.0267

**Figure 1.** Observed Pelagic Longline effort and turtle interactions between 1 January and 30 June, 2010. 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 as are seasonal closed areas in the SAB (C) and the mid-Atlantic (D).



**Figure 2.** Observed Pelagic Longline effort and marine mammal interactions between 1 January and 30 June, 2010. 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 as are seasonal closed areas in the SAB (C) and the mid-Atlantic (D).



**Appendix A:** Injury details and hook type for turtles captured in the U.S. Atlantic Pelagic Longline Fishery for sets between 1 January and 30 June 2010.

**A1a. Leatherback Turtles – Quarter 1**

#	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	207	Alive, injured	Released alive	Shoulder	No	No	No	1.00	5.50		
2	GOM	C-16/0	0	Squid	207	Alive, injured	Released alive	Unknown external	No	No	No	1.00	5.50		
3	CAR	C-18/0	10	Squid or Mackerel	207 or 302/410	Alive, uninjured	Released alive	Not hooked	N/a	Yes	No	0.00	4.50		
4	CAR	C-18/0	10	Squid or Mackerel	207 or 302/410	Alive, uninjured	Released alive	Not hooked	N/a	Yes	No	0.00	5.50		
5	FEC	C-16/0	0	Squid	221	Alive, injured	Released alive	Armpit	No	No	No	0.50	4.00		
6	SAB	C-18/0	10	Squid or Mackerel	248 or 261	Alive, injured	Released alive	Shoulder	No	No	No	6.00	5.00		
7	GOM	C-16/0	0	Squid	140	Alive, injured	Released alive	mouth, side, other	No	No	No	0.10	4.00		

### A1b. Leatherback Turtles – Quarter 2

#	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	Unknown	Unknown	Alive, uninjured	Released alive	not hooked	N/a	Yes	No	0.00	6.00		
2	GOM	C-16/0	0	squid	149	Alive, injured	Released alive	unknown internal	No	Yes	Unknown	10.00	5.00		
3	GOM	C-16/0	0	squid	149	Alive, injured	Released alive	not known if hooked	Unknown	Yes	Yes	25.00	4.00		
4	GOM	C-16/0	0	Mackerel	189	Alive, injured	Released alive	mouth, lower jaw, unknown	Yes	No	No	0.00	3.50		
5	GOM	C-16/0	0	Sardine	45	Alive, injured	Released alive	armpit	Yes	No	No	0.00	3.80		
6	GOM	C-16/0	0	Sardine	81	Alive, injured	Released alive	roof of mouth	No	No	No	1.00	5.00		
7	GOM	C-16/0	0	Sardine	72	Alive, uninjured	Released alive	not hooked	N/a	Yes	No	0.00	5.00		
8	NEC	C-18/0	10	Mackerel	257	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	6.00		

## A2a. Loggerhead Turtles – Quarter 1

#	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	SAR	C-18/0	10	Squid or Mackerel	207 or 410	Alive, injured	Released alive	Shoulder	Yes	No	No	0.00		68.8	64.9
2	FEC	C-18/0	10	Squid	207	Alive, injured	Released alive	swallowed, hook not visible	No	No	No	0.10		61.5	54.4
3	CAR	C-18/0	10	Mackerel	360	Alive, unknown	Released alive	Not known if hooked	Yes	Unknown	No	0.00	2.00		
4	SAR	C-16/0 or C-18/0	0 or 10	Squid	189	Alive, injured	Released alive	swallowed, hook not visible	No	No	No	0.00		69.8	62.7
5	CAR	C-18/0	10	Mackerel	360	Alive, injured	Released alive	Glottis	No	No	No	0.10		64	57.5

## A2b. Loggerhead Turtles – Quarter 2

#	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	Unknown	Unknown	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.00			67.2
2	GOM	C-16/0	0	Sardine	90	Alive, injured	Released alive	swallowed, hook not visible	Yes	No	No	0.00	2.70		
3	SAB	C-16/0	0	Mackerel	113	Alive, injured	Released alive	shoulder	No	No	No	0.10	3.00		
4	SAB	C-16/0	0	Mackerel	113	Alive, injured	Released alive	mouth, lower jaw, unknown	Yes	No	No	0.00		66.0	60.8
5	NEC	C-18/0	10	squid	194	Alive, injured	Released alive	swallowed, hook partially visible	Yes	No	No	0.00		65.5	57.9