

# **Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 October and 31 December, 2008**

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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, 2008.

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 2008 is compared to that observed in quarter 4 during the three year period prior to (2002-2004) and after (2005-2007) 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 203 longline sets (159,839 hooks) were observed during the fourth quarter of 2008 (Table 1) during normal fishing effort with only circle hooks (16/0 and 18/0) recorded. The majority of the observed sets occurred in the GOM fishing area (Figure 1). The number of hooks

and sets cannot be reported for some areas due to a small number of observed vessels and resulting confidentiality restrictions (Table 1).

In addition, a cooperative research program with NOVA Southeastern University was conducted during the fourth quarter of 2008 that included longline fishing inside and outside of areas normally closed to fishing in the FEC and SAB areas. These experiments included a total of 3 sets and 1,153 hooks fished inside closed areas (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. There was no incidental take of protected species in experimental sets in this quarter.

The locations of observed sets and turtle interactions are shown in Figure 1. During normal fishing, there were 6 observed interactions with leatherback turtles and 7 observed interactions with loggerhead turtles (Table 2). 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 6 leatherback turtles observed captured, 5 were released with either all gear removed or with the hook and trailing line less than one-half of the carapace length. The remaining turtle was released with a hook and trailing line greater than one-half of the carapace length. All 7 captured loggerhead turtles were released alive with all gear removed or with the hook and trailing line less than one-half the carapace length (Table 3).

Eight interactions were observed with marine mammals during this quarter, with 7 of these occurring in the MAB area (Table 4, Figure 2). One Risso's dolphins, 1 pilot whale, and 1 unidentified marine mammal were considered seriously injured based upon NOAA guidelines (Angliss and Demaster, 1998). The seriously injured animals were released with hooks in the mouth and/or trailing gear likely to further entangle the animal. The animals released without serious injury were generally entangled in the mainline around the tailstock, and all gear was removed by the fishermen prior to release.

The quarterly and regional bycatch rates are summarized for sea turtles in Table 5 and for marine mammals in Table 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 2005-2007 after implementation (Tables 7 and 8)

For leatherback turtles, the observed bycatch rate in during 2008 was lower than that observed in both the 2002-2004 and 2005-2007 periods in the GOM and MAB areas. The bycatch rate in the NEC area was consistent with that from 2005-2007 and lower than that for 2002-2004. There had been no previous observer coverage in the TUN area during quarter 4, so the observation of leatherback bycatch in this stratum is unique; the small size of the animal (64 cm CCL) is also notable. Bycatch of leatherbacks had been previously observed in the 4<sup>th</sup> quarter in the NED, but was not observed in 2008 (Table 7a).

For loggerhead turtles, the bycatch rate during 2008 in the FEC was lower than that observed in both the 2002-2004 and 2005-2007 periods. In the GOM, the 2008 bycatch was lower than that for 2002-2004, but higher than recent years where bycatch had not been observed. The bycatch rates in the NED in 2008 are much higher than those observed from 2005-2007. Bycatch had been previously observed in the MAB, NEC, and SAB during the fourth quarter, but was not observed during 2008 (Table 7b).

For marine mammals, the 2008 bycatch rate of pilot whales in the MAB is lower than that in previous years, while the rate for Risso's dolphins is higher (Table 8). As with leatherback turtles, the observation of bycatch in the TUN area is unique since there had not been observer coverage in this stratum prior to this year. Bottlenose dolphins and common dolphins, which had previously been observed as bycatch in the MAB, were not observed in 2008 (Table 8)

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 2008 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, 2008 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**

<b>Area</b>	<b>Sets</b>	<b>Hooks</b>
CAR	0	0
FEC	NR	NR
GOM	103	82,686
MAB	43	33,789
NCA	0	0
NEC	NR	NR
NED	NR	NR
SAB	15	7,793
SAR	0	0
TUN	NR	NR
<b>Total</b>	<b>203</b>	<b>159,839</b>

**B. Experimental Fishing**

<b>Area</b>	<b>Sets</b>	<b>Hooks</b>
CAR	0	0
FEC	NR	NR
GOM	0	0
MAB	0	0
NCA	0	0
NEC	0	0
NED	0	0
SAB	NR	NR
SAR	0	0
TUN	0	0
TUS	0	0
<b>Total</b>	<b>3</b>	<b>1,153</b>

**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, 2008 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**

<b>Area</b>	<b>Leatherback</b>	<b>Loggerhead</b>
CAR	-	-
FEC	0	1
GOM	4	1
MAB	0	0
NCA	-	-
NEC	1	0
NED	0	5
SAB	0	0
SAR	-	-
TUN	1	0
<b>Total</b>	<b>6</b>	<b>7</b>

**B. Experimental Fishing**

<b>Area</b>	<b>Leatherback</b>	<b>Loggerhead</b>
CAR	-	-
FEC	0	0
GOM	-	-
MAB	-	-
NCA	-	-
NEC	-	-
NED	-	-
SAB	0	0
SAR	-	-
TUN	-	-
<b>Total</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 between 1 October and 31 December, 2008.

<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	2	2
Released with all gear removed	3	5

**Table 4.** Interactions with marine mammals observed between 1 October and 31 December, 2008 in the U.S. Atlantic Pelagic Longline Fishery by fishing area during normal fishing operations. Observer comments and criteria described in Angliss and DeMaster (1998) were used to evaluate serious injury.

<b>Species</b>	<b>Region</b>	<b># Released Un-injured</b>	<b># Dead</b>	<b># Serious Injury</b>
Risso's Dolphin	MAB	2	0	1
Pilot Whale	MAB	1	0	1
Unid. Marine Mammal	MAB	1	0	1
Pilot Whale	TUN	1	0	0

**Table 5.** Estimated bycatch rate (Catch per 1000 hooks) for (A) Leatherback and (B) Loggerhead turtles by geographic area and between 1 October and 31 December, 2008 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	NR	0	0	-	-
GOM	Alive	103	3	0.0446	0.6004	0.0155 – 0.1284
MAB	Alive	43	0	0	-	-
NCA	Alive	0	-	-	-	-
NEC	Alive	NR	1	0.1115	1.0000	0.0228 – 0.5453
NED	Alive	NR	0	0	-	-
SAB	Alive	15	0	0	-	-
SAR	Alive	0	-	-	-	-
TUN	Alive	NR	1	0.0597	1.0000	0.0122 – 0.2916

**B. Loggerhead Turtles**

Area	Interaction Type	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
CAR	Alive	0	-	-	-	-
FEC	Alive	NR	1	0.2165	1.0000	0.0444 – 1.0581
GOM	Alive	103	1	0.0120	1.0000	0.0025 – 0.0587
MAB	Alive	43	0	0	-	-
NCA	Alive	0	-	-	-	-
NEC	Alive	NR	0	0	-	-
NED	Alive	NR	4	0.6696	0.4303	0.3053 – 1.469
SAB	Alive	15	0	0	-	-
SAR	Alive	0	-	-	-	-
TUN	Alive	NR	0	0	-	-

**Table 6.** Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area and quarter between 1 October and 31 December, 2008 in the U.S. Atlantic Pelagic Longline Fishery during normal fishing operations. CV indicates the coefficient of variation of the estimated rate. NR indicates areas where effort cannot be reported due to confidentiality considerations.

Species	Serious Injury ?	Area	# Observed Sets	# Positive Sets	Mean CPUE	CV CPUE	95% Confidence Interval
Risso's Dolphin	Y	MAB	43	1	0.0197	1.000	0.0040 – 0.0962
Risso's Dolphin	N	MAB	43	2	0.0559	0.6993	0.0168 – 0.1860
Pilot Whale	Y	MAB	43	1	0.0612	1.000	0.0125 – 0.2992
Pilot Whale	N	MAB	43	1	0.0277	1.000	0.0057 – 0.1354
Pilot Whale	N	TUN	NR	1	0.0673	1.000	0.0138 – 0.3292
Unid. Marine Mammal	Y	MAB	43	1	0.0388	1.000	0.0079 – 0.1895
Unid. Marine Mammal	N	MAB	43	1	0.0271	1.000	0.0055 – 0.1325

**Table 7.** Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic Pelagic Longline fishery between 1 October and 31 December, 2008 comparison to the fourth quarter average rate from 2002-2004 and the average rate from 2005-2007. 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	2005-2007 CPUE	2005-2007 95% CI	2008 CPUE	2008 95% CI
CAR	0	-	-	-	-	-
FEC	0	-	0	-	0	-
GOM	0.2300	0.1510 – 0.3503	0.1349	0.0841 – 0.2164	0.0446	0.0155 – 0.1284
MAB	0.1426	0.0796 – 0.2542	0.0927	0.0526 – 0.1635	0	-
NCA	-	-	-	-	-	-
NEC	0.2807	0.1476 – 0.5340	0.1082	0.0221 – 0.5290	0.1115	0.0228 – 0.5453
NED	-	-	0.2627	0.1656 – 0.4168	0	-
SAB	0	-	0	-	0	-
SAR	-	-	0.2385	0.1136 – 0.5004	-	-
TUN	-	-	-	-	0.0597	0.0122 – 0.2916

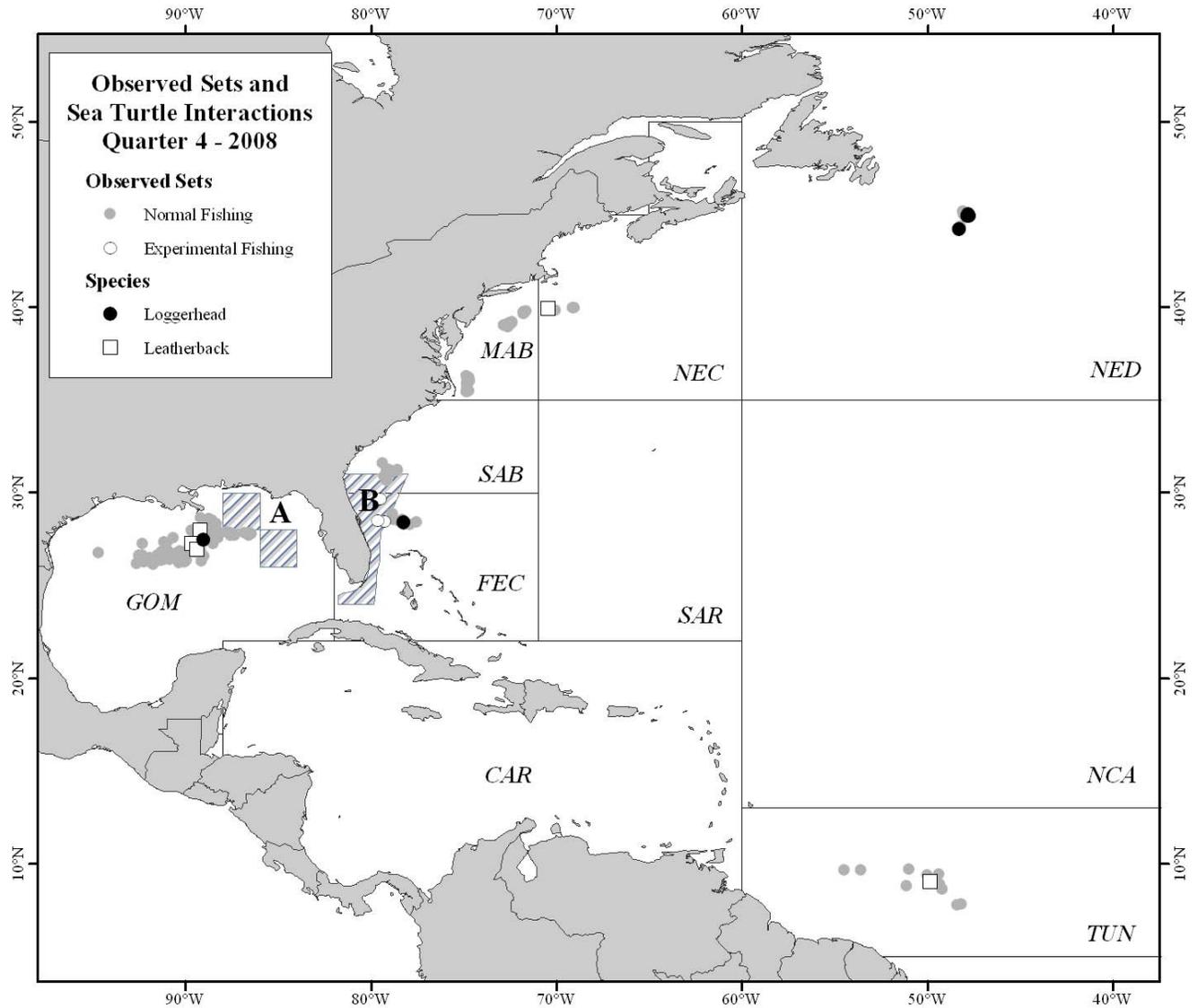
**B. Loggerhead Turtles**

Area	2002-2004 CPUE	2002-2004 95% CI	2005-2007 CPUE	2005-2007 95% CI	2008 CPUE	2008 95% CI
CAR	0.2451	0.0501 – 1.198	-	-	-	-
FEC	0.5612	0.1756 – 1.794	0.4427	0.1404 – 1.396	0.2165	0.0444 – 1.0581
GOM	0.0350	0.0135 – 0.0905	0	-	0.0120	0.0025 – 0.0587
MAB	0.1436	0.0805 – 0.2561	0.0584	0.0254 – 0.1344	0	-
NCA	-	-	-	-	-	-
NEC	0.0914	0.0279 – 0.2991	0	-	0	-
NED	-	-	0.1549	0.0814 – 0.2948	0.6696	0.3053 – 1.469
SAB	0.4673	0.1544 – 1.414	0	-	0	-
SAR	-	-	0.1931	0.0701 – 0.5323	-	-
TUN	-	-	-	-	0	-

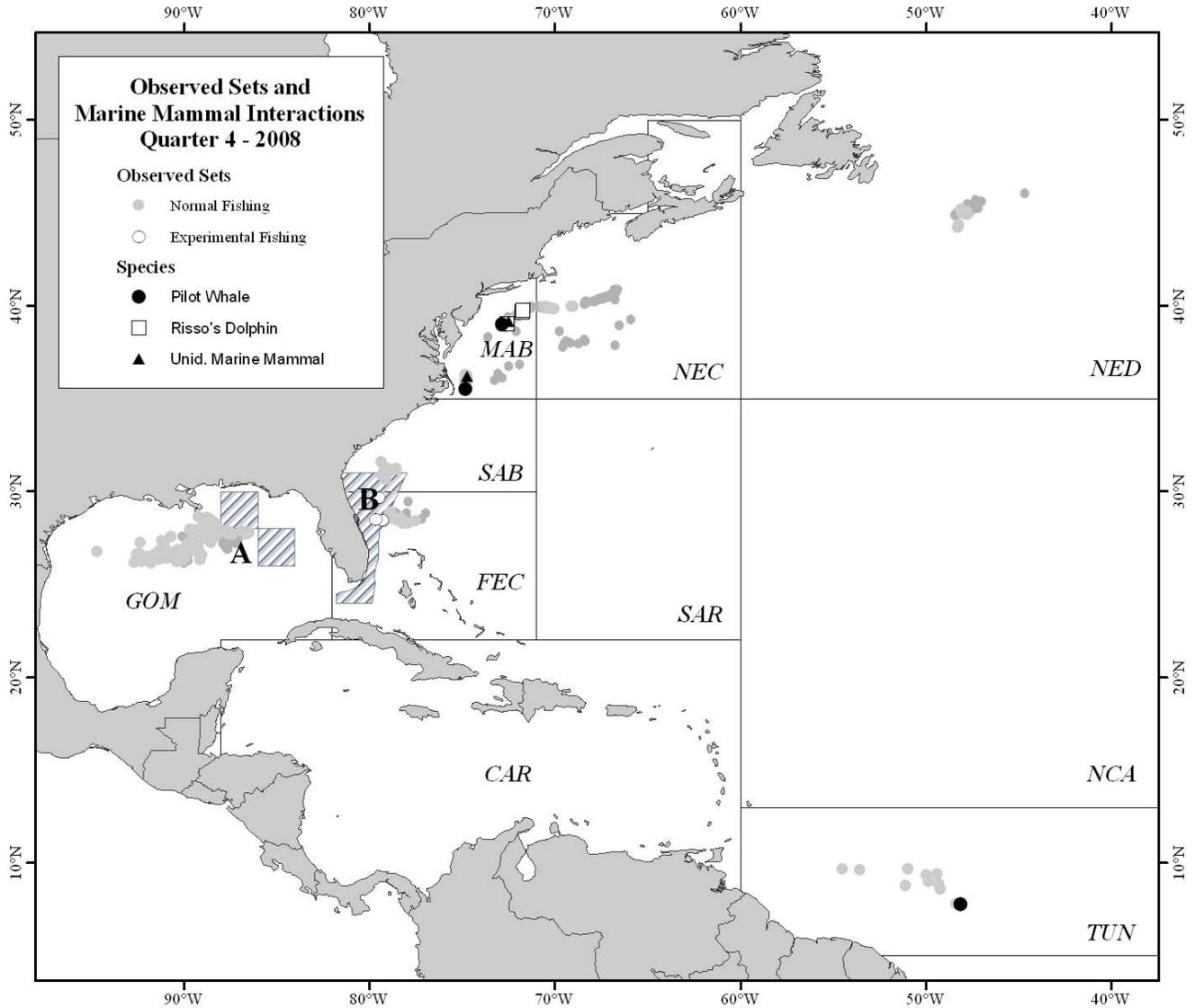
**Table 8.** Bycatch rates for marine mammals in the U.S. Atlantic Pelagic Longline Fishery between 1 October and 31 December, 2008 comparison to the fourth quarter average rate from 2002-2004 and the average rate from 2005-2007. 95% CI indicates the estimated 95% confidence interval of the mean bycatch 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	2005-2007 CPUE	2005-2007 95% CI	2008 CPUE	2008 95% CI
Risso's Dolphin	MAB	0.1274	0.0658 – 0.2465	0.0080	0.0016 – 0.0389	0.0756	0.0274 – 0.2083
Pilot Whale	MAB	0.1969	0.0797 – 0.4867	0.1246	0.0599 – 0.2590	0.0889	0.0249 – 0.3171
Common Dolphin	MAB	0.0313	0.0064 – 0.1531	0	-	0	-
Unid. Marine Mammal	MAB	0	-	0.0085	0.0017 – 0.0415	0.0659	0.0195 – 0.2226
Unid. Dolphin	MAB	0	-	0.0179	0.0053 – 0.0599	0	-
Bottlenose Dolphin	MAB	0	-	0.0097	0.0020 – 0.0476	0	-
Risso's Dolphin	NEC	0.2438	0.1178 – 0.5046	0.0952	0.0195 – 0.4653	0	-
Atl. Spotted Dolphin	SAR	-	-	0.0735	0.0150 – 0.3592	-	-
Unid. Dolphin	SAR	-	-	0.0441	0.0090 – 0.2155	-	-
Pilot Whale	TUN	-	-	-	-	0.0673	0.0138 – 0.3292

**Figure 1.** Observed Pelagic Longline effort and turtle interactions between 1 October and 31 December, 2008. 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.** Observed Pelagic Longline effort and marine mammal interactions between 1 October and 31 December, 2008. 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 2008.

**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	NEC	C-18/0	10	Squid	189	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	4.50		
2	GOM	C-16/0	0	Squid	113	Alive, injured	Released alive	armpit	No	No	No	1.00	5.00		
3	GOM	C-16/0	0	Squid	113	Alive, injured	Released alive	shoulder	No	No	No	0.00	4.00		
4	TUN	C-16/0	0	Squid	113	Alive, injured	Released alive	shoulder	Yes	No	No	0.00		64	
5	GOM	C-16/0	0	Squid	153	Alive, injured	Released alive	shoulder	No	Yes	Yes	100.00	5.00		
6	GOM	C-16/0	0	Squid	131	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	5.50		

## 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	NED	C-18/0	10	Mackerel	428	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.00		69.5	64.5
2	NED	C-18/0	10	Mackerel	428	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.00		52	46
3	NED	C-18/0	10	Mackerel	428	Alive, injured	Released alive	mouth, unknown	Yes	No	No	0.00		57	50
4	NED	C-18/0	10	Mackerel	428	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.00		51.5	47
5	NED	C-18/0	10	Mackerel	428	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.00		61	56
6	FEC	C-18/0	0	Mackerel	288	Alive, injured	Released alive	unknown internal	No	No	No	0.50	3.50		
7	GOM	C-16/0	0	Squid	200	Alive, injured	Released alive	beak internal, lower jaw	No	No	No	0.50	3.00		