

Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 April and 30 June 2005

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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 central North Atlantic ocean. The longline fishery has a documented history of incidental takes of non-target species including billfish, marine turtles, and marine mammals. A Biological Opinion on the pelagic longline fishery was recently developed by the National Marine Fisheries Service under the Endangered Species Act requiring several actions to be taken to improve monitoring and reduce interactions with leatherback and loggerhead turtles. These regulations reopened the northeast distant (NED) water fishing area, with restrictions, on June 30, 2004 and similar restrictions were imposed upon the rest of the fleet effective August 5, 2004. These regulations mandate that all longline gear use 16/0 or 18/0 circle hooks and eliminates J-hooks from the fishery. This quarterly report includes fishing under the new regulatory regime.

The biological opinion required quarterly reporting of interactions with protected species including marine mammals and marine turtles. The goal of this measure is to more closely monitor any potential short-term increases in interaction rates and thereby allow a more responsive management program. This report meets this requirements and includes the observed fishery effort and incidental takes observed by the pelagic longline observer program (POP) including sets from April 1, 2005 to June 30, 2005.

During quarter 2 of 2005, a cooperative research program (CRP) was conducted aboard six pelagic longline fleet vessels operating in the Gulf of Mexico and off of the U.S. east coast. These trips all had 100% observer coverage. In this project, fishermen conducted experimental fishing activities employing different hook baiting techniques and attaching hook timers and time-depth recorders to the fishing gear. The fishing gear used in this experiment also employed standardized gangion lengths, float line lengths, and other gear characteristics to reduce bias among various experimental treatments. Therefore, the fishing techniques and gear employed during the experimental fishery do not represent those used during “normal” fishing effort, and it would be inappropriate to extrapolate bycatch rates observed in these sets across the rest of the reported fishing effort for the quarter. Observed protected species bycatch, and the resulting bycatch rates, are therefore separated between experimental and normal fishing observed during this quarter.

While it is desirable to estimate the absolute level of takes (i.e., total number of turtles taken), this is not currently possible because the fishery effort data is reported on logbook forms by fishing captains. These data are not available until several months after the end of any given quarter primarily due to delays in reporting by the vessel captains. Therefore, I present the bycatch rate (i.e., catch per unit effort) based upon observer data as an indicator of the relative level of interactions with protected species. The observed bycatch rate by fishing area during 2005 is compared to that observed in 2004 (Garrison, 2004) and the average of the previous five years (2000-2004) to assess whether or not the observed rate in 2005 is unusually high or low. Bycatch rates are calculated applying the delta log-normal method using hooks as the unit of effort, and the analytical methods are described in detail in Garrison (2003).

Results and Discussion

A total of 154 longline sets (~126,000 hooks) were observed during quarter 2 of 2005 (Table 1) in “normal” fishing operations. The experimental fishery included an additional 124 observed sets (~72,000 hooks). The Gulf of Mexico had by far the highest number of observed sets. There were only 2 sets observed during normal fishing in the mid-Atlantic bight (MAB) area.

During normal fishing operations, there were 4 observed interactions with leatherback turtles and 1 interaction with a loggerhead turtle (Table 2). All turtles were listed as released alive and injured because they were hooked (Appendix A1). All interactions with leatherback turtles were observed in the GOM area, and the one interaction with a loggerhead turtle was observed in the NCA area (Table 2). The locations of observed sets and turtle interactions are shown in Figure 1. An additional 7 leatherback turtle interactions were observed during experimental fishing (Table 2, Appendix A2)

There were 5 observed interactions with pilot whales in the MAB area during this quarter (Table 3). Two of these interactions occurred during normal fishing operations, and both were considered seriously injured based upon observer comments and serious injury criteria (see Garrison, 2003; Angliss and Demaster, 1998). Of the three interactions with pilot whales in the experimental fishing, one was considered seriously injured (Table 3). Interactions with marine mammals were observed only in the MAB region (Figure 3).

The quarterly and regional bycatch rates during normal fishing operations are summarized for turtles in Table 4 and for marine mammals in Table 5. These rates are compared with those from the same quarter/area for 2004 and the average from 2000-2004 in Tables 6-7. Specific information on injuries to sea turtles and gear characteristics of each interaction are shown in Appendix A1 and A2.

For leatherback turtles, the catch rates observed during quarter 2, 2005 are substantially lower than those of 2004 and the previous five year average. Leatherback turtle interactions are typically seen throughout most of the observed fishery; however, takes were only observed in the GOM during this year. The bycatch rate in the GOM for this year was an order of magnitude

lower than that observed in Q2 of 2004, and it is significantly lower than the 2000-2004 average (Table 6a).

For loggerhead turtles, the bycatch rates were also generally lower than those observed in previous years since only one take in one region was observed during 2005. The observed bycatch rate in the NCA area was lower than that observed in the previous five years (Table 6b).

The bycatch (and serious injury) rates of pilot whales during this quarter was unusually high. The MAB fishing area typically has the highest and most consistent bycatch of pilot whales during the previous five years. The observed bycatch rate during quarter 2 of 2005 in normal fishing operations was nearly an order of magnitude higher than that observed in the previous five years. The high interaction rate also observed in the experimental fishing suggests that interactions with pilot whales were generally elevated this year compared to previous years. In the normal fishing operations, only 2 sets were observed in the MAB area (during the same trip), and both had interactions with a pilot whale. Therefore, the bycatch rate estimate is very high and the estimate of variance for this period is 0 (Table 7).

Only circle hooks (16/0 and 18/0) were observed during this quarter, consistent with recent regulations for this fishery. Concerted efforts by fishermen to remove hooks and disentangle captured turtles are also mandated by the Biological Opinion. All 4 leatherback turtles captured during this quarter in normal fishing were hooked, in the armpit or on the shoulder. In 2 of these 4 leatherback turtles, the hook was successfully removed and 2 leatherbacks were released with trailing gear but were not entangled (Appendix A1). The single loggerhead turtles was hooked in the lower jaw and the hook was removed (Appendix A1).

During experimental fishing, 6 of the 7 leatherbacks were hooked externally in either the front flipper or the shoulder. The hook was removed in 3 out of 6 cases. Only 1 leatherback was released with trailing line (Appendix A2).

There are a number of caveats and uncertainties associated with the current analysis. First, while these data have gone through an initial audit and review, they are subject to change upon further review after the end of the 2005 calendar year. Second, the delta log-normal estimator was applied to calculate bycatch consistent with previous estimates (e.g., Garrison 2003). This approach assumes 1) that catch rates (animals per hook) are lognormally distributed and 2) that the number of hooks is an appropriate unit of effort. The first assumption has been evaluated for turtles; however, violations of this assumption may result 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 is not correct, for example if there are saturation effects resulting in a non-linear relationship between the number of hooks and total catch, then there is potentially a bias in the estimate of bycatch rate and total bycatch.

The interaction between longline gear and marine turtles is a relatively rare event and is therefore inherently variable. Historically, there have been very large interannual 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. 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 FISHERIES-SEFSC-515: 52 p.

Garrison, L.P. 2004. Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery During January – June, 2004. SEFSC Document #PRD-03/04-10: 19 p.

Table 1. Number of sets and hooks (x1000) observed in the U.S. Atlantic Pelagic Longline Fishery between 1 April – 30 June, 2005 by fishing area during (A) Normal and (B) Experimental Fishery Operations.

A. Normal Fishing

Area	Sets	Hooks (x 1000)
CAR	0	0
FEC	16	9.94
GOM	87	74.29
MAB	2	1.50
NCA	11	11.88
NEC	1	1.08
NED	0	0
SAB	37	27.73
SAR	0	0
TUN	0	0
TUS	0	0
Total	154	126.41

B. Experimental Fishing

Area	Sets	Hooks (x 1000)
CAR	0	0
FEC	11	4.69
GOM	96	57.81
MAB	7	4.87
NCA	0	0
NEC	0	0
NED	0	0
SAB	9	3.69
SAR	0	0
TUN	0	0
TUS	0	0
Total	123	71.06

Table 2. Total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets beginning between 1 April – 30 June, 2005 by fishing area during (A) Normal and (B) Experimental fishery operations. All turtles were recorded as being released alive. Areas with missing values indicate no observer coverage during this time period.

(A) Normal Fishing

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

(B) Experimental Fishing

Area	Leatherback	Loggerhead
CAR	-	-
FEC	0	0
GOM	7	0
MAB	0	0
NCA	-	-
NEC	-	-
NED	-	-
SAB	0	0
SAR	-	-
TUN	-	-
TUS	-	-
Total	7	0

Table 3. Interactions with marine mammals observed during 1 April – 30 June 2005 in the U.S. Atlantic Pelagic Longline Fishery. Observer comments and criteria described in Angliss and DeMaster (1998) were used to evaluate serious injury.

Species	Region	Experiment	# Released Un-injured	# Dead	# Serious Injury
Pilot Whale	MAB	No	0	0	2
Pilot Whale	MAB	Yes	2	0	1

Table 4. Estimated bycatch rate (Catch per 1000 hooks) for (A) Leatherback and (B) Loggerhead turtles by geographic area and during 1 April – 30 June, 2005 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. All turtles were recorded as released alive.

A. Leatherback Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	16	0	0	-	-
GOM	87	4	0.0524	0.0007	0.5087
MAB	2	0	0	-	-
NCA	11	0	0	-	-
NEC	1	0	0	-	-
NED	0	-	-	-	-
SAB	37	0	0	-	-
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

B. Loggerhead Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	16	0	0	-	-
GOM	87	0	0	-	-
MAB	2	0	0	-	-
NCA	11	1	0.0842	0.0071	1.000
NEC	1	0	0	-	-
NED	0	-	-	-	-
SAB	37	0	0	-	-
SAR	0	-	-	-	-
TUN	0	-	-	-	-
TUS	0	-	-	-	-

Table 5. Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area and quarter during 1 April – 30 June, 2005 in the U.S. Atlantic Pelagic longline fishery during normal fishery operations. CV indicates the coefficient of variation of the estimated rate.

Species	Serious Injury ?	Area	# Positive Sets	# Observed Sets	Mean CPUE	Var CPUE	CV
Pilot Whale	Y	MAB	2	2	1.337	0	-

Table 6. Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic longline fishery during 1 April – 30 June, 2005 and comparison to 2004 and the average rate from 2000-2004. 95% CI indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a lognormal distribution of rates.

A. Leatherback turtles

Area	2005 CPUE	2005 95% CI	2004 CPUE	2004 95% CI	2000-2004 CPUE	2000-2004 95% CI
CAR	-	-	0.0710	0.0145 – 0.3472	0.0598	0.0122 – 0.2924
FEC	0	-	0.5970	0.1221 – 2.918	0.1465	0.0408 – 0.5259
GOM	0.0524	0.0210 – 0.1307	0.4620	0.3088 – 0.6912	0.2534	0.1919 – 0.3345
MAB	0	-	0.3329	0.1390 – 0.7974	0.2762	0.1461 – 0.5224
NCA	0	-	0	-	0.0259	0.0053 – 0.1265
NEC	0	-	0	-	0.0995	0.0302 – 0.3279
NED	-	-	-	-	-	-
SAB	0	-	0.0334	0.0068 – 0.1631	0.0661	0.0316 – 0.1382
SAR	-	-	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

B. Loggerhead Turtles

Area	2005 CPUE	2005 95% CI	2004 CPUE	2004 95% CI	2000-2004 CPUE	2000 - 2004 95% CI
CAR	-	-	0.0682	0.014 – 0.3334	0.0575	0.0118 – 0.2809
FEC	0	0	0	-	0.0373	0.0076 – 0.1822
GOM	0	0	0	-	0.0344	0.0171 – 0.0688
MAB	0	0	0	-	0	-
NCA	0.0842	0.0172 – 0.4115	0	-	0.2075	0.0986 – 0.4366
NEC	0	0	0	-	0.8724	0.4449 – 1.7107
NED	-	-	-	-	-	-
SAB	0	0	0.0634	0.0193 – 0.2077	0.0532	0.0218 – 0.1298
SAR	-	-	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

Table 7. Summary of bycatch rates for marine mammals in the U.S. Atlantic longline fishery during 1 April – 30 June, 2005 and comparison to rates from the previous year (2004) and the average of the previous five years (2000-2004). 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	2005 CPUE	2005 95% CI	2004 CPUE	2004 95% CI	2000 - 2004 CPUE	2000-2004 95% CI
Atlantic Spotted Dolphin	MAB	0	-	0	-	0.0273	0.0056 – 0.1336
Bottlenose Dolphin	NCA	0	-	0	-	0.0259	0.0053 – 0.1265
Minke Whale	NEC	0	-	0	-	0.0529	0.0108 – 0.2586
Pilot Whale	MAB	1.337	-	0	-	0.1427	0.0630 – 0.3233
Risso's Dolphin	NEC	0	-	0	-	0.0833	0.0170 – 0.4074

Figure 1. Observed Pelagic Longline effort and turtle interactions during 1 April – 30 June, 2005. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

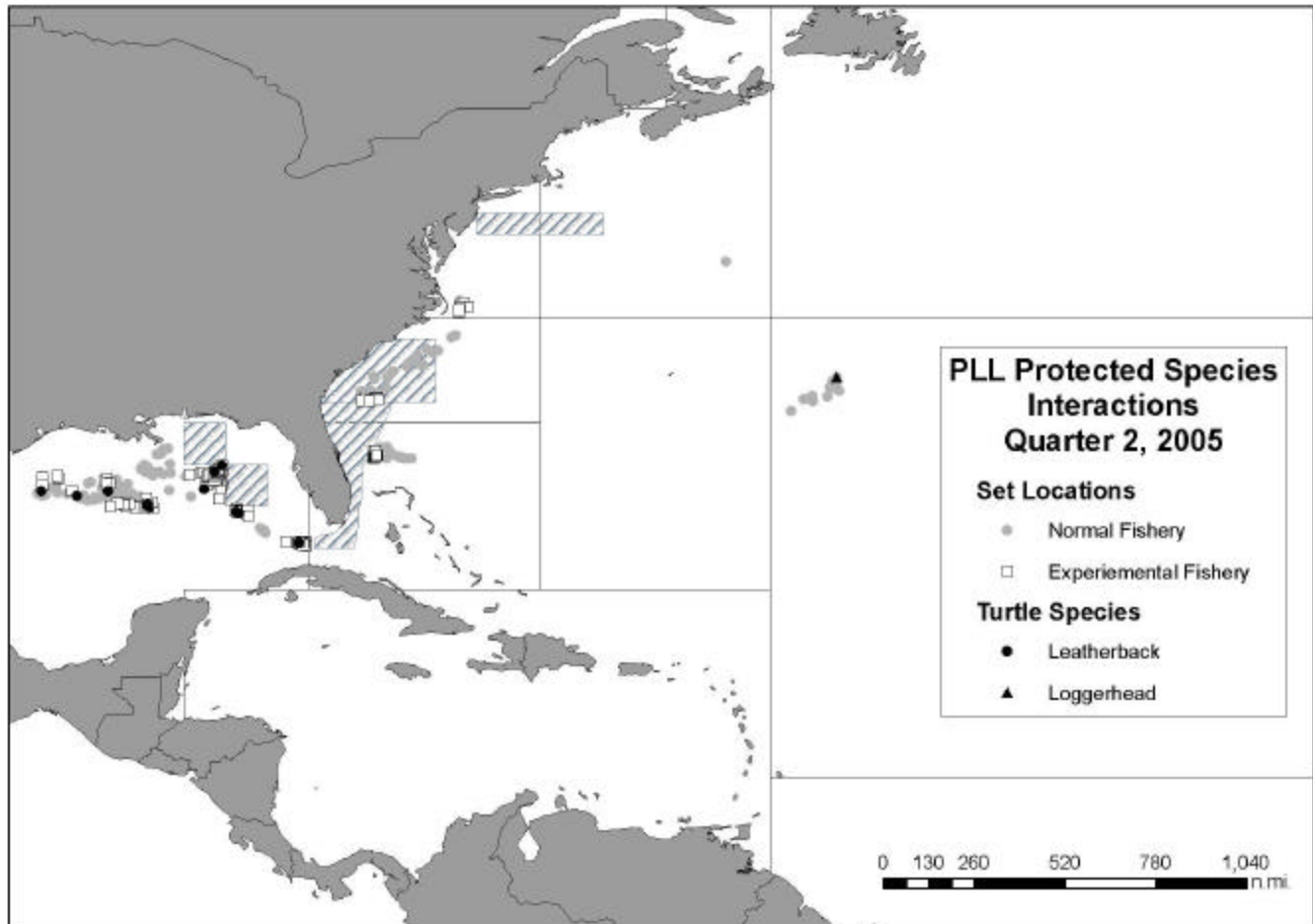
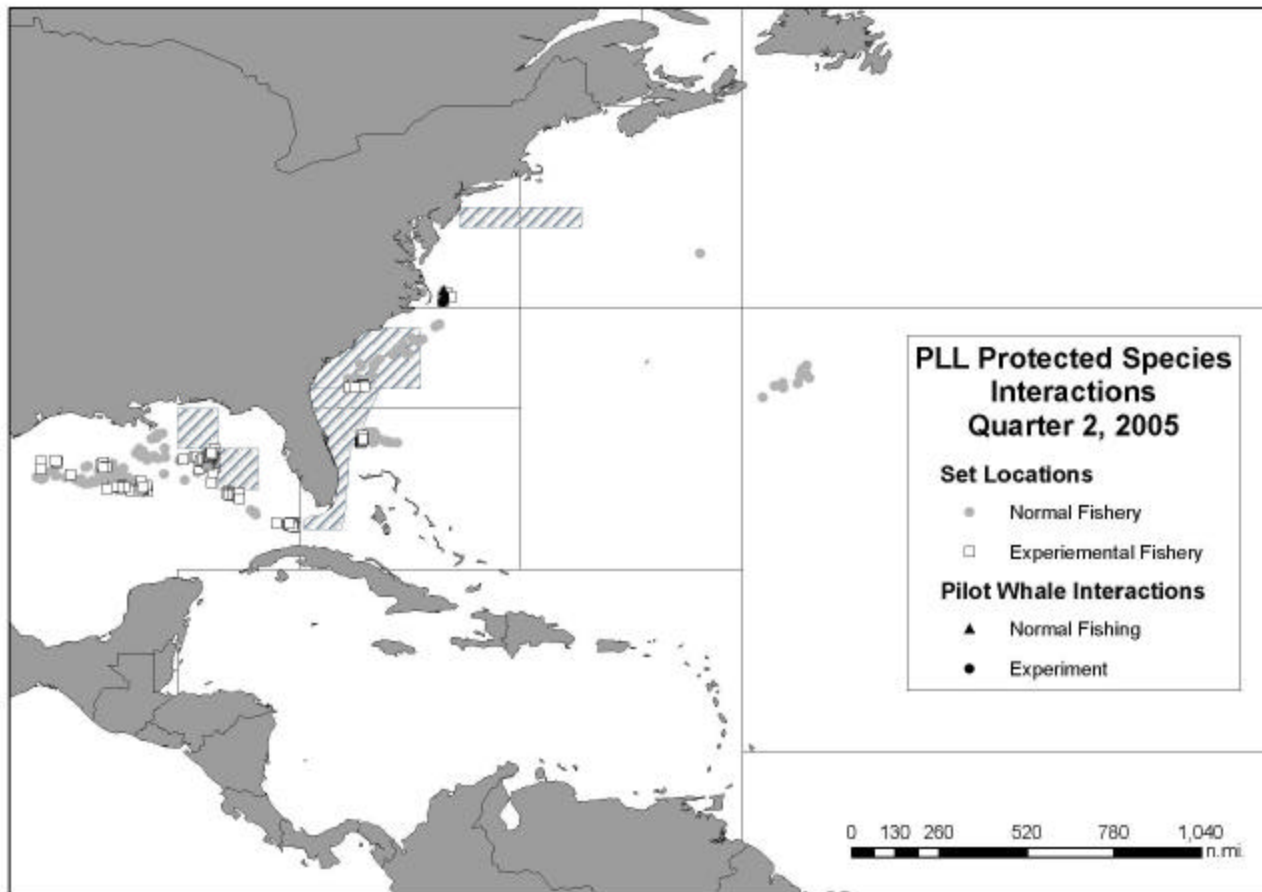


Figure 2. Observed Pelagic Longline effort and marine mammal interactions during 1 April – 30 June, 2005. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.



Appendix A1: Injury details and hook type for turtles captured in the pelagic longline fishery for sets beginning during 1 April – 30 June, 2005 during normal fishing operations

A. Leatherback Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	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	125	Alive, injured	armpit	na	na	yes	no	no	0.00	4.00		
2	GOM	C- 16/0	0	squid	114	Alive, injured	shoulder	na	na	no	no	no	2.00	4.00		
3	GOM	C- 16/0	0	sardines	86	Alive, injured	shoulder	na	na	yes	no	no	0.00	5.00		
4	GOM	C- 16/0	0	squid	224	Alive, injured	shoulder	na	na	no	no	no	6.00	5.00		

B. Loggerhead Turtles

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	NCA	C-18/0	10	unk	212 or 338	Alive, injured	mouth	lower other	na	yes	no	no	0.00		63.4	58.4

Appendix A2: Injury details and hook type for leatherback turtles captured in the pelagic longline fishery for sets beginning during 1 April – 30 June, 2005 during experimental fishing operations

#	Area	Hook Type	Offset (degrees)	Bait	Bait Size (g)	Release Condition	Hook Location	Jaw Location	Hook Visible?	Hook Removed?	Entangled Capture?	Entangled Release?	Line Left (ft)	CL Est. (ft)	CCL (cm)	Straight N-N (cm)
1	GOM	C-18/0	0	mackerel	500	Alive, injured	front flipper	na	na	yes	no	no	0.00	4.50		
2	GOM	C- 16/0	0	sardines	68	Alive, injured	unknown external	na	na	no	no	no	5.00	5.50		
3	GOM	C- 16/0	0	sardines	72	Alive, uninjured	not hooked	na	na	na	yes	no	0.00	4.00		
4	GOM	C- 16/0	0	sardines	75	Alive, injured	shoulder	na	na	yes	no	no	0.00	4.00		
5	GOM	C- 16/0	0	sardines	75	Alive, injured	front flipper	na	na	no	no	no	0.00	5.50		
6	GOM	C- 16/0	0	sardines	64	Alive, injured	shoulder	na	na	no	no	no	0.00	4.50		
7	GOM	C- 16/0	0	sardines	64	Alive, injured	front flipper	na	na	yes	no	no	0.00	4.50		