

Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery from 1 July – 30 September 2007

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Background

The U.S. Atlantic Pelagic Longline fleet operates along the U.S. coast from the Gulf of Mexico to New England, the waters of the Caribbean, and in international waters of the Northwestern Atlantic Ocean. The longline fishery has a documented history of incidental takes of non-target species including marine turtles and marine mammals. During recent years there were elevated takes of leatherback turtles in the Gulf of Mexico (Garrison, 2003). As a result, a Biological Opinion on the pelagic longline fishery was developed by NOAA Fisheries under the Endangered Species Act, which required several actions to be taken to improve monitoring and reduce interactions with leatherback and loggerhead turtles. These regulations reopened the Northeast Distant (NED) fishing area, with restrictions, on 30 June 2004, and similar restrictions were imposed on the rest of the fleet effective 5 August 2004. These regulations eliminated J-hooks from the fishery and mandated that all pelagic longline gear use circle hooks of size 16/0 or greater and that only hooks of size 18/0 or greater may be used in the NED area. The regulations further required that hooks less than 18/0 had no offset, while hooks of size 18/0 or greater may have an offset no greater than 10 degrees.

The Biological Opinion also required quarterly reporting of interactions with protected species including marine turtles and marine mammals. The goal of this measure was to more closely monitor any potential short-term increases in interaction rates and thereby allow a more responsive management program. This report meets this requirement and includes the observed fishery effort and incidental takes reported by the Pelagic Observer Program (POP) from 1 July 2007 through 30 September 2007.

While it would be desirable to directly 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. As a result, the bycatch rate (i.e. catch per unit effort) presented here is 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 2007 is compared to that observed in quarter 3 of 2006 and to the average of the previous five years (2002-2006) for quarter 3 to assess whether or not the observed rate in 2007 was unusually high or low. Bycatch rates were calculated by applying the delta log-normal method using hooks as the unit of effort. The analytical methods were described in detail in Garrison (2003).

Results and Discussion

A total of 212 longline sets (165,089 hooks) were observed during quarter 3 of 2007 (Table 1), with only circle hooks (sizes 16/0 and 18/0) recorded. The majority of the observed sets occurred in the Gulf of Mexico (GOM), the Mid-Atlantic Bight (MAB), and the Northeast Distant (NED) areas (Figure 1, Table 1).

The locations of observed sets and turtle interactions are shown in Figure 1. There were 13 observed interactions with leatherback turtles and 47 observed interactions with loggerhead turtles (Table 2). All turtles were released alive. Nine of the leatherbacks were hooked (three also were entangled), three were entangled only, and it was unknown whether one leatherback was hooked upon capture (Appendix A1). Forty-four of the loggerheads were hooked, two were entangled only, and it was unknown whether the remaining loggerhead was hooked when captured (Appendix A2).

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. Of the nine leatherback turtles known to be hooked, one was hooked in the mouth, seven were hooked in the shoulder, armpit or flipper, and one was hooked in an unknown external location (Appendix A1). Six leatherbacks were reported entangled at capture but none were released entangled. In fact, all 13 leatherback turtles were released with no trailing line, and only two were released with the hooks.

Of the 44 loggerhead turtles known to be hooked when captured, nine had swallowed the hook, 31 were hooked in the mouth or beak, three were hooked in the front flipper, and one was hooked in the rear flipper (Appendix A2). All gear was removed from 39 loggerhead turtles. Hooks remained in place on eight turtles at release, and line remained on five of those, but in all except one case, the amount of line remaining was less than 0.5 feet. No turtles were released entangled.

Eight interactions were observed with marine mammals during this quarter, all in the MAB area (Table 3, Figure 2). These included five interactions with pilot whales, one interaction with a Risso's dolphin, and two interactions with unidentified marine mammals. For three of the pilot whales and two unidentified marine mammals it was unknown if the whale was hooked, though a single gangion seemed to be connected with the animals' head or mouth. All these animals were released with 40-50 feet of line trailing and were considered to be released alive but seriously injured based upon observer

comments and serious injury criteria (see Garrison, 2003; Angliss and DeMaster, 1998). It could not be determined for one additional pilot whale whether it was hooked or entangled or if all the gear was removed upon release, though the animal was considered to be released alive and not seriously injured. The Risso's dolphin was hooked in the lower side of the mouth, and the dolphin was released with the hook and 0.3 feet of trailing line, and was considered to be released alive but seriously injured.

As indicated in the footnote in Table 3, one additional pilot whale was observed entangled in the fishing gear of a separate, unobserved vessel. The observer noted that the animal was in the other vessel's gear, hooked in the mouth, and was cut from the gear with 24 feet of trailing line. As per POP data collection standards, this animal was not recorded in the database, and it was not included in the subsequent analyses since it was not taken by a vessel with an observer onboard.

The quarterly and regional bycatch rates are summarized for marine turtles in Table 4 and for marine mammals in Table 5. These rates were compared with those from the same quarter/area for 2006 and the average for the third quarter/area from 2002-2006 in Tables 6 and 7 (Fairfield-Walsh and Garrison, 2006 and 2007). Specific information on injuries to sea turtles and gear characteristics of each interaction are shown in Appendix A.

For leatherback turtles, the bycatch rate in the GOM was lower than the 2006 bycatch rate and lower than the average rate for the previous five years (Table 6A), but was within the bounds of the 95% confidence intervals for the prior years. In the MAB area, the leatherback bycatch rate for quarter 3 of 2007 was higher than 2006 (when no leatherbacks were caught in this area) and higher than the average rate for 2002-2006; however the 2007 rate was within the 95% confidence limits of estimates from prior years. The bycatch rate in the Northeast Central (NEC) fishing area during 2007 was significantly higher than that in 2006 as well as the five year average rate. The bycatch rate for leatherbacks in the NED area was lower than that calculated for 2006 and was consistent with the average rate for 2002-2006. In both the Florida East Coast (FEC) and South Atlantic Bight (SAB) areas, there were no leatherbacks observed taken as was also observed in 2006 and was slightly lower than the observed bycatch for the previous five years.

For loggerhead turtles, the bycatch rate in the FEC area was significantly higher than in previous years when no loggerheads were observed taken from 2002-2006. The zero bycatch of loggerheads in the GOM fishing area was consistent with 2006, and lower than the 2002-2006 average rate. The bycatch rate in the MAB was significantly higher than the 2006 rate and the 2002-2006 average rate. The bycatch rate for loggerheads in the NEC during this third quarter of 2007 was lower than both 2006 and the average rate from 2002-2006, though not significantly so. In the NED area, the bycatch rate was consistent with 2006, yet significantly higher than the average 2002-2006 rate. The bycatch rate in the SAB area was higher than the zero bycatch observed in 2006 and was significantly higher than the average rate for 2002-2006, based on the limited overlap in the 95% confidence intervals.

No Kemp's ridleys were observed taken this quarter, though one had been observed taken in September of 2006. Similarly, no unidentified marine turtles were observed taken in this fishery during this third quarter of 2007, though one had been observed taken in July of 2003.

Bycatch of pilot whales, Risso's dolphins, and unidentified marine mammals were observed during the third quarter of 2007 in the MAB fishing area (Table 7). The bycatch rates for the latter two are significantly higher relative to the zero bycatch observed in 2006 and the average rate for 2002-2006. The bycatch rate for pilot whales in the MAB area was lower than that in 2006 and the average 2002-2006 bycatch rates, but this reduction was not significant. There was no bycatch of common dolphins in either the MAB or NED areas, consistent with 2006, which was lower than the average 2002-2006 rate. No pilot whales were observed taken in the NEC area which was lower than that observed in 2006 and 2002-2006. There were no Risso's dolphins observed taken during this quarter in the NEC area, consistent with 2006 and lower than the average bycatch rate for 2002-2006. There were also no unidentified marine mammals observed taken in the GOM during this quarter, which is consistent with 2006 and lower than the average 2002-2006 bycatch rate.

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 2007 calendar year when all logbook data are available. 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.

Fairfield-Walsh, C. and L.P. Garrison. 2006. Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery between 1 July and 30 September; SEFSC Document #PRD-06/07-99: 18 p.

Fairfield-Walsh, C. and L.P. Garrison. 2007. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2006. NOAA Technical Memorandum NOAA NMFS-SEFSC-560: 53p.

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. The number of sets and hooks observed in the U.S. Atlantic Pelagic Longline Fishery from 1 July – 30 September 2007 is shown by fishing area. Areas with missing values indicate there was no observer coverage during this time period in this area.

Area	# Sets	# Hooks
CAR	-	-
FEC	26	11,188
GOM	71	51,918
MAB	42	41,378
NCA	-	-
NEC	12	11,044
NED	30	27,388
SAB	18	8,673
SAR	-	-
TUN	13	13,500
TUS	-	-
Total	212	165,089

Table 2. Interactions with marine turtles observed during 1 July – 30 September 2007 in the U.S. Atlantic Pelagic Longline Fishery, shown by fishing area. Areas with missing values (dashes) indicate there was no observer coverage during this time period in this area.

Area	Leatherback Takes Observed	Loggerhead Takes Observed
CAR	-	-
FEC	0	3
GOM	1	0
MAB	3	10
NCA	-	-
NEC	3	2
NED	6	31
SAB	0	1
SAR	-	-
TUN	0	0
TUS	-	-
Total	13	47

Table 3. Interactions with marine mammals observed during 1 July – 30 September 2007 in the U.S. Atlantic Pelagic Longline Fishery, shown by fishing area. Observer comments and criteria described in Angliss and DeMaster (1998) were used to evaluate serious injury.

Species	Area	# Released Uninjured	# Serious Injury	# Dead
Pilot Whale ¹	MAB	1	4	0
Risso's Dolphin	MAB	0	1	0
Unid. Marine Mammal	MAB	0	2	0

¹In addition to the pilot whales included in this table, an additional pilot whale was observed while a vessel with an observer onboard was tangled in the gear of a boat that was not carrying an observer. The observer on the vessel that had not taken the whale noted that the animal was in the other vessel's gear, hooked in the mouth, and was cut from the gear with 24 feet of trailing line. As per POP data collection standards, this animal was not recorded in the database, and was not included in subsequent analyses, as it was not taken by a vessel with an observer onboard.

Table 4. Estimated bycatch rate (Catch per unit effort (CPUE) = catch per 1000 hooks) for (A) Leatherback, and (B) Loggerhead turtles by area during 1 July – 30 September 2007 in the U.S. Atlantic Pelagic Longline Fishery. Missing values (dashes) indicate areas with no observer coverage. “Var CPUE” indicates the variance of the catch per unit effort, and “CV” indicates the coefficient of variation of the estimated rate.

A. Leatherback Turtles

Area	Type of Injury	Number of Turtles	Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	-	-	-	-	-	-	-
FEC	-	0	26	0	-	-	-
GOM	Alive	1	71	1	0.0352	0.0012	1.0000
MAB	Alive	3	42	3	0.0679	0.0015	0.5679
NCA	-	-	-	-	-	-	-
NEC	Alive	3	12	3	0.2315	0.0146	0.5222
NED	Alive	6	30	6	0.2197	0.0067	0.3737
SAB	-	0	18	0	-	-	-
SAR	-	-	-	-	-	-	-
TUN	-	0	13	0	-	-	-
TUS	-	-	-	-	-	-	-

Table 4 (cont.)

B. Loggerhead Turtles

Area	Type of Injury	Number of Turtles	Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	-	-	-	-	-	-	-
FEC	Alive	3	26	3	0.2711	0.0226	0.5541
GOM	Alive	0	71	0	-	-	-
MAB	Alive	10	42	9	0.2407	0.0056	0.3106
NCA	-	-	-	-	-	-	-
NEC	Alive	2	12	2	0.1640	0.0123	0.6756
NED	Alive	31	30	15	0.9762	0.0686	0.2683
SAB	-	1	18	1	0.0926	0.0086	1.0000
SAR	-	-	-	-	-	-	-
TUN	-	0	13	0	-	-	-
TUS	-	-	-	-	-	-	-

Table 5. Estimated bycatch rate (Catch per unit effort (CPUE) = catch per 1000 hooks) for marine mammals by area during 1 July – 30 September 2007 in the U.S. Atlantic Pelagic Longline Fishery. Missing values (dashes) indicate areas with no observer coverage. Under “Type of Injury”, “Alive” indicates the animal was released alive uninjured, and “SI” indicates the animal was released alive with a serious injury, based on observer comments and criteria described in Angliss and DeMaster (1998). “Var CPUE” indicates the variance of the catch per unit effort, and “CV” indicates the coefficient of variation of the estimated rate.

Species	Type of Injury	Number of Animals	Area	# Positive Sets	# Observed Sets	Mean CPUE	Var CPUE	CV
Pilot Whale	Alive	1	MAB	1	42	0.0220	0.0005	1.0000
Pilot Whale	SI	4	MAB	3	42	0.0889	0.0048	0.7816
Risso’s Dolphin	SI	1	MAB	1	42	0.0187	0.0004	1.0000
Unid. Marine Mammal	SI	2	MAB	2	42	0.0445	0.0010	0.6986

Table 6. The bycatch rates are shown for (A) Leatherback turtles, and (B) Loggerhead turtles in the U.S. Atlantic longline fishery during 1 July - 30 September 2007 in comparison to 2006 and to the average rate from 2002-2006. “95% CI” indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a log-normal distribution of rates. CPUEs reflect total turtles caught including alive and dead turtles.

A. Leatherback Turtles

Area	2007 CPUE	2007 95% CI	2006 CPUE	2006 95% CI	2002-2006 CPUE	2002-2006 95% CI
CAR	-	-	-	-	-	-
FEC	0	-	0	-	0.0468	0.0096 – 0.2289
GOM	0.0352	0.0072 – 0.1721	0.0214	0.0044 – 0.1048	0.0949	0.0595 – 0.1512
MAB	0.0679	0.0248 – 0.1861	0	-	0.0405	0.0138 – 0.1186
NCA	-	-	-	-	-	-
NEC	0.2315	0.0908 – 0.5902	0.1412	0.0602 – 0.3309	0.0661	0.0299 – 0.1462
NED ¹	0.2197	0.1103 – 0.4376	0.3692	0.1266 – 1.0763	0.2455	0.1510 – 0.3991
SAB	0	-	0	-	0.0322	0.0066 – 0.1572
SAR	-	-	-	-	-	-
TUN	0	-	-	-	-	-
TUS	-	-	-	-	-	-

¹Fishery effort in the NED region during 2002 and 2003 (included in this table) followed an experimental design distinct from “normal” fishery operations.

Table 6 (cont.)**B. Loggerhead Turtles**

Area	2007 CPUE	2007 95% CI	2006 CPUE	2006 95% CI	2002-2006 CPUE	2002-2006 95% CI
CAR	-	-	-	-	-	-
FEC	0.2711	0.1011 – 0.7269	0	-	0	-
GOM	0	-	0	-	0.0160	0.0065 – 0.0393
MAB	0.2407	0.1350 – 0.4291	0.1114	0.0405 – 0.3067	0.0775	0.0395 – 0.1518
NCA	-	-	-	-	-	-
NEC	0.1640	0.0510 – 0.5276	0.4468	0.2699 – 0.7397	0.3240	0.2158 – 0.4865
NED ¹	0.9762	0.5906 – 1.6137	0.8279	0.2280 – 3.0068	0.2265	0.0979 – 0.5240
SAB	0.0926	0.0189 – 0.4526	0	-	0.0334	0.0068 – 0.1631
SAR	-	-	-	-	-	-
TUN	0	-	-	-	-	-
TUS	-	-	-	-	-	-

¹Fishery effort in the NED region during 2002 and 2003 (included in this table) followed an experimental design distinct from “normal” fishery operations.

Table 7. The summary of bycatch rates for marine mammals in the U.S. Atlantic longline fishery during 1 July – 30 September 2007 in comparison to rates from the previous year (2006) and the average of the previous five years (2002-2006). “95% CI” indicates the estimated 95% confidence interval of the mean bycatch rate (CPUE) in each cell assuming a log-normal distribution of rates. CPUEs reflect total marine mammals caught including alive, dead, and seriously injured animals.

Species	Area	2007 CPUE	2007 95% CI	2006 CPUE	2006 95% CI	2002-2006 CPUE	2002-2006 95% CI
Common Dolphin	MAB	0	-	0	-	0.0088	0.0018 – 0.0432
Common Dolphin	NED ¹	0	-	0	-	0.0120	0.0025 – 0.0587
Pilot Whale	MAB	0.1094	0.0363– 0.3300	0.1527	0.0558 – 0.4177	0.1941	0.1097 – 0.3432
Pilot Whale	NEC	0	-	0.0404	0.0083 – 0.1975	0.0152	0.0031 – 0.0744
Risso’s Dolphin	MAB	0.0188	0.0038 – 0.0916	0	-	0.0069	0.0014 – 0.0337
Risso’s Dolphin	NEC	0	-	0	-	0.0005	0.0096 – 0.1080
Unid. Marine Mammal	GOM	0	-	0	-	0.0041	0.0009 – 0.0202
Unid. Marine Mammal	MAB	0.0445	0.0134 – 0.1479	0	-	0	-

¹Fishery effort in the NED region during 2002 and 2003 (included in this table) followed an experimental design distinct from “normal” fishery operations.

Figure 1. The observed U.S. Pelagic Longline Fishery effort and marine turtle interactions during 1 July – 30 September 2007 are shown. The pelagic longline fishing areas in the North Atlantic Ocean are as follows: 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 and TUS = Tuna South. Area closures and the U.S. Exclusive Economic Zone (EEZ) are shown.

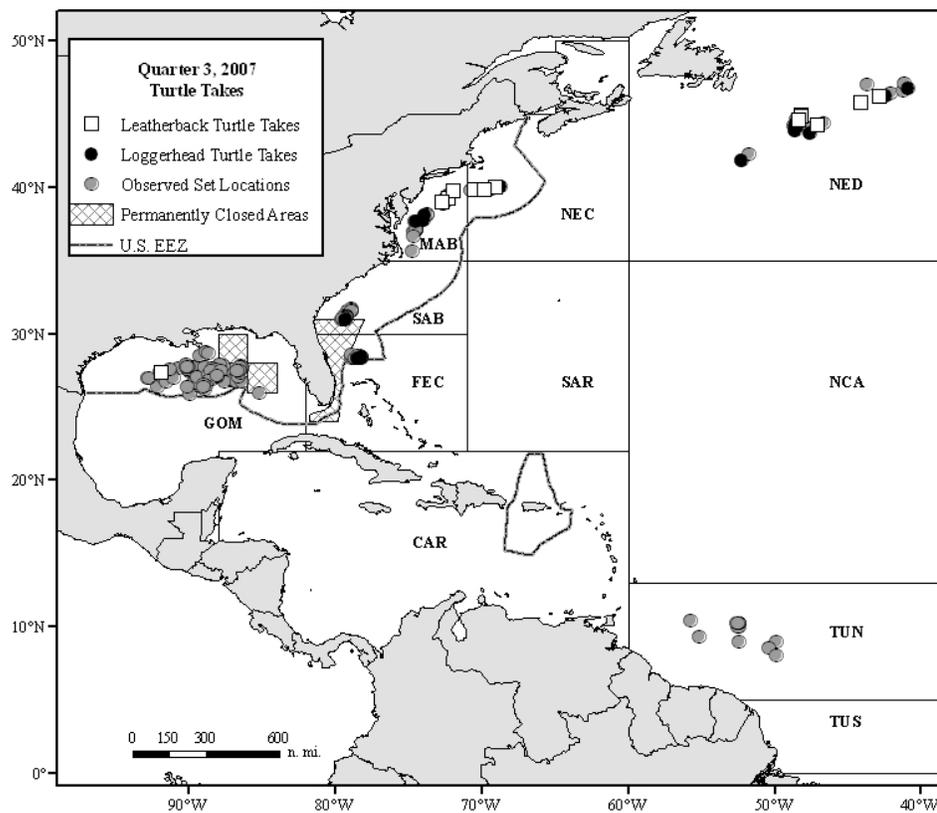
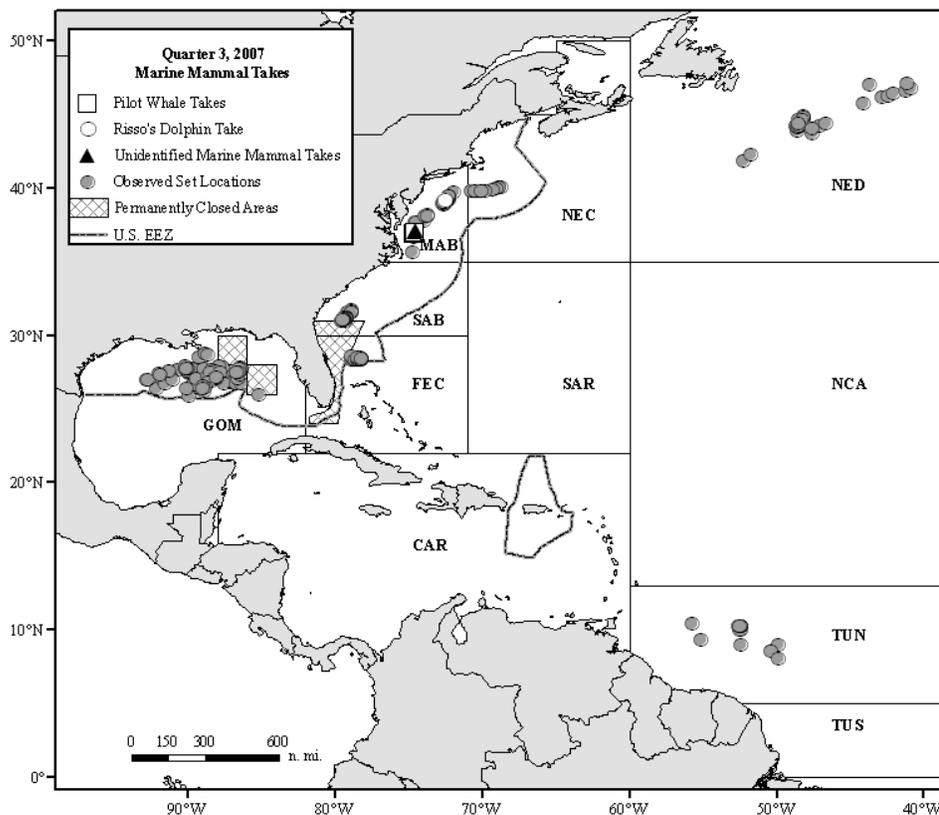


Figure 2. The observed U.S. Pelagic Longline Fishery effort and marine mammal interactions during 1 July – 30 September 2007 are shown. The pelagic longline fishing areas in the North Atlantic Ocean are as follows: CAR = Caribbean, GOM = Gulf of Mexico, FEC = Florida East Coast, SAB = South Atlantic Bight, SAR = Sargasso Sea, MAB = Mid-Atlantic Bight, NEC = Northeast Coastal, NED = Northeast Distant, NCA = North Central Atlantic, TUN = Tuna North and TUS = Tuna South. Area closures and the U.S. Exclusive Economic Zone (EEZ) are shown.



Appendix A: Injury details and hook types for turtles captured in the U.S. Atlantic Pelagic Longline Fishery during 1 July – 30 September 2007. “CL Est.” indicates an estimated carapace length in feet; “CCL” indicates a measured curved carapace length in cm; and “Straight N-N” indicates a straight line measurement of the turtle carapace from notch to notch.

1. Leatherback Turtles

#	Species	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	Leatherback	GOM	C-16/0	0	squid	225	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0	5.0		
2	Leatherback	MAB	C-18/0	10	squid or mackerel	163.5 or 544.8	Alive, unknown	Released alive	not known if hooked	Yes	Yes	No	0.0	4.0		
3	Leatherback	MAB	C-18/0	10	squid	158	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0	4.0		
4	Leatherback	MAB	C-18/0	10	squid	350	Alive, injured	Released alive	shoulder	No	No	No	0.0	5.0		
5	Leatherback	NEC	C-18/0	10	squid or mackerel	204.9 or 378.3	Alive, injured	Released alive	unknown external	Yes	No	No	0.0	5.0		
6	Leatherback	NEC	C-18/0	10	squid or mackerel	204.9 or 378.3	Alive, injured	Released alive	shoulder	No	No	No	0.0	5.5		
7	Leatherback	NEC	C-18/0	10	squid or mackerel	204.9 or 378.3	Alive, injured	Released alive	shoulder	Yes	No	No	0.0	5.5		
8	Leatherback	NED	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0	5.1		
9	Leatherback	NED	C-18/0	10	squid	244	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0	5.0		
10	Leatherback	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	armpit	Yes	Yes	No	0.0	6.0		
11	Leatherback	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	armpit	Yes	No	No	0.0	6.0		
12	Leatherback	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	armpit	Yes	No	No	0.0	4.0		
13	Leatherback	NED	C-18/0	10	mackerel	370	Alive, injured	Released alive	front flipper	Yes	Yes	No	0.0	5.0		

Appendix A (cont.):

2. Loggerhead Turtles

#	Species	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	Loggerhead	FEC	C-16/0	0	squid	205	Alive, injured	Released alive	swallowed, partial hook visible	No	No	No	0.1		57.0	50.0
2	Loggerhead	FEC	C-18/0	10	squid	193	Alive, injured	Released alive	beak internal, lower jaw	No	No	No	0.5	3.5		
3	Loggerhead	FEC	C-16/0	0	squid	300	Alive, injured	Released alive	beak internal, lower jaw	No	No	No	0.1	4.0		
4	Loggerhead	MAB	C-18/0	10	squid or mackerel	197.6 or 181.6	Alive, injured	Released alive	swallowed, partial hook visible	No	No	No	0.0		75.5	67.2
5	Loggerhead	MAB	C-18/0	10	squid or mackerel	197.6 or 181.6	Alive, injured	Released alive	swallowed, visible to insertion point	Yes	No	No	0.0		68.0	59.4
6	Loggerhead	MAB	C-18/0	10	squid or mackerel	181.6 or 544.8	Alive, injured	Released alive	mouth, lower, glottis	Yes	No	No	0.0		67.0	59.0
7	Loggerhead	MAB	C-18/0	10	squid or mackerel	197.6 or 181.6	Alive, injured	Released alive	mouth, lower, tongue	Yes	No	No	0.0		65.1	58.5
8	Loggerhead	MAB	C-18/0	10	squid	350	Alive, injured	Released alive	mouth, lower, tongue	Yes	No	No	0.0		73.0	66.8
9	Loggerhead	MAB	C-18/0	10	squid or mackerel	161.7 or 544.8	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0		85.0	76.2
10	Loggerhead	MAB	C-16/0	0	squid	225	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.0		65.0	57.5
11	Loggerhead	MAB	C-16/0	0	squid	300	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.0		71.2	64.3

Appendix A (cont.):

2. Loggerhead Turtles (cont.)

#	Species	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)
12	Loggerhead	MAB	C-16/0	0	squid	300	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.0		72.4	65.6
13	Loggerhead	MAB	C-16/0	0	squid	225	Alive, injured	Released alive	front flipper	No	No	No	3.0			
14	Loggerhead	NEC	C-18/0	10	squid or mackerel	204.9 or 378.3	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0		63.8	55.3
15	Loggerhead	NEC	C-18/0	10	squid	199	Alive, injured	Released alive	rear flipper	Yes	No	No	0.0		61.0	54.3
16	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	swallowed, partial hook visible	No	No	No	0.2		64.2	57.5
17	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	swallowed, partial hook visible	No	No	No	0.0		64.8	58.7
18	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	swallowed, visible to insertion point	Yes	No	No	0.0		67.0	61.2
19	Loggerhead	NED	C-18/0	10	squid	244	Alive, injured	Released alive	swallowed, visible to insertion point	Yes	No	No	0.0		64.6	57.7
20	Loggerhead	NED	C-18/0	10	mackerel	370	Alive, injured	Released alive	swallowed, visible to insertion point	Yes	No	No	0.0		65.5	56.7
21	Loggerhead	NED	C-18/0	10	squid	244	Alive, injured	Released alive	swallowed, hook not visible	No	No	No	0.5		73.7	67.4
22	Loggerhead	NED	C-18/0	10	squid	244	Alive, injured	Released alive	mouth, upper, roof of mouth	Yes	No	No	0.0		54.1	46.9

Appendix A (cont.):

2. Loggerhead Turtles (cont.)

#	Species	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)
23	Loggerhead	NED	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, injured	Released alive	mouth, upper, roof of mouth	Yes	No	No	0.0		63.2	57.9
24	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0		57.4	53.4
25	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0		49.4	43.7
26	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0		60.0	53.6
27	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0		57.6	51.4
28	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0		57.2	53.0
29	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.0		52.0	45.9
30	Loggerhead	NED	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, injured	Released alive	mouth, side, jaw joint	Yes	No	No	0.0		69.1	61.5
31	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, side, other	Yes	No	No	0.0		39.8	34.8
32	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, side, other	Yes	No	No	0.0		70.0	61.8
33	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	mouth, side, unknown	Yes	No	No	0.0		74.0	67.5
34	Loggerhead	NED	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, injured	Released alive	beak internal, upper jaw	Yes	No	No	0.0		63.8	55.7
35	Loggerhead	NED	C-18/0	10	squid or mackerel	246.8 or 373.6	Alive, injured	Released alive	beak internal, upper jaw	Yes	No	No	0.0		60.1	53.3

Appendix A (cont.):

2. Loggerhead Turtles (cont.)

#	Species	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)
36	Loggerhead	NED	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0		67.0	60.3
37	Loggerhead	NED	C-18/0	10	mackerel	370	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0		74.9	67.1
38	Loggerhead	NED	C-18/0	10	mackerel	370	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0		47.3	42.4
39	Loggerhead	NED	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0		72.0	66.4
40	Loggerhead	NED	C-18/0	10	squid	244	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0		73.9	66.8
41	Loggerhead	NED	C-18/0	10	squid	244	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0		69.3	63.0
42	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, injured	Released alive	front flipper	Yes	No	No	0.0		46.4	40.9
43	Loggerhead	NED	C-18/0	10	squid or mackerel	217 or 246.3	Alive, injured	Released alive	front flipper	Yes	No	No	0.0		55.4	48.6
44	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0		57.8	51.5
45	Loggerhead	NED	C-18/0	10	squid or mackerel	246.3 or 373.4	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.0		62.8	55.4
46	Loggerhead	NED	C-18/0	10	mackerel	216	Alive, unknown	Released alive	not known if hooked	Yes	No	No	0.0		55.4	49.4
47	Loggerhead	SAB	C-18/0	10	mackerel	240	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.0		64.0	61.0