

Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 October and 31 December, 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. The biological opinion also 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 requirement and includes the observed fishery effort and incidental takes observed by the pelagic longline observer program (POP) including sets from October 1, 2005 to December 31, 2005.

While it is desirable to estimate the absolute level of takes (i.e., total number of turtles taken) for recent quarters, it is not currently possible to develop an estimate based upon current fishing effort 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, 2005a) 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 98 longline sets (~79,200 hooks) were observed during quarter 4 of 2005 (Table 1) in “normal” fishing operations. The Gulf of Mexico and the mid-Atlantic Bight had the highest number of observed sets. During quarter 4 of 2005, a small number of sets were conducted under a cooperative research program (CRP) in the Gulf of Mexico. The experimental goals and design of these sets has been described in previous reports (Garrison, 2005b). The experimental fishery included an additional 4 observed sets (~2,350 hooks), and no protected species interactions were observed.

During normal fishing operations, there were 10 observed interactions with leatherback turtles and 5 interactions with loggerhead turtles (Table 2). One leatherback turtle was recorded as “fresh dead”, one leatherback turtle was listed as released alive and uninjured, one loggerhead turtle was released alive in unknown condition, and the remaining seven turtles were listed as released alive and injured because they were hooked (Appendix A). The locations of observed sets and turtle interactions are shown in Figure 1. The dead leatherback was necropsied by the observer and several organs and tissues were salvaged for scientific research.

There were 5 observed interactions with marine mammals during this quarter (Table 3, Figure 2), all occurring during normal fishing operations. Two pilot whale interactions were observed, and one of these was determined to be seriously injured based upon observer comments and serious injury criteria (see Garrison, 2003; Angliss and Demaster, 1998). Interactions were also observed with Risso’s dolphin, Atlantic spotted dolphin, and an un-identified dolphin (Table 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 A.

Leatherback turtles interactions were observed in the Gulf of Mexico (GOM) and Sargasso Sea (SAR) regions. The bycatch rate observed in the GOM region was higher than that observed in quarter 4 of 2004; however, the 2005 rate was consistent with the five-year average bycatch rate in the GOM (Table 6a). In previous years, bycatch was observed in the FEC, MAB, and NEC regions; however, no leatherback interactions were observed in these areas during quarter 4 of 2005. There had been no observer effort in the SAR region during the previous five years, and the interaction rate was relatively high in this area during quarter 4 of 2005.

Loggerhead turtle interactions were observed in the mid-Atlantic Bight (MAB) and SAR regions. The bycatch rate observed in the MAB was lower than that in previous years, and no interactions were observed in the FEC or GOM areas where interactions had previously occurred (Table 6b). The SAR region had not been observed during the previous five years.

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. One leatherback turtle was

recovered dead, and this animal was entangled in the gear rather than hooked. Of the remaining nine leatherbacks, eight were hooked in the extremities. The hook was removed in four of these eight cases, and virtually all of the trailing line was removed (Appendix A). Four of the five loggerhead turtles were known to be hooked. The hook was removed in all but one of these cases (Appendix A).

The bycatch rate observed for pilot whales in the MAB region is slightly lower than, but consistent with, that observed in previous years. The interaction rate with Risso's dolphin in the Northeast Coastal (NEC) region was elevated relative to previous years.

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 protected species 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 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.

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Garrison, L.P. 2005a. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2004. NOAA Technical Memorandum NMFS-SEFSC-531: 57 p.

Garrison, L.P. 2005b. Preliminary Estimates of Protected Species Bycatch Rates in the U.S. Atlantic Pelagic Longline Fishery Between 1 July and 30 September, 2005. SEFSC Document #PRD-05/06-05: 16 p.

Table 1. Number of sets and hooks (x1000) observed in the U.S. Atlantic Pelagic Longline Fishery between 1 October – 31 December, 2005 by fishing area during (A) Normal and (B) Experimental Fishery Operations.

A. Normal Fishing

Area	Sets	Hooks (x 1000)
CAR	0	0
FEC	2	0.70
GOM	45	32.38
MAB	27	21.72
NCA	0	0
NEC	3	3.04
NED	0	0
SAB	0	0
SAR	21	21.48
TUN	0	0
TUS	0	0
Total	98	79.32

B. Experimental Fishing

Area	Sets	Hooks (x 1000)
CAR	0	0
FEC	0	0
GOM	4	2.35
MAB	0	0
NCA	0	0
NEC	0	0
NED	0	0
SAB	0	0
SAR	0	0
TUN	0	0
TUS	0	0
Total	4	2.35

Table 2. Total observed interactions with marine turtles in the U.S. Atlantic Pelagic Longline Fishery for sets beginning between 1 October – 31 December, 2005 by fishing area during normal fishing operations. No turtles were captured in CRP fishery effort. Areas with missing values indicate no observer coverage during this time period. One leatherback turtle was reported dead in the Gulf of Mexico fishing area. All other turtles were released alive.

Area	Leatherback	Loggerhead
CAR	-	-
FEC	0	0
GOM	5*	0
MAB	0	1
NCA	-	-
NEC	0	0
NED	-	-
SAB	-	-
SAR	5	4
TUN	-	-
TUS	-	-
Total	10	5

* indicates one turtle reported dead.

Table 3. Interactions with marine mammals observed during 1 October – 31 December 2005 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.

Species	Region	Experiment	# Released Un-injured	# Dead	# Serious Injury
Pilot Whale	MAB	No	1	0	1
Risso's Dolphin	NEC	No	1	0	0
Atlantic spotted dolphin	SAR	No	1	0	0
Unid. Dolphin	SAR	No	1	0	0

Table 4. Estimated bycatch rate (Catch per 1000 hooks) for (A) Leatherback and (B) Loggerhead turtles by geographic area and during 1 October – 31 December, 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. Reported rates include all captured turtles, including one dead leatherback in the Gulf of Mexico.

A. Leatherback Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	2	0	0	-	-
GOM	45	5	0.1544	0.0046	0.4399
MAB	27	0	0	-	-
NCA	0	-	-	-	-
NEC	3	0	0	-	-
NED	0	-	-	-	-
SAB	0	-	-	-	-
SAR	21	5	0.2385	0.0093	0.4048
TUN	0	-	-	-	-
TUS	0	-	-	-	-

B. Loggerhead Turtles

Area	# Observed Sets	# Positive Sets	Mean CPUE	Var CPUE	CV
CAR	0	-	-	-	-
FEC	2	0	0	-	-
GOM	45	0	0	-	-
MAB	27	1	0.0441	0.0019	1.000
NCA	0	-	-	-	-
NEC	3	0	-	-	-
NED	0	-	-	-	-
SAB	0	-	-	-	-
SAR	21	3	0.1932	0.0122	0.5717
TUN	0	-	-	-	-
TUS	0	-	-	-	-

Table 5. Estimated bycatch rate (Catch per 1000 hooks) for marine mammals by geographic area and quarter during 1 October – 31 December, 2005 in the U.S. Atlantic Pelagic longline fishery during normal fishing 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	N	MAB	1	27	0.0412	0.0017	1.000
Pilot Whale	Y	MAB	1	27	0.0412	0.0017	1.000
Risso's Dolphin	N	NEC	1	3	0.3490	0.1218	1.000
Atlantic spotted dolphin	N	SAR	1	21	0.0735	0.0054	1.000
Unid. Dolphin	N	SAR	1	21	0.0441	0.0019	1.000

Table 6. Bycatch rates for (A) Leatherback turtles and (B) Loggerhead turtles in the U.S. Atlantic longline fishery during 1 October - 31 December, 2005 during normal fishing operations 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	-
FEC	0	-	0	-	0.1326	0.0271 – 0.6480
GOM	0.1544	0.0693 – 0.3442	0.0159	0.0032 – 0.0778	0.1692	0.1125 – 0.2543
MAB	0	-	0.2308	0.1177 – 0.4527	0.1284	0.0765 – 0.2157
NCA	-	-	-	-	-	-
NEC	0	-	0.3086	0.0631 – 1.509	0.2765	0.1561 – 0.4899
NED ¹	-	-	0.1036	0.0312 – 0.3440	0.0199	0.0072 – 0.05493
SAB	-	-	0	-	0.2108	0.0635 – 0.7004
SAR	0.2385	0.1136 – 0.5005	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

B. Loggerhead Turtles

Area	2005 CPUE	2005 95% CI	2004 CPUE	2004 95% CI	2000-2004 CPUE	2000 - 2004 95% CI
CAR	-	-	-	-	0.2451	0.0501 – 1.198
FEC	0	-	0	-	0.3572	0.1335 – 0.9559
GOM	0	-	0.0381	0.0078 – 0.1861	0.0245	0.0094 – 0.0634
MAB	0.0441	0.0090 – 0.2155	0.1587	0.0703 – 0.3581	0.1197	0.0661 – 0.2169
NCA	-	-	-	-	-	-
NEC	-	-	0	-	0.0843	0.0306 – 0.2324
NED ¹	-	-	0	-	0.0331	0.0098 – 0.1112
SAB	-	-	0.5608	0.1909 – 1.647	0.2335	0.0941 – 0.5793
SAR	0.1932	0.0701 – 0.5323	-	-	-	-
TUN	-	-	-	-	-	-
TUS	-	-	-	-	-	-

¹ Fishery effort in the NED region during 2001, 2002, and 2003 followed an experimental design distinct from “normal” fishery operations.

Table 7. Summary of bycatch rates for marine mammals in the U.S. Atlantic longline fishery during 1 October – 31 December, 2005 during normal fishing operations 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
Pilot Whale	FEC	0	-	0	-	0.1326	0.02712 – 0.6479
Common Dolphin	MAB	0	-	0	-	0.0199	0.0041 – 0.0975
Risso's Dolphin	MAB	0	-	0.0626	0.0182 – 0.2154	0.1156	0.0657 – 0.2034
Pilot Whale	MAB	0.0823	0.0168 – 0.4023	0.1490	0.0515 – 0.4308	0.1657	0.0807 – 0.3399
Risso's Dolphin	NEC	0.3490	0.0714 – 1.7062	0	-	0.1602	0.0795 – 0.3229
Risso's Dolphin	NED ¹	-	-	0	-	0.0088	0.0031 – 0.0250
Striped Dolphin	NED ¹	-	-	0	-	0.0028	0.0006 – 0.0136
Unid. Marine Mammal	NED ¹	-	-	0	-	0.0029	0.0006 – 0.0142
Pilot Whale	NED ¹	-	-	0	-	0.0021	0.0004 – 0.0101
Northern Bottlenose Whale	NED ¹	-	-	0	-	0.0023	0.0004 – 0.0110
Atl. Spotted Dolphin	SAR	0.0735	0.0150 – 0.3592	-	-	-	-
Unid. Dolphin	SAR	0.0441	0.0090 – 0.2155	-	-	-	-

¹ Fishery effort in the NED region during 2001, 2002, and 2003 followed an experimental design distinct from “normal” fishery operations.

Figure 1. Observed Pelagic Longline effort and turtle interactions during 1 October – 31 December, 2005. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.

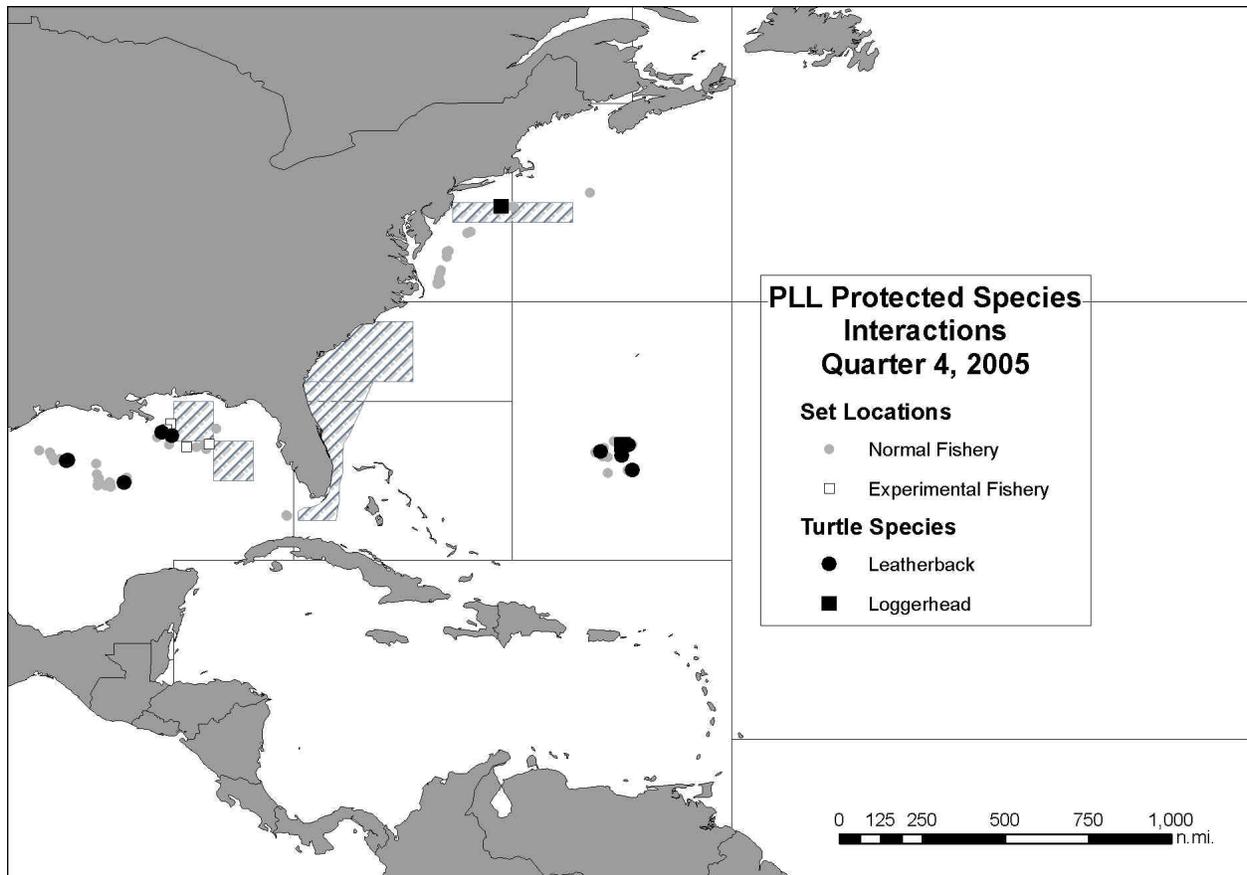
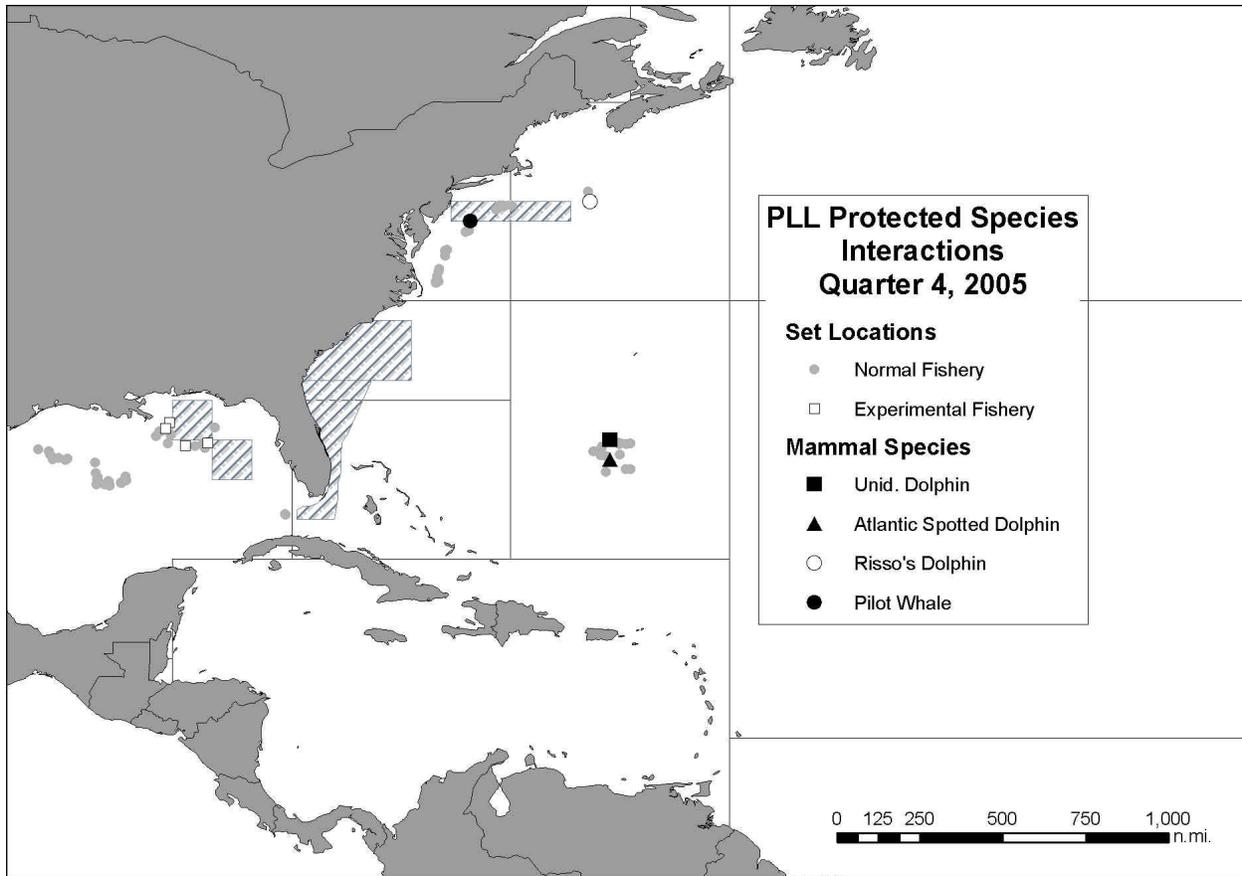


Figure 2. Observed Pelagic Longline effort and marine mammal interactions during 1 October – 31 December, 2005. Seasonal closed areas for the pelagic longline fishery are indicated by shaded areas.



Appendix A: Injury details and hook type for turtles captured in the pelagic longline fishery for sets during 1 October – 31 December, 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	SAR	C-18/0	10	squid	329g	Alive, uninjured	not hooked	n/a	n/a	n/a	Yes	No	0.00	5.00		
2	GOM	C- 16/0	0	squid	350g	Alive, injured	shoulder	n/a	n/a	No	No	No	1.00	5.00		
3	GOM	C- 16/0	0	squid	350g	Alive, injured	rear flipper	n/a	n/a	Yes	No	No	0.00	4.00		
4	GOM	C- 16/0	0	sardines	65g	Alive, injured	armpit	n/a	n/a	No	Yes	No	0.00	6.00		
5	GOM	C- 16/0	0	sardines	65g	Fresh dead	not hooked	n/a	n/a	n/a	Yes	n/a	0.00		142.2	
6	GOM	C- 16/0	0	squid	114g	Alive, injured	armpit	n/a	n/a	No	No	No	0.10	5.00		
7	SAR	C-18/0	10	squid	277g	Alive, injured	armpit	n/a	n/a	Yes	No	No	0.00	5.00		
8	SAR	C-18/0	10	squid	277g	Alive, injured	shoulder	n/a	n/a	Yes	No	No	0.00	5.00		
9	SAR	C-18/0	10	squid or mackerel	277 g SQ or 568 g mack	Alive, injured	armpit	n/a	n/a	Yes	Yes	No	0.00	4.50		
10	SAR	C-18/0	10	squid or mackerel	277 g SQ or 568 g mack	Alive, injured	armpit	n/a	n/a	No	No	No	0.00	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	SAR	C-18/0	10	squid	329g	Alive, injured	beak internal	lower other	n/a	Yes	No	No	0.00		69.6	63.6
2	MAB	C-18/0	10	squid	180-200g	Alive, injured	armpit	n/a	n/a	Yes	No	No	0.00		70	64.8
3	SAR	C-18/0	10	squid	277g	Alive, unknown	not known if hooked	unknown	unknown	Yes	No	No	0.00	3.00		
4	SAR	C-18/0	10	squid or mackerel	277 g SQ or 568 g mack	Alive, injured	swallowed	n/a	partial hook	No	No	No	0.10		62.4	55.3
5	SAR	C-18/0	10	squid or mackerel	277 g SQ or 568 g mack	Alive, injured	swallowed	n/a	visible to insertion point	Yes	No	No	0.00		67.8	61