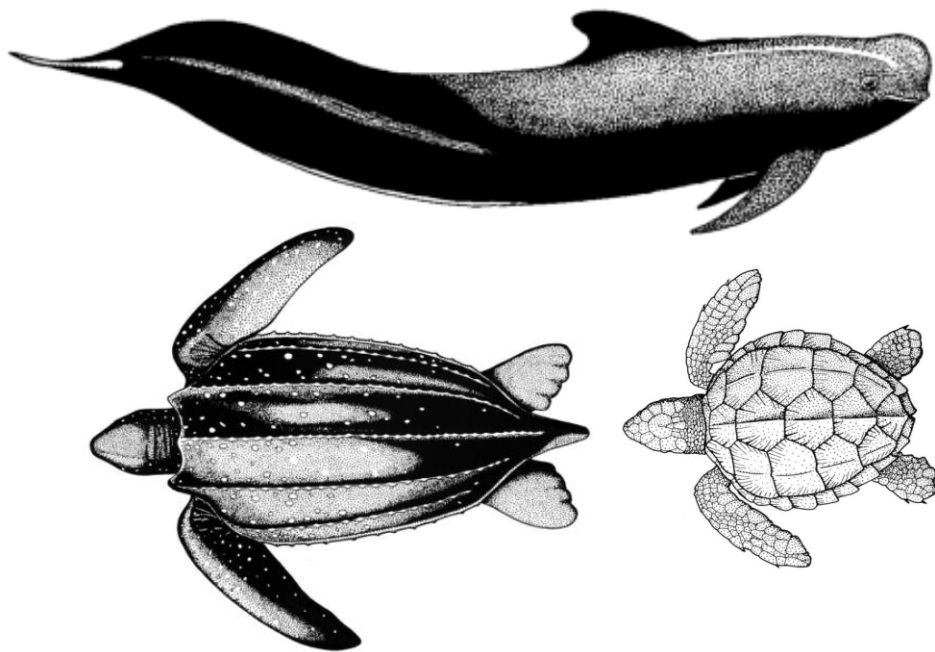




NOAA TECHNICAL MEMORANDUM NMFS-SEFSC-607

Estimated Bycatch of Marine Mammals and Sea Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2009

Lance P. Garrison and Lesley Stokes



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November 2010

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Abstract

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 Atlantic longline fleet is defined as a Category I fishery under the Marine Mammal Protection Act, and it is also the subject of management under the Endangered Species Act due to interactions with leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) turtles. Total bycatch of marine mammals and turtles in the longline fishery was estimated for 2009 using data from the pelagic longline fishery observer program and a mandatory fishery logbook reporting program. We applied a delta-lognormal approach to estimate region specific and total annual interactions with protected species in the fishery. During 2009, there were an estimated 285.8 (209.6 – 389.7 [95% CI]) interactions with leatherback turtles and 242.9 (167.9 – 351.2 [95% CI]) interactions with loggerhead turtles. The primary marine mammals interacting with this fishery were pilot whales (*Globicephala* sp.) with an estimated 35.7 (14.0 – 90.6 [95% CI]) interactions and Risso's dolphins (*Grampus griseus*) with 38.5 (16.0 – 92.6 [95% CI]) interactions. Potential sources of bias and uncertainty in these bycatch estimates are discussed. The estimates for each of these species are lower than prior years, and the estimated bycatch of loggerhead turtles is substantially lower than that occurring since 2006.

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Introduction

Pelagic longline fisheries operate throughout the world's oceans targeting large pelagic fish including swordfish, tunas, and sharks. The U.S. Atlantic pelagic longline fleet operates throughout the northwestern Atlantic Ocean, 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 (Figure 1). The Atlantic longline fleet is defined as a Category I fishery under the Marine Mammal Protection Act (50 CFR Part 229, Federal Register Vol. 69, No. 135, 15 July 2003) due to frequently documented interactions with marine mammals.

The fishery is also the subject of management under the Endangered Species Act (ESA) due to frequent interactions with marine turtles including leatherback (*Dermochelys coriacea*) and loggerhead sea turtles (*Caretta caretta*). In June 2004, a Biological Opinion was issued by the National Marine Fisheries Service, Southeast Regional Office, finding that the U.S. Pelagic Longline Fleet posed a jeopardy to leatherback turtles in the Atlantic Ocean as defined under the ESA. To allow continued operation of the fishery, the Biological Opinion mandated increased reporting of bycatch, required education and outreach programs to train fishers in careful handling and release of turtles, and instituted large-scale changes in fishing gear. Most notably, the fishery was required to exclusively use "circle" hooks (size 16/0 or greater) after August 2004. This mandate was based upon expected reductions in bycatch rate due to hook shape and size demonstrated by experimental studies conducted in the Northeast Distant Water (NED) fishing area (Watson *et al.*, 2005).

In addition, several time-area closures were introduced into the fishery in 2000 and 2001 due to concerns over both finfish and protected species bycatch (NMFS 2003, 50 CFR Part 635). These include year-round closures near the De Soto Canyon in the Gulf of Mexico after 1 November 2000 (Figure 1, Label A) and in waters off the Atlantic coast of Florida after 1 March 2001 (Figure 1, Label B). Seasonal closures are in effect in the Charleston Bump region between 1 February and 30 April (Figure 1, Label C) and in a bluefin tuna area off the New Jersey coast between 1 June and 30 June (Figure 1, Label D). The NED area was closed to non-experimental longline fishing from 2001 to 2004 in response to high turtle bycatch. However, with the implementation of gear changes, it was reopened to fishing in June 2004.

In late 2009, regulations were implemented in the fishery to reduce the serious injury and mortality of pilot whales and Risso's dolphins in the mid-Atlantic bight region. The Pelagic Longline Take Reduction Plan (PLTRP) was developed based upon consensus recommendations of a team of scientists, managers, and commercial fisheries organizations per the Take Reduction Team process under the MMPA. Regulations were effective on 18 June, 2009 and include restriction of mainline lengths to less than 20 nautical miles in the mid-Atlantic Bight area and mandatory reporting requirements for fishermen operating in waters offshore of Cape Hatteras, North Carolina (50 CFR Part 229, Federal Register Vol. 74, No. 95, 18 May 2009).

The pelagic longline fishery has had a fishery observer program (Pelagic Observer Program, POP) in place since 1992 to document finfish bycatch, characterize fishery behavior, and quantify the interactions with protected species (Beerkircher *et al.*, 2004). In addition, a mandatory fishery logbook system (FLS) has been in place since

1992 requiring vessel captains to report fishing effort, gear characteristics, and commercial catch. These data have been used to generate annual estimates of marine mammal and turtle bycatch (Johnson *et al.*, 1999; Yeung, 1999a; Yeung 1999b; Yeung, 2001; Garrison 2003; Garrison and Richards, 2004; Garrison 2005; Fairfield-Walsh and Garrison, 2006, 2007, 2008; Garrison, Stokes, and Fairfield 2009).

In this report, marine mammal and sea turtle bycatch estimates are calculated for pelagic longline fishery effort during 2009. Bycatch rates (catch per 1000 hooks) are quantified based upon observer data by fishing area and quarter. The estimated bycatch rate is then multiplied by the total fishing effort (number of hooks) reported to the FLS program to obtain estimates of total interactions for each species of marine mammal and turtle.

Methodology

Geographic Stratification

Fishery observer effort is currently allocated among 10 large geographic areas and calendar quarter based upon the historical fishing range of the fleet (Figure 1). The target annual coverage is 8% of the total reported hooks, and observer effort is allocated randomly based upon reported fishing effort during the previous calendar year in each quarter/fishing area stratum (Beerkircher *et al.*, 2004). Between 15 April and 15 June of 2008, observer coverage in the Gulf of Mexico (GOM) fishing area was greatly enhanced to collect more robust information on the interactions between pelagic longline vessels and spawning bluefin tuna. As a result, the observer coverage for this time and area is dramatically higher than is typical for other strata or previous years. The bycatch

estimates developed for each species are stratified by fishing area and quarter to reflect the design of the observer program.

In addition to observation of regular fishing, the POP program participated in a cooperative research program with NOVA Southeastern University that included longline fishing inside and outside of areas normally closed to fishing in the FEC and SAB areas. In addition, experimental fishing was conducted in the GOM region testing the effectiveness of “weak” hooks as a potential bycatch mitigation tool. There was 100% observer coverage of all experimental sets, and the experimental fishing is not included in extrapolated bycatch estimates because they are not representative of the normal fishing effort. A total of 212 sets (125,168 hooks) were observed in experimental fishing. The number of sets and hooks by area-quarter stratum cannot be reported due to confidentiality considerations.

Bycatch rates for quarter-area strata with reported longline fishery sets that had no corresponding observer coverage in 2009 were replaced with previously observed mean bycatch rates. In prior years, 5-year average quarter-area bycatch estimates were used to estimate bycatch in unobserved cells. However, the implementation of regulations in 2004 impacted the bycatch rates in the fishery. Therefore, a four-year average (2005-2008) was used to better reflect the current expected bycatch rates for most quarter-area strata. For strata where there was no observer coverage in a specific quarter from 2005-2008, the bycatch rate was estimated from the annual 2009 rate for that fishing area ignoring potential quarterly (i.e., seasonal) effects on rates. Finally, if there was no coverage at all in 2009 for a fishing area, then bycatch estimates were made based upon the annual average bycatch rate for that fishing area from 2005-2008. In this way,

bycatch rates for unobserved quarter-area strata were based upon the nearest available information preserving quarterly, annual, and regional variation in bycatch rates.

Recent changes to the Magnuson-Stevens Fishery Conservation and Management Act have changed the restrictions on reporting fishery information including that collected by observers. NMFS rules therefore restrict the reporting of business information within temporal or spatial strata including fewer than 3 vessels. Business information includes information on the fishing gear or level of effort. As such, the number of sets and hooks cannot be reported in some quarter-area strata in either the reported effort data, the observer data, or both. In cases where by simple calculation one could derive the level of effort in such cells, we have not reported sufficient information to make those calculations. Quarter-area strata where the level of reporting is limited by confidentiality concerns are noted in the appropriate tables.

Delta Lognormal Estimator

Sets in which a portion of the longline broke away, and therefore had multiple recorded haul times, were combined into single sets. This is consistent with the approach of the most recent mortality estimates (Garrison, 2003; Garrison and Richards, 2004; Garrison, 2005; Fairfield-Walsh and Garrison, 2006; Fairfield-Walsh and Garrison, 2007; Fairfield and Garrison, 2008). The mean and variance of catch rates for marine mammals and turtles observed in longline sets were calculated using a delta lognormal estimator (Pennington, 1983). The delta estimator is more appropriate than the simple mean because catch rates are generally log-normally distributed and bycatch events (i.e., positive sets) are rare. The unit of effort in this analysis is the number of hooks,

consistent with methods used to estimate total catch and bycatch of finfish and previous analyses of protected resource interactions (Johnson *et al.*, 1999). The mean bycatch rate for each analytical stratum, t , is calculated as:

$$(1) \quad C_t = \frac{m_t}{n_t} e^{L_t} G(s_{L_t}^2/2),$$

where:

m_t is the number of sets with observed bycatch,

n_t is the total number of observed sets,

L_t is the mean of the log-transformed number of animals taken per 1000 hooks when bycatch occurred,

$s_{L_t}^2$ is the observed sample variance of the log transformed bycatch rate, and G is the cumulative probability function from the Poisson distribution given as:

$$(2) \quad G(s_{L_t}^2/2) = 1 + \frac{m_t - 1}{m_t} (s_{L_t}^2/2) + \sum_{j=2}^{\infty} \frac{(m_t - 1)^{2j-1}}{m_t^j (m_t + 1)(m_t + 3) \dots (m_t + 2j - 3)} \times \frac{(s_{L_t}^2/2)^j}{j!}.$$

The series was computed numerically over j terms until meeting a convergence criterion of a change in the function value of < 0.0001 with additional terms (j). Convergence was generally achieved with < 10 terms. The variance of the delta estimator is:

$$(3) \quad \text{var}(C_t) = \frac{m_t}{n_t} (e^{2L_t}) \left[\frac{m_t}{n_t} G^2(s_{L_t}^2/2) - \left(\frac{m_t - 1}{n_t - 1} \right) G\left(\frac{m_t - 2}{m_t - 1} s_{L_t}^2 \right) \right].$$

When m_t is equal to 1, the mean bycatch rate reduces to the simple mean rate where

$$(4) \quad C_t = \frac{\exp(L_t)}{n_t},$$

and

$$(5) \text{ var}(C_t) = \left(\frac{\exp(L_t)}{n_t} \right)^2 .$$

The C_t calculated above gives the mean number of animals caught per 1000 hooks in the observed trips. To estimate total interactions, N , these rates are multiplied by the total number of hooks reported to the FLS database for each analytical stratum. The stratified estimates and associated variances were summed to provide annual estimates for each species. Approximate 95% confidence intervals (95% CI) were calculated assuming log-normal distribution of total mortality as N/C and $N \cdot C$ for the lower and upper confidence bounds respectively where:

$$(6) \quad C = \exp [z_\alpha \sqrt{\text{var}(\ln N)}] ,$$

and

$$(7) \text{ var}(\ln N) = \ln [1 + \text{var}(N)/N^2] ,$$

where z_α is 1.96, the z score for $\alpha = 0.05$.

Sea Turtle Life History Form

Detailed information on the characteristics of longline interactions with sea turtles was recorded by the fisheries observers during 2009. These data include detailed descriptions of the type of interaction, the extent of entanglement, the location of any hook attached to the animal or swallowed, and other data (Appendix A). Detailed information on entanglement, hooked animals, and the location of hooks are shown in Appendix B.

Marine Mammal Serious Injury Determination

The Marine Mammal Protection Act (MMPA) requires that mortality and serious injury of marine mammals incidental to commercial fishing operations be reduced to a level approaching a zero mortality rate. “Serious injury” has been defined as an injury likely to result in mortality (NOAA Fisheries 50 CFR 229.2, Angliss and DeMaster, 1998). A workshop of NOAA Fisheries and external experts was convened in 1997 to evaluate the types of injuries occurring in commercial fisheries and to develop guidelines for determining if a given marine mammal observed interacting with commercial fishing gear was seriously injured. For small cetaceans, including pilot whales and other delphinids, it was concluded that animals that ingested hooks, were released with significant amounts of trailing fishing gear, were swimming abnormally, or suffered some obvious severe external trauma, should be considered seriously injured (Angliss and DeMaster, 1998). Serious injury determinations are made on a case by case basis after reviewing the observations and comments of fishery observers. For this report, observer comments for all takes of marine mammals from 2009 (Appendix B) were reviewed and serious injury determinations were made based upon observer comments and photographs consistent with current NOAA fisheries guidelines.

Results and Discussion

Reported Fishing Effort and Observer Coverage

The total reported pelagic longline fishing effort included 6.85 million hooks during 2009 (Table 1A, Figure 2). The reported fishery effort included 9,175 sets during 2009, 1,376 of which were observed by the POP program (Tables 1B and 2B, Figure 2).

The overall percent coverage during regular fishing was 15.8% expressed as a proportion of reported hooks and 15.0% as a proportion of reported sets (Table 3). The relatively high annual rate reflects the 58.3% coverage of the fishery during the second quarter in the GOM. Observer coverage for other area-quarter strata is shown in Table 3. The location of experimental fishing sets is shown in Figure 3.

Areas with no observer coverage during 2009 with more than 10 sets of reported fishing effort include the Caribbean (CAR) in quarter 2, the Northeast Coastal (NEC) during quarter 2, the Northeast Distant (NED) during quarter 2, and the Tuna North (TUN) during quarters 1, 3 and 4 (Table 3).

Observed Protected Species Interactions

There were 63 observed interactions with leatherback turtles and 29 with loggerhead turtles (Table 4, Figure 4) in 2009. Two leatherback turtles and 1 loggerhead turtle were dead upon capture. The greatest number of observed leatherback takes occurred in the GOM during the 2nd quarter and in the NEC region during the 3rd quarter (Table 4A, Figure 4). Loggerhead takes were observed in the greatest numbers in the GOM in quarter 2 and NEC during the 3rd quarter (Table 4B, Figure 4). These totals include 4 leatherback turtles taken during experimental fishing in the GOM (3 turtles), and SAB (1 turtle) fishing areas.

The vast majority of the turtles were characterized as being released alive and injured (i.e., most had been hooked) based upon recorded information on the sea turtle life history form (Table 5). Leatherback turtles were most typically hooked externally, while loggerhead turtles were primarily hooked in the mouth or beak or swallowed the

hook (Table 5). All gear was removed before release from 37 of the 92 turtles captured (Table 6). A total of 18 leatherbacks and 3 loggerheads were released either entangled or with the hook and line remaining that was $> \frac{1}{2}$ the carapace length (Table 6).

There were 21 interactions observed with marine mammals (Table 7, Figure 5). This included one interaction with a pantropical spotted dolphin during experimental fishing in the GOM. Eleven of the observed marine mammal interactions were categorized as serious injuries including 2 pilot whales, 2 Risso's dolphins, and 4 pantropical spotted dolphins (Table 8). Seven of the serious injuries were due to animals being hooked in the mouth, and in 5 of those cases they were released with gear likely to further entangle the animal. One Risso's dolphin and one pilot whale were considered seriously injured based upon handling during the disentanglement process. The Risso's dolphin was brought aboard and laid on the vessel's deck while the pilot whale was suspended from the flukes while the gear was removed (Appendix B, Table B2). One common dolphin was dead upon capture (Table 8).

Stratum estimates of total interactions for sea turtles are shown in Table 9. High leatherback estimated interactions occurred in the GOM in quarter 2 (66 animals) and in the NEC in quarter 4 (43 animals, Table 9). For loggerhead turtles, the estimated interactions were highest in the NEC in quarter 3 (27 animals), the SAB in quarter 3 (22.3 animals), and the MAB in quarter 3 (22.4 animals, Table 9).

The quarter-area strata estimates for observed marine mammal mortality, serious injury, and live releases are presented in Table 10. All observed pilot whale serious injuries occurred in the MAB region with an estimated 16.5 pilot whales in quarter 4 (Table 10). Risso's dolphin serious injuries occurred in the NEC and MAB strata.

Estimated Interactions in Unobserved Areas with Fishing Effort

The average bycatch rates and estimated catches in strata that were not observed during 2009 are summarized in Table 11. Nine quarter-area strata bycatch rates were estimated from the 2005-2008 average for the same quarter (Bycatch rate source = “Quarterly 05-08” in Table 11) and two used the annual 2009 bycatch rate for the fishing area (“Annual 2009” in Table 11). The highest estimated take from these unobserved areas for leatherbacks included 29.4 in the NEC region in quarter 2. For loggerheads, the estimated take was highest in the NEC-Quarter 2 (12.5) and the NED-Quarter 4 (10.6, Table 11). For marine mammals, an additional 2.5 false killer whale live releases were estimated from historical data in TUN-Quarter 4 (Table 12).

Total Estimated Bycatch

There were an estimated total of 285.8 (209.6 – 389.7 [95% CI]) interactions with leatherback turtles during 2009 (Table 13). The highest number of interactions occurred in the GOM and the NEC. In addition, 4 leatherbacks were taken during experimental fishing. For loggerhead turtles, the estimated total number of interactions was 242.9 turtles (167.9 – 351.2 [95% CI], Table 13). The areas with the highest estimated interactions included the NEC and the SAB. Annual estimates of marine mammal bycatch are shown in Table 14 with a total of 35.7 (14.0 – 90.6 [95% CI]) interactions with pilot whales and 38.5 (16.0 – 92.6 [95% CI]) interactions with Risso’s dolphins.

Trends in Bycatch Estimates

The leatherback take estimate reached a historical high in 2004, and prior to that had increased nearly linearly since 1998 (Figure 6). A significant decrease in the leatherback bycatch rate and the annual estimated number of interactions with leatherback turtles occurred beginning in 2005 after the implementation of regulations in August 2004. The 2009 estimated take of leatherback turtles continues a downward trend since 2007 and remains well below the average prior to implementation of the gear regulations.

Loggerhead turtle interactions since 2000 have been well below the historical highs that occurred in the mid-1990's (Figure 6). Following the implementation of regulations, the bycatch dropped in 2005, but rebounded to be slightly lower than the pre-regulation period. The 2009 estimate is considerably lower than those in 2006 and 2007 and is consistent with historical averages since 2001 (Figure 6). The lower estimated take in 2009 is due to greatly reduced bycatch rates compared to 2008, particularly in the NEC and NED fishing areas.

For pilot whales, the 2009 estimate was much lower than that from 2005 through 2008 (Figure 7). This continues the downward trend observed since 2005. The bycatch estimate for Risso's dolphins is also lower than that observed in 2008 (Figure 7).

Sources of Bias and Uncertainty

The fishery logbook data is a mandatory reporting program, and thus it is expected that reporting rates are generally high. Due to the intense management focus on the longline fishery, there has been close monitoring of reporting rates, and observed trips

can be directly linked to reported effort. In general, the gear characteristics and amount of observed effort is consistent with the reported effort. However, reporting errors are possible in this fishery that would result in a bias in bycatch estimates.

Observer coverage in the pelagic longline fishery is generally high, particularly in comparison to that of other commercial fisheries. The sampling level is sufficient to provide reasonably precise estimates of interactions with protected species. The observed coefficients of variation for annual estimates of both loggerhead and leatherback turtles are well below the 30% benchmark established by guidelines for precision set by NOAA Fisheries. During 2008, the most notable gaps in coverage occurred in the CAR, SAR and NCA regions, which had no observer coverage during any time of year. In addition, the lack of coverage in the MAB during quarter 1 and low coverage in quarter 2 (11 sets total) is potentially problematic for estimating pilot whale and Risso's dolphin bycatch. Applying observer data from previous years or from grouped strata is inherently uncertain since bycatch rates can vary significantly in both time and space. Estimates for those strata supplemented by previous years' observer coverage should be treated with caution.

The delta estimator was applied to calculate bycatch rates primarily to maintain consistency with previous estimates for this fishery (Johnson *et al.*, 1999; Yeung, 1999a; Yeung, 1999b; Yeung, 2001; Garrison, 2003; Garrison and Richards, 2004; Garrison, 2005; Fairfield-Walsh and Garrison, 2006, 2007, 2008). This approach assumes that: 1) catch rates (animals per hook) are log-normally distributed, and 2) the number of hooks is an appropriate unit of effort. The first assumption was critically examined for sea turtles in Johnson *et al.* (1999); however, it is difficult to verify for marine mammals given the

generally low rate of these interactions. The delta estimator is sensitive to the assumption of log-normality, and 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. The current approach assumes that total bycatch is linearly related to the total number of hooks fished. 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, of unknown direction and magnitude, in the estimate of total bycatch.

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List of Tables and Figures

Table 1. Total amount of fishing effort reported to the pelagic longline logbook program during 2009 by quarter and fishing area. Fishing effort is reported as A) Number of hooks (thousands) and B) Number of sets. NR indicates strata where effort cannot be reported due to confidentiality considerations.

Table 2. Total amount of fishing effort observed during 2009 by quarter and fishing area. Fishing effort is reported as A) Number of hooks (thousands) and B) Number of sets. Dashes indicate cells where no fishery effort was reported. NR indicates strata where effort cannot be reported due to confidentiality considerations.

Table 3. Percentage of reported fishing effort observed during 2009 by quarter and fishing area by A) Number of hooks and B) Number of sets. Dashes indicate no reported fishing effort. Cells in which >10 longline sets were reported with no observer coverage are indicated in bold. Totals indicate overall percentage coverage by area and quarter. NR indicates strata where effort cannot be reported due to confidentiality considerations.

Table 4. Total number of observed interactions with A) Leatherback turtles, B) Loggerhead turtles, and C) All sea turtles in the pelagic longline fishery during 2009 by quarter and fishing area. Dashes indicate areas where there was no observed fishing effort, and an X indicates an area where no effort was reported. NR indicates strata where effort cannot be reported due to confidentiality considerations.

Table 5. Summary of A) Release condition, B) Hook location in hooked animals, and C) Animals with all gear removed, by hook location for sea turtles observed in the pelagic longline fishery during 2009. Hook location information is recorded on the sea turtle life history form (Appendix A) by the observer.

Table 6. Release status and gear removal for sea turtles captured and released alive in the U.S. Atlantic Pelagic Longline Fishery during 2009. Counts include turtles captured during experimental fishing.

Table 7. Total number of marine mammals observed in interactions with the pelagic longline fishery during 2009 by quarter and fishing area. Dashes indicate areas where there was no observed fishing effort, and an X indicates an area where no effort was reported.

Table 8. Summary of release condition and serious injury types for marine mammals observed in the pelagic longline fishery during 2009. Serious injury determinations were based upon written observer comments (Appendix B). “Entangled” indicates that the animal was released with > 4 feet of gear remaining attached.

Table 9. Estimated interactions with marine turtles in the pelagic longline fishery during 2009 by fishing area and quarter. Estimates include (A) Mortalities, (B) Released

Alive, (C) Unknown status, and (D) All Interactions. NR indicates strata where effort cannot be reported due to confidentiality considerations.

Table 10. Estimated A) Mortalities, B) Serious Injury, C) Released Alive, and D) Total Interactions with marine mammals in the pelagic longline fishery during 2009 by fishing area and quarter. NR indicates strata where effort cannot be reported due to confidentiality considerations.

Table 11. Bycatch rates for sea turtles in area-quarter strata with reported effort that were not observed in 2009. NR indicates strata where effort cannot be reported due to confidentiality considerations.

Table 12. Bycatch rates for marine mammals in area-quarter strata with reported effort that were not observed in 2009. NR indicates strata where effort cannot be reported due to confidentiality considerations.

Table 13. Total estimated interactions (including live, dead, and unknown status) with A) Leatherback, B) Loggerhead turtles in the pelagic longline fishery during 2009 by fishing area.

Table 14. Total estimated interactions with marine mammals in the pelagic longline fishery during 2009. These estimates include extrapolated values for areas with no observer coverage during 2009 (see Table 11).

Figure 1. Pelagic longline fishing areas in the North Atlantic Ocean: 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 along with seasonal closures in the Charleston Bump (C) and in the Mid-Atlantic (D).

Figure 2. Observed and reported pelagic longline fishing effort during 2009.

Figure 3. Locations of experimental sets during 2009.

Figure 4. Observed pelagic longline fishing effort and sea turtle takes during 2009.

Figure 5. Observed pelagic longline fishing effort and marine mammal takes during 2009.

Figure 6. Historical trends in fishery effort and estimated marine turtle takes in the pelagic longline fishery between 1992 and 2009 for A) Leatherback Turtles, and B) Loggerhead Turtles. Errors bars represent 95% confidence intervals.

Figure 7. Historic trends in fishery effort and estimated marine mammal takes in the pelagic longline fishery between 1992 and 2009 for A) Pilot Whales, and B) Risso's Dolphins. Errors bars represent 95% confidence intervals.

Table 1. Total amount of fishing effort reported to the pelagic longline logbook program during 2009 by quarter and fishing area. Fishing effort is reported as A) Number of hooks (thousands) and B) Number of sets. NR indicates strata where effort cannot be reported due to confidentiality considerations.

A. Number of Hooks (thousands)

Quarter	CAR	FEC	GOM	MAB	NEC	NED	SAB	SAR	TUN	Total
1	29.7	285.2	572.2	76.6	0.0	0.0	176.8	71.7	NR	NR
2	NR	165.0	808.6	164.3	91.2	NR	484.1	NR	NR	1807.7
3	0.0	226.8	1063.9	540.9	291.7	193.6	54.4	0.0	NR	NR
4	0.0	150.4	514.8	411.0	83.7	49.5	107.7	21.4	NR	NR
Total	NR	827.5	2959.3	1192.9	466.6	NR	823.0	NR	179.1	6846.0

B. Number of Sets

Quarter	CAR	FEC	GOM	MAB	NEC	NED	SAB	SAR	TUN	Total
1	36	418	753	128	0	0	211	84	NR	NR
2	NR	299	1078	252	107	NR	564	NR	NR	2414
3	0	400	1410	721	322	215	112	0	NR	NR
4	0	257	704	525	96	47	162	24	NR	NR
Total	NR	1374	3945	1626	525	NR	1049	NR	210	9175

Table 2. Total amount of fishing effort observed during 2009 by quarter and fishing area. Fishing effort is reported as A) Number of hooks (thousands) and B) Number of sets. Dashes indicate cells where no fishery effort was reported. NR indicates strata where effort cannot be reported due to confidentiality considerations.

A. Number of Hooks (thousands)

Quarter	CAR	FEC	GOM	MAB	NEC	NED	SAB	SAR	TUN	Total
1	0.0	34.5	53.2	NR	-	-	39.6	16.3	0.0	NR
2	0.0	9.9	471.0	NR	0.0	0.0	39.6	NR	NR	544.5
3	-	19.0	79.2	49.9	41.9	32.1	NR	0	0.0	NR
4	-	15.6	59.4	43.3	23.9	0.0	16.8	NR	0.0	NR
Total	0.0	78.9	662.8	108.4	65.8	32.1	NR	29.4	NR	1081.7

B. Number of Sets

Quarter	CAR	FEC	GOM	MAB	NEC	NED	SAB	SAR	TUN	Total
1	0	39	67	NR	-	-	45	19	0	NR
2	0	16	608	NR	0	0	45	NR	NR	700
3	-	37	107	75	40	39	NR	0	0	NR
4	-	23	77	48	22	0	23	NR	0	NR
Total	0	115	859	143	62	39	117	33	NR	1376

Table 3. Percentage of reported fishing effort observed during 2009 by quarter and fishing area by A) Number of hooks and B) Number of sets. Dashes indicate no reported fishing effort. Cells in which >10 longline sets were reported with no observer coverage are indicated in bold. Totals indicate overall percentage coverage by area and quarter and exclude experimental fishing.

A. Number of Hooks

Quarter	CAR	FEC	GOM	MAB	NEC	NED	SAB	SAR	TUN	Total
1	0.00	12.09	9.31	4.10	-	-	22.40	22.77	0.00	11.90
2	0.00	6.00	58.25	7.36	0.00	0.00	8.18	42.94	9.42	30.12
3	-	8.38	7.44	9.22	14.36	16.57	4.52	-	0.00	9.24
4	-	10.35	11.53	10.52	28.61	0.00	15.59	32.81	0.00	12.06
Total	0.00	9.54	22.40	9.08	14.11	12.43	11.96	27.42	3.31	15.80

B. Number of Sets

Quarter	CAR	FEC	GOM	MAB	NEC	NED	SAB	SAR	TUN	Total
1	0.00	9.33	8.90	3.13	-	-	21.33	22.62	0.00	10.52
2	0.00	5.35	56.40	6.35	0.00	0.00	7.98	43.75	10.81	29.00
3	-	9.25	7.59	10.40	12.42	18.14	3.57	-	0.00	9.30
4	-	8.95	10.94	9.14	22.92	0.00	14.20	29.17	0.00	10.75
Total	0.00	8.37	21.77	8.79	11.81	13.83	11.15	26.61	3.83	15.00

Table 4. Total number of observed interactions with A) Leatherback turtles, B) Loggerhead turtles, and C) All sea turtles in the pelagic longline fishery during 2009 by quarter and fishing area. Dashes indicate areas where there was no observed fishing effort, and an X indicates an area where no effort was reported. Counts include turtles taken during experimental fishing.

A. Leatherback Turtles

Quarter	CAR	FEC	GOM	MAB	NEC	NED	SAB	SAR	TUN	Total
1	-	1	2	0	X	X	1	0	-	4
2	-	1	39	1	-	-	2	0	0	43
3	X	0	0	2	6	4	0	X	-	12
4	X	0	1	0	0	-	3	0	-	4
Total	-	2	42	3	6	4	6	0	0	63

B. Loggerhead Turtles

Quarter	CAR	FEC	GOM	MAB	NEC	NED	SAB	SAR	TUN	Total
1	-	2	0	0	X	X	1	1	-	4
2	-	0	4	1	-	-	2	0	0	7
3	X	1	1	3	4	2	1	X	-	12
4	X	2	2	0	1	-	0	1	-	6
Total	-	5	7	4	5	2	4	2	0	29

C. All Turtles

Quarter	CAR	FEC	GOM	MAB	NEC	NED	SAB	SAR	TUN	Total
1	-	3	2	0	X	X	2	1	-	8
2	-	1	43	2	-	-	4	0	0	50
3	X	1	1	5	10	6	1	X	-	24
4	X	2	3	0	1	-	3	1	-	10
Total	-	7	49	7	11	6	10	2	0	92

Table 5. Summary of A) Release condition, B) Hook location in hooked animals, and C) Animals with all gear removed, by hook location for sea turtles observed in the pelagic longline fishery during 2009. Hook location information is recorded on the sea turtle life history form (Appendix A) by the observer. Counts include turtles taken during experimental fishing.

A. Capture condition

Species	Alive, Uninjured	Alive, unknown	Alive, injured	Dead/ Unresponsive	Unknown	Total
Leatherback	5	2	54	2	0	63
Loggerhead	2	1	25	1	0	29
Total	7	3	79	3	0	92

B. Hook Location in hooked animals

Species	Not Hooked	Unknown if Hooked	Hooked, Location Unknown	Internal			External	Total
				Unknown Internal	Swallowed	Beak or Mouth		
Leatherback	8	2	0	1	0	6	46	63
Loggerhead	1	1	0	0	6	19	2	29
Total	9	3	0	1	6	25	48	92

C. Animals with all gear removed, by hook location

Species	Not Hooked	Unknown if Hooked	Hooked, Location Unknown	Internal			External	Total
				Unknown Internal	Swallowed	Beak or Mouth		
Leatherback	3	1	0	0	0	1	11	16
Loggerhead	1	1	0	0	3	15	1	21
Total	4	2	0	0	3	16	12	37

Table 6. Release status and gear removal for sea turtles captured and released alive in the U.S. Atlantic Pelagic Longline Fishery during 2009. Counts include turtles captured during experimental fishing but excludes dead animals (2 leatherbacks and 1 loggerhead) and animals of unknown release status (1 leatherback).

Release Status	Leatherback	Loggerheads
Released entangled	5	0
Released with hook and line $\geq \frac{1}{2}$ carapace length	13	3
Released with hook and line $< \frac{1}{2}$ carapace length	26	5
Released with all gear removed	16	20

Table 7. Total number of marine mammals observed in interactions with the pelagic longline fishery during 2009 by quarter and fishing area. Dashes indicate areas where there was no observed fishing effort, and an X indicates an area where no effort was reported. These counts include one pantropical spotted dolphin taken in an experimental set in the Gulf of Mexico during the second quarter.

Quarter	CAR	FEC	GOM	MAB	NEC	NED	SAB	SAR	TUN	Total
1	-	0	0	0	X	X	0	0	-	0
2	-	0	6	0	-	-	1	0	0	6
3	X	0	1	3	4	1	0	X	-	9
4	X	0	1	4	0	-	0	0	-	5
Total	-	0	8	7	4	1	1	0	0	21

Table 8. Summary of release condition and serious injury types for marine mammals observed in the pelagic longline fishery during 2009. Serious injury determinations were based upon written observer comments (Appendix B). “Entangled” indicates that the animal was released with line remaining attached that is likely to further entangle the animal. These counts include one pantropical spotted dolphin released alive in an experimental set in the Gulf of Mexico during the second quarter.

Species	Alive	Dead	Serious Injury Type			Serious Injury Total	Total
			Mouth Hooked	Entangled	Mouth Hooked & Entangled		
Bottlenose Dolphin	1	0	1	1	0	2	3
Common Dolphin	0	1	0	0	0	0	1
Pantropical Spotted Dolphin	2	0	1	0	3	4	6
Pilot Whale	2	0	0	1*	1	2	4
Risso’s Dolphin	3	0	0	1**	1	2	5
Unidentified Dolphin	1	0	0	0	0	0	1
Unidentified Marine Mammal	0	0	0	1	0	1	1
Total	9	1	2	4	5	11	21

*This pilot whale was heavily wrapped and entangled in mainline. It was suspended above the water by the flukes while line was cut away. It was considered seriously injured based upon this handling. Analysis of biopsy sample identified this animal as short-finned pilot whale.

** This Risso’s dolphin was hauled aboard and placed on deck while being cut free from gear. It was considered seriously injured based upon this handling and placement of the animal on the deck.

Table 9. Estimated interactions with marine turtles in the pelagic longline fishery during 2009 by fishing area and quarter. Estimates include (A) Mortalities, (B) Released Alive, and (C) All Interactions. NR indicates strata where effort cannot be reported due to confidentiality considerations.

A. Mortalities

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV	Hooks Reported (x1000)	Estimated Catch
Leatherback	2	GOM	1	608	0.0071	1.000	808.6	5.7
Leatherback	3	NEC	1	40	0.0240	1.000	291.7	7.0
Loggerhead	2	SAB	1	45	0.0233	1.000	484.1	11.3

B. Released Alive

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV	Hooks Reported (x1000)	Estimated Catch
Leatherback	1	FEC	1	39	0.0237	1.0000	285.2	6.8
Leatherback	1	GOM	2	67	0.0330	0.7018	572.2	18.9
Leatherback	1	SAB	1	45	0.0224	1.0000	176.8	4.0
Leatherback	2	FEC	1	16	0.0730	1.0000	165.0	12.1
Leatherback	2	GOM	33	608	0.0775	0.1804	808.6	62.6
Leatherback	2	MAB	1	NR	0.0880	1.0000	164.3	14.5
Leatherback	2	SAB	1	45	0.0181	1.0000	484.1	8.7
Leatherback	3	MAB	2	75	0.0302	0.7361	540.9	16.3
Leatherback	3	NEC	4	40	0.1263	0.5033	291.7	36.8
Leatherback	3	NED	4	39	0.1269	0.5019	193.6	24.6
Leatherback	4	GOM	1	77	0.0147	1.0000	514.8	7.6
Leatherback	4	SAB	2	23	0.1706	0.7079	107.7	18.4

Table 9 cont.**B. Released Alive (cont.)**

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV	Hooks Reported (x1000)	Estimated Catch
Loggerhead	1	FEC	2	39	0.0234	1.0000	176.8	4.1
Loggerhead	1	SAB	1	45	0.0594	1.0000	71.7	4.3
Loggerhead	1	SAR	1	19	0.0110	0.5131	808.6	8.9
Loggerhead	2	GOM	4	608	0.0880	1.0000	164.3	14.5
Loggerhead	2	MAB	1	NR	0.0193	1.0000	484.1	9.4
Loggerhead	2	SAB	1	45	0.0575	1.0000	226.8	13.0
Loggerhead	3	FEC	1	37	0.0104	1.0000	1063.9	11.0
Loggerhead	3	GOM	1	107	0.0413	0.5775	540.9	22.4
Loggerhead	3	MAB	3	75	0.0937	0.4810	291.7	27.3
Loggerhead	3	NEC	4	40	0.0541	0.7337	193.6	10.5
Loggerhead	3	NED	2	39	0.4105	1.0000	54.4	22.3
Loggerhead	3	SAB	1	4	0.0967	0.6949	150.4	14.5
Loggerhead	4	FEC	2	23	0.0338	0.7024	514.8	17.4
Loggerhead	4	GOM	2	77	0.0365	1.0000	83.7	3.1
Loggerhead	4	NEC	1	22	0.1423	1.0000	21.4	3.0
Loggerhead	4	SAR	1	7	0.0234	1.0000	176.8	4.1

Table 9 cont.

C. Total Interactions

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV	Hooks Reported (x1000)	Estimated Catch
Leatherback	1	FEC	1	39	0.0237	1.0000	285.2	6.8
Leatherback	1	GOM	2	67	0.0330	0.7018	572.2	18.9
Leatherback	1	SAB	1	45	0.0224	1.0000	176.8	4.0
Leatherback	2	FEC	1	16	0.0730	1.0000	165.0	12.1
Leatherback	2	GOM	33	608	0.0816	0.1863	808.6	66.0
Leatherback	2	MAB	1	NR	0.0880	1.0000	164.3	14.5
Leatherback	2	SAB	1	45	0.0181	1.0000	484.1	8.7
Leatherback	3	MAB	2	75	0.0302	0.7361	540.9	16.3
Leatherback	3	NEC	4	40	0.1485	0.5324	291.7	43.3
Leatherback	3	NED	4	39	0.1269	0.5019	193.6	24.6
Leatherback	4	GOM	1	77	0.0147	1.0000	514.8	7.6
Leatherback	4	SAB	2	23	0.1706	0.7079	107.7	18.4
Loggerhead	1	FEC	2	39	0.0460	0.7063	285.2	13.1
Loggerhead	1	SAB	1	45	0.0234	1.0000	176.8	4.1
Loggerhead	1	SAR	1	19	0.0594	1.0000	71.7	4.3
Loggerhead	2	GOM	4	608	0.0110	0.5131	808.6	8.9
Loggerhead	2	MAB	1	NR	0.0880	1.0000	164.3	14.5
Loggerhead	2	SAB	2	45	0.0426	0.7022	484.1	20.6
Loggerhead	3	FEC	1	37	0.0575	1.0000	226.8	13.0
Loggerhead	3	GOM	1	107	0.0104	1.0000	1063.9	11.0
Loggerhead	3	MAB	3	75	0.0413	0.5775	540.9	22.4
Loggerhead	3	NEC	4	40	0.0937	0.4810	291.7	27.3
Loggerhead	3	NED	2	39	0.0541	0.7337	193.6	10.5
Loggerhead	3	SAB	1	4	0.4105	1.0000	54.4	22.3
Loggerhead	4	FEC	2	23	0.0967	0.6949	150.4	14.5
Loggerhead	4	GOM	2	77	0.0338	0.7024	514.8	17.4
Loggerhead	4	NEC	1	22	0.0365	1.0000	83.7	3.1
Loggerhead	4	SAR	1	7	0.1423	1.0000	21.4	3.0

Table 10. Estimated A) Mortalities, B) Serious Injury, C) Released Alive, and D) Total Interactions with marine mammals in the pelagic longline fishery during 2009 by fishing area and quarter. NR indicates strata where effort cannot be reported due to confidentiality considerations.

A. Mortality

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Common Dolphin	4	MAB	1	48	0.0207	1.0000	411.0	8.5

B. Serious Injury

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Bottlenose Dolphin	2	GOM	1	608	0.0039	1.0000	808.6	3.1
Pantropical Spotted Dolphin	2	GOM	3	608	0.0066	0.5808	808.6	5.4
Pantropical Spotted Dolphin	4	GOM	1	77	0.0169	1.0000	514.8	8.7
Unid. Marine Mammal	3	MAB	1	75	0.0149	1.0000	540.9	8.0
Bottlenose Dolphin	4	MAB	1	48	0.0207	1.0000	411.0	8.5
Pilot Whale	4	MAB	2	48	0.0401	0.6999	411.0	16.5
Risso's Dolphin	3	NEC	1	40	0.0210	1.0000	291.7	6.1
Risso's Dolphin	3	NED	1	39	0.0274	1.0000	193.6	5.3

Table 10 cont.

C. Released Alive

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Unid. Dolphin	2	GOM	1	608	0.0020	1.0000	808.6	1.6
Pantropical Spotted Dolphin	3	GOM	1	107	0.0118	1.0000	1063.9	12.5
Risso's Dolphin	3	MAB	1	75	0.0242	1.0000	540.9	13.1
Pilot Whale	3	MAB	1	75	0.0208	1.0000	540.9	11.3
Risso's Dolphin	3	NEC	2	40	0.0479	0.7017	291.7	14.0
Pilot Whale	3	NEC	1	40	0.0272	1.0000	291.7	7.9
Bottlenose Dolphin	2	SAB	1	45	0.0233	1.0000	484.1	11.3

Table 10 cont.

D. Total Interactions

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Bottlenose Dolphin	2	GOM	1	608	0.0039	1.0000	808.6	3.1
Pantropical Spotted Dolphin	2	GOM	3	608	0.0066	0.5808	808.6	5.4
Unid. Dolphin	2	GOM	1	608	0.0020	1.0000	808.6	1.6
Bottlenose Dolphin	2	SAB	1	45	0.0233	1.0000	484.1	11.3
Pantropical Spotted Dolphin	3	GOM	1	107	0.0118	1.0000	1063.9	12.5
Pilot Whale	3	MAB	1	75	0.0208	1.0000	540.9	11.3
Risso's Dolphin	3	MAB	1	75	0.0242	1.0000	540.9	13.1
Unid. Marine Mammal	3	MAB	1	75	0.0149	1.0000	540.9	8.0
Pilot Whale	3	NEC	1	40	0.0272	1.0000	291.7	7.9
Risso's Dolphin	3	NEC	3	40	0.0689	0.5655	291.7	20.1
Risso's Dolphin	3	NED	1	39	0.0274	1.0000	193.6	5.3
Pantropical Spotted Dolphin	4	GOM	1	77	0.0169	1.0000	514.8	8.7
Bottlenose Dolphin	4	MAB	1	48	0.0207	1.0000	411.0	8.5
Common Dolphin	4	MAB	1	48	0.0207	1.0000	411.0	8.5
Pilot Whale	4	MAB	2	48	0.0401	0.6999	411.0	16.5

Table 11. Bycatch rates for sea turtles in area-quarter strata with reported effort that were not observed in 2009. NR indicates strata where effort cannot be reported due to confidentiality considerations.

Bycatch Rate Source	Species	Area	Quarter	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (X1000) - 2009	Estimated Catch - 2009
Quarterly 05-08	Leatherback	1	TUN	1	20	0.0476	1.0000	NR	1.0
Quarterly 05-08	Leatherback	2	CAR	1	16	0.0789	1.0000	NR	0.2
Quarterly 05-08	Leatherback	2	NEC	4	16	0.3223	0.4589	91.2	29.4
Annual 09	Leatherback	2	NED	4	39	0.1269	0.5019	NR	1.9
Quarterly 05-08	Leatherback	4	NED	12	78	0.2032	0.2729	49.5	10.1
Quarterly 05-08	Leatherback	4	TUN	1	11	0.0597	1.0000	37.2	2.2
Quarterly 05-08	Loggerhead	1	CAR	3	13	0.2854	0.5274	29.7	8.5
Quarterly 05-08	Loggerhead	2	NEC	2	16	0.1408	0.6832	91.2	12.8
Annual 09	Loggerhead	2	NED	2	39	0.0541	0.7337	NR	0.8
Quarterly 05-08	Loggerhead	4	NED	12	78	0.2142	0.2801	49.5	10.6

Table 12. Bycatch rates for marine mammals in area-quarter strata with reported effort that were not observed in 2009. NR indicates strata where effort cannot be reported due to confidentiality considerations.

Bycatch Rate Source	Species	Interaction Type	Quarter	Area	# Positive Sets	#Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (X1000) 2009	Estimated Catch 2008
Quarterly 05-08	False Killer Whale	Released Alive	4	TUN	1	NR	0.0673	1.0000	NR	2.5

Table 13. Total estimated interactions (including live and dead animals) for A) Leatherback and B) Loggerhead turtles in the pelagic longline fishery during 2009 by fishing area.

A. Leatherbacks

Area	Total	Total CV	Total 95% Confidence Interval	Experimental Takes
CAR	0.2	1.000	0 - 1.1	-
FEC	18.8	0.734	5.2 - 68.2	3
GOM	92.4	0.212	61.3 - 139.3	1
MAB	30.8	0.611	10.2 - 92.8	-
NEC	72.7	0.367	36.2 - 146.1	-
NED	36.5	0.347	18.9 - 70.7	-
SAB	31.1	0.520	11.9 - 81.1	0
SAR	0	-	-	-
TUN	3.2	0.753	0.9 - 12.1	-
Total	285.8	0.159	209.6 – 389.7	4

B. Loggerheads

Area	Total	Total CV	Total 95% Confidence Interval	Experimental Takes
CAR	8.5	0.527	3.2 - 22.4	-
FEC	40.7	0.465	17.1 - 96.9	0
GOM	37.3	0.458	15.9 - 87.8	0
MAB	36.8	0.527	14 - 97.1	-
NEC	43.2	0.372	21.3 - 87.6	-
NED	21.9	0.377	10.7 - 44.7	-
SAB	47.1	0.572	16.6 - 133.6	0
SAR	7.3	0.717	2.1 - 25.8	-
TUN	0	-	-	-
Total	242.9	0.190	167.9 – 351.2	0

Table 14. Total estimated interactions with marine mammals in the pelagic longline fishery during 2009. These estimates include extrapolated values for areas with no observer coverage during 2009 (see Table 12).

Species	Estimated Alive	CV Alive	Estimated Serious Injury	CV Serious Injury	Estimated Dead	CV Dead	Estimated Total	CV Total	95% Confidence Interval
Bottlenose Dolphin	11.6	0.779	11.3	1.000	0	-	22.9	0.631	7.4 – 71.2
Common Dolphin	0	-	0	-	8.5	1.66 – 43.4	8.5	1.000	1.7 – 43.4
False Killer Whale	2.5	1.000	0	-	0	-	2.5	1.000	0.6 – 15.6
Pantropical Spotted Dolphin	12.5	1.000	14.1	0.657	0	-	26.6	0.585	9.2 – 77.0
Pilot Whale*	19.2	0.718	16.5	0.699	0	-	35.7	0.504	14.0 – 90.6
Risso's Dolphin	27.1	0.604	11.4	0.709	0	-	38.5	0.471	16.0 – 92.6
Unidentified Dolphin	1.6	1.000	0	-	0	-	1.6	1.000	0.32 – 8.2
Unidentified Marine Mammal	0	-	8.0	1.000	0	-	8.0	1.000	1.6 - 41.1

* This includes both un-identified pilot whales and one animal that was genetically identified as a short-finned pilot whale.

Figure 1. Pelagic longline fishing areas in the North Atlantic Ocean: 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 De Soto Canyon (A) and the Florida East Coast (B) are indicated along with seasonal closures in the Charleston Bump (C) and in the Mid-Atlantic (D).

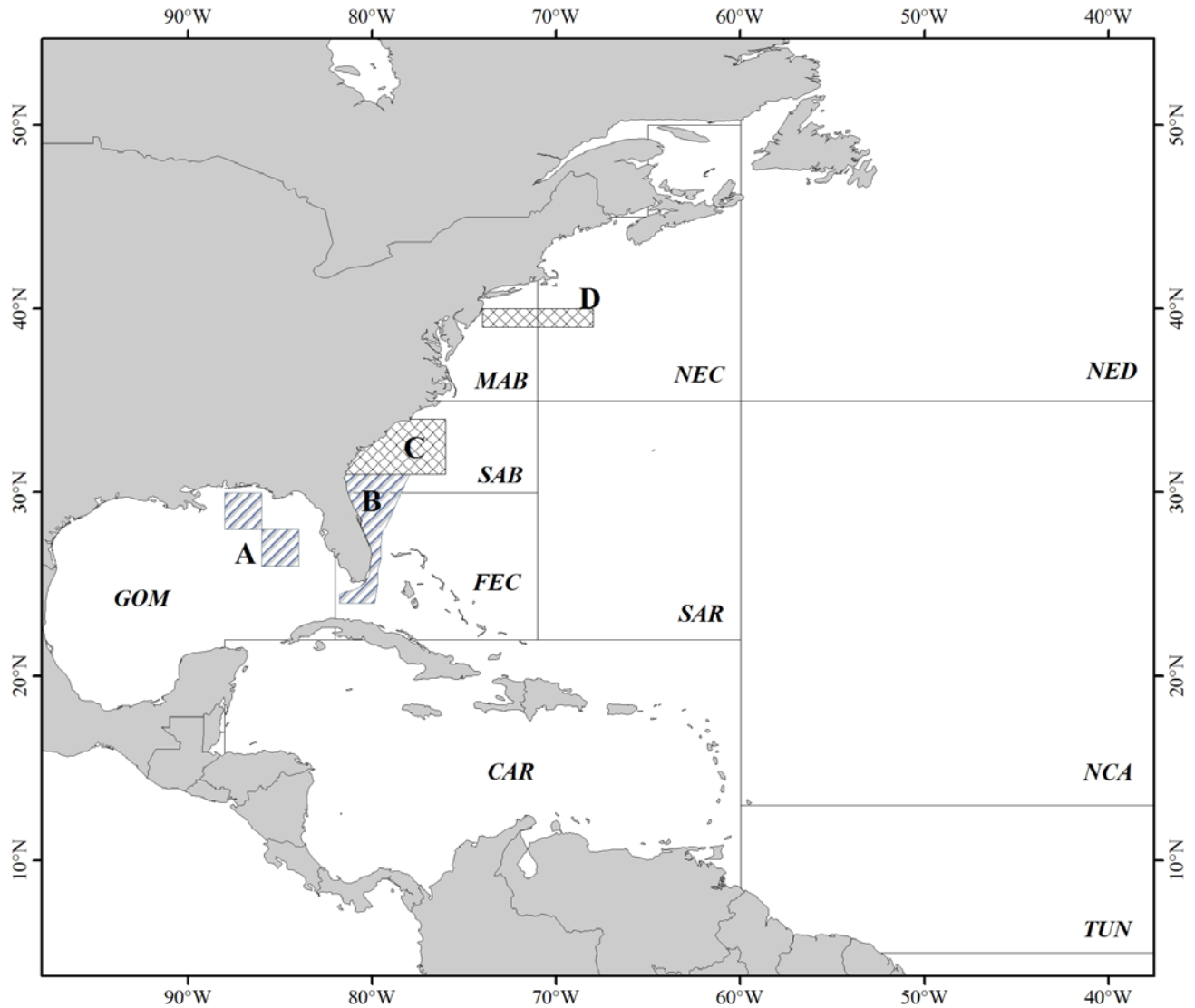


Figure 2. Observed (gray circles) and reported (black circles) pelagic longline fishing effort during 2009.

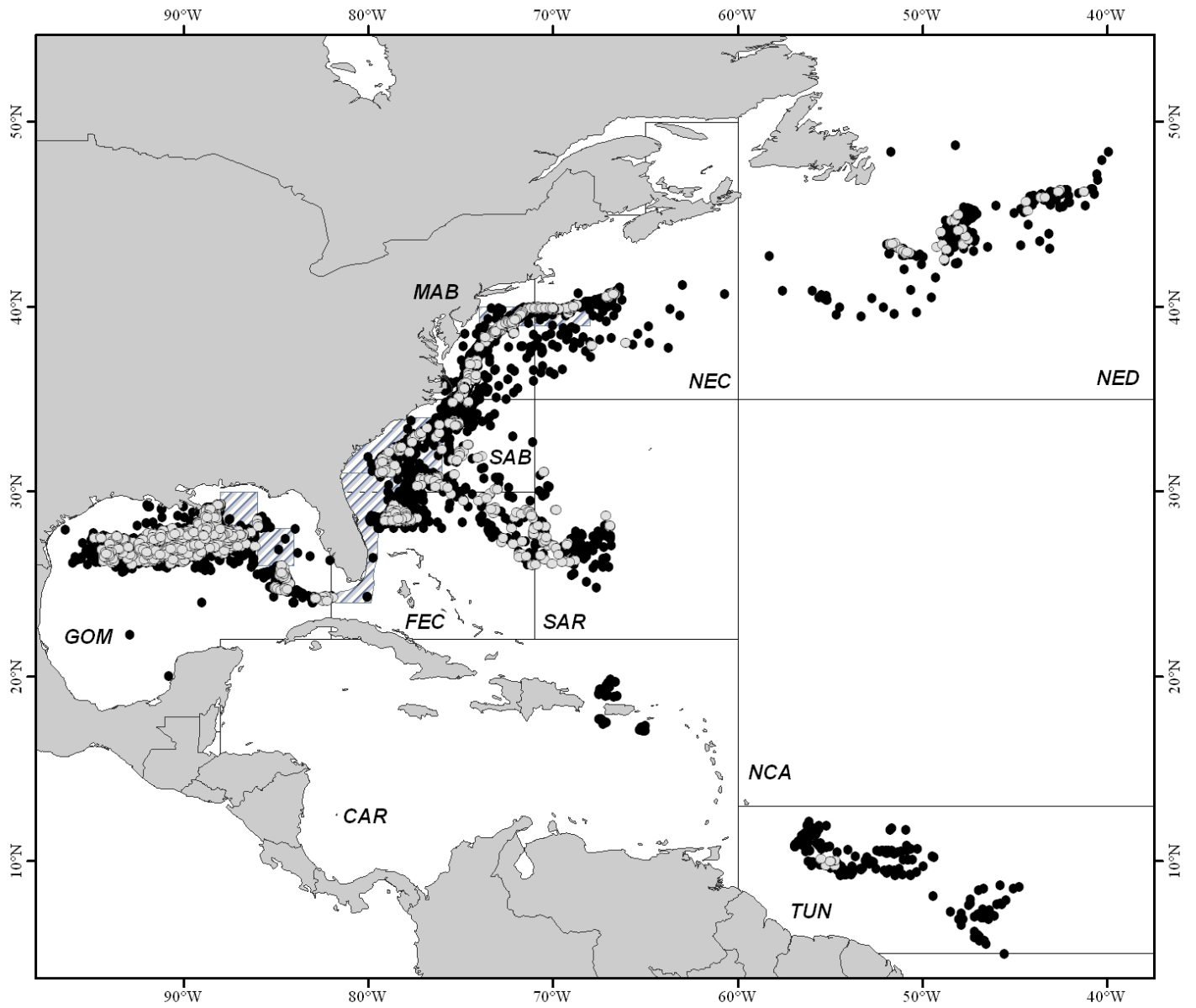


Figure 3. Locations of experimental sets during 2009.

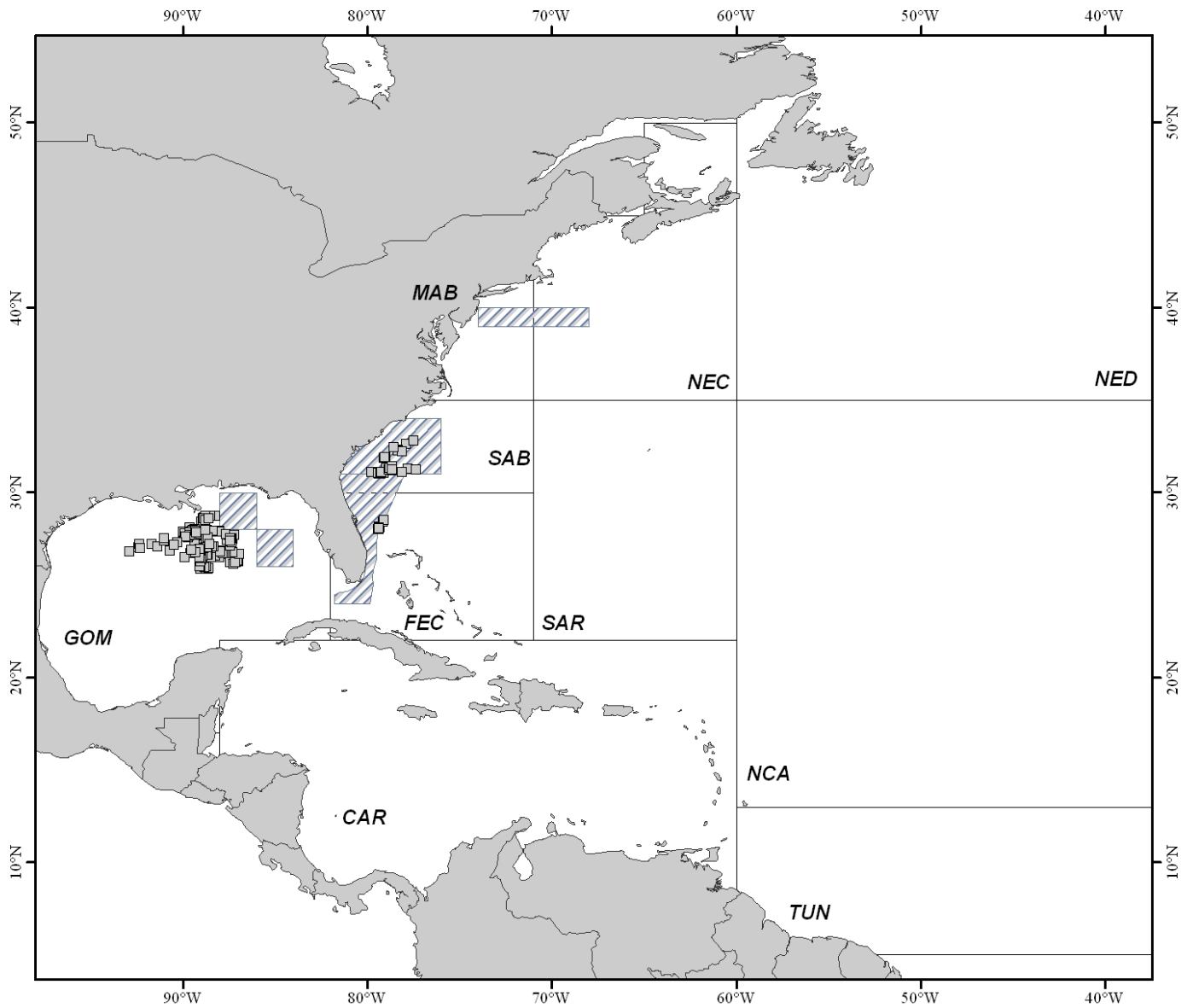


Figure 4. Observed pelagic longline fishing effort and sea turtle interactions during 2009.

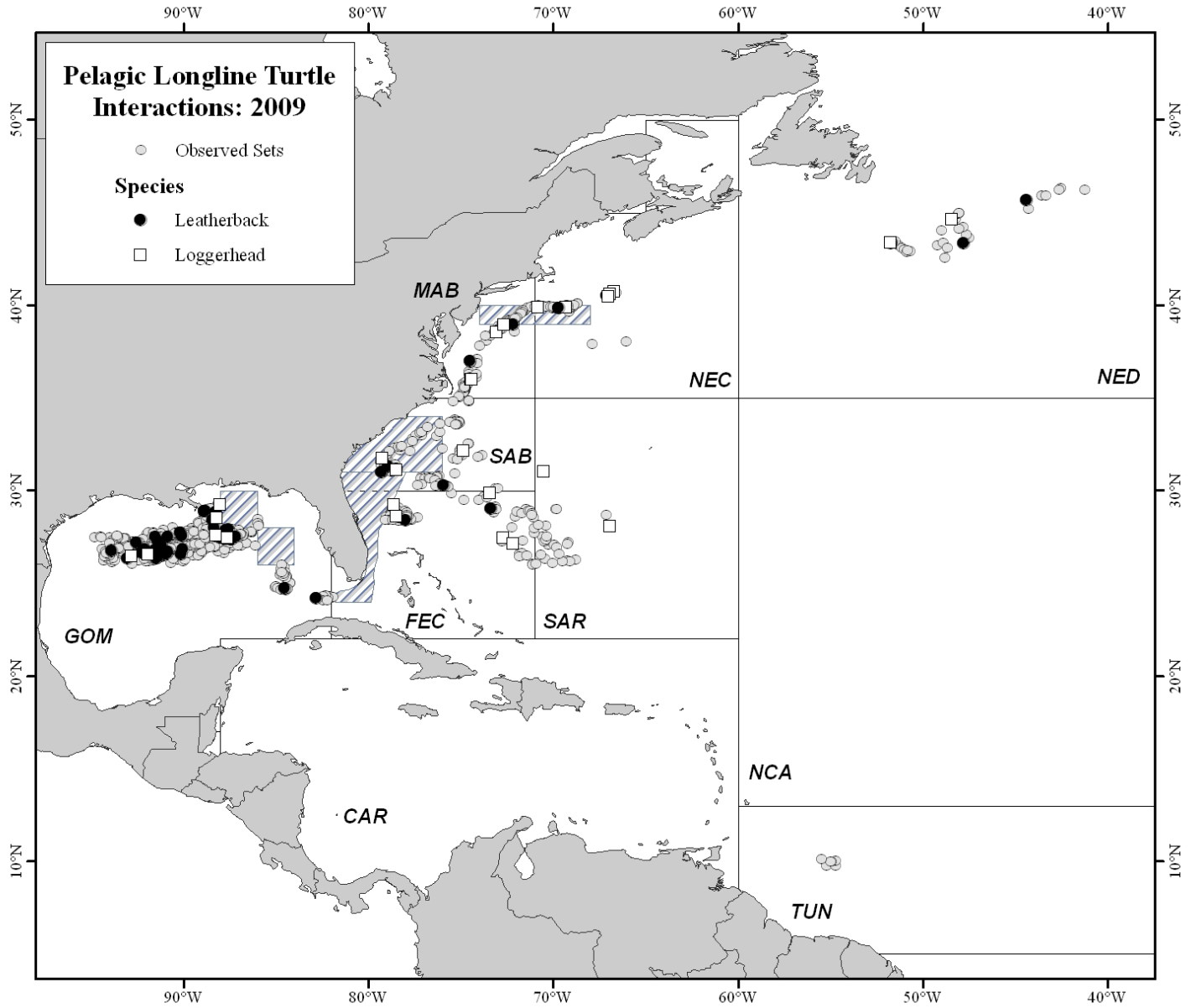


Figure 5. Observed pelagic longline fishing effort and marine mammal takes during 2009.

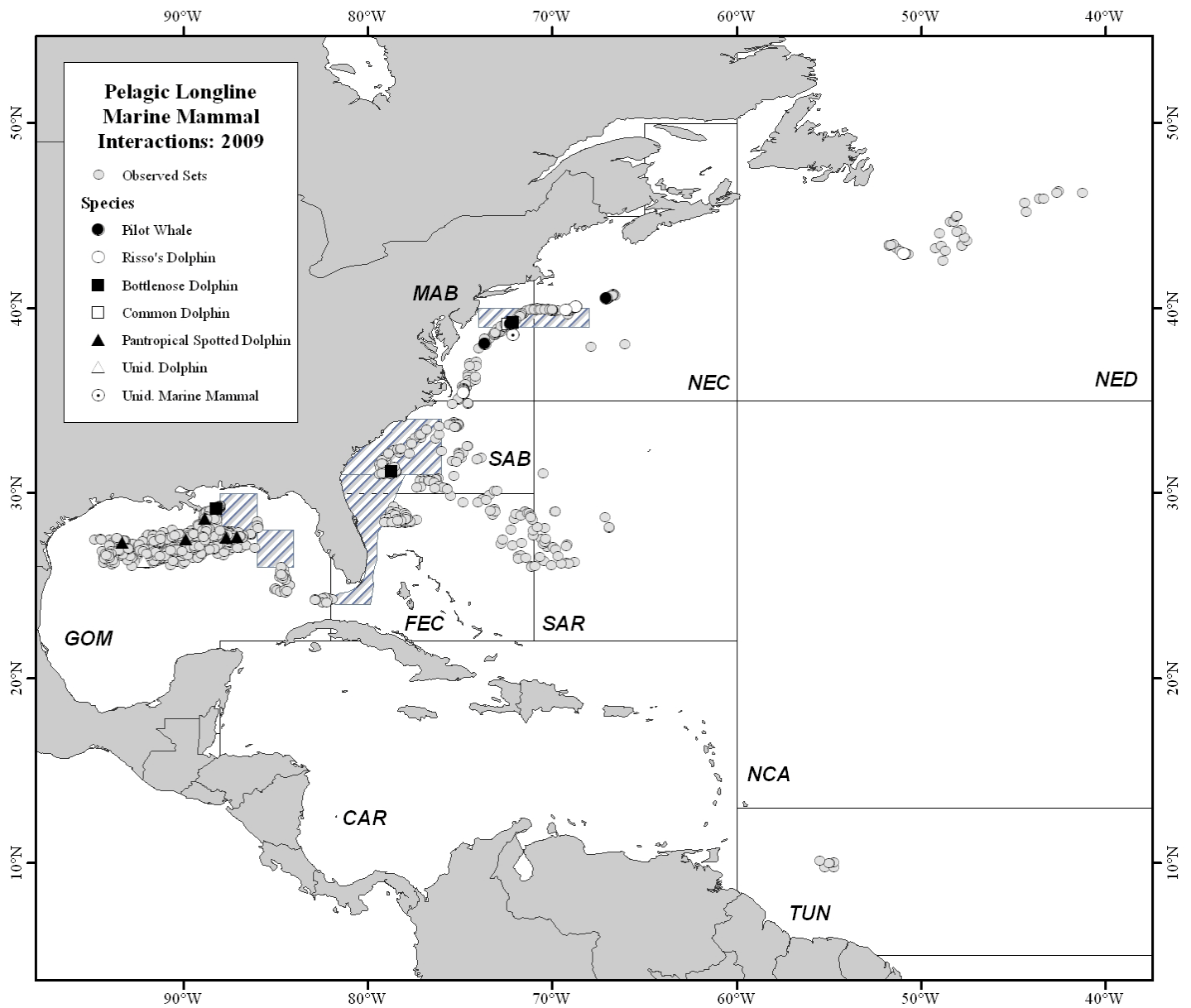
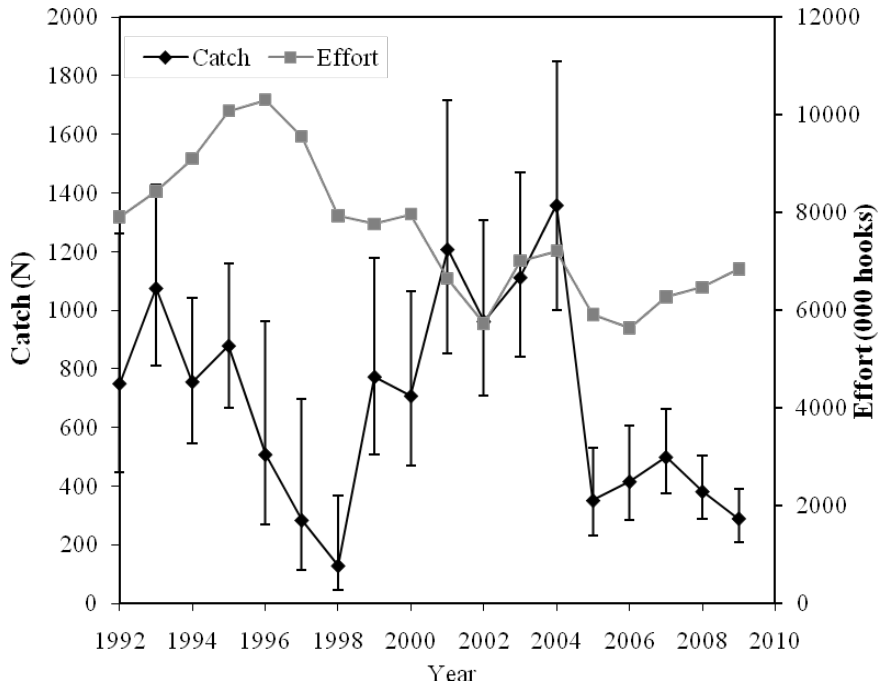


Figure 6. Historical trends in fishery effort and estimated marine turtle takes in the pelagic longline fishery from 1992 to 2009 for A) Leatherback Turtles, and B) Loggerhead Turtles. Errors bars represent 95% confidence intervals.

A. Leatherback Turtles



B. Loggerhead Turtles

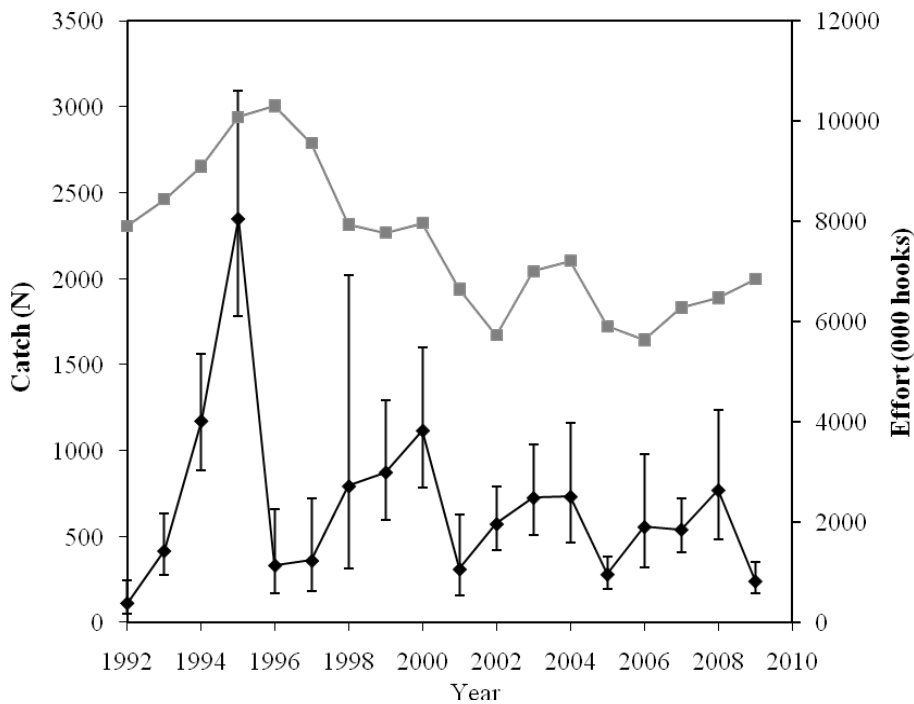
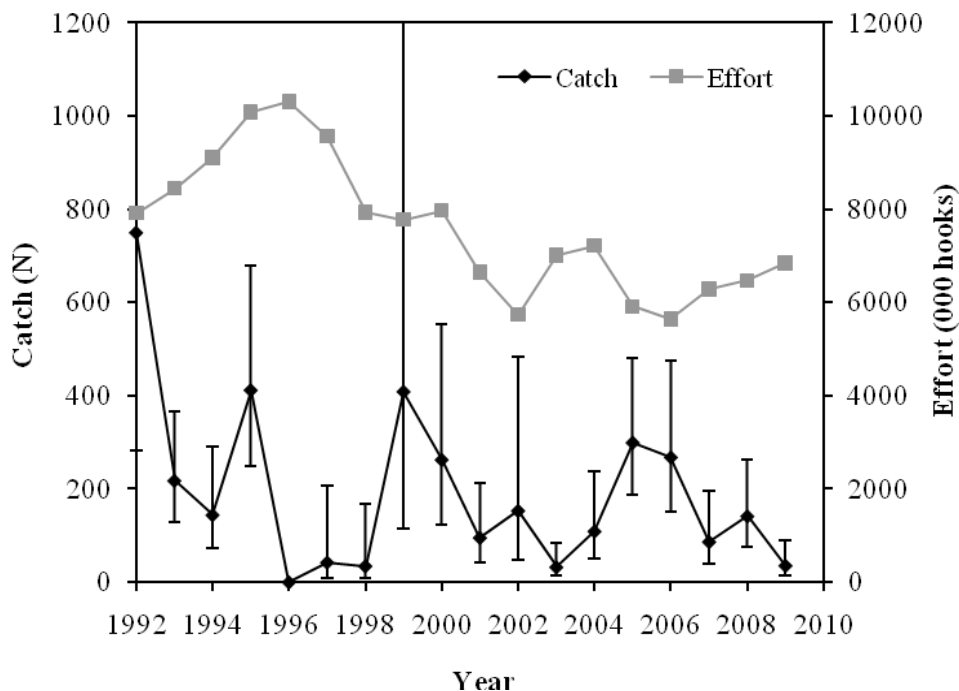
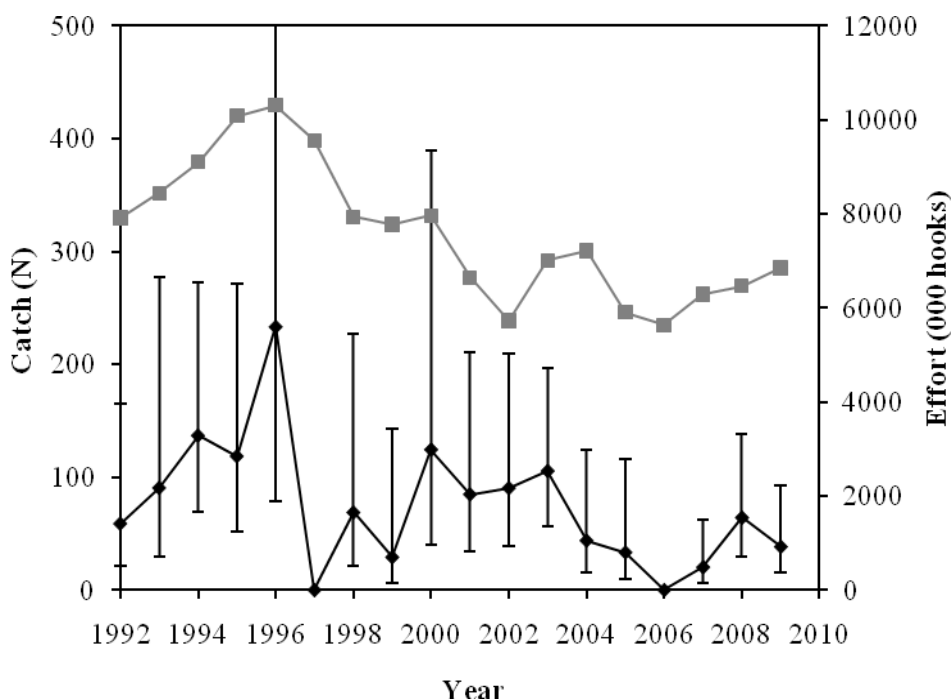


Figure 7. Historic trends in fishery effort and estimated marine mammal takes in the pelagic longline fishery from 1992 to 2009 for A) Pilot Whales and B) Risso’s Dolphins. Errors bars represent 95% confidence intervals.

A. Pilot Whales



B. Risso’s Dolphins



Appendix A. Sea Turtle Life History Form (dated 12/04)

CAPTURE INFORMATION

TRIP [][][][][][] YEAR 20[][] MONTH[][] DAY[][]
SET/HAUL/TOW [][][] SPECIMEN NUMBER BY TRIP [][][]

GEAR TYPE: [] Longline [] Gill Net [] Trawl (note time in comments)
GEAR DEPTH: [] Surface [] Midwater [] Bottom [] Other

TIME (24 hr) [][][] WATER TEMP (°F) [][][]

LATITUDE [][] deg [][] min N/S LONGITUDE [][][] deg [][][] min E /W

Did turtle slide out/escape from gear? Y / N Was turtle brought on board? Y / N

IDENTIFICATION (see back) Number of Photos Taken? [][]

SPECIES: [] Leatherback [] Loggerhead [] Kemp's ridley [] Green [] Hawksbill [] Olive ridley
[] Unidentified Hardshell [] Unknown

CONDITION OF TURTLE AT CAPTURE [] Injured [] Uninjured [] Unknown

(Please check injury status above as well as condition below)

[] Previously dead [] Fresh dead [] Comatose Attempted resuscitation? Y / N
[] Alive [] Unknown (describe) [] Other (describe)

IF GEAR IS A FORM OF HOOK AND LINE, COMPLETE THIS SECTION, AS APPLICABLE:

HOOK TYPE [] "J" [] Circle [] Other (describe) SIZE [][]/0

MANUFACTURER/STYLE NO. DEGREE OFFSET [][]°

BAIT [] Squid [] Mackerel [] Sardine [] Unknown [] Other (describe) SIZE

Caught on hook timer? Y / N If yes, fill in time elapsed [][][]

Was light stick on hook? Y/N/U Circle: White, Pink, Blue, Green, Black, Red, Yellow, Purple, Aqua, Other, Unknown

If No, number of gangions to next light stick [][]

Light Stick Color (circle)? White, Pink, Blue, Green, Black, Red, Yellow, Purple, Aqua, Other, Unknown

Number of gangions to next float [][]

HOOK LOCATION

(circle specific location; check box if specifics are not known; annotate drawing on reverse to indicate location as needed):

[] Not Hooked [] Not Known if Hooked [] Hooked, but location totally Unknown

Internal: [] Unknown, internal

[] Swallowed (Esophagus) Hook visible? Visible to insertion point / Partial hook / Not visible

[] Beak/ Mouth (Circle one) Jaw Location (Check one) [] upper [] lower [] side (mouth only)

Check one for mouth: [] tongue [] glottis [] roof of mouth [] jaw joint [] other (describe)

External: [] Unknown, external [] Beak/Head/Neck [] Carapace/Plastron

[] Front Flipper/Shoulder/Armpit [] Rear Flipper/Groin/Tail

Was hook removed from this animal? Y / N / Unknown / Not Applicable

Was animal entangled in gear? At capture? Y / N / Unknown At Release? Y / N / Unknown

How much gear (linear feet) was left on turtle when released? [][][].[] ft. (estimated/measured)

Estimated carapace length (notch-to-tip straight line): [][].[] ft (needed only if turtle is not boated & measured)

Appendix B

Table B1. Gear types and hooking locations based upon observed comments and the sea turtle life history form for each A) Leatherback and B) Loggerhead turtles observed during 2009. These data are summarized in Tables 5 and 6. Q indicates calendar quarter, 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 (see Appendix A).

A. Leatherback Turtles

#	Area	Q	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	FEC	1	C-18/0	10	Squid	167	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	4.50		
2	GOM	1	C-16/0	0	Squid	159	Alive, injured	Released alive	shoulder	No	No	No	3.00	5.00		
3	SAB	1	C-18/0	10	Squid	198	Alive, injured	Released alive	unknown internal	No	Yes	Yes	3.00	4.00		
4	GOM	1	C-16/0	0	Squid	150	Alive, injured	Released alive	front flipper	No	No	No	1.00	4.00		
5	GOM	2	C-16/0	0	squid	117	Alive, injured	Released alive	mouth, side, other	No	No	No	2.00	4.0		
6	GOM	2	C-16/0	0	squid	225	Alive, injured	Released alive	front flipper	Yes	Yes	No	0.00	4.5		
7	GOM	2	C-16/0	0	squid	225	Alive, injured	Released alive	armpit	No	No	No	20.00	5.0		
8	GOM	2	C-16/0	0	squid	225	Alive, injured	Released alive	front flipper	No	No	No	6.00	5.0		
9	GOM	2	C-16/0	0	squid	225	Alive, injured	Released alive	front flipper	Yes	No	No	0.00	5.0		
10	GOM	2	C-16/0	0	squid	UNK	Alive, uninjured	Released alive	not hooked	N/a	Yes	No	0.00	5.0		
11	GOM	2	C-16/0	0	squid	119	Alive, injured	Released alive	mouth, side	No	No	No	0.50	4.0		
12	GOM	2	C-16/0	0	squid	119	Alive, injured	Released alive	mouth, side	No	No	No	2.00	5.0		

Appendix B, Table B1, Leatherback Turtles cont.

#	Area	Q	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)
13	GOM	2	C-16/0	0	squid	114	Alive, injured	Released alive	armpit	No	No	No	4.00	4.0		
14	GOM	2	C-16/0	0	squid	117	Alive, unknown	Released alive	not known if hooked	Unknown	Unknown	Unknown	4.00	Unk		
15	GOM	2	C-18/0	10	mackerel	194	Alive, uninjured	Released alive	not hooked	N/a	Yes	No	0.00	5.0		
16	GOM	2	C-18/0	10	mackerel	194	Fresh dead	Discarded unmarked dead/unresponsive carcass	not hooked	N/a	Yes	No	0.00	5.0		
17	GOM	2	C-18/0	10	mackerel	194	Alive, injured	Released alive	shoulder	No	No	No	0.00	5.0		
18	GOM	2	C-16/0	0	squid	113	Alive, injured	Released alive	mouth, side, other	Yes	No	No	0.00	5.0		
19	GOM	2	C-16/0	0	squid	113	Alive, uninjured	Released alive	not hooked	N/a	Yes	Yes	3.00	5.0		
20	SAB	2	C-18/0	10	mackerel	249	Alive, injured	Released alive	unknown, external	No	No	No	10.00	5.0		
21	MAB	2	C-16/0	0	squid	185	Alive, injured	Released alive	shoulder	No	No	No	6.00	4.0		
22	FEC	2	C-18/0	10	squid	212	Alive, injured	Released alive	armpit	No	No	No	1.00	4.0		
23	GOM	2	C-16/0	0	squid	202	Alive, injured	Released alive	shoulder	No	No	No	1.00	4.5		
24	GOM	2	C-16/0	0	squid	140	Alive, injured	Released alive	shoulder	No	No	No	0.00	4.0		
25	GOM	2	C-16/0	0	squid	140	Alive, injured	Released alive	shoulder	No	No	No	0.10	4.0		
26	GOM	2	C-16/0	0	squid	135	Alive, injured	Released alive	shoulder	No	No	No	4.00	4.0		
27	GOM	2	C-16/0	0	squid	225	Alive, injured	Released alive	front flipper	Yes	No	No	0.00	4.5		

Appendix B, Table B1, Leatherback Turtles cont.

#	Area	Q	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)
28	GOM	2	C-16/0	0	squid	180	Alive, injured	Released alive	carapace	No	No	No	0.10	4.5		
29	GOM	2	C-16/0	0	squid	153	Alive, injured	Released alive	armpit	No	No	No	0.50	4.0		
30	GOM	2	C-16/0	0	squid	149	Alive, injured	Released alive	shoulder	No	No	No	1.50	4.0		
31	GOM	2	C-16/0	0	squid	144	Alive, injured	Released alive	front flipper	No	No	No	2.00	5.0		
32	GOM	2	C-16/0	0	squid	149	Alive, injured	Released alive	mouth, side, other	No	No	No	0.00	4.0		
33	GOM	2	C-16/0	0	squid	140	Alive, injured	Released alive	mouth, side, unknown	No	No	No	0.30	6.0		
34	GOM	2	C-16/0	0	squid	135	Alive, injured	Released alive	shoulder	No	No	No	0.50	5.0		
35	GOM	2	C-16/0	0	mackerel	360	Alive, unknown	Released alive	not known if hooked	Yes	Yes	No	0.00	3.0		
36	GOM	2	C-16/0	0	mackerel	320	Alive, injured	Released alive	front flipper	Yes	Yes	No	0.00	5.0		
37	GOM	2	C-16/0	0	squid	225	Alive, injured	Released alive	armpit	No	No	No	0.00	5.0		
38	GOM	2	C-16/0	0	squid	225	Alive, injured	Released alive	armpit	Yes	No	No	0.00	4.5		
39	GOM	2	C-16/0	0	squid	140	Alive, injured	Released alive	shoulder	No	No	No	0.50	5.0		
40	GOM	2	C-16/0	0	squid	140	Alive, injured	Released alive	flipper/shoulder/armpit	Yes	No	No	0.00	4.0		
41	GOM	2	C-16/0	0	squid	113	Alive, injured	Released alive	armpit	No	No	No	0.00	3.0		
42	GOM	2	C-16/0	0	squid	135	Alive, injured	Released alive	neck	No	No	No	0.10	4.0		

Appendix B, Table B1, Leatherback Turtles cont.

#	Area	Q	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)
43	GOM	2	C-16/0	0	squid	203	Alive, injured	Released alive	shoulder	No	No	No	0.30	4.5		
44	SAB - Exp	2	C-18/0	0	mackerel	225	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	4.0		
45	GOM - Exp	2	C-16/0	0	squid	158	Alive, injured	Released alive	shoulder	No	No	No	0.20	5.0		
46	GOM - Exp	2	C-16/0	0	squid	167	Alive, injured	Released alive	armpit	No	No	No	0.00	5.0		
47	GOM - Exp	2	C-16/0	0	sardine	63	Alive, injured	Released alive	shoulder	No	Yes	Yes	7.00	5.0		
48	MAB	3	C-16/0	0	Squid	171	Alive, uninjured	Released alive	not hooked	N/a	Yes	Yes	6.00	4.5		
49	NED	3	C-18/0	10	Mackerel	356	Alive, injured	Released alive	shoulder	No	No	Unknown	3.00	5.0		
50	NED	3	C-18/0	10	Mackerel	320	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	5.0		
51	NED	3	C-18/0	10	Mackerel	333	Alive, injured	Released alive	armpit	No	No	No	0.00	5.5		
52	NED	3	C-18/0	10	Mackerel	365	Alive, injured	Released alive	armpit	No	No	No	0.50	4.5		
53	NEC	3	C-18/0	10	Squid or Mackerel	203 or 338	Alive, injured	Released alive	shoulder	No	No	No	2.00	4.0		
54	NEC	3	C-18/0	10	Mackerel	338	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	5.0		
55	NEC	3	C-18/0	10	Squid or Mackerel	203 or 338	Alive, injured	Released alive	shoulder	No	No	No	5.00	5.0		
56	NEC	3	C-18/0	10	Unk	Unk	fresh dead	Discarded unmarked dead/unresponsive carcass	not hooked	No	Yes	Yes	24.00	6.0		
57	NEC	3	C-18/0	10	Squid or Mackerel	203 or 338	Alive, injured	Released alive	not hooked	N/a	Yes	Yes	6.00	6.0		

Appendix B, Table B1, Leatherback Turtles cont.

#	Area	Q	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)
58	MAB	3	C-18/0	10	Squid	134	Alive, injured	Released alive	shoulder	No	No	No	5.00	3.5		
59	NEC	3	C-18/0	10	Squid or Mackerel	243 or 284	Alive, injured	Released alive	armpit	Yes	No	No	0.00	6.0		
60	SAB	4	C-18/0	10	Squid	255	Alive, uninjured	Released alive	not hooked	N/a	Yes	No	1.00	4.50		
61	SAB	4	C-18/0	10	Mackerel	282	Alive, injured	Released alive	plastron	No	No	No	1.00	5.50		
62	GOM	4	C-16/0	0	Squid	198	Alive, injured	Released alive	shoulder	No	No	No	0.10	5.00		
63	SAB	4	C-18/0	10	Mackerel	347	Alive, injured	Released alive	shoulder	No	No	No	8.00	5.00		

Appendix B, Table B1 cont.

B. Loggerhead Turtles

#	Area	Q	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	1	C-18/0	10	Squid	239	Alive, injured	Released alive	swallowed hook partially visible	No	No	No	0.00		76.1	
2	SAR	1	C-18/0	10	Squid	225	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.00		65.6	59.7
3	FEC	1	C-18/0	10	Squid	266	Alive, injured	Released alive	tongue	Yes	No	No	0.00		62.5	60.2
4	FEC	1	C-18/0	10	Squid or Mackerel	266 or 450	Alive, injured	Released alive	glottis	Yes	No	No	0.00		71.8	66
5	GOM	2	C-18/0	10	mackerel	150	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.00			66.5
6	GOM	2	C-16/0	0	squid	119	Alive, injured	Released alive	mouth, side	No	No	No	1.00	2.0		
7	GOM	2	C-16/0	0	squid	189	Alive, injured	Released alive	mouth, lower jaw, other	No	No	No	0.30	3.0		
8	SAB	2	C-16/0	0	squid	146	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.00		66	62.5
9	SAB	2	C-16/0	0	squid	176	Fresh dead	Discarded marked dead/unresponsive carcass	tongue	Yes	No	No	0.00		74.3	67.8
10	MAB	2	C-16/0	0	squid	185	Alive, injured	Released alive	mouth, side, other	Yes	No	No	0.00		72.5	67.4
11	GOM	2	C-16/0	0	sardine	68	Alive, uninjured	Released alive	not hooked	N/a	Yes	No	0.00	2.0		
12	NED	3	C-18/0	10	Mackerel	383	Alive, injured	Released alive	mouth, lower, other	Yes	No	No	0.00		51.6	46.1

Appendix B, Table B1 cont. Loggerhead turtles

#	Area	Q	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)
13	MAB	3	C-16/0	0	Squid	180	Alive, injured	Released alive	tongue	Yes	No	No	0.00	3.5		
14	NED	3	C-18/0	10	Mackerel	365	Alive, unknown	Released alive	not known if hooked	Yes	No	No	0.00	2.2		
15	FEC	3	C-16/0	0	Squid	239	Alive, injured	Released alive	swallowed hook not visible	No	No	No	1.00		88	78
16	SAB	3	C-16/0	0	Squid or Mackerel	198 or 135	Alive, injured	Released alive	swallowed hook partially visible	Yes	No	No	0.00		64	57.6
17	NEC	3	C-18/0	10	Squid or Mackerel	203 or 338	Alive, injured	Released alive	tongue	No	No	No	0.00		68	58.7
18	NEC	3	C-18/0	10	Squid or Mackerel	203 or 338	Alive, injured	Released alive	shoulder	Yes	No	No	0.00		67	57
19	NEC	3	C-18/0	10	Squid or Mackerel	230 or 270	Alive, injured	Released alive	tongue	Yes	No	No	0.00		68	60.5
20	NEC	3	C-18/0	10	Squid	194	Alive, injured	Released alive	mouth, side, other	Yes	No	No	0.00		66	58.2
21	MAB	3	C-16/0	0	Squid	212	Alive, injured	Released alive	glottis	Yes	No	No	0.00		74	67.9
22	GOM	3	C-16/0	0	Squid	212	Alive, uninjured	Released alive	beak internal, lower jaw	Yes	No	No	0.00	4.5		
23	MAB	3	C-18/0	10	Squid	176	Alive, injured	Released alive	mouth, side, other	Yes	No	No	0.00		80	76
24	GOM	4	C-16/0	0	Squid	176	Alive, injured	Released alive	mouth, lower, other	No	No	No	5.00	2.50		
25	GOM	4	C-16/0	0	Squid	194	Alive, injured	Released alive	head external	No	No	No	4.00	2.50		
26	FEC	4	C-16/0	0	Squid	288	Alive, injured	Released alive	mouth, lower, other	Yes	No	No	0.00		78.4	
27	NEC	4	C-18/0	10	Squid	266	Alive, injured	Released alive	swallowed hook not visible	No	No	No	0.10		77	65.4

Appendix B, Table B1 cont. Loggerhead turtles

#	Area	Q	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)
28	SAR	4	C-18/0	10	Squid or Mackerel	248 or 243	Alive, injured	Released alive	mouth, lower, other	Yes	No	No			86	77
29	FEC	4	C-18/0	10	Squid or Mackerel	248 or 243	Alive, injured	Released alive	mouth, lower, other	Yes	No	No	0.00		63	59

Appendix B cont.

Table B2: 2009 observer comments and serious injury codes for marine mammals are presented. Lengths (cm) are estimated visually by the observer.

Animal #	Species	Length (cm)	Release Condition	Injury Code(s)	Observer Comments
1	Pantropical Spotted Dolphin	150	Serious Injury	Mouth hooked, Released with entangling gear	[Check boxes indicate animal was hooked in the side of the mouth. Leader line was cut leaving 17 ft. of line and the hook with the animal on release] The crew cut the leader to the weighted swivel using scissors. Animal swam away vigorously with hook and approximately 17ft. of leader still attached.
2	Pantropical Spotted Dolphin	150	Serious Injury	Mouth hooked, Released with entangling gear	[Check boxes indicate that animal was hooked in the lower side of the jaw and line was entangled around right flipper. Released with hook and ~3.5 feet of entangling line] Crew tried to remove hook by hitting the hook with their gaff, not a dehooker. They tried to smack the hook out about 3 times before cutting line. The crew did remove entangled line from the dolphin's right flipper before releasing it. The dolphin was alive after being released, however it floated at the surface for about a minute or so before I lost sight of it. Floating/Resting in normal position and breathing.
3	Bottlenose Dolphin	120	Alive, No SI	-	[Check boxes indicate animal was wrapped in mainline around flukes, not hooked] The bottlenose was pulled to the boat and gear was cut free of the caudal region (mono wrapped around fluke). All gear was removed. Dehooker was at the ready but wasn't needed. During this time, I made two attempts at biopsy, perhaps unsuccessfully. A very small amount of tissue was found in the corer. The biopsy was taken behind dorsal fin along the flank of the dolphin. [On release] animal swam vigorously toward the bottom.
4	Bottlenose Dolphin	240	Serious Injury	Released with entangling gear	[Check boxes indicate animal was not hooked, but was entangled in mainline] Dolphin had at least two wraps around tail, very strong, very upset. Crew unable to get animal close to the boat, mainline cut with 150 ft of mainline left. 2.75 ft. tails with center wrapped around the tail. Hopeful the line loosened after being cut., Dolphin fled. Animal fled rapidly after line cut.
5	Pantropical Spotted Dolphin	240	Serious Injury	Mouth hooked, Released with entangling gear	[Check boxes indicate animal hooked in the lower side of the mouth. Gangion line was cut leaving 5' and hook behind on animal]. Captain pulled in as much gear as he could with the animal thrashing about and cut the leader leaving behind both the hook and about 5ft of monofilament on the animal. At release the animal dove immediately and swam away strong and rejoined its pod. The pod stayed around the vessel for a few minutes and then left. Observer noted estimated 20-40 animals in close vicinity to vessel.
6	Unidentified Dolphin	180	Alive, No SI	-	[Check boxes indicate wrapped in gangion/leader line. Possibly hooked, but not known] Cut line and the wrap around the body came off. It is unknown if hook still inserted or if dolphin was only wrapped in line. Looks like line could have completely fallen off. [Estimated 15' of line involved]. Dolphin spun and tried to get loose as fisherman pulled toward boat. They got dolphin as close as possible and then cut the line. The wrap around dolphin came off and dolphin swam away. Unclear if still or ever was hooked.

Appendix B, Table B2 (cont.)

Animal #	Species	Length (cm)	Release Condition	Injury Code(s)	Observer Comments
7	Pantropical Spotted Dolphin	150	Alive, No SI	-	[Check boxes indicate dolphin hooked in fluke, not entangled] Dolphin pulled to boat, hooked in fluke. Line cut about 2 feet from tail. Dolphin very lively and swam away hard. Used knife to cut the line. Slapping water very hard when brought alongside. After line was cut, dolphin swam away quickly and dove. Actually did a small aerial once line was cut then dove. Appeared to be in strong shape.
8	Pilot Whale	270	Alive, No SI	-	[Check boxes indicate animals was wrapped in mainline around tail/flukes - all gear removed] Pilot whale had 2 or 3 wraps around tail, only mainline, no leaders hooks or floats involved. Crew pulled close to pilot whale. One strand of LL cut, remaining LL unraveled as pilot whale pulled (swam away). appeared unharmed. Swam away normally. [Note: many pilot whales sighted during interaction]
9	Pilot Whale	210	Alive, No SI	-	[Check boxes indicate animal was wrapped in mainline around tail/flukes - all gear removed] Multiple wraps of LL around tail. No hooks, floats, or leaders involved. Vessel moved along pilot whale. LL cut near tail while other end still connected to boat. Crew manually unwrapped wraps. Small pilot whale, crew able to control while unwrapping LL. Pilot whale swam away normally. Base of tail before flukes rubbed raw. Otherwise whale seemed OK.
10	Risso's Dolphin	165	Alive, No SI	-	[Check boxes indicate animal was wrapped in mainline around flukes - all gear removed]. 1 Loop around flukes. Easily flipped loop off flukes boatside while hauling mainline. Dove upon release.
11	Risso's Dolphin	150	Alive, No SI	-	[Check boxes indicate animal was entangled in mainline around flukes and through mouth. 3ft of line remained on animal]. Mammal brought up alongside vessel - could see tight wraps around base of tail with a line wrapping around its mouth. Crew used a line cutter and proceeded to cut wraps. I waited to get in when there was room for a biopsy. Upon scraping, MAM tail slapped and broke off remaining line. Some tight tail wraps not removed upon escape. Animal was tail slapping during entire release. Observer tried to biopsy from upper side of body between dorsal fin and tail. Tip seemed to bounce off. MAM seemed strong throughout interaction, breathing with no complications. Animal dove and swam away in good condition which was present. Adult was present during entire interaction.
12	Risso's Dolphin	150	Serious Injury	Placed on deck during disentanglement	[Check boxes indicate that animal was extensively wrapped in the mainline. It was pulled onboard by the flukes and disentangled on deck - all gear was removed] Pulled animal on board by flukes and tail-stock and disentangled by hand. Dove immediately upon release, did not see resurface. [Scored as serious injury because animal was hauled aboard and placed on deck. Initial ID was pilot whale. Confirmed Risso's by photograph. Biopsy taken.]

Appendix B, Table B2 (cont.)

Animal #	Species	Length (cm)	Release Condition	Injury Code(s)	Observer Comments
13	Risso's Dolphin	300	Serious Injury	Mouth hooked, Released with entangling gear	[Check boxes indicate that animals was hooked with the gangion leading to the head. The mouth was not seen. Released with 12 ft of line attached] MRD surfaced twice, this is when I got my photos. Then it dove for a while. While diving, the gangion broke leaving 2 fathoms of mono attached to the MRD. MRD quickly swam away when the gangion broke. I did not see any abnormal behavior. It did not come near the boat. It was very lively.
14	Risso's Dolphin	270	Alive, No SI	-	[Check boxes indicate that animal was wrapped in mainline around flukes and through mouth. All gear removed] Risso's pulled in - the fluke was held against the rail while wraps were cut with clippers. The piece of mainline in the mouth was pulled out as well. No line remaining. The Risso's was released. The captain says that it is likely that the whale swam into the mainline catching it in its mouth accidentally, and then panicked causing the tail wraps, etc. The animal swam away normally. No marine mammals were spotted during the incident, however, ~30 min later a dark colored beaked whale crossed in front of the vessel and a group of ~20 dark colored dolphins were sighted at several hundred meters.
15	Pantropical Spotted Dolphin	120	Alive, No SI	-	[Check boxes indicate animal hooked in tail. Line cut with 1ft and hook remaining on release] They pulled the dolphin to the door and reached down with mono cutters and cut the leader eith about 1 foot of mono and hook still on dolphin. Biopsy taken from back of animal by dorsal fin. Animal struggled a little after biopsy, but not difficult for crew to control. It was very lively when they cut the leader it tool a breath then dove away very quickly. [LPG Note: Confirmed as <i>S. attenuata</i> from biopsy]
16	Unid. Marine Mammal	270	Serious Injury	Released with entangling gear	[Check boxes indicate animal was wrapped in mainline around tail stock and flukes] Could see the animal's tail wrapped in the mainline. It was very active and struggling. Mainline was intentionally cut about 150 ft from animal. We then went to the end of the gear which was only 1 float away and hauled back towards the whale. It was no longer entangled and the mainline was curled near the end where the tail could have been wrapped. I did not see the last gangion from that float come back and cannot say if the animal was hooked or entangled in it or if any remaining mainline was on the animal when it swam away.
17	Pilot Whale	180	Serious Injury	Hung from flukes during disentanglement	[Entangled around tail stock - all gear removed]. Crew tied off mainline to cleat on bow while other end of mainline was still on spool. MPW was hanging by flukes at hauling station. Capt. Cut mainline and drop line with mono cutters. Capt. Removed all mono from animals. [LB] Observer took biopsy from back of animal, near dorsal fin. Scrape, not penetration. Observer does not believe the animal reacted to the biopsy, was reacting entire time to entanglement. MPW quickly swam away when released. [LPG NOTE: SI because animal was "hanging by flukes" while cut out of gear. - Biopsy id'd to SF Pilot whale]
18	Pilot Whale	270	Serious Injury	Released with entangling gear	[Check boxes indicate mainline and gangion wrapped around tail. Hooked in tail/flukes] Mainline and one gangion was wrapped around tail base. Animal was docile enough to bring alongside vessel. Mainline was wrapped around tail 6-7 times. Crew attempted to cut wraps with knife and cut 2-3. Animal became more lively and thrashed and swam off with 3-4 wraps still around tail including 1 snap and 1 hook. Remaining wraps were still tight around tail. Animal swam away slowly after thrashing near boat. Once away from the vessel, it swam very slowly and surfaced in approximately the same location. Appeared fatigued but not seriously injured other than the wraps remaining on the tail.
19	Bottlenose dolphin	150	Serious Injury	Mouth hooked	[Check boxes and drawing indicate hooked in mouth.] Leader was cut using mono cutters [LPG Note: Observer specifies 1ft mono trailing] MBD quickly swam away when released.
20	Pantropical Spotted Dolphin	105	Serious Injury	Mouth hooked	[Check boxes and drawing indicate hooked in mouth. Line cut, released with 3 feet trailing] Small dolphin pulled over to the boat the line pulled tight and cut. The dolphin made squeaking and clicking noises as it struggled to swim away from the boat, against the pulling fishermen. After the line was cut, the dolphin swam away with vigor.
21	Common Dolphin	130	Dead	Entangled	[Check boxes and drawing indicate wrapped in mainline around flukes] Mono cut off with mono cutters. Dolphin sank because it was dead. [Biopsies collected confirmed as <i>D. delphis</i>]