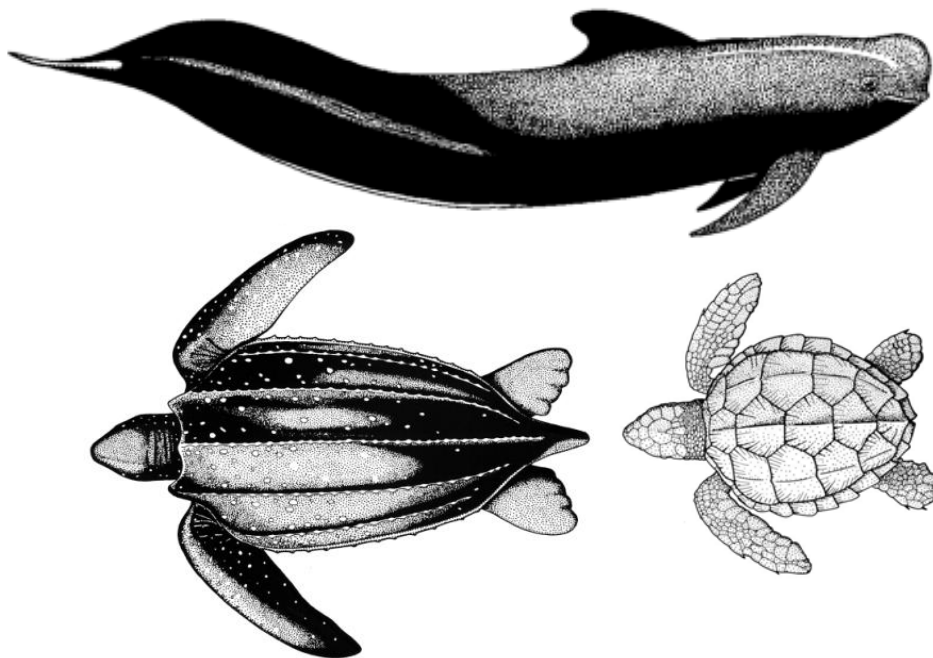




NOAA TECHNICAL MEMORANDUM NMFS-SEFSC-591

**Estimated Bycatch of Marine Mammals and Sea Turtles in the U.S. Atlantic Pelagic
Longline Fleet During 2008**

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Southeast Fisheries Science Center
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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 2008 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 2008, there were an estimated 381.3 (288.7 – 503.7 [95% CI]) interactions with leatherback turtles and 771.6 (481.4 – 1236.6 [95% CI]) interactions with loggerhead turtles. The primary marine mammals interacting with this fishery were pilot whales (*Globicephala* sp.) with an estimated 141.5 (76.1 – 263.3 [95% CI]) interactions and Risso's dolphins (*Grampus griseus*) with 64.4 (30.0 – 138.6 [95% CI]) interactions. Potential sources of bias and uncertainty in these bycatch estimates are discussed.

TABLE OF CONTENTS

Abstract.....	iii
Introduction.....	1
Methodology.....	3
Geographic Stratification.....	3
Delta Lognormal Estimator.....	5
Sea Turtle Life History Form.....	7
Marine Mammal Serious Injury Determination.....	7
Results and Discussion.....	8
Reported Fishing Effort and Observer Coverage.....	8
Observed Protected Species Interactions.....	9
Estimated Interactions in Unobserved Areas with Fishing Effort.....	10
Total Estimated Bycatch	11
Trends in Bycatch Estimates	11
Sources of Bias and Uncertainty.....	12
Literature Cited.....	14
List of Tables and Figures.....	16
Appendix A: Sea Turtle Life History Form.....	41
Appendix B: Detail Information on Observed Interactions with Protected Species	43

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.

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).

In this report, marine mammal and marine turtle bycatch estimates are calculated for pelagic longline fishery effort during 2008. 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 approximately 8% of the total reported sets, 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. 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 101 sets (57,500 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 2008 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 three-year average (2005-2007) 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 2005-2007, the bycatch rate was estimated from the annual 2008 rate for that fishing area ignoring potential quarterly (i.e., seasonal) effects on rates. Finally, if there was no coverage at all in 2008 for a fishing area, then bycatch estimates were made based upon the annual average bycatch rate for that fishing area from 2005-2007. 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, 1993). 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^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:

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

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:

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

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

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

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 2008. 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 2008 (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 6.47 million hooks during 2008 (Table 1A, Figure 2). The reported fishery effort included 8,800 sets during 2008, 1190 of which were observed by the POP program (Tables 1B and 2B, Figure 2). The overall percent coverage during regular fishing was 13.6% expressed as a proportion of reported sets and 13.5% as a proportion of reported hooks (Table 3). The relatively high annual rate reflects the 58.2% coverage of the fishery during the second quarter in the GOM. Observer coverage for other area-quarter strata is shown in Table 3.

Areas with no observer coverage during 2008 with more than 10 sets of reported fishing effort include the Caribbean (CAR) in quarters 1 and 2, the Mid-Atlantic Bight (MAB) in quarter 1, the North Central Atlantic (NCA) during quarter 1, the Northeast Coastal (NEC) during quarter 2, the Northeast Distant (NED) during quarter 2, the South

Atlantic Bight (SAB) during quarter 3, the Sargasso Sea (SAR) during quarters 1,2, and 4, and the Tuna North (TUN) during quarters 2 and 3 (Table 3).

Observed Protected Species Interactions

There were 90 observed interactions with leatherback turtles and 82 with loggerhead turtles (Table 4, Figure 3) in 2008. Four leatherback turtles were dead upon release and one was in unknown condition. All loggerhead turtles were released alive. 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 3). Loggerhead takes were observed in the greatest numbers in the NEC and NED during the 3rd quarter (Table 4B, Figure 3). These totals include 5 leatherback turtles taken during experimental fishing in the GOM (3 turtles), SAB (1 turtle) and FEC (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 99 of the 172 turtles captured (Table 6). A total of 16 leatherbacks and no loggerheads were released either entangled or with the hook and line remaining that was $> \frac{1}{2}$ the carapace length (Table 6).

There were 23 interactions observed with marine mammals (Table 7, Figure 4). The majority of these interactions were observed in the MAB region with pilot whales. Ten of the observed marine mammal interactions were categorized as serious injuries

including five pilot whales, four Risso's dolphins, and one unidentified marine mammal (Table 8). Four of the pilot whale serious injuries were due to animals being both hooked in the mouth and released with gear likely to further entangle the animal, while one was confirmed to be entangled only. One Risso's 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 NEC in quarter 3 (117 animals) and in the GOM in quarter 2 (103 animals, Table 9). For loggerhead turtles, the estimated interactions were highest in the NEC in quarter 3 (232 animals) and the NED in quarter 3 (263 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 47.1 pilot whales in quarter 3 and 32.2 pilot whales in quarter 4 (Table 10). Risso's dolphin serious injuries occurred in the GOM, NEC, and MAB strata. Notable interactions include an endangered sperm whale in the GOM, a killer whale in the GOM, and an interaction with a pilot whale in TUN (Table 10), all were released alive.

Estimated Interactions in Unobserved Areas with Fishing Effort

The average bycatch rates and estimated catches in strata that were not observed during 2008 are summarized in Table 11. Eight quarter-area strata bycatch rates were estimated from the 2005-2007 average for the same quarter (Bycatch rate source = "Quarterly 05-07" in Table 11), two used the annual 2008 bycatch rate for the fishing

area (“Annual 2008” in Table 11), and 4 used the non-seasonal averages for 2005-2007 (“Annual 05-07” in Table 11). The highest estimated take from these unobserved areas for leatherbacks included 9.8 in the NEC region in quarter 2. For loggerheads, the estimated take was highest in the CAR-Quarter 1 (16.6) and the NED-Quarter 2 (21.0, Table 11). For marine mammals, an additional 18.9 pilot whale serious injuries and 11.3 live releases were estimated from historical data in MAB-Quarter 1 (Table 12).

Total Estimated Bycatch

There were an estimated total of 381.3 (288.7 – 503.7 [95% CI]) interactions with leatherback turtles during 2008 (Table 13). The highest number of interactions occurred in the GOM, the NEC, and the MAB. In addition, 4 leatherbacks were taken during experimental fishing. For loggerhead turtles, the estimated total number of interactions was 771.6 turtles (481.4 – 1236.6 [95% CI], Table 13). The areas with the highest estimated interactions included the NED and the NEC. Annual estimates of marine mammal bycatch are shown in Table 14 with a total of 141.5 (76.1 – 263.3 [95% CI]) interactions with pilot whales and 64.4 (30.0 – 138.6 [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 5). 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 2008 estimated take of leatherback turtles was consistent with the annual numbers since 2005 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 5). Following the implementation of regulations, the bycatch dropped in 2005, but it has rebounded to be slightly lower than the pre-regulation period. The 2008 estimate is higher than that in 2007 and is consistent with historical averages since 2001 (Figure 5). The management actions put in place in 2004 appear to have resulted in consistent declines in bycatch rates for leatherback turtles; however, the results for loggerhead turtles are less apparent. Additional years of data and analyses will be required to fully assess the impacts of the management efforts to reduce turtle bycatch in the longline fishery.

For pilot whales, the 2008 estimate was lower than that from 2005 and 2006 (Figure 6) but was slightly higher than that for 2007. The bycatch estimate for Risso's dolphins is an increase over 2007 and continues an upward trend over the last three years, but the estimates remain relatively low (Figure 6).

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 2008 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 2008 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 2008 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 2008 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 2008. 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 2008. Counts include turtles captured during experimental fishing.

Table 7. Total number of marine mammals observed in interactions with the pelagic longline fishery during 2008 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 2008. 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 2008 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 2008 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 2008. 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 2008. 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 2008 by fishing area.

Table 14. Total estimated interactions with marine mammals in the pelagic longline fishery during 2008. These estimates include extrapolated values for areas with no observer coverage during 2008 (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 2008.

Figure 3. Observed pelagic longline fishing effort and sea turtle takes during 2008.

Figure 4. Observed pelagic longline fishing effort and marine mammal takes during 2008.

Figure 5. Historical trends in fishery effort and estimated marine turtle takes in the pelagic longline fishery between 1992 and 2008 for A) Leatherback Turtles, and B) Loggerhead Turtles. Errors bars represent 95% confidence intervals.

Figure 6. Historic trends in fishery effort and estimated marine mammal takes in the pelagic longline fishery between 1992 and 2008 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 2008 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	NCA	NEC	NED	SAB	SAR	TUN	Total
1	58.1	249.9	493.9	101.1	NR	0.0	0.0	174.7	85.7	NR	1210.3
2	NR	181.1	716.2	174.1	0.0	30.3	NR	500.6	19.2	NR	1682.2
3	0.0	134.4	602.4	618.2	0.0	426.4	127.4	48.8	0	NR	1996.7
4	NR	80.2	542.6	526.4	NR	122.6	100.9	118.5	33.2	NR	1584.2
Total	NR	645.7	2355.1	1419.8	16.1	579.2	243.0	842.6	138.1	NR	6473.4

B. Number of Sets

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	63	453	644	158	NR	0	0	224	96	NR	1694
2	NR	325	997	261	0	34	NR	610	22	NR	2324
3	0	269	835	807	0	480	151	96	0	NR	2686
4	NR	163	707	685	NR	134	116	196	37	NR	2096
Total	NR	1210	3183	1911	22	648	286	1126	155	NR	8800

Table 2. Total amount of fishing effort observed during 2008 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	NCA	NEC	NED	SAB	SAR	TUN	Total
1	0	24.7	106.7	0	0	-	-	NR	0	NR	131.4
2	0	9.8	416.5	NR	-	0	0	14.7	0	0	434.9
3	-	NR	30.3	48.6	-	73.5	NR	0	-	0	179.0
4	0	NR	82.7	33.8	0	NR	NR	7.8	0	NR	136.3
Total	0	50.1	636.2	91.0	0	NR	NR	27.1	0	NR	881.5

B. Number of Sets

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	0	36	129	0	0	-	-	6	0	NR	181
2	0	23	545	NR	-	0	0	18	0	0	597
3	-	NR	35	54	-	78	NR	0	-	0	209
4	0	NR	103	43	0	NR	NR	15	0	NR	203
Total	0	93	812	108	0	NR	NR	39	0	NR	1190

Table 3. Percentage of reported fishing effort observed during 2008 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	NCA	NEC	NED	SAB	SAR	TUN	Total
1	0.00	9.87	21.60	0.00	0.00	-	-	2.66	0.00	29.44	12.16
2	0.00	5.41	58.15	NR	-	0.00	0.00	2.93	0.00	0.00	26.73
3	-	NR	5.03	7.86	-	17.23	NR	0.00	-	0.00	8.96
4	0.00	NR	15.24	6.42	0.00	NR	NR	6.58	0.00	33.95	10.09
Total	0.00	7.75	27.01	6.41	0.00	14.06	9.40	3.22	0.00	17.67	13.61

B. Number of Sets

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	0.00	7.95	20.03	0.00	0.00	-	-	2.68	0.00	23.26	10.68
2	0.00	7.08	54.66	NR	-	0.00	0.00	2.95	0.00	0.00	25.69
3	-	NR	4.19	6.69	-	16.25	NR	0.00	-	0.00	7.78
4	0.00	NR	14.57	6.28	0.00	NR	NR	7.65	0.00	26.19	9.69
Total	0.00	7.69	25.51	5.65	0.00	13.73	9.79	3.46	0.00	12.65	13.52

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 2008 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	NCA	NEC	NED	SAB	SAR	TUN	Total
1	-	4	4	-	-	X	X	1	-	1	10
2	-	0	52	1	X	-	-	0	-	-	53
3	X	0	0	2	X	19	0	-	X	-	21
4	-	0	4	0	-	1	0	0	-	1	6
Total	-	4	60	3	-	20	0	1	-	2	90

B. Loggerhead Turtles

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	-	1	0	0	X	X	X	0	-	0	1
2	-	1	3	1	-	-	-	2	-	-	7
3	X	0	0	0	X	39	28	-	X	-	67
4	-	1	1	0	X	0	5	0	-	0	7
Total	-	3	4	1	-	39	33	2	0	0	82

C. All Turtles

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	-	5	4	0	X	X	X	1	-	1	11
2	-	1	55	2	-	-	-	2	-	-	60
3	X	0	0	2	X	58	28	-	X	-	88
4	-	1	5	0	X	1	5	0	-	1	13
Total	-	7	64	4	-	59	33	3	0	2	172

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 2008. 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. Release condition

Species	Alive, uninjured	Alive, unknown	Alive, injured	Dead/ Unresponsive	Unknown	Total
Leatherback	12	2	71	4	1	90
Loggerhead	2	0	80	0	0	82
Total	14	2	151	4	1	172

B. Hook Location in hooked animals

				Internal			External	Total
Species	Not Hooked	Unknown if Hooked	Hooked, Location Unknown	Unknown Internal	Swallowed	Beak or Mouth		
Leatherback	15	4	2	0	0	9	60	90
Loggerhead	2	0	2	2	21	41	14	82
Total	17	4	4	2	21	50	74	172

C. Animals with all gear removed, by hook location

				Internal			External	Total
Species	Not Hooked	Unknown if Hooked	Hooked, Location Unknown	Unknown Internal	Swallowed	Beak or Mouth		
Leatherback	11	1	0	0	0	5	23	40
Loggerhead	2	0	2	0	3	39	13	59
Total	13	1	2	0	3	44	36	99

Table 6. Release status and gear removal for sea turtles captured and released alive in the U.S. Atlantic Pelagic Longline Fishery during 2008. Counts include turtles captured during experimental fishing.

Release Status	Leatherback	Loggerheads
Released entangled	5 (+2 unknown)	0
Released with hook and line $\geq \frac{1}{2}$ carapace length	11	0
Released with hook and line $\leq \frac{1}{2}$ carapace length	27	19
Released with hook and no line	3	3
Released with all gear removed	40	59

Table 7. Total number of marine mammals observed in interactions with the pelagic longline fishery during 2008 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.

Quarter	CAR	FEC	GOM	MAB	NCA	NEC	NED	SAB	SAR	TUN	Total
1	-	0	1	-	-	X	X	0	-	0	1
2	-	0	4	0	X	-	-	0	-	-	4
3	X	0	0	5	X	5	0	-	X	-	10
4	-	0	0	7	-	0	0	0	-	1	8
Total	-	0	5	12	-	5	0	0	-	1	23

Table 8. Summary of release condition and serious injury types for marine mammals observed in the pelagic longline fishery during 2008. 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.

Species	Alive	Dead	Serious Injury Type				Total
			Mouth hooked	Entangled	Mouth Hooked & entangled	Serious injury total	
Risso’s Dolphin	4	1	2	1	1	4	9
Killer Whale	1	0	0	0	0	0	1
Sperm Whale	1	0	0	0	0	0	1
Beaked Whale	1	0	0	0	0	0	1
Pilot Whale	3	0	0	1	4	5	8
Bottlenose Dolphin	1	0	0	0	0	0	1
Unidentified Marine Mammal	1	0	0	1	0	1	2
Total	12	1	2	3	5	10	23

Table 9. Estimated interactions with marine turtles in the pelagic longline fishery during 2008 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.

A. Mortalities

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV	Hooks Reported (x1000)	Estimated Catch
Leatherback	2	GOM	2	545	0.0042	0.7072	716.2	3.1
Leatherback	3	NEC	1	78	0.0333	1.0000	426.4	14.2

B. Released Alive

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV	Hooks Reported (x1000)	Estimated Catch
Leatherback	1	FEC	3	36	0.1206	0.5712	249.9	30.1
Leatherback	1	GOM	4	129	0.0333	0.4957	493.9	16.4
Leatherback	1	TUN	1	NR	NR	1.0000	NR	3.6
Leatherback	2	GOM	42	545	0.1372	0.1667	716.2	98.3
Leatherback	2	MAB	1	NR	0.1082	1.0000	174.1	18.8
Leatherback	3	MAB	1	54	0.0396	1.0000	618.2	24.5
Leatherback	3	NEC	14	78	0.2399	0.2644	426.4	102.3
Leatherback	4	GOM	3	103	0.0446	0.6004	542.6	24.2
Leatherback	4	NEC	1	NR	0.1115	1.0000	122.6	13.7
Leatherback	4	TUN	1	NR	NR	1.0000	NR	2.8
Loggerhead	1	FEC	1	36	0.0567	1.0000	249.9	14.2
Loggerhead	2	FEC	1	23	0.0921	1.0000	181.1	16.7
Loggerhead	2	GOM	3	545	0.0062	0.5763	716.2	4.4
Loggerhead	2	MAB	1	NR	0.1045	1.0000	174.1	18.2
Loggerhead	2	SAB	2	18	0.1315	0.6913	500.6	65.8
Loggerhead	3	NEC	26	78	0.5450	0.1952	426.4	232.4
Loggerhead	3	NED	4	NR	2.0638	0.6489	127.4	263.0
Loggerhead	4	FEC	1	NR	0.2165	1.0000	80.2	17.4
Loggerhead	4	GOM	1	103	0.0120	1.0000	542.6	6.5
Loggerhead	4	NED	4	NR	0.6696	0.4303	100.9	67.6

Table 9 cont.**C. Unknown Status**

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV	Hooks Reported (x1000)	Estimated Catch
Leatherback	2	GOM	1	545	0.0027	1.0000	716.2	1.9

D. Total Interactions

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV	Hooks Reported (x1000)	Estimated Catch
Leatherback	1	FEC	3	36	0.1206	0.5712	249.9	30.1
Leatherback	1	GOM	4	129	0.0333	0.4957	493.9	16.4
Leatherback	1	TUN	1	NR	NR	1.0000	NR	3.6
Leatherback	2	GOM	44	545	0.1440	0.1628	716.2	103.2
Leatherback	2	MAB	1	NR	0.1082	1.0000	174.1	18.8
Leatherback	3	MAB	1	54	0.0396	1.0000	618.2	24.5
Leatherback	3	NEC	15	78	0.2732	0.2572	426.4	116.5
Leatherback	4	GOM	3	103	0.0446	0.6004	542.6	24.2
Leatherback	4	NEC	1	NR	0.1115	1.0000	122.6	13.7
Leatherback	4	TUN	1	NR	NR	1.0000	NR	2.8
Loggerhead	1	FEC	1	36	0.0567	1.0000	249.9	14.2
Loggerhead	2	FEC	1	23	0.0921	1.0000	181.1	16.7
Loggerhead	2	GOM	3	545	0.0062	0.5763	716.2	4.4
Loggerhead	2	MAB	1	NR	0.1045	1.0000	174.1	18.2
Loggerhead	2	SAB	2	18	0.1315	0.6913	500.6	65.8
Loggerhead	3	NEC	26	78	0.5450	0.1952	426.4	232.4
Loggerhead	3	NED	4	NR	2.0638	0.6489	127.4	263.0
Loggerhead	4	FEC	1	NR	0.2165	1.0000	80.2	17.4
Loggerhead	4	GOM	1	103	0.0120	1.0000	542.6	6.5
Loggerhead	4	NED	4	NR	0.6696	0.4303	100.9	67.6

Table 10. Estimated A) Mortalities, B) Serious Injury, C) Released Alive, and D) Total Interactions with marine mammals in the pelagic longline fishery during 2008 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
Risso's Dolphin	1	GOM	1	129	0.0088	1.0000	493.9	4.4

B. Serious Injury

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Risso's Dolphin	2	GOM	2	545	0.0055	0.7207	716.2	3.9
Risso's Dolphin	3	NEC	1	78	0.0144	1.0000	426.4	6.1
Risso's Dolphin	4	MAB	1	43	0.0197	1.0000	526.4	10.4
Unidentified Marine Mammal	4	MAB	1	43	0.0388	1.0000	526.4	20.4
Pilot Whale	3	MAB	4	54	0.0761	0.4886	618.2	47.1
Pilot Whale	4	MAB	1	43	0.0612	1.0000	526.4	32.2

Table 10 cont.

C. Released Alive

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Bottlenose Dolphin	3	NEC	1	78	0.0146	1.0000	426.4	6.2
Risso's Dolphin	3	NEC	1	78	0.0240	1.0000	426.4	10.2
Risso's Dolpin	4	MAB	2	43	0.0559	0.6993	526.4	29.4
Unidentified Marine Mammal	4	MAB	1	43	0.0271	1.0000	526.4	14.3
Pilot Whale	3	MAB	1	54	0.0192	1.0000	618.2	11.9
Pilot Whale	4	MAB	1	43	0.0277	1.0000	526.4	14.6
Pilot Whale	4	TUN	1	NR	NR	1.0000	NR	3.1
Killer Whale	2	GOM	1	545	0.0047	1.0000	716.2	3.4
Beaked Whale	3	NEC	1	78	0.0143	1.0000	426.4	6.1
Sperm Whale	2	GOM	1	545	0.0022	1.0000	716.2	1.6

Table 10 cont.

D. Total Interactions

Species	Quarter	Area	# Positive Sets	# Observed Sets	Mean CPUE	CV CPUE	# Hooks Reported (x1000)	Estimated Catch
Bottlenose Dolphin	3	NEC	1	78	0.0146	1.0000	426.4	6.2
Risso's Dolphin	1	GOM	1	129	0.0088	1.0000	493.9	4.4
Risso's Dolphin	2	GOM	2	545	0.0055	0.7207	716.2	3.9
Risso's Dolphin	3	NEC	2	78	0.0384	0.7244	426.4	16.4
Risso's Dolphin	4	MAB	3	43	0.0756	0.5719	526.4	39.8
Unidentified Marine Mammal	4	MAB	2	43	0.0659	0.7100	526.4	34.7
Pilot Whale	3	MAB	5	54	0.0953	0.4321	618.2	58.9
Pilot Whale	4	MAB	2	43	0.0889	0.7489	526.4	46.8
Pilot Whale	4	TUN	1	NR	NR	1.0000	NR	3.1
Killer Whale	2	GOM	1	545	0.0047	1.0000	716.2	3.4
Beaked Whale	3	NEC	1	78	0.0143	1.0000	426.4	6.1
Sperm Whale	2	GOM	1	545	0.0022	1.0000	716.2	1.6

Table 11. Bycatch rates for sea turtles in area-quarter strata with reported effort that were not observed in 2008. 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) - 2008	Estimated Catch - 2008
Quarterly 05-07	Leatherback	CAR	1	0	13	0.0000	-	58.1	0.0
Quarterly 05-07	Leatherback	CAR	2	1	16	0.0789	1.0000	16.9	1.3
Annual 05-07	Leatherback	CAR	4	1	29	NR	1.0000	NR	0.3
Quarterly 05-07	Leatherback	MAB	1	0	52	0.0000	-	101.1	0.0
Annual 05-07	Leatherback	NCA	1	0	16	0.0000	-	NR	0.0
Annual 05-07	Leatherback	NCA	4	0	16	0.0000	-	NR	0.0
Quarterly 05-07	Leatherback	NEC	2	4	16	0.3223	0.4589	30.3	9.8
Annual 2008	Leatherback	NED	2	0	28	0.0000	-	NR	0.0
Quarterly 05-07	Leatherback	SAB	3	0	39	0.0000	-	48.8	0.0
Quarterly 05-07	Leatherback	SAR	1	1	26	0.0413	1.0000	85.7	3.5
Annual 05-07	Leatherback	SAR	2	6	47	0.1294	0.3885	19.2	2.5
Quarterly 05-07	Leatherback	SAR	4	5	21	0.2385	0.4041	33.2	7.9
Annual 2008	Leatherback	TUN	2	2	NR	NR	0.7020	NR	2.2
Quarterly 05-07	Leatherback	TUN	3	0	NR	0.0000	-	NR	0.0
Quarterly 05-07	Loggerhead	CAR	1	3	13	0.2854	0.5274	58.1	16.6
Quarterly 05-07	Loggerhead	CAR	2	0	16	0.0000	-	16.9	0.0
Annual 05-07	Loggerhead	CAR	4	3	29	NR	0.5566	NR	0.8
Quarterly 05-07	Loggerhead	MAB	1	1	52	0.0200	1.0000	101.1	2.0
Annual 05-07	Loggerhead	NCA	1	1	16	0.0579	1.0000	NR	0.5
Annual 05-07	Loggerhead	NCA	4	1	16	0.0579	1.0000	NR	0.4
Quarterly 05-07	Loggerhead	NEC	2	2	16	0.1408	0.6832	30.3	4.3
Annual 2008	Loggerhead	NED	2	8	28	1.4300	0.4891	NR	21.0
Quarterly 05-07	Loggerhead	SAB	3	2	39	0.0889	0.6983	48.8	4.3
Quarterly 05-07	Loggerhead	SAR	1	2	26	0.0776	0.6951	85.7	6.6
Annual 05-07	Loggerhead	SAR	2	5	47	0.1289	0.4427	19.2	2.5
Quarterly 05-07	Loggerhead	SAR	4	3	21	0.1932	0.5717	33.2	6.4
Annual 2008	Loggerhead	TUN	2	0	NR	0.0000	-	NR	0.0
Quarterly 05-07	Loggerhead	TUN	3	0	NR	0.0000	-	NR	0.0

Table 12. Bycatch rates for marine mammals in area-quarter strata with reported effort that were not observed in 2008. 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) 2008	Estimated Catch 2008
Quarterly 05-07	Pilot Whale	Serious Injury	1	MAB	4	52	0.1869	0.5427	101.1	18.9
Annual 05-07	Unidentified Dolphin	Released Alive	1	SAR	1	47	0.0197	1.0000	85.7	1.7
Quarterly 05-07	Unidentified Dolphin	Released Alive	4	SAR	1	21	0.0441	1.0000	33.2	1.5
Annual 05-07	Atlantic Spotted Dolphin	Released Alive	2	SAR	1	47	0.0328	1.0000	19.2	0.6
Quarterly 05-07	Atlantic Spotted Dolphin	Released Alive	4	SAR	1	21	0.0735	1.0000	33.2	2.4
Annual 2008	Bottlenose Dolphin	Released Alive	2	NEC	1	89	0.0128	1.0000	30.3	0.4
Quarterly 05-07	Pilot Whale	Released Alive	1	MAB	2	52	0.1122	0.7641	101.1	11.3
Annual 2008	Pilot Whale	Released Alive	2	TUN	1	NR	NR	1.0000	NR	1.0
Annual 2008	Pilot Whale	Released Alive	3	TUN	1	NR	NR	1.0000	NR	1.4

Table 13. Total estimated interactions (including live, dead, and unknown status) with A) Leatherback, B) Loggerhead turtles in the pelagic longline fishery during 2008 by fishing area.

A. Leatherbacks

Area	Total	Total CV	Total 95% Confidence Interval	Experimental Takes
CAR	1.6	0.850	0.4-6.8	-
FEC	30.1	0.571	10.6-85.4	1
GOM	143.8	0.164	104.4-198.1	3
MAB	43.3	0.713	12.3-152.1	-
NCA	0.0	-	-	-
NEC	139.9	0.238	88.4-221.5	-
NED	0.0	-	-	-
SAB	0.0	-	-	1
SAR	13.9	0.349	7.2-27.1	-
TUN	8.6	0.559	3.1-24	-
Total	381.3	0.143	288.7 – 503.7	4

B. Loggerheads

Area	Total	Total CV	Total 95% Confidence Interval	Experimental Takes
CAR	17.4	0.504	6.8-44.1	-
FEC	48.2	0.579	16.8-138.4	0
GOM	10.9	0.640	3.5-34.4	0
MAB	20.2	0.905	4.4-92.1	-
NCA	0.9	0.710	0.3-3.3	-
NEC	236.6	0.192	162.9-343.7	-
NED	351.6	0.493	140.9-877.6	-
SAB	70.2	0.650	21.9-224.6	0
SAR	15.5	0.386	7.5-32.3	-
TUN	0.0	-	-	-
Total	771.6	0.244	481.4 – 1236.6	0

Table 14. Total estimated interactions with marine mammals in the pelagic longline fishery during 2008. These estimates include extrapolated values for areas with no observer coverage during 2008 (see Table 11).

Species	Estimated Alive	CV Alive	Estimated Serious Injury	CV Serious Injury	Estimated Dead	CV Dead	Estimated Total	CV Total	95% Confidence Interval
Atlantic Spotted Dolphin	3.1	0.8205	0	-	0	-	3.1	0.8205	0.8 – 12.5
Bottlenose Dolphin	6.6	0.9433	0	-	0	-	6.6	0.9433	1.4 – 31.5
Risso's Dolphin	39.6	0.5795	20.4	0.6053	4.4	1.0000	64.4	0.4062	30.0 – 138.6
Beaked Whale	6.1	1.0000	0	-	0	-	6.1	1.0000	1.2 – 31.2
Pilot Whale	43.3	0.4841	98.2	0.4165	0	-	141.5	0.3248	76.1 – 263.3
Killer Whale	3.4	1.0000	0	-	0	-	3.4	1.0000	0.7 – 17.2
Sperm Whale	1.6	1.0000	0	-	0	-	1.6	1.0000	0.3 – 8.0
Unidentified Dolphin	3.2	0.7089	0	-	0	-	3.2	0.7089	0.9 – 11.0
Unidentified Marine Mammal	14.3	1.0000	20.4	1.000	0	-	34.7	0.7100	9.9 – 121.3

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).

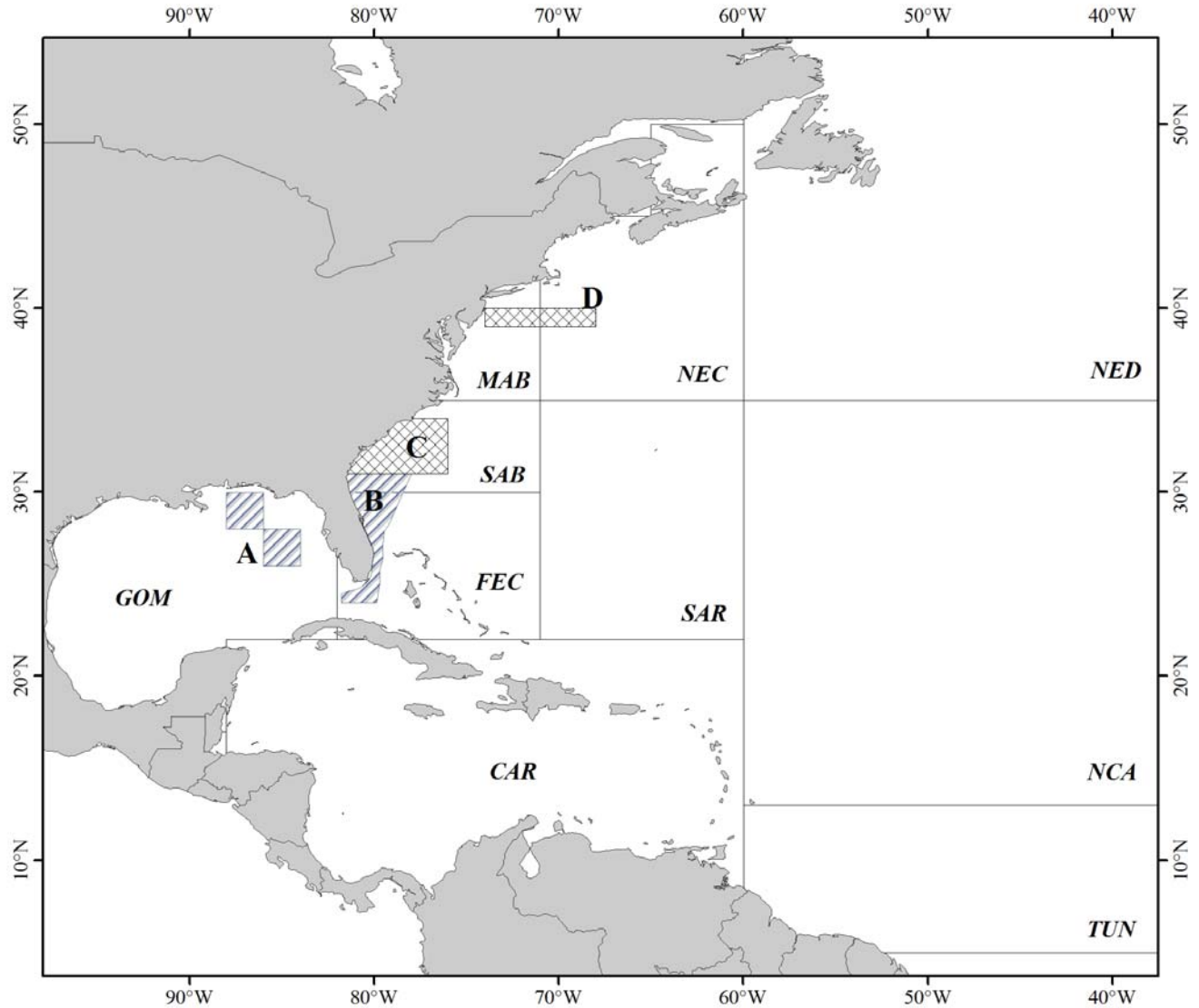


Figure 2. Observed (gray circles) and reported (black circles) pelagic longline fishing effort during 2008.

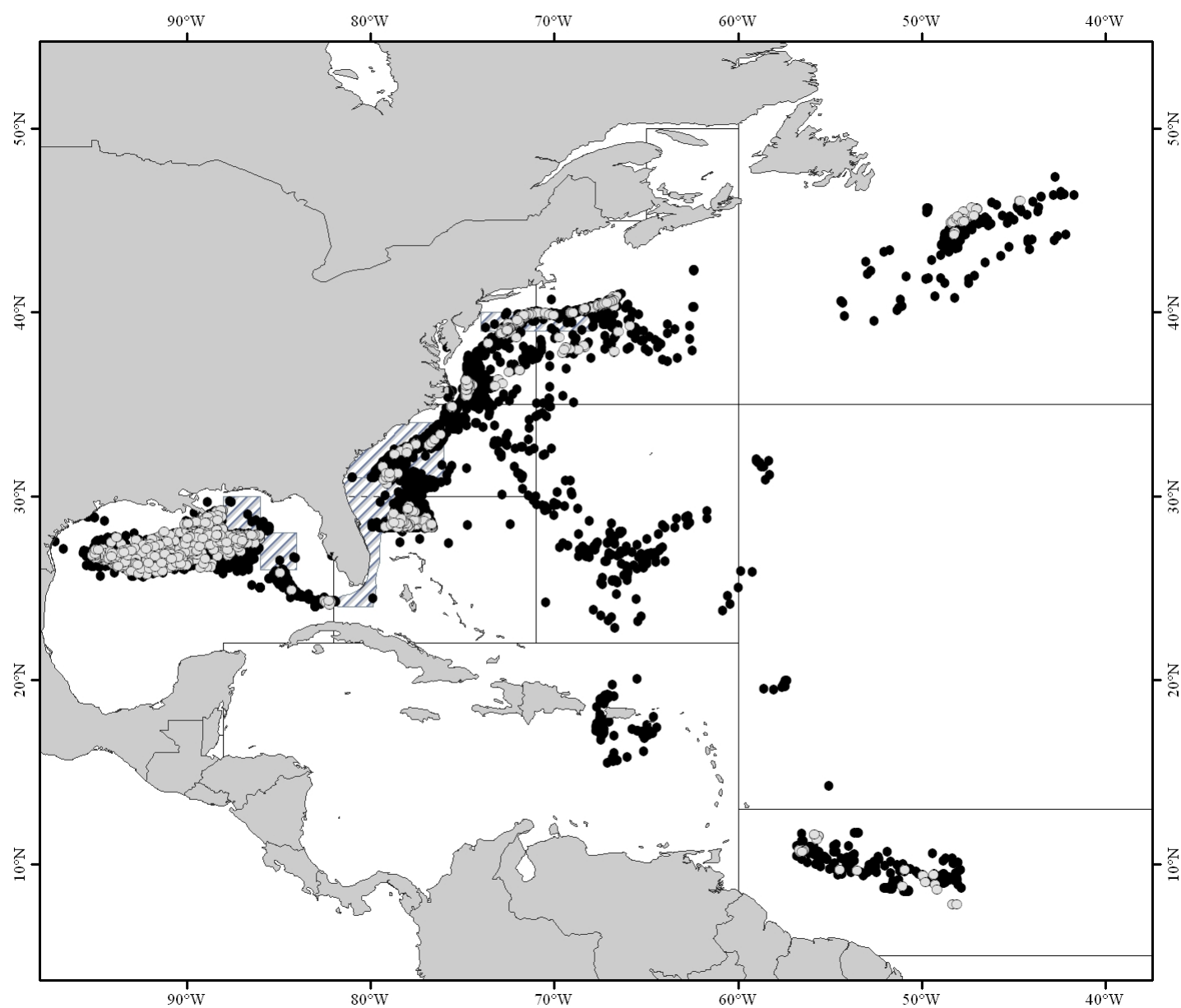


Figure 3. Observed pelagic longline fishing effort and sea turtle takes during 2008.

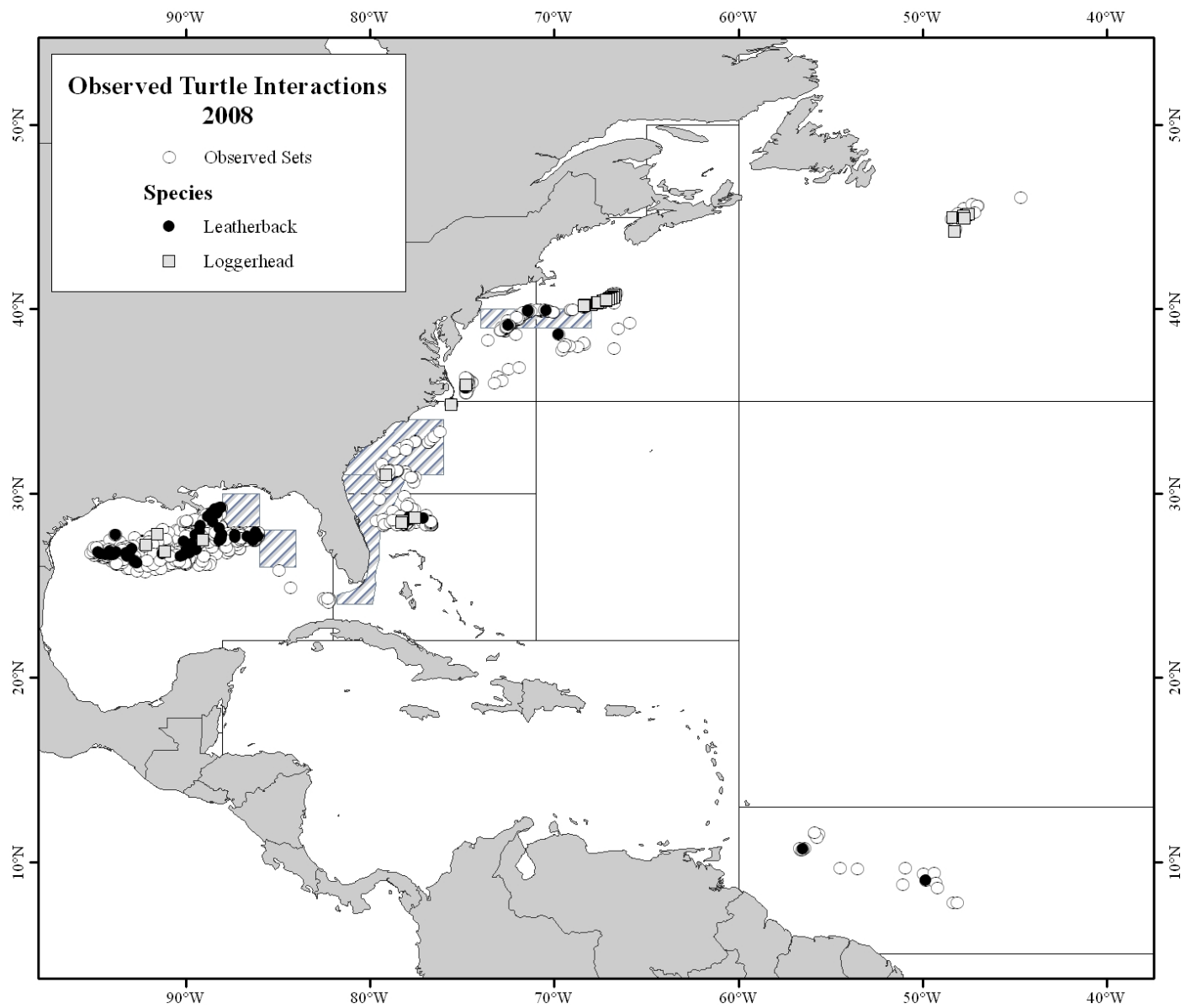


Figure 4. Observed pelagic longline fishing effort and marine mammal takes during 2008.

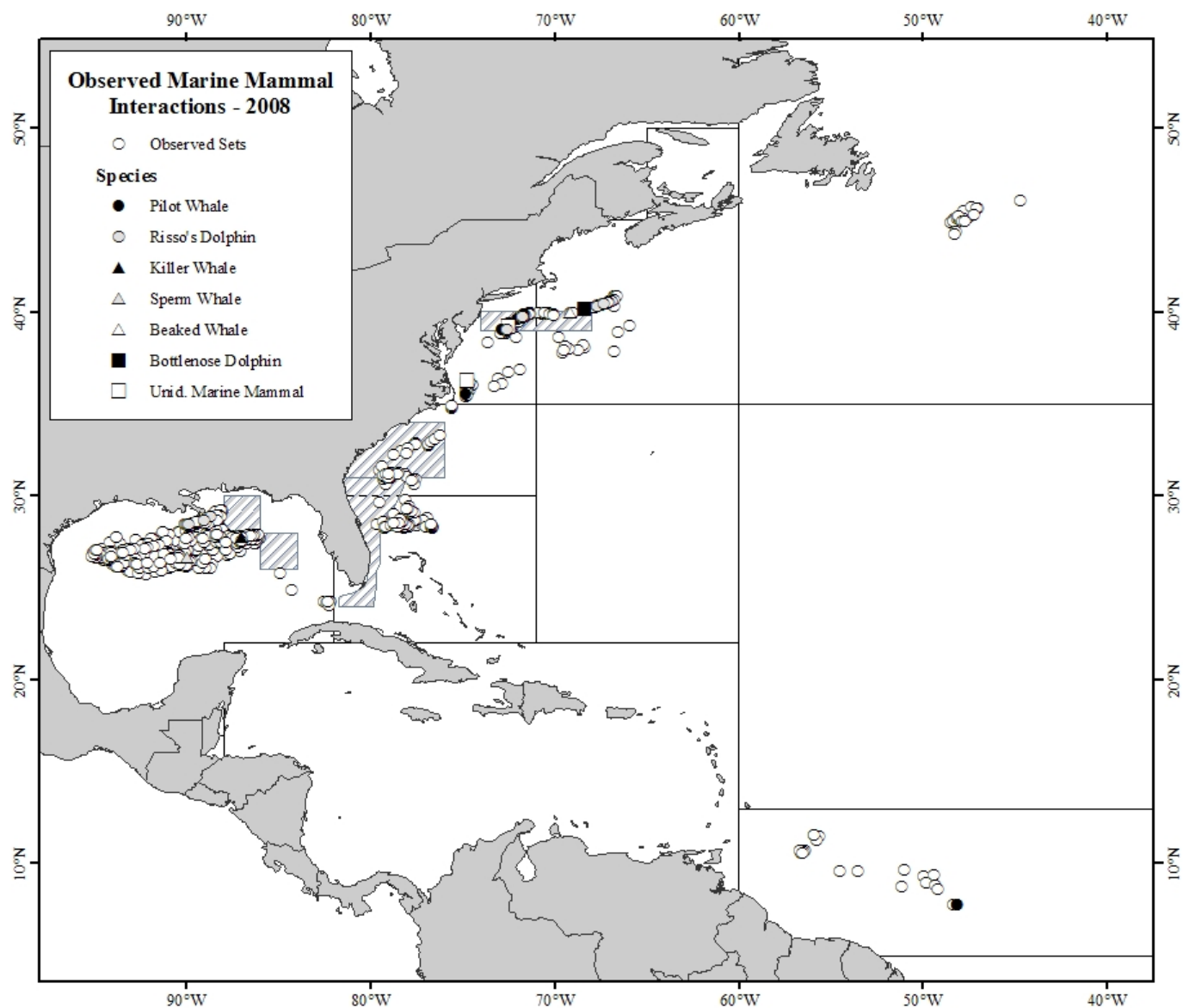
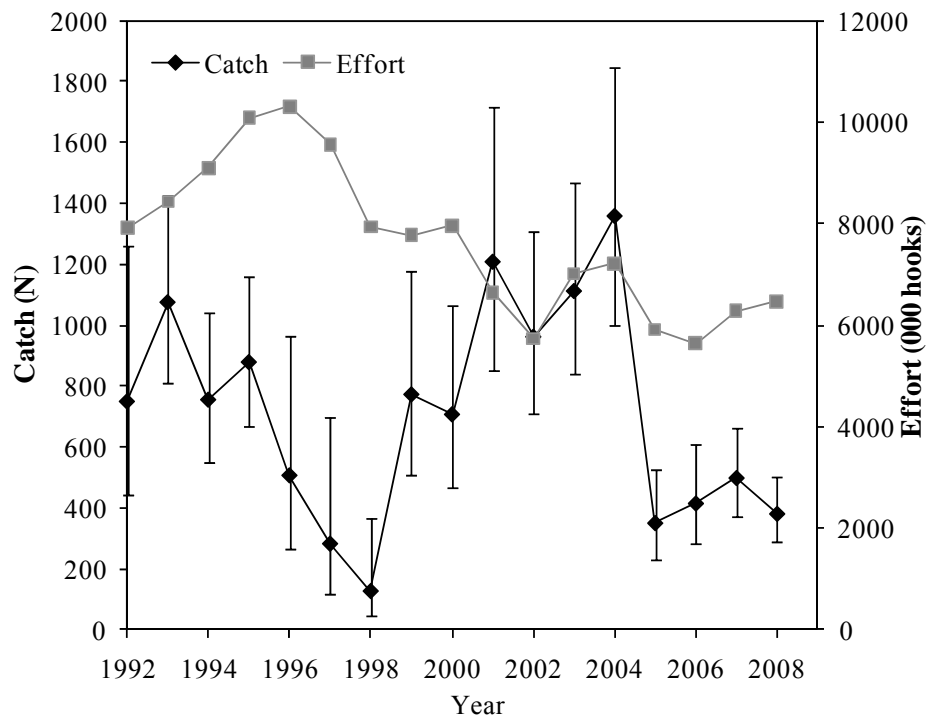


Figure 5. Historical trends in fishery effort and estimated marine turtle takes in the pelagic longline fishery between 1992 and 2008 for A) Leatherback Turtles, and B) Loggerhead Turtles. Errors bars represent 95% confidence intervals.

A. Leatherback Turtles



B. Loggerhead Turtles

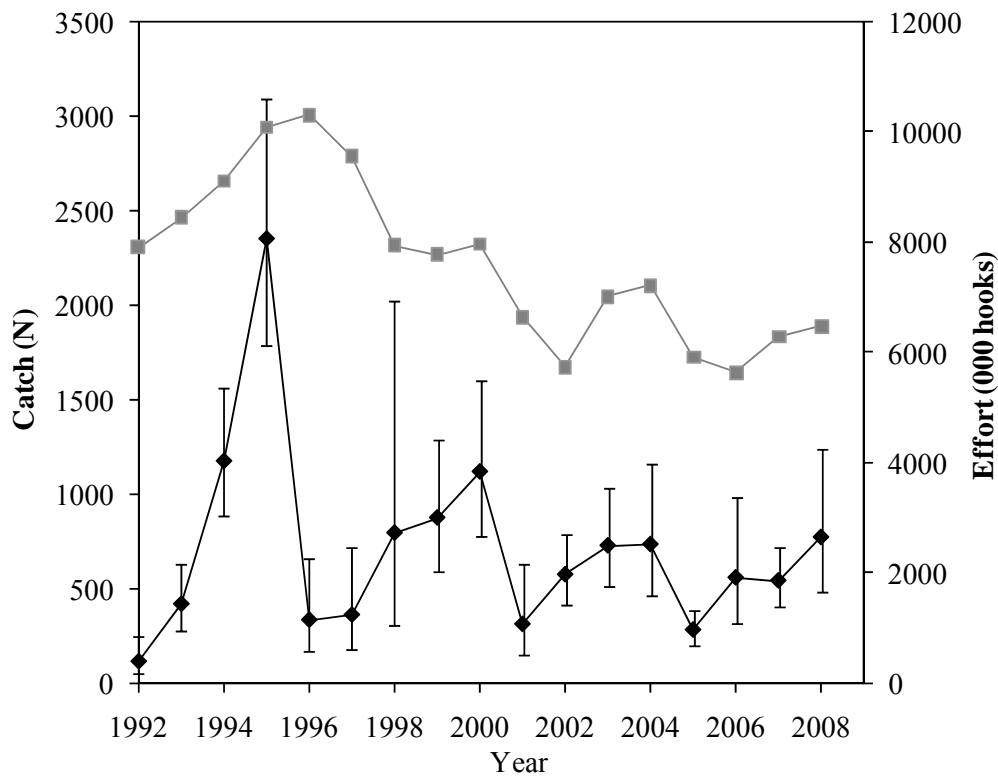
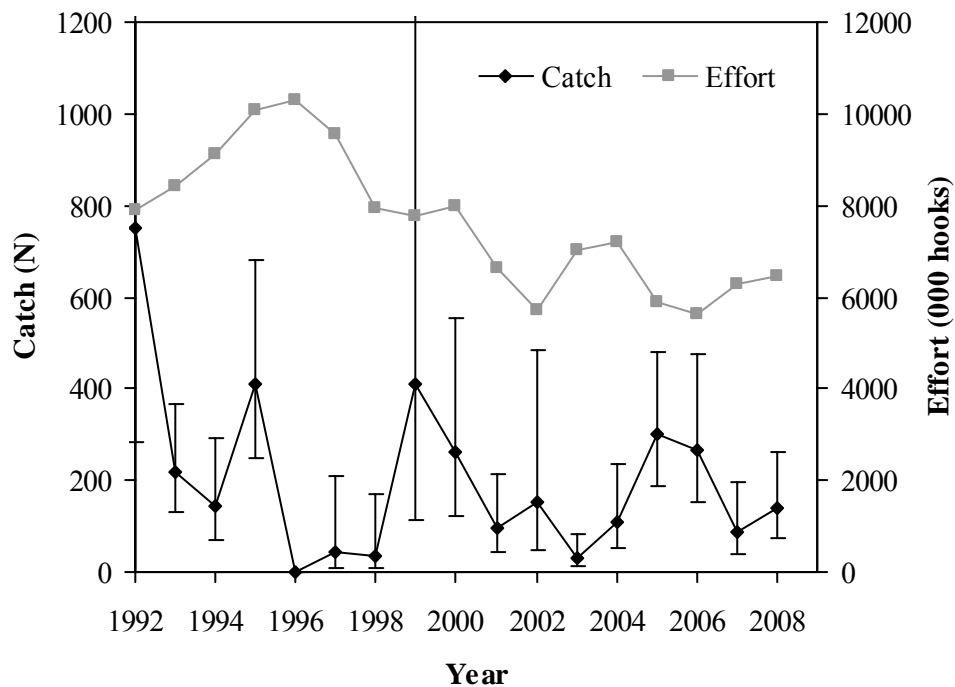
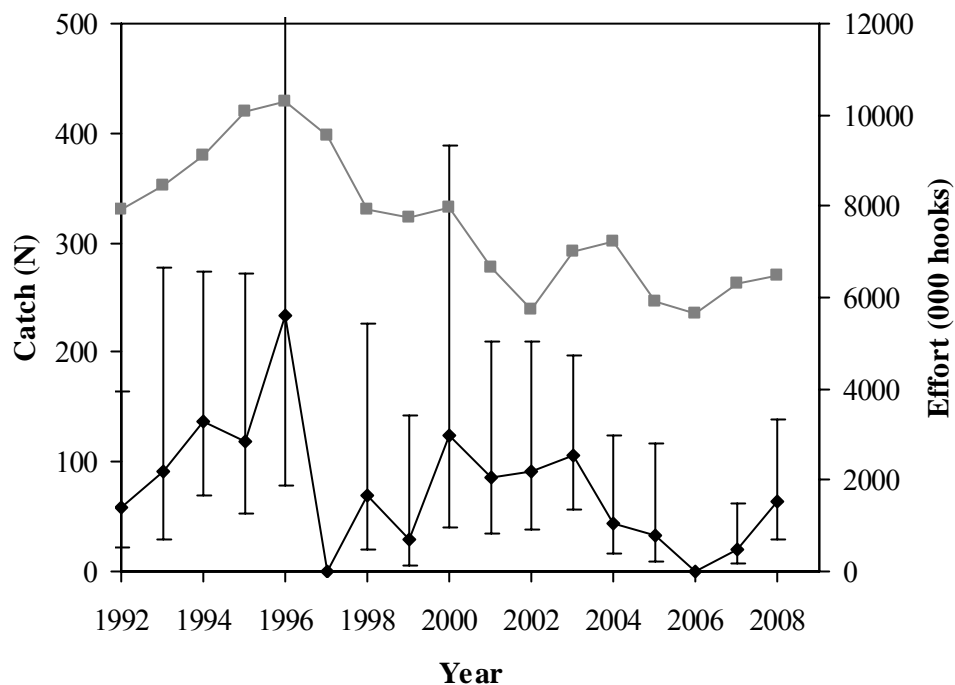


Figure 6. Historic trends in fishery effort and estimated marine mammal takes in the pelagic longline fishery between 1992 and 2008 for A) Pilot Whales and B) Risso's Dolphins. Errors bars represent 95% confidence intervals.

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 A. Sea Turtle Life History Form (cont.)

BIOLOGICAL INFORMATION

<u>DIMENSIONS (cm)</u>	Curved (measuring tape)	Straight Line (calipers)	Straight Line (calipers)
	Standard Measurements	Standard Measurements	
Carapace Length	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> notch-to-tip	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> notch-to-tip	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> notch-to-notch
Carapace Width	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	

TAGS (identify address on each tag in the comments section)

Flipper Tag Number	Metal (1) or Plastic (2)	Position (Flipper) LF, RF, LR, RR	Already Present (1) or Applied By Observer (2)	Were Tags Removed?
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/>	Y / N
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/>	Y / N
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/>	Y / N
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/>	Y / N
PIT Tag				
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>		<input type="text"/> <input type="text"/>	<input type="text"/>	Scanned? Y / N
Living Tag (describe) _____		Other Tags (describe) _____		

(Put PIT tag label here)

BIOPSY SAMPLES TAKEN? Y (itemize below) / N / Unsuccessful (If yes, USFWS 3-177 form may be needed)

RELEASE INFORMATION

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

TIME (24 hr) WATER TEMP (°F) .

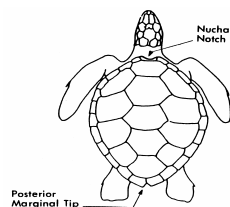
DATE, if different from capture: YEAR 20 MONTH DAY

FINAL DISPOSITION

☐ Discarded Marked Dead/Unresponsive Carcass ☐ Discarded Unmarked Dead/Unresponsive Carcass

☐ Salvaged Carcass/Parts (explain) ☐ Released Alive ☐ Taken to Holding Facility ☐ Unknown (explain)

ADDITIONAL COMMENTS (list all biological samples collected; describe or sketch any anomalies):



IDENTIFICATION CRITERIA

Number of:

Left Lateral Scutes	<input type="checkbox"/>	Overlapping Scutes?	Y / N / U	Does Nuchal Scute Touch 1 st Lateral Scute? Y / N / U
Right Lateral Scutes	<input type="checkbox"/>	Inframarginal Pores?	Y / N / U	
Vertebral Scutes	<input type="checkbox"/>	1 Pair Prefrontal Scales?	Y / N / U	
L. Inframarginal Scutes	<input type="checkbox"/>	Lacks Bony Shell?	Y / N	
R. Inframarginal Scutes	<input type="checkbox"/>			

Dorsal Coloration ☐ Black ☐ Orange/Red-Brown ☐ Brown

☐ Gray-Green ☐ Other _____

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 taken during 2008. 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 or mack	338 or 192	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	5.00		
2	GOM	1	C-16/0	0	squid	149	Alive, injured	Released alive	armpit	Yes	No	No	0.00	4.00		
3	GOM	1	C-16/0	0	squid	198	Alive, injured	Released alive	shoulder	No	No	No	0.10	4.00		
4	GOM	1	C-16/0	0	squid	198	Alive, injured	Released alive	armpit	No	No	No	0.00	4.00		
5	GOM	1	C-16/0	0	squid	324	Alive, injured	Released alive	front flipper	Yes	Yes	No	0.00	4.00		
6	FEC	1	C-18/0	10	squid	187	Alive, injured	Released alive	front flipper	Yes	No	No	0.00	4.50		
7	FEC	1	C-18/0	10	squid	160	Alive, injured	Released alive	front flipper	Yes	Yes	No	0.00	5.00		
8	TUN	1	C-16/0	0	squid	191	Alive, injured	Released alive	armpit	No	No	No	0.10	4.50		
9	SAB-EXP	1	C-18/0	0	Mack.	272	Alive, injured	Released alive	armpit	Yes	No	No	0.00	5.00		
10	FEC-EXP	1	C-18/0	0	squid	300	Alive, injured	Released alive	unknown	No	No	No	6.00	5.00		
11	GOM	2	C-16/0	0	sardine	131	Alive, injured	Released alive	tail	Yes	Yes	No	0.00	3.00		
12	GOM	2	C-16/0	0	squid	170	Alive, injured	Released alive	shoulder	No	No	No	20.00	6.00		

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	173	Alive, injured	Released alive	shoulder	No	No	No	0.50	4.00		
14	GOM	2	C-16/0	0	squid	149	Alive, injured	Released alive	front flipper	No	No	No	0.50	5.00		
15	MAB	2	C-16/0	0	squid	150	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	3.50		
16	GOM	2	C-16/0	0	squid	166	Unknown	Unknown	not known if hooked	Yes	Unknown	No	0.00	6.00		
17	GOM	2	C-16/0	0	squid	170	Alive, injured	Released alive	side jaw joint	No	No	No	0.50	5.00		
18	GOM	2	C-16/0	0	squid	170	Alive, injured	Released alive	shoulder	No	No	No	5.00	4.00		
19	GOM	2	C-16/0	0	squid	144	Alive, injured	Released alive	shoulder	No	No	No	2.50	6.00		
20	GOM	2	C-16/0	0	squid	225	Alive, unknown	Released alive	not known if hooked	No	Unknown	Unknown	8.00	6.00		
21	GOM	2	C-16/0	0	squid	225	Alive, uninjured	Released alive	not hooked	n/a	Yes	Yes	2.00	6.00		
22	GOM	2	C-16/0	0	squid	225	Alive, injured	Released alive	shoulder	No	No	No	1.00	5.00		
23	GOM	2	C-16/0	0	squid or mack	210 or 192	Alive, injured	Released alive	carapace	Yes	No	No	0.00	4.00		
24	GOM	2	C-16/0	0	squid or mack	208 or 167	Alive, injured	Released alive	shoulder	No	No	No	1.00	5.00		
25	GOM	2	C-16/0	0	squid or mack	233 or 175	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	4.00		
26	GOM	2	C-16/0	0	squid or mack	222 or 208	Alive, injured	Released alive	shoulder	No	No	No	1.00	5.00		
27	GOM	2	C-16/0	0	squid or mack	208 or 222	Alive, injured	Released alive	shoulder	Yes	Yes	No	0.00	5.00		

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-18/0	10	squid or mack.	209	Alive, injured	Released alive	shoulder	No	No	No	1.00	6.00		
29	GOM	2	C-16/0 or C-18/0	0 or 10	squid or mack.	208 or 222	Alive, injured	Released alive	shoulder	No	No	No	1.00	5.00		
30	GOM	2	C-16/0	0	sardine	63	Alive, injured	Released alive	shoulder	No	No	No	6.00	4.00		
31	GOM	2	C-16/0	0	squid	140	Alive, injured	Released alive	shoulder	No	No	No	0.30	4.00		
32	GOM	2	C-16/0	0	squid	149	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	4.00		
33	GOM	2	C-16/0	0	squid	149	Alive, injured	Released alive	upper, roof of mouth	No	No	No	0.20	3.50		
34	GOM	2	C-16/0	0	squid	149	Alive, injured	Released alive	upper, roof of mouth	No	No	No	0.20	3.00		
35	GOM	2	C-16/0	0	squid	149	Alive, injured	Released alive	side jaw joint	Yes	No	No	0.00	4.00		
36	GOM	2	C-16/0	0	sardine	75	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	6.00		
37	GOM	2	C-16/0	0	sardine	75	Alive, unknown	Released alive	not known if hooked	No	Unk.	Unknown	60.00	6.00		
38	GOM	2	C-16/0	0	herring	110	Fresh dead	Discarded carcass	not hooked	n/a	Yes	No	0.00	4.60		
39	GOM	2	C-16/0	0	squid	198	Alive, injured	Released alive	unknown location	No	No	No	10.00	7.00		
40	GOM	2	C-16/0	0	squid	112.5	Alive, injured	Released alive	armpit	No	No	No	1.00	5.00		
41	GOM	2	C-16/0	0	squid	112.5	Alive, injured	Released alive	armpit	No	No	No	1.00	4.50		
42	GOM	2	C-16/0	0	squid	198	Alive, injured	Released alive	shoulder	No	Yes	No	0.10	5.00		

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	176	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	4.00		
44	GOM	2	C-16/0	0	squid	100	Alive, injured	Released alive	front flipper	Yes	No	No	0.00	5.00		
45	GOM	2	C-16/0	0	squid	131	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	5.00		
46	GOM	2	C-16/0	0	squid	131	Alive, injured	Released alive	plastron	No	No	No	3.50	4.00		
47	GOM	2	C-16/0	0	squid	203	Alive, injured	Released alive	armpit	No	No	No	0.30	4.50		
48	GOM	2	C-16/0	0	squid	197	Alive, injured	Released alive	shoulder	No	No	No	0.30	4.50		
49	GOM	2	C-16/0	0	squid	197	Alive, injured	Released alive	armpit	No	No	No	0.30	4.50		
50	GOM	2	C-16/0	0	squid	176	Fresh dead	Discarded unmarked carcass	not known if hooked	No	Yes	Yes	11.00	6.00		
51	GOM	2	C-16/0	0	squid	176	Alive, injured	Released alive	front flipper	No	Yes	Yes	2.00	5.00		
52	GOM	2	C-16/0	0	squid	176	Alive, injured	Released alive	front flipper	No	No	No	9.00	6.00		
53	GOM	2	C-16/0	0	squid	176	Alive, injured	Released alive	beak internal, upper jaw	Yes	No	No	0.00	5.00		
54	GOM	2	C-16/0	0	squid	194	Alive, injured	Released alive	beak internal, unknown	Yes	No	No	0.00	5.50		
55	GOM	2	C-16/0	0	squid	194	Alive, injured	Released alive	mouth, lower, other	Yes	No	No	0.00	5.50		
56	GOM	2	C-16/0	0	squid	194	Alive, injured	Released alive	beak internal, unknown	Yes	No	No	0.00	5.50		

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)
57	GOM	2	C-16/0	0	squid	171	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	5.00		
58	GOM	2	C-16/0	0	squid	171	Alive, injured	Released alive	armpit	No	No	No	1.00	6.00		
59	GOM	2	C-16/0	0	squid	149	Alive, injured	Released alive	front flipper	No	No	No	30.00	4.00		
60	GOM-EXP	2	C-16/0	0	sardine	77	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	4.00		
61	GOM-EXP	2	C-16/0	0	sardine	75	Alive, injured	Released alive	front flipper	Yes	No	No	0.00	5.00		
62	GOM-EXP	2	C-16/0	0	sardine	75	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	5.00		
63	GOM-EXP	2	C-16/0	0	sardine	77	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	4.00		
64	NEC	3	18/0 -C or 16/0 -C	10 deg or 0 deg	Squid or mackerel	168 or 263	Alive, injured	Released alive	unknown external	No	No	No	5.00	5.50		
65	NEC	3	C-18/0	10	Mackerel	263	Alive, injured	Released alive	armpit	Yes	No	No	0.00	5.50		
66	NEC	3	C-18/0	10	Squid or mackerel	284 or 293	Alive, injured	Released alive	armpit	No	Yes	No	0.20	5.00		
67	NEC	3	C-18/0	10	Squid or mackerel	284 or 293	Alive, injured	Released alive	armpit	No	No	No	0.20	5.00		
68	NEC	3	C-18/0	10	Squid or mackerel	284 or 293	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	4.00		
69	NEC	3	C-18/0	10	Squid	153	Alive, injured	Released alive	shoulder	Yes	Yes	No	0.00	4.00		
70	NEC	3	C-18/0	10	Squid	113	Alive, injured	Released alive	shoulder	No	No	No	1.00	4.00		
71	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	5.00		

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)
72	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	armpit	Yes	Yes	No	0.00	5.00		
73	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	armpit	Yes	Yes	No	0.00	6.00		
74	NEC	3	C-18/0	10	Squid	227	comatose (not successfully resuscitated)	Discarded unmarked dead/unresponsive carcass	not hooked	n/a	Yes	No	0.00		147.2	
75	NEC	3	C-18/0	10	Squid	227	Alive, injured	Discarded unmarked dead/unresponsive carcass	not hooked	n/a	Yes	Yes	8.00	4.00		
76	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	mouth, lower, other	No	No	No	0.30	5.00		
77	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	armpit	No	No	No	3.00	4.00		
78	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	rear flipper	No	No	No	0.30	4.00		
79	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	armpit	Yes	No	No	0.00	5.00		
80	MAB	3	C-18/0	10	Squid	135	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	6.00		
81	MAB	3	C-18/0	10	Squid	135	Alive, injured	Released alive	armpit	No	No	No	0.00	5.00		
82	NEC	3	C-18/0	10	Squid or mackerel	186.3 or 362	Alive, injured	Released alive	shoulder	No	No	No	6.00	4.00		
83	NEC	3	C-18/0	10	Squid or mackerel	185.5 or 363.8	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	4.50		
84	NEC	3	C-18/0	10	Squid or mackerel	188.3 or 362.6	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	5.00		
85	GOM	4	C-16/0	0	Squid	153	Alive, injured	Released alive	shoulder	No	Yes	Yes	100.00	5.00		

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)
86	GOM	4	C-16/0	0	Squid	131	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00	5.50		86
87	TUN	4	C-16/0	0	Squid	113	Alive, injured	Released alive	shoulder	Yes	No	No	0.00		64	
88	GOM	4	C-16/0	0	Squid	113	Alive, injured	Released alive	armpit	No	No	No	1.00	5.00		
89	GOM	4	C-16/0	0	Squid	113	Alive, injured	Released alive	shoulder	No	No	No	0.00	4.00		
90	NEC	4	C-18/0	10	Squid	189	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	4.50		

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	FEC	1	C-18/0	0	squid	300	Alive, injured	Released alive	shoulder	Yes	No	No	0.00	3.50		
2	FEC	2	C-18/0	10	squid	117	Alive, injured	Released alive	swallowed	No	No	No	0.10		64.1	59.2
3	GOM	2	C-16/0	0	squid	153	Alive, injured	Released alive	shoulder	Yes	No	No	0.00		78	70
4	GOM	2	C-16/0	0	squid	198	Alive, injured	Released alive	unknown , internal	No	No	No	0.40	4.00		
5	GOM	2	C-16/0	0	squid	149	Alive, injured	Released alive	front flipper	No	No	No	1.00	2.50		
6	MAB	2	C-16/0	0	squid	150	Alive, injured	Released alive	tongue	Yes	No	No	0.00		81	73
7	SAB	2	C-16/0	0	sardine	72	Alive, injured	Released alive	side jaw joint	Yes	No	No	0.00		64	
8	SAB	2	C-16/0	0	squid	59	Alive, injured	Released alive	mouth, unknown	Yes	No	No	0.00	3.00		
9	NEC	3	C-18/0	10	Squid or mackerel	284 /293	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.20		68	61
10	NEC	3	C-18/0	10	Squid or mackerel	284 /293	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.20		69.5	61.2
11	NEC	3	C-18/0	10	Squid or mackerel	284 /293	Alive, injured	Released alive	armpit	Yes	No	No	0.00		74.5	64.8
12	NEC	3	C-18/0	10	Squid or mackerel	284 /293	Alive, injured	Released alive	tongue	Yes	No	No	0.00		64.2	63.5
13	NEC	3	C-18/0	10	Squid or mackerel	284 /293	Alive, injured	Released alive	glottis	Yes	No	No	0.00		72	70.8
14	NEC	3	C-18/0	10	Squid or mackerel	284 /293	Alive, injured	Released alive	armpit	Yes	No	No	0.00		61	
15	NEC	3	C-18/0	10	Squid	284	Alive, injured	Released alive	armpit	Yes	No	No	0.00		58.8	52
16	NEC	3	C-18/0	10	Squid or mackerel	284 /293	Alive, injured	Released alive	armpit	Yes	No	No	0.00		70.2	64
17	NEC	3	C-18/0	10	Mack.	293	Alive, injured	Released alive	Mouth-lower	Yes	No	No	0.00	2.30		

#	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)
18	NEC	3	C-18/0	10	Squid or mackerel	371 or 293	Alive, injured	Released alive	tongue	Yes	No	No	0.00		77.5	76
19	NEC	3	C-18/0	10	Squid or mackerel	371 or 293	Alive, injured	Released alive	armpit	Yes	No	No	0.00		67	60.7
20	NEC	3	C-18/0	10	Squid	153	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.30		69	64.5
21	NEC	3	C-18/0	10	Squid or mackerel	153 or 347	Alive, injured	Released alive	glottis	Yes	No	No	0.00		68	63.4
22	NEC	3	C-18/0	10	Mackerel	333	Alive, injured	Released alive	front flipper	Yes	No	No	0.00		59.2	54.2
23	NEC	3	C-18/0	10	Squid or mackerel	153 or 333	Alive, injured	Released alive	tongue	Yes	No	No	0.00		65.4	58.9
24	NEC	3	C-18/0	10	Mackerel	333	Alive, injured	Released alive	beak internal, unknown	Yes	No	No	0.00		69.8	63.6
25	NEC	3	C-18/0	10	Squid	163	Alive, injured	Released alive	tongue	Yes	No	No	0.00		69.4	62.5
26	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	tongue	No	No	No	0.10		72.1	65.2
27	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	swallowed , hook partially visible	No	No	No	0.20		63.7	57.3
28	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.30		58.8	53.9
29	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.20		70.4	65.7
30	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.20		69.2	63.7
31	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.20		71.3	64.1
32	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.20		74.1	65.6

Appendix B, Table B1, Loggerhead 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)
33	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.10		77	70.2
34	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	mouth, side	Yes	No	No	0.00		66.8	59.8
35	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	tongue	Yes	No	No	0.00		70	64.3
36	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	tongue	Yes	No	No	0.00		58	53.7
37	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	swallowed , hook partially visible	Yes	No	No	0.00		68.9	65.4
38	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	neck	Yes	No	No	0.00		60.8	55.6
39	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	tongue	Yes	No	No	0.00		75.2	68.8
40	NEC	3	C-18/0	10	Squid	227	Alive, injured	Released alive	swallowed , hook partially visible	Yes	No	No	0.00		65.1	59
41	NEC	3	C-18/0	10	Squid or mackerel	198 or 320	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.50		68.4	61.9
42	NEC	3	C-18/0	10	Squid	200	Alive, injured	Released alive	mouth, side, unknown	Yes	No	No	0.00		67.2	60.3
43	NEC	3	C-18/0	10	Mackerel	358	Alive, injured	Released alive	swallowed , hook partially visible	No	No	No	0.10		66.8	56.9
44	NEC	3	C-18/0	10	Mackerel	358	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.20		81.2	73
45	NEC	3	C-18/0	10	Squid	184	Alive, injured	Released alive	side jaw joint	Yes	No	No	0.00		77	70.3
46	NEC	3	C-18/0	10	Mackerel	358	Alive, injured	Released alive	side jaw joint	Yes	No	No	0.00		52	46.5
47	NEC	3	C-18/0	10	Mackerel	358	Alive, injured	Released alive	glottis	Yes	No	No	0.00		67	59.5
48	NED	3	C-18/0	10	Squid or mackerel	140 or 207	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00		58	

Appendix B, Table B1, Loggerhead 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)
49	NED	3	C-18/0	10	Squid or mackerel	135 or 203	Alive, uninjured	Released alive	not hooked	n/a	Yes	No	0.00		49	
50	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.10		69.4	
51	NED	3	C-18/0	10	Squid or mackerel	135 or 203	Alive, injured	Released alive	swallowed , hook visible to insertion pt	No	No	No	0.00		67	
52	NED	3	C-18/0	10	Squid or mackerel	135 or 203	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.00		66.5	
53	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	beak internal, upper jaw	Yes	No	No	0.00		63.1	
54	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	front flipper	Yes	No	No	0.00		52.5	
55	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	glottis	Yes	No	No	0.00		43	
56	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	swallowed , hook visible to insertion pt	Yes	No	No	0.00		67.5	
57	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	roof of mouth	Yes	No	No	0.00		55	
58	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	tongue	Yes	No	No	0.00		59	
59	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	tongue	Yes	No	No	0.00		72.8	
60	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	tongue	Yes	No	No	0.00		63	

Appendix B, Table B1, Loggerhead 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)
61	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	side jaw joint	Yes	No	No	0.00		76	
62	NED	3	C-18/0	10	Squid or mackerel	171 or 252	Alive, injured	Released alive	unknown location	Yes	No	No	0.00	2.00		
63	NED	3	C-18/0	10	Squid or mackerel	140 or 207	Alive, injured	Released alive	shoulder	Yes	No	No	0.00		57.1	
64	NED	3	C-18/0	10	Squid or mackerel	140 or 207	Alive, injured	Released alive	front flipper	Yes	No	No	0.00	2.00		
65	NED	3	C-18/0	10	Mackerel	207	Alive, injured	Released alive	side jaw joint	Yes	No	No	0.00		57.5	
66	NED	3	C-18/0	10	Squid or mackerel	140 or 207	Alive, injured	Released alive	tongue	Yes	No	No	0.00		58	
67	NED	3	C-18/0	10	Squid or mackerel	140 or 207	Alive, injured	Released alive	tongue	Yes	No	No	0.00		67	
68	NED	3	C-18/0	10	Squid or mackerel	140 or 207	Alive, injured	Released alive	unknown location	Yes	No	No	0.00	2.30		
69	NED	3	C-18/0	10	Squid or mackerel	135 or 203	Alive, injured	Released alive	armpit	Yes	No	No	0.00		68.5	
70	NED	3	C-18/0	10	Squid or mackerel	135 or 203	Alive, injured	Released alive	tongue	Yes	No	No	0.00		61.5	
71	NED	3	C-18/0	10	Squid or mackerel	135 or 203	Alive, injured	Released alive	tongue	Yes	No	No	0.00		68.3	
72	NED	3	C-18/0	10	Squid or mackerel	135 or 203	Alive, injured	Released alive	tongue	Yes	No	No	0.00		53.2	
73	NED	3	C-18/0	10	Squid or mackerel	135 or 203	Alive, injured	Released alive	tongue	Yes	No	No	0.00		53.2	

Appendix B, Table B1, Loggerhead 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)
74	NED	3	C-18/0	10	Squid or mackerel	135 or 203	Alive, injured	Released alive	tongue	Yes	No	No	0.00		61	
75	NED	3	C-18/0	10	Mackerel	423	Alive, injured	Released alive	swallowed , hook not visible	No	No	No	0.00		64	61.5
76	FEC	4	C-18/0	0	Mackerel	288	Alive, injured	Released alive	unknown internal	No	No	No	0.50	3.50		
77	GOM	4	C-16/0	0	Squid	200	Alive, injured	Released alive	beak internal, lower jaw	No	No	No	0.50	3.00		
78	NED	4	C-18/0	10	Mackerel	428	Alive, injured	Released alive	beak internal, lower jaw	Yes	No	No	0.00		69.5	64.5
79	NED	4	C-18/0	10	Mackerel	428	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.00		52	46
80	NED	4	C-18/0	10	Mackerel	428	Alive, injured	Released alive	mouth, unknown	Yes	No	No	0.00		57	50
81	NED	4	C-18/0	10	Mackerel	428	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.00		51.5	47
82	NED	4	C-18/0	10	Mackere l	428	Alive, injured	Released alive	mouth, lower jaw, other	Yes	No	No	0.00		61	

Appendix B cont.

Table B2: 2008 observer comments and serious injury codes for marine mammals are presented. Injury codes are as follows:

5 = inability to swim or dive; 8 = cetacean is hooked internally (e.g., in the mouth); 10 = line/net entangling the animal is likely to further entangle; 13 = laceration; 14 = listlessness or inability to defend itself. Lengths (cm) are estimated visually by the observer.

Animal #	Species	Length (cm)	Release Condition	Injury Code(s)	Observer Comments
1	Risso's Dolphin	270	Dead	10	Animal came up where the line parted. It's fluke had the mainline wrapped around it and at least 1 gangion. I did not see a hook in the animal. Took pictures. Crew cut mainline before biopsy could be taken. Floated away, head out of the water.
2	Risso's Dolphin	150	SI	8, 10	The mammal was being pulled up to the boat to remove the hook when the gangion broke from pressure forced by the mammal. The animal was not entangled but hooked in the mouth with about 20ft of line still attached. The animal surfaced for air a few times and then would dive back down to avoid the vessel. Upon the breaking of the gangion, the animal swam away showing no signs of distress.
3	Risso's Dolphin	300	SI	10	Gangion was wrapped around the body and looked to be hooked in the front left flipper at one time. Part of the flipper had been torn off. The mammal was brought as close to the boat and the Gangion was cut with about 5 feet of line left on the animal. Could not tell if the hook was still attached to the animal. When animal was brought to the boat, it put up a fight. The gangion was cut, about 5 ft attached to the animal and the animal swam away rapidly showing no signs of distress.
4	Killer Whale	420	Alive, No SI	-	Vessel approached slowly, keeping tension on line. When close enough (2 meters) used long handle line cutter to cut wraps. Animal very peaceful throughout procedure. Second animal sighted close to entangled animal. Swam away quickly and dove (night). All gear removed. Line wrapped around tailstock with hook forming "lasso".
5	Sperm Whale	-	Alive, No SI	-	Whale was about 20-30 ft. from vessel and dove out of sight. 20 seconds later mainline broke. Best guess took two gangions with her. One gangion tangled around the mainline and the gangion actually hooked to the whale. Second gangion hooked somewhere on the whale. When mainline snapped, I think the two gangions slipped off the mainline. The mainline broke between the whale and the boat. Animal swimming strongly, did not look tangled. Calf was swimming normally around the mother and had no interaction with gear. Mother dove and calf followed when mainline broke (est 198ft gear on animal).
6	Beaked Whale	300	Alive, No SI	-	Entanglement indicated in mainline/gangion around flipper and tail/flukes. Comments: Upon sighting of individual, line spooled in slowly until whale was alongside vessel. Captain removed tangled gear out of way and crew proceeded to use a line cutter on wraps around tail. After tail wraps removed, whale swam off with 1 wrap on front left flipper. Swam ~20 feet off of vessel and wrap popped off, allowing whale to submerge.

Appendix B, Table B2 (cont.)

Animal #	Species	Length (cm)	Release Condition	Injury Code(s)	Observer Comments
7	Pilot Whale	300	SI	10, 8?	Animal hooked near head/mouth. Line cut near snap with 48 feet trailing. Comment: The captain realized there was a whale on the line. He hauled the gear until he got to the snap and quickly cut the leader just below the snap.
8	Pilot Whale	240	Alive, No SI	-	Not hooked. Entangled in mainline around tail/flukes. Comment: All mono cut using long handle cutter.
9	Pilot Whale	360	SI	10	Unknown if hooked. No clear view of hook location. Unknown if wrapped. Comment: Gangion cut with long handle cutter. About 8 feet of leader left, no entanglement seen, but entanglement possible.
10	Pilot Whale	360	SI	10,8?	Animal hooked near head/mouth but not visible. Comments: Gear removal procedure was to cut the leader as quick as possible with a knife. The animal was about ten feet under the water when the leader was cut. There was about fifteen feet of mono left on animal when released.
11	Pilot Whale	300	SI	10,8?	Animal hooked near head/mouth but not visible. Comments: Crew pulled on leader and leader broke while MPW was under the boat. There was about 6 feet of the leader missing when brought up.
12	Risso's Dolphin	180	SI	8	Hooked in upper jaw. Released with hook and 2ft. Leader. Comments: Individual was pulled up to vessel as close as possible. Animal swimming strongly and hard to pull alongside. Could see hook in upper left jaw. Crew used line cutter and cut leader w/in 2 feet and hook remaining in individual. Captain deemed it unsafe to biopsy and cut line.
13	Risso's Dolphin	300	Alive, No SI	-	Unknown if hooked. Entangled in mainline and gangion around tail/flukes. Comment: Dolphin was pulled alongside the vessel where crew cut the gangion wraps. Then the mainline was loosened enough so that it could be slipped off the tail. This dolphin was freed quickly, approximately 4 minutes. (Debrief comment) Biopsy attempt was halted by captain who said taking the biopsy would be unsafe.
14	Risso's Dolphin	270	Alive, No SI	-	Not hooked. Entangled in mainline around flukes. Comments: This dolphin was pulled alongside and the mainline wraps were loosened enough so that they could be slipped off the tail. This dolphin was freed in under 2 minutes.

Appendix B, Table B2 (cont.)

Animal #	Species	Length (cm)	Release Condition	Injury Code(s)	Observer Comments
15	Bottlenose Dolphin	210	Alive, No SI	-	Animal entangled around tail/flukes. Comments: Dolphin was entangled w/~10 feet of line around its fluke (at base). Crew pulled line till individual on side and began to cut wraps w/ monocutters (handheld). After ~5 cuts made, dolphin was free of gear and submerged before biopsy could be taken. (Debrief note): Observer asked captain if it would be ok to biopsy, Capt. said yes. Observer got biopsy pole and was coming to rail when crew member (not Capt) cut line. Crewman apologized later.
16	Unid. Marine Mammal	180	SI	10	Floatline was cut close to mainline. Animal swam away still entangled in mono with ??? still attached. Do not know if a hook/gangion was involved.
17	Pilot Whale	210	SI	10, 8?	[Animal hooked, location unknown. Gangion line lead to head region, so presumed in mouth. Line snapped and animal released with 3 feet trailing line] Upon pulling a tight gangion in, saw pilot whale surface once. Line trailed to mouth region, but couldn't see location Capt. grabbed line cutter, but whale snapped line before cuts/pics/biopsy could be performed.
18	Risso's Dolphin	300	SI	8	The animal surfaced two times while hook was in its mouth. I could not see the hook. The line broke at the crimp and it quickly swam away.
19	Pilot Whale	250	Alive, No SI	-	[Animal entangled in mainline, gangion, and leader around tail stock] Used mono cutters to cut animal free. Biopsy attempted, animal very agitated by attempt. [Check Boxes on form indicate all gear removed]
20	Unid. Marine Mammal	200	Alive, No SI	-	Animal was lost when mainline parted. Observer never saw how animal was involved in gear, only that it must have been attached somehow. When the gear was retrieved after the line parted, it was impossible to tell how much (if any) gear had been lost.
21	Risso's Dolphin	330	Alive, No SI	-	[Animal entangled in mainline around tail stock] Mainline cut with long handled line cutter. Took biopsy from dorsal region posterior to dorsal fin. Observer did not think animal reacted to biopsy; even though the animal was green. [Check boxes on form indicate all gear removed]
22	Risso's Dolphin	300	Alive, No SI	-	[Animal entangled in mainline around tail stock] Mainline cut w/long handle line cutter. Attempted biopsy and photo during procedure. Took biopsy from dorsal region posterior to dorsal fin. Observer did not think animal reacted to biopsy; even though animal was pretty green. Swam away immediately and quickly when line cut. [Check boxes on form indicate all gear removed]
23	Pilot Whale	360	Alive, No SI	-	This pilot whale was hooked in the right front flipper. While they were pulling it to the boat, the gangion broke at the eye of the hook, leaving only hook in whale. Observer biopsied animal forward of dorsal fin on side. Animal reacted to biopsy, but not violently.