Summary of Kemp's Ridley and Green Sea Turtle Morphometric Data in the Southeastern U. S. Atlantic Ocean and Gulf of Mexico

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Introduction

The National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC) has summarized available green sea turtle (*Chelonia mydas*) and Kemp's ridley (*Lepidochelys kempii*) morphometric data from nearshore and inshore waters of the southeastern United States Atlantic Ocean (SEUS) and the Gulf of Mexico (GOM) to fulfill a request from the NMFS Southeast Regional Office (SERO) to compile available size and geographic location data for these species. The objectives of this report are: (1) to summarize available morphometric data for use by management in determining appropriate Turtle Excluder Device (TED) bar spacing dimensions in trawl fisheries in the SEUS and GOM, and (2) to detail the locations and sizes of incidentally captured turtles that have been documented by NMFS fishery observers in U.S. skimmer and otter trawl fisheries.

Fishery bycatch mitigation efforts require an understanding of how a turtle's size may affect its risk of incidental capture, injury, or mortality when interacting with various types of fishing gear. For example, in trawl fisheries where TEDs are used, fishery observers have documented the capture of turtles small enough to pass through the bars of the TED grid. These turtles, which pass into the tail bag and can no longer access the TED opening to escape, risk drowning due to forcible submergence (Epperly and Stokes 2012). Understanding the size composition of sea turtle populations in regions where fishery effort is present is critical to developing effective bycatch mitigation measures to reduce mortality. However, because actual population size distributions cannot be known, we focus here on the size composition of sea turtles incidentally captured in fishery interactions. We have used additional morphometric data to estimate body depth (BD) in an effort to address which sizes of turtles could potentially pass through various bar spacings.

It is important to note that this data summary does not represent a random or comprehensive sample, and biases in the data may exist relative to the size distribution of the total population. We cannot know whether these data are representative of actual population size distributions. With these data, we cannot make estimates of population level conservation impacts of proposed bar spacing dimensions or the proportion of the population that is vulnerable to trawl fisheries. The data summarized here have been used to estimate BD values to investigate the sizes of turtles that might get through various bar spacing dimensions, with no inference to what proportion of the population would be excluded by TEDs during normal fishery operations.

We present here a summary of standard straight carapace length notch-tip ($SCL_{n\text{-}t}$) and body depth (BD) data from a variety of data sources internal and external to NMFS. This morphometric data summary, in conjunction with Sea Turtle Stranding and Salvage Network (STSSN) data, will help inform NMFS conservation management decisions on trawl fishery TED design relative to the presence of small turtles within the waters of the SEUS and GOM.

Methods

Morphometric data were compiled and summarized from a variety of data sources including directed-capture research projects, hook-and-line incidental pier captures, the SEFSC Shrimp Observer Program, SEFSC experimental TED testing, dredge relocation trawl projects, and recent STSSN cold stun data (Table 1) for use in developing regression equations. Data gathered span a broad geographical range, including the coastal waters from North Carolina to Florida and throughout the GOM to Texas. These data sources were chosen based on collection methods that were not known to be size selective (except for observer data, as detailed in the discussion).

We used datasets with $SCL_{n\text{-}t}$ and BD measurements taken with calipers using standard protocols to build simple linear regression equations to predict BD based on measured $SCL_{n\text{-}t}$ for both species. Data from the GOM and SEUS were pooled to develop the equations used for predicting BD for all tables and figures whenever these metrics were not measured. Using estimated BD for observed Kemp's ridleys and greens incidentally captured in skimmer trawls in the GOM and SEUS and for turtles passing through the TED grid in the GOM, percentages of turtles with BDs ≥ given depth measurements of interest (4", 3.5", 3", 2.5" and 2") were calculated.

Converted data were used for the summary tables and figures, but these data were not used in regression equations to predict BD. Data provided as CCL were converted to $SCL_{n\text{-}t}$ using regression equations (Teas 1993; Kemp's ridleys – estimated SCL = 0.013 + (0.945*CCL), R^2 = 0.99; greens – estimated SCL = 0.294 + (0.937*CCL), R^2 = 0.99) from curved carapace length (CCL) measurements taken with a flexible measuring tape using standard protocols. Simple linear regressions were fitted to transform data provided as minimum SCL notch-to-notch ($SCL_{n\text{-}n}$) to $SCL_{n\text{-}t}$ using data sets where both measures were provided.

Summary statistics for SCL and BD (measured and estimated using regression equations) were calculated by species and region for the subset of data associated with shrimp fisheries interactions. Summary statistics for SCL and BD calculated by species and region for all data are presented in Appendix A.

Locations of small turtles (≤ 40 cm SCL to highlight smaller size classes) with measurement and lat/long coordinates available were mapped for the GOM and SEUS for turtles observed interacting with fishery gear. Data were displayed by species for turtles with measured or estimated BDs ≤ 4" and ≤ 3" for reference when considering management implications, such as TED design. Some sampling site data provided coordinates for the general study area and not individual captures, so some individual data overlap spatially, resulting in cases where one symbol represents multiple turtles. Similar maps are provided for reference in Appendix B for all data compiled for the GOM and SEUS (Appendix B). However, it is important not to interpret these maps as density estimates or a representation of actual distribution patterns. The maps indicate where small turtles have been encountered throughout the inshore and nearshore waters of GOM and SEUS in areas where research and fishing effort was present.

In Appendix B, data from the STSSN in the GOM and SEUS, inclusive of the cold stun data used to build the regressions, were summarized by statistical zone for all animals for which length measurements were taken, including stranding and incidental capture reports. Post-hatchlings (SCL <10 cm) and beach incident reports (primarily reports involving nesting turtles) were excluded. Additionally, within each statistical zone, data were broken out into inshore [bays, sounds, rivers, etc. – inside the Convention on the International Regulations for Preventing Collisions (COLREGS) line] and offshore (Gulf of Mexico or Atlantic Ocean) waters. Only STSSN data from a 2010 cold stun event in Florida and incidental pier captures in Mississippi were used in the summary statistics, regression equations, and figures in this report, as there was no reason to believe that these animals were in poor health prior to their encounter, and so pooling these data with other sources was considered appropriate.

Table 1. Data source details. Full affiliation details can be found in the Acknowledgments section. Data prior to 2000 were used in regression equations, but excluded in other summary tables and figures. Converted data (SCL_{n-n} to SCL_{n-t} and CCL to SCL_{n-t}) were used for summaries, but not in regression equations or estimates of BD. Gulf of Mexico = GOM; southeast U.S. coastal Atlantic Ocean = SEUS; Kemp's ridley = Lk; Green turtles = Cm.

Contact	Data Source	Species	Region	Dates	Comments
Mike Arendt	SCDNR	Lk, Cm	SEUS	2000 - 2015	Research data; converted from SCL_{n-n} to SCL_{n-t}
Joanne Braun-McNeill	NMFS	Lk, Cm	SEUS	2005 - 2015	Research data
Melissa Cook Eric Pulis	NMFS/IMMS	Lk	GOM	2012 - 2015	Hook-and-line incidental captures on fishing piers
Trish Bargo Allison Griffin	ECO/ REMSA	Lk, Cm	SEUS, GOM	2002-2011	Relocation trawl data; small subset converted from SCL_{n-n} to SCL_{n-t}
Allen Foley	FWC	Lk, Cm	GOM	2010	St. Joseph's Bay cold stun STSSN data
Jeff Gearhart	NMFS	Lk, Cm	SEUS	2004 - 2015	Experimental skimmer testing
Jacob Boyd	NCDMF	Lk, Cm	SEUS	2004 - 2015	NCDMF Gillnet Observer Program data; converted from CCL to SCL_{n-t}
Jonathan Gorham	Inwater Research Group	Lk, Cm	SEUS, GOM	2004 - 2015	Research data
Stacy Hargrove	UCF	Cm	SEUS	1985 - 2005	Research data
Kate Mansfield	UCF	Lk, Cm	GOM	2011 - 2015	Research data
Tasha Metz	Texas A&M	Lk, Cm	GOM	1991 - 2015	Research data
Jeff Schmid	Conservancy of Southwest FL	Lk	GOM	1986 - 2003	Research data
Elizabeth Scott-Denton	NMFS	Lk, Cm	SEUS, GOM	2008 - 2016	NMFS Shrimp Observer Program
Wendy Teas	STSSN	Lk, Cm	SEUS, GOM	2010 - 2015	STSSN data by statistical zone

Results

Simple linear regressions were fitted to investigate the relationship between measured SCL_{n-t} and BD for each species and to develop predictive equations to estimate BD. For green turtles, the following significant regression equation was found [F (1, 5599) = 108005.3, $p < 0.001$, 95% CI [0.394, 0.389], $R^2 = 0.951$]. For Kemp's ridleys, the following significant regression equation was found [F (1, 915) = 14032.7, $p < 0.001$, 95% CI [0.335, 0.324], $R^2 = 0.939$].

<u>Predictive equations to estimate BD from SCL_{n-t} (measured in cm):</u>

Green turtles: $BD = 0.3917\ (SCL_{n-t}) - 0.6987$

Kemp's ridleys: $BD = 0.3291\ (SCL_{n-t}) + 1.2473$

In evaluating the relationship between SCL_{n-n} and SCL_{n-t} in green turtles, a significant regression equation was found [F (1, 391) = 974278.4, $p < 0.001$, 95% CI [0.999, 1.002], $R^2 = 0.999$]. For Kemp's ridleys, a significant regression equation was found [F (1, 119) = 12927.53, $p < 0.001$, 95% CI [0.9614, 0.9956], $R^2 = 0.991$]. These converted data were used in summary statistics, but not to estimate BD.

<u>Predictive equations to estimate SCL_{n-t} from SCL_{n-n} (measured in cm):</u>

Green turtles: $SCL_{n-t} = 1.0009\ (SCL_{n-n}) + 0.694$

Kemp's ridleys: $SCL_{n-t} = 0.9785\ (SCL_{n-n}) + 1.4833$

Summary statistics for Kemp's ridley and green turtles interacting with skimmer trawl fishery gear during non-experimental and experimental trips and passing through otter trawl TED grids in the GOM and the SEUS are presented in Table 2. Descriptive statistics for Kemp's ridley and green sea turtles observed in experimental skimmer trawl fishery trips off the southeastern United States in the SEUS from 2010 – 2014 are given in Table 3. The mean SCLs for both species captured in skimmer trawls are nearly identical in the SEUS and GOM, indicating that similarly sized turtles are being encountered in this fishery in both regions. Turtles observed interacting with both types of trawl gear are generally smaller than the mean SCL for the entire data set. There are known negative size biases for the observer data, as some larger turtles may not be boated and measured due to their size. Also, skimmer trawls operate in inshore waters where smaller turtles may be expected to be found, and in otter trawl gear, where only turtles with a body depth smaller than the bar space in the TED grid are captured and measured.

SCL_{n-t} values corresponding to a range of estimated BD values (4", 3.5", 3", 2.5", 2") for Kemp's ridley and green turtles are given (Table 4) for ease of reference when evaluating morphometric data for management purposes (e.g., relative to TED bar spacing), as SCL_{n-t} is measured more often in the field than BD. Percentages of turtles observed to have interacted with otter and skimmer trawl fishing gear with estimated or measured BD values greater than or

equal to a range of estimated BD dimensions (4”, 3.5”, 3”, 2.5”, 2”) are given in Table 5. However, given the low sample size of observed turtles and known and potential biases in the data (e.g., only the smallest turtles can pass through TED grids), these results should be interpreted with caution, as it is unknown how these observed size ranges relate to the overall population size distribution in these regions.

Fishery interaction locations are shown for both species in the GOM for skimmer trawls (Figure 1) and turtles passing through otter trawl TED grids (Figure 2). Skimmer interactions from experimental trips are displayed in the SEUS (Figure 3).

Appendices

Summary statistics for all data sources, including mean, median, mode and ranges, for measured and estimated $SCL_{n\text{-}t}$ and BD data since 2000 for Kemp’s ridley and green turtles in the GOM and the SEUS are provided in Table A1. Capture locations of small turtles with measurement and lat/long coordinates available were mapped using symbols to differentiate individuals with measured or estimated BD values less than 4” and 3” in the GOM for Kemp’s ridleys (Figure A1) and green turtles (Figure A2), and in the SEUS for Kemp’s ridleys (Figure A3) and greens (Figure A4). Summary statistics by statistical zone (Figures B1a and b) for STSSN data are presented in Tables B1 and B2. These supplemental data are provided for reference here, but they are separated to avoid misinterpretation on how these data relate to population size distributions, abundance, density and geographic distribution.

Table 2. Straight carapace length notch-tip (SCL_{n-t}) and estimated body depth (BD) data summary for Kemp's ridley and green sea turtles observed in shrimp fishery interactions (non-experimental and experimental skimmer trawl fishery and passing through TED grids in otter trawls) in the GOM (2008 – 2015).

	Skimmer Trawl Interactions Gulf of Mexico				**Through Otter Trawl TED Grid Interactions Gulf of Mexico**			
	Kemp's Ridley		**Green**		**Kemp's Ridley**		**Green**	
	SCL (cm)	**BD (cm)**	**SCL (cm)**	**BD (cm)**	**SCL (cm)**	**BD (cm)**	**SCL (cm)**	**BD (cm)**
N	43	40	6		19		11	
Mean	28.8	10.9	27.9	10.2	21.6	8.4	22.7	8.2
Median	29.0	10.9	28.4	10.4	21.3	8.3	22.7	8.2
Mode	32.6	8.6	n/a	n/a	20.2	7.9	n/a	n/a
Min	19.3	7.6	21.0	7.5	18.5	7.3	19.3	6.9
Max	45.6	16.3	33.5	12.4	28.0	10.5	26.7	9.8

Table 3. Straight carapace length notch-tip (SCL_{n-t}) and estimated body depth (BD) data summary for Kemp's ridley and green sea turtles observed in experimental skimmer trawl fishery trips off the southeastern United States in the Atlantic from 2010 - 2014.

Skimmer Trawl Interactions - SEUS				
	Kemp's Ridley		**Green**	
	SCL (cm)	**BD (cm)**	**SCL (cm)**	**BD (cm)**
N	8		8	
Mean	28.3	10.6	29.7	10.5
Median	27.9	10.4	27.8	10.2
Mode	n/a	n/a	n/a	n/a
Min	19.9	7.8	21.0	7.5
Max	39.1	14.1	38.3	14.3

Table 4. Estimated straight carapace length notch-tip (SCL_{n-t}) values calculated for a given BD value (4", 3.5", 3", 2.5" and 2") from regression equations for Kemp's ridleys] and for green turtles with 95% Confidence Intervals (CI) shown in brackets.

Estimated SCL Values Corresponding to given BD values	**4"BD (10.2 cm)**	**3.5"BD (8.9 cm)**	**3"BD (7.6 cm)**	**2.5"BD (6.4 cm)**	**2.0" BD (5.1 cm)**
Kemp's ridley	27.2 cm	23.3 cm	19.3 cm	15.7 cm	11.7 cm
[95% CI]	[26.7 – 27.6]	[22.8 – 23.6]	[19.0 – 19.6]	[15.4 – 15.9]	[11.5 – 11.9]
Green turtle	27.8 cm	24.5 cm	21.2 cm	18.1 cm	14.8 cm
[95% CI]	[27.6 – 28.0]	[24.3 – 24.6]	[21.0 – 21.3]	[17.9 – 18.2]	[14.6 – 14.8]

Table 5 Percentage of Kemp's ridley and green turtles in the GOM and Atlantic observed during experimental and non-experimental fishing skimmer trawl operations and those observed having passed through otter trawl TED grids with estimated BDs ≥ the given dimensions (4", 3.5" 3", 2.5", and 2"). *The one Kemp's ridley that passed through a 4" TED was 28.0 cm $SCL_{n-t..}$

Gulf of Mexico						
Skimmer Trawls	**N**	**4"** **(10.2 cm)**	**3.5"** **(8.9 cm)**	**3"** **(7.6 cm)**	**2.5"** **(6.4 cm)**	**2"** **(5.1 cm)**
Kemp's ridley	40	60%	73%	100%	100%	100%
Green	6	50%	83%	100%	100%	100%
Through TED Grid						
Kemp's ridley	19	5%*	16%	95%	100%	100%
Green	11	0%	27%	64%	100%	100%
Atlantic						
Skimmer Trawls	**N**	**4"** **(10.2 cm)**	**3.5"** **(8.9 cm)**	**3"** **(7.6 cm)**	**2.5"** **(6.4 cm)**	**2"** **(5.1 cm)**
Kemp's ridley	8	63%	88%	100%	100%	100%
Green	8	50%	75%	88%	100%	100%

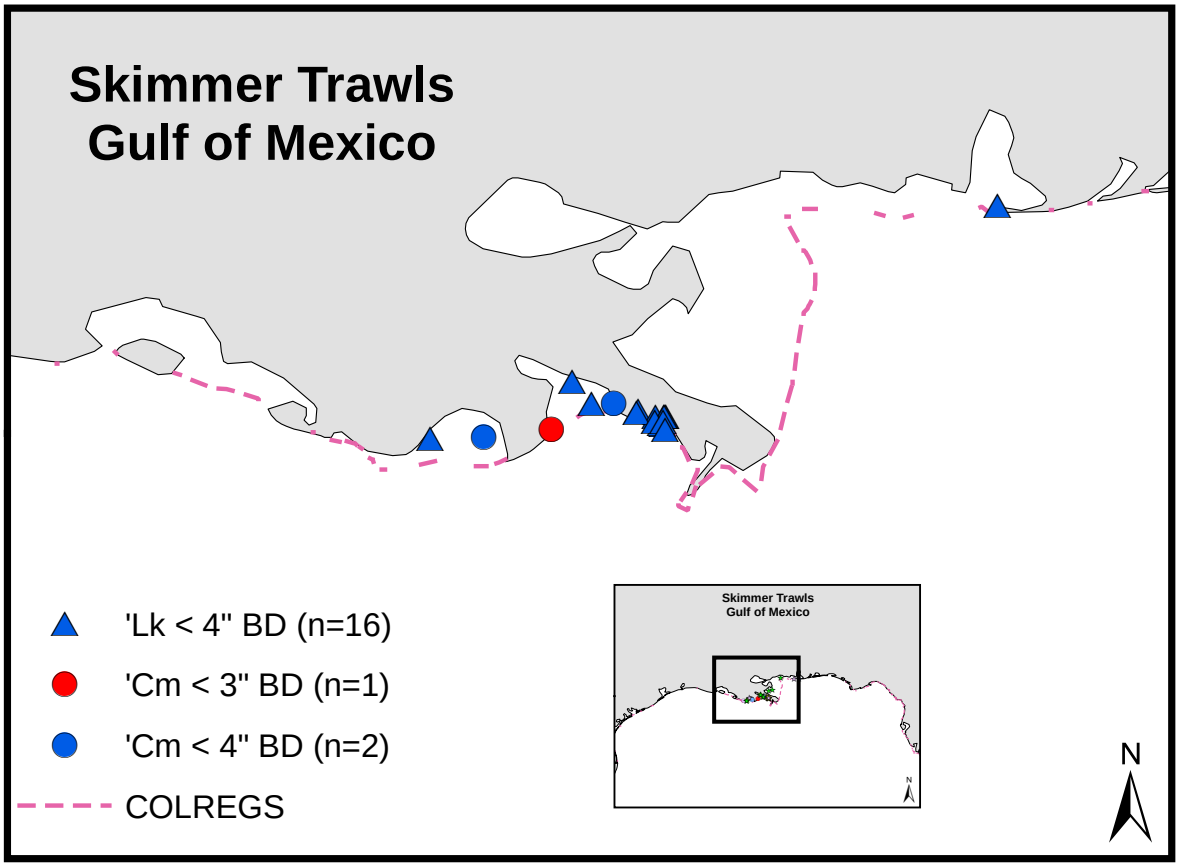

Figure 1. Capture locations of observed Kemp's ridley < 4" BD (< 27.2 cm SCL) and < 3" BD (< 19.3 cm SCL) and green sea turtles < 4" BD (< 27.8 cm SCL) and <3" BD (< 21.2 cm SCL) incidentally captured in skimmer trawl fishing gear in the GOM.

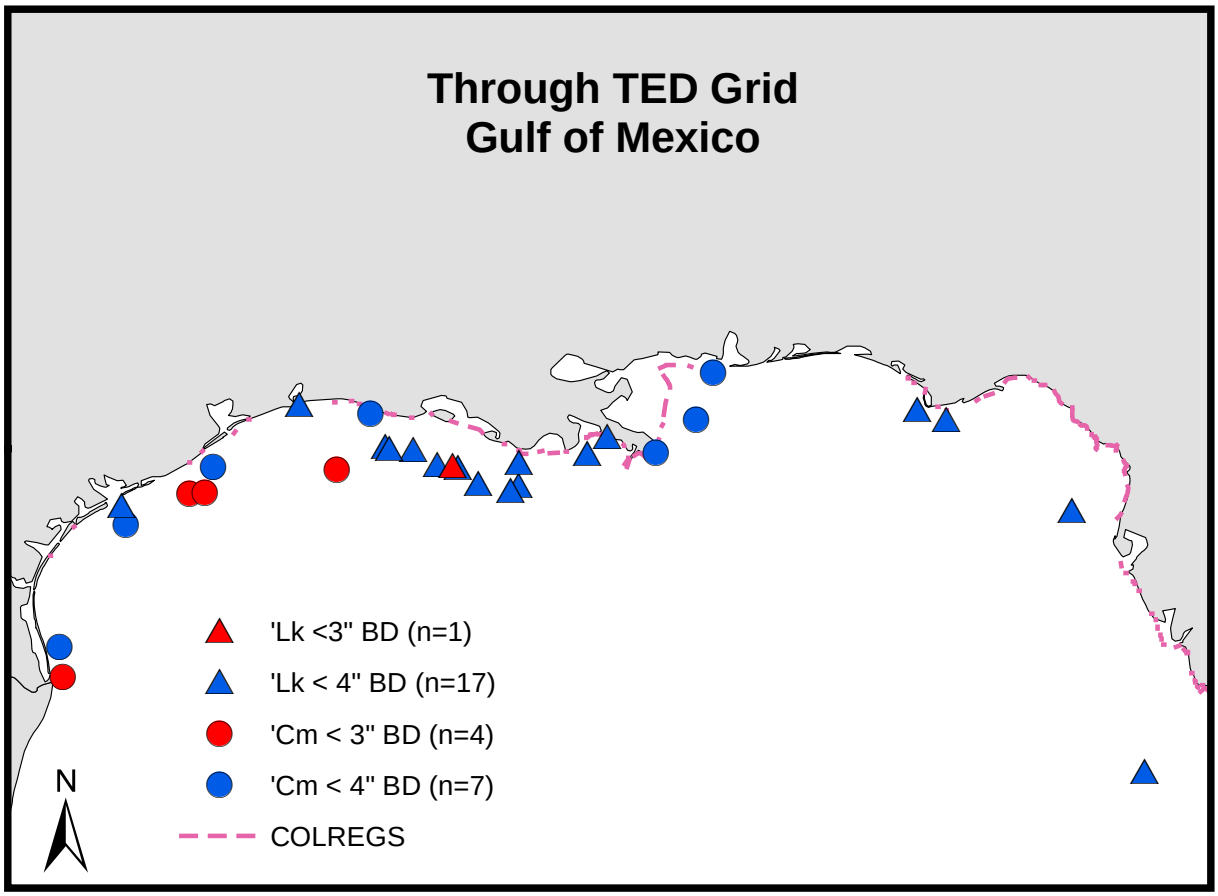

Figure 2. Capture locations of observed Kemp's ridley < 4" BD (< 27.2 cm SCL) and < 3" BD (< 19.3 cm SCL) and green sea turtles < 4" BD (< 27.8 cm SCL) and < 3" BD (< 21.2 cm SCL) passing through the bars of otter trawl TED grids in the GOM.

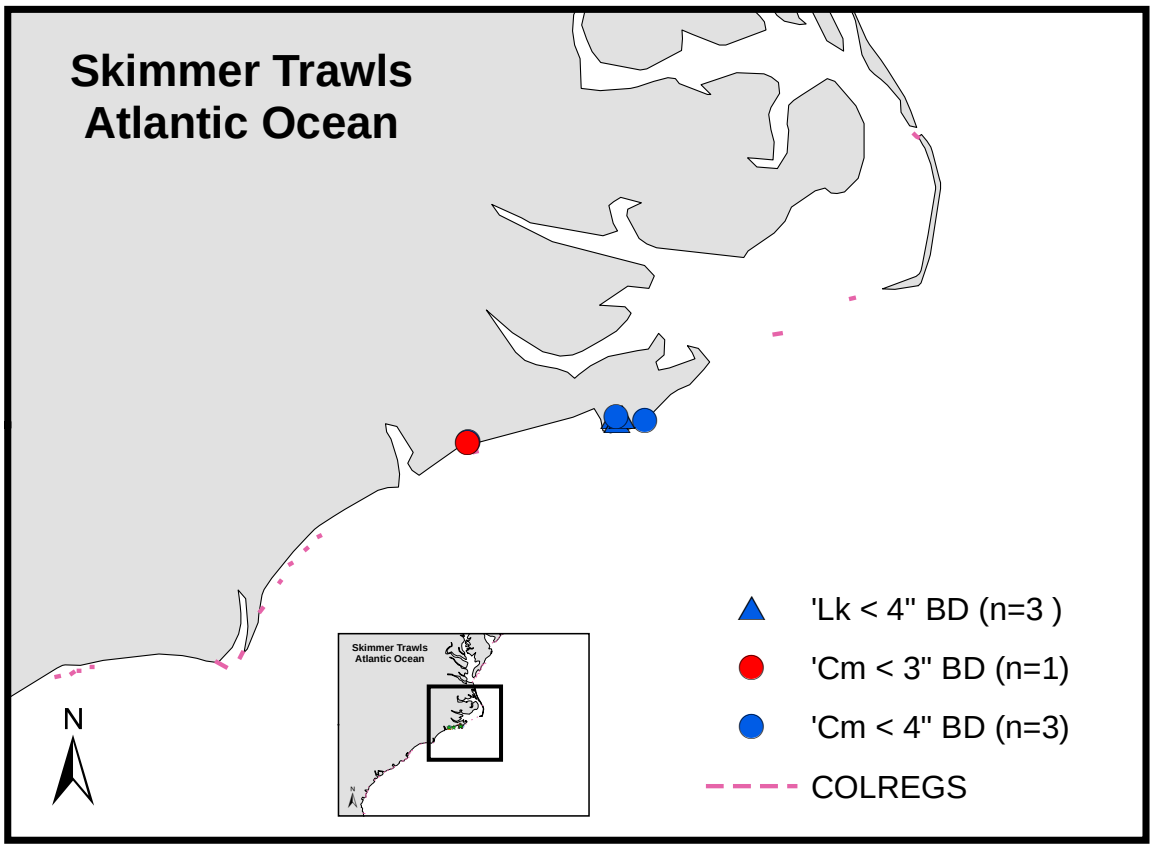

Figure 3. Capture locations of observed Kemp's ridley < 4" BD (< 27.2 cm SCL) and < 3" BD (< 19.3 cm SCL) and green sea turtles < 4" BD (< 27.8 cm SCL) and < 3" BD (< 21.2 cm SCL) SCL incidentally captured in skimmer trawl fishing gear in the Atlantic. All data are from experimental trips.

Discussion

Here, we present data detailing the sizes of turtles encountered in the inshore and nearshore waters of the southeastern U.S. Atlantic and GOM. We have provided estimates of the sizes of turtles that might get through various bar spacing dimensions based on BD, and we identified locations of measured turtles under 40 cm SCL encountered by a variety of sources. However, these historic data may not represent current size distributions, and they cannot address the actual size distribution of the population. We cannot use the data presented here to make estimates of population level conservation impacts of proposed bar spacing dimensions or the proportion of the population that is vulnerable to trawl fisheries.

Published data from long-term inwater research projects (e.g., Kubis et al. 2009, Landry et al. 2005, Metz and Landry 2015, Schmid 1998, Schmid and Barichivich 2004 and 2006, Schmid and Witzell 1997, Schmid and Witzell 2006, Witzell and Schmid 2004) present valuable historical size context and discussion of how regional size frequencies may change over time. They offer insight into the factors influencing distribution, such as habitat use, growth rates, environmental factors, seasonal trends, and foraging strategies. Shifts in temporal size-class distributions in some areas have been documented (Schmid 1998, Schmid and Barichivich 2004, Metz and Landry 2013). Overall decreasing trends in SCL and increased relative percentage of smaller individuals in some areas have also been reported (Metz and Landry 2013). Published telemetry data also yield key insights into the movement patterns, foraging ranges, and distribution of green turtles and Kemp's ridleys in the SEUS and GOM (e.g., Putman and Mansfield 2015, Schmid et al. 2003, Schmid and Witzell 2006, Seney and Landry 2008, Shaver et al. 2005, 2013 and 2016, Shaver and Rubio 2008).

When developing effective TED designs for use in commercial fisheries, one of the most important design features is the identification of optimum bar spacing to protect turtles and maintain target catch. Sea turtle body depth is the primary metric to consider when evaluating whether a turtle could pass through a TED grid. However, BD can be difficult to measure, especially under the field conditions in which fishery observers work, and even measured BD values can have a degree of variability. The carapace landmarks are not as distinct as other straight line and curved measurements, and dorsal keels are prominent in smaller turtles. In order to properly measure BD, it is recommended to turn the turtle on its side and take the average of at least three measurements between breaths because of the potential for depth changes during breathing (Wyneken 2001). Because of the logistical difficulties in reliably obtaining this measure during fishery operations, observers do not generally measure BD. Therefore, we rely on estimating BD using regression equations from a robust data set where both carapace length and body depth measurements were reliably taken.

To consider whether a turtle with a given body depth can be excluded from a trawl with a TED, many factors must be addressed. Turtle body compression due to water pressure, bending or

blockage of TED bars, turtle position relative to the TED grid upon approach, size related physical ability and behavior, and carapace morphometry, particularly the prominence of the dorsal keels on the vertebral scutes of juvenile turtles, may affect whether a turtle of a given size will pass through a TED grid. Consequently, the data presented here are not sufficient alone to estimate the percentage of turtles that may be excluded by TEDs in actual fishing operations, but a turtle's size is a major factor in determining whether it will be excluded by a TED.

Of the Kemp's ridleys observed to have passed through 4" otter trawl TED grids in the GOM (Table 5), one of 19 turtles (5%) had an estimated BD greater than 4", and yet it still passed through the grid. Although the reason for this anomaly is unknown, several factors could explain this occurrence: the bars of the TED could have been bent or deformed, the turtle could have been emaciated or with poor body condition, or this could be an example of how measurement and/or estimation error have the potential produce inaccurate estimated BD values.

The size data presented in this report represent a comprehensive effort to compile a large sample size from multiple data sources including in-water research projects, fishery observers, dredge relocation trawl surveys, cold-stun strandings, and recreational fishing pier incidental captures. We found that overall size distributions in the GOM and SEUS were similar for both green turtles and Kemp's ridleys; however, biases may exist in the relative frequencies due to the range of sampling designs and locations. These data also indicate that Kemp's ridley and green turtles of similar sizes are being encountered in skimmer trawl fisheries in both regions, and turtles observed interacting with trawl gear are smaller than the mean SCL for the entire data set. There are known biases for the observer data, though, as some larger turtles may not be boated and measured due to their size, and for trawls utilizing TEDs only turtles with a BD smaller than the TED bar spacing are generally captured and measured. Data from the STSSN show the presence of turtles from a range of size classes, including small individuals, throughout the GOM and SEUS. However, because sampling effort is not standardized or present in all areas, and size biases may exist in the reported data, these data cannot be interpreted as representative of the size distribution of the total population.

Because these projects do not sample in all areas at all times and because sampling methodologies may be size selective, it is unknown how well these data represent the actual size distribution of the populations in these regions. The data do demonstrate the presence of small juvenile turtles in the areas where sampling effort was present, but not the absence of small turtles in areas where they were not documented. Therefore, assumptions cannot be made here as to the proportional abundance of these size classes in relation to the actual population. Given these caveats, primary emphasis should be placed on the size distribution of turtles observed during fishery interactions when considering regional bycatch management strategies.

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Data Use Disclaimer Research and stranding data contributions were graciously provided for NMFS management purposes, and the summarized form presented here does not constitute publication. The original data owners must be contacted before these data can be used.

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Appendix A

Morphometric Data Summary – 2000 - 2015
Kemp's Ridleys and Green Turtles in the
Gulf of Mexico and Southeastern U.S. Atlantic Ocean

Table A1. Straight carapace length notch-tip (SCL_{n-t}) and body depth (BD) data summary from available data sets (Table 1) for Kemp's ridley and green sea turtles in the GOM and SEUS (2000 – 2015) with BD values measured or estimated using the regression equations derived from measured data for each species. This table includes data from observed fishery interactions from Table 3. Converted SCL values are included for turtles where SCL_{n-n} and CCL were given, but these data were not used to estimate BDs.

	Gulf of Mexico				**SEUS**			
	Kemp's Ridley		**Green**		**Kemp's Ridley**		**Green**	
	SCL (cm)	**BD (cm)**	**SCL (cm)**	**BD (cm)**	**SCL (cm)**	**BD cm)**	**SCL (cm)**	**BD (cm)**
N	1112	1109	1866		448	365	4094	
Mean	35.0	12.8	41.1	14.9	40.2	15.5	41.8	16.0
Median	32.3	11.9	37.9	13.6	41.1	15.6	39.2	15.1
Mode	30.5	11.0	33.3	11.4	27.4	15.7	29.2	11.2
Min	14.6	6.4	13.3	4.8	10.4	7.2	10.8	7.5
Max	69.8	24.2	108.5	41.8	66.4	26.6	107.0	41.2

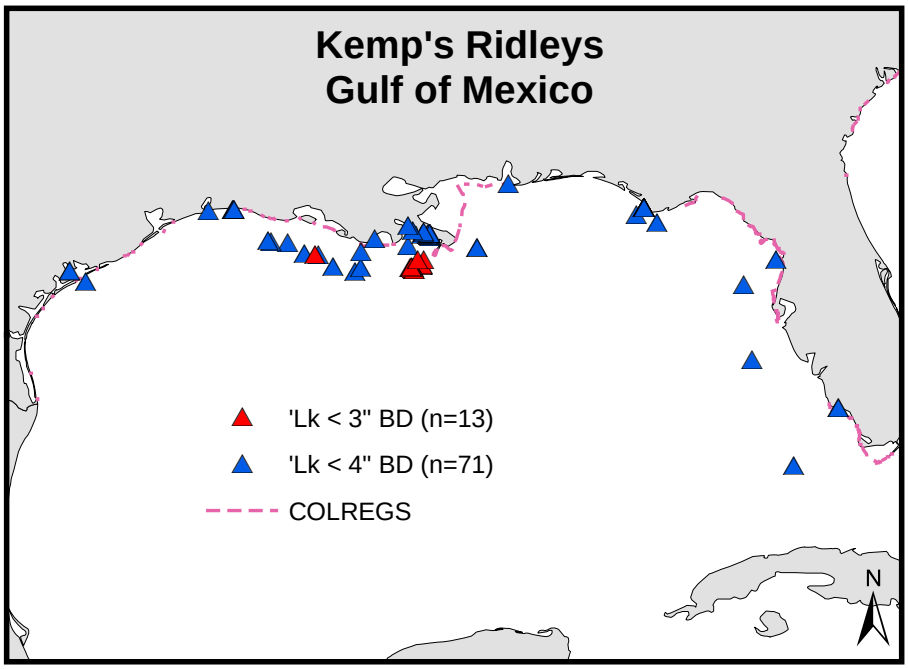


Figure A1. Capture locations of Kemp's ridleys < 4" BD (< 27.2cm SCL) and < 3" BD (< 19.3cm SCL) in the GOM.

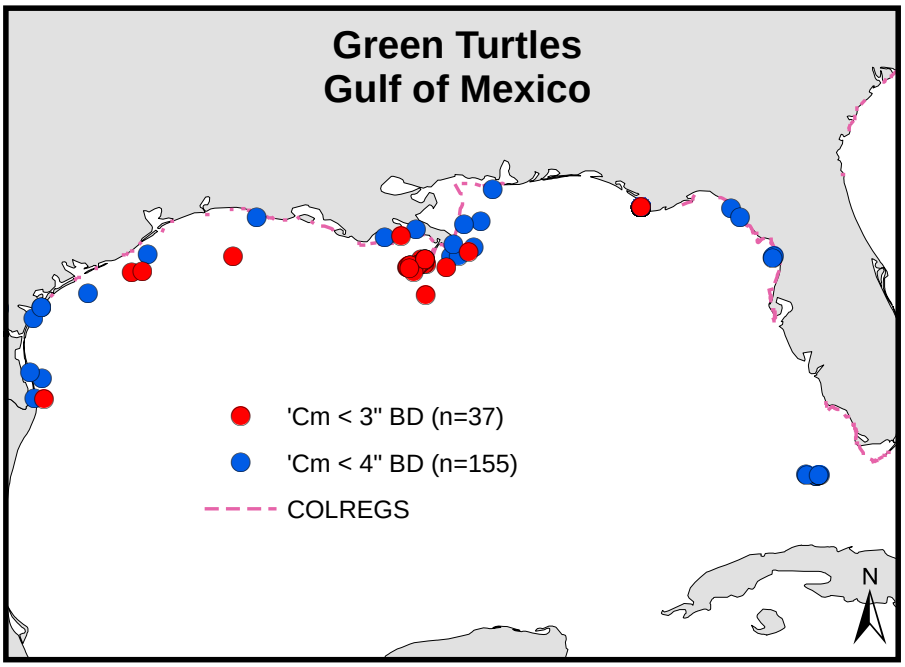


Figure A2. Capture locations of green turtles < 4" BD (< 27.8 cm SCL) and < 3" BD (< 21.2 cm SCL) in the GOM.

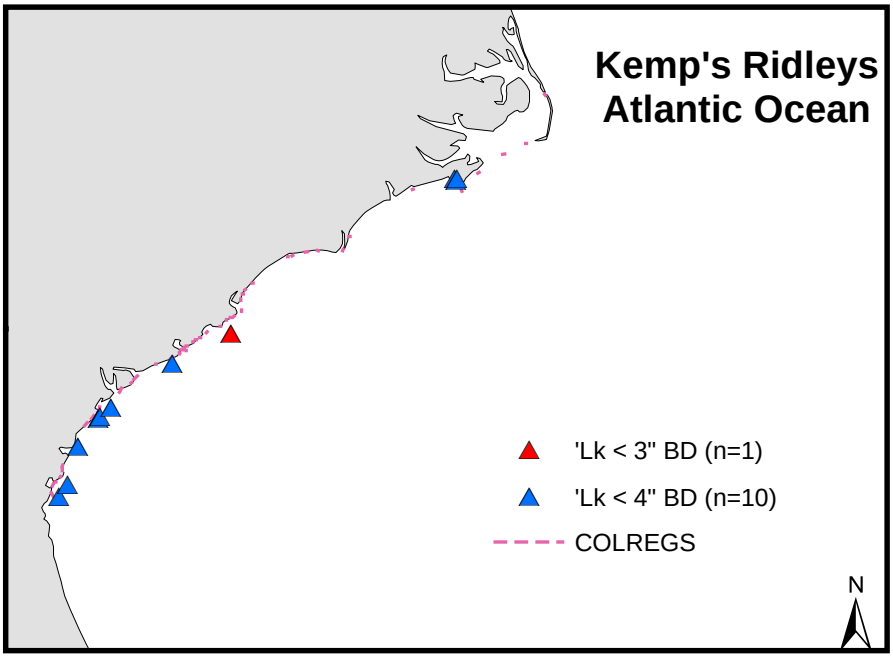


Figure A3. Capture locations of Kemp's ridleys < 4" BD (< 27.3 cm SCL) and < 3" BD (< 19.8 cm SCL) in the SEUS.

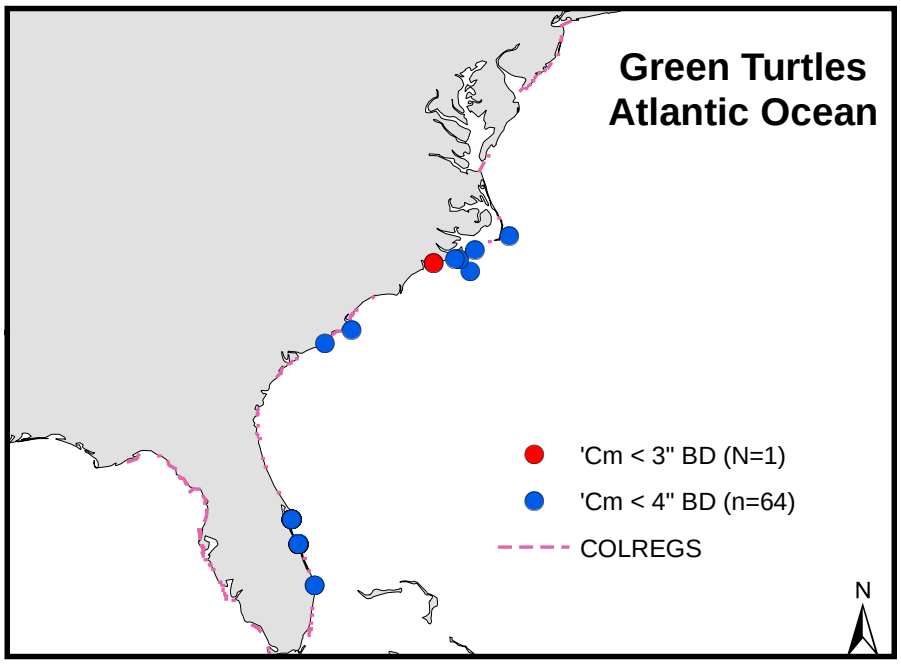


Figure A4. Capture locations of green turtles < 4" BD (< 27.3 cm SCL) and < 3" BD (< 19.8 cm SCL) in the SEUS.

Appendix B

Sea Turtle Stranding and Salvage Network Size Data – 2010 - 2015
Kemp's Ridleys and Green Turtles in the
Gulf of Mexico and Southeastern U.S. Atlantic Ocean

Table B1. Sea Turtle Stranding and Salvage Network (STSSN) green turtle SCL and BD data from 2010-2015 for turtles reported in the GOM (Zones 21 – 1, partial in Zone 24; Figure B1) and SEUS (Zones 24 – 36, partial in Zones 24 and 36; Figure B1), including incidental captures and excluding post-hatchlings and beach incident reports. Data are grouped by STSSN statistical zone for turtles reported from inshore and offshore waters. This table includes data found elsewhere in this report, including turtles sent to rehabilitation from the Port St. Lucie Power Plant intake canal, incidental pier captures in Mississippi, and cold stun data from St. Joseph's Bay, Florida.

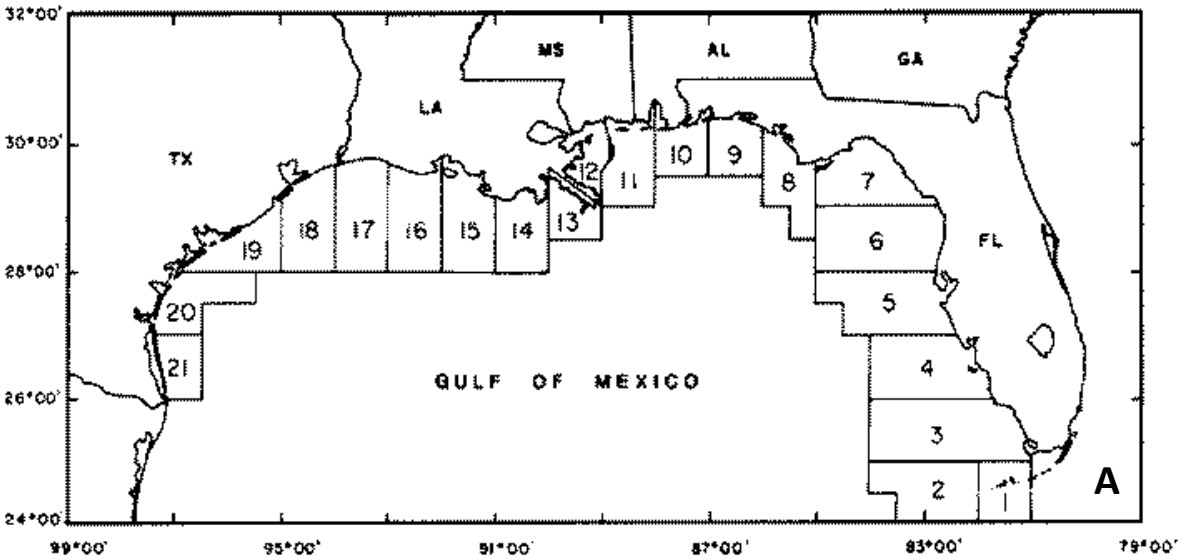
ZONE		N	SCL (cm)					BD (cm)				
			Mean	Median	Mode	Min	Max	Mean	Median	Mode	Min	Max
21	Inshore	1450	40.1	37.2	34.5	18.1	88.3	15.0	13.9	12.8	6.4	33.9
	Offshore	383	33.6	30.4	27.3	11.3	82.6	12.5	11.2	10.0	3.7	31.7
20	Inshore	2306	36.4	34.0	32.5	16.0	84.4	13.6	12.6	12.0	5.6	32.4
	Offshore	683	31.2	29.1	27.5	11.5	80.0	11.5	10.7	10.1	3.8	30.6
19	Inshore	243	37.1	34.9	33.4	16.9	76.8	13.8	13.0	12.4	5.9	29.4
	Offshore	81	27.8	27.9	24.5	11.9	63.0	10.2	10.2	8.9	4.0	24.0
18	Inshore	88	32.3	31.5	28.2	18.6	53.2	12.0	11.6	10.3	6.6	20.1
	Offshore	115	27.9	27.8	27.0	14.5	54.5	10.2	10.2	9.9	5.0	20.6
17	Inshore	0										
	Offshore	3	29.7	27.5		25.7	36.0	10.9	10.1		9.4	13.4
16	Inshore	0										
	Offshore	0										
15	Inshore	0										
	Offshore	0										
14	Inshore	9	35.8	35.0		16.3	55.6	13.3	13.0		5.7	21.1
	Offshore	24	34.8	31.1		24.0	57.6	12.9	11.5		8.7	21.9
13	Inshore	1	27.7	27.7		27.7	27.7	10.1	10.1		10.1	10.1
	Offshore	8	33.0	29.7		16.1	50.9	12.2	10.9		5.6	19.2
12	Inshore	8	35.5	33.3		23.5	55.0	13.1	12.0		8.5	20.8
	Offshore	0										
11	Inshore	5	40.9	44.2		22.1	62.0	15.3	16.6		8.0	23.6
	Offshore	1	20.9	20.9		20.9	20.9	7.5	7.5		7.5	7.5
10	Inshore	62	39.8	38.2	23.6	21.7	109.2	14.8	14.0	8.5	7.8	42.1
	Offshore	19	38.3	35.2		24.1	66.5	14.3	13.1		8.7	25.3
9	Inshore	14	42.3	41.3		29.6	60.3	15.9	15.5		10.9	22.9
	Offshore	55	41.0	35.9	23.4	15.8	99.6	15.4	13.4	8.5	5.5	38.3
8	Inshore	1891	37.9	35.4	33.3	16.6	78.6	13.7	12.6	11.4	5.8	30.1
	Offshore	32	46.2	43.6		16.7	99.9	17.4	16.4		5.8	38.4
7	Inshore	12	41.9	38.7		24.9	66.0	15.7	14.4		9.1	25.2
	Offshore	23	39.5	38.1		25.5	69.4	14.8	14.2		9.3	26.5
6	Inshore	143	39.8	38.3	34.5	22.1	69.4	14.9	14.3	12.8	8.0	26.5
	Offshore	197	36.4	34.7	33.0	16.7	95.5	13.6	12.9	12.2	5.8	36.7

ZONE		N	SCL (cm) Mean	Median	Mode	Min	Max	BD (cm) Mean	Median	Mode	Min	Max
5	Inshore	167	38.5	37.4	27.7	21.3	85.9	14.4	14.0	10.2	7.6	33.0
	Offshore	232	38.3	36.6	35.0	20.3	80.9	14.3	13.6	13.0	7.3	31.0
4	Inshore	87	44.0	44.4	22.5	21.8	67.2	16.5	16.7	8.1	7.8	25.6
	Offshore	78	44.8	42.0	31.9	18.1	102.0	16.8	15.7	11.8	6.4	39.3
3	Inshore	4	35.5	34.2		26.5	47.0	13.2	12.7		9.7	17.7
	Offshore	11	40.4	40.2		31.4	52.1	15.1	15.0		11.6	19.7
2	Inshore	2	53.3	53.3		48.7	57.9	20.2	20.2		18.4	22.0
	Offshore	1	46.7	46.7		46.7	46.7	17.6	17.6		17.6	17.6
1	Inshore	165	46.4	43.9	37.2	20.8	108.0	17.5	16.5	13.9	7.4	41.6
	Offshore	219	50.6	47.3	49.0	15.3	110.5	19.1	17.8	18.5	5.3	42.6
24	Inshore	70	45.2	43.3	36.0	18.1	94.9	17.0	16.2	13.4	6.4	36.5
	Offshore	98	47.3	43.2	30.3	18.1	103.8	17.8	16.2	11.2	6.4	40.0
25	Inshore	77	51.4	47.1	41.2	22.6	109.1	19.4	17.8	15.4	8.2	42.0
	Offshore	118	46.4	39.5	24.8	10.2	102.9	17.5	14.8	9.0	3.3	39.6
26	Inshore	174	42.1	39.3	43.4	13.1	107.4	15.8	14.7	16.3	4.4	41.4
	Offshore	373	43.8	34.8	31.2	10.3	113.0	16.5	12.9	11.5	3.3	43.6
27	Inshore	357	42.1	40.1	45.4	24.0	98.4	15.8	15.0	17.1	8.7	37.8
	Offshore	533	39.2	33.1	27.5	11.1	114.0	14.7	12.3	10.1	3.6	44.0
28	Inshore	230	37.5	34.0	28.9	20.4	76.5	14.0	12.6	10.6	7.3	29.3
	Offshore	411	36.1	30.8	31.2	20.3	106.2	13.5	11.4	11.5	7.2	40.9
29	Inshore	190	33.5	31.9	28.9	21.4	103.4	12.4	11.8	10.6	7.7	39.8
	Offshore	359	33.4	30.3	28.9	14.3	108.0	12.4	11.2	10.6	4.9	41.6
30	Inshore	102	33.5	31.2	31.2	12.0	96.8	12.4	11.5	11.5	4.0	37.2
	Offshore	170	34.5	31.4	28.4	19.0	94.3	12.8	11.6	10.4	6.8	36.2
31	Inshore	35	39.8	39.8	28.1	24.9	62.8	14.9	14.9	10.3	9.1	23.9
	Offshore	24	37.3	35.6		23.8	63.0	13.9	13.2		8.6	24.0
32	Inshore	51	36.0	31.6	26.5	23.3	88.4	13.4	11.7	9.7	8.4	33.9
	Offshore	20	34.8	30.3	30.3	25.0	87.7	12.9	11.2	11.2	9.1	33.7
33	Inshore	15	30.5	29.7		24.0	35.5	11.2	10.9		8.7	13.2
	Offshore	26	37.0	32.2	29.4	23.5	102.4	13.8	11.9	10.8	8.5	39.4
34	Inshore	418	29.0	28.6	27.5	21.0	50.0	10.7	10.5	10.1	7.5	18.9
	Offshore	112	29.4	28.9	27.0	20.5	42.9	10.8	10.6	9.9	7.3	16.1
35	Inshore	666	28.8	28.5	28.0	20.0	48.6	10.6	10.5	10.3	7.1	18.4
	Offshore	128	28.9	28.4	27.0	23.6	41.2	10.6	10.4	9.9	8.5	15.4
36	Inshore	2	31.2	31.2	31.2	31.2	31.2	11.5	11.5	11.5	11.5	11.5
	Offshore	4	27.7	27.5		24.5	31.4	10.2	10.1		8.9	11.6

Table B2. Sea Turtle Stranding and Salvage Network (STSSN) Kemp's ridley SCL and BD data from 2010-2015 for turtles reported in the GOM (Zones 21 – 1, partial in Zone 24; Figure B1) and SEUS (Zones 24 – 36, partial in Zones 24 and 36; Figure B1), including incidental captures and excluding post-hatchlings and beach incident reports. Data are grouped by STSSN statistical zone for turtles reported from inshore and offshore waters. This table includes some data found elsewhere in this report, including turtles sent to rehabilitation after capture at the Port St. Lucie Power Plant intake canal, incidental pier captures in Mississippi, and cold stun data from St. Joseph's Bay.

			SCL (cm)					BD (cm)				
ZONE		**N**	**Mean**	**Median**	**Mode**	**Min**	**Max**	**Mean**	**Median**	**Mode**	**Min**	**Max**
21	Inshore	2	40.9	40.9		34.6	47.1	14.7	14.7		12.6	16.7
	Offshore	112	55.0	58.7	58.2	14.6	67.4	19.4	20.6	20.4	6.1	23.4
20	Inshore	9	35.3	30.3	30.3	19.0	66.1	12.9	11.2	11.2	7.5	23.0
	Offshore	124	45.7	50.4	43.1	10.9	67.3	16.3	17.8	15.4	4.8	23.4
19	Inshore	16	30.8	30.1		13.0	53.8	11.4	11.1		5.5	19.0
	Offshore	48	45.1	43.7	40.9	18.4	65.4	16.1	15.6	14.7	7.3	22.8
18	Inshore	29	34.9	35.1	35.0	24.7	43.2	12.7	12.8	12.8	9.4	15.5
	Offshore	307	39.1	37.4	34.6	12.7	67.7	14.1	13.6	12.6	5.4	23.5
17	Inshore	3	41.1	37.0		36.0	50.4	14.8	13.4		13.1	17.8
	Offshore	124	39.8	38.4	45.7	13.8	63.3	14.3	13.9	16.3	5.8	22.1
16	Inshore	0										
	Offshore	4	38.9	37.0		29.8	51.6	14.0	13.4		11.0	18.2
15	Inshore	1	41.0	41.0		41.0	41.0	14.7	14.7		14.7	14.7
	Offshore	2	37.3	37.3		32.8	41.8	13.5	13.5		12.0	15.0
14	Inshore	27	36.9	34.8		18.5	63.2	13.4	12.7		7.3	22.0
	Offshore	123	35.1	33.6	20.5	16.7	65.0	12.8	12.3	8.0	6.8	22.6
13	Inshore	27	31.7	30.1		18.2	60.0	11.7	11.2		7.2	21.0
	Offshore	169	34.7	31.8	22.8	17.0	66.3	12.7	11.7	8.7	6.8	23.1
12	Inshore	1230	33.5	31.9	31.8	18.4	66.5	12.2	11.7	11.0	7.3	23.1
	Offshore	4	34.4	33.0		29.3	42.2	12.6	12.1		10.9	15.1
11	Inshore	611	32.8	31.7	32.2	20.1	66.2	12.0	11.6	11.2	6.4	23.0
	Offshore	76	37.3	36.0	35.6	18.8	65.2	13.5	13.1	13.0	7.4	22.7
10	Inshore	104	37.7	36.2	33.5	25.4	63.0	13.7	13.1	12.3	9.6	22.0
	Offshore	97	41.5	39.3	30.4	18.6	65.5	14.9	14.2	11.3	7.4	22.8
9	Inshore	17	34.4	32.9	35.5	16.4	52.0	12.6	12.1	12.9	6.6	18.4
	Offshore	100	40.2	35.8	28.8	21.0	67.0	14.5	13.0	10.7	8.2	23.3
8	Inshore	148	33.3	31.4	30.2	21.9	65.0	12.1	11.5	9.6	8.1	22.6
	Offshore	77	40.1	38.2	25.5	17.7	67.0	14.4	13.8	9.6	7.1	23.3
7	Inshore	33	35.1	31.0	29.7	24.3	62.4	12.8	11.4	11.0	9.2	21.8
	Offshore	48	37.7	34.3	33.7	16.7	66.6	13.7	12.5	12.3	6.7	23.2

ZONE		N	SCL (cm) Mean	Median	Mode	Min	Max	BD (cm) Mean	Median	Mode	Min	Max
6	Inshore	30	33.6	31.3	30.0	23.2	52.7	12.3	11.5	11.1	8.9	18.6
	Offshore	23	36.0	32.2		20.8	66.0	13.1	11.8		8.1	23.0
5	Inshore	55	40.3	39.5	32.0	26.2	67.1	14.5	14.2	11.8	9.9	23.3
	Offshore	77	38.1	37.4	18.3	18.3	65.4	13.8	13.6	7.3	7.3	22.8
4	Inshore	67	38.9	36.6	29.1	22.0	65.0	14.0	13.3	10.8	8.5	22.6
	Offshore	83	38.5	36.1	31.0	23.4	62.6	13.9	13.1	11.4	8.9	21.8
3	Inshore	10	41.3	41.8	42.0	32.2	56.8	14.8	15.0	15.1	11.8	19.9
	Offshore	12	40.1	39.3		18.1	57.8	14.5	14.2		7.2	20.3
2	Inshore	0										
	Offshore	0										
1	Inshore	0										
	Offshore	3	36.0	24.0		22.3	61.7	13.1	9.1		8.6	21.6
24	Inshore	1	51.6	51.6		51.6	51.6	18.2	18.2		18.2	18.2
	Offshore	2	33.7	33.7		29.5	37.9	12.3	12.3		11.0	13.7
25	Inshore	0										
	Offshore	3	44.5	40.4		36.1	56.9	15.9	14.5		13.1	20.0
26	Inshore	0										
	Offshore	14	24.0	20.4		10.1	56.2	9.1	8.0		4.6	19.7
27	Inshore	1	54.0	54.0		54.0	54.0	19.0	19.0		19.0	19.0
	Offshore	10	45.0	47.5		25.6	66.3	16.1	16.9		9.7	23.1
28	Inshore	0										
	Offshore	49	38.3	37.1	28.8	11.3	63.3	13.8	13.5	10.7	5.0	22.1
29	Inshore	3	39.5	34.8		33.6	50.2	14.3	12.7		12.3	17.8
	Offshore	76	33.4	30.1	27.0	10.5	62.0	12.2	11.2	10.1	4.7	21.7
30	Inshore	17	36.6	35.5	34.3	26.4	48.2	13.3	12.9	12.5	9.9	17.1
	Offshore	127	33.2	31.2	28.4	22.2	56.7	12.2	11.5	10.6	8.6	19.9
31	Inshore	57	33.1	29.6	26.4	13.7	65.5	12.1	11.0	9.9	5.8	22.8
	Offshore	126	35.7	33.5	27.5	20.7	57.5	13.0	12.3	10.3	8.1	20.2
32	Inshore	44	32.0	30.4	25.1	19.3	55.3	11.8	11.3	9.5	7.6	19.4
	Offshore	75	34.3	31.8	25.2	19.8	64.6	12.5	11.7	9.6	7.8	22.5
33	Inshore	39	29.1	27.6	21.4	20.6	47.4	10.8	10.3	8.3	8.0	16.8
	Offshore	100	31.0	28.7	24.0	14.2	58.2	11.4	10.7	9.2	5.9	20.4
34	Inshore	103	31.2	29.9	22.7	19.9	53.4	11.5	11.1	8.7	7.8	18.8
	Offshore	85	33.7	33.0	34.0	20.3	52.4	12.3	12.1	12.4	7.9	18.5
35	Inshore	330	31.7	29.2	25.4	18.0	61.5	11.7	10.9	9.6	7.2	21.5
	Offshore	83	35.2	33.6	25.5	20.2	61.7	12.8	12.3	9.6	7.9	21.6
36	Inshore	4	37.4	37.2		33.6	41.8	13.6	13.5		12.3	15.0
	Offshore	15	34.0	32.4		21.5	52.7	12.4	11.9		8.3	18.6



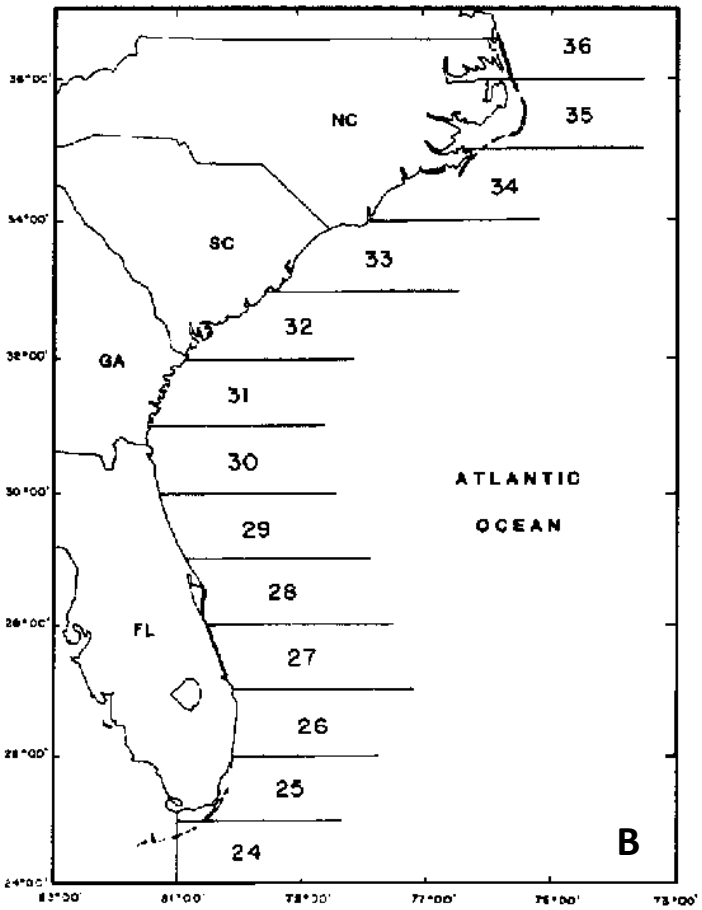


Figure B1. Statistical zones along the (A) U.S. Gulf of Mexico and (B) southeast U.S. Atlantic coasts.