UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Science Center
75 Virginia Beach Drive
Miami, Florida 33149 U.S.A.
(305) 361-4200 Fax: (305) 361-4499

September 24, 2012

MEMORANDUM TO: Roy E. Crabtree, Ph.D.
Regional Administrator, Southeast Regional Office

FROM: Bonnie Ponwith, Ph.D.
Science Director

SUBJECT: Revised SEFSC Response to Request for 2012 Skimmer Trawl Observer Data and Analysis: (1b), (2), (4), (5), (6), and Follow-Up Request Regarding the August 16, 2012 Observed Skimmer Trawl Sea Turtle Data Report

In response to SERO's request for 2012 Skimmer Trawl Observer Data and Analysis (Items 1b, 2, 4, 5, and 6) on July 23, 2012, and the August 16, 2012 request for a follow-up report on a previous Observed Skimmer Trawl Sea Turtle Data Report, please find enclosed the attached reports. Please note that the median for Method 3 in Table 5 has been corrected.

Cc:

F/SEC – Theo Brainerd, Stacy Hargrove, Larry Massey, Sophia Howard
F/SER – Miles Croom, Lauren Lugo, Heather Blough, John McGovern, Phil Steele, Karla Gore

Attachments (2)

ATTACHMENT ONE

Skimmer Trawl Observer Data and Analysis: (1b), (2), (4), (5), (6)

Tasks 1b & 2[1]. Fishing Characteristics

From May through August 2012, data from 796 tows were collected during 58 trips (119 sea days) aboard 26 unique skimmer trawl vessels. Trip, vessel, tow and environmental characteristics are summarized (Table 1). Trip length averaged 2.1 days with an average of 13.7 tows per trip. Vessel length ranged from 26 to 55 ft, with a mean of 37 ft. The majority ($\geq$ 80%) of vessels were fiberglass construction. Average tow time was 0.95 h with a range of 0.05 to 2.65. Average fishing depth was 1.6 fm. Most tows ($\geq$ 87%) occurred in seas <2 ft in wave height.

Net characteristics for observed skimmer trawl vessels are given (Table 2). Headrope length ranged from 14 to 25 ft. with an average of 17.9. Several dominant trawl characteristics included trawl body and codend material (poly), extension (none), and lazy line rigging (choke). Trawl body mesh size ranged from 1.3 to 2.1 in with a mean of 1.6 in. The majority of nets (Table 3) were not equipped with TEDs or BRDs.

Performance aspects of each tow were documented by the observer with operational codes and written comments. Observer logbook data (e.g., tow times and comments) for each tow are presented (Table 4).

Task 4. Preliminary estimates of sea turtle CPUE from the Skimmer Trawl Observer data, May through early August 2012.

The SEFSC used bootstrapping (Efron and Tibshirani, 1986) to generate preliminary estimates (Table 5) of the mean and median number of turtles captured per tow-hour per tow (catch per unit effort, CPUE) for the skimmer trawl fishery from observer data collected on vessels > 7 meters long between May and early August 2012. These estimated CPUE's were based on data that may have been biased with regard to the whole fishery because the observer program was restricted to sampling vessels > 7 meters, which represent about 79% of the sampling frame, and to fishing between May and early August 2012. Because we do not know the potential magnitude and direction of any bias if it exists, we recommend that extrapolations

---

[1] Adapted from: Pulver, J.R., E. Scott-Denton and J.A. Williams. 2012. Characterization of the U.S. Gulf of Mexico skimmer trawl fishery based on observer coverage. NOAA Technical Memorandum NMFS-SEFSC- (in prep.)

utilizing these statistics restrict the expansion factor to only the fishing effort of vessels > 7 meters, as well as those vessels operating in the same months. Other selection difficulties for this section of the fleet, such as the high rate (50%) of non-responders to the observer programs initial selection letter, may also produce unquantified biases. Despite these problems, we assumed a simple random selection of trips to generate summary statistics.

We present three different methods for determining estimates of the 95% confidence interval, and associated CV's and two methods of estimating CPUE. Within trips, tows are not independent, but are nested within trips. We maintained this nested structure within the bootstrap samples in all estimates presented in Table 5, but there are many ways to do this depending upon the assumptions one makes about the trip and/or tow level data. The three presented here are: Method 1 assumed that tows within a trip are a sample from a larger population, therefore individual tows were resampled, nested within resampled trips, and CPUE was calculated as turtle catch for each tow/tow-hours for each tow; Method 2 assumed that tows within a trip are completely known, all tows were used as the sample (not resampled from) within resampled trips, and CPUE was calculated as turtle catch for each tow/tow-hours for each tow; Method 3 was the same as Method 1 except we estimated the CPUE as the total turtles caught/total hours fished over all tows and trips. In Methods 1 and 2 bootstrapping was performed on the CPUE's, but in Method 3 bootstrapping was performed on the tow-hours and turtle catch by tow and then CPUE was calculated for each bootstrapped sample. We are not able at this time to determine which method is more appropriate, but other considerations, such as our choice of the percentile method (Efron and Tibshirani, 1986) for determining confidence intervals, which may misrepresent the interval if substantial bias exists in the data (Efron and Tibshirani, 1986), and the potential impact of other parameters such as gear characteristics, probably have a bigger impact on the uncertainty of these preliminary estimates. With the limited time we have available, the SEFSC recommends using the median derived using Method 3 because it appears to be more robust in that it may be less sensitive to the small number of turtles captured (about 3% of tows captured turtles) and the inclusion of short tows.

Task 5. Observed Sea Turtle Hot Spots

Twenty-four sea turtles and three sea birds were captured on observed trips using skimmer trawl gear (Table 6). The location of sea turtle captures and observed fishing effort (tow distribution) is depicted in Figure 1. The highest concentration of sea turtle captures occurred off southeastern Louisiana. To identify patterns in CPUE[2] for sea turtles, a local spatial statistic, the Getis-Ord Gi* (Gi*), was calculated using the Hot Spot Analysis tool in ArcGIS[3,4] to locate

[2] CPUE here does not refer to CPUE analysis in Task 4.

[3] Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

[4] ArcGIS 10.0 Computer Software. 380 New York Street, Redlands, Calif. 92373 (avail. at http://www.esri.com/software/arcgis/index.html).

clusters of features with similarly high or low values (Figure 2). A detailed description of the Hot Spot Analysis tool is given in Scott-Denton et al. (2011) and Scott-Denton et al. (2012). For the skimmer trawl fishery, the search radius was based on the maximum tow length (15 km) from tow start to tow end.

Task 6. Observer Effect

An evaluation of whether or not tow times changed due to an observer effect could not be quantified. Figure 3 depicts observed tow time in minutes and the seasonal legal maximum tow time (55 minutes)[5]. Approximately 35.3% of the tows were below the seasonal 55-minute limit based on calculated tow times.

Literature Cited

Scott-Denton, E., P. Cryer, M. Duffy, J. Gocke, M. Harrelson, D. Kinsella, J. Nance, J. Pulver, R. Smith, and J. Williams. 2012. Characterization of the U.S. Gulf of Mexico and South Atlantic penaeid and rock shrimp fisheries based on observer data. Marine Fisheries Review. In Press.

Scott-Denton, E., P. Cryer, J. Gocke, M. Harrelson, D. Kinsella, J. Pulver, R. Smith, and J. Williams. 2011. Descriptions of the U.S. Gulf of Mexico Reef Fish Bottom Longline and Vertical Line Fisheries Based on Observer Data. Marine Fisheries Review 73(2). 26 p.

---

[5] Federal Register. 1992. Sea Turtle Conservation. Vol. 57, No. 234. December 4, 1992. Rules and Regulations.

Tables and Figures

Table 1. —Trip, vessel, tow, and environmental characteristics based on mandatory observer coverage in the U.S. Gulf of Mexico skimmer trawl fishery from May through August 2012.

Trip	**Vessel**	**Tow**	**Environmental**
119 Sea days 58 trips aboard 26 vessels 796 tows	Length: Avg: 37 ft Range: 26 to 55 ft (± 8.2 s.d.).	Tow time: Avg: 0.95 hrs (± 0.38 s.d.) Range: 0.05 to 2.65 hours	Water depth: Avg: 1.6 fathoms (± 1.0 s.d.) Range: 0.5 to 6.7
Tows per trip: Avg: 13.7 (± 9.9 s.d.) Range: 4 to 48	Age: Avg: 18 yrs Range: 1 – 33 yrs		
Trip length (days): Avg: 2.1 (± 1.0 s.d.) Range: 1 to 6	Hull construction: Fiberglass: 80% Steel: 12% Fiberglass/wood: 8%	Vessel speed: Avg: 1.97 knots (± 0.54 s.d.) Range: 0.1 to 3.4 knots	Sea state: 0 to 2 foot seas: 87% 3 to 5 foot seas: 11% 6 to 8 foot seas: 2%
Trips per vessel: Avg: 2.2 (± 1.1 s.d.) Range: 1 to 4	Type: Ice boat: 96% Freezer: 4%		
Crew size: 0 to 3 individuals (excluding captain)	Engine horsepower: Avg: 376 hp (± 138 s.d.) Range: 200 to 700 hp		

Table 2.—Net characteristics based on mandatory observer coverage of the U.S. Gulf of Mexico skimmer trawl fishery from May through August 2012.

Item		n = 188 nets
Main net headrope length (ft)		
Mean		17.9
Range		14.0 - 25.0
s.d.		3.6
Main net footrope length (ft)		
Mean		28.2
Range		23.0 - 35.0
s.d.		2.9
Trawl body (%)	Poly	80
	Spectra	9
	Sapphire	7
	Nylon	5
Trawl body mesh size (in)		
Mean		1.6
Range		1.3 - 2.1
s.d.		0.2
Cod end (%)	Poly	54
	Nylon	40
	Sapphire	4
	Spectra	2
Cod end mesh size (in)		
Mean		1.4
Range		1.3 - 1.8
s.d.		0.2
Trawl extension type (%)	None	53
	Poly	28
	Nylon	12
	Sapphire	7
Lazy line rigging (%)	Choke	70
	Elephant ears	31
Tickler chain length (ft)		
Mean		28.9
Range		23.5 - 40.0
s.d.		4.4

Table 3.—Bycatch reduction device (BRD) and turtle excluder device (TED) characteristics based on mandatory observer coverage of the U.S. Gulf of Mexico skimmer trawl fishery from May through August 2012.

Item		
BRD type (%)	None	57
	Fisheye	43
BRD fisheye position (%)	None	57
	Top	36
	Offset	8
BRD escape shape (%)	None	57
	Cat eye	21
	Half moon	14
	Oval	9
TED type (%)	None	95
	Hard	5

Table 5 —Mean sea turtle catch rates, median, 95% confidence intervals, and CV's for skimmer trawl vessels > 7 meters sampled May thru early August 2012, by methodology. Sea turtle catch rates are in units of turtles per tow-hour.

Method	Mean	Median	95 % confidence interval	%CV
1. CPUE's by tow resampled, nested within resampled trips	0.0304	0.0295	0.0112 - 0.0542	36.4
2. CPUE's by tow not resampled, nested within resampled trips	0.0304	0.0300	0.0141 - 0.0489	29.4
3. Tow-hours and turtle catch by tow resampled, nested within resampled trips.	0.0318	0.0313	0.0161 – 0.0502	27.4

Effron B. and R. Tibshirani. 1986. Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy. Statistical Science 1:54-77.

Table 6. —Protected species interactions for all tows based on mandatory observer coverage of the U.S. Gulf of Mexico skimmer trawl fishery from May through August 2012.

Species	**Number**
Sea turtles	24
Sea birds (Laughing gull)	3

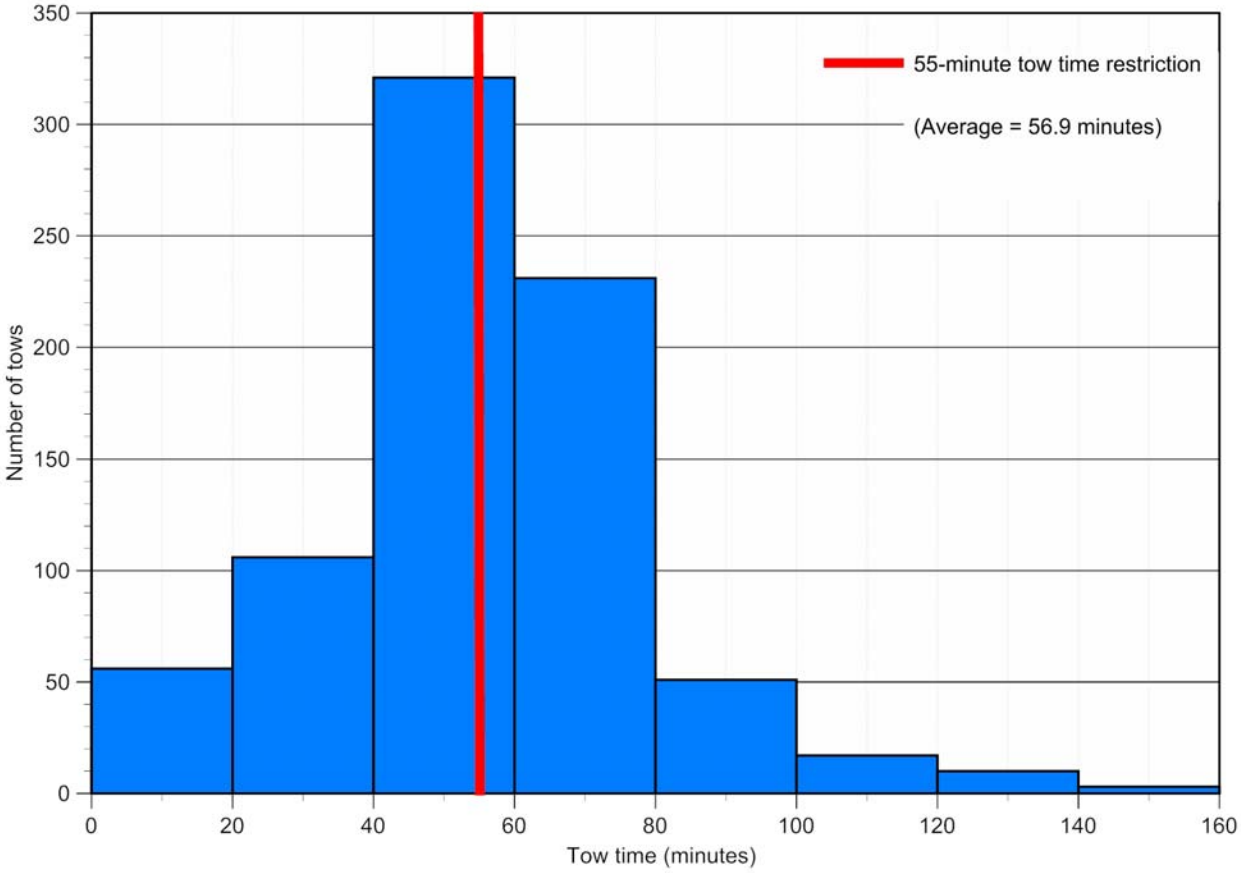

Figure 3. —Skimmer tow times relative to seasonal tow time restriction based on mandatory observer coverage of the U.S. Gulf of Mexico skimmer trawl fishery from May through August 2012.

ATTACHMENT TWO

Follow-Up Request Regarding the August 16, 2012 Observed Skimmer Trawl Sea Turtle Data Report

I. Turtle sizes and a comparison with turtle excluder device (TED) bar spacing and escape openings

In response to the SEFSC's August 16th memo that provided data on small sea turtles observed in the skimmer trawl fishery, SERO requested (1) available data on average bar spacing of TEDs and (2) data obtained via TED testing and experimental work that would improve our understanding of what percentage of the captured sea turtles would be expected to pass through the grid.

(1) To respond to the first portion of this request, the Harvesting Systems Unit conducted an informal TED survey of vessels along the NC, SC, GA, AL, and MS coasts. Ports surveyed included Bayou LaBatre AL, Fowl River AL, Pascagoula MS, Ocean Springs MS, Biloxi MS, Pass Christian MS, Waveland MS, Savannah GA, Brunswick GA, McClellanville SC, Beaufort SC, and Sneads Ferry NC. The survey was conducted September 10-14 and consisted of opportunistically inspecting TEDs during dockside visits and OLE vessel boardings. For each TED inspected, three bar spacings were measured with digital calipers to the nearest 0.01 inches, and all TEDs were inspected aboard each vessel. Three different TED types were inspected at one TED manufacturer and 37 vessels were inspected during the survey resulting in 79 TED inspections. Thirteen of the vessels inspected primarily fished offshore, 12 vessels exclusively fished inshore, and area fished was unknown for the remaining 12 vessels.

The overall average bar spacing for all TEDs inspected was 3.44" (8.74 cm) and ranged from 1.58" (4.01 cm) to 4.45" (11.30 cm) for undamaged TEDs (Table 1). Bar spacing as large as 4.625" (11.75 cm) was measured on TEDs with bent deflector bars. Mean bar spacing for undamaged Gulf Coast TEDs was 3.78" (9.60 cm) and ranged from 2.42" (6.15 cm) to 4.45" (11.30 cm), while East Coast TEDs averaged 2.87" (7.29 cm) and ranged from 1.58" (4.01 cm) to 4.09" (10.39 cm).

Vendors that manufacturer TEDs typically construct grids with bar spacing narrower than 4” to allow for bars to bend without violating regulations. To achieve this, deflector bars are welded into the frame on 4” centers, which varies bar spacing depending on the thickness of the deflector bar materials.

The data provided is cursory and a more comprehensive survey of vessels would yield more accurate results. The time provided for collection of this information did not allow for a statistically defensible survey design. In particular, if information regarding inshore fisheries where skimmer trawls might be used is required, then we would need to design and execute a survey specific to inshore waters.

Table 1. Results of shrimp trawl TED bar spacing survey conducted September 10-14, 2012 along Gulf Coast and East Coast ports.

			TED Bar Spacing		
TED Group	**N**	**Units**	**Min**	**Mean**	**Max**
All TEDS	79	*inches*	1.58	3.44	4.45
		cm	4.01	8.74	11.30
Gulf Coast TEDs	49	*inches*	2.42	3.78	4.45
		cm	6.15	9.60	11.30
East Coast TEDs	30	*inches*	1.58	2.87	4.09
		cm	4.01	7.29	10.39

(2) The second portion of SERO’s request asked for data obtained via TED testing and experimental work that would improve our understanding of what percentage of the captured sea turtles would be expected to pass through the grid. Presumably “the grid” referred to the maximum allowed bar spacing of 4” (10.16cm). The two year old loggerhead turtles used in TED testing are typically grown to a size large enough to prevent them from passing through 4” (10.16 cm) bar spacing. Therefore in an attempt to address this issue, a subset of TED testing data is provided here for TEDs tested with bar spacing larger than 4” (10.16 cm).

Seven tests were examined with TED bar spacing ranging from 4.72” (12 cm) to 6” (15.24 cm) (Table 2). Only one TED was exposed to a set of turtles in which all were small enough to pass through the deflector bars. The Costa Rican TED with 6” (15.24 cm) bar spacing was exposed to eight turtles with body depths (BD) ranging from 5.35” (13.6 cm) to 5.71” (14.5 cm). The exclusion rate for these turtles was 50%. All other tests listed were exposed to small percentages of turtles small enough to pass through the deflector bars. In 2004, the Flexible Flynet TED, which had 5.75” (14.61 cm) bar spacing, was tested in both top and bottom opening orientations. The TED also had horizontal bars throughout the grid spaced at 11” (27.94 cm) intervals. During bottom opening testing, all turtles had BDs larger than the bar spacing. During top opening testing for this TED, one turtle, which escaped, had a BD less than the bar spacing. In

2006, a modification of the Flexible Flynet TED was tested with the same 5.75” (14.61 cm) bar spacing. The TED was again tested in both top and bottom opening configurations. During top opening testing the TED was only exposed to one turtle with a BD less than the bar spacing and that turtle escaped. During bottom opening testing, the TED was exposed to one turtle small enough to pass through the grid. That turtle along with another that had a BD larger than the bar spacing passed through the grid. The reason for turtles with a larger BD than the bar spacing passing through the grid may be that the turtles compress at depth during the test and BD is smaller than measured. In 2008, the NEFSC provided a modified flounder TED with 5” (12.7 cm) bar spacing for testing. This TED was exposed to turtles with BDs that were either equal to or greater than the bar spacing. Two turtles with BDs greater than the bar spacing passed through the grid while two that had BDs equal to the bar spacing were excluded. In 2011, the Australian government provided a TED with 4.72” (12 cm) bar spacing for testing. Turtles exposed to this grid all had BDs greater than the bar spacing with one passing through the deflector bars.

Notably, some turtles that had BD measures larger than the bar spacing passed through deflector bars indicating inconsistency among these measurements. Factors that may affect the collection of minimum BD measurements for turtles are the amount of air remaining in the turtle’s lungs during measurement and compression at depth during testing. To accurately answer this portion of the request, small turtle testing should be conducted with turtles with BD measurements less than 4” (10.16 cm) exposed to grids with 4” (10.16 cm) bar spacing.

Table 2. Small turtle TED testing results and sea turtle sizes for TEDs with deflector bar spacing greater than 4” (10.16 cm).

Year	TED	Orientation Top/Bottom	Bar Spacing	Turtle Esc/Cap	SCL (cm) Mean	SCL (cm) Range	BD (cm) Mean	BD (cm) Range	Comments
2000	Costa Rican TED	Bottom	6" (15.24 cm)	4E/4C	33.50	33.0 - 35.2	13.84	13.6 - 14.5	All turtles captured passed through grid. All turtles BD < bar spacing
2004	Flexible Flynet TED	Bottom	5.75" (14.61 cm)	4E/3C	38.89	38.0 - 40.4	16.37	15.4 - 17.2	None thru the grid. All turtles BD > bar spacing
2004	Flexible Flynet TED	Top	5.75" (14.61 cm)	22E/1C	38.41	36.0 - 40.8	16.11	14.6 - 17.3	None thru the grid. One turtle BD < bar spacing escaped
2006	Flexible Flynet TED	Top	5.75" (14.61 cm)	24E/1C	36.48	35.2 - 37.9	15.48	14.4 - 16.5	None thru the grid. Two turtles BD < bar spacing escaped
2006	Flexible Flynet TED	Bottom	5.75" (14.61 cm)	13E/4C	38.37	35.2 - 44.4	16.15	14.0 - 19.0	Two turtles thru grid BD=14.0, 15.8 cm. One turtle < bar spacing
2008	NE Flounder TED	Top	5" (12.7 cm)	12E/2C	32.50	30.9 - 34.9	13.80	12.7 - 15.0	All captures thru grid BD=13.6, 14.5 cm. Two turtles = bar spacing escaped
2011	Australian TED	Bottom	4.45" (12 cm)	23E/2C	35.35	34.0 - 37.0	14.78	14.0 - 15.5	One turtle passed thru the grid. BD=14.0 cm.

(3) Although observer data were not specifically requested, we queried observer data from the otter trawl shrimp fishery to provide additional data regarding the specifics of how turtles captured in TED equipped otter trawls interacted with the TED. The data reveal that turtles where the interaction with the TED was documented (n=42) primarily went through the grid (n=27) or were caught before the TED (n=10). Others slid out the mouth of the net, escaped through the TED, or got caught in the headrope. Size data for the turtles that were measured indicate that all Kemp's ridleys that went through the grid were < 25.7 cm SCL as predicted (n=17, range 18.5-25.2 cm SCL) except one that was measured at 28.0 cm SCL. Three small green turtles (range 19.3 – 24.1 cm SCL) and 1 hawksbill (22.6 cm SCL) that went through the grid were observed as well. However, the total number of turtles interacting with the TEDs is unknown. Therefore, this information does not address the percentage of turtles entering the net that were captured, or those that were small enough to pass through the bars of the TED but instead successfully escaped capture.

II. Release condition and expected fate

SERO requested that we provide advice on the best available scientific information to use for estimating sea turtle mortality for the entire skimmer trawl fishery. Specifically, it was requested whether estimates should be based on: (1) extrapolation of the expected fate data from our previous report to the entire fleet, (2) the Epperly and Sasso (2006) logistic regression of tow time and mortality and average fleet tow time data, or (3) some combination of the two. We recommend that the most appropriate method is to base estimates on Option (1), an extrapolation of the expected fate data from the previous report to the entire fleet. Options (2) and (3) are not appropriate to use because observed release conditions are known for all turtles.

It was also requested that we provide advice on how the three sea turtles whose fate was unknown should be treated. The immediate fate (final disposition) for all turtles is known, as all were released alive. Because ultimate fate depends on multiple factors, any further determination on the animal's fate beyond the observed final disposition (released alive) would be speculative. Although we know the tow times and the time the turtles remained on deck for recovery, the amount of time that the turtles remained submerged in the net and each individual's physiological response to the submergence was not known. We do not have enough information regarding the two turtles discarded immediately by the crew or the one that escaped to predict their fate any differently than the other takes. Ryder et al. (2006) suggests that turtles which were not resuscitated and released alive may realize a 1% post-release mortality rate if not hooked and released with all gear removed. The National Research Council (1990) recommended including both dead and comatose turtles in mortality estimates (100% of comatose, resuscitated turtles can be considered dead) because the practice of the fishers in the absence of observers is unknown and because the ultimate fate of resuscitated turtles was unknown; we support this recommendation as the most conservative approach. A less conservative option would be to use the 60% mortality hypothesis from Ryder et al. (2006) for resuscitated hardshells released with no longline gear remaining.

III. Addendum to Table 2 of SEFSC Contribution PRBD-2012-05 (Epperly and Stokes 2012)

A loggerhead (74.3 cm SCLstd, 75.9 cm CCL, 58.2 cm SCW, 64.1 cm CCW) was observed captured in a skimmer trawl in 4 feet of water during research in North Carolina. There was no TED in the net, and the turtle was captured alive, uninjured and released alive. The tow time was 9 minutes, and the turtle remained onboard for 20 minutes.