FIELD AND DATA REPORT

EVALUATION OF A TOPLESS BOTTOM TRAWL DESIGN WITH REGARD TO EXCLUDING SEA TURTLES

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ABSTRACT

Previous work attempting to mitigate sea turtle interactions with a bottom trawl equipped with a turtle excluder device in the summer flounder fishery resulted in a significant loss of target species. A subsequent evaluation of a topless trawl in this fishery resulted in catch rates of target species equivalent to a traditional trawl, but the topless trawl needed to be evaluated in terms of its ability to exclude or not capture sea turtles. The purpose of this report is to present the methodology used and the data collected in the evaluation of the ability of several alternative topless trawl designs to exclude or not capture sea turtles, as compared to a traditional trawl design. Intentionally, no attempt has been made to analyze or interpret the data. A total of 177 comparative tows were accomplished off the Georgia coast in October and November 2011 using the FV Karen Elizabeth, a Rhode Island based twin-trawl vessel. Four topless trawl designs were evaluated. In a topless trawl the headrope follows the footrope, as compared to a traditional trawl design where the headrope leads the footrope. The topless trawl designs only varied in the length of their headropes (108', 133', 147' and 160') and all were compared to an identical net with a 65' headrope using a twin trawl rig. The sea turtle catch ratio data for the four designs (topless: traditional) were 4:6, 2:2, 2:7, 1:25, respectively. The results of the fieldwork indicate that the 160-foot headrope topless trawl experienced the greatest success in excluding or not capturing sea turtles as compared to the traditional trawl. Additionally, the mean catches of finfish and horseshoe crabs compared reasonably well across all four designs considering the small sample size.

INTRODUCTION

Previous work attempting to mitigate sea turtle interactions with a bottom trawl equipped with a turtle excluder device (TED) in the summer flounder fishery resulted in a significant loss of target species (Lawson, DeAlteris and Parkins, 2007). As an alternative to a TED in the trawl, a topless trawl design was proposed in an effort to mitigate sea turtle interaction with the trawl net. In essence, the theory is that if the topless trawl is successful, sea turtles will not be captured in the trawl. From a trawl design perspective, the issue is providing sufficient setback of the headrope so that a sea turtle, once alarmed or stimulated by the sweep of the trawl, has sufficient time to swim upward and escape the trawl before the headrope passes overhead. By increasing the length of the headrope for a given footrope length, the time between passage of the footrope and passage of the headrope is increased, allowing more time for a sea turtle to escape.

In the summer of 2010, an evaluation of the catch performance of a topless trawl design was conducted in the summer flounder trawl fishery (DeAlteris and Parkins, 2010). The topless trawl design investigated in that study had a 106-foot headrope and an 80-foot footrope. That topless trawl design was compared to a trawl net with an identical fishing circle, but of traditional design with a 65-foot headrope and an 80-foot footrope. Both trawls had identical sweeps made of small rubber and lead discs (cookies). Based on the results of 80 comparative tows (40 pairs), it was determined that there was no statistical difference between the catch rates of bottom fishes of the traditional trawl and the topless trawl with a 106 foot footrope. The results of that study prompted a call from the fishing industry to further investigate the ability of the topless trawl to exclude or allow for the escape of sea turtles (DeAlteris 2011). The National Marine Fisheries Service procedure to evaluate the success of a new sea turtle release technology in trawl nets involves the release of small farm-raised sea turtles in the mouth of a trawl net by divers, then the recapture of the same turtles as they passed through a TED opening in the back end of the trawl (NMFS 1990). Unfortunately, this procedure was not possible to implement for the topless trawl design, as the principle of the topless trawl is that sea turtles that encounter the trawl on the seabed will have the opportunity to escape upward before the headrope of the trawl captures them. Releasing turtles under the headrope directly into the mouth of the trawl clearly would not test the effectiveness of this net design.

The field testing procedure that was adopted for this study followed a design that was previously used by NMFS, and is referred to as a “wild turtle test” (NMFS 1987). This procedure required towing both the standard or control trawl and the experimental or topless trawl simultaneously, for the purpose of comparing the sea turtle catch rates between the control and experimental trawls in nearly identical time and space. In the past, this procedure was conducted aboard traditional shrimp trawlers that regularly tow two shrimp trawl nets simultaneously in the coastal waters of the Georgia and Florida coasts, where at certain times of the year there is a high likelihood of sea turtle encounters with trawl nets. Unlike shrimp trawl where the trawl doors are connected directly to the wing end, the traditional flounder trawls require wire bridles or legs and ground wires between the trawl wing ends and the trawl doors as these are used to increase the

herding of flatfish. Therefore, it was not possible to use a shrimp trawler, so a Rhode Island based twin-trawl vessel, the FV Karen Elizabeth was chartered to conduct this project. She is uniquely rigged with three tow wires and winches, so as to be able to tow two traditional trawls with legs and ground gear, simultaneously. In fact, this vessel has been used by the NMFS NEFSC to compare the catch performance of the new NEFSC bottom survey trawl with two different sweep designs, towing both sweeps simultaneously (Henry Milliken, NMFS, pers. comm.).

From a theoretical perspective, the headrope and the sweep of the trawl can be assumed to form a catenary or parabola, as a trawl net can be considered a system of flexible lines (Fridman, 1986). Based on the geometry of the net design, the distance between the footrope and the headrope in the center of the trawl can be calculated and the therefore the time between the passage of the headrope and the footrope estimated. When the terminal angle of a line in the catenary or parabolic form is 15^{o}, then the ratio of the chord length to the length of the line is 0.50, and the ratio of length of the line to the sag (the distance between the chord and the most depressed portion of the line) is 0.40. As an example, if the length line is 80 feet, then the chord length is 40 feet and the sag is 32 feet. Applying this to a traditional bottom trawl the theoretical wing spread of a trawl with an 80-foot footrope is estimated to be 40 feet, and the sag is 32 feet. For the topless trawl that was evaluated for fish catch performance, the extended headrope length was 108 feet, and assuming a wing spread of 40 feet, then the sag was 47 feet, and therefore the distance between the footrope and the headrope in the center of the trawl was about 15 feet. Assuming the net is being towed at 3 kts or 4.5 ft/sec, then the time delay between passage the footrope and the headrope is 3.3 sec. This estimated time delay represents the maximum amount of time that a turtle would have to swim upward and escape the net after encountering the footrope. As the headrope is lengthened and the sag in the line extended farther back, sea turtle escapement time increases. For example, at headrope lengths of 133 and 160 feet, the distances between the footrope and the headrope in the center of the trawl are estimated at 26.5 and 48.5 feet, and the escapement times at a towing speed of 3 kts, are estimated to be 5.9 and 10.8 sec, respectively. The differences in escapement times the guiding principle for this study, as there was concern that the 108-foot headrope may not allow sufficient time for a sea turtle to escape, but a 160-foot headrope would allow more than a three-fold increase in escapement time, 3.3 versus 10.8 sec.

METHODS

Trawl designs

While the primary goal of this project was to evaluate the ability of the topless trawl design with a 108-foot headrope to exclude sea turtles, we also planned to have additional topless trawl designs to evaluate if the 108-foot headrope design did not effectively exclude or allow for the escape of sea turtles. The traditional trawl and all the topless trawl designs evaluated were developed by a group of academics (DeAlteris and Parkins), trawl designers (Mary O'Rourke of

Trawlworks, and Jon Knight of Superior Trawl), fishermen (Capt Jim Ruhle), and NMFS personnel (Henry Milliken and Eric Matzen). The trawls were built by Trawlworks, but serviced in the field by Jon Knight of Superior Trawl. All the trawls had 320 x 6 inch fishing circles, and had an 80 foot footrope. The experimental topless designs included headrope lengths of 108, 133, 147 and 160 feet. Figures 1, 2, 3 and 4 illustrate the designs of the control, 108, 133 and 160 -foot topless trawl design trawls, respectively. The traditional and topless trawls were rigged with sweeps on travelers made of small rubber discs (cookies) with interspersed lead discs (cookies). Both the traditional and topless trawls were rigged with 16 8-inch plastic floats. The chartered fishing vessel traveled to Georgia with a single control trawl, and two experimental topless trawls built with 108-foot headropes. The vessel also carried pre-made upper trawl sections complete with headropes installed for the 133 and 160-foot headrope designs, and a small netting insert for the 147-foot headrope design.

Field work

The vessel and scientific crew included Capt. Chris Roebuck and his deck crew, and Chris Parkins (DeAlteris Associates Inc), Jon Knight (Superior Trawl) and Eric Matzen (NMFS). The nets and other gear were loaded and tested in local RI waters on 21 October 2011, and that evening the vessel departed for Georgia where the sea turtles were anticipated to be found. Fieldwork commenced off Brunswick, Georgia on 26 October. The field plan included two alternative strategies; the first involved continuous towing using camera equipped TEDs in both the control and experimental trawls with open codends. In principle, we would be able to observe in the video and record all sea turtle encounters in both gears. Unfortunately, poor water clarity made this method impractical. The alternative strategy was to remove the TEDs and close the codends. All tows were then standardized to a 30-minute duration to reduce the probability of drowning a sea turtle. Based on the preliminary fieldwork conducted on in Rhode Island it was decided to make all the tows with trawl nets equipped with 60-foot (10 fathom) legs or bridles, 30-foot (5 fathoms) ground wire, and 18-foot (3 fathoms) backstraps on the doors. Based on a specified ground gear and bridle angle of attack of 15^{o}, and a combined bridle, ground wire and door backstrap length of 108 feet (18 fathoms), and a specified trawl wing spread of 40 feet, the target door spread was 105 feet. Observed door spread was controlled by limiting the tow wire length to the extent possible.

On each tow, the start and end time and location as determined by GPS were noted. Door spread was monitored constantly during the tow using an acoustic trawl monitoring system. When the nets were hauled and the codends emptied, if sea turtles were present, they were measured and tagged. In addition, for hauls in the second half of the study, the catches of species other than sea turtles in the closed codends of the standard and experimental trawls were sorted and enumerated to provide some comparative data on the finfish catch efficiency of trawls.

RESULTS

A total of 177 tows of the traditional and topless trawls were completed in the ocean off Brunswick, Georgia during the period 26 October to 6 November 2011 (Figure 1 and Appendix Table 1). Tows were conducted during both day and night, and were only stopped during heavy weather conditions. Sea turtle catch data are summarized in Table 1 and individual tow data are provided in Appendix Table 2. The sea turtle catch included both loggerhead and Kemps ridley sea turtles. Detailed data on the measurements and tagging of the sea turtles in presented in Appendix Table 3. Figures 5 and 6 show the locations of all tows and when turtles were encountered, respectively. Table 3 summarizes the trawl performance data, in terms of door spread, Table 4 summarizes the catch of species other than sea turtle for tows 93 to 177, and the detailed tow by tow catch data are presented in Appendix Table 4. An electronic EXCEL file accompanies this report that provides all the raw data files and the tables included in the report.

The first 32 tows were devoted to evaluating the sea turtle catch performance of the 108-foot headrope trawl as compared to the traditional trawl with a 65-foot headrope. On tows 1-8 and 15-16 the codend was open, and the trawls were rigged with camera equipped TEDs. Unfortunately due to poor water clarity conditions, it was difficult to observe the passage of sea turtles through the TED opening, if they occurred, so the study design was shifted to the alternate plan of conducting 30 minute tows with a closed codend. Tows 10-14 and 17 to 32 had closed codends (as well as all the remaining tows of the study). A total of 4 sea turtles were captured in the topless trawl with the 108 foot headrope, compared to 6 sea turtles captured in the traditional trawl. The door spreads of the topless and traditional or control trawls were 101 and 102 feet respectively. With the sea turtle catch in the 108-foot headrope topless trawl so high relative to the traditional trawl, it was decided to proceed with the evaluation of the 160-foot headrope trawl.

Tows 33 to 92 were made with closed codends and compared the sea turtle catch performance of the 160-foot headrope topless trawl to the traditional trawl. A total of 9 sea turtles were captured in the traditional trawl as compared to 0 sea turtles in the 160-foot headrope topless trawl. The door spreads of the topless and traditional trawls were 108 and 100 feet, respectively. With the sea turtle catch of the 160-foot headrope trawl at 0, as compared to the sea turtle catch of the traditional trawl at 9, it was decided to next evaluate the performance of the 133-foot headrope trawl.

Tows 93 to 119 were made with closed codends and compared the sea turtle catch performance of the 133-foot headrope topless trawl to the traditional trawl. A total of 2 sea turtles were captured in the traditional trawl as compared to 2 sea turtles in the 133-headrope topless trawl. The door spreads of the topless and traditional trawls were 92 and 89 feet, respectively. The mean catch per tow (# of animals) of other than sea turtles in the traditional trawl was 18.3 skates and rays, 2.0 flounder species, and 32.5 crabs, as compared to the 133-foot headrope topless trawl catch of 16.3 skates and rays, 2.0 flounder species, and 35.4 crabs. With the sea turtle catch

of the 133-foot headrope trawl at 2, as compared to the sea turtle catch of the traditional trawl at 2, it was decided to return to the evaluation of the performance of the 160 foot headrope trawl.

Tows 120 to 155 augmented data collection of the 160-foot headrope topless trawl comparison. All tows were completed with closed codends. The traditional trawl captured 16 sea turtles as compared to 1 sea turtle in the 160-headrope topless trawl. It is worth noting that the turtle caught in the 160-foot headrope topless trawl was entangled in the mesh forward of the extension, and did not pass into the codend of the net; this type of entanglement would not have been prevented with a TED. The door spreads of the topless and traditional trawls were 105 and 100 feet, respectively. The mean catch per tow (# of animals) of other than sea turtles in the traditional trawl was 9.5 skates and rays, 1.2 flounder species, and 20.1 crabs, as compared to the 160-foot headrope topless trawl catch of 8.4 skates and rays, 1.2 flounder species, and 17.1 crabs. With the total sea turtle catch of the 160 foot headrope trawl at 1 (tows 33 to 92 and 120 to 155), as compared to the sea turtle catch of the traditional trawl at 25 (tows 33 to 92 and 120 to 155), it was decided to evaluate of the performance of the 147-foot headrope topless trawl.

The 147-foot headrope trawl was constructed by inserting a small netting panel and associated headrope in the 160-foot headrope topless trawl. Tows 156 to 177 were made with closed codends and compared the sea turtle catch performance of the 147-foot headrope topless trawl to the traditional trawl. Seven sea turtles were captured in the traditional trawl as compared to two sea turtles in the 147-headrope topless trawl. The door spreads of the topless and traditional trawls were 103 and 98 feet, respectively. The mean catch per tow 9# of animals) of species other than sea turtles in the traditional trawl was 5.2 skates and rays, 1.7 flounder species, and 13.8 crabs, as compared to the 147-foot headrope topless trawl catch of 3.3 skates and rays, 21.6 flounder species, and 17.4 crabs. The fieldwork was concluded after the 177th tow.

DISCUSSION

The participants of the 2012 trawl workshop suggested that NMFS look at the feasibility of using a topless trawl to reduce sea turtle takes in the trawl fishery (DeAlteris 2010). This suggestion led to a collaboration of academics, industry fishermen and net builders, and NMFS staff who worked together to develop the topless trawl design and sampling protocols that made this project a success. The purpose of this report is to present the methodology used and the data collected in the evaluation of the ability of several topless trawl designs to exclude or not capture sea turtles, as compared to a traditional trawl design. No attempt has been made to analyze or interpret the data. However, it appears clear that the 160-foot headrope trawl was successful at excluding or not capturing sea turtles, but still captured finfish, skates and rays and crabs at reasonable rates. This latter issue must next be evaluated in the fishery to consider the topless trawl project a complete success, which is maintaining reasonable levels of catch performance for the target species, summer flounder, while successfully excluding sea turtles.

ACKNOWLEDGMENTS

As noted previously this project would not have been possible without the cooperation and participation of many individuals: Henry Milliken, Heather Haas and Eric Matzen of the NMFS Northeast Fisheries Science Center, Captains Jim Ruhle and Chris Roebuck, Jon Knight of Superior Trawl and Mary O'Rourke of Trawlworks, Lindsey Parker of the University of Georgia, and Dominy Hataway and Dan Foster of NMFS Southeast Fisheries Science Center.

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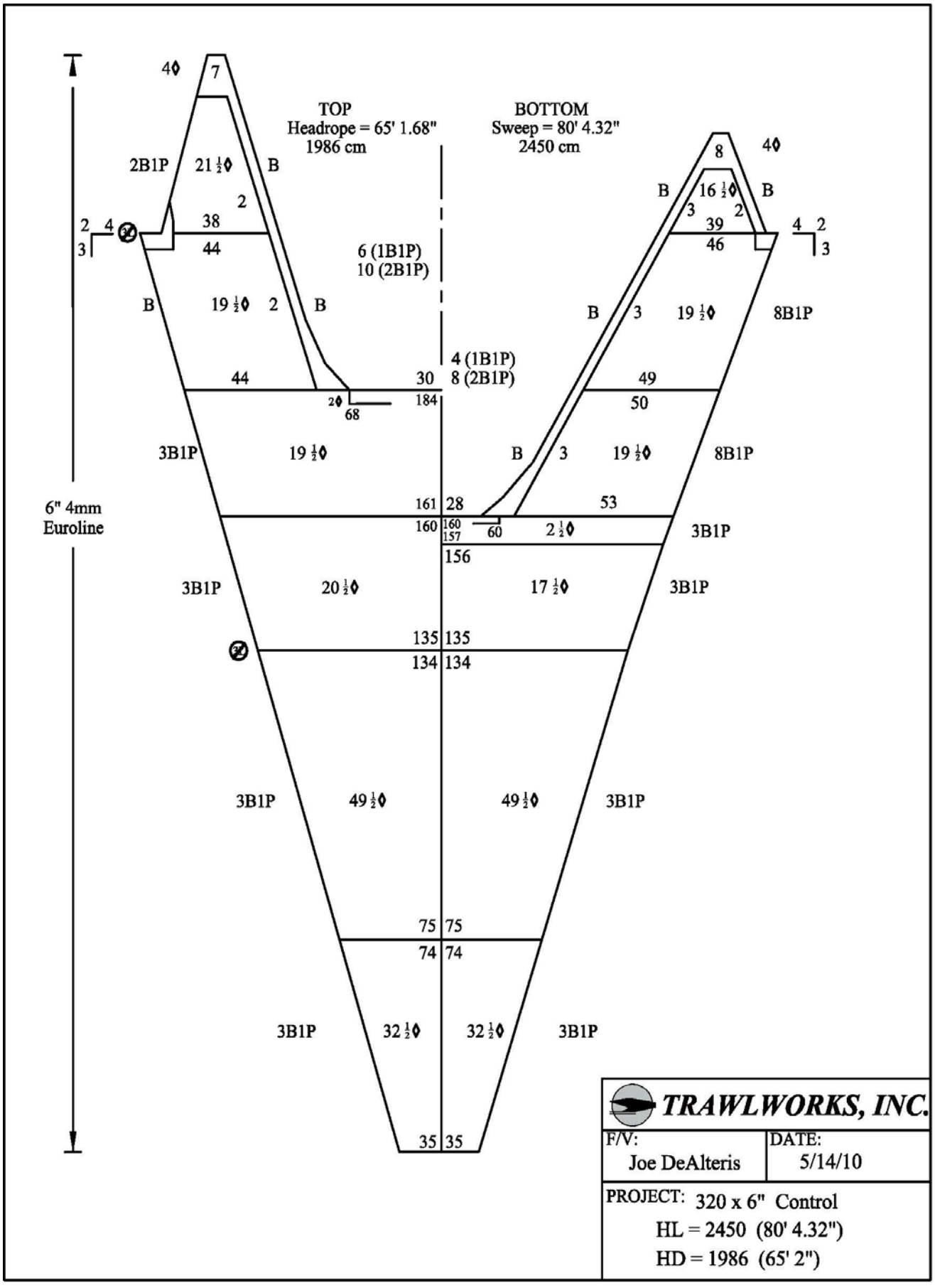

Figure 1. Schematic of 360x6” control or traditional trawl with a 65-foot headrope used in this study.

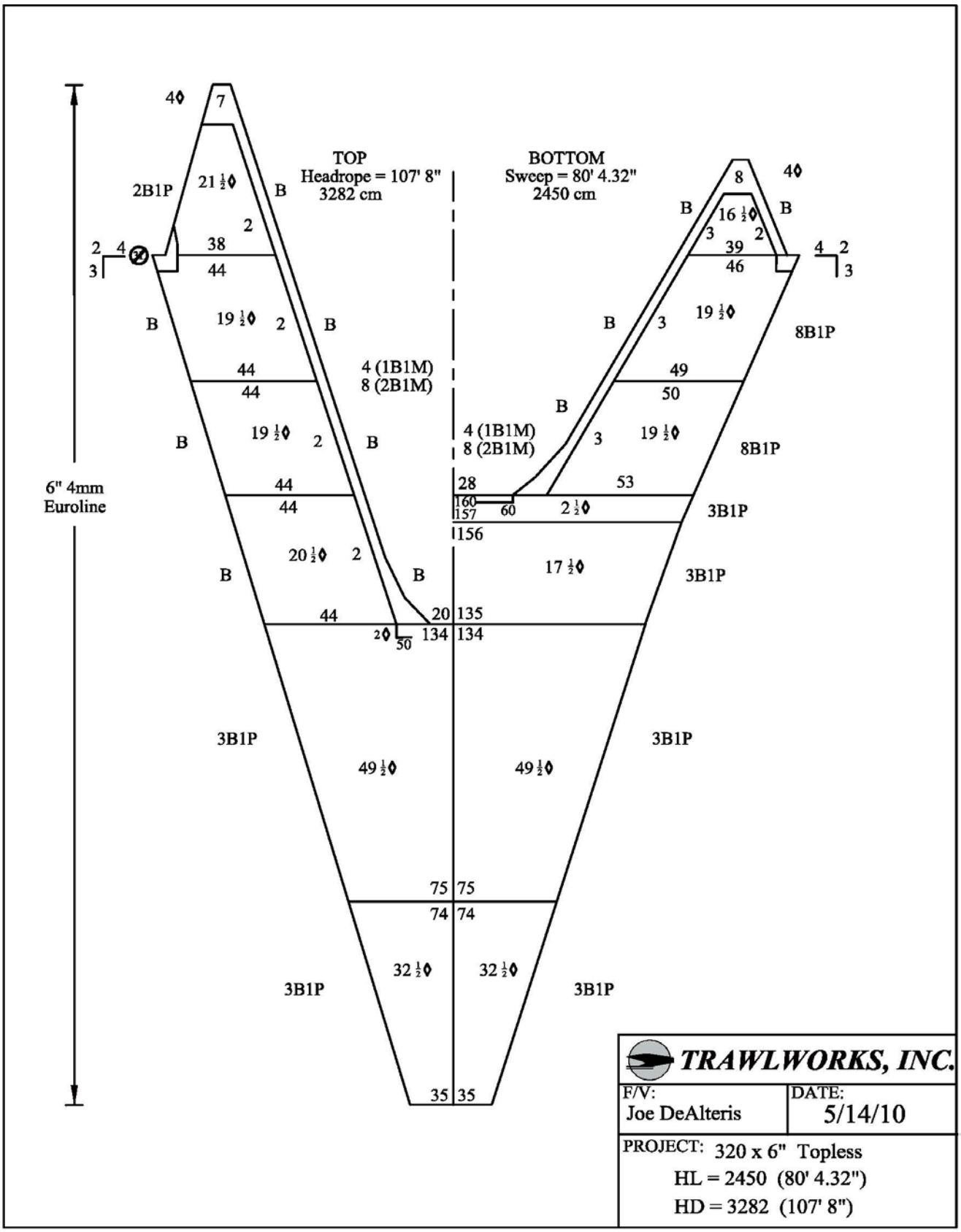

Figure 2. Schematic of 320 x 6” original topless trawl with 108-foot headrope used in this study.

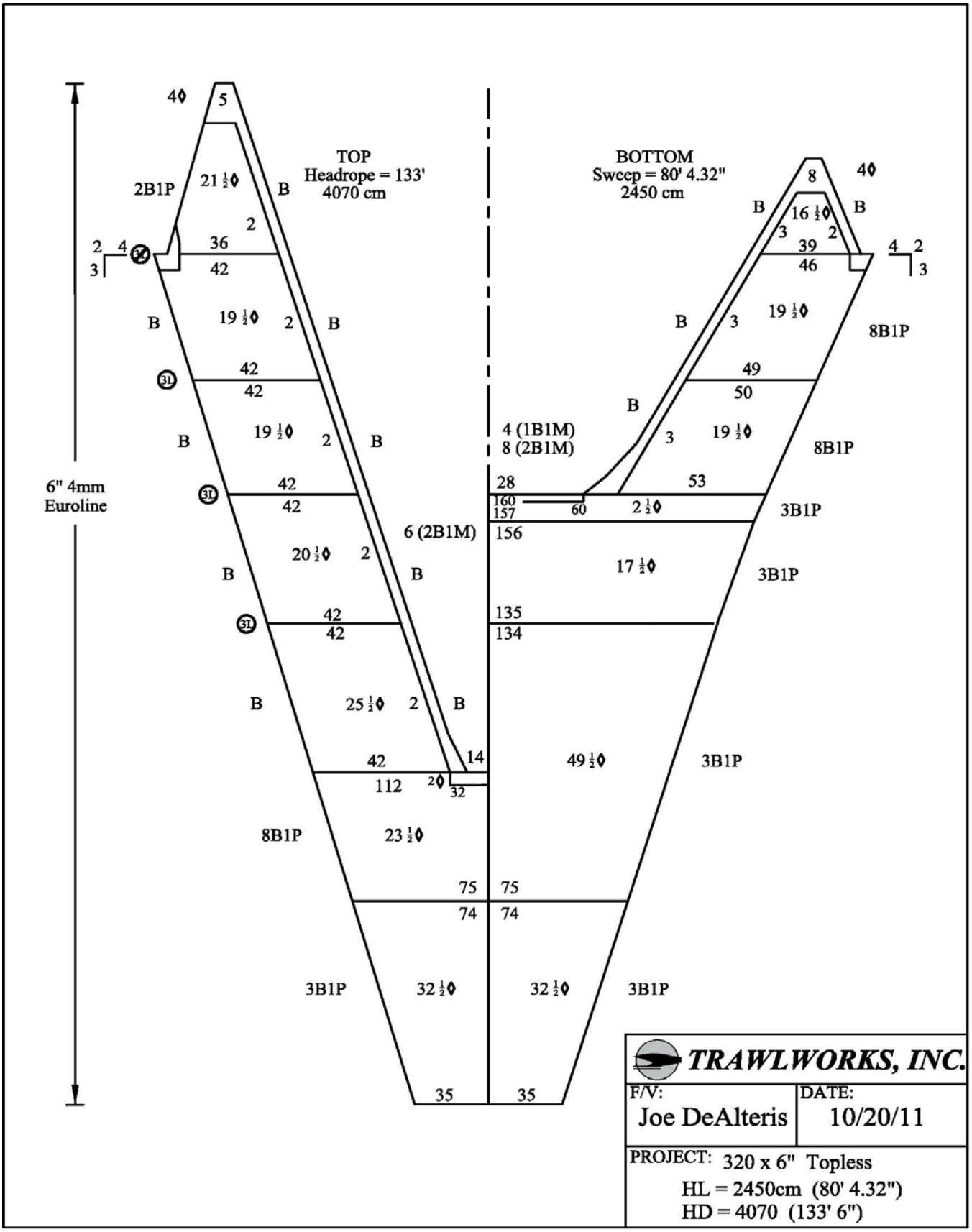

Figure 3. Schematic of 320 x 6 inch topless trawl with 133-foot headrope used in this study.

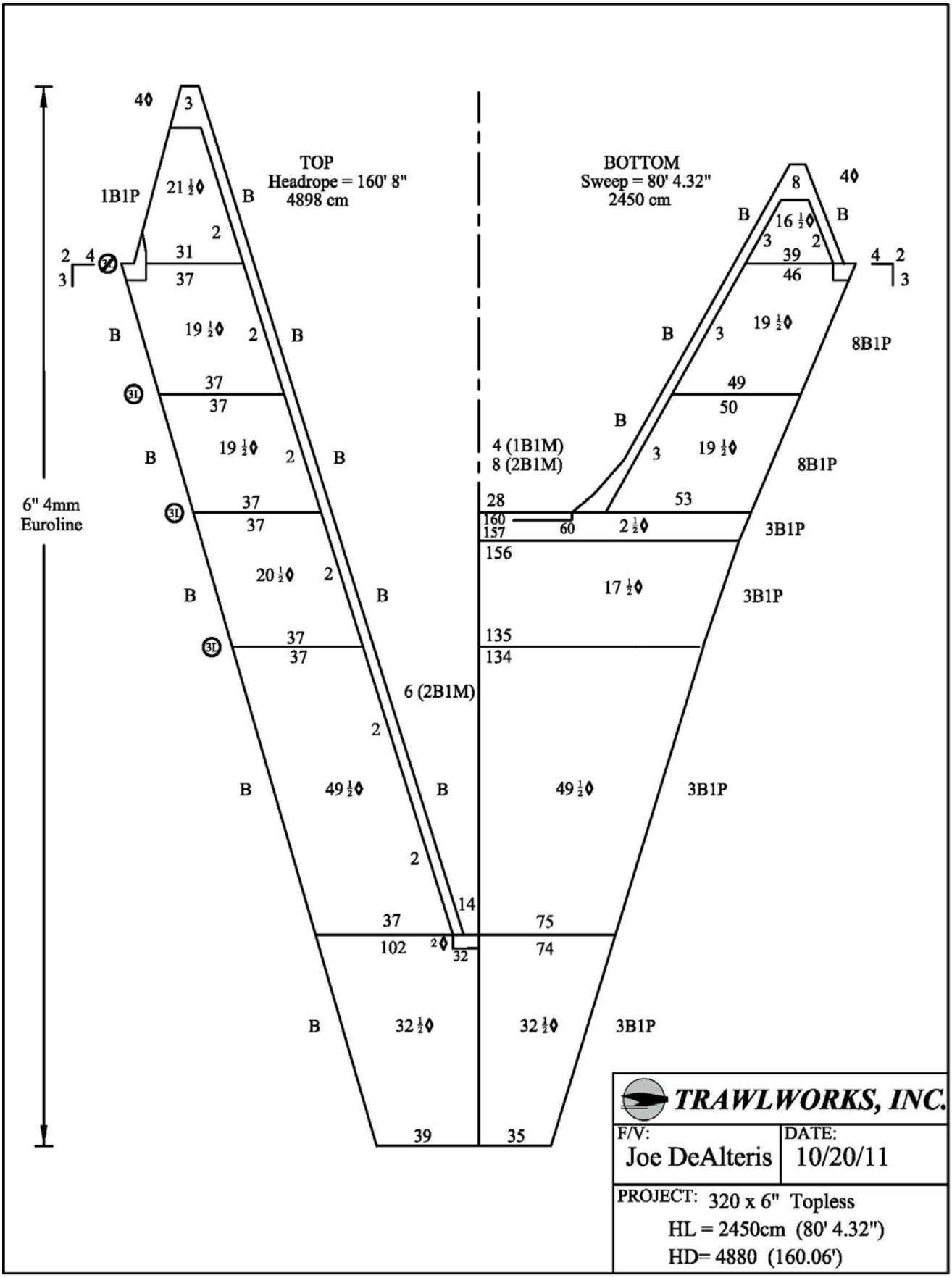

Figure 4. Schematic of 320 x 6 inch topless trawl with 160-foot headrope used in this study.

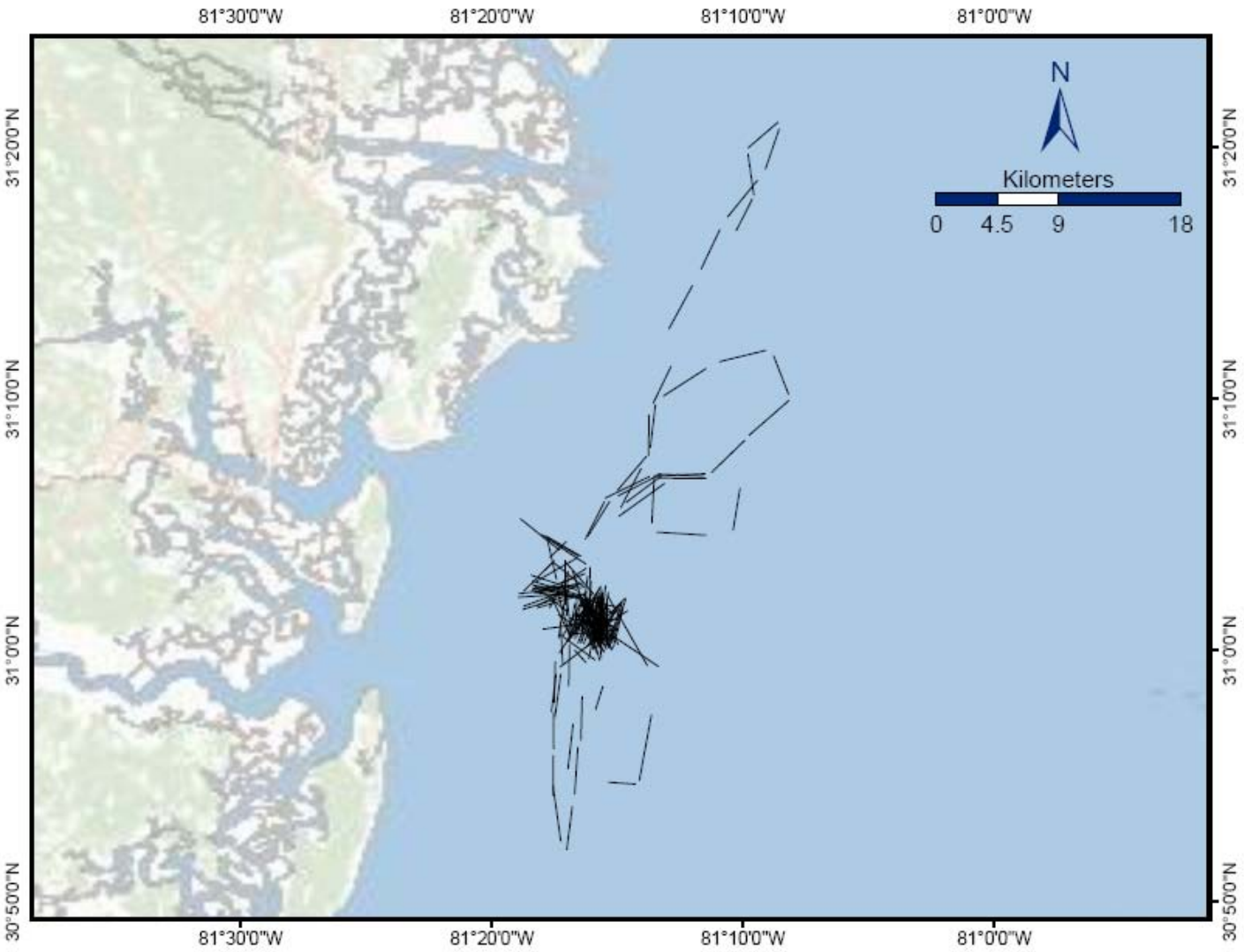

Figure 5. Chart showing all 177 tows paths conducted in this study.

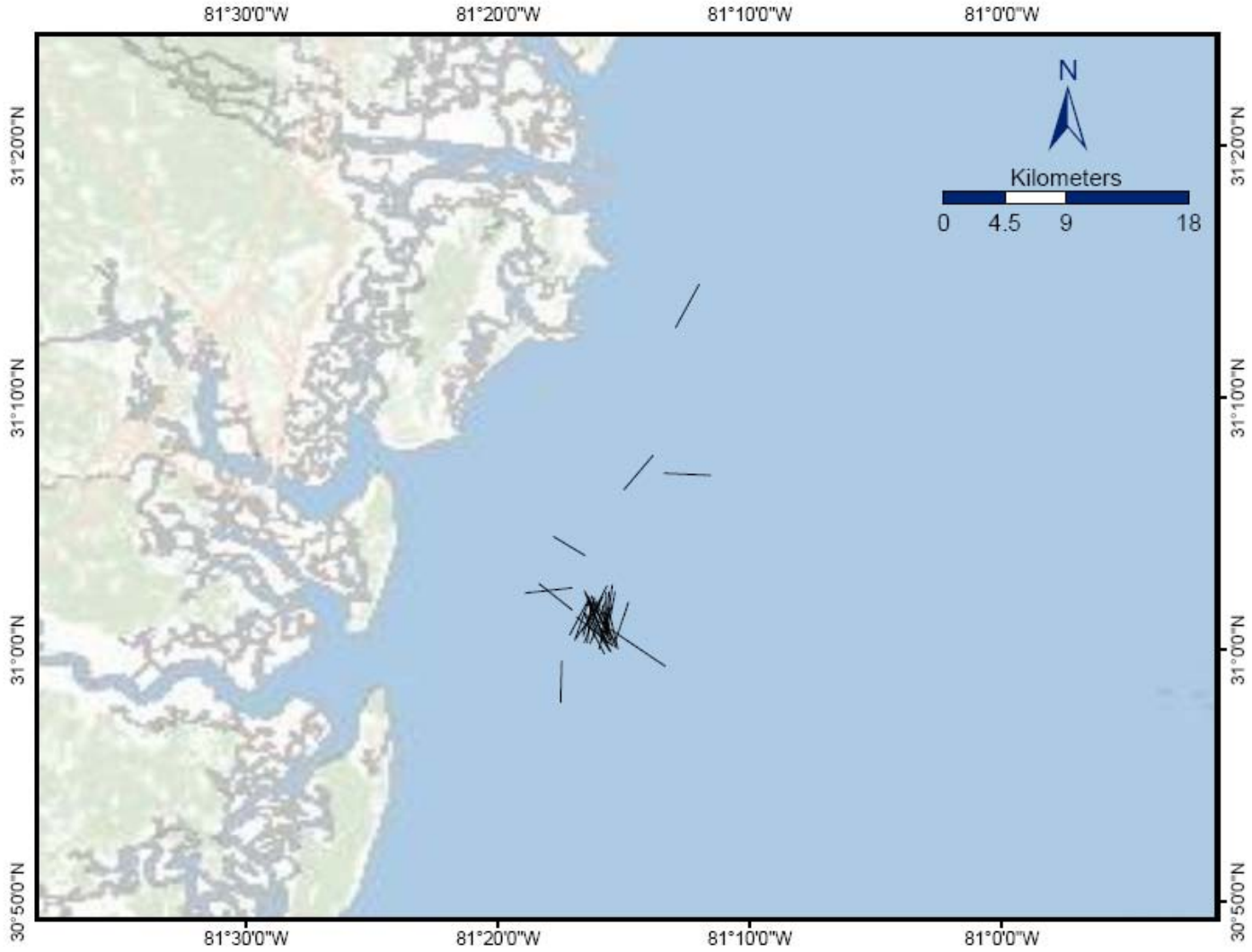

Figure 6. Chart showing all tow paths that captured sea turtles in this study.

Table 1. Summary of sea turtle catch data in the experimental (topless) trawl net with the various headrope lengths and the control trawl net with the 65-foot headrope length.

Tow Numbers	Topless Headrope Length (ft)	Exp. Turtle Catch	Cont. Turtle Catch
1 to 32	108	4	6
33 to 92	160	0	9
93 to 118	133	2	2
119 to 155	160	1	16
156 to 177	148	2	7

Table 2. Summary of trawl performance in terms of mean observed door spread for the experimental (topless) trawl nets with the various headrope lengths and the control trawl net with the 65-foot headrope length.

Tow Numbers	Topless Headrope Length (ft)	Mean Topless Door Spread (ft)	Mean Control Door Spread (ft)
1 to 32	108	101	102
33 to 92	160	108	100
93 to 119	133	92	89
119 to 155	160	105	100
156 to 177	148	103	98

Table 3. Summary of catch data other than sea turtles (mean # of animals) in the experimental (topless) trawl nets with various headrope lengths and the control trawl net with a 65-foot headrope length.

		Control Trawl			Exp. Trawl 133 ft Headrope		
Tow numbers	Sample Size	Skate/Ray	Flounder	Crab	Skate/Ray	Flounder	Crab
93 to 119	15	18.3	2.0	32.5	16.3	2.0	35.4

		Control Trawl			Exp. Trawl 160 ft Headrope		
Tow numbers	Sample Size	Skate/Ray	Flounder	Crab	Skate/Ray	Flounder	Crab
119 to 155	39	9.5	1.2	20.1	8.4	1.2	17.1

		Control Trawl			Exp. Trawl 147 ft Headrope		
Tow numbers	Sample Size	Skate/Ray	Flounder	Crab	Skate/Ray	Flounder	Crab
156 to 177	20	5.2	1.7	13.8	3.3	1.6	17.4

Appendix Table 1. Start and end date, time and location data for each tow conducted in this study. The experiment gear headrope length is noted as well as the location in the twin trawl rig (port or starboard).

	Exp.	Exp.				Latitude in		Longitude in		Latitude out		Longitude out	
Haul	Gear	Side	Date	time in	time out	Deg	Minutes	Deg	Minutes	Deg	Minutes	Deg	Minutes
1	108	Port	10/26/2011	9:16	9:41	31	3.000	81	17.000	31	1.687	81	17.703
2	108	Port	10/26/2011	10:06	10:53	31	0.849	81	17.970	31	1.257	81	15.040
3	108	Port	10/26/2011	11:54	12:11	30	58.604	81	15.578	30	57.665	81	15.872
4	108	Port	10/26/2011	12:40	13:13	30	57.092	81	16.765	30	55.289	81	16.971
5	108	Port	10/26/2011	13:39	13:50	30	54.778	81	15.358	30	54.691	81	14.273
6	108	Port	10/26/2011	14:35	15:29	30	54.839	81	14.134	30	57.447	81	13.641
7	108	Port	10/26/2011	16:05	17:03	30	59.404	81	13.803	31	2.208	81	15.407
8	108	Port	10/26/2011	17:12	17:29	31	2.162	81	15.650	31	1.147	81	15.470
9	108	Port	10/26/2011	18:11	18:40	31	3.582	81	17.505	31	2.368	81	18.749
10	108	Port	10/26/2011	18:50	19:20	31	2.276	81	18.933	31	2.474	81	17.064
11	108	Port	10/26/2011	20:16	20:45	31	2.130	81	18.967	31	2.251	81	17.044
12	108	Port	10/26/2011	20:53	21:23	31	2.160	81	17.082	31	1.642	81	18.775
13	108	Port	10/26/2011	21:32	22:02	31	1.762	81	18.739	31	2.405	81	16.985
14	108	Port	10/26/2011	22:14	22:43	31	2.403	81	16.611	31	3.000	81	18.438
15	108	Port	10/27/2011	9:07	9:24	31	2.170	81	15.772	31	1.436	81	15.184
16	108	Port	10/27/2011	10:15	11:51	31	1.140	81	15.988	30	59.371	81	13.367
17	108	Port	10/27/2011	13:26	13:55	30	59.940	81	15.506	31	1.288	81	16.297
18	108	Port	10/27/2011	14:32	15:01	31	0.467	81	15.125	31	1.255	81	16.590
19	108	Port	10/27/2011	15:12	15:41	31	1.600	81	17.046	31	2.642	81	18.386
20	108	Port	10/27/2011	15:50	16:20	31	2.779	81	18.389	31	2.190	81	16.433
21	108	Port	10/27/2011	16:30	16:59	31	2.122	81	16.592	31	2.309	81	18.313
22	108	Port	10/27/2011	17:07	17:37	31	2.413	81	18.424	31	2.631	81	16.630
23	108	Star.	10/27/2011	18:05	18:35	31	1.922	81	16.460	31	0.603	81	17.156
24	108	Star.	10/27/2011	18:44	19:14	31	0.642	81	17.286	30	59.639	81	15.891
25	108	Star.	10/27/2011	19:23	19:53	30	59.603	81	15.699	31	1.329	81	16.164
26	108	Star.	10/27/2011	20:01	20:31	31	1.477	81	16.192	31	0.054	81	15.428
27	108	Star.	10/27/2011	20:39	21:06	31	0.099	81	15.332	31	1.527	81	15.868
28	108	Star.	10/27/2011	21:20	21:50	31	2.500	81	16.410	31	2.555	81	18.257
29	108	Star.	10/27/2011	21:58	22:28	31	2.113	81	16.430	31	2.493	81	18.399
30	108	Star.	10/27/2011	22:37	23:07	31	1.947	81	16.120	31	0.385	81	15.405
31	108	Star.	10/27/2011	23:29	23:48	31	0.468	81	15.126	31	1.825	81	15.743
32	108	Star.	10/27/2011	23:59	0:27	31	2.243	81	15.941	31	3.502	81	17.052
33	160	Star.	10/28/2011	13:59	14:30	31	6.941	81	11.544	31	7.028	81	13.417
34	160	Star.	10/28/2011	14:56	15:25	31	6.962	81	13.542	31	5.082	81	13.626
35	160	Star.	10/28/2011	15:34	16:04	31	4.707	81	13.428	31	4.594	81	11.469
36	160	Star.	10/28/2011	16:15	16:45	31	4.779	81	10.391	31	6.473	81	10.116
37	160	Star.	10/28/2011	16:59	17:30	31	6.854	81	11.445	31	6.866	81	13.356
38	160	Star.	10/28/2011	17:38	18:08	31	6.659	81	13.117	31	5.353	81	14.953
39	160	Star.	10/28/2011	18:27	18:56	31	3.698	81	16.588	31	2.751	81	18.243
40	160	Star.	10/28/2011	19:04	19:34	31	2.600	81	18.306	31	2.183	81	16.593

Appendix Table 1 (continued).

	Exp.	Exp.				Latitude in		Longitude in		Latitude out		Longitude out	
Haul	Gear	Side	Date	time in	time out	Deg	Minutes	Deg	Minutes	Deg	Minutes	Deg	Minutes
41	160	Star.	10/28/2011	19:42	20:12	31	2.046	81	16.380	31	0.396	81	16.961
42	160	Star.	10/28/2011	20:21	20:51	31	0.300	81	15.900	31	1.826	81	15.488
43	160	Star.	10/28/2011	21:00	21:30	31	1.942	81	15.407	31	0.256	81	15.396
44	160	Star.	10/28/2011	21:38	22:09	31	0.139	81	15.388	31	1.764	81	14.787
45	160	Star.	10/28/2011	22:18	22:48	31	1.902	81	14.849	31	0.407	81	15.788
46	160	Star.	10/28/2011	22:55	23:25	31	0.342	81	15.943	31	2.029	81	15.771
47	160	Star.	10/28/2011	23:34	0:03	31	2.134	81	15.845	31	0.753	81	16.676
48	160	Star.	10/29/2011	0:12	0:43	31	0.661	81	16.842	31	2.288	81	17.031
49	160	Star.	10/29/2011	0:54	1:25	31	2.310	81	17.053	31	0.502	81	17.341
50	160	Star.	10/29/2011	1:34	2:05	31	0.377	81	16.984	31	1.761	81	15.796
51	160	Star.	10/29/2011	7:15	7:47	31	0.560	81	15.580	31	2.226	81	15.782
52	160	Star.	10/29/2011	7:59	8:30	31	2.284	81	16.015	31	0.761	81	16.808
53	160	Star.	10/29/2011	8:39	9:10	31	0.678	81	16.761	31	0.832	81	14.945
54	160	Star.	10/29/2011	9:17	9:48	31	0.948	81	15.027	31	1.276	81	16.887
55	160	Star.	10/29/2011	9:55	10:27	31	1.332	81	16.787	31	1.597	81	14.898
56	160	Star.	10/29/2011	10:35	10:45	31	1.741	81	15.024	31	1.856	81	15.563
57	160	Star.	10/29/2011	10:49	11:20	31	1.911	81	15.816	31	2.367	81	17.680
58	160	Star.	10/29/2011	11:28	11:59	31	2.145	81	17.633	31	0.618	81	16.900
59	160	Star.	10/29/2011	12:07	12:37	31	0.272	81	16.913	30	58.592	81	16.930
60	160	Star.	10/29/2011	12:44	13:13	30	58.196	81	16.406	30	56.437	81	16.458
61	160	Star.	10/29/2011	13:22	13:52	30	56.163	81	16.577	30	54.291	81	16.706
62	160	Star.	10/29/2011	14:01	14:31	30	53.812	81	16.802	30	52.077	81	17.012
63	160	Port	10/29/2011	14:53	15:24	30	52.421	81	17.255	30	54.625	81	17.569
64	160	Port	10/29/2011	15:33	16:03	30	54.244	81	17.569	30	55.842	81	17.548
65	160	Port	10/29/2011	16:11	16:41	30	56.093	81	17.540	30	57.547	81	17.547
66	160	Port	10/29/2011	16:50	17:20	30	57.931	81	17.516	30	59.582	81	17.474
67	160	Port	10/29/2011	17:29	17:59	30	59.901	81	17.323	31	1.287	81	16.415
68	160	Port	10/29/2011	18:08	18:40	31	1.435	81	16.233	31	3.171	81	16.774
69	160	Port	10/29/2011	18:48	19:20	31	3.175	81	16.969	31	1.391	81	17.022
70	160	Port	10/29/2011	19:28	19:58	31	1.168	81	17.268	30	59.448	81	17.170
71	160	Port	10/29/2011	20:07	20:37	30	59.092	81	17.256	30	57.360	81	17.487
72	160	Port	10/29/2011	20:49	21:19	30	57.570	81	17.620	30	59.070	81	17.435
73	160	Port	10/29/2011	21:28	21:58	30	59.347	81	17.279	31	0.456	81	15.850
74	160	Port	10/29/2011	22:11	22:43	31	0.412	81	15.690	31	2.041	81	15.675
75	160	Port	10/29/2011	22:51	23:22	31	2.086	81	15.801	31	0.417	81	16.017
76	160	Port	10/29/2011	23:31	0:02	31	0.461	81	16.179	31	2.097	81	16.199
77	160	Port	10/30/2011	0:11	0:42	31	2.259	81	16.334	31	1.698	81	18.184
78	160	Port	10/30/2011	0:53	1:42	31	1.780	81	18.212	31	2.645	81	16.535
79	160	Port	10/30/2011	1:32	2:03	31	2.689	81	16.387	31	2.346	81	18.149
80	160	Port	10/30/2011	2:12	2:42	31	2.421	81	17.976	31	3.078	81	16.281

Appendix Table 1 (continued).

	Exp.	Exp.				Latitude in		Longitude in		Latitude out		Longitude out	
Haul	Gear	Side	Date	time in	time out	Deg	Minutes	Deg	Minutes	Deg	Minutes	Deg	Minutes
81	160	Port	10/30/2011	2:50	3:21	31	2.774	81	16.036	31	1.112	81	16.175
82	160	Port	10/30/2011	9:59	10:31	31	6.072	81	15.491	31	6.923	81	13.717
83	160	Port	10/30/2011	10:39	11:11	31	6.949	81	13.528	31	7.046	81	11.494
84	160	Port	10/30/2011	11:19	11:50	31	7.077	81	11.262	31	8.367	81	9.929
85	160	Port	10/30/2011	12:01	12:35	31	8.554	81	9.775	31	9.951	81	8.168
86	160	Port	10/30/2011	21:42	13:13	31	10.187	81	8.183	31	11.728	81	8.792
87	160	Port	10/30/2011	13:22	13:52	31	11.951	81	9.084	31	11.488	81	10.946
88	160	Port	10/30/2011	14:02	14:33	31	11.228	81	11.465	31	10.121	81	13.167
89	160	Port	10/30/2011	14:42	15:12	31	9.805	81	13.480	31	8.074	81	13.687
90	160	Port	10/30/2011	5:23	15:53	31	7.722	81	13.853	31	6.373	81	15.014
91	160	Port	10/30/2011	16:01	16:31	31	5.947	81	15.298	31	4.540	81	16.179
92	160	Port	10/30/2011	16:43	17:11	31	3.769	81	16.545	31	4.514	81	17.794
93	133	Port	10/31/2011	17:53	18:24	31	5.246	81	18.871	31	3.987	81	17.302
94	133	Port	10/31/2011	18:31	19:02	31	3.566	81	17.083	31	1.852	81	17.079
95	133	Port	10/31/2011	19:11	19:42	31	1.330	81	16.888	31	0.173	81	15.439
96	133	Port	10/31/2011	19:49	20:19	31	0.022	81	15.195	31	1.173	81	16.056
97	133	Port	10/31/2011	20:26	20:57	31	1.736	81	16.128	31	3.317	81	16.092
98	133	Port	10/31/2011	21:05	21:35	31	3.296	81	16.238	31	2.721	81	17.081
99	133	Port	10/31/2011	21:43	22:13	31	1.439	81	17.344	31	0.402	81	15.875
100	133	Port	10/31/2011	22:22	22:53	31	0.400	81	15.707	31	2.087	81	15.991
101	133	Port	10/31/2011	23:03	23:32	31	2.503	81	16.287	31	3.526	81	17.562
102	133	Port	10/31/2011	23:39	23:56	31	3.714	81	17.695	31	4.345	81	17.035
103	133	Port	11/1/2011	8:03	8:28	31	16.706	81	10.277	31	17.969	81	9.621
104	133	Port	11/1/2011	8:37	9:07	31	18.120	81	9.564	31	19.755	81	9.798
105	133	Port	11/1/2011	9:15	9:44	31	19.991	81	9.806	31	21.026	81	8.596
106	133	Port	11/1/2011	9:54	10:24	31	20.748	81	8.555	31	19.150	81	9.112
107	133	Port	11/1/2011	10:33	11:04	31	18.699	81	9.425	31	17.243	81	10.611
108	133	Port	11/1/2011	11:12	11:44	31	16.762	81	10.916	31	15.174	81	11.670
109	133	Port	11/1/2011	11:56	12:27	31	14.521	81	12.016	31	12.792	81	12.948
110	133	Port	11/1/2011	12:46	13:17	31	11.320	81	12.855	31	9.825	81	13.582
111	133	Port	11/1/2011	13:28	13:58	31	9.384	81	13.744	31	7.743	81	13.772
112	133	Port	11/1/2011	14:06	14:37	31	7.268	81	14.057	31	5.690	81	14.875
113	133	Star.	11/1/2011	14:59	15:32	31	5.897	81	14.664	31	6.953	81	13.241
114	133	Star.	11/1/2011	15:38	16:09	31	7.001	81	13.293	31	6.165	81	14.978
115	133	Star.	11/1/2011	16:18	16:50	31	5.936	81	15.512	31	4.436	81	16.277
116	133	Star.	11/1/2011	17:00	17:30	31	3.762	81	16.444	31	4.578	81	17.879
117	133	Star.	11/1/2011	17:36	18:06	31	4.463	81	17.794	31	2.834	81	17.420
118	133	Star.	11/1/2011	18:14	18:46	31	2.418	81	17.408	31	0.567	81	16.893
119	133	Star.	11/1/2011	18:55	19:25	31	0.564	81	16.620	31	2.080	81	16.162
120	160	Star.	11/2/2011	10:07	10:38	31	4.628	81	18.028	31	3.445	81	16.246

Appendix Table 1 (continued).

	Exp.	Exp.				Latitude in		Longitude in		Latitude out		Longitude out	
Haul	Gear	Side	Date	time in	time out	Deg	Minutes	Deg	Minutes	Deg	Minutes	Deg	Minutes
121	160	Star.	11/2/2011	10:48	11:19	31	2.983	81	16.187	31	1.292	81	16.384
122	160	Star.	11/2/2011	11:28	11:57	31	1.227	81	16.362	31	2.561	81	15.669
123	160	Star.	11/2/2011	12:05	12:37	31	2.458	81	15.628	31	0.686	81	15.653
124	160	Star.	11/2/2011	12:45	13:17	31	0.597	81	15.908	31	2.184	81	16.567
125	160	Star.	11/2/2011	13:25	13:54	31	1.888	81	16.694	31	0.501	81	16.920
126	160	Star.	11/2/2011	14:10	14:32	31	0.478	81	16.900	31	1.810	81	15.965
127	160	Star.	11/2/2011	14:40	15:11	31	1.781	81	15.857	31	0.223	81	15.480
128	160	Star.	11/2/2011	15:19	15:50	30	59.964	81	15.554	31	1.499	81	16.569
129	160	Star.	11/2/2011	15:59	16:29	31	1.473	81	16.607	30	59.860	81	15.777
130	160	Star.	11/2/2011	16:38	17:08	30	59.691	81	15.633	31	1.404	81	15.812
131	160	Star.	11/2/2011	17:17	17:47	31	1.332	81	15.845	30	59.664	81	16.136
132	160	Star.	11/2/2011	17:55	18:25	30	59.526	81	16.247	31	0.031	81	16.711
133	160	Star.	11/2/2011	18:36	19:06	31	1.245	81	16.558	31	2.525	81	15.663
134	160	Star.	11/2/2011	19:13	19:44	31	2.372	81	16.586	31	0.741	81	15.634
135	160	Star.	11/2/2011	20:01	20:31	31	0.369	81	15.573	31	1.894	81	16.180
136	160	Star.	11/2/2011	20:41	21:12	31	1.857	81	16.157	31	0.216	81	16.110
137	160	Star.	11/2/2011	21:22	21:54	31	0.039	81	15.977	31	1.702	81	15.672
138	160	Star.	11/2/2011	22:03	22:32	31	1.807	81	15.656	31	0.152	81	15.754
139	160	Star.	11/2/2011	22:41	23:11	31	0.082	81	15.852	31	1.529	81	16.463
140	160	Star.	11/3/2011	8:29	8:59	31	2.335	81	15.592	31	0.609	81	15.705
141	160	Star.	11/3/2011	9:08	9:38	31	0.489	81	15.805	31	2.135	81	16.430
142	160	Star.	11/3/2011	9:46	10:18	31	2.242	81	16.612	31	0.458	81	16.693
143	160	Star.	11/3/2011	10:27	11:00	31	0.294	81	16.574	31	2.105	81	15.876
144	160	Star.	11/3/2011	11:09	11:39	31	0.505	81	15.958	31	2.177	81	15.797
145	160	Star.	11/3/2011	11:48	12:19	31	0.343	81	15.917	31	1.804	81	14.936
146	160	Star.	11/3/2011	12:27	12:58	31	1.912	81	14.813	31	0.278	81	15.370
147	160	Star.	11/3/2011	13:06:00	13:36	31	0.250	81	15.627	31	1.898	81	16.434
148	160	Star.	11/3/2011	13:46	14:16	31	1.948	81	16.389	31	0.810	81	15.025
149	160	Port	11/3/2011	14:38	15:09	31	0.232	81	14.962	31	1.949	81	15.699
150	160	Port	11/3/2011	15:21	15:52	31	1.865	81	15.771	31	0.194	81	15.642
151	160	Port	11/3/2011	15:59	16:30	31	0.132	81	15.734	31	1.751	81	16.250
152	160	Port	11/3/2011	16:39	17:07	31	1.926	81	16.290	31	0.291	81	16.445
153	160	Port	11/3/2011	17:16	17:47	31	0.171	81	16.220	31	1.617	81	15.051
154	160	Port	11/3/2011	17:59	18:29	31	1.636	81	14.791	31	0.115	81	15.169
155	160	Port	11/3/2011	18:36	19:07	31	0.048	81	15.244	31	1.733	81	15.633
156	147	Port	11/3/2011	20:24	20:57	31	2.604	81	15.461	31	0.742	81	15.702
157	147	Port	11/3/2011	21:08	21:39	31	0.602	81	15.824	31	2.337	81	16.300
158	147	Port	11/3/2011	21:49	22:19	31	2.377	81	16.240	31	0.717	81	16.389
159	147	Port	11/3/2011	22:27	22:58	31	0.605	81	16.143	31	1.601	81	14.587
160	147	Port	11/4/2011	7:42	8:13	31	2.329	81	15.355	31	0.474	81	15.693

Appendix Table 1 (continued).

	Exp.	Exp.				Latitude in		Longitude in		Latitude out		Longitude out	
Haul	Gear	Side	Date	time in	time out	Deg	Minutes	Deg	Minutes	Deg	Minutes	Deg	Minutes
161	147	Port	11/4/2011	8:22	8:53	31	0.418	81	15.757	31	2.017	81	16.452
162	147	Port	11/4/2011	9:01	9:33	31	2.186	81	16.313	31	0.541	81	15.599
163	147	Port	11/4/2011	9:44	10:14	31	0.447	81	15.465	31	2.238	81	15.689
164	147	Port	11/4/2011	10:23	10:54	31	2.296	81	15.722	31	0.614	81	15.691
165	147	Port	11/4/2011	11:04	11:35	31	1.291	81	16.108	31	2.238	81	16.523
166	147	Port	11/4/2011	11:44	12:16	31	2.291	81	16.381	31	0.582	81	15.568
167	147	Port	11/4/2011	12:26	12:57	31	0.561	81	15.538	31	2.321	81	15.593
168	147	Port	11/4/2011	13:05	13:35	31	1.849	81	15.935	31	0.877	81	16.034
169	147	Port	11/4/2011	13:45	14:15	31	0.725	81	16.033	31	2.075	81	14.685
170	147	Port	11/4/2011	14:23	14:54	31	2.079	81	14.660	31	0.312	81	15.225
171	147	Port	11/4/2011	15:03	15:34	31	0.377	81	15.358	31	2.121	81	15.706
172	147	Port	11/4/2011	15:42	16:17	31	2.208	81	15.871	31	0.364	81	16.430
173	147	Port	11/4/2011	16:25	16:56	31	0.263	81	16.352	31	1.952	81	15.725
174	147	Port	11/4/2011	17:08	17:38	31	2.105	81	15.600	31	0.300	81	15.590
175	147	Port	11/4/2011	17:44	18:18	31	0.270	81	15.672	31	1.907	81	16.405
176	147	Port	11/4/2011	18:27	18:58	31	2.019	81	16.252	31	0.525	81	15.433
177	147	Port	11/4/2011	19:08	19:39	31	0.336	81	15.206	31	2.119	81	15.811

Appendix Table 2. Sea turtle catch data

Tow No.	Exp. Gear	Exp. Turtle Catch	Cont. Turtle Catch	Codends	Comments: turtle species
1	108			Open	
2	108			Open	
3	108			Open	
4	108			Open	
5	108			Open	
6	108			Open	
7	108			Open	
8	108			Open	
9	108			Closed	
10	108	1	1	Closed	Turtles 1 and 2 both Loggerheads
11	108			Closed	
12	108			Closed	
13	108			Closed	
14	108			Closed	
15	108			Open	
16	108	1		Open	Turtle 3 (unknown) observed in video
17	108	1	1	Closed	Turtle 4 and 5 Kemps Ridleys
18	108			Closed	
19	108		1	Closed	Turtle 6 Kemps Ridley
20	108			Closed	
21	108			Closed	
22	108			Closed	Turtle 7 was caught while switching gears, and therefore not included in the study results
23	108		1	Closed	Turtle 8 Kemps Ridley
24	108			Closed	
25	108			Closed	
26	108			Closed	
27	108	1		Closed	Turtle 9 Kemps Ridley
28	108			Closed	
29	108			Closed	
30	108		2	Closed	Turtle 10 Loggerhead and turtle 11 Kemps Ridley
31	108			Closed	
32	108			Closed	
33	160		1	Closed	Turtle 12 Loggerhead
34	160			Closed	
35	160			Closed	
36	160			Closed	
37	160			Closed	
38	160			Closed	
39	160			Closed	
40	160			Closed	

Appendix Table 2 (continued)

Haul	Exp. Gear	Exp. Turtle Catch	Cont Turtle Catch	Codends	Comments: turtle species
41	160		1	Closed	Turtle 13 Kemps Ridley
42	160		1	Closed	Turtle 14 Loggerhead
43	160			Closed	
44	160			Closed	
45	160			Closed	
46	160			Closed	
47	160		2	Closed	Turtle 15 Kemps Ridley, 16 Loggerhead
48	160			Closed	
49	160			Closed	
50	160			Closed	
51	160			Closed	
52	160			Closed	
53	160			Closed	
54	160			Closed	
55	160			Closed	
56	160			Closed	
57	160			Closed	
58	160			Closed	
59	160			Closed	
60	160			Closed	
61	160			Closed	
62	160			Closed	
63	160			Closed	
64	160			Closed	
65	160			Closed	
66	160		1	Closed	Turtle 17 Kemps Ridley
67	160			Closed	
68	160			Closed	
69	160			Closed	
70	160			Closed	
71	160			Closed	
72	160			Closed	
73	160			Closed	
74	160			Closed	
75	160			Closed	
76	160		1	Closed	Turtle 18 Loggerhead
77	160			Closed	
78	160			Closed	
79	160			Closed	
80	160			Closed	

Appendix Table 2 (continued)

Haul	Exp. Gear	Exp. Turtle Catch	Cont Turtle Catch	Codends	Comments: turtle species
81	160			Closed	
82	160			Closed	
83	160			Closed	
84	160			Closed	
85	160			Closed	
86	160			Closed	
87	160			Closed	
88	160			Closed	
89	160			Closed	
90	160		1	Closed	Turtle 19 Kemps Ridley
91	160			Closed	
92	160		1	Closed	Turtle 20 Kemps Ridley
93	133			Closed	
94	133			Closed	
95	133	1		Closed	Turtle 21 Kemps Ridley
96	133			Closed	
97	133			Closed	
98	133			Closed	
99	133			Closed	
100	133			Closed	
101	133			Closed	
102	133			Closed	
103	133			Closed	
104	133			Closed	
105	133			Closed	
106	133			Closed	
107	133			Closed	
108	133			Closed	
109	133	1	1	Closed	Turtle 22 and 23 Loggerheads
110	133			Closed	
111	133			Closed	
112	133			Closed	
113	133			Closed	
114	133			Closed	
115	133			Closed	
116	133			Closed	
117	133			Closed	
118	133			Closed	
119	133		1	Closed	Turtle 24 Loggerhead
120	160			Closed	

Appendix Table 2 (continued)

Haul	Exp. Gear	Exp. Turtle Catch	Cont Turtle Catch	Codends	Comments: turtle species
121	160			Closed	
122	160		1	Closed	Turtle 25 Kemps Ridley
123	160			Closed	
124	160			Closed	
125	160			Closed	
126	160		1	Closed	Turtle 26 Loggerhead
127	160		1	Closed	Turtle 27 Kemps Ridley
128	160		1	Closed	Turtle 28 Loggerhead
129	160		2	Closed	Turtle 29 and 30 Kemps Ridleys
130	160			Closed	
131	160			Closed	
132	160			Closed	
133	160			Closed	
134	160	1	1	Closed	Turtle 31 and 32 Kemps Ridleys
135	160		1	Closed	Turtle 33 Kemps Ridley
136	160			Closed	
137	160		1	Closed	Turtle 34 Green Turtle
138	160			Closed	
139	160			Closed	
140	160		1	Closed	Turtle 35 Loggerhead
141	160		1	Closed	Turtle 36 Kemps Ridley
142	160			Closed	
143	160		1	Closed	Turtle 37 Kemps Ridley
144	160			Closed	
145	160			Closed	
146	160		1	Closed	Turtle 38 Kemps Ridley
147	160		1	Closed	Turtle 39 Kemps Ridley
148	160			Closed	
149	160			Closed	
150	160			Closed	
151	160			Closed	
152	160		1	Closed	Turtle 40 Kemps Ridley
153	160			Closed	
154	160			Closed	
155	160		1	Closed	Turtle 41 Kemps Ridley
156	147		1	Closed	Turtle 42 Loggerhead
157	147			Closed	
158	147			Closed	
159	147			Closed	
160	147	1	1	Closed	Turtle 43 and 44 Loggerheads

Appendix Table 2 (continued)

	Exp.	Exp. Turtle	Cont Turtle		
Haul	Gear	Catch	Catch	Codends	Comments: turtle species
161	147		1	Closed	Turtle 45 Kemps Ridley
162	147	1		Closed	Turtle 46 Loggerhead
163	147			Closed	
164	147		1	Closed	Turtle 47 Kemps Ridley
165	147		1	Closed	Turtle 48 Kemps Ridley
166	147			Closed	
167	147			Closed	
168	147			Closed	
169	147			Closed	
170	147			Closed	
171	147			Closed	
172	147			Closed	
173	147		1	Closed	Turtle 49 Loggerhead
174	147			Closed	
175	147		1	Closed	Turtle 50 Kemps Ridley
176	147			Closed	
177	147			Closed	

Appendix Table 3 Summary of sea turtle measurement and tag data. Sea surface water temperature (SST) is ^{o}F; sea turtle species codes are: CC is Loggerhead, LK is Kemps Ridley, CM is Green, and NK is unknown; and all measurement are centimeters. Empty cells indicate no data collected. Note sea turtle #7 was taken while switching gear so was not included in the study results.

Turtle #	Haul #	Date	SST	Species	Notch to Notch	Notch to Tip	Width	Total Tail	Vent to Tip (tail)	Flipper tag R	Flipper tag L	Pit tag #
1	10	10/26/2011	72.3	CC	78.0	81.0	74.0	12.5	4.3	RRX255	TTC320	4b08363200
2	10	10/26/2011	72.3	CC	72.0	73.5	66.5	9.0	6.0	TTC318	TTC315	4367076162
3	16	10/27/2011	72.5	NK								
4	17	10/27/2011	72.7	LK	32.0	32.8	32.5	3.0	2.0			
5	17	10/27/2011	72.7	LK	45.5	46.5	53.0	6.0	3.5			
6	19	10/27/2011	72.0	LK	37.0	37.5	39.0	6.3	4.0			4368032C2D
7	XX	10/27/2011	72.7	LK	27.0	28.0	27.0	4.8	1.5			436A1F561B
8	23	10/27/2011	72.6	LK	34.5	35.0	35.3	6.3	1.8	TTC316	TTC317	4349367236
9	27	10/27/2011	73.5	LK	57.0	58.0	66.0	8.0	3.0	XXC498	XXC498	43491D4929
10	30	10/27/2011	73.1	CC	72.0	73.3	71.0	12.3	3.0	RRX252	TTC313	434A157D0A
11	30	10/27/2011	73.5	LK	31.8	32.0	33.5	4.5	1.5	RRX254	TTC314	43670C1D1E
12	33	10/28/2011	73.5	CC	78.0	79.0	74.0	9.0	3.0	RRT042	RRT043	436A1F0111
13	41	10/28/2011	72.6	LK	44.0	44.5	45.0	5.0	2.0	RRT044	RRT045	434A1A443A
14	42	10/28/2011	72.6	CC	78.5	79.5	77.0	13.5	7.0	RRX248	RRX247	436A2A3F67
15	47	10/29/2011	72.7	LK	45.0	44.5	47.5	8.0	3.0	TTC312	RRX257	434A0F2868
16	47	10/29/2011	72.7	CC	63.0	64.0	64.0	8.0	3.5	RRX253	RRX256	436755433F
17	66	10/29/2011	72.2	LK	34.8	35.3	36.0	5.5	2.5	RRX258	RRX251	436A041961
18	76	10/30/2011	72.4	CC	59.5	60.5	57.0	11.5	5.0	RRT039	RRX226	436A1D4218
19	90	10/30/2011	71.3	LK	41.0	40.5	44.0	7.5	2.3	RRT040	RRT037	4349776C55
20	92	10/30/2011	71.0	LK	42.3	43.0	44.0	7.0	2.0	RRT041	RRT038	4348313A12
21	95	10/31/2011	69.7	LK	47.5	48.0	49.0	9.0	3.0	XXC497	XXC476	43677E613B
22	109	11/1/2011	68.4	CC								
23	109	11/1/2011	68.4	CC								
24	119	11/1/2011	67.2	CC	66.0	68.0	62.0	13.0	2.5	XXC500	XXC499	434B542B32
25	122	11/2/2011	67.6	LK	43.5	44.0	48.0	5.5	2.5	XXC496	XXC495	4348337C22

Appendix Table 3 (continued)

Turtle #	Haul #	Date	SST	Species	Notch to Notch	Notch to Tip	Width	Total Tail	Vent to Tip (tail)	Flipper tag R	Flipper tag L	Pit tag #
26	126	11/2/2011	68.3	CC	40.0	71.0	69.0	14.0	3.5	XXC493	XXC494	4367542046
27	127	11/2/2011	68.6	LK	39.0	39.8	40.0	5.0	2.3			4349401704
28	128	11/2/2011	68.7	CC	67.5	68.5	66.0	9.0	2.5	XXC491	XXC492	436A187A3B
29	129	11/2/2011	68.6	LK	29.5	30.0	31.0	5.8	2.0	XXC489	XXC490	436A3A2329
30	129	11/2/2011	60.6	LK	31.5	32.0	32.5	5.5	2.0	XXC487	XXC488	43481D110C
31	134	11/2/2011	68.1	LK	36.5	36.8	38.3	4.5	2.0	XXC485	XXC486	436A3B144D
32	134	11/2/2011	68.1	LK	37.5	38.0	39.0	7.0	1.5	XXC484	XXC483	4349010418
33	135	11/2/2011	68.1	LK	43.3	43.8	45.0	9.0	2.5	XXC480	XXC479	434748762B
34	137	11/2/2011	67.9	CM	34.8	35.5	30.0	6.0	1.8	XXC481	XXC482	
35	140	11/3/2011	67.5	CC	64.5	65.3	64.0	12.0	2.5	XXC478	XXC477	434A4E2178
36	141	11/3/2011	67.4	LK	48.0	48.8	51.0	10.5	3.0	RRX232	RRX227	436A036E17
37	143	11/3/2011	67.4	LK	37.3	37.8	35.0	6.0	1.8	RRX230	RRX231	434A481A3F
38	146	11/3/2011	68.3	LK	41.0	41.8	43.5	5.3	1.5	RRX234	RRX229	434A0F467A
39	147	11/3/2011	68.9	LK	33.5	34.0	34.0	7.3	1.5	RRX228	RRX233	43694C6C79
40	152	11/3/2011	69.7	LK	30.0	30.5	32.3	5.0	1.5		RRX273	436A3B2B7B
41	155	11/3/2011	69.8	LK	38.8	39.3	39.5	6.3	2.3			4349681570
42	156	11/3/2011	69.1	CC	62.0	62.5	59.3	10.0	3.5			43673C0C38
43	160	11/4/2011	68.1	CC	68.5	69.8	66.5	13.0	3.5			43480A3A4D
44	160	11/4/2011	68.1	CC	67.8	69.5	66.0	10.0	2.8			4366211564
45	161	11/4/2011	68.0	LK	41.0	41.8	43.0	5.5	2.0			436A34553F
46	162	11/4/2011	67.5	CC	60.3	61.5	58.0	11.5	3.3			436A123317
47	164	11/4/2011	67.7	LK	33.0	33.5	34.0	5.5	2.0			434A065E01
48	165	11/4/2011	67.6	LK	33.5	34.0	35.3	5.5	2.3			4349186A25
49	173	11/4/2011	68.1	CC	69.8	71.0	68.0	11.0	3.0			43493F5804
50	175	11/4/2011	68.1	LK	49.8	50.8	50.3	8.5	3.3			436A342418

Appendix Table 4. Catch data other than sea turtles. Number of individual skates/rays, flounder species, and crabs caught in the tows of the various designs. Note that catch data other than sea turtle was not collected for the tows before haul # 93.

	Control trawl			Topless trawl, 130-foot headrope		
Haul #	Skate/Ray	Flounder	Crab	Skate/Ray	Flounder	Crab
93	35		68	29		105
94	16	2	23	30		24
96	10	6		8	2	
97	13	1	12	14		28
98	10	1	6	12		7
99	16		52	12		36
100	14	1	6	14		20
101	11		8	12		7
103	14		3	12		2
104	30		7	14		3
105	34	1	5	36		
106	23		3	15		4
107	19			19		5
108	17		216	11		202
110	12		13	7		17

Appendix Table 4 (continued).

	Control trawl			Topless trawl, 160-foot headrope		
Haul #	Skate/Ray	Flounder	Crab	Skate/Ray	Flounder	Crab
	3		7	8		15
112	4		8	10	1	8
113	9	1	11	4		8
114	3		7	6		8
115	8		3	7		6
116	19		19	16		12
117	23		20	20		24
118	35		12	34		19
120	20		12	16		12
121	18		57	16		23
122	12		17	8	1	20
123	4		10	6	1	12
124	4		49	11		38
125	5	2	20	11		7
126	10	1	19	6	1	24
127	10		10	5		3
128	8		10	6		25
129	8	2	23	8		24
130	16		8	4		1
131	4		7	6	2	4
132	8		31	8	1	25
133	6	1	69	9		24
135	9	1	12	5		5
136	13		18	11	1	17
138	7		1	7		1
140	6		11	7		2
141	12	1	51	5		41
142	14		47	3		81
143	8		32	5		27
144	7	1	8	8		6
145	8		3	5	1	2
146	6		1	6	1	2
147	11		58	8		49
148	8		24	4		15
150	4		9	5		7
151	3		7	4	2	13
152	5		52	5		48
153	7		18	9	1	5
154	5	1	3	6		3

Appendix Table 4 (continued)

	Control trawl			Topless trawl, 147-foot headrope		
Haul #	**Skate/Ray**	**Flounder**	**Crab**	**Skate/Ray**	**Flounder**	**Crab**
156	5		8	5		13
157	6	1	33	5		42
158	9		15	5	2	58
159	8	1	7	3		12
160	4		2	2		9
161	2	1	29	3		42
162	5		21	3		16
163	6	2	12	4	1	16
164	4		9	3		9
165	9		39	6		20
166	5		26	3		33
167	4		5	3		3
168	5		22	4		14
169	4	1	4	2	1	2
170	3		1	3	1	2
171	4		4	3	1	5
172	8	2	12	3	1	20
174	4		9	1	3	8
175		4	12	5	3	17
176	5		12	1		17
177	4		7	3	1	8