EVALUATION OF THE CATCH PERFORMANCE OF THE NMFS FLOUNDER TURTLE EXCLUDER DEVICE (TED) WITH A LARGE OPENING IN THE U.S. MID-ATLANTIC SCALLOP TRAWL FISHERY

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Submitted by

Joseph DeAlteris and Christopher Parkins
DeAlteris Associates Inc.
PO Box 251
Jamestown, RI 02835

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ABSTRACT

A previous study conducted in 2006 of catch performance of a NMFS certified whelk TED in the scallop trawl fishery documented a 7-8% on average loss of the target species depending on the net design, and a low bycatch rate of other species (Lawson and DeAlteris 2006). The results of this study of the catch performance of a NMFS certified flounder TED installed in a scallop trawl net documented similar results. In leg 1 with 18 paired tows, the scallop loss was 7%, and this was a significant difference. The result of leg 2 conducted on a different vessel documented a similar loss, but it was not significant likely due to a smaller number of replicate tows (n=9). Leg 3 included the use of an additional extension section ahead of the TED extension section, and the loss of scallop increased to 13%, but there was not a significant difference between the TED mean catch of scallops and the control catch of scallops again likely due the low replicate sample size (n=9). Total discarded bycatch in the fishery including shells, sponge, crabs, fish, etc ranged from 7-15%, and skate was the dominant fish bycatch at about 4-7% of the total catch. Skate catch was reduced significantly with the use of the TED in leg 1 but not significantly in legs 2 and 3, again likely due to the smaller replicate sample size.

INTRODUCTION

An evaluation of the performance of a turtle excluder device (TED) in the scallop trawl fishery of the mid-Atlantic was conducted in July and August of 2006 by comparing the catch of target and bycatch species for two different commonly used types of trawl nets in this region (Lawson and DeAlteris 2006). The TED was NMFS certified whelk TED, trapezoidal shaped (48 x 37 x 36 inches), constructed with aluminum tubing, and was installed in a 3.5 inch double twine extension section with a 28.5 inch forward cut x 81 inch horizontal cut opening covered with a single flap of small mesh. For both nets, use of a TED resulted in a significant reduction in the total weight of in-shell scallops. The loss was about 8% for the first net, a flounder trawl; and 7% for the second net, a scallop trawl. There was no indication of a change in the size selection in the scallop catch of the TED net, indicating that the loss of scallops is a function of decreased efficiency rather than size selection. Underwater video data confirmed that scallops were lost from the net out of the TED escape opening, which could explain the difference observed. An increased difference between the catch of the control and TED net was observed in the field as the total catch increased, and this was confirmed by the data analysis. The loss of scallop catch was double, about 14%, when the scallop catch was over 340 kg. Analysis of the effect of the TED on the performance of trawls with respect to fish bycatch produced mixed results that do not follow any consistent pattern. Overall, the flounder net had more discarded bycatch by weight than the scallop net, although bycatch rates with both nets were exceptionally low.

In 2009, the study described herein, was conducted again evaluating the catch performance of a TED in the sea scallop trawl fishery because NMFS had developed a flounder TED, constructed with flat bars. The study was conducted in June of 2009 aboard two different fishing vessels operating south of western Long Island, NY. The boats were landing daily in Jones Inlet, NY. While the Statement of Work for the project requested field evaluation in two different areas, the contracted fishing vessels for the study also had the requirement to catch commercial quantities of scallops, and as it turned out both vessels fished on sea scallop concentrations in the same area. Fortunately, the original study (Lawson and DeAlteris, 2006) was conducted off the Delmarva Peninsula, so in reality the geographic scope of the evaluations is wide. Both fishing vessels were double rigged shrimp trawlers typical of the vessels that operate in the scallop trawl fishery. The advantage of using double rigged vessels is that the experimental and control trawls can be towed simultaneously, thus reducing the number of tows required to conduct an experiment with sufficient statistical rigor by one-half. The Statement of Work also requested the evaluations be divided equally between the two vessels, but NMFS (Henry Milliken, personal communication) later requested that the experimental design be modified to include an evaluation of the flounder TED catch performance with the addition of an extension section ahead of the TED extension, in an effort to improve the scallop catch retention. This request was accommodated, but as a result the replicate sample size for the basic evaluation on the second vessel was reduced, as the additional research had to be conducted on the more powerful first vessel.

METHODS

The study was divided into three legs. The first leg was conducted aboard the FV Capt Dell owned and operated by Capt Edward Newman, and the goal was to compare the catch of a trawl equipped with the flounder TED to a trawl with no TED, but an extension section of identical length as the extension section with the TED. The rationale for this was to be sure that two sides were balanced in terms of net drag. The second leg was conducted aboard the FV Papa's Girl, owned and operated by Capt Floyd Gibbs. The goal and TEDs were identical to the first leg. The third leg was conducted on board the FV Capt Dell again, but this time the flounder TED was installed behind a webbing extension section, 30 meshes in length, as it was proposed that the addition of an extension section ahead of the TED may improve the catch performance of the net equipped with the TED. The FV Capt Dell was used for leg 3 with NMFS concurrence (Henry Milliken, personal communication) as the FV Papa's Girl was having difficulty towing the basic TED, and the FV Capt. Dell was a more powerful vessel.

The NMFS flounder TED (Figure 1) was 43.4 x 51.0 inches overall, constructed of aluminum pipe around the perimeter, and designed to have three windows or openings in the lower section (14.1 x 10.0 inches). The interior section of the TED was constructed of aluminum flat bars oriented vertically, and spaced to provide 4 inch openings. The TED was installed at 50^{o}, in an extension section constructed of double twine, braided polyethylene netting, 27 meshes in depth, and 100 meshes around. The mesh size in the extension was 3.5 inches. The opening in the extension section above the TED was 41x28 inches (21x8 meshes), rectangular in shape and was designed to meet the large opening requirement, it was closed with small mesh (1.5 inch) single flap cover. Rubber mat chaffing gear was attached to the extension section webbing, so as to reduce the wear on the netting when the TED contacted the sea bed.

The FV Capt. Dell is a 47 foot North Carolina trawler, rigged to tow two trawls, port and starboard simultaneously. The scallop trawls used on the FV Capt. Dell have 50 foot sweeps, and are constructed with 5.5 inch stretched mesh netting. The FV Papa's Girl is also a 47 foot North Carolina trawler, and she is also rigged to tow two trawls, port and starboard simultaneously. The scallop trawls used on the FV Papa's Girl have 40 foot sweeps, and are constructed with 5.5 inch stretched mesh netting. All tows were commercial length in duration, ranging from approximately 45 to 90 minutes in duration depending on the abundance of sea scallops in the fishing area. Towing speed was approximately 2.0 knots on both vessels. Most tows were conducted in the night as the vessel captains preferred to fish at night so as to maintain catch quality, and to be able to offload at the dock daily during normal business hours. The first day on board each vessel was devoted to making comparisons between the catches of the port and starboard sides of the vessel to ensure that there was no obvious bias in the study due to one side outperforming the other side. Each day the trawl with the TED equipped trawl was switched with the side towing the control trawl, so as to reduce any possible port/starboard bias effect.

At the end of each tow, the cod-end of each trawl was dumped into a bin, and the catch sorted by species. The entire scallop catch was weighed in baskets, and a sub-sample of the scallop catch was measured for shell height to the next largest mm. All finfish catch was weighed and measured when possible. Observations were made of the condition of the TED, possible blockage of the TED, and condition of the trawl and cod-end. Digital still pictures were taken of the fishing operations, and underwater video was attempted during daylight when possible.

The data were analyzed by first comparing the paired scallop catch weights in the TED and the control trawls for each set of tows in each leg of the study using a paired T-test implemented in Excel. The null hypothesis was no difference in the catch weights, and this was evaluated at $\alpha=0.05$ in a one tailed comparison, assuming that the TED equipped net would only catch a equal or less weight of scallops. When the null hypothesis was accepted, then power of the T-test was also evaluated using methods described by Zar, 1984. The power of the test is the probability of correctly rejecting a false null hypothesis. Additionally, the mean ratio of the weight of the scallop catch in the TED equipped trawl to the weight of the scallop catch in the control trawl for each pair was estimated, and evaluated in Excel to determine if it was significantly different from 1 at $\alpha=0.05$. The null hypothesis was that if there was no difference between the scallop catch rates, the ratio would be 1. The ratio test is an alternate evaluation procedure, and is less affected by the relative magnitude of the catch weights in the experimental and control nets, and therefore may be more sensitive to detecting true differences in the catch performance of the experimental and control nets. The length-frequency (LF) distributions of the scallop catches in the TED and control trawls were evaluated using a Kolmorgov-Smirnoff test on the cumulative L-F distributions with $\alpha=0.05$. The null hypothesis was that there was no significant difference in the L-F distributions. The relationship of total catch weight to the ratio of the scallop catch weight in the TED trawl to the control trawl was evaluated using regression analysis implemented in Excel at $\alpha=0.05$. If the slope of the relationship was not significantly different from 0, then there was no statistical effect of total catch weight on scallop catch performance in the TED equipped trawl relative to the control trawl. Finally, the total catch weights and catch weights of dominant bycatch in the tows were evaluated. A paired T-test was implemented in Excel at $\alpha=0.05$ in a one-tailed comparison. The null hypothesis was that there is no difference between the total catch weight and the catch weights of skate and dogfish in the TED equipped trawl as compared to the control trawl.

RESULTS

Field Observations

Leg 1

The first leg of the study was conducted between 1 and 9 June 2009, and a total 18 pairs of tows were completed. All tows were conducted in an area south of western Long Island. The locations of all tows are shown in Figure 2, and listed in Table 1. The

size of the TED caused many problems while being hauled aboard the FV Capt. Dell. The scallop trawls are traditionally short in length with a sharp or strong taper, in order to reduce the amount of netting that must be dealt with and stored on deck. There were dangerous situations created when the crew had to haul the large TED aboard with the heavy rubber chaffing gear. Capt. Newman reported that he believed the large rubber mats used for chaffing gear caused the TED to dig into the sediment and produced a significant amount of drag, and was pulling the vessel off course. He also expressed concern with the problems associated with the drag, such as limited horsepower and extra fuel cost. With the addition of twine chaffing gear, Capt. Newman believed that some of these net drag problems could be eliminated, however this would result in insufficient protection of the gear, damaging the netting on the bottom of the TED, thus causing an additional expense to repair. Scallops were documented building up at the base of the TED, where the round bar frame is attached to the bottom of the net (Figures 3 and 4). Although many hours of video data collection were collected, only a very limited segment of underwater video with sufficient clarity showed a limited number of scallops escaping out the top opening of the extension.

Leg 2

The second leg of the study was conducted between 10 and 13 June on board the FV Papa's Girl, and a total 9 pairs of tows were completed. All tows were conducted in an area south of western Long Island. The locations of all tows are shown in Figure 2, and listed in Table 1. Aboard the FV Papa's Girl many problems arose due to difficulty with the trawl doors. While it is not clear that TED directly caused these problems, Capt Gibbs believed that the twisting of the doors before they reached the bottom was related to the use of the TED. Capt Gibbs was concerned that that drag caused by the TED chaffing gear was too much for his low powered vessel to handle. There were times when the vessel was pulled up to 8 degrees off course. His concern was being able to pull two of the TEDs as would be required per regulation. Capt Gibbs believed he would no longer be able to participate in the scallop fishery due to his vessel's inability to effectively fish two TEDs. No underwater video was successfully collected in this leg.

Leg 3

The third leg of the study was conducted between 14 and 16 June, and a total 9 pairs of tows were completed. All tows were conducted in an area south of western Long Island. The locations of all tows are shown in Figure 2, and listed in Table 1. During leg 3 there were the same problems as noted previously occurred aboard the FV Capt Dell. Capt Newman noted his biggest problem was associated with the all the extra gear aboard vessel, there was a lack of space available to handle the cumbersome TEDs. No underwater video was successfully collected in this leg.

Data Analysis

Leg 1

The scallop catch weights for leg 1 are listed in Table 2. The mean catch of whole scallops in the control trawl was 811 pounds, while the mean catch of whole scallops in the TED equipped trawl was 753 pounds. The results of the paired T-test for scallop catch weights indicated a significant difference in scallop catch between the TED equipped trawl and the control trawl ($p=0.005$). On average the TED equipped trawl caught 93% of the scallop weight of the control trawl, representing a 7% loss in scallops. The mean of the ratios was significantly different from 1, further reinforcing the conclusion that the TED was significantly the TED catch efficiency for scallops. The length-frequency distribution of the scallop catches between the TED equipped trawl and the control trawl are shown in Figure 5, and the results of the K-S test indicated a significant difference in the distributions, however this was due to the very large sample size and sensitivity of the analysis to large sample sizes. Visual examination of the L-F plots indicates no substantive differences between the distributions. The total catch weights for leg 1 are listed in Table 3. The mean total catch in the control trawl was 932 pounds, while the mean total catch in the TED equipped trawl was 842 pounds. On average the TED equipped trawl caught 90% of the total catch weight of the control trawl, representing a 10% loss in total catch weight. The slope of the regression of total catch weight on the ratio of scallop catch weight to control trawl catch weight was not significantly different from 0, so total catch weight did not have a significant statistical effect on scallop retention. Total bycatch in both the TED equipped and control scallop trawls including shell, sponge, crabs, starfish, skate, dogfish, and other finfish amounted to 13-15% of the total catch. The dominant fish bycatch was skate with a mean catch weight of approximately 60 pounds per tow for both the TED equipped and control trawls, or about 7 % of the total catch weight. The skate catch weights for leg 1 are listed in Table 4. There was a significant difference in the catch weight of skate per tow between the TED equipped trawl and the control trawl, with the TED equipped trawl catching about 90% of the skate of the control trawl. The second most dominant fish bycatch was dogfish with a mean catch weight of approximately 27 pounds per tow in the control trawl, and 13 pounds per tow in the TED equipped trawl, or about 3 % of the total catch weight. There was a significant difference in the catch weight per tow of dogfish between the TED equipped trawl and the control trawl, with the TED equipped trawl catching about 50% of the dogfish of the control trawl.

Leg 2

The scallop catch weights for leg 2 are listed in Table 5. The mean catch of whole scallops in the control trawl was 643 pounds, while the mean catch of whole scallops in the TED equipped trawl was 600 pounds. The results of the paired T-test for scallop catch weights indicated no significant difference in scallop catch between the TED equipped trawl and the control trawl ($p=0.120$). The power of the test was 0.60. However, on average the TED equipped trawl caught 93% of the scallop weight of the control trawl, representing a 7% loss in scallops. The mean of the ratios was also not

significantly different from 1. The failure of the paired T-test and the other descriptive statistical tests to detect a significant difference is likely due to the small sample size, resulting in low power of the tests, 9 pairs on Leg 2 versus 18 pairs on Leg 1. The length-frequency distribution of the scallop catches between the TED equipped trawl and the control trawl are shown in Figure 6, and the results of the K-S test indicated a significant difference in the distributions, however this was due to the very large sample size and sensitivity of the analysis to large sample sizes. Visual examination of the L-F plots indicates no substantive differences between the distributions. The total catch weights for leg 2 are listed in Table 6. The mean total catch in the control trawl was 723 pounds, while the mean total catch in the TED equipped trawl was 664 pounds. The results of the paired T-test for total catch weights indicated no significant difference in total catch between the TED equipped trawl and the control trawl. Total bycatch in the scallop trawls including shell, sponge, crabs, starfish, skate, dogfish, and other finfish amount to 10-11% of the total catch. The dominant fish bycatch was skate with a mean catch weight of approximately 27 pounds per tow, or about 4 % of the total catch weight. The skate catch weights for leg 2 are listed in Table 7. There was no significant difference in the catch weight of skate per tow between the TED equipped trawl and the control trawl, with the TED equipped trawl catching on average about 106% of the skate of the control trawl. The second most dominant fish bycatch was dogfish with a mean catch weight of approximately 3 pounds per tow in both the TED equipped trawl and the control trawl, or about less than 1% of the total catch weight. There was no significant difference in the catch weight of dogfish per tow between the TED equipped trawl and the control trawl.

Leg 3

The scallop catch weights for leg 3 are listed in Table 8. The mean catch of whole scallops in the control trawl was 766 pounds, while the mean catch of whole scallops in the TED equipped trawl was 664 pounds. The results of the paired T-test for scallop catch weights indicated no significant difference in scallop catch between the TED equipped trawl and the control trawl ($p=0.055$). The power of the T-test was 0.89. On average the TED equipped trawl caught 87% of the scallop weight of the control trawl, representing a 13% loss in scallops. The mean of the ratios was not significantly different from 1. The failure of the paired T-test and the other descriptive statistical tests to detect a significant difference is again likely due to the small sample size, 9 pairs on Leg 3 versus 18 pairs on Leg 1, and in fact if α was set to 0.10, then the difference would be significant. The length-frequency distribution of the scallop catches between the TED equipped trawl and the control trawl are shown in Figure 7, and the results of the K-S test indicated no significant difference in the distributions. The total catch weights for leg 3 are listed in Table 9. The mean total catch in the control trawl was 872 pounds, while the mean total catch in the TED equipped trawl was 759 pounds. The results of the paired T-test for total catch weights indicated no significant difference in total catch between the TED equipped trawl and the control trawl. Total bycatch in the scallop trawls including shell, sponge, crabs, starfish, skate, dogfish, and other finfish amount to about 12% of the total catch. The dominant fish bycatch was skate with a mean catch weight of approximately 41 pounds per tow, or about 5-6 % of the total catch weight. The skate

catch weights for leg 3 are listed in Table 10. There was a no significant difference in the catch weight of skate per tow between the TED equipped trawl and the control trawl. Only a single dogfish was caught in Leg 3, so no statistical comparison was conducted.

DISCUSSION AND CONCLUSIONS

The previous study conducted in 2006 of catch performance of a NMFS certified whelk TED in the scallop trawl fishery documented a 7-8% on average loss of the target species depending on the net design, and an low bycatch rate of other species (Lawson and DeAlteris 2006). The results of this study of the catch performance of a NMFS certified flounder TED in scallop trawl fishery documented similar results. In leg 1 with 18 paired tows, the scallop loss was 7%, and this was a significant difference. The result of leg 2 conducted on a different vessel documented a similar loss, but it was not significant, likely due to a smaller number of replicate tows (n=9). Leg 3 included the use of an additional extension section ahead of the TED extension section, and the loss of scallop increased to 13%, but there was not a significant difference between the TED catch weigth of scallops and the control catch weight of scallops, again likely due the low sample size (n=9). Total bycatch in fishery was including shells, sponge, crabs, fish, etc ranged from 7-15%, and skate was the dominant fish bycatch at about 4-7% of the total catch. Skate catch was reduced significantly with the use of the TED in leg 1 but not significantly in legs 2 and 3, again likely due to the smaller replicate number for Legs 2 and 3.

For fishermen that fish under a limited access permit with a 400 pound daily limit, the catch limit can often be realized in 2 to 3 tows. If equipped with TEDS, scallop trawl vessels may trawl longer to compensate for the catch loss. Hence a 7% catch loss per haul may not mean that a trip returns to port with 7% less catch for this set of vessels. However, TEDs will be a challenge for the small boat fishermen to handle at sea, and some smaller and low- powered vessels in the fishery will have difficulty towing and handling the TEDs.

LITERATURE CITED

Lawson DD, DeAlteris JT. 2006. Evaluation of a turtle excluder device (TED) in the scallop trawl fishery of the mid-Atlantic. [Final report; 145 p] NOAA Contract No. EA133F-05-SE6561

Zar, J.H. 1984. Biostatistical analysis. Prentice Hall. NJ. 718p.

Figure 1. A diagram of the NMFS flounder TED, showing all dimensions in inches.

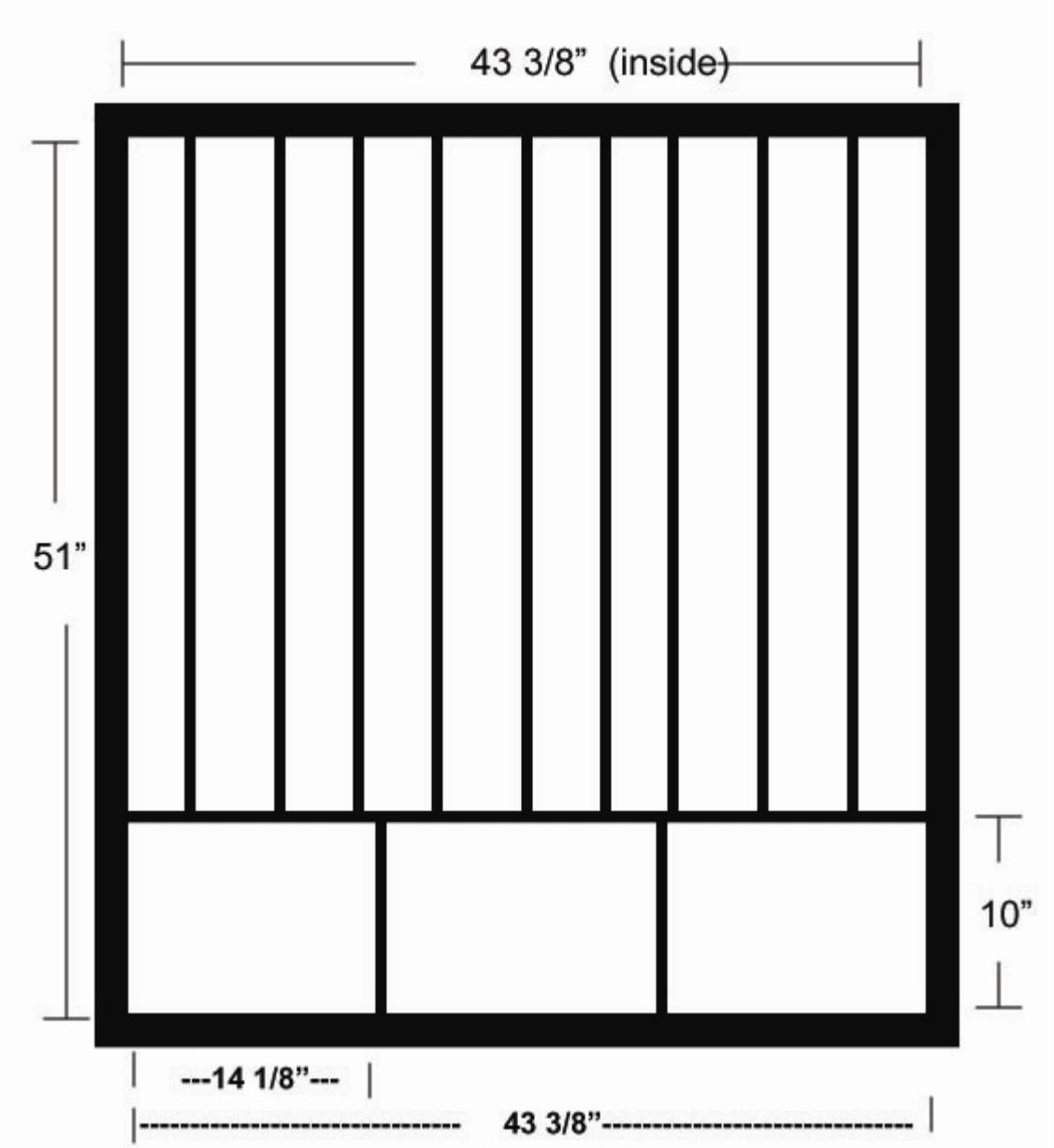

Figure 2. Chart showing the locations of the starting points of all tows conducted during Leg 1, 2 and 3 respectively of the study.

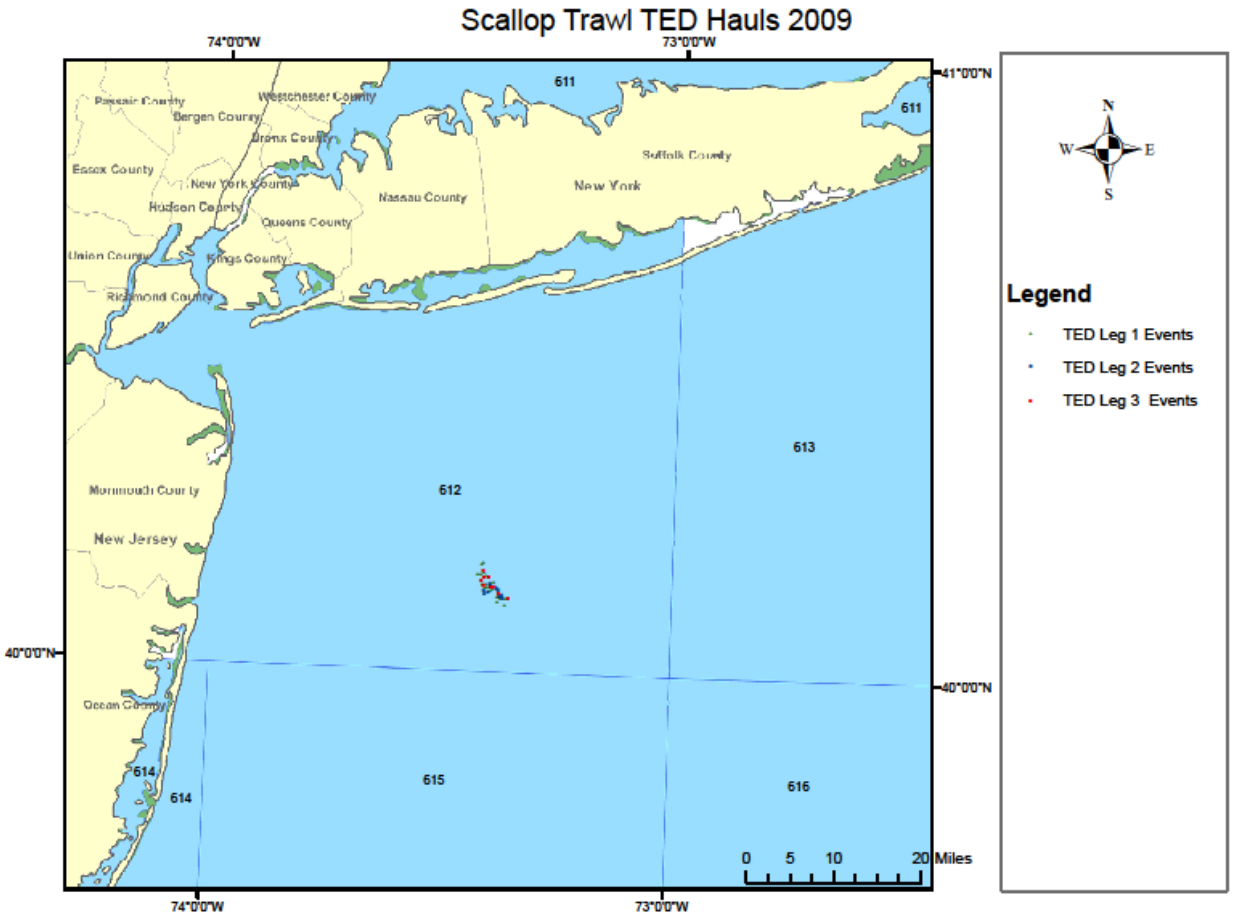

Figure 3. Photograph of accumulated scallops ahead of the TED, that have not moved back into the codend before haulback.

Figure 4. Scallops in the rear section of the belly of the trawl that did not make it back to the TED extension section, and therefore did not pass into the codend.

Figure 5. Length-frequency distribution of scallop shell height for Leg 1.

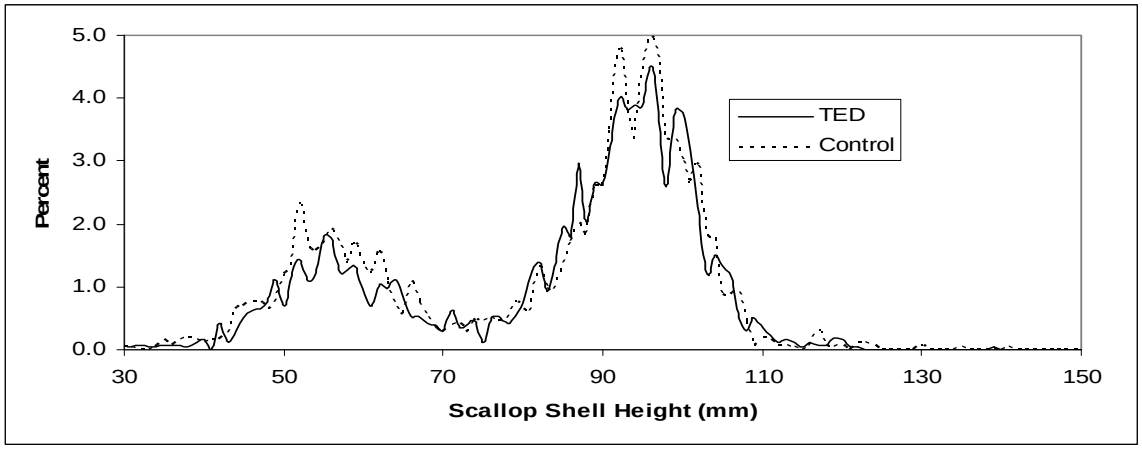

Figure 6. Length-frequency distribution of scallop shell height for Leg 2.

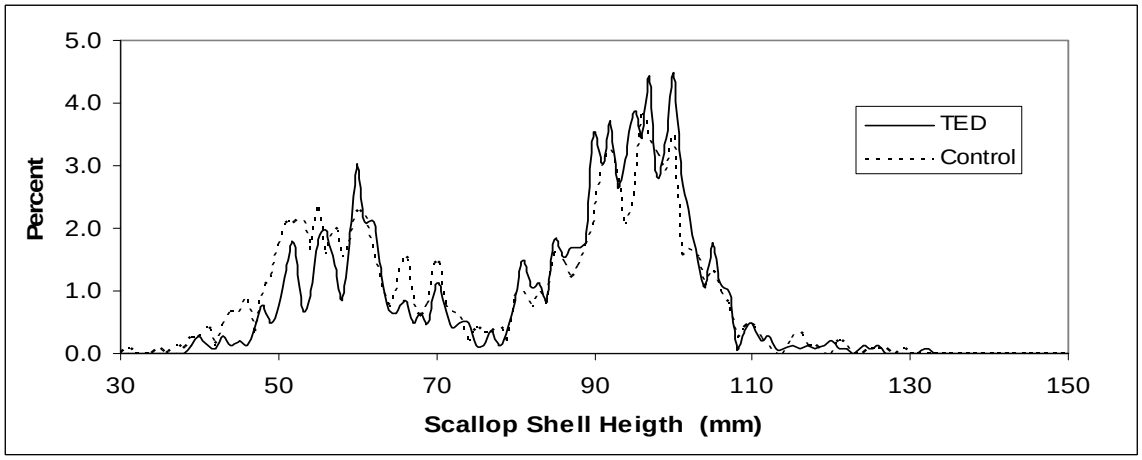

Figure 7. Length-frequency distribution of scallop shell height for Leg 3

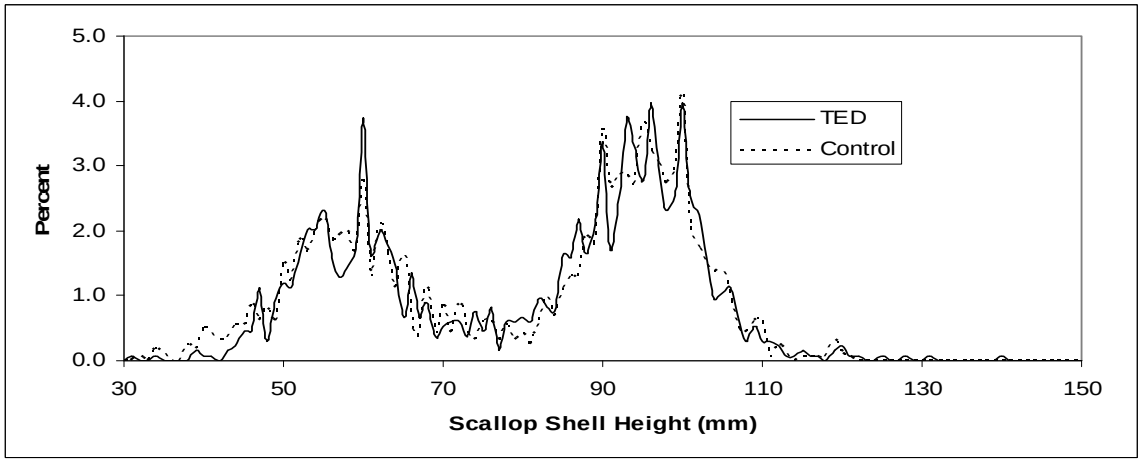

Table 1. Latitude and longitude (degrees . minutes . hundredths of a minute) of the starting locations of all experimental tows in Legs 1, 2 and 3.

Leg 1, FV Capt Dell

Date	Tow #	Latitude	Longitude
1-Jun-09	1	40.10.46	73.24.37
	2	40.08.52	73.23.14
2-Jun-09	1	40.08.76	73.23.55
	2	40.07.23	73.22.41
	3	40.06.38	73.21.41
4-Jun-09	1	40.09.43	73.24.30
	2	40.07.77	73.24.04
	3	40.07.27	73.22.31
6-Jun-09	1	40.10.29	73.24.52
	2	40.08.36	73.23.98
	3	40.06.52	73.22.40
7-Jun-09	1	40.09.30	73.24.56
	2	40.07.97	73.23.76
	3	40.07.09	73.22.17
8-Jun-09	1	40.09.25	73.24.78
	2	40.07.78	73.23.78
	3	40.07.56	73.22.96
9-Jun-09	1	40.08.89	73.24.13
	2	40.07.66	73.23.18
	3	40.07.10	73.21.35

Leg 2, FV Papa's Girl

Date	Tow #	Latitude	Longitude
10-Jun-09	1	40.07.62	73.23.91
	2	40.07.68	73.22.48
	3	40.07.51	73.23.56
11-Jun-09	1	40.07.44	73.23.84
	2	40.07.65	73.22.39
	3	40.06.97	73.21.69
	4	40.07.29	73.21.88
12-Jun-09	1	40.08.34	73.23.39
	2	40.07.12	73.21.61
	3	40.08.19	73.23.08
13-Jun-09	1	40.08.54	73.23.40
	2	40.07.28	73.21.73

Leg 3, FV Capt Dell

Date	Tow #	Latitude	Longitude
14-Jun-09	1	40.08.60	73.24.48
	2	40.08.21	73.23.38
	3	40.07.13	73.21.14
15-Jun-09	1	40.09.13	73.23.51
	2	40.07.82	73.23.18
	3	40.09.12	73.23.88
16-Jun-09	1	40.09.52	73.24.35
	2	40.08.24	73.23.93
	3	40.07.48	73.21.93

Table 2. Scallop catch weights for Leg 1 of the study. Catch weights are in pounds, and are for scallops in the shell. Side is the net location on the Port and Starboard side of the vessel. Ratio T/C is ratio of TED catch weight to Control catch weight.

Date	Tow #	TED	Control	Side	Ratio T/C
2-Jun-09	1	941	1045	P-S	0.90
	2	828	953	P-S	0.87
	3	704	886	P-S	0.79
4-Jun-09	1	570	673	S-P	0.85
	2	471	374	S-P	1.26
	3	1363	1351	S-P	1.01
6-Jun-09	1	584	693	P-S	0.84
	2	443	554	P-S	0.80
	3	920	898	P-S	1.02
7-Jun-09	1	519	652	S-P	0.80
	2	281	389	S-P	0.72
	3	945	1095	S-P	0.86
8-Jun-09	1	294	391	P-S	0.75
	2	852	810	P-S	1.05
	3	1155	1120	P-S	1.03
9-Jun-09	1	202	344	S-P	0.59
	2	1200	1064	S-P	1.13
	3	880	889	S-P	0.99

Table 3. Total catch weights for Leg 1 of the study. Catch weights are in pounds. Side is the net location on the Port and Starboard side of the vessel. Ratio T/C is ratio of TED catch weight to Control catch weight.

Date	Tow #	TED	Control	Side	Ratio T/C
2-Jun-09	1	1005	1144	P-S	0.88
	2	898	1071	P-S	0.84
	3	819	1024	P-S	0.80
4-Jun-09	1	699	837	S-P	0.84
	2	574	475	S-P	1.21
	3	1609	1693	S-P	0.95
6-Jun-09	1	716	874	P-S	0.82
	2	540	649	P-S	0.83
	3	1022	1056	P-S	0.97
7-Jun-09	1	681	833	S-P	0.82
	2	353	487	S-P	0.72
	3	1201	1331	S-P	0.90
8-Jun-09	1	347	481	P-S	0.72
	2	945	956	P-S	0.99
	3	1260	1278	P-S	0.99
9-Jun-09	1	260	418	S-P	0.62
	2	1298	1200	S-P	1.08
	3	935	979	S-P	0.96

Table 4. Skate catch weights for Leg 1 of the study. Catch weights are in pounds. Side is the net location on the Port and Starboard side of the vessel. Ratio T/C is ratio of TED catch weight to Control catch weight.

Date	Tow #	TED	Control	Side	Ratio T/C
2-Jun-09	1	19	45	P-S	0.42
	2	51	64	P-S	0.80
	3	75	91	P-S	0.82
4-Jun-09	1	58	52	S-P	1.12
	2	65	50	S-P	1.30
	3	167	191	S-P	0.87
6-Jun-09	1	26	36	P-S	0.72
	2	48	43	P-S	1.12
	3	57	71	P-S	0.80
7-Jun-09	1	65	74	S-P	0.88
	2	44	51	S-P	0.86
	3	180	171	S-P	1.05
8-Jun-09	1	24	35	P-S	0.69
	2	20	25	P-S	0.80
	3	25	29	P-S	0.86
9-Jun-09	1	18	19	S-P	0.95
	2	40	50	S-P	0.80
	3	17	24	S-P	0.71

Table 5. Scallop catch weights for Leg 2 of the study. Catch weights are in pounds of scallops in shell. Side is the net location on the Port and Starboard side of the vessel. Ratio T/C is ratio of TED catch weight to Control catch weight.

Date	Tow #	TED	Control	Side	Ratio T/C
11-Jun-09	1	290	251	P-S	1.16
	2	453	431	P-S	1.05
	3	582	561	P-S	1.04
	4	354	452	P-S	0.78
12-Jun-09	1	581	688	S-P	0.84
	2	656	700	S-P	0.94
	3	383	613	S-P	0.62
13-Jun-09	1	780	876	S-P	0.89
	2	1319	1212	S-P	1.09

Table 6. Total catch weights for Leg 2 of the study. Catch weights are in pounds. Side is the net location on the Port and Starboard side of the vessel. Ratio T/C is ratio of TED catch weight to Control catch weight.

Date	Tow #	TED	Cont	Side	Ratio T/C
11-Jun-09	1	367	313	P-S	1.17
	2	513	517	P-S	0.99
	3	661	646	P-S	1.02
	4	417	514	P-S	0.81
12-Jun-09	1	629	759	S-P	0.83
	2	720	775	S-P	0.93
	3	426	704	S-P	0.61
13-Jun-09	1	828	945	S-P	0.88
	2	1411	1332	S-P	1.06

Table 7. Skate catch weights for Leg 2 of the study. Catch weights are in pounds. Side is the net location on the Port and Starboard side of the vessel. Ratio T/C is ratio of TED catch weight to Control catch weight.

Date	Tow #	TED	Control	Side	Ratio T/C
11-Jun-09	1	51	31	P-S	1.16
	2	29	30	P-S	1.05
	3	28	32	P-S	1.04
	4	19	23	P-S	0.78
12-Jun-09	1	23	26	S-P	0.84
	2	29	23	S-P	0.94
	3	21	23	S-P	0.62
13-Jun-09	1	14	20	S-P	0.89
	2	45	37	S-P	1.09

Table 8. Scallop catch weights for Leg 3 of the study. Catch weights are in pounds for scallops in shells. Side is the net location on the Port and Starboard side of the vessel. Ratio T/C is ratio of TED catch weight to Control catch weight.

Date	Tow #	TED	Control	Side	Ratio T/C
14-Jun-09	1	283	226	P-S	1.25
	2	897	724	P-S	1.24
	3	1142	1203	P-S	0.95
15-Jun-09	1	482	707	S-P	0.68
	2	417	545	S-P	0.77
	3	988	1327	S-P	0.74
16-Jun-09	1	592	667	P-S	0.89
	2	176	178	P-S	0.99
	3	1003	1319	P-S	0.76

Table 9. Total catch weights for Leg 3 of the study. Catch weights are in pounds. Side is the net location on the Port and Starboard side of the vessel. Ratio T/C is ratio of TED catch weight to Control catch weight.

Date	Tow #	TED	Control	Side	Ratio T/C
14-Jun-09	1	329	277	P-S	1.19
	2	989	794	P-S	1.25
	3	1259	1311	P-S	0.96
15-Jun-09	1	518	763	S-P	0.68
	2	475	611	S-P	0.78
	3	1061	1440	S-P	0.74
16-Jun-09	1	678	765	P-S	0.89
	2	225	236	P-S	0.95
	3	1296	1653	P-S	0.78

Table 10. Skate catch weights for Leg 3 of the study. Catch weights are in pounds. Side is the net location on the Port and Starboard side of the vessel. Ratio T/C is ratio of TED catch weight to Control catch weight.

Date	Tow #	TED	Control	Side	Ratio T/C
14-Jun-09	1	24	20	P-S	1.20
	2	30	31	P-S	0.97
	3	50	55	P-S	0.91
15-Jun-09	1	10	9	S-P	1.11
	2	21	11	S-P	1.91
	3	10	17	S-P	0.59
16-Jun-09	1	4	10	P-S	0.40
	2	13	6	P-S	2.17
	3	218	209	P-S	1.04