Field Trials of 4" Rings in the Inshore Scallop Fishery of the Gulf of Maine.

Final Report to the Northeast Consortium

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A collaborative project:

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ABSTRACT:
In November of 2003, a project in eastern Maine coastal waters evaluated the selectivity of 4” (101.6mm) diameter rings used in a scallop drag, as compared to a drag rigged with the regulation-sized 3.5” (88.9mm) rings. This project was a partnership between industry members and staff from Maine Sea Grant. The fieldwork used side-by-side tows by two fishing vessels, and a paired tow analysis. Experimental and control drags were switched between vessels each day. Data collection included: catch volumes of scallops and other species, and scallop shell heights (SH), as a function of location and bottom type.

Ten fishing days were completed in eastern Maine, both inside and outside of Cobscook Bay. A significant loss of scallops was observed with the larger rings. A lesser difference also existed for urchin catch volumes, but no differences were detected for lobster, sea cucumber or rubble.

Scallop numbers caught in the drags were analyzed, with respect to sub-legal and legal sizes. Loss of legal scallops, by number, at the 2003-2004 regulated SH of 3.75” (95.2mm) was approximately 10%. Loss of legal scallops, by number, when judged at the present regulated SH of 4.00” (101.6mm) was 3%. Sub-legal scallop landings were reduced by approximately 25.5%. Further testing in deeper waters along the coast will help to understand selectivity patterns more fully.

INTRODUCTION:
The fishery for sea scallops (*Placopecten magellanicus)* in Maine’s coastal waters is important to fishermen of the state. Though landings fluctuate, the fishery takes place during a time of year when fishermen are not generally occupied in other fisheries, and represents an important source of income. Maine scallops enjoy a premier place in the market, and often command top prices. The fishery is prosecuted via the traditional means of dragging and through diving, which is more contemporary.

Configuration of scallop drags remains much the same as when they were first introduced (Cook, 1983). The behavior of scallop drags has thus been well described for offshore fisheries, and their efficiency and selectivity is reasonably well understood (Caddy, 1972; DuPaul and Kirkley, 1995; Serchuck and Smolowitz, 1980), including the use of 4” rings (DuPaul, 2002-a, -b and -c; Bourne, 1965). However, inshore drags such as those used in Maine are less well understood. It is important to better understand the gear in inshore waters. A series of prioritization meetings, held in 2000, identified scallop gear research as a high-level goal (Maine Dept. of Marine Resources, 2001). Specific language in the report from that effort included:

"With the national focus by environmental groups on the effects of dragging, scallopers place a high priority on credible studies of the impact of scallop gear on the bottom, and its' impact on the scallop resource and discard rate. Conservation engineering on scallop gear emerged as a very high priority.

Research priorities are:
A- Improve the design of scallop gear to better select out juveniles, reduce discards, and reduce bottom impacts
B - Develop and communicate credible methods for doing gear impact research."

The issue of cutting sub-legal scallops ('shorts') came up several times during the course of the meetings in 2000. Increased scallop drag selectivity would reduce mortality from the capture process, and would reduce the opportunity to harvest short scallops.

The PI's met during the 2003 Maine Fishermen's Forum, held annually in Rockport. The comparison between the two ring sizes was identified as a topic of interest to both, and NEC funding was sought and granted later in 2003.

OBJECTIVES:

Our project entailed three objectives:

1 - Evaluate the selectivity of a standard drag rigged with 3.5" rings, vs. an experimental drag rigged with 4" rings.
2 – Conduct the study in such a way that the process and the findings are credible, and of use to fishermen, scientists, managers and others.
3 - Transfer the results of the work to industry and other interested groups and individuals.

METHODS AND MATERIALS:

Locations:
Consultations with fishermen and others revealed that fishing both inside and outside Cobscook Bay was important. Thus, six days were planned for fishing in Cobscook Bay, and four days outside the bay, from the shore west of Cutler to Buck's Harbor. Fishing patterns were kept as close to the commercial standard as possible. Capt. Patryn operated his own vessel while Capt. Larry White operated the F/V Double J. Both operators have significant experience in scalloping.

Time:
All fieldwork was conducted in November of 2003. Maine's regulated season for scallops begins in December, so a Special License was obtained for the work from the Maine Dept. of Marine Resources, as approved by their Advisory Council. Regular contact was maintained with Marine Patrol. November was chosen so the vessels would have access to as minimally disturbed a population as possible, close to the actual fishing season.

Vessels:
Vessels owned by the co-PI's were used during this project. Some specifications of the vessels and photos are shown below in Table 1, and Figure 1.

Table 1. Some characteristics of the *F/V's Northern Eagle* and *Double J*.

	F/V Northern Eagle	**F/V Double J**
Owner	Steve Patryn	Robert Holland
Captain	Steve Patryn	Larry White
LOA	49 ft. (14.9m)	44 ft. (13.4m)
Width	15 ft. (4.6m)	14 ft. (4.3m)
Draft	5.5 ft. (1.7m)	5.0 ft. (1.5m)
Horsepower	375 (Caterpillar)	255 (Isuzu)

Figure 1. F/V Double J (left) and F/V Northern Eagle, preparing to begin the project.

Both vessels hail from Jonesport, ME, and are both rigged to fish over the stern. As such, they dump the catch from the back of the drag, described below.

Drags:

Drags were built by Blue Fleet, Inc. of New Bedford, MA. The drags measured 5.5' (1.7m) between the outside edges of the shoes, in compliance with size limitations for Cobscook Bay. Head bails were constructed of 2" (50mm) round iron stock. Twine tops were 6" (152mm) diamond mesh. Since both vessels are set up to empty drags through the club end, the drags were equipped with a 'pocketbook' style dump. Photos of the drags are shown in Figures 2 and 3, some rigging specifications are shown in Table 2.

Figure 2. Control Drag (3.5" rings)

Figure 3. Experimental Drag (4.0" rings)

Table 2. Some construction characteristics of the Control and Experimental drags.

	Control (3.5" rings)	Experimental (4" rings)
Bottom linking	Triple	Triple
Top and side linking	Double	Double
# Rings in 1st top row	14	12
# Rings deep (bottom)	6	5
Approx. length of bag overall	5.2 ft (1.6m)	5.2 ft. (1.6m)
Twine top meshes across	51	36
Twine top meshes down	5.5	6.5

The difference in the twine tops was noticed late in the study, and is discussed later in this report.

Fishing protocol:

A paired tow approach was applied: vessels fished as nearly side by side as possible. One vessel fished the experimental (4.0" rings) drag, while the other, the control (3.5") drag. The vessel captains were in regular radio contact, to coordinate setting and retrieval of the drags. Start and stop time were determined by the setting and loosening of the brake. Drags were switched between boats daily. Notes were kept on start/stop time and position, speed over ground (knots), depth (fathoms), and the ratio of wire out to depth. Captains were also asked to give an estimate of the hardness of the bottom.

Sampling:

On both vessels, catch was emptied from the drag onto a stern table. Crewmembers (each vessel carried 2 crew) sorted the catch by the categories: scallops, sea cucumbers (*Cucumaria frondosa*), green sea urchins (*Strongylocentrotus droebachiensis*), starfish species, finfish species, lobster (*Homarus americanus*), crab species, and 'trash,' which included rocks, shells, seaweed and other debris. Volumes of the catch were recorded in 'standard' orange fish scaling baskets.

Scallop shell heights, in millimeters, were determined with digital calipers (Sylvac Ultra-Cal IV). Heights were taken from the umbo to the anterior margin. Shell height data was transmitted directly from the calipers to a Juniper Systems Allegro CE field computer. In cases where time permitted, all scallops from a tow were measured, rather than measuring a sample from the tow.

<u>Analysis:</u>
Once fieldwork was complete, and the data sheets and other materials submitted, the information was reviewed to determine which tow pairs were useable. Few tow pairs were discarded; the most common reason for discarding a tow pair was that one boat or other 'hung down' (the drag caught on an obstruction on the bottom) or otherwise had to interrupt its tow.

<u>Tow Times and Depths:</u>
Tow durations of all tows were compared between the experimental and control drags via a paired t-Test. Average tow durations (with standard error) were also calculated for all tows inside Cobscook, outside Cobscook, and all tows together. Tow depths were observed to be identical between vessels, and are summarized in the results.

Based on conversations with industry and scientists, the data was grouped in segments with respect to bottom type and location, as follows:

Cobscook Bay, soft bottom
Cobscook Bay, hard bottom
Outside Cobscook bay, soft bottom
Outside Cobscook bay, hard bottom
All Cobscook tows
All Outside tows
All tows combined

<u>Catch Volumes:</u>
Catch volume data for scallops, trash, lobsters, crabs, sea cucumbers, starfish and urchins were analyzed. F-Tests were used to determine heterogeneity of variance, and the appropriate paired-sample t-Test (for similar or dissimilar variance) was then applied. All tests were carried out at the 95% confidence level, using Microsoft Excel Software Version X for Macintosh.

<u>Effects of vessels, locations, bottom type and drags:</u>
The effects on catch volumes for four variables were tested via ANOVA: vessel (Northern Eagle vs. Double J), location (inside vs. outside Cobscook), bottom type (hard vs. soft) and drag (control vs. experimental). Factors were tested separately, and as interactions between the factors.

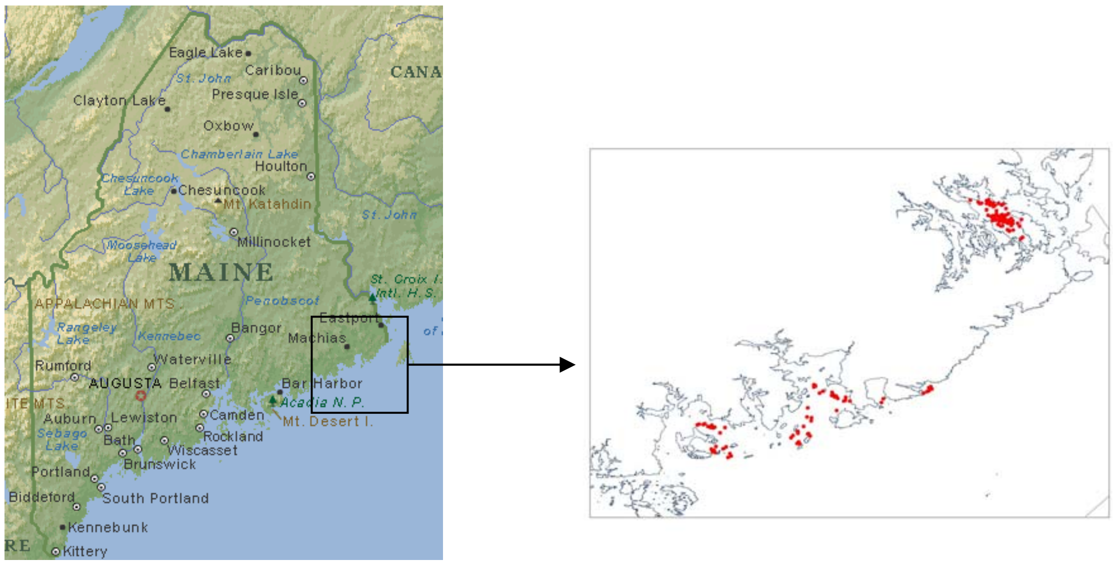
Length Frequency Data:
Comparisons concerning shell height were made between the control and experimental drags with respect to location: within Cobscook Bay, outside Cobscook Bay, and all tows over all locations. The analysis used was the Kolmogorov-Smirnov two-sample test, calculated at 95% confidence.

Estimation of numbers of scallops caught, by size:
It was not possible to measure every scallop during all the tows, and thus the total number of scallops captured was unknown. An estimate of scallop numbers was produced. Length frequencies for each data group (location, bottom type and drag type) were matched with the percentage of the total catch that was sampled for that group, and numbers of scallops at each size estimated. For example, if the sampling on hard bottom in Cobscook Bay resulted in measuring 50 scallops of 75mm with the 4" drag, and we sampled 50% of the hard bottom/Cobscook/experimental drag catch, then we estimated an actual catch of one hundred 75mm scallops, for that bottom type/location/drag type.

Estimates of actual catches were then pooled by location (Cobscook, outside Cobscook, and all locations together), and shown graphically. Further estimates of the difference in actual catches of legal and sublegal scallops, under the assumptions of a 3.75" minimum size and 4" minimum size, were also made. In this way, estimates in the reduction of the legal scallop harvest by the experimental drag (as well as the potential reduction of short scallops landed on deck) were created.

RESULTS:
Initial project plans included six fishing days in Cobscook Bay, and four fishing days outside the bay. However, logistics and weather forced an early move from Cobscook, and thus there were five fishing days in each general location. Locations for the tows are shown in Figure 4.

Figure 4. Locations of scallop tows made during drag tests, November 2003.



<u>Depth and Tow Duration:</u>
Depths and tow durations were similar for both vessels. 165 tows were compared for tow duration, covering the entire study, with tow times for each drag averaging an identical 8.22 minutes (S.E. for the control = 0.131, S.E. for the experimental = 0.132). Tows in Cobscook averaged 7.45 (S.E. = 0.95) minutes for the control drag and 7.46 (S.E. - 0.093) minutes for the experimental, and tows outside of Cobscook averaged 9.1 minutes for both drags (S.E. = 0.221 and 0.224 for the control and experimental, respectively).

Vessels recorded identical depths fished, for all tows. Cobscook tows averaged 48.3 feet (14.7m, S.E.=0.92) in depth, while tows outside Cobscook averaged 75.5 feet (23.0m, S.E.=3.47).

<u>Volume summary stats / T-test results:</u>
Results of catch volumes and t-Tests for urchins, cucumbers, lobsters and trash are summarized in Table 3. Finfish catch was too low to permit useful analysis. Scallop catch volumes are described in somewhat closer detail, in Table 4. In both tables, '# Tows in Analysis' refers to the number of tows in which the species appeared.

Catch rates dropped by roughly half once outside of Cobscook Bay. t-Tests detected significant difference in catch volumes for all locations except for tows on hard bottom outside Cobscook.

Table 3. Summary of catch volumes (# of baskets) and t-Test results for some species and trash, over all tows.

Species	Drag	Total Catch (baskets)	# Tows in Analysis	Catch/tow (baskets)	Significant Difference Cont.vs Exp?	p-Value
Urchins	Control	71.8	125	0.6	Yes	<.01
	Experimental	51.7	121	0.4		
Cucumbers	Control	15.4	122	0.1	No	0.97
	Experimental	14	112	0.1		
Lobster	Control	32	21	1.5	No	0.16
	Experimental	26	21	1.2		
Trash	Control	433.3	159	2.7	No	0.15
	Experimental	396.4	159	2.5		

Table 4. Scallop volumes (# of baskets) and t-Test results, by location and bottom type.

Description	Total Catch	# Tows in Analysis	Catch/tow (baskets)	Significant Difference Cont.vs Exp?	p-value (2-tailed)
Cobscook, soft bottom		79			
Control	110.7		1.4	Yes	<.01
Experimental	91.6		1.2		
Cobscook, hard bottom		7			
Control	8.5		1.2	No	0.59
Experimental	7		1		
Outside, soft bottom		58			
Control	34.2		0.6	Yes	0.03
Experimental	26.4		0.5		
Outside, hard bottom		19			
Control	9.3		0.5	No	0.57
Experimental	8.4		0.4		
All Cobscook tows		86			
Control	119.2		1.4	Yes	<.01
Experimental	98.6		1.1		
All Outside tows		77			
Control	43.5		0.6	Yes	0.03
Experimental	34.9		0.5		
All Tows		163			
Control	162.7		1	Yes	<.01
Experimental	133.5		0.8		

ANOVA results:

ANOVA test results on single factors are summarized in Table 5, which indicates that both location and drag type had a significant effect on scallop catch volume. Test results for multiple factor interactions are summarized in Table 6, and show significant effects from the boat/location/drag interaction and the boat/drag interaction.

Table 5. ANOVA results from single-factor analysis

Source	DF	S.S.	Mean Square	F Value	P >F
Model	4	49.4706271	12.3676568	56.92	<.0001
Error	322	69.9599845	0.217267		
Corrected Total	326	119.4306116			
R-Square	Coeff. Var.	Root MSE	Vol. Mean		
0.414221	51.38074	0.466119	0.907187		
Source	DF	Type III SS	Mean Square	F Value	P >F
Bottom	1	0.0957297	0.0957297	0.44	0.5073
Location	1	45.12942754	45.12942754	207.71	<.0001
Boat	1	0.41332808	0.41332808	1.9	0.1688
Drag	1	2.7220954	2.7220954	12.53	0.0005

Table 6. ANOVA results from multiple-factor analysis

Source	DF	S.S.	Mean Square	F Value	P >F
Model	13	55.4261416	4.2635494	20.85	<.0001
Error	313	64.00447	0.2044871		
Corrected Total	326	119.4306116			
R-Square	Coeff. Var.	Root MSE	Vol Mean		
0.464087	49.8467	0.452203	0.907187		
Source	DF	Type III SS	Mean Square	F Value	P >F
Bottom	1	0.44214118	0.44214118	2.16	0.1424
Location	1	4.77410561	4.77410561	23.35	<.0001
Bottom*Location	1	0.2697039	0.2697039	1.32	0.2517
Boat	1	0.0336222	0.0336222	0.16	0.6854
Bottom*Boat	1	0.00734335	0.00734335	0.04	0.8498
Location*Boat	1	0.10565407	0.10565407	0.52	0.4728
Bottom*Location*boat	0	0	0	0	0
Drag	1	0.50116619	0.50116619	2.45	0.1185
Bottom*Drag	1	0.00419687	0.00419687	0.02	0.8862
Location*Drag	1	0.20137019	0.20137019	0.98	0.3218
Bottom*Location*Drag	0	0	0	0	0
Boat*Drag	1	0.84347201	0.84347201	4.12	0.0431
Bottom*Boat*Drag	1	0.04092932	0.04092932	0.2	0.6549
Location*Boat*Drag	1	2.9098117	2.9098117	14.23	0.0002
Bottom*Location*Boat*Drag	0	0	0	0	0

KS-Test results:
The results of KS tests are summarized in Table 7. All tests indicated a significant difference in the length frequency distributions, with the exception of sublegal scallops harvested outside Cobscook Bay. Generally, the greatest separation between control and experimental drags occurred at roughly 100 mm.

Table 7. K-S Test results for length frequency distributions of scallops caught during all tows, segmented by location.

Location/Drag Type	N	Predicted K-S Statistic	Observed K-S Statistic	Significant Difference?	Size at Max. Difference
Cobscook Tows					
Control	16577	1.524	4.032	Yes	94 mm
Experimental	15316				
Outside Tows					
Control	5534	2.76	10.13	Yes	101 mm
Experimental	4324				
All Tows Combined					
Control	22111	1.334	4.319	Yes	99 mm
Experimental	19640				

Estimations of catch numbers:
In Cobscook Bay 53.0% and 61.8% of the catch was sampled for the control and experimental, respectively. 97.7% of the control catch and 99.8% of the experimental catch was sampled in those tows outside of Cobscook.

Extrapolations of the total number of scallops actually landed to the deck were generated, based on the total catch volumes, total sample volumes, and the length frequency distributions of the samples. Results of the extrapolations are shown in Table 8.

Table 8. Results of catch number extrapolations, and estimates of catch differences by number, by location and drag type, for previous and current legal shell sizes.

Legal Size	**Location**	**Size Group**	**Cont. N**	**Exp. N**	**Difference**	**% Reduction**
At 3.75" S.H.	Cobscook	Short	22164.7	16583.7	5581.0	25.2
		Legal	9117.3	8223.3	894.0	9.8
	Outside	Short	2248.7	1351.5	897.2	39.9
		Legal	3383.8	2977.4	406.4	12.0
	Total	**Short**	**24413.4**	**17935.2**	**6478.2**	**26.5**
		Legal	**12501.1**	**11200.7**	**1300.4**	**10.4**
At 4.00" S.H.	Cobscook	Short	26798.7	20418.1	6380.6	23.8
		Legal	4483.2	4388.8	94.4	2.1
	Outside	Short	3141.5	1976.2	1165.2	37.1
		Legal	2491.1	2352.7	138.3	5.6
	Total	**Short**	**29940.2**	**22394.4**	**7545.8**	**25.2**
		Legal	**6974.3**	**6741.5**	**232.8**	**3.3**

A comparison of catch numbers reveals that at the 2003/2004 legal size of 3.75", the larger rings reduced legal catch overall by approximately 10.4%. When the 4" minimum size is used as the reference point, the larger rings caught approximately 3.3% fewer scallops. Table 8 also provides an indication of the amount of catch that might be lost due to the increase in legal SH, by comparing the total legal catches at the two legal shell heights. Catch reductions due to the minimum size increase can be thus estimated to be on the order of 50% or more, by number.

Graphic representations of the scallop catches are shown in Figures 5, 6 and 7.

Figure 5. Estimated numbers of scallops caught, by size, for all tows in Cobscook Bay.

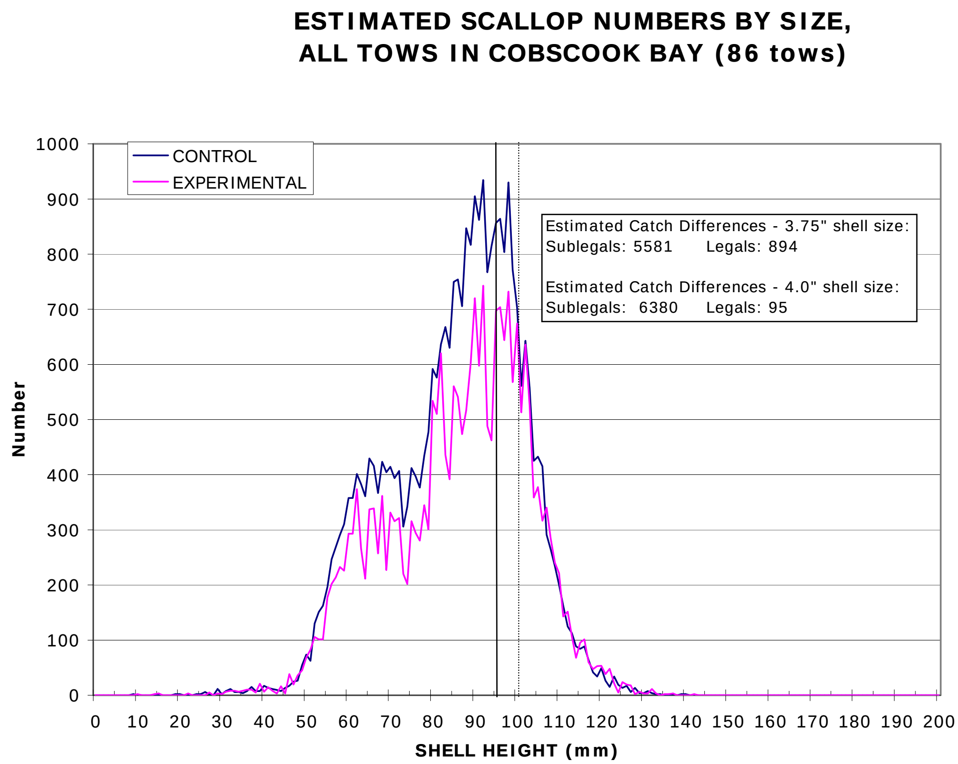


Figure 6. Estimated numbers of scallops caught, by size, for all tows outside Cobscook Bay.

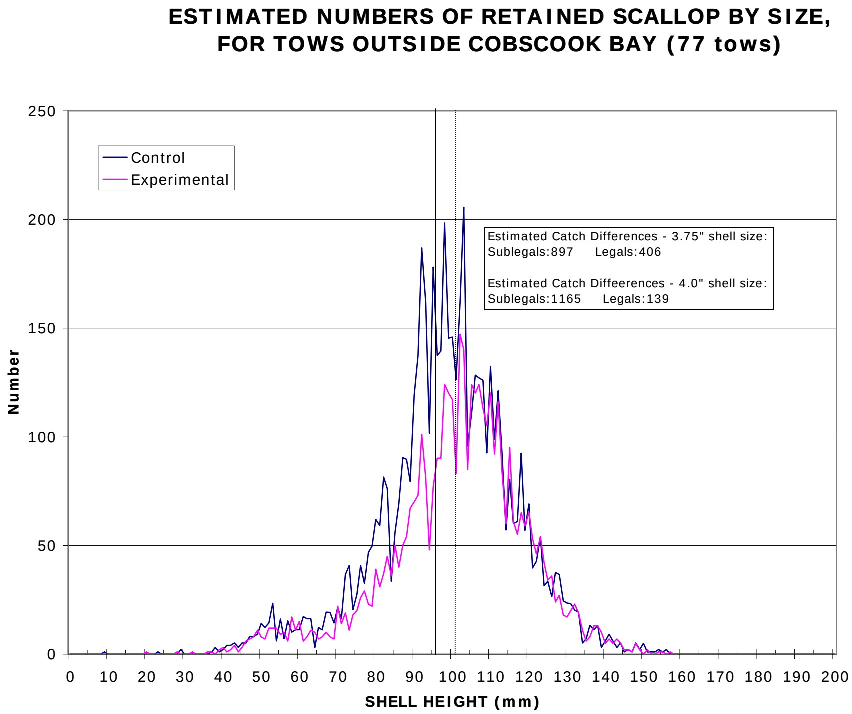
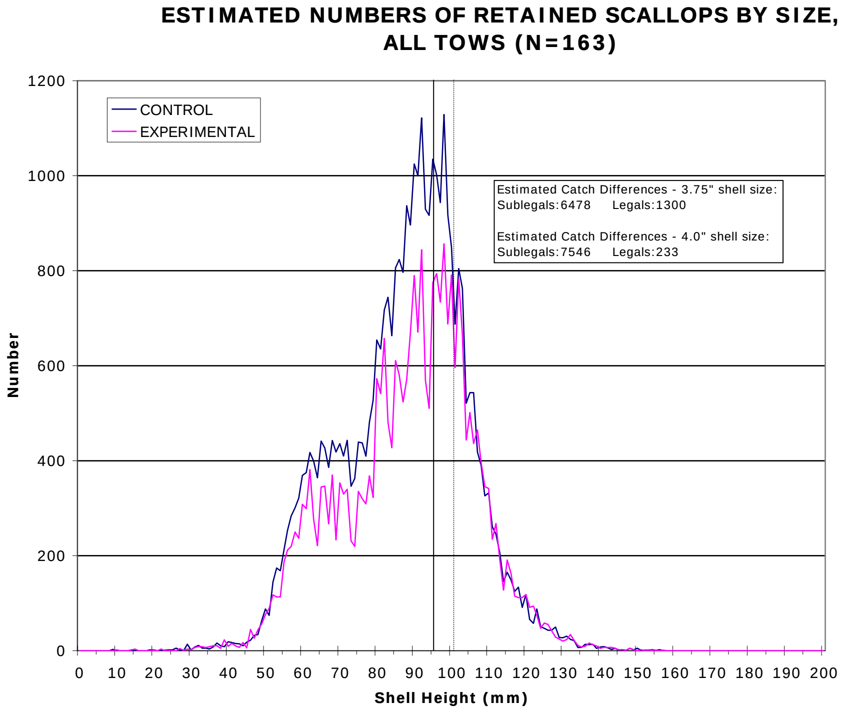
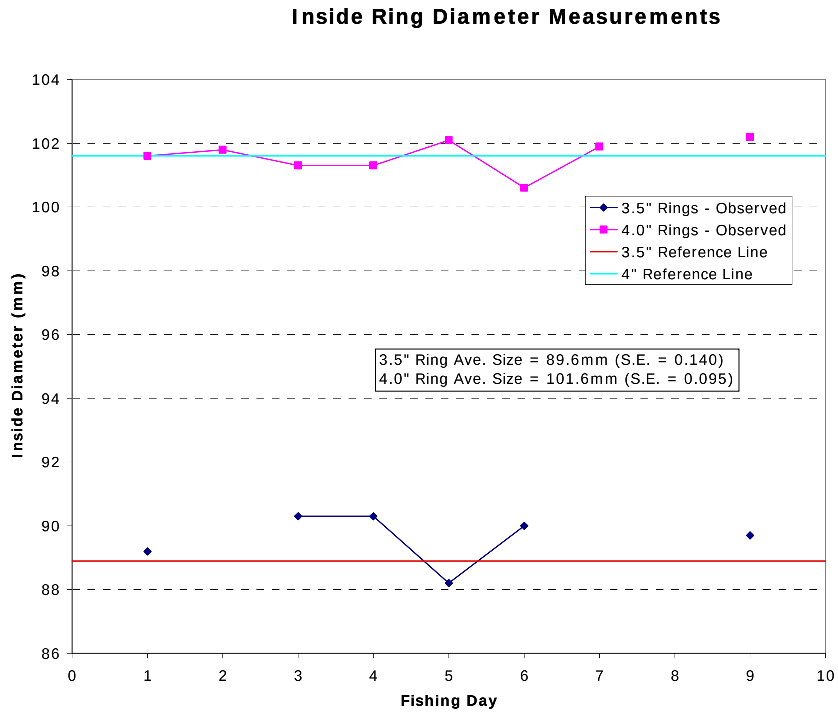


Figure 7. Estimated numbers of scallops caught, by size, for all tows.



Actual ring inside diameters, and inter-ring spaces:
Before the fieldwork for the study began, the concern arose that the larger rings would be more subject to deformity than the smaller rings. To evaluate this, dial calipers were used to measure the inside diameter of at least 10 rings, during several days of the study. Rings were chosen haphazardly from the bottom of the chain bag, in two rows of five rings each. Results of our observations are described in Figure 8.

Figure 8. Inside diameters, in mm, for both size rings during the study.



In addition, measurements were made of the inter-ring spaces on both of the drags (after DuPaul, 2002a, b, and c), top and bottom. Using a ruler, we measured the inter-ring spaces to the nearest millimeter. This measurement was taken when each drag hung slack from the boom, and also as a 'forced' measurement, where we manually spread the links as far apart as possible. Recall that the bag tops were double linked and the bottoms were triple linked. Table 9 lists the results.

Table 9. Average inter-ring distances in millimeters, taken as 'slack' and 'forced' distance measurements.

	Control (3.5")	Experimental (4.0")
Top of bag, unforced	93.6	97.2
Top of bag, forced	132.2	125.8
Bottom of bag, unforced	110.2	90.6
Bottom of bag, forced	112.2	122.6

These data are based on a small number of observations (5). We expected all distances to be larger for the experimental, as compared to the control. A closer examination of inter-ring spaces is warranted.

Presentations and outreach:

At the time of this writing, preliminary results have been presented at the 2004 Maine Fishermen's Forum (Morse and Patryn presenting), and project details have been posted on the Maine Sea Grant Web site. Contact with industry members and scientists has been ongoing. After final data analysis is complete, project details will be related directly to the Cobscook Bay Fishermen's Association, and with the Maine Sea Scallop Advisory Council. The final report will be posted on the ME SG Web site.

PARTNERSHIPS:

The principal partnership in this project, between Capt. Patryn and Mr. Morse, worked very well. The partners were able to develop a relationship from scratch, identify a project of mutual interest, apply and receive funds, and complete the fieldwork, all within a space of approximately nine months. It was helpful to Capt. Patryn as a way to enter the realm of cooperative research, and to Mr. Morse to work on scallop gear research, and to work with downeast fishermen.

In addition, there are some excellent secondary outcomes of this research. For example, Mr. Drew Gowen, who acted as observer in the present study, was able to build on this experience and become funded as co-PI in his own right on NEC research. Capt. Patryn is participating in this new project. Consistent with the goals of the NEC, Capt. Patryn retained the sampling gear from the study. He is thus better equipped for continued scientific collaboration.

DISCUSSION, IMPACTS AND APPLICATIONS:

Data from this study indicates that a switch to 4" rings would result in loss of marketable size scallops. Similarly, there would be a reduction in the number of undersized scallops landed to the deck. However, given the size ranges of scallops that were encountered during this study, it appears that a greater impact on the scallop harvest will come because of the increase in minimum shell size. Whereas the change in ring size resulted in anywhere between 3% and 12% loss of legal scallops brought to the deck (relative to the minimum shell size), the shell height change itself may reduce the legal-sized portion of the catch by approximately 25%.

The actual impact of the increased shell height is unknown presently. On one hand, the resource stands a chance to benefit, because of increased reproductive capacity of the larger scallops (Langton et.al, 1987). However, when faced with a drastic reduction in income, scallopers may have extra incentive to poach undersized scallops, and thus reduce some of the gains of the increased reproductive potential. With enforcement of the legal shell height being a difficult task, it remains to be seen how the regulation impacts future harvests.

Contrary to the observations of Bourne (1965) and DuPaul (2002a, b and c), there was no noticeable increase in the harvest of larger scallops by the experimental gear. We suspect that numbers of scallops greater than 110mm are in short supply in the areas fished, though without a more comprehensive inventory, this cannot be verified.

Earlier in this report, it was noted that the twine tops of the drags differed in their hanging ratios: the control was hung at 3:1, whereas the experimental was hung at 2:1. Thus, the experimental could have been expected to lose more scallops through the twine top. However, it is not possible at this time to exactly estimate the effects of this difference, and information cited in the literature is scanty. When mentioned at the 2004 Maine Fishermen's Forum, the response from the fishermen in the audience was essentially that the difference was likely minimal. Personal contacts with scientists familiar with scallop selectivity generally corroborated this (R. Smolowitz, D. Schick, personal communication). We therefore view it as an un-quantified source of error, but with slight probable impact.

The reduction in capture of sub-legal scallops has potentially strong benefit. The dragging process has been documented to relate to increased stress in scallops of various species, with a subsequent reduction in ability to escape from predators (Maguire et. al., 2002; Medcof and Bourne, 1964; Jenkins and Brand, 2001). Exposure to air following dragging appears to add stress and mortality (Medcof and Bourne, 1964; Jenkins and Brand, 2001), though there is some evidence to the contrary for juveniles (LaFrance et. al., 2002). In addition, dragging for the great scallop, *Pecten maximus*, has been shown to lead to aggregation of predators, for up to 72 hours post-dragging (Veale et.al., 2000, Jenkins et. al., 2004). Presumably in Maine waters, increased predator concentrations and increased stress in dragged (escapees or discards) generally equates to higher scallop mortality. Taken in total, it appears to be very beneficial to leave non-harvestable scallops on the bottom.

The actual fishing of the drags presented no distinct problems. While there was initially some concern that the larger rings would deform more quickly than the smaller rings, this was not observed during the study. A full season's fishing might prove otherwise, but both captains appeared satisfied with the performance of both ring sizes. No discernable difference was seen in the way that the drags towed along the bottom, such as speed in relation to rpm, number of hangups, or the number of times that the drag flipped over.

Finally, this study encompassed relatively shallow waters. It is generally acknowledged that water depth has impact on the fishing tendencies of the drag, because of the effects of tide, waves and other factors. This study did not undertake an assessment of drag selectivity based on depth, but since much of the Maine fishery occurs in water deeper than was fished in the present work, it is recommended that future work include such activity.

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