Fishery Resource Grant Program Final Report

Project title: Improving Gill net Selectivity by Altering Mesh Characteristics
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Give a brief summary of the project.

This project was conducted to see if variations in twine size (mesh diameter), hanging ratio and numbers of spaces between sections effected catch composition with regard to striped bass, American shad and Atlantic sturgeon.

What work did you intend to do, and how did you plan to accomplish it?

We proposed that four nets consisting of four fifty foot net sections would be run three times a week for 12 weeks (36 total days) from February 12- May 4th. Conduit poles would be used to anchor nets and to mark specific net locations so that net location will be standardized. Location of each specific net was to be randomly selected at the start of the study and location of specific net's rotated on a weekly basis so that effect of location was minimized. During this twelve week period a total number of 36 trials were to be conducted each for a twenty-four hour duration. Five and one half inch stretched mesh webbing was to be used. The twine size of each consecutive 50 ft net section was to alternated between .4 and .57 mm. Hang ratios were to vary between .5 (5 meshes in 13.75 inches) and .625 (4 meshes in 13.75) and sections were to be hung so that the effect of section location within each 200 ft string can be examined as a variable. Look to Table 1 for proposed design and more thorough explanation of hanging ratios. (Hanging ratio explanation: In other words if the net were six inch mesh and it was a 600 foot stretched bundle hung on .5 it would turn out to be a 300ft net and four meshes would be hung between knots 12 inches apart. When you hang on .6 you are hanging a tighter net that has meshes that are more opened. Your net ends up being approximately 360ft and there are four meshes hung between knots about 15 inches apart.) A net hung with less play is less likely to entangle fish that have reduced gill plates like shad and may be less likely to retain scute covered sturgeon. The effect of sections being tied together verses not tied together will be examined by daily alteration of this variable. Not tying sections together may create escape slots between sections and allow for fish such as shad that are known to track down the webbing while pinned against it by the tide to escape capture.

Retained fishes were to be enumerated by species and panel and total length measured to the nearest millimeter. Physical characteristics of environment such as water clarity, temperature, and salinity will be recorded prior to fishing each day. Duration of set will be recorded in case set time varies from proposed twenty four hour duration due to weather or other events. Data sheets will be entered on a weekly basis in order to make sure that variability due to location of each 200ft net section is reasonably evenly distributed across four preset locations.

A generalized linear model was to be used to examine effect of each variable with the null hypothesis being that the mean catch of striped bass and American shad per section is evenly distributed.

Table 1: This table contains a diagram of the four nets fished and the section of which they were composed.

Net section distribution

		1st 50 ft section	2nd 50 ft section	3rd 50 ft section	4 th 50 ft section
Section 1	Hanging ratio	0.5	0.625	0.5	0.625
	Webbing size	0.4	0.57	0.4	0.57
Section 2	Hanging ratio	0.625	0.5	0.5	0.625
	Webbing size	0.4	0.57	0.4	0.57
Section 3	Hanging ratio	0.5	0.5	0.625	0.625
	Webbing size	0.4	0.57	0.4	0.57
Section 4	Hanging ratio	0.625	0.625	0.5	0.5
	Webbing size	0.4	0.57	0.4	0.57

Sections between nets will be joined and separated on alternate days.

What was accomplished?

Four nets consisting of four fifty foot net sections as shown in Table 1 were constructed. They were run for 36 days but not every net section was run on every day. The study started late due to late funding and thus many promising days were missed when shad were known to be running. Net locations were chosen to minimize distance between comparative nets. Nets were placed as close a possible so that bottom type and exposure to fish was standardized as much as possible. Location at which each net was fished randomly selected.

Fishes were enumerated by species and panel and total length measured to the nearest millimeter. Physical characteristics of environment such as water clarity, temperature, and salinity were recorded. Duration of set was standardized to 24 hours when possible. Some longer sets did occur due to unavoidable weather. Data sheets were entered and proofed by Dr. Hager.

Nets varied in total soak times and in temporal distribution across the study's duration. Net one was fished for 13 days (3/6-4/14), section 2 was fished for 16 days

(3/23-4/14), section 3 was fished for 33 days (3/24-5/6) and section 4 was fished for 35 days (3/22-5/6). Inconsistent soak times and temporal deployments resulted in non uniform efforts to collect targeted species. Simply stated not all sections were fished at the same time or when fish were available to be caught. Because the research design was very strict in its design and objectives this inconsistency resulted in insufficient catch data being collected on some nets sections. Openings between net sections were not tied and untied on alternate days because this proved too difficult and time consuming. Data collection took a great deal more time than expected and catches of sellable fish were not as large as expected. This of course caused problems with analysis of this attribute. Nets containing no openings between sections and three openings, that is an opening between every panel, were robust enough when combined to provide meaningful comparisons.

Data Analysis

Catch-per-unit-efforts (CPUE) can be used to examine what data is suggesting at this point. CPUEs were calculated to help determine if design variations in anchored gill nets consisting of a uniform stretched mesh size (5.5") known to catch shad, striped bass and sturgeon affected catch ratios with regard to striped bass, American shad and Atlantic sturgeon. The CPUE standardize catches by soak time. It does not address temporal or spatial attributes that would be affected by varied total soak time and temporal aspects of collection efforts. A more robust analysis of data will follow, if possible, by Dr. Hager. Statistical analyses of CPUEs are not possible due to restricted assumptions of applicable test. Raw catch numbers at this point are so low that comparisons would likely not be valid.

Sturgeon are rare in the York River and yet five were caught from 3/22/07-5/06/07. Only one was caught in nets hung on a .625 bases. Three out of five were caught in .4 mm diameter netting.

comparing all to none						
TwineSize	HangingRatio	Number of Spaces	Species ID	Sum Of Totnum	CPUE	
0.4	00:50	0	30	4	0.008772	
0.4	00:50	3	30	6	0.005208	down
0.4	00:62	0	30	1	0.002193	
0.4	00:62	3	30	1	0.001603	down
0.52	00:50	0	30	9	0.019737	
0.52	00:50	3	30	1	0.001603	down
0.52	00:62	0	30	4	0.008772	
0.52	00:62	3	30	2	0.001736	down

Table 2: Table two contains comparisons between American shad catch rates in nets containing no openings and openings between all sections. Limited fishing of other designs restricted comparison. In all situations providing openings between sections reduced catch rates.

comparing all to none

TwineSize	HangingRatio	Number of Spaces	Species ID	Sum Of Totnum	CPUE	
0.4	00:50	0	31	18	0.039474	
0.4	00:50	3	31	33	0.028646	down
0.4	00:62	0	31	10	0.02193	
0.4	00:62	3	31	5	0.008013	down
0.52	00:50	0	31	25	0.054825	
0.52	00:50	3	31	17	0.027244	down
0.52	00:62	0	31	30	0.065789	
0.52	00:62	3	31	43	0.037326	down

Table 3: Table three contains comparisons between striped bass catch rates in nets containing no openings and openings between all sections. Limited fishing of other designs restricted comparison. In all situations providing openings between sections again reduced catch rates. For this reason nets with no opening and all separated where examined separately in later comparisons.

Table 4 and 5 contain CPUE comparisons between American shad and striped bass. Nets with no openings and all sections separated, where examined separately due to findings presented in table 2 and 3.

hanging ratio comparisons

TwineSize	HangingRatio	Number of Spaces	Species ID	Sum Of Totnum	CPUE	
0.4	00:50	0	30	4	0.008772	
0.4	00:62	0	30	1	0.002193	down
0.52	00:50	0	30	9	0.019737	
0.52	00:62	0	30	4	0.008772	down
0.4	00:50	3	30	6	0.005208	
0.4	00:62	3	30	1	0.001603	down
0.52	00:50	3	30	1	0.001603	
0.52	00:62	3	30	2	0.001736	same?

Table 4: Table 4 provides comparisons between CPUEs for American shad between nets with altered hanging ratios containing no openings and all sections separated. Findings suggest that increasing hanging ratios reduces retention of American shad. More data is needed to statistically prove this.

Twine comparisons

TwineSize	HangingRatio	Number of Spaces	Species ID	Sum Of Totnum		
0.4	00:50	0	30	4	0.008772	
0.52	00:50	0	30	9	0.019737	up
0.4	00:62	3	30	1	0.001603	
0.52	00:62	3	30	2	0.001736	same
0.4	00:50	3	30	6	0.005208	
0.52	00:50	3	30	1	0.001603	down
0.4	00:62	0	30	1	0.002193	
0.52	00:62	0	30	4	0.008772	up

Table 5: Table 5 provides comparisons between CPUEs for American shad between nets with altered twine sizes containing no openings and all sections separated. Findings suggest that increasing twine size from .4 to .52 does not alter retention of American shad. More data is needed to statistically prove this.

Results thus far suggest that American shad retention may be substantially reduced by altering hanging ratios. Twine size alterations between .4 and .52 mm do not seem to large enough to effect retention.

hanging ratio comparisons

TwineSize	HangingRatio	Number of Spaces	Species ID	Sum Of Totnum	CPUE	
0.4	00:50	0	31	18	0.039474	
0.4	00:62	0	31	10	0.02193	down
0.52	00:50	0	31	25	0.054825	
0.52	00:62	0	31	30	0.065789	up
0.4	00:50	3	31	33	0.028646	
0.4	00:62	3	31	5	0.008013	down
0.52	00:50	3	31	17	0.027244	
0.52	00:62	3	31	43	0.037326	up

Table 6: Table 6 provides comparisons between CPUEs for striped bass between nets with altered hanging ratios containing no openings and all sections separated. Findings suggest that increasing hanging ratios has no effect on retention of striped bass. More data is needed to statistically prove this.

Table 6 data suggest that hanging ratios do not significantly affect the retention of striped bass. Findings in table 7 suggest that twine sizes from .4 to .52 likely increase catch rates of striped bass. This finding may be due to large striped bass breaking free of the smaller /lighter twine during struggle.

twine comparisons						
TwineSize	HangingRatio	Number of Spaces	Species ID	Sum Of Totnum		
0.4	00:50	0	31	18	0.039474	
0.52	00:50	0	31	25	0.054825	up
0.4	00:62	0	31	10	0.02193	
0.52	00:62	0	31	30	0.065789	up
0.4	00:50	3	31	33	0.028646	
0.52	00:50	3	31	17	0.027244	same
0.4	00:62	3	31	5	0.008013	
0.52	00:62	3	31	43	0.037326	up

Table 7: Table 7 provides comparisons between CPUEs for striped bass between nets with altered twine sizes containing no openings and all sections separated. Findings suggest that increasing twine sizes likely increases retention of striped bass. More data is needed to statistically prove this.

What was planned and not accomplished?

Simultaneous testing of gear did not occur for various unforeseeable and frequently uncontrollable reasons. This alteration in collection methods vastly complicates statistical analysis. It is well recognized by scientist and fishermen alike that fish runs vary tremendously in species composition and species specific number over time and space i.e. if gear is not fished simultaneously the assumption that catch differences are due to gear and not these normal variations is not valid.

Luckily due to the design of nets it was impossible to not fish some comparative gear simultaneously because it occurred in the same 200 ft net section, therefore, valid compassion between net sections occurring within the same shot of gear are still valid. This greatly complicates analysis however and requires more time for completion. This analysis will be done by Dr. Hager following this final report.

Twine size alterations did not seem to effect catch rates, however, this finding is likely due to the fact that, due to net availability, only .4 and .52 mm diameter were compared in very cloudy waters. We hope to increase this difference and standardize net construction in the coming year to determine if twine sizes of greater variability significantly affect catch rates and to eliminate the need to fish all gear simultaneously to get consistent comparison. With this additional data we hope to better understand how anchored gill nets can be altered to minimize their retention of American shad and yet retain striped bass. This study's data suggest that we are on the correct path. We simply need to increase our sample size to statistically prove that that these approaches work. Once this is attained we can take these findings to the proper management authorities so that such gear alterations can be applied to regulations and our fisheries improved.

Applicant Signature: _____Date: _____

Robert Weagley