MESH-SPECIFIC CATCH COMPOSITIONS AND SIZE DISTRIBUTIONS OCCURING IN VIRGINIA'S 2005 WINTER-SPRING STRIPED BASS GILL NET FISHERY

SUBMITTED TO

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Introduction

Data presented in this report was collected during a Fisheries Resource Grant Project entitled "The Assessment of Sturgeon Bycatch, Bycatch Mortality and Other Regulatory Discard Mortality in Virginia's Winter/Spring Striped Bass and Other Gill Net Fisheries." Both fishery dependent and independent data were collected during an extensive joint effort between fishermen, researchers, and scientists. This report contains only a fraction of the data collected. This portion is presented at this time at the request of VMRC to aid the Commission in constructing new gill net regulations that will concurrently reduce the average size of striped bass harvested and minimize regulatory bycatch.

Methods

Fishery dependent data was recorded by observers placed on vessels targeting striped bass in Virginia's coastal and estuarine waters from Mid-February thru March of 2005. Distribution of mesh sizes observed (Table 1) reflects fisher's preference. Concurrent use of 5" and 6" mesh in a fisheries independent effort in the James River allowed for a more robust examination of striped bass size distribution in these meshes. Fishery dependent and independent data sets for these two mesh sizes were combined based on the assumption that net ownership did not influence net selectivity. Bycatch was assessed based on over 147 million foot net hours (over 63,000 feet of net with most sets run for 24 hours). Bycatch data was quantified using Sea Grant observers who were randomly placed on commercial boats during normal operations.

Results

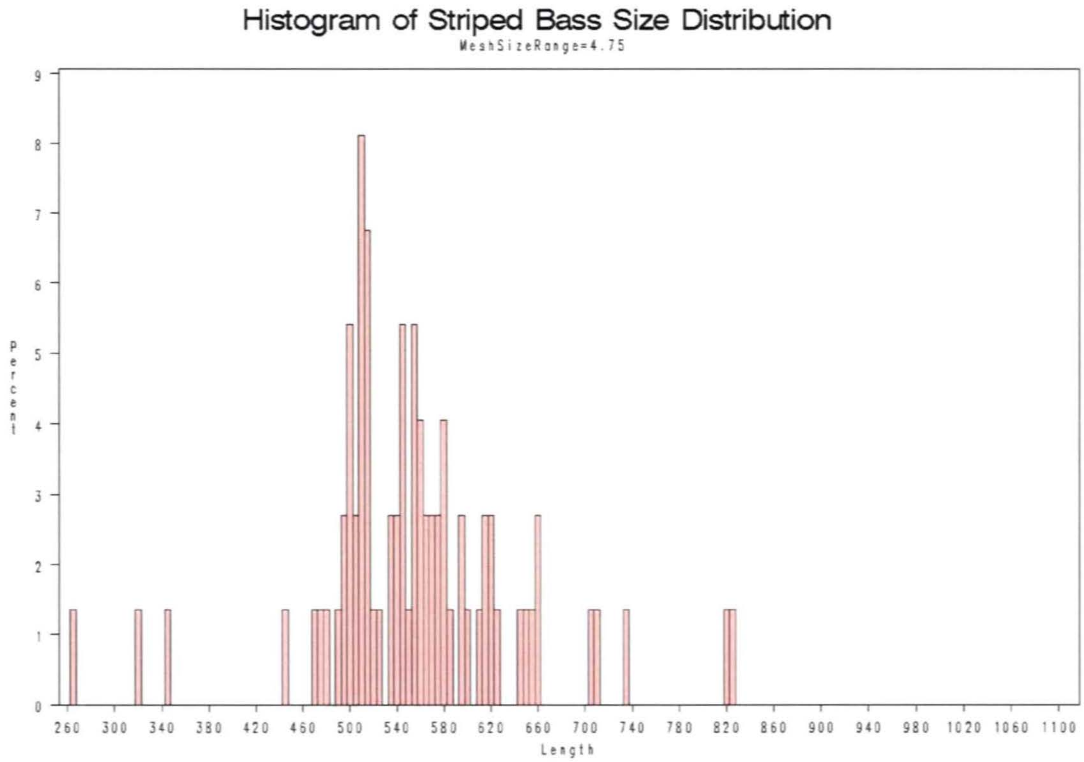
Mesh sizes observed during the striped bass fishery ranged from 4.75" to 8.625" stretched mesh. Table 1 clearly indicates that 8 inch mesh is currently the most widely used.

Table 1.

Mesh size	4.75	6	7	7.5	8	8.25	8.375	8.5
% used	8	3	6	3	72	3	2	3

Charts 1-9 illustrate mesh specific striped bass size selectivity.

Chart 1 and 2. Striped bass retained in 4.75" and 5" mesh.



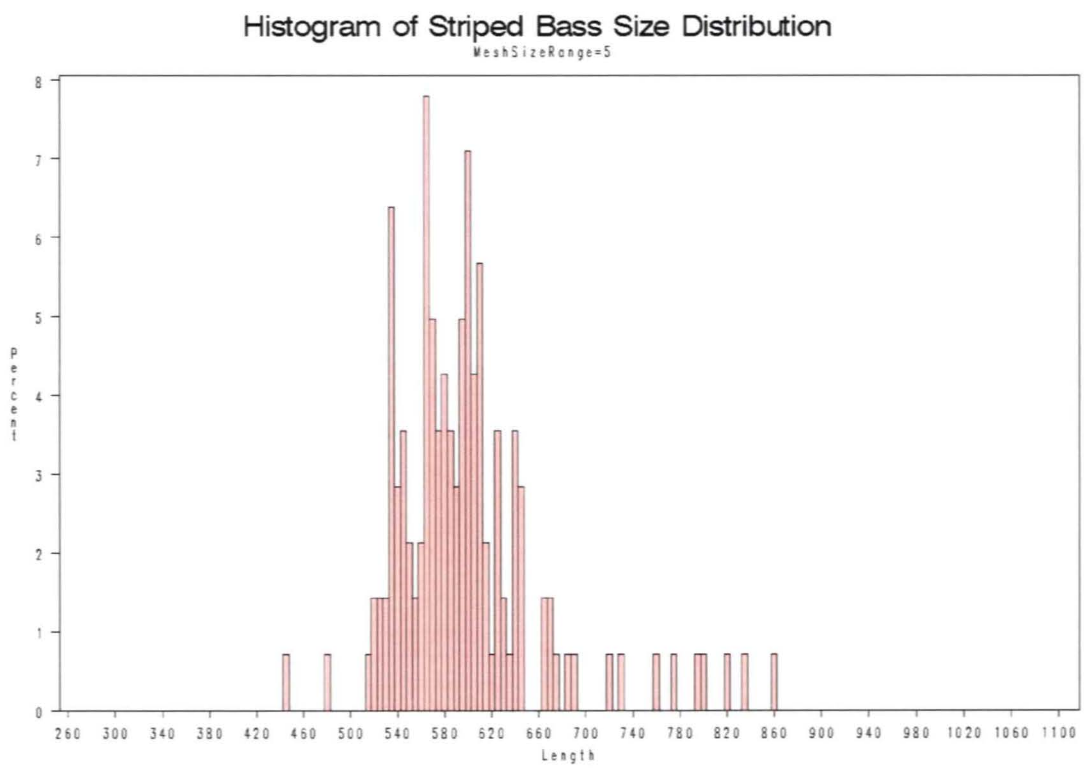
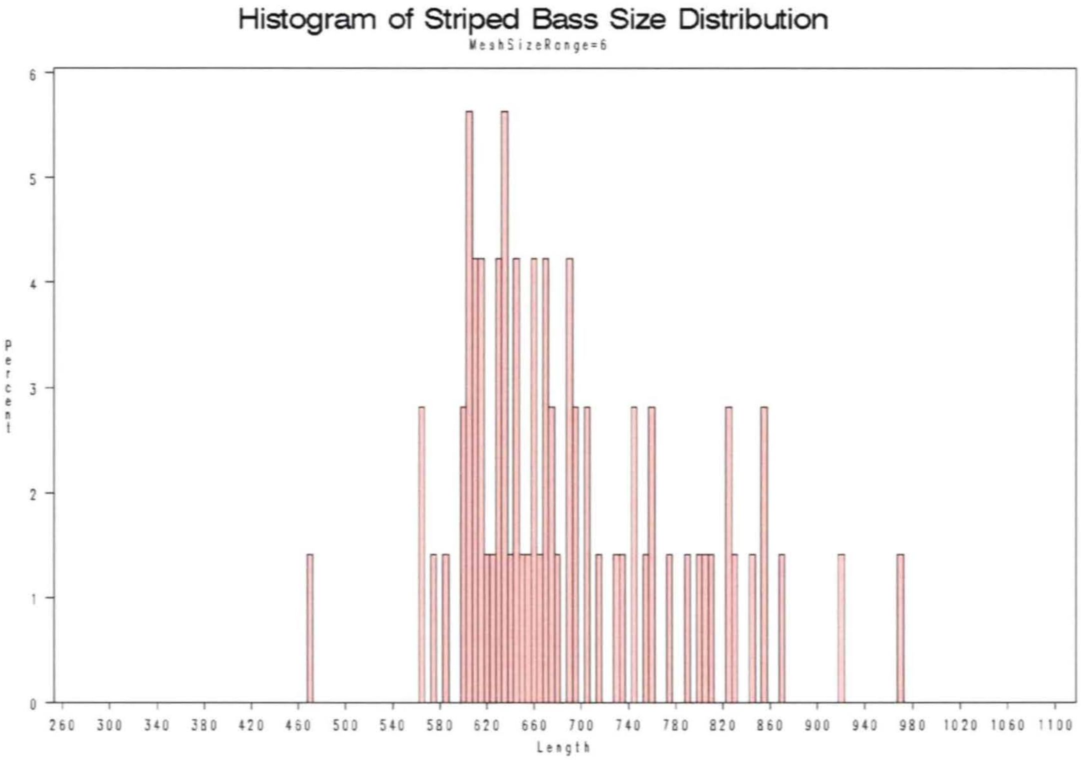


Chart 3 and 4. Striped bass retained in 6" and 7" mesh.



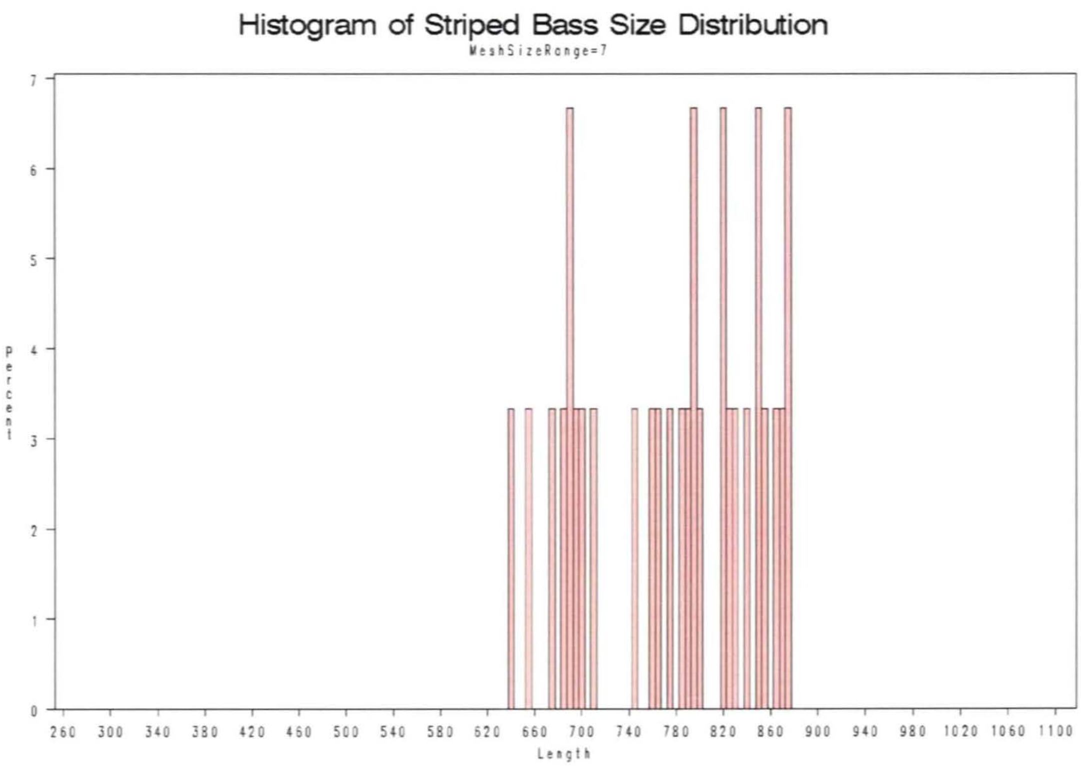
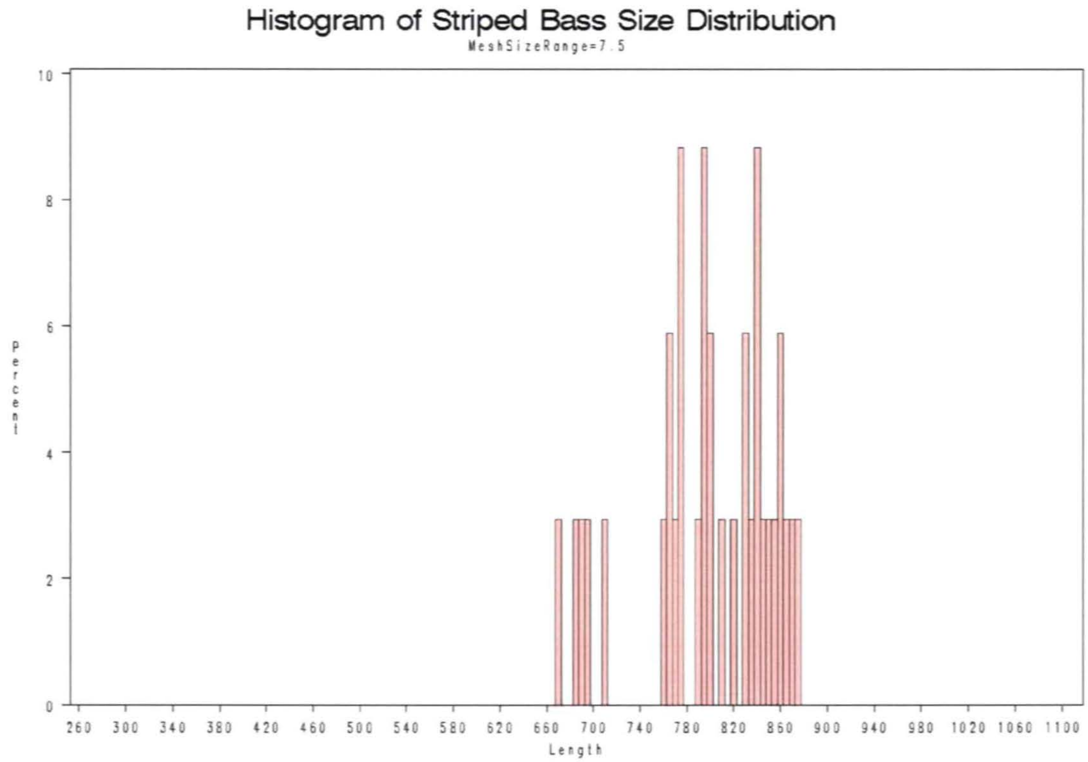


Chart 5 and 6. Striped bass retained in 7.5" and 8" mesh.



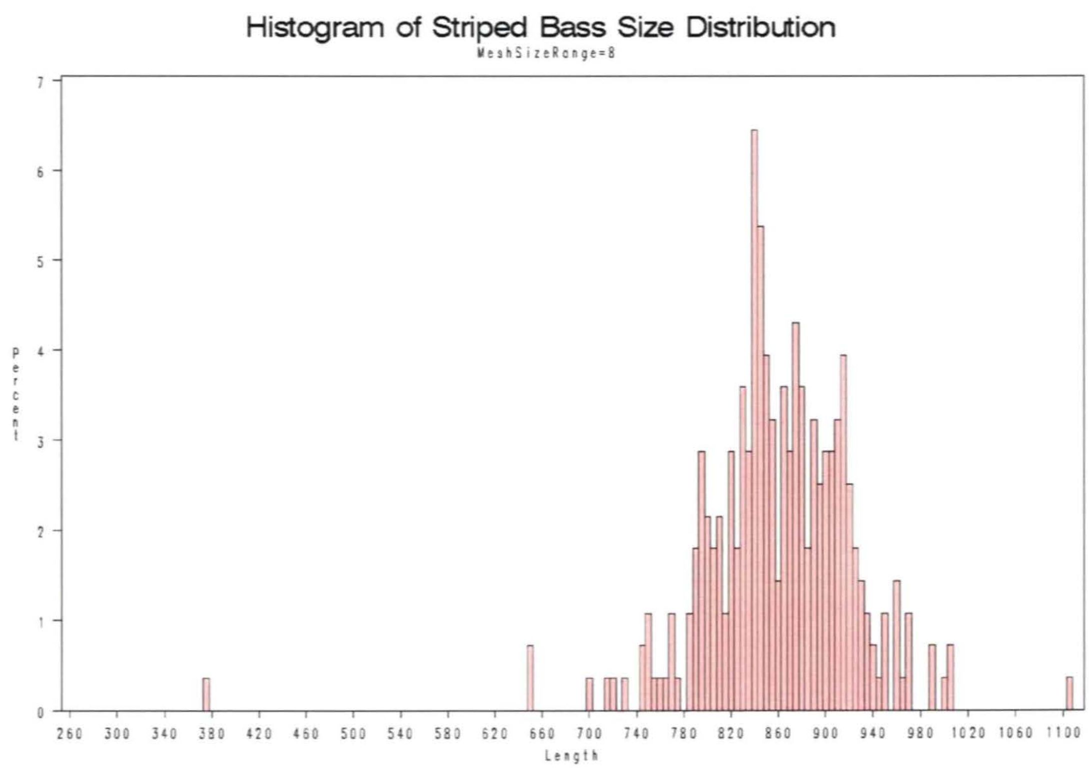
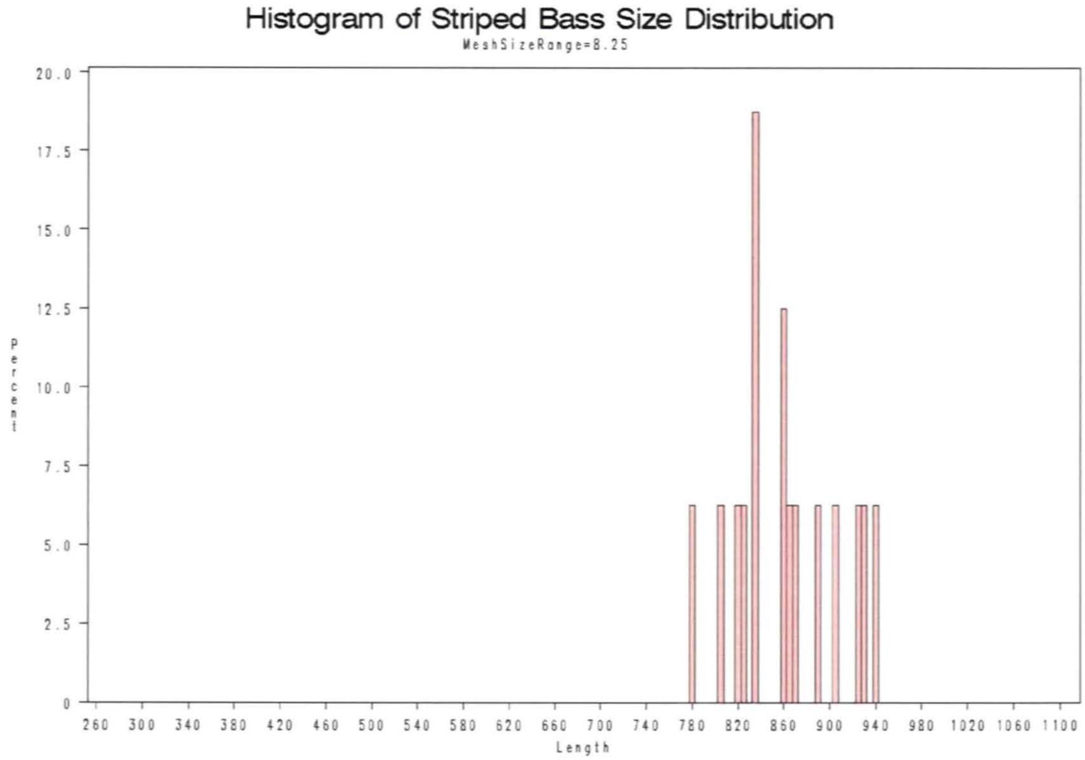


Chart 7 and 8. Striped bass retained in 8.25" and 8.375" mesh.



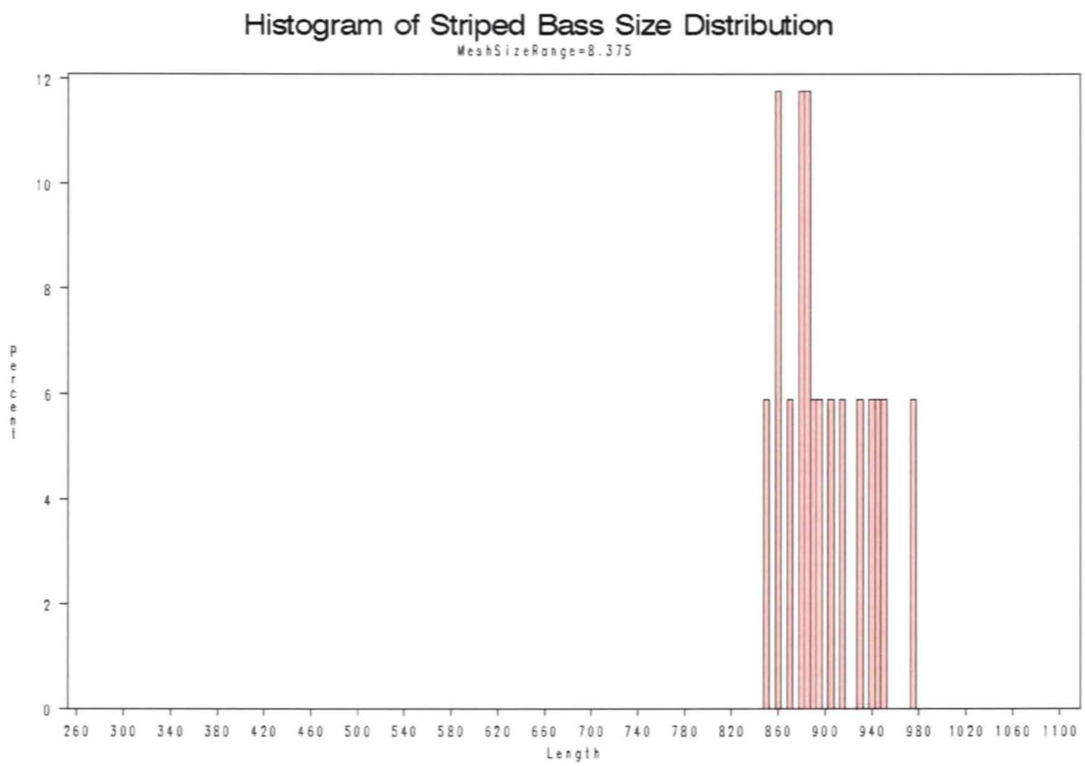
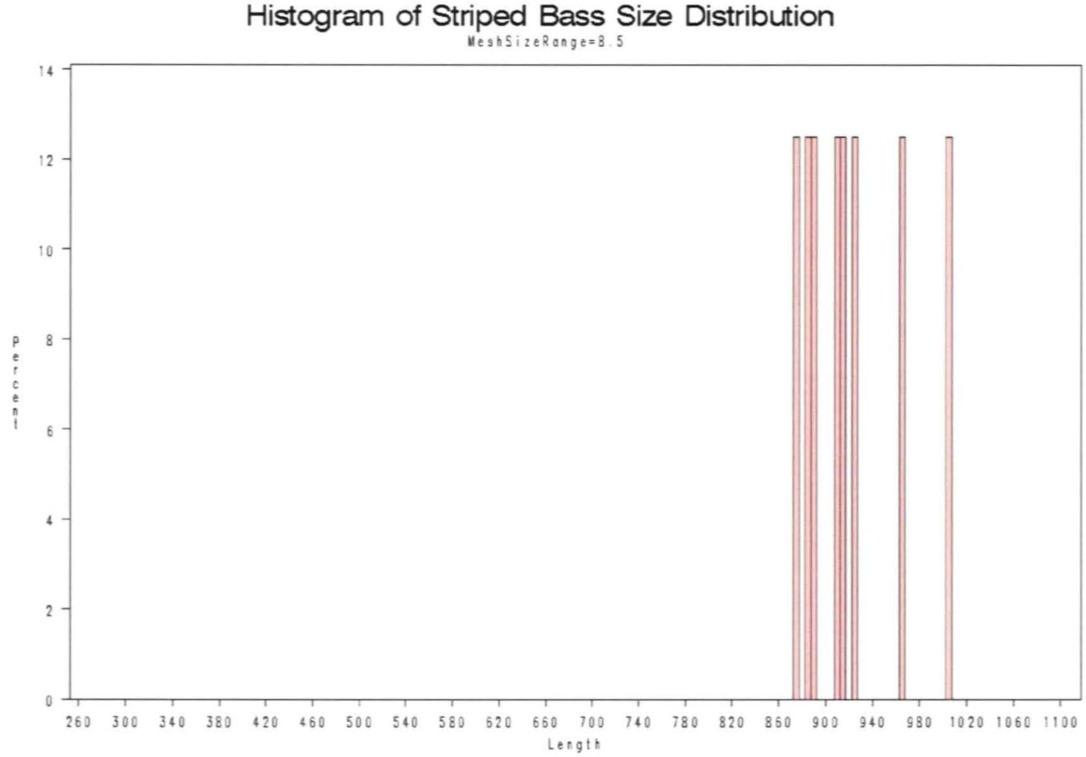


Chart 9. Striped bass retained in 8.5" mesh.



The use of 5" mesh was not observed and no fish were captured in the 6" mesh observed. Corresponding striped bass size distributions for these meshes were, therefore, calculated based in large part on fish collected in a fishery independent data collection effort. Ten inch mesh was fished by one vessel in the ocean but the nets in which it occurred contained 10" mesh along the float line sewn to 8" mesh along the lead line. Size distributions of striped bass taken in duel mesh nets were not presented due to difficulty in determining mesh of capture in field because webbing bunched together as it entered boat and was spooled onto net reel.

Striped bass size minimums, means, and maximums are presented in Table 2 for each mesh size observed. Size specific percentages of capture above 711 mm (28"), between 711 mm (28") and 635 mm (25"), below or equal to 635 mm (25"), and below or equal to 457 mm (18") are also given. The 25" size was selected to help convey potential retention under high grading methodology if a 28" maximum size was selected.

Table 2.

Mesh size (in)	Min. (in)	Mean (in)	Max. (in)	%≤18"	%≤25"	25"<%≤28"	%>28"
4.75	11	23	33	6	80	9	5
5	18	24	34	1	81	12	6
6	18	28	38	0	32	37	31
7	25	32	34	0	0	30	70
7.5	26	33	34	0	0	15	85
8	15	35	44	0.1	0	0.9	99
8.25	31	35	37	0	0	0	100
8.375	34	37	38	0	0	0	100
8.5	34	38	39	0	0	0	100

Percent catch composition is presented in Table 3. Species are presented in order of decreasing abundance left to right. Data for 6" mesh is not included because no fish captures were observed in this mesh during the fisheries dependent portion of study.

Table 3.

Mesh size (in)	Striped bass	Atlantic menhaden	Spiny dogfish	American shad	Hickory shad	Atlantic sturgeon
4.75	81.91	4.02	*	10.05	3.02	0.50
7	39.13	40.22	20.65	*	*	*
7.5	80.95	19.05	*	*	*	*
8	54.01	42.86	2.80	*	*	0.05
8.25	0.05	27.27	*	*	*	*
8.375	100.00	*	*	*	*	*
8.5	100.00	*	*	*	*	*

All Atlantic menhaden were discarded because they were not targeted and generally must be landed at different markets than bass. Though a spiny dogfish bycatch quota existed at the time, all dogfish were discarded because fishers claimed bycatch allotment was too small to make retention of catch profitable and available markets would not accept small landings. American shad and Atlantic sturgeon were regulatory discards. Atlantic sturgeon bycatch was released alive. Summer flounder, weakfish, blue crab, and clearnose skate were also taken but composed less than 0.5 percent of catch and were thus omitted from chart for clarity. Bird bycatch was also omitted. All shad species were taken within the Bay at the mouth of major tributaries and all dogfish were taken in the ocean.

To exemplify more clearly the effect of mesh size on spiny dogfish retention in the ocean fishery, the results of a single net made up of three sections of various meshes is provided in Table 4. Quantification of species represents individual fish captured.

Table 4.

Mesh size (in)	Net length (ft)	Striped bass	Spiny dogfish
7	300	5	19
8	300	9	6
8.5	600	29	0

Discussion and management considerations

The reauthorization of the Magnuson - Stevens Fishery Conservation and Management Act (MSFCMA) of 1996 mandates "that any fisheries management plan prepared by Council, or by the Secretary of Commerce, with respect to any fishery, shall assess and specify the present and probable future condition of, and the maximum sustainable yield and optimum yield from, the fishery, and include a summary of information utilized in making such specifications." Integral to this new management approach are the new national standards for fishery conservation and management that now require by law that, to the extent practical, measures shall minimize bycatch and, to the extent bycatch cannot be avoided, minimize the mortality of such bycatch. Mesh selectivity and bycatch data is presented in this document to provide the Commission with the best available science upon which to base their regulations in order to accomplish these legal mandates.

A narrow distribution of values in striped bass mesh selectivity implies increased size selectivity and/or a reduced sample size. As Table 2 and 3 suggest, gill nets retain fish by means other than simply gilling. Small fish can be retained in large mesh and large fish in small due to various gear and biological factors. Abundant schools of relatively small Atlantic menhaden occurred concurrently with schools of much larger targeted striped bass. Some of these menhaden became entangled in meshes large enough for them to easily swim through because their morphology (jaw shape), feeding habits (swimming with mouth open), and escape mechanisms (rapid swimming when panicked) made them susceptible to capture. As menhaden filter feed, their open mouth can catch a bar of mesh, reactively they close their mouth, panic, and spin. Large striped bass can be retained in small mesh (Table 2) for several reasons both gear related and biological. If a mesh breaks gape is doubled. In addition, striped bass have morphological characteristics that make them susceptible to capture in a larger range of gill net mesh sizes. A striped bass too large to gill in a given mesh may still become entangled due to the shape of its jaws. This occurs when the fish's mouth fits the mesh size being fished so that the corners of its jaws become entangled. If the fish panics and spins it becomes more entangled. Because this non-targeted catch of large fish is often fatal and unavoidable it should be taken into managerial consideration. This method of retention also makes maximum size an inadequate criterion by which to select regulated mesh sizes.

Under the current mesh regulations menhaden are the largest contributor to bycatch in the winter/spring striped bass fishery and this species is taken in all mesh sizes. Fortunately, the resulting mortality is likely not large enough to affect the current population's sustainability. A few Atlantic sturgeon were also captured across mesh sizes but concurrent research (Hager, unpublished) suggests that these fish survive interactions well especially in the cooler water temperatures (Collins, 1996). Presently the striped bass gill net fishery has very little bycatch. The large mesh which is predominantly used (≥8" for 80% of effort) is simply too large to retain most concurrently available fishes. However, bycatch data in reduced meshes suggest (Table 3) that catch composition will change drastically in the ocean and Bay if fishers are no longer allowed to use mesh in excess of 7".

Resulting increases in bycatch mortality could have potentially severe consequences. This is especially true for species like the American shad and spiny dogfish whose stocks are already at critically depleted levels. Once stocks are depleted, increases in mortality due to bycatch are far more likely to negatively affect each stocks recovery. In the ocean fishery a sizable bycatch (21%) of spiny dogfish was observed in 7" nets. If this is the largest allowed mesh in a one tag one fish management scheme, spiny dogfish bycatch will increase significantly. The effect this mortality augmentation will have on spiny dogfish reproductive potential could be acute from continued stock reduction alone. However, in this case likelihood of future recruitment failure is increased because 7" mesh unequally selects for mature females, which are larger than males (Musick, personal communication).

A striped bass fishery using smaller meshes may have an impact on continuing efforts to restore American shad. American shad have been protected by a complete moratorium in Virginia's tributaries and portion of the Chesapeake Bay since 1994 due to stock depletion and a slow recovery. However, the ban does not prevent mortalities due to bycatch. In this study, American shad constituted 10% of the catch observed in 4.75" mesh fished in the Bay. Assuming that this mesh would have an equally high catch of shad wherever fished may not be a valid assumption because this mesh size was only observed in one location and catch rates are location dependent. This having been said, if regulation 4VAC 20-751-20 (prohibits the use of meshes from 3.75" to 6" in the tributaries from January 1- March 25) is removed, more mesh sizes historically recorded as being effective at capturing shad will be used. Shad discard mortality is likely to increase due to an overall augmentation of such meshes use especially if such nets are deployed in the tributaries during the shad's spawning run. If large mesh nets (>7") are simultaneously banned, striped bass fishers will have no alternative but to select meshes ranging from 5" - 7 ". This mesh size range overlaps that of the traditional shad fishery (mesh sizes 4.875" - 5.5" and twine sizes #3 - 6) which is currently banned in an effort to preserve remaining American shad stocks.

Table 2 is provided to assist in selection of mesh regulations if such regulation cannot be avoided. If an upper size limit is placed on striped bass, greatest catch per unit effort could be achieved by selecting a mesh size that would retain fish of this upper size only. For reasons previously discussed, no such gill net gear exists. For the same reasons, size selection should be based on mean and minimum sizes so that retention will be improved and high grading and/or discarding of overly large fish minimized. The 25" cut off presented in Table 2 was randomly chosen to help illustrate potential retention percentages during active high grading, if a maximum retention size of 28" was selected. High grading is unavoidable as long as the fishery is based on a one fish one tag system.

If regulations mandating use of reduced mesh sizes cannot be avoided, various gear alterations should be researched to address the unique bycatch issues the striped bass gill net fishery will face. Twine size alterations are currently being researched as a means of reducing bycatch of unwanted fish species in the croaker fishery which has developed off of the New Jersey coast. Given historically documented poor catches of American shad in twine sizes greater than #6 (.4 mm) and lack of perceived difference in striped bass retention in larger twine sizes (.9 commonly used), this gear alteration could offer significant reductions in shad bycatch even if traditional shad mesh sizes were fished. Other mesh alterations should also be explored, as modifications in density and color have been shown to significantly reduce marine mammal and seabird bycatch (Tripple et al. 2003) and hanging ratios are traditionally altered to affect species specific retention.

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