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<u>Final Report</u>

<u>Evaluation of the Effect of Vent Size and Shape on Black Sea Bass Behavior and Escapement from Pot Gear</u>

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Executive Summary

The black sea bass pot fishery south of Long Island, NY is conducted as a combination of black sea bass and lobster harvest fishery. Pots are constructed and fished to maximize harvest of both species within the parameters of harvest regulation for both species. The required vent sizes for lobster are larger than the required vent size for black sea bass so pots are filled with lobster regulation vents. We conducted a study on the fishing grounds south of Long Island, NY to evaluate the effect of vent size and shape on black sea bass escapement from pot gear. Standard traps used in this commercial fishery were fitted with vents of the following sizes: double circular 2.5" diameter; 5.75" x 2.0"; single circular 2.375" diameter; 2.0" square; double circular 2.625" diameter. A control pot with no vent was also used. Pots were randomized on 12 pot strings. Ten strings of gear were used and fishing took place during August through November 2004 and May through July 2006. A total of 18 trips were made. 138 string-pulls were accomplished for a total of 1635 pot hauls.

Except for the 5.75" x 2" vent, all other vent configurations (including no vent) were not significantly different in terms of length frequency distribution of black sea bass retained as well as in total pounds or numbers of black sea bass caught. Also, except for the 5.75" x 2" vent, all other vent sizes (including no vent) were all equivalent in terms of small fish retention and total catch of black sea bass. Soak time was also a significant factor with longer soak times generally producing larger catches. Also, longer soak times do not produce greater mortality of black sea bass in the pots.

A dockside sampling program for black sea bass was developed. A total of 35 dockside black sea bass samples were collected, consisting of 1397 lengths and 585 age structures. An at–sea observer program was initiated. Three observer trips were completed.

A video camera was attached to one of the pots to record fish behavior and activities in the pot. Due to various difficulties with the camera as well as theft of the camera, no useable video of black sea bass in the pots was produced. A black sea bass tagging opportunity was also to have been a part of this project. Due to scheduling issues between CMP and NMFS, tagging was not able to take place during this project.

Purpose

Project Description

The black sea bass pot fishery conducted south of Long Island by New York vessels is primarily executed as a combination black sea bass and lobster harvest fishery. The same pots are fished for both species at the same time. Fishermen in this fishery are primarily both sea bass and lobster harvesters. As such, they must abide by the regulations and gear specifications of both fisheries. The lobster regulations for Lobster Management Area 4 (LMA4) in effect at the start of this project specify escape vents of the following dimensions: either one or more unobstructed rectangular openings not less than five and three quarter inches long by not less than two inches in height or two or more unobstructed circular openings not less than two and one half inches in diameter each. The sea bass escape vent dimensions in place at the time of the study were 1.375 inches by 5.75 inches; or a circular vent 2.375 inches in diameter; or a square vent with sides of 2 inches inside measure. Therefore, black sea bass fishermen operating in the mixed lobster/sea bass fishery in New York are using pots with escape vents larger than required for sea bass only harvest. In fact those fishermen using circular escape vents are not only using an escape vent 1/8 inch in diameter larger, but are using two such vents to satisfy the lobster regulations. Fishermen operating in the mixed black sea bass/lobster fishery south of Long Island are unique along the coast in that they utilize a wood and nylon twine “A frame” combination pot to pursue both species together. Additionally both lobsters and black sea bass in this area enter the pots in search of structure and shelter. As such the pots are successfully fished without bait. The purpose of the study is to examine the difference in gear selectivity for black sea bass relative to those pots using the LMA4 lobster regulation vents compared to pots using the sea bass regulation vents. Additionally, this study was to use underwater video to document the behavior of legal size and sub-legal size black sea bass in terms of entering the pot, activities within the pot and escapement.

The state quota for black sea bass for New York is relatively low and has resulted in the past in periods of time when the quota is closed for management purposes. During this time the pot gear remains on the fishing grounds in order to hold the bottom for prime fishing locations, and to continue to fish for lobster. However, there is concern on the part of fishery managers that there may be mortality of black sea bass left in pots for extended periods of time during closed quota periods.

Additional research is needed relative to commercial fishing activities. This includes increased and more representative sea sampling and port sampling of black sea bass fisheries with a special emphasis on larger specimens. This project will initiate a sea sampling program for the pot fishery off of Long Island, New York. The project will additionally expand and supplement dockside sampling currently conducted by NMFS contractors to include an elevated and directed black sea bass commercial dockside sampling program during black sea bass season. Special emphasis will be on larger specimens to the extent that they are included in the catch. An effort to expand the NMFS black sea bass tagging program will also be included.

Goals and Objectives

Goal 1: to provide fishery managers, fishery scientists and commercial fishermen with an accurate evaluation of various pot vent sizes and shapes for black sea bass.

Objective 1a: evaluate the effectiveness of various sizes and shapes of escape vents used in the combination black sea bass/lobster fishery in LMA4.

Objective 1b: evaluate the size selectivity of various sizes and shapes of escape vents used in the black sea bass/lobster fishery in LMA4.

Objective 1c: document via underwater video the behavior of black sea bass entering pots, behavior while in the pot and escapement behavior.

Goal 2: to provide accurate information to help quantify mortality of black sea bass.

Objective 2a: estimate the mortality of black sea bass left in pots that continue to fish during the closed season.

Goal 3: to expand the sea sampling and port sampling of black sea bass fisheries.

Objective 3a: develop a sea sampling program to target the black sea bass fishery off Long Island, New York.

Objective 3b: expand the existing dockside sampling program in New York to provide for greater numbers of dockside samples for commercial trips.

Objective 3c: expand the existing dockside sampling program in New York with an emphasis on large specimens.

Goal 4: increase knowledge of black sea bass populations and migration patterns.

Objective 4a: participate in the black sea bass tagging program sponsored by the Northeast Fisheries Science Center.

Approach

Work Performed

Pots used in the black sea bass/lobster fishery south of Long Island are "A frame" pots constructed of 2-inch tarred nylon mesh stapled to an oak-framed pot with an oak lath bottom. Dimensions are 38 inches long, 22 inches across the bottom, 18 inches across the top and 14 ½ inches high. They have a single wood lath funnel and are set without bait. These standard pots fitted with various vent configurations are being used in this study. The following vent sizes and configurations were originally detailed to be used in this study: double circular 2.5 inch diameter (standard in the fishery and sized for lobster regulation in LMA4); 5.75 inches by 2.0 inches rectangular (lobster regulation); 5.75 inches by 1.375 inches rectangular (sea bass regulation); single circular 2.375 inches diameter (black sea bass regulation); 2.0 inches square (black sea bass regulation). However, the 5.75 inches by 1.375 inches rectangular vent was not available from any gear supplier on either the east or the west coasts of the U.S. This vent size is not being used by sea bass fishermen. Approval was obtained from NMFS to replace this vent in the study with a 2.625 inches double circular vent. The double 2.625 inches circular was the proposed new lobster vent size in LMA4 at the time. See Figure 1 for vent size configuration. Vents were placed in a side panel near the bottom of the pot. As a control, a pot with no escape vent was also used. This gives 6 pot configurations: 5 experimental and 1control. The pots were set in blocks of six (5 experimental, 1 control) with 2 blocks to a string. Pot vent sizes and shapes were randomized within each block.

A random number generator was used to obtain a randomized sequence of pots without duplication. See Table 1 for the specifics of the configuration of each string of gear. Ten strings of experimental gear were fished on a 10-day soak cycle. One additional string was to be used for long-term mortality and was designated to be hauled on 20 day, 30 day and 40 day soaks. Pots were spaced 90 feet apart on each string as is the standard gear used in the commercial fishery. A continuously recording electronic thermometer was attached to one pot on each string to provide a continuous temperate record for the gear. Surface temperature was also recorded for each haul.

The gear was fished in an area with the regular commercial gear fished by the F/V AJ. The F/V AJ is a new fiberglass 37 foot "Novi" design pot boat. Hauling station is on the starboard side. The vessel displaces 17 gross registered tons and has 300 H.P. The area fished was south of Shinnecock Inlet, Long Island, New York, in 11 to 15 fathoms of water and 1 to 3 miles offshore. The specific location of trap sets was left to the discretion/experience of the vessel captain and was intermingled with his regular gear.

This project was originally scheduled to start at the beginning of June 2004 and continue through the end of October 2004. However because of various delays associated with obtaining the project's Exempted Fishing Permit (EFP) the project could not commence until August 20, 2004. Fieldwork for this project continued until the onset of winter weather forced the removal of the gear from the water in mid-November, 2004. The Long Island sea bass pot fishery does not operate during the winter. The project then continued in a subsequent year.

The original EFP for this project expired on 12/31/04. The renewal of the EFP for continuing work on this project in 2005 was not issued until July 15, 2005. This caused the project to miss the spring/early summer fishery. However the renewal EFP was valid through July 14, 2006. Since the mid-summer/autumn fishery was targeted during activities in 2004, a decision was made in consultation with NMFS in July 2005 to forgo any additional field work in 2005 and instead concentrate our remaining efforts during the spring/early summer fishery in 2006. Thus the project was completed in two segments; the period August 2004, through November 2004 covered the late summer and autumn fishery; the period April 2006 through July 2006 covered the spring and early summer fishery. The experimental gear portion of the project was completed on July 14, 2006 with the expiration of the EFP.

During the period 8/04 through 11/04, and then 4/06 through 7/06 the experimental gear was fished on a target soak of ten days and thus hauled approximately every ten days. The schedule was interrupted due to weather conditions at the discretion of the Captain. Delays caused by weather, as well a replacements for lost gear, caused the soak time of the gear to vary from the target 10 day soak. Table 2 shows the soak time of the gear for each lift. A total of 18 trips were made to haul the experimental gear. A total of 138 string-pulls were accomplished representing 13 complete sets and a total of 1635 pot hauls. A total of 2,128 black sea bass (2,167 lbs) and 164 scup were caught during these hauls. We also caught 406 lobsters and incidental numbers of invertebrates, triggerfish and blackfish and other finfish during the project. Individual lengths and total weight by pot were recorded for all sea bass. Length frequencies, sex and presence and condition of eggs were recorded by string for all lobsters. All other fish and invertebrates were quantified by pot.

Data collected during research trips was recorded in a logbook. As pots were hauled, the contents of each pot were emptied into a basket. An inventory of each pot was taken according to vent configuration in order to evaluate the effect of vent size and shape on escapement from pot gear. Each individual black sea bass was counted and measured. The combined weight of fish kept and discarded in each pot was recorded. Fish under the minimum legal size of 11" (27.9 cm) were discarded. In addition to black sea bass, all other species captured in each pot were recorded. Each lobster was measured. Lobster sex, shell state and egg state were recorded. Temperature data loggers were attached to one pot per string. HOBO Water Temp Pro loggers were used. Temperature was recorded every hour for the duration of the project.

The long term mortality component was completed but with a slightly different approach than originally planned. We originally modified the work plan, upon suggestion from NMFS, to include 20 day and 30 day soak times, in addition to the 40 day soak time for examining mortality in extended-soak pots. We planned to use a specific 12 pot string of gear for this extended mortality component. However that string of gear was stolen (or trawled up) early on in the project and could not be replaced (see further discussion in Problems Encountered Section). However due to weather conditions and other factors, several strings of the regular experimental gear were left soaking for extended periods of time. Sixteen different strings of gear were fishing for the extended soak times of 28, 33, 34, 40, 44, 45, 48 and 49 days. See Table 2 for specific strings/soak times. Even without the specific long term mortality string of gear we were able to cover the extended soak times of 20, 30 and 40 days. Overall, there were 20 times when gear was fished for less than 20 days and 16 times when gear was fished for 20 days or greater.

After the 2004 field work on this project, it was suggested that a gap near the top of the pots, created as part of the construction design of the commercial pots, may be allowing some escapement of small sea bass from the pots. When the field component of the project was resumed in 2006, we added extra laths to all of our pots to close off this gap to see if it made any difference in the catch, size or length frequency of black sea bass for our pots. All data from 2004 was compared to 2006. There was no statistical significant difference in the data between the two gears. All data for both years was therefore combined.

A Simrad Silicon –intensified target camera system was utilized to attempt to obtain underwater video footage of black sea bass within and around fish traps. The camera is sensitive to extremely low light levels, as low as 10^{-3} lux. The system consists of a silicon-intensified tube camera attached via a short umbilical to a recording system and battery pack inside pressure housing. The recorder utilizes Hi-8 videotapes, and produces a high-resolution analog video image. An advantage of this system is that the fish's behavior is not altered by supplemental lighting. The camera was attached to a "camera pot". This "camera pot" was the same as one of the normal experimental pots but with a mounting platform attached in order to mount the camera and recording system. Video was conducted in association with hauling/setting of the experimental gear. At the start of the day the special trap was deployed and set as a single trap with buoys near the first string of experimental gear. It was then retrieved a few hours later. Many complications with both the camera battery packs and fabricating a proper mounting system (so that the camera pot would not tip over when set) delayed the deployment of the camera system. The camera set-up was successfully deployed seven times: 11 /4/04; 11/10/04; 11/16/04; 11/17/04; 5/5/06; 5/24/06; 6/5/06. During the 6/5/06 deployment the camera set-up was stolen and thus ended this component of the project. See the Problems Encountered section for more details.

Three sea sampling trips were conducted during normal fishing operations of the F/V AJ. One trip was made on 9/16/04 and another two on 11/10/04. (The vessel made two separate trips on 11/10/04.) All standard NMFS Fisheries Observer Program protocols were employed on these trips. All standard NMFS Fisheries Observer Program data were collected and recorded on the standard logs in use for this Program. CCE utilized one of the NMFS trained fishing observers that normally covers Long Island as an observer contractor. He was available for our use independent of that contract and in-between normal NMFS coverages. These trips in 2004 were the only ones we could schedule. In 2006 this observer was not available to us for our program. His unavailability coupled with reduced income from RSA harvest precluded this component of the project from proceeding beyond 3 trips. However, the experience was beneficial in that it provided some observer coverage in this fishery. Additionally it laid the ground work and a good working relationship if NMFS chooses to request observer coverage with this vessel in the future.

This project was to include an opportunity for NMFS to expand its existing black sea bass tagging program by providing two days of vessel time to tag fish caught during the vessel's normal fishing operations. Coordinating this component of the project with NMFS-NEFSC proved to be unsuccessful. Multiple attempts were made to coordinate tagging trips aboard the F/V AJ with sea bass personnel from NMFS-NEFSC. NMFS desired to tag fish only during the months of May and September and CCE/NMFS attempted numerous times to coordinate trips during these two months. A multiple of logistical issues prevented the final scheduling of any tagging trips. These issues included NMFS staff unavailable due to other scheduled tagging efforts; travel time and distance from Woods Hole, MA to Long Island, NY; lack of large numbers of fish; weather issues; time constraints of both projects. All factors combined to negatively impact the ability to successfully coordinate any tagging trips.

Project Management

Day to day operations of the scientific components of the project both onshore and at sea were the responsibility of the Cornell Marine Program (CMP). All data recording, data entry and basic analysis were also the responsibility of the CMP. All at-sea vessel support for all fishing operations relative to experimental gear was provided by the F/V AJ. Rigorous ANOVA and Tukey's data analysis were conducted by Dr. Eric Powell and Dr. Eleanor Bochenek of The Rutgers University Haskin Shellfish Research Laboratory.

Findings

Accomplishments and Findings

The length frequency distribution for all black sea bass caught in the experimental gear by vent configuration, including the control of no vent, is shown in Figure 2. The length frequency distribution for black sea bass for each vent configuration as compared to the no vent control in shown in Figures 3 through 7. The mean length of black sea bass captured in each vent configuration is shown in Figure 8. These data show that except for the 5.75" x 2" vent, the length frequency distribution for all vents (including no vent) is relatively similar. Vent size had a significant effect on mean length only due to the fact that the 5.75" x 2" vent caught fish that were significantly larger than the other vents, but did not differ from the pots without vents. There was no significant difference in length frequency distribution among the other vent sizes. Other than the 5.75" x 2" vent none of the vent configurations showed greater or lesser escapement of small fish compared to no vent. The 5.75" x 2" vent also caught fish with a distribution that was more peaked than the other vent types (except on 2/0" square). Haul date also had an influence on size. However, these differences are the result of the daily change in fish availability of various sizes. When the data for only those catches where the discard rate was greater than 80% was used, few significant differences between pot configurations were found. This indicates that significance of vent size came from the size of larger fish caught rather than the differential in the numbers of small fish retained (or allowed to escape). See the discussion in the Statistical Analysis section for further details.

These results are similar to those of Weber and Briggs (1983). They compared lobster pots fished south of Long Island, NY with no vents and pots with double circular 58 mm (2.283") vents. They found that there was no significant difference in the length frequency distribution and mean total lengths of black sea caught in the vented pots and the unvented pots. A study by Shepherd el at. (2002) found that increasing vent size reduced the number of sub-legal black sea bass while at the same time reducing the catch of legal – size fish. Skrobe and Lee (2003) also found that increasing the vent size showed some significant decreases in the catch of sub-legal black sea bass but in most cases this was coupled with a significant loss of legal–size fish. Our study shows that there is no significant decrease in the catch of sub-legal black sea bass for vented pots compared to unvented pots. However the 5.75" x 2" vent overall caught significantly fewer black sea bass (Figures 9 & 10) and had the fewest mean number of sub-legal black sea bass per pot haul (Figure 13). However, it also had the highest percent by number of sub-legal black sea bass (Figure 14).

The total number of black sea bass captured in each vent configuration is shown in Figure 9. The total weight of black sea bass captured in each vent configuration is shown in Figure 10. The mean weight of black sea bass per pot haul is shown in Figure 11. Number, weight and mean weight of black sea bass caught in the control pots as well as all vent configurations (except the 5.75" x 2") are all similar. The only vent size that was significantly different from the others, and from the control, was the 5.75" x 2" vent. It caught significantly fewer black sea bass by number and weight than the other vent types (including no vent). See the discussion in the Statistical Analysis section for further details. These results are also similar to those of Weber and Briggs (1983). They found that there was no significant difference in total numbers of black sea bass or the portion of legal/sub-legal fish in vented pots compared to unvented pots.

The total number of legal and sub-legal black sea bass captured for each vent configuration is shown in Figure 12. The mean number of legal and sub-legal black sea bass captured per pot haul is shown in Figure 13. The percent by number of legal and sub-legal black sea bass for each vent configuration is shown in Figure 14. The mean weight of legal and sub-legal black sea bass captured per pot haul for each vent configuration is shown in Figure 15. The percent by weight of legal and sub-legal black sea bass for each vent configuration is shown in Figure 16. Again, the catch of kept (legal size) and discarded (sub-legal) black sea bass among the pot configuration (including control) is similar except for the 5.75" x 2" vent. The 5.75" x 2" vent was the only vent significantly different from the others in terms of the number of black sea bass kept, the total number and pounds of black sea bass caught as well as the fraction kept by number. These effects of vent size are due to the 5.75" x 2" catching significantly fewer black sea bass. The effect of the 5.75" x 2" vent was significant both when looking at all catches as well as only those hauls that had a 20% or greater fraction of discards. Haul date also had a significant effect on total number, total pounds, pounds kept, pounds discarded and number kept of black sea bass. This effect is likely due to the daily change in the availability of black sea bass to the gear. These effects are further detailed in the Statistical Analysis section.

The mean weight of black sea bass captured per pot haul for each vent configuration is shown in Figure 11. Catch per unit of effort (CPUE) as defined by the total number of black sea bass per pot haul is shown in Figure 17 for each vent configuration. CPUE as defined by the total weight of black sea bass per pot haul is shown in Figure 18 for each vent configuration. CPUE by number or weight is significantly less for the 5.75" x 2" vent than for any other of the vent sizes. CPUE for all the others (including no vent) is similar. Likewise mean weight per pot haul is significantly lower for the 5.75" x 2" vent but is similar for the others. As mentioned above, even though the 5.75" x 2" vent caught significantly larger fish than the other vent sizes it also caught significantly fewer black sea bass based on numbers or weight.

The average catch of black sea bass in pounds (excluding zero catches) as a function of soak time is presented in Figure 19. Generally average catch increases with soak time. In fact soak time had a highly significant effect on the number and pounds of black sea bass caught. More fish tended to be caught the longer the pots were soaked, likely due to the reduced probability of a zero catch. There was also significant vent – haul date interaction based on the distribution of zero catches which were more likely to occur on some dates rather than others. The soak time and the vent – haul date effects are further detailed in the Statistical Analysis section.

In the extended soak mortality component of the project we were able to have 16 different strings of gear fish for extended soak times of 28, 33, 34, 40, 44, 45, 48 and 49 days. See Table 2 for specifics. For the experimental gear used in this study, long term soak time did not have a significant impact on black sea bass mortality in pots over extended periods. Table 7 details the mortality we experienced during the project. Additional mortality of black sea bass during extended soak times over the normal 10 day soak does not increase with increasing days between hauls. Vent configuration also did not have an impact, nor did season. Soak times of less than 10 days did not yield any dead black sea bass. There was only one incidence of mortality for gear fished for 10 days. The 13 day soak produced 2 dead black sea bass, the 15, 19 and 33 day soaks each yielded 1 dead black sea bass. Of the total 9 strings of gear that fished for 40 days or more soak time, there was only 1 dead black sea bass total. Longer sets tend to produce a greater catch of black sea bass but do not increase mortality in the pot.

The mean number of scup per pot haul for each vent configuration is shown in Figure 20. As with black sea bass, the 5.75" x 2" vent caught far fewer scup than did any of the other vent sizes. The pot with no vent caught more scup than any of the pots with vents. However since the focus of this project was black sea bass and not scup, length frequencies of scup were not recorded. It is therefore not known if the greater number of scup in the pots without vents is due to larger number of small scup.

The mean number of lobsters per pot haul for each vent configuration is shown in Figure 21. The mean size of lobsters captured for each vent size configuration is shown in Figure 22. For lobsters, the 5.75" by 2" vent did not catch fewer lobsters than the other vent sizes; except for the 2" square and no-vent which each caught more lobsters than the other vent sizes. The mean number of lobsters caught is nearly equal for the 5.75" x 2", double circular 2.625" and double circular 2.5" vents. The no-vent and 2" square vent caught the smallest mean size of lobsters at nearly the same mean size. The 2" square is equally effective at retaining small lobsters as the no-vent pot. The 5.75" x 2" vent retained the largest mean size lobsters but was nearly the same as for the double 2.625" and double 2.5" vents. Thus for lobsters the 5.75" x 2", the double circular 2.625" and the double circular 2.5" vents all had a similar effect on mean number of lobsters caught and mean size of lobsters caught.

Many problems and issues with the underwater video camera caused the results of this component of the project to be considerably less than expected. Camera performance, when operational, was adequate to view activities in the pot. However issues with the battery life, length of recording time and theft of the camera equipment rendered poor results for this component of the study. Further details on these issues are provided in the Problems Encountered section. Seven successful camera pot deployments were accomplished, four in 2004 and three in 2006. There was approximately 7 hours of recorded video footage of the experimental pot while fishing. Unfortunately, no sea bass were recorded in the pot during any of the recorded deployments. We even tried baiting the pot to attract sea bass more quickly into the pot, without success. Problems with recording time and battery life continued to plague the project. This component of the project did not yield any useful results and the theft of the camera ended any further deployment.

In 2004 there were 3 observed trips aboard the F/V AJ. These trips were observed by a NMFSC Certified Observer and official NMFS Observer Program logs were completed. These logs included the Vessel and Trip Information Log, Lobster, Crab & Fish Pot Haul Log, and Length Frequency Log. These trips occurred in the fall of 2004 towards the end of the fishing season. One trip occurred on 9/16/04 and two trips occurred on 11/10/04. Two trips occurred this day due to pots being hauled, stowed and taken back to port after which another trip was made in the same day.

This project was successful in establishing a dockside black sea bass sampling program with the F/V AJ. This was developed and designed to provide additional dockside black sea bass samples to the NEFSC. Previous to this development, dockside samples of the commercial sea bass pot fishery were very low and reflected the limited opportunities for sampling this fishery. All length frequency and associated sample/trip information have been entered into the NMFS Biological Sampling Monitoring Data Base System (BSMDB). All age structures have been sent to the NEFSC for age determination.

Beginning with 2004 and continuing through to 2007 dockside sampling opportunities from the F/V AJ have increased significantly. The number of dockside samples collected over the years 2004-2007 from the F/V AJ totaled 62. Species sampled include black sea bass, lobster, tautog, scup, triggerfish, and ocean pout. Dockside sampling started out slow in 2004 and 2005. Two black sea bass samples were collected in 2004 with a total of 74 length frequencies. One sample was collected in 2005 with a total of 4 length frequencies and age structures collected.

Once the staff learned to better coordinate at sea procedures with dockside sampling procedures, sample collection increased. When the project resumed in spring of 2006 dockside sampling procedures became a priority and continued to be important into 2007. This will continue into 2008 and future years. A total of 28 dockside samples were collected in 2006. Of these samples 19 were black sea bass which tallied 770 length frequencies and 293 age structures collected. Eight lobster samples totaling 226 length frequencies and 1 triggerfish sample consisting of 15 lengths were also collected in 2006.

After the conclusion of the black sea bass pot study, dockside biological sampling opportunities were still made available by the F/V AJ. In 2007 a total of 31 dockside samples were collected. Thirteen of these were black sea bass totaling 549 length frequencies and 288 age structures collected. Thirteen lobster samples were also collected consisting of 612 lengths. Other species sampled included 3 tautog samples which tallied 23 lengths, a scup sample totaling 25 lengths and 25 ages, and an ocean pout sample which consisted of 11 lengths. Overall thru the end of 2007 a total of 35 dockside black sea bass samples were collected, consisting of 1397 lengths and 585 age structures. Sampling will continue in 2008 and future years.

Methods-Statistical Analysis

Black sea bass catch, in both weight (pounds) and numbers of fish, was evaluated.   ANOVAs were run using ranked raw variables because of the many zero catches in the data set. The model includes block, vent, and haul date as main effects and soak time as a covariate. All possible interactions between main effects were also investigated. Dependent variables were the total number caught, total pounds caught, total pounds kept, total number kept, total pounds discarded, and total number discarded (discarded fish are all sub-legal fish). A preliminary analysis showed that catches between blocks were significantly different more frequently than expected by chance; thus, we retained block as a main effect. Significant differences identified by the ANOVA were further investigated using Tukey's studentized range test. This test was only used as a guide in cases were interaction terms were not significant.

In addition, we examined specific subsets of the data as follows. To evaluate the influence of zero catches, all zero catches were deleted from the dataset and the primary ANOVAs rerun. We evaluated the distribution of positive and negative catches by assigning a one to positive catches and a zero to any other catches. ANOVAs were conducted on this dataset. In addition, we calculated the kept fraction (Kept/Kept + Discards) for both numbers and weight. To further evaluate discarding, we reduced the dataset to those collections where discarding occurred. ANOVAs were conducted on this reduced dataset. Finally, we excluded all the haul dates where the fraction kept was greater than 80% in order to evaluate hauls in which escapement might substantially influence the catch. These remaining hauls represent cases where small black sea bass were relatively abundant. This analysis focused on hauls made on August 30, 2004, May 5, 2006, June 5, 2006, June 30, 2006, October 7, 2004, September 23, 2004, July 7, 2006, and July 14, 2006.

For the length frequency data, all the datasets that had less than ten length measurements were first deleted from the dataset. Insufficient data were available to retain block as a main effect. Consequently, the ANOVA was reduced to vent and haul date as main effects. The dependent variables were mean size, the percentiles of size (25^{th}, 50^{th}, and 75^{th}), the interquartile range, the range, kurtosis, and skewness.

Results-Statistical analysis

Total Catch of Black Sea Bass

We ran ANOVAs for total pounds and numbers of black sea bass caught using all the data, then deleting the zeros to evaluate the influence of zero catches, and then evaluating just the positive and zero catches. Haul date had a highly significant effect on the total number of black sea bass caught and discarded for the analyses with zeros, without zeros, and positive versus zero catches (p=0.0001) (Table 3). No obvious temporal pattern was present, however. For example, the smallest catch of black sea bass occurred on June 5, 2006 and the largest catch occurred on June 30, 2006. There was a tendency for the 2006 catch to be less than the 2004 catch, but the pattern was not consistent.

For the analysis with zero catches, block had a significant effect on the total number and pounds of black sea bass caught (Table 3). The average of the parts for the two blocks were very similar however, so the significant difference is mainly a function of the large sample size. For the analysis without zeros, block was only significant for pounds caught (P=0.0040) (Table 3). For the data set in which the data were reduced to positive versus zero catches, block was not significant. Therefore, the significant block effect originates from the distribution of fish caught among blocks and not from the distribution of null catches.

Vent had a highly significant effect on the total number and pounds of black sea bass caught for all three analyses (Table 3). A Tukey's *a posteriori* test identified the 5.75 x 2 rectangular vent that caught significantly fewer black sea bass by number and weight than the other vent types. The remaining vent types were not significantly different.

Soak time had a highly significant effect on the number and pounds of black sea bass caught (Table 3). A Spearman's rank test showed a positive correlation between soak time and the number of black sea bass caught (rho=0.317) and pounds of black sea bass caught (rho=0.339). More black sea bass tended to be caught the longer the pots were soaked. The dominant effect of increased soak time is to reduce the probability of a zero catch.

The vent*haul date interaction term had a significant effect upon the number and pounds of black sea bass caught when the entire data set was analyzed and no significant effect when the zero catches were removed from the data set, but a significant effect when the analysis focused solely on positive and null catches (Table 3). This significant vent*haul date interaction is thus caused by the distribution of null catches which were more likely to occur on some haul dates than others, even taking into account soak time, rather than a tendency for positive catches to be disproportionately higher on some haul dates.

Kept and Discarded Catch of Black Sea Bass

We analyzed the kept and discarded catch (pounds and numbers) and the fraction of pounds and numbers kept. Haul date significantly influenced the number of black sea bass kept, pounds of black sea bass kept and discarded, and the fraction of pounds and numbers kept of black sea bass (p values ranging from 0.0001 to 0.0003) (Table 4). The haul date effect is again most likely due to the daily change in availability of black sea bass. Vent had a significant effect only on the number of black sea bass kept (p=0.0019) (Table 4). A Tukey's *a posteriori* test showed that this was due to the 5.75 x 2 rectangular vent catching fewer kept black sea bass than the other vents.

Discarding can only be affected by vent if small black sea bass are common. We focused on the fraction of the kept catch and deleted all the haul dates were the fraction kept was greater than 80%. When we looked at the remaining hauls that had higher numbers of black sea bass, we found similar effects as in the previous analyses (Table 5). Haul date had a highly significant effect on total number, total pounds, pounds kept, pounds discarded, and number kept (Table 5). Vent had a highly significant effect on total number and pounds caught (p=0.0001) (Table 5). A Tukey's *a posteriori* test showed that this result again is solely due to the 5.75x2 rectangular vent catching significantly fewer black sea bass than the other vent types. The fraction kept by number also was significantly influenced by vent (p=0.0412). This effect of vent is due to the 5.75x2 rectangular vent catching significantly fewer black sea bass than the double 0.625 vent and the 2.20 square vent based on Tukey's *a posteriori* test (Table 5).

Length Frequency of Black Sea Bass Catch

Where the entire size frequency data set was analyzed with both vent and haul date as main effects, vent had a significant effect on mean length (p=0.0250) (Case A, Table 6). The 5.75 x 2 rectangular vent caught fish that were significantly larger than the other vent styles, but interestingly, did not differ from the pots without vents. The statistic kurtosis measures how peaked or flat the data are compared to the normal distribution. Kurtosis (p=0.0190) was significantly affected by vent (Case A, Table 6). Based on Tukey's *a posteriori* test, the 5.75 x 2 rectangular vent caught fish with a distribution that was more peaked than the other vent types, but did not differ from the 2.0 square vent type. Haul date had a significant influence on the 25th percentile of size (p=0.0048), the range (p=0.0013), the interquartile range p=0.0148), skewness (p=0.0063), and kurtosis (p=0.0006) (Case A, Table 6). These differences are the result of the daily change in fish availability of varying sizes.

We then looked at the entire size frequency data set with only vent as the main effect. The results were the same as the previous analysis for mean length and kurtosis (Case B, Table 6). Vent also had a significant effect on the 75th percentile of size (p=0.0379) (Case B, Table 6). Results of Tukey's *a posteriori* test showed that the 5.75 x 2 rectangular vent caught significantly larger black sea bass than the other vent types when looking at the larger size fraction caught.

To further evaluate the discarded size frequency, we reduced the dataset to those collections where the discard rate was greater than 0.80 using vent and haul date as main effects and then just vent as the main effect. Few significant differences were found indicating that the significant vent main effects came from the size of larger fish caught rather than the differential in the numbers of small fish retained. (Case D, Table 6).

Conclusions

Except for the 5.75" x 2" vent, all other vent configurations (including no-vent) were not significantly different in terms of length frequency distribution of black sea bass retained as well as in total pounds or numbers of black sea bass caught. Even though the 5.75" x 2" vent caught significantly larger fish than the other vent sizes, it also caught significantly fewer black sea bass based on numbers or weight. All the other vent sizes (including no-vent) were all equivalent in terms of small fish retention and total catch of black sea bass. As long as they are not using the 5.75" x 2" vent, fishermen off Long Island, NY engaged in the combination black sea bass/lobster fishery are not experiencing reduced catches of black sea bass by using the required larger lobster escape vents. This is likely why no one that we know of in this fishery is using the 5.75" x 2.0" lobster vent. It seems the fishermen have previously figured this out based on their own observations. Soak time is also a significant factor, with longer soak times generally producing larger catches. Longer soak times do not produce greater mortality of black sea bass in the pots.

Problems Encountered

The long-term mortality component of the study could not be conducted as originally planned. The string of experimental gear for the long-term mortality was set with the other gear in August 2004 and was hauled ten days later to make sure it was fishing properly. However when we went to haul the gear subsequently after a 20-day soak, this string of pots could not be located despite an extensive search. The entire string was either hauled and stolen by someone else, or caught by trawl gear. Both of these scenarios are not uncommon in this fishery. The string of gear could not be found during subsequent trips. It was Captain Goncharuk's firm belief that a continued attempt to fish a string of gear on a regular 20 to 30 day soak would likely result in continued gear loss. Because of the loss of the gear, the continued risk of lost gear and the lack of contingency funds to replace this string of gear, the long-term mortality component of this study was discontinued with the specific long term mortality string. However we were able to obtain information on mortality in pots set for long periods of time. See discussion above in Approach and Findings Sections.

Other gear tampering problems were also encountered during the project. One or two pots on either end of a random string were hauled and raided several times. This resulted from someone obtaining easy access to the end pots without hauling the entire string of gear. The situation is quickly recognized by the Captain when hauling the gear as evidenced by the end pots fishing next to each other rather than 90' apart. There were also incidents where the end one or two pots on a string were cut off and removed. We also experienced the pots being raided by divers as evidenced by the twine mesh on the pots being cut or torn away. All of these problems are, unfortunately, all too common in this fishery and are experienced on a regular basis by fishermen, and contribute to gear loss and reduced catches. Additionally some of the gear that was stolen also contained the temperature recorders and they were lost as well. The lost pots represent an expense of $65.00 each and the temperature recorders are $80.00 each. Gear loss during this project amounted to 31 pots and 3 temperature recorders. Additionally 11 pots were damaged and had to be repaired. Gear tampering problems (with the exception of the camera pot) were more severe in 2004 than in 2006. Yet another problem we encountered was long stretches bad weather that kept the vessel at the dock and reduced the number of hauls that we could make.

Deployment and use of the underwater video camera proved to be less than desirable. There were some issues with the camera that proved to be difficult to resolve. Issues with the battery packs and development and fabrication of a mounting device for the camera delayed deployment. A camera mounting system was designed and fabricated for the project. The mounting system successfully held the camera to view activities within the pot and also allowed the pot to be set successfully without tipping over or upside down. Camera battery packs were no longer available from Simrad and a source had to be located for custom fabrication. Over time these issues were addressed and the camera and pot worked well at depth, but recording time was limited. However during the successful deployments of the camera, no black sea bass entered the pot during the video cassette cycle. Using bait in the pot did not attract black sea bass any quicker into the pot.

When the camera pot was deployed successfully and video footage captured, the length of the video tape and short battery life limited the amount of footage able to be obtained. Approximately 45 minutes of video was the most we were able to obtain instead of the 2-3 hours of recording time we expected. Although the pot was baited with squid, this was not enough time to observe black sea bass entering the pot. We were unable to capture any footage of black sea bass in order to evaluate behavior in the pot. Theft of the underwater camera pot was the largest problem encountered during this project.

During the trip of 6/5/06 the camera pot was deployed as usual at the beginning of the trip, in the vicinity of the experimental gear with two large floats and high-flyer attached for identification and retrieval. GPS coordinates of where the gear was set were also recorded. The deployment went smoothly and the buoys were observed floating properly. After hauling and re-setting the experimental gear, we returned to haul the camera pot, but it could not be located. We returned to the exact GPS coordinates but could not locate the buoys and high-flyer. The F/V AJ initiated a search of the area within a 3 mile radius but could not locate the camera pot. All vessels that could be identified as near that area during the day (local draggers and party boats and even the R/V Albatross) were contacted via radio and none reported any interaction with any of our gear. Captain Goncharuk of the A.J. said that while we were hauling the experimental gear, he noticed a small private sports-fishing boat in the area of the camera pot. The incident was reported to the Coast Guard and the local police. The F/V AJ grappled for the missing camera pot for several days after the incident, but it was not recovered. Notices about the loss were posted at all local marinas and docks. All draggers that normally work that area were personally notified to watch for the missing camera pot. Captain Goncharuk also moved some of his regular gear to open up some trawling lanes in the area where the camera was set. A couple of local draggers trawled the area for us to try to recover the camera pot. The camera and associated gear were never recovered and are believed to have been stolen from the fishing location while we were hauling the other gear a couple of miles away.

RSA harvest did not go smoothly for this project. The original intent was to have the participating vessel (F/V AJ) and a couple of inshore draggers harvest much of the RSA in the spring and early summer when the black sea bass migrate into the area and inshore catches are highest. However, as stated previously, the Exempted Fishing Permits were not finalized until the end of August 2004. During the summer and fall of 2004, catches of black sea bass by the fleet were small and very little RSA harvest was made. A concerted effort was made to bring other New York vessels and vessels from other states, into the RSA harvest component of this Project. As other vessels were brought in, the trip limit in New York was increased and vessels were not able to harvest much more than the increased state trip limits, thus keeping RSA landings low. Offshore RSA harvest during December 2004 was successful, but the calendar year ran out before we could fully harvest our RSA allocation. A total of 52,244 lbs of black sea bass RSA were harvested for this project out of a total RSA allocation of 71,500 lbs. Research set-aside income, therefore, was less than required in the original budget for complete project implementation.

We had intended to resume fieldwork on this project in the spring of 2005. This would have allowed the experimental gear to be fished during the most productive season for this fishery off Long Island (spring and early summer). However, due again to delays in extending the Exempted Fishing Permit for the project from 2004 through 2005, the EFP was not issued until July 15, 2005. The new EFP was valid through July 14, 2006, thus allowing work to continue on this project through that date without having to go through the EFP application process again. At the time of the most recent EFP issuance, we had already missed the productive spring and early summer seasons of both 2004 and 2005 and our remaining funds were low and had to be spent wisely in order to accomplish the main goals of the project. The consideration of these important factors indicated that it would be prudent to suspend activity on this project until the spring/early summer fishery in 2006. Since the EFP was valid into 2006, this revised schedule approved by NMFS allowed us to adequately prepare for and capture the spring/summer fishery. Our efforts in 2006 focused on the ten strings of experimental vent configuration gear and limited additional attempts at video, within the confines of the remaining funds.

Black sea bass tagging did not take place during the field operations of this project. Logistical complications of coordinating with the availability of the NEFSC tagging program personnel coupled with a low catch rate during the end of the summer and the autumn precluded any tagging from being completed. Because of these issues and the lack of full RSA funds, the tagging component of the project was suspended.

Need For Additional Work

We currently do not see a need for additional work on this project.

Evaluation

Attainment /Modification of Goals and Objectives

Goal 1: to provide fishery managers, fishery scientists and commercial fishermen with an accurate evaluation of various pot vent sizes and shapes for black sea bass.

This goal was attained by the implementation of this project. It was modified by changing one of the vent sizes and by the lack of video documentation of fish in the pots (see objectives below).

Objective 1a: evaluate the effectiveness of various sizes and shapes of escape vents used in the combination black sea bass/lobster fishery in LMA4

This objective was met by this project. It was modified, with NMFS approval, by substituting a double circular 2.625 inch vent for the 5.75" by 1.375" vent. We completed 18 trips with the experimental gear. A total of 138 string-pulls were accomplished representing 13 complete sets and a total of 1635 pot hauls. The data generated by this activity resulted in the analysis of the effectiveness of vent sizes in the fishery.

Objective 1b: evaluate the size selectivity of various sizes and shapes of escape vents used in the black sea bass/lobster fishery in LMA4.

This objective was met by this project. It was modified, with NMFS approval, by substituting a double circular 2.625 inch vent for the 5.75" by 1.375" vent. We completed 18 trips with the experimental gear. A total of 138 string-pulls were accomplished representing 13 complete sets and a total of 1635 pot hauls. The data generated by this activity resulted in the analysis of the size selectivity of the various vents used in this study.

Objective 1c: document via underwater video the behavior of black sea bass entering pots, behavior while in the pot and escapement behavior.

This objective was not met. Insufficient recording time of the unit and the theft of the camera and associated gear prevented this objective from being met. These issues are detailed above in the Approach and Findings sections.

Goal 2: to provide accurate information to help quantify mortality of black sea bass.

This goal was attained through the implementation of the project.

Objective 2a: estimate the mortality of black sea bass left in pots that continue to fish during the closed season.

This objective was met by this project. It was met by providing information on mortality in extended soak time sets. 16 different strings of gear fished for extended soak times of 28, 33, 34, 40, 44, 45, 48 and 49 days. Additional mortality of black sea bass during extended soak time over the normal 10 day soak did not increase with increasing days between hauls. This objective was modified in that the dedicated long term mortality string of pots was lost and could not be replaced. However the data was still obtained by having the other experimental gear soak for extended periods of time.

Goal 3: to expand the sea sampling and port sampling of black sea bass fisheries.

This goal was attained through the implementation of this project. However the sea sampling component could have been more robust but was limited by issues described in the Approach and Findings sections.

Objective 3a: develop a sea sampling program to target the black sea bass fishery off Long Island, New York.

A sea sampling program was in fact developed for the black sea bass fishing off Long Island, NY. However it was only able to be implemented in the first year of the project. We were not able to continue the sea sampling program during the second year of the project due to reduced RSA income and the unavailability of the certified sea sampling person. These issues are further detailed in the Approach and Findings sections.

Objective 3b: expand the existing dockside sampling program in New York to provide for greater numbers of dockside samples for commercial trips.

This objective was met by this project. A total of 35 dockside black sea bass samples were collected, consisting of 1397 lengths and 585 age structures. Sampling has continued beyond the time line of this project. Dockside sampling goals were in fact exceeded. The original work plan called for 10 sampling events, we have conducted 35.

Objective 3c: expand the existing dockside sampling program in New York with an emphasis on large specimens.

This objective was met by this project. A rigorous dockside sampling program was implemented as described for Objective 3b. The catch is sampled for all sizes of black sea bass landed. When large size sea bass are landed the sampling captures these length frequencies and age structures. Additionally the large size cull category is prioritized during sampling.

Goal 4: increase knowledge of black sea bass populations and migration patterns.

Objective 4a: participate in the black sea bass tagging program sponsored by the Northeast Fisheries Science Center.

This goal and objective were not met by this project. NMFS preferred to tag black sea bass only during the months of May and September. CMP and NMFS attempted numerous times to coordinate trips during these two months. A multiple of logistical issues prevented the final scheduling of any tagging trips. These issues included NMFS staff unavailable due to other scheduled tagging efforts; travel time and distance from Woods Hole, MA to Long Island, NY; weather issues; time constraints of both projects. All factors combined to negatively impact the ability to successfully coordinate any tagging trips. The original work plan called for two tagging trips.

Dissemination of Results

Preliminary results of this project were presented at the 2005 Black Sea Bass and Scup Vent Size Workshop. This workshop was held March 22-23, 2005 and was sponsored by the Atlantic States Marine Fisheries Commission and the Mid Atlantic Fishery Management Council. The goal of the workshop was to develop recommendations for managers on minimum vent size and trap and pot configurations for the black sea bass and scup commercial fisheries.

Once The Final Report is approved, it will be provided to: ASMFC; MAFMC; NYDEC; the Long Island Commercial Fishing Association; the Long Island Sound Lobstermen's Association; and other interested fishing organizations. The report will also be made available to the Commercial Fisheries News for trade press coverage. We will attempt to make a presentation at a future meeting of the Long Island Sound Lobstermen's Association meeting.

Literature Cited

Shepherd, G.R., C.W. Moore and R.J. Seagraves, 2002. The effect of escape vents on the capture of black sea bass, Centropristis striata, in fish traps. Fisheries Research 54: 195-207.

Skrobe, L.G. and L. M. Lee, 2003. Evaluation of catch efficiency and size selectivity of inshore New England fish pots for black sea bass and scup as a function of escape vent size. URI Fisheries Center Technical Report: 02-03.

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Table 1

	String 61	String 62	String 63	String 64	String 65	String 66	String 67	String 68	String 69	String 70	String 71
Block 1	Double 2 5/8"	2.0" Square	2.0" Square	5.75" x 2.0"	Single 2 3/8"	2.0" Square	Single 2 3/8"	Double 2.5"	2.0" Square	No Vent	2.0" Square
	5.75" x 2.0"	Double 2.5"	Double 2.5"	Double 2 5/8"	2.0" Square	Single 2 3/8"	Double 2.5"	5.75" x 2.0"	Double 2 5/8"	Double 2 5/8"	Double 2.5"
	No Vent	5.75" x 2.0"	Single 2 3/8"	2.0" Square	No Vent	Double 2 5/8"	2.0" Square	2.0" Square	No Vent	2.0" Square	5.75" x 2.0"
	2.0" Square	Single 2 3/8"	5.75" x 2.0"	Single 2 3/8"	5.75" x 2.0"	No Vent	Double 2 5/8"	Single 2 3/8"	5.75" x 2.0"	5.75" x 2.0"	No Vent
	Double 2.5"	No Vent	Double 2 5/8"	No Vent	Double 2 5/8"	Double 2.5"	No Vent	Double 2 5/8"	Double 2.5"	Double 2.5"	Single 2 3/8"
	Single 2 3/8"	Double 2 5/8"	No Vent	Double 2.5"	Double 2.5"	5.75" x 2.0"	5.75" x 2.0"	No Vent	Single 2 3/8"	Single 2 3/8"	Double 2 5/8"
Block 2	2.0" Square	5.75" x 2.0"	Double 2.5"	2.0" Square	Double 2 5/8"	5.75" x 2.0"	Single 2 3/8"	5.75" x 2.0"	5.75" x 2.0"	2.0" Square	Double 2.5"
	Double 2 5/8"	Double 2 5/8"	Double 2 5/8"	Single 2 3/8"	No Vent	Double 2 5/8"	Double 2 5/8"	No Vent	No Vent	Double 2 5/8"	5.75" x 2.0"
	Single 2 3/8"	Double 2.5"	5.75" x 2.0"	5.75" x 2.0"	Single 2 3/8"	Single 2 3/8"	Double 2.5"	Double 2.5"	Single 2 3/8"	No Vent	Single 2 3/8"
	Double 2.5"	2.0" Square	2.0" Square	No Vent	5.75" x 2.0"	2.0" Square	5.75" x 2.0"	Double 2 5/8"	Double 2 5/8"	Single 2 3/8"	Double 2 5/8"
	No Vent	No Vent	No Vent	Double 2.5"	2.0" Square	No Vent	No Vent	2.0" Square	Double 2.5"	Double 2.5"	2.0" Square
	5.75" x 2.0"	Single 2 3/8"	Single 2 3/8"	Double 2 5/8"	Double 2.5"	Double 2.5"	2.0" Square	Single 2 3/8"	2.0" Square	5.75" x 2.0"	No Vent

Table 2. Soak Times for Each String Pulled per Haul Date

Haul Date	Number of Strings Pulled	Soak Time (days)
August 20, 2004	2	10
	2	14
	2	44
	1	45
	1	48
August 23, 2004	1	10
	2	49
August 30, 2004	3	7
	8	10
September 13, 2004	11	13
September 23, 2004	11	10
October 4, 2004	5	11
October 7, 2004	1	3
	5	14
October 14, 2004	3	10
November 4, 2006	4	28
November 16, 2006	1	33
	2	40
November 17, 2004	2	34
	1	44
May 5, 2006	5	15
	5	16
May 24, 2006	1	17
	9	19
June 5, 2006	10	12
June 16, 2006	10	11
June 30, 2006	10	14
July 7, 2006	10	7
July 14, 2006	10	7

Table 3. Results of ranked ANOVAs evaluating the influence of block, vent, haul date, and soak time on black sea bass total catch (numbers of fish and pounds). The first two columns are ANOVAs with zero catches, the 3rd and 4th columns are ANOVAs without zero catches, and the last two columns are ANOVAs of caught versus not caught. P > 0.05. *, interaction term.

	With Zeros		**Without Zeros**		**Caught versus Not Caught**	
	Total Number Caught	**Total Pounds Caught**	**Total Number Caught**	**Total Pounds Caught**	**Total Number Caught**	**Total Pounds Caught**
Block	0.0332	0.0163	NS	0.0040	NS	NS
Vent	0.0001	0.0001	0.0001	0.0067	0.0001	0.0001
Vent*Block	0.0467	0.0233	NS	NS	NS	0.0366
Haul date	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Block*Haul date	NS	NS	NS	NS	NS	NS
Vent*Haul date	0.0001	0.0001	NS	NS	0.0014	0.0003
Soak time	0.0001	0.0001	0.0226	NS	0.0001	0.0081

Table 4. Results of ranked ANOVAs evaluating the influence of block, vent, haul date, and soak time on black sea bass kept and discarded (numbers of fish and pounds), and the fraction of pounds and number kept. P > 0.05. *, interaction term.

	Number Kept	**Number Discarded**	**Pounds Kept**	**Pounds Discarded**	**Fraction of Pounds Kept[1]**	**Fraction of Number Kept[1]**
Block	NS	NS	NS	NS	NS	NS
Vent	0.0019	NS	NS	NS	NS	NS
Vent*Block	NS	NS	NS	NS	NS	NS
Haul date	0.0001	NS	0.0001	0.0003	0.0003	0.0001
Block*Haul date	NS	NS	NS	NS	NS	NS
Vent*Haul date	NS	NS	NS	NS	NS	NS
Soak time	0.0115	NS	NS	NS	NS	NS

*Calculated the fraction of pounds or numbers kept by the following formula: Kept / Kept + Discards

Table 5. Results of ranked ANOVAs evaluating the influence of block, vent, haul date and soak time on black sea bass total pounds and number of fish caught, kept and discarded pounds and number of fish, and the fraction of the kept catch (pounds and number of fish). The haul dates where the fraction kept was greater than 80% were excluded from this analysis. The following haul dates were used August 30, 2004, May 5, 2006, June 5, 2006, June 30, 2006, October 7, 2004, September 23, 2004, July 7, 2006, and July 14, 2006. P > 0.05. *, interaction term.

	Total Number Caught	**Total Pounds Caught**	**Pounds Kept**	**Pounds discarded**	**Number Kept**	**Number discarded**	**Fraction Kept by pounds**	**Fraction Kept by number**
Block	NS	NS	NS	NS	NS	NS	0.0184	NS
Vent	0.0001	0.0001	NS	NS	0.0082	NS	NS	0.0412
Vent*Block	NS	NS	NS	NS	0.0390	0.0236	0.0035	0.0005
Haul date	0.0001	0.0001	0.0001	0.0003	0.0021	NS	NS	NS
Block*Haul date	NS	NS	NS	NS	NS	NS	NS	NS
Vent*Haul date	0.0005	0.0004	NS	NS	NS	NS	NS	NS
Soak time	0.0261	0.0277	NS	NS	NS	NS	NS	NS

Table 6. Results of ANOVAs evaluating the influence of vent and haul date in Case A; vent without haul date in Case B; vent and haul date from hauls with a discard rate >0.80 in Case C; and vent only from hauls with a discard rate >0.80 in Case D on black sea bass mean length, the 25th, 50th, and 75th percentiles of size, the interquartile range, skewness, and kurtosis. $P > 0.05$. *, interaction term

Case A	Mean length	Median Length	25th Percentile	75th % Percentile	Range	Interquartile range	Skewness	Kurtosis
Vent	0.0250	NS	NS	NS	NS	NS	NS	0.0109
Haul date	NS	NS	0.0048	NS	0.0013	0.0148	0.0063	0.0006
Case B								
Vent (no haul date)	0.0215	NS	NS	0.0379	NS	NS	NS	0.0190
Case C Hauls with Discard Rate >0.80								
Vent	NS	NS	NS	NS	NS	NS	NS	NS
Haul Date	NS	NS	NS	NS	NS	NS	NS	NS
Case D Hauls with a Discard Rate >0.80								
Vent (no haul date)	NS	NS	NS	NS	NS	NS	NS	0.0256

Table 7 . Incidences of Black Sea Bass Mortality

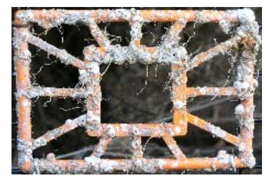
Soak Time (Days)	Date	String Number	Vent Size	Number of Dead Fish Captured	Notes
10	8/30/2004	67	2 3/8"	1	1 dead black sea bass
13	9/13/2004	66	2" Square	1	1 dead black sea bass (decomposing)
13	9/13/2004	71	Double 2 5/8"	1	1 dead black sea bass (decomposing)
15	5/5/2006	70	2 3/8"	1	1 dead black sea bass
19	5/24/2006	65	No Vent	1	1 dead black sea bass (skeleton)
33	11/16/2004	67	5.75" X 2"	1	1 dead black sea bass
49	8/23/2004	66	2 3/8"	1	1 dead black sea bass (partially decomposed)

Figure 1

2 3/8" Circle
(Black Sea Bass Regulation)

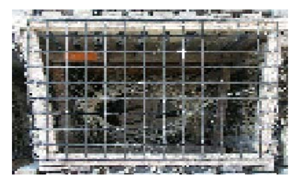
2 1/2" Double Circle
(Lobster Regulation)

2 5/8" Double Circle
(proposed Lobster, replaces
1 3/8" x 5.75")



2" Square
(Black Sea Bass Regulation)

5.75" x 2" Rectangle
(Lobster Regulation)



No Vent
(Control)

Figure 2

Length Frequency Distribution for Black Sea Bass by Vent Configuration

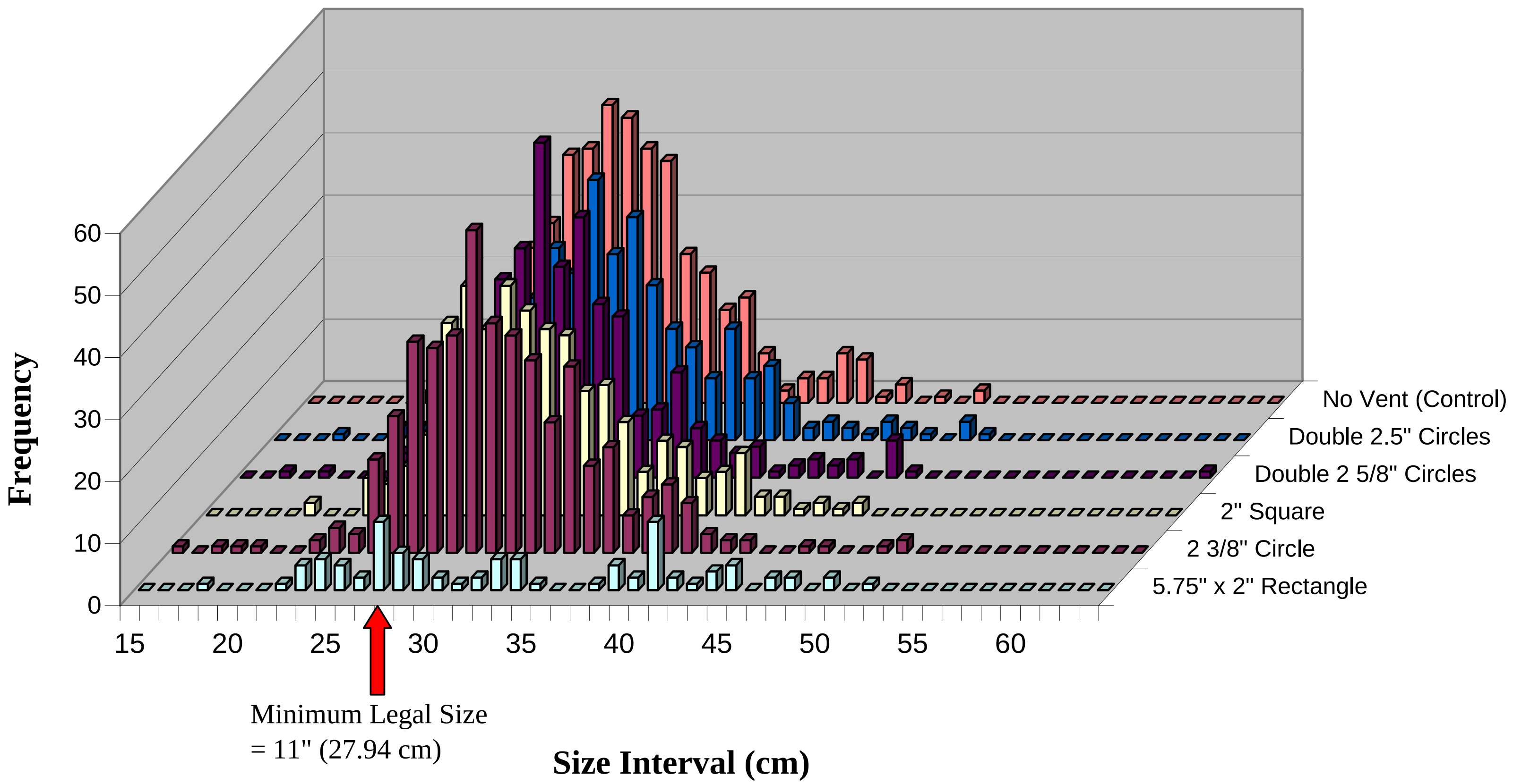


Figure 3

Length Frequency Distribution for Black Sea Bass For $2^3/_8$" Circle Vent Compared to No Vent (Control)

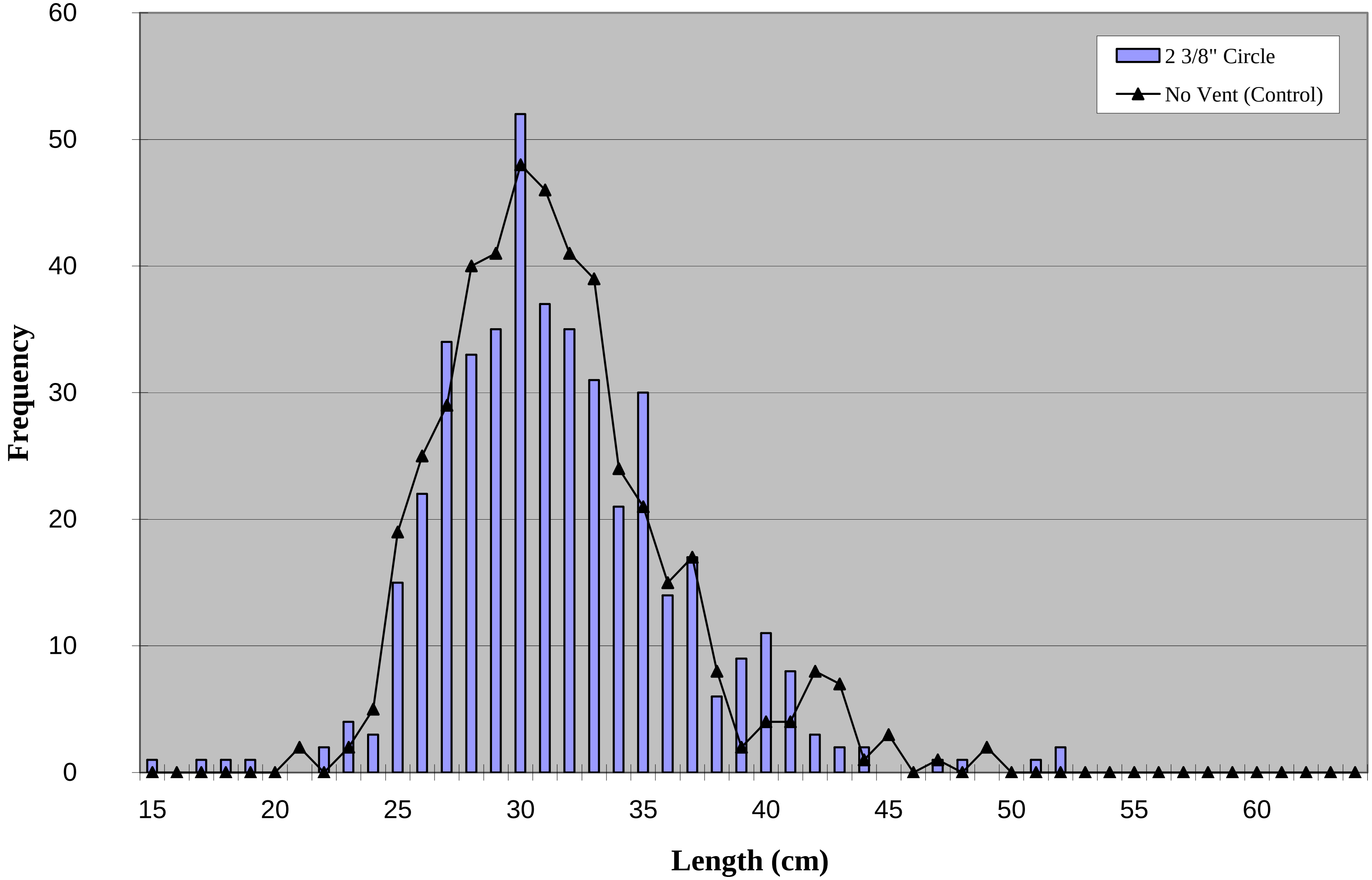


Figure 4

Length Frequency Distribution for Black Sea Bass For 2" Square Vent Compared to No Vent (Control)

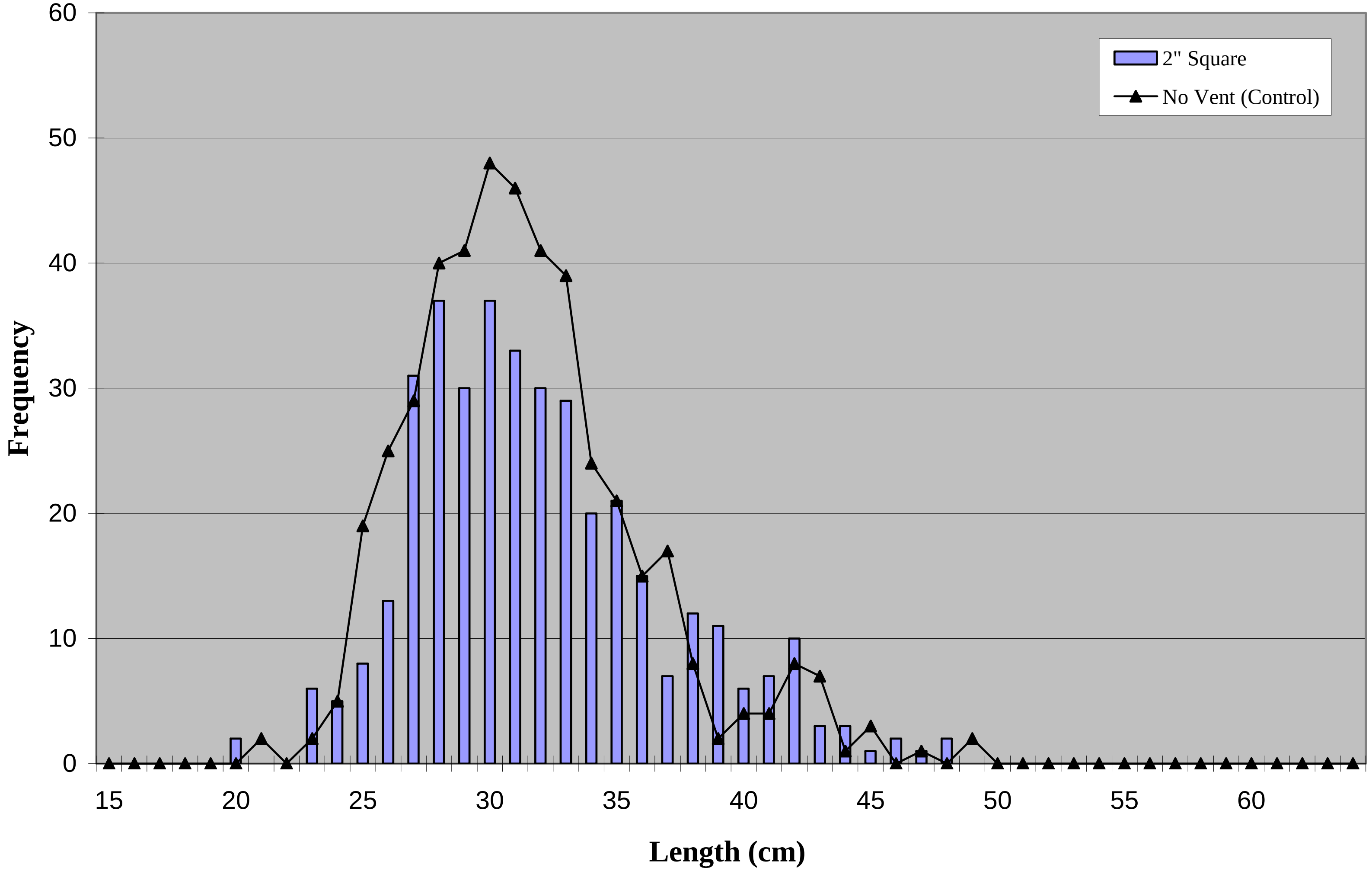


Figure 5

Length Frequency Distribution for Black Sea Bass For 5.75" x 2" Rectangle Vent Compared to No Vent (Control)

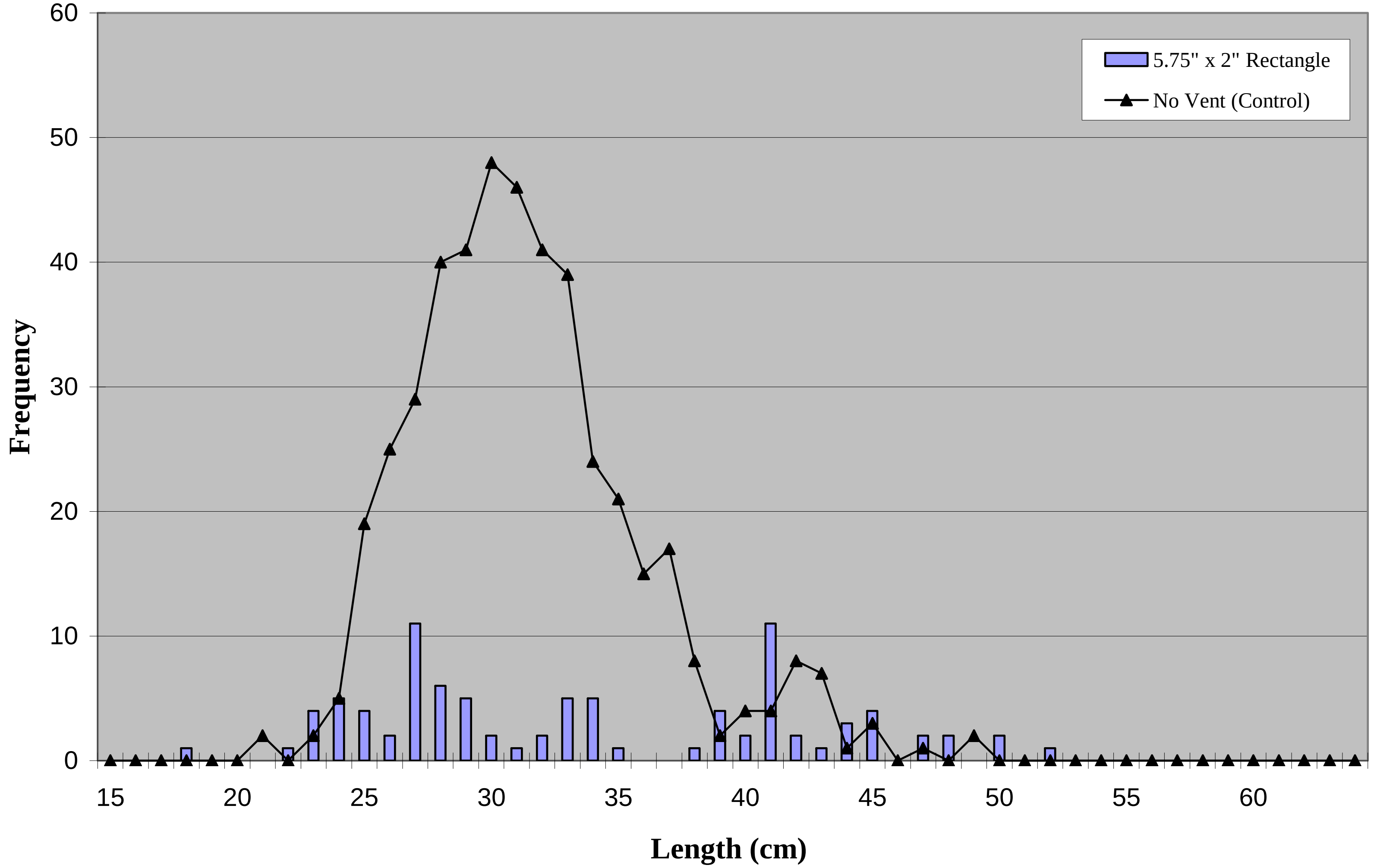


Figure 6

Length Frequency Distribution for Black Sea Bass For Double $2^5/_8$" Circles Vent Compared to No Vent (Control)

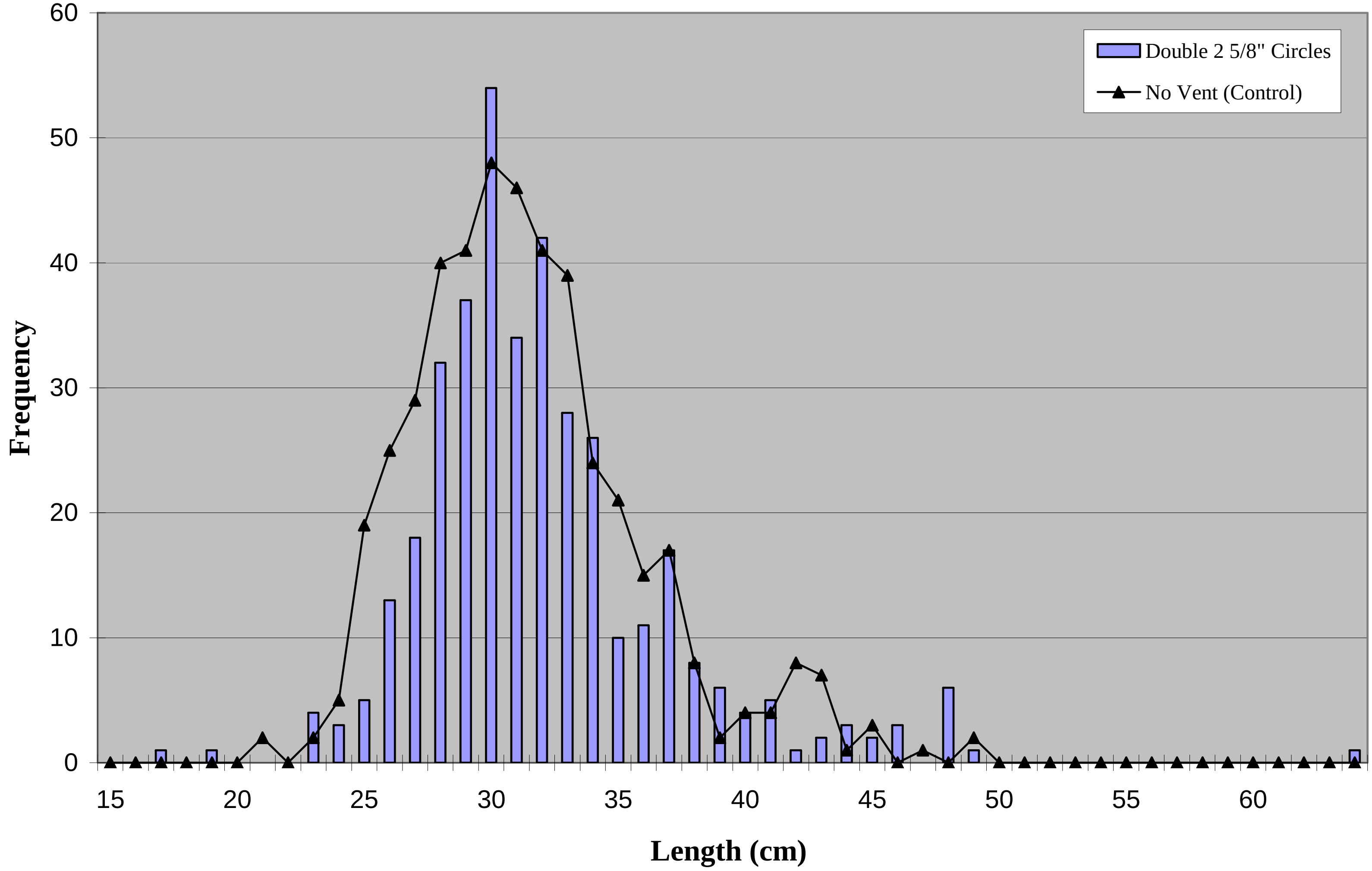


Figure 7

Length Frequency Distribution for Black Sea Bass For Double 2.5" Circles Vent Compared to No Vent (Control)

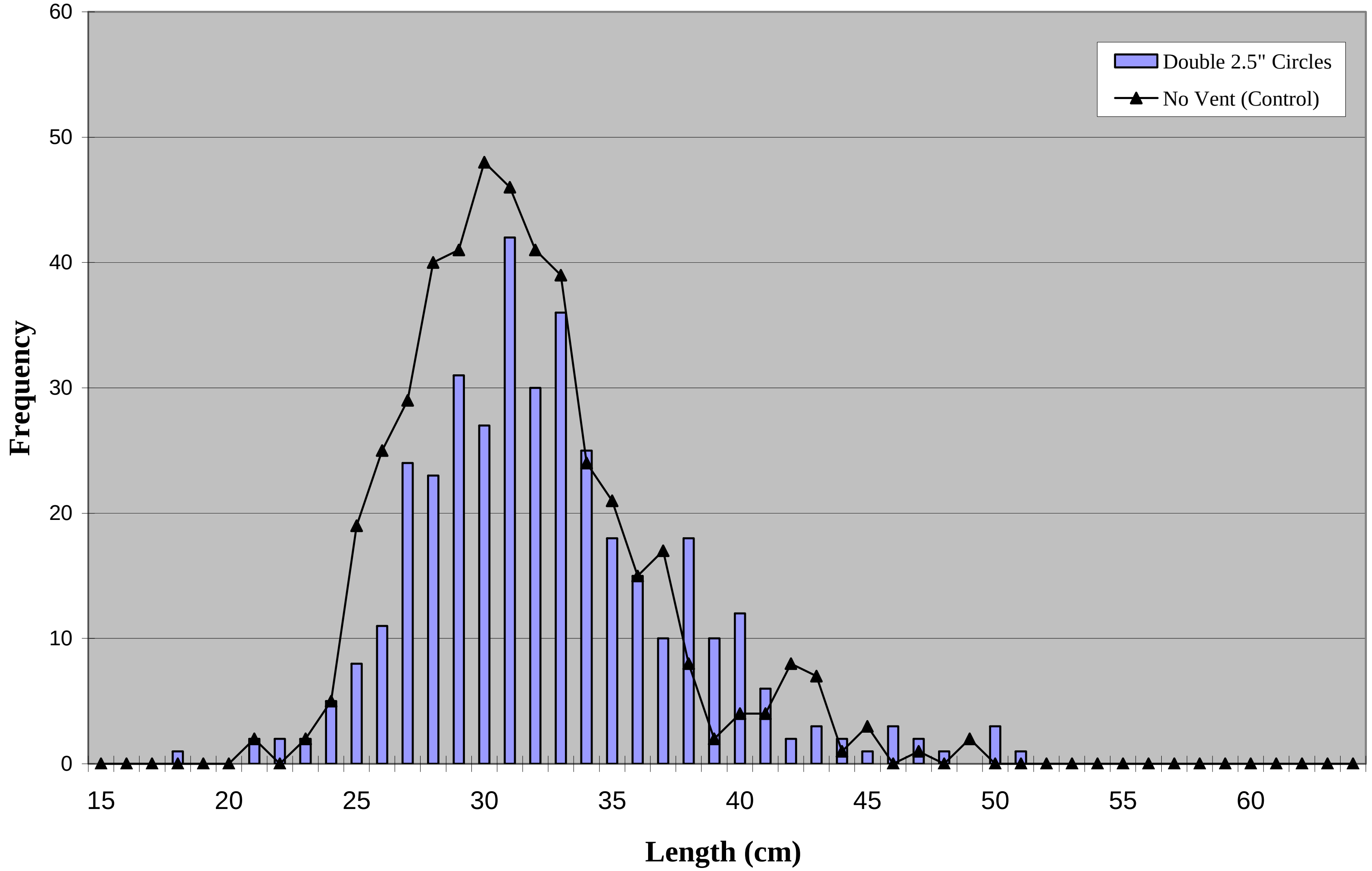


Figure 8

Mean Length of Black Sea Bass Captured in Each Vent Configuration

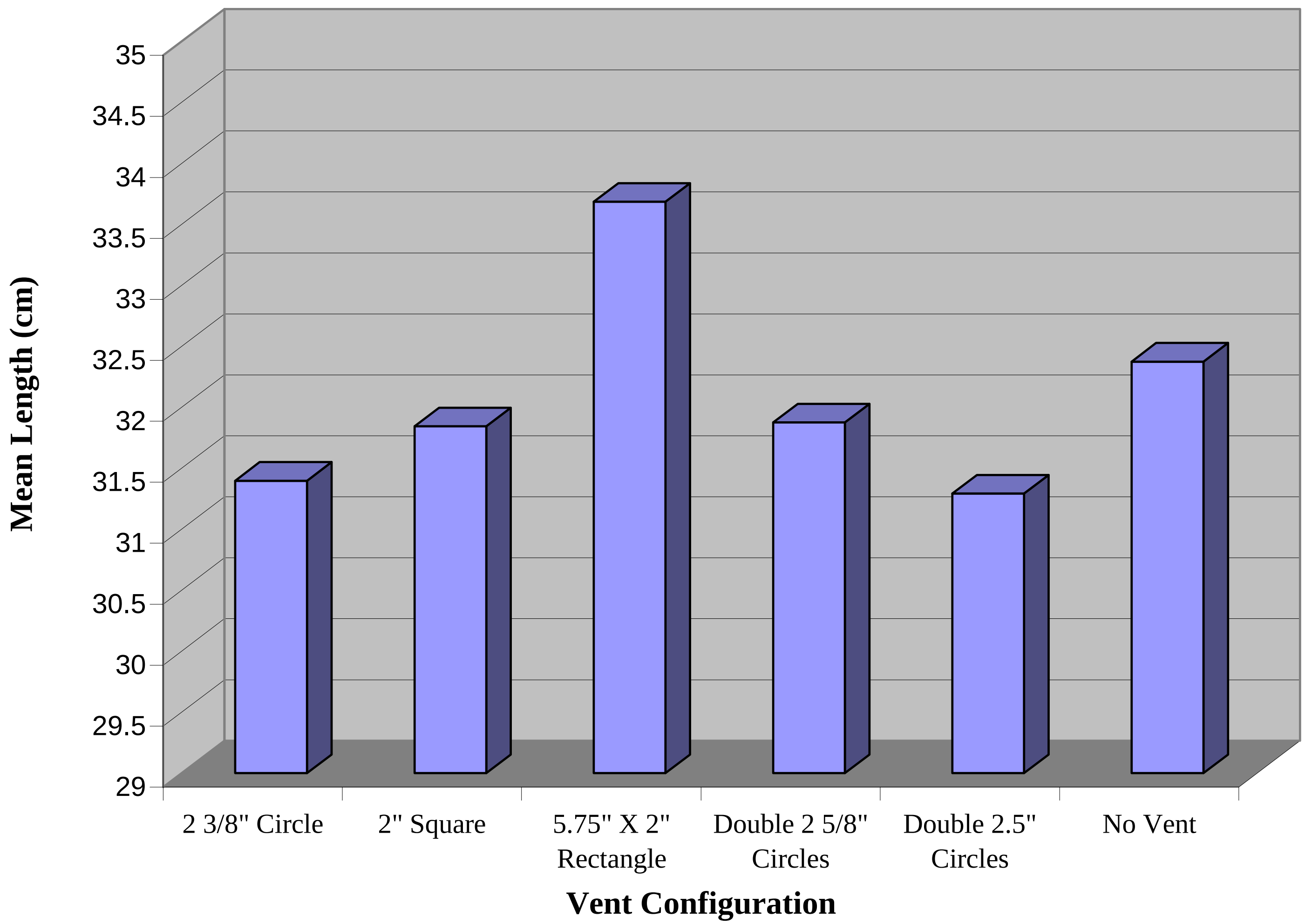


Figure 9

Total Number of Black Sea Bass Captured for Each Vent Configuration

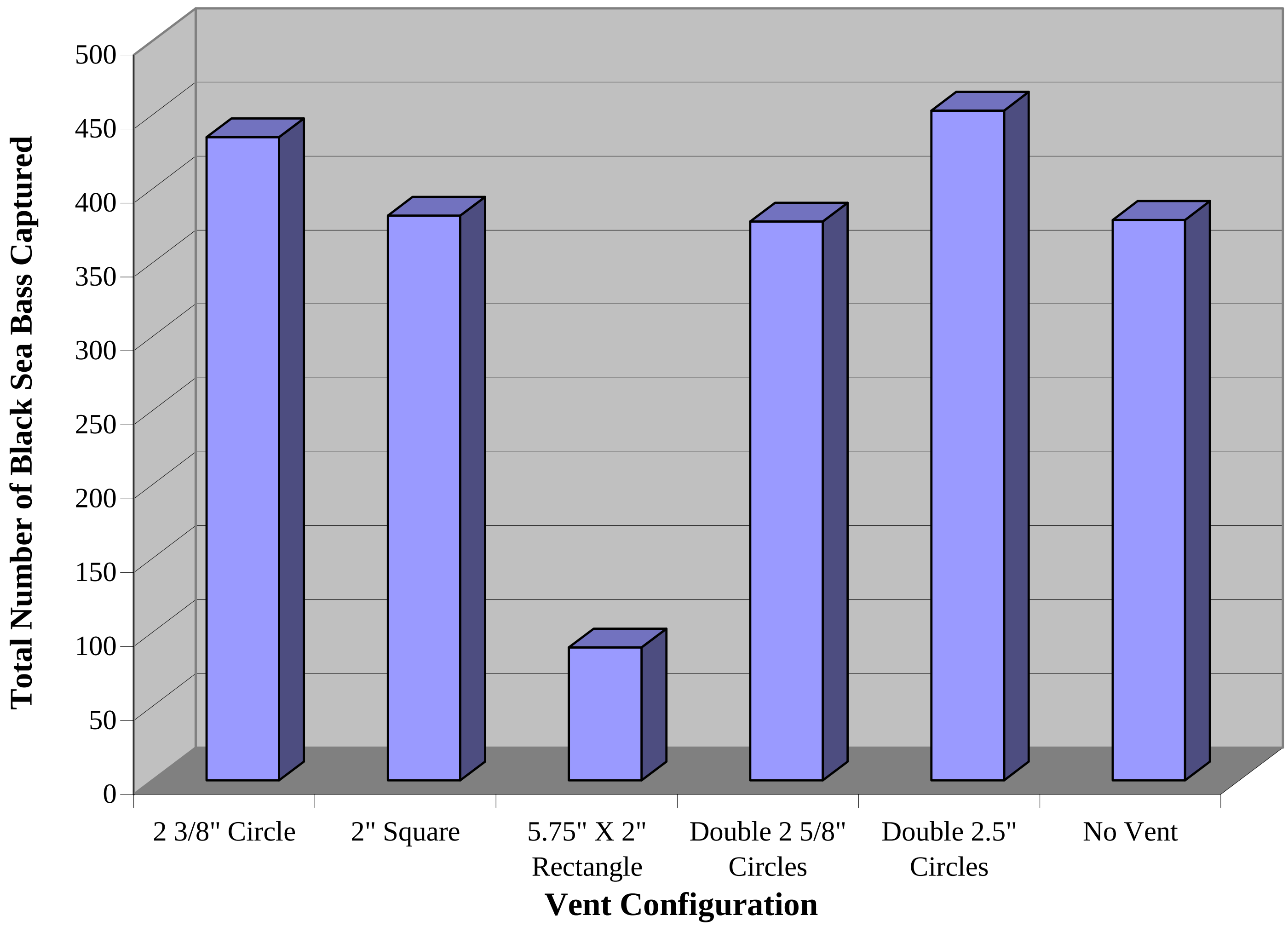


Figure 10

Total Weight of Black Sea Bass Captured for Each Vent Configuration

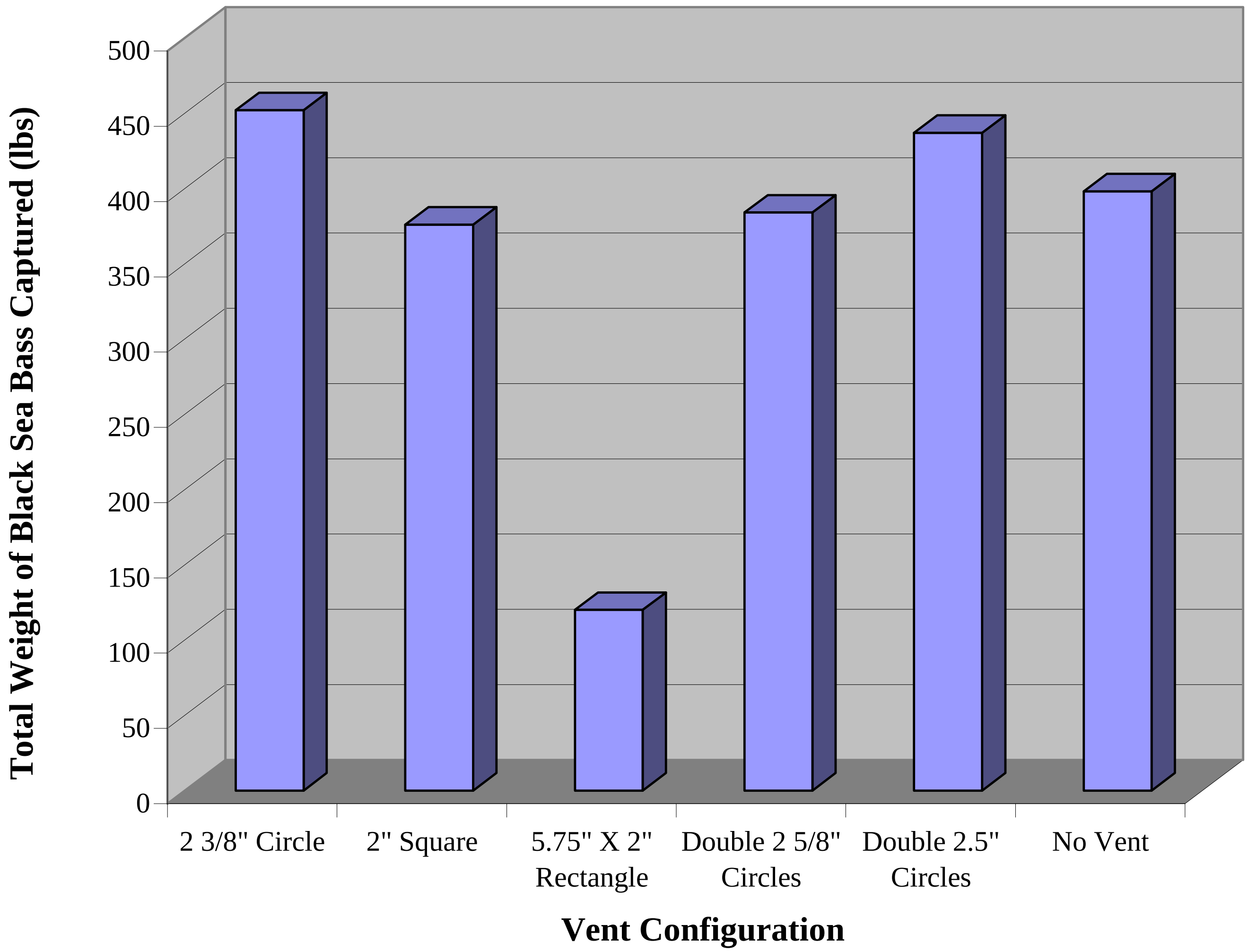


Figure 11

Mean Weight of Black Sea Bass Captured per Pot Haul for Each Vent Configuration

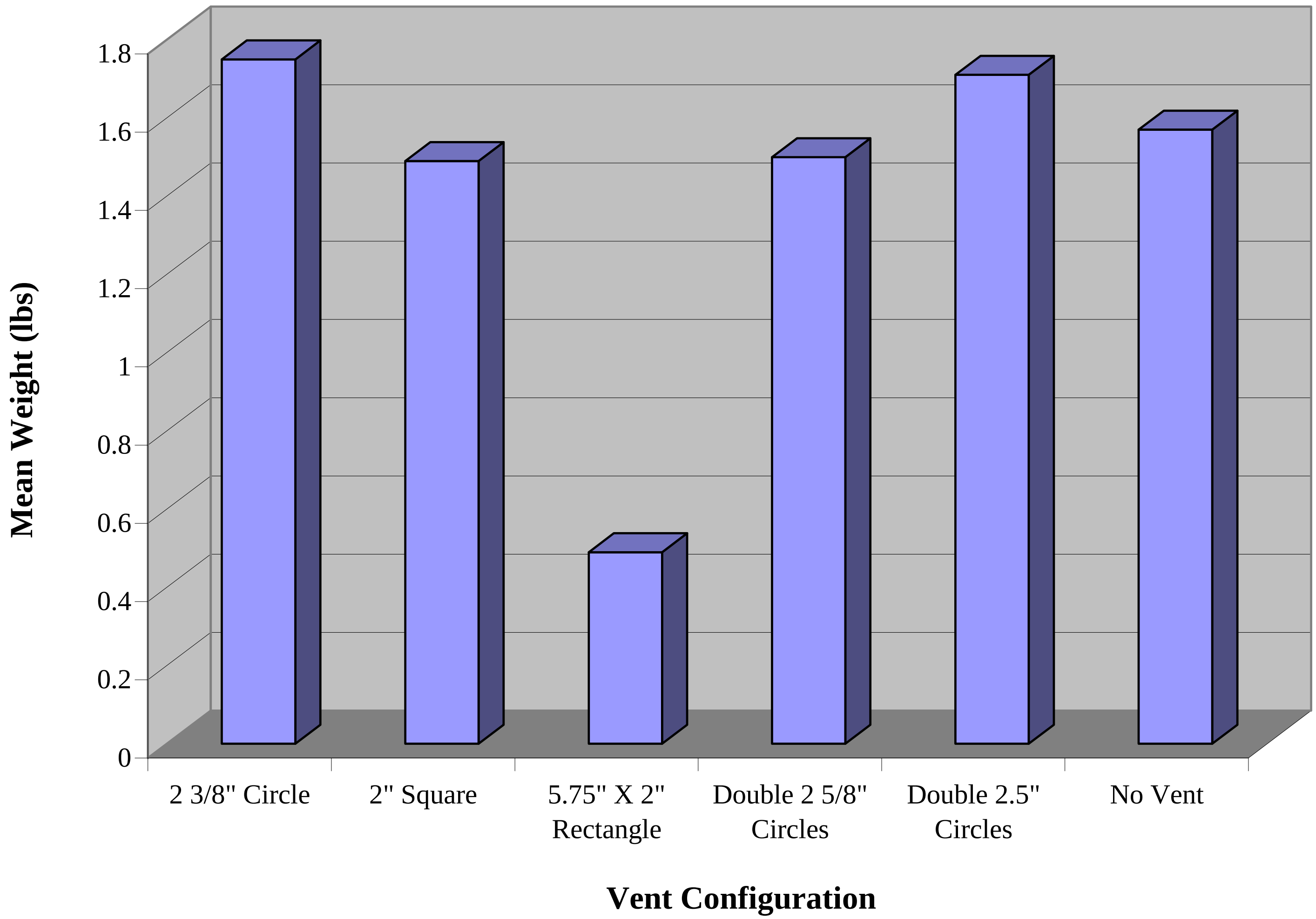


Figure 12

Total Number of Legal & Sub-Legal Black Sea Bass Captured for Each Vent Configuration

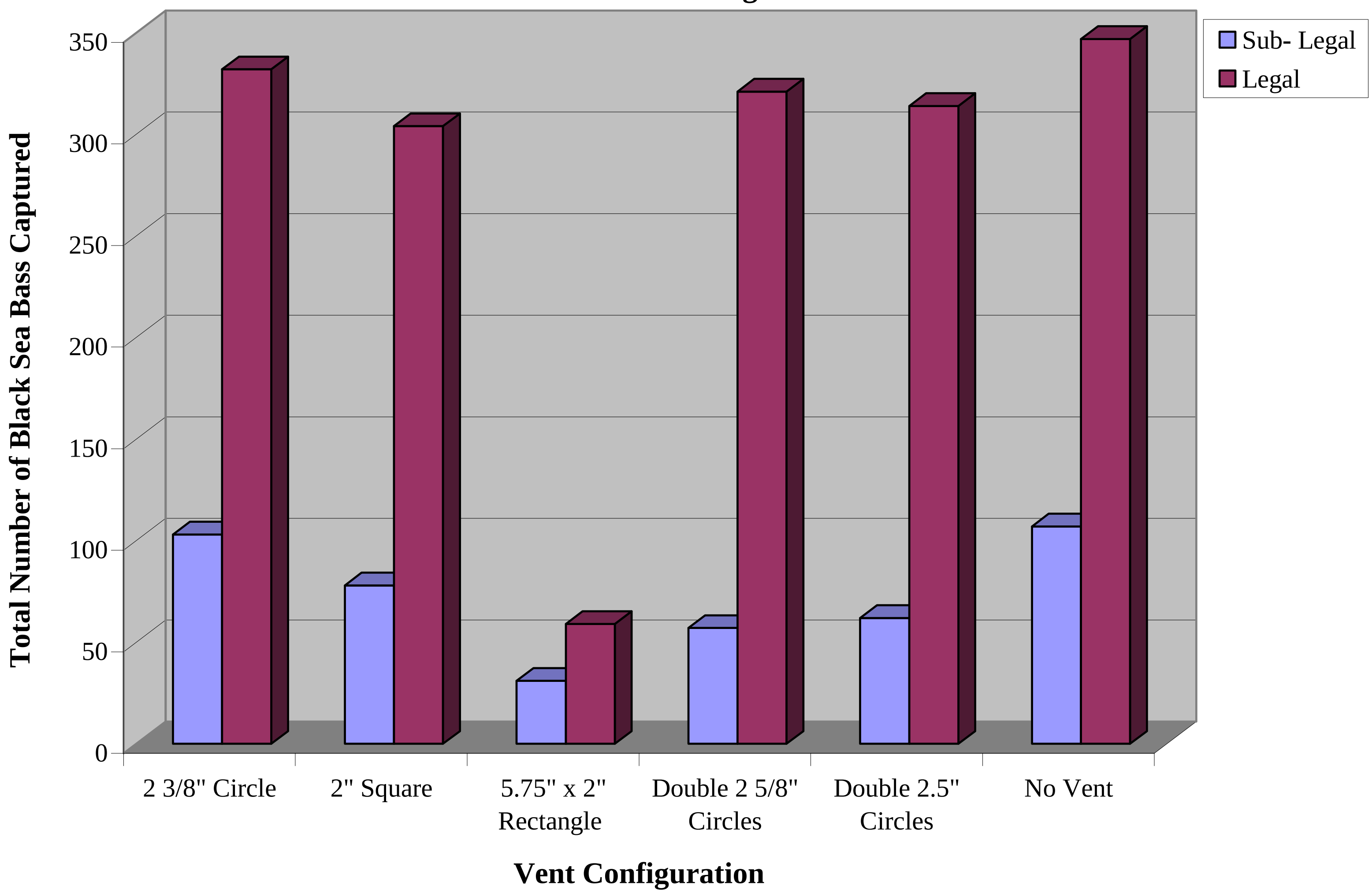
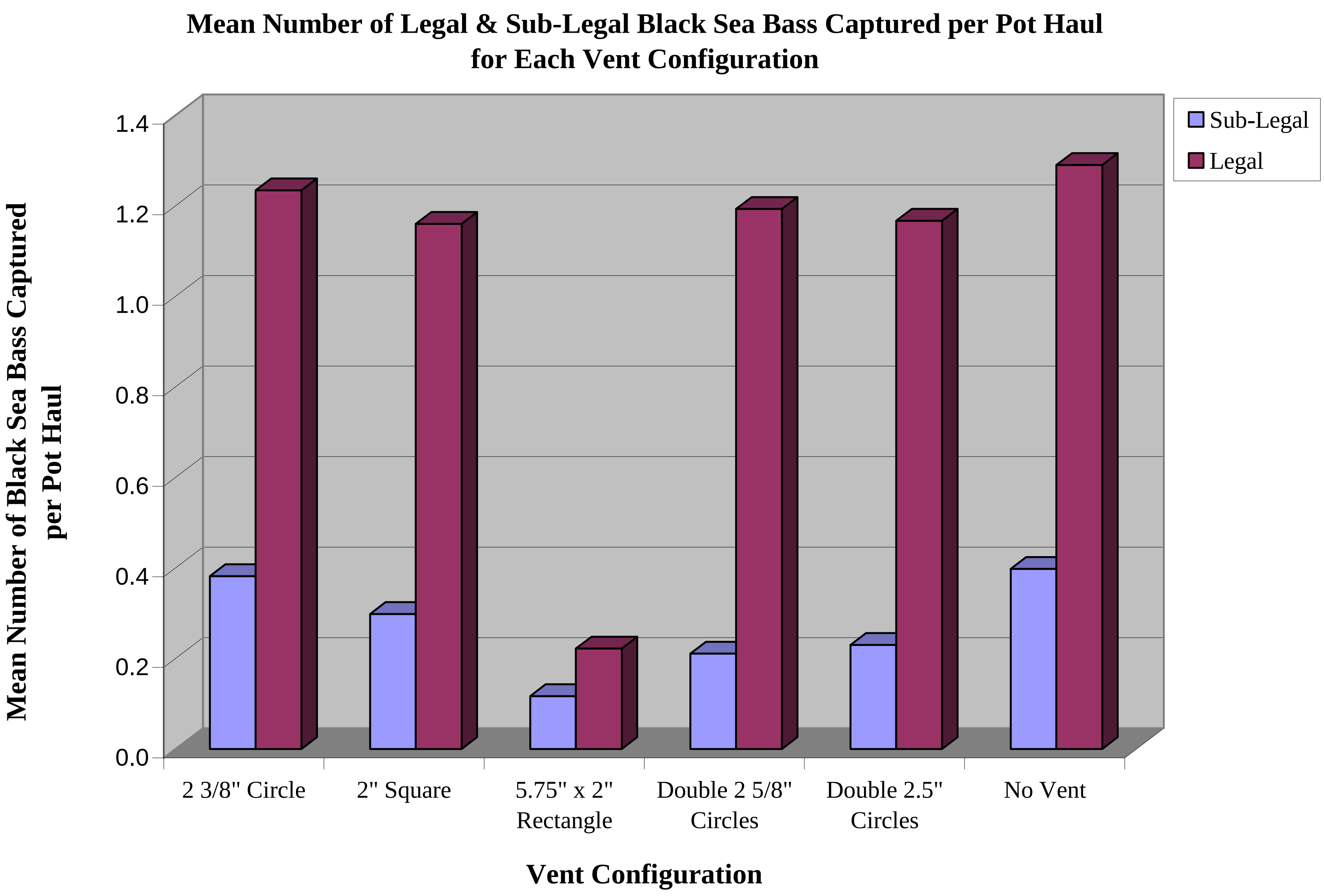


Figure 13



Mean Number of Legal & Sub-Legal Black Sea Bass Captured per Pot Haul for Each Vent Configuration
Mean Number of Black Sea Bass Captured per Pot Haul
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Sub-Legal
Legal
2 3/8" Circle
2" Square
5.75" x 2" Rectangle
Double 2 5/8" Circles
Double 2.5" Circles
No Vent
Vent Configuration

Figure 14

Percent by Number of Legal and Sub-Legal Black Sea Bass for Each Vent Configuration

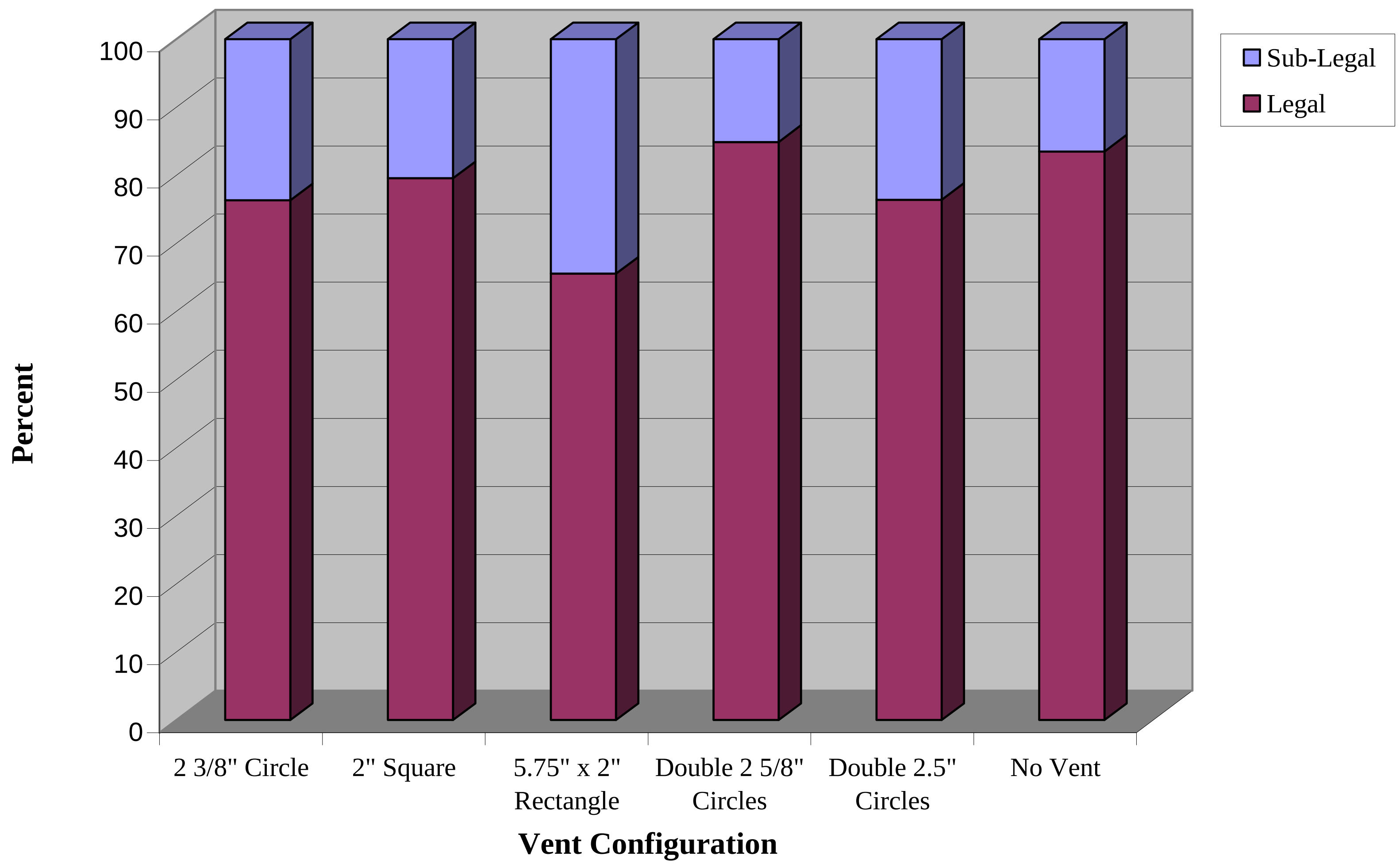


Figure 15

Mean Weight of Legal and Sub-legal Black Sea Bass Captured per Pot Haul for Each Vent Configuration

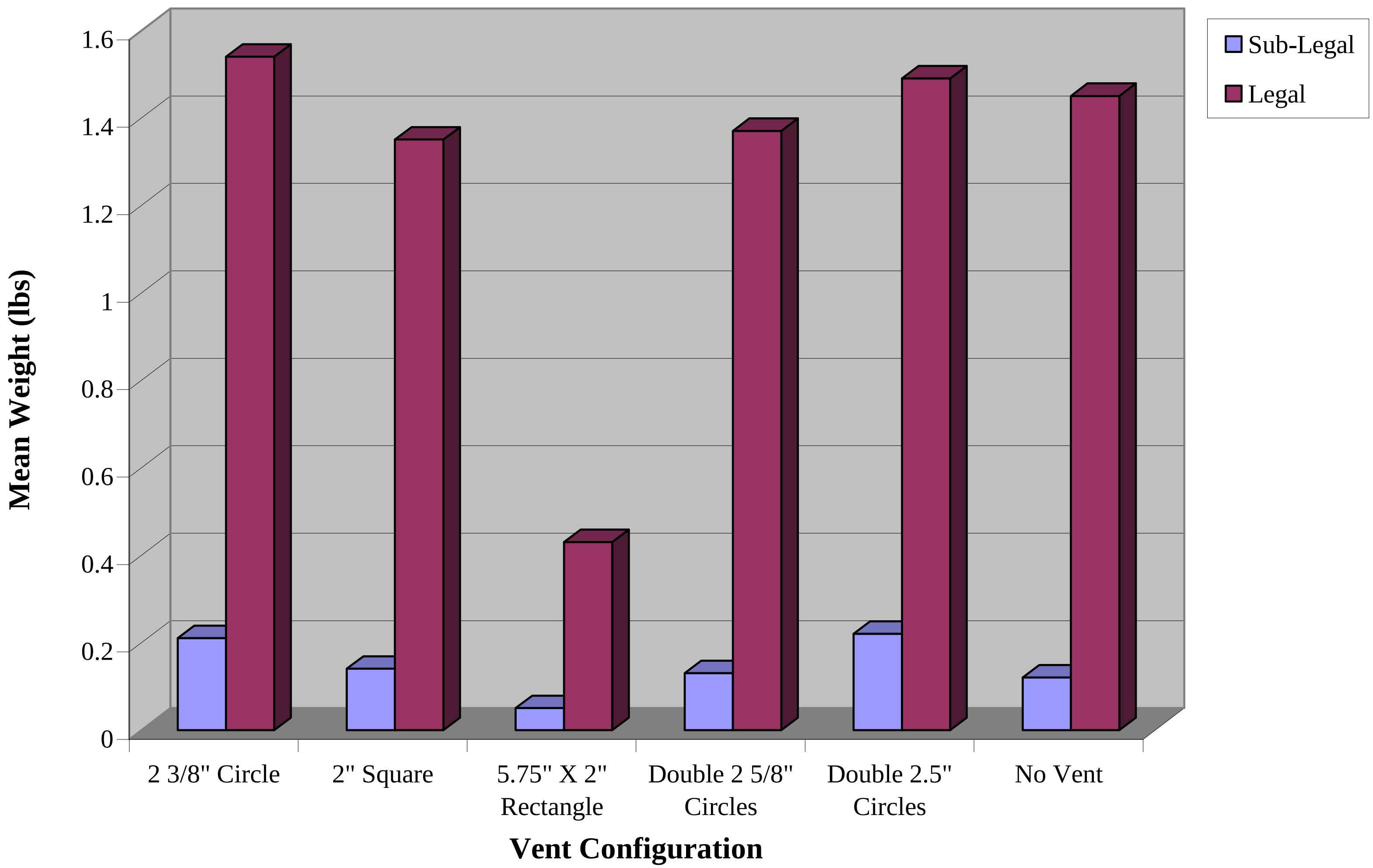


Figure 16

Percent by Weight of Legal and Sub-Legal Black Sea Bass for Each Vent Configuration

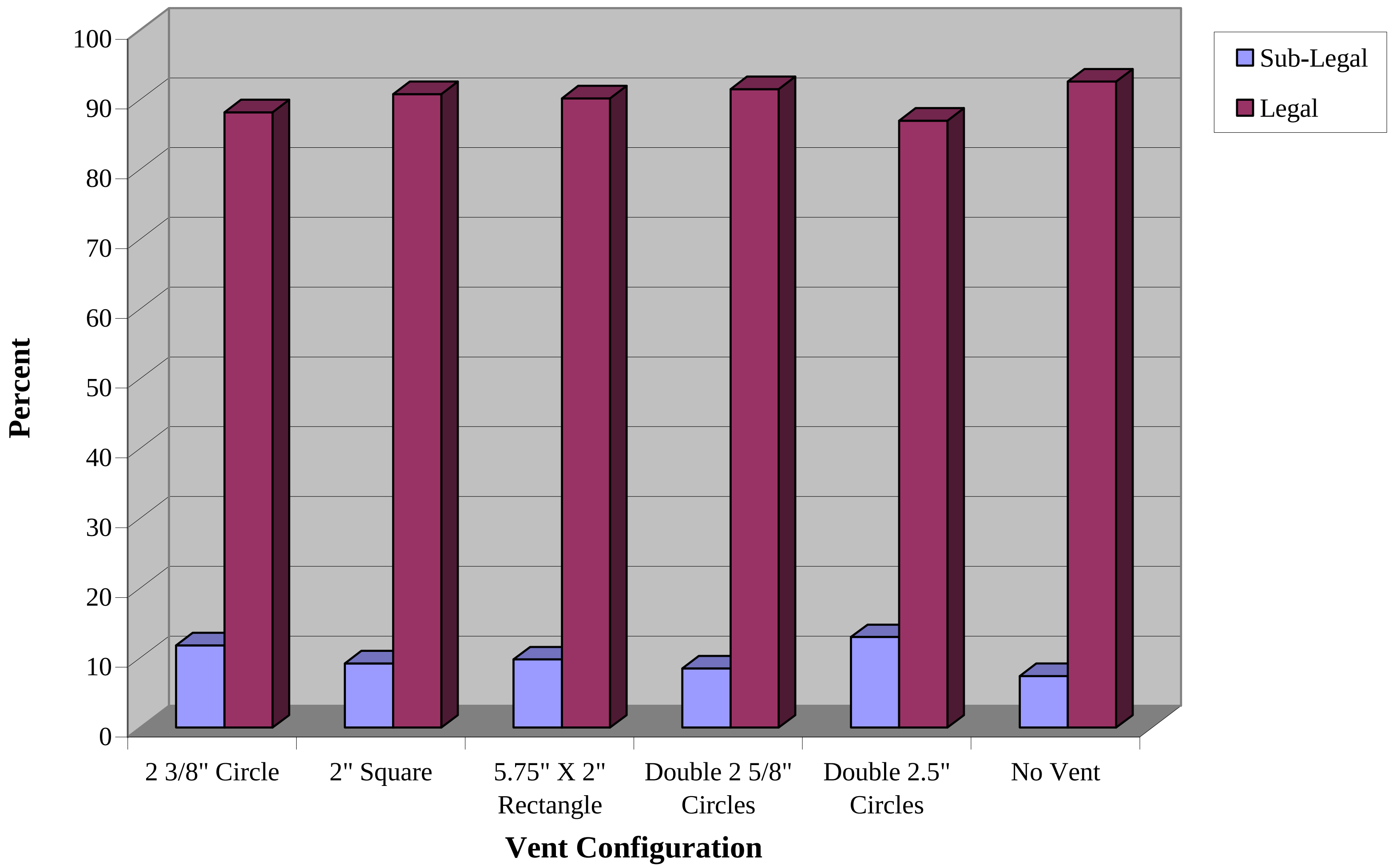


Figure 17

Catch Per Unit Effort (CPUE) as Defined by Total Number of Black Sea Bass Per Pot Haul for Each Vent Configuration

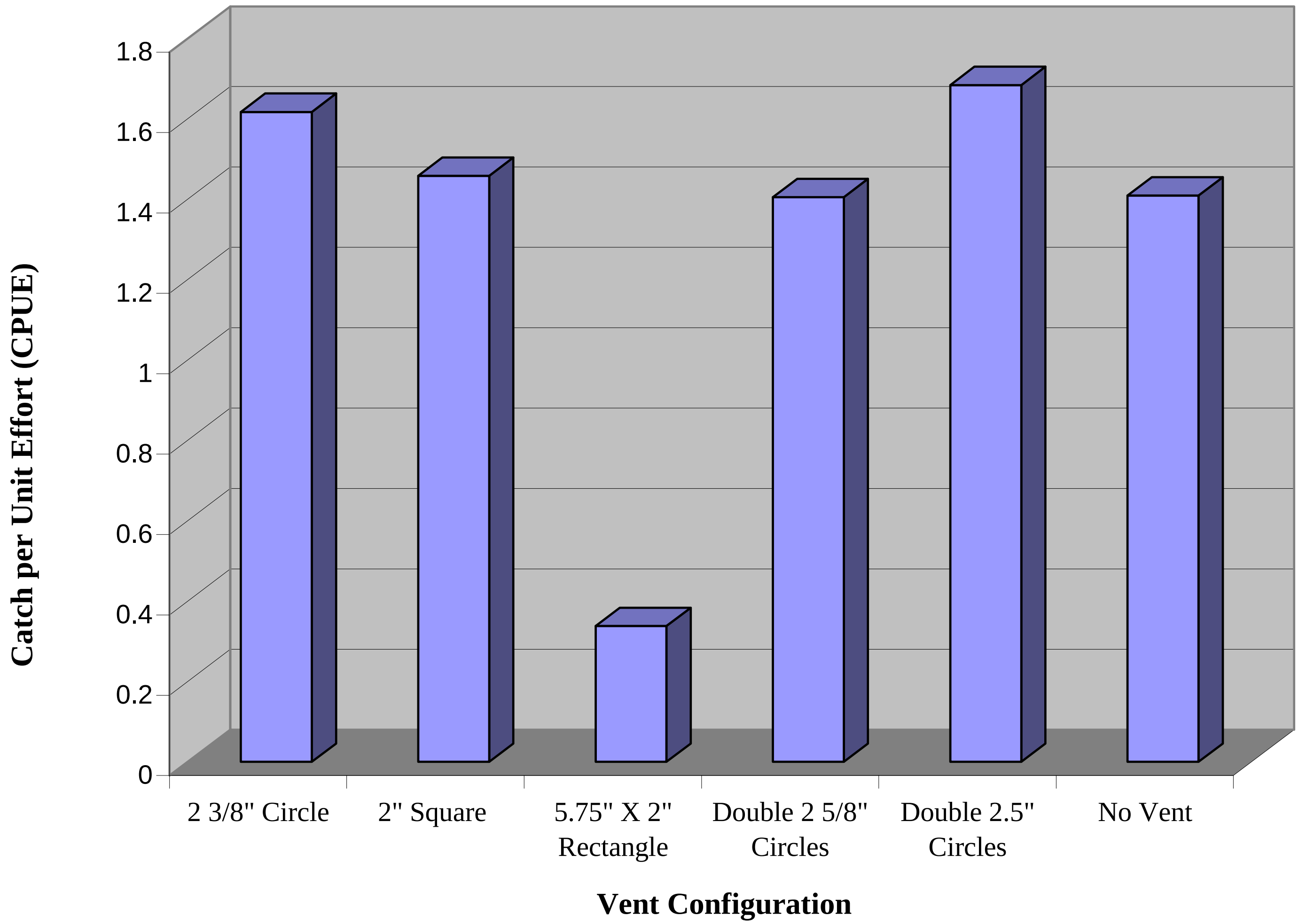


Figure 18

Catch per Unit Effort (CPUE) as Defined by Total Weight of Black Sea Bass Per Pot Haul for Each Vent Configuration

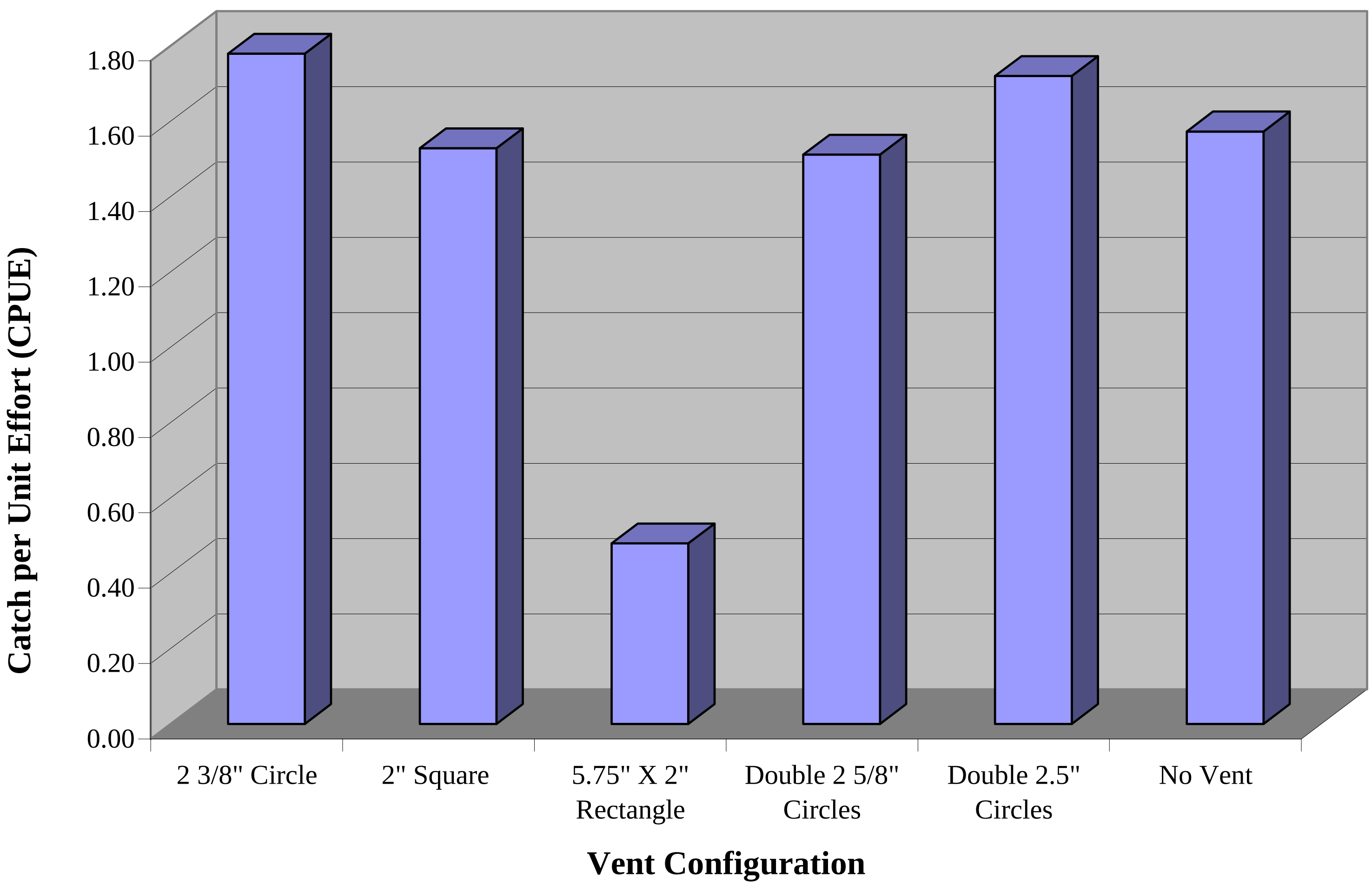


Figure 19

Average Weight of Black Sea Bass Captured by Soak Time (Excluding Zero Catches)

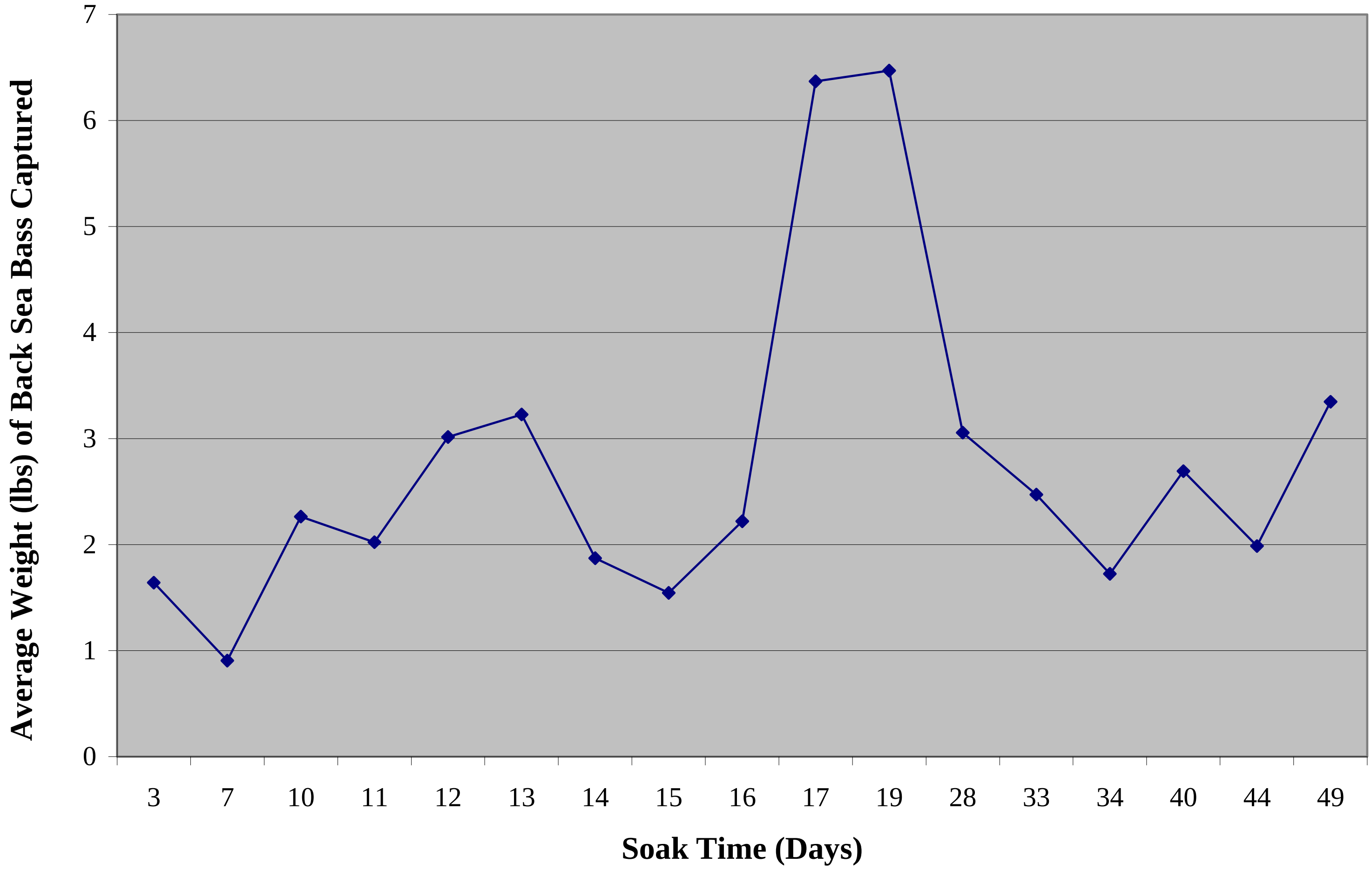


Figure 20

Mean Number of Scup Captured per Pot Haul for Each Vent Configuration

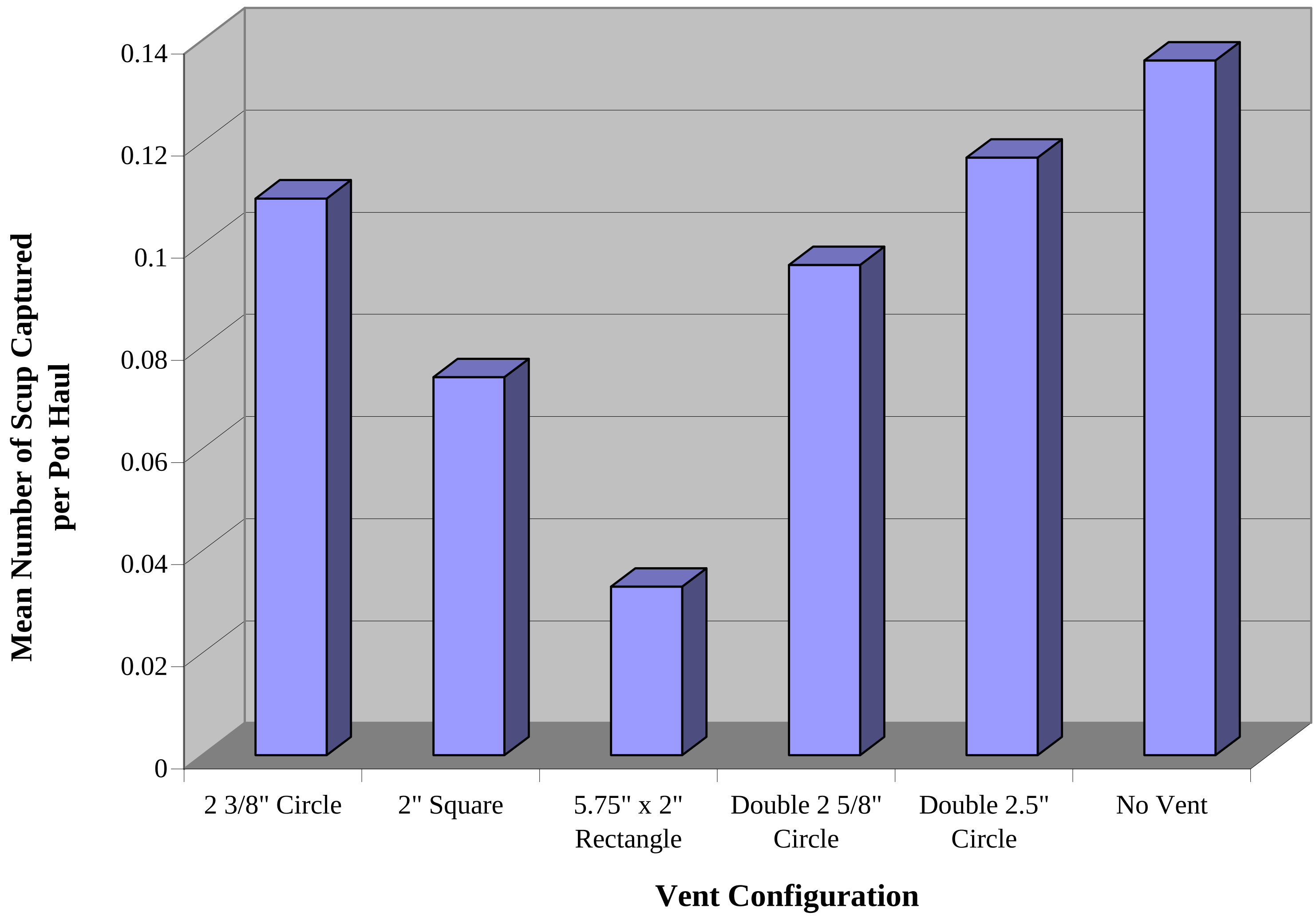


Figure 21

Mean Number of Lobsters Captured per Pot Haul for Each Vent Configuration

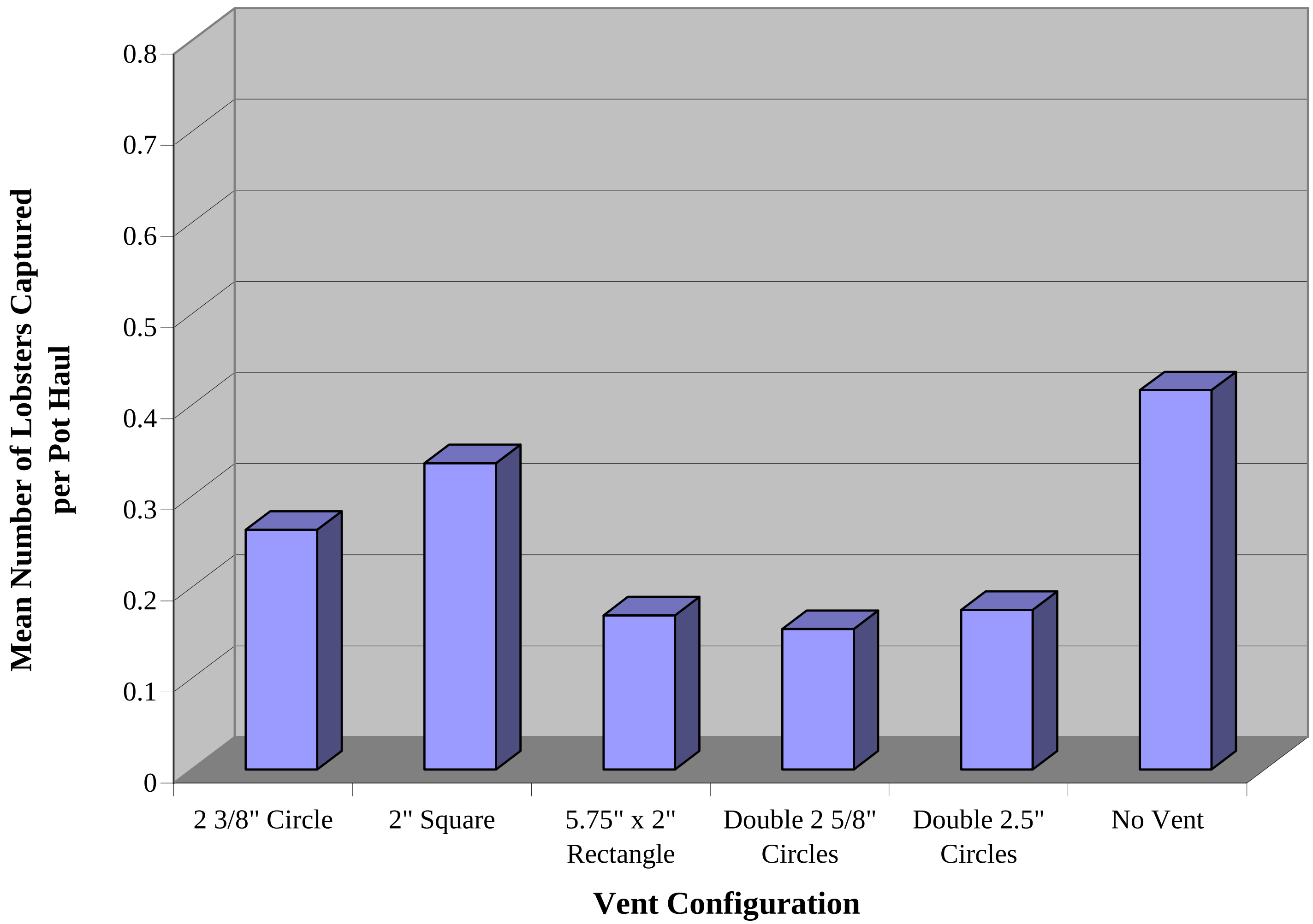


Figure 22

Mean Lobster Size for Each Vent Configuration