

2004 Chesapeake Bay Blue Crab Advisory Report

Prepared by the Chesapeake Bay Stock Assessment Committee: June 2, 2004

Status of the Stock: Analysis of long term fishery-independent surveys conducted in Chesapeake Bay (Maryland and Virginia trawl surveys, Calvert Cliffs peeler pot survey and Baywide winter dredge survey) indicate that blue crab abundance improved in 2003, compared to the near historically low levels of the previous four years. However, survey results are not uniform, and relatively low stock levels continue to create a risk of recruitment failure. The current status of the stock was compared to thresholds and targets endorsed by regional management agencies in January 2001. Stock abundance in 2003 was above the overfished threshold but remained below the Bi-State Blue Crab Advisory Committee (BBCAC) abundance action threshold (Figure 1). Measures of fishing mortality (F) indicated high exploitation rates, though the winter dredge survey measured fishing mortality below the action threshold level for the first time since 1997. Low abundance combined with a high exploitation rate indicated a stock condition that warrants concern for the seventh consecutive year.

Estimated fishing mortality from the winter dredge survey (the preferred method of estimation by CBSAC) of $F = 0.80$ decreased substantially compared to the previous five years, when F ranged from 1.04 to 1.80 (Figure 2 – solid line). The estimate of F derived from the length-based method ($F = 0.83$) suggests that F has remained relatively stable for six years (Figure 2 – dashed line). F estimates in 2003 from both methods were below the overfishing threshold ($F_{10\%} = 1.0$) but above the target ($F_{20\%} = 0.7$). Continued uncertainty about the appropriate rate of natural mortality (M) and the conversion rates used to change harvest data from pounds to numbers are primary factors contributing to uncertainty in the estimation of fishing mortality rates and biological reference points.

The 2003 Chesapeake Bay commercial harvest of approximately 48 million pounds represents a 10% decrease from 2002. Baywide harvest continued to follow a significant downward trend, and the 2003 harvest was well below the time series (1968 - 2003) average of 73 million pounds (Figure 3). The low harvest in 2003 was principally a result of low exploitable stock abundance. However, the harvest was also constrained by management measures implemented in prior seasons.

Despite uncertainty, it appears that fishing mortality was above the target level. Recruitment improved compared to recent years, and was approaching average, relative to historical levels. Female spawning stock biomass was average after several years at or near historically low levels. However, estimates of female abundance from the Virginia trawl survey have been below average for 10 of the past 12 years, including 2003. Exploitable stock abundance was below the Bi-State Blue Crab Advisory Committee (BBCAC) Decision Rule action threshold. Overall, stock levels appeared to improve in 2003. However, there is a consensus among committee members that restrictions should not be lifted until indices show a significant improving trend, and until stock abundance and fishing mortality rates intersect outside the Control Rule precautionary range (Figure 1).

Data: Four fishery-independent surveys are used to determine stock status: Virginia trawl survey, Maryland summer trawl survey, Calvert Cliffs crab pot survey, and Baywide winter dredge survey. Data from the two trawl surveys and the Calvert Cliffs pot survey are based on calendar year collections through 2003. The winter dredge survey data represent seasonal collections from December 2003 through March 2004. Indices from the winter dredge survey are expressed as estimates of the number of crabs per unit area. All other indices are expressed as the geometric mean catch per unit effort. Modified and standardized width-age cutoff values were used to differentiate age classes for three of the four surveys (Maryland and Virginia trawl and Calvert Cliffs pot survey) used to derive the abundance indices.

Biological Reference Points: A review of targets and thresholds for Chesapeake Bay blue crabs was conducted by an expert panel, convened by the BBCAC, in 2000. The panel identified exploitation and abundance thresholds and an exploitation target. The overfishing threshold ($F_{10\%} = 1.0$) and target fishing mortality rate ($F_{20\%} = 0.7$) refer to the levels of spawning potential which are 10% and 20%, respectively, of the spawning potential expected in a stock on which no fishing occurs. The overfished threshold (B_{low}) is equal to the lowest exploitable stock size observed in the fishery independent trawl, pot and dredge surveys

conducted in Chesapeake Bay, from 1968 – present and corresponds to the 1968 Virginia trawl survey estimate of stock size. There is considerable uncertainty about the appropriate value for natural mortality (M), but it is assumed to be 0.375.

Fishing Mortality: The winter dredge survey estimate of F was 0.80 in 2003. This was the first year in the last five that the dredge survey estimate of F was lower than the BBCAC threshold, though it was still above the target F . The length-based F , as determined from the Maryland and Virginia trawl surveys, the Calvert Cliffs crab pot survey, and the Baywide winter dredge survey, was 0.83 in 2003 (range = 0.74 to 0.88). None of the current length-based fishing mortality rates, estimated from individual surveys, exceeded the threshold $F = 1.0$, and none were below the target $F = 0.7$.

Recruitment (2001-03): Recruitment, averaged over the most recent three years, was near the long-term average for the Maryland and Virginia trawl surveys whereas the Baywide winter dredge survey results suggest that recruitment has been below average for five years. With data for the three surveys combined, it appears that recruitment improved in 2003 (Figure 4). Recruitment has stayed within ‘normal’ bounds (between -1.0 and 1.0 in Figure 4) for 11 years, but it has not exceeded the long-term average level (0 in Figure 4), for the past 5 years.

Exploitable Stock Abundance (2001-03): The three-year running average abundance of exploitable (Age 1+) crabs was at or below the lower prediction bound (i.e. ‘below average’), for all four surveys. Data for all surveys combined indicate that the exploitable stock abundance was nearly unchanged, compared to 2002 (Figure 5). Though within ‘normal’ bounds (between -1.0 and 1.0 in Figure 5), abundance of exploitable blue crabs has been below the long-term average level (0 in Figure 5) for nine of the past ten years. However, exploitable stock abundances in 2002 and 2003 were significantly higher compared to near historic low levels of abundance in 1998, 2000, and 2001.

Spawning Stock Abundance (2001-03): The three-year running average of mature female spawning stock abundance was within the prediction bounds (i.e. ‘average’) for three of the four fishery independent surveys (Calvert Cliffs, MD trawl, winter dredge), but each was only slightly above the lower prediction bound. The running average for the fourth survey (VA trawl survey) was below the prediction bound for the tenth straight year. Data for all surveys combined indicated that spawning stock abundance trended upwards for the past three years following an historical low in 2000 (Figure 6), but has been below the long-term average (0 in Figure 6) for ten of the past twelve years.

Harvest: The three-year (2001-2003) average, commercial Baywide harvest (50 million pounds) was 32% below the long-term (1968 - 2003) average of about 73 million pounds and was considerably below the prediction bounds (Figure 3). The 2003 Baywide harvest of approximately 48 million pounds was below average and was near the historical low. Based on the historical relationship between winter dredge survey abundance and commercial harvest, it is expected that the 2004 Baywide commercial Chesapeake Bay harvest will be similar to the 2003 harvest.

Management Advice: Management measures implemented between 2001 and 2003 to conserve the blue crab stock were necessary, given the persistent condition of low stock abundance. States should, at a minimum, keep all current management measures in place. The primary management goal of doubling the blue crab spawning potential has yet to be achieved, and is dependent upon maintaining a fishing mortality rate equal to the BBCAC target of $F=0.7$.

Special comments: Previously, the CBSAC suggested that fishing mortality rate estimates based absolute estimates of abundance from the winter dredge survey and on estimates of total catch in the Baywide recreational and commercial fisheries (direct enumeration of F) were more accurate than F estimates derived from a length-based method. Now, the CBSAC endorses replacement of the length-based method by the direct enumeration method. The CBSAC believes the direct enumeration method better tracks annual changes in fishing mortality rates. The Control-Rule graph (Figure 1) is presented this year with a time-series line connecting each data point. The fact that points on this graph tend to scatter around the equilibrium line is more evidence that the direct enumeration methodology is superior to the length-based

method. For comparative purposes, we also include the BBCAC Control Rule graph based on the previous length-based measurements of F (Figure 7).

A comprehensive update of the blue crab stock assessment is underway and completion is expected in approximately December 2004. It is anticipated that the new assessment will use updated data treatments and methodologies that will render obsolete some of the analyses presented in this and previous CBSAC annual updates.

Critical data needs: As was stated in previous advisory reports, it is critical that a carefully designed, Baywide data collection program be implemented for blue crabs in Chesapeake Bay. The design of the data collection program should be based, in part, on the need for improved information on: (1) harvest and effort data for the commercial and recreational fisheries, (2) growth and natural mortality rates, and (3) the age, size, sex and maturity composition of the harvest and stock.

We anticipate that a thorough review of the methods of estimating F, M, and biological reference points (thresholds and targets) will be conducted as elements of the new assessment. Such a review is critical to successful future management.

Chesapeake Bay Stock Assessment Committee Members:

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Figure 1. Bi-state Blue Crab Advisory Committee (BBCAC) Control Rule, with Fishing Mortality Rate as measured by the Winter Dredge Survey.

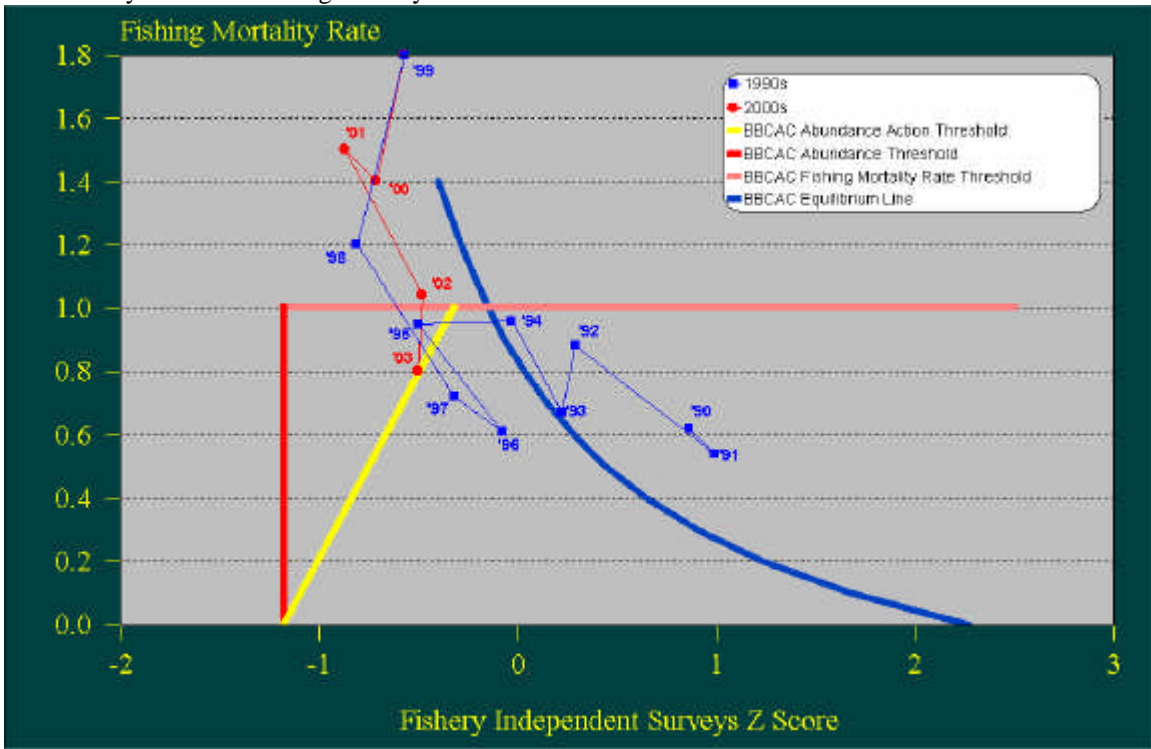


Figure 2. Fishing mortality rate as estimated by two methods, with target and threshold levels (assuming $M=0.375$).

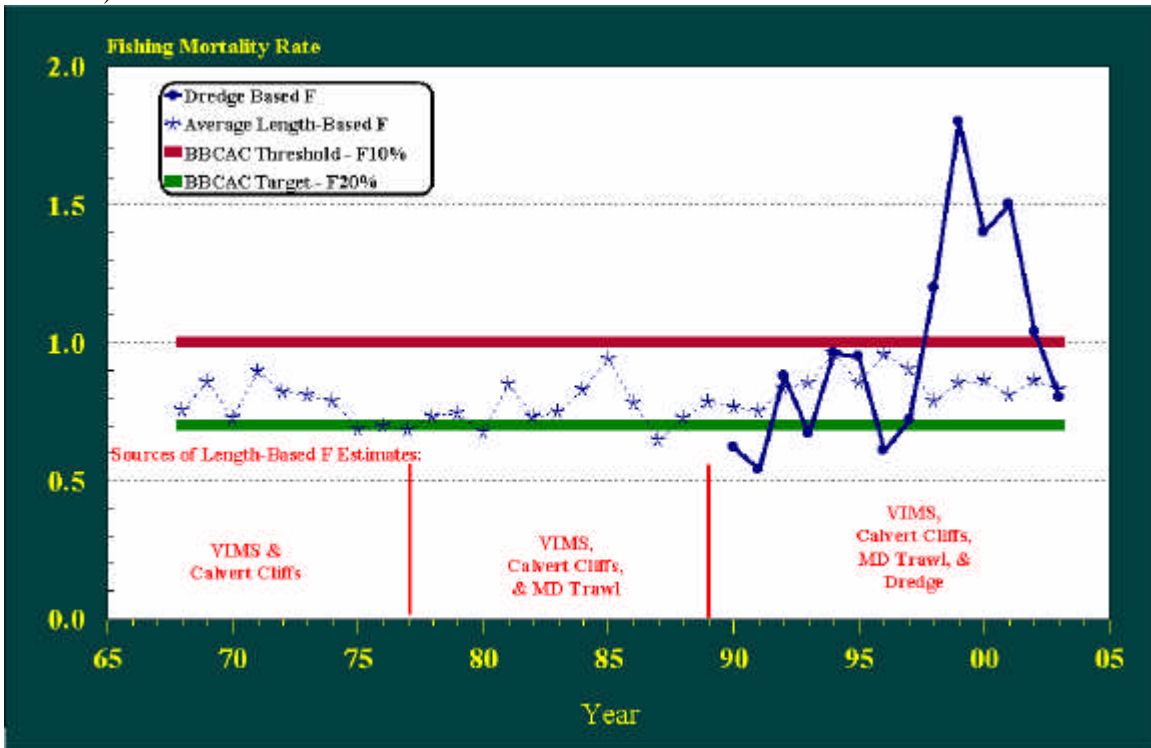


Figure 3. Combined Chesapeake Bay blue crab harvest.

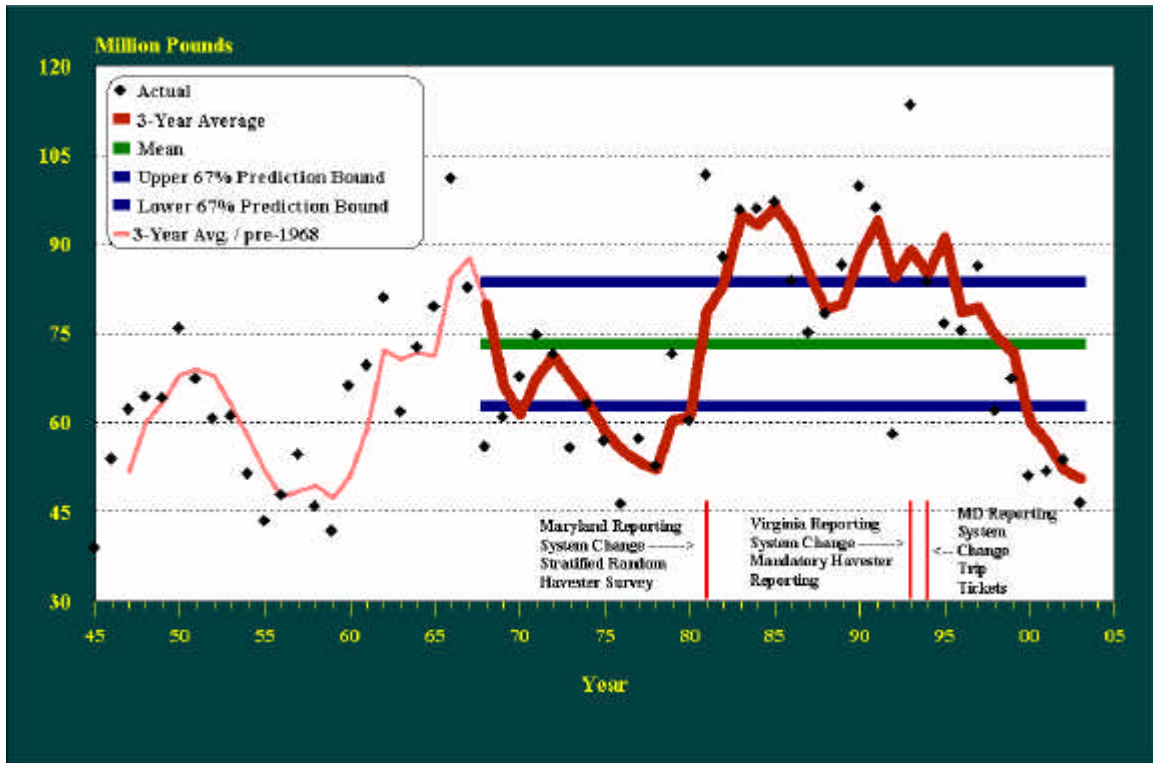


Figure 4. Average of standard normal transformed abundance indices for Age 0 blue crabs.

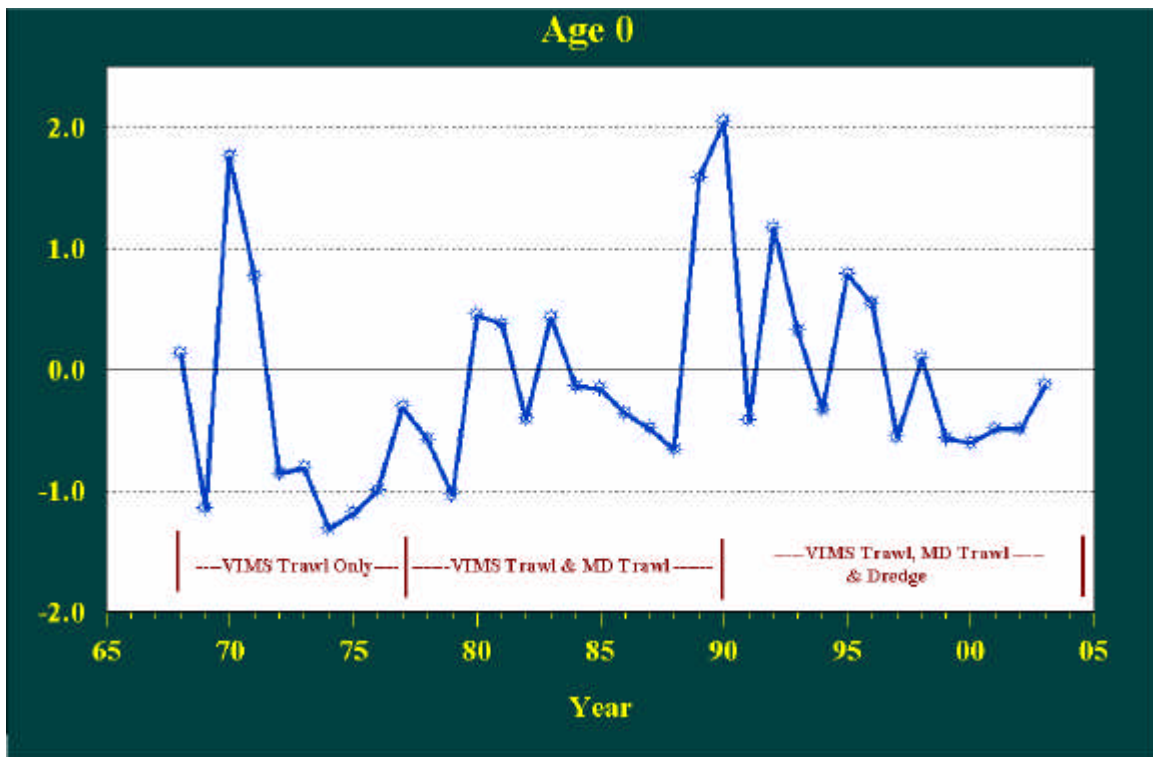


Figure 5. Average of standard normal transformed abundance indices for Age 1+ (exploitable) blue crabs.

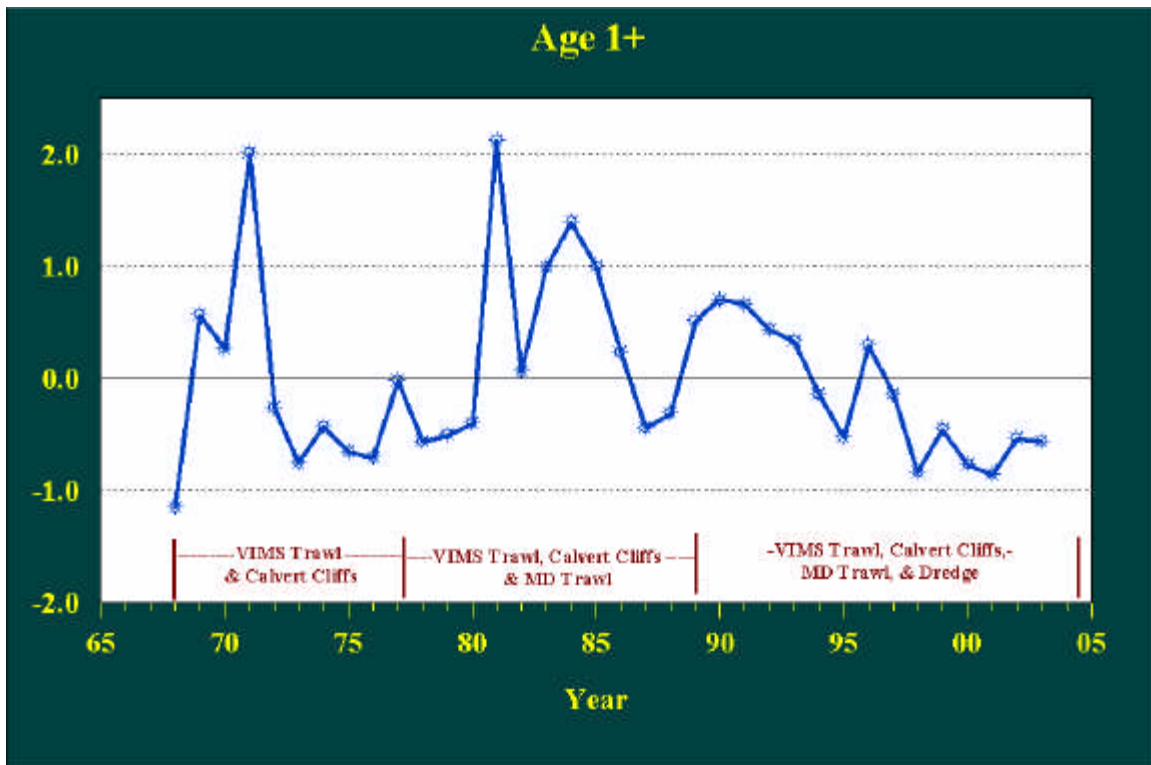


Figure 6. Average of standard normal transformed abundance indices for adult female blue crabs.

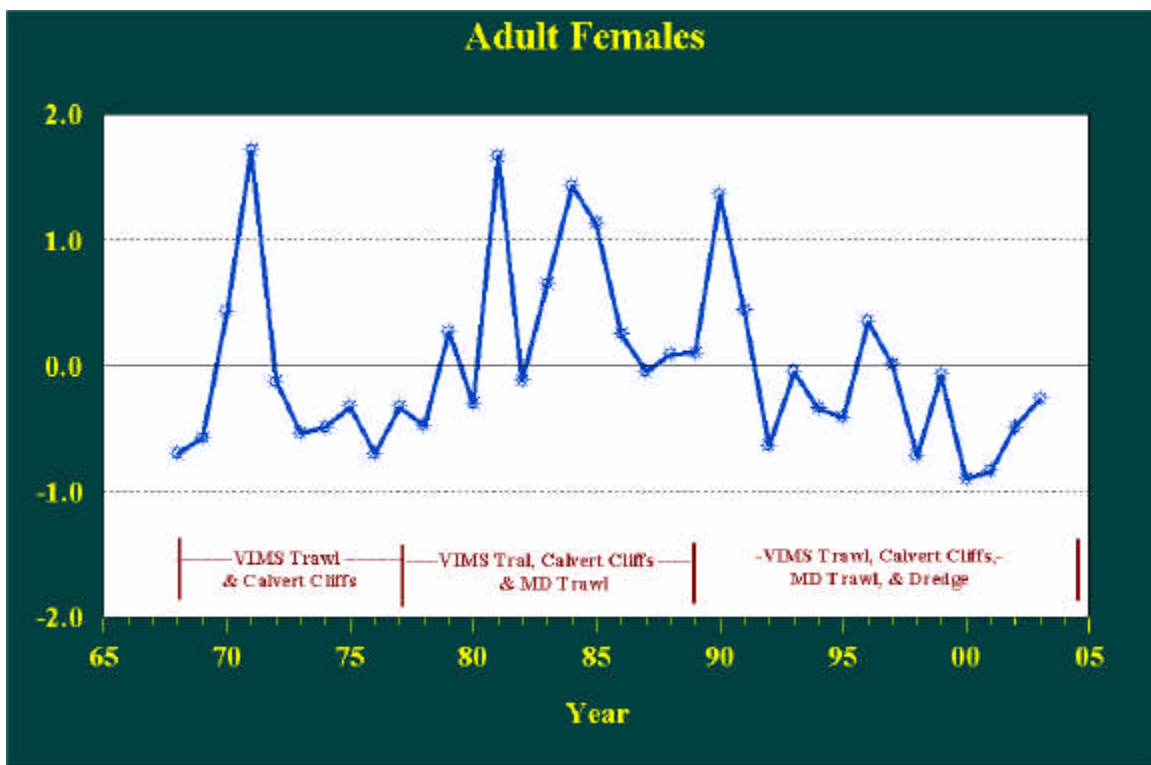


Figure 7. Bi-state Blue Crab Advisory Committee (BBCAC) Control Rule, with Fishing Mortality Rate as Measured by the four-survey average of length-based Fs.

