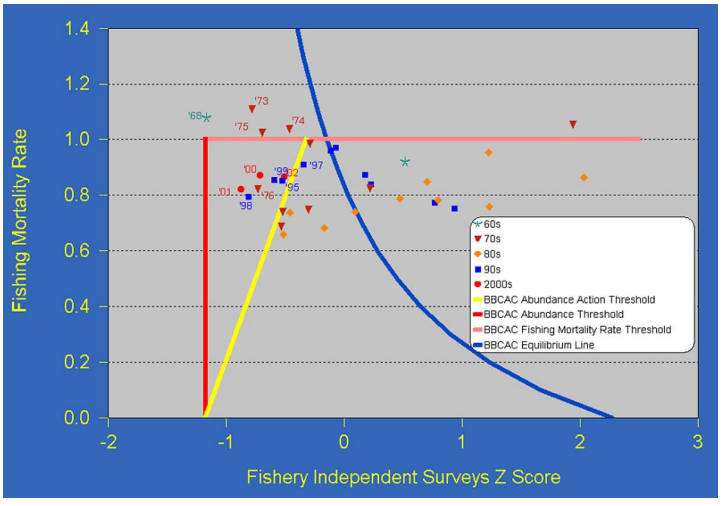
Blue Crab Advisory 2003

Status of the Stock

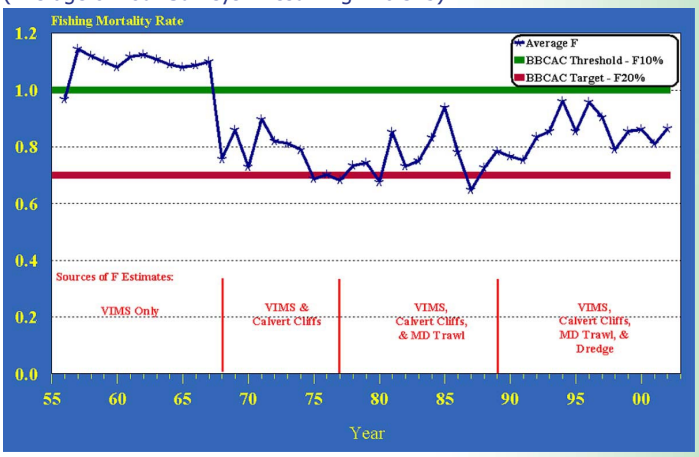
Analysis of long term fishery independent surveys conducted in Chesapeake Bay (Maryland and Virginia trawl surveys, Calvert Cliffs crab pot survey and Baywide winter dredge survey) indicate that blue crab abundance has stabilized near historically low levels over the last four years. This continued low abundance puts the stock at increased risk for recruitment failure. The current status of the stock was compared to thresholds and targets endorsed by regional management agencies in January 2001. Stock abundance was above the overfished threshold. The absolute magnitude of fishing mortality is uncertain but some measures of exploitation indicate an increasing trend over the past decade. There is an indication from the winter dredge survey that fishing mortality has decreased from 2001 to 2002. Although stock abundance improved slightly in 2002, it was still below the Blue Crab Decision Rule action threshold (Figure 1). The low abundance combined with a high exploitation rate indicates a stock condition that warrants concern for the sixth consecutive year.

Figure 1. Bi-state Blue Crab Advisory Committee (BBCAC) Control Rule. Updated by CBSAC, May 2003



The recent trend in fishing mortality rate (F) is not clear. A length-based method of F estimation suggests that F has remained stable for five years. The estimated 2002 fishing mortality rate of F = 0.86 is below the overfishing threshold ($F_{10\%}$ = 1.0) but above the target

Figure 2. Fishing Mortality Rate and Threshold Levels
(Average of Four Surveys - Assuming M-0.375)



($F_{20\%}$ = 0.7) (Figure 2). In contrast, estimates of fishing mortality rates from the winter dredge survey indicate higher rates and an increasing trend over the last decade (Figure 3). Continued uncertainty in the appropriate rate of natural mortality (M) and the conversion of harvest data from pounds to numbers are the primary factors contributing to the uncertainty which are fundamental to estimation of fishing mortality rates and biological reference points.

The 2002 Chesapeake Bay commercial blue crab harvest of approximately 52 million pounds is well below the time series (1968 - 2002) average of about 73 million pounds (Figure 4). The low harvest in 2002 was principally a result of low exploitable stock abundance. However, the harvest was also constrained by management measures implemented in Maryland, Virginia and the Potomac River Fisheries Commission prior to and during the 2001 and 2002 seasons.

It is apparent that F is above the target, recruitment is low relative to historical levels, female spawning stock biomass is near the historical low established in 2000, and that exploitable stock abundance is below the Blue Crab Decision Rule action threshold. There is a consensus among committee members that the level of risk to the stock and to the fishery associated with low recruitment, low

female spawning stock size and low exploitable stock size remains high. It is important to note that estimation of fishing mortality rates is important for evaluating the effectiveness of management actions, but it is the spawning stock biomass that is relevant to the assessment of risk of recruitment failure.

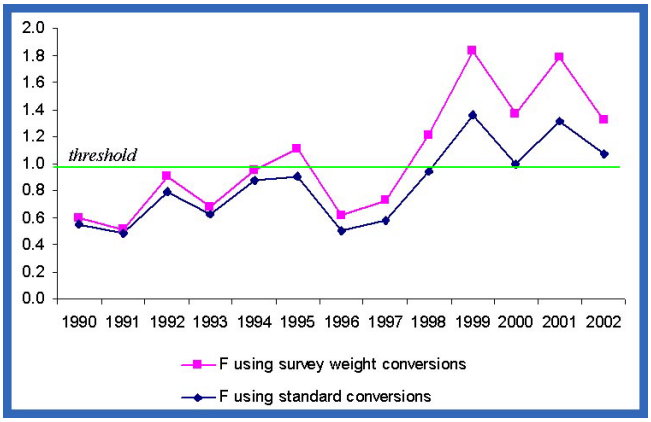
Data

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 2002. The winter dredge survey data represent seasonal collections through the 2002/03 season. For abundance indices the dredge survey is referred to as 2003 data, but for estimates of fishing mortality rates the dredge survey is referred to as 2002 data since the mortality took place in 2002. All 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 study) used to derive the abundance indices. Sliding monthly cutoff values were used to model the variable growth of age-0 crabs. Age-0 crabs are defined as being less than 50-90 mm depending on month, and age-1+ are all crabs larger than the monthly cutoff values.

Biological Reference Points. A review of targets and thresholds for Chesapeake Bay blue crabs was conducted by an expert panel, convened by the Bi-State Blue Crab Advisory Committee in 2000. The panel identified exploitation and abundance thresholds, a precautionary zone in which exploitation is too high at low abundance, and an exploitation target. The overfishing threshold ($F_{10\%}$ = 1.0) and target ($F_{20\%}$ = 0.7) fishing mortality rates 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 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. M is assumed to be 0.375.

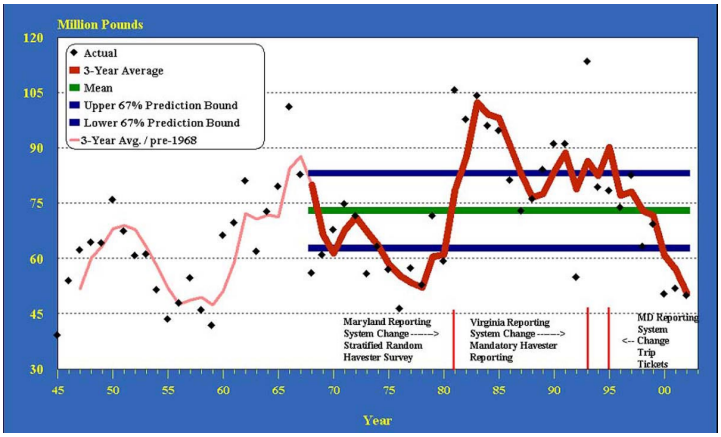
Fishing Mortality. The average length-based fishing mortality rate as determined from the Maryland and Virginia trawl surveys, the Calvert Cliffs crab pot survey and the Baywide winter dredge survey was 0.86 in 2002 (range = 0.79 to 0.94). None of the current length-based fishing mortality rates exceeded the threshold fishing mortality rate F = 1.0. It is important to note that the winter dredge survey indicates higher rates and an increasing trend over the last decade. Winter dredge survey based fishing mortality rates were computed using two different estimates of the number of crabs in the harvest. One harvest time series resulted in estimates of F ranging from a low of 0.5 in 1991 to a high of 1.8 in 1999 (Figure 3). A second times series resulted in estimates of F ranging from 0.5 to 1.4. The two harvest time series produced terminal year F estimates ranging from 1.1 to 1.3. The methods of estimating the fishing mortality rate are discussed below.

Figure 3. Dredge-based F with Two Methods of Converting Pounds Harvested to Numbers Harvested (M=0.375)



Recruitment (2000-02). Recruitment, averaged over the most recent three years, has been above average based on the Maryland trawl survey whereas the Virginia trawl and Baywide winter dredge survey results suggest that recruitment has been below average in recent years. With data for the three surveys combined, it appears that recruitment has been stable at a relatively low level in recent years (Figure 5).

Figure 4. Combined Chesapeake Bay Blue Crab Harvest



Exploitable Stock Abundance (2000-02). The average exploitable abundance of age 1+ crabs for the last three years was considered to be below average for all four surveys (Maryland and Virginia trawl surveys, Calvert Cliffs pot survey and Baywide winter dredge survey). Data for all surveys combined indicate that the exploitable stock abundance has been stable over the last four years at low levels last seen in the mid-1970s (Figure 6).

Spawning Stock Abundance (2000-02). The three year average mature female spawning stock abundance was below the long-term average in each of the four fishery dependent surveys. Data for all surveys combined indicate that spawning stock abundance has declined since the early 1990. The abundance estimate for 2002 is slightly above the historically low levels reported for 2000 and 2001 (Figure 7).

Harvest. The three-year (2000-2002) average, commercial Baywide harvest (51 million pounds) is below the long term (1968 - 2002) average of about 73 million pounds. The 2002 Baywide harvest of approximately 52 million pounds is below average and for the second consecutive year is the lowest since the Maryland commercial crab reporting system changed in 1981. For the 1968-2002 period, Baywide commercial harvests exceeded 100 million pounds in 1966, 1981, 1983 and 1993. Based on the historical relationship between winter dredge survey abundance and commercial harvest, we expect the Baywide commercial harvest in 2003 to be less than 60 million pounds in the absence of changes to the regulations.

Management Advice

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The management measures initiated in 2001/02 to provide additional protection to the blue crab stock were prudent. States should, at a minimum, keep all measures in place to reduce fishing mortality rates.

The long term goal of reaching the spawning stock target has yet to be achieved. Managers should consider the development of a rebuilding plan to achieve the targets. In light of current uncertainties, the Chesapeake Bay Stock Assessment Committee (CBSAC) recommends a review of the basis for the estimation of fishing mortality rates and biological reference points for blue crab prior to the 2004 Blue Crab Advisory Report.

Figure 5. Average of Standard Normal Transformed Abundance Indices

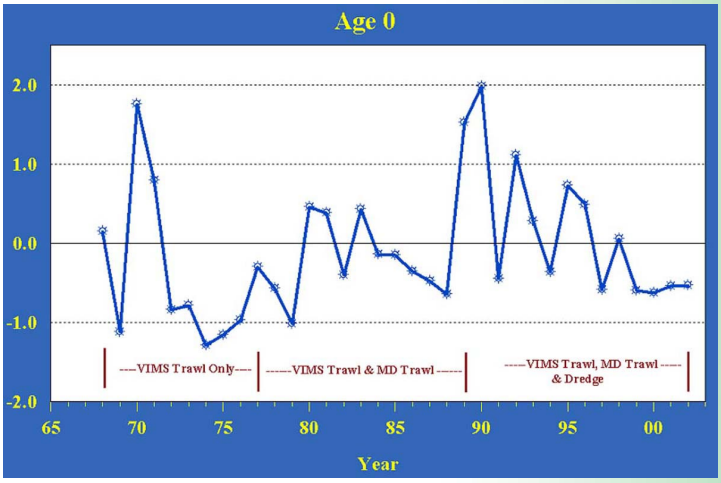
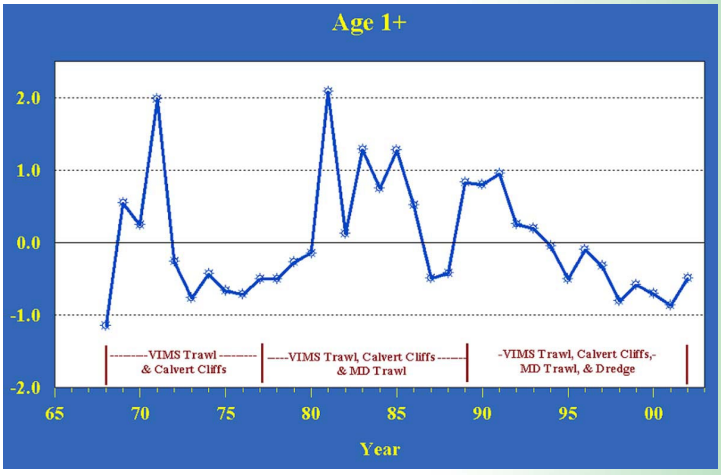


Figure 6. Average of Standard Normal Transformed Abundance Indices



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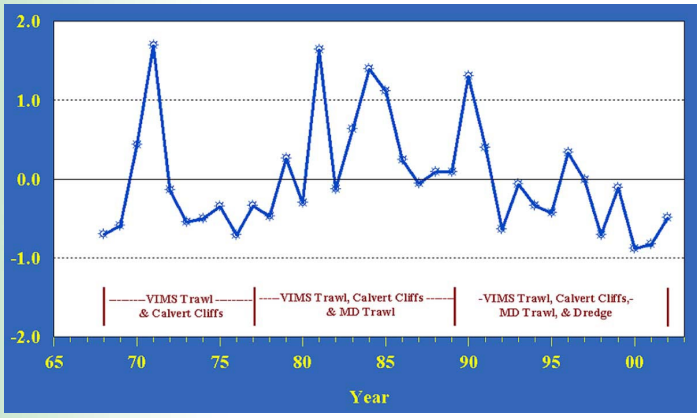
Special Comments

Improvements are needed in the estimation of fishing mortality. The length-based method of calculating mortality rates, used by CBSAC for many years, was selected because it has minimal data requirements. It is based on the assumption that recruitment is constant over time. By applying this technique to data obtained over a period of years, it is possible to gauge the average level of mortality. Provisionally, the estimator proved useful in revealing that fishing mortality rates are high. However, the estimator was never designed to track interannual changes in mortality rates and can give misleading indications when it is used to measure year to year changes. This year, the CBSAC is providing fishing mortality rates based on absolute estimates of abundance from the winter dredge survey and on estimates of total catch in the Baywide recreational and commercial fisheries. The CBSAC believes this approach improves our ability to track annual changes in fishing mortality rates. When introducing a new method, it is good practice to use the old and new methods side by side for a few years so that when perceptions of stock status change over time, one can examine whether this is due to changing biology or changing methodology.

Figure 7. Average of Standard Normal Transformed Abundance Indices - Adult Females



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. In light of current uncertainties, CBSAC recommends a review of the basis for the estimation of fishing mortality rates and biological reference points for blue crab prior to the 2004 Blue Crab Advisory Report.

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This report was prepared by the Chesapeake Bay Stock Assessment Committee (CBSAC) in June 2003. For an on-line pdf, visit: http://noaa.chesapeakebay.net

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