# 2001 Chesapeake Bay Blue Crab Advisory Report

**Prepared by the Chesapeake Bay Stock Assessment Committee's Technical Subcommittee[1]: June 7, 2001**

**Status of the Stock:** Analysis of long term juvenile and adult 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 is below average and in decline in recent years. The current status of the stock was compared to thresholds and targets endorsed by regional management agencies. Exploitable stock abundance was above the overfished threshold in 2000 but below the action threshold for the fourth consecutive year (Figure 1). Length based estimates of fishing mortality indicate that the stock is fully exploited. The average fishing mortality rate (F) of 0.9 in 2000 is below the overfishing threshold ($F_{10\%}$ = 1.0) but well above the target ($F_{20\%}$ = 0.7) (Figure 2). The 2000 Chesapeake Bay blue crab harvest of 51 million pounds is well below the time series (1968 - 2000) average of about 75 million pounds (Figure 3). Early life history data collected in the Virginia portion of Chesapeake Bay by the Chesapeake Bay Program Zooplankton Monitoring Program indicate that megalopal abundance has generally declined since sampling began in 1985 (Figure 4.)

**Data:** Five fishery-independent surveys are used to determine stock status: Virginia trawl survey, Maryland summer trawl survey, Calvert Cliffs crab pot survey, Baywide winter dredge survey and Baywide zooplankton monitoring. The first four sample crabs after settlement, the latter samples megalopal abundance in the water column. Data from the two trawl surveys and the Calvert Cliffs pot survey are based on calendar year collections through 2000. The winter dredge survey data represent seasonal collections through the 2000/01 season. For abundance indices the dredge survey is referred to as 2001 data, but for estimates of fishing mortality rates the dredge survey is referred to as 2000 data since the mortality took place in 2000. Data from the zooplankton monitoring program is based on calendar year collections. Indices are expressed as the geometric mean catch per unit effort. The width-age cutoff values 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, were modified and standardized for this report. These procedural changes involved the use of sliding monthly cutoff values that model the 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 Maryland and Virginia biologists in 2000 with the help of outside experts from the National Marine Fisheries Service. The workgroup identified exploitation and abundance limits, 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 level of spawning potential which is 10% and 20% respectively, of the spawning potential expected in a stock on which no fishing occurs. Age-specific partial recruitment was based on the selectivity of the harvest gears and established as 10% (age 0), 75% (age 1), 95% (age 2) and 100% (age 3+). 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.

**Fishing Mortality** The average fishing mortality rate was 0.91 in 2000 (range = 0.82 to 0.96). None of the current length based fishing mortality rates exceeded the threshold fishing mortality rate F = 1.0. All F estimates were above the target fishing mortality rate F = 0.7. However, it is important to note that an alternative method of calculating F's based on the Baywide winter dredge survey indicated that exploitation rates are increasing and may be substantially higher than the overfishing threshold (Sharov et al. 2001).

**Recruitment (1998-00):** Results from the Maryland and Virginia trawl surveys indicate that recruitment has been average whereas the Baywide winter dredge survey results suggest that recruitment has been below average in recent years. With data for the three surveys combined, there appears to be a declining trend in recruitment in recent years (Figure 5).

**Exploitable Stock Abundance (1998-00):** 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 is declining and is approaching the low for the time series (Figure 6).

**Spawning Stock Abundance (1998-00):** Mature female spawning stock abundance was below the long term average for the Baywide winter dredge and Virginia trawl surveys and average for the Maryland trawl and the Calvert Cliffs pot surveys. Data for all surveys combined indicate that spawning stock abundance has declined since the early 1990s. It is also important to note that the 2000 abundance estimate is the lowest of the time series (Figure 7).

**Harvest:** The three-year (1998-2000) average, commercial Baywide harvest (60 million pounds) is below the long term (1968 - 2000) average of about 75 million pounds. The 2000 Baywide harvest of 50.8 million pounds is below average and is the lowest since the Maryland commercial crab reporting system changed in 1981. For the 1968-2000 period, Baywide commercial harvests exceeded 100 million pounds in 1966, 1981, 1983 and 1993. The 1993 harvest of 113 million pounds is the highest recorded harvest. Based on the historical relationship between winter dredge survey abundance and commercial harvest, we expect the Baywide commercial Chesapeake Bay harvest in 2001 to be less than 60 million pounds.

**Management Advice:** Based on a review of data collected in the Maryland and Virginia trawl surveys, the Calvert Cliffs crab pot survey and the Baywide winter dredge survey it appears that: (1) there is a declining trend in recruitment in recent years; (2) age 1+ blue crab stock size is approaching a low not seen since the late-1960s; (3) adult female abundance is currently below the previous historical low set in 1968; and (4) F is well above the target, and may be increasing.

There is a consensus among biologists that action needs to be taken to reduce fishing effort as a way to reduce fishing mortality. The context of this consensus is important. A focused review of appropriate targets and thresholds for Chesapeake Bay blue crabs was conducted by Maryland and Virginia biologists in 2000 with the help of outside experts from the National Marine Fisheries Service. This workgroup identified an absolute minimum stock size below which it is dangerous to be, even if there

is no fishing mortality. The danger is seen both on empirical grounds (comparison with other stocks) and experiential grounds – the stock size has never been below the overfished threshold. Of course, if fishing mortality is not zero, then being slightly above the overfished threshold can be dangerous. Hence, there is an "action threshold" depicted by the diagonal line in Figure 1. A situation to the left of this line is risky because of the combination of the low abundance and the existing fishing mortality rate. This action line has an extremely important practical consequence in terms of stability of the fishery. It calls for progressively stronger reductions in fishing as the abundance declines. If only an abundance threshold was specified (a vertical line), then a situation where biomass is equal to one crab more than the threshold would imply no action is needed while one crab less than the threshold would imply shutting down the fishery. With that type of control rule, there would be no intermediate level of action.

The current situation is thus risky because of the combination of low biomass and high fishing mortality rate. The nature of the risk is worthy of note. Recruitment is highly variable. If an exceptionally strong year class were to arrive, the population might increase for a year or two, though the high amount of effort would quickly reduce the population size. On the other hand, if a very poor year class was to occur, the already low biomass would drop much lower (due to lack of replenishment). Fishing mortality would likely increase as crabbers compensate for low catches by fishing harder which could lead to stock collapse. It is clear that weak year classes do occur from time to time, and they are more likely to occur when stock size is low. The consensus among technical committee members is that it is risky to remain in the current situation. When a weak year class arrives, there will be those that attribute the stock decline or collapse to unusual environmental conditions instead of fishing, but unusual environmental conditions are only unusual in the short term. Fishing mortality rate must be reduced and stock abundance should be increased as rapidly as possible.

**Special comments**: As was stated in the 2000 advisory report, 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 mortality rates; (3) size at maturity; and (4) the age, size, sex and maturity composition of the harvest and stock.

**References:**

Sharov, A. F., J.H.Vølstad, G.R. Davis, B.K. Davis, R.N. Lipcius and M.M. Montane. 2001. Abundance and exploitation rate of the blue crab (*Callinectes sapidus* ) in Chesapeake Bay. Bull. Mar. Sci.

**Technical Subcommittee Participants:**

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| Chris Bonzek | VIMS | Rob O'Reilly | VMRC |
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| Rom Lipcius | VIMS | Alexei Sharov | Maryland DNR |
| Tom Miller | CBL | Doug Vaughan | NMFS/SEFSC |

# Abundance Indices - Megalopae
# Chesapeake Bay Program Zooplankton Monitoring

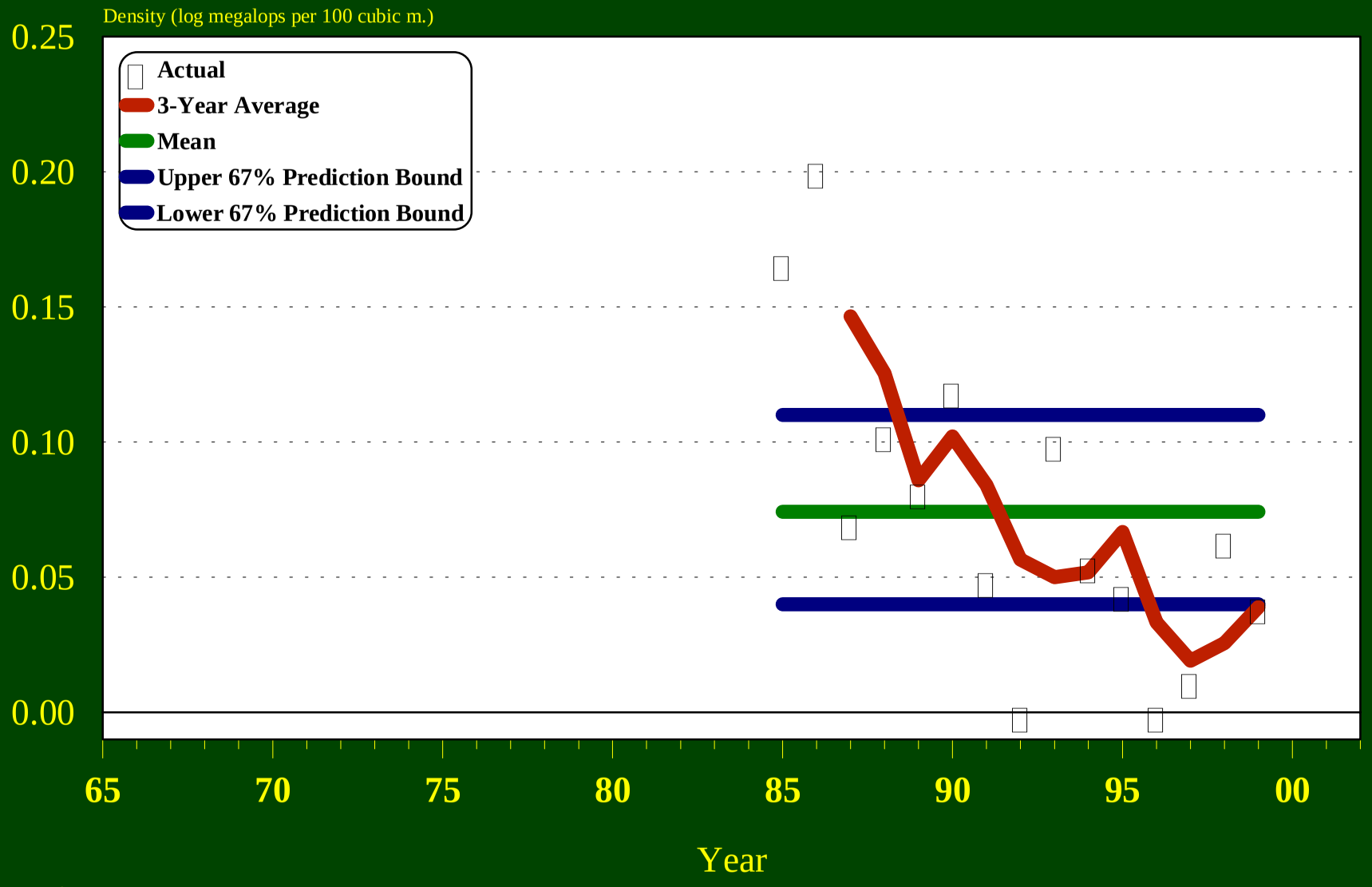


Figure 4

# Fishing Mortality Rate and Threshold Levels

## (Average of Four Surveys - Assuming M=0.375)

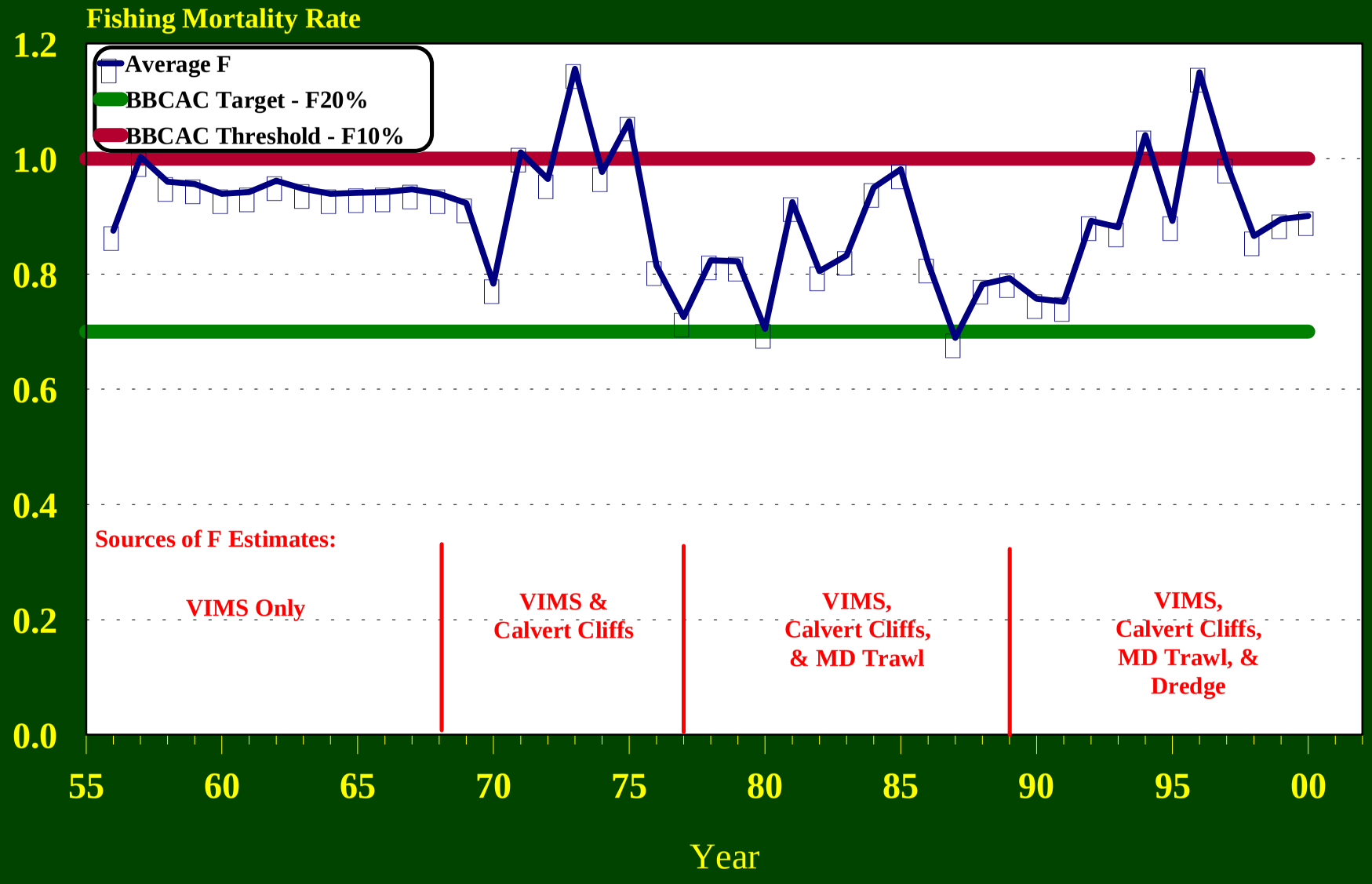


Figure 2

# Bi-state Blue Crab Advisory Committee (BBCAC) Control Rule
# Updated by CBSAC TSC, June 2001

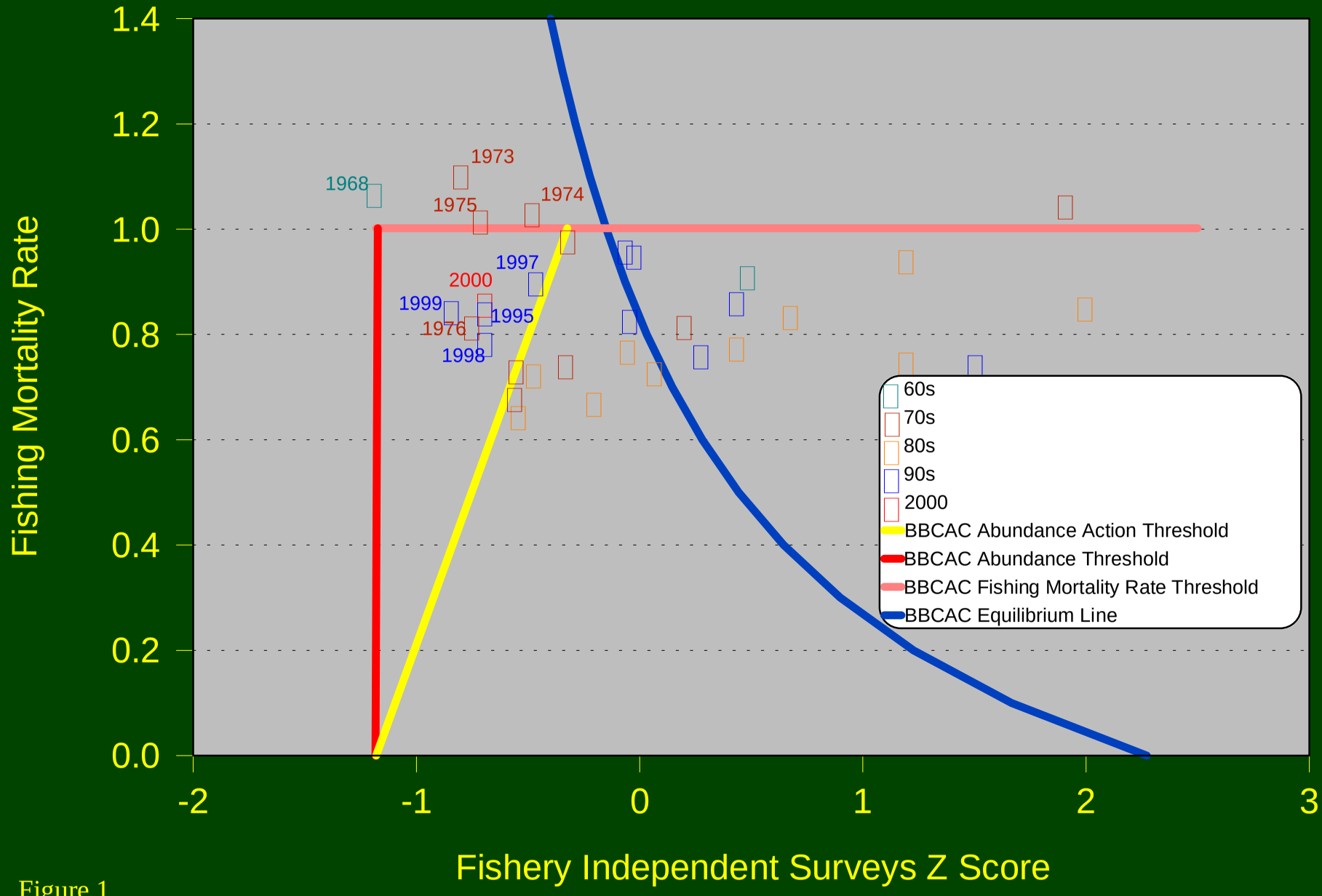


Figure 1

# Combined Chesapeake Bay Blue Crab Harvest

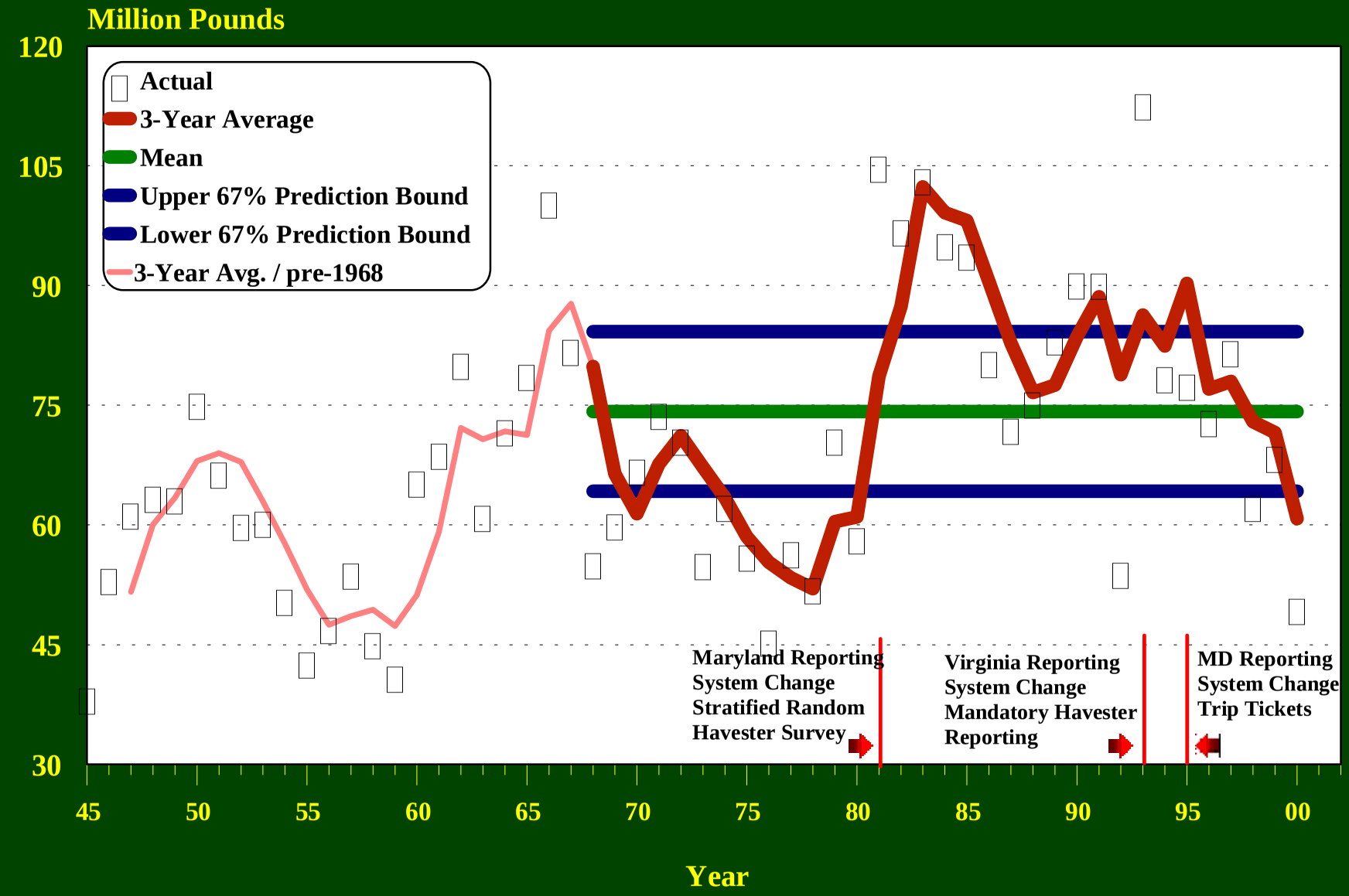


Figure 3

# Chesapeake Bay Blue Crab Surveys
## Average of Standard Normal Transformed Abundance Indices
## Age 0

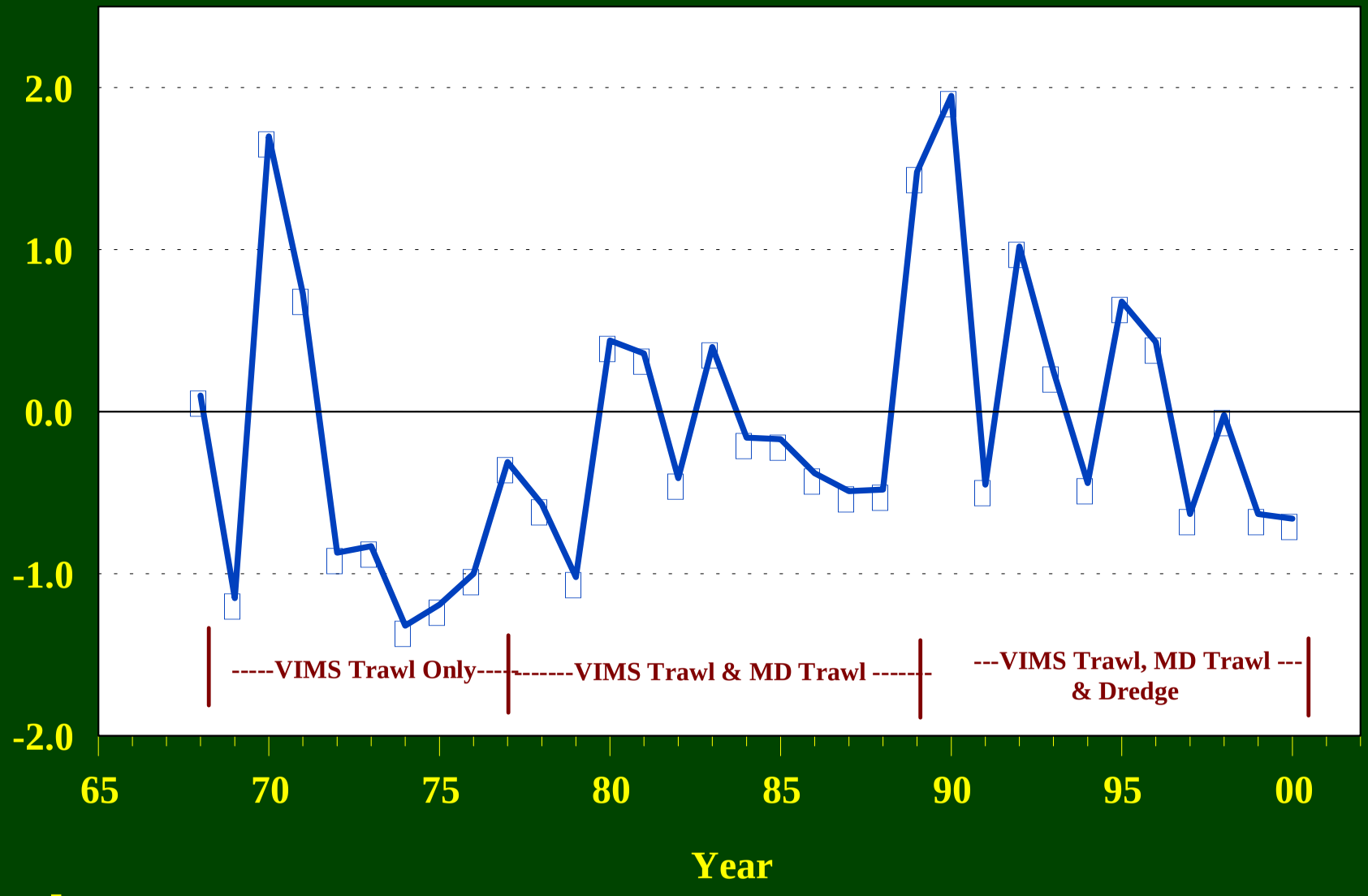


Figure 5

# Chesapeake Bay Blue Crab Surveys
# Average of Standard Normal Transformed Abundance Indices
# Age 1+

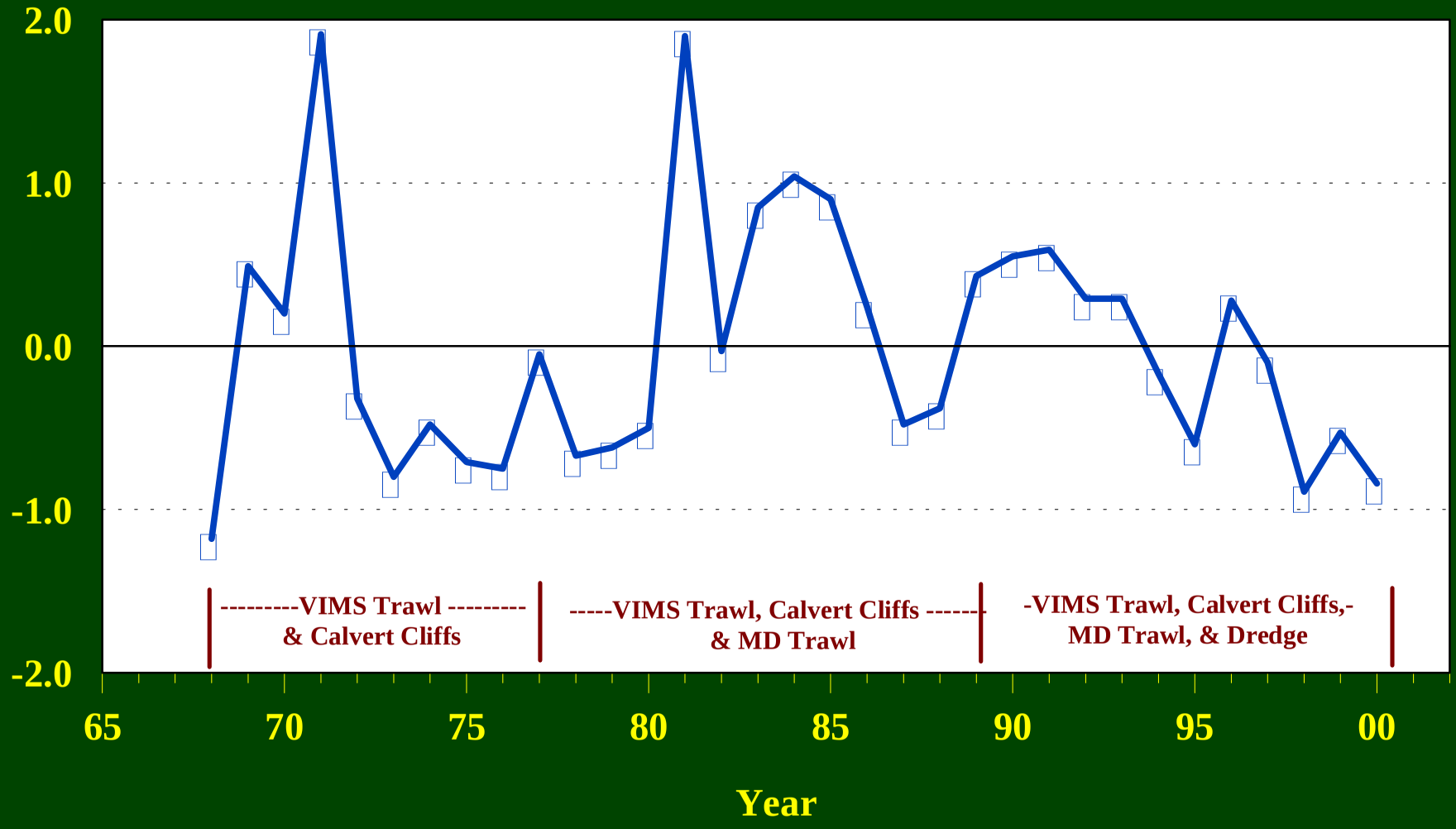


Figure 6

# Chesapeake Bay Blue Crab Surveys
# Average of Standard Normal Transformed Abundance Indices
# Adult Females

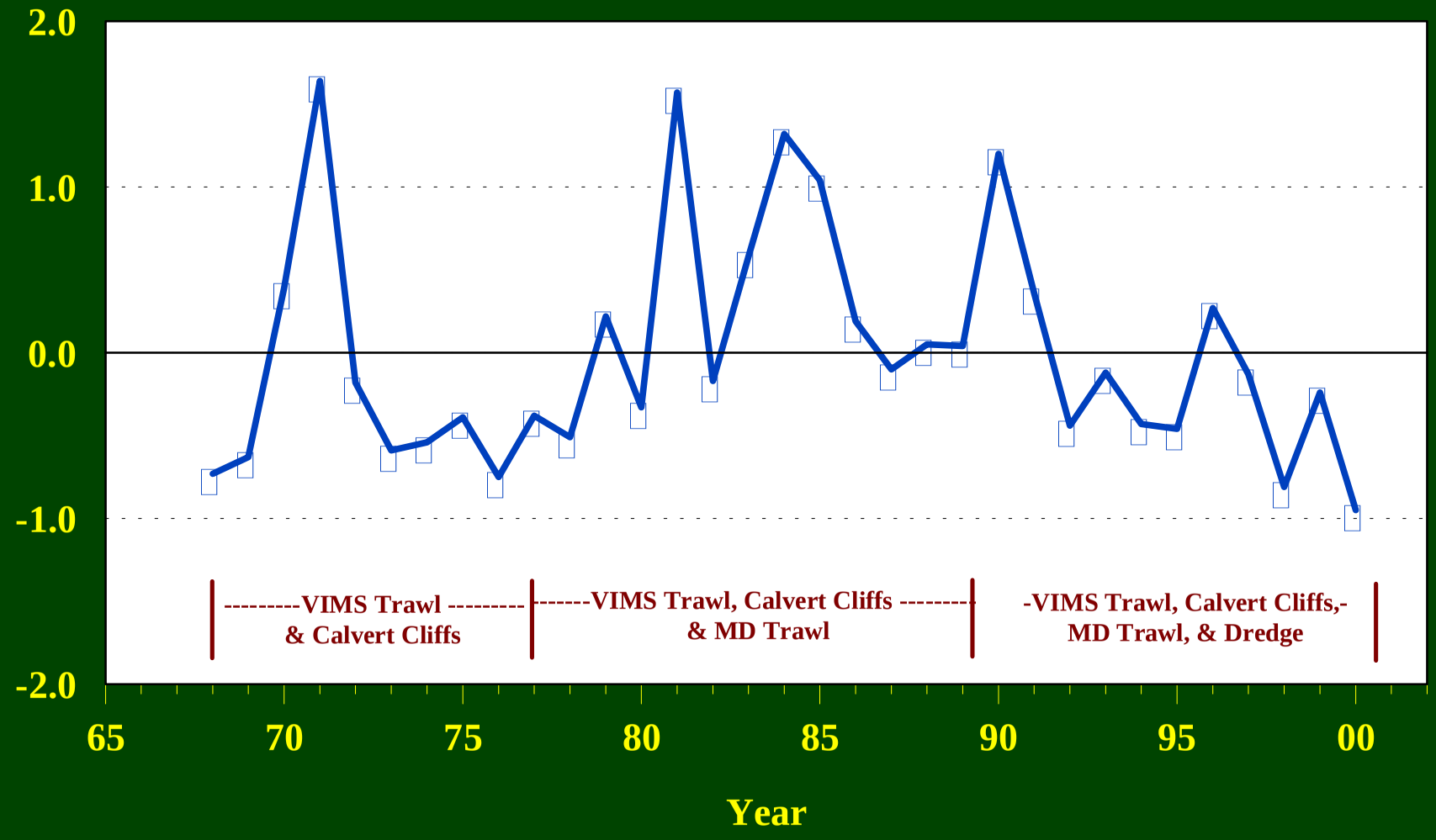


Figure 7