

**Amendment #2**  
**1997 Chesapeake Bay Blue Crab Fishery Management Plan**  
**May 31, 2012**

**Introduction**

A new benchmark stock assessment for the Chesapeake Bay blue crab population and associated fisheries was completed in 2011 (Miller et al, 2011). This assessment generated new biological reference points specific to the female component of the blue crab population. In August of 2011, the Chesapeake Bay Stock Assessment Committee (CBSAC) met to review the assessment and recommended that the jurisdictions adopt the new female-specific reference points. In order to ensure that male abundance does not drop below a critical level relative to female abundance, the CBSAC also recommended the development of a threshold reference point for male crabs that would provide a management trigger for male conservation (CBSAC, 2011). The Chesapeake Bay Program's Sustainable Fisheries Goal Implementation Team, an interjurisdictional group of fisheries managers and scientists, endorsed the CBSAC report and the new biological reference points (November 2011). Amendment #2 to the 1997 Chesapeake Blue Crab Fishery Management Plan provides the mechanism for formally adopting the new biological reference points and control rule (Figures 1 & 2). Amendment #2 also establishes the need for developing a male threshold reference point; and, recognizes the importance of fishery-independent and fishery-dependent monitoring. Amendment #2 replaces the first six actions in the 2003 Amendment #1 to the 1997 Chesapeake Blue Crab Fishery Management Plan.

**Background**

The first baywide blue crab stock assessment was completed in 1997 (Rugolo et al.). The results of the assessment indicated that the blue crab stock was moderately to fully exploited and at average levels of abundance. Concern about the status of the stock continued and, in 2001, biological reference points (targets and thresholds) for biomass and exploitation were developed. In 2003, Amendment #1 to the 1997 Chesapeake Bay Blue Crab Fishery Management Plan formally adopted fishery management thresholds, targets, and a control rule for the blue crab resource in Chesapeake Bay. Amendment #1 also reaffirmed the strategy to reduce fishing rates; recognized the importance of monitoring the blue crab population; acknowledged the need to protect habitat; and called for the consideration of ecosystem processes.

The next full stock assessment occurred in 2005 (Miller et al.). New information on growth, reproduction and mortality were incorporated and changes were made to the methods for calculating fishing rates. Instead of using calculations based on fishing mortality (F), calculations were based on the exploitation fraction ( $\mu$ ). This change was preferred because calculating  $\mu$  was less reliant on estimates of natural mortality. Stock assessment methodologies are, in general, sensitive to assumptions made about natural mortality. Full consideration was given to using the most appropriate value for natural

mortality in the 2005 stock assessment. Based on the new calculations, the stock assessment indicated that the blue crab stock had experienced a period of overfishing in the early 1970s and in the late 1990s. The assessment found a strong negative relationship between exploitation fraction and abundance, i.e., a greater proportion of the stock was harvested when there was low abundance; an unsustainable strategy. Differences between male and female exploitation patterns were also noted. The 2005 stock assessment resulted in the reevaluation and update of the control rule for the fishery. Biological reference points that used an exploitation fraction to define overfishing and the target exploitation rate were adopted. The 2005 reference points (target and threshold) indicated that the blue crab stock was at a low level of abundance; the stock was not overfished but rebuilding was not occurring; and, exploitation had declined but was still higher than the target level. As a result, in 2008, the Chesapeake Bay jurisdictions implemented management measures to reduce exploitation.

The most recent blue crab stock assessment began in 2009 and was completed in 2011. The assessment included additional data on reproduction, lifespan, sex-specific abundance and distribution. Eight terms of reference were used to complete a thorough revision of the 2005 stock assessment. The terms of reference addressed the following: an assessment and revision of life history and vital rates; an evaluation of biological reference points (BRPs) and recommendations for new sex-specific BRPs; a quantification of fishery-independent surveys; a quantification of catch, effort, and exploitation by sector and region; the development and implementation of assessment models; an examination of density-dependent exploitation patterns; a characterization of uncertainty; and the resulting evaluation of stock status in relationship to new reference points. The 2011 stock assessment was conducted using a sex-specific catch multiple survey analysis. This was a major improvement over the previous model because it integrated the calculation of reference points within the model rather than using two separate processes as in the 2005 assessment. The 2011 stock assessment resulted in the development of new reference points for the female component of the stock (Table 1). The 2011 stock assessment was peer reviewed through the Center of Independent Experts (CIE). The CIE concluded that the 2011 stock assessment was an improvement over the 2005 stock assessment and they made some recommendations for additional considerations and future improvements. The 2011 stock assessment represents the best available science for managing the blue crab stock at this time.

### **Stock Status**

The 2011 stock assessment generated female-specific biological reference points based on maximum sustainable yield (MSY) and replaces the former maximum spawning potential overfishing threshold. The 2011 stock assessment also replaces the empirical overfished abundance threshold and interim target based on both sexes, with a MSY-based threshold and target based on female age 1+ crabs only (CBSAC 2011). For a comparison of the 2005-2010 control rule and the new 2011 control rule and reference points see Table 1.

The Chesapeake Bay blue crab stock is currently not overfished and overfishing is

not occurring where the terminal year of status determination is 2010. The bay jurisdictions began implementing additional management actions to reduce fishing mortality after the 2005 stock assessment indicated that the blue crab population was at low levels. Actions to reduce harvest included: a closure of the Virginia winter dredge fishery; daily catch limits; time limits; pot limits; and reductions in latent effort. Since 2008, the population abundance of blue crabs in Chesapeake Bay has been rebuilding and the stock has responded positively to management measures focused on conservation of the female portion of the stock. The 2011 stock assessment recommended a MSY-based female abundance target of 215 million spawning-age females, to replace the previous interim target of 200 million male and female spawning-age crabs. The stock assessment also linked the fishing and abundance targets. If the population is fished at the target level over many years; on average, the abundance should vary around the target level of spawning age crabs. In 2010, the abundance of spawning-age females exceeded the female-specific target of 215 million crabs. In 2011 there was a decrease in the number of spawning-age crabs mainly due to a colder than normal winter that caused a higher than average overwintering mortality (approximately 30%). The abundance of female blue crabs age 1+ during 2011 was estimated at 190 million which is below the recommended target of 215 million female crabs but well above the threshold (Figure 1). The preliminary 2012 estimate of age 1+ females (adults) from the winter dredge survey indicates a further decrease in older females but a more than 50% increase in recruitment (Figure 3).

The 2011 stock assessment noted that continued sex-specific exploitation could change the natural ratio of females to males in the population. The CBSAC recommended exploring the ratio of male to female abundance from the Winter Dredge Survey (WDS) but several key issues need to be addressed before such a ratio could be useful as a management trigger. Issues to address include gear efficiency; gear selectivity; sperm limitation and over-wintering mortality estimates. The CBSAC recommended the development of a male-specific threshold reference point that would trigger conservation measures for male crabs. A workshop to develop a male-specific threshold reference point is tentatively planned for the fall/winter of 2012.

A control rule for the blue crab stock has been used to assess the status of the stock. Control rules describe a variable as a function of another variable that management can influence or have some control over (Restrepo and Powers, 1999). Determining the variables depends on the characteristics of the stock and the fishery. These variables are then used to develop definitions of biological reference points, i.e., targets and thresholds. In developing a control rule, the selection of a target is risk-averse even though it is expected that the target may be exceeded because of natural annual variability. Currently, the control rule for blue crabs is based on spawning stock biomass and exploitation.

Since 1992, the stock has been assessed every 3-7 years. As additional data and information become available, new and improved methods of assessing the blue crab stock become possible. The history of assessing the blue crab stock illustrates how over time, changes in methodologies can result in changes to the control rule and biological reference points. Periodic stock assessments and benchmarks have the potential to

improve and refine model parameters and input. It is anticipated that control rules and biological reference points will be improved and changed over time.

### **Stock Status Strategy**

The Bay jurisdictions will utilize biological reference points and a control rule to assess the status of the blue crab stock in Chesapeake Bay and develop appropriate management actions.

#### **Action 1**

The jurisdictions will develop biological reference points based on a control rule to manage the blue crab resource. Currently, female-specific targets and thresholds have been developed. Until a threshold reference point is developed for male blue crabs, the jurisdictions will maintain current conservation levels for male crabs (e.g. size limits).

#### **Action 2**

The jurisdictions will adopt threshold values or overfished designations for stock biomass and exploitation based on the most recent stock assessment results.

#### **Action 3**

The jurisdictions will adopt target values for stock biomass and exploitation based on the most recent stock assessment results.

#### **Action 4**

The jurisdictions will develop decision-making rules or harvest control rules that delineate actions to be taken if the biological reference points are under achieved, achieved or exceeded.

### **Commercial and Recreational Fisheries**

Since the exploitation target and threshold are a percentage of population abundance, commercial harvest can increase or decrease depending on population abundance. Beginning in 2008, the commercial harvest of blue crabs has been above the long-term average. The 2010 baywide commercial harvest was more than 89 million pounds, the highest harvest since 1994. The 2011 preliminary estimate of the baywide commercial fishery is 67.3 million pounds. Maryland DNR Fisheries Service has developed an adaptive management approach to keep blue crab harvest at the target level and works with the Tidal Fisheries Advisory Commission's (TFAC), Blue Crab Industry Advisory Committee on matters concerning the blue crab commercial fishing industry. The Department has the authority to adjust annual catch limits and closed periods through public notice. Each year the number of crabs in the Bay is estimated based on the results of the Winter Dredge Survey. The Department provides the TFAC Blue Crab Industry Advisory Committee with a suite of harvest options dependent on the level of crab

abundance. The Committee determines which option best meets the industry's needs. In this way, the Department and the fishing industry work cooperatively in the best interest of the resource.

In addition to providing advice on current management actions, the TFAC Blue Crab Industry Advisory Committee can also bring other fishery issues of concern to the Department for discussion with the possible development of future management strategies. All recommendations from the TFAC Blue Crab Industry Advisory Committee are vetted through the Tidal Fisheries Advisory Commission. Any regulations resulting from the advisory process adhere to the established public process for initiating regulatory change. This includes public scoping of the regulatory idea, input from both the Tidal and Sport Fisheries Advisory Commissions, and a public comment opportunity during the regulatory process.

Besides the commercial harvest of blue crabs, the recreational harvest is estimated to be between 8% and 11% of the total baywide harvest. However, the recreational catch from the Chesapeake Bay is poorly quantified. Recreational catch is an important part of describing and quantifying patterns of catch and effort by sector for the stock assessment. The CIE recommended conducting a baywide survey of recreational crabbers at regular intervals to quantify the recreational harvest. In order to conduct a survey of recreational crabbers, MDNR may need to consider a new licensing system to establish a database of crabbers to survey.

Maryland fisheries are currently managed as a "commons" where fishermen are motivated to optimize income by catching as many fish and shellfish as possible. To conserve fishery resources, MDNR implements fisheries management strategies through a variety of controls including limited entry, gear restrictions, areal and seasonal closures, size limits, harvest limits and quotas. Maryland DNR also can make changes to protocols for gathering and processing data for stock assessments. The Report of the Task Force on Fishery Management (December 2008) discussed the topic of alternative management, methods to optimize the economics associated with annual allowable harvest. The Task Force was unable to reach a consensus on alternative management approaches but agreed that the Department should continue to explore how limited entry programs, individual transferable quotas, or other right's-based privileges could stabilize the commercial fisheries and how other limited entry concepts could be adapted to provide benefits and improve the design of fishery management measures currently in use.

A Blue Crab Industry Design Team has been formed by waterman to develop recommendations for long-term management improvements to the commercial blue crab fishery. The Blue Crab Industry Design Team is researching management measures that will improve the timeliness and accuracy of harvest information. The lack of real-time and accurate crab harvest and effort data are critical issues that result in uncertainty and the implementation of conservative management measures. The Design Team is working with DNR to develop accountability tools that will provide timely, accurate and verifiable data. Pilot projects for demonstration and evaluation of alternative accountability

practices will enhance the development and application of improved management practices.

### **Commercial and Recreational Fisheries Strategy**

The Maryland DNR will set appropriate commercial and recreational harvest limits to meet the exploitation target and threshold.

#### **Action 5**

Utilize the results of the Winter Dredge Survey to establish appropriate levels of harvest to meet the target exploitation level.

#### **Action 6**

Work with the TFAC Blue Crab Industry Advisory Committee and the Blue Crab Industry Design Team to implement harvest management actions that meet the needs of the resource and the commercial fishery. Management actions may include time limits, seasons, gear restrictions, catch limits, size limits, pot tagging, quotas and/or other methods as necessary and appropriate.

#### **Action 7**

Evaluate the need for modifying the recreational crab license requirements to support an effective and efficient survey for estimating catch and effort in the recreational fishery.

#### **Action 8**

Conduct a baywide survey of recreational crabbers on a recurring basis in order to quantify recreational catch and effort.

#### **Action 9**

Establish acceptable levels of recreational harvest with appropriate management strategies and actions.

### **Pilot Management Studies Strategy**

The Department may conduct pilot management studies of the blue crab fisheries to test and evaluate various strategies, techniques, and tools to increase harvest accountability as well as efficiency and value within the fishery. Studies may address: harvest and activity reporting, market segments, time, area, gear, season, economic conditions, or any other activity deemed appropriate.

#### **Action 10**

Conduct alternative management studies as necessary to address participation and harvest strategies. Studies must be in accordance with applicable regulations for pilot studies and may be conducted in cooperation with the fishing industry.

**Action 11**

Prepare a written evaluation of any pilot study and submit it to the General Assembly as part of the annual Fishery Management Plan report.

**Action 12**

Implement alternative management strategies as appropriate after complete evaluation of results, with input from advisory groups and stakeholders.

**Monitoring**

Fishery-independent and fishery-dependent monitoring are vital components of assessing the blue crab resource in Chesapeake Bay. In 2006, the baywide winter dredge survey (WDS) was recognized as the primary fishery-independent survey for assessing the blue crab stock. The WDS is a comprehensive and statistically robust survey that measures the density of crabs from sites (approximately 1,500) around the entire bay. Results from the WDS are reported as the number of crabs per 1,000 square meters, corrected for bias in gear selectivity, and extrapolated to estimate abundance. The WDS provides an annual estimate of over-wintering blue crab abundance by age and gender. The CIE strongly recommended the continued implementation of the WDS (Addison 2011). In addition, other surveys provide valuable data for assessing the stock including the Virginia (VIMS) trawl survey and the Maryland summer trawl survey. Fishery-dependent monitoring provides important information necessary to describe and quantify patterns in catch and effort. It also provides key information on size and sex for determining growth, mortality rates, and population dynamics.

**Monitoring Strategy**

The bay jurisdictions will collect fishery-independent and fishery-dependent data on the blue crab stock in order to provide critical data for stock assessments.

**Action 12**

The bay jurisdictions will continue to monitor the blue crab resource in the Bay in order to describe and quantify the biological, environmental, and fishery information.

**Table 1. Comparison of the 2011 female-specific biological reference points to the 2005-2010 biological reference points.**

|   | <b>Target</b> | <b>Threshold</b> | <b>2011 Stock Status</b> | <b>2012 Stock Status</b> |
|---|---------------|------------------|--------------------------|--------------------------|
| <b>2011 Female-specific Exploitation Fraction</b>     | <b>25.5%</b>  | <b>34%</b>       | 24% preliminary          | TBD                      |
| 2005-2010 Exploitation Fraction (males & females)     | 46%           | 53%              | 46% preliminary          | TBD                      |
| <b>2011 Abundance (millions of female crabs)</b>      | <b>215</b>    | <b>70</b>        | 190                      | 100 preliminary          |
| 2005-2010 Abundance (millions of male & female crabs) | 200           | 86               | 254                      | 180 preliminary          |



## References

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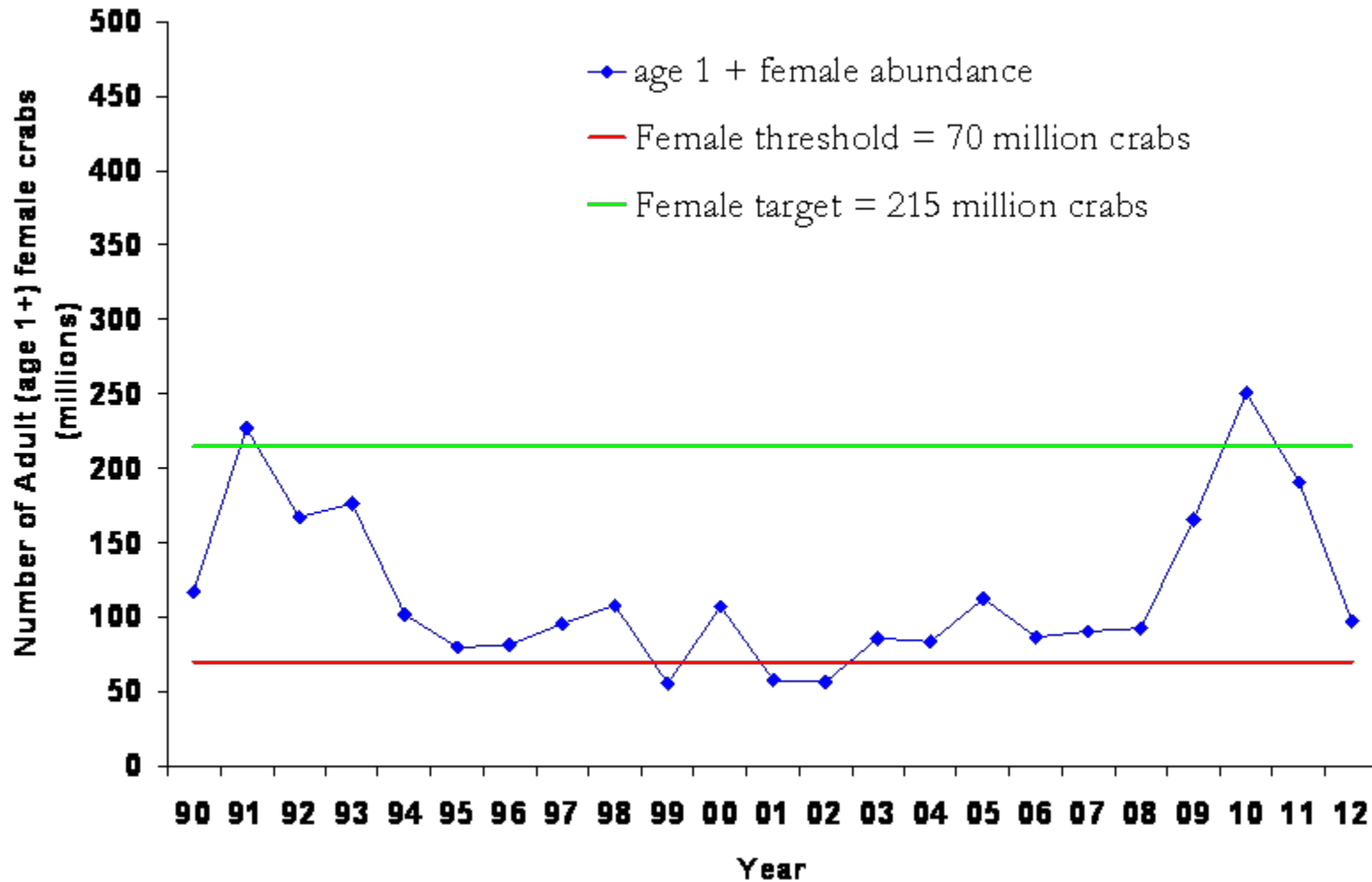
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**Figure 1.** Winter dredge survey estimate of **abundance of female blue crabs age one year and older** (age 1+) 1990-2012 with 2011 reference points. These are female crabs measuring greater than 60mm across the carapace and are considered the ‘exploitable stock’ that will spawn within the coming year.



**Figure 2.** The percentage of female crabs removed from the population each year by fishing relative to the 2011 female-specific target and threshold levels. The value for 2011 is preliminary.

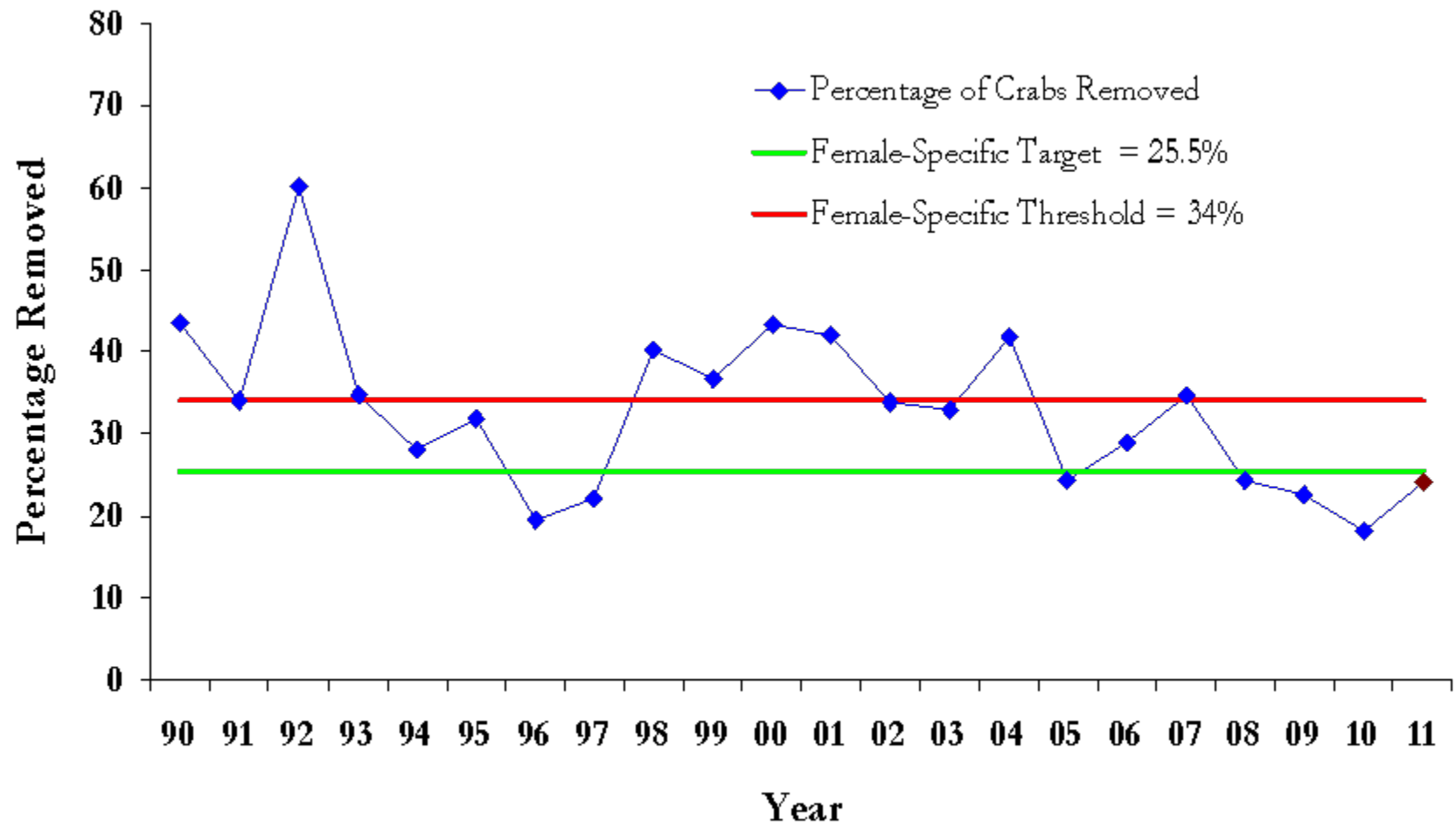


Figure 3. Results of the Blue Crab Winter Dredge Survey, 2012.

