



## **2010 Chesapeake Bay Blue Crab Advisory Report**

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**Annapolis, Maryland**

**Report Approved by the Fisheries Goal Implementation Team:**

**June 14, 2010**

The Chesapeake Bay Stock Assessment Committee combines the expertise of scientists from the Chesapeake Bay region, with that of Federal Fisheries Scientists from the National Marine Fisheries Service Northeast and Southeast Fisheries Science Centers. This group meets each year to review the results of annual Chesapeake Bay blue crab surveys and harvest data, and develop management advice for the Bay jurisdictions. The annual Chesapeake Bay surveys of blue crabs include the baywide winter dredge survey, the Maryland trawl survey, the Virginia trawl survey and the Calvert Cliffs pot survey.

In 2006, the NOAA Chesapeake Bay Stock Assessment Committee (CBSAC) adopted the baywide winter dredge survey (WDS) as the primary indicator of blue crab stock status because it is the most comprehensive and statistically robust of the blue crab surveys conducted in the Bay<sup>1</sup>. The WDS measures the density of crabs (number per 1,000 square meters) at approximately 1,500 sites around the Bay (Figure 1). The measured densities of crabs are adjusted to account for the efficiency of the sampling gear and then are expanded to reflect the area of Chesapeake Bay, providing an annual estimate of the number of over-wintering crabs by age and gender (Sharov et al. 2000).

### **Population Size**

The number of spawning-age crabs (age 1+) is a key indicator of stock status and is used to determine if the population is overfished (see control rule section below). At the beginning of the 2010 crabbing season, results of the 2010 WDS provide an estimate of 315 million age 1+ blue crabs. This represents a 41% increase over the 2009 estimate of 223 million age 1+ crabs. For the first time in 15 years, the number of spawning-age crabs has been above the interim target level of 200 million for two consecutive years (Figure 2). As in 2009, the increase in the number of spawning-age adults in 2010 was primarily the result of an increase in the number of females that are likely to spawn this season (females greater than 60 mm or 2.4 inches carapace width). The

estimated number of these spawning-age females in the 2010 survey was approximately 240 million crabs (Figure 3). The abundance of mature males (number of males greater than 60mm or 2.4 inches carapace width) in 2010 was approximately 75 million crabs (Figure 4). Recruitment, as measured by the number of age 0 crabs (less than 60 mm or 2.4 inches carapace width) doubled from 173 million in 2009 to 345 million (Figure 5).

Data from three supporting blue crab surveys (the Maryland and Virginia trawls and the Calvert Cliffs Pot study) were reviewed. Results of these surveys are presented in Appendix 1 of this report. These surveys are under review as part of the 2010 benchmark stock assessment. Therefore, details of these surveys are not presented in this report.

### **Harvest**

The 2009 Maryland commercial harvest was estimated to be 28.5 million pounds. The 2009 Virginia commercial harvest was reported to be 22.5 million pounds, while in the jurisdictional waters of the Potomac River Fisheries Commission it was 2.9 million pounds (Figure 6). Recreational harvest is assumed to be 8% of the total Bay wide harvest in all years (Ashford and Jones 2001, 2002, 2005)<sup>2a, b, c</sup>. Therefore, the 2009 Bay wide recreational harvest was estimated to be 4.3 million pounds. Combining these categories, the estimated 2009 baywide commercial crab harvest from the Bay and tributaries was 53.9 million pounds, 24% higher than the record-low 2007 harvest of 43.5 million pounds, but well below the long-term (19xx-2009) average of 74 million pounds.

Based on continued evidence of inflated harvest reports, Maryland's 2009 commercial harvest was estimated from fishery-independent data sources including the Maryland commercial reference fleet and an annual survey of crab pot effort in the Maryland portion of Chesapeake Bay (CBSAC, 2009). While the reported commercial harvest of 36.4 million pounds may reflect a maximum possible value, the estimated 2009 harvest of 28.5 million pounds is closer to expected values based on recent inter-state distributions of harvest. In recent years, Maryland's commercial harvest has accounted for approximately 53%, by weight, of the Bay wide harvest, which in 2009, is equivalent to the estimated commercial harvest of 28.5 million pounds.

The estimated exploitation fraction in 2009 (total catch divided by 2009 WDS abundance) was 43%. If Maryland's 2009 reported commercial harvest of 36.4 million pounds is applied, the baywide commercial harvest increases to 61.8 million pounds. Adding the 8% recreational harvest would result in a 2009 exploitation fraction of 50%. This represents a potential upper bound on harvest and exploitation in 2009.

### **Control rule**

The control rule, which was adopted by the Bi-State Blue Crab Advisory Committee in 2001<sup>3</sup> and updated in the 2005 stock assessment<sup>4</sup> is the foundation for sustainable management of the blue crab fishery in Chesapeake Bay (Figure 7). The control rule represents the relationship between the number of spawning-age crabs, exploitation (the fraction of crabs removed from the population by the commercial and recreational fisheries each year) and management reference points. In 2006, the CBSAC defined the overfished limit to be 86 million age 1+ crabs. This threshold value is applied as a proxy based on a lack of historical evidence that a sustainable fishery can be maintained at lower abundances than the minimum observed in the WDS. This value of 86 million age-1+ crabs was observed in the 1999 WDS. The overfishing definition, or exploitation threshold, for this stock, is based on the consensus that a minimum of 10% of the spawning potential of an unfished population must be preserved to minimize the risk of recruitment failure and stock collapse. The target exploitation fraction of 46%, maintained over several years, represents an exploitation fraction that would preserve 20% of the unfished spawning potential.

In January 2008, CBSAC established an interim target of 200 million spawning-age (1+) crabs. This target was established based on analyses suggesting that 200 million age 1+ crabs is the lowest abundance associated with consistently higher levels of recruitment (Fegley 2008, CBSAC 2008)<sup>5,6</sup>. The target level of 200 million is meant to be a goal for initial rebuilding and likely will be replaced by a subsequent target derived from a statistically structured assessment model that integrates all data sources. A benchmark stock assessment that will recommend new reference points, including abundance targets, is currently underway and will be completed in the spring of 2011.

## **Stock Status**

The Chesapeake Bay blue crab stock is currently not overfished and overfishing is not occurring. The number of spawning-age crabs in 2010 exceeded the interim target level for the second consecutive year. The percentage of crabs removed from the population by commercial and recreational fishing (exploitation fraction) in 2009 was estimated as 43%, and is less than the overfishing threshold of 53% and the target of 46%. When considering both commercial and recreational harvest, the exploitation fraction has been less than the threshold exploitation fraction of 53% in 5 of the last 7 years (Figure 8) and less than the target of 46% for the second time in the last 5 years. Historically, low population sizes are associated with high levels of exploitation. The 2009 fishery represents the first year in the 21-year time series that exploitation was less than the target despite a relatively low population size (393 million crabs) at the start of the fishery, and only the second time (2005) that exploitation has been at or less than the target when abundance has been below 600 million crabs. Further, the exploitation fraction has not been less than the threshold for more than two consecutive years since the mid-1990s.

## **2010 Potential Harvest and exploitation**

Based on the number of crabs estimated to be present in the Bay at the start of the 2010 crabbing season, the 2010 harvest should increase even under the current regulatory structure. The projected 2010 baywide harvest is approximately 90 million pounds based on the historic relationship between the population size and subsequent harvest. A harvest of this magnitude should not exceed the 46% exploitation target. This potential increase in harvest highlights the benefits of conservation measures taken during 2008 and again in 2009. It is noteworthy that the number of crabs estimated to be in the Bay has been equal to or greater than the 2010 abundance in only 5 of the last 21 years (Table 1). In these 5 years (1990, 1991, 1993, 1996 and 1997), baywide harvest averaged approximately 88 million pounds.

## **Management Advice – Short Term**

### *1) Maintain conservation measures until full effects of these are known:*

Management actions since 2008 substantially restricted female harvest. Management actions are summarized in Appendix 2. The 2008 management resulted in an increase in spawning-age females in 2009. This increased number of spawning-age females contributed to the production of a strong year-class in 2010. Crab recruitment is

inherently variable, but it tends to be higher with high spawner abundance. CBSAC recommends that regulations be maintained to ensure that exploitation on the spawning component of the stock remains within safe limits. Changes in regulations to achieve equivalent conservation should be carefully evaluated before they are implemented.

2) *Latent effort:*

Conservation efforts since 2008 appear to have resulted in an increased number of crabs in Chesapeake Bay. One threat to the sustainability of the crab stock, even under conservation actions comparable to 2008 and 2009, is the substantial commercial and recreational effort that remains latent in the fishery. The CBSAC recommends that management pursue methods for eliminating latent effort to prevent the addition of effort that would compromise the ability of Bay managers to constrain the fishery to the 46% target removal level. Control of active effort is impeded because of the unknown quantity of latent licenses that may become active and an unknown amount of recreational crabbing potential.

3) *Catch Reports:*

If management based on exploitation fraction continues, CBSAC recommends that the jurisdictions implement procedures that allow accurate accountability of all commercial and recreational. If the jurisdictions continue with a sex-specific regulatory strategy, CBSAC recommends greater efforts to characterize the biological characteristics of all catch.

4) *Recreational Catch and Effort:*

Recreational catch and effort remains poorly quantified in Chesapeake Bay. The jurisdictions should consider methods for more precisely calculating recreational catch and effort, possibly through licensing systems.

## **Management Advice – Long Term**

CBSAC recommends two principal strategies for consideration of future management of the blue crab fishery:

### *1) Catch Control:*

A management strategy that sets annual catch levels based on estimates of abundance from the winter dredge survey could potentially balance annual harvests with highly variable recruitment. CBSAC recommends that jurisdictions evaluate the benefits of quota-based systems including property rights systems.

### *2) Effort Control:*

Controlling effort has been the foundation of crab management in recent years. The principal tools used by managers have been limited entry, size limits, catch limits and seasonal closures. However, the total amount of effort expended in the fishery remains poorly quantified. Thus, the effectiveness of management efforts remains difficult to quantify. Effort monitoring programs could be improved by incorporating pot tagging so that pot effort is measurable and enforceable.

## **Critical Data and Analysis Needs:**

Blue crab management now employs sex-specific regulatory strategies and the 2011 benchmark stock assessment will explore the application of sex-specific assessment models. Given this, the lack of data describing sex ratio and size composition of the harvest will impede efforts to develop effective management strategies. CBSAC recommends that jurisdictions sample for biological characteristics in proportion to the magnitude of harvest from each harvest sector. A collaborative and coordinated baywide, fishery-independent survey focused on the spring through fall distribution and abundance of blue crabs remains important, especially if agencies are considering regional or spatially-explicit management strategies. Finally, an assessment of the magnitude of incidental mortality due to various sources such as discarding female sponge crabs, the peeler fishery, predation effects and gear effects, would potentially improve reliability of exploitation estimates, and inform future assessments.

**CBSAC Members:**

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**Other Attendees:**

Eric Johnson	Smithsonian Environmental Research Center
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## **Literature Cited**

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3. Bi-State Blue Crab Advisory Committee. 2001. Taking Action for the Blue Crab: Managing and Protecting the Stock and its Fisheries. A report to the Chesapeake Bay Commission; Annapolis, Md, Richmond, Va. 24p.
4. Miller, T. J. et al. 2005. Stock Assessment of the Blue Crab in Chesapeake Bay. Technical Report Series No. TS-487-05 of the University of Maryland Center for Environmental Science, 162p.
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Table 1. A summary of annual estimates of the total number of crabs, and of the number of spawning-age adults and age 0 crabs from the baywide winter dredge survey, as well as annual commercial harvest and exploitation fraction. Years when the number of crabs was equal to or greater than in 2010 are highlighted. Harvest during these years averaged 88 million pounds, with exploitation below the target level of 46%.

Winter of Survey	Survey Year (Year the Survey Ended)	Total Number of Crabs in Millions (All Ages)	Number of Age-0 Crabs in Millions	Number of Spawning-Age Crabs in Millions	Baywide Commercial Harvest in Millions of Pounds	Percentage of Crabs Removed (Assuming 8% Recreational Harvest)
1989 - 1990	1990	791	463	276	96	42
1990 - 1991	1991	828	356	457	90	38
1991 - 1992	1992	367	105	251	53	54
1992 - 1993	1993	852	503	347	107	44
1993 - 1994	1994	487	295	190	77	57
1994 - 1995	1995	487	300	183	72	56
1995 - 1996	1996	661	476	146	69	41
1996 - 1997	1997	678	512	165	77	45
1997 - 1998	1998	353	166	187	56	64
1998 - 1999	1999	308	223	86	62	79
1999 - 2000	2000	281	135	146	49	69
2000 - 2001	2001	254	156	101	47	71
2001 - 2002	2002	315	194	121	50	59
2002 - 2003	2003	334	172	171	47	51
2003 - 2004	2004	268	146	124	47	72
2004 - 2005	2005	396	247	158	58	47
2005 - 2006	2006	311	199	121	54	54
2006 - 2007	2007	249	114	141	49	56
2007 - 2008	2008	291	169	131	43	48
2008 - 2009	2009	393	173	223	49	43
2009 - 2010	2010	658	345	315		