COMMONWEALTH of VIRGINIA

Marine Resources Commission
2600 Washington Avenue
Third Floor
Newport News, Virginia 23607

Molly Joseph Ward
Secretary of Natural Resources

John M.R. Bull
Commissioner

December 1, 2017

MEMORANDUM

TO: The Honorable Terry McAuliffe
Governor of the Commonwealth of Virginia
And
Members of the Virginia General Assembly

THROUGH: The Honorable Molly Joseph Ward
Secretary of Natural Resources

FROM: John M.R. Bull

SUBJECT: Blue Crab Fishery Management Plan

On behalf of the Virginia Marine Resources Commission, I am providing this report on the status and current implementation of the blue crab fishery management plan, in accordance with the provisions of § 28.2-203.1 of the Code of Virginia.

EXECUTIVE SUMMARY

Results from the 28th Bay-wide Winter Dredge Survey, conducted from December 2016 to March 2017 (Attachment 1). Table 2 presents 2008 to present data from the survey by the Virginia Institute of Marine Science and Maryland Department of Natural Resources. Recent results indicate the blue crab stock is not depleted and overfishing is not occurring. The 2016-2017 Winter Dredge Survey estimates of abundance of all size classes of crabs was 455 million crabs, and this total abundance is lower than the estimate from the 2015-16 total abundance of 553 million crabs but near the long-term average total abundance of 457 million crabs. The most recent abundance of juvenile crabs enumerated from this winter survey was 125 million and the fourth lowest number of recruits since 1990 and well below the long-term survey average of 262 million juvenile crabs.

The importance of the juvenile crabs surveyed in wintertime is their contribution to the following late summer and fall harvest when they have recruited to harvestable size and their contribution to the subsequent year's late May and July-August spawning periods.

The number of overwintering female crabs that could potentially spawn (if not harvested prior to the spawning seasons) in 2017 was 254 million and is the highest amount of spawning-age female crabs determined from this survey. The importance of the mature female crabs is their contribution to the spawning events in late May and July – August of the same year the Bay-wide Winter Dredge Survey is completed. These crabs also are important to the spring and early summer harvest, as a high proportion of the Virginia commercial and recreational harvests consist of female crabs.

Year-to-year variation in abundance of blue crabs can be expected as a result of the effects of environmental influences, especially for early life stages of crabs. Juvenile crab abundance can vary because of inter-annual difference in entrainment of crab larvae from the ocean to the Virginia portion of Chesapeake Bay that is subject to prevailing current and wind patterns. Environmental factors including weather conditions and predation can have an effect on all life stages of the crab population. Conservation of female spawning-age and juvenile crabs is the primary management objective to attempt to lessen variability of the blue crab stock abundance.

Since 2008, there has been a continuation by all Chesapeake Bay jurisdictions of management measures that conserve the spawning-age female crabs. The number of spawning-age female crabs, estimated in 2017 as 254 million, increased 31% from the 2016 estimate of 194 million. This increase may be partly attributed to the absence of a winter dredge fishery that has been closed since the 2008-09 winter in Virginia. That conservation measure allowed the juvenile crabs from the previous year to be free of fishing pressure after they matured in fall of 2016.

The relatively low overwintering mortality on spawning-age female crabs in the winter of 2017 also can be cited as a positive factor in the resulting high abundance of these female crabs. In addition, management measures from 2008 that were extensive and implemented throughout the Chesapeake Bay jurisdictions have helped to mitigate year-to-year variability in the fisheries that previously resulted in overfishing during many years (see Attachment 1).

The Chesapeake Bay jurisdictions have also relied on a new management framework for the past three season in which the fishery is regulated from July through July. The benefit of this approach is that two Bay-wide winter dredge surveys can be accomplished in that 12-month period, and conservation efforts can be applied after either survey is complete. Since 2014 the Virginia Marine Resources Commission (VMRC) and other Chesapeake jurisdictions no longer manage only the spawning-age female crabs but pay close attention the current year's juvenile abundance, as the juveniles are the subsequent year's spawning stock

Just two years ago, the low abundance (68.5 million) of spawning-age female crabs indicated a depleted stock, as an abundance below the threshold of 70 million spawning-age female crabs is considered depleted. Now, in 2017, the abundance of juvenile crabs is very low at 125 million, and predation and harvest in late summer and fall 2017 will determine how many of these juveniles in 2017 will mature as spawning-age female crabs in 2018 and join the mature female crabs that were not exploited by fisheries in 2017.

The VMRC, PRFC (Potomac River Fisheries Commission) and MD DNR (Maryland Department of Natural Resources) are agreed that before any substantial liberalization of current management measures concerning the blue crab occurs, the crab stock needs to stabilize at an annual abundance that consistently approaches the 215 million spawning-age female crab target. In response to the very low abundance of juvenile crabs in 2017, each jurisdiction implemented conservation measures to reduce the harvest of juvenile crabs in the late fall or early spring or both periods.

The VMRC implemented additional, reduced bushel limits for November of 2017 and March of 2018 and reestablished the traditional crab pot season as a March 17 opening (in 2018) and November 30 closure in 2017. Previously, there had been a December 20 closure in 2016 and a March 1 opening of the season in 2017. The recent shift to a July to July crab management framework allows conservation of spawning-age female blue crabs in the spring prior to spawning and a portion of juvenile female crabs for the next year's spawn.

In Virginia, maintained measures (since 2014) include reduced crab pot bushel and vessel possession limits for specific time periods and a shorter harvest season closure for all other crab gear that exploits juvenile (peeler-size) crabs. The reduced crab pot bushel limits extend from July 5, 2017 through July 4, 2018 for all crab pot license categories. Each year the VMRC can adjust measures based on results of the Bay-wide Winter Crab Dredge Survey, while depending on the bushel and vessel limits already in place to buffer inter-annual variability in juvenile crab production.

Virginia crab and oyster industries that benefitted from disaster relief funds initially provided in 2008 by the Department of Commerce for the declared Fishery Disaster in Chesapeake Bay blue crab fisheries continue to benefit today. The 2008 Disaster Relief Fund has provided various crab industry members (harvesters, buyers, and processors) negatively impacted by poor crab stock conditions during many years, through 2007, a source of employment. These funds have provided an opportunity to work in resource or habitat enhancement projects. The total amount of funding from the Disaster Relief Fund was $14,995,000. All of the six project areas detailed in previous reports have been completed and are shown in Attachment 4.

THE 2017VIRGINIA BLUE CRAB FISHERY MANAGEMENT PLAN

Status of the Blue Crab Stock

The 2011 benchmark stock assessment control rule established female-specific reference points based on the biological status of female crabs. Biological reference points are a primary output of stock assessments, and fishery regulations are implemented to conform to those biological standards. The 2011 blue crab stock assessment provided female-specific reference points for both the abundance of female crabs at least 2.4 inches in carapace width (spawning-age female crabs categorized as age 1+) and the annual removal rate based on the percentage of female crabs of all sizes harvested in a year.

The abundance and exploitation rate targets and thresholds (biological limits) used to monitor the health of the blue crab stock in Chesapeake Bay are provided in Table 1 below.

Table 1. Abundance and exploitation rate targets and thresholds for the Chesapeake Bay blue crab stock. This is the control rule.

2011 Stock Assessment – Biological Reference Points		
Abundance	Overfished (Threshold)	70 million age 1+ female crabs
	Target	215 million age 1+ female crabs
Exploitation Rate	Overfishing (Threshold)	34% of all female crabs
	Target	25.5% of all female crabs

The abundance estimate from the 2016-2017 Bay-wide Winter Dredge Survey of female spawning-age crabs (age 1+) was 254 million crabs. This abundance of spawning potential for 2017 is the highest amount of female crabs capable of spawning. However, this capability is challenged by continuous bay-wide harvesting during 9 months of this year.

Spawning-age crabs are crabs at least 2.4 inches in carapace width sampled by the survey, and these crabs will spawn either in late May or during the July - August peak spawning period. This 2017 estimate is well above the overfished threshold of 70 million spawning-age female crabs that signals a depleted stock condition. That depletion did occur in 2014. The most recent (2016) female crab exploitation rate estimate was 16%, and is below the target exploitation rate of 25.5% removal of female crabs on an annual basis from fisheries alone. This estimate is below the overfishing threshold of 34%, and overfishing is not occurring on this stock. For the last nine consecutive years the removal rate has been near or less than the target. Yet, the Chesapeake Bay jurisdictions are concerned that this removal rate, based on all sizes of female crabs, suffers from the assumption that the number of juvenile crabs collected by the dredge is always only 40% of the total number of juveniles each year since 2009.

The total abundance of 455 million crabs, determined by the Winter Dredge Survey is near the survey average but is imbalanced, in that nearly 56 percent of the total abundance is represented by spawning-age females, but only 27 percent of the total abundance is represented by juveniles. Approximately one-half of those juveniles are female crabs. It is equally important that both mature female crabs and juvenile crabs are conserved for spawning potential in 2018.

Overwintering mortality for all blue crabs in the Chesapeake system was 1.9%; as in 2016. Over-wintering mortality was highest for adult female crabs (4.2%), followed by adult males (1.7%), and lowest among juveniles (0.5%) in 2017.

In the 2017 Chesapeake Bay Blue Crab Advisory Report, the Chesapeake Bay Stock Assessment Committee (CBSAC) recognized several topics as critical data and analysis needs to aid in the understanding of the variability in the blue crab stock. CBSAC identified a list of fishery dependent and independent data needs that would provide better information on blue crab abundance and survival, such as in 2016, for management measures, to include:

- Increased accountability and harvest reporting for both commercial and recreational fisheries;
- Gear efficiency pertaining to selectivity of the Winter Dredge Survey methods;
- Improving recruitment estimate through a shallow-water survey;
- Application of fishery independent survey data;
- Other sources of incidental mortality;
- Investigation of the potential for sperm limitation;

Table 2, below, provides a 28-year summary of the results from the Chesapeake Bay-wide Winter Dredge Survey conducted by the Virginia Institute of Marine Science (VIMS) and the Maryland Department of Natural Resources (MD DNR). The abundance of recruits (termed age 0 crabs) and the spawning-age crabs (termed age 1+) are differentiated according to size, with 2.4 inches in carapace width as the separator between the two size classes. Any abundance estimate represents the number of crabs that will be available to Chesapeake Bay fisheries following the end (March) of the seasonal (December - March) Bay-wide Winter Dredge Survey (Figure 1). A basis for the disaster relief can be readily understood by the overfishing that existed in 7 of 10 years from 1998 through 2007, as the removal rate or percentage of female crabs harvested exceeded the overfishing threshold of 34%.

Table 2. Bay-Wide Winter Dredge Survey results (winter of 2007-08 through winter of 2016-17. 016). The winter of 2008 preceded the 34 percent reduction in female harvest by all Chesapeake jurisdictions. All surveys begin in December and end in March the next year. Commercial harvest and percentage of female crabs removed in 2016 are not yet available.

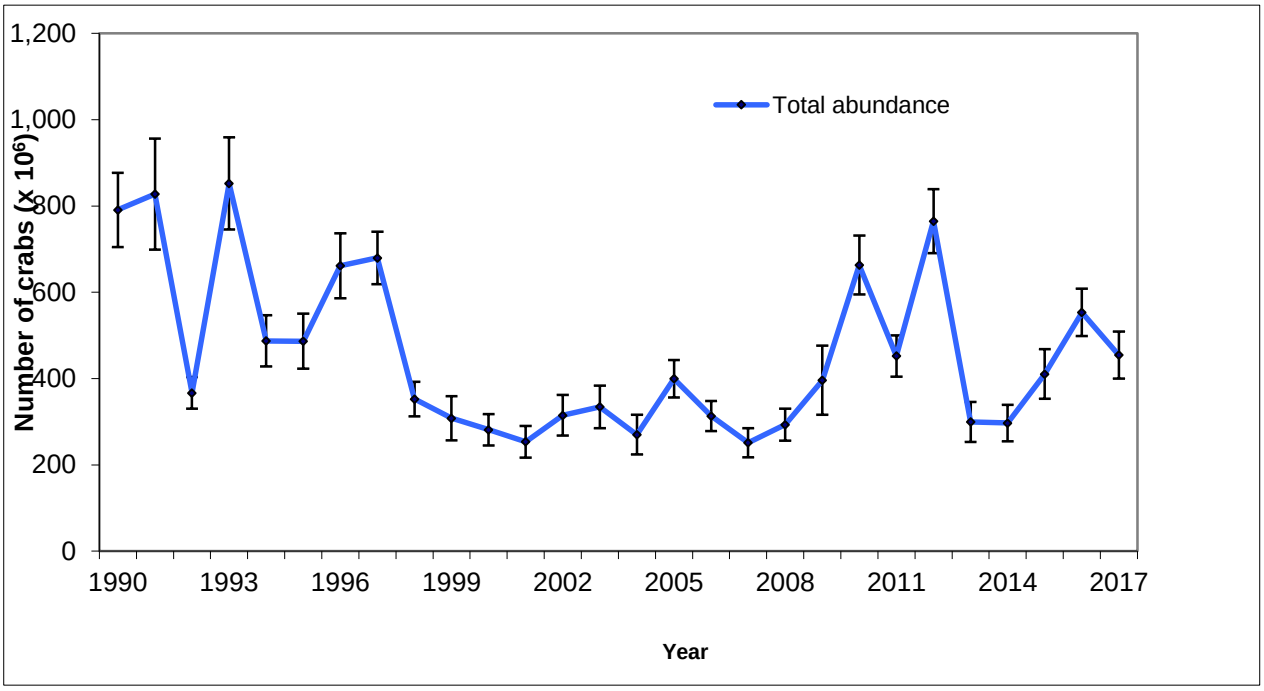
Survey Year (Year Survey Ended)	Total Number of Crabs in Millions (All Ages)	Number of Juvenile Crabs in Millions (both sexes	Number of Spawning-Age Crabs in Millions (both sexes)	Number of spawning age Female crabs in Millions	Baywide Commercial Harvest (Millions of Pounds)	Percentage of Female Crabs Harvested
1990	791	463	276	117	104	43
1991	828	356	457	227	100	40
1992	367	105	251	167	61	63
1993	852	503	347	177	118	28
1994	487	295	190	102	84	36
1995	487	300	183	80	79	36
1996	661	476	146	108	78	25
1997	680	512	165	93	89	24
1998	353	166	187	106	66	43
1999	308	223	86	53	70	42
2000	281	135	146	93	54	49
2001	254	156	101	61	54	42
2002	315	194	121	55	54	37
2003	334	172	171	84	49.5	36
2004	270	143	122	82	60	46
2005	400	243	156	110	58.5	27

2006	313	197	120	85	52	31
2007	251	112	139	89	43	38
2008	293	166	128	91	49	21
2009	396	171	220	16	54	24
2010	663	340	310	246	85	16
2011	452	204	255	191	67	24
2012	765	581	175	95	56	10
2013	300	111	180	14	37	23
2014	297	198	99	68.5	35	17
2015	411	269	14	101	50	15
2016	553	271	284	194	**60**	**16**
2017	**455**	**125**	**330**	**254**	**TB**	**TB**

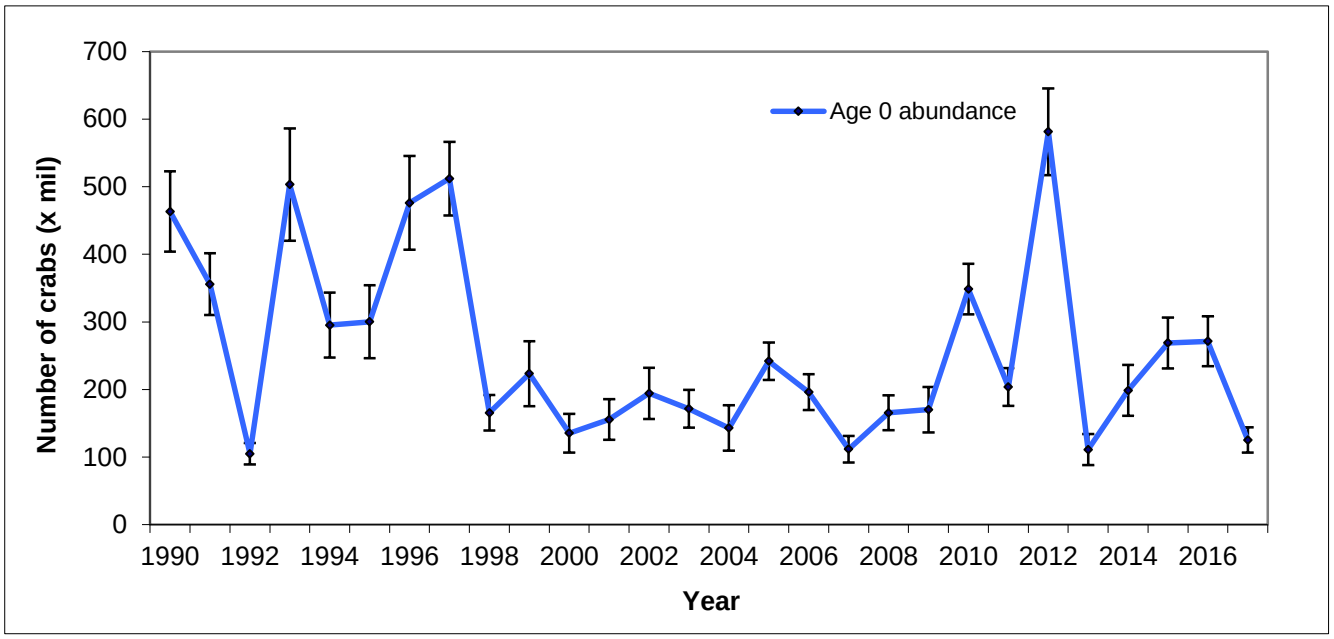
* 2017 Baywide commercial harvest and exploitation rate are preliminary (TBD= to be determined)

Figure 1. Abundance estimates (number of crabs in millions) for the 28-year Bay-wide Winter Dredge Survey for: A). total crab abundance (male and female), B) juvenile (new recruits) crab abundance, and C) spawning-age (age 1+) female and male crab abundance, 1990 through 2017.

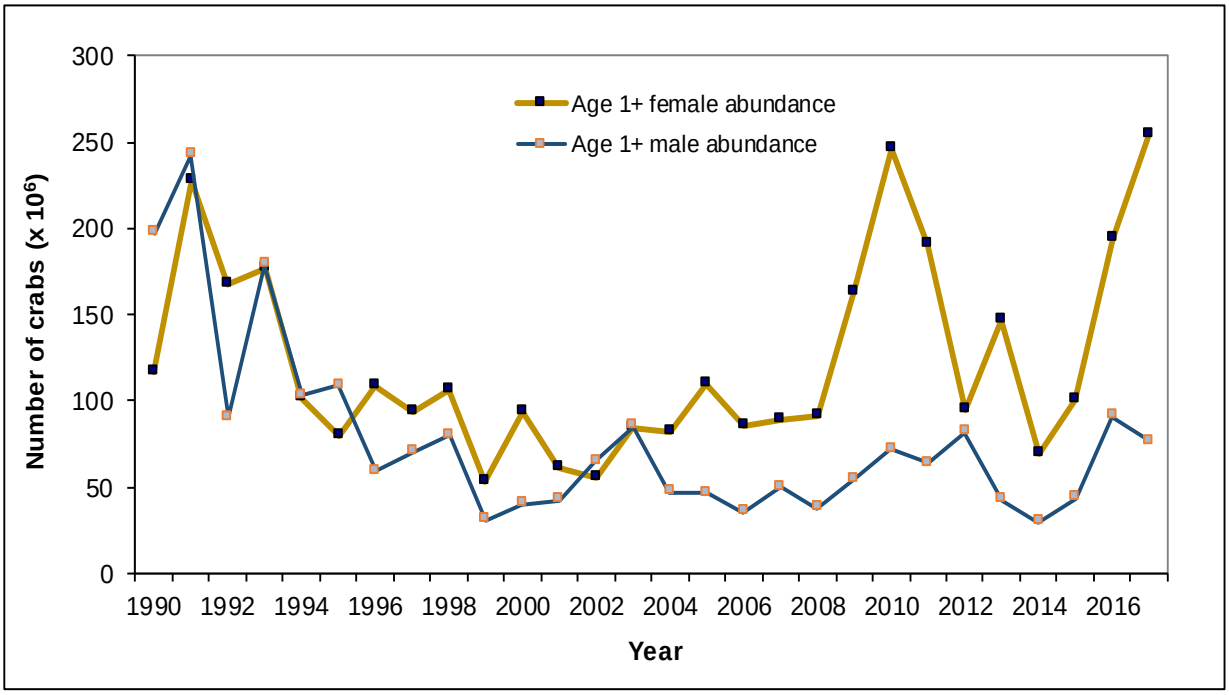
A).



B).



C)



Harvest and Effort Statistics

The total 2016 Baywide commercial harvest of approximately 60 million pounds remains below average but increased by 20% from the 2015 Baywide commercial harvest of approximately 50 million

pounds (see in-text Table, below). The 2016 commercial harvest for both males and females from the Bay and its tributaries was estimated as 30.7 million pounds in Maryland, 26.0 million pounds in Virginia and 3.2 million pounds in the Potomac River. This was an increase from 2015 commercial harvest levels for all three jurisdictions: a 15% increase for Maryland, 24% increase for Virginia and a 60% increase for the Potomac River (Figure 2).

FIGURE 2. Chesapeake Baywide harvests (pounds), by jurisdiction, 1990-2016.

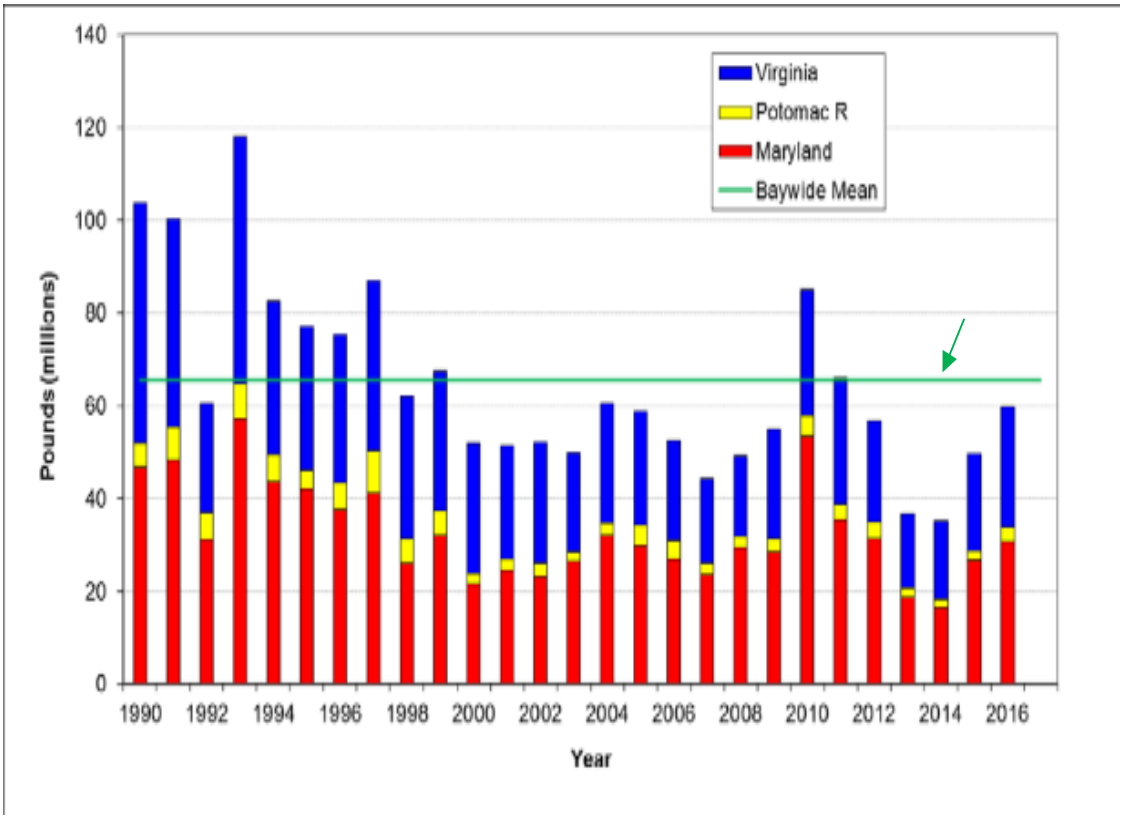


Figure 3 below displays the time series of Virginia commercial crab harvest for all Virginia waters in pounds and estimated dockside value (first sale from harvester). The dockside value has been adjusted to account for inflation using the Consumer Price Index. Harvest statistics have been collected from Virginia fisheries since the late 1920s; however, 1994 is the first representative year of the mandatory commercial harvest reporting system. Both harvest and dockside value generally declined from 1994 through 2006. There was an increase in value that began in 2006, while harvest continued to decline until 2008. There were increases in both harvest and dockside values until 2010, followed by another decline in 2011 and 2012. In 2013, pounds harvested declined while value remained stable compared to 2012, which indicates price per pound increased as supply was limiting. In 2014 through 2016, both pounds harvested and dockside value increased. Value of these harvests is not considered highly accurate, as VMRC depends on voluntary reporting of dockside value even though harvest and effort reporting are mandatory.

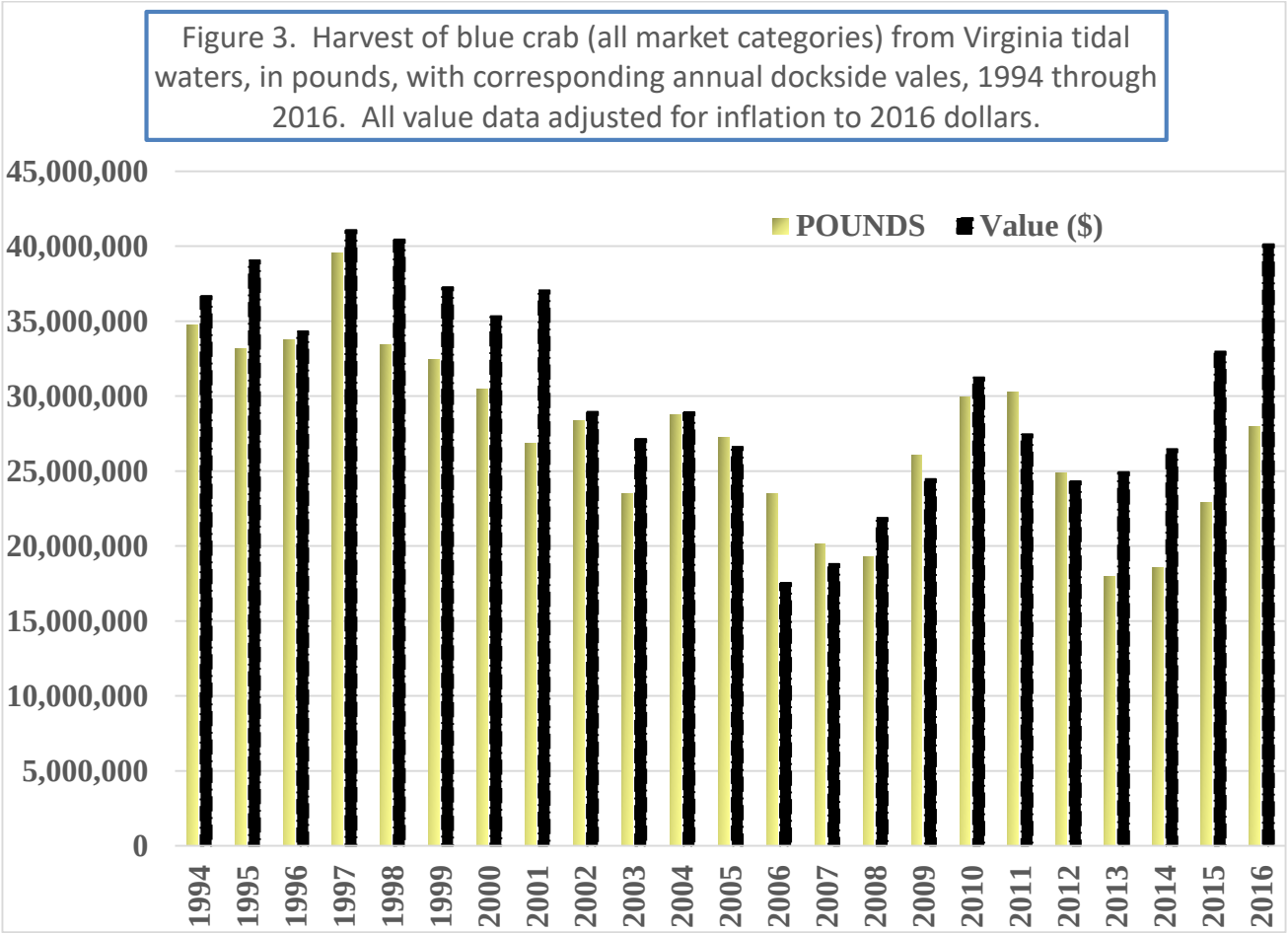


Table 3 provides a summary of harvest data by market category. Hard crabs dominate the Virginia harvest, and peeler-size crabs (minimum size of 3 ¼-inch through July 15 and 3 ½-inch minimum size crabs after July 15) are a lesser contributor to the overall harvest in pounds but often comprise up to 8 percent of the harvest in numbers (roughly, 5 peeler crabs = 1 pound). Harvest of peeler crabs peaked in 2014 at almost 2.5 million pounds and these harvests have been somewhat in flux, between just more 700,000 pounds and just less than one million pounds in recent years.

Table 3. Harvest of blue crab from Virginia waters by market category (hard crabs and peeler and soft crabs), in pounds, 2008 – 2016. In 2008 all Chesapeake Bay jurisdictions imposed a 34 percent reduction in the harvest of blue crab using varied conservation measures. Mostly, all measures remain today.

Year	Hard crab (Pounds)	Peeler & soft crab (Pounds)
2008	18,278,467	995,014
2009	25,112,135	961,474

2010	29,000,113	969,942
2011	29,529,054	759,016
2012	23,992,153	879,751
2013	17,352,456	599,696
2014	17,566,425	985,254
2015	22,101,692	800,745
2016	27,206,408	735,203

Table 4 provides harvest data for the two dominant gears used in the blue crab fisheries. By far, crab pot provides the most harvest of any gear type. Of the 20 different gear types that reported harvest during any year, from 2008 through 2016, the crab pot accounted for 95 percent of the total 2008-2016 harvest from Virginia waters, and the peeler pot fishery contributed four percent of that total. In terms of numbers of crab, the peeler pot contributes more than four percent.

TABLE 4. Virginia harvests of blue crab, by the peeler pot and crab pot fisheries, 2008-2017.

YEAR	Crab pot harvest (pounds)	Peeler pot harvest (pounds)
2008	17,512,157	963,324
2009	24,916,142	981,319
2010	28,733,039	1,057,239
2011	29,224,208	894,902
2012	23,750,604	917,917
2013	16,981,833	646,156
2014	17,403,296	1,038,156
2015	21,796,383	997,534
2016	26,858,482	971,332
2017	17,831,802	792,533

Figures 4A and 4B provide an 11-year summary of different types of participation in the crab pot and peeler pot fisheries. Each chart indicates numbers of harvesters who are either eligible for that fishery, purchased a license or were active in any year or were active by harvesting at least one pound of crab. Since 2010, any licensee can remain eligible without purchasing a license. Similarly, anyone can purchase a license and choose whether to be an active harvester.

It can be seen from these charts that the number of active crab pot fishermen has been mostly stable, while the number of peeler pot fishermen who are active has declined. These charts indicate an abundance of potential or latent effort might exist in either fishery. However, there has been no rush by eligible, but inactive, crab fishermen to join either fishery solely because of higher abundance in a given year. Since there has been a license moratorium since 1999, many eligible crabbers are holding licenses for family members or for sale.

Figure 4A. 2006 - 2016 Crab Pot License Eligibility, Sales, and Activity

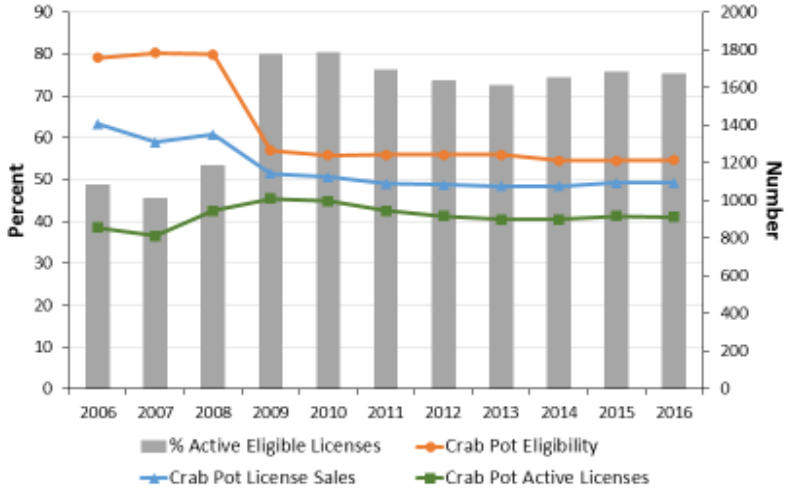
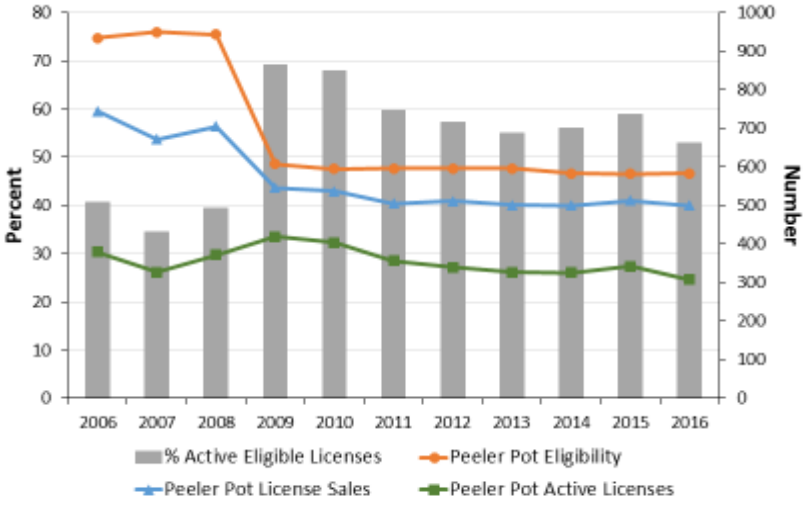


Figure 4B. 2006 - 2016 Peeler Pot License Eligibility, Sales, and Activity



Blue Crab Conservation Actions in 2016 and Previous Years

Commission actions since 1994 that have attempted to promote sustainability of the blue crab stock and fishery through conservation measures are included in Attachment 3. Many of these measures were designed to promote spawning potential of blue crabs and have helped in stabilizing the crab stock. Mostly, abundance has been low since 2011, but 2014, 2015, and 2016 Bay-wide Winter Dredge Survey data showed some improvement in juvenile production. However, juvenile production is the most unpredictable variable life stage and was low this year, while spawning-age female crabs were very abundant. These measures by the Commission were employed before scientists developed status of the stock indicators, and these health-of-the stock indicators improved after each analytical stock assessment in 1997, 2005 and 2011. These improvements in science allowed the Commission to better target problem areas in the stock and its fisheries.

A short-term conservation approach for 2015 and 2016 was developed. Management measures for 2015 and 2016 were modified to provide more protection for the female spawning-age and juvenile blue crabs that will contribute to the spawning stock in 2017. For 2017 the Commission enacted conservation measures to afford additional conservation of the low juvenile crab abundance in 2017. The Commission approved the following management measures at its May 2017 meeting:

- Reduction in crab pot bushel limits and vessel limits

In June 2017 the Commission further reduced crab pot bushel and vessel possession limits for two additional weeks in November 2017 and March 2018, as an effort to conserve juvenile crabs from the winter of 2017. Crab pot bushel limits and vessel limits extend from July 5, 2016 through July 4, 2017 for all crab pot license categories and were implemented in 2014. This time period is effectively the new commercial blue crab management framework for Virginia, shifting management measures from a commercial blue crab season of March through November each year to July from one year to the next. The Commission closed the winter crab dredge fishery season for the tenth consecutive season to allow for continued rebuilding of the spawning stock biomass. The main basis was that the juvenile abundance was severely low, and those juveniles would be mature and exploited by a 2017-18 winter dredge season. In addition, the Commission adopted an earlier closure of November 30, for the crab pot fishery, as compared to the 2017 closure of December 20. Similarly, the early March 1, 2017 opening of the crab pot season was pushed back to March 17 in 2018.

Modified crab pot gear license category-specific bushel limits established by the Commission, effective July 5, 2017 through July 4, 2018.

B. From July 5, 2017 through October 31, 2017, and April 1, 2018, through July 4, 2018, any Commercial Fisherman Registration Licensee legally licensed for any crab pot license, as described in 4VAC20-270-50 B, shall be limited to the following maximum daily harvest and possession limits, for any of the following crab pot license categories:

1. 10 bushels, or 3 barrels and 1 bushel, of crabs, if licensed for up to 85 crab pots.

2. 14 bushels, or 4 barrels and 2 bushels, of crabs, if licensed for up to 127 crab pots.

3. 18 bushels, or 6 barrels, of crabs, if licensed for up to 170 crab pots.

4. 29 bushels, or 9 barrels and 2 bushels, of crabs, if licensed for up to 255 crab pots.

5. 47 bushels, or 15 barrels and 2 bushels, of crabs, if licensed for up to 425 crab pots.

C. From November 1, 2017 through November 30, 2017, and March 17, 2018, through March 31, 2018, any Commercial Fisherman Registration Licensee legally licensed for any crab pot license, as described in 4VAC20-270-50 B, shall be limited to the following maximum daily harvest and possession limits, for any of the following crab pot license categories:

1. 8 bushels, or 2 barrels and 2 bushels, of crabs, if licensed for up to 85 crab pots.

2. 10 bushels, or 3 barrels and 1 bushel, of crabs, if licensed for up to 127 crab pots.

3. 13 bushels, or 4 barrels and 1 bushel, of crabs, if licensed for up to 170 crab pots.

4. 21 bushels, or 7 barrels of crabs, if licensed for up to 255 crab pots.

5. 27 bushels, or 9 barrels of crabs, if licensed for up to 425 crab pots.

Daily vessel harvest possession limits are related to crab pot bushel limits, so a reduction in crab pot bushel limits results is a reduction in the vessel possession limit. A vessel harvest possession limit corresponds to the highest crab pot bushel limit of only one licensee onboard a vessel. Commercial harvesters fishing for blue crab may have multiple licensees onboard a vessel.

- Winter crab dredge fishery season

The Commission closed the 2017/18 winter crab dredge fishery season from December 1, 2016 through March 31, 2017 for the tenth consecutive season after reviewing the abundance estimates from the Winter Dredge Survey and being mindful of the depleted condition of juvenile crabs in 2017 and the depleted condition of the blue crab stock in 2014.

- Season closure for all other crab harvest gears

The Commission established a season of April 1 through October 31, for all gears that harvest peeler crabs.

Ecosystem Constraints on the Blue Crab Resource

§ 28.2.203.1 of the Code of Virginia provides that the blue crab fishery management plan shall be designed to reverse any fishing practices, environmental stressors, and habitat deterioration negatively impacting the short and long term viability and sustainability of the crab stock in Virginia waters. In recent years, the Commission has adopted effective conservation measures to reverse fishing practices that have negatively impacted the stock. The Commission relies on the efforts of its sister agencies to promote and sponsor improvements of Chesapeake Bay's water quality in order to meet the requirements of §28.2.203.1 of the Code of Virginia dealing with environmental stress and habitat deterioration.

Algal blooms can result in hypoxic and anoxic conditions (low dissolved oxygen levels) in Chesapeake Bay that cause blue crabs to be displaced or result in mortality. The Commission is a member of the Virginia Department of Health's Harmful Algal Bloom Task Force (HAB TF). This year, HAB TF members combined efforts to conduct fly-overs, take and analyze samples from areas with active HABs, and update the public about HABs. VMRC staff worked with HAB TF to provide links to VDH Harmful Algal Bloom notices on the VMRC website. VMRC staff will participate in the annual HAB TF meeting, to be held on December 6, 2016. The impact of HABs on blue crab meat safety or health is unknown.

The Commission and the industry recognize that improvements in blue crab habitat and water quality could increase the probability for improved recruitment to the stock and fisheries; however, many water quality and habitat impacts to the stock are not fully quantified or understood. The relationship between

blue crabs and other components of the ecosystem is being explored by Chesapeake Bay scientists. Many natural and man-induced impediments continue to challenge the stability of the blue crab stock, including hypoxia, shoreline development, and pollution. The issue of climate change will continue to be important as well, as blue crab behavior is linked to water temperature.

The Commission and the industry recognize that improvements in blue crab habitat and water quality could increase the probability for improved recruitment to the stock and fisheries; however, many water quality and habitat impacts to the stock are not fully quantified or understood. The relationship between blue crabs and other components of the ecosystem is being explored by Chesapeake Bay scientists. Many natural and man-induced impediments continue to challenge the stability of the blue crab stock, including hypoxia, shoreline development, and pollution. The issue of climate change will continue to be important as well, as blue crab behavior is linked to water temperature.

Water quality in Chesapeake Bay is improving due to the ongoing efforts of the Commonwealth and the signatories of the Chesapeake Bay Agreement. Additional work is being implemented to meet pollution reduction goals in Chesapeake Bay. Each of the bay jurisdictions has developed a Watershed Implementation Plan to guide restoration plans through 2025. The federal government developed Executive Order 13508, which guides the federal agencies plan to meet pollution reduction goals and establishes the Federal Leadership Committee that will publish an annual Chesapeake Bay Action Plan. A Chesapeake Bay Watershed Agreement was signed in June 2014 by governors from all seven watershed states, the Chesapeake Bay Commission, and the Environmental Protection Agency. The Watershed Agreement contains ten goals and 29 measureable, time-bound outcomes to improve the health of Chesapeake Bay including sustaining blue crabs. The 2015 Update to the 2014-2015 Milestone Progress Report published by the Federal Government in May, 2016, demonstrates progress toward milestones and includes planned Bay restoration and protection for fiscal year 2016.

Past reductions in submerged aquatic vegetation (SAV) beds have likely impacted the blue crab stock, especially juvenile crabs that use SAV beds as protection from predators. Seagrass beds provide nursery habitat for newly settled, young juvenile, and mating blue crabs. The dominant SAV in Virginia waters is eelgrass (a seagrass). The importance of eelgrass habitat functions in Chesapeake Bay was first demonstrated by VIMS in a 1961 report to the National Science Foundation. Subsequent studies by VIMS have led to a greater understanding of SAV Bay-wide distribution, abundance, and health. VIMS established the first broad-scale aerial monitoring of SAV in 1974, and expanded the survey in 1978 to cover all of Virginia's tidal waters. VIMS maintains a research and monitoring program that has significantly expanded our understanding of SAV, its role in the greater Bay ecosystem, and its linkages with the health of the blue crab stock. Ongoing SAV research and monitoring programs include:

- Annual Bay wide aerial survey;
- Eelgrass restoration in Virginia's seaside bays;
- The use of restored eelgrass beds by estuarine fauna;
- Targeted water quality monitoring and study of key SAV locations in Virginia waters for effects from water quality changes, global warming, and climate change;
- Assessment and monitoring of the effects of certain fishing techniques on eelgrass beds;
- Water quality assessments for evaluation of water quality standards attainment (SAV distribution is a criterion for water clarity);
- The role of abiotic factors influencing the flowering of eelgrass;
- The roles of dispersal and seed predation in determining eelgrass population dynamics;

- The influence of climate change factors on the use of eelgrass and widgeon grass beds;
- Habitat suitability of exotic algae versus native seagrass as an alternative nursery habitat for juvenile blue crabs;
- The distribution of overwintering age-0 blue crabs in shallow water habitats; and
- The functional relationships between seagrass characteristics and juvenile blue crabs under high recruitment.

Eelgrass is near its southern limits along the Atlantic coast in Virginia, so high summertime water temperatures can be especially harmful to eelgrass beds. Unusually high temperatures during periods in the summer of 2005 and 2010 resulted in severe diebacks in eelgrass beds, most dramatically in high-salinity areas (Orth *et al.* 2016). After each of these diebacks, some recovery was observed over the next few years; however, VIMS research (Jarvis and Moore 2010) has shown that since eelgrass seeds in the sediment are only viable for a year or less, consecutive years of diebacks would be especially deleterious. If water temperatures continue to increase as a result of climate change, losses of eelgrass beds in Virginia may accelerate. VIMS research has demonstrated that increased water clarity can help eelgrass beds persist under higher temperatures. Therefore, VIMS is working with Virginia regulatory agencies, MD DNR, and the Environmental Protection Agency to assess the current water clarity goals for Chesapeake Bay to determine if changes are appropriate and needed. Storms can also be stressful to SAV beds through direct physical disruption or by greatly increasing sediment and nutrient inputs into the Bay and its tributaries. Excess sediments and nutrients can promote increased turbidity, compounding the effects of high temperatures (Moore et al. 2012). Results of VIMS' studies indicate that Virginia's SAV beds do relatively well in withstanding the direct physical disruption by storms.

VIMS annual Bay-wide aerial survey serves as a significant indicator of Bay health and as a tool for determining compliance with Virginia water quality standards. Virginia tidal waters are home to 12 species of SAV, with eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*) having the most overlap with the distribution of juvenile blue crabs in Chesapeake Bay. Since historically low abundances in 1984, SAV restoration has varied between tidal waters with different salinities. Seagrass beds have continually increased in lower salinity tidal waters, increased initially in areas of medium-salinity followed by variable annual abundance levels, and increased initially in the high-salinity region followed by a general decline in abundance (Orth et al. 2010). These general trends remain accurate in the years since this study. A recent VIMS study has shown that juvenile blue crabs prefer denser SAV beds over thinner beds (Ralph et al. 2013), further demonstrating the positive influence that the quality of seagrass beds have on blue crab population dynamics. VIMS studies have also demonstrated the high value to juvenile blue crabs of unvegetated areas both adjacent to salt marshes in upriver areas of Bay tributaries and areas that contain an abundance of food such as clams and polychaetes (marine worms); and within areas of abundant macroalgae where native SAV nursery habitat has experienced reductions in aerial coverage (Seitz et al. 2003, Seitz et al. 2005, Johnston and Lipcius 2012).

Blue crabs have a diverse assemblage of parasites and pathogens, and the presence and occurrence of these pathogens has been a long-time research focus at VIMS. Many pathogens are present in the tidal waters of Virginia, but only a few have the potential to damage the blue crab stock or fisheries (Shields & Overstreet 2007, Shields 2012). Two agents, in particular, occur at high prevalence levels and show signs of high pathogencity. These are *Hematodinium perezi* and a recently identified reo-like virus. *Hematodinium perezi* is a parasitic dinoflagellate found primarily in the higher salinity waters of the Bay, particularly in the seaside bays of the Eastern Shore and along the eastern portions of lower Chesapeake

Bay (Messick & Shields 2000). Prevalence levels of *Hematodinium* have a small peak in early summer and a large peak in autumn followed by a rapid decline with the onset of winter temperatures. Prevalence levels are associated with molting in juvenile blue crabs, which explains the bimodal peak occurrence of the parasite. Mortality levels of 87% have been observed in laboratory experiments (Shields and Squyars 2000). VIMS scientists recently discovered and described the life cycle of *Hematodinium perezi* in the blue crab (Li et al. 2011), and this will lead to a greater understanding of the risk of mortality and the environmental and biological factors that may influence the effects of this pathogen. The reo-like virus was initially described from juvenile crabs held in the laboratory (Johnson and Bodammer 1975). It has been implicated as a source of mortality in the production of soft-shell crabs based on infection trials and sampling of crabs from shedding facilities (Bowers et al. 2010). VIMS continues to be actively engaged in research on these pathogens.

Blue Crab Disaster Relief Funding Updates

In 2008, Virginia was awarded $14,995,000 in disaster relief funds by the National Marine Fisheries Service (NMFS) after the declaration of a blue crab fishery disaster. The Commission implemented a set of six projects (Items I through VI, below), beginning in December 2008 with the Derelict Crab Pot and Marine Debris Removal Project. The remaining five projects were initiated in 2009, and all projects were completed by 2016 (see Attachment 4).

VI. Update of the blue crab stock assessment

In 2016, the CBSAC Report was completed (Attachment 2). Findings of the stock assessment were endorsed by the Chesapeake Bay Program Sustainable Fisheries Goal Implementation Team's executive committee. The executive committee is represented by VMRC, MD DNR, the Potomac River Fisheries Commission, the National Oceanic and Atmospheric Administration's Chesapeake Bay Office, Maryland Sea Grant, the Atlantic States Marine Fisheries Commission, and the District of Columbia's Division of Fish and Wildlife.

Managers and scientists expect annual estimates of abundance and exploitation rate to vary. However, if at any time the Bay-wide Winter Dredge Survey results indicate the abundance of female spawning-age crabs has fallen below the overfished level of 70 million, then management measures would be implemented to protect the biological stability of the blue crab stock. Based on results from the 2015/16 Winter Dredge Survey, the female spawning-age biomass is not below the overfished threshold and has shown some recovery since management measures to reduce harvest on all crabs by 10% Bay-wide were implemented. Despite a history of variable abundance over the last several years, VMRC continues to promote conservation efforts that can afford benefits to all user groups.

References

Federal Leadership Committee for the Chesapeake Bay. 2015. Executive Order 13508, Strategy for Protecting and Restoring the Chesapeake Bay Watershed: 2014-2015 Milestones Progress Report. Available at: http://executiveorder.chesapeakebay.net/category/Reports-Documents.aspx.

Jarvis, J.C., and K.A. Moore. 2010. The role of seedlings and seed bank viability in the recovery of

Chesapeake Bay, USA, *Zostera marina* populations following a large-scale decline. Hydrobiologia 649: 55-68.

Johnston, C.A., and R.N. Lipcius. 2012. Exotic macroalga *Gracilaria vermiculophylla* provides superior nursery habitat for native blue crab in Chesapeake Bay. Marine Ecology Progress Series467: 137-146.

Li, C., T.L. Miller, H.J. Small, and J.D. Shields. 2011. In vitro culture and developmental cycle of the parasitic dinoflagellate *Hematodinium* sp. from the blue crab *Callinectes sapidus*. Parasitology 138: 1924-1934.

Messick, G.A., J.D. Shields, 2000. Epizootiology of the parasitic dinoflagellate Hematodinium sp. in the American blue crab Callinectes sapidus

Moore, K.A, E.C. Shields, D.B. Parrish, and R.J. Orth. 2012. Eelgrass survival in two contrasting systems: role of turbidity and summer water temperatures. Marine Ecology Progress Series 448: 247-258.

Orth, R.J., M.R. Williams, S.R. Marion, D.J. Wilcox, T.J.B. Carruthers, K.A. Moore, W. M. Kemp, W.C. Dennison, N. Rybicki, P. Bergstrom, and R.A. Batiuk. 2010. Long-term trends in submersed aquatic vegetation (SAV) in Chesapeake Bay, USA, related to water quality. Estuaries and Coasts 33: 1144-1163.

Orth *et al.* 2016. Preliminary 2015 Distribution of Submerged Aquatic Vegetation in Chesapeake Bay and Coastal Bays, Executive Summary.

Ralph, G.M., R.D. Seitz, R.J. Orth, K.E. Knick, and R.N. Lipcius. 2013. Broad-scale association between seagrass cover and juvenile blue crab density in Chesapeake Bay. Marine Ecology Progress Series 488: 51-63.

Seitz, R.D., R.N. Lipcius, W.T. Stockhausen, K.A. Delano, M.S. Seebo, and P.D. Gerdes. 2003. Potential bottom-up control of blue crab distribution at various spatial scales. Bulletin of Marine Science 72(2): 471-490.

Seitz, R.D., R.N. Lipcius, and M.S. Seebo. 2005. Food availability and growth of the blue crab in seagrass and unvegetated nurseries of Chesapeake Bay. Journal of Experimental Marine Biology and Ecology 319: 57-68.

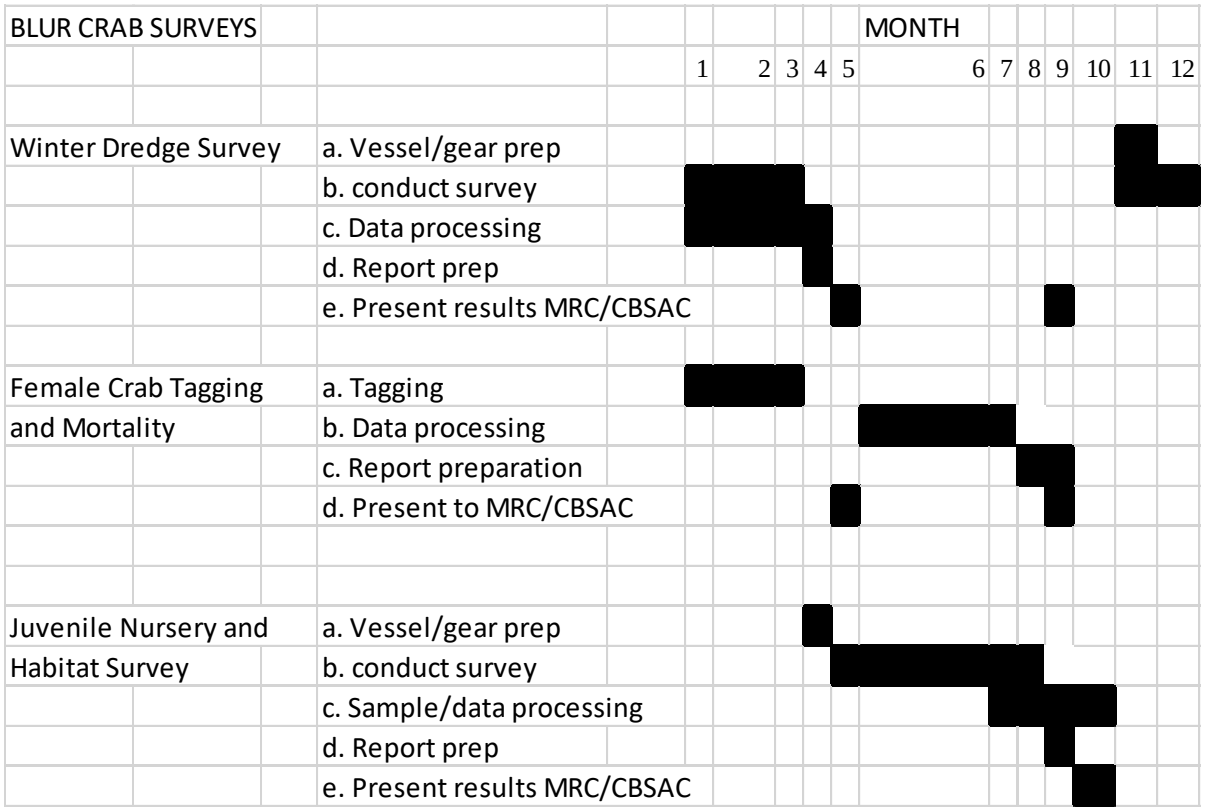
Shields, J.D. and C.M. Squyars. 2000. Mortality and hematology of blue crabs, *Callinectes sapidus*, experimentally infected with the parasitic dinoflagellate *Hematodinium perezi*. Fishery Bulletin 98(1): 139-152.

Shields, J.D. and R.M. Overstreet. (2007) Parasites, symbionts, and diseases, pp. 299-417. In: The blue crab *Callinectes sapidus*. (V. Kennedy and L.E. Cronin, eds.). University of Maryland Sea Grant College, College Park, Maryland.

Shields, J.D. 2012. The impact of pathogens on exploited populations of decapod crustaceans. Journal of Invertebrate Pathology 110: 211-224

VIMS Blue Crab Surveys

VIMS conducts several blue crab surveys. VIMS conducted the: (1) Winter Dredge Survey (WDS), (2) Female Tagging and Mortality (FTM) estimation associated with the WDS, and (3) Juvenile Nursery Habitat Survey (JNS). In addition, blue crab data was also gathered by VIMS Trawl Survey and ChesMMAP—a Baywide mainstem trawl survey of mostly adult fishes. The JNS is complementary to VIMS Trawl Survey in that it gathers data on juvenile blue crabs and habitat quality in shallow-water habitats where none of the other surveys is able to sample. Samples and data from the WDS, MPBS and FTM were processed during the course of the WDS and into the summer, whereas samples from JNS required laboratory processing (e.g. a single seagrass sample can take up to a full workday to process) and were frozen for processing during a portion of each month from August through October. The activities of the WDS and their timing (by month) are listed below.



Bay-Wide Winter Dredge Survey results (winter of 1989-90 through winter of 2016-17. 016). All surveys begin in December and end in March the next year. Commercial harvest and percentage of female crabs removed in 2016 are not yet available.

Survey Year (Year Survey Ended)	Total Number of Crabs in Millions (All Ages)	Number of Juvenile Crabs in Millions (both sexes	Number of Spawning-Age Crabs in Millions (both sexes)	Number of spawning age Female crabs in Millions	Baywide Commercial Harvest (Millions of Pounds)	Percentage of Female Crabs Harvested
1990	791	463	276	117	104	43
1991	828	356	457	227	100	40
1992	367	105	251	167	61	63
1993	852	503	347	177	118	28
1994	487	295	190	102	84	36
1995	487	300	183	80	79	36
1996	661	476	146	108	78	25
1997	680	512	165	93	89	24
1998	353	166	187	106	66	43
1999	308	223	86	53	70	42
2000	281	135	146	93	54	49
2001	254	156	101	61	54	42
2002	315	194	121	55	54	37
2003	334	172	171	84	49.5	36
2004	270	143	122	82	60	46
2005	400	243	156	110	58.5	27
2006	313	197	120	85	52	31
2007	251	112	139	89	43	38
2008	293	166	128	91	49	21
2009	396	171	220	162	54	24
2010	663	340	310	246	85	16
2011	452	204	255	191	67	24
2012	765	581	175	95	56	10
2013	300	111	180	147	37	23
2014	297	198	99	68.5	35	17
2015	411	269	143	101	50	15
2016	553	271	284	194	**60**	**16**
2017	**455**	**125**	**330**	**254**	**TBD***	**TBD***

* 2017 Baywide commercial harvest and exploitation rate are preliminary (TBD= to be determined)

Attachment 2

2017 Chesapeake Bay Blue Crab Advisory Report

CBSAC Meeting Dates: May 16 & June 1, 2017
Report Final: June 26, 2017

1. INTRODUCTION

1.1 Background: Science and Management

The Chesapeake Bay Stock Assessment Committee (CBSAC) combines the expertise of state representatives and scientists from the Chesapeake Bay region, as well as federal fisheries scientists from the National Marine Fisheries Service's Northeast and Southeast Fisheries Science Centers. This committee has met each year since 1997 to review the results of annual Chesapeake Bay blue crab surveys and harvest data, and to develop management advice for Chesapeake Bay jurisdictions: the state of Maryland, Commonwealth of Virginia, and the Potomac River Fisheries Commission (PRFC).

Three benchmark stock assessments of the Chesapeake Bay blue crab have been conducted since 1997. The most recent assessment was completed in 2011[1] with support from the Virginia Marine Resources Commission (VMRC), Maryland Department of Natural Resources (MD DNR), and the NOAA Chesapeake Bay Office (NCBO). The 2011 assessment recommended revision of the former overfishing reference point, which had been based on conserving a fraction of the maximum spawning potential (MSP), to one based on achieving the maximum sustainable yield (MSY; Table 1). The 2011 stock assessment recommended replacing the empirically-estimated overfished age 1+ (both sexes) abundance threshold and target with an MSY-based threshold and target based solely on the abundance of female age 1+ crabs.

Female-specific reference points were formally adopted by all three management jurisdictions in December 2011. Management of the blue crab stock is coordinated among the jurisdictions by the Chesapeake Bay Program's Sustainable Fisheries Goal Implementation Team (SFGIT). Organized by the Chesapeake Bay Program and chaired by NCBO, the SFGIT is led by an Executive Committee of senior fisheries managers from MD DNR, VMRC, PRFC, the Atlantic States Marine Fisheries Commission, and the District Department of the Environment.

CBSAC adopted the Baywide Winter Dredge Survey (WDS) as the primary indicator of blue crab population health in 2006 because it is the most comprehensive and statistically robust of the blue crab surveys conducted in the Bay[2]. The WDS measures the density of crabs (number per 1,000 square meters) at approximately 1,500 sites throughout the Bay. The measured densities of crabs are adjusted to account for the efficiency of the sampling gear and are expanded based on the area of Chesapeake Bay, providing an annual estimate of the number of over-wintering crabs by age and sex[2]. An estimate of the mortality during winter is also obtained from the survey results.

1.2 Background: Stock Status and Current Management Framework

Under the current framework, annual estimates of exploitation fraction are calculated as the annual harvest of female crabs in a given year (not including discards, bycatch, or unreported losses) divided by the total number of female crabs (age 0+) estimated in the population at the start of the season. As part of this calculation, the juvenile component of the total estimated number of crabs is scaled up by a factor of 2.5 so that the empirical estimate of exploitation uses the same assumption about juvenile susceptibility to the survey as the stock assessment that generated the reference points. Thus, the empirical estimates of exploitation rate can be compared with the assessment model derived target and threshold reference points. The 2017 exploitation fraction cannot be calculated until the completion of the 2017 fishery and is therefore listed as TBD (to be determined).

Crab abundance is estimated from the WDS each year. The current framework recommends monitoring the abundance of spawning-age female crabs (age 1+) in comparison to female- specific abundance reference points. Management seeks to control the fishery such that the number of crabs in the population remains above the minimum set by the overfished (depleted) threshold. Ideally, the fishery should operate to meet target values and should never surpass the exploitation fraction threshold value and never go below the abundance threshold value (Table 1).

Table 1. Stock status based on reference points for age 0+ (exploitation fraction) and age 1+ (abundance) female crabs. Recent stock status levels that did not exceed threshold values are shown in green, whereas exploitation values or abundance estimates exceeding thresholds are shown in red.

Control Rule	Reference Points			Stock Status						
	Period	Target	Threshold	2011	2012	2013	2014	2015	2016	2017
Exploitation Fraction (age 0+ female crabs)	Current, Female-specific	25.5%	34% (max)	24%	10%	23%	17%	15%	**16%**	TBD
Abundance (millions of age 1+ female crabs)	Current, Female-Specific	215	70 (min)	190	97	147	68.5	101	194	**254**

2. CONTROL RULES

2.1 Control Rule from 2011 Benchmark Assessment

The 2011 benchmark assessment recommended a control rule based on biological reference points for the female component of the population. The application of a control rule to management of the blue crab fisheries was first adopted by the Bi-State Blue Crab Advisory Committee in 2001[3]. The current female-specific targets and thresholds were developed using an MSY approach. U_{MSY} is defined as the level of fishing (expressed as the percentage of the population harvested) that achieves the largest average catch that can be sustained over time without risking stock collapse. Following precedent adopted by the New England and Mid- Atlantic Fishery Management Councils, the 2011 assessment recommended a target exploitation level that was associated with 75% of the value of U_{MSY} and a threshold exploitation level set equal to U_{MSY}. The female-specific, age-1+ abundance target and threshold were set accordingly at abundance levels associated with $N_{0.75*UMSY}$ (target) and 50% N_{MSY} (threshold).

2.2 Spawning-age Female Crabs: Reference Points

The 2011 benchmark assessment recommended a threshold abundance of 70 million female spawning-age (age 1+) crabs and a target abundance of 215 million spawning-age female crabs. Approximately 254 million female spawning-age crabs were estimated to be present in the Bay at the start of the 2017 crabbing season, a 30% increase from the 2016 estimate of 194 million spawning-age female crabs (Figure 1). The 2017 abundance of spawning-age female crabs is above the threshold and above the target.

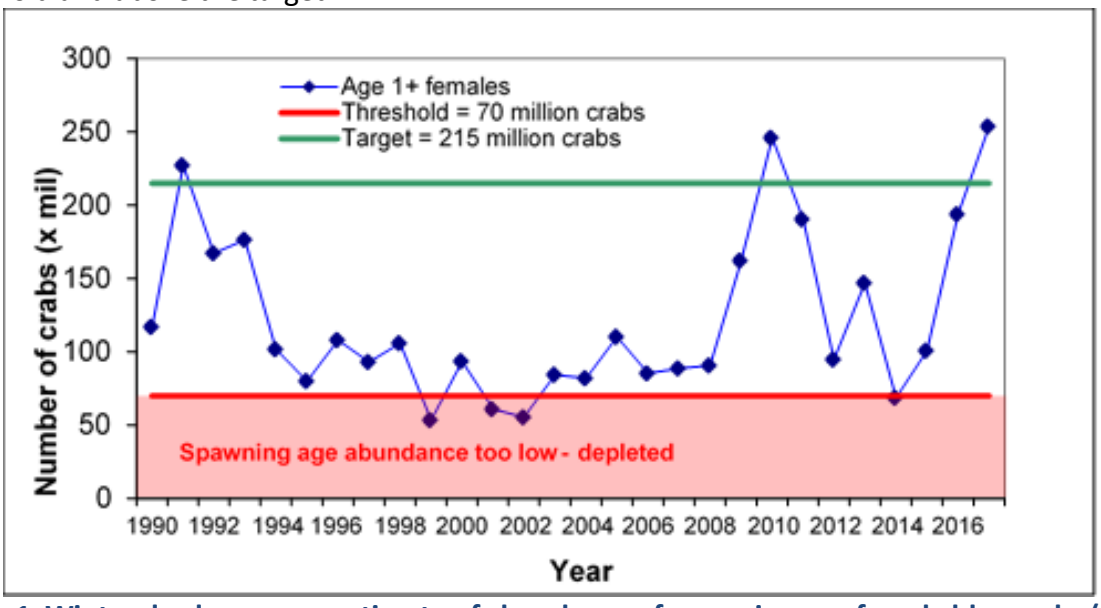


Figure 1. Winter dredge survey estimate of abundance of spawning-age female blue crabs (age 1+) 1990-2017 with female-specific reference points. These are female crabs measuring greater than 60 mm across the carapace and are considered the 'exploitable stock' that could spawn within this year.

2.3 Female Exploitation Fraction: Reference Points

The percentage of all female crabs (ages 0+) removed by fishing (exploitation fraction) in 2016 was approximately 16%. This exploitation fraction is below the target of 25.5% and the threshold of 34% for the ninth consecutive year since 2008, when female-specific management measures were implemented (Figure 2).

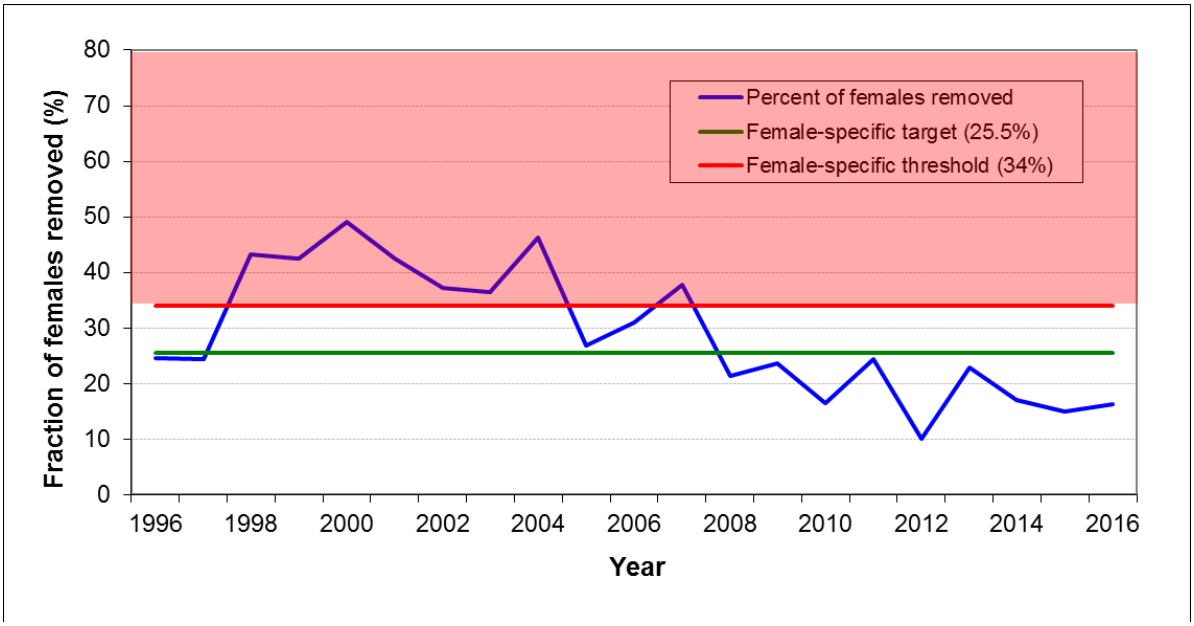


Figure 2. The percentage of all female blue crabs removed from the population each year by fishing relative to the female-specific target (25.5%) and threshold (34%) exploitation rates, 1990 through 2016. Exploitation rate (% removed) is the number of female crabs harvested within a year divided by the female population (age 0 and age 1+) estimated by the WDS at the beginning of the year.

2.4 Control Rule Visualization

Figure 3 shows the status of the blue crab stock for each year relative to both the female age 1+ abundance (N) reference points and female age 0+ exploitation (U) reference points (explained in sections 2.2 and 2.3). The red areas show where the threshold for female abundance and/or the threshold for female exploitation fraction are exceeded. The intersection of the green lines shows where both the abundance and exploitation fraction targets would be reached. The figure includes data through 2016. 2017 data will be added at the completion of the 2017 fishery.

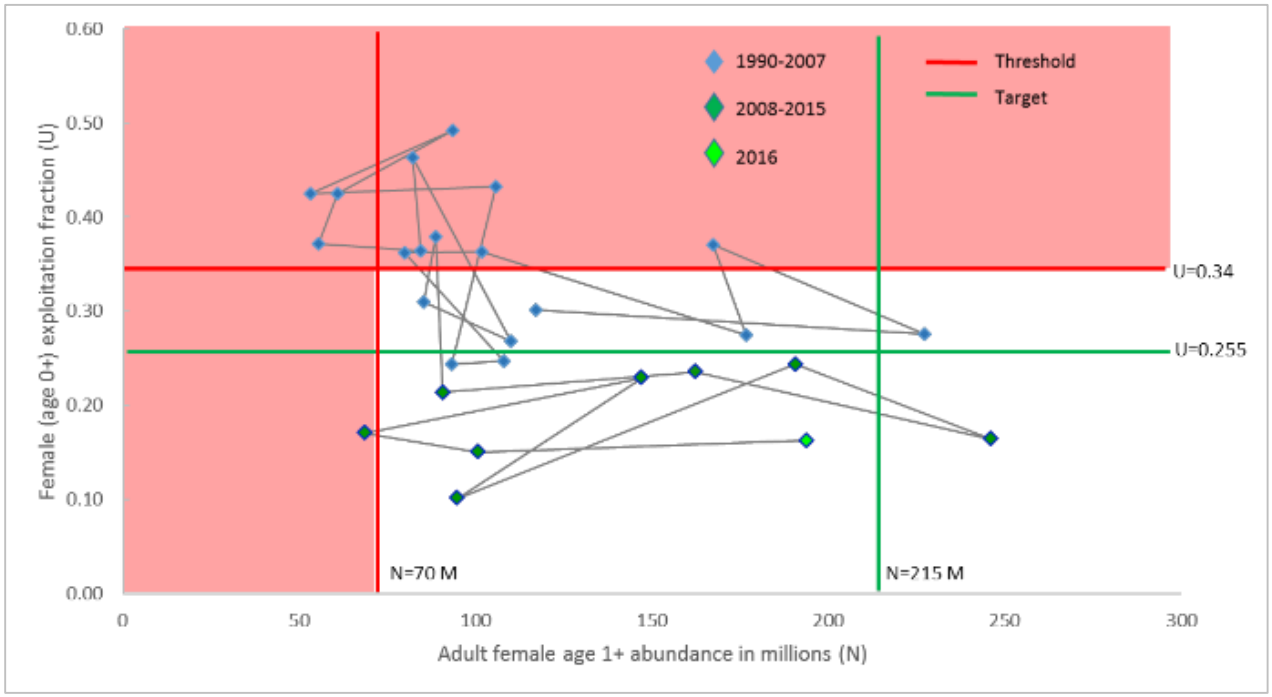


Figure 3. The female-specific control rule for the Chesapeake Bay blue crab fishery prior to and after implementation of initial female-specific management measures in 2008. The current female-specific management framework was formally adopted in 2011. In 2016, adult female abundance (N) was 194 million, which is below the 215 million target and above the 70 million threshold. The 2016 female exploitation fraction (U) was 16%, which was below the 25.5% target and 34% threshold.

---

3. POPULATION SIZE (ABUNDANCE)

3.1 All Crabs (both sexes, all ages)

Based on survey estimates, the total abundance of all crabs (males and females of all ages) decreased by almost 18% from 553 million crabs in 2016 to 455 million crabs in 2017 (Figure 4). The decline in total abundance was driven by the low 2017 estimates of age 0 crabs. The increase in age 1+ female abundance was offset by the large decrease in juvenile abundance (section 3.2) and a drop in the number of age 1+ males (section 3.3).

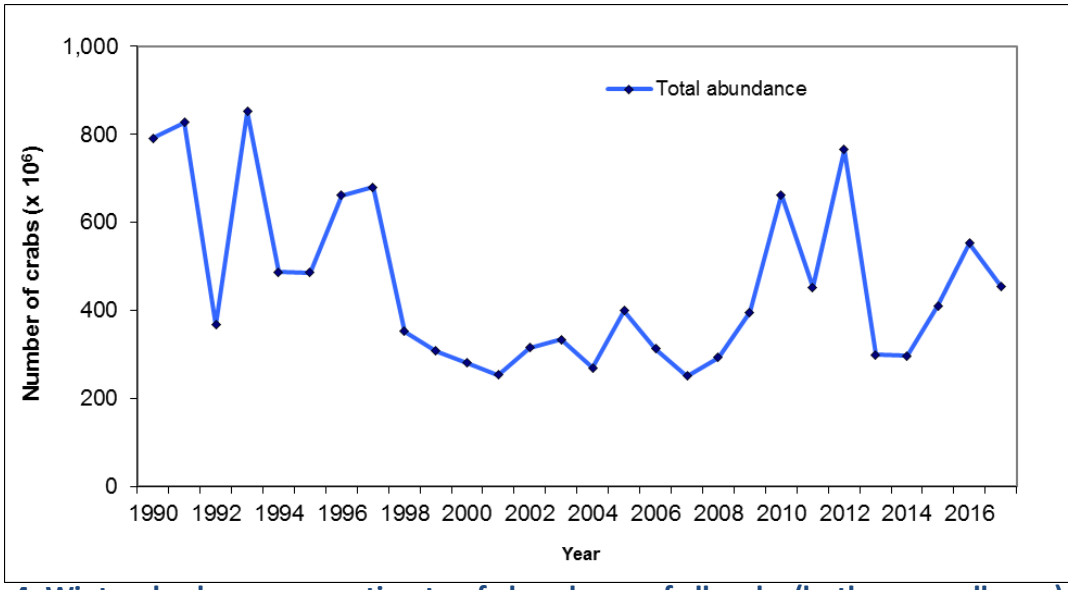


Figure 4. Winter dredge survey estimate of abundance of all crabs (both sexes, all ages) in Chesapeake Bay, 1990 through 2017.

3.2 Age 0 Crabs

Recruitment is estimated as the number of age 0 crabs (less than 60 mm or 2.4 inches carapace width) in the WDS. Based on survey estimates, the abundance of age 0 crabs was 125 million crabs in 2017, a 54% decrease from the 2016 abundance of 271 million crabs (Figure 5).
Juvenile abundance in 2017 is among the five lowest estimates of the time series, the most recent of which occurred in 2013.

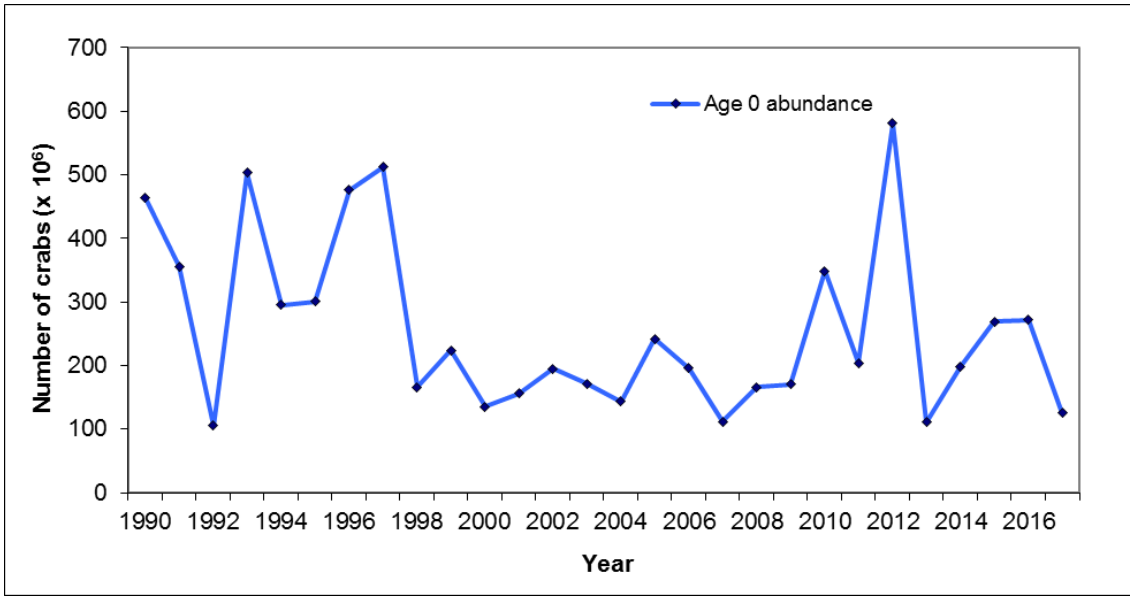


Figure 5. Winter dredge survey estimate of abundance of juvenile blue crabs (age 0), 1990-2017 calculated without the catchability (section 1.2) adjustment for juveniles. These are male and female crabs measuring less than 60 mm across the carapace.

3.3 Age-1+ Male

The survey estimate of age 1+ male crabs (greater than 60 mm or 2.4 inches carapace width) in 2017 was 76 million crabs, a 16.5% decrease from the 2016 estimate of 91 million adult male crabs (Figure 6). Although age 1+ male abundance is above the mean level observed between 1995 and 2017, it remains approximately half that of the levels observed in the early 1990s.

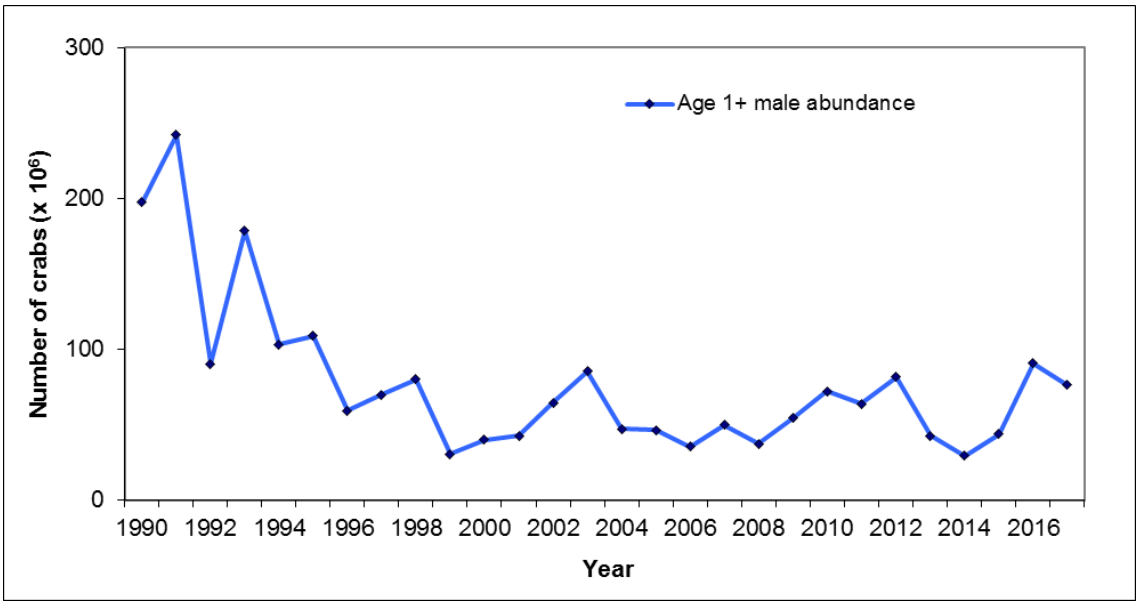


Figure 6. Winter dredge survey estimate of abundance of male blue crabs age one year and older (age 1+), 1990-2017. These are male crabs measuring greater than 60 mm across the carapace and are considered the 'exploitable stock' capable of mating within this year.

3.4 Overwintering Mortality

Overwintering mortality in 2017 was below average and lower than the high values seen in 2015 (Table 2).

Table 2. Percent dead crabs found in late winter dredge samples each year from 2012-2016 and the average for 1996-2011.

Baywide Age/sex group	1996-2011 average	2012	2013	2014	2015	2016	2017
All crabs	4.78%	1.59%	4.00%	3.79%	15.68%	1.9%	1.9%
Juveniles	1.00%	0.52%	0.00%	0.89%	10.84%	0.5%	0.5%
Adult Females	9.53%	2.69%	3.00%	7.68%	19.25%	3.0%	4.2%
Adult Males	9.11%	4.90%	13.88%	13.58%	28.11%	1.1%	1.7%

4. HARVEST

4.1 Commercial and Recreational Harvest

Blue crab harvest has increased since 2014. The three management jurisdictions implemented additional commercial harvest restrictions, mostly lower bushel limits, for females for the 2014 season in response to the depleted abundance of females in 2014. Maryland increased these bushel limits in 2015 and 2016, and all three jurisdictions extended the fall crab pot season in 2016. The 2016 commercial harvest for both males and females from the Bay and its tributaries was estimated as 30.7 million pounds in Maryland, 26.0 million pounds in Virginia and 3.2 million pounds in the Potomac River. This was an increase from 2015 commercial harvest levels for all three jurisdictions: a 15% increase for Maryland, 24% increase for Virginia and a 60% increase for the Potomac River. The total 2016 Baywide commercial harvest of approximately 60 million pounds remains below average, but increased by 20% from the 2015 Baywide commercial harvest of approximately 50 million pounds (Figures 7-8).

Mean: 65.5 mil lbs

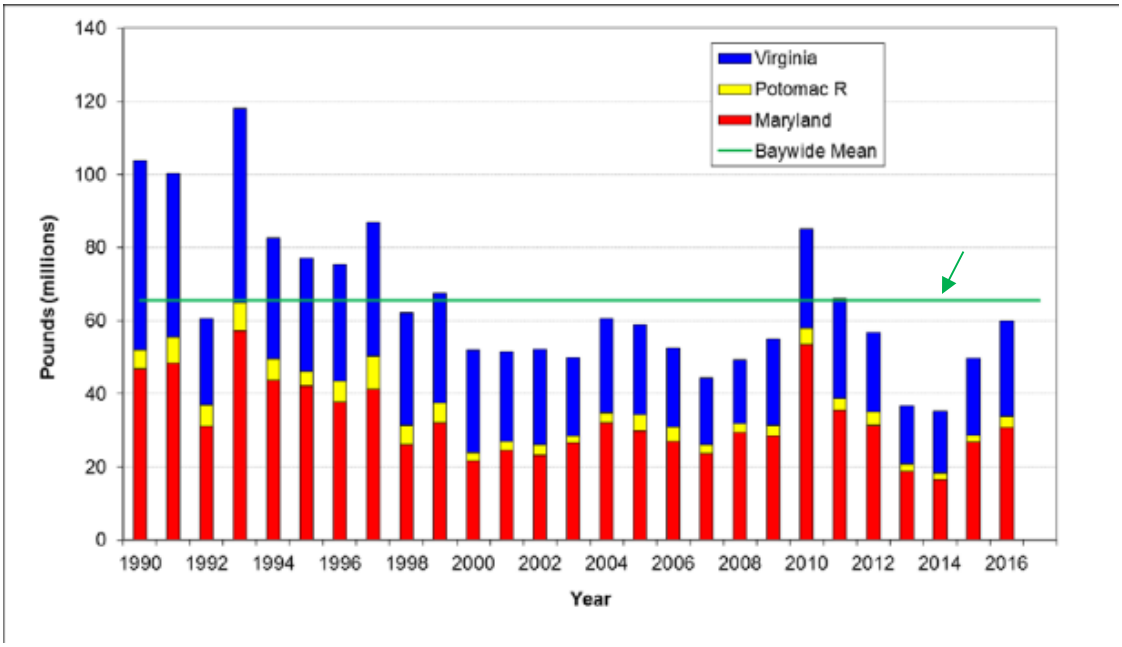


Figure 7. Total commercial blue crab landings (all market categories) in Chesapeake Bay, 1990-2016.

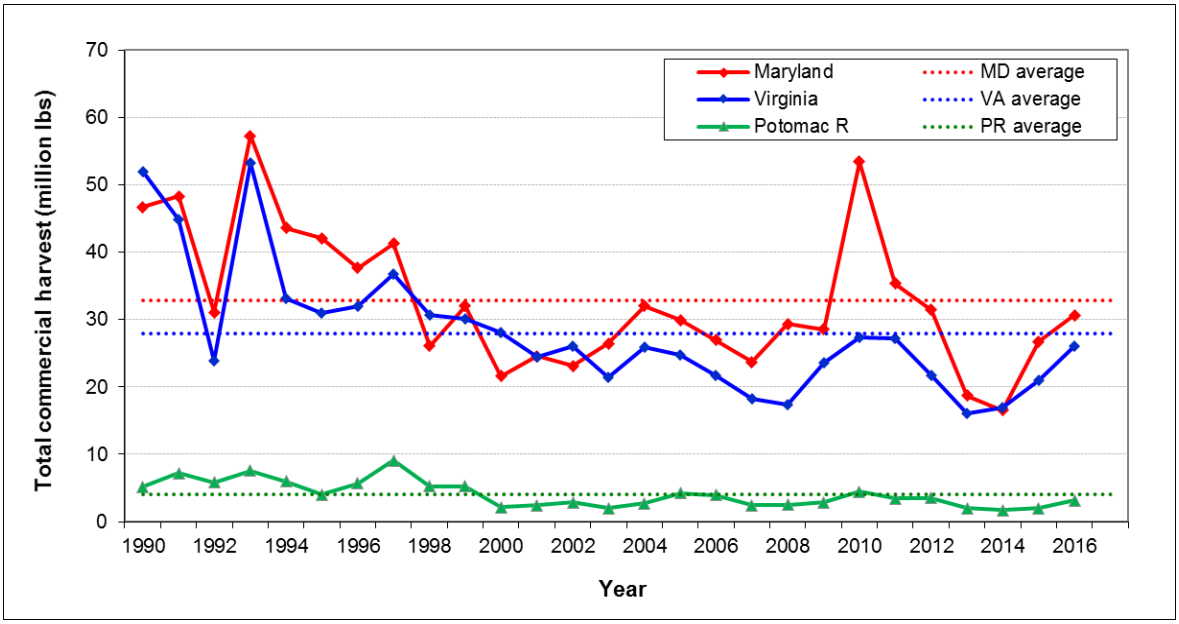


Figure 8. Maryland, Virginia and Potomac River commercial blue crab harvest in millions of pounds from Chesapeake Bay, all market categories, 1990-2016.

Prior to 2009, recreational harvest had been assumed to be approximately 8% of the total Bay wide commercial harvest.[4,5,6] Since recreational harvest of female blue crabs is no longer allowed in Maryland or in the Maryland tributaries of the Potomac River, recreational harvest is better described as 8% of commercial male harvest in those jurisdictions. 2016 Baywide recreational harvest was estimated as 4.2 million pounds, a 20% increase from the 2015 recreational harvest estimate of 3.5 million pounds. Combining the commercial and recreational harvest, approximately 64 million pounds of blue crabs were harvested from Chesapeake Bay and its tributaries during the 2016 crabbing season.

5. STOCK STATUS

5.1 Female Reference Points

The Chesapeake Bay blue crab stock is currently **not depleted and overfishing is not occurring** (Figure 1-2). The 2017 estimated abundance of the stock is above the threshold of 70 million age 1+ female crabs and above the target of 215 million age 1+ female crabs outlined in the current management framework. The 2016 exploitation fraction of 16% was below the target (25.5%) and threshold (34%). Abundance, harvest, and exploitation of all crabs are summarized in Appendix A and in the preceding sections.

5.2 Male Conservation Triggers

In 2011, CBSAC recommended that male abundance should not be allowed to decline to a critically low level relative to female abundance and that a conservation trigger based on male abundance should be developed. In 2013, CBSAC recommended a conservation trigger for male

crabs based on the history of male exploitation. Under this trigger, conservation measures should be considered for male blue crabs if male exploitation rate exceeds 33% (calculated with the juvenile scalar as described in section 1.2), which is the second highest exploitation fraction observed for male crabs since 1990. Choosing the second highest value in the time series ensures a buffer from the maximum observed value of exploitation. It should be noted that this value does not represent a fishing threshold or target. Rather, this trigger will ensure that the male component of the stock is not more heavily exploited than at levels that have occurred in 24 of the last 26 years. The 2016 male exploitation fraction was estimated at 23%, which is below the 33% male exploitation rate conservation trigger (Figure 9). Because the male conservation trigger was not exceeded, no management action is recommended at this time specific to male blue crabs.

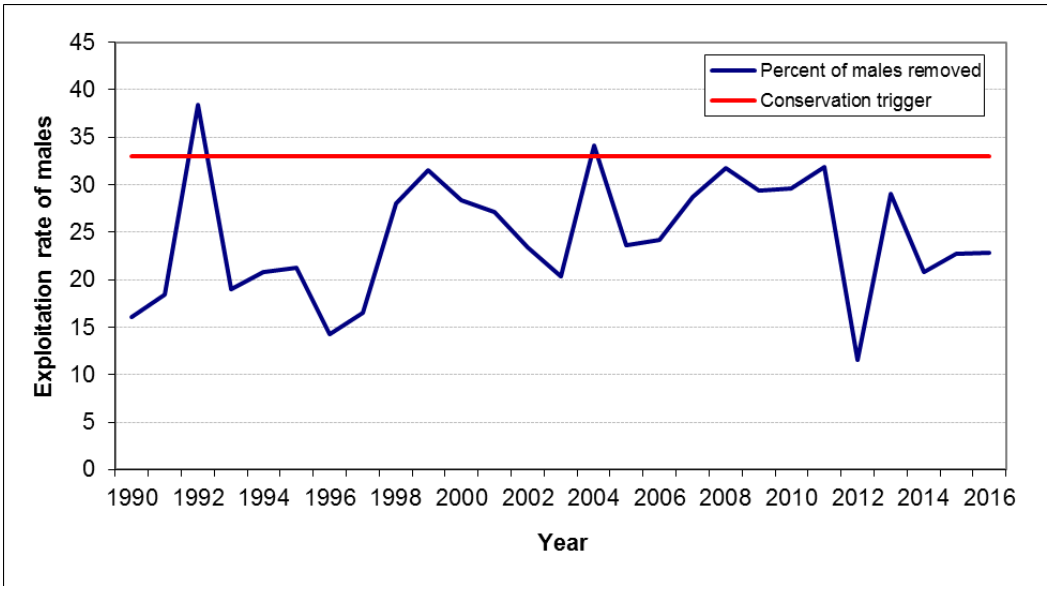


Figure 9. The percentage of male crabs removed from the population each year by fishing, 1990 through 2016. Exploitation rate (% removed) is the number of male crabs harvested within a year divided by the male population estimate (age 0 and age 1+) at the beginning of the year calculated with the juvenile scalar.

5.3 Potential Management Impact

Female exploitation fractions from 1990-2007 were much higher than the exploitation fractions seen from 2008-2016. These lower female exploitation fractions in recent years illustrate the probable influence of the female-specific management measures implemented by the jurisdictions starting in 2008. Male exploitation fractions have not shown the same pattern (Figure 10). Additionally, the rapid increase in abundance from 2008 to 2010 and again from
2014 to 2016 may indicate that the current management framework has allowed the stock to regain some of its natural resilience to environmental perturbations.

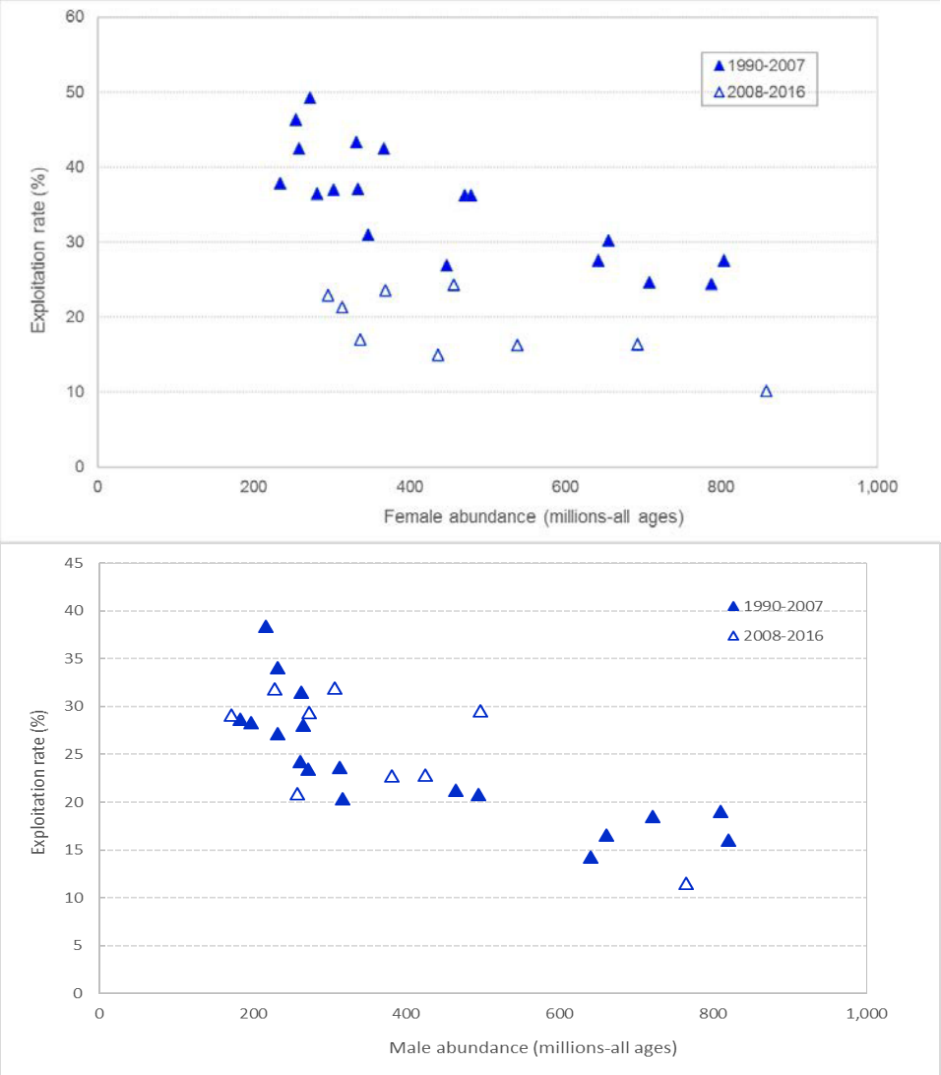


Figure 10. Female (top) and male (bottom) exploitation rate comparison of the time periods prior to and after the 2008 implementation of female-specific management measures.

6. MANAGEMENT ADVICE--SHORT TERM

6.1 Monitor fishery performance and stock status relative to reference points

The female exploitation fraction in 2016 was below the target of 25.5% for the ninth consecutive year. The abundance of adult female crabs increased and exceeded the target in 2017, but the abundance of juveniles decreased by 54%. Based on analysis of the 2017 winter dredge survey results, CBSAC recommends the jurisdictions maintain a cautious, risk-averse approach in the 2017 season, and consider scaling back the 2017 fall fishery from last year's more liberal fall regulations in order to protect the age 0 crabs. This incoming year class will become vulnerable to the fall fishery and represent the majority of spawners for next year. Past harvest regulations are summarized in Appendix B.

Large variations in recruitment (age 0 abundance) are a characteristic of blue crab biology and not unexpected. However, it should be the goal of management to maintain a robust spawning stock, thereby increasing the resiliency of the population to downturns in recruitment.

Beginning in the 2014 crabbing season, the three management jurisdictions adjusted their management timeframe to run from July 2014 through July 2015. CBSAC recommended this switch in the 2014 Blue Crab Advisory Report, which allows for consideration of the WDS results in the spring before management decisions are made in the summer. However, it places more importance on the estimate of juvenile abundance, as each year class is presumed to be the majority component of the fishery within this time frame. In this case, the low abundance of age 0 crabs will begin recruiting to the fall 2017 fishery. The current control rule does not account for juvenile abundance as a management-setting metric, but the jurisdictions should consider that the juvenile abundance estimate will comprise the majority of spawners the following year.

6.2 Catch Reports and Quantifying Effort

CBSAC again recommends that the jurisdictions implement procedures that provide accurate accountability of all commercial and recreational harvest. All three Chesapeake Bay management jurisdictions are working to improve the quality of catch and fishing effort information submitted by commercial and recreational harvesters. Maryland, Virginia, and PRFC all require daily harvest reports to be submitted on a regular basis and are collaborating with industry groups to pursue new reporting technologies. Maryland has implemented a pilot electronic reporting program that allows for daily harvest reporting in real time and harvest validation. Virginia continues to promote its online reporting system that began in 2009. PRFC is exploring the use of electronic reporting to potentially begin in the next few years.

While implementing systems for greater accuracy, efforts should also be made, where possible, to better determine the biological characteristics of the catch, both landed and discarded. Note that when changes in reporting requirements are implemented, it is vital that an analysis be undertaken to quantify the impact of these changes on the estimates of harvest. Efforts should also be undertaken to assess the reliability of estimates of recreational harvest Baywide.

---

7. MANAGEMENT ADVICE--LONG TERM

7.1 Characterizing and Quantifying Effort

The blue crab fishery is managed by both effort control and output control strategies. Most regulations in place focus on effort control in the form of limited entry, size limits, daily time limits, pot limits, spatial closures, spatial gear restrictions, and seasonal closures. Output controls currently used are daily harvest limits. In many cases, the amount of effort expended in the fishery is recorded at a broad resolution that makes it difficult to quantify. CBSAC

recommends further quantification of effort data in the next stock assessment and increased investment in Baywide effort monitoring, which may include a pot marking system and a Bay-wide survey of gear-specific effort to estimate the total, as well as spatial and temporal patterns of effort in the blue crab fishery.

7.2 Latent effort

In both Maryland and Virginia, significant numbers of commercial crabbing licenses are unused. This could pose the potential risk that unused effort could enter the fishery, causing unforeseen impacts on the fishery and the blue crab population. Based on recommendations from previous advisory reports, the jurisdictions conducted initial analysis of effort levels relative to crab abundance over time to evaluate this risk. These analyses indicate that there is little evidence that effort changes in response to changes in blue crab abundance. This indicates that latent effort has most likely not had a significant impact on the fishery in recent years. A comprehensive analysis of latent effort would, ideally, include a socio-economic component, and CBSAC recognizes that temporal and seasonal shifts in blue crab abundance may alter existing effort exerted by active licenses. These components could be incorporated into future continued analysis of latent effort.

---

8. CRITICAL DATA AND ANALYSIS NEEDS

CBSAC has identified the following prioritized list of fishery-dependent and fishery-independent data needs as well as the benefits provided to management.

In addition to specific data needs, CBSAC recognizes the importance of future stock assessments in providing in-depth analyses of the Chesapeake Bay blue crab population and scientific guidance to managers. The timing and need for a benchmark stock assessment can depend on availability of new data, consideration of a new management framework, or other reasons. In fall 2017, CBSAC plans to discuss potential drivers and resources needed for a future blue crab stock assessment and scope out specific objectives and research that would be needed.

8.1 Increased accountability and harvest reporting for both commercial and recreational fisheries

CBSAC recommends jurisdictions continue to develop, explore and evaluate implementation of real time electronic reporting systems to increase the accuracy of commercial and recreational landings. Improving commercial and recreational blue crab harvest accountability would provide managers with a more accurate exploitation fraction each year and better support mid- season management changes.

The jurisdictions have been working to implement new harvest reporting technologies over the past few years. Since pilot efforts were introduced in 2012, MD DNR has been using an electronic reporting system that allows commercial crabbers to enter each day's harvest from their vessel. The system includes random daily catch verification and a "hail-in, hail-out" protocol. Maryland is continuing to expand the use of this system for the commercial crabbing fleet. Virginia implemented electronic reporting in 2009 as an alternative mandatory harvest reporting option, but growth has been slow. Through cooperative work among VMRC, Virginia Sea Grant and various industry groups, promotional products were produced and participation of commercial crab harvesters has increased. There is interest among PRFC stakeholders, and it is possible that PRFC will consider using an electronic reporting system in the next few years.

CBSAC recommends a survey of recreational catch and effort be undertaken to ensure the reliability of estimates of recreational removals. The last available estimate for Maryland waters was that for 2011[4,5,6,7]. The last available estimate for Virginia was 2002[5]. Future surveys should ensure that recreational harvest from the Potomac River is also included. A license for recreational crabbing in all jurisdictions would greatly increase the accuracy of catch and effort estimates.

8.2 Gear efficiency pertaining to selectivity of WDS methods

There is no update from 2016-17 regarding how gear efficiency is estimated. Data from paired tows between the two survey vessels were again collected, and the multi-year dataset should be analyzed to help guide the process dealing with the evaluation of efficiency corrections and, possibly, juvenile catchability. CBSAC recommends the jurisdictions continue to analyze these data from recent years.

Planning discussions for a future stock assessment have included the possible use of the winter dredge survey as an index of relative abundance rather than an index of absolute abundance. This approach was recommended by the independent review panel of the last stock assessment. CBSAC will include this in any stock assessment discussions.

8.3 Improving recruitment estimate through a shallow-water survey

Based on the 2011 stock assessment and field experiments by VIMS and the Smithsonian Environmental Research Center, a large fraction of juvenile blue crabs in shallow water is not sampled by the WDS[8]. VIMS is actively pursuing funding at the state level to conduct a shallow- water survey concurrent with the Virginia WDS to assess the potential for interannual bias in the fraction of juveniles not sampled by the WDS. CBSAC will discuss applying this effort Baywide based on funding and based on initial findings if the Virginia survey moves forward.

8.4 Application of fishery independent survey data

CBSAC recommends continued review of existing fishery-independent survey data and potential application to provide additional information on the blue crab population,

complementing the population estimates from the WDS. Characterizing the spring through fall distribution and sex-specific abundance of blue crabs remains important, especially if agencies consider spatial management strategies.

8.5 Fishery-dependent data

Mandatory harvest reporting is currently the only fishery-dependent data in Virginia and the Potomac River. Understanding catch composition, by size, sex, and growth phase, spatially and temporally, as well as effort characterization (mentioned in 6.2), would help improve the effectiveness of regulations and assure they were compatible at a Baywide level. VMRC conducted short-term fishery-dependent sampling in 2016-17 to provide some characterization of commercial harvest. CBSAC recommends that the jurisdictions consider options for future fishery-dependent sampling programs. VMRC

8.6 Other sources of mortality

CBSAC also recommends analyzing the magnitude of other sources of incidental mortality, specifically sponge crab discards, unreported losses after harvest from the peeler fishery, and predation. An analysis of non-harvest mortality could improve reliability of exploitation fraction estimates and inform future assessments.

8.7 Investigation of the potential for sperm limitation

CBSAC recommends continued examination to quantify and better understand the influence of male crabs on reproductive success and overall population productivity. The evidence for sperm limitation resulting from a lower abundance of sexually mature male crabs is ambiguous and has been discussed in several recent studies[9,10,11].

8.8. Biological parameters

Longevity, age structure and growth rates, particularly with respect to the timing of recruitment to the fishery within the season, are not fully characterized and remain as sources of uncertainty**.**

CBSAC Members:

Glenn Davis (Chair)	Maryland Department of Natural Resources
Joe Cimino	Virginia Marine Resources Commission
Ellen Cosby	Potomac River Fisheries Commission
Lynn Fegley	Maryland Department of Natural Resources
Daniel Hennen	NMFS, Northeast Fisheries Science Center
John Hoenig	Virginia Institute of Marine Science
Eric Johnson	University of North Florida
Katie May Laumann	Virginia Marine Resources Commission
Rom Lipcius	Virginia Institute of Marine Science John
McConaugha	Old Dominion University
Tom Miller	UMCES, Chesapeake Biological Laboratory
Rob O'Reilly	Virginia Marine Resource Commission
Amy Schueller	NMFS, Southeast Fisheries Science Center
Mike Seebo	Virginia Institute of Marine Science
Alexei Sharov	Maryland Department of Natural Resources
Mike Wilberg	UMCES, Chesapeake Biological Laboratory
Emilie Franke (Coordinator)	ERT/NOAA Chesapeake Bay Office

Literature Cited

1. Miller, T. J. et al. 2011. Stock Assessment of Blue Crab in Chesapeake Bay. 2011. Final Report. Ref: [UMCES] CBL 11-011. UMCES Tech. Ser. No. TS-614-11-CBL.

2. Sharov, A. F., J. H. Volstad, G. R. Davis, B. K. Davis, R. N. Lipcius, and M.M. Montane. 2003. Abundance and exploitation rate of the blue crab (*Callinectes sapidus*) in Chesapeake Bay. Bulletin of Marine Science 72:543-565.

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. Ashford, J. R., and C. M. Jones. 2001. Survey of the blue crab recreational fishery in the Chesapeake Bay, 2001. Final Report to the Maryland Department of Natural Resources. Annapolis, MD. 61p.

5. Ashford, J. R., and C. M. Jones. 2003. Survey of the blue crab recreational fishery in Maryland and Virginia, 2002. Final report from Old Dominion University to the National Oceanic and Atmospheric Administration Chesapeake Bay Office, Annapolis, Maryland.

6. Ashford, J. R., and C. M. Jones. 2005. Survey of the blue crab recreational fishery in Maryland, 2005. Final Report to the Maryland Department of Natural Resources. Annapolis, MD. 31p.

7. Ashford, J. R., and C. M. Jones. 2011. Survey of the blue crab recreational fishery in Maryland, 2009. Final Report to the Maryland Department of Natural Resources. Annapolis, MD. 29p.

8. Ralph, G.M., and R.N. Lipcius. 2014. Critical habitats and stock assessment: age- specific bias In the Chesapeake Bay blue crab population survey. Transactions of the American Fisheries Society 143(4): 889-898.

9. Ogburn, M.B., P.M. Roberts, K.D. Richie, E.G. Johnson, and A.H. Hines. 2014. Temporal and spatial variation in sperm stores in mature female blue crabs (*Callinectes sapidus*) and potential effects on brood production in Chesapeake Bay. Marine Ecology Progress Series 507: 249-262.

10. Hines, A.H., and M.B. Ogburn. 2014. Evaluating population level impacts of sperm limitation on the Chesapeake blue crab stock. Final Report to NOAA Chesapeake Bay Office for NA11NMF4570230.

11. Rains, S.A. 2014. Potential for sperm limitation in blue crabs of Chesapeake Bay. M.S. thesis, University of Maryland.

Appendix A. Estimated abundance of blue crabs from the Chesapeake Baywide winter dredge survey, annual commercial harvest, and removal rate of female crabs.

Survey Year (Year Survey Ended)	Total Number of Crabs in Millions (All Ages)	Number of Juvenile Crabs in Millions (both sexes	Number of Spawning-Age Crabs in Millions (both sexes)	Number of spawning age Female crabs in Millions	Baywide Commercial Harvest (Millions of Pounds)	Percentage of Female Crabs Harvested
1990	791	463	276	117	104	43
1991	828	356	457	227	100	40
1992	367	105	251	167	61	63
1993	852	503	347	177	118	28
1994	487	295	190	102	84	36
1995	487	300	183	80	79	36
1996	661	476	146	108	78	25
1997	680	512	165	93	89	24
1998	353	166	187	106	66	43
1999	308	223	86	53	70	42
2000	281	135	146	93	54	49
2001	254	156	101	61	54	42
2002	315	194	121	55	54	37
2003	334	172	171	84	49.5	36
2004	270	143	122	82	60	46
2005	400	243	156	110	58.5	27
2006	313	197	120	85	52	31
2007	251	112	139	89	43	38
2008	293	166	128	91	49	21
2009	396	171	220	162	54	24
2010	663	340	310	246	85	16
2011	452	204	255	191	67	24
2012	765	581	175	95	56	10
2013	300	111	180	147	37	23
2014	297	198	99	68.5	35	17
2015	411	269	143	101	50	15
2016	553	271	284	194	**60**	**16**
2017	**455**	**125**	**330**	**254**	**TBD***	**TBD***

* 2017 Baywide commercial harvest and exploitation rate are preliminary (TBD= to be determined)

Baywide harvest totals and female exploitation rates listed on this page for 2010 and prior were updated in 2016 to reflect final Baywide harvest totals. Previous reports listed preliminary harvest data on this page.

Appendix B. Summary of Female Blue Crab Harvest Regulations in the Chesapeake Bay Jurisdictions 2008-2016

Starting in 2008, the jurisdictions (Maryland, Virginia, Potomac River Fisheries Commission) implemented female-specific management measures for the Chesapeake Bay blue crab fishery. The jurisdictions adopted the current female-specific reference points with targets and thresholds for spawning-age (age 1+) female abundance and female exploitation rate in December 2011. The chart below summarizes changes in spawning-age female management regulations each year from 2008-2016.

Year	All Crabs	Age 0 Juv Crabs	Age1+ Female Crabs	%Female Crabs Harvested	Maryland Female Harvest Regulations	Virginia Female Harvest Regulations	Potomac River Fisheries Commission Female Harvest Regulations
2008	293	166	91	21%	34% reduction: restricted access to female fishery from Sept 1 to Oct 22 based on harvest history; created tiered bushel limits for females based on harvest history.	34% reduction: closed winter dredge fishery; closed the fall season for females early on Oct 27 (five weeks early); eliminated the five-pot recreational crab license; required two additional/larger cull rings; reduced # pots per license by 15% as of May 1 & another 15% next year; reduced #peeler pots per license by 30% on May 1.	34% reduction: closed the mature female hard crab season early on Oct 22; established separate female daily bushel limits Sept 1 to Oct 22 for areas upstream of St. Clements Isl. and areas downstream of St. Clements Isl; reduced peeler & soft shell seasons; established that all hard males, hard females, peelers and soft shell crabs kept separate on catcher's boat.
2009	396	171	162	24%	Open access, with industry input created season-long bushel limits that vary by license type and through the season. Created a 15-day June (1-15) closure and a 9 day fall (9/26 - 10/4) closure to female harvest.	Closed crab sanctuary from May 1-Sept 15 (closed loophole that prevented a uniform May 1 closure for entire sanctuary). Nov 21 harvest closure; waived proposed 15% reduction of pots per license class; reinstated 5-pot recreational license; continued closure of winter dredge fishery.	Maintained 2008 season dates. Did not continue female daily bushel limits from 2008.

Year	Age 0 All Crabs	Age 0 Juv Crabs	Age1+ Female Crabs	%Female Crabs Harvested	Maryland Female Harvest Regulations	Virginia Female Harvest Regulations	Potomac River Fisheries Commission Female Harvest Regulations
2010	663	340	246	16%	Same bushel limits as 2009, but eliminated the 9-day fall closure based on industry input.	Continued moratorium on sale of new licenses; relaxed dark sponge crab regulation to allow possession as of July 1 (instead of July 16); continued closure of winter dredge fishery.	Established three mature female hard crab closure periods: Sept 22-28 above 301 bridge; Sept 29-Oct 6 from 301 bridge to St. Clements Isl./Hollis Marsh; Oct 7-13 below St. Clements Isl./Hollis Marsh. Closed season Nov 30.
2011	452	204	191	24%	Increased bushel limits Sept 1 - Nov 10.	Closed sanctuary May 16 instead of May 1; continued closure of winter dredge fishery.	Refined mature female closed seasons: Sept 20-30 above St. Clements Isl./Hollis Marsh; Oct 4-14 below St. Clements Isl./Hollis Marsh.
2012	765	581	95	10%	Decreased bushel limits to compensate for removal of June closure, which added 15 days (based on industry advice). 6-day emergency extension to offset days lost to Hurricane Sandy.	Extended fall season until Dec 15; 6-day emergency extension to offset days lost to Hurricane Sandy; continued closure of winter dredge fishery.	Maintained 2011 mature female closed seasons.
2013	300	111	147	23%	Decreased bushel limits.	Implemented daily bushel limits to offset 2012 fall extension; extended fall pot season to Dec 15; continue closure of winter dredge fishery.	Refined mature female closed seasons: Sept 18-Oct 2 above St. Clements Isl./Hollis Marsh; Oct 3-17 below St. Clements Isl./Hollis Marsh.

Attachment 2

Year	All Crabs	Age 0 Juv Crabs	Age1+ Female Crabs	%Female Crabs Harvested	Maryland Female Harvest Regulations	Virginia Female Harvest Regulations	Potomac River Fisheries Commission Female Harvest Regulations
2014	297	198	68.5	17%	Daily bushel limits the same as 2013; additional vessel bushel limit reduction of 12%.	10% reduction: reduced pot bushel and vessel limits; continued closure of winter dredge fishery.	10% reduction: Closed mature female hard crab season Nov 20 and extended closure periods: Sept 12-Oct 2 above St. Clements Isl./Hollis Marsh; Oct 3-23 below St. Clements Isl./Hollis Marsh.
2015	411	269	101	15%	Increase in min. peeler size April-July 14 due to low 2014 adult females. Daily bushel limits increased ~20% Sept-Nov 10 based on adult female increased abundance in 2015.	Maintained 2014 daily bushel limits; continued closure of winter dredge fishery. Redefined the blue crab sanctuary into 5 areas with separate closure dates.	Set female daily bushel limits from April-June.
2016	553	271	194	16%	Extended season to Nov 30, adding 20 days. Increased bushel limits in Sept and Oct.	Extended season 3 weeks to Dec 20; maintained 2014 bushel limits; continued closure of winter dredge fishery.	Extended fall season through Dec 10th. Set female daily bushel limits starting in July for the whole season.

Maryland Department of Natural Resources: http://dnr2.maryland.gov/Fisheries/Pages/default.aspx
Potomac River Fisheries Commission: http://prfc.us/
Virginia Marine Resources Commission: http://www.mrc.state.va.us/

Attachment 3

VIRGINIA'S 21-POINT BLUE CRAB MANAGEMENT PLAN

October 1994, the Commission established the following 7-point blue crab management plan:

- Expanded the spawning sanctuary (146 sq. mi.) establish in 1942 by 75 sq. mi., with no crab harvest allowed from June 1 through September 15.
- Established a 14,500-acre winter-dredge sanctuary in Hampton Roads.
- Shortened the crab pot season to April 1 through November 30.
- Required two cull (escape) rings in each commercial and recreational crab pot.
- Required four cull rings in each peeler pound that allows escapement of small peeler crabs.
- Capped the number of peeler pots per license to prevent expansion of the fishery.
- Limited the crab dredge size to 8 feet to prevent increases in effort.

The Commission reinforced the 7-point management plan in January 1996.

- Prohibited the possession of dark-colored (brown through black) sponge crabs (adult female hard crab which had extruded her eggs on her abdomen), with a 10-sponge crab per bushel tolerance.
- Limited license sales of hard crab licenses, based on previous eligibility or exemption requirements.
- Established a 300-hard crab pot limit for all Virginia tributaries of the mainstem Chesapeake Bay. Other Virginia harvest areas were limited to a 500-hard crab pot limit.
- Established a 3 1/2-inch minimum possession size limit for all soft shell crabs.

Concerns over excess effort in the fisheries and a persistent trend of low spawning stock biomass during most of the 1990's led to additional crab conservation measures in 1999 and 2000.

- Lowered the maximum limit on peeler pots from 400 to 300 pots in 1999. Harvest by this gear type increased by 90%, from 1994 through 1998, while the overall harvest remained relatively static.
- Initiated a moratorium on additional commercial licenses for all commercial crabbing gear. This moratorium became effective May 26, 1999 and continued until May 26, 2004.
- Established (in 2000) a Virginia Bay-wide Blue Crab Spawning Sanctuary, in effect June 1 through September 15. This additional sanctuary (435 sq. mil) allows for increased spawning potential.

A cooperative Bay-wide agreement (October 2000) to reduce harvest 15% by 2003 led to new measures.

- Enacted an 8-hour workday for commercial crabbers (2002) that replaced Wednesday closures of 2001.
- Established a 3-inch minimum size limit for peeler crabs (2002).
- Reduced peeler pot limits from 400 to 300 pots (for 2001).
- Reduced the winter dredge fishery limit from 20 to 17 barrels (2001).
- Augmented (2002) the Virginia Blue Crab Sanctuary by 272 sq. mi. (total sanctuary area = 928 sq. mi.).
- Reduced unlicensed recreational harvester limits to 1 bushel of hard crabs, 2 dozen peelers (2002).
- Reduced licensed recreational harvester limits to 1 bushel of hard crabs, 2 dozen peelers, with vessel limit equal to number of crabbers on board multiplied by personal limits (2001).

Attachment 3

ACTIONS TO PROMOTE REBUILDING OF CHESAPEAKE BAY BLUE CRAB STOCK (2008 through 2016)

February 2008

- Larger cull ring (2-5/16") required to be open at all times in all tidal VA waters to promote additional increases in escapement.
- Peeler crab minimum size limit increased from 3" to 3 ¼" (through July 15) and to 3 ½" (as of July 16).
- Use of agents modified to prevent license "stacking" and to curtail use of agents.
- Winter dredge fishery capped at 53 licensees (from previous 225 licensees), all being active harvesters in previous two winter seasons.

March 2008

- Adopted an extended closure (May 1 - September 15) of blue crab spawning sanctuary, to protect spawning females, except for the historical sanctuary (146 square miles) managed by law.

April 2008

- Established a fall closure for female harvest (October 27 – November 30).
- Implemented a 15% reduction in pots per individual for 2008 crab pot fishery and a 30% reduction for 2009 crab pot and peeler pot fishery.
- Closed 2008/09 winter dredge fishery season.
- Required use of two 3/8" cull rings for all areas (except Seaside of Eastern Shore) effective July 1.
- Eliminated 5-crab pot recreational license.
- Revamped revocation procedures, to allow a hearing after just two crab violations in a 12-month period.

November 2008

- In an attempt to address the latent effort, the Commission placed crab pot and peeler pot fishermen who had been inactive (no harvest) for a 4-year period (2004-07) on a waiting list until the abundance determined from the Bay-wide Winter Dredge Survey of age-1+ crabs exceeds the interim target of 200 million.

May 2009

- Shortened closed season for female crabs to November 21 - November 30.
- Closed 2009/10 winter dredge fishery season.
- Lowered percentage reduction of crab pots from 30% (2008) to 15% (2009).
- Reestablished 5-pot recreational crab pot license but prohibited harvest on Sunday and from Sept 16 - May 31.
- Right to hold revocation hearing for crab licensee after two crab violations by authorized agent (agents cannot be licensed for any crab fishing gear).

May 2010

- Made it unlawful (from March 17 - June 30) to possess dark sponge crabs exceeding regulation tolerance of 10 per bushel (previously March 17 – July 15).
- Made it lawful (indefinitely) that commercial licenses (crab/peeler pot, scrape, trap, ordinary/patent trot line, dip net) shall be sold only to commercial fishermen eligible in 2010, except those placed on the waiting list established in November 2007.
- Closed 2010/11 winter dredging fishery season.

April 2011

- Changed closed season on harvest from Virginia Blue Crab Sanctuaries from May 16 to May 1.
- Changed boundary line of Blue Crab Sanctuary in upper Bay near Smith Point Light.

September 2011

- Closed 2011/12 winter dredging fishery season.
- Established 5-day maximum tending requirement for crab pots and peeler pots.

November 2012

- Closed 2012/13 winter dredge fishery season.
- Funded the Winter Dredge Gear Study using Marine Fishing Improvement Funds.
- Extended the 2012 season until December 15, 2012 for both male and female crabs and applied conservation equivalent bushel limits to the 2013 crab pot season by gear license categories as follows:
    - For up to 85 crab pots a maximum limit of 27 bushels.
    - For up to 127 crab pots a maximum limit of 32 bushels.
    - For up to 170 crab pots a maximum limit of 38 bushels.
    - For up to 255 crab pots a maximum limit of 45 bushels.
    - For up to 425 crab pots a maximum limit of 55 bushels.
- Restricted crabbing in the Virginia portion of the Albemarle and Currituck watersheds to crab pots and peeler pots only.

February 2013

- Established a vessel harvest and possession limit equal to only one of the largest legal bushel limits on board any vessel.
- Limited the use of agents in the hard pot fishery to 168, with priority going to those licensees who received approval for agent use in 2012.

June 2013

- Established daily individual and vessel harvest and possession limits for the 2013 season.

October 2013

- Closed 2013/14 winter dredge fishery season.
- Results of the Winter Dredge Mortality Project were presented.
- Extended the 2013 season until December 15, 2013 for both male and female crabs and applied conservation equivalent bushel limits to the 2013 season extension and the 2014 crab pot season by gear license categories as follows:
    - For up to 85 crab pots a maximum limit of 16 bushels.
    - For up to 127 crab pots a maximum limit of 21 bushels.
    - For up to 170 crab pots a maximum limit of 27 bushels.
    - For up to 255 crab pots a maximum limit of 43 bushels.
    - For up to 425 crab pots a maximum limit of 55 bushels.
- Established the 2014 crab pot season as March 17 through November 30, 2014 for both male and female blue crabs.
- Established a declaration date for agent use requirements in the crab pot fishery for the 2014 season.

June 2014

- Closed the 2014/15 winter dredge fishery season.
- Enacted management reductions in response to the current scientific determination that the Chesapeake Bay blue crab abundance of spawning-age female crabs is depleted. The basis for this 10 percent reduction, which equals a potential savings of 1,316,726 pounds of female blue crab, is to augment spawning in summer 2014 and spring 2015 and help reverse the depleted stock condition of blue crab.
- From July 5, 2014 through November 15, 2014 and April 1, 2015 through July 4, 2015:
    - 10 bushels, or 3 barrels and 1 bushel, of crabs, if licensed for up to 85 crab pots.
    - 14 bushels, or 4 barrels and 2 bushels, of crabs, if licensed for up to 127 crab pots.
    - 18 bushels, or 6 barrels, of crabs, if licensed for up to 170 crab pots.
    - 29 bushels, or 9 barrels and 2 bushels, of crabs, if licensed for up to 255 crab pots.
    - 47 bushels, or 15 barrels and 2 bushels, of crabs, if licensed for up to 425 crab pots
- From November 16, 2014 through November 30, 2014 and March 17, 2015 through March 31, 2015:
    - 8 bushels, or 2 barrels and 2 bushels, of crabs, if licensed for up to 85 crab pots.
    - 10 bushels, or 3 barrels and 1 bushel, of crabs, if licensed for up to 127 crab pots.
    - 13 bushels, or 4 barrels and 1 bushel, of crabs, if licensed for up to 170 crab pots.
    - 21 bushels, or 7 barrels of crabs, if licensed for up to 255 crab pots.
    - 27 bushels, or 9 barrels of crabs, if licensed for up to 425 crab pots.
- The lawful season for the commercial harvest of blue crabs by all other commercial gears shall be March 17, 2014 through September 15, 2014 and May 1, 2015 through November 30, 2015. It shall be unlawful to place, set, fish or leave any lawful commercial gear used to harvest crabs, except crab pots, in any tidal waters of Virginia from September 16, 2014 through April 30, 2015.

May 2015

- Maintained and modified measures to conserve and allow rebuilding of the Blue Crab Resource:
    - Maintained previous crab management season and bushel limits.
    - Adjusted closure dates for non-crab pot gear season, closing September 26 and reopening April 21.
    - Amended Chapter 4 VAC 20-270-10 et seq., making it unlawful for any vessel to act as both a crab harvester and a crab buyer on the same trip.
    - Amended Chapter 4 VAC 20-370-10 et seq., making it unlawful for any person to possess dark sponge crabs from March 17 through June 15.
    - Amended Chapter 4 VAC 20-752-10 et seq., redefining Virginia Blue Crab Sanctuary Area 1 as Virginia Blue Crab Sanctuary Area 1A and Blue Crab Sanctuary Area 1B and implement separate closure dates for Blue Crab Sanctuary Areas 1A, 1B and Areas 2 through 4.
    - Amended Chapter 4 VAC 20-1140 et seq., to close the winter crab dredge fishery season from December 1, 2015 through March 31, 2016.

October 2015

- Closed 2015/16 winter dredge fishery season to allow for continued rebuilding of the spawning-stock biomass.

June 2016

- Closed 2016/17 winter dredge fishery season to allow for continued rebuilding of the spawning stock biomass.

May 2016

- Closed 2017/18 winter dredge fishery season to allow for continued rebuilding of the spawning stock biomass.
- Reestablished the traditional crab pot harvest season
- Added additional time for lower bushel limits

June 2017

- Closed 2017/18 winter dredge fishery season to allow for continued rebuilding of the spawning-stock biomass and guard against over-depletion of an expected low 2018 spawning stock
- The Commission further reduced crab pot bushel and vessel possession limits for two additional weeks in November 2017 and March 2018, as an effort to conserve juvenile crabs from the winter of 2017 for the 2018 spawning potential
- The Commission adopted an earlier closure of November 30, for the crab pot fishery, as compared to the 2017 closure of December 20. Similarly, the early March 1, 2017 opening of the crab pot season was pushed back to March 17 in 2018, in order to conserve part of the 2018 spawning stock in late 2017 and early 2018

Attachment 4

Virginia Marine Resources Commission
Blue Crab Fishery Resource Disaster Relief Plan
(Submitted January 30, 2009 to the National Marine Fisheries service)

Overview

The Commonwealth of Virginia's plan, for the blue crab fishery resource disaster funding, consists of several projects that are designed to provide additional work opportunities to those in the crab industry and to restructure the blue crab fishery. Specific details and budget narratives, for each component, are summarized below.

I. Derelict Blue crab pot and marine debris removal project (VMRC/VIMS)
II. Cull ring and excluder device project (VIMS)
III. Supplemental funding, for the Fishery Resource Grant Program (VIMS)
IV. Oyster Aquaculture (VMRC)
V. Crab pot and peeler pot license buy out (VMRC)
VI. Update of blue crab stock assessment (VMRC/MD DNR)
VII. Administration fees (VMRC)