COMMONWEALTH of VIRGINIA

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

Douglas W. Domenech
Secretary of Natural Resources

Jack G. Travelstead
Commissioner

December 1, 2012

MEMORANDUM

TO: The Honorable Robert F. McDonnell
Governor of the Commonwealth of Virginia
And,
Members of the Virginia General Assembly

THROUGH: The Honorable Douglas W. Domenech
Secretary of Natural Resources

FROM: Jack G. Travelstead

SUBJECT: Blue Crab Fishery Management Plan

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

EXECUTIVE SUMMARY

Results from the 2012 Bay-wide Winter Dredge Survey, conducted December 2011 to March 2012 by the Virginia Institute of Marine Science and Maryland Department of Natural Resources, indicate the blue crab stock was not overfished and overfishing did not occur in 2011. The 2011-2012 Winter Dredge Survey estimates of total abundance indicates a 66% increase in crabs of all sizes compared to the previous year's survey. The total abundance of 764 million crabs was the highest estimate since the 1990 Winter Dredge Survey and was bolstered by the record number (587 million) of juvenile crabs. However, the number of spawning-age female crabs (97 million) was well below the long-term average for this survey.

At its November 2012 meeting the Commission closed the winter dredge fishery season for the fifth consecutive season in order to continue the protection of the spawning stock biomass but also passed a scientific study of incidental mortality that results from crab dredge gear. Four commercial crab dredge captains and their vessels will participate in the scientific gear study with staff members from the Commission and the Virginia Institute of Marine Science (VIMS). The study will examine incidental mortality associated with various gear configurations over different substrate type. The Commission approved the use of Marine Fishing Improvement Funds to support a December 2012 - March 2013 crab dredge gear study, designed by scientists at VIMS, with input from VMRC staff, that will provide an estimate of non-harvest (or incidental) mortality caused by crab dredge gear for future winter dredge management decisions.

At its November meeting the Commission also extended the 2012 crab pot season to December 15, 2012, and established gear-specific bushel limits for 2013 to compensate for the projected harvest. The Commission voted to restrict crab scrapes from the Albemarle and Currituck watersheds, but permitted the commercial harvest of crab pots and peeler pots because both are documented as historical gears, and there limited evidence suggesting peeler pots would cause a detrimental impact to stock juvenile fishes in the watershed. The Commission also approved the merging of two separate regulations into one, reducing regulatory complexity and establishing a uniform date of closure for all four blue crab sanctuary areas (May 16-September 15).

Virginia crab and oyster industries continue to benefit from disaster relief funds provided in 2009 by the Department of Commerce for the declared Fishery Disaster in the Chesapeake Bay blue crab fisheries. This Disaster Relief Fund has provided various crab industry members (harvesters, buyers, and processors) who experienced past financial setbacks from the very low abundance of the blue crab resource, from 1998-2008, an opportunity to work in resource or habitat enhancement projects. The total amount of funding from the Disaster Relief Fund was $14,995,000. Of the six project areas, two projects continue in 2012: the derelict crab pot and marine debris collection program, and the oyster aquaculture projects. They oyster aquaculture projects have stimulated technical advances in hatchery production which is needed for spat-on-shell projects.

THE 2012 VIRGINIA BLUE CRAB FISHERY MANAGEMENT PLAN

Status of the Blue Crab Stock

The 2011 stock assessment control rule differs from its interim predecessor in that the reference points are based on the biological status of female crabs, instead of both sexes combined. Biological reference points are the primary outputs of stock assessments, and fishery regulations are implemented to meet those biological standards. The 2011 blue crab stock assessment provide new female-only reference points for crab abundance (expressed in millions of female crabs 2.4 inches in carapace width) and exploitation rate (rate of removal of female crabs of all sizes, by the fisheries, expressed as a percentage), which replaced the interim reference points established in 2005.

The table below lists the abundance and exploitation rate targets and thresholds that managers are now using to monitor the health of the blue crab stock in the Bay.

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

The abundance estimate from the December 2011 through March 2012 Baywide Winter Dredge Study of female spawning-age crabs (age 1+) was 97 million, representing a 51% decline from the 2010-2011 Winter Dredge Survey results. Spawning age crabs are crabs (>2.4 inches in carapace width) sampled by the survey that will spawn either in late May or during the July-August peak spawning period. While this estimate is below the target of 215 million spawning-age female crabs, it is above the overfished threshold of 70 million and the stock healthy and not overfished. However, the low number (97 million) of female spawning-age crabs necessitates that the Chesapeake Bay jurisdictions maintain essentially the same crab conservation plan, in 2012, as in 2011. The most recent (2011) female-crab exploitation rate estimate was 24%, which is just below the target exploitation rate of 25.5% removal of female crabs on an annual basis, from fisheries, alone. This estimate is above the overfishing threshold (34%), and overfishing is not occurring in this stock.

The total abundance of 764 million crabs was the highest estimate since the 1990 Winter Dredge Survey, and is boosted by the high number of juvenile crabs (587 million age-0 crabs, and the highest estimate in the history of the survey).

Table 1 below provides a 23-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 (MDDNR). 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 of the two size classes of crabs. Any abundance estimate represents the number of crabs that will be

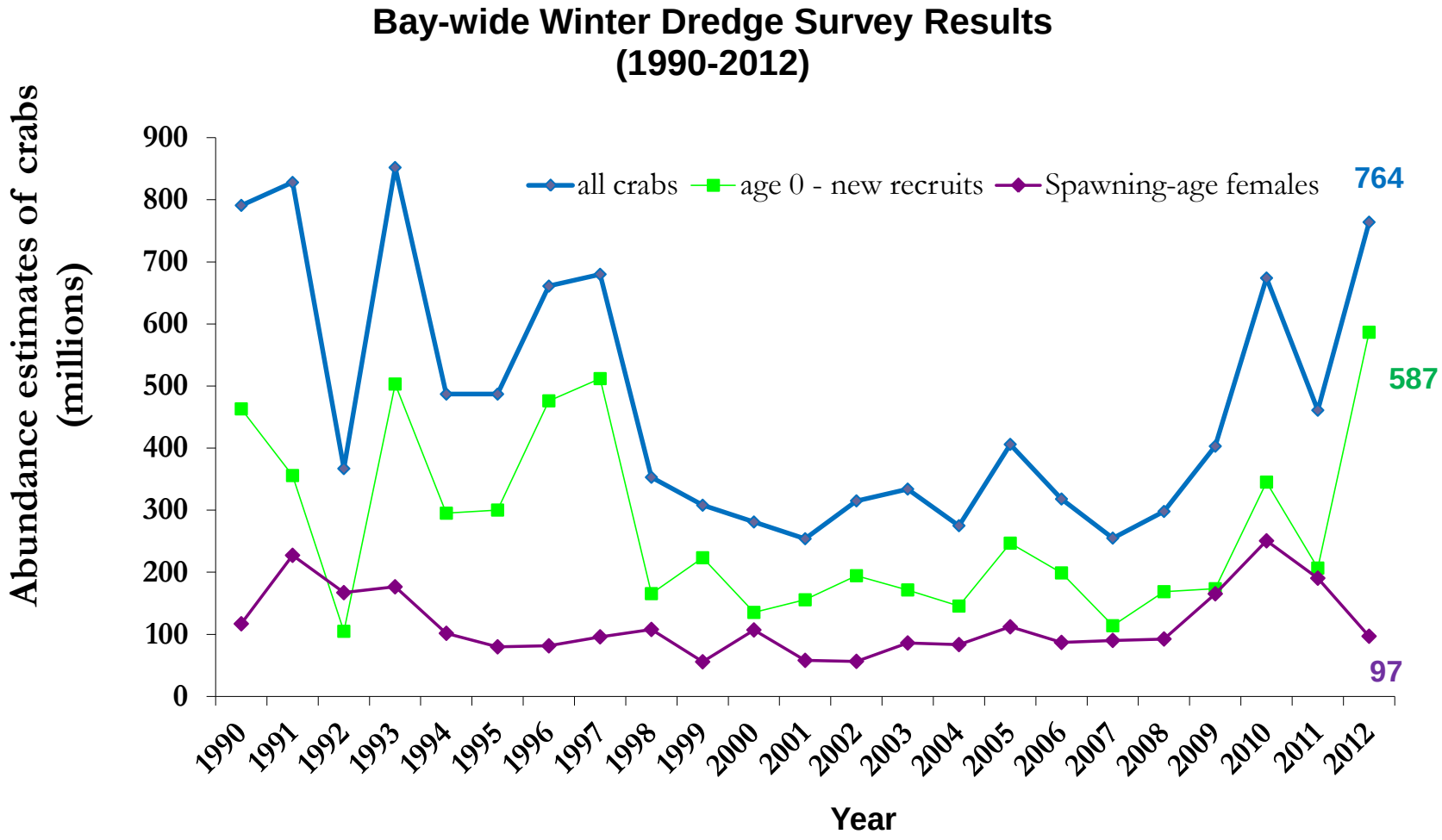
available to the Chesapeake Bay fisheries following the end (March) of the seasonal (December-March) Bay-wide Winter Dredge Survey.

Table 1. Bay-Wide Winter Dredge Survey results (1990-2012). All surveys begin in December and ended in March of the next year.

Survey Year (Year Survey Ended)	Total Number of Crabs in Millions (All Ages)	Number of Age-0 Crabs in Millions	Number of Spawning-Age Crabs in Millions (both sexes)	Number of spawning age Female crabs	Bay-wide Commercial Harvest (Millions of Pounds)	Percentage of Female Crabs Removed
1990	791	463	276	117	96	44
1991	828	356	457	227	90	34
1992	367	105	251	167	53	60
1993	852	503	347	177	107	35
1994	487	295	190	102	77	28
1995	487	300	183	80	72	32
1996	661	476	146	108	69	20
1997	678	512	165	93	77	22
1998	353	166	187	106	56	40
1999	308	223	86	53	62	37
2000	281	135	146	93	49	43
2001	254	156	101	61	47	42
2002	315	194	121	55	50	34
2003	334	172	171	84	47	33
2004	268	146	124	84	47	42
2005	396	247	158	112	58	24
2006	311	199	121	87	54	29
2007	249	114	141	90	49	35
2008	291	169	131	92	43	24
2009	393	173	223	165	55	23
2010	658	345	315	250	91	18
2011	461	207	254	194	67	24
2012	764	587	178	97	By 2013	By 2013

Note: 4% of the total female removal rate is assigned to recreational fishing removals

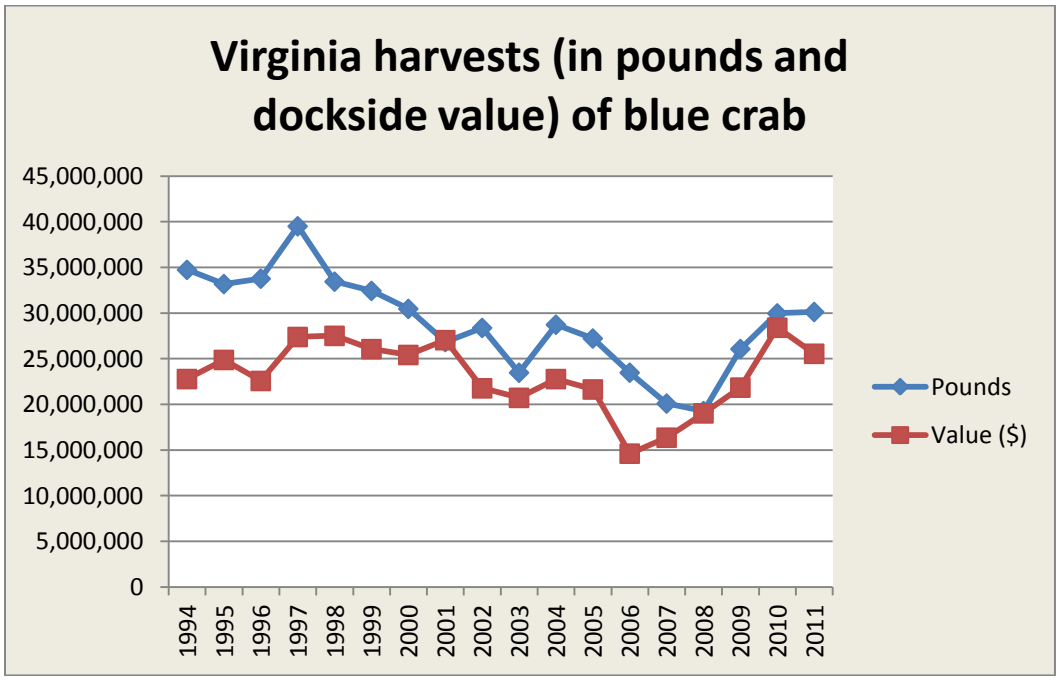
The following figure provides the results of the 23-year Bay-wide Winter Dredge Survey for total crabs, juvenile (recruits) crabs, and spawning-age (age-1+) female crabs.



Harvest and Effort Statistics

In June 2012 the Chesapeake Bay Stock Assessment Committee (CBSAC) reported (Attachment I), the 2011 Bay-wide crab commercial harvest was 67 million pounds, 26% lower than the 2010 Bay-wide crab harvest of 91 million pounds. The recreational harvest was estimated as 4.4 million pounds. Of the Bay-wide commercial harvest, Maryland harvested 35.3 million pounds, Virginia harvested 28.4 million pounds, and 3.5 million pounds were harvested in the jurisdiction of the Potomac River Fisheries Commission. The total 2011 reported commercial harvest for all Virginia tidal waters, including the bays and tributaries seaside of the Eastern Shore and Virginia Beach, is 30.1 million pounds.

The figure below displays the time-series of Virginia commercial crab harvests for all Virginia waters in pounds of reported harvest and estimated dockside value (first sale from harvester). Harvest statistics have been collected from Virginia fisheries since the last 1920's; however, 1994 is considered the first representative year of the mandatory commercial harvest reporting system. Despite a modest increase (5%) in harvest in 2011 from 2010, the economic value of crab harvest declined by about 10%.

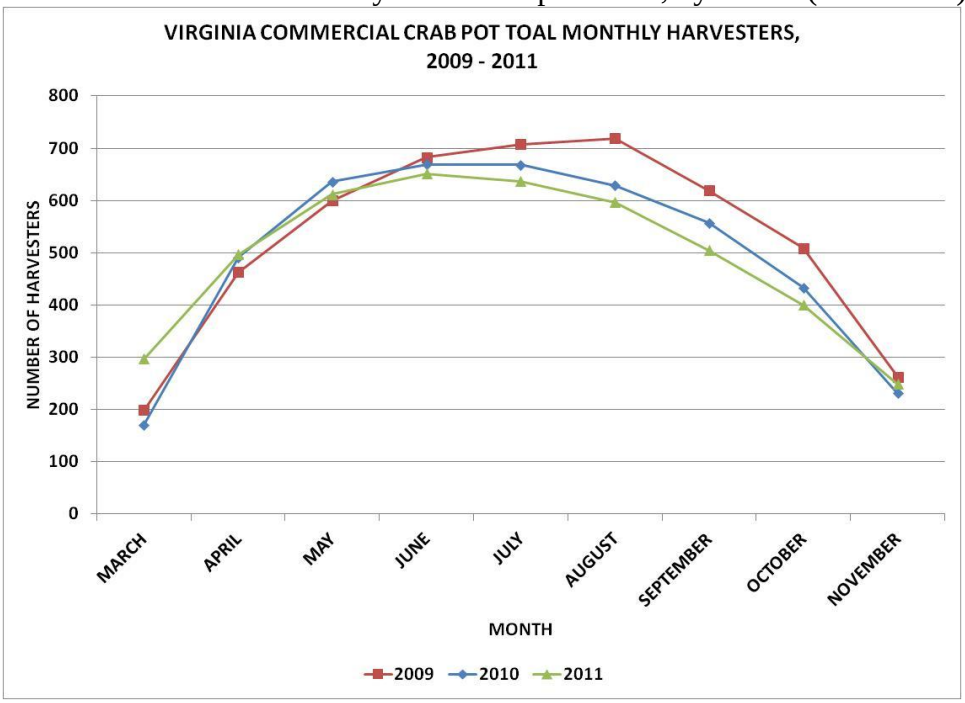


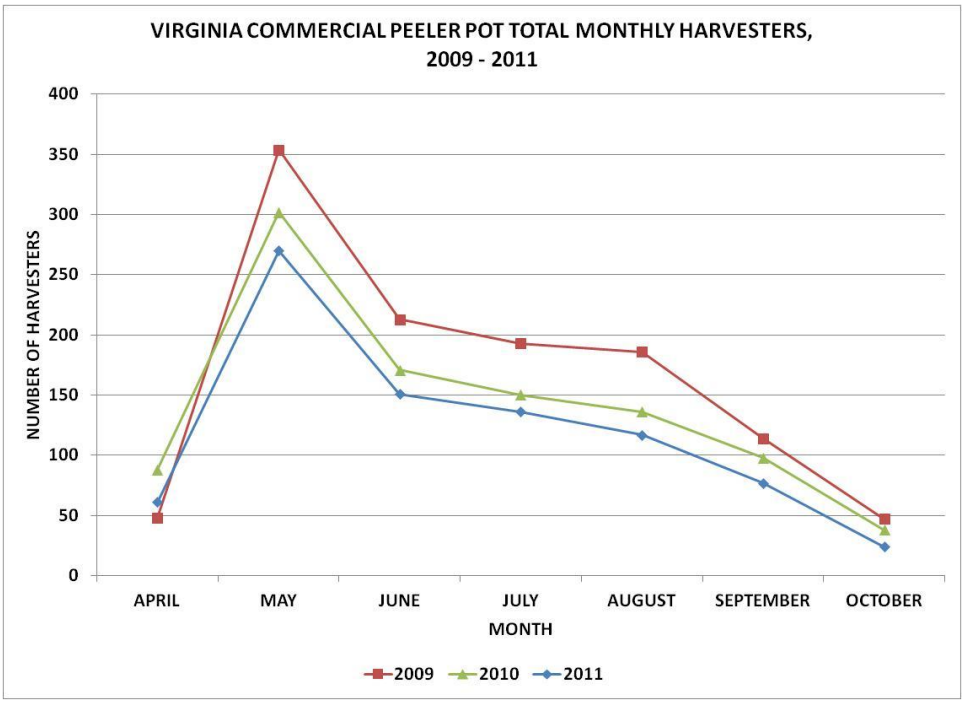
The table below contains Virginia harvest data by market category (hard crabs and peeler and soft crabs), in pounds, for the last three years of complete data (2009-2011).

Year	Hard	Peeler and Soft	Total
2009	25,112,135	961,474	26,073,609
2010	29,006,875	969,915	29,976,789
2011	29,373,582	759,016	30,132,598

The crab pot fishery has accounted for approximately 96% of the total crab harvest from Virginia tidal waters in recent years. The sex composition of the crab pot harvest in 2011 was 66% female, compared to about 60% female in 2010 and 65% in 2009.

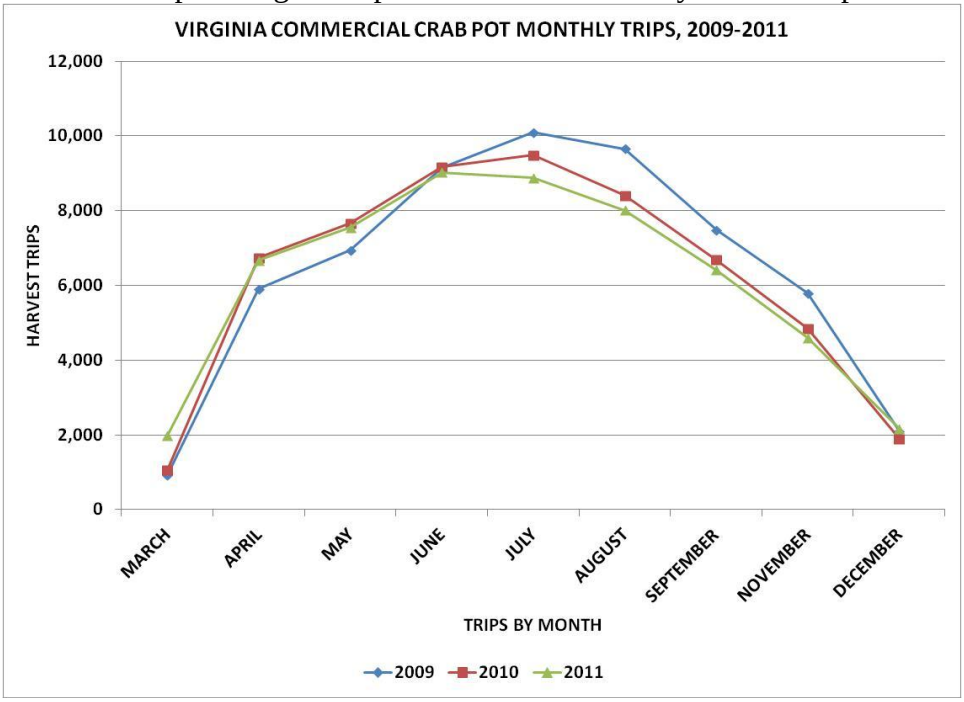
The figures below depict effort (the number of active crab harvesters) in the crab pot and peeler pot fisheries for the last three years of complete data, by month (2009-2011).

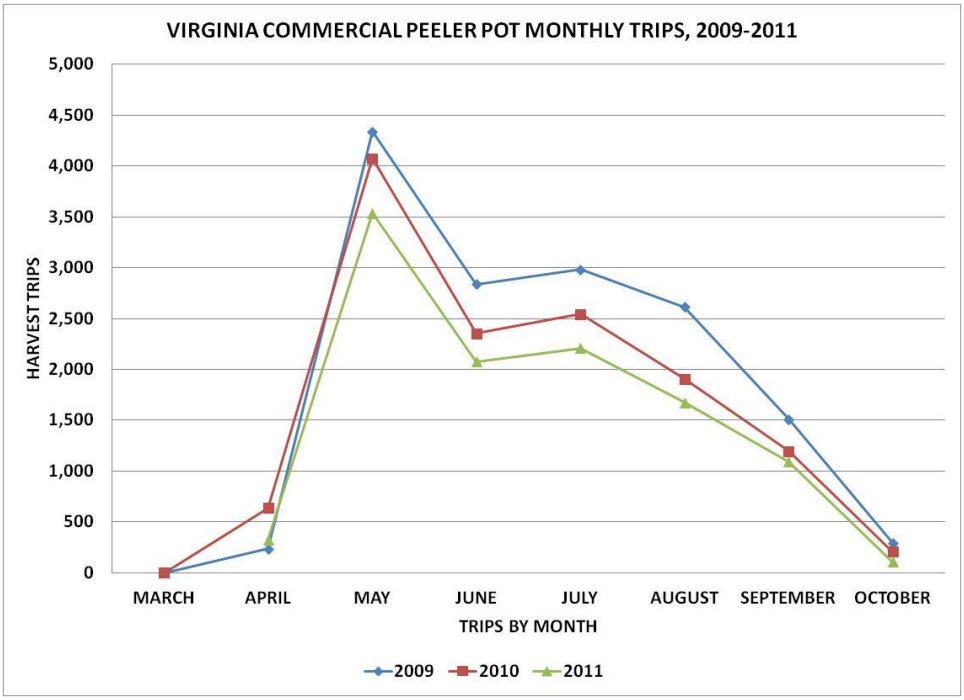




In 2011, a total of 905 crab pot licensees and 325 peeler pot licensees reported harvest which is slightly lower than the number of active harvesters of 2010 (940 crab pot licensees and 363 peeler pot licensees). June through August are the peak months for total numbers of harvesters in the crab pot fishery. Harvester activity in the peeler pot fishery peaks in May and gradually declines from June through August.

The figures below depict Virginia trip data for the last three years of complete data.





The number of trips with reported crab harvest from crab pot gear totaled 55,324 in 2011 (compared to 55,988 crab pot harvest trips in 2010). The number of peeler pot trips in 2011 totaled 11,027 (a decline from 12,925 trips in 2010). May through September are the peak months for crab pot trips. Peeler pot trips peak in May, with a gradual decline from June through August.

Commission Blue Crab Conservation Actions in 2012

Commission actions that have attempted to promote sustainability of the blue crab stock and fishery, since 1994, the conservation measures that helped rebuild the crab stock and improve our fishery harvests are included in Attachment II. In 2012, the Commission held a public hearing on November 19 to review blue crab conservation issues as well as industry requests. The decline in spawning-age female crabs in the 2011-2012 Winter Dredge Survey warranted caution in any relaxation of conservation measures, many of which were implemented in 2008. The three Chesapeake Bay jurisdictions have agreed that any change in harvest expected from any new management measure, will be compensated for by another conservation measure. After briefings by its staff on current abundance data, harvest data, industry requests and public comments, the Commission approved the following measures at its November 2012 meeting:

- Closure of the 2012-2013 crab dredge fishery season

  The Commission closed the winter crab dredge fishery season for the fifth consecutive season. Some former crab dredge fishermen did request an opening of the 2012-2013 crab dredge fishery season, however the Commission did not support reopening that season before receiving the information from a winter 2012-2013 crab dredge gear study to be conducted by VIMS, with support from VMRC staff. Public opinion remains in opposition of this fishery. Female crabs that are harvested by a winter dredge fleet are poised to spawn in the spring or summer, and protecting the spawning stock biomass is important while the stock continues to recover.

- Funding the 2012-2013 Winter Crab Dredge Gear Study through the Marine Fishing Improvement Fund.

  The December 2012 - February 2013 crab dredge gear study, designed by scientists at VIMS, with input from VMRC staff, will attempt to estimate non-harvest (or incidental) mortality caused by crab dredge gear. There are no data on the condition of blue crabs that remain on the Bay floor after dredging, and on-board mortality and waste estimates are outdated. The results from this study will aid the Commission in the decisions on whether or not to reopen a future dredge season. Additionally, CBSAC has recommended that the Bay jurisdictions seek incidental mortality estimations for all major crab gears. These estimates have been labeled as a critical data need (Attachment I). Expenditures from the

Marine Fishing Improvement Fund to pay for this project are expected to not exceed $132,000.

- Extension of fall 2012 crab pot season to December 15 with bushel limits, as conservation equivalency measure for spring 2013.

  The Commission extended the 2012 crab pot season for male and female blue crabs until December 15, 2012, and established crab pot gear category-specific bushel limits for 2013 to compensate for the projected potential additional exploitation of female crab component of the stock. This means that an expected fall 2012 increase in crab harvest will be "paid back" by bushel limits in 2013. This conservation equivalency is based on compensating for lost spawning potential (females crabs) in 2012. Originally the 2012 female crab pot season would have ended on November 20, 2012 and the male crab pot season would have ended on November 30 2012. The 2013 crab pot season will open on March 16, for both male and female blue crab harvest, and end on November 20, 2013 for female harvest and November 30, 2013 for male harvest. The bushel limits per crab pot category are as follows:

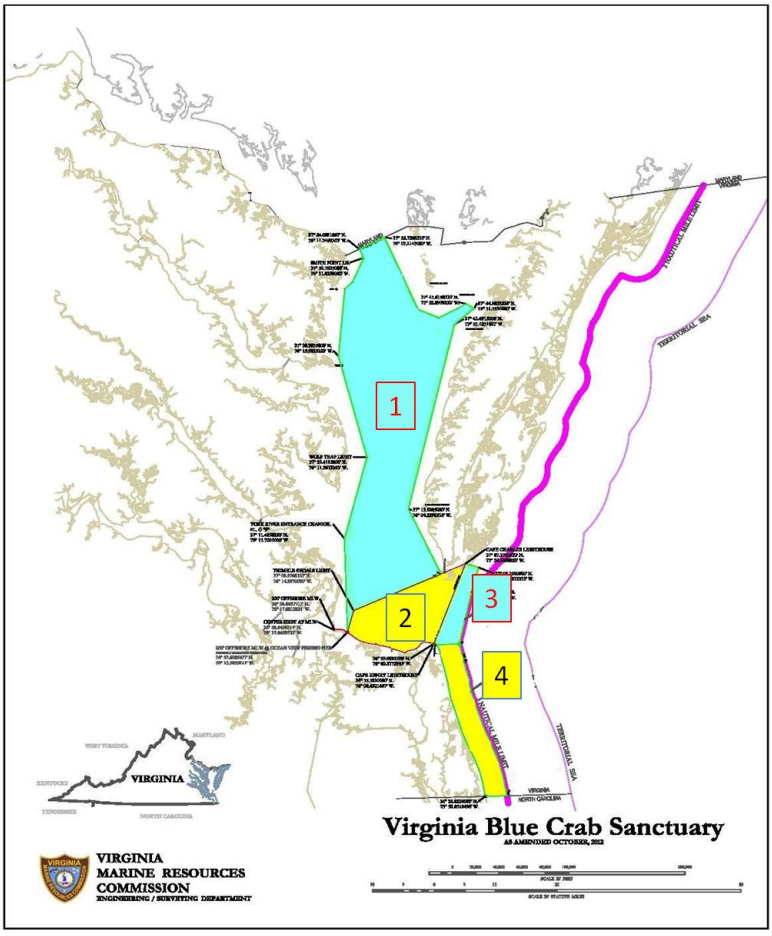
License Category	March 17 – November 30, 2013 Only
Crab Pot 85 or Less	27
Crab Pot 127 or Less	32
Crab Pot 170 or Less	38
Crab Pot 255 or Less	45
Crab Pot 425 or Less	55

- Restriction of commercial crab harvest in the Virginia portion of the Albemarle watershed to crab pot and peeler pot only

  On July 1, 2012, Virginia House Bill 238 became effective, clarifying that the Commission has jurisdiction over recreational and commercial crab harvest in the waters of the Albemarle and Currituck watersheds. Staff of the Virginia Department of Game and Inland Fisheries presented a request to the Commission to restrict commercial crab harvest to crab pot gear only in the Albemarle watershed, and requested that crab scrapes, which damage submerged aquatic vegetation, and peeler pots that could catch stocked juvenile fish be prohibited. The Commission voted to restrict crab scrapes from the Albemarle watershed, but permitted the commercial harvest of crab pots and peeler pots because both are documented as historical gears, and there is very limited evidence suggesting peeler pots would cause a detrimental impact to stocked juvenile fishes in the watershed.

- <u>Differentiation of blue crab spawning sanctuaries as four areas with uniform dates of closure to harvest</u>

  At its May 2011 meeting, the Commission voted to delay the initial date of the closure of the spawning sanctuary from May 1 to May 16 at the request of industry. The closing date of this sanctuary is September 15. The delayed closure was intended for all spawning sanctuary areas. However, the Commission only amended one of two sanctuary specific regulations at that time. The other regulation contained a May 1 closuring of the sanctuary but the Commission's intent was for a May 16 closure to harvest. In November 2012, the Commission voted to merge the two separate regulations into one, reducing regulatory complexity and establishing a uniform date of closure for all four blue crab sanctuary areas (May 16-September 15). Below, please find a figure that shows the four areas, and indicates areas where either commercial or recreational harvest is prohibited during the May 16 – September 15 period.



Areas 1 and 3 apply to closed harvest season (May 16 – September 15) for recreational and commercial crab harvest

Areas 2 and 4 apply to closed harvest season (May 16 – September 15) for commercial crab harvest only

Ecosystem Constraints on the Blue Crab Resource

§28.2.203.1 of the Code of Virginia provides that the Blue Crab 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. Concerning environmental stress and habitat deterioration, the Commission relies on the efforts of its sister agencies to promote and sponsor improvements in the Chesapeake's water quality.

Just recently the Commission participated in a Harmful Algal Bloom (HAB) Task Force meeting to provide updated information on the 2012 HAB season. The 2012 HAB season was discussed in terms of concentration and diversity of major bloom producers; microscopic, molecular and bioassay study results; guidelines for reporting monitoring efforts to the general public; and opportunities for future HAB research and funding. In the major tributaries of the Chesapeake Bay, HABs have been steadily increasing in duration, intensity, and spatial coverage. The Virginia Department of Health is developing guidelines for dealing with blooms of *Mycrocystis spp*., as well as potential mechanisms for reporting the results of their HAB monitoring efforts, as they relate to public health and beach closures.

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 the fisheries; however, many water quality and habitat impacts on this stock are not fully quantified or understood, and the relationship of blue crab among other components of the ecosystem is still being explored by Chesapeake Bay scientists. Many natural and man-induced impediments continue to challenge the stability of the blue crab stock, including hypoxia (low oxygen levels in the water), shoreline development and pollution. The issue of climate change will continue to be important as well, as crab behavior is tied to water temperature.

Water quality in the Chesapeake Bay is improving due to the ongoing efforts of the Commonwealth and the signatories of the Chesapeake Bay Agreement. Additional work need to be done to help the Chesapeake Bay meet state water quality standards or criteria to be "fishable and swimmable". Each of the jurisdictions has developed a Watershed Implementation Plan to guide restoration plans through 2025. The federal government developed Executive Order 13508 which establishes the Federal Leadership Committee which will publish an annual Chesapeake Bay Action Plan.

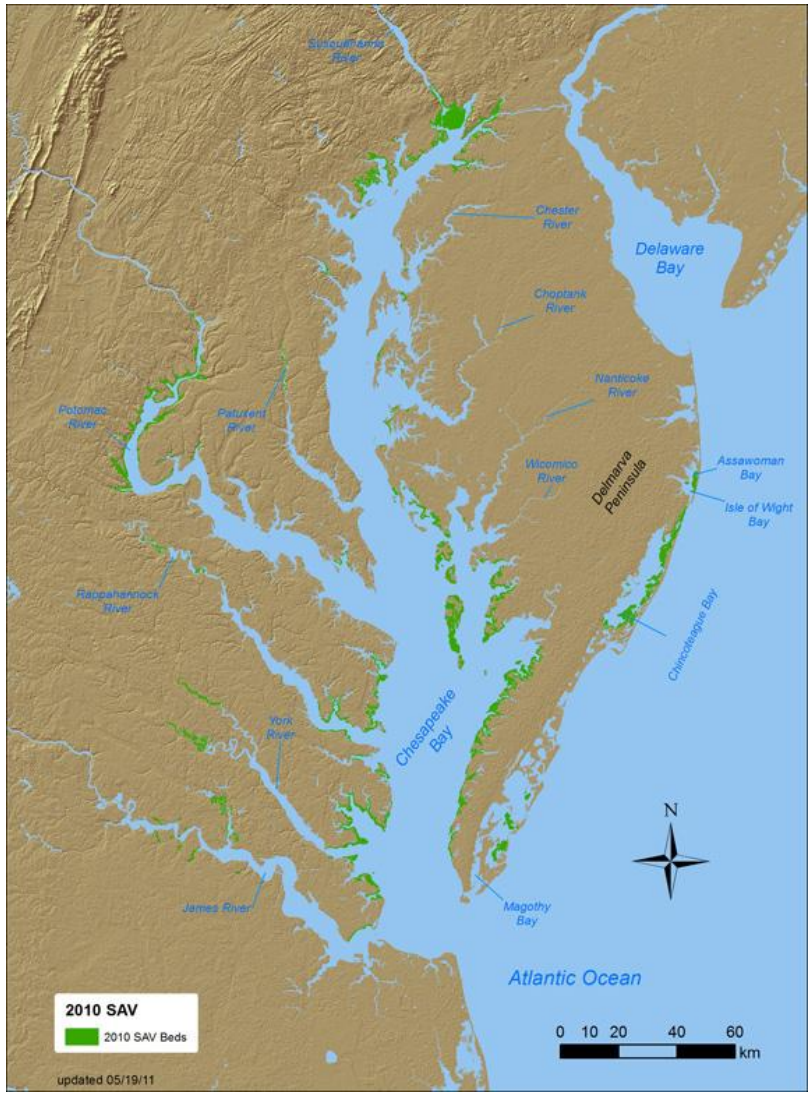
The drastic reduction in seagrass beds has also likely impacted the blue crab stock, especially juvenile crabs that use seagrass beds as protection from predators. Seagrass beds provide nursery habitat for newly settled, young juvenile and mating blue crabs. Since 2001, the Commission has approved a set-aside area for seagrass restoration in South Bay. In 2006, this area was expanded to total 727.85 acres of protected area. The South Bay set-aside area has developed into one of the largest eelgrass beds in the lower Delmarva Peninsula and is now self sustaining. In 2011, the Commission voted to

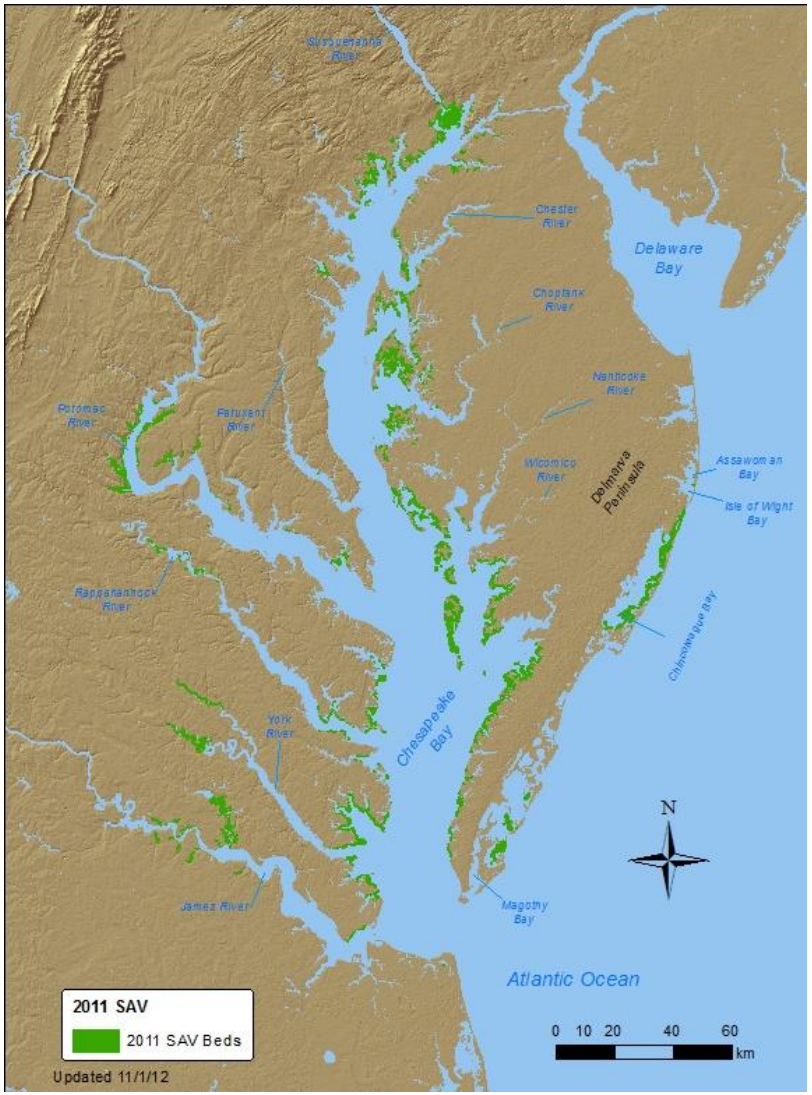
protect this set-aside area for an indefinite amount of time. Dredging is also prohibited in the protected area.

The annual aerial submerged aquatic vegetation (SAV) monitoring program has been conducted throughout the Chesapeake Bay and its tributaries since 1984. On December 10, 2012, Dr. Robert Orth of VIMS will provide the Commission with an update of the completed 2011 SAV status survey. Threats to SAV recovery in Virginia include water quality degradation, propeller scarring, and climate change (including increased rainfall events and rising water temperatures). Crab dredging has also been linked to damaging SAV beds. The 2010 Chesapeake Bay Program restoration goal for SAV in the Chesapeake Bay is 185,000 acres. During the 2011 SAV survey, 57,956 acres were mapped. While this was a decline from the 2010 SAV survey of 79,675 acres, some portions of the Bay were not mapped because SAV signatures were obscured by excess turbidity caused by Hurricane Irene and Tropical Storm Lee. In order to accurately compare 2011 SAV distribution and abundance to 2010, only areas mapped in both 2011 and 2010 were analyzed. Notable changes in SAV distribution were measured between 2010 and 2011. SAV decreased 22% from 74,271 acres to 57,681 acres in the regions mapped for both years. SAV decreased in all three (Upper, Middle, and Lower) Chesapeake Bay geographic zones. An interactive map of SAV distribution mapping with interactive charts can be accessed at the following web address: http://web.vims.edu/bio/sav/maps.html.

The Chesapeake Bay Program Sustainable Fisheries Goal Implementation Team (GIT) identified research needs in 2011 pertaining to blue crabs, including a comprehensive, Bay-wide recreational crab survey and an integrated Bay-wide fishery-dependent crab survey. As part of this effort, a Blue Crab Species Team, consisting of blue crab experts, was assembled to identify the critical ecosystem stressors impacting blue crabs in the Chesapeake Bay. One goal of the GIT is to move fisheries management forward, from a single species approach, to an Ecosystem-Based Fisheries Management (EBFM) process that would develop ecosystem-based tools and fishery management plans for key species, including blue crabs.

Maps of known SAV beds identified by Dr. Bob Orth in 2010 (left) and 2011 (right).





Blue Crab Disaster Relief Funding Updates

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 two will continue into the winter 2012-13.

A truncated Derelict Blue Crab Pot and Marine Debris Removal Project will be in effect starting this December with four part-time participants. Continued oyster aquaculture opportunities, provided to previous crab licensees, will also continue in 2013.

I. DERELICT BLUE CRAB POT AND MARINE DEBRIS REMOVAL PROJECT

Discarded debris such as tires, gill nets, appliances, and crab pots can be found throughout the tidal waters of Virginia. Derelict crab pots may remain in the environment for years and continue to capture and kill fish, shellfish, birds and marine mammals including endangered or threatened species. It is estimated that around 20% of crab pots deployed are lost each season and each functional lost crab pot can continue to capture about a bushel of market-sized crabs per season. There is an environmental benefit in removing marine debris from Virginia's waters if the removal can be accomplished safely and without damaging the marine habitat and ecosystem. This project includes work specifically aimed at removing marine debris from Virginia's tidal waters with the assistance of watermen (Attachment III).

During the abbreviated fourth year of Marine Debris Location and Removal Program (Dec 2011-Mar 2012), a total of seventy participants surveyed the Virginia portion of the Chesapeake Bay. The participants recorded the by-catch associated with the over 4,215 derelict crab pots that were removed. For detailed information, including training instruction and specific maps showing the location of all removed items and the associated by-catch to date visit http://ccrm.vims.edu/marine_debris_removal/

II. CULL RING AND TERRAPIN EXCLUDER DEVICE PROJECT

The goals of this study were to employ Virginia's watermen (1) to investigate the effects of different crab pot cull-ring sizes in on blue crab catch, biomass, and survival, and (2) to determine the effects of bycatch reduction devices (BRDs) in crab pots on blue crab catch, finfish bycatch, and diamondback terrapin bycatch (Attachment IV).

Larger cull-rings reduced the amount of sublegal crabs caught. A pot with no cull-ring catches approximately 39% sublegal catch. A pot with the regulation 2 3/8" cull rings decreases that amount by 25%

The study was completed in late November and VIMS has started analyzing and interpreting the data. The mean abundance per BRD pot was less than mean abundance for regulation pots by both location and soak time. Crabbers on the James River thought the BRDs actually increased the number of peelers caught in their pots while keeping larger hard crabs from entering the pots.

III. SUPPLEMENTAL FUNDING FOR THE FISHERY RESOURCE GRANT PROGRAM

Restoration activities for the blue crab population in the Chesapeake Bay have included several new restrictions on the harvest by Virginia. These new regulations affect the livelihoods of Virginia Crabbers. In order to supplement the income of harvester to maintain their financial stability in response to the 2008 blue crab harvest restrictions, the state proposed to support the crabbers by training them in oyster aquaculture. Funding was used to employ one fulltime advisory service person to assist the crabbers in their new venture into oyster aquaculture. Two methods of oyster aquaculture were implemented, cultch less and remotes setting. Three full years of aquaculture training were supported with additional educational effort in shellfish handling, storage and transportation. Surveys of participants indicate a strong willingness to continue to develop their shellfish aquaculture enterprises (Attachment V).

IV. OYSTER AQUACULTURE

In 2010, the Commission's Conservation and Replenishment Department began training crab industry participants in modern techniques for growing oysters on private grounds. These techniques are easily adaptable to boats and equipment available to crab harvesters, and should provide alternative sources of income for the crabbing industry. More than 130 watermen were trained in cage aquaculture in 2010 and 2011, and many have harvested their first crop of oysters and have purchased additional oyster seed and equipment to continue growing oysters after the completion of their training projects. More than 60 other crab industry participants were trained in spat-on shell oyster production in 2010 and 2011, and they have also begun harvesting their oysters. With spat-on-shell, oyster larvae are set on shells in large tanks, to produce oyster seed that is very similar to wild oyster seed. More oysters are produced by growing them loose on the bottom in this technique, with less labor. The oysters produced in this manner are primarily used for the shucking industry. In all of the training projects, selectively bred, disease tolerant, triploid (reproductively sterile) oysters are being grown. These oysters are highly marketable because of superior meat quality year round. Crab industry participants were again trained in 2012 in oyster aquaculture. More than 40 crabbers participated in the spat-on-shell program in 2012. In total, 25,845

bushels of shells were set with 1.086 billion eyed larvae produced by Virginia hatcheries. These shells were deployed with 153 million small oysters on private oyster beds throughout Virginia's Chesapeake Bay and tributaries. This year was the most productive for this project to date. The growth of private oyster hatcheries in Virginia has been hastened by these projects over the past three years, which has given needed stability to his new industry. Harvests of oysters from private oyster ground have increased significantly over the past three years due partly to the success of this project.

V. CRAB POT AND PEELER POT LICENSE BUY OUT PROGRAM

The Crab License Buy-Back Program was initiated and completed in 2009, in order to reduce the overcapacity in the crab pot and peeler pot fisheries. In total, 75,441 crab pots or peeler pots and 359 crab licenses were purchased and removed from future fisheries. Overcapacity remains an issue in the crab fisheries.

VI. UPDATE OF BLUE CRAB STOCK ASSESSMENT

In 2011, an analytical stock assessment of the blue crab was completed. The previous complete stock assessment was available to Chesapeake Bay jurisdictions in 2005. 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 the Marine Resource's Commission, the Maryland Department of Natural Resources, 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.

The 2011 blue crab stock assessment provided new and more conservative reference points for crab abundance and exploitation rate, which replaced the interim reference points established in 2005. The 2011 stock assessment control rule differs from its interim predecessor in that the reference points are based on the biological status of female crabs, instead of both sexes combined.

A summary of the improvements associated with the 2011 Stock Assessment of the Blue Crab in Chesapeake Bay follows:

- Uses the latest available data
- Uses more recent life history and vital rates (growth rates, age and size at maturity, mortality, fecundity)
- Provides sex-specific reference points
- Model is able to replicate time series of total catch, sex-specific catch, and sex-specific abundances for the Bay-wide Dredge Survey, the VIMS trawl survey, and the Maryland trawl survey

- Avoids use of empirically-derived reference points
- Incorporates use of MSY (Maximum Sustainable Yield). This is the largest average catch or yield that can continuously be taken from a stock under existing environmental conditions
- Accounts for inefficiency of dredge catch of age-0 crabs

The table below lists the abundance and exploitation rate targets and thresholds that managers are now using to monitor the health of the blue crab stock in the Bay.

2011 stock assessment - biological reference points		
Abundance	Overfished	70 million age-1+ female crabs
	Target	215 million age-1+ female crabs
Exploitation rate	Overfishing	34% of all female crabs
	Target	25.5% of all female crabs

Managers and scientists expect the 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 aggressive measures would be taken to protect the blue crab stock.

ATTACHMENT I. 2012 Chesapeake Bay Blue Crab Advisory Report

2012 Chesapeake Bay Blue Crab Advisory Report
CBSAC Meeting Date: June 19th, 2012
Report Approved by the Fisheries Goal Implementation Team: July 20th, 2012

1. INTRODUCTION

1.1 Background

The Chesapeake Bay Stock Assessment Committee combines the expertise of scientists from the Chesapeake Bay region with that of Federal fisheries scientists from the National Marine Fisheries Service Northeast and Southeast Fisheries Science Centers. Since 1997, this group meets each year to review the results of annual Chesapeake Bay blue crab surveys, harvest data, and to develop management advice for Chesapeake Bay jurisdictions: Maryland, Virginia, and the Potomac River Fisheries Commission (PRFC).

Benchmark stock assessments of the Chesapeake Bay blue crab have been conducted every 3-7 years since 1992. 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). This assessment generated new reference points for the female component of the blue crab population. The maximum sustainable yield (MSY) based female reference points were recommended as replacements for the previous reference points which used combined data for both sexes. The new assessment recommended revision of the overfishing reference points which had been based on maximum spawning potential (MSP), with an exploitation fraction reference point based on MSY (Table 1). Similarly, the 2011 stock assessment recommended replacing the empirically-estimated overfished age 1+ (both sexes) abundance threshold and interim 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 the Bay Program's Sustainable Fisheries Goal Implementation Team (SFGIT) in December of 2011 and are currently implemented in all management jurisdictions. Organized by the Chesapeake Bay Program and Chaired by the NOAA Chesapeake Bay Office, the SFGIT is led by an executive committee made up of senior fisheries managers from the MD DNR, VMRC, PRFC, the Atlantic States Marine Fisheries Commission (ASMFC), and the District Department of the Environment (DC DOE). The full team is made up of scientists, managers, stakeholders and non-profit organizations who share a common goal of advancing ecosystem-based fisheries management through science based management decisions that cross jurisdictional boundaries.

As the winter dredge survey (WDS) is the most comprehensive and statistically robust of the blue crab surveys conducted in the Bay[2], CBSAC has adopted the WDS as the primary indicator of blue crab population health. The WDS measures the density of

crabs (number per 1,000 square meters) at approximately 1,500 sites around the Bay (Figure 1). The measured densities of crabs are adjusted to account for the efficacy of the sampling gear and are then expanded to reflect the area of Chesapeake Bay, providing an annual estimate of the number of over-wintering crabs by age and sex[2].

1.2 Background: Previous and Current Management Framework

A comparison of the current female-specific and previous (both sexes combined) biological reference points for Chesapeake Bay blue crab fishery is presented in Table 1. The exploitation fraction is the percentage of all crabs removed from the population by commercial and recreational fisheries. Under the current framework, annual estimates of exploitation fraction are calculated as the annual harvest of female crabs divided by the total number of female crabs (age 0+) estimated in the population at the start of the season. Population estimates are derived from the winter dredge survey each year. The 2012 exploitation fraction cannot be calculated until the completion of the 2012 fishery and estimation of harvest and is therefore listed as *TBA*. Management seeks to control the fishery such that the overfishing threshold is not exceeded, resulting in a larger number of crabs than required by the overfished threshold. Ideally, the fishery should operate to meet target values to maintain sustainability. Stock status levels that do not exceed threshold values are shown in green.

2. CONTROL RULES

2.1 Control Rule from 2011 Benchmark Assessment

The 2011 Benchmark assessment recommended a new framework (control rule) based on biological reference points for the female component of the population (Figure 2). The application of a control rule framework to management of the blue crab fisheries was first adopted by the Bi-State Blue Crab Advisory Committee in 2001[7.] The current female-specific targets and thresholds were developed using the MSY concept. F_{MSY} or U_{MSY} is defined as the level of fishing that achieves the largest average catch that can be sustained over time without risking stock collapse. Following federal guidelines, the 2011 assessment recommended a target exploitation level that was associated with 75% of F_{MSY} and a threshold exploitation level set equal to F_{MSY}. The female-specific, age 1+ abundance target and threshold were set accordingly at abundance levels associated with fishing levels at 75% N_{MSY} (target) and 50% N_{MSY} (threshold). Annual exploitation was calculated as the number of female crabs removed by the fisheries divided by the total number of age-0+ female crabs estimated to be in the Bay at the beginning of the fishing season. Within this calculation, the juvenile component of the total estimated number of crabs was scaled up by a factor of 2.5 to achieve the best fits of the model to the observed data.

3. POPULATION SIZE (ABUNDANCE)

3.1 Spawning-age Female Crabs: Current Reference Points

The 2011 benchmark assessment recommended establishing a threshold number of 70 million female spawning-age crabs and replacing the interim target of 200 million male and female spawning-age crabs with a target of 215 million female spawning-age crabs. Approximately 97 million female age 1+ crabs were estimated to be present in the Bay at the start of the 2012 crabbing season. This number is below the recommended target but still above the new threshold (Figure 3). The 2012 estimate of female age 1+ crabs represented a significant drop from the over-wintering population of 190 million in 2011. However, the 2012 estimate is within the range of values observed for the 13 year period prior to implementation of the female-specific regulations being put in place. Although the 2012 estimate represents the median of the 22 year time series, the estimated 97 million female age 1+ crabs is below the 23 year average of 117 million age 1+ female crabs.

3.2 Age 1+ Male and Age 0 Crabs

In 2012, the number of age 1+ male crabs (greater than 60 mm or 2.4 inches carapace width) estimated to be present in the Bay was approximately 83 million crabs (Figure 4). This represents a 32% increase from male abundance in 2011 and is slightly below the survey average of 87 million crabs. Recruitment, as measured by the number of age 0 crabs (less than 60 mm or 2.4 inches carapace width), increased from 207 million in 2011 to 587 million in 2012 (Figure 5). This was the largest recruitment event recorded in the 22 years of the WDS.

4. HARVEST

4.1 2011 Commercial and Recreational Harvest

The 2011 Maryland commercial crab harvest from the Bay and its tributaries was estimated as 35.3 million pounds. The 2011 commercial harvest in Virginia was reported to be 28.4 million pounds, and 3.5 million pounds were reported to have been harvested from the jurisdictional waters of the Potomac River Fisheries Commission (Figure 6). Maryland's 2011 commercial harvest declined 34% from 2010. Commercial harvest in Virginia increased by 6% and declined by 22% in the Potomac River. Figure 7 shows levels of commercial harvest of male and female crabs by jurisdiction relative to male and female exploitable stock as estimated by the WDS (Table 2).

Prior to 2008, recreational harvest had been assumed to be 8% of the total Bay wide commercial harvest.[3,4,5] 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 male harvest in those jurisdictions. Therefore, 2011 Bay-wide recreational harvest was estimated to be 4.4 million pounds. Combining these categories, approximately 71.6 million pounds were harvested from Chesapeake Bay and its tributaries during the 2011 crabbing season. Despite decreasing by almost 20 million lbs, the 2011 Bay-wide harvest was the second highest since 1999.

Based on continued evidence of inflated harvest reports, Maryland's 2011 commercial harvest was estimated from fishery-independent data sources including the Maryland commercial reference fleet and an annual survey of crab pot effort in the Maryland portion of Chesapeake Bay[6]. Maryland's 2011 reported commercial harvest of 48.7 million pounds was 38% higher than the estimated harvest.

4.2 Exploitation Fraction: Recommended and Current Reference Points.

While the 2011 commercial female harvest remained nearly the same as the 2010 harvest, the over-wintering population of females dropped by 35%. Despite the decline in exploitable stock, the percentage of crabs removed by fishing (exploitation fraction) of female crabs in 2011 was approximately 25% compared to the recommended target of 25.5% and below the threshold of 34% (Figure 8).

When considering the previous reference points, the percentage of crabs removed by fishing (exploitation fraction) was approximately 45%, which was at the current target of 46% and below the previous threshold of 53% (Figure 9).

5. STOCK STATUS

The Chesapeake Bay blue crab stock is currently **not overfished** and **overfishing is not occurring**. These conclusions remain true even under the previous control rule framework using both sexes. Thus, the conclusion that the Chesapeake Bay blue crab fishery is operating sustainably is not only a reflection of the revised 2011 control rule, but is supported by both current and previous management frameworks. Abundance, harvest, and exploitation of all crabs are summarized in Table 3.

6. MANAGEMENT ADVICE-SHORT TERM

6.1) Monitor fishery performance and stock status relative to recommended reference points before adjusting regulations:

The female exploitation fraction in 2011 was below the recommended target of 25.5% for the 4th consecutive year. Management jurisdictions should carefully consider the performance of 2012 fisheries relative to the recommended female-specific reference points and the outcome of the 2011-2012 winter dredge survey before making regulatory decisions. The CBSAC notes that, despite record high recruitment in 2012, the abundance of adult female crabs has declined substantially over the past two years. As a result, the late-season 2012 and 2013 fisheries will depend heavily on the strong 2012 year class. Therefore, CBSAC recommends that jurisdictions exercise caution when considering management scenarios that may disproportionately impact the 2012 year class. If recruitment, as measured in the 2013 dredge survey, is low compared to the survey time series, the 2013 fishery will be primarily dependent on the 2013 year class and jurisdictions may need to adjust management to ensure that harvest is adequately constrained relative to abundance.

6.2) Catch Reports:

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

6.3) Recreational Catch and Effort:

Recreational catch and effort remains poorly quantified in Chesapeake Bay. The jurisdictions should continue to develop and evaluate methods for more precisely calculating recreational catch and effort, possibly through licensing systems. In March 2011, the benchmark stock assessment underwent rigorous peer review by international stock assessment scientists representing the Center for Independent Experts (CIE). All three reviewers identified improving estimates of recreational catch as a priority. Thus CBSAC formally recommends that each jurisdiction renew efforts to quantify recreational catch and effort

7. MANAGEMENT ADVICE- LONG TERM

7.1) Catch Control:

A management strategy that sets annual catch levels based on estimates of abundance from the WDS and that potentially accounts for sex-specific seasonal distribution of crabs, could potentially balance annual harvests with highly variable recruitment. The CBSAC recommends that jurisdictions evaluate the benefits of quota-based management systems. Allocating annual quotas to each jurisdiction would improve performance of a Bay-wide quota and lead to jurisdictional accountability of harvest relative to the Bay-wide exploitation target.

7.2) Effort Control:

The blue crab fishery is currently managed under effort control with limited entry, size limits, catch limits and seasonal closures as the principal tools. However, the amount of effort expended in the fishery remains poorly quantified. CBSAC recommends an increased investment in bay wide effort monitoring that should include actions in all jurisdictions to implement a pot marking scheme and a bay wide survey of crab pot effort to estimate the total, spatial, and temporal patterns of the crab pot fishery.

7.3) Latent effort:

In both states, significant numbers of commercial crabbing licenses are unused. An increase in the blue crab population may increase the use of licenses that have, for some time, been inactive. During 2009 and 2010, both Maryland and Virginia have made headway addressing the amount of latent effort in the blue crab fishery with both states

using Federal fishery disaster relief money to buy back commercial licenses. CBSAC recommends that continued efforts be made to estimate and monitor the level and possible re-entry of latent effort into the fishery. In addition to increases in latent effort, CBSAC also recognizes that temporal and seasonal shifts in estimated blue crab abundance may alter existing effort exerted by active licenses. The impact of inherent variability of blue crab abundance on both latent and active effort should be investigated and better understood as a part of this recommendation.

8. CRITICAL DATA AND ANALYSIS NEEDS

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

CBSAC Members:

Lynn Fegley (Chair)	Maryland Department of Natural Resources
Derek Orner	NOAA Chesapeake Bay Office
Tom Miller	UMCES, Chesapeake Biological Laboratory
Daniel Hennen	NMFS, Northeast Fisheries Science Center
Alexei Sharov	Maryland Department of Natural Resources
Rob O'Reilly	Virginia Marine Resource Commission
John Hoenig	Virginia Institute of Marine Science
Rom Lipcius	Virginia Institute of Marine Science
Amy Schueller	NMFS, Southeast Fisheries Science Center
Eric Johnson	University of North Florida

Other Attendees:

Glenn Davis	Maryland Department of Natural Resources
Allison Watts	Virginia Marine Resources Commission
Andrew Turner	NOAA Chesapeake Bay Office
Adam Davis	NOAA Chesapeake Bay Office

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Table 1.

		Target	Threshold	2010 Stock Status	2011 Stock Status	2012 Stock Status
Overfishing: Exploitation Fraction (% of market size crabs harvested)	Current, Female-specific	25.5%	34%	18%	25%	*TBA*
	Previous, Sexes Combined	46%	53%	39%	45%	*TBA*
Overfished: Abundance (millions of crabs)	Current, Female-Specific	215	70	251	190	97
	Previous, Sexes Combined	200	86	315	254	178

Table 2. Comparison of how market category composition has changed in the commercial harvest since female-specific regulations took effect. The aggregated proportions are also compared to the most recent, 2011, harvest composition.

2008-09

	Male	Female	Peeler	Total
MD	0.31	0.20	0.05	0.55
VA	0.11	0.25	0.03	0.39
PR	0.03	0.02	0.00	0.05
Bay	0.45	0.47	0.08	1.00

2008-10

	Male	Female	Peeler	Total
MD	0.41	0.16	0.03	0.60
VA	0.12	0.22	0.01	0.35
PR	0.03	0.02	0.00	0.05
Bay	0.57	0.39	0.05	1.00

2008-11

	M	F	P	Total
MD	0.32	0.19	0.05	0.56
VA	0.11	0.26	0.02	0.39
PR	0.03	0.02	0.00	0.05
Bay	0.46	0.46	0.07	1.00

2011

	Male	Female	Peeler	Total
MD	0.35	0.15	0.03	0.53
VA	0.13	0.28	0.01	0.42
PR	0.04	0.01	0.00	0.05
Bay	0.52	0.44	0.04	1.00

Table 3. Estimated abundance of blue crabs from the Chesapeake Bay-wide winter dredge survey, annual commercial harvest, and removal rate of all crabs.

Survey Year (Year Survey Ended)	Total Number of Crabs (All Ages)[1]	Number of Age-0 Crabs[1]	Number of Spawning-Age Crabs[1]	Number of spawning-age FEMALE crabs[1]	Bay-wide Commercial Harvest (Pounds)[1]	Percentage of Crabs Removed
1990	791	463	276	117	96	42
1991	828	356	457	227	90	38
1992	367	105	251	167	53	54
1993	852	503	347	177	107	44
1994	487	295	190	102	77	57
1995	487	300	183	80	72	56
1996	661	476	146	81	69	41
1997	678	512	165	96	77	45
1998	353	166	187	108	56	64
1999	308	223	86	56	62	79
2000	281	135	146	107	49	69
2001	254	156	101	58	47	71
2002	315	194	121	56	50	59
2003	334	172	171	86	47	51
2004	268	146	124	84	47	72
2005	396	247	158	112	58	47
2006	311	199	121	87	54	54
2007	249	114	141	90	49	56
2008	291	169	131	92	43	48
2009	393	173	223	165	55	43
2010	658	345	315	251	91	43
2011	460	207	254	190		
2012	765	587	178	97		

[1] All values are in millions.

[2] Virginia Shellfish Aquaculture Situation and Outlook Report – Results of 2011 Virginia Shellfish

Figure 1. Winter dredge survey index of total blue crab abundance (density of males and females, all sizes combined) in Chesapeake Bay, 1990 through 2012. Error bars represent 95% confidence intervals.

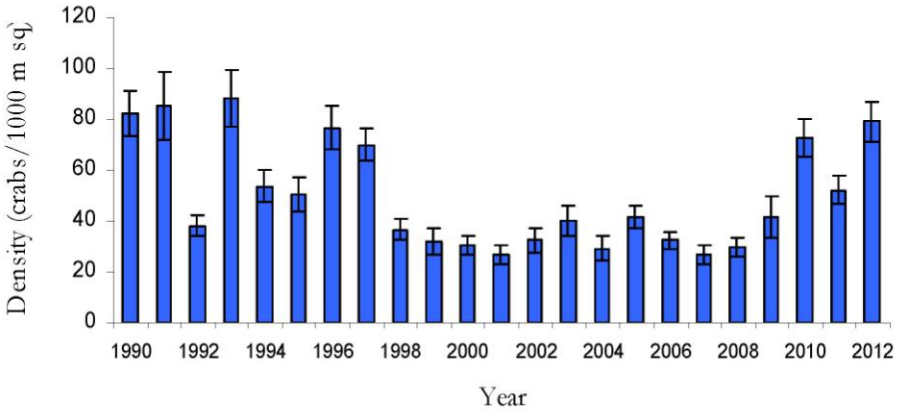


Figure 2. The female-specific control rule for the Chesapeake Bay blue crab fishery. In 2011, abundance was below the overfished target, while the exploitation rate was below the overfishing target. Reference points were derived from a statistical assessment model incorporating multiple surveys. Please see text for explanation of terms.

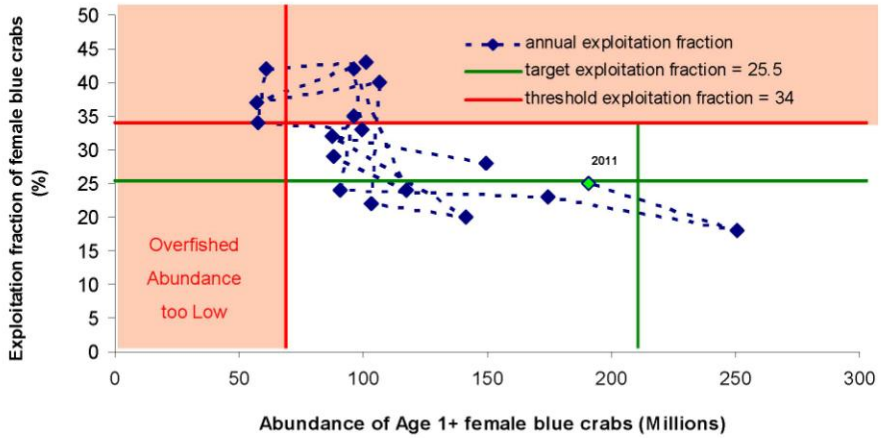


Figure 3. Winter dredge survey estimate of **abundance of female blue crabs age one year and older** (age 1+) 1990-2012 with female-specific reference points. These are female crabs measuring greater than 60mm across the carapace and are considered the 'exploitable stock' that will spawn within the coming year.

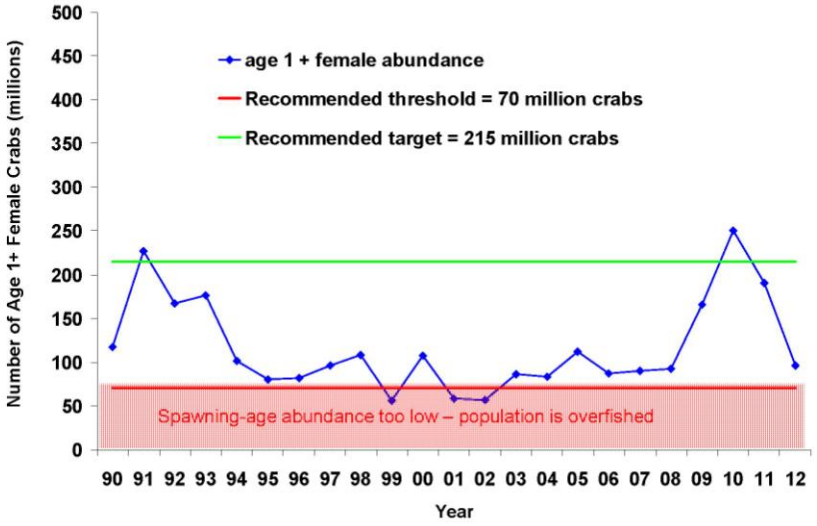


Figure 4. Winter dredge survey estimate of **abundance of male blue crabs age one year and older (age 1+)** 1990-2012. These are male crabs measuring greater than than 60mm across the carapace and are considered the 'exploitable stock' that will spawn within the coming year.

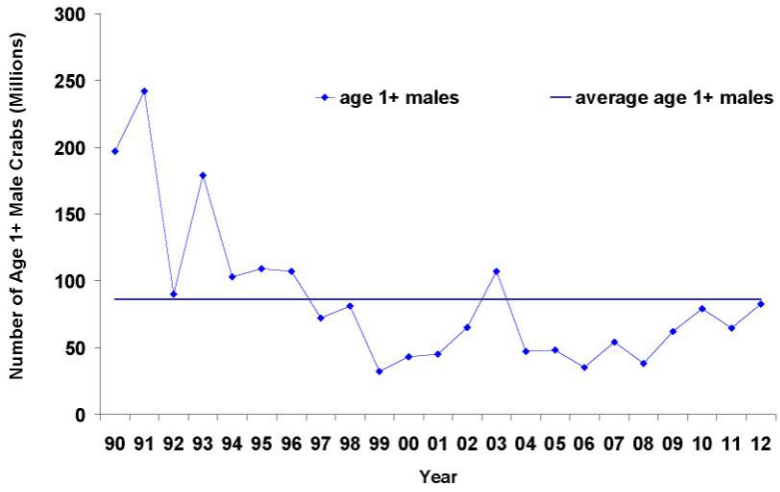


Figure 5. Winter dredge survey estimate of **abundance of juvenile blue crabs (age 0)**, 1990-2012. These are male and female crabs measuring less than 60mm across the carapace.

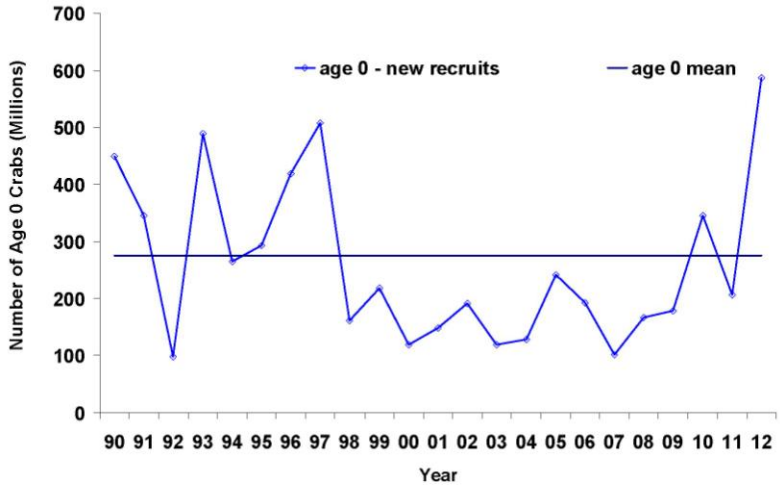


Figure 6. Maryland and Virginia Chesapeake Bay commercial blue crab harvest in millions of pounds, 1993-2011.

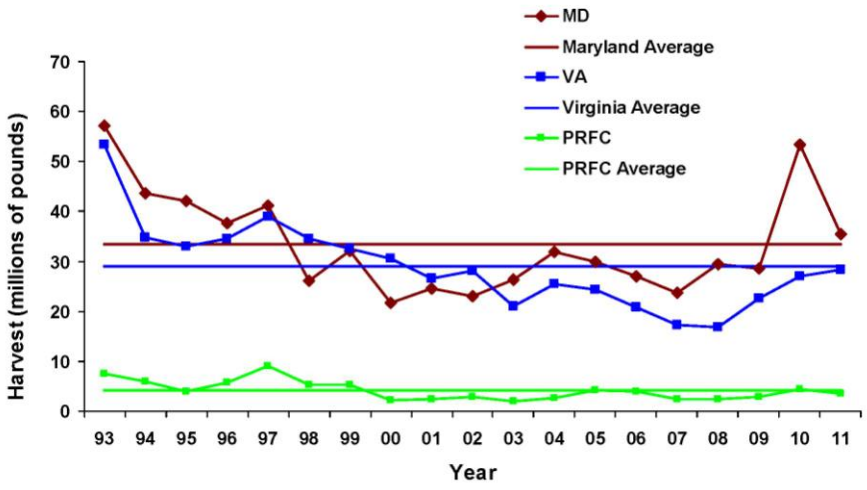


Figure 7. Trends in Bay-wide male and female blue crab abundance and male and female commercial harvest within Maryland and Virginia since the implementation of female-specific regulations.

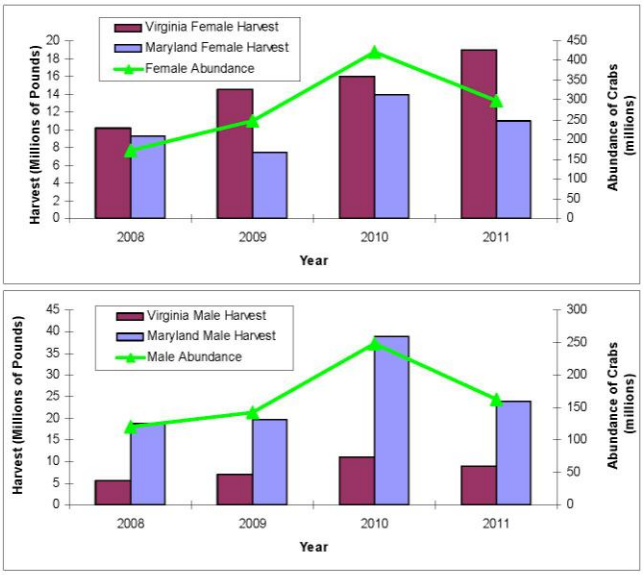


Figure 8. The percentage of female crabs removed from the population each year by fishing relative to the female-specific target and threshold levels 1990 through 2011.

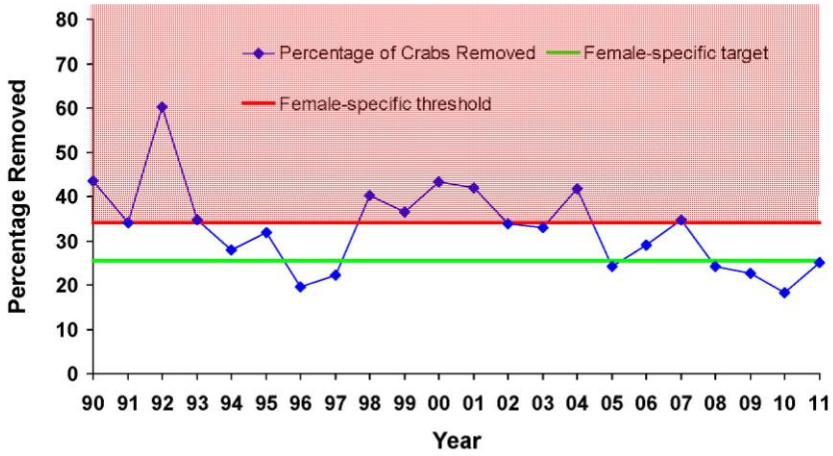
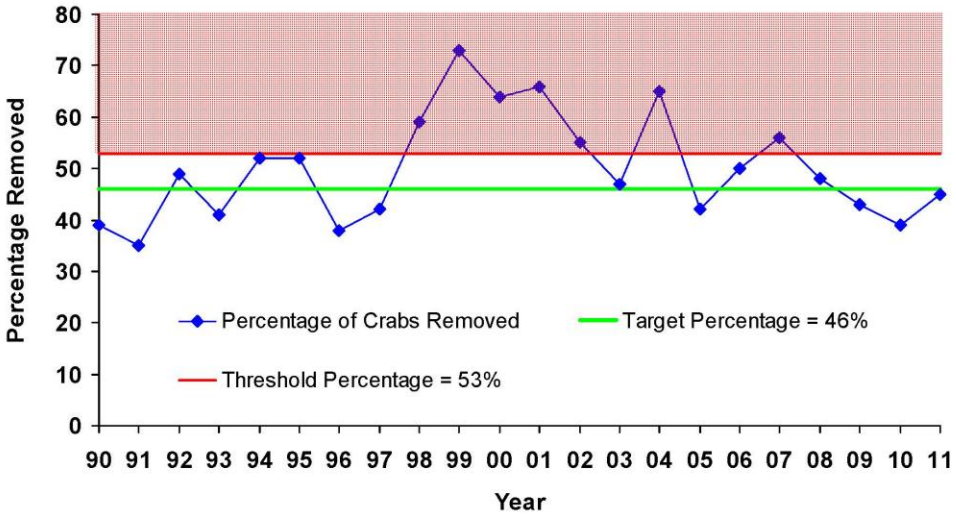


Figure 9. The percentage of male and female crabs removed from the population each year by fishing relative to previously used target and threshold levels 1990 through 2011.



ATTACHMENT II. Virginia Marine Resources Commission: 21-Point Blue Crab Management Plan (1994-2007) and Actions to Promote Rebuilding of Chesapeake Bay Blue Crab Stock (2008-2012)

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).

ACTIONS TO PROMOTE REBUILDING OF CHESAPEAKE BYA BLUE CRAB STOCK (2008 – 2012)

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)
- regulation tolerance of 10 per bushel (Previously March 17 – July 15)

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 Albermarle and Currituck watersheds to crab pots and peeler pots only

ATTACHMENT III. Derelict Blue Crab Trap and Marine Debris Location and Removal

Final Report
October 2012

Derelict Blue Crab Trap & Marine Debris Location and Removal
Grant #: NA09NMF4520027
Virginia Institute of Marine Science
Center for Coastal Resources Management
Kirk Havens, Donna Marie Bilkovic, David Stanhope, Kory Angstadt

Project Summary

Discarded debris such as tires, gill nets, appliances, and crab pots can be found throughout the tidal waters of Virginia. Derelict crab pots may remain in the environment for years and continue to capture and kill fish, shellfish, birds and marine mammals including endangered or threatened species (Guillory 1993, Guillory et al. 2001, Havens et al. 2008, and see NOAA Marine Debris Program website: http://marinedebris.noaa.gov/). It is estimated that around 20% of crab pots deployed are lost each season and each functional lost crab pot can continue to capture about a bushel of market-sized crabs per season (Havens et al. 2008).

There is an environmental benefit in removing marine debris from Virginia's waters if the removal can be accomplished safely and without damaging the marine habitat and ecosystem. This project includes work specifically aimed at removing marine debris from Virginia's tidal waters with the assistance of watermen. Watermen who would have been eligible to participate in the 2008/2009, 2009/2010, 2010/2011, and 2011/2012 winter crab dredge season (the fishery season was closed by VMRC) were invited to participate in the program. A total of 70 watermen participated in the program. The fourth year of the program was an abbreviated year with a total of 24 days of removal effort (compared to approx 49 days during the past 3 years). The on-the-water location and removal portion of the project took place from December 2011 through March 2012. Data quality assurance and analysis began in December 2011 and will be conducted through October 2012.

Summary of Activities

During the abbreviated fourth year of Marine Debris Location and Removal Program (Dec 2011-Mar 2012), a total of seventy participants surveyed the Virginia portion of the Chesapeake Bay. The participants recorded the by-catch associated with the over 4,215 derelict crab pots that were removed. For detailed information, including training instruction and specific maps showing the location of all removed items and the associated by-catch to date visit http://ccrm.vims.edu/marine_debris_removal/

Accomplishments/Problems

4,385 items were removed (96 % were crab, peeler, or eel pots) during the abbreviated 2011-2012 season. The four year total of debris removed is over 34,000 items. Of the over 32,000 pots removed, 11% were peeler pots (Figure 1). In addition, in the four years over 30,000 animals (mostly blue crabs but also including ducks, fish, muskrats, and turtles) were documented in the recovered derelict pots (Figure 2). A post activity survey was conducted with participants that identified some potential changes in the program.

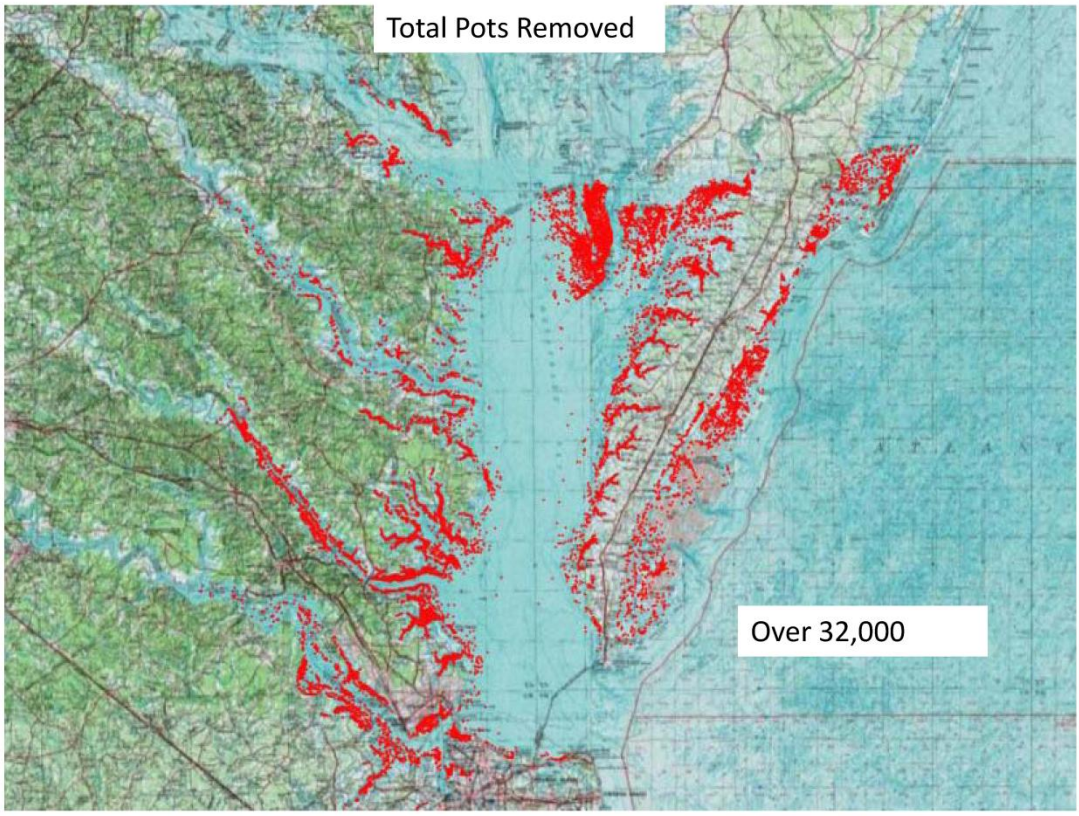
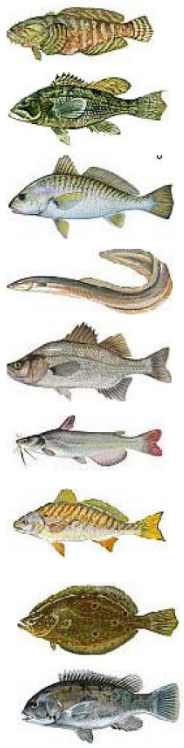


Figure 1. Derelict blue crab pots recovered – red dots.



FISH - Bycatch	ABUNDANCE	% of TOTAL	Cumulative %
OYSTER TOADFISH	3348	66.8	66.8
BLACK SEABASS	415	8.3	75.1
ATLANTIC CROAKER	313	6.2	81.3
AMERICAN EEL	184	3.7	85.0
WHITE PERCH	174	3.5	88.5
CATFISH SPP	171	3.4	91.9
SPOT	93	1.9	93.7
FLOUNDER	52	1.0	94.8
TAUTOG	52	1.0	95.8
MINNOW	47	0.9	96.7
UNKNOWN FISH	43	0.9	97.6
SHEEPSHEAD	29	0.6	98.2
STRIPED BASS	24	0.5	98.7
PIGFISH	19	0.4	99.0
ATLANTIC SPADEFISH	6	0.1	99.2
REDDRUM	6	0.1	99.3
STARGAZER	5	0.1	99.4
MULLET	4	0.1	99.5
PUFFERFISH	4	0.1	99.5
BUTTERFISH	3	0.1	99.6
ATLANTIC MENHADEN	2	0.0	99.6
HOGCHOKER	2	0.0	99.7
BLACK DRUM	2	0.0	99.7
SOLE	2	0.0	99.8
STRIPED BURRFISH	2	0.0	99.8
BOWFIN	1	0.0	99.8
CUNNER	1	0.0	99.8
PORGY SPP	1	0.0	99.9
SCUP	1	0.0	99.9
BLUEFISH	1	0.0	99.9
FEATHER BLENNY	1	0.0	99.9
PINFISH	1	0.0	99.9
SHAD	1	0.0	100.0
SPADEFISH	1	0.0	100.0
STRIPED KILLIFISH	1	0.0	100.0

9 species groups made up >95% of catch

Oyster toadfish
Black Sea Bass
Atlantic croaker
America eel
White perch
Catfish
Spot
Flounder
Tautog

5,012 fish bycatch

Figure 2. Fish bycatch recorded in derelict blue crab pots.

Participant survey results for 2008-2009, 2010-2011, and 2011-2012 are available on the website. In the 2011-2012, 70% of the participants responded to the post-activity survey and 50% remarked that they would change nothing while 50% made suggestions for the next year. The suggested modifications were 1) provide more days (37%), 2) remove nonproductive participants (8%), 3) make program permanent (4%), and 4) provide more money for crew mates (2%). When asked what they liked about the program, 59% responded they needed the work during the hard winter months and 51% expressed the importance of helping "clean the bay". In addition, when asked how many crab pots the participants lose annually in their commercial operation, the average over three years was 19.3 %. For additional information see Havens et al. (2011), *Fishery failure, unemployed commercial fishers, and lost blue crab pots: An unexpected success story*, **Environmental Science & Policy 14: 445-450**.

In addition, participants collected data on oysters attached to derelict crab pots and since the information is geo-referenced a spatially explicit map of crab pots with significant oyster growth was produced. This has implications in oyster reef restoration efforts (Figure 3).

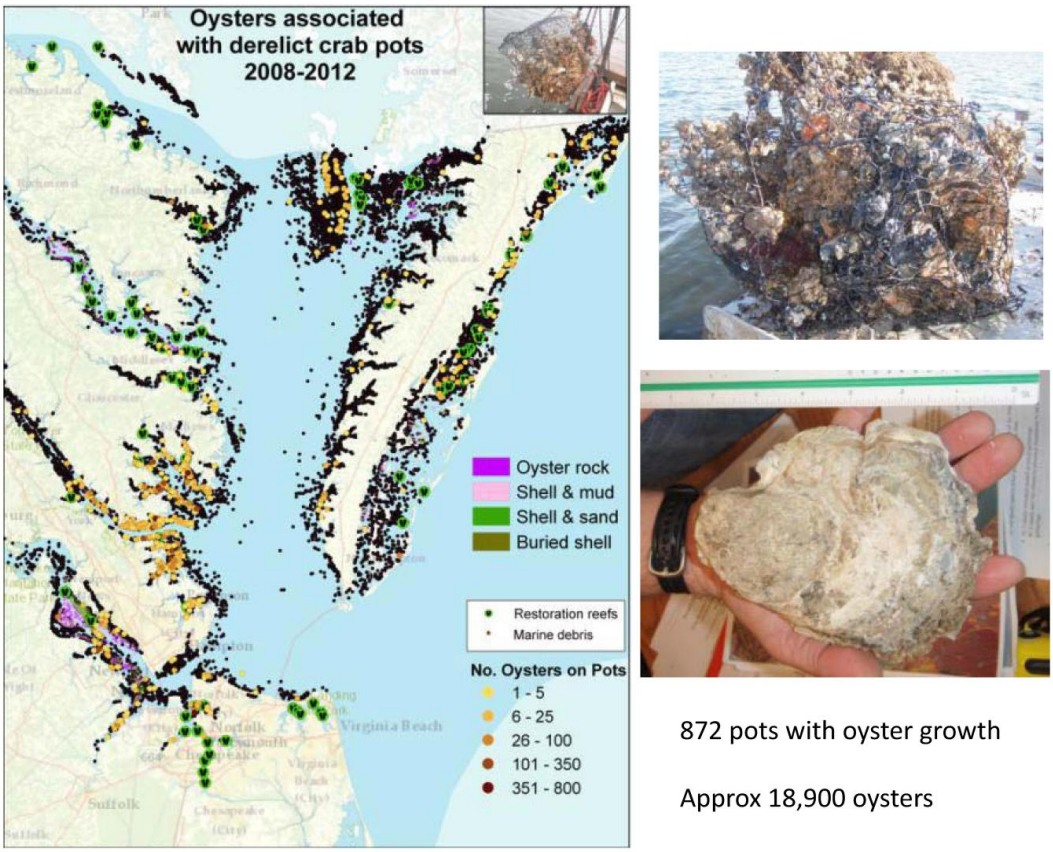


Figure 3. Derelict crab pots (n = 872) with oyster growth equaling approximate 18,900 oysters.

Invited talks on Marine Debris Location & Removal Program during reporting period.
May 23, 2012. Science under Sail
May 19, 2012. Virginia Institute of Marine Science, Marine Science Day
April 26, 2012. Healthy Bay for Healthy Kids: Cooking with the First Lady
February 28-29, 2012. New England Derelict Fishing Gear Workshop, NOAA/NFWF, Portland, ME
February 1, 2012. Virginia Sea Grant Symposium

Press Coverage
Governor McDonnell (VA) selected program for Earth Day press conference highlighting the program was conducted by the Virginia Marine Resources Commission, the Virginia Institute of Marine Science, and the Virginia Secretary of Natural Resources on April 22, 2011. Notable speakers and attendees included:

Hon. Doug Domenech, Virginia Secretary of Natural Resources.
Hon. Harvey Morgan, Delegate, Virginia House, Chair, Virginia House Committee on Agriculture, Chesapeake, and Natural Resources.
Steve Bowman, Commissioner of the Virginia Marine Resources Commission.
John Wells, Dean and Director of the Virginia Institute of Marine Science.
Hon. Rob Wittman, US House of Representatives.
David Kennedy, NOAA NOS Asst. Administrator.

For additional information see:
http://www.vims.edu/newsandevents/topstories/ghost_pots_2011.php

Other Selected Press Coverage
NBC Nightly News with Brian Williams
http://ccrm.vims.edu/marine_debris_removal/press/nbc_video_page.html
A healthy Bay for Healthy Kids: Cooking with the First Lady
http://www.vims.edu/newsandevents/topstories/healthybay_healthykids.php
Washington Post
http://www.washingtonpost.com/national/health-science/ghosts-haunt-creatures-on-bays-bottom/2011/12/12/gIQAjbexUP_story.html
Testimony of Dr. Holly Bamford, NOAA Deputy Asst. Administrator
http://naturalresources.house.gov/UploadedFiles/BamfordTestimony12.15.11.pdf

Information requests regarding program/partnerships
VIMS received information requests regarding the Program removal activities and biodegradable panel research from 10 States as well as the United Kingdom and the Sultanate of Oman.

Partnerships on Recently Submitted Proposals
Removal of lost and abandoned blue crab pots from Virginia Chesapeake Bay hotspots. Partnership with Virginia Watermen's Association. Submitted to the National Fish and Wildlife Foundation.

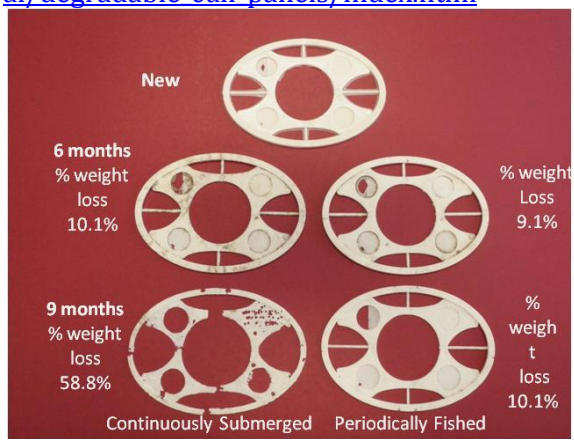
Testing biodegradable panels and ferrous metal "O" rings for lobster pots in Maine & Massachusetts. Partnership with the Massachusetts Lobstermen's Association, NOAA Woods Hole Sea Grant, Woods Hole Oceanographic Institution, and the Gulf of Maine Lobster Foundation. Submitted to the National Fish and Wildlife Foundation.

Biodegradable panels to reduce bycatch entrapment in derelict traps in Florida's Spiny Lobster, blue crab, and stone crab fisheries. Partnership with the Florida Keys Commercial Fishermen's Association, the Florida Fish and Wildlife Conservation Commission, and NOAA/NMFS/Southeast Fisheries Science Center. Submitted to National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Cooperative Research Program,

Reducing trap mortality for targeted and bycatch species in multiple fisheries using fully biodegradable panels and components. Partnership with Gulf of Maine Lobster Foundation, Woods Hole Sea Grant/Woods Hole Oceanographic Institution, Florida Fish and Wildlife Conservation Commission, National Marine Fisheries Service, NOAA, Auke Bay Laboratory, Alaska Fisheries Science Center, Virginia Watermen's Association, North Carolina Sea Grant, NC State University, Florida Fish and Wildlife Conservation Commission. Submitted to NOAA/NMFS Bycatch Reduction Engineering Program.

Synergistic activities
The Program has enabled subsequent NOAA Sea Grant and NOAA/National Fish & Wildlife Foundation funded projects to hire watermen during the crabbing season to test inexpensive, easy to install, and fully biodegradable panels in crab pots to provide a mechanism for escape of animals caught in lost or abandoned pots (Figure 4) (see Bilkovic

et al., 2012, *The use of fully biodegradable panels to reduce derelict pot threats to marine fauna*, Conservation Biology).
http://ccrm.vims.edu/marine_debris_removal/degradable_cull_panels/index.html




Example of a biodegradable panel inserted into a crab pot.

Figure 4. Fully biodegradable panels for blue crab pots.

The Virginia Institute of Marine Science received additional funding from the Commonwealth Research Commercialization Fund to study biodegradable panels or components for lobster, stone crab, and Dungeness crab traps.

In addition, the ability to mark the coordinates of recovered pots has allowed for detailed information on the affect of derelict pots on terrapin populations and facilitate research on a model to reduce blue crab commercial fishing and terrapin population interactions (http://ccrm.vims.edu/research/mapping_surveying/terrapin/index.html).

The Program also collaborated with NOAA Virginia SeaGrant to produce a Bridge data series **Ghostbusting in the Chesapeake:** *Rounding Up Derelict Fishing Gear* for grades 6-12. The Bridge is a growing collection of the best marine education resources available on-line. It provides educators with a convenient source of accurate and useful information on global, national, and regional marine science topics, and gives researchers a contact point for educational outreach. Resources are organized as indicated on the sidebar on the left side of the screen.
http://www2.vims.edu/bridge/DATA.cfm?Bridge_Location=archive1010.html

Publications resulting from Program

Bilkovic, D., K.J. Havens, D. Stanhope, and K. Angstadt. 2012. The use of biodegradable cull ring panels to reduce derelict crab pot threats to marine fauna. Conservation Biology. DOI: 10.1111/j.1523-1739.2012.01939.x.

Havens, K.J., D. Bilkovic, D. Stanhope, and K. Angstadt. 2011. Fishery Failure, Unemployed Commercial Fishers, and Lost Blue Crab Pots: An Unexpected Success Story. Environmental Science and Policy 14(4): 445-450.

Havens, K.J., D. Bilkovic, D. Stanhope, and K. Angstadt. 2009. Location, location, location: the importance of cull ring placement in blue crab traps. Transactions of the American Fisheries Society 138:720–724.

Havens, K.J., D.M. Bilkovic, D. Stanhope, K. Angstadt, and C. Hershner. 2008. The effects of derelict blue crab traps on marine organisms in the lower York River, Virginia North American Journal of Fisheries Management 28(4):1194-1200.

ATTACHMENT IV. Cull Ring and Terrapin Excluder Device Project

BLUE CRAB DISASTER RELIEF PROJECT PROGRESS REPORT

Romuald N. Lipcius[a,c] and Danielle McCulloch[b,c]

11 June 2012

a. Principal Investigator

b. Marine Scientist

c. Virginia Institute of Marine Science
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Gloucester Point, VA 23062 USA

WILLIAM & MARY
VIMS
VIRGINIA INSTITUTE OF MARINE SCIENCE
SCHOOL OF MARINE SCIENCE

Contents

1 Cull-ring and BRD Study, Fall 2009

1.1 Purpose

The goals of this study were to employ Virginia's watermen (1) to investigate the effects of different cull-ring sizes in crab pots on blue crab catch, biomass, and survival, and (2) to determine the effects of bycatch reduction devices (BRDs) in crab pots on blue crab catch, finfish bycatch, and diamondback terrapin bycatch.

1.2 Sites

This study began in September 2009, and was conducted at 16 sites:

Upriver and downriver of the Potomac, Rappahannock, York, and James Rivers

4 sites on the Eastern Shore (Chincoteague, Saxis, Quinby Bay, Harborton)

2 sites in Tangier (Pocomoke and Tangier Sounds)

2 sites in Lynnhaven Bay (eastern and western branches)

A local waterman in each area was hired to bait and pull the 24 experimental crab pots and measure all crabs caught. Each waterman was paid $225 per data set (cost covered fuel, bait, pot line, labor) and compensated $225 for pot pick-up and drop-off.

1.3 Methods

Each crabber was required to disperse the experimental pots randomly within their lines of crab pots. They were required to bait the pots, and then pull them within 48 hours. After a pot was pulled, they measured the carapace width of each crab (from spine to spine), determined each crab's sex, and noted overall condition. They also recorded all bycatch species caught in each pot. Data were collected for a total of 10 days, providing us with 10 data sets for each site.

There were 6 different treatments. Each set of 24 experimental pots included 4 pots of each treatment. A different color float was used to designate treatment type for each pot:

4 pots without any cull rings (blue)

4 pots with 2 7/16" cull rings (white)

4 pots with 2 3/8" cull rings (green)

4 pots with 2 5/6" cull rings (red)

4 pots with 2 3/16" cull rings (pink)

4 pots with 2 3/8" cull rings and orange BRDs (orange)

VIMS staff accompanied each crabber once during the duration of the study to ensure that the proper protocol was being followed. Both VIMS staff and the crabber measured each crab, so that the two measurements could later be compared for measurement bias.

1.4 Results

The fall 2009 data have been entered and are ready for analysis.

When we compared VIMS measurements to each crabber's measurements, the crabbers' measurements were underestimates, probably because the measuring device they were using was made of wood, and the spines of the crab were sinking into it. We will compare the more precise VIMS caliper measurements with each crabber's measurements and adjust for error.

(NOTE: Measuring boards were rebuilt so that crab spines no longer sink into wood. A piece of hard Plexiglas material was placed where the spines were digging into the wood.)

We are expecting that about 25% of the data will not be reliable for statistical analysis because some watermen did not followed the protocol exactly. For example, some data sets were lacking several crab measurements. For some crabbers, twice as many crabs were caught on the day VIMS helped as any other day, suggesting that on the days VIMS did not go out and monitor, the crabber may not have been measuring every crab caught, but instead measured only a select few crabs from each pot. In addition, some crabbers may not have realized the importance of measuring all crabs from each pot separately. In these cases, the crabs from all pots were combined and measured together, which eliminated replication of the treatments. In general, however, most crabbers followed the protocol and were extremely cooperative.

2 Peeler Pot Study, Spring 2010

2.1 Purpose

The purpose of this study was to employ Virginia's watermen to examine the effects of bycatch reduction devices (BRDs) in crab peeler pots on blue crab catch and biomass and the ability of BRDs to exclude finfish and diamondback terrapins from crab pots.

2.2 Sites

This study began during the beginning of the peeler run in early May, 2010 at 6 locations:

2 upriver sites each in the James, York and Rappahannock Rivers.

All sites were located upriver, where the male peeler run persisted. Two crabbers from each of the 3 rivers were hired to install BRDs in 10 of their own peeler pots. Crabbers then placed 10 BRD pots and 10 non-BRD pots close to where they fished their own peeler pots. Crabbers were required to fish pots, and measure all crabs and bycatch for a total of 4 days. VIMS staff were present for 2 of the 4 days, starting on the first day of data collection. By going on the first day, we were able to make sure the protocol was being followed from the beginning.

2.3 Methods

Of their 20 experimental peeler pots, crabbers were required to attach BRDs to 10 pots. Crabbers were asked to use 20 uniform pots to eliminate any pot effects. Each crabber was required to disperse the experimental pots randomly within their line of peeler pots. Because we were sampling during the male peeler run, pots were not baited.

Crabbers were required to pull the experimental peeler pots within 48 hours of setting them. After a pot was pulled, crabbers measured the width of each crab carapace (from spine to spine), and determined each crab's sex and overall condition (peeler, soft, freshly molted, juvenile, etc.). They also recorded all bycatch species caught in each pot. Data were collected for a total of 4 days, providing us with 4 data sets for each of the 6 sites. VIMS staff went out on the boat with each crabber twice during the duration of the study to ensure that the proper protocol was being followed.

VIMS staff accompanied each crabber twice during the duration of the study to ensure that the proper protocol was being followed. Both VIMS staff and the crabber measured each crab, so that the 2 measurements could later be compared for measurement bias. All finfish were kept when VIMS staff went out with the crabbers. The guts of these fish were preserved to determine the effect of bycatch predation within peeler pots on crab catch and biomass. (NOTE: The reconstructed measuring boards were used for this study.)

2.4 Results

Data are currently being processed. A preliminary look at the data for this project determined that BRDs decrease commercial catch in peeler pots by approximately 1 crab per pot. It was also determined that BRDs significantly reduced bycatch.

The crabbers on the James River feel that the BRDs actually increased the number of peelers they caught in a pot. Their theory was that the BRDs kept larger hard crabs from entering their pots, and that the peelers made more effort to get past the BRD to find a refuge for molting. Every eel caught in a peeler pot had its stomach full of soft crabs. Some oyster toadfish had crab shell parts in their guts. One oyster toadfish had consumed a whole crab of approximately 30 mm carapace width. Most catfish were caught upriver

in the Rappahannock River in < 5 psu salinity where very few peeler crabs were caught. Catfish were not abundant in peeler pots this spring.

3 Cull-ring and BRD Study, Early Summer 2010

3.1 Purpose

The goals of this study were to employ Virginia's watermen (1) to investigate the effects of different cull-ring sizes in crab pots on blue crab catch, biomass, and survival, and (2) to determine the effects of bycatch reduction devices (BRDs) in crab pots on blue crab catch, finfish bycatch and diamondback terrapin bycatch.

3.2 Sites

This study began in June and was completed by the first week of July, 2010 at 14 sites:

Upriver and downriver of the Potomac, Rappahannock, York, and James rivers

4 sites on the Eastern Shore (Chincoteague, Saxis, Quinby Bay, Harborton)

2 sites in Lynnhaven Bay (eastern and western branches)

A local waterman in each area was hired to bait and pull 24 experimental crab pots, and measure all crabs caught. Each waterman was paid $300 per data set (cost covers fuel, bait, pot line, labor) and compensated $300 for pot pick-up and for time spent going over protocol.

3.3 Methods

Each crabber was required to disperse the experimental pots randomly within their lines of crab pots. They were required to bait the pots, and then pull them within 48 hours. After a pot was pulled, the carapace width of each crab was measured (from spine to spine), each crab's sex was recorded, and overall condition was noted. They also recorded all bycatch species caught in each pot. Data were collected for a total of 4 days, providing us with 4 data sets for each site.

There were 6 different treatments. Each set of 24 experimental pots included 4 pots of each treatment. A different color float was used to designate treatment type for each pot.

4 pots without any cull rings (blue)

4 pots with 2 7/16" cull rings (white)

4 pots with 2 3/8" cull rings (green)

4 pots with 2 5/6" cull rings (red)

4 pots with 2 3/16" cull rings (pink)

4 pots with 2 3/8" cull rings and orange BRDs (orange)

VIMS staff accompanied each crabber twice during the duration of the study to ensure that the proper protocol was being followed. Both VIMS staff and the crabber measured each crab, so that the two measurements could later be compared for measurement bias.

3.4 Results

Data are currently being processed. A preliminary look at the data suggests that there is no significant effect of BRDs on blue crab catch. BRDs do however seem to have a significant effect on reducing bycatch. Data on the effects of cull-ring size is currently being evaluated and compared to the fall 2009 data.

4 Cull-ring and BRD Study, Late Summer 2010

4.1 Purpose

The goals of this study were to employ Virginia's watermen (1) to investigate the effects of different cull-ring sizes in crab pots on blue crab catch, biomass, and survival, and (2) to determine the effects of bycatch reduction devices (BRDs) in crab pots on blue crab catch, finfish bycatch and diamondback terrapin bycatch.

4.2 Sites

This study began late August and was completed by September, 2010 at 14 sites:

Upriver and downriver of the Potomac, Rappahannock, York, and James Rivers

4 sites on the Eastern Shore (Chincoteague, Saxis, Quinby Bay, Harborton)

2 sites in Lynnhaven Bay (eastern and western branches).

A local waterman in each area was hired to bait and pull 24 experimental crab pots, and measure all crabs caught. Each waterman was paid $300 per data set (cost covers fuel, bait, pot line, labor).

4.3 Methods

Each crabber was required to disperse the experimental pots randomly within their lines of crab pots. They were required to bait the pots, and then pull them within 48 hours. After a pot was pulled, the carapace width of each crab was measured (from spine to spine),

each crab's sex was recorded, and overall condition was noted. They also recorded all bycatch species caught in each pot. Data were collected for a total of 4 days, providing us with data sets for each site.

There were 6 different treatments. Each set of 24 experimental pots included 4 pots of each treatment. A different color float was used to designate treatment type for each pot.

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4 pots with 2 5/6" cull rings (red)

4 pots with 2 3/16" cull rings (pink)

4 pots with 2 3/8" cull rings and orange BRDs (orange)

VIMS staff accompanied each crabber twice during the duration of the study to ensure that the proper protocol was being followed. Both VIMS staff and the crabber measured each crab, so that the two measurements could later be compared for measurement bias.

4.4 Results

All data from the early summer and late summer of 2010 has been entered and analyzed for effects of cull-ring size and presence of BRDs on blue crab catch and bycatch reduction. We find that the larger the cull-ring is, the fewer sublegal crabs are caught. A pot with no cull-ring catches approximately 39% sublegal catch. A pot with the regulation 2 3/8" cull rings decreases that amount by 25% (Figure 1.1). We noticed a slight decreasing trend in total abundance per pot for the larger the cull-ring size (Figure 1.2). This could be because the larger cull-rings are more effective at releasing smaller, sublegal crabs. Crab carapace width, however, increased with an increase in cull-ring size
(Figure 1.3)

5 BRD Study, Seagrass and Unvegetated Sites

5.1 Background Information

The use of bycatch reduction devices (BRDs) in blue crab traps has recently been proposed as a tool that can promote conservation and fishery goals simultaneously. Conservation is facilitated through the reduction of diamondback terrapin and other bycatch (e.g. finfish) mortality, whereas fishery yield is not compromised due to the minimal effect of specific BRDs on catch. In Chesapeake Bay, there have been various studies on the effectiveness of BRDs in blue crab traps, but these have focused upon shallower habitats and have usually been conducted at single sites. Thus, we investigated the effect of BRDs in blue

crab traps upon crab catch and bycatch at a wide spatial scale in lower Chesapeake Bay. Moreover, we reviewed the literature on BRDs and provide fishery management recommendations aimed at optimizing terrapin conservation and blue crab fishery production concurrently.

In a pilot study, paired traps with (control) and without (experimental) BRDs were deployed at 23 sites throughout the river, 16 unvegetated and 7 vegetated. Only 2 terrapins were captured, both in control traps, which also caught 7 of the 8 fish captured. Patterns in total, legal and sublegal catch between control and BRD traps differed by habitat. In unvegetated habitats, legal crab catch in BRD traps was 14.6% lower than in control traps; for sublegal crabs it was 22.2% lower. Conversely, in vegetated habitats legal crab catch in BRD traps was 72.4% higher than in control traps, and 38.9% higher for sublegal crab catch.

Within crab traps, there was no correlation between legal and sublegal catch, indicating that over the range of catch rates examined, legal and sublegal crabs did not influence each other's likelihood of capture. Mean crab size differed little between control and BRD traps, being higher by less than 1% in BRD traps irrespective of habitat; size was 2% higher in unvegetated than unvegetated habitats. Some specific trends for crab size between BRD and control traps emerged for particular habitat-treatment-size combinations, but the differences were never greater than 4%, similar to that observed in prior studies. In our review of 7 studies, including ours, that utilized 4.5 x 12 cm BRDs in shallow unvegetated habitats, legal crab catch was both higher (4 studies: 3-12%) and lower (3 studies: 12-14%) in BRD traps than in controls, which was in sharp contrast to the substantially higher catch for BRD traps (72.4%) in vegetated habitats. The collective findings indicate that unintended bycatch, including terrapins, is minimized by the use of BRDs, whereas crab catch is not affected substantially. Consequently, BRDs should be required in all recreational blue crab traps in lower Chesapeake Bay, whereas their broad utility in vegetated habitats requires investigation at wider spatial scales. However, before such a regulation can be implemented, the previous results needed to be replicated over the lower bay, which was the purpose of this final study.

5.2 Methods

The goals of this study are to employ Virginia's watermen to determine the effects of bycatch reduction devices (BRDs) in crab pots on blue crab catch at a wide spatial scale.

There were 6 sites total: 3 each on the eastern and western shores. The sites were selected based on their proximity to vegetation and coverage of the lower bay. Three sites were located on Virginia’s Eastern shore: Site 1 was located near Saxis (northern eastern shore), Site 2 was near Pungoteague (Middle eastern shore) and Site 3 was located south of Silver Beach (southern eastern shore). 3 sites were located on Virginia’s western shore: Site 4 was located off Dameron Marsh (northern western shore), Site 5 was located

off of Goodwin Island (middle western shore), and Site 5 was located in Back Creek (southern western shore).

Each site had 2 crabbers each working 20 pots. Ten of the 20 pots had BRDs fitted in them, and 10 were standard regulation crab pots. Each waterman was required to bait the pots, and then pull them within 48 hours. After a pot was pulled, the carapace width of each crab was measured (from spine to spine), each crab's sex was recorded, and overall condition was noted. They also recorded all bycatch species caught in each pot. Data were collected for a total of 10 days, and VIMS personnel accompanied watermen for 2 days to ensure protocol was being followed.

5.3 Results

We completed the study in late November and have started analyzing and interpreting the data. We noticed that mean abundance per BRD pot was less than mean abundance for regulation pots by both location and soak time (Figures 1.4-1.5). We are continuing analyses of the data in this quarter.

6 Figures

Figure 1.1

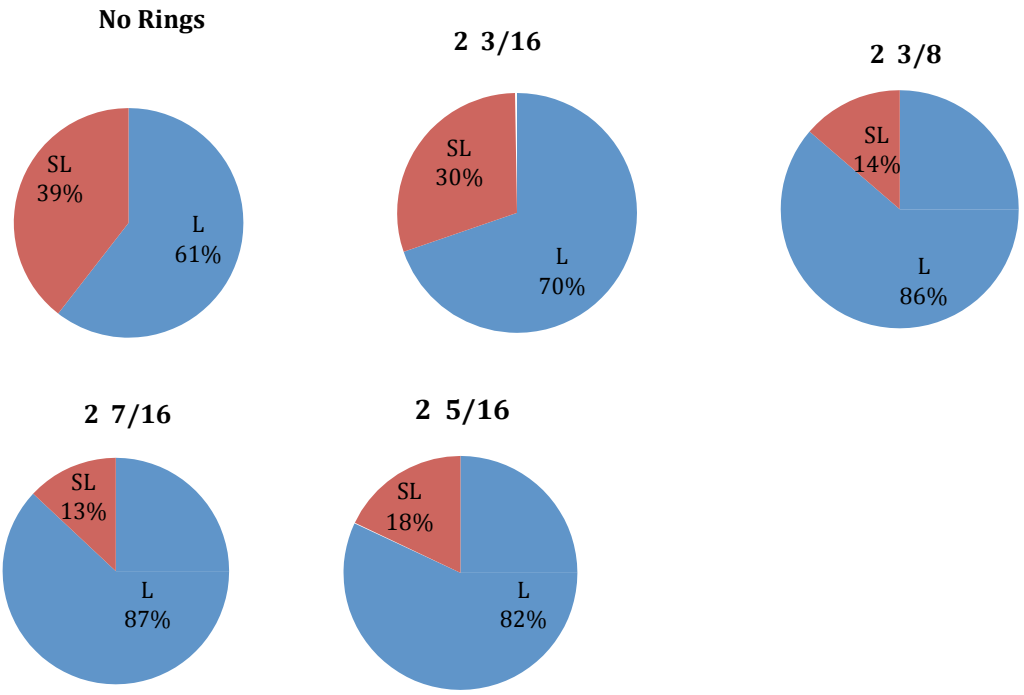


Figure 1.2

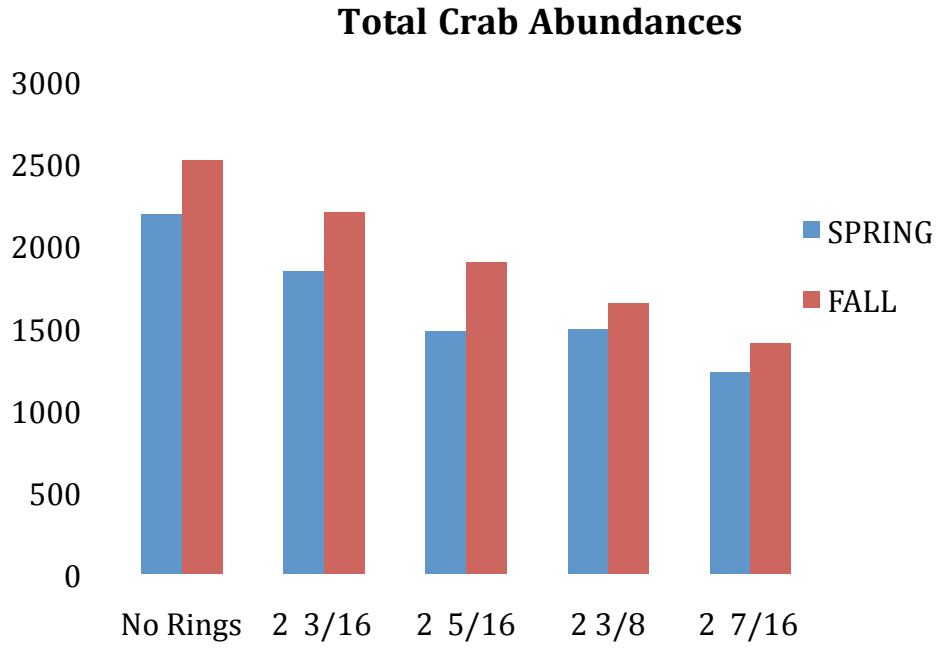


Figure 1.3

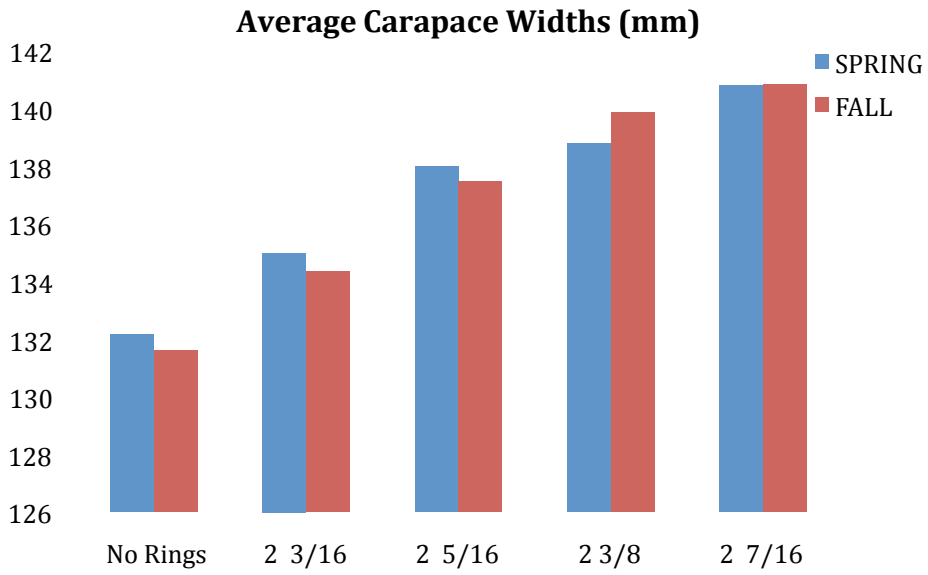

Average Carapace Widths (mm)
142
140
138
136
134
132
130
128
126
No Rings
2 3/16
2 5/16
2 3/8
2 7/16
SPRING
FALL

Figure 1.4

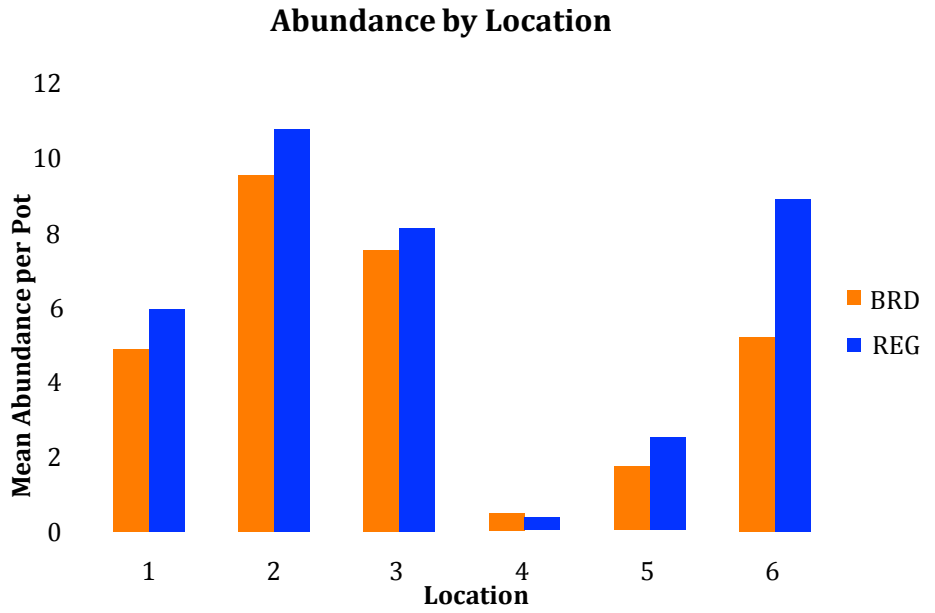
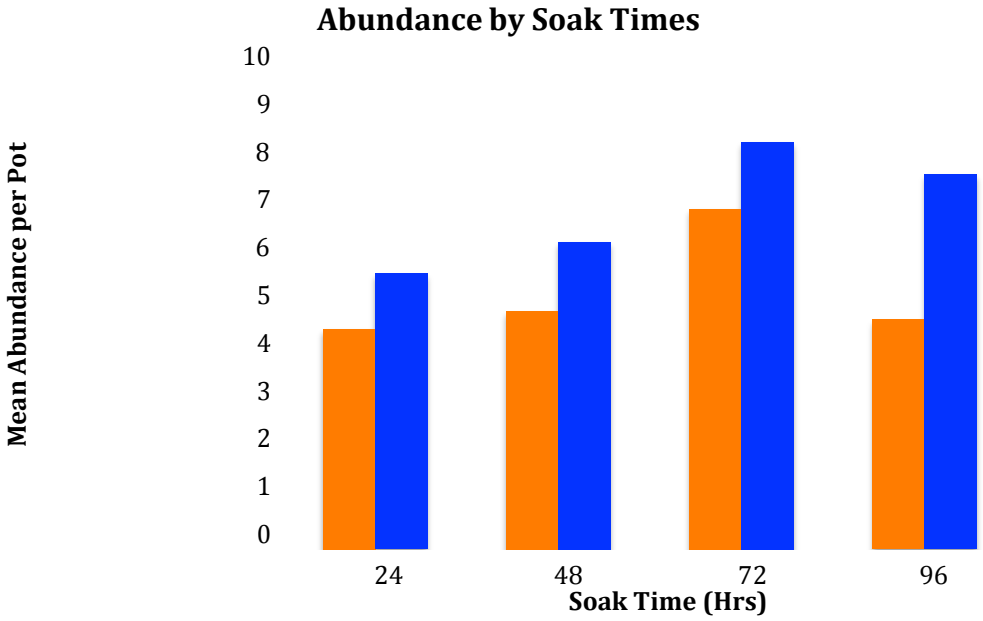


Figure 1.5



ATTACHMENT V. Blue Crab Industry – Oyster Aquaculture Training and Transition

Project Impact Summary Report

NOAA Blue Crab Disaster Grant

NA09NMF45200027-Task III Fishery Resource Grant Program

Project Title: Blue Crab Industry- Oyster Aquaculture Training and Transition

Project Investigator: Thomas J. Murray, VIMS Advisory Services

Project scope: Assist VMRC in implementing one-time disaster mitigation assistance by utilizing the Virginia Fishery Resource Grant Fund to support blue crab industry aquaculture training and related projects.

Abstract:

Due to the depletion of the blue crab population in the Chesapeake Bay several new restrictions have been placed on the harvest by Virginia. These new regulations affect the livelihoods of Virginia Crabbers. In order to supplement their income to maintain their financial stability, the state proposed to support the crabbers by training them in oyster aquaculture. Funding was used to employ one fulltime advisory service person to assist the crabbers in their new venture into oyster aquaculture. Two methods of oyster aquaculture were implemented, cultch less and remotes setting. Three full years of aquaculture training were supported with additional educational effort in shellfish handling, storage and transportation. Surveys of participants indicate a strong willingness to continue to develop their shellfish aquaculture enterprises.

Impacts:

Overall the project funding has supported the blue crab industry in a number of ways:

1. ***Supported the training of Crabbers in Oyster Aquaculture***.

A total of 131 crab license holders chosen by Virginia Marine Resources Commission, were able to participate in the cultch less aquaculture project (Appendix I). Participants from all over the Virginia portion of the Chesapeake Bay were shown how to raise 50,000 cultch less oysters in cages for the half-shell market. Most training and all equipment transfer was completed prior to the time period covered in this report. During the 2011-2012 project, these participants were surveyed to determine future interest in cultch less aquaculture. The survey found that the majority of the respondents are going to continue cultch less aquaculture and most of them will expand their practices. The survey also found that while 48% said that it was fairly easy to market their oysters, a majority of respondents also would like some sort of help marketing (such as a Seminar on marketing or a Co-Op).

The survey (appendix III) shows that, of the participants that responded, over 90% will continue cultch less oyster aquaculture and may even expand to more than 50,000 seed oysters in the future. One third expects to sell directly to retail outlets, one third will sell

to distributors and the balance expects to produce for "shucking houses". Each market adds a different level of value to the grower. This new entry from blue crabbers to oyster culture produces 6.5 million single oysters at the existing pilot levels. Based upon average market price of $.30 per oyster, the gross crabber sales are estimated to be $2.0 million to the grower.[2]

Annual Economic Impact of Crabber Oyster Culture Training and Output - 2012 ($ Millions)		
Output Impacts[3]	Direct Impacts	$2.0
	Indirect Impacts	$.31
	Induced Impacts	$.72
	Total	$3.03

As illustrated above the impact of increased aquaculture output multiplies throughout the Commonwealths economy impacting businesses that support aquaculture (indirect impacts) and households who received earned income either directly in shellfish aquaculture or indirectly from businesses supplying the growers.

2. Oyster Aquaculture Training Video

Building on the successful training efforts completed under this task an educational video has been produced for continuing access to shellfish harvesters and handlers.
The main goal of this new task was to produce an educational DVD that explains regulations and policies of the Virginia Marine Resource Commission and the Virginia Department of Health intended to address harvesting, handling, processing and transportation controls to ensure at a minimum: shellfish are harvested in approved growing areas; minimize pathogen growth in shellfish during and after harvest; and to ensure the sanitary control of shellfish. The objective with this video is to provide consistent and factual information on the new requirements facing the shellfish industry as well as for existing regulations and policies.

The CD will be distributed to the commercial shellfish industry; including aqua culturists and harvesters, certified shellfish dealers, etc. The video will be shown in training workshops and available on the internet to maximize educational outreach. The intent is to maximize the distribution of the educational content as quickly and widely as possible to inform industry of newly developing harvest regulations as well as established best practice. The impact of the training video will arise from supporting new entrant's (many of whom were trained under this initiative) adaptation of sustainable harvesting practices and reduced risk of human health issues related to shellfish consumption.

3. *Blue Crab Industry Water Access and Working Waterfronts Retention.*

[2] Virginia Shellfish Aquaculture Situation and Outlook Report – Results of 2011 Virginia Shellfish Aquaculture Crop Reporting Survey." T. Murray, K. Hudson. VIMS Marine Resource Report No. 2012-04. VSG -12-07. May 2012
[3] IMPLAN. "Draft Report- Economic Impact of Shellfish Aquaculture in Virginia – 2011". T. Murray

"Perrin River Crab Industry Working Waterfront Planning."

To understand the objective of the project, one has to understand the pressures that contribute to the problem. Cook's Seafood in Gloucester County served as a key hub for commercial crabbing operations in the past. Cook's Seafood transported and processed crabs and other locally caught seafood throughout the region, and many watermen relied on their infrastructure to conduct their crabbing and related seafood business. After seventy years, in March of 2010, Cook's Seafood waterfront property ceased operation. More than 15 crabbers moored their boats at Cook's and since have been forced to seek moorage elsewhere assimilating into the Perrin River. The Perrin River plays host to countless commercial crabbers also seeking various finfish and bivalves permitted for harvest by VMRC. It is estimated that between 10-15% of Virginia's blue crab harvest is unloaded via these local facilities. In short Perrin River water access is vital to the commercial fisheries in particular blue crabs.

This project explored the planning needs required to designate Perrin River, in Gloucester County, as a commercial seafood port. Specifically this plan conducted a site analysis including existing harbor conditions. The plan relied on community participation to identify and discuss potential harbor improvements. Technical staff developed cost opinions including discussion of ownership and management, capital improvement needs, and capacity analysis for private and public facilities.

As our coastal communities change, it is essential that plans be developed to address the infrastructure needs of watermen, now and in the future. Blue crabbers are central to the local culture and disappearing water access has become its own "blue crab disaster"-in slow motion. Without such a plan, it is likely that crabbers and the commercial seafood industry will no longer have the access to the water or the proper infrastructure to continue business. In that case this culturally important industry will be squeezed out of the coastal landscape and become a thing of the past. Through a partnership with Gloucester County Watermen, long time Perrin River crabber Billy Bonniville served as the point of contact for the watermen. Technical planning and policy assessment was coordinated with Gloucester County Planning Staff, the Middle Peninsula Chesapeake Bay Public Access Authority (MPCBPAA) and staff from the Middle Peninsula Planning District Commission (MPPDC). Collectively, these participants worked toward developing a The Perrin River Commercial Seafood Harbor Master Plan. The Plan will enable local government, industry and others to continue to afford working waterfronts and water access to crabbers and related commercial fishing and aquaculture enterprises.