COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

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

Steven G. Bowman
Commissioner

November 26, 2008

MEMORANDUM

TO: The Honorable Timothy M. Kaine
Governor of the Commonwealth of Virginia
And,
Members of the Virginia General Assembly

THROUGH: The Honorable L. Preston Bryant, Jr.
Secretary of Natural Resources

FROM: Steven G. Bowman

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

All findings from recent reviews of the status of the Chesapeake Bay blue crab stock indicate a continuation of a low abundance of both exploitable size blue crabs (2.4 inches and greater, in carapace width) and mature female blue crabs. The most recent results, from the December 2007 – March 2008 Chesapeake Bay Winter Dredge Survey, indicates that 60% of the stock is being removed, on an annual basis, strictly from harvesting activities. This exploitation rate exceeds the target and overfishing exploitation rate of 46% and 53%, respectively. Managers within the Chesapeake Bay continue to utilize the control rule, whereby annual estimates of abundance, as well as exploitation rates, are referenced against empirical and model-based standards, respectively, to guide management efforts. The control rule is guided by an overfishing threshold, equal to an annual percentage harvest-removal rate of 53%. It may take several years of maintaining an exploitation rate, for blue crab, at or near the target exploitation rate (0.46) to increase the spawning potential of this Bay-wide stock.

Overfishing, based on the most recent data is occurring. In 7 of the last 10 years, overfishing (an exploitation rate or harvest rate greater than 53% annually) of the blue crab stock has occurred. The Chesapeake Bay blue crab stock is not overfished. The estimated 120 million harvestable-size crabs recorded from the Bay-wide winter dredge survey, from December 2007 through March 2008, was greater than the empirical overfished threshold of 86 million harvestable-size blue crabs recorded in 1999. However, since that lowest abundance, in 1999, the crab stock has never rebounded to an exploitable abundance of 200 million crabs. An abundance of 200 million crabs is viewed by Chesapeake Bay fishery managers, as an interim target level of abundance to attain, in order to provide sufficient crabs for successful replenishment and harvest. Historically, an abundance of 200 million crabs (2.4 inches and greater) has supported harvests of 60 to 70 million pounds, compared to the 2007 Bay-wide harvest of 42 million pounds.

Extensive steps were taken by the Marine Resources Commission, in 2007 and early 2008, to gather scientific expertise that could assist the Commission in assessing the degree of effectiveness of its blue crab management plan. A continued low abundance and high exploitation rates and very low recent harvests of blue crab, prompted the Commission to establish a Blue Crab Regulatory Review Committee (BCRRC), in 2007, to gain a comprehensive scientific review of its management plan. Concurrently and throughout 2008, the Commission's Crab Management Advisory Committee met frequently and provided several key recommendations, concerning crab conservation measures. The Commission also reviewed the findings from a fall 2007 and spring 2008 advisory report conducted by the Chesapeake Bay Stock Assessment Committee, as detailed below. The Commission's management process and actions, on behalf of the blue crab resource, are detailed, below, as the 2008 Virginia Blue Crab Fishery Management Plan.

Additional scientific expertise on the biological status of the blue crab stock was provided by the NOAA Chesapeake Bay Stock Assessment Committee's 2008 advisory report (Attachment I). These advisory reports have been an integral component in the formation of the Commission's management measures, on an annual basis, since 1997. The advisory provides the most recent status of the stock, in terms of exploitation rates and abundance. The CBSAC reported that the abundance of spawning age crabs (age 1+) is a key indicator of stock status, and is used to determine if the population is overfished. At the beginning of the 2008 commercial season, results of the 2007-2008 WDS indicated that the abundance of age 1+ blue crabs declined slightly from 16 crabs per 1,000 square meters in 2006-2007 to 12 crabs per 1,000 square meters in 2007-2008 (Figure 1). These densities equate to estimates of spawning age abundance of 143 million crabs in 2006-2007 and 120 million crabs in 2007-2008, which is well below the target level of 200 million spawning age crabs. This interim abundance target of 200 million spawning crabs was established by the CBSAC in January of 2008 and was accepted by the Chesapeake blue crab management authorities in April of 2008.

Initially, in 2008, the Commission held several public hearings, on blue crab conservation measures, and ultimately adopted new conservation measures in February, March, April and May, as described below. Concurrently, in late winter and early spring 2008, The Secretaries of Natural Resources and staffs, from Virginia and Maryland, the Maryland Department of Natural Resources, the Potomac River Fisheries Commission and the Marine Resources Commission began meeting and planning a Bay-wide approach to reducing the exploitation rate and thereby increasing the abundance of spawning-size crabs. On April 15, 2008 the Governors Kaine and O'Malley endorsed a conservation plan that called for a 34% reduction in the harvest of female crabs, in 2008, relative to the amount of harvest, on average, that occurred from 2004 through 2007. By that time, the Commission had already adopted several important blue crab

conservation measures (see below) but welcomed the opportunity to be part of a Bay-wide blue crab conservation plan. The 34% Bay-wide reduction of the harvest of female crabs, in 2008, was needed, to lower the exploitation rate to 46%, initially, and stimulate an increase in abundance of the stock. The 34% Bay-wide reduction in the harvest of female crabs, in 2008 offers a method to increase abundance to an interim target of 200 million harvestable-size blue crabs, especially if the overfishing target of an exploitation rate of 46% can be maintained for a few years.

The Marine Resources Commission and Maryland Department of Natural Resources collaborated on a request for disaster assistance to the National Marine Fisheries Service. The basis, for the request was the continued depleted abundance of the blue crab, and this request was submitted on June 13, 20008. The documentation, in support of asking the National Marine Fisheries Service to declare a blue crab fishery disaster, for Chesapeake Bay, can be found under Attachment II. On August 13, 2008, staff members, from the Office of the Secretary of Natural Resources, the Marine Resources Commission and the Maryland Department of Natural Resources met with national Marine Resources staff and additional information was requested of the states, especially economic data related to the blue crab fishery (Attachment III). On September 22, 2008, the Secretary of Commerce, Carlos M. Gutierrez, notified the states of Virginia and Maryland of his decision to declare a commercial fishery failure for the soft and peeler crab fisheries in the Chesapeake Bay. On October 15, 2008, Governor Kaine and Governor O'Malley thanked the Secretary of Commerce and asked him to expedite the allocation of disaster funds, insure that Virginia and Maryland receive $30 million, over the next 3 years and provide these states with the flexibility and discretion in developing and implementing the spending plans, for the fishery disaster funds. On November 18, 2008 Governor Kaine was informed by the Department of Commerce that Virginia will receive up to $10 million to respond to the Blue Crab Fishery Disaster. A variety of programs are now being considered for funding that are designed to employ crab fishermen in work programs and to involve them in other fishery ventures, like cage oyster aquaculture and spat on shell oyster production. The funds will also be utilized to reduce over-capitalization of the crab fishery through a crab license buy-back program.

The Commission has also planned, and will fund, a work program, designed to assist some of the 53 crab dredge fishermen who were impacted by the closure of the 2008/09 winter crab dredge season. This work project will utilize side-scan sonar techniques to retrieve derelict crab pots ("ghost" pots) in several areas of the Chesapeake Bay. "Ghost pots," refer to lost or abandoned fishing gear and crab pots. When left alone, the pots sink to the bottom of the water but continue to trap and kill marine life. They are typically lost during storms or when boat propellers accidentally slice through a marker buoy and rope that holds them in place. Ghost pots are also considered marine debris. Studies by the Virginia Institute of Marine Science indicate that as many as 60,000 crabs are trapped in ghost pots each year in the lower York River, alone.

The program will offer training to the commercial fishermen, on how to use the sonar to locate derelict pots, and those pots will be "grapple-hooked", from the bottom areas, using a mechanism fashioned by the Virginia Institute of Marine Science. The Virginia Institute of Marine Science will provide eligible commercial fishermen, with training on the use of side-scan sonar and will also use G.I.S. programs to pinpoint environmentally sensitive areas, such as oyster beds and submerged aquatic vegetation areas, to be avoided by the derelict pot and debris removal program. This program is responsive to Section 28.2-203.1, as it offers an improvement to the crab habitat, by reducing the occurrences of mortality, for crabs that get trapped in derelict pots. Removal of derelict pots would augment the spawning stock and allow additional female crabs to spawn.

Once relief funding has been approved by the Office of Management and Budget and provided to Virginia, similar work-related programs will be implemented, by the Commission, to eligible commercial crab fishermen who were impacted by this natural resources disaster.

The Marine Resources Commission has submitted an important blue crab conservation proposal, for the 2009 Session of the General Assembly, as summarized below. The suggested legislation would authorize the Commission to adopt seasonal closures of the Blue Crab Sanctuary beyond the currently legislated closed dates of June 1 through September 15.

The basis for this proposed legislation is to protect female crabs from harvest, as early as May 1, to augment the spawning capabilities of the crab stock. Scientific findings indicate that female crabs do spawn in the lower Chesapeake Bay, as early as May 1. For over a decade, all scientific data, from fishery-independent trawl, pot and dredge surveys for over a decade, indicate the abundance of blue crab is very low. Of major concern is that the abundance of the spawning stock, as estimated from trawl surveys on the spawning grounds, has remained at low abundance, since 1992.

In response to this depleted condition of the spawning stock, the Marine Resources Commission, following a public hearing, moved the starting date of the closure of the sanctuary areas established by regulation, from June 1 to May 1. The ending date of the regulated sanctuary areas remains as September 15. These actions only applied to 786 square miles of the 928 square-mile spawning sanctuary, within the Chesapeake Bay. The remaining 142 square miles of spawning sanctuary were established by legislative action (§ 28.2-709, Code of Virginia), and the closure to harvest in this sanctuary area extends from June 1 to September 15. For the 2009 Legislative Session, the Marine Resources Commission is requesting authority to modify the current closed season of this sanctuary area. This area serves as an important spawning area, and most of the female crabs in these spawning areas have overwintered, prior to their first spawning. Given the continued low abundance of the blue crab stock, any conservation measures that would promote additional spawning can only benefit the stock.

THE 2008 VIRGINIA BLUE CRAB FISHERY MANAGEMENT PLAN

Extensive steps were taken by the Marine Resources Commission in 2007 to gather scientific expertise that could assist the Commission in assessing the degree of effectiveness of its blue crab regulations. A continued low abundance and high exploitation rates prompted the Commission to establish a Blue Crab Regulatory Review Committee (BCRRC

To gain a comprehensive scientific review of the twenty-two management measures implemented by the VMRC, from 1994 through 2007, the VMRC enlisted the involvement of a diverse group of scientists experienced in blue crab management issues. This review panel consisted of scientists from South Carolina, North Carolina, Virginia and Maryland, two associate commission members and the deputy commissioner of the VMRC. The Commission's enlistment of a BCRRC review of the current regulations, is responsive to § 28.2-203.1. of the Code of Virginia, in that current regulations and restrictions relating to: (i) winter dredging; (ii) commercial licensing; (iii) spawning stock; (iv) nursing sanctuaries; (v) submerged aquatic vegetation; (vi) peeler and soft shell crabs; (vii) size limits; (viii) the use of cull rings and the use of crab pots; and (ix) time of day restrictions and closed seasons were thoroughly evaluated by the BCRRC. The findings, listed below, were presented to the Commission.

The BCRRC met on three occasions, once in June, August and November of 2007. The findings and recommendations of the BCRRC were very useful to the Commission, when it developed its 2008 management plan. A detailed report of this review is provided under Attachment IV, Regulatory_Review, and important findings of the committee are highlighted, below.

This review committee determined that it was difficult to quantitatively determine the effects of any of the 22 management measures, shown in Attachment V, as the variable role of environmental influences confounds determination of which measures directly affect the exploitation rate or abundance. The review committee viewed most of the VMRC management efforts as having prevented an even more depleted stock condition. Importantly, the review committee agreed, by consensus, that the VMRC management plan has not reduced effort or mortality in the fisheries and the conservation merits of the current VMRC plan are often compromised by the overcapacity of effort in the fisheries. The BCRRC also concluded the larger number of legal, inactive licensees (latent effort) poses risk to any rebuilding strategy, as inactive licenses could become active, in response to any gains in blue crab abundance. Concerning key gear-based blue crab fisheries, the BCRRC determined. Discussions on excess capacity (pots and fishermen) were extensive, at each of the three meetings of the review committee. The BCRRC recommended the Commission should consider measures that more effectively reduce and control effort in these fisheries, and, as a very important part of an effort control plan, the VMRC should implement a crab pot-tagging system. The BCRRC also provided recommendations on key gear-based fisheries, as follows:

- Crab Pot Fishery - The VMRC should consider any measures that would reduce effort in this fishery, until such time that exploitation rates remain at or near the target, for several years. Any effort reductions in this fishery will also improve the exploitation rate on female crabs, as this fishery harvests the majority of female crabs.

- Winter Dredge Fishery – The Commission should develop a plan to preclude any expansion of fishing mortality in the winter dredge fishery, relative to other blue crab fisheries, and address the risk posed by latent effort in this fishery to a potential recovery of the population or the increased regulation of other blue crab fisheries.

- Peeler Fishery - The VMRC should develop an effort control system for the peeler fishery in order to prevent overfishing and constrain mortality at the target level. Recognizing that an effort control system will take some time to develop, and as an additional precautionary action to reduce exploitation, the VMRC should consider raising the minimum size limit on peelers. A higher minimum size limit would provide some benefits to the spawning potential and would reduce waste associated with green crabs.

- Virginia Blue Crab Sanctuary - The sanctuary does afford protection to female crabs. Currently, harvest within the sanctuary is prohibited from June 1 through September 15. As there is spawning activity in May, the harvest prohibition should extend from May 15 through September 15. Alternatively, since there is a high percentage of mature, legal females harvested from the Hampton Roads area, female mortality rates could be reduced by other conservation measures aimed at females prior to or during their migration to the spawning sanctuary, including sanctuary modifications.

- Effort Control – Effort control in the Virginia fisheries is hampered by substantial latent effort. It is expected, although not quantified, that declines in active effort, year to year, have been the result of low stock abundance. VMRC data indicate there are many

inactive harvesters, year to year, such that any increase in abundance could result in increased activity. Additionally, many active licenses are only active at token levels of activity, and could substantially increase effort in response to any improvement in blue crab abundance resulting from regulatory reform. The lack of an adjustable effort system prevents management from adding or removing active effort in the fisheries, to ensure the exploitation rate is at, or near, the target in any year.

- Latent effort has the potential to offset or reverse any progress that is made towards the future successful management of blue crabs, since any increases in abundance would be an inducement for inactive harvesters to become active. In addition, the current allowance of agents, whereby any person is able to fish an inactive harvester's gear, adds to the overcapacity of effort in these fisheries. In order to effectively manage effort, the Commission is encouraged to develop a strategy to address agency and transfers. Reduction measures should encompass reductions in latent effort and the use of agents. An individual transferable effort system, combined with a pot-tagging program, is a sound approach and offers a better probability that the annual exploitation rate will be at or near the target rate.

The Commission, equipped with the advice of the Blue Crab Regulatory Review Committee, recommendations from its Crab Management Advisory Committee (Attachment VI) and its staff, a briefing on the fall 2007 findings of the Chesapeake Bay Stock Assessment Committee (the CBSAC report presented below, in Attachment I, is a June 2008 version), and the results of the 2007 harvest (Tables 1 and 2) proceeded to hold several public hearings during 2008, in an effort to reverse the decade-long trends in low blue crab abundance and the high exploitation rate associated with the many fisheries that harvest blue crab. The 2007 Bay-wide crab harvest of 43.5 million pounds is the lowest recorded since 1945 (see Attachment I).

Table 1. Virginia harvests of hard crabs by month (all areas), 1996-2007.

Month	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1996-2006 avg.
January	1,620,518	1,765,253	1,045,613	375,856	752,031	438,042	807,441	367,964	852,679	815,052	672,887	596,984	864,849
February	678,958	903,453	527,340	93,525	993,359	177,227	304,811	440,521	672,341	835,753	325,071	167,418	541,124
March	201,972	172,351	333,793	51,301	236,910	132,056	198,129	237,910	311,382	359,897	126,058	612,072	214,705
April	601,437	2,813,466	3,300,654	3,253,588	4,287,438	1,290,719	3,417,745	1,208,053	2,722,502	2,212,084	4,198,419	2,482,516	2,664,191
May	2,168,338	2,669,977	1,958,251	2,074,695	3,162,424	1,643,394	2,494,483	2,159,471	2,586,418	2,556,094	2,443,650	1,652,684	2,356,109
June	3,278,371	5,116,924	4,359,075	3,046,710	3,591,376	2,723,672	3,211,911	1,906,196	3,865,557	2,659,813	2,711,594	2,361,461	3,315,564
July	4,302,239	6,011,618	5,061,836	4,427,563	3,325,680	3,220,089	4,055,830	3,051,304	3,699,367	3,347,813	2,986,479	2,306,702	3,953,620
August	4,659,500	5,223,631	4,108,799	4,062,842	3,432,835	3,895,212	3,707,174	3,366,307	3,546,013	3,725,451	2,734,187	2,469,514	3,860,177
September	4,261,491	3,658,057	4,002,663	3,986,883	3,124,198	3,625,598	2,980,198	2,487,301	3,129,465	3,322,319	1,822,004	2,065,001	3,309,107
October	4,635,921	4,078,321	3,878,969	3,990,888	3,089,210	4,154,181	2,881,012	3,361,607	3,355,512	3,220,483	2,236,721	2,231,126	3,534,802
November	1,205,341	1,272,374	1,422,609	1,929,515	1,172,115	1,884,885	1,128,805	1,660,737	1,334,645	1,772,141	1,092,613	1,108,416	1,443,253
December	4,417,598	3,679,732	932,180	2,976,048	1,171,092	1,193,376	1,025,707	1,565,595	1,366,665	1,182,498	1,062,857	774,664	1,870,304
Total	32,031,684	37,365,157	30,931,782	30,269,414	28,338,668	24,378,451	26,213,246	21,812,966	27,442,546	26,009,398	22,412,540	18,828,557	27,927,805

Table 2. Virginia harvests of peeler/soft crabs by month (all areas), 1996-2007.

Month	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1996-2006 avg.
April	9,767	14,818	248,364	65,174	104,312	48,457	342,847	18,450	60,567	9,155	35,876	12,397	87,072
May	558,449	838,822	1,014,099	850,840	886,698	1,121,529	855,394	649,379	831,286	430,748	470,557	352,251	773,436
June	320,427	361,182	356,982	432,637	261,362	375,376	242,217	248,193	213,368	231,634	118,127	103,959	287,410
July	374,823	406,350	415,914	398,187	357,006	369,651	357,018	292,041	266,339	224,618	165,195	112,134	329,740
August	379,563	395,941	324,759	303,196	353,313	369,199	231,098	334,730	207,563	166,739	113,206	103,911	289,028
September	93,046	129,462	151,950	111,519	161,243	168,682	132,220	100,717	123,334	68,075	46,010	47,315	116,933
October	9,473	8,088	12,743	13,442	8,541	9,397	10,995	19,899	8,705	26,660	6,035	5,958	12,180
November	6	2	124	310	329	258	2	1,037	32	48	3	4	196
Total	1,745,554	2,154,665	2,524,935	2,175,305	2,132,804	2,462,549	2,171,791	1,664,446	1,711,194	1,157,677	955,010	737,930	1,895,994
Total	33,777,238	39,519,822	33,456,717	32,444,719	30,471,472	26,841,000	28,385,037	23,477,412	29,153,740	27,167,075	23,367,550	19,566,487	29,823,798

Note: Shaded months correspond to the lawful crab pot and peeler pot season.
Note: In 2007 season started on March 17, earlier seasons began April 1.

The Commission enacted a number of conservation measures, at the conclusion of several public hearings, as described below. As noted earlier, the prevailing conservation plan was to afford the blue crab resource an opportunity to better replenish itself, by allowing 34% less harvest of female crabs, in 2008, as compared to the amount of female crabs harvested, on average, from 2004 through 2007. At each public hearing, in accordance with) §§ 28.2-201, 28.2-202, 28.2-203 and 28.2-203.1 of the Code of Virginia, the Commission reviewed the best available scientific, biological, economic and sociological data available, regarding proposed regulations relating to: (i) winter dredging; (ii) commercial licensing; (iii) spawning stock; (iv) nursing sanctuaries; (vi) peeler and soft shell crabs; (vii) size limits; (viii) the use of cull rings and the use of crab pots; and (ix) closed seasons were thoroughly evaluated by the BCRRC. The findings, listed below, were presented to the Commission.

<u>February 26 Adopted Conservation Measures</u>

- The larger (2 5/16-inch cull ring) was required to be open in all tidal Virginia waters. Since 1993, the mainstem Bay, Pocomoke and Tangier sounds and Seaside of Eastern Shore areas have been exempt from this requirement. This action affords a significant increase in escapement of sublegal males, immature females and some legal (mature) females.

- The peeler crab minimum size limit was increased, from 3 inches to 3 ¼ inches, through July 15. As of July 16, the peeler crab size limit will be 3 ½ inches. This gradation of size limits matches the Maryland provisions. The Potomac is 3 ½ inches all season. For the Seaside of Eastern Shore, the peeler size limit will remain 3 ¼ inches throughout the

season (these crabs are not fully a component of the Bay stock). Any change in a size limit increases the spawning potential.

- The use of agents was modified by the Commission to prevent license "stacking" (a single licensee holding the licenses of several family, members, for example, in order to increase his competitive advantage). The Commission expects this initial control plan will offer more than just a modest reduction in effort.

- The winter dredge fishery was capped at a new level. The previous cap was 225 licenses. By February 2008, the cap was 53 licensees and the basis was harvest activity in two consecutive seasons (2005/06 and 2006/07).

March 25 Adopted Conservation Measure

- The Commission held a public hearing to determine the beginning date for the closed period, for the blue crab spawning sanctuary (928 square miles within the mainstem Chesapeake Area and 95 miles along coastal Virginia). Since 1942, the closed period has extended from June 1 through September 15. The Commission adopted a closure that begins May 1, to allow protection to female crabs that will spawn in spring (early to mid-May) or later in the season. The new closed period does not affect the 1942 (original) 146-square mile sanctuary, as a change in the Code of Virginia would be required and the Commission has submitted legislation, for the 2009 General Assembly session that would authorize the Commission to adopt seasonal closures of the Blue Crab Sanctuary beyond the current dates of June 1 through September 15, as set in Code.

- The combined actions of raising the minimum size on peeler crabs, initiating the closure of the sanctuary, effective May 1, and the requirement, for all crab pots in all tidal Virginia waters, to maintain open 2 3/16" and 2 5/16" cull rings achieves an 11% reduction in the 2008 harvest of female crabs.

April 22 Adopted Conservation Measures That Finalized a 34% Reduction in Female Crab Harvest In 2008

- A fall closure to the harvest, by any gear, of female crabs from October 27 through November 30 (a 6% reduction in the harvest of female crabs) was established by the Commission. Maryland and the Potomac River Fisheries Commission established an October 23 closed season on the harvest of female crabs. The fundamental objective of a synchronized closed harvest season throughout the Chesapeake Bay, in fall 2008, is to allow a large number of female crabs that have not previously spawned an opportunity to overwinter in Virginia waters and spawn in spring or summer of 2009.

- The Commission adopted, by emergency regulation, a 15% reduction in pots, per individual, for the crab pot fishery and a 30% reduction in pots, per individual, for the peeler pot fishery, for 2008. For 2009, the Commission adopted a 30% reduction in pots, per individual, for both the peeler pot and crab pot fishery. Crab pot limits currently range from up to 100 pots to up to 500 pots. Peeler pot licensees are currently limited to 300 pots. As of May 1, 2008, an up-to 300-pot crab pot license will be an up to 255-pot license. In 2009 that same license will be an up-to 210 pot license. The maximum number of peeler pots was reduced from 300 to 210 pots.

- The Commission suspended the 2008/09 winter dredge fishery season. This fishery is not as productive, as in past seasons, but its closure accounts for 50% of the 34% reduction, since the harvest from this fishery consists of mostly (96%) female crabs.

- Mandatory use of 2 3/8" cull rings in all areas, except the Seaside of Eastern Shore, was adopted by emergency regulation and was effective July 1, 2008. The 2 3/8" cull rings are in addition to the required 2 3/16" and 2 5/16" cull rings (4 cull rings per pot). These larger cull rings will afford greater escapement of female crabs but will also allow small, poor-quality males to escape from pots and increase their marketability.

- The Commission eliminated the commercial license for recreational use of 5 crab pots. This license will be reinstated, when the abundance of age 1+ crabs reaches the interim target of 200 million crabs.

1) The Commission will also summons any crab licensee, for a revocation hearing, upon that licensee having been found guilty by a court for 2 crab violations, within a 12-month period.

Special Notes: 1) All reduction-in-harvest calculations based on average (2004-2007) mandatory harvest reports; 2) The 6% reduction in female harvest attributed to Commission actions that raised the peeler size limit, mandated the use of 2 5/16" and 2 3/16" statewide and initiated an earlier closure of the sanctuary, will be less than 11%, as the 1942 sanctuary area remains open, until May 31 (see March actions). However, at its April 2008 meeting the Commission mandated the use of two 2 3/8" cull rings, starting July 1 and lowered the amount of hard crab pots and peeler pots that an individual can set or fish, by 15% and 30%, respectively. These two actions ensure that the planned reduction in the 2008 harvest of female crabs is equal to or greater than 34%. 3) Section 28.2-229 of the Code of Virginia prohibits refunds of license fees (crab dredge, 5-pot recreational license) or proration of license fees, when fishing effort is reduced or seasons are closed, in order to promote conservation of the fisheries.

<u>May 27, 2008</u>

1) The Commission passed a regulation, effective march 17, 2009, prohibiting the marking of crab pot buoys, with more than one identification number. Exceptions, for fishermen, who also crab in the Potomac River or in North Carolina, will be allowed.

2) Staff presented a timeline, for the consideration and implementation of a crab pot-tagging program (costs, tag replacement mechanisms and other administrative protocols) and effort reduction and transfer system. Staff and the industry-based advisory committee will discuss the timeline in June, as a start.

<u>August 26, 2008</u>

1) Commission staff presented proposals on Crab Pot (Buoy) Tagging: The Commission and many in industry have long supported a requirement to tag crab pots and peeler pots. Tagging is an essential element in proper enforcement of rules that limit each licensee to a specified number of pots and further limit crabbers to maximum pot numbers in the Chesapeake Bay and in the tributaries to the Bay. Since much of Virginia's crab conservation program depends on proper enforcement of these effort limits, a tagging program should be viewed as a critical element to that program. The Commission

decided to postpone this program, until such time there can be funding available, as funding would be an annual investment, and the Commission did not think the harvester should incur the costs of tags.

2) The Commission was briefed on an effort transfer program. Given the 30 percent reduction, in 2009, of crab pot and peeler pot limits, an effort transfer program should be viewed favorably. This program would allow crabbers an opportunity to rebuild their crabbing rigs to preferable levels. It also provides an economic opportunity to those wishing to exit the fishery. The current limit of 100 transfers per year would be eliminated. The most important aspect of an effort transfer program is that it not convert unused or part-time effort, into full time effort. One would need to limit the number of pots a fisherman may transfer to a percentage based on the number of days the fisherman used his pots during the 2004 – 2007 period. For example, a fisherman who fished 50 percent of the available days in 2004 – 2007 would only be permitted to transfer 50 percent of his pots, to another fisherman, who is assumed to use those pots full-time. The other 50% of the pots would be retired from the fishery. The Commission decided to postpone this measure, as it thinks that the crab pot buoy tagging system needs to be in place to effectively manage an effort transfer program.

October 28, 2008

1) As part of its effort control plan, the Commission will devise plans to reduce latent effort. For several years, active licensees comprise only one-half or less of the crab licensees that are eligible to harvest. The administrative costs to control latent effort are minimal, compared to pot (buoy) tagging, and Commission staff has been working with the Crab Management Advisory Committee (Attachment VI) to define and control latent effort. Latent, or unused, effort, if activated, can present a significant impediment to the full recovery of the blue crab resource. Though there are several hundred crab pot and peeler pot licenses that are not now being used, and have not been used for many years, activation of these licenses places additional harvest effort on the resource and additional product in the market place at a time when demand is soft. The blue crab resource cannot withstand additional effort at this time. And, active fishermen cannot withstand the further product in the market when demand is so soft. Commission staff has recommended, for the Commission's November 25, 2008 public hearing on this issue, the "elimination" of latent effort by placing on a waiting list those individuals who have not harvested a single pound of crabs in the last four years (2004 – 2007), prior to the control date (December 17, 2007). Some on the advisory committee have disagreed with this approach because they view crabbing a right, rather than a privilege. Others support elimination of latent effort, because it is this effort, once it becomes active, that could lead to additional over-capacity in the fishery.

ATTACHMENT I.

2008 Chesapeake Bay Blue Crab Advisory Report

Approved by the Fisheries Steering Committee: June 21, 2008

Status of the stock:

In 2006, the NOAA Chesapeake Bay Stock Assessment Committee (CBSAC) adopted the Bay-wide winter dredge survey (WDS) as the primary indicator of blue crab stock status because it is the most comprehensive and statistically robust of the blue crab surveys conducted in the Bay[1].

The WDS measures the density of crabs (number per 1,000 square meters) in Chesapeake Bay. These densities are then adjusted for the efficiency of the sampling gear and expanded to the area of Chesapeake Bay in order to derive precise annual estimates of abundance of over-wintering crabs by age and gender grouping.

The abundance of spawning age crabs (age 1+) is a key indicator of stock status, and is used to determine if the population is overfished (see control rule section below). At the beginning of the 2008 commercial season, results of the 2007-2008 WDS indicated that the abundance of age 1+ blue crabs declined slightly from 16 crabs per 1,000 square meters in 2006-2007 to 12 crabs per 1,000 square meters in 2007-2008 (Figure 1). These densities equate to estimates of spawning age abundance of 143 million crabs in 2006-2007 and 120 million crabs in 2007-2008, which is well below the target level of 200 million spawning age crabs (Figure 2). The interim abundance target of 200 million spawning crabs was established by the CBSAC in January of 2008 and was accepted by the Chesapeake blue crab management authorities in April of 2008.

Recruitment, as measured by the abundance of age 0 crabs, increased slightly in the 2007-2008 WDS. Despite this slight increase over last year, the abundance of young crabs remains well below the survey average (Figure 3). Therefore, 2008 represents a continuation of a period of low recruitment that has persisted since 1997-1998. In the 2007-2008 WDS, female spawning potential (abundance of females greater than 60mm or 2.4 inches carapace width) remained below the average range for the WDS (Figure 4).

A management control rule is used to determine the status of the Chesapeake Bay blue crab stock and guide management decisions. Despite continued low abundance, the blue crab stock remains above the abundance (overfished) threshold of 86 million age 1+ crabs, but below the target abundance of 200 million (Figure 5). The exploitation fraction for 2007 (percentage of crabs removed from the population by fishing) was estimated to be 55%, which is above the overfishing threshold of 53%. One change from previous advisory reports was the incorporation of recreational harvest into the annual exploitation fractions. Landings from recreational crabbers was estimated to be 8% (Ashford and Jones 2002) [2] of the total harvest for all years. When considering both commercial and recreational harvest, the exploitation fraction has been above the target exploitation fraction of 46% in 9 of the last 10 years. Further, the exploitation fraction has not fallen below the overfishing threshold for more than 2 consecutive years since the mid-1990's.

Data from three supporting blue crab surveys (the Maryland and Virginia trawls and the Calvert Cliffs Pot study) were reviewed. Results of these surveys are presented in Appendix 2 of this report. The results of these surveys were generally consistent, showing an overall decline of crab abundance in 2007.

Harvest:
The 2007 Bay-wide crab harvest of 43.5 million pounds is the lowest recorded since 1945 (Figure 6). The 2007 Maryland harvest of 23.7 million pounds is the second lowest recorded, but above the historical low of 20 million pounds observed in 2000. Virginia's harvest of 17.4 million pounds is the lowest recorded since the mid-1970s (Figure 7).

Projected harvest and exploitation:
The 2007-2008 WDS resulted in an estimated total abundance of 280 million crabs. Based on the historical relationship between crab abundance estimated from the WDS and the subsequent harvest, the 2008 harvest is predicted to be 49 million pounds with a possible range of 33.4 to 65

million pounds based on 95% prediction intervals (Figure 8). This projection is based on fishery performance in the absence of any additional regulatory action that could limit harvest.

In 2008, the Bay management jurisdictions took action to reduce female harvest by 34%, which is equal to a total harvest reduction of 17%, since the Bay-wide harvest is divided equally among male and female crabs. This reduction was based on the difference between the projected harvest of 49 million lbs and the harvest (in pounds) that would be equivalent to 46% of the estimated 2008 crab abundance, which would be approximately 40 million lbs.

Control rule:
The control rule, which was adopted by the Bi-State Blue Crab Advisory Committee in 2001[3], and updated in the 2005 stock assessment[4], is the foundation for sustainable management of the blue crab fishery in Chesapeake Bay. The control rule represents the relationship between adult crab abundance (millions of crabs), exploitation (the fraction of crabs removed by the fishery in a year) and management reference points. In 2006 the CBSAC defined the overfished limit to be 86 million age 1+ crabs. This value, observed in the 1999-2000 WDS, is the lowest value in the 17-year WDS time series, and delineates the overfished threshold based on a lack of historical evidence that a sustainable fishery can be maintained at an age 1+ abundance that is less than 86 million crabs. The overfishing definition, or exploitation threshold, for this stock is based on the consensus that a minimum of 10% of the spawning potential of an unfished population must be preserved to reliably produce the next generation of crabs. The target exploitation fraction of 46%, maintained over several years, represents an exploitation fraction that would preserve 20% of the unfished spawning potential.

Special comments:
In January 2008, CBSAC established an interim rebuilding target of 200 million spawning age (1+) crabs. The committee also recommended that the jurisdictions take action to achieve this target and specified that management action expanding protection for mature female crabs would maximize the odds of increasing recruitment and rebuilding the blue crab stock. In making these recommendations, CBSAC recognized that blue crab recruitment is strongly influenced by environmental drivers which could prevent an immediate substantial increase in recruitment (age 0 abundance) despite increased adult abundance. Ultimately, effective management of the blue crab requires implementation of ecosystem-based approaches that deal not only with the fishery, but also with broader issues such as habitat quality and food web interactions.

The regulatory actions taken in 2008 were coordinated among the three management jurisdictions and were designed to protect the 2008 cohort of female crabs migrating down the Bay in fall, and the subsequent spring to the spawning grounds in Virginia.

As a result of the 2005 blue crab stock assessment, a number of changes and improvements have been made in our analysis of stock status. Harvest has been adjusted to account for a number of historical changes in estimation methodology employed by the Maryland Department of Natural Resources and the Virginia Marine Resources Commission[5]. Additionally, annual harvest has been adjusted to include landings from both the commercial and recreational fisheries. In constructing the control rule, the annual estimates of abundance and exploitation fraction use data from the WDS and reported fishery harvest.

Critical data needs:
It is critical that robust, fishery-dependent data collection programs be implemented for blue crabs throughout the Chesapeake Bay. The design of these programs should be based on the need for improved information on biological characteristics of the harvest and reliable effort data for

the commercial and recreational fisheries. A collaborative and coordinated Bay-wide fishery-independent survey focused on the spring through fall distribution and abundance of blue crabs remains important.

Chesapeake Bay Stock Assessment Committee Members:

Chris Bonzek VIMS
Lynn Fegley Maryland DNR – chair
John Hoenig VIMS
Tom Miller CBL
Rob O'Reilly VMRC
Derek Orner NMFS/NCBO
Alexei Sharov Maryland DNR
Joe Idoine NMFS/NEFSC
Doug Vaughan NMFS/SEFSC

Also participating:
Eric Johnson SERC
Glenn Davis Maryland DNR

Literature Cited

1. Sharov, A. F., J. H. Volstad, G. R. Davis, B. K. Davis, R. N. Lipcius, and M. M. Montane. 2003. Abundance and exploitation rate of the blue crab (Callinectes sapidus) in Chesapeake Bay. Bulletin of Marine Science **72**:543-565.
2. Ashford, J. R., and C. M. Jones. 2002. Survey of the blue crab recreational fishery in Maryland, 2002. Final Report to the Maryland Department of natural Resources. Annaplos, MD. 31p.
3. Bi-State Blue Crab Advisory Committee. 2001. Taking Action for the Blue Crab: Managing and Protecting the Stock and its Fisheries. A report to the Chesapeake Bay Commission; Annapolis, Md, Richmond , Va. 24p.
4. Miller, T. J. et al. 2005. Stock Assessment of the Blue Crab in Chesapeake Bay. Technical Report Series No. TS-487-05 of the University of Maryland Center for Environmental Science, 162p.
5. Fogarty, M.F. and T.J. Miller. 2004. Impact of a Change in Reporting Systems in the Maryland Blue Crab Fishery. Fisheries Research. 68:37-43.

Figure 1. Winter dredge survey density of blue crabs aged one year and older (age 1+) 1989-2007. These are crabs measuring greater than 60mm across the carapace and are considered the 'exploitable stock'. 95% confidence intervals (1.96*std error) shown around individual points. The average range for the survey is defined as the standard deviation of the annual crab density values divided by the square root of three.

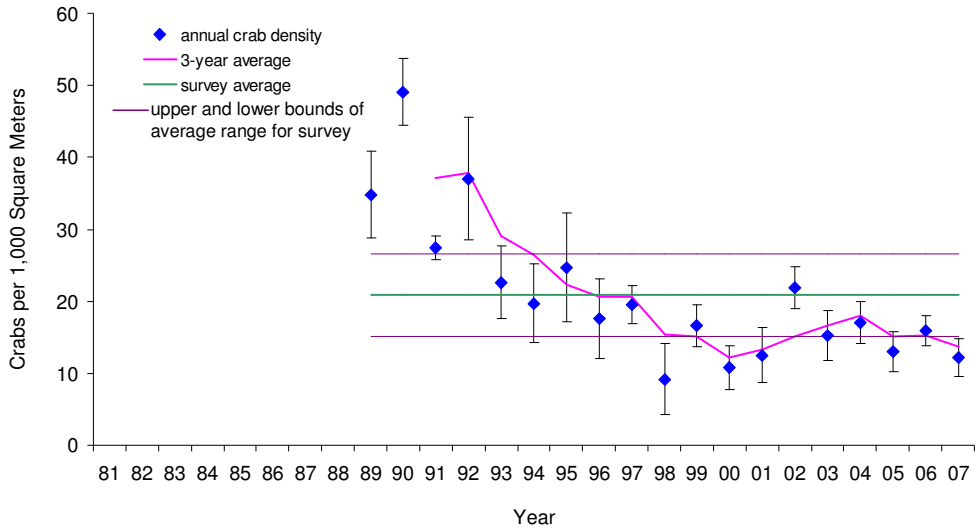


Figure 2. Estimate of abundance of blue crabs aged one year and older from the Bay wide winter dredge survey 1989-2007. These are crabs measuring greater than 60mm across the carapace and are considered the 'exploitable stock'. The lowest observed abundance of 86 million crabs was observed in the 1998-1999 survey. This is considered the overfished threshold. The interim target abundance has been set at 200 million crabs.

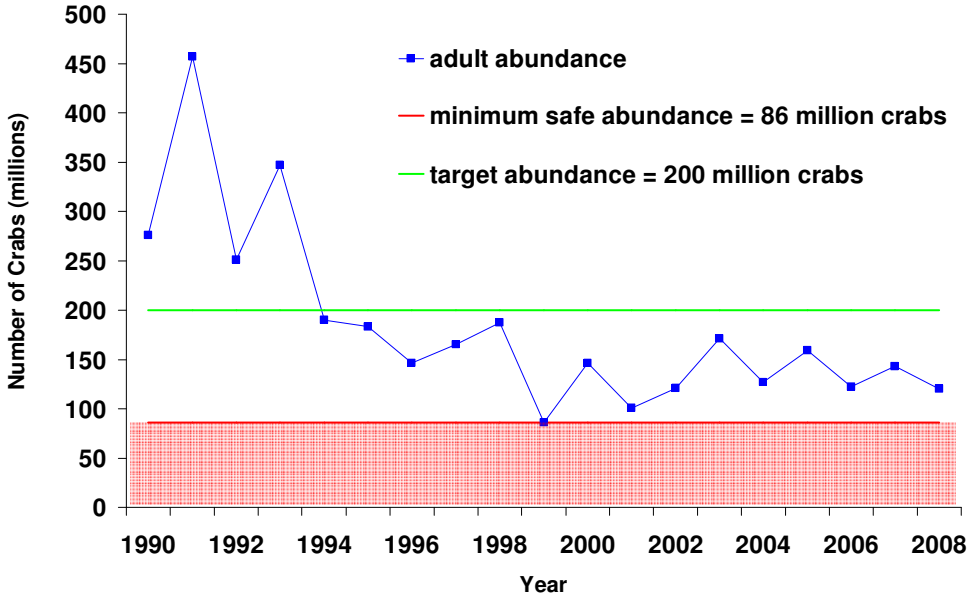
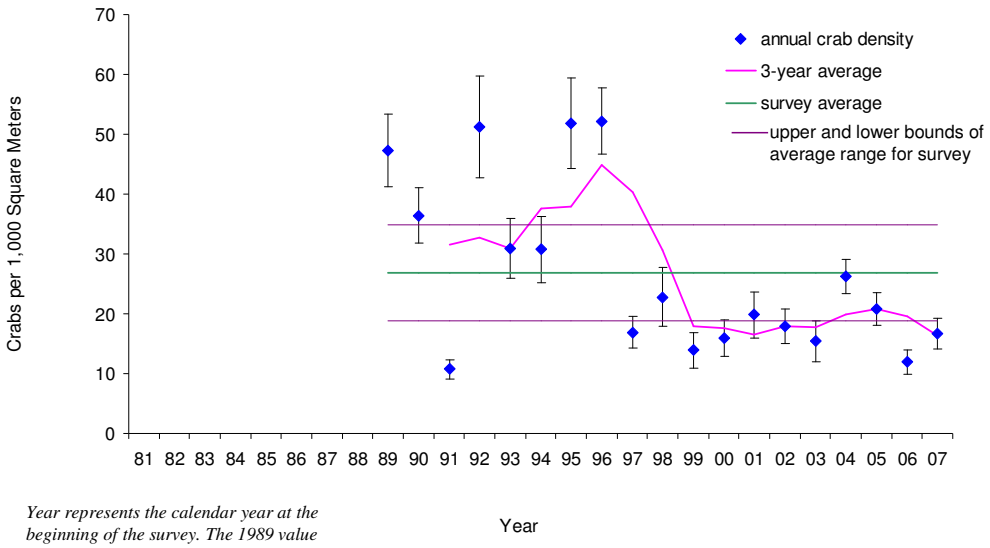


Figure 3. Winter dredge survey density of age 0 blue crabs (recruits) 1989-2006. These are crabs measuring less than 60mm (2.4 inches) across the carapace. 95% confidence intervals (1.96*std error) shown around individual points. The average range for the survey is defined as the standard deviation of the annual crab density values divided by the square root of three.



Year represents the calendar year at the beginning of the survey. The 1989 value represents results for the winter of 1989-1990.

Figure 4. Winter dredge survey density of female spawning potential 1989-2006. These are immature and mature female crabs measuring greater than 60mm (2.4 inches) across the carapace. 95% confidence intervals (1.96*std error) shown around individual points. The average range for the survey is defined as the standard deviation of the annual crab density values divided by the square root of three.

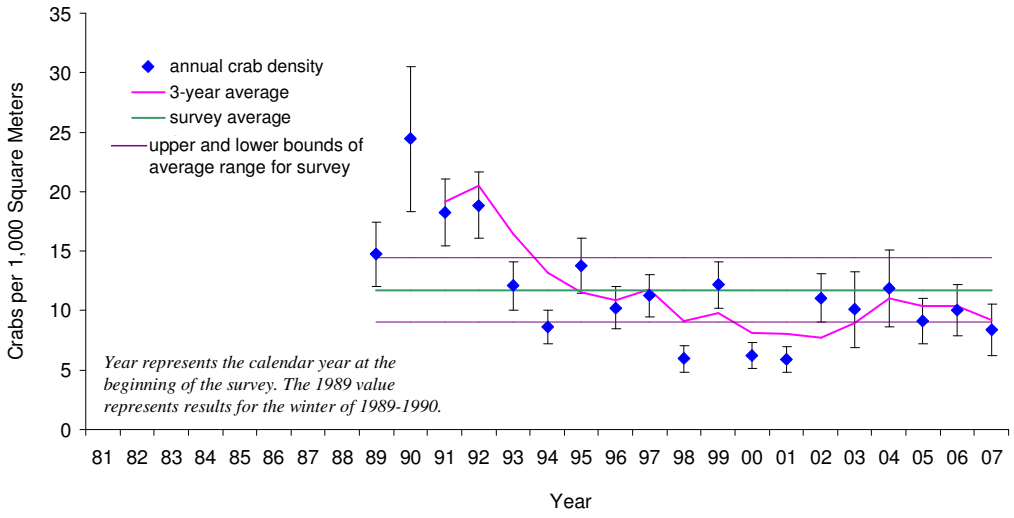


Figure 5. The control rule used to manage the Chesapeake Bay blue crab fishery. An abundance of 86 million age 1+ crabs represents the overfished threshold. In 2007, abundance was above the overfished threshold and the exploitation rate was above the overfishing threshold.

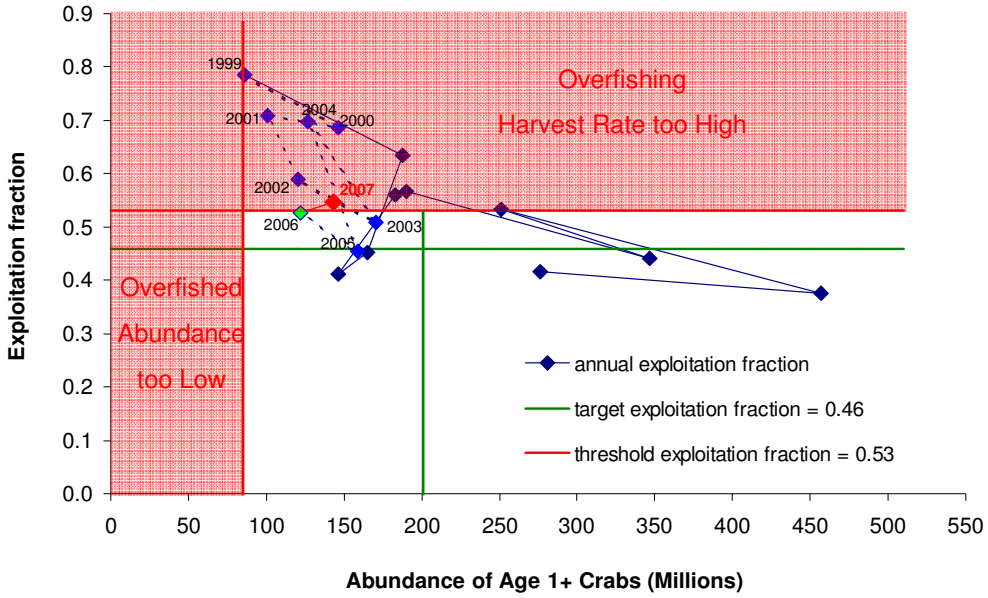


Figure 6. Chesapeake Bay Blue Crab harvest 1945-2007, adjusted for changes in reporting methods.

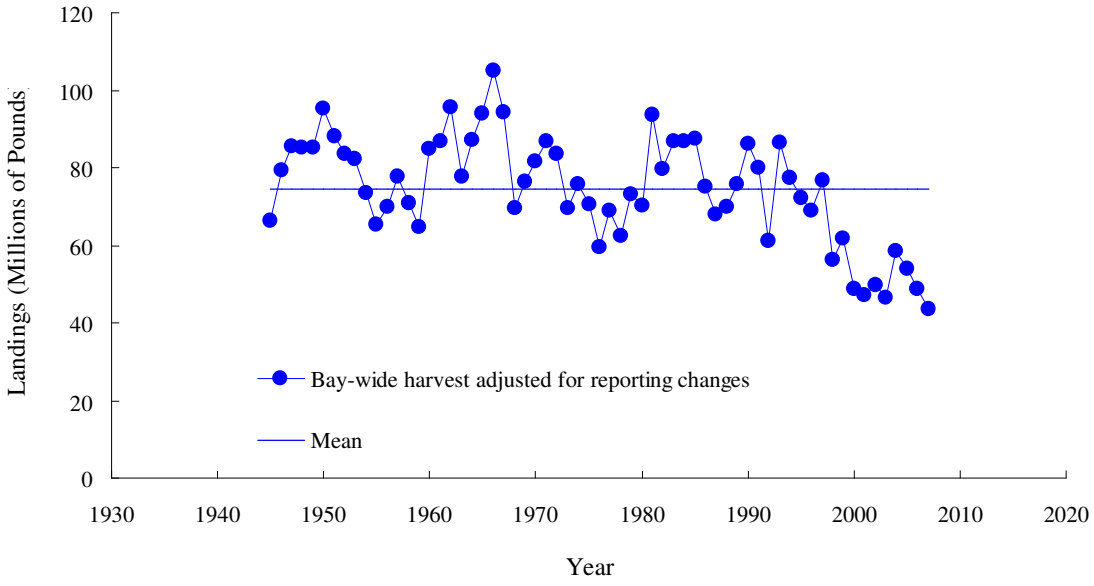


Figure 7. Maryland and Virginia Chesapeake Bay Blue Crab harvest 1945-2007, adjusted for changes in reporting methods.

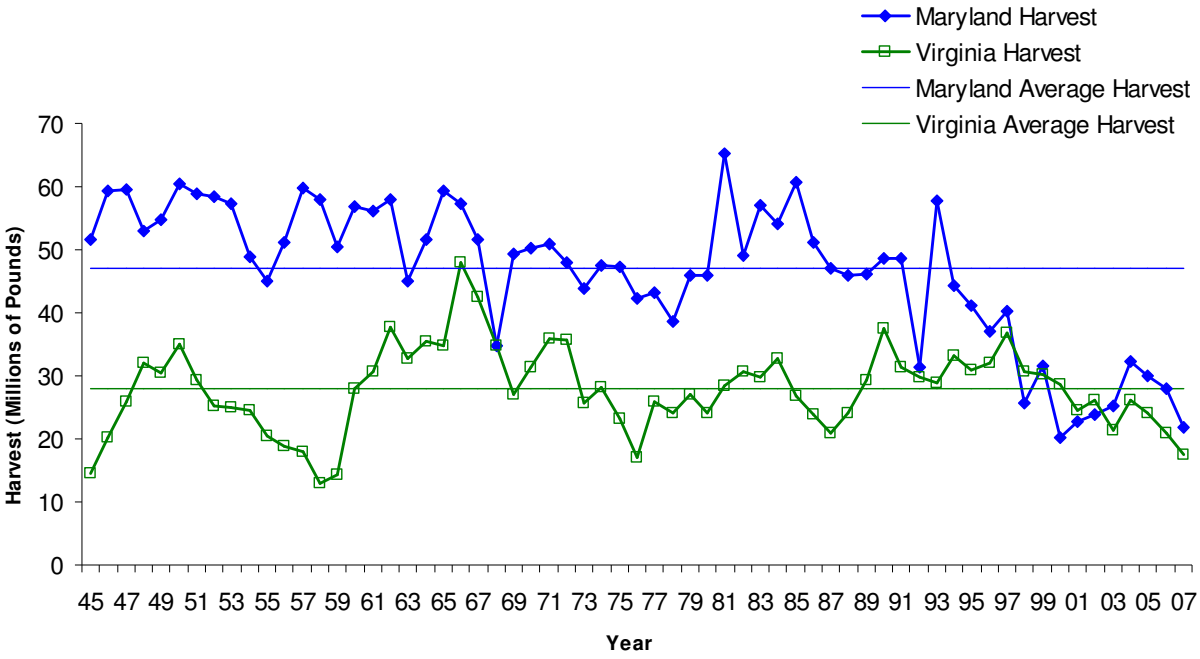
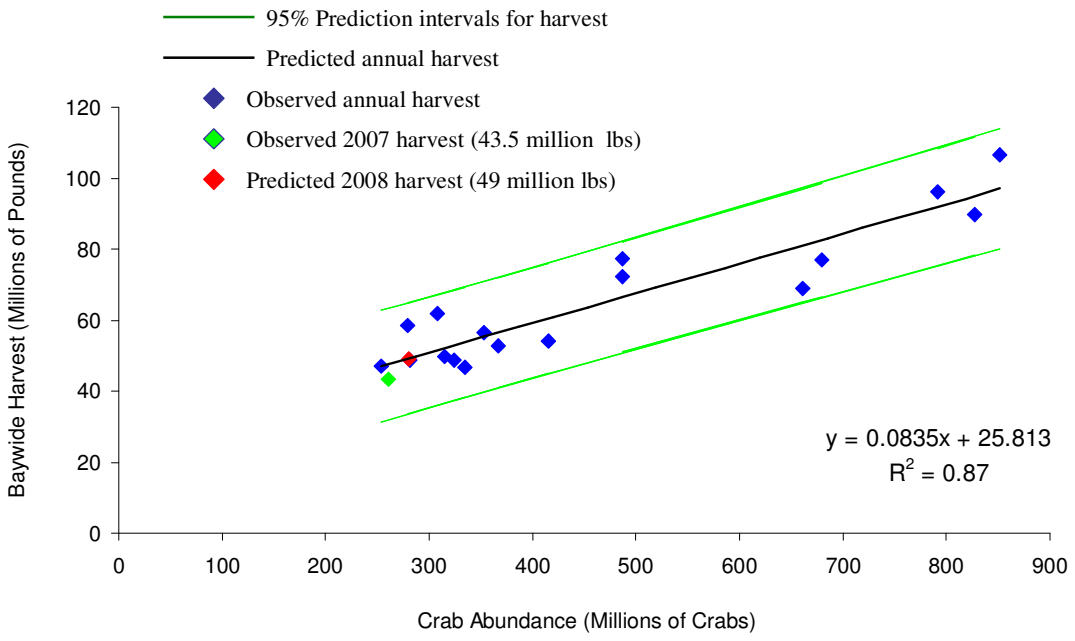


Figure 8. The relationship between the total abundance of crabs measured in the Bay-wide winter dredge survey (WDS), and the subsequent year's harvest in pounds. Based on this relationship, the 2007 harvest is predicted to be 48.7 million pounds with a possible range of 32.3 to 65.1 million pounds. The lowest total abundance of crabs was observed in 2001. The highest abundance and the largest harvest during this time period was recorded in 1993.



ATTACHMENT II. Request for Disaster Relief

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

June 13, 2008

Mr. Harold C. Mears, Office Director
State, Federal, and Constituent Program Office
United States Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northwest Region
One Blackburn Drive
Gloucester, MA 01930-2296

Dear Harry,

Thank you for the opportunity to provide additional documentation in support of the Virginia and Maryland request for declaration of a blue crab fishery resource disaster.

The request for a disaster assistance evaluation in 2008, and for a subsequent 3-year period, is based mainly on commercial fishery losses (harvest opportunities) due to adverse environmental conditions in Chesapeake Bay. These conditions include the catastrophic loss of essential habitat, a decline in water quality, an overabundance of native and non-native predators, and the decimation of key prey species for the blue crab.

The blue crab has provided an invaluable source of opportunities to many in Chesapeake Bay during past decades. Commercial harvests of Chesapeake Bay blue crab remain very important to this region but have been in a state of decline the last 10 years. The 2007 bay-wide harvest of 43,474,420 pounds was 43% less than the 1997 harvest of 76,887,854 pounds. The 1945 – 2007 average harvest is 73 million pounds.

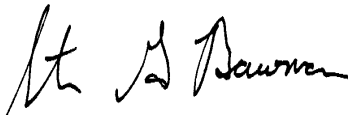
Despite the repeated management efforts taken by Virginia and Maryland over the last decade in an attempt to improve the condition of the blue crab stock, abundance of all size groups of blue crab has remained low. Results from our premier fishery independent survey, the bay-wide winter dredge survey, indicates that the blue crab population has declined by 70 percent, in just 15 years. Since 1999, dredge survey estimates of exploitable-size crabs have been well below what the two states have determined as a desired level of abundance (200 million crabs), and in 8 of the last 10 years, overfishing of the stock has occurred.

Only in recent years, has the peer-reviewed science that guides our management decisions allowed us to better understand the extent of deterioration in this valued resource. It is evident that a convergence of adverse environmental conditions in Chesapeake Bay with historic excess fishing pressure has resulted in a depressed blue crab fishery and the loss of employment opportunity for fishery-dependent workers. Therefore, in response to the recent analytical stock assessment and findings of the Chesapeake Bay Stock Assessment Committee, Virginia and Maryland have committed to an unprecedented 34 percent reduction in female harvest, for 2008, in order to allow this stock to rebound to an interim abundance of 200 million crabs and to immediately reduce the exploitation rate to or near the target of 46%.

These actions will impose economic hardships for many Chesapeake Bay fishermen, processors, and others in this valuable industry. At this time, given the urgency of this matter we have not addressed the value-added economic outcome losses and have limited our economic impacts to those direct economic outputs associated with the harvesting and processing sectors. Nonetheless, economic impacts from this currently depleted resource are widespread in this region.

We thank you for your promptness in responding to our Governors' request that Secretary Gutierrez perform a disaster assistance evaluation of the Chesapeake Bay blue crab fisheries.

Sincerely,



Steven G. Bowman, Commissioner
Virginia Marine Resources Commission

Thomas O'Connell
Director Fisheries Service
Maryland Department of Natural Resources

Request for the Determination, by the National Marine Fisheries Service, of a Fishery Resource Disaster in the Chesapeake Bay Blue Crab Fisheries

Introduction

Sections 312 and 315 of the Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Reauthorization Act of 2006, provide for the declaration, by the Secretary of Commerce, of a commercial fishery failure due to a fishery resource disaster. In their May 2, 2008 letters to Secretary of Commerce Carlo Gutierrez, Governors Timothy M. Kaine and Martin O'Malley requested a disaster assistance evaluation, for those Chesapeake Bay fishermen who have suffered hardships related to extremely low and unstable abundance of the blue crab population.

This request, for a disaster assistance evaluation, is based mainly on commercial fishery losses (harvest opportunities), in 2008 and a subsequent 3-year period. Economic losses have been accumulating over the last decade, as blue crab abundance in Chesapeake Bay has persisted at extremely low levels and harvest has declined precipitously (Figure 1). Economic losses will be severely compounded in 2008 as the states of Maryland and Virginia have committed to a plan that maximizes the chance for rebuilding the crab population and associated fisheries. This plan includes regulatory measures designed to achieve a 34% reduction of the bay-wide harvest of female crabs in 2008. A fundamental component of this plan is for each state to enact early season closure to the harvesting of females crabs, in order to allow pregnant female crabs that have yet to spawn transit from Maryland waters to the lower (Virginia) bay, where these female crabs can over-winter and spawn in 2009. A description of regulatory action for 2008 is included in Appendix I.

Background

The blue crab is an iconic symbol of Chesapeake Bay and is a source of rich cultural heritage in the region. In addition to being an essential component of the Chesapeake Bay ecosystem, the blue crab supports one of the last major commercial fisheries in the Bay and provides the economic foundation for many small Bay-side communities. Despite repeated regulatory action over the last decade, a convergence of historic excess fishing pressure and adverse environmental conditions in Chesapeake Bay have resulted in a depressed blue crab fishery and the loss of employment opportunity for fishery-dependent workers.

In 2000, Maryland and Virginia reached consensus on a framework for managing a sustainable Bay-wide blue crab fishery. This framework is known as a control rule, and was adopted by the Chesapeake Bay Commission's Bi-State Blue Crab Advisory Committee in 2001 and appended to the Chesapeake Bay Blue Crab Fishery Management Plan in 2003 (Figure 2), (BBCAC 2001, CBP, 1997). In 2005, an updated stock assessment of the blue crab recognized that the maturation and development of the Bay-wide winter dredge survey represented one of the most key advances in the science necessary for crab management (Sharov et al. 2003, Miller et al. 2005). Hence, the control rule framework was updated so that winter dredge survey results provide the primary management data. According to this current framework, the overfishing threshold for blue crabs is set at 53% of the population. A target level of sustainable annual harvest is set at 46% (Figure 2).

The control rule framework relates the threshold and target levels of fishery removals to the abundance of spawning age blue crabs present in Chesapeake Bay as measured by the winter

dredge survey. If the blue crab fisheries (commercial and recreational) consistently remove more than 53% of the population, the spawning abundance will likely degrade until healthy reproduction can no longer be assured. The minimum safe level of spawning abundance is defined on the control rule as 86 million crabs. In early 2008 the Chesapeake Bay Stock Assessment Committee set an interim rebuilding target at 200 million spawning age crabs (2.4 inches and greater, in carapace width) (CBSAC 2008).

In the context of the control rule, the Chesapeake Bay blue crab population experienced an extended period of overfishing from 1998 through 2002, when annual removals averaged 68% of the population. In response to this elevated level of fishing pressure, the Chesapeake Bay jurisdictions took management action in 2000, 2001 and 2002 (Appendix II). As a result, fishing pressure declined so that from 2003 through 2007, the average annual removals were 55% (Figure 3). Despite this declining trend in the fishery, crab abundance has remained extremely low and well below the established interim rebuilding target of 200 million crabs (Figure 4). In 2008, the results of the winter dredge survey indicated a decline in abundance of spawning age crabs, and a slight upturn in abundance of young-of-the-year crabs. It is this cohort of young crabs that the 2008 regulatory action is designed to protect while constraining the 2008 fishery to the target removal level (Figure 5). In the face of environmental challenges, the 2008 management action to reduce the harvest of female blue crabs by 34% is necessary to maximize the chances for stock response and fishery recovery.

Adverse environmental conditions in Chesapeake Bay that have contributed to economic losses in the blue crab fishery and created challenges for rebuilding the crab population and associated fisheries include, but are not limited to: A) loss of essential habitat such as submerged aquatic vegetation and oyster reefs, B) overall degradation of benthic habitat due to increasing severity of hypoxic conditions, C) an over-abundance of native and non-native predators on blue crab, and D) the decimation by disease of key bivalve prey species for the blue crab.

NMFS Response

On May 19, 2008, Mr. Harold C. Mears, Office Director, State, Federal and Constituent Programs Office, National Marine Fisheries Service, Northeast Regional Office, requested specific information supporting the disaster declaration, for the Chesapeake Bay blue crab fishery. This report contains responses to the questions (1 through 3, shown below), from the National Marine Fisheries Service, and supporting documentation of the disaster condition is also provided.

1. Status of stock – The NOAA Chesapeake Bay Office supports the Chesapeake Bay Stock Assessment Committee. The National Marine Fisheries Service (NMFS) has substantial background from that effort. However, additional supporting data based on any other available peer reviewed stock assessments and surveys would be especially helpful in determining a fishery resource disaster. In particular, we do not have the most recent results of the 2008 winter dredge survey.

In addition to the Bay-wide winter dredge survey, the Chesapeake Bay jurisdictions have conducted various surveys to assess the biological health of the blue crab that include: A Virginia Institute of Marine Science Trawl Survey (1955 – present); An Academy of Natural Science / Morgan State University Calvert Cliffs, Maryland Peeler Pot Survey (1968 – present), and a Maryland Trawl Survey; (1978 – present).

Although all of these surveys provide more localized and less precise indices of abundance than does the winter dredge survey, they do provide a historical context that is lacking in the comparatively short time series of the dredge survey. The results of the 2007 surveys consistently indicate a decline in blue crab abundance. Importantly, the Virginia trawl survey is the only Bay survey that samples mature female crabs on the spawning grounds, during the spawning period. Results of this spawning area survey indicate that, in 2007, female crab abundance persists at extremely low levels (Figure 6). Likewise, the results of the Maryland Trawl survey indicate that, in 2007, the abundance of adult female and age 0 (young-of-the-year) crabs dropped below the average range for the survey (Figures 7-8)..

2. Causative factors – the letters to the Secretary both indicate that factors including water quality and habitat might contribute to the decline. Additional data on these as well as other causative factors and associated impacts related to the declines in blue crab population abundance and commercial catch are essential to our analysis.

Causative Agents listed in Background Section:

A) Loss of Essential Habitat

Blue crabs depend on structured habitat such as submerged aquatic vegetation (SAV) and oyster reefs for protection from predation when crabs are newly settled out of the megalopal stage. (Heck and Spitzer 2001). These habitats also provide crucial protection during subsequent molting periods and provide rich foraging areas (Kennedy et al. 2007). Both SAV and oyster reef habitat have declined significantly in the past two decades.

Submerged Aquatic Vegetation (SAV)

Seagrass beds and marshes have been identified as important nurseries for the blue crab. A major proportion of the crabs in vegetated habitats are <20 mm in carapace width and utilize these habitats, especially seagrasses, in the winter. *Zostera marina*, commonly referred to as eelgrass, was once abundant in the more saline portions of the bay and its major tributaries. Eelgrass is now either absent or rare in each of the major western shore tributaries of Chesapeake Bay: the Patuxent, Potomac, Rappahannock, York, and James rivers, as well as much of the eastern side of the bay, owing largely to Tropical Storm Agnes in June 1972 (Orth pers. comm.).

Despite a period of recovery of eelgrass beds after Agnes, abundance of the SAV began a sharp decline again in 1993, and in 2007 record low levels of eelgrass were observed in Chesapeake Bay (Figure 9). While the downward trajectory in eelgrass abundance appears to be related to declining water clarity (EPA Chesapeake Bay Program water quality data) two recent events have contributed to this serious loss. In 2003 Hurricane Isabel resulted in the loss many beds exposed to the predominant wind field while in 2005, a bay-wide dieback occurred as a result hot and very calm conditions in July and August (Orth Pers. Comm.). Hurricanes have been increasing in frequency over the last decade. The number of documented major storms recorded by the National Hurricane Center (www.nhc.noaa.gov) impacting the Chesapeake Bay watershed or waterways have increased from 7 and 3 during the ten year periods from 1977-1986 and 1987-1996, respectively, to 12 from 1997-2006 (there have been a total of 90, 107 and 147 recorded storms for the Gulf and Atlantic, respectively). As

with Tropical Storm Agnes, hurricanes can lead to a loss of important nursery sea grasses, for blue crabs and slow recovery.

Another species of SAV, widgeongrass (*Ruppia maritima*), can co-occur with eelgrass or grow in mono-specific stands. A number of areas that once supported these mixed beds now have only widgeongrass, e.g. Bloodsworth Island, Honga River, north shore of the lower Rappahannock River). Widgeongrass may provide habitat for the blue crab but it is a boom or bust species. An annual survey conducted by the Virginia Institute of Marine Science has shown areas with dense beds for several years and then total absence the following year. Widgeongrass beds in mixed stands appear more stable.

Remaining eelgrass beds can be potentially negatively influenced by other biotic and abiotic stressors including cownose rays (*Rhinoptera bonasus*) and hurricanes. While rays and hurricanes have always been an integral part of the Bay ecosystem, these stressors may be more problematic today because their effects could easily place already diminished eelgrass populations well below the capacity for natural recovery (Orth pers.comm.). Cownose rays have been demonstrated to affect eelgrass distribution by uprooting plants digging for clams. However, recent data suggest cownose rays to be increasing in abundance as a result of significant losses of important ray predators-- sharks (Pers. Comm. University of Miami, Science Daily. March 29, 2007).

Oyster Reef Habitat

In a survey conducted from 1970 to 1983 by the Maryland Bay Bottom Survey (MBBS), it was estimated that there were 200,000 acres of oyster habitat in the Chesapeake Bay. Half of this habitat (100,000 acres) was classified as poor quality habitat. Since 1983, the poor quality habitat identified in the MBSS survey has completely vanished. Current work estimates that only 36,144 acres of oyster habitat remain in the Maryland portion of Chesapeake Bay, and only a small percentage of this remnant habitat can be considered high quality (Greenhawk et al. 2007, Smith et al. 2001). The VMRC has determined that only 11,000 acres of the 210,074 acres identified by the Baylor Survey (1894) have a realistic chance of being restored (Wesson pers.comm). Oyster reefs serve as feeding sites and refuge, from predators, for juvenile blue crabs.

B) Overall Degradation of Benthic Habitat through Loss of Dissolved Oxygen

The Chesapeake Bay is being impacted by the addition of excess nutrients (nitrogen and phosphorous) from point (sewage treatment plants or industrial operations), non-point (storm-water running off of urban or rural land) and atmospheric sources. Once the nutrients are in the Bay, they become food for plants. But excess nutrients cause too much plant growth, especially algae (microscopic floating plants).

When the algae die, they settle to the bottom where they are naturally decomposed by bacteria. During this normal decomposition process, the bacteria use dissolved oxygen from the Bay's bottom waters. When large amounts of algae are decomposed by bacteria, the removal of dissolved oxygen is substantially increased. This dissolved oxygen is needed by blue crabs and other organisms living on and near the bottom. This situation worsens in the summer when several natural factors act to further lower the amount of dissolved oxygen in the Bay's water. In order to protect critical aquatic living resources (including blue crabs) in the Bay, Maryland,

Virginia, Delaware and the District of Columbia adopted the US EPA's water quality criteria developed specifically the Chesapeake Bay (including dissolved oxygen and bottom habitat.)

Dissolved Oxygen

Currently, the majority (88%) of Chesapeake Bay waters fail to attain the dissolved oxygen required by the respective States (Figure 10). The resulting low dissolved oxygen concentrations drive blue crabs from their preferred habitat and kill many of the small bottom organisms on which the blue crabs feed. The low dissolved oxygen conditions caused by excess nutrients are the primary reason large bottom sections of the Bay are unsuitable as blue crab habitat.

Bottom habitat

The bottom habitat of the Chesapeake Bay is assessed by measuring aspects of the benthic community (diversity, composition, abundance). This indicator represents potential food available for crabs and other Bay organisms. Large portions (57%) of the Chesapeake Bay's bottom habitat fail to attain the score required by the respective States (Figure 11). Suspected sources for degradation include low dissolved oxygen, contaminants and unknown sources.

C) Elevated Abundances of Native and Non-Native Predators of the Blue Crab

Documented predators of the blue crab include striped bass, Atlantic croaker, red drum, blue catfish, and cownose rays. The Maryland Department of Natural Resources has monitored populations of striped bass in Chesapeake Bay since 1958 via a juvenile seine survey and an adult spawning stock survey. Results of both of these surveys indicate a substantial increase in abundance of striped bass since the mid-1990's (Figures 12 and 13). Likewise, the population and harvest of Atlantic croaker has been monitored within the mid-Atlantic region for several decades, and that status of the stock is regularly assessed by a technical committee of the Atlantic States Marine Fisheries Commission. The 2004 stock assessment indicated that abundance of croaker in the mid-Atlantic region increased dramatically through the mid 1990's (Figure 14).

Several studies have documented predation rates of fish such as striped bass, croaker, and red drum on blue crab. Increasing abundances of these predators could impact blue crab populations. Orth, et al. (1999), on two days in 1998, sampled striped bass, croaker and red drum in seagrass beds in the York River where juvenile blue crabs were abundant and found that 60% of the striped bass, 100% of the drum and 34% of the Atlantic croaker had consumed juvenile blue crabs. Further, limited studies in Virginia grass beds in 1999 found 55% of striped bass, 64% of red drum and 10% of croaker ate crabs. Crabs made up 45%, by weight, of the diet of striped bass feeding in grass beds. Data from a more intensive and extensive study in the fall of 2000 were analyzed. A preliminary analysis of the 2000 data indicated that the average number of crabs in striped bass varied from 1.9 to 15.1 and averaged 3.5 crabs per stomach. The proportion of striped bass eating crabs appeared to be similar to previous years.

Speir (2001) summarized studies of predation by striped bass on blue crab and stated these studies illustrate the large difference between diets of striped bass sampled in grass beds and striped bass sampled in open waters of the Bay. The grass beds in Virginia waters are where the crab larvae, which are moving back into Bay waters from offshore, settle to molt into young crabs. The grass bed offers food and shelter for the growing crabs and densities of young crabs have been found to average 30 per square meter in grass beds and only one per square meter on adjacent un-vegetated habitat (Orth et al. 1996). That predators in the grass beds would find greatly increased opportunities and increased striped bass feeding on crabs is a not surprising

consequence. Speir (2001) concluded, from comparison with historical studies, there are some indications that presently crabs are more commonly found in striped bass stomachs and that they may make up a larger portion of the weight of all food items (Anthony Overton, Univ. Md. Eastern Shore, personal communication). The increased consumption of crabs is probably not sufficient to account for the decline in crab abundance over the past four years. Latour and MontFrans (VIMS) provided an updated assessment of predation, by finfish on blues crabs in grass beds. In this 2005 study, a spring sampling complemented a fall sampling of key predators of blue crab in grass beds. Primary predators captured were 'resident' striped bass (ages 1-4) and Atlantic croaker. Compared to the 1998 study by Orth et al. (only a fall sampling was conducted) the spring sampling in 2005 revealed a much higher striped bass predation (% weight) on blue crab than in fall 1998 or 2005 (Figure 15). Blue crab, as prey in Atlantic croaker, comprised roughly 4% and 15% of the fall and spring diet, respectively (Figure 16).

Blue catfish have been observed to prey on blue crabs in Virginia tributaries to the Chesapeake Bay. Because the blue catfish is an introduced species, and a relatively new arrival to habitat shared by the blue crab, few quantitative diet studies have been conducted. The diet of blue catfish is omnivorous and facultative (Figure 17; Latour pers. comm.). Results from diet studies (Latour pers. comm..) conducted on blue catfish collected by trawl during 2004 – 2006, in the James, York and Rappahannock rivers, do show the samples of blue catfish, from the mesohaline (6 – 18 ppt) portion of the James River were associated with the highest percentage of blue crab, as a prey item (Figures 18 - 20). However, there is documentation of significant increases in abundance of blue catfish in the Potomac River (Figure 21). Anecdotal reports of encounters of blue catfish in commercial fishing gear, including crabbing gear have increased in the past couple of years, as have anecdotal reports of predation by blue catfish on crabs.

D) Loss of Key Prey Resources for Blue Crab.

Bivalves, including *crassostrea virginica* (oyster), *macoma spp*, *mya arenaria* (soft shell clam), and *tagelus plebius* (razor clams) comprise a large component of the blue crab diet (Kennedy et al). The decline of the oyster due to disease has been well documented in Chesapeake Bay (NRC 2004). Less well documented, but equally important is the impact of disease on other bivalve populations in the Bay. Two diseases, *Perkinsus chesapeaki* and disseminated neoplasia (DN) have been documented in other species of bivalve (Dungan et al. 2002).

Since 2001, soft shell clam populations have continued to decline from an already low stock size. In 2002, a major mortality event occurred in most of the Bay (Homer et al. 2005). It is estimated that soft shell clam stocks in Maryland are less than 3% of what they were from 1955-1975.

In June 2004 there was a major mortality of razor clams that was coincident with the appearance and geographical spread of DN disease in razor clams (Homer et al). By June 2004, it was estimated that 60-70% of the entire Chesapeake Bay razor clam population (>30mm) had died between December 2003 and May 2004 (Homer et al. 2005).

3. Economics – Additional supporting material is needed to assess the economic status of commercial blue crab fishery participants. Statistical summaries of blue crab harvest and associated revenues (e.g., over the last five years) will also help us with our determination.

The average (1945 – 2007) harvest of blue crab from Chesapeake Bay is 73 million pounds. Table 1 shows the annual harvest of blue crab from the waters of the Chesapeake, 1990 – 2007, has been below the long-term average, since 1998, with extremely low harvests (less than 50 million pounds), in 6 of the last 8 years.

During the last 10 years, the average landings (harvested within the Chesapeake or other jurisdictions) of blue crab in the Chesapeake Region was 55.5 million pounds, and the lowest annual landings occurred in 2006, as shown in Table 2 (NMFS Commercial Fishery landings Data). Based on the 2007 bay-wide harvest and using the 2006 average price per pound, the 2007 ex-vessel value is well under $40 million dollars.

In 2007 Maryland and Virginia were faced with industry-reported all-time low harvests of blue crab, very low recruitment (age-0 crabs) during the winter of 2006 and 2007 and marginal amounts of exploitable-size crabs (2.4 inches and greater) despite repeated adoption of fishery conservation measures, as recently as 2002. Especially, the continued low abundance of the spawning stock of female crabs was cause of great concern. Figure 5 indicates that abundance of the spawning stock was below average, through 2006, for a decade, and the 2007 abundance is only a slight improvement over 2006. All of these factors prompted the two states to cooperate on a female harvest reduction plan for 2008.

Virginia

In Virginia despite the stepwise implementation of a 22-point management plan, 1994 – 2002 (Appendix II), there is no current evidence that the management plan increased either the bay-wide stock abundance or harvest. Many of the Virginia conservation measures, such as a 7–fold increase of the acreage that protects crabs for spawning during the June 1 – September 15 period and cull (escape) ring requirements were attempts to increase the spawning potential. The 2007 estimates of the spawning stock remained very low. This advice and poor condition of the crab stock and its fisheries led the Virginia Marine Resources Commission (VMRC) to invite blue crab scientists, from Georgia through Maryland, to gain a comprehensive scientific review of the twenty – two management measures implemented by the VMRC, from 1994 through 2007. Critical findings of this review committee included:

- Substantial reductions in effort in this crab pot fishery will directly conserve female crabs and can lead to a lower exploitation rate on female crabs, since the sex composition from this fishery is often 70% female.

- Despite variability in environmental factors, the focus of management should be achieving an exploitation fraction that falls consistently near the target exploitation rate (0.46). If exploitation can be constrained to the target, for several years, there would be a greater chance of success as measured by increased (or rebuilt) crab abundance and an optimized fishery.

- The committee discussed the benefits of reducing the November fishery, even by two weeks. Given the high exploitation rate on female crabs and low abundance of the spawning stock, a shorter late-fall season could benefit the stock.

Following this series of meetings with the scientists and additional meetings with its advisory groups, the VMRC held initiated a series (February through April) of public hearings, with the intent of reducing an exploitation rate that had exceeded the overfishing threshold six of the previous nine years.

Two main components of the Virginia plan to reduce the harvest of female crabs that are associated with lost income, to fishermen, are the establishment of an early season closure in 2008 and the elimination of the 100-year old winter dredge fishery. Other measures established by Virginia (cull ring changes, changes in the peeler crab minimum size limit and establishment of an earlier closure to the sanctuary, reduction in pot limits) are detailed in Appendix II and contribute to the overall, 34% reduction in the harvest of female crabs in 2008 but cannot be directly related to loss of income. However, the losses associated with closing the harvest to female crabs on October 27 (rather than November 30), given that Virginia fisheries are dominated (75% or more) by female crabs can be projected (Table 3).

Table 3 provides a summary of economic impacts associated with the early (October 27) closed season on the harvest of female crabs. Appendix III provides a complete listing of all fishermen who will be impacted, by this early 2008 closure, and provides the methodology used to calculate the impact... It is expected, given the new regulatory measures adopted by Maryland and Virginia, that a minimum of 3 years of improved crab stock conditions will be necessary, for fishermen to recoup the losses not only associated with the 2008 closure but also related to the poor economic returns of the reference period (2004-07), compared to earlier years. The VMRC estimates a 2008 economic loss of $1,382,093, to those harvesters who will be prohibited from harvesting female crabs, from October 27 through November 30. The 3-year projection of losses equals $4,146,278.

Tables 4 and 5 summarize activity, harvest and projected economic impacts, for the Virginia crab dredge fishery. In April the VMRC eliminated this long standing fishery. The data in Table 4 indicate a gradual decline in active licensees through the 2003-04 season, followed by large decline in participation after then. This is a traditional fishery that has supplied crabs to markets, at a critical time of the year, but low crab abundance, and overhead (especially fuel) costs contributed to the declines in participation, in recent years.

Table 5 provides a projection of 2008 and 2008-10 economic losses, for crab dredge fishermen that are now prevented from crab dredging in Virginia waters. The initial economic impact, based on the new prohibition on harvesting, by dredge, is estimated as $2,996,216. A 3-year economic impact equals $8,988,648.90. Appendix II provides the complete enumeration of fishermen affected by this elimination of a fishery.

It was very difficult for the Commission, in Virginia, to eliminate the crab dredge fishery. However, the commitment of Virginia to protect the cohort of pregnant crabs that emigrate from Maryland in the fall to over-wintering grounds, within these same crab dredge areas, took precedent. Mitigating factors, in the Commission's decision to eliminate this fishery, included the knowledge that many more crab fishermen would be faced with a much longer closed fall season, were the crab dredge fishery allowed to continue.

Maryland

The regulations adopted in 2008 will have an estimated economic impact of $1,471,780 to commercial crab harvesters and $1,466,895 to processors and laborers.

The estimate of the economic impact on commercial crab harvesters accounts for the lost revenue for harvesters from the decrease in harvest as a result of the closure of the female crab harvest on October 23 and the tiered bushel limits that would be in effect in the September and

October ($1,569,400). Fewer crabs will be available on the market due to the bushel limits and closed season for females. This demand will cause an increase in the market price of the crabs sold by watermen. To determine the increase in price that would occur due to a reduction in female harvest, we estimated a series of demand equations for the different market categories of hard crabs. The price increase was small ($97,600) and there was little compensation to the watermen due to the reduced landings from increased prices. To calculate commercial fishing impacts, we assumed that crabbers would continue to fish with the same effort under the bushel limit and closed (for females only) season as they would without the regulations. They would simply discard females. Thus, the cost of fishing does not change due to the regulations and the net change in watermen income would be exactly equal to the change in gross revenue (landings times price). This assumption means no impact on supporting industries such as bait or gear providers has been accounted or estimated.

The estimate of the impact on crab processors accounts for the loss in the profit due to reduced production of Maryland crabmeat ($266,600). To calculate the reduction in processed product due to the regulations, we estimated what the production was in 2006 for each month (2007 processor data is not yet available) from Maryland crab and reduced that by the percentage decrease in crabs landed as calculated from the impact on watermen. We also adjusted the price that processors would have to pay to purchase crabs by increasing the reported crab purchase price by the same percentage as we calculated price would increase from the demand model estimated for the harvesters.

The estimate of the impact on laborers employed by processors ($1,007,400) assumes that processors will hire less labor, or that laborers will work fewer hours, due to the decrease in production.

The estimated impacts on commercial crab harvesters, processors, and processing laborers are based on the 2007 commercial harvest and assume that the same harvest would occur in 2008. However, the 2007-2008 winter dredge survey indicates that without new regulations, the harvest in 2008 might be higher that in 2007, in which case the regulations would be more costly to the affected entities since they would have to forgo greater potential revenue as a result of the regulations.

References:

BBCAC (Bi-State Blue Crab Advisory Committee). 2001. Taking Action for the Blue Crab: Managing and Protecting the Stock and its Fisheries. A report to the Chesapeake Bay Commission; Annapolis, Md, Richmond , Va. 24pp.

CBSAC (Chesapeake Bay Stock Assessment Committee). 2008. Output From a Working Meeting, January 2008, Annapolis, Maryland. Report to NOAA Chesapeake Bay Office.

CBP (Chesapeake Bay Program). 1997. 1997 Chesapeake Bay Blue Crab Fishery Management Plan. Living Resources Subcommittee. 102pp.

Dungan, C.F., Hamilton, R.M., Hudson, K.L., McCollough, C.B., and Reece, K.S. (2002). Two epizootic diseases in Chesapeake Bay commercial clams *Mya arenaria* and *Tagelus plebeius. Dis. quat. Org.* 50: 67-78.

Greenhawk, K., T. O'Connell and L.S. Barker. 2007. Oyster population estimates for the Maryland Portion of Chesapeake Bay 1994 – 2006. Maryland Department of Natural Resources, Fisheries Service. Annapolis, Maryland.

Heck, K.L., Jr. and P.M. Spitzer. 2001. Post Settlement Mortality of Juvenile Blue Crabs: Patterns and Process. Pages 18-27 in V. Guillory, H. Perry and S. VanderKooy (eds.). Proceedings: Blue Crab Mortality Symposium. Gulf States Marine Fisheries Commission Publication 90. Ocean Springs, Mississippi.

Mark Homer, Mitchell Tarnowski, and Chris Dungan. 2005. Assessment of Chesapeake Bay Commercial Softshell Clams *Mya arenaria* and *Tagelus plebeius.* Extended abstract for NOAA CBSAC presentation.

Kennedy, V.S. and L. E. Cronin (eds.). 2007. The Blue Cra*b: Callinectes sapidus* Maryland Sea Grant Press. College Park, Maryland. 773pp.

Miller, T. J. et al. 2005. Stock Assessment of the Blue Crab in Chesapeake Bay. Technical Report Series No. TS-487-05 of the University of Maryland Center for Environmental Science, 162pp.

NRC (National Research Council of the National Academies). 2004. Nonnative Oysters in the Chesapeake Bay. The National Academies Press. Wasington D.C. 323pp.

Orth, R...J. and J. van Montfrans. 1990. Utilization of marsh and seagrass habitats by early stages of *Callinectes sapidus:* a latitudinal perspective. Bulletin of Marine Science. 46(1), 126-144

Orth, R.J., J. van Montfrans, J. Fishman. 1999. A preliminary study of predation on blue crabs by three fish predators in a seagrass bed. Virginia Institute of Marine Science.

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

Smith, G.F., K.N. Greenhawk, D.G. Bruce, E.B. Roach and S.J. Jordan. 2001 A digital presentation of the Maryland oyster habitat and associated bottom types in the Chesapeake Bay (1974-1983). Journal of Shellfish Research 20:197-206.

Speir, H. 1981, A review of predation on blue crabs in Chesapeake Bay.
http://www.dnr.state.md.us/fisheries/recreational/articles/crabpred.html (5/20/08).

Figure 1. The control rule used to manage the Chesapeake Bay blue crab fishery. An abundance of 86 million age 1+ crabs represents the overfished threshold and 200 million age 1+ crabs is the target abundance. In 2007, abundance was above the overfished threshold, but well below the target. The exploitation rate was above the overfishing threshold.

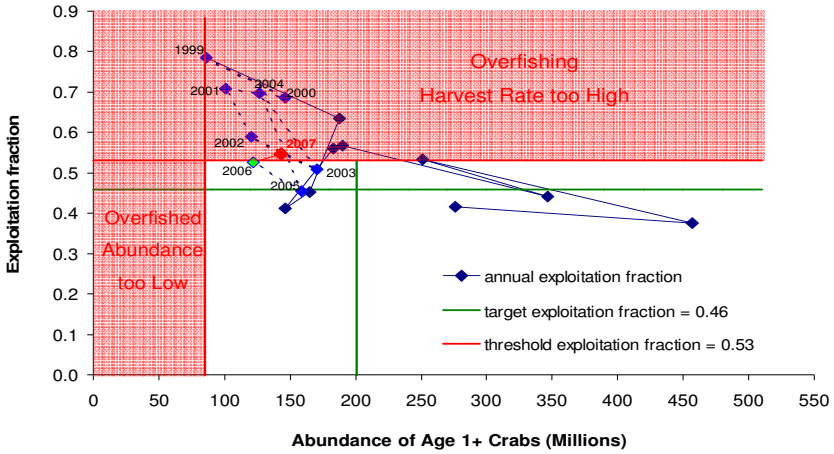


Figure 2. Annual exploitation fraction (percentage of crabs removed by fishing) of blue crabs in Chesapeake Bay. If greater than 53% of crabs are removed in a given year, overfishing is occurring. Overfishing has occurred in 7 of the past 10 years.

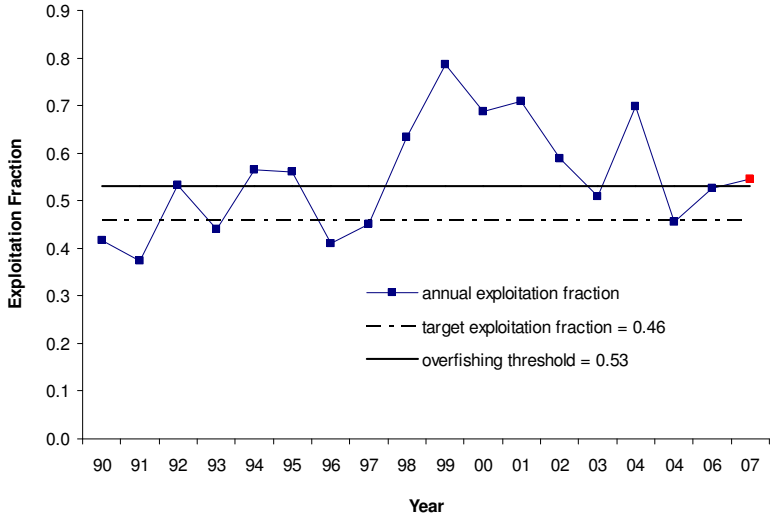


Figure 3. The annual abundance of spawning age crabs in Chesapeake Bay. The threshold or minimum save level of abundance is set at 86 million crabs. The target level is 200 million crabs. The 2007-2008 winter dredge survey estimate was 120 million crabs, which represents a slight decline from the previous year.

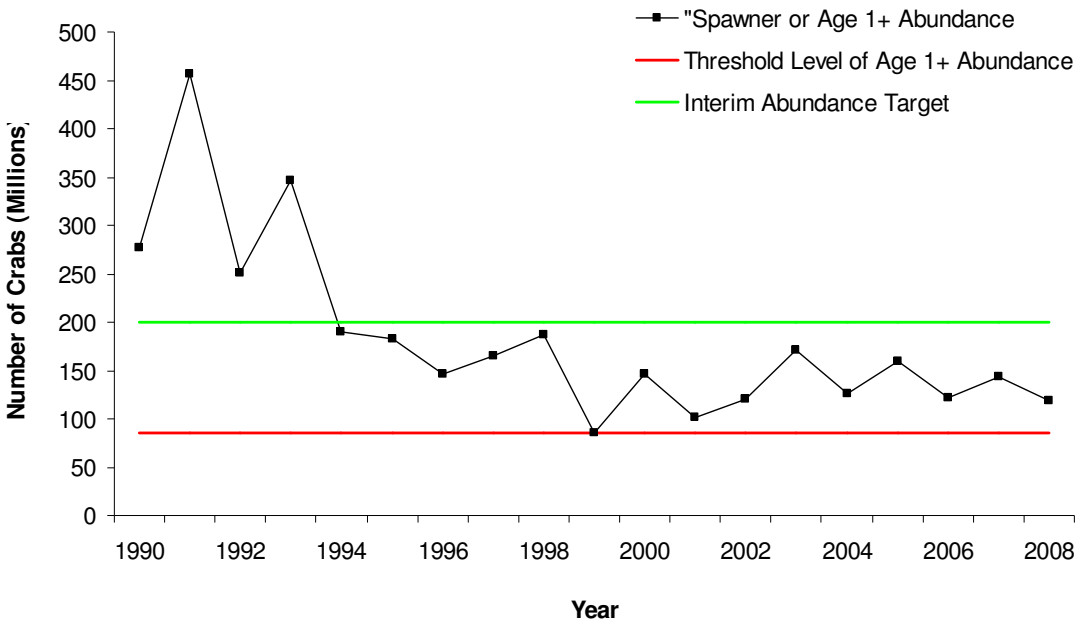


Figure 4. The annual abundance of young-of-the-year crabs in Chesapeake Bay. The 2007-2008 winter dredge survey estimate was 160 million crabs, which represents a slight increase from the previous year. These young crabs will be vulnerable to the 2008 fishery beginning in August. The 2008 regulations will allow greater protection of female component of this year-class as they mature to spawning age in the fall of 2008.

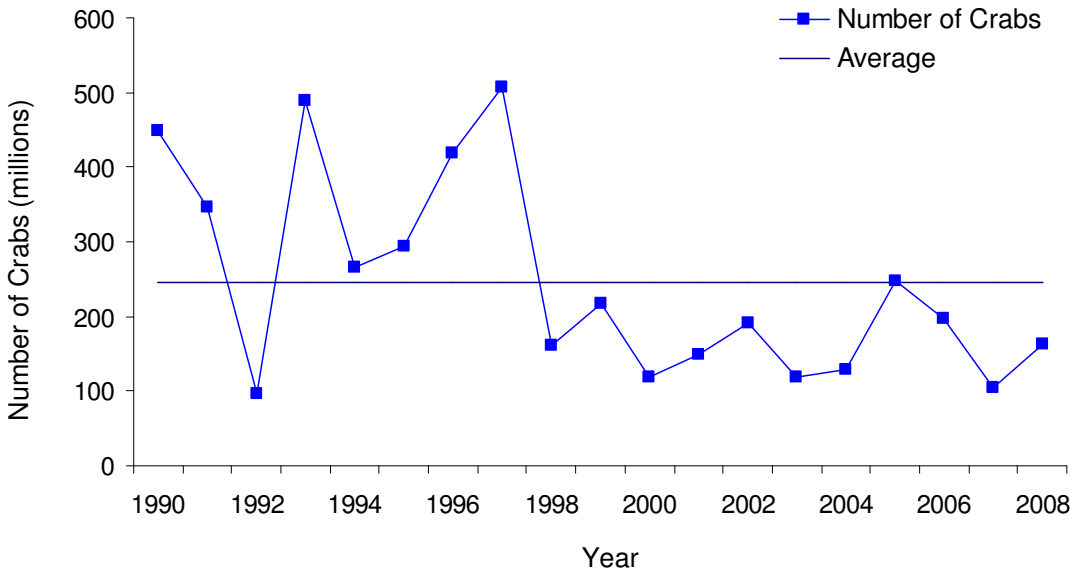


Figure 5. Virginia Trawl Survey catch per tow of adult female crabs, 1968 through 2007, from sites in the upper and lower rivers, and the mainstem of Chesapeake Bay. All females caught from August through November are considered to be adult, in that they will likely spawn within 1 year.

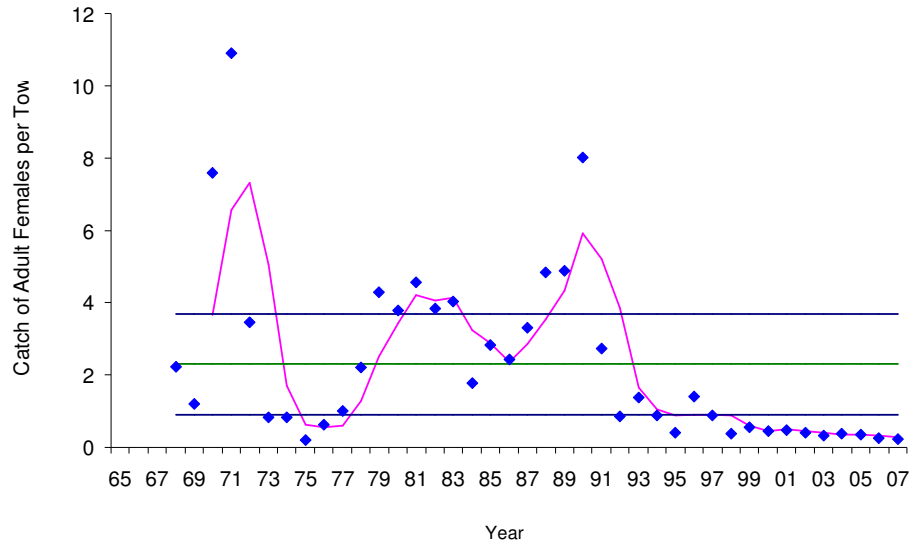


Figure 6. Maryland Trawl Survey catch per tow of adult female crabs, 1977 -2007. Adult female crabs caught from August through October are classified in adult, in that they will likely spawn within one year.

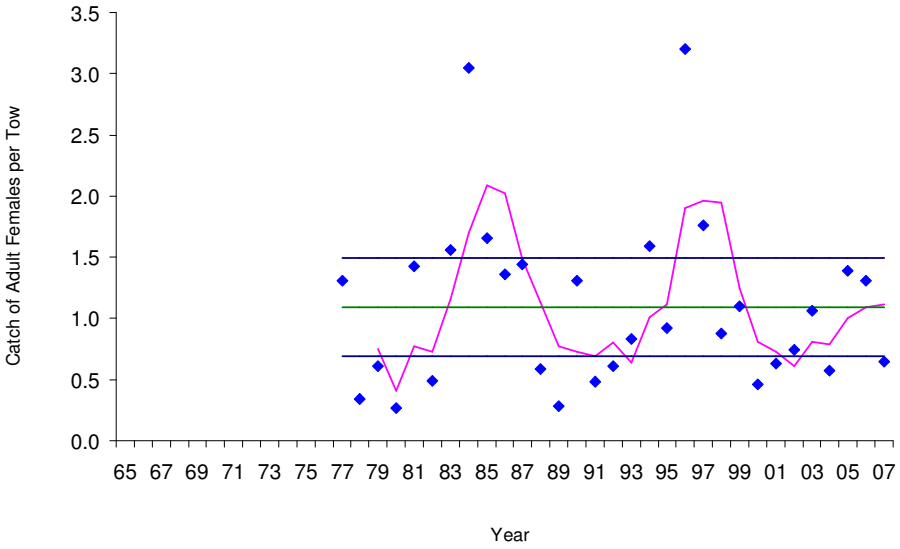


Figure 7. Maryland Trawl Survey catch per tow of age 0 crabs, 1977 - 2007. Age 0 is assigned to crabs caught during September and October that are less than or equal to 50 mm across the carapace. The average range is defined as the standard deviation of the annual crab density values divided by the square root of three.

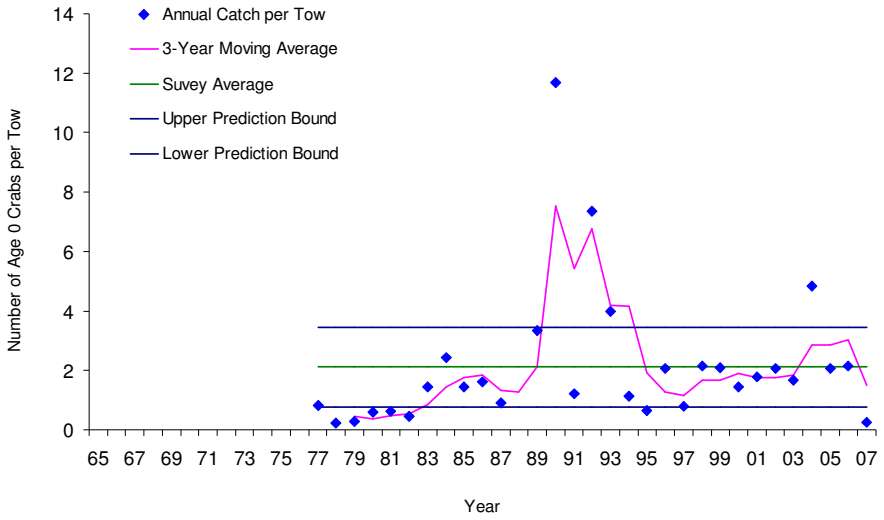


Figure 8. Eelgrass distribution and abundance over time in Chesapeake Bay. A - the maximal distributional limits of eelgrass prior to 1972 and the current distributional limits (colored polygon). B - Abundance of eelgrass (hectares) in the lower bay area within the current distributional limits from 1984 through 2006 (determined from the VIMS SAV annual baywide survey). C - Secchi depth data showing mean water clarity values measured from the surface (March through November) from 28 EPA mid-channel water quality sampling stations within the present-day range of eelgrass in the Chesapeake Bay.

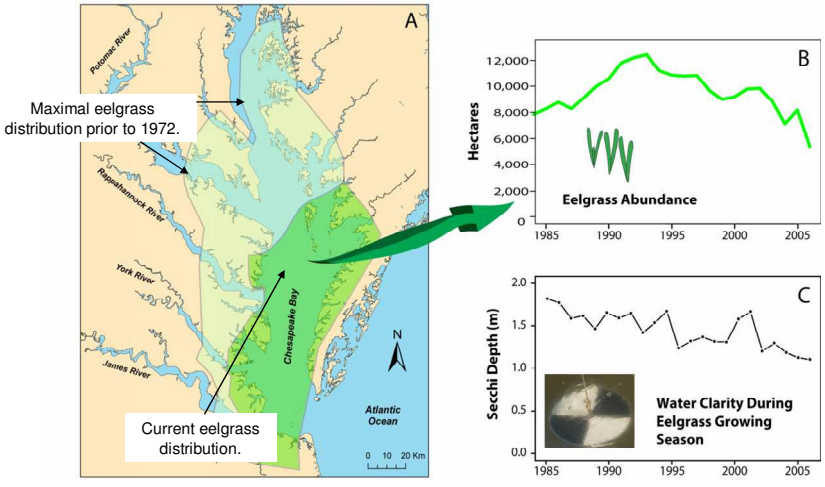


Figure 9 – Percentage of Chesapeake Bay segments achieving dissolved oxygen standards set by Maryland, Virginia and District of Columbia. Standards were designed to protect the aquatic living resources in the Chesapeake Bay.

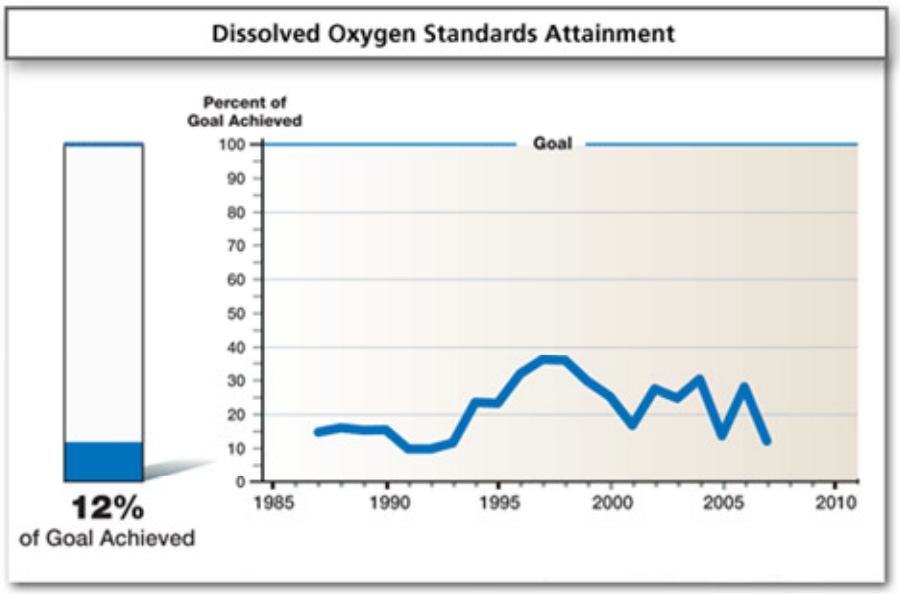


Figure 10 - Percentage of Chesapeake Bay segments achieving bottom habitat (Benthic Index of Biotic Integrity) standards set by Maryland, Virginia and District of Columbia. Standards were designed to protect the aquatic living resources in the Chesapeake Bay.

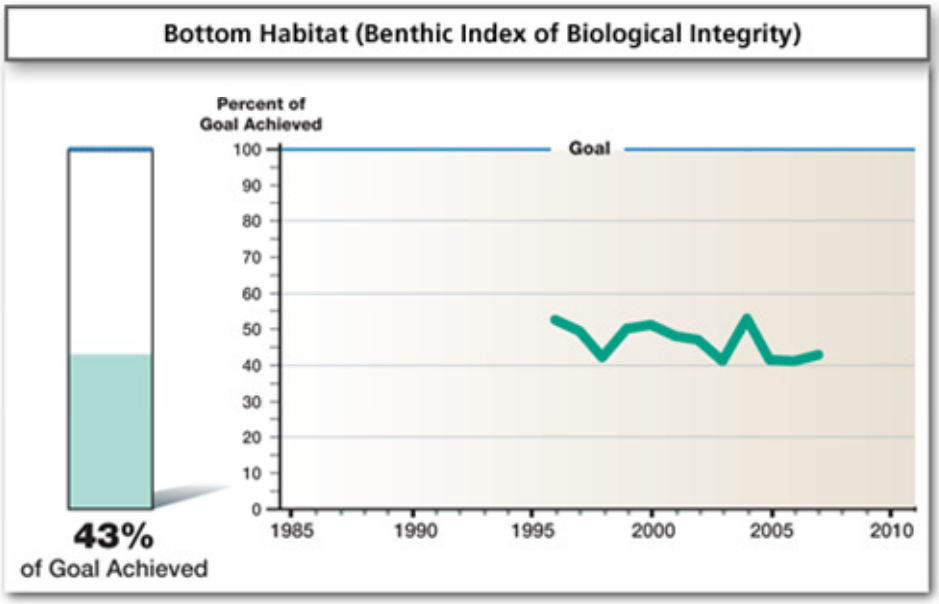


Figure 11. Index of abundance of juvenile striped bass in Chesapeake Bay from 1958 to 2007 from the Maryland DNR seine survey. Striped bass reproduction, and striped bass abundance has increased substantially since the mid 1990's.

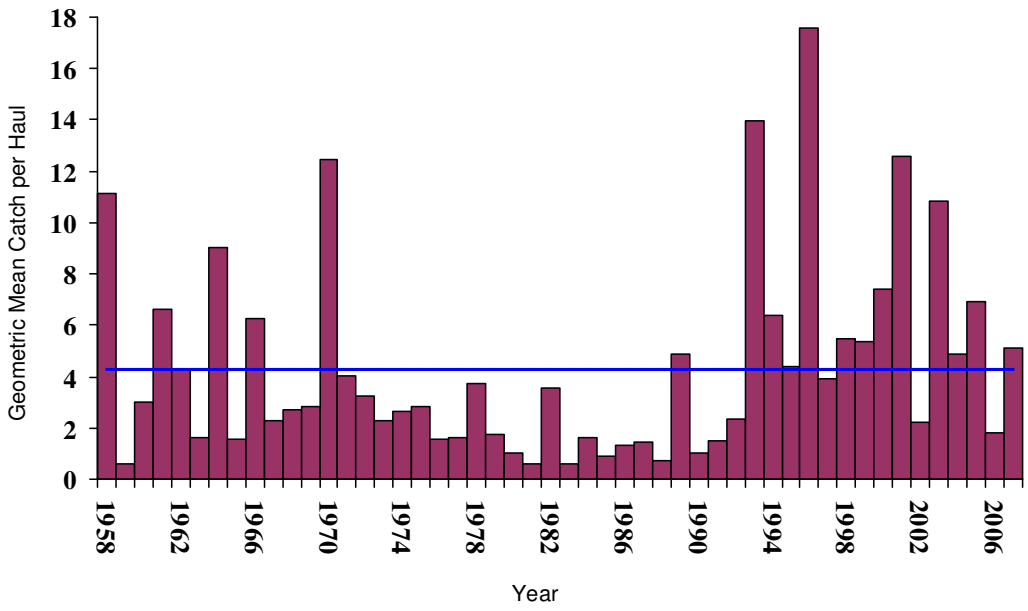


Figure 12. Index of abundance of adult spawning striped bass in Chesapeake Bay from 19585 to 2006 from the Maryland DNR spawning stock gill net survey conducted in the Potomac River and the Upper Chesapeake Bay. Effort is standardized as 1000 square yards of drift gill net per hour.

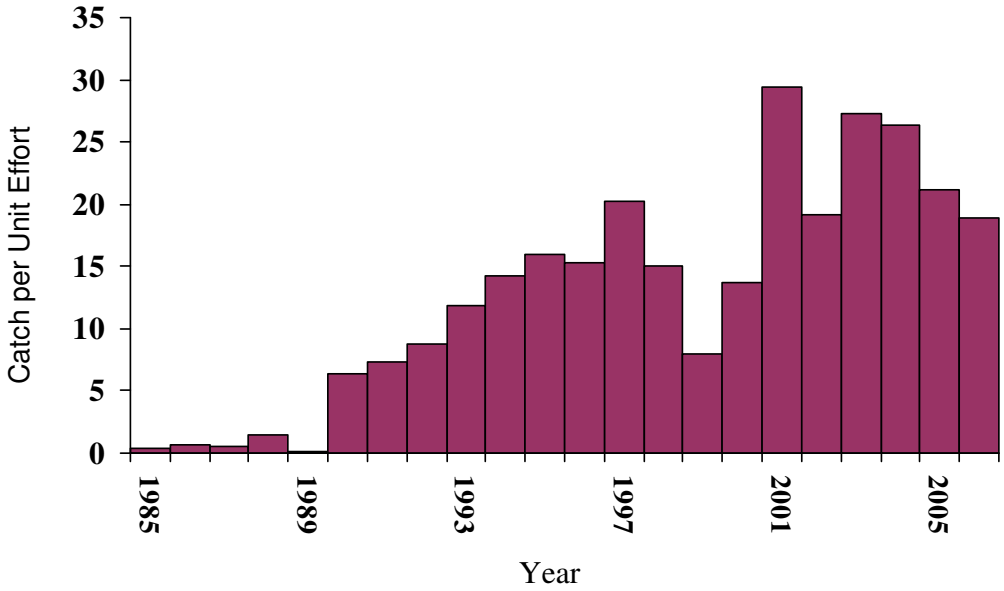


Figure 13. Estimate of spawning stock biomass for Atlantic Croaker in the Mid-Atlantic from the Atlantic States Marine Fisheries Commission Stock Assessment Report for Peer Review, 2004. Abundance of croaker in the Chesapeake Bay and mid-Atlantic has increased dramatically since the early 1990's.

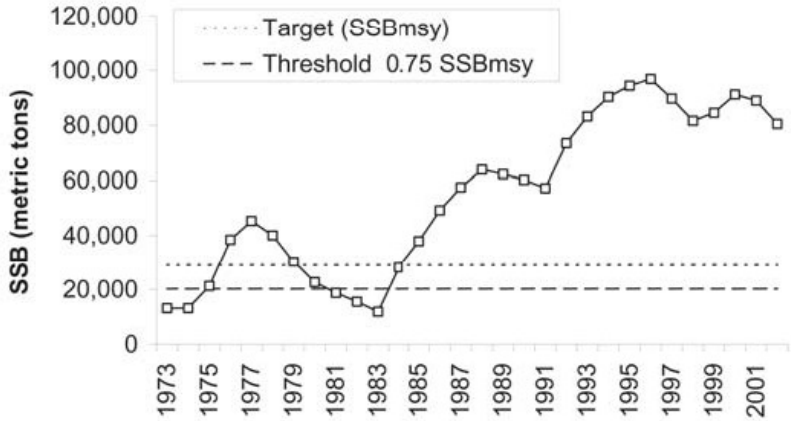


Figure 14. Diet composition of striped bass, from lower Chesapeake Bay grassbeds, in 2005.

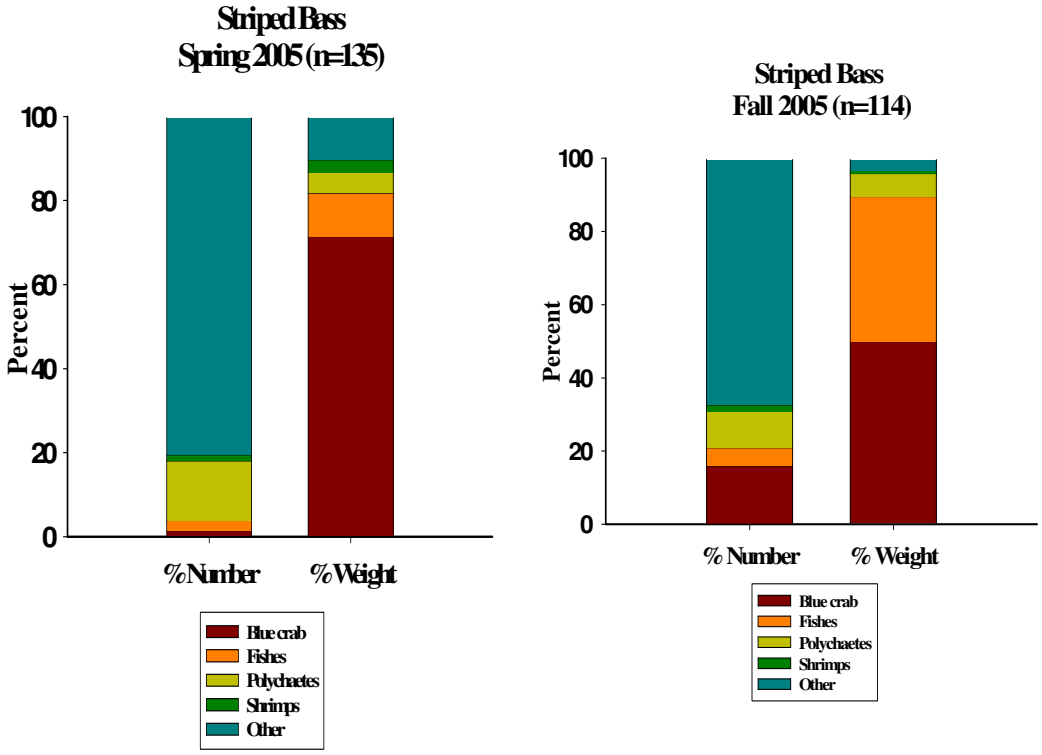


Figure 16. Blue Catfish Diet composition – combined groups (VIMS Trawl Survey)

Misc.

unidentified material
hydroids
detritus
mud
vegetation
plant seeds
peanuts
shell
rock
sand
wood
bait (scrap)
plastic trash
animal tubes
corn

Fishes

Atlantic menhaden
Bay anchovy
Atlantic croaker
white perch
gizzard shad (only large catfish)
hogchoker
unidentified fishes
spotted hake
gobies
silversides
American eel
fish scales

Figure 17. Blue catfish diet items, from trawl collections in the James River, 2004-2006.

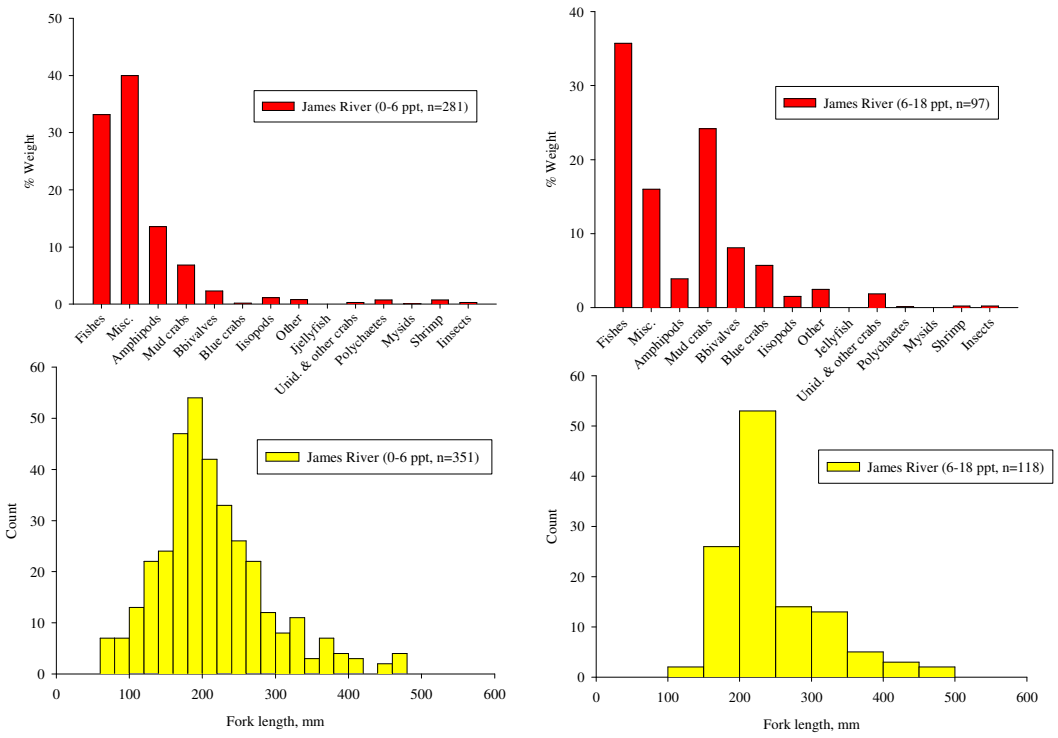


Figure 18. Blue catfish diet items, from trawl collections in the York River, 2004-2006.

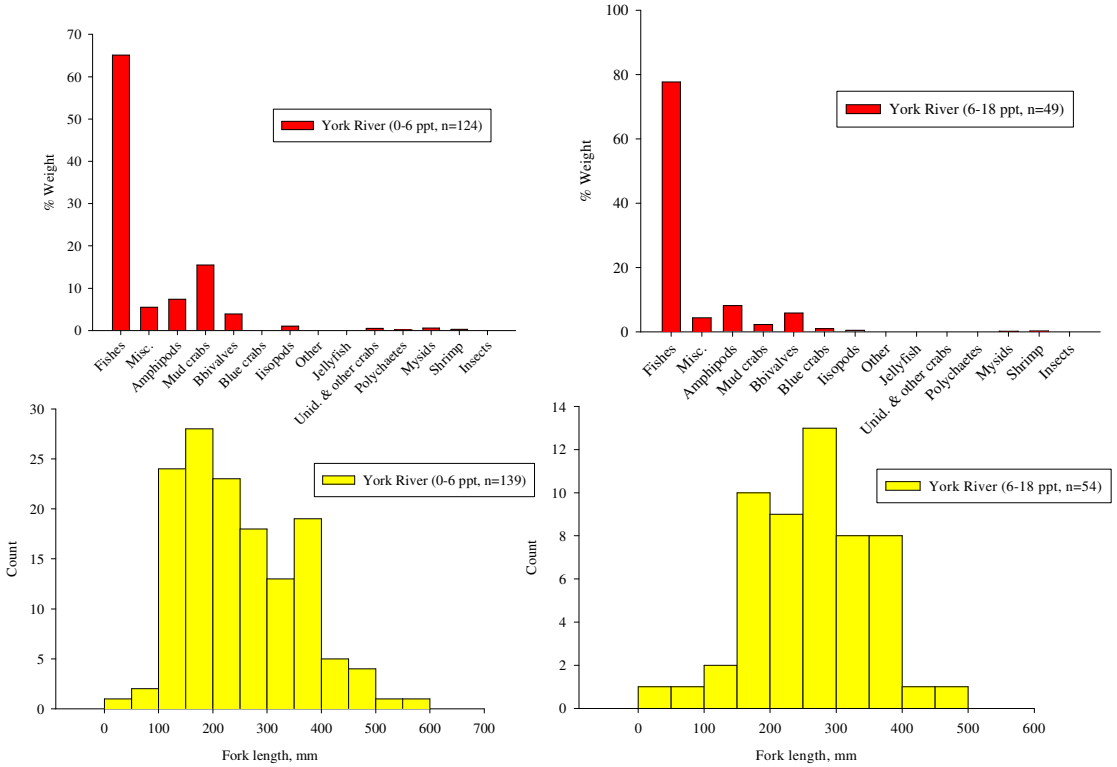


Figure 19. Blue catfish diet items, from trawl collection in the Rappahannock River, 2004-2006.

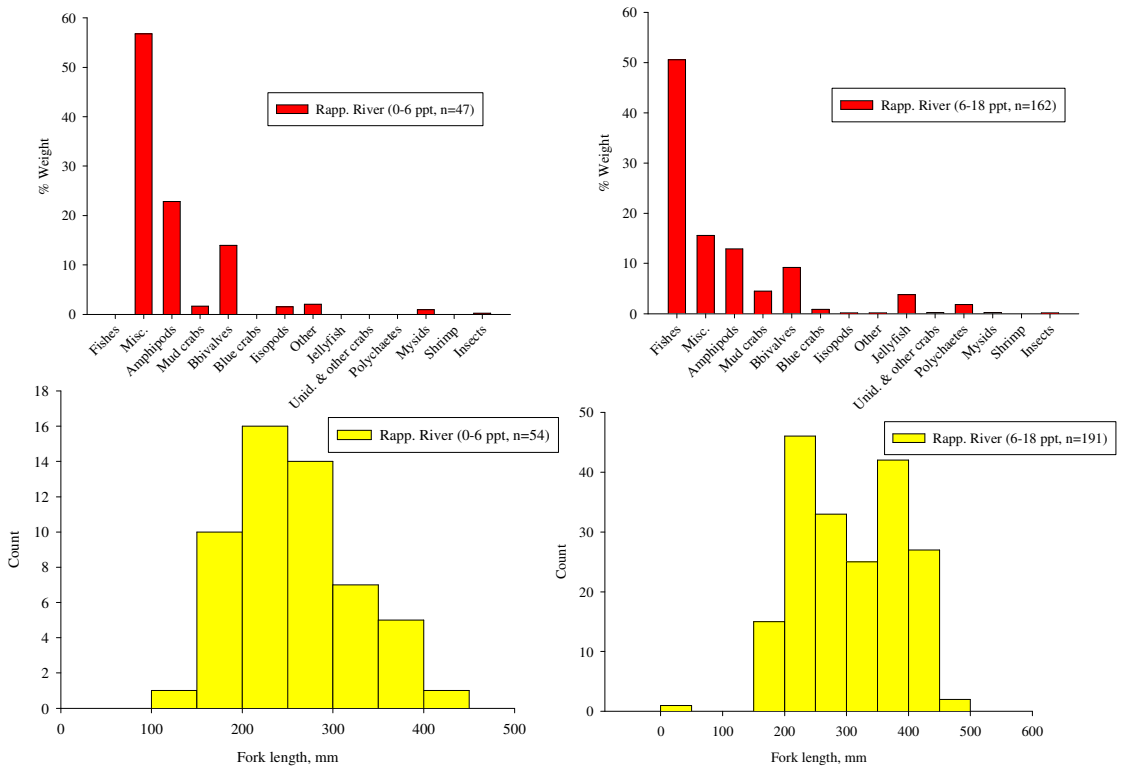


Table 1. Annual harvests of blue crab, from Chesapeake Bay

Year	Bay-wide Harvest of blue crab in Pounds
1990	96,169,486
1991	89,884,812
1992	52,720,597
1993	106,537,563
1994	77,428,305
1995	72,136,657
1996	69,008,858
1997	76,887,854
1998	56,314,880
1999	61,772,820
2000	48,784,181
2001	47,187,715
2002	49,897,500
2003	46,646,906
2004	58,395,475
2005	54,052,543
2006	48,869,127
2007	43,474,420

Table 2. Chesapeake Bay blue crab landings (pounds)

And ex-vessel value ($), 1998-2007 (from NMFS Commercial Fishery Landings Data.

Year	Pounds	Ex-Vessel Value	Price per Pound
1998	65,469,731	$61,464,980	$0.94
1999	66,808,107	$65,383,780	$0.98
2000	51,693,192	$54,957,123	$1.06
2001	50,990,539	$60,280,919	$1.18
2002	53,781,082	$51,421,511	$0.96
2003	49,280,594	$53,662,096	$1.09
2004	61,468,008	$60,927,809	$0.99
2005	60,978,161	$60,540,163	$0.99
2006	52,164,493	$45,207,825	$0.87
2007*	43,474,420	$36,745,527	$0.87
Average (1998-07)	55,503,391	$55,059,173	$0.99

* 2007 data are harvest data and the 2006 price per pound was used to compute the 2007 value.

Table 3. Projected economic loss to fishermen who harvested female crabs from October 27 through November 30

Year	Number of Fishermen	Total Pounds	Highest Value*	3-Year Impact**
2004	383	1,285,859		
2005	299	1,789,290		
2006	252	1,119,284		
2007	274	1,140,681		
2008			$1,382,093	
2008-10				$4,146,278

* Based on whichever year of the 4 years, an individual fisherman Realized the highest value during October 27 - November 30.

**Expected 3-year period of recovery of economic losses

Table 4. Active Virginia commercial crab dredge licensees and harvests (in pounds), December 1993 through March 2007.

Season	Number of fishermen	Total pounds
Dec93-Mar94	342	7,976,439
Dec94-Mar95	302	2,241,666
Dec95-Mar96	272	5,123,586
Dec96-Mar97	257	7,257,501
Dec97-Mar98	244	5,582,765
Dec98-Mar99	222	1,430,356
Dec99-Mar00	228	5,021,449
Dec00-Mar01	205	2,408,766
Dec01-Mar02	195	2,487,471
Dec02-Mar03	176	2,064,498
Dec03-Mar04	175	3,390,915
Dec04-Mar05	94	3,349,776
Dec05-Mar06	81	2,289,154
Dec06-Mar07	69	1,987,067

Table 5. Projected economic loss to fishermen who harvested female crabs, using crab dredge gear, by recent season.				
Season	**Number of Fishermen**	**Total Pounds**	**Highest Value***	**3-Year Impact****
2003/04	175	3,390,915		
2004/05	94	3,349,776		
2005/06	81	2,289,154		
2006/07	69	1,987,067		
2008/09			$2,996,216	
2008-10				$8,988,648.90
* Based on whichever year of the 4 seasons, an individual fisherman realized the highest value during December 1 - March 31				
**Expected 3-year period of recovery of economic losses				

ATTACHMENT III.

Supplementary information presented to the National Marine Fisheries Service, In Support of The Commission Request, for the National Marine Fisheries Service to Declare a Blue Crab Fishery Resource Disaster

BACKGROUND:

On June 13, 2008, Maryland and Virginia submitted a request for disaster assistance, in 2008 and the following 3 years, to the National Marine Fisheries Service. An extensive disaster evaluation package was submitted on that date, and the evaluation responded to Mr. Harold C. Mears (Northeast Regional Office, NMFS) request for specific information supporting the disaster declaration, for the Chesapeake Bay blue crab fishery, shown below. This supplementary package was

1. Status of stock – The NOAA Chesapeake Bay Office supports the Chesapeake Bay Stock Assessment Committee. The National Marine Fisheries Service (NMFS) has substantial background from that effort. However, additional supporting data based on any other available peer reviewed stock assessments and surveys would be especially helpful in determining a fishery resource disaster. In particular, we do not have the most recent results of the 2008 winter dredge survey pot, per day. 2. Causative factors – the letters to the Secretary both indicate that factors including water quality and habitat might contribute to the decline. Additional data on these as well as other causative factors and associated impacts related to the declines in blue crab population abundance and commercial catch are essential to our analysis

2. Causative factors – the letters to the Secretary both indicate that factors including water quality and habitat might contribute to the decline. Additional data on these as well as other causative factors and associated impacts related to the declines in blue crab population abundance and commercial catch are essential to our analysis.

3. Economics – Additional supporting material is needed to assess the economic status of commercial blue crab fishery participants. Statistical summaries of blue crab harvest and associated revenues (e.g., over the last five years) will also help us with our determination.

The documentation provided in our June 13, 2008 disaster evaluation package responded directly to those 3 requests, for additional information. However, we were fortunate to be able to meet with NMFS staff members on August 13 and learned that we can submit additional information, in support of our request that the NMFS declare a blue crab fishery resource disaster, for the Chesapeake Bay. At that meeting, the NMFS did provide the states with a preliminary assessment of economic impacts, in terms of 3-year average (199-2001) value vs. other 3-year average (2004-2006) value or just 2006 or 2007 values. For that reasons, there are several comparison of average (199-2001) fishery-specific, dockside value vs. 2007 value (mostly), in this document.

We welcome this opportunity, to provide additional evidence of the disaster. The focus, of this supplemental information, concerns item 3 (economics), as described above.

ADDITIONAL DATA AND INFORMATION ON THE ECONOMIC STATUS OF BLUE CRAB FISHERMEN:

Table 1 provides an indication that after 1997, an overall decline in the resource (blue crab abundance, all crabs) exists, and there has been no rebound in overall crab abundance, as was present in the years, prior to 1997. The abundance of harvestable-size blue crabs was at its lowest, in 1999, and has not returned to pre-1998 abundance.

Table 1. Total blue crab abundance and abundance of harvestable-size (age 1+) crabs (millions) in Chesapeake bay, 1990-2008, as determined from the Bay-wide winter dredge survey (2008 = December 2007 – March 2008).

Year	All crabs (all sizes)	Age 1+ (2.4 inches and greater in size)
1990	791	276
1991	828	457
1992	367	251
1993	852	347
1994	487	190
1995	487	183
1996	661	146
1997	680	165
1998	353	187
1999	308	86

2000	281	146
2001	254	101
2002	315	121
2003	334	171
2004	280	127
2005	415	159
2006	324	122
2007	260	143
2008	**283**	**120**

Table 2 indicates almost a continual decline in blue crab landings and associated ex-vessel value (value is adjusted to 2008 dollars), since 1998. The Virginia Marine Resources Commission implemented a trial mandatory harvester reporting program in 1993, and 1994 data represent the second year of this program and are considered more representative of the trends in fishery landings. Prior to 1993, landings were collected, on a voluntary basis, from seafood buyers, so those years of collected data are considered under-estimates of seafood landings (not all buyers volunteered data), compared to the mandatory harvester reporting data.. For this reason, comparison of ex-vessel vale (dollars) among years is confined to the post-1993 years. From 1994 through 2007, landings (pounds) of blue crabs ranged from 39.8 million pounds (1997) to 18.9 million pounds (2007). The ex-vessel value (in 2008 constant dollar values) ranged from 39.5 million dollars (1997) to 15.5 million dollars (2006). Ex-vessel value (adjusted to 2008 dollars), averaged for 2002 – 2007 was $21.4 million and declined by 37%, from the average (1994-01) ex-vessel value of $34.0 million. Further, the ex-vessel values in 2006 or 2007 ($15.5, $15.7 million, respectively) is 51% of the average (1999-2001) ex-vessel value of $31.8 million.

Table 2. Virginia landings (pounds and dollars) of blue crab, 1994 – 2007, all fisheries combined.

Landings in Virginia

Year	Pounds	Ex-vessel Value ($)
1994	35,488,934	33,940,506
1995	32,663,170	35,490,976
1996	33,884,234	32,138,449
1997	39,820,009	39,529,453
1998	33,449,530	35,410,975
1999	31,585,143	34,333,075
2000	28,590,754	29,969,847
2001	25,280,045	31,242,264
2002	27,469,956	25,304,612
2003	21,825,284	22,606,676
2004	28,535,571	25,672,612
2005	27,435,341	23,698,246
2006	23,429,686	15,507,495
2007	18,930,978	15,688,128

The major blue crab fisheries are the pot fisheries (peeler pot, hard crab pot or just termed crab pot) and winter dredge fishery. As explained in our June 13, 2008 request for disaster assistance from the National Marine Fisheries Service, stringent management measures are in place, in 2008, for these two fisheries, in order to reduce the harvest of female crabs. In the case of the winter dredge fishery, there has been a suspension of harvesting activities, by that fishery, by the VMRC. From 1998 through 2007, landings (ex-vessel dollars) of blue crabs

Table 3. Landed Ex-vessel Value (Gross Revenues) of Virginia Blue Crabs, 1998-2007, from the major fisheries.

declined from $34.3 to $15.3 million, for the pot and dredge fisheries, combined

Year	CPI (2008 = 100%)	Dockside Landed Value ($)		Total* Landed Value ($)	Constant (2008 = 100%) Dollar Value		
		POTS**	DREDGE		POTS**	DREDGE	Total
1998	0.7588	24,207,172	1,796,878	26,004,050	31,901,913	2,368,052	34,269,965
1999	0.7754	23,432,826	2,130,939	25,563,765	30,220,307	2,748,180	32,968,487
2000	0.8015	21,164,410	1,892,966	23,057,376	26,406,001	2,361,779	28,767,780
2001	0.8241	22,610,702	1,202,227	23,812,929	27,436,842	1,458,836	28,895,679
2002	0.8373	19,459,868	1,093,605	20,553,473	23,241,213	1,306,109	24,547,322
2003	0.8565	17,841,503	808,282	18,649,785	20,830,710	943,703	21,774,413
2004	0.8793	19,904,592	1,872,149	21,776,741	22,636,862	2,129,136	24,765,997
2005	0.909	18,796,579	2,128,926	20,925,505	20,678,305	2,342,052	23,020,357
2006	0.9383	13,212,881	1,118,178	14,331,058	14,081,723	1,191,706	15,273,429
2007	0.9651	13,715,145	1,091,091	14,806,236	14,211,113	1,130,547	15,341,660
2008	1						

* Pots and dredge landings usually represent 95% or more of total Virginia landings (pounds).
**peeler pots and hard crab pots, combined.
NOTES: 1) These data indicate a 49% reduction in total ex-vessel value, from average (1999-2001) to either 2006 or 2007 total ex-vessel value;
Source of Data: Landings and nominal value obtained from Virginia Marine Resources Commission; the consumer price index (CPI) obtained from the Bureau of Labor Statistics and converted to 2008 base period. Constant dollar value obtained, by dividing nominal or current dollar value by the CPI.

A brief summary (Tables 4) provides additional evidence of the economic impacts that have resulted from a persistent decline in abundance of blue crab (see Table 1). Changes in landings, revenues, employment, and income over time are indicative of the persistent economic downturn experienced by participants in the blue crab fisheries and its industries are based on an input/output model developed for Virginia using the 2006 IMPLAN input/output software. This is the latest modeling platform available for estimating the economic impacts of changes in

economic activity (NMFS 2007 data is not final). Three levels of impacts, direct, indirect, and induced, and five market or economic sectors: harvesters or watermen; dealers and processors; wholesalers and distributors; grocery stores and related sales outlets; and, and restaurants were considered (these results were provided by Dr. James Kirkley, Virginia Institute of Marine Science).

Employment, output, and income declined in all sectors, from 1998 through 2006 (Table 5). In 1998, there were approximately 365 full-time or person years of employment in the harvesting sector; earnings or income was approximately $7.8 million. In 2006, the number of person years of employment in harvested decreased to only 146, while earnings declined to $3.12 million or by more than 50 % relative to 1998. In 1998, sales or total output generated by the harvesting sector (direct impacts) equaled $18. 7 million; in 2006, sales or output had declined to $7.5 million. Ex-vessel revenues, income, and total sales all declined by 60.04 %, from 1998 to 2006.In 1998, there were approximately 365 full time or person years of employment in the harvesting sector; earnings or income was approximately $7.8 million. In 2006, the number of person years of employment in harvested decreased to only 146, while earnings declined to $3.12 million or by more than 50 % relative to 1998. In 1998, sales or total output generated by the harvesting sector (direct impacts) equaled $18. 7 million; in 2006, sales or output had declined to $7.5 million. Ex-vessel revenues, income, and total sales all declined by 60.04 % between 1998 and 2008 (J. Kirkley, pers. com).

Table 4. Estimated Sales (Output), Income, and Full Time Employment of Virginia's Blue Crab Fishery (All Values are in 2006 constant dollar values)

1998	Direct Harvesters	Harvesters	Processors	Secondary wholesalers	Grocers	Restaurants
Employment	365	445	309	269	169	3,627
Income	7,805,000	11,267,000	11,791,000	14,655,000	6,520,000	75,299,000
Sales/Output	18,652,000	29,492,000	23,247,000	29,280,000	11,043,000	127,358,000
Income Per Employee	21,384	25,319	38,159	54,480	38,580	20,761
1999	Direct Harvesters	Harvesters	Processors	Secondary wholesalers	Grocers	Restaurants
Employment	342	417	289	252	159	3,395
Income	7,305,000	10,546,000	11,037,000	13,718,000	6,103,000	70,480,000
Sales/Output	17,458,000	27,605,000	21,759,000	27,406,000	10,337,000	119,208,000
Income Per Employee	21,360	25,290	38,190	54,437	38,384	20,760
2000	Direct Harvesters	Harvesters	Processors	Secondary wholesalers	Grocers	Restaurants
Employment	300	365	254	220	139	2,974
Income	6,400,000	9,239,000	9,669,000	12,018,000	5,346,000	61,746,000
Sales/Output	15,295,000	24,184,000	19,063,000	24,010,000	9,056,000	104,436,000
Income Per Employee	21,333	25,312	38,067	54,627	38,460	20,762
2001	Direct Harvesters	Harvesters	Processors	Secondary wholesalers	Grocers	Restaurants
Employment	330	402	279	243	153	3,278
Income	7,054,000	10,184,000	10,657,000	13,246,000	5,893,000	68,058,000
Sales/Output	16,858,000	26,656,000	21,011,000	26,464,000	9,982,000	115,112,000
Income Per Employee	21,376	25,333	38,197	54,510	38,516	20,762
2002	Direct Harvesters	Harvesters	Processors	Secondary wholesalers	Grocers	Restaurants
Employment	271	331	230	200	126	2,694
Income	5,797,000	8,369,000	8,759,000	10,886,000	4,843,000	55,932,000
Sales/Output	13,855,000	21,907,000	17,268,000	21,749,000	8,203,000	94,602,000
Income Per Employee	21,391	25,284	38,083	54,430	38,437	20,762
2003	Direct Harvesters	Harvesters	Processors	Secondary wholesalers	Grocers	Restaurants

Employment	241	294	204	177	112	2,393
Income	5,150,000	7,434,000	7,780,000	9,670,000	4,302,000	49,685,000
Sales/Output	12,307,000	19,460,000	15,339,000	19,320,000	7,287,000	84,035,000
BLE 4. (Continued).						
Income Per Employee	21,369	25,286	38,137	54,633	38,411	20,763
2004	Direct Harvesters	Harvesters	Processors	Secondary wholesalers	Grocers	Restaurants
Employment	260	317	220	192	121	2,585
Income	5,562,000	8,029,000	8,403,000	10,440,000	4,646,000	53,659,000
Sales/Output	13,291,000	21,016,000	16,566,000	20,865,000	7,870,000	90,756,000
Income Per Employee	21,392	25,328	38,195	54,375	38,397	20,758
2005	Direct Harvesters	Harvesters	Processors	Secondary wholesalers	Grocers	Restaurants
Employment	228	277	193	167	106	2,259
Income	4,860,000	7,017,000	7,343,000	9,127,000	4,060,000	46,893,000
Sales/Output	11,616,000	18,366,000	14,477,000	18,234,000	6,877,000	79,313,000
Income Per Employee	21,316	25,332	38,047	54,653	38,302	20,758
2006	Direct Harvesters	Harvesters	Processors	Secondary wholesalers	Grocers	Restaurants
Employment	146	178	124	107	68	1,450
Income	3,119,000	4,503,000	4,713,000	5,857,000	2,606,000	30,094,000
Sales/Output	7,454,000	11,787,000	9,291,000	11,702,000	4,414,000	50,901,000
Income Per Employee	21,363	25,298	38,008	54,738	38,324	20,754

Figures 1 through 4 provide harvester-based information on dockside earnings, from the two major crab fisheries, the pot and dredge fisheries. Figure 1 compares the dockside average earnings of the 867 peeler pot or hard crab pot harvesters of 2007 to the 1766 harvesters who utilized the same gear types during the 1999-2001 period. The attrition that has occurred in those two pot fisheries, since 2001, is reflected in the total dockside value, for the two periods, with the 2007 value (adjusted for the change in the consumer price index) less than one-half of the average (1999-2001) value.

Figure 1. A comparison of crab pot and peeler pot harvesters' combined dockside earnings (dollars), in 2007, to crab pot and peeler pot harvesters' combined average (1999 - 2001) dockside earnings (dollars). Earnings are solely from blue crab harvests.

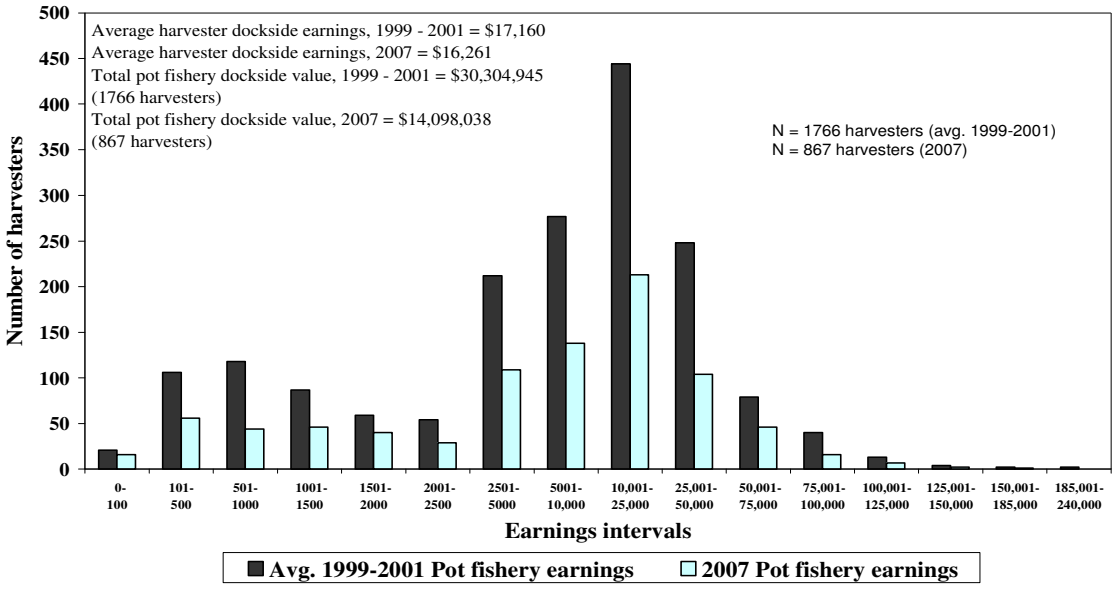


Figure 2 evaluates these same harvesters, as in Figure 1, according to their earning in all fisheries (includes the pot fisheries) during the same time periods. There is little difference in the average earnings, for the two periods, but, again, the total dockside value, in 2007, is much less than total earnings (all species, all fisheries), for those crab pot and peeler pot fishermen who harvested during the 1999-2001 period.

Figure 2. A comparison of crab pot and peeler pot harvesters' combined dockside earnings (dollars), from all fisheries, in 2007, to crab pot and peeler pot harvesters' combined average (1999 - 2001) dockside earnings (dollars). Earnings are from the harvest of all species, from all fisheries.

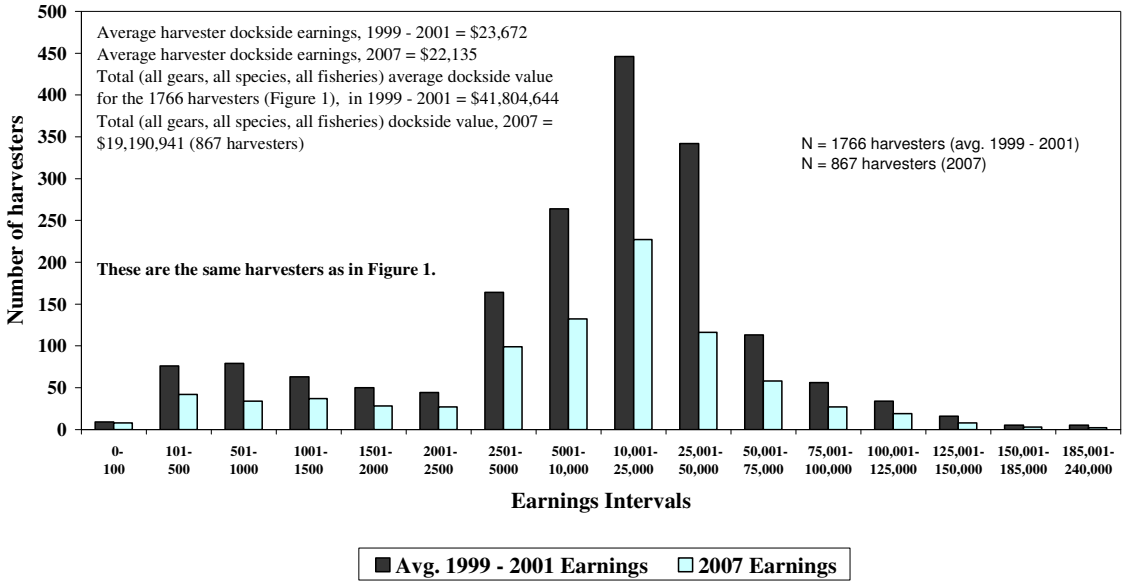


Figure 3 is similar to Figure 1, except it summarizes the earning of crab dredge fishermen, solely from the dredge fishery, in 2007 and during 1999-2001. Participation in 2007 (74 harvesters) was much lower than during 1999-2001 (263 participants), but the 2007 total value generated by the dredge fishery was less than one-half of the value from the average of the 1999-2001 period.

Figure 3. A comparison of crab dredge harvesters' dockside earnings (dollars), in 2007, to crab dredge harvesters' combined average (1999 - 2001) dockside earnings (dollars). Earnings are solely from the harvest of blue crabs.

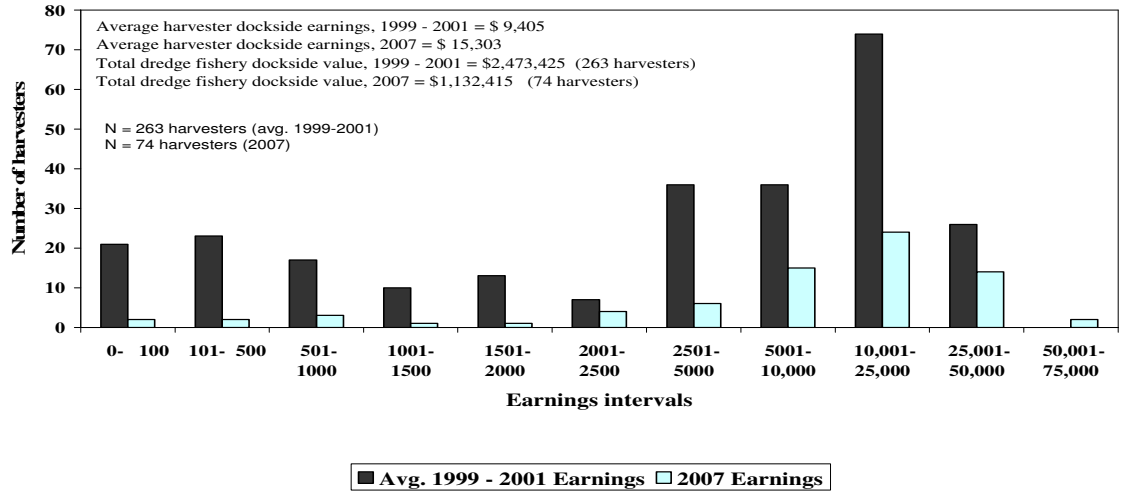
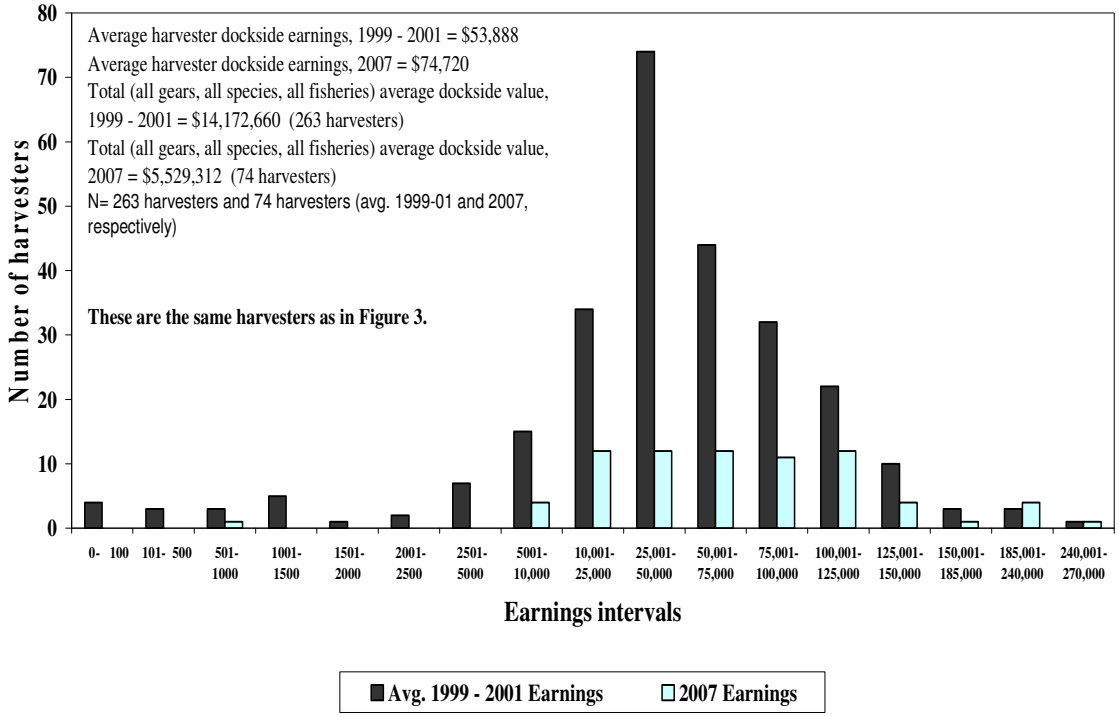


Figure 4 provides earnings data (gross dockside value), for the same crab dredge harvesters summarized in Figure 3. These earnings are based on harvests from all fisheries (includes the dredge fishery). Average harvester earnings were higher in 2007 than on average, for 1999-2001. However, total dockside value, for the 2007 harvesters were 61% less than average (1999-2001) dockside value, for those harvesters who were part of the crab dredge and other fisheries.

Figure 4. A comparison of crab dredge harvesters' dockside earnings (dollars) from all fisheries, in 2007, to crab dredge harvesters' combined average (1999 - 2001) dockside earnings (dollars) from all fisheries. Earnings are from the harvest of all species, from all fisheries.



Figures 5 through 7 provide information on the major Virginia crab fisheries, crab pot (or hard crab pot), peeler pot and crab dredge, in terms of activity levels. Each figure consists of 3 activity criteria: eligible (means the harvesters were eligible for a crabbing license; license purchase (indicates those eligible fishermen who purchased a license); and, licensee reporting crab harvest (means those eligible crab harvesters who bought a specific license (pot or dredge) and also reported a harvest of one pound or more (deemed active). Starting in 2004, a registered commercial fisherman did not need to purchase a license, to remain eligible for a license (pot or dredge) in subsequent years. However, these figures do show that licenses are purchased but not used. The activity level in these major fisheries

Figure 5 shows a similar amount (1979 – 1783) of commercial fishermen have been eligible, for a crab pot license during the last 10 years. The data also indicate a 41% decrease in the number of active crab pot harvesters, in comparing the average number of active (1999-2001) harvesters (1226 harvesters) to those in 2007 (723 crab pot harvesters).

Figure 5. Summary of performance of fishermen eligible for hard crab pot licenses, 1998 - 2007, especially in terms of activity (reported harvest) through those years.

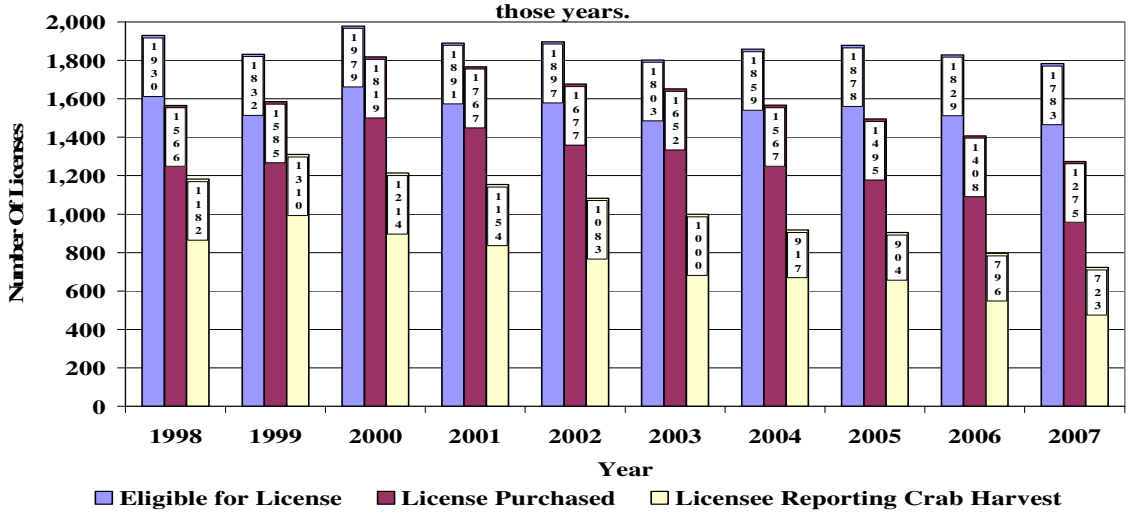


Figure 6 shows a continuous decline in peeler pot activity (harvesters who harvested 1 pound or more), since 2001. Only 284 of 949 eligible commercial fishermen were active in 2007, as compared to an activity level of 528 harvesters, on average, from 1999-2001. The data indicate a 46% decrease in the number of active crab pot harvesters, for these two time periods.

Figure 6. Summary of performance of eligible peeler pot fishermen, 1998 - 2007, especially in terms of activity (reported harvest) in that fishery.

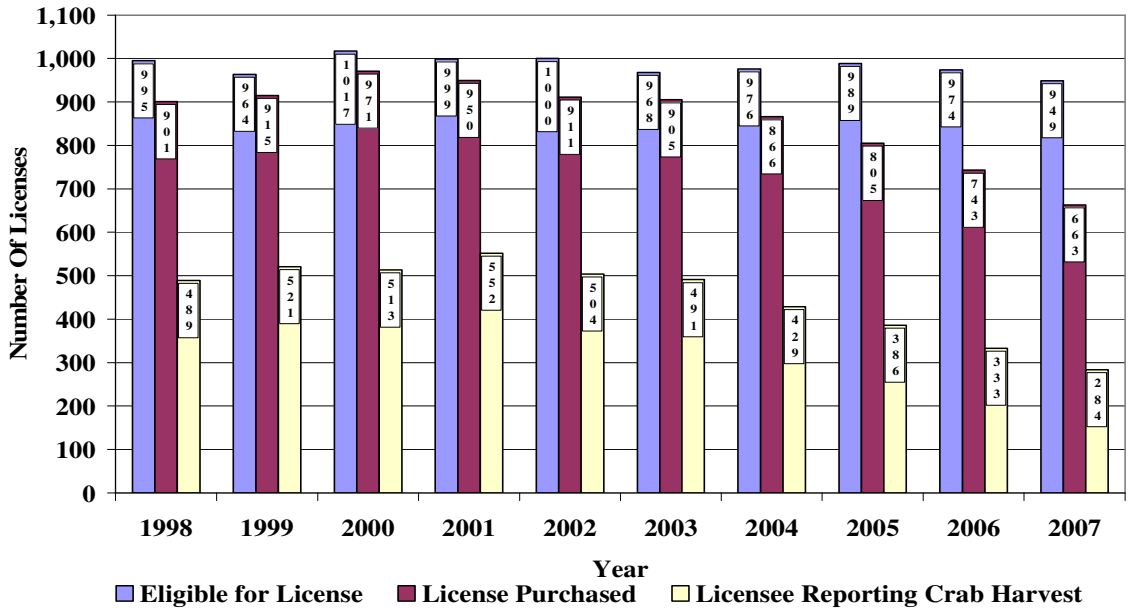
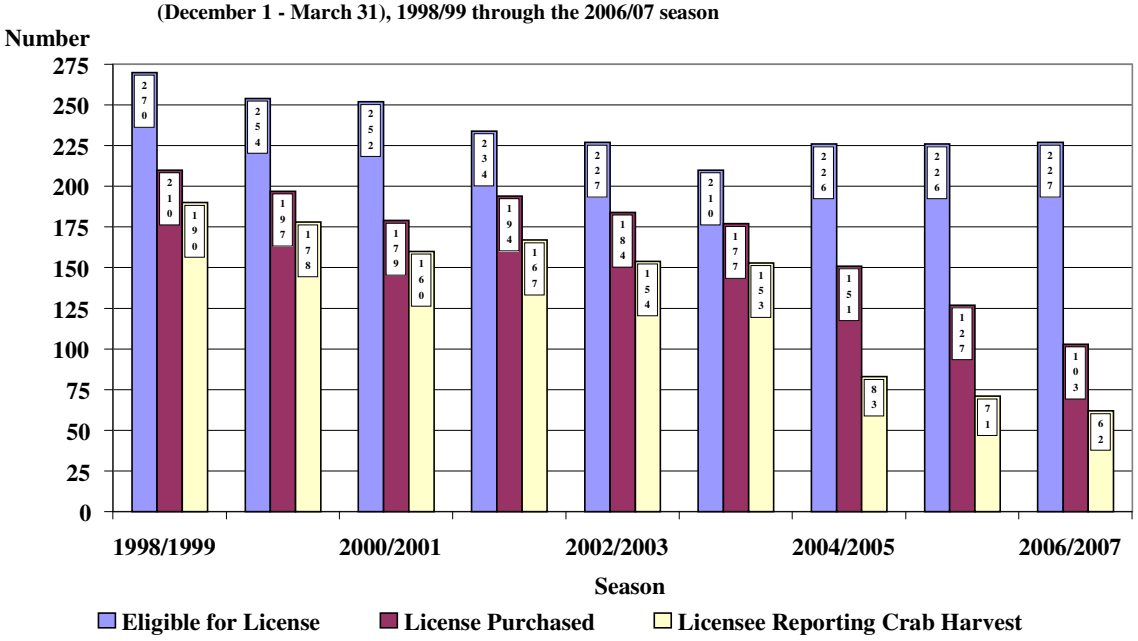


Figure 7 shows a gradual (through continuous decline in peeler pot activity (harvesters who harvested 1 pound or more), since 2001. Only 62 of 227 eligible crab dredge fishermen were active in the 2006/2007 season (December 1 through March 31), as compared to an activity level of 176 harvesters, on average, from the 1998/99 through 2000/01 seasons. The data indicate nearly a 65% decrease in the number of active crab pot harvesters, for these two time periods.

Figure 7. Summary of activity of eligible crab dredge harvesters, by season (December 1 - March 31), 1998/99 through the 2006/07 season



ATTACHMENT IV.

REPORT OF THE BLUE CRAB REGULATORY REVIEW COMMITTEE ON:

THE VIRGINIA MARINE RESOURCES COMMISSION MANAGEMENT PLAN FOR BLUE CRAB

January 1, 2008

Members of the Blue Crab Regulatory Review Committee

Dr. Elizabeth Wenner, South Carolina Department of Natural Resources
Dr. Thomas Wolcott, North Carolina State University
Mr. Lynn Henry, North Carolina Division of Marine Fisheries
Dr. John Hoenig, Virginia Institute of Marine Science
Dr. Romuald Lipcius, Virginia Institute of Marine Science
Dr. Thomas Miller, Chesapeake Biological Laboratory, University of Maryland
Ms. Lynn Fegley, Maryland Department of Natural Resources
Dr. John McConaugha, Old Dominion University and Associate Commission Member, Virginia Marine Resources Commission
Mr. Rick Robins, Associate Commission Member, Virginia Marine Resources Commission
Mr. Jack G. Travelstead, Deputy Commissioner, Virginia Marine Resources Commission

Acknowledgements

The Blue Crab Regulatory Review Committee wishes to thank Joe Grist, Stephanie Iverson, Mike Johnson, Alicia Middleton and Rob O'Reilly of the Virginia Marine Resources

Commission, for providing license and harvest data for the various blue crab fisheries in Virginia and providing background information on existing regulations. The Blue Crab Regulatory Review Committee also thanks the Commission, for convening this panel and inviting a diverse group of blue crab scientists to participate**.**

INTRODUCTION

The Blue Crab Regulatory Review Committee (BCRRC) was established from a request to the Virginia Marine Resources Commission (VMRC) by Mr. Rick Robins, a member of the Commission and Chair of the Commission's Crab Management Advisory Committee. In April 2007 the Commission unanimously endorsed the formation of a review committee. A copy of Mr. Robins' letter of request, for formation of this committee, is provided in Attachment I.

To gain a comprehensive scientific review of the twenty-two management measures implemented by the VMRC, from 1994 through 2007, the VMRC enlisted the involvement of a diverse group of scientists experienced in blue crab management issues. Attachment II provides a listing of the committee members and highlights these scientists' involvement with blue crab management issues. This review panel consisted of scientists from South Carolina, North Carolina, Virginia and Maryland, two associate commission members and the deputy commissioner of the VMRC. The BCRRC met on three occasions, once in June, August and November of 2007.

On different occasions, the VMRC staff posed two basic questions to this review panel: 1) why hasn't the management plan (22 measures) resulted in an increase in abundance of the Chesapeake Bay population of blue crab?; and, 2) of the management measures currently in effect, which ones should be modified, or are there new measures that should be implemented to improve the biological status of this resource?

The review panel described the difficulty in being able to quantitatively determine the effects of any of the 22 management measures, shown in Attachment III, as the variable role of environmental influences confounds determination of which measures directly affect the exploitation rate or abundance. Most of the VMRC management efforts can be viewed as having prevented an even more depleted stock condition. However, the VMRC management plan has not reduced effort or mortality in the fisheries. It seems that the conservation merits of the current VMRC plan are often compromised by the overcapacity of effort in the fisheries. The larger number of legal, inactive licensees poses risk to any rebuilding strategy, as inactive licenses could become active, in response to any gains in blue crab abundance. In addition, the relative role of fishing pressure by Maryland and Potomac River crabbers upon the Chesapeake Bay stock remains unresolved, such that effective management measures in Virginia must be combined with complementary management actions in Maryland and the Potomac.

The Commission should consider measures that more effectively reduce and control effort in these fisheries, and, as a very important part of an effort control plan, the VMRC should implement a crab pot-tagging system. A crab pot-tagging system would enable the VMRC to effectively monitor and enforce effort in the pot fisheries, and also enable the VMRC to measure effects of subsequent management actions. However, even an effort control strategy, such as an individual transferable effort system, needs to be reinforced by a pot-tagging system. That way, illegal increases in pot effort can be detected, and the effort control system will not be undermined. Adjustments in harvesting days could be based on the predicted exploitation rate from the winter dredge survey, to manage these fisheries according to the target exploitation rate ($u = 0.46$).

Statement of the Problem:

The Virginia Marine Resources Commission recently convened a Blue Crab Regulatory Review Committee (BCRRC) to investigate the potential of existing regulations to reverse current resource conditions of low overall abundance and low spawning potential. In addition the BCRRC, composed of eight scientists from South Carolina, North Carolina, Maryland and Virginia, was asked to assess current regulations, in terms of their ability to promote optimum yield and effectively control effort in the fisheries and promote increases in abundance of the stock.

Since 1994, the objectives of Virginia regulations, for the blue crab resource and its fisheries, have been to promote increased abundance of exploitable crabs (2.4 inches and greater or age 1+) and a spawning stock that sustains an optimum yield. Despite the step-wise implementation of a 22-point management plan, 1994 through 2002, there is no evidence that the management plan has increased either the bay-wide stock abundance or harvest (Figure 1).

Figure 1. Abundance of age 1+ blue crabs, 1989 - 2006, determined from the bay-wide winter dredge survey, in comparison to the CBSAC overfished threshold of 86 million age 1+ crabs.

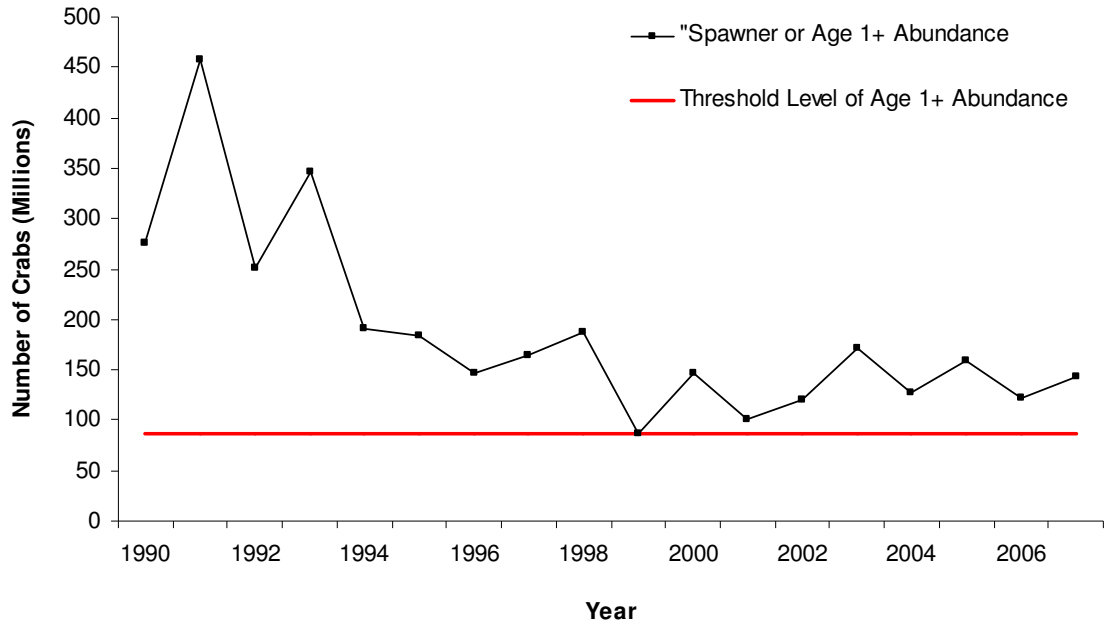
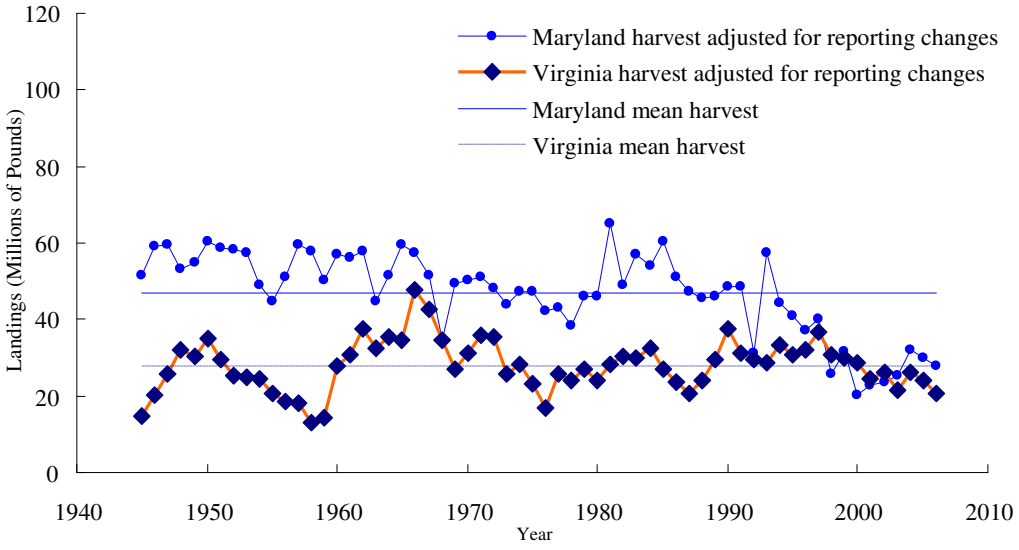


Figure 1 indicates the bay-wide abundance estimates of age-1+ crabs estimated from the 2005-2006 winter dredge survey was 122 million crabs (the value from the 2006-2007 survey was 143 million crabs and was similar to the estimated abundance of 2005. This abundance estimate is as much as 70% less than abundance estimates for the early 1990s. The 2006 bay-wide harvest of blue crab was 48.9 million pounds and is among the lowest recorded, since 1945, and well below the long-term (1945 - 2006) average harvest of 73 million pounds (Figure 2).

Figure 2. Virginia and Maryland harvests of blue crab (pounds), 1945 - 2006



Especially troubling is that the spawning potential has remained at low levels, since 1992, despite implementation of measures such as several expansions of the summertime spawning sanctuary (Figure 3; see Attachment III).

Old Dominion University reports the spawning potential appears to be much lower than anticipated by simply applying the size-fecundity equation. Female crabs apparently no longer show a size-fecundity relationship, and there is published evidence by VIMS and unpublished information from Duke University Marine Lab that the average female crab size is smaller than in the 1980s, with reduced lipid content of eggs. This may be offset, to some extent, by smaller females producing more egg masses over a longer period.

Currently there is a Bay-wide framework for managing blue crabs. This framework—known as the control rule—sets a threshold and a target level of fishing pressure (exploitation fraction or *u*), which is the fraction of total crab abundance removed each year by fishing.

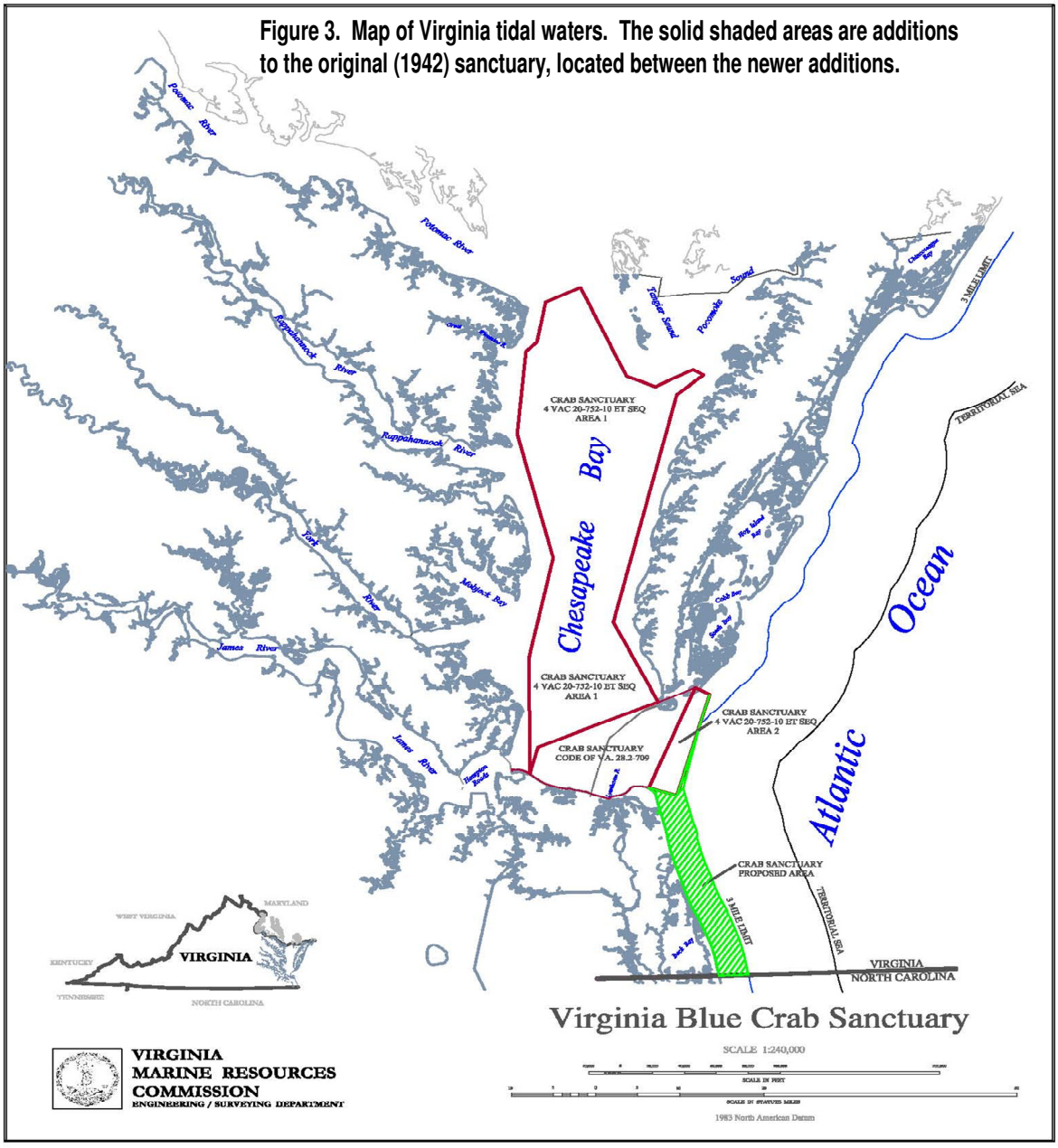


Figure 3. Map of Virginia tidal waters. The solid shaded areas are additions to the original (1942) sanctuary, located between the newer additions.

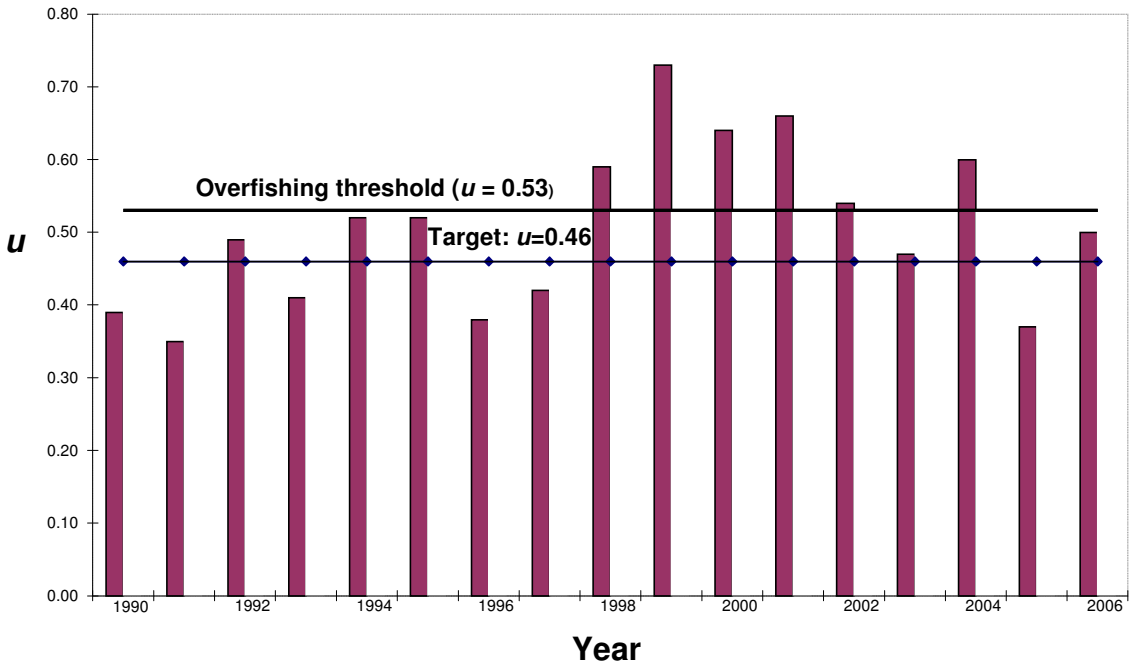
The threshold level of fishing is 53%. Removing this fraction of animals each year would be sustainable, but consistently removing a higher fraction would threaten sustainability, and overfishing would be occurring. To provide a margin of safety, a 'target' level of exploitation has been set at 46%.

The control rule also establishes a threshold level of abundance. In theory, as exploitation rises, abundance decreases or consistent overfishing will lead to a population that is overfished. The abundance (or overfished) threshold is 86 million age 1+ crabs – these represent the spawning population. There is no historical evidence that the crab population would be sustainable if the spawning population drops below 86 million.

An underlying cause, for low stock abundance and poor harvests, is that between 1998 and 2006 exploitation rates have exceeded the overfishing threshold 6 times. Exploitation fell below the

threshold in 2003, 2005 and 2006, although the 2006 value of u=0.5 was only slightly lower than the overfishing threshold (Figure 4). The exploitation rate has been above the target level of u=0.46 for 11 of last the 17 years. Stock abundance has been near the lowest estimated bay-wide abundance of 1999 (equal to the overfished threshold of 86 million pounds) in several recent years. South Carolina fishery scientists determined that high exploitation rates can lead to a fishery, which, being largely dependent upon a single year class, can be considered an 'annual crop. In recent years, this attribute is shared by the Chesapeake Bay crab fisheries.

Figure 4. Exploitation rates (u), for Blue Crab, from the winter dredge survey



The current management plan may have staved off even lower levels of abundance or landings, but more aggressive, direct methods that prevent overfishing and promote an increase in stock size are warranted. Previously, increases in sanctuary areas, adoption of a minimum peeler size limit, and cull ring requirements in crab pots were attempts to increase overall crab abundance. However, there has been no observed improvement in the stock. Ultimately, a management plan that seeks to build and maintain a biologically safe level of abundance should function despite variable environmental effects, especially the effects on recruitment strength, but current management measures seem to fall short of that objective. As a first step, there is a need for managers and stakeholders to define the attributes of a successful or quality fishery, as opposed to a marginal fishery, and develop a management plan that fits those attributes. As some form of consensus on the attributes of a quality fishery develops, it should be more evident which existing management measures are important to maintain.

Role of the Environment

Success of management efforts can be complicated by variability in environmental conditions. Ongoing losses in submerged aquatic vegetation (SAV) that serves as primary nursery areas for juvenile crabs and reduction of oyster reefs that provide food and refuge for age 1+ crabs evidently impede the growth of this stock. VIMS indicates there is evidence of high mortality rates of juvenile crabs tied to the loss of SAV, and this loss has a direct impact on recruitment to age 1 and older. The extent of predation on blue crabs by predators such as striped bass, red drum, and Atlantic croaker is unknown. Another form of natural mortality, cannibalism, is well

documented for blue crab, but like predation, it is not known whether the removal of crabs by cannibalism is enhanced or diminished, under low crab stock conditions.

Changes in sea surface temperatures, recent hurricane and tropical storm events, as well as a continuation of marginal water quality conditions negatively impact the biological stability of the blue crab stock. It is also plausible that the carrying capacity of the ecosystem, for blue crab, has changed over time. Changes in abundance and the lack of large inter-annual fluctuations in total abundance as seen in the species from 1950s to early 1990s may indicate an ecological shift to a different carrying capacity. Despite evidence that the blue crab stock faces many environmental challenges, the management plan must continue to promote measures that can lead to annual exploitation rates that are near the target level exploitation rate (u = 0.46). To date, there has been difficulty keeping the exploitation rate near the target level over consecutive years, let alone over extended time periods (see Figure 4). In the context of the current environmental conditions, corrective management action is necessary to end overfishing and constrain mortality towards the target exploitation rate.

Despite variability in environmental factors, the focus of management should be achieving an exploitation fraction that falls consistently near the target exploitation rate (0.46). If exploitation can be constrained to the target, for several years, there would be a greater chance of success as measured by increased (or rebuilt) crab abundance and an optimized fishery.

Review of Regulations

The most direct approach to ensure the exploitation rate on blue crab will be near the target (u = 0.46) involves an effort-control system (discussed below). However, implementation of effort-control measures may take time and require social and political adjustments to adapt to a new management regime. Management measures were adopted by the VMRC in 1994 and may have prevented an even more reduced stock condition than currently exists, and this committee supports continuation or improvements of these measures until an effort-control strategy and pot-tagging or marking system are in place. Should the VMRC not support an effort-control approach, as was the case in North Carolina (see below), or need time to develop that system, the committee provides recommendations on select elements of the current 22-point management plan. However, the committee cautions that these adjustments should not be considered as a substitute for an effectively designed effort control system.

CRAB POT FISHERY

During the last 20 years the crab pot (hard pot) fishery has accounted for at least 74% and as much as 87% of the total annual harvest of blue crab in Virginia. The crab pot harvests mainly (95–97%) hard crabs and some (3–5%) peeler crabs. Exclusive of the winter dredge fishery, the crab pot fishery harvests most of the remainder (in pounds and numbers) of hard crabs landed in Virginia (Tables 1 and 2).

Table 1. Virginia harvest (in pounds) of blue crab, 1986 - 2006.

YEAR	Peeler and soft++	% Total	HARD*	% Total	DREDGE	% Total Harvest	TOTAL HARVEST
1986	710,776	2%	26,028,225	74%	8,200,068	23%	34,939,069
1987	473,555	2%	23,940,564	80%	5,570,499	19%	29,984,618

1988	1,093,265	3%	27,166,810	79%	6,203,458	18%	34,463,533
1989	1,287,878	3%	30,427,582	73%	9,935,700	24%	41,651,160
1990	963,845	2%	40,965,804	82%	7,928,549	16%	49,858,198
1991	1,317,576	3%	32,296,871	78%	7,669,254	19%	41,283,701
1992	492,367	2%	17,078,139	80%	3,816,465	18%	21,386,971
1993	1,713,137	3%	40,246,598	81%	7,611,119	15%	49,570,854
1994	1,476,853	4%	28,745,955	83%	4,535,186	13%	34,757,994
1995	1,808,898	5%	28,158,774	85%	3,224,182	10%	33,191,854
1996	1,745,554	5%	25,114,654	74%	6,917,030	20%	33,777,238
1997	2,154,665	5%	30,845,631	78%	6,519,526	16%	39,519,822
1998	2,524,935	8%	28,116,395	84%	2,815,387	8%	33,456,717
1999	2,175,305	7%	26,777,056	82%	3,561,718	11%	32,514,079
2000	2,132,804	7%	25,188,283	81%	3,642,934	12%	30,964,021
2001	2,471,375	9%	22,439,840	84%	1,938,611	7%	26,849,826
2002	2,171,791	8%	23,894,754	84%	2,318,492	8%	28,385,037
2003	1,664,446	7%	19,213,342	82%	2,599,624	11%	23,477,412
2004	1,669,649	6%	24,074,855	83%	3,153,030	11%	28,897,534
2005	1,116,153	4%	22,529,826	85%	2,880,010	11%	26,525,989
2006	931,951	4%	19,525,816	87%	2,074,303	9%	22,532,070

*Mostly pot, excludes dredge. Note: Peeler and soft = 97.2% peeler, on average.

Table 2 shows the Virginia crab harvest, in numbers. The most noticeable difference between harvest in pounds and numbers is that the peeler harvest accounts for a greater portion of the total harvest in numbers than in pounds (Tables 1 and 2).

Table 2. Virginia harvest (in numbers) of blue crab, 1986 - 2006.

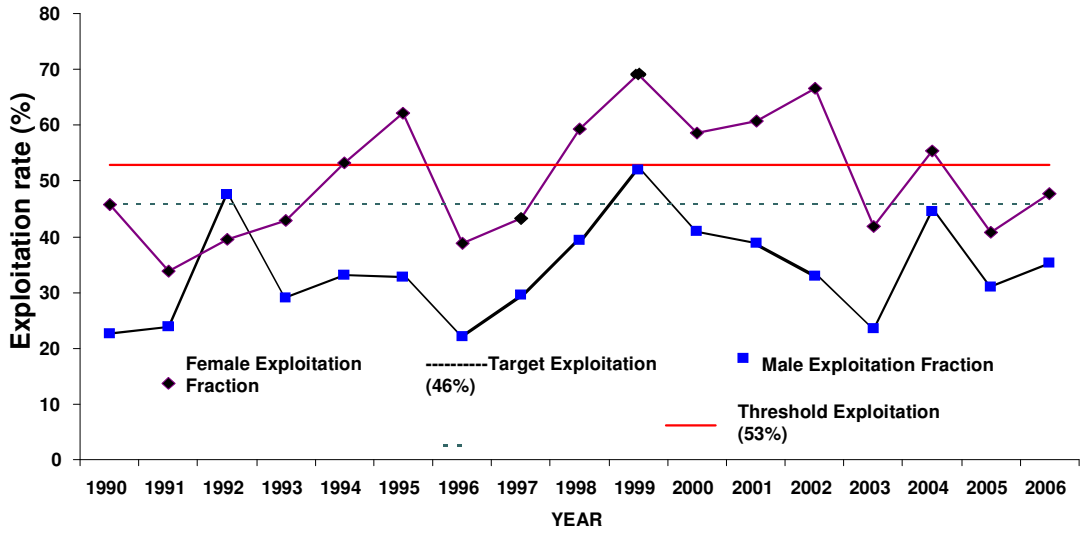
YEAR	Peeler and soft++	% Total	HARD*	% Total	DREDGE	% Total Harvest	TOTAL HARVEST
1986	3,412,271	3%	74,366,357	71%	27,333,560	26%	105,112,188
1987	2,273,428	3%	68,401,611	77%	18,568,330	21%	89,243,369
1988	5,248,512	5%	77,619,457	75%	20,678,193	20%	103,546,162
1989	6,182,804	5%	86,935,949	69%	33,119,000	26%	126,237,752
1990	4,627,196	3%	117,045,154	79%	26,428,497	18%	148,100,847
1991	6,325,377	5%	92,276,774	74%	25,564,180	21%	124,166,331
1992	2,363,740	4%	48,794,683	76%	12,721,550	20%	63,879,973
1993	8,224,373	6%	114,990,280	77%	25,370,397	17%	148,585,050
1994	7,090,029	7%	82,131,300	79%	15,117,287	14%	104,338,615
1995	8,684,100	9%	80,453,640	81%	10,747,273	11%	99,885,013
1996	8,380,000	8%	71,756,154	70%	23,056,767	22%	103,192,921
1997	10,344,047	9%	88,130,374	73%	21,731,753	18%	120,206,175
1998	12,121,627	12%	80,332,557	79%	9,384,623	9%	101,838,808
1999	10,443,135	11%	76,505,874	77%	11,872,393	12%	98,821,403
2000	10,239,097	11%	71,966,523	76%	12,143,113	13%	94,348,734
2001	11,864,498	14%	64,113,829	78%	6,462,037	8%	82,440,364
2002	10,426,265	12%	68,270,726	79%	7,728,307	9%	86,425,297
2003	7,990,619	11%	54,895,263	77%	8,665,413	12%	71,551,295
2004	8,015,598	9%	68,785,300	79%	10,510,100	12%	87,310,998
2005	5,358,392	7%	64,370,931	81%	9,600,033	12%	79,329,357
2006	4,474,081	7%	55,788,046	83%	6,914,343	10%	67,176,470

Note: Weight per crab - 0.2083 lbs. (peeler); 0.35 lbs. (hard); other 0.3 lbs. dredge.
Note: Peeler and soft is primarily peeler crabs. *Mostly pot, excludes dredge

Conservation measures that impact the crab pot fishery will have the most impact on the annual exploitation rate. Industry members have told the VMRC that regulations regarding the 8-hour workday and different pot limits in the tributaries and mainstem bay areas can be circumvented by setting additional (illegal) pots. Based on information from VMRC staff, conservation gains associated with the 8-hour limit or pot limits are undermined, simply through setting additional crab pots. Such illegal effort is extremely difficult for the Commission to enforce in the absence of a pot-marking system.

Substantial reductions in effort in this crab pot fishery, will directly conserve female crabs and can lead to a lower exploitation rate on female crabs, since the sex composition from this fishery is often 70% female. Figure 5 shows that Virginia crab fisheries account for a higher exploitation rate on females than Maryland fisheries, owing to the presence of the spawning grounds in Virginia waters. It is evident from Figure 5 that the female-specific exploitation rate needs immediate attention from management, and the crab pot fishery is the best candidate for reducing the exploitation rate on female crabs.

Figure 5. Comparison of sex-specific exploitation rates, for bay-wide blue crab



Cull Rings

The VMRC requires two unobstructed cull rings per crab pot. One cull ring must be at least 2 5/16-inches inside diameter, and the other at least 2 3/16-inches diameter. The VMRC allows an exemption from the requirement to maintain an unobstructed 2 5/16-inch cull ring in crab pots located in the mainstem Bay, the Seaside of Eastern Shore, and Pocomoke and Tangier Sounds. The cull rings promote an increase in % MSP (the percentage of the maximum spawning potential in the absence of fishing), since probability favors some eventual escapement to the spawning stock, compared to an absence of cull ring measures. Cull rings also prevent some waste, as small crabs can exit the crab pot. There have been concerns expressed by Virginia blue crab ecologists that cull rings may promote a phenotypic response, in that the release of small females can lead to sexual maturity at a smaller size. However, this committee found the positive attributes of cull ring usage outweigh these possibly short-term and not widespread, divergences from the typical maturity schedule.

The committee understands that harvesters in the mainstem Bay are concerned over the documented escapement of legal (mature) females through the larger cull ring, and seaside harvesters encounter a greater abundance of small, mature female crabs than bay-side crabbers. However, 69% of females harvested in 2006 by crab pots were from the mainstem Chesapeake or seaside areas, and these areas are allowed to obstruct the 2 5/16-inch cull rings. Since only a 6% escapement of legal females has been estimated for the 2 3/16-inch cull ring, tangible benefits would accompany a mandated use of the 2 5/16-inch cull ring in all hard crab pots. It is encouraging that some harvesters support increasing the size of the cull rings, so the past resistance against this change may have lessened.

Crab Pot Tagging or Marking System

The obvious benefits of a pot marking system are that it would provide a baseline of existing effort and make the pot limit a more enforceable management tool. The current management plan relies on crab pot limits, but enforcement and monitoring are ineffective in the absence of a pot marking system. As one committee member stated: "how on earth can we assess the effects of reducing effort when we really have no way of knowing what effort is now?"

Another benefit of a pot-marking system would result if the VMRC chose to establish management zones, and issued zone-specific tags. For example, at the most basic level, the Commission could designate the mainstem and tributaries as separate management zones. If managers then chose to further expand the sanctuary, either spatially or temporally, then the pot marking system could be used in conjunction with management zones to more effectively address displaced effort. If there were a particular concern, for example, that a sanctuary expansion could result in a substantial and undesirable increase in effort in the tributaries, then managers could limit the number of pots in the tributaries by issuing a limited number of zone-specific pot tags for use in the tributaries.

In order to be successful, a pot marking system must have a replacement mechanism that is both controlled and realistic. A replacement mechanism could allow for the automatic distribution of a certain number of replacement tags to be issued monthly, or periodically, during the crab pot season. The number of replacement tags issued should be consistent with average industry-wide estimated losses of pots during a season. Pot tags should be issued annually and should be non-transferrable. The details of a pot marking system should be developed with stakeholder input.

As part of the North Carolina effort reduction proposals (discussed below), a crab pot buoy tagging system was planned. All programmatic aspects and contingencies were planned by the Division of Marine Fisheries (e.g. replacement tags, catastrophic gear loss, tag attachment sites and hardship provisions). The buoy tagging system was not implemented because an effort control plan was not adopted in North Carolina. The North Carolina plan can help guide a Virginia pot-tagging system. This year, Florida established a crab pot (trap) tagging system, with provisions for tag loss and replacement, for its limited entry fishery. Virginia can also benefit from the success and setbacks Florida encounters with its trap tagging regulation. Comparative analysis of the pot tagging systems used in other jurisdictions should be considered in the design of a pot tagging system in Virginia's blue crab fishery.

Season Limits

The Virginia crab pot (and peeler pot) season extends from March 17 through November 30. Prior to 2007, the fishery opened on April 1. The committee discussed the benefits of reducing the November fishery, even by two weeks. Given the high exploitation rate on female crabs and

low abundance of the spawning stock, a shorter late-fall season could benefit the stock. The best approach would involve a shorter season in all three bay jurisdictions. However, Maryland ends its season on December 15, so it would be difficult to close the last two weeks of November throughout the bay. Shortening a season may not be a beneficial approach because of the potential for recoupment. Harvesters would have advance knowledge of any closure and would react by either setting more pots during the open season or a number of inactive harvesters may become active during that time of the season. Additionally, female crabs that escaped harvest during a short term fall closure of any jurisdiction would be susceptible to harvest in each subsequent month until they spawn the following summer.

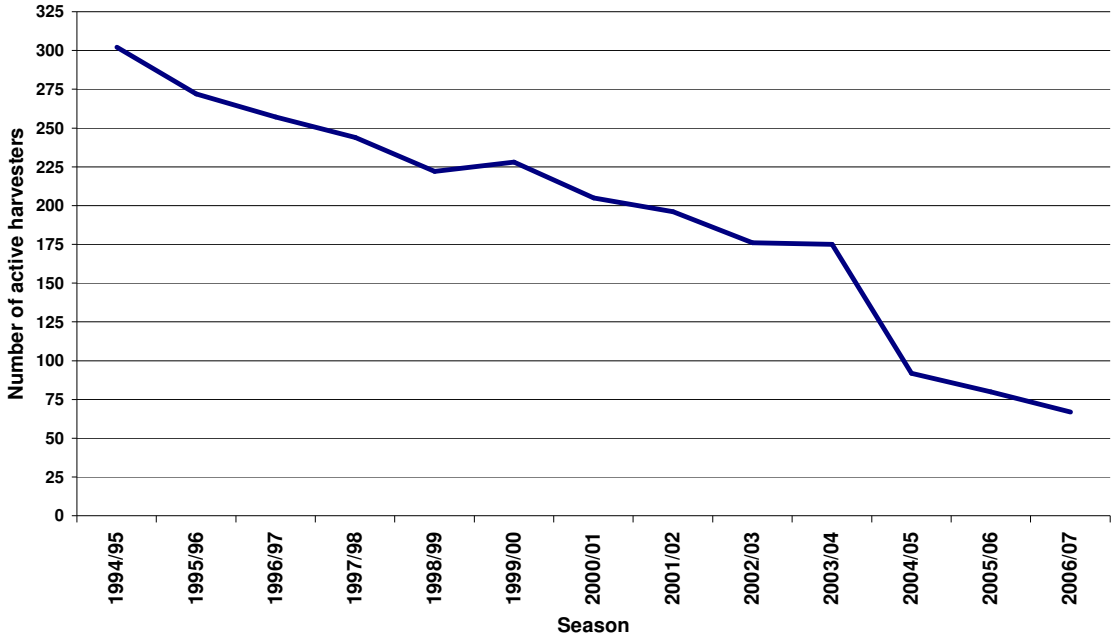
Recommendation: The VMRC should take corrective action to end overfishing in the blue crab fishery and constrain mortality towards the exploitation target. The VMRC should develop an effort control strategy that will enable the Commission to directly control and monitor effort as part of a comprehensive management plan, and in response to changing biological conditions. The VMRC should consider any measures that would reduce effort in this fishery, until such time that exploitation rates remain at or near the target, for several years. Any effort reductions in this fishery will also improve the exploitation rate on female crabs, as this fishery harvests the majority of female crabs. Since an effort control system will take time to develop and implement, as a precautionary action, the VMRC should consider requiring use of a 2 ¼-inch, unobstructed cull ring in the mainstem Bay and Pocomoke and Tangier Sounds. This size cull ring will allow additional escapement and reduce waste. Implementation of a pot-marking system would allow effective enforcement of the cull-ring regulation, in addition to other benefits discussed above.

WINTER DREDGE FISHERY

This is one of the Commission's earliest attempts to limit entry to a fishery through license and participation requirements. The sale of additional licenses was suspended, until such time that the number of licenses reached 225. At that time, 1994, there were 385 licenses. For the last few years, there have been less than 225 licenses. In earlier years, the daily harvest limit ranged from 30 to 20 barrels. In 2000 the current limit of 17 barrels was established by the VMRC.

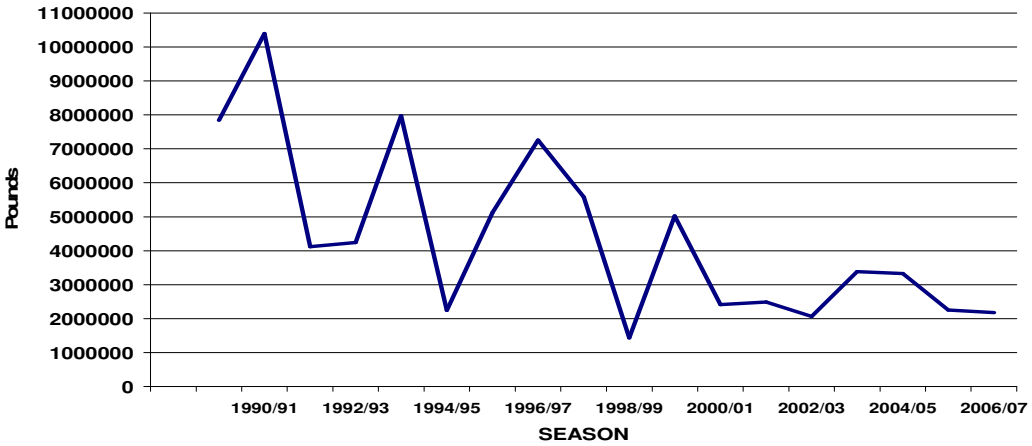
As shown in Figure 6, the number of active harvesters declined from 302 (1994–95 season) to 67 in the 2006–07 season. This means 158 potential licenses are inactive.
Participation in the crab dredge fishery has declined greatly since 1994. Market factors, overhead and labor costs and regulations could be considered responsible for this decline in licenses and effort.

Figure 6. Activity levels in the Virginia crab dredge fishery, by season, 1994/95 through 2006/07



Seasonal (December 1-March 31) crab dredge harvests during the last 17 seasons have ranged from 10.4 million pounds (1990/91) to 1.4 million pounds (1998/99). Harvest during the 2006/07 season was 2.2 million pounds (Figure 7). In comparing annual winter dredge harvests (pounds) to the total annual harvest of blue crab, the contribution of the dredge harvest to the total harvest of crabs has decreased, over the last decade. The 1996 crab dredge fishery accounted for 20.5% of the total harvest of blue crab. In contrast, 2.1 million pounds harvested by crab dredge gear in 2006 means that only 9.2% of the total harvest (22.5 million pounds) was from crab dredge.

Figure 7. Virginia crab dredge harvest (in pounds), by season, 1989/90-2006/07



The Report of the Task Force on The Virginia Blue Crab Winter Dredge Fishery (2000) to the Governor and General Assembly of Virginia characterized several impacts from this fishery:

1) Over the last 13 years, the winter dredge fishery accounted for 7.3% of Bay-wide harvest annually, and since 1993 has accounted for 8.7% of the female crabs harvested annually.

2) Since 1991, the winter dredge fishery has harvested on average 32% of the female crabs at least one year of age that reside in the Bay at the beginning of the winter dredge fishery, and 21% of the total number of crabs 1 year of age or older at the start of the dredge season.

The task force comprised of VIMS and ODU scientists provided the following recommendations:

1) The Task Force does not recommend that the winter dredge fishery be singled out for additional restrictions. However, the Task Force would not be opposed to future restrictions on the dredge fishery, if those restrictions were deemed necessary as part of an overall blue crab management plan that considered additional restrictions in all fisheries.

2) Because the winter dredge fishery has the potential to significantly impact the number of over-wintering crabs, the Task Force does not recommend that any expansion of the winter dredge fishery be allowed.

After 1999, annual crab dredge harvests accounted for less of the total harvest of blue crab (in percentage) than in nearly all other years, since 1986. Are the recommendations of the Task Force (2000) still valid? Because this fishery predominately exploits female crabs (96% female), at a time of year when the stock has already been reduced by other fisheries, any expansion, especially during this prolonged period of low stock abundance, should be avoided. The majority of the females exploited by the dredge fishery are a new cohort of mature female crabs not the cohort that was heavily fished through most of the potting season. Megalopae recruit in late summer or fall and females reach maturity the following fall and begin the fall "run', migration, to the lower Bay. The end of the potting season and the dredge fishery exploit this cohort. At least historically there may be a small fraction of the previous cohort still in the lower Bay (~ 5 - 25%) that would be subjected to the winter dredge fishery. Given the high exploitation rates of recent years 25% may be too high.

Fishery data from the Maryland Department of Natural Resources and the VMRC indicate the exploitation rate on age 1+ female crabs, from the Bay-wide winter dredge survey, substantially exceeds the exploitation rate on males, in most years. From 1990–2006, on average, the female exploitation rate was 53% higher than on male blue crabs (see Figure 5). From this data set, the Maryland Department of Natural Resources determined that annual female-specific exploitation rates on age 0+ crabs, from the Virginia dredge fishery, averaged 17% of the total Virginia exploitation rate on female crabs during 1990–2006.

Proportionally, the fraction of females removed by the winter dredge fishery, in 2001 through 2006, is similar or greater than in some earlier years. During recent years, the Bay-wide harvest was well below average. Is the current barrel limit (17 barrels or 51 bushels) achieving conservation of female crabs, as the Commission intended? Were there to be a slight rebound in abundance, what additional measures might be needed to offset renewed interest in this fishery?

Recommendation: The Committee recommends the Commission develop a plan to preclude any expansion of fishing mortality in the winter dredge fishery, relative to other blue crab fisheries, and address the risk posed by latent effort in this fishery to a potential recovery of the population or the increased regulation of other blue crab fisheries.

PEELER FISHERY

There is a 3-inch minimum size limit on the possession of peeler crabs in Virginia. Maryland requires peelers to be 3 ¼-inch, in carapace width, until July 15. From July 15 through December 15, the minimum size limit is 3 ½-inches. The Potomac River Fisheries Commission requires peelers to measure 3 ½-inches. There are some inter-jurisdictional inconsistencies, in peeler size limits.

The VMRC requires that peeler crabs are at least white sign peelers, but the difficulties in enforcing this law leads to the harvest of green crabs. Harvest of green crabs (crabs 14–50 days prior to molt), especially in spring, leads to waste in terms of increased mortality because of the longer holding times required, prior to molt, compared to a white-sign, red-sign or rank peeler. The committee did discuss the benefits of prohibiting white-sign peeler crabs, as this type of regulation would improve enforcement and help to decrease the interstate commerce and overall waste of white-line peelers throughout the mid-Atlantic region.) The VMRC reports peeler harvest doubled from 1994–2002, but has since returned to 1994 and earlier levels (Figure 8). Since the Chesapeake Bay fisheries depend heavily on annual recruitment of blue crabs, and the peeler fishery is the first to encounter crabs from the previous year's spawn, it is not surprising that this fishery has trended down in recent years. Figure 9 indicates that recruitment, as indexed by the Bay-wide winter dredge survey has been mostly below the survey, average catch per unit of effort, since 1997.

Figure 8. Virginia harvest of peeler crabs (all areas), 1990-2006

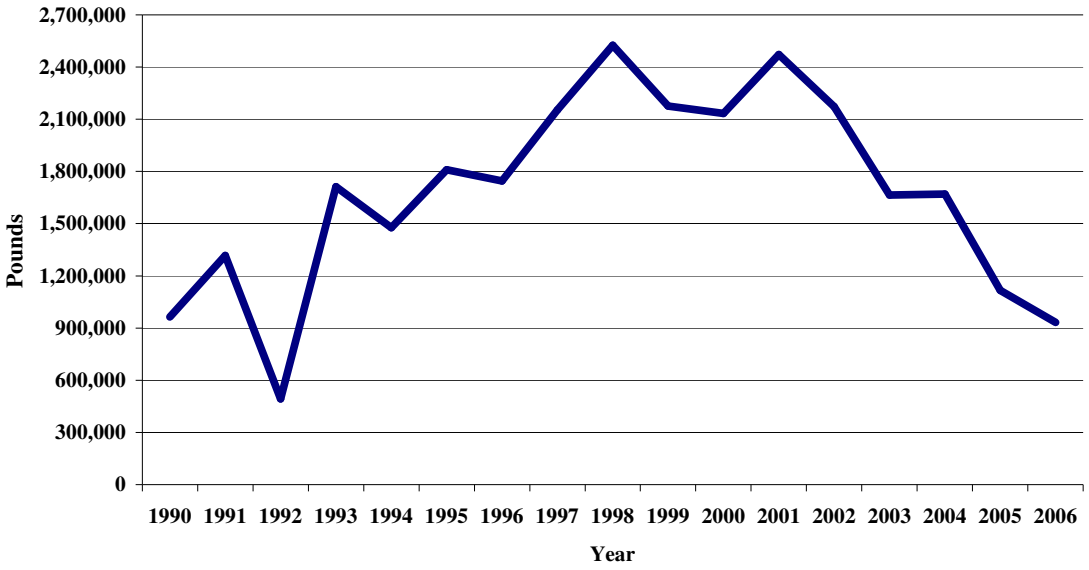
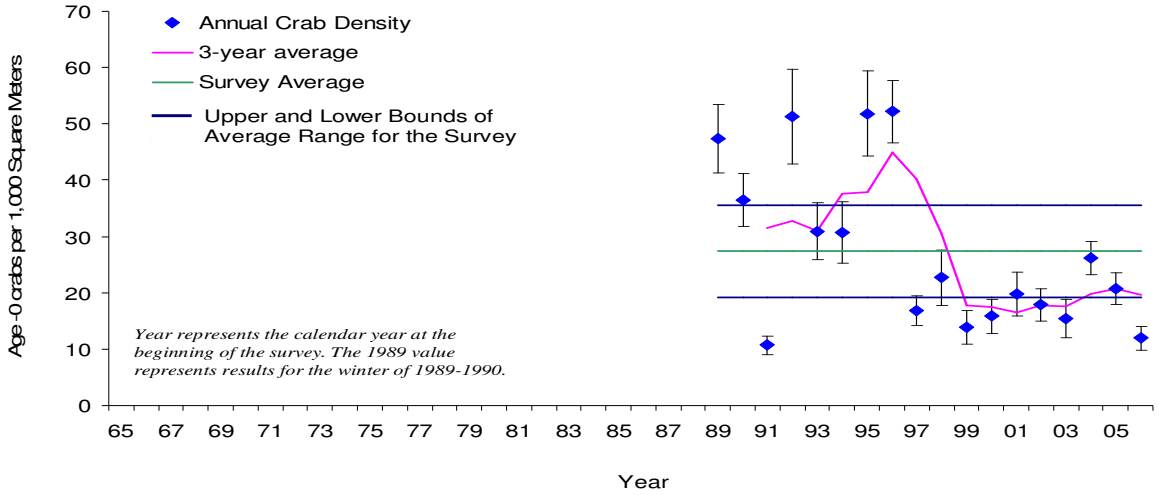


Figure 9. Winter dredge survey density of age 0 blue crabs (recruits) 1989-2006. These are crabs measuring less than 60mm (2.4 inches) across the carapace. 95% confidence intervals (1.96*std error) shown around individual points. The average range for the survey is defined as the standard deviation of the annual crab density values divided by the square root of three.



Recommendation: The VMRC should develop an effort control system for the peeler fishery in order to prevent overfishing and constrain mortality at the target level. Recognizing that an effort control system will take some time to develop, and as an additional precautionary action to reduce exploitation, the VMRC should consider raising the minimum size limit on peelers. A higher minimum size limit would provide some benefits to the spawning potential and would reduce waste associated with green crabs. It may be beneficial, for all three Chesapeake Bay jurisdictions, to have similar minimum peeler size limits. The VMRC could also consider prohibiting the sale of white-line peelers, but allow harvesters to retain white-line peelers for use in their own (permitted or licensed) shedding system. Prohibiting the sale of white-line peelers would provide some benefits to the spawning potential and would reduce waste associated with attempting to shed green crabs and white-line peelers. It would be beneficial, for all the mid-Atlantic jurisdictions, to have similar rules on white-line peeler harvest.

VIRGINIA BLUE CRAB SANCTUARY

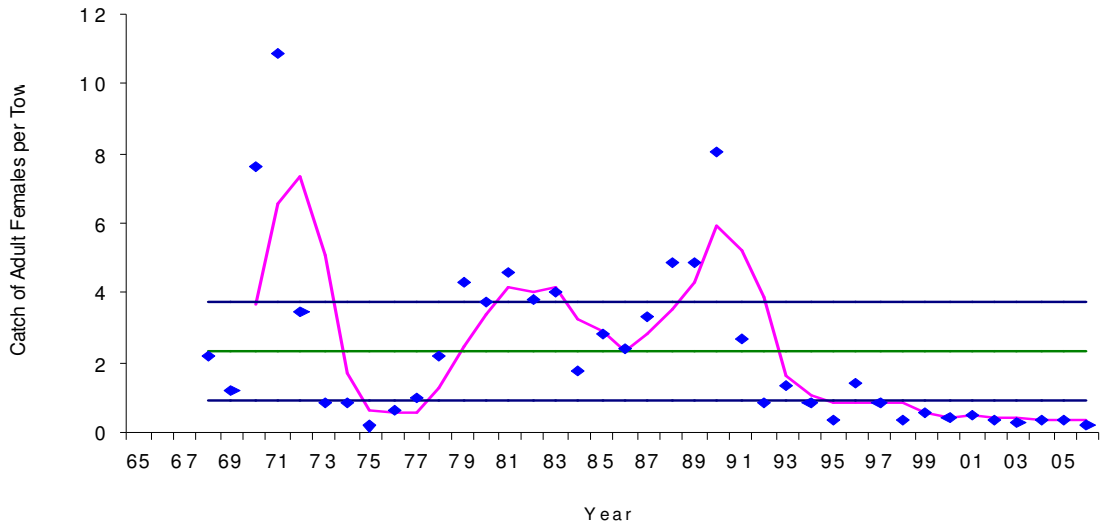
The purpose of the original 146-square mile sanctuary (adopted by the General Assembly in 1942) was to relieve harvest pressure on female blue crabs during peak spawning times (June 1–September 15). The VMRC expanded this important spawning sanctuary by 75 additional square miles in 1994. In 2000 the Commission protected another 434 square miles from the harvest of blue crabs during June 1 through September 15, with an additional 272 square miles of sanctuary established in 2002. In 2007 a 95-sqare mile area that includes ocean waters that stretch south, from near the Capes of Virginia to the North Carolina-Virginia Line, was incorporated into the summertime Virginia Blue Crab Sanctuary. Currently, the Virginia Blue Crab Sanctuary provides protection, from harvest, to crabs, from June 1 through September 15, within 1,022 square miles of Virginia waters (see Figure 3).

Despite several expansions of the sanctuary there is no evidence of any recent increases in spawning stock biomass. Have the increases in sanctuary areas forestalled an even lower level of spawning biomass? Although the sanctuary protects females within its borders, there is movement of some crabs outside the boundaries of the sanctuary, there is no protection of female crabs migrating into Virginia waters from Maryland and the Potomac during spring and fall, and overwintering females are exploited by the Virginia dredge fishery. Since there is a fall run

which is tantamount to a spawning aggregation, should a portion of the sanctuary be closed year-round, to allow those crabs a chance to spawn, as early as May of the next year? This spawning aggregation faces exploitation pressure throughout Chesapeake jurisdictions, prior to May, from fisheries in the fall, the Virginia dredge fishery and spring crab fisheries.

As indicated by multi-year tagging studies in 2002–2005 by VIMS and in the late 1980s by ODU, the spawning sanctuary has been effective in meeting its intended goal of protecting a sizeable fraction (~ 75%) of females in the spawning grounds, but females also need protection prior to their entry into the sanctuary. Industry has preferred increased sanctuary acreage, in the past, rather than being required to maintain unobstructed 2 5/16-inch cull rings in the mainstem bay area and the sounds. The bay-wide winter dredge density of female spawning potential is less then the time-series (1989–2006) average the past two years. In contrast, the Virginia trawl index of adult female crabs has been below average, since 1991 (Figure 10).

Figure 10. Virginia Trawl Survey catch per tow of adult female crabs, 1968 through 2006, from sites in the upper and lower rivers, and the mainstem of Chesapeake Bay. All females caught from August through November are considered to be adult, in that they will likely spawn within 1 year.



The committee discussed benefits expected from establishment of a smaller bay-wide, year-round sanctuary. Current regulations do not protect mature (mated) females migrating down-estuary, beginning in September–October, and these migrating females clearly are targeted by the fishery. With the adoption of hydraulic pot pullers, deep channels present no refuge, and the mated females are susceptible to harvest.

VIMS described that unlike the current, expansive Virginia blue crab spawning sanctuary, the year-round, bay-wide sanctuary could be effective even as a narrow corridor from Maryland through Virginia. Moreover, spatial management, similar to that presently used in oyster and scallop fisheries, could be directed at foraging grounds and nursery habitats that eventually link to the spawning sanctuary. There was not consensus among committee members on the issue of future sanctuary modifications, though further study is advised.

Recommendation: The sanctuary does afford protection to female crabs. Currently, harvest within the sanctuary is prohibited from June 1 through September 15. As there is spawning activity in May, the harvest prohibition should extend from May 15 through September 15. Alternatively, since there is a high percentage of mature, legal females harvested from the

Hampton Roads area, female mortality rates could be reduced by other conservation measures aimed at females prior to or during their migration to the spawning sanctuary, including sanctuary modifications.

EFFORT CONTROL

Effort Control has been an elusive management objective of Virginia's blue crab management plan. The VMRC has used a multi-faceted approach to constrain effort, focusing primarily on pot limits and moratoria on license sales (since 1999). Presently, effort controls are difficult to enforce, given the large area, number of fishery participants, the required time that Law Enforcement spends on any one suspected violation, and, especially the current lack of a pot-tagging system. The fundamental basis, for any effort control strategy, is an initial measure of existing effort, in terms of pot-days or number of pots actively fishing for blue crab. The VMRC mandatory reporting system (Attachment IV) collects information on gear use (amount, hours fished) but expects these data do not fully account for effort in the blue crab fisheries since they do not include illegal effort or unreported landings. There are incentives to under-report effort, and VMRC staff expects these data may be useful strictly for trend analysis, rather than an index of catch per unit effort.

Effort control in the Virginia fisheries is hampered by substantial latent effort. It is expected, although not quantified, that declines in active effort, year to year, have been the result of low stock abundance (see Figures 11 and 12).

Figure 11. Comparison of Activity Levels for Licensees Eligible for up to 300 crab pots, 2003 thorugh 2007. Active (denoted as licensee reporting) means at least 1 pound of harvest was reported to VMRC.

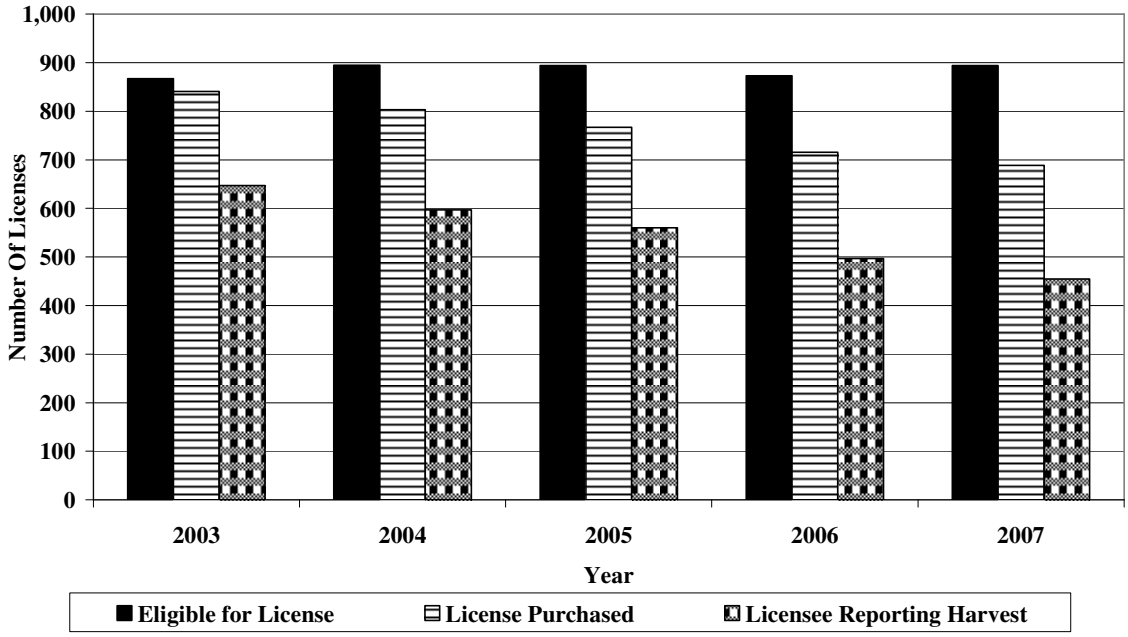
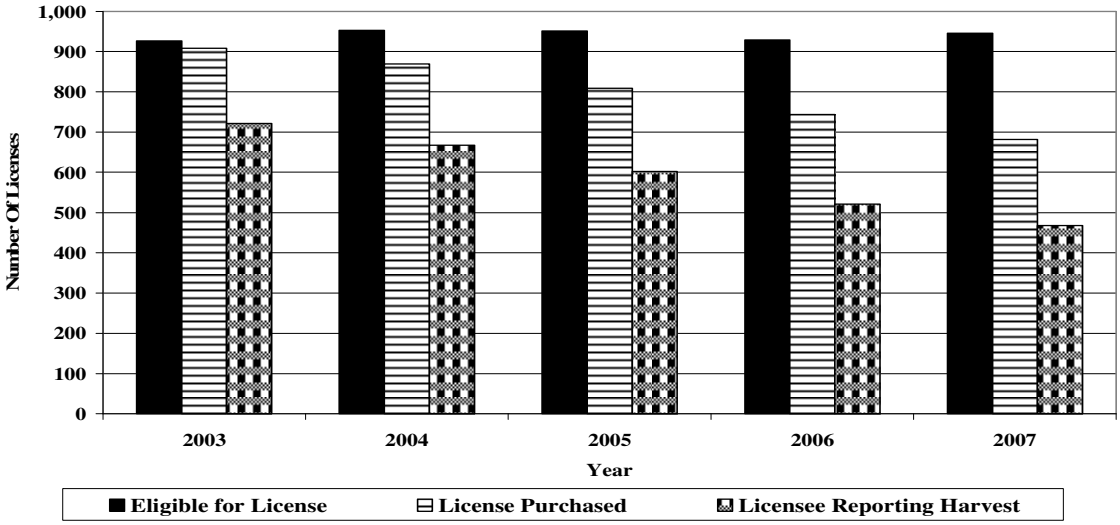


Figure 12. Comparison of Activity Levels for Licensees Eligible for a peeler pot license, 2003 through 2007. Activity (denoted as licensee reporting) means at least 1 pound was reported to VMRC.



VMRC data indicate there are many inactive harvesters, year to year, such that any increase in abundance could result in increased activity. Additionally, many active licenses are only active at token levels of activity, and could substantially increase effort in response to any improvement in blue crab abundance resulting from regulatory reform. The lack of an adjustable effort system prevents management from adding or removing active effort in the fisheries, to ensure the exploitation rate is at, or near, the target in any year. There have been a number of attempts by the VMRC to limit or reduce effort in these fisheries. Overall, these attempts have resulted in caps on existing licenses but have not effectively reduced effort in the fishery. For example, pot limits were implemented for the hard crab pot and peeler pot fisheries but have proven to be very difficult to enforce. Industry has reported that harvesters can, and do, circumvent enforcement of pot limits. In general, managers think there is a large surplus or overcapacity of effort in the fishery, given the sustained low level of abundance. Table 3 shows that nominal effort (licenses sold) has changed very little, since the mid-1990s to late 1990s, despite implementation of a license sales moratorium in 1999 that continue today. Compounding this perceived overcapacity are problems related to latent effort.

Table 3. Comparison of crab license sales between 1995 - 1998 and 2006.

License Type	1995	1996	1997	1998	2006
Crab Pot	1642	1741	1697	1714	1734
Peeler Pot	585	739	813	894	929
Crab Trap	1785	1825	1859	2025	1551
Scrape	193	205	238	283	355
Ordinary Trotline	13	17	18	17	34
Patent Trotline	4	3	2	0	6
Dip Net	14	38	38	21	54

*Note: 1) Crab Pot-150 and Crab Pot-200 or less was started in May 1999;
2) eligible licensees in 2006 are equivalent to license sales of earlier years.

Roughly 40% of the hard pot and peeler pot licensees have not been active in those fisheries during 2004 through 2006 (Figures 11 and 12).

Latent effort has the potential to offset or reverse any progress that is made towards the future successful management of blue crabs, since any increases in abundance would be an inducement for inactive harvesters to become active. In addition, the current allowance of agents, whereby any person is able to fish an inactive harvester's gear, adds to the overcapacity of effort in these fisheries. In order to effectively manage effort, the Commission is encouraged to develop a strategy to address agency and transfers. Given the historical concerns of overcapacity, it may be helpful to develop a rationalization strategy to further limit the number of participants in the fishery, recognizing that the resource cannot be simultaneously restored to historical levels of abundance while supporting the current number of participants at their current level of effort.

The Commission is encouraged to control "agency", the provision that allows any individual to serve as an agent for a licensed crab fisherman. Agency even allows one person to serve as an agent for multiple license holders. This system further complicates the Commission's ability to address latent effort. Except for true emergency situations, no agency should be allowed. Certainly, no individual should be allowed to purchase the right to fish another licensee's pots.

Other states have struggled with effort control in the crab fisheries. North Carolina enacted a moratorium on the sale of commercial fishing licenses in 1994 and its Fisheries Reform Act required that blue crab be the focus of the first fisheries management plan. From this plan, four effort control plans were recommended in 1998, and options were based on varied landing histories of licensees. North Carolina did not implement any of the effort control strategies, as industry was not in support, but an elegant template exists for future considerations.

Initially, this committee discussed the merits of an individual transferable pot (ITP) system. To facilitate this system, Virginia would need to implement a pot-tagging system in order to enforce and monitor effort in the pot fishery. Since the pot-tagging system can identify existing effort levels, managers can adjust individual crab pot allowances, on an annual basis, if necessary, according to the most recent estimates of exploitation rates.

Later discussions of the committee centered on an individual transferable effort (ITE) system. This management tool is similar to the ITP system, but allowable crab potting days, or weeks, is the effort control mechanism. As with the ITP system the Commission would have to develop a plan to address the risk of latent effort by managing inactive licenses and licenses that are active at nominal levels. A pot-tagging system would be central to an ITE effort control system, as it would be an important mechanism by which the system is monitored and enforced. Without a pot-tagging system, even a well designed ITE system would be open to abuse. Performance data (trips = days of crabbing) are already available for the pot fisheries (Figure 13 and 14), and the Commission's mandatory reporting database could serve as a basis for developing and implementing an effort control system.

Figure 13. Number of peeler pot harvesters, according to number of crab harvest trips (in categories), 2003 - 2006.

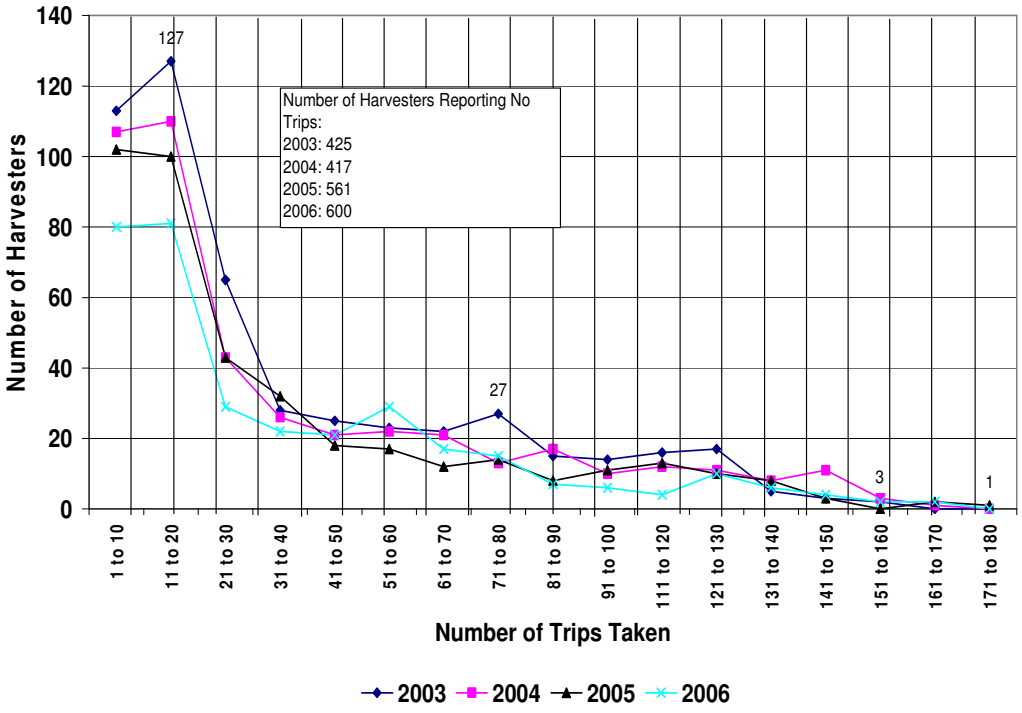
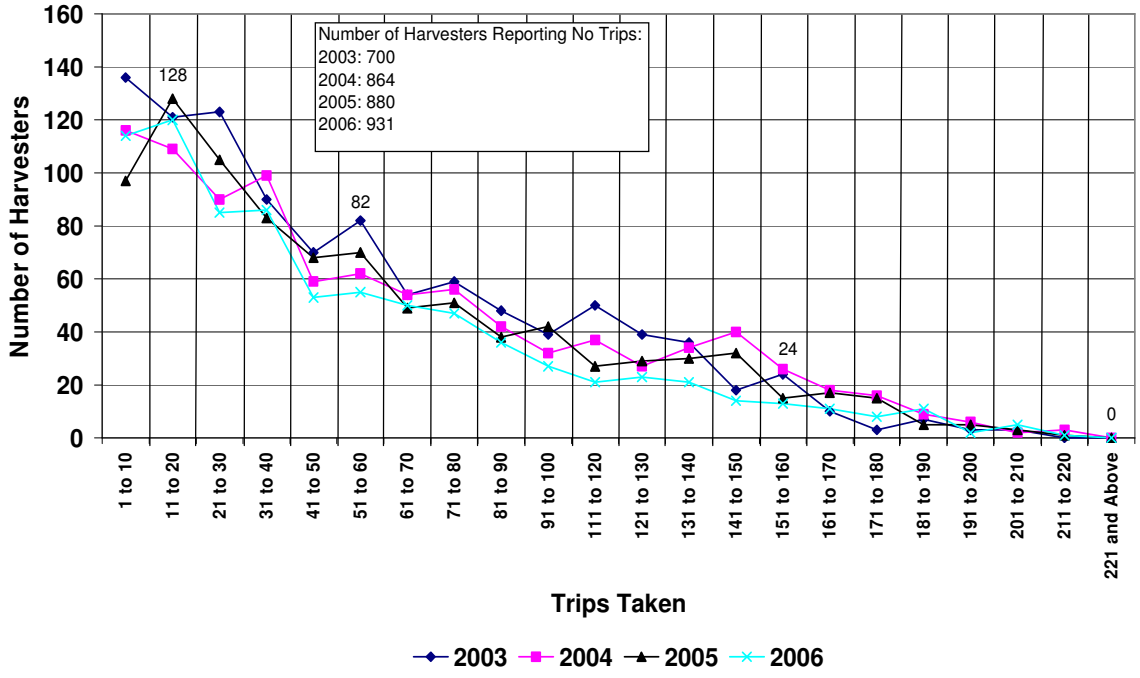


Figure 14. Number of crab pot harvesters, according to number crab harvest trips (in categories), 2003 - 2006.



ITE systems have been used successfully in the sea scallop fishery, in conjunction with a rotational area management system, but are not as common as ITQ (individual transferable

quota) systems. However, the blue crab fishery is not managed by a quota or total allowable catch (TAC), as is the case for many ITQ systems for finfish. While there was consensus among committee members that the blue crab fishery would be ideally managed by an annual TAC to directly control fishing mortality, the VMRC staff indicates there are numerous landing sites throughout Tidewater areas, and that makes the enforcement of a quota system, including trip or daily limits, unmanageable. An ITE system would allow for transfers of crab harvesting days, and this system would allow management to modify an individual's seasonal crab harvesting days (denominated in weeks, or otherwise), within a season based on the winter dredge survey's predicted exploitation rate, for that season. Unlike the current management plan, which is essentially static, an effective ITE system would enable the Commission to manage the resource adaptively, in response to biological conditions, and in the context of a rebuilding framework.

Figure 13 shows that many peeler pot harvesters only harvest from peeler pots during 60 days or less. That is not surprising since 50% or more of the annual peeler crab harvest occurs in May. The 10-day intervals can be modified, even to daily basis. The important aspect of the mandatory reporting data is that an ITE system can be configured and tailored to different criteria. Please note the current amount of latent effort. The number of inactive harvesters increased substantially by 2006. Only 329 of 929 eligible licensees harvested at least one day in 2006.

Figure 14 combines all pot license categories (up to 100 pots–up to 500 pots) and shows that slightly more than one-half of 1734 eligible licensees in 2006 harvested crabs from crab pots during 60 days or less. Earlier years show a similar trend.

Recommendation: The BCRRC finds that a successful evaluation of the blue crab fisheries depends, initially, on the quantification of existing effort and catch-per-unit-of-effort statistics. Once this baseline understanding of existing effort characteristics is established, the Commission should develop an effort control system designed to prevent overfishing and constrain fishing mortality towards the exploitation target. Reduction measures should encompass reductions in latent effort and the use of agents. An individual transferable effort system, combined with a pot-tagging program, is a sound approach and offers a better probability that the annual exploitation rate will be at or near the target rate.

REBUILDING FRAMEWORK

The Committee discussed the absence of a rebuilding target, framework or schedule in the existing management plan. While the committee agreed that effort control and constraining mortality towards the target should be the highest priority items for management action, the Committee did consider the shortcomings in the mortality target, in relation to a rebuilding of the stock. The Committee did offer support for managing the population within a rebuilding framework, over a reasonable time period, and some members suggested using the federal guideline of 10 years.

ATTACHMENT A: Request for a scientific review of Virginia crab fishery regulations.

Richard B. Robins, Jr.
5103 Mariners Cove
Suffolk, Virginia 23435

The Honorable Steven G. Bowman
Virginia Marine Resources Commission
2600 Washington Avenue
Newport News, VA 23607

April 16, 2007

Dear Steve Commissioner ~~Bowman~~:

The Chesapeake Bay Commission's 2006 blue crab status report raises substantial concerns regarding the status of the baywide blue crab population. For nearly a decade, the blue crab population has been at a relatively low level of abundance, and in recent years the population has not cycled as it did in the past. The past decade has also seen the implementation of significant regulatory changes by the Virginia Marine Resources Commission, including an 8-hour workday, sanctuary expansions and other regulatory modifications. In addition to fishing pressure, the blue crab population has been subjected to adverse environmental conditions, including large areas within the bay with low levels of dissolved oxygen, catastrophic eelgrass losses in 2005, and possible stresses associated with a recovered striped bass population. Despite the extensive regulation of this fishery, in 7 of the past 8 years, harvest pressure, as measured by the exploitation fraction, was above the target rate that would conserve just 20 percent of the spawning stock, and in 5 of the past 8 years, the exploitation rate was above the critical threshold that would conserve a minimal 10 percent of the spawning stock. The baywide blue crab population has remained at levels below the long term average for 10 of the past 11 years. The new data presented in the report raise questions regarding the effectiveness and sustainability of the current blue crab management plan. I believe the seriousness of these biological concerns warrants a *de novo* review of Virginia's blue crab management plan and regulations, and I hereby request that the Commission undertake a comprehensive review of Virginia's blue crab regulatory and statutory management measures.

I submit that the process should begin with an independent scientific review of Virginia's blue crab management plan, evaluating the intent and effectiveness of each management measure, as well as the consistency of each measure with the bi-state management goal of doubling the blue crab spawning stock and the Commission's statutory obligation to manage the population for optimum yield (§ 28.2-203). To that end, I recommend that the Commission empanel a broad group of independent fisheries scientists to initiate the review.

While the data indicate that the blue crab population is at a relatively low level and raise questions over the sustainability of recent exploitation rates, the impacts of environmental factors may be less well known, but should also be considered and addressed. Adverse

exogenous factors, however, do not foreclose the Commission from meeting its statutory responsibilities to manage the blue crab stock for optimum yield. The best available scientific data suggest that some degree of management reform may be necessary to restore the blue crab stock—and fishery—to a healthy level, and indicate the need for a review of Virginia's blue crab management plan.

Grateful for your kind consideration, I remain

Very truly yours,

Richard B. Robins, Jr.
Associate member

cc: The Honorable Preston Bryant

Literature cited

Chesapeake Bay Commission, Bi-State Blue Crab Technical Advisory Committee. Blue Crab 2005, Status of the Chesapeake Population and its Fisheries, August, 2006.

Code of Virginia. §28.2-203. Online http://leg1.state.va.us/000/src.htm.

ATTACHMENT B.

T. G. Wolcott and Donna Wolcott have conducted research relevant to management issues. In North Carolina their students explored microhabitat choice for molting (M. Shirley) and migration of females to, and the efficacy of, NC's spawning sanctuaries (D. Medici). Donna and her student C. W. Bost explored the issue of sperm limitation in lab
and field. In the Chesapeake, in collaboration with A. H. Hines at SERC, the Wolcotts and students used biotelemetry and dataloggers to explore molting, foraging and agonism (M. Clark), mating behaviors (A. Carver), and migration of adult females toward the spawning sanctuary.

Thomas Miller Ph.D. (Professor, Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science)

Miller has been researching the ecology and population dynamics of blue crab for more than a decade. He has developed new approaches to describing growth, quantified patterns in their spatial distribution in Chesapeake Bay, and has developed matrix-based models of their population dynamics. Miller has been involved in providing scientific advice in the management arena since 1997. Most recently, he led the 2006 Chesapeake Bay blue crab stock assessment.

Elizabeth Wenner, Senior Marine Scientist, Marine Resources Research Institute

My background with blue crab stems from early childhood in Virginia and my participation in the blue crab survey as a graduate student. Williard Van Engel was one of my major advisors for my Ph.D. After coming to South Carolina, I worked on blue crab utilization of marsh habitats, incidence of insemination in blue crabs, population assessment of blue crab in various parts of South Carolina, and climatological effects on larval and juvenile blue crab. I currently serve on the SEAMAP Crustacean workgroup which discusses blue crab populations and management as it is a priority species in the SEAMAP survey. I am currently also in charge of the blue crab survey for the state of SC and run the SEAMAP trawl survey that samples from Cape Hatteras to Cape Canaveral, SC. I have served on numerous committees within the state of South Carolina dealing with science and management of blue crab.

Lynn Henry has worked 5 years for the North Carolina Division of Water Quality and 23 years for the NC Division of Marine Fisheries (NCDMF).

During employment with NCDMF, he has worked 10 years as a Striped Bass Biologist and 13 years as a Blue Crab Biologist in the Northeast District. He was the co-lead biologist on development of the 1998 and 2004 NC Blue Crab Fishery Management Plans. Served as the lead biologist for developing effort/conflict management plans for the blue crab pot fishery in 1999–2000. Principle duties are fishery dependent and independent data collection, and managing statewide crab migration/utilization, ghost pot, and pot escapement device projects. Other duties include serving on various committees and developing agency positions on development and water quality related issues in the Northeast District.

John McConaugha, Old Dominion University.

My first professional encounter with blue crabs was when I learned the art of growing *Callenectes sapidus* larvae as a postdoc. These skills were applied to understanding the physiology and development of blue crab larvae. Other projects have looked at larval and post-larval feeding mechanisms and feeding energetics. Subsequent work included developing an understanding of blue crab larval transport, and retention on the continental shelf and subsequent recruitment back into the Bay. This included interannual variation associated with wind patterns. Later work looked at reproductive effort in the Bay population and included estimates of the time a female spends on the spawning grounds, migration patterns onto and out of the spawning sanctuary and estimates of fecundity. Additional work focused on the development of a lipofuscin technique for aging female blue crabs. As part of that study blue crabs were raised in the lab through their maximum age of 3.5–4.5 years depending on temperature. Current work is examining changes in reproductive effort since the numerical decline in the Bay population after the mid-1990s. Female size, number of eggs produced and possibly quality of eggs has declined suggesting a change in the reproductive norm for this population. Juvenile blue crabs also provide an excellent model for limb regeneration that students and I have used to look at hormonal and physiological processes controlling limb regeneration.

ATTACHMENT V. Blue Crab Management Efforts of the Virginia Marine Resources Commission: A 22-Point Management Plan

The first Blue Crab Fishery Management Plan, adopted in 1989, placed controls on fishing effort and established other measures to reduce or eliminate wasteful harvesting practices in the blue crab fishery. By 1995, the Commission expanded, by 75 square miles, the Blue Crab Spawning Sanctuary (146 square miles), originally established by the General Assembly in 1942. It also shortened the crab pot season to the current April1 through November 30 period, and for the first time, required two cull rings in each crab pot to allow for the escapement of the smaller, immature, crabs.

In January 1996, the Commission reinforced it prior management efforts, by adoption of the following additional measures:

1. Prohibited the possession of dark-colored (brown through black) female sponge crabs, with a 10- sponge crab per bushel tolerance.

A sponge or cushion of eggs is caused by the extrusion of eggs onto the abdomen of the female crab. Prior to that time, female crabs carry their eggs internally, from the onset of maturity and mating (at approximately 1 ½ years of age), and can produce 2 or more batches of eggs within its lifetime. The prohibition on the taking of dark-colored sponge crabs is projected to protect approximately 28 percent of female crabs. This action effectively increases the spawning potential of the blue crab stock, yet allows the lower Bay crabbing industry, which depends on egg-bearing female crabs, to continue. Crabs are available to the fishery, within a few days after they release their eggs. Protection of the dark sponge crabs occurs over the entire spawning season, increasing the probability that those crabs that are allowed to spawn will do so during a period of favorable environmental conditions.

2. Limited license sales of hard crab and peeler pot licenses, based on previous eligibility or exemption requirements.

This moratorium on the sale of crab pot and peeler pot licenses was proposed for one year. Eligible participants for the 1996 crabbing season were limited to those who participated in the 1995 fishery. This element was considered as critical to preventing further expansion of the fishery in order to stabilize the resource and its fisheries.

3. 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.

The 300-pot limit was the second element needed to cap effort and attempt to stabilize the resource and its fisheries. Only eight percent of the crabbers, from 1993 – 1995, reported fishing more than 300 hard crab pots. This measure was designed as a cap on effort and was not intended to reduce effort substantially.

4. Established a 3 ½-inch minimum possession size limit for all soft shell crabs.

The 3 ½-inch minimum size limit for soft shell crabs provides additional protections for the resource, by reducing harvests of small peeler crabs, at a time of low crab abundance. The measure complimented similar action in the State of Maryland and at the Potomac River Fisheries Commission to protect small soft crabs. Continued concern over excess effort in the

blue crab fisheries and a persistent trend of low spawning stock biomass during most of the 1990's led the Commission to adopt additional crab conservation measures in 1999 and 2000:

1. Lowered the maximum limit on peeler pots per licensee from 400 to 300 pots.

Effort reductions were clearly needed in this fishery that had grown significantly since 1994, but severe reductions on an immediate basis would result in severe economic burdens on the industry. Consequently, the Commission lowered the pot limit by 25 percent to minimize the economic impacts of the provision. Reports from many fishermen indicated that many did not fish the maximum 400 pots previously allowed.

2. In May 1999, the Commission initiated a one-year moratorium on the sale of all additional commercial crabbing licenses. In May 2000, the crabbing license sales moratorium was continued until May 26, 2001. The moratorium was again extended for 2002 and 2003, and, recently, this moratorium on the sale of additional crabbing licenses was extended through 2007.

Although scientists continue to debate the finer points of the blue crab stock assessment, all agree that the levels of effort in the peeler and hard crab fisheries have increased substantially, are too high to support viable incomes for many industry members, and may be eroding the abundance of the spawning stock

3. Established (in 2000) the Virginia Blue Crab Spawning Sanctuary. This additional sanctuary of 435 square miles was closed to all crabbing during the spawning season of June 1st through September 15th.

Through extensive research by Dr. Rom Lipcius (VIMS), the Commission was able to identify the proper boundaries of the sanctuary, in order to protect female crabs during their spawning migration down the Bay. To effectively protect females during their entire migration in Virginia waters and their entire spawning period, the sanctuary is closed from June 1 through September 15 and stretches from the VA-MD line to the mouth of the Bay. The sanctuary was further supported by research that indicated the blue crab abundance continued below average levels and the stock was fully exploited. Recruitment of young crabs to the fishery was also below average. Scientists also reported studies documenting a 70 percent decline in female spawning stock.

In 2000, the Commission entered into crab management discussions with the State of Maryland and the Potomac River Fisheries Commission, through the Bi-State Blue Crab Advisory Committee, a subcommittee of the Chesapeake Bay Commission. An Action Plan was adopted that recommended a harvest threshold that would preserve 10 percent of the blue crab spawning potential and a minimum stock size threshold that would be set at the lowest stock size that had been shown to have subsequently sustained a fishery. Managers further recommended the adoption of fishing targets that are more conservative than the thresholds and are the levels of fishing to be achieved each year. The recommended target level for blue crab fishing mortality was that level which achieves a doubling of the blue crab spawning potential. More importantly, it is estimated that a 15 percent decrease in harvest (based on the 1997-1999 landings average) was needed to achieve the target (F=0.7) in 2001. The Chesapeake Bay Commission recommended that the reductions be phased in over one to three years to minimize economic impacts associated with large reductions in harvest. The Marine Resources Commission endorsed the recommendations of the Chesapeake Bay Commission and its Bi-State Blue Crab Advisory Committee and promulgated the following regulations in 2002 to achieve the agreed upon harvest reduction target.

1. Enacted an 8-hour workday for commercial crabbers (2002) that replaced a prior closure of crabbing on Wednesdays.

In April 2001, staff conducted analyses of the harvest reductions associated with a variety of restrictions such as hourly workday limits, day of week closures, seasonal or monthly closures, and catch limits. Percent harvest reductions were calculated for each targeted fishery as well as the contributions each measure provided to the overall goal of a five percent reduction in blue crab harvest for the first year. The Commission adopted a Wednesday closure of the crab pot and peeler pot fisheries from June 6 through August 22, calculated as a 5.7 percent reduction in harvest in the crab pot/peeler pot fishery. The advantages of this measure included equal treatment of all fishermen and ease of enforcement.

In January 2002, the Commission removed the Wednesday closure, at the request of industry, and replaced it with an 8-hour workday. There appeared to be more support from industry members for an 8-hour workday than there was in 2001. The new measure also was endorsed by the industry-based Crab Management Advisory Committee

2. Established a 3-inch minimum size limit for peeler crabs in 2002.

The size limit on soft crabs had proven to be difficult to enforce on the water, where conservation is best served, since the fishery harvests mostly peeler crabs. Consequently the Commission adopted a 3- inch size limit on peeler crabs, with the intent to improve enforcement and to protect a significant portion of the immature female crab population.

The previously adopted crab sanctuary and the ban on harvesting dark sponge crabs protects over half the female spawning stock. Yet, these measures are meaningless, if crabbing effort is redirected to the immature female crab portion that has not had an opportunity to spawn. The minimum peeler size limit provides protection for those immature females. Thus, the combined efforts, to protect the adult spawners and the immature portion of the population, work together to provide more biological stability to the population.

3. Reduced the winter dredge fishery trip limit from 20 to 17 barrels per boat per day in 2001.

The Crab Management Advisory Committee supported this measure and noted that it should be enforceable. Staff determined that a reduction of the catch limit of 20 barrels during the Virginia winter dredge season to 17 barrels would result in a 3.1 percent reduction in harvest from that fishery.

4. Augmented (2002) the Virginia Blue Crab Sanctuary by 272 sq. miles.

The expansion of the Virginia Blue Crab Sanctuary increased the closed area from 661 square miles to 947 square miles. Commercial and recreational harvesting of crabs is prohibited in the Sanctuary from June 1 through September 15. The benefit of the expanded sanctuary is its significant protection of spawning female crabs, about 70 percent of the spawning stock.

5. Reduced unlicensed recreational harvester limits to 1 bushel of hard crabs, 2-dozen peelers (2002).

Recreational fishermen willingly supported reductions in their crab harvest. The regulations established a harvest limit for the vessel regardless of the number of crabbers on board. Since most recreational harvesters take well less than one bushel per day, the total reduction in harvest was expected to be minimal. A 2001 study concluded that the Virginia recreational harvest was only a fraction (< 5%) of total blue crab harvests, but other studies show the Bay-wide recreational fishery can be significant when blue crab abundance is not low.

6. Reduced licensed recreational harvester limits to 1 bushel of hard crabs, 2 dozen peelers, with a vessel limit equal to number of crabbers on board multiplied by personal limits (2001).

In March 2007 the Commission modified its prohibition on the possession of dark sponge crabs, based on advice from scientists at Old Dominion University, and implemented an additional crab spawning sanctuary to compensate for any possible reinforced it prior management efforts, by adoption of the following additional measures:

1. Prohibited the possession of dark-colored (brown through black) female sponge crabs, with a 10- sponge crab per bushel tolerance, only through July 15 of the crab season.

2. Established an additional sanctuary (95 square miles) in coastal Virginia, to compensate for any loss of spawning potential resultant from the modification to the ban on sponge crabs regulation.

These measures were supported by the Crab Management Advisory Committee.

ATTACHMENT VI
Recommendations of the VMRC Blue Crab Management Committee January 2007 through October 2008

Recommendations of the VMRC Blue Crab Management Committee
January 2007 through October 2008

January 2007

- The Committee recommended the PRFC proposal for size limit changes for blue crabs in Virginia's tributaries of the Potomac River to the Commission.
- The Committee voted to support the repeal of the black sponge rule and to offset the ruling by extending the crab sanctuary to offshore Virginia Beach, closing that area from June 1 through September 15.
- The Committee voted to suggest moving the start of the crab pot season from April 1 to March 15. This would be done by an emergency regulation by the Commission.

March 2007

- The Crab pot season extension (by emergency action) was discussed.
- The Committee discussed hard crab minimum size limits in the Code of Virginia and heard data and presentations about the use of agents, upriver sanctuaries for male crabs, and bushel limits. No recommendations were made at this time.

April 2007

- There was a consensus to take up the issue of derelict crab pots.

February 2008

- The committee voted to recommend leaving the current crab pot season dates as they currently were.
- The committee voted to recommend reducing peeler pots by 10 to 30%.
- The committee voted to open the 2 5/16" cull ring in all Virginia waters.
- The committee voted against recommending putting a single 2 3/8" cull ring in the tributaries of Chesapeake Bay.
- The committee voted to advertise changing the dates of the crab sanctuary to possibly as early as April 15.
- The committee voted to recommend allowing the use of agents only in emergency situations.
- The committee voted to advertise for a public hearing on reducing the number of crab pots by 10 to 30%.

March 2008

- The committee voted to recommend changing the dates of closing the crab sanctuary to may 1.

April 2008

- The committee voted to recommend adding two 2 3/8" cull rings to hard crab pots in all Virginia waters.
- The committee voted against recommending closing the crab dredge fishery and instead voted to recommend closing areas of hard bottom to dredging during the period of January 15 through February 28 and institute a 21 bushel limit on dredgers.
- The committee voted to recommend reducing the number of opts per license by 30%.
- The committee voted against lowering the number of recreational crab pots allowed under the recreational crab pot license from 5 to 3.

June 2008

- The committee discussed a pot-tagging system and if one were established that there should be a system to get replacement tags for lost gear.

July 2008

- The committee had a consensus that the industry would prefer that pot tags be labeled with the waterman's MRC_ID numbers, did not want to record pot tag serial numbers in the event of a catastrophic loss, and did not think that watermen should have to pay for pot tags.

August 2008

- No recommendations.

October 2008

- The committee did not vote but had consensus for reducing latent effort by utilizing a waiting list for crab pot harvesters with no activity from 2004 through 2007.