REPORT OF THE BLUE CRAB REGULATORY REVIEW COMMITTEE ON:

THE VIRGINIA MARINE RESOURCES COMMISSION MANAGEMENT PLAN FOR BLUE CRAB

January 1, 2008

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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

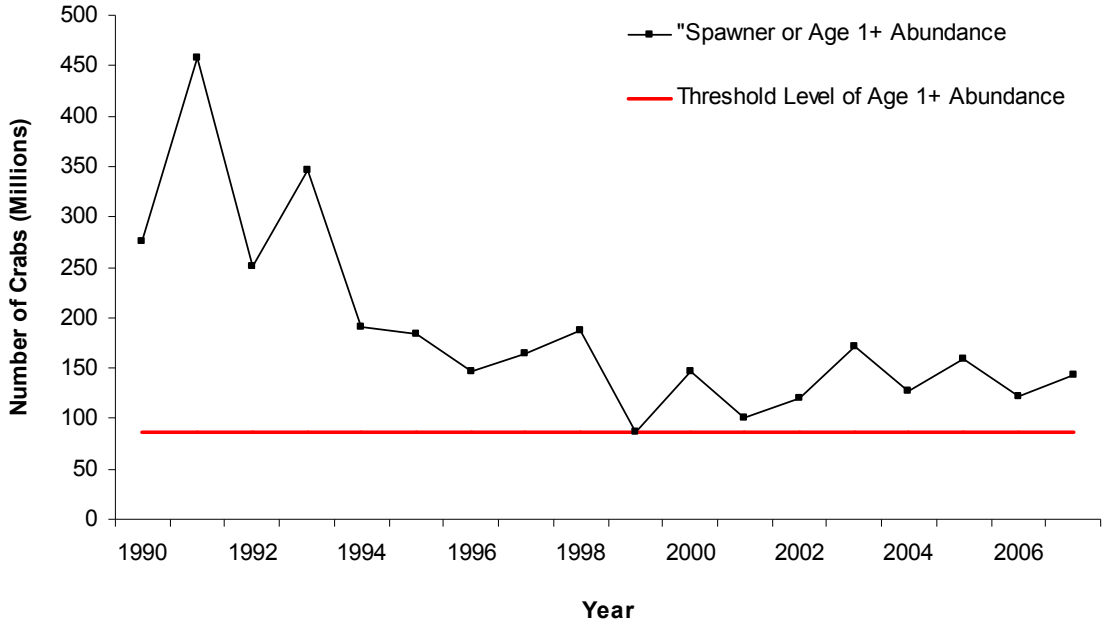
detected, and the effort control system will not be undermined. Adjustments in harvesting days could be based on the predicted exploitation rate from the winter dredge survey, to manage these fisheries according to the target exploitation rate (u = 0.46).

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.

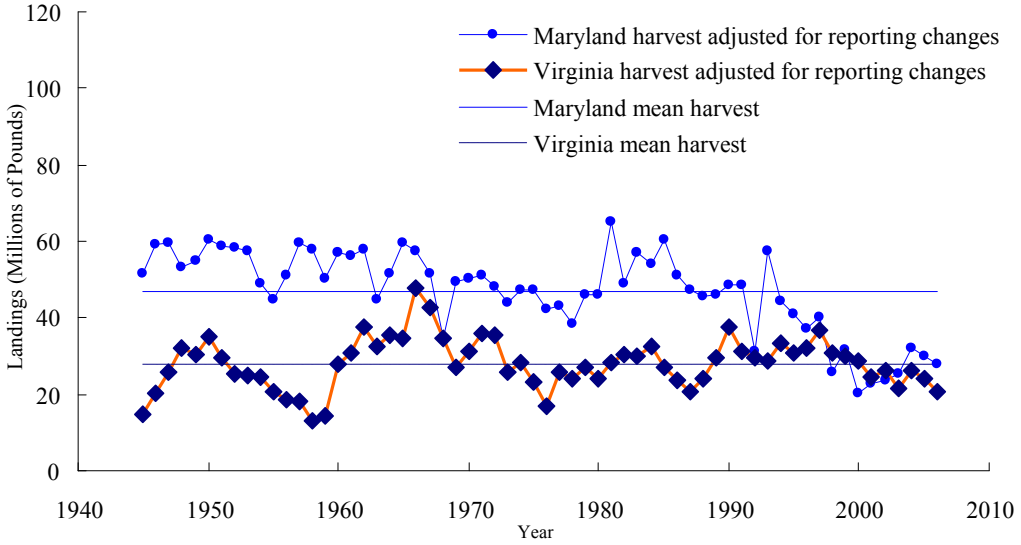
Since 1994, the objectives of Virginia regulations, for the blue crab resource and its fisheries, have been to promote increased abundance of exploitable crabs (2.4 inches and greater or age 1+) and a spawning stock that sustains an optimum yield. Despite the step-wise implementation of a 22-point management 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.



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 was similar to the estimated abundance of 2005 (see Figure 1). 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.

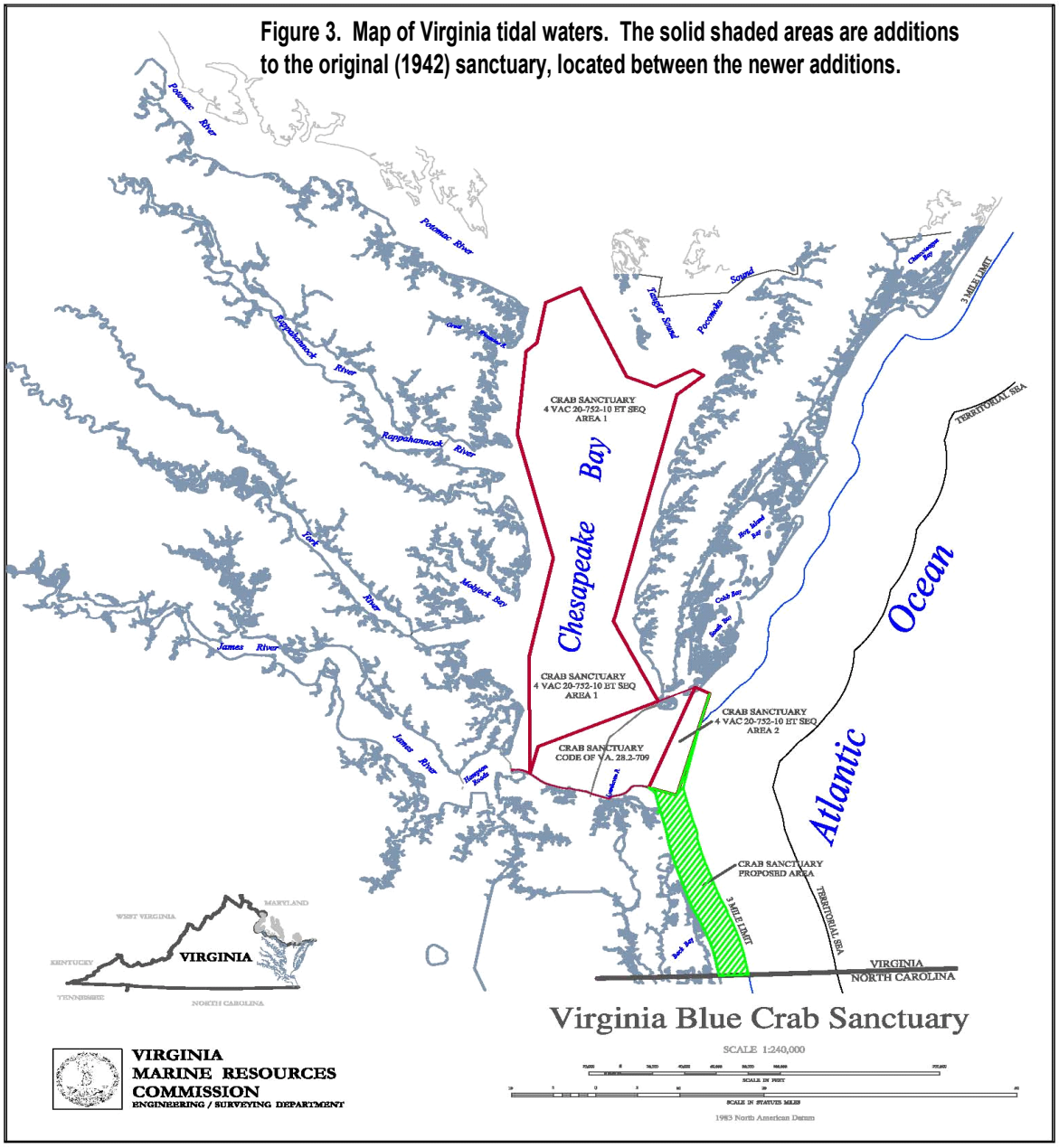


Figure 3. Map of Virginia tidal waters. The solid shaded areas are additions to the original (1942) sanctuary, located between the newer additions.

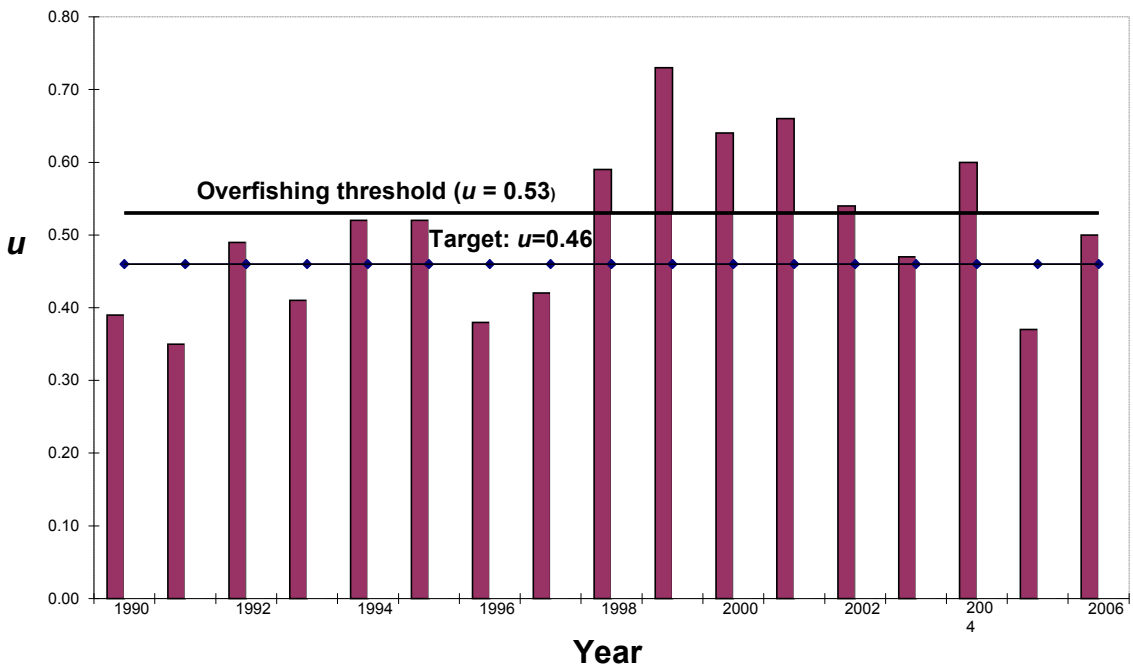
The threshold level of fishing is 53%. Removing this fraction of animals each year would be sustainable, but consistently removing a higher fraction would threaten sustainability, and overfishing would be occurring. To provide a margin of safety, a 'target' level of exploitation has been set at 46%.

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 evidence that the crab population would be sustainable if the spawning population drops below 86 million. This situation has not yet occurred.

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 that, 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

The focus of management should be achieving an exploitation fraction that falls consistently between the target and threshold levels. If exploitation were constrained to the reference levels, there would be a greater chance of success as measured by increased (or rebuilt) crab abundance and an optimized fishery.

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+ . 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.

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

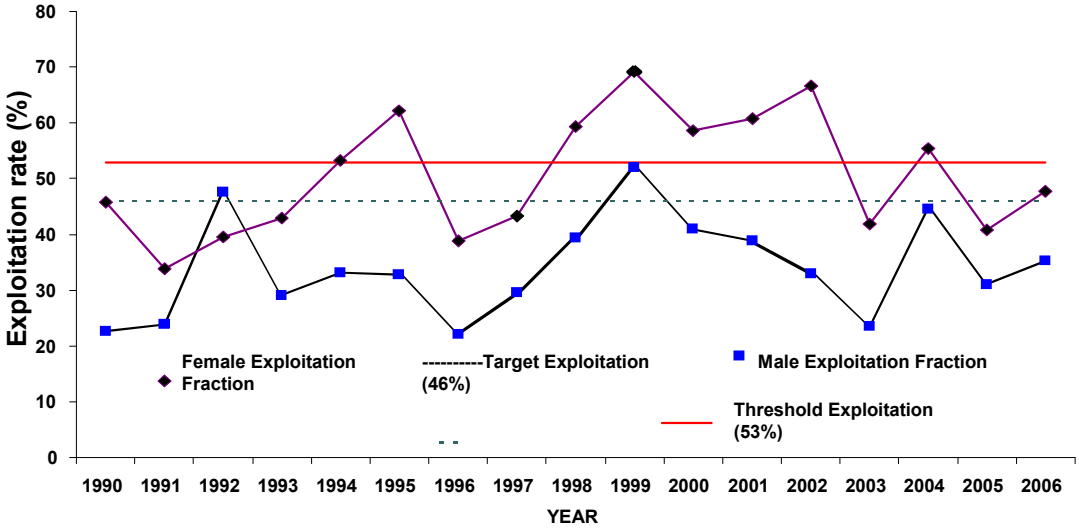
Note: Weight per crab - 0.2083 lbs. (peeler); 0.35 lbs. (hard); other 0.3 lbs. dredge.

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.

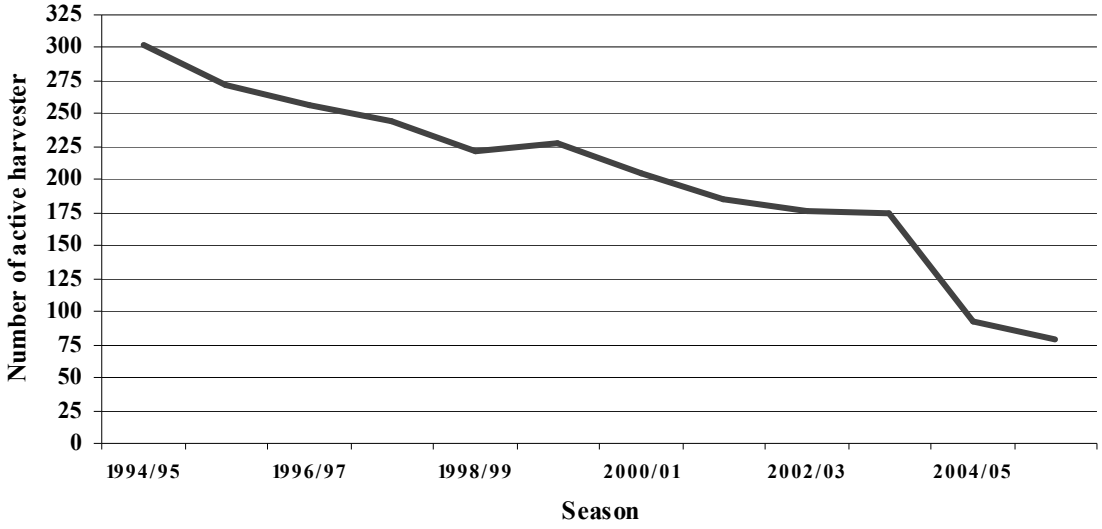
Recommendation: The VMRC should take corrective action to end overfishing in the blue crab fishery and constrain mortality towards the exploitation target. The VMRC should develop an effort control strategy that will enable the Commission to directly control and monitor effort as part of a comprehensive 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 79 in the 2005–06 season. This means 146 potential licenses are inactive.

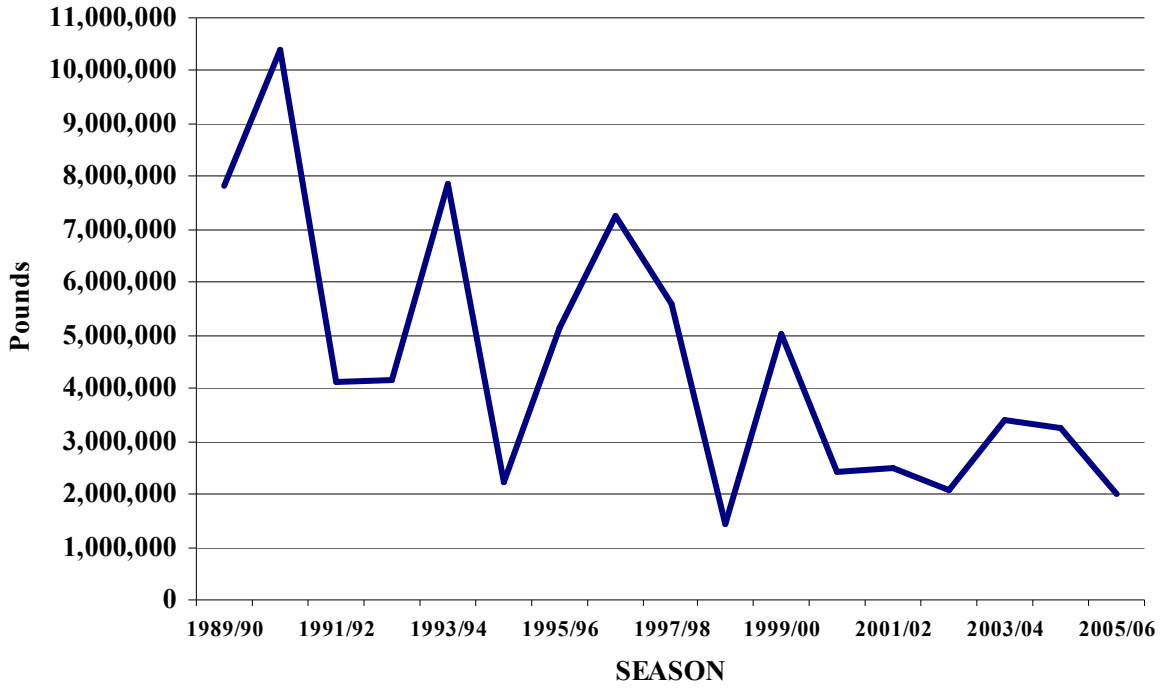
Figure 6. Activity levels in the Virginia crab dredge fishery, by season, 1994/95 - 2005/06



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.

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 2005/06 season was 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, 1989/90-2005/06



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 (~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

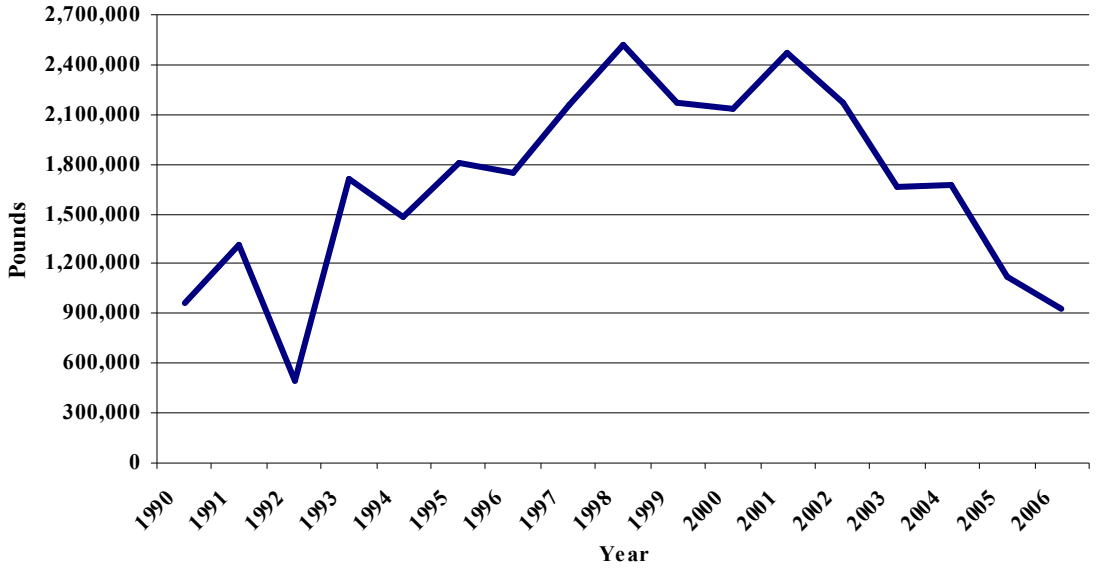
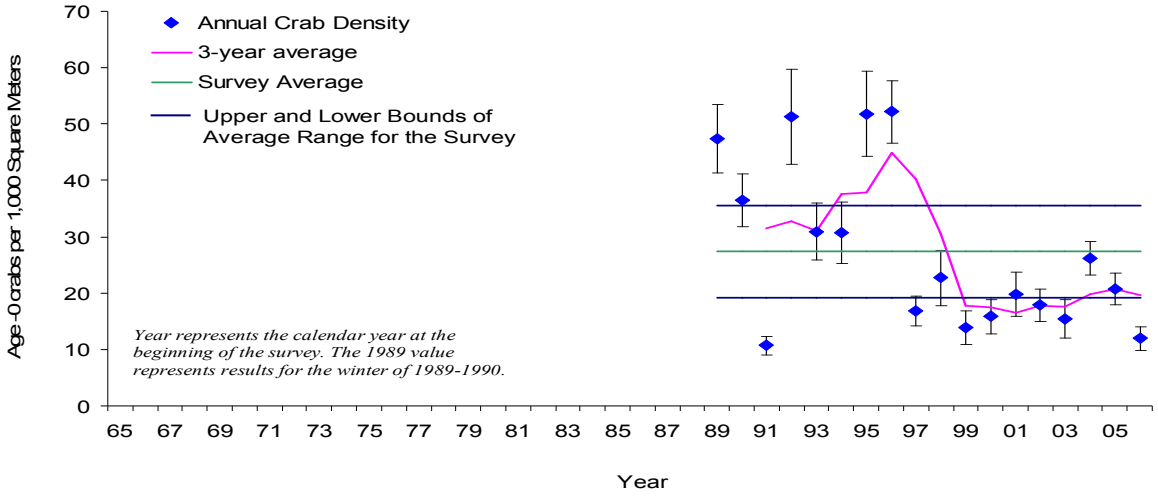


Figure 9. Winter dredge survey density of age 0 blue crabs (recruits) 1989-2006. These are crabs measuring less than 60mm (2.4 inches) across the carapace. 95% confidence intervals (1.96*std error) shown around individual points. The average range for the survey is defined as the standard deviation of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

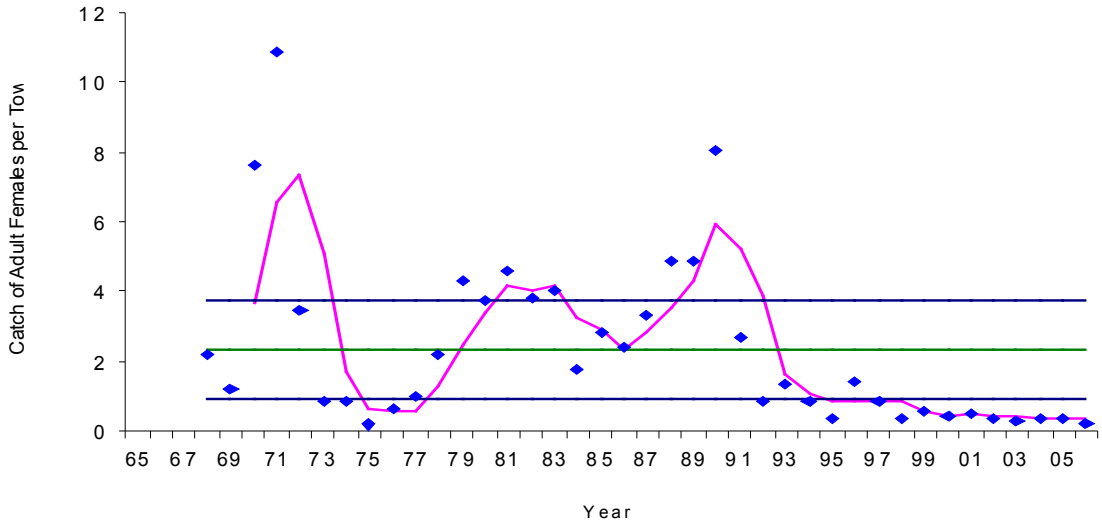
VIRGINIA BLUE CRAB SANCTUARY

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 the sanctuary be opened before those crabs have 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 (~ 75%) of females in the spawning rounds, 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 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 through 2006. Active (denoted as licensee reporting) means at least 1 pound of harvest was reported to VMRC.

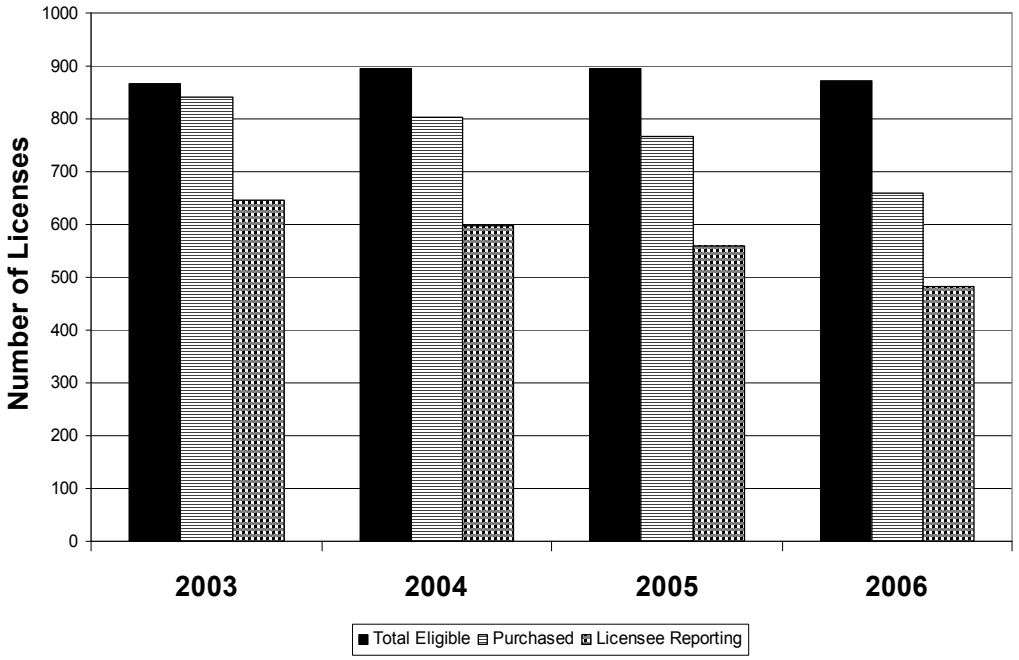
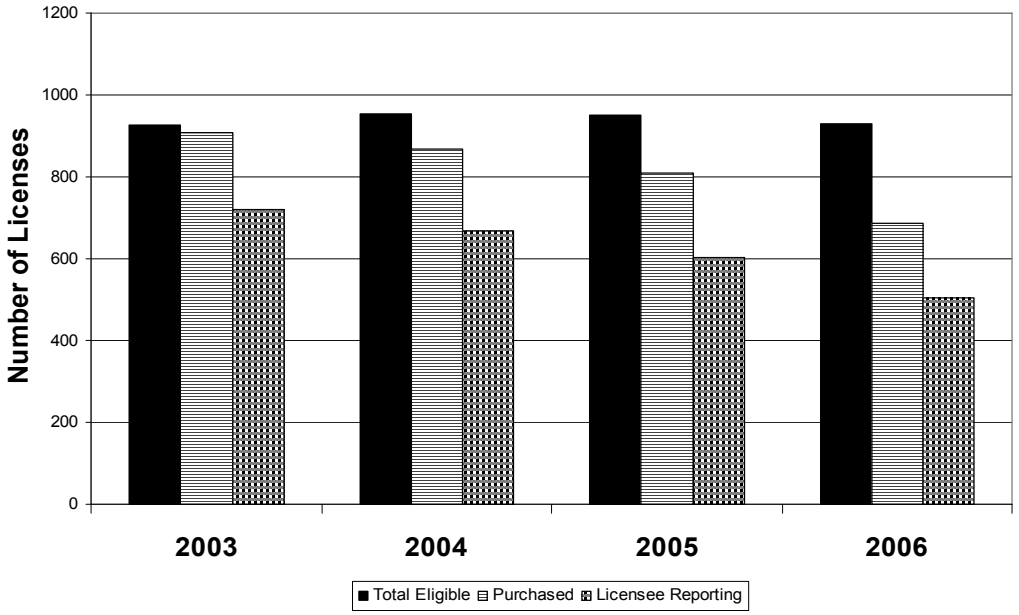


Figure 12. Comparison of activity levels for licensees eligible for a peeler pot license, 2003 - 2006. Activity (denoted as licensee reporting) means at least 1 pound reported.



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.

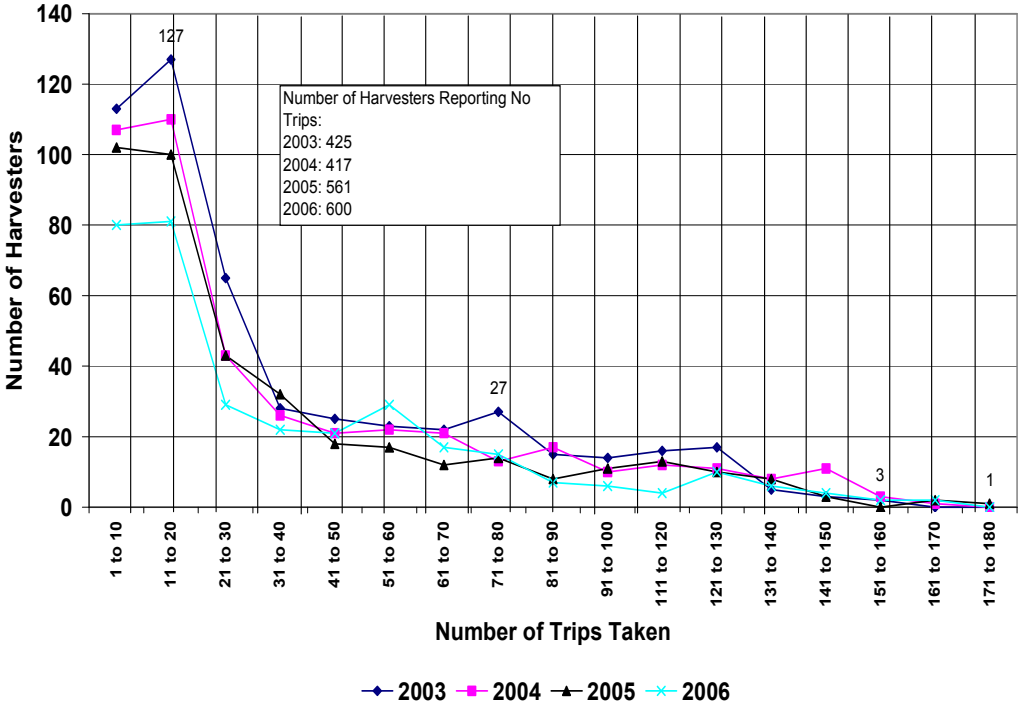
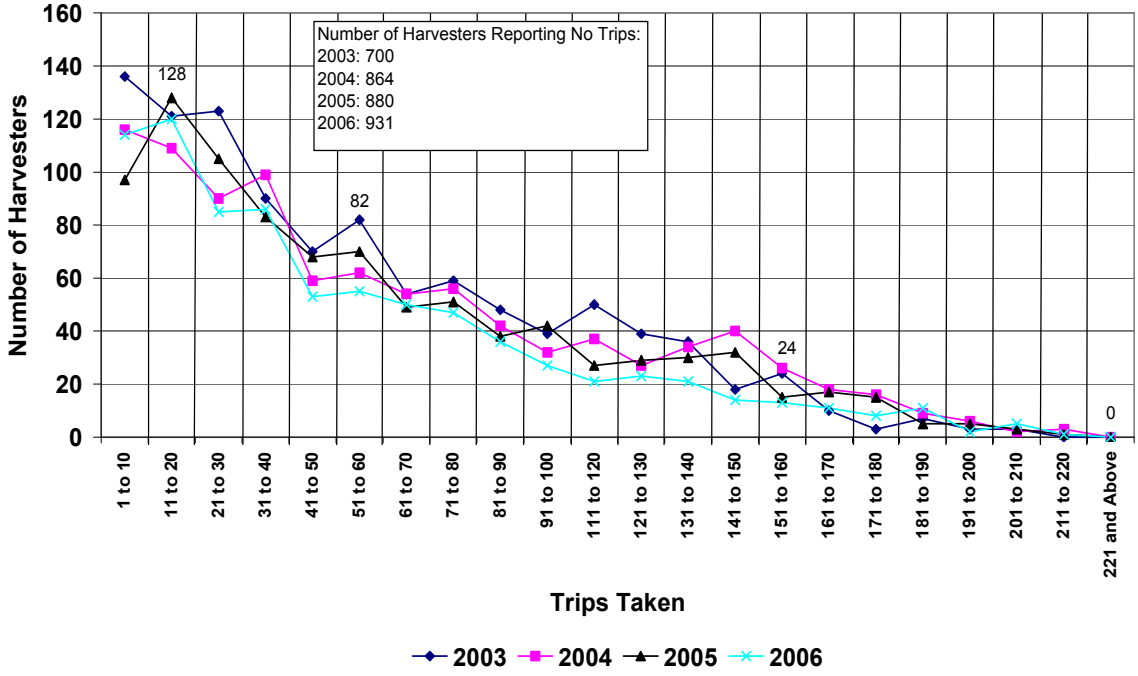


Figure 14. Number of crab pot harvesters, according to number crab harvest trips (in categories), 2003 - 2006.



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.

<u>Recommendation:</u> 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 I: 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 ~~Commissioner Bowman~~ Steve:

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 II

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 III: Virginia's 22-Point Blue Crab Management Plan

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

1. Expanded the spawning sanctuary (146 sq. mi.) established in 1942 by 75 sq. mi., with no crab harvest allowed from June 1 through September 15
2. Established a 14,500-acre winter-dredge sanctuary in Hampton Roads
3. Shortened the crab pot season to April 1 through November 30. In 2007 the season opening date was established as March 17.
4. Required two cull (escape) rings in each commercial and recreational crab pot
5. Required four cull rings in each peeler pound that allows escapement of small peeler crabs
6. Capped the number of peeler pots per license to prevent expansion of the fishery
7. Limited the crab dredge size to 8 feet

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

1. Prohibited the possession of dark-colored (brown through black) sponge crabs, with a 10-sponge crab
2. Limited license sales of hard crab licenses, based on previous eligibility or exemption requirements
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.)
4. Established a 3 1/2-inch minimum possession size limit for all soft shell crabs

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

1. Lowered the maximum limit on peeler pots from 400 to 300 pots in 2000
2. Initiated a moratorium on additional commercial licenses for all commercial crabbing gear (This moratorium became effective May 26, 1999 and will continue until the end of the 2010 season.)
3. Established (in 2000) a Virginia Bay-wide Blue Crab Spawning Sanctuary, in effect June 1 through September 15. This additional sanctuary of 435 square miles increased the sanctuary to 656 square miles.

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

1. Enacted an 8-hour workday for commercial crabbers (2002) that replaced Wednesday closures of 2001
2. Established a 3-inch minimum size limit for peeler crabs in 2002
3. Reduced the winter dredge fishery limit from 20 to 17 barrels in 2001

4. Augmented (2002) the Virginia Blue Crab Sanctuary by 272 square miles (The spawning sanctuary extends 928 square miles.)
5. Reduced unlicensed recreational harvester limits to 1 bushel hard crabs, 2 dozen peelers (2002)
6. Reduced licensed recreational harvester limits to 1 bushel of hard crabs and 2 dozen peelers, with a vessel limit equal to number of crabbers on board multiplied by personal limits (2001)

Limited evidence that sponge crab mortality was offsetting any gains in spawning potential expected from the prohibition on the possession of dark-colored (late-stage) sponge crabs resulted in the Commission enacting the following management measures in 2007:

1. Possession of dark-colored (brown through black) sponge crabs is lawful starting July 16
2. To compensate for any loss in spawning potential resultant from a change to the sponge crab prohibition, an industry-backed extension of the spawning sanctuary extends out to the Three Nautical Mile Limit Line, from the mouth of the Chesapeake Bay southward along the Virginia Beach coast to the Virginia-North Carolina line, was adopted. This extension added 94 square miles to the sanctuary.

ATTACHMENT IV: Description of Fields (Mandatory Reporting Database)

1. Batch = Batch number assigned to data when it is loaded or entered
2. Date_Input = Date the data is entered
3. Initials = Initials of data entry clerk
4. VMRCID = Commercial harvester (Commercial Registration and Aquaculture license unique identification—8 characters (2007)
5. Buyer_Name = Reported buyer of harvest
7. Buyer_Code = Numberical code for buyer name
8. Year_Fished = Year harvest
9. Month_Fished = Month harvest
10. Day_Fished = Day harvest
11. Harvdate = Total harvest date
12. Hrs_fished = Hours gear fished
13. Gear_Amnt = Amount of gear fished
14. Gear_Abbr = Alpha gear abbreviations
15. Gear = NMFS three digit numerical gear code
16. Water_abbr = Alpha water abbreviation
17. Water = Water numberical code
18. Disp_Code = Disposition code of harvest
19. Landing = Name of county landed harvest
20. County = Numerical county code
21. Port = Port harvested landed
22. Spec_Abbr = Species alpha abbreviation
23. Species = NMFS numerical species code
24. Live_Proc = Live or Processed (L or P)
25. Unit = Unit of measure of harvest (lbs, bu, etc…)
26. Amount = Number of harvest (100, 5, etc…)
27. Pounds = Total Pounds harvested (amount * unit)
28. Value = Value of harvest (unit * price/unit)
29. Unitprice = Unit price
30. Userprice = (True or False – logic)
31. Permit = Indicates if harvester has a permit for species
32. Audit_Stat = Check on data when loaded if there is a problem (i.e. P = Passed audit check)
33. CRL = Indicates if harvester has a valid Commercial Registration License
34. GRL = Indicates if harvester has a valid gear license
35. Source = Indicates source of data and whether record has been sent to NMFS (V = Mandatory reporting not sent to NMFS yet)
36. Info = Memo field for miscellaneous information
37. Gear_Length = total gear length on specific gear (i.e. 14 feet (2-7ft) crab dredges)
38. Crew_Size = Number of people working on the boat including captain
39. Wtrman_hrs = Number of hours harvester out on water
40. Form_num = Document Form number (tracking number link to scan document)
41. Helper = All last 4's of CRL holders on boat with captain

42. SpecialTag = Number of Striped bass tags per harvest
43. Vssl_Name = Harvester Vessel Name
44. Vssl_Num = Harvester Vessel number
45. ACCSP_trip = Tracking number when harvest is sent to ACCSP database
46. Billing = Billing aquaculture number
47. Lease = Lease aquaculture number
48. Oys_Abbr = Oyster Rock Abbreviation

Fields highlighted in Yellow have been in existence for the following years: 1993–Present
Fields highlighted in Peach have been in existence for the following years: 2001–Present
Fields highlighted in Green have been in existence for the following years: 2007
Fields highlighted in Blue have been modified for the following years: 2007

ATTACHMENT IV (continued)

<u>Manadatory Reporting Fields Entered by Data Entry Company:</u>
<u>Description of a Row of Data (28 fields);</u>

DATE OF INPUT	C.10 (mm/dd/yyyy)
LAST 4 DIGITS OF THE COMMERCIAL REGISTRATION NUMBER	C.4
NAME OF THE BUYER	C.25
DESCRIPTION OF THE CITY OR COUNTY LANDED	C.20
MONTH	N.2
DAY	N.2
WATER FISHED **ABBREVIATION**	C.5
GEAR **ABBREVIATION**	C.5
SPECIES **ABBREVIATION**	C.10
AMOUNT (WEIGHT)	N.8
UNIT **ABBREVIATION**	C.5
PRICE (LEAVE BLANK)	N.7,2 (decimal place)
LIVE – PROC (L OR P FOR LIVE OR PROCESSED)	C.1
HOURS FISHED	N.3
AMOUNT OF GEAR	N.4
FIRST ADDITIONAL INFO	C.100 (memo)
INITIALS OF THE DATA ENTRY PERSON	C.2
FORM NUMBER (also referenced as tracking number)	N.8
LENGTH OF GEAR	N. 8,2 (decimal place)
CREW SIZE	N.2
WATERMAN HOURS FISHED	N.3
HELPER INFO (multiple last4s must be in last4 order)	C.100
SECOND ADDITIONAL INFO (SPECIAL TAG INFORMATION)	C.100 (memo)
VESSEL NAME	C.30
VESSEL NUMBER	C.15
*BILLING NUMBER	N.8
*LEASE NUMBER	N.8
*ROCK ABBREVIATION	C.5

All fields should be treated as text with lengths as defined above, e.g., “V1,” “V2,”, “V3,”……, “V28.” Data may also be treated as a combination of character and numeric data as long as lengths and format indicated above are used.