2015 Maryland FMP Report (June 2016)
Section 10. Maryland Coastal Bays Blue Crab (*Callinectes sapidus)*

Maryland's Coastal Bays and Chesapeake blue crab fisheries are managed separately under two different fishery management plans (FMPs). The Coastal Bays Blue Crab Fishery Management Plan (Coastal BCFMP) recognizes that Maryland's Atlantic Coastal Bays comprise a separate, unique ecosystem from the Chesapeake Bay. The plan identifies management measures to conserve the coastal blue crab stock while protecting its ecological and socio-economic value. The Coastal BCFMP was developed in 2001 and was determined to be an appropriate framework for managing the resource during the last plan review in 2010.

The development of the 2001 Coastal BCFMP was triggered by the Comprehensive and Conservation Management Plan (CCMP) adopted for Maryland's Coastal Bays in 1999. The CCMP recommended that the Maryland Department of Natural Resources address fishery issues specific to Maryland's Coastal Bays. To view the entire CCMP, please visit the Maryland Coastal Bays National Estuary Program website at http://www.mdcoastalbays.org. The CCMP is reviewed and updated on a regular basis. A comprehensive review of the CCMP was completed during 2013 and resulted in updated goals, objectives and actions. The plan was revised as, the 2015-2025 Maryland Coastal Bays Comprehensive Conservation and Management Plan. The revised plan addresses water quality and environmental health of the estuaries around Ocean City and Assateague Island. The CCMP includes 4 additional plans, 15 goals, 33 challenges and 222 actions.

Stock Status

There is no area specific stock assessment for blue crabs in the Coastal Bays. The Coastal Bays Fisheries Investigation (CBFI) program samples blue crabs as part of their trawl and seine surveys. Catch-per-unit-effort (CPUE) calculated from both the seine and trawl surveys indicate that the relative abundance of blue crabs has varied over time without any trends (Figures 1 & 2). Additional fishery independent data collected by the CBFI trawl survey indicate that the mean size of blue crabs in the Coastal Bays has slightly increased. The fishery independent indices, the relative stability of the commercial harvest, and a slight increase in mean size indicate a stable population.

Recruitment of juveniles into the Coastal Bays is largely driven by environmental and hydrologic elements of the Atlantic Ocean waters. Although there is evidence that some internal recruitment is occurring, it is hypothesized that the majority of juveniles that take up residence in Maryland's Coastal Bays are transported by ocean currents from the mouth of the Chesapeake and Delaware Bays. Recent climate change analysis indicates that oceanic currents are influenced by the total amount of carbon dioxide in the atmosphere (greenhouse effect) and the rate of carbon dioxide increase. The complex factors that drive circulation patterns are non-linear. As a result, circulation patterns could change much faster than previously indicated. Consequently, changes in climate patterns could effect blue crab larval recruitment into the Coastal Bays.

Fishery Statistics

Maryland's Coastal Bays support both a commercial and recreational blue crab fishery. The 2015 commercial harvest of hard, soft and peeler crabs from the Coastal Bays was 1.7 million pounds, an increase from 2014 (Figure 1). Annual commercial harvest of blue crabs from the Coastal Bays has ranged from 0.54 to 2.4 million pounds with an average harvest of 1.3 million pounds. Crab pots accounted for 99.8% of the total commercial harvest in 2015. The recreational fishery is primarily a small boat fishery due to limited public shoreline/pier/bulkhead access. Recreational harvest of blue crabs in the Coastal Bays is undocumented. Estimates of recreational harvest from the Chesapeake Bay are believed to be between 8 and 11% of the commercial harvest. Whether or not this estimate is applicable to the Coastal Bays is unknown.

Maryland DNR began implementing an electronic method of reporting blue crab harvest in the Chesapeake Bay in 2012. Providing timely and verifiable harvest data on a daily basis is the first step towards improving the blue crab management system. Watermen from the Coastal Bays have also been participating in the voluntary program.

Management Measures

DNR manages the Coastal Bays commercial blue crab fishery through daily catch limits (25 bushels/boat/day), seasons (closed between Nov 1 & Mar 31), gear restrictions (no scrapes or dredges), size limits [minimum 5" for hard crabs, 3 ½" for soft crabs and time period size differences for peeler crabs (3¼" prior to July 15th and 3½" after July 15th], limited entry, and other management strategies as necessary to control fishing effort. DNR manages the recreational blue crab fishery in the Coastal Bays through daily catch limits (1 bushel/person/day and no more than 2 bushels/boat/day), gear restrictions (no more than 600 ft of trotline/person or two 600 ft. trotlines/boat; 10 collapsible traps or crab net rings/person or 25 traps or rings/boat), and minimum size limits. The taking of sponge crabs is prohibited and there is no minimum size limit on mature female crabs. No license is required. Waterfront property owners can use two crab pots off their dock/pier. The pots must be marked with the owner's name and address or DNR identification number and must have 2 cull rings with required dimensions located in the exterior side panel or on the top panel of the pot. Landowners that use crab pots off their docks must also have a turtle excluder device attached to each entrance or funnel in the lower

chamber constructed of wire or plastic, rectangular in shape and not larger than 1 ¾ inch high by 4 ¾ inch long. The excluder device is required to keep terrapins from drowning in pots. Special regulations are in place for crabbing in Worcester County and may change annually (see COMAR for a complete list of restrictions).

Concerns/Issues

A parasitic dinoflagellate, *Hematodinium* sp., can cause mortality in blue crabs from the Coastal Bays. Studies conducted in 2005 and 2006 indicated that the number of infected crabs followed a seasonal pattern increasing from late summer through December. Results indicated that salinity and water temperature are vital components for the proliferation of the parasite and associated mortality. There is still much that is unknown about *Hematodinium* sp. and its effects on the blue crab population in the Coastal Bays. The Virginia Institute of Marine Science (VIMS) and University of Maryland Eastern Shore (UMES) are currently studying the effects of *Hematodinium* on blue crabs.
http://www.vims.edu/research/departments/eaah/programs/crustacean/research/hematodinium/eid_project/index.php

Viruses of all types have been documented in blue crabs and it is likely that diseases can impact population dynamics. Recent advances in molecular and biotechnological tools have been utilized to assess the prevalence and intensity of diseases. More research is needed to quantify diseases effects on abundance of crabs in the Chesapeake Bay and Coastal Bays.

Figure 1. Maryland blue crab seine CPUE from the Coastal Bays Bay Fisheries Investigations, 1989-2015.

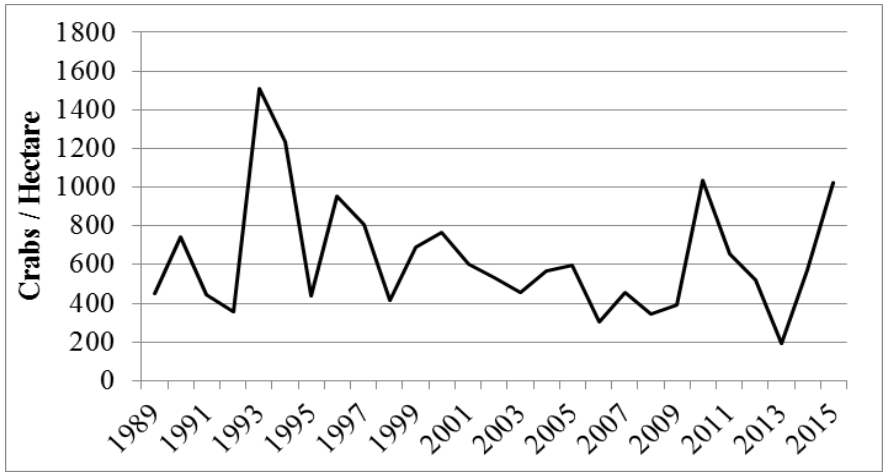


Figure 2. Maryland blue crab trawl CPUE from the Coastal Bays Fisheries Investigation, 1989-2015.

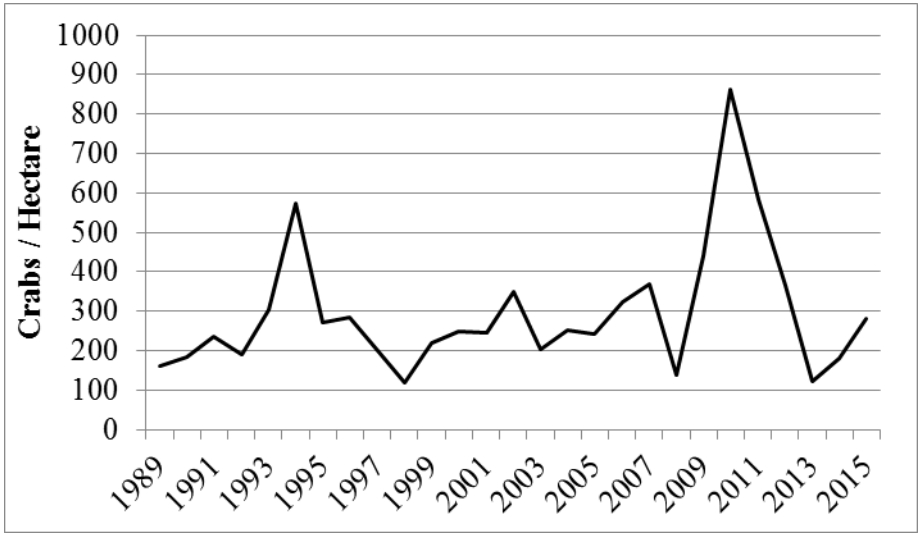
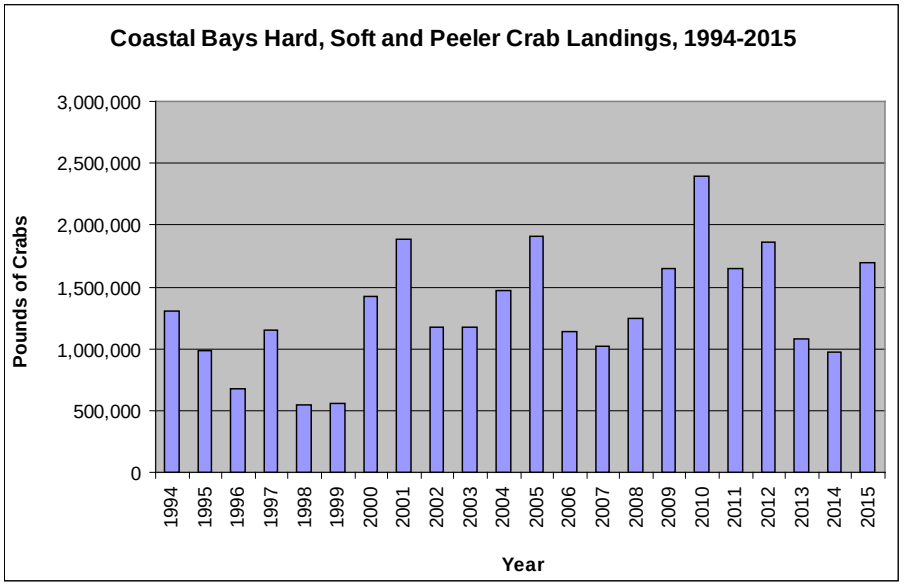


Figure 1. Total Maryland Coastal Bays Blue Crab commercial harvest in pounds, 1994-2015 (MD DNR data).



2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (updated 6/16)		
Objective/Problem	**Action**	**Implementation**
Obj. 1. Improve our understanding of how *Hematodinium* contributes to the mortality and population abundance of blue crabs. Prob. 1.1: Research and Monitoring.	**1.4.1** DNR and MCBP will identify potential funding sources to support the following research and monitoring activities: a) Assess the impact of *Hematodinium* in the coastal bays blue crab population (i.e. identify what intensity of *Hematodinium* infection causes mortality, and identify other factors, environmental and/or biological, that may influence blue crab mortality from *Hematodinium*). b) Identify factors which influence *Hematodinium* proliferation, elucidating different life stages, determining the full life cycle of the parasite, and eventual production of a more specific diagnostic tool either by immunoassay or molecular assay techniques. c) Examine how crabs become infected with *Hematodinium*.	Research includes monitoring prevalence in MD coastal bays. Research is ongoing with the NOAA Oxford Cooperative. University of MD Eastern Shore, and VIMS. A 2010/2011 University of MD project found the presence of *Hematodinium* sp. in 9% of the water & sediment samples. Viruses of all types have been documented in blue crabs & likely impact population dynamics. VIMS is currently conducting a disease study on crabs from the Eastern Shore of Virginia.
	1.4.2 DNR will define the criteria under which a Marine Protected Area can be effective in assessing the impacts of *Hematodinium* on blue crabs	The Coastal Bays Fisheries Advisory Committee discussed MPAs in the past, without any specific outcome. This committee was disbanded and fishery issues are now discussed through the Maryland Coastal Bays Program http://www.mdcoastalbays.org/
Obj. 2. Improve our understanding of blue crab biology and stocks. Prob. 2.1: Stock Status	**Action 2.1.1:** Adopt an overfishing threshold consistent with Chesapeake Bay that preserves a minimum of 10 percent of the blue crab's spawning potential (F_{10} percent), and a fishing target that preserves 20 percent of an unfished stock. (F_{20} percent).	No targets and thresholds have been determined for Coastal Bays blue crabs. **Reported landings of hard, soft and peeler crabs from the Coastal Bays was 1.7 million lbs. (2015). Average landings have been approximately 1.3 million lbs.**
	2.1.2:DNR will work towards implementing the necessary research and monitoring programs to determine the appropriate fishing mortality rates that will achieve the established fishing target of F_{20} percent. (Chesapeake Bay mortality rates (fishing and natural) are not necessarily transferable to Maryland's coastal bays.)	There is no direct blue crab monitoring in the Coastal Bays but data is collected through the Coastal Bays fishery independent trawl and seine survey. Research

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		needs have not been defined.
	2.1.3: DNR will work towards allocating funds specific to the Department's coastal bays blue crab monitoring program and data analysis.	No specific funds are designated for blue crab monitoring in the Coastal Bays but data is collected through an ongoing fisheries monitoring program.
	2.1.4: DNR and MCBP will encourage research that examines the stock - recruitment relationship of blue crabs in the coastal bays, level of localized reproduction and entrapment of larvae, and effects of environmental parameters which influence fluctuations in crab abundance (i.e. including this action in the FMP will identify these research needs as a high priority which will better enable DNR, MCBP, Universities and others to obtain support for funding these research projects).	No research completed.
	2.1.5: DNR will examine the utility of developing a public outreach indicator(s) of blue crab abundance that can be used to inform the community on the annual status of blue crab stocks in the coastal bays.	Dependent on all the actions specified in Objective 2.
Prob 2.2: Commercial Catch and Effort Data.	**2.2.1:** DNR will establish, implement and evaluate a commercial reporting monitoring program to obtain accurate catch and effort data from anyone crabbing commercially in Worcester County consistent with recommendations of the Atlantic Coast Cooperative Statistics Program. a) Evaluate the effectiveness of the A pilot@ daily logbook reporting system implemented in 2000 for commercial crab harvesters and dealers in Worcester Co b) Consider using the Chesapeake Bay's commercial crab reporting system, but make it specific to the coastal bays, including more detailed information on location of harvest and effort data.	As a result of the pilot project, blue crab reporting went from a monthly summary to a daily logbook. The daily logbook program was expanded to the entire state in 2001. A pilot study was conducted in the Chesapeake Bay during 2012 to evaluate the use of an electronic reporting system to improve the timely reporting of catch statistics. **A few crab harvesters from the Coastal Bays participated in the study during 2015.**
	2.2.2: DNR will improve the enforcement of mandatory monthly reporting	New penalties are now in effect which create a more effective system for commercial fishing licensees who are late or don't turn in their fishing reports. The new penalty system should improve reporting.

2001 Coastal Bays Blue Crab Fishery Management Plan Implementation (updated 6/16)		
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Prob. 2.3: Recreational Catch and Effort Data. .	**2.3.1:** DNR will design and implement a recreational crabbing survey in the coastal bays consistent with the pilot recreational crabbing survey in Chesapeake Bay.	A project to determine the design of a survey was completed. Implementation has been limited due to lack of funding. A Maryland Volunteer Angler Survey started in 2008 and was expanded in 2009. It includes blue crabs but there has been limited response.
	2.3.2: DNR will identify potential funding mechanisms to fund and complement monitoring efforts outlined in Strategies 2.3.1 and 2.1.1.	No funding has been identified.
Prob. 2.4: Invasive, Non-indigenous Species	**2.4.1:** DNR will continue to monitor the abundance and impact of green crabs and other invasive, non-indigenous crab species.	Ongoing but limited due to lack of funding. In eastern North America, green crabs have been shown to significantly reduce populations of shellfish including soft shell clams, scallops and hard clams.
	2.4.2: DNR will evaluate the following management strategies related to green crabs: a) DNR will prohibit the possession and sale of imported green crabs, and promote the harvest and sale of locally harvested green crabs. b) DNR will prohibit the importation and sale of green crabs.	Green crabs have not been prohibited as bait. They are prohibited from being transported (COMAR 08.02.19.04)
	2.4.3: DNR will continue to work with Maryland's Non-Indigenous Species Task Force to examine invasive species issues, and develop an Aquatic Nuisance Species Plan to become eligible for Federal funding	An Aquatic Nuisance Species Task Force developed a management plan for green crabs for the entire U.S. in 2002. **A draft Maryland Aquatic Nuisance Species Management Plan was released for public review in December 2015. The European green crab was identified as a high priority species.**
	2.4.4: MCBP will develop an outreach program (i.e. brochures) to educate the coastal bays community on the impacts of exotic species.	Impacts of exotic or non-native species were included in Shifting Sands (2009), a book about the Coastal Bays.
Prob. 2.5: Functional	**2.5.1:** DNR will examine methods/studies to better understand the natural ecological	No studies have been conducted on

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Role of Blue Crabs in the Natural Ecological Community.	functions of blue crabs in the coastal bays, including the establishment of a Marine Protected Area in the coastal bays.	marine protected areas.
Obj.3. Maintain an economically stable and sustainable commercial blue crab fishery.	**3.1.1:** DNR will improve the accuracy of effort data in the coastal bays' commercial blue crab fishery by implementing actions related to Problem 2.2 - Commercial Reporting.	See comments Action 2.2.1 and Action 2.2.2.
	3.1.2: DNR will continue to manage the coastal bays commercial blue crab fishery through the use of time limits, seasons, gear restrictions, catch limits, size limits, limited entry, and other management strategies as necessary, to prevent further increases in fishing effort. a) **Gear Restrictions** - Prohibit the taking of blue crabs in the coastal bays by scrape and dredge to prevent these fisheries from developing, and lessen the gear impacts on blue crab habitat; b) **Time Restrictions** - Establish similar time restrictions to those in the Chesapeake Bay to prevent a shift in crabbing effort from the Chesapeake Bay to the coastal bays during years when crab abundance is low in the Chesapeake Bay. 1) For 2001 - Prohibit the taking of crabs for commercial purposes between 2:00 p.m. and 5:30 a.m.	Completed. Prohibition of scrapes & dredges has been enacted. (COMAR.08.02.03.06E) Time restrictions have been enacted. (COMAR.08.02.03.06D2) Closed season enacted: November 1 to April 1. (COMAR 08.02.03.06C)
Prob. 3.2: Harvest of Female Crabs,	**3.2.1:** DNR will continue to prohibit the harvest of sponge crabs, and limit the taking of female crabs in the coastal bays through the use of time limits, seasons, area closures, gear restrictions, catch limits, and size limits, as necessary. a) **Area Closures** - DNR will delineate areas where female blue crabs are concentrated (Action 5.2.1(a)), and determine the appropriate time periods for which commercial crabbing and hydraulic clam dredging should be allowed within these areas. The following areas have been identified as potential closure areas but need to be delineated further: 1) The Convention Hall site, bayside of Ocean City roughly between 36th and 50th Street; and 2) The Therefore site, in southern Isle of Wight Bay; 3) The Bridge site, just north of the Verrazano Bridge on the barrier island side. b) **Catch and Size Limits** - Determine if the current catch and size limits for female crabs are appropriate.	Ongoing.
	3.2.2: DNR will investigate the economic impact of prohibiting the possession and sale of sponge crabs within the state.	Completed. (Lipton and Sullivan 2002).
Prob. 3.3: Wasteful Harvest Practices.	**3.3.1** DNR will require unobstructed cull rings in crab pots from June 1 through April 30, and will adjust cull ring requirements based upon further research (peeler pot cull ring study being planned on Chesapeake Bay).	Ongoing

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	3.3.2: DNR will determine if measures are necessary to reduce the bycatch mortality of crabs in the hydraulic clam dredge fishery (i.e. Action 3.2.1(a) - prohibition of hydraulic clam dredging in areas where female crabs are concentrated).	Hydraulic Clam Dredging is currently prohibited in Maryland's Coastal Bays, 2007. Natural Resource Article § 4-1002
	3.3.3: DNR will continue to require terrapin excluders in crab pots set for noncommercial purposes, encourage watermen to install terrapin excluders in commercial crab pots, and investigate the feasibility (i.e. effects on catch; economic impact) of requiring terrapin excluders in all crab pots set in the coastal bays.	Ongoing. (Lukacovic et al. 2005)
	3.3.4: MCBP will coordinate an annual/seasonal volunteer effort to locate and remove derelict pots.	Ongoing.
Obj. 4. Improve the recreational crabbing experience. Prob. 4.1: Satisfaction of Recreational Crabbers.	**4.1.1:** DNR and MCBP will obtain information on satisfaction levels of recreational crabbers in the coastal bays to evaluate the effectiveness of management measures.	No recreational crabbing surveys have been completed.
	4.1.2: DNR will examine the effects of habitat quality on the success rates of recreational crabbing in the coastal bays.	No studies have been conducted.
	4.1.3: DNR and MCBP will develop and distribute the following information pertaining to the recreational crab fishery in the coastal bays: a) Recreational crabbing brochure summarizing crabbing restrictions; b) Recreational crabbing sign for access points (i.e. boat ramps and fishing/crabbing piers); c) Maps of land-based public access and boat based crabbing locations, list of boat ramps and marinas with rental boats, and recreational crabbing tips.	Ongoing.
	4.1.4: DNR, MCBP, Town of Ocean City and Worcester County will work towards increasing the number of land-accessible areas for recreational crabbing.	Ongoing.
Obj. 5. Protect, maintain and enhance blue crab habitat. Prob. 5.1: Submerged Aquatic Vegetation (SAV).	**5.1.1:** DNR will alleviate the impact of hydraulic clam dredging and prop scarring to SAV in the coastal bays by: a) Prohibit hydraulic clam dredging in SAV; b) Annually documenting the areas and extent of impact; c) Researching seagrass recovery time; d) Investigating the use of buoys to mark beds, SAV setbacks, depth restrictions, GPS equipment to identify boundaries, and education as tools to protect beds from damage; and e) Implementing and enforcing necessary regulations to protect SAV from hydraulic clam dredging.	Hydraulic Clam Dredging is currently prohibited in Maryland's Coastal Bays, 2007. Natural Resource Article § 4-1002
	5.1.2: By implementing Action 3.1.2, DNR will prohibit the taking of blue crabs in the	Completed.

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	coastal bays by scrape and dredge to prevent these fisheries from developing and impacting SAV.	
	5.1.3: DNR and MCBP will continue to identify SAV species needing protection and activities needing restrictions.	Ongoing.
	5.1.4: MCBP will expand surveys/citizens monitoring to ground truth SAV species composition and determine accuracy of photo interpretive maps.	Most recent survey results indicate that SAVs continued to decrease in all areas of the Coastal Bays during 2014. At the time of this update, maps from VIMS surveys were not available for 2015. SAV beds in Maryland's Coastal Bays appear to be an important area of primary habitat for fish.
	5.1.5: DNR and Natural Resources Conservation Service (NRCS) will develop habitat requirements for the growth of seagrasses in the coastal bays by: a) DNR will develop water quality requirements for seagrasses; b) DNR will identify areas that meet water quality requirements for restoration purposes; c) NRCS will compile data relating coastal bay soil types to bottom communities and identify other variables having effects on seagrass establishment and maintenance; and d) NRCS will complete soil mapping effort for entire coastal bays	a) Completed (Maryland Department of Natural Resources 2004). b) Ongoing. c) Completed by MGS & DNR. d) Not yet initiated.
Prob. 5.2: Overwintering Habitat.	**5.2.1:** DNR will identify and protect blue crab overwintering areas in the coastal bays by: a) Delineating and mapping overwintering areas; and b) Prohibiting hydraulic clam dredging in important overwintering areas year-round, unless data indicates that these areas can be opened on a seasonal basis (see Action 3.2.1(a)). c) DNR will define the criteria under which a Marine Protected Area can be effective in protecting blue crab overwintering areas.	No mapping has occurred for blue crabs. Hydraulic clam dredging is prohibited (2007). No steps have been taken to define marine protected areas.
Prob. 5.3: Shallow Water and Shoreline Habitats.	**5.3.1:** DNR will support actions in the CCMP, specifically "Challenge 1.9 of the Fish and Wildlife Section" to protect and enhance shallow water and shoreline habitats important to blue crabs. DNR and Worcester County are the lead agencies for the majority of these actions. Refer to the CCMP for more specific information on these actions.	Ongoing. **The CCMP was revised in 2015.**
Prob. 5.4: Dissolved Oxygen.	**5.4.1:** DNR will support actions in the CCMP, specifically in the "Water Quality" section and "Fish and Wildlife" section to minimize the impacts of unsuitable dissolved oxygen levels to blue crabs in the coastal bays. Maryland's Coastal Bays Program, Town of Ocean City, and Worcester County are the lead agencies for the majority of these actions. Refer to the CCMP for more specific information on these actions.	Ongoing. (Maryland Department of Natural Resources 2004).The CCMP went through a thorough review and strategies and actions were updated during 2013**. It resulted in an updated CCMP**

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		(2015).
	5.4.2: DNR will identify areas which have unsuitable levels of dissolved oxygen (i.e. < 3 mg/L) for blue crabs.	Ongoing. (Maryland Department of Natural Resources 2004).
Prob. 5.5: Nutrient, Sediment and Chemical Inputs.	**5.5.1:** DNR will support actions in the "Water Quality" section of the CCMP to control nutrient, sediment and chemical inputs which will protect and enhance blue crab habitats. Worcester County and Maryland's Coastal Bays Program are the lead agencies for the majority of these actions. Refer to the CCMP for more specific information on these actions.	Ongoing. (Maryland Department of Natural Resources 2004).
Obj. 6. Improve enforcement of crabbing restrictions. Prob. 6.1: Enforcement of Conservation Measures.	**6.1.1:** DNR will consider increasing the number of enforcement personnel in the coastal bays, specifically during the crabbing season.	NRP hires seasonal staff to increase patrols during summer months. Penalties for violating regulations and enforcement procedures have been enhanced over the past several years.
	6.1.2: DNR will consider expanding the Natural Resource Police reserve officer program.	The reserve officer program is composed of volunteers committed to performing non-law enforcement duties that would otherwise be performed by commissioned police officers.

Acronyms:
COMAR = Code of Maryland Regulations
DNR = Department of Natural Resources
MCBP = Maryland Coastal Bays Program
MPAs = Marine Protected Areas
NOAA = National Oceanographic and Atmospheric Administration
NRP = Natural Resources Police
SAV = Submerged Aquatic Vegetation
VIMS = Virginia Institute of Marine Science