

Section 12. Horseshoe Crab (*Limulus polyphemus*)

Chesapeake Bay FMP

The Chesapeake Bay and Atlantic Coast Horseshoe Crab Fishery Management Plan (CBFMP) was adopted in 1994. The CBFMP prohibits the harvest of horseshoe crabs during a specific season to protect loggerhead turtles and shorebirds that rely on horseshoe crabs and their eggs for food. The plan established a spawning stock census of horseshoe crabs, stricter harvest reporting standards, and a program to delineate important spawning areas.

ASMFC's Interstate Fishery Management Plan for Horseshoe Crab and Addendum I established state-by-state quotas on bait landings. The quotas were set at 25% below reference period landings. Addendum II allowed quota transfer between states. Addendum III further reduced commercial harvest of horseshoe crabs for bait in and around Delaware Bay. This action was taken because horseshoe crab eggs are a major dietary component for migratory shorebirds including the rufa red knot (*Calidris canutus*), whose population has decreased since the 1980s. Addendum IV placed a two-year harvest restriction (October 1, 2006 to September 30, 2008) on Delaware and New Jersey fisheries. Since a portion of Maryland and Virginia's horseshoe crabs landings originate from Delaware Bay, Maryland and Virginia (Federal waters only) were required to have a January 1 through June 7 harvest restriction during the same time period as Delaware and New Jersey. Addendum V extended harvest restrictions until October 31, 2010. Addendum VI was initiated in 2010 to develop management options prior to the expiration of Addendum V. Maryland is required to submit an annual compliance report to ASMFC.

Stock Status

Tag and release studies have demonstrated that a significant proportion of horseshoe crabs caught in coastal Maryland waters are from the Delaware Bay stock. Spawning survey results from Delaware Bay detected a significant increase in male spawning activity, but it did not detect any trend in female spawning activity. Available data indicate that the Delaware Bay stock is undergoing positive population growth. Juvenile and adult male horseshoe crab abundance has increased significantly since 1998. An increase in adult female abundance was detected by one of the five monitoring surveys. These demographic patterns match expected abundance trends for a recovering population. No biological reference points to determine overfishing and overfished conditions have been developed due to limited data. However, a relative biomass index and a relative fishing mortality index were developed for the 2009 stock assessment to estimate trends since 1998 (Figure 1). Relative biomass decreased during 1994 to 2001. By 2009, horseshoe crab relative biomass increased to 1991 levels. Relative fishing mortality peaked in 1998, but has since decreased to the 1991 level.

In 2009, the ASMFC Horseshoe Crab Technical Committee and Shorebird Technical Committee jointly developed a multi-species management framework for horseshoe crab harvest based on structured decision making and adaptive management paradigms. This multi-species management framework is unique because it links the demographics of each species by incorporating biological and habitat metrics. The multi-species management policy is primarily for harvest in Delaware Bay, but it relies on multi-state monitoring efforts.

Current Management Measures

Addendum IV (2006) to the ASMFC FMP established the current January 1 through June 7 harvest restriction in Maryland. Male horseshoe crabs may be harvested from May 1 to June 7. Maryland's 2009 harvest total was 165,344 crabs. The fishery start date for 2010 was delayed until July 13. Maryland's harvest quota has remained at 170,653 horseshoe crabs since 2004. Maryland horseshoe crab landings have varied between 200,000 and 700,000 crabs since 1998 (Figure 2).

The biomedical uses of horseshoe crabs have advanced eye research, surgical suture wound dressing development, detection of bacterial endotoxins in pharmaceuticals and cancer research. Currently, horseshoe crabs are bled to isolate *Limulus* Amebocyte Lysate which is used to screen injectable drugs, biologics, medical devices, and raw materials for the presence of endotoxins. Mortality is low during the bleeding process (Figure 3) but is estimated to be 15% when release mortality is included. Since 2004, crabs collected for the biomedical industry can also be used for the bait market as long as the crabs are counted towards the bait quota. Coast wide, biomedical harvest has increased from 343,126 crabs (292,760 were bled) in 2004 to 511,478 crabs (423,614 were bled) in 2008.

Issues/Concerns

Horseshoe crab spawning stock and egg production are being monitored for sufficient egg production to support migratory shorebird feeding (esp. red knot *Calidris canutus*). The coastal states need to continue developing and using the multi-species management framework that includes red knot population status to modify horseshoe crab harvest policy. Increased catch for the biomedical industry has caused increases in horseshoe crab mortality. Catch limits for the biomedical industry will need to be developed. Only limited funds are available to collect population data for the Delaware Bay stock which is necessary for developing a stock assessment.

The Fisheries

Figure 1. Horseshoe crab relative biomass (B/BMSY) and fishing mortality (F/FMSY) with 50% and 80% confidence intervals (CI) as estimated by the surplus production model.

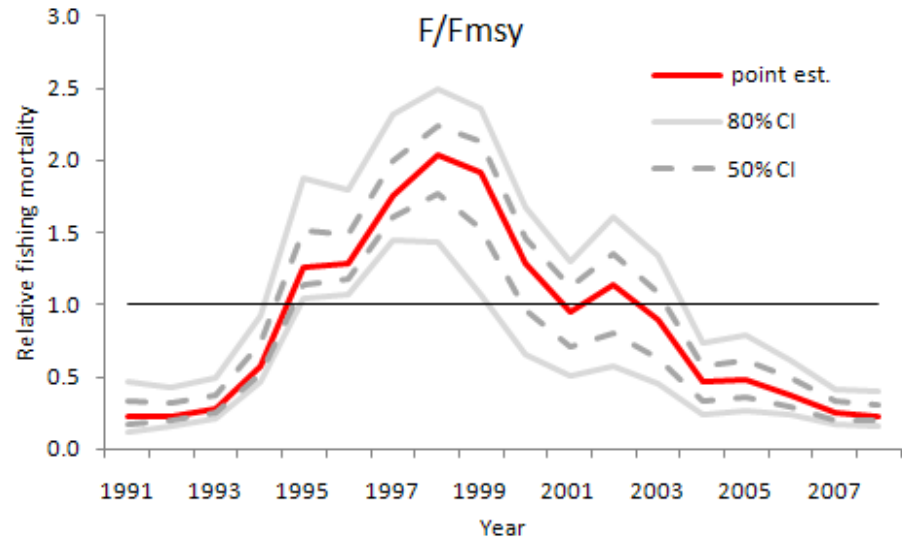
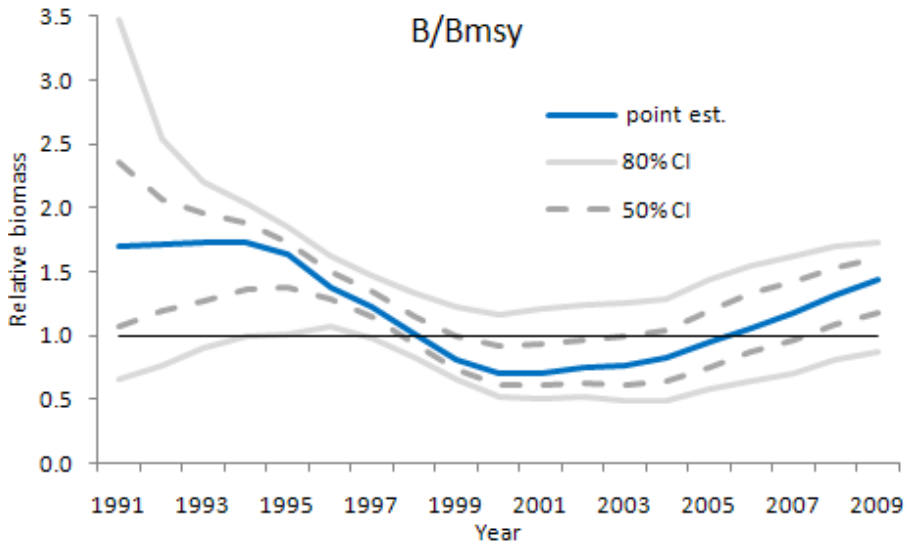


Figure 2. Commercial horseshoe crab landings in Maryland and Virginia since 1975.

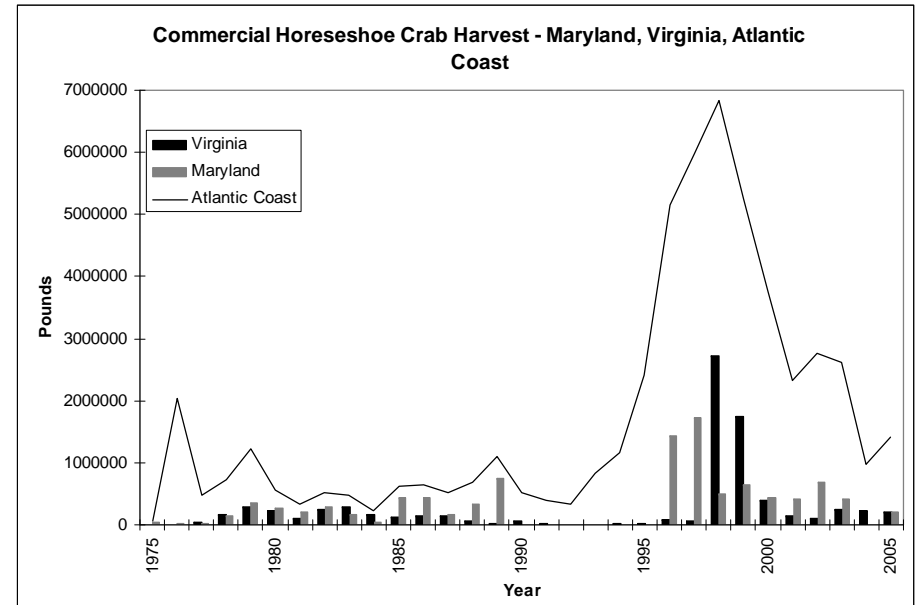
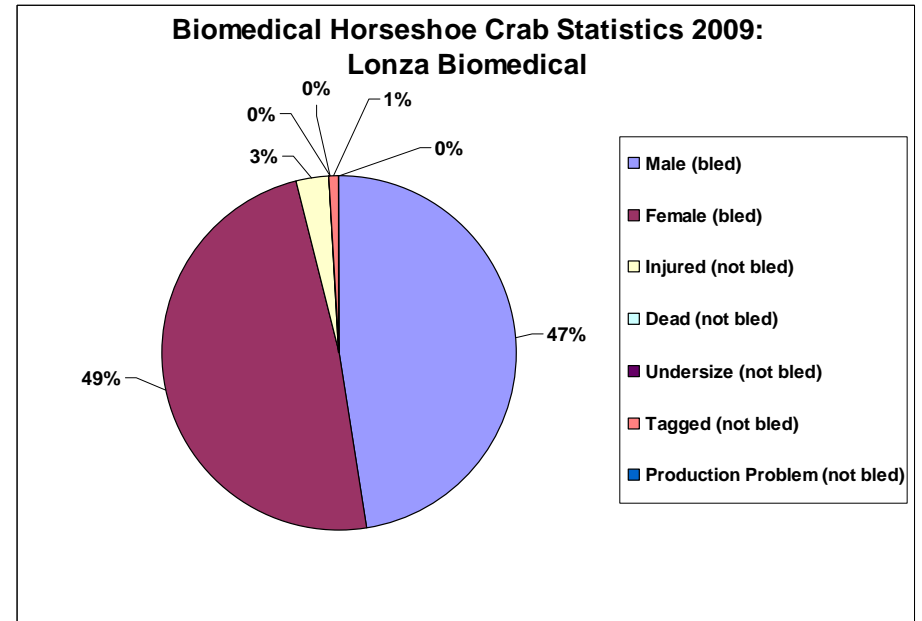


Figure 3. 2009 statistics for horseshoe crabs landed in Maryland for biomedical use.



1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab Management Plan Implementation Table (updated 5/10)			
Problem Area	Action	Date	Comments
Strategy 1.1 Maryland and Virginia will protect the ecological role of horseshoe crabs by protecting horseshoe crab spawning areas and monitoring harvest.	1.1 Maryland and Virginia will prohibit the hand collection of horseshoe crabs from beaches during the peak time of shorebird migration, May 1-June 7.	1995	MD (Action to prohibit hand collection of HSCs between May 1 and June 7 was changed based on MD spawning survey data. In January, 1996, MD adopted measures to restrict the hand collection of HSC between April 1 and June 30 to Monday and Thursday only.
		1998	Since the CBP Horseshoe Crab FMP was adopted in 1994, a coastal ASMFC was adopted in 1998.
		2009	The coastal commercial harvest during 2009 was below the allowable quota. The jurisdictions are in compliance with all of the ASMFC harvest restrictions for HSCs.
		Open	VA restricts hand collection unless a person has a \$16 HSC hand harvester license. 5 HSCs/person may be harvested for personal use without a license. VA prevents HSC harvest within 1000 ft of mean low water May 1 through June 7.
		2006	
	1.2a Maryland will prohibit the scraping, trawling or dredging of horseshoe crabs between May 1 and June 7 within the Chesapeake Bay, coastal bay areas, and 1 mile of the Atlantic Coast.	1995	The time period recommended to prohibit the scraping, trawling, and dredging of HSCs with the Chesapeake Bay, coastal bay areas, and within 1 mile of the Atlantic coast was changed from May 1 and June 7 to April 1 and June 30 based upon MD spawning survey data.
	1.2b Virginia will continue its ban on trawling within state waters.	1995	Virginia prohibits the use of trawls in Virginia's portion of the Territorial Sea.
	1.3 Virginia will prohibit a directed horseshoe crab fishery between May 1 and June 7, continue mandatory reporting in the conch dredge fishery and monitor bycatch of horseshoe crabs.	1995	An ASMFC HSC FMP was adopted in 1998 and since then additional harvest restrictions have been implemented. An amendment to the CBP FMP has been recommended.
Strategy 2.1 Maryland and Virginia will coordinate with Delaware and begin to develop a spawning stock census of horseshoe crabs which will serve as the basis for determining	2.1 Maryland and Virginia will coordinate and implement a horseshoe crab spawning stock census in Chesapeake Bay, coastal bays, and along the Atlantic coast.	1995	An annual spawning stock survey was initiated from 1994-2000 in MD. The Delaware spawning survey provides data on assessing the status of the spawning population.
		2002	Maryland Coastal Bays program began a volunteer spawning survey. In 2008, male:female ratio was approximately 4:1.
		Continue	Biomedical industry is collaborating with USFWS
		2008	Coast wide Tagging Program for HSC.

1994 Chesapeake Bay and Atlantic Coast Horseshoe Crab Management Plan Implementation Table (updated 5/10)

Problem Area	Action	Date	Comments
		<p>2008</p> <p>2008</p> <p>2009</p>	<p>bait fishery will be included in that states allowable harvest.</p> <p>Biomedical industry will make available all HSC that expire prior to live release to the bait fishery.</p> <p>Harvest closure was Dec 1 – March 31 and May 1 - June 7. Harvest was allowed >1 mile offshore during April 1 – 30 & June 8 - 30. Harvest was allowed from July 1 – Nov 30 in all MD tidal waters. HSC seasonal catch limits continue from 2005.</p> <p>Quota reduced by 1,464 HSC due to 2007 overage. Male:female landings were 1.5:1, within the 1:1 minimum requirement.</p> <p>No MD commercial landings were listed in the NMFS database. VA commercial landings were 132,024 lbs (NMFS).</p> <p>MD changed the HSC harvest ratio to 2:1 male:female ratio (issued by public notice)</p>
	3.1b Maryland will determine if a special permit to harvest horseshoe crabs is necessary after evaluating the new federal reporting system and the results of the monthly reports	1995 2001	MD requires a special HSC permit to land HSCs. ASMFC allows state to state transfer of quotas.
	3.2 Virginia will continue their mandatory reporting procedures implemented in January, 1993.	Continue 2000 2006	Implemented in January of 1993. VA has a commercial quota based on coastal reference period. ASMFC instituted a 25% reduction in horseshoe crab bait landings using 1995-1997 as the reference period. ASMFC Addendum IV changed the start of harvest closure from May 1 to January 1 through 2008. It also required that Virginia trawl harvest not exceed a certain percentage from a specified area and must maintain at a 2:1 male:female harvest ratio to protect the Delaware stock. Commercial quota is 152,495 HSCs. Quota can be transferred from other jurisdictions with a combined cap.
	3.3 Maryland and Virginia will survey American eel harvesters and their use of horseshoe crabs by sex for bait.	1995 2000	No longer an issue. Both eels and horseshoe crabs are managed through an ASMFC coastal FMP.
4.1.1 The jurisdictions	4.1 Maryland and Virginia will initiate a study to	Open	A HSC hotline and spawning beach survey was

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will define and protect horseshoe crab spawning areas that are used by migrating shorebirds.	delineate the geographic distribution of horseshoe crab spawning habitat in the Chesapeake Bay and coastal bays if funding is available.		developed in 1994 to delineate spawning habitat in Maryland. The survey is available through the DNR website. VA has also established a hotline.
	4.2 The jurisdictions will promote research to define the water quality requirements for horseshoe crabs.	Open	In addition to water quality, the coastal states support and Adaptive Resource Management Modeling (ARM) approach to managing HSCs. The modeling efforts take into consideration the ecological interaction between HSCs and shorebirds plus the economic and biological value of the commercial fishery and the biomedical uses of HSCs.
	4.3 The jurisdictions will continue to work with the Chesapeake Bay Program, the Coastal Bay Initiative, and water quality improvement goals for the Bay and coastal areas.	Continue	The Chesapeake 2000 agreement commits to improving habitat and water quality for living resources in the Bay.

Acronyms:

HSC = Horseshoe Crab

ASMFC= Atlantic States Marine Fisheries Commission

FMP= Fishery Management Plan

USFWS= US Fish and Wildlife Service

NMFS = National Marine Fisheries Service