

October 18, 2017

**End-of-Year Report for 2017**

*Limulus polyphemus*

Horseshoe Crab Monitoring & Tagging Activity in Raritan Bay & Sandy Hook Bay, Monmouth County, New Jersey, May & June 2017. Conducted by Volunteers with the Bayshore Regional Watershed Council.

Copy of report to:

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M.A.S.T (Marine Academy of Science and Technology)  
Monmouth University  
National Park Service/Gateway National Recreation Area  
NJDEP/Fish & Wildlife Division  
New York-New Jersey Baykeeper  
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The full HSC monitoring database is available for downloading from the Bayshore Regional Watershed Council's web site: <http://www.restoreraritanbay.org/horseshoe-crab-monitoring.html>

# Summary

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This is an end-of-year report for a study in 2017 to monitor Horseshoe Crab mating activities at five estuarine sites along Sandy Hook Bay & Raritan Bay in Monmouth County, New Jersey. The project began in 2009 and is ongoing. This report marks the ninth year of the study.

A Raritan Bay – Sandy Hook Bay, Monmouth County, New Jersey Horseshoe Crab spawning survey was implemented by volunteers with the Bayshore Regional Watershed Council, with cooperation from high school students with the Marine Academy of Science and Technology (M.A.S.T.), located at Sandy Hook, NRA. Volunteers with Monmouth County Parks & Bergen County Parks have also been on hand for many years. More than 50 volunteers in total are involved every year to implement this survey. By collaborating with efforts from the general public, the benefits of citizen-based conservation activities become clear: education and public involvement are key components to the most effective wildlife conservation programs.

## **OLD BUSINESS for 2017**

Volunteers with the Bayshore Regional Watershed Council at five (5) sites conducted monitoring and tagging activities during periods of high tide on dates that coordinated with full and new moon phases.

## **FINDINGS for 2017**

The total Horseshoe Crab population in the study area was 2,077, which was higher than the low of 828 attained in 2015, but still lower than the height of 2,913 achieved in 2013. There has been no sign of sustained recovery in the 9 years of survey work conducted by the watershed council. The population seems to remain at only 1/4 (quarter) of its carrying capacity, the maximum number the estuary can naturally support. We need more crabs.

There is a lack of any signs of recovery in the female horseshoe crab population of the Raritan Bay-Sandy Hook Bay complex since 2009. There were 400 total females counted compared to 1,677 total males. Single male crabs continually out-number single females. The sex ratio in 2017 was 8 single females compared to 1,066 single males. The numbers seem greatly imbalanced compared to sex ratio amounts reported in data from Delaware Bay, a sex ratio of 10:1, 10 males for every one female. The extreme low female ratio is having a ripple effect on numbers for burrowing pairs and clusters.

The hot spot for HSC mating activity continues to be Cliffwood Beach in Aberdeen Township.

## **Background**

Horseshoe crabs are 'living fossils', the last survivors of a group of organisms that first appeared in the fossil record over 400 million years ago. Besides their extraordinary antiquity, horseshoe crabs are also of paramount importance to human health. Their blood contains a clotting agent, LAL (Limulus Amoebocyte Lysate), which provides a fast, reliable test for the presence of infectious bacteria in drugs, as well as prosthetic devices such as heart valves and hip replacements.

Horseshoe crabs play a vital role ecologically along the shores of the New York – New Jersey Harbor Estuary, including Sandy Hook Bay & Raritan Bay. Migratory shorebirds, including ruddy turnstones (*Arenaria interpres*), dunlins (*Calidris alpine*), and sanderlings (*Calidris alba*) rely on a large amount of horseshoe crab eggs to provide nourishment during their migrations from the tropics to northern Canada to breed. One bird in particular, the red knot (*Calidris canutus*) feeds primarily on horseshoe crab eggs during its stopover. Although red knots have a limited migratory population in Lower New York Bay, including Raritan Bay and Sandy Hook Bay, regular sightings by volunteers with the Bayshore Watershed Council have seen the bird during spring migration at the tip of Sandy Hook peninsula and at Conaskonk Point in Union Beach. Sightings usually occur in May with a small population of less than a dozen birds. The red knot population in October 2013 was listed as a threatened species under the federal Endangered Species Act by the U.S. Fish and Wildlife Service.

In 2009, volunteer members of the Bayshore Regional Watershed Council approved a measure to conduct a study to monitor and tag horseshoe crab (*Limulus polyphemus*) spawning populations at five (5) sites along Sandy Hook Bay & Raritan Bay in Monmouth County, New Jersey. The goal of the study was to obtain a better determination of the spawning population of this aquatic species, and to ascertain if the population is stable, increasing, or decreasing. In addition, by tagging horseshoe crabs, this study will help to better understand the migration patterns, abundance, and survival rates of recaptured tagged horseshoe crabs over the course of the study in the project area.

The five (5) monitoring sites along Raritan Bay & Sandy Hook Bay in Monmouth County, New Jersey include: 1) Plum Island at Sandy Hook Gateway National Recreation Area, 2) near the mouth of Many Mind Creek in the Borough of Atlantic Highlands, 3) Leonardo Beach in Middletown Township, 4) At the mouth of Flat Creek in the Borough of Union Beach, and 5) Cliffwood Beach in Aberdeen Township.

## **Field Methods**

Data was collected during full moon and new moon high tide event cycles in May and June. Monitoring activities by volunteers were divided into two activities: (1) counting spawning populations of Horseshoe Crabs and (2) tagging single adult

Horseshoe Crabs in order to determine travel patterns. Both activities took place at the same time by watershed volunteers in May & June.

Field methods and activities for counting crab populations by watershed volunteers were similar to protocol described by the USGS in their volunteer information entitled, "SURVEYING HORSESHOE CRABS" (please see USGS web site: <http://www.lsc.usgs.gov/aeb/2065/protocol.asp>).

In brief, watershed volunteers first determined the tide height or water's edge during high tide using a tide stick. When the height of the tide on the tide stick remained constant for approximately 10 minutes or began to decrease, volunteers would walk 1 meter (approx 3 feet) below the water's edge to place the first meter stick for width. From this tide meter stick, a volunteer would walk one meter (approx 3 feet) from the water's edge and place a second meter stick for width. There was a total of 2 meters or approximately 6 feet for width. For length, volunteers marked out exactly 1,000 feet of beach or as close to 1,000 feet as possible, for example on small, narrow beaches including in Atlantic Highlands, beaches on either side of the creek were included. Volunteers then began to walk towards one end of the beach, counting and recording on tally sheets all horseshoe crabs within the 6-foot width transect along the entire 1,000 feet length of the survey area.

Field methods for tagging crab population were the same protocol as described by USFWS. Only single adult Horseshoe Crabs were tagged. Crabs that were in the process of mating were left alone so as not to interrupt the course of action. In brief, the protocol called for volunteers to attach a circular individual numbered disc to the left posterior (rear) of the prosoma (first section of body) by drilling a 5/32" hole through the side and then pushing the plastic pin (with tag) into the hole as far as it can go. Data sheets recorded the tag number, sex, prosomal width (PW) in millimeters (widest point of the crab), the date tagged, beach name, waterbed name, and state.

In 2014, two new tagging protocols were instituted as directed by US Fish and Wildlife and the National Park Service:

1. All single crabs to be tagged will first have the area where the hole will be drilled to be cleaned by rubbing the spot with alcohol.
2. Then the drill should be dipped into a Betadine antiseptic solution to disinfect the drill before making the hole in the shell (prosoma).
3. This procedure should be repeated for every individual to be tagged.
4. Any crabs found with tags already attached to the shell will be reported to the Beach Captain and recorded on a re-sighting form.

The watershed council received a total of 400 tags in 2017 supplied by USFWS. About 350 tags were employed this year

# RESULTS FOR 2017:

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Below are the results for the ninth (9th) year of monitoring HSC at five sites along the edge of Sandy Hook Bay and Raritan Bay in Monmouth County, NJ. Data was collected on a total of four nights, which corresponded with full and new moon evenings.

## **FIRST NIGHT**

Wednesday, May 10, 2017

FIRST Monitoring Event for 2017

Raritan Bay & Sandy Hook Bay

Starting time: 8:30pm

Moon Phase: FULL Moon

### Water & Weather Conditions

Water temperature: upper 50s F

Water condition: Turbid to Clear

Wave condition: Light

Air temperature: Low 50s to upper 40s F.

Sky conditions: partly cloudy, no rain past 48 hours

Winds: east 5-10 mph

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Plum Island	37	6	31	23	0	4	0	1	3 M
Mouth Of Many Mind Creek	11	4	7	2	0	3	1	0	1M 1U
Leonardo Beach	98	32	57	25	0	15	17	0	7M 2F
Mouth of Flat Creek	19	8	11	3	0	8	0	0	0
Cliffwood Beach	272	90	180	82	0	27	56	7	1M 1F

\* m = males, f = females, u = sex unidentified

### **Total for all five sites monitored in the Raritan Bay – Sandy Hook Bay complex**

	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Total	434	140	286	135	0	57	74	8	16

**SECOND NIGHT**

**\*\*CANCELLED\*\***

Saturday, May 25, 2017

Moon Phase: NEW Moon

Unfortunately, the second HSC monitoring event scheduled for May 25, 2017 was **CANCELLED** at all five (5) sites due to a coastal flood advisory for the Bayshore region of Monmouth County. Flooding conditions created an unsafe environment for both people and Horseshoe crabs.

Horseshoe Crabs will likely not mate (at least not in abundance) on flooded beaches or when waters are choppy or turbulent from gusty east winds. These conditions create a high risk for the crabs to get turned over on their backside and for eggs to get washed away.

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Plum Island									
Mouth Of Many Mind Creek									
Leonardo Beach									
Mouth of Flat Creek									
Cliffwood Beach									

\* m = males, f = females, u = sex unidentified

**Total for all five sites monitored in the Raritan Bay – Sandy Hook Bay complex**

	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Total									

**THIRD NIGHT**

Friday, June 9, 2017

THIRD Monitoring Event for 2017

Raritan Bay &amp; Sandy Hook Bay

Starting time: 8:45pm

Moon Phase: FULL Moon

**Water & Weather Conditions**

Water temperature: upper 60s to low 70s

Water condition: Turbid to Clear

Wave condition: Light

Air temperature: mid 70s F.

Sky conditions: clear, no significant rain past 48 hours

Winds: light &amp; variable

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Plum Island	113	12	101	78	0	8	2	2	5M
Mouth Of Many Mind Creek	277	52	224	153	3	21	17	11	3M 1U
Leonardo Beach	204	31	173	130	3	12	8	8	0
Mouth of Flat Creek	1	0	1	0	0	0	0	0	0
Cliffwood Beach	874	145	729	477	1	42	47	54	0

\* m = males, f = females, u = sex unidentified

**Total for all five sites monitored in the Raritan Bay – Sandy Hook Bay complex**

	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Total	1469	240	1228	838	7	83	74	62	9

**FOURTH NIGHT**

Friday, June 23, 2017

FOURTH & FINAL Monitoring Event for 2017

Raritan Bay & Sandy Hook Bay

Starting time: 8:00pm

Moon Phase: NEW Moon

Water & Weather Conditions

Water temperature: mid 70s to upper 70s.

Water condition: Very turbid

Wave condition: Light

Air temperature: upper 70s F.

Sky conditions: partly cloudy, rain in the morning

Winds: SSE 5-10 mph

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Plum Island	7	1	6	2	0	1	0	0	3M
Mouth Of Many Mind Creek	53	3	50	43	1	2	0	0	5M
Leonardo Beach	67	12	55	43	0	10	2	0	0
Mouth of Flat Creek	0	0	0	0	0	0	0	0	0
Cliffwood Beach	16	4	12	5	0	1	0	0	3F 6M

\* m = males, f = females, u = sex unidentified

**Total for all five sites monitored in the Raritan Bay – Sandy Hook Bay complex**

	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Total	143	20	123	93	1	14	2	0	17

**Total Horseshoe Crab activity for May & June 2017**

	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
TOTAL	2077	400	1677	1066	8	154	150	70	42



**TOTAL HSC ACTIVITY FOR THE FIVE MONITORING SITES IN THE  
RARITAN BAY – SANDY HOOK BAY ESTUARINE COMPLEX FOR  
YEARS: 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 & 2017.**

YEAR	Total crabs	Total females	Total males	Single males	Single females	*Swimming pairs	*Burrowing pairs	Clusters	Dead
2009	1,174	495	679	251	96			27	6
2010	1,025	178	847	475	16			55	20
2011	2,321	399	1,922	1,225	86			139	28
2012	2,430	701	1,729	753	25			119	118
2013	2,913	743	2,170	1,259	40	265	276	240	95
2014	1,828	287	1,541	1,168	10	145	92	33	44
2015	828	157	663	347	32	51	43	15	30
2016	1,246	217	1,016	769	15	130	50	16	39
<b>2017</b>	<b>2,077</b>	<b>400</b>	<b>1,677</b>	<b>1066</b>	<b>8</b>	<b>154</b>	<b>150</b>	<b>70</b>	<b>42</b>
<b>Average</b>	1756.7	353	1174.1	812.5	36.4	149	122.2	79.3	46.8

- In 2013, the parameter known as “pairs” was divided into two separate categories: “swimming pairs” and “burrowed pairs.” This was done in order to clarify better HSC mating activities at each monitoring site. Other parameters are consistent with the term of the study. The following is the total numbers of pairs (both swimming pairs and burrowing pairs) recorded from 2009 to 2012:  
 2009: 334  
 2010: 261  
 2011: 254  
 2012: 507

**RECOMMENDATIONS**

The harvest of crabs for bait should end. Since 2006, New Jersey has had a total moratorium on the harvesting of Horseshoe Crabs. New York State, on the other hand, is the only state along the eastern seaboard that does not provide any protection for Horseshoe Crabs during the spawning season. Management efforts for Horseshoe Crabs by New York and the Atlantic States Marine Fisheries Commission (ASMFC) need at the very least include greater protection for female Horseshoe crabs.

Since 2009, New York State’s commercial quota for horseshoe crabs has been around 150,000 crabs, with a certain amount of captured crabs coming from Raritan Bay, Jamaica Bay, and Lower New York Bay. Many bait harvesters in New York State prefer gravid females (those carrying eggs) to single male crabs. Typically, horseshoe crabs are harvested as bait for the American eel and Channel whelk fisheries. Fishermen will use the body parts of female Horseshoe crabs as bait to attract eels and whelks, locally known as conch. In about 20 years, the price for a single horseshoe crab has jumped from .25 cents to more than \$5.00 per crab.

In addition to bait, horseshoe crabs are harvested by the medical industry for their copper-based blood, which turns blue when exposed to air. Horseshoe crab blood has remarkable antibacterial properties and enormous medical value that makes certain no impurities exist in medicines. The U.S. Food and Drug Administration (FDA) requires all intravenous drugs and vaccines, and any medical device, such as replacement hips, hearts, pacemakers or knees, coming in contact with the human body to be first tested through the crab's blood for bacterial toxins, such as toxic shock syndrome, meningitis, and typhoid. As a result, millions of people survive each year in the United States due to the clotting characteristics of the Horseshoe crab's blue blood.

Environmental scientists, John Tanacredi and Sixto Portilla, tell us from a technical research paper published in *Changing Global Perspectives on Horseshoe Crab Biology, Conservation and Management*, 2015, that many crabs taken from New York waters to be bled by the medical industry are often **not** returned to New York. From research on Horseshoe crab populations from Brooklyn to Montauk from 2003 to 2014, they found that numerous crabs permitted by the State of New York to be harvested and taken to Massachusetts to be bled for the medical industry are often released "to local waters in Cape Cod, not back in NYS waters as required" by their permit. In the end, "many of those animals are re-harvested for bait and sold back to NYS fishermen at an average cost of US \$5/crab." In total, the medical industry bleeds over 600,000 crabs, and probably kills about a third. Reproduction efforts by the other approximately 400,000 crabs are almost certainly diminished because they bleed only females.

The overharvesting of female Horseshoe crabs by commercial fishermen, coupled with the loss of spawning habitat from overdevelopment of estuarine beaches and increasing beach erosion associated with sea level rise in Lower New York Bay has resulted in a precipitous decline in the female Horseshoe crab population decline, and therefore the number of eggs available to feed migratory shorebirds and a sustainable Horseshoe Crab population.

There needs to be greater protection for known mating sites in Raritan Bay and Sandy Hook Bay, including Cliffwood Beach in Aberdeen Township. Horseshoe crabs congregate along estuarine beaches seasonally to spawn, which make them especially vulnerable to exploitation, either intentionally or not, by local fishermen or beachgoers. A need exists for a public education campaign to inform people not to disturb spawning horseshoe crabs and to alert local residents about the importance of horseshoe crabs in local estuarine ecology.

## **APPRECIATION**

Appreciation and gratitude is given to the project partners. This study is a cooperative effort involving the U.S. Fish and Wildlife Service, National Park Service, Gateway National Recreation Area, the New Jersey Division of Fish and Wildlife, Bayshore Regional Watershed Council, Brookdale Community College, Environmental Science Department, and Marine Academy of Science and Technology (M.A.S.T.) at Sandy Hook.

In addition, appreciation is given to over 50 volunteers from the watershed council, local citizens, and volunteers with the Monmouth County Park System and the Bergen County Park System, who routinely give up a bit of their time in May and June to assist in this project, so that other people might gain a better understanding of horseshoe crab activity in Raritan Bay & Sandy Hook Bay, Monmouth County, New Jersey. Without the help of everyone involved, this project would not have been accomplished. Thank you!