

October 17, 2016

**End-of-Year Report for 2016**

*Limulus polyphemus*

Horseshoe Crab Monitoring & Tagging Activity in Raritan Bay & Sandy Hook Bay, Monmouth County, New Jersey, May & June 2016. 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 2016 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 eighth 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 2016**

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 2016**

The total Horseshoe Crab population in the study area was 1,246, which was higher than the low of 828 attained last year, but still lower than the height of 2,913 achieved in 2013.

Single male crabs once again greatly out-numbered single females this year. The sex ratio was 15 single females compared to 1,016 single males. The numbers seem 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 seems to have had a ripple effect on decreasing numbers for swimming pairs, burrowing pairs and clusters throughout the five monitoring sites.

The hot spot for HSC mating activity in 2016 was Cliffwood Beach in Aberdeen Township. For the past 7 years this site has been a significant and consistent location for peak HSC mating activities. Populations of crabs continue to be high also at Plum Island at Sandy Hook, Gateway National Park.

Monitoring activities in Union Beach were changed in 2016 from Conaskonck Point to the Mouth of Flat Creek. The sites are about a mile apart, but more crabs over the last 10 years seem to have traveled to the mouth of the creek to spawn. Perhaps due to the high amount of peat on the beach at Conaskonck Point.

## **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 goes. 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 2016 supplied by USFWS. About 225 tags were employed this year.

# RESULTS FOR 2016:

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Below are the results for the eighth (8th) 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**

Friday, May 6, 2016

8:30pm to 10:00pm approximately

Moon Phase: New Moon

**CANCELLED DUE TO GUSTY WINDS AND A COASTAL FLOOD WARNING FOR THE ENTIRE BAYSHORE REGION OF MONMOUTH COUNTY. CONDITIONS WERE UNSAFE FOR VOLUNTEERS AND FOR MATING HORESESHOE CRABS.**

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									

**SECOND NIGHT**

Saturday, May 21, 2016

8:30pm – 10:00pm approximately

Moon Phase: Full Moon

Weather and water conditions:

Water temperature: mid 50s to lower 60s F

Water condition: Turbid

Wave condition: Light to moderate

Air temperature: mid 50s F

Sky conditions: Showers

Winds: North 5 to 15 mph

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Plum Island	172	34	135	97	1	32	0	1	3 (u)
Mouth Of Many Mind Creek	2	1	1	0	0	1	0	0	0
Leonardo Beach	3	1	2	0	0	0	1	0	1(m)
Mouth of Flat Creek	66	26	37	8	0	4	22	0	3(u)
Cliffwood Beach	22	11	17	1	0	6	3	1	1(f) 5(m)

\* 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	265	73	192	106	1	43	26	2	13

**THIRD NIGHT**

Sunday, June 5, 2016

8:45pm to 10:00pm approximately

Moon Phase: New Moon

Weather and water conditions:

Water temperature: low to mid 70s F.

Water condition: Turbid

Wave condition: Light

Air temperature: mid 70 F.

Sky conditions: Cloudy, heavy rain earlier in day

Winds: Southeast 5 to 10 mph

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Plum Island	147	15	132	112	3	10	0	2	2(m)
Mouth Of Many Mind Creek	179	31	147	116	3	18	8	2	1(m) 1(u)
Leonardo Beach	99	13	86	74	0	9	2	0	1(m) 2(f)
Mouth of Flat Creek	44	9	31	21	1	6	0	2	4(u)
Cliffwood Beach	185	24	161	128	0	20	2	2	1(m)

\* 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	654	92	557	451	7	63	12	8	12

**FOURTH NIGHT**

Monday, June 20, 2016

8:30pm to 10:00pm approximately

Moon Phase: Full Moon

Weather and water conditions:

Water temperature: upper 60s to mid 70 F.

Water condition: VERY Turbid with Jellies

Wave condition: Light

Air temperature: upper 70 F.

Sky conditions: clear skies

Winds: light and variable

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Plum Island	50	10	40	32	3	5	0	1	1(m) 1(f)
Mouth Of Many Mind Creek	32	7	25	17	0	4	2	1	0
Leonardo Beach	38	5	32	27	0	2	3	0	1(m)
Mouth of Flat Creek	21	2	12	10	0	2	0	0	7(u)
Cliffwood Beach	186	28	158	126	4	11	7	4	2(m) 2(f)

\* 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	327	52	267	212	7	24	12	6	14

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**Total Horseshoe Crab activity for May & June 2016**

	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs
Total	1246	217	1016	769	15	130	50	16	39



**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.**

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	1016	769	15	130	50	16	39
<b>AVERAGE</b>	1,720	397	1,320	780	40	147	115	80	47

- 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**

Management efforts for horseshoe crabs by New York and New Jersey, and the Atlantic States Marine Fisheries Commission (ASMFC), need to include greater protection for female Horseshoe crabs. Many bait harvesters in New York State prefer gravid females (those carrying eggs) to single male crabs. 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 birds and continue a sustainable Horseshoe Crab population.

There also 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 makes them especially vulnerable to exploitation, either intentionally or not, by local fishermen or beachgoers. There should be a better 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.

Since horseshoe crabs mature slowly, requiring nine to twelve years to attain sexual maturity, there is a recommendation for the watershed council to continue this study. Changes in subsistence (increases or decreases) are not readily recognizable because they occur over a period of years. More time and data is needed to research the horseshoe crab population in Raritan Bay and Sandy Hook Bay to determine if the population is continuing.

### **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 the Marine Academy of Science and Technology, 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 gave 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!