

October 8, 2019

End-of-Year Report for 2019

Limulus polyphemus

Horseshoe Crab Monitoring & Tagging Activity in Raritan Bay & Sandy Hook Bay, Monmouth County, New Jersey, May & June 2019. Conducted by Volunteers with the Bayshore Regional Watershed Council and Save Coastal Wildlife nonprofit.

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
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The full HSC monitoring database is available for downloading from Save Coastal Wildlife website at: <https://www.savecoastalwildlife.org/horseshoe-crab-monitoring>

Summary

This is an end-of-year report for a study in 2019 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 eleventh 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, Save Coastal Wildlife, and with cooperation from high school students with the Marine Academy of Science and Technology (M.A.S.T.), located at Sandy Hook, Gateway National Recreation Area. Volunteers with the Monmouth County Park System & Bergen County Parks have also lent a 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 2019

Volunteers with the Bayshore Regional Watershed Council and other organizations conducted monitoring and tagging activities at five (5) sites during periods of high tide on dates that coordinated with full and new moon phases in May and June, the representative spawning season for horseshoe crabs in New Jersey.

FINDINGS for 2019

The total Horseshoe Crab population in the study area was 3,405 crabs. This is the second highest number since monitoring activities began in 2009. The number follows a high water mark of 6,480 crabs in 2018. The 2019 number is a sharp decline from 2018; the total HSC population in 2019 is nearly half the population in 2018. It will be interesting to see if the population continues to decline or will there be a rebound next year.

Total female horseshoe crabs in 2019 made up approximately 25 percent of the population. This is an increase from past years when the total female population was between 15 to 18 percent of the total HSC population, but still a decline from 2009 when the total female population comprised approximately 40 percent of the population. Adult male crabs continue to out-number the adult female population.

The hot spot for HSC mating activity continues to be Cliffwood Beach in Aberdeen Township. Locations where horseshoe crab spawning activity is robust include Leonardo Beach in Middletown Township, the mouth of Many Mind Creek in Atlantic Highlands, and Keyport Harbor in the Borough of Keyport. The spawning population of horseshoe crabs at Plum Island at Gateway Sandy Hook seems to be suffering from extensive beach erosion issues.

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. 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 alpina*), and sanderlings (*Calidris alba*) relay 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 almost exclusively on horseshoe crab eggs during its spring stopover along the Atlantic Coast of the United States on their way to breeding grounds in the tundra. 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 and Save Coastal Wildlife have observed birds 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 November 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) Keyport Harbor, near the mouth of Chingarora Creek and at the western side of Conaskonk Point in the Borough of Keyport, and 5) Cliffwood Beach in Aberdeen Township.

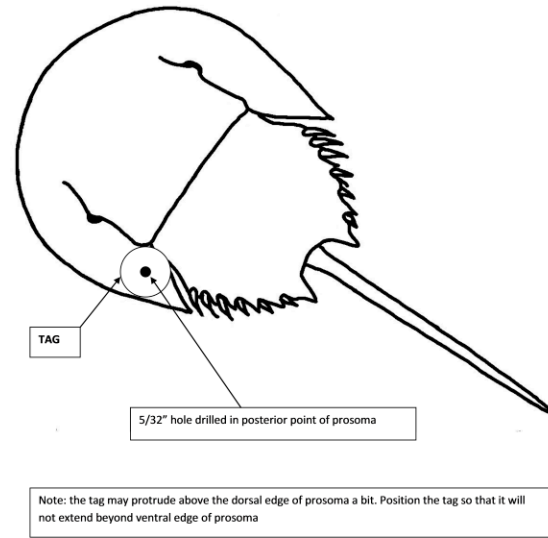
Field Methods

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>

Protocol to Tag HSC



Only single crabs will be tagged. Never tag crabs that are in pairs or clusters. Crabs will only be selected for tagging activities within the monitoring area or transect zone on the beach after the crab has been counted or surveyed by an observer.

Attach only one tag per animal. If the animal is damaged near the attachment area, do not tag the animal.

1. Tags will be attached to the left posterior (rear) point of the prosoma (first section of body). There is a high concentration of fibrous material within the body in this area, which minimizes bleeding. Before drilling the attachment hole, clean off any epibionts (barnacles, etc.) near the attachment site.

2. USFWS (US Fish & Wildlife) recommends first cleaning the area where the hole will be drilled by rubbing the spot with alcohol.

3. Next the drill should be dipped into a Betadine antiseptic solution to disinfect the drill before making the hole in the shell (prosoma).

4. The tag is attached by drilling a 5/32" hole (7/64" for small tags) through the left side of the prosoma near the dorsal edge and then pushing the plastic pin (with tag) into the hole as far as it will go (it should NOT go all the way through the prosoma and come out the other side).

5. This procedure should be repeated for every individual that is being tagged.

6. All tags will be used in consecutive sequential procedure. One number after another.

7. Any crabs found with tags already attached to the shell are to be reported to the Beach Captain and recorded on the re-sighting form.

If you plan to tag crabs, please bring a cordless drill with tape on a 5/32-inch drill bit up 1/8" from the tip to tag the crabs. Also, we will need measuring tape and rulers that measure in millimeters. Bring plenty of clipboards, pens/pencils, flashlights or headlamps.

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 2019 supplied by USFWS. About 299 tags were employed this year. The tally is as follows:

150 crabs were tagged at Cliffwood Beach in Aberdeen Township.

125 crabs were tagged at the mouth of Many Mind Creek in Atlantic Highlands.

24 crabs were tagged at Plum Island at Sandy Hook NRA.

All horseshoe crabs tagged were single males except for two single females tagged at Cliffwood Beach on May 29, 2018.

Protocol to Conduct Spawning Survey

Each site beach will be sampled along a transect of 1,000 feet.

1. As volunteers walk to the starting location, find a stick (1 to 2 ft. long) that you can use to determine high tide. When you get to the starting location, stand the stick in the sand at the tide line. The tide line is the highest point on the beach that the water reaches. Move the stick up the beach as the water reaches higher on the beach. Begin the survey when the tide begins to recede and the water no longer reaches the stick. Record your starting time on the Beach Site Sheet where it says START OF SURVEY.

2. The "horseshoe crab line" you will follow is not a straight line and may be above or below the water line or the surf zone - typically the area where the waves break and wash over the horseshoe crabs, especially males seeking females. If there is an obstruction or discontinuation in the beach section (bulkhead, large boulder, etc.), pace up to the obstruction, walk to the other side of it, and then continue your pace count on the other side. Do not include the width of the obstruction in your transect.

3. Count the animals of each sex separately. If a horseshoe crab is not buried, the two most common ways to determine its sex are its size and position. Males are for the most part smaller and clasped or crowded on top of females. The first pair of appendages for males is also bulbous (like a marble), so they have the strength to clasp a female tightly. The bulbous shape is diagnostic for males.

4. To survey horseshoe crabs, you will start at one end of a marked section of beach. At the "start time," you should begin counting all horseshoe crabs (dead or alive, single males and females, swimming pairs, buried pairs, and clusters) along a 1,000 feet of beach.

5. The Observer (first person) will walk along the "horseshoe crab line" and count out loud the number of horseshoe crabs and the Recorder (second person) records these observations on the Data Sheet. The Observer should always focus on counting horseshoe crabs that are spawning on the beach according to the following rules:

- a. Crabs above the Surf Zone (on beach): Count all that are present.
- b. Crabs in the Surf Zone: Count all that are present and include the submerged crabs that are obviously part of the spawning event.

6. Continue this way until you have sampled a 1,000 foot transect. You can stop while counting, but do not walk backwards and re-count.

RESULTS FOR 2019:

Below are the results for the eleventh (11th) 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

Saturday, May 4, 2019

Raritan Bay & Sandy Hook Bay

Starting time: 8:30pm

Moon Phase: NEW Moon

Water & Weather Conditions

Surface Water temperature: Low to Mid 50s F.

Water condition: Turbid

Wave condition: Calm

Air temperature: mid 50s F.

Sky conditions: Cloudy

Winds: ENE 6 mph

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs	Crabs Tagged
Plum Island	9	3	6	2	0	2	0	1	0	6
Mouth Of Many Mind Creek	21	10	11	1	0	10	0	0	0	0
Leonardo Beach	25	10	15	5	0	8	2	0	0	0
Keyport Harbor	39	15	24	9	0	11	4	0	0	0
Cliffwood Beach	6	3	3	0	0	2	2	0	0	0

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

Total for all five sites monitored on Saturday, May 4, 2019

	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs	Crabs Tagged
Total	100	41	59	17	0	33	8	1	0	6

SECOND NIGHT

Saturday, May 18, 2019

Raritan Bay & Sandy Hook Bay

Starting time: 8:30pm

Moon Phase: FULL Moon

Water & Weather Conditions

Surface Water temperature: Upper 50s to low 60s F.

Water condition: Turbid

Wave condition: Calm

Air temperature: mid 60s F.

Sky conditions: Partly Clear

Winds: ENE 5 - 15 mph

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs	Crabs Tagged
Plum Island	132	38	94	49	0	30	3	5	0	19
Mouth Of Many Mind Creek	224	71	153	72	1	36	26	8	0	31
Leonardo Beach	263	79	184	80	0	27	36	16	1 (m)	0
Keyport Harbor	165	64	101	34	1	26	33	12	0	0
Cliffwood Beach	77	26	51	21	0	12	12	2	0	18

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

Total for all five sites monitored on May 18, 2019

	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs	Crabs Tagged
Total	861	278	583	256	2	131	110	43	1 (m)	68

THIRD NIGHT

Monday, June 3, 2019
Raritan Bay & Sandy Hook Bay
Starting time: 8:30pm
Moon Phase: NEW Moon

Water & Weather Conditions
Surface Water temperature: Mid to Upper 60s F.
Water condition: VERY Turbid
Wave condition: Chop
Air temperature: Upper 50s F.
Sky conditions: Clear
Winds: WNW 8 - 18mph

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs	Crabs Tagged
Plum Island	39	7	32	24	1	5	0	0	1 (u)	50
Mouth Of Many Mind Creek	205	53	150	82	3	22	17	11	2 (u)	85
Leonardo Beach	308	98	210	93	1	30	55	12	1 (f) 1 (m)	0
Keyport Harbor	226	54	172	106	3	17	25	9	1 (m)	0
Cliffwood Beach	777	241	536	180	1	82	88	70	0	132

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

Total for all five sites monitored on June 3, 2019

	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs	Crabs Tagged
Total	1,555	453	1,100	485	9	156	185	102	6	267

FOURTH NIGHT

Monday, June 17, 2019

Raritan Bay & Sandy Hook Bay

Starting time: 8:30pm

Moon Phase: FULL Moon

Water & Weather Conditions

Surface Water temperature: Mid to Upper 60s F.

Water condition: Cloudy to Very Cloudy

Wave condition: Calm

Air temperature: Low 70s

Sky conditions: Cloudy

Winds: SE 5 mph

Site Name	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs	Crabs Tagged
Plum Island	9	1	8	6	0	1	0	0	1 (m)	5
Mouth Of Many Mind Creek	129	3	126	122	0	2	1	0	1 (m)	40
Leonardo Beach	116	9	106	94	1	5	1	2	1 (u)	0
Keyport Harbor	195	22	168	134	0	12	10	5	1 (m)	0
Cliffwood Beach	440	55	385	254	0	28	10	17	0	0

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

Total for all five sites monitored on June 17, 2019

	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs	Crabs Tagged
Total	889	90	793	610	1	48	22	24	4	45

Total Horseshoe Crab activity for May & June 2019

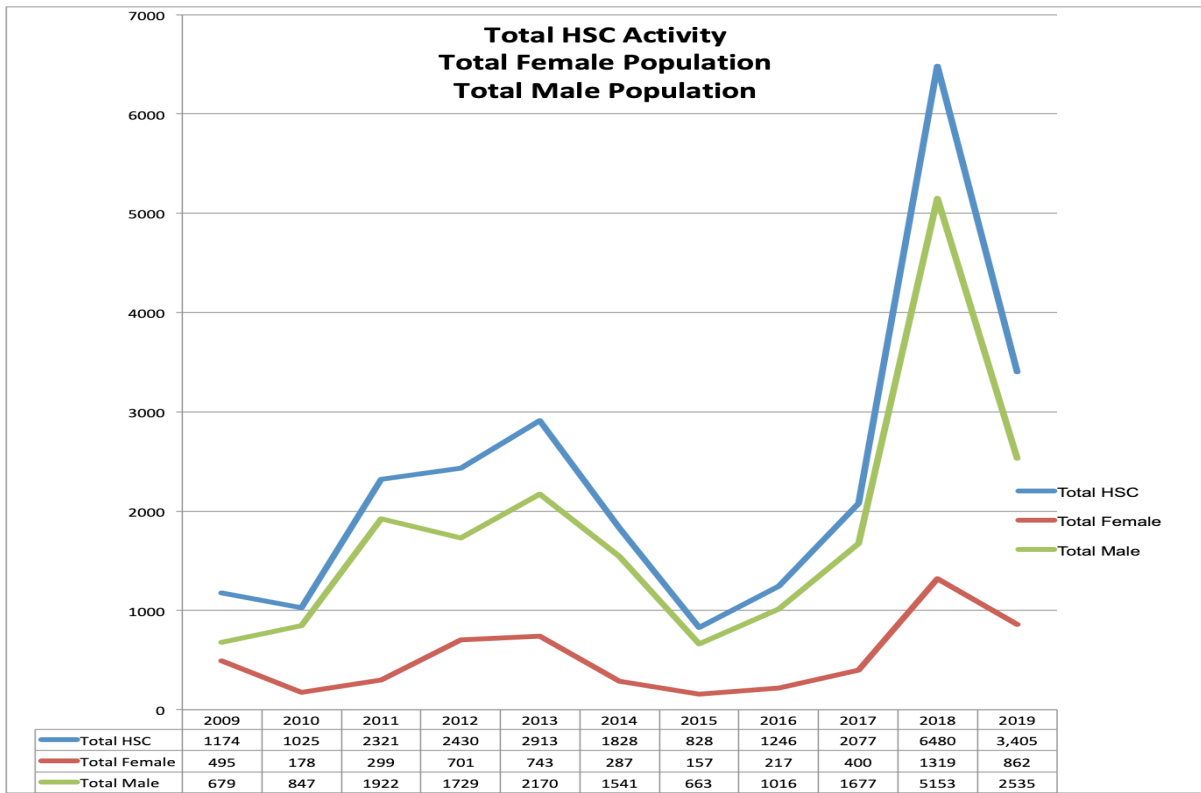
	Total Crabs	Total females	Total males	Single males	Single females	Swimming Pairs	Burrowed Pairs	Clusters	Dead crabs	Crabs Tagged
TOTAL	3,405	862	2,535	1,368	12	368	325	170	11	341

**TOTAL HSC ACTIVITY FOR THE FIVE MONITORING SITES IN THE
RARITAN BAY – SANDY HOOK BAY ESTUARINE COMPLEX FOR
YEARS: 2009 to 2019 (eleven years).**

YEAR	Total crabs	Total females	Total males	Single males	Single females	*Swimming pairs	*Burrowing pairs	Clusters	Dead	** Crabs Tagged
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	
2017	2,077	400	1,677	1066	8	154	150	70	42	
2018	6480	1319	5153	2923	12	735	279	338	24	
2019	3,405	862	2535	1368	12	368	325	170	11	341

- 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

** In 2019 another parameter was added – how many HSC were tagged during each monitoring event. Although volunteer members have tagged crabs since the monitoring program’s inception in 2009, the field was added to better illustrate and coordinate tagging activities alongside monitoring activities for future reference.



RECOMMENDATIONS

There needs to be greater protection for known mating sites in Raritan Bay and Sandy Hook Bay, including Cliffwood Beach in Aberdeen Township, Keyport Harbor in the Borough of Keyport, and the mouth of Many Mind Creek in Atlantic Highlands. 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. In addition, a need exists for greater public education to inform people about the importance for horseshoe crab conservation and in local estuarine ecology; and for people not to disturb spawning horseshoe crabs.

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, Save Coastal Wildlife, 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!