

## **The 2014 Delaware Bay Horseshoe Crab Spawning Survey**

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### **Abstract**

Spawning counts of horseshoe crabs were scheduled in advance for 25 beaches in New Jersey and Delaware during moon phases in May and June. The schedule included 300 events of which 257 counts were completed with 43 dates cancelled due to no access (20), no surveyors (10), weather (12) and other (1).

The single day peak estimate of 322,672 horseshoe crabs was attained on May 26th, two days before the new moon. This estimate was lower than last year's peak estimate (384,548) and was lower than peak estimates in 11 of the 15 previous years (Data series from 1999-2014). The 2014 estimate surpassed only three years, 2000, 2001 and 2003. Delaware's estimate (215,394) and New Jersey's estimate (107,278) were lower than ten of the previous years.

The grand total of seasonal activity for the Delaware Bay was 1,401,580 of which 587,460 individuals were estimated for the New Jersey side and 814,120 for the Delaware side. Seasonal activity for the Delaware shoreline was greater than only two estimates, the 2005 estimate (749,473) and the 2012 estimate (622,619). While New Jersey's estimate was slightly greater than most of the previous years (10), it fell short of the preceding years of 2011, 2012 and 2013.

The average male to female sex ratio of 4.38 (3.95 for New Jersey and 4.77 for Delaware) was higher than 2013. Although lower than six of the years (2006 - 2009, 2011 and 2012), the ratio was higher than nine of the years (1999-2005, 2010 and 2013). The higher sex ratio combined with the low seasonal estimate translated into the second lowest estimate of females spawning (260,517). The only year with fewer estimated female spawners was in the year 2012 (238,737).

### **Introduction**

Since its inception in 1999, the Delaware Bay horseshoe crab spawning survey has made tremendous strides and is considered the premier method of estimating the spawning population of horseshoe crabs. To continue with this undertaking each year the survey relies on many eager and energetic groups and volunteers who generously give of their time and their efforts to learn, count, enter and analyze the data collected from the survey.

## Methods

Horseshoe crabs were enumerated for 12 nights during the months of May and June 2014 along the shores of the Delaware Bay. Twenty-five beaches were represented in this year's count (13 along the state of Delaware's coast and 12 along the coast of New Jersey). The Delaware beaches from north to south were Woodland, Pickering, Kitts Hummock, Ted Harvey Wildlife Management Area (WMA), North Bowers, South Bowers, Bennetts Pier, Big Stone, Slaughter, Fowlers, Primehook, Broadkill, and Cape Henlopen. New Jersey beaches included Gandys, Fortescue, Reeds, Kimbles, Pierces Point, Highs, South Cape Shore Lab, Norburys Landing (Sunray), Villas, Townbank, North Cape May and Higbees. The most northern beach in New Jersey, Sea Breeze, is no longer surveyed due to flooding and access problems.

Simultaneous counts were taken on both New Jersey and Delaware beaches during the high tide. The survey dates coincide with the new and full moon periods in May and June: May 12, 14, 16, 26, 28, 30 and June 11, 13, 15, 25, 27, 29. High tide times ranged from 7:50 p.m. to 11:27 p.m. at Breakwater Harbor, allowing adjustments for tidal flow entering the bay. Counts are initiated with the onset of the changing tide from peak high to beginning ebb on one kilometer of preset beach. Where one contiguous kilometer of beach is not available, adjustments are made to randomly place quadrats closer to each other to complete the count with 100 quadrats.

## Results

Three hundred survey dates were scheduled and 257 dates completed or 86% of actual surveying. The remaining counts were canceled due to flooding (20), inclement weather (12), volunteer unavailability (10) or other reason not specified (1). Seventeen counts were incomplete: 13 in New Jersey and four in Delaware.

In New Jersey, 18 dates were cancelled, due to no access and flooding (1), weather (8), no surveyors (8) and other (1). The eight weather cancellations occurred on June 13<sup>th</sup>. Gandys Beach continued to pose a problem with five cancellations and seven incomplete surveys. Despite reducing the survey length to 66 meters, 61 quadrats were counted on May 12<sup>th</sup>, 62 quadrats on May 26<sup>th</sup>, 37 quadrats on May 30<sup>th</sup>, 36 quadrats on June 11<sup>th</sup>, 40 quadrats on June 15<sup>th</sup>, 30 quadrats on June 11<sup>th</sup> and 39 quadrats on June 29<sup>th</sup>. (Table 1A)

Twenty-five cancellations occurred in Delaware during the 2014 spawning season due to no access/flooding (19), weather (4) or no surveyors (2). The weather cancellations occurred on May 28<sup>th</sup> (2), June 11<sup>th</sup> (1) and June 13<sup>th</sup> (1). The majority of the cancellations (8) due to no access occurred on May 28<sup>th</sup>. In addition, six surveys were deemed incomplete, four for high water along the beach area and two for weather. The four incomplete surveys due to high water were at Broadkill

on May 14<sup>th</sup> (91 quadrats) and at Primehook on May 14<sup>th</sup> (50 quadrats) and May 28<sup>th</sup> (50 quadrats) and at Ted Harvey on June 15<sup>th</sup> (98 quadrats). (Table 1B)

The 2014 peak estimate of spawners along Delaware Bay shores (322,672) was lower than the 2013 estimate (384,548) and was lower than many estimates from previous years (11) (Data set from 1999-2014). The 2014 estimate was greater than the years 2000, 2001 and 2003 (Table 2). In New Jersey, 71% of the seasonal spawning occurred in May and 29% in June. The highest densities of the season occurred during the counts of May 12<sup>th</sup>, May 14<sup>th</sup> and May 26<sup>th</sup>. However, the densities never reached great numbers as in previous years. The greatest density, 13.15 crabs per square meter, was reached at Reeds Beach on May 26<sup>th</sup>. (Table 1A)

In Delaware, the seasonal spawning activity was more evenly distributed with 57% activity in May and 43% in June. The May activity was lessened by the low May 28<sup>th</sup> estimate of only 50 horseshoe crabs (estimated at Kitts Hummock) due to weather conditions canceling counts (ten beaches) and rendering zero counts (2 beaches). Spawning activity dropped considerably during the last round of counts in June. Woodland's low estimate in 2014 was comparable to other years with the exception of the greater 2012 estimate of 1,200 horseshoe crabs. Access was an issue at Woodland with four counts cancelled. The greatest densities were observed on May 26<sup>th</sup> at Pickering Beach of 22.83 crabs per square meter and at Kitts Hummock of 20.07 crabs per square meter. (Table 1B and Figure 1)

The male to female sex ratio of 4.38 was higher than last year's estimate of 3.74. Although lower than six other years (2006 - 2009, 2011 and 2012), it was higher than nine years (1999-2005, 2010 and 2013). The sex ratio is highly variable among years, among beaches and within beaches. The average sex ratio for Delaware was 4.77 and for New Jersey, 3.95. Average sex ratios in Delaware ranged from a low of 2.28 males per female at Bennetts to 6.02 at Kitts Hummock and 6.28 at Pickering. In New Jersey, the average sex ratios ranged from 2.03 at Higbees to 5.79 at Kimbles.

The seasonal activity for the Delaware side of the Bay was one of the lowest estimates encountered in the time series and only exceeded the 2005 estimate (749,473) and the 2012 estimate (622,619). While New Jersey's estimate was greater than most of the previous years, it fell short of the preceding years of 2011, 2012 and 2013. (Table 4 and Figure 4) The average male to female sex ratio of 4.38 was high and combined with the low seasonal estimate translated to the second lowest estimate of females spawning (260,517) in the time series. The only year with fewer female spawners was 2012 (238,737). (Table 5 and Figure 5)

We observe and utilize four levels of spawning activity to categorize the densities for each count. No spawning activity equals 0 crabs, low activity equals less than 5 crabs per meter, moderate activity equals 5 to 10 crabs per meter, and high activity equals greater than 10 crabs per meter. The data is analyzed in percentages since the number of dates and/or beaches may change yearly. As in

previous years, the majority of the dates surveyed (64% in NJ and 55% in DE) showed horseshoe crabs densities lower than five crabs per meter. Dates with high densities were sparse, especially in New Jersey (6%). Dates with zero crabs (12 in Delaware and 7 in New Jersey) were minimal (5% and 8% respectively) (Table 3 and Figure 3). In Delaware, seven of the zero dates were observed at Woodland beach, the most northern beach surveyed. In New Jersey, four of the zero dates were observed at the more southern beaches during the first round of counts. (Table 1A and 1B)

Observations of tagged horseshoe crabs during the survey counts are summarized (Table 6). On the back of the Tally Sheets, tag information is recorded: the tag number, the type of tag, if the tagged horseshoe crab was observed in the quadrat or outside, and if the crab was dead or alive. During the years 2007 to 2014, 990 tagged horseshoe crabs were observed. The majority of the tagged animals were alive (92%) and encountered outside the quadrats (76%). (Table 6)

Another observation noted during this year's survey was the great number of stranded horseshoe crabs encountered, particularly during the May 30<sup>th</sup> date. Horseshoe crabs become stranded (flipped over) during rough waters. Rough waters may involve high wave height and/or strong directional onshore flow. The slope of the beach may also contribute to the strandings. Volunteers recorded this observation on the tally sheet and some volunteers sent photos.

## **Discussion**

The 2014 survey results were considerably low. Primary results such as peak spawning and seasonal activity estimates were some of the lowest on record. In addition, the male to female sex ratio was one of the highest, meaning more males were counted in ratio to females. The spawning surveys document trends in horseshoe crab numbers throughout years of recording and observations. The long term results demonstrate generally lower horseshoe crab numbers with low sex ratios (less males in relation to females) during the years 1999-2006 with increasing spawning individuals and higher sex ratios (more males than females) during the years 2007-2013. This year had the least favorable estimates: low peak and seasonal estimates and a high sex ratio. Cancellations during the May 28<sup>th</sup> count, a time when spawning would usually be at its greatest, contributed to the low peak estimate and seasonal estimate in 2014.

Erosion along many Delaware Bay survey beaches is increasing, diminishing the length and depth of the sandy beach available for spawning. The reasons for the increasing erosion can be attributed to a multitude of factors including but not limited to the deterioration of the "sluice gates" erected by early settlers to keep the salt water out in order to farm salt hay, the lingering effects of Hurricane Sandy and the rise in sea level. Erosion along the New Jersey shoreline of the Delaware Bay was evident years ago. More recently, the beaches along the Delaware shoreline are showing evidence of severe erosion with nineteen cancellations due to no

access/flooding in 2014. A prime example is at Fowlers Beach with a deteriorated and flooded roadway. The volunteer from the State of Delaware, Department of Natural Resources and Environmental Control had to park about one quarter mile from the beach and walk in to conduct the survey last year.

However, areas have been created and enhanced, both naturally and man-made. These areas have the potential to provide additional spawning habitat for the horseshoe crabs and should be taken into account. In addition, the areas around creek mouths exhibit concentrated spawning activity. In the very early years of the survey, observations and counts revealed good spawning activity around the creek mouths and this is still evident, perhaps even more so in the past few years.

The Delaware Bay shoreline is continually changing and in turn, altering the spawning area for the horseshoe crabs. Collecting data in this changing environment, yearly and over time, makes the Delaware Bay Spawning Survey essential for managing the horseshoe crab resource.

### **Acknowledgements**

This year as in past years, the survey is conducted by enthusiastic and committed volunteers, and without their help the survey would not exist. Thank you to all involved.

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Figure 1. New Jersey and Delaware Spawning Estimates During 2014 Survey

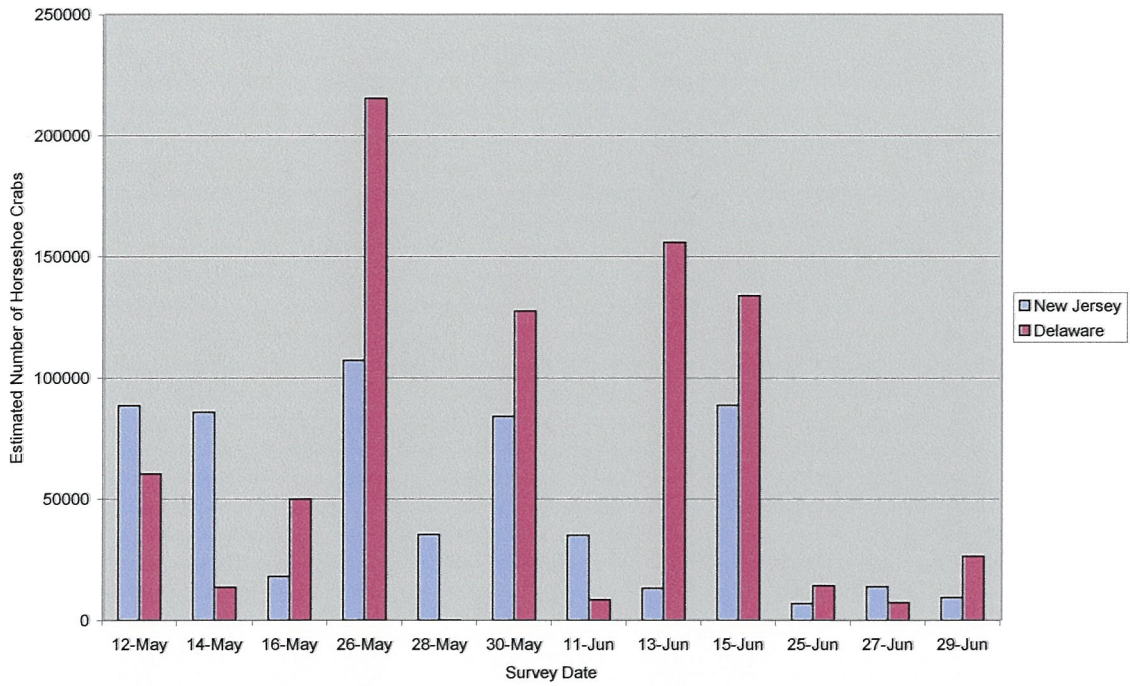


Figure 2. Peak Estimates of Spawning Horseshoe Crabs Years 1999-2014

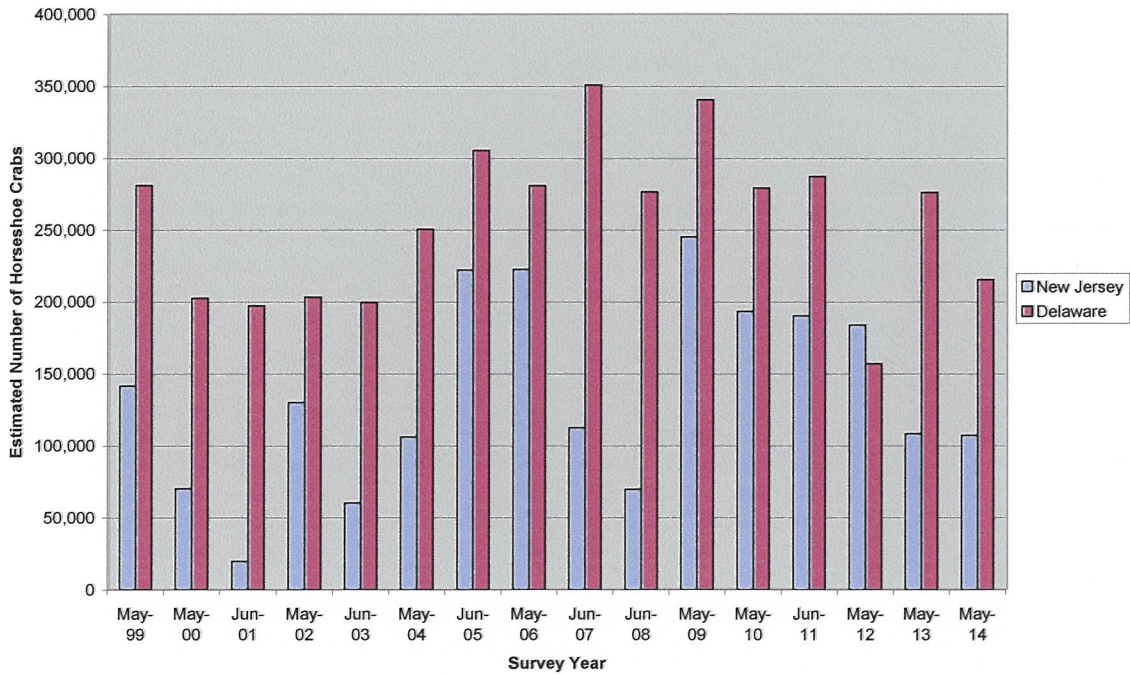


Figure 3. Percentages of Horseshoe Crab Densities 1999-2014

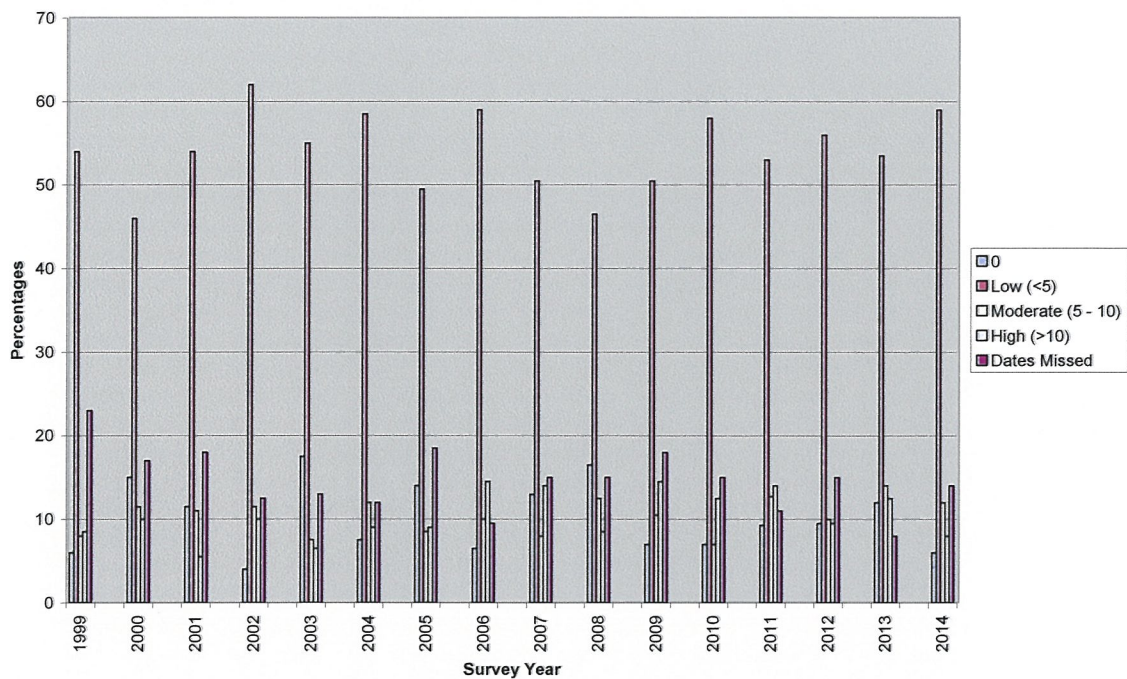
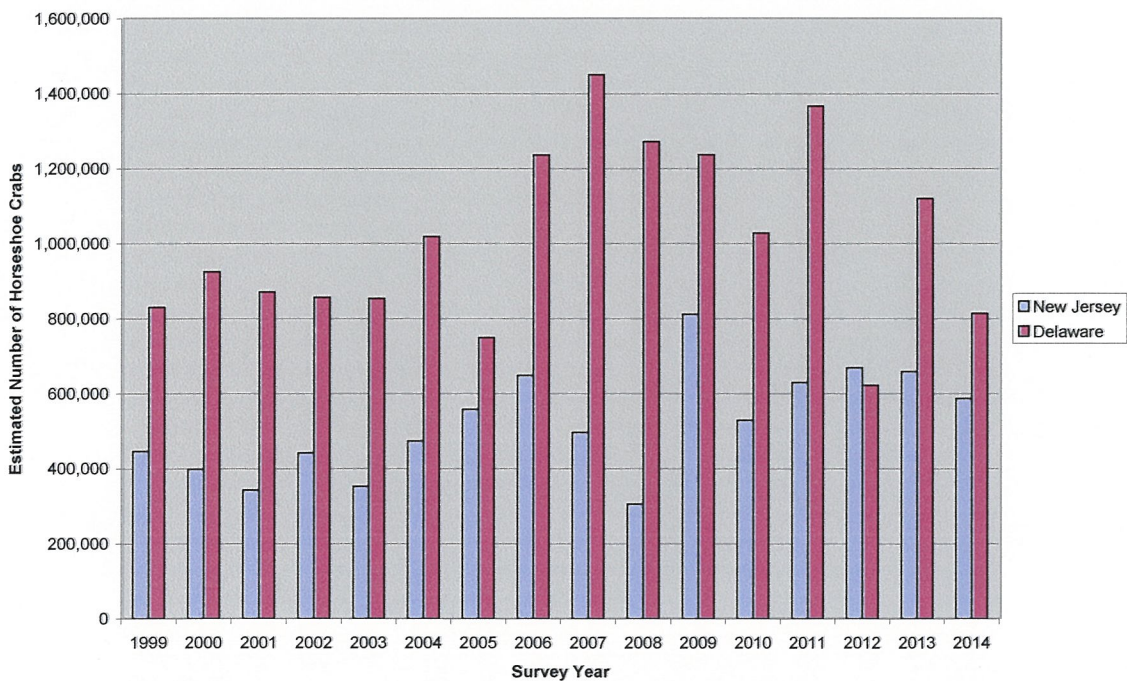


Figure 4. Seasonal Estimates of Horseshoe Crabs 1999-2014



**Figure 5. Seasonal Estimates of Male and Female Horseshoe Crabs  
1999-2014**

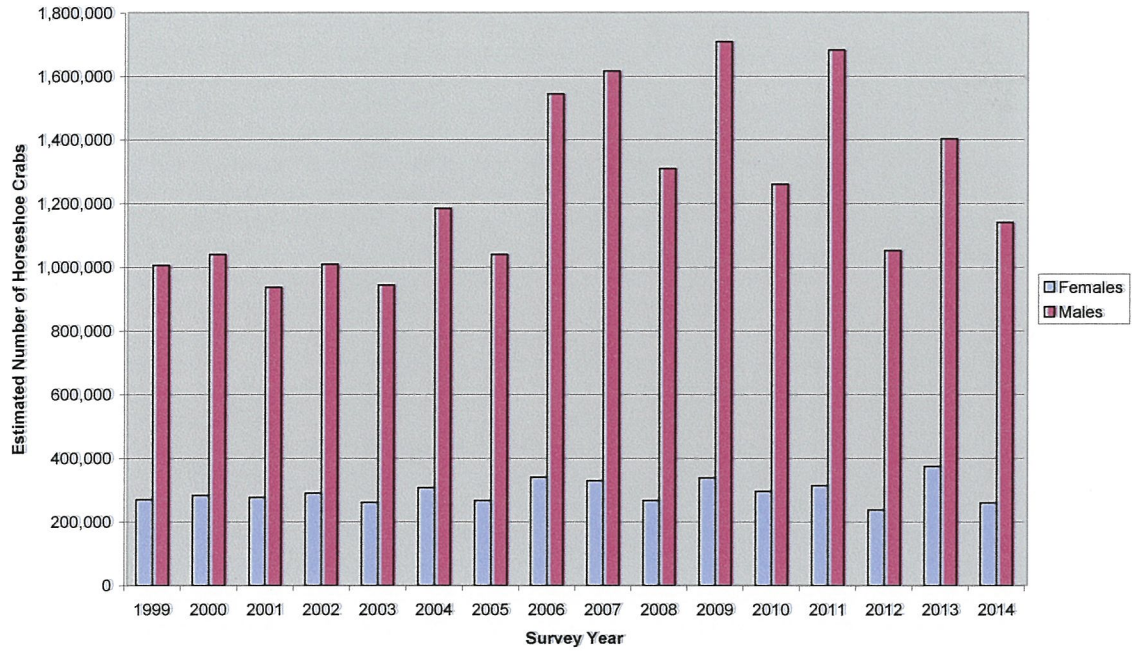




Table 3. Percentages of Horseshoe Crab Densities 1999-2014

Survey Year	State	Percentage				Dates Missed
		0	Low (<5)	Moderate (5-10)	High (>10)	
1999	New Jersey	4	65	10	6	15
	Delaware	8	43	6	11	31
2000	New Jersey	16	54	10	5	14
	Delaware	14	38	13	15	20
2001	New Jersey	10	63	5	5	17
	Delaware	13	45	17	6	19
2002	New Jersey	3	61	10	8	18
	Delaware	5	63	13	12	7
2003	New Jersey	17	60	7	3	13
	Delaware	18	50	8	10	13
2004	New Jersey	5	63	9	8	14
	Delaware	10	54	15	10	10
2005	New Jersey	14	48	6	10	21
	Delaware	14	51	11	8	16
2006	New Jersey	5	64	8	12	11
	Delaware	8	54	12	17	8
2007	New Jersey	16	58	1	10	15
	Delaware	10	43	15	18	15
2008	New Jersey	21	51	8	0	19
	Delaware	12	42	17	17	11
2009	New Jersey	4	50	8	14	24
	Delaware	10	51	13	15	12
2010	New Jersey	5	60	6	8	20
	Delaware	9	56	8	17	10
2011	New Jersey	10	58	15	7	10
	Delaware	8	49	10	21	12
2012	New Jersey	6	56	16	8	14
	Delaware	13	56	4	11	16
2013	New Jersey	11	56	15	8	10
	Delaware	13	51	13	17	6
2014	New Jersey	5	64	13	6	13
	Delaware	8	55	12	10	16

Table 4. Seasonal Estimates of Horseshoe Crabs 1999-2014

<b>Year</b>	<b>New Jersey</b>	<b>Delaware</b>	<b>Total</b>
<b>1999</b>	447,128	830,405	1,277,533
<b>2000</b>	398,847	925,837	1,324,684
<b>2001</b>	343,351	871,375	1,214,726
<b>2002</b>	442,586	857,362	1,299,948
<b>2003</b>	352,800	853,721	1,206,521
<b>2004</b>	474,019	1,019,014	1,493,033
<b>2005</b>	557,956	749,473	1,307,429
<b>2006</b>	648,728	1,236,627	1,885,355
<b>2007</b>	496,535	1,450,837	1,947,372
<b>2008</b>	306,306	1,272,312	1,578,618
<b>2009</b>	811,724	1,237,476	2,049,200
<b>2010</b>	529,606	1,028,611	1,558,217
<b>2011</b>	630,091	1,367,112	1,997,203
<b>2012</b>	668,950	622,619	1,291,569
<b>2013</b>	658,675	1,120,264	1,778,939
<b>2014</b>	587,460	814,120	1,401,580

Table 5. Average Sex Ratios and Male and Female Estimates 1999-2014

<b>Year</b>	<b>Sex Ratio</b>	<b>Females</b>	<b>Males</b>
<b>1999</b>	3.72	270,664	1,006,869
<b>2000</b>	3.67	283,658	1,041,026
<b>2001</b>	3.38	277,335	937,391
<b>2002</b>	3.48	290,167	1,009,781
<b>2003</b>	3.61	261,718	944,803
<b>2004</b>	3.85	307,842	1,185,191
<b>2005</b>	3.89	267,368	1,040,061
<b>2006</b>	4.53	340,932	1,544,423
<b>2007</b>	4.90	330,064	1,617,308
<b>2008</b>	4.90	267,562	1,311,056
<b>2009</b>	5.04	339,271	1,709,929
<b>2010</b>	4.25	296,803	1,261,414
<b>2011</b>	5.36	314,026	1,683,177
<b>2012</b>	4.41	238,737	1,052,832
<b>2013</b>	3.74	375,304	1,403,635
<b>2014</b>	4.38	260,517	1,141,063

Table 6. Tagged Horseshoe Crabs Observed During the Surveys 2007-2014

<b>Year</b>	<b>Total</b>	<b>Delaware</b>	<b>New Jersey</b>	<b>In Quadrat</b>	<b>Outside</b>	<b>Alive</b>	<b>Dead</b>	<b>Unreadable</b>
<b>2007</b>	116	95	21	30	86	102	14	3
<b>2008</b>	73	65	8	16	57	70	3	0
<b>"2009</b>	153	62	91	26	127	145	8	10
<b>2010</b>	100	71	29	19	81	94	6	14
<b>2011</b>	191	87	104	31	160	175	16	11
<b>2012</b>	106	42	64	50	56	104	2	4
<b>2013</b>	147	88	59	45	102	130	17	3
<b>2014</b>	104	56	48	22	82	94	10	1
<b>Totals</b>	<b>990</b>	<b>566</b>	<b>424</b>	<b>239</b>	<b>751</b>	<b>914</b>	<b>76</b>	<b>46</b>

Table 1. 2014 Survey Results- Densities and Estimates  
 A. New Jersey Beaches (\*Indicates beaches surveyed every year)

Moons Phase	Full-2	Full	Full+2	New-2	New	New+2	Full-2	Full	Full+2	New-2	New	New+2	Totals
Date	12-May	14-May	16-May	26-May	28-May	30-May	11-Jun	13-Jun	15-Jun	25-Jun	27-Jun	29-Jun	Totals
<b>Higbees * (0.98 km)</b>													
Density of HSC, Crabs/m	0	0	0.02	cancel	0.06	0.09	0.15	cancel	4.73	0.35	0.49	1.2	
Estimated Number of HSC	0	0	20	surveyors	59	88	147	surveyors	4,635	343	480	1,176	6,948
<b>North Cape May * (3 km)</b>													
Density of HSC, Crabs/m	0.02	0	0.01	0.04	0.09	0.1	0.63	cancel	4.58	0.09	0.69	0.43	
Estimated Number of HSC	60	0	30	120	270	300	1,890	weather	13,740	270	2,070	1,290	20,040
<b>Villas (2 km)</b>													
Density of HSC, Crabs/m	1.57	1.65	0	5.18	4.33	5.77	3.25	cancel	6.22	1.03	0.87	0.84	
Estimated Number of HSC	3,140	3,300	0	10,360	8,660	11,540	6,500	weather	12,440	2,060	1,740	1,680	61,420
<b>Townbank (2.3 km)</b>													
Density of HSC, Crabs/m	0.02	0.11	cancel	1.36	cancel	5.62	1.21	cancel	6.93	0.8	2.11	0.71	
Estimated Number of HSC	46	253	surveyors	3,128	surveyors	12,926	2,783	weather	15,939	1,840	4,853	1,633	43,401
<b>Norburys Landing (2.43 km)</b>													
Density of HSC, Crabs/m	9.34	6.95	0.6	4.71	3.64	10.73	2.31	cancel	3.65	0.4	0.54	0.49	
Estimated Number of HSC	22,696	16,889	1,458	11,445	8,845	26,074	5,613	weather	8,870	972	1,312	1,191	105,365
<b>South CSL * (2.2 km)</b>													
Density of HSC, Crabs/m	7.44	9.64	0.5	6.99	cancel	cancel	0.86	1.2	3.02	0.27	0.2	0.47	
Estimated Number of HSC	16,368	21,208	1,100	15,378	surveyors	surveyors	1,892	2,640	6,644	594	440	1,034	67,298
<b>Highs * (0.8 km)</b>													
Density of HSC, Crabs/m	11.92	8.16	1.26	4.21	4.59	6.48	1.56	cancel	1.04	0.48	0.47	0.42	
Estimated Number of HSC	9,536	6,528	1,008	3,368	3,672	5,184	1,248	weather	832	384	376	336	32,472
<b>Pierces Point (0.7 km)</b>													
Density of HSC, Crabs/m	11.51	12.74	9.38	9.31	2.48	9.26	1.56	cancel	3.9	0.29	2.95	1.11	
Estimated Number of HSC	8,057	8,918	6,566	6,517	1,736	6,482	1,092	weather	2,730	203	2,065	777	45,143
<b>Kimbles (1 km)</b>													
Density of HSC, Crabs/m	11.46	7.07	0.32	7.69	2.74	4.17	0.25	cancel	0.86	0.04	0	0.1	
Estimated Number of HSC	11,460	7,070	320	7,690	2,740	4,170	250	weather	860	40	0	100	34,700
<b>Reeds * (1.53 km)</b>													
Density of HSC, Crabs/m	9.65	10.69	2.97	13.15	4.12	3.61	1.94	2.42	3.23	0.03	0.22	0.16	
Estimated Number of HSC	14,765	16,356	4,544	20,120	6,304	5,523	2,968	3,703	4,942	46	337	245	79,851
<b>Fortescue (2.6 km)</b>													
Density of HSC, Crabs/m	0.98	2.08	1.18	10.58	1.2	4.49	2.23	2.66	2.36	0.1	0.12	0.01	
Estimated Number of HSC	2,548	5,408	3,068	27,508	3,120	11,674	5,798	6,916	6,136	260	312	26	72,774
<b>Gandys * (1.2 km)</b>													
Density of HSC, Crabs/m	0	cancel	cancel	1.37	cancel	0.27	4.22	cancel	9.15	cancel	0.03	0	
Estimated Number of HSC	0	other	surveyors	1,644	no access	324	5,064	weather	10,980	surveyors	36	0	18,048
<b>Totals</b>	88,676	85,929	18,114	107,278	35,406	84,285	35,246	13,259	88,748	7,012	14,021	9,488	587,460

Table 1. 2014 Survey Results - Densities and Estimates  
 B. Delaware Beaches (\*Indicates Beaches Surveyed Every Year)

Month Phase	Full-2 12-May	Full 14-May	Full+2 16-May	New-2 26-May	New 28-May	New+2 30-May	Full-2 11-Jun	Full 13-Jun	Full+2 15-Jun	New-2 25-Jun	New 27-Jun	New+2 29-Jun	Totals
<b>Cape Henlopen (1.5 km)</b>													
Density of HSC, Crabs/m	0.27	1	3.06	0.77	cancel	4.84	2.87	3.21	6.35	1.98	2.31	2.81	
Estimated Number of HSC	405	1,500	4,590	1,155	weather	7,260	4,305	4,815	9,525	2,970	3,465	4,215	44,205
<b>Broadkill (1.5 km)</b>													
Density of HSC, Crabs/m	0.24	0.1	0.17	6.7	cancel	4.95	0.3	9.37	5.38	1.20	0.46	1.2	
Estimated Number of HSC	360	150	255	10,050	no access	7,425	450	14,055	8,070	1,800	690	1,800	45,105
<b>Primehook * (2.0 km)</b>													
Density of HSC, Crabs/m	7.29	0.34	1.83	8.97	0	5.84	0.8	cancel	9.86	0.25	0.14	0.49	
Estimated Number of HSC	14,580	680	3,660	17,940	0	11,680	1,600	weather	19,720	500	280	980	71,620
<b>Fowler * (3 km)</b>													
Density of HSC, Crabs/m	0.62	cancel	0.34	2.75	cancel	0.9	0.19	cancel	cancel	0.22	0.07	0	
Estimated Number of HSC	1,860	no access	1,020	8,250	no access	2,700	570	no access	surveyors	660	210	0	15,270
<b>Slaughter * (3 km)</b>													
Density of HSC, Crabs/m	1.71	cancel	0.25	3.26	cancel	0.34	0.13	13.52	cancel	0.60	0.23	2.45	
Estimated Number of HSC	5,130	no access	750	9,780	no access	1,020	390	40,560	surveyors	1,800	690	7,350	67,470
<b>Big Stone * (5.0 km)</b>													
Density of HSC, Crabs/m	0.06	0.07	0.04	15.9	cancel	6.27	0.16	11.05	9.11	0.13	0.36	0.98	
Estimated Number of HSC	300	350	200	79,500	weather	31,350	800	55,250	45,550	650	1,800	4,900	220,650
<b>Bennetts Pier (2.6 km)</b>													
Density of HSC, Crabs/m	0.37	0	1.12	1.23	cancel	0.88	cancel	0	0.13	1.01	0.03	0.19	
Estimated Number of HSC	962	0	2,912	3,198	no access	2,288	no access	0	338	2,626	78	494	12,896
<b>South Bowers (2.3 km)</b>													
Density of HSC, Crabs/m	2.61	cancel	2.22	10.86	cancel	8.14	cancel	cancel	6.82	0.55	cancel	1.29	
Estimated Number of HSC	6,003	no access	5,106	24,978	no access	18,722	no access	no access	15,686	1,265	no access	2,967	74,727
<b>North Bowers * (1.3 km)</b>													
Density of HSC, Crabs/m	4.47	0.67	2.65	2.81	cancel	2.72	0.17	2.25	2.44	0.16	0.01	0.64	
Estimated Number of HSC	5,811	871	3,445	3,653	no access	3,536	221	2,925	3,172	208	13	832	24,687
<b>Ted Harvey WMA (1.0 km)</b>													
Density of HSC, Crabs/m	10.42	0.69	11.53	13.99	cancel	9.52	0.16	8.86	11.63	1.10	0.04	0.68	
Estimated Number of HSC	10,420	690	11,530	13,990	no access	9,520	160	8,860	11,630	1,100	40	680	68,620
<b>Kitts Hummock * (1.0 km)</b>													
Density of HSC, Crabs/m	6.31	3.00	11.83	20.07	0.05	12.69	cancel	15.82	10.57	0.51	0.06	1.32	
Estimated Number of HSC	6,310	3,000	11,830	20,070	50	12,690	weather	15,820	10,570	510	60	1,320	82,230
<b>Pickering (1 km)</b>													
Density of HSC, Crabs/m	8.29	6.4	4.83	22.83	0	19.45	0.03	13.73	9.61	0.20	0.12	0.96	
Estimated Number of HSC	8,290	6,400	4,830	22,830	0	19,450	30	13,730	9,610	200	120	960	86,450
<b>Woodland * (0.5 km)</b>													
Density of HSC, Crabs/m	0	cancel	0	0	cancel	0	cancel	cancel	0.38	0	0	0	
Estimated Number of HSC	0	no access	0	0	no access	0	no access	no access	190	0	0	0	190
<b>Totals</b>	60,431	13,641	50,128	215,394	50	127,641	8,526	156,015	134,061	14,289	7,446	26,498	814,120

**Table 2. Comparison of Data on Horseshoe Crabs Spawning on Delaware Bay Shores  
Years 1999-2014**

	26-May-14	23-May-13	22-May-12	3-Jun-11	29-May-10	24-May-09	3-Jun-08	1-Jun-07	27-May-06	8-Jun-05	21-May-04	14-Jun-03	28-May-02	5-Jun-01	18-May-00	30-May-99
Horseshoe Crabs	322,672	384,548	341,062	477,715	472,759	586,298	346,319	463,587	503,435	527,520	356,739	259,957	333,553	216,929	272,770	422,775
New Jersey Estimate	107,278	108,194	184,046	190,449	193,463	245,444	69,669	112,497	222,653	222,168	105,973	60,272	130,164	19,726	70,293	141,720
Delaware Estimate	215,394	276,354	157,016	287,266	279,296	340,854	276,650	351,090	280,782	305,352	250,766	199,685	203,389	197,203	202,477	281,055
Beaches in DE	13	13	13	13	13	13	13	13	13	13	13	13	13	13	11	9
Beaches in NJ	12	12	12	12	12	13	12	11	11	11	11	10	10	10	11	13
Beaches in DE	Kitts Hummock Pickering Big Stone	Slaughter Pickering Big Stone	Pickering Ted Harvey S. Bowers Big Stone	Big Stone Slaughter S. Bowers Pickering	Big Stone Slaughter S. Bowers Pickering	Big Stone Slaughter S. Bowers Pickering	Big Stone Slaughter S. Bowers Pickering	Big Stone Slaughter S. Bowers Pickering	Big Stone Slaughter S. Bowers Pickering	Big Stone S. Bowers Bennets Slaughter Pickering	Big Stone Slaughter Pickering	Big Stone Slaughter Pickering Ted Harvey	S. Bowers Slaughter Big Stone Pickering	Slaughter Big Stone Big Stone Pickering	Slaughter Big Stone Big Stone Pickering	Slaughter Big Stone Big Stone Pickering
Beaches in NJ	Norburys Reeds Fortescue	Fortescue Norburys	Fortescue South CSL Gandys	South CSL Norburys Gandys	South CSL Norburys Gandys	South CSL Norburys Reeds	South CSL Norburys	South CSL Norburys Fortescue	South CSL Norburys Fortescue	South CSL Norburys Villas	South CSL Fortescue Norburys	South CSL Fortescue Norburys	South CSL Gandys Sea Breeze	South CSL Norburys	South CSL Norburys South CSL	Townbank Norburys South CSL