



## MARYLAND COASTAL BAYS PROGRAM

9919 Stephen Decatur Highway – Suite 4

OceanCity, Maryland 21842

(410) 213-2297 - PHONE

(410) 213-2574 – FAX

[mcbp@mdcoastalbays.org](mailto:mcbp@mdcoastalbays.org)

[www.mdcoastalbays.org](http://www.mdcoastalbays.org)

Carol Cain, Technical Coordinator, MCBP

Steve Doctor, Maryland Department of Natural Resources, Fisheries Division

### 2014 Horseshoe Crab Spawning Survey results

The thirteenth annual horseshoe crab (*Limulus polyphemus*) spawning survey continues the local assessment of population abundance and critical habitat availability in the Coastal Bays. Thanks to the generosity of volunteers who provided their time and effort, 66 surveys were collected from five beach sites, and reveal a sum total of 35,278 crabs. This is more than 11% higher than the total number observed last year; 31,873 (Table 1).

Horseshoe crabs and their eggs are a critical food source for many marine species including sharks, turtles and especially shore birds. Additionally, these crabs are harvested by waterman for bait and for biomedical uses. The status of horseshoe crab populations along the Atlantic Coast are slowly evolving through surveys, research, and harvest records.

Horseshoe crab spawning varies by latitude but generally occurs between May and July along the Atlantic coast. Spawning in the Maryland coastal bays typically peaks in June, and often continues through July. This pattern was repeated in 2014, indicating the spawning period was protracted through late spring and early summer.

The Maryland Coastal Bays survey was initially set up to mirror the same time frame as the Delaware Bay horseshoe crab spawning surveys (May and June) to allow for comparisons. Since the noticeable temporal range of spawning seemed longer than this initial sampling period, the 2014 survey was again conducted throughout July as it has been since 2008. All surveys begin in late May and continue throughout July to better capture peak spawning activity.

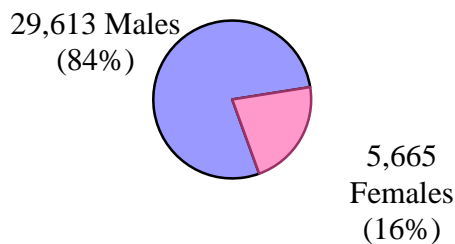
YEAR	May	June	July	Aug	Grand Total
2002	0	105			105
2003	2	521			523
2004	57	632			689
2005	48	261			309
2006	125	3,793			3,918
2007	711	6,636	270		7,617
2008	1	4,689	5,928		10,618
2009	10	18,627	3,190	19	21,846
2010	1,205	17,285	4,948		23,438
2011	5	15,166	7,934		23,105
2012	2,032	13,330	5,748	17	21,127
2013	261	22,875	8,737		31,873
2014	560	28,790	5,928		35,278
Grand Total	5,017	132,710	42,683	36	180,446

The majority of crabs, 26,194 (82.2%), were observed to be spawning at or within one meter of the high tide line. It was noted that during the highest spawning activity along Skimmer Island that a substantial number of the crabs were spawning up to 2 meters out along the shoreline. These results only reflect those estimates for 1m<sup>2</sup> of the high tide line to be consistent in surveying methodology, and therefore the estimates of total crabs on the beach during high density spawning are lower than actually observed.

Table 2. Total number of Males and Females and sex ratio by year.

	Males	Females	M:F ratio
2002	67	38	1.8:1
2003	314	209	1.5:1
2004	438	251	1.8:1
2005	182	127	1.4:1
2006	2,939	979	3.0:1
2007	5,799	1,818	3.2:1
2008	8,289	2,329	3.6:1
2009	17,551	4,295	4.1:1
2010	18,642	4,796	3.9:1
2011	18,508	4,597	4.0:1
2012	16,872	4,255	4.0:1
2013	24,876	6,997	3.6:1
2014	29,613	5,665	5.2:1

**2014 Male to Female Ratio  
(5.2 : 1)**



The survey counts over the last decade indicate a gradual increase in male to female ratios and have remained relatively stable (Table 2). In 2014, we found 5.2 males to every female crab. This is important for maintaining genetic diversity. Conservationists and ecologists know from experience in managing other economically important species that the higher the genetic diversity, the healthier the population. Harvest regulations in Delaware Bay, Maryland, and Virginia have capped the number of female horseshoe crabs that can be harvested. This data indicates that male biased harvest in recent years has not had an effect on the local spawning population's ratio.

It is widely recognized that temperature, wind direction and wave energy influence where crabs will spawn (Table 3). It is noteworthy that in 2009, 546 crabs were counted along the west side of Assateague Island, 49 crabs were observed there in 2010, and 413 in 2012. Previous surveys have indicated that horseshoe crabs often move to new areas of spawning along beaches from year to year, which tends to complicate replicate site monitoring. Increases in abundance were documented at Skimmer Island and at the Oceanic Motel. Assateague Island, Gudelsky Park and Sunset Island saw decreases from last year.



Residents at the Sunset Island community, 67<sup>th</sup> bayside in Ocean City, MD recorded 353 total spawning crabs in 2014. Photo credit: Carol Sottili



Substantial numbers of crabs and wading birds were observed at the sand deposit areas on western Skimmer Island. Photo credit: C. Cain

Skimmer Island has been the target of beach renourishment efforts in the past three years. More than 2,500 cubic yards of sand that has collected in the approach channel to the Ocean City Fishing Center has been dredged and deposited on Skimmer Island. As a result, this has expanded the available area for spawning. Note that the expanded areas were not surveyed this year and are not reflected in the final results for 2014. Waves and subsequent spawning causes egg masses to wash out of the nests and collect in the wrack line. The eggs feed many species of birds and fish and are an integral part of the food web.

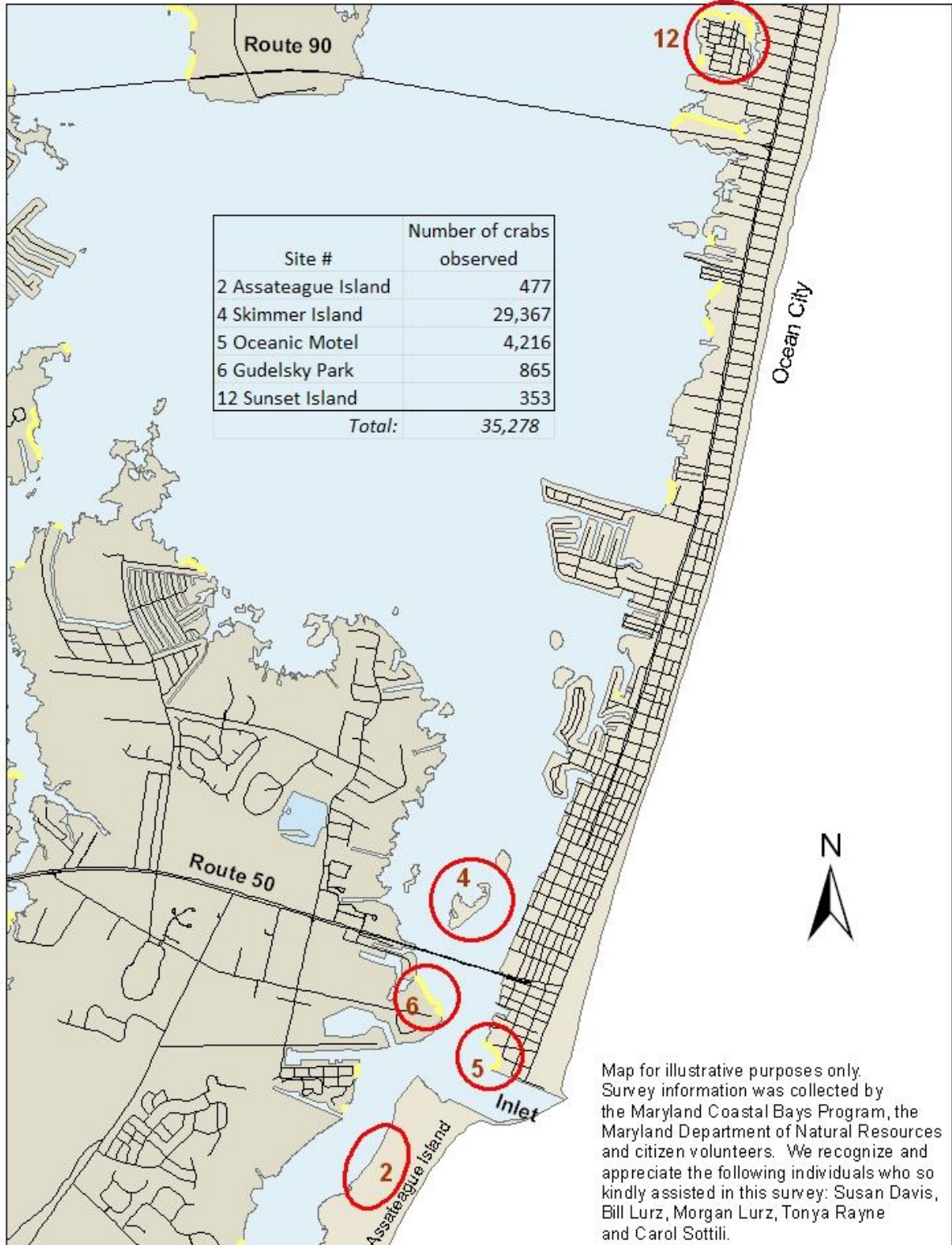
Table 3. Number of Horseshoe Crabs observed at survey locations over time.

<b># of crabs observed</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
North Assateague Island bayside	1,007	413	489	477
Skimmer Island (two sites)	21,265	20,138	25,338	29,367
Oceanic Motel at Inlet	824	563	2,652	4,216
Gudelsky Park in West O.C.	9	13	2,432	865
Sunset Island (67 <sup>th</sup> St.)	*	*	962	353
Macky's Bar & Grill (54 <sup>th</sup> St.)	#	#	12	#

\*new site      #site lacking volunteer presence



# Maryland Coastal Bays 2014 Horseshoe Crab Spawning Survey



Another consideration is changes in frequency and volunteer coverage of monitoring beaches. Access to the bayside of northern Assateague Island and Skimmer Island was surmounted with the assistance of DNR Fisheries Service in 2006. An attempt to standardize these findings through count per unit effort via “total hours invested” and “number of surveys returned” is calculated, (Table 4).

Table 4. Catch Per Unit Effort of Horseshoe Crabs by year.

Year	total # of crabs	total hours	CPUE- hours	# of surveys	CPUE- surveys
2002	105	7.52	13.96	19	5.53
2003	523	5.57	93.90	13	40.23
2004	689	35.22	19.56	53	13.00
2005	309	27.07	11.41	46	6.72
2006	3,918	18.63	210.31	57	68.74
2007	7,617	27.28	279.22	115	66.23
2008	10,690	16.57	645.14	86	124.30
2009	21,846	19.87	1,099.63	63	346.76
2010	23,438	11.08	2,114.71	42	558.05
2011	23,105	30.85	748.95	58	398.36
2012	21,127	14.01	1,509.07	60	352.12
2013	31,873	20.45	1,558.58	83	384.01
2014	35,278	12.52	2817.73	66	534.52

### Long term trends

The 2014 counts were higher than the three year average counts, and both are considerably higher than the thirteen year mean. The data seem to indicate that there has been a substantial increase in spawning activity in the Maryland Coastal Bays since the survey standardization in 2006. This is reflected in both CPUE and the total number of surveys comparisons. This is noteworthy because harvest restrictions were placed on the commercial fishery in 2001 and have since been maintained. This data indicates that the commercial harvest restrictions are working to increase local horseshoe crab populations.

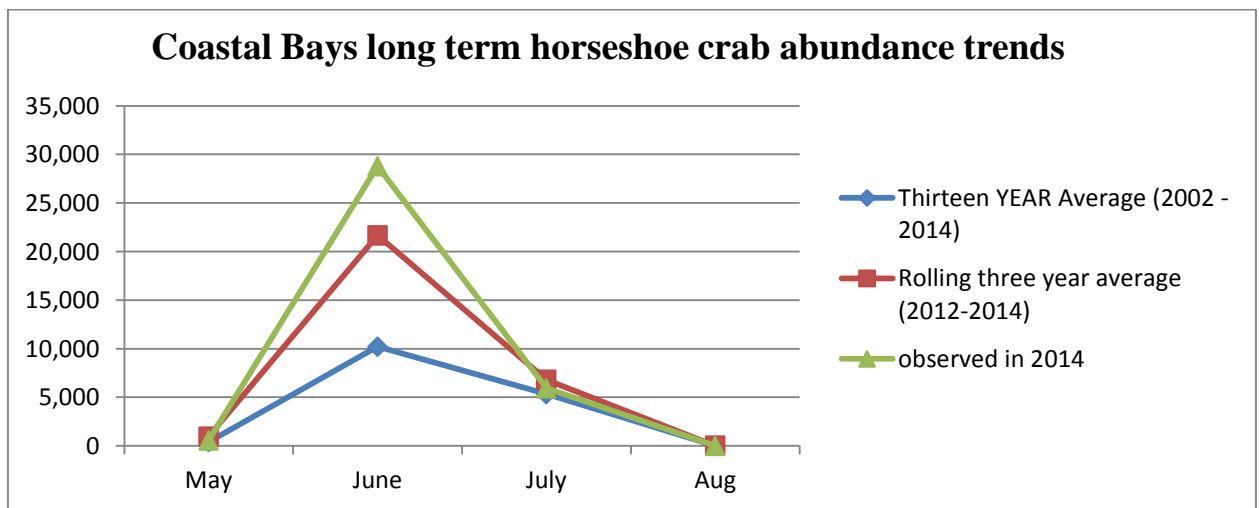


Figure 1. Long term trends

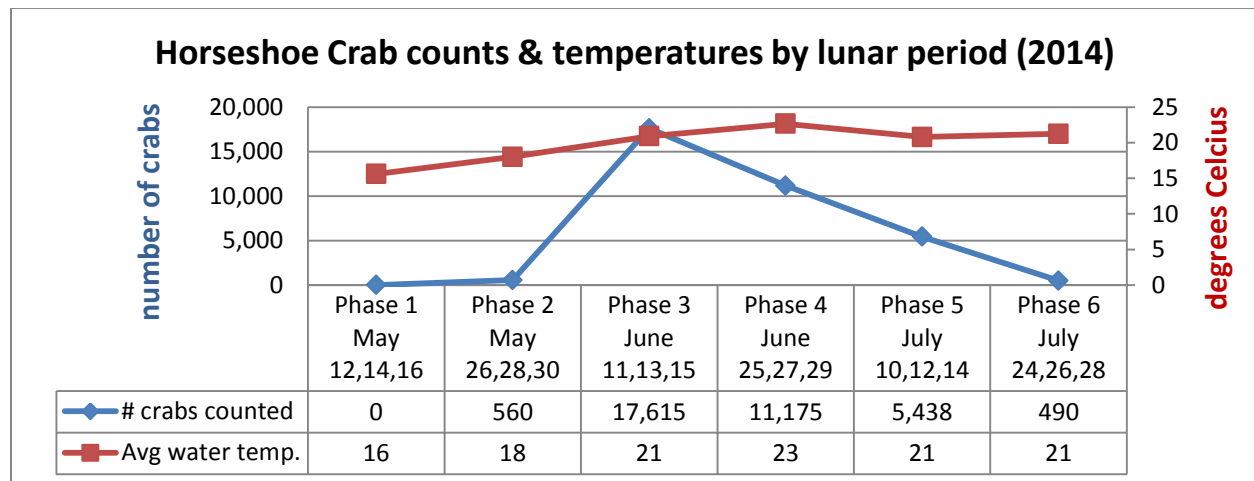
## Tagging and recaptures

Dick Arnold, a Fish and Wildlife volunteer has tagged 7,998 horseshoe crabs in the Maryland Coastal Bays since 2010. In 2014 Mr. Arnold tagged 600 horseshoe crabs, 99% female at the Oceanic Motel near the Ocean City inlet. Eight tagged crabs were observed and reported for this year.

## Temperature and Lunar Period analysis

Spawning activity began at around 18°C in 2014 in Maryland. Temperature and lunar period data in 2014 indicates spawning peaked in lunar phase three (mid-June) and at a temperature of 21 degrees centigrade (Figure 2). Temperature is taken in the water by handheld thermometer. Similar analysis done in the Delaware Bay spawning survey has found that the critical water temperature for spawning initiation is 15°C. That survey uses the sea buoy at the mouth of Delaware Bay for their temperature measurement which may explain the difference (Michels et al 2010). The water temperature is cooler at an open deep water site such as the sea buoy at the mouth of Delaware Bay, than in the shallow water where spawning is actually occurring, as is measured in our survey.

Figure 2. Horseshoe crabs counts and spawning temperatures by lunar period.



## References

Michels, S., D. Smith, and S. Bennett. 2010. Horseshoe crab spawning activity in Delaware Bay: 1999-2009. Report to the Atlantic States Marine Fisheries Commission's Horseshoe Crab Technical Committee (March 26, 2010).

Sweka, J.A, et. al. 2014. Horseshoe Crab Stock Assessment Update. Report by the Atlantic States Marine Fisheries Commission's Horseshoe Crab Technical Committee. (August 2014)

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