

The 2007 Delaware Bay Horseshoe Crab Spawning Survey

**Benjie Lynn Swan
William R. Hall, Jr.
Carl N. Shuster, Jr.**

Abstract

In May and June, the shores of Delaware Bay play host to hundreds of spawning horseshoe crabs. During this same period, on 12 nights timed to coincide with the new and full moon phases, the yearly Delaware Bay horseshoe crab survey is conducted. All systematic counts are taken in the darkness at high tides along 24 beaches, 11 in New Jersey and 13 in Delaware.

The scheduled 288 dates for surveying resulted in 245 or 85% of the dates completed. Cancellations were due to flooding (20), weather related (11), volunteer unavailability (5) and miscellaneous reasons (7). Of the scheduled dates, actual coverage totaled 85% or 245 dates of the 288 proposed dates.

2007 produced its highest single day peak estimate of 463,587 on June 1st, with the moon at its fullest. It proved lower than last year's estimate of 527,520. Delaware's 2007 single day peak estimate of 351,090 was the highest recorded since 1997's figure of 377,323. On the New Jersey shores, the peak estimate of 112,497 was slightly more than half the previous two year's estimates of 2005 (222,168) and 2006 (222,653).

The 2007 male to female sex ratio (4.90) surpassed last year's record estimate of 4.53 and proved considerably higher than previous years as well as being the highest ratio since 2000. The preceding years' ratios were 3.67 in 2000, 3.38 in 2001, 3.48 in 2002, 3.61 in 2003, 3.85 in 2004 and 3.89 in 2005.

The aggregate total of seasonal activity for New Jersey and Delaware was 1,947,372 horseshoe crabs (330,064 females and 1,617,308 males), slightly higher than last year's estimate of 1,885,355 individuals. However, due to the higher sex ratio of male to female crabs, the number of spawning females decreased to 330,064 and the males increased to 1,617,308.

Introduction

Since its inception in 1999, our survey has made tremendous strides and is now considered the premier method of estimating the spawning population of horseshoe crabs. To continue with this undertaking each year we rely on many eager and energetic groups and volunteers who generously give of their time to count, enter and analyze the data reaped from the results of the survey.

Methods

Horseshoe crabs were enumerated in the months of May and June 2007 along the shores of the Delaware Bay. The beaches represented in this year's count totaled 24 (13 along the state of Delaware's coast and 11 along the Delaware Bay coast of New Jersey). The Delaware beaches north to south were Woodland, Pickering, Kitts Hummock, Ted Harvey Wildlife Management Area (WMA), North Bowers, South Bowers, Bennetts Pier, Big Stone, Slaughter, Fowler, Primehook, Broadkill and Cape Henlopen. New Jersey beaches included Sea Breeze, Fortescue, Gandys, Reeds, Pierces Point, Highs, South Cape Shore Lab, Norburys Landing, Townbank, North Cape May and Sunset Beach.

Counts were taken simultaneously along the beaches at the high tides encompassing the new and full moons. The dates of counting were April 30th, May 2nd, 4th, 14th, 16th, 18th, 30th and June 1st, 3rd, 13th, 15th and 17th. High tide times ranged from 7:29 pm to 11:28 pm allowing adjustments for tidal flow entering the Bay.

Results

Coverage by the volunteers accounted for 85% or 245 of the entire 288 scheduled counts. In New Jersey, 20 dates were not staffed, 2 of these dates due to volunteer no-shows, 3 weather related, 9 due to flooding and 6 for miscellaneous circumstances. The nine cancellations due to flooding occurred at South Cape Shore Lab May 18th, Pierces Point June 3rd and June 13th, Gandys Beach June 13th and 15th and Sea Breeze May 18th, June 13th, 15th and 17th. Table 1. A.

Twenty three cancellations occurred in Delaware during the 2007 spawning season. Of these, 8 were canceled due to weather, 11 for no access and 3 due to lack of volunteers. The majority of Delaware's cancellations occurred on June 3rd (10 of 13 beaches canceled) and June 13th (8 of 13 beaches canceled). On the June 3rd date, weather cancellations occurred at Cape Henlopen, Primehook, Fowler, Big Stone, Bennetts and South Bowers, access problems arose at Ted Harvey WMA, Kitts Hummock and Woodland and volunteers were not available at North Bowers. On June 13th, Fowler, Slaughter, Big Stone, South Bowers and Woodland beaches were not surveyed due to access difficulties, Primehook for weather and Kitts Hummock for no volunteers. Table 1. B.

This year's survey produced a marked increase in the estimated number of spawners along Delaware's shores and a decrease in spawners along New Jersey's shores. The peak of activity was June 1st, the full moon date with 463,587 individuals estimated. Delaware spawners were calculated to be 351,090 on this date and New Jersey spawners 112,497. Both of these counts were the highest estimate for a single night during the season.

Eighty-six percent of the seasonal spawning occurred during the second and third set of counts May 14th, 16th and 18th and May 30th, June 1st and June 3rd. The June 3rd date estimate (21,987) contributed little to the percentage as many cancellations and few crabs were observed due to weather related issues. Table 1. Figure 1.

Spawning along the New Jersey shoreline was at its highest during mid May and early June with 84% of the total seasonal spawning activity occurring. Spawning activity for the overall season was the greatest at South Cape Shore Lab (162,316 individuals). The other beaches held lesser numbers of horseshoe crabs. In particular, Reeds Beach and Fortescue had far less spawning activity than previous years. The highest densities recorded were 23.76 crabs per meter at South Cape Shore Lab and 21.39 crabs per meter on Highs Beach. These densities were achieved on May 16th. Table 1. A.

In Delaware, 81% of the estimated number of spawners were observed during the May 14th, 16th and 18th and May 30th. June 1st and June 3rd counts. The highest seasonal activity occurred on Big Stone beach and was estimated to be 345,300. The other top estimates were 241,950 at Slaughter and 226,665 at South Bowers. The greatest densities occurred at Pickering Beach with 28.18 crabs per meter on May 16th, 28.07 on May 30th and 27.68 on June 1st. Table 1. B.

The 2007 male to female ratio was 4.90, higher than last year's ratio of 4.53. This year's ratio exceeded the previous 1999-2005 ratios of 3.72, 3.67, 3.38, 3.48, 3.61, 3.85, 3.89. respectively. (Sex ratios are computed by averaging the total number of males and females counted throughout the entire season.)

The seasonal estimate of 1,947,372 is a slight increase over previous years' estimates. Spawning individuals increased 62,017 from the 2006 estimate of 1,885,355 (Table 4 and Figure 4). On Delaware beaches, numbers increased by 214,210 while the New Jersey number dropped by 152,193 individual crabs. Utilizing the sex ratios, male spawners increased by 72,885 but spawning females decreased by 10,868 baywide (table 5, figure 5).

We observe and utilize four levels of spawning activity to categorize the densities for each count. No spawning activity = 0 crabs, low activity = less than 5 crabs per meter, moderate = 5-10 crabs per meter

and high activity = greater than 10 crabs per meter. The data is then analyzed in percentages since dates and/or beaches may change yearly. As in previous years, the majority of the dates surveyed (43% in DE and 58% in NJ) showed horseshoe crab densities lower than five crabs per meter. High densities of horseshoe crabs were observed with more frequency than in previous years. In New Jersey, the percentage of densities (10%), greater than 10 crabs per meter, was higher than the average (8%) percentage calculated from previous survey years 2001-2006. High densities in Delaware were reached on 18% of the survey dates. This percentage was the highest since 2001 as well as much higher than the average density of 10.5%. Moderate densities in New Jersey were observed only 1% of the time along the Delaware Bay shores and is by far the lowest since 2001 (percentages ranging from 5 - 10%). Table 3 and Figure 3.

Thirty-six dates (12.5%) with zero crabs observed were in New Jersey (21) and in Delaware (15). Most counts (18) containing zero crabs in New Jersey were noted during the first round of counts April 30th, May 1st and May 3rd at the most southern and northern beaches in New Jersey. Six of the 11 dates in Delaware occurred at Woodland beach, the most northern surveyed beach in Delaware during the May dates.

Discussion

This year the trends in spawning numbers deviated from the previous two years' data. Spawning estimates were drastically reduced along the New Jersey shores of Delaware Bay. The peak estimate coupled with the seasonal estimate reveal a marked decrease in New Jersey's spawning numbers. Numbers plummeted particularly at Reeds beach (27,632 in 2007 down from 84,502 in 2006) and Fortescue beach (31,694 spawners down from 94,402 in 2006). During this year's season, the shores of Delaware welcomed 214,210 additional spawners than last year. Slaughter, Big Stone and South Bowers beaches in Delaware had much higher estimates of spawners than last year.

Flooding was more of a factor in 2007 with many cancellations (9 in Delaware and 11 in New Jersey). Counting along the beaches was hampered by the high water conditions. Fortescue volunteers reported counting was difficult due to water/beach conditions and surveyors at Reeds noted extreme high water.

The 2007 estimate for Delaware of 351,090 spawners is the highest estimate encountered since the year 1997. On the flip side, New Jersey's estimate was almost half of the years 2005 and 2006 estimates. A greater percentage of densities were zero and the percentage of medium densities (5 to 10 horseshoe crabs per quadrat) in New Jersey were almost non existent (1%). The high density percentage for 2007 in both states was above the average taken from previous years (2001-2006).

This year's spawning numbers of 1,947,372 exceeded previous years' estimates. However, the sex ratio of male to female crabs has been rising steadily with this year's male to female ratio showing a considerable increase. The ratio of 4.9 coupled with the 2007 seasonal estimate translates into an increase of males only. The estimated number of females dropped in 2007 (152,193 less females than last year).

Acknowledgements

Our sincere thanks to all the volunteers. The States of New Jersey and Delaware deserve our thanks as well for their support. A special thank you also to Dave Smith for his contributions to the spawning survey.

Figure 1. NJ and DE Spawning Estimates During 2007 Survey

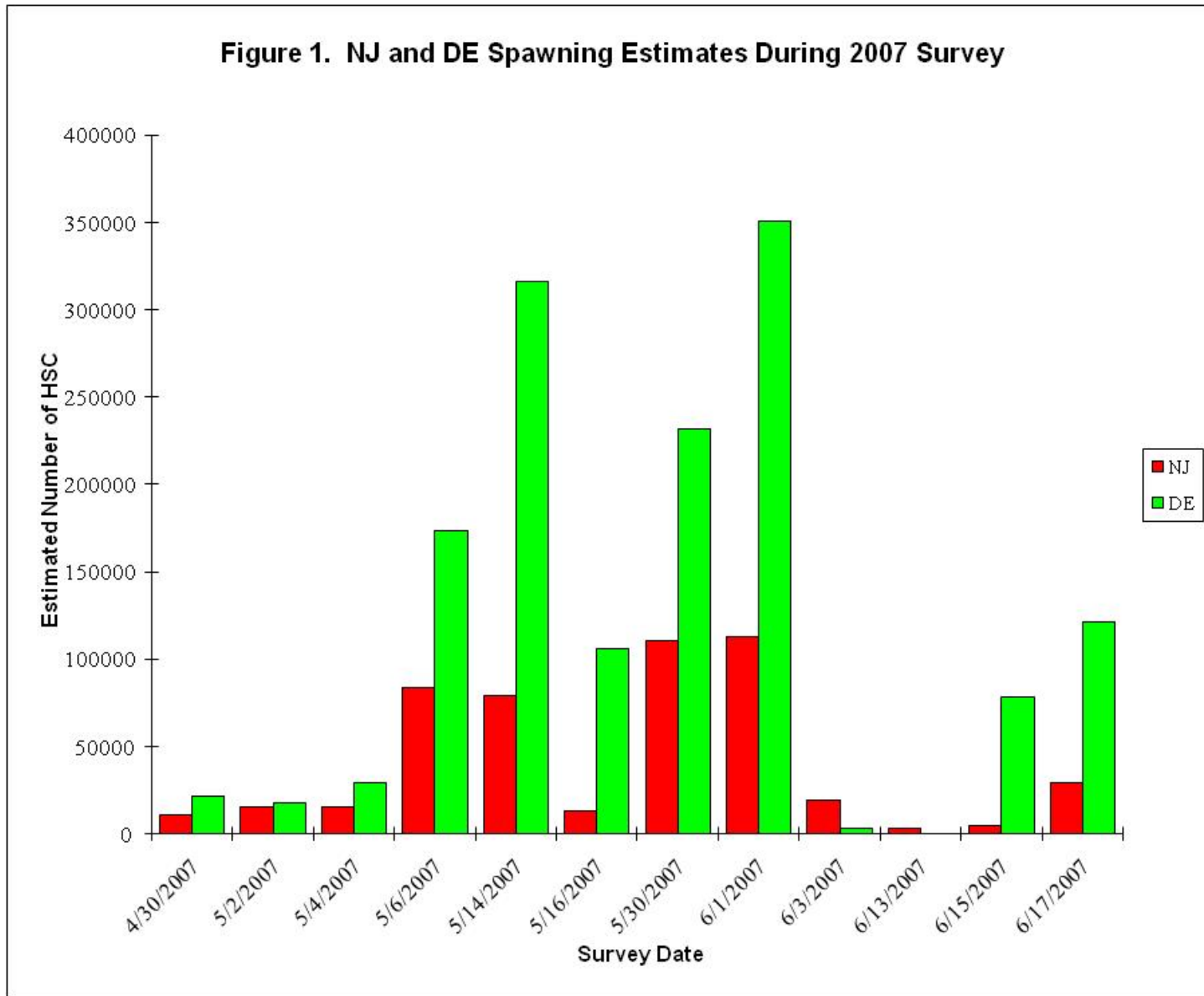


Figure 2. Peak Estimates of Spawning Horseshoe Crabs 1997-2007

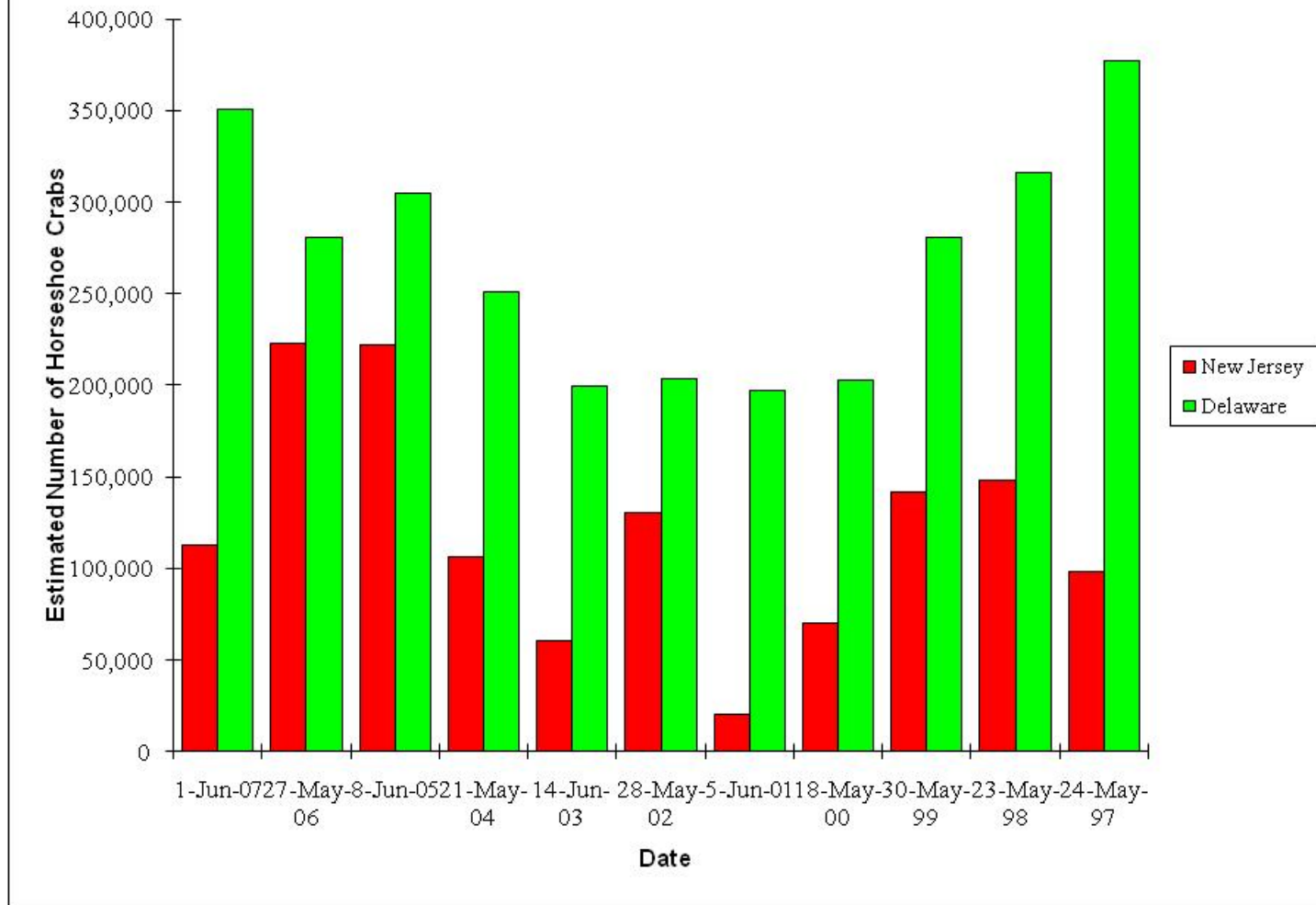


Figure 3. Densities of Horseshoe Crabs 2001-2007

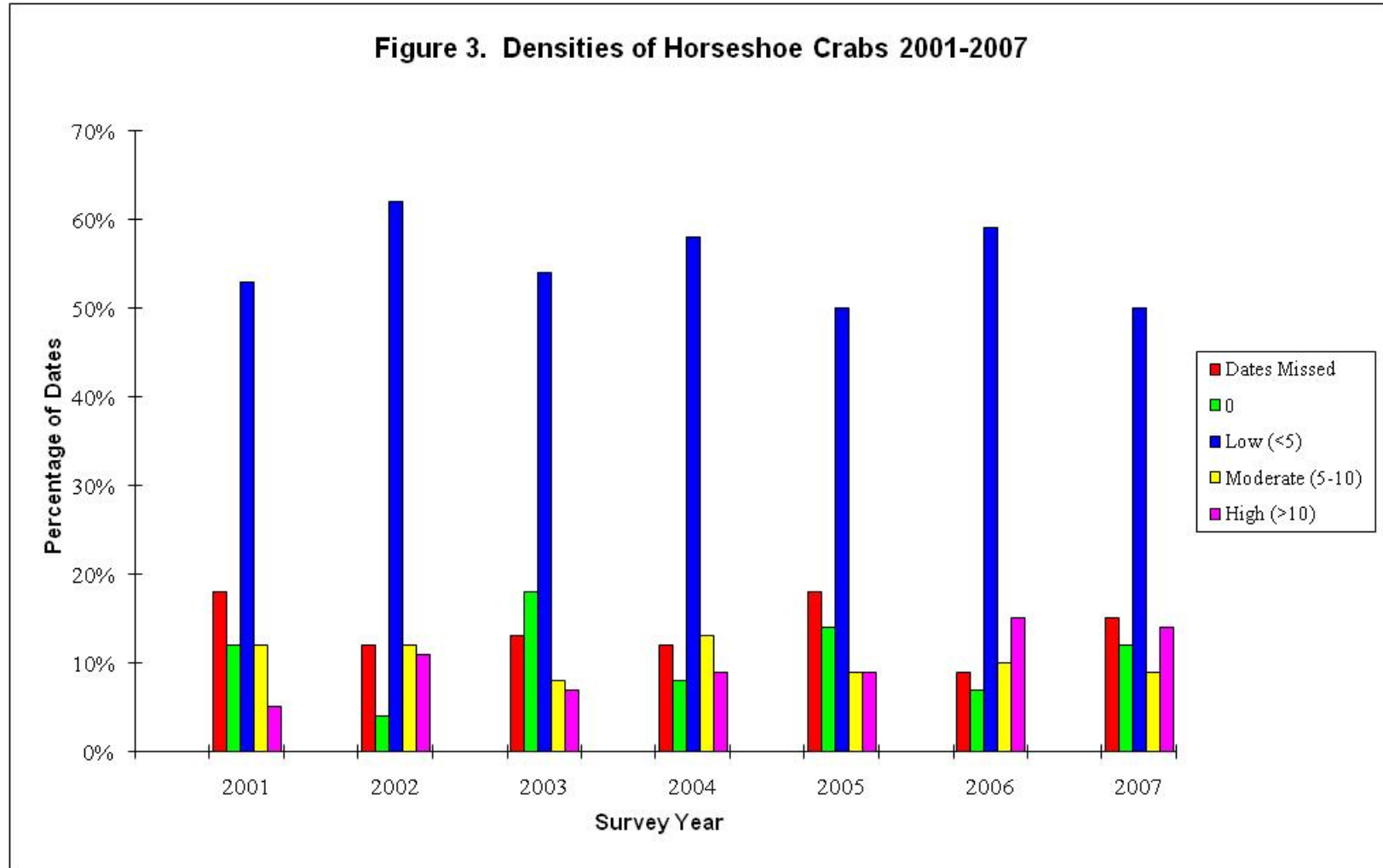


Figure 4. Seasonal Estimates of Spawning Horseshoe Crabs

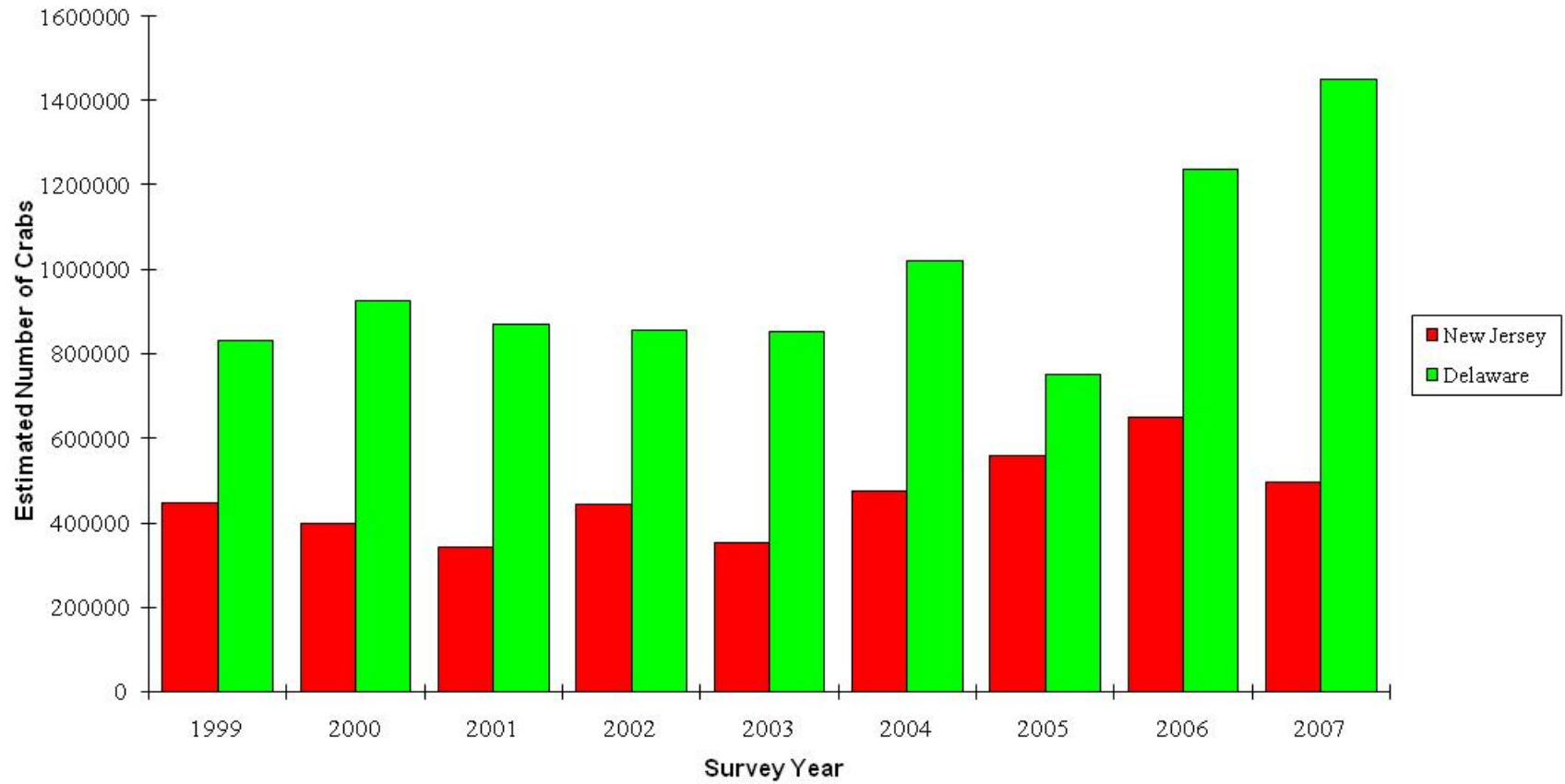


Figure 5. Seasonal Estimates of Male and Female Horseshoe Crabs

