

Limulus Spawning Activity on Delaware Bay Shores 25 May 1991

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About this Report

The horseshoe crab is truly one of the treasures of the Delaware Estuary. Regarded by most as a peculiar, essentially useless, aquatic creature occasionally seen on the beach in the summer, the horseshoe crab has in fact been valuable to humans in diverse ways. It has been used as food, fertilizer (it is rich in nitrogen), bait, and utensils. It has played a role in modern medicine and been used in eye research, the making of sutures, and for a substance in its blood that helps to detect low levels of bacterial contamination.

Equally as important, the horseshoe crab plays a vital role in the food web of the Estuary. Every spring thousands of shorebirds migrating from South America to the Arctic stop over in the Delaware Bay to feast on horseshoe crab eggs. The arrival of the birds occurs when the horseshoe crabs are spawning. This annual spectacle occurs at full moon in late spring and is one of the most exciting natural events of the estuary.

The horseshoe crab is not at the moment an endangered species. Scientists do want to avoid what happened to the horseshoe crab in Japan where because of loss of habitat they are now an endangered species. This report, which provides details of a census that was taken last spring, is part of an effort to learn more about the horseshoe crab so that we can better protect it.

ABSTRACT

*On May 1991, the spawning population of *Limulus polyphemus* was estimated to be 1,225,000 based on the survey of 23 beaches: 15 in Delaware and 8 in New Jersey. There were 2.6 males to each female. About 57% of the total number of spawners were seen on New Jersey beaches. The P.M. tide estimate was 2.85 times greater than the A.M. high tide. These are conservative estimates, the actual number may have been up to 30% greater or 25% fewer.*

INTRODUCTION

Historically, horseshoe crabs have been heavily harvested from Delaware Bay. A steady decrease occurred from over 4 million a year in the 1870's to less than 1 million taken annually before the 1940's. By the 1960's very few were left to be harvested, but by the mid-1970's at least 273,000 adults spawned on the full moon tide (Shuster and Botton, 1985). This slow rebuilding of the population was due to several factors, including the long-life cycle of the species. Males reach maturity in 10 years, females 11; both may survive another 5 years.

Several year classes spawn each year, as revealed by the condition of their carapaces. First year adults have a shiny carapace.

From then on this lustrous carapace is severely eroded, primarily by burrowing and mating. Extensive black scratches and areas occur in the second or third year. In five years or more the carapace becomes a dull black and is pitted. Another sign of age is the presence of many attached organisms.

PROCEDURE

The 1991 survey was conducted to estimate the size of the adult population of horseshoe crabs in the Delaware Bay. Census volunteers counted the number of crabs in randomly selected 10 meter increments during the A.M. and P.M. high tides on May 25th 1991, along 15 beaches in Delaware and 8 in New Jersey during the period of the full moon, the most opportune time to survey the spawning population.

RESULTS

Analysis of the survey/census data indicates that the spawning population on 25 May 1991, was 1,225,000 [comparable 1990 Census data are given within brackets: 8 June 1990 = 1,240,700]. Of these, 56.9% [81.2%] were on the New Jersey shore, 43.1% [18.8%] on Delaware beaches. Fifteen [22] beaches were surveyed in Delaware, 8 [13] in New Jersey. The ratio of the population during the night high tide, to that of the day time A.M. high tide, was 2.85:1 [2.9:1].

Delaware's main spawning beaches were North Bowers, Kitts Hummock, Port Mahon, and Killy Island [Cedar Beach, South Bowers and Kitts Hummock]. In New Jersey the major spawning areas were Fortesque, Moores Beach, and East Point [Cooks, Highs, Moores, Thompsons, and East Point].

It is common to find more males than females participating in the spawning activity on any given high tide period. The highest male to female ratio, 11.3:1, was observed at Pickering Beach, Delaware during the A. M. tide [9:1 at Roosevelt Inlet, DE].

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DISCUSSION

When planning the first surveys, 1990 and 1991, two major questions arose: 1) Was it possible for a volunteer force to survey all of the major spawning areas along Delaware Bay shores? This was answered affirmatively in both 1990 and 1991. 2) Will the results of the surveys be reliable, i.e., useful in monitoring the spawning population? We believe so, especially with improvements. In 1991 more emphasis was placed on random sampling and, for 1992, we are going to implement additional procedures. What are the reasons for refining the procedures?

We are well aware that the procedure employed to obtain data for this and the 1990 survey cannot be used in any rigorously statistical analysis. We believe, however, despite innate sampling errors (e.g., reliance upon one day of sampling, unevenness in sampling quality and quantity between beaches, etc.), **that we are on the right track - that the spawning horseshoe crab population in Delaware Bay can be and should be monitored.**

To restate the situation: the validity of an annual survey based upon present procedures has been questioned. Some consider that it is not sufficient to form a basis for good management decisions. We respond: Yes and No. The worst part of the situation is that it is, at the least, better than doing nothing. The good news is that the survey procedure can be improved upon, resulting in statistically valid conclusions. Accordingly, we expect to implement improvements in the survey approach. A revised procedure will be followed in the 1992 survey.

Basically, the sampling program has to deal with the crab's patchy distribution throughout the bay (actually, the horseshoe crab is not evenly distributed anywhere in its entire geographical range). Some considerations will be whether to monitor all spawning areas or only select sites, to have additional and alternative sampling dates, to use more rigorous random sampling techniques, etc.

With a reliable, volunteer program in place, the next 5 years will begin to delineate the significance of the annual occurrence of more than one age class of spawners.

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SUMMARY

The experience thus far justifies the reiteration of the conclusion of the 1990 survey. This, rephrased: It is appropriate to take steps to maintain an annual census of spawning horseshoe crabs along Delaware Bay shores. Not only is it a means of better understanding the population dynamics of the species but it is also a means of establishing a data bank that would be invaluable to fishery management species.

So far, the 1990/1991 observations lead us to be assured that the horseshoe crab population is not in immediate danger. Of course, only an annual program for 5 years or more to cover, at a minimum, the average possible span of adulthood of *Limulus* will yield some idea of trends. At present, we suggest use of a "ballpark" range of percentages until a more reliable guideline can be established. Right now we consider that our spawning population estimates may range no more than 30% too high to 25% too low.

DEDICATION

This report is dedicated to James J. Finn, a tireless and enthusiastic promoter of research on *Limulus*, a good friend, and a gentleman. In 1990, when he initiated what he hoped would be an annual survey of the spawning population of horseshoe crabs in Delaware Bay, Jim did not know that he would not live to see the second survey. He suffered a fatal heart attack on 11 May 1991.

Finn, James J, Carl N. Shuster, Jr. and Benjie Lynn Swan. 1991. *Limulus Spawning Activity on Delaware Bay Shores*, 1990 Private Printing (Finn-Tech Industries, Inc.) :brochure of 8pages

Shuster, C.N. Jr. and Mark L. Botton (1985). *A contribution to the population biology of horseshoe crabs, Limulus polyphemus (L.), in Delaware Bay.* Estuaries : 363-372.

Volunteers are needed to participate in the 1992 Census of horseshoe crabs along the Delaware Bay Estuary . Volunteers participate by counting horseshoe crabs along a particular beach during the full moon in late Spring. The 1992 scheduled census date is May 16, 1992. For more information call or write: in New Jersey, Benjie Lynn Swan, 7 Bay Avenue, Dias Creek, Cape May Courthouse, NJ 08210, (609) 465-6552 in Delaware, William R. Hall, Jr., University of Delaware, Sea Grant Program, Lewes, DE 19958-1298, (302) 645 4253.

