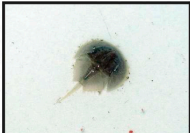


A PUBLIC AWARENESS OF LIMULUS AND CONSERVATION ON LI SOUND, AS WELL AS DATA GATHERING ON THE GROWTH RATE OF POST-EMBRYONIC HORSESHOE CRABS

Elizabeth McGonagle, Dr. Mathieu Freeman at Greens Farms Academy and Adam Rudman Project Limulus at Sacred Heart University

ABSTRACT

In order to spread a larger public awareness of horseshoe crabs and their role in the environment, Project Limulus came to the fourth grade class at Greens Farms Academy to give a presentation this past January. Later in the year Project Limulus will have a field trip for the fourth graders to South Beach to further expand the fourth graders' knowledge of horseshoe crabs and organisms in the inter-tidal zone. In another portion of the project, post-embryonic horseshoe crabs were raised in two tanks and fed different protein level foods. These horseshoe crabs were then measured weekly to determine the difference if any in growth rates depending upon protein content in the diet. The results of the experiment with the diet of the post-embryonic horseshoe crabs were inconclusive. There was also tagging data obtained from Project Limulus that was analyzed to acquire a greater sense of the travel patterns of horseshoe crabs in the Long Island Sound. The results of the tagging data showed some movement within each of the crabs' travel pattern, but not extensive movement.



COMMUNITY OUTREACH & EDUCATION PORTION

On Thursday January 23rd, 2014 there was a presentation by Mr. Rudman and his colleagues at Project Limulus from Sacred Heart University to the fourth grade class at Greens Farms Academy. Project Limulus is a study that examines the horseshoe crab population and also works as an outreach program to educate younger children about horseshoe crabs. The presentation included education about horseshoe crab conservation efforts, medicinal purposes of horseshoe crabs, as well as the impact of the steadily declining population of horseshoe crabs on the ecosystem and the organisms within this ecosystem. At the end of the school year Mr. Rudman and his colleagues will return to lead a beach trip for the fourth graders at Southport Beach. On this beach trip the kids will be able to gain hands-on experience learning, as well as tagging the horseshoe crabs that they have been studying. In addition, the students will also learn about various other organisms that live in the inter-tidal zone in Long Island Sound. This portion of the project is aimed to have a lasting positive impact on the younger children and hopefully impart awareness about endangered species as a whole.

Experiment on post-embryonic horseshoe crab growth rates.

Procedure

1. Two 15-gallon salt-water fish tanks were set up in the wet lab.

A. Tank Conditions

- i. Water Temperature: 72°-78° Fahrenheit
- ii. Water Quality (pH): 8.1 - 8.4
- iii. Fine textured play sand covering the bottom of each tank (1-2 cm deep)
- iv. Salinity: 15-20 ppt
- v. A sponge filter present in both tanks.

2. The fine textured play sand was rinsed off before being placed in both tanks.

3. 30 Horseshoe crabs were obtained in their sacro to be used to live in their new environment.

4. A cup of water from the set up tanks was poured into the container the horseshoe crabs were obtained in. This process was repeated every fifteen minutes for an hour and a half until the horseshoe crabs were assimilated into their new environment.

5. Then using a plastic pipette with the end cut off the horseshoe crabs were evenly distributed between the two tanks.

6. The horseshoe crabs were then measured monthly using a digital caliper.

7. The horseshoe crabs were then fed once a week.

A. One tank was fed with Mysis shrimp (10.5% protein)

B. The other tank was fed with Brine shrimp (6.8% protein)

Tagging Data Analysis

In this section a large number of tagging data was sorted through and contributed to the data below. This data represents the travel patterns of specific horseshoe crabs within the Long Island Sound. This data is crucial in determining the variety in the genetic diversity of the species, depending on the amount of distance traveled by the tagged horseshoe crabs. The eight horseshoe crabs represented below display a fairly small amount of travel, but travel nonetheless.



| Tag # | Sex | Male | Female | Town | Longitude | Latitude |
|---------|------|---------|--------|-----------|-----------------|-----------------|
| 1/25/10 | UNKP | Midford | PT | Greenwich | 73.510987000000 | 41.174957000000 |
| 4/74/12 | N/A | Midford | PT | New Haven | 73.926320000000 | 41.303770000000 |

| Tag # | Sex | Male | Female | Town | Longitude | Latitude |
|---------|-----|------------|----------|-----------|-----------------|-----------------|
| 6/14/04 | N/A | Long Wharf | New | Greenwich | 73.924227000000 | 41.388534000000 |
| 6/26/05 | N/A | Long Wharf | New | Greenwich | 73.922270000000 | 41.388540000000 |
| 4/7/06 | N/A | New | Stamford | Greenwich | 73.911170000000 | 41.387120000000 |

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| 9/2/04 | N/A | Midford | PT | Greenwich | 73.510987000000 | 41.174957000000 |
| 3/15/10 | N/A | Stamford | Stamford | Greenwich | 73.926000000000 | 41.310800000000 |
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INTRODUCTION

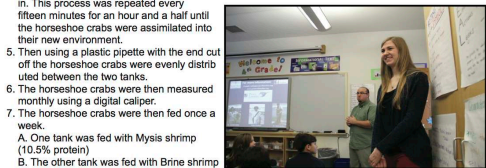
Horseshoe crabs are one of the oldest living fossils today. Horseshoe crabs are very important in our world today due to the medicinal purposes of their blood. Horseshoe crabs also play a large role in the ecosystem, and with the decline in their population there have been declines in other populations connected to the horseshoe crab. It is for these reasons that it is very important to protect this species. Through educating kids, researching on growth rate, and mapping tagging data a great overall knowledge of horseshoe crabs was achieved through this project. It is important to educate others about horseshoe crabs in order to spread awareness, support, and protection for horseshoe crabs. The fourth graders from Greens Farms Academy had an assembly where Mr. Rudman and his colleagues came in to speak about Project Limulus and horseshoe crabs in general. This assembly was followed up by a classroom activity a few weeks later that furthered the children's knowledge about horseshoe crabs and the vital role they play in our ecosystem. This portion of the project will be concluded by a field trip to the beach, this spring. One of the goals of the educational session was to teach the children in the Lower School of Greens Farms Academy, specifically grade 4, about the importance of the horseshoe crab's anatomy, their ecosystem, how to tag and the Limulus project in general. Another goal included spreading awareness about the decreasing population numbers of horseshoe crabs and how this connects to human health. My goal for the experimental research part of the project was to collect data on the growth rates of the post-embryonic horseshoe crabs, depending on the protein levels of the food consumed by the horseshoe crabs. This information can be used to guide the horseshoe crab conservation projects or experiments within captivity. My goal for mapping and analyzing the tagging data was to gain a greater knowledge of the movement patterns and how this impacts the genetic diversity of a population.



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HYPOTHESIS

If younger children, such as Greens Farms fourth grade, are educated about horseshoe crabs and horseshoe crab conservation, then a positive influence will be made towards horseshoe crab conservation and overall awareness of endangered species, such as the horseshoe crab, as well as other wildlife in the Long Island Sound. If the horseshoe crabs are separated into two different tanks and half are fed food with high protein and the other half are fed food with low protein, then the horseshoe crabs with the higher protein food will have a higher growth rate than the horseshoe crabs with the lower protein food.



RESULTS

The results from the post-embryonic horseshoe crab experiment were inconclusive. The results yielded little change throughout the duration of the experiment and between the two tanks. There were no results collected from the community outreach portion of the project with the fourth graders at GFA. Although the goal was achieved to educate the fourth graders further, there is no tangible data that can be collected from this. The result from the analysis of the tagging data was that the majority crabs selected for the analysis only traveled very short distances.

CONCLUSION

The general public does not have a large awareness of the importance of horseshoe crabs. It is very important to spread awareness about horseshoe crabs and their rapidly decreasing population. People and young students are very interested by this topic, but might never have the chance to learn about horseshoe crabs. It is especially important to educate the younger generations about the horseshoe crabs and their ecological importance because they are the future generation.

The data for the horseshoe crab experiment was inconclusive because there was insufficient data collected from the experiment. Part of the reason the results were inconclusive is due to the fact that there was a small amount of crabs originally obtained and a large die off with these few crabs, which was anticipated.

REFERENCES

Project Limulus data supplied by Mr. Rudman from Sacred Heart University. There was also reference data collected for the experiment, which was also provided by Mr. Rudman at Sacred Heart University.

