

Survey and Analysis of Banded Sunfish Population in Zeke's Pond

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Abstract

Population Survey and Analysis of Banded Sunfish in Zeke's Pond. KATIE HEISER (Lafayette College, Easton, PA 18042) DR. TIMOTHY GREEN (Brookhaven National Laboratory, Upton, NY 11973)

Banded sunfish (*Enneacanthus obesus*) are listed in New York State as a threatened species. During the Peconic River restoration at Brookhaven National Laboratory, approximately 200 Banded Sunfish were relocated to Zeke's Pond in an effort to conserve the population. Although the pond originally had a native population of Banded Sunfish, it is thought that they were nearly eradicated when it evaporated to a mere puddle in 2002. An accurate survey and assessment of the population is now needed to determine the success of the conservation project. Therefore, seine nets were used to sample sections of the population. From these samples, a population density in the pond was determined and a total population was estimated. Approximately 1,200 Banded sunfish were surveyed and released back into the pond. Different regions of the pond were sampled in an effort to minimize sampling error. This random sampling seemed to show that the population was relatively evenly distributed throughout the pond. The health and reproductive success of the fish was also assessed. The standard length of the fish was determined before they were released. With this information, the average size and age of the population can be continually surveyed and monitored. Since the sunfish have very few predators in Zeke's pond, they have been able to reproduce rapidly. This rapid reproduction has greatly increased the population size. Conservative estimates place the population at well over 100,000 Banded Sunfish. Since the population has grown so

much, the average length of the population has shifted to under 40 mm. The youngest size class has clearly become the largest. With such success in the first years after relocating the fish, it is likely that they will continue to do well in Zeke's pond. It is hopeful that some of the population can be reintroduced into the Peconic River following the restoration project.

Introduction

In New York State the range of the Banded Sunfish (*Enneacanthus obesus*) is constrained to small areas of Long Island. There are only nine known places with established populations in New York. Because of this, it has been listed as a threatened species in New York State.

The habitat of the Banded Sunfish is restricted to highly vegetated, slow moving bodies of water. The headwaters of the Peconic River provided one such suitable habitat with thick vegetation lining the shores. However, during the Peconic River restoration project at Brookhaven National Laboratory, much of this habitat was destroyed. In 2003 and 2004, an attempt to save the population was made. Many of the Banded Sunfish living in the Peconic River were relocated to Zeke's pond.

Zeke's was chosen not only because it provided slow moving, densely vegetated habitat, but also because Banded Sunfish had once been confirmed living there. However, in 2002 the pond dried up almost entirely. It is unlikely that many, if any, of the sunfish from the original population survived. Since the population had been well established prior to that, it was assumed that they would be able to reestablish themselves fairly easily. It was also thought that the drying had eliminated many or all of the predatory fish in the pond. It was hopeful that this would make the fish's reestablishment easier because Banded Sunfish are often prey to larger fish.

Banded Sunfish measure only about 9.5 cm at their largest. Their vertical banding and rounded tail fin make it easy to distinguish Banded Sunfish from their relatives. They also display a variety of colors including blue, green and purple. The adults display far more color than the younger fish. Juveniles are usually a light gray or green color and do

not have the iridescent coloring of the adults. [1] They are assumed to feed mostly on insects and aquatic plants. However since they are fairly uncommon, little is known for certain about their habits.

Their breeding behavior is assumed to be similar to other members of the sunfish family. Sunfish build small circular nests in either sand or mud at the bottom of the body of water. The males of the species guard the nests and watch over the eggs until they hatch [1]. However, Banded Sunfish much smaller than many of their relatives and they are often timid and found hiding under vegetation. In Zeke's pond they are usually found under clumps of bladderwort or in *Scirpus*.

Materials and Methods

When the project to survey the Banded Sunfish began, it was uncertain what method of sampling would be the most effective. Therefore, the sunfish were tentatively sampled using simple dip nets; to ensure that there was a substantial population. However this method seemed random and would not prove an effective way to estimate the population. Next, mesh minnow traps were used to try to get a larger portion of the population and a better estimate of the actual number of fish. However, turtles and other larger animals repeatedly destroyed the traps. It was also found that the traps were ineffective at retaining the small fish.

After a few trials, it was determined that seine nets would be used to sample the population. A seine net is a large net with two poles at either end that is pulled through the water by two people. Ideally the net will end up covering everything from the bottom to the surface of the pond. This proved to be a much more effective way to capture the

Banded Sunfish. Originally it was thought that the fish would prefer the more vegetated portions of the pond. This would mean differences in the density of banded sunfish in the pond. Therefore, both open water and vegetated areas were seined in an attempt to find the densities of the different habitats.

All of the runs were logged individually and described. Basic information such as date, time and location was logged first. The distance covered by the seine run was also approximated. Then they were classified as either open water or shoreline. The relative densities of the flora in the pond were also recorded. They were ranked at densities of none, low, moderate, or high. The three most common plants found in Zeke's are Bladderwort, Scirpus and Lily Pads. Scirpus was typically found along the shore and Lily Pads were found mostly in open water. Bladderwort was spread through both near shore areas and open water.

After the fish were captured, they were counted, measured and then released back into the pond immediately. The standard length was measured from the snout to the end of the body or just prior to the start of the tail fin. This system of measurement reduces discrepancies due to lost or damaged tails, which is a relatively common occurrence.

At the beginning of the project it had not been determined exactly how many fish would be sampled and measured before the end. As more fish were collected it became clear that in order to achieve consistent results at least 1,000 would need to be sampled. However as a precaution 1,200 were sampled.

Results

The population of Banded sunfish in Zeke's pond in 2003 was estimated to be between 200 and 300 individuals. During the initial attempts to survey the fish (dip netting and minnow traps) no conclusive results were found. The data was too random and not easily interpreted. However once seining began, the information was consistent and much easier to work with.

Since samples were taken from many parts of Zeke's pond, there were variable densities. There were also many operators who took the samples, so the number of fish seined out per square foot varied greatly person to person. So, the data used to find the density and the population size was only from two operators. However the size of the fish appeared to remain consistent regardless of the operator and all of the data was included in determining the average size.

When the data was trimmed to only two operators, about 750 fish were surveyed to find the density. These fish were spread over 20 seine runs. The number of fish per square foot was determined for each seine run. Then a density was determined for all of the distance seined. The total average was .035 Banded Sunfish per square foot. Assuming a 98% confidence rate there was a range of .033-.037 fish per square foot.

In order to apply the densities, a total area for Zeke's pond needed to be determined. Since there were multiple aerial images of the pond, a best-fit area was determined using a geographic information system (GIS). The total area covered by the pond is approximately 290,800 square feet.

Based on the average number of fish per square foot there would be approximately 101,800 fish in the pond. However, based on the range of .033 to .037 per

square foot, there could be anywhere from 95,900 fish to 107,600 fish in Zeke's pond population. The efficiency of the seining was not evaluated so there could be a significant number more than predicted.

Although the objective of the study was to estimate the population, there were other observations recorded. The most notable observation was change in size of the fish. As shown in figure 2 there was about a 2mm increase in average size from the first day to the last. As the project progressed there was more evidence for a fast growth rate for young Banded Sunfish.

Discussion

The relocation was an effort to conserve the Banded Sunfish population until it could be reintroduced to the Peconic. Since conservative estimates place the population at well over 300 times the number introduced, it is very likely that the project has so far been successful. The huge population growth will likely allow Banded Sunfish to be returned to the Peconic River in upcoming years.

Despite the efforts to increase accuracy in calculating the population totals, there is still quite a bit of ambiguity. As mentioned early, there has not been any evaluation of the efficiency of seining for the fish. Since there was no study, the seining has been assumed to be 100% efficient. While this is clearly not true, it would be impossible to justify using any other number. The population is likely much larger than estimated in this report.

Predications based on visual observations place the effectiveness of the seining as low as 50%. Of course it is uncertain, however that would place the estimate significantly

higher at approximately 200,000 banded sunfish. Since this study did not evaluate the seine, the total estimate for this study will remain at approximately 100,000.

The study also clearly includes this year's hatchlings and the mortality rate is unknown. At a different point in the year the number of fish surviving in the pond could be very different. However since the Banded Sunfish have not been studied very closely, their population patterns are unknown. The abundance of hatchlings and rapid growth rate could indicate a growing overpopulation problem and the population could plummet in future years from over crowding or lack of resources. It is also possible that the population is still growing and could expand to become even larger in coming years.

Since the youngest generation is the largest (as shown in figure 1) the population clearly is still growing. While it is possible that there will be a high mortality among younger fish, it is more likely that the number of breeding adults will be increased next year. It is unknown what will happen to the population dynamics in coming years.

Although the primary goal of the study was to assess the population size and health, it also provided other interesting information with regard to the Banded Sunfish. One such interesting observation was the rapid growth rate in the fish. Figure 2 shows the average growth rate from the first day of seining to the last. The young fish grew so rapidly that there were few fish left under 30mm by the final week of seining.

There were also many behavioral observations made. As mentioned earlier, the fish tended to stay under floating vegetation, such as bladderwort, or near plants, like *Scirpus*. However, the larger fish were more often found in open water than the smaller ones. The seine runs that were in the center of the pond had many more adults than the shoreline runs. While the population was being surveyed the sunfish were also observed

occasionally guarding small six to eight inch nests. This would support the theory that they breed in very similar manner to other sunfish. Further study of the fish would be needed before any kind of conclusion could be drawn.

While seining Zeke's pond, there were a number of other fauna pulled up in the nets. The next most prominent animals found in the nets were bullfrog and green frog tadpoles. The tadpoles were not counted or measured, and were immediately released. However, the relationship between the frogs and the Banded Sunfish is unknown. The next most common animal found in the net was the Pumpkinseed Sunfish. While they were not part of the study, they were still measured. By the end of the study there had been approximately 20 Pumpkinseeds ranging in length from 18mm to 65mm. Since Pumpkinseeds appear to be much stronger swimmers than Banded Sunfish, it is unlikely that the seine captured a notable portion of the population. Larger adult Pumpkinseeds were also observed, but none were captured. Although this information may not serve to estimate the size of the population it does show an established population of Pumpkinseed Sunfish in Zeke's pond. It is unknown how this will affect the Banded Sunfish.

Despite the variable range of possible population estimates presented in this report, the project appears to have been successful regardless. Based on the study, the original population has grown to be at least 300 times its original size. It is hopeful that this phenomenal growth rate has allowed the sunfish to become permanently established in Zeke's and they will soon be reintroduced to the Peconic River.

Literature Cited:

[1] L. M. Page, and B. M. Burr, A Field Guide to Freshwater Fishes of North America North of Mexico, New York: Houghton Mifflin Company, 1991.

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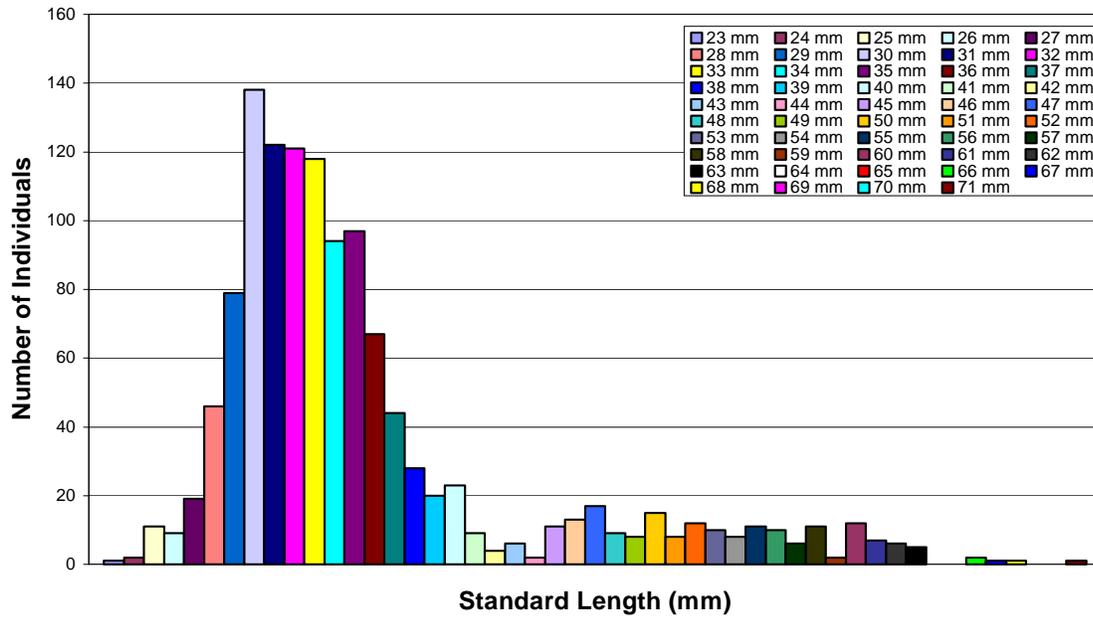


Figure 1. All of the individuals surveyed by length (mm)

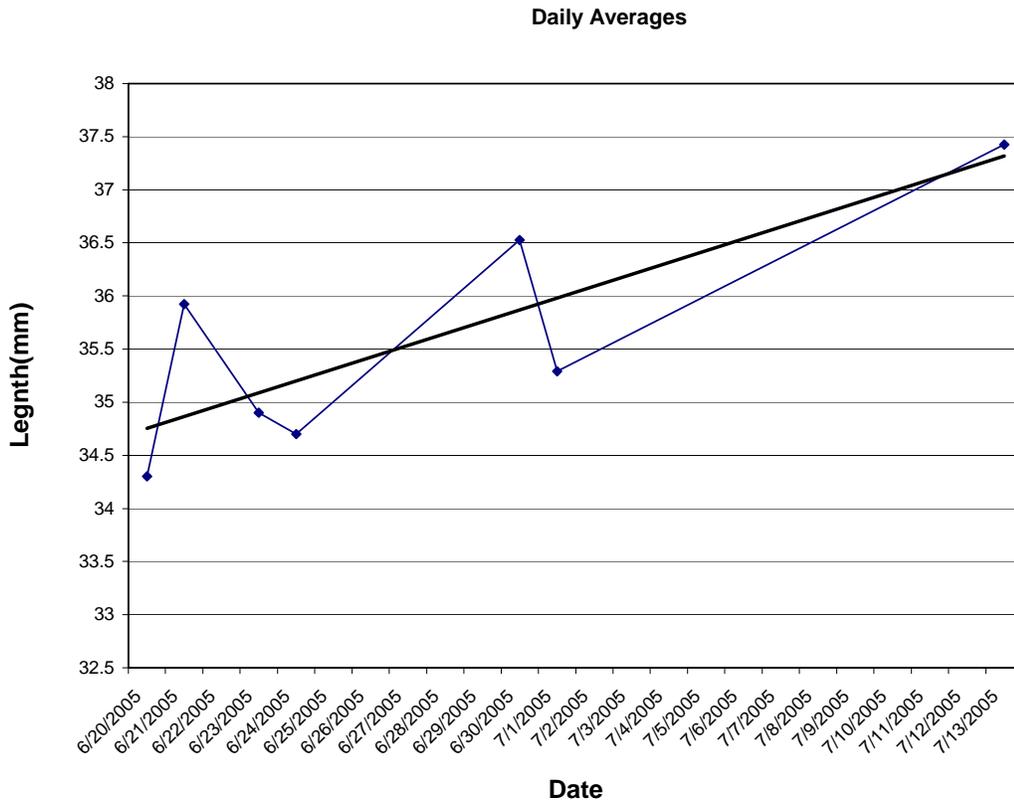


Figure 2. Daily average of standard length of surveyed fish from 6/20/2005 to 7/13/2005