## Introduction

The tiger salamander, *Ambystoma tigrinum tigrinum*, is presently recognized as a single distinctively polytypic species with a wide geographic range (Collins, et al., 1980). The species ranges from Long Island to Northern Florida, to Minnesota, to Missouri (Dunn, 1940). On Long Island, the New York State Department of Environmental Conservation (NYSDEC) has confirmed 91 active tiger salamander breeding sites, most of the distribution centering around the towns of Brookhaven and Southampton.

The tiger salamander spends most of its life underground, but emerges from its burrow in February or March (on Long Island) to migrate at night, usually during periods of precipitation (Semlitsch, 1983), to the breeding ponds. *Ambystoma tigrinum tigrinum*, though breed in both temporary and permanent habitats, more consistently breeds in temporary aquatic habitats (Collins, et al. 1983). Reproductively mature *A. t. tigrinum*, although possible, are rare; there are only two documented cases from a single collection, which occurred in Michigan in 1964 (Hensley, 1964). After a brief courtship, eggs are laid in a mass attached to twigs or weed stems under water. The female may deposit one or more egg masses containing 25-50, with an average of thirty, eggs per mass. About four weeks later, hatching occurs, and larvae remain in the ponds until late July or early August, at this time transforming into air-breathing sub-adults (approximately four to five inches in length), leaving the ponds at night during wet weather to begin their underground existence. Four to five years later, they reach sexual maturity and may live for 12-15 years.

For the past three years, surveys have been conducted on site at Brookhaven National Laboratory, in Upton, NY, to determine the presence of egg masses and larvae in suspected tiger salamander habitats. Many of these sites are ephemeral and do not hold water through the *A. tigrinum* larval season if rainfall is insufficient in the fall and winter. Consequently, there will be fewer egg masses laid, fewer surviving masses of those which are laid, and thus fewer larvae which to survive to emerge at sub-adults.

Weather conditions play a key role in amphibian population fluctuations and survival rates. Breeding population sizes are subject to variability, even more so than adult population sizes (Pechmann et al., 1991). Amphibian population decline is a topic that has recently spawned much discussion in the scientific as well as the non-scientific world. However, there have been relatively few long-term amphibian studies conducted, and long-term data is essential for analysis of population fluctuations, as yearly rainfall is certainly a factor in the existence of available breeding ponds for dependent amphibians. It has been shown (Pechmann et al., 1991) that breeding populations of A. tigrinum as well as populations of other salamanders have been reduced in comparatively dry years and that drought has been largely responsible for juvenile recruitment failures. Additionally, rainfall and pond hydroperiod have been shown to be significantly positively correlated in data analysis of long-term studies (Pechmann et al., 1991). It has also been suggested that selection may favor a tendency of amphibians to breed in years when the area has received comparatively greater amounts of rainfall (Pechmann et al., 1991).

## Materials and Methods

For the past three years, surveys have been conducted in the early spring to determine the presence of tiger salamander egg masses and then in late spring/early summer to determine the presence of larvae in the ponds on site at Brookhaven National Laboratory. At each pond, data was taken on weather and water quality, using a Kestrel handheld weather station and a YSI model 600XL, respectively. Measurements were taken on water and air temperature, conductivity, dissolved oxygen, pH, oxidation/reduction potential, turbidity, relative humidity, dew point, and wind speed. Seining was carried out in approximately fifteen-minute sessions using a ten-foot minnow seine with quarter inch mesh. At the end of each drag, the net was brought up to the surface and any salamanders caught were transferred to a holding bucket (see figure 4). Measurements were taken on the salamanders collected. Snout-vent length (in centimeters), total length (in centimeters), and weight (in grams) were taken on each individual salamander. All tiger salamander larvae and adults were immediately released after they were measured to the area in which they were found. All research was conducted under New York State Fish and Wildlife permit # ESP01-0085 for endangered/threatened species. During the summer of 2001, coverboards were added to the perimeters of two of the ponds in three rows, at five, ten, and 15 meters from the shoreline of the pond, each board 10 meters apart (see figs 1 and 2). The positions of all of the boards were taken with a Global Positioning System (GPS) unit (figs 1 and 2). This year, to better monitor microhabitat conditions created by the coverboards, HOBO data loggers (Onset Computer Corporation) were installed according to instructions (Onset) on three boards at both ponds (TS-10 and TS-7) as well as on one randomly chosen tree near each pond at the standard height of five feet in order to compare macrohabitat conditions with coverboard microhabitats. The three boards were chosen based on the previous year's data of salamander board usage. At least one board that had been used by tiger salamanders and at least one board that had not been used by tiger salamanders were chosen for data logger installation for each pond. The data loggers were programmed according to manufacturer instructions (Boxcar Pro 4 User's Guide, 1999) to take temperature, relative humidity, absolute humidity, and dew point readings every six minutes. The loggers began taking readings at 0:00:00 on June 9 and were allowed to continuously take readings until 0:00:00 on August 1. The results were uploaded onto a PC and were transferred to an Excel spreadsheet according to instructions (BoxCar Pro 4 User's Guide) and averages appear in Table 1. The coverboards were checked no less than once per week and no more than once per day for the presence of herpetiles, and any positive findings were identified by species, recorded, and later entered into a spreadsheet. Additionally, a database has been created, which includes all egg mass, larval, and coverboard survey information covering the present year and the two previous years to increase ease of access and analysis, as well as utility of such information. Monthly precipitation data from 1999 to present have been obtained for analysis purposes from the NOAA weather station, which exists on site at Brookhaven National Laboratory (www.bnl.gov/weather). Breeding season rainfall has been used to determine correlation between numbers of egg masses/larvae and amount of rainfall received by the area.

## Results

In the summer 2002 season, there were only two adult Tiger salamanders observed under any of the coverboards at either of the ponds. Only one was a newly emerged metamorph; the other was a mature adult (see fig 5). Each was found on separate days at separate locations. The water level in TS-7 had been low, but had been holding some water until 07/02/2002, when it was observed to be completely dry, and remained so until 07/24/2002, when water levels began to rise again after a rainstorm the previous night.

The temperature and humidity data for each of the HOBO data loggers can be found in Table 1. The ** refers to the fact that this logger appears to have been malfunctioning, the cause of which is not yet known. Results for rainfall data as compared to egg mass survey data can be found in figure 6. The rainfall data used for each year was monthly rainfall from November of the previous year to March of the year for which egg mass surveys were done. This covers five months of precipitation data.

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