Translocation of Radio-implanted Eastern tiger salamanders (*Ambystoma tigrinum tigrinum*) at Brookhaven National Laboratory

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ABSTRACT

A way to combat deteriorating upland habitat that surrounds amphibian breeding ponds is the translocation of jeopardized species to restored wetlands. Information on movement patterns of translocated individuals is crucial to comprehending the ecology of a species by detecting any detrimental effects the translocation has on the individual. This type of knowledge is vital when making management decisions regarding land use. Although the indigenous range stretches from Long Island down to northern Florida, the eastern tiger salamander is a New York state endangered amphibian found on New York's Long Island. This amphibian species is affected by increased urbanization that threatens its breeding habitat. This status makes this species a worthy candidate of translocation to suitable habitat. In an effort to determine the impact of translocation on this particular species, eleven eastern tiger salamander juveniles were collected from two different ponds, Pond A and Pond B, and surgically implanted with radio transmitters. This implantation allowed for the tracking of movement patterns after pond emergence. Five individuals from Pond A were translocated to Pond B, while five were returned to Pond A. The individual collected from Pond B was implanted and returned to its collection site. All individuals were radio-tracked for four weeks to determine movement patterns and habitat selection through the recording of vegetation in a plot surrounding the individual's location. Of the five individuals returned to their native pond, three were lost to predation, one died in the field, and one was lost when its signal became untraceable. The greatest distance traveled occurred by the salamanders placed at pond of original collection. Of the translocated individuals, four were preyed on. This may indicate that translocated individuals are more susceptible to predation. Additionally, translocated individuals at Pond B moved a shorter distance, in comparison to individuals at Pond A. This is indicative of stress and unfamiliarity

with the area. Due to a very dry summer, Pond A dried up completely, prompting an early emergence of the salamanders at a smaller size, making these individuals more vulnerable to mortality. Although transience existed at both ponds it appears that Eastern tiger salamanders fare better when they are not translocated. With all the abiotic and biotic factors of each study site, more research is necessary to deem translocation a worthy way to manage the Eastern tiger salamander population of Long Island.

INTRODUCTION

The eastern tiger salamander (*Ambystoma tigrinum tigrinum*) is a widely distributed ambystomid species ranging from Northern Florida to Long Island, New York. Due to increased urbanization and the resulting loss of breeding habitat, the New York range of tiger salamanders is only on Long Island, in Suffolk County. Presently, this species is listed as Endangered in New York State [1].

In an effort to rectify this status, conserve and recover *A. t. tigrinum* in New York, management decisions are being made. In an effort to reduce risk of extinction, a recently popular way of managing populations of endangered species in areas where they have been extirpated has been translocation [2]. Translocation of jeopardized species to restored wetlands is an option of combating deteriorating habitat that surrounds amphibian breeding ponds. This method is viewed as a way to save a species in decline. The state-endangered status of this particular species makes it a worthy candidate for translocation. But first, information regarding the basic needs of this species and the monitoring of movement patterns is necessary to deem translocation a viable method of restoring a species. Amphibians can be found in similar areas throughout a given period and have specific habitat needs, such as vegetative structure, moisture requirements, and corridors for dispersal [2]. Translocation is believed to disrupt these movement patterns due to differences in habitat availability and familiarity.

This research attempts to validate translocation of Eastern tiger salamanders as a conservation management strategy by evaluating the impact of translocation on movement patterns. This study expects to achieve information that will be necessary when making land use and species management decisions.

MATERIALS AND METHODS

Study area

The study took place from 7 July 2008 to 7 August 2008 in Upton, Suffolk County, Long Island, New York on Brookhaven National Laboratory property. Two breeding ponds were selected based on the presence of egg masses in winter surveys. The selected ponds were within pitch pine (*Pinus rigida*) /oak (*Quercus* spp.) forest.

Pond A was surrounded by grasses, forbs, and shrubs with one road bordering the southern edge of the pond. This pond is completely sun exposed and is subject to flooding and complete dryness, based on hydroperiod and rainfall accumulation. The average depth for this pond is 0.5 m. Aquatic vegetation included algae.

Pond B was a more isolated pond more south of Pond A. This pond was also surrounded by grass, forbs with upland vegetation beginning 10 m from the pond edge. Aquatic vegetation was primarily cattails and lilies. This pond was deeper than Pond B, with the deepest part at 2.5 m. This pond is also sun exposed but does not dry up or flood as frequently as Pond A.

Radiotelemetry Procedures

Larval Eastern tiger salamanders (*Ambystoma tigrinum*) were initially captured from Pond A by seining the area. Ten individuals were collected from Pond A. One individual was collected from Pond B by dip netting instead of seining, due to the depth of the pond and its large amount of emergent vegetation. The animals were taken from the field in plastic containers to a laboratory for implant surgery.

Surgery procedures followed those outlined by Madison [3] and Faccio [4]. For anesthesia, the salamanders were individually submerged into 0.25% solution of MS222 (3-Aminobenzoic acid ester methanosulfate salt). Complete anesthesia occurred within 20 minutes, depending on body size and development of external gills. Holohil BD-2H 1.8g transmitters with internal antennas were implanted internally into the coelomic cavity of each animal at Brookhaven National Laboratory. After surgery, the salamanders were rinsed in distilled water and allowed to recover overnight in tanks of water. The salamanders were released 24 h after surgery. On 1 July 2008, five salamanders from Pond A were returned to Pond A at the pond's edge, nearest their capture point. Five salamanders from Pond A were placed in Pond B for translocation. The individual from Pond B was returned to Pond B 2 July 2008.

Over a four-week period, transmitter-implanted salamanders were tracked every 1-2 days at a consistent time using a Communications Specialist, INC model R1000 Telemetry Receiver. SporTrak Pro Global Positioning System (GPS) unit was used to collect position information on all tracked animals. A Kestrel 4000 was used to collect temperature, wind speed and humidity data. A 1 m^2 plot was placed around the individual and the amount of trees, saplings, shrubs, patches of grass, forbs, ferns, moss, coniferous litter, deciduous litter and coniferous/deciduous litter was noted. Percent deciduous canopy and coniferous canopy was also noted, along with abiotic factors such as temperature, soil moisture and estimated distance from pond. Any peculiar item about the salamander's location was noted, such as incidences of predation or other mortality.

Analyses

GPS waypoints were plotted using ArcGIS software for spatial analyses of distance traveled, as well as the production of a range map.

RESULTS

Pond A

A total of 5 non-translocated salamanders were tracked for as long as 8 days at Pond A (Fig. 1). No salamanders survived at this site the entire study period of 7 July 2008- 7 August

2008. A total of 3 bare transmitters were recovered (Table 1). The signal of one salamander was lost completely after 4 days of tracking (Table 1). And one salamander died in the field (Table 1). The average distance traveled by the individuals at this study site was 56.8 m with the greatest distance traveled at 123.9 m (Table 1). Tracked individuals seemed to stay within a certain range for a few days and then make a directed movement. Deciduous canopy was a more common microhabitat.

Pond B

Of the total translocated to Pond B, 3 were killed by predators such as the bullfrog (*Rana catesbeiana*) and eastern ribbon snake (*Thamnophis sauritus sauritus*). Predation was listed as a fate when the signal followed a snake. Predation was also noted when 2 individuals in particular, M063008-10T and M063008-11, were tracked throughout the study period in the water to where *R. catesbeiana* were always present. Distance traveled was lower for translocated individuals leaving Pond B (54.3 m, Table 1). Distance data from two snake-predated individuals, M063008-06T and M063008-07T, were not counted due to inability to delineate salamander movements from snake movements.

DISCUSSION AND CONCLUSION

Transmitters allow for the location and observation not typically observable. It is difficult to test whether the tracked animal's behavior is the same as that of an animal without a transmitter [5]. Although it is difficult to determine if the transmitter itself makes the animal more susceptible to fatality, the results show that translocated individuals appear to be more susceptible to predation. This may be due to exposure to different abundances of predators at Pond B in comparison to Pond A. This may also be attributed to the size of the metamorphosed individual, which increases risk of predation as body size decreases.

A possible reason for the loss of all resident individuals at Pond A is likely due to the hydroperiod. *A. t. tigrinum* is a species that is capable of facultative emigration and therefore will leave a drying-out pond at a smaller size [6]. This was the case for Pond A, since the natal pond dried out completely by 10 July 2008, forcing the larvae to metamorphose earlier at a smaller, more vulnerable, size. The small size would yield an unfavorable surface to volume ratio of the body of the salamander, hindering its ability to thermoregulate in the weeks of little precipitation

Although these results indicate that *A. t. tigrinum* fare better when not translocated, the biotic and abiotic factors at each site seem to affect the results. Hydroperiod, predation, and influx of water into ponds potentially affected the survivorship of salamanders during this study. Due to such circumstances, more research is necessary to determine translocation as an effective way of combating declining populations [2].

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APPENDIX

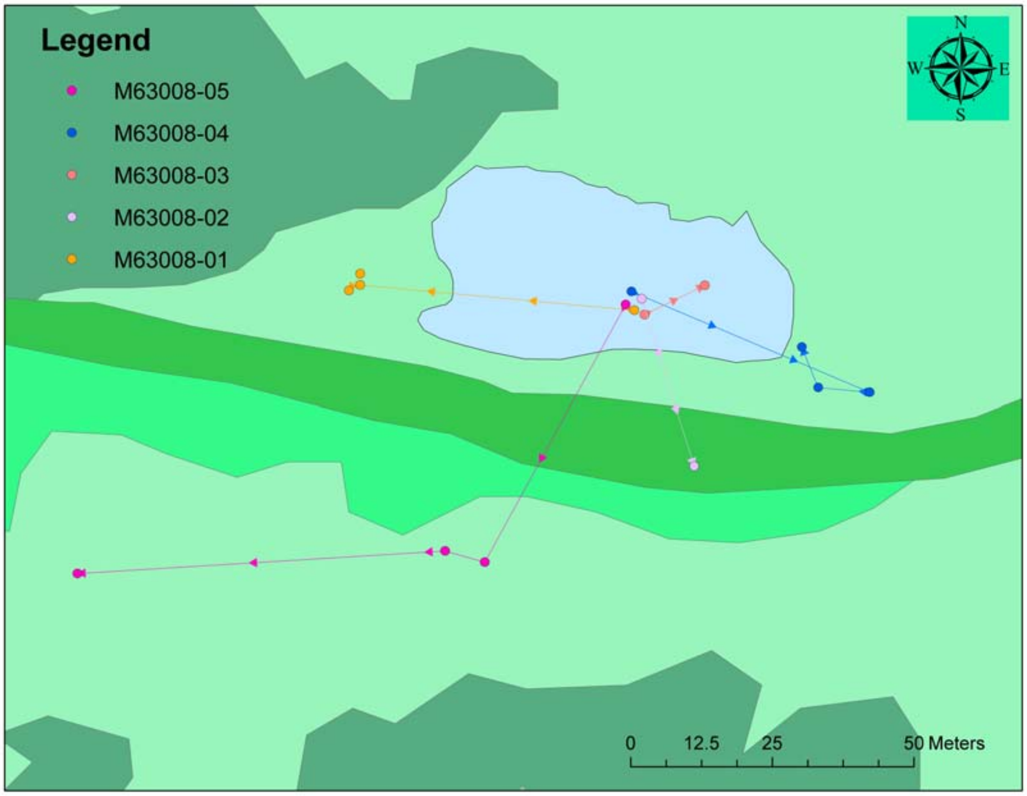

Figure 1. Movement patterns of non-translocated individuals at Pond A, Brookhaven National Laboratory, Long Island, New York.

Individual	Days Tracked	Distance Traveled (m)	Fate
Pond A			
M063008-01	4	53.8	Lost Signal
M063008-02	8	31.8	Died in Field
M063008-03	1	11.8	Naked Transmitter
M063008-04	8	62.5	Naked Transmitter
M063008-05	4	123.9	Naked Transmitter
Pond B			
M063008-06T	12	Snake	Snake Predation
M063008-07T	32	Snake	Naked Transmitter
M063008-08T	2	21.8	Naked Transmitter
M063008-09T	8	86.8	Naked Transmitter
M063008-10T	23	0	Bullfrog predation
M063008-11	23	0	Bullfrog predation
	Average	**Average**	
Non-translocated	5	56.76	
Translocated	15.4	54.3	

Table 1. Outcome of study period 7 July 2008- 7 August 2008 at Pond A and Pond B at Brookhaven National Laboratory, Long Island, New York.

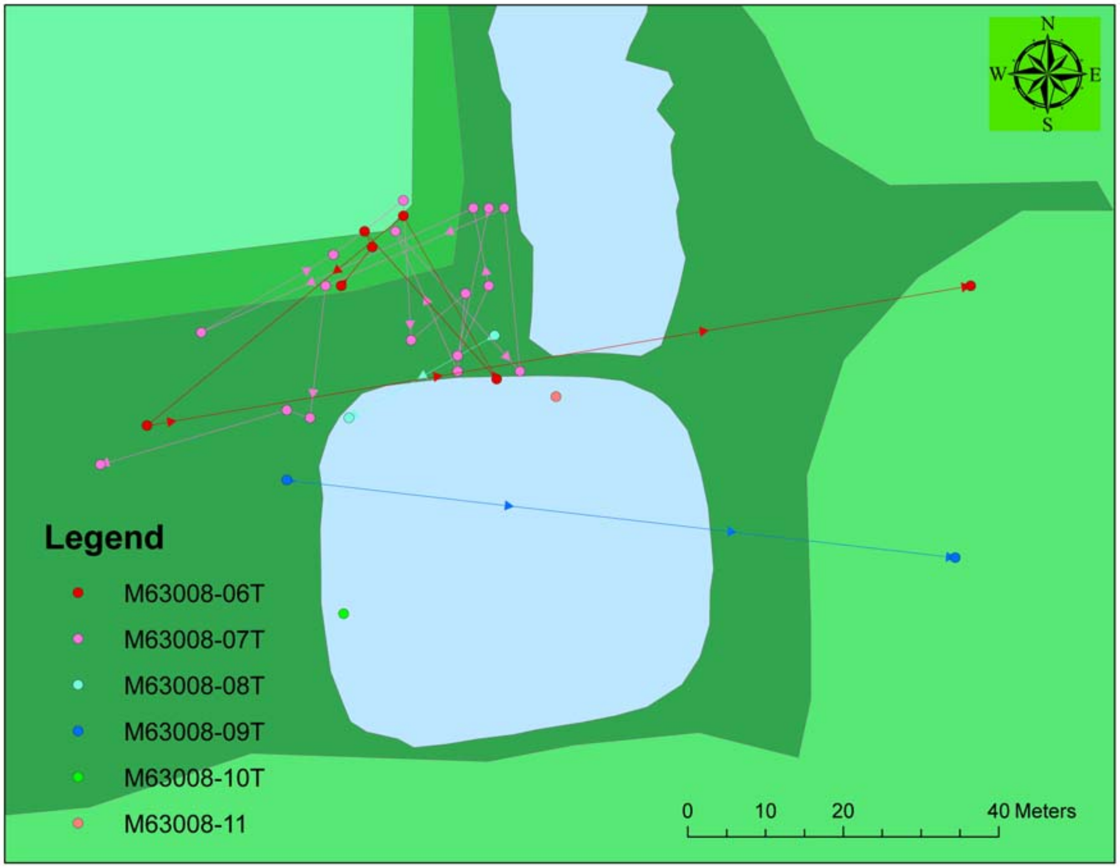

Figure 2. Movement patterns of translocated individuals at Pond B