



PATIENT TIGER, HIDDEN RESULTS?

A DECADE-LONG SALAMANDER (*AMBYSTOMA TIGRINUM*) REPATRIATION EFFORT IN MANAGED WETLANDS.

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Abstract

One strategy used to reverse population declines for some amphibian species is repatriation – moving healthy individuals from a donor population to a recipient site. Translocated individuals can either be placed immediately into suitable habitat (hard release), or placed in enclosures for an acclimation period prior to being freed in the recipient site (soft release). We report on a 10-year effort to repatriate Tiger Salamanders (*Ambystoma tigrinum*) at two breeding ponds within an 80-ha nature preserve in central Illinois. Soft-released individuals included all life-history stages (egg, larvae, and adult) released in enclosures over a five-year period, whereas hard releases involved only adults in the latter two of those years. All adults were individually marked prior to release, or at time of capture (if caught as new in subsequent years). The two ponds have since been monitored during the breeding seasons with either a drift fence-pitfall trap array or minnow traps. Following the last year of releasing new individuals, variable numbers of adults returned to the ponds and recapture rates have been low, especially between years. Within each year, whether recaptured or a new individual, more adult males were captured than females. Interannual variation in climate parameters during the transition from winter to spring necessitated variable sampling periods among years. We cautiously view our repatriation effort as a success, and discuss our findings as they pertain to amphibian conservation efforts.

Introduction

- Habitat alteration is a primary, but potentially reversible, cause for declines in amphibian populations [1,2].
- Because unsuitable areas limit the likelihood of dispersal between suitable habitat patches, colonization of restored habitat occasionally involves human intervention to establish a historically-present species [3,8].
- Our objective was to quantify the efficacy of repatriating Tiger Salamanders (*Ambystoma tigrinum*) to man-made ponds within a restored nature preserve in central Illinois.

Methods

- Warbler Woods Nature Preserve (WWNP; est. 1999 in Coles County, Ill.) is 81.5 ha, and comprised of patches of oak-hickory forest and late-successional old field (Fig. 1). Tiger Salamanders have not been observed at this site, or adjacent habitat, in nearly 70 years.
- The southeast portion of WWNP contains 4 ponds, ranging in size from 400–900 m². As part of restoration efforts at WWNP, all ponds have been fish-free since 2003 [10].
- In the Spring of each of 4 years, we repatriated different life-history stages of *A. tigrinum* from two different source populations into Ponds A and B (Table 1; Figs. 1, 2A).
- We monitored both ponds with either an encircling drift fence-pitfall trap array (2005–2008) or minnow traps spaced *circa* 10 m apart along the pond margins (2010–2014).
- We measured adult individuals (both introduced and collected on site; Fig. 2B,C), and marked each with a unique combination of toe-clips and visible implant elastomer [4].

Table 1.—Number of each of three life-history stages of *Ambystoma tigrinum* released in each of two ponds at WWNP. All larvae hatched from eggs that were placed in two 1-m² enclosures within the ponds; larvae were released into ponds within 1 week of hatching.

Year	Pond	Soft-released subadults		Hard-released adults	
		Eggs	Larvae	Males	Females
2005	A	—	—	—	—
	B	~4500	543	—	—
2006	A	—	—	—	—
	B	2577	293	1	—
2008	A	—	11	13	12
	B	—	—	—	—
2011	A	—	37	—	—
	B	—	—	—	—

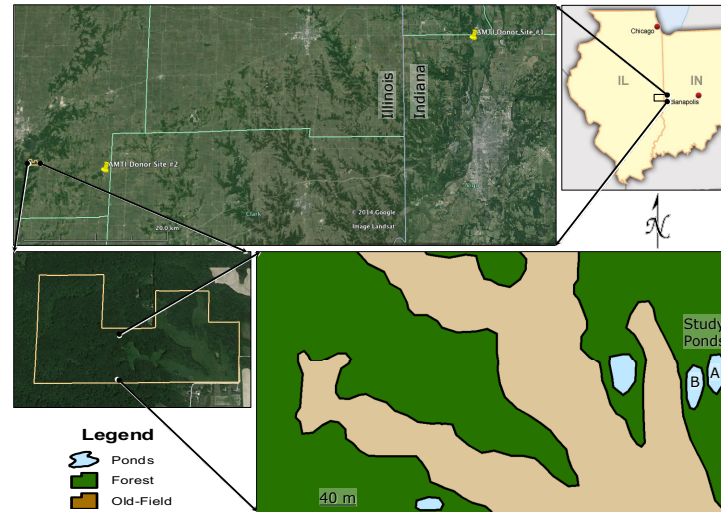


Fig. 1.—Localities for repatriation of Tiger Salamanders (tan polygons both indicate Warbler Woods Nature Preserve, WWNP; Coles Co., Ill.). Counter-clockwise from upper right: State boundaries of Illinois and Indiana, enlarged area showing donor sites (yellow pins) and recipient site; WWNP; and, southeastern portion of WWNP indicating donor Ponds A and B.

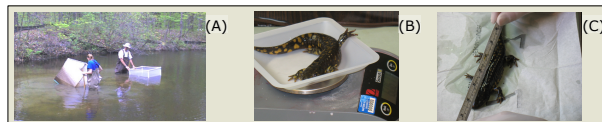


Fig. 2.—(A): Deploying enclosures for soft release *Ambystoma tigrinum* egg masses at WWNP. Mesh size of 0.5 mm isolated eggs and larvae while permitting exchange of water to allow chemical imprinting on pond water. Note, drift fence array in background. (B), (C): Measuring adult individuals before hard release in mid-Spring.

Table 2.—Number of new and recaptured adult *Ambystoma tigrinum* in each of two ponds at WWNP. Recaptures within each year are excluded.

Year	Pond	New adults observed		Recaptured adults	
		Male	Female	Male	Female
2010	A	2	—	1	—
	B	3	1	—	1
2011	A	12	1	2	—
	B	2	—	—	—
2013	A	1	1	1	—
	B	3	—	—	—
2014	A	4	1	—	—
	B	—	—	—	—

Results

- Survivorship of soft-released eggs to hatchling stage was 11–12 %.
- Of the hard-released adults, males were more likely to be recaptured in subsequent years (Table 2) — recapture probability ranged from 5–30 %; between 1 and 5 years elapsed between recaptures of the same individual.
- Males represented a greater percentage (87 %) of new individuals detected at the 2 ponds, and were more common among both new and recaptured adults (Fig. 3). New adult females were observed ovipositing in two different years.
- A few individuals (representing both recaptured and new adults) showed evidence of infestation by digenean parasites (Platyhelminthes: Trematoda). Adult mortality by predators (e.g., raccoons) occurred at least twice.

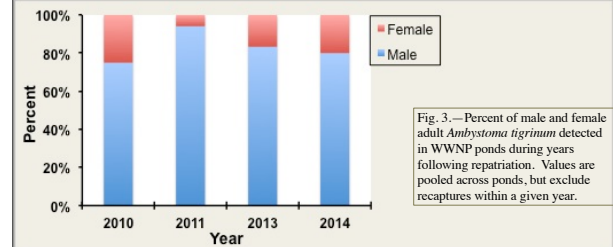


Fig. 3.—Percent of male and female adult *Ambystoma tigrinum* detected in WWNP ponds during years following repatriation. Values are pooled across ponds, but exclude recaptures within a given year.

Discussion

- Recaptured and recruited adult *A. tigrinum* at WWNP ponds indicate that breeding attempts have continued in the years following repatriation.
- Adult female salamanders can skip years between reproductive events [5,6], and typically spend less time in breeding ponds [7], both of which might explain why fewer adult females were detected in the years following repatriation.
- We have some confidence that an *A. tigrinum* population is now established at two WWNP ponds, with the potential to colonize other ponds, both on-site and at adjacent properties.
- Providing that suitable conditions are available, multiple attempts using different life-history stages can produce successful repatriations for amphibians [9].

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Acknowledgments — We thank the members of the EIU Herpetology lab, the Illinois Nature Preserves Commission, and J. Foster, B. Hutchinson, R. Jansen (Illinois DNR), D. Mott, L. Peterchef (Indiana DNR), R. Szafoni (Illinois DNR), and especially L.B. Hunt for logistical support on this project. Partial funding was provided by EIU, and the Illinois Dept. of Natural Resources.

