Longtail salamander (*Eurycea longicauda longicauda*) distribution and habitat associations in New Jersey

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Introduction

The longtail salamander (*Eurycea longicauda longicauda*) is part of a group called "brook salamanders" ranging from central to eastern United States (Conant 1975). New Jersey lists the species as state threatened. It historically occurred in 10 counties, but currently it is known from only 4 counties (Zappalorti and Reap 1983, Stein 1991). Anderson and Martino (1966) reported habitat associations of the species with temporary ponds in the limestone belt of northern New Jersey that were confirmed during surveys in 1983 (Zappalorti and Reap) and 1990-1991 (Stein). The limestone pond association is unreported outside of the state.

Since the early 1990's little work has been done in New Jersey to identify new populations or expand upon our knowledge of the species' habitat associations. A survey of historic longtail sites was conducted to collect data for analysis within a GIS framework to examine landscape-based trends and to produce a predictive habitat map identifying areas where future surveys and research can be targeted. Information on local populations is integrated into the New Jersey Division of Fish and Wildlife's Endangered and Nongame Species Program's (ENSP) Landscape Project mapping to identify critical habitats, which is used as a regulatory tool to protect the species' habitat.

Materials and methods

A survey of known locales of the species was conducted during 2006-2007. Individual occurrences were recorded in the field using a handheld global positioning systems unit. Only the first occurrence was recorded per site although multiple specimens may have been located during a visit.

A 100 meter buffer was placed around each differentially corrected point occurrence to represent the inferred minimum extent of habitat use (NatureServe 2008) and the percent limestone bedrock (NJGS) and land use/land cover types (2002 NJDEP) were calculated for each polygon in ArcGIS 9.2. The distance from an occurrence to a vernal pool (examples of which are limestone sink ponds) and stream was calculated from the NJ ENSP's 2008 Vernal Pool point dataset and the NJDEP's 2002 Stream line coverage, respectively. The results were intersected with the NJDEP's Physiographic Provinces data to examine differences by region.

We built a minimum convex polygon around used longtail salamander points using the Animal Movement Extension in ArcView 3.2 to define the study area, and generated an equal set of random occurrences (n=58) for comparison within that area that were at least 200 meters away from the nearest used occurrence to act as surrogates for unused occurrences. One hundred meter radius buffers were created around these random points and habitat attributes were calculated similar to those for the used occurrences. We explored relationships of the habitat attributes and eliminated those that were multicollinear or invariant. Models were built using logistic regression in SPSS 10.0 for every combination of the variables and we selected the best model based on classification success of used and random occurrences. We then generated datasets representing each of the attributes in the final model that covered the study area and converted each into a raster dataset with 30m pixels to ease computation time. The model equation was applied to every possible buffer in the study area to generate a predictive map displaying the probability of presence of longtail salamanders in northern NJ.

Results

Survey efforts in 2006-2007 resulted in 44 precise occurrences recorded which were added to an existing set of 15 points (original observations from 1990-1995) (n=59). This dataset was used in full, or in part, for each analysis.

The final model (Table 1) predicts that longtail salamanders select areas with a large percentage of limestone bedrock, mixed forest with >50% crown closure, large streams/canals, and that are near either a vernal pool or a stream (Fig.1). They are unlikely to select areas with a large percentage of residential area. The model correctly classified 86.2% (50/58) of longtail occurrences as habitat in high probability areas and 84.5% (49/58) of random locations as habitat in low probability areas.

Table. 1. Final predictive model variables.

Variable	B	SE	P
Residential (%)	-0.070	0.033	0.033
Limestone (%)	0.021	0.006	0.000
Mixed forest with >50% crown closure (%)	0.045	0.027	0.088
Streams and canals (> 80ft. Wide) (%)	0.342	0.164	0.037
Distance to nearest vernal pool or stream	-0.002	0.001	0.006

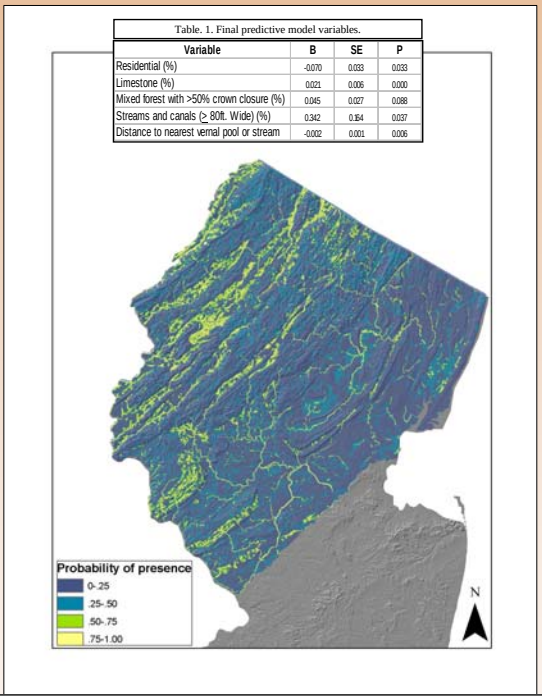

Fig. 1. Predicted probability of longtail salamander presence in northern New Jersey. The lighter colors indicate higher probability.

- The average time to locate a longtail salamander at a known site was 15.14 minutes.
- Limestone bedrock makes up only 16% (1270 km2/7959)of the Ridge and Valley, Highlands, and Piedmont physiographic provinces, yet 79% of longtail salamander occurrences were located in areas of limestone (Fig. 2).
- Longtail salamanders were found significantly closer to vernal pools in the Ridge & Valley province than to streams (Fig. 3).
- The distance from a longtail salamander occurrence to a stream was the smallest in the Piedmont and Highlands provinces (Fig. 3).

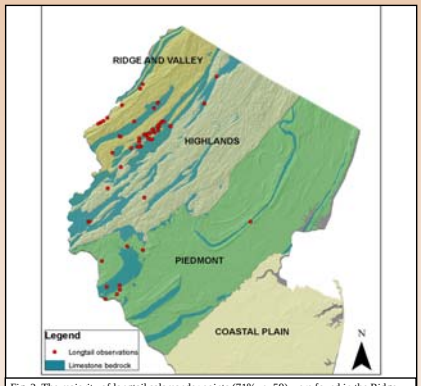

Fig. 2. The majority of longtail salamander points (71%, n=59) were found in the Ridge and Valley Province. Although limestone bedrock is only present in 16% of the 3 northern New Jersey provinces longtail salamander points fall within limestone bedrock 79% (n=47) of the time.

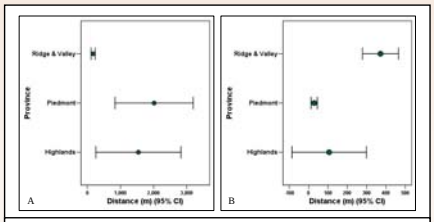

Fig. 3. Longtail salamanders were found closer to vernal pools in the Ridge & Valley province (A), but farther from streams (B) relative to either the Piedmont or Highlands.

Conclusions

Longtail salamanders are strongly associated with limestone bedrock. The high correlation between longtail salamander locations and vicinity to vernal pools in the Ridge and Valley province's limestone bedrock regions appears significant to the species' long term viability in the state. Longtail salamanders are found closer to streams, on the other hand, in the Highlands and Piedmont. It is likely that limestone plays a role in providing shelter habitat for the species when proximal to either a vernal pool or stream depending upon province.

The predictive model supports observations made in the field and will serve as a guide for supplemental targeted surveys outside of known locales. However, it has not been tested with an independent dataset to determine the degree of confidence with which it can be used. We plan to conduct surveys to gather the necessary data to test and refine the model. While it is unlikely due to urbanization that longtail salamanders are still present in their original 10 counties it is probable that unknown occurrences exist in limestone regions surrounding known populations.

State regulations that impede the degradation of streams and inhibit the loss of vernal pools may prevent the loss of important habitat for longtail salamanders. Critical over-wintering areas must be identified for local populations as these features are often nondescript landscape features and potentially subject to alteration or outright destruction.

Literature cited

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For further information

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