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Biochemistry & Allergy 2019: Conservation genetics and genomics of the fire salamander, Salamandra infraimmaculata- Leon Blaustein- Institute of Evolution- University of Haifa

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Salamandra infraimmaculata is deliberated as a threatened species in Israel. However, since when we started studying Salamandra, we have found many more breeding sites in the past 10 years than were known previously. Also, O. Rybak (unpublished results) has found that Salamandra does well in urban habitats on Mount Carmel. *Salamandra infraimmaculata* has strong pond site fidelity that likely results in differential genetic structure among breeding sites. Strong pond site fidelity has been found by multiple researchers. An exception is that on Mount Carmel, S Bar David found dispersal as far as 1280 m, which is likely to result in overlapping genetic structuring. During our first genetics study, in which-nine breeding sites in Mount Carmel and 11 sites in the Galilee were surveyed and tissue samples were taken from 475 adults. Microsatellites were used for observing differences in genetic structure in the study which was performed in Prof Juha Merilä's Lab (University of Helsinki, Finland). In this study, we found that there were substantial genetic differences between Mount Carmel and Galilee. Allelic richness was much higher in the Galilee than in Mount Carmel; 40 unique alleles were found in the Galilee and 0 in Mount Carmel. Unrooted neighbor-joining tree diagrams resulted in pure separations between Mount Carmel and the Galilee. Structure analysis showed strong differences between the Galilee and Mount Carmel. A second microsatellite study was conducted in Finland in Juha Merilä's Lab. The goal was to consider genetic diversity in peripheral populations compared to populations closer to the core. We collected 692 tissue samples from adult and juvenile fire salamanders from 33 breeding sites (13 from upper Galilee, ten from lower Galilee, nine from Mount Carmel, and one from Tel Dan). This study also considered vegetation types and meteorological aspects such as elevation, average temperature, and precipitation. A maximum entropy analysis was also used to score major regions. The lower Galilee had the lowest stability values of the three regions. Allelic richness increased with maximum entropy scores in the Upper Galilee. Allelic richness also increased with latitude. A Bayesian analysis of population structure (BAPS) also demonstrated that Mt Carmel and the upper Galilee were homogeneous genetically while the lower Galilee contained genetically differentiated populations. Lastly, we performed transcriptomics/gene expression studies on fire salamander larvae. We insisted that Salamandra tailfins (which do not cause damage to the Salamandra larvae) can demonstrate gene expression as opposed to using the whole body. We found that Salamandra larvae turn darker when exposed to ultraviolet radiation and they turn darker with increased density. We are currently conducting gene expression studies on Salamandra larval development, oxygen ranges, color change, and temperature change. Study theoretical and applied aspects of oviposition habitat selection in temporary pools for mosquito control and amphibians and for understanding the role of this behavior on population regulation and community dynamics. We study habitat preference regarding the risk of predation, risk of competition, resource quality, and habitat size. Collaborators have included Marc Mangel (UC Santa Cruz), Joel E. Cohen (Rockefeller University), and Matthew Spencer (Liverpool University). Advance our understanding of how food web manipulations affect mosquitoes. We intend to develop theory, and test empirically, the notion of manipulating an ecosystem such that mosquito problems are minimized while simultaneously maximizing biodiversity. Conversely, we intend to study how species diversity and community simplification affect mosquito dynamics. Collaborators and consultants have been Peter Morin (Rutgers University), Rick Ostfeld (Cary Institute of Ecosystem Studies), Phil Lounibos (Florida Medical Entomology Lab), and Marc Mangel (UC Santa Cruz).

Salamandra infraimmaculata

The appearance of this species is quite different among subspecies; *Salamandra infraimmaculata* is large (up to 324 mm), and has big yellow dots over the whole body, except the belly. Usually, there are four yellow spots on the head; one on each paranoid and one above each eye. *S. i. Orientalis* is in appearance about the same as *S. i. infraimmaculata*, but has small, yellow spots over the whole body, except the belly. The validity of this subspecies is questioned. S. i. Semenov is large and has rose-like, round spots over the whole body. The head is fairly round. This is the largest fire salamander species; it can reach a length of 324 mm. The females are usually larger than males. This species has no coloration on the belly, the underside is completely black. The negative things of habitat fragmentation and populace isolation on population viability, genetic variability, and organizing are well documented, and conservation plans failing to take into account spatial

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population structure and connectivity can be ineffectual. Of special concern are populations at the periphery of the species range that might show reduced genetic diversity, thus affecting their adaptive potential at environmental margins. We investigated genetic variability and differentiation of the globally near-threatened and locally endangered fire *Salamandra infraimmaculata* in northern I Israel, an area that represents the periphery of this species' distribution range. Examines of variability in 15 microsatellite loci from 20 sites revealed substantial population structuring, most of which was due to a strong subdivision between two regions separated by a heavily urbanized valley. Also, levels of genetic variability within populations were lowest in the peripheral, southernmost populations. These results propose that the conservation plans for this species should identify the lower diversity and increased divergence in the peripheral regions, and take into account the observed spatial population organization when devising strategies and measures to confirm the species resolve.

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