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Conservation genetics and genomics of the fire salamander, Salamandra infraimmaculata

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Introduction:

Salamandra infraimmaculata is considered as a threatened species in Israel. However, sincewhen we started studying Salamandra, we have found many more breeding sites in the past 10 years than were known previously. In addition, O. Rybak (unpublished results) has found that Salamandra does well in urban habitats on Mount Carmel.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 the 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 neighbour 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. 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 ultra violet radiation and they turn darker with increased density. We are currently conducting gene expression studies on Salamandra larval development, oxygen ranges, colour change and temperature change.