Landscape Genomics Study for California Tiger Salamander

Develop tools to assess mitigation strategies that support the recovery of California Tiger Salamander (CTS) and minimize the spread of Barred Tiger Salamander (BTS) and CTS/BTS hybrids.

WHAT IS THE NEED?

The California Tiger Salamander (CTS), also known as Ambystoma californiense, is a federal and state listed endangered salamander that is endemic to California. The United States Fish and Wildlife Service divides CTS into three distinct population segments (DPS): The Sonoma County DPS, the Santa Barbara County DPS, and the Central California DPS. The CTS in Sonoma County and Santa Barbara County DPSs are federally listed as Endangered, while in the Central California DPS is federally listed as Threatened. CTS is also listed as Threatened under the California Endangered Species Act (ESA). The California Department of Transportation (Caltrans) is required to consult with regulatory agencies about the impacts of transportation projects on CTS according to the ESA, the California Environmental Quality Act, and the National Environmental Policy Act.

Counties in the central coast region are the core area where non-native Barred Tiger Salamander (BTS), also known as Ambystoma mavortium, were introduced in the 1950’s. As a result, hybridization between the natives and the non-natives has occurred, which threatens the recovery of CTS. Understanding precisely how human modifications enhance or stop the movements of genes is critical.

This study will specifically investigate what effects roads have on the movements of native CTS and non-native BTS genes as they traverse the landscape. Learning the effects of roads may be a key to implementing mitigation that impedes movement of the non-native genes in hybrid areas, where landscape-scale movements would negatively impact the recovery of native CTS. Through this research, Caltrans may be able to help prevent the spread of introgression by using roadways as barriers to dispersal and gene flow.
WHAT ARE WE DOING?

Landscape genomics is at the leading edge of new genetic tools that provide fine scale, spatially explicit data allowing researchers and planners to achieve a deeper understanding of how different habitat types impede or enhance the resistance to movement of organisms on landscapes.

For species like the CTS, which are extremely cryptic and very difficult to track with standard ecological approaches, landscape genomics is frequently the only way to assess habitat connectivity and movement. This research will tackle the landscape genomics of the Central and Santa Barbara DPSs of CTS, quantifying habitat resistance across the range of the species.

The research team will focus on landscape genomics of both native and non-native genes in areas of Monterey and Santa Barbara County where they are both represented in hybrid swarms, and in comparable pure CTS regions in Contra Costa County. This study will be completed in two years, the researchers will perform field work between March and June 2018, and a final sampling in March and April 2019, and continuously conduct laboratory and Geographic Information System work throughout the duration of this project.

WHAT IS OUR GOAL?

The immediate outcome of this research will inform Caltrans on the extent to which roads may be used as barriers to the movement of non-native genes, particularly at the edge of the hybrid invasion in northern and eastern Monterey and Santa Barbara County.

Furthermore, the research team will provide specific recommendations on the positive and negative effects of roads in different regions, including the measurable effects of roads on the movement of pure CTS genes where salamander undercrossings are useful to promote the movement of native genes, and areas where such crossings should not be installed to inhibit the spread of non-native BTS genes. This study constitutes the first such genomic data set explicitly designed to quantify the effects of roads on gene movement in an endangered species. The data and approach developed will serve as a model for similar research in other parts of California on CTS, and on other species that maybe be impacted by roads.

WHAT IS THE BENEFIT?

CTS is listed as either endangered or threatened under both the state and federal regulations. Therefore, understanding how human modifications and how other landscape features like highway, rail, or transit corridors, enhance or hinder the movements of these salamanders is critical to prevent further introgression and support CTS recovery actions and decision making.

Additionally, since Caltrans may enhance or restore seasonal wetland habitat as mitigation for CTS because of regulatory permit conditions, it is important to understand what attributes of mitigation sites will favor the development and recovery of CTS populations, while impeding the development of hybrid salamanders.

WHAT IS THE PROGRESS TO DATE?

This task has been completed on June 30, 2020. DRISI’s Task closeout process has also been completed.

IMAGE

California Tiger Salamander on the left and Bared Tiger Salamander on the right (Credit: Jarrett Johnson)