Data Science II

White Paper

Madison Harris

Introduction & Background

The desert dace (Eremichthys acros) is a thermophilic cyprinid endemic to a small hot spring system in Soldier Meadows, Northwestern Nevada, Great Basin physiographic province. Due to their long history of isolation with no exact time frame known, desert dace are considered to be a relict species (Hubbs and Miller 1948). The species was listed under the ESA in 1983 (Federal Register on June 14, 1983 (48 FR 27273) and the primary threats include habitat alteration leading to habitat loss and degradation from livestock grazing, water diversions and invasive species. Desert dace have the highest temperature tolerance of any minnow in the western North America (Nyquist 1963), and are found in waters ranging from 40.5°C to 18°C; individuals will behaviorally thermo-regulate by moving away from spring heads when temperatures exceed this comfortable range (Duncan 2010). Therefore, cooler waters downstream of springheads represent critical habitat. Climate change leading to decreasing and/or more variable surface water resources is likely to further impact long term persistence probability of the desert dace. Here I propose to characterize the population genetic structure, gene flow, genetic diversity and effective population size of the extant desert dace populations. My main objectives are to assess: 1) whether there is evidence of movement among springs, and 2) characterize the environmental correlates of observed patterns. Little is known about this species

To begin to accomplish this, I aim to use USGS streamflow data downloaded from the National Water Information System: Web Interface to build predictor models and to aid in later study. This will help guide me later to create temperature gradients of the hot spring systems for conservation purposes and predict locations of other viable habitats.

Methods

Using the USGS website and integrated mapping tool, I have located approximately 30 stream and spring gauges with relevant information, ranging from water temperature, air temperature, streamflow velocity, discharge, and chemical concentrations, to name a few. Site name, site number, latitude and longitude location, status, elevation, and date range have been pulled and placed into a .csv file for ease of access, which has already been cleaned and properly formatted using OpenRefine; see OpenRefine homework in my Bio792\_Shared GitHub. Data for each gauge has been pulled from USGS via the Surface-water Daily Data for Nevada site via site numbers. OpenRefine will be utilized to clean up and organize the data as-needed. Pandas via Jupyter Notebook will be used to create a for-loop code to organize and combine the multiple .csv files into one or more files, such as separating water temperature from all the USBLM DESERT DACE SW TEMP gauges into one file. Commands used will include pd.read\_csv(), pd.concat(), usecols= , sort\_values(), pd.DataFrame.to\_csv(), and others.

Part two will be to take the latitude and longitude locational data and plot them into an R map along with locational data from my sample sites to visually identify which gauges will corelate the best with which samples and sampling areas.

A stretch goal, which may or may not be included in the final paper will be to repeat the above steps with niche climate data pulled from various sites and sources that will eventually be put into ArcGIS for modeling purposes. I would be using Pandas and OpenRefine to clean up and organize this data into a format that can be ported easily into GIS.

Citations

Duncan, Doug. (2010). Desert Pupfish (Cyprinodon macularius) 5-Year Review: Summary and Evaluation. 10.13140/2.1.1563.9364.

Hubbs, C.L and R.R. Miller. 1948. Two new, relict genera of cyprinid fishes from Nevada. Univ. Michigan. Mus. Zool. Occ. Pap. 507:1-30.

Nyquist, D. 1963. The ecology of Eremichthys acros, an endemic thermal species of cyprinid fish from northwestern Nevada. M.S. Thesis, University of Nevada. Reno.