**Methods:**

**Study Region:** The Texas Coastal Prairie contains grassland prairie with forested areas occurring primarily along riverine systems. During March and April of 2017, we sampled ten, wadable, perennial streams which span 12 counties from Kleberg County to Montgomery in South-Central Texas, USA. Each study site is located within 100 meters of a USGS stream gauge which continuously monitor streamflow and climate data year-round.

Study sites were chosen to maximize differences in precipitation with minimal changes in underlying geology and elevation. The annual precipitation ranges from 48-125 cm within the study region which spans a linear distance of 378 km (Falcone 2011). The surface geology is characterized by fine clays, quaternary and sedimentary sand. The streams have similar median flows (0.02-22.09 m3⸱min-1), elevations (14-61 m), substrates (quaternary), and average air temperatures (19.9-22.1℃) (Table 1).

**Biological Sampling:** Fish communities were sampled using a Smith-Root LR-24 Backpack in a single pass survey of a 100-meter reach (Lamberti 2007). Fish species are field identified to species using a field guide (Thomas C 2007) and photographed. Several specimens of each species were euthanized using tricaine mesylate (MS-222) and stored in >70% denatured ethanol as voucher specimens for lab confirmation of species identification. Fish Voucher specimens were identified using the Texas Academy of Science dichotomous key (Hubbs 2008) and cross referenced with field identifications.

Single-pass electrofishing surveys are considered contentious in their accuracy. Although most species are caught in the first pass, rare species are often missed until the second or third pass (Pusey, Kennard et al. 1998). The sample reach length for a single-pass survey needs to include a number of representative habitats that depends on the sampling efficiency of the shockers and density of fish within the system. The reach length for a survey of fish assemblages is recommended to be 40 times the wetted width of a given stream (Reynolds, Herlihy et al. 2003). However, idealized electrofishing surveys adhering to this recommendation in wide, shallow streams lose practicality and can last over 10 hours. In our study, the average wetted stream width is 4.89 meters which entails a single-pass shock length of approximately 200 meters. The study sites are characterized by low variation in geomorphology and overall habitat heterogeneity. Shocking intensity is high due to narrow stream widths and homogenous habitat profiles, so we elected to survey a representative 100-meter reach.

Macroinvertebrates were collected using a D-frame net equipped with 500-micron mesh. The netter vigorously disturbed vegetation and substrate in a 1-square foot area while capturing disturbed insects in D-frame net. The debris within the net was rinsed and placed in a sieve bucket with a 500-micron mesh to prevent loss of insects between sweeps. This process was repeated 20 times at each sample location. Specimens were preserved in 95% ethanol for storage. Each sample was sub-divided and picked in a randomized grid approach until 300 individuals were obtained. Samples containing less than 300 individuals were picked to completion. Then, individuals were identified to genus or species (Merritt and Cummins 2008). The sum of individuals in each taxon were multiplied by the fraction of unpicked sample and reported as abundance of individuals per square foot.

**Environmental Sampling:**

Habitat measurements were taken at 4 stream cross-sections spaced 25 meters apart. Variables included canopy coverage measured with a spherical densiometer, riparian vegetation type, sediment grain size, water depth, channel width, bank height, and bank slope. At each station on each visit, two 60 mL water samples were collected and filtered through a pre-combusted (500℃ for 4 hours) glass fiber filter (Whatman GF/F) into acid washed bottles, transferred on ice inside of a cooler, and stored in the lab frozen (-20℃) until analysis for nutrients (NH4+, NO3-, and SRP), dissolved organic carbon (DOC) and total nitrate (TN). Water samples were run by the Oklahoma University Soil Water and Forage Laboratory. Oxygen (mg/L), temperature (℃), conductivity (µcm/S), turbidity (NTU), and pH were measured at each point using a YSI ProDSS multiparameter probe.

**Data Analysis:** In addition to the habitat metrics measured in the field, long term climate averages and flow metrics were obtained from the US Geologic Surveyors Geospatial Attributes of Gages for Evaluating Streamflow, version II (USGS GAGES II) dataset. Several flow metrics including flash index, high flow pulse percent 3x, and low flow pulse percent were calculate using the USGS GAGES II continuous 20-year flow record for each site except Tranquitas CK at Kingsville TX (USGS 08212300) which only has a 4-year record (Table 2).

Fish and Invertebrate communities were analyzed separately. To assess community diversity and evenness, we calculated rarified richness and the Shannon diversity index with the equation, (Shannon 1948). To examine relationships between species diversity and stream environments, single and stepwise multiple regressions were performed on 10 independent variables (Table 2). These included annual precipitation, conductivity, dissolved oxygen, pH, canopy cover, ammonia concentration, nitrate concentration, flash index value, high flow pulse percent 3x, and low flow pulse percent. Conductivity and nitrate concentrations were log transformed prior to regressions. The multivariate generalized linear regressions were generated using the dredge function in R. Regressions are ranked by AIC values from which we selected the top 3 models for interpretation.

We created ordinations using the VEGAN package in R to detect assemblage patterns. First, we performed non-metric multidimensional scaling (NMDS) which uses adequate dissimilarity measures, runs NMDS with multiple starting configurations, compares results, and stops after finding a similar minimum stress solution. The ordination then scales, rotates the solution, and adds species scores to the configuration as weighted averages. Sites were grouped using hierarchical clustering based on environmental traits. Site groupings were visualized using convex hulls. Finally, we fit environmental variables to each ordination in which the arrow displays the direction of the (increasing) gradient, and the length of the arrow is proportional to the correlation between the variable and the ordination. To improve readability, several environmental predictors with low correlation were removed and the species scores were replaced with labeled pictures of prominent taxonomic units.

Cited Literature

Falcone, J. (2011). GAGES-II: Geospatial Attributes of Gauges for Evaluating Streamflow. Reston, Virginia, U.S. Geological Survey.

Hubbs, C. (2008). An Annotated Checklist of the Freshwater Fishes of Texas, with Keys to Identification of Species. R. J. E. a. G. P. Garrett, Texas Academy of Science.

Lamberti, H. (2007). Methods in Stream Ecology, Elsevier Inc.

Merritt, R. W. and K. W. Cummins (2008). An introduction to the Aquatic insects of North America. Dubuque, Iowa, Kendall/Hunt Pub. Co.

Pusey, B. J., M. J. Kennard, J. M. Arthur and A. H. Arthington (1998). "Quantitative sampling of stream fish assemblages: Single- vs multiple-pass electrofishing." Australian Journal of Ecology **23**(4): 365-374.

Reynolds, L., A. T. Herlihy, P. R. Kaufmann, S. V. Gregory and R. M. Hughes (2003). "Electrofishing effort requirements for assessing species richness and biotic integrity in western Oregon streams." North American Journal of Fisheries Management **23**(2): 450-461.

Shannon, C. E. (1948). "A Mathematical Theory of Communication." Bell System Technical Journal **27**(3): 379-423.

Thomas C, B. T., Whiteside BG (2007). A Field Guide: Freshwater Fishes of Texas. College Station, Texas, Texas A&M University Press.