

**ANNUAL PROCEEDINGS
of the
TEXAS CHAPTER
AMERICAN FISHERIES SOCIETY**



22-24 February 2024

Volume 46

TEXAS CHAPTER

AMERICAN FISHERIES SOCIETY

The Texas Chapter of the American Fisheries Society was organized in 1975. Its objectives are those of the parent Society – conservation, development and wise use of recreational and commercial fisheries, promotion of all branches of fisheries science and practice, and exchange and dissemination of knowledge about fishes, fisheries, and related subjects. A principal goal is to encourage the exchange of information among members of the Society residing within Texas. The Chapter holds at least one meeting annually at a time and place designated by the Executive Committee.

MEMBERSHIP

Persons interested in the Texas Chapter and its objectives are eligible for membership and should apply at the Chapter's web page ([Membership | Texas Chapter - American Fisheries Society](#)) or contact the Chapter Secretary-Treasurer:

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ANNUAL PROCEEDINGS OF THE TEXAS CHAPTER AMERICAN FISHERIES SOCIETY

22-24 February 2024

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2024

Published by:
Texas Chapter, American Fisheries Society

Table of Contents

Awards	v
Scholarships	vi
Oral Presentations	1
Poster Presentations.....	35
Index.....	63

Awards

Outstanding Fisheries Worker of the Year Award:

Fish Culture: Paul Cason

Fisheries Education: Steven Bardin

Fisheries Student: Chase Nimee

Special Recognition for Fisheries Support: Ivonne Blandon

Fisheries Research: Kevin Conway

Sport Fish Restoration Outstanding Project Award, American Fisheries Society, Fisheries Administration Section: “Repatriation of Guadalupe Bass to the Blanco River”

Best Presentation Awards: 2024 Annual Meeting

Student Presentation: Anastasia Umstott, Stephen F. Austin State University

“Beta Diversity of Stream Fishes in East Texas: Partitioning Variation Among Spatial Scales”

Student Poster: Jacob Wolff, Texas A&M University-College Station

“Does Rio Grande Cichlid (*Herichthys cyanoguttatus*) Induce Trophic Niche Shifts in Native Centrarchids?”

Scholarships

Texas Chapter American Fisheries Society

Undergraduate (B.S.) – Nichole Dopp – Texas A&M University—Corpus Christi

Guadalupe River Trout Unlimited

Graduate (M.S.) – Dillon Flowers – University of Texas at Tyler

Graduate (Ph.D.) – Owen George – Texas Tech University

Harry Tennison (provided by the Sportsmen’s Club of Fort Worth)

Graduate (Ph.D.) – C. Melman Neill – University of Texas Marine Science Institute

Graduate (M.S.) – Blake Munz – Texas A&M University – Corpus Christi

Graduate (M.S.) – Jacob Wolff – Texas A&M University — College Station

Graduate (M.S.) – Jonathan Ellard – Texas A&M University - College Station

Graduate (M.S.) – Christa Kieley – Texas A&M University at Galveston

Graduate (Ph.D.) – Michaela Labare – Texas A&M University – Corpus Christi

Graduate (Ph.D.) – Zach Moran – Baylor University

Graduate (M.S.) – Chase Nimee, Stephen F. Austin State University

David Terre Student Scholarship

Rebecca Mangold – Texas A&M University - College Station

Clark Hubbs Student Research Award

Ingrid Vasconcellos Bunholi (Ph.D.)– University of Texas Marine Science Institute

Oral Presentations

A Prehistoric Fish in a Modern Estuary: Exploring Alligator Gar Movement and Habitat Use in Cedar Lakes, Texas

Jillian Swinford, Texas Parks and Wildlife Department, Coastal Fisheries Division, Professional

Joel Anderson, Carey Gelpi, Shambhu Paudel, and Dan Daugherty, Texas Parks and Wildlife Department,

Keywords: Alligator Gar, Cedar Lakes, Brazos River, San Bernard River, acoustic telemetry

While Alligator Gar (*Atractosteus spatula*) are widely regarded as freshwater fish, they are also one of the dominant predators in estuarine bays throughout Texas and are often more prevalent than other marine predators. Abundance of Alligator Gar has been well documented in Texas estuaries, indicating their role as apex predators within these ecosystems, but seasonal movements and habitat use of gar in these regions requires further research. Cedar Lakes, a small coastal region between Matagorda Bay and Galveston Bay, saw record alligator gar CPUE following Hurricane Harvey in 2017, catching more gar than any other bay system, a trend which has continued in the subsequent years. This area is a series of marsh lagoons that straddle the Intracoastal Waterway, is bisected by the Brazos and San Bernard rivers, and provides a unique intersection to study estuarine fish movement. An acoustic telemetry array was deployed in 2023 in Cedar Lakes with the goal of tracking gar movement between the two major rivers and bays that form the boundaries of this section of the Texas Gulf Coast. This study tracked forty-three tagged fish as they utilized Cedar Lakes habitats and tracked large scale movement within this array throughout the spring and summer of 2023. Telemetry data shows the majority (44.2%) of the fish tagged have stayed near the Cedar Lakes marsh lagoons, likely utilizing abundant food resources found there. While most have stayed in the Cedar Lakes region, other individuals have made large scale movements into the bordering bay systems (30.2%) and upriver in both the Brazos (9.3%) and San Bernard (14%). This presentation describes the preliminary analysis of the first six months of movement of Alligator Gar in this unique estuarine region with the goal of better understanding the Alligator Gar's role within coastal ecosystems.

The Use of Environmental DNA (eDNA) in Comparison to Contemporary Trawls and Historical Catch Data for Assessing Marine Finfish in Matagorda Bay, Texas

Polly Hajovsky, Texas Parks & Wildlife Department, Professional

Damon Williford, Corey Waddell, Emily Miller, Caren Utley, Leslie Hartman, and Joel Anderson, Texas Parks & Wildlife Department

Keywords: eDNA, Matagorda Bay

Environmental DNA (eDNA) has emerged as a versatile tool to assess aquatic communities, including the presence of cryptic taxa and species that are not easily detected with traditional sampling gears. The focus of this study was to compare the finfish community of Matagorda Bay as inferred by eDNA metabarcoding with a 47-year dataset of fishery-independent sampling conducted by Texas Parks and Wildlife Department (TPWD) in Matagorda Bay using bag seines, trawls, and gill nets. We collected 72

water samples from March to June during 2023 in conjunction with trawl sampling conducted by TPWD. Universal and elasmobranch-specific primers were used to amplify a small segment of the mitochondrial 12S ribosomal gene, and PCR products were sequenced using the Illumina sequencing platform. Taxonomy was assigned to eDNA metabarcodes using a reference file developed by our lab. A total of 62 families have been detected between 1976-2022 via historical sampling, of which 34 (54%) were detected via eDNA in one season of one year. Environmental DNA also detect 4 families not previously detected with traditional methods. The top commonly detected species across all methods (eDNA included) were Gulf Menhaden (19%), Atlantic Croaker (15%), Bay Anchovy (12%), Alligator Gar (8%), and Gizzard Shad (5%). Focusing on the March – June 2023 samples (trawl and eDNA data), Atlantic Croaker and Bay Anchovy are highly detectable by both methods while other species (Hardhead Catfish and Gulf Menhaden) are detected better by either trawls or eDNA. Species richness differed significantly (<0.001) between eDNA, 2023 trawls, and historical data. In conclusion, eDNA did an exceptional job detecting finfish. Differences among gears could be due to gear bias, specifically size-selected bias of most fishing gears, and from the ubiquitous presence of eDNA in the water column, potentially making it a more unbiased sampling method.

Long-Term Shifts in Composition of Fishes and Macroinvertebrates in Texas Coastal Waters

Damon Williford, Texas Parks and Wildlife Department

Joel Anderson, Texas Parks and Wildlife Department

Keywords: commercial shrimping, sea surface temperature, Atlantic Multidecadal Oscillation

Commercial shrimping in Texas has declined since the implementation of a license buyback program in 1996, which has also coincided with increases in sea surface temperatures in the Gulf of Mexico. We used trawl data collected between 1987–2022 as part of fishery-independent resource monitoring conducted by Texas Parks and Wildlife Department to examine long-term changes in the community composition of fishes and macroinvertebrates in the northwestern Gulf of Mexico. Specifically, we assessed how the 54 most common species of fishes and macroinvertebrates have responded to the decline of commercial shrimping in Texas and long-term trends in climatic factors. We predicted that we would observe increases in annual sample frequency of typical bycatch species due to the decline of commercial shrimping. Mann-Kendall tests showed increased sample frequencies of 26 species, including White Shrimp (*Penaeus setiferus*) and typical bycatch species, such as Hardhead (*Ariopsis felis*), Pinfish (*Lagodon rhomboides*), Atlantic Croaker (*Micropogonias undulatus*), and Spot (*Leiostomus xanthurus*), exhibited significant increases. Eighteen species, including several invertebrates, Pigfish (*Orthopristis chrysoptera*), and flatfishes, declined. Correspondence analysis, analysis of similarities, and non-metric dimensional scaling (nMDS) demonstrated that the pre-buyback period (1987–1996). The nMDS indicated that changes in the Atlantic Multidecadal Oscillation had the greatest impact on community structure over time, with smaller effects contributed by sea surface temperatures and decline of commercial shrimping. The decline of commercial shrimping has undoubtedly benefitted many species as demonstrated by increases in their sample frequencies. However, climatic factors may have played a greater role in reshaping coastal communities as indicated by significant declines of other bycatch species, such as Pigfish. Warming of the Gulf of Mexico may enhance or offset the effects of reduced commercial shrimping.

Aquatic Plant Ecology for the Fish Conservationist

Casey Williams, BIO-WEST Inc.

Keywords: aquatic plants

Aquatic plants are vital to many aquatic habitats and fish ecology although sometimes they present a nuisance. In this educational talk I will present a basic overview, from a botanical perspective, of aquatic plant ecology, some common aquatic plant species identification, and other important information geared towards fisheries managers. I will introduce what classifies an aquatic plant, their lifecycle and growth patterns and why they matter in fish ecology. In many cases aquatic plant ecology, management and restoration should be considered a parallel component with fisheries management and conservation.

Have Climate-Mediated Changes to Southern Flounder Reproductive Phenology Driven Population Declines in the Gulf of Mexico?

Joel Anderson, Texas Parks and Wildlife Department

Keywords: Southern Flounder, juvenile growth functions, temperature change

The Southern Flounder (*Paralichthys lethostigma*) is a key mid-trophic predator species found throughout estuaries and nearshore areas of the Gulf of Mexico and western Atlantic Ocean. Declines in abundance of this species range-wide have led to speculation that changes to climate-mediated timing of various life history events (e.g. ideal spawning and hatch timing) might have resulted in those events becoming uncoupled. I will report the results of two recent studies conducted by the Texas Parks and Wildlife Department, both of which were supported by fishery-independent data collections going back over 40 years. The first study developed juvenile growth functions by examination of daily growth from otolith structures in young-of-the-year individuals captured in bag seines. Growth functions were then used to project age (based on observed length) of all juvenile Southern Flounder captured through time in TPWD seines to estimate changes in mean Southern Flounder hatch dates. The second study used weekly catch rates of Southern Flounder in fall-deployed gill nets to estimate changes in the timing of the offshore adult spawning migration over the same time span. Increasing estuarine temperatures throughout the western Gulf of Mexico have resulted in later spawning runs in more recent years. In contrast, the timing of mean hatch has shifted to earlier in the year. These data suggest that, while a fitness advantage may be conferred to the offspring of individuals that migrate and spawn early on in the spawning season, the majority of the adult population is migrating later in the spawning season. As predicted in previous studies, the narrowing of ideal developmental windows for larval/juvenile survival may be at odds with concurrent changes in migratory behavior of adults, and this contrast may be a key driver of population declines in Texas and the greater the Gulf of Mexico.

Reconstructed Environmental Stress Histories from Geochemical Records in Eastern Oyster Shells from Subtropical Estuarine Systems

Jessica Randall, Texas Parks and Wildlife

Benjamin Walther, Texas A&M University - Corpus Christi

Keywords: oysters, carbon 13, Ba/Ca ratio

The geochemical records stored in biogenic carbonate oyster shells can serve as powerful tools to reconstruct individual environmental stress histories as variations in ambient water chemistry, influenced by factors such as salinity, temperature, and primary productivity, result in discernible shifts in isotopic and elemental compositions within the accreted shell material. This study focused on evaluating the potential of geochemical records, specifically $\delta^{13}\text{C}$ and Ba/Ca, within eastern oyster (*Crassostrea virginica*) shells to discern past environmental variability in dynamic, subtropical estuarine systems that are subject to major climactic events such as droughts and floods. In low, fluctuating salinity environments that experienced hypersalinity during droughts and dramatic declines during flood events, $\delta^{13}\text{C}$ and Ba/Ca reflected distinct flood signals that aligned with local salinity conditions. Conversely, in high, stable salinity environments with minimal salinity fluctuations, only typical seasonal variations were observed, likely influenced by vital effects for $\delta^{13}\text{C}$ and by temperature and primary productivity for Ba/Ca. Observed $\delta^{13}\text{C}$ values closely matched predicted $\delta^{13}\text{C}$ values and monthly salinity estimates derived from a concentration-dependent mixing equation (Fry 2002), emphasizing the efficacy of this chemical proxy utilized alone or in combination with Ba/Ca for similar investigations. Moreover, the transplanted shells not only demonstrated reproducibility among shells, but also highlighted their ability to display such changes promptly, as both $\delta^{13}\text{C}$ and Ba/Ca reflected the composition of their new environment within less than six months. This study confirms the capability of eastern oyster shells to capture fine-scale temporal changes in ambient environmental conditions. Ultimately, this allows them to serve as reliable, long-term bioindicators and recorders of their habitats, which can be crucial for identifying potential restoration sites, developing adaptive management strategies, and monitoring environmental changes that may impact oyster population dynamics.

Crevalle Jack Ecology and Harvest in the Texas Gulf of Mexico

Ethan Getz, Texas Parks and Wildlife Department

Catherine Eckert and Charles Downey, Texas Parks and Wildlife Department

Keywords: Crevalle Jack

Crevalle Jack are important coastal predators and support an increasingly popular catch-and-release sport fishery. However, population declines have recently been perceived by stakeholders in parts of their range. Here, we aimed to provide distribution and harvest trends for Crevalle Jack in the Texas Gulf of Mexico. Long-term fishery-independent and dependent data were collected by the Texas Parks and Wildlife Department from 1983-2021. Bag seine, bay trawl and gill net samples were collected in

conjunction with angler creel surveys. Crevalle Jack observed in fishery-independent sampling were used to assess patterns in both juvenile and adult relative abundance, distribution, and seasonality. In addition, Boosted Regression Tree models were used to highlight important predictors of Crevalle Jack presence. Crevalle Jack harvest observed during angler surveys was used to describe the fishery, including differences in inshore and offshore catch patterns. Relative abundance of both juveniles and adults was variable across years but displayed no trend throughout the time series. Crevalle Jack of all sizes were found within inshore waters with subadult and large adults particularly reliant on estuarine systems. Shifts in recruitment were evident in bag seines with mean date of catch trending almost two weeks earlier over the study period. The Crevalle Jack fishery was spread across inshore and offshore waters with significantly larger fish harvested offshore during summer. Most anglers who harvested Crevalle Jack stated that they were specifically targeting other species, supporting the notion that the targeted fishery is mainly catch-and-release. As Crevalle Jack declines have been noted elsewhere in their range, these results could help inform future management decisions in Texas.

Movement, Home Range, and Structural Habitat Use of Largemouth Bass in Two Large Texas Reservoirs

Todd Driscoll, Texas Parks and Wildlife Department

Jake Norman, Dan Bennett, and Brian Metz, Texas Parks and Wildlife Department; and Dave Smith, Louisiana State University

Keywords: Largemouth Bass, Toledo Bend, Lake Fork, habitat preference

Angler complaints regarding perceived declines in angling quality prompted research to examine home range, movement, water depth use, and structural habitat use and selection of Largemouth Bass *Micropterus salmoides* in Toledo Bend and Lake Fork reservoirs, Texas. A total of 21 Largemouth Bass at Toledo Bend (386-604 mm TL) and 22 at Lake Fork (364-545 mm TL) were implanted with radio transmitters and tracked over a two-year period. At both reservoirs, home range areas were relatively small (< 50 ha) and overall movement was low (approximately 140 to 250 m/week). Movement rates were higher during winter and spring in both reservoirs, but diverging trends were observed during summer (lower at Toledo Bend, higher at Lake Fork). Largemouth Bass primarily occupied water column depths of 3 to 4 m in Toledo Bend and 2 to 3 m in Lake Fork, and fish were found in the shallowest depths during the spring. Although overall structural habitat occurrence and selection of Largemouth Bass varied between reservoirs, primarily due to differences at shorelines and creeks (2X higher in Toledo Bend) and drops (3X higher in Lake Fork), fish selected for the shoreline, drops, points, and creeks in both reservoirs, while drains and flats reflected avoidance. Habitat occurrence varied seasonally at Toledo Bend, primarily due to differences in shoreline use, and flats had the highest occurrences during all seasons. At Lake Fork, occurrences at flats and drops were high and similar during all seasons. Results will be used to inform anglers regarding Largemouth Bass movement and structural habitat use, potentially increase angler catch and satisfaction, and promote enhanced public relations and support for future management activities.

Coastal Brigade, Growing our Future Coastal Conservation Leaders

Emily Miller, Texas Parks and Wildlife Department

Keywords: Coastal Brigade

In 2016, Coastal Brigade joined the Texas Brigades lineup. Texas Brigades is a nonprofit organization with a “mission to educate and empower kids with leadership skills and knowledge in wildlife, fisheries, and land stewardship to become conservation ambassadors for a sustained natural resource legacy.” Texas Brigades offers ten 5-day educational camps across the state, on topics ranging from ranch and wildlife to fisheries management, all to encourage today’s youth to become our conservation leaders of tomorrow. Coastal Brigade focuses on educating 13–17-year-olds on coastal habitat and fisheries management, as well as coastal ecology, saltwater fishing, boater safety, and more. Coastal Brigade takes place each summer in Galveston, where professionals from several agencies, including Texas Parks and Wildlife Department and Texas A&M AgriLife Extension Service, come together to pass on their knowledge and skills in conservation to future generations. At camp, students gain practical, hands-on experience in how a fishery is managed, which includes two off-site trips to the Sea Center Texas and Galveston Island State Park. Cadets also learn about watersheds, aquatic vegetation, and many of the marine species that inhabit the Texas coast. Students also have the chance to explore skills in photography, journaling, and art. Most importantly, each Brigades camp teaches life skills, such as leadership, team building, critical thinking, and public speaking. Coastal brigade aims to grow conservation leaders from our youth and encourages them to spread the conservation messages in their communities.

Employing a Style of Participation Self-Classification Measure to Understand Recreational Spotted Seatrout Angler Needs and Preferences in Texas

Daniel Pilgreen, Texas A&M University

Gerard Kyle and William Smith, Texas A&M University; Zack Thomas, Texas Parks and Wildlife Department; Danial Nayeri, Texas A&M University; and Steven Sutton, Atlantic Salmon Federation

Keywords: recreational specialization, Style of Participation self-classification, anglers

Recreation specialization is a process by which participants develop specific styles of participation (SOP) as they gain experience (Bryan, 1977). Specialization has been a decision-making tool for fisheries managers to understand the preferences, attitudes, and needs of their heterogeneous users (Bryan, 1979, 2000). Previous research has developed a SOP self-classification measure to classify fishing guides on context-specific SOP attributes such as tackle and bait type, fishing technique, casting tactic, water depth, and species (Smith, 2012; Smith & Kyle, 2010; Smith et al., 2023). The purpose of this research is to further Smith et al.’s SOP self-classification measure to a population with a diversity of specialization, recreational anglers, and explore the variability of management preferences across SOP. Data were collected from 846 licensed anglers in the state of Texas including recreational anglers (n=491) and fishing guides (n=355). The survey was developed with the Texas Parks and Wildlife Department and was administered online through email using a modified Dillman et al. (2008) method in fall 2023. The survey included the SOP self-classification measure (Smith et al., 2023) and items measuring lifestyle centrality, slot limit preferences, and respondent demographics. A series of chi-square and t-tests were conducted to explore the differences in SOP, centrality, and management preferences across guides and recreational

anglers. ANOVA was used to examine differences in slot regulation preferences across SOP in recreational anglers. Results support the extended use of the SOP self-classification measure in populations that exhibit diverse levels of specialization. Further, they identify significant differences in preferences for slot limit regulations across SOP. Although prescribing slot limit regulations to meet the needs of diverse constituents is a difficult task, the SOP self-classification measure offers fisheries managers a parsimonious and user-friendly technique to classify their diverse constituents and leverage SOP to find common management preferences across users.

Decision Making and Prioritization for the Conservation of Texas Fish SGCN

Diane Le Bouille, U. S. Geological Survey/Texas Tech University

Jane Rogosch, U. S. Geological Survey/Texas Tech University; Megan Bean and Tim Birdsong, Texas Parks and Wildlife Department; Daniel Bunting, U. S. Fish and Wildlife Service; Adam Cohen and Dean Hendrickson, Fishes of Texas; and Nate Smith, Texas Parks and Wildlife Department

Keywords: Native Fish Conservation Areas, species of greatest conservation need

The 2012 Texas Conservation Action Plan (i.e., the State Wildlife Action Plan for Texas) identified the need to prioritize geographic areas of the state for the restoration and preservation of species of greatest conservation need (SGCN). The Native Fish Conservation Areas (NFCA) are a network of 20 freshwater systems across Texas, identified as priority areas for the conservation of freshwater fish SGCN and the habitats they need to thrive. Conservation networks such as NFCAs are a primary tool in multi-species stream conservation at large spatial scales, provided that they are based on accurate predictions of species occurrence. We previously developed species distribution models (SDMs) to update predicted occurrences of SGCN across 3 main hydroregions centered around Texas. In addition to current species ranges, we also predicted future ranges, at several time horizons and under various scenarios of both climate change and land cover change. Finally, we identified, when possible, the main drivers of those range shifts. Here we present how we used that information for hierarchical prioritizations, with which we identify possible needed updates to current NFCAs. We also compare recommendations made under a variety of conservation goals including exclusively maximizing species conservation with factors such as range coverage and species representation or adding additional targets such as maximizing connectivity within an NFCA and providing additional conservation value to areas with recreational opportunities or existing public river access. Finally, we will discuss possible ways to integrate information on climate and land use drivers affecting projected range shifts and the challenges that come with this in conservation decision making.

Thermal Sensitivity and Exposure of Endemic Spring-Associated Fishes of the Edwards Plateau

Matthew Troia, The University of Texas at San Antonio

Nick Loveland and Garrett Tucker, The University of Texas at San Antonio; Marty Kelly, Nate Smith, David Young, and Warren Schlechte (retired), Texas Parks and Wildlife Department

Keywords: springs, San Felipe Creek, Honey Creek, temperature, Edwards Plateau, Guadalupe Roundnose Minnow, Devils River Minnow, Plateau Shiner, Guadalupe Bass, Rio Grande Darter, Greenthroat Darter, thermal tolerance

Springs and spring-influenced streams are important harbors of endemic faunas, yet they are threatened by land use change, groundwater extraction, and climate disruption. Despite these anthropogenic stressors, surprisingly few spatiotemporally complete temperature datasets exist for these habitats, limiting our understanding of baseline thermal regimes and our ability to forecast changes. To address this gap, we monitored fine-scale temperature variation at 15-minute intervals for 12 months in San Felipe Creek (Val Verde County; n=37 monitoring stations) and Honey Creek (Comal County; n=56). We also monitored coarse-scale temperature variation across eight drainages of the Edwards Plateau (n=55) at 15-minute intervals for the same 12-month period. This monitoring network generated > four million water temperature measurements. The sensitivity of water temperature to diel and seasonal air temperature fluctuations varied substantially across monitoring stations and increased at lower-magnitude springs and with increasing downstream distance from springs. Statistical models fit with spatial (e.g., distance from spring) and temporal (e.g., air temperature) covariates predicted daily water temperature with high accuracy ($r^2=0.93$). Next, we used laboratory assays to measure upper thermal tolerances at acute and chronic timescales and across acclimation temperatures for six species: Guadalupe Roundnose Minnow, Devils River Minnow, Plateau Shiner, Guadalupe Bass, Rio Grande Darter, and Greenthroat Darter. These assays revealed substantial interspecific variation in acute tolerance, chronic tolerance, and acclimation capacity. Consistent with putative spring association, the Guadalupe Roundnose Minnow was most sensitive and Plateau Shiner the least sensitive. Integrating field-based thermal exposure with lab-based thermal sensitivity suggests that springs provide essential thermal refugia for the most thermally sensitive species, whereas other species exhibit tolerance to withstand higher temperatures beyond the realm of spring influence. Overall, our findings reveal substantial spatial variation in thermal exposure and taxonomic variation in thermal sensitivity that, together, can inform spatially-explicit and species-specific conservation.

Shifting Saltwater Angler Preferences and Management of Spotted Seatrout in Texas

Dakus Geeslin, Texas Parks and Wildlife Department

Hanna Bauer and Zack Thomas, Texas Parks and Wildlife Department

Keywords: Spotted Seatrout, Winter Storm Uri, anglers, fishery management

In February 2021 Winter Storm Uri caused a fish kill of over 3.8 million fish on the Texas Coast. Spotted Seatrout (*Cynoscion nebulosus*) mortality was the highest among game fish with an estimated 160,000 lost coastwide. The event ranked as the largest freeze related fish kill since the 1980's and resulted in

emergency management action and a two-year temporary reduced harvest rule aimed at accelerating recovery of Spotted Seatrout which expired August 31st, 2023. Beginning in Spring 2023, Texas Parks and Wildlife Department (TPWD) Coastal Fisheries began to hear from saltwater anglers concerned about the long-term sustainability of the fishery and advocating to make the more restrictive harvest regulations permanent through Texas Parks and Wildlife Commission (Commission) action. To gauge public satisfaction with the Texas Spotted Seatrout fishery and gather angler preferences, TPWD held public scoping meetings at six locations along the coast to solicit angler input on the fishery and if regulation changes were desired. Additionally, TPWD contracted with Texas A&M University to conduct an online survey of 10,000 saltwater anglers and 1,600 fishing guides. Both the in-person meetings and online survey conducted as part of the scoping process showed preferences for smaller bag limits and a reduced slot limit size. The department also analyzed angler satisfaction as it related to different bag sizes. These analyses resulted in the development of a management proposal recommending changing the existing Spotted Seatrout harvest regulations. Results of the scoping efforts and shifts in saltwater angler preferences will be discussed and an update on recent Commission action will be provided.

Enhancing Endangered Mussel Conservation: Leveraging Multi-Scale Models for Effective Stocking Strategies

Cody Craig, Arrowhead Ecology Group

Keywords: mussels, machine learning models

Conservation managers in Texas face the challenge of efficiently utilizing limited resources to enhance mussel redundancy, resiliency, and representation (3 R's). To aid in this challenge, we developed machine learning models on multiple scales to identify optimal locations for mussel stocking. Our fine-scale models integrated climate, topography, and geology, while broader HUC12 instream models utilized water quality, habitat, and fish presence. These models, validated by field efforts, accurately predict candidate mussel species' occurrence. The synthesis of these models provides a strategic roadmap for protecting and improving current mussel populations, which contribute to conservation efforts in Texas.

Texas Angler Compliance during the Temporary Regulation Adjustment for Spotted Seatrout in Response to Winter Storm Uri in February 2021

Caren Utley, Texas Parks and Wildlife Department

Hanna Bauer and Leslie Hartman, Texas Parks and Wildlife Department

Keywords: Spotted Seatrout, Winter Storm Uri, fishery management, anglers

In February 2021, Texas was crippled with sub-freezing air temperatures for eight consecutive days. The reported all site mean bay water temperature, from NOAA, was a consistent 42°F for four days within that freeze event. The lower lethal temperature threshold for *Cynoscion nebulosus*, Spotted Seatrout, is approximately 42°F. Due to the extended exposure of the Spotted Seatrout's lethal thermal threshold, the estimated freeze mortality rate coastwide was over 160,000 individuals. Texas Parks and Wildlife Commission enacted two separate regulatory acts in the wake of this environmental impact to the population. First was an emergency regulation to immediately mitigate freeze mortality rates for Upper and Lower Laguna Madre. This emergency act lasted 120 days, from April 2021 to July 2021. The

Commission then enacted a secondary temporary regulation on March 16, 2022, and ending August 31, 2023. This second temporary regulation stemmed from a multitude of factors, including a decrease in overall abundance, decrease in recruitment, freeze mortality rates, and angler concerns. East Matagorda Bay to Lower Laguna Madre, served as the range extent of the temporary regulation. The regulation slot limit was adjusted to 17 to 23 inches, with a 3-bag limit. The effectiveness of the adjusted regulation was projected to increase the spawning biomass potential by 27% over the next seven years. Compliance of anglers during this temporary regulation adjustment was crucial for ensuring this population met biomass targets. Since extreme environmental events can shift fish size and age structures within a species population, it was pivotal that anglers play a role in the continuing conservation of Spotted Seatrout. Texas angler compliance during the temporary regulation yielded high compliance overall to slot and bag limits adjustments.

Will the Future Go with the Flow? Protecting and Restoring Environmental Flows and Water Levels in Texas Through the Environmental Flows Information Toolkit (EFIT)

Lindsey Elkins, Texas Parks and Wildlife Department

David Young and Kevin Mayes, Texas Parks and Wildlife Department; Mark Lueders and Ryan McManamay, Baylor University; and Marty Kelly, Texas Parks and Wildlife Department

Keywords: environmental flow, Environmental Flow Information Toolkit, Hydrology Dashboard, Flow Ecology Dashboard,

The Texas Parks and Wildlife Department (TPWD) led the development of the Environmental Flow Information Toolkit (EFIT). EFIT is a web-based geospatial decision support tool that identifies areas to align with voluntary management strategies for the restoration and protection of environmental flows. Currently, EFIT consists of the state-wide Hydrology Dashboard which quantifies flow alteration and deficits and assists in development of environmental flow protection and restoration strategies as well as a Flow Ecology Dashboard for the Southern Great Plains. Future goals include expanding the Flow Ecology Dashboard to aid in development of prioritization schemes used to meet environmental needs for fish and wildlife including sportfish and Species of Greatest Conservation Need. To support future goals, TPWD has funded work to identify flow-thresholds for expanding the Flow Ecology Dashboard for all river basins. The Water Planning Dashboard will contain a geospatial representation on the environmental flow regime recommendations prepared by bay and basin expert science teams, established under Senate Bill 3, as well as the environmental flow standards adopted by the Texas Commission on Environmental Quality. This will enable practitioners to examine how restoration or protection strategies can be used to meet flow standards. Ultimately, the EFIT will inform future management and conservation actions for Texas by identifying areas where species and habitats of concern, altered streamflow, and the pieces needed to craft environmental flow protection and restoration strategies intersect. Additionally, collaborators in the McManamay Lab at Baylor University have contributed to EFIT through multiple projects, including literature review and geospatial analyses. Most recently, they have implemented the ELOHA framework and reconstructed reference and human-altered hydrology for Texas rivers to help identify ecologically relevant thresholds of hydrologic alteration. This presentation will highlight some of the strategies TPWD and collaborators are developing.

Evaluation of Environmental Factors Influencing Survival, and Sex Determination, of Southern Flounder (*Paralichthys lethostigma*) on the Texas Coast

Ivonne Blandon, Texas Parks and Wildlife Department

Christopher Mace, Texas Parks and Wildlife Department

Keywords: Southern Flounder, sex ratios

The Texas Parks and Wildlife Department (TPWD) is implementing a stock enhancement program for Southern Flounder (*Paralichthys lethostigma*) focused on supplementing natural populations on the Texas coast. Fisheries managers in Texas have correlated warmer winter temperatures as a likely reason for population declines observed for this species along the Texas coast. Sexual differentiation in Southern Flounder is temperature dependent and TPWD staff release juvenile flounder at smaller sizes, prior to sex determination. The effect of natural environmental conditions across seasons on survival and sex of the juveniles in a bay and ponds were evaluated. Trials were conducted for 12 weeks during summer, fall, winter, and spring. Juveniles (25-35 mm TL, initially reared at 18°C to produce a documented 50:50 female: male ratio), were stocked into replicated (N=3) net pen enclosures. Natural environmental factors (such as temperature, oxygen, pH, and salinity) were measured with automatic data loggers. Average survival was calculated from the number of juveniles recovered per trial. The sex was resolved using RT-PCR RNA gene expression analysis. Fish stocked at 25-30 mm TL and reared under the 18°C temperature regime yielded more males than expected. In contrast RT-PCR gene expression analysis of fish recovered during summer showed nearly a 50:50 male to female ratio for juveniles ranging in size from 85-150 mm TL. Juvenile survival ranged from 0.13-85% across all trials, the lower value was observed in the open bay with predators. The best survival (85%) and fish growth from 23-120 mm TL was obtained during summer 2022 in earthen ponds with abundant primary and secondary productivity. Data collected on these trials suggests it may be advantageous to culture larger size Southern Flounder juvenile during summer, potentially improving survival and conditioning of hatchery produced juveniles without biasing sex ratios.

Eel Ramps and eDNA Detect Recruitment of American Eel (*Anguilla rostrata*) in Texas

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Keywords: American Eel, eel ramps, eDNA

The American Eel (*Anguilla rostrata*) is a facultative catadromous fish. Data are lacking related to juvenile (glass eel and elver) recruitment into the bays and estuaries of the Gulf of Mexico. The goal of the study was to document glass and elver American Eel to understand their recruitment timing and distribution in Texas. The study implemented year-round monitoring using eel ramps, and environmental DNA (eDNA) to increase the likelihood of detecting even highly sporadic recruitment events. Twelve sites were identified based on connectivity to coastal estuarine waters and the ability to support a gravity-fed eel ramp. Ramps were deployed in June-July 2022 and were checked weekly for one year. A subset of eight ramp sites were also monitored for eDNA during each ramp check. A total of 28 juvenile eels (19 glass and 9 elvers) were captured (three of which were captured outside of the scope of this study).

Detections of glass eels began in January, and detections of elvers ended in May. Environmental DNA positives were highest for the site where the majority of the eels were captured. Temporally, overall eDNA hits were correlated with the recruitment window observed through captures in the ramps. This study represents the first documented glass American eels in Texas, and provides critical information about recruitment timing and juvenile eel morphometrics along the northern Gulf Coast. Continued deployment of eel ramps during the shorter estimated recruitment window are planned for 2024 and 2025 focused on more strict site conditions with more frequent checks with the goal of assisting natural resource agencies in determining the conservation and management needs of American Eel in Texas.

Freshwater Mussel Recolonization in an East Texas Reservoir Four Years Following Dewatering, with Implications for Management of ESA-Proposed Texas Heelsplitter *Potamilus amphichaenus*

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Keywords: B. A. Steinhagen Reservoir, Texas Heelsplitter, dewatering

During a summer 2019 drawdown of B.A. Steinhagen Reservoir, an abundant and diverse assemblage of mussels was documented, including state-listed and ESA-proposed Texas Heelsplitter *Potamilus amphichaenus*. Since this drawdown resulted in complete mussel mortality over most of the reservoir, it provided a unique opportunity to evaluate recolonization and growth rates of mussels following refilling. In July 2023, the reservoir was dewatered again. We conducted dive surveys at 10 transects immediately prior to dewatering, and then revisited the same areas post-dewatering to document the mussel community present. The overarching goal was to evaluate mussel recolonization of the reservoir and sizes of Texas Heelsplitter to infer growth rates since the 2019 drawdown. A secondary goal was to examine community composition and species abundance between pre-dewatering dive surveys and post-dewatering surveys to assess species-specific patterns in detectability and behavioral response to desiccation. Results demonstrated a diverse and abundant mussel assemblage had recolonized the reservoir since 2019. Both species richness and density of mussels were higher in post-dewatering surveys than in dive surveys. Length frequency histograms suggest that Texas Heelsplitter can reach sizes of up to 131 mm within approximately four years. Study results can be utilized by lake managers to plan future reservoir maintenance activities while accounting for impacts to listed mussel species.

Blotchy Bass Syndrome in the Lone Star State: A Synergistic Approach to Citizen and Agency Science Integration

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Keywords: Blotchy bass syndrome, Angler's Atlas MyCatch, Largemouth Bass

Recent studies have determined that blotchy bass syndrome (BBS) in black basses in the northeastern United States has been associated with a family of viruses. In 2022, Texas Parks and Wildlife (TPWD) partnered with the United States Geological Survey (USGS) and West Virginia University (WVU) to collect distribution and prevalence data on blotchy bass syndrome in black bass species in Texas. For this effort, we implemented a two-pronged approach leveraging state agency biologists and anglers. Each of the 15 Inland Fisheries districts and River Studies received sterile swabs from USGS and WVU to collect DNA samples from fish displaying blotchy bass syndrome collected during standard electrofishing surveys. Five districts collected and shipped swabs to USGS for analysis. Additional sample collections are anticipated during 2024 sampling seasons. Simultaneously, we solicited anglers' reports via social media, ultimately requesting they submit photos and catch location information to us via email or through the Angler's Atlas MyCatch app. At the time of this abstract, over 1,100 individual submissions have been submitted. Most submissions have been Largemouth Bass, though presumptive cases of BBS have been documented in all four black bass species found in Texas. Angler reports of BBS were highest in April and lowest in August. Submissions to the app will continue to be accepted through February 2024. In the coming months, the team at USGS and WVU will determine the presence and novelty of viruses in Texas black basses.

Quantifying a Century of Suburban Succession in the Dallas – Fort Worth Metroplex and Effects on Carbon Export to Urban Streams

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Keywords: carbon export, C3 carbon, C4 carbon

Increasingly higher numbers of people are moving into urbanizing environments, and dynamics of suburban succession are expected to have important implications for watershed biodiversity, ecosystem functioning, and resiliency. Suburban succession is a unique form of secondary succession that occurs in residential ecosystems following development and in which humans function as ecosystem engineers. In this research, we used a space-for-time approach to quantify more than a century of suburban succession in the Dallas – Fort Worth metroplex (DFW) and consequences for carbon export to receiving waterbodies. Residential landscape plant diversity and habitat complexity were quantified for 232

individual properties nested within 14 neighborhoods constructed between 1906 and 2020. Home age, property value, and lot and home sizes were extracted from public records. Plant community structure and habitat complexity were positively correlated with home age, whereas plant density and taxonomic richness were positively correlated with home value. Specifically, suburban succession progressed from a starting point of simple turf lawns with limited habitat complexity to landscapes dominated by deciduous trees and high habitat complexity, but social trends and homeowner decisions related to landscape management affect the rate of that transition and the number of plants and taxa present. Plant community structure was correlated with the proportion of C3 carbon exported from neighborhoodsheds, but other metrics of suburban succession, namely mean home age, home value, plant density, and plant diversity, were not. Estimated proportion of C3 vs. C4 carbon exported during Spring and Fall rainfall events ranged from approximately 25% to 80%, and the proportion of C3 carbon was higher in larger size fractions and this difference was greatest during Fall. This research utilizes relevant ecological and sociological scales to link dynamic attributes of urbanizing environments to composition of carbon export. Ongoing research is investigating how changing composition of carbon imported affects aquatic ecosystem functioning.

Exploring the challenges and opportunities for eDNA bioassessment in aquatic systems of the arid Southwest

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Keywords: eDNA, Brazos River

Novel approaches for assessing environmental DNA (eDNA)—or DNA found in faeces, mucus, skin cells, organelles, gametes, or even extracellular DNA—have revolutionized bioassessment efforts, transforming the speed, scale, and consistency with which biodiversity measurements can be made. For example, loop-mediated isothermal amplification (LAMP) assays show promise for high-sensitivity, on-site detection of target species. Alternatively, DNA metabarcoding has the capacity to measure the entire biodiversity in a sample—from microbes to mammals—and is increasingly being used to assess multispecies patterns and metacommunity dynamics. Despite the promise of these and other approaches, much of the eDNA work globally in freshwater systems has been concentrated in temperate or cold ecosystems, where DNA likely persists in the environment long after it is deposited. Arid streams of the Southwest, which experience extreme temperatures, high variability in flow dynamics, and can have very high sediment loads, present unique challenges to eDNA bioassessment approaches. To explore these challenges, on March 24-25th, 2023, we hosted an eDNA Workshop and Symposium with the theme, “Exploring Challenges and Opportunities Across Diverse Applications,” which brought together 10 international experts in eDNA and 82 registered participants spanning diverse sectors, including government agencies, NGOs, private companies, and academic institutions. In addition to showcasing the utility of a host of eDNA bioassessment tools with interested participants, a workgroup including eDNA experts and practitioners explored the challenges and opportunities for using eDNA in Southwestern aquatic systems, using the upper Brazos River of Texas as a case study. Here, we showcase some of the key outcomes of the eDNA workshop, outlining important considerations—including eDNA collection, storage, extraction, and cleanup, ideal PCR conditions, sequencing constraints, and bioinformatic decisions—that should be evaluated when planning a project utilizing eDNA for bioassessment in aquatic systems of the Southwestern U.S., as well as other arid freshwater systems.

Striking and Previously Unnoticed Secondary Sexual Dimorphism of the Musculoskeletal System in Minnows and Shiners Enables Rapid, Non-Invasive Sex Identification

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Keywords: Leuciscidae, sexual dimorphism, Red Shiner, Sand Shiner, Sharpnose Shiner, Common Minnow

Many North American and Eurasian minnows and shiners of the family Leuciscidae (formerly Cyprinidae) exhibit obvious sexual dimorphism (tubercles) and dichromatism during the spawning season but can be challenging to sex when not reproductively active. We report on a striking sexual dimorphism of the pectoral fin and girdle in leuciscids that can be viewed externally and used reliably to identify the sex of larger juvenile or adult individuals. Using *Cyprinella lutrensis* (Red Shiner), *Notropis stramineus* (Sand Shiner), *N. oxyrhynchus* (Sharpnose shiner) and *Phoxinus phoxinus* (Common minnow) as examples, we show that the cleithrum, scapula, coracoid, and pectoral radials are larger and more heavily ossified in males than in females. Muscles originating on these bones (inserting on to the pectoral-fin rays) are also larger in males than in females. As far as we know, dimorphism of the shoulder girdle has not been reported previously in leuciscid fishes, but is present in members of at least ten genera and in members of at least two other families of cyprinoids (Cyprinidae and Gobionidae), suggesting that this dimorphism is a widespread, and potentially ancient trait of the Cyprinoidei. The discovery of this sexual dimorphism in minnows and shiners has implications for fisheries science and management, the most obvious being rapid, non-invasive sex identification of minnows and shiners in the field or within a hatchery setting.

Lavaca Bay Ecosystem Assessment: Gathering Key Baseline Data Among Nursery Habitats Across a Pollution Gradient

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Keywords: Lavaca Bay, marsh

The Lavaca Bay System is an important estuarine ecosystem located in the northwest corner of Matagorda Bay along the central Texas coast. Within this system, juvenile fish, shrimp, and crabs inhabit fringe marsh habitats and provide substantial ecological, commercial, and recreational benefits. However, this area has been ecologically altered over several decades due to industrial activities resulting in elevated levels of mercury, polycyclic aromatic hydrocarbons (PAHs), microplastics, and other pollutants. Today, it is the site of numerous restoration projects. While previous studies have focused on open bay sampling, there is limited data for the region's critical marsh habitats. The goal of this study is to establish

a contemporary baseline for the area's fringe marsh ecosystems and determine the effects of pollution on estuarine dependent nekton abundance and community structure. Since May 2022, we have collected quarterly faunal samples from eight sites located across a presumed pollution gradient. Additionally, water samples have been collected at each site and will be analyzed to determine the presence of microplastics. Upon completion of sampling in February 2024, two years of seasonal ecological data will be compared to existing studies in similar habitats along the central Texas coast. The results of this study will help determine the overall health of the Lavaca Bay System and inform researchers, resource managers, and policymakers responsible for future management and restoration efforts.

Shallow Stream Cyanotoxin Loading into Texas Lakes

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Keywords: cyanotoxins, microcystins, tributaries

Toxin-producing cyanobacteria are problematic in freshwater bodies across the globe. Shallow stream surveys in various regions of the United States have reported widespread cyanotoxins, and in some cases have contributed to deleterious downstream effects. Here, we report widespread occurrence of microcystins in shallow streams across Texas, and in their downstream lakes. In many instances, stream microcystins, which ranged from 0.21 to 0.48 µg per liter when detected, closely matched the concentration of microcystins in each stream's corresponding lake. A simple mathematical model was created to simulate the stream loading of microcystins into our lakes of interest and the natural decay rate of microcystins. Tributary discharges for this model were estimated using HAWQS. Focusing on loading periods of 7, 14 and 30 days, our model suggests that tributary contribution to in-lake microcystins concentrations could be as high as 21%. Early explorations of watershed land use have suggested that large areas of croplands, in addition to historical precipitation averages, heavily contribute to stream concentrations of microcystins. Future work will explore commonalities between specific crops that tend to correlate positively with higher stream microcystins. Finally, our findings suggest that a tributary monitoring network might serve as an early warning system for lakes.

Sexual Dimorphism and Dispersal: What Morphological Differences Can Tell Us about Dispersal Capability in the Highly Invasive Western Mosquitofish (*Gambusia affinis*)

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Keywords: Western Mosquitofish, sexual dimorphism, dispersal studies

Fish dispersal and the ability to move to novel environments is vital for surviving in a changing world. Moving to new environments allows access to favorable habitats, increases the likelihood of finding a mate, and provides refuge. Studies of multiple species show that individuals that disperse are not a random subset of a population, and thus dispersing individuals may exhibit unique morphology compared to non-dispersing individuals. However, studies on sex-specific differences in dispersal among fishes are rare. The Western Mosquitofish (*Gambusia affinis*) is a model system for studying sex-specific dispersal traits given that they are sexually dimorphic and can be easily identified in field settings (i.e., males have

a modified anal fin called a gonopodium). This study focused on sexual dimorphism in Western Mosquitofish and the influence it may have on dispersal ability of males versus females. We utilized linear morphological measurements and proportional ratios related to dispersal ability to test if sexes differed in morphology related to dispersal capability. Multiple analysis of variance and random forest models revealed females were generally larger in size and had larger caudal fin aspect ratios, two traits positively correlated with fish dispersal ability. However, males exhibited longer relative caudal area, a trait that positively correlates with swimming ability. Results across multiple traits suggest that female Western Mosquitofish might be superior dispersers compared to males. Given that most previous dispersal studies focused on male mosquitofish, the inclusion of females is likely vital to understanding population-level patterns and processes that are maintained by movement, including invasion success and establishment of new populations in novel habitats.

Cellular Mechanism of Intracellular pH Regulation During Exposure to High CO₂ in Rainbow Trout (*Oncorhynchus mykiss*) and Channel Catfish (*Ictalurus punctatus*)

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Keywords: Rainbow Trout, Channel Catfish, pH regulation, carbon dioxide

Freshwater systems worldwide have a mean partial pressure of CO₂ (PCO₂) of approximately 0.3 kPa (~3100 µatm), which is about eight times higher than atmospheric PCO₂. High CO₂ is also found in aquaculture environments where PCO₂ can reach 4 kPa PCO₂; these high CO₂ environments act as a stressor that may be energetically expensive for fish and impact their optimal growth patterns. High CO₂ may exacerbate other stressors in aquaculture (e.g., high density and fish transport). Such stressors may impose increased metabolic demand due to active transport of ions to maintain homeostasis because of the acid-base disturbance induced by high CO₂. There are two general strategies of pH regulation in fishes: (1) coupled pH regulation (CPR), where regulation of blood pH facilitates tissue pH regulation; fishes using this strategy are less tolerant of high aquatic PCO₂; (2) preferential intracellular pH (pHi) regulation (PPR), where pH blood is reduced and not regulated but tissue pH remains tightly regulated, thus maintaining intracellular homeostasis at very high PCO₂. The cellular and molecular mechanisms underlying the differences in pHi regulation between the two strategies of acid-base regulation are currently unknown. We investigated the mechanisms of pH regulation in fishes using Rainbow Trout (*Oncorhynchus mykiss*) and Channel Catfish (*Ictalurus punctatus*) which use CPR and PPR, respectively. Fish were exposed to high CO₂ pressures for 3 and 24 h, then blood, heart, gill, liver, and muscle samples were collected. We found upregulation of sodium-bicarbonate cotransporters (NBCs) after 24 h of CO₂ exposure; these corresponded to changes in plasma chloride ion concentrations. No change in sodium-potassium ATPase (NKA) was observed, apart from one isoform in liver at 3 h. Increased NBC expression in catfish suggests that fishes using PPR are better suited for aquaculture conditions where high CO₂ tensions may occur alongside other aquaculture related stressors.

Historical Change of a Large River Fish Assemblage Following Lock and Dam Construction

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Keywords: Red River, lock and dam, periodic species, equilibrium species, functional richness

The Southeastern United States is rich in freshwater fish diversity. However, habitat alteration has a profound impact on fish assemblages across this region. The Red River, Louisiana has historically been diverse in fishes. In the 1980's and 1990's a series of five lock and dams were constructed on the Red River to facilitate watercraft traffic. To assess assemblage changes attributable to lock and dam construction, I analyzed historical survey data from the Red River between 1966 and 2002. I compared changes in assemblages pre- and post-construction of the first lock and dams using species composition and richness, life history strategist composition, and functional richness. The results show similar species richness across time, but the data also show a shift in assemblage composition after dam construction with three distinct periods corresponding to pre-construction, during construction, and post-construction of lock and dams. Life history analyses are similar, with the time periods following the first lock and dam construction showing a rapid decline in Periodic species and an increase in Equilibrium species. Functional richness also decreases following lock and dam construction. These results indicate a multi-metric approach may be the most informative when examining assemblage change.

High-Resolution Species Distribution Modeling of Endemic Texas Crayfish Species Under Current and Future Conditions

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Keywords: Bastrop Crayfish, Fayette's Crayfish, Nueces Crayfish, ecological niche modeling

This study uses ecological niche modeling under current and future climates to understand the habitat associations of three crayfish species endemic to the Jackson Vale of Central Texas: *Procambarus texanus* (Bastrop Crayfish), *P. fayetti* (Fayette's Crayfish), and *P. nueces* (Nueces Crayfish). Our study uses pedological, hydrological, and climatic variables in a comprehensive, high resolution, and multivariate framework. We found that the niches of abutting species *P. texanus* and *P. faeyttei*, found in smaller, flatter and more moderate precipitation environments were ecologically very similar to one another, but were different from *P. nueces*, which is found in areas with less precipitation, increased slope and larger waterways. Under the future climate forecast that we used HadGEM3-GC31-LL for the years 2041-2060 with a shared socioeconomic pathway, SSP, of 585, we found that the native environment for all three species becomes dramatically less habitable. This work, the most detailed crayfish habitat modeling to be carried out at a broad spatial extent, provides insights into the environmental factors that distinguish the habitats of these three species, and provides reason for alarm for conservation managers of this group. This project will be expanded to include more climate models and different SSPs to evaluate how sensitive the future model forecasts are to different assumptions.

Beta Diversity of Stream Fishes in East Texas: Partitioning Variation Among Spatial Scales

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Rebecca Mangold, Johnathan Ellard, Joshua Perkin, and Kevin W. Conway, Texas A&M University; Kole Kubicek, Lamar University; and Carmen Montaña, Stephen F. Austin State University

Keywords: Neches River basin, Sabine River basin, beta diversity, additive diversity partitioning, local contributions to beta diversity partitioning

Understanding the mechanisms that influence patterns of biodiversity and community assembly at different spatial and temporal scales can aid in predicting changes in natural resources and prioritizing conservation management actions. East Texas streams harbor rich freshwater biodiversity; however, recent changes in land uses over the last decades appear to be major drivers influencing species richness, abundance, and distribution in this region. In this study, standardized surveys were conducted at 60 stream reaches throughout the Neches River basin and Sabine River basin, during the summer season, to examine the spatial scale (i.e., ecological region, basin, sub-basin) patterns influencing fish assemblages at local stream sites. We hypothesized significant differences in beta diversity across all spatial scales. To assess this, we performed dissimilarity analyses to examine the differences in dispersion among fish assemblage compositions across all spatial scales. In addition, an additive diversity partitioning (ADP) was used to examine the relative contributions of each spatial scale to total beta diversity. Likewise, the ecological uniqueness, or species dissimilarity, of each site was calculated by local contributions to beta diversity (LCBD) partitioning. The dissimilarity analyses did not find significant variation in beta diversity at the ecological region and sub-basin scales; however, significant differences in beta diversity were observed at the basin scale. The ADP analysis suggested that the smallest spatial scales (between and within sites) explained more than half of the total beta diversity, while the LCBD suggested that five stream sites within the Neches River basin significantly contributed to the dissimilarity of all sites. Finally, species replacement (turnover) was dominant across all spatial scales. Our findings emphasize the importance of both broad and local-scale conservation efforts in order to maintain overall diversity and inform conservation practices.

Mesohabitat and Macroecological Correlates of Blue Sucker Occurrence in Regulated Rivers

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Keywords: Blue Sucker, Angelina River

Blue sucker (*Cycleptus elongatus*) populations occur in the Mississippi River and Gulf of Mexico drainages of North America and are negatively affected by habitat fragmentation and flow regime alteration caused by dams. During fish assemblage surveys in August of 2022, we collected five juvenile Blue Suckers (312–428 mm total length) in the Angelina River upstream of Sam Rayburn Reservoir in East Texas (46,335 ha surface area) where the occurrence of the species was previously unconfirmed. Given this unexpected finding, we (1) analyzed mesohabitat associations to compare habitats we sampled with reports in the literature and (2) reviewed Blue Sucker occurrences in state, national, and global databases across historical (1950–1980) and contemporary (1981–2022) time periods to assess occurrence

across gradients of habitat fragmentation and streamflow regulation. The Blue Sucker population in the Angelina River upstream of Sam Rayburn Reservoir was previously unconfirmed but is within the native range. Mesohabitats occupied by blue suckers were consistent with literature reports, including fast velocity, shallow depth, and coarse substrates. The low degree of regulation (19% of natural runoff stored by upstream reservoirs) and a high degree of habitat connectivity (287 rkm of unfragmented mainstem habitat) for the Angelina River upstream of Sam Rayburn Reservoir matched range-wide patterns of persistence within relatively intact (unfragmented and unregulated) or remnant (fragmented but unregulated) riverscapes. Our review reveals that Blue Sucker populations might persist (1) in remnant river fragments where local habitat conditions are appropriate and (2) where effects of habitat fragmentation and flow regulation are not coupled.

Long-Term Changes in Fish Assemblage Structure Across the Neches River Basin

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Keywords: Neches River, Angelina River, Pine Island Bayou, Sabine Shiner, Blue Sucker, , environmental flows

River regulation and fragmentation caused by dam construction are primary threats to large river fish assemblages on a global scale. However, there is increased interest in restoration of riverine ecosystems through flow regime management that mimics natural flow regimes. A necessary first step in assessing the potential for flow restoration to contribute to ecological restoration is identification of target or historical ecological conditions. Long-term ecological perspectives considering historical, pre-regulated conditions and contemporary, post-regulation conditions provide valuable insight for guiding restoration decisions. The Neches River Basin supports some of the highest fish diversity in Texas and encompasses several sections of preserved land including the Big Thicket National Preserve, the Angelina National Forest, and the Davy Crockett National Forest. However, a lack of data on basin-wide fish diversity change hinders conservation planning for initiatives like the Sustainable Rivers Program which seeks to improve aquatic diversity through the design and management of environmental flows. In this study, we investigate stream fish assemblage change over a 67-year period (1956 versus 2023) in the Neches River Basin. We resampled 26 sites from a historical Texas Game and Fish Commission community survey conducted on the Neches River, Angelina River, and Pine Island Bayou. We used non-metric multidimensional scaling and spatial dissimilarity along different segments of the rivers (upper Neches, lower Neches, Angelina, and Pine Island Bayou) to quantify shifts in fish assemblage structure throughout the basin. Two major changes include decline in Sabine Shiner (*Notropis sabinae*) throughout the basin and invasion of marine species in the lower basin, while other species such as Blue Sucker (*Cycleptus elongatus*) have persisted in fragmented but minimally regulated segments. Our results help inform flow management through initiatives such as the Sustainable Rivers Program by establishing historical baseline conditions and the locations and fish species that have contributed to long-term shifts.

An Investigation of Personality in the Creek Chub, (*Semotilus atromaculatus*)

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Keywords: Creek Chub, personality, behavior syndrome

Intraspecific variation in personality traits is increasingly recognized as an important driver of ecological processes, particularly within the context of species invasions. However, relatively few studies have investigated personality in native fauna with more localized dispersal patterns, and information regarding the existence of personality in stream fishes native to the southeastern United States is particularly lacking. In this study, we investigated and characterized personality in a native and widespread minnow species, the Creek Chub (*Semotilus atromaculatus*). The Creek Chub presents a unique opportunity to investigate the importance of personality-dependent processes for stream communities due to its piscivorous diet, use of its nests by nest-associating minnows, and its role as a colonizer of intermittent streams. We identified personality traits by estimating the repeatability of sociability, boldness, exploration, and activity in two separate behavioral assays, and interpreted correlations between traits as evidence of behavioral syndromes. We did not detect repeatability for measures of sociability, possibly due to potential predatory interactions within this species. However, boldness, exploration, and activity were significantly repeatable and positively correlated, pointing to the existence of a bold-exploratory-active syndrome in this species. Larger individuals were less active, and, despite a relatively small sample size, we detected significant differences between source populations for measures of boldness. This is the first study to identify the existence of a behavioral syndrome in Creek Chub and points to the importance of considering the role of personality in ecological processes involving native fauna.

Assessing the Distribution of Fish Biomass Associated with Seafloor Characteristics at Two Natural Reefs Within the Gulf of Mexico

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Keywords: East Bank Ridge, Big Seabree Reef, split beam sonar

Sonar mapping and imagery are commonly utilized in marine environments where environmental factors such as depth, water conditions, size, and visibility are limiting. Biomass estimates and seafloor characteristics are also frequently determined using acoustic surveying methods in these restrictive conditions. This study was conducted on two natural reef formations in the northwestern Gulf of Mexico. East Bank Ridge and Big Seabree Reef are located between 15 and 18 nautical miles off the coast of South Padre Island at depths of 30-45m. There is little data on the structural composition or fish community at East Bank Ridge, but both are well-known fishing sites in the local community. In this study, we identified high-relief structures, determined the seafloor characteristics, and quantified fish biomass across both sites. Sonar maps of the formations were created using side-scan and multibeam sonar to identify suitable habitats for reef fish species. Split beam sonar was used to determine fish biomass and quantify bottom characteristics across the two sites. Generalized Additive Models (GAMs) were conducted using heading, time, depth relief, bottom rise time, bottom roughness, and area surveyed.

This informed how differences in high relief structure and location impacted fish abundance between two local natural reef formations that are popular fishing sites.

Asymmetric Competition Among Stream Fishes: Do Food Web Pathways Mediate Competitive Outcomes?

Owen George, Texas Tech University

Scott Collins, Texas Tech University

Keywords: asymmetric competition, Brown Trout, Rio Grande Chub, Rio Grande Sucker, diet richness, diet overlap, benthic macroinvertebrates

Limiting resources are often unevenly distributed among competing consumers, as larger, more aggressive, and faster-growing species disproportionately exploit food or habitat. In such cases, asymmetric competition can occur, resulting in stronger negative effects for some species and comparatively weaker effects for others. The objective of this study was to assess how energy flows along different food web pathways affect patterns of growth and production of invasive Brown Trout (*Salmo trutta*) and native Rio Grande Chub (*Gila pandora*) and Rio Grande Sucker (*Catostomus plebeius*). We hypothesized that the accessibility of differing food web pathways determines the degree of diet overlap among species which, in turn, affects growth rates among species. To test this hypothesis, we quantified (1) diet richness, (2) utilization of aquatic and terrestrial food web pathways, (3) diet overlap, and (4) mass-specific growth rates of all species in six mountain streams (New Mexico, USA) from 2020 – 2021. Diet breadth varied among species from 17 to 78 unique diet items, with Brown Trout having the largest diet breadth. Diet overlap was greatly influenced by the inclusion or exclusion of select food web pathways. Pathways including allochthonous terrestrial inputs and predation on fish and crayfish were important to Brown Trout, but not Rio Grande Chub and Rio Grande Sucker. In contrast, benthic macroinvertebrates were an important food resource for all fish species. After excluding food web pathways in a systematic manner, we identified benthic macroinvertebrates as the key food web pathway shared among species. Mass specific growth rates of native species were lower than Brown Trout, especially at small sizes where diets overlapped the greatest. Moreover, growth rates of native species declined in streams where Brown Trout consumed more benthic macroinvertebrates. Our findings indicate that diet plasticity is an important determinant of asymmetric growth and competition in stream fish communities.

Using eDNA Metabarcoding to Assess Fish Assemblages in the Rivers and Streams of Texas

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Keywords: eDNA, National Rivers and Streams Assessment

Long-term and large spatial-scale studies on fish distribution and community assemblage are important in understanding environmental effects on population trends, species demographics, and the health of aquatic systems. Traditional methods for monitoring fish in riverine environments (e.g. electrofishing) are widely accepted, however they are time and resource consuming and require skilled taxonomists.

Environmental DNA (eDNA) metabarcoding has emerged as a rapid and non-invasive tool for inventorying fish communities in diverse freshwater systems. While it cannot replace traditional methods for quantification or growth, it has proven useful in identifying the presence of fishes and can be superior at detecting rare or cryptic fishes. In this project, we compare the use of eDNA metabarcoding to electrofishing for characterizing fish communities within the rivers and streams of Texas. A total of 80 randomly distributed sites as part of the National Rivers and Streams Assessment (NRSA) will be sampled in the summers of 2023-2024. With a sample reach of each site is 40x the average width, two types of eDNA samples are collected at each site, one 1L grab sample at designated coordinates and a composite sample of eleven 100mL samples collected at evenly distributed transects throughout the study reach. The fish community at the sites is also sampled using electrofishing and physical habitat and environmental conditions are recorded following NRSA protocols. Metabarcoding of eDNA using the 12S and 16S mitochondrial genes is ongoing, with planned comparisons between the two types of eDNA samples and with the electrofishing results. We expect to be able to share preliminary results at the time of the meeting. To date we have completed 38 sites, and this project will continue through 2024 with the goal of evaluating the reach and limitations of eDNA metabarcoding in the diverse river systems of Texas.

Fish Metacommunity Dynamics in Response to Drought in the Upper Brazos River Basin

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Chase Nimee, Stephen F. Austin University; Kaley Cave and Zacchaeus Compson, University of North Texas; Carmen Montaña, Stephen F. Austin University; and David Hoeinghaus, University of North Texas

Keywords: Brazos River, Double Mountain Fork of the Brazos River, Salt Fork of the Brazos River, Smalleye Shiner, Sharpnose Shiner, Red River Pupfish, Red Shiner, metacommunity dynamics, diversity partitioning

Patterns of fish community composition at the regional scale provide valuable information for managers and stakeholders, including crucial knowledge of the processes controlling how communities are organized in space and time. Understanding these processes and how they relate to environmental dynamics is critical to effectively manage imperiled species, design and implement recovery strategies, and maintain biodiversity and ecosystem functioning. The upper Brazos River is an ideal system to investigate environmental drivers of metacommunity dynamics – it is representative of southern plains rivers in that it traverses a heterogeneous landscape, experiences high variation in flow and connectivity, and is home to an imperiled fauna, including the endemic and federally endangered Smalleye Shiner (*Notropis buccula*) and Sharpnose Shiner (*Notropis oxyrhynchus*). For one-year, we performed monthly field surveys at 22 sites along the mainstem (BRM), Double Mountain Fork (DMF), and Salt Fork (SF) of the upper Brazos River basin. During each survey, we quantified several biotic and abiotic variables, including species composition and relative abundance, and environmental parameters at multiple scales (instream, riparian, landscape). In total, 29 species were identified in our surveys, with high variation in local community composition and species richness in space and over time. For example, both endangered shiner species showed higher abundances in the BRM and lower parts of the DMF, whereas Red River Pupfish (*Cyprinodon rubrofluviatilis*) dominated low-diversity sites along the SF, and Red Shiner (*Cyprinella lutrensis*) was more abundant in the upper DMF. Diversity-partitioning analyses quantified local community and species-specific contributions to beta diversity (LCBD and SCBD, respectively). Beta-diversity partitioning results identify critical locations and the roles of individual species to turnover, and when integrated with environmental variables, can provide evidence for how environmental

dynamics, such as drought, mediate species distributions and turnover, including for imperiled species of interest.

The *Carpiodes* Conundrum: Molecular and Morphological Patterns of a Putative Undescribed Catostomid, the Llano River Carpsucker

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Keywords: Llano River Carpsucker, carpsuckers

In the Colorado River of Texas, there is evidence of an undescribed species of carpsucker, the Llano River Carpsucker (*Carpiodes* sp. cf. *carpio*). The Llano River Carpsucker (LRCS) is thought to possess a more elongated body compared to sympatrically occurring River Carpsucker (*Carpiodes carpio*). Published accounts of LRCS are limited, and molecular relationships to valid species of *Carpiodes* are currently unknown. The objective of this study was to assess morphological and molecular variation among members of the genus *Carpiodes* inhabiting central Texas river basins. Sampling resulted in whole body and tissue preservation of 260 specimens. Seventeen homologous landmarks from photographed specimens were used to perform a morphological analysis assessing gradients of body shape variation. Specifically, a principal component analysis (PCA) was performed on the landmarks to determine shape features that best explained the morphological variation. DNA from tissue samples were extracted and amplified using Polymerase Chain Reaction (PCR) protocols unique to the Mitochondrial Cytochrome b (CYTB) gene and Nuclear IRBP2 gene and sanger sequenced. The aligned DNA sequences were used as input to develop minimum spanning haplotype networks for each gene. For the CYTB gene, a common haplotype was revealed that was generally restricted to the Edwards Plateau Region of Texas where LRCS are common. Three dominant haplotypes encompassing over 75% of the specimens were used as predictor variables for a permutational multivariate analysis of variance (PERMANOVA) with morphological principal components (PC) from the PCA as response variables. A significant relationship between haplotypes and the first PC, which itself demonstrated variation in body depth, was revealed. This study provides insight into the morphological and molecular covariance among members of *Carpiodes* within Texas and can be used to inform taxonomists whether LRCS are in fact genetically and morphologically unique, or simply an anomalous morph of a valid member within *Carpiodes*.

Using Mark-Recapture to Evaluate the Success of a Relocated Mussel Community in the Lower Sulphur River

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Keywords: mussels, Sulphur River

Conservation efforts to preserve freshwater mussel communities have become more common as these animals become increasingly threatened by their changing habitats. As humans continue to shape and change the world around them, aquatic species living in modified and disturbed water systems can be negatively impacted leading to ecosystem decline. Freshwater mussels work as habitat engineers acting as

important filter feeders who stabilize the substrate, impact water clarity, and chemistry, and partake in nutrient cycling. During disturbance events involving a stream, river, or pond, the relocation of affected mussel beds is becoming more widespread. Although there are few of these studies, many of those that have been conducted are seen as successful in relocating and conserving their mussel communities. This study will focus on the growth, detection probability, and success of relocating a mussel community impacted by a dewatering event to repair a dam located on the Wright Patman reservoir on the Sulphur River. We collected mussels along the bank following a receding water line and within the dewatered basin over a three-day period. Collected mussels were transported downstream to a predetermined relocation site. At the relocation site, all mussels were identified to species and a representative number of each species were measured and tagged. During our initial survey, we collected and relocated a total of 1199 individual mussels from 11 different species. From the 1199 total relocated, we tagged 229 mussels from 10 of the species we collected. Our first resample of the relocation site took place in September of 2023. From the total 168 mussels found, 61 had been previously tagged and 107 were untagged. All untagged mussels collected were measured and tagged. A final resampling event will take place within the next year to evaluate the success of the relocation efforts using a mark-recapture approach.

Investigating the Effectiveness of Stream Temperature, Intermittency, and Conductivity Loggers to Quantify River Connectivity

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Jane Rogosch, U.S. Geological Survey; and Nate Smith and Clint Robertson, Texas Parks and Wildlife Department

Keywords: intermittent streams, Concho River, Onion Creek, San Saba River, South Llano River

Supra-seasonal droughts are drying events that occur across seasons and increase concern for water availability in aquatic ecosystems. In intermittent systems, the severity of decreased stream flow is amplified by droughts, including those occurring in Texas. Documentation of these drying events is necessary to evaluate ecosystem health. However, perennial river sections are prioritized for stream gauging, and many intermittent reaches remain un-gauged. Our objective was to document stream flow to determine the timing, duration, and severity of drying events in the Colorado River tributaries. HOBO loggers were converted to Stream Temperature, Intermittency, and Conductivity (STIC) loggers, providing a low-cost method for water presence monitoring. These loggers were deployed at 19 sites, one in each habitat of the required pool-riffle sequence, and recorded a measurement every six hours for a 350-day monitoring period (June 2022-May 2023). Initial analysis of STIC logger data from the four tributaries in our study show that the Concho River and Onion Creek were disconnected (riffles without water presence) for 100% of the monitoring period and, on average, the pools of these tributaries had water presence during 32% and 44% of the sampling period, respectively. Continuous streamflow was recorded for 44% and 40% of the monitoring period for the San Saba River and the South Llano River respectively, and the pools of these sites have retained water presence throughout. Evaluation of intermittency patterns will continue over a two-year sampling period. Understanding drying metrics will be used to study ecosystem responses in un-gauged systems in further studies.

Local Stream Predictors of Darter (Percidae) Assemblages in East Texas Streams

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Keywords: darters, Neches River basin, Sabine River basin

Darters are members of the family Percidae, the second richest group of freshwater fishes in North America. They inhabit lotic environments, have benthic lifestyles, and exhibit ecomorphological adaptations to variation in water depths, flows, and substrates. Their small slender bodies allow the ability to “dart” between and under structures found in swift-moving streams. Despite their advantageous adaptations and phenotypic differentiations, darters face conservation challenges due to anthropogenic threats. East Texas is home to a high diversity of darters with over 15 species occurring in the region, including 5 Species of Greatest Conservation Need (SGCN). In summer of 2023, we conducted standardized surveys across 60 streams in the Neches River and Sabine River basins to examine local environmental variables that could explain the distribution of darters within these basins. Given their affinity for lotic/benthic lifestyles, we hypothesized that water flow and substrate composition will be the main drivers of darter assemblage structure in these streams. A redundancy analysis performed on abundances and local habitat variables across all streams revealed that assemblage structure is influenced by substrate composition (e.g., sandy bottom), water discharge, and depth. The better predictors for darter assemblages within the Neches River basin were water discharge, temperature, conductivity, and sandy substrate, while the main predictor for the Sabine River basin was sandy substrate. As expected, evidence of darter habitat affinity was observed across sites in both river basins. Our findings can aid in planning conservation decisions for darters and other SGCN in east Texas. The next steps in this research will be ecomorphological analysis of darter species in these basins to better assist in improving understanding of fish responses, vulnerability to land use changes, and conservation needs of stream fishes in Texas.

Metabarcoding for Rapid Detection of Imperiled Fishes in the Upper Brazos River, Texas

Kaley Cave, University of North Texas

Tobin Davidson, Mississippi State University, Lindsey Davis and Michael Curtis, University of North Texas; Chase Nimee, Stephen F. Austin State University; Michael Sandel and Kayla Fast, Mississippi State University; Minh Vu, University of North Texas; Carmen Montaña, Stephen F. Austin State University, Nacogdoches, TX); and David Hoeinghaus and Zacchaeus Compson, University of North Texas

Keywords: eDNA, Brazos River, Sharpnose Shiner, Smalleye Shiner

Environmental DNA (eDNA) metabarcoding is a revolutionary bioassessment tool that can provide non-invasive, long-term monitoring for the management of imperiled species. Despite its promise, application of DNA metabarcoding for resource management is limited by information gaps related to amplicon reference databases and the effectiveness of primers. We are addressing those limitations for the upper Brazos River, a southern plains river system home to the endemic and federally endangered shiners,

Sharpnose (*Notropis oxyrhynchus*) and Smalleye (*Notropis buccula*). Of the 29 fish species present in the upper Brazos River in Texas, 20 did not have sequenced genomes in GenBank. We extracted DNA from 87 vouchered specimens deposited at the Biodiversity Research and Teaching Collection at Texas A&M University; these specimens represent all known fish species occurring in the upper Brazos River. Next, we sequenced the mitochondrial genomes of the two endangered shiners (Smalleye, n = 5, and Sharpnose, n = 6) and used in silico analysis to assess the efficacy of 22 different metabarcoding primer sets (12S, 16S, CytB, and COI gene regions) for distinguishing shiners at the species level. We also assessed which primers could distinguish most of the remaining 27 species present in the upper Brazos River. Five of those primers were tested in the lab to validate that each of the 29 fish species could be amplified and sequenced those amplicons. Finally, we validated the most promising of these primers on environmental samples where species occurrences were documented using traditional sampling methods (i.e., seining). DNA sequences were uploaded to GenBank, enabling future eDNA work for the entire fish assemblage of the upper Brazos River and beyond. Findings from our work enhance the utility of eDNA metabarcoding as a non-invasive method for rapid detection and biomonitoring of imperiled fish species, including the two endangered shiners and associated fish assemblages.

Reconstructing Reference and Altered Streamflow to Identify Environmental Flow Thresholds in Texas Rivers

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Keywords: environmental flows, EFIT, Species Distribution Models, Fish of Texas

While alteration to natural flow regimes is understood to be detrimental to native communities, easily implementable thresholds of flow alteration are difficult to identify. As part of the larger EFIT project led by Texas Parks and Wildlife (TPWD), this study utilized diverse geospatial products to better understand flow alteration in Texas and predict thresholds of ecological effect. As opposed to a typical space-for-time reference scheme, this study implemented both spatial and temporal characteristics to identify locations and periods of reference hydrology. Reference hydrology data were used to build models predicting reference conditions, while controlling for climate variability, and allowing for calculation of time-dependent flow alteration. Calculated alteration values and geospatial data of anthropogenic impacts were used to predict alteration for every stream segment in Texas from 1938-2020 -- a total of 42 million observations. Alteration values were investigated for ecological effect using Species Distribution Models from Fish of Texas (FoTX), along with capture information from FoTX and other sources. The products of this study will be used in EFIT and future studies to provide valuable information to the public, aid stakeholders in assessing and implementing past and future flow management strategies, and predict flow alteration and corresponding ecological effects in the State.

Seventy Years of Change: Analyzing Fish Assemblage Shifts of the Upper Sabine River, Texas

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Rebecca Mangold, Texas A&M University; Anastasia Umstott and Carmen Montaña, Stephen F. Austin State University; Kevin W. Conway, Texas A&M University; Kole Kubicek, Lamar University; and Joshuah Perkin, Texas A&M University

Keywords: Sabine River, fish assemblage

River regulation and fragmentation affect flowing water ecosystems on a global scale, but there is rising interest in managing these alterations to benefit biodiversity and ecosystem goods and services provided to humans. A critical first step in developing management plans is estimation of historical ecological states and subsequent deviations from these states. In this study we reviewed a historical fish survey collected by Texas Game and Fish Commission (1954-1955) in the upper Sabine River, between present day Lake Tawakoni and Toledo Bend Reservoir, and compared those data with replicated contemporary surveys (2023). We used non-metric multidimensional scaling (NMDS), permuted multivariate analysis of variance (PMANOVA), and similarity percentage (SIMPER) analyses to assess long-term changes in fish assemblage composition and species abundances. The NMDS revealed a temporally persistent (i.e., present during both periods) longitudinal gradient in fish assemblage composition. The PMANOVA revealed that 53% of variation in fish assemblage composition was explained by longitudinal river position and 11% by changes through time. The SIMPER analysis identified species that contributed most to change temporally, including decline of small-bodied fishes in the genus *Notropis* (e.g., Sabine Shiner *Notropis sabinae*) but increase by basses, sunfishes, and shads. Our analysis did not detect extensive decline of fish species confirmed or suspected to be hosts to imperiled freshwater mussels, though this could be attributed to gear bias (seine) excluding some mussel host fishes or the season sampled (summer). These long-term changes in fish assemblage composition are consistent with those documented for the lower Sabine River downstream of Toledo Bend Reservoir, including a declining prevalence of opportunistic species but increasing prevalence of equilibrium life history strategists. Our work provides guidance to management by filling knowledge gaps in the Sabine River basin fish assemblage, providing spatially explicit historical baselines, and highlighting species that have contributed to long-term change.

Local Drivers Influencing The Distribution of Two Endangered Shiners (Sharpnose *Notropis oxyrhynchus* and Smalleye *N. buccula*) In a Southern Great Plains River

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Mike Curtis, Kaley Cave, David Hoeinghaus, and Zacchaeus Compson, University of North Texas; and Carmen Montaña, Stephen F. Austin State University

Keywords: Sharpnose Shiner, Smalleye Shiner, Brazos River, Salt For of the Brazos River, Double Mountain Fork of the Brazos River

Patterns of distribution and relative abundances of ecological communities depend on a complex interplay between regional and local scale processes. Regional processes may shape distributions due to species' broad physiological tolerances and potential for dispersal, whereas local processes associated with habitat

filtering and biotic interactions determine the presence and relative abundances of species that are capable of colonizing a potentially suitable location. Understanding local drivers of community structure has important implications for management and conservation of imperiled species. Here, we investigated the relationship between local abiotic variables and the distribution of two federally listed endangered shiner species: the Sharpnose (*Notropis oxyrhynchus*) and Smalleye (*N. buccula*) endemic to the upper Brazos River, Texas. Stream reaches in this upper basin are dynamic, and changes in the historical hydrology of this area due to anthropogenic activities have raised conservation concerns for imperiled fishes including these two endangered shiners. Over one year, we conducted monthly field surveys of fishes and quantified environmental parameters at 22 sites in the Salt Fork [SF], Double Mountain Fork [DMF], and Brazos River mainstem [BRM]. In general, Sharpnose and Smalleye were broadly distributed along the BRM and DMF but were largely absent from the SF. Variation in distributions across seasons was explained by local factors including wetted width, depth, flow, and conductivity. Furthermore, a generalized linear model (GLM) demonstrated significant relationships between instream conditions and the presence and abundance of Sharpnose and Smalleye shiners. For example, abundance of Smalleye correlated with the absence of macrophytes, low temperatures, and high amounts of woody debris, whereas Sharpnose were commonly found at sites with less algae, greater canopy cover, and continuous flow throughout the year. These findings emphasize the importance of environmental variables related to hydrology and habitat structure in shaping the distribution of two imperiled species in the upper Brazos River.

Quantifying an Artificial Reef's Ability to Act as a Carbon Sink

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Keywords: Rio Grande Valley Artificial Reef, *Leptogorgia*, blue carbon

Artificial reefs can help to restore the balance and biodiversity of our Oceans' natural resources and have the potential to sequester blue carbon. Blue carbon is the carbon sequestered within ocean ecosystems, in living plant or animal matter, within sediment and root structures, or within carbon containing matter possessed by ocean structures. The Rio Grande Valley Artificial Reef (RGV Reef) is the largest reef placement on the Texas coast and provides fish habitat and areas for settlement of encrusting invertebrate species. Encrusting species like *Leptogorgia* (Sea Whip Coral) provide juvenile fish habitat and have been documented to sequester carbon in their structures, laying the foundation for blue carbon studies of artificial reef structures hosting *Leptogorgia* and other encrusting invertebrates.

This study is currently analyzing blue carbon in the Rio Grande Valley Artificial Reef to document how much carbon can be sequestered within encrusting organisms' structures and over the entire reef. Physical reef samples taken from the reef are being assessed to determine organic and inorganic carbon content per square meter of reef structure. Reef samples are dried and run through a carbon elemental analyzer to determine respective carbon percentages. Additionally, videos taken at the time of sample collection are reviewed to determine species abundance. Lastly, images are reviewed in ImageJ software to determine carbon per square meter at individual reef sites. Determining the RGV Reef's impact on blue carbon sequestration is integral for determining the benefits of artificial reefs in addition to fish habitat.

Are Constructed Wetlands Functionally Equivalent to Natural Wetlands?

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Keywords: constructed wetlands, Benthic Community Index

This project will evaluate fish and macroinvertebrate assemblages and their relationships with constructed wetlands and natural wetlands. There will be five natural wetland sites sampled to create a baseline for wetland structure and function, and an additional thirty-five reconstructed wetland sites will be sampled to determine their structure and function. Currently one sampling trip has taken place with more tentatively planned for the spring. The objective of this project is to create a national-scale ecological monitoring and assessment framework for wetland structure and function with hopes that these analyses can be performed for future projects assessing wetland structure and function. Macroinvertebrate community sampling and analysis will closely follow the Benthic Community Index (Butcher et al., 2003). Fish community sampling and analysis will be largely associated with a traditional fish IBI. Although fish are not typically key indicators for wetlands, their communities will be sampled as a complement to the macroinvertebrate communities collected. Canonical correspondence analysis (CCA) and variance partitioning will be used to relate fish and macroinvertebrate assemblages to environmental variables such as water and soil chemistry, hydrology, general vegetation cover and types, algae/periphyton biomass, and bird and amphibian communities.

Spatial and Interspecific Variation in Feeding Habits of Four Native Prairie Stream Fishes

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Jane Rogosch, U.S. Geological Survey; Scott Collins, Texas Tech University; and Bart Durham, Lubbock Christian University

Keywords: Red River basin, Plains Minnow, Prairie Chub, Red River Shiner, Red River Pupfish, stable isotopes

Environmental variation in stream ecosystems is known to influence the quality, quantity, and availability of food items for freshwater fishes. Yet, fundamental information about the feeding habits of many imperiled fishes, and how feeding habits change as a function of spatial variation, is often incomplete. We characterized spatial variation in the feeding habits of four fishes of greatest conservation need native to the upper Red River basin, including Plains Minnow (*Hybognathus placitus*), Prairie Chub (*Macrhybopsis australis*), Red River Shiner (*Notropis bairdi*), and Red River Pupfish (*Cyprinodon rubrofluviatilis*) by comparing habitat metrics with integrated stable isotope and fish gut content analyses. Specific conductivity decreased significantly from westernmost to easternmost sites (36,563 – 1,314 $\mu\text{S cm}^{-1}$), whereas turbidity (4.99 – 755 FTU) and stream discharge (3.17 – 794 $\text{m}^3 \text{s}^{-1}$) increased. Carbon $\delta^{13}\text{C}$ values varied significantly ($F_{3,8} = 245.98$, $p < 0.01$) between all species except *H. placitus* and *N. bairdi* ($p = 0.129$), suggesting that focal species may rely on multiple sources of primary production. Differences in $\delta^{15}\text{N}$ values were significant between *C. rubrofluviatilis* and *H. placitus* ($p = 0.035$) which may indicate that these species feed at different trophic positions considering cooccurrence at westernmost sites. Gut content analyses revealed that *H. placitus* consumed a higher proportion of diatoms and filamentous algae in westernmost sites, which may point to turbidity as a limiting factor of instream primary production in eastern sites. The foreguts of *C. rubrofluviatilis*, *M. australis*, and *N. bairdi*

frequently contained sediment, macroinvertebrates, and detritus across all sites, suggesting a greater reliance on consumers when available. Future analyses will compare stable isotope values of individual fish with their gut content composition and assess trophic niche space overlap between species to provide baseline data from which to compare how species may be affected by environmental change such as stream regulation, stream fragmentation, and salinization.

Poster Presentations

Changes in the Abundance of Atlantic Croaker in Northwestern Gulf of Mexico

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Joel Anderson, Texas Parks and Wildlife Department

Keywords: Atlantic Croaker, Atlantic Multidecadal Oscillation Index, sea surface temperature, shrimping

Commercial shrimping in Texas has declined since the implementation of a license buyback program in 1996 and has coincided with increases in sea surface temperatures in the Gulf of Mexico. We used offshore trawl data collected between 1987–2022 as part of fishery-independent resource monitoring conducted by Texas Parks and Wildlife Department to characterize abundance trends of Atlantic Croaker and infer the causes of observed trends. Specifically, we wanted to assess how warming in the Gulf of Mexico and changes in the intensity of inshore shrimping has affected the abundance of Atlantic Croaker, a major species in commercial shrimp trawl bycatch. The catch-per-unit effort (CPUE) of Atlantic Croaker has increased along the Texas coast since 2006. Simple linear regression revealed that CPUE was positively correlated with the Atlantic Multidecadal Oscillation (AMO) index ($R^2 = 0.37$, $P < 0.001$) and sea surface temperatures in the northwestern Gulf of Mexico ($R^2 = 0.18$, $P < 0.001$) and negatively correlated with Texas commercial shrimp landings ($R^2 = 0.30$, $P < 0.001$). The abundance of Atlantic Croaker increased as the AMO entered its warm (positive) phase, which also results in warmer temperatures in the Gulf of Mexico. Abundance was lower during periods of high commercial shrimp harvest. Our results suggest that Atlantic Croaker has benefitted from both warmer conditions in the Gulf and the decline of shrimping. Warmer winters may favor faster growth by croaker due to greater availability of food and higher metabolism. Estuaries are important nursery habitat for Atlantic Croaker, and less commercial shrimping, especially in bays, should lead to greater survivability of young-of-the-year croaker and, ultimately, greater abundance of juvenile and adult croaker.

Estuarine Residency and Habitat Preferences of Atlantic Tripletail (*Lobotes surinamensis*) in the Northwestern Gulf of Mexico

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David Ushakow, Zachary Olsen, Joel Anderson, and Leslie Hartman, Texas Parks and Wildlife Department

Keywords: Atlantic Tripletail

The Atlantic Tripletail (*Lobotes surinamensis*) is a globally distributed tropical/subtropical fish species that inhabits estuaries throughout the northern Gulf of Mexico, particularly during warm months. Little is known about distribution and residency patterns within estuaries, because the species is a rare catch in the recreational fishery, and virtually no commercial fishery exists for the species in the Gulf. We used data from long-term fishery-independent gill net surveys to model estuarine distribution throughout Texas and to relate environmental variables to tripletail catch. Although there were no observable temporal trends in catch over the time series (1990 – 2022), the most recent six years included record catches in six of the 10 major Texas estuaries, possibly indicating a recent pulse in abundance. Catch throughout the time series

was spatially aggregated in a small number of “hot spots” observed coastwide. Latitude was the best predictor of catch, although wind fetch and wind aspect (wind direction in relation to shoreline direction) were important predictors, and catch was highest near Gulf of Mexico inlets. The TPWD gill net program catches a range of Atlantic Tripletail between 200 – 700 mm total length, possibly indicating a gear selectivity against both juveniles and exceptionally large adults. Regardless, these data shed light on the factors that drive Atlantic Tripletail estuarine distribution and abundance in the northern Gulf of Mexico. Wind-driven passive movements in the estuary, combined with active selection of polyhaline habitats near Gulf inlets, might be primary drivers of tripletail catch, supporting findings from previous studies.

Sampling Logistics of Hydraulic Tongs and Oyster Dredges

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Keywords: tongs, oyster dredge

The Texas Parks and Wildlife Department (TPWD) currently uses dredge sampling to monitor oyster reefs in Texas estuaries. However, dredges have been shown to produce biased sampling data with regard to the density and relative sizes of the oysters collected. In this project, we compared the logistics of sampling oyster reefs using oyster dredges and hydraulic (patent) oyster tongs. Specifically, we compared variation in oyster density estimates at differing sample sizes and overall collection and processing time for dredge and tong samples. Results indicate that although deployment, retrieval, and processing for one tong sample takes less time than one dredge sample, tong sampling requires one additional staff member and approximately 2-3x more samples to see stabilized estimates of density, compared to dredge sampling, depending on the overall distribution of oysters across the reef landscape. While the value of tong derived density estimates is clear, our results indicate that tongs are best suited for focused (spatially or temporally) sampling initiatives where a greater number of samples and staff time are feasible.

State of the Basin: Brazos River Instream Flow Program

Cory Scanes, Brazos River Authority

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Keywords: Brazos River basin, Brazos River Authority, Leon River, Navasota River, Aquilla Creek, environmental flows

The Brazos River is the longest river flowing entirely in the State of Texas and reaching from New Mexico to the Gulf of Mexico, passing through numerous reservoirs, cities, and ecoregions. The Brazos is an attractive resource for use by humans and is host to diverse native fish and benthic invertebrate communities. The purpose of this summary is to provide a snapshot of the overall status of fish communities in the Brazos River Basin through the lens of fish IBIs and stream discharge presented over time. Utilizing standardized methods of fish capture and habitat assessment consistent with Texas Instream Flow Program protocols, the Brazos River Authority conducts assessments at five sites on the mainstem Brazos and three major tributary sites: the Leon River, the Navasota River, and Aquilla Creek. Most sites obtained ALU scores of “high” or “exceptional” across five hydrological targets established for

each site by Texas Senate Bill 3 (subsistence, low base, medium base, high base, and greater than high base) with the exceptions of Brazos River near Glen Rose (“intermediate” at one low base sampling event) and Brazos River near Rosharon (“intermediate” at one subsistence and one medium base). The results of 11 years of sampling at sites on the mainstem Brazos River and three of its major tributaries indicate overall sound ecological environments to support biological communities regardless of flow tiers and highlight the resiliency of fish communities in ever-changing habitats.

An Ichthyofaunal Survey of the Trinity River in Downtown Fort Worth

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Keywords: West Fork Trinity River, Clear Fork Trinity River, citizen science

The Texas Academy of Biomedical Sciences (TABS) is an Early College High School within the Trinity River Campus of Tarrant County College. TABS is located at the confluence of the West Fork and Clear Fork of the Trinity River in downtown Fort Worth, offering a unique setting conducive to engaging students in immersive fieldwork. Our research has catalogued 20 species, with additional species expected in the future. This research initiative is underpinned by the fundamental principles of citizen science, wherein active participation of individuals contributes significantly to the data collection process. Leveraging the iNaturalist platform as a central repository for the storage and collation of data emerges as a pivotal facet of our research and educational objectives. To date, morphometric data has been systematically recorded for over 200 individual fish, including key parameters such as length and mass, along with location and temporal data. As we embark on a multi-year trajectory of investigation, this endeavor will be augmented with the implementation of mark-recapture methodologies, scheduled to commence in 2024. This phased approach ensures the longitudinal continuity and depth of our research efforts, thereby enriching the scientific understanding of the ichthyofaunal dynamics at the confluence of the West Fork and Clear Fork of the Trinity River.

Fish Community Dynamics in an Intermittent River of the Edwards Plateau: Results from Inaugural Monitoring by the New Student AFS Subunit of the University of Texas at San Antonio

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Keywords: Guadalupe River, fish sampling

The Student Subunit of the American Fisheries Society at the University of Texas at San Antonio (UTSA) was established in the Spring of 2023. Since then, the Subunit has initiated regular sampling of the fish community in the Guadalupe River near Comfort, Texas with the goal of (1) providing experiential learning opportunities for student members of the Subunit and (2) commencing long-term monitoring of a USGS-gaged river that periodically dries during droughts. The nearby USGS gage documented an 81-day zero-flow period from 16 July to 5 October 2023. Therefore, we sampled once before (3 May), once during (16 September), and twice following (21 October, 18 November) the drought period. In a

collective effort by 23 student members of the Subunit, fish were sampled using seining and electrofishing to determine community composition in riffle and pool habitats. We captured 551 total fish representing 17 species across the four sampling events. Raw abundance was highest in an isolated pool during the drought in September (252 individuals) and lowest immediately following the return of flow in October (53 individuals). Rarefied species richness was 8.8 in May, decreased to 8.0 in September and October, and increased to 10.5 in November. Rarefied richness was higher in pool habitats (12.7 species) compared to riffle habitats (10.0 species). Principal components analysis revealed stronger differences in community composition between pool and riffle habitats relative to temporal differences before, during, and following drying. Specifically, minnows and darters were relatively more abundant in riffles than in pools, whereas sunfishes, cichlids and livebearers were relatively more abundant in pools. These spatiotemporal community dynamics generally align with theoretical and previous empirical expectations. We plan to sample this location seasonally in 2024 and beyond with the goal of immersing UTSA students in fisheries science and documenting inter-annual drivers of fish community dynamics.

Early Developmental Morphology of Southern Flounder

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Christopher Jingle, Texas Parks and Wildlife Department

Keywords: Southern Flounder culture

Southern Flounder (*Paralichthys lethostigma*) undergo substantial changes in morphology during metamorphosis. There are many less distinctive changes that occur during early development that have been identified that aid stock enhancement staff in managing these fish through incubation and intensive culture until they are released. Observations via high resolution microscopy, photography, and videography have allowed for real time adaptations in husbandry which have led to shifts in protocols directly based on developmental needs of the flounder. Batch success predictions, incubator stocking densities, and live feed introductions are all directly driven by developmental morphology.

Overview of Acoustic Telemetry Array Installation in the Sabine Lake System, Texas/Louisiana, USA

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Keywords: Sabine Lake, Sabine Lake System Acoustic Array, Texas Acoustic Array Network, Integrated Tracking of Aquatic Animals, acoustic receivers, Southern Flounder, Spotted Seatrout, Red Drum, Black Drum, Bull Shark, Alligator Gar

An array of 29 acoustic receivers (VR2Tx) has been deployed throughout the Sabine Lake System to monitor fish movements and residency within multiple estuarine and nearshore habitat types as well as movement among estuaries along the Gulf of Mexico. The Sabine Lake System Acoustic Array (SLSAA) is part of a network of bay-scale and nearshore acoustic receiver arrays that now exist across the Texas Coast as well as much of the US Gulf of Mexico coast referred to as the Texas Acoustic Array Network (TEXAAN) and the Integrated Tracking of Aquatic Animals in the Gulf of Mexico (iTAG) respectively.

The VR2Tx acoustic receivers used throughout the array are able to detect tagged fish within a ~0.5 km radius of the receiver location. Therefore, the Sabine Lake System is well-suited to allow high resolution monitoring of fish movement due to many single access bottlenecks into major portions of the surrounding marsh, rivers, and Gulf of Mexico. Initial tagging in the Sabine Lake System has focused on Southern Flounder, Spotted Seatrout, Red Drum, Black Drum, Bull Shark and Alligator Gar. Results suggest that Southern Flounder and Bull Shark and to a lesser extent Red and Black Drum undergo seasonal migrations to the Gulf while Spotted Seatrout and Alligator Gar tagged within the estuary remain within the estuarine system and may exhibit site fidelity to certain areas. Species differences in movement patterns such as minimum distances traveled, minimum rate of movement, habitat association and residency are being elucidated, in addition results are informing a better understanding of inter-estuarine exchange and migratory timing. We anticipate the SLSAA will improve life history understanding of Northern Gulf of Mexico fish species, provide data that presently does not exist for Southeast Texas, and facilitate collaboration between academic institutions and state/federal management agencies.

Assessment of Juvenile Abundance of Marine Nursery Dependent Species in a Man-made Dredge Placement Compartment in Sabine Lake

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Keywords: Sabine Lake, Pleasure Island, nursery habitat

Estuaries along the Gulf coast provide nursery habitats (e.g., seagrass beds, coastal marshes) which serve as a refuge for larval and juvenile fishes and invertebrates and are therefore essential in maintaining the ecological integrity of marine ecosystems. The Texas shoreline of Sabine Lake, an estuary supplied by the Neches and Sabine River, has been heavily altered by hydrological diversions, ship channels and revetments resulting in a greatly reduced connection between the estuary and the surrounding marshland nursery habitat. Despite this, there is a highly productive, local recreational fishery located on Pleasure Island, Port Arthur, Texas that is centered around a dredge material placement area enclosed within the island revetment. The enclosed compartment consists of open water habitat with emergent vegetation along much of the perimeter and maintains a connection with Sabine Lake via tidal flow through two sets of large diameter pipes, allowing organisms to move freely between the two. In this study, we aim to determine if this manmade enclosure serves as an important nursery habitat for larval and juvenile fishes and invertebrates along the highly modified Texas shoreline of Sabine Lake. To accomplish this, we are conducting population inventories of the enclosure via otter trawls, bag seining, and gill netting following the methods of the TPWD Coastal Fisheries Division. The data collected from these surveys is compared to that collected by TPWD for the Sabine Lake System (including modified shoreline and unmodified marshland habitat) to determine if there is a significant difference in the abundance of juveniles and recruits within the north levee enclosure compared to the surrounding estuary. We present the results of abundance data collected via trawls and seines over the course of a year for juveniles of 10 species known to utilize nursery habitat.

Ctenophores in Texas: the Rise of Comb Jellies Along Our Coast

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Keywords: ctenophores, comb jellies

While many marine species have been displaced by warming waters and anthropogenic influences, ctenophores, or comb jellies, have found a way to expand their numbers in many areas throughout the world. Since they play a significant role as planktonic predators in coastal and Gulf habitats of Texas, this could have great impacts on larval fish and invertebrate populations, highlighting the importance for resource managers to keep track of population trends and range expansions. The Texas Parks and Wildlife Department has been collecting fisheries-independent resource data from 1983-2022. Here, bay trawl, Gulf trawl, and bag seine data were utilized to determine relative abundance, distribution, and seasonality of ctenophores. Results indicated that the relative abundance of ctenophores increased over time throughout Texas estuaries and Gulf waters. Spatial data illustrated that ctenophores in estuaries were most abundant along the mid-coast, while abundance followed a clear gradient in Gulf waters. Differences in seasonality were also detected between estuaries and Gulf waters. These results are consistent with ctenophore and other observed jellyfish expansions worldwide. The continued monitoring of abundance, seasonal and spatial trends should give researchers and managers an important window into the ecological function of ctenophores in Texas and how they may affect marine ecosystems and valuable fisheries in the future.

Habitat-Driven Differences in the Biomass of Three Economically Important Species Along the Lower Texas Coast

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Ethan Getz and Lillian Marshall, Texas Parks and Wildlife Department

Keywords: Spotted Seatrout, Red Drum, Black Drum, seagrass, salt marsh

Globally, coastal habitats are changing and will continue to change in the midst of warming climates and increased coastal populations. In order to maintain the productivity and sustainability of fisheries along the Texas coast, it is vital that fisheries managers understand the potential impacts of habitat alterations on fish populations. Here, four years (August 2018-January 2022) of in-situ habitat data paired with fishery-independent bag seine data collected by the Texas Parks and Wildlife Department Coastal Fisheries Division was used to investigate differences in the biomass of three economically important species (i.e., Spotted Seatrout *Cynoscion nebulosus*, Red Drum *Sciaenops ocellatus*, Black Drum *Pogonias cromis*) in habitats along the lower half of the coast of Texas. The peak season of catch (i.e., based on species-specific recruitment) was determined for each species and the biomass/hectare of bag seine samples within peak seasons was calculated and visually compared across four aquatic/emergent habitat types: bare/bare, bare/saltmarsh, seagrass/bare, and seagrass/saltmarsh. Kernel density maps of biomass/hectare were used to display areas of high biomass for each species across the study area. Spotted Seatrout had the highest average biomass/hectare in seagrass/saltmarsh habitat, followed by bare/saltmarsh and seagrass/bare. The highest average biomass/hectare of Red Drum was seen in bare/saltmarsh habitat, followed by seagrass/bare and seagrass/saltmarsh, although variance among samples was high. Bare/saltmarsh habitat also supported the highest biomass/hectare of Black Drum, followed by

seagrass/saltmarsh and bare/bare. These results were further supported by the kernel density plots, which showed increased Spotted Seatrout biomass in areas with high seagrass/saltmarsh coverage and increased Red and Black Drum biomass in areas with high bare/saltmarsh coverage. These results could be used to better inform fisheries managers as habitats continue to change and could help guide future restoration and restitution efforts to maximize the positive impacts on these commercially and recreationally important species.

Updated Maps of Shallow and Terrestrial Coastal Habitats in the Aransas Bay System

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Keywords: Aransas Bay system, Texas Orthoimagery Program, National Agriculture Imagery Program, eCognition

The Coastal Fisheries Habitat Assessment Team has recently completed the generation of updated habitat maps for the Aransas Bay system using existing publicly available high-resolution aerial imagery. An extensive bay-wide habitat survey had not been completed since 2004. Free historical imagery from the Texas Orthoimagery Program (TOP) and National Agriculture Imagery Program (NAIP) underwent supervised classification using Trimble's eCognition software. Shallow and terrestrial coastal habitat extents (i.e. seagrass, mangroves, oyster reefs, salt marsh, tidal flats, and beaches) were identified through classification algorithms and manual editing, and verified through subsequent ground truthing efforts. The resulting, publicly available geospatial data products can be used to quantify changes in habitat extent over time and aid in assessments to inform natural resource management decisions.

The *Phenacobius mirabilis* in East Texas - Adding Context to a "Deceptive Life"

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Keywords: Suckermouth Minnow, Angelina River, Neches River

Phenacobius is Greek for "deceptive life," likely due to this minnow's sucker-like herbivorous appearance, versus its true preference for invertebrates. Further, the "suckermouth" common name relegates the fish to association with the "sucker minnow" (*Catostomus commersonii*), a common bait species. In the case of this study, "deception" could apply to a propensity for suddenly appearing outside of described range and then disappearing, not to be found again. The same could be said for the minnow's chronic absence from known range in East Texas, despite recent intensive surveys. Considering Clark Hubbs' contention that range was limited by water chemistry, not stream division, we sought to fill gaps in the distribution of *Phenacobius mirabilis* based on our limited records of occurrence, correlated with deterrent water quality indicators. Our 33 years of sampling and 73 years of historic references suggest that *Phenacobius mirabilis* is indeed a rare fish species in East Texas streams, which is supported by the literature. The construction of Sam Rayburn Reservoir on the Angelina River appears to have blocked migration and isolated populations in the northern segment. Our sampling indicates that the fish does venture into intermittent streams, with recurrent droughts necessitating retreat for refuge in the Neches

River. Given these occurrences and the published record, we would assert that the north Angelina and Neches Rivers should be listed within the established range in Texas.

Changes in Diversity of Adult Finfish in East Bay after the Closure of Rollover Pass

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Jessica Geiskopf and Rileigh Hawk

Keywords: Rollover Pass, East Bay, fish community

Rollover Pass was a man-made channel connecting East Bay to the Gulf of Mexico at the north end of Bolivar Peninsula. The pass was constructed in 1955 to improve water quality and aid fish migration. The pass was closed due to erosion affecting the beach on Bolivar Peninsula and the Intracoastal Waterway. Construction started in September 2019 and was completed in April 2020. Estuarine environments are dynamic and are affected by factors such as tidal movement and water inflow. The closure of Rollover Pass likely caused a shift in both tidal flow and freshwater retention in East Bay. Additionally, species that utilize both East Bay and the Gulf of Mexico could be limited in their ability to access both environments after the closure. Texas Parks and Wildlife monitors the population of adult finfish through gill net surveys conducted in the fall and spring. Data from these nets was analyzed with both a Simpson's and Shannon diversity index for the fall gill net season over the past eleven years. In 2019, both indices were lower than the mean. A Grubb's test revealed a statistically significant outlier for Simpson's index with a p-value of 0.000724, but the Shannon index showed no significance, producing a p-value of 0.1586. This suggests that the construction of the closure had a significant change on the relative abundance of species in East Bay, but not on the species richness. This information can be used to determine if the closure of a major pass has immediate impacts on the estuary and how resilient ecosystem is to such an event.

Rising Turbidity in Matagorda Bay Associated with Oyster Reef Health

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Keywords: oysters, turbidity, Matagorda Bay

The eastern oyster, *Crassostrea virginica*, is an essential species in the Gulf of Mexico. It supports a commercial fishery, provides recreational fishing opportunities, and is considered a keystone species. Oysters construct reefs that are crucial marine habitats, filter the water column, and help reduce land erosion. Oysters improve water quality by filtering out nutrients and detritus. The water quality services of oysters are often lost due to fluctuating salinities and temperature, freshwater inflows, as well as over harvesting and predation which is causing the average turbidity of the bay to increase. Oysters exhibit lower respiration rates at higher turbidity levels, which induces them into a closed state as they wait for conditions to improve so they can flush the excess material out of their gills and palps. The longer they remain in this closed state, the longer the recovery time is which lowers the rate of filtering. Along with decreasing effectiveness of filtering, higher turbidity also decreases the survival of oyster egg and larvae which severely reduces recruitment. This poster will depict the trend analysis on average turbidities of Matagorda Bay by minor bays that have established oyster populations. Furthermore, any effects of events, such as commercial fishery policies, Texas DSHS shellfish harvesting area closures, and extreme weather events will be analyzed alongside the timeseries of turbidity and oyster dredge data. As oyster

reefs continue to degrade through natural and anthropogenic impacts and turbidities increase, the long-term ecosystem structure of Matagorda bays will alter with impacts reverberating throughout all tropic levels.

Combining Spatial Gradients and Sparse Time Series Data to Predict Fish Assemblage Response to Increasing Aridity

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Keywords: spatial gradient analysis, sparse time series, fish assemblage

Spatial gradients (e.g., land cover land use, aridity) representing proxies for future change (e.g., landcover transformation, climate change) are useful for developing predictions for organism response to future change. However, such ‘space-for-time’ substitutions might result in erroneous predictions and validation is best achieved through long-term, temporally replicated surveys. Given that long-term surveys are challenging, cost-prohibitive, and in short supply, an alternative approach involves the use of spatial gradients and relatively sparse time series data (e.g., multiple, potentially non-consecutive snapshots). Here we apply spatial gradient analysis with sparse time series data to test the hypothesis that stream fish assemblage change along an aridity gradient provides a proxy for future fish assemblage change under climate projections. We surveyed 102 sites during 2021 under average precipitation and temperature regimes, and then revisited a subset of 16 of these locations in 2023 after two years of high intensity drought. We then used the 2021 data to project assemblage composition under climate change scenarios involving higher temperatures and reduced rainfall and used the 2023 data to assess the directionality and magnitude of short-term temporal change in fish assemblage structure. Results revealed that under climate change scenarios, fish assemblage projections moved in the direction expected along the aridity gradient (i.e., towards warmer and drier streams). When we overlaid 2023 data that were collected following two years of intense drought, fish assemblages moved in the direction indicated by the climate projections, though the magnitude of change was reduced. Our work provides a framework for integrating space-for-time substitutions and sparse time series data that can ultimately be used in other systems and circumstances.

Angler Bait Preferences for Targeted Red Drum and Spotted Seatrout Landings in Matagorda Bay

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Keywords: Spotted Seatrout, Red Drum, Matagorda Bay, bait preference

Bait preferences vary by anglers and targeted species and often lead to passionate exchanges and unexpected associations by Texas anglers. The Texas Parks and Wildlife Department (TPWD) Coastal Fisheries Creel Survey Program collects both bait type and landings information. We reviewed existing data for Spotted Seatrout (*Cynoscion nebulosus*) and Red Drum (*Sciaenops ocellatus*) landings and associated usage for Matagorda bays. This study limited the creel survey data from 1991-2022 and only looked at fishing trips that landed Spotted Seatrout or Red Drum and using only a single bait preference.

Soft-plastics have led the way in trout landings, until recent years, where live shrimp and live fish as bait have landed comparable numbers to soft-plastics. For Red Drum, live shrimp has become the most common bait used over the last few years. Bait preference for each species also varied between recreational anglers, guided trips, and tournament fishing. For both Spotted Seatrout and Red Drum, guided fishing trips most frequently used live shrimp and recreational anglers prefer soft plastics. Tournament fishermen however do not have a particular bait preference for either species. In summary, bait preference by anglers for Spotted Seatrout and Red Drum has changed throughout the time period of this study and also varies depending on the purpose of the fishing trip.

Diel Activity, Site Fidelity, and Experimental Exclusion of Suckermouth Armored Catfish in the San Marcos River

Ka'inoa o kekai Lee, The Meadows Center - Texas State University

Collin Garoutte, The Meadows Center - Texas State University; Rebecca Mangold and Wesley Arend, Texas A&M University; Christopher Riggins and Thomas Heard, The Meadows Center - Texas State University; and Joshua Perkin, Texas A&M University

Keyword: Suckermouth Armored Catfish, San Marcos River, submersible ultrasonic receivers, diel activity, site fidelity

Non-native suckermouth armored catfish in the genus *Hypostomus* are established in the San Marcos River, TX where their burrowing behavior increases bank instability. The resulting failure and collapse of artificial bank infrastructure provides an abundance of crevices that function as cover for *Hypostomus* sp. This failing infrastructure potentially contributes to *Hypostomus* sp. persistence despite population control through spearfishing. The goal of this study was to assess site fidelity and diel activity patterns to enhance current management practices. Our study involved two deployments of submersible ultrasonic receivers (SURs) to monitor the activity of *Hypostomus* sp. tagged with internal transmitters. The first deployment occurred in spring 2022 and included two SURs placed 15 m apart within failing infrastructure and in the vicinity of 10 fish fitted with transmitters. The second deployment occurred in spring 2023 and included four SURs deployed near the river headwaters, specifically within crevices and near the locations of 10 tagged fish. Results from Deployment One revealed a strong diel activity pattern characterized by greater movement and activity during dark periods, and then return to specific crevices during the day. Deployment Two was designed to assess diel patterns of when fish occupy and vacate crevices, allowing for experimentally sealing a crevice known to be used by a fish and measuring the behavioral response. We found that when a fish was excluded, it moved to another nearby crevice, resulting in shifts in crevice use showing potential competition between tagged fish for space. Our results suggest that *Hypostomus* sp. exhibit strong site fidelity and predictable increases in nocturnal activity. Furthermore, exclusion of *Hypostomus* sp. from artificial crevices is likely to contribute to increased competition for limited space. These findings advance management by highlighting the utility of nocturnal spearfishing and the potential benefit of large-scale exclusion of *Hypostomus* sp. from artificial crevices.

Hook, Line, and Storytime: Unraveling the Fin-Tastic Narrative of Commercial Red Snapper (*Lutjanus campechanus*) for Recreational Anglers in Coastal Texas

Elizabeth Harris, National Academy of Sciences Gulf Research Program Science Policy Fellowship and Texas Parks and Wildlife Department

Keywords: Red Snapper

Red snapper (*Lutjanus campechanus*) is economically and culturally significant to the Gulf of Mexico region, with a longstanding history of both recreational and commercial fishery management. Commercial management strategies have undergone extensive changes over time, creating a complex narrative for those not directly involved in the industry. Therefore, the purpose of this initiative is to communicate Red Snapper life and management history through an infographic for an audience of recreational anglers. The main objectives will focus on elucidating the critical role of the Texas Parks and Wildlife Department (TPWD) in facilitating regulatory compliance within the Red Snapper fishery. This includes a detailed exploration of TPWD's involvement in the federal comment process, providing clarity on its trip ticket program, and offering insights into collaborative efforts to sustain a healthy Red Snapper population. Additionally, to enhance the accessibility of information to the Texas recreational angling community, the infographic will include a compilation of commonly asked questions. These questions will address various aspects of Red Snapper life, management strategies, and the regulatory framework. Through the creation and distribution of the infographic, we seek to enhance transparency between recreational anglers and TPWD, as well as foster increased stakeholder engagement with the potential to distribute the infographic at boat ramps and through TPWD media.

An Analysis of Fish Assemblages and Flow Regimes Upstream and Downstream of Falcon Reservoir

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Keywords: Rio Grande, Falcon Reservoir, Tamaulipas Shiner, Speckled Chub

The lower Rio Grande is regulated by Falcon and Amistad dams. Native fish species rely on the natural flow regime for habitat and spawning. We analyzed streamflow discharge and fish assemblages above and below Falcon Reservoir to assess potential impacts of dam impoundment. Fish collections were conducted by seine, and river discharge data was provided by the International Boundary and Water Commission. We found significant differences in fish assemblages above vs below Falcon Reservoir, and the flow regime was significantly more altered downstream of Falcon Reservoir. We also identified two Species of Greatest Concern for Texas above Falcon Reservoir (Tamaulipas Shiner *Notropis braytoni* and Speckled Chub *Macrhybopsis aestivalis*). Although the entire river below the upstream most dam (Amistad) had considerable hydrologic alteration, the reach between Amistad and Falcon reservoirs retains important biodiversity in need of protection. Further research on the ecological and conservation implications of these findings is warranted to inform management and conservation efforts in the Rio Grande.

Effects of Extreme Flow Events on Community Composition and Habitat Complexity of Groundwater Dominated Systems

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Keywords: San Marcos River, Comal River, fish assemblage

Extreme flow events in the form of major floods and droughts are primary drivers in structuring aquatic habitats and communities. While floods and droughts can directly alter aquatic biota by displacement or by increased mortalities, these extreme flow events can have an indirect and prolonged effect on biota by altering habitat complexity, which in turn delays the recovery of the aquatic biota. Interrelationships among stream flow extremes, habitat complexity, and stream fish communities are established in streams and rivers with waters dominated by run-off. Less known are the interrelationships among stream flow extremes, habitat complexity, and fish communities in hydrologically stable aquatic systems, such as spring systems with surface flows provided primarily by groundwater discharges. The San Marcos and Comal rivers are the two largest groundwater dominated systems located on the Edwards Plateau within Central Texas. These groundwater dominated systems function as evolutionary and hydrologic refugia for many endemic species. The purpose of this study is to assess how extreme flow events affect habitat complexity and the fish community within the San Marcos and Comal rivers using an 8-year dataset. Habitats were quantified as deep or shallow based on sampling effort (SCUBA or seine) and the habitat complexity was quantified using a Canonical Correspondence Analysis (CCA). Fishes were placed into water-column usage guilds and their resistance and recovery were assessed using univariate and multivariate analyses. Changes in habitat composition were also quantified. Results indicated that deep water habitats had higher levels of habitat complexity and a fish community less affected by flow extremes than shallow water habitats. Complex habitats were defined as having greater vegetation cover, heterogeneity within the substrate, and slower current velocities. Overall, all fish guilds were relatively unaffected by extreme flow events with few exceptions.

Modelling Habitat Associations of Sympatric *Cichla* spp. in the Essequibo River Basin, Guyana

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Kirk Winemiller, Texas A&M University

Keywords: Guyana, Peacock Bass, habitat characterization

Although it is a relatively small country (215 km², about the size of the state of Idaho), Guyana has among the highest diversity of freshwater fishes on Earth. This biodiversity is threatened by multiple human impacts, ranging from gold mining to climate change. Research in the last few decades has revealed a wealth of undiscovered aquatic biodiversity. One example is the newly discovered Peacock Bass, *Cichla cataractae* (endemic to the Essequibo River Basin). *Cichla cataractae* was discovered by biologists in 2018 (locals already knew of the species) co-existing with a well-known species of Peacock Bass, *C. ocellaris* (the type species for the genus). A field expedition was completed between January 7, 2023, and March 24, 2023 in the Rupununi, Rewa, and Essequibo Rivers, where 1,011 Peacock Bass were collected by angling. 207 were *C. cataractae*. This expedition aimed to collect information on biotic and abiotic factors associated with the niche breadth of these two species. Sampling was broken into 82

unique reaches across every available habitat. In each reach, we used recreational grade side-scanning sonar to create substrate and bathymetry maps. Additionally, we measured other limnologically important variables in each reach. At each location where a Peacock Bass was captured, we measured depth, substrate, flow, structure type, and structure complexity. With these variables using Random Forest models, we modeled the best predictors of the two species' abundance at the microhabitat and mesohabitat levels. From these models we can infer how these two species share their environment while also identifying important habitats for the conservation of these two species.

Does Rio Grande Cichlid (*Herichthys cyanoguttatus*) Induce Trophic Niche Shifts in Native Centrarchids?

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Chris Johnson, Living Waters Fly Fishing, and Joshua Perkin, Texas A&M University

Keyword: Rio Grande Cichlid, Guadalupe Bass, stable isotopes, trophic shift

Non-native species invasions affect aquatic ecosystems globally. This can be caused by, but not limited to, anthropogenic alterations to aquatic habitats that open niche space for invaders and human introductions of species outside their native range. In the case of fishes, species that are successful in these scenarios exhibit characteristics such as plasticity in feeding strategies, a strong tolerance of poor water quality conditions, or an aggressive nature that allow them to outcompete native fishes. The Rio Grande Cichlid (*Herichthys cyanoguttatus*) exhibits all of these characteristics. Native to the Rio Grande Basin of Texas and south into Mexico, the Rio Grande Cichlid has spread rapidly throughout the southern United States. The Rio Grande Cichlid has potential to induce trophic niche shifts, extirpate or displace native fishes, and alter natural food webs and trophic hierarchies. Alternatively, anecdotal evidence suggests Rio Grande Cichlid may exhibit trophic plasticity and adjust their own feeding ecology in the presence of Centrarchidae fish competitors. The goal of this study was to determine trophic overlap and niche shift in Rio Grande Cichlid and an imperiled species, the Guadalupe Bass (*Micropterus treculii*). To answer this question, Rio Grande Cichlid and Guadalupe Bass were collected in Brushy Creek, Texas, a stream where both species are common. Fin clips were collected and preserved from both species, as well as basal carbon resources, in order to conduct stable isotope analyses. Trophic overlap and niche shift of the two species in the presence of one another were then assessed. We hope to use the results of this study to inform management strategies of Rio Grande Cichlid outside their native range where they could be negatively affecting endemic fish communities.

Development of a Novel eDNA Sampling Method for Macroinvertebrate Species of Greatest Conservation Need (SGCN) in Texas

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Keyword: eDNA, Species of Greatest Conservation Need, benthic macroinvertebrates

The macroinvertebrate community of streams and rivers has long been studied as a bio-indicator of stream health. However, the sampling methods currently employed to conduct such a study are costly and

extremely time-consuming when factoring in the amount of time needed to identify the specimens to family or genus taxonomic levels. Another issue is that there is a large gap in knowledge when identifying to the genus and/or species level of most macroinvertebrates. Therefore, we are working to develop a novel eDNA sampling method for 8 macroinvertebrate species that are listed as Species of Greatest Conservation Need (SGCN) in Texas that will greatly reduce sampling time and effort. The main objective of this study is to determine the current distribution of 8 SGCN macroinvertebrates by sampling historical sites and other sites within the same watersheds. In order to develop an eDNA sampling method, we will extract and sequence DNA for these species as well as closely related species found at these sites. Furthermore, we will attempt to develop species-specific primers by first targeting two nuclear genes (18S and 28S) and one mitochondrial gene (COI). These species-specific primers will be used to identify the target species from eDNA samples collected at novel sampling sites. After the first year of sampling, only 3 of the target species (two mayflies and one stonefly) were found from sampling 30 sites. The other 5 target species are Trichopterans (Caddisflies) which cannot be identified to the species level in their larval stage. We attempted to rear individual Trichopterans that were identified to the family level of the 5 target species. Unfortunately, these individuals did not develop to the pupae stage.

Cichlid Assemblages in Habitats of the Rupununi River-Guyana During the Rising Water Season

Megan Beeksmma, Stephen F. Austin State University

Sophie Scott and Lily Williams, Stephen F. Austin State University; Kendall Hasting, Calvin Young, Takiya Jackson, Leslie Winemiller, and Kirk Winemiller, Texas A&M University; and Donald Burt, James Vankley, and Carmen Montaña, Stephen F. Austin State University

Keywords: cichlids, Rupununi River, morphology

Neotropical cichlids are taxonomically and morphologically diverse and occupy a variety of habitats making them ideal organisms for exploring morphological aspects related to habitat use and trophic ecology. We surveyed assemblages of cichlids inhabiting floodplain lakes and main channel of the Rupununi River near the Village of Yupukari, Guyana. Surveys were conducted in May 2023 during the early phase of the rising water season which occurs from April to August. Surveys of littoral habitats using multiple types of fishing gear yielded 18 cichlid species contained in 12 genera. Although survey effort differed among locations, more species were collected from floodplain lakes (n=17) compared to sites in the river channel (n=4). Cichlid species richness was greater than previous reports for the same area of the Rupununi River which reported nine species. All specimens (n=104) were preserved, and 28 morphological traits related to swimming performance, habitat use, and trophic ecology were measured. A principal components analysis (PCA) performed on log-transformed morphological data produced two dominant gradients in morphospace: body-shape (PCA 1) and trophic ecology (PCA 2). PCA 1 ordinated species between elongate, wide bodies (e.g., *Crenicichla*) and deep, laterally compressed bodies (e.g., *Biotodoma*, *Satanoperca*). PCA 2 ordinated species between short snout with small mouth gape (e.g., *Mesonauta*) to long snout with large mouth gape (*Crenicichla*, *Cichla*). Cichlid assemblages in floodplain lakes had more trophic and habitat guilds than those in the main channel. Floodplain lakes had more habitat structure, such as woody debris and aquatic vegetation, which probably supports greater diversity of food resources and trophic niches of cichlids. Our surveys corroborate previous studies highlighting the diversity of cichlids in the Rupununi region during the rising water season. The next step in this research

will be analysis of stable isotope ratios of cichlid tissue samples and food resources to estimate trophic niche diversity and interspecific overlap in floodplain lakes and main channel.

Competition and Abiotic Environmental Filtering Drive Co-Occurrence Patterns of Congeneric Cyprinids

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Keywords: Red Shiner, Blacktail Shiner, species co-occurrence

Elucidating the ecological processes that give rise to patterns of species co-occurrence is a fundamental goal in ecology and an essential task in predicting the effects of habitat alteration and exotic species introductions on native biodiversity. Here, we combined broad scale observational data with a manipulative laboratory experiment to assess the importance of abiotic versus biotic factors in mediating co-occurrence of the congeneric cyprinids, *Cyprinella lutrensis* (Red shiner) and *C. venusta* (Blacktail shiner). First, we compiled 367 fish community surveys from the 2008, 2013, and 2018 National Rivers and Streams Assessments in which both species are native. We used null models and joint species distribution models to quantify the role of abiotic filtering and competition. These observational analyses revealed that the two focal species, relative to 58 other cyprinids in the study region, are functionally similar, occupy similar abiotic niches, and yet show strong spatial segregation among the surveyed reaches. Second, we performed a laboratory experiment in which we measured physiological and behavioral responses of the two focal species exposed to low-density intraspecific competition, high-density intraspecific competition, or high-density interspecific competition for 35 days. Linear mixed effects models indicated that high density reduced indices of body condition and that *C. venusta* had a stronger effect on *C. lutrensis* than *C. lutrensis* had on conspecifics. This suggests that *C. venusta* may outcompete *C. lutrensis* in sympatric watersheds, although the role of environmentally-mediated competition on more integrative fitness responses should be further evaluated. These observational and experimental findings highlight how the effects of competition and abiotic environmental filtering drive community assembly. This more thorough understanding of these drivers provides a basis for additional insights into the broader ecological implications of invasion and habitat alteration.

A Framework for Integrating Stream Ecosystem Theories into Spatial Modelling of Fish Richness and Assemblage Structure

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Keywords: White Creek, fish assemblage, river continuum concept, serial discontinuity concept, network dynamics hypothesis, asymmetric eigenvector maps

Freshwater streams are frequently fragmented by dams, road crossings, and flood control infrastructure that have the potential to significantly affect stream fish assemblages. Separating natural versus anthropogenically-derived assemblage structuring mechanisms within fragmented riverscapes is challenging. Riverscape concepts such as the river continuum concept (RCC), serial discontinuity concept

(SDC), and network dynamics hypothesis (NDH) conceptualize the roles of natural and anthropogenic regulators of assemblage structure along longitudinal gradients in streams. We surveyed fish assemblages and habitat variables across three years from 40 sites along the longitudinal dimension of White Creek, a headwater stream in College Station, Texas, to test theory-based hypotheses regarding the structuring of fish metacommunities. To achieve this goal, we constructed asymmetric eigenvector maps (AEMs) that integrated aspects of RCC, NDH, and SDC theories and used these AEMs to test three hypotheses. We hypothesized that: (H1) fish species richness would increase in a downstream direction but fragmentation by road-stream crossings would disrupt this increase, (H2) spatial contexts based on the RCC, SDC, and NDH would explain more variation in metacommunity structure compared to a neutral model, and (H3) distinct fish assemblages would exist within fragments of stream created by impassable road-stream crossings. Competing generalized additive models based on stream theories revealed the SDC was the top-ranked model for predicting longitudinal increase in species richness, supporting H1. Spatial variables based on AEMs integrating stream ecosystem theories (particularly the SDC) explained more variation in assemblage structure relative to the neutral model, supporting H2. Assemblage clustering and ordination showed unique assemblage structure in three of the four fragments, providing partial support for H3. Our results help to bridge the gap between theory and conservation of stream fishes by revealing that integration of stream ecosystem theories provides insight to origins of spatial processes that regulate assemblage structure.

Wastewater Effluent Impact on *Lepomis auritus* Reproductive Physiology in Cibolo Creek

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Keywords: Cibolo Creek, Longear Sunfish, hormones, hepatosomatic index, gonadosomatic index, vitellogenin

Wastewater treatment is vital for community well-being and positively impacts stream ecosystems and biodiversity by providing continuous flow during dry periods. However, the presence of unregulated hormones and abnormal temperature from effluent discharge pose potential risks for receiving waterbodies, thereby necessitating ecological assessments of ichthyofauna. The objective of this study was to assess whether and how temperature regimes and estrogen compounds 17- β estradiol (E2) and 17- α ethinyl-estradiol (EE2) altered reproductive physiology of *Lepomis auritus* in Cibolo Creek, a wastewater effluent receiving stream near San Antonio. We measured hepatosomatic index (HSI) and gonadosomatic index (GSI) monthly on male and female fish captured from a wastewater effluent reach and an upstream control reach. We also assessed males for vitellogenin proteins (VTG) using mucus swabs and an ELISA kit for VTG. Multifactor ANOVAs of GSI and HSI showed a significant difference (p -value = 0.05) between locations and months for males. Female GSI differed significantly by month, while female HSI showed a significant interaction effect between location and month, suggesting the effect of location varied temporally. Lastly, mucus analysis of males showed detectable amounts of VTG in 1 out of 14 samples. HSI and GSI for both sexes were higher at the effluent site for 9 out of 10 and 3 out of 10 months, respectively, suggesting notable impacts of wastewater effluent on *Lepomis auritus* reproductive physiology. Further analysis of effluent contaminants and reproductive physiology is required to determine the exact cause of the observed differences in GSI and HSI within this study. Despite little effect on male VTG seen here and the numerous positive impacts of wastewater treatment on stream ecosystems and biodiversity, the increase of effluent from the growing population,

urbanization, and climate change should continue to be monitored for effects on ichthyofauna and receiving water bodies.

Temporal and Spatial Variability of Fish Assemblages in Harmon Creek: The Influence of Habitat Complexity and Environmental Drivers

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Keywords: Harmon Creek, Blacktail Shiner, Western Mosquitofish, fish assemblage

Habitat heterogeneity and environmental factors can be key drivers of fish diversity in pristine headwater stream systems. Monitoring how these parameters change through time and space can provide insight into shifts in fish community dynamics. This research project is set in Harmon Creek, a second order stream in the Trinity River Basin, and seeks to explore how fish assemblages vary amongst the stream's various habitat types (e.g., pools, riffles, and runs) and how key environmental drivers (e.g., temperature, dissolved oxygen, and turbidity) influence the fish community composition through time. Previous assessments of the fish community indicate that the Blacktail Shiner (*Cyprinella venusta*) and Western Mosquitofish (*Gambusia affinis*) are the most dominant species with the total community diversity including 16 species. Blacktail Shiner ranks 1st in overall abundance in this stream system with population estimates of over 15,000. We hypothesize that habitat complexity (e.g., habitat type) will have a strong influence on fish diversity. We also hypothesize that fish diversity will be highest in areas/sampling events when temperature is moderate, turbidity is low, and dissolved oxygen is high. To test these hypotheses, we will conduct monthly fish surveys at 5 locations, for the period of one year, along the Harmon Creek ecosystem. Water column temperature, dissolved oxygen and turbidity will also be recorded. Temporal data is essential in understanding how the ecosystem responds to change. Our goal is that this study will help habitat managers better understand how streams, and more specifically the fish that inhabit them, respond to fluctuations in key environmental variables through time. The relationship between biotic and abiotic drivers is fundamental to maintaining fish biodiversity, and it is expected that the results of this study will provide a thorough understanding of this relationship.

Toxicity Assessment and Real-Time Metabolic Trait Responses of Juvenile *Macrobrachium rosenbergii* to Ammonia Exposure at Different Salinities

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Keywords: prawn, *Macrobrachium*, ammonia

Macrobrachium rosenbergii, commonly known as the giant freshwater prawn, has gained significant attention in global aquaculture initiatives. As a catadromous species, *M. rosenbergii* relies on brackish water for early life stage development, making it versatile for cultivation at typical salinity values of brackish groundwater desalination concentrate, thereby offering an opportunity to employ byproducts that would otherwise be disposed of. High density aquaculture results in the potential for harmful nitrogenous waste accumulation in the form of ammonia, which is a toxic compound, affecting the survival, growth,

and overall health of aquatic animals. However, the interactive effects of ammonia and salinity on *M. rosenbergii* remain poorly understood, particularly during the juvenile stages that coincide with the transition to brackish water. This study aims to determine the 24 and 48-hour ammonia LC50 values across three different salinities (1, 5, and 10 ppt). Informed by these LC50 concentrations, the acute real-time effects of ammonia exposure on the routine metabolic rate of juvenile *M. rosenbergii* will be investigated using static intermittent respirometry. This research will assist in developing a sentinel respirometry system that can detect changes in water quality in real-time by monitoring the metabolic rate of the prawns. Gathering data on the survival and metabolic costs linked with acute ammonia stress in different salinities will greatly inform effective aquaculture management of *M. rosenbergii*. Furthermore, this research holds promise for broader applications such as in enhancing aquaculture efforts that support stocking for various fisheries.

Predicting Habitat Suitability of Crayfish Using a Multiple Logistic Regression Accounting for Spatial Autocorrelation

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Keywords: crayfish, Moran Eigenvector Maps

Macroinvertebrate biomass and play important ecological roles. Yet while 32% of crayfish species are threatened, they comprise only 1% of the US endangered species list. The objective of this study is to better understand the habitat requirements of Texas crayfish to aid in their conservation, through the use of species distribution modeling. This study builds on past modeling efforts by using presence-absence (as opposed to presence-only) data to train the models, as well as by accounting for spatial autocorrelation. Spatial autocorrelation occurs when the values of variables sampled at nearby locations are not independent from each other. This is a problem because it impedes ecological inferences. There are different methods to correct for spatial autocorrelation in different scenarios. Here, we use Moran Eigenvector Maps (MEMs) in a logistic regression framework.

Determining the Viability of Amphibian and Reptile Communities in Reconstructed Wetlands within the Red River Watershed

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Keywords: Red River basin, wetlands, reptiles, amphibians

Wetland restoration efforts have become more prevalent as the ecological processes and benefits of these systems are more understood. Wetlands aid in flood control, nutrient cycling, sediment stabilization, water quality, economic benefits, and provide unique habitats. Reptiles and amphibians are commonly used as indicator species in reconstructed wetlands due to their increased sensitivity to environmental conditions and fast responses to change as a result of their short generation cycles (Dewey et al. 2022). Through the Agriculture Conservation Easement Program, ACEP, private landowners can help protect, restore, and enhance wetlands that have been affected by agricultural uses (USDA-NRCS). This project will evaluate reptile and amphibian communities in reconstructed and natural wetlands within the Red River Basin of

Northeastern Texas and Northwestern Louisiana. There will be five natural wetlands sampled to create a working baseline for wetland functionality. In addition, thirty-five reconstructed wetlands will be sampled over a three-year period, starting in winter 2024. Data will be collected through visual encounters and aquatic traps to understand herpetofauna species and abundance.

Scale-Dependent Tradeoffs between Habitat and Time in Explaining Alligator Gar (*Atractosteus spatula*) Movement

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Keywords: Alligator Gar, Brazos River, fish movement, habitat dissimilarity

Ecological theory predicts that movement by riverine fishes at the population level is characterized by both stationary and mobile individuals together creating a leptokurtic distribution of movement distances. However, studies testing this theory typically ignore spatial heterogeneity in riverscapes and the theory has not been tested using Alligator Gar (*Atractosteus spatula*), a species of growing interest among anglers and fisheries managers alike. We characterized movements and habitat associations of Alligator Gar in the Brazos River, Texas, at fine (every two hours for 24 hours) and coarse (every month for 16 months) spatiotemporal scales. We tested for the presence of leptokurtosis and relationships between movement distance, habitat dissimilarity, and time-at-large using multivariate and univariate statistical approaches. Dispersal by Alligator Gar revealed leptokurtosis at the coarse scale but not the fine scale. At the fine scale, mixed effects quantile regression revealed there was no relationship between habitat dissimilarity and dispersal distance, but dispersal was positively correlated with time. At the coarse scale, dispersal was positively correlated with increased habitat dissimilarity and time, but only for the most mobile individuals. Our work suggests that short-term movements by riverine Alligator Gar during warm seasons and at base flows increased with time but were unrelated to habitat, while long-term movements over an annual cycle during warm season flow pulses revealed highly mobile members of the population accessed distant and novel floodplain environments.

Projecting Survival and Growth of Eastern Brook Trout (*Salvelinus fontinalis*) for Contemporary and Future Climate Scenarios in the Southern Appalachian Mountains

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Keywords: Eastern Brook Trout, Appalachian Mountains, temperature effects

Bioenergetic modelling, which employs an energy balance equation to estimate daily energy gains via consumption and losses via respiration, can be used to understand how organismal survival and growth vary along spatial temperature gradients and to forecast how organisms will respond to ongoing climate change. To predict how Eastern Brook Trout will respond to temperature alterations, we modeled growth at 11 sites in the southern Appalachian Mountains of Tennessee and North Carolina. We estimated daily

mass changes over one year based on temperature monitoring in 2018 for age-0, -1, and -2 cohorts. Next, we forecasted daily mass changes for a future climate scenario with a 2°C increase in daily mean water temperature. Mean catchment elevation ranged from 846 to 1168 meters above sea level while annual mean temperature ranged from 9.9°C to 12.5°C across contemporary sites. We defined mortalities as a zero or negative end-of-year mass. The contemporary scenario predicted mortalities at 4, 2, and 0 of the 11 sites for age-0, -1, and -2 cohorts, respectively. The future scenario predicted mortalities at 5, 1, and 1 of the 11 total sites for respective cohorts. Mean modeled end-of-the-year mass was 97.6, 94.1, and 89.8% lower for the future temperature scenario when compared to the contemporary scenario for the three cohorts, respectively. All cohorts experienced energy deficits or reduced energy gains during the summer when compared to the other seasons. We did not observe a relationship between growth and elevation; however, this may be a consequence of the relatively few sites and short environmental gradient. We plan to expand projections from 11 sites to all interconfluence stream reaches in the southern Appalachians to lengthen gradients of temperature and elevation. This application is practical to assess species vulnerability to temperature alterations, both spatially and temporally.

A Novel Approach to Estimating Suckermouth Armored Catfish Population Size in the San Marcos River

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Keywords: Suckermouth Armored Catfish, San Marcos River,

Suckermouth armored catfishes in the genus *Hypostomus* have invaded freshwater ecosystems on a global scale, including the San Marcos River (SMR) of Texas. The *Hypostomus* sp. population in the SMR is managed through spearfishing to suppress population size. Fisheries-dependent data (i.e., based on spearfishing landings) suggest spearfishing suppresses biomass by increasing fishing mortality relative to natural mortality. However, no fisheries-independent assessment of population size exists. We leveraged high underwater visibility in the SMR to conduct visual counts of *Hypostomus* sp. along a 1-km longitudinal transect beginning at the headwaters and continuing downstream to the confluence with Purgatory Creek. We deployed a raft fitted with two underwater 4K full-spectrum cameras, waterproof LED lights, and an onboard GPS unit to collect georeferenced counts of fish. The raft was guided by a snorkeler and floated once a week across three consecutive weeks during spring 2022, fall 2022, and spring 2023. We paired georeferenced fish counts with remotely sensed or modelled habitat variables including water depth, water velocity, aquatic vegetation coverage, and distance to artificial structures (e.g., concrete bulkheads) in the river. We then fitted N-mixture models to estimate total number of *Hypostomus* sp., including environmental covariates for abundance and vegetation coverage as a covariate for detection. Results revealed *Hypostomus* sp. abundance was consistently highest near artificial structures and in shallow water, and detection was negatively correlated with increasing vegetation coverage. Fitted estimates (95% confidence intervals) of population size for *Hypostomus* sp. in the upper most 1-km of the SMR included 4,585 (3,025-7,089) for spring 2022, 4,695 (2,122-10,704) for fall 2022, and 2,942 (1,567-5,996) for spring 2023. The decline in abundance corresponded with decreasing streamflow in the SMR. These estimates represent the first measurement of the magnitude of *Hypostomus* sp. population size in the SMR and can be used to guide future management decisions.

Estimation of Fish Biomass on the RGV Reef Using Split Beam Sonar

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Keywords: Rio Grande Valley Reef, split beam sonar, Echoview, nautical area scattering coefficient

The Rio Grande Valley Reef is an artificial reef located 13 nautical miles off the coast of South Padre Island. The RGV Reef area spans 1,650 acres and is comprised of hundreds of patches of material ranging from low relief (<1m) to high relief (3-10m) reef structure. This reef provides crucial habitat for multiple fish species during different life stages and supports local fisheries. Since the deployment of structures in 2016, there has been a noticeable increase in fish abundance and recruitment, particularly commercially harvested snapper (*Lutjanus* sp.), however quantification of fish biomass is necessary to evaluate the effectiveness of different structure types in recruitment of fish. For this project, a Simrad EK80 split beam sonar was used to estimate fish biomass associated with the reef patches. Analysis of the sonar data was conducted with Echoview by application of filters to eliminate background noise and to remove echo returns from plankton and other non-fish marine life from the fish measurements. Biomass estimation was calculated using nautical area scattering coefficient (NASC) value from fish echo returns and biomass calibration curves created from captured fish. Additionally, carbon content contained within the fish populations associated at the RGV reef will be estimated from the biomass of fish schools and individual fish tracks. This study will provide important quantitative information on the success of the reef in recruitment of fish and carbon capture within the fish associated with the RGV reef.

Fish Diversity in Habitats of the Rupununi River, Guyana

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Megan Beeksma and Lily Williams, Stephen F. Austin State University; Takiya Jackson, Kendall Hastings and Calvin Young, Texas A&M University; James Vankley and Donald B. Burt, Stephen F. Austin State University; Leslie Winemiller and Kirk Winemiller, Texas A&M University; and Carmen Montaña, Stephen F. Austin State University

Keywords: Rupununi River, fish assemblage

Rivers within the Guiana Shield in South America possess a rich freshwater biodiversity with a high degree of endemism. The Rupununi region, situated in the Central Rupununi savannas, is influenced by hydrological seasonality, with flooding during the wet season that creates aquatic habitat connectivity between the Rupununi River (Essequibo Basin) and the Branco River (Amazon Basin). This connectivity facilitates potential exchange of fish and other aquatic organisms between these river basins. In May 2023, we surveyed fish assemblages in littoral habitats at sites within the Rupununi River and associated floodplain lakes near Yupukari Village during the early phase of the annual flood pulse. The river channel was characterized by sandy substrates with low total dissolved suspended solids (TDS), and moderate to rapid water velocity; whereas floodplain lakes had substrates dominated by detritus, leaf litter, and woody debris, higher TDS, and no flow. Surveys using multiple fishing gears yielded a total of 139 fish species (847 individual fish), with more species in floodplain lakes (90 spp.) compared to the river channel (73 spp.), and an overlap of 22 spp. between the two habitat types. Most species were from the orders

Characiformes and Siluriformes and the families Characidae, Serrasalminidae, Loricariidae, Doradidae, and Pimelodidae had the highest species richness in our samples. Eleven trophic guilds were identified, with omnivore and carnivore guilds being most common in both habitats. The parasitic guild (trichomycterid catfishes) was more common in the river channel, and detritivores were common in floodplain lakes. Our results fill knowledge gaps concerning fish diversity in the Central Rupununi Region during the rising water season. Future research will use stable isotope analysis to estimate trophic niche diversity among major taxa and infer basal production sources supporting fish biomass in river channel and floodplain habitats.

Abiotic and Biotic Factors Influence Population Structure of the Threatened Red River Pupfish (*Cyprinodon rubrofluviatilis*) in the Salt Fork of the Upper Brazos River

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Keywords: Red River Pupfish, Salt Fork of the Brazos River, Red Shiner

The Red River Pupfish (*Cyprinodon rubrofluviatilis*) is an endemic cyprinodontoid inhabiting saline environments in the upper reaches of the Red and Brazos River systems of Texas and Oklahoma. The Red River Pupfish (RRP) is listed as threatened in Texas due to habitat alteration and introduction of nonnative species. To better understand how abiotic and biotic factors influence the abundance and distribution of RRP, we measured local abiotic and biotic factors at three sites with different environmental conditions in the Salt Fork of the Brazos River, Texas. Abiotic factors included multiple parameters associated with instream habitat, water flow and quality, and biotic factors included the presence and abundance of other fish species, primarily Red Shiner (*Cyprinella lutrensis*) which may be an important predator of larval pupfish. Higher abundance of RRP was associated with low abundance of Red Shiner, and RRP at the high-abundance site also had larger mean body size. This site was characterized by high conductivity and salinity, constant water flow throughout the year, and drain brine oil in the stream sediments. The other two sites, which had lower RRP abundance, had narrower channels and more isolated pools, with one of the sites relatively less saline, but with greater species richness. In particular, low RRP abundance was associated with higher densities and larger body sizes of Red Shiner. Our data suggest that RRP persist as 'fugitive species' that are tolerant of abiotic conditions that exceed tolerances of other taxa, but unable to maintain populations in less extreme habitats where potential predators and competitors are present in higher densities. Additional research is needed to understand the relative importance and interaction of abiotic and biotic factors affecting Red River Pupfish distribution and abundance.

Hydrodynamics and Fish Assemblage Fluxes in a Forested Riverscape

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Keywords: fish assemblage, wetlands, floodplains

Abiotic factors such as hydrologic variability in rivers, streams, and floodplains affect fish abundance and distribution. Fish assemblage variability is strongly tied to hydrologic fluctuations in channel-floodplain ecosystems where hydrologic connectivity (i.e., water-mediated connections during floods) between a channel and a floodplain allows for fish immigration and emigration. Understanding how flow variability affects hydrologic connectivity and thus fish movement is therefore important for understanding how channel-floodplain ecosystems might be managed and preserved. We tracked water mediated connectivity between creek channels and floodplains and associated changes in fish assemblage composition in Lick Creek Park near College Station, TX. We surveyed fish assemblages and measured environmental variables across two paired channel-floodplain sets of sites during fall of 2023. Floodplain habitats were relatively shallow compared to creek channel sites and largely devoid of fishes following extreme drought during summer 2023. Wetland fish assemblages were dominated by phytophilic species (spawning over vegetation) while creek fish assemblages represented a mixture of spawning strategies, including vegetation spawners, nest spawners, substrate spawners, and broadcast spawners. These results provide baseline data for tracking fish assemblage development in wetlands following the return of high water and highlight the importance of hydrologic connectivity between channel and floodplain habitats.

Using Vegetation Surveys to Compare Natural and Constructed Wetlands

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Keywords: wetlands, Red River basin, Floristic Quality Assessment Index, Vegetation Index of Biotic Integrity

Wetland vegetation provides an abundance of ecosystem services such as water quality regulation, flood control, and it provides habitat space for fish, amphibians, and macroinvertebrates. Not only that, but these plants also act as excellent indicators of wetland conditions as dominant vegetation types are often used as biological criteria for classifying wetlands and other habitats (Cowardin & Golet, 1995). This project will assess the structure of vegetation communities to determine how they differ in constructed and natural wetlands. Five natural wetlands in the Red River drainage basin in northeastern Texas and northwestern Louisiana will be sampled to establish a baseline of vegetation communities. Additionally, 35 constructed wetlands in the same drainage basin will be sampled to draw a comparison between the structure and function of both wetland types. The purpose of this project is to create a national-scale

ecological monitoring and assessment framework for wetland structure and function using vegetation. A Relevé plot method will be used to generate a species list to conduct a Floristic Quality Assessment Index (FQAI) for each site and a Vegetation Index of Biotic Integrity (VIBI) for each dominant plant community. Data from this project will help us determine if constructed and restored wetlands are functioning as their natural counterparts.

eDNA Use in Southern Flounder Detection and Observation

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Keywords: eDNA, Southern Flounder

Environmental DNA is a relatively new scientific technique with a wide array of uses. Some uses of eDNA are the tracking of animal migrations, spawning of species, and detecting and monitoring species presence in challenging areas. The Southern Flounder (*Paralichthys lethostigma*) is a commercial and recreationally important species found in the Gulf of Mexico. Since the 1980's there have been drastic declines in Southern Flounder populations in the Gulf of Mexico. Flounder populations have been declining due to several factors such as overfishing, climate change, pollution and habitat degradation. In this study we are developing an eDNA detection assay for the Southern Flounder through the design of primers and optimization of a PCR protocol and water sampling methods. The eDNA assay will be tested for its efficiency in the detection of Southern Flounder at several locations. It will also be tested in comparison to standard TPWD sampling methods using bag seines and gill nets. If successful, eDNA sampling could be used to help monitor the populations of Southern Flounder in Texas.

Physiological Responses to Global Climate Change Stressors and Determination of Associated Functional Traits in Plains Fishes in Support of Management and Conservation Efforts

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Keywords: aerobic scope, climate change, ideal temperature range

Species of Greatest Conservation Need (SGCN) list from the Association of Fish and Wildlife Agencies (AFWA) is reviewed and updated regularly. Numerous fish species of the Red River, Canadian River, and Upper Brazos River are currently listed as federally endangered, federally threatened, or under review for listing. Maintaining current data on the status of these populations and understanding how functional traits of each species corresponds with observed physiological responses to environmental stressors is crucial for accurately prioritizing sensitive species for intercessory efforts, creating intervention plans, and allocating funds appropriately. Global climate change leading to warming trends in Texas rivers has introduced selective pressures among Texas Plains fish populations that have not been fully investigated to date. Water temperatures influence the energy budget of aquatic ectotherms by impacting both the maximum metabolic rate and the minimum metabolic rate. This range between these two thresholds is referred to as the aerobic scope and can be determined experimentally by measuring the rate of O₂ consumption of a fish at rest (MO₂min) and the rate of O₂ consumption at maximal energy output (MO₂max). The aerobic scope, or energy budget, is broadest and performance is optimized in fishes when

temperatures fall within an ideal temperature range (ToptAS). The aim of our study is to determine the species-specific ToptAS for at least 10 native Texas species on the SGCN list, test physiological responses to compounding stressors related to global climate change (elevated temperature and hypoxia), and link performance metrics to species distributions, population abundances, and associated physical attributes of each functional group (gill SA). Our results will provide crucial insights needed for accurate SGCN list future revisions and to produce conservation plans for high-risk species.

Index

acoustic receivers	39	Blayk Michaels	14
acoustic telemetry	1	Blotchy bass syndrome	14
Adam Cohen	7	blue carbon	32, 33
Adam Feltman	40	Blue Sucker	21, 22, 23
Adam Summers	16	Brad Littrell	13
additive diversity partitioning	21	Brazos River 1, 15, 16, 25, 26, 29, 30, 32, 36, 37, 55, 58, 59, 61	
Alligator Gar	1, 2, 39, 55	Brazos River Authority	36, 37
Allison White	57	Breana Smithers	53
Amanda Pinion	16	Brian Laub	52
American Eel	12	Brian Metz	5
amphibians	55, 60	Britney Brevell	40
Anastasia Umstott	20, 22, 28, 31, 42	Brown Trout	24
Andrew Brinker	37	Bull Shark	39
Angel Flowers	40	C3 carbon	15
Angel Velasquez	38	C4 carbon	15
Angelina River	21, 22, 42	Cale Corley	36
Angler's Atlas MyCatch	14	Calvin Young	50, 58
anglers	5, 6, 7, 9, 10, 11, 14, 45, 46, 55	Cameron Emadi	53
Ann Jeffers	19	carbon 13	4
Anthea Fredrickson	12	carbon dioxide	19
Appalachian Mountains	56	carbon export	15
aquatic plants	3	Caren Utley	1, 10, 45
Aquilla Creek	37	Carey Gelpi	1, 39
Aransas Bay	42	Carmen Montaña .. 21, 22, 26, 29, 31, 32, 42, 50, 58, 59	
Archis Grubh	49	carpsuckers	26
Ashlyn Sak	12	Casey Williams	3
asymmetric competition	24	Catherine Eckert	5, 41
asymmetric eigenvector maps	51, 52	Cedar Lakes	1
Atlantic Croaker	2, 35	Channel Catfish	18, 19
Atlantic Multidecadal Oscillation	2, 3, 35	Charles Downey	5, 40
Atlantic Tripletail	35	Chase Nimee	26, 29, 32, 58
B. A. Steinhagen Reservoir	13	Chris Johnson	48
Ba/Ca ratio	4	Christa Kunkel	13
bait preference	45	Christopher Austin	47
Bart Durham	33	Christopher Conneen	54
Bastrop Crayfish	20	Christopher Jingle	38
behavior syndrome	23	Christopher Kopack	18
Benjamin Walther	4	Christopher Mace	12
Benthic Community Index	33	Christopher Riggins	45, 56
benthic macroinvertebrates	24, 49	Christopher Taylor	47
Benton Fry	48	Cibolo Creek	52
beta diversity	21, 26	<i>Cichla</i>	48, 50
Big Seabree Reef	24	Cienna Hanson	28
Black Drum	39, 41	citizen science	37
Blacktail Shiner	50, 53	Clayton Raines	14
Blake Elzi	59		
Blanco River	v		

Clear Fork Trinity River.....	37	Donald Burt	50
Climate Change.....	61	Double Mountain Fork of the Brazos River ...	26, 32
Clint Robertson	28	East Bank Ridge	24
Coastal Brigade.....	6	East Bay.....	43
Cody Cox	40	Eastern Brook Trout.....	56
Cody Craig.....	10	Echoview	57
Collin Garoutte.....	45, 56	eCognition	42
Colm Conneen	20	ecological niche modeling.....	20
Comal River.....	47	eDNA.....	1, 2, 12, 15, 25, 29, 49, 61
comb jellies	40	Edward Mager	53, 61
commercial shrimping	2, 35	Edwards Plateau	8, 9, 27, 38, 47
Common Minnow	16	eel ramps.....	12
constructed wetlands.....	33, 60	Elizabeth Benson	40
co-occurrence.....	50, 51	Elizabeth Harris	46
Corey Waddell.....	1, 43	Elliot Briell	35
Cory Scanes	36	Emily Miller	1, 6, 44
crayfish.....	20, 24, 54	Emily Parker	51
Creek Chub	23	Emma Clarkson	42
Crevalle Jack.....	5	environmental flow.....	11
Crista Kieley	17	Environmental Flow Information Toolkit.....	11
ctenophores	40	environmental flows	11, 22, 30, 37
cyanotoxins	17	equilibrium species.....	19
Cynthia Fox Holt.....	14	Erica Hagmeyer	53
Dakus Geeslin	9	Erica Underwood.....	12
Damon Williford	1, 2, 35	Erik Pilgrim	25
Dan Bennett	5	Essequibo River.....	48
Dan Daugherty	1, 55	Ethan Getz	5, 40, 41
Danial Nayeri.....	7	Evan Pettis	42
Daniel Bunting.....	7	Fabio Dos Santos Neto	53
Daniel Pilgreen.....	7	Falcon Reservoir.....	46, 47
Daniel Roelke.....	17	Fayette's Crayfish	20
Danny Palmer.....	40	Fernando Chavez	51
Dave Peterson	42	fish assemblage.....	21, 22, 30, 31, 44, 47, 51, 53, 58, 60
Dave Smith	5	fish community	24, 25, 26, 38, 43, 47, 51, 53
David Hoeinghaus.....	14, 15, 26, 29, 32, 58, 61	fish sampling.....	38
David Norris.....	42	fishery management.....	9, 10, 46
David Portnoy	16	Floristic Quality Assessment Index	60
David Smith	21, 44	Flow Ecology Dashboard	11
David Ushakow.....	35	Floyd Boyett	13
David Young	8, 11, 30	functional richness	19, 20
Dean Hendrickson.....	7	Garrett Tucker.....	8
Devils River Minnow.....	8, 9	Gary Voelker	26
dewatering.....	13, 27	George Guillen.....	12
Diane Le Bouille	7	Gerard Kyle	7
diel activity	45	gonadosomatic index	52
diet overlap.....	24	Grant Maresh	43
diet richness	24	Greenthroat Darter	8, 9
Dillon Flowers	18	Greg Stunz	17
dispersal studies	18	Guadalupe Bass	v, 8, 9, 48, 49
diversity partitioning.....	21, 26		
Donald B. Burt.....	58		

Guadalupe River	38	Ka'inoa o kekai Lee.....	45
Guadalupe Roundnose Minnow.....	8, 9	Kaley Cave	15, 26, 29, 32, 58
Guadalupe River	38	Kannon Byckovski	56
Guyana	48, 50, 58	Karmann Kessler	56
habitat preference.....	5	Kasey Pruett.....	61
Haley Matay.....	37	Kayla Fast	29
Hanna Bauer.....	9, 10	Kendall Hasting	50
Hannah Evans	21, 51, 59	Kendall Hastings.....	58
Harmon Creek.....	53	Kennedi Davis	60
Hayden Roberts.....	21, 26, 55	Kevin Mayes.....	11
Henry Bart.....	26	Kevin W. Conway.....	16, 20, 22, 26, 29, 31
hepatosomatic index.....	52	Kimberlie Travelstead.....	40
Honey Creek	8, 9	Kirk Winemiller	48, 50, 58
Hydrology Dashboard.....	11	Kole Kubicek.....	21, 22, 29, 31, 40
Integrated Tracking of Aquatic Animals	39	Kyle Piller.....	19
Isabela Silva	38	Kyle Sullivan	13
Ivonne Blandon	12	Kylie Perkins	25
Jacob Barrett	23	Lake Fork.....	5
Jacob Wolff	21, 48, 51	Lance Williams	27, 33, 49, 54, 60
Jake Barrett	44	Landes Randall	39
Jake Harris	42	Largemouth Bass	5, 14
Jake Madewell	51	Lauren Yancy	51
Jake Norman	5	Lavaca Bay	17
James Vankley.....	50, 58	Lelaina Clayburg	61
James York	49	Leon River.....	37
Jane Rogosch	7, 28, 33	Leslie Hartman	1, 10, 35, 45
Jared Dickson.....	20, 33, 54, 60	Leslie Winemiller	50, 58
Jay Oliver	30	Leuciscidae	16
Jay Rooker	39	Lillian Marshall	41
Jeffrey Wozniak	53	Lily DiFrank	58
Jennifer Beseres Pollack	36	Lily Williams	50, 58
Jennifer Butler.....	38	Lindsey Davis.....	29
Jenny Oakley.....	12, 25	Lindsey Elkins	11
Jeremy Nickolai	36	Lisa Rodriguez.....	38
Jesse Guajardo	52	Llano River Carpsucker.....	26, 27
Jessica Coleman	54	lock and dam.....	19, 20
Jessica Geiskopf.....	43	Logan Johnson.....	36
Jessica Labonté	17	Longear Sunfish.....	52
Jessica Randall	4	Lucas Stevens	51, 59
Jillian Swinford.....	12	Luis Rios.....	47
Joel Anderson.....	1, 2, 3, 12, 35	Luke Iwanowicz	14
Johnathan Ellard.....	20, 21, 22, 28, 31, 55	machine learning models.....	10
Jonathan Richard.....	40	<i>Macrobrachium rosenbergii</i>	53, 54
Jordan Lindholm	28	Margaret Wheat-Walsh	36
Joshua Banta	20, 27, 54	Marisol Farias	38
Joshua Tivin	47	Marissa Lamb	23
Joshuah Perkin 18, 20, 21, 22, 26, 28, 31, 44, 45, 48, 51, 55, 56, 59		Mark Lueders.....	11, 30
Juana Perez.....	40	marsh	1, 17, 39, 41, 42
Justin Rea	33	Marsha Williams.....	27, 33, 49, 54
juvenile growth functions	3	Marty Kelly.....	8, 11
		Matagorda Bay	1, 2, 11, 17, 43, 44, 45

Matt Hoch	40	Rainbow Trout	18, 19
Matthew Acre	55	Ralf Britz	16
Matthew Greenwold	49	Rebecca Mangold	20, 21, 22, 28, 31, 45, 56
Matthew Streich	17	recreational specialization	7
Matthew Troia	8, 38, 50, 56	Red Drum	39, 41, 44, 45
Megan Bean	7	Red River	19, 26, 34, 54, 55, 58, 59, 60, 61
Megan Beeksma	50, 58	Red River Pupfish	26, 34, 58, 59
Meghan Booknis	21	Red River Shiner	34
metacommunity dynamics	15, 26	Red Shiner	16, 26, 50, 59
Michael Curtis	15, 25, 29	Red Snapper	46
Michael Sandel	29	Regan Doss	38
Michelle King	32	reptiles	55
Michelle Laing	18	Richard Kline	23, 32, 57
microcystins	17	Rileigh Hawk	43
Miguel Acevedo	53	Rio Grande	8, 9, 23, 24, 32, 33, 47, 48, 49, 57, 61
Mike Curtis	32, 58	Rio Grande Chub	24
Minh Vu	29	Rio Grande Darter	8, 9
Mollie F. Cashner	23	Rio Grande Sucker	24
Morgan Biggs	14	Rio Grande Valley Artificial Reef	32, 33
mussels	10, 13, 27, 31	river continuum concept	51
Nate Smith	7, 8, 28	Robinson McMillan	17
Nathan Schubert	54	Rollover Pass	43
Nathan Shubert	20	Roni Maddox	50
National Agriculture Imagery Program	42	Rose Blanchard	18
National Rivers and Streams Assessment	25	Rupununi River	50, 58
Native Fish Conservation Areas	7	Ryan Byrge	36
nautical area scattering coefficient	57	Ryan McManamay	11, 30
Navasota River	37	Ryan Shartau	19
Neches River	21, 22, 29, 42, 43	Sabine Lake	39, 40
Neches River basin	21, 29	Sabine Lake System Acoustic Array	39
network dynamics hypothesis	51	Sabine River basin	21, 29, 31
Nick Loveland	8	Sabine Shiner	22, 31
Noah Santee	21, 51	Salt Fork of the Brazos River	26, 59
Nueces Crayfish	20	San Bernard River	1
nursery habitat	35, 40	San Felipe Creek	8, 9
Owen George	24	San Marcos River	45, 47, 56, 57
oyster dredge	36, 44	Sand Shiner	16
oysters	4, 36, 43	Sara McGillewie	15
periodic species	19	Sarah Burgett	20, 54
personality	23	Scott Collins	24, 33
pH regulation	19	sea surface temperature	2, 35
Pierce Kean	12	seagrass	40, 41, 42
Pine Island Bayou	22	serial discontinuity concept	51
Plains Minnow	34	sex ratios	12
Plateau Shiner	8, 9	sexual dimorphism	16, 18
Pleasure Island	40	Shambhu Paudel	1, 39
Polly Hajovsky	1	Sharpnose Shiner	16, 26, 29, 32
Prairie Chub	34	Shelby Rodriguez-Edwards	54
Preston Bean	26, 30	shrimping	2, 35
R. J. David Wells	39	site fidelity	39, 45
Rachel Leicher	27		

Smalleye Shiner	26, 29, 32	Texas Orthoimagery Program	42
Sofia Sayeed.....	38	thermal tolerance	8
Sophie Scott	50, 58	Thomas Dodson.....	19
Southern Flounder.....	3, 12, 38, 39, 61	Thomas Heard.....	45, 56
sparse time series	44	Tim Birdsong.....	7
spatial gradient analysis	44	Timothy Bonner.....	13, 47
species of greatest conservation need	7	Tobin Davidson.....	29
Species of Greatest Conservation Need	11, 29, 49, 61	Todd Driscoll	5
Speckled Chub	47	Toledo Bend.....	5, 31
split beam sonar	24, 57	Tom Dodson	44
Spotted Seatrout.....	6, 9, 10, 39, 41, 44, 45	tongs	36
springs.....	8, 9	Torry Tucker	19
stable isotopes	34, 48	Travis Sterne.....	42
Stephen Curtis.....	12	tributaries.....	17, 28, 37
Stephen Davis	12	turbidity	34, 43, 53
Steven Sutton	7	Vegetation Index of Biotic Integrity	60
Story Leshner.....	42	vitellogenin	52
Style of Participation self-classification	7	Wade Wilson	33
submersible ultrasonic receivers	45	Warren Schlechte	8
Suckermouth Armored Catfish.....	45, 56	Wastewater.....	52
Suckermouth Minnow.....	42	Wesley Arend.....	45, 56
Sustainable Rivers Program.....	22	West Fork Trinity River.....	37
Takiya Jackson	50, 58	Western Mosquitofish.....	18, 53
Tamaulipas Shiner.....	47	Wetlands	33, 54, 55, 60
temperature 3, 4, 8, 10, 12, 29, 43, 44, 52, 53, 56, 61		White Creek.....	51
temperature change	3	William Smith.....	7
Terry Corbett.....	13	Winter Storm Uri	9, 10
Texas Acoustic Array Network	39	Xingli Giam	56
Texas Heelsplitter.....	13	Zacchaeus Compson	15, 26, 29, 32, 58
		Zachary Olsen.....	35, 36
		Zack Thomas	7, 9