ANNUAL PROCEEDINGS

of the

TEXAS CHAPTER

AMERICAN FISHERIES SOCIETY

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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 (https://units.fisheries.org/tx/tc-membership/) or contact the Chapter Secretary:

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Annual Chapter membership dues are $12 for Affiliate Members and $5 for Student Members.

ANNUAL PROCEEDINGS OF THE TEXAS CHAPTER AMERICAN FISHERIES SOCIETY

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Awards

Outstanding Fisheries Worker of the Year Award:

Lifetime Achievement: *Michelle Nations*
Special Recognition: *Coastal Fisheries Team*
Support: *Diana Isabel*
Administration*: San Antonio River Authority Aquatic Biology Team, Adrian Reyna, Austin Davis, Caille Marshall, Garrett Tucker, Mitch Magruder and Sara Thompson*
Management: *Travis Tidwell*
Education: *Todd Sink*
Research: *Carmen Montaña*
Student: *Anastasia Umstott*
Most Active Student Subunit: *University of Texas at San Antonio*

Best Student Oral Presentation:

Jacob Oster — Texas A&M University at Corpus Christi
"How is Fish Behavior Influenced by Exposure to Environmental Mercury or Hypoxia?"

Best Student Poster Presentation:

Katelyn Defrancis — Stephen F. Austin State University
"Exploring the Relationship Between Index of Biotic Integrity and Species Composition Variability in East Texas Streams"

Scholarships

Texas Chapter American Fisheries Society Scholarship

Anastasia Umstott — Stephen F. Austin State University

Clark Hubbs Student Scholarship

Kylie Perkins – University of Houston at Clear Lake

Guadalupe River Trout Unlimited Foundation Scholarship

Erica Hagmeyer – Sam Houston State University

Roselyn Aguila — Texas A&M University at Galveston

Harry Tennison Student Scholarship by The Sportsmen's Club of Fort Worth

Madison Nguyen – Texas A&M University at College Station

Meghan Booknis – Texas A&M University at College Station

Danny Martinez – Texas A&M University at Galveston

Jacob Matthew Oster – Texas A&M University at Corpus Christi

Christina Marconi – University of Texas Marine Science Institute

Allison Weber – Texas A&M University at Corpus Christi

Benton Fry – Texas A&M University at College Station

Karmann Kessler – The University of Texas at San Antonio

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Oral Presentations

Measuring and Predicting Fish Movement in a Restored but Serially Fragmented Riverscape

Jacob Barrett, Texas A&M University, Student

Co-authors: Thomas Dodson, Texas A&M University; Megan DiNicola and Belize Lane, Utah State University; Mitchell Magruder and Austin Davis, San Antonio River Authority; David Smith, U. S. Army Corps of Engineers; and Joshuah Perkin, Texas A&M University

Keywords: mussels, San Antonio River, erosion control structures, fish passage

In North America, Unionid mussels have exhibited severe declines, and reintroduction represents a valuable conservation tool. Freshwater fishes and mussels have coevolved a relationship whereby fishes serve as hosts for early life stages of mussels (glochidia), and successful recolonization is partially dependent on the ability of fish hosts to successfully disperse to suitable mussel habitat. The Mission Reach of the San Antonio River is an urban stream reach with a particularly flashy hydrologic regime, and restoration projects have involved the construction of 31 erosion control structures which have the potential to structurally fragment the riverscape but have yet to be evaluated for fish passage. Although juvenile mussels have been reintroduced, natural recolonization by sexually mature mussels that persist has yet to be documented. One hypothesis for the lack of recolonization success is that movement by fish hosts may be limited by installed structures or the unique hydrology, thereby reducing connectivity between mussel reintroduction sites and suitable rearing habitat. Our objective was to determine whether individual fish are successfully passing erosion control structures and evaluate intrinsic and extrinsic predictors of passage. We used passive integrated transponder (PIT) tags to evaluate movement across a subset of seven structures within the Mission Reach. We PIT tagged 1,140 individuals representing 20 species and used a mobile antenna system to redetect individuals biweekly from May to August in 2024. We redetected 229 individuals and documented 22 passage events, including several individuals which passed multiple structures since their previous observation. Passage was positively correlated with fish length and time at large, indicating that larger (and most likely older) individuals pass structures more frequently. Our results will be used to inform future mussel reintroduction efforts and indicate that erosion control structures comparable to those in the Mission Reach do not represent complete barriers to movement by fishes.

Predicting Movement of the Highly Invasive Western Mosquitofish

Rose Blanchard, Texas A&M University, Student

Co-author: Joshuah Perkin, Texas A&M University

Keywords: Western Mosquitofish, invasive species, fish movement

Predicting movement of invasive species is essential to controlling their spread. This study investigates movement patterns of highly invasive Western Mosquitofish through mark-recapture, model validation, and development of movement predictions in new waterbodies. Through mark-recapture, we show that Western Mosquitofish movement is predictable based on fish morphology (size and caudal fin shape), stream size, and time since release. However, a higher percentage of the studied Western Mosquitofish populations were considered mobile compared to typical fish populations. We then validated movement predictions using two case studies, one in artificial mesocosms that mimic water troughs where Western Mosquitofish are commonly stocked, and the second using invaded streams in the state of Nebraska. The first case study demonstrated accuracy of the model in predicting movement in small, man-made systems. The second case study showed a breakdown in the predictive capacity of the model in large order rivers (5th, 6th, and 7th), specifically that mosquitofish move significantly farther than predicted. Finally, we used an account of a recent introduction of the Western Mosquitofish in the Eastern Himalayas to predict their spread from the newly recognized introduction site. We predict initially slow spread in small order streams over a period of 12 years, followed by accelerated spread once a large river mainstem is reached resulting in nearly 8-km movement over a 2-year time horizon. This project provides quantitative estimates of Western Mosquitofish spread across a range of contexts and can be used to direct conservation and management actions aimed at preventing, eradicating, or controlling spread of the species where it has been introduced outside its native range round the world.

Diversity and Stability of Fish and Invertebrates in Bays Along the Texas Coast

Hannah Bleth, Texas A&M University, Student

Co-author: Masami Fujiwara, Texas A&M University

Keywords: bays, species diversity

Climate change is affecting coastal marine ecosystems in many ways including changing species distribution. With this changing distribution, it's important to understand how that is impacting the stability of an ecosystem. To investigate this, we calculated the variability and diversity of a community at a local scale using bag seine sampling data collected by Texas Parks and Wildlife in Sabine Lake, Galveston Bay, Matagorda Bay, San Antonio Bay, Aransas Bay, Corpus Christi Bay, Upper Laguna Madre, and Lower Madre from 1982 to 2022. We utilized methods, from a previous study, to quantify compositional and aggregate variability. We found that as Shannon diversity increased, aggregate variability decreased for fish and invertebrates. Richness showed a positive relationship with compositional and aggregate variability for invertebrates. The relationship between Shannon diversity and compositional variability was shown to be insignificant. For fish and invertebrates, richness and Shannon diversity increased over the thirty years. The results indicate that there is now a greater number of species in these bays than there was thirty years ago. From the variability trends seen, it can be suggested that stability is

increasing in the bays for fish but there are differing results for invertebrates. This conclusion adds to previous research looking at the diversity-stability relationship.

Golden Algae Under Control: Prophylactic and Reactive Use of Humic Acid

Brittany Chesser, Texas A&M University, Student

Co-author: Todd Sink, Texas A&M University

Keywords: Golden algae, humic acid

Golden algae (*Prymnesium parvum*) blooms present significant challenges to aquatic ecosystems and aquaculture operations, producing toxins that impair respiratory functions in gill-breathing organisms and leading to considerable economic and ecological losses. Current management strategies often rely on algaecides, chemical treatments, dilution, or adjustments to water chemistry, but these methods may be impractical in certain systems. Humic acid, an organic compound derived from natural decomposition, provides a carbon source for beneficial bacteria and has been used commercially in recirculating aquaculture systems and agriculture for diverse purposes. This study explored the potential of humic acid as an alternative approach to managing golden algae blooms by assessing its ability to reduce nutrient concentrations and control algal proliferation. A controlled experiment was conducted using various dosages of humic acid (prophylactic, low, and high) applied to outdoor systems mimicking pond environments, with and without soil presence. Key water quality metrics, including total phosphorus and nitrogen, were monitored before and after treatment. Results showed significant phosphorus binding within six hours across all treatments and the most notable nitrogen reductions observed in soil-present conditions. By week 5, prophylactic treatments significantly reduced golden algae cell counts, while low and high doses achieved similar results by week 6, keeping cell concentrations below bloom thresholds (<10,000 cells/mL). These findings highlight the efficacy of humic acid, particularly as a prophylactic treatment, in preventing and mitigating golden algae blooms while reducing nutrient availability. This research supports the use of humic acid as a cost-effective, environmentally sustainable management tool for golden algae and potentially other harmful algal blooms, with promising applications in aquaculture and natural aquatic systems.

Fish Species and Assemblage Thresholds Associated with Drought in the Upper Brazos River

Michael Curtis, University of North Texas, Student

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

Keywords: drought, TITAN, Brazos River, Sharpnose Shiner, Smalleye Shiner, Red River Pupfish, Plains Killifish, sunfish

Drought is a pervasive natural phenomenon that impacts aquatic systems, particularly in semi-arid climates such as the southern plains of North America. Drought frequency, intensity, and duration is exacerbated by anthropogenic influences, resulting in environmental extremes (e.g. reduced stream flow and dissolved oxygen concentration, increased water temperature and conductivity, and fragmentation) that may exceed capacities of native species adapted to drought-prone conditions. Managing populations of imperiled species in regions experiencing increasing pressures associated with drought can be aided by identifying thresholds at which populations respond strongly to individual or combined environmental stressors. We tested for threshold responses using Threshold Indicator Taxa Analysis (TITAN) and a dataset of fish species (n=31) relative abundances and environmental conditions quantified monthly at 22 sites over two years in the upper Brazos River basin. TITAN was conducted using individual environmental gradients (e.g. stream flow and others listed above) as well as composite gradients (i.e. axis loadings from PCA) representing the combined effects of multiple environmental conditions. We omitted 13 fish species prior to analyses due to low frequency of occurrence, leaving a total of 18 for analysis. Of those species, between 8 and 11 were identified as indicator taxa using TITAN, depending on the environmental gradient being analyzed. The federally endangered Sharpnose (*Notropis oxyrhynchus*) and Smalleye (*Notropis buccula*) shiners, among others, exhibited positive threshold responses associated with stream flow, as well as positive threshold responses along PC1 and PC2, representing composite gradients associated with reduced conductivity and increased wetted width, depth, and dissolved oxygen concentration. In contrast, Red River Pupfish (*Cyprinodon rubrofluviatilis*), sunfish (*Lepomis* spp.), and Plains Killifish (*Fundulus zebrinus*), among others, exhibited negative threshold responses to the same gradients. Specific thresholds indicated in this study can inform environmental targets supporting conservation of imperiled species in this river basin.

Assessing Scales of Temporal Inference for Stream Fish Assemblage Structure in the San Saba and Llano Rivers

Thomas Dodson, Texas A&M University, Student

Co-authors: Jacob Barrett, Calvin Young, and Joshuah Perkin, Texas A&M University; and David Smith, ERDC, United States Army Corps of Engineers

Keywords: San Saba River, Llano River, time scale, fish assemblage

The relative contributions of spatial and temporal dimensions of scale and their governance of ecosystem variation is an area of focus in ecology. From conservation, management, and monitoring perspectives, understanding assemblage fluctuations across temporal scales is of great interest. For example, most stream fish monitoring programs rely on data from single snapshots (e.g., one year) taken during a single time of year (e.g., summer low flows). Whether or not these snapshots are reflective of broader temporal variation is rarely tested. We surveyed stream fish

assemblages at three longitudinally distributed locations in the San Saba River and the Llano River multiple times at two temporal scales. Surveys included annual samples of each site during the summers of 2021, 2023, and 2024 (i.e., annual scale), and season samples of each site during March, May, June, August, and November of 2024 (i.e., seasonal scale). We used standardized seining protocols during each survey, and we identified and counted all fishes collected. We used permuted multivariate analysis of similarity and fourth root-transformed abundance data to test for temporal differences in assemblage structure at the annual and seasonal scales. Results revealed no significant difference in assemblage structure among years or seasons for the six sites in the analysis. These findings suggest that inference gained from a single survey conducted during summer is representative of broader seasonal and annual time scales. Our results support the loose equilibrium theory that posits fish assemblages remain within some bounds around a central tendency with temporal fluxes in species abundances. However, environmental disturbances and anthropogenic alterations can push assemblages outside of their loose equilibrium state and into a state of directional change. Consequently, we suggest long-term monitoring programs be established in regions where future change is expected and our results provide guidance for designing such programs.

Changes in Riverine Fish Assemblage Structure and Function Post-Reservoir Construction: a 70-Years Perspective

Johnathan Ellard, Texas A&M University, Student

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

Keywords: Sabine River, Toledo Bend Reservoir, fish assemblage, life history strategies, mussels

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 repeated a historical, spatially intensive fish survey conducted 70 years ago (1954-1955) in the upper Sabine River of Texas to assess spatiotemporal change in the fish fauna. We used the same sampling gears and surveyed the same locations as the historical survey, but excluded sites that are now inundated by reservoirs that did not yet exist during the historical survey. Beta-diversity dissimilarity analyses revealed high species replacement in upstream and downstream areas near reservoirs with no assemblage change attributable to species nestedness across the longitudinal system. Regarding fish life history theory, change in relative abundance of periodic life history strategists (LHS) displayed a longitudinal recovery gradient, while opportunistic LHS showed unexpected increases in areas nearest to dams. The opportunistic LHS spatial patterns revealed potential support for convergent fish assemblages in riverine areas near reservoirs as a result of reservoir stocking. Additional analyses revealed that areas near Toledo Bend Reservoir displayed a functional gain of fish mussel hosts traits, highlighting a mismatch between mussel declines and

an apparent increase in diversity of potential fish hosts. Overall, this study utilized taxonomic and functional indices to bring insight to fish assemblage changes of the upper Sabine River in potential response to dam construction. This work provides guidance on conservation and management of regulated rivers by delineating the spatial footprints of reservoirs and identifying the fish species and groups most affected by this globally pervasive form of environmental change.

Investigating the Effects of Osmotic Stress on Virulent *Aeromonas hydrophila*, the Causative Agent of Motile *Aeromonas* Septicemia (MAS) in U.S. Catfish Aquaculture

Ozgur Erdogan, Texas A&M University, Student

Co-authors: Md Inja-Mamun Haque, Hridi A. Biswas, Ty J. Werdel, and Haitham H. Mohammed, Texas A&M University

Keywords: *Aeromonas hydrophila*, Channel Catfish, aquaculture, disease control

Aeromonas hydrophila, a gram-negative, facultative aerobic pathogen belonging to the Aeromonadaceae family, causes motile *Aeromonas septicemia* (MAS) in cultured fish all over the world. The rapid spread of MAS outbreaks and subsequent economic losses for the most commercially important fish species, especially Channel Catfish, are due to *A. hydrophila*'s pathogenicity. The United States Department of Agriculture (USDA) estimated the catfish business revenues at $447 million in 2022, while MAS causes the loss of tens of millions of pounds of market-sized catfish per year. However, there are currently no effective preventative measures and insufficient management options for control of this pathogen, which emphasizes the need for creative ways to lessen its effects. By assessing vAh's growth, morphology, biofilm formation, survival, and virulence at different sodium chloride (NaCl) concentrations (0.5%, 1.5%, and 4.5%), our study explores the impact of osmotic stress on vAh. According to preliminary research, bacterial growth and biofilm formation (two essential components of the pathogen's survival and virulence) are adversely affected by high salt levels. At greater salt concentrations, morphological investigations showed structural alterations in vAh cells and decreased survival rates. Our findings demonstrate how salinity control may be used as a useful strategy to decrease the incidence of MAS outbreaks in aquaculture systems. To reduce the ecological and financial impacts of MAS in catfish farming, our ongoing research focuses on investigating how vAh responds to various environmental stressors. Furthermore, the knowledge attained thus far lays a solid foundation for further research into controlling bacterial infections in various aquaculture systems worldwide.

Intra-Guild and Spatial Variation in Trophic Ecology of Fishes in the Rupununi River and Floodplain: Evidence from Stable Isotopes

Benton Fry, Texas A&M University, Student Co-authors: Calvin J. Young, Texas A&M University; Carmen Montaña, Stephan F. Austin State University; and Leslie Kelso Winemiller and Kirk Winemiller, Texas A&M University

Keywords: stable isotopes, Rupununi River, Guyana, trophic guilds

Many tropical rivers have strongly seasonal flow regimes, with a high flow pulse that connects channel and floodplain habitats during the wet season and isolation of floodplain aquatic habitats during low-water dry season conditions. During the flood period, aquatic food webs are strongly supported by terrestrial (allochthonous) production sources, and autochthonous production sources assume greater importance during the dry season. To test the latter pattern, stable isotope analysis was performed on tissue samples from fishes from five trophic guilds and basal production sources collected from the river channel and three floodplain lakes of the Rupununi River, Guyana. For fish trophic guilds at each location, we estimated basal source assimilation, vertical trophic position, and the overlap of isotopic spaces between guilds at each location, and between habitats within each guild. Seston was the principal source assimilated by feeding guilds in every habitat, with the only exception being piscivores in the river channel (terrestrial plants were most important, possibly reflecting a time lag for assimilated material to pass several steps up food chains). Trophic guilds from the river channel had higher trophic positions when each was compared to the same guild from floodplain lakes. For each guild, isotopic space overlap was high between channel and combined floodplain samples. In most intraguild comparisons among the three floodplain lakes, isotopic overlap was low, indicating large spatial variation in food web dynamics. This variability among lakes appears to be associated with differences in topography, water depth, water body distance from the active river channel, and riparian vegetation. Findings further support the importance of autochthonous production sources for aquatic food webs of tropical rivers during the dry season and the role of floodplain heterogeneity in creating spatial variation in food web dynamics.

Columnaries-Causing Bacteria in Texas Cultured and Sport Fish Genotyping and Antimicrobial Susceptibility.

MD Inja Mamun Haque, Student

Co-authors: Ozgur Erdogan, Hridi A. Biswas, Todd Sink, and Haitham H. Mohammed, Texas A&M University

Keywords: Columnaris disease, aquaculture, hybrid catfish, hybrid tilapia, Red Drum, Largemouth Bass, Bluegill, crappie

Columnaris disease affects a variety of freshwater fishes, including game and commercially crucial species worldwide. It is caused by a group of gram-negative, yellow-pigmented bacteria collectively known as columnaris-causing bacteria (CCB). CCB includes four species with host associations: *Flavobacterium columnare*, *F. covae*, *F. davisii*, and *F. oreochromis*. Severe columnaris disease outbreaks recently impacted commercial species including hybrid catfish (*Ictalurus furcatus* x *I. punctatus*), hybrid tilapia (*Oreochromis mossambicus* x *O. niloticus*), Red

Drum (*Sciaenops ocellatus*), and other sport fish species such as Largemouth Bass (*Micropterus salmoides*), Bluegill (*Lepomis macrochirus*), and crappie (*Pomoxis* spp.) in south Texas.

The current research aimed to identify the predominant species of CCB involved in columnaris disease outbreaks to better understand the epidemiology of this disease within Texas aquaculture and recreational ponds. Additionally, antimicrobial susceptibility testing was performed to determine the bacterial resistance profiles and select the antibiotic of choice for treatment during columnaris disease outbreaks.

Putative CCB isolates (n=40) were recovered following standard microbiological procedures from the different fish species submitted to the Texas AgriLife Aquatic Diagnostics Laboratory, Fish Health and Disease Lab at Texas A&M University during columnaris outbreaks throughout 2023-2024. Multiplex polymerase chain reaction (PCR) identified *F. covae* and *F. davisii* as the most prevalent species across the samples. Antibiograms of representative isolates were performed against FDA-approved antibiotics for use in food fish aquaculture, including oxytetracycline, florfenicol, and Romet-30. The findings of the study will be presented. The current research is crucial for monitoring the differential incidence of CCB in the Texas aquaculture and recreational ponds and identifying which *Flavobacterium* species have a significant economic impact on aquaculture producers and private pond owners. New CCB surveillance, control, and prevention strategies can be developed targeting the predominant species using the findings of this study.

The Effect of Mate Choice, Competition, and Physiology on Hybrid Swarm Dynamics in Darters (*Etheostoma* sp.)

Brynn Johnson, Texas A&M University, Student

Co-authors: Taylor Black, Texas A&M University; Mysia Dye, Whitman College; Isa Mendoza and Rachel Moran, Texas A&M University

Keywords: Orangethroat Darter, Orangebelly Darter, speciation

Speciation, the process by which one lineage splits into two, is central to generating biodiversity. A key goal in speciation research is to determine the conditions leading to different outcomes when closely related lineages come back into contact, including the formation and collapse of hybrid swarms. Among vertebrate taxa, fish exhibit the highest rate of hybridization, which can be affected by various environmental factors. Darters, benthic stream fishes, are the most diverse group of vertebrates in North America. These fishes are disproportionately affected by human-induced habitat change, with over 50% of darter species considered imperiled. Here, we focused on two darter species: the Orangethroat Darter (*Etheostoma pulchellum*) and the Orangebelly Darter (*E. radiosum*). Two replicate hybrid swarms were discovered in neighboring river drainages in the 1960's. However, as of the early 2000s, the swarm had collapsed in one drainage. In this drainage, several droughts have led to increased water temperature, pooling of streams, and lower dissolved oxygen. We hypothesized that the Orangethroat Darters may be less tolerant

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of these conditions or less able to compete for resources. First, we used a series of mate choice and male-male competition trials to examine the level of behavioral isolation between the species in sympatry compared to allopatry. Next, we used physiological assays and behavioral trials to compare the critical thermal maxima and competitive abilities of the two species at higher temperatures. Our results provide insight into the effect of environmental change on processes of speciation in an imperiled clade.

Novel Methodology in Bioenergetic Modeling to Project Survival and Growth: Eastern Brook Trout (*Salvelinus fontinalis*) Case Study

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Co-authors: Matthew Troia, University of Texas at San Antonio; and Giam Xingli, University of Tennessee

Keywords: Eastern Brook Trout, bioenergetic models

Understanding growth and survival of fishes is essential to understanding natural range limits and forecasting how climate change is shifting range limits. Bioenergetics models (BEMs) project growth by employing energy balance equations to estimate daily energy gains via consumption and daily energy losses via respiration. Consumption depends on food availability and competition in the environment, and is accounted for in the BEM via the CP parameter. Alternatively, respiration depends on activity level which is elevated in high velocity environments and with frequent antagonistic interactions, and is represented by the ACT parameter. Modeled growth is highly sensitive to the values chosen for the CP and ACT parameters, yet measuring CP and ACT in wild fish is logistically challenging. We integrate a novel parameter resampling technique with field-based growth data to estimate ecologically realistic values for CP-ACT parameter sets using Eastern Brook Trout (EBT) in Southern Appalachia as a model system. We resampled 1,000 CP-ACT parameter sets, projected growth with these sets for 365 days, and compared end-of-year body mass with field-based mass-at-age data at four streams putatively occupied by EBT to validate our models. CP and ACT values for validated parameter sets ranged from 0.22 to 0.44 and from 1.26 to 2.64, respectively. Another challenge of BEMs is scaling growth to individual responses that ultimately affect population dynamics. We used daily changes in body length and mass to estimate condition factor (K) and projected mortality events at $K < 0.4$. Finally, we projected survival and growth across 128 streams and compared these physiological performance metrics with habitat suitability scores from a published species distribution model. We show that BEMs provide realistic estimates of growth in suitable streams and also elucidates lower elevation range limits. This technique can inform conservation of EBT and other at-risk species.

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Environmental Correlates and Ecological Consequences for Long-Term Fish Assemblage Change in the Neches River Basin

Rebecca Mangold, Texas A&M University, Student

Co-authors: Johnathan Ellard, Texas A&M University; Anastasia Umstott, Stephen F. Austin University; Kole Kubicek, Lamar University; Kevin Conway, Texas A&M University; Carmen Montaña, Stephen F. Austin University; and Joshuah Perkin, Texas A&M University

Keywords: Neches River, fish assemblage, betadiversity, urbanization

Freshwater ecosystems have become increasingly threatened by anthropogenic stressors brought on by intensifying Land Cover/Land Use change and stream impoundments at a global scale. Fish provide several ecosystem services that contribute to ecosystem function and resilience, thus understanding fish responses to these forms of anthropogenic change is vital for freshwater conservation and management. In this study, we compared historical data from 1956-1957 to replicated sampling conducted in 2023 to assess long-term changes in taxonomic and functional fish assemblage structure brought on by anthropogenic alterations in the Neches River Basin of Texas. We focused on two scales of analysis, the basin scale (including all sites in the study) and the mainstem scale (only sites on the mainstem Neches River) and assessed temporal betadiversity patterns and environmental correlates as well as the relationship between taxonomic species replacement and functional dispersion (a metric of functional diversity) change at different degrees of anthropogenic alteration. Betadiversity analysis revealed that species replacement was the primary form of species change through time in the basin. At the basin scale, streamflow alteration was negatively correlated with species replacement, while at the mainstem scale, urbanization was positively correlated with species replacement. Our functional diversity analysis revealed that taxonomic species replacement was positively correlated with functional dispersion change at high urbanization levels but showed no relationship at low urbanization levels for three fish traits: stream size preference, substrate association, and mussel hosts. No relationship was found between taxonomic species replacement and functional dispersion change at either high or low streamflow alteration for any fish traits. These findings highlight urbanization as a key driver of taxonomic changes in fish communities, with potential ecological consequences through the accompanying alteration in functional trait composition. This underscores the importance of addressing anthropogenic impacts, particularly urbanization, in freshwater ecosystem management and conservation efforts.

Tackling Tarpon: Using Fish Scales to Track Atlantic Tarpon Movements in the Gulf of Mexico

Blake Munz, Texas A&M University Corpus Christi, Student

Co-author: Benjamin Walther, Texas A&M University Corpus Christi

Keywords: Atlantic Tarpon, Gulf of Mexico, carbon isotope, nitrogen isotope, oligohaline, mesohaline

Atlantic Tarpon, *Megalops atlanticus*, is a highly mobile, euryhaline fish inhabiting a diverse range of habitats throughout its life history. This has led to it becoming a highly sought after

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sportfish contributing greatly to coastal economies in the Gulf of Mexico. Due to a population decline in the 1960's the US fishery is now primarily catch-and-release, and they are considered Vulnerable by the IUCN. Historically, fish scales of Atlantic Tarpon have been taken as trophies by fishermen who would record useful demographic information such as sex, length, and weight. State agencies have also maintained similar records of tarpon demographics. As fish scales grow, they incorporate chemical signatures from the ambient environment and diet that can be used to infer movements and dietary behaviors across the fish's lifetime. Therefore, this study used carbon and nitrogen stable isotope ratios (Î´13C and Î´15N) of tarpon scales from the late 1950's Florida to track their historical movements and concurrent dietary shifts in the Gulf of Mexico. Differences in Î´13C and Î´15N within individual fish ranged from 2.2-8.5‰ and 1.1-6‰ respectively, suggesting diverse lifetime habitat and resource use. Two salinity thresholds (oligohaline and mesohaline) were determined, and the results showed only 22% (8/37) of fish crossed into oligohaline habitats, while 91% (34/37) utilized mesohaline habitats at least once in their life. Between sex comparisons indicated no significant differences in either Î´13C or Î´15N isotopic values, suggesting that males and females had equally variable histories. The archived scales predate the tarpon population decline, and these findings help define a historical baseline of life history ecology for this iconic recreational fish.

Developing and Validating a Bioenergetic Model for Guadalupe Bass (*Micropterus treculii*)

Gabriel Murillo, University of Texas at San Antonio, Student

Co-authors: Matthew Troia, University of Texas at San Antonio; Preston Bean, Nate Smith, and Mitch Nisbet, Texas Parks and Wildlife

Keywords: Guadalupe Bass, bioenergetics models, Cmax, Rrout, South Llano River

The Guadalupe Bass (*Micropterus treculii*, hereafter GB) is an endemic species of greatest conservation need. There is a lack of knowledge on physiology and behavior that would enhance conservation efforts. We fill this knowledge gap by projecting the growth of GB using a bioenergetics model (BEM) and comparing projections to those made in other studies. Other studies have developed BEMs for congeneric species or have made GB projections from parameters resampled from Largemouth Bass BEMs. The first objective was to use laboratory assays to quantify the temperature and mass dependence of maximum consumption (Cmax) and routine respiration (Rrout). Cmax was quantified by feeding GB ad libitum rations of Western Mosquitofish (*Gambusia affinis*) across temperatures ranging from 10 to 35°C and sizes ranging from 45 to 117 mm. Rrout was quantified via intermittent flow respirometry across aforementioned temperatures and sizes. Temperature and mass dependent Cmax were qualitatively similar to other studies. The optimum temperature for Cmax was 29.7°C, with Cmax at 364.1 j/g/d whereas, previous studies projected an optimum at 27.5°C and 28.0°C with Cmax at 258.1 and 359.7 j/g/d respectively. In contrast, temperature and mass dependent Rrout deviated from theoretical expectations and were substituted with reliable estimates from other studies. Next, laboratory data was used as BEM inputs to project growth of age-0 GB over one year using

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the temperature regime of the South Llano River. Growth projections were validated using length-at-age data from the South Llano River. Projected end-of-year mass matched field-determined mass-at-age when ecological parameters (activity level and proportion of consumption) were tuned to realistic values. With the development of BEMs for GB, we will create mechanistic links between temperature and GB performance allowing managers to take both reactive and proactive measures to conserve this state fish of Texas.

How is Fish Behavior Influenced by Exposure to Environmental Mercury or Hypoxia?

Jacob Oster, Texas A&M University Corpus Christi, Student

Co-authors: Benjamin Walther, Texas A&M University Corpus Christi; and Karin Limburg, State University of New York

Keywords: hypoxia, mercury, Red Drum, Southern Flounder, Atlantic Croaker, elemental ratios, stable isotopes

Estuarine-dependent fishes in Texas often use bay systems as nurseries and migrate offshore as adults. However, not much is known about the variation in the timing of this offshore movement or the subsequent behavior once offshore. In addition, stress from exposure to hypoxia and mercury may change the migration and feeding patterns of ecologically and economically important species. Red Drum (*Sciaenops ocellatus*), Southern Flounder (*Paralichthys lethostigma*), and Atlantic Croaker (*Micropogonias undulatus*) are important parts of the saltwater recreational fishery in Texas and much effort has gone into the protection and management of these species. Therefore, our research is investigating variation in migration and feeding behaviors in these species captured near Matagorda Bay, Texas. Otoliths, eye lenses and muscle were taken from each fish and analyzed for a suite of chemical markers including elemental ratios, stable isotopes and mercury concentrations. Here we present preliminary insights into the life history of these three species. This data suggests that individuals with high mercury concentrations in muscle tend to have otolith trace element profiles with elevated strontium to barium ratios, indicative of higher residence time in estuarine habitat. More time spent in estuaries may coincide with exposure to hypoxia, as indicated by manganese to magnesium ratios in the otolith. In addition, fish with high manganese to calcium ratios tended to have lower phosphorus to calcium ratios, indicating fish exposed to hypoxia may have reduced metabolic rates. Together, these results indicate the complicated responses mobile fishes have to important environmental stressors that could impact their population sustainability.

Comparing eDNA Metabarcoding and Standardized Electroshocking to Assess Fish Assemblages in Texas Rivers and Streams

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Keywords: eDNA, electroshocking

Long-term and large spatial-scale studies on fish distribution and community assemblage are important in understanding 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, require skilled taxonomists, and can underrepresent rare and cryptic species. Environmental DNA (eDNA) metabarcoding has emerged as a rapid and non-invasive tool for inventorying fish communities in diverse freshwater systems. Our goal is to evaluate the efficacy and limitations of eDNA metabarcoding in the diverse river systems of Texas. A total of 27 sites were sampled using paired electroshocking and eDNA sampling in the summer (May-September) of 2023. Two types of eDNA samples were collected: a 1L grab sample at the centroid of the flow (FIL) and a composite sample of eleven 100mL aliquots collected near alternating banks at evenly spaced transects throughout the survey reach (COM). Metabarcoding of eDNA using the 12S and 16S mitochondrial genes was completed for all water samples. A total of 160 species of fish were detected throughout the study; 104 species detected using eDNA and 109 species detected using electrofishing. A total of 53 species of fish (33%) were detected with both methods, 51 species were detected with eDNA only (32%), and 56 species were detected with electrofishing only (35%). Preliminary analyses suggest that across all sites, there was no significant difference in the number of fish species detected between the two eDNA collection methods (FIL and COM). A number of variables likely impact the efficacy of both eDNA and electrofishing as methods to assess fish communities in rivers and streams. Depending on the specific goals of a study, a combination of both eDNA and traditional methods such as electrofishing can provide the most robust representation of the fish species present within a waterbody.

Long Term Effects of Jim Chapman Reservoir on Upper Sulphur River Fish Communities

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Co-author: Bjorn Schmidt, Texas A&M University Commerce

Keywords: Sulphur River, Jim Chapman Reservoir, Red Shiner, River Carpsucker, Index of Biotic Integrity, Suckermouth Minnow, Longear Sunfish, Green Sunfish, Mosquitofish

Reservoirs, along with their importance in development, bring a serious alteration in the natural fish habitat. However, studies on their impact are mostly limited to short time scales. We compared fish communities of upper Sulphur River tributaries in 2024 with pre-impoundment surveys conducted in 1971. Jim Chapman reservoir was built in 1986 and isolates upstream Middle, and upstream South Sulphur sections from the rest of the system. Twenty-five sites from

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fragmented and non-fragmented regions were surveyed with backpack electrofishing and seine nets from February 2024 to September 2024. Data were analyzed using NMDS, ANOSIM, IBI, SIMPER, indicator species analysis, species richness, Shannon index, Jaccard similarity and abundance. Two species, *Cyprinella lutrensis* and *Carpiodes carpio*, were significantly reduced over the years including complete extirpation of *C. lutrensis* in the Upstream Middle Sulphur section. Fish communities seem to have homogenized since 1971 across regions. The system had ~36% species richness increase compared to 1971, while the Upstream Middle Sulphur had a negative community shift with ~29% decline in species richness and lowest IBI score. Upstream South Sulphur showed high diversity and included the presence of *Phenacobius mirabilis*, a species of conservation needs in Texas. Centrarchidae species like *Lepomis aquilensis*, *Lepomis macrochirus* and *Lepomis cyanellus* and Mosquitofish *Gambusia affinis* were indicator species in the 2024 samples, replacing *Carpiodes carpio* and *Cyprinella lutrensis* from 1971 samples. These findings suggest that the stream size is significant in shaping fish communities upstream of the impoundments, and indicates a possible relationship between stream size, drought, and available refugia in connected systems. Homogenization may have been driven by compounded effects from long-term modifications such as channelization, reservoir, land use, variability in flows, and drought. Further studies could address patterns and causes for the declines for *C. lutrensis* and *C. carpio*. The Upper South Sulphur had the capacity to conserve diversity including *P. mirabilis*, thus, any water projects in that section are not recommended.

Llano River Carpsucker or Hill Country Quillback? Morphological, Molecular, and Phylogenetic Relationships of Texas *Carpiodes* Inhabiting the Edwards Plateau

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Co-authors: Preston Bean, Texas Parks and Wildlife Department; Katrina Keith, Kevin Conway, Gary Voelker, and Joshuah Perkin, Texas A&M University

Keywords: Llano River Carpsucker, River Carpsucker, Edwards Plateau, Colorado River, Brazos River

In Texas hill country, there is evidence of a potentially undescribed catostomid, the Llano River Carpsucker (LRCS). The putative LRCS possess a more elongated body compared to sympatric River Carpsucker (*Carpiodes carpio*; RCS). Although abundant in the Edwards Plateau, its relationship with recognized species of *Carpiodes* is unknown. The objective of this study was to assess morphological and genetic differences between LRCS and RCS inhabiting Texas waterbodies and implement phylogenetic and population structure methods to determine evolutionary relationships between LRCS and other *Carpiodes* species. We collected 260 specimens, preserved them, and used photographs to develop homologous landmarks for a multivariate morphological analysis assessing gradients in body shape. We extracted DNA from tissues, amplified the mitochondrial cytochrome b (CYTB) and nuclear IRBP2 genes, and sequenced data for each specimen. Single nucleotide polymorphisms from each gene were analyzed using genetic clustering analysis (e.g., k-means clustering) and a permuted multivariate analysis of variance was performed with individual cluster identity used as a predictor variable

and morphological principal components (PC) from a principal component analysis as response variables. There was evidence for a significant relationship between genetic clusters and the first PC, revealing LRCS had a significantly different genetic cluster and were more slender than RCS. Using additional sequences from *Carpiodes* across North America, phylogenetic and population structure analyses revealed that RCS populations in the Brazos and Colorado rivers were introgressed with LRCS populations. Further, LRCS populations were closely related to *Carpiodes cyprinus* populations west of the Appalachian Mountains. This study provides insight into the phylogenetic relationships among members of *Carpiodes* within Texas (and beyond) which can be used to determine whether LRCS are an undescribed species requiring special conservation status, or a genetically and morphologically unique locally adapted population of a recognized species of *Carpiodes* endemic to the Edwards Plateau.

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

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Keywords: fish assemblage, river continuum concept, serial discontinuity concept, network dynamics hypothesis, White Creek, 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.

Safeguarding Zebra Shark Population through Research and Conservation Efforts

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Keywords: Zebra Shark, *Stegostoma tigrinum* Augmentation and Recovery project, Raja Ampat Research and Conservation Center, Ocean IQ, Great Barrier Reef Aquarium, Aquarium des Lagoons, Loro Parque Aquarium, Georgia Aquarium, Shedd Aquarium, Ocean Park Hongkong

Zebra Shark (*Stegostoma tigrinum*) is one of many elasmobranch species threatened with extinction due to various overexploitation pressures, resulting in a drastic decline of their populations in the wild. Urgent research and conservation efforts are essential to recover this species. Growth data is one of the fundamental pieces of information for understanding how populations respond to environmental changes in order to support species conservation and management. As the part of StAR (*Stegostoma tigrinum* Augmentation and Recovery) project, this study aimed to estimate the growth pattern of the *S. tigrinum*, and assess how water parameter conditions may influence growth of sharks across facilities with different water systems. Biometric data including birth size, length, and weight were collected from 269 Zebra Sharks from 8 different water system facilities: four open water system facilities (RARCC, Ocean IQ, Reef HQ, and Aquarium des Lagoons) and four closed water system (Loro Parque Aquarium, Georgia Aquarium, Shedd Aquarium, and Ocean Park Hongkong) between 2010 until 2024, with an age range from birth to approximately 7 years old. The analysis incorporated Analysis of Variance, Model Selection to choose functions including the von Bertalanffy Growth Function, and estimation of the Length-Weight Relationship to understand the correlation. Results showed that sharks in open water system facilities exhibited faster growth compared to the closed water systems, with weight increasing rapidly compared to length. In addition, study identified dissolved oxygen and temperature as the most critical variables affecting the Zebra Shark growth. The findings enhance deeper understanding of the species' life history traits and provide valuable recommendations in optimizing the facility system management. By supporting this information, the study intended to contribute towards the recovery and conservation of the Zebra Shark populations.

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Disentangling Drivers of Beta Diversity in Stream Fish Communities in Texas: Taxonomic, Functional, and Phylogenetic Approaches

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Keywords: beta diversity, turnover, nestedness, Neches River, Sabine River

Analyzing beta diversity (i.e., BD, variation in species composition), offers valuable insights into the ecological processes governing community organization across multiple spatial and temporal scales. To enhance our understanding of these processes, BD can be partitioned into turnover (i.e., species gain/loss) and nestedness (i.e., species richness differences) components. Furthermore, examining BD dimensions (taxonomic, functional, and phylogenetic) may provide a more comprehensive view on community structure. Streams in East Texas support rich freshwater biodiversity and are ideal for these types of analyses. Across an entire year, 60 stream reaches were surveyed in the Neches and Sabine River basins to examine the relationships and relative contributions of turnover and nestedness to taxonomic, functional, and phylogenetic BD patterns. Additionally, the influence of local, regional, and temporal (i.e., season) variables on the total BD for each dimension were assessed. Across all seasons and in both river basins, taxonomic BD was consistently higher than functional and phylogenetic BD and primarily driven by turnover. In contrast, functional and phylogenetic BD showed comparable contributions from turnover and nestedness. Significant correlations among all BD dimensions and across all seasons were revealed by Mantel tests. The strongest relationships were observed between taxonomic and phylogenetic BD, while functional and phylogenetic BD showed the weakest relationship. Variation partitioning showed that fish communities in the Neches River basin were structured by regional and local factors, with their combined effects being more influential to phylogenetic BD. In the Sabine River basin, functional BD was driven by local and regional factors, while taxonomic and phylogenetic BD were structured by both individual and combined effects. Seasonal variation did not significantly contribute to BD in either basin. These findings emphasize the importance of integrating multiple diversity dimensions into BD analyses to better understand the factors driving community composition across multiple spatial and temporal scales.

Abundance and Detection Correlates for Ash Meadows Speckled Dace Across a Heterogenous Desert Riverscape

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Co-authors: Michael Schwemm, Ambre Chaudoin, and Michael Bower, U.S. Fish and Wildlife Service; Kevin Guadalupe, Nevada Department of Wildlife, and Joshuah Perkin, Texas A&M University

Keywords: Ash Meadows Speckled Dace, Ash Meadows National Wildlife Refuge

The Ash Meadows Speckled Dace (*Rhinichthys osculus nevadensis*) is a federally endangered minnow endemic to the Mojave Desert at Ash Meadows National Wildlife Refuge, Nevada. This

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subspecies was historically threatened by anthropogenic alterations such as groundwater pumping, agricultural redirection of spring outflows, non-native species introductions, and peat mining activities. Today, habitat restoration efforts to increase numbers are in place but require science-based evidence for guidance. Past surveys showed high abundances immediately after vegetation removal and channel restoration downstream of spring outflows. However, analyses that account for imperfect detection (i.e., capturing a dace when it is present) and responses to woody plant encroachment post-restoration are needed. This study identifies environmental correlates for dace abundance and detection. We distributed minnow traps across strong gradients of environmental variables hypothesized to correlate with abundance (i.e., water temperature, water velocity, canopy cover, channel area, and number of invasive crayfish). We used minnow traps to capture 244 and 314 dace in March and April of 2024, respectively, from Fairbanks, Jackrabbit, Tubbs, Bradford 1, and Bradford 2 springs, as well as a portion of the Kings Pool outflow. Preliminary results from N-mixture modelling suggest abundance correlated positively with canopy cover (i.e., more vegetation = more dace), water velocity, and channel area, while detection was negatively correlated with canopy cover (i.e., dace are less likely to be captured when vegetation is dense). These findings suggest natural vegetative cover (e.g., Coyote Willow, Ash trees) might benefit site abundances of dace despite reducing sampling efficiency. This presentation reports analyses from the first two of four sampling events.

Quantifying Short-Term Movement of Mussel Host Fishes to Advance Ecological Modeling

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Co-authors: Jacob Barrett and Thomas Dodson, Texas A&M University; Justin Greenfield, Astrid Schwalb, and Todd Swannack, Texas State University; and Kirk Winemiller and Joshuah Perkin, Texas A&M University

Keywords: San Saba River, mussels, host fish

Unionid freshwater mussels depend on host fish for reproduction and dispersal as their larvae require host fish to develop into juvenile mussels during their early life history. Therefore, host fish are integral in understanding the distribution of mussels. The goal of this study was to examine fish movement in relation to the distribution and density of mussels at a micro- (~1 m) and meso-habitat scale (~10 m), and to advance ecological models linking fish and mussel population and community dynamics. We predicted that fish would spend significantly more time (= residency time) in microhabitat with higher mussel densities than in microhabitat with lower mussel densities. We used passive integrated transponder (PIT) tags and a temporary stationary array of antennas to quantify fine-scale fish movement within a 100 m reach of the San Saba River, Texas. Over a two-week period, we PIT tagged 510 fishes representing 19 species and tracked movement patterns for five consecutive days. We positioned eight antennas across a gradient of mussel densities and georeferenced their locations to quantify movement distances. We recorded movements by 49 individual fish (12 species). The average movement distance across all individuals was 10 m (range = 0 to 96.8 m) and the average residency time (time spent

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at an antenna) was 58 seconds (range = 2 to 2,348 sec). There was no relationship between mussel density and fish residency time. Results from this study will be used to inform testing of this concept across a broader gradient of mussel densities and our work will ultimately inform ecological models in which residency time serves as a proxy for fish host inoculation, and fish movement estimates serve as a proxy for mussel dispersal. Our field methods and modeling framework are transferable to other river systems and fish and mussel assemblages.

Growth Performance and Age Structure of Red Drum in Texas' Inland Lakes: A Fresh Look at the State Saltwater Fish of Texas

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Co-authors: Mitchell Nisbet and Nathan Smith, Texas Parks and Wildlife Department

Keywords: Red Drum, Braunig Lake, Calaveras Lake

The Texas Parks and Wildlife Department (TPWD) has been stocking Red Drum (*Sciaenops ocellatus*) into a small number of Texas' inland lakes since the 1970's. Currently, stocking of this estuarine fish into inland waters is constrained to 2 power plant cooling reservoirs near San Antonio: Victor Braunig Lake and Calaveras Lake. These stockings support one of the most popular inland fisheries in the state based on angler effort and allow a unique opportunity for anglers that don't have regular access to this species due to distance from the coast. Little is known about the biological characteristics of Red Drum in freshwater, and life history data are needed to understand the growth and mortality of the species outside of its native habitat range. In this study, we used otoliths extracted from angler-caught fish (and supplemented with targeted gill net catches) to examine age structure and growth rates of Red Drum from both reservoirs. Analysis of age structure indicated that Red Drum harvested from the inland lakes represented a broad range of ages (1-16 in Braunig, 1-6 in Calaveras) recruited to the fisheries, and age-frequency analysis indicated that periodic pulses of high year-class survival might support the broader populations in each lake (evidenced by a single overrepresented cohort from Lake Braunig). Comparative growth curve analysis indicated that Red Drum in these lakes had very similar growth trajectories to their estuarine/marine counterparts along the Gulf coast. Collections are ongoing and this presentation represents a preliminary data analysis nested within a broader study. Ultimately these data will add life history context to the management of Red Drum in inland lakes and inform TPWD management decisions by providing a more complete understanding of the biology of a fish out of its waters.

Ecological and Community Uplift through Stream Restoration in the Urban San Antonio River System

Adrian Arroyos, San Antonio River Authority, Professional

Keywords: San Antonio River Authority, San Antonio River, Texas Logperch, Grey Redhorse, Tadpole Madtom, Guadalupe Bass, San Antonio River Improvements Project, Westside Creeks Restoration Project, Natural Channel Design

Stream restoration projects in highly urbanized areas offer significant environmental uplift and benefits to the local community, demonstrated by the San Antonio River Authority's (River Authority) collaborative restoration projects. Portions of the upper San Antonio River (SAR) were historically altered to promote flood conveyance, which limited ecological function and resilience. In partnership with the Army Corps of Engineers, Bexar County, and the City of San Antonio, the River Authority has worked to restore several sections of the highly urbanized SAR. These areas have been designed to achieve a marriage of flood conveyance, ecological integrity, and human recreation. The most notable effort is the San Antonio River Improvements Project, which created the Mission Reach. Since its completion in 2013, the project has led to significant improvements in water quality and biological communities, while also making a remarkable impact on the local community. The recolonization of key native fish species like Texas Logperch, *Percina carbonaria*, Grey Redhorse, *Moxostoma congestum*, and Tadpole Madtom, *Noturus gyrinus*, and the successful reintroduction of Guadalupe Bass, *Micropterus treculii*, highlight the improvements made to instream habitat. Uplift in the local community is evident in the widespread use of improved recreational amenities, including hiking, biking, and paddling trails that connect to the San Antonio Missions National Historic Park. The success of this restoration has inspired similar efforts, including the ongoing Westside Creeks Restoration Project which aims to enhance four tributaries of the SAR within a densely populated portion of San Antonio. Applying Natural Channel Design principles, restoration efforts in the upper SAR aim to enhance instream and riparian ecosystems, provide the community with safe and accessible recreational opportunities, and serve as a global model for managing and revitalizing urban riverscapes.

Science Needs to Inform Regulatory Programs to Conserve Texas Streams

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Co-authors: Kevin Mayes and Sue Reilly, Texas Parks and Wildlife Department

Keywords: Fish and Wildlife Coordination Act, Sand and Gravel Permit

The Texas Parks and Wildlife Department (TPWD) considers physical processes (hydrology, geomorphology) and fish and wildlife habitat and life history needs in reviewing projects and providing recommendations to other regulatory agencies under the Fish and Wildlife Coordination Act, and in issuing TPWD permits. For example, disturbance of state-owned or state-navigable streambeds and/or removal of streambed materials may require a Sand and Gravel permit from TPWD. Considerations for issuing such a permit include 1) impacts to hydrology, 2) sediment transport and 3) aquatic organism passage, among other factors such as recreation and navigation. This talk will provide an overview of science needs to inform permit and regulatory decisions.

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I See Dead Fish. What Now? - An Overview of the Kills and Spills Team

Jennifer Bronson Warren, Texas Parks and Wildlife Department, Professional

Co-authors: Travis Tidwell and Bregan Brown, Texas Parks and Wildlife Department

Keywords: Kills and Spills Team, wildlife kills, fish kills

Do you have a construction project that impacts aquatic environments? Did you see dead aquatic organisms? Maybe dead wildlife? The Texas Parks and Wildlife Department is here to assist you. Our Kills and Spills Team (KAST), which includes four regional coordinators and additional support staff, serves as a resource for citizens, local authorities, state and federal agencies, and interdivisional programs to address pollution and water quality issues affecting aquatic organisms and wildlife in Texas. This presentation aims to provide an overview of KAST's responsibilities, the circumstances under which you should reach out to us, and what you can expect when you do so.

Status and Trends of the Salado Salamander (*Eurycea chisholmensis*)

Jennifer Bronson Warren, Texas Parks and Wildlife Department, Professional

Co-author: Peter Diaz, US Fish and Wildlife Service

Keywords: Salado Salamander

The Salado Salamander (*Eurycea chisholmensis*) is a neotenic karst species found at the surface near spring orifices, representing the northernmost distribution of the *Eurycea* genus within Texas. This species was designated as federally threatened in 2014, with its critical habitat being established in 2021. Recent genetic research has led to an expansion of its historic range from Bell County into Williamson County. In 2015, the U.S. Fish and Wildlife Service (USFWS) initiated monitoring efforts for salamanders in the Salado area, marking the first instance of long-term routine monitoring for *E. chisholmensis*. The data gathered through this long-term monitoring has facilitated the testing of methodologies and the collection of information related to water quality, habitat association, surface population density, and mark-recapture strategies. This presentation will provide an overview of the long-term monitoring findings and discuss potential future directions for research on *E. chisholmensis*.

Evidence of Changing Age and Growth and Sex Ratio of Southern Flounder (*Paralichthys lethostigma*) in Texas

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Keywords: Southern Flounder

Southern Flounder (*Paralichthys lethostigma*) are an important sportfish found throughout the Gulf of Mexico and the southeastern Atlantic coast. Despite increasingly stringent fishing regulations, Southern Flounder populations have been declining for decades. Texas Southern Flounder age and growth data are outdated but may provide insight to factors contributing to decline. Therefore, this study aimed to update age and growth knowledge for Southern Flounder sampled near two Texas inlets by examining age structure, length-at-age, and growth models. Southern Flounder were collected from fishery-independent and fishery-dependent methods. Biological measurements (e.g., total length, standard length, total weight) and sex were recorded, and all Southern Flounder were aged from sagittal otoliths sections following standard methods. Four growth models were fit to all length-at-age data. A total of 734 Southern Flounder were aged, and the F:M sex ratio from fishery independent samples was 4.8:1. Ages ranged from 0-3 years, with age-1 comprising more than 50% of all sampled fish. Total length ranged from 221 to 585 mm. Mean length-at-age was greater for females than males, with females consistently reaching older ages. The von Bertalanffy model was selected as the best fit for both sexes combined and individually. The female and male von Bertalanffy equations were $Lt = 495.6 [1^{(e^{-0.91 (t â€“ (-0.19))}}]$ and $Lt = 464.0 [1^{(e^{-0.35 (t â€“ (-1.67))}}]$ respectively. Mean length-at-age for older fish was less than previous Texas studies. These findings suggest age structure, sex ratio, length-at-age, and growth rates for Southern Flounder have changed since previous Texas studies in the late 1990s potentially due to increased fishing effort and climate change impacts on population structure. Therefore, updating Southern Flounder age and growth data is necessary to provide relevant information to fishery managers with the goal of maintaining population sustainability.

Texas Abandoned Crab Trap Removal Program: Supporting Volunteer Efforts and Trap Detection

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Co-author: Evan Pettis, Texas Parks and Wildlife Department

Keywords: Abandoned Crab Trap Removal Program, Galveston Bay Foundation, Christmas Bay Foundation, San Antonio Bay Partnership

In 2024, Texas Parks and Wildlife Department received funds from Gulf States Marine Fisheries Commission (GSMFC) to support the annual Abandoned Crab Trap Removal Program. Abandoned crab traps litter coastal waters and “ghost fish” important species like blue crab and diamond back terrapin. To prevent these negative environmental impacts, the Texas commercial crab fishery closes for 10 consecutive days along the Texas coast every February to allow volunteers and managers to remove abandoned traps. The grant funding received in 2024 from GSMFC went to support volunteer events hosted by the Galveston Bay Foundation, the Christmas Bay Foundation, and the San Antonio Bay Partnership. Volunteers remove the majority of traps along the coast and supporting such events is crucial to the program's success. Additionally, aerial imagery of Christmas Bay was obtained in August 2024 to help identify

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crabbing “hot-spots” to assist volunteers increase efficiency with their clean-up efforts during the 2025 Abandoned Crab Trap Removal Program. The survey results indicate that, at the time of the flyover, actively fishing crab traps (i.e. not derelict/abandoned) were predominantly concentrated in the southwestern portion of the bay. Additionally, an analysis of the imagery confirmed that artificial debris was most abundant on the north and west shorelines. Several derelict traps were also detected in the general vicinity of the identified crabbing “hot-spot” north of Arcadia Reef.

Sex Determination and Stock Enhancement of Southern Flounder

Christopher Jingle, Texas Parks and Wildlife Department, Professional

Keywords: Southern Flounder, sex determination

The goal of the Texas Parks and Wildlife stock enhancement program is to produce as many female flounder as possible and enhance the reproductive output of the population. However, sex determination of flounder is not only genetically controlled, but environmentally controlled as well. Flounder exhibit an XX/XY female/male determination system where females that are XX may transmute to a male phenotype if exposed to stressing environmental factors. There is believed to be a window of growth whereas sex determination occurs that prevents females from masculinization. The goal of this research is to discern on a high-resolution scale where the determination window exists. Our hypothesis states that controlled stock enhancement protocols may increase the number of females produced in a given brood. A combination genetic testing by means of male and female genetic markers (mis, cyp19a1a, foxl2) and temperature-controlled rearing will be used to determine the efficiency of female production and success of the Southern Flounder stock enhancement program.

Impact of Parametric Uncertainty on Predictions of an Analytical Streamflow Depletion Model

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Co-author: Joshuah Perkin, Texas A&M University

Keywords: streamflow depletion modeling, parametric uncertainty

Groundwater pumping leads to streamflow depletion and thus has important implications for freshwater ecosystems. Streamflow depletion puts stress on local populations and may result in local population extinctions for fishes and other aquatic organisms. The negative impact of groundwater pumping may continue for years after the pumping stops and may be more severe during years with dry weather conditions. Ongoing modeling efforts aim to predict both short- and long-term impacts of groundwater pumping to help guide water use management policies. Process-based (numerical) models work well for local applications but tend to be complex and costly to develop. Analytical streamflow depletion models have been shown to be a useful

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alternative since they are relatively simple and well understood, and thus are more practical for broader applications. Nevertheless, the assumptions of analytical models are often violated in real world applications, and parametric uncertainty due to insufficient data can lead to errors in streamflow depletion estimates. We investigated the impact of parametric uncertainty on the predictions of an established analytical streamflow depletion model (the Glover model). We used data from Oklahoma on (1) the date of construction and geographical distribution of wells, (2) groundwater withdrawal, and (3) physical characteristics of aquifers. Results of our streamflow depletion predictions highlight the importance of considering not only the duration of pumping and the distance of wells from streams, but also the physical characteristics of aquifers for which parametric uncertainty is higher.

Current Status of Zebra Mussels in Texas with Lake-Specific Invasion Risk Assessment

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Co-author: Robert McMahon, University of Texas at Arlington (Professor Emeritus)

Keywords: zebra mussels, risk assessment, invasive species

As invasive zebra mussels (*Dreissena polymorpha*) continue to spread through the freshwaters of the United States, and in Texas since 2009, efforts have been made to develop mussel invasion risk assessments to focus invasion prevention, monitoring, rapid response, and macrofouling control on at risk water bodies. Previous invasion risk assessments have been based on broadly applied single factors such as calcium concentration or summer water temperature or on global scale climate variables. While such factors applied on a nationwide basis provide a general overview of regions susceptible to mussel invasion, they do not determine mussel invasion risk for specific water bodies, which can be variable even among those that are closely adjacent. Furthermore, these broad risk assessments may over or underestimate risk due to lack of water body specificity. In order to develop effective mussel prevention and control strategies, managers need mussel invasion risk assessments that can be applied to specific water bodies allowing limited resources to be focused on those most likely to be invaded. This study reports the use of easily determined factors (i.e., calcium concentration, pH, salinity, and summer surface water temperature) to specifically determine mussel invasion risk for 133 Texas water bodies as a case study of simplistic methods with broad geographic applicability. This study demonstrates that these methods provide finer scale risk assessment for Texas water bodies in this case study, finding higher risk in western and southern regions than was predicted by climate-based risk assessments and more nuanced risk levels in the eastern region than predictions based on calcium alone. These methods can provide invaluable information for natural resource managers and water infrastructure operators on a broad geographic scale to guide monitoring and mitigation efforts

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Coastal Brigade, Growing our Future Coastal Conservation Leaders

Emily Miller, Texas Parks and Wildlife Department, Professional

Keywords: Coastal Brigade, Texas Brigades

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 10, 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 around Galveston Bay, 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 typically 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.

Seasonal Variation in Invasive Suckermouth Armored Catfish Distributions and Habitat Use: An Integrated Approach with Implications for Broad-Scale Population Control

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Co-authors: Jennifer Smith, Caesar Kleberg Wildlife Research Institute, Texas A&M University – Kingsville; Monica McGarrity, Texas Parks and Wildlife Department; and Matthew Troia, University of Texas at San Antonio

Keywords: Suckermouth armored catfish, San Felipe Creek

Suckermouth armored catfish (SAC) *Hypostomus plecostomus* are a tropical species native to South America. Introductions via the aquarium trade have led to established populations in southern North America, where they threaten native ecosystems at multiple trophic levels. In Texas, SAC have become established in springfed waterbodies, including San Felipe Creek (Val Verde County). Successful management strategies rely on identifying factors driving nonnative SAC distributions and habitat use at multiple spatial and temporal scales. Our objectives were to identify seasonal habitat relationships with SAC occurrence and site abundance and determine if spatial aggregations were associated with water temperature. We used snorkel surveys to count

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SAC at thalweg and margin transects in San Felipe Creek (hereafter sites) various distances from thermal refugia in winter, spring, summer, and autumn 2024 (hereafter seasons). At each site, we measured instream habitat characteristics to characterize environmental variation among sites and across seasons. We used an integrated population model to estimate SAC occurrence and abundance while accounting for variable spatiotemporal detection. Species detection probability was consistently high (>0.9) across sites and seasons. Conversely, individual capture probability associated with abundance was highly variable despite clear water. The proportion of sites occupied by SAC was lower in spring (~0.65) compared to other seasons (~0.95). There were also seasonal shifts in site abundance associated with spatial position and instream habitat interactions (e.g., increased thalweg abundance with higher velocity and larger substrate in autumn). Aggregations were more associated with margin characteristics than water temperature. Our study reveals finer-scale SAC habitat associations and indicates that optimal locations for targeted removal may vary seasonally. Our findings also show that sampling approaches should account for variable detection for unbiased SAC abundance estimates. This information also complements coarser-scale studies and will be incorporated into a broader integrated model for population-control decisions.

From a Muddy Bottom to a Flourishing Oasis

Rachel Parmer, Texas Parks and Wildlife Department, Professional

Keywords: Artificial Reef Program

The Texas Artificial Reef Program began in 1989 to create a state program to enhance fisheries. Predominantly, there is bare seafloor comprised of mud and silt with little habitat for organisms. With the Texas Artificial Reef Program, Texas has successfully reefed oil and gas structures, ships, and other recycled and pre-fabricated items to enhance the bare seafloor, developing flourishing oases across the Texas coast. Our shallow reef sites (0-50 ft.) have been successful due to the aid of non-profit Friend organizations that put every ounce into creating lasting reefs for future generations. As our program continues to grow, it is important to look at these established reef sites and study what has made them successful! Is it the connectivity with natural reefs? Is it recruitment of certain benthic organisms? What more can we do to ensure for healthy ecosystems in a changing ocean? This summer we will be adding new research methods into our biological monitoring program. For a larger picture of organisms on the reef site we will be collecting water samples for eDNA analysis and placing acoustic receivers on a few sites to look at movement for select tagged species. We will also turn our focus to the benthic organisms and add benthic surveys along the artificial reef sites. We are looking for a “big picture” snapshot encompassing coral, algae, sponges, and macro critters. From this data, we can compare benthic growth with fish diversity and abundance to see if there is a correlation. Artificial reefs could be the helping hand to combat global changes in our oceans.

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Effects of Size-Selective Catch-and-Release Angling on Population Size Structure of Two Black Bass (*Micropterus* spp.) Species in an Alabama Reservoir

Thomas Pullen, Texas Parks and Wildlife Department, Professional

Co-authors: Matthew Catalano, Taryn Garlock, and Russell Wright, Auburn University School of Fisheries, Aquaculture, and Aquatic Sciences

Keywords: Largemouth Bass, Alabama Bass, Neely Henry Reservoir, Alabama, angling, size-selectivity, Ricker stock recruitment model, Beverton-Holt model

The potential for size-selective catch-and-release angling to affect the size distributions of black bass (*Micropterus* spp.) populations is not well understood. Angling is highly size-selective, and competitive fishing events (i.e., tournaments), may be particularly size-selective by incentivizing the capture of large fish. We conducted research on Largemouth and Alabama Bass at Neely Henry reservoir in Alabama to assess the potential for size-selective angling to affect population size structure. This system is characterized by high fishing effort and a high proportion of fish captured in tournaments. Size-selectivity of tournament and non-tournament angling was estimated from a high reward tagging study. Size-specific vulnerability estimates from angler tag returns revealed that vulnerability of 300 mm Largemouth Bass was 0.75 and vulnerability of the same size class of Alabama Bass was 0.66. Variation in growth among individual fish was estimated by ageing samples of fish from the creel and from standardized electrofishing surveys. A pairwise comparison between gears for each age class was conducted for both Alabama Bass and Largemouth Bass. Younger age-classes for both species collected from tournaments were significantly larger than fish collected from electrofishing samples. An age- and size-structured equilibrium model was used that accounted for individual variation in growth within these populations under encounter rates developed from Neely Henry. The Ricker stock-recruitment model and Beverton-Holt model were used to assess influence on the abundance of quality (>305 mm) and memorable (>508 mm) fish of both species. Under high encounter rates the model predicted angling could reduce the abundance of quality sized Largemouth and Alabama Bass by 6% and 12% relative to the unfished condition, respectively. A decline of 48% in memorable size Largemouth Bass abundance and 79% in memorable size Alabama Bass abundance was predicted relative to the unfished condition.

Mussel Community Structure Changes Relative to a New Wastewater Discharge in the Upper Sabine River

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Co-author: Adam Whisenant, Texas Parks and Wildlife Department

Keywords: Sabine River, mussels, ammonia, wastewater

Freshwater mussels are one of the most imperiled taxa groups in North America. Freshwater mussels are susceptible to many threats that have contributed to their imperilment, such as habitat

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alteration, loss of host fish, and water quality degradation. Understanding the impact of these threats is critically important for the conservation of these species. Water quality degradation from wastewater effluent has been documented to impact mussel community structure. Ammonia is a common pollutant from wastewater treatment facilities and one in which mussels are known to be highly sensitive compared to other taxa. This study's objective is to assess mussel community impacts from a recently permitted wastewater discharge in the upper Sabine River. Sampling was conducted over a 5 year period in a 4 km reach of the Sabine River and over 27,000 live mussels were collected represented by 22 of the 33 species found in the Sabine River basin. Of the 5 state-listed species in the Sabine River basin, 4 were collected during this study. Data analysis will focus on population structure changes upstream and downstream of the discharge relative to substrate, habitat types, and species life history.

Experimental Oyster Restoration to Inform Site Design and Planning

Lindsey Savage, Texas Parks and Wildlife Department, Professional

Co-authors: Margaret Wheat-Walsh, Zachary Olsen, and Evan Pettis, Texas Parks and Wildlife Department; and Emma Clarkson, National Oceanic and Atmospheric Administration

Keywords: oyster restoration

To date, the Texas Parks and Wildlife Department (TPWD) has restored over 700 acres of oyster reef. Oyster restorations are typically conducted by placing “cultch” (shell or rock material) on degraded reef, thereby providing increased surface area for juvenile oyster settlement. TPWD employs several approaches when designing restorations. A “flats” approach deploys cultch in a continuous, uniform layer (~1-6 inches thick) spread evenly across the restoration area and is suitable across a range of water depths. A “mounds” approach deploys cultch in distinct piles with significant vertical relief (~2 ft tall) at predetermined spatial intervals, which is suitable in deeper water and may improve resiliency. In recent years, the cost of cultch material has increased exponentially. In response, TPWD constructed experimental oyster restorations to identify the most economically and ecologically effective techniques. Several experimental sites were built in 2020 and 2021 and have undergone continuous monitoring. Restoration designs tested include using different (1) placement configurations, i.e. mounds vs flats, (2) cultch layer thicknesses, and (3) spatial intervals. Predetermined criteria were used to assess restoration success, employing a before-after-control-impact design. All designs tested resulted in increased oyster abundances, comparable to or exceeding those of nearby natural reefs. Preliminary results indicate that placing greater amounts of cultch per square meter typically produces more oysters within the restored footprint. Qualitatively, we observed that restoration methods with lower vertical relief may be more prone to sedimentation or subsidence. Results from this study provide resource managers with insight on how to more efficiently deploy cultch across larger restoration areas. TPWD is continuing to assess the cost-effectiveness of different restoration strategies, considering overall impacts to oyster abundance and long-term resiliency.

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Implementation of a Large-Scale Sea Turtle Restoration Project

Angela Schrift, Texas Parks and Wildlife Department, Professional

Keywords: Deepwater Horizon, sea turtle restoration

In April 2010, the Deepwater Horizon oil rig exploded, caught fire, and sank, leading to one of the largest marine oil spills in U.S. history. Over the course of 87 days, approximately 134 million gallons of oil were released into the Gulf of Mexico, severely impacting marine life, including an estimated 94,900 to 202,600 sea turtle deaths. In response, funding was allocated through the Natural Resource Damage Assessment process for a large-scale sea turtle restoration project. This presentation will provide an in-depth overview of Texas' efforts to restore imperiled sea turtles. I will explore the funding requirements, showcase the remarkable contributions of the project partners, discuss the intricacies of project management, and conclude with the lessons learned. Attendees will gain practical insights that can help inform how they implement or manage future projects.

Harnessing Humic Acid: A Promising Approach to Managing *Microcystis* Blooms

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Co-author: Brittany Chesser, Texas A&M AgriLife Extension Service

Keywords: humic acid, *Microcystis aeruginosa*

Harmful algal blooms (HABs) are increasingly reported across the southern United States, leading to fish, livestock, and companion animal deaths, losses in agricultural productivity, and interruptions in domestic water supplies. This rise is attributed to improved identification and monitoring but is also likely exacerbated by environmental changes, particularly the high heat and prolonged droughts that concentrate nutrients and diminish water availability for flushing. HABs, including those caused by *Microcystis aeruginosa*, thrive in hot, nutrient-rich, stagnant conditions. Traditional management strategies, such as nutrient control, flushing, algaecides, and toxin oxidation, face significant limitations. Nutrient management is costly and impractical for large water bodies, flushing is unfeasible under drought conditions, and algaecides are expensive and must be applied precisely before toxin production escalates. Similarly, oxidizing toxins with potassium permanganate is both costly and potentially harmful to aquatic life. These challenges have highlighted the need for cost-effective, sustainable alternatives, such as humic acid. Humic acid, an organic compound derived from natural decomposition, offers promising potential for HAB management. Previous studies on *Prymnesium parvum* demonstrate it can be used prophylactically to prevent blooms, disrupt algal cell processes, and bind nutrients. By providing a carbon source for beneficial bacteria, humic acid may enhance natural nutrient cycling and reduce conditions conducive to algal proliferation. This presentation will explore the evaluation of humic acid as a management tool during blooms of *M. aeruginosa*. Results on humic acid use as a treatment, prophylactic preventative, and nutrient binder when used during *M. aeruginosa*

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blooms will be shared, with a focus on its practical applications and potential to serve as a low-cost, environmentally sustainable alternative to traditional HAB management strategies.

Reintroducing Freshwater Mussels into the Restored Mission Reach of the San Antonio River

Garrett Tucker, San Antonio River Authority, Professional

Co-authors: Austin Davis, Mitch Magruder, Adrian Arroyos, Caille Marshall, and Sara Thompson, San Antonio River Authority

Keywords: mussels, San Antonio River, San Antonio River Improvements Project, Mission Reach, Threeridge, Yellow Sandshell, Pistolgrip, Pimpleback

Anthropogenic stressors have led to the rapid decline of freshwater species in a myriad of ways, most notably through habitat loss and decreased water quality and quantity. Freshwater mussels (Unionidae) are among one of the most affected groups in a rapidly urbanizing landscape. The Upper San Antonio River (USAR) once supported a relatively diverse mussel community, which became extirpated due to urbanization and channelization of the river to facilitate flood conveyance. Completed in 2013, the San Antonio River Improvements Project established the Mission Reach, a ~13 km restored portion of the USAR. This effort provided complex instream habitat and greater riparian buffers to promote greater ecosystem resiliency. In 2017, plans to reintroduce freshwater mussels to the Mission Reach were initiated to restore the freshwater mussel community and their associated ecosystem services to the USAR. Multiple feasibility studies have been conducted by the San Antonio River Authority and partners within the Mission Reach to assess mussel survivability, habitat suitability, and host fish populations, while developing propagation methodology to inform and eventually supply the ongoing reintroduction efforts. Four native species were selected for reintroduction including the Threeridge, *Amblema plicata*, Yellow Sandshell, *Lampsilis teres*, Pistolgrip, *Tritogonia verrucosa*, and Pimpleback, *Cyclonaias pustulosa*. The first cohorts of propagated freshwater mussels were reintroduced into the Mission Reach in 2024, marking a significant milestone in the reintroduction project and the continued restoration of the USAR. Our objectives are to reintroduce these species into the restored Mission Reach and employ a mark-recapture study to monitor their survival and growth, dispersal, and determine the influence of large- and small-scale abiotic factors on reintroduction success. In the long-term, we aim to evaluate mussel recruitment and establish quantitative measures of ecological uplift through the ecosystem services that reintroduced mussels provide for the Mission Reach.

Aquatic Plant Identification for the Fisheries Professional

Casey Williams, BIO-WEST, Professional

Keywords: aquatic plants

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As primary producers in most freshwater aquatic systems aquatic plants and their ecology are an important component to understand for fisheries managers, conservationists and researchers. In this presentation I will highlight some important ecological and biological factors to consider for aquatic plant growth and management. I will also highlight some important aquatic plant groups for fisheries professionals to recognize.

Abundance and Growth of Spot (*Leiostomus xanthurus*) in the Western Gulf of Mexico

Damon Williford, Texas Parks and Wildlife Department, Professional

Co-author: Joel Anderson, Texas Parks and Wildlife Department

Keywords: Spot, shrimping

Spot (*Leiostomus xanthurus*) is a species in the family Sciaenidae that occurs in the western Atlantic and Gulf of Mexico. Abundance and life history of Spot in the Gulf of Mexico have been poorly documented in comparison with the Atlantic component of its distribution. Therefore, we used 38 years (1986 - 2023) of fishery-independent data collected with bag seines, gill nets, and bay and offshore trawls to assess the long-term trends in abundance and length of Spot and assess juvenile growth on the Texas coast. The abundance of Spot increased along the Texas coast as indicated by positive trends observed in annual trawl and gill net catch-per-unit effort (CPUE). Mean annual total length (TL in mm) of Spot also increased over the 38-year time series in each sampling gear. Spot in Texas begin to recruit into fishery-independent bag seines and trawls in January at approximately 22 mm and grow at a rate of 10.6 mm TL/mo (0.35 mm TL/day) to approximately 138 mm by December. Analysis of monthly growth of juvenile Spot through the time series suggests that growth rates have increased in more recent years, and year was significant predictor of growth that accounted for 34% of the variation in annual growth. Increasing catch, size, and growth rates could all be driven by the decline of commercial shrimp trawling in Texas coupled with the trend of milder winters in the Gulf of Mexico.

Why We Shouldn't Kill Old, Large, Long-Lived Fish

Kirk Winemiller, Texas A&M University, Professional

Keywords: old fish, longevity depletion

Recreational, commercial and subsistence fisheries generally have a disproportionately large impact on the oldest and largest individuals in stocks. Research on diverse vertebrate and invertebrate taxa has demonstrated the importance of old individuals to fundamental biological and ecological processes, including reproduction and recruitment, trophic dynamics, and population resistance and resilience to ecological and anthropogenic disturbances. The importance of old individuals spans taxa ranging from mollusks to fishes, whales, and humans.

The benefits of old age are supported by life-history theory and old animal storage effects. Life-history theory explains why old, large, highly fecund fishes can have a strong influence on reproduction and population stability. Gars and buffalos are examples of an extreme periodic (bet-hedging) life history strategy associated with long lifespan, large recruitment variation, and populations typically comprised of several dominant cohorts. Longevity conservation should become an explicitly stated objective for management of long-lived species. This will require methods for detecting and measuring longevity depletion (i.e., age-truncation) when formulating policies for sustainable fisheries and recovery of threatened species. Longevity conservation to reduce mortality of old individuals is feasible using strategies such as age- and size-based harvest regulations, catch-and-release, time-area restrictions, and networks of protected areas. Research and management priorities should include understanding: 1) how old fish may yield storage effects that enhance population resilience and community stability; 2) trophic dynamics of old, large fish and their role in food web structure and function; 3) how behaviors exhibited by older individuals influences migration, habitat use, and survival; and how human alteration of natural patterns of environmental variation impact recruitment of long-lived fish species.

Blue and Channel Catfish Gill Net Selectivity in Texas Reservoirs

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Co-authors: Michael Homer, Quintin Dean, Greg Binion, and John Tibbs, Texas Parks and Wildlife Department

Keywords: Blue Catfish, Channel Catfish, gill nets, selectivity curves, selectivity model

Gill nets are commonly used in freshwater systems to survey fish populations but are highly selective based on fish size. The Texas Parks and Wildlife Department (TPWD) frequently assesses Blue and Channel Catfish populations with gill nets in Texas Reservoirs, but size selectivity has not been evaluated for the TPWD gill net configuration. Our objectives were to calculate size selectivity for the TPWD gill net and evaluate differences in size structure (PSD, PSD-P, PSD-M) and mortality estimates between unadjusted and selectivity adjusted data. Ten Blue Catfish and six Channel Catfish populations were sampled from 2020-2023 and a total of 3,268 Blue Catfish and 2,087 Channel Catfish were used to calculate selectivity curves. Catch data was pooled among reservoirs for each species and five different log-linear selectivity curves were calculated. For both species the bimodal model was the best fit among model types. Blue Catfish peak selectivity was 575 mm while Channel Catfish peak selectivity was higher at 659 mm. We used the bimodal selectivity model to adjust length-frequency data from historical surveys to examine the impacts of gill net selectivity on Blue and Channel Catfish size structure indices. Meaningful changes to Blue Catfish size structure estimates occurred for 11.1%, 10.1%, and 12.4% of all PSD, PSD-P, and PSD-M estimates, while meaningful changes to Channel Catfish size structure occurred for 63.4%, 1.4%, and 0.0% of all PSD, PSD-P, and PSD-M estimates, respectively. Selectivity adjustments had marginal impact on mortality estimates as over half of all estimates changed by less than 2% and no estimate changed more than 6.4%. The

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impacts of selectivity adjusted data were variable among species and metrics, however, adjusting catch data for size selectivity can provide more accurate assessments of length-based metrics.

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Poster Presentations

Evaluating the Body Condition of Rio Grande Cutthroat Trout (*Oncorhynchus clarkii virginalis*) in Mountain Streams With and Without Non-Native Brown Trout (*Salmo trutta*)

Hannah Adams, Texas Tech University, Student

Co-authors: Owen George and Scott Collins, Texas Tech University

Keywords: Rio Grande Cutthroat Trout

Rio Grande Cutthroat Trout (*Oncorhynchus clarkii virginalis*; RGCT) are native to southern Colorado and northern New Mexico. Over the past century, non-native Brown Trout (*Salmo trutta*; BRT) have replaced RGCT throughout most of their historical range. Competition with BRT for food resources is thought to contribute to RGCTs' decline because they occupy similar stream habitats and presumably have similar ecological niches. BRT, being more aggressive, may outcompete RGCT in streams where food resources are limited. We hypothesize that higher BRT densities negatively influence RGCT body condition (Wr). To test this hypothesis, we collected length (mm) and weight (g) for 3,821 BRT and 503 RGCT (421 in allopatry; 82 in sympatry with BRT). When in sympatry, BRT comprised 14% - 91% of the trout population within study stream reaches. We detected an inverse relationship between RGCT body condition and BRT density (fish/m2). As BRT densities increased, RGCT average body condition declined. We found that RGCT Wr was higher in allopatry than in sympatry. These preliminary analyses indicate density-dependence with negative effects on RGCT body condition, suggesting competition for food resources between the two species. Understanding the relationship between the body condition of these two species provides insight into the dynamics of resource competition. This information helps us understand the productivity of RGCT populations and will help develop effective species management plans and protect the overall stream biodiversity.

Aggregation and Collation of Texas Crayfish Museum Specimens to Determine Their Current Conservation Statuses

Adrian Alvarez, University of Texas at Tyler, Student

Co-authors: Archis Grubh, Texas Parks and Wildlife Department; and Josh Banta and Ryan Shartau, University of Texas at Tyler

Keywords: crayfish

Crayfish are macroinvertebrates that remain largely understudied in Texas despite their ecological significance. They account for over half of the macroinvertebrate biomass in many ecosystems and serve as crucial bioindicators because of their behavioral and physiological adaptability to

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environmental changes. Their presence in aquatic systems often signifies healthy water quality. Despite being home to approximately 53 native crayfish species, Texas currently lacks protective regulations for any of them. This gap is primarily due to insufficient information about the distribution and occurrences of crayfish species in the state, including Species of Greatest Conservation Need (SGCN). This study will compile museum records of crayfish across Texas and compare them with more recent field survey data to address these knowledge gaps and recommend SGCN status updates. This document aims to provide a comprehensive starting point for researchers seeking background information on Texas crayfish and a foundation for future research.

Muddying the Water: A Taxonomic Investigation into the Mud Darter (*Etheostoma asprigene*) and Gumbo Darter (*E. thompsoni*)

Wesley Arend, Texas A&M University, Student

Co-authors: Kevin Conway, Gary Voelker, and Joshuah Perkin, Texas A&M University

Keywords: Mud Darter, Gumbo Darter, Creole Darter, Sabine River basin, Neches River basin

Darters of the genus *Etheostoma* (Teleostei: Percidae) represent a diverse radiation of small-bodied freshwater fishes endemic to eastern North America. Here we present preliminary results of an integrative taxonomic investigation of two similar looking and putatively closely related darters of the subgenus *Oligocephalus*, *Etheostoma asprigene* (Mud Darter) and *E. thompsoni* (Gumbo Darter). *Etheostoma thompsoni* was diagnosed as a new species in 2012 based solely on morphological characters and hypothesized to represent a recent “Gulf slope derivative” of the putatively closely related and similar looking *E. asprigene*. *Etheostoma asprigene* has near ubiquitous distribution throughout rivers of the Mississippi River basin in the mid-Eastern United States while the distribution of *E. thompsoni* is restricted to the Sabine and Neches River basins of Texas and the Calcasieu River of Louisiana. The limited distribution of *E. thompsoni* prompted both states to list it as a species of conservation need which has in turn prompted this taxonomic investigation. We collected specimens of both species from across their distribution to obtain tissues in order to conduct a phylogenetic analysis using data from two mitochondrial (CO1, cyt b) and three nuclear (S7, RAG1, zic1) genes. Results of our preliminary maximum likelihood analysis of mitochondrial genes do not support the hypothesized sister group relationship between *E. thompsoni* and *E. asprigene*, and instead support *E. collettei* (Creole darter) and *E. asprigene* as sister taxa. These preliminary results lend support to the earlier taxonomic decision to describe *E. thompsoni* as a species, distinct from *E. asprigene*. Our work has also uncovered a putative mitochondrial introgression event between *E. asprigene* from the Red River drainage (TX) and *E. collettei* that deserves further investigation.

Establishing Species-Specific Hematological Reference Intervals for Channel Catfish (*Ictalurus punctatus*) Using Automated Profiling

Hridi Arnab, Texas A&M University, Student

Co-authors: Ozgur Erdogan, Md Inja-Mamun Haque, and Haitham H. Mohammed, Texas A&M University

Keywords: hematological analysis, Vetscan VS2 Chemistry Analyzer, Countess 3 Automated Cell Counter, Channel Catfish

Hematological analyses are essential tools for assessing fish health and welfare in aquaculture. However, blood biochemistry evaluations in fish have been less common compared to other animals (e.g., pets, livestock, and poultry) due to reliance on manual methods, which are time-consuming and prone to human error. Manual blood cell counting in fish is particularly challenging due to their nucleated erythrocytes, which are incompatible with the automated techniques typically used for mammals. This study aims to address these challenges by evaluating the use of automated instruments to measure blood chemistry and perform blood cell counts in fish. Automated systems, such as the Vetscan VS2 Chemistry Analyzer (Zoetis Services LLC) and Countess 3 Automated Cell Counter (Invitrogen), offer significant advantages over manual techniques, including speed, consistency, and reproducibility. These instruments have been successfully used in other species, but their application in fish has been minimally documented. In this study, we used these automated tools to establish preliminary reference intervals for selected blood biochemistry analytes and red blood cell (RBC) counts in channel catfish. Blood was collected and processed to obtain three sample types: whole blood, plasma, and serum. Blood biochemistry parameters, including total protein, albumin, globulin, creatinine kinase, uric acid, aspartate aminotransferase, glucose, sodium, potassium, calcium, and phosphorus, were measured using VS2. Simultaneously, RBC counts were performed using both manual (hemocytometer) and automated (Countess 3) methods. No significant differences in biochemical analytes were observed among the three sample types, indicating that whole blood can serve as a reliable alternative to plasma and serum. The automated RBC counts closely aligned with manual counts. This study provides the first species-specific reference intervals for hematological parameters in channel catfish using automated instruments and highlights the practicality of automated tools as efficient and reliable alternatives to manual methods.

Assessing Blue Sucker Tributary Use in the Lower Colorado River of Texas

Meghan Booknis, Texas A&M University, Student

Co-authors: Matthew Acre, United States Geological Survey; Stephen Davis and Anthea Fredrickson, Lower Colorado River Authority; Nate Smith, Texas Parks and Wildlife; Eric Waits and Lucas Smith, U.S. Environmental Protection Agency; and Joshuah Perkin, Texas A&M University

Keywords: Catostomidae, tributary movement model, Colorado River,

Members of family Catostomidae (“suckers”) have experienced population declines in regulated rivers across their North American distribution. Research aimed at sucker conservation and

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management has resulted in an emerging hypothesis postulating that suckers are generally migratory and utilize tributaries to reproduce. The goal of this study is to assess the applicability of the tributary movement model (TMM) to Blue Sucker (*Cycleptus elongatus*) in the Lower Colorado River (LCR) of Texas. We developed three objectives: (1) assess the generality of the TMM for suckers, (2) use existing natural history collections to model Blue Sucker tributary use in the LCR, and (3) develop field techniques to directly test tributary use. For Objective 1, we conducted a literature review using the search terms “sucker” and “tributary” and “movement”. This review demonstrated the recent development of this hypothesis (~25 years) and widespread support for the TMM. For Objective 2, we coupled riverscape data (e.g., stream size, flow magnitude) with presence-absence data from Blue Sucker occurrences (presence) or collections that resulted in capture of *Moxostoma* spp. but not Blue Sucker (absence) in the LCR to model probability of occurrence. The model predicted a high probability of occurrence in five tributaries in the LCR, and we selected Wilbarger, Onion, and Cummins creeks as focal areas. For Objective 3, we developed a three-pronged approach to directly measure tributary use. First, we plan to deploy passive integrated transponder (PIT) arrays in each tributary to assess movement of individuals tagged by the Texas Parks and Wildlife Department in the mainstem. Second, we plan to use environmental DNA (eDNA) surveys in tributaries during high flows when Blue Sucker movement is known to occur. Third, we will use the eDNA results to guide electrofishing, seining, and gillnetting surveys. This work will advance ongoing management and monitoring of Blue Sucker in the LCR.

Improving Land Cover Detection for Fisheries Management: Comparing High-Resolution Models to the NLCD

Eden Brody, Texas Tech University, Student

Co-authors: Mark Kirk, Chris Shaffer, Lee Demi, Casey Bradshaw-Wilson, and Kelly Pearce, Allegheny College

Keyword: sedimentation, National Land Cover Database, land use, Caldwell Creek, Brown Trout

Intensive land use practices are correlated with harmful pollutants, such as sewage effluent, agricultural runoff, and fine sediments, which degrade biological integrity. Fishery managers rely on the National Land Cover Database (NLCD) to track land use practices, however, the NLCD often has difficulty identifying small-scale land alteration due to its coarse resolution (30x30 meters). High-resolution (1x1 meter) land cover models promise to improve the detection of small-scale land alteration while increasing model accuracy, however, these models are largely untested. Caldwell Creek is a fishery in Northwest Pennsylvania that is experiencing a decline in the abundance of Brown Trout (*Salmo trutta*). Previous research has linked this decline to increased fine sediment deposition. To identify sources of fine sediments, three land cover models: the NLCD, an AI Deep-Learning Model (AI), and a Supervised Classification Model (SC) were utilized to assess land alteration at 12 sites over 8 years (2011-2019). Analysis was conducted to determine changes in forest, agricultural, and wetland land cover according to each model. Models were then compared against control sites to assess model accuracy. The NLCD

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found an increase in forested land cover, a decrease in agricultural land cover, and little change in wetland land cover. In contrast, the high-resolution models found decreases in forested land cover, and increases in agricultural and wetland land cover. Furthermore, the AI Model (Accuracy = 99.26% ± 0.16%) and SC Model (Accuracy = 98.51% ± 0.19%) had significantly higher accuracy ($p < 0.001$) compared to the NLCD (Accuracy = 92.75% Â± 0.8%). The AI and SC models identified small-scale (<100 acres) logging as the driver of recent land cover change, while the NLCD detected no change in these areas. The adoption of higher resolution models by fishery managers is therefore crucial to more accurately detect sources of land cover degradation.

Aiding Imperiled Fish and Mussel Conservation Using Swimming Performance Metrics to Inform the Design or Modification of Road Stream Crossings

Allie Burdette-Lapuz, University of North Texas, Student

Co-authors: Preston Bean, Texas Parks and Wildlife Department; Cameron Emadi, University of British Columbia; and Edward Mager, University of North Texas

Keywords: swimming speed, Colorado Roundnose Minnow, Texas Shiner, Headwater Catfish, Largemouth Bass, Green Sunfish, Channel Catfish, Blacktail Shiner

Improper culvert construction at stream crossing sites can lead to zones of high-velocity water flow which can disrupt dispersal and connectivity of species of greatest conservation need (SGCN) in Texas. To help inform effective culvert design, the swimming performance of the following seven fish species will be measured, the first three are SGCN species themselves, and the last four serve as hosts for glochidia of SGCN mussels (mussel genera indicated in parentheses): Colorado Roundnose Minnow, Texas Shiner, Headwater Catfish, Largemouth Bass (*Lampsilis* spp.), Green Sunfish (*Lampsilis* spp.), Channel Catfish (*Cyclonaias* spp.) and Blacktail Shiner (*Fusconaia* spp.). The primary objective is to measure the maximum sustained swimming speeds (Ucrit) under a range of relevant temperatures (15°, 22.5°, and 30° C) to be used in site-specific calculations of culvert water velocities (Vf) . A secondary objective is to collect additional physiological endpoints of relevance to overall swimming performance, including maximum burst swimming speed (Umax), metabolic rate measurements (i.e., standard (SMR), maximum (MMR) and aerobic scope (AS)) and calculations of cost of transport (CoT) and optimal swimming speed (Uopt). Thus far, experiments have been completed for the Blacktail Shiner and Texas Shiner. Progressive significant increases in Ucrit with increasing temperature were observed in Blacktail Shiner. Similar results were observed in Texas Shiner, with a significant difference in Ucrit found between fish in the coolest and warmest treatments (15° and 30°C). To further aid in the conservation of the three SGCN fishes, physiological tolerances are also currently being determined to inform the potential resilience of their respective populations to future climate change. Specifically, thermal tolerance is being assessed using critical thermal maxima (CTmax), while hypoxia tolerance is being measured using critical oxygen tension thresholds (Pcrit) combined with loss-of-equilibrium experiments. Tolerance results obtained thus far for the Texas Shiner will be presented.

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Evolutionary Change in Killifish Fitness in Response to Differential Parasitism and Predation

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Co-authors: Matthew Walsh and Shannon Beston, University of Texas at Arlington

Keywords: Healthy Herds Hypothesis, Hart's Killifish, *Camallanus*, parasites

Parasites often have strong effects on evolution due to exploitative interactions with their hosts. The Healthy Herds Hypothesis posits that predation tends to make prey populations healthier by reducing the impact of pathogens on prey populations, reducing population densities and targeting sick individuals. It is unclear whether this process causes evolutionary shifts in prey populations that would limit the degree to which these populations evolve resistance to a novel invasive pathogen. Here we seek to determine if predation limits the impact of a rapidly invading parasite (*Camallanus* sp.) on an established fish population: this study addresses whether predators can modify the selection effects of parasites by changing infection rates in the host population. Hart's Killifish (*Anablepsoides hartii*) are found across a predation gradient. Killifish caught in 2016, 2022, and 2024 across both high-predation and low-predation sites were dissected for *Camallanus*, an intestinal nematode parasite. Dissections conducted on killifish revealed shifts in parasite distribution moderated by predator control. Findings show that killifish at low-predation sites show a significantly higher prevalence and degree of *Camallanus* infection than killifish facing high predation pressure. *Camallanus* exerts selective pressure on killifish: the parasite has a negative effect on fish body condition, and female killifish infected with *Camallanus* have reduced investment in egg production in their ovaries. Predation moderates parasite infection, and therefore may limit the selective pressure *Camallanus* exerts on its hosts. This suggests that predation may prevent their prey populations from evolving resistance to novel introduced pathogens by reducing exposure. A lack of predators may in turn result in stronger evolutionary pressures for prey populations, due to greater exploitation from parasites.

Exploring the Relationship Between Index of Biotic Integrity and Species Composition Variability in East Texas Streams

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Keywords: Index of Biotic Integrity, beta diversity, Neches River basin, Sabine River basin

In freshwater ecosystems, understanding the relationship between stream health and species composition is necessary for informing effective conservation and management decisions. Species composition dissimilarity quantified using metrics such as local contributions to beta

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diversity (LCBD), reflects a site's unique biological community within a study area. Sites with high LCBD values have been identified as potential indicators for conservation and management efforts within watersheds. The Index of Biotic Integrity (IBI) is a commonly used indicator of stream health and integrates species richness and functional traits (e.g., trophic position, diet) to evaluate the quality of freshwater streams. Modifications to the original IBI metrics that account for ecoregional differences in communities have further improved the estimation of aquatic life use in streams. For example, the regionalization of the IBI for Texas streams has created an ideal setting for exploring the relationship between aquatic life use and species composition dissimilarity within Texas ecoregions. In this study, we used data from stream fish assemblages surveyed across 60 stream reaches in the Neches and Sabine River basins during the Summer 2023 to assess the IBI scores and their correlation with LCBD values. A significant negative relationship was observed between the two metrics, indicating that sites with higher species composition dissimilarity had lower aquatic life use. The majority of streams scored “High” in aquatic life use, with few streams receiving the lowest IBI classification of “Low” use. The conditions of these streams suggest that they are generally in good health. Current research focuses on identifying the environmental variables that influence both IBI and LCBD scores of these streams to provide further information of stream health and freshwater fish diversity.

Image Recognition Model for Crustacean Postlarvae Counting and Size Estimation

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Keywords: shrimp post-larvae, Congested Scene Recognition, *Macrobrachium rosenbergii*

In aquaculture, most shrimp postlarvae counting tasks are currently performed manually either volumetrically or by average weight, which is not only time-consuming and laborious but also has low precision and accuracy. Moreover, using these traditional methods, when collecting continuous data for growth-rate and survival, subsamples of a population need to be sacrificed to be counted and obtain length and weight measurements, resulting in a decrease of the total population being tested and analyzed. To address this issue, the use of machine learning and image recognition techniques for shrimp postlarvae counting and measuring are being developed in this research. An image recognition system was developed based on a convolutional neural network for Congested Scene Recognition (CSRNet) and resulting data was analyzed using the R software. *Macrobrachium rosenbergii* postlarvae (about 60 DPH) were used to develop counting and length measurement algorithms. Length-Weight relationships were analyzed during a 60-day grow out period at days 1, 30 and 60. The algorithm has been successfully implemented, enabling automatic counting and measuring of shrimp postlarvae within seconds, with an accuracy rate of 95%. The postlarvae counting and measuring image recognition system investigated in this study can be widely used in crustacean research as well as by the aquaculture industry to more easily determine individual length, size distribution, and mean weight, and thus help to increase precision and accuracy in data collection with minimal handling of the animals.

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The Influence of Fish Density and In Stream Structure on Blacktail Shiner (*Cyprinella venusta*) Habitat Preference: A Microcosm Study

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Keywords: Blacktail Shiner, habitat complexity, density

In freshwater stream ecosystems, the combined effects of habitat complexity and fish density are key drivers of fish diversity. Stream ecosystems are comprised of a wide variety of habitat types including pools, riffles, and runs, each possessing various in-stream structures. It is well known that fish rely on a heterogeneous environment for success, however, why fish prefer certain areas over others is understudied. This research study aims to understand the effects of fish density on habitat selection of the Blacktail Shiner (*Cyprinella venusta*) in a pristine, 2nd order east Texas stream ecosystem. A microcosm design will be employed consisting of four different treatments that mimic the diverse in-stream structures found in the system (e.g., submerged vegetation, root-wads, submerged logs, and sandy bottom with no structure). Following an increasing density gradient (3, 6 and 12 fish), fish will be placed in a microcosm (7x15x5) containing two different habitat treatments. Fish location in the microcosm will be recorded every minute during the 15-minute trials. We hypothesize that submerged logs will be the highest use habitat, followed by root-wads, and submerged vegetation. In higher density treatments, we hypothesize an increase in the number of fish utilizing the sandy bottom treatment. This study will help habitat managers to better understand the specific micro-habitats Blacktail Shiner inhabit and subsequently which habitat types to preserve, and or restore, to ensure the long-term success of the Blacktail Shiner population in pristine, upper-watershed ecosystems.

Morphological - Habitat Correlates in a Species-Rich Fish Assemblage “The Characiformes,” in the Essequibo River, Guyana

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Keywords: Characiformes, Essequibo River, piranhas, tetras, vampire fish, Hatchetfish, Wolf Characin, fish assemblage

The order Characiformes includes ecologically and morphologically diverse fishes, including well-known fishes like piranhas and tetras, which occupy various habitats in Neotropical rivers. Fish within this order display a vast array of trophic specializations and the range of body size is remarkable. Given the extraordinary diversity both taxonomically and ecologically, we aimed to

explore the diversity and distribution of body sizes in characiform fishes from the Essequibo River, Guyana, South America. Fish assemblage surveys were conducted in May 2024 during the rising water period. Using a variety of fishing gears, fish were collected from different habitats including the main channel, floodplain lakes, and creeks. After collection, characiforms were identified to the lowest taxonomic level (genus or species), counted, and the body size of five individuals were measured. We collected 58 species within 31 genera, and 12 families, with most species collected from the main channel and creek habitats. The families Serrasalmidae (e.g., piranhas) and Characidae (e.g., tetras) had the greatest number of species. Furthermore, species in the Family Serrasalmidae exhibited the most variability in body shape and size, while the largest individuals collected were in the family Cynodontidae (payara or vampire fish). A few species were collected from unique habitats, for example, the Hatchetfish (Gasteropelecidae) and the Wolf Characin Hoplias (Erythrinidae) were collected from shallow creeks containing leaf litter substrates and vegetation, while the Pinktail surface-dweller Characin Chalceus (Chalceidae) was only collected in marginal shallow areas of the main channel. These findings can lead to further research on ecological niche partitioning and biodiversity of these fishes. Future research will focus on quantifying trophic position of Characiformes using stable isotope analysis of carbon and nitrogen to examine correlates of body size, trophic traits, and trophic position among characiforms among different families and across surveyed habitats in the Essequibo River.

Estimates of Fish Taxonomic Diversity in the Essequibo River, Guyana, Based on Environmental DNA Versus Traditional Sampling Methods

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Co-authors: Madison Nguyen and Holden Carey, Texas A&M University; Joseph Sheffield, Adair Hernandez, Stephanie Fox, and Anastasia Simpson, Stephen F. Austin State University; Moses Rover, and Tracy Russell, University of Guyana; Kirk Winemiller and Leslie Winemiller, Texas A&M University; and Carmen Montaña and Sheryll Jerez, Stephen F. Austin State University

Keywords: Essequibo River, eDNA

The Essequibo River, Guyana, has exceptionally high fish diversity, yet remains poorly surveyed. We sampled six locations in the river channel and floodplain lakes within the Iwokrama Conservation Area of Guyana's Potaro-Siparuni region during the beginning of the rainy season in May 2024. We collected water samples and analyzed environmental DNA (eDNA) to determine the presence of fish species, and then compared those results with the fish species obtained at the same locations using traditional surveys with various nets and angling. These results were compared based on two different DNA primers. Polymerase chain reaction (PCR) was used to amplify the eDNA, which was then sequenced using a ribosomal RNA vertebrate eDNA primer (12SVertF,12SVert R) and mitochondrial ribosomal RNA fish eDNA primer (MiFishUR, MiFishUF). The traditional surveys yielded 46 fish species within 38 genera, with three genera overlapping between traditional and eDNA methods 12SVertF,12SVert R eDNA read, and 18 genera overlapping with data from the MiFishUR, MiFishUF eDNA read. A

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comparison of the number of genera collected between each method revealed that the fish primer yielded the most genera (111), with 108 being fish and two identified genera not endemic to the sample locations. The vertebrate primer yielded the fewest genera (46), with 39 being fish. This indicates that the use of more specific forward and reverse primers targeting fish species resulted in a more comprehensive survey. Understanding the distribution of fish diversity in the Essequibo River is important for assessing overall ecosystem health and conservation of biodiversity. Further research on the effectiveness of eDNA survey methods is needed to improve the reliability of biodiversity estimates.

The Mechanosensory Lateral Line System of the Federally Endangered Clear Creek Gambusia *Gambusia heterochir*

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Co-author: Kevin Conway, Texas A&M University

Keywords: Clear Creek Gambusia, lateral line

Gambusia heterochir (Clear Creek Gambusia) is known only from a single spring-fed tributary of the San Saba River (Clear Creek) in Menard County, Texas. This species was placed on the Endangered Species List in 1967 and is also a SGCN in Texas. Due to a combination of stressors, the population of *G. heterochir* within Clear Creek has plummeted and the species may now be extinct in the wild. An aging captive population housed at Inks Dam National Fish Hatchery, and recently transferred to the San Antonio Zoo, offers a fleeting (and perhaps final) opportunity to gather basic information about this unique species. We used a combination of intravital fluorescence staining, scanning electron microscopy and clearing and double staining techniques to investigate (for the first time) the mechanosensory lateral line system of *G. heterochir*. As reported for other species of *Gambusia*, the cephalic lateral line canal system of *G. heterochir* is reduced to a series of open troughs on the ventral, lateral and dorsal surface of the head, leaving the rostro-caudally or dorso-ventrally elongate canal neuromasts of the infraorbital, supraorbital and preoperculo-mandibular canals exposed. Superficial neuromasts are present in surprisingly low numbers on the head (~24 on left side only), body (~60 on left side only), and caudal fin (2-3 on left side only) of *G. heterochir*. As reported for *G. affinis*, *G. heterochir* exhibits sexual dimorphism in the placement of superficial neuromasts on the anteroventral part of the body adjacent to the pelvic region, suggesting that sexual dimorphism of the lateral line mechanosensory system may be widespread within *Gambusia* (and by extension also Poeciliidae). Intravital staining of hair cells in neuromast organs requires access to living individuals and the window of opportunity for using such techniques on *G. heterochir* may be closing.

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Local Environmental Drivers Influencing Two Imperiled Sympatric Cyprinids in East Texas Streams

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Keywords: Sabine Shiner, Blackspot Shiner, Neches River basin, Sabine River basin, Redundancy Analysis

The Southeastern United States is a biodiversity hotspot, with East Texas rivers supporting high fish diversity, including several endemic species. Within the Sabine and Neches River basins, the Sabine Shiner *Notropis sabinae* and Blackspot Shiner *Notropis atrocaudalis* were reported historically abundant, but in recent decades they have experienced significant declines in distribution and abundance. These species are now classified as Species of Greatest Conservation Need (SGCN) in Texas. This study investigated local abiotic and biotic factors influencing the distribution and abundance of these two shiners. Standardized surveys were conducted seasonally at 60 stream sites from Summer 2023 to Spring 2024, in-stream conditions related to habitat and water quality (e.g., depth, turbidity, flow, substrate composition, and water quality) and fish surveys were conducted on a seasonal basis. High abundances of both species were reported in streams in the Neches River basin. Lower abundances of Blackspot Shiner and no presence of Sabine Shiner were reported for streams in the Sabine River. Redundancy analyses (RDAs) at both annual and seasonal basis were performed to assess species-environment relationships. On the annual basis, both species appeared to respond similarly to environmental conditions. However, at the seasonal basis, RDAs revealed that the Blackspot Shiner exhibited stronger associations with water quality metrics (e.g., turbidity) compared to the Sabine Shiner responses. Additionally, Pearson correlations showed seasonal variation for associations of the focal species with other shiner species. This included a positive association with the Sabine Shiner and the Blacktail Shiner, which is considered a native invader that potentially could compete the two sympatric imperiled shiners for resources. The Sabine Shiner, found only in the Neches River basin, highlights the need for continued monitoring of these populations. Our results emphasize the importance of evaluating local in-stream conditions for continued conservation of imperiled and native species in East Texas streams.

Establishing the Distribution of the Australian Redclaw Crayfish (*Cherax quadricarinatus*) and the Impacts It Could Have on Native Populations

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Keywords: Australian Redclaw Crayfish, invasive species

The introduction of invasive species, specifically crayfish, is common through aquaculture and can be an important factor causing the decline and/or extinction of native species. Invasive species cause billions of dollars in damage and threaten almost half of the native species in the

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United States. Australian Redclaw crayfish (ARC) are large individuals that are similar to the native crayfish in the United States. They are an exotic species that originated in Australia and New Guinea and has been reared in aquaculture industry worldwide. They are known to have a high tolerance to their environment, specifically in tropical and subtropical locations. They are a non-burrowing species that can survive, and thrive, in high temperatures and low oxygen. ARC are non-aggressive individuals and can reach sexual maturity in less than a year. The females can produce up to 1,000 eggs and can reproduce consecutively within a single year. This means ARC have the potential to spread rapidly if environmental conditions are met. The main objectives of this study are to 1) determine the current range of ARC in south Texas, and 2) to determine its habitat use. To address the first objective, modified minnow traps will be deployed at multiple sites in areas starting with locations identified from previous records and expanding to additional new locations. For the second objective, water quality and habitat descriptions will be recorded, and their associations will be analyzed. Results from this study will provide valuable information on the current distribution and potential impacts of the invasive ARC on native species. Future analyses will also be conducted to help predict the establishment and spread of ARC in south Texas. This project will serve as a baseline to support future studies on the long-term impacts of the ARC on Texas' aquatic ecosystems, and aquatic invasions in general.

Fish Species Richness in Tributary Creeks along the Essequibo River: Comparison of Estimates from Net Surveys and eDNA

Madison Nguyen, Texas A&M University, Student

Keywords: Essequibo River, eDNA

The Essequibo River in Guyana supports some one of the richest fish faunas on Earth. The region experiences strong wet-dry seasonality, and during the wet season, numerous small creeks drain the rainforest that dominate the watershed along the mainstem of the river. Using a seine and dipnets, we collected fishes from creeks that drain into the mainstem Essequibo in the Iwokrama Protected Area in Central Guyana during the early rainy season of May 2024. We also collected water samples for environmental DNA (eDNA) analysis of fish species. Genetic sequences were obtained using two different markers: the 12S ribosomal gene (12SVert) useful for identifying vertebrate taxa, and a mitochondrial gene (MiFishU) useful for identifying fish to genus and species levels. We compared estimates of fish species richness based on each of the three datasets, including calculation of a between-sample similarity index. Overall, the MiFishU eDNA yielded the highest species richness and had higher similarity with the fish survey estimate than the 12SVert estimate. Nonetheless, the overlap between the eDNA and fish survey data was low overall, with fishes captured from the creeks being undetected by the eDNA analysis, and fish species detected by eDNA analysis not captured during the surveys with nets. The latter finding likely is explained by eDNA originating from fishes residing in the main river channel being carried into the creeks as the water level rose during the early phase of the annual flood pulse.

Life History Strategies Predict Species Responses to Environmental Gradients in the Upper Brazos River, Texas

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Keywords: Brazos River, Salt Fork Brazos River, Double Mountain Fork Brazos River, life history strategy,

Fishes possess a high diversity of traits influenced by ecological tradeoffs in survival, fecundity and generation time that allow them to cope with varying environments. Here, we investigated environmental predictors of fish life history strategies (LHS; opportunistic [O], periodic [P], and equilibrium [E]) in three river segments of the upper Brazos River, Texas, including the Salt Fork [SF], Double Mountain Fork [DMF], and Brazos River mainstem [BRM] for one year (four consecutive seasons; fall, winter, spring, and summer). We used the Winemiller & Rose fish life history model to quantify the LHS of 28 fish species based on trade-offs among size at maturation, fecundity, and investment per progeny. Our analysis revealed important seasonal and local environmental predictors in which O strategists dominated assemblages across all three river segments and every season. The P and E strategists were more prevalent in the DMF and BRM. The variation in the LHS affinity for each site was explained by stream wetted width, stream flow, conductivity, and water depth. Fishes with O strategists occupied sites with shallow waters and high conductivity while E strategists were found in sites with large wetted width and deep water. Finally, the P strategists were found at sites with deep water and high flow, and low conductivity. Our study highlights the importance of maintaining variation in environmental conditions to support species with different LHS. Reaches of the SF are dynamic and highly saline (high conductivity) which favor O strategists while downstream portions of the DMF and throughout the BRM, conditions are more environmentally stable with variation in key variables such as wetted width, depth, and flow that favor P and E strategists. Our results demonstrate the utility of LHS for understanding the ecological responses of fishes to stream alterations and highlight the importance for maintaining specific environmental conditions which could promote the conservation of native species with different LHS in each river segment.

Assessing Seasonal Variation in Habitat Associations and Co-Occurrence between Invasive Suckermouth Armored Catfish and Imperiled Rio Grande Darter in San Felipe Creek

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Keywords: Suckermouth Armored Catfish, Rio Grande Darter, San Felipe Creek, invasive species

Springs rising from the Edwards Plateau in Central Texas harbor diverse communities of endemic and imperiled fishes. Several of these springs have been invaded by suckermouth armored catfishes (Family Loricariidae; hereafter SACs). Whether SACs negatively affect populations of

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native spring-associated fishes remains poorly understood. We assessed habitat associations and co-occurrence patterns between SACs and the state threatened Rio Grande Darter (*Etheostoma grahami*; hereafter RGD). We conducted this study in San Felipe Creek (Val Verde County, Texas)--the third largest spring by discharge in Texas, the primary water source for the city of Del Rio, and a designated critical habitat for the federally threatened Devils River Minnow (*Dionda diaboli*). First, we established 36 ten-meter-long transects representing pool and riffle habitats, and distributed along a 5-km gradient of spring influence. Next, we performed snorkel counts of RGDs and SACs at these transects on four consecutive days during January, March, August, and November of 2024. Lastly, we quantified relationships between RGD abundance and habitat gradients using regression and ordination analyses. We also used null model analysis to quantify patterns of co-occurrence (the degree of segregation) between RGD and SACs. Mean RGD abundance was 0.31 individuals per square meter (range 0 to 5 individuals) and ranged from 0.22 during the fall to 0.47 during the spring. RGD abundance was higher in riffles than in pools and decreased with distance from the springs. Our null model analysis provided some evidence of segregation, but this negative co-occurrence varied within and among seasons. Our findings suggest that interference competition, egg predation, and/or environmental filtering may cause negative co-occurrence, but controlled experiments or SAC suppression are needed to improve understanding of the aforementioned mechanisms. Our findings highlight the need for continued monitoring and suppression of SACs to negate their impact on imperiled spring fishes.

Language as a Tool for Conservation: Evaluating Marine Protected Area Policies Across Nations

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Keywords: Marine Protected Areas, policies

Research supports the finding that Marine Protected Areas (MPAs) can be effective at increasing biodiversity and aiding in fish population and marine mammal recovery due to overfishing or poaching. However, a comparative language analysis performed across international MPA policies to help explain their success or failure remains to be explored. Information, language, and patterns in policies can be assessed to project policy efficacy. This research will examine the language of policies within Palau, the United Kingdom, Australia, Namibia, the United States, and the state of Texas, and evaluate them utilizing a scale based on political, analytical, and operational mechanisms established by Bali et al. in 2019. Australia, the UK, Palau, and the United States were selected for investigation due to their high percentage of MPAs. Texas, specifically, was selected because its state waters extend nine nautical miles compared to the typical three nautical miles in other states. Finally, Namibia was chosen due to its lack of MPA policy and radical change in fishing value since the rewriting of its constitution in 1990. This study will examine critical aspects of the policy to determine whether political, analytical, and operational mechanisms are present. Following this evaluation, patterns will be assessed utilizing qualitative analysis of individual policy language to project which patterns, methods, and mechanisms may be contributing factors in making policies effective. Effectiveness, here, is unique to each policy as individual policies have different goals set out in the language, thus

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effectiveness will be evaluated based on the metrics set forth by each policy, rather than using a general determiner. In turn, the information gained from this research can be applied to create more impactful policies for domestic MPAs. Ultimately, we anticipate that stricter policies with appropriate enforcement mechanisms will be the most effective.

Short Term Drought Impacts are Influenced by Annual Flow Patterns and Fish Life History Strategies in North Texas

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Keywords: drought, Red River basin, life history strategy

In order to determine short-term impacts of drought on stream communities, we compared fish communities in 16 locations of the Red River drainage in spring 2022 and spring 2023, with a severe drought affecting the region in summer 2022. We used standardized single pass electrofishing sampling along stream reaches of 150 m, measuring species occurrence and abundance at each site. For each site, we calculated a drought risk rank, which was an average of ranks from annual low flow values and annual flow variation (annual flow stability). We split streams into two groups: higher drought risk (n=7; average risk rank = 11.5) and lower drought risk (n = 9; average risk rank = 6.2), and then conducted six two-sample T-tests comparing different patterns of community change. Non-metric multidimensional scaling (NMDS) analysis of six life history traits for each species was used to define a more opportunistic vs. less opportunistic group, based on shared traits. Another NMDS was used with community data to compare pre-and post-drought surveys, with annual change indicated by Euclidean distance between paired sites. We found that greater annual community change occurred in higher drought risk sites, mainly caused by species losses rather than other potential components of community change. Regarding life history strategies, more opportunistic species increased after drought by 5.2%, and less opportunistic species decreased by 2.5% (significant difference; $p = 0.03$). This research shows that life history strategies are a good indicator of species drought risk and response, and that annual flow patterns (low flow and flow variation) can be a good indicator of potential community change following droughts. We believe this data could be useful to manage fish diversity and understand species and community risk in light of recent increases in severe drought frequency in North Texas.

Evaluation of Invasive Risk Models using eDNA

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Keywords: invasive species, Zebra Mussels, eDNA, invasive species

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Lacustrine ecosystems can be disrupted by nonindigenous, often invasive species which are spread via recreational boating. Many aquatic invasive invertebrates and macrophytes are spread by boats and become established in lakes due to favorable environmental conditions. Among them, Zebra Mussels (*Dreissena polymorpha*), are of high concern due to their large economic and ecological impacts. Therefore, they have been the focus of many risk assessments, including a recently developed spatially explicit approach based on lake-boater transportation networks. To increase the transferability of this risk assessment, our objectives were to 1) evaluate predictions from the Zebra Mussel risk assessment and 2) determine the environmental tolerances of other aquatic invasive species threats spread by the boater pathway. We collected water samples for Zebra Mussel eDNA detection and habitat measurements from twenty lakes in Texas and New Mexico to compare predicted and observed occurrences at known infested and potentially susceptible high-risk lakes. We identified eight additional invertebrates and macrophytes from the USDA's National Invasive Species Information Center and the USGS's Nonindigenous Aquatic Species that were considered a high threat and spread by boats. Then, we performed a literature review to identify these species environmental tolerance ranges for temperature, salinity, phosphorus, turbidity, chlorophyll-a, pH, DO, and desiccation. We confirmed the presence of Zebra Mussel eDNA in three lakes with large populations, and no detections for susceptible priority lakes predicted by the risk assessment. From our literature review, we conclude that considering species with desiccation tolerance of greater than 48 hours, such as Giant Salvinia, Eurasian Milfoil, and New Zealand Mudsnail, may facilitate preventative management prioritizations due to the high survivability of these species during boat transport. Increasing the public's awareness of and monitoring top priority nonindigenous species can aid community members in identifying and helping to stop the spread of aquatic invasive species.

Exploring Taxonomic and Body Size Diversity of Catfishes (Order Siluriformes) in Rivers of the Guiana Shield

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Co-authors: Adair Hernandez, Stephanie Fox, Anastasia Simpson, Madison Nguyen, Megan Hobratschk, Holden Carey, Leslie Winemiller, and Kirk Winemiller, Texas A&M University; and Carmen Montaña, Stephen F. Austin State University

Keywords: Essequibo River, Rupununi River, catfish, Pimelodidae

Neotropical catfishes are among the most diverse freshwater fishes and span a broad range of body sizes and trophic niches, making them ideal organisms for studying the influence of functional trait variation on community organization and ecosystem function. We examined variation in the taxonomic composition and body size distributions of neotropical catfishes across habitats and trophic guilds in two rivers in the Essequibo River Basin of Guyana, the Rupununi River and the Essequibo River mainstem. Field surveys were conducted during May of 2023 and May of 2024, a time of year coinciding with the start of the region's annual rainy season and initial phase of the flood pulse. Using a variety of fishing gears, fish surveys were conducted in three different aquatic habitats, including creeks, floodplain lakes, and the river channel.

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Combined fish samples from the Rupununi and Essequibo rivers yielded 55 catfish species, representing 37 genera and 9 families. More catfish species were collected from sites in the Rupununi River compared to the Essequibo River (41 vs 22 spp., respectively). More catfishes were collected from sites in the main channel (n=24 spp.) and floodplain lakes (n=28 spp.) of the Rupununi River compared to the similar habitats surveyed in the Essequibo River (channel n=18 spp., lakes n=4 spp.). Differences may reflect unequal survey effort and/or gear efficiency across habitats and rivers. Across both rivers, species in the family Pimelodidae had the largest body size out of nine families collected. Pimelodids had, on average, higher trophic positions (i.e., carnivores, piscivores) than catfishes in other families. Ongoing research will examine the relationship between body size and trophic position for catfishes in these rivers by using carbon and nitrogen stable isotope analysis.

Fish Community Dynamics in the Guadalupe River of the Edwards Plateau: Results from Long-Term Monitoring by the Student AFS Subunit of the University of Texas at San Antonio

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Keywords: Guadalupe River, fish assemblage, University of Texas San Antonio

Understanding the natural drivers of community dynamics and predicting community change under growing anthropogenic stressors inherently requires long-term monitoring. In May 2023, the Student Subunit of the American Fisheries Society at the University of Texas at San Antonio (UTSA) initiated regular sampling of the fish community in the Guadalupe River near Comfort, Texas. This stream is ideal for long-term study because it is transitioning from perennial to intermittent, has a long-term flow gage documenting this transition, and harbors unique and imperiled fishes. Since then, the Subunit has completed 11 sampling events during which a cumulative count of 1,814 individual fish representing 20 species and seven families have been enumerated and measured. We had three analytical objectives for this poster with the overarching goal of (1) providing experiential learning for Subunit members and (2) beginning to characterize spatiotemporal community dynamics. First, we characterized temporal variation in species richness using rarefaction curves. Mean species richness was 10.5 across the 11 sampling events and ranged from 8 species in October 2023 to 13 species in May 2024. Second, we compared variation in community composition along spatial (pool-riffle) and temporal (across months) dimensions using ordination. Relative abundances of species differed more between pools and riffles than they did temporally. Sunfishes and livebearers were relatively most abundant in pools whereas darters and minnows were numerically dominant in riffles. Third, we explored temporal changes in size structure of five most commonly encountered species using length-frequency analysis. We observed multiple modes for these species indicating the presence of multiple age classes and probably reproduction and recruitment success over the last two years. We plan to

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sample this location seasonally in 2025 and beyond with the goal of immersing UTSA students in fisheries science and documenting inter-annual drivers of fish community dynamics.

Water Return Following Extreme Drought Contributes to Fish Assemblage Structural Convergence Across a Stream Channel-Floodplain Riverscape

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Co-authors: Joshuah Perkin, Blake Elzi, and Lucas Stevens, Texas A&M University

Keywords: drought, fish assemblage, Lick Creek, structural divergence model, structural convergence model

Extreme drought characterized by unusually high levels of drying in surface waterbodies can have a significant effect on fish assemblage composition. As water becomes increasingly rare at some locations within a region, fish assemblages may diverge in opposing directions caused by stochastic changes in species abundance or occurrence. This hypothesis might be called the “structural divergence” model as it posits that local fish assemblages distributed across a region will become increasingly different as drying advances, but remnant fish assemblages persist. In highly connected riverscapes, the return of water following drought can facilitate fish colonization and contribute to regional fish assemblage homogenization as the same species colonize local sites across the region. This hypothesis might be called the “structural convergence” model as it posits that fish assemblages distributed across a region will become increasingly similar as water returns and mass effects allow fish movement from the regional species pool into local assemblages. We tracked fish assemblage change across four locations in Lick Creek Park in College Station, Texas to test the fish assemblage structural convergence hypothesis. We surveyed fish assemblages in two creek channels and two adjacent wetlands beginning in December 2023 immediately after rain returned water to previously dry or drying habitats in the wetlands. We surveyed fish assemblages during five occasions (December 2023, March 2024, April 2024, September 2024, and November 2024) and used nonmetric multidimensional scaling analysis to test whether fish assemblages diverged or converged through time. Results indicated that fish assemblages across the four sites in the riverscape converged in their structure following the return of water and fish colonization opportunities. This work has implications for managing channel-floodplain habitats and highlights the capacity for fish assemblage recovery following drought under the conditions of hydrologic connectivity between channels and wetlands.

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Assessing Co-occurrence and Competition Between Guadalupe Bass and Largemouth Bass: Evidence from Observational Studies and a Laboratory Experiment

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Co-authors: Jacob Pace, Mary Sears, and Matthew Troia, University of Texas San Antonio

Keywords: Guadalupe Bass, Largemouth Bass, San Antonio River, aggression

Elucidating ecological processes that drive patterns of species co-occurrence is a fundamental goal in ecology and essential for conserving native species. We combined two observational datasets with a manipulative laboratory experiment to assess the importance of abiotic versus biotic factors in mediating co-occurrence of Guadalupe bass (GB) and Largemouth bass (LMB). We focus on GB because the species is endemic, recreationally important, and threatened by multiple anthropogenic stressors. First, we compiled 48 fish community surveys from 2008 to 2019 within the GB native range and used ordination and null models to quantify the role of abiotic filtering and competition. These observational analyses revealed that GB and LMB occupy similar abiotic niches and also co-occur, suggesting that these species may compete for limited food resources. Second, we completed seasonal surveys of GB and LMB from 2020-2021 at five riffles and three pools in an urbanized reach of the San Antonio River, and used ordination to quantify abiotic niche differentiation among juvenile and adult size classes of each species. This analysis revealed that juvenile GB occupy riffle habitats whereas adult GB and all LMB occupy pools. These observational studies indicate the potential for competition between GB and LMB but fall short of confirming competition and identifying competitive asymmetry between the two species. Lastly, we conducted a 14-day laboratory experiment where we measured survival of the juvenile GB and LMB each alone, paired with a conspecific, or paired with a congener. Our results demonstrated (1) interspecific aggression is stronger than intraspecific aggression and (2) GB are more competitively dominant over LMB. The lack of juvenile co-occurrence in the San Antonio River combined with evidence of interspecific aggression in the lab suggests that habitat associations of juveniles are driven by competition. Our findings can inform GB management decisions on repatriation locations and habitat restoration.

Environmental Tolerances and Habitat Association of Three Critically Imperiled Crayfish Species in Texas

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Co-author: Ryan Shartau, University of Texas at Tyler

Keywords: crayfish, Jackson Vale ecoregion

Globally, crayfish play a significant role in freshwater systems as ecosystem engineers, indicator species, and a food source for avian, terrestrial, and aquatic predators. Crayfish are considered one of the most threatened taxa due to factors including pollution, habitat loss, and climate change. The Jackson Vale ecoregion of Southeast Texas is home to three species of understudied endemic crayfish, two of which are listed as Species of Greatest Conservation Need by the Texas Parks and Wildlife Department, *Procambarus fayetti*, *Procambarus, nueces*, and *Procambarus texanus*. My Research will consist of performing physiological tests on these 3 species as well as

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temperature (CTmax), hypoxia (Pcrit), and water chemistry (pH) through dynamic loss of equilibrium experiments. I hypothesize that the widespread *P. acutus* will have a broader tolerance of these parameters than the three geographically restricted endemic species and that the narrower tolerance ranges of the three endemics will make them more susceptible to environmental changes. Findings from these experiments will inform wildlife managers on the conservation status of these species as well as highlight similarities and differences in habitat limitations among the four species. These findings could be useful in modeling habitat suitability in relation to future climate trends.

Factors Affecting Persistence of Fish Attracting Structures in Reservoirs

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Keywords: fish attracting structures

As reservoirs age and coarse woody habitat degrades, fisheries managers often utilize fish attracting structures (FAS) made from either natural (e.g., brush piles) or synthetic (e.g., Georgia cubes) materials to concentrate fish for anglers. The effectiveness and longevity of FAS varies greatly and has been anecdotally described as dependent on materials used in their construction and characteristics of their deployment locations. However, factors affecting FAS longevity have not been thoroughly assessed. We surveyed FAS locations published online for anglers in sixteen Texas reservoirs using side-scan sonar to assess presence or absence of FAS at their original deployment locations and to locate FAS that were not present at their original locations. Presence/absence and distance from original location were modeled as responses to their construction (e.g., material, design type) and deployment location (e.g., depth, slope, distance to river channel) characteristics. Results from this study will inform construction and placement of FAS to better match anticipated site longevity with fisheries management goals.

Sex-Specific Spotted Seatrout Distribution and Trends in Texas Estuaries

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Keywords: Spotted Seatrout, Galveston Bay, Aransas Bay, Upper Laguna Madre

Spotted Seatrout have been shown to follow sex-specific spatial distributions which may follow seasonal patterns and/or respond to environmental changes (e.g., freshets). Texas estuaries provide an opportunity to compare sex-specific trends and spatial distributions of Spotted Seatrout across varying salinity gradients. Here, we examine sex-specific Spotted Seatrout patterns in Galveston Bay (positive estuary), Aransas Bay (neutral estuary), and the Upper

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Laguna Madre (negative estuary). We used TPWD gill net data (1979-2023) to examine the spatial, seasonal, and environmental patterns in sex-specific Spotted Seatrout distribution among these three representative estuaries. Annual trends for male and female Spotted Seatrout were examined for each of these estuaries and boosted regression tree analysis of binary Spotted Seatrout sex (male-female) was conducted to examine the impacts of salinity, temperature, dissolved oxygen, turbidity, inlet distance, and total length on the sex-specific distribution of Spotted Seatrout in the estuary. Our findings indicate that annual sex-specific trends (i.e., percentage of female or male specimens) were stable across the full timeseries but variable from year to year. Sex-specific spatial patterns in Spotted Seatrout occurrence appears to be highly dependent on the estuary's salinity gradient as well as proximity to the nearest inlet (which are likely related variables). More broadly, our findings may contribute to understanding sex-specific movement in Spotted Seatrout populations as well as how captured sex ratios may impact length and abundance patterns observed in TPWD gill net surveys.

Characterization of the Texas Sheepshead Fishery Highlights Substantial Pressure on Spawning Aggregations

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Keywords: Sheepshead, fisheries management

We utilized fishery-independent and dependent data (1983-2023) collected by the Texas Parks and Wildlife Department to assess Sheepshead populations and describe the fishery. In the 1900s, Sheepshead were one of the most targeted species in the Gulf of Mexico and supported substantial fisheries before stocks were depleted and interest shifted to other species. Even recently, Sheepshead have been characterized as one of the most vulnerable species to overfishing based on their unique spawning behavior. Here, gill net data were used to describe Sheepshead abundance and distribution, while creel surveys were conducted to determine spatial and temporal characteristics of the fishery and evaluate targeted fishing activity during the spawning season. Sheepshead encountered in gill nets were especially common around Gulf passes along the mid and lower coast. Trends in Sheepshead abundance over time were not evident. However, increased harvest, catch rate and length indicated that Sheepshead experience heightened fishing pressure during their spawning season (February-April) compared to the rest of the year. In addition, fishing pressure was highly concentrated spatially with a disproportionate number of landings observed at two ramps near Aransas Pass. These results suggest that while Sheepshead populations in Texas are stable, fishing pressure is most intense when Sheepshead are highly vulnerable due to spawning behavior.

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Long-Term Population Trends of Texas Red Drum Using Fishery Dependent and Independent Data

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Keywords: Red Drum, fisheries management

The purpose of this study is to evaluate more recent angler activity and population trends of Red Drum (*Sciaenops ocellatus*) along the Texas Gulf Coast and explore the potential for management implications. Red Drum are considered a valuable and highly sought after recreational sport fish in the Gulf of Mexico, particularly in the state of Texas. During the late 1970's, the Texas Red Drum population was in decline which ultimately led to the introduction of regulations for recreationally harvested Red Drum and the cessation of commercially harvested Red Drum. Analysis of both fishery-dependent and fishery-independent data (TPWD) were utilized to determine catch rates (CPUE) of Red Drum coastwide from 1980 to the present. Catch rates for angler creel surveys were calculated by determining the number of Red Drum landed per hour spent fishing (CPUE= catch/angler-hour). Gillnet catch rates were assessed by considering the number of Red Drum captured in each net and the amount of time the net was in the water (CPUE= catch/hour). The results indicate that the Red Drum population experienced a period of growth from approximately 1985-2005, before beginning to stabilize in both the fisheries dependent and independent data. Conclusions from this study hope to provide useful insights for the future management of the Texas Red Drum population.

Enumerating Larval Southern Flounder (*Paralichthys lethostigma*) with Photography Post Harvest

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Keywords: Southern Flounder, Adobe Photoshop

Accurately recording how many post-metamorphic flounder are released is critical to inform management decisions at both a hatchery and state level. The Coastal Conservation Association Marine Development Center in Corpus Christi, Texas, is one of two Texas Parks and Wildlife coastal hatcheries raising Southern Flounder for stock enhancement. As production numbers increase, hand-counting the fish prior to release is a very labor-intensive task. An efficient but accurate method for counting fingerlings is needed. Larvae were hand-counted during harvest and through photographs post-harvest. The larvae were placed into a 71cm by 38 cm acrylic container with holes drilled in the side to reduce the water volume. This reduced the possibility of larval stacking and swimming, which could lead to inaccurate counts due to individuals being blurred or obstructed. A variety of cameras were used to take a total of 2,181 photographs. However, only 276 were used for annotated counts. Photos were eliminated from annotated counts due to poor photo quality, glare, and blur. Adobe Photoshop was used to count the larval flounder. No significant difference was found between the count types, suggesting that it is as accurate to count

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flounder by hand as it is to count them post-harvest with photography. By using post-harvest photography, we can confirm the accuracy of our hand counts and our harvest data.

Artificial Reef Site Selection Modeling in Texas Offshore Waters

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Keywords: artificial reefs

This project aims to use GIS tools to select reef habitat restoration sites by incorporating available geographical data. Artificial Reefs (ARs) have been deployed in marine ecosystems globally to address various conservation objectives. For more than half a century, deploying ARs has been practiced as means of coastal habitat restoration in the Gulf of Mexico. Since 1990, the Texas Parks and Wildlife Department (TPWD) has deployed artificial reefs in Texas coastal marine habitats to enhance the habitat and recreational opportunities. Restoration efforts rely on State and Federal guidelines and rarely employ site selection modeling processes using Geographic Information Systems (GIS). The research plans to use the site selection criteria of water depth, the seafloor's topography, water quality, distance to the natural reefs, and distance from gas pipelines to determine optimal reef locations. The ArcGIS Pro environment's spatial analyst and Geo-statistics extension tools will be used to prepare the raster formats of the selection criteria. The relative importance of each criterion will be obtained by computing the eigenvector of each criterion using multivariate analysis. Then, potential restoration sites will be generated using multicriteria analysis in the ArcGIS Pro environment. The research output will give managers the information to select successful reef sites that meet State and Federal criteria and management goals.

Changes in the Catch Rates of Alligator Gars in Galveston Bay Following Major Flood Events

Jessica Geiskopf, Texas Parks and Wildlife Department, Professional

Keywords: Alligator Gar, Galveston Bay, freshwater inflow, intervention analysis

Following major flood events in 2015, 2016, and 2017, a large increase in catch rates of Alligator Gars in Galveston Bay was observed. The aim of this study was to evaluate the significance and magnitude of the increase and whether they could be attributed to these flooding events. Though often classified as a freshwater species, the Alligator Gar (*Atractosteus spatula*) can commonly be found in some Texas coastal bays. Although Alligator Gars can tolerate a wide range of salinities from a young age, individuals that reside in the bays or move between the bays and rivers are likely influenced by freshwater inflow. The Texas Parks and Wildlife Department conducted gill

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net sampling from 1983 to 2023. The highest average catch rates of Alligator Gars were seen along the upper Texas coast, including Galveston Bay, likely because the upper coast receives more precipitation and freshwater inflow leading to lower salinities on average than the lower coast. An intervention analysis was performed to detect a change, if any, in the catch rates following the flood events, and the magnitude of that change. Although it cannot specifically be stated that the mean catch rate changes were caused by a flood event, these results provide insight into the possible alteration of movement patterns when freshwater inflow to the bays is drastically increased. While we have been working to increase our understanding of their roles and behaviors in a saltwater environment, there is still much to learn about the movement of Alligator Gars between coastal bays and the rivers connected to them.

Larval and Early Juvenile Fish Recruitment to Micro Habitats in Matagorda Bay, Texas

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Co-authors: Joel Anderson and Damon Williford, Texas Parks and Wildlife Department

Keywords: Matagorda Bay, larval fish, Clupeidae, Sciaenidae, Sparidae, Atherinopsidae, Gobiidae

Larval and early juvenile fish have different requirements for survival and growth compared to adult fish. Currently, these life stages are not readily caught by Texas Parks & Wildlife Department routine sampling gears, and they are therefore underrepresented in long-running TPWD data sets. Establishing a baseline for recruitment of larval and early juvenile fish can aid in the understanding of these early life stages and improve management decisions for several managed species. The objective of this ongoing study is to assess the taxonomy and seasonal differences of post-flexion and early juvenile fish recruitment to the upper estuary. Light traps were used to collect fish along a jetty and salt marsh habitat in Matagorda Bay, Texas. Captured fish were identified to the lowest taxonomic level possible with the use of a stereo microscope. Abundance, richness, and diversity were calculated at the family level for each trap. We assessed seasonal differences using analysis of variance (ANOVA) and principal component analysis (PCA). A total of 23 families were observed with the top five most abundant families being Clupeidae (49.3%), Sciaenidae (15.5%), Sparidae (11.1%), Atherinopsidae (8.4%), and Gobiidae (6.4%). In the spring, abundance and richness were observed to be significantly higher than the other seasons (ANOVA <0.0001, Tukey <0.0001). However, there were no significant differences in diversity among the seasons. Future work includes assessment of the capability of environmental DNA in conjunction with light traps, as well as monthly changes in length of commonly observed species.

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Building a West Texas Fishery from the Ground Up

Michael Homer, Texas Parks and Wildlife Department, Professional

Keywords: Early, angling, Texas B.A.S.S. Nation, Major League Fishing Black Bass Stewardship Group

Small impoundments in communities are important resources to provide fishing recreation and subsistence opportunities. Larger reservoirs are typically less convenient for individuals and families because of travel, lack of shoreline angling access, lack of amenities, as well as the need for vessels. Community fishing ponds are usually closer in proximity to homes, are situated in park spaces that offer a variety of amenities and features and may be less intimidating for families to partake in fishing, especially for those new to the sport. In West Texas, these waterbodies are crucial for attracting new anglers as well as keep active anglers engaged in fishing. In 2020, Texas Parks and Wildlife Department (TPWD) partnered with the City of Early to revitalize a fishery at site planned to create a new park and commerce space. In 2021, the TPWD's Habitat and Angler Access Program awarded $95,000 to install two fishing piers, create gravel spawning beds, armor shoreline, native vegetation and other fish habitat enhancements. In 2023, the City of Early received additional HAAP funding to create a kayak launch on the pond as well as a fishing pad. Planning, design, and implementation of the pond revitalization were collaborative efforts with the city and contracted engineers. In 2023, Texas B.A.S.S. Nation and Major League Fishing Black Bass Stewardship Group partnered with TPWD and City of Early to further habitat enhancement efforts. This presentation will highlight the project, particularly the planning and implementation processes, successes, challenges, and lessons learned.

The Effect of Freshwater Inflow on Species Assemblage in San Antonio Bay

Jason Jaworski, Texas Parks and Wildlife Department, Professional

Keywords: freshwater inflow, San Antonio Bay

The purpose of this project is to determine if there is a correlation between freshwater inflow and the diversity of common marine species in the San Antonio Bay (SAB) system and its associated minor bays. SAB, located on the Texas coast, is an estuarine system fed by the San Antonio and Guadalupe rivers. Estuarine systems rely heavily on freshwater inflow for the input of nutrients and the maintenance of salinity gradients. Climate change and increased anthropogenic water use may be affecting the amount of freshwater inflow or exacerbating flood and drought events. Discharge data was acquired from United States Geological Survey (USGS) at monitoring stations for both the Guadalupe and San Antonio rivers between 1992 and 2023. Species data was collected from Texas Parks and Wildlife (TPWD) bay trawl samples throughout the entire time series. Several different diversity measures were calculated based on water discharge values including species richness, evenness, and overall diversity. The goal of this project is to evaluate how freshwater inflow rates and seasonality may impact different marine communities in an estuarine environment.

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An Assemblage Survey of a Highly Productive Recreational Fishery in a Man-Made Dredge Placement Compartment in Sabine Lake

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Co-authors: Jonathan Richard, Adam Feltman, Thai Nguyen, and Paige Frederick, Lamar University; and Joshuah Perkin, Texas A&M University

Keywords: Sabine Lake, Pleasure Island, fish assemblage

Estuaries along the Gulf Coast provide nursery habitat (e.g., seagrass beds, coastal marshes) which not only serve as a refuge for larval and juvenile fishes and invertebrates but also provide resources for adult individuals of numerous species. This includes many species collected for sport and as a result, these areas often support popular recreational fisheries. 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. Preliminary results of a study assessing the potential for the compartment to serve as supplemental nursery habitat indicate it is comparable to unmodified nursery habitat found in the Sabine Lake system. In addition to surveys targeting earlier life stages, we also conducted population inventories of the enclosure via 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 to determine if there is a significant difference in the community assemblage within the north levee enclosure compared to the surrounding estuary and what environmental variables may be associated with these differences. We present the results of these surveys conducted during the Fall 2023 and Spring 2024 gill net sampling periods.

In-Situ Habitat Data Collection with Concurrent Fisheries-Independent Data along the Texas Coast

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Co-authors: Chelsea Crosby, Jake Harris, Evan Pettis, and David Norris, Texas Parks and Wildlife Department

Keywords: habitat assessment

The Texas Parks and Wildlife Department (TPWD) Coastal Fisheries Division has been collecting fisheries data since the 1970s. It is known that estuarine habitat influences marine fish and invertebrate growth, recruitment, and survival. However, habitat data have seldom been

collected concurrently with fisheries independent data coastwide. In 2016, the TPWD Habitat Assessment Team initiated a pilot study to pair in situ habitat data collection with the nekton community data collected by TPWD's Fisheries Management Team's bag seine monitoring program. The in situ data include information on aquatic habitat and sediment type, emergent and intertidal shoreline habitat, intertidal habitat slope and heterogeneity, and presence of other habitats and anthropogenic structures. Following refinement of the habitat assessment methodologies utilized in the pilot study, the TPWD management teams on Texas's Lower Coast (Aransas Bay, Corpus Christi Bay, Upper Laguna Madre, and Lower Laguna Madre) have collected this paired habitat data since 2018 and the program was extended to the Upper Coast (Sabine Lake, Galveston Bay, Matagorda Bay, and San Antonio Bay) in 2024. This data can provide insight on how habitat affects nekton community diversity, region-specific habitat preferences for important coastal fish species, and potential target areas for habitat restoration. The data collected through this program have a broad range of applications for fisheries and habitat management/research and are publicly available upon request.

Effects of Salinity on the Toxicity and Real-Time Metabolic Rate Responses of Acute Ammonia Exposure to Juvenile *Macrobrachium rosenbergii*

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Co-authors: Cameron Emadi, University of British Columbia; and Fabio Dos Santos Neto, Breanna Smithers, and Miguel Acevedo, University of North Texas

Keywords: prawn, ammonia toxicity, recirculating aquaculture systems

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, and can be grown to market size at typical salinities observed for brackish groundwater desalination concentrate. This offers an opportunity to use desalination waste to offset the operating and environmental costs of brine disposal. A major challenge in aquaculture is receiving real-time, comprehensive feedback on changing water quality parameters and the health status of organisms. For example, high density recirculating aquaculture systems (RAS) incur the potential for ammonia accumulation which affects 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 from brackish water to freshwater. The main goal of this research is to develop an in-line, real-time sentinel respirometry system to promptly detect subtle changes in water quality that might affect growth and survival within RAS. To this end, we sought to first determine the acute toxicity of ammonia at different salinities to establish LC50s at various time points out to 48 h. Informed by these data, we then sought to test the acute real-time effects of stepwise increases in sublethal ammonia exposures on the routine metabolic rates of juvenile *M. rosenbergii* using static intermittent respirometry. Acute mortality generally increased with increased exposure duration and was highest at 10 ppt for all time points except 24 h (no significant difference across salinities). Subsequent respirometry trials revealed that

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metabolic responses were also highest at 10 ppt and statistically significant responses could be detected when compared to control resting metabolic rates, regardless of salinity.

Influence of Survey Methods on Size Structure Detection in Freshwater Mussel Populations: Implications for Demographic Assessment

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Co-authors: Cody Craig, Arrowhead Ecology Group; and Kara Posso and Allison Schellenberg, Zara Environmental

Keywords: mussels, Colorado River, colanders

Traditional freshwater mussel surveys often employ tactile and visual search methods that may underestimate juvenile recruitment and bias population demographic assessments. We evaluated the effectiveness of different sampling approaches during a salvage survey of freshwater mussels in the Colorado River, Texas. The survey area was divided into 27 cells, with systematic searches conducted using both traditional tactile methods and substrate sieving using colanders. In cells where colanders were employed, we found significantly greater densities, as well as different species structure and demographics, compared to cells surveyed using only tactile methods. Overall, 72% of mussels detected were juveniles (<40 mm), with 90% of mussels found in the substrate sieving cells being juveniles. These cells yielded both statistically greater total densities and greater proportions of juvenile mussels, including threatened and endangered species. The use of colander sieves enhanced detection of smaller size classes, particularly in areas with sand and gravel substrates. Our findings demonstrate that survey methodology can influence community composition and demographic assessments of mussel populations and highlight the importance of employing multiple sampling techniques to accurately assess population structure. These results have important implications for conservation planning, as accurate demographic data are crucial for evaluating recruitment and population viability of imperiled mussel species.

Nekton Community and Habitat Assessment Plan for Pre- and Post-Condition Monitoring at Otilla Dam

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Keywords: San Antonio River Authority, Otilla Dam, Salado Creek, San Antonio River, fish assemblage, TXRAM

Dams are known to cause habitat fragmentation for aquatic species including fish and mussels, preventing access to habitats important for various life history stages. The San Antonio River Authority (River Authority) seeks to reconnect 60 miles of waterways in the San Antonio River

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Basin by modifying Otilla Dam, the only major barrier of the mainstem river below the urban bounds of San Antonio. Its modification would allow connection to tributaries like Salado Creek and restored areas within San Antonio like the Mission Reach and West Side Creeks, and could facilitate upstream movement by species of interest, including American Eel *Anguilla rostrata*, Burrhead Chub *Macrhybopsis marconis*, and Guadalupe Bass *Micropterus treculii*. An additional interest of this project is to increase the free movement of native freshwater mussel host fishes, including Bluegill *Lepomis macrochirus*, Spotted Gar *Lepisosteus oculatus*, Longnose Gar *Lepisosteus osseus*, Flathead Catfish *Pylodictus olivaris* and Channel Catfish *Ictalurus punctatus*. Objectives of pre-condition monitoring include characterization of the current habitat and nekton community upstream and downstream of Otilla Dam. Monitoring includes sampling via backpack electroshocker, straight seine, bag seine and trammel net and the implantation of Passive Integrated Transponder (PIT) and Visible Implant Elastomer (VIE) tags to track fish passage during the post-condition monitoring. Habitat monitoring includes nekton-associated measurements of depth, velocity, and instream cover and the use of the Texas Rapid Assessment Method (TXRAM) to detect larger, longer-term changes in landscape habitats and riparian conditions. Initial surveys have seen 27 total fish species (26/27 downstream, 18/27 upstream). Construction is expected to occur in calendar year 2026. Objectives of post-condition monitoring include the characterization of future nekton communities, and whether passage in either direction can be detected via PIT and VIE tagging. TXRAM will be re-assessed following the project completion.

Application of a Known-Fate Model to Assess Crayfish Mark Retention

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Co-author: Travis Waldrep, Texas Parks and Wildlife Department

Keywords: crayfish, tags, nail polish, mark retention

Effective animal marking methods are fundamental to ecological studies. A myriad of marking options are available to aquatic scientists, each with their own tradeoffs. For example, tags increase individual recognition and (may) have longer retention time, though with increased injury risk. Simple external marks (e.g., clips and coloration) have more limited applications, but are typically less intrusive and expensive. Nail polish is an external marking method common for shorter-term crayfish studies. However, retention time is seldom reported, and evaluations of overall efficacy are lacking. Our objective was to evaluate nail-polish retention time for crayfish in a probabilistic framework. We examined two types (gel and lacquer) using Red Swamp Crayfish *Procambarus clarkii*. Crayfish create a unique challenge for external mark-retention studies because, in addition to mortality, an individual may molt before losing the mark. Thus, we used a variation of a known-fate model, which allowed us to retain all information about retention time. We marked the carapace of 90 crayfish with each nail-polish type in an indoor raceway that mimicked natural habitat. The marking comprised six unique bottles of each type (hereafter treatments). Overall, gel had slightly higher retention than lacquer, but with more variability among treatments. Both types had, on average, a >0.9 30-day and a >0.8 60-day retention

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probability. Ninety-day retention probability was ~0.1 higher for gel. Male crayfish had a higher retention time than females, but there was no relationship with size. Our findings indicate that both gel and lacquer nail polish are effective, noninvasive, and inexpensive crayfish marking methods for shorter-term research and abundance estimation. Gel, however, may be preferred for field studies due to quicker dry time. Our general study design is also applicable to any mark-retention study where individuals perish, molt, or go unseen prior to losing the mark.

Towards a Better Understanding of Southern Great Plains Fish Responses to Increasing Droughts in Texas

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Keywords: drought, Brazos River, Red River, Great Plains fishes, Red River Pupfish

Native fishes of the southern Great Plains of Texas are a focus of conservation because many species have declined dramatically in distribution and abundance, and several are formally listed as imperiled, threatened, or endangered. Natural flows regimes drive the ecological processes that support fish assemblages in southern Great Plains rivers such as the upper Brazos River (UBR) and upper Red River (URR). Texas has suffered exceptional droughts in recent decades and the persistence of aquatic habitats has been severely threatened. The increase in frequency and severity of droughts in the state have created fundamental changes in aquatic ecosystems inhabited by native and state imperiled species. Here, we use both published and ongoing research data from Great Plain fish assemblages and their stream habitats to help identify key responses of Great Plains fishes to drought conditions. Specifically, in this review, we focus on discussing how droughts affect fish habitats, what are the life history strategies displayed by drought tolerant species, and what are the drought refuges for fishes inhabiting southern Great Plain rivers. Our aim was to summarize and provide some key insights that policy makers and/or stakeholders need to consider when identifying fish responses to drought conditions. There is evidence that Texas droughts have reduced habitat complexity in the UBR and URR, by altering substrates, flow regimes, disconnecting pools, desiccating long reaches of streams, and making these fluvial ecosystems more saline; consequently, putting several native and imperiled species at risk. Pelagic-broadcast spawning cyprinids including the Brazos River endangered shiners (*Notropis buccula* and *N. oxyrhynchus*) have been sensitive to these alterations, while other temperature and salt-tolerant species (e.g., Red River Pupfish) have become more resistant and with high fluctuations in their abundance. Overall, droughts have the potential to negatively affect our freshwater ecosystems and their biota.

Variability and Environmental Drivers of Eastern Oyster Growth in Texas Coastal Bays (1990-2023)

Jessica Randall, Texas Parks and Wildlife Department, Professional

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Variability and Environmental Drivers of Eastern Oyster Growth in Texas Coastal Bays (1990-2023)

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Keywords: oysters, Galveston Bay, Matagorda Bay, San Antonio Bay, Aransas Bay

The growth dynamics of eastern oysters (*Crassostrea virginica*) and the factors influencing them were analyzed across four major Texas bay systems - Galveston, Matagorda, San Antonio, and Aransas Bay using Texas Parks and Wildlife (TPWD) oyster dredge data collected from 1990-2023. To model bay-specific oyster growth, mean total length estimates of assigned age-0.5 and age-1.5 oysters were generated using each winter season as a repeated measure of growth. These size-at-age estimates were then used to fit von Bertalanffy growth functions (VBGF), generating mean growth curves over all years for each bay system. To identify potential drivers of growth variation among bays, a boosted regression tree (BRT) model was applied to evaluate the influence of multiple environmental variables on age-0.5 and 1.5-year-old oysters. These analyses can reveal influential drivers of growth in oysters within Texas bay systems, providing crucial information to guide restoration efforts and the development of adaptive management strategies that support sustainable harvesting and monitoring practices to ensure the resilience of these ecologically and economically significant reef systems.

Monitoring Results from The Upper Galveston Bay Sustainable Oyster Reef Restoration Project: The Influence of ENSO on Monitoring Results and Project Performance

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Keywords: oysters, Upper Galveston Bay Sustainable Oyster Restoration Project, Galveston Bay, El Niño, oyster restoration

The Upper Galveston Bay Sustainable Oyster Restoration Project is a partnership between The Nature Conservancy, Texas Parks and Wildlife Department, and the Galveston Bay Foundation where partners restored ~25 acres of harvestable oyster reef and ~13 acres of sanctuary reef (protected from oyster harvest) in upper Galveston Bay, Texas. This creates a resource-sink dynamic where the protected broodstock within the sanctuary reef (resource) supply larvae to the harvestable (sink) reefs. Quarterly monitoring was conducted to assess restoration success and inform adaptive management and future design of other similar landscape-scale approach restoration projects. Monitoring results indicate that seasonality and salinity regime can impact short-term project success, but long-term success can be achieved as natural salinity and climatic cycles shift to favorable conditions. The project's location experiences wide fluctuations in salinity driven by the ENSO (El Niño/Southern Oscillation) cycle in the Eastern Equatorial Pacific. During El Niño periods, increased rainfall can depress salinity, while La Niña periods produce drought conditions causing salinity to increase.. Construction of the reefs occurred in early 2021 during an El Niño period and the persistence of low salinity conditions in the area caused concern about the project's success, as spat and oysters were absent from the restored reef. In 2022, a shift to La Niña conditions caused salinity to increase resulting in increased oyster and spat abundance on the restoration sites. No additional adaptive management strategies (e.g.,

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additional cultch placement or seeding) were required to overcome short-term apparent failure; the reef naturally recruited oysters when conditions improved. Not only can the results of this study inform the timing of cultch placement for oyster restoration projects, but it also indicates that long-term monitoring may be required to adequately assess project success in areas with highly variable climatic and salinity regimes.

American Eel (*Anguilla rostrata*) Staging and Morphometrics at Recruitment to a Texas Bayou

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Keywords: American Eel, Lynn Bayou

The American eel (Anguilla rostrata) is a panmictic facultative catadromous fish inhabiting Atlantic fresh and coastal waters from Venezuela and Brazil to Greenland. Research regarding recruitment into Gulf of Mexico coastal states is limited. The goal of this study is to evaluate morphometric relationships at each juvenile life history stage of American eel recruiting into Texas. An eel ramp with ½ inch sheet drain and a gravity-fed siphon was deployed at a wastewater treatment plant outfall in Lynn Bayou, Port Lavaca, TX and monitored throughout the preliminary recruitment window (December through June) for two years (2022 - 2024). Life stage (glass/elver/yellow), developmental staging of glass eels using pigmentation (stage 1-7), and morphometric measurements (length, weight, head length, body depth, body width, and pre-anal length) were recorded for every eel captured. To date, 100 juvenile American eels (51 glass; 48 elvers, and 1 yellow eel) have been caught. Peak glass eel recruitment occurred in January (week of Jan. 30 and Jan. 8 in 2023 and 2024, respectively) while peak elver recruitment occurred in March of 2023 (week of Mar. 13) and February in 2024 (week of Feb. 19). We present preliminary length-weight relationships for glass and elver life history stages. Overall, the results of this ongoing study provide critical insights into the timing and distribution of juvenile American eel recruitment into Texas bays and freshwaters. These data can be utilized in the development and implementation of future conservation efforts to help protect this enigmatic species.

Fish Community Monitoring as Part of the Trinity River Authority's Clean Rivers Program

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Keywords: Trinity River Authority, Trinity River basin, Index of Biotic Integrity, fish assemblage

With only four species of fish collected in the Dallas Fort Worth Metroplex as recently as the 1970's, it is no surprise that the Trinity River was once referred to as the “mythological river of death.” Since then, coordinated improvements in water quality have led to the recovery of fish assemblages within the Trinity, becoming a well-documented environmental success story. To monitor that recovery, the Trinity River Authority has conducted Aquatic Life Monitoring surveys on one or more Trinity Basin waterbodies biannually since 2013. These surveys have targeted waterbodies with documented concerns or impairments for one or more water quality parameters, capturing conditions in both the Index (March 15-Oct 15) and Critical (July 1-Sept 30) periods. At each site, whole community fish data was collected via backpack electroshocking and seine netting, alongside benthic macroinvertebrate and habitat data. As of 2024, 30 surveys have been conducted on 13 waterbodies throughout the Upper Trinity basin. Although these surveys have targeted streams with water quality concerns, 90% of sites have scored as either High or Exceptional on the State of Texas Regionalized Nekton Index of Biotic Integrity. Here we will characterize the collected fish communities with over 12,000 individuals from 42 unique species collected during these surveys, while also describing the vision of the program over the next decade.

Diversity of Fish Assemblages Across Rivers and Streams in Texas

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Keywords: National Rivers and Streams Assessment, fish assemblage, ecoregions

Global biodiversity is in decline with nearly a quarter of all freshwater fishes threatened with extinction. Routine biological monitoring provides an opportunity to quantitatively evaluate patterns and trends in aquatic biodiversity through time. The EPA's National Rivers and Streams Assessment (NRSA) assesses long-term trends in river and stream ecosystem health, including the evaluation of fish assemblages, across the United States. The NRSA is performed over two summers, every five years, with sites designated as either new (e.g., not previously sampled) or resample (e.g., sampled twice across surveys). Using nationally standardized electrofishing procedures, we assessed fish assemblage data from 251 sites across 10 Omernik Level III Ecoregions over a 15-year period (e.g., summers of 2008-09, 2013-14, 2018-19, and 2023-24). Seventy-four of those sites were resampled across survey periods. Assemblage data were stratified using ecoregions to evaluate spatial variances in fish assemblage biodiversity. While electrofishing is not an exhaustive method for sampling full fish assemblages, this dataset represents a unique opportunity to evaluate spatial and temporal changes in fish assemblage structure through standardized collection methods at the landscape scale. Factors that can

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influence freshwater fish biodiversity at the ecoregion-scale include things like, climate change, water diversion, barriers to movement, and other watershed-level anthropogenic impacts. These results can help to inform future resource management decisions aimed at protecting fish biodiversity in Texas.

An Analysis of Ten Years of Fish Kill Data from The Texas Parks and Wildlife Department's Kills and Spills Team

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Keywords: Kills and Spills Team, fish kills, pollution events

The Texas Parks and Wildlife Department's Kills and Spills Team (KAST) in the Inland Fisheries and Coastal Fisheries division is responsible for the assessment and documentation of fish kills and pollution events, and the mitigation of activities that impact, or could potentially impact, fish and wildlife. The analysis of pollution patterns, including sources and location of pollution events, supports management strategies and informs measures to prevent fish kills. Fish kills are caused by two primary source types: anthropogenic and natural. We analyzed 1,218 fill kill reports between 2012 and 2022 across the state of Texas. We observed more anthropogenic-sourced fish kills, consisting primarily of infrastructure failures, than natural events in Texas. Fish kills in freshwater are most likely to be caused by sewage and chlorinated water discharges. Fish kills in coastal waters are most likely to be caused by industry discharges. Fish kills are also more prevalent in densely populated areas, such as metroplexes. We suggest that this observation is the result of increased infrastructure and associated failures in these environments. We will discuss measures that have been taken to prevent and mitigate fish kills in Texas

Environmental and Socio-Economic Variables Influencing Angler Trip Grade Satisfaction for Three Heavily Targeted Species in Texas Coastal Waters: Red Drum (*Sciaenops ocellatus*), Spotted Seatrout (*Cynoscion nebulosus*), and Red Snapper (*Lutjanus campechanus*)

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Co-author: Joel Anderson, Texas Parks and Wildlife Department

Keywords: Red Drum, Spotted Seatrout, Red Snapper, angler satisfaction

Angler satisfaction following a fishing trip is a complicated psychological phenomenon that can be influenced by environmental/weather variables, management regulations, and social interactions among other factors.

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The Texas Parks and Wildlife Department has been collecting post-trip responses from marine recreational anglers through the Harvest Creel Program since the 1970's. The program is designed to obtain estimates of total daylight marine landings, catch per unit of effort, and size composition by species among private and party-boat sport anglers in both bay-pass and Gulf of Mexico waters. A social and economic questionnaire portion was added to the program in 1987 and reformatted in 1991 to include inquiries about trip grade satisfaction (0-10, “How satisfied were you with today's trip?”) and species sought (“Were you fishing for a particular type of fish today?”).In the latter case, responses are transcribed as a numerical value based on a predetermined sportfish code.

Using those responses, in concert with other known trip variables, we developed a regression tree model to determine what influences angler satisfaction in three heavily targeted species in Texas coastal waters: Red Drum (*Sciaenops ocellatus*), Spotted Seatrout (*Cynoscion nebulosus*), and Red Snapper (*Lutjanus campechanus*).

Variables included in the analysis stem from three different elements: environmental, management regulations, and human dimensions. Environmental factors include wind speed, air temperature, and precipitation (rain of fog) on the day of the trip. Fisheries management regulations for each species include total catch limits, mean catch lengths, and abundance. Social influences are based on angler CPUE, number of anglers, private vs party boat trips, bait types, and trip length.

Determining the prominent variables of driving trip grade satisfaction for three heavily managed species can aid fisheries managers in understanding angler motives and help to define best management practices.

Using Natural Tags to Track Southern Flounder (*Paralichthys lethostigma*) Movement Through Texas Estuaries

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Keywords: Southern Flounder, diet

Southern Flounder (*Paralichthys lethostigma*) are a migratory species of flatfish that depend on freshwater and estuarine habitats for juvenile recruitment, and that support economically important commercial and recreational fisheries in Texas. Despite regional populations of Southern Flounder exhibiting differences in habitat use and migration strategies, recent assessments have noted population and stock declines of up to 70%. Therefore, this project will aim to provide new insights into the migration patterns, habitat use, and dietary histories of Southern Flounder to allow for a more robust evaluation of essential fish habitat and current management strategies aimed at conserving this economically important species. To do so, otolith microchemistry and stable isotope analysis of muscle tissue will be analyzed to quantify movements into oligohaline habitats as well as the reliance on freshwater-derived productivity

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sources to help inform essential fish habitat management practices. Based on previous assessments regarding Southern Flounder freshwater interactions, juvenile Southern Flounder are expected to rely more on diets derived from lower salinity sources, and post-sex determination females are expected to rely on freshwater derived diets more heavily than males. Due to their estuary residency, female Southern Flounder are expected to spend a larger percentage of their life in low-salinity waters than males, who have been known to inhabit deeper, marine waters. Ultimately, determining Southern Flounder's reliance on freshwater habitat and diet sources will help facilitate the development of conservation strategies based on freshwater availability and aid state and federal agencies to assess and conserve estuarine-dependent migratory species.

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